

FCC PART 15.247 TEST REPORT

For

IMachine (Xiamen) Intelligent Devices Co.,Ltd.

Unit 1502-2, No.3 Jinzhong Road, Huli District, Xiamen, China

FCC ID: 2AUA5-IMACHINE-A1

Report Type: Original Report	Product Type: ALL IN ONE
Report Number: RXM190916056-00B	
Report Date: 2020-03-19	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	ALL IN ONE
Tested Model	A1
Multiple Model	B1, C1, D1, E1, F1, G1, H1, I1, J1
Frequency Range	Bluetooth: 2402~2480MHz
Transmit Power	Bluetooth: 1.43dBm
Modulation Technique	Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna Specification	3dBi
Voltage Range	DC 24V from adapter
Date of Test	2019-10-15 to 2020-03-19
Sample serial number	RXM190926050-RF-S1(Assigned by BACL, Shenzhen)
Received date	2019-09-16
Sample/EUT Status	Good condition
Adapter information	Model: DJ-240250-SA Input: AC 100-240V, 50/60Hz, 0.15A Output: DC 24V, 2.5A

Notes: This series products model: B1, C1, D1, E1, F1, G1, H1, I1, J1 and A1 are electrically identical. Model A1 was selected for fully testing, the detailed information can be referred to the product similarity declaration letter.

Objective

This test report is prepared on behalf of *IMachine (Xiamen) Intelligent Devices Co.,Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS, Part 15B JBC submissions with FCC ID: 2AUA5-IMACHINE-A1.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

For Radiated Emissions testing, please refer to DA 00-705 Released March 30, 2000, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1 °C
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

EUT Exercise Software

“DRTU” exercise software was used.

Mode	Data rate	Power level		
		Low channel	Middle channel	High channel
BT	/	4	6	6

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

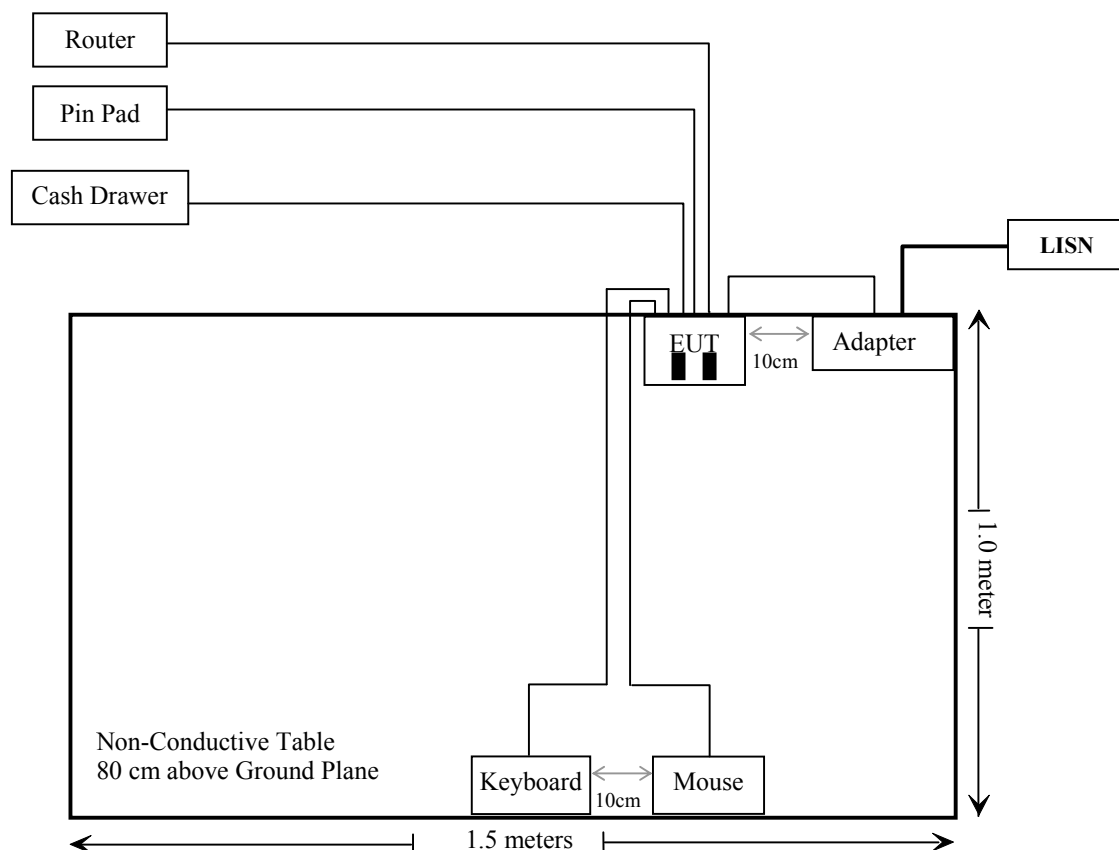
Manufacturer	Description	Model	Serial Number
Microsoft	Keyboard	1406	0200706128743
DELL	Mouse	MOC5UO	G1900NKD
TECLAST	U-disk	Unkown	Unkown
ADATA	U-disk	Unkown	Unkown
SAGEM	Router	SAGEM F@ST TM 2604 White	Unkown
MAKEN	Cash Drawer	MT-350T	Unkown
YD	PIN Pad	YD511DA-RJ	Unkown

External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-Shielding Detachable USB Cable	1.5	EUT	Mouse
Shielding Detachable K/B Cable With Magnet Ring	1.5	EUT	Keyboard
Un-Shielding Detachable AC Cable	1.2	LISN	Adapter
Un-Shielding Detachable DC Cable	1.2	EUT	Adapter
Un-Shielding Detachable RJ45 Cable	10	EUT	Router
Un-Shielding Detachable RJ11 Cable	10	EUT	Cash Drawer
Un-Shielding Detachable RJ9 to RS232 Cable	10	EUT	PIN Pad

Block Diagram of Test Setup

For conducted emission:



Note: ■ mark U-disk

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §2.1091	Maximum Permissible Exposure(MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance*
§15.247(a)(1)	Channel Separation Test	Compliance*
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance*
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance*
§15.247(b)(1)	Peak Output Power Measurement	Compliance*
§15.247(d)	Band edges	Compliance*

Compliance*: The EUT's Wifi module is identical with the product which the Model named iMachine P1 and FCC ID is 2AUA5-P1. So these test items please referred to FCC ID: 2AUA5-P1 that has been certified on 2019-12-04, report No.: RXM190916056-00B, which was tested by Bay Area Compliance Laboratories Corp. (Shenzhen).

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2019/7/9	2020/7/8
Rohde & Schwarz	LISN	ENV216	101613	2019/1/25	2020/1/24
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2018/11/29	2019/11/29
/	CE Cable	CE Cable	UF A210B-1-0720-504504	2018/11/29	2019/11/29
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2019/7/9	2020/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2019/4/20	2020/4/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
/	Cable 2	RF Cable 2	/	2019/11/29	2020/11/28
/	Cable	Chamber Cable 1	/	2019/11/29	2020/11/28
/	Cable	Chamber Cable 4	EC-007	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019/7/22	2020/07/21
COM-POWER	Pre-amplifier	PA-122	181919	2018/11/29	2019/11/29
COM-POWER	Amplifier	QLW-18405536-J0	15964001002	2018/11/29	2019/11/29
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
the electro-Mechanics Co	Horn Antenna	3116	9510-2270	2019/10/13	2022/10/12
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2018/11/29	2019/11/29
/	RF Cable	W1101-EQ1 OUT	/	2018/11/29	2019/11/29
/	Signal Cable	RG-214	2	2018/11/29	2019/11/29
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2019/4/20	2020/4/20

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 (i) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Max Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
2402-2480	3.0	2.0	2.0	1.58	20	0.0006	1.0

Note: Bluetooth and Wifi can not transmitting simultaneously.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

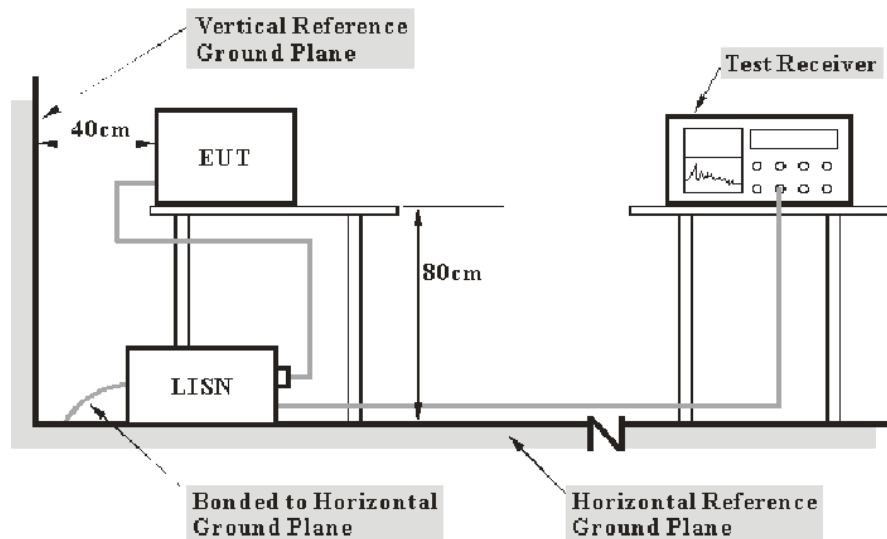
Result: compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



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.

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

EMI Test Receiver 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

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

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

Corrected Factor & Margin Calculation

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

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the EUT complied with the FCC Part 15.207,

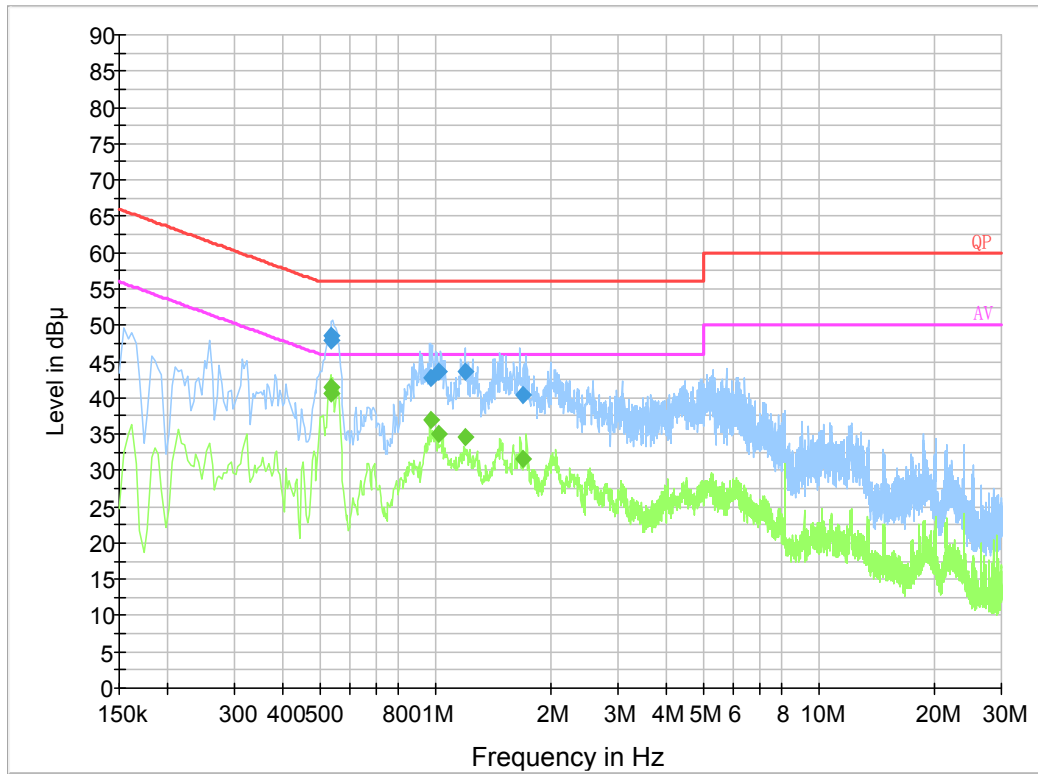
Test Data

Environmental Conditions

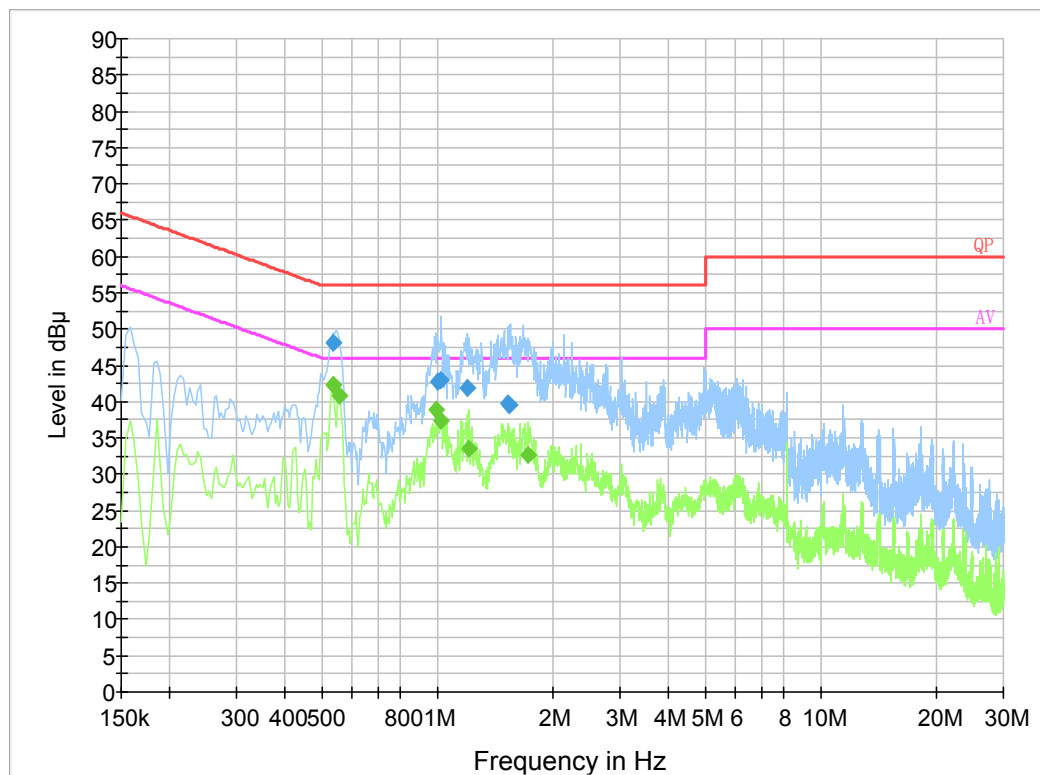
Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Kiki Geng on 2019-10-15.

EUT operation mode: Transmitting & charging (the worst case is 8DPSK Mode, High channel)

AC 120V/60 Hz, Line

Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.537870	48.6	19.8	56.0	7.4	QP
0.537950	48.0	19.8	56.0	8.0	QP
0.975390	42.8	19.9	56.0	13.2	QP
1.026490	43.6	19.9	56.0	12.4	QP
1.204030	43.6	19.8	56.0	12.4	QP
1.689010	40.3	19.9	56.0	15.7	QP
0.537870	40.5	19.8	46.0	5.5	Ave.
0.537950	41.4	19.8	46.0	4.6	Ave.
0.975390	36.9	19.9	46.0	9.1	Ave.
1.026490	35.1	19.9	46.0	10.9	Ave.
1.204030	34.6	19.8	46.0	11.4	Ave.
1.689010	31.5	19.9	46.0	14.5	Ave.

AC 120V/60 Hz, Neutral

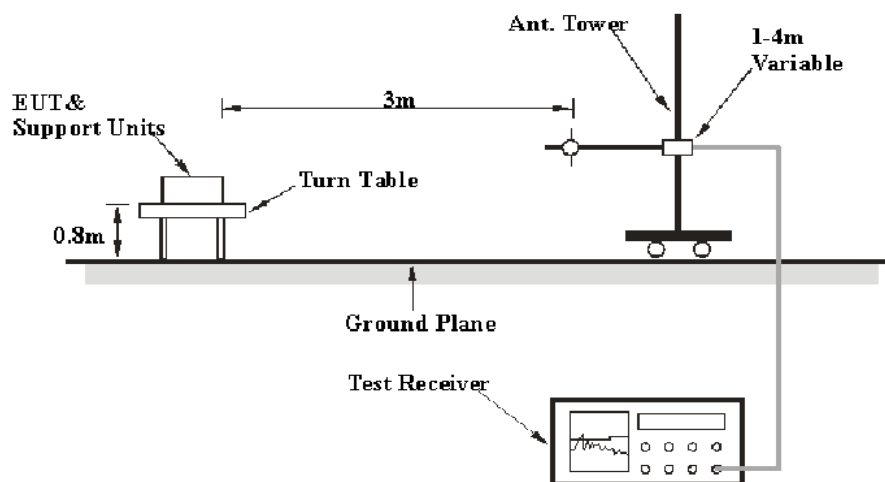
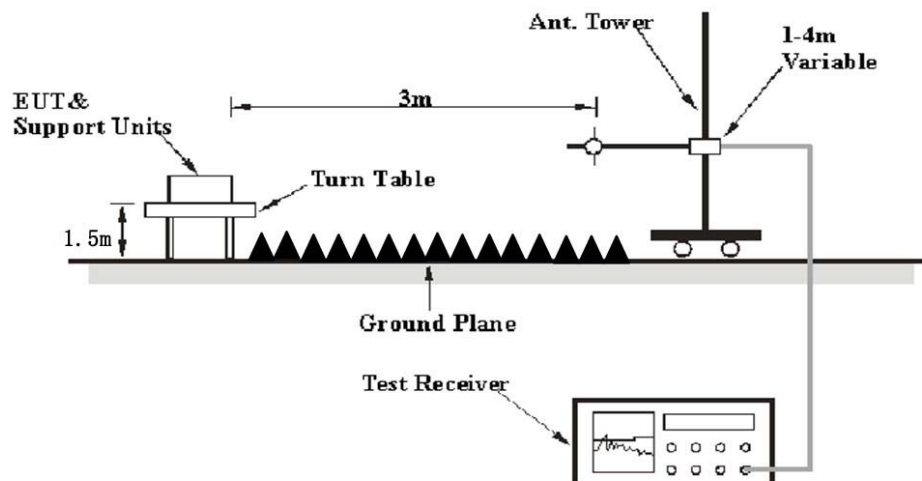
Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.537810	48.1	19.8	56.0	7.9	QP
1.003030	42.7	19.8	56.0	13.3	QP
1.022610	43.0	19.8	56.0	13.0	QP
1.195970	42.0	19.8	56.0	14.0	QP
1.530690	39.8	19.8	56.0	16.2	QP
1.548890	39.5	19.8	56.0	16.5	QP
0.534000	42.4	19.8	46.0	3.6	Ave.
0.558000	40.9	19.8	46.0	5.1	Ave.
0.998000	38.9	19.8	46.0	7.1	Ave.
1.026000	37.3	19.8	46.0	8.7	Ave.
1.214000	33.5	19.8	46.0	12.5	Ave.
1.726000	32.7	19.8	46.0	13.3	Ave.

Note:

- 1) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS**Applicable Standard**

FCC §15.205; §15.209; §15.247(d)

EUT Setup**Below 1 GHz:****Above 1GHz:**

The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, according to the DA 00-705 Released March 30, 2000, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	PK

Test Procedure

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

All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data

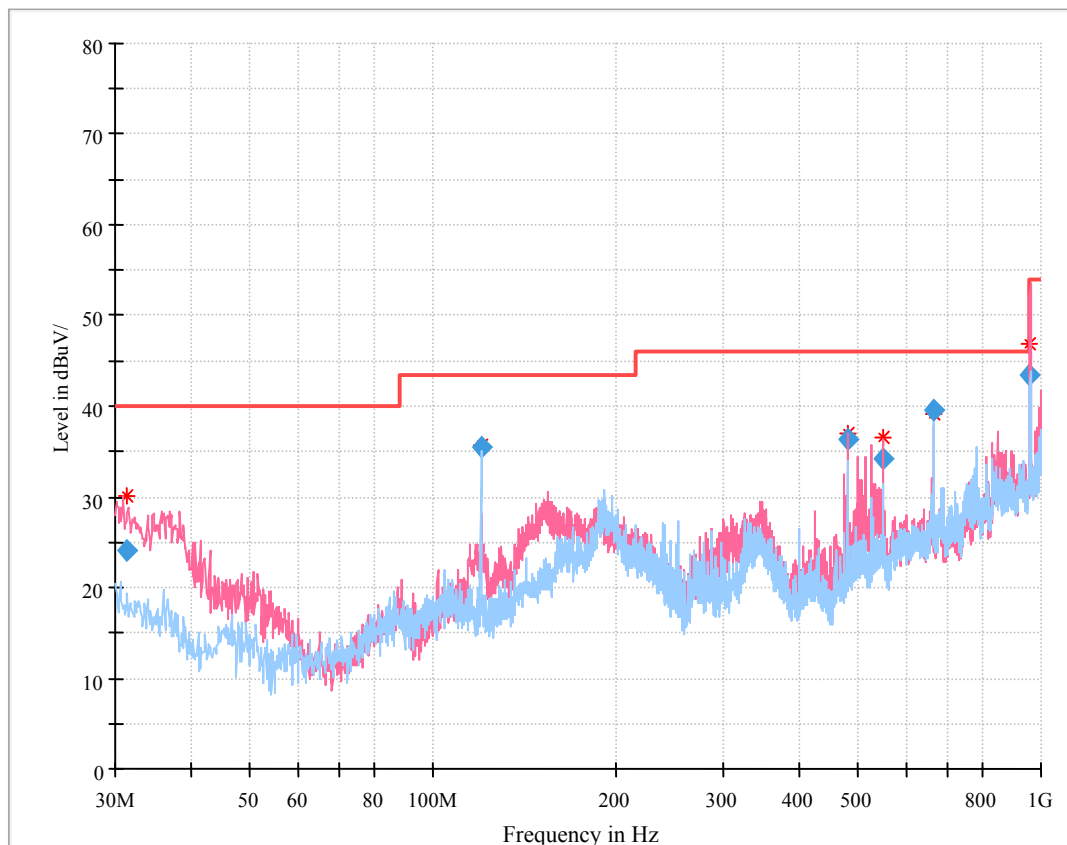
Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Zero Yan on 2020-03-19 for below 1G and Curry Xiang on 2019-10-19 for above 1G.

EUT operation mode: Transmitting (Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK mode, the worst case is 8DPSK Mode)

30 MHz~1 GHz: (the worst case is 8DPSK Mode, high channel)



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
31.320250	24.02	103.0	V	356.0	-8.4	40.00	15.98
120.012750	35.51	254.0	H	158.0	-14.3	43.50	7.99
480.032875	36.37	367.0	V	327.0	-6.4	46.00	9.63
550.033125	34.23	111.0	V	13.0	-4.1	46.00	11.77
666.688375	39.50	110.0	H	323.0	-1.5	46.00	6.50
960.021500	43.52	130.0	V	15.0	5.3	54.00	10.48

1 GHz - 25 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2402 MHz)									
2343.52	28.67	PK	163	1.6	V	31.64	60.31	74	13.69
2343.52	14.72	Ave.	163	1.6	V	31.64	46.36	54	7.64
2497.21	27.98	PK	54	2.2	V	32.13	60.11	74	13.89
2497.21	14.06	Ave.	54	2.2	V	32.13	46.19	54	7.81
1625.71	61.03	PK	114	1.9	V	-2.40	58.63	74	15.37
1625.71	37.22	Ave.	114	1.9	V	-2.40	34.82	54	19.18
4804.00	43.71	PK	195	1.9	V	5.40	49.11	74	24.89
4804.00	28.66	Ave.	195	1.9	V	5.40	34.06	54	19.94
Middle Channel (2441 MHz)									
1625.71	60.89	PK	357	1.5	V	-2.40	58.49	74	15.51
1625.71	36.92	Ave.	357	1.5	V	-2.40	34.52	54	19.48
4882.00	43.96	PK	242	1.2	V	6.43	50.39	74	23.61
4882.00	28.73	Ave.	242	1.2	V	6.43	35.16	54	18.84
High Channel (2480 MHz)									
2328.47	28.49	PK	168	1.4	V	31.64	60.13	74	13.87
2328.47	14.65	Ave.	168	1.4	V	31.64	46.29	54	7.71
2485.13	29.99	PK	191	1.2	V	32.13	62.12	74	11.88
2485.13	15.21	Ave.	191	1.2	V	32.13	47.34	54	6.66
1625.71	61.20	PK	265	2.2	V	-2.40	58.80	74	15.20
1625.71	37.14	Ave.	265	2.2	V	-2.40	34.74	54	19.26
4960.00	43.91	PK	205	1.4	V	6.95	50.86	74	23.14
4960.00	28.84	Ave.	205	1.4	V	6.95	35.79	54	18.21

Note:

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

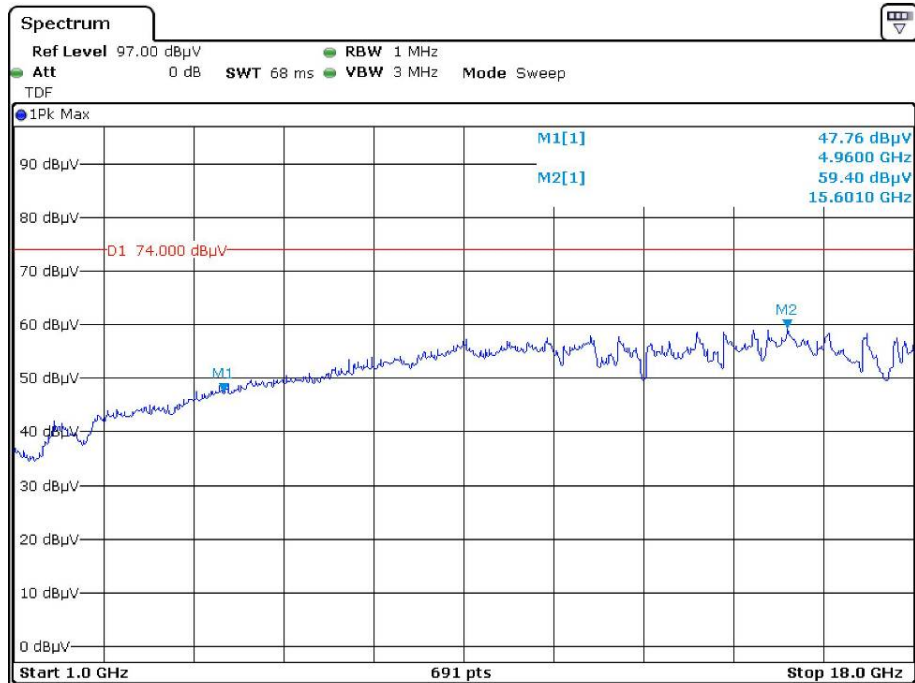
Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

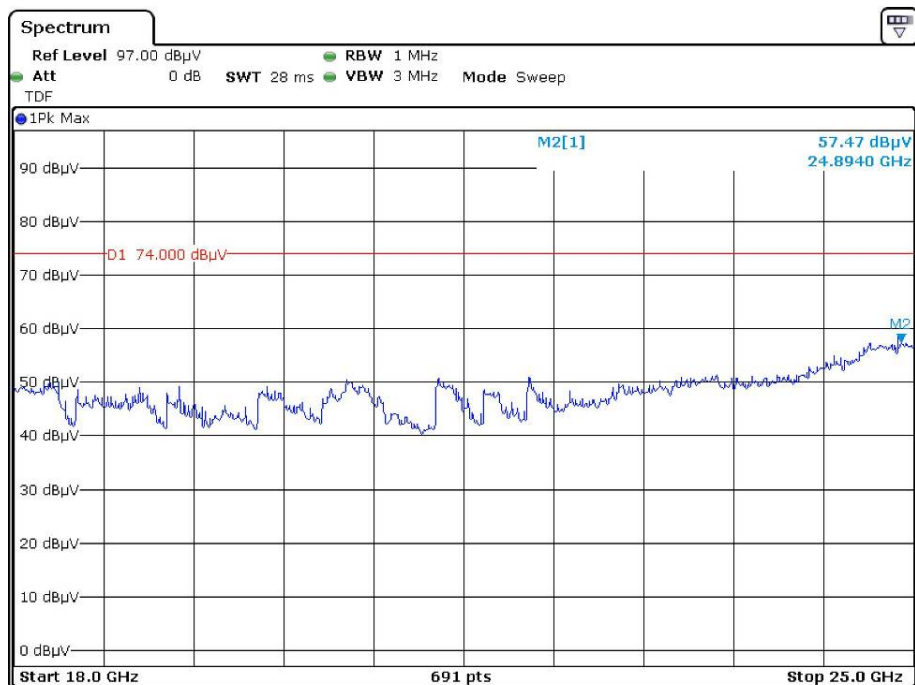
The other spurious emission which is 20dB to the limit was not recorded.

And for the pre-scan is performed with the 2400-2483.5MHz band filter.

Pre-scan with high channel Peak Horizontal

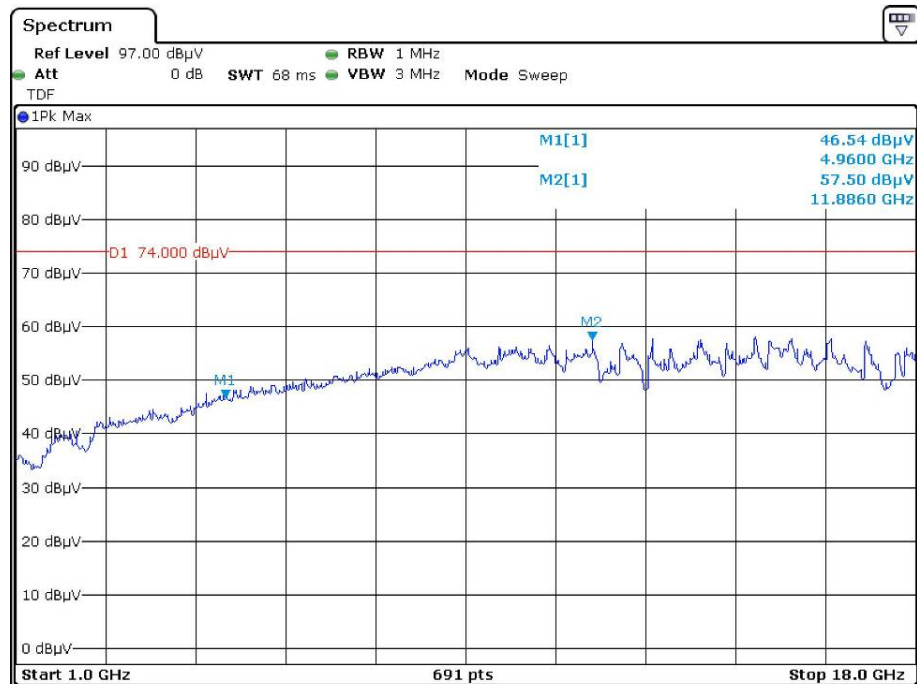


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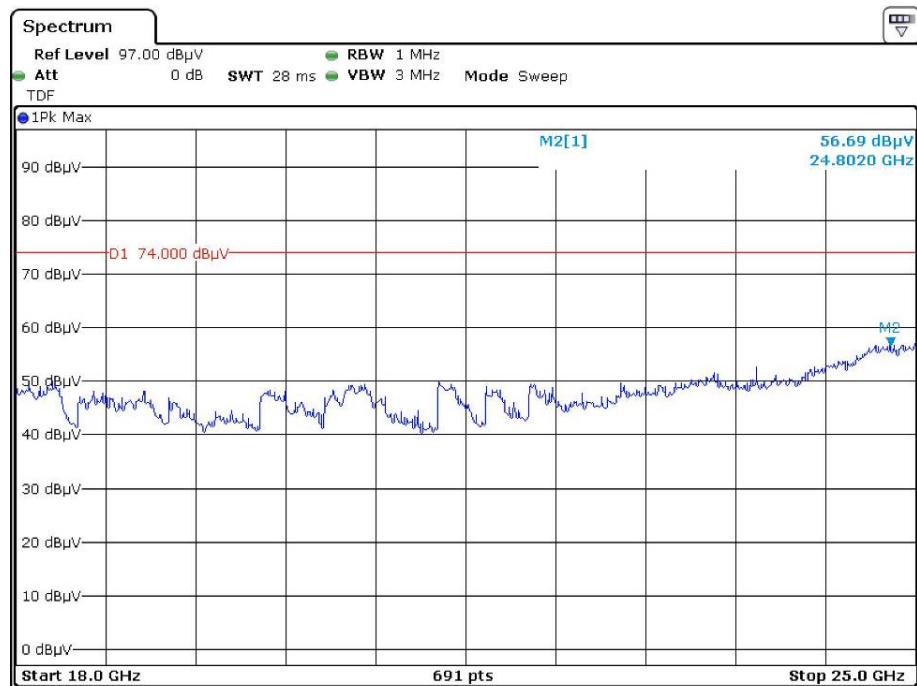


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Vertical

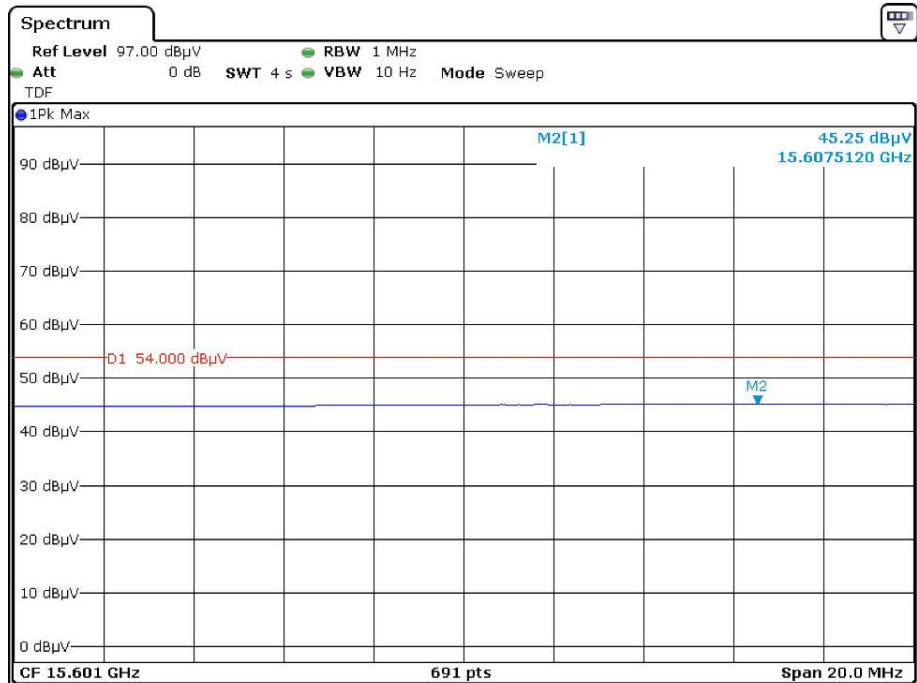


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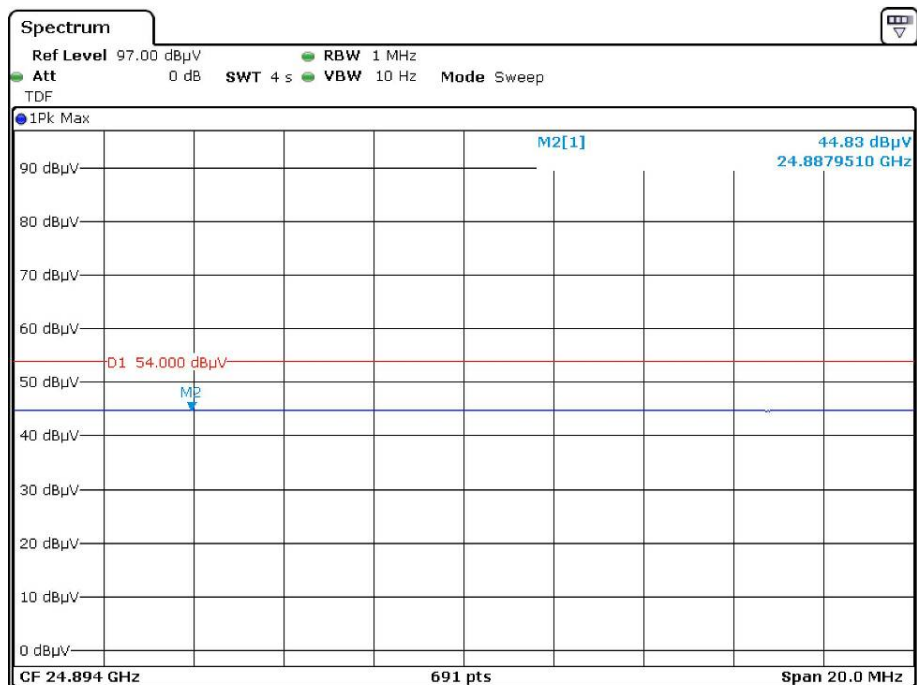


Date: 19.OCT.2019 19:52:43

Pre-scan for Average Horizontal

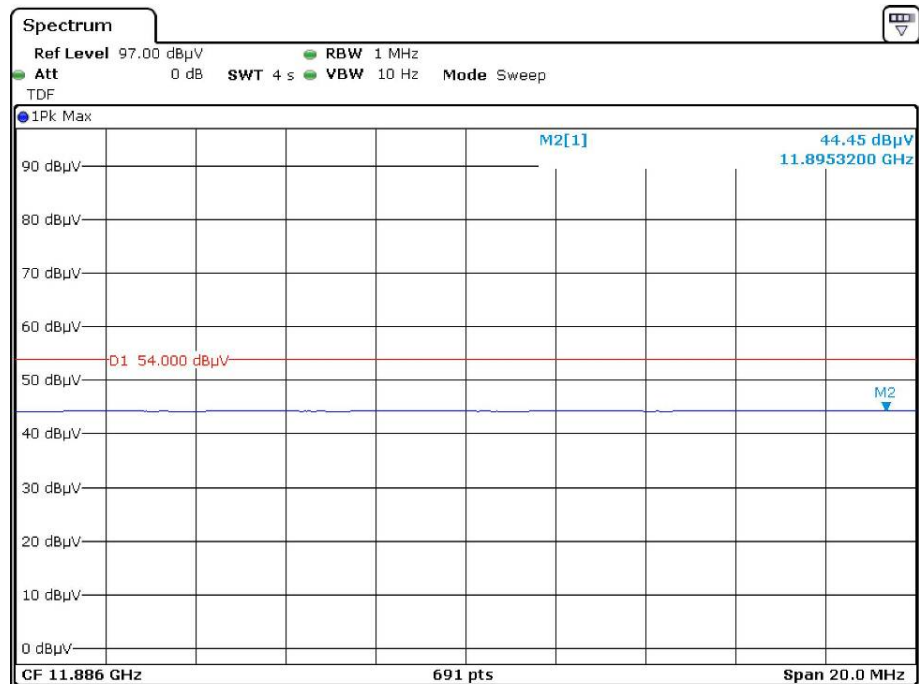


Date: 19.OCT.2019 19:00:42

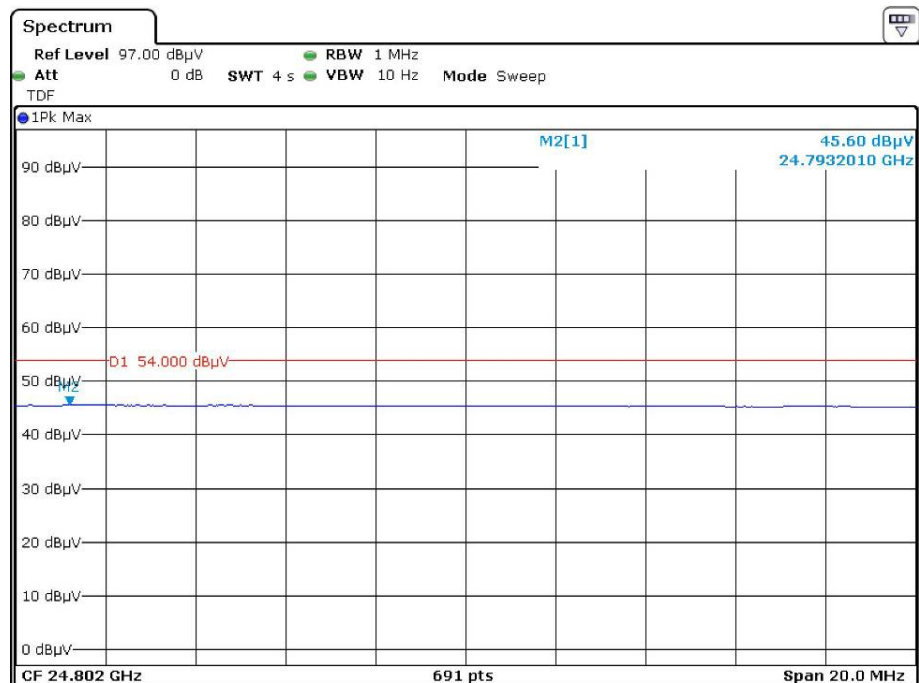


Date: 19.OCT.2019 19:49:15

Vertical



Date: 19.OCT.2019 19:07:45



Date: 19.OCT.2019 19:56:28

***** END OF REPORT *****