RF TEST REPORT

Report No.:	SET2019-15911
Product Name:	Handheld Data Terminal
FCC ID:	SWSDT40
Model No. :	DT40, DT40S , DT40T
Applicant:	UROVO TECHNOLOGY CO., LTD.
Address:	36F,High-Tech Zone Union Tower,No.63,Xuefu Road, Nanshan District, Shenzhen, Guangdong, China.
Dates of Testing:	11/01/2019 — 12/04/2019
Issued by:	CCIC Southern Testing Co., Ltd.
Lab Location:	Electronic Testing Building, No.43 Shahe Road Xili Street, Nanshan District, Shenzhen, Guangdong, 518055 China. **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

Test Report

Product Name ..... :	Handheld Data Terminal
Trade Name ..... :	UROVO
Brand Name ..... :	UROVO
Applicant ..... :	UROVO TECHNOLOGY CO., LTD.
Applicant Address ..... :	36F, High-Tech Zone Union Tower, No.63, Xuefu Road, Nanshan District, Shenzhen, Guangdong, China.
Manufacturer ..... :	UROVO TECHNOLOGY CO., LTD.
Manufacturer Address..... :	36F, High-Tech Zone Union Tower, No.63, Xuefu Road, Nanshan District, Shenzhen, Guangdong, China.
Test Standards ..... :	47 CFR FCC Part 15.225
Test Result ..... :	PASS

Tested by ..... : Vincent 2019.12.04

Vincent，Test Engineer

Reviewed by..... : Chris You 2019.12.04

Chris You, Senior Engineer

Approved by..... : Shuangwen Zhang 2019.12.04

Shuangwen Zhang, Manager

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Change History		
Issue	Date	Reason for change
1.0	2019.12.04	First edition

1. GENERAL INFORMATION

1.1 EUT Description

EUT Type	Handheld Data Terminal
Power Supply	5.0Vdc(adapter or host equipment) 3.85Vdc(Li-ion battery)
Frequency Range	13.553MHz – 13.567MHz
Operating Rang	13.56MHz
Number of channel	1
Modulation Type	ASK
Antenna Type	Internal Antenna
Antenna Gain	0dBi

1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

1. 47 CFR FCC Part 15

2. ANSI C63.10-2013

3. FCC KDB 174176

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

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207	Conducted Emission	Compliant
15.225(d) §15.209	Radiated Emission Test	Compliant
§15.225(a) (b) (c) §15.31(f)	Field Strength of Radiated Emissions	Compliant
§15.225(e)	Frequency Stability	Compliant
§15.215(c)	20 dB Bandwidth Testing	Compliant

The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10 2013.

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 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: CN5031, valid time is until December 31, 2020.

ISED Registration: 11185A-1

CAB identifier: CN0064

CCIC Southern Testing 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 Dec.31, 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 (%):	30% -60%
Atmospheric Pressure (kPa):	86KPa-106KPa

2. 47 CFR PART 15C REQUIREMENTS

2.1 Antenna requirement

2.1.1 Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

2.1.2 Antenna Information

Antenna Category: Integral antenna

Antenna General Information:

No.	EUT Model	Ant. Cat.	Gain(dBi)
1	DT40, DT40S , DT40T	Internal antenna	0

Result: comply

The EUT has a permanently antenna. which complies with the Part 15.203. Please refer to the EUT internal photos.

2.2 Field Strength of Radiated Emissions

2.2.1 Requirement

As per FCC Part 15.225

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
(d)Distance extrapolation Factor = 40 $\log_{10}$(specific distance/test distance),
Limit line= specific limit(dBμV)+Distance extrapolation Factor

Test Description
The measured Field Strength of Radiated Emissions was calculated by the reading of the spectrum analyzer and calibration.

A. Test Setup:

The radiated emission tests were performed in the 3-meter chamber A test site, using the setup accordance with the ANSI C63.10:2013. The specification used was the FCC Part Subpart C limits.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	R&S	ESU8	100071	2019.04.30	2020.04.29
Passive Loop Antenna	R&S	HFH2-Z2	100047	2019.04.26	2022.04.25

2.2.2 Test Result

A. Test Verdict:

Test Mode: Continuous Transmitting

Indicated			Detector PK/QP/AV	FCC Part 15.225	
Frequency Range (MHz)	Mark point (MHz)	Maximum Reading (dBμV/m) @3m		Limit (dBμV/m) @3m	Result
1.705-13.110	12.580	20.659(H)	QP	69.5	Pass
13.110-13.410	13.342	21.574(H)	QP	80.5	Pass
13.410-13.553	13.487	20.357(H)	QP	90.5	Pass
13.553-13.567	13.560	38.985(H)	QP	124.0	Pass
13.567-13.710	13.580	23.586(H)	QP	90.5	Pass
13.710-14.010	13.758	22.638(H)	QP	80.5	Pass
14.010-30.000	26.575	26.357(H)	QP	69.5	Pass
1.705-13.110	12.582	20.743(V)	QP	69.5	Pass
13.110-13.410	13.285	22.648(V)	QP	80.5	Pass
13.410-13.553	13.502	21.654(V)	QP	90.5	Pass
13.553-13.567	13.561	37.275(V)	QP	124.0	Pass
13.567-13.710	13.565	22.740(V)	QP	90.5	Pass
13.710-14.010	13.948	24.395(V)	QP	80.5	Pass
14.010-30.000	25.981	22.758(V)	QP	69.5	Pass

2.3 20 dB Bandwidth Testing

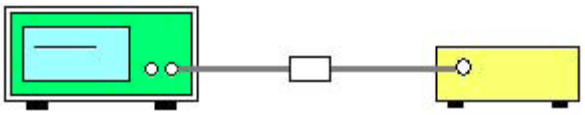
2.3.1 Requirement

Per 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (13.553-13.567MHz).

2.3.2 Test Description

A. Test Set:



The EUT which is powered by the AC 120V/60Hz is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss and Atten as the factor is calibrated to correct the reading.

Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference

level. Record the frequency difference as the emission bandwidth.

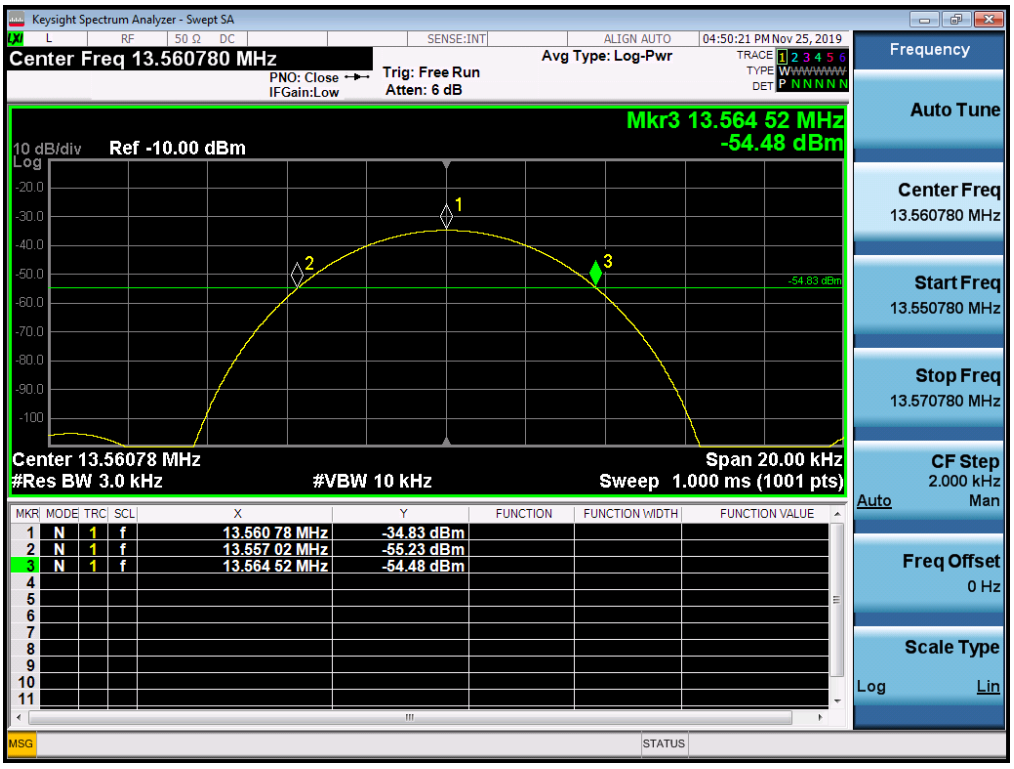
A. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Spectrum Analyzer	Keysight	N9030A	/	2019.06.05	2020.06.04

2.3.3 Test Result

Test Frequency(MHz)	20dB Bandwidth(KHz)
13.56	7.5
F_L:13.55702MHz, F_H:13.56452MHz Within: 13.553-13.567MHz	

20 dB Occupied Bandwidth



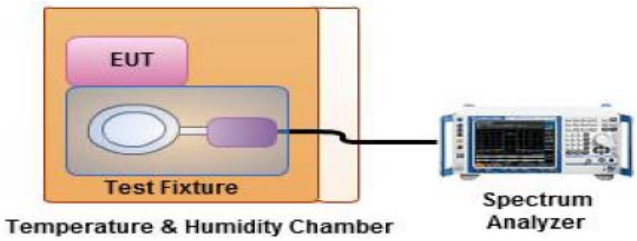
2.4 Frequency Stability

2.4.1 Requirement

According to FCC section 15.225(e), the frequency tolerance of the carrier signal shall be maintained within ±0.01%(100ppm) of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery

2.4.2 Test Description

A. Test Set:



The EUT is powered by AC 120V/60Hz,which is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

B. Test Procedure

Frequency Stability vs. Temperature: The EUT is powered by AC 120V/60Hz, than antenna was connected to a Spectrum Analyzer. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable AC power supply Source. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the end point. The output frequency was recorded for each voltage.

C. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Spectrum Analyzer	Keysight	N9030A	/	2019.06.05	2020.06.04
Constant Temperature humidity chamber	Dongguan gaoda instrument CO.LTD	GD-7005-100	A130301254	2019.04.22	2020.04.21

2.4.3 Test Result

Test Mode: Continuous Transmitting

Test Environment		Frequency Reading (MHz)	Frequency Error (ppm)	Part 15.225 Limit (ppm)	Result
Adapter Power Supply	Temperature (^{O}C)				
DC3.85V	-20	13.560072	5.310	±100ppm (±0.01%)	Pass
	-10	13.560072	5.310		Pass
	0	13.560069	5.088		Pass
	10	13.560072	5.310		Pass
	20	13.560071	5.236		Pass
	30	13.560072	5.310		Pass
	40	13.560072	5.310		Pass
	50	13.560072	5.310		Pass
Max. = DC 4.4V	20	13.560069	5.088		Pass
Min. = DC 3.6V	20	13.560066	4.867		Pass

2.5 Conducted Emission

2.5.1 Requirement

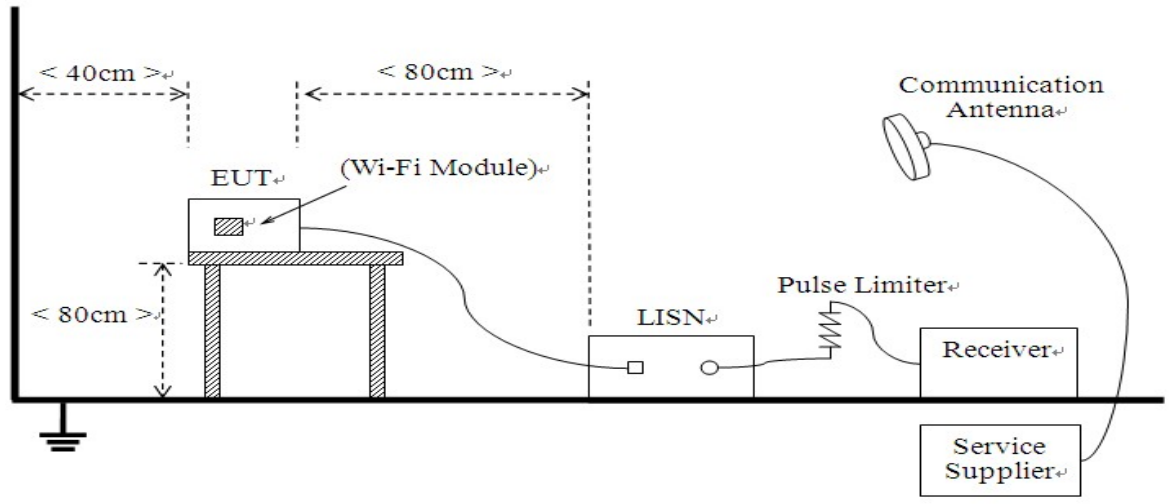
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

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

NOTE:
(a) The lower limit shall apply at the band edges.
(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.5.2 Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10:2013

The EUT is powered by AC 120V/60Hz. The factors of the site are calibrated to correct the reading. During the measurement.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Test Receiver	R&S	ESIB26	A0304218	2019.05.20	2020.05.19
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2019.04.30	2020.04.29

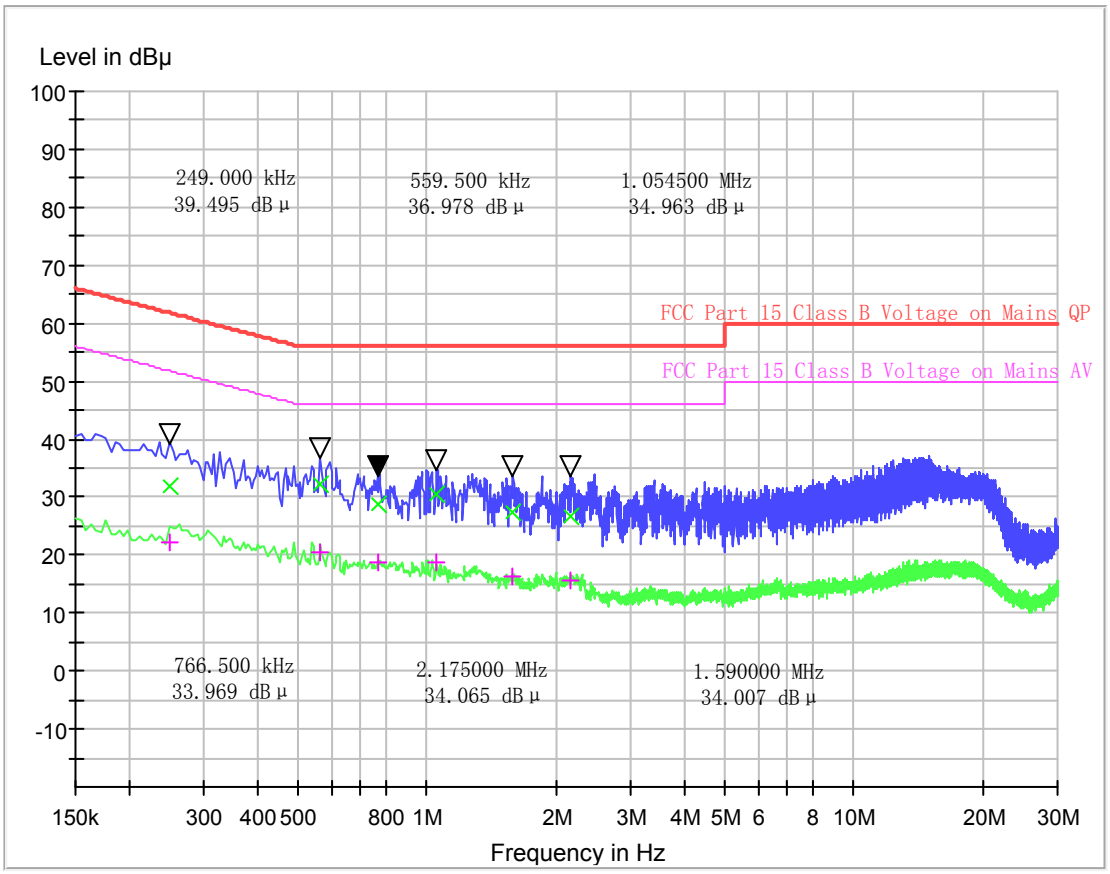
2.5.3 Test Result

The maximum conducted interference is searched using Peak (PK), if 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. Refer to recorded points and plots below.

A. Test setup:

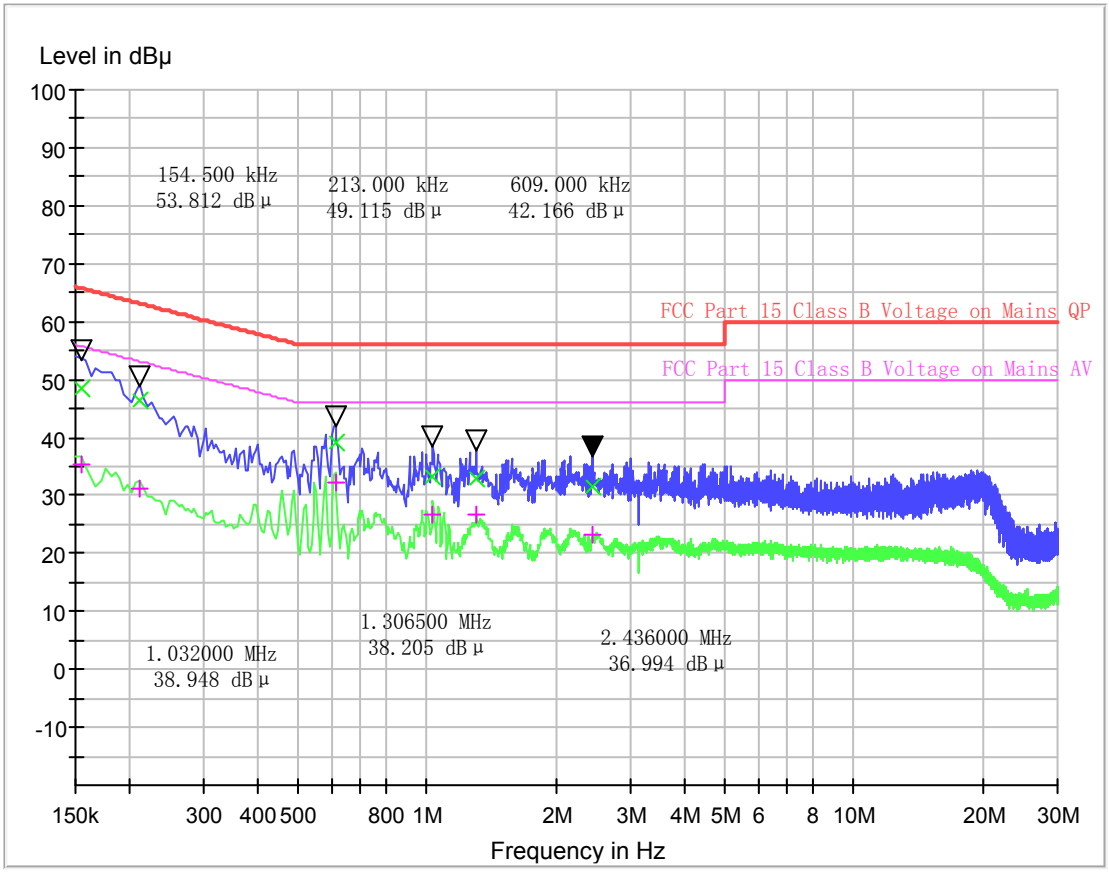
The EUT configuration of the emission tests is EUT.

B. Test data and Plots:



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dB µ V)
0.249000	31.74	22.11	0.1	10.1	30.05	61.8	29.68	51.8
0.559500	32.15	20.48	0.1	10.1	23.85	56.0	25.52	46.0
0.766500	28.60	18.67	0.1	10.1	27.40	56.0	27.33	46.0
1.054500	30.39	18.79	0.1	10.1	25.61	56.0	27.21	46.0
1.590000	27.28	16.31	0.2	10.2	28.72	56.0	29.69	46.0
2.175000	26.65	15.72	0.2	10.2	29.35	56.0	30.28	46.0



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dBµV)
0.154500	48.48	35.45	0.1	10.1	17.27	65.8	20.30	55.8
0.213000	46.55	31.32	0.1	10.1	16.54	63.1	21.77	53.1
0.609000	39.10	32.26	0.1	10.1	16.90	56.0	13.74	46.0
1.032000	33.33	26.56	0.1	10.1	22.67	56.0	19.44	46.0
1.306500	32.96	26.81	0.2	10.2	23.04	56.0	19.19	46.0
2.436000	31.42	23.18	0.2	10.2	24.58	56.0	22.82	46.0

Test Result: PASS

Note: Correction factor=Cabel loss+ attenuation factor
attenuation factor=10dB

2.6 Radiated Emission

2.6.1 Requirement

According to FCC section 15.225(e), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

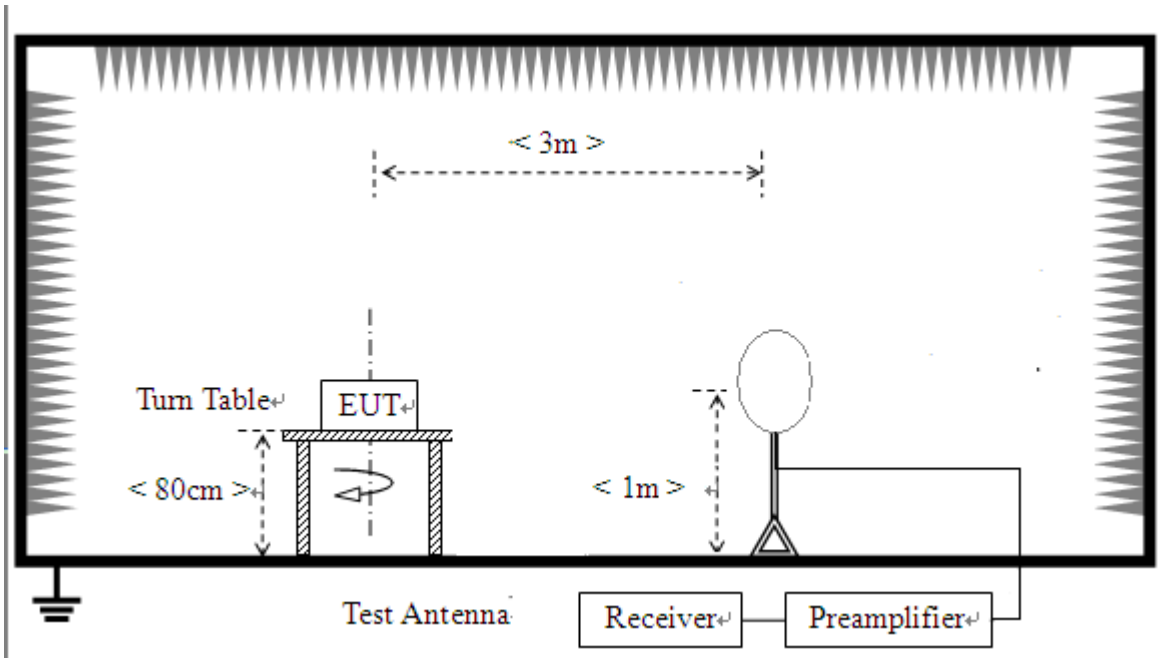
Frequency (MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	20log(2400/F(KHz))+80	300
0.490 - 1.705	24000/F(kHz)	20log(24000/F(KHz))+40	30
1.705 - 30.0	30	20log(30)+40	30
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

Note:

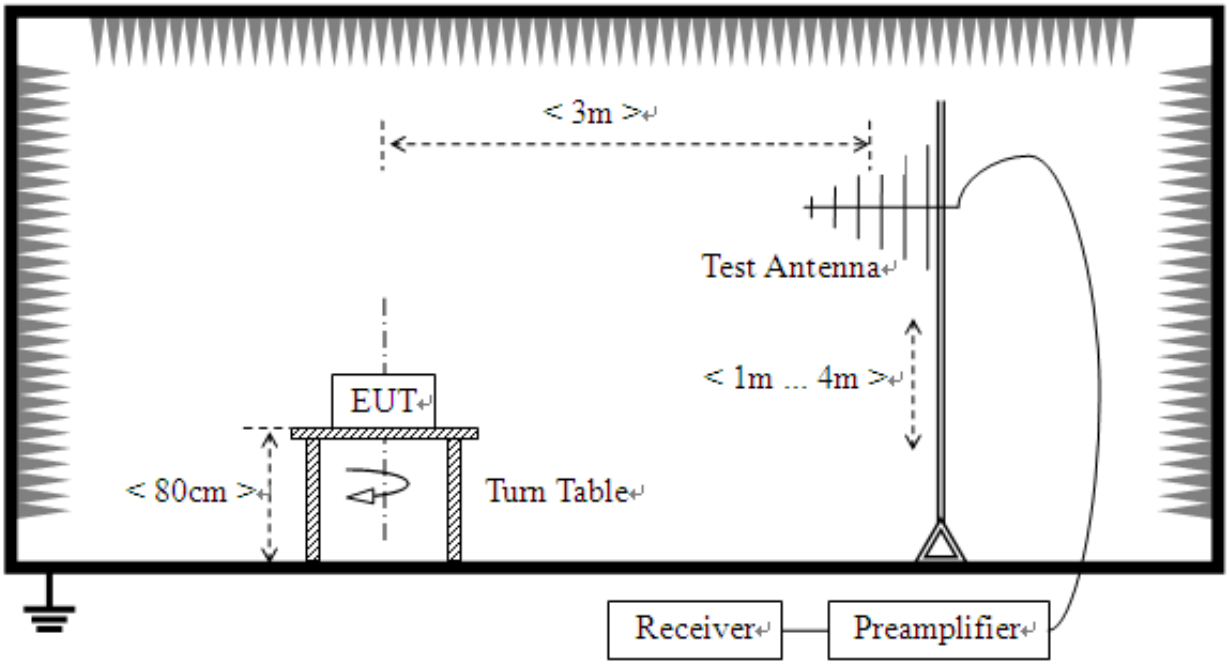
The radiated emission tests were performed in the 3-meter chamber test site, using the setup accordance with the ANSI C63.10:2013. The specification used was the FCC Part Subpart C limits.

2.6.2 Test Description

(1) For radiated emissions from 9kHz to 30MHz



(2) For radiated emissions from 30MHz to1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10:2013. The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10:2013.

For the Test Antenna:

(a) In the frequency range of 9 kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz). 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.

A. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Due Date
Receiver	R&S	ESIB26	A0304218	2019.05.20	2020.05.19
Test Antenna - Bi-Log	Schwarzbeck	VULB 9160	A0805560	2019.05.24	2022.05.23
Passive Loop Antenna	R&S	HFH2-Z6	A0805563	2016.05.25	2021.05.24

2.6.3 Test Result

According to ANSI C63.10:2013 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.
The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

$L_{Cable\ loss}$: Cable loss

During the test, the total correction Factor AT and A_{Factor} were built in test software.

The radiated frequency ranges from 9 kHz to1 GHz.

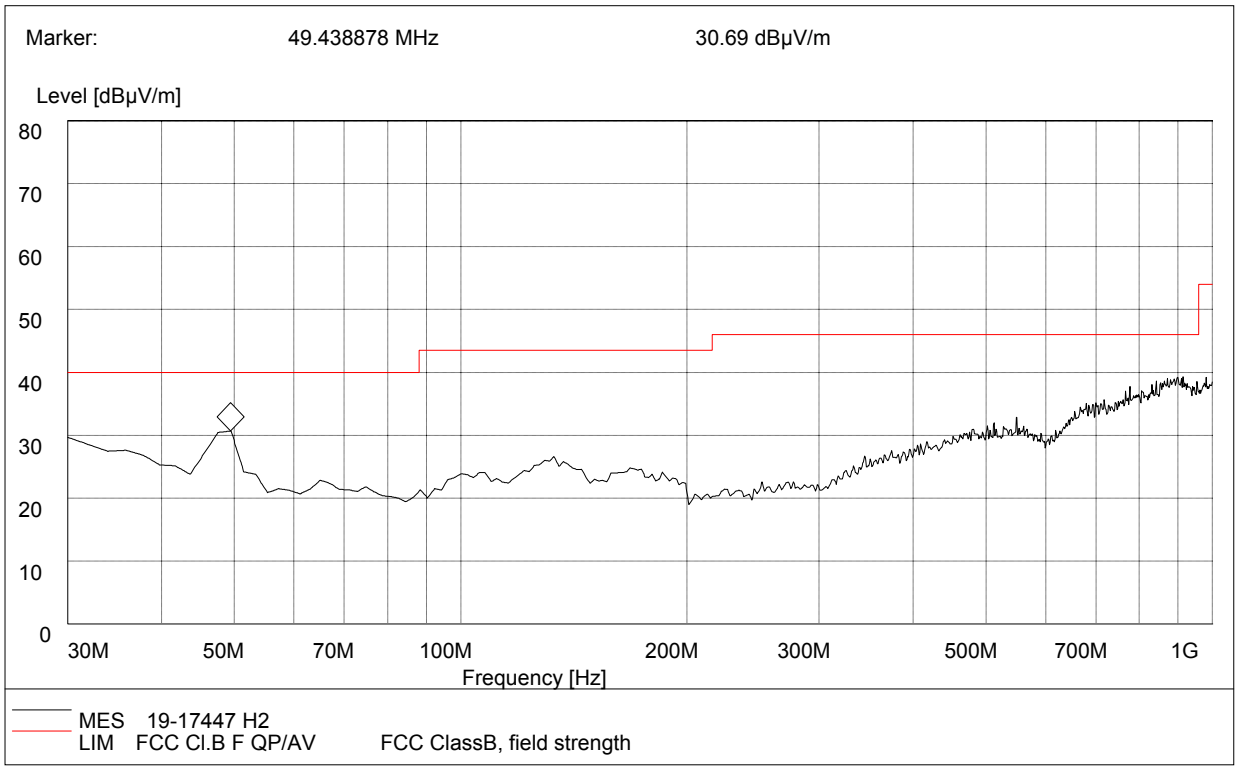
Test plots for the whole measurement frequency range：

For 9 kHz to 30 MHz

Test Mode: Continuous Transmitting

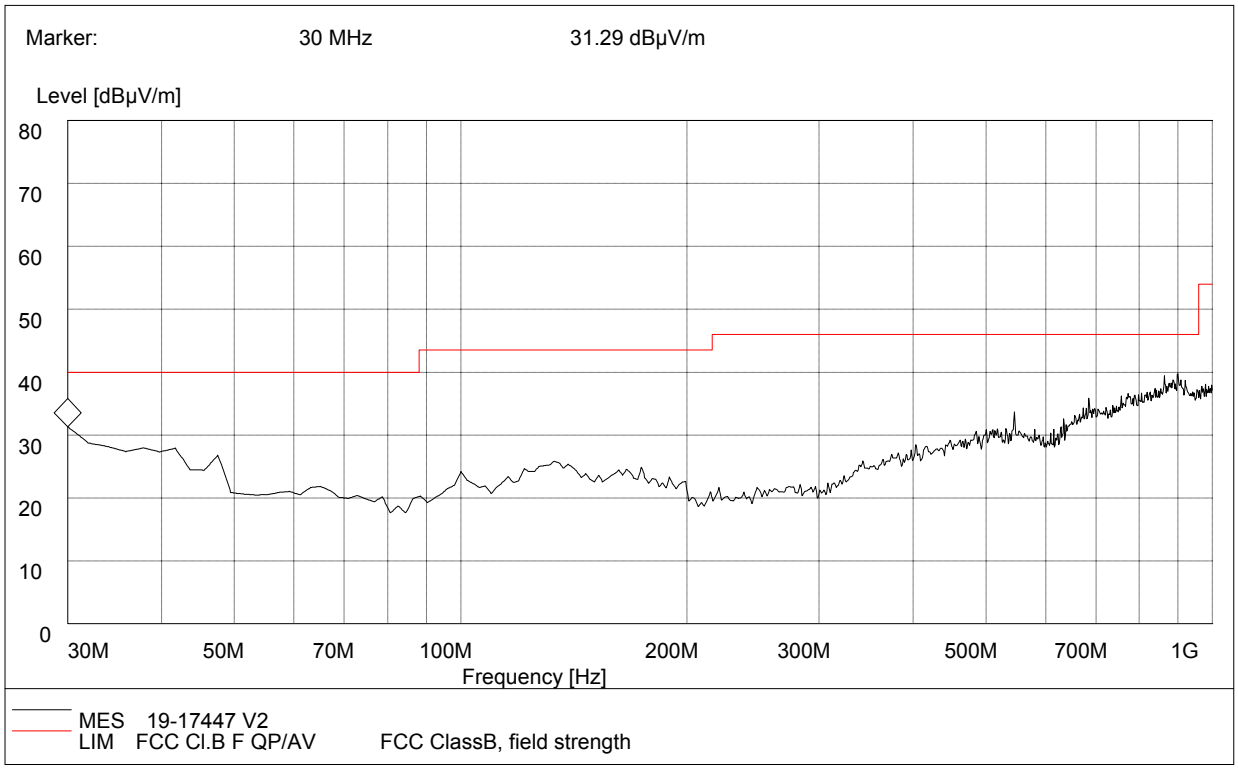
Indicated		Detector PK/QP/AV	FCC Part 15.225	
Frequency Range (MHz)	Maximum Reading (dBμV/m) @3m		Limit (dBμV/m) @3m	Result
0.5718	29.36(H)	PK	92.46	Pass
2.642	25.48(H)	PK	69.54	Pass
13.56	38.95(H)	PK	124	Pass
13.56	39.27(V)	PK	124	Pass
0.287	32.35(V)	PK	98.45	Pass
10.046	35.18(V)	PK	69.54	Pass

For 30MHz to 1000 MHz



(Plot A: 30MHz to 1GHz, Antenna Vertical)

Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Antenna height (cm)	Correction Factor （dB）	Limit (dB µ V/m)	Margin	Antenna	Verdict
30	29.87	120.000	100.0	17.9	40.0	10.13	Vertical	Pass
49.44	30.69	120.000	100.0	8.7	40.0	9.31	Vertical	Pass
145.98	26.57	120.000	100.0	12.3	43.5	16.93	Vertical	Pass
557.65	32.84	120.000	100.0	20.0	46.0	13.16	Vertical	Pass
789.64	37.35	120.000	100.0	23.1	46.0	8.65	Vertical	Pass
908.67	38.47	120.000	100.0	24.8	46.0	7.53	Vertical	Pass



(Plot B: 30MHz to 1GHz, Antenna Horizontal)

Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Antenna height (cm)	Correction Factor （dB）	Limit (dB µ V/m)	Margin	Antenna	Verdict
30	31.29	120.000	100.0	17.9	40.0	8.71	Horizontal	Pass
48.38	26.98	120.000	100.0	8.7	40.0	13.02	Horizontal	Pass
148.99	26.95	120.000	100.0	12.3	43.5	16.55	Horizontal	Pass
536.62	34.41	120.000	100.0	20.0	46.0	11.59	Horizontal	Pass
688.57	35.84	120.000	100.0	22.0	46.0	10.16	Horizontal	Pass
875.65	40.15	120.000	100.0	24.8	46.0	5.85	Horizontal	Pass

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. Margin value = Limit value - Emission Level
4. The other emission levels were very low against the limit.

** END OF REPORT **