TEST REPORT

Product Name:	Fanless Embedded BOX PC
Trademark:	WG
Model Number:	WBOX-5601 WBOX-5602, WBOX-5603, WBOX-2875-6C, WBOX-2875-LY, WBOX-5701, WBOX-5702, WBOX-5681, WBOX-5683, WBOX-5685, WBOX-5687
Prepared For:	Shanghai Fusheng Well Intelligent Control Technology Co., Ltd.
Address:	2nd Floor, 16th Building, No.481, Guiping Road, Xuhui District, Shanghai, China
Manufacturer:	Shanghai Fusheng Well Intelligent Control Technology Co., Ltd.
Address:	2nd Floor, 16th Building, No.481, Guiping Road, Xuhui District, Shanghai, China
Prepared By:	Shenzhen BCTC Testing Co., Ltd.
Address:	BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China
Sample Received Date:	Dec. 13, 2019
Sample tested Date:	Dec. 13, 2019 to Feb. 18, 2020
Issue Date:	Feb. 18, 2020
Report No.:	BCTC1912002784E
Test Standards	EN 55032:2015, EN 55035: 2017
Test Results	PASS

Compiled by:	Reviewed by:	Approved by:
Icey Chen	Eric Yang	Zero Zhou/Manager

The test report is effective only with both signature and specialized stamp.This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen BCTC Testing Co., Ltd, this report can't be reproduced except in full.The tested sample(s) and the sample information are provided by the client.

TABLE OF CONTENT

(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
BCTC1912002784E	Feb. 18, 2020	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

EMISSION		
Standard	**Test Item**	**Test result**
EN 55032	Conducted emissions from the AC mains power ports	N/A[1]
EN 55032	Asymmetric mode conducted emissions	Pass
EN 55032	Conducted differential voltage emissions	N/A[1]
EN 55032	Radiated emissions	Pass

IMMUNITY (EN 55035)		
Standard	**Test Item**	**Test result**
IEC 61000-4-2	Electrostatic discharge (ESD)	Pass
IEC 61000-4-3	Continuous RF electromagnetic field disturbances(RS)	Pass
IEC 61000-4-4	Electrical fast transients/burst (EFT)	N/A[1]
IEC 61000-4-5	Surges	N/A[1]
IEC 61000-4-6	Continuous induced RF disturbances (CS)	N/A[1]
IEC 61000-4-6	Broadband impulse noise disturbances, repetitive	N/A[2]
IEC 61000-4-6	Broadband impulse noise disturbances, isolated	N/A[2]
IEC 61000-4-8	Power frequency magnetic field (PFMF)	N/A[3]
IEC 61000-4-11	Voltage dips and interruptions (DIPS)	N/A[1]

Remark:
1. The Product only has USB port.
2. Applicable only to CPE xDSL ports.
3. The Product doesn't contain any device susceptible to magnetic fields.

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Value (dB)
Conducted Emission (150kHz-30MHz)	3.20
Radiated Emission(30MHz~1GHz)	4.80
Radiated Emission(1GHz~6GHz)	4.90

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Ratings: DC 12V 3A

Model difference: All models are identical except for the appearance color, the test model is WBOX-5601 and the test results are applicable to other tests.

The highest frequency of the internal sources of the EUT is (less than 108)MHz:

☒ less than 108 MHz, the measurement shall only be made up to 1 GHz.
☐ between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz.
☐ between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz.
☐ above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less.

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

No	Device Type	Brand	Model	Series No.	Data Cable	Power Cord
1.	---	---	---	---	---	---

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Test Mode

Test item	Test Mode	Test Voltage
Asymmetric mode conducted emissions(150KHz-30MHz) Class A	Ping IP	AC 230V/50Hz*
Radiated emissions(30MHz-1GHz) Class A	Full Load +VGA	AC 230V/50Hz
	Full Load +HDMI	AC 230V/50Hz*
Electrostatic discharge (ESD) B ☒Air Discharge: ±8kV ☒Contact Discharge: ±4kV ☒HCP & VCP: ±4Kv 10 times each point/	Full Load +VGA	AC 230V/50Hz
Continuous RF electromagnetic field disturbances(RS) A 80MHz-1000MHz,2600MHz,3500MHz, 5000MHz, 3V/m,80% Front, Rear, Left, Right H/V	Full Load +VGA	AC 230V/50Hz
All test mode were tested and passed, only Conducted Emissions, Radiated Emissions shows (*) is the worst case mode which were recorded in this report.		

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

Conducted emissions Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Receiver	R&S	ESR	102075	Jun. 13, 2019	Jun.12, 2020
LISN	R&S	ENV216	101375	Jun. 13, 2019	Jun.12, 2020
ISN	HPX	ISN T800	S1509001	Jun. 13, 2019	Jun.12, 2020
Software	Frad	EZ-EMC	EMC-CON 3A1	\	\

Radiated emissions Test (966 chamber)					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
966 chamber	ChengYu	966 Room	966	Jun. 19, 2018	Jun. 18, 2021
Receiver	R&S	ESR3	102075	Jun. 13, 2019	Jun. 12, 2020
Amplifier	Schwarzbeck	BBV9718	9718-309	Jun. 13, 2019	Jun. 12, 2020
Amplifier	Schwarzbeck	BBV9744	9744-0037	Jun. 25, 2019	Jun. 24, 2020
TRILOG Broadband Antenna	schwarzbeck	VULB 9163	VULB9163-942	Jun. 25, 2019	Jun. 24, 2020
Horn Antenna	SCHWARZBECK	BBHA9120 D	1201	Jun. 22, 2019	Jun. 21, 2020
Software	Frad	EZ-EMC	FA-03A2 RE	\	\

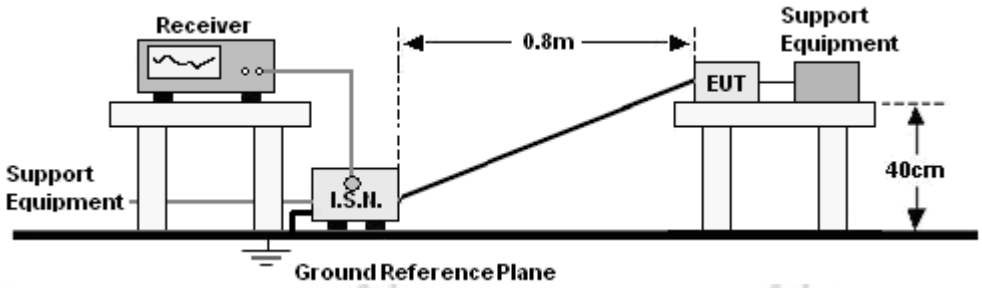
Electrostatic discharge Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
ESD Tester	KIKISUI	KES4201 A	UH002321	Jul. 12, 2019	Jul. 10, 2020

Radio frequency electromagnetic fieldsTest					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Power meter	Keysight	E4419	GB42421440	Jun. 17, 2019	Jun. 16, 2020
Power sensor	Keysight	E9300A	US39211305	Jun. 17, 2019	Jun. 16, 2020
Power sensor	Keysight	E9300A	US39211659	Jun. 17, 2019	Jun. 16, 2020
Amplifier	SKET	HAP-8010 00M-250W	/	Jun. 25, 2019	Jun. 24, 2020
Amplifier	SKET	HAP-8010 00M-75W	/	Jun. 25, 2019	Jun. 24, 2020
Amplifier	SKET	HAP-8010 00M-50W	/	Jun. 25, 2019	Jun. 24, 2020
Stacked double Log.-Per. Antenna	Schwarzbeck	STLP 9129	077	\	\
Field Probe	Narda	EP-601	80256	Jul. 07, 2019	Jul. 06, 2020
Signal Generator	Aglilent	N5181A	MY50143748	Jun. 13, 2019	Jun. 12, 2020
Software	SKET	EMC-S	1.2.0.18	\	\

6. CONDUCTED EMISSIONS

6.1 Block Diagram Of Test Setup

For asymmetric mode ports:



6.2 Limit

Limits for asymmetric mode conducted emissions of Class A MME

Frequency range (MHz)	Voltage Limits dB(μV)		Current Limits dB(μA)	
	Quasi-pea	Average	Quasi-pea	Average
0,15 to 0,50	97-87*	84-74*	53-43*	40-30*
0,50 to 30	87	74	43	30

Notes: *Decreasing linearly with logarithm of frequency.

6.3 Test procedure

For asymmetric mode ports:

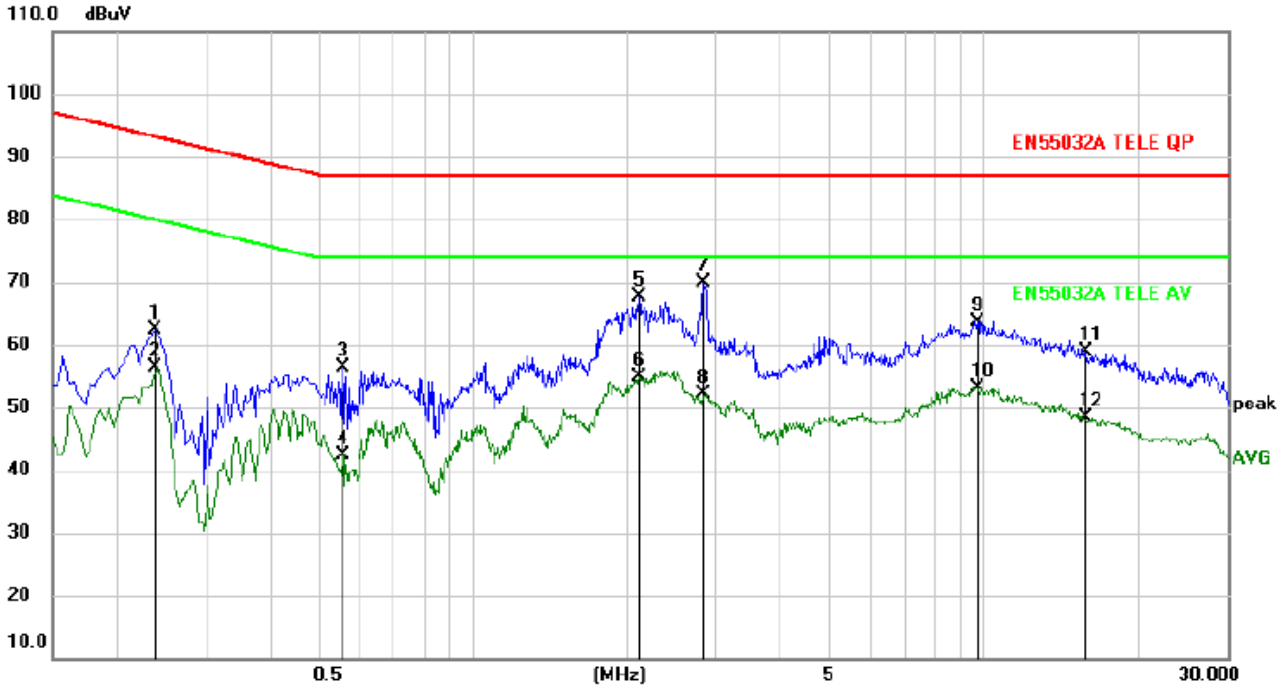
a. The Product was placed on a non-conductive table 0.8m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the associated port through votalge probe.

b. The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.

c. For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

6.4 Test Result

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Phase :	TELE
Test Voltage :	AC 230V/50Hz	Test Mode:	Ping IP



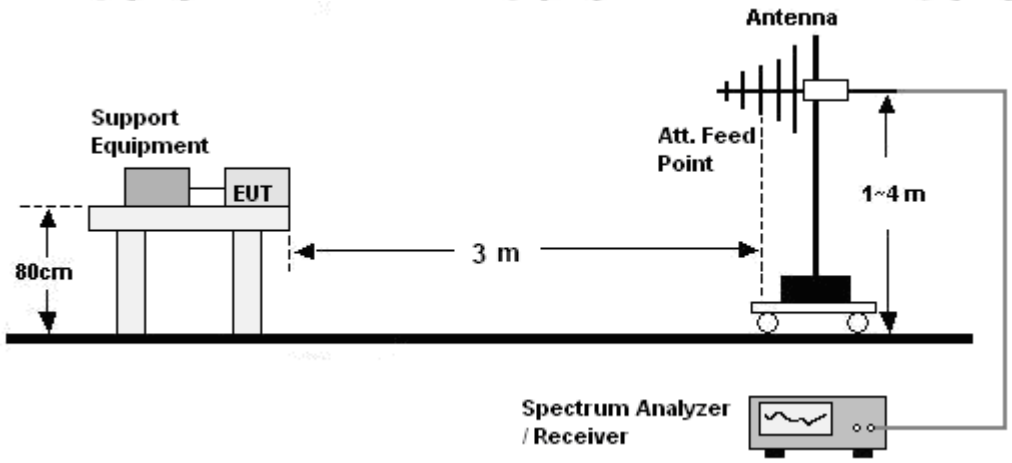
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV		dBuV	dBuV	dB	Detector	Comment
1		0.2380	52.66	9.62	62.28	93.17	-30.89	QP	
2		0.2380	46.64	9.62	56.26	80.17	-23.91	AVG	
3		0.5580	46.78	9.61	56.39	87.00	-30.61	QP	
4		0.5580	32.86	9.61	42.47	74.00	-31.53	AVG	
5		2.1180	57.86	9.70	67.56	87.00	-19.44	QP	
6		2.1180	45.25	9.70	54.95	74.00	-19.05	AVG	
7	*	2.8380	60.03	9.75	69.78	87.00	-17.22	QP	
8		2.8380	42.29	9.75	52.04	74.00	-21.96	AVG	
9		9.6740	54.21	9.42	63.63	87.00	-23.37	QP	
10		9.6740	43.79	9.42	53.21	74.00	-20.79	AVG	
11		15.7300	49.53	9.26	58.79	87.00	-28.21	QP	
12		15.7300	39.16	9.26	48.42	74.00	-25.58	AVG	

Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

7. RADIATED EMISSIONS TEST

7.1 Block Diagram Of Test Setup

30MHz ~ 1GHz:



7.2 Limits

Limits for radiated disturbance of Class A MME

Frequency (MHz)	Quasi-peak limits at 3m dB(μV/m)
30-230	50
230-1000	57

Note: The lower limit shall apply at the transition frequencies.

7.3 Test Procedure

30MHz ~ 1GHz:

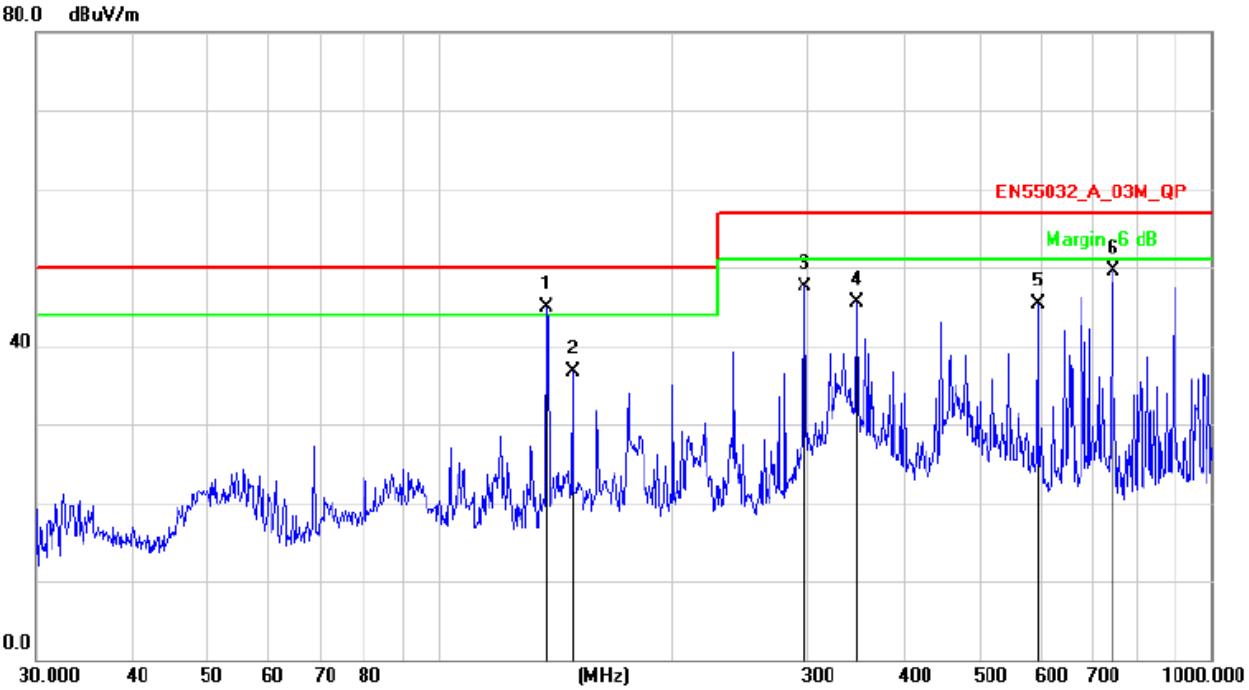
a. The Product was placed on the nonconductive turntable 0.8 m above the ground in a semi anechoic chamber.

b. Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.

c. For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

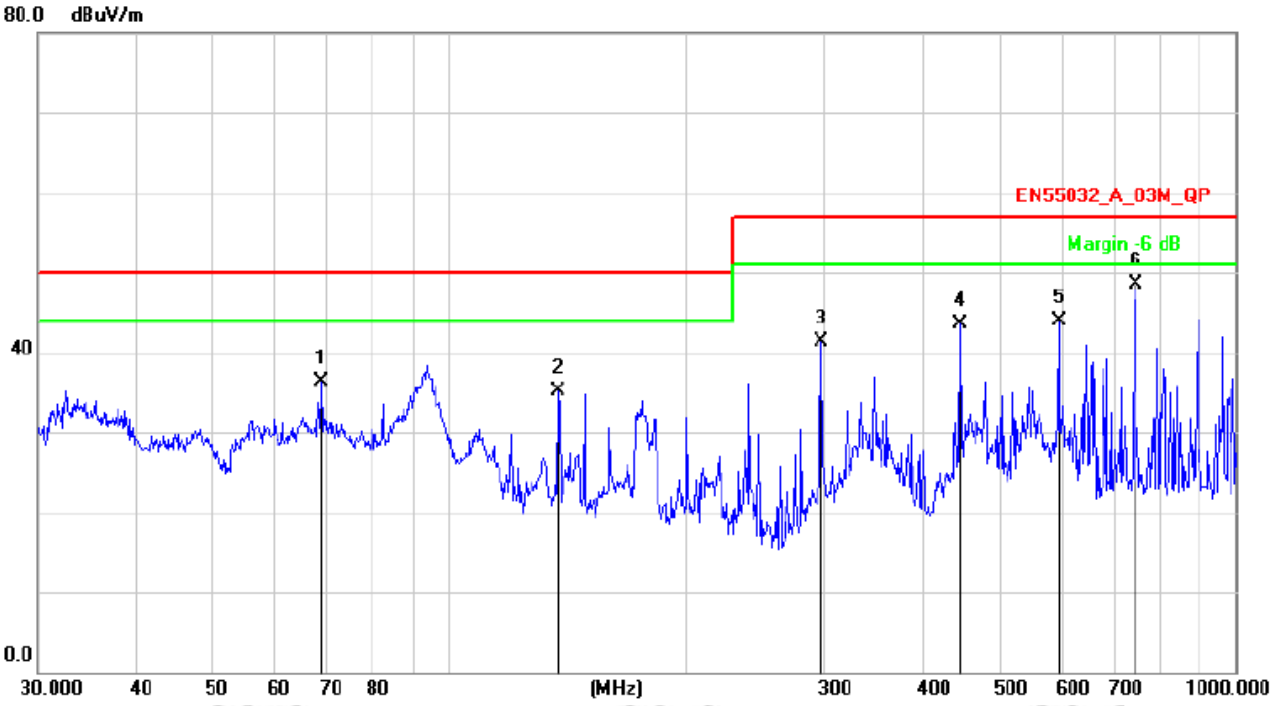
7.4 Test Results

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Phase :	Horizontal
Test Voltage :	AC 230V/50Hz	Test Mode:	Full Load +HDMI



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	137.4202	63.51	-18.69	44.82	50.00	-5.18	QP
2		148.4410	56.02	-19.40	36.62	50.00	-13.38	QP
3		297.2241	61.20	-13.69	47.51	57.00	-9.49	QP
4		346.8091	57.90	-12.32	45.58	57.00	-11.42	QP
5		595.1327	51.93	-6.63	45.30	57.00	-11.70	QP
6		744.8661	53.99	-4.42	49.57	57.00	-7.43	QP

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Phase :	Vertical
Test Voltage :	AC 230V/50Hz	Test Mode:	Full Load +HDMI



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		68.8721	54.33	-17.93	36.40	50.00	-13.60	QP
2		137.4199	53.84	-18.69	35.15	50.00	-14.85	QP
3		297.2241	55.02	-13.69	41.33	57.00	-15.67	QP
4		446.4141	53.57	-10.05	43.52	57.00	-13.48	QP
5		595.1326	50.56	-6.63	43.93	57.00	-13.07	QP
6	*	742.4881	52.96	-4.46	48.50	57.00	-8.50	QP

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

8. IMMUNITY TEST OF GENERAL THE PERFORMANCE CRITERIA

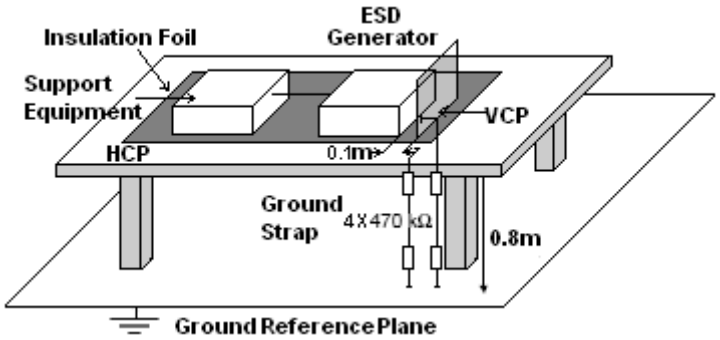
Product Standard	EN 55035:2017 clause 5
CRITERION A	The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is 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.
CRITERION 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.
CRITERION 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.

9. ELECTROSTATIC DISCHARGE (ESD)

9.1 Test Specification

Test Port	:	Enclosure port
Discharge Impedance	:	330 ohm / 150 pF
Discharge Mode	:	Single Discharge
Discharge Period	:	one second between each discharge

9.2 Block Diagram of Test Setup



9.3 Test Procedure

a. Electrostatic discharges were applied only to those points and surfaces of the Product that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the Product.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the Product as fast as possible (without causing mechanical damage) to touch the Product. After each discharge, the ESD generator was removed from the Product and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

g. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the Product. The ESD generator was positioned vertically at a distance of 0.1 meters from the Product with the discharge electrode touching the HCP.

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the Product were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the Product.

9.4 Test Results

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Test Mode:	Full Load +VGA
Test Voltage :	AC 230V/50Hz		

Discharge Method	Discharge Position	Voltage (±kV)	Min. No. of Discharge per polarity (Each Point)	Required Level	Performance Criterion
Contact Discharge	Conductive Surfaces	4	10	B	A
	Indirect Discharge HCP	4	10	B	A
	Indirect Discharge VCP	4	10	B	A
Air Discharge	Slots, Apertures, and Insulating Surfaces	8	10	B	A
Note: N/A					

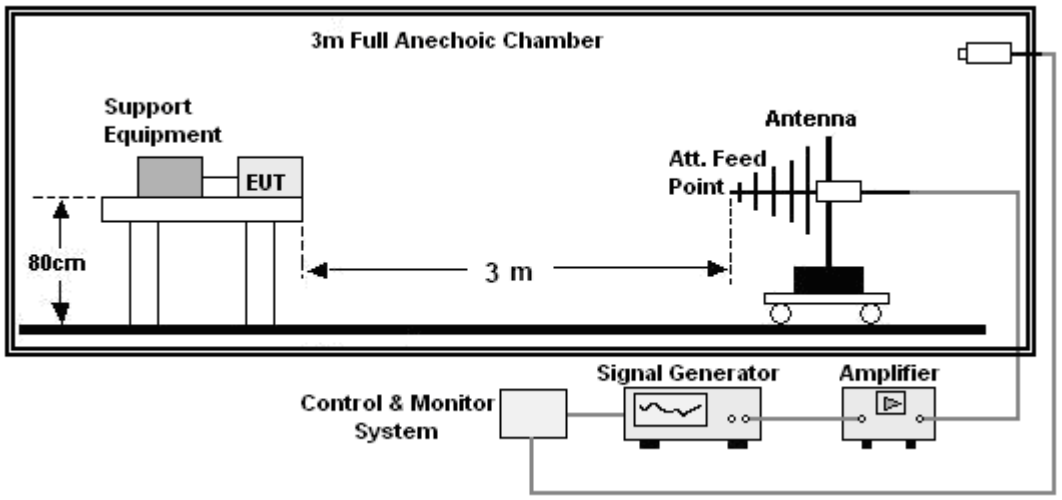
10. CONTINUOUS RF ELECTROMAGNETIC FIELD DISTURBANCES (RS)

10.1 Test Specification

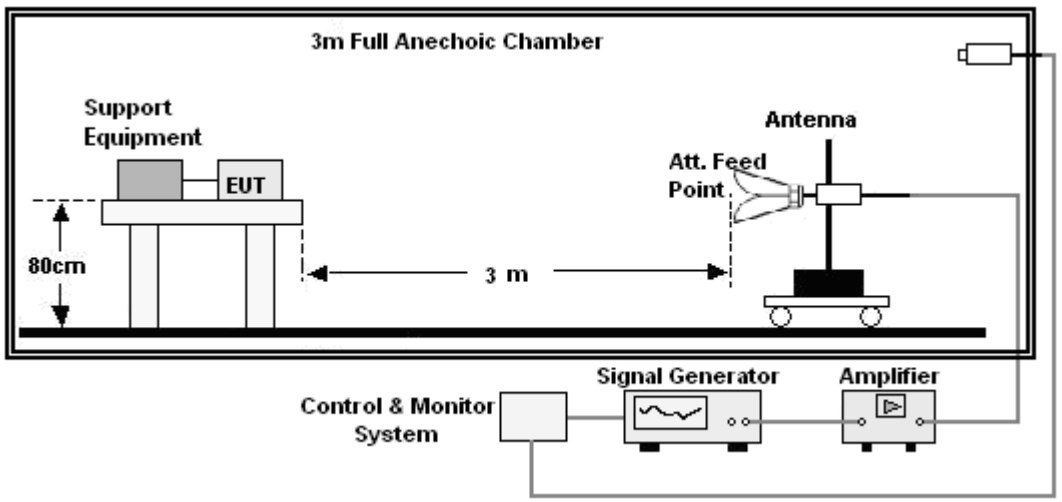
Test Port	:	Enclosure port
Step Size	:	1%
Modulation	:	1kHz, 80% AM
Dwell Time	:	1 second
Polarization	:	Horizontal & Vertical

10.2 Block Diagram of Test Setup

Below 1GHz:



Above 1GHz:



10.3 Test Procedure

a. The testing was performed in a fully-anechoic chamber. The transmit antenna was located at a distance of 3 meters from the Product.

b. The frequency range is swept from 80MHz to 1000MHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz,with the signal 80% amplitude modulated with a 1 kHz sine wave,and the step size was 1%.

c. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond, but should not exceed 5 s at each of the frequencies during the scan.

d. The test was performed with the Product exposed to both vertically and horizontally polarized fields on each of the four sides.

e. For Broadcast reception function: Group 2 not apply in this test.

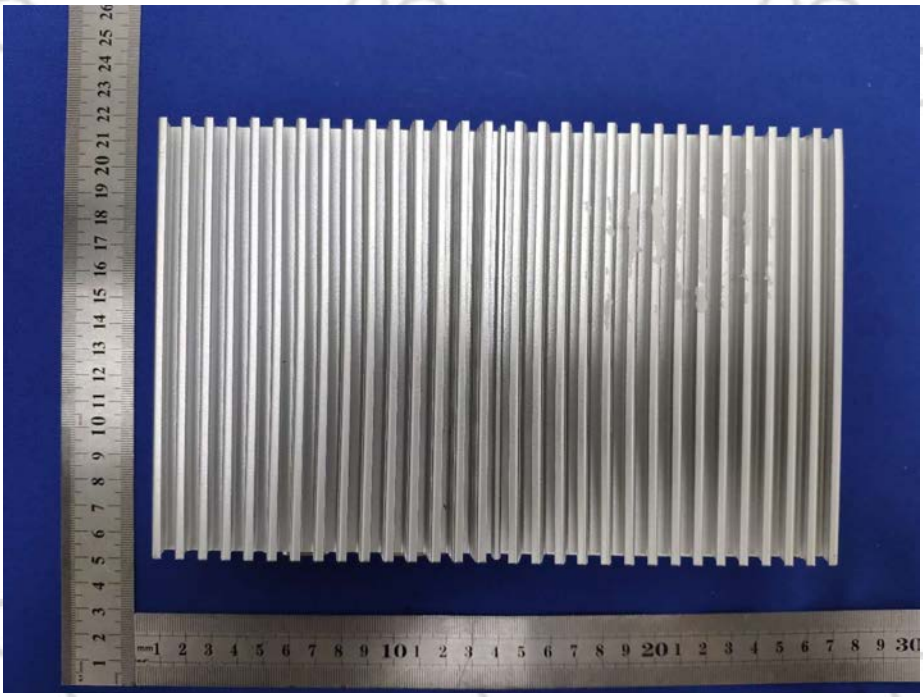
10.4 Test Results

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Test Mode:	Full Load +VGA
Test Voltage :	AC 230V/50Hz		

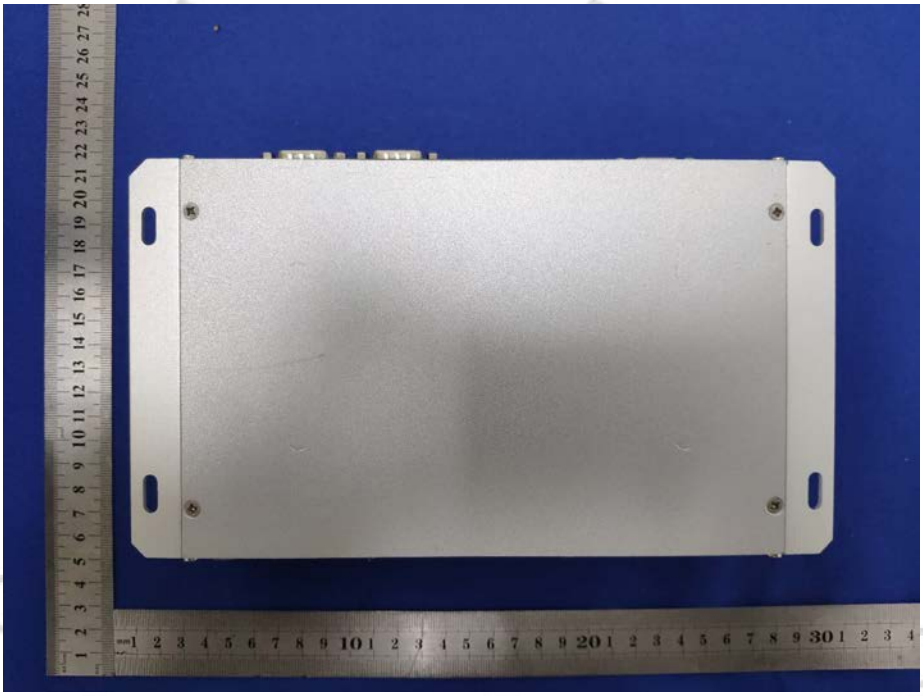
Frequency	Position	Field Strength (V/m)	Required Level	Performance Criterion
80 - 1000MHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz	Front, Right, Back, Left	3	A	A
Note: N/A				

11. EUT PHOTOGRAPHS

EUT Photo 1



EUT Photo 2

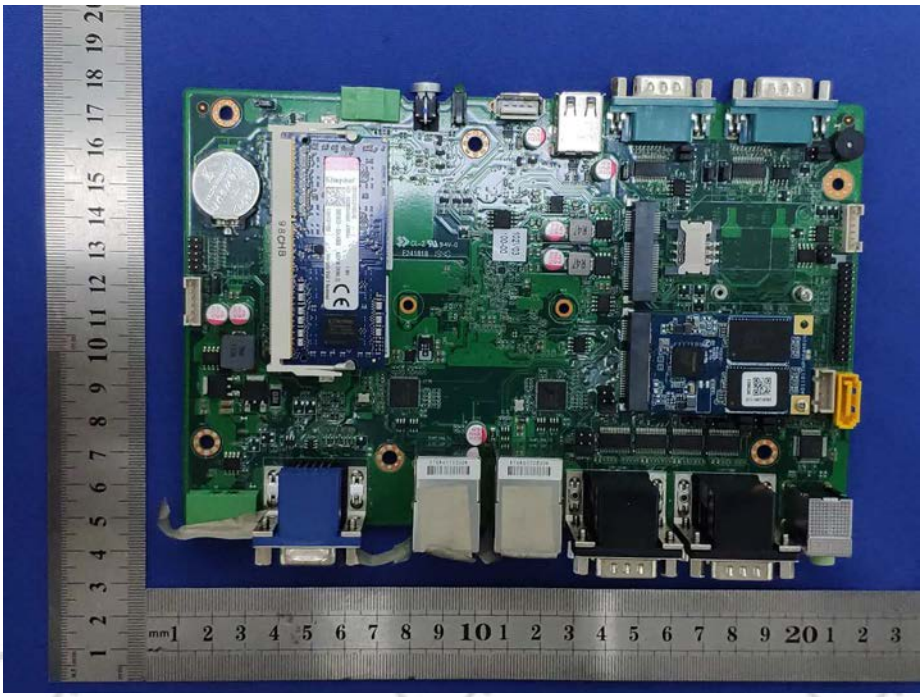


EUT Photo 3

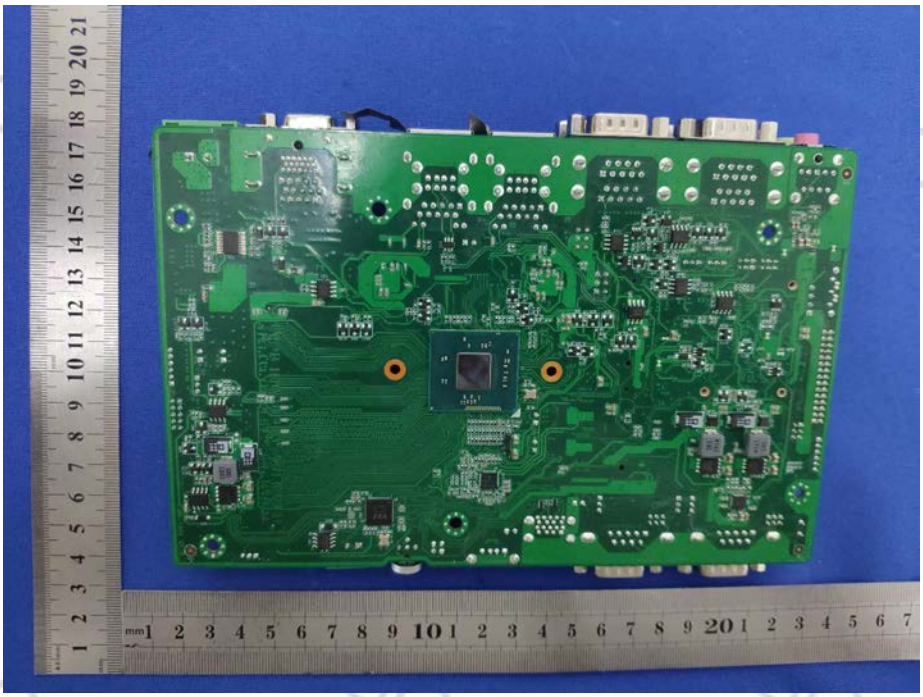
EUT Photo 4

EUT Photo 5

EUT Photo 6

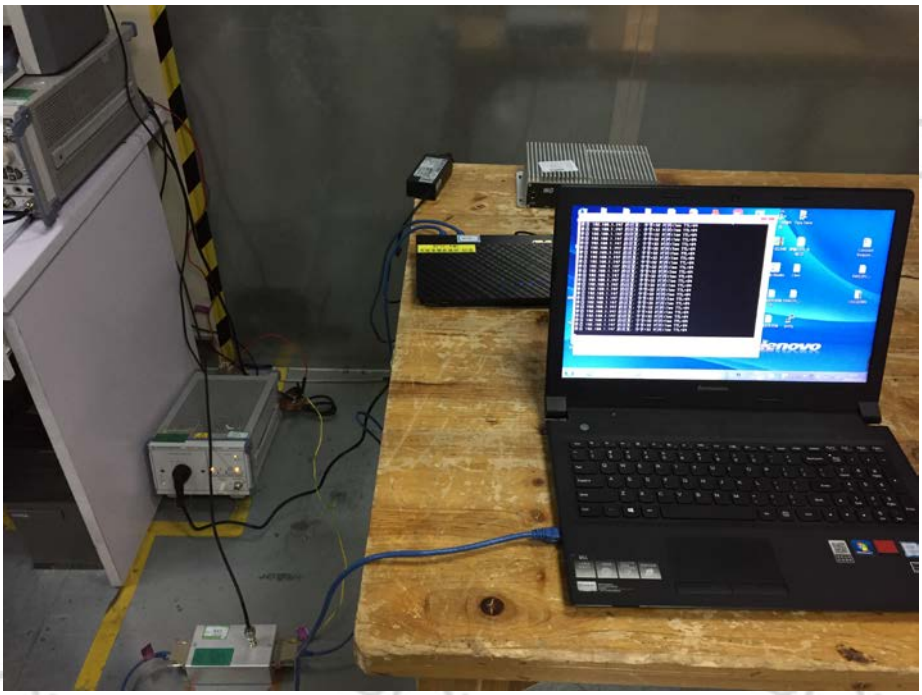


EUT Photo 7



12. EUT TEST SETUP PHOTOGRAPHS

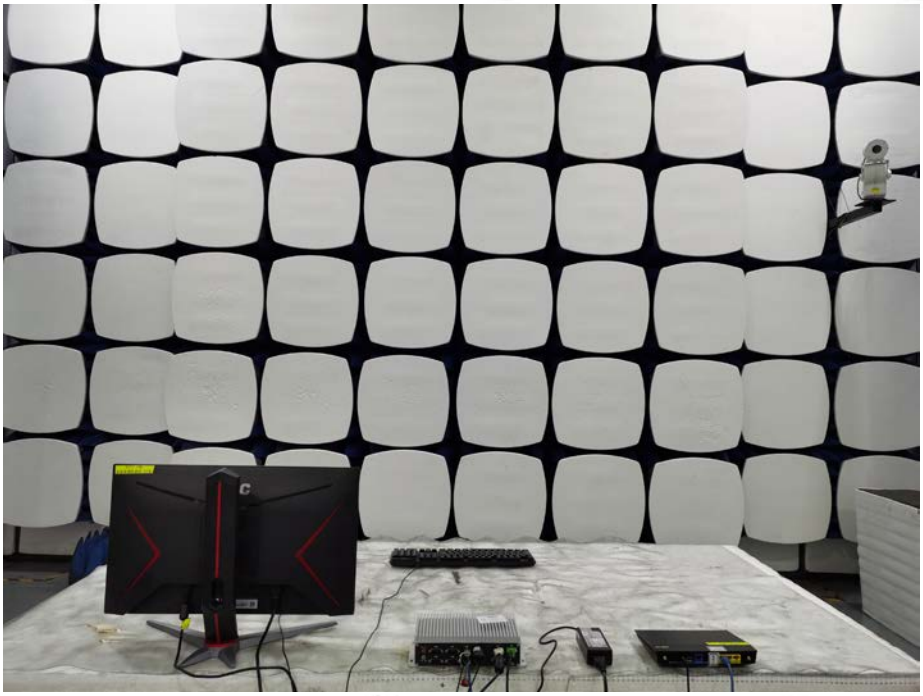
TELE



Radiated emissions

ESD

RS



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