

Test Report Cover Sheet

10061323 001

for SIGFOX 21F65A



according to

SIGFOX certification for End Products
Test Specification for certification labs
Rev. 1.1 Date: 26th August 2016

This cover sheet is not part of the test report and does not carry a page number.

Prüfbericht-Nr.: <i>Test Report No.:</i>	10061323 001	Auftrags-Nr.: <i>Order No.:</i>	114065594	Seite 2 von 14 Page 2 of 14	
Kunden Referenz-Nr.: <i>Client Reference No.:</i>	21F65A	Auftragsdatum: <i>Order date:</i>	2017-06-03		
Auftraggeber: <i>Client:</i>	SIGFOX Ready TM Certification Ms Brigitte Ray 425, rue Jean Rostand – 31670 Labège France				
Prüfgegenstand: <i>Test item:</i>	The Oyster Sigfox device from Digital Matter				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	21F65A				
Auftrags-Inhalt: <i>Order content:</i>	Reference test according to SIGFOX specification				
Prüfgrundlage: <i>Test specification:</i>	SIGFOX certification for End Products, Test Specification for certification labs, Rev. 1.1, Date: 26th August 2016				
Wareneingangsdatum: <i>Date of receipt:</i>	2017-06-06				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000562728-001				
Prüfzeitraum: <i>Testing period:</i>	2017-06-09 - 2017-06-16				
Ort der Prüfung: <i>Place of testing:</i>	Taipei				
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland Taiwan Ltd.				
Prüfergebnis: <i>Test results:</i>	PASS				
Geprüft von <i>Tested by:</i>	Kontrolliert von <i>Reviewed by:</i>				
2017-06-19 Stanislas Charles, Test Engineer	2017-06-19 Arvin Ho, Reviewer				
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sontiges / Other:					
The test was performed as a reference test. For details refer to page 4 of this report.					
The test result "PASS" above refers indicates that test have been conducted according to the Sigfox specifications. No PASS / FAIL criteria have been given.					
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark</i>					

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1 EXECUTIVE SUMMARY

TÜV Rheinland is an international TIC (testing, inspection and certification) organization supporting the international community with necessary requirements for promoting safety, performance and quality in many industry verticals. TÜV Rheinland has been assigned and authorized by SIGFOX as a preferred test lab to undertake testing to their requirements as stated below. Please find in this report the details of the EUT and subsequent testing undertaken with final conclusions in terms of test results.

TÜV Rheinland provides the following test case results summary in accordance with SIGFOX requirements.

Test	RF Test	Performed	Test-Setup	OP. Mode	Verdict Pass/Fail
A1	Effective Radiated Power in 2 dimensions	Yes	1	CW	Pass
A2	Radiation pattern in 2 dimensions	Yes	1	CW	Pass
B1	Effective Radiated Power in 3 dimensions	Not Requested	---	---	---
B2	Radiation pattern in 3 dimensions	Not Requested	---	---	---
C 1	Spurious emissions – radiated	Not Requested	---	---	---
C2	Spurious emissions - conducted if required	Not Requested	---	---	---
D	Sensitivity radiated	Not Requested	---	---	---

Notes: - B1/B2/C1/C2/D not requested for this project by SIGFOX

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2 PRODUCT INFORMATION

General information

Description:	The product is a battery operated Sigfox radio transmitter with a PCB antenna.
Manufacturer Serial Number	21F65A
Hardware version:	Not specified
Software version:	Not specified
Contact person:	Brigitte Ray
E-mail:	brigitte.ray@sigfox.com

SIGFOX Information

Type of EUT A	Battery operated Sigfox transmitter
Auxiliary Equipment	None
Test-Setup 1	EUT A
Device Class	Not specified
Geographical area of operation	Not specified
Operating frequency	868.13MHz
Output Power	Not specified
Number / Type of Antenna(s)	PCB
Antenna Gain	1.5dBi
Modulation	DBPSK (non spreading)
Testing modulation (Op. mode)	<input type="checkbox"/> Modulated <input checked="" type="checkbox"/> Unmodulated [Continuous Wave (CW)]
Duty Cycle	100 %
Power supply	<input checked="" type="checkbox"/> DC <input checked="" type="checkbox"/> Battery <input type="checkbox"/> AC
Voltage	Not specified(Using 3 batteries, type:AA)

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Submitted Documents

- N/A

Remarks

This test was performed as a reference test upon customer's requirements. Only transmitter tests were conducted.

Requested tests:

- EIRP effective radiated power in vertical and horizontal polarization(CW mode)
- Radiation pattern in both polarizations (CW mode)

All tests have been performed in CW mode.

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3 TEST EQUIPMENT

Kind of Equipment	Manufacturer	Model Name	Serial Number	Cal. Interval	Cal. Date	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	FSV-40	101112	1 year	2016/09/22	2017/09/22
Signal Generator	Rohde & Schwarz	SMB 100A	104167	1 year	2016/09/01	2017/09/01
Bilog Antenna	TESEQ	CBL6111D	29804	1 year	2016/06/23	2017/06/23
Horn Antenna	Com-Power	AH-840	101031	1 year	2016/11/22	2017/11/22

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.

4 MEASUREMENT UNCERTAINTY

Measurement Type	Frequency	Uncertainty
Radiated Emission (966 Semi-Anechoic Chamber with absorber on the floor: 3m)	30MHz - 1GHz	2.82dB
	> 1GHz	2.42dB

5 TEST SET-UP AND OPERATION MODES

Test Methodology

Radio: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Operation Modes

The basic operation mode used for testing is:

- A. EUT transmits an unmodulated signal at nominal frequency (868.13MHz) with 100% duty cycle.

The EUT was operated on battery power and not connected to any external equipment during the test. It was taken care that the battery was sufficiently charged to not influence the test result.

6 TEST RESULTS

Radiation Pattern (2D) and EIRP

Date of testing: 2017-06-16
Ambient temperature: 24°C
Relative humidity: 26%
Reference standard: ETSI EN 300 220(*)
and SIGFOX certification for End Products, Rev. 1.1

Test procedure: ETSI EN 300 220(*)
and SIGFOX certification for End Products, Rev. 1.1

Measurement distance: 3m
Kind of test site: Semi-Anechoic Chamber with absorber on the floor
Supply voltage during testing: DC ==V
Test mode applied: Mode A

(*)ETSI EN 300 220 standards were used as reference for this measurement. The pass/fail verdict is based on the ERP measurement reported in the next section.

The EUT was placed on a styrene foam table in a Semi-Anechoic Chamber with absorber on the floor and set to produce an unmodulated signal. The power emitted by the EUT was measured by a test antenna connected to a spectrum analyzer.

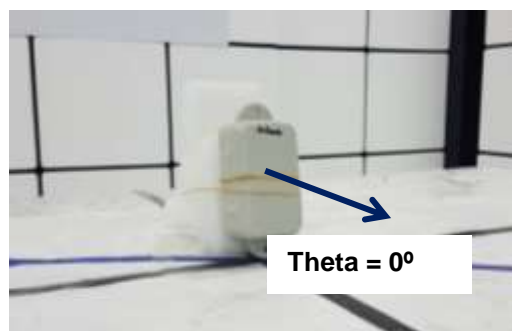
The measurement was performed for both horizontal and vertical polarizations of the test antenna. The table was rotated in order to find the maximum emission angle and the measured power was corrected by a substitution method factor.

This correction factor was obtained by replacing the EUT by a substitution antenna connected to a signal generator (SG). The factor was calculated based on the known SG output power, substitution antenna gain and reading of the spectrum analyzer.

Measurements were performed with a spectrum analyzer using the Sample detector with a resolution bandwidth and a video bandwidth of 100kHz.

The measurements were taken during the full rotation and are recorded in 5 degree steps.
The highest value is indicated as maximum EIRP.

Antenna Axis:



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Graph: Radiation Pattern Vertical & Horizontal

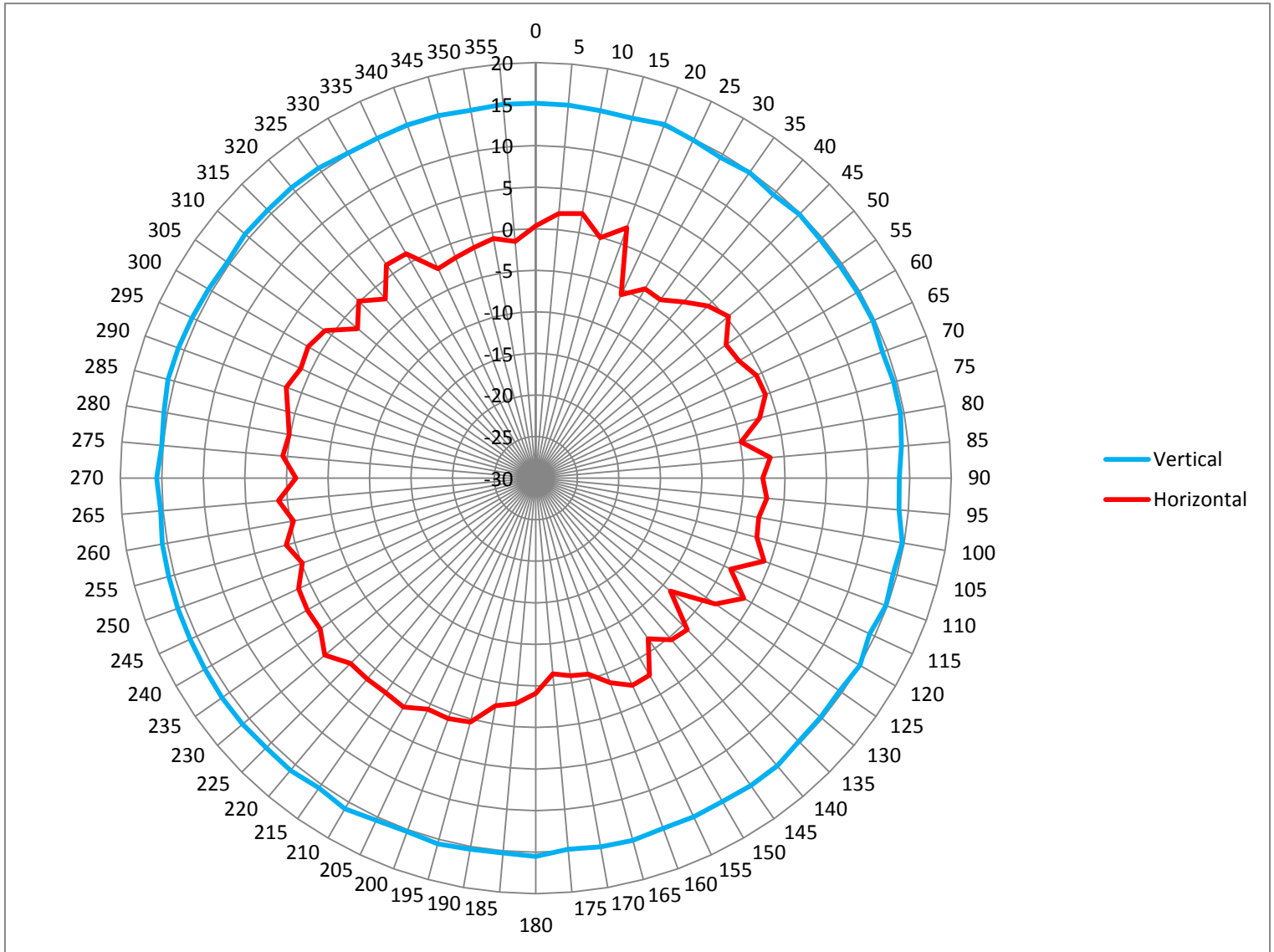


Table 1: Data in Vertical Polarization

Angle (°)	Power (dBm)	Angle (°)	Power (dBm)	Angle (°)	Power (dBm)
0	15.11	120	15.03	240	15.96
5	15.03	125	14.65	245	15.88
10	14.88	130	14.73	250	15.83
15	14.82	135	14.76	255	15.73
20	15.28	140	15.21	260	15.63
25	14.87	145	15.14	265	15.29
30	14.52	150	14.94	270	15.61
35	14.88	155	14.95	275	15.17
40	14.51	160	14.84	280	15.43
45	14.89	165	15.13	285	15.80
50	14.68	170	15.04	290	15.76
55	14.63	175	14.83	295	15.61
60	14.71	180	15.50	300	15.46
65	14.78	185	15.25	305	15.29
70	14.39	190	15.33	310	15.64
75	14.58	195	15.56	315	15.61
80	14.58	200	15.25	320	15.67
85	14.17	205	15.42	325	15.54
90	13.73	210	15.94	330	15.16
95	13.87	215	15.51	335	15.10
100	14.79	220	15.91	340	15.21
105	14.51	225	15.86	345	15.14
110	14.86	230	16.05	350	14.93
115	14.34	235	16.07	355	15.16

Table 2: Data in Horizontal Polarization

Angle (°)	Power (dBm)	Angle (°)	Power (dBm)	Angle (°)	Power (dBm)
0	0.33	120	-1.10	240	1.73
5	1.94	125	-3.60	245	1.48
10	2.33	130	-8.85	250	-0.13
15	-0.05	135	-4.20	255	1.09
20	2.06	140	-4.60	260	-0.42
25	-5.64	145	-6.41	265	1.08
30	-3.69	150	-2.62	270	-1.15
35	-3.80	155	-2.50	275	0.57
40	-2.33	160	-3.82	280	0.14
45	-0.71	165	-5.61	285	0.89
50	0.29	170	-5.85	290	1.96
55	-2.05	175	-6.38	295	1.19
60	-1.77	180	-4.11	300	1.61
65	-0.71	185	-2.78	305	0.94
70	-0.59	190	-2.21	310	-2.01
75	-2.11	195	0.40	315	0.09
80	-4.90	200	0.78	320	-1.87
85	-1.68	205	0.69	325	1.30
90	-2.67	210	1.81	330	1.16
95	-2.08	215	1.49	335	-2.19
100	-2.76	220	1.54	340	-1.79
105	-2.45	225	1.53	345	-1.27
110	-0.77	230	3.14	350	-0.74
115	-4.12	235	1.65	355	-1.40

Effective Isotropic Radiated Power (EIRP)

Date of testing: 2017-06-16
 Ambient temperature: 24°C
 Relative humidity: 26%
 Reference standard: ETSI EN 300 220(*)
 and SIGFOX certification for End Products, Rev. 1.1

Test procedure: ETSI EN 300 220(*)
 and SIGFOX certification for End Products, Rev. 1.1

Measurement distance: 3m
 Kind of test site: Semi-Anechoic Chamber with absorber on the floor
 Supply voltage during testing: DC ==V
 Test mode applied: Mode A

(*)ETSI EN 300 220 standard was used as reference for this measurement. The limit is indicated as reference based on this standard.

The maximum EIRP is derived from the EIRP radiation pattern in the previous section. The angle represents the center of the recorded maximum values.

Table 3: Effective Isotropic Radiated Power

Nominal Frequency [MHz]	EUT / Antenna Orientation	Effective Isotropic Radiated Power [dBm]	Angle Theta [degrees]	Limit (Sigfox) [dBm]	Limit (Standard) [dBm]	Margin [dB]
868.13	X / Vertical	16.07	235	16	16.12	0.05

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7 PHOTO DOCUMENTATION



Photo 1: EUT front view



Photo 2: EUT rear view

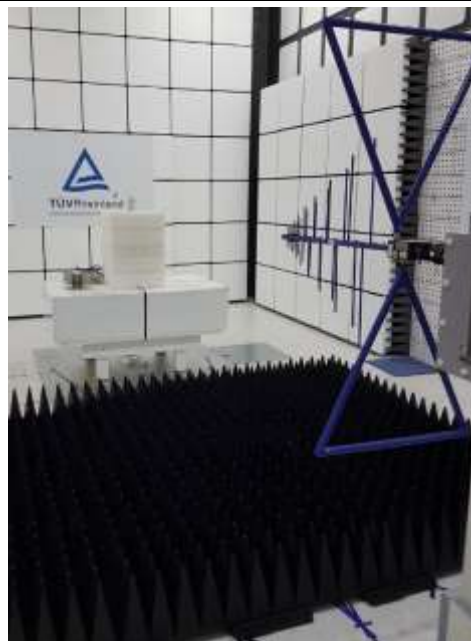


Photo 3: Test Setup Radiated Measurements

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