TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.247

RSS-GEN, ISSUE 5,FEBRUARY 2021AMENDMENT 2

RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Autel Robotics Co., Ltd.

9th Floor, Bldg.B1, Zhiyuan, 1001 Xueyuan Rd. Xili, Nanshan, Shenzhen, China

FCC ID: 2AGNTEF9RC2458A
IC: 20910-EF9RC2458A

Report Type:	**Product Name:**
Original Report	Autel Smart Controller

Report Number:	SZ1210507-15794E-00B
Report Date:	2021-05-26
Reviewed By:	Ivan Cao Assistant Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Autel Smart Controller
EUT Model:		EF9-2
Operation Frequency:		2412-2462 MHz(802.11b/g/n ht20)
Maximum Peak Output Power (Conducted):		25.55 dBm
Modulation Type:		DSSS, OFDM
Rated Input Voltage:		DC 11.55V from battery
Adapter Information:	**Model:**	GaN-001
	Input:	100-240VAC~50/60Hz 1.5A
	Output:	USB-C1/C2:5V=3A,9V=3A,12V=3A,15V=3A,20V=3.25A USB-A:3.4-5.5V=5A,5V=3A,9V=3A,12V=3A,20V=3A
Serial Number:		SZ1210507-15794E-RF -S_536
EUT Received Date:		2021.05.10
EUT Received Status:		Good

Objective

This report is prepared on behalf of ***Autel Robotics Co., Ltd.*** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205,15.207, 15.209 and 15.247 rules, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

This device modified base on the model: EF9-1, which was certified with FCC ID: 2AGNTEF9RC2409A, IC: 20910-EF9RC2409A, the changes below:

1.Changed the SRD module.

2. Removed the Wi-Fi Radio 1 and it`s antennas.

The changes made to the device not affected the Wi-Fi Radio 0 RF characteristic. Therefore, all RF conducted Port data and above 1GHz radiation test data please refer to the report of model: EF9-1, report number: RSZ201027002-00A.

Related Submittal(s)/Grant(s)

FCC Part 15C DTS, 15E NII submissions with FCC ID: 2AGNTEF9RC2458A
Part of system with FCC ID: 2AGNTMCA2458A
RSS-247 DTSs, LE-LAN submissions with IC: 20910-EF9RC2458A
Part of system with IC: 20910-MCA2458A

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. And 558074 D01 15.247 Meas Guidance v05r02, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB,200M~1GHz: 5.92 dB,1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

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

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "△ ". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
§15.247 (i) & §1.1310 & §2.1093 RSS-102 Clause 4	RF Exposure	Compliance
FCC §15.203, RSS-GEN Clause 6.8	Antenna Requirement	Compliance*
FCC §15.207 (a); RSS-Gen Clause 8.8	AC Line Conducted Emissions	Compliance
FCC §15.205, §15.209, §15.247(d); RSS-247 Clause 5.5 RSS-Gen Clause 8.10	Spurious Emissions	Compliance
FCC §15.247 (a)(2); RSS-247 Clause 5.2 a) RSS-Gen Clause 6.7	6 dB Bandwidth and 99% Occupied Bandwidth	Compliance*
FCC §15.247(b)(3); RSS-247 Clause 5.4 d)	Maximum Conducted Output Power	Compliance*
FCC §15.247(d); RSS-247 Clause5.5	100 kHz Bandwidth of Frequency Band Edge	Compliance*
FCC §15.247(e) RSS-247 Clause5.2 b)	Power Spectral Density	Compliance*

Compliance*: Please refer to Wi-Fi Radio 0 results in report RSZ201027002-00A of FCC ID: 2AGNTEF9RC2409A and IC: 20910-EF9RC2409A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

For 2.4GHz band, total 11 channels are provided:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

For 802.11b, 802.11g, and 802.11n ht20 modes were test with channel 1,6,11.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates, bandwidths, and modulations. The device supports SISO and MIMO in 802.11n modes, per pretest, MIMO mode was the worst mode and reported.

EUT Exercise Software

The software “RF test tool” was used for testing, which was provided by manufacturer. The maximum power was configured as report number: RSZ201027002-00A.

Equipment Modifications

No modification was made to the EUT.

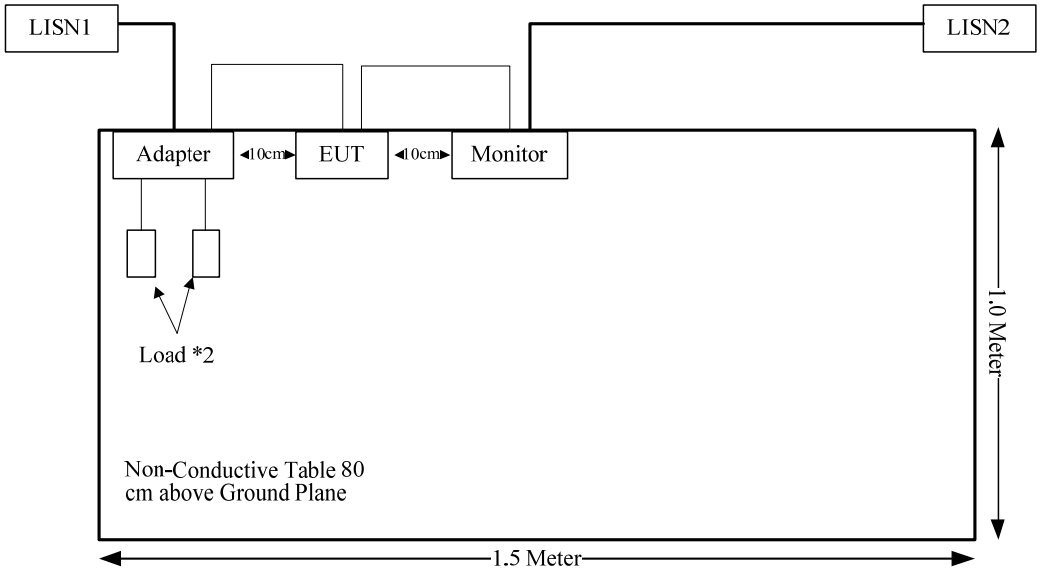
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Monitor	U3011t	CN-OPH5NY-74445-16T-290L
Unknown	Resistive load	1ohm	1ohm-1
Unknown	Resistive load	1ohm	1ohm-2

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB-C Cable	Yes	No	1.2	Adapter	EUT
HDMI Cable	Yes	Yes	1.5	EUT	Monitor
USB-A Cable*2	Yes	No	0.2	Adapter	Resistive Load

Block Diagram of Test Setup



FCC §15.247 (i) & §1.1310 & §2.1093, RSS-102 CLAUSE 4- RF Exposure

Applicable Standard

According to§15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to RSS-102 Clause 4 Table 3, SAR limits for device used by the general public.

Body Region	Average SAR (W/Kg)	Averaging Time (minutes)	Mass Average (g)
Whole Body	0.08	6	Whole Body
Localized Head, Neck and Trunk	1.6	6	1
Localized Limbs	4	6	10

Test Result

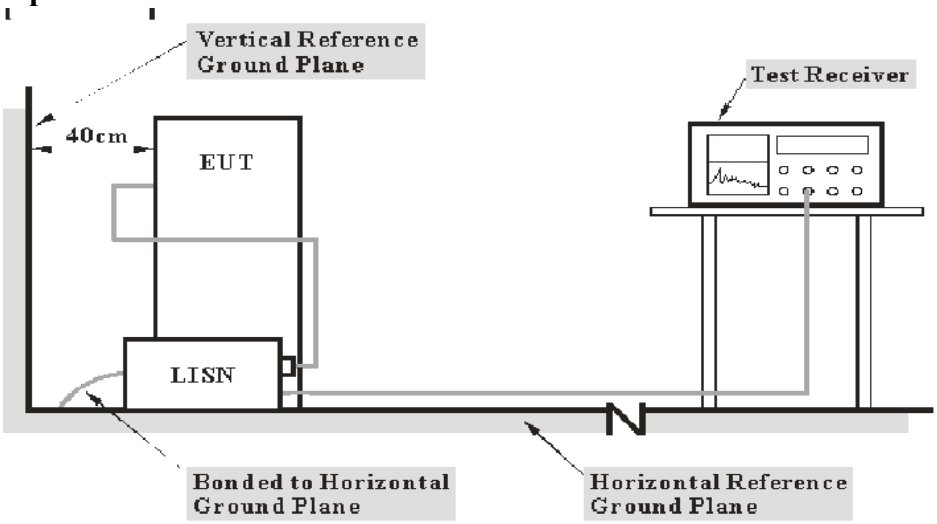
Compliance, Please refer to the SAR report: SZ1210507-15794E-20.

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 setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN with a 120 V/60 Hz AC power source.

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 first LISN.

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase ("hot") line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
V_C (cord. Reading): corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN
C_f: Correction Factor

The "**Margin**" column of the following data tables indicates the degree of compliance within 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:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV 216	101614	2020-09-12	2021-09-12
R&S	EMI Test Receiver	ESCI	101121	2020-07-07	2021-07-07
MICRO-COAX	Coaxial Cable	C-NJNJ-50	C-0200-01	2020-09-05	2021-09-05
R&S	Test Software	EMC32	Version 9.10.00	N/A	N/A

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

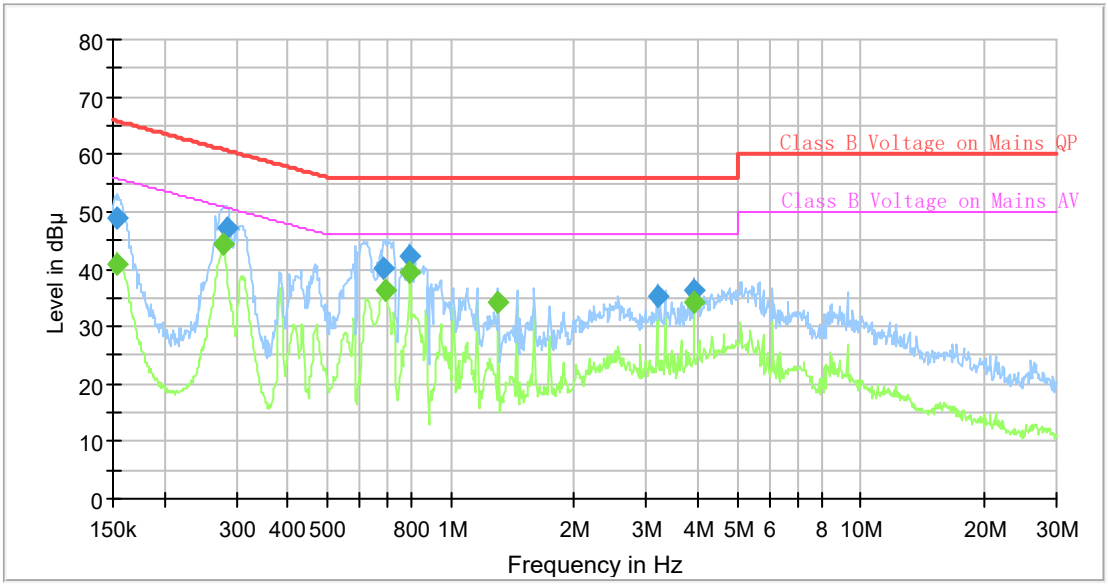
Test Data

Environmental Conditions

Temperature:	25.7℃
Relative Humidity:	57%
ATM Pressure:	100.4kPa
Tester:	Walker Chen
Test Date:	2021-05-17

Test Mode: Transmitting(802.11b mode middle channel is the worst)

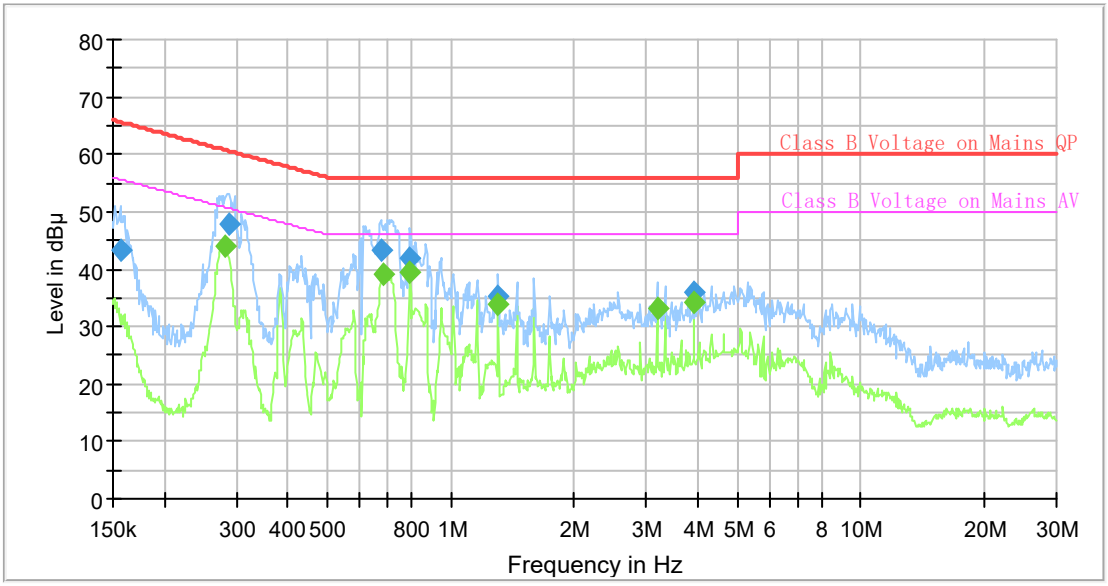
AC120 V, 60 Hz, Line:



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.153023	---	40.74	55.83	15.09	9.000	L1	9.6
0.153788	48.87	---	65.79	16.92	9.000	L1	9.6
0.278409	---	44.26	50.86	6.60	9.000	L1	9.6
0.284019	47.31	---	60.70	13.39	9.000	L1	9.6
0.686657	40.04	---	56.00	15.96	9.000	L1	9.6
0.690091	---	36.49	46.00	9.51	9.000	L1	9.6
0.793516	42.20	---	56.00	13.80	9.000	L1	9.7
0.793516	---	39.38	46.00	6.62	9.000	L1	9.7
1.306658	---	34.08	46.00	11.92	9.000	L1	9.7
3.190708	35.33	---	56.00	20.67	9.000	L1	9.7
3.914674	---	34.39	46.00	11.61	9.000	L1	9.7
3.914674	36.33	---	56.00	19.67	9.000	L1	9.7

AC120 V, 60 Hz, Neutral:



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.156106	43.41	---	65.67	22.26	9.000	N	9.6
0.282606	---	44.19	50.74	6.55	9.000	N	9.6
0.288300	47.77	---	60.57	12.80	9.000	N	9.6
0.676460	43.49	---	56.00	12.51	9.000	N	9.6
0.686657	---	39.20	46.00	6.80	9.000	N	9.6
0.793516	---	39.37	46.00	6.63	9.000	N	9.6
0.793516	41.76	---	56.00	14.24	9.000	N	9.6
1.306658	---	34.00	46.00	12.00	9.000	N	9.6
1.306658	35.22	---	56.00	20.78	9.000	N	9.6
3.190708	---	33.04	46.00	12.96	9.000	N	9.6
3.914674	---	34.17	46.00	11.83	9.000	N	9.6
3.914674	36.13	---	56.00	19.87	9.000	N	9.6

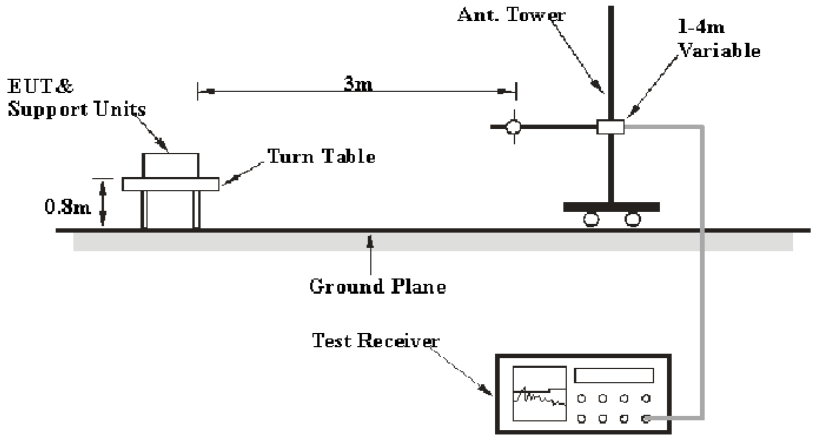
FCC §15.209, §15.205 & §15.247(d), RSS-247 CLAUSE 5.5, RSS-GEN CLAUSE 8.10 - SPURIOUS EMISSIONS

Applicable Standard

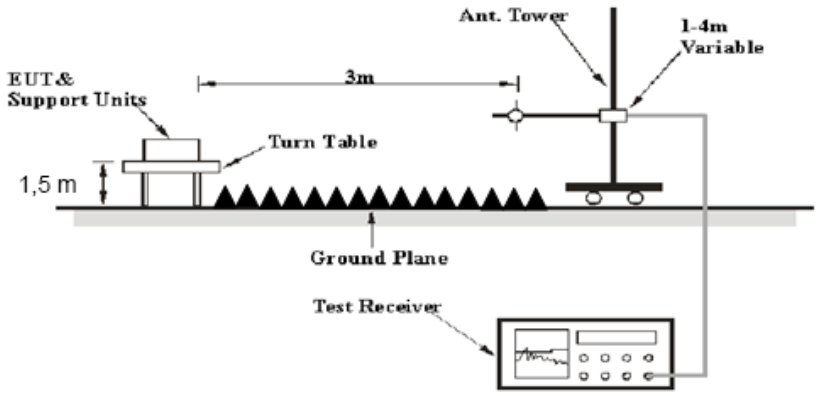
FCC §15.247 (d); §15.209; §15.205; RSS-247 §5.5, RSS-GEN §8.10.

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission Below 1GHz tests were performed in the 10 meters chamber, above 1GHz tests were performed in the 3 meters chamber B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.247 and RSS-247,RSS-Gen limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

Measurement	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, 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:

Corrected Amplitude = Meter Reading + 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 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation Below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-2	2020-08-25	2023-08-25
R&S	EMI Test Receiver	ESCI	100224	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2020-09-24	2021-09-24
Sonoma	Amplifier	310N	185914	2020-10-13	2021-10-13
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A

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

Test Data

Environmental Conditions

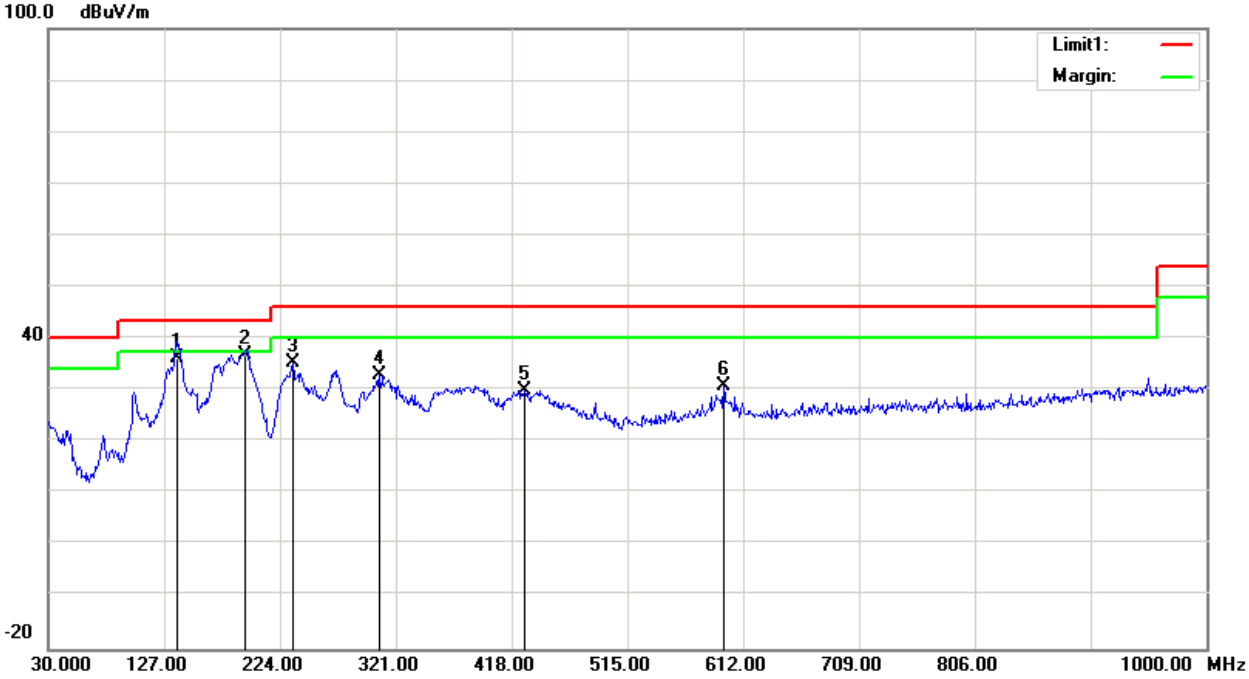
Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	24.9°C	27.3°C
Relative Humidity:	50%	52%
ATM Pressure:	101.3kPa	101.2 kPa
Tester:	Burt Hu	Lee Li
Test Date:	2021-05-13	2021-05-14

Test Result: Compliance, the changes not affect the radiation above 1GHz test, please Refer to the following data for below 1GHz, and the Wi-Fi Radio 0 above 1GHz data in the report No. RSZ201027002-00A

Test Mode: Transmitting

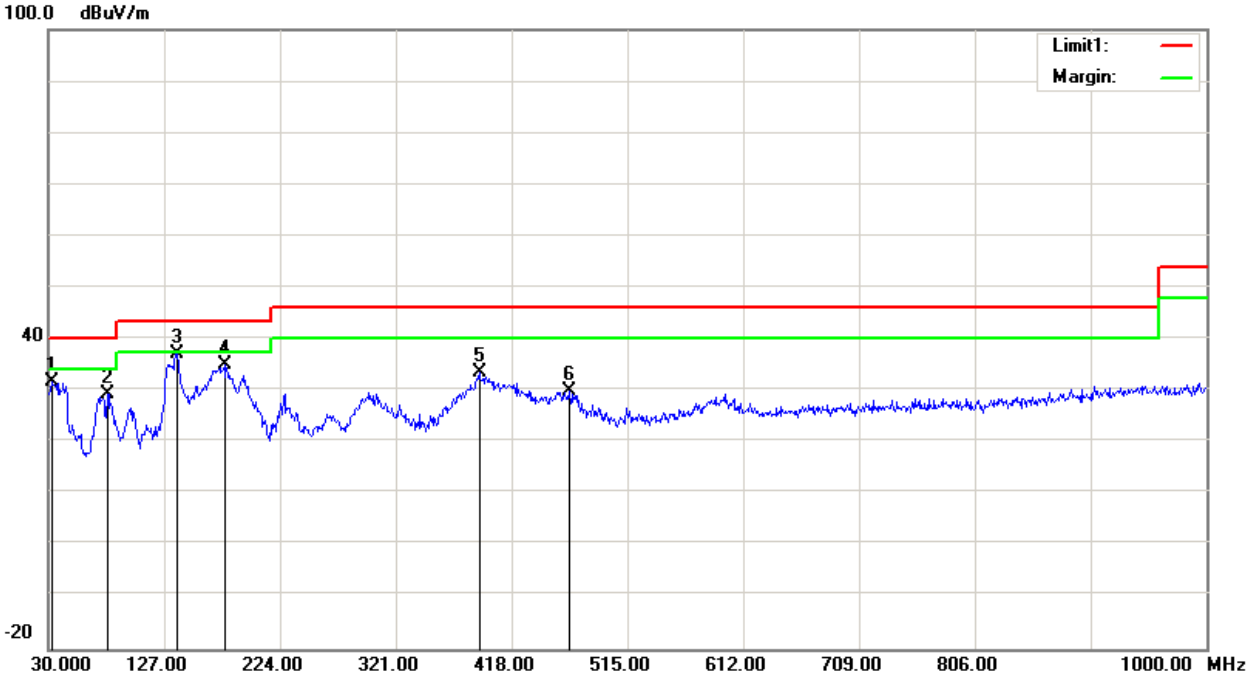
1) 30MHz-1GHz(802.11b mode middle channel was the worst)

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
137.6700	45.53	QP	-9.23	36.30	43.50	7.20
194.9000	46.93	QP	-9.93	37.00	43.50	6.50
234.6700	45.41	peak	-10.19	35.22	46.00	10.78
307.4200	40.13	peak	-7.08	33.05	46.00	12.95
428.6700	34.77	peak	-4.68	30.09	46.00	15.91
595.5100	32.28	peak	-1.49	30.79	46.00	15.21

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.9100	37.41	peak	-5.69	31.72	40.00	8.28
79.4700	45.32	peak	-15.90	29.42	40.00	10.58
137.6700	46.40	peak	-9.23	37.17	43.50	6.33
177.4400	44.69	peak	-9.75	34.94	43.50	8.56
390.8400	38.96	peak	-5.51	33.45	46.00	12.55
466.5000	33.82	peak	-3.96	29.86	46.00	16.14

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