TEST REPORT

Applicant	:	Trimble Europe BV.
Address of Applicant	:	Industrieweg 187a, 5683 CC Best, Netherlands
Product Name	:	Rugged Smart Phone
Model No.	:	TDC600_2, MobileMapper60_2
Sample No.	:	E20100017-01#11
FCC ID	:	NZI-11705920
ISED Number	:	9288A-11705920
Standards	:	FCC CFR47 Part 15, Subpart C RSS-Gen (Issue 5, March 2019) RSS-210 (Issue 10, December 2019)
Date of Receipt	:	2021-01-26
Date of Test	:	2021-01-26-2021-03-15
Date of Issue	:	2021-03-15

Remark:

This report details the results of the testing carried out on one sample, the results contained in this report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Prepared by: Jennifer Zhou (Jennifer Zhou) Reviewed by: Oliver Xiang (Oliver Xiang) Approved by: Guoyou Chi (Authorized signatory: Guoyou Chi)

TEST REPORT

Contents

1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Service (Shanghai) Co., Ltd.
Address	No.1298 Pingan Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Company Name	Trimble Europe BV.
Address	Industrieweg 187a, 5683 CC Best, Netherlands
Contact Person	Joel Hamberg Magnusson
Telephone	+46764953125
Email	joel_hambergmagnusson@trimble.com

1.3 Details of EUT

Product Name	Rugged Smart Phone
Brand Name	Trimble; Spectra Geospatial
Model Name Under Test	TDC600_2
Series Model Name	TDC600_2; MobileMapper60_2
Description of Model name differentiation	All model are same with electrical paramters and Internal circult structure,but only different on model name,brand name and colors and software version.
FCC ID	NZI-11705920
Mode of Operation	NFC
Frequency Range	13.56MHz
Modulation Type	ASK
Hardware version	V1.0
Software version	TDC600_2.53.10.14 (model:TDC600_2) MM60_2.53.10.05 (model: MobileMapper60_2)
Antenna Type	Internal Antenna
Extreme Temperature Range	-20℃~ +55℃
Test Voltage	High:DC 4.35V Normal:DC 3.8V Low:DC 3.7V

1.4 Test Methodology

47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Note(s):

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test.

1.5 Test Verdict

No.	FCC Part No.	ISED Part No.	Description	Test Result	Verdict
1	15.203	RSS-Gen7.1.4	Antenna Requirement	Clause 4.1.1	PASS
2	15.225(e)	RSS-210 B.6	Frequency Tolerance	Clause 4.1.2	PASS
3	2.1049	RSS-Gen	20dB Bandwidth and 99% Bandwidth	Clause 4.1.3	PASS
4	15.225	RSS-210 B.6	Radiated Emission	Clause 4.1.4	PASS
5	15.207	RSS-Gen	Conducted Emission	Clause 4.1.5	PASS

2 Test Condition

2.1 Environmental conditions

Temperature (°C)	18-25
Humidity (%RH)	40-65
Barometric Pressure (mbar)	960-1060

2.2 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Due Date
Spectrum Analyzer	Keysight	N9020B	MY59260184	2021-08-18
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2021-06-08
V-network	SCHWARZBECK	NSLK 8127	8127-902	2021-07-28
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-07
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-11-21
EMC chamber 9*6*6（L*W*H)	CHANGNING	966	N/A	2021-06-08
Shielded Enclosure 8*5*4（L*W*H)	CHANGNING	854	N/A	2021-06-08
Test Software	BL	BL410_E	N/A	N/A

2.3 Measurement Uncertainty

Parameter	Frequency	Uncertainty
Antenna Port Conducted Emission	150kHz-30MHz	± 1.96 dB
Radiated Emission	30 MHz – 1 GHz	± 3.42 dB
	> 1GHz	± 4.20 dB

3 Test Set-up and Operation Modes

3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:

Channel	Frequency
Test channel	13.56MHz

The basic operation modes are:

A. On
   1. test mode
      a. Transmitting
         i. Test Channel
B. Standby
C. Off

3.2 Special Accessories and Auxiliary Equipment

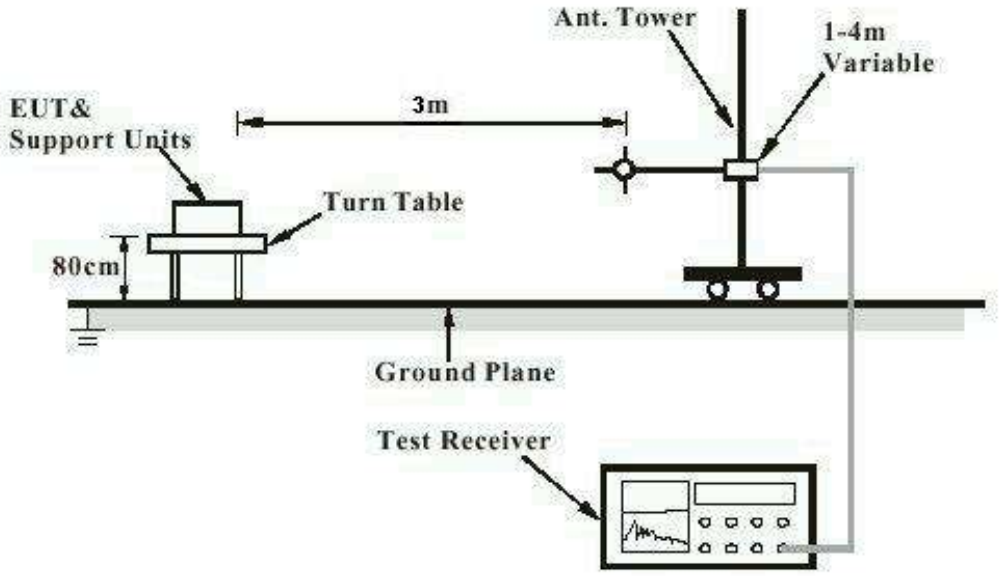
Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	TP00083A	N/A

3.3 Support Software

Description	Manufacturer	Software Name
Software	/	/

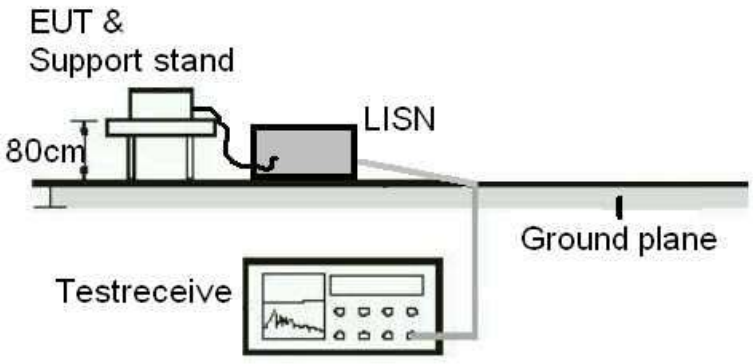
3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 30MHz are done with a table height of 0.8m.

Diagram of Measurement Equipment Configuration for Conduction Measurement



4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT: **PASS**

Test standard	:	Part 15.203
Requirement	:	The use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a gain of 0 dBi. The antenna is an internal antenna with no possibility of replacement with a non-approvrd antenna by the end-user.

Therefore, the EUT is considered to comply with this provision.

4.1.2 Frequency Tolerance

RESULT: **PASS**

Test standard : FCC Part 15.225(e)

Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Test channel
Operation Mode : A.1.a
Ambient temperature : 25°C
Relative humidity : 50%

Test Procedure

1.The test is performed in a Temperature Chamber.
2.The EUT is configured as MS + DC Power Supply.

Table 1: Frequency Tolerance

Temperature (℃)	Voltage (VDC)	Measured		Deviation Limit
		Frequency (MHz)	Tolerance (ppm)	
-20	3.8	13.559900	-7.374631	±0.01%
-10		13.560360	26.548673	
0		13.560420	30.973451	
+10		13.560650	47.935103	
+20		13.560000	0.000000	
+40		13.560900	66.371681	
+50		13.560720	53.097345	
+20	2.8	13.560840	61.946903	
+20	4.35	13.559560	-32.448378	

4.1.3 20dB Bandwidth and 99% Bandwidth

RESULT: **PASS**

Test standard : FCC Part 2.1049

Requirement : ANSI C63.10-2013

Kind of test site : Chamber

Test setup

Test Channel : Test channel

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 50%

Test procedure

The 20dB bandwidth is measured with a spectrum analyzer connected via a receiver antenna placed near the EUT while the EUT is operating in transmission mode.

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth RBW ≥ 1% of the 20 dB bandwidth

VBW ≥ RBW

Sweep = auto

Detector function = peak Trace = max hold.

Table 2: 20dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
ASK	13.56	435.6	497.8

Figure: 20dB Bandwidth

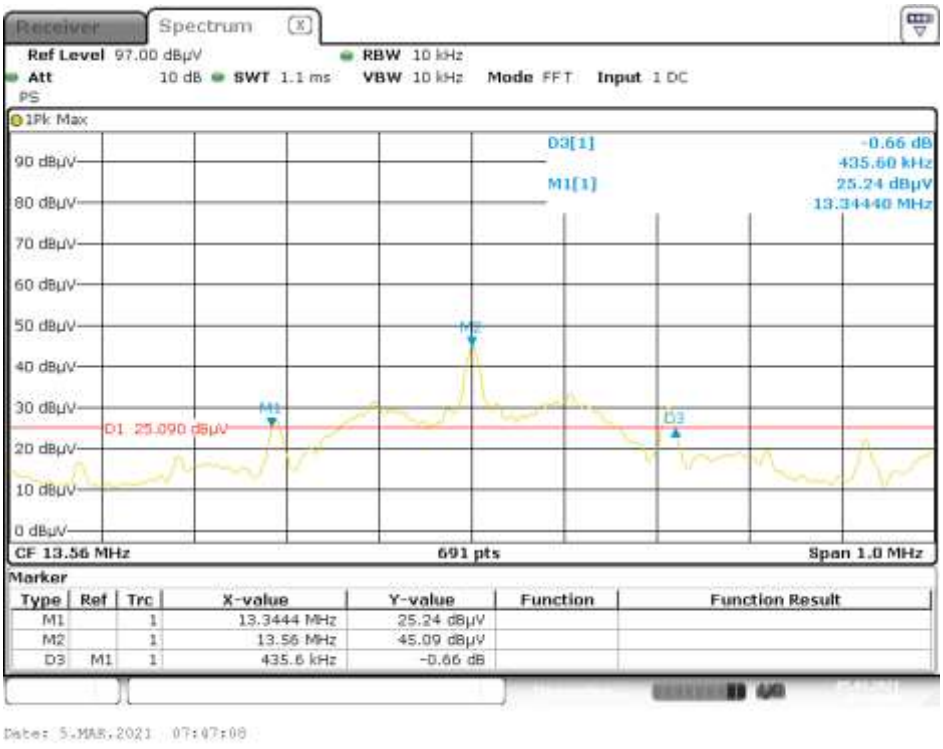
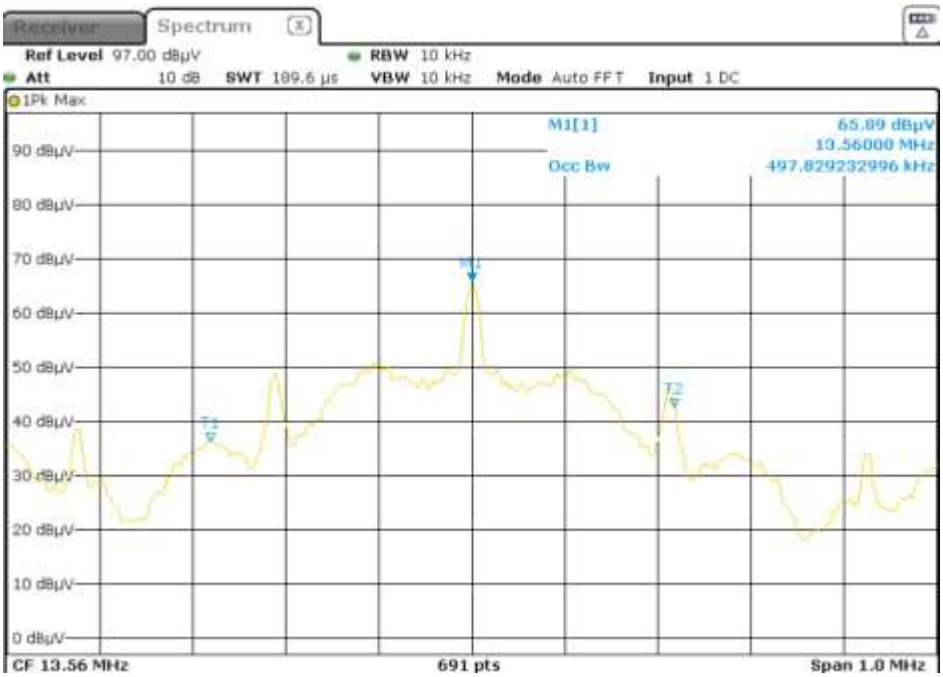


Figure: 99% Bandwidth



4.1.4 Radiated Emission

RESULT: **PASS**

Test standard	:	FCC Part 15.225
Requirement	:	ANSI C63.10-2013
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Test channel
Operation Mode	:	A
Ambient temperature	:	25°C
Relative humidity	:	50%

Notes:
Operation within the band 13.110-14.010 MHz as contained in §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 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) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

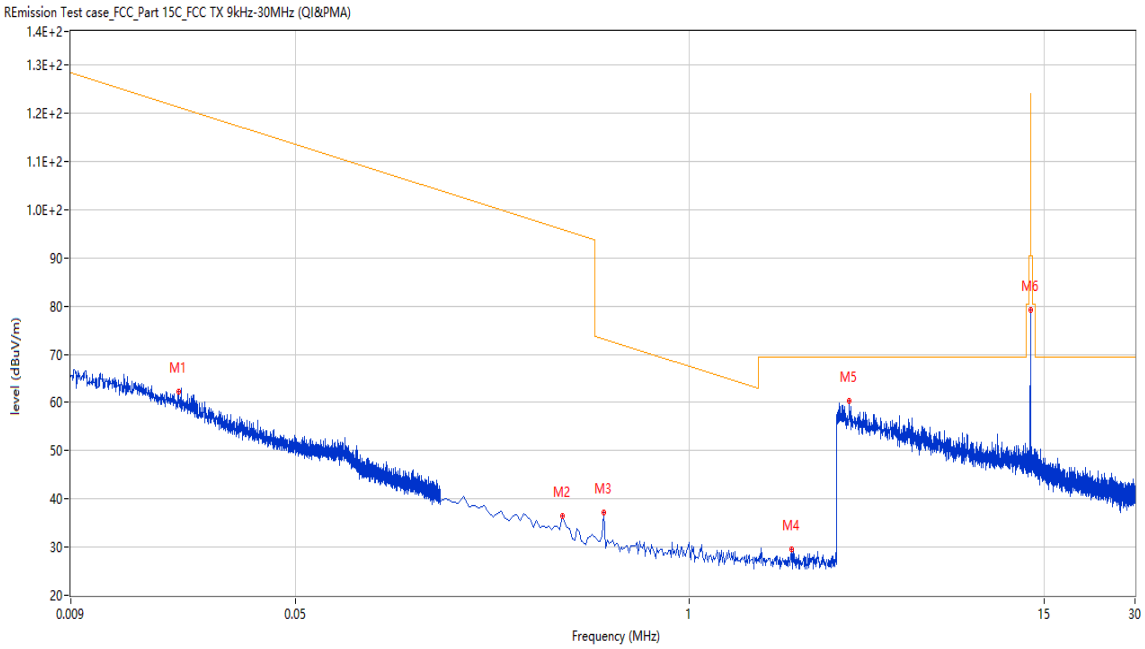
FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(KHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(KHz)	87.6-20log(F)
1.705 ~ 13.110	30	30	29.54
13.110 ~ 13.410	30	106	40.51
13.410~ 13.553	30	334	50.47
13.553~13.567	30	15848	84.00
13.567~13.710	30	334	50.47
13.710~14.010	30	106	40.51
14.010~30	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0

(1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz and above 1000MHz.Radiated emissions limits in these three bands are based on measurements employing an average detector.
(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:
$Limit_{3m}(dBuV/m) = Limit_{300m}(dBuV/m) + 40Log(300m/3m) = Limit_{300m}(dBuV/m) + 80$
$Limit_{3m}(dBuV/m) = Limit_{30m}(dBuV/m) + 40Log(30m/3m) = Limit_{30m}(dBuV/m) + 40$

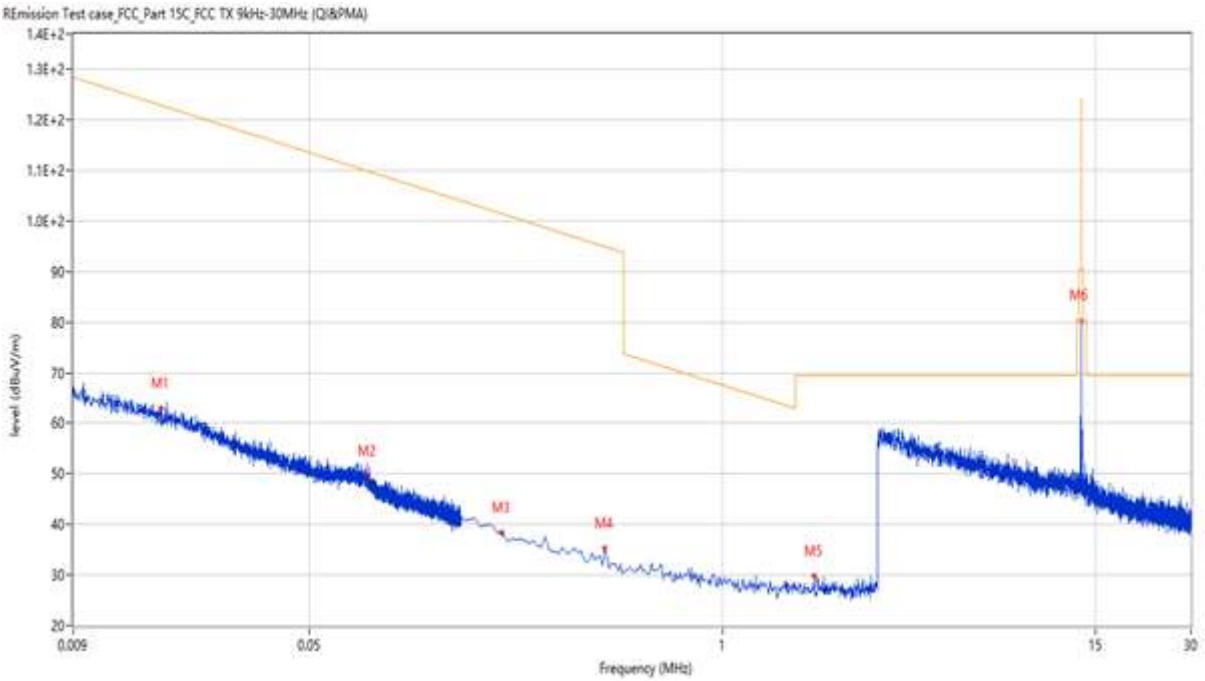
(3) EUT was placed on a non-metallic table, 100 cm above the ground plane inside a semi-anechoic chamber.
(4) Test antenna was located 3m from the EUT on an adjustable mast

According ANSI C63.10:2013 clause 6.4.4.2 and 6,5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also be positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. for measurement above 30MHz, the Trilog Broadband Antenna or Horn Antenna was located 3m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

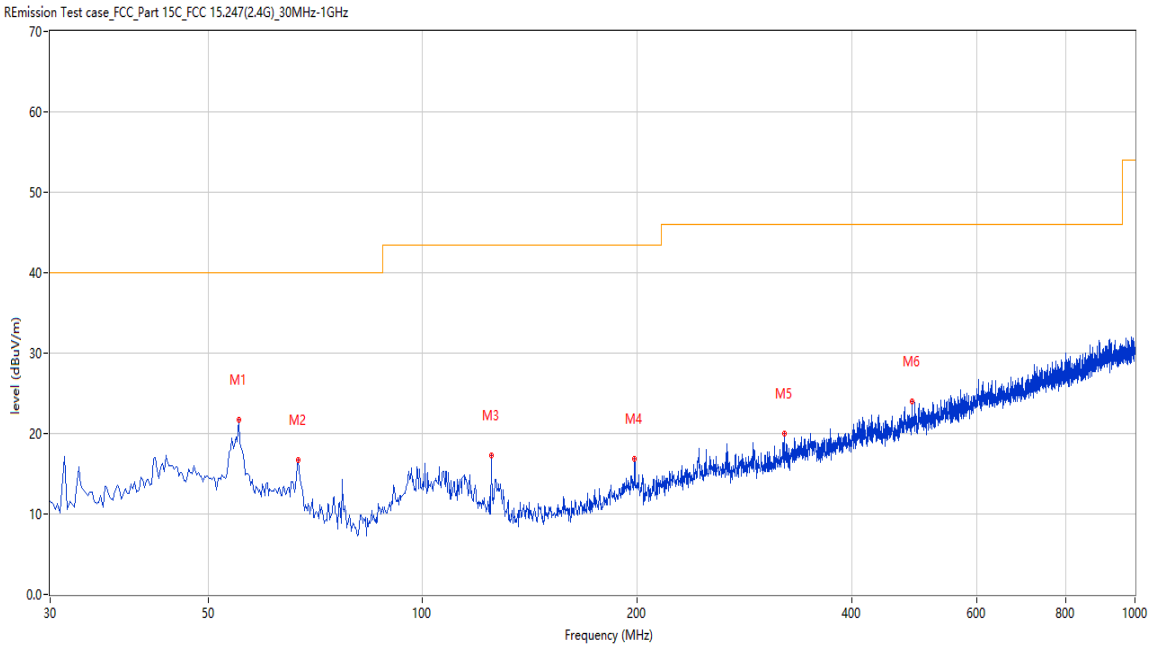
Test data :



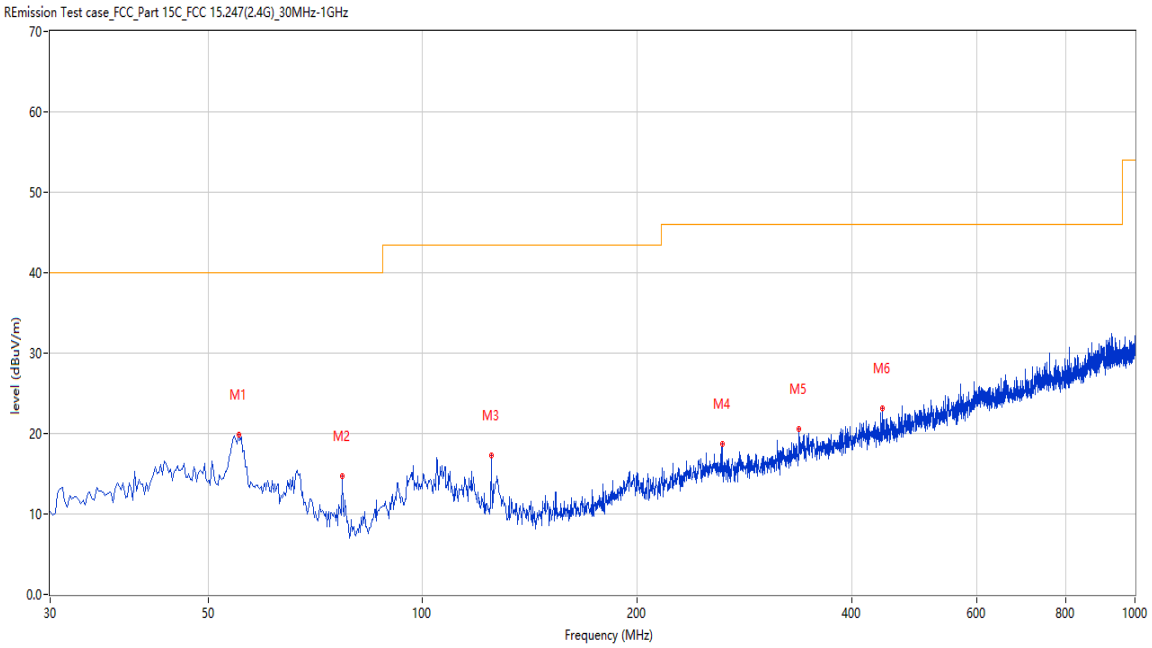
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.021	61.89	19.76	121.3	-59.41	Peak	297.20	100	Horizontal	Pass
2	0.381	36.43	19.90	95.9	-59.47	Peak	275.80	100	Horizontal	Pass
3	0.523	37.17	19.88	73.1	-35.93	Peak	75.60	100	Horizontal	Pass
4	2.187	29.51	19.85	69.5	-39.99	Peak	360.00	100	Horizontal	Pass
5	3.395	60.28	19.88	69.5	-9.22	Peak	360.00	100	Horizontal	Pass
6	13.557	79.24	19.88	124.0	-44.76	Peak	33.90	100	Horizontal	Pass



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.017	61.39	19.66	123.0	-61.61	Peak	94.20	100	Vertical	Pass
2	0.076	47.76	20.05	109.9	-62.14	Peak	135.90	100	Vertical	Pass
3	0.202	38.35	19.97	101.4	-63.05	Peak	360.00	100	Vertical	Pass
4	0.426	35.24	19.89	94.9	-59.66	Peak	176.00	100	Vertical	Pass
5	1.948	29.80	19.86	69.5	-39.70	Peak	72.20	100	Vertical	Pass
6	13.557	80.12	19.88	124.0	-43.88	Peak	34.10	100	Vertical	Pass



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	55.214	21.65	-20.00	40.0	-18.35	Peak	356.40	100	Horizontal	Pass
2	66.851	16.76	-20.03	40.0	-23.24	Peak	178.30	100	Horizontal	Pass
3	124.794	17.31	-23.36	43.5	-26.19	Peak	193.40	100	Horizontal	Pass
4	198.495	16.80	-20.04	43.5	-26.70	Peak	85.90	100	Horizontal	Pass
5	321.655	20.02	-17.18	46.0	-25.98	Peak	353.40	100	Horizontal	Pass
6	486.513	23.93	-12.84	46.0	-22.07	Peak	200.80	100	Horizontal	Pass



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	55.214	19.92	-20.00	40.0	-20.08	Peak	234.00	100	Vertical	Pass
2	77.033	14.78	-25.90	40.0	-25.22	Peak	48.90	100	Vertical	Pass
3	124.794	17.32	-23.36	43.5	-26.18	Peak	161.10	100	Vertical	Pass
4	263.227	18.64	-18.63	46.0	-27.36	Peak	299.40	100	Vertical	Pass
5	337.171	20.56	-16.41	46.0	-25.44	Peak	23.30	100	Vertical	Pass
6	442.632	23.21	-14.33	46.0	-22.79	Peak	344.20	100	Vertical	Pass

Note ： margin（Over Limit）>10dB,so do not need to test by QP Detector

4.2 Mains Emissions

4.2.1 Conducted Emission on AC Mains

RESULT: **PASS**

Test standard	:	FCC Part 15.207(a)
Requirement	:	ANSI C63.10-2013
Kind of test site	:	Shielded room

Test setup

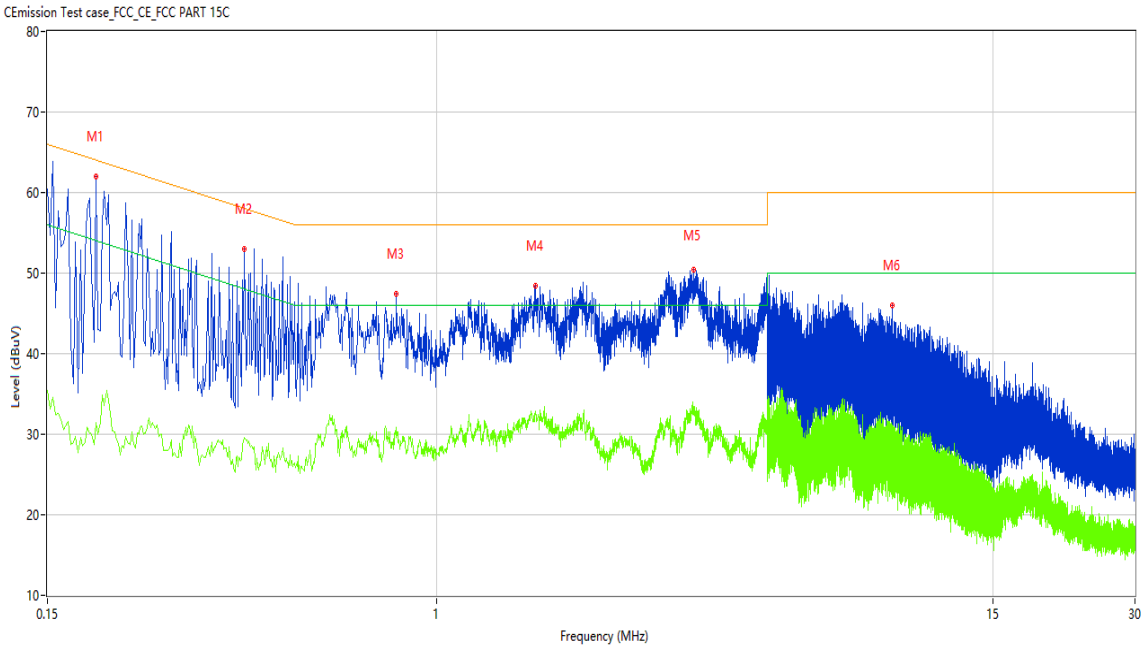
Input Voltage	:	AC 120V, 60Hz; AC 240V, 50Hz
Operation Mode	:	A.1.a
Earthing	:	Not Connected
Ambient temperature	:	25°C
Relative humidity	:	50%

For details refer to following test plot.

Note:

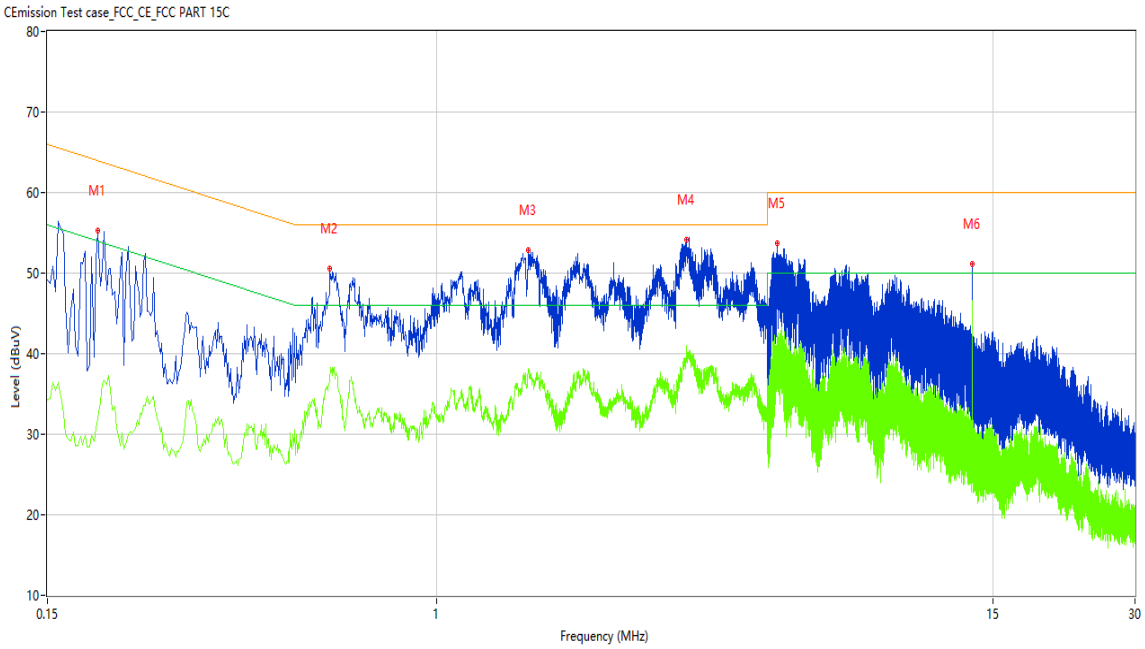
The all configurations were tested respectively, but only the worst configuration shown here.

Figure 1: Conducted Emission on AC Mains, L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.190	61.98	9.65	64.04	-2.06	Peak	L	Pass
1*	0.190	50.25	9.65	64.04	-13.79	QP	L	Pass
1**	0.190	31.42	9.65	54.04	-22.62	AV	L	Pass
2	0.392	52.55	9.73	58.02	-5.47	Peak	L	Pass
2*	0.392	39.37	9.73	58.02	-18.65	QP	L	Pass
2**	0.392	29.59	9.73	48.02	-18.43	AV	L	Pass
3	0.822	44.10	9.75	56.00	-11.90	Peak	L	Pass
3*	0.822	35.85	9.75	56.00	-20.15	QP	L	Pass
3**	0.822	30.79	9.75	46.00	-15.21	AV	L	Pass
4	1.620	48.14	9.67	56.00	-7.86	Peak	L	Pass
4*	1.620	41.18	9.67	56.00	-14.82	QP	L	Pass
4**	1.620	32.68	9.67	46.00	-13.32	AV	L	Pass
5	3.494	48.48	9.69	56.00	-7.52	Peak	L	Pass
5*	3.494	41.50	9.69	56.00	-14.50	QP	L	Pass
5**	3.494	32.49	9.69	46.00	-13.51	AV	L	Pass
6	9.180	46.99	9.66	60.00	-13.01	Peak	L	Pass
6*	9.180	38.12	9.66	60.00	-21.88	QP	L	Pass
6**	9.180	31.21	9.66	50.00	-18.79	AV	L	Pass

Figure: Conducted Emission on AC Mains, N Phase



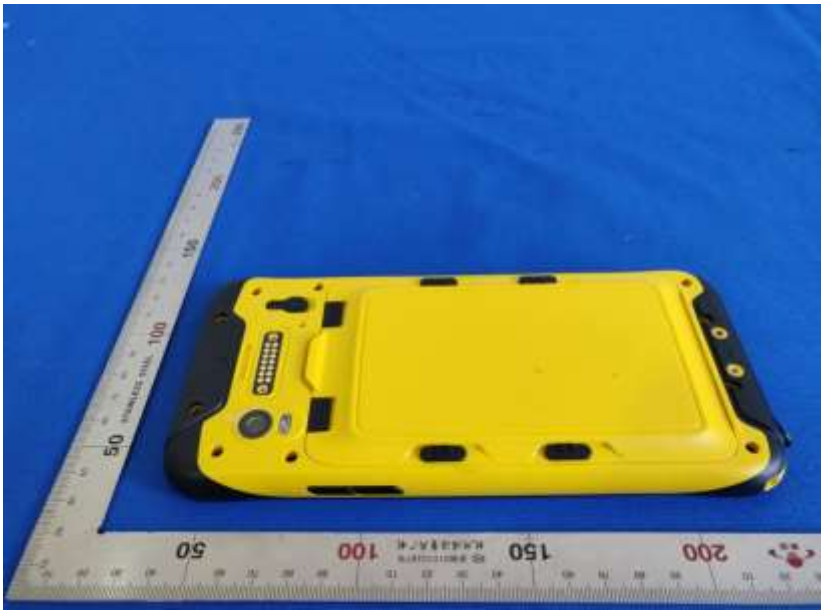
No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.192	60.63	9.65	63.95	-3.32	Peak	N	Pass
1*	0.192	47.12	9.65	63.95	-16.83	QP	N	Pass
1**	0.192	32.00	9.65	53.95	-21.95	AV	N	Pass
2	0.594	51.03	9.76	56.00	-4.97	Peak	N	Pass
2*	0.594	46.09	9.76	56.00	-9.91	QP	N	Pass
2**	0.594	36.69	9.76	46.00	-9.31	AV	N	Pass
3	1.564	50.64	9.67	56.00	-5.36	Peak	N	Pass
3*	1.564	45.89	9.67	56.00	-10.11	QP	N	Pass
3**	1.564	38.09	9.67	46.00	-7.91	AV	N	Pass
4	3.372	52.66	9.69	56.00	-3.34	Peak	N	Pass
4*	3.372	46.26	9.69	56.00	-9.74	QP	N	Pass
4**	3.372	40.32	9.69	46.00	-5.68	AV	N	Pass
5	5.242	53.15	9.70	60.00	-6.85	Peak	N	Pass
5*	5.242	46.45	9.70	60.00	-13.55	QP	N	Pass
5**	5.242	39.58	9.70	50.00	-10.42	AV	N	Pass
6	13.558	43.55	9.59	60.00	-16.45	Peak	N	Pass
6*	13.558	36.29	9.59	60.00	-23.71	QP	N	Pass
6**	13.558	46.60	9.59	50.00	-3.40	AV	N	Pass

5 Appendixes

5.1 Photographs of the Sample

TDC600_2 Model

Front of the sample



Rear of the sample

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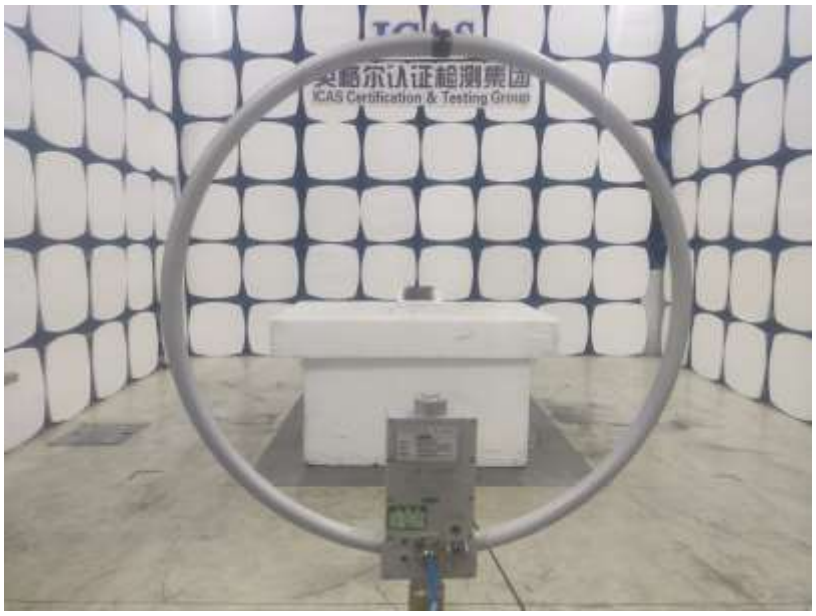
MobileMapper60_2 Model

Front of the sample

Rear of the sample

5.2 Photographs of the Test Set-up

Below 30MHz



Above 30MHz

End of the report