

TEST REPORT

Application No.: SZEM1905014350AT
Applicant: iOttie, Inc
Address of Applicant: 20W, 37th Street, 6th FL. New York, NY 10018 United States
Manufacturer: iOttie, Inc
Address of Manufacturer: 20W, 37th Street, 6th FL. New York, NY 10018 United States
Factory: Shenzhen ICHECKKEY Technology Co., Ltd
Address of Factory: B302, Building 4, Tianyanxuan, No.1, Lane 14, Bantian East Village, Bantian Street, Longgang District, Shenzhen 518000
ShenzhenShiGuangdongsheng

Equipment Under Test (EUT):

EUT Name: Auto Sense Wireless

Model No.: HLCRIO161, HLCRIO162, HLCRIO163 ♣

♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.

Trade mark: iOttie

FCC ID: 2AMRO-HLCRIO161

Standard(s) : 47 CFR Part 15, Subpart C

Date of Receipt: 2019-05-23

Date of Test: 2019-05-31 to 2019-06-25

Date of Issue: 2019-06-28

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu

Keny Xu
EMC Laboratory Manager



Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2019-06-28		Original

Authorized for issue by:			
			
		<hr/> Peter Geng /Project Engineer	
			
		<hr/> Eric Fu /Reviewer	



2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.209	N/A	47 CFR Part 15, Subpart C 15.203	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
20dB Bandwidth	47 CFR Part 15, Subpart C	ANSI C63.10 (2013) Section 6.9.2	47 CFR Part 15, Subpart C 15.215	Pass
Restricted Bands	47 CFR Part 15, Subpart C	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205	Pass
Radiated Emissions (9kHz-30MHz)	47 CFR Part 15, Subpart C	ANSI C63.10 (2013) Section 6.4	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Emissions (30MHz-1GHz)	47 CFR Part 15, Subpart C	ANSI C63.10 (2013) Section 6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

Remark:

Model No.: HLCRIO161, HLCRIO162, HLCRIO163

Only the model HLCRIO161 was tested, since the electrical circuit design, layout, components used, internal wiring and functions were identical for the above models, with only difference on accessories parts.



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4 General Information

4.1 Details of E.U.T.

Power supply:	for Car charger, Input: DC 12V-24V Output: DC 5V/3A, DC 9V/2A, DC 12V/1.5A for wireless charger, Input: DC 5V/2A, DC 9V/1.67A Output: 5W/7.5W/10W USB Type A output: DC 5V, 2.4A
Cable:	DC cable: 120cm, unshielded
Operation Frequency:	118.59kHz to 151.12kHz
Modulation Type:	Load Modulation
Antenna Type:	Loop Antenna
Remark:	1) Tests were conducted in all three load modes and the worst case 10W (DC 9V/1.1A) is reported only. 2) All tests were conducted in both supply mode of DC 12V and DC 24V and the worst case (DC 12V) were reported only.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
DC power	ZHAOXIN	RXN-305D	REF. No.SEA2700
iPhone 8	Apple	A1863	F4GVQ656JC6D
Load Resistor	SGS	N/A	REF. No.SEA0600
SAMSUNG Galaxy S8	SAMSUNG	SM-G9500	R28J9140LPB



4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Occupied Bandwidth	$\pm 3\%$
3	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
4	Temperature test	$\pm 1^\circ\text{C}$
5	Humidity test	$\pm 3\%$
6	Supply voltages	$\pm 1.5\%$
7	Time	$\pm 3\%$



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4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2018-09-27	2019-09-26
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2018-07-12	2019-07-11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24

Restricted Bands Measurement					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2018-09-27	2019-09-26
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2018-07-12	2019-07-11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24

Radiated Emissions (9kHz-30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018-03-31	2021-03-30
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2018-07-12	2019-07-11
EMI Test Receiver (9kHz-7GHz)	Rohde & Schwarz	ESR	SEM004-03	2019-04-01	2020-03-31
Trilog-Broadband Antenna(30MHz-1GHz)	Schwarzbeck	VULB9168	SEM003-18	2016-06-29	2019-06-28
Pre-amplifier	Sonoma Instrument Co	310N	SEM005-04	2019-04-12	2020-04-11
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21



Radiated Emissions (30MHz-1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018-03-31	2021-03-30
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2018-07-12	2019-07-11
EMI Test Receiver (9kHz-7GHz)	Rohde & Schwarz	ESR	SEM004-03	2019-04-01	2020-03-31
Trilog-Broadband Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168	SEM003-18	2016-06-29	2019-06-28
Pre-amplifier	Sonoma Instrument Co	310N	SEM005-04	2019-04-12	2020-04-11
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2018-09-27	2019-09-26
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2019-04-04	2020-04-03



6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of an so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement.

Antenna location: Refer to Appendix(Internal photos)



7 Radio Spectrum Matter Test Results

7.1 20dB Bandwidth

Test Requirement: 47 CFR Part 15, Subpart C 15.215
Test Method: ANSI C63.10 (2013) Section 6.9.2
Limit: N/A

7.1.1 E.U.T. Operation

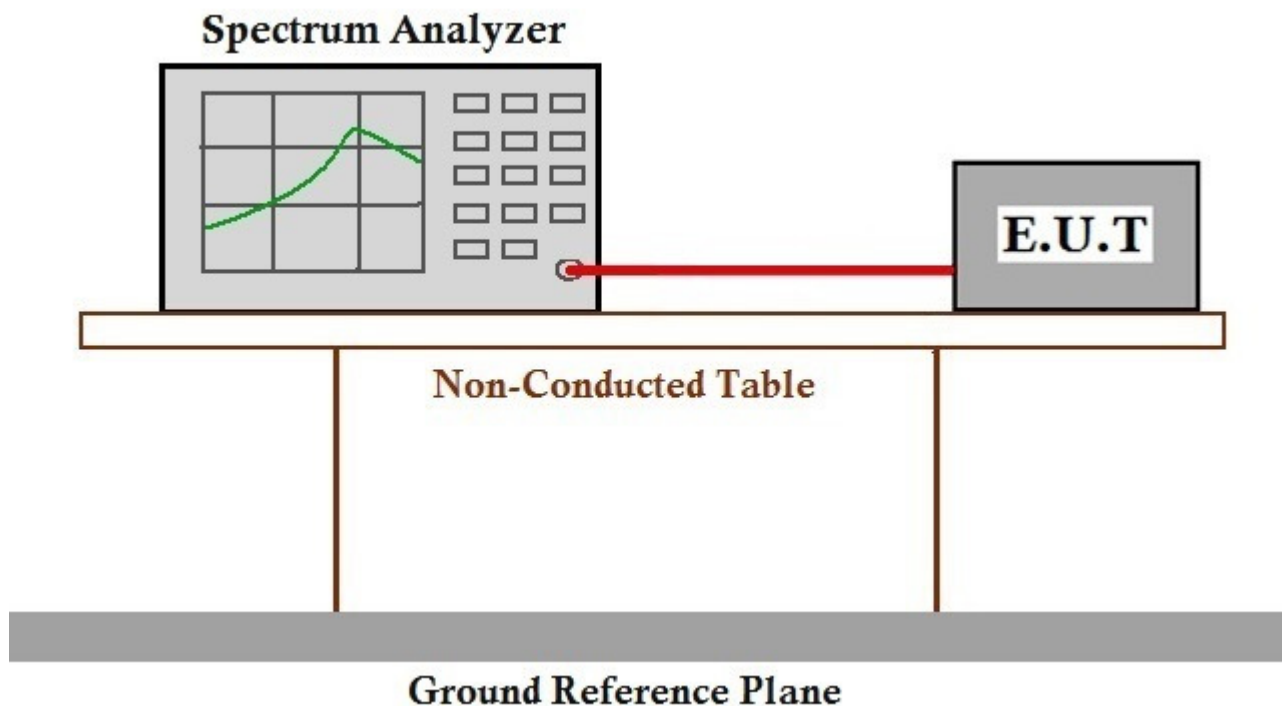
Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1005 mbar

Pretest these modes to find the worst case:
a: TX mode_Keep the EUT in transmitting with modulation mode(5W).
b: TX mode_Keep the EUT in transmitting with modulation mode(7.5W).
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

The worst case for final test:
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data



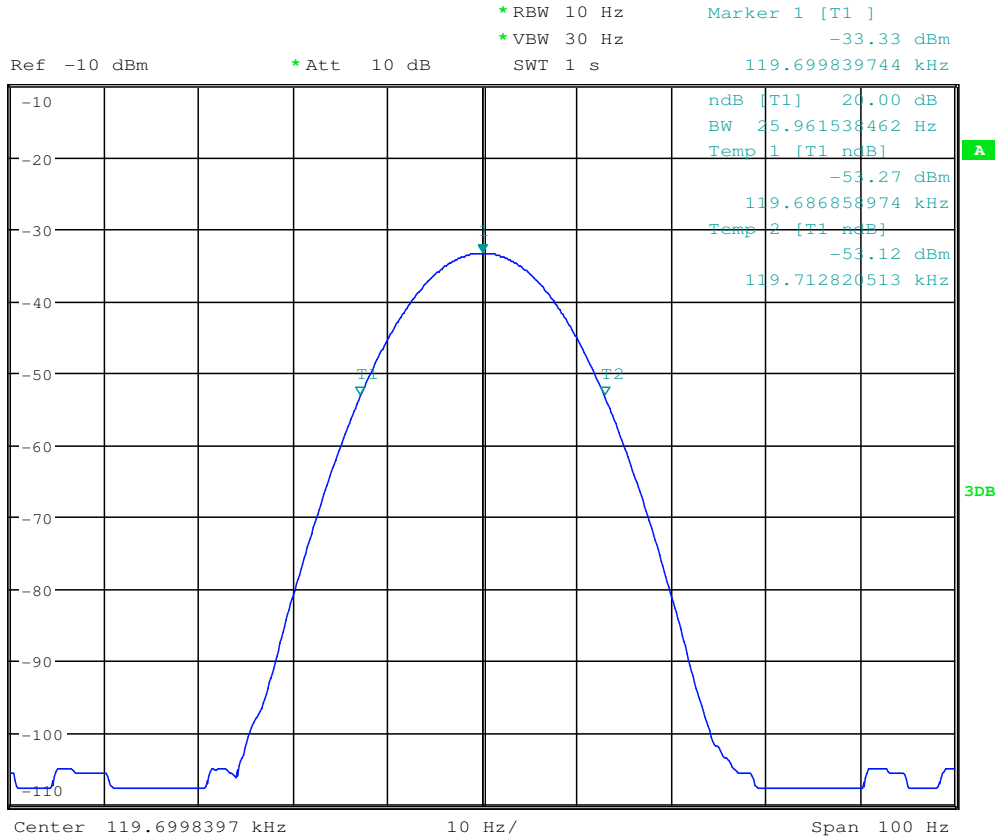
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1 PK
VIEW



7.2 Restricted Bands

Test Requirement: 47 CFR Part 15, Subpart C 15.205
Test Method: ANSI C63.10 (2013) Section 6.10.5
Limit: The fundamental wave can not fall in the restricted band 90KHz-110KHz

7.2.1 E.U.T. Operation

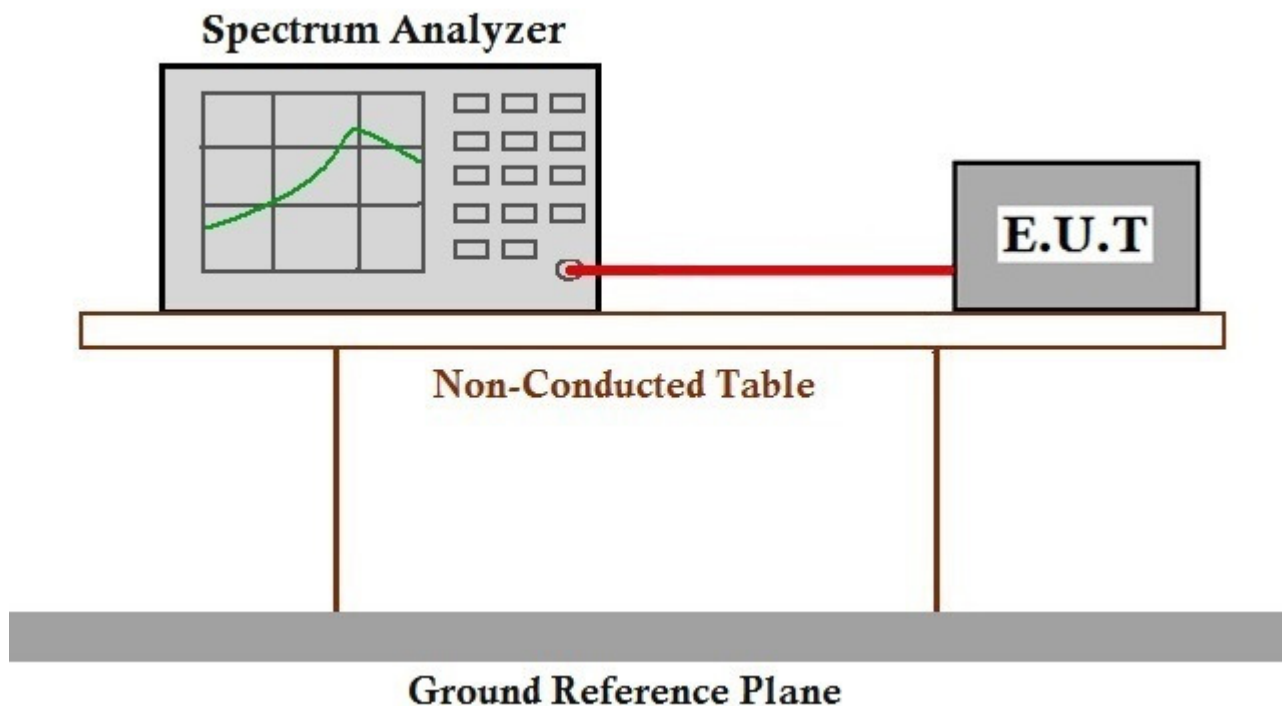
Operating Environment:

Temperature: 56.3 °C Humidity: 58.6 % RH Atmospheric Pressure: 1020 mbar

Pretest these modes to find the worst case:
a: TX mode_Keep the EUT in transmitting with modulation mode(5W).
b: TX mode_Keep the EUT in transmitting with modulation mode(7.5W).
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

The worst case for final test:
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

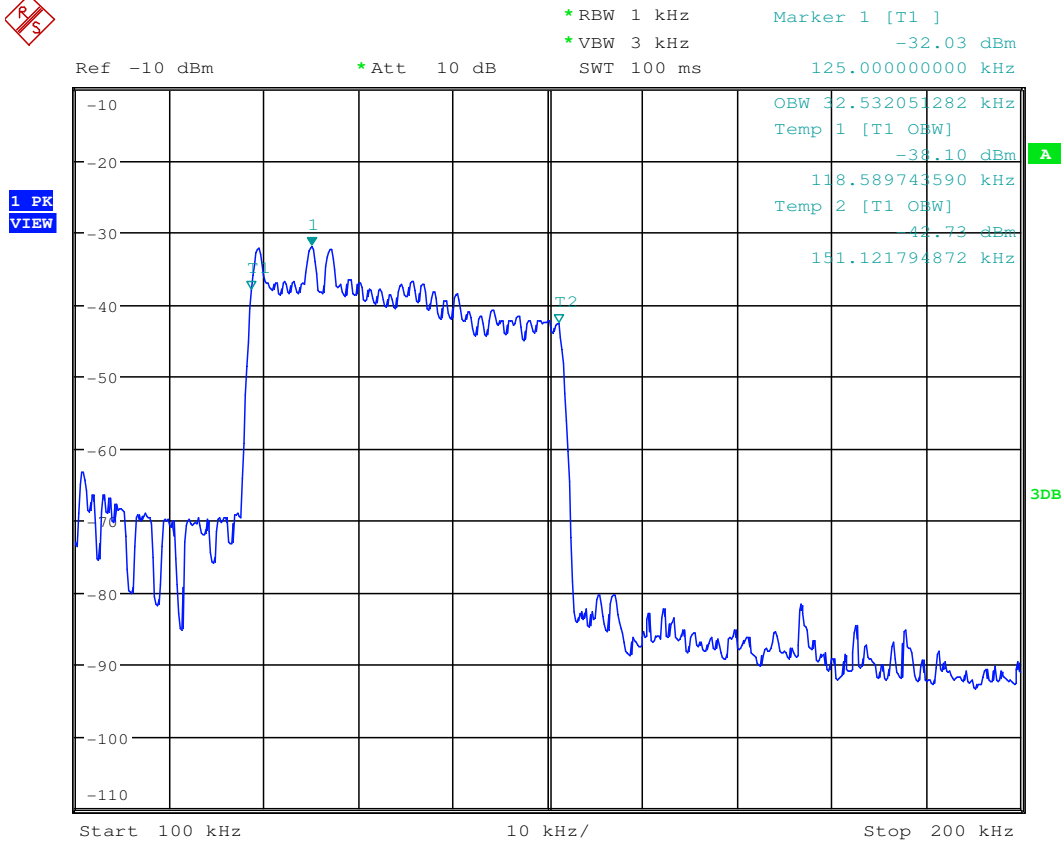
7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data



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7.3 Radiated Emissions (9kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4
Measurement Distance: 3m
Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

If field strength is measured at only a single point, then that point shall be at the radial from the EUT that produces the maximum emission at the frequency being measured, as described in 5.4. If that point is closer to the EUT than $\lambda/2\pi$ and the limit distance is greater than $\lambda/2\pi$, the measurement shall be extrapolated to the limit distance by conservatively presuming that the field strength decreases at a 40 dB/decade of distance rate to the $\lambda/2\pi$ distance, and at a 20 dB/decade of distance rate beyond $\lambda/2\pi$. This shall be accomplished using Equation (2):

$$FS_{(10m)} = FS_{(30/300m)} + 40\log\{d_{(\text{near field})}/d_{(10m)}\} + 20\log\{d_{(30/300m)}/d_{(\text{near field})}\} \quad (2)$$

If the single point measured is at a distance greater than $\lambda/2\pi$, then extrapolation to the limit distance shall be calculated using Equation (3):

$$FS_{(10m)} = FS_{(30/300m)} + 20\log\{d_{(30/300m)}/d_{(10m)}\} \quad (3)$$

If both the single point and the limit distance are equal to or closer to the EUT than $\lambda/2\pi$, then extrapolation to the limit distance shall be calculated using Equation (4):

$$FS_{(10m)} = FS_{(30/300m)} + 40\log\{d_{(30/300m)}/d_{(10m)}\} \quad (4)$$

Remark:

$$d_{\text{near field}} = 47.77 / f_{\text{MHz}}$$

where f_{MHz} is the frequency of the emission being measured in MHz.



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7.3.1 E.U.T. Operation

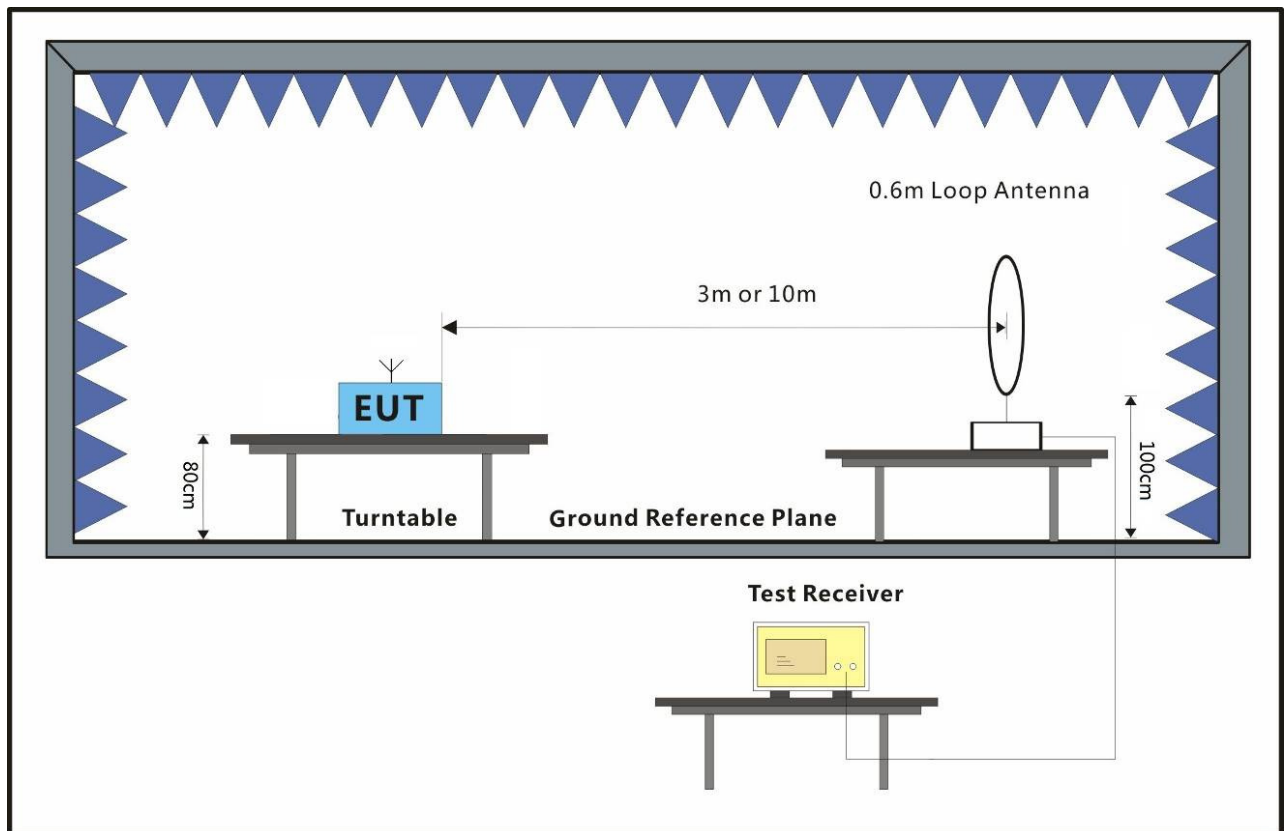
Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1005 mbar

Pretest these modes to find the worst case:
a: TX mode_Keep the EUT in transmitting with modulation mode(5W).
b: TX mode_Keep the EUT in transmitting with modulation mode(7.5W).
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

The worst case for final test:
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

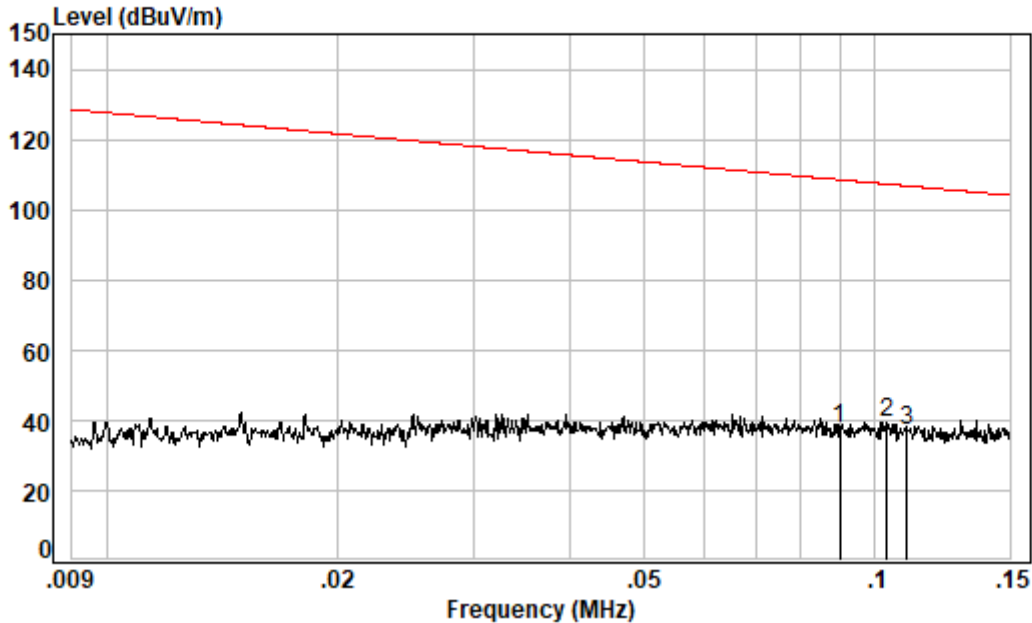
7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

Mode: c
9kHz-150KHz

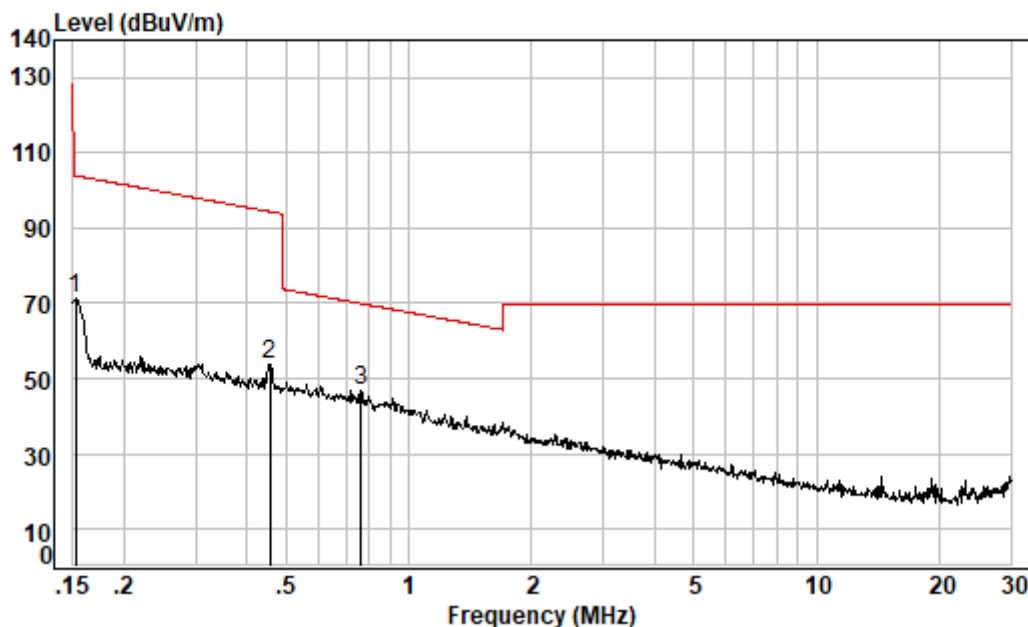


Condition: 3m
Job No. : 14350AT
Test Mode: c

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	0.09	0.00	12.04	32.56	58.35	37.83	108.52	-70.69
2 pp	0.10	0.00	11.97	32.56	60.21	39.62	107.28	-67.66
3	0.11	0.00	11.93	32.56	57.43	36.80	106.78	-69.98



150kHz-30MHz



Condition: 3m

Job No. : 14350AT

Test Mode: c

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over
	MHz	dB		dB/m	dB	dBuV	dBuV/m	dB
1	0.15	0.00	11.71	32.56	91.96	71.11	103.94	-32.83
2	0.46	0.00	11.74	32.56	74.80	53.98	94.42	-40.44
3 pp	0.76	0.00	12.00	32.56	67.21	46.65	69.95	-23.30



7.4 Radiated Emissions (30MHz-1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.5
Measurement Distance: 10m

7.4.1 E.U.T. Operation

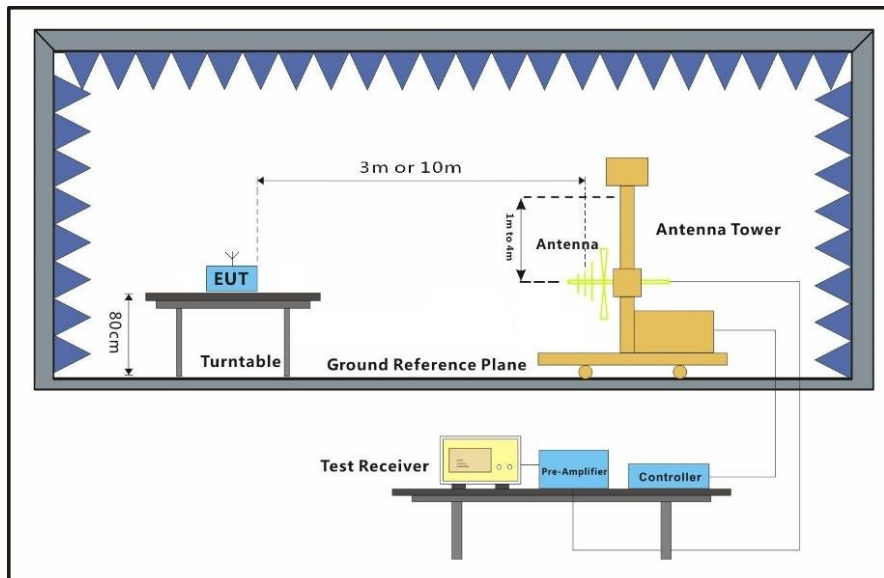
Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1005 mbar

Pretest these modes to find the worst case:
a: TX mode_Keep the EUT in transmitting with modulation mode(5W).
b: TX mode_Keep the EUT in transmitting with modulation mode(7.5W).
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

The worst case for final test:
c: TX mode_Keep the EUT in transmitting with modulation mode(10W).

7.4.2 Test Setup Diagram





7.4.3 Measurement Procedure and Data

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground for below 1GHz at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the highest channel
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.
- i. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

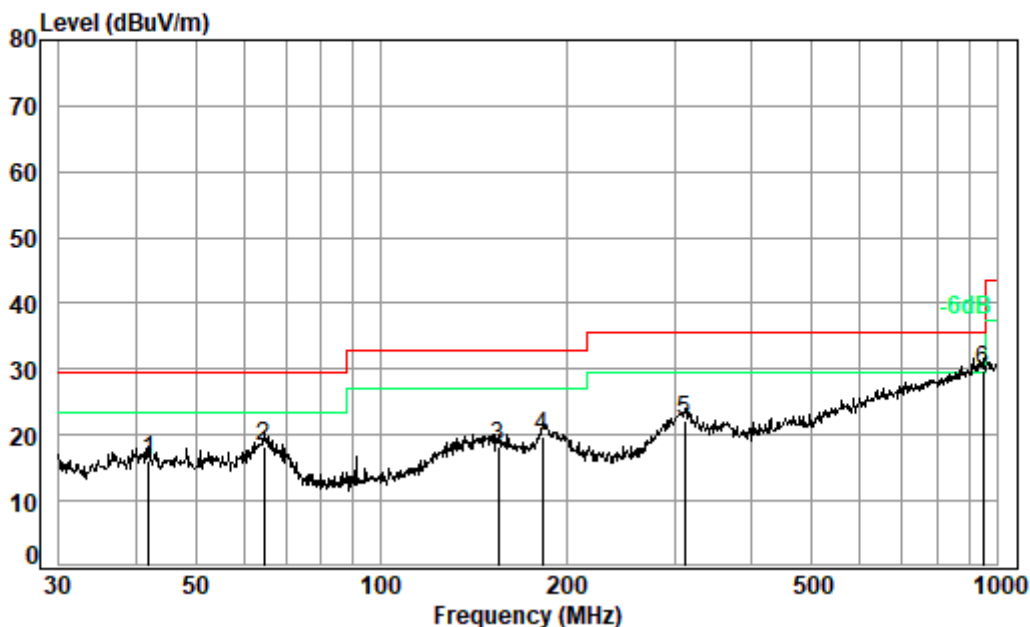


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Mode: c; Polarization: Horizontal;



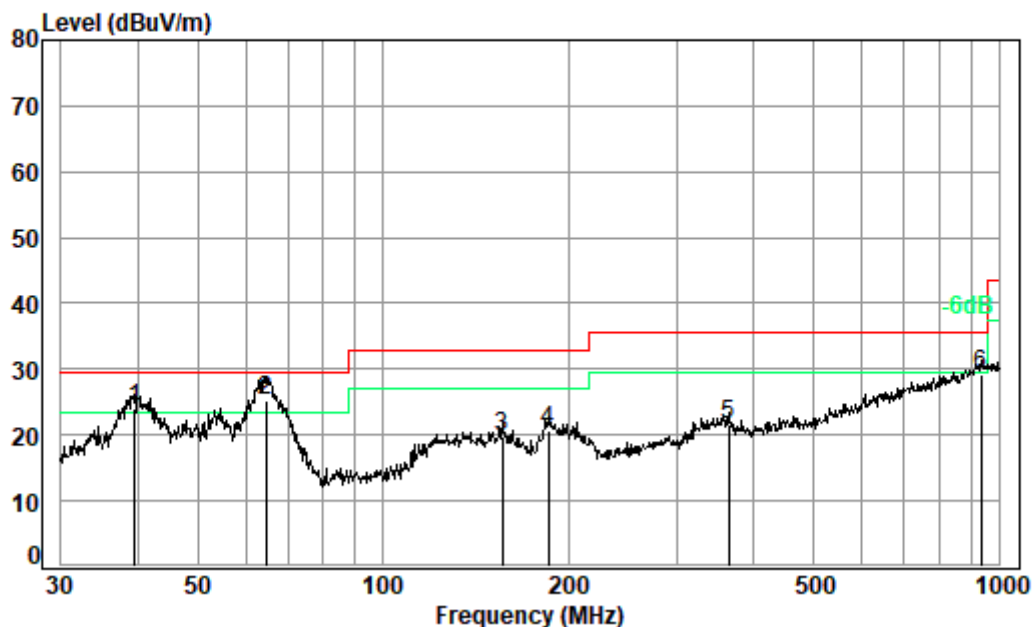
Condition: 10m HORIZONTAL

Job No. : 14350AT

Test Mode: c

	Freq	Cable	Ant	Preamp	Read	Limit	Over
	MHz	Loss	Factor	Factor	Level	Line	Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m
1	42.01	6.80	13.15	32.54	28.74	16.15	29.50
2	64.66	7.00	11.06	32.56	32.79	18.29	29.50
3	154.82	7.48	13.40	32.51	29.84	18.21	33.00
4	183.20	7.52	10.55	32.52	34.35	19.90	33.00
5	311.09	8.08	12.98	32.44	33.56	22.18	35.60
6 pp	948.76	9.57	22.72	31.16	28.61	29.74	35.60

Mode :c; Polarization: Vertical



Condition: 10m VERTICAL

Job No. : 14350AT

Test Mode: c

	Freq	Cable	Ant	Preamp	Read	Limit	Over
	MHz	Loss	Factor	Factor	Level	Line	Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dB
1	39.58	6.79	13.27	32.56	36.68	24.18	29.50
2 pp	64.66	7.00	11.06	32.56	39.60	25.10	29.50
3	156.46	7.48	13.40	32.51	31.48	19.85	33.00
4	185.79	7.53	10.26	32.52	35.45	20.72	33.00
5	364.26	8.30	14.16	32.43	31.49	21.52	35.60
6	935.55	9.54	22.63	31.26	28.41	29.32	35.60

The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance,

$$L_3 / L_{10} = D_{10} / D_3$$

Note:

L₃: Level @ 3m distance. Unit: uV/m;

L₁₀: Level @ 10m distance. Unit: uV/m;

D₃: 3m distance. Unit: m

D₁₀: 10m distance. Unit: m

The level at 3m test distance is below:

Frequency (MHz)	Polarity	Level @ 10m (dBuV/m)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)
39.58	V	24.18	34.64	40.00	-5.36
64.66	V	25.10	35.56	40.00	-4.44
156.46	V	19.85	30.31	43.50	-13.19
185.79	V	20.72	31.18	43.50	-12.32
364.26	V	21.52	31.98	46.00	-14.02
935.55	V	29.32	39.78	46.00	-6.22
42.01	H	16.15	26.61	40.00	-13.39
64.66	H	18.29	28.75	40.00	-11.25
154.82	H	18.21	28.67	43.50	-14.83
183.20	H	19.90	30.36	43.50	-13.14
311.09	H	22.18	32.64	46.00	-13.36
948.76	H	29.74	40.20	46.00	-5.80



8 Photographs

8.1 Test Setup

Please refer to setup photos.

8.2 EUT Constructional Details (EUT Photos)

Please refer to external and internal photos for details.

- End of the Report -

