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FCC TEST REPORT

FCC 47 CFR Part 15C
Industry Canada RSS-210
Operation within the 13.110 – 14.010 MHz band

Report Reference No. ..... :	G0M-1603-5477-TFC225RI-V01
Testing Laboratory ..... :	Eurofins Product Service GmbH
Address ..... :	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation ..... :	A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Filed Test Laboratory, Reg.-No.: 96970 IC OATS Filing assigned code: 3470A
Applicant's name ..... :	Owlet GmbH
Address ..... :	Mosbacher Str. 9 65187 Wiesbaden GERMANY
Test specification:	
Standard..... :	47 CFR Part 15C RSS-210, Issue 8, 2010-12
Test scope…….. ..... :	complete Radio compliance test
Equipment under test (EUT):	
Product description	Luminaire Controller
Model No.	LUCO P7 CM
Additional Model(s)	None
Brand Name(s)	Owlet IoT
Hardware version	3A-2213-2100-7238-1111
Firmware / Software version	3.12.10.17
	FCC-ID: 2AIOB-LCP7CM IC: 21585-LCP7CM
Test result	**Passed**

Possible test case verdicts:	
- neither assessed nor tested ..... :	N/N
- required by standard but not appl. to test object ..... :	N/A
- required by standard but not tested ..... :	N/T
- not required by standard for the test object ..... :	N/R
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)

Testing:		
Test Lab Temperature ..... :	20 – 23 °C	
Test Lab Humidity ..... :	32 – 38 %	
Date of receipt of test item ..... :	2016-08-03	
Date (s) of performance of tests ..... :	2016-11-25	
Compiled by ..... :	Christian Weber	
Tested by (+ signature) ..... : (Responsible for Test)	Wilfried Treffke	W. Treffke .....
Approved by (+ signature) ..... : (Head of Lab)	Christian Weber	C. Weber .....
Date of issue ..... :	2016-11-25	
Total number of pages ..... :	27	

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

Additional comments:

Version History

Version	Issue Date	Remarks	Revised by
01	2016-11-25	Initial Release	

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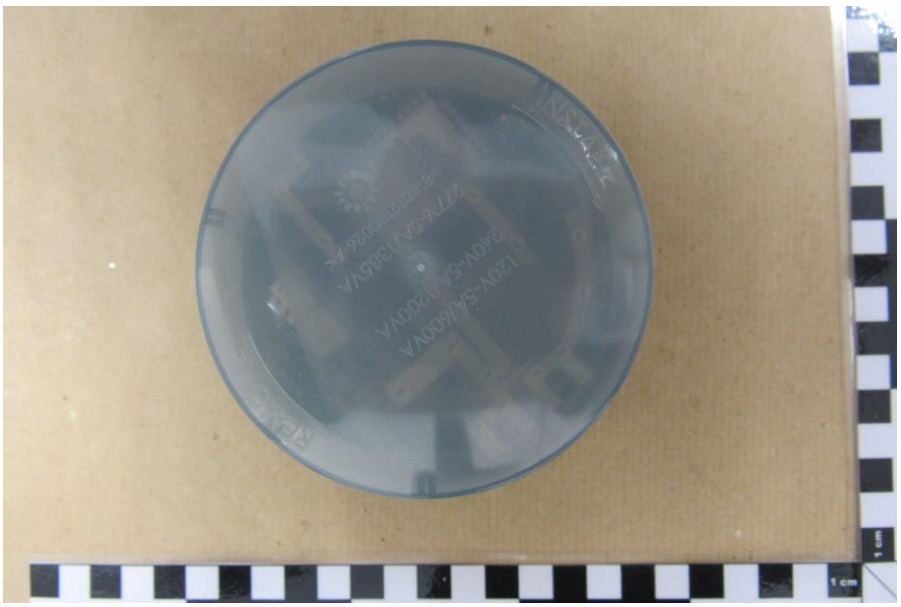
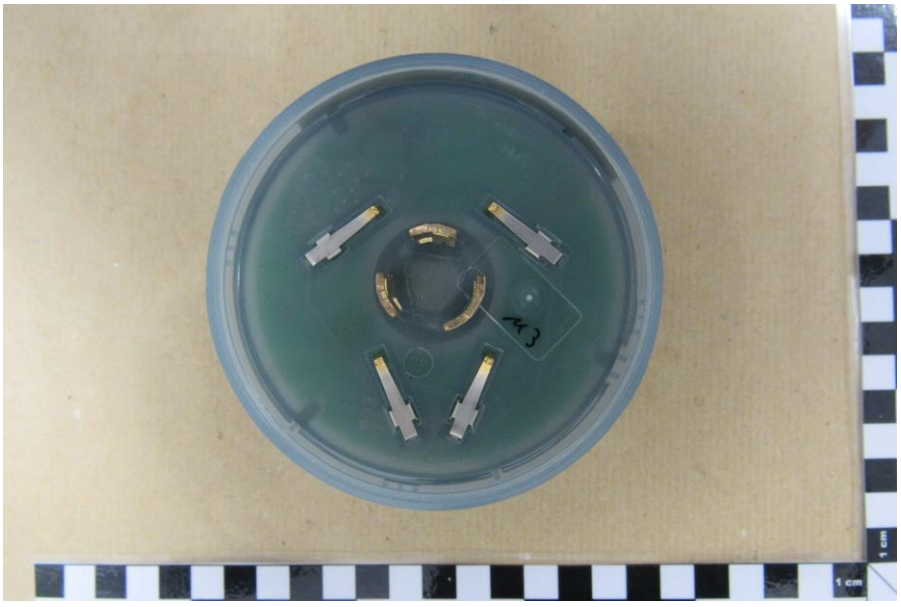
1 Equipment (Test item) Description:

Description	Luminaire Controller	
Model	LUCO P7 CM	
Additional Model(s)	None	
Brand Name(s)	Owlet IoT	
Serial number	None	
Hardware version	3A-2213-2100-7238-1111	
Software / Firmware version	3.12.10.17	
PMN	N/A	
HVIN	LUCO P7 CM	
FVIN	N/A	
HMN	N/A	
FCC-ID	2AIOB-LCP7CM	
IC	21585-LCP7CM	
Equipment type	End product	
Radio type	Transceiver	
Radio technology	13.56 MHz RFID	
Operating frequency range	13.56 MHz	
Assigned frequency band	13.110 - 14.010 MHz	
Frequency range	F_{MID}	13.56 MHz
Spreading	None	
Modulations	ASK	
Number of channels	1	
Channel spacing	None	
Number of antennas	1	
Antenna	Type	integrated
	Model	printed loop antenna
	Manufacturer	metraTec
Manufacturer	Owlet GmbH Mosbacher Str. 9 65187 Wiesbaden GERMANY	
Power supply	V_{NOM}	120.0 VAC
	V_{MIN}	102 VAC
	V_{MAX}	138 VAC
Temperatures	T_{NOM}	25°C
	T_{MIN}	-10°C
	T_{MAX}	80°C

AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Input	N/A
	Output	N/A

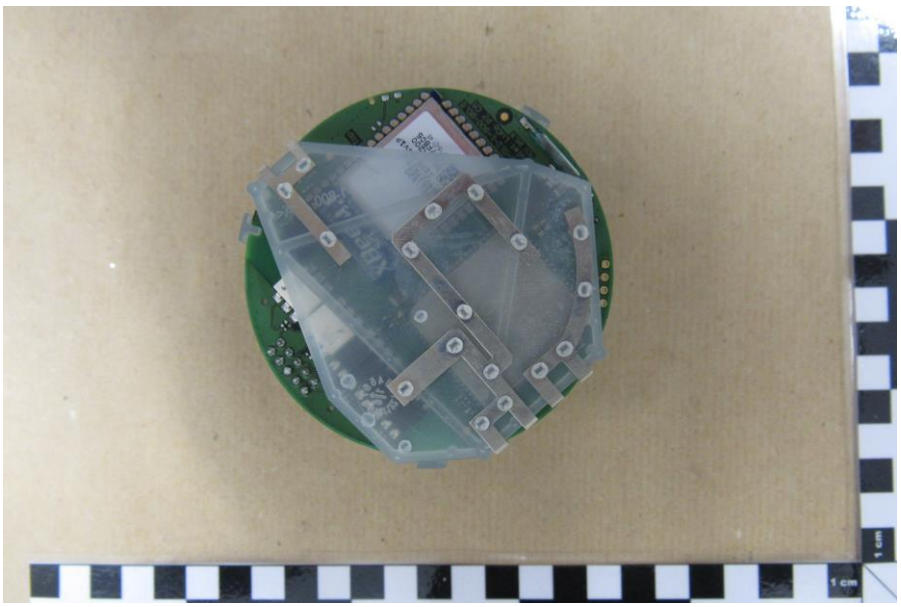
1.1 Photos – Equipment External

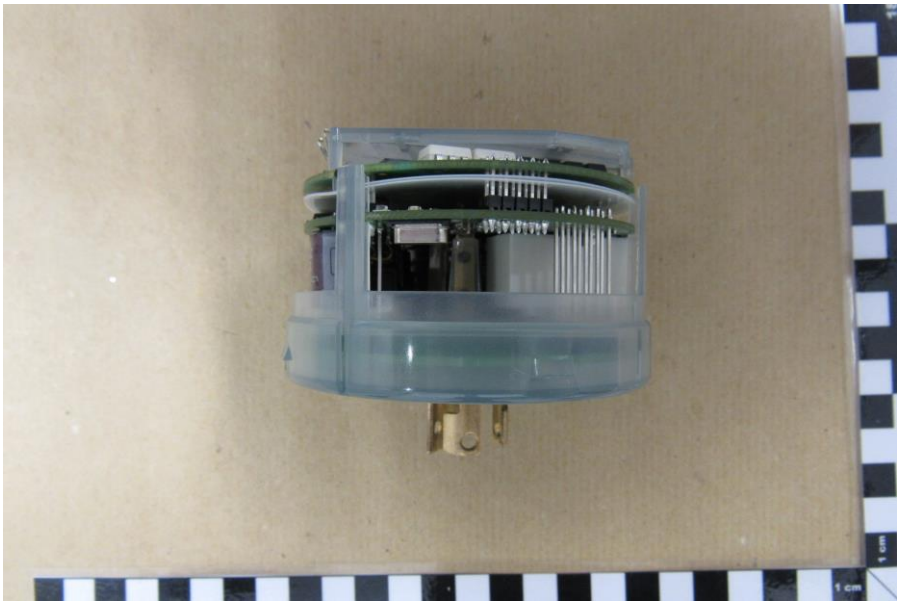
EUT Top


EUT Bottom


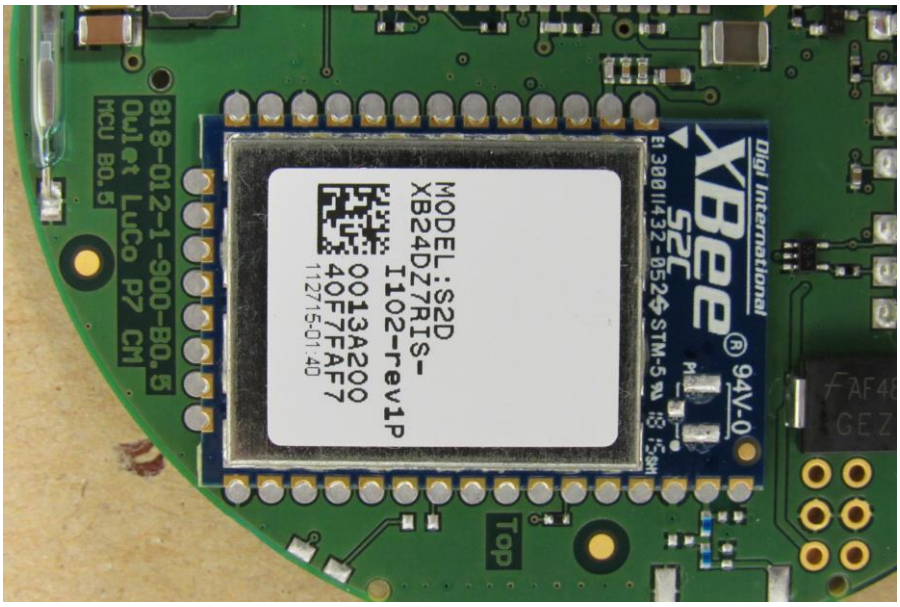
EUT Side

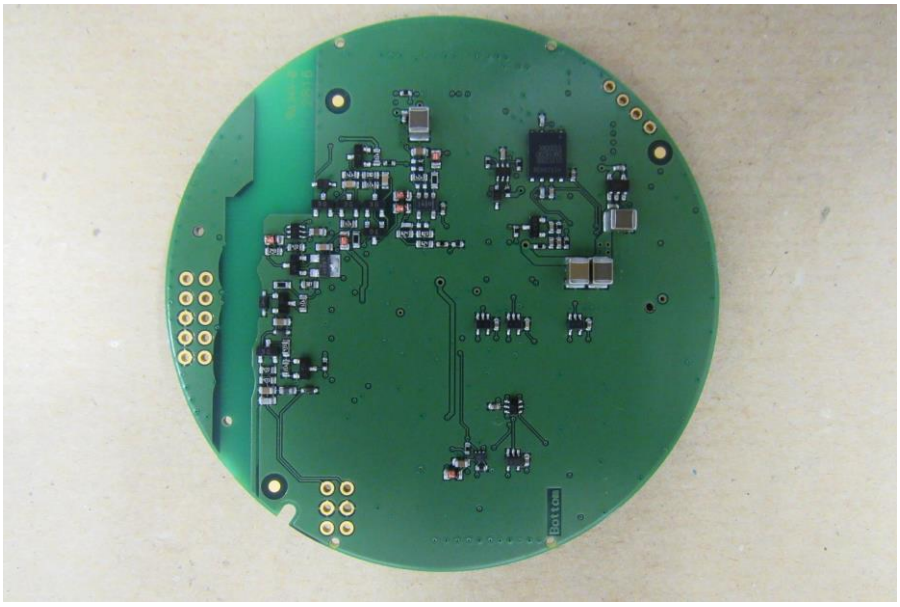

1.2 Photos – Equipment internal

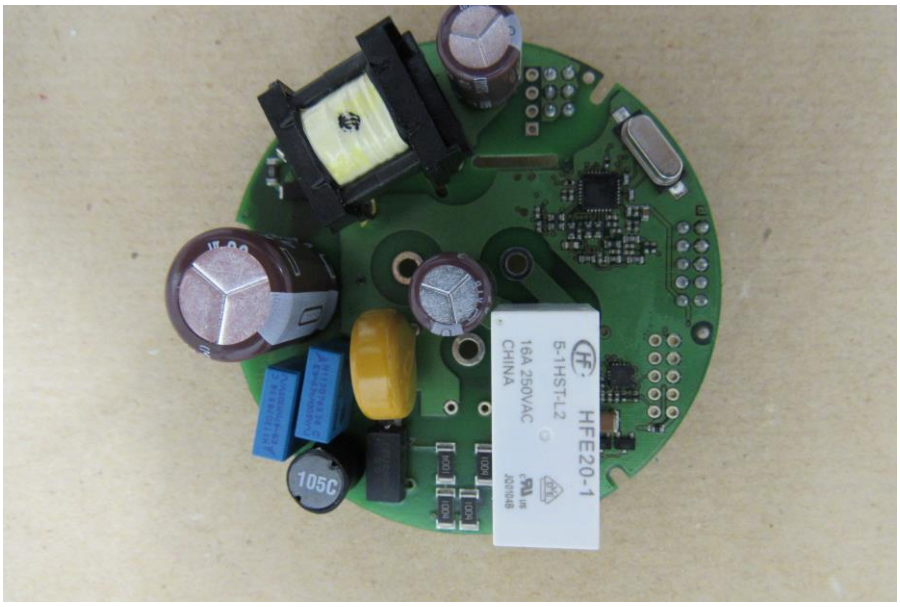
PCB Antenna


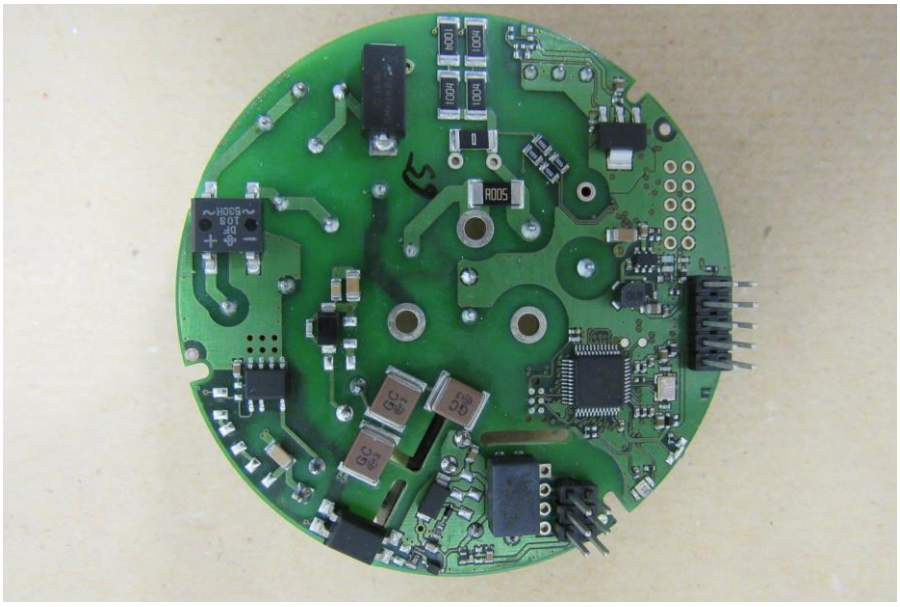
EUT complete


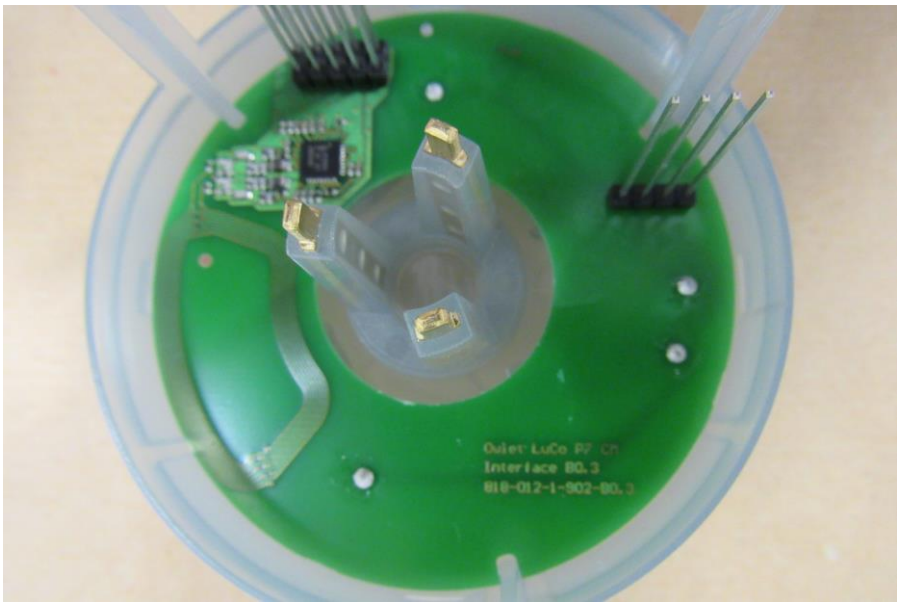
Radio PCB Top

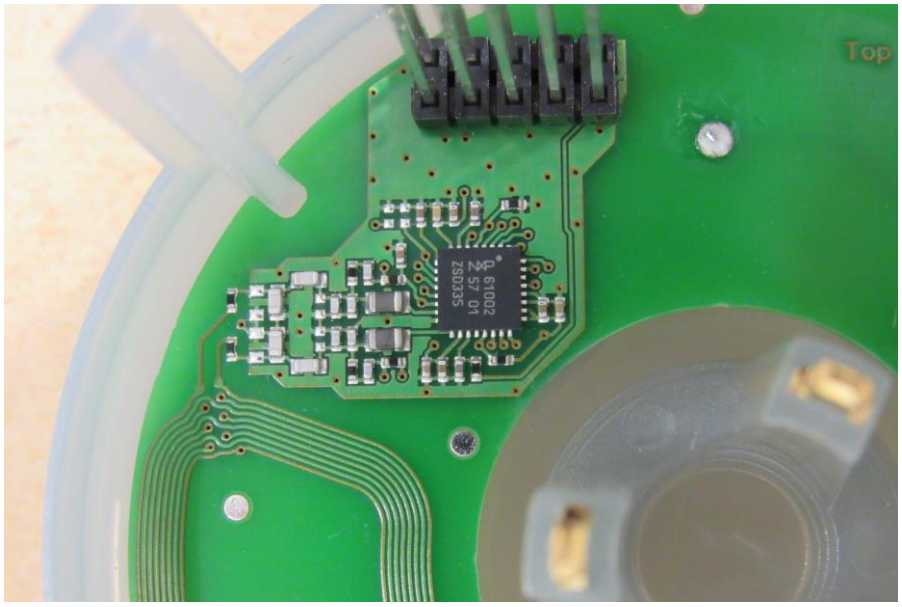

ZigBee Module


Radio PCB Bottom


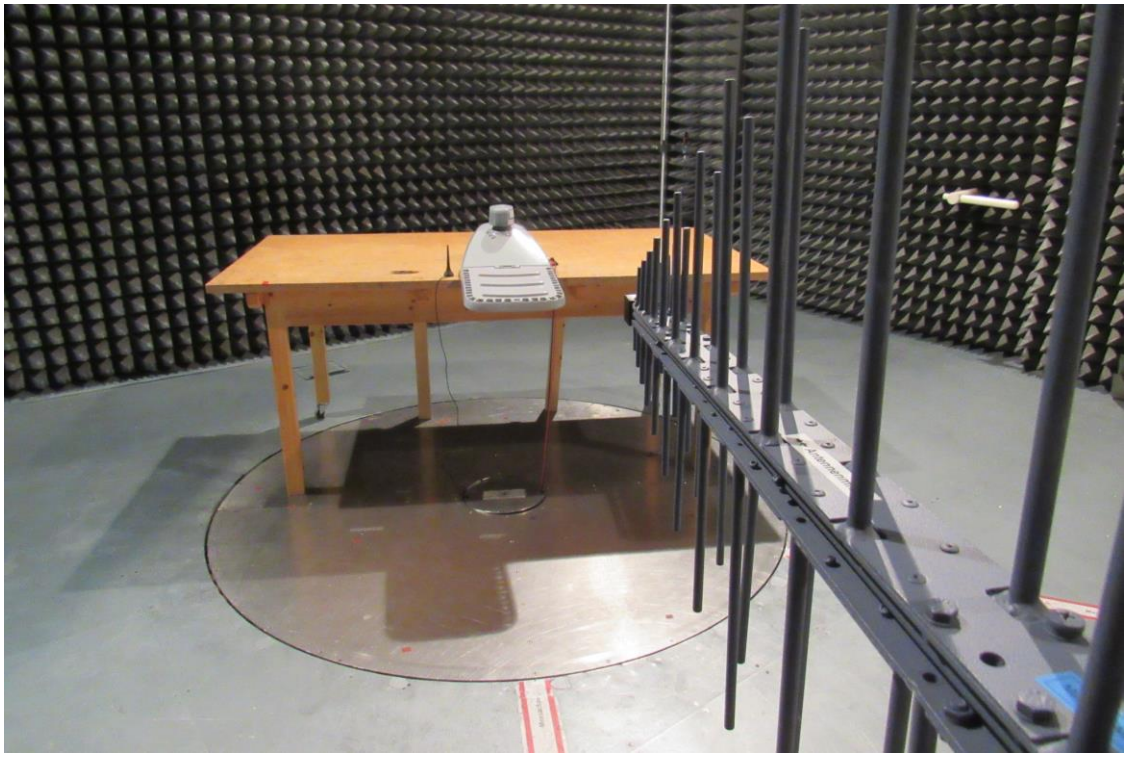
HV PCB Top


HV PCB Bottom


Connector Side


Connector Side in detail


1.3 Photos – Test setup

Test setup: Radiated Emissions


1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
None				

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Test Modes

Mode #	Description	
Single	General conditions:	EUT powered by ac-mains
	Radio conditions:	Mode = standalone transmit Modulation = ASK Power level = Maximum

1.6 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2015.2.4

Occupied Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2016-02	2017-02

Field strength emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	-	-
Spectrum Analyzer	R&S	FSIQ26	EF00242	2016-04	2017-04
Loop Antenna	R&S	HFH2-Z2	EF00184	2014-11	2016-11
Biconical Antenna	R&S	HK 116	EF00012	2016-05	2019-05
LPD Antenna	R&S	HL 223	EF00187	2016-05	2019-05
LPD Antenna	R&S	HL 025	EF00327	2015-10	2018-10

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBµV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyzer (dBµV) + A.F. (dB) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

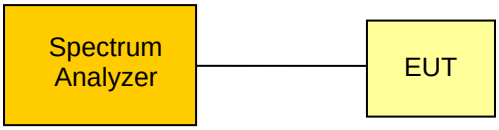
Reading	+	AF	=	Net Reading	:	Net reading - FCC limit	= Margin
21.5 dBµV	+	26 dB	=	47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, IC RSS-210				
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Result**	**Remarks**
RSS-Gen 6.6	Occupied Bandwidth	RSS-Gen 6.6	N/R	Informational only
FCC 15.225(a-c) IC RSS-210 A2.6(a-c)	Fundamental in-band field strength emissions	ANSI C63.4	PASS	
FCC 15.225(d) FCC 15.209 IC RSS-210 A2.6(d)	Emission radiated outside the specified frequency band	ANSI C63.4	PASS	
FCC 15.225(e) IC RSS-210 A2.6	Frequency stability	ANSI C63.4	PASS	Note 1
IC RSS-Gen 4.10 IC RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C 63.4	N/A	
47 CFR 15.207 RSS-Gen 8.8	AC power line conducted emissions	ANSI C63.4	PASS	
Remarks: Note 1: Fundamental emission far below spurious emission limit. Measurement has been omitted				

3 Test Conditions and Results

3.1 Test Conditions and Results – Occupied Bandwidth

Occupied Bandwidth acc. to IC RSS-Gen		**Verdict: PASS**
Test according to measurement reference	Reference Method	
	RSS-Gen 6.6	
Test frequency range	Tested frequencies	
	F_{MID}	
EUT test mode	Single	
Limits		
None (Informational only)		
Test setup		
		
Test procedure		
1. EUT set to test mode (Communication tester is used if needed) 2. Span set to at least twice the emission spectrum 3. Resolution bandwidth set to 1 % of span 4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function		
Test results		
Channel	Frequency [MHz]	Occupied Bandwidth [kHz]
F_{MID}	13.56	86.53
Comments: Measurement is applicable to all variants		

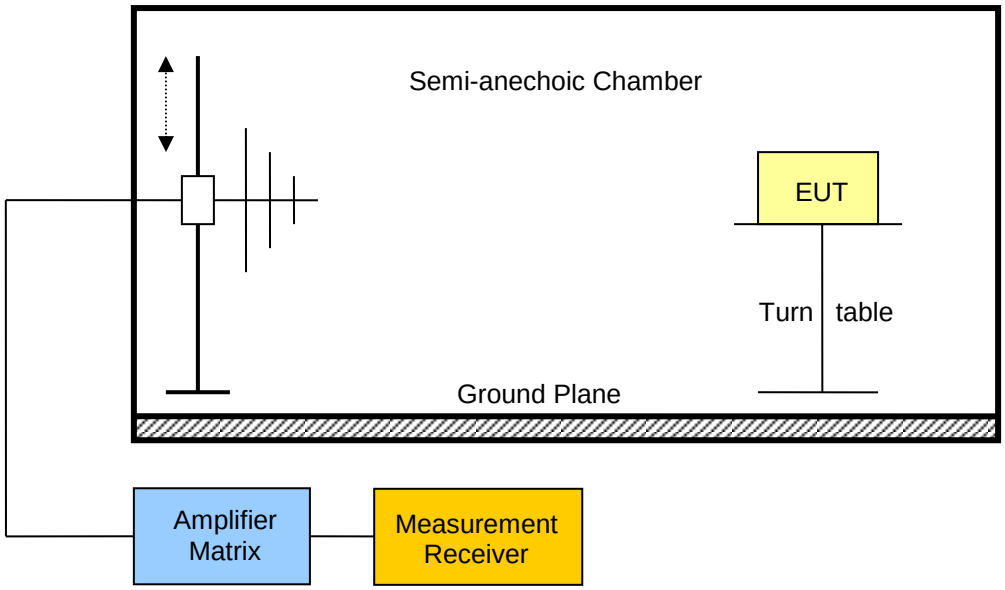
3.2 Test Conditions and Results – Fundamental in-band field strength emissions

Field strength emissions acc. to FCC 47 CFR 15.225 / IC RSS-210	**Verdict: PASS**
Test according referenced standards	Reference Method
	FCC 15.225(a-c) / IC RSS-210 A2.6(a-c)
Test according to measurement reference	Reference Method
	ANSI C63.4
Test frequency range	Tested frequencies
	F_{MID}
EUT test mode	Single

Limits

Frequency range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
13.553 – 13.567	15848	84	30
13.410 – 13.553 13.567 – 13.710	334	50.5	30
13.110 – 13.410 13.710 – 14.010	106	40.5	30

Test setup



Test procedure

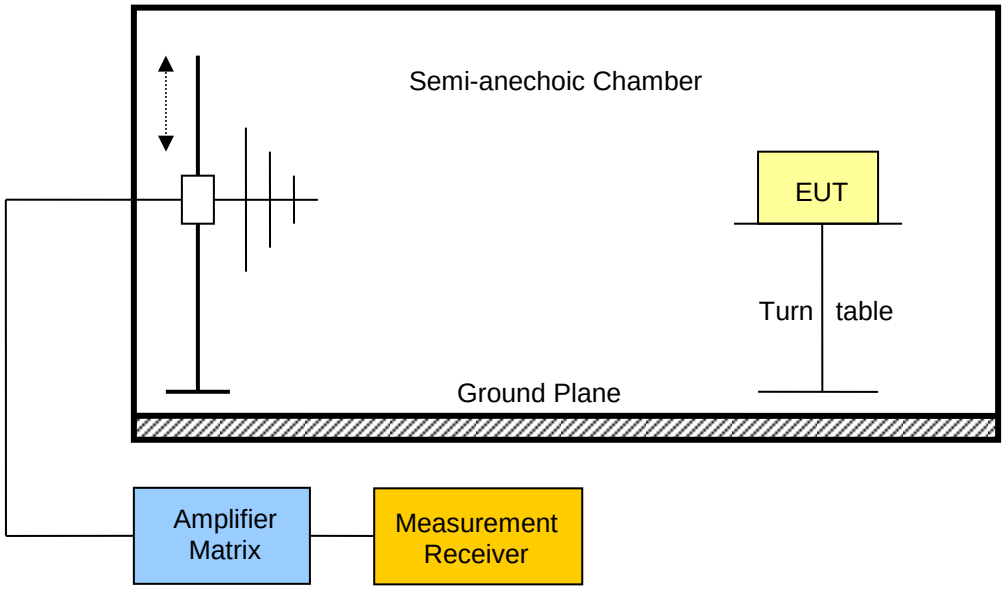
1. EUT set to test mode
2. Span it set according to measurement range
3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector
4. Below 30MHz and extrapolation factor of 40dB/decade is used and at 30MHz and above an extrapolation factor of 20dB/decade is used (47 CRF 15.31(f)).

Test results							
Channel	Frequency [MHz]	Emission [MHz]	Level @ 30m [dbµV/m]	Det.	Limit @ 30m [dbµV/m]	Limit distance [m]*	Margin [dB]
F_{MID}	13.56	13.562	14.4	pk	84	30	-69.60
Comments: * Physical distance between EUT and measurement antenna. See Annex							

3.3 Test Conditions and Results – Emissions radiated outside the specified frequency band

Radiated out-of-band band emissions acc. to FCC 47 CFR 15.225 / IC RSS-210				**Verdict: PASS**
Test according referenced standards		Reference Method		
		FCC 15.225(d) / IC RSS-210 A2.6(d)		
Test according to measurement reference		Reference Method		
		ANSI C63.4		
Test frequency range		Tested frequencies		
		9 kHz – 216 MHz		
EUT test mode		Single		
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
0.009 – 0.490	Quasi-Peak	2400/F[kHz]	48.5 – 13.8	300
0.490 – 1.705	Quasi-Peak	2400/F[kHz]	13.8 – 2.97	30
1.705 – 30	Quasi-Peak	30	29.5	30
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
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.				

Test setup



Test procedure

1. EUT set to test mode
2. Span it set according to measurement range
3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz
4. Markers are set to maximum emission levels

Test results

Channel	Frequency [MHz]	Emission [MHz]	Level [dbµV/m]	Detector	Pol. Limit [dbµV/m]	Limit distance [m]*	Margin [dB]
F_{MID}	13.56	27.11	-14.1	pk	29.5	30	-43.60

Comments: * Physical distance between EUT and measurement antenna.

3.4 Test Conditions and Results – AC power line conducted emissions

Power line conducted emissions acc. to FCC 47 CFR 15.207 / IC RSS-Gen				**Verdict: PASS**
Test according referenced standards	Reference Method			
	ANSI C63.4			
Fully configured sample scanned over the following frequency range	Frequency range			
	0.15 MHz to 30 MHz			
Points of Application	Application Interface			
AC Mains	LISN			
EUT test mode	AC-Powerline			
Limits and results				
Frequency [MHz]	Quasi-Peak [dBµV]	Result	Average [dBµV]	Result
0.15 to 5	66 to 56*	PASS	56 to 46*	PASS
0.5 to 5	56	PASS	46	PASS
5 to 30	60	PASS	50	PASS
Comments: * Limit decreases linearly with the logarithm of the frequency.				

Conducted Emissions 1

EMI voltage test in the ac-mains according to FCC 47 CFR 15.107 / ICES-003

Project number: G0M-1603-5477

Applicant:	Owlet GmbH
EUT Name:	Luminaire Controller
Model:	LUCO P7 CM
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 23.4°C, Unom: 120V AC
LISN:	ESH2-Z5 L
Mode:	1
Test Date:	2016-08-12
Note:	

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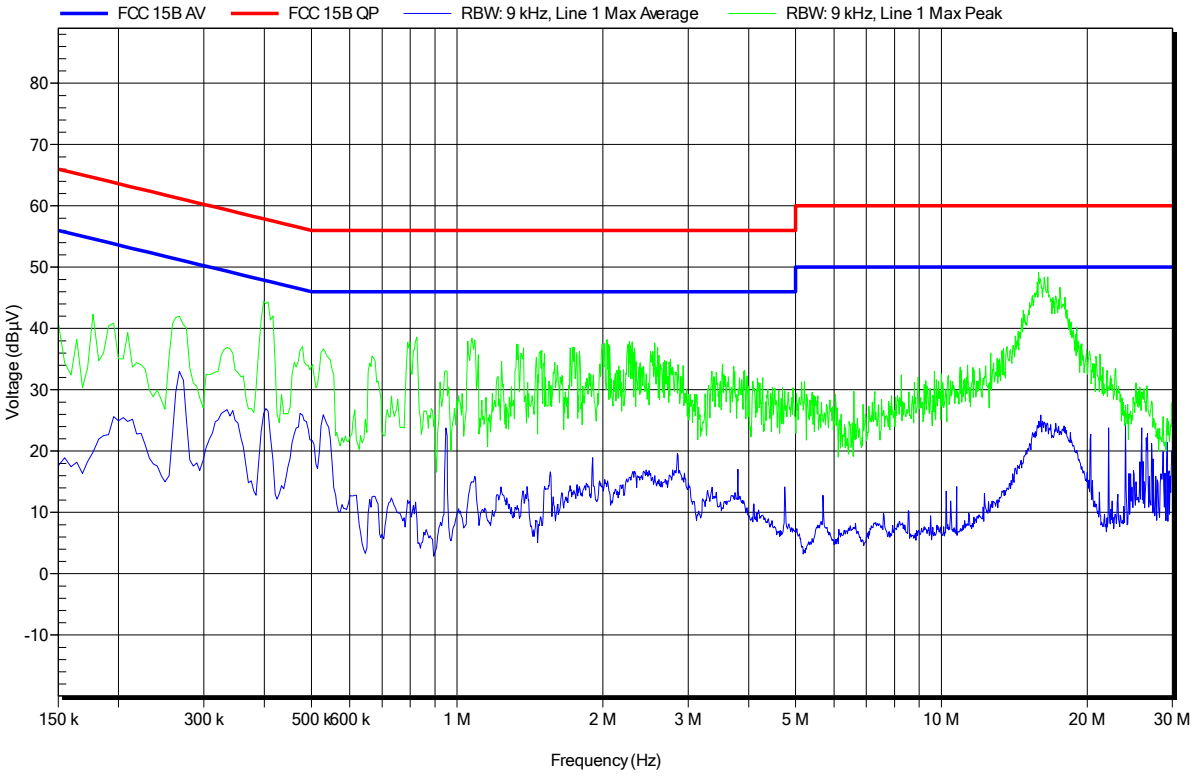

Conducted Emissions 2

EMI voltage test in the ac-mains according to FCC 47 CFR 15.107 / ICES-003

Project number: G0M-1603-5477

Applicant:	Owlet GmbH
EUT Name:	Luminaire Controller
Model:	LUCO P7 CM
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 23.4°C, Unom: 120V AC
LISN:	ESH2-Z5 N
Mode:	1
Test Date:	2016-08-12
Note:	

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