



TEST REPORT
FCC ID: 2AJOYPOOLMATE

For

Swimovate Ltd

PoolmatePlus swim watch

Model No. : PoolmatePlus

Trade name : Swimovate

Prepared for : Swimovate Ltd
Address : 4 The Worple, Wraysbury, Staines Middlesex TW19 5NY, UK

Prepared by : Shenzhen Alpha Product Testing Co., Ltd.
Address : Building B, East Area of Nanchang Second, Industrial Zone,
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Report No. : T1861540 06

Date of Receipt : August 09 , 2016

Date of Test : August 10-30, 2016

Date of Report : August 31 , 2016

Version Number : REV0

Contents

1.	General Information.....	4
1.1.	Description of Device (EUT).....	4
1.2.	Accessories of device (EUT)	5
1.3.	Test Lab information	5
2.	Summary of test	6
2.1.	Summary of test result	6
2.2.	Assistant equipment used for test.....	6
2.3.	Block Diagram	6
2.4.	Test mode	6
2.5.	Test Conditions.....	7
2.6.	Measurement Uncertainty (95% confidence levels, k=2)	8
2.7.	Test Equipment.....	9
3.	20dB bandwidth	10
3.1.	Limit.....	10
3.2.	Test Procedure.....	10
3.3.	Test Setup.....	10
3.4.	Test Result.....	11
4.	Radiated emissions.....	12
4.1.	Limit(FCC 15.209).....	12
4.2.	Block Diagram of Test setup	12
4.3.	Test Procedure.....	13
4.4.	Test Result.....	14
4.5.	Field strength.....	18
5.	Frequency stability	19
5.1.	Test limit	19
5.2.	Test Procedure.....	19
5.3.	Test Setup.....	19
5.4.	Test Results	19
6.	Power Line Conducted Emissions	21
6.1.	Block Diagram of Test Setup	21
6.2.	Limit.....	21
6.3.	Test Procedure.....	21
6.4.	Test Result.....	22
7.	Antenna Requirements.....	24
7.1.	Limit.....	24
7.2.	Result	24
8.	Test setup photo	25
9.	Photos of EUT.....	27

DECLARATION

Applicant : Swimovate Ltd
Manufacturer : Shenzhen Berny Industrial Co.,Ltd
Product : PoolmatePlus swim watch
(A) Model No. : PoolmatePlus
(B) Trade Name : Swimovate
(C) Power supply : DC 3.0V From battery or DC 5V from USB Port

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C 2015, ANSI C63.10:2013

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the Part 15C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Reak Yang
Test Engineer

Approved by (name + signature).....: Simple Guan
Project Manager

Date of issue.....: August 31 , 2016

1. General Information

1.1. Description of Device (EUT)

EUT	:	PoolmatePlus swim watch
Model No.	:	PoolmatePlus
DIFF	:	N/A
Trade mark	:	Swimovate
Power supply	:	DC 3.0V From battery or DC 5V from USB Port
Radio Technology	:	RFID
Operation frequency	:	13.56MHz
Antenna Type and Gain	:	Integrated antenna, PK Gain: 0dBi
Applicant	:	Swimovate Ltd
Address	:	4 The Worple, Wraysbury, Staines Middlesex TW19 5NY, UK
Manufacturer	:	Shenzhen Berny Industrial Co., Ltd
Address	:	Berny bldg, Watch&Clock Ind. Allomeration Base, Guangming new district, ShenZhen China

1.2. Accessories of device (EUT)

Accessories 1 : N/A

M/N : N/A

1.3. Test Lab information

Shenzhen Alpha Product Testing Co., Ltd.

Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd
Road, Bao'an, Shenzhen, China

March 25, 2015 File on Federal Communication Commission
Registration Number: 203110

July 18, 2014 Certificated by IC
Registration Number: 12135A

2. Summary of test

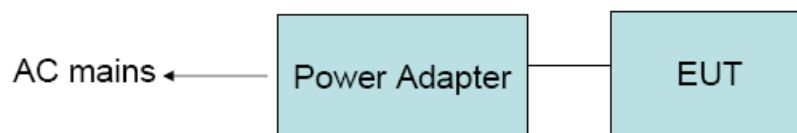
2.1. Summary of test result

Description of Test Item	Standard	Results
20dB Bandwidth	FCC Part 15: 15.225 ANSI C63.4 :2014	PASS
Radiated Emission (9KHz-1GHz)	FCC Part 15: 15. 225&209 ANSI C63.4 :2014	PASS
Power Line Conducted Emissions (150KHz-30MHz)	FCC Part 15: 15.207 ANSI C63.4 :2014	PASS
Frequency stability	FCC Part 15: 15.225 ANSI C63.4 :2014	PASS
Antenna Requirement	FCC Part 15: 15.203	PASS

2.2. Assistant equipment used for test

N/A

2.3. Block Diagram



2.4. Test mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
1	CH1	13.56
Note: According exploratory test, EUT will have maximum output power in those data rate. so those data rate were used for all test.		

2.5. Test Conditions

Temperature range	21-25°C
Humidity range	40-75%
Pressure range	86-106kPa

2.6. Measurement Uncertainty (95% confidence levels, k=2)

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.71dB	
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB	Polarize: V
	2.57dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.90 dB	Polarize: V
	3.92dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.28 dB	Polarize: H
	4.26 dB	Polarize: V
Uncertainty for radio frequency	1×10^{-9}	
Uncertainty for conducted RF Power	0.65dB	
Uncertainty for temperature	0.2°C	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.06%	

2.7. Test Equipment

Equipment	Manufacture	Model No.	Serial No.	Due Cal.	Cal Interval
3m Semi-Anechoic	CHENYU	N/A	N/A	2018.01.18	2Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2017.01.16	1Year
Receiver	R&S	ESPI	101873	2017.01.16	1Year
Receiver	R&S	ESCI	101165	2017.01.16	1Year
Bilog Antenna	SCHWARZBECK	VULB 9168	VULB9168-438	2018.01.18	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2017.01.20	2Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2017.01.16	1 Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2017.01.16	1 Year
Cable	Resenberger	N/A	No.1	2017.01.16	1Year
Cable	SCHWARZBECK	N/A	No.2	2017.01.16	1Year
Cable	SCHWARZBECK	N/A	No.3	2017.01.16	1Year
Pre-amplifier	HP	HP8347A	2834A00455	2017.01.18	1Year
Pre-amplifier	Agilent	8449B	3008A02664	2017.01.18	1Year
vector Signal Generator	Agilent	N5182A	MY49060042	2016.11.16	1 Year
vector Signal Generator	Agilent	E4438C	US44271917	2016.11.16	1 Year
X-series USB Peak and Average Power Sensor	Agilent	U2021XA	MY54080020	2016.11.16	1 Year
X-series USB Peak and Average Power Sensor	Agilent	U2021XA	MY54110001	2016.11.16	1 Year
Signal Analyzer	Agilent	N9020A	MY48030494	2016.11.16	1 Year

3. 20dB bandwidth

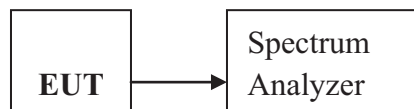
3.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part and section RSS-210, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

3.2. Test Procedure

The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3KHz RBW and 10kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

3.3. Test Setup



4. Radiated emissions

4.1. Limit(FCC 15.209)

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Note:

- a) The tighter limit applies at the band edges.

For example: F.S limit at 88MHz is 100uV/m

- b) If measurement is made at 3m distance, then F.S Limit at 3m distance is adjusted by using the formula of $L_{d1} = L_{d2} * (d2/d1)^2$.

For example:

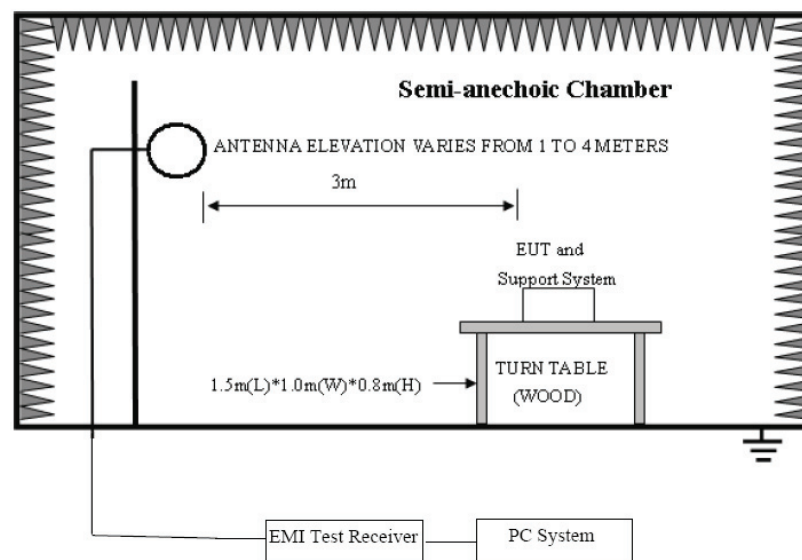
F.S Limit at 30m(d2) distance is 30uV/m(L_{d2}), then F.S Limit at 3m(d1) distance is

$$L_{d1} = 30\text{uV/m} * (30/3)^2 = 100 * 30\text{uV/m} = 69.54 \text{ dBuV/m}$$

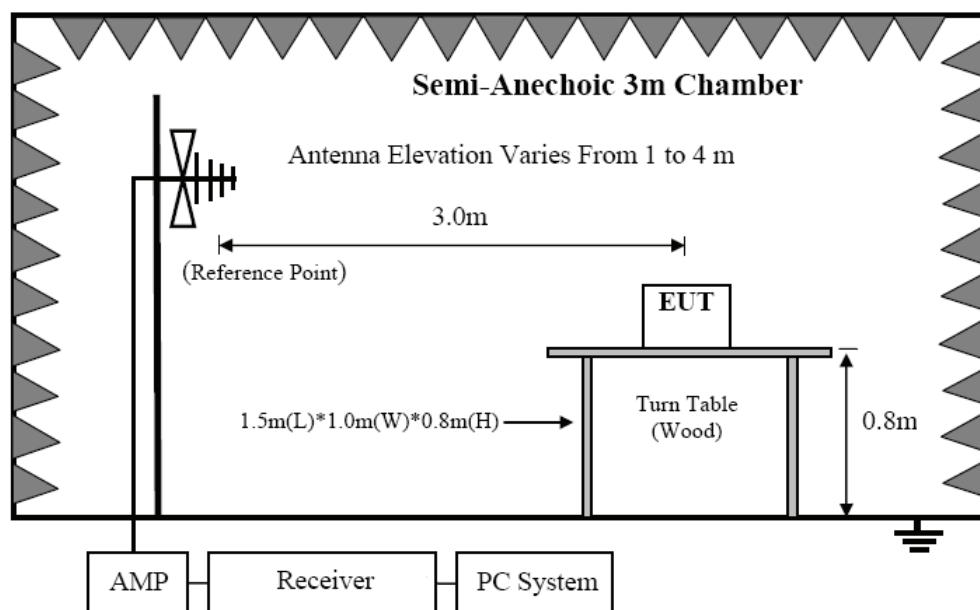
4.2. Block Diagram of Test setup

In 3m Anechoic Chamber Test Setup Diagram for below 30MHz

4.2. Block diagram of test setup



In 3m Anechoic Chamber Test Setup Diagram for frequency 30MHz-1GHz



4.3. Test Procedure

Procedure of Preliminary Test

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 4.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4:2003.

Mains cables, telephone lines or other connections to auxiliary equipment located outside the test are shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turntable. No extension cords shall be used to mains receptacle.

The antenna was placed at 3 meter away from the EUT as stated in ANSI C63.10:2013. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.

The Receiver quickly scanned from 9KHz to 30MHz and 30MHz to 1GHz The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

The test mode(s) described in clause 2.4 were scanned during the preliminary test:

After the preliminary scan, we found the test mode producing the highest emission level. The EUT and cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

Procedure of Final Test

EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.

The Receiver scanned from 9KHz to 30MHz and 30MHz to 1GHz. Emissions were scanned and

measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

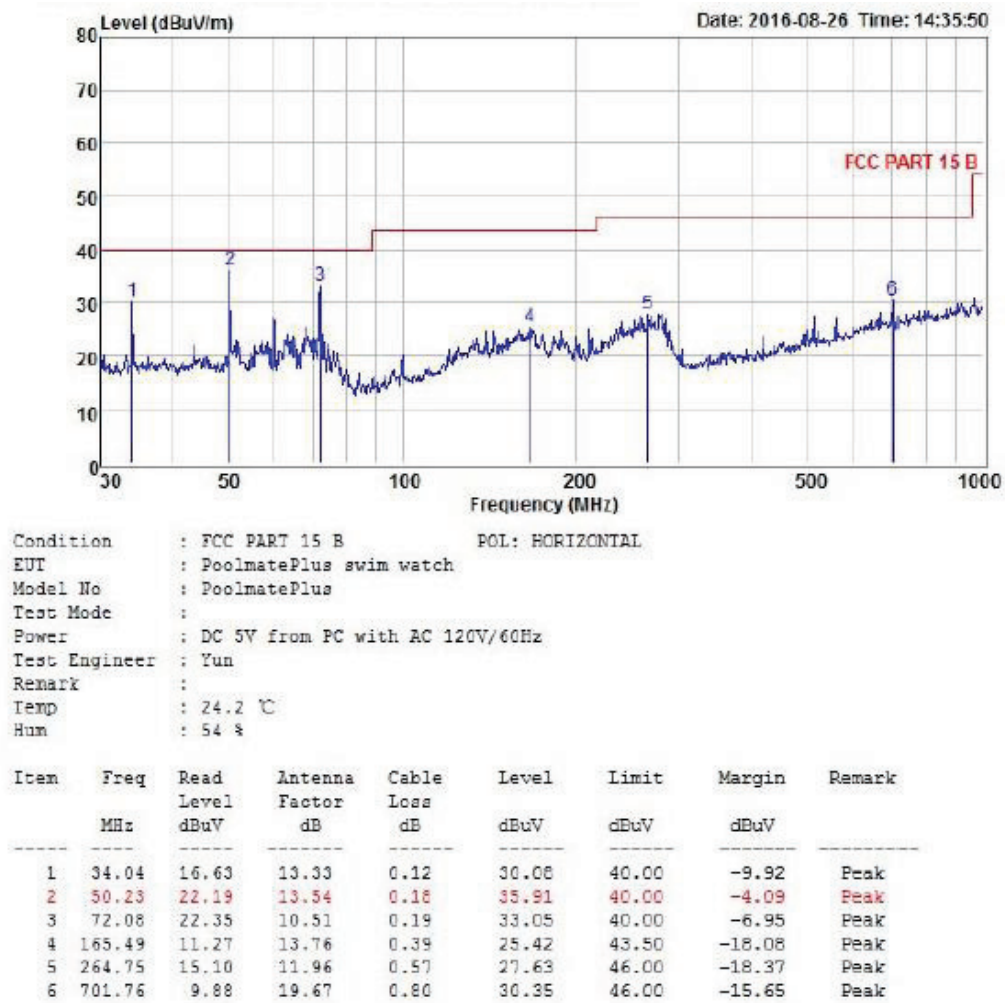
Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.

The test data of the worst-case condition(s) was recorded.

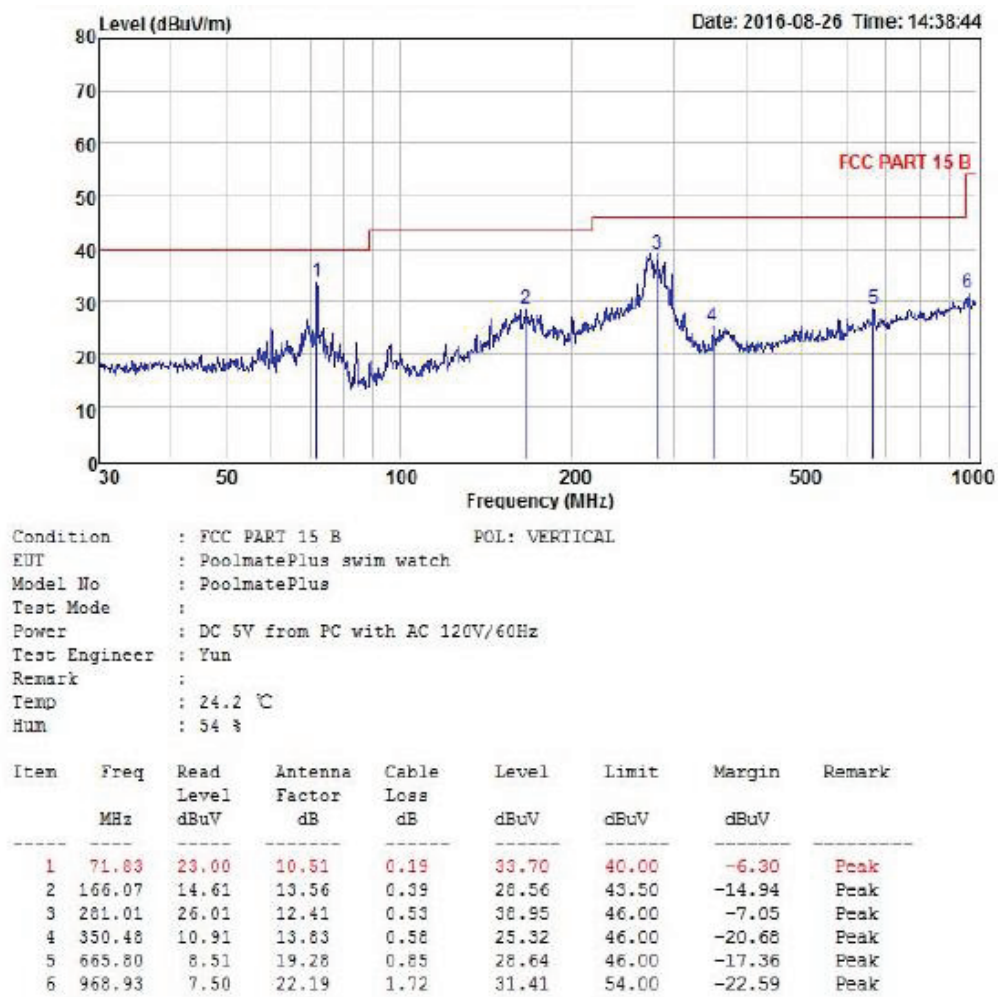
The bandwidth of test receiver is set at 200Hz for 9 KHz to 150 KHz measure, 10 KHz for 150 KHz to 30MHz measure and 120 KHz for 30 MHz to 1GHz measure .

4.4. Test Result

PASS. (See below detailed test result)



Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss



Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss

Radiated Emissions Result of Inside band (13.56MHZ)

EUT	PoolmatePlus swim watch	Model Name	PoolmatePlus
Temperature	26°C	Relative Humidity	58%
Pressure	960hPa	Test voltage	DC 3.0V From battery
Test Mode	TX	Antenna polarization	X/Y/Z
Distance	3m		

Channel (13.56MHZ)									
Fre. MHz	Position H/V	Reading dBuV	Antenna Factor dB	Cable Loss dB	Amplifier Gain dB	Correct Factor dB	Measure Result dBuV/m	Limit dBuV/m	Margin dB
13.56	H	91.32 (PK)	10.6	0.33	24.65	-13.94	77.41	144	---
13.56	H	80.29 (AV)	10.6	0.33	24.65	-13.94	66.38	124	---
--	--	--	--	--	--	--	--	--	--
13.56	V	84.77 (PK)	10.6	0.33	24.65	-13.94	70.86	144	---
13.56	V	72.49 (AV)	10.6	0.33	24.65	-13.94	58.58	124	---
--	--	--	--	--	--	--	--	--	--

Notes: --Means other frequency and mode comply with standard requirements and at least have 20dB margin.

Correct Factor=Cable Loss+ Antenna Factor- Amplifier Gain

Measurement Result=Reading + Correct Factor

Margin=Measurement Result-Limit

--Spectrum setting:

a. Peak setting RBW=10KHz, VBW=30KHz.

4.5. Field strength

4.5.1 Limit

Please see the section 15.225(b) and 15.225(c) & RSS-210

15.225(b): Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (50.5dBuV/m) at 30 meters

15.225©: Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (40.5dBuV/m) at 30 meters

Note: 30m to 3m correction factor calculation:

$$40 * \log(30\text{m}/3\text{m}) = 40$$

4.5.2 Test Result:

EUT	PoolmatePlus swim watch	Model Name	PoolmatePlus
Temperature	26°C	Relative Humidity	56%
Pressure	960hPa	Test voltage	DC 3.0V From battery
Test Mode	TX	Distance	3m

Freq. (MHz)	Position H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Margin (dBuV/m)
13.110	H	Peak	42.45	-13.94	28.51	69.5	---
13.410	H	Peak	43.51	-13.94	29.57	69.5	---
13.553	H	Peak	42.29	-13.94	28.35	69.5	---
13.567	H	Peak	45.75	-13.93	31.82	69.5	---
13.710	H	Peak	43.32	-13.93	29.39	69.5	---
14.010	H	Peak	44.09	-13.93	30.16	69.5	---

Freq. (MHz)	Position H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Margin (dBuV/m)
13.110	V	Peak	42.66	-13.94	28.72	69.5	---
13.410	V	Peak	45.63	-13.94	31.69	69.5	---
13.553	V	Peak	43.57	-13.94	29.63	69.5	---
13.567	V	Peak	42.43	-13.94	28.49	69.5	---
13.710	V	Peak	43.32	-13.93	29.39	69.5	---
14.010	V	Peak	44.29	-13.93	30.36	69.5	---

5. Frequency stability

5.1. Test limit

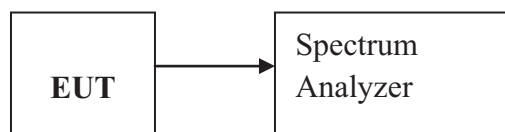
Please refer section 15.225e & RSS-210.

Regulation 15.225(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ (± 100 ppm) of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.2. Test Procedure

The following equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

5.3. Test Setup



5.4. Test Results

PASS.

Detailed information please see the following page.

Assigned Frequency(MHz): 13.56MHz				
Voltage: DC 3.0V From battery				
Voltage	Temperature	Measured Frequency (MHz)	Frequency stability	Limit
new battery DC 3V	-20°C	13.56063	0.00063	±100 ppm ±0.001356MHz
	-10°C	13.55959	-0.00041	
	0°C	13.56032	0.00032	
	+10°C	13.55951	-0.00049	
	+20°C	13.56016	0.00016	
	+30°C	13.56032	0.00032	
	+40°C	13.55979	-0.00021	
	+50°C	13.55983	-0.00017	
new battery DC 3V	+20°C	13.56016	0.00016	