TEST REPORT

Applicant	:	**DUALi Inc.**
Applicant's Address	:	1-309 Innoplex, 552 Woncheon-dong, Youngtong-gu, Suwon, Gyeonggi-do, South Korea
Manufacturer	:	**DUALi Inc.**
Manufacturer's Address	:	1-309 Innoplex, 552 Woncheon-dong, Youngtong-gu, Suwon, Gyeonggi-do, South Korea
EUT		
Type of Product	:	SMART CARD READER
Model	:	DE-630
Buyer Model/ Multi Model	:	N/A
Serial Number	:	Prototype
Test Standards	:	ANSI C63.4-2009
Rule Parts	:	FCC Part 15 Subpart B - Unintentional Radiators
Equipment Class	:	Class B personal computers and peripherals
Test Date(s)	:	Apr. 9, 2012 ~ Apr. 14, 2012
Test Report	:	SKTEFC-120425-041
Date of Issue	:	Apr. 25, 2012
Overall Test Result	:	**Compliance**

The above equipment was tested by SK Tech Co., Ltd. For compliance with the requirements set forth in FCC Part15 Subpart B mentioned above. The test results show the maximum emission levels emanating from the equipment are within the compliance requirements. The test results of this report only apply to the specific sample tested under stated test conditions.

K.H. Bae **/Test Engineer**

J.S. Yoon **/Technical Manager**

REVISION HISTORY

Rev. #	Changes of Content	Section Affected	Reviewed by	Date
0	Original Release	All	J.S. Yoon	Apr. 25, 2012

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SUMMARY OF TEST RESULT

EMISSION			
STANDARD	**ITEM**	**CLASS/SEVERITY**	**RESULT**
ANSI C63.4-2009 FCC Part 15 Subpart B	FCC 15.107(a) AC Power line Conducted Emission Test	Meets Class B limits and the minimum passing margin is 16.61 dB at 0.16 MHz	PASS
	FCC 15.109(a) Radiated Emission Test	Meets Class B limits and the minimum passing margin is 2.3 dB at 311.85 MHz	PASS

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1. General

The tests listed in this report have been performed and the results recorded by SK Tech Co., Ltd. in accordance with the procedures stated in each test requirement and specification. As a result, the subject product has been verified to comply with each test specification. The test results relate only to the items tested.

We attest to the accuracy of data. All measurements reported herein were performed by SK TECH Co., Ltd. and were made under Technical Manager's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. Facilities and Accreditations

2.1 Facilities

All of the measurements described in this report were performed at SK Tech Co., Ltd

Site I: 820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

Site II: 688-8, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

The test site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 16-1-4. It complies with the Normalized Site Attenuation requirements given in ANSI C63.4, and site VSWR requirements specified in CISPR 16-1-4. The measuring equipment conforms to CISPR 16 requirements for Electromagnetic Noise and Field Strength Instrumentation.

2.2 Accreditations

Our testing laboratories are accredited by the following accreditation bodies in accordance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

Korea	**:**	**KOLAS No.191**
Germany	**:**	**DAKKS DAT-P-076/97-02**

The laboratories have been also notified to FCC by RRA as a Conformity Assessment Body, and designated to perform compliance testing on equipment subject to Declaration of Conformity (DOC) and Certification under Parts 15 and 18 of the FCC Rules.

Designation number : KR0007

2.3 Test and Measurement Instruments Used

- **Conducted Disturbance**

Name of Equipment	Type	S/N	Calibrated until
EMI Test Receiver	ESHS10	862970/019	07.2012
Artificial Mains Network	ESH2-Z5	834549/011	07.2012
Artificial Mains Network	ESH3-Z5	836679/018	07.2012
Artificial Mains Network	NNLK8129	8129-215	03.2013
Impedance Stabilization Network	ISN T8	24806	02.2013

- **Radiated Disturbance**

Name of Equipment	Type	S/N	Calibrated until
EMI Test Receiver	ESPI	101206	07.2012
EMI Test Receiver	ESIB40	100277	03.2013
Pre-Amplifier (30 MHz ~ 1 GHz)	8447F	3113A05153	07.2012
Pre-Amplifier (30 MHz ~ 1 GHz)	8447D	2944A07994	07.2012
Pre-Amplifier (1 GHz ~ 18 GHz)	MLA-100M18-B02-38	1539546	03.2013
Bilog broadband Antenna	VULB9168	9168-189	05.2012
Bilog broadband Antenna	JB1	A060910	10.2012
Broadband Horn Antenna (1 GHz ~ 18 GHz)	BBHA 9120D	9120D-816	12.2012
Band Reject Filter	WRCGV2400/2483-2375/2505-50/10SS	5	02.2013

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3. EUT Description

The EUT is a SMART CARD READER. The following information has been supplied by the applicant.

ITEM	SPECIFICATION
CPU	STM32F103ZCT6 (ARM Cortex_M3, 144pin)
Program Memory	256 Kbytes FLASH (default) Up to 8 Mbytes external Flash(Basically 4 Mbyte)
Data Memory	48 Kbytes SRAM (default) Up to 8 Mbytes external PSRAM(Basically 2 Mbyte)
Display	4 Status LED 128 x 64 Graphic LCD (Yellow green)
Communication	RS-232 - default RS-485 - optional USB 2.0 (recommended for firmware development)
BUZZER	Magnetic Buzzer
RF Card	Frequency : 13.56 MHz Speed : 106, 212, 424, 848 Kbps ISO-14443 A/B ,MIFARE
SAM	4 SAM slots Class A and B, T=0 and T=1

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4. EUT Operating Conditions

The EUT was powered from DC voltage fed from the AC Adapter that was connected to AC mains with 120 V, 60 Hz. The test configuration and mode of operation described in this section were used during all the measurements as the worst case, unless otherwise noted elsewhere in this report.

4.1 EUT Operation Modes

The radio link was established by deploying RFID card on the EUT, and communications between the EUT and PC was made via the serial interface and checked with the test software.

4.2 Ancillary Equipment

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests.

#	Equipment	Manufacturer	Model No.	Serial No.
1	PC	Samsung Electronic	DB-P70	CB1297AQ400040A
2	LCD Monitor	QISDA (SUZHOU) CO., LTD.	ST2210b	CN-0T503R-74261-04T-0UJM
3	Printer	P.T.INDONESIA EPSON IND.	Stylus C41Plus	EUNY019010
4	Keyboard(USB)	CHICONY ELECTRONICS CO., LTD.	KU-0225	0020914
5	Mouse(USB)	DONGGUAN PRIMAX ELECTRONICS LTD.	MO28UOL	4448387
6	AC Adapter (for EUT)	HUIZHOU SANHUA INDUSTRIAL CO., LTD.	SAWA-07-33012	N/A
7	RFID Card	N/A	N/A	N/A

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4.3 Interconnection and I/O cables

#	START		END		CABLE	
	Name	I/O Port	Name	I/O Port	Length(m)	Shielded/ Unshielded
1	EUT	RJ45	PC	Serial	0.3	Unshielded
2	EUT	DC Input	Adapter	DC Output	1.3	Unshielded
3	EUT	-	RFID Card	-	-	-
4	PC	DVI	LCD Monitor	DVI	1.8	Shielded
5	PC	USB	Printer	USB	1.8	Shielded
6	PC	USB	Mouse	USB	1.8	Shielded
7	PC	USB	Keyboard	USB	1.8	Shielded
8	PC	AC Input	AC Mains	AC Mains	1.8	Unshielded
9	LCD Monitor	AC Input	AC Mains	AC Mains	1.8	Unshielded
10	Printer	AC Input	AC Mains	AC Mains	1.8	Unshielded
11	AC Adapter (for EUT)	AC Input	AC Mains	AC Mains	1.8	Unshielded

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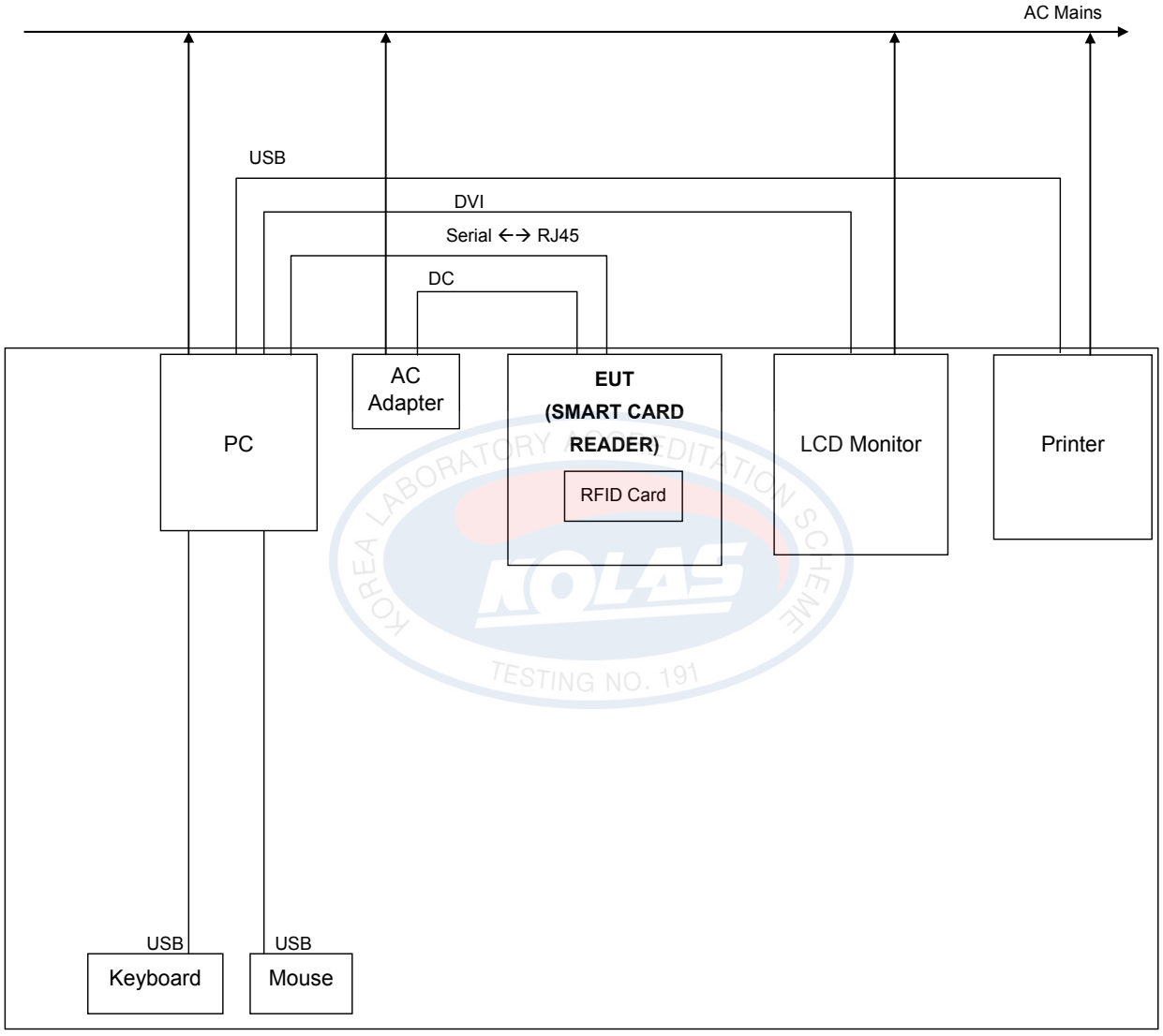
4.4 Test Configuration

For the actual test configuration, please refer to photographs of the test setup.



[System Block Diagram of Test Configuration]

4.5 Uncertainty

1) **Radiated disturbances from 30 MHz to 6000 MHz at a distance of 3 m and 10 m Expanded Uncertainty**

   ***U* = k * *Uc*(xi) = 2 * 2.10 = ±4.20 dB (for 30 MHz to 1000 MHz at the 10 m distance)**

   ***U* = k * *Uc*(xi) = 2 * 2.53 = ±5.06 dB (for 1000 MHz to 6000 MHz at the 3 m distance)**

   The coverage factor k =2 yields approximately a 95 % level of confidence.

2) **Conducted disturbance from 150 kHz to 30 MHz using a 50 Ω / 50 μH AMN Expanded uncertainty**

   ***U* = k * *Uc*(xi) = 2 * 1.57 = ±3.14 dB**

   The coverage factor k =2 yields approximately a 95% level of confidence.

※ When the measured emission is positioned within the range of the uncertainty of measurement from the emission limit, the uncertainty of measurement shall be concerned as follow.

Compliance or non-compliance with a disturbance limit shall be determined in the following manner.

If Ulab is less than or equal to Ucispr
- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If Ulab is greater than Ucispr
- Compliance is deemed to occur if no measured disturbance, increased by (Ulab - Ucispr), exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance, increased by (Ulab - Ucispr), exceeds the disturbance limit.

※ If the measurement value is lower or equal to the limit, the EUT is considered to pass the test.

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5. Test Results EMISSION

5.1 Conducted Disturbance at mains terminals

Result		PASS

Test Environment	Temperature	23 ºC
	Humidity	37 % R.H.

Test Procedure	Test method: **ANSI C63.4** Limit: **FCC Part 15.107(a) Class B digital device** (a) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room. (b) Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source. (c) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement. (d) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz. (e) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

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Conducted Disturbance Test Data

<Quasi-Peak>

Frequency (MHz)	Reading (dBμV)	Line	C/F (dB)	C/L (dB)	Actual (dBμV)	Limit (dBμV)	Margin (dB)
0.16	48.72	L	0.11	0.02	48.85	65.46	16.61
0.18	45.02	N	0.11	0.02	45.15	64.49	19.34
0.19	44.12	L	0.11	0.02	44.25	64.26	20.01
0.20	41.76	N	0.12	0.02	41.90	63.61	21.71
0.35	37.78	L	0.12	0.03	37.93	59.08	21.15
0.37	40.22	L	0.12	0.03	40.37	58.61	18.24

<Average>

Frequency (MHz)	Reading (dBμV)	Line	C/F (dB)	C/L (dB)	Actual (dBμV)	Limit (dBμV)	Margin (dB)
0.16	34.85	L	0.11	0.02	34.98	55.46	20.48
0.35	32.07	L	0.12	0.03	32.22	49.08	16.86
0.37	31.52	L	0.12	0.03	31.67	48.61	16.94
0.98	22.66	L	0.13	0.07	22.86	46.00	23.14
1.00	23.22	L	0.13	0.07	23.42	46.00	22.58
23.95	28.60	L	0.88	0.24	29.72	50.00	20.28

▶ NOTE

*** C/F = Correction Factor**

*** C/L = Cable Loss**

*** LINE: L = Line-PE, N = Neutral-PE**

*** Margin Calculation**

Margin (Q.P) = Limit - Actual

[Actual (Q.P) = Reading (Q.P) + C/F + C/L]

REMARK: the frequency in the vicinity of the transmitting frequency of 13.56 MHz was excluded, because it was measured another test report for the intentional radiator.

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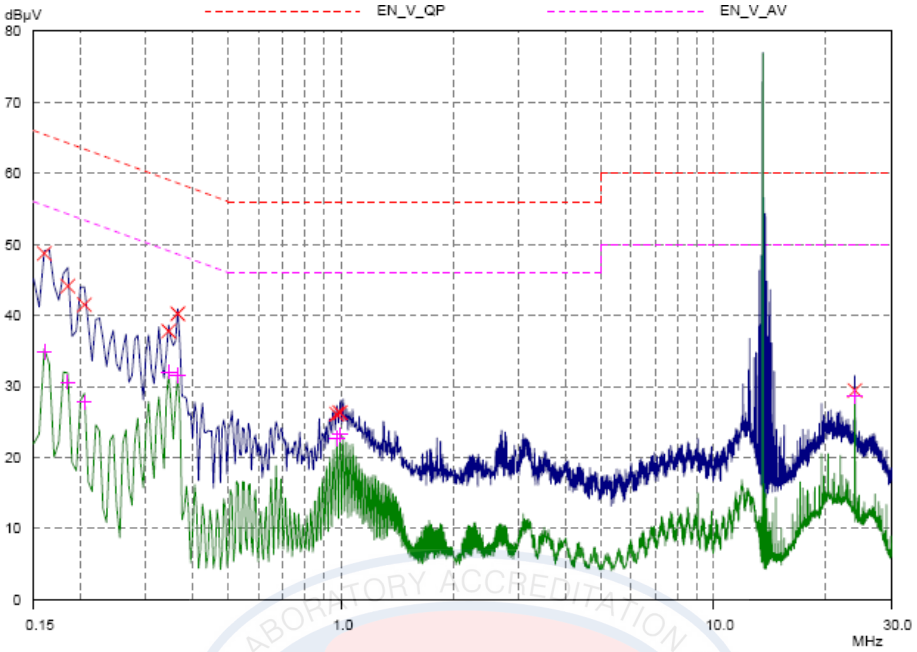
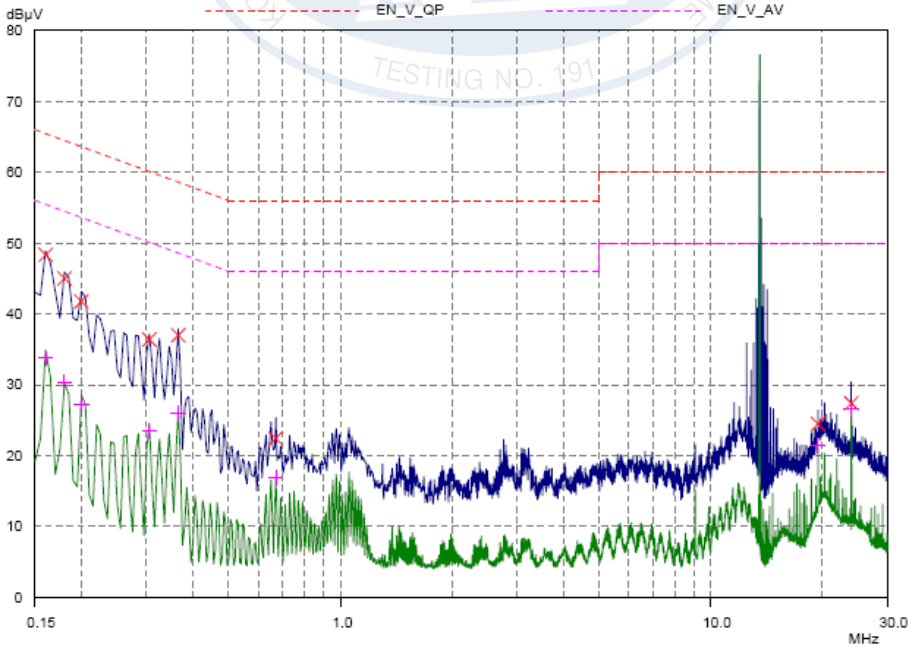
Spectral Diagram, LINE – PE



Spectral Diagram NEUTRAL – PE



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5.2 Radiated Disturbance

Result		PASS

Test Environment	**Test site**	OATS (below 1 GHz)	3-m anechoic chamber (above 1 GHz)
	Temperature	6 ºC	22 ºC
	Humidity	40 % R.H.	40 % R.H.

Test Procedure	Test method: **ANSI C63.4** Limit: **FCC Part 15.109(a) Class B digital device** (a) The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber. (b) For the final measurement, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth. (c) Bilog broadband antenna was used for the frequency up to 1 GHz, and Horn antenna was used for the frequency above 1 GHz. (d) Radiated emission measurement for the frequency up to 1 GHz (at OATS) (1) The EUT was placed on the top of the 0.8-meter height with non-metallic table. (2) The receiving antenna was set at a distance of 3 m from the EUT. (3) The EUT was rotated about 360 º and the receiving antenna was scanned from 1 m up to 4 m in order to capture the maximum emission. (e) Radiated emission measurement for the frequency above 1 GHz (at Chamber) (1) The EUT was placed on the top of the 0.8-meter height with non-metallic table. (2) The receiving antenna was set at a distance of 3 m from the EUT. (3) The EUT was rotated about 360 º to capture the maximum emission.

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Radiated Disturbance Test data – below 1 GHz

Frequency [MHz]	Reading [dBμV]	Pol.	Height [m]	AMP [dB]	AF [dB/m]	CL [dB]	ACTUAL [dBμV/m]	LIMIT [dBμV/m]	MARGIN [dB]
40.54	47.41	V	1.00	28.59	12.50	0.69	32.01	40.0	8.0
67.87	53.04	V	1.00	28.49	11.16	0.94	36.65	40.0	3.4**
216.98	51.62	H	3.84	27.89	9.99	1.68	35.40	46.0	10.6
244.01	52.56	H	3.82	27.82	11.19	1.81	37.74	46.0	8.3
311.85	55.88	V	2.95	27.76	13.55	2.03	43.70	46.0	2.3**
339.01	55.08	H	1.00	27.95	14.16	2.11	43.40	46.0	2.6**

NOTES:

1. All other emissions are non-significant.
2. Measurements using CISPR Quasi-Peak mode.
   (Resolution bandwidth: 120 kHz)
3. H = Horizontal, V = Vertical Polarization.
4. AMP, AF and CL stands for Gain of Pre-amplifier, Antenna Factor and Cable loss respectively
5. ACTUAL = Reading - AMP + (AF + CL)
6. MARGIN = LIMIT - ACTUAL
7. Radiated Measurements at 3-meters.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty ; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

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Radiated Disturbance Test data – above 1 GHz

Freq. [MHz]	RBW [kHz]	POL [V/H]	ANT [m]	Angle [°]	READING [dBμV]		AMP [dB]	AF [dB/m]	CL [dB]	ACTUAL [dBμV/m]		LIMIT [dBμV/m]		MARGIN [dB]	
					PK	AV				PK	AV	PK	AV	PK	AV
1497.0	1000	H	1.00	181	59.42	47.11	41.16	24.59	4.74	47.59	35.28	74.0	54.0	26.4	18.7

Actual [dBμV/m] = Reading [dBμV] - AMP gain [dB] + AF [dB/m] + CL [dB]
MARGIN [dB] = Limit [dBμV/m] - Actual [dBμV/m]

PK/AV : Peak / Average detector
AMP : Gain of the pre-amplifier
AF : Antenna Factor
CL : Cable loss

NOTES:

1. Radiated Measurements at 3-meters
2. The radiated disturbance was measured from 1 GHz to 6 GHz.

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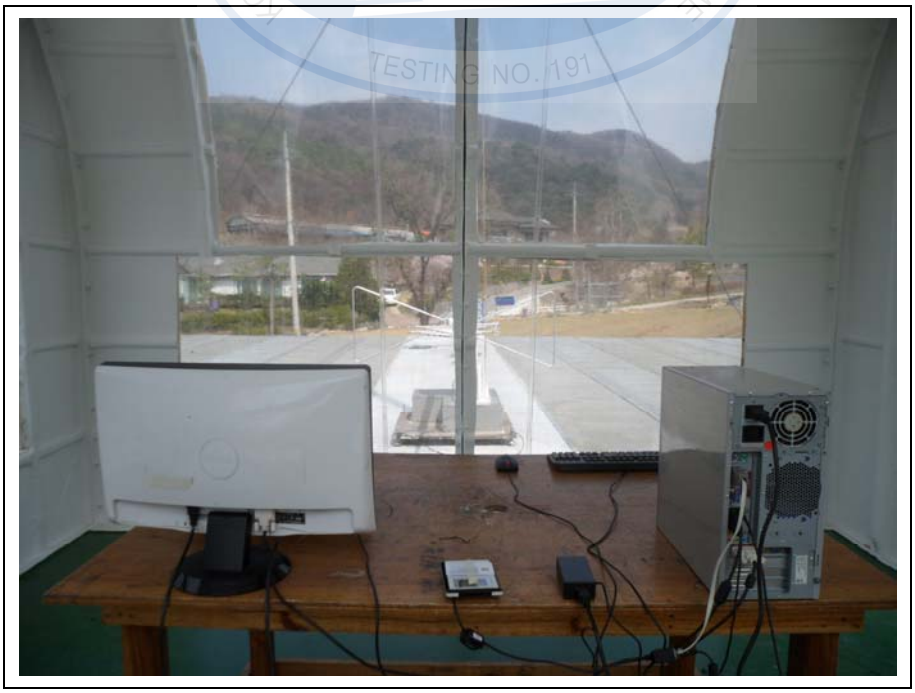
Appendices

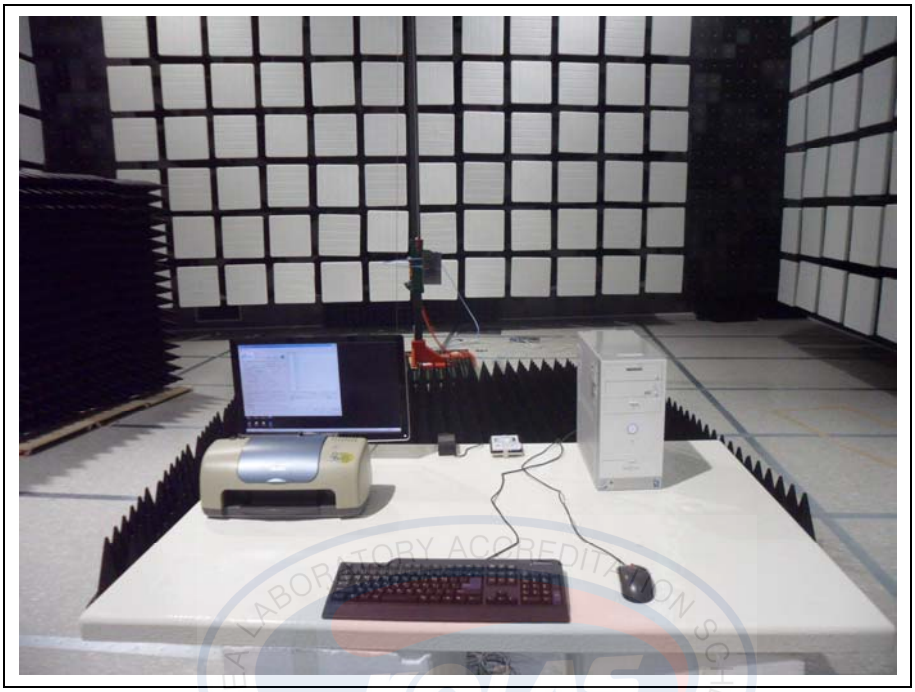
A1: Photograph of test set-Up

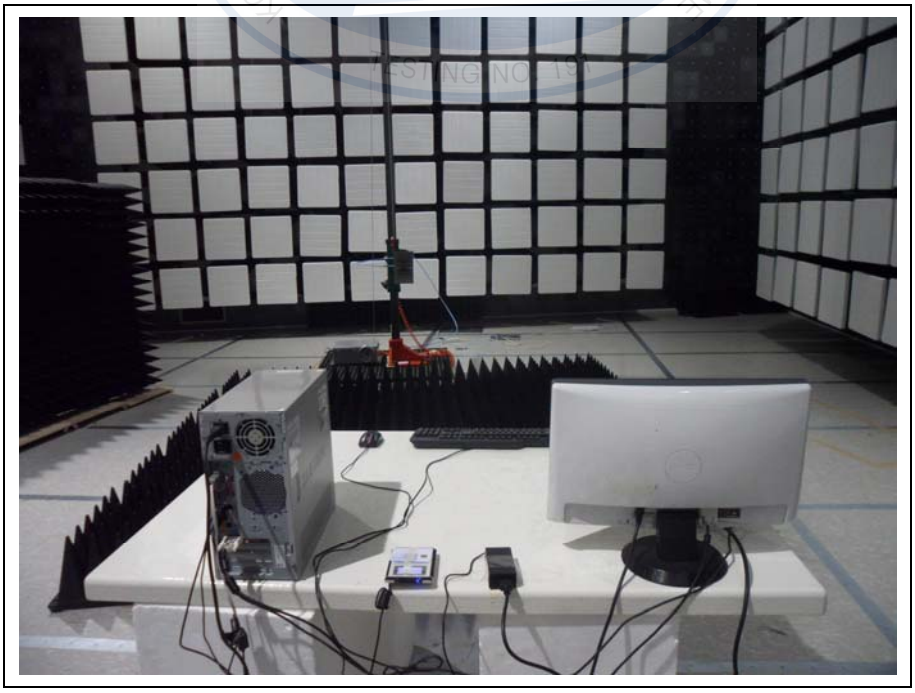
A1.1: Conducted Disturbance

A1.2: Radiated Disturbance (below 1 GHz)



A1.3: Radiated Disturbance (above 1 GHz)





A2: EUT Photographs

A2.1: <Front>

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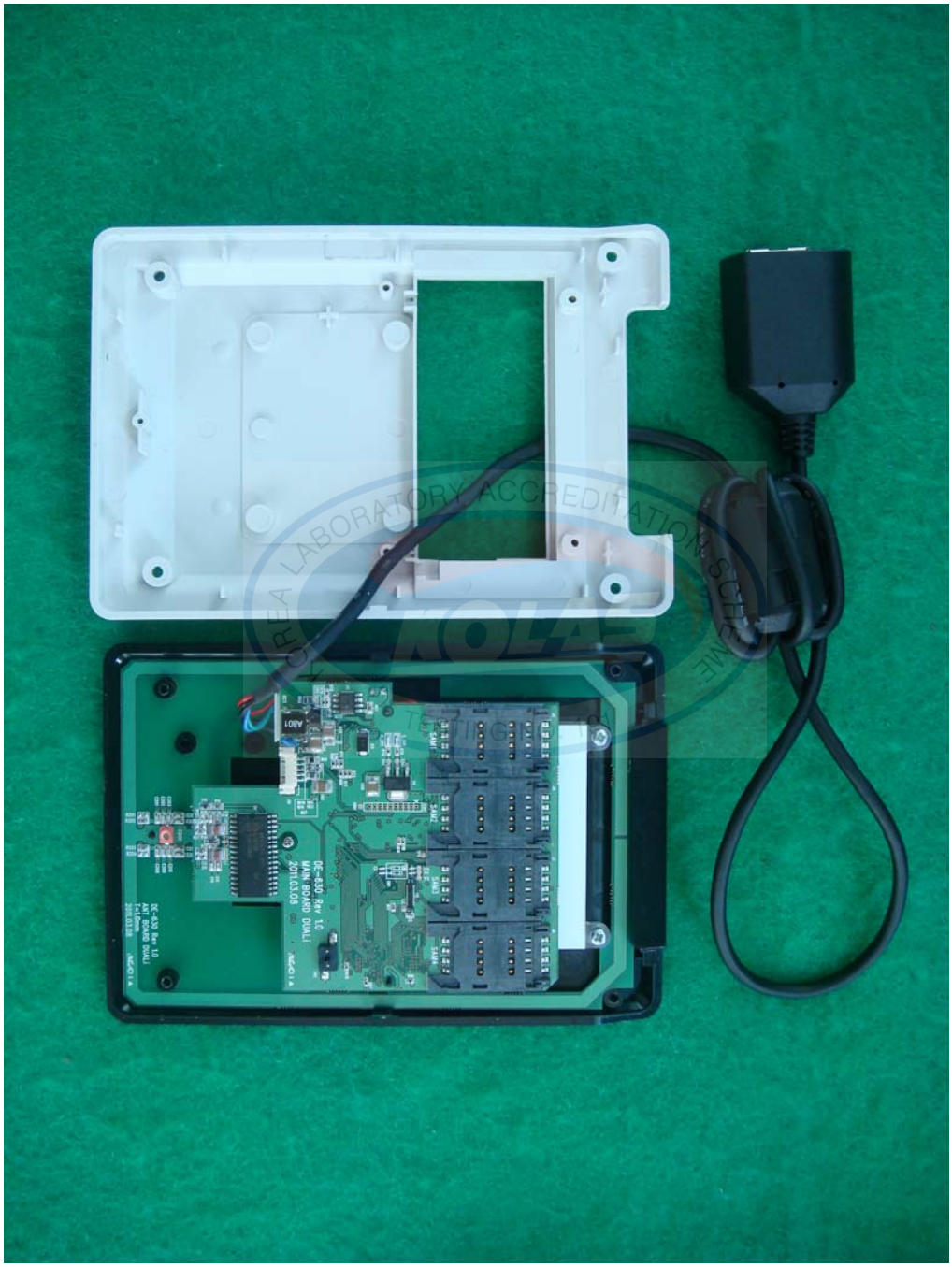
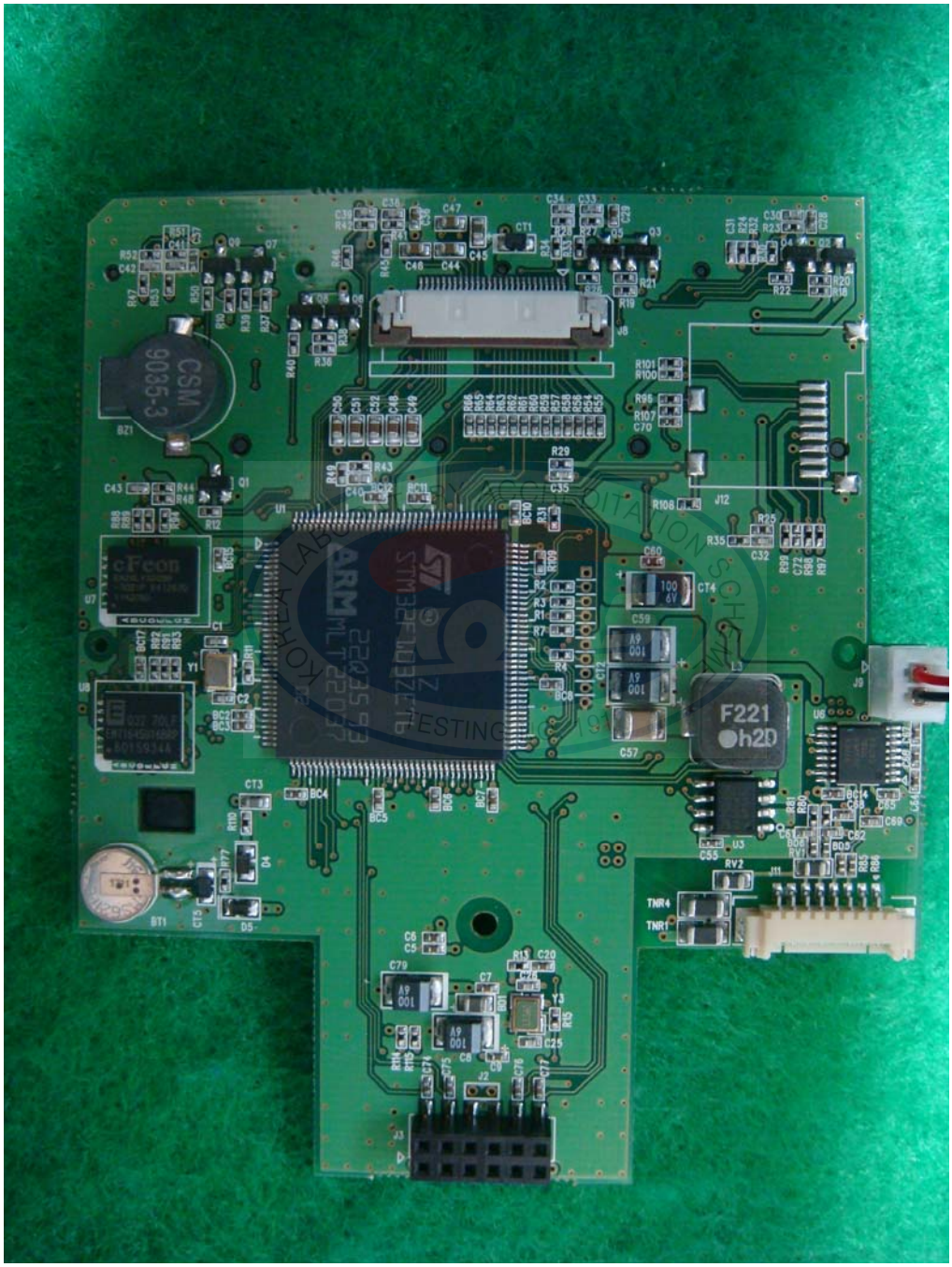
A2.2: <Rear>

A2.3: <Internal>



A2.4: <Main Board Front>



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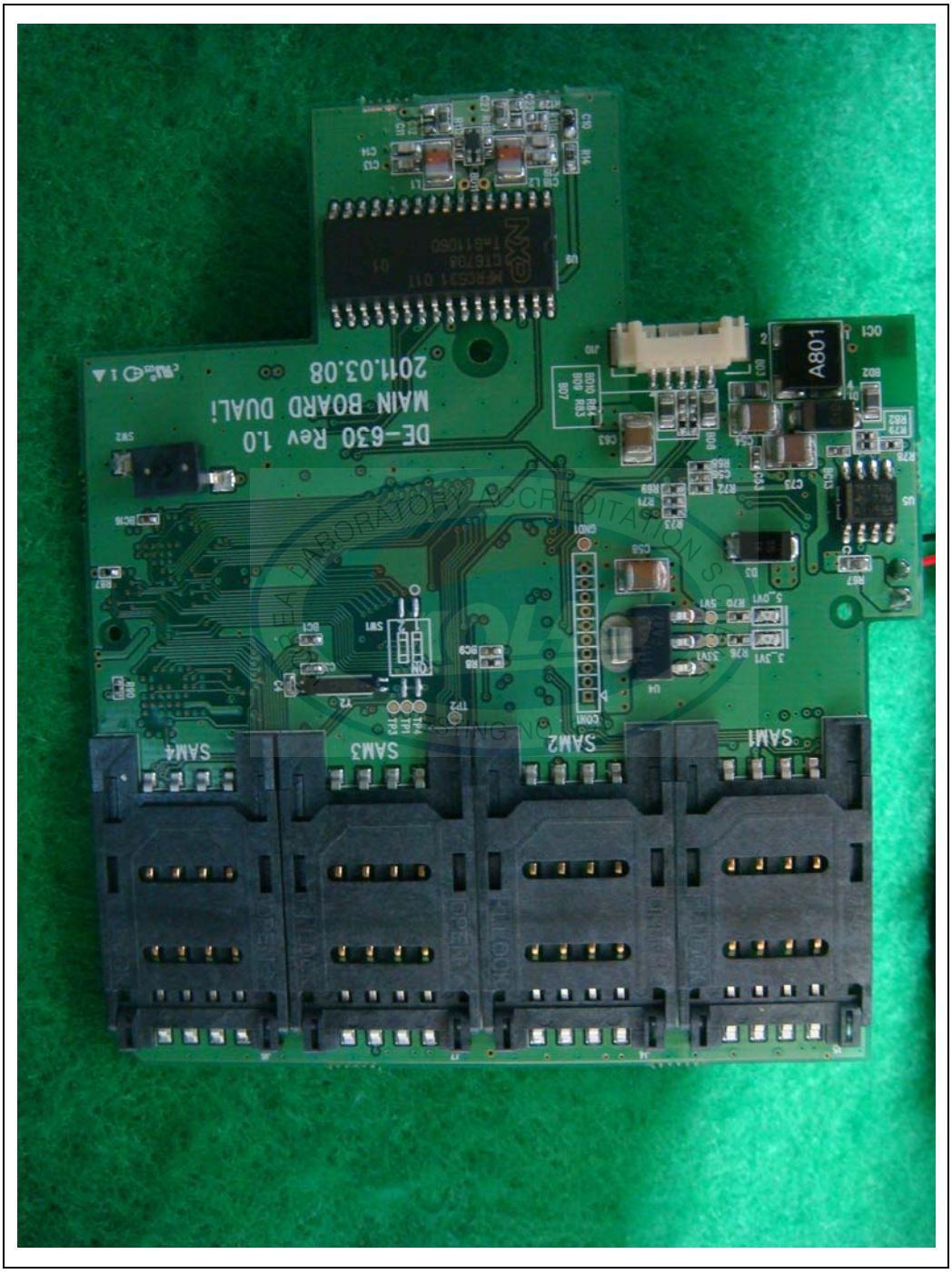
A2.5: <Main Board Rear>



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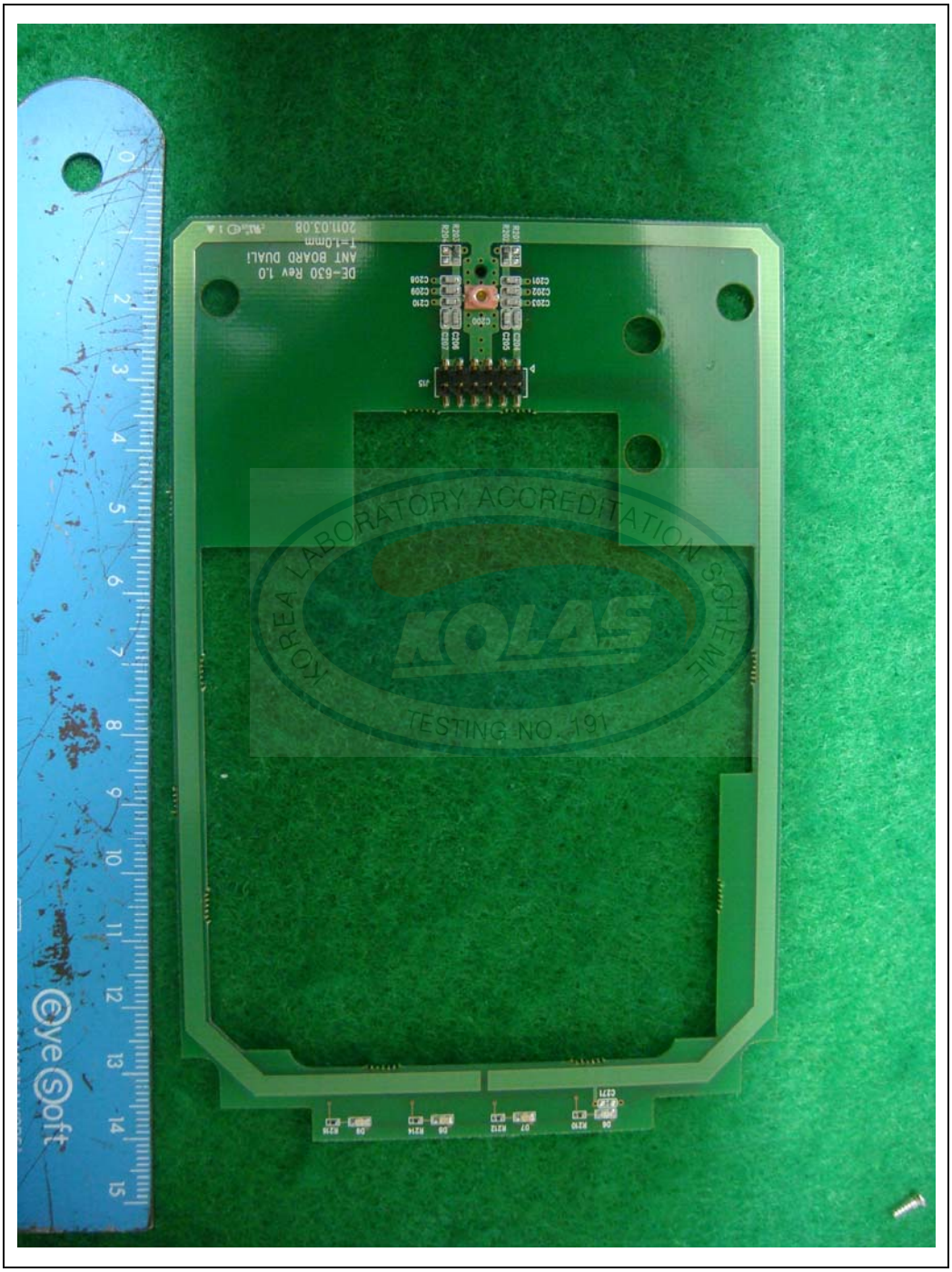
A2.6: <Antenna Board Front>



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A2.7: <Antenna Board Rear>

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A2.8: <LCD Panel Front>

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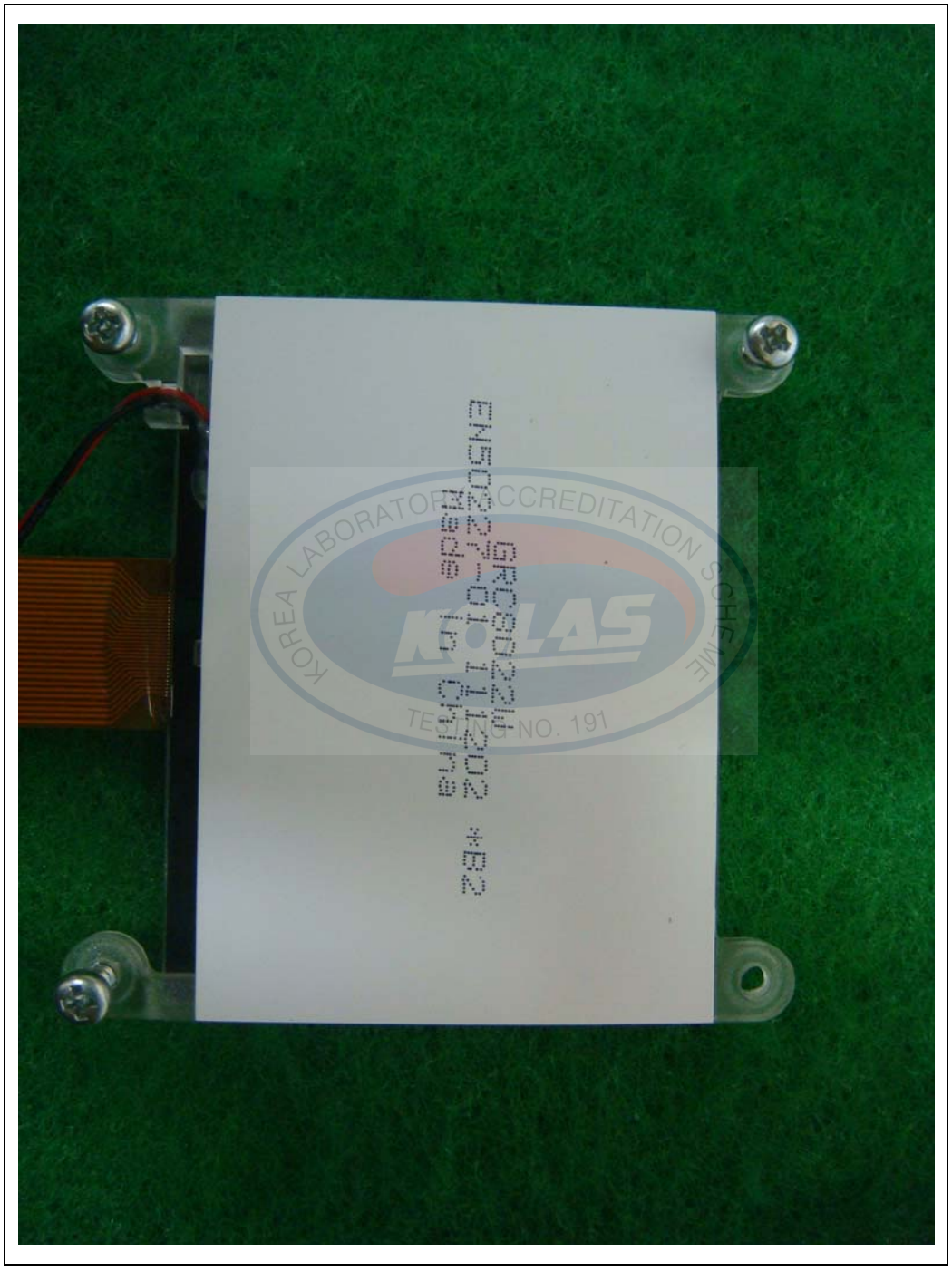
A2.9: <LCD Panel Rear>



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A2.10: <AC/DC Adapter Front>

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A2.11: <AC/DC Adapter Rear>

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