

# EMI – TEST REPORT

- Human Exposure -

**Type / Model Name** : EBI 10-System (IF 100, IF 100-1, IF 150, IF 200)

**Product Description** : Wireless data logger system

**Applicant** : Xylem Analytics Germany GmbH

**Address** : Dr.-Karl-Slevogt-Strasse 1

82362 WEILHEIM, GERMANY

**Manufacturer** : Xylem Analytics Germany GmbH

**Address** : Dr.-Karl-Slevogt-Strasse 1

82362 WEILHEIM, GERMANY

**Licence holder** : Xylem Analytics Germany GmbH

**Address** : Dr.-Karl-Slevogt-Strasse 1

82362 WEILHEIM, GERMANY

**Test Result** according to the standards  
listed in clause 1 test standards:

**POSITIVE**

**Test Report No. :** **T40058-00-12HS**

23. August 2016

Date of issue



Deutsche  
Akkreditierungsstelle  
D-PL-12030-01-01  
D-PL-12030-01-02

The test report merely corresponds to the test sample.  
It is not permitted to copy extracts of these test results  
without the written permission of the test laboratory.

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ATTACHMENT A as separte supplement

## 1 TEST STANDARDS

The tests were performed according to following standards:

### **FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969**

Part 1, Subpart I, Section 1.1310                      Radiofrequency radiation exposure limits

Part 1, Subpart 2, Section 2.1091                      Radiofrequency radiation exposure evaluation: **mobile devices**.

Part 1, Subpart 2, Section 2.1093                      Radiofrequency radiation exposure evaluation: **portable devices**.

### **OET Bulletin 65, 65A, 65B Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.**

KDB 447498 D01 v05r02                      Mobile and portable devices RF Exposure procedures and equipment authorisation policies, February 7, 2014.

KDB 865664 D01                      SAR Measurement Requirements for 100 MHz to 6 GHz, February 7, 2014.

ANSI C95.1: 2005                      IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

ETSI TR 100 028 V1.3.1: 2001-03,                      Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

## **2 EQUIPMENT UNDER TEST**

### **2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT A**

### **2.2 Equipment type**

ZigBee, fixed station

### **2.3 Short description of the equipment under test (EUT)**

Interface for data logging system. The system consists of a fixed interface and one up to 4 mobile data logger (EBI10 Series, EBI100 Series). The interface identifies a logger in the programming slot via 13.56 MHz RFID-Transceiver. In the mobile data logger is a RFID-Tag only. A 2.4 GHz "ZigBee" port (Chipset according IEEE 802.15.4) is used for data exchange, communication and programming the data logger. The power supply as stand alone system is normally via USB, cascaded up to max. 3 systems the 15 VDC power supply have to be used.

Number of tested samples: 1

Serial number, IF200: 20007277, Firmware number: 2.08

#### **EUT configuration:**

(The CDF filled by the applicant can be viewed at the test laboratory.)

### **2.4 Variants of the EUT**

Variant	Device-Name	Comment	Antenna
I01	IF200	Interface	external
I02	IF100	Interface	external
I03	IF100-1	Interface	integrated
I04	IF150	Interface	integrated
I05	IF300	Interface	integrated

Note: The interface IF 200 is selected for test.

### **2.5 Operation frequency and channel plan**

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan:

Channel	Frequency	Channel	Frequency
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

Note: the marked frequencies are determined for final testing.

## 2.6 Transmit operating modes

The EUT allows the user to switch the transmission on or off. There are no further operating modes.

The EUT use O-QPSK modulation and may provide following data rate:

- 250 kbps (kbps = *kilobits per second*)

## 2.7 Antenna

The following antennas shall be used with the EUT:

Number	Type	Certification name	Plug	Frequency range (GHz)	Gain (dBi)
1	Omni	AN2400-1901RS (Monopole)	SMA-R	2.4	5
2	Omni	AL 112 (Monopole)	SMA-R	2.4	-7.8
3	Omni	rod antenna (Monopole)	SMA-R	2.4	2
4	Omni	PCB meander antenna (Inverted F)	none	2.4	5

## 2.8 Power supply system utilised

Power supply voltage,  $V_{nom}$  : 15 VDC (external AC mains adapter)

Power supply voltage (alternative) : USB supply voltage 5 VDC

## 2.9 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- USB-Cable (host to client) 1 m Model : As usual in trade
- Notebook for control Model : Toshiba
- Power supply, 100 V-230 VAC, 15 VDC Model : GlobTek, GT-41080-1817-9-2-9

## 2.10 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X-position. The tests are carried out in the following frequency band:

**2400 MHz – 2483.5 MHz**

Preliminary tests are performed to find the worst case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate. The output power can not be set.

**For the final test the following channels and test modes are selected:**

IEEE Standard	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.15.4	11 to 26	11, 18, 26	Pmax	DSSS	O-QPSK	250 kbps

- TX continuous mode

### 2.11 Test jig

No special test jig is used for testing.

### 2.12 Test software

For testing, the interface is set in TX-continuous mode. The test software is available for testing only.

### **3 TEST RESULT SUMMERY**

WLAN device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz and 5725 MHz – 5850 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.247(i)	RSS 102, 2.5.2	MPE	passed
KDB 447498	RSS 102, 2.5.1	SAR exclusion consideration	not applicable
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	not applicable

The mentioned RSS Rule Parts in the above table are related to:  
RSS 102, Issue 5, March 2015

#### **3.1 Final assessment**

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 24 May 2016

Testing concluded on : 15 June 2016

Checked by:

Tested by:

\_\_\_\_\_  
Klaus Gegenfurtner  
Teamleader Radio

\_\_\_\_\_  
Hermann Smetana  
Radio Team

## **4 TEST ENVIRONMENT**

### **4.1 Address of the test laboratory**

**CSA Group Bayern GmbH  
Ohmstrasse 1-4  
94342 STRASSKIRCHEN  
GERMANY**

### **4.2 Environmental conditions**

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 °C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

### **4.3 Statement of the measurement uncertainty**

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor  $k = 2$ . The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	$\pm 3.29$ dB
20 dB Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
99% Occupied Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	$\pm 3.53$ dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	$\pm 3.71$ dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	$\pm 2.34$ dB
Peak conducted output power	902 MHz to 928 MHz	95%	$\pm 0.35$ dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	$\pm 2.15$ dB



## 4.1 Measurement protocol for FCC and ISED

### 4.1.1 General information

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

**IC 3009A-1**

The Anechoic chamber is a listed test site under the Canadian Test-Sites File-No:

**IC 3009A-2**

In compliance with RSS 247 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the CISPR 22 limits.

## 5 TEST CONDITIONS AND RESULTS

### 5.1 Maximum peak conducted output power

For test instruments and accessories used see section 6 Part **CPC 3**.

#### 5.1.1 Description of the test location

Test location: NONE

According to FCC Part 15, Section 15.247(b)(3):

For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

#### 5.1.2 Description of Measurement

The maximum peak conducted output power is measured using a spectrum analyser following the procedure set out in KDB 558074, item 9.1.1. The EUT is set in TX continuous mode while measuring.

#### 5.1.3 Test result

802.15.4, 250 kbps, TX		Test results		
		A (dBm)	Peak power limit (dBm)	Margin (dB)
Lowest frequency: CH11				
$T_{nom}$	$V_{nom}$	-2.6	30.0	-32.6
Middle frequency: CH18				
$T_{nom}$	$V_{nom}$	-2.2	30.0	-32.2
Highest frequency: CH26				
$T_{nom}$	$V_{nom}$	-1.4	30.0	-31.4

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	30	1.0
<b>2400-2483.5</b>	<b>30</b>	<b>1.0</b>
5725-5850	30	1.0

The requirements are **FULFILLED**.

**Remarks:** This test result is taken from test report T40058-00-10HS by CSA Group Bayern GmbH.

## 6 HUMAN EXPOSURE

### 6.1 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPC 3**.

#### 6.1.1 Description of the test location

Test location: NONE

#### 6.1.2 Applicable standard

According to FCC Part 15, Section 15.247(i):

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

#### 6.1.3 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, can be calculated the MPE in a defined distance away from the product.

Friis transmission formula:

$$P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

Where:

$P_d$  = power density (mW/cm<sup>2</sup>)

$P_{out}$  = output power to antenna (mW)

$G$  = gain of antenna (linear scale)

$r$  = distance between antenna and observation point (cm)

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device. The EUT is designed to be used that radiating structures are 20 cm outside of the body of the user. ( $r = 20$  cm)

**6.1.4 Test result**

According FCC:

Channel No.	Power	A (dBm)	Antgain (dBi)	A (mW)	G linear	P (W)	S (mW/cm <sup>2</sup> )	Limit S <sub>eq</sub> (mW/cm <sup>2</sup> )	Margin (mW/cm <sup>2</sup> )
11	max	0.0	5.0	1.00	3.16	0.0032	0.0006	1.0	-0.9994
18	max	0.0	5.0	1.00	3.16	0.0032	0.0006	1.0	-0.9994
26	max	0.0	5.0	1.00	3.16	0.0032	0.0006	1.0	-0.9994

According ISED:

Channel No.	Power	A (dBm)	Antgain (dBi)	A (mW)	G linear	P (W)	S (mW/cm <sup>2</sup> )	Limit S <sub>eq</sub> (mW/cm <sup>2</sup> )	Margin (mW/cm <sup>2</sup> )
11	max	0.0	5.0	1.00	3.16	0.0032	0.0006	0.54	-0.5394
18	max	0.0	5.0	1.00	3.16	0.0032	0.0006	0.54	-0.5394
26	max	0.0	5.0	1.00	3.16	0.0032	0.0006	0.54	-0.5394

Limits for maximum permissible exposure (MPE) according FCC:

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(B) Limits for General Population / Uncontrolled Exposure</b>				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/ <i>f</i>	2.19/ <i>f</i>	180/ <i>f</i> <sup>2</sup>	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	<i>f</i> /1500	30
<b>1500-100000</b>	---	---	<b>1.0</b>	<b>30</b>

*f* = Frequency in MHz

Limits for maximum permissible exposure (MPE) according RSS 102, 2.5.2:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-1021	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> <sup>0.5</sup>	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> <sup>0.25</sup>	0.1540/ <i>f</i> <sup>0.25</sup>	8.944/ <i>f</i> <sup>0.5</sup>	6
48-300	22.06	0.05852	1,291	6
<b>300-6000</b>	<b>3.142 <i>f</i><sup>0.3417</sup></b>	<b>0.008335 <i>f</i><sup>0.3417</sup></b>	<b>0.02619 <i>f</i><sup>0.6834</sup></b>	<b>6</b>
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> <sup>1.2</sup>
150000-300000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616000/ <i>f</i> <sup>1.2</sup>

Note: *f* is frequency in MHz. \*Based on nerve stimulation (NS). \*\* Based on specific absorption rate (SAR)

The requirements are **FULFILLED**.

**Remarks:**     The output power used is the maximum rated output power. No averaging over time is done.

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## 6.2 Co-location and Co-transmission

**Applicable standard:**

OET Bulletin 65, Edition 97-01, Section 2: Multiple-transmitter sites and Complex Environments

The FCC's MPE limits vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100 % in terms of percentage.

- |                                |  |
|--------------------------------|--|
| 1. Magnetic field of System 1: | $H_{\max} = 0.021 \text{ A/m}$<br>Limit: 0.16 A/m<br>Fraction of H-field: 13.4 %           |
| 2. MPE of System 2:            | $P_d = 0.0006 \text{ mW/cm}^2$<br>Limit: 1.0 mW/cm <sup>2</sup><br>Fraction of MPE: 0.06 % |

The requirements are **FULFILLED**.

Remarks:

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## **7 USED TEST EQUIPMENT AND ACCESSORIES**

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
-	-	-	-	-	-	-