

ELECTROMAGNETIC COMPATIBILITY TEST REPORT

Test Report No.		RAPA18-O-046
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-A101WR
Multi Model Name		N/A
Serial number		N/A
Total page of Report		60 pages (including this page)
Test period		July 12, 2018 – July 24, 2018
Issuing date of report		July 25, 2018

SUMMARY

The equipment complies with the standards; EN 55032:2012, EN 55024:2010, EN61000-3-2:2014 and EN61000-3-3:2013.

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-II Shin / Assistant General 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 Mains terminal continuous disturbance voltage	9
5.2 Conducted common mode disturbance at telecommunication ports	12
5.3 Radiated electromagnetic field (Below 1 GHz).....	16
5.4 Radiated electromagnetic field (Above 1 GHz)	18
5.5 Harmonic Current Emissions.....	23
5.6 Voltage changes, Voltage fluctuations and Flicker	28
6. IMMUNITY TESTS	33
6.1 Electrostatic discharge immunity test.....	33
6.2 Radiated RF-electromagnetic field immunity test.....	36
6.3 Electrical fast transient/burst immunity test.....	38
6.4 Surge immunity test.....	40
6.5 Conducted disturbance induced by RF fields immunity	42
6.6 Main supply voltage Dips and Short interruptions immunity test.....	44
APPENDIX I - TEST SET-UP PHOTOS: Mains terminal disturbance voltage.....	46
APPENDIX II - TEST SET-UP PHOTOS: Conducted common mode disturbance at TEL ports	47
APPENDIX III - TEST SET-UP PHOTOS: Radiated electromagnetic field (Below 1 GHz)	48
APPENDIX IV - TEST SET-UP PHOTOS: Radiated electromagnetic field (Above 1 GHz)	49
APPENDIX V - TEST SET-UP PHOTO: Harmonic Current Emissions	50
APPENDIX VI - TEST SET-UP PHOTO: Voltage changes, Voltage fluctuations and Flicker.....	50
APPENDIX VII - TEST SET-UP PHOTO: Electrostatic discharge immunity	51
APPENDIX VIII - TEST SET-UP PHOTO: Radiated frequency electromagnetic field	51
APPENDIX IX - TEST SET-UP PHOTO: Electrical fast transient/burst immunity	52
APPENDIX X - TEST SET-UP PHOTO: Surge immunity	53
APPENDIX XI - TEST SET-UP PHOTO: Conducted disturbance induced by RF fields Immunity	54
APPENDIX XII - TEST SET-UP PHOTO: Voltage Dips and Short interruptions	55
APPENDIX XIII – PHOTOGRAPHS: Internal and External appearances	56

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		Hwang young / Engineer / comfile@nate.com
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	Met / PASS
	Conducted common mode disturbance at TEL ports	Met / PASS
	Radiated Emission (Below 1 GHz)	Met / PASS
	Radiated Emission (Above 1 GHz)	Met / PASS
EN 61000-3-2:2014	Harmonic Current Emission	Met / PASS
EN 61000-3-3:2013	Voltage Change, Voltage fluctuations and Flicker	Met / PASS
EN 55024:2010	Electrostatic discharge immunity	Met / PASS
	Radio frequency electromagnetic fields	Met / PASS
	Electrical fast transient/burst immunity	Met / PASS
	Surge immunity	Met / PASS
	Conducted disturbance induced by RF fields immunity	Met / PASS
	Power frequency magnetic field immunity	N/A (See Note)
	Voltage Dips and Short interruptions	Met / PASS

NOTE: 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	During and after the test the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a minimum performance level specified by the manufacturer when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
B	After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
C	During and after testing, a temporary loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls or cycling of the power to the EUT by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

3. EUT (Equipment Under Test)

3.1 Identification of the EUT

- Equipment : Touch Display Controller for Industrial
- Model name : CPi-A101WR
- 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-A101WR (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
GPU	Broadcom VideoCore IV
RAM	1 GB
Storage	1 micro SD Slot (Default 8 GB)
LCD	10.1 Inch (1024 * 600)
Aspect Ratio	16:9
Colors	262 k
Contrast Ratio	600:1
Brightness	250 cd/㎡
Touchscreen	Pressure-sensitive (Resistive Film Type)
Housing	Flame retardant ABS IP65 Water-Resistant Front Panel
Ethernet	100 Base-T (1 Port)
Audio	Stereo audio output (Φ 3.5 Audio Jack)
USB	USB 2.0 * 3 Port
Serial	COM0 (RS232C) / COM1 (RS485)
I2C	1 Port
Input power	DC 12 V ~ 24 V
Power Consumption	<10 W (0.8A @12 V)
Dimension	246 * 170 * 53 mm
Weight	0.92 kg
Operating Temperature	0 °C ~ 70 °C
Storage Temperature	-20 °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-A101WR	Comfile Technology Inc.	Touch Display Controller for Industrial (EUT)	-
KPL-060F	Channel Well Technology	AC/DC Adapter	EUT
HP ProBook 650 G1	HP	Notebook	EUT
PPP012D-S	Delta Electronics(JIANGSU) Ltd.	Notebook Adapter	Notebook
TCC-80	Moxa Technologies Co., Ltd.	Port Powered RS-232 to RS-422/485 Converter	EUT
CP-IO22	Comfile Technology Inc.	JIG	EUT
PP1101U	HP	Keyboard	EUT
SNJ-B138	Samsung	Mouse	EUT
SHS-100V/M	Samsung	Stereo Headset	EUT
16GB	SanDisk	USB Memory	EUT
8GB	SanDisk	Micro SD	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 230 VAC, 50 Hz to AC/DC Adapter. 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.

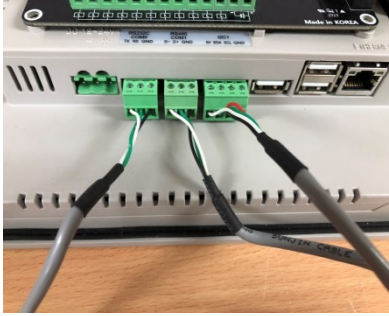




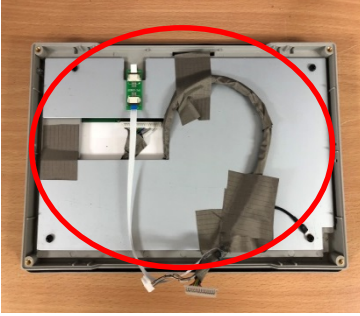
Model Name	Differences	Tested
-	-	-

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)	GPIO	No	No	No	Direct	JIG
	ETHERNET (RJ-45)	No	No	Yes	3.0	Notebook
	USB	Yes	No	Yes	1.5	Keyboard
	USB	Yes	No	Yes	1.8	Mouse
	USB	No	No	Yes	Direct	USB Memory
	I2C1	No	Yes	No	0.2	LINE
	COM1 RS485	Yes	Yes	No	1.8	Notebook
	COM0 RS232C	Yes	Yes	No	1.5	Notebook
	DC Input	No	Yes	No	1.5	AC/DC Adapter
	SOUND OUT	No	No	No	2.1	Stereo Headset
Micro SD	No	No	No	Direct	Micro SD	
Notebook	RJ-45	No	No	Yes	3.0	EUT (ETHERNET (RJ-45))
	Serial	Yes	Yes	No	1.8	EUT (COM1 RS485)
	USB	Yes	Yes	No	1.5	EUT (COM0 RS232C)
	DC Input	No	Yes	No	2.1	Notebook Adapter

4. EUT MODIFICATIONS

No.	Before	After	Modifications
1			<ul style="list-style-type: none"> • Apply Ferrite core on flat cable - manufacturer: TDK - model: ZCAT2035-0930, ZCAT1518-0730
2			<ul style="list-style-type: none"> • Apply Gasket (Conductive tape)
			<ul style="list-style-type: none"> • Apply Gasket (Conductive tape)

5. EMISSION TESTS

5.1 Mains terminal continuous disturbance voltage

5.1.1 Operating environment

- Temperature: 27.0 °C
- Humidity : 53.5 % R.H.

5.1.2 Test set-up

The EUT was placed on a wooden table with 0.8 m height above the floor. The EUT was connected to AC power supply and the input power was supplied through a 50 Ω/ 50 μH ± 5 Ω Artificial Mains Network (AMN). 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 95.45 % with the coverage factor, $k = 2$.

5.1.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	ESCI7	Rohde & Schwarz	EMI Test Receiver	100938	Jan. 15, 2018
☒	ESH3-Z2	Rohde & Schwarz	Pulse Limiter	101631	Jan. 15, 2018
☒	ENV216	Rohde & Schwarz	LISN	100103	Aug. 21, 2017
☒	3825/2	EMCO	LISN	9004-1635	Aug. 22, 2017
☒	ES-SCAN	R&S	EMI Software	N/A	N/A

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

5.1.5 Test data

- Test date : July 24, 2018
- Resolution bandwidth : 9 kHz
- Frequency range : 150 KHz ~ 30 MHz

Frequency (MHz)	Line	Quasi-peak			CISPR-Average		
		Emission level(dBμV)	Limits (dBμV)	Margin (dB)	Emission level(dBμV)	Limits (dBμV)	Margin (dB)
0.15	H	45.10	79.00	33.90	26.31	66.00	39.69
0.20	N	40.15	79.00	38.85	21.11	66.00	44.89
0.30	N	31.53	79.00	47.47	16.99	66.00	49.01
0.85	H	25.91	73.00	47.09	19.73	60.00	40.27
6.77	N	29.68	73.00	43.32	24.08	60.00	35.92
16.00	N	35.56	73.00	37.44	29.69	60.00	30.31

Tabulated test data for Mains Terminal Continuous Disturbance Voltage

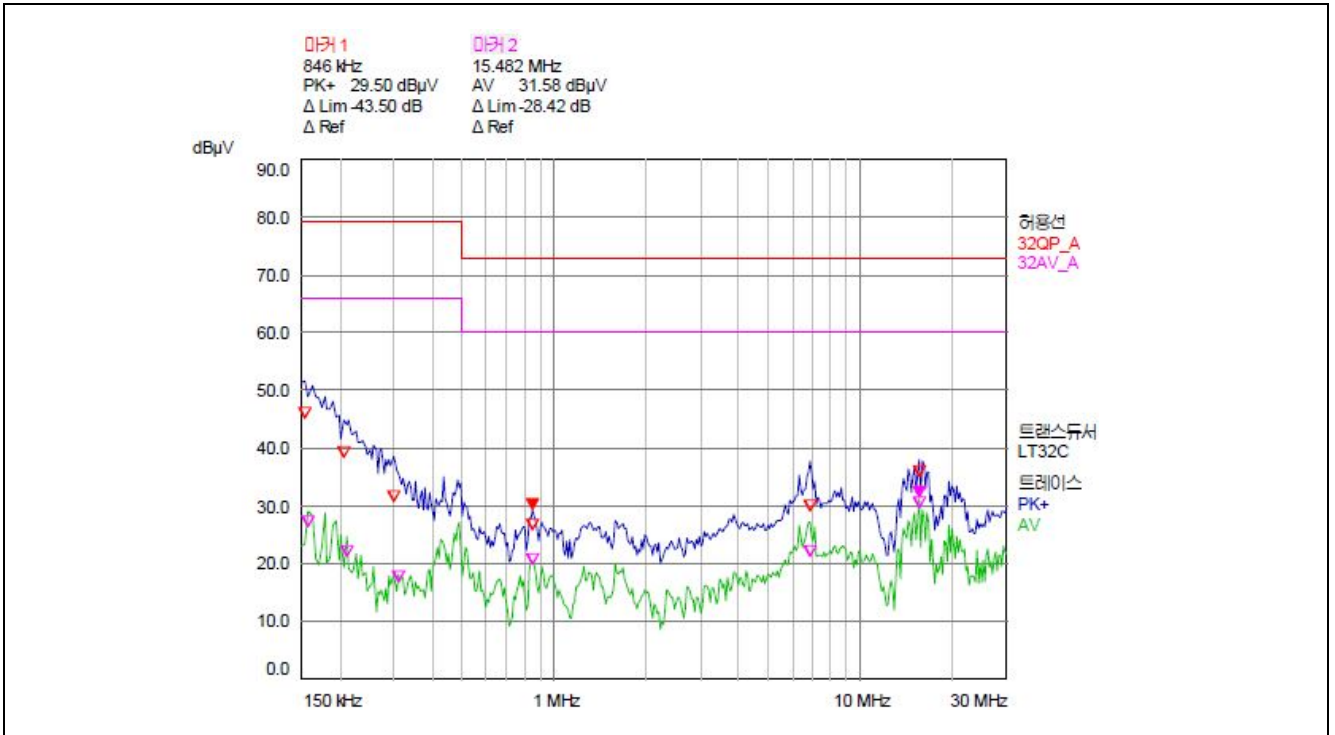
Here, H: Hot Line, N: Neutral line

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

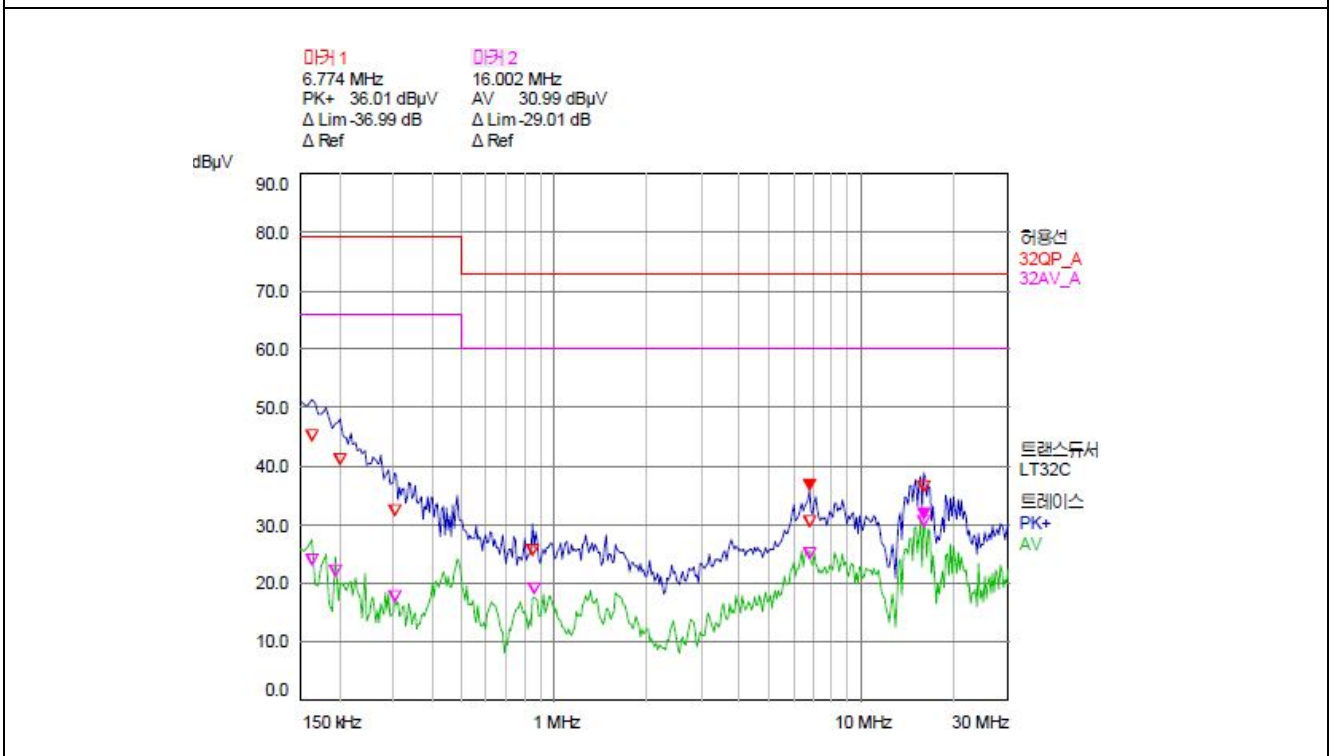


Tested by: Dongsu Jin / Manager

• Plots



HOT LINE



NEUTRAL LINE

5.2 Conducted common mode disturbance at telecommunication ports

5.2.1 Operating environment

- Temperature: 27.0 °C
- Humidity : 53.5 % R.H.

5.2.2 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 II.

5.2.3 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, $k = 2$.

5.2.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	ESCI7	Rohde & Schwarz	EMI Test Receiver	100938	Jan. 15, 2018
<input checked="" type="checkbox"/>	ESH3-Z2	Rohde & Schwarz	Pulse Limiter	101631	Jan. 15, 2018
<input checked="" type="checkbox"/>	LT32C	AFJ Instruments	LISN	32031430208	Aug. 22, 2017
<input checked="" type="checkbox"/>	3825/2	EMCO	LISN	9004-1635	Aug. 22, 2017
<input checked="" type="checkbox"/>	CAT3 8158	Schwarzbeck	ISN	8158-0031	Jan. 15, 2018
<input checked="" type="checkbox"/>	CAT5 8158	Schwarzbeck	ISN	8158-0047	Jan. 15, 2018
<input checked="" type="checkbox"/>	NTFM 8158	Schwarzbeck	ISN	8158-0035	Mar 07, 2018
<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.

5.2.5 Test data

- Test date : July 24, 2018
- 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)
0.79	Four	59.45	87.00	27.55	53.32	74.00	20.68
14.27	Four	60.28	87.00	26.72	56.20	74.00	17.80
23.13	Four	66.43	87.00	20.57	61.87	74.00	12.13
26.61	Four	64.48	87.00	22.52	59.41	74.00	14.59
27.16	Four	65.56	87.00	21.44	60.01	74.00	13.99
28.69	Four	65.20	87.00	21.80	58.54	74.00	15.46

- 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)
0.52	Four	59.24	87.00	27.76	55.04	74.00	18.96
0.83	Four	60.31	87.00	26.69	54.19	74.00	19.81
8.77	Four	58.03	87.00	28.97	53.80	74.00	20.20
9.29	Four	58.36	87.00	28.64	53.47	74.00	20.53
13.81	Four	57.76	87.00	29.24	52.15	74.00	21.85
15.49	Four	58.65	87.00	28.35	53.14	74.00	20.86

- Test Mode: 1 000 Mbps

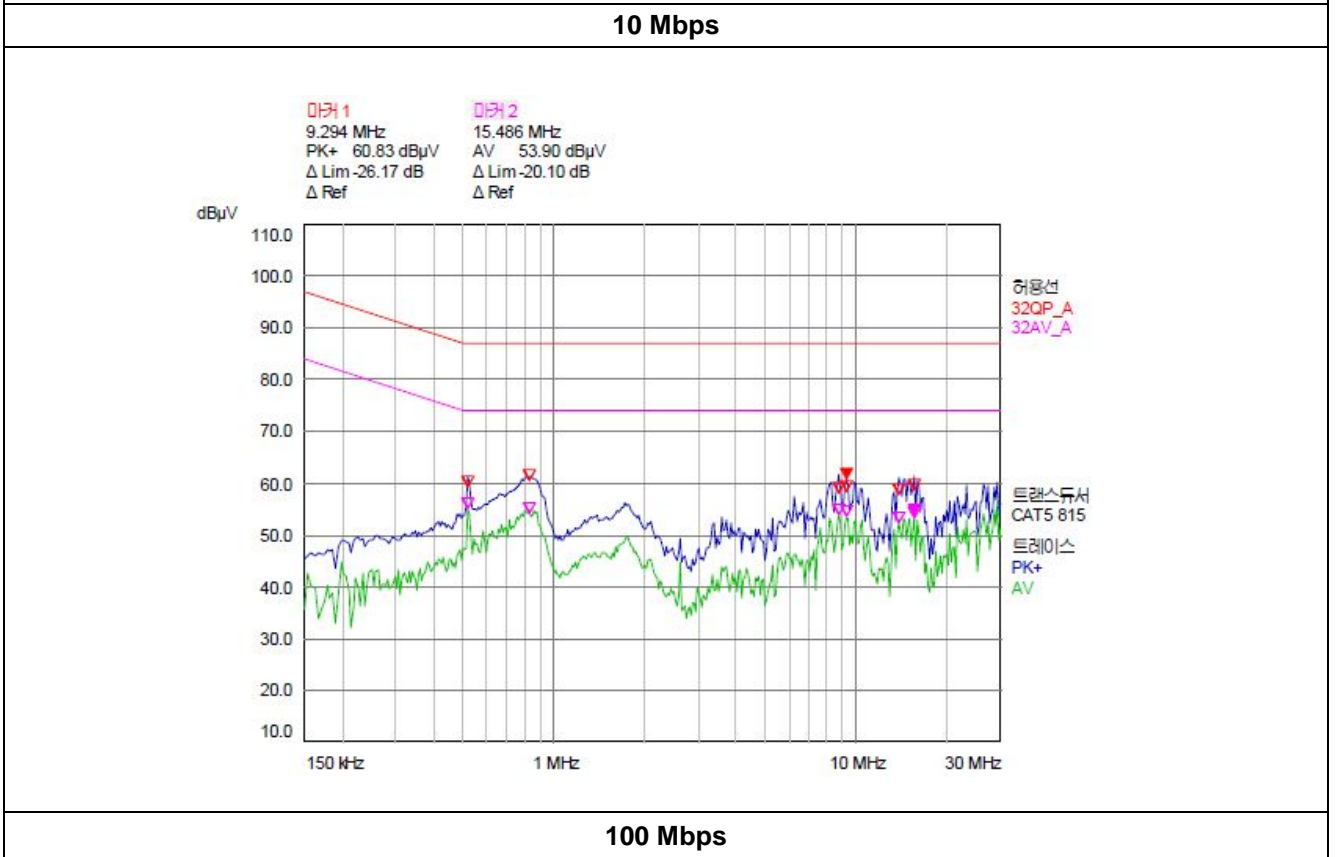
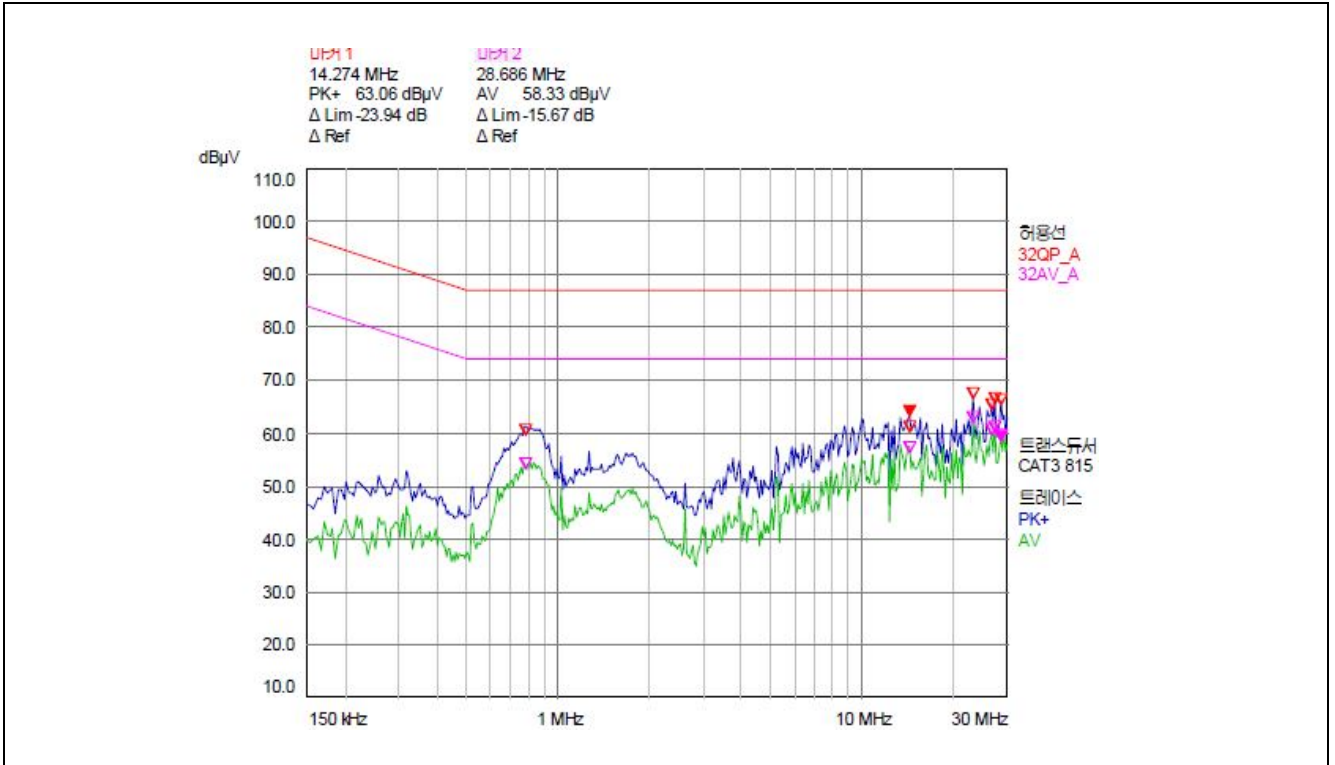
Frequency (MHz)	Port	Quasi-peak			CISPR-Average		
		Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)
0.52	Four	59.76	87.00	27.24	55.14	74.00	18.86
0.83	Four	61.28	87.00	25.72	55.59	74.00	18.41
8.77	Four	59.75	87.00	27.25	54.96	74.00	19.04
14.32	Four	58.60	87.00	28.40	53.07	74.00	20.93
14.84	Four	58.10	87.00	28.90	52.50	74.00	21.50
15.48	Four	59.07	87.00	27.93	53.14	74.00	20.86

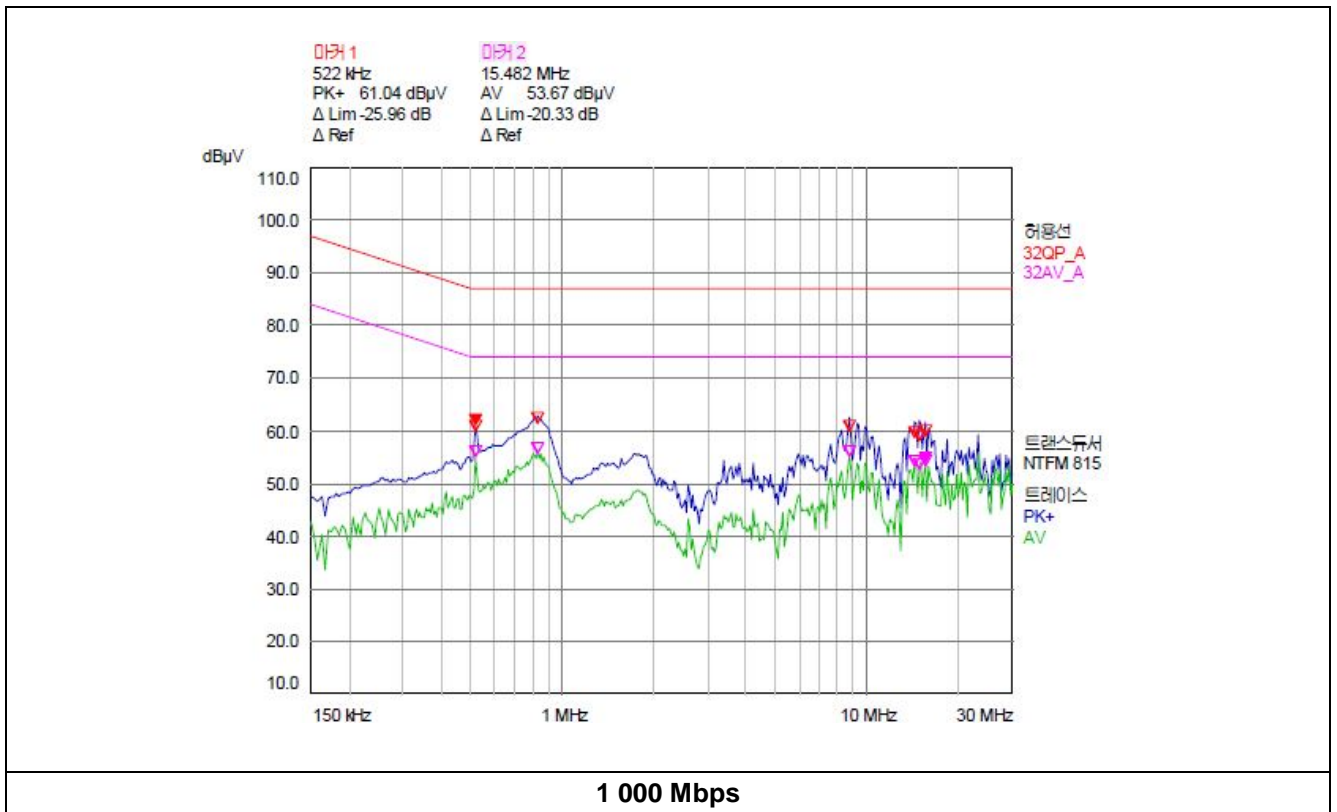
Here, Four = Two unscreened balance pair, P = Peak detect

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


Tested by: Dongsu Jin / Manager

• Plots





5.3 Radiated electromagnetic field (Below 1 GHz)

5.3.1 Operating environment

- Temperature: 35.0 °C
- Humidity : 33.0 % R.H.

5.3.2 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 III.

5.3.3 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, $k = 2$.

5.3.4 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, 2017
<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. 28, 2017
<input checked="" type="checkbox"/>	VULP9118A	Schwarzbeck	Log Periodic Antenna	382	Nov. 28, 2017
<input checked="" type="checkbox"/>	SCU 01	R&S	Pre-AMP	10020	Jan. 15, 2018

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

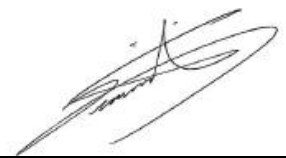
5.3.5 Test data

- Test date : July 23, 2018
- 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)
34.89	53.20	V	1.00	20.00	16.38	-38.38	31.20	40.00	8.80
48.04	58.10	H	1.80	360.00	11.85	-38.27	31.68	40.00	8.32
147.00	54.60	H	4.00	110.00	15.07	-37.86	31.81	40.00	8.19
588.98	53.80	V	3.60	40.00	18.94	-35.13	37.61	47.00	9.39
686.01	53.70	V	3.50	350.00	20.40	-35.32	38.78	47.00	8.22
931.04	49.90	V	1.20	350.00	23.34	-35.55	37.69	47.00	9.31

Tabulated test data for Radiated Electromagnetic Field

Here, H = Horizontal, V = Vertical



Tested by: Dongsu Jin / Manager

5.4 Radiated electromagnetic field (Above 1 GHz)

5.4.1 Operating environment

- Temperature: 25.0 °C
- Humidity : 57.0 % R.H.

5.4.2 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 IV.

5.4.3 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, $k = 2$.

5.4.4 Test equipment used

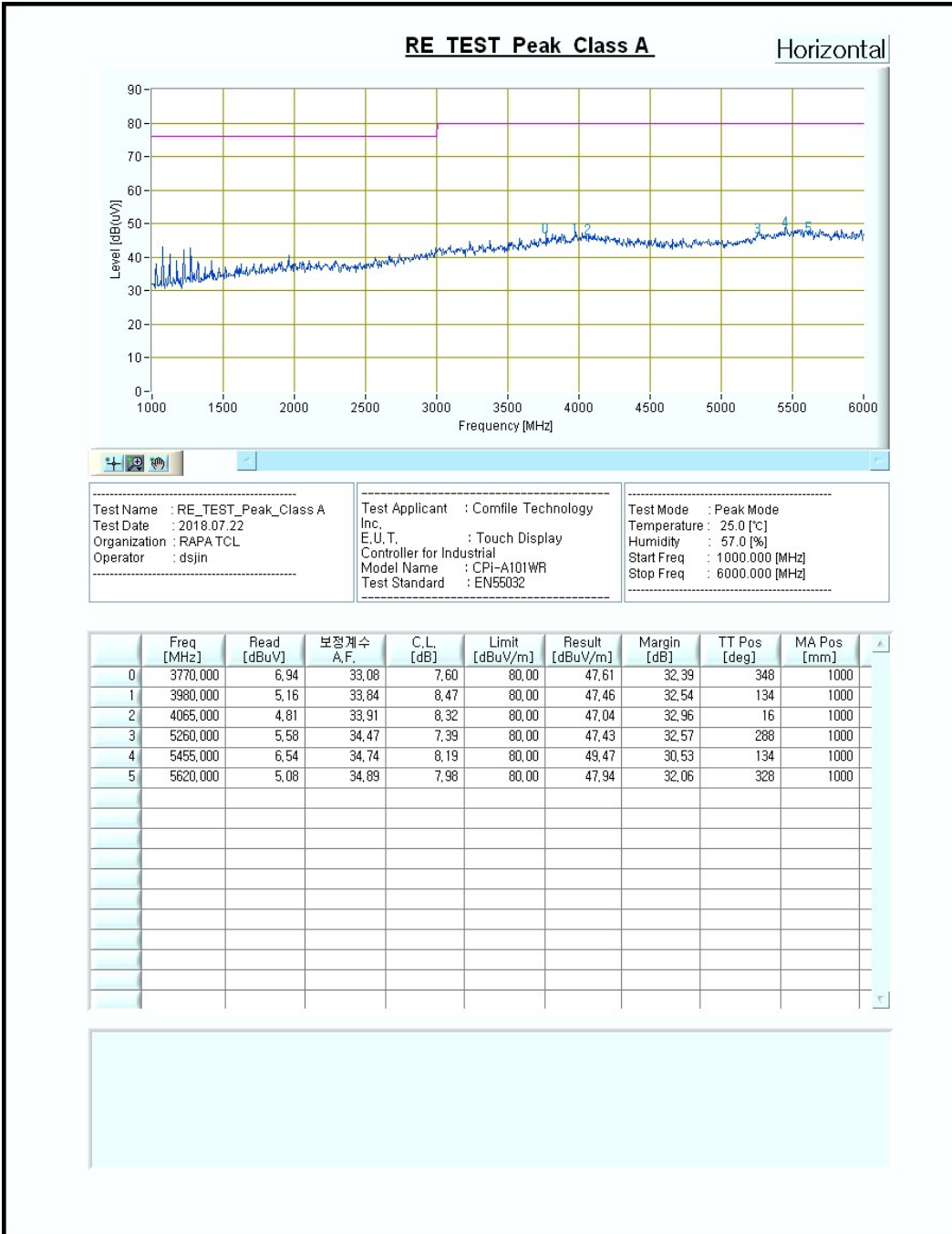
Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	ESPI	Rohde & Schwarz	Test Receiver	101002	Aug. 21, 2017
<input checked="" type="checkbox"/>	Turn Table(#1)	Airlink Lab.	Turn Table	N/A	N/A
<input checked="" type="checkbox"/>	Antenna Mast(#1)	Airlink Lab.	Antenna Master	N/A	N/A
<input checked="" type="checkbox"/>	Controller(#1)	Airlink Lab.	Controller	N/A	N/A
<input checked="" type="checkbox"/>	Broadband Pre-AMP	Infinitech	Broadband Pre-AMP	2013 05 00001/1	Jan. 15, 2018
<input checked="" type="checkbox"/>	Horn Antenna	EMCO	3115	9402-4229	July. 13, 2018
<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.

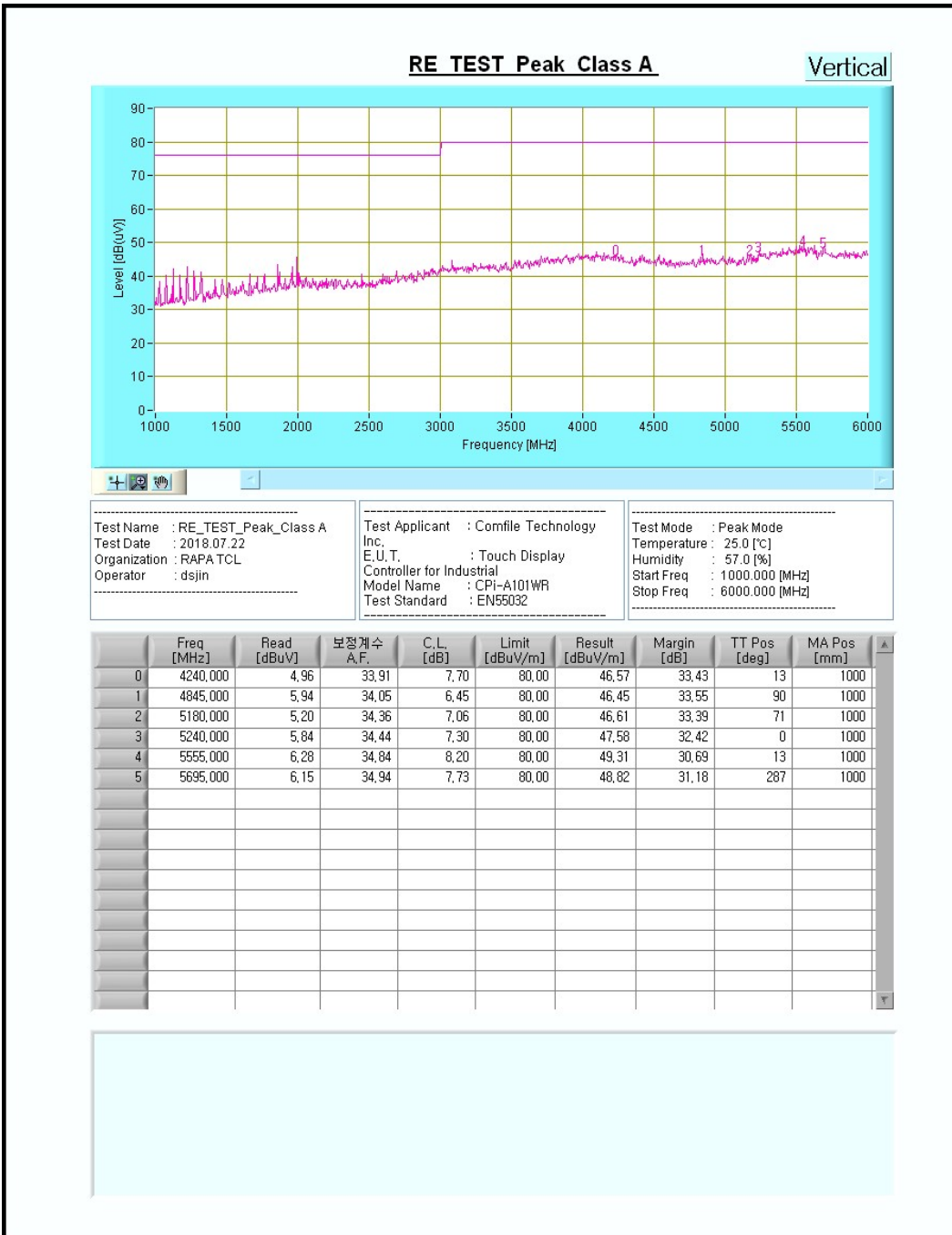
5.4.5 Test data

- Test date : July 22, 2018
- Resolution bandwidth : 1 MHz
- Frequency range : 1 000 MHz ~ 6 000 MHz
- Measurement distance : 3 meter

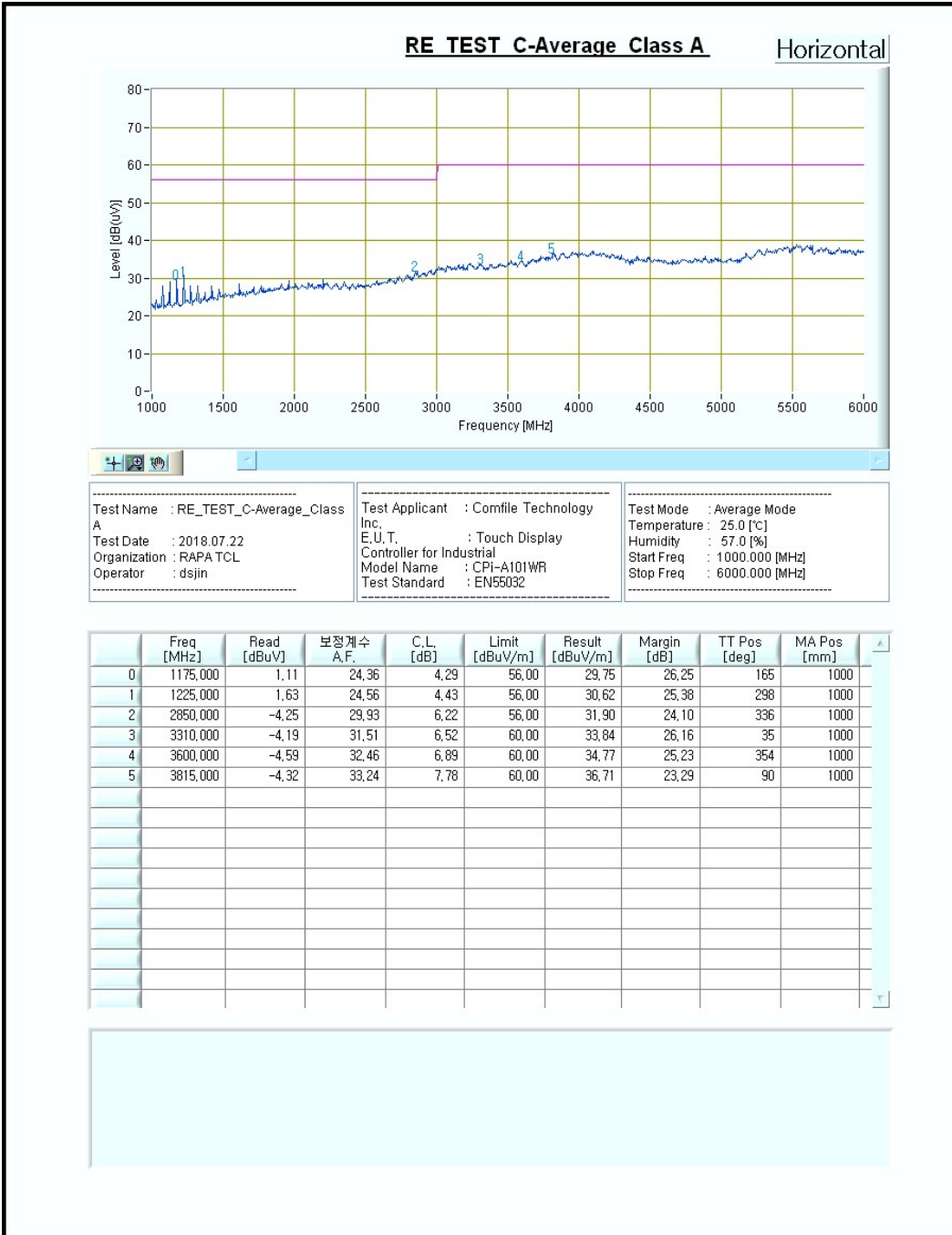
▪ Test mode: Peak_Horizontal



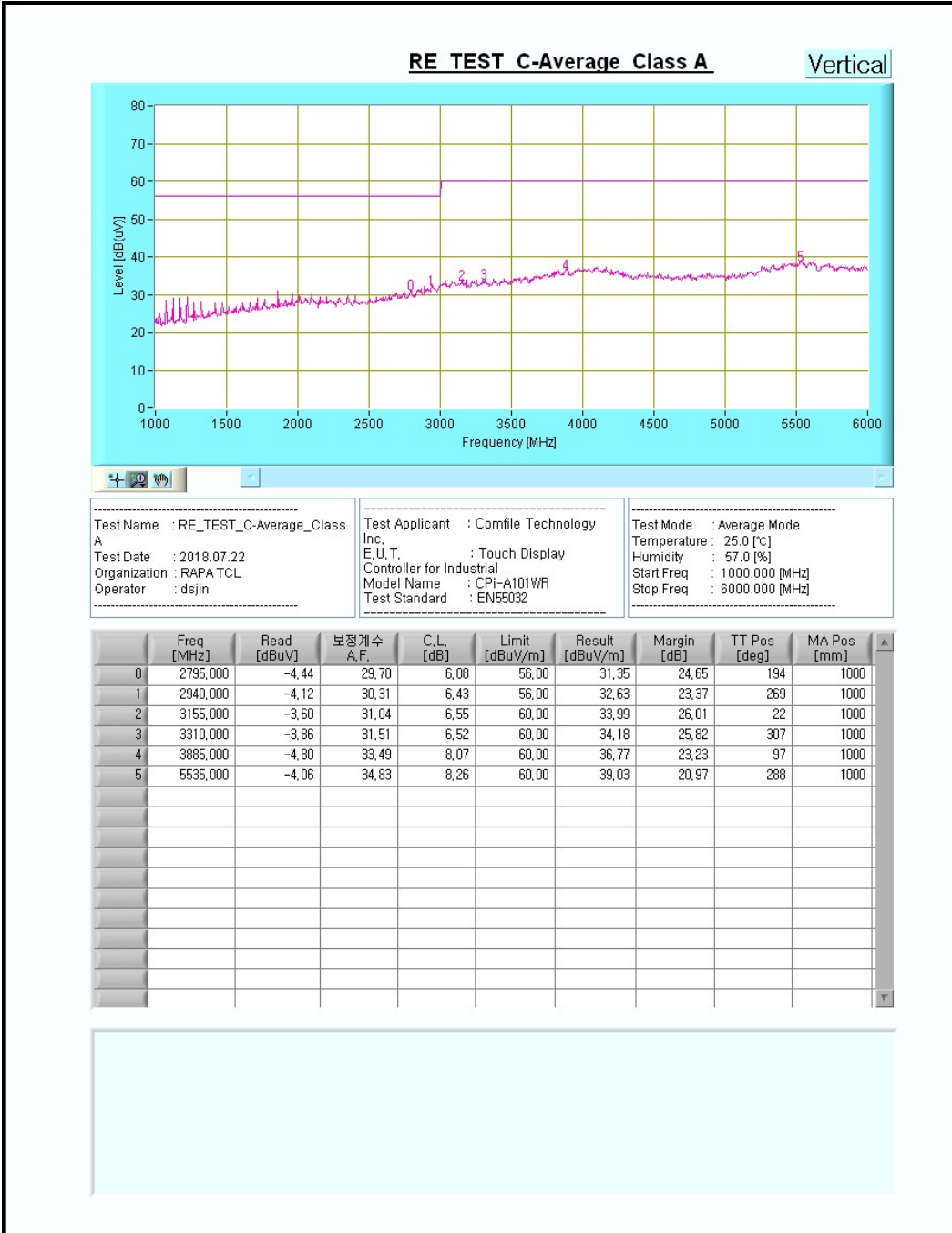
▪ Test mode: Peak_Vertical



▪ Test mode: Average_Horizontal



▪ Test mode: Average_Vertical



5.5 Harmonic Current Emissions

5.5.1 Operating environment

- Temperature: 22.0 °C
- Humidity : 51.0 % R.H.

5.5.2 Test set-up

Harmonics of the fundamental current were measured up to 2 kHz using a universal power analyzer. The measurements were carried out under steady conditions and identical test conditions.

Before taking measurements, it is necessary for the EUT to decide which class the EUT fulfills into; A, B, C or D.

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

5.5.3 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	DPA500N	EM Test	Digital Power Analyzer	V0937105136	Jan 15, 2018
<input checked="" type="checkbox"/>	ACS500N	EM Test	Universal Power Analyzer	V0937105137	N/A
<input checked="" type="checkbox"/>	dpa.control	EM Test	The measurement and analysis software for Harmonics & Flicker	N/A	N/A

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

5.5.4 Test data

- Test date : July 21, 2018
- Test result : Pass

See next page for test data of Harmonics on AC Mains.



Tested by: Dongsu Jin / Manager

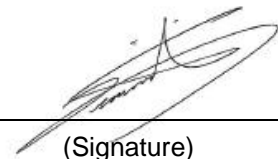
Test Report

Report title:	RAPA18-O-046
Company Name:	RAP TCA
Date of test:	11:53 21.Jul 2018
Measurement file name:	Harmonics_3_2_Ed4.rsd
Tester:	dsjin
Standard used:	EN/IEC 61000-3-2 Ed.4 Quasi-stationary Equipment class A <= 200% of the limit (Limit factor: 1.00)
Observation time:	150s
Windows width:	10 periods - (EN/IEC 61000-4-7 Edition 2002 + A1:2008)
Customer:	Comfile Technology Inc.
E. U. T.:	Touch Display Controller for Industrial
Temperature / Humidity:	22.0 / 51.0
Model Name	CPI-A101WR
Comment:	Moving Color Bar, 1 kHz, 0 dB, TF Generator, File Read/Write, Serial Communication

Test Result	
E. U. T.:	PASS
Power Source:	PASS

July 21, 2018

(Date)



(Signature)

Average harmonic current results

Hn	I_{eff} [A]	% of Limit	Limit [A]	Result
1	48.900E-3			
2	4.205E-3			PASS
3	43.409E-3	2.097	2.07	PASS
4	6.359E-3	1.643	387.00E-3	PASS
5	42.680E-3	4.160	1.03	PASS
6	4.914E-3			PASS
7	42.028E-3	6.065	693.00E-3	PASS
8	4.018E-3			PASS
9	40.759E-3	11.322	360.00E-3	PASS
10	4.370E-3			PASS
11	39.299E-3	13.232	297.00E-3	PASS
12	4.672E-3			PASS
13	37.674E-3	19.933	189.00E-3	PASS
14	4.548E-3			PASS
15	35.562E-3	26.342	135.00E-3	PASS
16	4.203E-3			PASS
17	33.377E-3	28.021	119.11E-3	PASS
18	3.918E-3			PASS
19	31.247E-3	29.318	106.58E-3	PASS
20	3.694E-3			PASS
21	28.940E-3	30.012	96.43E-3	PASS
22	3.380E-3			PASS
23	26.540E-3	30.143	88.05E-3	PASS
24	3.028E-3			PASS
25	23.977E-3	29.601	81.00E-3	PASS
26	2.706E-3			PASS
27	21.530E-3	28.708	75.00E-3	PASS
28	2.409E-3			PASS
29	19.103E-3	27.357	69.83E-3	PASS
30	2.116E-3			PASS
31	16.672E-3	25.522	65.32E-3	PASS
32	1.796E-3			PASS
33	14.418E-3	23.497	61.36E-3	PASS
34	1.518E-3			PASS
35	12.205E-3	21.093	57.86E-3	PASS
36	1.287E-3			PASS
37	10.218E-3	18.671	54.73E-3	PASS
38	1.154E-3			PASS
39	8.341E-3	16.066	51.92E-3	PASS
40	1.082E-3			PASS

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.

Maximum harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	52.260E-3			
2	5.470E-3	0.253	2.16	PASS
3	47.438E-3	1.031	4.60	PASS
4	6.953E-3	0.809	860.00E-3	PASS
5	46.529E-3	2.041	2.28	PASS
6	5.345E-3	0.891	600.00E-3	PASS
7	45.394E-3	2.948	1.54	PASS
8	5.200E-3	1.130	460.00E-3	PASS
9	43.924E-3	5.491	800.00E-3	PASS
10	5.023E-3	1.365	368.00E-3	PASS
11	42.439E-3	6.430	660.00E-3	PASS
12	5.098E-3	1.663	306.66E-3	PASS
13	40.631E-3	9.674	420.00E-3	PASS
14	4.968E-3			PASS
15	38.226E-3	12.742	300.00E-3	PASS
16	4.612E-3			PASS
17	35.891E-3	13.559	264.70E-3	PASS
18	4.280E-3			PASS
19	33.363E-3	14.087	236.84E-3	PASS
20	4.018E-3			PASS
21	30.665E-3	14.311	214.28E-3	PASS
22	3.708E-3			PASS
23	28.072E-3	14.347	195.66E-3	PASS
24	3.363E-3			PASS
25	25.156E-3	13.975	180.00E-3	PASS
26	2.996E-3			PASS
27	22.592E-3	13.555	166.66E-3	PASS
28	2.708E-3			PASS
29	19.873E-3	12.806	155.18E-3	PASS
30	2.339E-3			PASS
31	17.153E-3	11.817	145.16E-3	PASS
32	2.114E-3			PASS
33	14.813E-3	10.863	136.36E-3	PASS
34	1.845E-3			PASS
35	12.347E-3	9.602	128.58E-3	PASS
36	1.568E-3			PASS
37	10.337E-3	8.499	121.62E-3	PASS
38	1.382E-3			PASS
39	8.624E-3	7.475	115.38E-3	PASS
40	1.253E-3			PASS

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.

Maximum harmonic voltage results

Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	231.85	100.806		
2	116.36E-3	0.051	0.2	PASS
3	69.86E-3	0.030	0.9	PASS
4	34.57E-3	0.015	0.2	PASS
5	73.28E-3	0.032	0.4	PASS
6	36.11E-3	0.016	0.2	PASS
7	82.28E-3	0.036	0.3	PASS
8	21.38E-3	0.009	0.2	PASS
9	60.40E-3	0.026	0.2	PASS
10	7.74E-3	0.003	0.2	PASS
11	35.09E-3	0.015	0.1	PASS
12	9.15E-3	0.004	0.1	PASS
13	110.40E-3	0.048	0.1	PASS
14	26.62E-3	0.012	0.1	PASS
15	23.46E-3	0.010	0.1	PASS
16	28.09E-3	0.012	0.1	PASS
17	35.05E-3	0.015	0.1	PASS
18	24.42E-3	0.011	0.1	PASS
19	74.99E-3	0.033	0.1	PASS
20	21.37E-3	0.009	0.1	PASS
21	24.60E-3	0.011	0.1	PASS
22	15.35E-3	0.007	0.1	PASS
23	55.66E-3	0.024	0.1	PASS
24	10.27E-3	0.004	0.1	PASS
25	46.06E-3	0.020	0.1	PASS
26	13.85E-3	0.006	0.1	PASS
27	32.06E-3	0.014	0.1	PASS
28	13.61E-3	0.006	0.1	PASS
29	58.93E-3	0.026	0.1	PASS
30	12.77E-3	0.006	0.1	PASS
31	16.26E-3	0.007	0.1	PASS
32	10.45E-3	0.005	0.1	PASS
33	36.11E-3	0.016	0.1	PASS
34	10.63E-3	0.005	0.1	PASS
35	31.17E-3	0.014	0.1	PASS
36	10.66E-3	0.005	0.1	PASS
37	19.28E-3	0.008	0.1	PASS
38	9.30E-3	0.004	0.1	PASS
39	52.21E-3	0.023	0.1	PASS
40	5.95E-3	0.003	0.1	PASS

5.6 Voltage changes, Voltage fluctuations and Flicker

5.6.1 Operating environment

- Temperature: 22.0 °C
- Humidity : 51.0 % R.H.

5.6.2 Test set-up

The voltage changes at the supply terminals were measured across the complex reference impedance $Z = (0.4 + j0.25) \Omega$. The short-term flicker values are measured during a time interval of 10 min. D_c (relative voltage change between two steady states) and D_{max} (maximum single voltage change) are measured over the reference impedance.

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

5.6.3 Measurement uncertainty

- The uncertainty of our equipment for flicker measurement: $\pm 5 \%$.

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

5.6.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
<input checked="" type="checkbox"/>	DPA500N	EM Test	Digital Power Analyzer	V0937105136	Jan 15, 2018
<input checked="" type="checkbox"/>	ACS500N	EM Test	Universal Power Analyzer	V0937105137	N/A
<input checked="" type="checkbox"/>	dpa.control	EM Test	The measurement and analysis software for Harmonics & Flicker	N/A	N/A

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

5.6.5 Test data

- Test date : July 21, 2018
- Test result : Pass

See next page for test data of Voltage Fluctuations on AC mains.



Tested by: Dongsu Jin / Manager

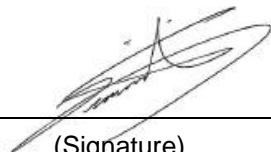
Test Report

Report title:	RAPA18-O-046
Company Name:	RAP TCA
Date of test:	11:567 21.Jul 2018
Tester:	dsjin
Standard used:	EN/IEC 61000-3-3 Ed.3 Flicker
Short time (Pst):	10 min
Observation time:	120 min (12 Flicker measurements)
Flickermeter:	230V / 50Hz according IEC 61000-4-15 Ed.2
Flicker Impedance:	Zref (IEC 60725)
Customer:	Comfile Technology Inc.
E. U. T.:	Touch Display Controller for Industrial
Temperature / Humidity:	22.0 / 51.0
Model Name	CPI-A101WR
Comment:	Moving Color Bar, 1 kHz, 0 dB, TF Generator, File Read/Write, Serial Communication

Test Result	PASS
-------------	------

July 21, 2018

 (Date)



 (Signature)

Maximum Flicker results

	EUT values	Limit	Result
Pst	0.462	1.00	PASS
Plt	0.202	0.65	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.182	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Detail Flicker data

Flicker measurement 1	EUT values	Limit	Result
Pst	0.462	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.182	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 2	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.045	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 3	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.044	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 4	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.043	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 5	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.043	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 6	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.047	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 7	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.044	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 8	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.045	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 9	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.046	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 10	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.048	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 11	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.044	4.00	PASS
Tmax [s]	0.000	0.50	PASS

Flicker measurement 12	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.044	4.00	PASS
Tmax [s]	0.000	0.50	PASS

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 : July 20, 2018

Here, S121 = Shield room number

6.1.1 Operating environment

Item	Measured	Recommended
Ambient temperature	24.0 °C	15 °C ~ 35 °C
Relative humidity	54.0 % R.H.	30 % R.H ~ 60 % R.H
Atmospheric pressure	100.9 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 VII.

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	Jan. 30, 2018
<input checked="" type="checkbox"/>	TC-815P	NOISEKEN	ESD Gun	ESS0120522	Jan. 30, 2018

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
- Monitoring of the EUT : The EUT was operated with all operating mode continuously during the test
- Test mode : AC 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.

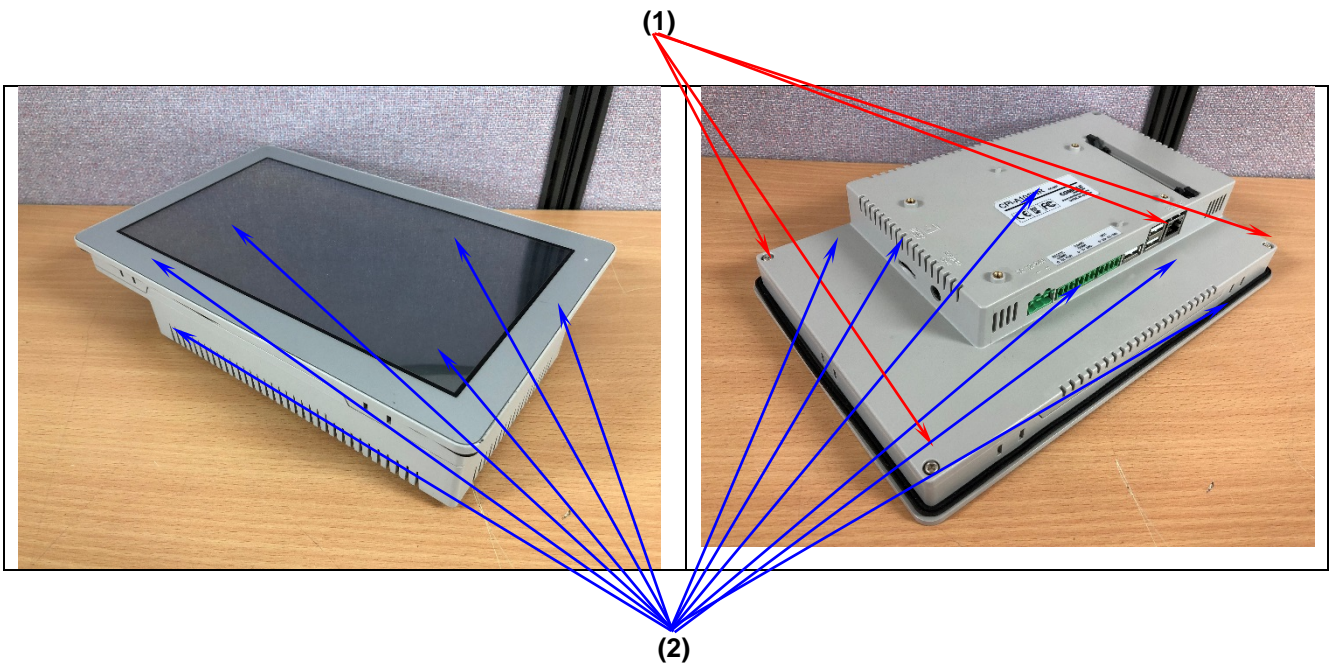
Point		Test level [±kV]	Pass / Fail	Description
(1)	Ports (USB, RJ-45)	4 (Contact)	Pass	When engage ESD test signal on the ports (USB, RJ-45, SOUND OUT, Micro SD), white noise is occurred on the LCD display temporarily.
(1)	Screws	4 (Contact)	Pass	
(2)	Non-metal Frame, LCD	2 / 4 / 8 (Air)	Pass	
(2)	Ports (SOUND OUT, Micro SD)	2 / 4 / 8 (Air)	Pass	
HCP / VCP		HCP / VCP	Pass	



Tested by: Dongsu Jin / Manager

6.1.6 ESD Test point table

ESD Point		Discharge voltage [\pm kV]	Results
(1)	Ports (USB, RJ-45)	4 (Contact)	Criterion B
(1)	Screw	4 (Contact)	Criterion A
(2)	Nonmetal Frame, LCD	2 / 4 / 8 (Air)	Criterion A
(2)	Ports (SOUND OUT, Micro 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 12, 2018

Here, S111 = Anechoic Chamber number

6.2.1 Operating environment

- Ambient temperature : 23.0 °C
- Humidity : 50.0 % R.H.
- Atmospheric pressure : 101.2 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 VIII.

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	N/A	N/A
<input checked="" type="checkbox"/>	E4432B	Agilent	ESG-D Series Signal Generator	MY43350147	Jan 15, 2018
<input checked="" type="checkbox"/>	NRP-Z91	Rohde&Schwarz	Power Sensor	100882	Aug 21, 2017
<input checked="" type="checkbox"/>	NRP-Z91	Rohde&Schwarz	Power Sensor	100883	Aug 21, 2017
<input checked="" type="checkbox"/>	ITRS-0830K	Infinitech	Power Amplifier	N/A	Jan 17, 2018
<input checked="" type="checkbox"/>	STLP9128D	Schwarzbeck	Log Periodic Dipole Antenna	9128D015	N/A
<input checked="" type="checkbox"/>	TST-1000	TESTEK	Sound Acoustic Tester	150043	Aug 25, 2017
<input checked="" type="checkbox"/>	CA111	BSWA TECH	Calibrator for Microphone	520042	Aug 25, 2017
<input checked="" type="checkbox"/>	TIB-R1	TESTEK	Impedance Box	150030	Aug 25, 2017
<input checked="" type="checkbox"/>	MPA261	BSWA TECH	Microphones	530025	Aug 25, 2017

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
(80, 120, 145, 160, 230, 375, 435, 460, 600, 814, 835 MHz (±1 %))
- 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 : AC 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 Fast Transient/Burst was performed in a shield room.

- Test location : Shielded Room (S121).
- Date : July 19, 2018

6.3.1 Operating environment

- Ambient temperature : 23.0 °C
- Humidity : 52.5 % R.H.
- Atmospheric pressure : 101.0 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 IX.

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 21, 2017
<input checked="" type="checkbox"/>	HFK	EM Test	Capacitive Coupling Clamp	0709-26	Jan. 15, 2018
<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 : 1.0 kV (AC-mains supply), 0.5 kV (Signal Cable >3 m)
- Burst frequency : 5 kHz
- Polarity : Positive / Negative
- Coupling methods : AC mains – Coupling Decoupling Network (CDN),
Signal line – Capacitive Coupling Clamp (CCC)
- Lines for test : AC mains and Signal line of the EUT
- Type of line & length : Unshielded 0.5 m AC and Unshielded 3.0 m Signal Cables
- The EUT-position : Table Top
- Required performance criterion : B
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was operated with all operating mode continuously during the test
- Test mode : AC input mode

The results of test are listed in below table.

Line for test	Coupling Method	Test level [±kV]	Pass / Fail	Description
AC mains (L)	CDN	1.0	Pass	There was no deviation from normal operation condition.
AC mains (N)	CDN	1.0	Pass	
AC mains (L+N)	CDN	1.0	Pass	
AC mains (L+PE)	CDN	1.0	Pass	
AC mains (N+PE)	CDN	1.0	Pass	
AC mains (L+N+PE)	CDN	1.0	Pass	
Signal Cable (LAN)	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 Surge immunity test

The measurement of the Surge Transients immunity was performed in a shield room.

- Test location : Shielded Room (S121).
- Date : July 19, 2018

6.4.1 Operating environment

- Ambient temperature : 23.5 °C
- Humidity : 52.0 % R.H.
- Atmospheric pressure : 101.0 kPa

6.4.2 Test set-up

The EUT and all peripheral equipment were placed on a 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 X.

6.4.3 Measurement uncertainty

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

6.4.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	UCS 500N7	EM Test	Ultra Compact Generator	V0937105138	Aug 21, 2017
☒	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.

6.4.5 Test data

- Test level : 1.0 kV (Line-Line), 2.0 kV (Line-PE)
- Number of surge : 5 surges / polarity
- Polarity : Positive / Negative
- Angle : 0° / 90° / 180° / 270°
- Repetition rate : 60 s
- Coupling methods : AC mains – Coupling Decoupling Network (CDN)
- Lines for test : AC mains of AC/DC Adapter
- Type of line and length : Unshielded 0.5 m AC mains
- The EUT-position : Table Top
- Required performance criterion : B
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was operated with all operating mode continuously during the test
- Test mode : AC input mode

The results of test are listed in below table.

Line for test	Coupling Method	Test level [±kV]	Pass/Fail	Description
L-N	CDN	1.0	Pass	There was no deviation from normal operating condition.
L-PE	CDN	2.0	Pass	
N-PE	CDN	2.0	Pass	

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



Tested by: Dongsu Jin / Manager

6.5 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 : July 20, 2018

6.5.1 Operating environment

- Ambient temperature : 24.0 °C
- Humidity : 55.0 % R.H.
- Atmospheric pressure : 100.9 kPa

6.5.2 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 XI.

6.5.3 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 %.

6.5.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	CWS 500N	EM Test	Continuous Wave Simulator	V0937105141	Aug 22, 2017
☒	5906 N-50-1	Huber + Suhner	Attenuator 6dB/75W	253452201	Jan. 16, 2018
☒	FCC-801-M2/M3-16A	FCC	CDN	091759	Aug 21, 2017
☒	M016	Schaffner	CDN	16678	Aug 21, 2017
☒	FCC-801-T4-RJ45	FCC	CDN	091757	Aug 21, 2017
☒	TST-1000	TESTEK	Sound Acoustic Tester	150043	Aug 25, 2017
☒	CA111	BSWA TECH	Calibrator for Microphone	520042	Aug 25, 2017
☒	TIB-R1	TESTEK	Impedance Box	150030	Aug 25, 2017
☒	MPA261	BSWA TECH	Microphones	530025	Aug 25, 2017
☒	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.

6.5.5 Test data

- Test level : 3 V (AM 80 %, 1 kHz)
- Frequency range : 0.15 MHz ~ 80 MHz
(0.2, 1.0, 7.1, 13.56, 21.0, 27.12, 40.68, 52 MHz (±1 %))
- Frequency step : 1 %
- Dwell time at each frequency : 3 s
- Coupling methods : AC power lines – Coupling Decoupling Network (CDN),
Signal/Control lines – Coupling Decoupling Network (CDN)
- Lines for test : AC Mains and Signal line
- Type of line & length : Unshielded 0.3 m AC power, and 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 : AC 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(M3)	AC 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

6.6 Main supply voltage Dips and Short interruptions immunity test

The measurement of the Voltage Dips and Interruptions Immunity was performed in a shield room.

- Test location : Shielded Room (S101).
- Date : July 19, 2018

6.6.1 Operating environment

- Ambient temperature : 23.0 °C
- Humidity : 52.0 % R.H.
- Atmospheric pressure : 101.0 kPa

6.6.2 Test set-up

The EUT and all local support equipment were placed on a 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 XII.

6.6.3 Measurement uncertainty

It has been demonstrated that the voltage dips and interruptions generator meets the specified requirements in the standard with at least 95 % confidence.

6.6.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	UCS 500 N	EM Test	Ultra Compact Generator	V0937105138	Aug 21, 2017
☒	MV2616	EM Test	Motorized VARIAC	V0937105140	N/A
☒	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.

6.6.5 Test data

- Nominal Mains Voltage (V_{NOM}) : 230 Vac ~
- Level of Reduction (dip) : 200 ms at 30 % of V_{NOM}
- Level of Interruptions : 10 ms at 100 % of V_{NOM}
- No. of dips/interruption : 3
- Interval : 10 s
- Type of line & length : Unshielded 0.5 m AC mains of the EUT
- The EUT-position : Table Top
- Required performance criterion : B and C
- Test result : Met criterion A and C
- Monitoring of the EUT : EUT was under the normal operating mode continuously during the test
- Test mode : AC input mode

The results of test are listed in below table.

Test	Reduction (% of V_{NOM})	Duration In time (period)	Pass / Fail	Performance Criterion		Notes
				Criteria	Result	
Voltage dips	> 95	0.5	Pass	B	A	3 interrupts with 10 sec interval between each test
	30	25		C		
Voltage Interruptions	> 95	250	Pass	C	C	

Performance Criterion Results

Here,

A = Normal performance within the specification limits.

B = Temporary degradation or loss of function or performance which is self-recoverable.

C = Temporary degradation or loss of function of performance which requires operator intervention or system reset.



Tested by: Dongsu Jin / Manager

APPENDIX I - TEST SET-UP PHOTOS: Mains terminal disturbance voltage



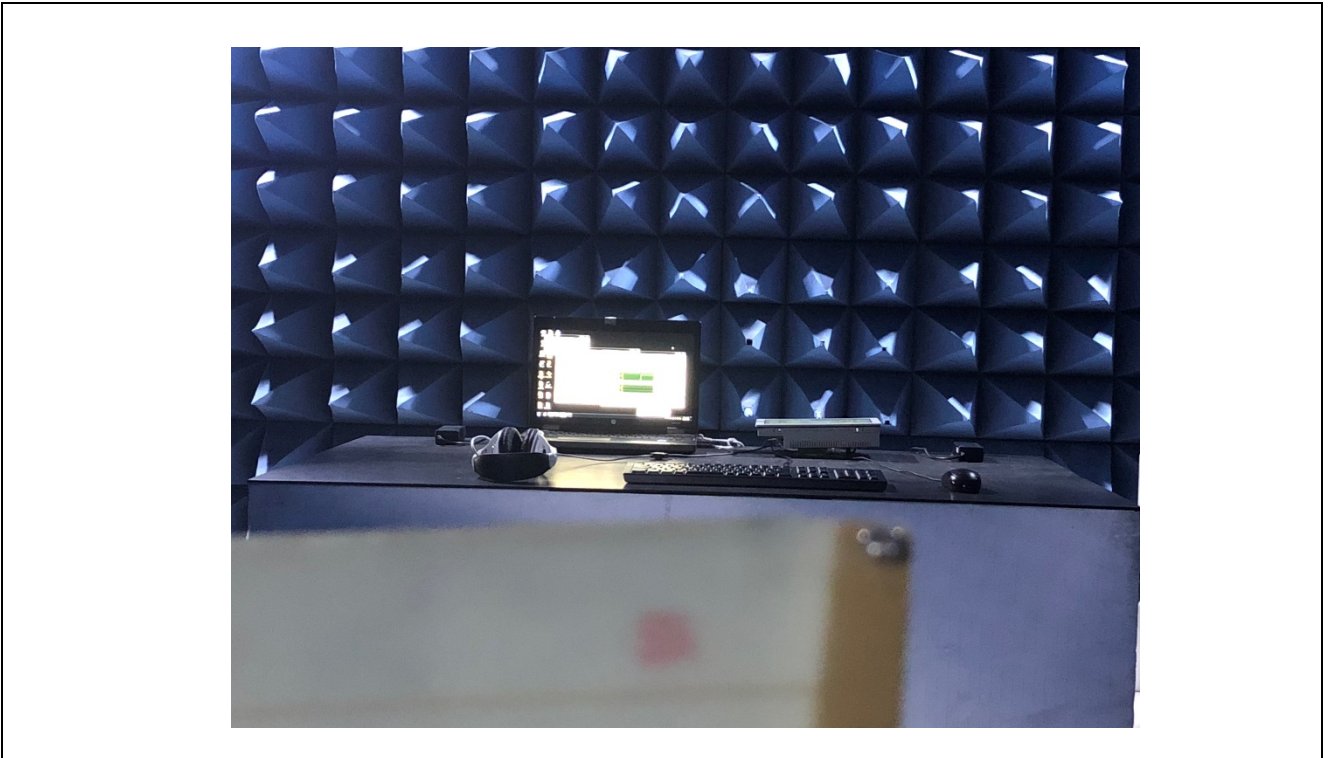
APPENDIX II - TEST SET-UP PHOTOS: Conducted common mode disturbance at TEL ports



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



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



APPENDIX V - TEST SET-UP PHOTO: Harmonic Current Emissions



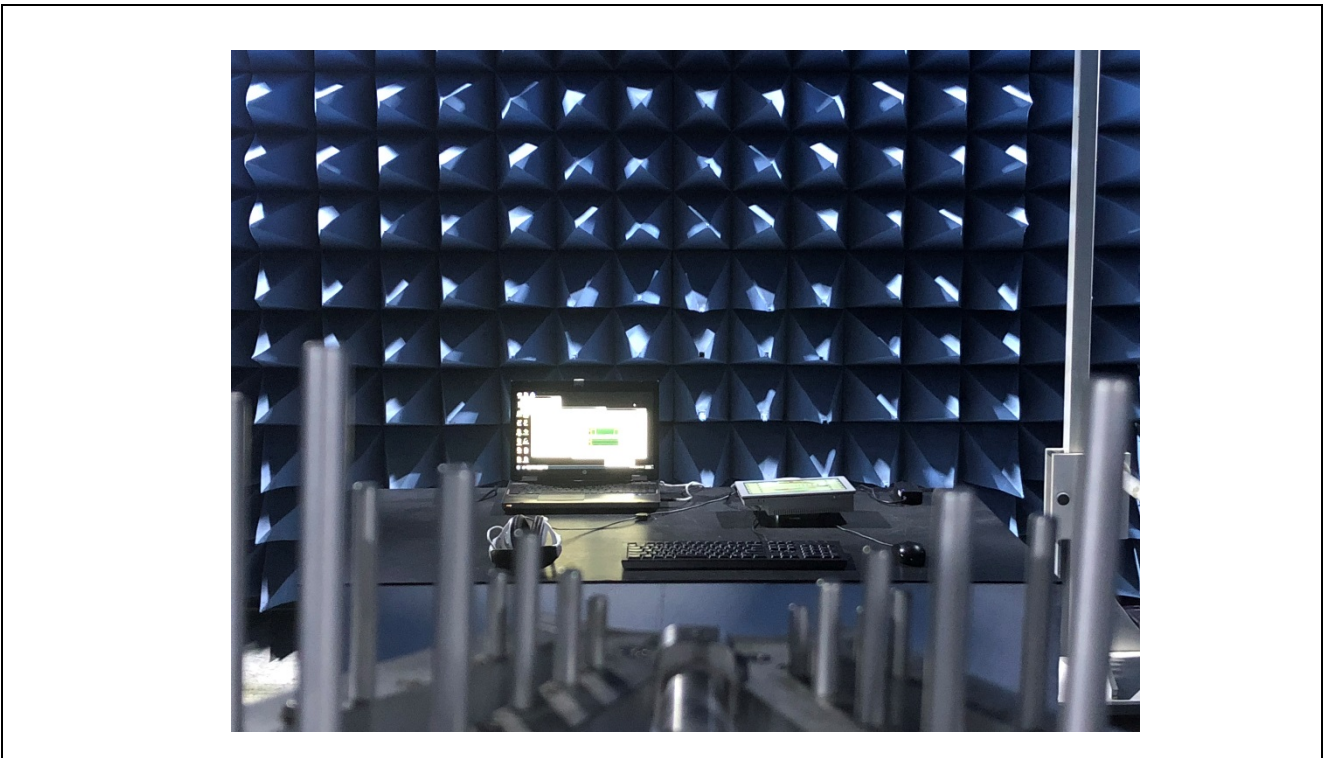
APPENDIX VI - TEST SET-UP PHOTO: Voltage changes, Voltage fluctuations and Flicker



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



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



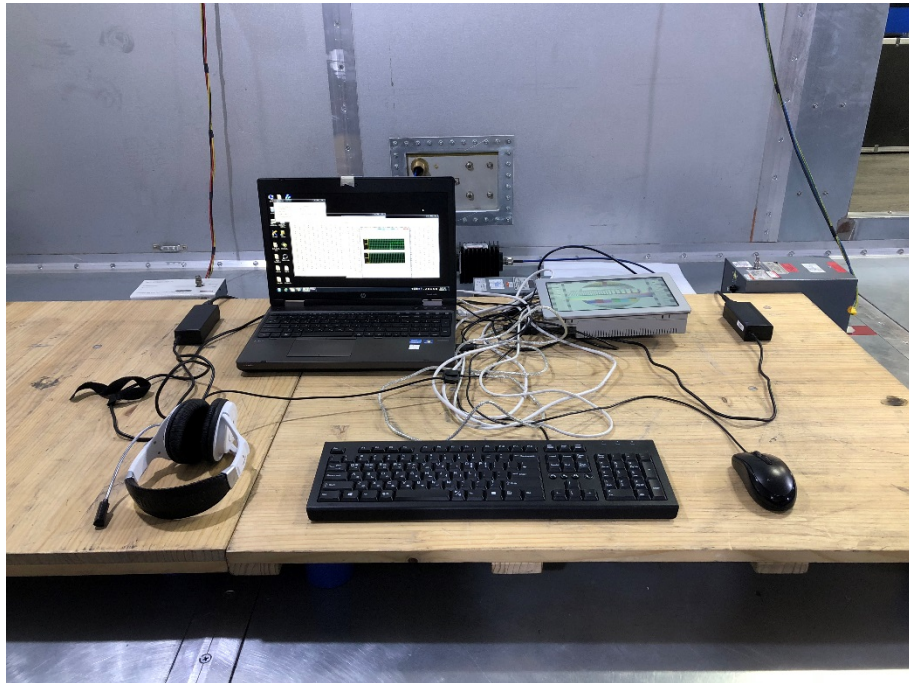
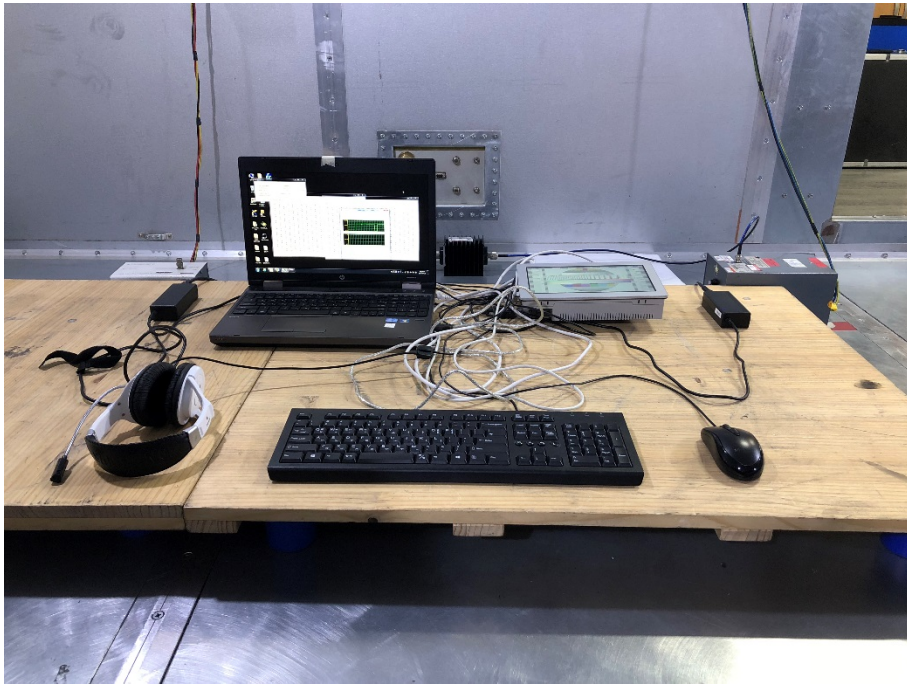
APPENDIX IX - TEST SET-UP PHOTO: Electrical fast transient/burst immunity



APPENDIX X - TEST SET-UP PHOTO: Surge immunity



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



APPENDIX XII - TEST SET-UP PHOTO: Voltage Dips and Short interruptions





It should not be reproduced in full or partly without the written approval by TCL of RAPA.

CE-EMCD (Rev.0)

HEAD OFFICE & EMC Testing Dept:

101 & B104, Aanyang Megavalley, 799, Gwanyang-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea (TEL: +82-31-427-9100, FAX: +82-31-427-2323)

