Test Report

Product Name	AIS SART
Model No.	PLOMO-500

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

Date of Receipt	July 26, 2011
Issued Date	Aug. 19, 2011
Report No.	118010R-RFCEP77V01
Report Version	V1.0

Test Report Certification

Issued Date : Aug. 19, 2011
Report No. : 118010R-RFCEP77V01

QuieTek

Product Name	AIS SART
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.	PLOMO-500
Rated Voltage	DC 6V(Power by Battery)
EUT working Voltage	DC 6V(Power by Battery)
Trade Name	AMEC
Applicable Standard	ETSI EN 301 489-1: V1.8.1 (2008-04) ETSI EN 301 489-3:V1.4.1 (2002-08)
Test Result	Complied

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of QuieTek Corporation.

Documented By : Genie Chang
(Senior Adm. Specialist / Genie Chang)

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(Engineer / Henk Huang)

Approved By :
(Manager / Vincent Lin)

ilac-MRA TAF Testing Laboratory DNV TÜV NEMKO

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1. General Information

1.1. EUT Description

Product Name	AIS SART
Model No.	PLOMO-500
Trade Name	AMEC
Frequency Range	1575.42MHz
Type of Modulation	Phase Modulation
Antenna Type	Right Hand Circular Polarization
Hardware	M-PCB-SARTV03
Software	SART Ver. 1.1

Working Frequency of Each Channel	
Channel	Frequency
01	1575.42MHz

Note:

The EUT is an AIS SART with a built-in GPS Receiver at 1575.42MHz.

1.2. Test Mode

QuieTek verified the 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	
EMI	Mode 1: Receiver Mode
EMS	Mode 1: Receiver Mode

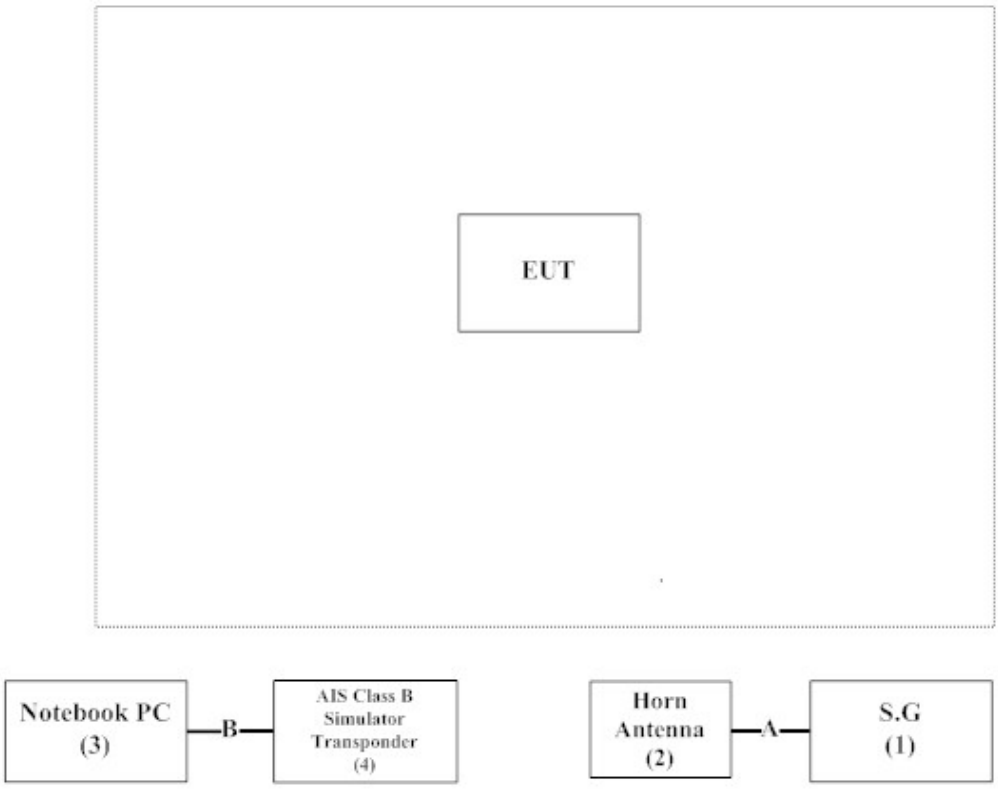
1.3. Tested System Details

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

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	S.G	Agilent	E8257D	MY44320633	Non-Shielded, 1.8m
2	Horn Antenna	Schwarzbeck	3115	6348	N/A
3	Notebook PC	DELL	PPT	N/A	Non-Shielded, 1.8m
4	AIS Class B Simulator Transponder	AMEC	N/A	N/A	Non-Shielded, 1.8m

Signal Cable Type		Signal cable Description
A	Coaxial Cable	Shielded, 1.0m
B	RS-232 Cable	Non-Shielded, 1.8m,two PCS.

1.4. Configuration of Test System



1.5. EUT Exercise Software

(1) Setup the EUT and Peripherals as shown on 1.4
(2) Turn on the power of all equipments.
(2) Enable the VHF and GPS function of the EUT.
(3) The VHF and GPS function is used to perform the wireless data transmission.
(5) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Required	Actual
Temperature (°C)	IEC 61000-4-2	15-35	25
Humidity (%RH)		30-60	49
Barometric pressure (mbar)		860-1060	950-1000
Temperature (°C)	IEC 61000-4-3	15-35	25
Humidity (%RH)		25-75	54
Barometric pressure (mbar)		860-1060	950-1000
Temperature (°C)	IEC 61000-4-4	15-35	24
Humidity (%RH)		25-75	49
Barometric pressure (mbar)		860-1060	950-1000
Temperature (°C)	IEC 61000-4-5	15-35	25
Humidity (%RH)		10-75	49
Barometric pressure (mbar)		860-1060	950-1000
Temperature (°C)	IEC 61000-4-6	15-35	25
Humidity (%RH)		25-75	52
Barometric pressure (mbar)		860-1060	950-1000
Temperature (°C)	IEC 61000-4-11	15-35	25
Humidity (%RH)		25-75	49
Barometric pressure (mbar)		860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site : http://tw.quietek.com/modules/myalbum/

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

Site Description: Accredited by NVLAP
NVLAP Lab Code: 200533-0

Accredited by DNV
Statement No. : 413-99-LAB11

Accredited by Nemko
Certificate No.: ELA 165

Accredited by TUV Rheinland
Certificate No.: 10011438-1-2010

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

Testing Laboratory
0914

2. Conducted Emission

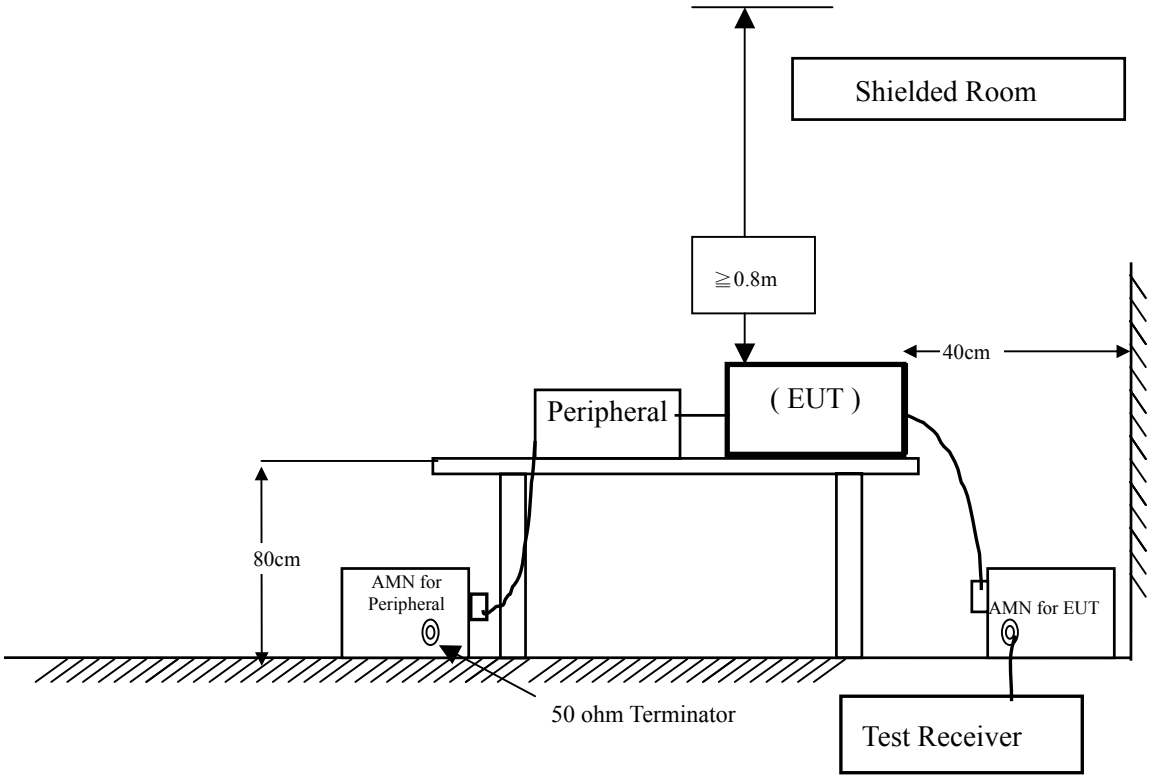
2.1. Test Equipmen

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

Item	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
1	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2010	
2	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2011	Peripherals
3	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2011	EUT
4	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2011	
5	4-wire ISN	R & S	ENY41 / 837032/001	Feb., 2011	
6	Double 2-Wire ISN	R & S	ENY22 / 835354/008	Feb., 2011	
7	No.1 Shielded Room			N/A	

Note: All equipments are calibrated every one year.

2.2. Test Setup



2.3. Limits

(1) Mains terminal

Frequency MHz	Limits (dBuV)			
	Limit for conducted emissions of equipment intended to be used in telecommunication centers only		Limit for conducted emissions	
	QP	AV	QP	AV
0.15 - 0.50	79	66	66-56	56-46
0.50-5.0	73	60	56	46
5.0 - 30	73	60	60	50

Remarks: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz ~ 0.50 MHz.

(2) Telecommunication ports

Frequency MHz	Limits (dBuV)			
	Limit for conducted emissions from telecommunication ports of equipment intended for use in telecommunication centers only		Limit for conducted emissions from telecommunication ports	
	QP	AV	QP	AV
0.15 – 0.50	97-87	84-74	84-74	74-64
5.0 – 30	87	74	74	64

Remarks: In the above table, the tighter limit applies at the band edges.

2.4. Test Procedure

AC Mains:

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ETSI EN 301 489-1:V1.8.1 (2008-04) on conducted measurement.

The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

Telecommunication Port:

The mains voltage shall be supplied to the EUT via the LISN when the measurement of telecommunication port is performed. The common mode disturbances at the telecommunication port shall be connected to the ISN, which is 150ohm impedance. Both alternative cables are tested related to the LCL requested. The measurement range is from 150kHz to 30MHz. The bandwidth of measurement is set to 9kHz. The 60dB LCL ISN is used for cat. 5 cable, 50dB LCL ISN is used for cat. 3 and 80dB LCL is wed for alternative one.

2.5. Test Specification

According to ETSI EN 301 489-1:V1.8.1 (2008-04)

EN 55022: 2006+A1: 2007

2.6. Uncertainty

± 2.26 dB

2.7. Test Result

Owing to the EUT use battery supply voltage, this test item is not performed.

3. Radiated Emission

3.1. Test Equipment

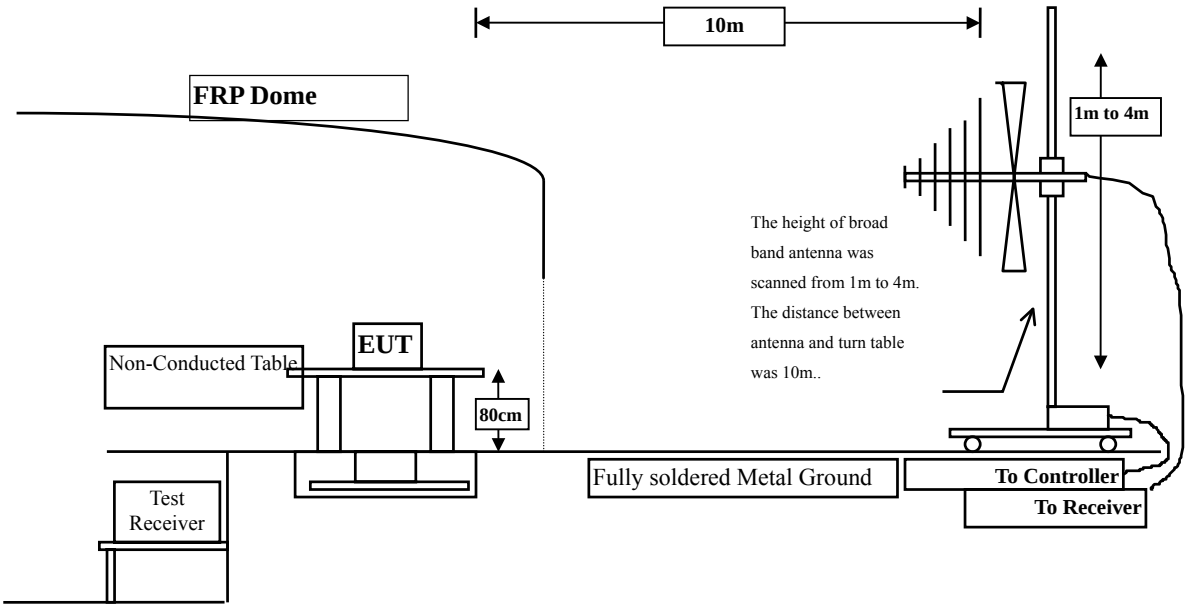
The following test equipment are used during the Radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☐Site # 1	Test Receiver	R & S	ESVS 10 / 834468/003	July, 2011
	Spectrum Analyzer	Advantest	R3162/ 00803480	May, 2011
	Pre-Amplifier	Advantest	BB525C/ 3307A01812	May, 2011
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	Nov., 2010
☐Site # 2	Test Receiver	R & S	ESCS 30 / 836858 / 022	Nov., 2010
	Spectrum Analyzer	Advantest	R3162 / 100803466	May, 2011
	Pre-Amplifier	Advantest	BB525C/3307A01814	May, 2011
	Bilog Antenna	SCHAFFNER	CBL6112B / 2705	Oct., 2010
	Horn Antenna	ETS	3115 / 0005-6160	July, 2011
	Pre-Amplifier	QTK	QTK-AMP-01/ 0001	July, 2011
☒Site # 3	Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2011
	Spectrum Analyzer	Advantest	R3162 / 100803480	May, 2011
	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2011
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2011
	Horn Antenna	ETS	3115 / 0005-6160	July, 2011
	Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2011
	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2010

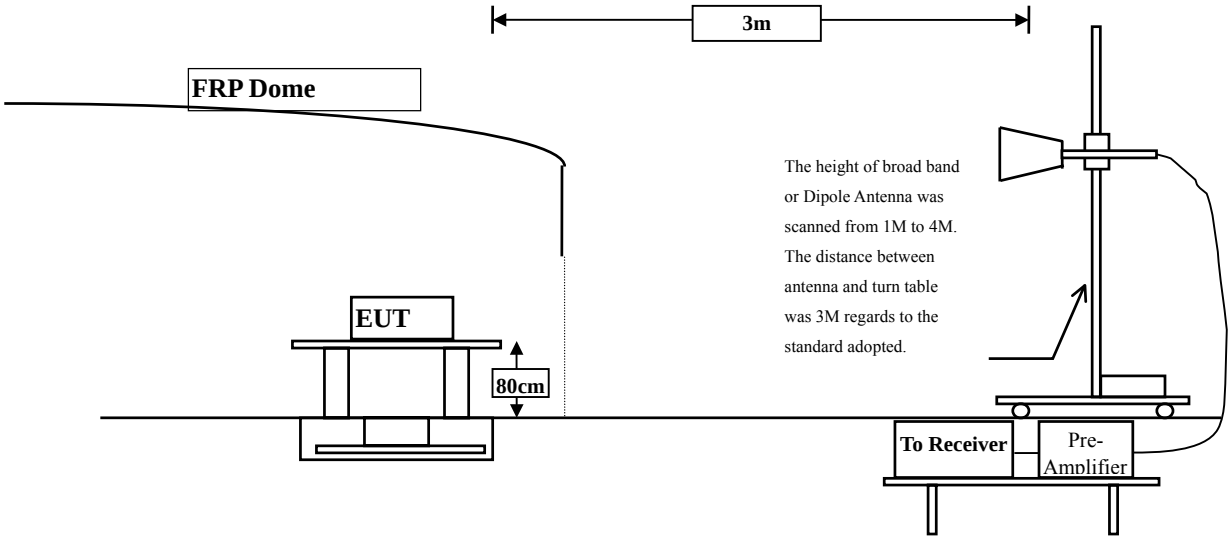
Note: 1. All equipments are calibrated every one year.
2. The test instruments marked by “X” are used to measure the final test results.

3.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



3.3. Limits

Limits for radiated disturbance under 1 GHz at a measurement distance of 10 m

Frequency MHz	Limits (dBuV/m)	
	Limit for radiated emissions from ancillary equipment intended for use in telecommunication centers only, and measured on a stand alone basis	Limit for radiated emissions from ancillary equipment, measured on a stand alone basis
	QP	QP
30-230	40	30
230-1000	47	37

Limits for radiated disturbance above 1 GHz at a measurement distance of 3 m

Frequency range	Average Limit (dBμV/m)	Peak limit (dBμV/m)
1 000 MHz to 3 000 MHz	50	70
3 000 MHz to 6 000 MHz	54	74
NOTE: The lower limit applies at the transition frequency.		

Limits above 1 GHz for radiated emissions from ancillary equipment intended for use in telecommunication centres only,and measured on a stand alone basis at a measurement distance of 3 m

Frequency range	Average Limit (dBμV/m)	Peak limit (dBμV/m)
1 000 MHz to 3 000 MHz	56	76
3 000 MHz to 6 000 MHz	60	80
NOTE: The lower limit applies at the transition frequency.		

3.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter 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 10 meters.The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ETSI EN 301 489-1:V1.8.1 (2008-04) on radiated measurement.
The additional motch filter below 1GHz was used to measure the level of harmonics radiated emission during field dtrength of harmonics measurement. The bandwidth below 1GHz setting on the field strength meter (R&S Test Receiver ESCS 30)is 120 kHz, and 1MHz bandwidth is adpted above 1GHz. The frequency range from 30MHz to 10^{th} harmonics is checked.
Radiated emissions were invested over the frequency range from 1GHz to 6GHz using a receiver bandwidth of 1MHz. Radiated was performed at an antenna to EUT distance of 3 meters.

3.5. Test Specification

According to ETSI EN 301 489-1:V1.8.1 (2008-04)

EN 55022: 2006+A1: 2007

3.6. Uncertainty

± 3.19 dB

3.7. Test Result

The emission from the EUT was below the specified limits. The worst-case emissions are shown in section 3.8. The acceptance criterion was met and the EUT passed the test.

3.8. Test Result

Product : AIS SART
Test Item : General Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Receiver Mode

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
99.517	14.477	-7.260	7.217	-22.783	30.000
338.783	18.440	2.703	21.143	-15.857	37.000
493.983	21.950	-3.632	18.318	-18.682	37.000
662.117	24.460	-6.178	18.282	-18.718	37.000
810.850	26.460	-1.308	25.152	-11.848	37.000
902.360	27.696	-6.181	21.516	-15.484	37.000
Vertical					
57.483	8.416	4.676	13.093	-16.907	30.000
287.050	17.120	0.985	18.105	-18.895	37.000
550.567	22.934	-3.672	19.261	-17.739	37.000
666.967	24.517	1.907	26.424	-10.576	37.000
805.180	26.392	-4.989	21.403	-15.597	37.000
956.350	28.430	-8.110	20.320	-16.680	37.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : AIS SART
Test Item : General Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Receiver Mode

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
1812.500	-2.353	41.767	39.413	-30.587	70.000
2837.500	-3.747	42.420	38.673	-31.327	70.000
4800.000	0.319	39.304	39.623	-34.377	74.000
Average Detector:					
--					
Vertical					
Peak Detector:					
1775.000	-2.043	42.867	40.825	-29.175	70.000
3150.000	-4.632	42.766	38.134	-35.866	74.000
4775.000	0.600	39.954	40.554	-33.446	74.000
Average Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3.9. Test Photo

Test Mode ： Mode 1: Receiver Mode
Description： Front View of Radiated Emission Test (Bilog)

Test Mode ： Mode 1: Receiver Mode
Description： Back View of Radiated Emission Test

Test Mode ： Mode 1: Receiver Mode
Description： Front View of Radiated Emission Test (Horn)

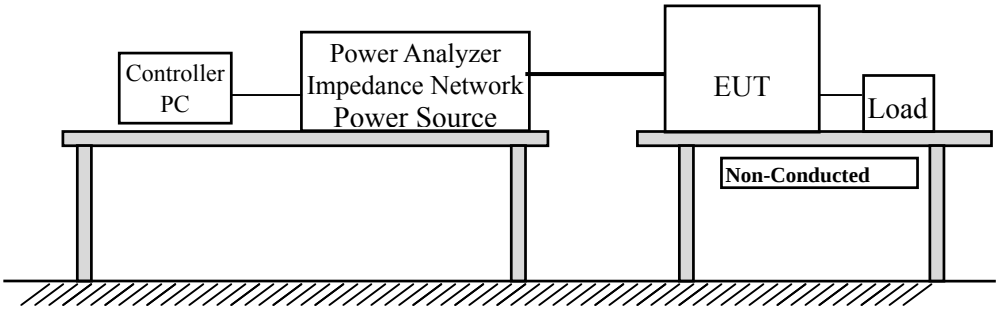
4. Power Harmonics, Voltage Fluctuation and Flicker

4.1. Test Equipment

Instrument	Manufacturer	Type No.	Serial No	Cal. Date
AC Power Source (Harmonic)	Schaffner	NSG 1007	HK54148	2010/09/06
IEC1000-4-X Analyzer (Flicker)	Schaffner	CCN 1000-1	X7 1887	2010/09/06

Note: All equipments are calibrated every one year.

4.2. Test Setup



4.3. Limits

➢Limits of Class A Harmonics Currents

Harmonics Order n	Maximum Permissible harmonic current A	Harmonics Order n	Maximum Permissible harmonic current A
Odd harmonics		Even harmonics	
3	2.30	2	1.08
5	1.14	4	0.43
7	0.77	6	0.30
9	0.40	8 ≤ n ≤ 40	0.23 * 8/n
11	0.33		
13	0.21		
15 ≤ n ≤ 39	0.15 * 15/n		

➢Limits of Class B Harmonics Currents

Foe Class B equipment, the harmonic of the input current shall not exceed the maximum permissible values given in table which is the limit of Class A multiplied by a factor of 1.5.

➢Limits of Class C Harmonics Currents

Harmonics Order n	Maximum Permissible harmonic current Expressed as a percentage of the input current at the fundamental frequency %
2	2
3	30 · λ*
5	10
7	7
9	5
11 ≤ n ≤ 39 (odd harmonics only)	3
∗λ is the circuit power factor	

➢Limits of Class D Harmonics Currents

Harmonics Order n	Maximum Permissible harmonic current per watt mA/W	Maximum Permissible harmonic current A
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
11 ≤ n ≤ 39 (odd harmonics only)	3.85/n	See limit of Class A

4.4. Test Procedure

The EUT is supplied in series with power analyzer from a power source having the same normal voltage and frequency as the rated supply voltage and the equipment under test. And the rated voltage at the supply voltage of EUT of 0.94 times and 1.06 times shall be performed.

4.5. Test Specification

According to EN 61000-3-2:2006+A2: 2009, EN 61000-3-3:2008

4.6. Uncertainty

± 3.23 %

4.7. Test Result

Owing to the EUT use battery supply voltage, this test item is not performed.

5. Electrostatic Discharge (ESD)

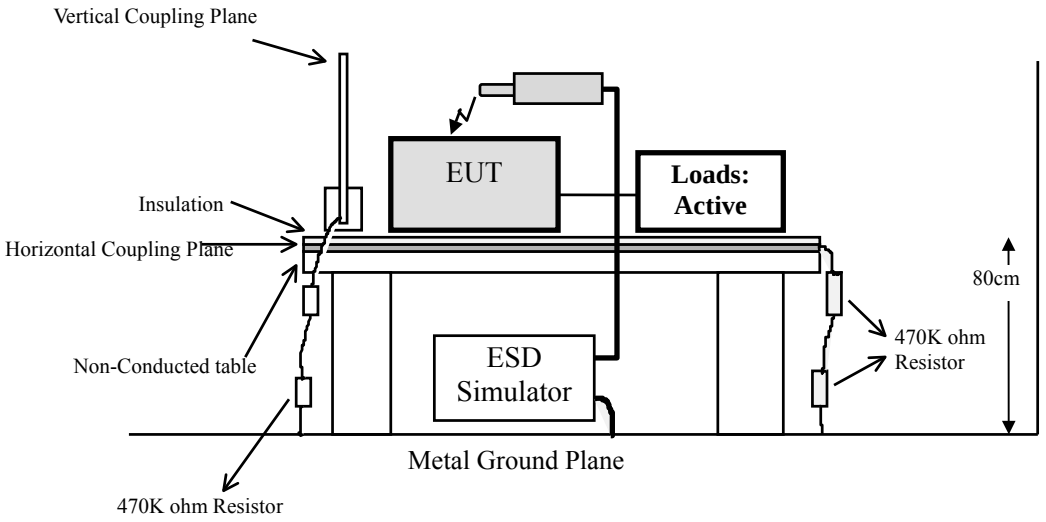
5.1. Test Equipment

	Instrument	Manufacturer	Type No.	Serial No	Cal. Date
	ESD Simulator System	SCHAFFNER	NSG 438	695	May, 2011
X	ESD Simulator System	NoiseKen	TC-815R	ESS0929097	Aug, 2011
	ESD Simulator System	Thermo	MZ-15/EC/ TPC-2A	0510189/ 0510190	June, 2011
	ESD Simulator System	EM TEST	dito	V0635101749	Sep, 2010
X	Horizontal Coupling Plane (HCP)	QuieTek	HCP AL50	N/A	N/A
X	Vertical Coupling Plane (VCP)	QuieTek	VCP AL50	N/A	N/A

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

5.2. Test Setup



5.3. Test Level

Item	Environmental Phenomena	Units	Test Specification	Performance
Enclosure Port				
	Electrostatic Discharge	kV(Charge Voltage)	±8 Air Discharge ±4 Contact Discharge	B

5.4. Test Procedure

Direct application of discharges to the EUT:

Contact discharge was applied only to conductive surfaces of the EUT.

Air discharges were applied only to non-conductive surfaces of the EUT.

During the test, it was performed with single discharges. For the single discharge time between successive single discharges will be keep longer 1 second. It was at least ten single discharges with positive and negative at the same selected point.

The selected point, which was performed with electrostatic discharge, was marked on the red label of the EUT.

Indirect application of discharges to the EUT:

Vertical Coupling Plane (VCP):

The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from, the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge. It was at least ten single discharges with positive and negative at the same selected point.

Horizontal Coupling Plane (HCP):

The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge. It was at least ten single discharges with positive and negative at the same selected point.

5.5. Test Specification

According to IEC 61000-4-2: 2008

5.6. Uncertainty

The uncertainty of the voltage of the waveform is ± 1.63 %

The uncertainty of the timing of the waveform is ± 2.76%

5.7. Test Result

The measurement of the electrostatic discharge was investigated and test result was shown in section 5.8. The acceptance criterion was met and the EUT passed the test.

5.8. Test Result

Product : AIS SART
Test Item : Electrostatic Discharge
Test Site : No.6 Shielded Room
Test Mode : Mode 1: Receiver Mode

Item	Amount of Discharge	Voltage	Required Criteria	Complied To Criteria (A, B, C)	Results
Air Discharge	10	+2kV, +4kV, +8kV	B	A	Pass
	10	-2kV, -4kV, -8kV	B	A	Pass
Contact Discharge	25	+2kV, +4kV	B	A	Pass
	25	-2kV, -4kV	B	A	Pass
Indirect Discharge	25	+2kV, +4kV	B	A	Pass
(HCP)	25	-2kV, -4kV	B	A	Pass
Indirect Discharge	25	+2kV, +4kV	B	A	Pass
(VCP Front)	25	-2kV, -4kV	B	A	Pass
Indirect Discharge	25	+2kV, +4kV	B	A	Pass
(VCP Left)	25	-2kV, -4kV	B	A	Pass
Indirect Discharge	25	+2kV, +4kV	B	A	Pass
(VCP Back)	25	-2kV, -4kV	B	A	Pass
Indirect Discharge	25	+2kV, +4kV	B	A	Pass
(VCP Right)	25	-2kV, -4kV	B	A	Pass

Note:

The testing performed is from lowest level up to the highest level as required by standard, but only highest level is shown on the report.

NR: No Requirement

☒ Meet criteria A: Operate as intended during and after the test
☐ Meet criteria B: Operate as intended after the test
☐ Meet criteria C: Loss/Error of function
☐ Additional Information
  ☐ EUT stopped operation and could / could not be reset by operator at ____ kV.
  ☒ No false alarms or other malfunctions were observed during or after the test.

5.9. Test Photo

Test Mode ： Mode 1: Receiver Mode
Description： Electrostatic Discharge Test Setup

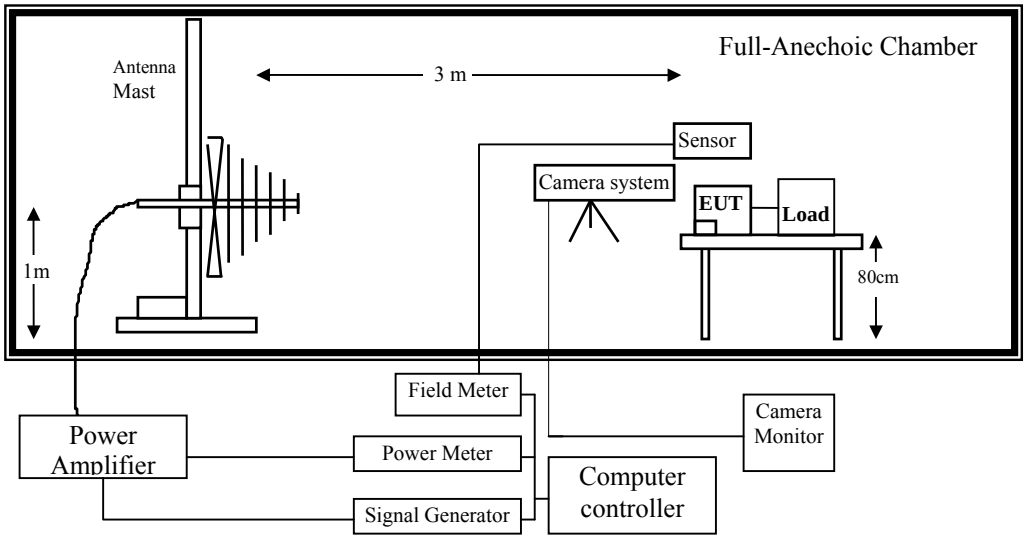
6. Radiated Susceptibility (RS)

6.1. Test Equipment

Item	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.
1	Signal Generator	R & S	SML03/103330	Sep., 2010
2	Power Amplifier	Schaffner	CBA9413B/4020	N/A
3	Power Amplifier	A & R	30S1G3/309453	N/A
4	Biconilog Antenna	EMCO	3149/00071675	N/A
5	Power Meter	R & S	NRVD / 100219	Jan., 2011
6	Directional Coupler	A & R	DC6180/22735	N/A
7	Directional Coupler	A & R	DC7144A/312249	N/A
8	No.2 EMC Fully Chamber			

Note: All equipments are calibrated every one year.

6.2. Test Setup



6.3. Test Level

Item	Environmental Phenomena	Units	Test Specification	Performance Criteria
Enclosure Port				
	Radio-Frequency Electromagnetic Field Amplitude Modulated	MHz V/m(Un-modulated, rms) % AM (1kHz)	80-1000 1400-2700 3 80	A

6.4. Test Procedure

The EUT and load, which are placed on a table that is 0.8 meter above ground, are placed with one coincident with the calibration plane such that the distance from antenna to the EUT was 3 meters.

Both horizontal and vertical polarization of the antenna and four sides of the EUT are set on measurement.

In order to judge the EUT performance, a CCD camera is used to monitor EUT screen.

All the scanning conditions are as follows:

	Condition of Test	Remarks
1.	Field Strength	3 V/m Level 2
2.	Radiated Signal	AM 80% Modulated with 1kHz sinusoidal audio signal
3.	Scanning Frequency	80MHz - 1000MHz, 1400MHz - 2700MHz
4	Dwell Time	3 Seconds
5.	Frequency step size Δf :	1% for class 1 and class 2; 10% for class 3
6.	The rate of Swept of Frequency	1.5 x 10^{-3} decades/s

Exclusion Bands for receiver:

For receivers capable of operating on more than one frequency in an operating frequency band the width of which is less than 20 % of the centre frequency of the operating band, the lower frequency of the exclusion band is the lower frequency of the operating band minus the extension value given in table 2, and the upper frequency of the exclusion band is the upper frequency of the operating band plus the extension value given in table 2.

The calculated extension value shall be based on the centre frequency of the operating band.

Exclusion Bands for receivers:

Operating Receiver Frequency f_0	**EMC exclusion band SRD equipment**		
	Receiver Class 1	**Receiver Class 2**	**Receiver Class 3**
< 300kHz	f_0±200kHz (see note 1)	f_0±300kHz (see note 1)	f_0±300kHz (see note 1)
300kHz to < 30 MHz	f_0±2MHz (see note 1)	f_0±3MHz (see note 1)	f_0±5MHz (see note 1)
30MHz to < 1GHz	f_0±10MHz, or±2%* f_0, whichever is greater	f_0±15MHz, or±5%* f_0, whichever is greater	f_0±15MHz, or±10%*f_0, whichever is greater
1GHz to < 2GHz	f_0±75MHz (see note 2)	f_0±100MHz(see note 2)	f_0±300MHz(see note 2)

6.5. Test Specification

According to IEC 61000-4-3: 2010

6.6. Uncertainty

± 2.72dB

6.7. Test Result

Product : AIS SART
Test Item : Radiated Susceptibility
Test Site : No.2 EMC fully Chamber
Test Mode : Mode 1: Receiver Mode

Frequency (MHz)	Position (Angle)	Polarity (H or V)	Field Strength (V/m)	Required Criteria	Complied To Criteria (A, B, C)	Results
80-1000	Front	H	3	A	A	Pass
80-1000	Front	V	3	A	A	Pass
80-1000	Back	H	3	A	A	Pass
80-1000	Back	V	3	A	A	Pass
80-1000	Left	H	3	A	A	Pass
80-1000	Left	V	3	A	A	Pass
80-1000	Right	H	3	A	A	Pass
80-1000	Right	V	3	A	A	Pass
80-1000	Top	H	3	A	A	Pass
80-1000	Top	V	3	A	A	Pass
80-1000	Down	H	3	A	A	Pass
80-1000	Down	V	3	A	A	Pass
1400-2700	Front	H	3	A	A	Pass
1400-2700	Front	V	3	A	A	Pass
1400-2700	Back	H	3	A	A	Pass
1400-2700	Back	V	3	A	A	Pass
1400-2700	Left	H	3	A	A	Pass
1400-2700	Left	V	3	A	A	Pass
1400-2700	Right	H	3	A	A	Pass
1400-2700	Right	V	3	A	A	Pass
1400-2700	Top	H	3	A	A	Pass
1400-2700	Top	V	3	A	A	Pass
1400-2700	Down	H	3	A	A	Pass
1400-2700	Down	V	3	A	A	Pass

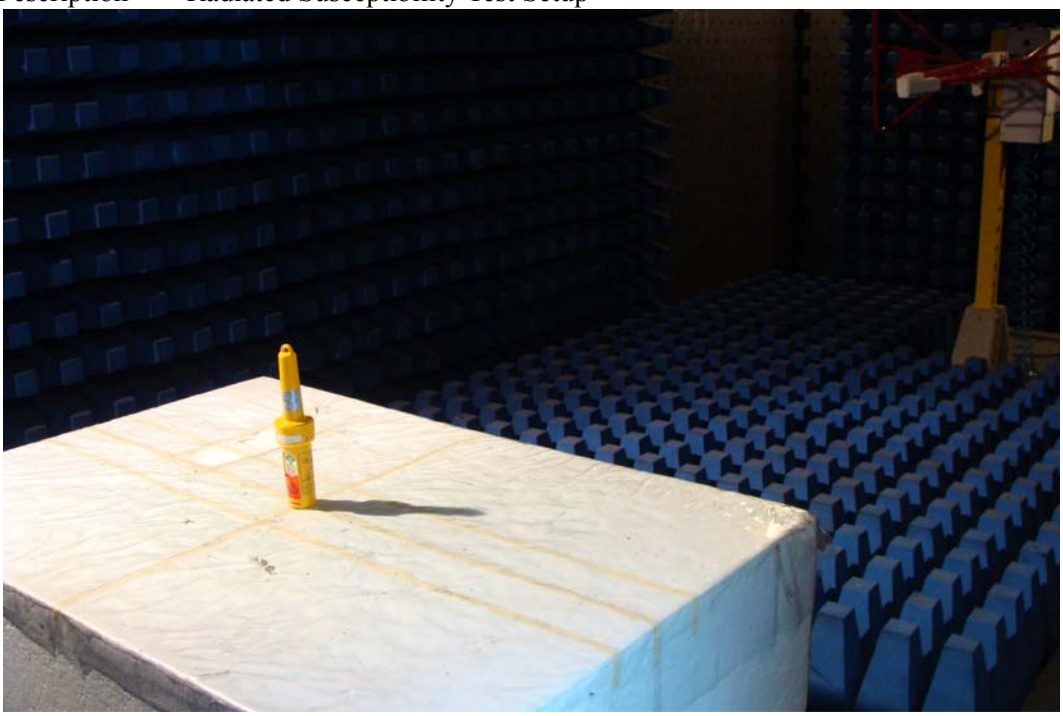
Note:

1. Exclusion Bands: fo±300MHz.

☒ Meet criteria A: Operate as intended during and after the test
☐ Meet criteria B: Operate as intended after the test
☐ Meet criteria C: Loss/Error of function
☐ Additional Information
  ☐ There was no observable degradation in performance.
  ☐ EUT stopped operation and could / could not be reset by operator at _____ V/m at frequency _____MHz.
  ☒ No false alarms or other malfunctions were observed during or after the test.

6.8. Test Photo

Test Mode ： Mode 1: Receiver Mode
Description： Radiated Susceptibility Test Setup



7. Electrical Fast Transient/Burst (EFT/B)

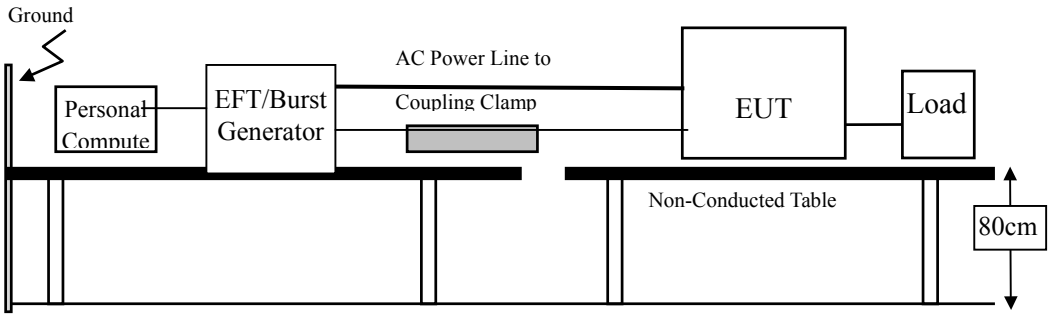
7.1. Test Equipment

	Instrument	Manufacturer	Type No.	Serial No	Cal. Date
	Schaffner NSG 2050 System Mainframe	Schaffner	N/A	N/A	Jan, 2011
	EMC immunity system	Thermo	EMCPRO PLUS	0411225	Mar, 2011
X	TRANSIENT TEST SYSTEM	EMC PARTNET	TRA2000IN6	1138	Dec, 2010

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

7.2. Test Setup



7.3. Test Level

Item	Environmental Phenomena	Units	Test Specification	Performance Criteria
Ports for signal lines and control lines				
	Fast Transients Common Mode	kV (Peak) Tr/Ts ns Rep. Frequency kHz	±0.5 5/50 5	B
Input DC Power Ports				
	Fast Transients Common Mode	kV (Peak) Tr/Ts ns Rep. Frequency kHz	±0.5 5/50 5	B
Input AC Power Ports				
	Fast Transients Common Mode	kV (Peak) Tr/Ts ns Rep. Frequency kHz	±1 5/50 5	B

7.4. Test Procedure

The EUT and load are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min. And projected beyond the EUT by at least 0.1m on all sides.

For Signal Ports and Telecommunication Ports:

The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 1min.

For Input DC and AC Power Ports:

The EUT is connected to the power mains through a coupling device that directly couples the EFT interference signal.

Each of the Line and Neutral conductors is impressed with burst noise for 1 min.

The length of power cord between the coupling device and the EUT shall be 1m.

7.5. Test Specification

According to IEC 61000-4-4: 2011

7.6. Uncertainty

The uncertainty of the voltage of the waveform is ± 1.63 %

The uncertainty of the timing of the waveform is ± 2.76%

7.7. Test Result

Owing to the EUT use battery supply voltage, this test item is not performed.

8. Surge

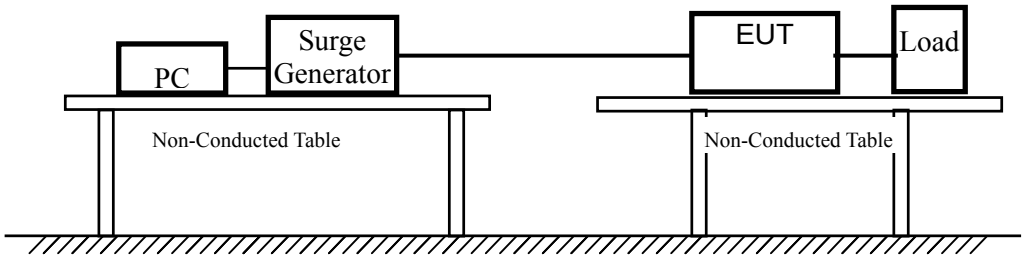
8.1. Test Equipment

	Instrument	Manufacturer	Type No.	Serial No	Cal. Date
	Schaffner NSG 2050 System Mainframe	Schaffner	N/A	N/A	Jan, 2011
	EMC immunity system	Thermo	EMCPRO PLUS	0411225	Mar, 2011
X	TRANSIENT TEST SYSTEM	EMC PARTNET	TRA2000IN6	1138	Dec, 2010

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

8.2. Test Setup



8.3. Test Level

Item	Environmental Phenomena	Units	Test Specification	Performance Criteria
Telecommunication Ports (See 1) and 2))				
	Surges Line to Ground	Tr/Th us kV	1.2/50 (8/20) ± 1	B
Telecommunication Ports in Telecom Centres (See 1) and 2))				
	Surges Line to Ground	Tr/Th us kV	1.2/50 (8/20) ± 0.5	B
AC Input and AC Output Power Ports				
	Surges Line to Line Line to Ground	Tr/Th us kV kV	1.2/50 (8/20) ±1 ± 2	B
AC Input and AC Output Power Ports in Telecom Centres				
	Surges Line to Line Line to Ground	Tr/Th us kV kV	1.2/50 (8/20) ±0.5 ± 1	B

Notes:

1) Applicable only to ports which according to the manufacturer's may directly to outdoor cables.

2) Where normal functioning cannot be achieved because of the impact of the CDN on the EUT,no test shall be required.

8.4. Test Procedure

The EUT and its load are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min. And projected beyond the EUT by at least 0.1m on all sides. The length of power cord between the coupling device and the EUT shall be 2m or less.

For Signal Ports and Telecommunication Ports

The disturbance signal is through a coupling and decoupling networks (CDN) device couples to the signal and Telecommunication lines of the EUT.

For Input and Output AC Power or DC Input and DC Output Power Ports:

The EUT is connected to the power mains through a coupling device that directly couples the Surge interference signal.

The surge noise shall be applied synchronized to the voltage phase at 0^0, 90^0, 180^0, 270^0 and the peak value of the a.c. voltage wave. (Positive and negative)

Each of Line-Earth and Line-Line is impressed with a sequence of five surge voltages with interval of 1 min.

8.5. Test Specification

According to IEC 61000-4-5: 2005

8.6. Uncertainty

The uncertainty of the voltage of the waveform is 1.63 %

The uncertainty of the timing of the waveform is 2.76%

8.7. Test Result

Owing to the EUT use battery supply voltage, this test item is not performed.

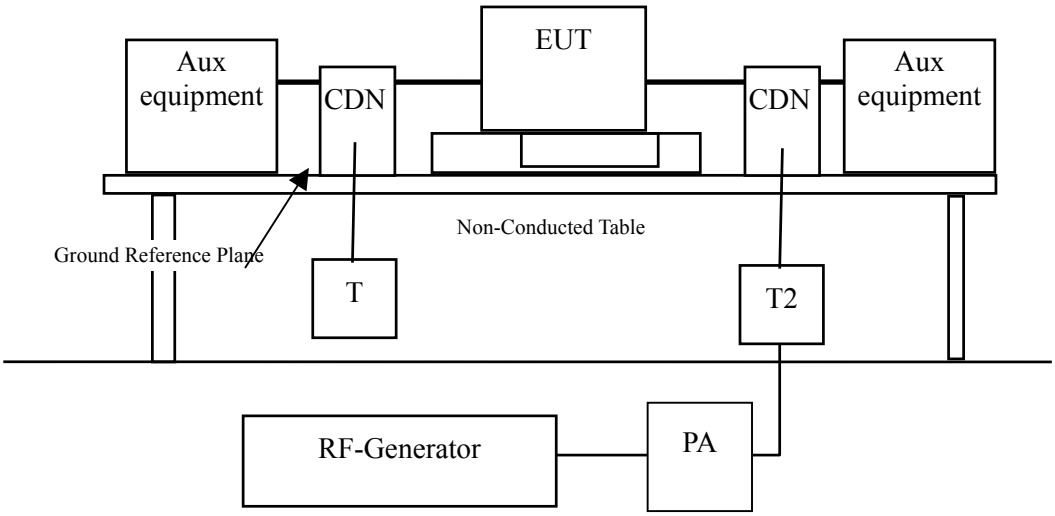
9. Conducted Susceptibility (CS)

9.1. Test Equipment

Item	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.
1	CS SYSTEM	SCHAFFNER	NSG 2070	March, 2011
2	CDN	SCHAFFNER	CDN M016S / 20822	Dec., 2010
3	CDN	SCHAFFNER	CDN M016S / 20823	Dec., 2010
4	FIXED PAD	SCHAFFNER	INA 2070-1 / 2115	N/A
5	EM Clamp		KEMZ 801 / 21024	March, 2011
6	No.6 Shielded Room			

Note: All equipments are calibrated every one year.

9.2. Test Setup



9.3. Test Level

Item	Environmental Phenomena	Units	Test Specification	Performance Criteria
AC Input and AC Output & DC Input and DC output Power Ports & Functional Earth Ports				
	Radio-Frequency Common Mode. Amplitude Modulated	MHz V (rms, Unmodulated) % AM (1kHz) Source Impedance Ω	0.15-80 3 80 150	A

9.4. Test Procedure

The EUT are placed on a table that is 0.8 meter height, and a Ground reference plane on the table, EUT are placed upon table and use a 10cm insulation between the EUT and Ground reference plane.

For Signal Ports and Telecommunication Ports

The disturbance signal is through a coupling and decoupling networks (CDN) or EM-clamp device couples to the signal and Telecommunication lines of the EUT.

For Input DC and AC Power Ports

The EUT is connected to the power mains through a coupling and decoupling networks for power supply lines. And directly couples the disturbances signal into EUT.

Used CDN-M2 for two wires or CDN-M3 for three wires.

All the scanning conditions are as follows:

Condition of Test	Remarks
1. Field Strength	130dBuV(3V) Level 2
2. Radiated Signal	AM 80% Modulated with 1kHz sinusoidal audio signal
3. Scanning Frequency	0.15MHz – 80MHz
4 Dwell Time	3 Seconds
5. Frequency step size Δf :	0.15MHz-5MHz: 1% 5MHz-80MHz: 1% for class 1 and class 2 5MHz-80MHz: 10% for class 3
6. The rate of Swept of Frequency	1.5 x 10^{-3} decades/s

9.5. Test Specification

According to IEC 61000-4-6: 2008

9.6. Uncertainty

The uncertainty of the injected modulated signal level through CDN is ± 3.72dB

The uncertainty of the injected modulated signal level through EM Clamp/Direct Injection is ± 2.78 dB

9.7. Test Result

The measurement of the Conducted Susceptibility was investigated and test result was shown in section 9.8. The acceptance criterion was met and the EUT passed the test.

9.8. Test Result

Owing to the EUT use battery supply voltage, this test item is not performed.

10. Voltage Dips and Interruption Measurement

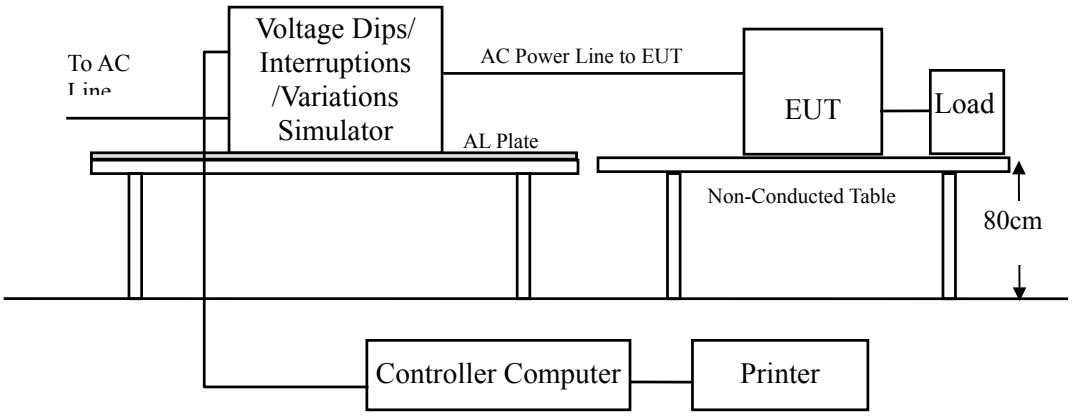
10.1. Test Equipment

	Instrument	Manufacturer	Type No.	Serial No	Cal. Date
	Schaffner NSG 2050 System Mainframe	Schaffner	N/A	N/A	Jan, 2011
	EMC immunity system	Thermo	EMCPRO PLUS	0411225	Mar, 2011
X	TRANSIENT TEST SYSTEM	EMC PARTNET	TRA2000IN6	1138	Dec, 2010

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

10.2. Test Setup



10.3. Test Level

Item	Environmental Phenomena	Units	Test Specification	Performance Criteria
AC Input and AC Output Power Ports				
	Voltage Dips	% Reduction (Cycle)	100 % 0.5	B
	Voltage Dips	% Reduction (Cycle)	100 % 1	B
	Voltage Dips	% Reduction (Cycle)	30 % 25	B
	Voltage Interruptions	% Reduction (Cycle)	100 % 250	C (see note)

NOTE: Equipment is fitted with or connected to a battery back-up, the performance criteria is "B".

10.4. Test Procedure

The EUT and its load are placed on a table which is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min. And projected beyond the EUT by at least 0.1m on all sides. The power cord shall be used the shortest power cord as specified by the manufacturer.

For Voltage Dips/ Interruptions test:

The selection of test voltage is based on the rated power range. If the operation range is large than 20% of lower power range, both end of specified voltage shall be tested. Otherwise, the typical voltage specification is selected as test voltage.

The EUT is connected to the power mains through a coupling device that directly couples to the Voltage Dips and Interruption Generator.

The test levels shall be:

voltage dip: 0 % residual voltage for 0,5 cycle;

voltage dip: 0 % residual voltage for 1 cycle;

voltage dip: 70 % residual voltage for 25 cycles (at 50 Hz);

voltage interruption: 0 % residual voltage for 250 cycles (at 50 Hz).

Voltage phase shifting are shall occur at 0^0, 45^0, 90^0 ,135^0 ,180^0 ,225^0, 270^0 ,315^0 of the voltage.

10.5. Test Specification

According to IEC 61000-4-11: 2004

10.6. Uncertainty

The uncertainty of the voltage of the waveform is ± 1.63 %

The uncertainty of the timing of the waveform is ± 2.76%

10.7. Test Result

The measurement of the Voltage Dips and Interruption was investigated and test result was shown in section 10.8. The acceptance criterion was met and the EUT passed the test.

10.8. Test Result

Owing to the EUT use battery supply voltage, this test item is not performed.

11. Attachement

➢ EUT Photograph

(1) EUT Photo

(2) EUT Photo

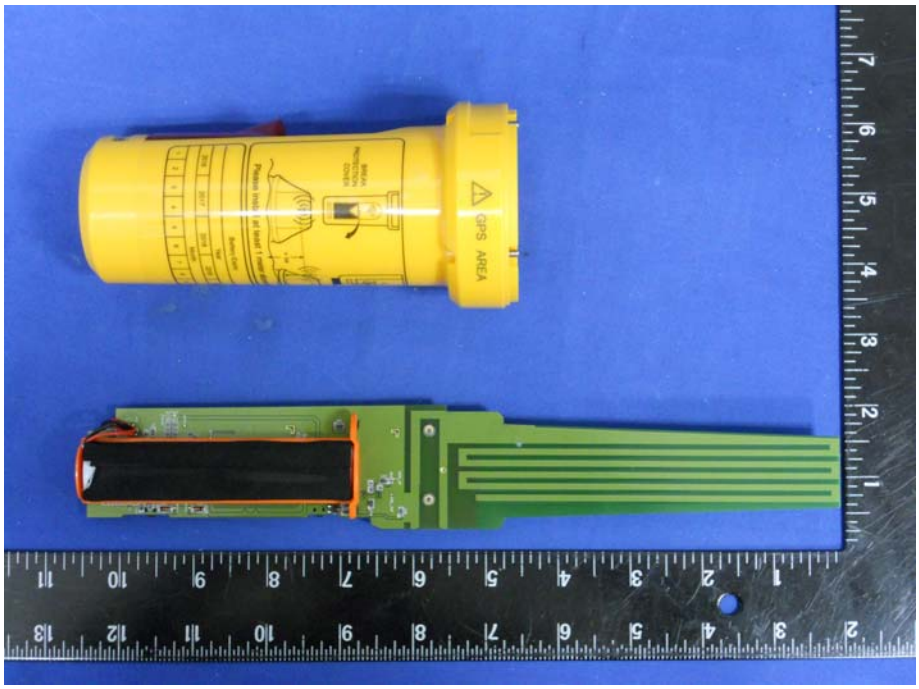
(3) EUT Photo

(4) EUT Photo

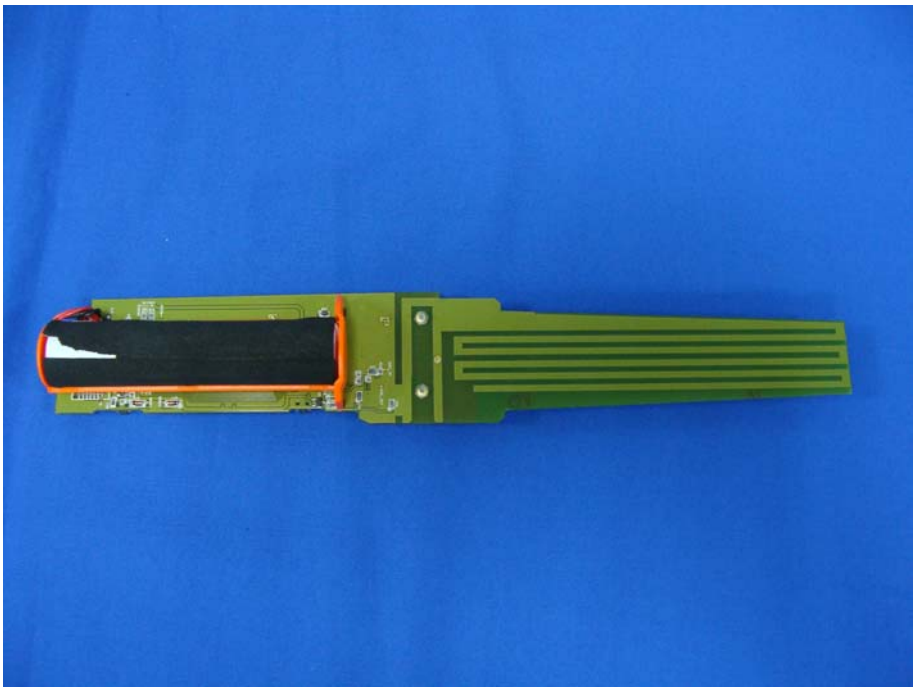
(5) EUT Photo

(6) EUT Photo

(7) EUT Photo

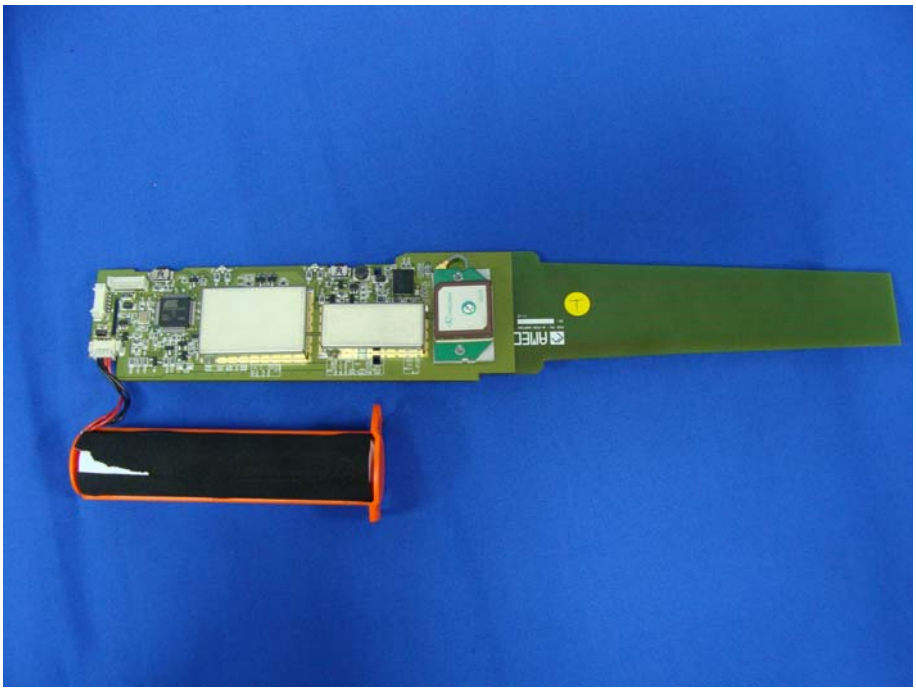


(8) EUT Photo



(9) EUT Photo

(10) EUT Photo



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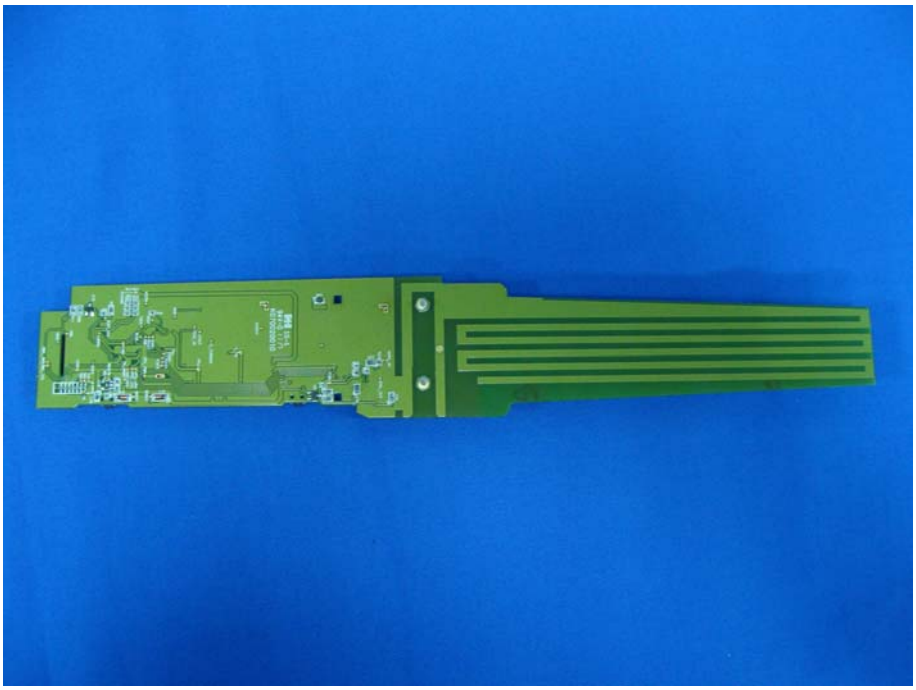

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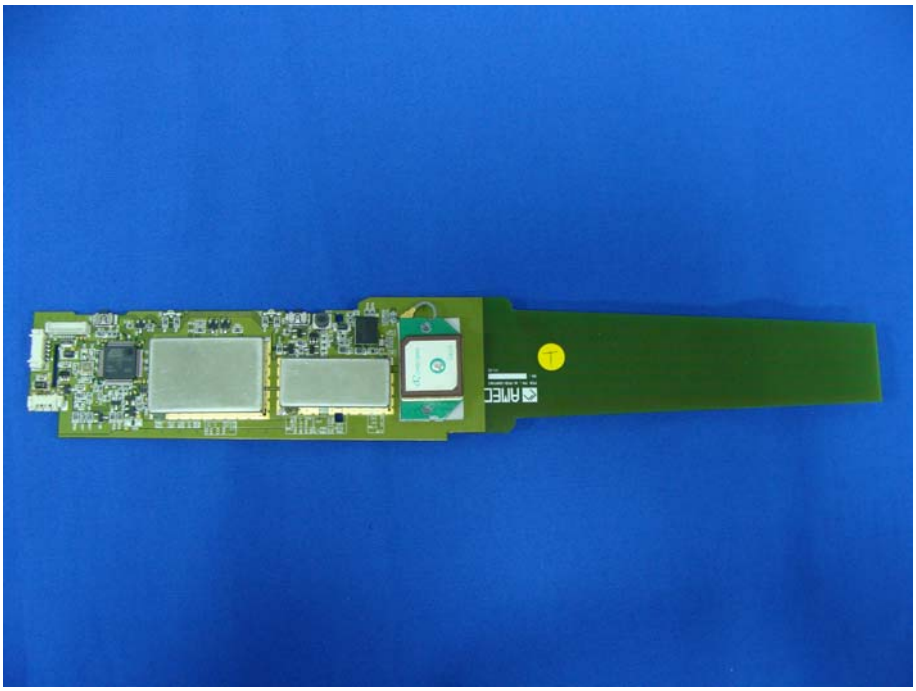

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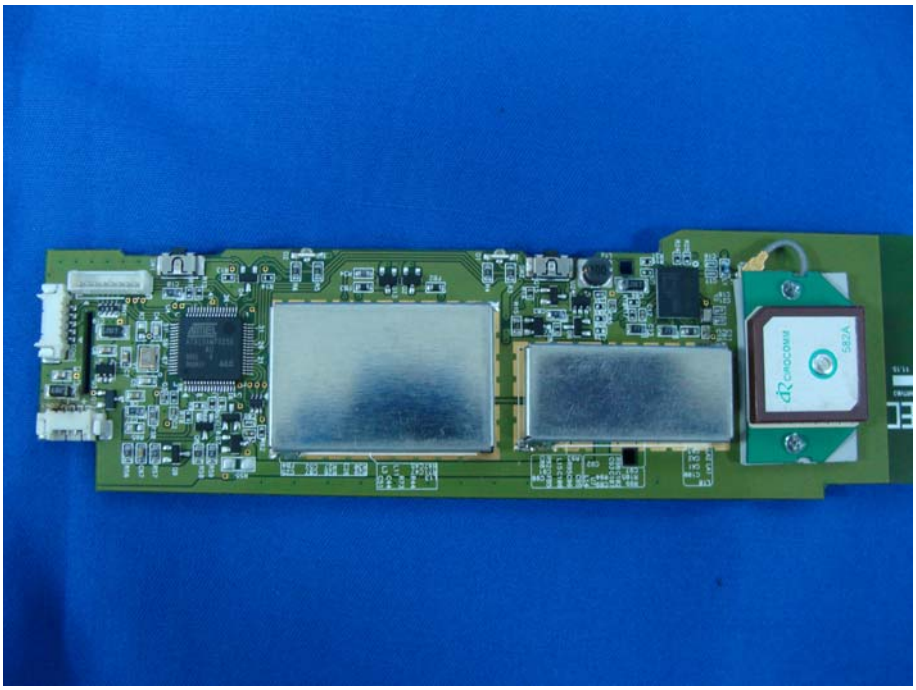
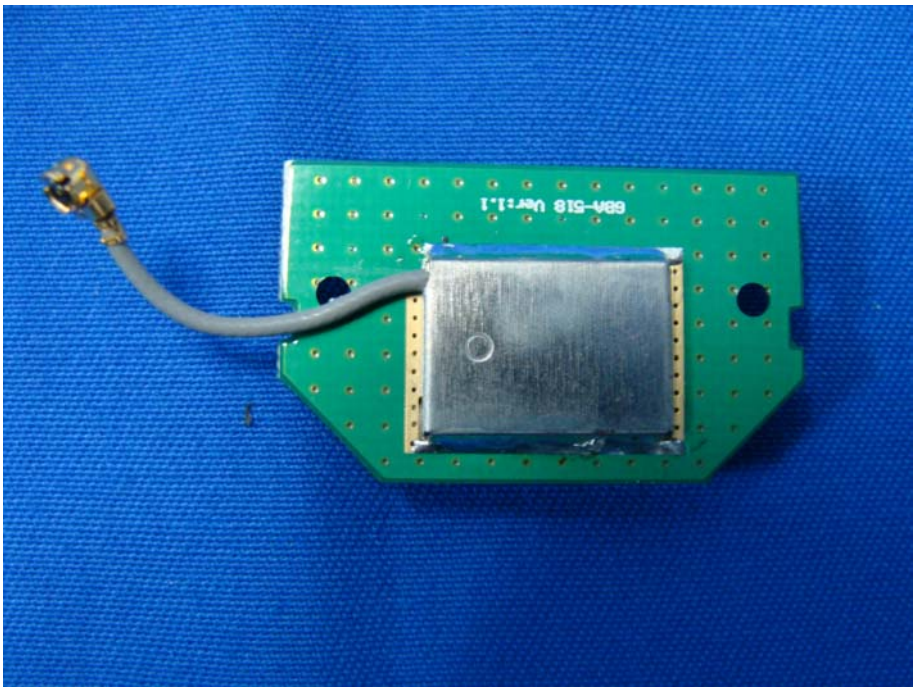


(14) EUT Photo

(15) EUT Photo

(16) EUT Photo



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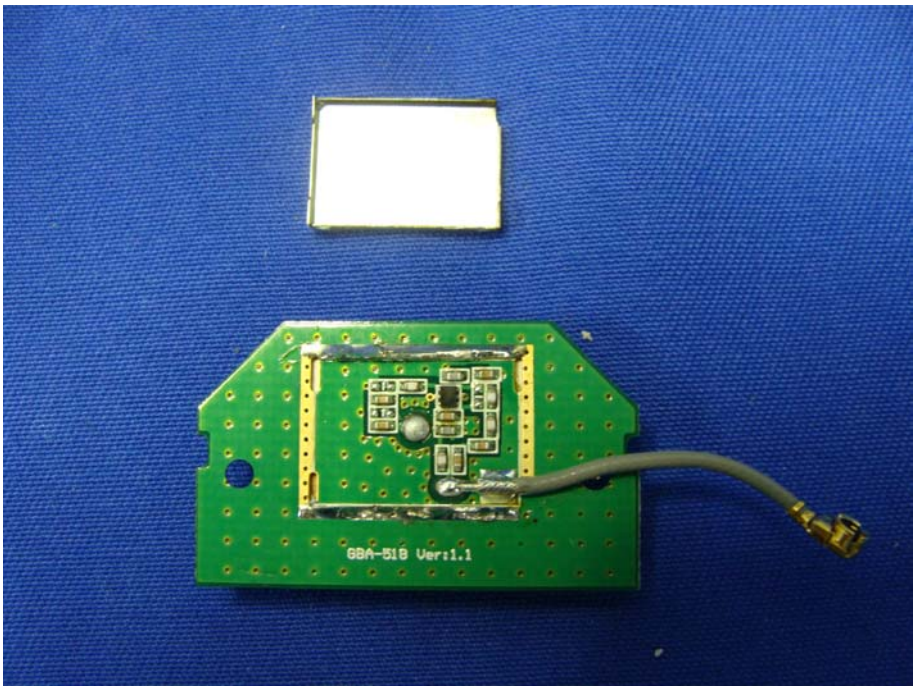

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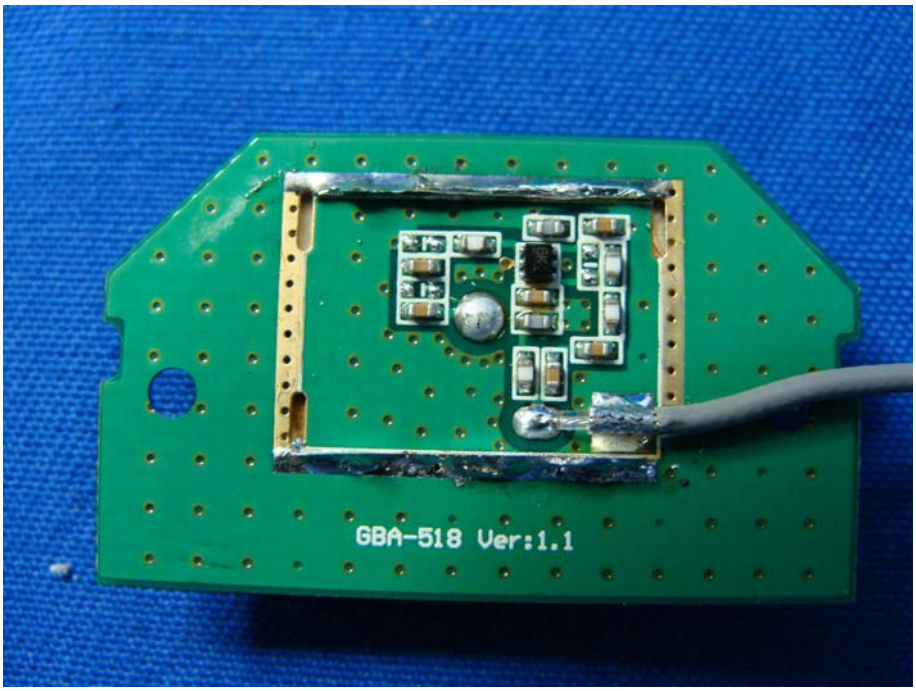

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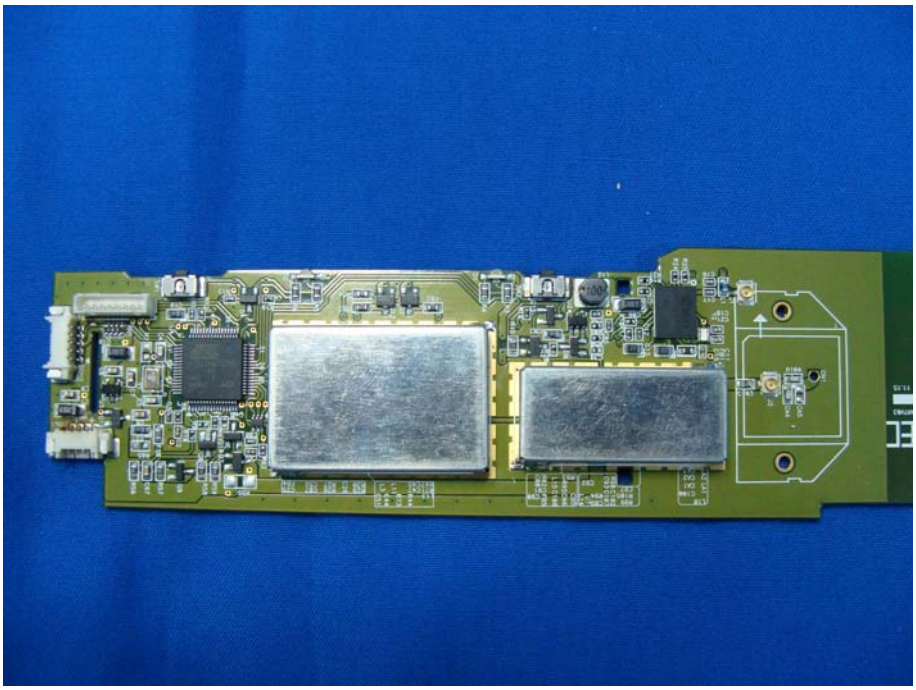

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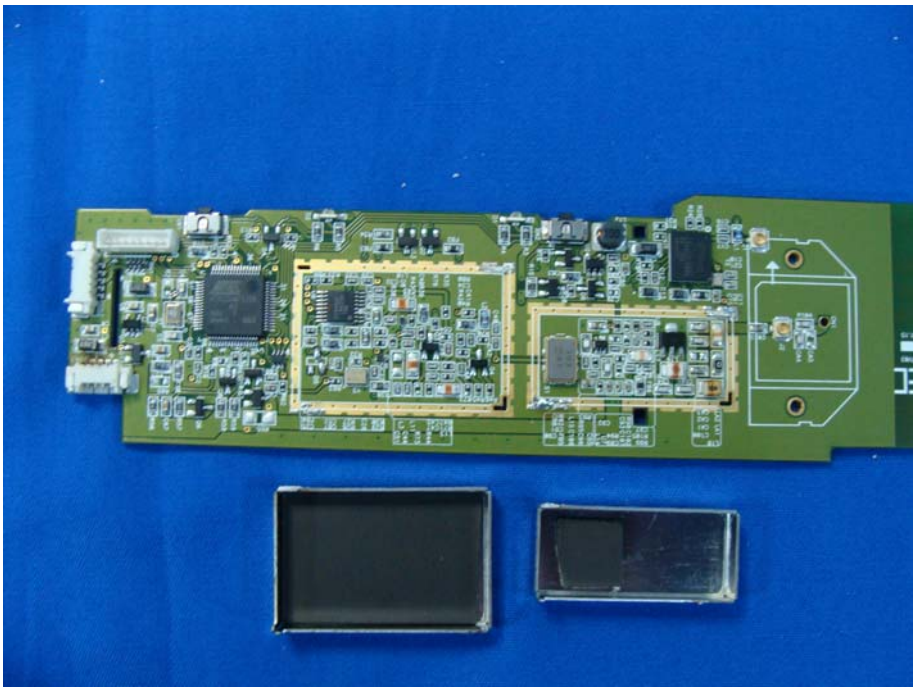

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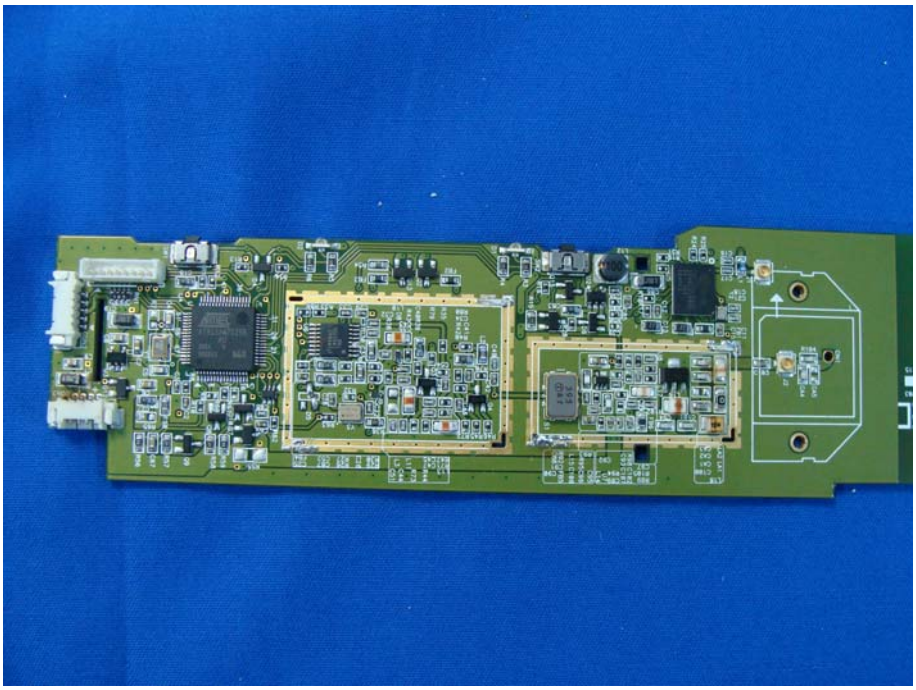

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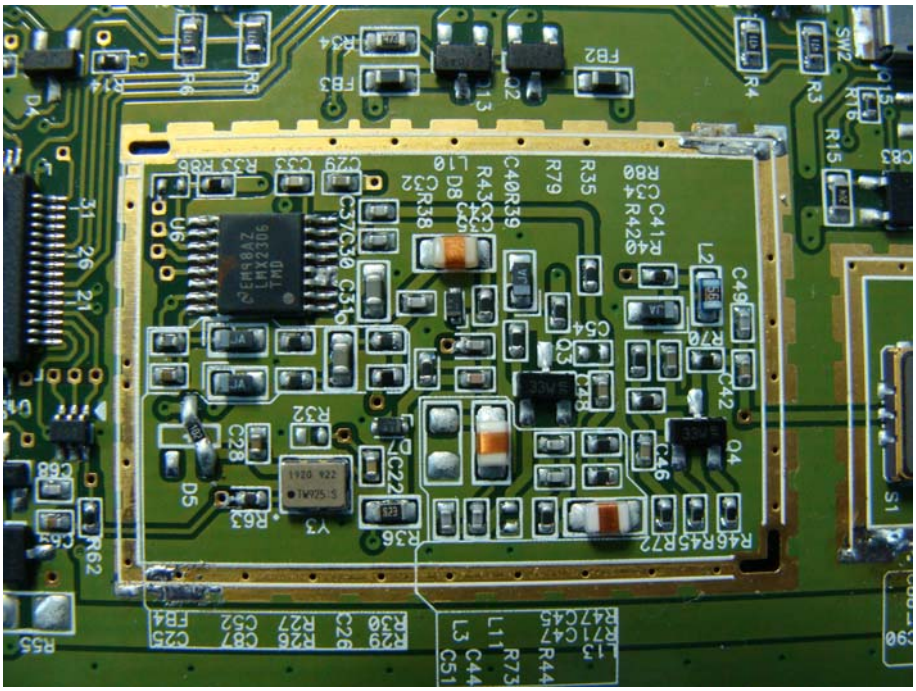

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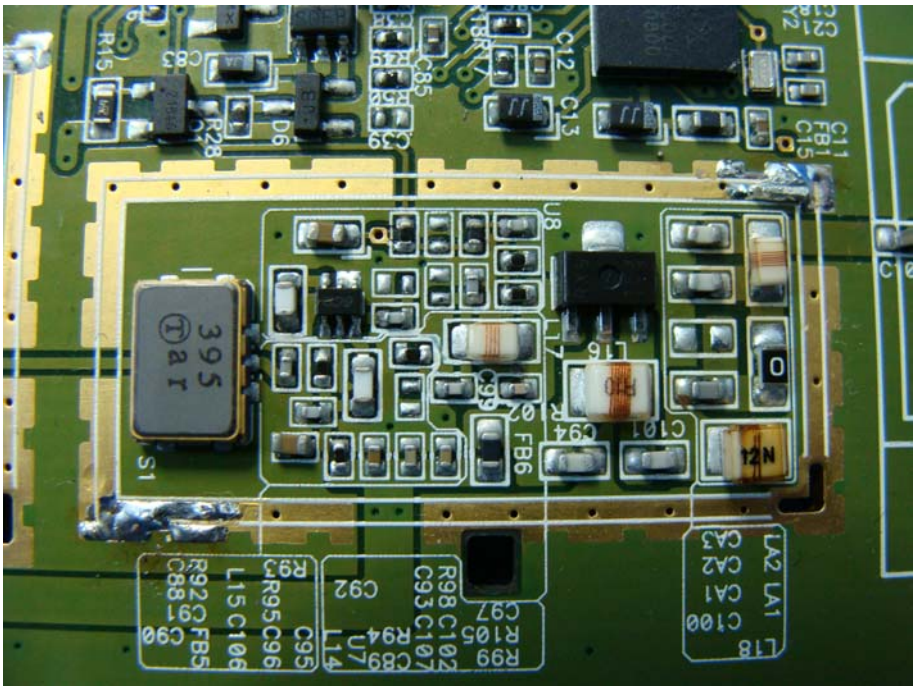

(24) EUT Photo