

TEST REPORT

Reference No..... : WTS17S1194324E
FCC ID : 2AN7F-HDM02
Applicant..... : Shenzhen Haisen Technology Co.,Ltd
Address..... : Block A6,Nan pu,Science & Technology Park, Hao si, Shajing Street,
Bao an Dist., Shenzhen, China.
Manufacturer : The same as above
Address..... : The same as above
Product..... : 5.8G microwave sensor module
Model(s). : HDM02
Standards : FCC CFR47 Part 15 Section 15.249: 2016
Date of Receipt sample : 2017-11-02
Date of Test : 2017-11-03 to 2017-11-23
Date of Issue..... : 2017-11-24
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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2 Laboratories Introduction

Waltek Services Test Group Ltd. is one of the largest and the most comprehensive third party testing organizations in China, our headquarter located in Shenzhen (CNAS Registration No. L3110, A2LA Certificate Number: 4243.01) and have branches in Foshan (CNAS Registration No. L6478), Dongguan (CNAS Registration No. L9950), Zhongshan, Suzhou (CNAS Registration No. L7754), Ningbo and Hong Kong, Our test capability covered four large fields: safety test. Electronic Magnetic Compatibility(EMC), reliability and energy performance, Chemical test. 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), CPSC(Consumer Product Safety Commission), CEC(California energy efficiency), IC(Industry Canada) and ELI(Efficient Lighting Initiative). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as UL, Intertek(ETL-SEMKO), CSA, TÜV Rheinland, TÜV SÜD, etc. 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.

Waltek Services (Shenzhen) Co., Ltd.

A. Accreditations for Conformity Assessment (International)

Country/Region	Accreditation Body	Scope	Note
USA	CNAS (Registration No.: L3110) A2LA (Certificate No.: 4243.01)	FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		International Services	WPC
Thailand	NTC		-
Singapore	IDA		-
Note: 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. 2. IC Canada 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

3 Revision History

Test report #	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S1194324E	2017-11-02	2017-11-03 to 2017-11-23	2017-11-24	original	-	Valid

4 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emission	15.249(a) 15.209 15.205(a)	PASS
Periodic Operation	15.35(c)	PASS
Outside Restricted band	15.249 15.205 15.209	PASS
20dB Bandwidth	15:215(c)	PASS
Antenna Requirement	15.203	PASS

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6 General Information

6.1 General Description of E.U.T

Product:	5.8G microwave sensor module
Model(s):	HDM02
Model Differences:	N/A
Type of Modulation:	GFSK
Frequency Range:	5761MHz
Antenna installation:	Integrated Antenna

6.2 Details of E.U.T.

Ratings:	DC 4.5-5.5V
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6.3 Channel List

Channel No.	Frequency (MHz)
1	5761

6.3.1 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	Lower channel	Middle channel	Upper channel
Transmitting	N/A	5761MHz	N/A

7 Equipment Used during Test

7.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	2017-09-12	2018-09-11
2.	LISN	R&S	ENV216	101215	2017-09-12	2018-09-11
3.	Cable	Top	TYPE16(3.5M)	-	2017-09-12	2018-09-11
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	2017-04-29	2018-04-28
2	Amplifier	Agilent	8447D	2944A10178	2017-01-12	2018-01-11
3	Active Loop Antenna	Beijing Dazhi	ZN30900A	0703	2017-10-17	2018-10-16
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2017-04-07	2018-04-06
5	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2017-09-12	2018-09-11
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2017-04-07	2018-04-06
7	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2017-04-09	2018-04-08
8	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2017-04-07	2018-04-06
9	Coaxial Cable (above 1GHz)	Top	1GHz-18GHz	EW02014-7	2017-04-07	2018-04-06
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2017-04-06	2018-04-05
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2017-04-07	2018-04-06
3	Amplifier	ANRITSU	MH648A	M43381	2017-04-07	2018-04-06
4	Cable	HUBER+SUHNER	CBL2	525178	2017-04-07	2018-04-06
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2017-04-13	2018-04-12
2.	Spectrum Analyzer	R&S	FSL6	100959	2017-09-12	2018-09-11

	(9k-6GHz)					
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2017-04-06	2018-04-05
4.	Humidity Chamber	GF	GTH-225-40-1P	IAA061213	2017-04-13	2018-04-12

7.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)

7.3 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.

8 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI 63.10: 2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

8.1 E.U.T. Operation

Operating Environment :

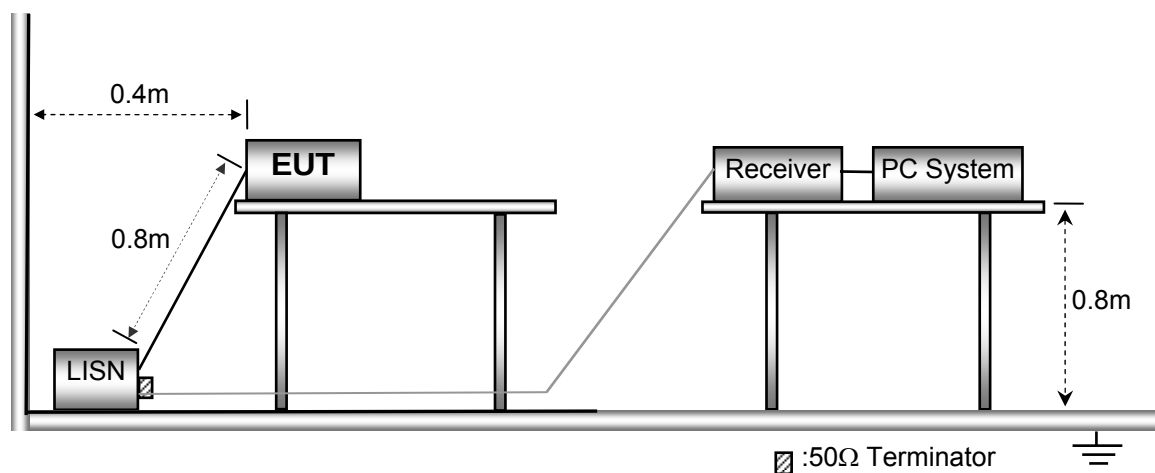
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

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

8.2 EUT Setup

The EUT was placed on the test table in shielding room.



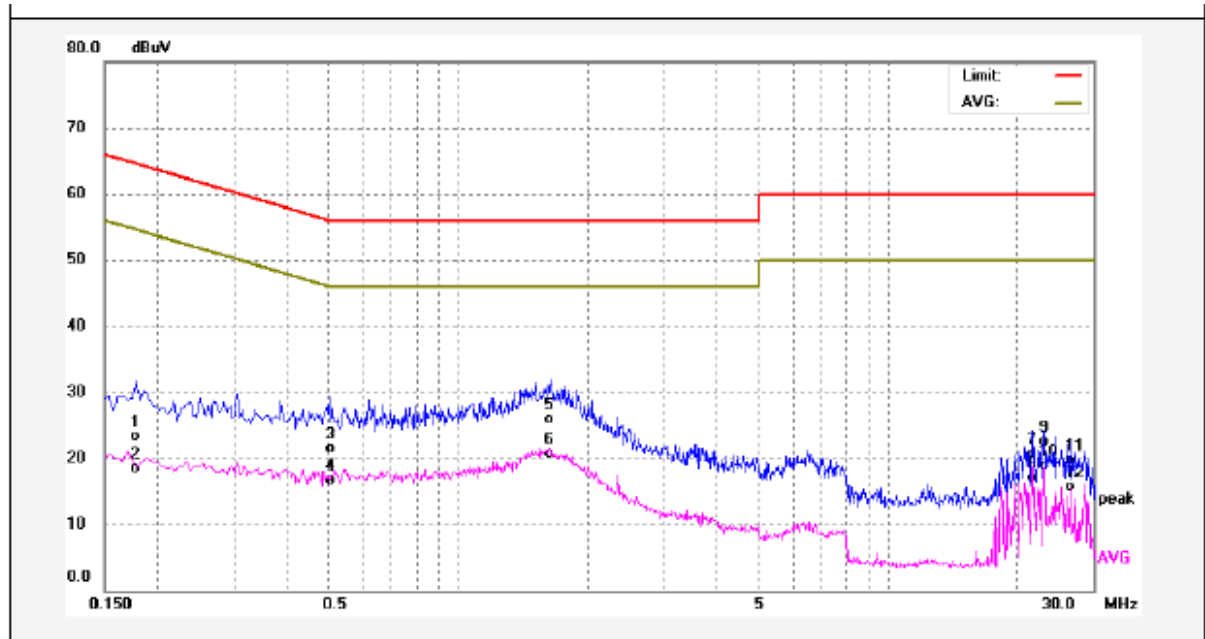
8.3 Measurement Description

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.

8.4 Conducted Emission Test Result

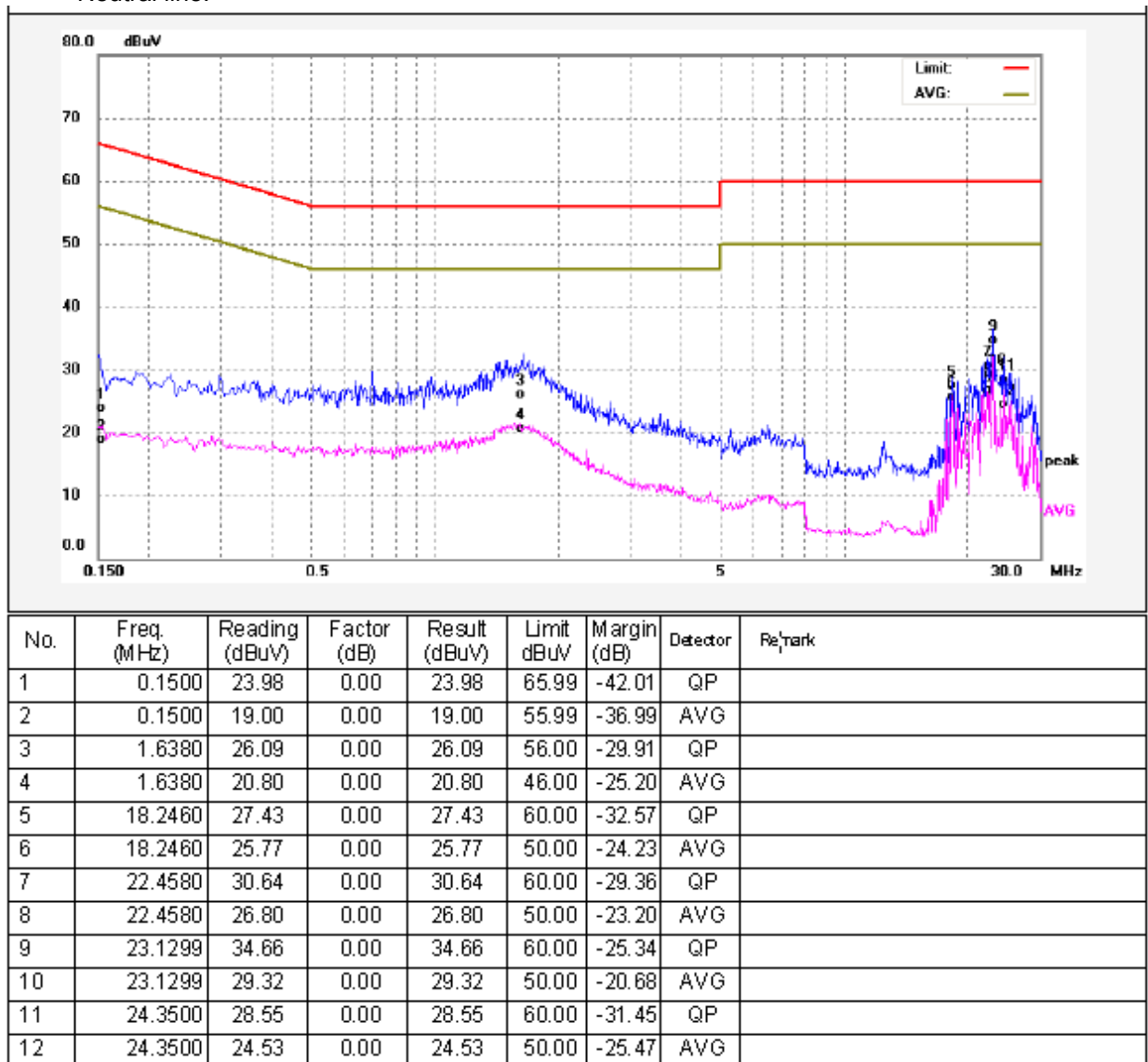
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1780	23.36	0.00	23.36	64.57	-41.21	QP	
2	0.1780	18.53	0.00	18.53	54.57	-36.04	AVG	
3	0.5060	21.43	0.00	21.43	56.00	-34.57	QP	
4	0.5060	16.70	0.00	16.70	46.00	-29.30	AVG	
5	1.6380	25.81	0.00	25.81	56.00	-30.19	QP	
6	1.6380	20.65	0.00	20.65	46.00	-25.35	AVG	
7	21.6620	20.63	0.00	20.63	60.00	-39.37	QP	
8	21.6620	17.17	0.00	17.17	50.00	-32.83	AVG	
9	23.1299	22.52	0.00	22.52	60.00	-37.48	QP	
10	23.1299	18.85	0.00	18.85	50.00	-31.15	AVG	
11	26.4900	19.76	0.00	19.76	60.00	-40.24	QP	
12	26.4900	15.61	0.00	15.61	50.00	-34.39	AVG	

Neutral line:



9 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249&15.209&15.205

Test Method: ANSI 63.10: 2013

Measurement Distance: 3m

Test Result: PASS

15.249(a)Limit:

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

15.209 Limit:

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

Note: RF Voltage(dBuV)= $20 \log_{10}$ RF Voltage(uV)

9.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

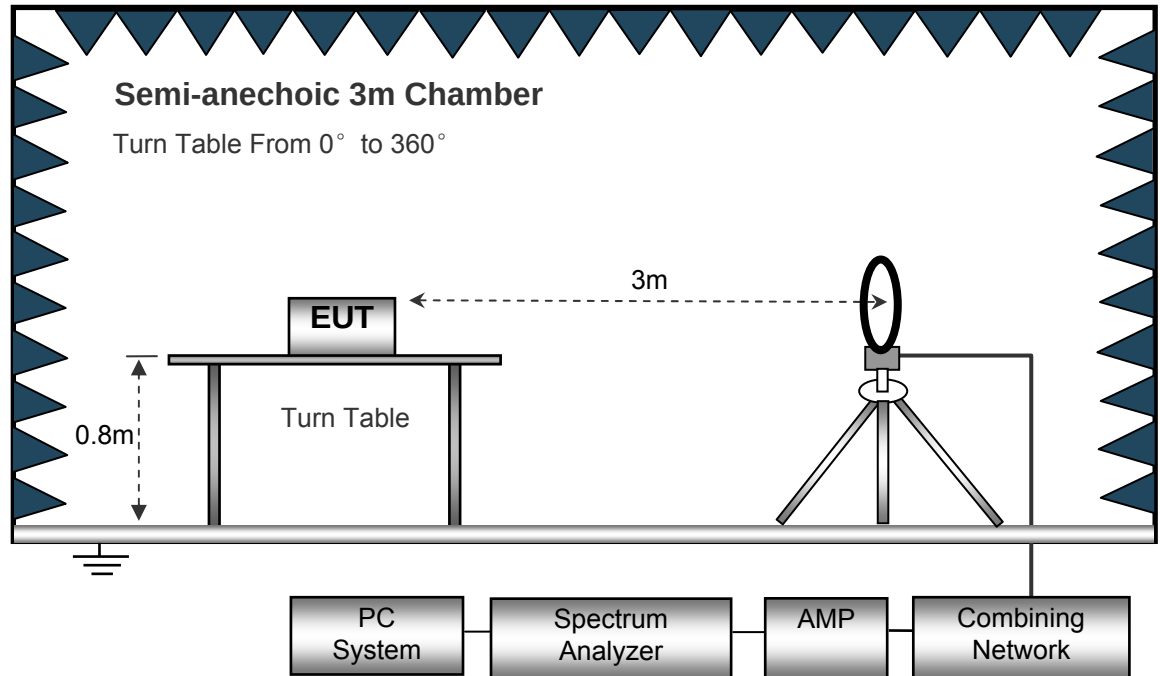
EUT Operation :

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

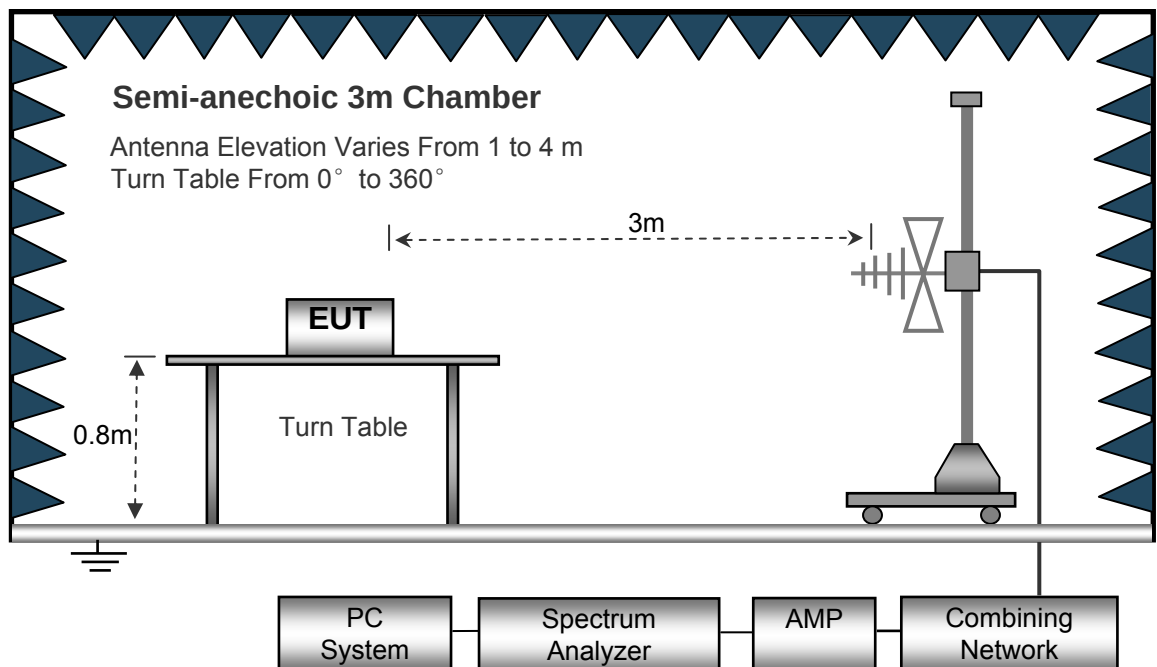
9.2 Test Setup

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

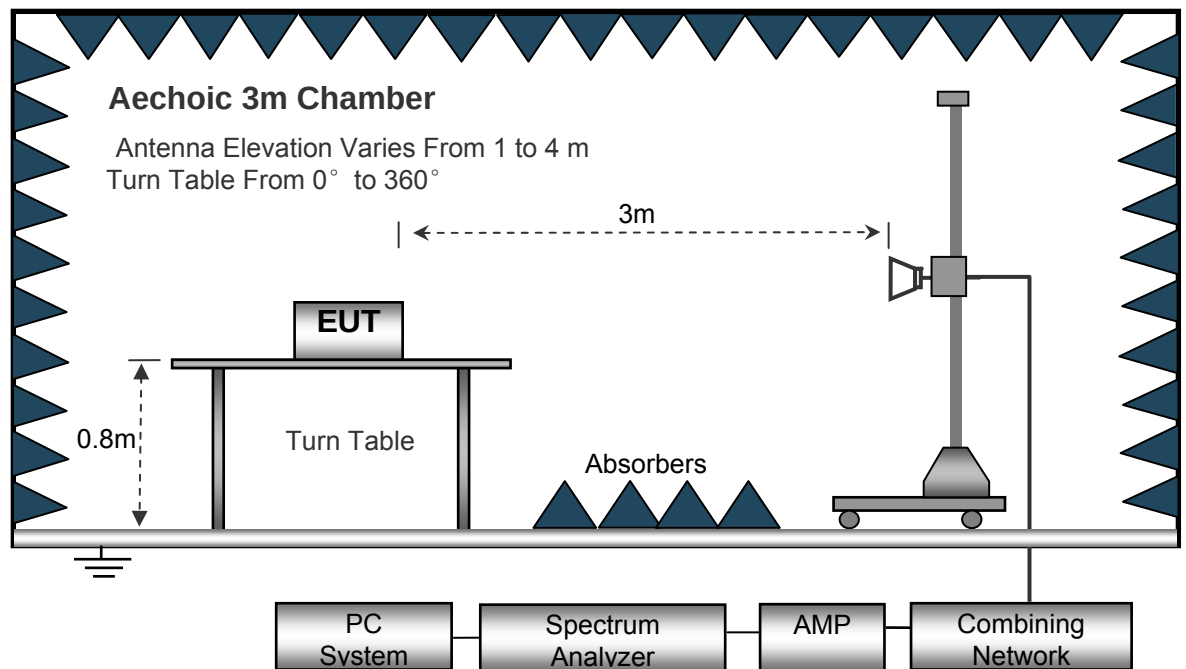
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



9.3 Spectrum Analyzer Setup

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth.....10kHz
 Video Bandwidth10kHz
 Resolution Bandwidth10kHz

30MHz ~ 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....100kHz
 Video Bandwidth300kHz

Above 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....1MHz
 Video Bandwidth3MHz
 DetectorAve.
 Resolution Bandwidth.....1MHz
 Video Bandwidth10Hz

9.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m 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 X position. So the data shown was the X position only.

9.5 Test Result

Test Frequency : 9KHz~ 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 40GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.249/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
5761.00	95.18	PK	81	1.1	H	-2.23	73.91	114	-40.09
5761.00	81.78	PK	269	1.4	V	-2.23	83.69	114	-30.31
11522.00	45.61	PK	42	1.8	H	-13.19	32.42	74	-41.58
11522.00	44.37	PK	182	1.9	V	-13.19	31.18	74	-42.82
17283.00	43.68	PK	220	1.4	H	-13.14	30.54	74	-43.46
17283.00	42	PK	355	1.7	V	-13.14	28.86	74	-45.14
23044.00	42.15	PK	68	1.9	H	-13.08	29.07	74	-44.93
23044.00	42.88	PK	245	1.9	V	-13.08	29.80	74	-44.20
26362.15	44.12	PK	182	1.2	V	0.09	44.21	74	-29.79
26362.15	42.3	PK	186	1.8	V	0.09	42.39	74	-31.61
30256.06	46.16	PK	258	1.9	V	3.01	49.17	74	-24.83
30256.06	45.22	PK	286	2.0	V	3.01	48.23	74	-25.77

AV = Peak +20Log10(duty cycle) =PK+(0) [refer to section 8 for more detail]

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.249/209/205	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
5761.00	73.91	81	1.1	H	0.00	73.91	94.00	-20.09
5761.00	83.69	269	1.4	V	0.00	83.69	94.00	-10.31
11522.00	32.42	42	1.8	H	0.00	32.42	54	-21.58
11522.00	31.18	182	1.9	V	0.00	31.18	54	-22.82
17283.00	30.54	220	1.4	H	0.00	30.54	54	-23.46
17283.00	28.86	355	1.7	V	0.00	28.86	54	-25.14
23044.00	29.07	68	1.9	H	0.00	29.07	54	-24.93
23044.00	29.80	245	1.9	V	0.00	29.80	54	-24.20
26362.15	44.21	182	1.2	V	0.00	44.21	54	-9.79
26362.15	42.39	186	1.8	V	0.00	42.39	54	-11.61
30256.06	49.17	258	1.9	V	0.00	49.17	54	-4.83
30256.06	48.23	286	2.0	V	0.00	48.23	54	-5.77

10 Periodic Operation

The duty cycle was determined by the following equation:

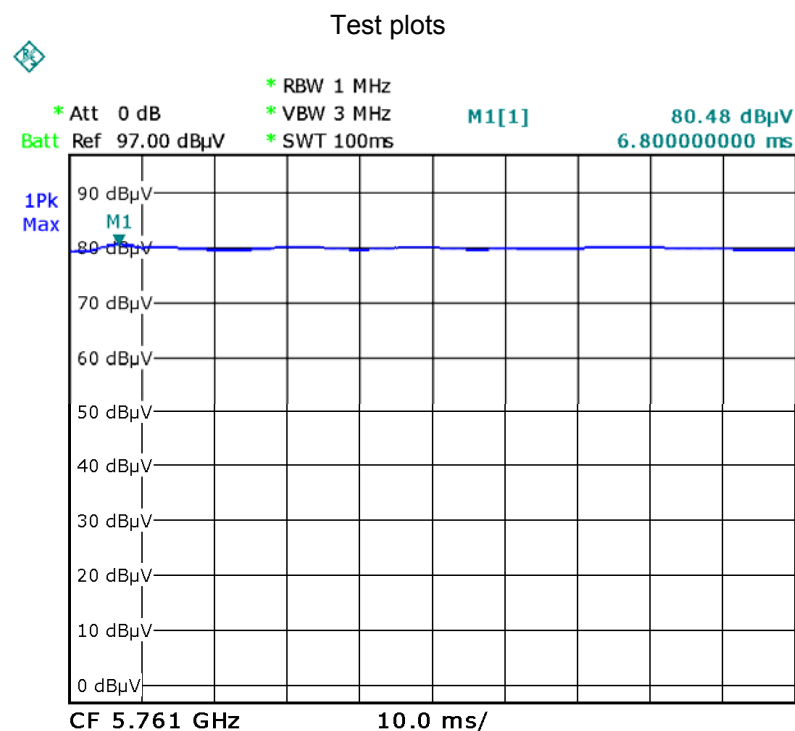
To calculate the actual field intensity, the duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor(dB)=20 * Log₁₀(Duty Cycle)

Total transmission time(ms)	100
Length of a complete transmission period(ms)	100
Duty Cycle(%)	1
Duty Cycle Correction Factor(dB)	0

Refer to the duty cycle plot (as below)



11 Restricted band

Test Requirement: FCC Part15 Paragraph 15.205

Test Method: ANSI C63.10: 2013

Test Result: N/A

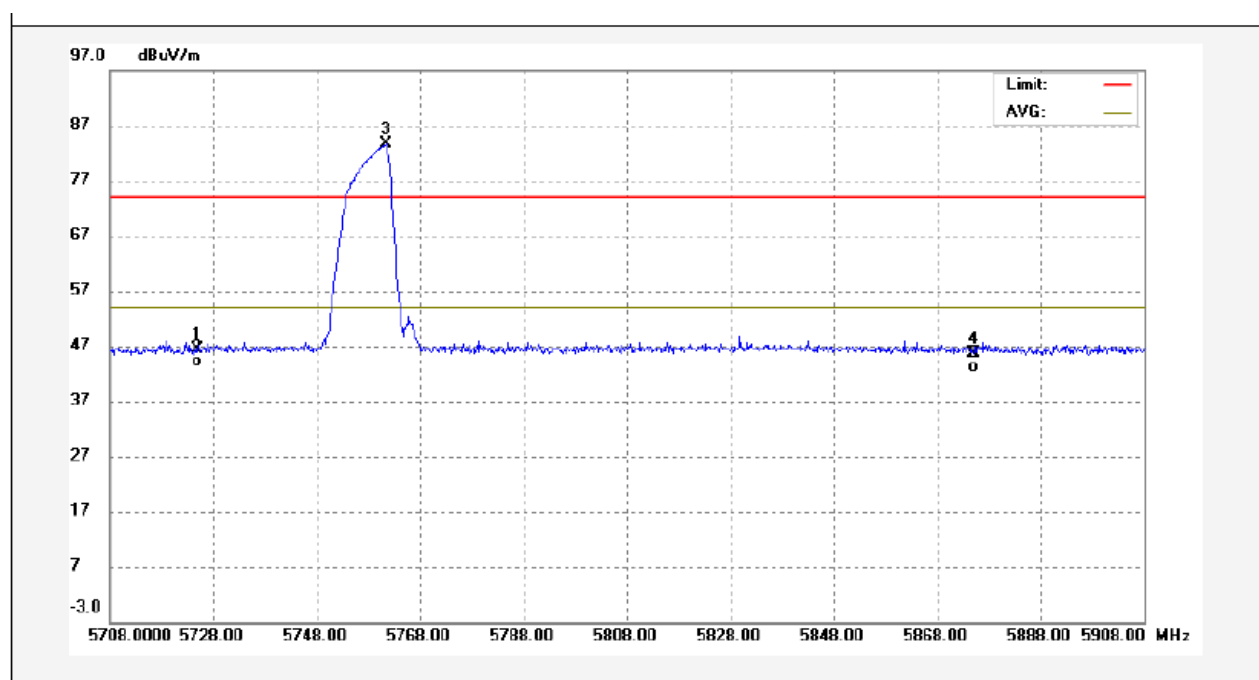
11.1 Requirements:

emissions that fall in the restricted bands(15.205).Above 1000MHz, compliance with the emissions limits in section 15.209 shall be demonstrated based on the average value of the measured emissions,The provisions in section 15.35apply to these measurements.

11.2 Test Result

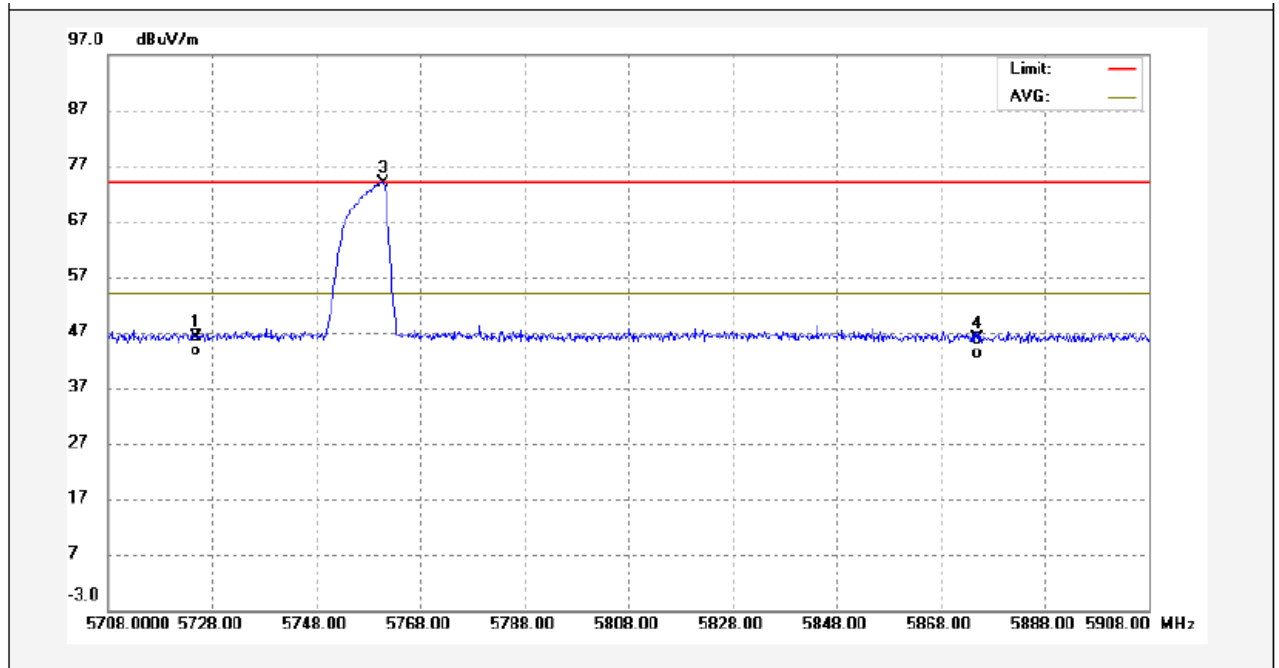
Mode: Continuously Transmitting

Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	5725.000	49.90	-3.59	46.31	74.00	-27.69	peak	
2	5725.000	47.81	-3.59	44.22	54.00	-9.78	AVG	
3	5761.000	87.24	-3.55	83.69	74.00	9.69	peak	
4	5875.000	48.91	-3.35	45.56	74.00	-28.44	peak	
5	5875.000	46.49	-3.35	43.14	54.00	-10.86	AVG	

Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	5725.000	49.83	-3.59	46.24	74.00	-27.76	peak	
2	5725.000	47.16	-3.59	43.57	54.00	-10.43	AVG	
3	5761.000	77.47	-3.55	73.92	74.00	-0.08	peak	
4	5875.000	49.15	-3.35	45.80	74.00	-28.20	peak	
5	5875.000	46.60	-3.35	43.25	54.00	-10.75	AVG	

12 20 dB Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.215(c)

Test Method:

ANSI C63.10:2013

Test Mode:

Transmitting

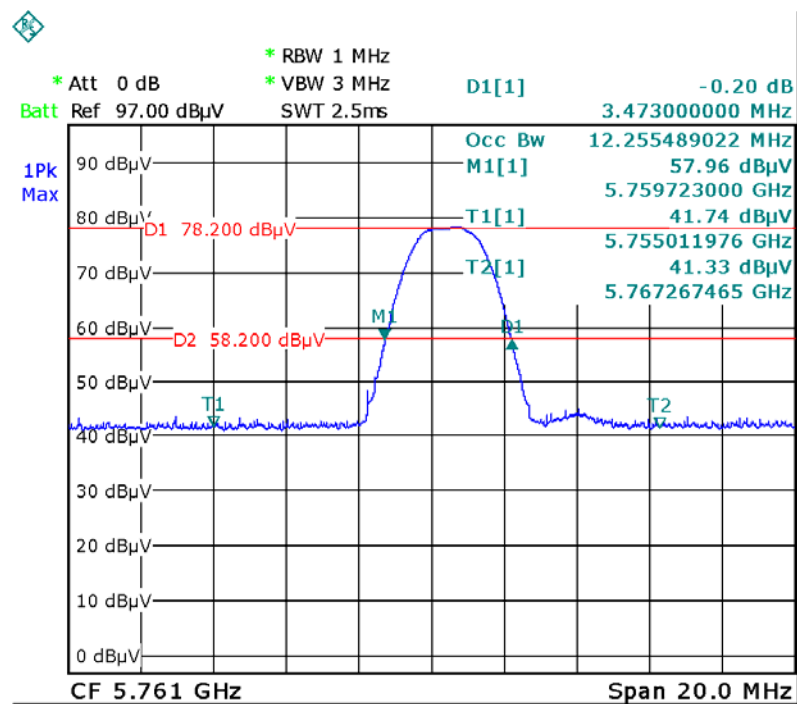
12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 1MHz, VBW = 3MHz

12.2 Test Result

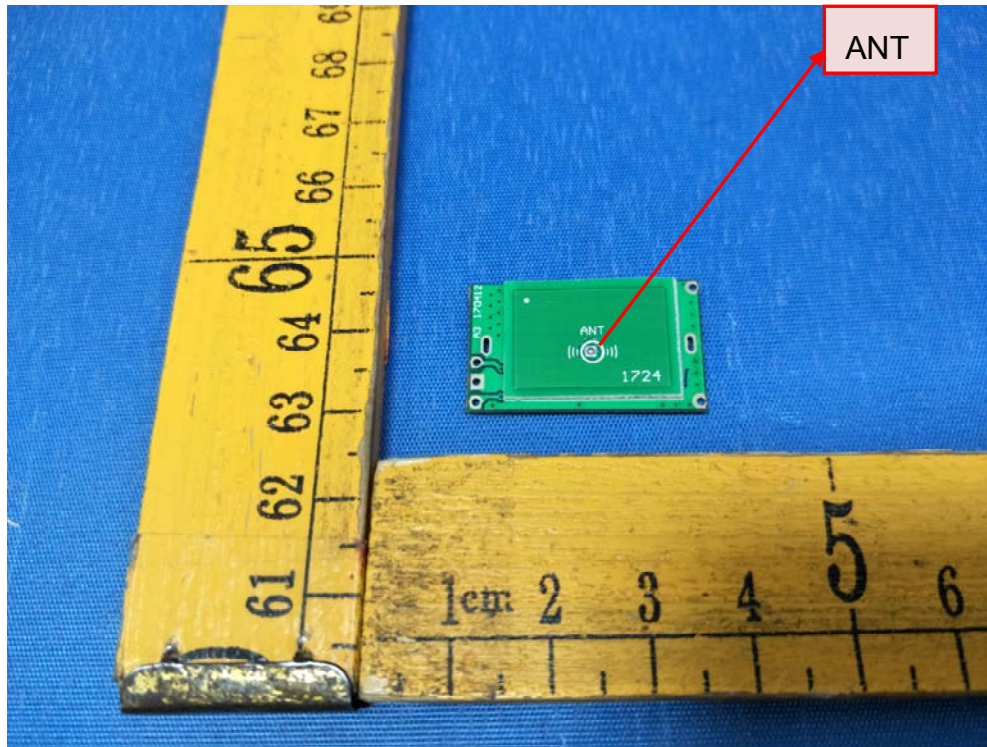
Frequency (MHz)	Bandwidth Emission (MHz)
5761	3.473

Test plots



13 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a Integrated Antenna , fulfil the requirement of this section.



14 Photographs- Model HDM02 Test Setup

14.1 Photograph –Conducted Emissions



14.2 Photograph – Radiation Emission

Test frequency from 9KHz to 30MHz



Test frequency from 30MHz to 1GHz

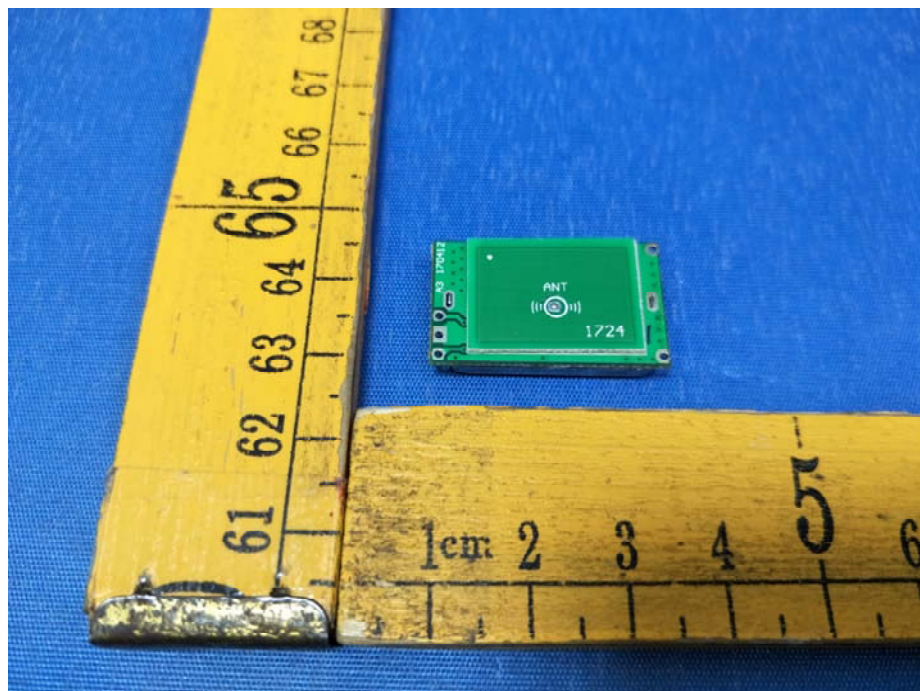
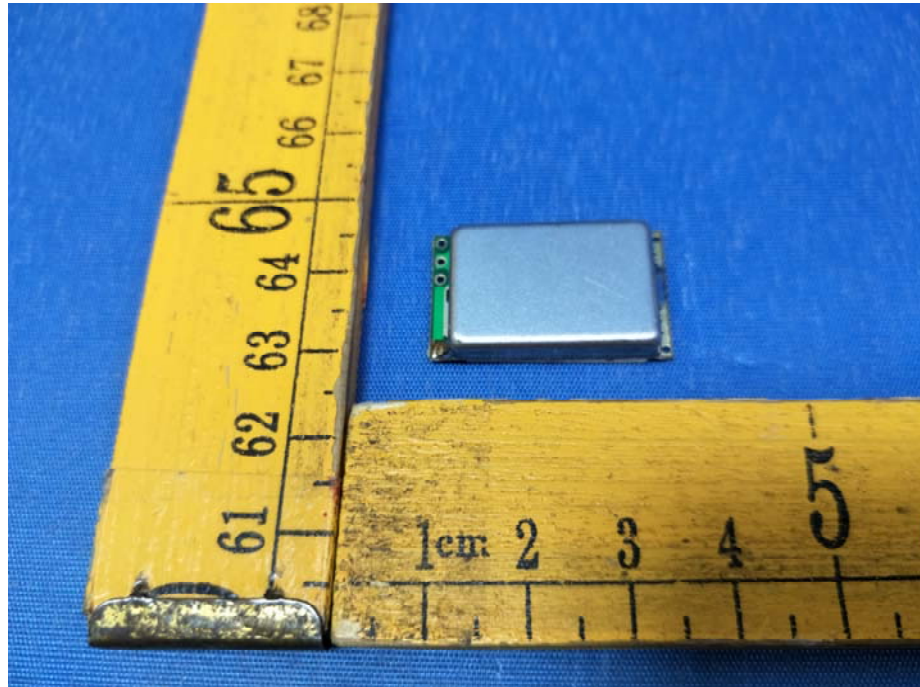


Test frequency above 1GHz

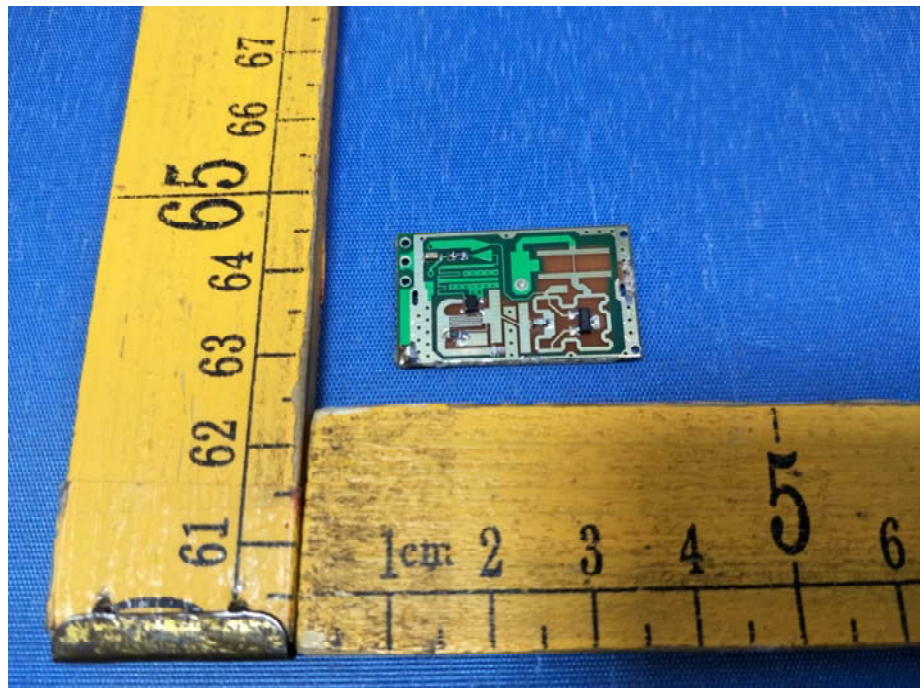
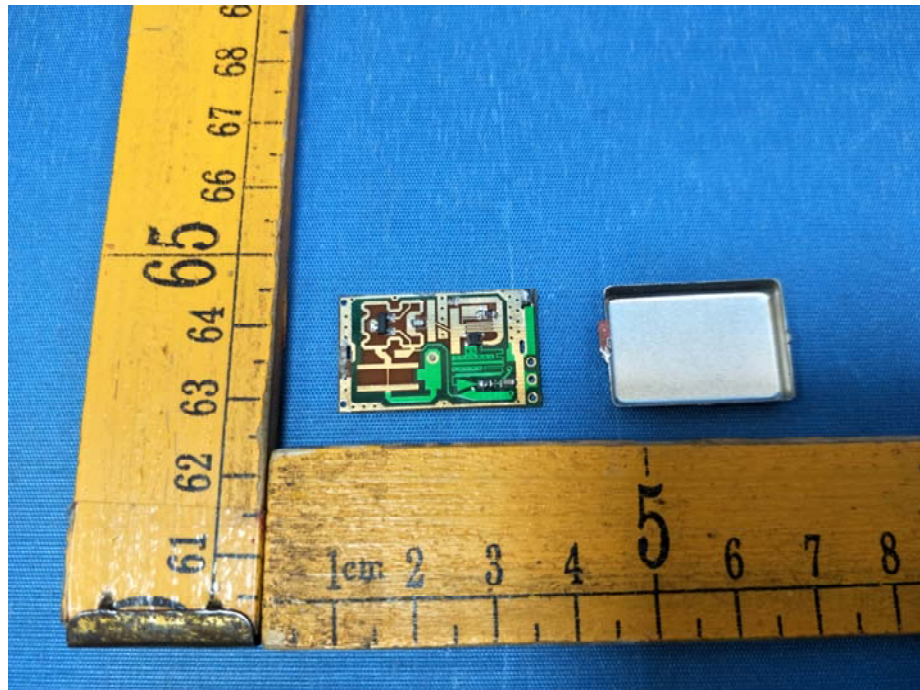


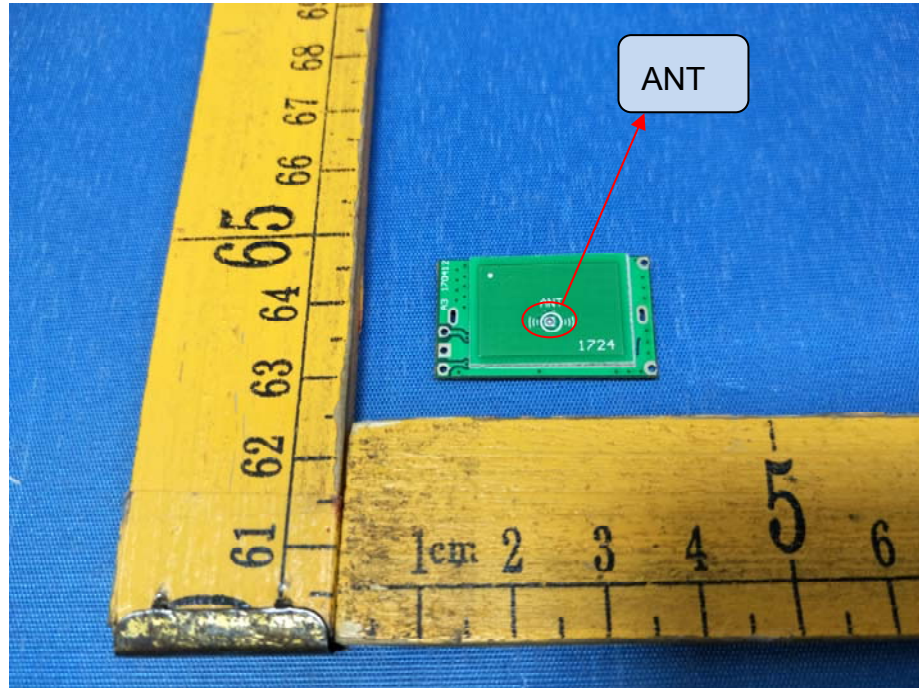
15 Photographs - Constructional Details

15.1 Model HDM02-External Photos



15.2 Model HDM02-Internal Photos





=====End of Report=====