



FCC ID: 2AJ7M-SQ1
Report No.: T200812W02-RP2

IC: 23518-SQ1

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FCC 47 CFR PART 15 SUBPART C & INDUSTRY CANADA RSS-210

TEST REPORT

For

Sequoia

Model No.:

SQ1P

Trade Name: Molekule

Issued to

Molekule Inc.

FCC:

1301 Folsom St. San Francisco California 94103 United States

IC:

**1301 Folsom Street San Francisco CA 94103 United States Of America (Excluding
The States Of Alaska)**

Issued by

Compliance Certification Services Inc.

Wugu Laboratory

No.11, Wugong 6th Rd., Wugu Dist.,

New Taipei City, Taiwan. (R.O.C.)

Issued Date: September 30, 2020

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	September 24, 2020	Initial Issue	ALL	Mita Wu
01	September 30, 2020	See the following note Rev.(01)	P.5, P.8, P.14, P.17, P.20-P.25, P.28-P.29	Mita Wu
02	September 30, 2020	See the following note Rev.(02)	P.28-29	Allison Chen

Rev.(01)

1. Revised power supply Power from AC Power.
2. Revised the worst mode of measurement EUT power by AC Power.
3. Revised test procedure RBW=10Hz, VBW = 30Hz.
4. Revised RSS-Gen general
5. Added data conversion formula in remark for reference.
6. Revised & Added temperature -10 to 50 degree.

Rev.(02)

1. Revised frequency stability test data in section 8.3.



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1. TEST RESULT CERTIFICATION

Applicant: Molekule Inc.
FCC:
1301 Folsom St. San Francisco California 94103 United States
IC:
1301 Folsom Street San Francisco CA 94103 United States Of America (Excluding The States Of Alaska)

Manufacturer: Inventec Appliances (Pudong) Corporation
No.789, Puxing Rd., Minhang District, Shanghai, P.R.C

Equipment Under Test: Sequoia

Trade Name: Molekule

Model No.: SQ1P

Date of Test: August 19 ~ September 2, 2020

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C & RSS-210 Issue 10 and RSS-GEN Issue 5	No non-compliance noted
Statements of Conformity	
Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.	

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample tested as described in this report is in compliance with the requirements of FCC Rules Part 15.225.

The test results of this report relate only to the tested sample identified in this report.

Approved by:

Kevin Tsai
Deputy Manager
Compliance Certification Services Inc.



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2. EUT DESCRIPTION

Product	Sequoia
Model No.	SQ1P
Model Discrepancy	N/A
Trade	Molekule
Received Date	August 12, 2020
Power Supply	Power from AC Power.
Frequency Range	13.56MHz
Modulation Technique	ASK
Number of Channels	1 Channel
Antenna Requirement	Antenna type: Coil Antenna Antenna gain (max): 0 dBi

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

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3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 Part 15.207, 15.209, 15.225.

The tests documented in this report were performed in accordance with IC RSS-210, IC RSS-Gen, and ANSI C63.10: 2013

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.3 RSS GEN SECTION 8.10 RESTRICTED BANDS OF OPERATIONS

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

- (a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
- (b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.
- (c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7 – Restricted frequency bands ^{Note 1}			
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	608 - 614	9.0 - 9.2
0.495 - 0.505	16.69475 - 16.69525	960 - 1427	9.3 - 9.5
2.1735 - 2.1905	16.80425 - 16.80475	1435 - 1626.5	10.6 - 12.7
3.020 - 3.026	25.5 - 25.67	1645.5 - 1646.5	13.25 - 13.4
4.125 - 4.128	37.5 - 38.25	1660 - 1710	14.47 - 14.5
4.17725 - 4.17775	73 - 74.6	1718.8 - 1722.2	15.35 - 16.2
4.20725 - 4.20775	74.8 - 75.2	2200 - 2300	17.7 - 21.4
5.677 - 5.683	108 - 138	2310 - 2390	22.01 - 23.12
6.215 - 6.218	149.9 - 150.05	2483.5 - 2500	23.6 - 24.0
6.26775 - 6.26825	156.52475 -	2655 - 2900	31.2 - 31.8
6.31175 - 6.31225	156.52525	3260 - 3267	36.43 - 36.5
8.291 - 8.294	156.7 - 156.9	3332 - 3339	Above 38.6
8.362 - 8.366	162.0125 - 167.17	3345.8 - 3358	
8.37625 - 8.38675	167.72 - 173.2	3500 - 4400	
8.41425 - 8.41475	240 - 285	4500 - 5150	
12.29 - 12.293	322 - 335.4	5350 - 5460	
12.51975 - 12.52025	399.9 - 410	7250 - 7750	
12.57675 - 12.57725		8025 - 8500	
13.36 - 13.41			

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

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3.4 DESCRIPTION OF TEST MODES

The EUT had been tested under engineering test mode condition and the EUT staying in continuous transmitting mode.

All modes and data rates were investigated and it was determined that ISO 14443A/B and ISO 18092 Type y, 106/212/424/848 kbps.

All data rates were investigated and it was determined that 106 Kbps was considered worst-case. Therefore, all testing was performed in 106 Kbps mode.

3.4.1 The worst mode of measurement

AC Power Line Conducted Emission	
Test Condition	AC Power line conducted emission for line and neutral
Test Mode	Mode 1: EUT power by AC Power
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Radiated Emission Measurement Above 1G	
Test Condition	Band edge, Emission for Unwanted and Fundamental
Power supply Mode	Mode 1: EUT power by AC Power
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4
Worst Position	☐ Placed in fixed position. ☒ Placed in fixed position at X-Plane (E2-Plane) ☐ Placed in fixed position at Y-Plane (E1-Plane) ☐ Placed in fixed position at Z-Plane (H-Plane)
Worst Polarity	☒ Horizontal ☐ Vertical

Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Power supply Mode	Mode 1: EUT power by AC Power
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case(Y-Plane and Horizontal) were recorded in this report



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4. TEST SUMMARY

FCC Standard Sec.	IC Standard Sec.	Chapter	Test Item	Result
15.203	RSS-GEN Sec. 8.3	2	Antenna Requirement	Pass
15.215	RSS-210	8.1	Occupied Bandwidth (99%) and 20dB Bandwidth	Pass
15.209	RSS-210	8.2	Radiated Emissions	Pass
15.225	RSS-210	8.3	Frequency Stability	Pass
15.207	RSS-GEN Sec. 8.8	8.4	AC Power-line Conducted Emission	Pass

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5. INSTRUMENT CALIBRATION

5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

RF Conducted Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
Coaxial Cable	Woken	WC12	CC001	06/29/2020	06/28/2021
Coaxial Cable	Woken	WC12	CC003	06/29/2020	06/28/2021
Signal Analyzer	R&S	FSV 40	101073	09/25/2019	09/24/2020
Power Meter	Anritsu	ML2487A	6K00003260	05/21/2020	05/20/2021
Power Sensor	Anritsu	MA2490A	032910	05/21/2020	05/20/2021
Thermostatic/Humidity Chamber	TAICHY	MHG-150LF	930619	10/04/2019	10/03/2020
Software	N/A				

3M 966 Chamber Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
Band Reject Filters	MICRO TRONICS	BRM 50702	120	02/25/2020	02/24/2021
Bilog Antenna	Sunol Sciences	JB3	A030105	07/24/2020	07/23/2021
Coaxial Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	02/25/2020	02/24/2021
Coaxial Cable	EMCI	EMC105	190914+25111	09/20/2019	09/19/2020
Digital Thermo-Hygro Meter	WISEWIND	1206	D07	01/15/2020	01/14/2021
double Ridged Guide Horn Antenna	ETC	MCTD 1209	DRH13M02003	10/04/2019	10/03/2020
Loop Ant	COM-POWER	AL-130	121051	03/27/2020	03/26/2021
Pre-Amplifier	EMEC	EM330	060609	02/25/2020	02/24/2021
Pre-Amplifier	HP	8449B	3008A00965	02/25/2020	02/24/2021
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180323	07/24/2020	07/23/2021
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Software	e3 6.11-20180413				

Remark:

1. Each piece of equipment is scheduled for calibration once a year.
2. N.C.R. = No Calibration Request.



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AC line Conduction Test Room					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
CABLE	EMCI	CFD300-NL	CERF	06/29/2020	06/28/2021
EMI Test Receiver	R&S	ESCI	100064	07/17/2020	07/16/2021
LISN	SCHAFFNER	NNB 41	03/10013	02/13/2020	02/12/2021
Software	EZ-EMC(CCS-3A1-CE)				

Remark:

1. Each piece of equipment is scheduled for calibration once a year.
2. N.C.R. = No Calibration Request.

5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 20dB bandwidth	+/- 0.0014
RF output power, conducted	+/- 1.14
Power density, conducted	+/- 1.40
3M Semi Anechoic Chamber / 30M~200M	+/- 4.12
3M Semi Anechoic Chamber / 200M~1000M	+/- 4.68
3M Semi Anechoic Chamber / 1G~8G	+/- 5.18
3M Semi Anechoic Chamber / 8G~18G	+/- 5.47
3M Semi Anechoic Chamber / 18G~26G	+/- 3.81
3M Semi Anechoic Chamber / 26G~40G	+/- 3.87

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)
Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10: 2013 and CISPR Publication 22.

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bucolical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."



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7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix A for the actual connections between EUT and support equipment.

7.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Cable length & Type Describe
1	NB(J)	TOSHIBA	PT345T-00L002	N/A	N/A	N/A

Remark:

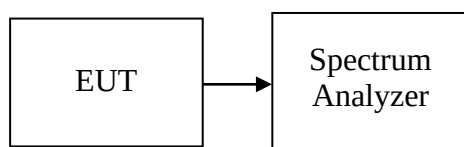
1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



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8. FCC PART 15.225 REQUIREMENTS & RSS-210 REQUIREMENTS

8.1 OCCUPIED BANDWIDTH(99%) AND 20 dB BANDWIDTH TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10Hz, VBW = 30Hz, Span = 10kHz, Sweep = auto.
4. Record the max. reading.

TEST RESULTS

No non-compliance noted.

Temperature: 24°C

Humidity: 50% RH

Tested by: Rick Lee

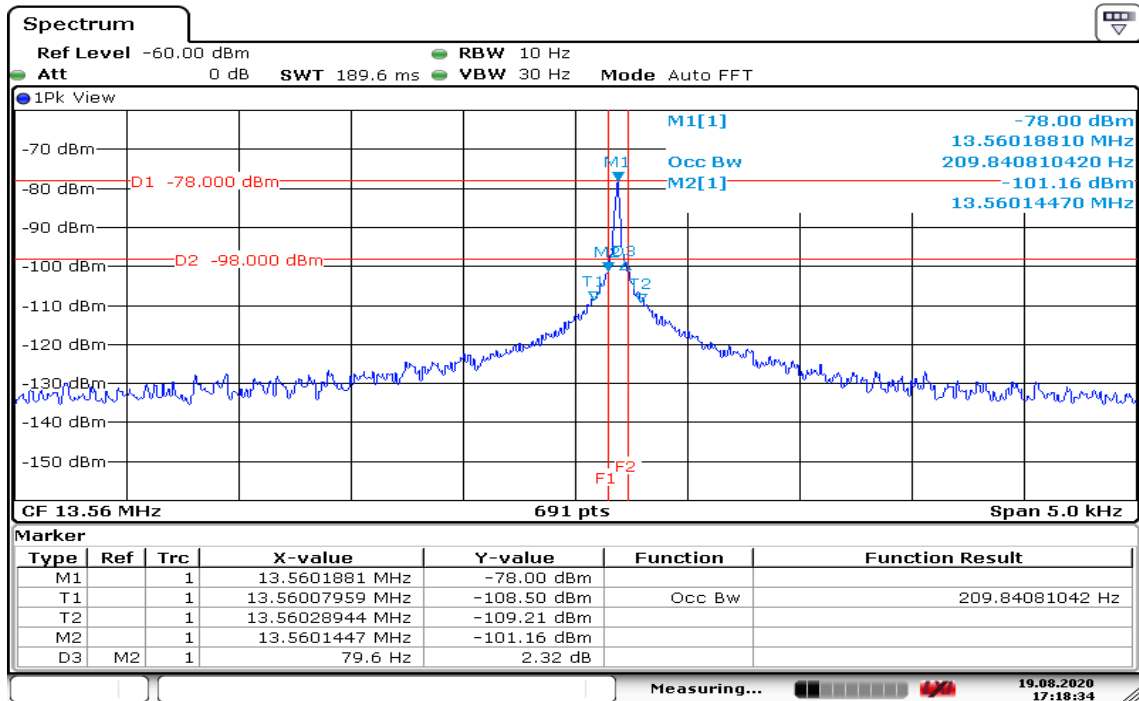
Test Condition	Frequency(MHz)	Occupied Bandwidth 99% (kHz)	20 dB Bandwidth (kHz)
NFC	13.56	0.2098	0.0796

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Test Plot

20dB & 99% Bandwidth



Date: 19.AUG.2020 17:18:34



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8.2 FUNDAMENTAL AND RADIATED EMISSIONS

LIMIT

According to §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) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz and shall not exceed the general radiated emission limits in §15.209.

According to §15.225, 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 (μ V/m at meter)	Measurement Distance (meter)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 - 88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

According to RSS 210 §B.6

The field strength of any emission shall not exceed the following limits:

- (a) 15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz;
- (b) 334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz;
- (c) 106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz; and
- (d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

Below 30 MHz

Frequency	Magnetic field strength (H-Field) (µA/m)	Measurement Distance (metres)
9-490 kHz Note 1	6.37/F (F in kHz)	300
490-1,705 kHz	63.7/F (F in kHz)	30
1.705-30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

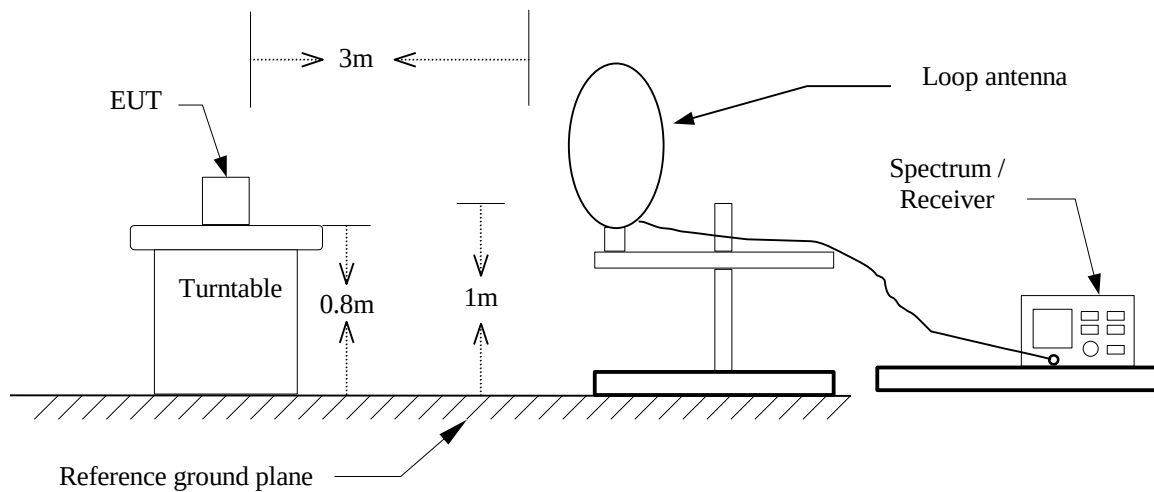
Above 30 MHz

Frequency	Field strength (µV/m at 3 m)
30-88	100
88-216	150
216-960	200
Above 960	500

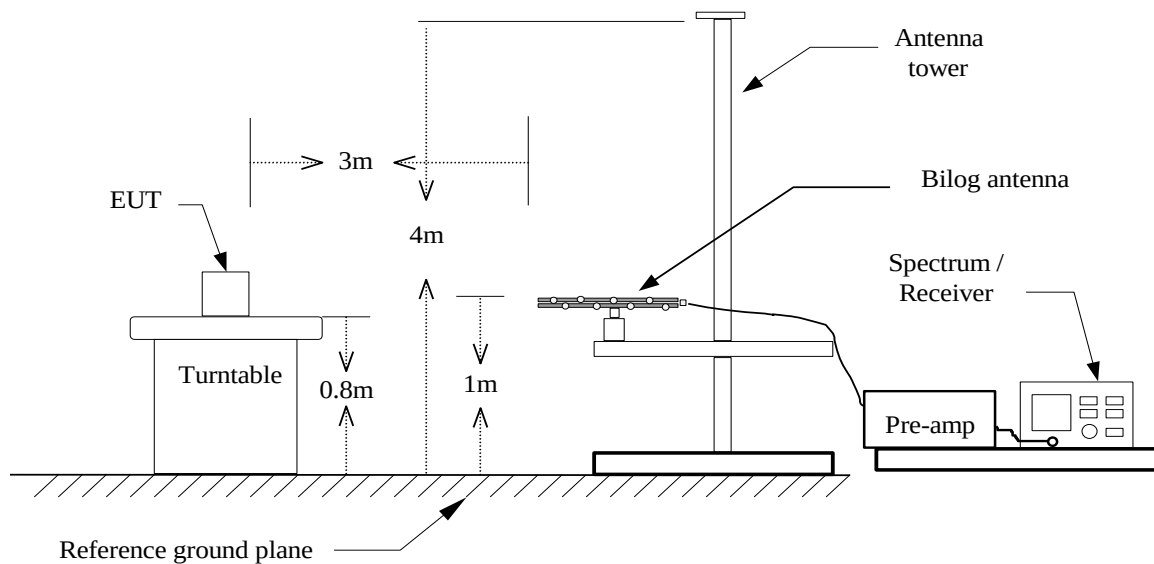
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Test Configuration

9kHz ~ 30MHz



30MHz ~ 1GHz





TEST PROCEDURE

For 9kHz ~ 30MHz

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, The center of the loop shall be 1 m above the ground then to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Set the spectrum analyzer in the following setting as:
9KHz-490KHz : RBW=200Hz / VBW=1kHz / Sweep=AUTO
490KHz-30MHz : RBW=10kHz / VBW=30kHz / Sweep=AUTO
6. Repeat above procedures until the measurements for all frequencies are complete.

For 30MHz ~ 1GHz

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
RBW=100kHz / VBW=300kHz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

Remark :

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.



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Operation Mode: TX mode

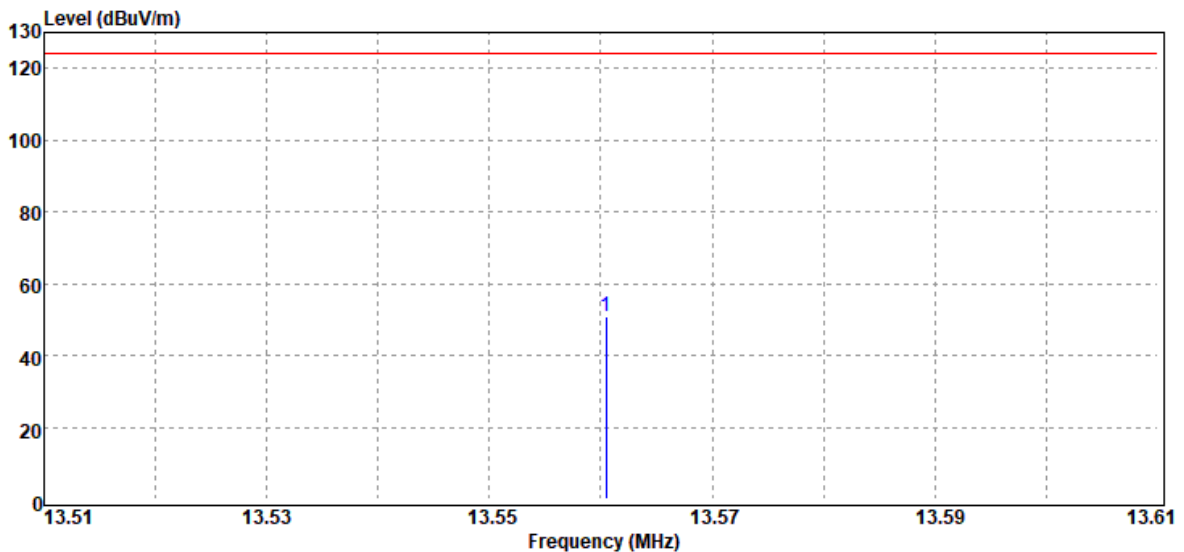
Test Date: September 2, 2020

Temperature: 25.3°C

Tested by: Jerry Chang

Humidity: 45 % RH

Polarity: Ver.



No.	Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
1	13.56	Peak	35.65	15.34	50.99	124.00	-73.01

Remark:

1. Radiated emissions measured were made with an instrument using peak/quasi-peak/average detector mode.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Margin (dB) = Result (dBuV/m) – Limit (dBuV/m).
4. 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40*Log (300 meters/3 meters)
490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40*Log (30 meters/3 meters)
1.705MHz to 30MHz Limit (@3m) = 30 + 40*Log (30 meters/3 meters)



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Operation Mode: TX mode

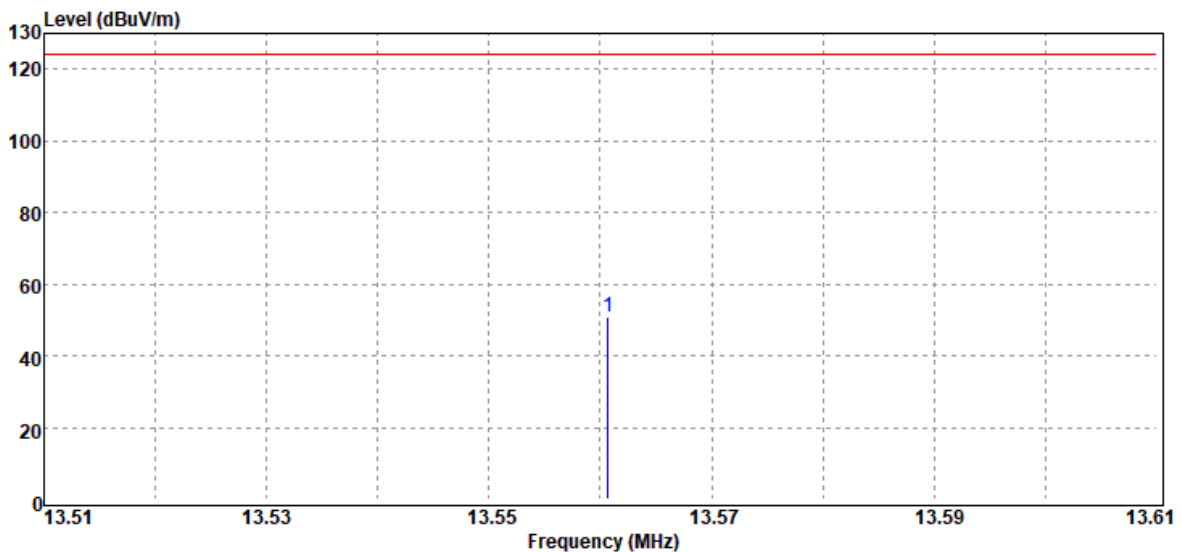
Test Date: September 2, 2020

Temperature: 25.3°C

Tested by: Jerry Chang

Humidity: 45 % RH

Polarity: Hor.



No.	Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
1	13.56	Peak	35.70	15.34	51.04	124.00	-72.96

Remark:

1. Radiated emissions measured were made with an instrument using peak/quasi-peak/average detector mode.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Margin (dB) = Result (dBuV/m) – Limit (dBuV/m).
4. 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40*Log (300 meters/3 meters)
490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40*Log (30 meters/3 meters)
1.705MHz to 30MHz Limit (@3m) = 30 + 40*Log (30 meters/3 meters)

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Test Result of Mask

Operation Mode: TX mode

Test Date:

September 2, 2020

Temperature: 25.3°C

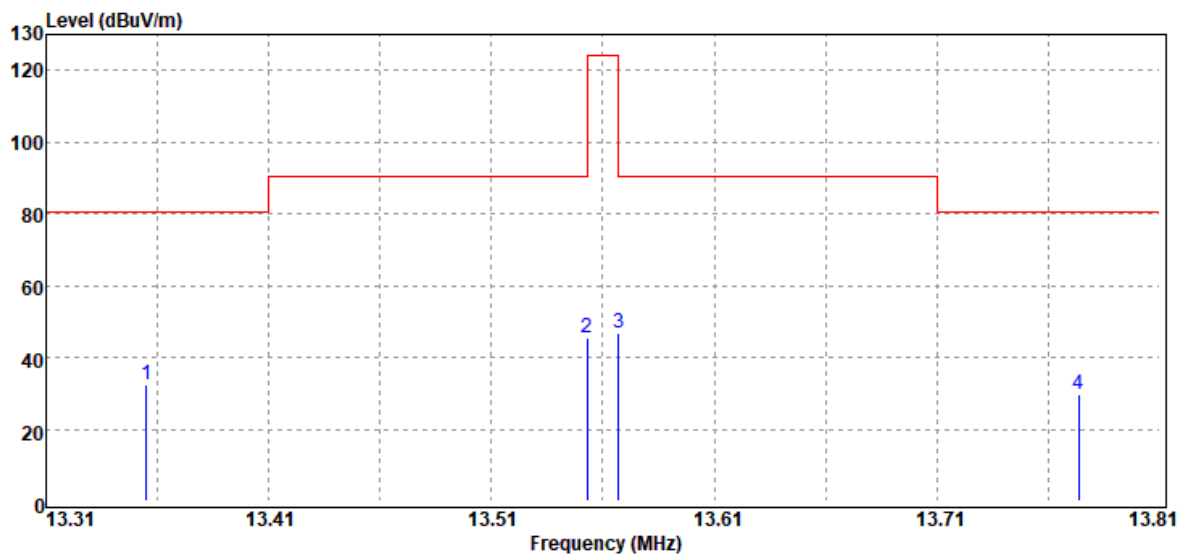
Tested by:

Jerry Chang

Humidity: 45 % RH

Polarity:

Ver.



No.	Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
1	13.36	Peak	16.94	15.35	32.29	80.54	-48.25
2	13.55	Peak	30.23	15.34	45.57	90.47	-44.90
3	13.57	Peak	31.44	15.34	46.78	90.47	-43.69
4	13.77	Peak	14.16	15.33	29.49	80.50	-51.01

Remark:

1. Radiated emissions measured were made with an instrument using peak/quasi-peak/average detector mode.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Margin (dB) = Result (dBuV/m) – Limit (dBuV/m).
4. 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40*Log (300 meters/3 meters)
490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40*Log (30 meters/3 meters)
1.705MHz to 30MHz Limit (@3m) = 30 + 40*Log (30 meters/3 meters)

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Test Result of Mask

Operation Mode: TX mode

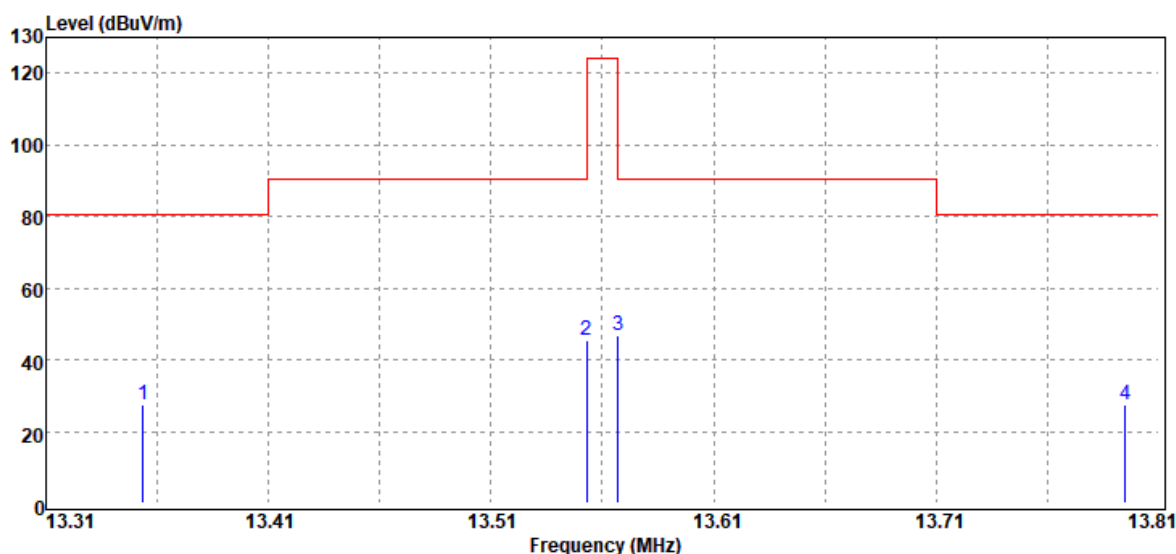
Test Date: September 2, 2020

Temperature: 25.3°C

Tested by: Jerry Chang

Humidity: 45 % RH

Polarity: Hor.



No.	Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
1	13.35	Peak	11.95	15.35	27.30	80.54	-53.24
2	13.55	Peak	30.04	15.34	45.38	90.47	-45.09
3	13.57	Peak	31.33	15.34	46.67	90.47	-43.80
4	13.80	Peak	11.94	15.33	27.27	80.50	-53.23

Remark:

1. Radiated emissions measured were made with an instrument using peak/quasi-peak/average detector mode.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Margin (dB) = Result (dBuV/m) – Limit (dBuV/m).
4. 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40*Log (300 meters/3 meters)
490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40*Log (30 meters/3 meters)
1.705MHz to 30MHz Limit (@3m) = 30 + 40*Log (30 meters/3 meters)

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9kHz ~ 30MHz

Operation Mode: TX mode

Test Date:

September 2, 2020

Temperature: 25.3°C

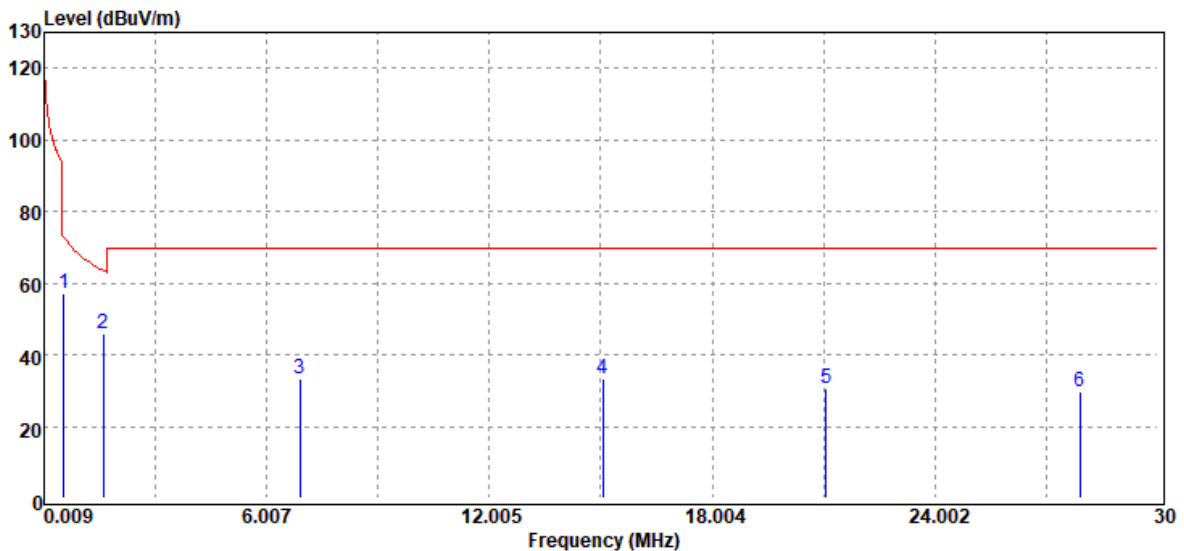
Tested by:

Jerry Chang

Humidity: 45 % RH

Polarity:

Ver.



No.	Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
1	0.55	Peak	43.21	13.87	57.08	72.82	-15.74
2	1.60	Peak	31.70	14.08	45.78	63.53	-17.75
3	6.91	Peak	18.26	15.22	33.48	69.54	-36.06
4	15.06	Peak	18.08	15.27	33.35	69.54	-36.19
5	21.06	Peak	15.65	14.82	30.47	69.54	-39.07
6	27.90	Peak	16.29	13.37	29.66	69.54	-39.88

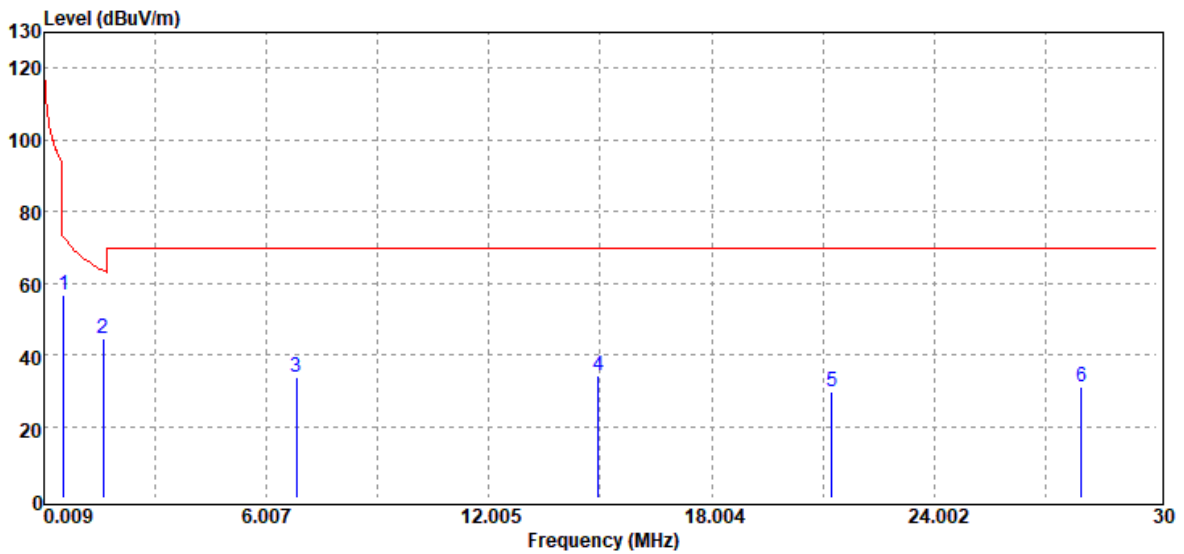
Remark:

- 9kHz to 490kHz Limit(@3m) = $2400(F/\text{kHz}) + 40 \cdot \log(300 \text{ meters}/3 \text{ meters})$
490kHz to 1.705MHz Limit (@3m) = $2400(F/\text{kHz}) + 40 \cdot \log(30 \text{ meters}/3 \text{ meters})$
1.705MHz to 30MHz Limit (@3m) = $30 + 40 \cdot \log(30 \text{ meters}/3 \text{ meters})$

Report No.: T200812W02-RP2

Operation Mode: TX mode
Temperature: 25.3°C
Humidity: 45 % RH

Test Date: September 2, 2020
Tested by: Jerry Chang
Polarity: Hor.



No.	Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
1	0.55	Peak	42.79	13.87	56.66	72.82	-16.16
2	1.60	Peak	30.44	14.08	44.52	63.53	-19.01
3	6.82	Peak	18.64	15.20	33.84	69.54	-35.70
4	14.95	Peak	18.90	15.27	34.17	69.54	-35.37
5	21.24	Peak	15.10	14.78	29.88	69.54	-39.66
6	27.96	Peak	17.69	13.36	31.05	69.54	-38.49

Remark:

- 9kHz to 490kHz Limit(@3m) = $2400(F/\text{kHz}) + 40 \cdot \log(300 \text{ meters}/3 \text{ meters})$
 490kHz to 1.705MHz Limit (@3m) = $2400(F/\text{kHz}) + 40 \cdot \log(30 \text{ meters}/3 \text{ meters})$
 1.705MHz to 30MHz Limit (@3m) = $30 + 40 \cdot \log(30 \text{ meters}/3 \text{ meters})$



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30MHz ~ 1GHz

Operation Mode: TX mode

Test Date:

September 2, 2020

Temperature: 25.3°C

Tested by:

Jerry Chang

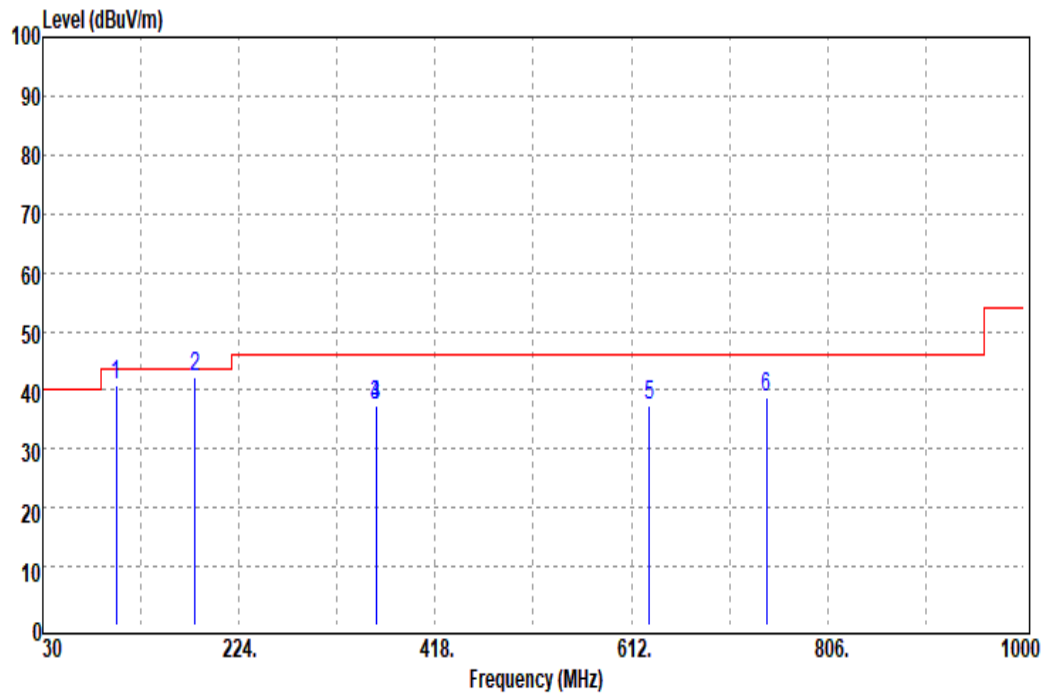
Humidity: 45% RH

Polarity:

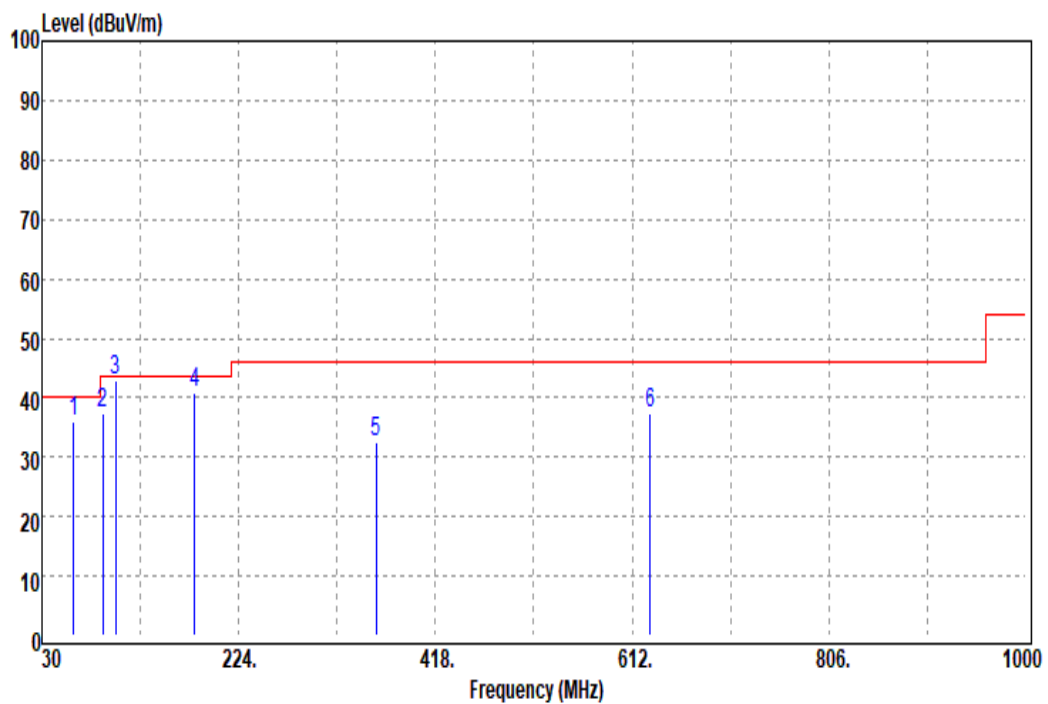
Ver. / Hor.

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB	Polarity
102.75	QP	52.77	-12.09	40.68	43.50	-2.82	V
180.35	Peak	53.78	-11.40	42.38	43.50	-1.12	V
359.80	Peak	44.04	-6.78	37.26	46.00	-8.74	V
359.80	Peak	44.04	-6.78	37.26	46.00	-8.74	V
629.46	Peak	38.30	-0.79	37.51	46.00	-8.49	V
745.86	Peak	37.82	0.77	38.59	46.00	-7.41	V
61.04	Peak	51.75	-15.87	35.88	40.00	-4.12	H
90.14	Peak	52.83	-15.48	37.35	43.50	-6.15	H
102.75	Peak	54.99	-12.09	42.90	43.50	-0.60	H
180.35	Peak	52.09	-11.40	40.69	43.50	-2.81	H
359.80	Peak	39.48	-6.78	32.70	46.00	-13.30	H
629.46	Peak	38.12	-0.79	37.33	46.00	-8.67	H

Vertical



Horizontal



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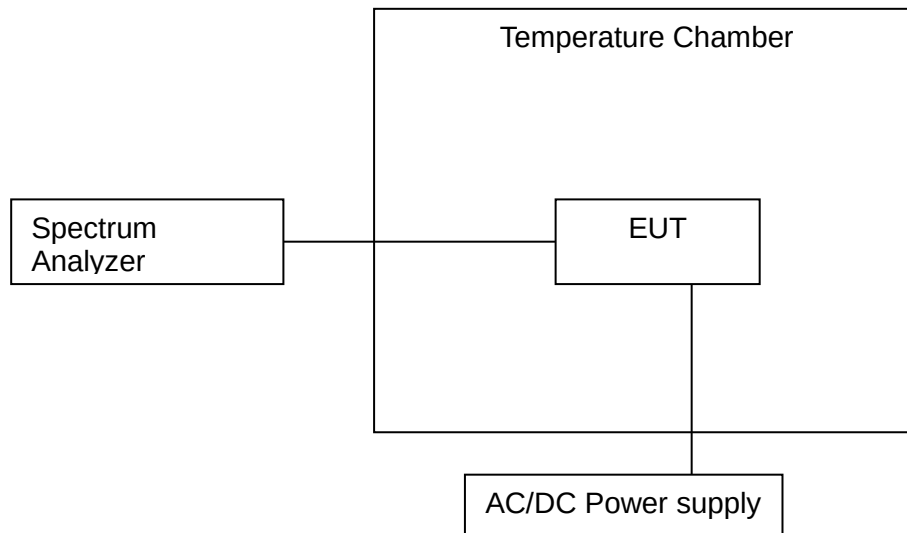
8.3 FREQUENCY STABILITY

LIMIT

According to §15.225(e) and RSS-210, B.6,
The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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.

Test Configuration

Temperature and Voltage Measurement (under normal and extreme test conditions)



TEST PROCEDURE

1. Turn the EUT off, and place it inside the environmental temperature chamber.
2. Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.
3. Set the spectrum analyzer as RBW=1kHz, VBW = RBW, Span = 200kHz, Sweep = auto.
4. Turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized.
5. Switch off the EUT and Lower the chamber temperature by not more than 10°C and allow the temperature inside the chamber to stabilize.
6. Mark the peak frequency and measure the frequency tolerance using frequency counter function.
7. Repeat step 4 through step 6 down to the lowest specified temperature.



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TEST RESULTS

No non-compliance noted.

Temperature: 24°C

Humidity: 50% RH

Tested by: Rick Lee

TEST DATA

Condition			Frequency Error (ppm)									
Temperature	Modulation Mode	Test Freq.	0 min	2 min	5 min	10 min	0 min	2 min	5 min	10 min	Limit (ppm)	Result
Normal												
T _{20°C} V _{max}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00	100	Pass
T _{20°C} V _{min}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00		Pass
Extreme												
T _{50°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00	100	Pass
T _{40°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00		Pass
T _{30°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00		Pass
T _{20°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	N/A	N/A	N/A	N/A		Pass
T _{10°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00		Pass
T _{0°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00		Pass
T _{-10°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00		Pass
T _{-20°C} V _{nom}	CW	13.56	13.560188	13.560188	13.560188	13.560188	0.00	0.00	0.00	0.00	Pass	

Remark: Vnom: 120

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8.4 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Operation Mode: NFC mode **Test Date:** August 19, 2020
Temperature: 24°C **Tested by:** Rick Lee
Humidity: 50% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1820	32.87	18.38	10.21	43.08	28.59	64.39	54.39	-21.31	-25.80	L1
0.2540	39.37	29.90	10.21	49.58	40.11	61.63	51.63	-12.05	-11.52	L1
0.2700	28.78	14.69	10.21	38.99	24.90	61.12	51.12	-22.13	-26.22	L1
0.3900	31.27	19.13	10.22	41.49	29.35	58.06	48.06	-16.57	-18.71	L1
0.4340	26.33	11.46	10.22	36.55	21.68	57.18	47.18	-20.63	-25.50	L1
0.6460	30.92	13.39	10.22	41.14	23.61	56.00	46.00	-14.86	-22.39	L1
0.1540	33.07	24.90	10.18	43.25	35.08	65.78	55.78	-22.53	-20.70	L2
0.2500	39.28	29.37	10.19	49.47	39.56	61.76	51.76	-12.29	-12.20	L2
0.2660	36.41	21.33	10.19	46.60	31.52	61.24	51.24	-14.64	-19.72	L2
0.2980	30.73	22.09	10.19	40.92	32.28	60.30	50.30	-19.38	-18.02	L2
0.4500	27.13	13.11	10.19	37.32	23.30	56.88	46.88	-19.56	-23.58	L2
0.6540	31.07	14.67	10.19	41.26	24.86	56.00	46.00	-14.74	-21.14	L2

Remark:

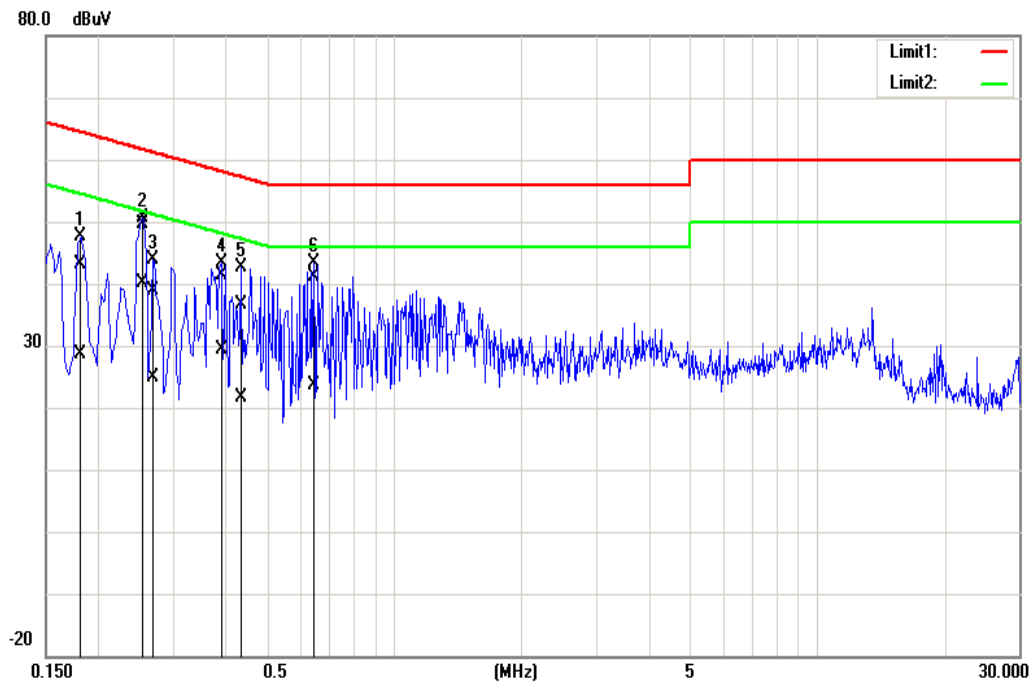
1. The measuring frequencies range between 0.15 MHz and 30 MHz.
2. The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
3. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)
5. "-" means Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.



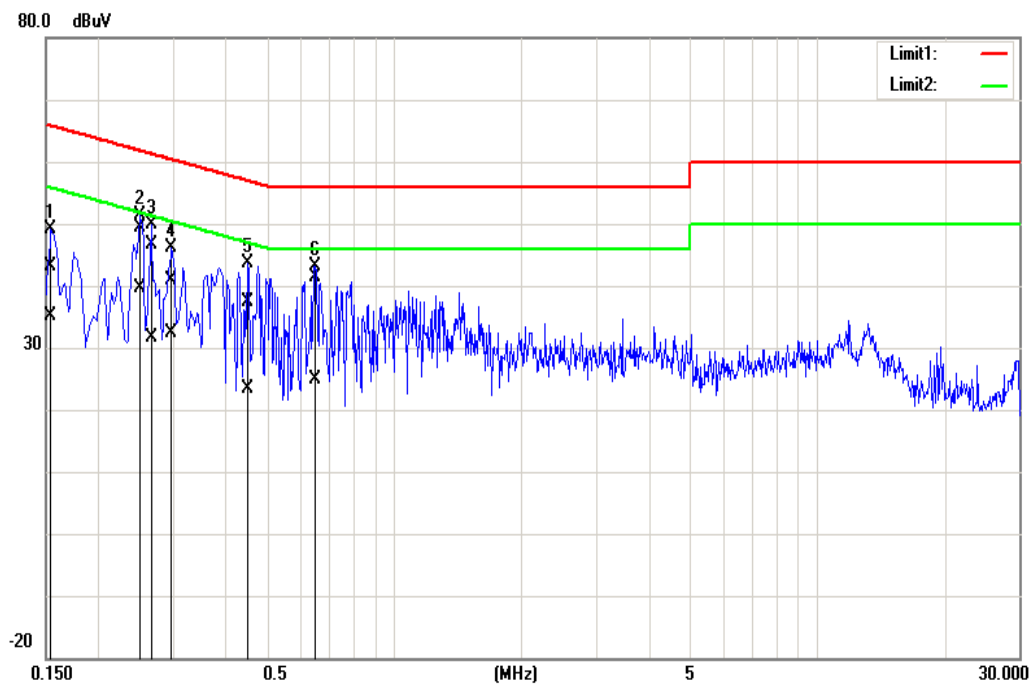
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Test Plots

Conducted emissions (Line 1)



Conducted emissions (N)



- End of Test Report -