

EMC TEST REPORT

Applicant : Toast, Inc.
Address of Applicant : 401 Park Drive, Suite 801, Boston, MA 02215,
USA
Product Name : On-Counter Guest Facing Dispaly
Model No. : TW200
Standards : 47 CFR Part 15 Subpart B
ICES-003(Issue6,January 2016)
ANSI C63.4-2014
Date of Receipt : 2019-11-07
Date of Test : 2019-11-07~2019-11-19
Date of Issue : 2019-11-19

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Guoyou Chi

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.

TABLE OF CONTENTS

REMARK:	1
1. GENERAL INFORMATION	3
1.1 TESTING LABORATORY	3
1.2 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
2. SUMMARY OF TEST RESULTS	4
2.1 TEST STANDARDS	4
2.2 TEST UNCERTAINTY	4
3. SYSTEM TEST CONFIGURATION	5
3.1 EUT TEST MODE	5
3.2 SUPPORT EQUIPMENT LIST AND DETAILS OF TEST EQUIPMENT	5
3.3 BLOCK DIAGRAM OF TEST SETUP	5
4. 47 CFR PART 15B & ICES-003 § CONDUCTED EMISSION (ANSI C63.4)	6
4.1 TEST SYSTEM DIAGRAM	6
4.2 EMI TEST SETUP	6
4.3 TEST EQUIPMENT LIST	6
4.4 TEST LIMIT	6
4.5 TEST PROCEDURE	7
4.6 TEST RECORD	8
5. 47 CFR PART 15B & ICES-003 § RADIATED EMISSION(ANSI C63.4)	10
5.1 TEST SYSTEM DIAGRAM	10
5.2 EMI TEST SETUP	11
5.3 TEST EQUIPMENT LIST	11
5.4 TEST LIMIT	11
5.5 TEST PROCEDURE	11
5.6 TEST RECORD	12

1. GENERAL INFORMATION

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Services (Shanghai) Co., Ltd.
Address	1298 Pingan Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Product Description for Equipment under Test (EUT)

Product Name	On-Counter Guest Facing Dispaly
Brand Name	Toast
Model No.	TW200
Class type	Class B
Working Voltage	High 28V, Normal: 24 V,Low 20V
Wireless Description	N.A
Hardware version	CT541SB40C_20191016
Software version	N.A
FCC ID	2AMNG-TW200

2. SUMMARY OF TEST RESULTS

2.1 Test Standards

47 CFR Part 15 Subpart B ICES-003(Issue6,January 2016)		
Rule	Description	Results
§ FCC Part 15.107 § ICES-003 6.1	Conducted Emission	Compliance
§ FCC Part 15.109 § ICES-003 6.1	Radiated Emission	Compliance

No.	Identity	Document Title
1	47 CFR Part 15 Subpart B (10-1-16 Edition)	PART 15—RADIO FREQUENCY DEVICES --Unintentional Radiators
2	ICES-003(Issue6,January 2016)	Information Technology Equipment(Including Digital Apparatus)—Limits and Methods of Measurement
3	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz

2.2 Test Uncertainty

Measurement	U cispr
Conducted disturbance at mains port (9 kHz to 30 MHz)	1.9 dB
Conducted disturbance at telecommunication port (150 kHz to 30 MHz)	1.9 dB
Radiated disturbance (30 MHz to 1000 MHz)	3.2 dB
Radiated disturbance (1 GHz to 18 GHz)	3.2 dB

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

3. SYSTEM TEST CONFIGURATION

3.1 EUT Test Mode

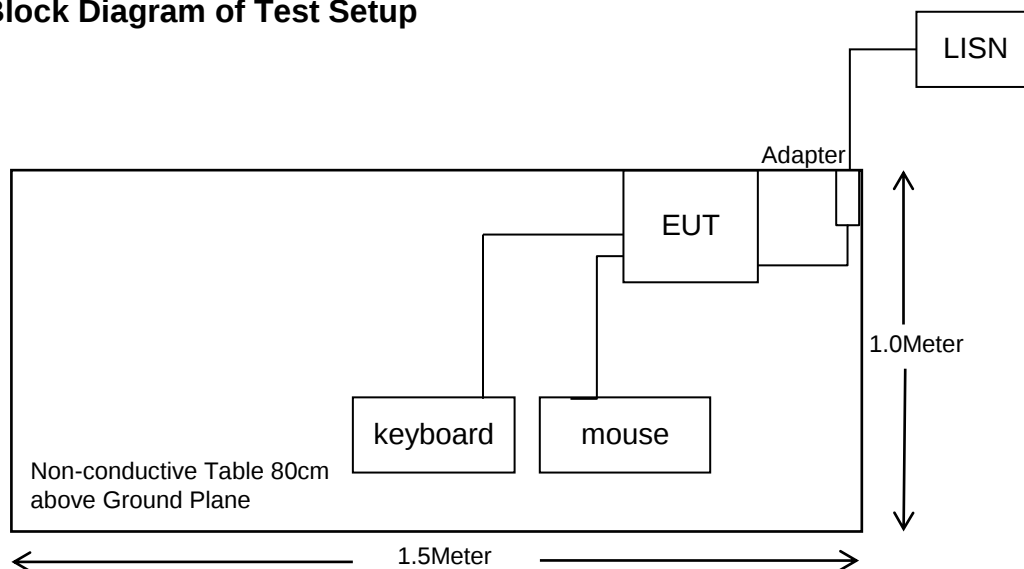
The system was configured for testing in a typical Mode(as normally used by a typical user).

3.2 Support Equipment List and Details of test Equipment

Manufacturer	Description	Model	Serial Number
Dell	Mouse	MS116P	N/A
Dell	keyboard	KB216T	N/A
Manufacturer	Description	Length(m)	I/O Port
N/A	N/A	N/A	N/A

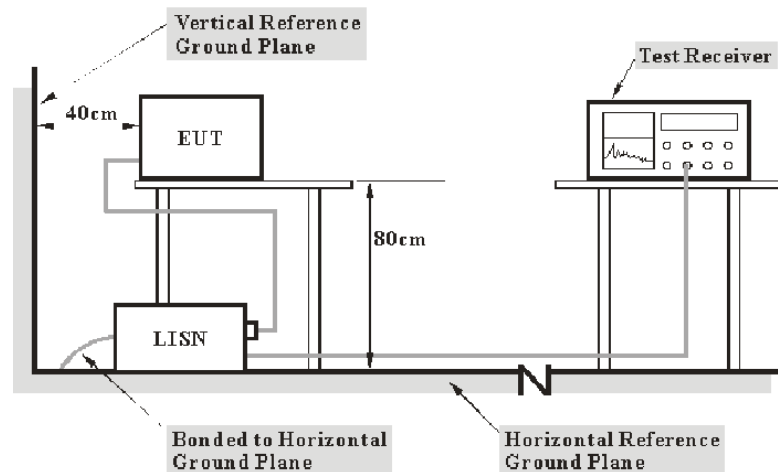
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI3	100173	2019/6/19	2020/6/19
SCHWARZBECK	V-network	NSLK 8127	8127-902	2019/2/20	2020/2/20
R&S	EMI Test Receiver	ESR7	101911	2019/6/19	2020/6/19
Schwarzbeck	Antenna	VULB9163	9163-1037	2019/1/27	2020/1/27
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1775	2019/7/26	2020/7/26

3.3 Block Diagram of Test Setup



4. 47 CFR Part 15B & ICES-003 § CONDUCTED EMISSION (ANSI C63.4)

4.1 Test System Diagram



Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

4.2 EMI Test Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz. During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

4.3 Test Equipment List

Manufacturer	Description	Model	Serial Number	Test use
R&S	EMI Test Receiver	ESPI3	100173	☒
TESQ	V-network	NSLK 8127	8127-902	☒

4.4 Test Limit

Frequency Range	Limit	
	Quasi-peak (dBμV)	Average (dBμV)
0.15MHz – 0.50MHz	66-56	56-46
0.50MHz – 5MHz	56	46
5MHz – 30MHz	60	50

4.5 Test Procedure

EUT was connected to the outlet of the LISN.
The LISN was bounded to ground.

Measurement was carried out in a stable mode of operation, which means with a stable light output.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination.

All data was recorded in the Quasi-peak and average detection mode.

Factor & Margin Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 3dB means the emission is 3 dB below the limit. The equation for margin calculation is as follows:

Q-peak Level / Average Level = Reading + Factor

Margin = QP Limit –Q-peak Level or Margin = AV Limit –Average Level

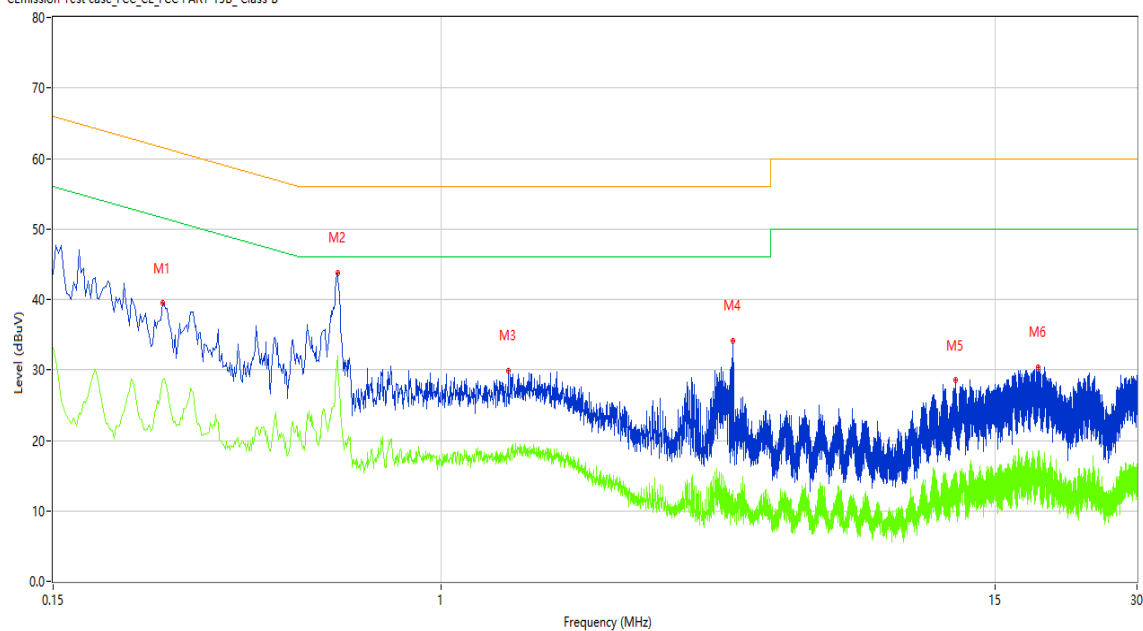
Note : Margin just showing the least value of QP and AV

Frequency (MHz)	Peak Level (dBuV)	Q-peak Level (dBuV)	Average Level (dBuV)	Factor (dB)	QP Limit (dBuV)	AV Limit (dBuV)	Margin (dB)	Line	Verdict
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4.6 Test Record

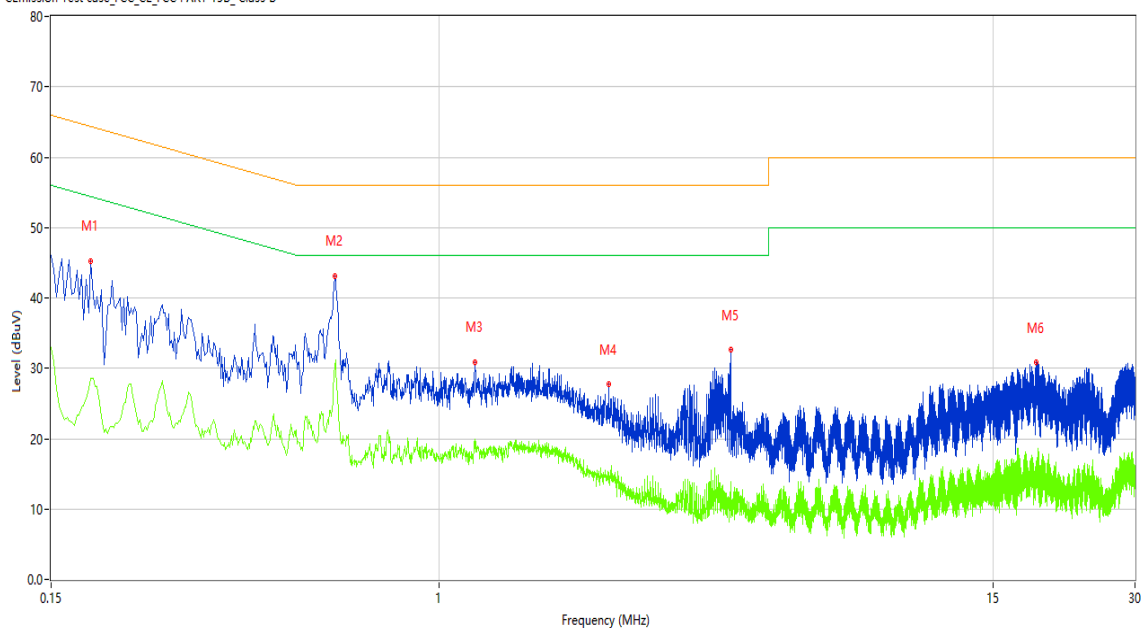
Model : TW200

CEmission Test case_FCC_CE_FCC PART 15B_Class B



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.256	39.47	10.14	61.56	-22.09	Peak	L	Pass
1**	0.256	28.54	10.14	51.56	-23.02	AV	L	Pass
2	0.602	44.46	10.15	56.00	-11.54	Peak	L	Pass
2*	0.602	41.78	10.15	56.00	-14.22	QP	L	Pass
2**	0.602	32.00	10.15	46.00	-14.00	AV	L	Pass
3	1.388	29.94	10.16	56.00	-26.06	Peak	L	Pass
3**	1.388	18.95	10.16	46.00	-27.05	AV	L	Pass
4	4.166	34.57	10.25	56.00	-21.43	Peak	L	Pass
4*	4.166	29.06	10.25	56.00	-26.94	QP	L	Pass
4**	4.166	12.27	10.25	46.00	-33.73	AV	L	Pass
5	12.360	28.50	10.46	60.00	-31.50	Peak	L	Pass
5**	12.360	15.59	10.46	50.00	-34.41	AV	L	Pass
6	18.524	30.37	10.46	60.00	-29.63	Peak	L	Pass
6**	18.524	17.91	10.46	50.00	-32.09	AV	L	Pass

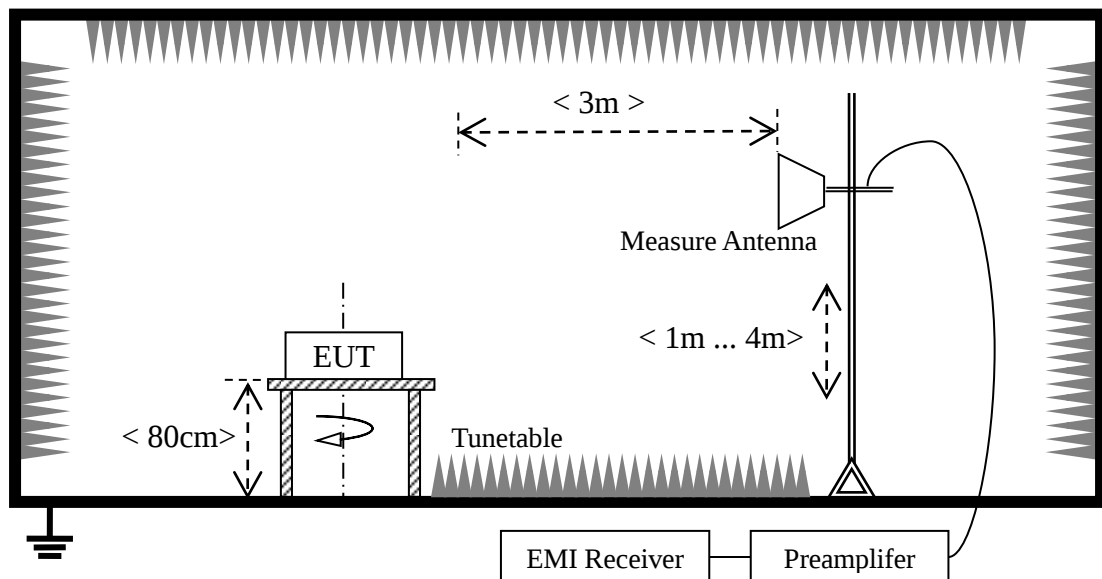
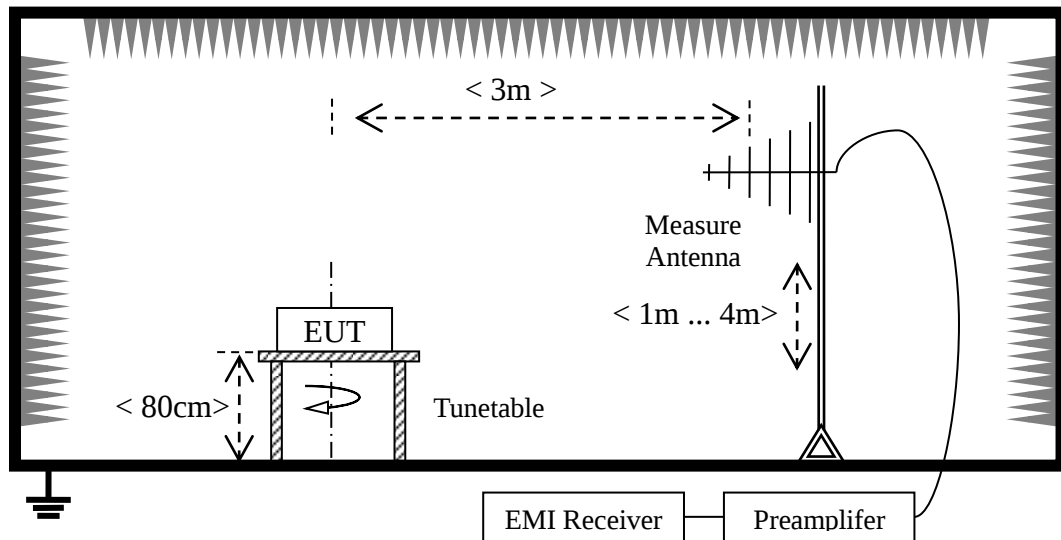
CEmission Test case_FCC_CE_FCC PART 15B_ Class B



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.182	45.21	10.15	64.39	-19.18	Peak	N	Pass
1**	0.182	28.57	10.15	54.39	-25.82	AV	N	Pass
2	0.600	43.38	10.15	56.00	-12.62	Peak	N	Pass
2*	0.600	40.83	10.15	56.00	-15.17	QP	N	Pass
2**	0.600	30.25	10.15	46.00	-15.75	AV	N	Pass
3	1.192	30.86	10.16	56.00	-25.14	Peak	N	Pass
3**	1.192	19.93	10.16	46.00	-26.07	AV	N	Pass
4	2.292	27.75	10.19	56.00	-28.25	Peak	N	Pass
4**	2.292	14.93	10.19	46.00	-31.07	AV	N	Pass
5	4.154	33.63	10.25	56.00	-22.37	Peak	N	Pass
5*	4.154	25.93	10.25	56.00	-30.07	QP	N	Pass
5**	4.154	13.88	10.25	46.00	-32.12	AV	N	Pass
6	18.516	30.90	10.46	60.00	-29.10	Peak	N	Pass
6**	18.516	16.05	10.46	50.00	-33.95	AV	N	Pass

5. 47 CFR Part 15B & ICES-003 § RADIATED EMISSION(ANSI C63.4)

5.1 Test System Diagram



5.2 EMI Test Setup

The system was investigated from 30 MHz to 6000 MHz.

During the radiated emission test, the EMI test receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	120 kHz	300 kHz	120kHz	QP
1000MHz-6000MHz	1MHz	3MHz/10Hz	/	PK/AV

5.3 Test Equipment List

Manufacturer	Description	Model	Serial Number	Test use
R&S	EMI Test Receiver	ESR7	101911	☒
Schwarzbeck	Antenna	VULB9163	9163-1037	☒
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1775	☒

5.4 Test Limit

Frequency Range	Limit(3m distance)
	Quasi-peak
30MHz – 88MHz	40 dB μ V/m
88MHz – 216MHz	43.5 dB μ V/m
216 MHz -960 MHz	46 dB μ V/m
Above 960MHz	54 dB μ V/m

5.5 Test Procedure

For the radiated emissions test, the adapter was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode.

Factor & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Reading. The basic equation is as follows:

Peak Level / Q-peak Level /Average Level = Reading + Antenna Factor + Cable Loss - Amplifier Gain

Factor = Antenna Factor + Cable Loss - Amplifier Gain

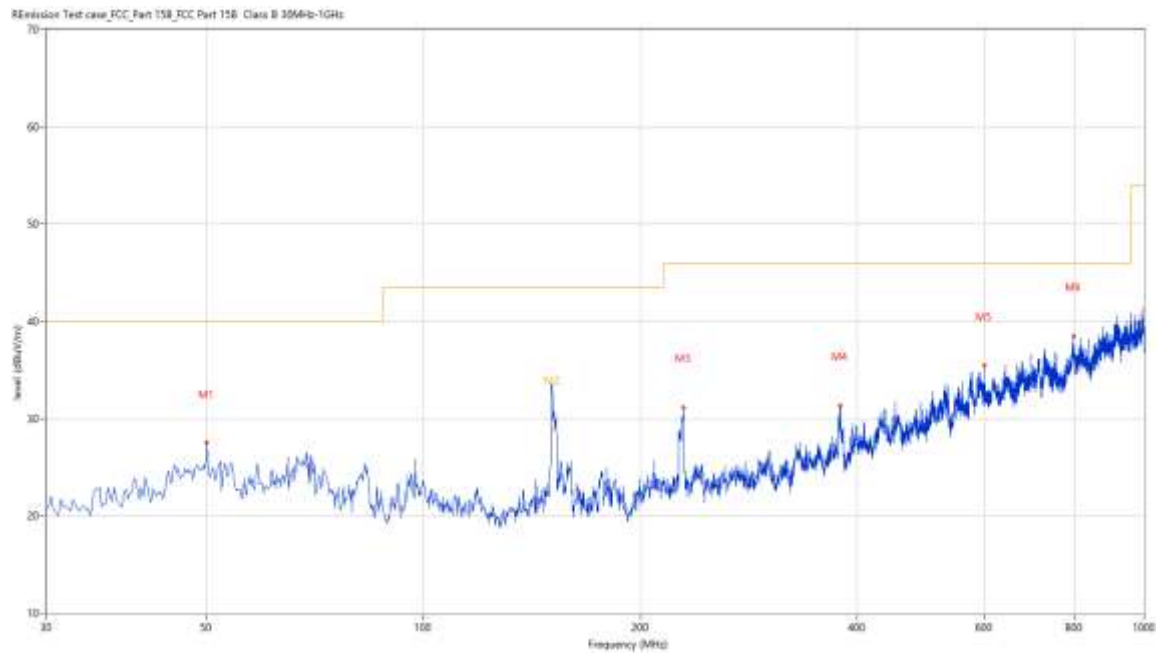
The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 3 dB means the emission is 3 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{QP Limit} - \text{Q-peak Level} \text{ or } \text{Margin} = \text{AV Limit} - \text{Average Level}$$

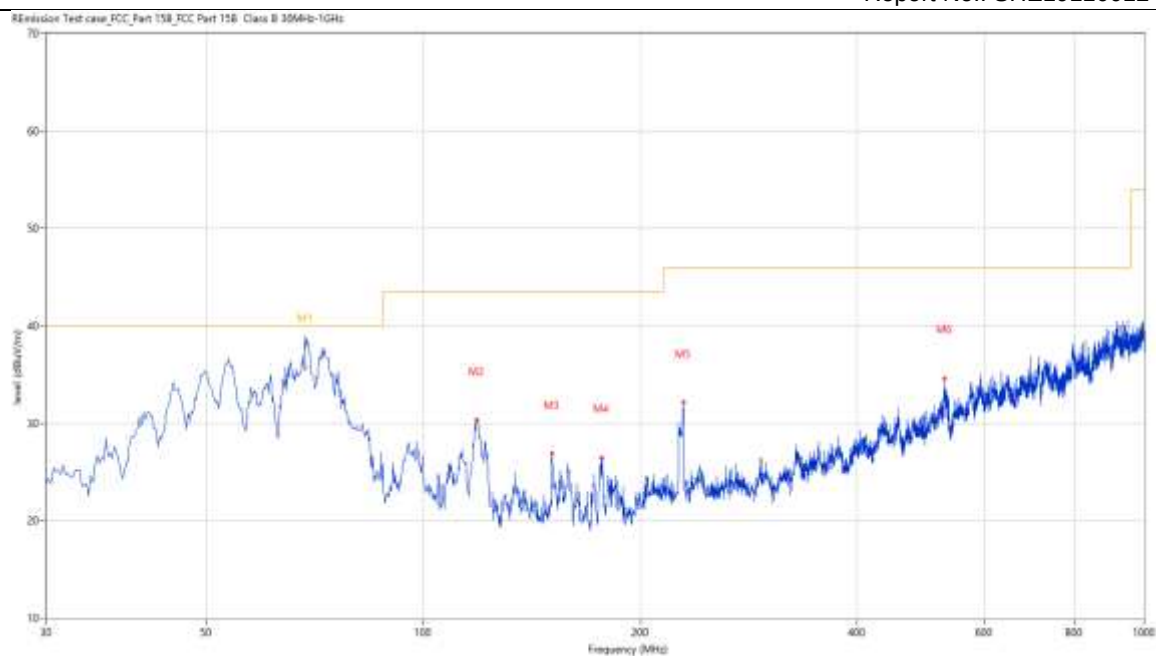
Note : Margin just showing the least value of QP and AV

Frequency (MHz)	Peak Level (dBuV/m)	Q-peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
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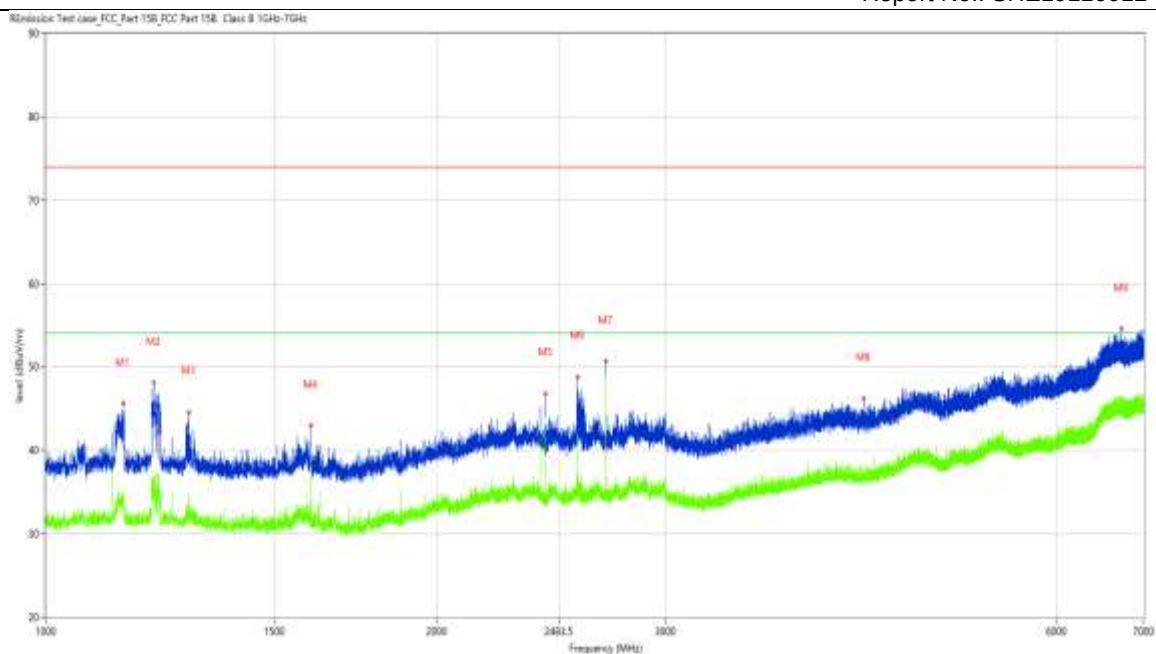
5.6 Test Record



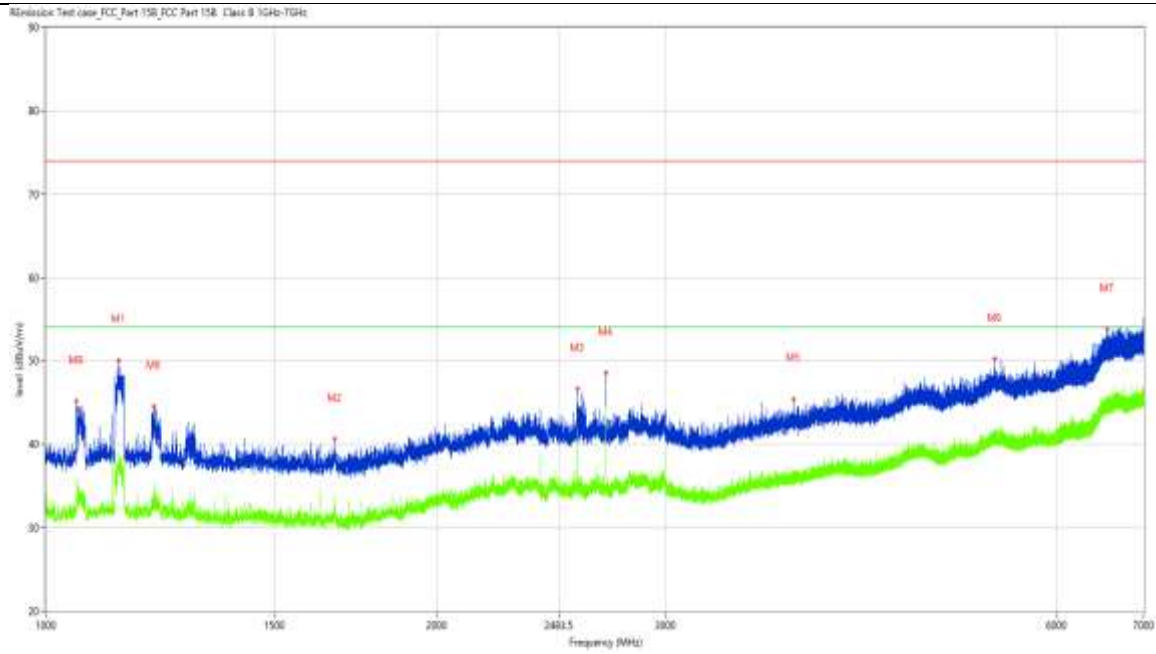
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	50.122	27.49	-24.25	40.0	-12.51	Peak	104.60	200	Horizontal	Pass
2	151.212	33.45	-28.42	43.5	-10.05	Peak	1.40	108	Horizontal	Pass
2*	151.212	28.96	-28.42	43.5	-14.54	QP	1.40	108	Horizontal	Pass
3	229.528	31.16	-25.70	46.0	-14.84	Peak	275.40	100	Horizontal	Pass
4	379.113	31.35	-21.78	46.0	-14.65	Peak	292.90	100	Horizontal	Pass
5	599.975	35.44	-16.90	46.0	-10.56	Peak	240.00	100	Horizontal	Pass
6	797.563	38.50	-11.61	46.0	-7.50	Peak	149.40	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	68.774	40.40	-27.25	40.0	0.40	Peak	186.50	100	Vertical	N/A
1*	68.774	35.79	-27.25	40.0	-4.21	QP	186.50	100	Vertical	Pass
2	118.733	30.33	-27.13	43.5	-13.17	Peak	294.90	100	Vertical	Pass
3	150.977	26.93	-28.42	43.5	-16.57	Peak	353.00	100	Vertical	Pass
4	176.918	26.48	-28.45	43.5	-17.02	Peak	139.50	100	Vertical	Pass
5	229.528	32.12	-25.70	46.0	-13.88	Peak	360.00	200	Vertical	Pass
6	528.698	34.62	-18.23	46.0	-11.38	Peak	302.10	200	Vertical	Pass



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1146.732	45.59	-7.13	74.0	-28.41	Peak	330.30	100	Horizontal	Pass
1**	1146.732	35.61	-7.13	54.0	-18.39	AV	330.30	100	Horizontal	Pass
2	1211.474	48.12	-7.23	74.0	-25.88	Peak	336.30	100	Horizontal	Pass
2**	1211.474	37.05	-7.23	54.0	-16.95	AV	336.30	100	Horizontal	Pass
3	1289.214	44.61	-7.53	74.0	-29.39	Peak	345.70	100	Horizontal	Pass
3**	1289.214	34.98	-7.53	54.0	-19.02	AV	345.70	100	Horizontal	Pass
4	1599.925	42.98	-8.75	74.0	-31.02	Peak	33.60	100	Horizontal	Pass
4**	1599.925	38.73	-8.75	54.0	-15.27	AV	33.60	100	Horizontal	Pass
5	2426.072	46.82	-4.47	74.0	-27.18	Peak	355.10	100	Horizontal	Pass
5**	2426.072	39.88	-4.47	54.0	-14.12	AV	355.10	100	Horizontal	Pass
6	2567.554	48.83	-4.06	74.0	-25.17	Peak	2.00	100	Horizontal	Pass
6**	2567.554	38.39	-4.06	54.0	-15.61	AV	2.00	100	Horizontal	Pass
7	2699.788	50.68	-4.08	74.0	-23.32	Peak	355.10	100	Horizontal	Pass
7**	2699.788	48.93	-4.08	54.0	-5.07	AV	355.10	100	Horizontal	Pass
8	4260.967	46.23	-0.04	74.0	-27.77	Peak	290.70	100	Horizontal	Pass
8**	4260.967	37.43	-0.04	54.0	-16.57	AV	290.70	100	Horizontal	Pass
9	6731.284	54.56	5.92	74.0	-19.44	Peak	70.70	100	Horizontal	Pass
9**	6731.284	46.69	5.92	54.0	-7.31	AV	70.70	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	1138.233	50.08	-7.08	74.0	-23.92	Peak	74.90	100	Vertical	Pass
1**	1138.233	38.58	-7.08	54.0	-15.42	AV	74.90	100	Vertical	Pass
2	1669.666	40.64	-8.46	74.0	-33.36	Peak	350.60	100	Vertical	Pass
2**	1669.666	32.79	-8.46	54.0	-21.21	AV	350.60	100	Vertical	Pass
3	2567.554	46.64	-4.06	74.0	-27.36	Peak	338.80	100	Vertical	Pass
3**	2567.554	37.68	-4.06	54.0	-16.32	AV	338.80	100	Vertical	Pass
4	2700.037	48.55	-4.08	74.0	-25.45	Peak	0.30	100	Vertical	Pass
4**	2700.037	41.55	-4.08	54.0	-12.45	AV	0.30	100	Vertical	Pass
5	3765.654	45.42	-0.74	74.0	-28.58	Peak	215.80	100	Vertical	Pass
5**	3765.654	36.80	-0.74	54.0	-17.20	AV	215.80	100	Vertical	Pass
6	5374.203	50.21	1.46	74.0	-23.79	Peak	174.30	100	Vertical	Pass
6**	5374.203	41.53	1.46	54.0	-12.47	AV	174.30	100	Vertical	Pass
7	6558.180	53.85	5.17	74.0	-20.15	Peak	174.60	100	Vertical	Pass
7**	6558.180	45.39	5.17	54.0	-8.61	AV	174.60	100	Vertical	Pass
8	1055.743	45.18	-7.16	74.0	-28.82	Peak	329.90	100	Vertical	Pass
8**	1055.743	35.93	-7.16	54.0	-18.07	AV	329.90	100	Vertical	Pass
9	1210.974	44.53	-7.23	74.0	-29.47	Peak	74.90	100	Vertical	Pass
9**	1210.974	34.79	-7.23	54.0	-19.21	AV	74.90	100	Vertical	Pass

END OF REPORT