

ELECTROMAGNETIC COMPATIBILITY TEST REPORT

Test Report No.		RAPA17-O-005
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		Human Machine Interface Panel
Model Name		CHA-102WR
Multi Model Name		N/A
Serial number		N/A
Total page of Report		58 pages (including this page)
Test period		February 16, 2017 – March 4, 2017
Issuing date of report		March 7, 2017

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.

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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		Hyung Tae Park / Research engineer
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 61000-3-2:2006/A2:2009	Harmonic Current Emission	Met / PASS
EN 61000-3-3:2008	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	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 : Human Machine Interface Panel
- Model name : CHA-102WR
- 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 CHA-102WR (referred to as the EUT in this report) of Comfile Technology Inc. is an Industrial Touch Panel. Product specification described herein was obtained from product data sheet or user's manual.

MCU	32 Bit RISC CPU(ARM926EJ-S Core) – 400 MHz
Memory	SDRAM : 128 MB (OS Image: 18 MB / User : 110 MB) NAND Flash : 256 MB(OS Image:17 MB / User : 239 MB)
LCD	TFT LCD(260,000 Color) 10.2 Inch (800 x 480) 300 cd/m2
Backlight	LED Backlight
Ethernet	100 Base-T (1 Port)
Touch	4 wire resistive panel
RTC	Maxim DS3231SN(Battery replaceable)
Audio	<0.8 W Micro speaker embedded Stereo audio output (ø3.5 Audio Jack)
USB	Host 1Port Device 1Port
Serial	COM1 (RS232C) COM2 (RS232C) COM3 (RS485)
SDCARD	Support external SD CARD (32 GB bytes)
Input Power	DC 24 V
Power Consumption	< 5 W (0.4 A @ 12 V)
MAX. Current	400 mA
Dimension (mm)	170 (H) x 264 (V) x 46 (D)
Weight	2074 g
Operating Temperature	0 °C ~ 70 °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
CHA-102WR	Comfile Technology Inc.	Human Machine Interface Panel	-
WRAD-24062A	Woori TEC	AC/DC Adapter	EUT
B138	Samsung	Mouse	EUT
8GB	SanDisk	Micro SD CARD	EUT
N/A	Apply	Earphone	EUT
ProBook 6560b	HP	Notebook	EUT
Series PPP012H-S	HP.	Notebook Adapter	Notebook

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
None	None	☐

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
Human Machine Interface Panel (EUT)	DC INPUT	No	No	No	1.2	AC Adapter
	USB HOST	Yes	No	Yes	1.6	Mouse
	Micro SD	No	No	No	Direct	Micro SD CARD
	USB Device	Yes	No	Yes	1.6	Notebook USB
	Ethernet	No	No	No	3.0	Notebook LAN(RJ-45)
	COM3 RS485	No	No	No	1.0	LINE
	COM2 RS232C	No	No	No	1.0	LINE
	COM1 RS232C	No	No	No	1.0	Notebook Serial
	Audio Out	No	No	No	1.2	Earphone
Notebook	DC Input	No	Yes	No	2.4	AC/DC Adapter
	Serial	No	No	No	1.0	EUT (COM1 RS232C)
	LAN(RJ-45)	No	No	No	3.0	EUT (Ethernet)
	USB	Yes	No	Yes	1.6	EUT (USB Device)

4. EUT MODIFICATIONS

- None

5. EMISSION TESTS

5.1 Mains terminal continuous disturbance voltage

5.1.1 Operating environment

- Temperature: 19.5 °C
- Humidity : 33.5 % 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 μ H $\pm$ 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: $\pm$ 3.46 dB
- Conducted emission, CISPR-Average detection: $\pm$ 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. 16, 2017
☒	ESH3-Z2	Rohde & Schwarz	Pulse Limiter	101631	Jan. 16, 2017
☒	LT32C	AFJ Instruments	LISN	32031430208	Aug. 23, 2016
☒	3825/2	EMCO	LISN	9004-1635	Aug. 23, 2016
☒	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 : February 21, 2017
- Resolution bandwidth : 9 kHz
- Frequency range : 150 KHz ~ 30 MHz

Frequency (MHz)	Line	Quasi-peak			CISPR-Average		
		Emission level(dB μ V)	Limits (dB μ V)	Margin (dB)	Emission level(dB μ V)	Limits (dB μ V)	Margin (dB)
0.19	H	46.65	79.00	32.35	36.04	66.00	29.96
0.26	H	45.07	79.00	33.93	38.41	66.00	27.59
0.32	H	41.38	79.00	37.62	35.32	66.00	30.68
0.70	H	38.62	73.00	34.38	30.95	60.00	29.05
1.02	N	39.40	73.00	33.60	27.78	60.00	32.22
17.60	N	36.33	73.00	36.67	31.25	60.00	28.75

Tabulated test data for Mains Terminal Continuous Disturbance Voltage

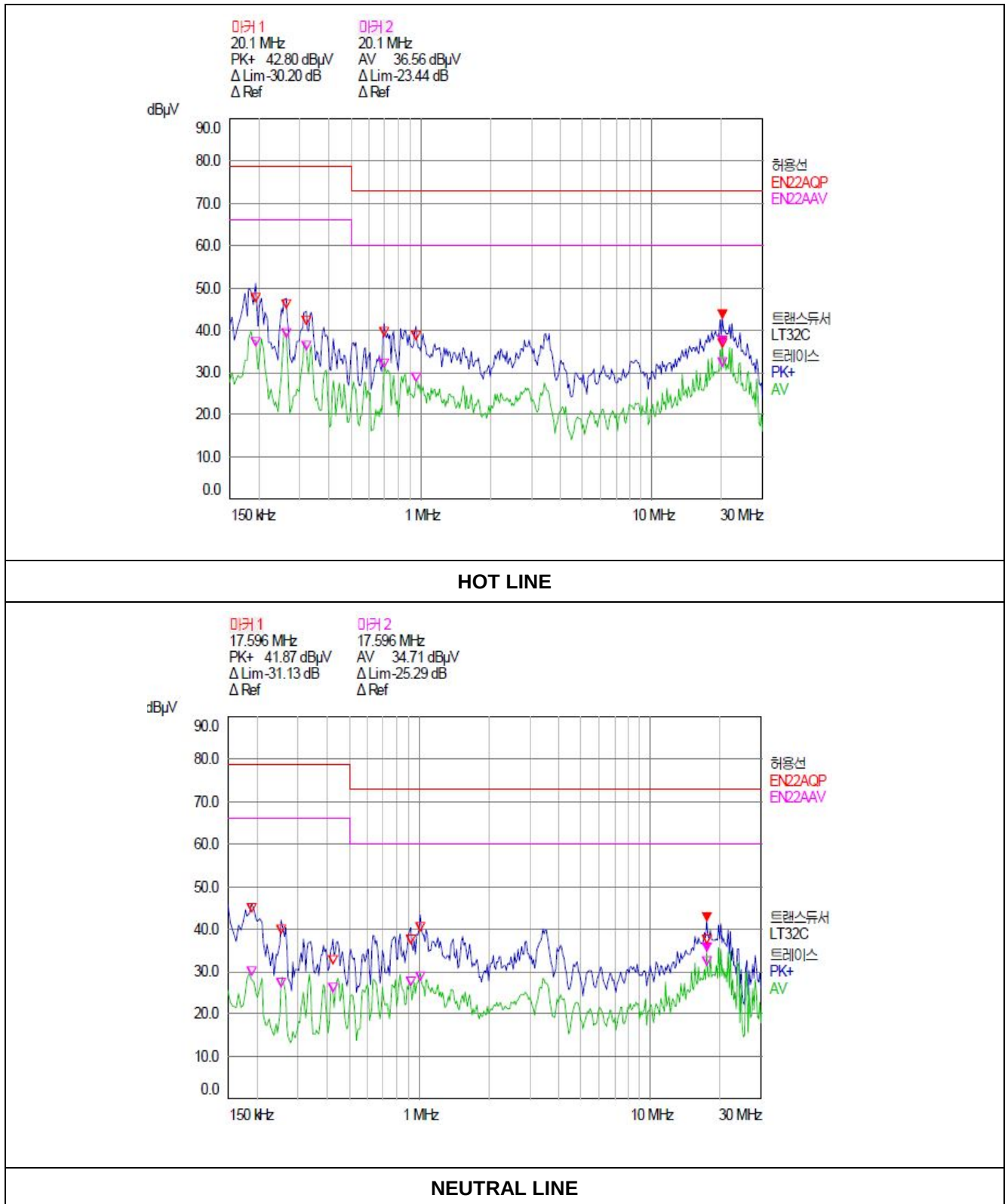
Here, H: Hot Line, N: Neutral line

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



Tested by: Dongsu Jin / Manager

• Plots



5.2 Conducted common mode disturbance at telecommunication ports

5.2.1 Operating environment

- Temperature: 19.5 °C
- Humidity : 33.5 % 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
☒	ESCI7	Rohde & Schwarz	EMI Test Receiver	100938	Jan. 16, 2017
☒	ESH3-Z2	Rohde & Schwarz	Pulse Limiter	101631	Jan. 16, 2017
☒	LT32C	AFJ Instruments	LISN	32031430208	Aug. 23, 2016
☒	3825/2	EMCO	LISN	9004-1635	Aug. 23, 2016
☒	CAT3 8158	Schwarzbeck	ISN	8158-0031	Jan. 19, 2017
☒	CAT5 8158	Schwarzbeck	ISN	8158-0047	Jan. 19, 2017
☐	NTFM 8158	Schwarzbeck	ISN	8158-0035	Jan. 24, 2017
☒	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 : February 21, 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)
0.34	Four	56.70	90.25	33.55	50.98	77.25	26.27
0.42	Four	55.38	88.41	33.03	49.38	75.41	26.03
1.02	Four	61.38	87.00	25.62	53.03	74.00	20.97
2.27	Four	58.12	87.00	28.88	52.11	74.00	21.89
18.24	Four	64.81	87.00	22.19	61.41	74.00	12.59
23.13	Four	66.49	87.00	20.51	63.52	74.00	10.48

▪ Test mode: 100 Mbps

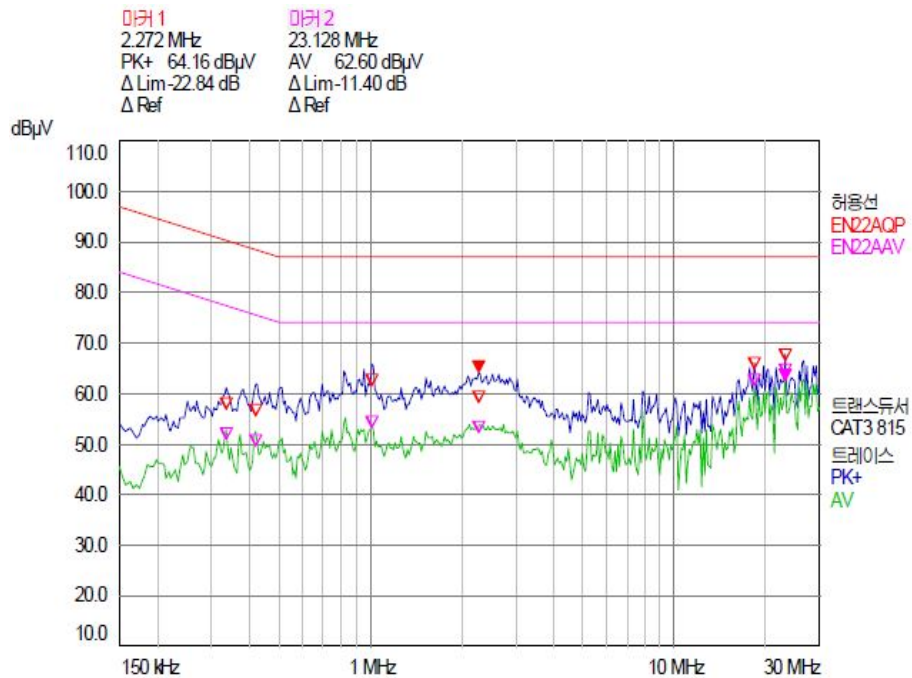
Frequency (MHz)	Port	Quasi-peak			CISPR-Average		
		Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)
0.39	Four	54.48	89.06	34.58	48.16	76.06	27.90
0.47	Four	55.66	87.44	31.78	49.07	74.44	25.37
0.84	Four	59.21	87.00	27.79	53.39	74.00	20.61
0.95	Four	60.39	87.00	26.61	53.09	74.00	20.91
1.01	Four	60.63	87.00	26.37	52.64	74.00	21.36
26.61	Four	59.37	87.00	27.63	56.18	74.00	17.82

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

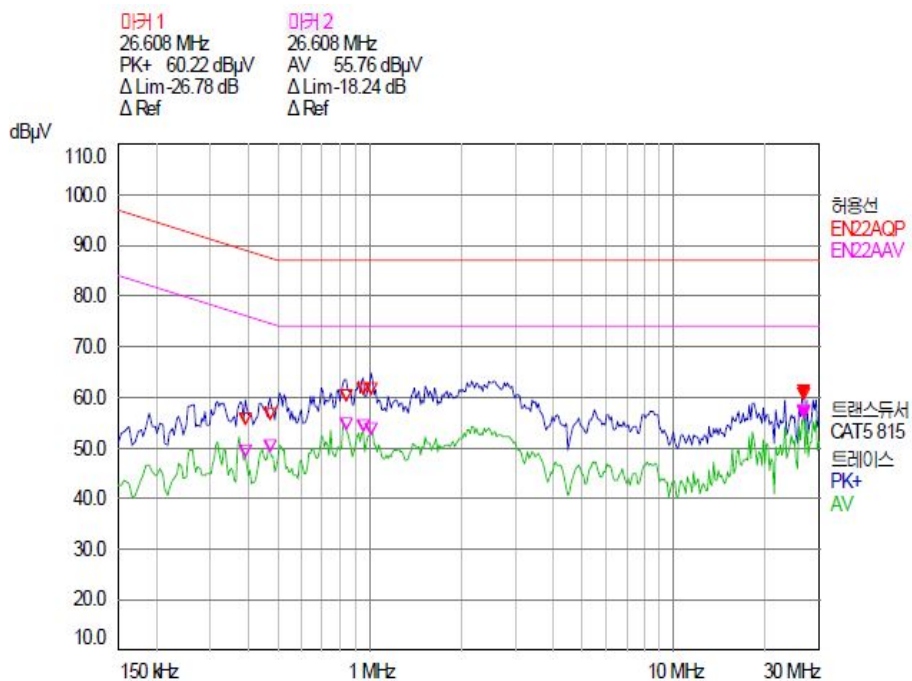
See next page for an overview sweep performed with peak detector.


Tested by: Dongsu Jin / Manager

▪ Plots



10 Mbps



100 Mbps

5.3 Radiated electromagnetic field (Below 1 GHz)

5.3.1 Operating environment

- Temperature: 8.0 °C
- Humidity : 26.0 % 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
☒	ESS	R&S	EMI Test Receiver	833776/011	Aug. 22, 2016
☒	DS 1500 S-1t-O	Innco GmbH	Turn Table	N/A	N/A
☒	MA4000-O	Innco GmbH	Antenna Mast	N/A	N/A
☒	CO 2000	Innco GmbH	Controller	N/A	N/A
☒	VHA9103	Schwarzbeck	Biconical Antenna	2217	Nov. 04, 2016
☒	VULP9118A	Schwarzbeck	Log Periodic Antenna	382	Nov. 04, 2016

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

5.3.5 Test data

- Test date : February 27, 2017
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 10 meter

Frequency (MHz)	Reading (dB μ V)	ANT Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
100.00	23.30	V	1.60	190.00	10.27	1.54	35.11	40.00	4.89
166.68	18.90	H	2.80	200.00	15.79	1.82	36.51	40.00	3.49
175.01	16.10	H	2.80	200.00	15.84	1.91	33.85	40.00	6.15
266.67	23.20	H	3.00	180.00	15.87	2.32	41.39	47.00	5.61
399.99	25.00	V	1.70	180.00	15.35	3.07	43.42	47.00	3.58
500.00	21.40	H	4.00	240.00	17.42	3.32	42.14	47.00	4.86

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: 18.0 °C
- Humidity : 31.5 % 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

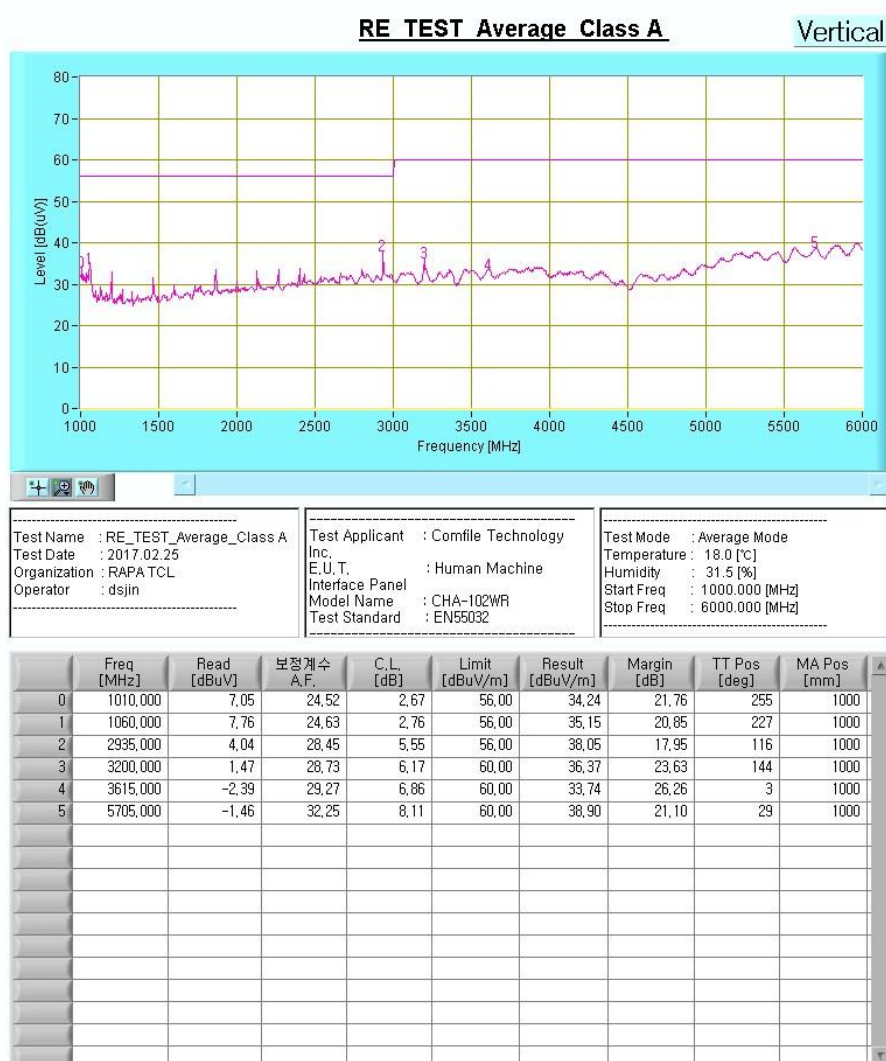
Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	ESPI	Rohde & Schwarz	Test Receiver	101002	Aug. 22, 2016
☒	ALL1.5TT	Airlink Lab.	Turn Table	N/A	N/A
☒	ALL2.2MA	Airlink Lab.	Antenna Master	N/A	N/A
☒	ALL-TC-V1.0	Airlink Lab.	Controller	N/A	N/A
☒	AMP 1000-6000	Infinitech	Broadband Pre-AMP	2013 05 00002/1	Jan. 16, 2017
☒	BBHA-9120D	Schwarzbeck	Horn Antenna	395	Jun 05, 2016
☒	RE32_V1_5	Airlink Lab.	RE Test System	N/A	N/A

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

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

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5.5 Harmonic Current Emissions

5.5.1 Operating environment

- Temperature: 19.0 °C
- Humidity : 32.0 % 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
☒	DPA500N	EM Test	Digital Power Analyzer	V0937105136	Jan 19, 2016
☒	ACS500N	EM Test	Universal Power Analyzer	V0937105137	N/A
☒	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 : February 22, 2017
- Class : A
- Test result : Pass

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



Tested by: Dongsu Jin / Manager

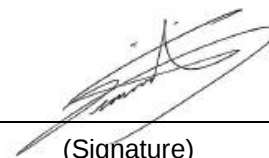
Test Report

Report title:	RAPA16-O-009
Company Name:	EMTEST AG
Date of test:	12:20 29.Jan 2016
Measurement file name:	Harmonics_3_2_Ed3.rsd
Tester:	dsjin
Standard used:	EN/IEC 61000-3-2 Ed.3 Random 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.:	CPCV5-101BR

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

February 22, 2017

(Date)



(Signature)

Average harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	52.455E-3			
2	4.671E-3	0.481	972.00E-3	PASS
3	47.019E-3	2.271	2.07	PASS
4	6.104E-3	1.577	387.00E-3	PASS
5	46.214E-3	4.504	1.03	PASS
6	5.319E-3	1.970	270.00E-3	PASS
7	45.272E-3	6.533	693.00E-3	PASS
8	4.535E-3	2.191	207.00E-3	PASS
9	43.838E-3	12.177	360.00E-3	PASS
10	4.657E-3	2.812	165.60E-3	PASS
11	42.277E-3	14.235	297.00E-3	PASS
12	4.754E-3	3.445	138.00E-3	PASS
13	40.599E-3	21.481	189.00E-3	PASS
14	4.660E-3	3.940	118.29E-3	PASS
15	38.327E-3	28.391	135.00E-3	PASS
16	4.332E-3	4.185	103.50E-3	PASS
17	35.926E-3	30.161	119.11E-3	PASS
18	4.057E-3	4.410	92.00E-3	PASS
19	33.557E-3	31.486	106.58E-3	PASS
20	3.803E-3	4.593	82.80E-3	PASS
21	30.975E-3	32.123	96.43E-3	PASS
22	3.496E-3	4.644	75.28E-3	PASS
23	28.412E-3	32.269	88.05E-3	PASS
24	3.159E-3	4.579	68.99E-3	PASS
25	25.622E-3	31.632	81.00E-3	PASS
26	2.812E-3	4.415	63.69E-3	PASS
27	22.938E-3	30.586	75.00E-3	PASS
28	2.487E-3	4.206	59.14E-3	PASS
29	20.319E-3	29.097	69.83E-3	PASS
30	2.198E-3	3.982	55.20E-3	PASS
31	17.634E-3	26.995	65.32E-3	PASS
32	1.884E-3	3.640	51.75E-3	PASS
33	15.217E-3	24.799	61.36E-3	PASS
34	1.607E-3	3.300	48.71E-3	PASS
35	12.800E-3	22.123	57.86E-3	PASS
36	1.354E-3	2.944	46.00E-3	PASS
37	10.593E-3	19.356	54.73E-3	PASS
38	1.180E-3	2.707	43.58E-3	PASS
39	8.707E-3	16.769	51.92E-3	PASS
40	1.085E-3	2.620	41.40E-3	PASS

Maximum harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	57.939E-3			
2	6.289E-3	0.291	2.16	PASS
3	52.938E-3	1.151	4.60	PASS
4	7.022E-3	0.816	860.00E-3	PASS
5	52.260E-3	2.292	2.28	PASS
6	5.814E-3	0.969	600.00E-3	PASS
7	50.355E-3	3.270	1.54	PASS
8	6.012E-3	1.307	460.00E-3	PASS
9	48.588E-3	6.074	800.00E-3	PASS
10	5.590E-3	1.519	368.00E-3	PASS
11	46.796E-3	7.090	660.00E-3	PASS
12	5.229E-3	1.705	306.66E-3	PASS
13	44.990E-3	10.712	420.00E-3	PASS
14	5.153E-3	1.960	262.86E-3	PASS
15	42.444E-3	14.148	300.00E-3	PASS
16	4.759E-3	2.069	230.00E-3	PASS
17	39.921E-3	15.082	264.70E-3	PASS
18	4.563E-3	2.232	204.44E-3	PASS
19	37.061E-3	15.648	236.84E-3	PASS
20	4.215E-3	2.291	184.00E-3	PASS
21	33.796E-3	15.772	214.28E-3	PASS
22	3.897E-3	2.330	167.28E-3	PASS
23	30.923E-3	15.804	195.66E-3	PASS
24	3.475E-3	2.267	153.32E-3	PASS
25	27.562E-3	15.312	180.00E-3	PASS
26	3.103E-3	2.192	141.54E-3	PASS
27	24.560E-3	14.736	166.66E-3	PASS
28	2.855E-3	2.172	131.42E-3	PASS
29	21.584E-3	13.909	155.18E-3	PASS
30	2.447E-3	1.995	122.66E-3	PASS
31	18.487E-3	12.736	145.16E-3	PASS
32	2.156E-3	1.875	115.00E-3	PASS
33	15.833E-3	11.611	136.36E-3	PASS
34	1.928E-3	1.781	108.24E-3	PASS
35	13.147E-3	10.225	128.58E-3	PASS
36	1.695E-3	1.658	102.22E-3	PASS
37	10.772E-3	8.857	121.62E-3	PASS
38	1.382E-3	1.427	96.84E-3	PASS
39	9.033E-3	7.829	115.38E-3	PASS
40	1.304E-3	1.418	92.00E-3	PASS

Maximum harmonic voltage results

Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	231.68	100.732		
2	46.48E-3	0.020	0.2	PASS
3	71.57E-3	0.031	0.9	PASS
4	36.44E-3	0.016	0.2	PASS
5	79.47E-3	0.035	0.4	PASS
6	34.63E-3	0.015	0.2	PASS
7	80.01E-3	0.035	0.3	PASS
8	21.40E-3	0.009	0.2	PASS
9	58.84E-3	0.026	0.2	PASS
10	8.94E-3	0.004	0.2	PASS
11	37.86E-3	0.016	0.1	PASS
12	10.72E-3	0.005	0.1	PASS
13	110.39E-3	0.048	0.1	PASS
14	29.87E-3	0.013	0.1	PASS
15	37.37E-3	0.016	0.1	PASS
16	27.95E-3	0.012	0.1	PASS
17	34.79E-3	0.015	0.1	PASS
18	18.66E-3	0.008	0.1	PASS
19	68.82E-3	0.030	0.1	PASS
20	24.83E-3	0.011	0.1	PASS
21	38.84E-3	0.017	0.1	PASS
22	15.35E-3	0.007	0.1	PASS
23	59.46E-3	0.026	0.1	PASS
24	9.54E-3	0.004	0.1	PASS
25	49.89E-3	0.022	0.1	PASS
26	16.36E-3	0.007	0.1	PASS
27	22.92E-3	0.010	0.1	PASS
28	11.23E-3	0.005	0.1	PASS
29	58.72E-3	0.026	0.1	PASS
30	16.71E-3	0.007	0.1	PASS
31	7.40E-3	0.003	0.1	PASS
32	13.13E-3	0.006	0.1	PASS
33	30.85E-3	0.013	0.1	PASS
34	8.80E-3	0.004	0.1	PASS
35	38.98E-3	0.017	0.1	PASS
36	10.87E-3	0.005	0.1	PASS
37	7.68E-3	0.003	0.1	PASS
38	10.87E-3	0.005	0.1	PASS
39	61.21E-3	0.027	0.1	PASS
40	10.42E-3	0.005	0.1	PASS

5.6 Voltage changes, Voltage fluctuations and Flicker

5.6.1 Operating environment

- Temperature: 19.0 °C
- Humidity : 32.0 % 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: ± 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
☒	DPA500N	EM Test	Digital Power Analyzer	V0937105136	Jan 19, 2017
☒	ACS500N	EM Test	Universal Power Analyzer	V0937105137	N/A
☒	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 : February 22, 2017
- Test result : Pass

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



Tested by: Dongsu Jin / Manager

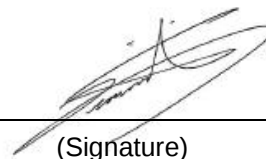
Test Report

Report title:	RAPA17-O-005
Company Name:	EMTEST AG
Date of test:	9:16 22.Feb 2017
Tester:	dsjin
Short time (Pst):	10 min
Observation time:	120 min (12 Flicker measurements)
Flickermeter:	230V / 50Hz
Flicker Impedance:	Zref (IEC 60725)
Customer:	Comfile Technology Inc.
E. U. T.:	Human Machine Interface Panel
Model Name:	CHA-102WR

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

February 22, 2017

(Date)



(Signature)

Maximum Flicker results

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.284	4.00	PASS
dt [s]	0.000	0.50	PASS

Detail Flicker data

Flicker measurement 1	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.284	4.00	PASS
dt [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 [%]	0.054	4.00	PASS
dt [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 [%]	0.052	4.00	PASS
dt [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 [%]	0.052	4.00	PASS
dt [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 [%]	0.056	4.00	PASS
dt [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 [%]	0.058	4.00	PASS
dt [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 [%]	0.058	4.00	PASS
dt [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 [%]	0.054	4.00	PASS
dt [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 [%]	0.056	4.00	PASS
dt [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 [%]	0.056	4.00	PASS
dt [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 [%]	0.058	4.00	PASS
dt [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 : February 16, 2017

Here, S121 = Shield room number

6.1.1 Operating environment

Item	Measured	Recommended
Ambient temperature	19.5 °C	15 °C ~ 35 °C
Relative humidity	33.5 % R.H.	30 % R.H ~ 60 % R.H
Atmospheric pressure	102.0 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
☒	ESS-2000	NOISEKEN	ESD Simulator	ESS0308043	Feb. 02, 2017
☒	TC-815P	NOISEKEN	ESD Gun	ESS0120522	Feb. 02, 2017

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

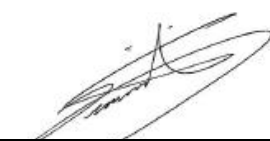
6.1.5 Test data

- 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
- 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).

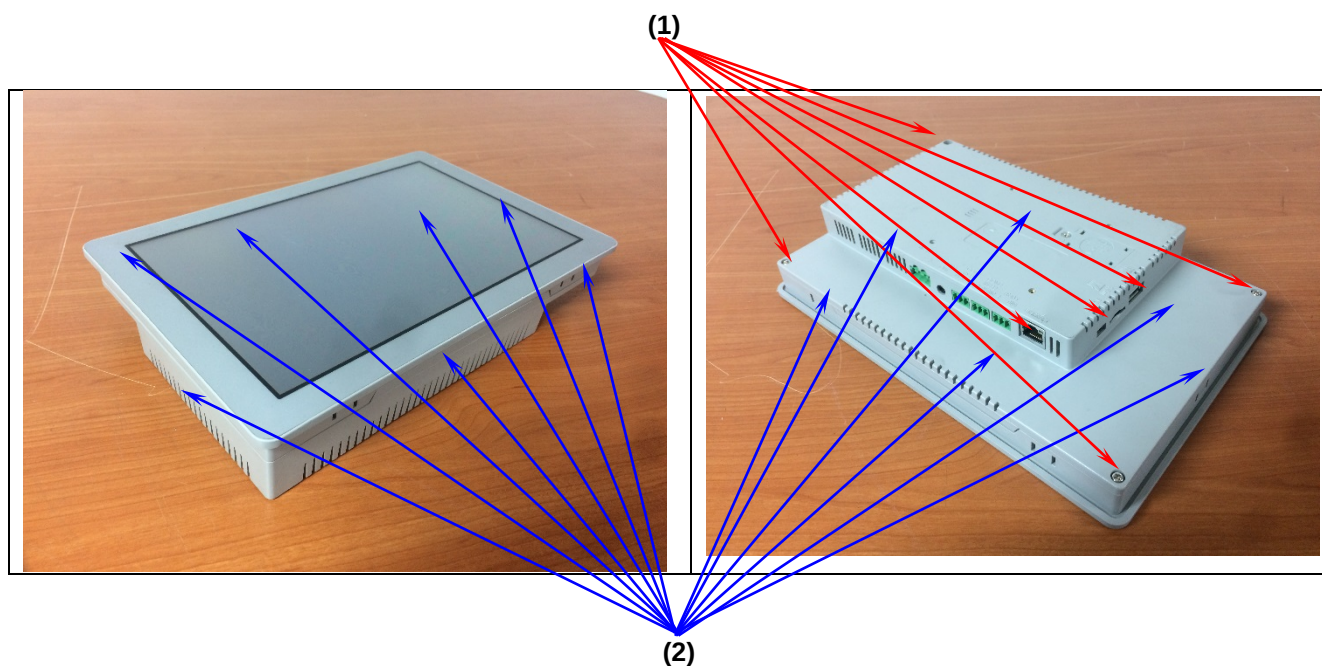
The results of selected test points of the EUT are listed in the below table.

Point		Test level [± kV]	Pass / Fail	Description
(1)	Ports(USB, LAN)	4 (Contact)	Pass	There was no deviation from normal operation condition.
(1)	Screws	4 (Contact)	Pass	
(2)	Nonmetal Frame, LCD Panel	2 / 4 / 8 (Air)	Pass	
(2)	Port(Audio 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, LAN)	4 (Contact)	Criterion B
(1)	Screws	4 (Contact)	Criterion A
(2)	Nonmetal Frame, LCD Panel	2 / 4 / 8 (Air)	Criterion A
(2)	Port(Audio 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 : March 04, 2017

Here, S111 = Anechoic Chamber number

6.2.1 Operating environment

- Ambient temperature : 21.0 °C
- Humidity : 35.0 % R.H.
- Atmospheric pressure : 102.0 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
☒	IMS	KTI	Integrated measurement system for EMS	-	-
☒	E4432B	Agilent	ESG-D Series signal generator	MY43350147	Jan 16, 2017
☒	NRP-Z91	Rohde & Schwarz	Power Sensor	100882	Aug 22, 2016
☒	NRP-Z91	Rohde & Schwarz	Power Sensor	100883	Aug 22, 2016
☒	ITRS-0830K	Infinitech	Power Amplifier	-	Jan 17, 2017
☒	STLP9128D	Schwarzbeck	Log Periodic Dipole Antenna	9128D015	-

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

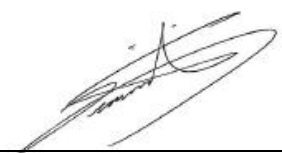
6.2.5 Test data

- Test level : 3 V/m (AM 80 %, 1 kHz)
- Frequency range : 80 MHz ~ 1 000 MHz
(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 : February 20, 2017

6.3.1 Operating environment

- Ambient temperature : 19.5 °C
- Humidity : 36.0 % R.H.
- Atmospheric pressure : 102.0 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
☒	UCS 500N7	EM Test	Ultra Compact Generator	V937105138	Aug 23, 2016
☒	HFK	EM Test	Capacitive Coupling Clamp	0709-26	Jan. 16, 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.

6.3.5 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 (L1)	CDN	1.0	Pass	There was no deviation from normal operation condition.
AC mains (N)	CDN	1.0	Pass	
AC mains (L1+N)	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 : February 20, 2017

6.4.1 Operating environment

- Ambient temperature : 20.0 °C
- Humidity : 36.5 % R.H.
- Atmospheric pressure : 101.9 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 23, 2016
☒	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)
- 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.

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 : March 03, 2017

6.5.1 Operating environment

- Ambient temperature : 19.0 °C
- Humidity : 33.5 % R.H.
- Atmospheric pressure : 102.0 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	P1532162360	Jun 09, 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.

6.5.5 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 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)	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 : February 20, 2017

6.6.1 Operating environment

- Ambient temperature : 20.0 °C
- Humidity : 36.0 % R.H.
- Atmospheric pressure : 101.9 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 23, 2016
☒	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
- Monitoring of the EUT : EUT was under the normal operating mode continuously during the test
- Test mode : AC 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.

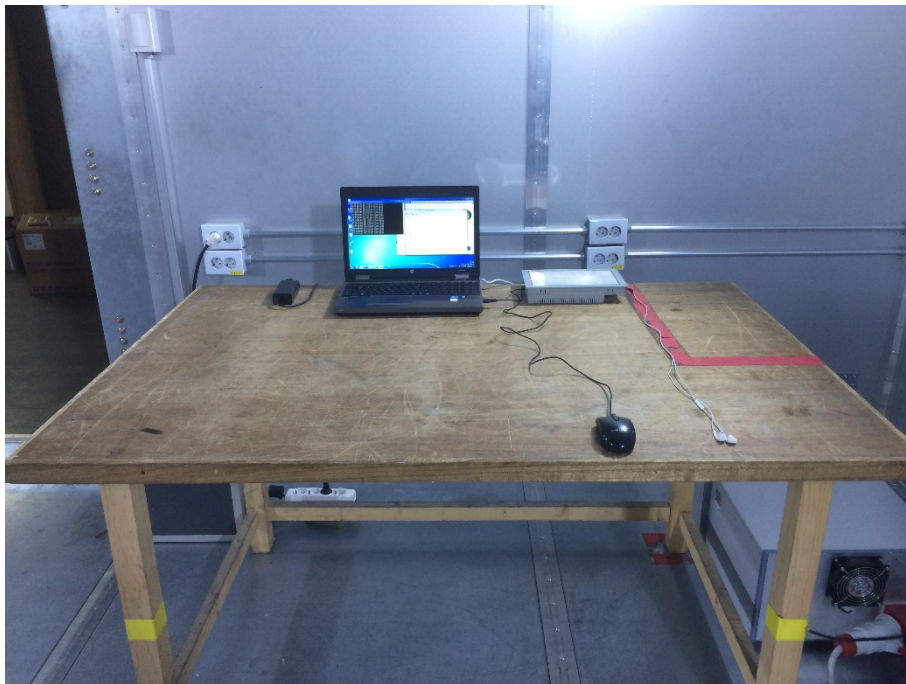
B = Temporary degradation or loss of function or performance which is self-recoverable.

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

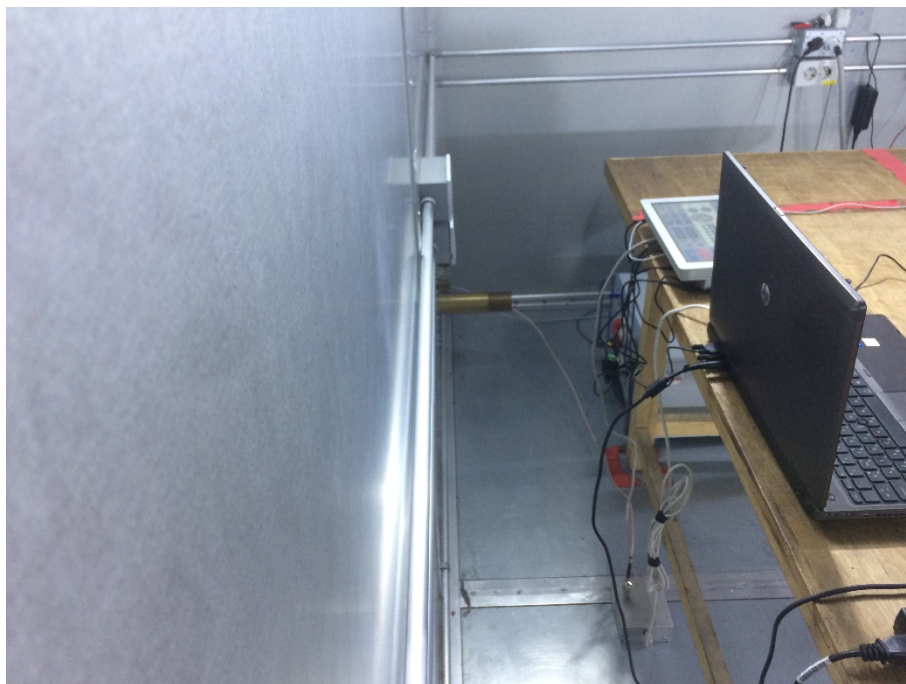
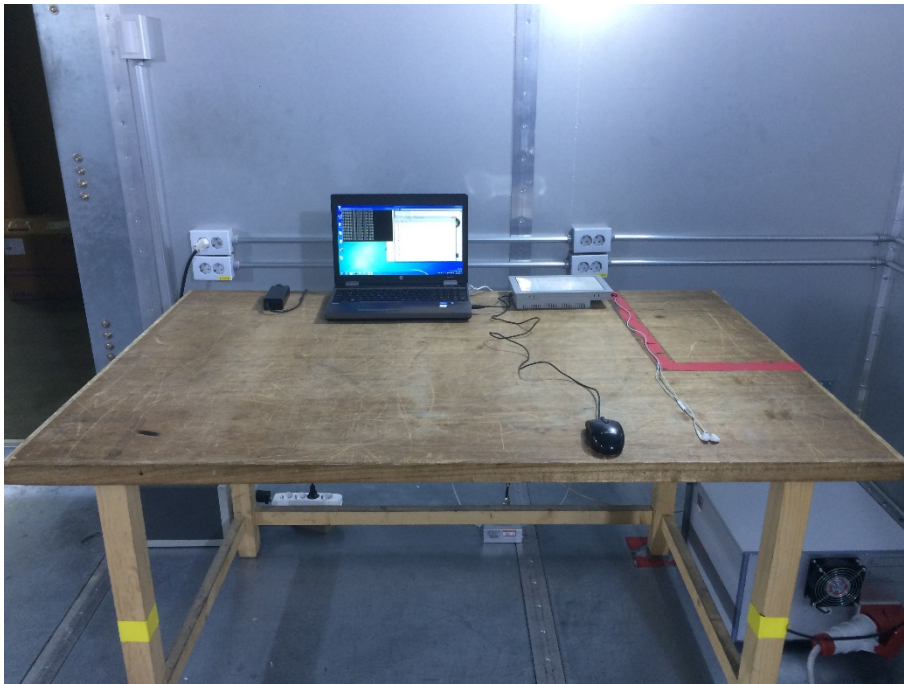


Tested by: Dongsu Jin / Manager

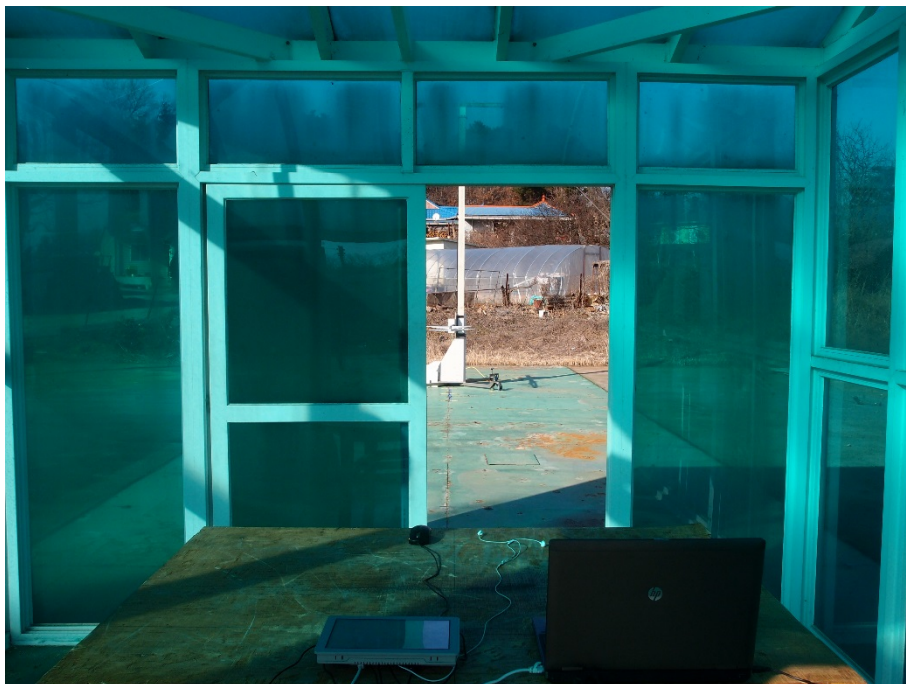
APPENDIX I - TEST SET-UP PHOTOS: Mains terminal disturbance voltage



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



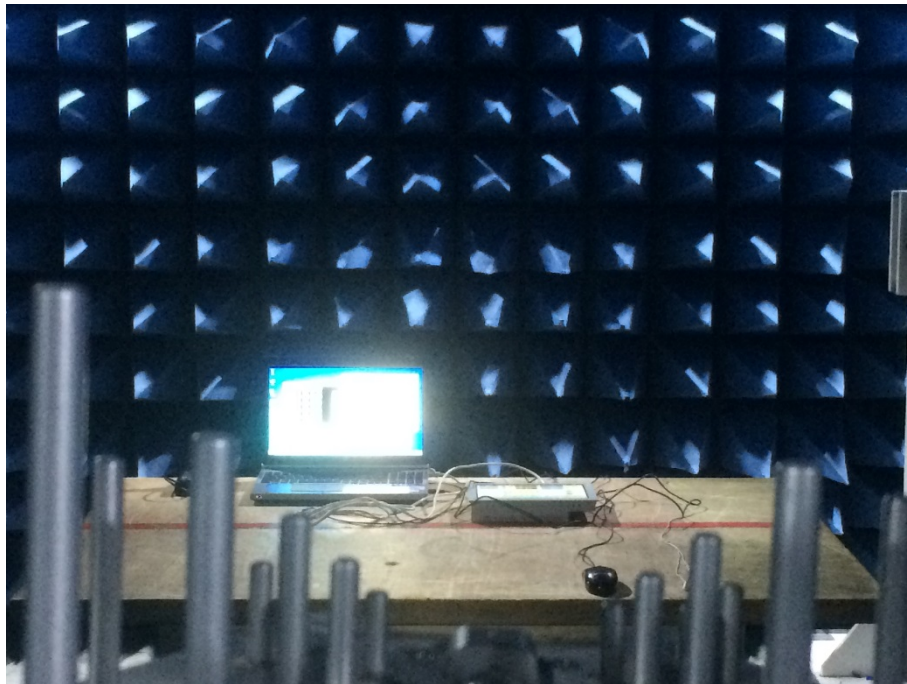
APPENDIX VI - TEST SET-UP PHOTO: Voltage changes, Voltage fluctuations and Flicker



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



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



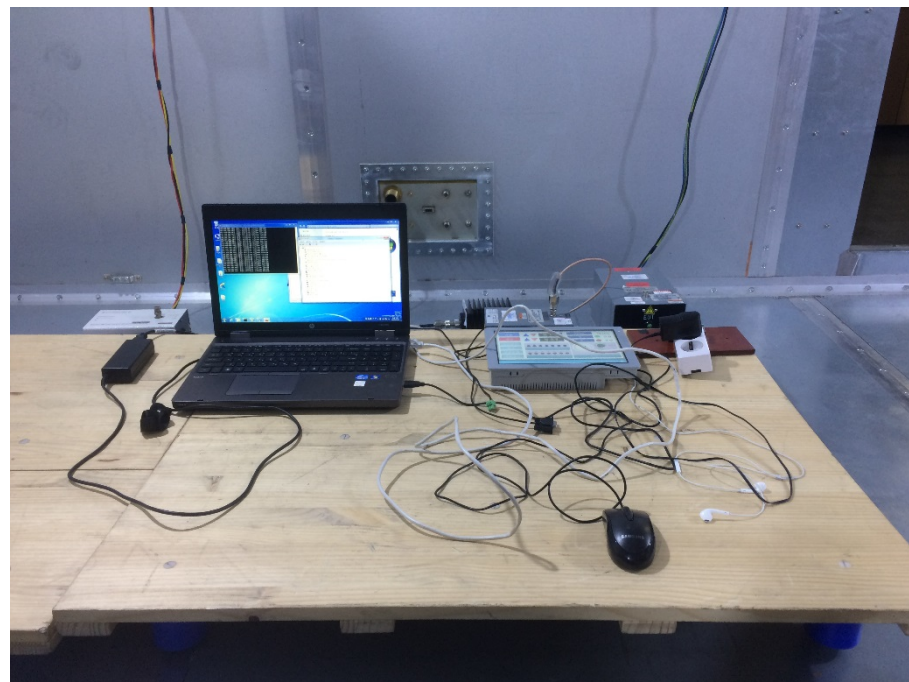
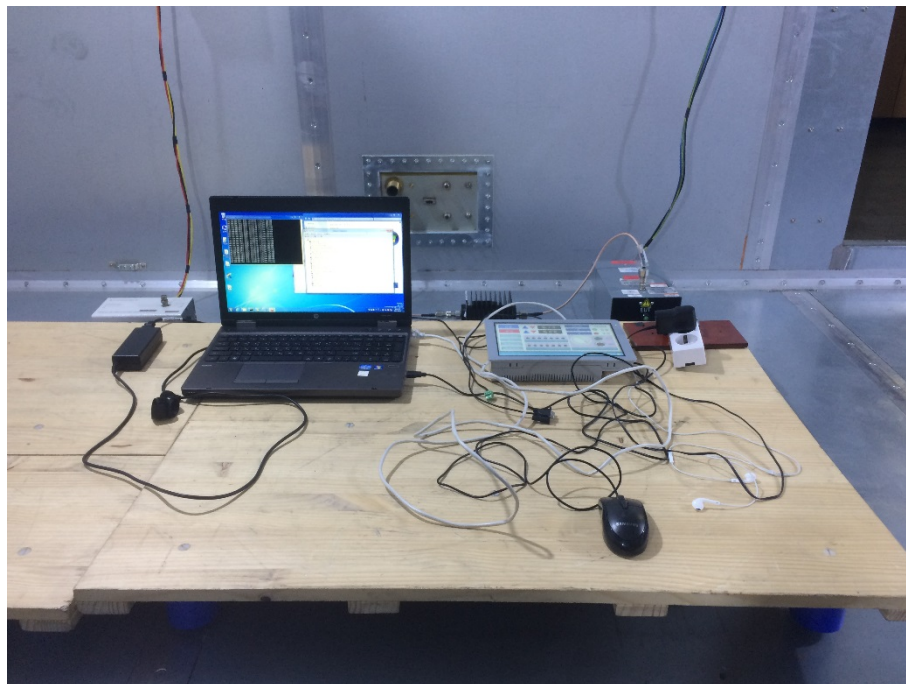
APPENDIX IX - TEST SET-UP PHOTO: Electrical fast transient/burst immunity



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



APPENDIX XIII – PHOTOGRAPHS: Internal and External appearances

