

ELECTROMAGNETIC COMPATIBILITY TEST REPORT

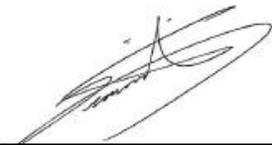
Test Report No.		RAPA17-O-024
Applicant	Name	Comfile Technology Inc.
	Address	104-5, Guro5-dong, Guro-gu, Seoul, Korea
Manufacturer	Name	Comfile Technology Inc.
	Address	104-5, Guro5-dong, Guro-gu, Seoul, Korea
Type of Equipment		Touch Display Controller for Industrial
Model Name		CPI-A070WR
Multi Model Name		N/A
Serial number		N/A
Total page of Report		35 pages (including this page)
Test period		June 8, 2017 – July 5, 2017
Issuing date of report		July 6, 2017

SUMMARY

The equipment complies with the standards; EN 55032:2012 and EN 55024:2010.

This test report contains only the result of a single test of the sample supplied for the examination. It is not a general valid assessment of the features of the respective products of the mass-production.

Prepared by :



Dongsu Jin / Manager
TCL of RAPA.

Reviewed by :



Gun-Il Shin / Senior Manager
TCL of RAPA.

CONTENTS

1. APPLICANT AND MANUFACTURER INFORMATION	3
2. TEST SUMMARY	3
2.1 Test standards and results	3
2.2 Additions, deviations, exclusions from standards	3
2.3 Purpose of the test.....	3
2.4 Test facilities	4
2.5 Criterion description	4
3. EUT (Equipment Under Test).....	5
3.1 Identification of the EUT	5
3.2 Additional information about the EUT	5
3.3 Peripheral equipment.....	6
3.4 Mode of operation during the test	6
3.5 Alternative type(s)/model(s); also covered by this test report	6
3.6 EUT cable description.....	7
4. EUT MODIFICATIONS.....	8
5. EMISSION TESTS.....	9
5.1 Conducted common mode disturbance at telecommunication ports.....	9
5.2 Radiated electromagnetic field (Below 1 GHz)	12
5.3 Radiated electromagnetic field (Above 1 GHz)	14
6. IMMUNITY TESTS	19
6.1 Electrostatic discharge immunity test	19
6.2 Radiated RF-electromagnetic field immunity test	22
6.3 Electrical fast transient/burst immunity test	24
6.4 Conducted disturbance induced by RF fields immunity.....	26
APPENDIX I - TEST SET-UP PHOTOS: Conducted common mode disturbance at TEL ports	28
APPENDIX II - TEST SET-UP PHOTOS: Radiated electromagnetic field (Below 1 GHz)	29
APPENDIX III - TEST SET-UP PHOTOS: Radiated electromagnetic field (Above 1 GHz)	30
APPENDIX IV - TEST SET-UP PHOTO: Electrostatic discharge immunity	30
APPENDIX V - TEST SET-UP PHOTO: Radiated frequency electromagnetic field	31
APPENDIX VI - TEST SET-UP PHOTO: Electrical fast transient/burst immunity	32
APPENDIX VII - TEST SET-UP PHOTO: Conducted disturbance induced by RF fields Immunity.....	33
APPENDIX VIII – PHOTOGRAPHS: Internal and External appearances	34

1. APPLICANT AND MANUFACTURER INFORMATION

Applicant	Name	Comfile Technology Inc.
	Address	104-5, Guro5-dong, Guro-gu, Seoul, Korea
Manufacturer	Name	Comfile Technology Inc.
	Address	104-5, Guro5-dong, Guro-gu, Seoul, Korea
Name of contact		Hyeon-Cheol Hwang / Manager
Telephone No.		+82-2-711-2592
Fax No.		+82-2-856-2611

2. TEST SUMMARY

2.1 Test standards and results

	STANDARDS	RESULTS
EN 55032:2012	Main Terminal Continuous Disturbance Voltage	N/A (See Note 1)
	Conducted common mode disturbance at TEL ports	Met / PASS
	Radiated Emission (Below 1 GHz)	Met / PASS
	Radiated Emission (Above 1 GHz)	Met / PASS
EN 55024:2010	Electrostatic discharge immunity	Met Class A / PASS
	Radio frequency electromagnetic fields	Met Class A / PASS
	Electrical fast transient/burst immunity	Met Class A / PASS
	Surge immunity	N/A (See Note 1)
	Conducted disturbance induced by RF fields immunity	Met Class A / PASS
	Power frequency magnetic field immunity	N/A (See Note 2)
	Voltage Dips and Short interruptions	N/A (See Note 1)

NOTE 1: This test is not performed because the EUT is operated by DC voltage.

NOTE 2: The equipment under test was not susceptible to magnetic fields, so this test was not executed.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standards.

2.3 Purpose of the test

To determine whether the equipment under test fulfills the EMC requirements of the standards stated in section 2.1.

2.4 Test facilities

- Place of test : Head office
101 & B104, Anyang Megavalley, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
- Open area test site
103, Anseok-dong, 138beon-gil, Hwaseong-si, Gyeonggi-do, Korea
(FCC OATS Registration Number : 931589)
(FCC Conformity Assessment Body, Registration Number : 608365)
(IC Company address code : 9355B)
(RRA Designation Number : KR0027)

2.5 Criterion description

Criterion	Descriptions
A	No loss of performance or function.
B	The apparatus shall continue operate as intended after test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.
C	Temporary loss of function or performance, which is provided the function, is self-recoverable or can be restored by the operation of the controls.

3. EUT (Equipment Under Test)

3.1 Identification of the EUT

- Equipment : Touch Display Controller for Industrial
- Model name : CPi-A070WR
- Multi model name : N/A
- Brand name : Comfile Technology Inc.
- Serial number : N/A
- Manufacturer : Comfile Technology Inc.

3.2 Additional information about the EUT

The model CPi-A070WR (referred to as the EUT in this report) of Comfile Technology Inc. is a Touch Display Controller for Industrial. Product specification described herein was obtained from product data sheet or user's manual.

MCU	1.2 GHz 64 Bit Quad Core ARM Cortex-A53 processor
Memory	SDRAM : 1 GB, microSD: 8 GB
LCD	TFT LCD(260,000 Color) / 7 Inch (800 x 480) / 400 cd/m ²
Backlight	LED Backlight (ON/OFF switchable)
Ethernet	100 Base-T (1Port)
Touch	4 wire resistive panel
Audio	Stereo audio output (ø3.5 Audio Jack)
USB	USB 2.0 x 4 Port
Serial	COM1 (RS232C), COM2 (RS232C)
Input Power	DC12 V
Power Consumption	<6 W (0.5 A@12 V)
MAX. Current	500 mA
Dimension (mm)	222(H) x 152(V) x 56(D)
Weight	650 g
Operating Temperature	0 °C ~ 70 °C
Storage Temperature	-30 °C ~ 80 °C

3.3 Peripheral equipment

It is defined as peripheral equipment needed for correct operation of the EUT but not considered as tested.

Model	Manufacturer	Description	Connected to
CPI-A070WR	Comfile Technology Inc.	Touch Display Controller for Industrial [EUT]	-
KU-0316	HP	Keyboard	EUT
B138	SAMSUNG	Mouse	EUT
8GB	SanDisk	Micro SD CARD	EUT
8GB	memorette	USB Memory	EUT
SHS-150V/W	SAMSUNG	Headset	EUT
ProBook 6560b	HP	Notebook	EUT
Series PPP012H-S	HP	Notebook Adapter	Notebook
ED-200E	ED LABORATORY	DC Power Supply	EUT

3.4 Mode of operation during the test

The EUT has maintained normal operation and full loaded traffic mode during the test. EUT Input power is DC 12 V. Tests were executed under the normal operation condition.

3.5 Alternative type(s)/model(s); also covered by this test report

The followings are added model names and their differences.

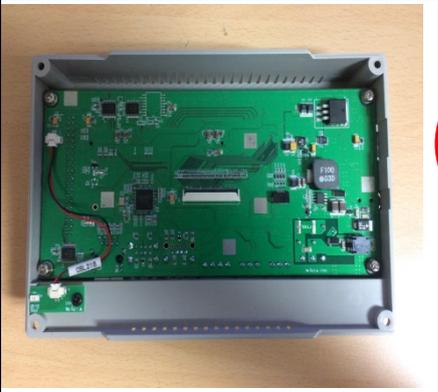
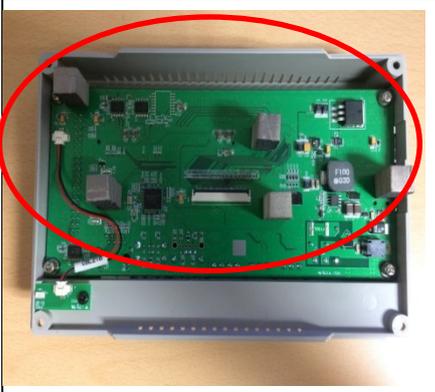
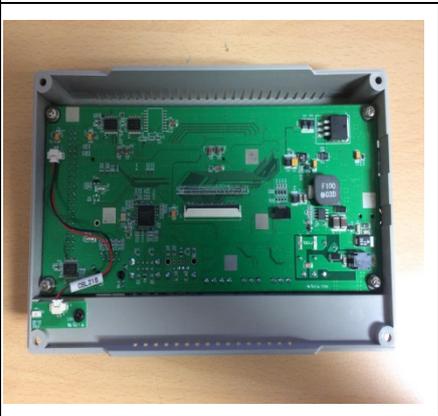
Model Name	Differences	Tested
None	None	<input type="checkbox"/>

NOTE1: Applicant asks only basic model to test. Therefore, testing laboratories just guarantee the unit which has been tested.

3.6 EUT cable description

Port Name		Shielded	Ferrite Bead	Metal Hood	Length (m)	Connected to
Touch Display Controller for Industrial [EUT]	DC INPUT	Unshielded	No	None	1.8	DC Power Supply
	USB	shielded	No	EUT end	1.2	Keyboard
	USB	shielded	No	EUT end	1.6	Mouse
	USB	-	No	None	Direct	USB Memory
	Micro SD	-	No	None	Direct	Micro SD CARD
	Ethernet(RJ-45)	Unshielded	No	None	3.0	Notebook (LAN(RJ-45))
	COM0 RS232C	shielded	No	None	0.3	LINE
	COM1 RS232C	shielded	No	None	1.5	Notebook (Serial)
	I2C1	Unshielded	No	None	0.3	LINE
	SOUND OUT	Unshielded	No	None	1.8	Headset
	GPIO	shielded	No	None	0.5	LINE
Notebook	DC INPUT	Unshielded	No	None	2.4	Notebook Adapter
	Serial	shielded	No	None	1.5	EUT (COM1 RS232C)
	LAN(RJ-45)	Unshielded	No	None	3.0	EUT (Ethernet(RJ-45))

4. EUT MODIFICATIONS

No.	Before	After	Modifications
1			Apply gasket
2			Apply gasket
3			Apply gasket

5. EMISSION TESTS

5.1 Conducted common mode disturbance at telecommunication ports

5.1.1 Operating environment

- Temperature: 27.0 °C
- Humidity : 55.0 % R.H.

5.1.2 Test set-up

The EUT and other support equipment were placed on a wooden table, 0.8 m height above the floor. Telecommunication line for the EUT connected to the associated equipment through an Impedance Stabilization Network (ISN) which has a common mode termination impedance of 150 Ω to the telecommunication port under test. The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

The test set-up photos are included in appendix I.

5.1.3 Measurement uncertainty

- Conducted emission, Quasi-peak detection: ± 3.46 dB
- Conducted emission, CISPR-Average detection: ± 3.14 dB

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

5.1.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	ESCI7	Rohde & Schwarz	EMI Test Receiver	100938	Jan. 16, 2017
<input checked="" type="checkbox"/>	ESH3-Z2	Rohde & Schwarz	Pulse Limiter	101631	Jan. 16, 2017
<input checked="" type="checkbox"/>	LT32C	AFJ Instruments	LISN	32031430208	Aug. 23, 2016
<input checked="" type="checkbox"/>	3825/2	EMCO	LISN	9004-1635	Aug. 23, 2016
<input checked="" type="checkbox"/>	CAT3 8158	Schwarzbeck	ISN	8158-0031	Jan. 19, 2017
<input checked="" type="checkbox"/>	CAT5 8158	Schwarzbeck	ISN	8158-0047	Jan. 19, 2017
<input type="checkbox"/>	NTFM 8158	Schwarzbeck	ISN	8158-0035	Jan. 24, 2017
<input checked="" type="checkbox"/>	ES-SCAN	Rohde & Schwarz	EMI Software	N/A	N/A

Remark: All test equipment used is calibrated on a regular basis.

5.1.5 Test data

- Test date : July 4, 2017
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz

▪ **Test mode: 10 Mbps**

Frequency (MHz)	Port	Quasi-peak			CISPR-Average		
		Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)
0.42	Four	58.66	88.41	29.75	52.74	75.41	22.67
0.52	Four	61.69	87.00	25.31	61.48	74.00	12.52
16.23	Four	67.07	87.00	19.93	63.83	74.00	10.17
20.26	Four	67.43	87.00	19.57	65.00	74.00	9.00
21.66	Four	68.24	87.00	18.76	65.72	74.00	8.28
23.13	Four	67.97	87.00	19.03	65.11	74.00	8.89

▪ **Test mode: 100 Mbps**

Frequency (MHz)	Port	Quasi-peak			CISPR-Average		
		Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)
0.34	Four	70.23	90.15	19.92	62.53	77.15	14.62
0.42	Four	73.34	88.41	15.07	67.44	75.41	7.97
0.51	Four	68.82	87.00	18.18	62.38	74.00	11.62
0.59	Four	71.10	87.00	15.90	65.32	74.00	8.68
0.68	Four	67.52	87.00	19.48	60.82	74.00	13.18
23.13	Four	66.27	87.00	20.73	63.22	74.00	10.78

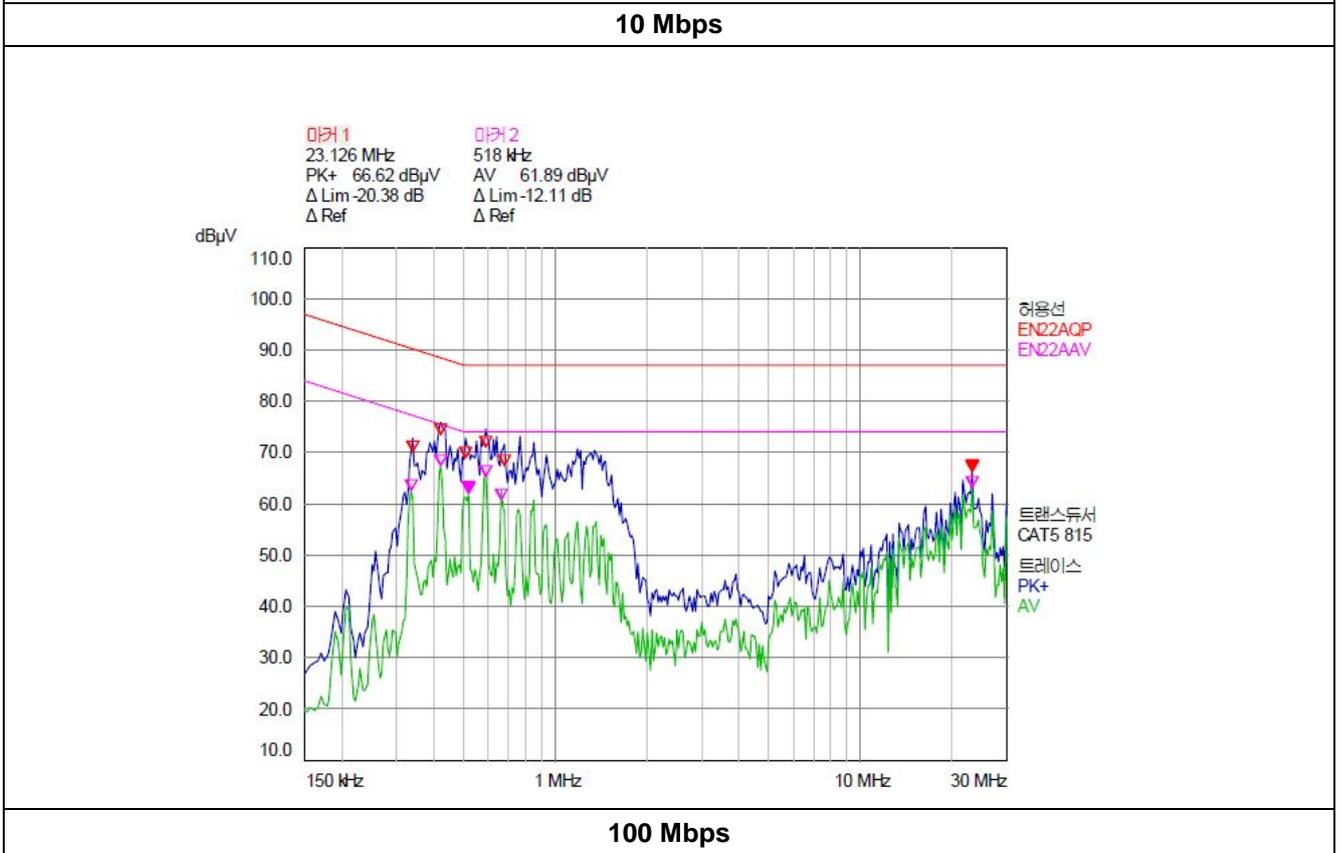
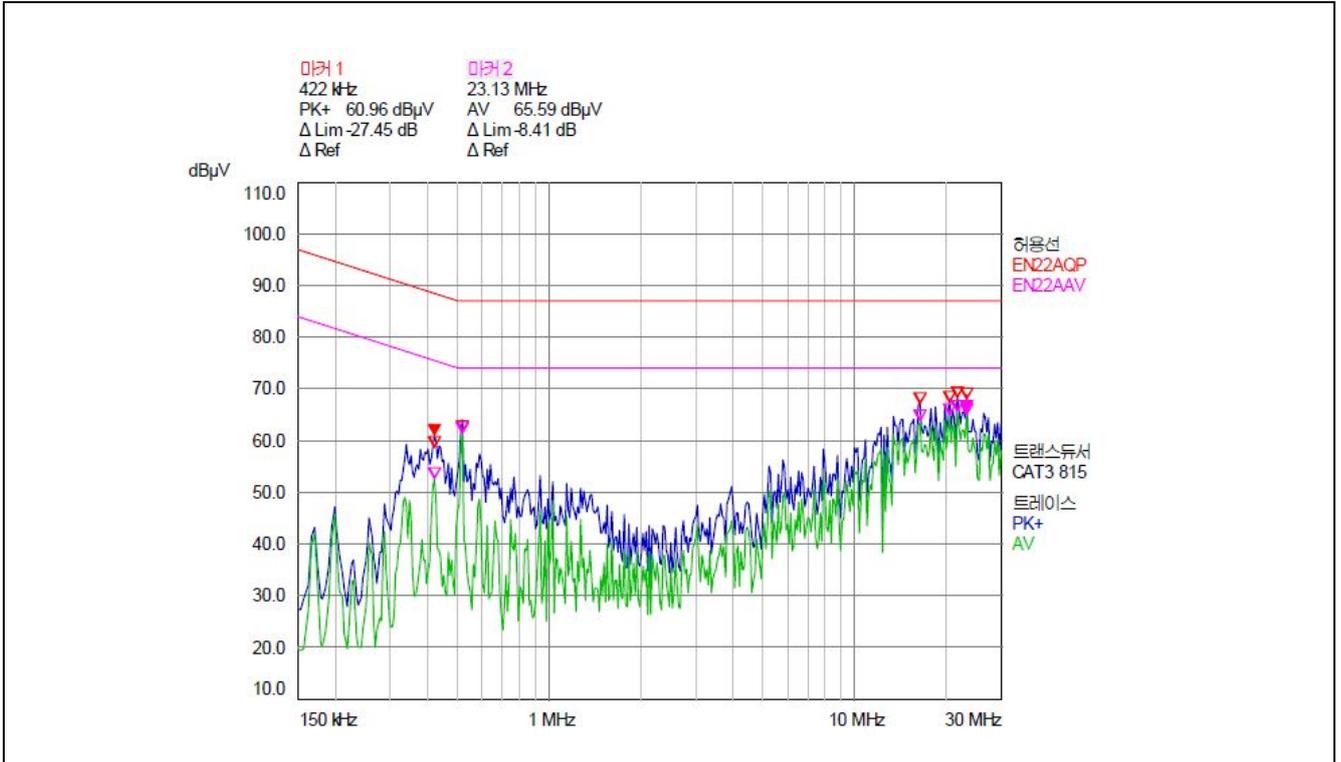
Here, Four = Two unscreened balance pair, P = Peak detect

See next page for an overview sweep performed with peak detector.



Tested by: Dongsu Jin / Manager

• Plots



5.2 Radiated electromagnetic field (Below 1 GHz)

5.2.1 Operating environment

- Temperature: 42.0 °C
- Humidity : 17.0 % R.H.

5.2.2 Test set-up

The radiated emissions were measured at the 10 m Open Area Test Site. The EUT was placed on a wooden table with 0.8 meters height above the ground plane.

The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels at each frequency recorded. The table was rotated 360° and the antenna was varied in height between 1.0 m and 4.0 m in order to detect the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The test set-up photos are included in appendix II.

5.2.3 Measurement uncertainty

- Radiated emission electric field intensity in the range of 30 MHz ~ 1 000 MHz, Quasi-peak detection: ± 4.36 dB

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

5.2.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	ESS	R&S	EMI Test Receiver	833776/011	Aug. 22, 2016
<input checked="" type="checkbox"/>	DS 1500 S-1t-O	Innco GmbH	Turn Table	N/A	N/A
<input checked="" type="checkbox"/>	MA4000-O	Innco GmbH	Antenna Mast	N/A	N/A
<input checked="" type="checkbox"/>	CO 2000	Innco GmbH	Controller	N/A	N/A
<input checked="" type="checkbox"/>	VHA9103	Schwarzbeck	Biconical Antenna	2217	Nov. 04, 2015
<input checked="" type="checkbox"/>	VULP9118A	Schwarzbeck	Log Periodic Antenna	382	Nov. 04, 2015

Remark: All test equipment used is calibrated on the regular basis.

5.2.5 Test data

- Test date : July 5, 2017
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 10 meter

Frequency (MHz)	Reading (dBμV)	ANT Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
53.62	24.50	V	1.80	10.00	9.86	1.28	35.64	40.00	4.36
64.36	22.70	H	2.50	350.00	7.00	1.36	31.06	40.00	8.94
93.86	20.40	H	2.50	360.00	9.17	1.54	31.11	40.00	8.89
123.37	15.80	H	1.40	40.00	13.25	1.59	30.64	40.00	9.36
155.61	14.20	H	2.20	130.00	15.49	1.72	31.41	40.00	8.59
250.00	10.60	H	3.20	360.00	17.26	2.17	30.03	47.00	16.97

Tabulated test data for Radiated Electromagnetic Field

Here, H = Horizontal, V = Vertical



Tested by: Dongsu Jin Manager

5.3 Radiated electromagnetic field (Above 1 GHz)

5.3.1 Operating environment

- Temperature: 23.0 °C
- Humidity : 56.0 % R.H.

5.3.2 Test set-up

The radiated emissions were measured at the 3 m Anechoic Chamber. The EUT was placed on a wooden table with 0.8 meters height above the ground plane.

The frequency spectrum from 1 000 MHz to 6 000 MHz was scanned and maximum emission levels at each frequency recorded. The table was rotated 360° and the antenna was varied in height between 1.0 m and 2.0 m in order to detect the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The test set-up photos are included in appendix III

5.3.3 Measurement uncertainty

- Radiated emission electric field intensity in the range of 1 000 MHz ~ 6 000 MHz, peak detection: ± 4.80 dB
- Radiated emission electric field intensity in the range of 1 000 MHz ~ 6 000 MHz, CISPR-average: ± 4.72 dB

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

5.3.4 Test equipment used

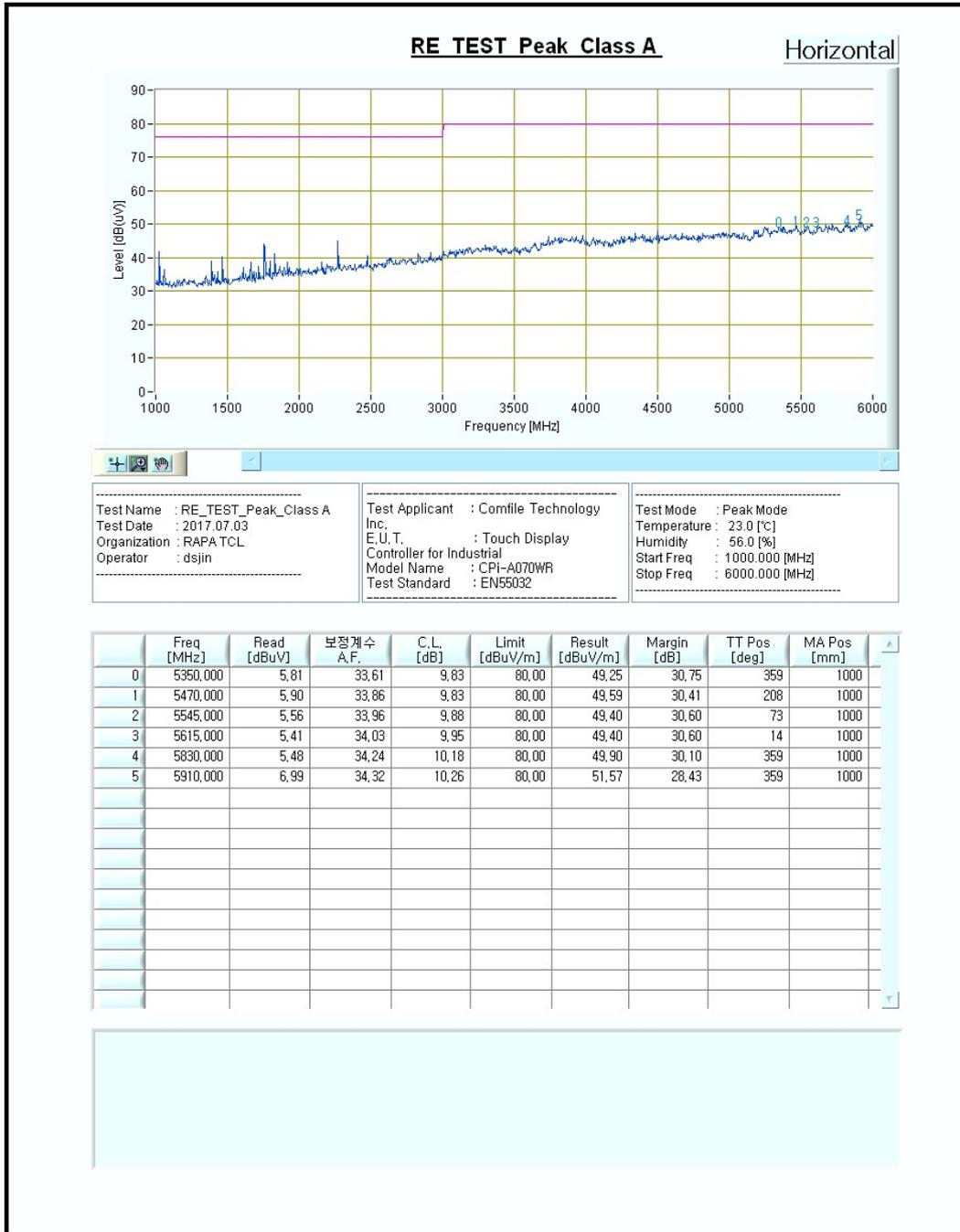
Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	ESPI	Rohde & Schwarz	Test Receiver	101002	Aug. 22, 2016
<input checked="" type="checkbox"/>	ALL1.5TT	Airlink Lab.	Turn Table	N/A	N/A
<input checked="" type="checkbox"/>	ALL2.2MA	Airlink Lab.	Antenna Master	N/A	N/A
<input checked="" type="checkbox"/>	ALL-TC-V1.0	Airlink Lab.	Controller	N/A	N/A
<input checked="" type="checkbox"/>	AMP 1000-6000	Infinitech	Broadband Pre-AMP	2013 05 00002/1	Jan. 16, 2017
<input checked="" type="checkbox"/>	Horn Antenna	EMCO	Horn Antenna	9402-4229	Jul. 01, 2017
<input checked="" type="checkbox"/>	RE32_V1_5	Airlink Lab.	RE Test System	N/A	N/A

Remark: All test equipment used is calibrated on the regular basis.

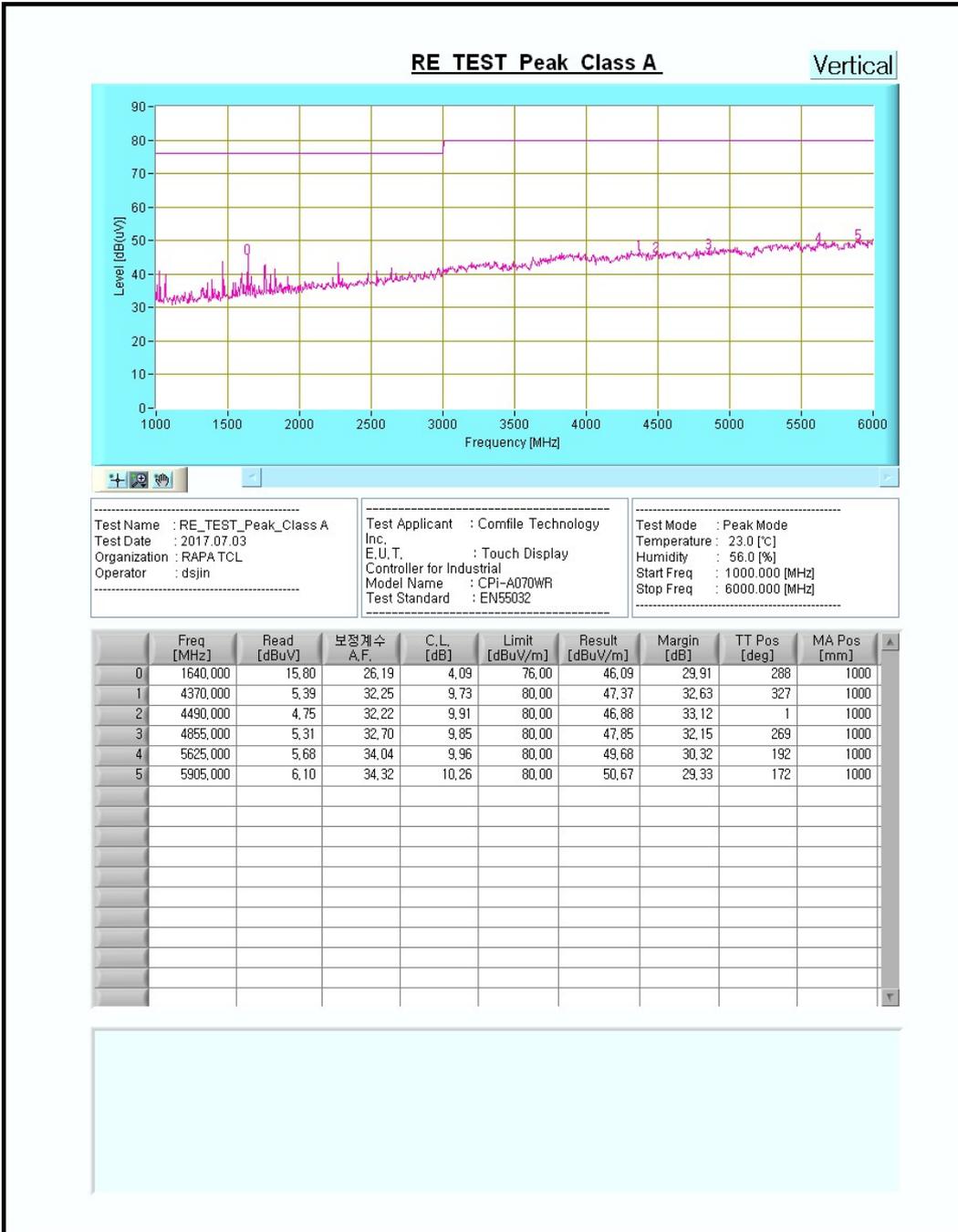
5.3.5 Test data

- Test date : July 3, 2017
- Resolution bandwidth : 1 MHz
- Frequency range : 1 000 MHz ~ 6 000 MHz
- Measurement distance : 3 meter

▪ Test mode: Peak_Horizontal



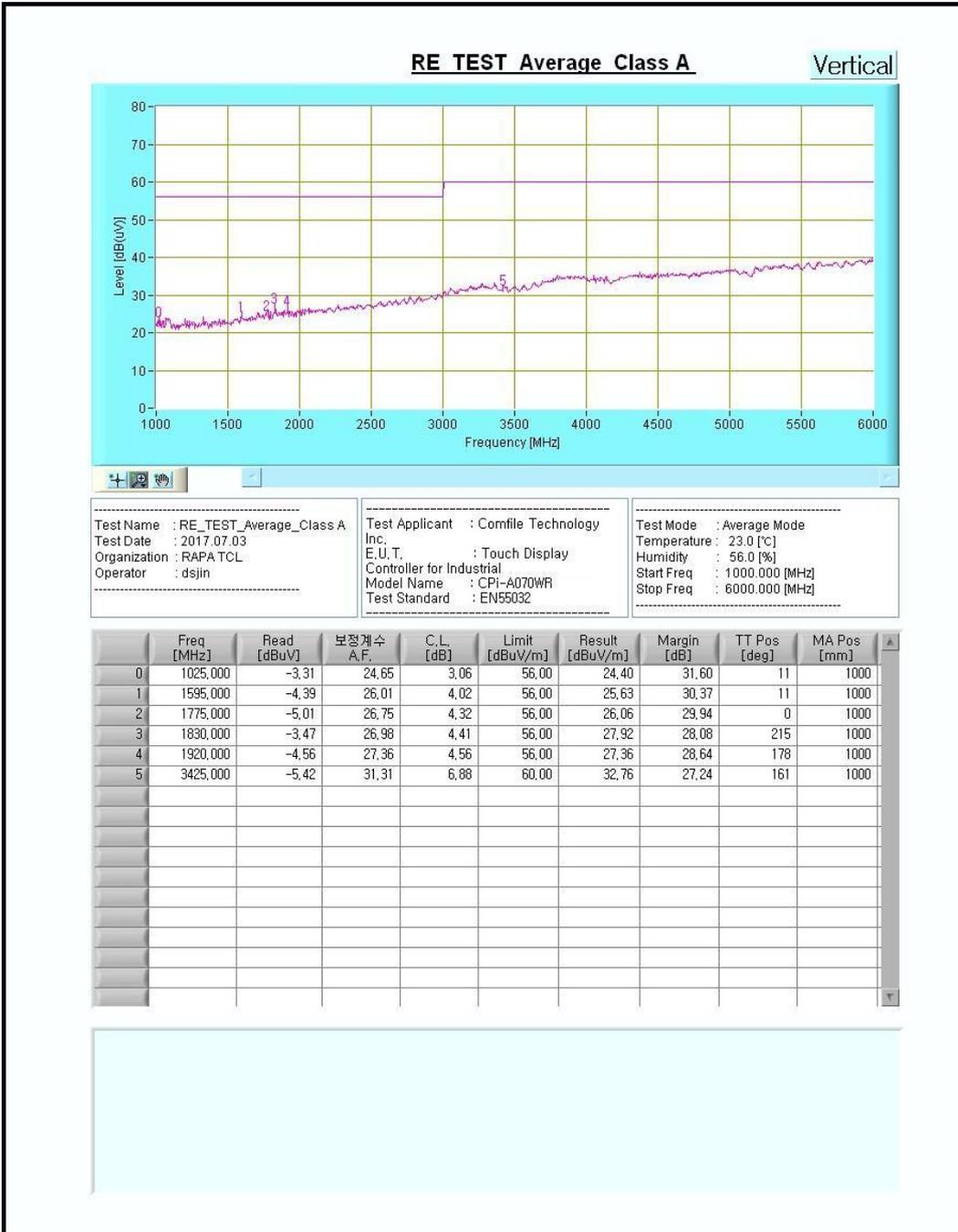
▪ Test mode: Peak_Vertical



▪ Test mode: Average_Horizontal



▪ Test mode: Average_Vertical



6. IMMUNITY TESTS

6.1 Electrostatic discharge immunity test

The measurement of the Immunity against Electrostatic Discharge was performed in a shield room.

- Test Location : Shielded Room (S121)
- Date : June 8, 2017

Here, S121 = Shield room number

6.1.1 Operating environment

Item	Measured	Recommended
Ambient temperature	24.0 °C	15 °C ~ 35 °C
Relative humidity	56.0 % R.H.	30 % R.H ~ 60 % R.H
Atmospheric pressure	101.5 kPa	86.0 kPa ~ 106.0 kPa

6.1.2 Test set-up

The EUT and all peripheral equipment were placed on non-metallic support with 0.8 m height above a reference ground plane (RGP) and were put into operation according to the specified operating mode.

The test set-up photo is included in appendix IV.

6.1.3 Measurement uncertainty

It has been demonstrated that the ESD generator meets the specified requirements in the standard with at least 95 % confidence.

6.1.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	ESS-2000	NOISEKEN	ESD Simulator	ESS0308043	Feb. 02, 2017
<input checked="" type="checkbox"/>	TC-815P	NOISEKEN	ESD Gun	ESS0120522	Feb. 02, 2017

Remark: All test equipment used is calibrated on the regular basis.

6.1.5 Test data

- Test levels : Contact discharge 4 kV, Air discharge 2 kV / 4 kV / 8 kV
- Number of discharges : 25 each pol. at each point for contact discharge, 10 each pol. at each point for air discharge
- Polarity : Positive / Negative
- The EUT Position : Table Top
- Required performance criterion : B
- Test result : Met criterion A and B
- Monitoring of the EUT : The EUT was operated with all operating mode continuously during the test
- Test mode : DC input Mode

The test points of the EUT are each location on the surface touchable by hand (see test point in next page) and four sides of the EUT (through VCP and HCP).

The results of selected test points of the EUT are listed in the below table.

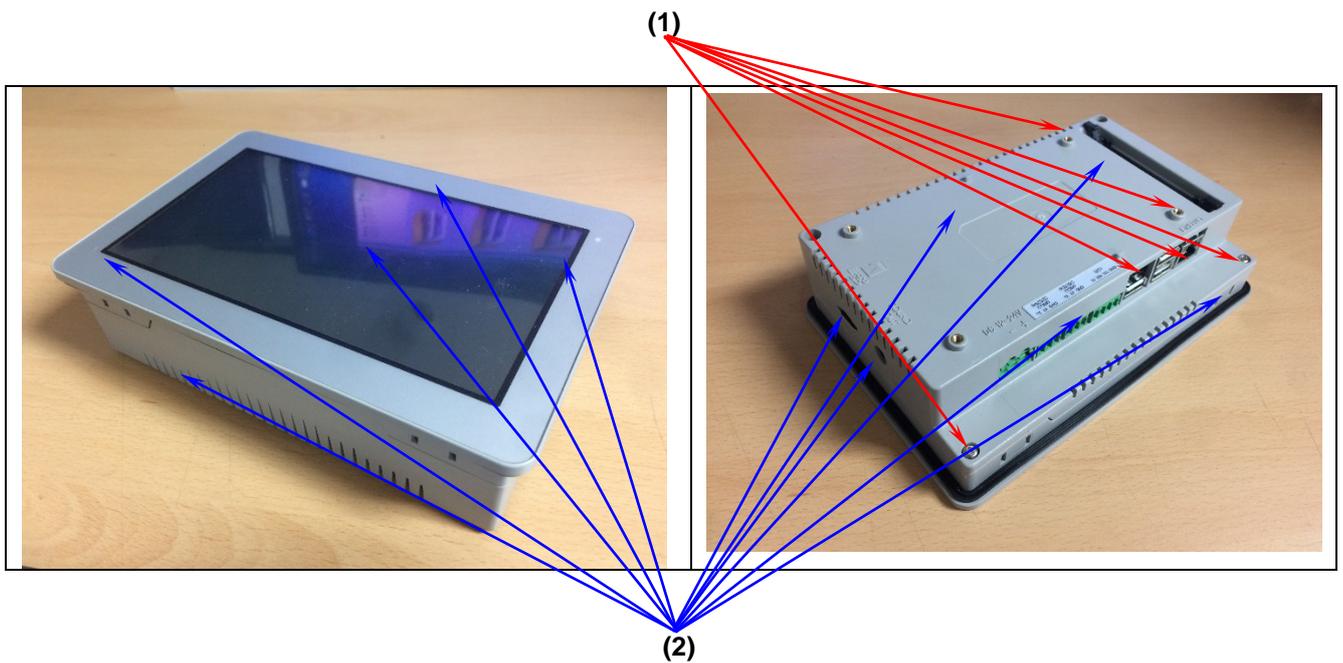
Point		Test level [± kV]	Pass / Fail	Criterion
(1)	Port(USB), Screws	4 (Contact)	Pass	B
(2)	Non-metal Frame, LCD	2 / 4 / 8 (Air)	Pass	A
(2)	Port(Audio, SD)	2 / 4 / 8 (Air)	Pass	B
HCP / VCP		4 (Contact)	Pass	A



Tested by: Dongsu Jin / Manager

6.1.6 ESD Test point table

ESD Point		Discharge voltage [\pm kV]	Results
(1)	Port(USB), Screws	4 (Contact)	Criterion B
(2)	Non-metal Frame, LCD	2 / 4 / 8 (Air)	Criterion A
(2)	Port(Audio, SD)	2 / 4 / 8 (Air)	Criterion B
HCP / VCP		4 (Contact)	Criterion A



6.2 Radiated RF-electromagnetic field immunity test

The measurement of the Immunity against Radiated RF-Electromagnetic Field was performed in an anechoic chamber.

- Test location : Anechoic Chamber (S111)
- Date : July 1, 2017

Here, S111 = Anechoic Chamber number

6.2.1 Operating environment

- Ambient temperature : 23.0 °C
- Humidity : 57.0 % R.H.
- Atmospheric pressure : 101.4 kPa

6.2.2 Test set-up

The EUT and all peripheral equipment were placed on a non-metallic support 0.8 m above a reference ground plane (RGP) and were put into operation according to the specified operating mode.

The test set-up photo is included in appendix V.

6.2.3 Measurement uncertainty

- The measurement uncertainty: ± 0.23 V/m for 1 V/m, ± 0.70 V/m for 3 V/m, and ± 2.30 V/m for 10 V/m.

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95%.

6.2.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	IMS	KTI	Integrated measurement system for EMS	-	-
<input checked="" type="checkbox"/>	E4432B	Agilent	ESG-D Series signal generator	MY43350147	Jan 16, 2017
<input checked="" type="checkbox"/>	NRP-Z91	Rohde & Schwarz	Power Sensor	100882	Aug 22, 2016
<input checked="" type="checkbox"/>	NRP-Z91	Rohde & Schwarz	Power Sensor	100883	Aug 22, 2016
<input checked="" type="checkbox"/>	ITRS-0830K	Infinitech	Power Amplifier	-	Jan 17, 2017
<input checked="" type="checkbox"/>	STLP9128D	Schwarzbeck	Log Periodic Dipole Antenna	9128D015	-

Remark: All test equipment used is calibrated on the regular basis.

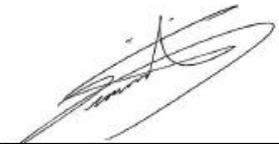
6.2.5 Test data

- Test level : 3 V/m (AM 80 %, 1 kHz)
- Frequency range : 80 MHz ~ 1 000 MHz
- Frequency step : 1 %
- Dwell time at each frequency : 3 s
- Exposed side : Front / Rear / Left / Right
- Polarization of antenna : Horizontal / Vertical
- The EUT position : Table Top
- Distance from antenna to EUT : 3 m
- Required performance criterion : A
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was operated with all operating mode continuously during the test
- Test mode : DC power input mode

The results of test are listed in below table.

Freq. Range [MHz]	Ant. Pol.	Exposed side	Pass / Fail	Description
80 ~ 1 000	V	Left / Right / Front / Rear	Pass	There was no deviation from normal operation condition.
80 ~ 1 000	H	Left / Right / Front / Rear	Pass	

Here, H = Horizontal, V = Vertical



Tested by: Dongsu Jin / Manager

6.3 Electrical fast transient/burst immunity test

The measurement of the Immunity against Fast Transient/Burst was performed in a shield room.

- Test location : Shielded Room (S121).
- Date : July 2, 2017

6.3.1 Operating environment

- Ambient temperature : 22.0 °C
- Humidity : 55.0 % R.H.
- Atmospheric pressure : 101.5 kPa

6.3.2 Test set-up

The EUT was placed on non-metallic support with 0.1 m height above a reference ground plane (RGP) and was put into operation according to the specified operating mode. If the manufacturer provides a non-detachable supply cable more than 0.5 m long with the equipment, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1 m above the ground reference plane.

The test set-up photo is included in appendix VI.

6.3.3 Measurement uncertainty

It has been demonstrated that the burst generator met the specified requirements in the standard with at least 95 % confidence.

6.3.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	UCS 500N7	EM Test	Ultra Compact Generator	V937105138	Aug 23, 2016
<input checked="" type="checkbox"/>	HFK	EM Test	Capacitive Coupling Clamp	0709-26	Jan. 16, 2017
<input checked="" type="checkbox"/>	iec.control	EM Test	Software for industrial and telecom testing	N/A	N/A

Remark: All test equipment used is calibrated on the regular basis.

6.3.5 Test data

- Test level : 0.5 kV (DC-mains), 0.5 kV (Signal Cable >3 m)
- Burst frequency : 5 kHz
- Polarity : Positive / Negative
- Coupling methods : DC mains – Coupling Decoupling Network (CDN),
Signal line – Capacitive Coupling Clamp (CCC)
- Lines for test : DC line and Signal line of the EUT
- Type of line & length : Unshielded 0.5 m DC line and Unshielded 3.0 m Signal Cables
- The EUT-position : Table Top
- Required performance criterion : B
- Test result : Met criterion B
- Monitoring of the EUT : The EUT was operated with all operating mode continuously during the test
- Test mode : DC power input Mode

The results of test are listed in below table.

Line for test	Coupling Method	Test level [± kV]	Pass / Fail	Criterion
DC mains (P)	CDN	0.5	Pass	B
DC mains (N)	CDN	0.5	Pass	
DC mains (P+N)	CDN	0.5	Pass	
Signal Cable (Ethernet)	CCC	0.5	Pass	

Here, for the AC mains, L = Hot, N = Neutral, PE = Protective Earth, for the DC-mains, P = Positive, N = Negative.



Tested by: Dongsu Jin / Manager

6.4 Conducted disturbance induced by RF fields immunity

The measurement of the Immunity against Injection Current was performed in the Shield Room.

- Test Location : Shielded Room (S121).
- Date : June 24, 2017

6.4.1 Operating environment

- Ambient temperature : 25.0 °C
- Humidity : 57.0 % R.H.
- Atmospheric pressure : 101.5 kPa

6.4.2 Test set-up

The EUT and all peripheral equipment were placed on a non-metallic support with 0.1 m height above a reference ground plane (RGP) and were put into operation according to the specified operating mode.

The test set-up photo is included in appendix VII

6.4.3 Measurement uncertainty

- The measurement uncertainty: ± 0.17 V for 1.8 V, ± 0.50 V for 5.4 V and ± 1.70 V for 18 V.

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95 %.

6.4.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	CWS 500N1	EM Test	Continuous Wave Simulator	V0937105141	Aug 22, 2016
☒	5906 N-50-1	Huber + Suhner	Attenuator 6dB/75W	253452201	Jan. 16, 2017
☒	FCC-801-M2/M3-16A	FCC	CDN	091759	Aug 22, 2016
☒	FCC-801-T4-RJ45	FCC	CDN	091757	Aug 22, 2016
☒	M016	Schaffner	CDN	16678	Aug 22, 2016
☒	icd.control	EM Test	Software for conducted immunity from DC to 1 GHZ	N/A	N/A

Remark: All test equipment used is calibrated on the regular basis.

6.4.5 Test data

- Test level : 3 V (AM 80 %, 1 kHz)
- Frequency range : 0.15 MHz ~ 80 MHz
- Frequency step : 1 %
- Dwell time at each frequency : 3 s
- Coupling methods : DC power lines – Coupling Decoupling Network (CDN),
Signal lines – Coupling Decoupling Network (CDN)
- Lines for test : DC power lines and Signal line of the EUT
- Type of line & length : Unshielded 0.3 m DC power lines, Unshielded 3.0 m Signal Cable
- EUT-position : Table Top
- Required performance criterion : A
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was operated with all operating mode continuously during the test
- Test mode : DC power input mode

The results of test are listed in below table.

Freq. Range [MHz]	Coupling Method	Line for test	Test level [V]	Pass/ Fail	Description
0.15 ~ 80	CDN(M2)	DC mains	3	Pass	There was no deviation from normal operation condition.
0.15 - 80	CDN(T4)	Signal Cable	3	Pass	



Tested by: Dongsu Jin / Manager

APPENDIX I - TEST SET-UP PHOTOS: Conducted common mode disturbance at TEL ports



Front



Side

APPENDIX II - TEST SET-UP PHOTOS: Radiated electromagnetic field (Below 1 GHz)

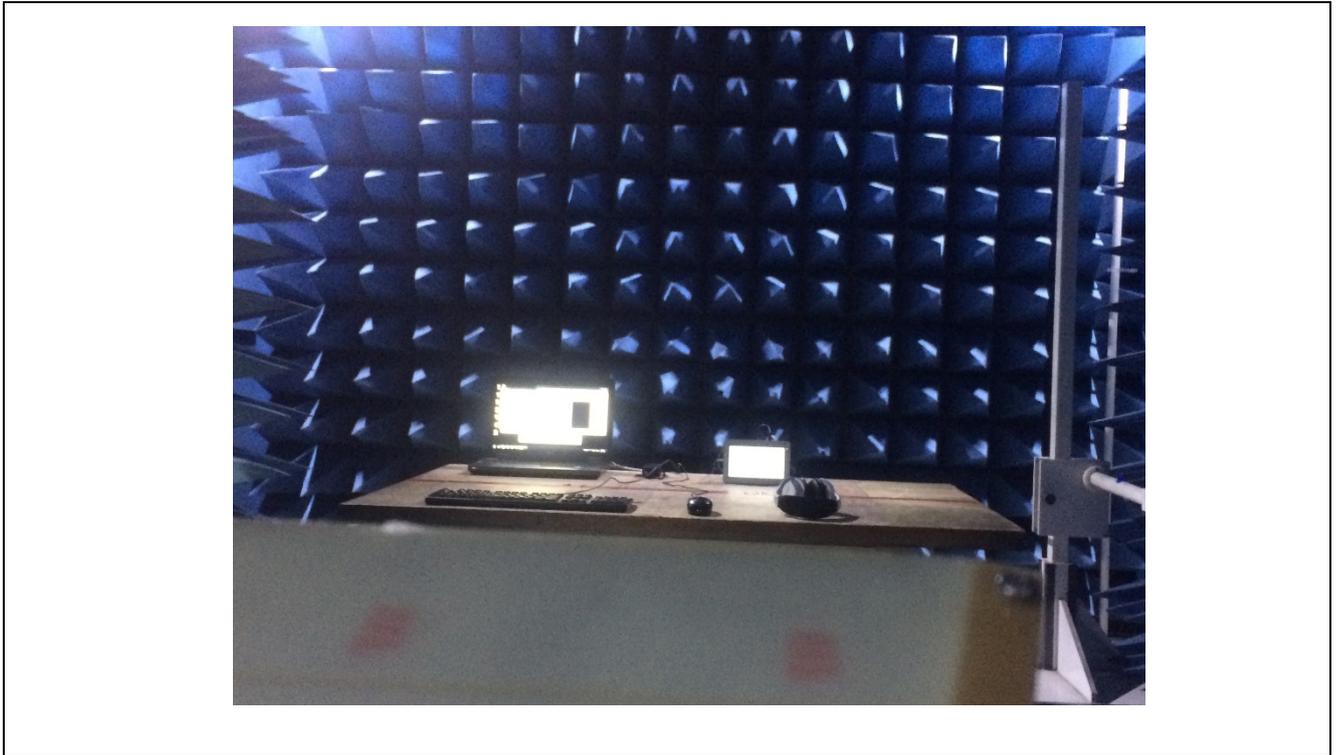


Front



Rear

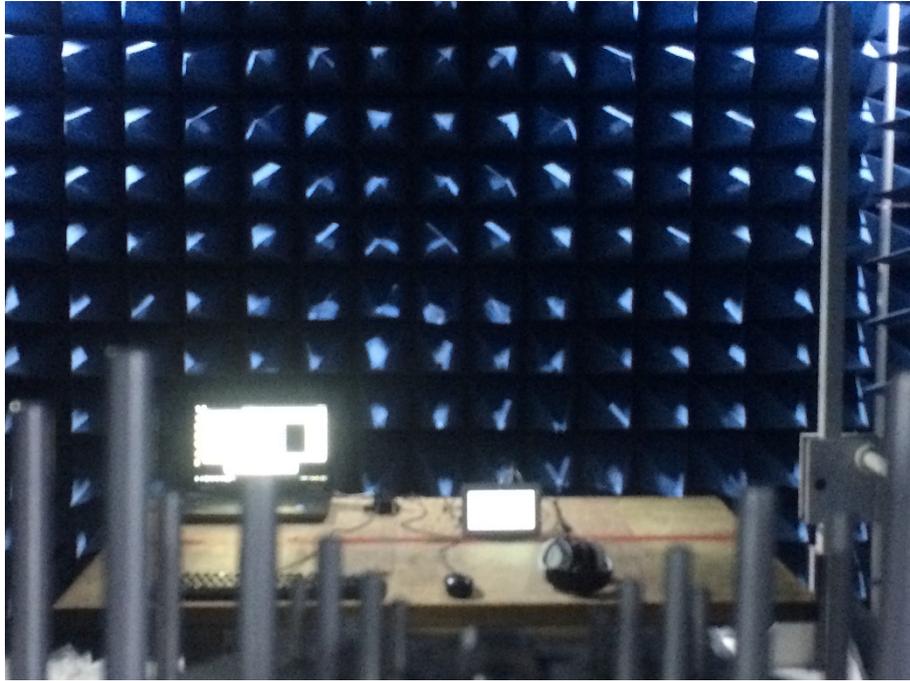
APPENDIX III - TEST SET-UP PHOTOS: Radiated electromagnetic field (Above 1 GHz)



APPENDIX IV - TEST SET-UP PHOTO: Electrostatic discharge immunity



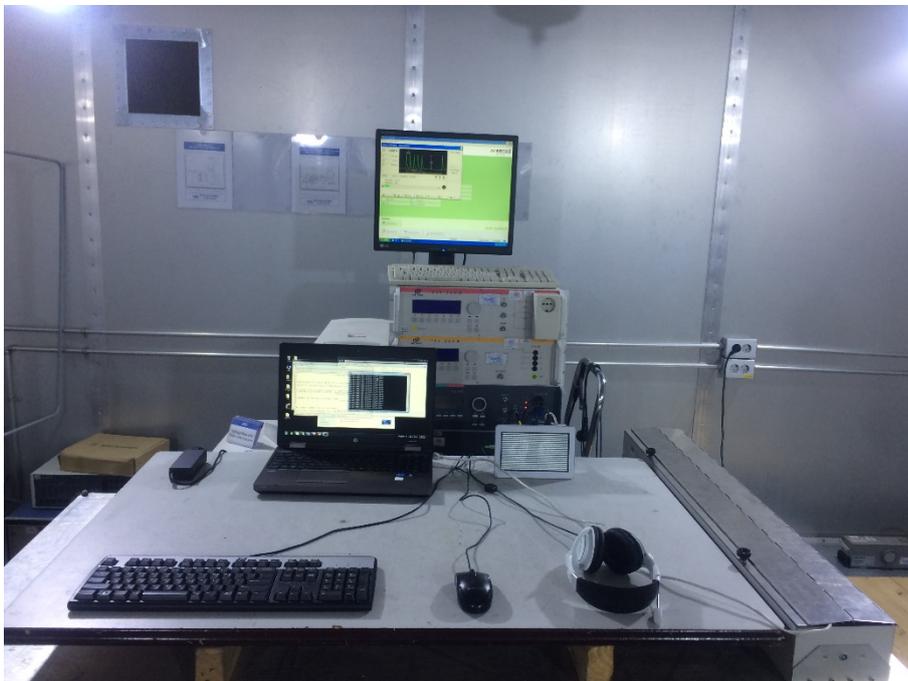
APPENDIX V - TEST SET-UP PHOTO: Radiated frequency electromagnetic field



APPENDIX VI - TEST SET-UP PHOTO: Electrical fast transient/burst immunity



DC mains



Signal

APPENDIX VII - TEST SET-UP PHOTO: Conducted disturbance induced by RF fields Immunity



DC Mains

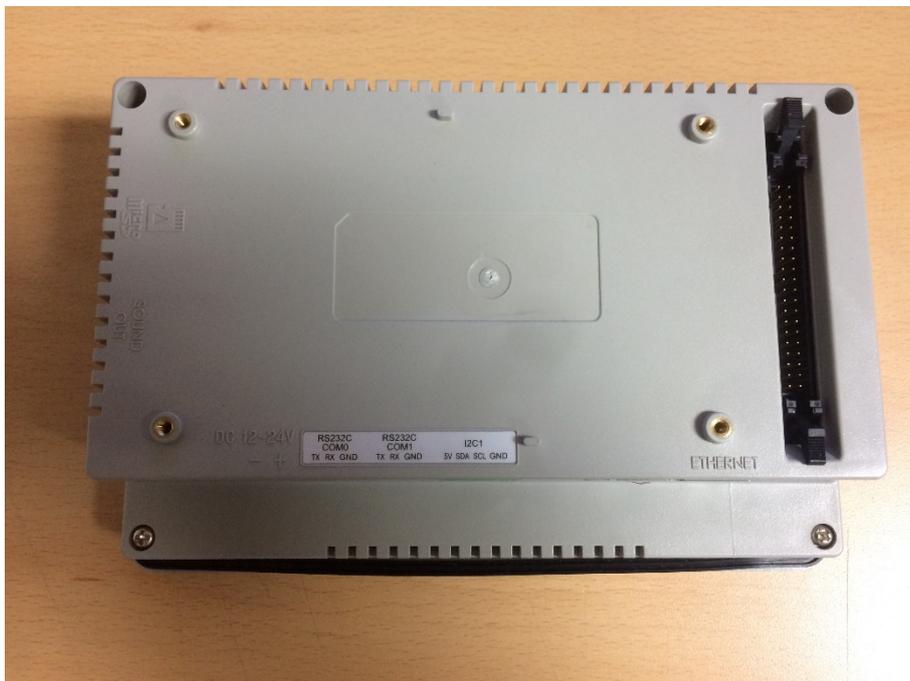


Signal

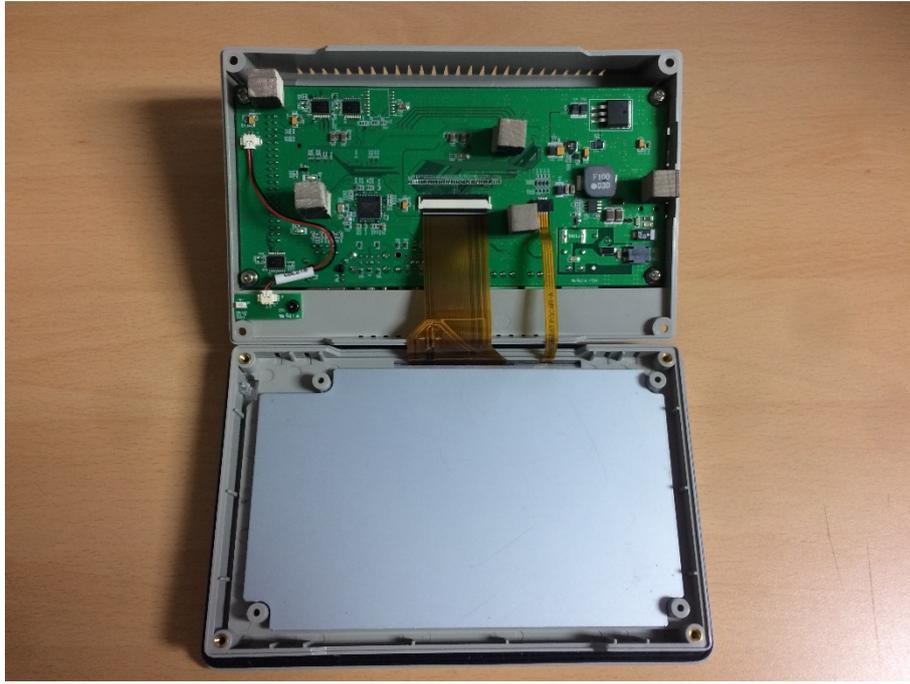
APPENDIX VIII – PHOTOGRAPHS: Internal and External appearances



Front view



Rear view



Internal view