EMC TEST REPORT

Report No.:	SET2018-09466
Product Name:	Handheld Data Terminal
FCC ID:	HLEEA602BTNFL
Model No. :	EA600, EA602
Applicant:	Unitech Electronics Co., Ltd.
Address:	5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan.
Received Date:	2018-07-11
Tested Date:	2018-07-11—2018-07-27
Issued by:	CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.
Lab Location:	Building 28/29, East of Shigu Xili Industrial Zone, Nanshan District Shenzhen, Guangdong 518055, China **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

Product Name.....: Handheld Data Terminal

Model No. .....: EA600, EA602

Applicant.....: Unitech Electronics Co., Ltd.

Applicant Address.....: 5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan.

Manufacturer.....: Unitech Electronics Co., Ltd.

Manufacturer Address.....: 5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan.

Test Standards..... : 47 CFR Part 15 Subpart B: Radio Frequency Devices

Test Result.....: PASS

Tested by .....: Chris You

Chris You Test Engineer 2018.07.27

Reviewed by.....: Zhu Qi

Zhu Qi Senior Engineer 2018.07.27

Approved by..... : Smartli

2018.07.27

Smart Li, Manager

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Change History		
Issue	Date	Reason for change
1.0	2018.07.27	First edition

1. GENERAL INFORMATION

1.1 EUT Description

EUT Name..... .: Handheld Data Terminal
FCC ID.....: HLEEA602BTNFL
Trade Name……: N/A
Brand Name……: unitech
Hardware Version..... .: SQ51CW_V1.1
Software Version.....: SQ51CW_P1_XX_D_0_180706_02

Note1:The EUT is a Handheld Data Terminal, it supports the following operating frequency band: GSM/WCDMA/LTE, 2.4GHz/5G WLAN, Bluetooth, NFC;

Note2:The EUT is equipped with a T-Flash card slot; equipped with a USB port which can be connected to the ancillary equipments.

*Note 3:*The two models have been tested and were recorded in this report.

Note 4: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 2017	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

CNAS-Lab Code: L1659

CCIC-SET is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

FCC-Registration No.: CN5031

CCIC Southern Electronic Product Testing (Shenzhen) 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: CN5031, valid time is until December 31, 2018.

ISED Registration: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until Aug. 03, 2019.

NVLAP Lab Code: 201008-0

CCIC-SET is a third party testing organization accredited by NVLAP according to ISO/IEC 17025. The accreditation certificate number is 201008-0.

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 = 3.6 dB (k=2)
Uncertainty of Radiated Emission:	Uc = 4.5 dB (k=2)

2. TEST CONDITIONS SETTING

2.1 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
Micro SD card	SanDisk	N/A	N/A	N/A
Mouse	Logitech	M100r	25011051	DOC

Support Cable:

Description	Shield Type	Ferrite Core	Length
PC Power adapter Cable	Un- shielding	No	1.2m
Mouse Cable	Un- shielding	No	1m

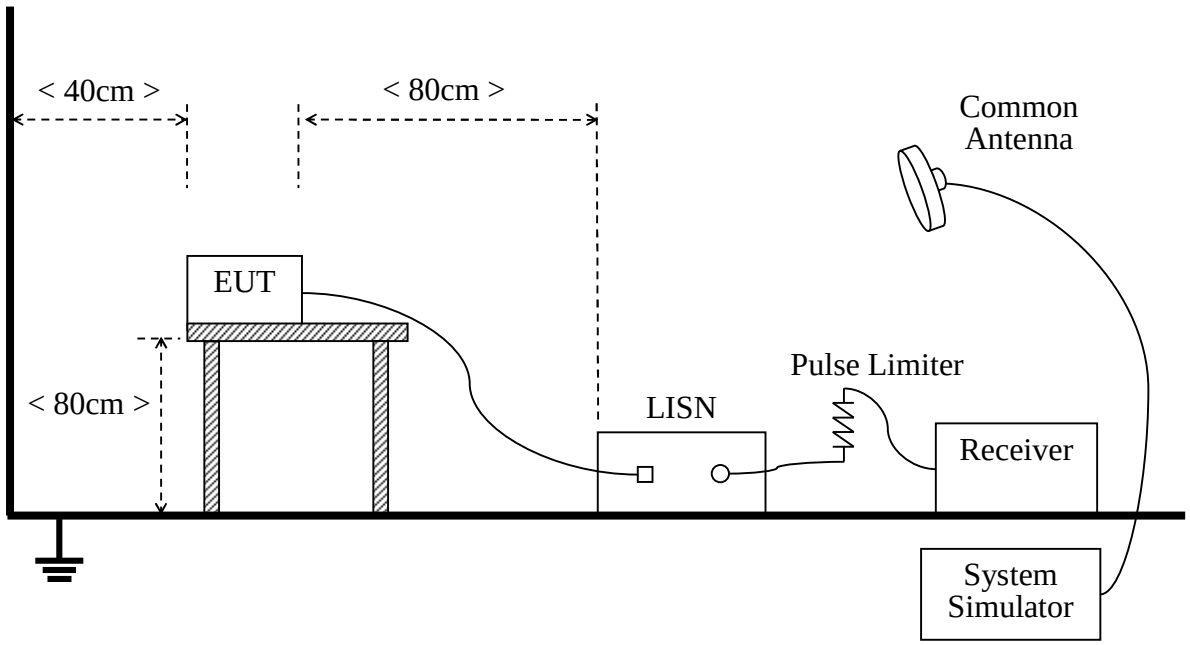
2.2 Test Mode

The EUT configuration of the emission tests is EUT + PC+Mouse.

2.3 Test Setup and Equipments List

2.3.1 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.

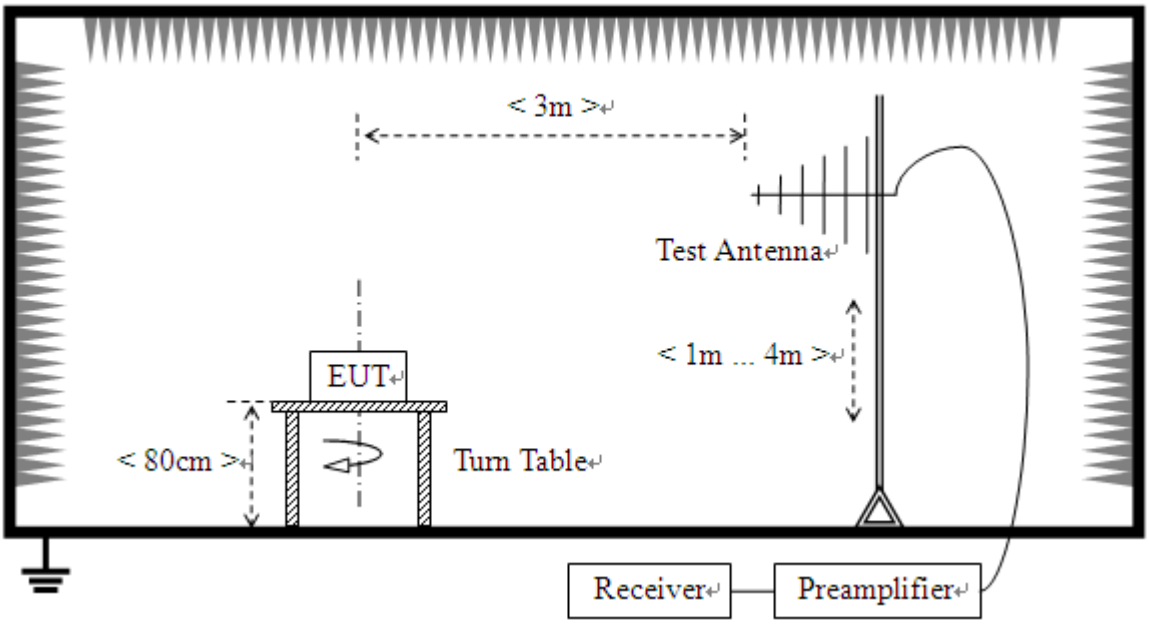
B. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
Test Receiver	KEYSIGHT	N9038A	A141202036	2017.12.13	2018.12.12
LISN	ROHDE&SCHWARZ	ENV216	A140701847	2018.01.08	2019.01.07
Cable	MATCHING PAD	W7	/	2018.04.02	2019.04.01

2.3.2 Radiated Emission

A. Test Setup:

1) For radiated emissions from 30MHz to1GHz



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	ROHDE&SCHWARZ	ESW26	A180502935	2017.10.18	2018.10.17
Semi-Anechoic Chamber	Albatross	9m*6m*6m	A0412372	2018.05.09	2019.05.08
Test Antenna - Bi-Log	ETC	MCTD 2786	A150402239	2018.06.10	2019.06.09
Test Antenna – Horn	ROHDE&SCHWARZ	HF906	A0304225	2018.05.26	2019.05.25
Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4 m	A0304210	2018.05.09	2019.05.08
Amplifier 1G~18GHz	ROHDE&SCHWARZ	MITEQ AFS42-0010 1800	A0509366	2018.06.04	2019.06.03
Amplifier 20M~3GHz	Compliance Direction System	PAP-0203H	A0509377	2018.06.03	2019.06.02
Cable	SUNHNER	SUCOFLEX 100	/	2018.06.03	2019.06.02
Cable	SUNHNER	SUCOFLEX 104	MY1758/4	2018.06.03	2019.06.02

3. 47 CFR PART 15B REQUIREMENTS

3.1 Conducted Emission

3.1.1 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

Note:

a) The limit subjects to the Class B digital device.

b) The lower limit shall apply at the band edges.

c) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

3.1.2 Test Description

See section 2.3.1 of this report.

3.1.3 Test Result

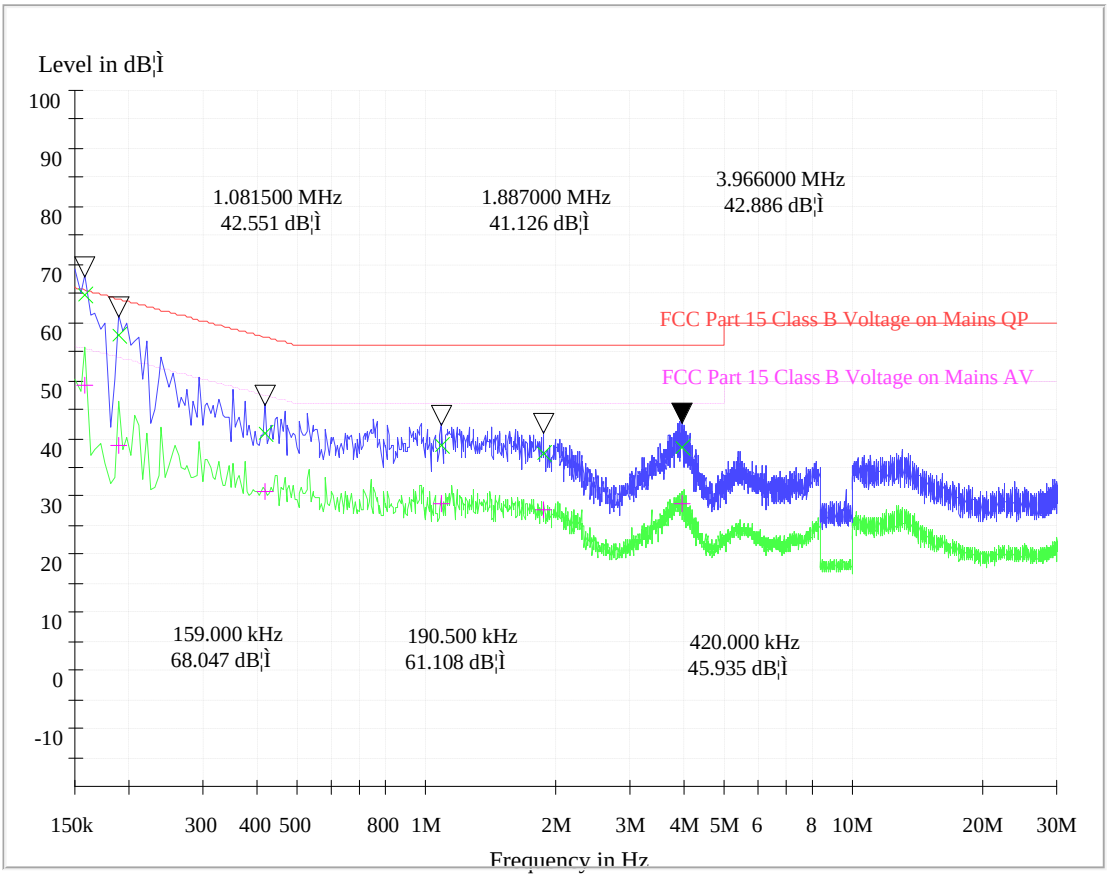
The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines 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.

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

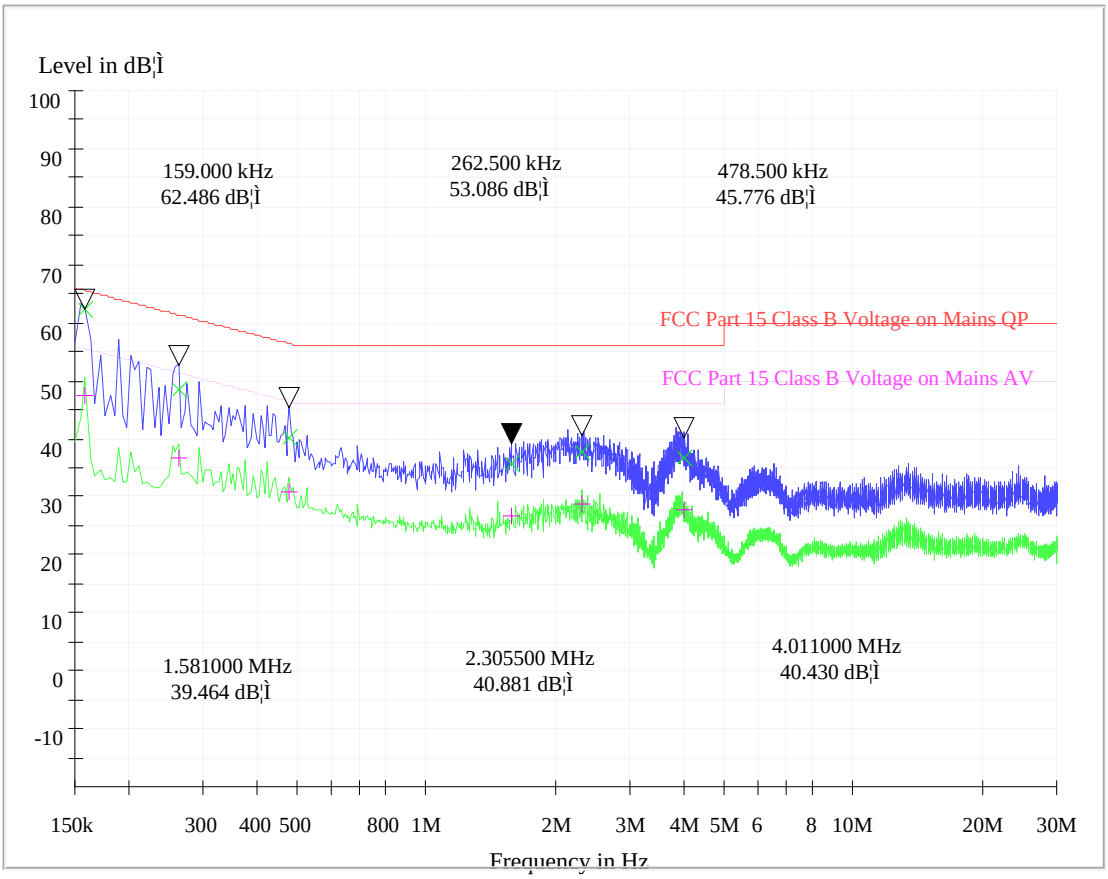
A. Mains terminal disturbance voltage, L phase



(Plot A: L Phase)

Conducted Disturbance at Mains Terminals							
L Test Data							
QP				AV			
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Margin (dB)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Margin (dB)
0.1590	65.50	64.58	0.94	0.1590	55.50	49.07	6.45
0.1905	64.00	57.85	6.16	0.1905	54.00	38.88	15.13
0.4200	57.40	40.87	16.58	0.4200	47.40	30.86	16.59
1.0815	56.00	38.63	17.37	1.0815	46.00	28.87	17.13
1.8870	56.00	37.33	18.67	1.8870	46.00	27.78	18.22
3.9660	56.00	38.36	17.64	3.9660	46.00	28.86	17.14

B. Mains terminal disturbance voltage, N phase



(Plot B: N Phase)

Conducted Disturbance at Mains Terminals							
N Test Data							
QP				AV			
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)
0.1590	65.50	62.15	3.37	0.1590	55.50	47.51	8.01
0.2625	61.40	48.64	12.71	0.2625	51.40	36.73	14.62
0.4785	56.40	40.32	16.05	0.4785	46.40	30.99	15.38
1.5810	56.00	35.80	20.20	1.5810	46.00	26.58	19.42
2.3055	56.00	37.75	18.25	2.3055	46.00	28.83	17.17
4.0110	56.00	36.88	19.12	4.0110	46.00	27.78	18.22

Test Result: PASS

3.2 Radiated Emission

3.2.1 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)
0.009 - 0.490	2400/F(kHz)	300m	10000* 2400/F(kHz)	20log 2400/F(kHz) + 80
0.490 - 1.705	2400/F(kHz)	30m	100* 2400/F(kHz)	20log 2400/F(kHz) + 40
1.705 - 30.00	30	30m	100*30	20log 30 + 40
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
   $Ld1 = L1 = 30uV/m * (10)^2 = 100 * 30uV/m$.

3.2.2 Test Description

See section 2.3.2 of this report.

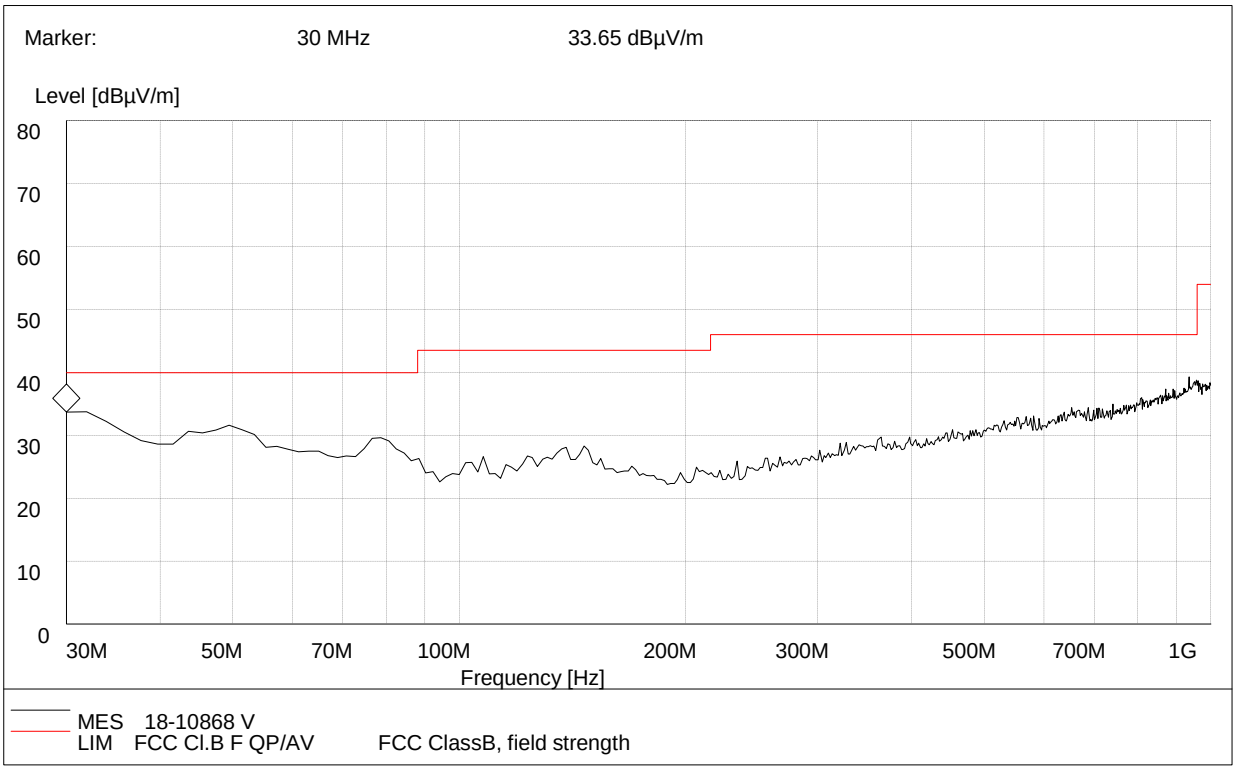
3.2.3 Test Result

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.

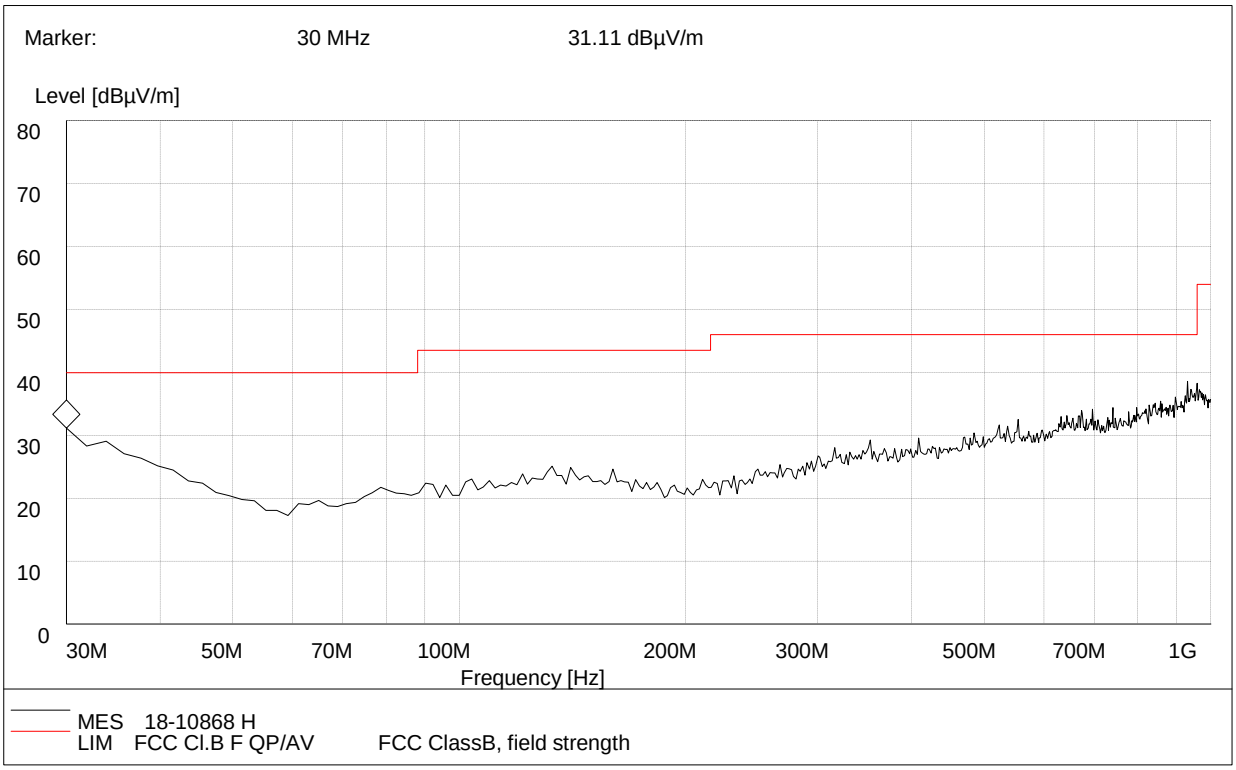
C. Radiation disturbances, antenna polarization:Vertical



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

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµV/m)	Margin (dB)	Antenna	Verdict
30.26	31.43	120.000	208.0	40.00	8.57	Vertical	Pass
52.87	30.15	120.000	129.0	40.00	9.85	Vertical	Pass
78.05	29.11	120.000	147.0	40.00	10.89	Vertical	Pass
148.58	26.59	120.000	241.0	43.50	16.91	Vertical	Pass
338.19	28.97	120.000	169.0	46.00	16.03	Vertical	Pass
931.96	37.18	120.000	207.0	46.00	8.82	Vertical	Pass

D. Radiation disturbances, antenna polarization: Horizontal

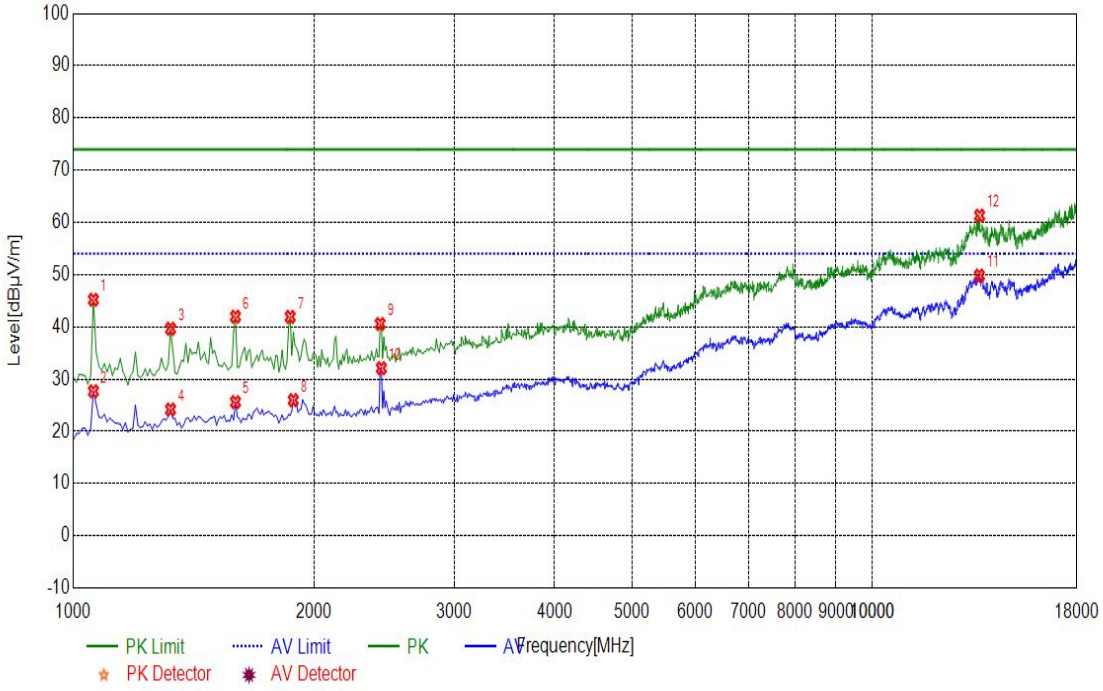


(Plot D: Test Antenna Horizontal 30M - 1G)

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµV/m)	Margin (dB)	Antenna	Verdict
30.00	30.86	120.000	223.0	40.00	9.14	Horizontal	Pass
77.54	20.13	120.000	209.0	40.00	19.87	Horizontal	Pass
100.58	26.75	120.000	126.0	43.50	16.75	Horizontal	Pass
337.13	26.85	120.000	268.0	46.00	19.15	Horizontal	Pass
560.68	31.80	120.000	214.0	46.00	14.20	Horizontal	Pass
657.88	33.91	120.000	364.0	46.00	12.09	Horizontal	Pass

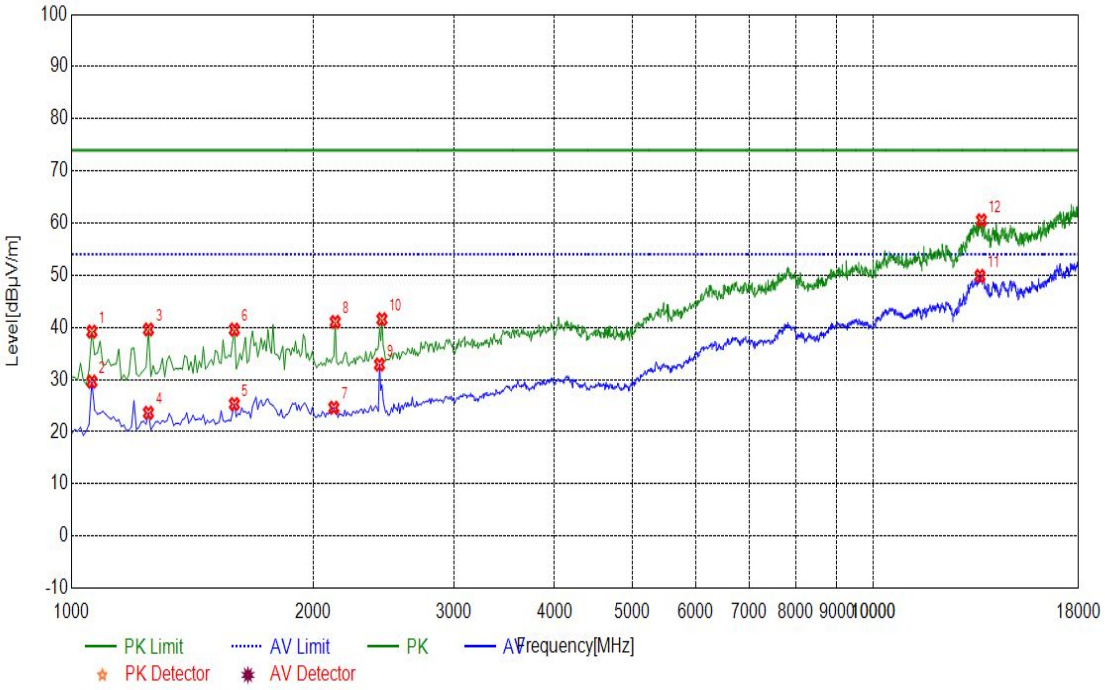
Test Result: PASS

E. Radiation disturbances, antenna polarization: Horizontal



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

F. Radiation disturbances, antenna polarization: Vertical



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