

CE Test Report

Product Name	AIS Class B Transponder
Model No.	CAMINO-108, CAMINO-108W

Applicant	Alltek Marine Electronics Corp.
Address	7F, No.605, Ruei Guang Rd., Neihu, Taipei, Taiwan, 114 R.O.C.

Date of Receipt	May 06, 2013
Issued Date	Oct. 21, 2013
Report No.	135096R-RFCEP14V01
Report Version	V2.0



The test results relate only to the samples tested.

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Test Report Certification

Issued Date : Oct. 21, 2013

Report No. : 135096R-RFCEP14V01



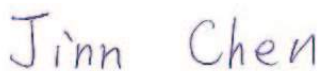
Product Name	AIS Class B Transponder
Applicant	Alltek Marine Electronics Corp.
Address	7F, No.605, Ruei Guang Rd., Neihu, Taipei, Taiwan, 114 R.O.C.
Manufacturer	Alltek Marine Electronics Corp.
Model No.	CAMINO-108, CAMINO-108W
EUT Rated Voltage	DC 9.6~31.2V
EUT Test Voltage	DC 12/24V
Trade Name	AMEC
Applicable Standard	ETSI EN 300 328:V1.7.1 (2006-10)
Test Result	Complied

The test results relate only to the samples tested.

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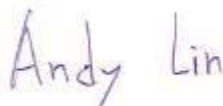
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Documented By :



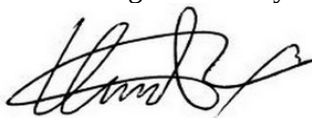
(Senior Adm. Specialist / Jinn Chen)

Tested By :



(Assistant Engineer / Andy Lin)

Approved By :



(Manager / Vincent Lin)

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Attachment 1: EUT Test Setup Photographs

Attachment 2: EUT Detailed Photographs

Revision History

Rev.	Issue Date	Revisions	Effect page
V1.0	August 20, 2013	Initial Issue	All
V2.0	October 21, 2013	1) Add Revision History 2) Modify section 1.2 Tested System Details 3) Modify section 1.3 EUT Test Setup Environment & Configuration of AIS System 4) Modify section 2.8 Test Result 5) Modify section 5.8 Test Result	5, 8, 12, 20

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	AIS Class B Transponder
Trade Name	AMEC
Model No.	CAMINO-108, CAMINO-108W
Frequency Range	2412-2472MHz for 802.11b/g/n-20BW
Number of Channels	802.11b/g/n-20MHz: 13
Data Rate	802.11b: 1-11Mbps, 802.11g: 6-54Mbps, 802.11n: up to 72.2Mbps
Channel Separation	802.11b/g/n: 5 MHz
Type of Modulation	802.11b:DBPSK, DQPSK, CCK 802.11g/n:OFDM, BPSK, QPSK, 16QAM, 64QAM
Antenna Type	Dipole Antenna
Antenna Gain	Refer to the table "Antenna List"
Channel Control	Auto
VHF Cable	Shielded, 10m
GPS Cable	Shielded, 10m
Hardware	M-PCB-B108MBV1
Software	V1.2.6

Antenna List

No.	Manufacturer	Model No.	Antenna Type	Peak Gain
1	Alltek Marine Electronics Corp.	M-ANT-SAA04-05005G-01	Dipole	2dBi for 2.4 GHz

802.11b/g/n-20MHz Center Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 01:	2412 MHz	Channel 02:	2417 MHz	Channel 03:	2422 MHz	Channel 04:	2427 MHz
Channel 05:	2432 MHz	Channel 06:	2437 MHz	Channel 07:	2442 MHz	Channel 08:	2447 MHz
Channel 09:	2452 MHz	Channel 10:	2457 MHz	Channel 11:	2462 MHz	Channel 12:	2467 MHz
Channel 13:	2472 MHz						

Note:

- 1 The EUT is a AIS Class B Transponder with a built-in WLAN transceiver.
- 2 The operation voltage is evaluated at both DC 12V and 24V. DC 24V is worst case, through pre-testing. Only worst case is shown in the report.
- 3 QuieTek is verified all construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode	Mode 1: Transmit (802.11b 1Mbps)
	Mode 2: Transmit (802.11g 6Mbps)
	Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW)
	Mode 4: Receive (802.11n MCS8 14.4Mbps 20MBW)

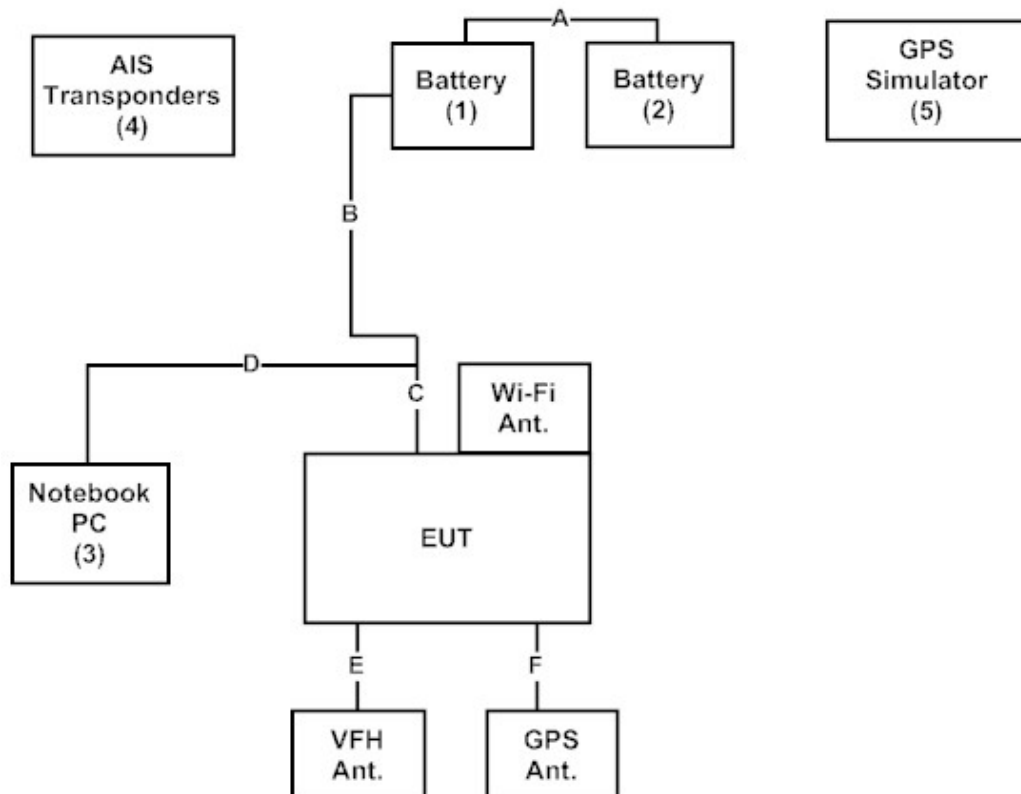
1.2. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including SD cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 DC 12V Battery	TRANE	12B50PE	N/A	N/A
2 DC 12V Battery	Chen Guang	66N50	N/A	N/A
3 Notebook PC	DELL	PPT	N/A	N/A
4 AIS Transponders	AMEC	CAMINO-101 / CAMINO-701	N/A	Non-shielded, 1.8m
5 GPS Simulator	Agilent	E4438C	N/A	Non-shielded, 1.8m

Signal Cable Type	Signal cable Description
A Power Cable	Non-shielded, 0.9m
B Power Cable	Non-shielded, 0.9m
C Power/Data Cable	Shielded, 1.4m
D RS232 Cable	Shielded, 1.2m
E VHF cable	Shielded, 10m
F GPS cable	Shielded, 10m

1.3. EUT Test Setup Environment & Configuration of AIS System



1.4. EUT Operation Procedures

- (1) Setup the EUT as shown in Section 1.3
- (2) Execute “WL.exe” program on the Notebook PC.
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Press “OK” to start the continuous Transmit.
- (5) Verify that the EUT works properly.

1.5. Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Required	Actual
Temperature (°C)	ETSI EN 300 328	15-35	20-35
Humidity (%RH)		20-75	50-55

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site: <http://www.quietek.com/tw/ctg/cts/accreditations.htm>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site: <http://www.quietek.com/>

Site Description: Accredited by TAF
 Accredited Number: 0914

Site Name: Quietek Corporation
Site Address: No.5-22, Ruishukeng,
 Linkou Dist. New Taipei City 24451,
 Taiwan, R.O.C.
 TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
 E-Mail : service@quietek.com

2. Equivalent Isotropic Radiated Power

2.1. Test Equipment

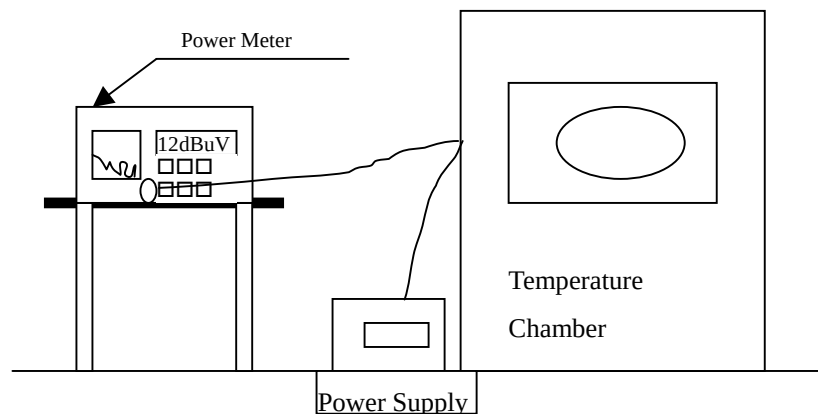
	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Power Meter	Anritsu	ML2495A/6K00003357	May, 2013
X	Power Sensor	Anritsu	MA2411B/0738448	Jun, 2013
	8-WAY Power Divider	JFW	50PD-647 / 526770 0916	Apr., 2013
X	Temperature Chamber	TDE	CHM 150CT	March, 2013

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.
3. The power combiner is used for measure 11n mode.

2.2. Test Setup

Conduction Power Measurement



2.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

2.4. Limits

The equivalent isotropic radiated power is defined as the total power of the transmitter.

The equivalent isotropic radiated power shall be equal to or less than -10 dBW (100 mW) e.i.r.p. This limit shall apply for any combination of power level and intended antenna assembly.

2.5. Test Procedure

The following method of measurement shall apply to both conducted and radiated measurements. The measurement shall be performed using normal operation of the equipment with modulation, using the test data sequence, applied. Using a suitable means, the output of the transmitter shall be coupled to a diode detector; the output of the diode detector shall be connected to the vertical channel of an oscilloscope; the combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the envelope peaks and the duty cycle of the transmitter output signal.

The measurement shall be repeated at the lowest, the middle, and the highest frequency of the stated frequency range.

FHSS equipment shall be made to hop continuously to each of these three frequencies separately.

2.6. Uncertainty

The measurement uncertainty is defined as $\pm 1.27\text{dB}$

2.7. Test Specification

According to ETSI EN 300 328:V1.7.1 (2006-10)

2.8. Test Result

The emissions from the EUT were below the specified limits. The worst-case emission is shown in section 9.1.

The acceptance criterion was met and the EUT passed the test.

3. Peak Power Density

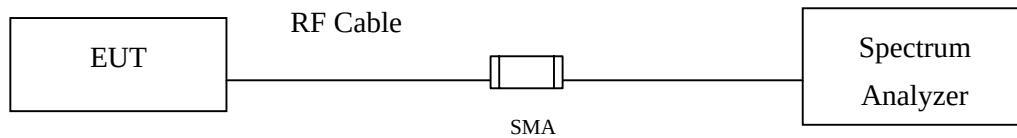
3.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2013
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2013
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2013
	8-WAY Power Divider	JFW	50PD-647 / 526770 0916	Apr., 2013

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.
3. The power combiner is used for measure 11n mode.

3.2. Test Setup



3.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

3.4. Limits

The maximum spectral power density is defined as the highest level of power in Watts per Hertz generated by the transmitter within the power envelope.

For equipment using FHSS modulation, the maximum spectral power density shall be limited to -10 dBW (100 mW) per 100 kHz e.i.r.p. For equipment using other types of modulation, the maximum spectral power density shall be limited to -20 dBW (10 mW) per MHz e.i.r.p.

3.5. Test Procedure

The maximum spectral power density shall be determined using a spectrum analyzer of adequate bandwidth for the type of modulation being used in combination with an RF power meter.

Connect an RF power meter to the IF output of the spectrum analyzer and correct its reading using a known reference source, e.g. a signal generator.

The above procedure shall be repeated for each of the three frequencies identified by the procedure given in limit (sub clause 5.7.2.2.)

Where the spectrum analyzer bandwidth is non-Gaussian, a suitable correction factor shall be determined and applied.

Where a spectrum analyzer is equipped with a facility to measure power density, this facility may be used instead of the above procedure.

3.6. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

3.7. Test Specification

According to ETSI EN 300 328:V1.7.1 (2006-10)

3.8. Test Result

The test result was shown in section 9.2.

The acceptance criterion was met and the EUT passed the test.

4. Frequency Range

4.1. Test Equipment

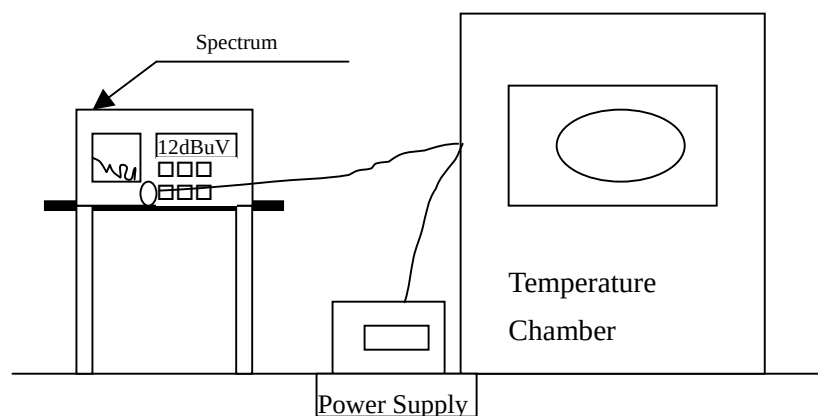
	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2013
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2013
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2013
	8-WAY Power Divider	JFW	50PD-647 / 526770 0916	Apr., 2013
X	Temperature Chamber	TDE	CHM 150CT	March, 2013

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.
3. The power combiner is used for measure 11n mode.

4.2. Test Setup

Conduction Power Measurement



4.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

4.4. Limits

The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope.

f_H is the highest frequency of the power envelope: it is the frequency furthest above the frequency of maximum power where the output power drops below the level of -80 dBm/Hz e.i.r.p. spectral power density (-30 dBm if measured in a 100 kHz bandwidth).

f_L is the lowest frequency of the power envelope; it is the frequency furthest below the frequency of maximum power where the output power drops below the level equivalent to -80 dBm/Hz e.i.r.p. spectral power density (or -30 dBm if measured in a 100 kHz bandwidth).

For a given operating frequency, the width of the power envelope is ($f_H - f_L$). In equipment that allows adjustment or selection of difference operation frequencies, the power envelope takes up difference positions in the allowed band. The frequency range is determined by the lowest value of f_L and the highest value of f_H resulting from the adjustment of the equipment to the lowest and highest operating frequencies.

For all equipment the frequency range shall lie within the band 2.4GHz to 2.4835GHz ($f_L > 2.4\text{GHz}$ and $f_H < 2.4835\text{GHz}$).

4.5. Test Procedure

The measurement procedure shall be as follows:

- a) Place the spectrum analyzer in video averaging mode with a minimum of 50 sweeps selected and activate the transmitter with modulation applied. The RF emission of the equipment shall be displayed on the spectrum analyzer;
- b) Select lowest operating frequency of the equipment under test;
- c) Using the marker of the spectrum analyzer, find lowest frequency below the operating frequency at which spectral power density drops below the level given in limit (subclause 5.2.3);
- d) Select the highest operating frequency of the equipment under test;
- e) Find the highest frequency at which the spectral power density drops below the value given in limit (subclause 5.2.3);
- f) The difference between the frequencies measured in steps c) and e) is the frequency range.

4.6. Uncertainty

The measurement uncertainty is defined as $\pm 100\text{ kHz}$

4.7. Test Specification

According to ETSI EN 300 328:V1.7.1 (2006-10)

4.8. Test Result

The test result was shown in section 9.3.

The acceptance criterion was met and the EUT passed the test.

5. Spurious Emission

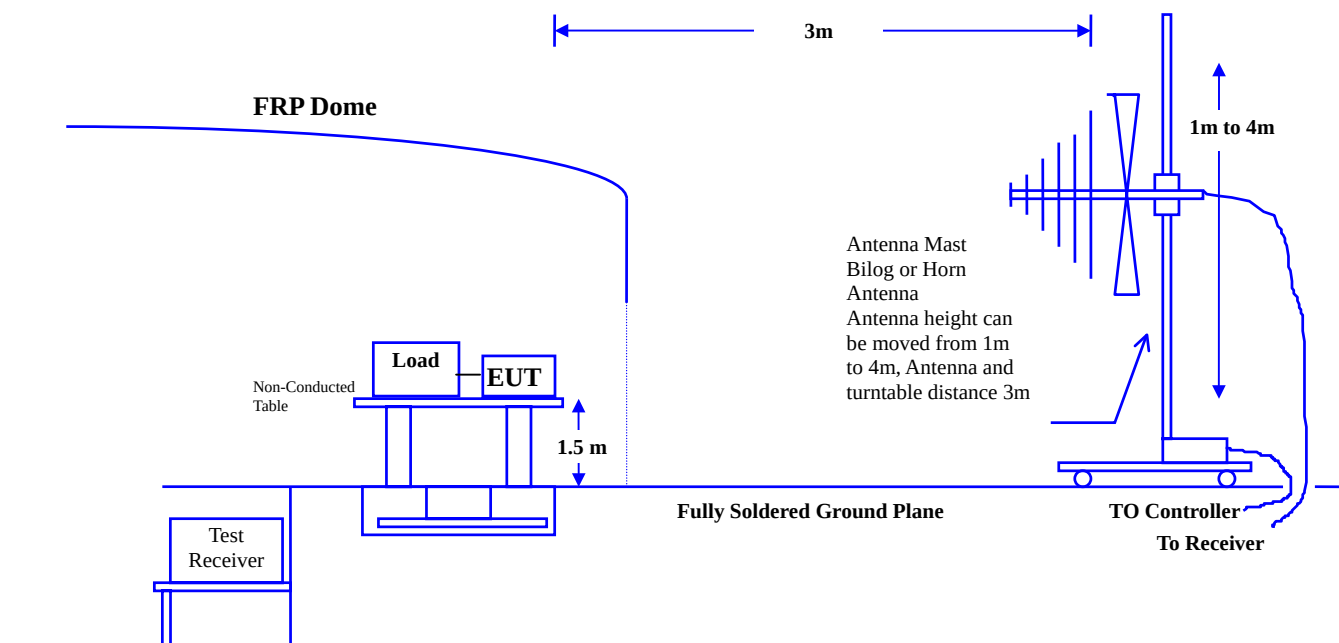
5.1. Test Equipment

The following test equipment are used during the radiated emission test:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Site # 3	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2012
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2012
		Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2012
		Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2013
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

5.2. Test Setup



5.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

5.4. Limits

Transmitter limits for narrowband spurious emission

Frequency Range	Limit when operating	Limit when in standby
30MHz to 1 GHz	-36 dBm	-57 dBm
Above 1 GHz to 12.75 GHz	-30 dBm	-47 dBm
1.8 GHz to 1.9 GHz 5.15 GHz to 5.3 GHz	-47 dBm	-47 dBm

Transmitter limits for wideband spurious emission

Frequency Range	Limit when operating	Limit when in standby
30MHz to 1 GHz	-86 dBm/Hz	-107 dBm/Hz
Above 1 GHz to 12.75 GHz	-80 dBm/Hz	-97 dBm/Hz
1.8 GHz to 1.9 GHz 5.15 GHz to 5.3 GHz	-97 dBm/Hz	-97 dBm/Hz

Narrowband spurious emission limit for receivers

Frequency Range	Limit
30MHz to 1 GHz	-57 dBm
Above 1 GHz to 12.75 GHz	-47 dBm

Wideband spurious emission limit for receivers

Frequency Range	Limit
30MHz to 1 GHz	-107 dBm/Hz
Above 1 GHz to 12.75 GHz	-97 dBm/Hz

5.5. Test Procedure

The EUT is placed on a turn table which is 1.5 meters above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Broadband antenna (calibrated bi-log and horn antenna) are used as a receiving antenna.

Both horizontal and vertical polarization of the antenna are set on measurement. And a high frequency preamplifier were used increase the sensitivity of the measuring. In order to find the maximum emission, all of the interface cables must be manipulated according to ETSI EN 300 328:V1.7.1 (2006-10) on radiated measurement.

The additional notch filter below 1GHz was used to measure the level of harmonics radiated emission during field strength of harmonics measurement. The bandwidth setting on the field strength meter (R & S Spectrum Analyzer ESI26) is 100 kHz. The frequency range from 30MHz to 12.75GHz is checked.

5.6. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB
under 1G is defined as ± 3.8 dB

5.7. Test Specification

According to ETSI EN 300 328:V1.7.1 (2006-10)

5.8. Test Result

The emissions from the EUT were below the specified limits. The worst-case emission is shown in section 9.4.

The acceptance criterion was met and the EUT passed the test.

6. Medium access protocol

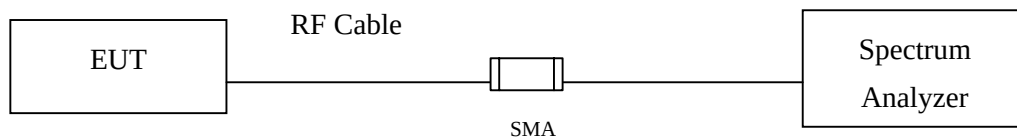
6.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2013
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2013
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2013
	8-WAY Power Divider	JFW	50PD-647 / 526770 0916	Apr., 2013

Note:

- 1.All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
- 2.The test instruments marked with “X” are used to measure the final test results.
- 3.The power combiner is used for measure 11n mode.

6.2. Test Setup



6.3. Test Condition

Normal test condition.

6.4. Requirement

A medium access protocol shall be implemented by the equipment.

6.5. Test Specification

According to ETSI EN 300 328:V1.7.1 (2006-10)

6.6. Test Result

The test data is shown in Section 9.5.

7. Measurement Uncertainty Values

The maximum values of the absolute measurement uncertainties of the measurements defined in the present document shall not exceed the values given below:

Parameter	Uncertainty
Radio frequency	$\pm 1 \times 10^{-5}$
Total RF power, conducted	± 1.5 dB
RF power density, conducted	± 3 dB
Spurious emissions, conducted	± 3 dB
All emissions, radiated	± 6 dB
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	± 5 %
DC and low frequency voltages	± 3 %

8. EMC Reduction Method During Compliance Testing

No modification was made during testing.

9. Test Result

The test results in the emission and the immunity were performed according to the requirements of measurement standard and process. Quietek Corporation is assumed full responsibility for the accuracy and completeness of these measurements. The test data of the emission is listed as below.

All the tests were carried out with the EUT in normal operation, which was defined as:

Test Mode	Mode 1: Transmit (802.11b 1Mbps)
	Mode 2: Transmit (802.11g 6Mbps)
	Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW)
	Mode 4: Receive (802.11n MCS8 14.4Mbps 20MBW)

9.1. Test Data of Equivalent Isotropic Radiated Power

Product : AIS Class B Transponder
Test Item : Equivalent Isotropic Radiated Power
Test Mode : Mode 1: Transmit (802.11b 1Mbps)

Antenna Gain: 2dBi, Duty Cycle: 1, Cable Loss: 0.5dB						
Test Conditions		Channel	Freq. (MHz)	Reading Level (dBm)	Emission Level (dBm)	Limit (dBm)
Tnom (20) °C	Vnom (24) V	1	2412	15.51	17.51	20
		7	2442	14.88	16.88	20
		13	2472	14.25	16.25	20
Tmax (55) °C	Vmax (31.2) V	1	2412	15.06	17.06	20
		7	2442	14.68	16.68	20
		13	2472	14.14	16.14	20
Tmax (55) °C	Vmin (21.6) V	1	2412	15.02	17.02	20
		7	2442	14.59	16.59	20
		13	2472	14.11	16.11	20
Tmin (-15) °C	Vmax (31.2) V	1	2412	15.74	17.74	20
		7	2442	15.37	17.37	20
		13	2472	14.63	16.63	20
Tmin (-15) °C	Vmin (21.6) V	1	2412	15.68	17.68	20
		7	2442	15.09	17.09	20
		13	2472	14.58	16.58	20

* Emission Level = Reading Level + Antenna Gain + Cable loss + 10 log (1/Duty Cycle)

Note: DC 24V is worst case, through pre-testing.

Product : AIS Class B Transponder
Test Item : Equivalent Isotropic Radiated Power
Test Mode : Mode 2: Transmit (802.11g 6Mbps)

Antenna Gain: 2dBi, Duty Cycle: 0.972, Cable Loss: 0.5dB						
Test Conditions		Channel	Freq. (MHz)	Reading Level (dBm)	Emission Level (dBm)	Limit (dBm)
Tnom (20) °C	Vnom (24) V	1	2412	14.06	16.18	20
		7	2442	13.56	15.68	20
		13	2472	13.55	15.67	20
Tmax (55) °C	Vmax (31.2) V	1	2412	13.81	15.93	20
		7	2442	13.27	15.39	20
		13	2472	13.28	15.40	20
Tmax (55) °C	Vmin (21.6) V	1	2412	13.84	15.96	20
		7	2442	13.21	15.33	20
		13	2472	13.11	15.23	20
Tmin (-15) °C	Vmax (31.2) V	1	2412	14.08	16.20	20
		7	2442	13.59	15.71	20
		13	2472	13.51	15.63	20
Tmin (-15) °C	Vmin (21.6) V	1	2412	14.03	16.15	20
		7	2442	13.61	15.73	20
		13	2472	13.49	15.61	20

* Emission Level = Reading Level + Antenna Gain + Cable loss + 10 log (1/Duty Cycle)

Note: DC 24V is worst case, through pre-testing.

Product : AIS Class B Transponder
Test Item : Equivalent Isotropic Radiated Power
Test Mode : Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW)

Antenna Gain: 2dBi, Duty Cycle: 0.97, Cable Loss: 0.5dB						
Test Conditions		Channel	Freq. (MHz)	Reading Level (dBm)	Emission Level (dBm)	Limit (dBm)
Tnom (20) °C	Vnom (24) V	1	2412	12.35	14.48	20
		7	2442	11.88	14.01	20
		13	2472	11.52	13.65	20
Tmax (55) °C	Vmax (31.2) V	1	2412	11.81	13.94	20
		7	2442	11.73	13.86	20
		13	2472	11.41	13.54	20
Tmax (55) °C	Vmin (21.6) V	1	2412	11.83	13.96	20
		7	2442	11.72	13.85	20
		13	2472	11.44	13.57	20
Tmin (-15) °C	Vmax (31.2) V	1	2412	12.03	14.16	20
		7	2442	11.91	14.04	20
		13	2472	11.55	13.68	20
Tmin (-15) °C	Vmin (21.6) V	1	2412	11.98	14.11	20
		7	2442	11.88	14.01	20
		13	2472	11.57	13.70	20

* Emission Level = Reading Level + Antenna Gain + Cable loss + 10 log (1/Duty Cycle)

Note: DC 24V is worst case, through pre-testing.

9.2. Test Data of Peak Power Density

Product : AIS Class B Transponder
Test Item : Peak Power Density
Test Mode : Mode 1: Transmit (802.11b 1Mbps)

Antenna Gain: 2dBi, Cable Loss: 0.5dB, Duty Cycle: 1					
Channel	Freq. (MHz)	Reading Level (dBm/MHz)	Measure Level (dBm/MHz)	Limit (dBm/MHz)	Test Result
1	2412	0.01	2.01	10	PASS
7	2442	-0.71	1.29	10	PASS
13	2472	-0.65	1.35	10	PASS

* Measure Level = Reading Level + Antenna Gain + Cable loss + 10 log (1/Duty Cycle)

Product : AIS Class B Transponder
 Test Item : Peak Power Density
 Test Mode : Mode 2: Transmit (802.11g 6Mbps)

Antenna Gain: 2dBi, Cable Loss: 0.5dB, Duty Cycle: 1					
Channel	Freq. (MHz)	Reading Level (dBm/MHz)	Measure Level (dBm/MHz)	Limit (dBm/MHz)	Test Result
1	2412	-1.41	0.72	10	PASS
7	2442	-1.77	0.36	10	PASS
13	2472	-2.02	0.11	10	PASS

* Measure Level = Reading Level + Antenna Gain + Cable loss + 10 log (1/Duty Cycle)

Product : AIS Class B Transponder
 Test Item : Peak Power Density
 Test Mode : Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW)

Antenna Gain: 2dBi, Cable Loss: 0.5dB, Duty Cycle: 1					
Channel	Freq. (MHz)	Reading Level (dBm/MHz)	Measure Level (dBm/MHz)	Limit (dBm/MHz)	Test Result
1	2412	-2.69	-0.56	10	PASS
7	2442	-4.55	-2.42	10	PASS
13	2472	-4.14	-2.01	10	PASS

* Measure Level = Reading Level + Antenna Gain + Cable loss + 10 log (1/Duty Cycle)

9.3. Test Data of Frequency Range

Product : AIS Class B Transponder
Test Item : Frequency Range
Test Mode : Mode 1: Transmit (802.11b 1Mbps)

Test Conditions		Frequency (MHz)	
Tnom (20 °C)	Vnom (24 V)	F _L	2404.00
		F _H	2480.05
Tmax (55 °C)	Vmax (31.2 V)	F _L	2404.05
		F _H	2480.00
Tmax (55 °C)	Vmin (21.6 V)	F _L	2404.05
		F _H	2480.00
Tmin (-15 °C)	Vmax (31.2 V)	F _L	2404.00
		F _H	2480.25
Tmin (-15 °C)	Vmin (21.6 V)	F _L	2404.00
		F _H	2480.20

Note: DC 24V is worst case, through pre-testing.

Test Result	F _L : 2404.00 MHz F _H : 2480.25 MHz
-------------	--

Product : AIS Class B Transponder
Test Item : Frequency Range
Test Mode : Mode 2: Transmit (802.11g 6Mbps)

Test Conditions		Frequency (MHz)	
Tnom (20 °C)	Vnom (24 V)	F _L	2403.00
		F _H	2480.85
Tmax (55 °C)	Vmax (31.2 V)	F _L	2402.95
		F _H	2480.85
Tmax (55 °C)	Vmin (21.6 V)	F _L	2402.95
		F _H	2480.85
Tmin (-15 °C)	Vmax (31.2 V)	F _L	2402.95
		F _H	2481.15
Tmin (-15 °C)	Vmin (21.6 V)	F _L	2402.95
		F _H	2481.25

Note: DC 24V is worst case, through pre-testing.

Test Result	F _L : 2402.95 MHz F _H : 2481.25 MHz
-------------	--

Product : AIS Class B Transponder
 Test Item : Frequency Range
 Test Mode : Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW)

Test Conditions		Frequency (MHz)	
Tnom (20 °C)	Vnom (24 V)	F _L	2402.55
		F _H	2481.25
Tmax (55 °C)	Vmax (31.2 V)	F _L	2402.70
		F _H	2481.20
Tmax (55 °C)	Vmin (21.6 V)	F _L	2402.70
		F _H	2481.20
Tmin (-15 °C)	Vmax (31.2 V)	F _L	2402.75
		F _H	2481.45
Tmin (-15 °C)	Vmin (21.6 V)	F _L	2402.75
		F _H	2481.40

Note: DC 24V is worst case, through pre-testing.

Test Result	F _L : 2402.55 MHz F _H : 2481.45 MHz
-------------	--

9.4. Test Data of Spurious Emission

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11b 1Mbps) (2412MHz)

Frequency MHz	Correct Factor dB	Reading Level dBm	Measurement Level dBm	Margin dB	Limit dBm
Horizontal					
Peak Detector					
142.520	-1.818	-55.050	-56.868	-20.868	-36.000
280.260	2.435	-60.537	-58.102	-22.102	-36.000
431.580	5.181	-60.930	-55.749	-19.749	-36.000
561.560	7.174	-59.018	-51.844	-15.844	-36.000
703.180	8.034	-66.154	-58.120	-22.120	-36.000
912.700	9.950	-73.537	-63.587	-27.587	-36.000
Vertical					
Peak Detector					
111.480	2.443	-68.174	-65.731	-29.731	-36.000
280.260	-0.003	-60.331	-60.334	-24.334	-36.000
480.080	6.210	-67.860	-61.650	-25.650	-36.000
701.240	7.860	-64.479	-56.619	-20.619	-36.000
842.860	9.061	-69.666	-60.605	-24.605	-36.000
982.540	9.198	-63.352	-54.154	-18.154	-36.000

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11b 1Mbps) (2412MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
4824.000	16.682	-57.840	-41.158	-11.158	-30.000
7236.000	25.392	-81.830	-56.438	-26.438	-30.000
9648.000	26.800	-82.190	-55.390	-25.390	-30.000
Vertical					
Peak Detector					
4824.000	18.055	-58.810	-40.755	-10.755	-30.000
7236.000	25.342	-80.600	-55.258	-25.258	-30.000
9648.000	25.907	-81.280	-55.373	-25.373	-30.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11b 1Mbps) (2472MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
4944.000	17.590	-61.510	-43.920	-13.920	-30.000
7416.000	26.954	-82.720	-55.766	-25.766	-30.000
9888.000	26.925	-81.450	-54.525	-24.525	-30.000
Vertical					
Peak Detector					
4944.000	18.480	-62.020	-43.540	-13.540	-30.000
7416.000	26.336	-82.790	-56.454	-26.454	-30.000
9888.000	26.345	-81.780	-55.435	-25.435	-30.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11g 6Mbps) (2412MHz)

Frequency MHz	Correct Factor dB	Reading Level dBm	Measurement Level dBm	Margin dB	Limit dBm
Horizontal					
Peak Detector					
41.640	6.130	-77.586	-71.456	-35.456	-36.000
167.740	-3.116	-64.072	-67.188	-31.188	-36.000
280.260	2.435	-60.647	-58.212	-22.212	-36.000
503.360	6.932	-66.539	-59.607	-23.607	-36.000
703.180	8.034	-66.195	-58.161	-22.161	-36.000
912.700	9.950	-73.247	-63.297	-27.297	-36.000
Vertical					
Peak Detector					
115.360	2.467	-68.813	-66.346	-30.346	-36.000
280.260	-0.003	-60.476	-60.479	-24.479	-36.000
480.080	6.210	-67.939	-61.729	-25.729	-36.000
623.640	7.573	-65.885	-58.312	-22.312	-36.000
701.240	7.860	-64.845	-56.985	-20.985	-36.000
930.160	8.330	-73.315	-64.985	-28.985	-36.000

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11g 6Mbps) (2412MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
4824.000	16.682	-68.810	-52.128	-22.128	-30.000
7236.000	25.392	-81.480	-56.088	-26.088	-30.000
9648.000	26.800	-81.260	-54.460	-24.460	-30.000
Vertical					
Peak Detector					
4824.000	18.055	-70.580	-52.525	-22.525	-30.000
7236.000	25.342	-81.890	-56.548	-26.548	-30.000
9648.000	25.907	-81.770	-55.863	-25.863	-30.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11g 6Mbps) (2472MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
4944.000	17.590	-71.550	-53.960	-23.960	-30.000
7416.000	26.954	-83.100	-56.146	-26.146	-30.000
9888.000	26.925	-81.610	-54.685	-24.685	-30.000
Vertical					
Peak Detector					
4944.000	18.480	-72.060	-53.580	-23.580	-30.000
7416.000	26.336	-82.790	-56.454	-26.454	-30.000
9888.000	26.345	-82.320	-55.975	-25.975	-30.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW) (2412MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
109.540	0.113	-60.574	-60.461	-24.461	-36.000
336.520	2.743	-65.932	-63.189	-27.189	-36.000
421.880	5.331	-64.422	-59.091	-23.091	-36.000
577.080	7.019	-68.989	-61.970	-25.970	-36.000
701.240	7.995	-66.750	-58.755	-22.755	-36.000
961.200	10.286	-72.265	-61.979	-25.979	-36.000
Vertical					
Peak Detector					
132.820	1.749	-61.137	-59.388	-23.388	-36.000
301.600	0.879	-62.723	-61.844	-25.844	-36.000
480.080	6.210	-67.955	-61.745	-25.745	-36.000
701.240	7.860	-64.912	-57.052	-21.052	-36.000
842.860	9.061	-69.641	-60.580	-24.580	-36.000
982.540	9.198	-63.790	-54.592	-18.592	-36.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW) (2412MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm

Horizontal

Peak Detector

4824.000	16.682	-72.110	-55.428	-25.428	-30.000
7236.000	25.392	-81.450	-56.058	-26.058	-30.000
9648.000	26.800	-81.830	-55.030	-25.030	-30.000

Vertical

Peak Detector

4824.000	18.055	-73.220	-55.165	-25.165	-30.000
7236.000	25.342	-81.330	-55.988	-25.988	-30.000
9648.000	25.907	-81.640	-55.733	-25.733	-30.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n MCS8 14.4Mbps 20MBW) (2472MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
4944.000	17.590	-72.490	-54.900	-24.900	-30.000
7416.000	26.954	-82.540	-55.586	-25.586	-30.000
9888.000	26.925	-81.030	-54.105	-24.105	-30.000
Vertical					
Peak Detector					
4944.000	18.480	-74.220	-55.740	-25.740	-30.000
7416.000	26.336	-82.640	-56.304	-26.304	-30.000
9888.000	26.345	-81.030	-54.685	-24.685	-30.000

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 4: Receive (802.11n MCS8 14.4Mbps 20MBW) (2412MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
132.820	-0.736	-64.963	-65.699	-8.699	-57.000
198.780	-2.709	-69.445	-72.154	-15.154	-57.000
336.520	2.743	-67.628	-64.885	-7.885	-57.000
528.580	7.187	-70.397	-63.210	-6.210	-57.000
769.140	7.847	-74.412	-66.565	-9.565	-57.000
912.700	9.950	-76.366	-66.416	-9.416	-57.000
Vertical					
Peak Detector					
169.680	-0.781	-64.246	-65.027	-8.027	-57.000
311.300	1.359	-67.797	-66.438	-9.438	-57.000
528.580	5.840	-71.274	-65.434	-8.434	-57.000
720.640	8.178	-76.512	-68.334	-11.334	-57.000
844.800	9.090	-79.028	-69.938	-12.938	-57.000
908.820	8.609	-75.963	-67.354	-10.354	-57.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : AIS Class B Transponder
 Test Item : Spurious Emission
 Test Site : No.3 OATS
 Test Mode : Mode 4: Receive (802.11n MCS8 14.4Mbps 20MBW) (2412MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm

Horizontal

Peak Detector

2412.000	11.068	-68.320	-57.252	-10.252	-47.000
4824.000	16.751	-80.440	-63.689	-16.689	-47.000
7236.000	25.241	-81.300	-56.059	-9.059	-47.000

Vertical

Peak Detector

2412.000	11.706	-62.080	-50.374	-3.374	-47.000
4824.000	18.143	-81.560	-63.417	-16.417	-47.000
7236.000	25.302	-82.000	-56.698	-9.698	-47.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : AIS Class B Transponder
Test Item : Spurious Emission
Test Site : No.3 OATS
Test Mode : Mode 4: Receive (802.11n MCS8 14.4Mbps 20MBW) (2472MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
2472.000	11.521	-79.160	-67.639	-20.639	-47.000
4944.000	17.630	-81.280	-63.650	-16.650	-47.000
7416.000	26.854	-82.760	-55.906	-8.906	-47.000
Vertical					
Peak Detector					
2472.000	11.495	-79.680	-68.185	-21.185	-47.000
4944.000	18.530	-80.600	-62.070	-15.070	-47.000
7416.000	26.376	-82.000	-55.624	-8.624	-47.000

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

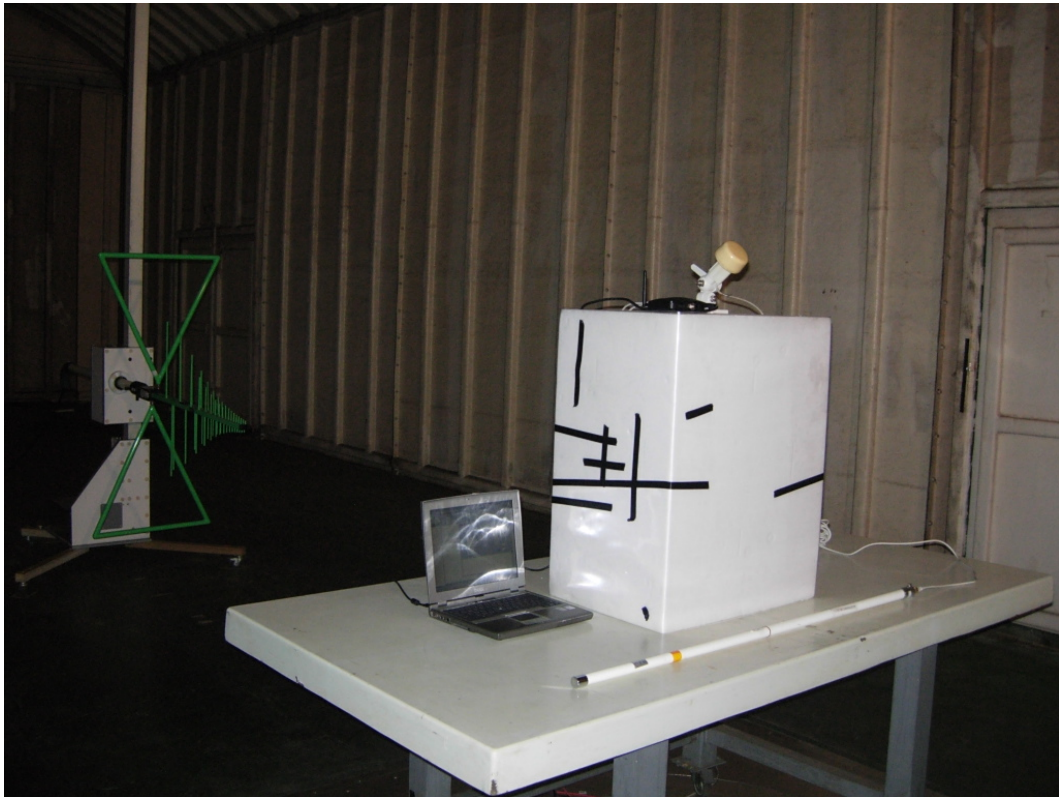
9.5. Test Data of Medium access protocol

A medium access protocol Distributed Coordination Function (DCF) is implemented by this equipment, which is a fundamental MAC technique of the IEEE 802.11 wireless LAN standard. It is a mechanism designed to facilitate spectrum sharing with other devices in a wireless network.

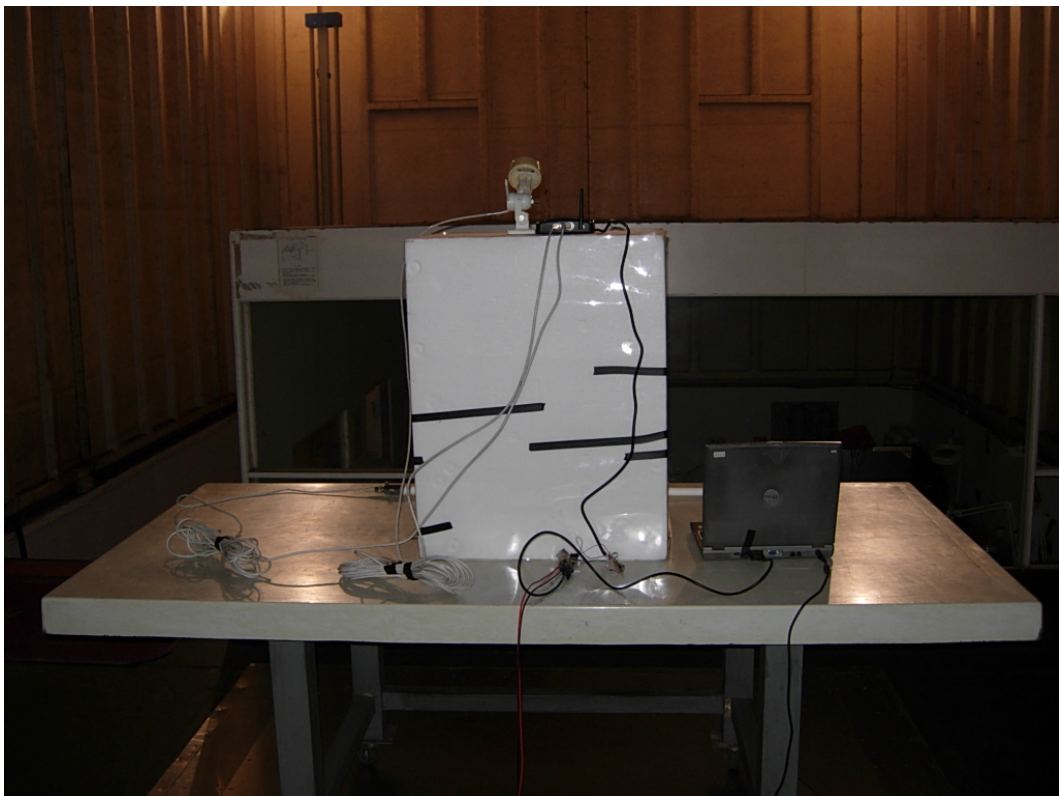
Attachment 1: EUT Test Setup Photographs

Attachment 1: EUT Test Setup Photographs

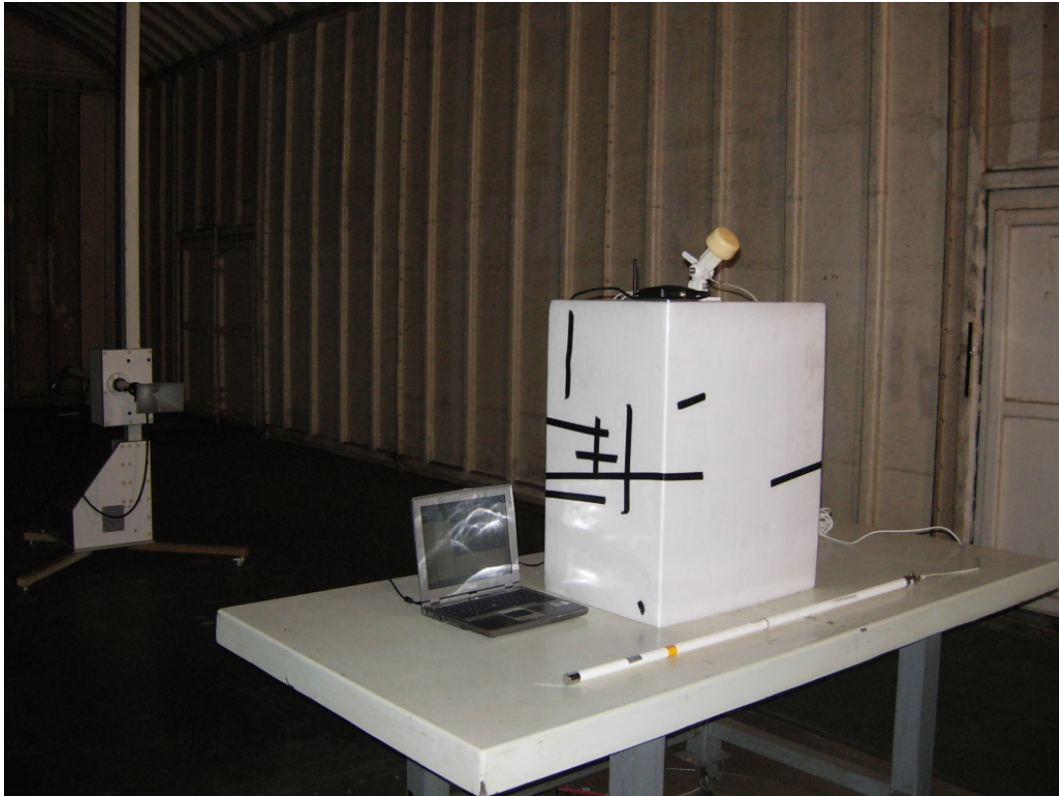
Front View of Spurious Emission Test



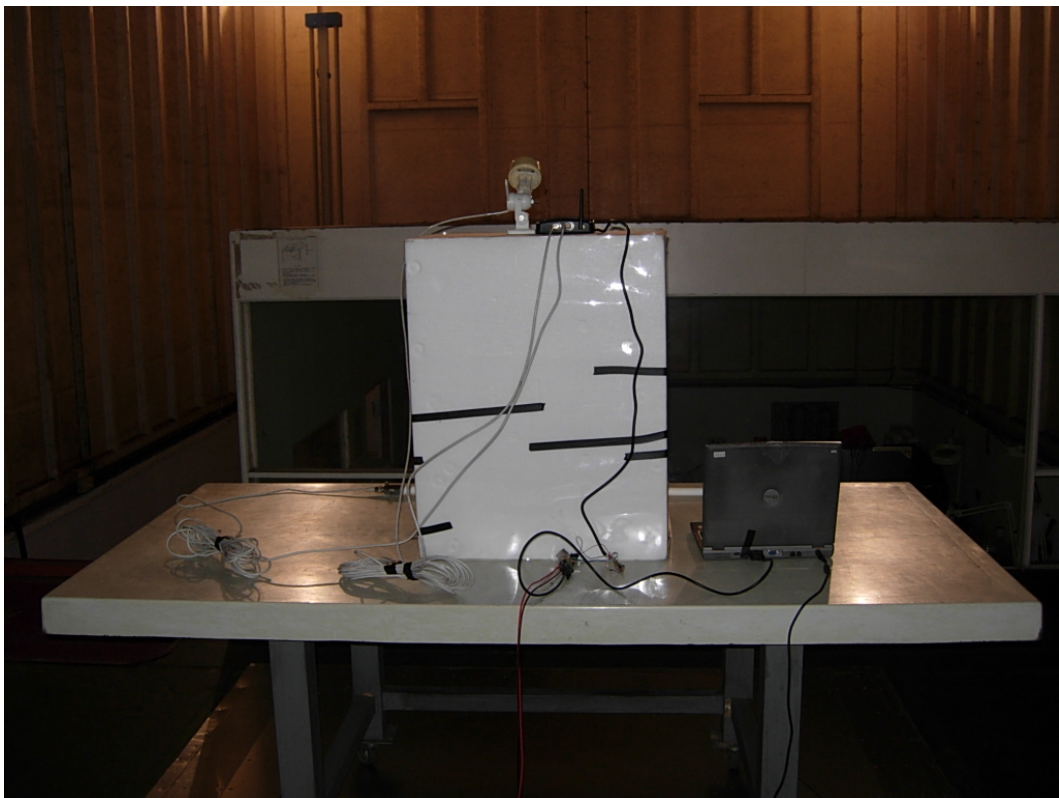
Back View of Spurious Emission Test



Front View of Spurious Emission Test (Horn)



Back View of Spurious Emission Test (Horn)



Attachment 2: EUT Detailed Photographs

Attachment 2 : EUT Detailed Photographs

(1) EUT Photo



(2) EUT Photo



(3) EUT Photo



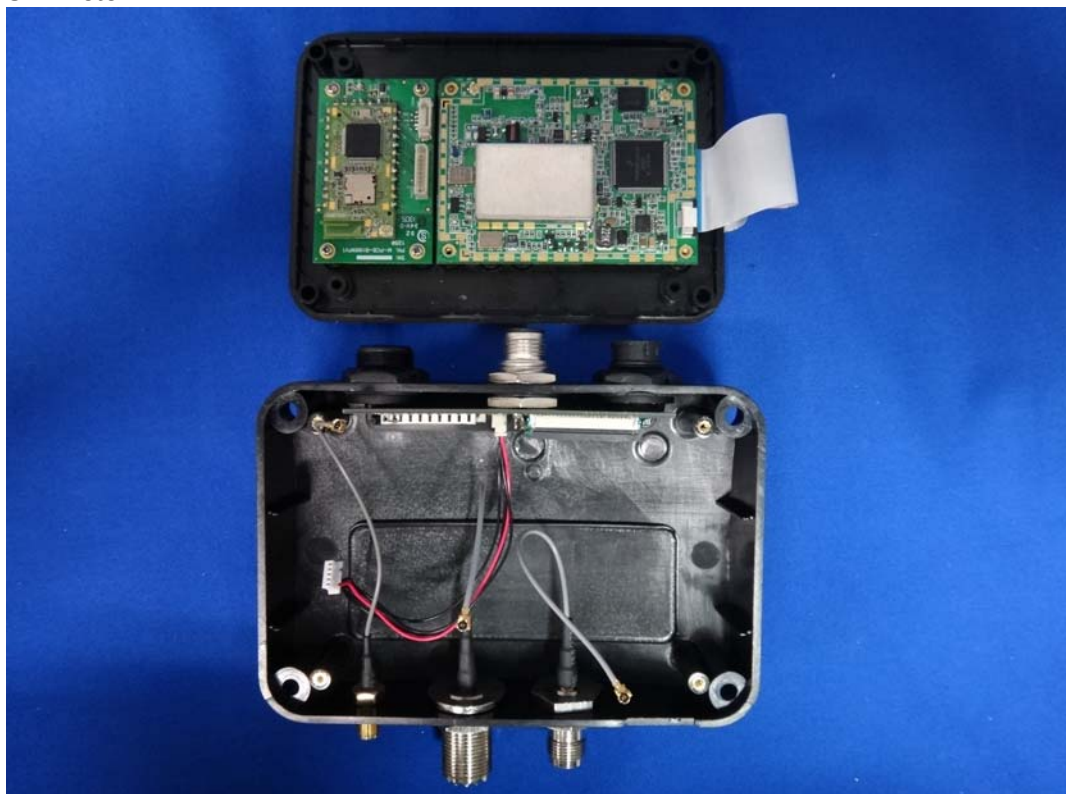
(4) EUT Photo



(5) EUT Photo



(6) EUT Photo



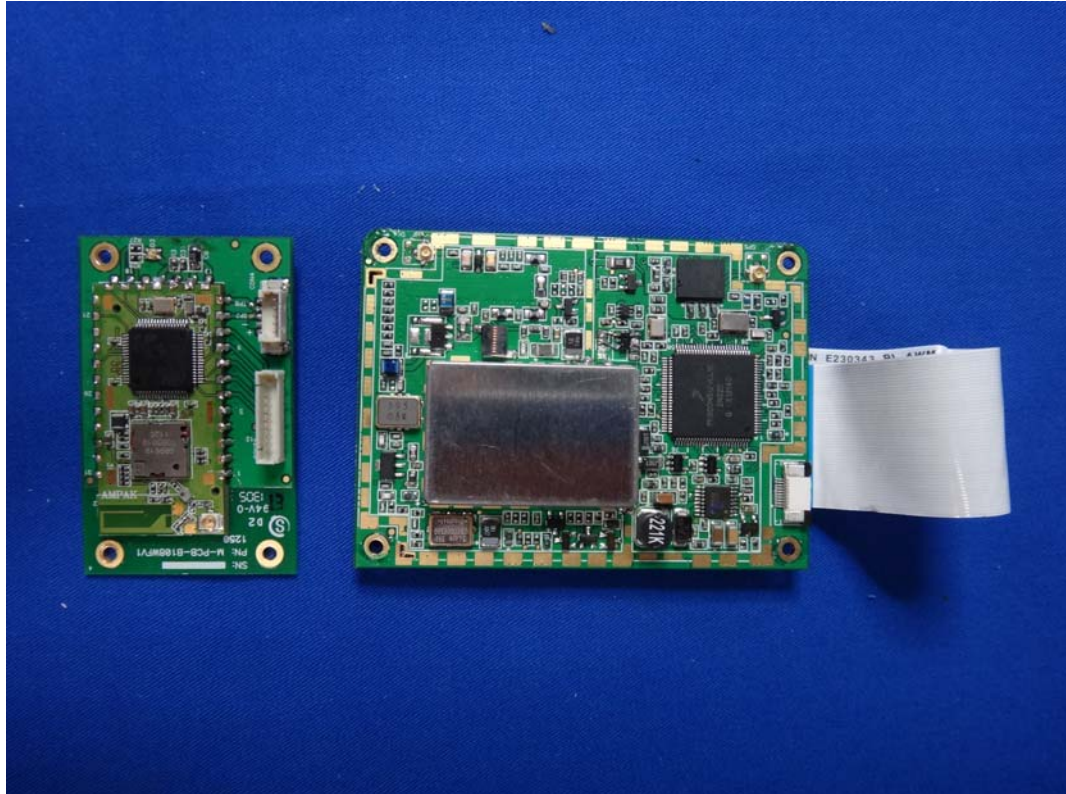
(7) EUT Photo



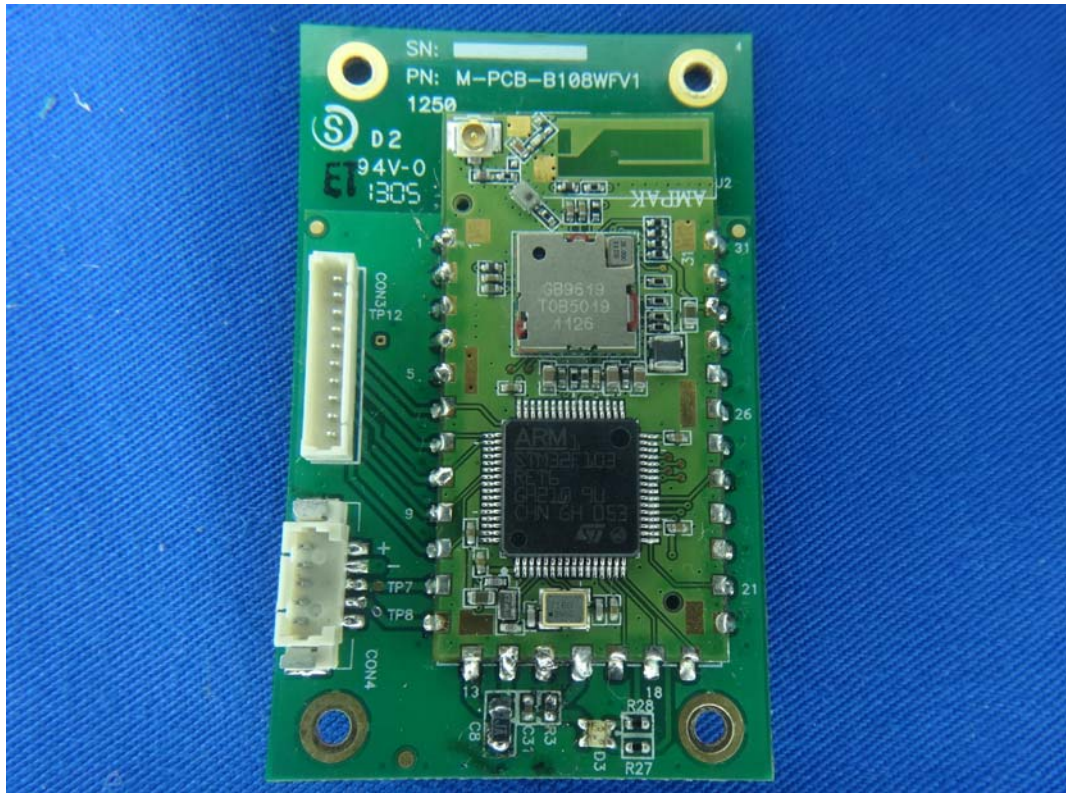
(8) EUT Photo



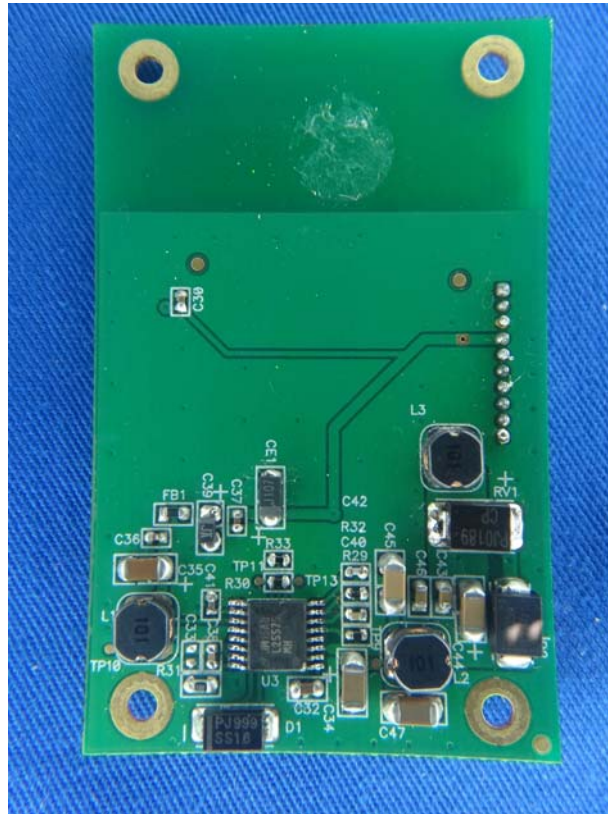
(9) EUT Photo



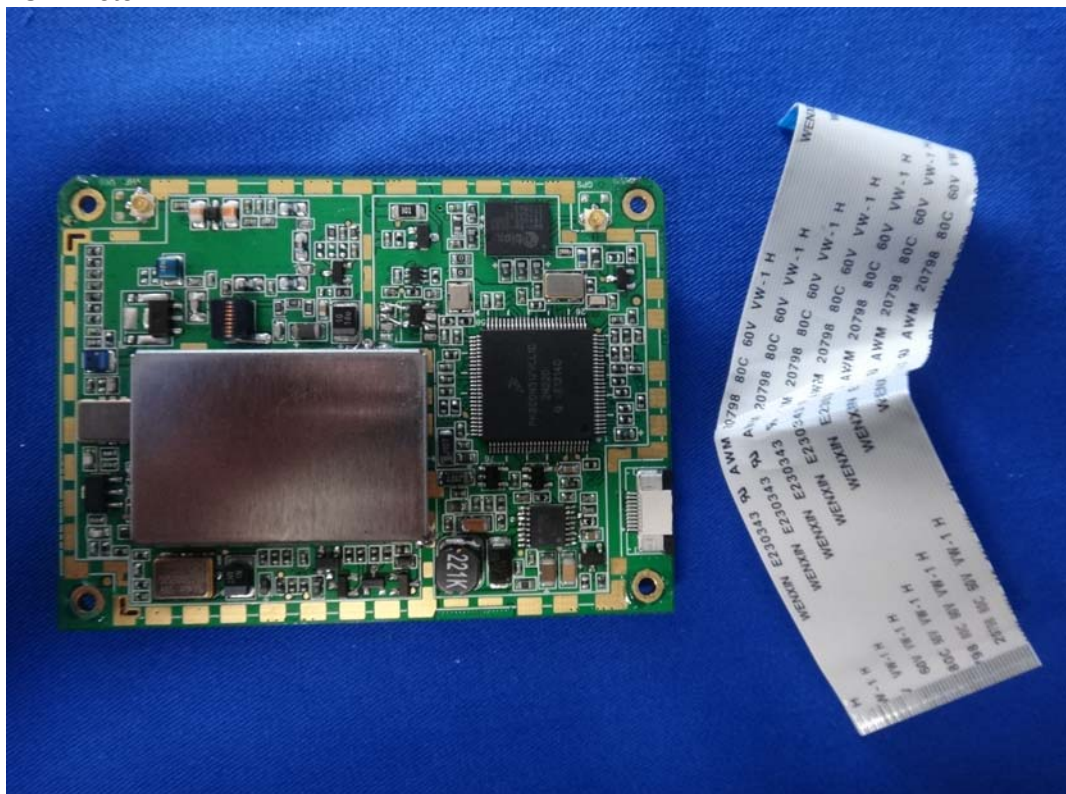
(10) EUT Photo



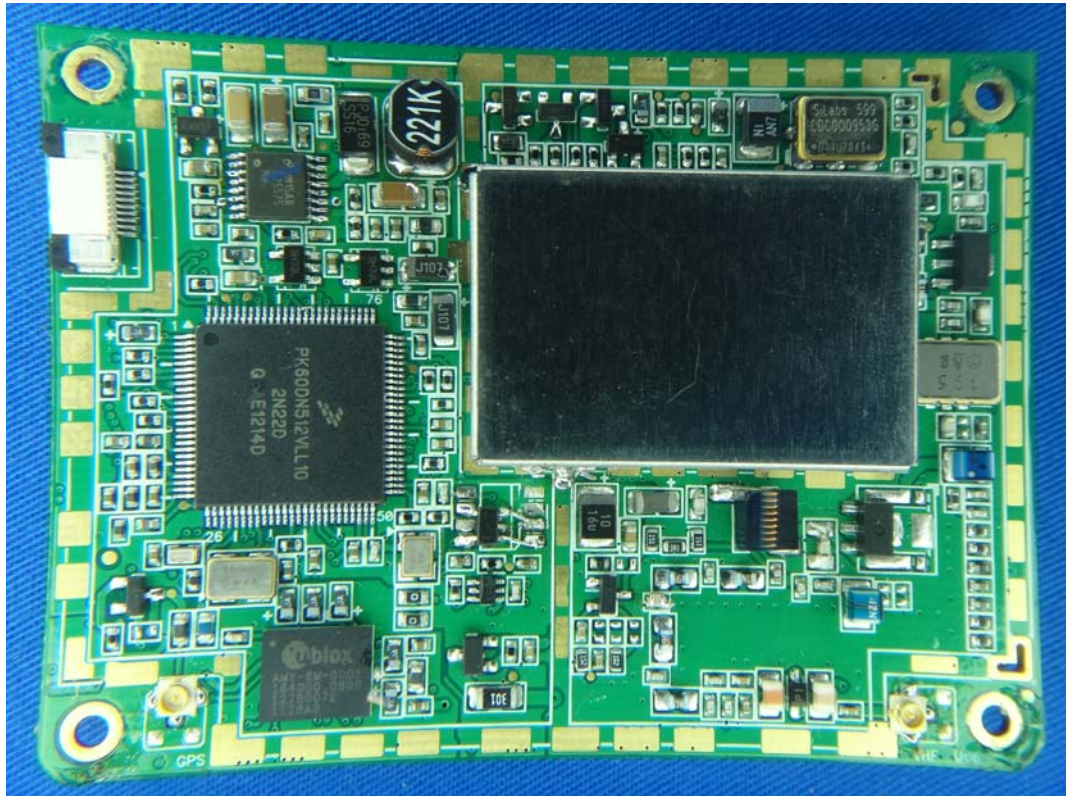
(11) EUT Photo



(12) EUT Photo



(13) EUT Photo



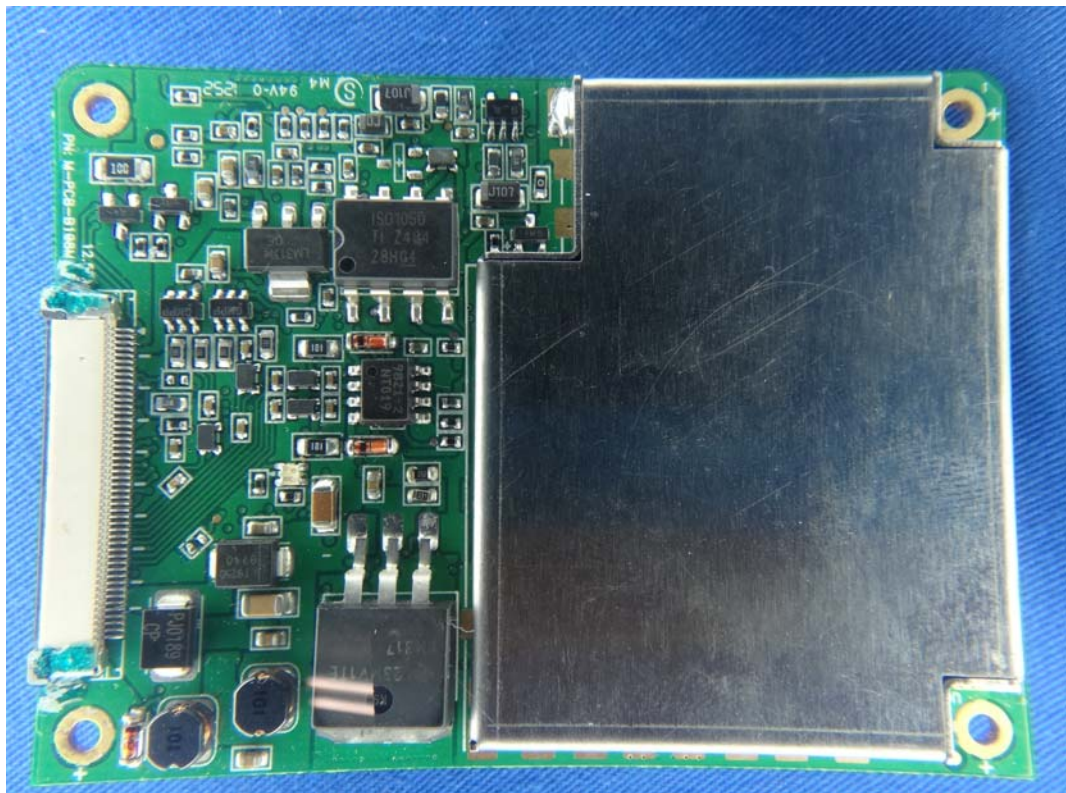
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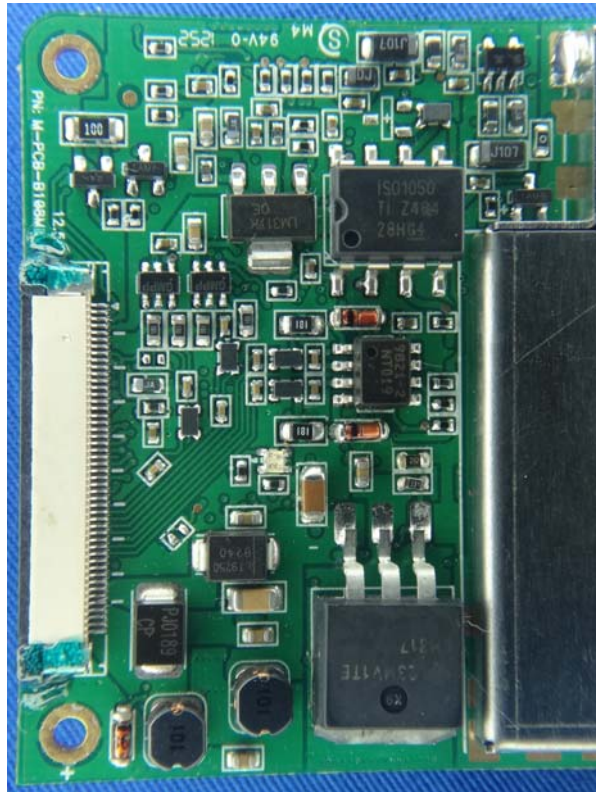
(15) EUT Photo



(16) EUT Photo



(17) EUT Photo



(18) EUT Photo (WLAN –ANT)



(19) EUT Photo (GPS Antenna-10m)



(20) EUT Photo (GPS Antenna-10m)



(21) EUT Photo (VHF Antenna)



(22) EUT Photo (VHF Antenna)



(23) EUT Photo (VHF Antenna Cable-10m)

