ELECTROMAGNETIC COMPATIBILITY TEST REPORT

Test Report No.		RAPA20-O-002
Applicant	Name	Comfile Technology Inc.
	Address	104-5, Guro5-dong, Guro-gu, Seou, Korea
Manufacturer	Name	Comfile Technology Inc.
	Address	104-5, Guro5-dong, Guro-gu, Seoul, Korea
Type of Equipment		Touch Display Controller
Model Name		CHC-070WR
Multi Model Name		N/A
Serial number		N/A
Total page of Report		40 pages (including this page)
Test period		Jan. 09, 2020 – Jan 22, 2020
Issuing date of report		Jan 30, 2020

SUMMARY

The equipment complies with the standards; EN 55032:2015, EN 55035:2017, 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 : 
Dong-su, Jin / Manager
TCL of RAPA.

Reviewed by : 
Gunil-Shin / Executive Managing Director
TCL of RAPA.

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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		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 55032:2015	Main Terminal Continuous Disturbance Voltage	N/A (See Note 1)
	Conducted common mode disturbance at TEL ports	Met / PASS
	Radiated Emission (Below 1 GHz)	Met / PASS
	Radiated Emission (Above 1 GHz)	Met / PASS
EN 61000-3-2:2014	Harmonic Current Emission	N/A (See Note 1)
EN 61000-3-3:2013	Voltage Change, Voltage fluctuations and Flicker	N/A (See Note 1)
EN 55035:2017	Electrostatic discharge immunity	Met / PASS
	Radio frequency electromagnetic fields immunity	Met / PASS
	Electrical fast transient/burst immunity	Met / PASS
	Surge immunity	N/A (See Note 6)
	Conducted disturbance induced by RF fields immunity	Met / PASS
	Power frequency magnetic field immunity	N/A (See Note 4)
	Voltage Dips and Short interruptions immunity	N/A (See Note 1)

NOTE 1: The equipment uses DC power so this test was not executed.
NOTE 2: The equipment under test was not on the cable lengths more than 3.0 m, so this test was not executed.
NOTE 3: This test is not performed because the EUT operating frequency is less than 108 MHz.
NOTE 4: The equipment under test was not susceptible to magnetic fields, so this test was not executed.
NOTE 5: The equipment under test was not on the manufacturer's support cable lengths more than 3.0 m, so this test was not executed.
NOTE 6: The equipment under test is excluded from the test item because it does not have ports that can be connected directly to outdoor cables and there is no cable longer than 3 m in length according to the manufacturer's specifications.

2.2 Additions, deviations, exclusions from standards

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

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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	The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment 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 equipment if used as intended.
B	During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test. After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment 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), or recovery time, 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 equipment if used as intended.
C	Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

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3. EUT (Equipment Under Test)

3.1 Identification of the EUT

- Equipment : Touch Display Controller
- Model name : CHC-070WR
- 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 CHC-070WR (referred to as the EUT in this report) of Comfile Technology Inc. is Touch Display Controller. Product specification described herein was obtained from product data sheet or user's manual.

Item	Description
MCU	32Bit RISC CPU(Cortex-A9 Dual, 1000MHz)
Memory	SDRAM : 1024MB eMMC : 4GB
LCD	TFT-LCD(260,000 Color) 7Inch(800x480) 400cd/m2
Backlight	LED Backlight
Ethernet	10/100/1000 M-bits Ethernet (1Port)
Touch	4 wire resistive panel
RTC	Maxim DS3231SN (Battery replaceable)
Audio	<0.8W 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 MicroSD CARD (32GB bytes)
Input Power	DC12V
Power Consumption	< 6.6W (0.55A@12V)
MAX. Current	550mA
Dimension (mm)	124(H)x187(V)x45(D)
Weight	447g
Operating Temperature	0℃~70℃

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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
CHC-070WR	Comfile Technology Inc.	Touch Display Controller (EUT)	-
ProBook 6560b	HP	Notebook	EUT
Series PPP012L-E	LITE-ON TECHNOLOGY(CHANGZHOU) CO., LTD	AC Adapter	Notebook
6674A	HP	DC POWER SUPPLY	EUT
solo HD	beats by dr.dre	headphone	EUT
8 GB	N/A	USB Memory	EUT
8 GB	SanDisk	MicroSD Card	EUT

3.4 Mode of operation during the test

The EUT has maintained normal operation and full loaded mode under the condition of Serial, ETHERNET, USB Communication during the test and EUT Input power was 24 Vdc (through DC Power Supply) during the test.

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.

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3.6 EUT cable description

Port Name		Shielded	Ferrite Bead	Length (m)	Connected to
Touch Display Controller (EUT)	DC Input	No	No	2.5	DC POWER SUPPLY
	SOUND OUT	No	No	1.5	headphone
	COM1 RS232	No	No	1.2	Notebook
	COM2 RS232	No	No	1.2	LINE
	RS485	No	No	1.2	LINE
	ETHERNET (RJ-45)	No	No	3.0	Notebook
	USB DEVICE	Yes	No	1.5	Notebook
	MicroSD	No	No	Direct	MicroSD Card
	USB HOST	No	No	Direct	USB Memory
Notebook	DC Input	No	Yes	2.4	AC Adapter
	Serial	No	No	1.2	EUT
	LAN(RJ-45)	No	No	3.0	EUT
	USB	Yes	No	1.5	EUT
DC Power Supply	DC Output	No	No	2.5	EUT
	AC Input	No	No	1.8	AC Mains

4. EUT MODIFICATIONS

▪ None

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5. EMISSION TESTS

5.1 Conducted common mode disturbance at telecommunication ports

5.1.1 Operating environment

▪ Temperature: 20.0 °C
▪ Humidity : 41.0 % R.H.

5.1.2 Test set-up

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

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

5.1.3 Measurement uncertainty

▪ Conducted emission, Quasi-peak detection: ±3.36 dB
▪ Conducted emission, CISPR-Average detection: ±3.39 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. 15, 2019
☒	ESH3-Z2	Rohde & Schwarz	Pulse Limiter	101631	Jan. 14, 2019
☒	ENV216	Rohde & Schwarz	LISN	101264	Aug. 07, 2019
☒	3825/2	EMCO	LISN	9004-1635	Aug. 22, 2019
☒	CAT3 8158	Schwarzbeck	ISN	8158-0031	Jan. 15, 2019
☒	CAT5 8158	Schwarzbeck	ISN	8158-0047	Jan. 15, 2019
☒	NTFM 8158	Schwarzbeck	ISN	8158-0035	Jan. 15, 2019
☒	ES-SCAN	Rohde & Schwarz	EMI Software	N/A	N/A

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

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5.2.5 Test data

- Test date : Jan 09, 2020
- 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)
0.18	Four	42.78	95.39	52.61	22.27	82.39	60.12
0.53	Four	64.51	87.00	22.49	64.82	74.00	9.18
3.29	Four	54.87	87.00	32.13	42.98	74.00	31.02
6.26	Four	53.09	87.00	33.91	43.64	74.00	30.36
17.83	Four	56.24	87.00	30.76	36.31	74.00	37.69
26.01	Four	58.29	87.00	28.71	33.30	74.00	40.70

- 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)
0.26	Four	49.97	92.37	42.40	42.55	79.37	36.82
0.53	Four	68.05	87.00	18.95	68.03	74.00	5.97
2.72	Four	59.34	87.00	27.66	47.61	74.00	26.39
3.25	Four	58.31	87.00	28.69	47.58	74.00	26.42
6.30	Four	54.30	87.00	32.70	43.93	74.00	30.07
8.52	Four	53.63	87.00	33.37	43.94	74.00	30.06

- 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)
0.15	Four	31.52	96.78	65.26	22.94	83.78	60.84
0.53	Four	64.08	87.00	22.92	64.37	74.00	9.63
2.91	Four	56.35	87.00	30.65	44.66	74.00	29.34
3.20	Four	55.68	87.00	31.32	45.38	74.00	28.62
6.45	Four	52.62	87.00	34.38	43.40	74.00	30.60
8.50	Four	52.24	87.00	34.76	44.07	74.00	29.93

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

This test is not executed because this EUT doesn't have Ethernet port.

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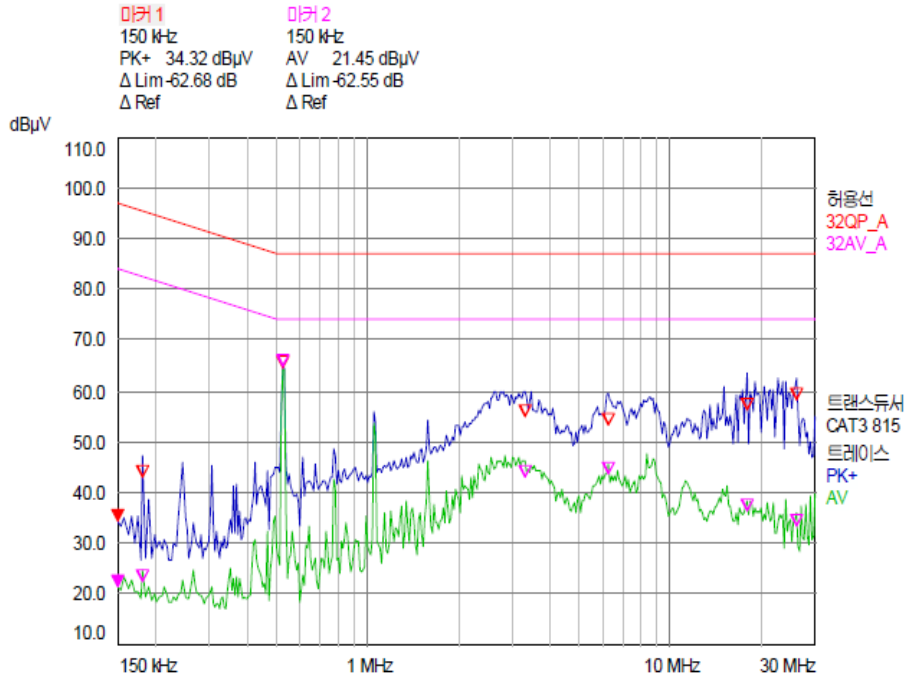
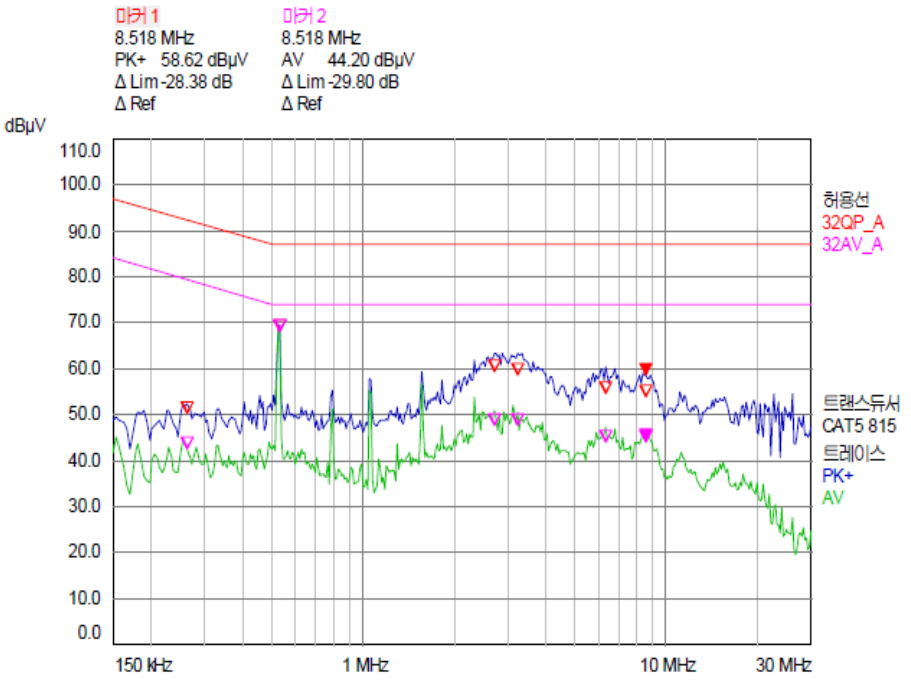
▪ Plots



10 Mbps



100 Mbps

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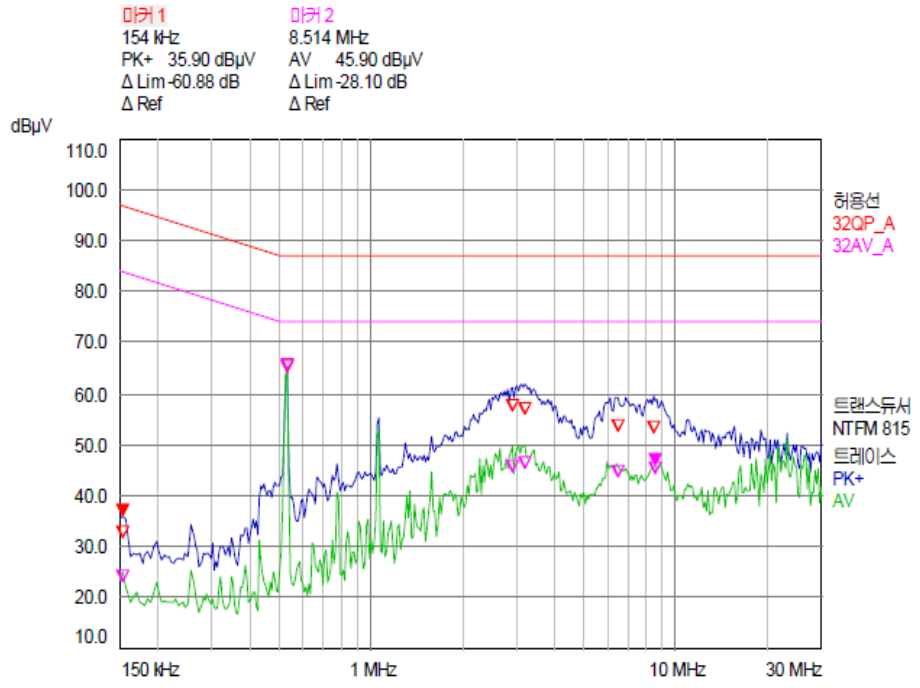

1 000 Mbps

Tested by: Dongsu Jin / Manager

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5.2 Radiated electromagnetic field (Below 1 GHz)

5.2.1 Operating environment

- Temperature : 15.8 °C
- Humidity : 36.9 % R.H.

5.2.2 Test set-up

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

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

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

5.2.3 Measurement uncertainty

- Radiated emission electric field intensity in the range of 30 MHz ~ 1 000 MHz, Quasi-peak detection: Horizontal ±5.61 dB, Vertical ±5.64 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
☒	ESS	Rohde & Schwarz	EMI Test Receiver	833776/011	Aug. 06, 2019
☒	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	Jan. 03, 2020
☒	VULP9118A	Schwarzbeck	Log Periodic Antenna	382	Jan. 03, 2020
☒	SCU 01	Rohde & Schwarz	Pre-AMP	10020	Jan. 14, 2020

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

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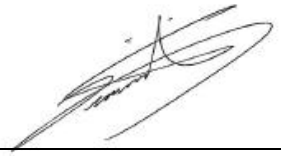
5.2.5 Test data

- Test date : Jan. 22, 2020
- 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)	CL+AG (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
34.92	46.80	V	1.30	180.00	16.91	-31.63	32.08	40.00	-7.92
61.32	54.50	V	1.10	190.00	8.01	-31.60	30.91	40.00	-9.09
67.65	56.90	V	1.40	190.00	6.98	-31.64	32.24	40.00	-7.76
168.75	48.70	H	3.10	20.00	15.68	-31.49	32.89	40.00	-7.11
371.24	52.30	V	2.00	250.00	14.98	-30.50	36.78	47.00	-10.22
375.00	48.60	V	1.90	240.00	15.07	-30.48	33.19	47.00	-13.81

Tabulated test data for Radiated Electromagnetic Field

Here, H = Horizontal, V = Vertical, CL = Cable loss, AG = AMP gain



Tested by: Dongsu Jin / Manager

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5.3 Radiated electromagnetic field (Above 1 GHz)

5.3.1 Operating environment

▪ Temperature: 18.2 °C
▪ Humidity : 38.7 % R.H.

5.3.2 Test set-up

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

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

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

5.3.3 Measurement uncertainty

▪ Radiated emission electric field intensity in the range of 1 000 MHz ~ 6 000 MHz, peak detection: ±5.68 dB
▪ Radiated emission electric field intensity in the range of 1 000 MHz ~ 6 000 MHz, CISPR-average: ±5.68 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. 13, 2019
☒	ALL1.5TT	Airlink Lab.	Turn Table(#1)	N/A	N/A
☒	ALL2.2MA	Airlink Lab.	Antenna Mast(#1)	N/A	N/A
☒	ALL-TC-V1.0	Airlink Lab.	Controller(#1)	N/A	N/A
☒	AMP 1000-6000	Infinitech	Broadband Pre-AMP	2013 05 00001/1	Jan. 14, 2020
☒	3115	EMCO	Horn Antenna	9402-4229	Jul. 13, 2018
☒	RE32_V1_5	Airlink Lab.	RE Test System	N/A	N/A

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

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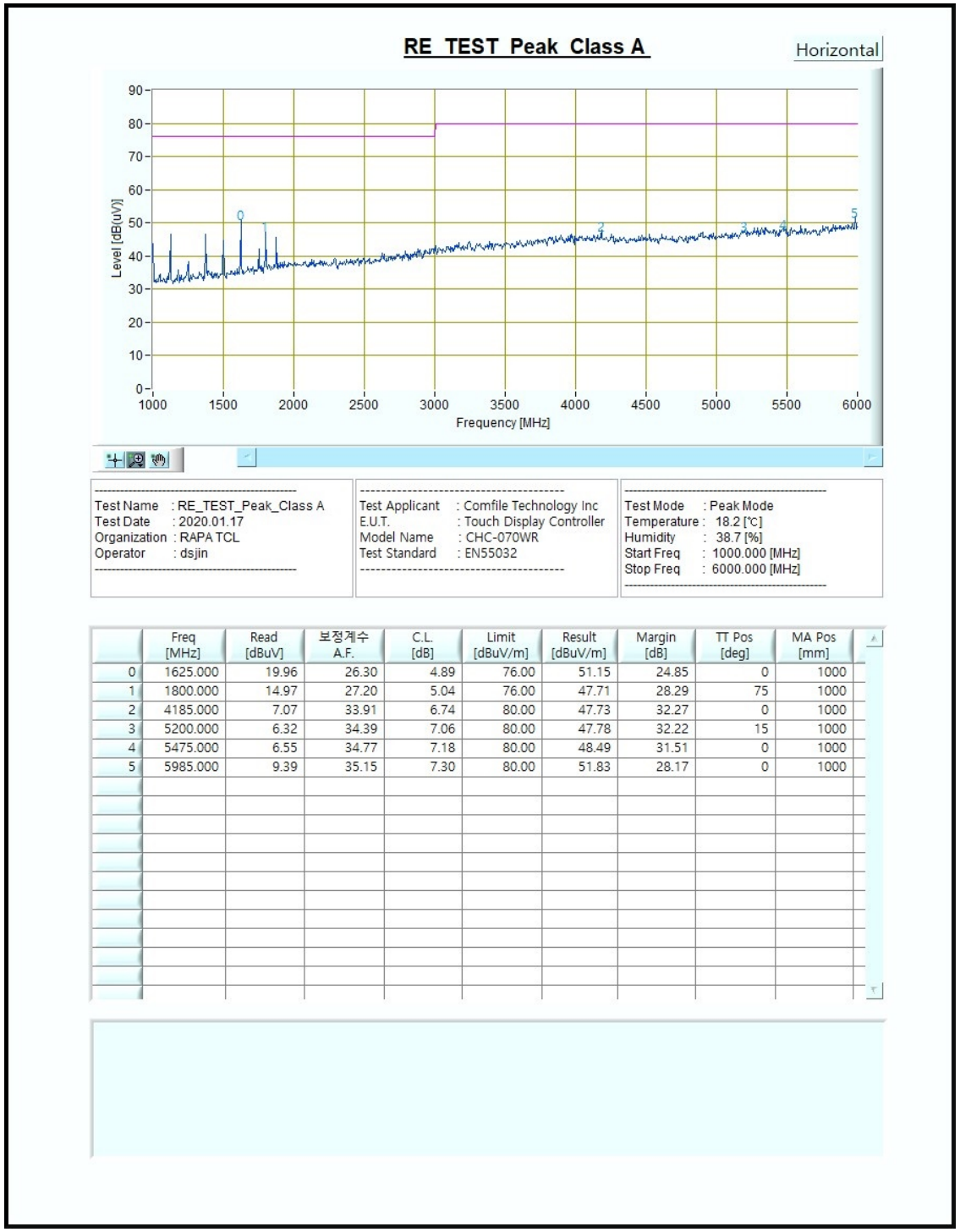
5.4.5 Test data

- Test date : Jan. 17, 2020
- Resolution bandwidth : 1 MHz
- Frequency range : 1 000 MHz ~ 6 000 MHz
- Measurement distance : 3 meter

▪ Test mode: Peak_Horizontal



	Freq [MHz]	Read [dBuV]	보정계수 A.F.	C.L. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]	TT Pos [deg]	MA Pos [mm]
0	1625.000	19.96	26.30	4.89	76.00	51.15	24.85	0	1000
1	1800.000	14.97	27.20	5.04	76.00	47.71	28.29	75	1000
2	4185.000	7.07	33.91	6.74	80.00	47.73	32.27	0	1000
3	5200.000	6.32	34.39	7.06	80.00	47.78	32.22	15	1000
4	5475.000	6.55	34.77	7.18	80.00	48.49	31.51	0	1000
5	5985.000	9.39	35.15	7.30	80.00	51.83	28.17	0	1000

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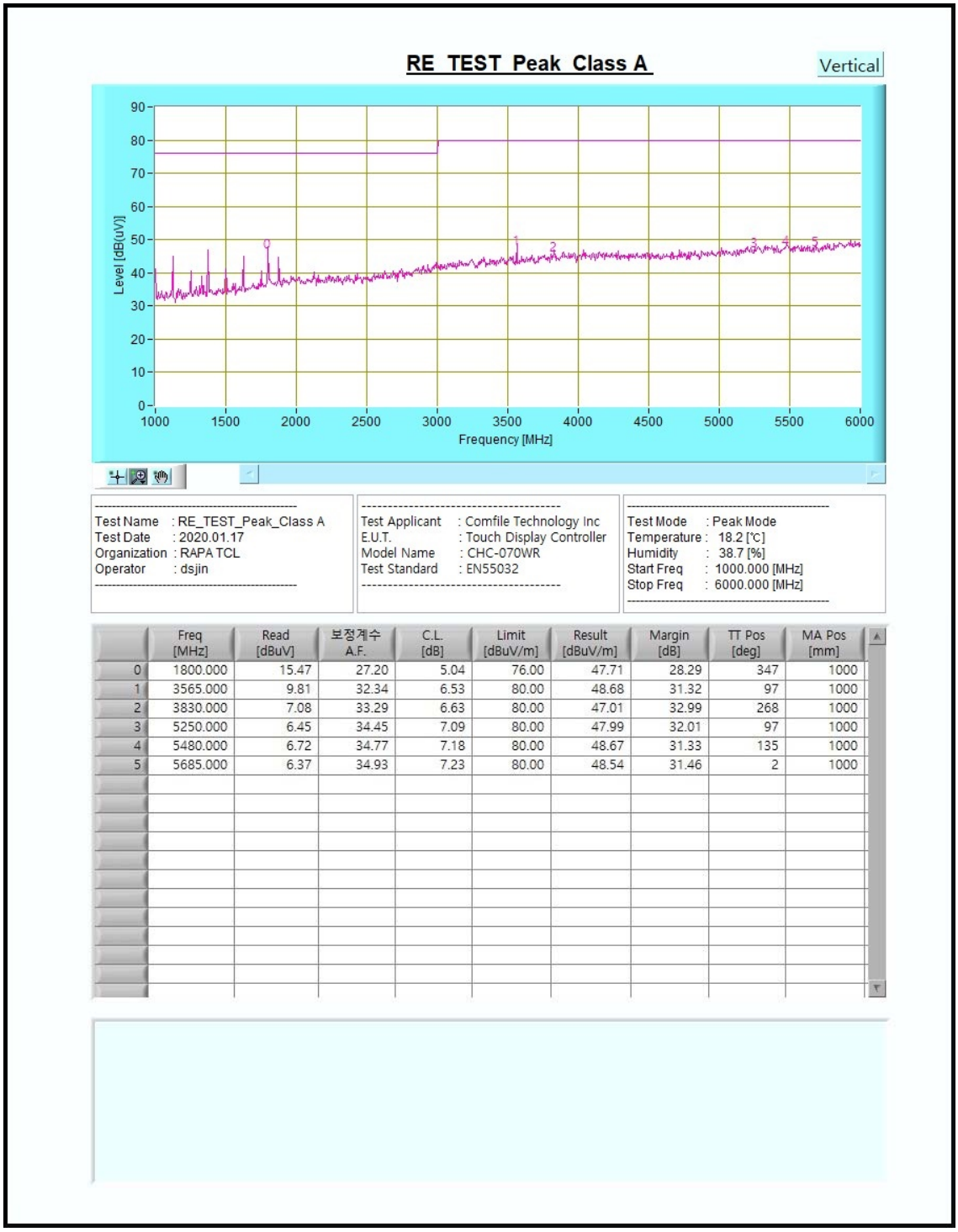
▪ **Test mode: Peak_Vertical**



	Freq [MHz]	Read [dBuV]	보정계수 A.F.	C.L. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]	TT Pos [deg]	MA Pos [mm]
0	1800.000	15.47	27.20	5.04	76.00	47.71	28.29	347	1000
1	3565.000	9.81	32.34	6.53	80.00	48.68	31.32	97	1000
2	3830.000	7.08	33.29	6.63	80.00	47.01	32.99	268	1000
3	5250.000	6.45	34.45	7.09	80.00	47.99	32.01	97	1000
4	5480.000	6.72	34.77	7.18	80.00	48.67	31.33	135	1000
5	5685.000	6.37	34.93	7.23	80.00	48.54	31.46	2	1000

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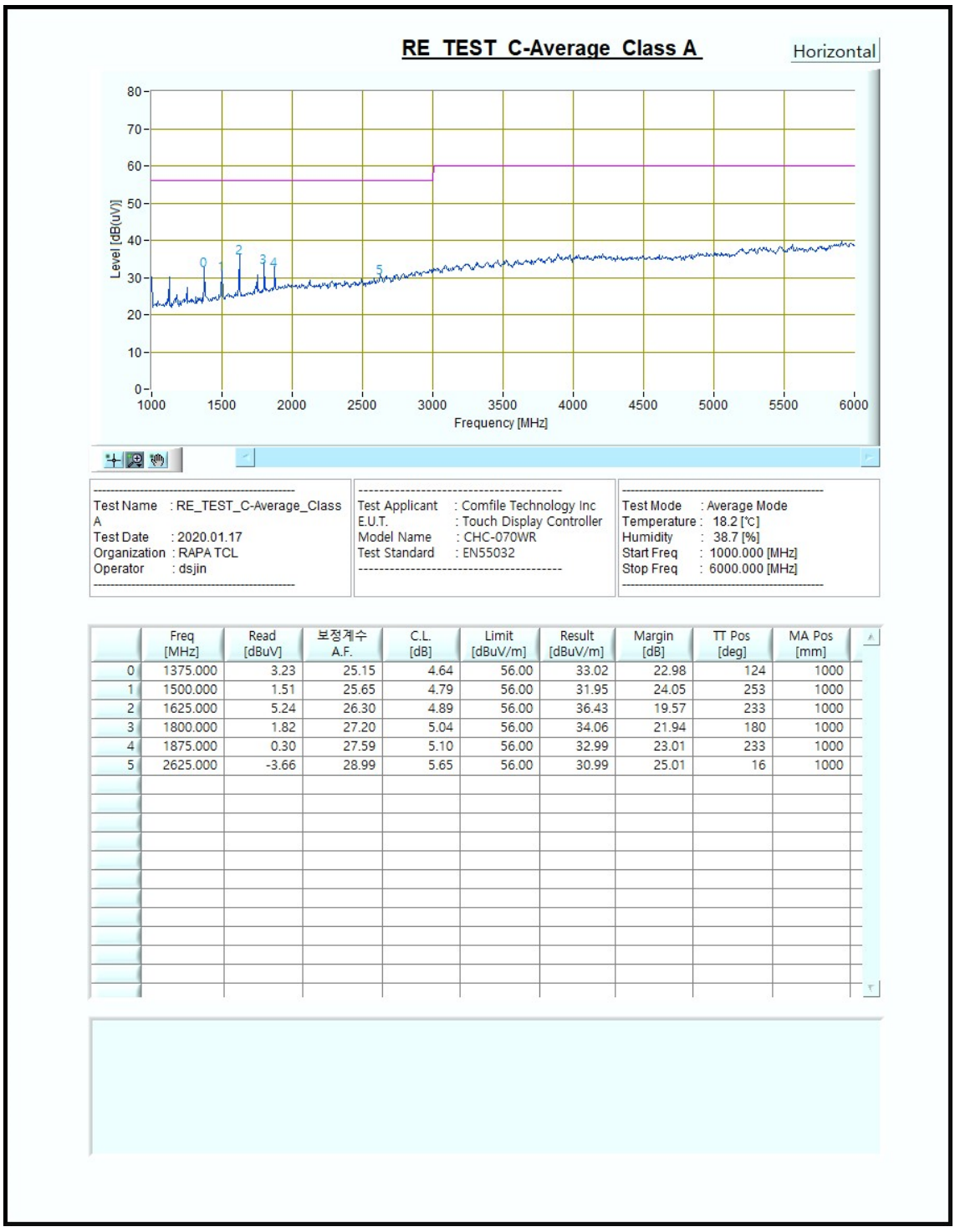
▪ **Test mode: Average_Horizontal**



Test Name	: RE_TEST_C-Average_Class A
Test Date	: 2020.01.17
Organization	: RAPA TCL
Operator	: dsjin

Test Applicant	: Comfile Technology Inc
E.U.T.	: Touch Display Controller
Model Name	: CHC-070WR
Test Standard	: EN55032

Test Mode	: Average Mode
Temperature	: 18.2 [℃]
Humidity	: 38.7 [%]
Start Freq	: 1000.000 [MHz]
Stop Freq	: 6000.000 [MHz]

	Freq [MHz]	Read [dBuV]	보정계수 A.F.	C.L. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]	TT Pos [deg]	MA Pos [mm]
0	1375.000	3.23	25.15	4.64	56.00	33.02	22.98	124	1000
1	1500.000	1.51	25.65	4.79	56.00	31.95	24.05	253	1000
2	1625.000	5.24	26.30	4.89	56.00	36.43	19.57	233	1000
3	1800.000	1.82	27.20	5.04	56.00	34.06	21.94	180	1000
4	1875.000	0.30	27.59	5.10	56.00	32.99	23.01	233	1000
5	2625.000	-3.66	28.99	5.65	56.00	30.99	25.01	16	1000

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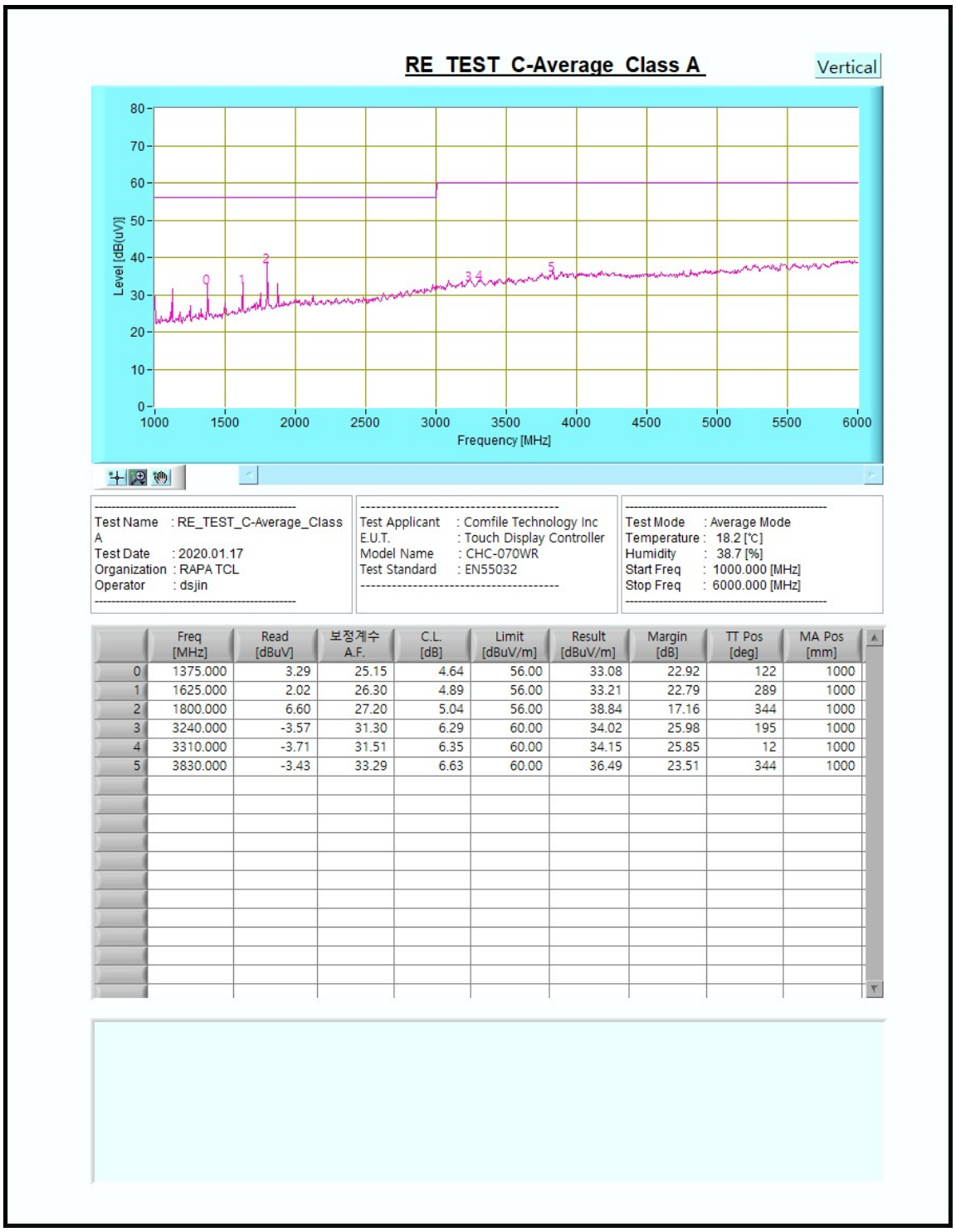
▪ **Test mode: Average_Vertical**



	Freq [MHz]	Read [dBuV]	보정계수 A.F.	C.L. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]	TT Pos [deg]	MA Pos [mm]
0	1375.000	3.29	25.15	4.64	56.00	33.08	22.92	122	1000
1	1625.000	2.02	26.30	4.89	56.00	33.21	22.79	289	1000
2	1800.000	6.60	27.20	5.04	56.00	38.84	17.16	344	1000
3	3240.000	-3.57	31.30	6.29	60.00	34.02	25.98	195	1000
4	3310.000	-3.71	31.51	6.35	60.00	34.15	25.85	12	1000
5	3830.000	-3.43	33.29	6.63	60.00	36.49	23.51	344	1000

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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 : Jan. 11, 2020

Here, S121 = Shield room number

6.1.1 Operating environment

Item	Measured	Recommended
Ambient temperature	19.0 ºC	15 ºC ~ 35 ºC
Humidity	42.0 % R.H.	30 % R.H ~ 60 % R.H
Atmospheric pressure	102.2 kPa	86.0 kPa ~ 106.0 kPa

6.1.2 Test set-up

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

The test set-up photo is included in appendix IV

6.1.3 Measurement uncertainty

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

6.1.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	ESS-2000	NOISEKEN	ESD Simulator	ESS0308043	Jan. 18, 2019
☒	TC-815P	NOISEKEN	ESD Gun	ESS0120522	Jan. 18, 2019

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

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6.1.5 Test data

- Test levels : Contact discharge 4 kV, Air discharge 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
- Performance criterion required : B
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was in normal operating mode during the test.

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)	Screws, Ethernet(RJ-45) Port	4 (Contact)	Pass	There was no deviation from normal operation condition.
(2)	Frame(Non-Metal), Ports, LCD	2,4,8 (Air)	Pass	
HCP / VCP		HCP / VCP	Pass	

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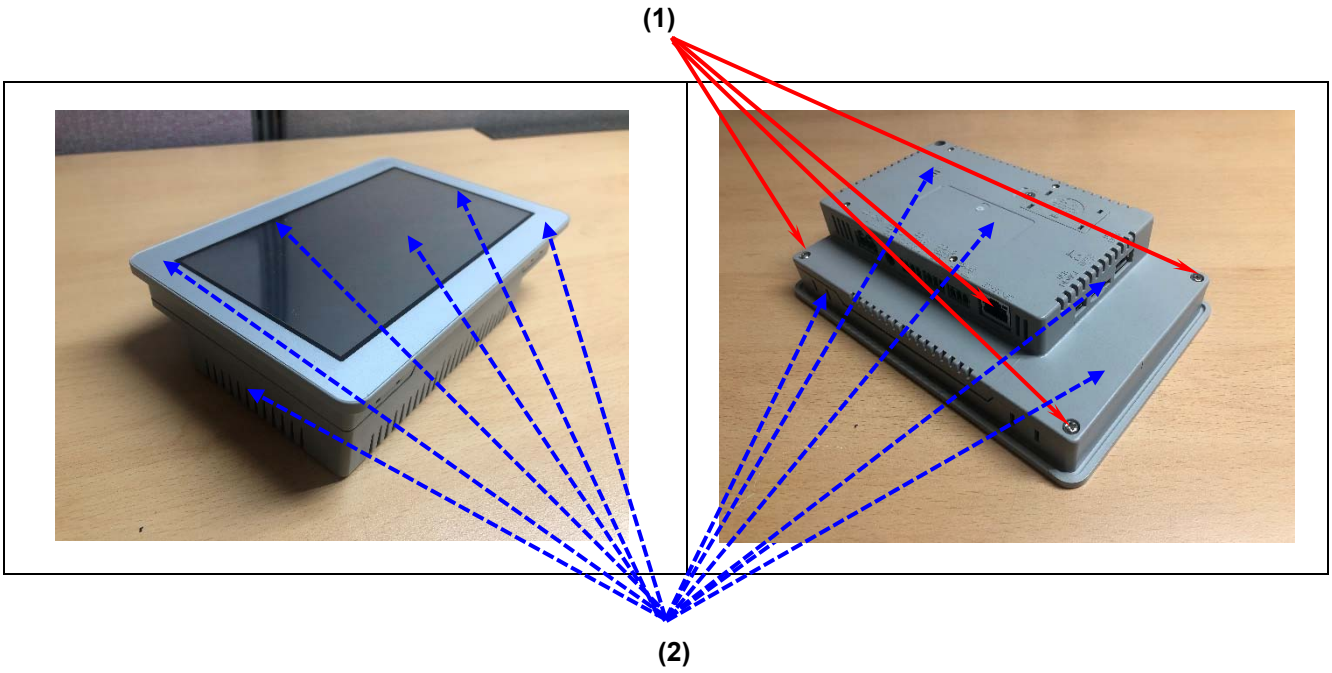
6.1.6 ESD Test point table

ESD Point		Discharge voltage [± kV]	Results
(1)	Screws, Ethernet	4 (Contact)	Criterion A
(2)	Frame(Non-Metal), Ports, LCD	2,4,8 (Air)	Criterion A
HCP / VCP		4 (Contact)	Criterion A



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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 (S112)
- Date : Jan 10, 2020

Here, S112 = Anechoic Chamber number

6.2.1 Operating environment

- Ambient temperature : 16.4 °C
- Humidity : 41.9 % 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 V.

6.2.3 Measurement uncertainty

- The measurement uncertainty: ±2.19 V/m for 1 V/m, 3 V/m, 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
☒	SMP 02	Rohde&Schwarz	Signal Generator	841571/009	Jan.15 2019
☒	E4417A	Agilent	EPM-P series Power Meter	GB41050440	Jan.14 2019
☒	E9301A	Agilent	Power Sensor	US39212227	Jan.14 2019
☒	E9301A	Agilent	Power Sensor	US39212310	Jan.14 2019
☒	ITRS-0830K	Infinitech	Power Amplifier	-	Jan.14 2019
☒	ITA-4500KL-50	Infinitech	High Power Amplifier	4500KL-19020001	N/A
☒	STLP9128D	Schwarzbeck	Log Periodic Dipole Antenna	9128D015	N/A
☒	3115	EMCO	Horn Antenna	9402-4229	Jul.13 2019
☒	TST-1000	TESTEK	Sound Acoustic Tester	150043	Aug.06.2019
☒	TIB-R1	TESTEK	Impedance Box	150030	Aug.07.2019
☒	ITRS-086KM2	KTI	IMS	N/A	N/A

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

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6.2.5 Test data

- Test level : 3 V/m (AM 80 %, 1 kHz)
- Frequency range : 80 MHz ~ 1 000 MHz, 1.8 GHz, 2.6 GHz, 3.5 GHz, 5.0 GHz (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
- Performance criterion required : A
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was in normal operating mode during the test.

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

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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 : Jan. 11, 2020

6.3.1 Operating environment

- Ambient temperature : 19.0 ºC
- Humidity : 42.0 % R.H.
- Atmospheric pressure : 102.2 kPa

6.3.2 Test set-up

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

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

6.3.3 Measurement uncertainty

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

6.3.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	UCS 500N7	EM Test	Ultra Compact Generator	V937105138	Aug. 06, 2019
☒	HFK	EM Test	Capacitive Coupling Clamp	0709-26	Jan. 14, 2019
☒	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.

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6.3.5 Test data

- Test level : 0.5 kV (DC mains), 0.5 kV (Signal Cable >3 m)
- Burst frequency : 5 kHz
- Polarity : Positive / Negative
- Coupling methods : DC mains – Coupling Decoupling Network (CDN), Signal Cable (LAN)
- Lines for test : DC mains of the EUT
- Type of line and length : Unshielded 0.5 ±0.05 m DC mains, , Unshielded > 3.0 m Signal Cables
- The EUT-position : Table Top
- Performance criterion required : B
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was in normal operating mode during the test.

The results of test are listed in below table.

Line for test	Coupling Method	Test level [± kV]	Pass / Fail	Description
DC mains (P)	CDN	0.5	Pass	There was no deviation from normal operation condition.
DC mains (N)	CDN	0.5	Pass	
DC mains (P+N)	CDN	0.5	Pass	
Signal Cable (ETHERNET(RJ-45))	CCC	0.5	Pass	

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

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6.4 Conducted disturbance induced by RF fields immunity

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

- Test Location : Shielded Room (S121).
- Date : Jan 11, 2020

6.4.1 Operating environment

- Ambient temperature : 19.5 °C
- Humidity : 41.0 % R.H.
- Atmospheric pressure : 102.2 kPa

6.4.2 Test set-up

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

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

6.4.3 Measurement uncertainty

- The measurement uncertainty: ±1.36 V for 1.0 V, 3.0 V, 18.0 V.

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

6.4.4 Test equipment used

Use	Model Number	Manufacturer	Description	Serial Number	Last Calibration
☒	CWS 500N1	EM Test	Continuous Wave Simulator	V0937105141	Aug.08, 2019
☒	5906 N-50-1	Huber + Suhner	Attenuator 6dB/75W	253452201	Jan.14, 2019
☒	FCC-801-M2/M3-16A	FCC	CDN	091759	Aug.08, 2019
☒	M016	Schaffner	CDN	16678	Aug.08, 2019
☒	TST-1000	TESTEK	Sound Acoustic Tester	150043	Aug.06.2019
☒	TIB-R1	TESTEK	Impedance Box	150030	Aug.07.2019
☒	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.

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6.4.5 Test data

- Test level : 3 V, 3 ~ 1 V, 1 V(AM 80 %, 1 kHz)
- Frequency range : 0.15 MHz ~ 10 MHz, 10 MHz ~ 30 MHz, 30 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 : DC power lines – Coupling Decoupling Network (CDN), Signal/Control lines – Coupling Decoupling Network (CDN)
- Lines for test : DC Mains and Signal line
- Type of line and length : Unshielded (0.1 ~ 0.3) m DC mains, Unshielded > 3.0 m Signal Cable
- EUT-position : Table Top
- Performance criterion required : A
- Test result : Met criterion A
- Monitoring of the EUT : The EUT was in normal operating mode during the test.

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)	DC mains	3.0	Pass	There was no deviation from normal operation condition.
0.15 - 80	CDN(T4)	Signal Cable	3.0	Pass	

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

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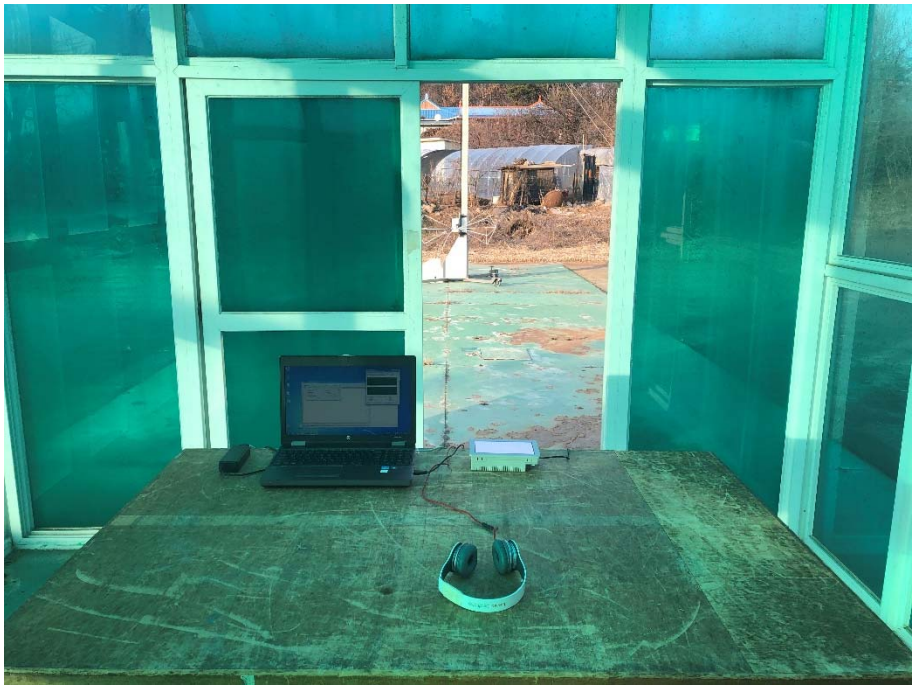
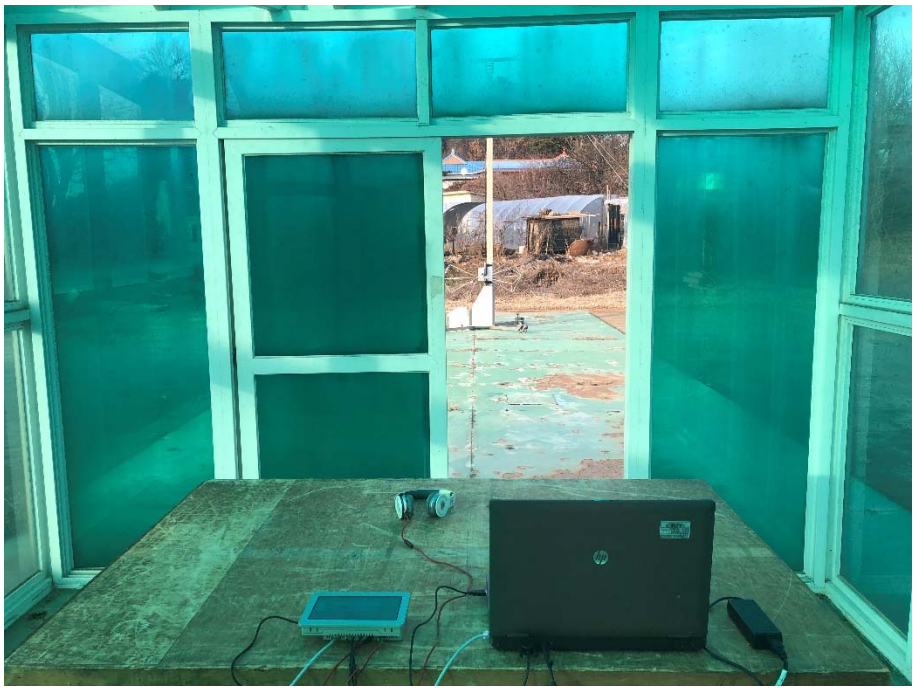
APPENDIX II - TEST SET-UP PHOTOS: Radiated electromagnetic field (Below 1 GHz)





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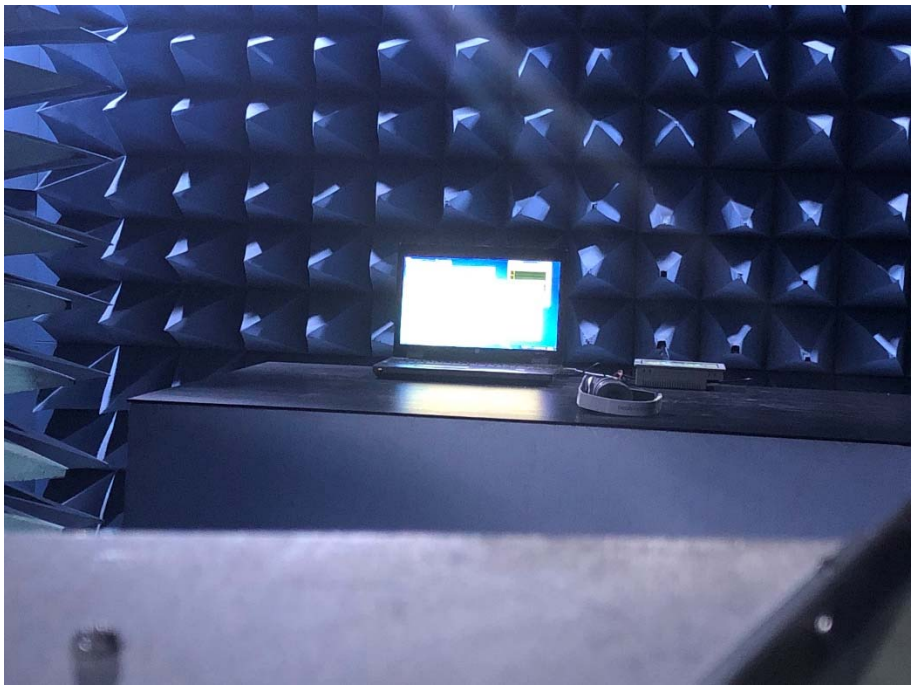
APPENDIX III - TEST SET-UP PHOTOS: Radiated electromagnetic field (Above 1 GHz)



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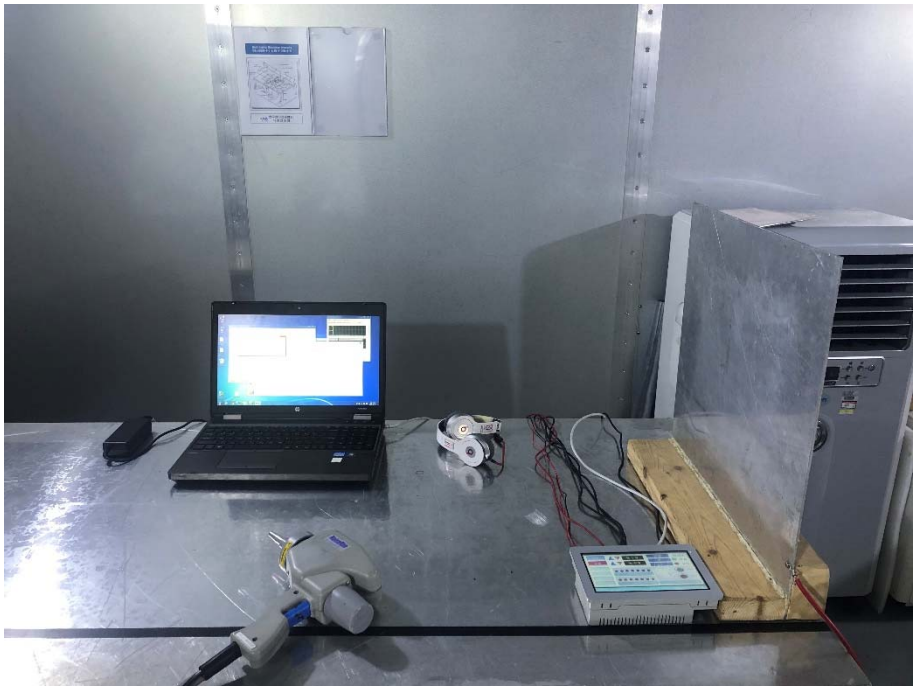
APPENDIX IV - TEST SET-UP PHOTO: Electrostatic discharge immunity



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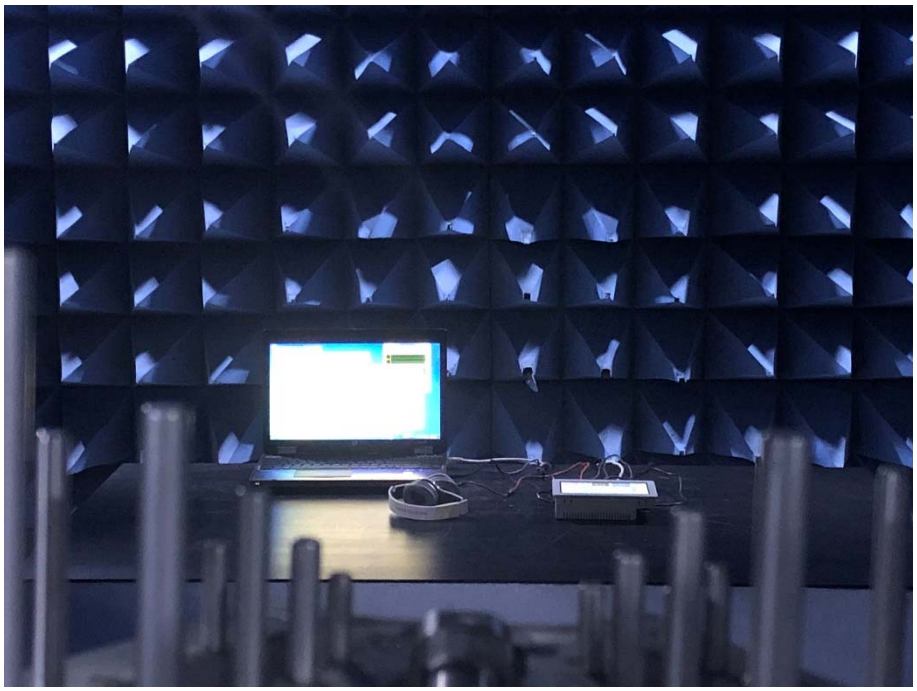
APPENDIX V - TEST SET-UP PHOTO: Radiated frequency electromagnetic field immunity



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

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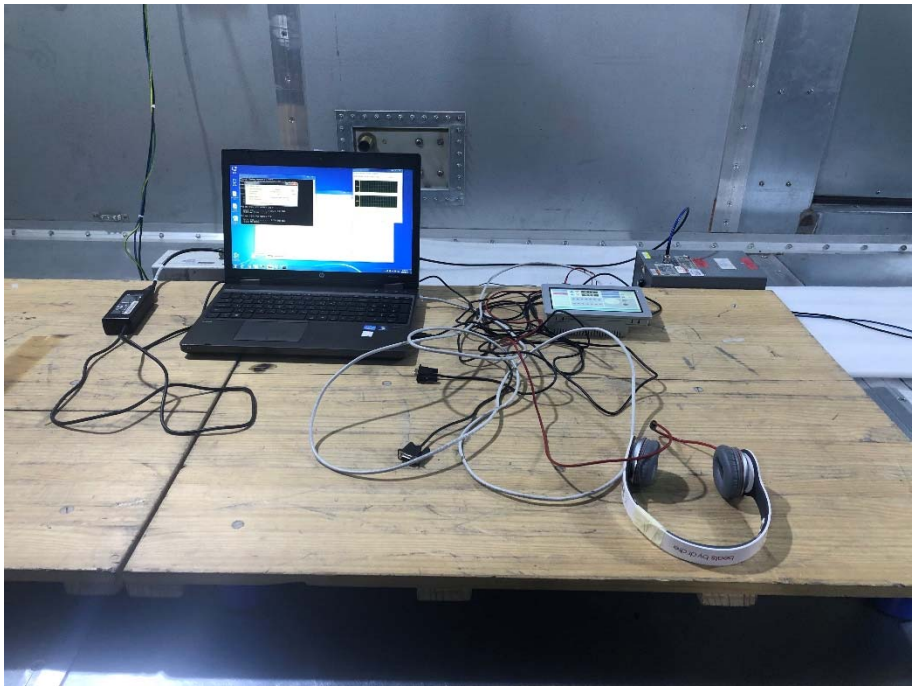
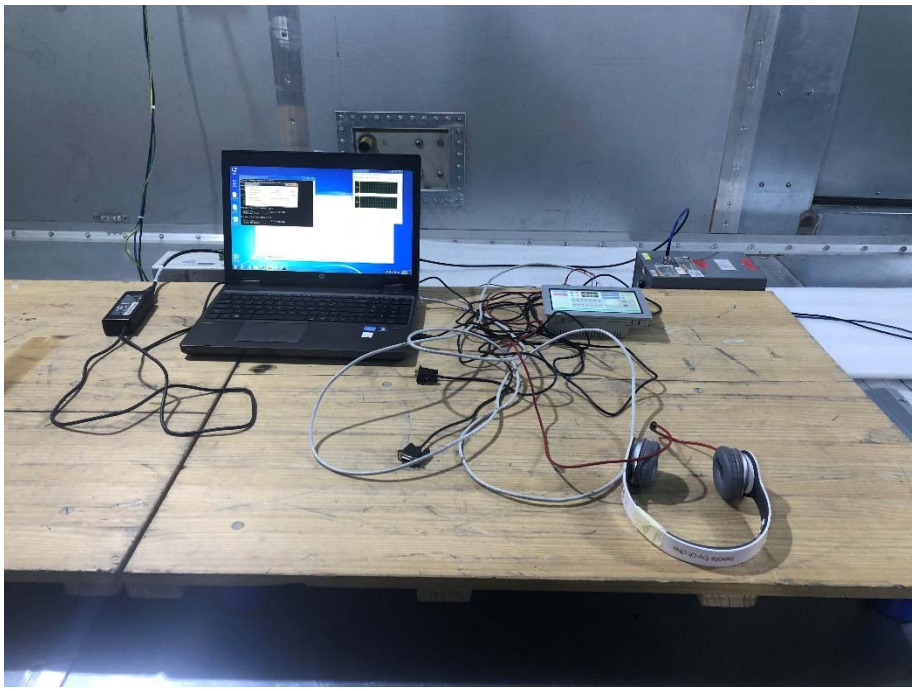
APPENDIX VII - TEST SET-UP PHOTO: Conducted disturbance induced by RF fields immunity





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APPENDIX VIII – PHOTOGRAPHS: Internal and External appearances

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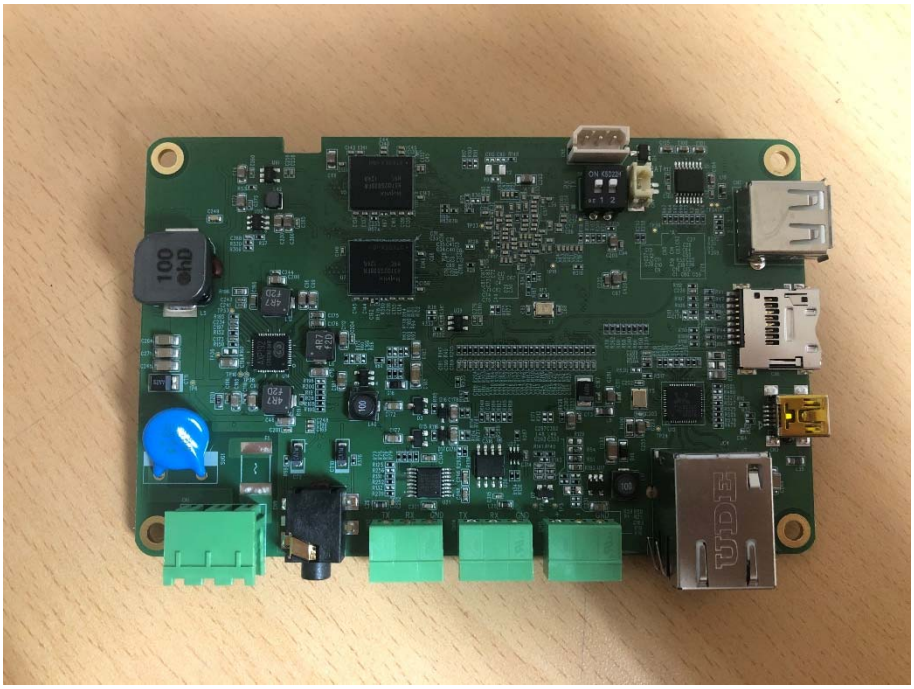

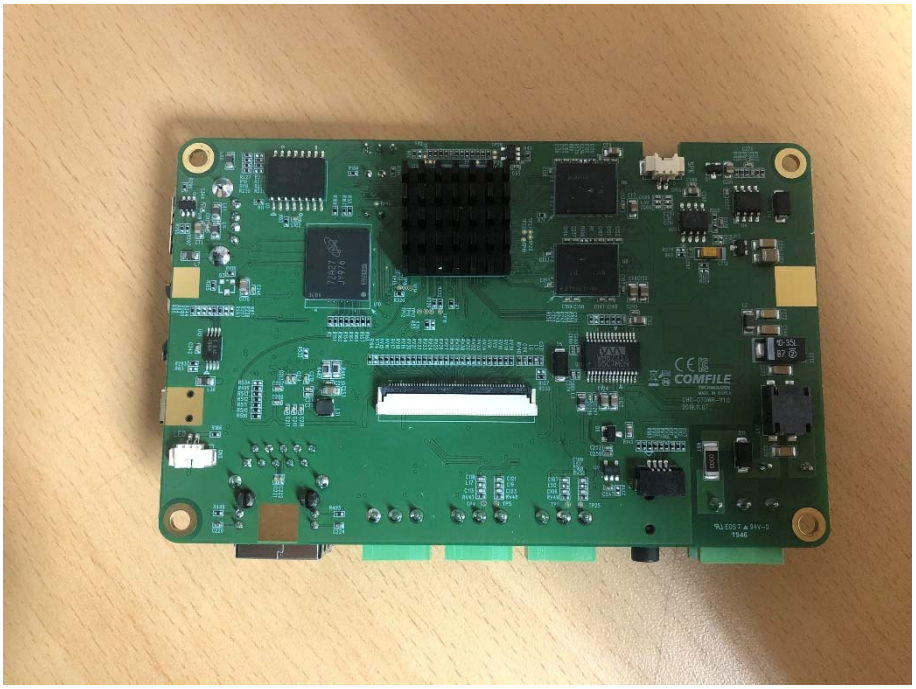

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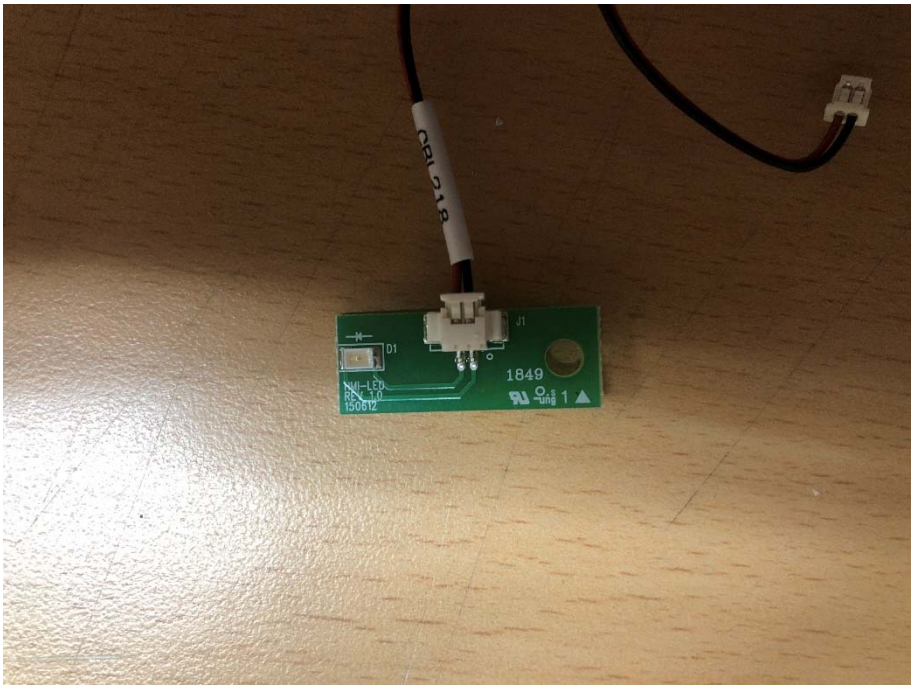

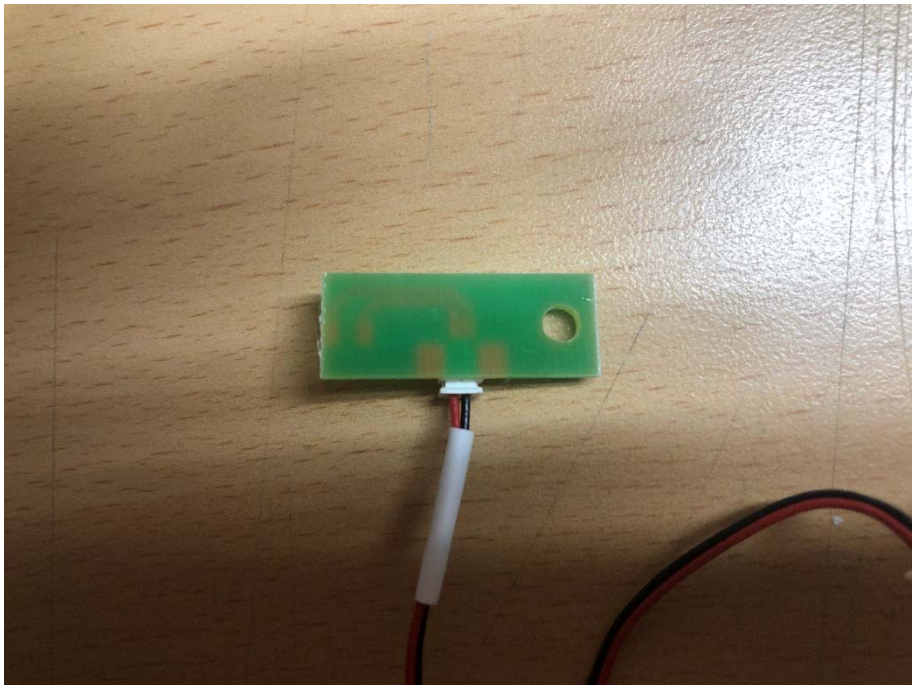

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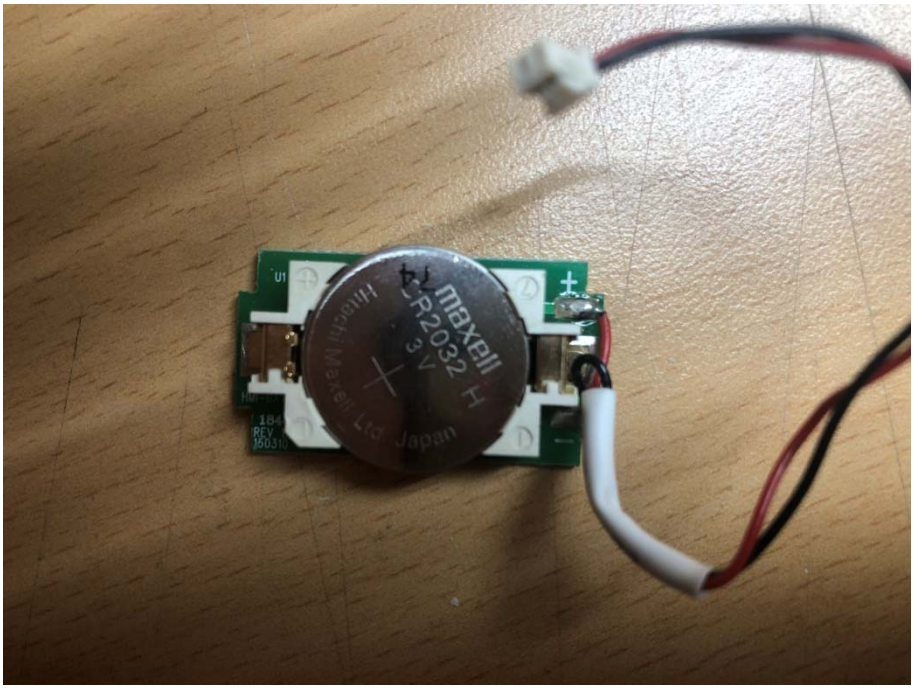

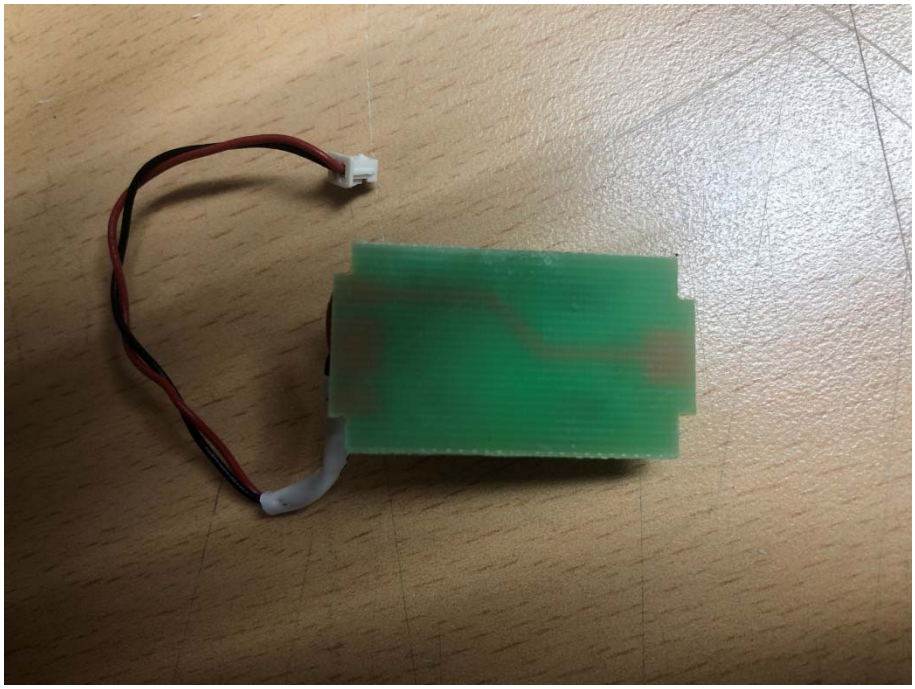

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