

TEST REPORT

FCC ID : XBADSB45
Applicant : Aeon Labs LLC.
Address : 121 Buckingham Drive, Unit 36, Santa Claras, California, 95051 United States
Manufacturer : The same as above
Address : The same as above

Equipment Under Test (EUT) :

Product Name : Water Sensor
Model No. : DSB45-ZWUS
Rules : FCC CFR47 Part 15 Section 15.249: 2010,

Date of Test : April 19~28, 2013

Date of Issue : May 08, 2013

Test Result	: PASS*
<p>Remark: * The sample described above has been tested to be in compliance with the requirements of the rules listed above. The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.</p>	

PERPARED BY:

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Shenzhen, China

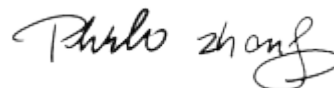
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Compiled by:



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Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Restricted Band	15.205	PASS
20dB Bandwidth	15:215(c)	PASS
Conducted Emissions	15.207	PASS
Radiated Emission	15.205(a) 15.209 15.249(a)	PASS
Antenna Requirement	15.203	PASS

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4 General Information

4.1 General Description of E.U.T.

Product Name	: Water Sensor
Model No.	: DSB45-ZWUS
Type of Modulation	: FSK
Frequency Range	: 908.42Mhz MHz, 908.40Mhz MHz
Oscillator	: 32MHz
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: DC 1.5V*2, Size"AAA "
Adapter manufacturer	: N/A
M/N	: N/A

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011.

- **IC – Registration No.:7760A**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A, July 12, 2012.

4.4 Test Location

All Emissions tests were performed at:-
1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen
518105, Guangdong, China.

4.5 General condition

Ambient Condition: 25.5 °C 58 %RH

4.5.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

The follow condition is not applicable

Test Voltage	Input voltage
Rated voltage-15%	
normal	
Rated voltage+15%	

The follow condition is applicable.

Test voltage	Test Voltage
Rated voltage	New Battery 3.0V DC

4.5.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	MHz	908.42MHz	MHz
Receiving	MHz	MHz	MHz

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation(TDK) (Test Frequency:30MHz~1000MHz)						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	Aug.09,2012	Aug.09,2013
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Aug.11,2012	Aug.11,2013
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Apr.07,2013	Apr.07,2014
4	Cable	HUBER+SUHNE R	CBL2	525178	Sep.15,2012	Sep.15,2013
3m Semi-anechoic Chamber for Radiation Emissions (Test Frequency:Above 1GHz)						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 13,2013
2.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2012	Aug. 13,2013
3.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 13,2013
4.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.07,2014
5.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 13,2013
6.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug. 13,2012	Aug. 13,2013

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emission Test

Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	ANSI C63.4
Frequency Range:	150kHz to 30MHz
Class:	Class B
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average
Limit	
Test Result:	N/A
Remark:	This device powered by battery, this test is not applicable.

7 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249
 Test Method: ANSI 63.4
 Measurement Distance: 3m
 Detector: Peak for pre-scan (120kHz resolution bandwidth)
 Quasi-Peak if maximised peak within 6dB of limit
 Test Result: PASS

15.247(a)Limit:

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

15.209 Limit:

Frequency(MHZ)	Distance(m)	Field strength	
		uV/m	dBuV/m
30-88	3	100	40.0
88-216	3	150	43.5
216-960	3	200	46.0
Above 960	3	500	54.0

Note: RF Voltage(dBuV)=20 log₁₀ RF Voltage(uV)

7.1 EUT Operation:

Operating Environment:

Temperature: 25.5 °C
 Humidity: 51 % RH
 Atmospheric Pressure: 1012 mbar

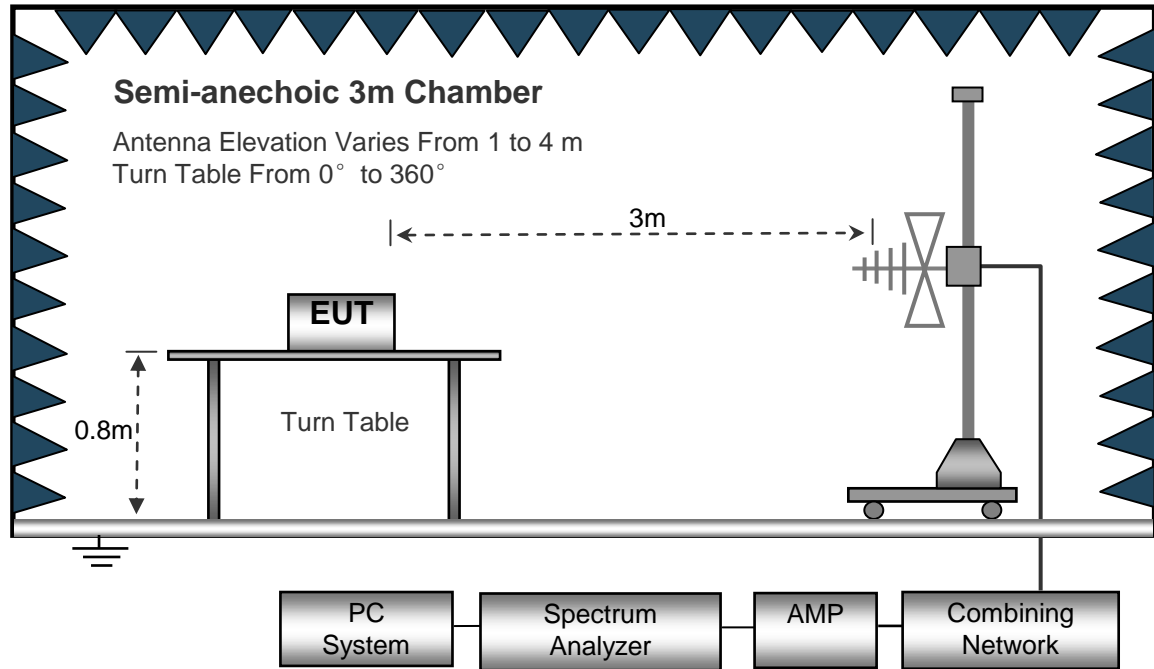
Operation Mode:

The EUT was tested in normal linking mode. The test data were shown as follow.

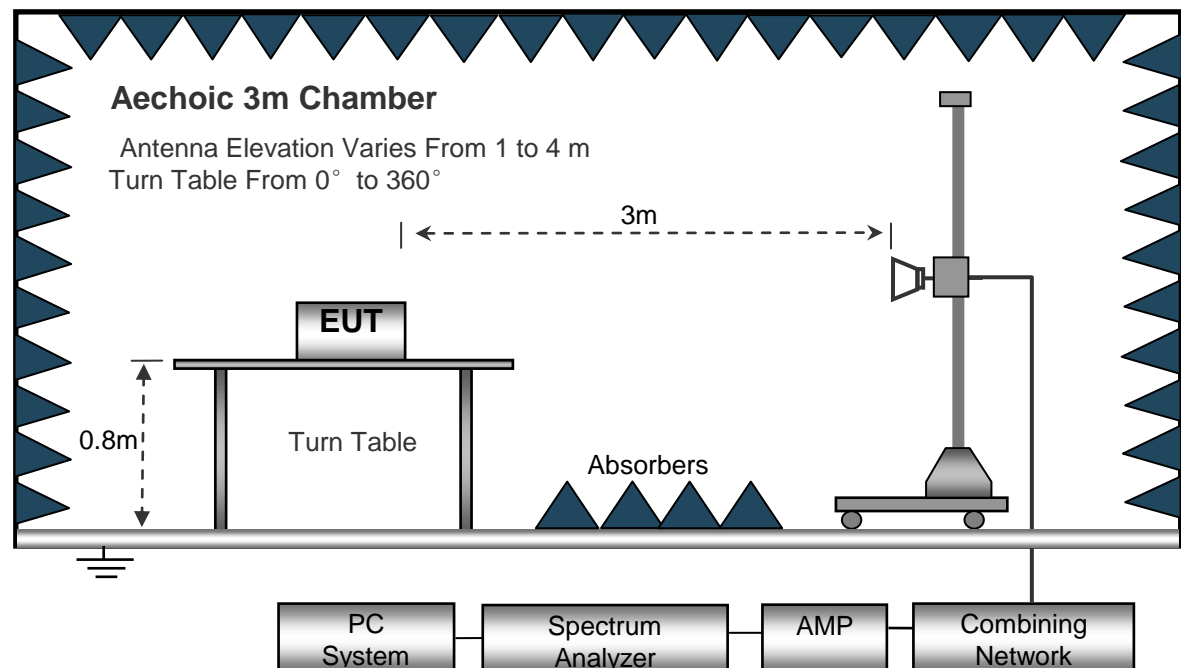
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 30MHz to 10GHz.

30MHz ~ 1GHz

Sweep Speed	Auto
IF Bandwidth	120 KHz
Video Bandwidth.....	100KHz
Quasi-Peak Adapter Bandwidth	120 KHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth.....	100KHz

Above 1GHz

Sweep Speed	Auto
IF Bandwidth	120 KHz
Video Bandwidth.....	3MHz
Quasi-Peak Adapter Bandwidth	120 KHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth.....	1MHz

7.4 Test Procedure

1. The new battery was used in the equipment under test for radiated emissions test.
2. This is a handheld device, The radiation emission should be tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position.
So the data shown was the X position only.
3. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
4. All data was recorded in the peak and average detection mode.
5. The EUT was under working mode during the final qualification test and the configuration was used to represent the worst case results.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

7.6 Radiated Emissions Test Result

Formula of conversion factors: the field strength at 3m was established by adding
The meter reading of the spectrum analyzer (which is set to read in units of dBuV/m)
To the antenna correction factor supplied by the antenna manufacturer. The antenna
Correction factors are stated in terms of dB. The gain of the preselector was accounted
For in the spectrum analyser meter reading.

Example:

Freq(MHz) Meter Reading +ACF=FS

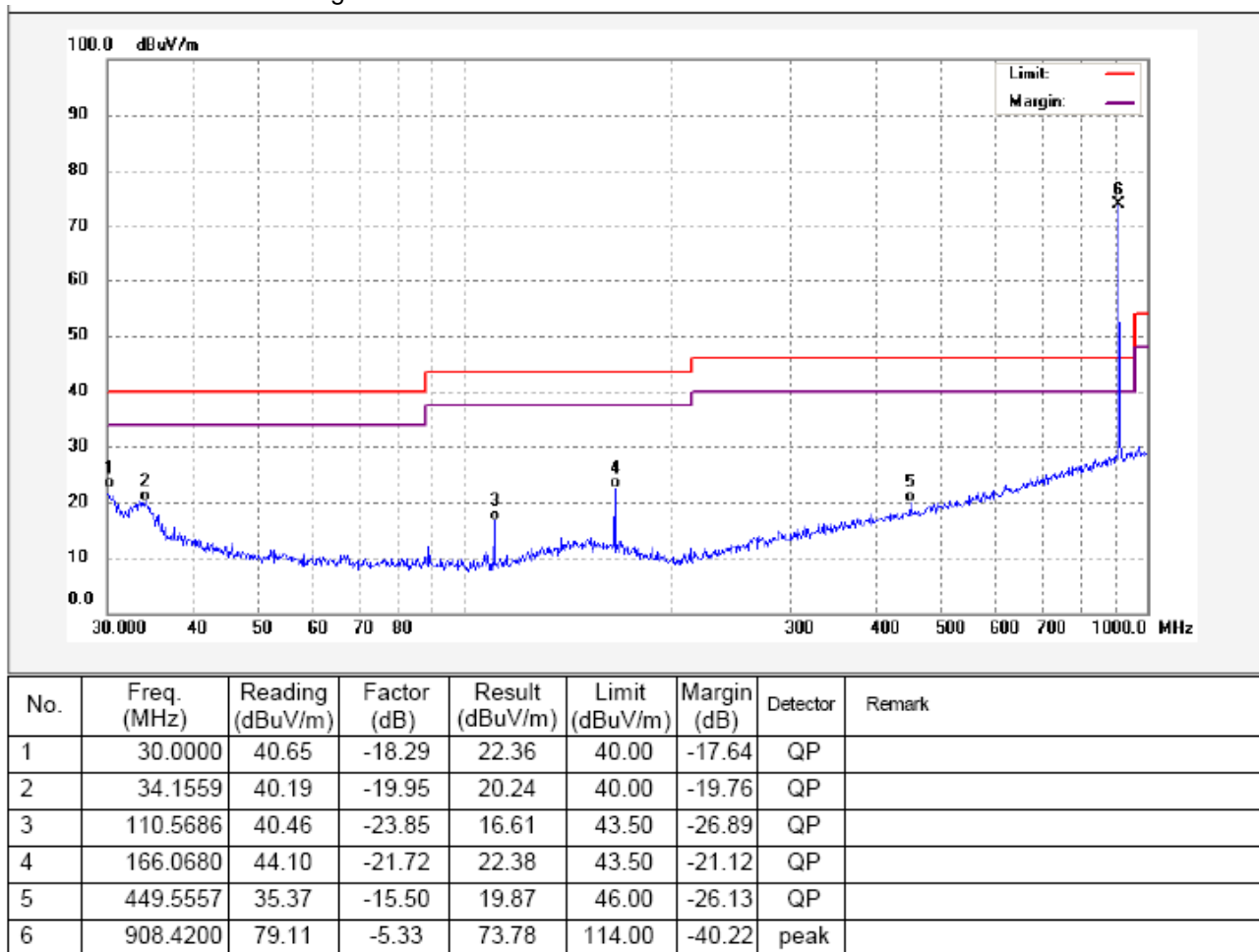
33 20dBuV+10.36dB=30.36dBuV/m @3m

7.7 Radiated Emission Data

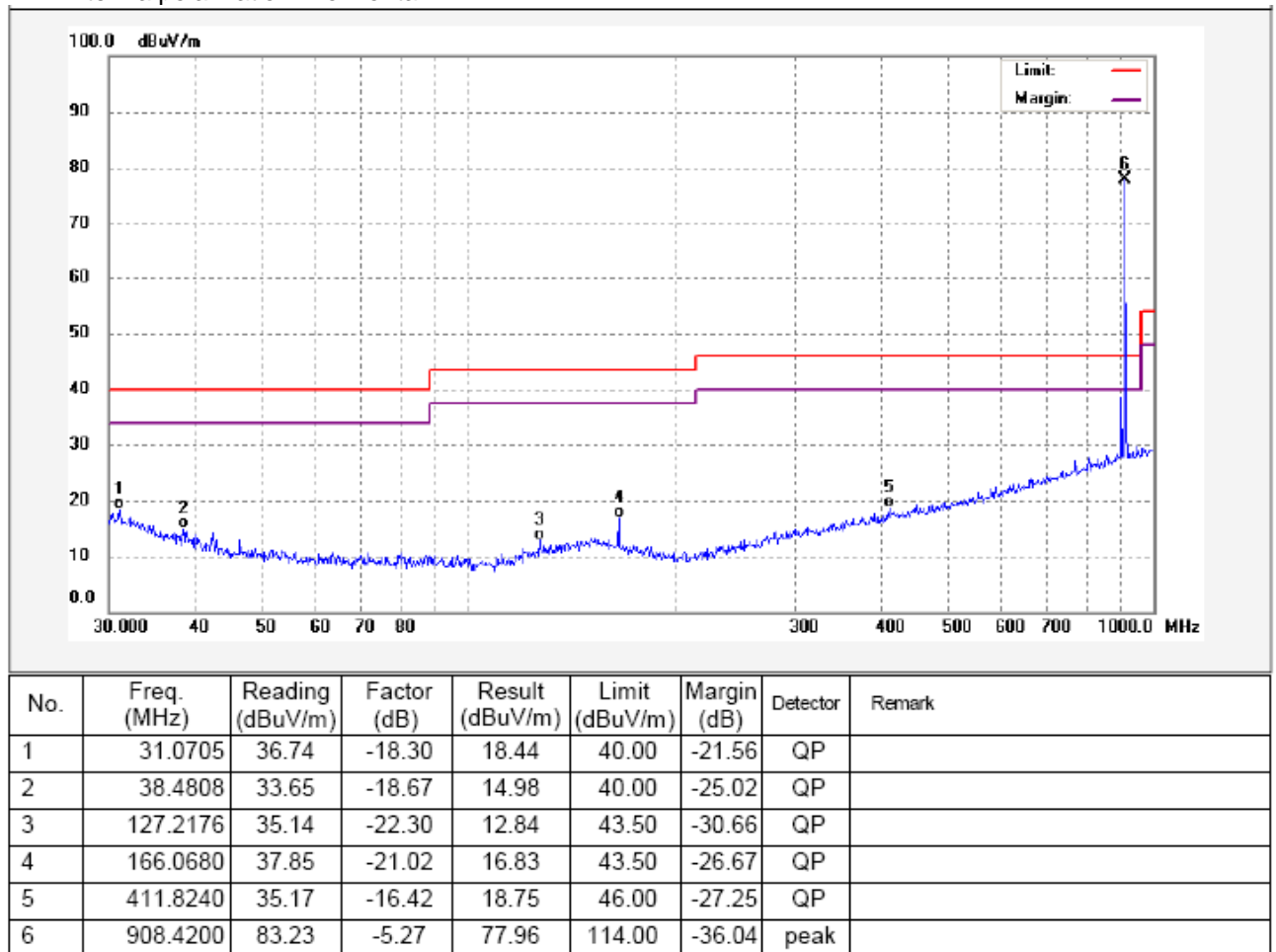
Test Frequency: 30MHz ~ 1000MHz

Antenna polarization: Vertical

Test Mode: Normal linking



Antenna polarization: Horizontal



And the below is the Fundamental and Harmonic .

Test Mode:Continuous transmitting

AV = Peak +20Log₁₀(duty cycle) =PK+(-7)

See section 8 for duty cycle factor.

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	FCC 15 Subpart C Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
1816.84	AV	Vertical	39	54.00	-15	1.2	100
2725.26	AV	Vertical	31.01	54.00	-22.99	1.8	60
3633.68	AV	Vertical	30.42	54.00	-23.58	1.5	120
4542.1	AV	Vertical	28.63	54.00	-25.37	1.5	120
5450.52	AV	Vertical	29.22	54.00	-24.78	1.2	90
6358.94	AV	Vertical	28.89	54.00	-25.11	1.8	10
7267.36	AV	Vertical	31.67	54.00	-22.33	1.8	120
8175.78	AV	Vertical	31.78	54.00	-22.22	1.5	100
9084.2	AV	Vertical	26.02	54.00	-27.98	1.2	135
1816.84	AV	Horizontal	34.26	54.00	-19.74	1.6	10
2725.26	AV	Horizontal	29.25	54.00	-24.75	1.8	60
3633.68	AV	Horizontal	30.33	54.00	-23.67	1.0	40
4542.1	AV	Horizontal	26.19	54.00	-27.81	1.8	135
5450.52	AV	Horizontal	26.62	54.00	-27.38	1.0	60
6358.94	AV	Horizontal	23.73	54.00	-30.27	1.8	0
7267.36	AV	Horizontal	26.57	54.00	-27.43	1.5	90
8175.78	AV	Horizontal	27	54.00	-27	1.5	60
9084.2	AV	Horizontal	28.81	54.00	-25.19	1.0	0
1816.84	PK	Vertical	46.00	74.00	28.00	1.1	10
2725.26	PK	Vertical	38.01	74.00	35.99	1.4	120
3633.68	PK	Vertical	37.42	74.00	36.58	1.7	120
4542.1	PK	Vertical	35.63	74.00	38.37	1.0	180
5450.52	PK	Vertical	36.22	74.00	37.78	1.5	0
6358.94	PK	Vertical	35.89	74.00	38.11	1.0	120
7267.36	PK	Vertical	38.67	74.00	35.33	1.8	0
8175.78	PK	Vertical	38.78	74.00	35.22	1.5	0
9084.2	PK	Vertical	33.02	74.00	40.98	1.2	50
1816.84	PK	Horizontal	41.26	74.00	32.74	1.2	40
2725.26	PK	Horizontal	36.25	74.00	33.75	1.5	100

3633.68	PK	Horizontal	37.33	74.00	36.67	1.0	90
4542.1	PK	Horizontal	33.19	74.00	40.81	1.0	60
5450.52	PK	Horizontal	33.62	74.00	40.38	1.5	60
6358.94	PK	Horizontal	30.73	74.00	43.27	1.8	110
7267.36	PK	Horizontal	33.57	74.00	40.43	1.8	180
8175.78	PK	Horizontal	34.00	74.00	40.00	1.8	0
9084.2	PK	Horizontal	35.81	74.00	38.19	1.0	20

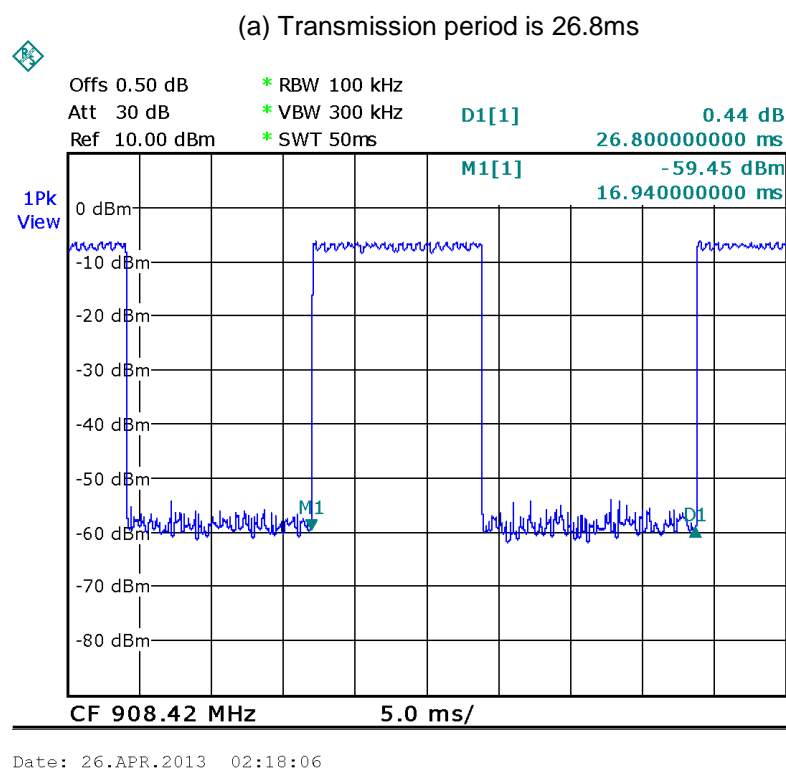
8 Duty Cycle

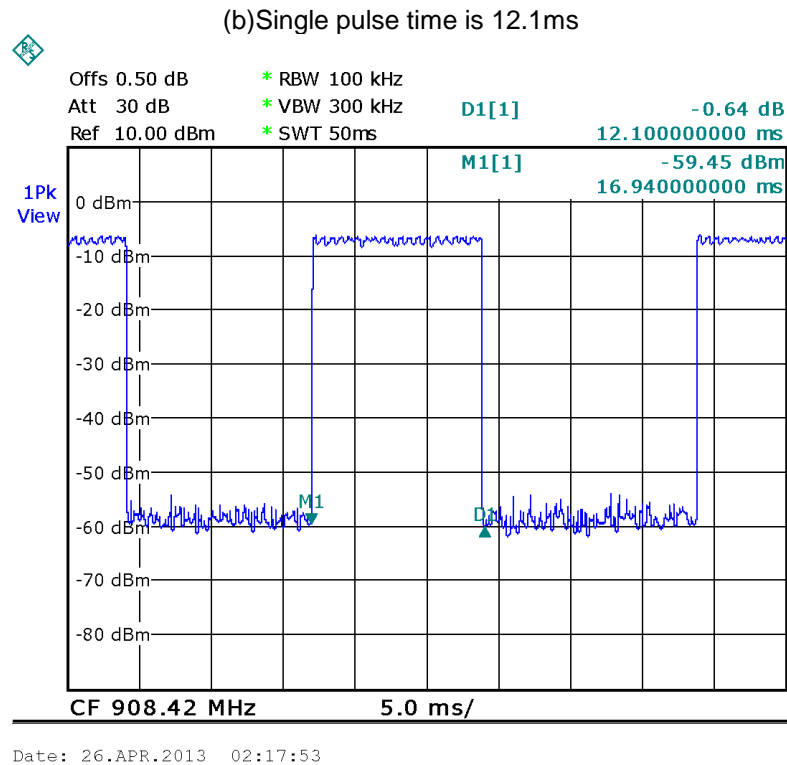
Test Requirement: FCC Part 15.35
Test Method: ANSI C63.4:2003
Test Status: Normal working mode.

8.1 Test Procedure

1. The EUT was placed on a turntable which is 0.8m above ground plane
2. Set EUT as normal operation mode
3. Set SPA center frequency = fundamental frequency, RBW = 100kHz, VBW = 300kHz, Span = 0 Hz, Adjacent sweep time.

8.2 Test Result





The EUT is auto. operation for transmitter, it is declared by the manufacturer as a duty cycle ratio of less than 100%.

The EUT's work time : $T_{on} = \text{pulse time} = 12.1 \text{ ms}$

The EUT's work period : $T = T_{ON} + T_{OFF} = \text{transmission period} = 26.8 \text{ ms}$

The EUT's duty cycle : $D = T_{on} / T = 12.1 / 26.8 * 100\% = 45.15 \%$

Duty Cycle Correction Factor(dB) = $20 * \log_{10}(\text{Duty Cycle}) = 20 * \log_{10}(45.15 \%)$
= -7 dB

9 20dB Bandwidth

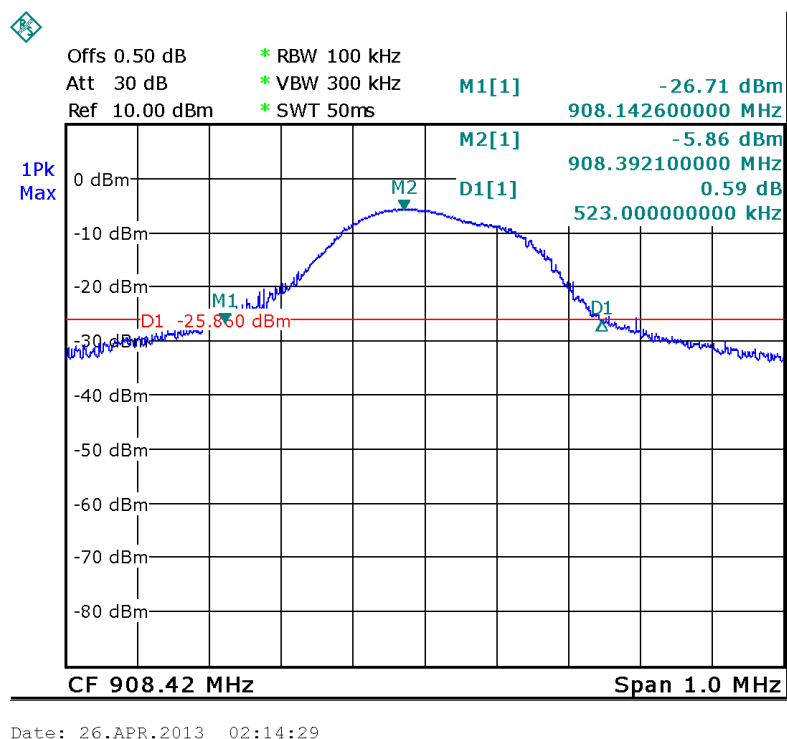
Test Requirement: FCC Part15.215(c)
Test Method: ANSI C63.4
Test mode: Transmitting
Test Result: PASS

9.1 Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 100KHz RBW and 300KHz VBW.

9.2 Test Result

Please refer the graph as below:



10 Restricted band

Test Requirement:	FCC Part15 Paragraph 15.205
Test Method:	ANSI C63.4
Test Result:	N/A

Requirements:

emissions that fall in the restricted bands(15.205).Above 1000MHz, compliance with the emissions limits in section 15.209 shall be demonstrated based on the average value of the measured emissions,The provisions in section 15.35apply to these measurements.

Remark:Transmitter operates only at 908MHz,center of band.

11 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has a PCB printed antenna, fulfil the requirement of this section.

12 Photographs of Testing

12.1 Radiation Emission From 30MHz-1GHz



12.2 Radiation Emission Above 1GHz



13 Photographs - Constructional Details

13.1 EUT - Appearance View



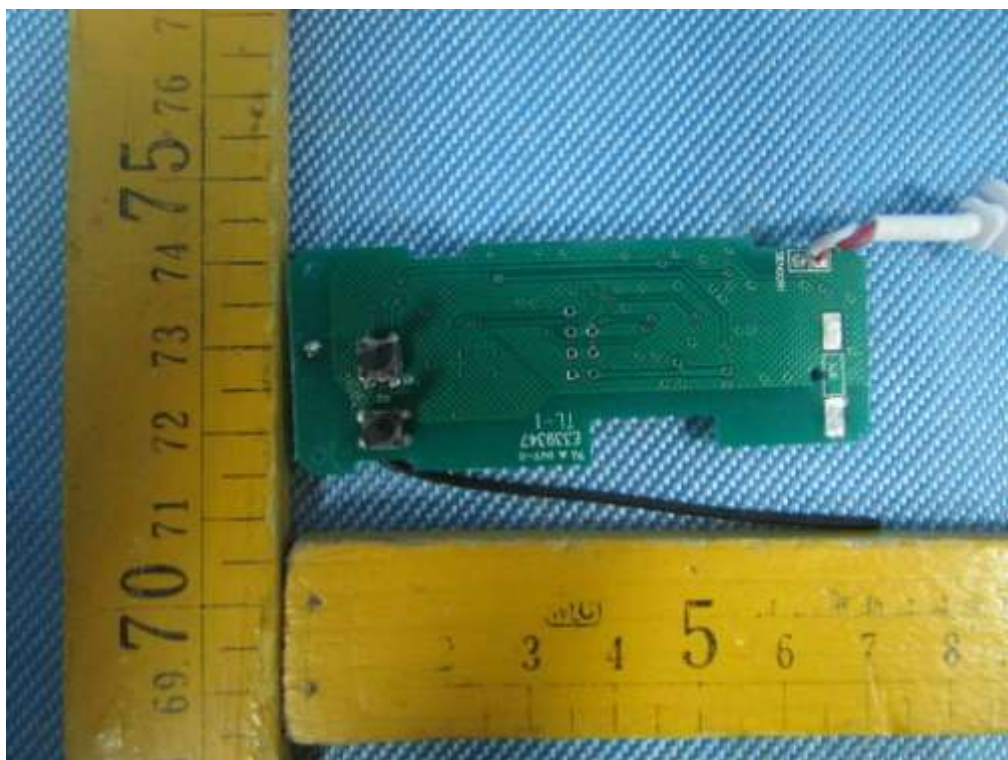
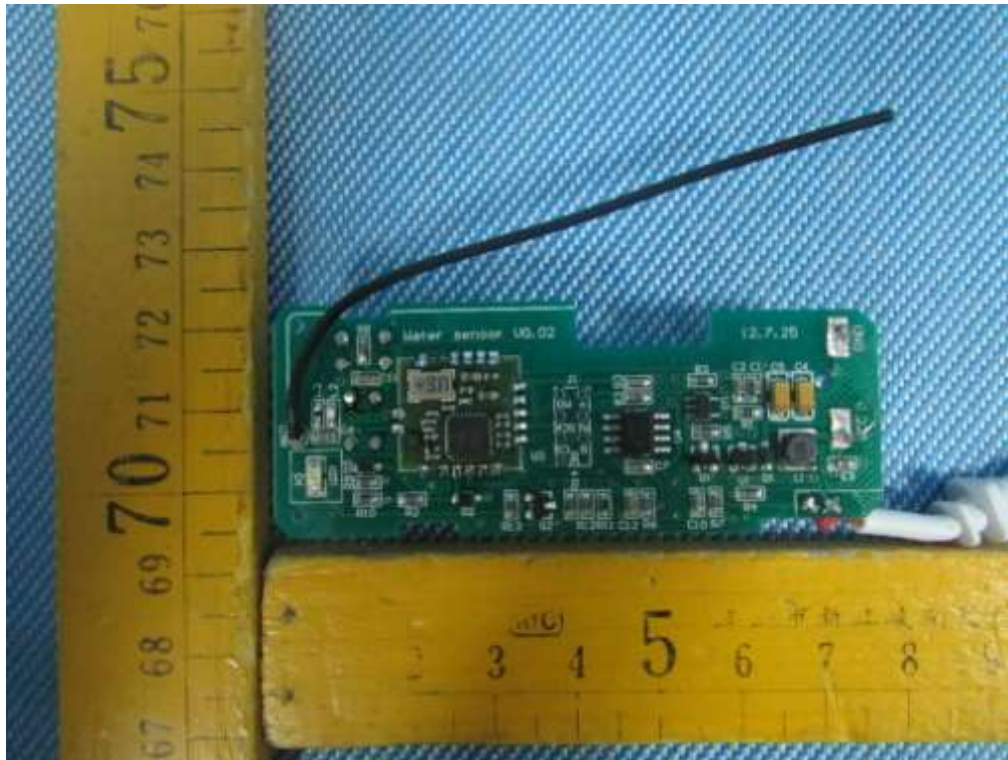




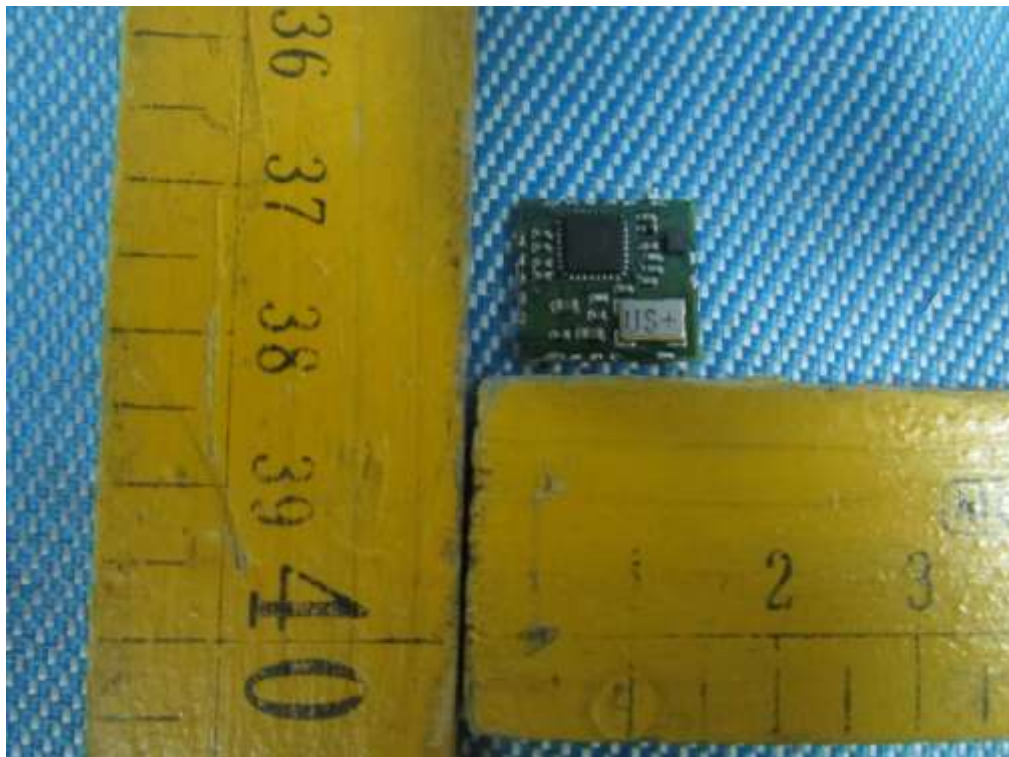
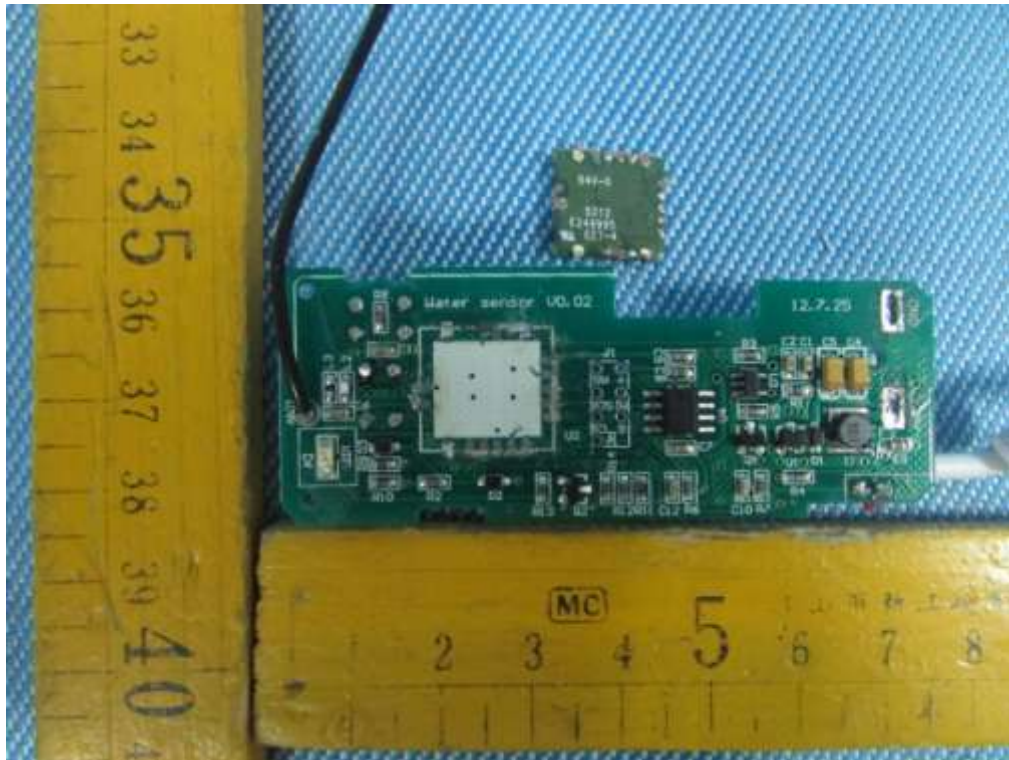
13.2 EUT - Open View

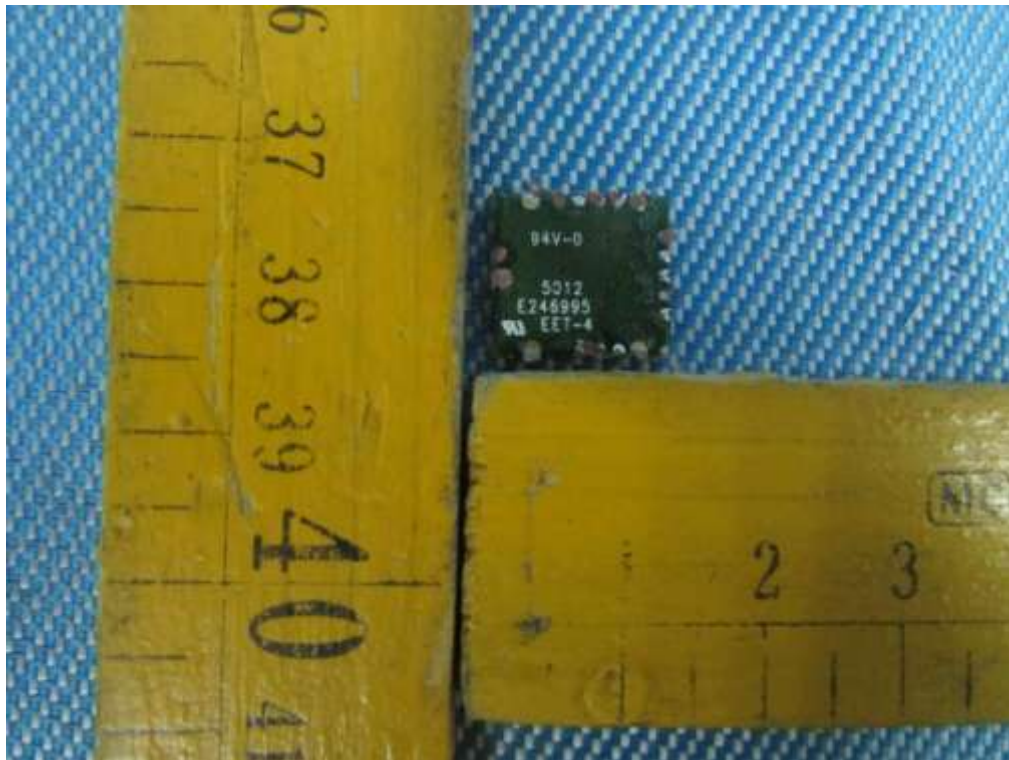


13.3 PCB - View



13.4 EUT – RF Module





14 FCC ID Label

14.1 Label sample

Label sample for model: DSB45-ZWUS

FCC ID: XBADSB45

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

14.2 Label Location

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.



==END==