



**DATE: 19 January 2016**

**I.T.L. (PRODUCT TESTING) LTD.**  
**FCC Radio Test Report**  
**for**  
**Galcon Bakarim Agricultural**  
**Cooperative Society Ltd.**

**Equipment under test:**  
**Irrigation Controller**

**11000BT-SN; 11000BT\***

\*See customer's Declaration on page 6

Tested by:   
M. Zohar

Approved by:   
D. Shidlovsky

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This report relates only to items tested.



**Measurement/Technical Report for**  
**Galcon Bakarim Agricultural Cooperative Society**  
**Ltd.**

Irrigation Controller

**11000BT-SN**

**FCC ID: SZ811BT**

This report concerns:                      Original Grant:                      X  
Class I Change:  
Class II Change:

Equipment type:                              Digital Transmission System

Limits used:                                    47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 v03r03 and ANSI C63.4-2014.

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# 1. General Information

## 1.1 Administrative Information

|                                |                                                                                                            |
|--------------------------------|------------------------------------------------------------------------------------------------------------|
| Manufacturer:                  | Galcon Bakarim Agricultural Cooperative Society Ltd.                                                       |
| Manufacturer's Address:        | Kibbutz Kfar Blum<br>D.N. Upper Galilee<br>12150<br>Israel<br>Tel: +972-4-690-0222<br>Fax: +972-4-690-2727 |
| Manufacturer's Representative: | Tom Rash                                                                                                   |
| Equipment Under Test (E.U.T):  | Irrigation Controller                                                                                      |
| Equipment Model No.:           | 11000BT-SN, 11000BT*                                                                                       |
| Equipment Serial No.:          | Not designated                                                                                             |
| Date of Receipt of E.U.T:      | 26.11.2015                                                                                                 |
| Start of Test:                 | 26.11.2015                                                                                                 |
| End of Test:                   | 07.12.2015                                                                                                 |
| 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                                                                                     |

\*See customer's Declaration on following page.



## DECLARATION

**I HEREBY DECLARE THAT:**

**MODEL No. 11000BT-SN**

**IS A FULL CONFIGURATION MODEL,**

**OTHER MODELS No. WHICH INCLUDE ARE:**

**11000BT**

**DIFFER FROM THE 11000BT-SN ONLY BY EXTRACTED COMPONENTS.**

**Please relate to them all (from a RF/EMC point of view) as the same product.**

**Thank you,**

**Full Name: Dvora Zilberas Fine**

**Position: Engineering Manager Date: 03.08.2015**

**Signature: Dvora Z**

**Place: Kfar Blum**



## **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**

Bluetooth operated irrigation controller with an integrated electric motor actuator.  
The controller works on 9V alkaline battery with optional rain sensor connector.

|                                  |                       |
|----------------------------------|-----------------------|
| Model name                       | 11000BT-SN            |
| Working voltage                  | 9VDC battery operated |
| Mode of operation                | Transceiver BLE       |
| Modulations                      | GFSK                  |
| Frequency Range                  | 2402MHz-2480MHz       |
| Transmit power                   | 8dBm                  |
| Antenna Gain                     | -5.0 dBi              |
| Modulation BW                    | >500kHz               |
| Temperature (°C)/ Humidity (%RH) | 18°C/35%              |

### 1.4 **Test Methodology**

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r03 and ANSI C63.4: 2014. 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**

#### **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):

± 4.98 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          | 87.7            | 86.6            | 85.6            |
| 2440.0          | 85.4            | 82.4            | 80.3            |
| 2480.0          | 81.2            | 80.6            | 80.4            |

**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.

### 2.2 EUT Exercise Software

No special exercise software was used.

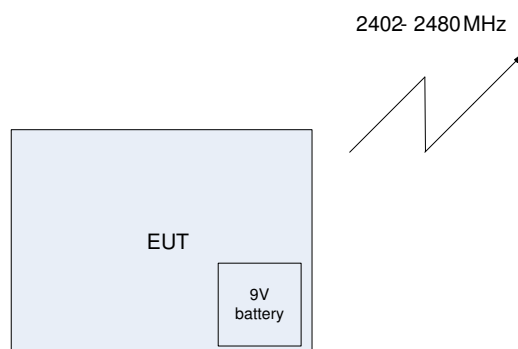
### 2.3 Special Accessories

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**

### 3. Radiated Measurement Test Set-Up Photos



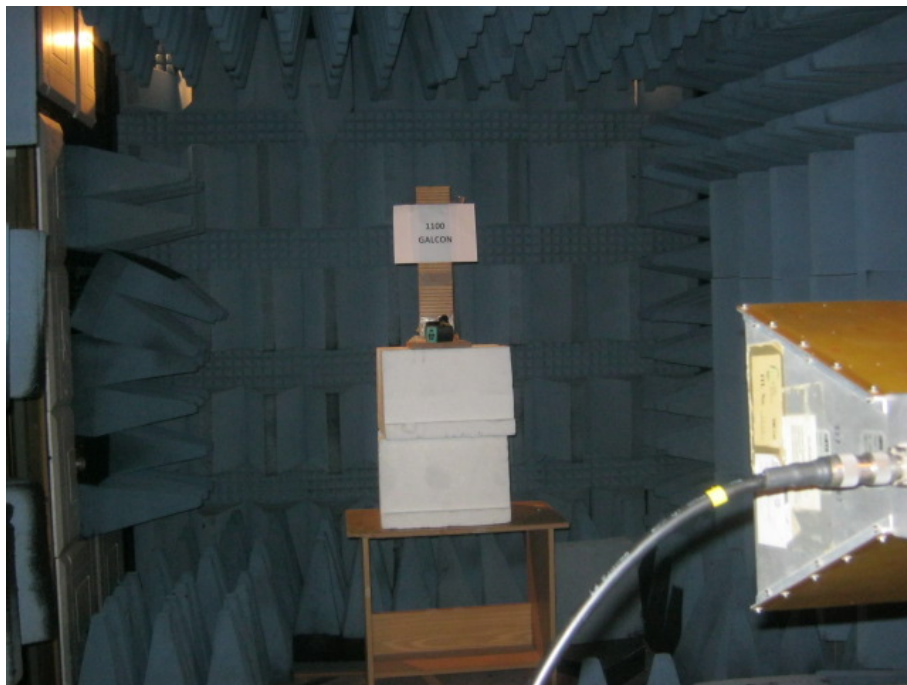
**Figure 3. Radiated Emission Test**



**Figure 4. Radiated Emission Test**



**Figure 5. Radiated Emission Test**



**Figure 6. Radiated Emission Test**

## 4. 6 dB Minimum Bandwidth

### 4.1 Test Specification

FCC Part 15, Subpart C, Section 247(a)(2)

### 4.2 Test Procedure

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

The E.U.T was tested 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 2*.

.

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.

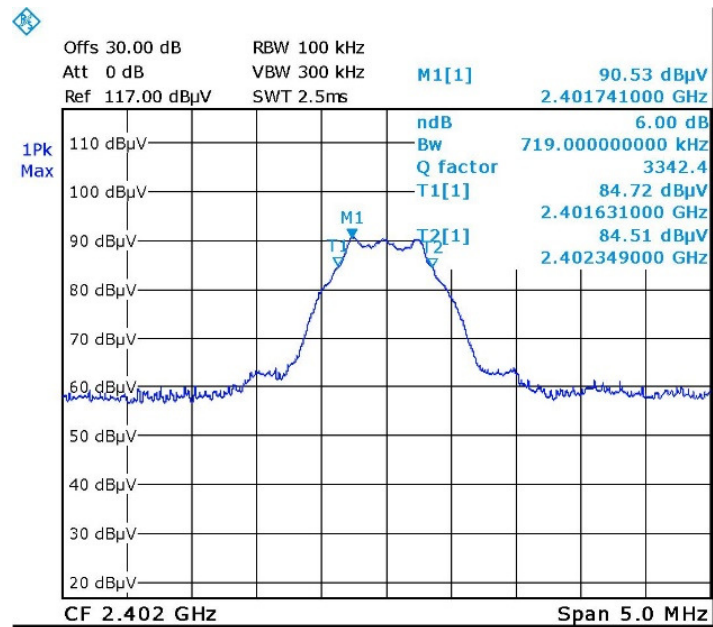
### 4.3 Test Results

| Operation Frequency (MHz) | Reading (MHz) | Specification (MHz) |
|---------------------------|---------------|---------------------|
| 2402.0                    | 0.719         | >0.5                |
| 2440.0                    | 0.729         | >0.5                |
| 2480.0                    | 0.768         | >0.5                |

**Figure 7 6 dB Minimum Bandwidth**

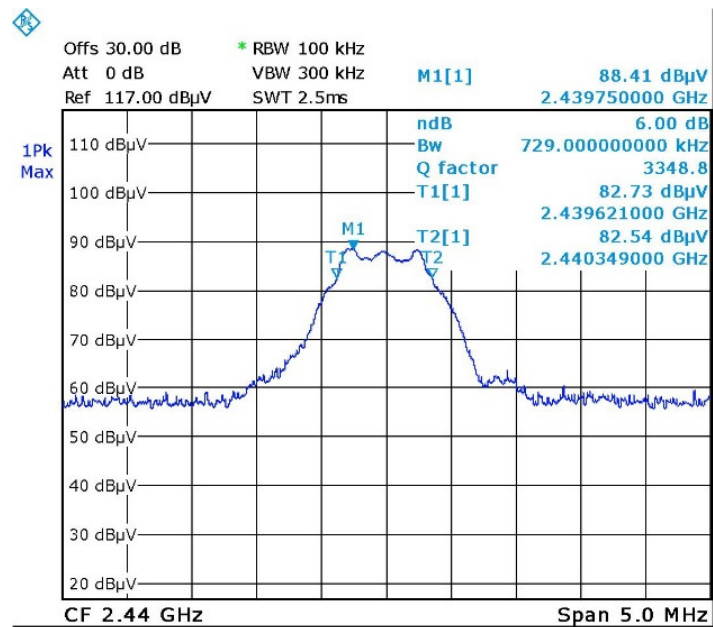
JUDGEMENT: Passed

For additional information see *Figure 8* to *Figure 10*.



Date: 26.NOV.2015 13:57:23

Figure 8. 2402.0 MHz



Date: 26.NOV.2015 14:07:13

Figure 9. 2440.0 MHz

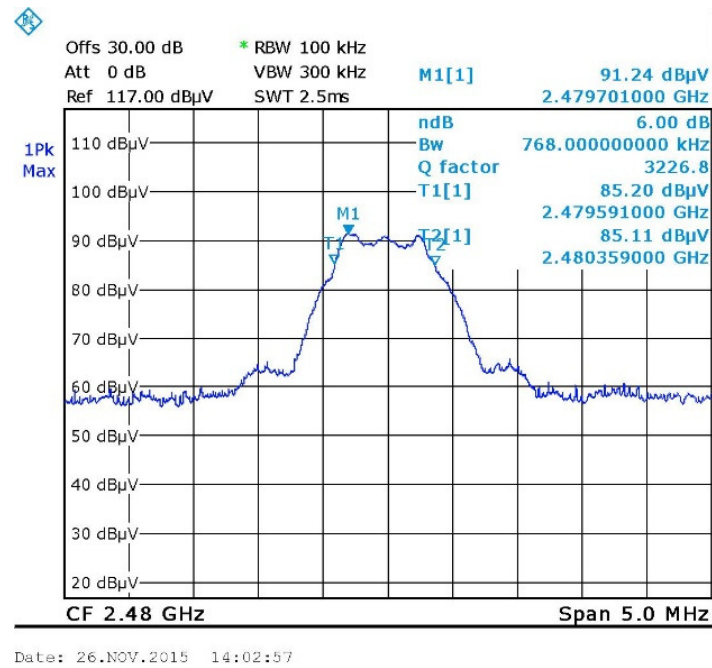


Figure 10. 2480.0 MHz



#### 4.4 *Test Equipment Used; 6dB Bandwidth*

| <b>Instrument</b>           | <b>Manufacturer</b> | <b>Model</b> | <b>Serial No.</b> | <b>Last Calibration Date</b> | <b>Next Calibration Date</b> |
|-----------------------------|---------------------|--------------|-------------------|------------------------------|------------------------------|
| Spectrum Analyzer           | R&S                 | FSL6         | 100194            | January 1, 2015              | January 1, 2016              |
| Horn Antenna                | ETS                 | 3115         | 6142              | May 19, 2015                 | May 19, 2018                 |
| Semi Anechoic Civil Chamber | ETS                 | S81          | SL 11643          | N/A                          | N/A                          |

**Figure 11 Test Equipment Used**

## 6. Maximum Transmitted Peak Power Output

### 6.1 Test Specification

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

### 6.2 Test Procedure

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

The E.U.T was tested 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 2*.

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

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

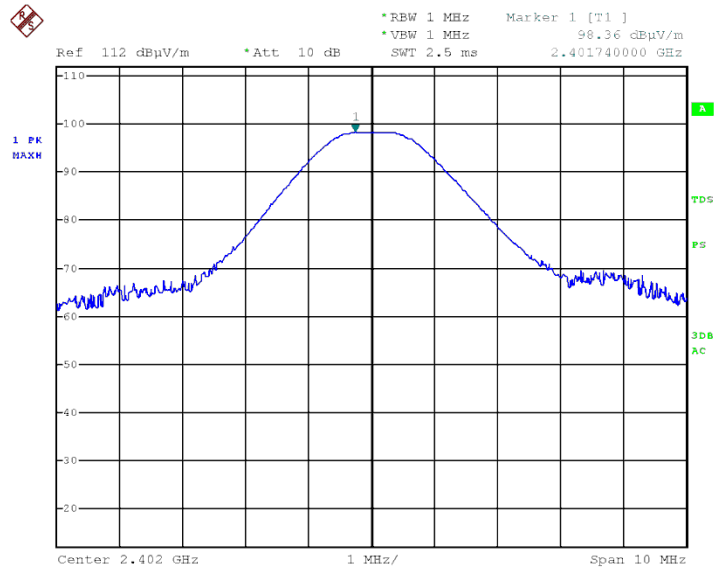
### 6.3 Test Results

| Operation Frequency (MHz) | Polarization (V/H) | Power (dBuV/m) | Power (dBm) | Power (mW) | Specification (mW) | Margin (mW) |
|---------------------------|--------------------|----------------|-------------|------------|--------------------|-------------|
| 2402.0                    | V                  | 98.4           | 3.2         | 2.09       | 1000.0             | -997.91     |
| 2402.0                    | H                  | 93.3           | -1.9        | 0.65       | 1000.0             | -999.35     |
| 2440.0                    | V                  | 96.4           | 1.2         | 1.32       | 1000.0             | -998.68     |
| 2440.0                    | H                  | 91.4           | -3.8        | 0.42       | 1000.0             | -999.58     |
| 2480.0                    | V                  | 96.8           | 1.6         | 1.45       | 1000.0             | -998.55     |
| 2480.0                    | H                  | 91.6           | -3.6        | 0.44       | 1000.0             | -999.56     |

**Figure 12 Maximum Peak Power Output**

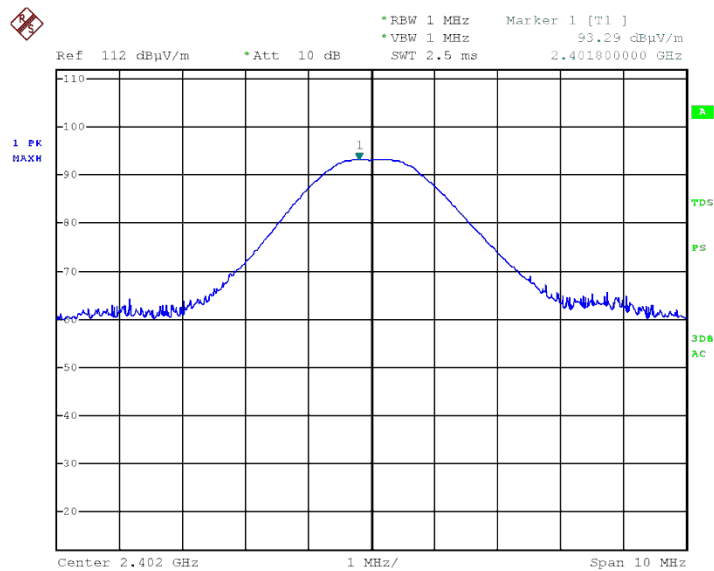
JUDGEMENT: Passed by 997.91 mW

For additional information see *Figure 13* to *Figure 18*.



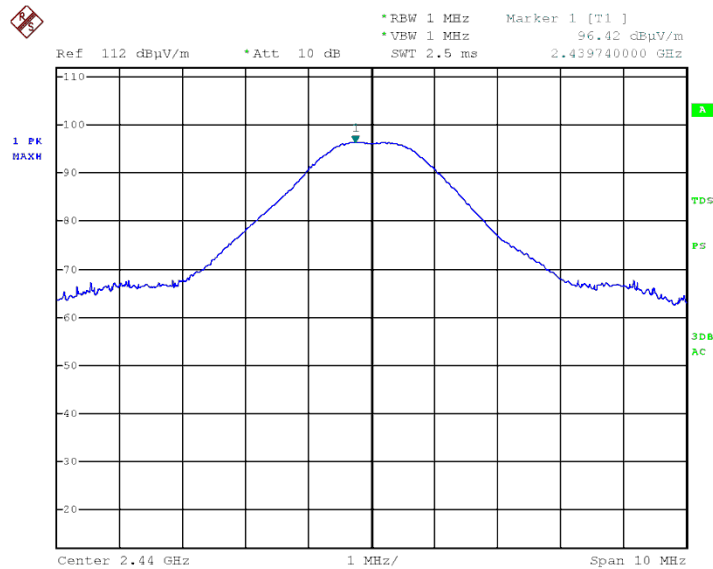
Date: 6.DEC.2015 13:51:45

**Figure 13 2402.0 MHz – Vertical**



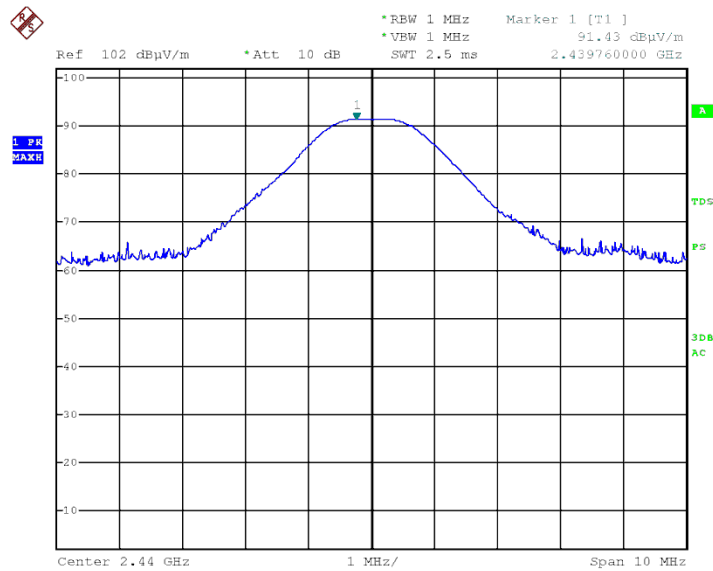
Date: 6.DEC.2015 14:02:57

**Figure 14 2402.0 MHz – Horizontal**



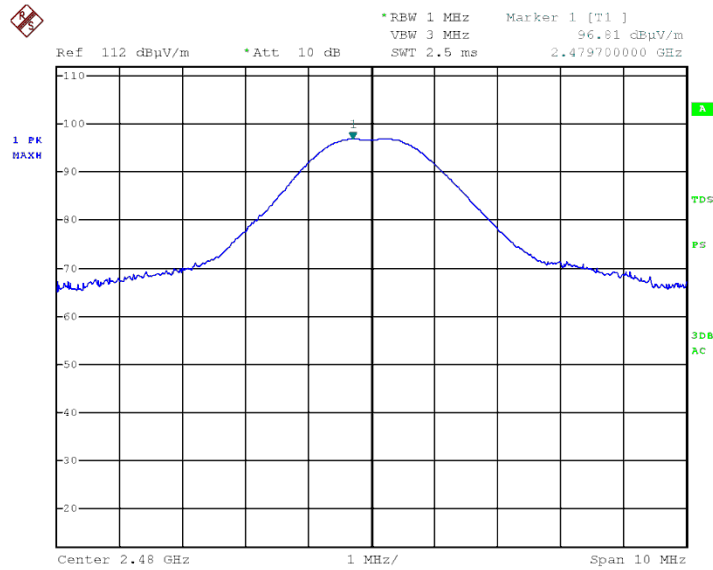
Date: 6.DEC.2015 13:44:57

**Figure 15 2440.0 MHz – Vertical**



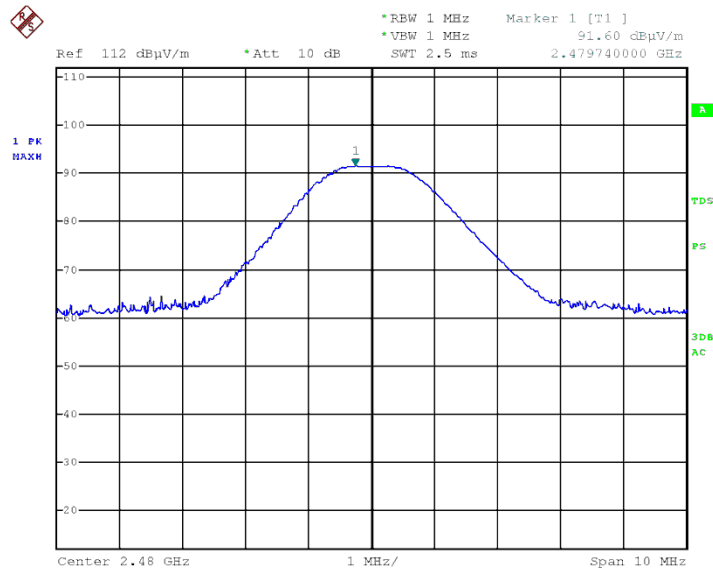
Date: 6.DEC.2015 13:39:51

**Figure 16 2440.0 MHz – Horizontal**



Date: 6.DEC.2015 12:23:14

**Figure 17 2480.0 MHz – Vertical**



Date: 6.DEC.2015 12:31:31

**Figure 18 2480.0 MHz – Horizontal**



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

| Instrument                  | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Date |
|-----------------------------|--------------|-------|------------|-----------------------|-----------------------|
| EMI Receiver                | R&S          | ESCI7 | 100724     | January 4, 2015       | January 31, 2016      |
| Horn Antenna                | ETS          | 3115  | 6142       | May 19, 2015          | May 19, 2018          |
| Semi Anechoic Civil Chamber | ETS          | S81   | SL 11643   | N/A                   | N/A                   |

**Figure 19 Test Equipment Used**

## 7. Band Edge Spectrum

### 7.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

### 7.2 Test Procedure

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

The E.U.T was tested 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 2*.

The RBW was set to 100 kHz.

### 7.3 Test Results

| Operation Frequency (MHz) | Modulation | Band Edge Frequency (MHz) | Spectrum Level (dBuV/m) | Specification (dBuV/m) | Margin (dB) |
|---------------------------|------------|---------------------------|-------------------------|------------------------|-------------|
| Low                       | BLE        | 2400.0                    | 56.6                    | 70.6                   | -14.0       |
| High                      | BLE        | 2483.5                    | 57.3                    | 71.3                   | -14.0       |

**Figure 20 Band Edge Spectrum**

JUDGEMENT: Passed by 14.0 dB

For additional information see *Figure 21* and *Figure 22*.

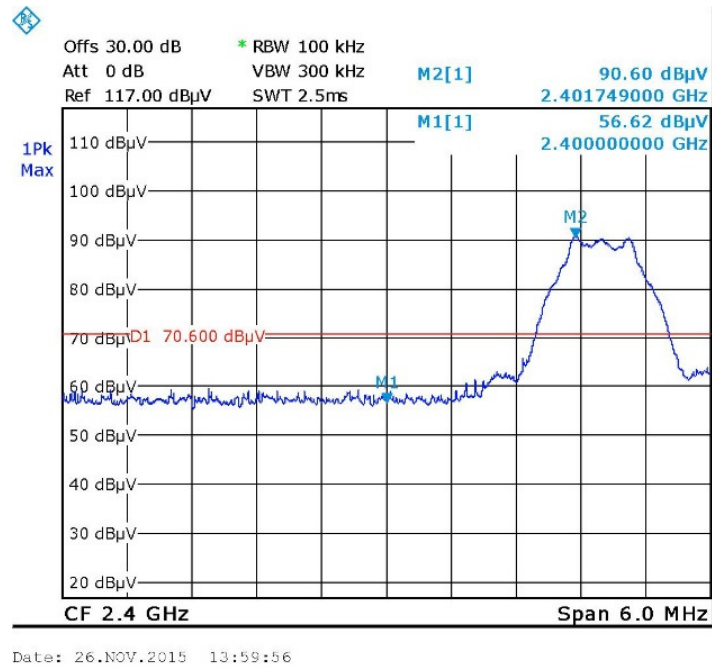


Figure 21 —Lower Band Edge

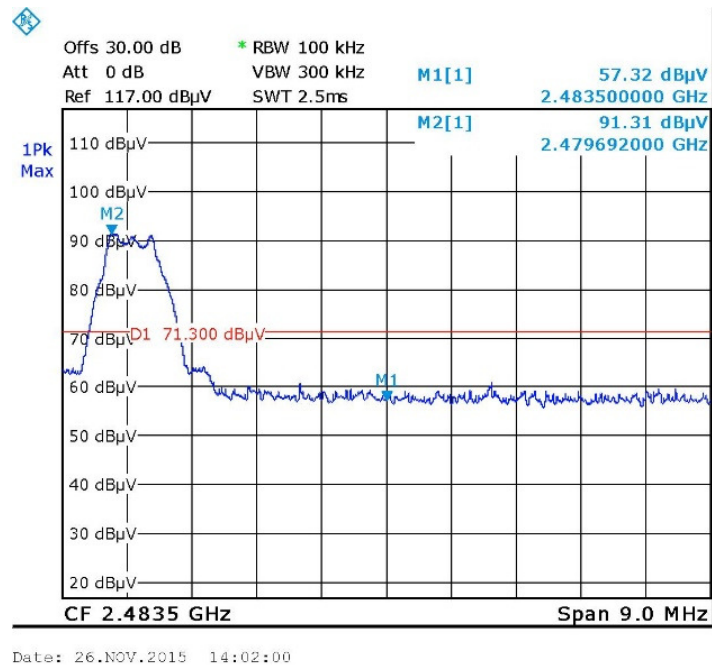


Figure 22 —Upper Band Edge



#### 7.4 *Test Equipment Used; Band Edge Spectrum*

| Instrument                  | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Date |
|-----------------------------|--------------|-------|------------|-----------------------|-----------------------|
| EMI Receiver                | R&S          | FSL6  | 100194     | January 1, 2015       | January 1, 2016       |
| Horn Antenna                | ETS          | 3115  | 6142       | May 19, 2015          | May 19, 2018          |
| Semi Anechoic Civil Chamber | ETS          | S81   | SL 11643   | N/A                   | N/A                   |

**Figure 23 Test Equipment Used**

## 8. Emissions in Non-Restricted Frequency Bands

### 8.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

### 8.2 Test Procedure

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

#### **For 0.009MHz-1000MHz range:**

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 configuration tested is shown in *Figure 2*.

The frequency range 0.009 MHz-1000 MHz was scanned.

RBW was set to 100 kHz.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

In the frequency range of 9 kHz – 30 MHz, the center of the loop antenna height was one meter above the ground.

In the frequency range of 30 MHz – 1000 MHz the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

#### **For 1000MHz-25000MHz 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 2*.

The frequency range 1000 MHz - 25000 MHz was scanned.

RBW was set to 100 kHz.

In the frequency range 30 – 7000 MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 7000 MHz -25000 MHz, a spectrum analyzer including a low noise amplifier was used.

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

For all final evaluations the distance was 3 meters.

The E.U.T. was operated at the low, mid and high channels (2402.0 MHz, 2440 MHz and 2480.0 MHz).

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.



### **8.3 Test Results**

JUDGEMENT: Passed

All detected emissions were greater than 20dBc below the fundamental level.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) specification.

#### 8.4 *Test Instrumentation Used, Emission in Non Restricted Frequency Bands*

| Instrument                  | Manufacturer    | Model        | Serial No.    | Last Calibration Date | Next Calibration Date |
|-----------------------------|-----------------|--------------|---------------|-----------------------|-----------------------|
| EMI Receiver                | R&S             | ESCI7        | 100724        | January 4, 2015       | January 31, 2016      |
| Spectrum Analyzer           | HP              | 8592L        | 3826A01204    | March 4, 2015         | March 3, 2016         |
| EMI Receiver                | HP              | 8542E        | 3906A00276    | March 11, 2015        | March 31, 2016        |
| RF Filter Section           | HP              | 85420E       | 3705A00248    | March 19, 2015        | March 31, 2016        |
| Spectrum Analyzer           | HP              | 8564E        | 3442A00275    | March 11, 2015        | March 31, 2016        |
| Biconical Antenna           | EMCO            | 3104         | 2606          | December 28, 2014     | December 28, 2015     |
| Active Loop Antenna         | EMCO            | 6502         | 9506-2950     | November 4, 2015      | November 4, 2016      |
| Log Periodic Antenna        | EMCO            | 3146         | 9505-4081     | December 28, 2014     | December 28, 2015     |
| Horn Antenna                | ETS             | 3115         | 29845         | May 19, 2015          | May 19, 2018          |
| Horn Antenna                | ARA             | SWH-28       | 1007          | March 3, 2014         | March 30, 2016        |
| Low Noise Amplifier         | Narda           | DBS-0411N313 | 13            | March 1, 2015         | March 1, 2016         |
| Low Noise Amplifier         | Sophia Wireless | LNA28-B      | 232           | March 1, 2015         | March 1, 2016         |
| Spectrum Analyzer           | HP              | 8593EM       | 3536A00120ADI | February 24, 2015     | February 28, 2016     |
| Semi Anechoic Civil Chamber | ETS             | S81          | SL 11643      | N/A                   | March 1, 2016         |
| 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 24 Test Equipment Used**

## 8.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", using the following equation:

$$FS = RA + AF + CF$$

|     |                                            |
|-----|--------------------------------------------|
| FS: | Field Strength [dB $\mu$ v/m]              |
| RA: | Receiver Amplitude [dB $\mu$ v]            |
| AF: | Receiving Antenna Correction Factor [dB/m] |
| CF: | Cable Attenuation Factor [dB]              |

Example:  $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are used.

## 9. Emissions in Restricted Frequency Bands

### 9.1 Test Specification

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

### 9.2 Test Procedure

#### **For 0.009MHz-1000MHz range:**

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 configuration tested is shown in Figure 2.

The frequency range 0.009 MHz-1000 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

In the frequency range of 9 kHz – 30 MHz, the center of the loop antenna height was one meter above the ground.

In the frequency range of 30 MHz – 1000 MHz the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

#### **For 1000MHz-25000MHz 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 2.

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.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

In the frequency range 30-7000MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 7000M-25000 MHz, a spectrum analyzer including a low noise amplifier was used.

For all final evaluations, the distance was 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 25 Table of Limits**

### 9.3 Test Results

JUDGEMENT: Passed by 5.1dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 8.0dB at the frequency of 2390.0 MHz, vertical polarization.

For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is in the worst case 9.6 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 5.1dB 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 26* to *Figure 27*.

## Radiated Emission

E.U.T Description    Irrigation Controller  
Type                      11000BT-SN  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 0.009MHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak

| Operation<br>Frequency | Freq.  | Polarity | Peak<br>Reading | Peak.<br>Specification | Peak.<br>Margin |
|------------------------|--------|----------|-----------------|------------------------|-----------------|
| (MHz)                  | (MHz)  | (H/V)    | (dB $\mu$ V/m)  | (dB $\mu$ V/m)         | (dB)            |
| 2402.0                 | 2390.0 | H        | 60.5            | 74.0                   | -13.5           |
| 2402.0                 | 2390.0 | V        | 61.5            | 74.0                   | -12.5           |
| 2402.0                 | 4804.0 | H        | 61.5            | 74.0                   | -12.5           |
| 2402.0                 | 4804.0 | V        | 63.6            | 74.0                   | -10.4           |
| 2440.0                 | 4880.0 | H        | 63.5            | 74.0                   | -10.5           |
| 2440.0                 | 4880.0 | V        | 64.4            | 74.0                   | -9.6            |
| 2480.0                 | 4960.0 | H        | 62.6            | 74.0                   | -11.4           |
| 2480.0                 | 4960.0 | V        | 62.9            | 74.0                   | -11.1           |
| 2480.0                 | 2483.5 | H        | 66.2            | 74.0                   | -7.8            |
| 2480.0                 | 2483.5 | V        | 67.7            | 74.0                   | -6.3            |

**Figure 26. 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    Irrigation Controller  
Type                    11000BT-SN  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical  
Test Distance: 3 meters

Frequency range: 0.009MHz to 25.0 GHz  
Detector: Average

| Operation Frequency<br>(MHz) | Freq.<br>(MHz) | Polarity<br>(H/V) | Average Reading<br>(dBμ V/m) | Average Specification<br>(dB μ V/m) | Average Margin<br>(dB) |
|------------------------------|----------------|-------------------|------------------------------|-------------------------------------|------------------------|
| 2402.0                       | 2390.0         | H                 | 45.1                         | 54.0                                | -8.9                   |
| 2402.0                       | 2390.0         | V                 | 46.0                         | 54.0                                | -8.0                   |
| 2402.0                       | 4804.0         | H                 | 41.7                         | 54.0                                | -12.3                  |
| 2402.0                       | 4804.0         | V                 | 42.6                         | 54.0                                | -11.4                  |
| 2440.0                       | 4880.0         | H                 | 42.4                         | 54.0                                | -11.6                  |
| 2440.0                       | 4880.0         | V                 | 42.7                         | 54.0                                | -11.3                  |
| 2480.0                       | 4960.0         | H                 | 40.5                         | 54.0                                | -13.5                  |
| 2480.0                       | 4960.0         | V                 | 41.6                         | 54.0                                | -12.4                  |
| 2480.0                       | 2483.5         | H                 | 47.0                         | 54.0                                | -7.0                   |
| 2480.0                       | 2483.5         | V                 | 48.9                         | 54.0                                | -5.1                   |

**Figure 27. 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 Date |
|-----------------------------|-----------------|--------------|---------------|-----------------------|-----------------------|
| EMI Receiver                | R&S             | ESCI7        | 100724        | January 4, 2015       | January 31, 2016      |
| Spectrum Analyzer           | HP              | 8592L        | 3826A01204    | March 4, 2015         | March 3, 2016         |
| EMI Receiver                | HP              | 8542E        | 3906A00276    | March 11, 2015        | March 31, 2016        |
| RF Filter Section           | HP              | 85420E       | 3705A00248    | March 19, 2015        | March 31, 2016        |
| Spectrum Analyzer           | HP              | 8564E        | 3442A00275    | March 11, 2015        | March 31, 2016        |
| Biconical Antenna           | EMCO            | 3104         | 2606          | December 28, 2014     | December 28, 2015     |
| Active Loop Antenna         | EMCO            | 6502         | 9506-2950     | November 4, 2015      | November 4, 2016      |
| Log Periodic Antenna        | EMCO            | 3146         | 9505-4081     | December 28, 2014     | December 28, 2015     |
| Horn Antenna                | ETS             | 3115         | 29845         | May 19, 2015          | May 19, 2018          |
| Horn Antenna                | ARA             | SWH-28       | 1007          | March 3, 2014         | March 30, 2016        |
| Low Noise Amplifier         | Narda           | DBS-0411N313 | 13            | March 1, 2015         | March 1, 2016         |
| Low Noise Amplifier         | Sophia Wireless | LNA28-B      | 232           | March 1, 2015         | March 1, 2016         |
| Spectrum Analyzer           | HP              | 8593EM       | 3536A00120ADI | February 24, 2015     | February 28, 2016     |
| Semi Anechoic Civil Chamber | ETS             | S81          | SL 11643      | N/A                   | March 1, 2016         |
| 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 28 Test Equipment Used**

## 10. Transmitted Power Density

### 10.1 Test Specification

FCC, Part 15, Subpart C, Section 247(e)

### 10.2 Test Procedure

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

The E.U.T was tested 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 2*.

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

The E.U.T was evaluated in 3 channels: Low (2402MHz), Mid (2440MHz) and High (2480MHz).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \quad [W]$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

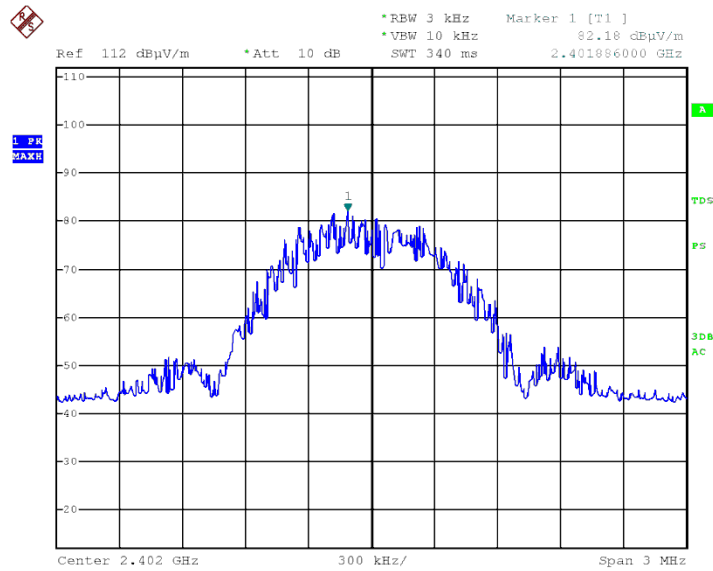
### 10.3 Test Results

| Operation Frequency<br>(MHz) | Reading Spectrum Analyzer<br>(dBμV/m) | Reading Spectrum Analyzer<br>(dBm) | Specification<br>(dBm) | Margin<br>(dB) |
|------------------------------|---------------------------------------|------------------------------------|------------------------|----------------|
| 2402.0                       | 82.8                                  | -12.4                              | 8.0                    | -20.4          |
| 2440.0                       | 80.4                                  | -14.8                              | 8.0                    | -22.8          |
| 2480.0                       | 80.7                                  | -14.5                              | 8.0                    | -22.5          |

Figure 29 Test Results

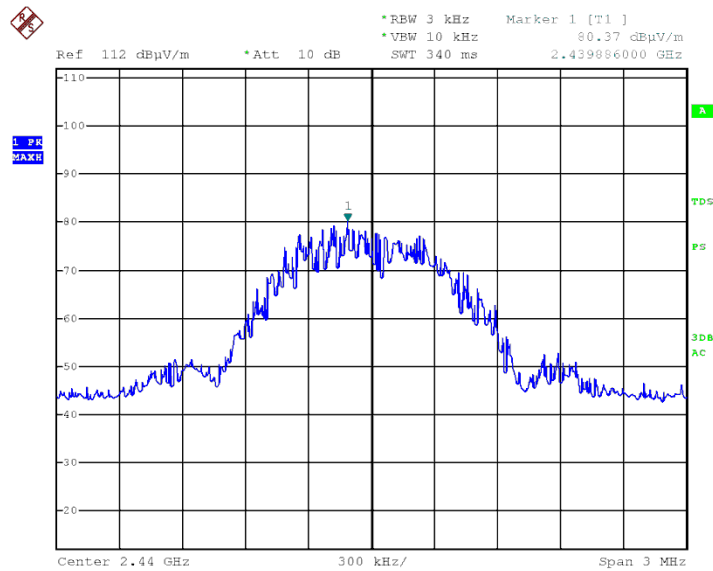
JUDGEMENT: Passed by dB

For additional information see *Figure 30* to *Figure 32*.



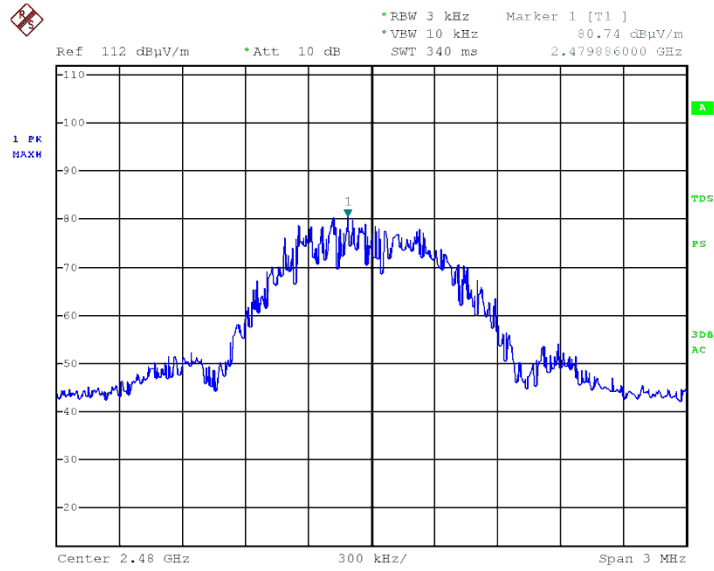
Date: 6.DEC.2015 13:50:07

Figure 30 — 2402.0 MHz



Date: 6.DEC.2015 13:47:38

Figure 31 — 2440.0 MHz



Date: 6.DEC.2015 12:24:08

**Figure 32 — 2480.0 MHz**



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

| Instrument                  | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Date |
|-----------------------------|--------------|-------|------------|-----------------------|-----------------------|
| EMI Receiver                | R&S          | ESCI7 | 100724     | January 1, 2015       | January 31, 2016      |
| Horn Antenna                | ETS          | 3115  | 29845      | May 19, 2015          | May 19, 2018          |
| Semi Anechoic Civil Chamber | ETS          | S81   | SL 11643   | N/A                   | N/A                   |

**Figure 33 Test Equipment Used**



## 11. Antenna Gain/Information

The antenna gain is -5.0 dBi, integral.

## 12. R.F Exposure/Safety

Typical use of the E.U.T. is as a Bluetooth irrigation controller.

The typical placement of the E.U.T. is outside in field/garden. The typical distance between the E.U.T. and the user is 20 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 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<sub>t</sub>- Transmitted Power 98.4 dBuV/m (Peak) 2.09mW (testing performed radiated; power results include antenna gain)

G<sub>T</sub>- Antenna Gain, -5.0 dBi

R- Distance from Transmitter using 20cm worst case

(c) The peak power density is:

$$S = \frac{(2.09)}{4\pi(20)^2} = 4.16 \times 10^{-4} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

## 13. APPENDIX A - CORRECTION FACTORS

### 13.1 Correction factors for CABLE from EMI receiver

to test antenna  
at 3 meter range.

| Frequency<br>(MHz) | Cable<br>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<br>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



**13.2 Correction factors for**

**Horn Antenna**

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

| <b>FREQUENCY</b><br>(GHz) | <b>APE</b><br>(dB /m) | <b>Gain</b><br>(dB1) |
|---------------------------|-----------------------|----------------------|
| 18.0                      | 40.3                  | 16.1                 |
| 19.0                      | 40.3                  | 16.3                 |
| 20.0                      | 40.3                  | 16.1                 |
| 21.0                      | 40.3                  | 16.3                 |
| 22.0                      | 40.4                  | 16.8                 |
| 23.0                      | 40.5                  | 16.4                 |
| 24.0                      | 40.5                  | 16.6                 |
| 25.0                      | 40.5                  | 16.7                 |
| 26.0                      | 40.6                  | 16.4                 |

**13.3 Correction factors for Horn ANTENNA.**  
**Model: 3115**  
**Antenna serial number: 6142**  
**3 meter range**

| <b>FREQUENCY</b> | <b>Antenna Factor</b> | <b>FREQUENCY</b> | <b>Antenna Factor</b> |
|------------------|-----------------------|------------------|-----------------------|
| <b>(MHz)</b>     | <b>(dB/m)</b>         | <b>(MHz)</b>     | <b>(dB/m)</b>         |
| <b>1000</b>      | <b>23.9</b>           | <b>10500</b>     | <b>38.4</b>           |
| <b>1500</b>      | <b>25.4</b>           | <b>11000</b>     | <b>38.5</b>           |
| <b>2000</b>      | <b>27.3</b>           | <b>11500</b>     | <b>39.4</b>           |
| <b>2500</b>      | <b>28.5</b>           | <b>12000</b>     | <b>39.2</b>           |
| <b>3000</b>      | <b>30.4</b>           | <b>12500</b>     | <b>39.4</b>           |
| <b>3500</b>      | <b>31.6</b>           | <b>13000</b>     | <b>40.7</b>           |
| <b>4000</b>      | <b>33</b>             | <b>14000</b>     | <b>42.1</b>           |
| <b>4500</b>      | <b>32.7</b>           | <b>15000</b>     | <b>40.1</b>           |
| <b>5000</b>      | <b>34.1</b>           | <b>16000</b>     | <b>38.2</b>           |
| <b>5500</b>      | <b>34.5</b>           | <b>17000</b>     | <b>41.7</b>           |
| <b>6000</b>      | <b>34.9</b>           | <b>17500</b>     | <b>45.7</b>           |
| <b>6500</b>      | <b>35.1</b>           | <b>18000</b>     | <b>47.7</b>           |
| <b>7000</b>      | <b>35.9</b>           |                  |                       |
| <b>7500</b>      | <b>37.5</b>           |                  |                       |
| <b>8000</b>      | <b>37.6</b>           |                  |                       |
| <b>8500</b>      | <b>38.3</b>           |                  |                       |
| <b>9000</b>      | <b>38.5</b>           |                  |                       |
| <b>9500</b>      | <b>38.1</b>           |                  |                       |
| <b>10000</b>     | <b>38.6</b>           |                  |                       |

**13.4 Correction factors for Horn ANTENNA.**  
**Model: 3115**  
**Antenna serial number: 29845**  
**10 meter range**

| FREQUENCY | AFE    | FREQUENCY | AFE    |
|-----------|--------|-----------|--------|
| (MHz)     | (dB/m) | (MHz)     | (dB/m) |
| 1000      | 22.4   | 10000     | 36.1   |
| 2000      | 25.2   | 11000     | 37.0   |
| 3000      | 31.1   | 12000     | 41.3   |
| 4000      | 30.2   | 13000     | 38.1   |
| 5000      | 34.2   | 14000     | 41.7   |
| 6000      | 31.6   | 15000     | 39.0   |
| 7000      | 34.7   | 16000     | 38.8   |
| 8000      | 34.8   | 17000     | 43.2   |
| 9000      | 36.2   | 18000     | 43.7   |

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

#### CALIBRATION DATA

| Frequency, MHz | Antenna factor, dB/m <sup>1)</sup> |
|----------------|------------------------------------|
| 200            | 11.55                              |
| 250            | 11.60                              |
| 300            | 14.43                              |
| 400            | 15.38                              |
| 500            | 17.98                              |
| 600            | 18.78                              |
| 700            | 21.17                              |
| 800            | 21.16                              |
| 900            | 22.67                              |
| 1000           | 24.09                              |

<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.

### 13.7 Correction factors for *Biconical Antenna EMCO, Model 3104, Serial #2606*

CALIBRATION DATA

| Frequency, MHz | Near free space antenna factor, dB/m | Geometry specific correction factor, dB | Free space antenna factor, dB/m <sup>1)</sup> |
|----------------|--------------------------------------|-----------------------------------------|-----------------------------------------------|
| 30             | 12.97                                | 0.13                                    | 12.84                                         |
| 35             | 12.34                                | 0.09                                    | 12.25                                         |
| 40             | 12.03                                | 0.06                                    | 11.97                                         |
| 45             | 11.42                                | 0.02                                    | 11.40                                         |
| 50             | 11.91                                | 0.03                                    | 11.88                                         |
| 60             | 11.92                                | 0.37                                    | 11.55                                         |
| 70             | 9.60                                 | 0.25                                    | 9.35                                          |
| 80             | 6.99                                 | -0.45                                   | 7.44                                          |
| 90             | 10.87                                | -0.34                                   | 11.21                                         |
| 100            | 11.51                                | -0.06                                   | 11.57                                         |
| 120            | 13.30                                | 0.20                                    | 13.10                                         |
| 140            | 12.56                                | -0.01                                   | 12.57                                         |
| 160            | 14.49                                | -0.12                                   | 14.61                                         |
| 180            | 16.53                                | 0.05                                    | 16.48                                         |
| 200            | 15.30                                | 0.15                                    | 15.15                                         |

<sup>1)</sup> The antenna factor shall be added to receiver reading in dBμV to obtain field strength in dBμV/m.

### 13.8 Correction factors for **ACTIVE LOOP ANTENNA**

**Model 6502**

**S/N 9506-2950**

| <b>FREQUENCY</b> | <b>Magnetic Antenna Factor</b> | <b>Electric Antenna Factor</b> |
|------------------|--------------------------------|--------------------------------|
| (MHz)            | (dB)                           | (dB)                           |
| .009             | -35.1                          | 16.4                           |
| .010             | -35.7                          | 15.8                           |
| .020             | -38.5                          | 13.0                           |
| .050             | -39.6                          | 11.9                           |
| .075             | -39.8                          | 11.8                           |
| .100             | -40.0                          | 11.6                           |
| .150             | -40.0                          | 11.5                           |
| .250             | -40.0                          | 11.6                           |
| .500             | -40.0                          | 11.5                           |
| .750             | -40.1                          | 11.5                           |
| 1.000            | -39.9                          | 11.7                           |
| 2.000            | -39.5                          | 12.0                           |
| 3.000            | -39.4                          | 12.1                           |
| 4.000            | -39.7                          | 11.9                           |
| 5.000            | -39.7                          | 11.8                           |
| 10.000           | 40.2                           | 11.3                           |
| 15.000           | -40.7                          | 10.8                           |
| 20.000           | -40.5                          | 11.0                           |
| 25.000           | -41.3                          | 10.2                           |
| 30.000           | 42.3                           | 9.2                            |