EMC TEST REPORT

Report No.:	SET2021-17004
Product Name:	TUBE THERMAL IMAGING SCOPE
FCC ID:	2AYGT-TD50L
Model No. :	TD50L
Applicant:	IRay Techonlogy Co.,Ltd
Address:	11GUIYANG STREET,YANTAI ECONOMY AND TECHNOLOGY DEVELOPMENT DISTRICT,YANTAI SHANDONG, P.R.CHINA.
Dates of Testing:	2021.06.28—2021.12.15
Issued by:	CCIC Southern Testing Co., Ltd.
Lab Location:	Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China. Tel: 86 755 26627338 Fax: 86 755 26627238

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Test Report

Product Name	TUBE THERMAL IMAGING SCOPE
Trade name	InfiRay
Applicant	IRay Techonlogy Co.,Ltd
Applicant Address	11GUIYANG STREET,YANTAI ECONOMY AND TECHNOLOGY DEVELOPMENT DISTRICT,YANTAI SHANDONG, P.R.CHINA.
Manufacturer	IRay Techonlogy Co.,Ltd
Manufacturer Address	11GUIYANG STREET,YANTAI ECONOMY AND TECHNOLOGY DEVELOPMENT DISTRICT,YANTAI SHANDONG, P.R.CHINA.
Test Standards	47 CFR Part 15 Subpart B
Test Result	PASS

Tested by .....

Ruihong Xie Test Engineer 2021.12.15

Reviewed by.....

Chris You Senior Engineer 2021.12.15

Approved by .....

2021.12.15

Shuangwen Zhang, Manager

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Change History		
Issue	Date	Reason for change
1.0	2021.12.15	First edition

1. GENERAL INFORMATION

1.1 EUT Description

EUT Name ..... .:	TUBE THERMAL IMAGING SCOPE
Trade Name……:	InfiRay
Brand Name……:	InfiRay
Power supply……..:	Battery Brand Name : JUDA Battery Model No.: 36AQ517-02 Capacitance: 6200mAh/1.323Wh Rated Voltage: 3.6V Charge Limit: 4.3V Manufacturer: DONGGUAN LARGE ELECTRONICS CO., LTD.
Ancillary Equipment…….:	AC Adapter Brand Name : Infiray Model No.: LX10B-050200E I/p: 100-240V～50/60Hz ,350mA O/p: 5.0V⎓2000mA Manufacturer : ShenZhen LvXiangYuan Technology Co.,Ltd.
Hardware Version……...:	V50C
Software Version .....:	V0307

Note 1: The EUT is a TUBE THERMAL IMAGING SCOPE ; It could support the following operating mode and frequency band: 2.4GWIFI

Note 2:For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

:

1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart B:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart B	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Result
1	15.107	Conducted Emission	PASS
2	15.109	Radiated Emission	PASS

NOTE:

(1) The EUT has been tested according to 47 CFR Part 15 Subpart B,Class B.The test procedure is according to ANSI C63.4:2014.

1.3 Facilities and Accreditations

1.3.1 Facilities

FCC-Registration No.: CN1283

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until April 19th, 2023.

A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

1.3.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15°C - 35°C
Relative Humidity (%):	25% -75%
Atmospheric Pressure (kPa):	86kPa-106kPa

1.3.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission:	Uc = 2.6 dB (k=2)
Uncertainty of Radiated Emission: (30MHz~1GHz)	Uc = 3.91 dB (k=2)
Uncertainty of Radiated Emission: (1~18GHz)	Uc = 4.5 dB (k=2)
Uncertainty of Radiated Emission: (18~40GHz)	Uc = 4.9 dB (k=2)

test conditions setting

1.4 Test Peripherals

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

Support Equipment:

Description	Brand name	Model	Serial No.	FCCID
Notebook	ThinkPad	E430C	A131101550	N/A
Mouse	Logitech	M100r	25011051	N/A

1.5 Use of Software Checklist

Software	Version number	Manufacturer	Use the project
ES-K1	V1.73	ROHDE&SCHWARZ	Radiated Emissions below 1GHz
TS+	JS32-RE 2.5.2.0	Tonsceng	Radiated Emissions above 1GHz
EMC32	Version 10.35.10	ROHDE&SCHWARZ	Conducted Emission

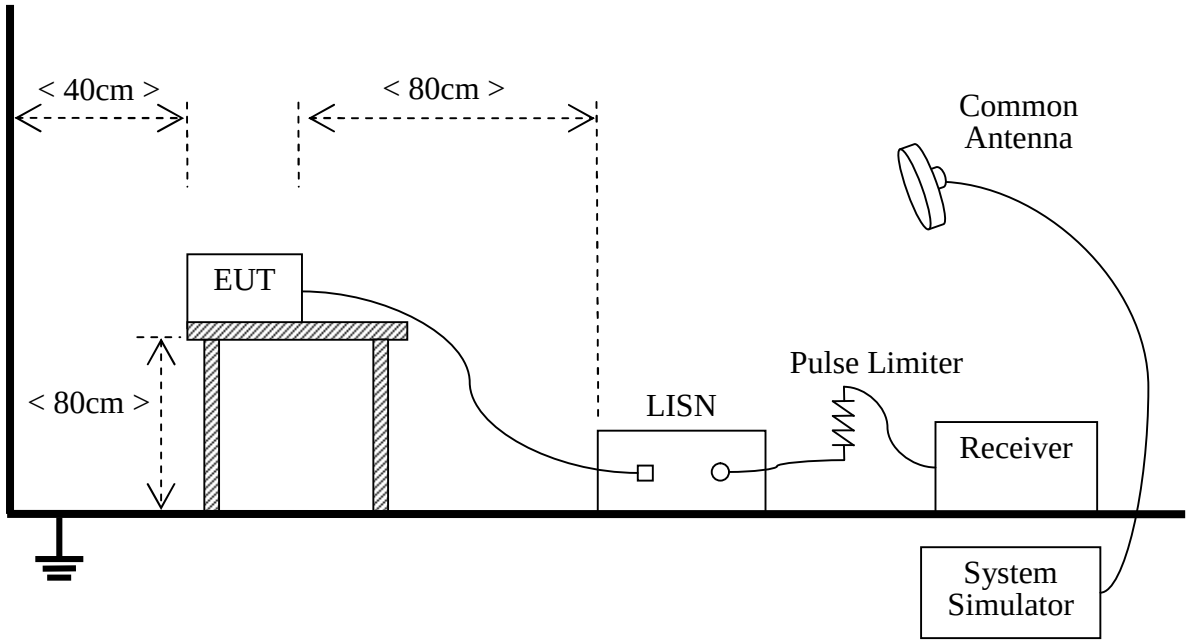
1.6 Test Mode

Note1：The EUT have the following typical setups during the test:
Setup1: EUT+ Charger;
Setup2: EUT+DATA Transfer;
Note2：All the patterns have been tested and only the worst results are recorded in the report.
Note3：Please refer to ANNEX I for the photographs of the EUT. For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacture.

1.7 Test Setup and Equipments List

1.7.1 Conducted Emission

A. Test Setup:



The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides 50Ω/50μH of coupling impedance for the measuring instrument. The Common Antenna is used for the call between the EUT and the System Simulator (SS). A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

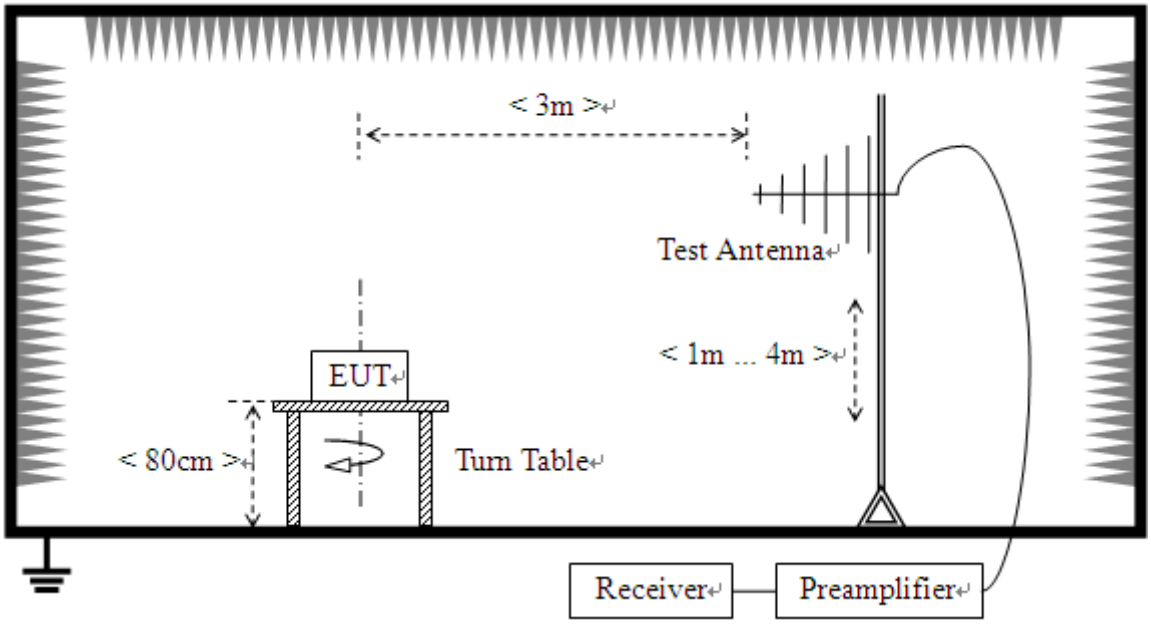
B. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
Test Receiver	KEYSIGHT	N9038A	A141202036	2021.09.20	2022.08.04
LISN	ROHDE&SCHWARZ	ENV216	A140701847	2021.08.02	2022.08.02
Cable	MATCHING PAD	W7	/	2021.08.02	2022.08.02

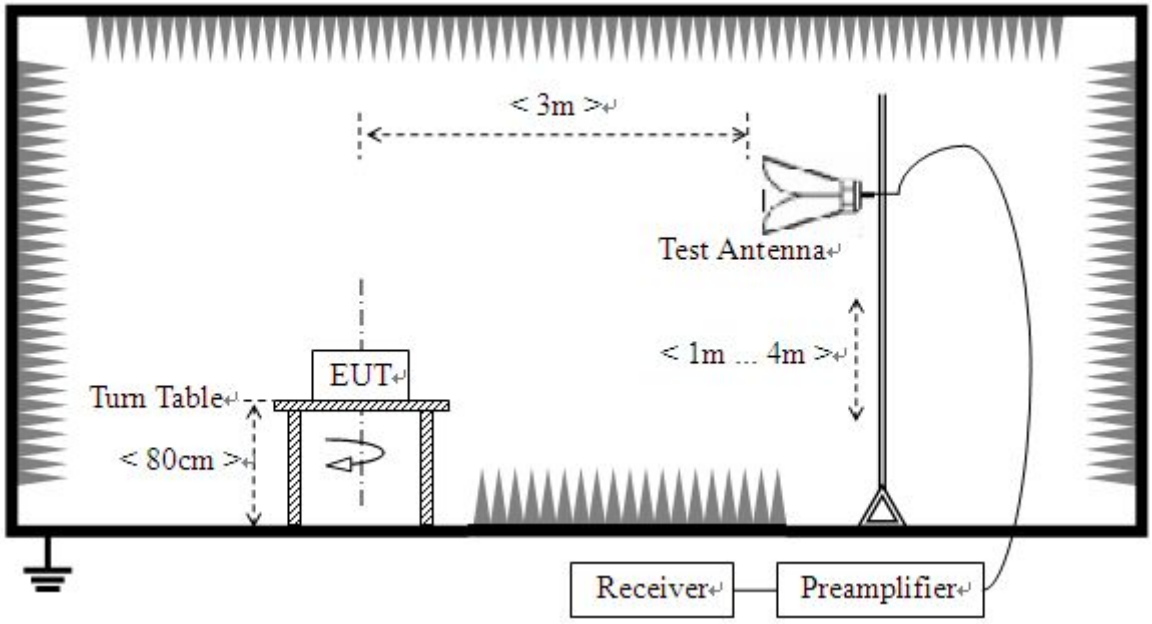
1.7.2 Radiated Emission

A. Test Setup:

1) For radiated emissions from 30MHz to1GHz



2) For radiated emissions above 1GHz



B. Test Procedure

The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a

variable-height antenna master tower.

For the test Antenna:

1) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

C. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
Test Receiver	KEYSIGHT	N9038A	A141202036	2021.09.20	2022.08.04
LISN	ROHDE&SCHWARZ	ENV216	A140701847	2021.09.21	2022.08.02
Shield Room	Xinju Electronics	L7300*W4500 *H3100	A181003226	2021.09.05	2024.07.29
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	A0902601	2021.06.23	2022.05.23
Broadband Ant.	2786	ETC	A150402239	2021.09.16	2024.03.03
3M Anechoic Chamber	Albatross	SAC-3MAC 9*6*6m	A0412375	2019.03.26	2023.03.25
EMI Test Receiver	ROHDE&SCHWARZ	ESW26	A180502935	2021.08.12	2022.08.06
System Simulator	ROHDE&SCHWARZ	CMW500	A150802214	2021.08.02	2022.07.22
5M Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4m	A0304210	2019.03.25	2023.03.24
EMI Horn Ant.	ROHDE&SCHWARZ	HF906	A0304225	2019.04.17	2022.04.17

2. 47 CFR PART 15B REQUIREMENTS

2.1 Conducted Emission

2.1.1 Requirement

According to FCC section 15.107, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

2.1.2 Test Description

See section 1.7.1 of this report.

2.1.3 Test Result

The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. All test modes are considered, refer to recorded points and plots below.

Note:

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a Nominal 120V AC,50/60Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

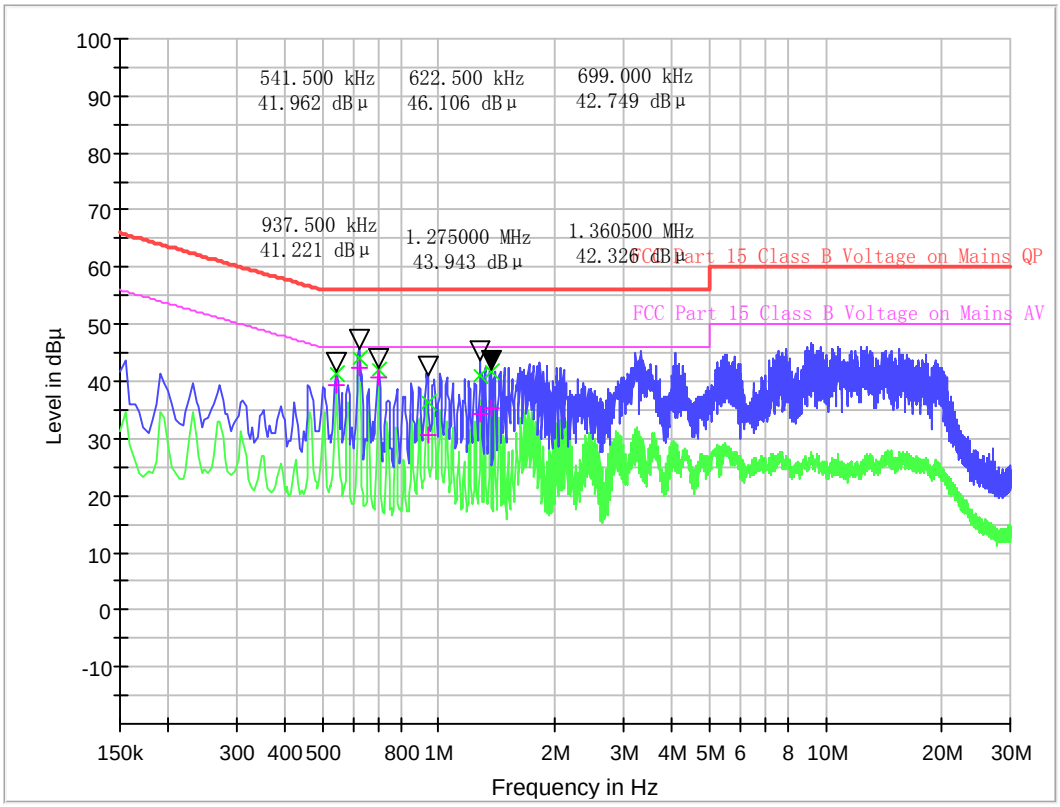
-Level(dBuv)=Read Level(dBuv)+Correction Factor(dB)

-Margin= Read Level(dBuv)-Limit Line(dBuv)

-Correction factor= LISN Factor(dB)+Cable Loss(dB)+ attenuation factor(dB)

Test voltage and frequency (120V AC,60Hz)

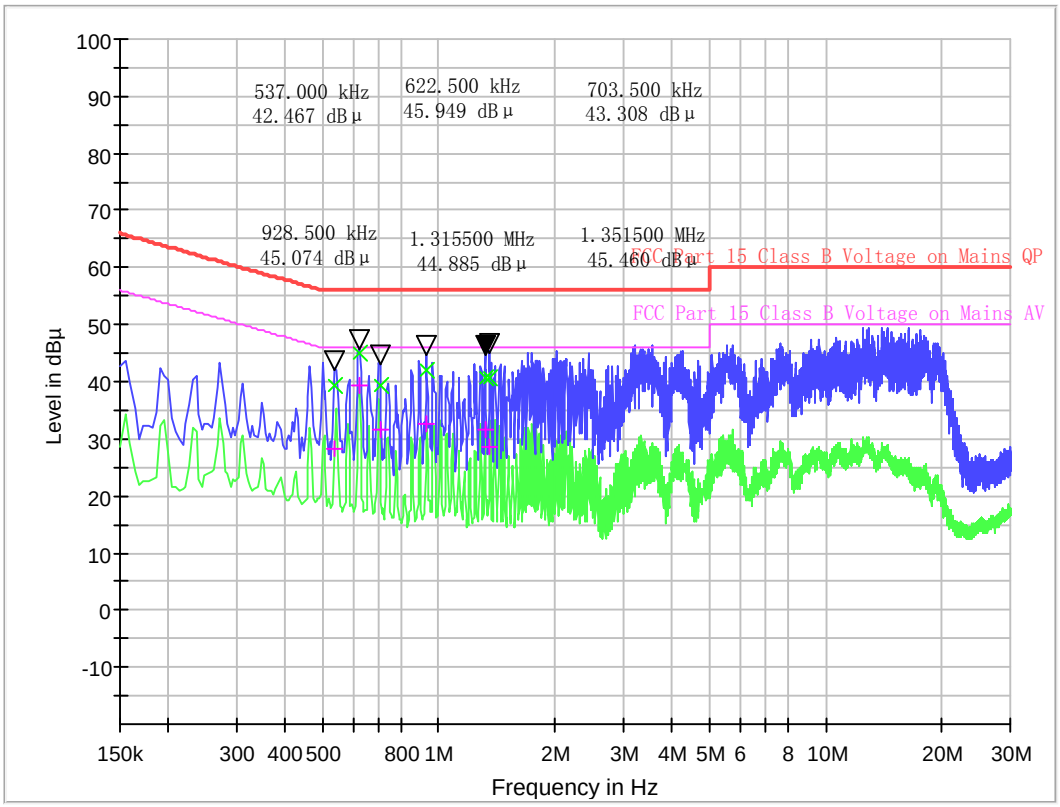
A. Mains terminal disturbance voltage, L phase



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak	CAverage (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV
0.541500	41.19	39.32	0.1	19.5	14.81	56.0	6.68	46.0
0.622500	43.97	42.20	0.2	19.5	12.03	56.0	3.80	46.0
0.699000	42.00	40.54	0.2	19.5	14.00	56.0	5.46	46.0
0.937500	36.39	30.59	0.1	19.5	19.61	56.0	15.41	46.0
1.275000	41.15	34.25	0.1	19.5	14.85	56.0	11.75	46.0
1.360500	41.70	35.40	0.2	19.5	14.30	56.0	10.60	46.0

B. Mains terminal disturbance voltage, N phase



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak	CAverage (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dBµV)
0.537000	39.25	28.27	0.1	19.4	16.75	56.0	17.73	46.0
0.622500	45.05	39.25	0.2	19.4	10.95	56.0	6.75	46.0
0.703500	39.40	31.56	0.2	19.4	16.60	56.0	14.44	46.0
0.928500	41.94	32.61	0.1	19.4	14.06	56.0	13.39	46.0
1.315500	40.78	31.64	0.3	19.4	15.22	56.0	14.36	46.0
1.351500	40.66	28.70	0.1	19.4	15.34	56.0	17.30	46.0

2.2 Radiated Emission

2.2.1 Requirement

According to FCC section 15.109, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency range (MHz)	Field Strength		Field Strength Limitation at 3m Measurement Dist	
	μV/m	Dist	(uV/m)	(dBuV/m)
30.0 - 88.0	100	3m	100	20log 100
88.0 - 216.0	150	3m	150	20log 150
216.0 - 960.0	200	3m	200	20log 200
Above 960.0	500	3m	500	20log 500

a) As shown in FCC section 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector. When average radiated emission measurements are specified in this part, including emission measurements below 1000MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

b) Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

c) For below 1G :QP detector RBW 120kHz ,VBW 300kHz.

d) For Above 1G: PK detector RBW 1MHz,VBW 3MHz for PK value ;AV detector RBW 1MHz, VBW 10Hz for AV value.

Note:

1) The tighter limit shall apply at the boundary between two frequency range.
2) Limitation expressed in dBuV/m is calculated by 20log Emission Level(uV/m).
3) If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of $Ld1 = Ld2 * (d2/d1)^{2.}$
   Example:
   F.S Limit at 30m distance is 30uV/m, then F.S Limitation at 3m distance is adjusted as
   $Ld1 = L1 = 30uV/m * (10)^2 = 100 * 30uV/m.$

2.2.2 Test Description

See section 2.3.2 of this report.

2.2.3 Test Result

The maximum radiated emission is searched using PK, QP and AV detectors; the emission levels more than the limits, and that have narrow margins from the limits will be re-measured with AV and QP detectors. Both the vertical and the horizontal polarizations of the Test Antenna are considered to perform the tests. All test modes are considered, refer to recorded points and plots below.

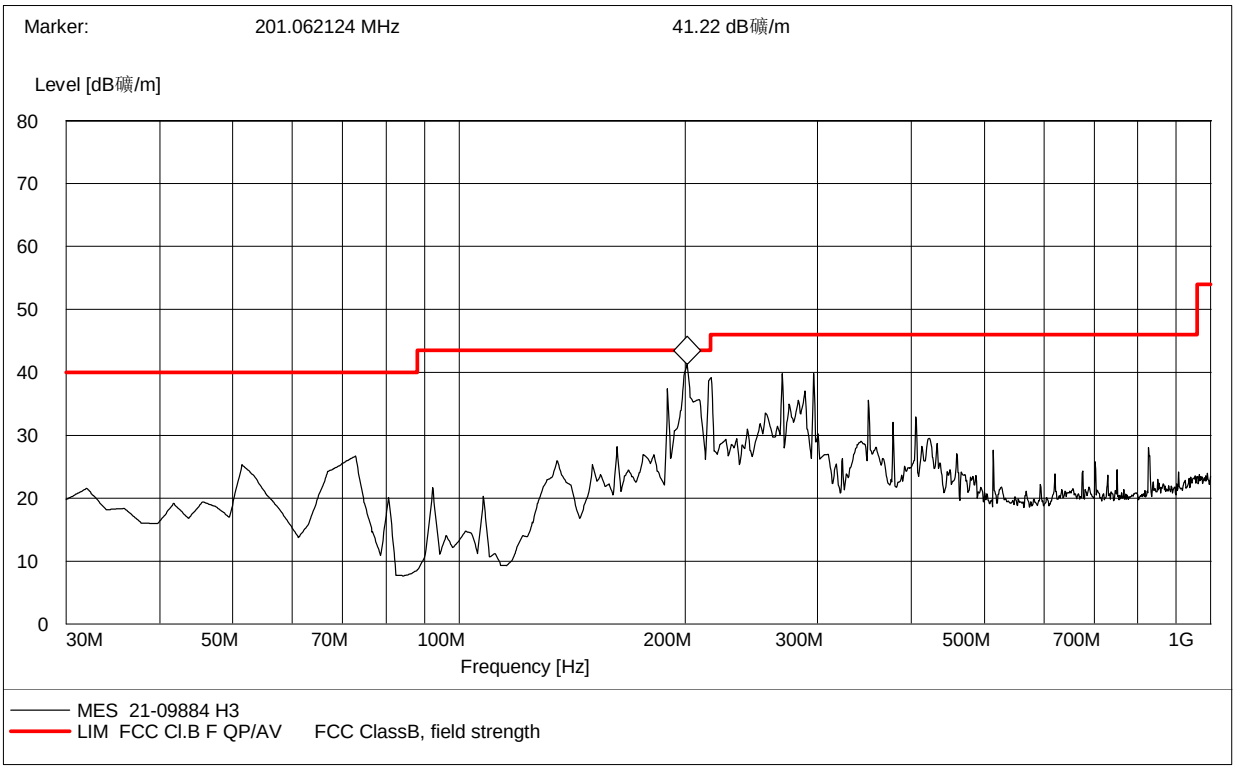
The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

Note: All radiated emission tests were performed in X, Y, Z axis direction, and only the worst axis test condition was recorded in this test report.

-Emission Level(dBuV/m)= 20log Emission Level(uV/m)

-Corrected Reading=Antenna factor+Cable Loss+Read Level-Preamp Factor= Level

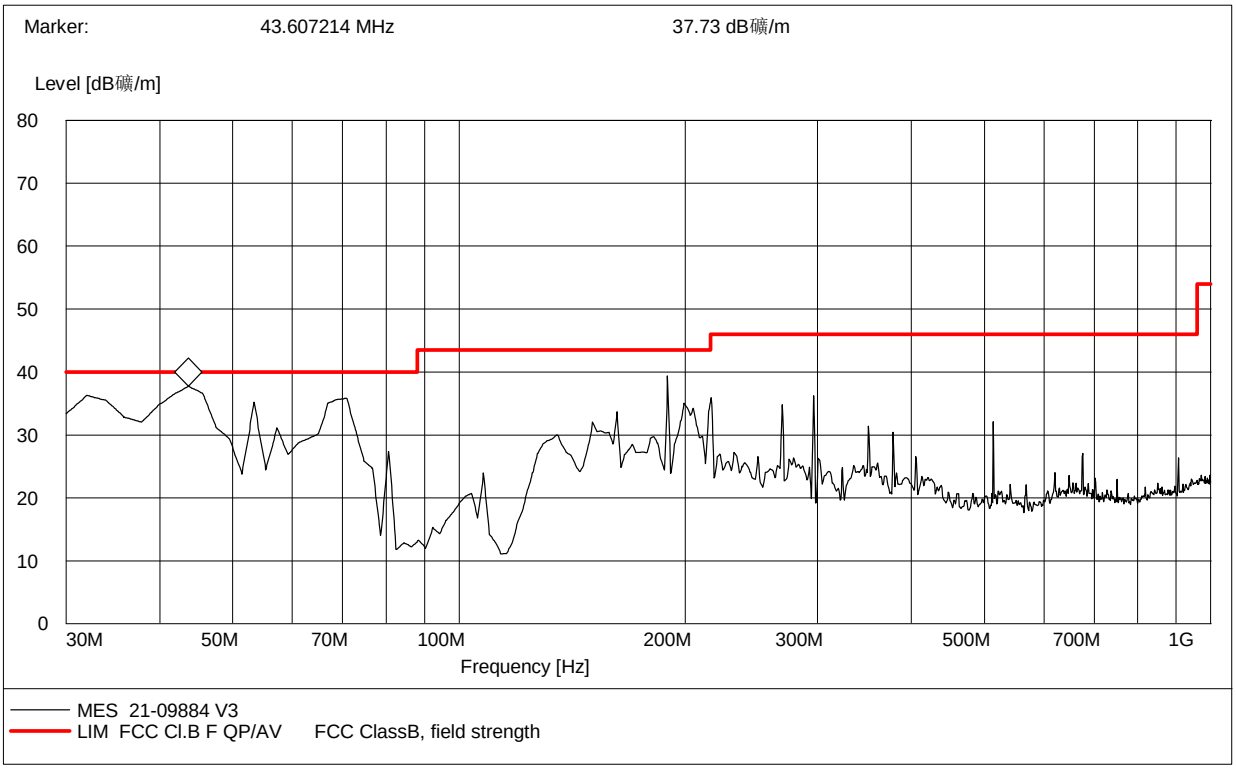
A.Radiation disturbances, antenna polarization: Horizontal



(Plot C: Test Antenna Vertical 30M - 1G)

Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBμV/m)	Margin (dB)	Antenna	Cable Loss(dB)	ANT. Factor(dB)	Verdict
31.41	21.34	120.000	144	40.0	18.66	Horizont	0.3	26.0	Pass
72.15	25.27	120.000	106	40.0	14.73	Horizont	0.3	26.3	Pass
189.03	36.63	120.000	147	43.5	6.87	Horizont	0.4	26.1	Pass
201.31	41.01	120.000	165	43.5	2.49	Horizont	0.5	26.2	Pass
268.93	38.20	120.000	109	46.0	7.80	Horizont	0.4	29.0	Pass
295.60	38.35	120.000	114	46.0	7.65	Horizont	0.4	29.1	Pass

B.Radiation disturbances, antenna polarization: Vertical

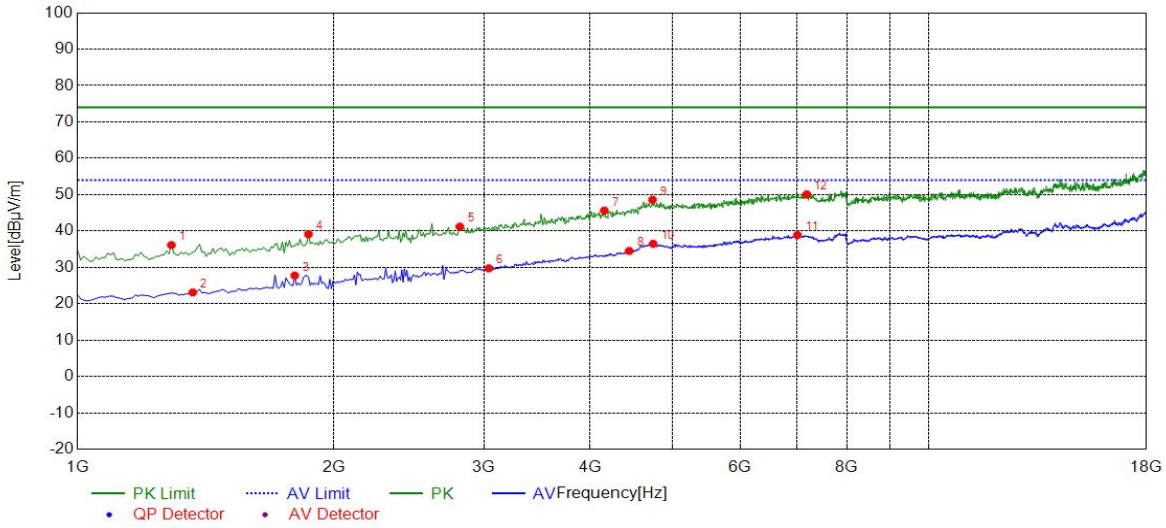


(Plot D: Test Antenna Horizontal 30M - 1G)

Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBμV/m)	Margin (dB)	Antenna	Cable Loss(dB)	ANT. Factor(dB)	Verdict
31.74	35.82	120.000	141	40.0	4.18	Vertical	0.1	26.2	Pass
43.35	36.85	120.000	107	40.0	3.15	Vertical	0.1	26.1	Pass
161.09	32.89	120.000	122	43.5	10.61	Vertical	0.2	26.1	Pass
188.27	38.21	120.000	119	43.5	5.29	Vertical	0.3	26.3	Pass
295.38	35.59	120.000	163	46.0	10.41	Vertical	0.3	28.9	Pass
514.45	31.02	120.000	159	46.0	14.98	Vertical	0.5	29.0	Pass

Test Result: PASS

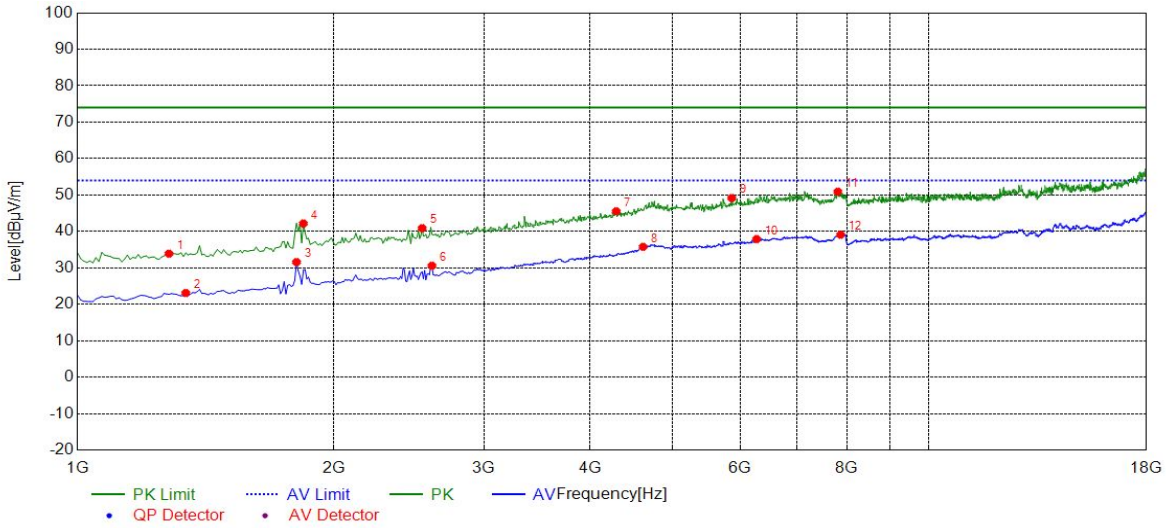
A.Radiation disturbances, antenna polarization: Horizontal



(Plot E: Test Antenna Horizontal 1G – 18G)

Suspected List									
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	1280.6	33.90	-14.52	74.00	40.10	PK	154	331	Vertical
2	1340.1	23.10	-14.25	54.00	30.90	AV	136	15	Vertical
3	1807.9	31.58	-11.96	54.00	22.42	AV	127	258	Vertical
4	1841.9	42.18	-11.78	74.00	31.82	PK	155	324	Vertical
5	2539.2	40.89	-9.11	74.00	33.11	PK	109	277	Vertical
6	2607.3	30.59	-8.88	54.00	23.41	AV	144	333	Vertical
7	4291.1	45.52	-2.25	74.00	28.48	PK	172	319	Vertical
8	4614.3	35.77	-0.27	54.00	18.23	AV	130	354	Vertical
9	5864.4	49.16	1.33	74.00	24.84	PK	141	58	Vertical
10	6272.6	37.89	2.31	54.00	16.11	AV	199	351	Vertical
11	7811.90	50.91	3.88	74.00	23.09	PK	134	346	Vertical
12	7871.4	39.09	3.93	54.00	14.91	AV	125	332	Vertical

B.Radiation disturbances, antenna polarization: Vertical



(Plot F: Test Antenna Vertical 1G – 18G)

Suspected List									
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	1289.1	36.12	-14.49	74.00	37.88	PK	116	241	Horizontal
2	1365.6	23.10	-14.12	54.00	30.90	AV	108	207	Horizontal
3	1799.3	27.74	-12.00	54.00	26.26	AV	125	265	Horizontal
4	1867.4	39.11	-11.64	74.00	34.89	PK	174	217	Horizontal
5	2811.40	41.19	-8.24	74.00	32.81	PK	108	215	Horizontal
6	3041.0	29.72	-7.19	54.00	24.28	AV	133	223	Horizontal
7	4155.0	45.61	-2.75	74.00	28.39	PK	144	249	Horizontal
8	4444.2	34.51	-1.56	54.00	19.49	AV	127	55	Horizontal
9	4733.3	48.59	0.28	74.00	25.41	PK	131	347	Horizontal
10	4741.8	36.48	0.31	54.00	17.52	AV	184	250	Horizontal
11	7004.0	38.86	3.44	54.00	15.14	AV	111	213	Horizontal
12	7182.5	50.08	3.57	74.00	23.92	PK	154	174	Horizontal

-----End of Report-----