

TEST REPORT

Reference No..... : WTS19S08058310W
FCC ID : KE3-PIF150-1
Applicant..... : Radio Systems Corp
Address..... : 10427 PetSafe Way, Knoxville, Tennessee 37932, United States
Manufacturer : Radio Systems Corp
Address..... : 10427 PetSafe Way, Knoxville, Tennessee 37932, United States
Product..... : PIF-150
Model(s) : RFA-554A
Standards..... : FCC CFR47 Part 15.209:2019
Date of Receipt sample : 2019-08-22
Date of Test : 2019-08-23 to 2019-09-16
Date of Issue..... : 2019-09-17
Test Result..... : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

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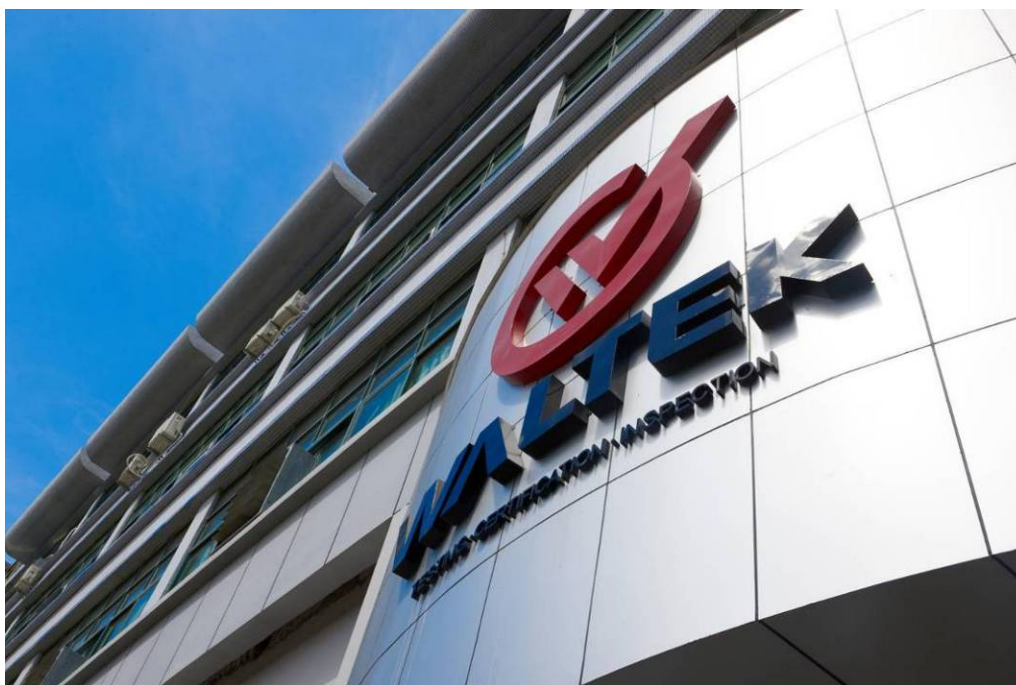


Philo Zhong

Philo Zhong / Manager

1 Laboratories Introduction

Waltek Services (Shenzhen) Co., Ltd is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation, the certification number is 4243.01) of USA, CNAS (China National Accreditation Service for Conformity Assessment, the registration number is L3110) of China. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CEC(California energy efficiency), ISED (Innovation, Science and Economic Development Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.



Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

1.1 Test Facility

A. Accreditations for Conformity Assessment (International)

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ SDoC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		WPC	-
Thailand		NTC	-
Singapore		IDA	-
Note: 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. 2. ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.			

B.TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd.	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS19S08058310W	2019-08-22	2019-08-23 to 2019-09-16	2019-09-17	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product: PIF-150
Model(s): RFA-554A
Hardware Version: 000
Software Version: 001

4.2 Details of E.U.T.

Operation Frequency: 18.726kHz
Type of Modulation: Phase
Antenna installation: Internal Integrated Loop Antenna
Antenna Gain: N/A
Ratings: Input: 19V $\overline{=}$ 1.26A powered by AC ADAPTER
(AC ADAPTER: Model NF19V-1.26C-DC,
Input 100-240V~50/60Hz, 0.8A Max)

4.3 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Test channel
Transmitting	18.726kHz

5 Equipment Used during Test

5.1 Equipment List

Conducted Emissions Test Site						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMI Test Receiver	R&S	ESCI	100947	2019-07-15	2020-07-14
2	LISN	R&S	ENV216	100115	2019-07-15	2020-07-14
3	Cable	Top	TYPE16(3.5M)	-	2019-07-15	2020-07-14
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2019-04-20	2020-04-19
2	Spectrum Analyzer	R&S	FSL6	100959	2018-11-18	2019-11-17
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2019-05-24	2020-05-23
4	Active Loop Antenna	Com-power	AL-130R	10160007	2019-04-28	2020-04-27
5	Amplifier	ANRITSU	MH648A	M43381	2019-04-19	2020-04-18
6	Cable	HUBER+SUHNER	CBL2	525178	2019-04-20	2020-04-19
7	Coaxial Cable (below 1GHz)	Top	TYPE16 (13M)	-	2018-10-15	2019-10-14

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
Conducted Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Radiated Spurious Emissions test	± 3.03 dB (Loop antenna 9k~30MHz)
	± 5.03 dB (Bilog antenna 30M~1000MHz)
Confidence interval: 95%. Confidence factor:k=2	

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave, Tianhe District, Guangzhou, Guangdong, China.

6 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207(a)	Pass
Radiated Spurious Emissions	15.205(a) 15.209(a)	Pass
Bandwidth Measurement	15.205(a) 15.215(c)	Pass
Antenna Requirement	15.203	Pass

Note: Pass =Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.

7 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B

Limit:	Frequency (MHz)	Conducted Limit (dB μ V)	
		Quasi-peak	Average
	0.15 to 0.5	66 to 56*	56 to 46*
	0.5 to 5.0	56	46
	5.0 to 30	60	50

*Decreases with the logarithm of the frequency.

7.1 E.U.T. Operation

Operating Environment :

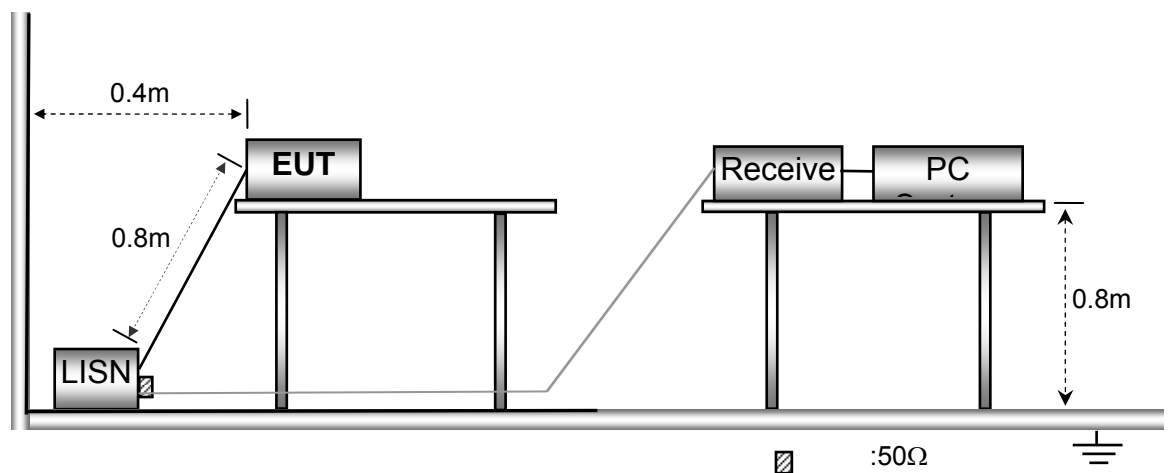
Temperature:	22.6 °C
Humidity:	54.2 % RH
Atmospheric Pressure:	101.8kPa
Test Voltage:	AC 120V, 60Hz

EUT Operation :

The test was performed in Transmitting mode, the test data were shown in the report.

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.

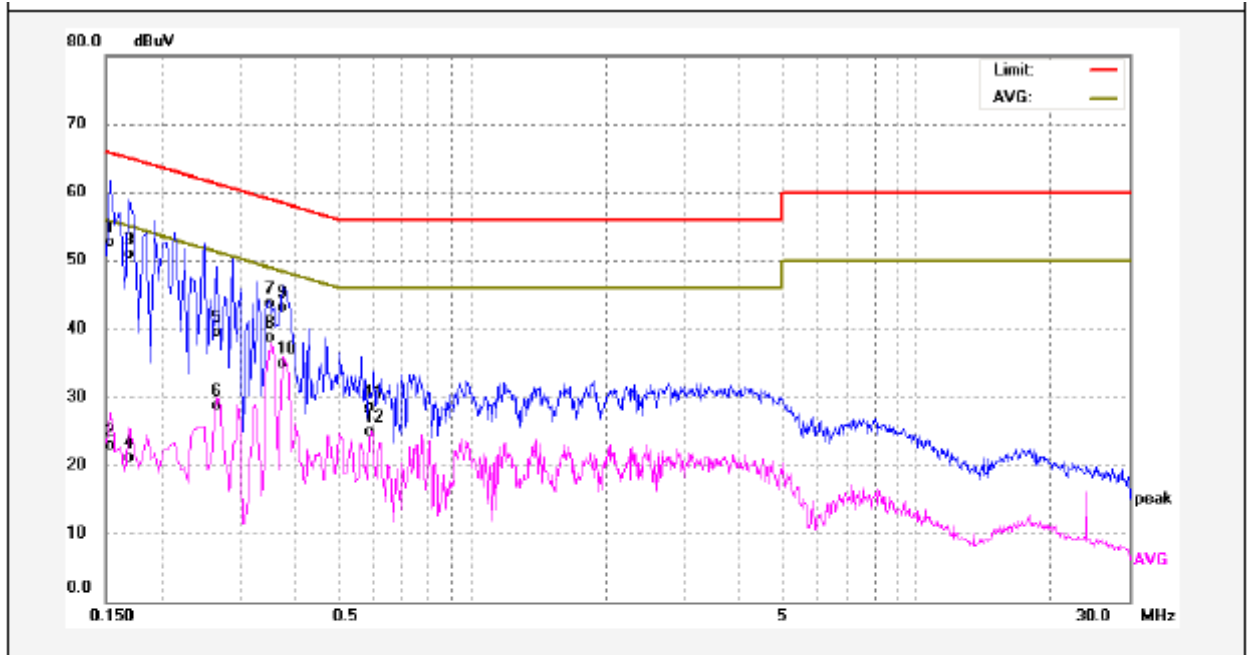


7.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

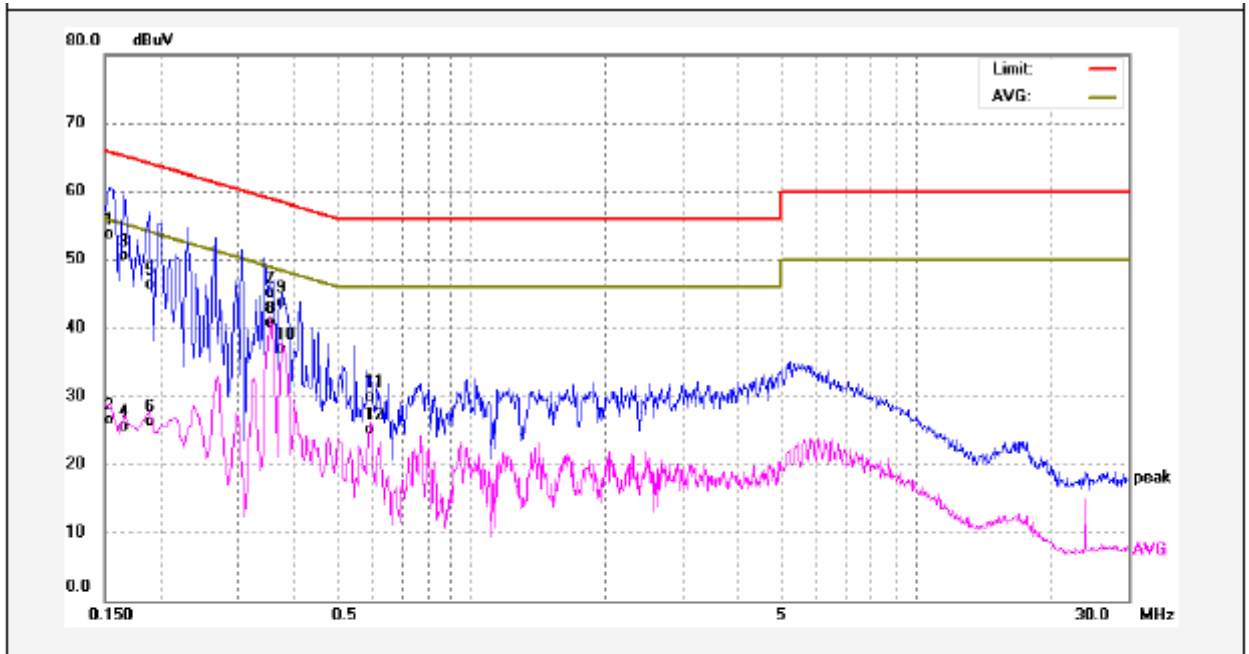
7.4 Conducted Emission Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	43.01	9.76	52.77	65.78	-13.01	QP	
2	0.1539	13.24	9.76	23.00	55.78	-32.78	AVG	
3	0.1700	41.11	9.78	50.89	64.96	-14.07	QP	
4	0.1700	11.28	9.78	21.06	54.96	-33.90	AVG	
5	0.2660	29.76	9.78	39.54	61.24	-21.70	QP	
6	0.2660	18.97	9.78	28.75	51.24	-22.49	AVG	
7	0.3540	33.90	9.80	43.70	58.87	-15.17	QP	
8	0.3540	28.81	9.80	38.61	48.87	-10.26	AVG	
9	0.3740	33.33	9.81	43.14	58.41	-15.27	QP	
10	0.3740	25.15	9.81	34.96	48.41	-13.45	AVG	
11	0.5940	18.65	9.84	28.49	56.00	-27.51	QP	
12	0.5940	15.11	9.84	24.95	46.00	-21.05	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	43.97	9.76	53.73	65.78	-12.05	QP	
2	0.1539	16.67	9.76	26.43	55.78	-29.35	AVG	
3	0.1660	40.78	9.77	50.55	65.15	-14.60	QP	
4	0.1660	15.69	9.77	25.46	55.15	-29.69	AVG	
5	0.1900	36.49	9.77	46.26	64.03	-17.77	QP	
6	0.1900	16.56	9.77	26.33	54.03	-27.70	AVG	
7	0.3540	35.40	9.80	45.20	58.87	-13.67	QP	
8	0.3540	30.81	9.80	40.61	48.87	-8.26	AVG	
9	0.3740	33.90	9.81	43.71	58.41	-14.70	QP	
10	0.3740	27.01	9.81	36.82	48.41	-11.59	AVG	
11	0.5940	20.00	9.84	29.84	56.00	-26.16	QP	
12	0.5940	15.35	9.84	25.19	46.00	-20.81	AVG	

8 Radiated Spurious Emissions

Test Requirement: FCC Part15 Paragraph 15.209, 15.205(a)

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

FCC Part15 Paragraph 15.209

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment :

Temperature: 23.4 °C

Humidity: 54.1 % RH

Atmospheric Pressure: 101.9kPa

Test Voltage: AC 120V, 60Hz

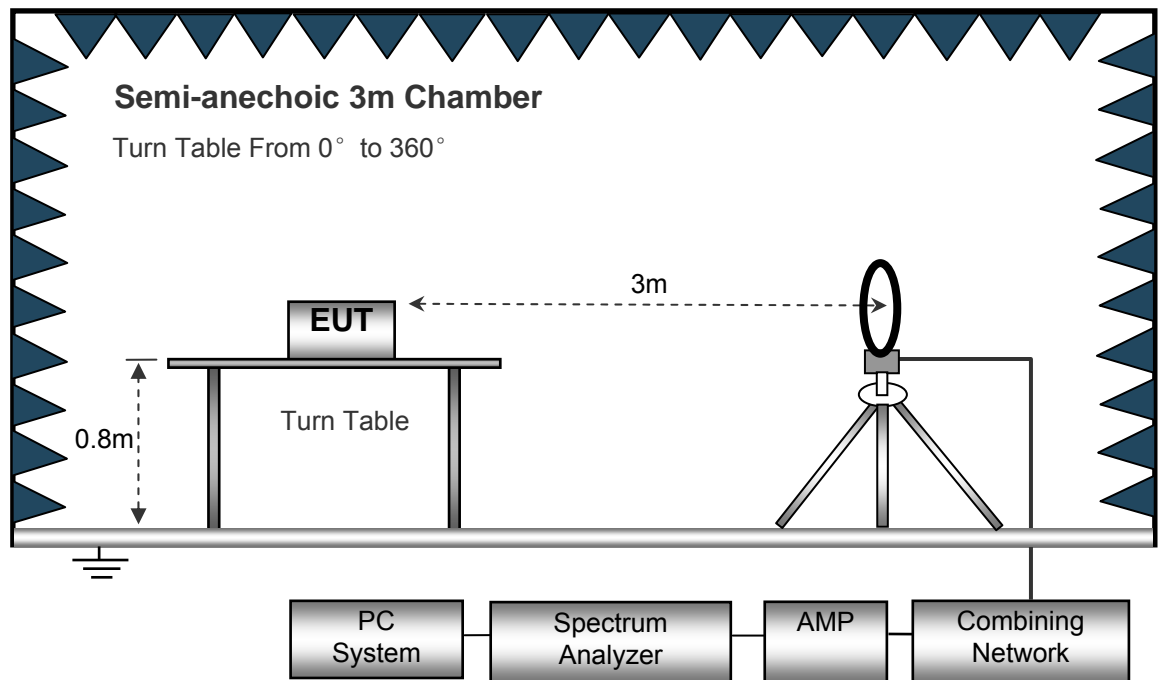
EUT Operation :

The test was performed in Transmitting mode, the test data were shown in the report.

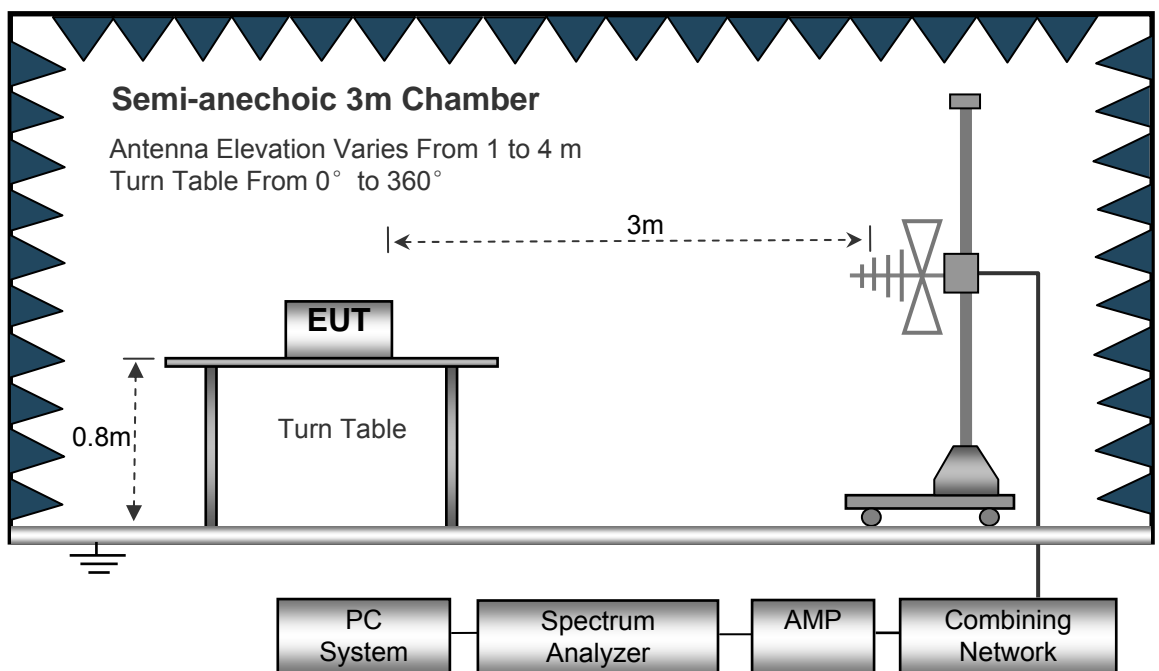
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013

The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
 IF Bandwidth..... 10kHz
 Video Bandwidth..... 10kHz
 Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 100kHz
 Video Bandwidth..... 300kHz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
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 moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
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. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.

8.5 Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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 maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

8.6 Summary of Test Results

Test Frequency: 9 kHz ~ 30 MHz

Frequency	Receiver Reading (AV)	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude (AV)	FCC Part 15.209	
			Height	Polar			Limit	Margin
(kHz)	(dB μ V @3m)	Degree	(m)	(H/V)	(dB/m)	(dB μ V @3m)	(dB μ V/m @3m)	(dB)
18.726	63.56	343	1.7	H	28.00	91.56	122.16	-30.60
18.726	59.34	169	1.6	V	28.00	87.34	122.16	-34.82
415.26	32.19	99	1.6	H	20.10	52.29	95.24	-42.95
885.41	23.45	323	1.9	V	20.81	44.26	68.66	-24.40
1765.83	19.37	343	1.7	V	20.55	39.92	69.54	-29.62

Test Frequency: 30 MHz ~ 1 GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.209	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V @3m)	QP	Degree	(m)	(H/V)	(dB/m)	(dB μ V/m @3m)	(dB μ V/m @3m)	(dB)
36.90	32.64	QP	174	1.4	H	-17.21	15.43	40.00	-24.57
36.90	45.08	QP	283	1.4	V	-17.21	27.87	40.00	-12.13
114.11	37.10	QP	252	1.1	H	-19.09	18.01	43.50	-25.49
114.11	40.80	QP	293	1.2	V	-19.09	21.71	43.50	-21.79
455.91	40.67	QP	29	1.7	H	-12.83	27.84	46.00	-18.16
455.91	39.98	QP	258	1.5	V	-12.83	27.15	46.00	-18.85

Note: Correct factor = Cable loss + Antenna factor

9 Bandwidth Measurement

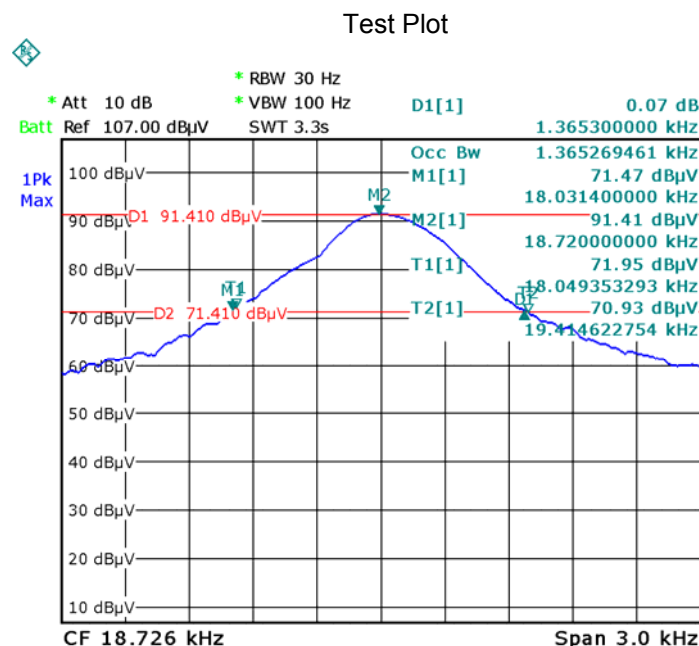
Test Requirement: FCC Part15.215(C), Part15.205 (a)
 Test Method: ANSI C63.10: 2013

9.1 Test Procedure

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 moved from 1m to 4m to find out the maximum 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. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.
7. Bandwidth Measure the resolution bandwidth of 30 Hz and the video bandwidth of 100 Hz were used.
8. Measured the spectrum width with power higher than 20dB below carrier and 99% Bandwidth.

9.2 Test Result

Frequency(kHz)	20dB Bandwidth Emission(kHz)	99% Bandwidth Emission(kHz)
18.726	1.365	1.365



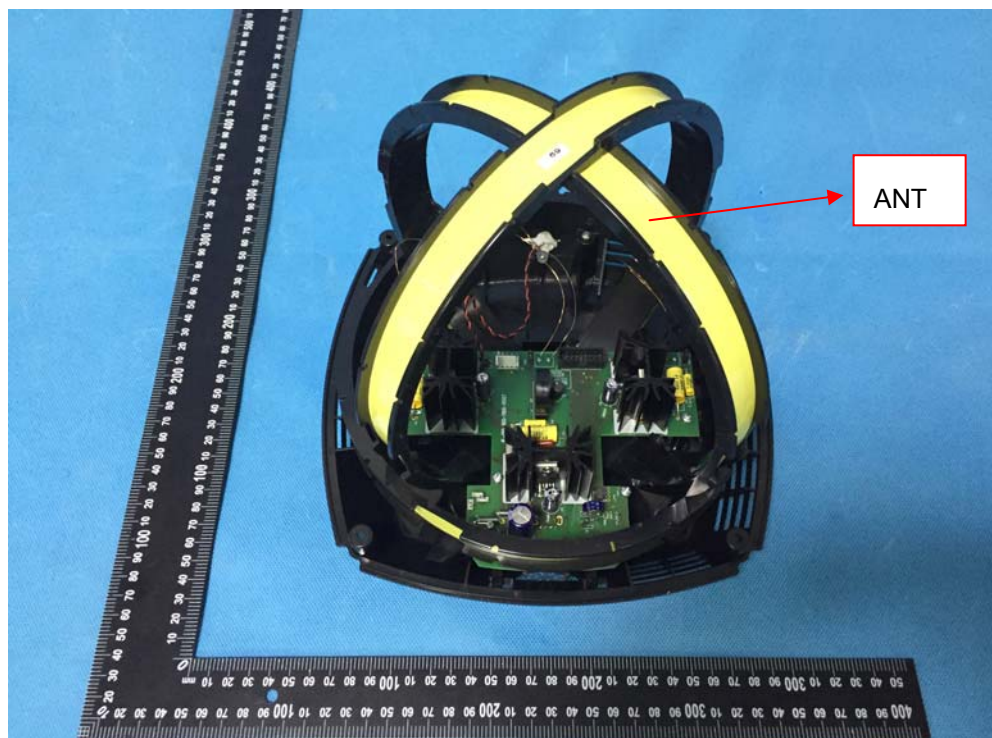
10 Antenna Requirement

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 permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 15 CFR Section 15.203, 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.

Result:

The EUT has one Internal Integrated Loop Antenna, Meets the requirements of FCC 15.203.



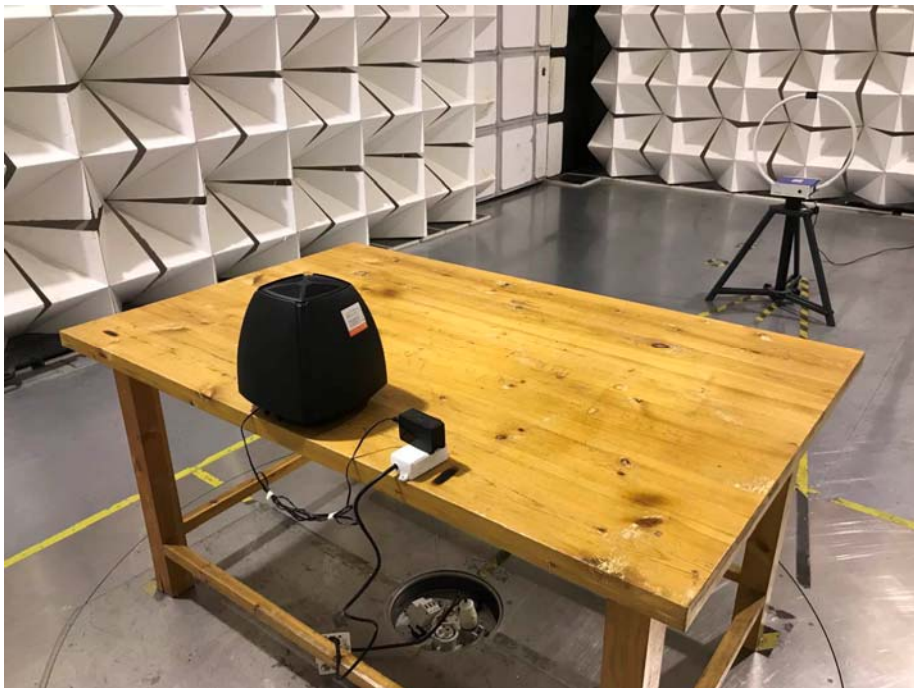
11 Photographs – Model RFA-554A Test Setup Photos

11.1 Photograph-Conducted Emissions Test Setup Photos



11.2 Photograph – Radiation Spurious Emission Test Setup Photos

9 kHz to 30 MHz



From 30 MHz to 1GHz



12 Photographs - Constructional Details

12.1 Model RFA-554A – External Photos



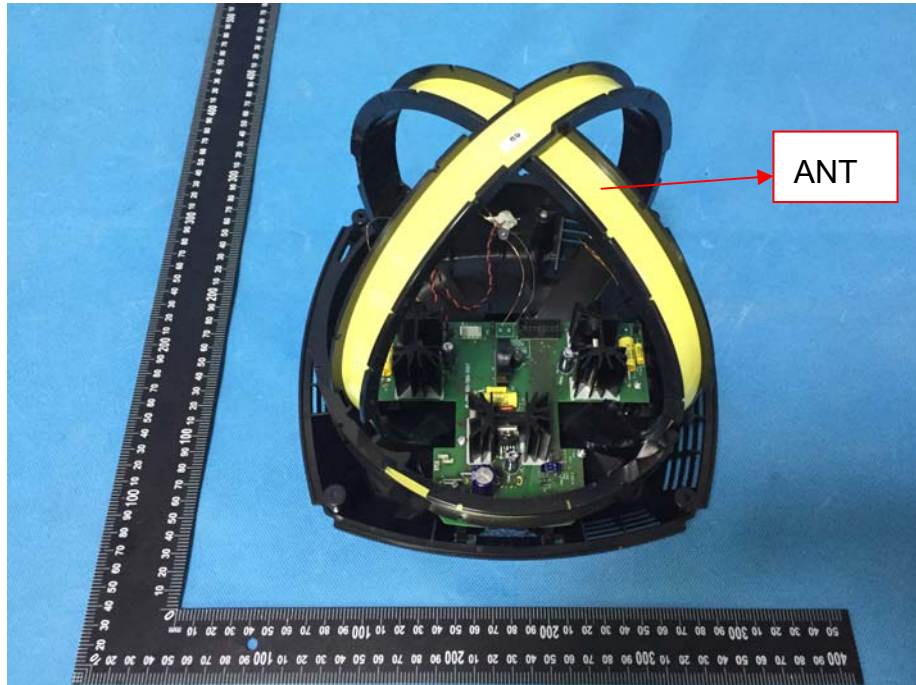


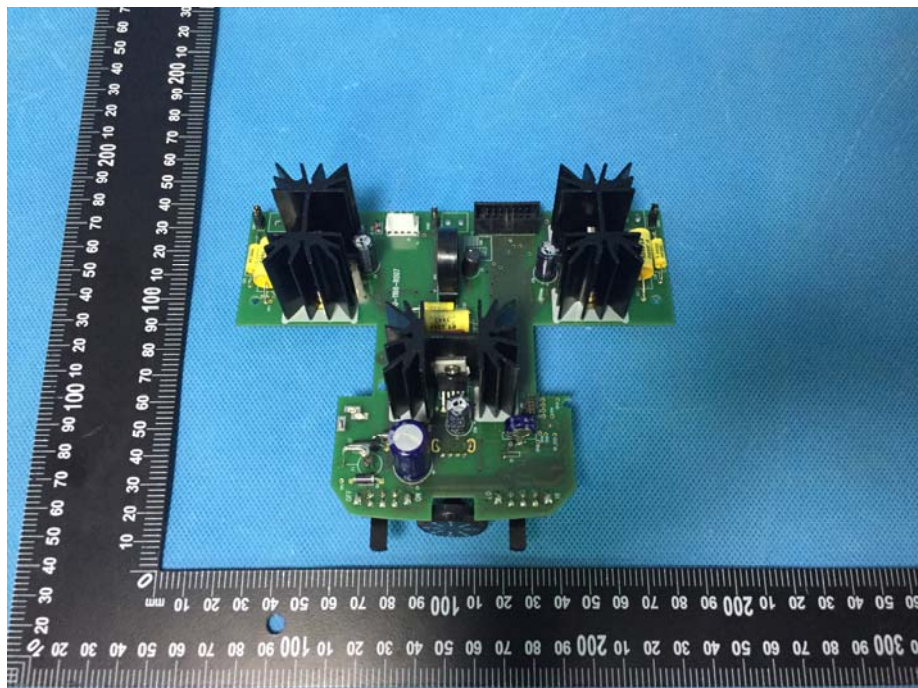
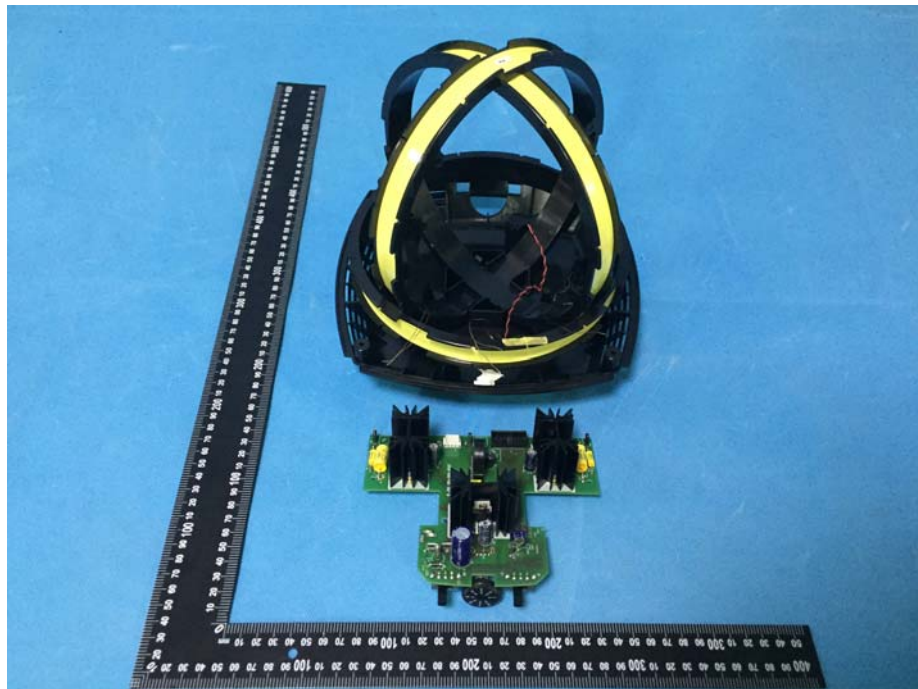


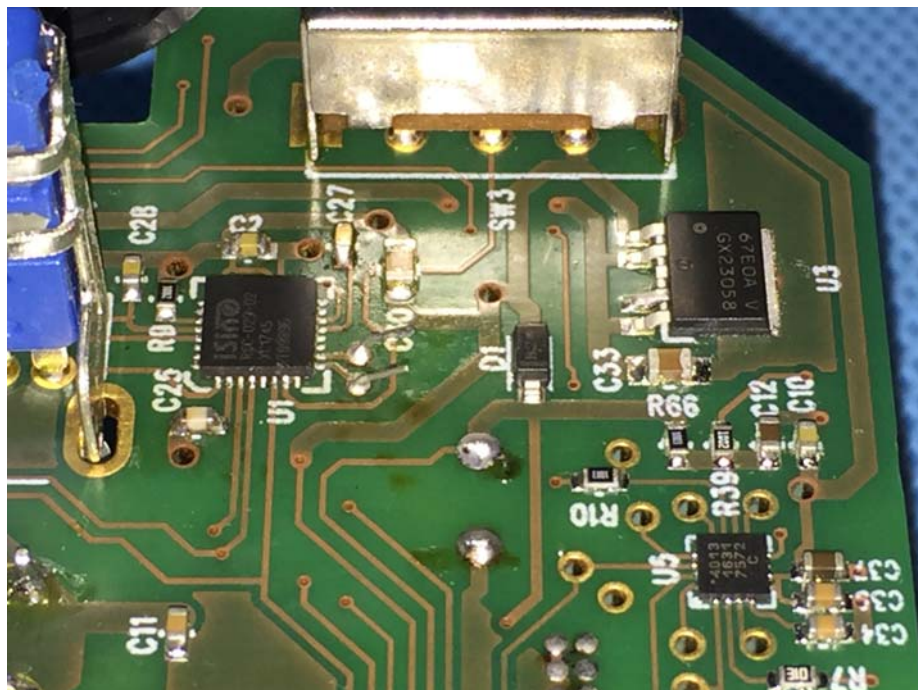
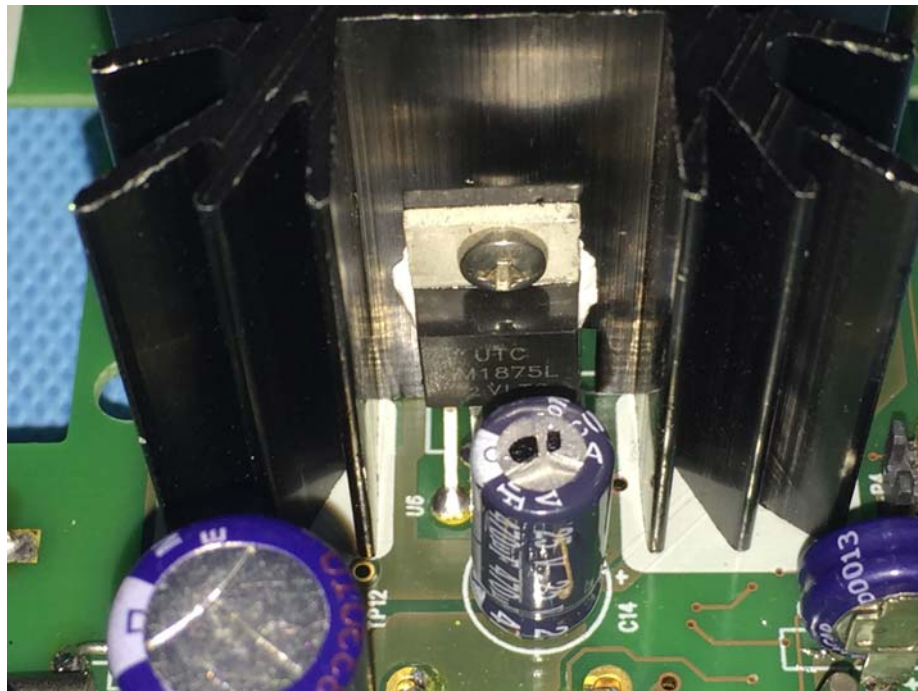




12.2 Model RFA-554A – Internal Photos









====End of Report====