



TEST REPORT

FCC ID: L73-90478

For

Sanwa Electronic Instrument Co., Ltd

Digital High Response Telemetry System

Model No. : 90478

Trade Name : AIRTRONICS

Prepared for : Sanwa Electronic Instrument Co., Ltd
Address : 1-2-50, Yoshida Honmachi, Higashi-Osaka, Osaka 578-0982, Japan

Prepared by : Shenzhen Alpha Product Testing Co., Ltd.
Address : Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road,
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Contents

1. General Information	5
1.1. Description of Device (EUT)	5
1.2. Accessories of device (EUT)	6
1.3. Test Lab information	6
2. Summary of test	7
2.1. Summary of test result	7
2.2. Assistant equipment used for test	7
2.3. Block Diagram	8
2.4. Test mode	8
2.5. Test Conditions	9
2.6. Measurement Uncertainty (95% confidence levels, k=2)	9
2.7. Test Equipment	10
3. Maximum Peak Output power	11
3.1. Limit	11
3.2. Test Procedure	11
3.3. Test Setup	11
3.4. Test Result	11
4. Bandwidth	12
4.1. Limit	12
4.2. Block Diagram of Test setup	12
4.3. Test Procedure	12
4.4. Test Result	12
5. Carrier Frequency Separation	15
5.1. Limit	15
5.2. Block Diagram of Test setup	15
5.3. Test Procedure	15
5.4. Test Result	15
6. Number Of Hopping Channel	17
6.1. Limit	17
6.2. Block Diagram of Test setup	17
6.3. Test Procedure	17
6.4. Test Result	17
7. Dwell Time	19
7.1. Test limit	19
7.2. Block Diagram of Test setup	19
7.3. Test Procedure	19
7.4. Test Results	19
8. Radiated emissions	22
8.1. Limit	22
8.2. Block Diagram of Test setup	23
8.3. Test Procedure	24
8.4. Test Result	25

9. Band Edge Compliance	31
9.1. Block Diagram of Test Setup	31
9.2. Limit	31
9.3. Test Procedure	31
9.4. Test Result	32
PASS.	32
10. Power Line Conducted Emissions	36
10.1. Block Diagram of Test Setup	36
10.2. Limit	36
10.3. Test Procedure	36
10.4. Test Result	37
11. Antenna Requirements	38
11.1. Limit	38
11.2. Result	38
12. Test setup photo	39
12.1. Photos of Radiated emission	39
13. Photos of EUT	41

DECLARATION

Applicant : Sanwa Electronic Instrument Co., Ltd
 Manufacturer : Dongguan Dongkeng Sanwa Electro Device Factory
 Product : Digital High Response Telemetry System
 (A) Model No. : 90478
 (B) Trade Name : AIRTRONICS
 (C) Power supply : DC 6V from battery

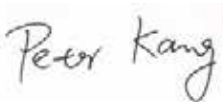
Measurement Standard Used:

**FCC Rules and Regulations Part 15 Subpart C Section 15.247: 2014,
ANSI C63.4:2009**

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Peter Kang
 Test Engineer 

Approved by (name + signature).....: Simple Guan
 Project Manager 

Date of issue..... : October 30, 2015

1. General Information

1.1. Description of Device (EUT)

EUT	:	Digital High Response Telemetry System
Model No.	:	90478
DIFF.	:	N/A
Trade mark	:	AIRTRONICS
Power supply	:	DC 6V from battery
Operation frequency	:	2410-2465MHz
Spread Spectrum Technology:	:	FHSS
Modulation type	:	GFSK
Channel number	:	56
Channel spacing	:	1MHz
Antenna Type	:	Reverse ipex Antenna, max gain 3.14dBi
Software version	:	sp-118-0_2_1
Hardware version	:	V4.0
Applicant	:	Sanwa Electronic Instrument Co., Ltd
Address	:	1-2-50, Yoshida Honmachi, Higashi-Osaka, Osaka 578-0982, Japan
Manufacture	:	Dongguan Dongkeng Sanwa Electro Device Factory
Address	:	Qiaolian Industrial District, Erhuan St., Dongkeng Town, Dongguan City, Guangdong, P.R.China

Note: Because EUT applicable next question, so EUT modulation is FHSS.

The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies and Each frequency must be used equally on the average by each transmitter? YES. For OP:

Pseudorandom Frequency Hopping Sequence below (example)

Channel:4,47,11,53,5,30,26,41,56,29,9,7,14,54,19,33,10,39,49,15,32,42,27,24,21,16,46,51,38,25,34,23,8,35,50,36,22,44,28,18,20,31,2,45,13,43,6,55,12,52,37,3,48,17,1,40

and Number Of Hopping Channel and Dwell Time informed by the test, The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies and Each frequency must be used equally on the average by each transmitter

2 The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals?

Yes. For OP:

The RX system have input bandwidths that match the hopping channel bandwidths of their corresponding TX system and shift frequencies in synchronization with the transmitted signals. When RX system was able to receive the signal of the TX system, it outputs sensing data at the same frequency. RX system outputs it while linking frequency-hopping of the TX system. So The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals

1.2. Accessories of device (EUT)

Accessories 1 : N/A

Type : N/A

1.3. Test Lab information

Shenzhen Alpha Product Testing Co., Ltd.

Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road, Bao'an, Shenzhen, China

March 25, 2015 File on Federal Communication Commission

Registration Number: 203110

July 18, 2014 Certificated by IC

Registration Number: 12135A

2. Summary of test

2.1. Summary of test result

Description of Test Item	Standard	Results
Maximum Peak Output Power	FCC Part 15: 15.247 (b(1))	PASS
Bandwidth	FCC Part 15: 15.215& FCC Part 15: 15.247 (a(1))	PASS
Carrier Frequency Separation	FCC Part 15: 15.247 (a(1))	PASS
Number Of Hopping Channel	FCC Part 15: 15.247(b(1))	PASS
Dwell Time	FCC Part 15: 15.247(a(1)iii)	PASS
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d)	PASS
Band Edge Compliance	FCC Part 15: 15.247(d)	PASS
Power Line Conducted Emissions	FCC Part 15: 15.207	N/A
Antenna requirement	FCC Part 15: 15.203	PASS
Note: 1 N/A is not applicable. 2 EUT power supply by battery, so Power Line Conducted Emissions test not applicable. 3. The EUT has been tested as an independent unit. And Continual Transmitting in maximum power (The new battery be used during Test).		

2.2. Assistant equipment used for test

Description	:	N/A
Manufacturer	:	N/A
Model No.	:	N/A

2.3. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 meter high above ground. EUT was be set into FHSS test mode by adb.exe software before test.



2.4. Test mode

Test methodology: Test had been referenced to the DA 00-705.

The test was used to control EUT work in Continuous TX mode, and select test channel, wireless mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
FHSS	Low :CH1	2410
	Middle: CH28	2437
	High: CH56	2465
Note: For the relevant Conducted Measurement, the temporary antenna connector is used during the measurement. Antenna Connector Impedance: 50 Ω , Cable Loss: 1.0 dB		

FH4TE Channel list					
CH1	2410MHz	CH20	2429MHz	CH39	2448MHz
CH2	2411MHz	CH21	2430MHz	CH40	2449MHz
CH3	2412MHz	CH22	2431MHz	CH41	2450MHz
CH4	2413MHz	CH23	2432MHz	CH42	2451MHz
CH5	2414MHz	CH24	2433MHz	CH43	2452MHz
CH6	2415MHz	CH25	2434MHz	CH44	2453MHz
CH7	2416MHz	CH26	2435MHz	CH45	2454MHz
CH8	2417MHz	CH27	2436MHz	CH46	2455MHz
CH9	2418MHz	CH28	2437MHz	CH47	2456MHz
CH10	2419MHz	CH29	2438MHz	CH48	2457MHz
CH11	2420MHz	CH30	2439MHz	CH49	2458MHz
CH12	2421MHz	CH31	2440MHz	CH50	2459MHz
CH13	2422MHz	CH32	2441MHz	CH51	2460MHz
CH14	2423MHz	CH33	2442MHz	CH52	2461MHz
CH15	2424MHz	CH34	2443MHz	CH53	2462MHz
CH16	2425MHz	CH35	2444MHz	CH54	2463MHz
CH17	2426MHz	CH36	2445MHz	CH55	2464MHz
CH18	2427MHz	CH37	2446MHz	CH56	2465MHz
CH19	2428MHz	CH40	2447MHz		

2.5. Test Conditions

Temperature range	21-25 °C
Humidity range	40-75%
Pressure range	86-106kPa

2.6. Measurement Uncertainty (95% confidence levels, k=2)

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.70dB	
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.90 dB	Polarize: V
	3.92dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.26 dB	Polarize: H
	4.28 dB	Polarize: V
Uncertainty for conducted RF Power	0.16dB	

2.7. Test Equipment

Equipment	Manufacture	Model No.	Serial No.	Cal. Due day	Cal Interval
3m Semi-Anechoic	ETS-LINDGREN	N/A	SEL0017	2016.01.18	1 Year
Spectrum analyzer	Agilent	E4407B	MY49510055	2016.01.18	1 Year
Signal Analyzer	Agilent	N9020A	MY499100060	2015.11.17	1 Year
Receiver	R&S	ESCI	101165	2016.01.18	1 Year
Bilog Antenna	SCHWARZBECK	VULB 9168	9168-438	2016.01.21	2 Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2016.01.21	2 Year
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170 D(1432)	2016.01.21	2 Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2016.01.21	1 Year
Cable	Resenberger	SUCOFLEX 104	MY6562/4	2016.01.18	1 Year
Cable	Resenberger	SUCOFLEX 104	309972/4	2016.01.18	1 Year
Cable	Resenberger	SUCOFLEX 104	329112/4	2016.01.18	1 Year
Power Meter	Anritsu	ML2487A	6K00001491	2016.01.18	1 Year
Power sensor	Anritsu	ML2491A	32516	2016.01.18	1 Year
Pre-amplifier	SCHWARZBECK	BBV9743	9743-019	2016.01.18	1 Year
Pre-amplifier	Quietek	AP-180C	CHM-0602012	2016.01.18	1 Year

3. Maximum Peak Output power

3.1. Limit

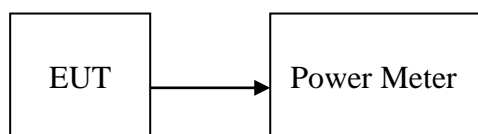
Please refer section 15.247 b(1).

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W

3.2. Test Procedure

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.

3.3. Test Setup



3.4. Test Result

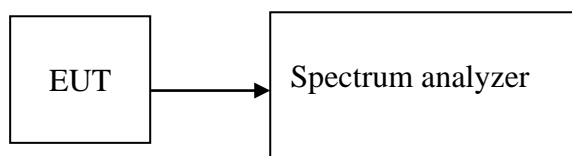
EUT: Digital High Response Telemetry System		M/N: 90478			
Test date: 2015-10-26		Test site: RF site		Tested by: Peter	
Mode	Freq (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)	Result
FHSS	2410	1.55	1.43	21.00	Pass
	2437	2.04	1.60	21.00	Pass
	2465	1.83	1.52	21.00	Pass
Conclusion: PASS					

4. Bandwidth

4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.2. Block Diagram of Test setup



4.3. Test Procedure

The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.4. Test Result

EUT: Digital High Response Telemetry System		M/N: 90478		
Test date: 2015-10-28		Test site: RF site		Tested by: Peter
Mode	Freq (MHz)	20dB Bandwidth (MHz)	Limit (kHz)	Conclusion
FHSS	2410	1.187	/	PASS
	2437	1.199	/	PASS
	2465	1.205	/	PASS

EUT: Digital High Response Telemetry System			M/N: 90478	
Test date: 2015-10-28		Test site: RF site		Tested by: Peter
Mode	Freq (MHz)	99% Bandwidth (MHz)	Limit (kHz)	Conclusion
FHSS	2410	1.0699	/	PASS
	2437	1.0741	/	PASS
	2465	1.0813	/	PASS

Original Test data:





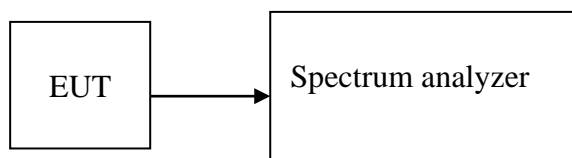
5. Carrier Frequency Separation

5.1. Limit

Please refer section 15.247 a(1):

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

5.2. Block Diagram of Test setup



5.3. Test Procedure

The transmitter output was coupled to a spectrum analyzer via an antenna. The carrier frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW.

5.4. Test Result

EUT: Digital High Response Telemetry System		M/N: 90478		
Test date: 2015-10-28		Test site: RF site		Tested by: Simple
Mode/Channel	Channel separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz) 2/3 20dB bandwidth	Conclusion
FHSS	1.002	1.205	0.80	PASS

Original test data for channel separation



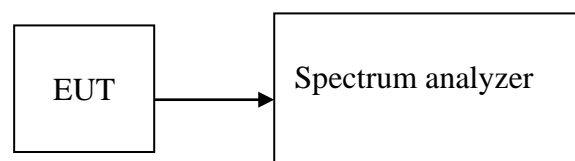
6. Number Of Hopping Channel

6.1. Limit

Please refer section 15.247 a(1):

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

6.2. Block Diagram of Test setup



6.3. Test Procedure

The transmitter output was coupled to a spectrum analyzer via an antenna. The number of hopping channels was measured by the spectrum analyzer with 100kHz RBW and 300kHz VBW.

6.4. Test Result

EUT: Digital High Response Telemetry System		M/N: 90478	
Test date: 2015-10-28		Test site: RF site	Tested by: Peter
Mode	Number of hopping channel	Limit	Conclusion
FHSS	56	>15	PASS

Original test data for hopping channel number



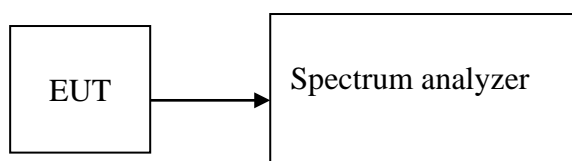
7. Dwell Time

7.1. Test limit

Please refer section 15.247 a(1):

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

7.2. Block Diagram of Test setup



7.3. Test Procedure

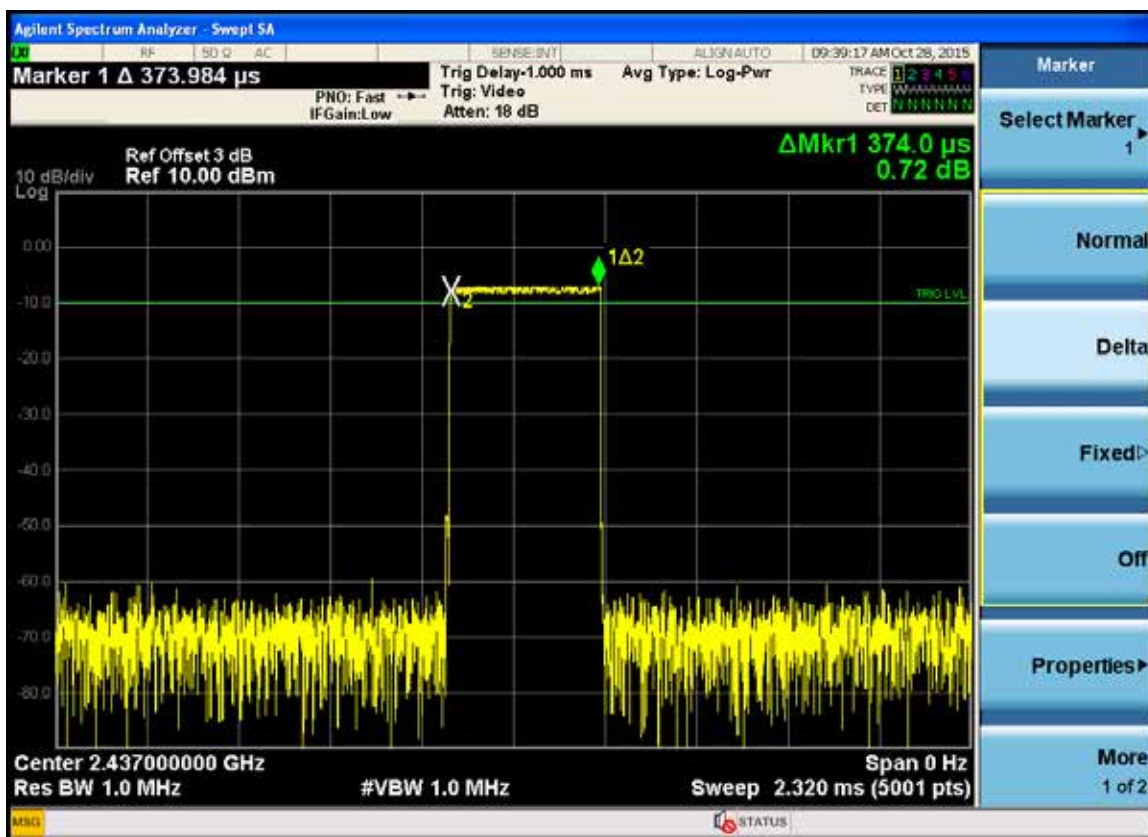
- (1) Place the EUT on the table and set it in transmitting mode.
- (2) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- (3) Set center frequency of spectrum analyzer = operating frequency.
- (4) Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
- (5) Repeat above procedures until all frequency measured was complete.
- (6) The spectrums are scanned by using the spectrum analyzer (*1). And the numbers of occupied channel per Nsec (period of 0.4 seconds multiplied by the number of hopping channels employed) were counted by using the delta-marker function of spectrum analyzer and recorded as "N".
- (7) The dwell time was calculated by $T_{on} \times N$.

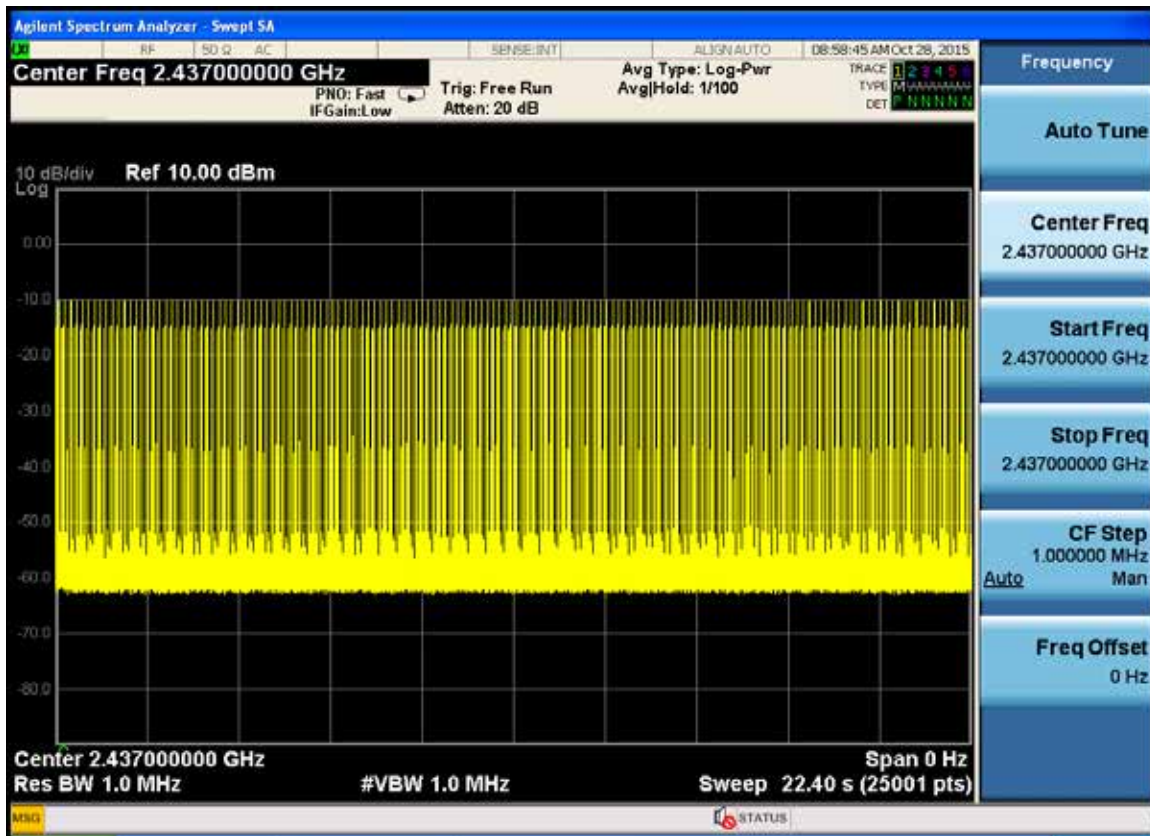
7.4. Test Results

PASS.

Detailed information please see the following page.

EUT: Digital High Response Telemetry System		M/N: 90478			
Test date: 2015-10-28	Test site: RF site	Tested by: Peter			
Mode	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit (ms)	Conclusion
FHSS	2437	0.374	121.55	<400	PASS
Note: 1 N=325					
2 Dwell Time = Pulse Duration * N					





Note: The numbers is 325.

8. Radiated emissions

8.1. Limit

Please refer section 15.247 d:

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band:

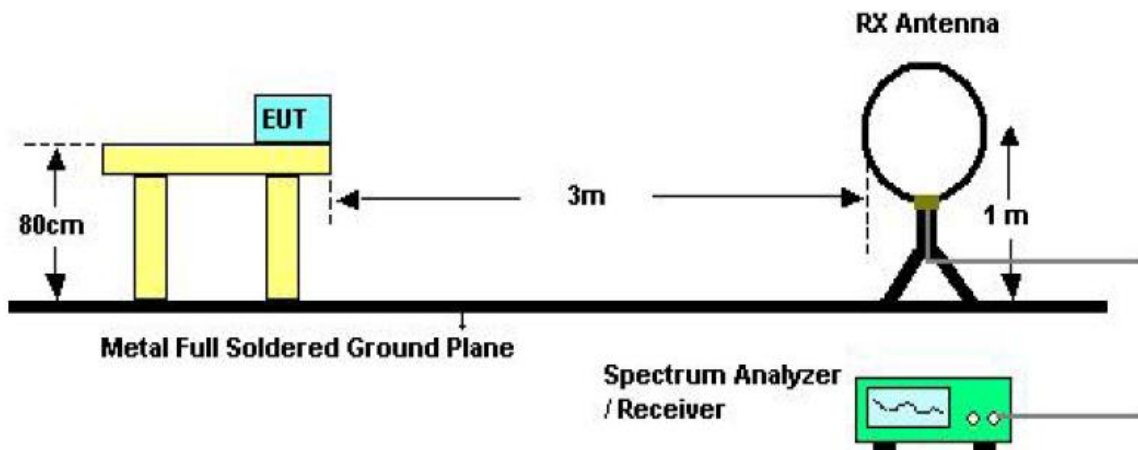
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

15.209 Limit:

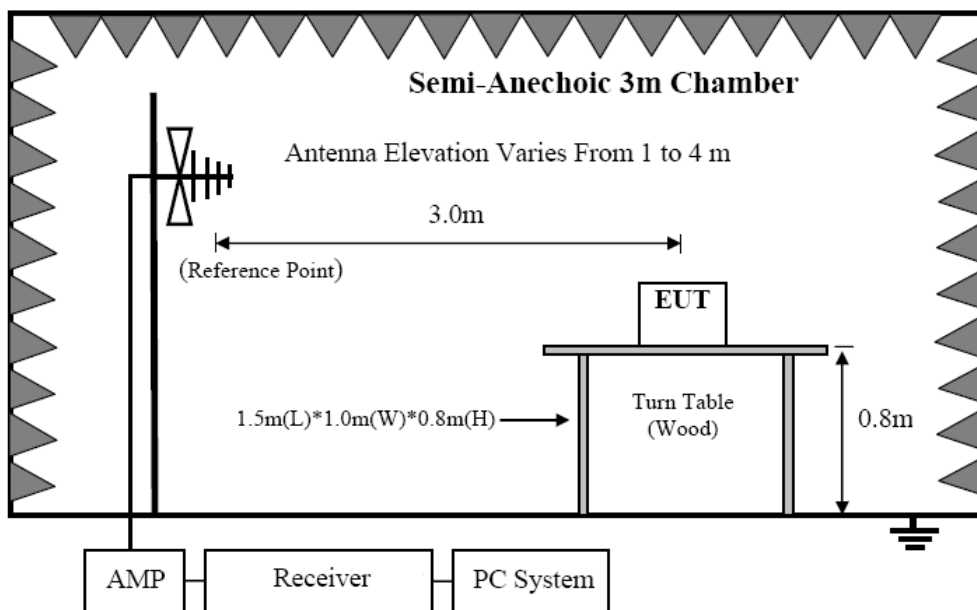
FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

8.2. Block Diagram of Test setup

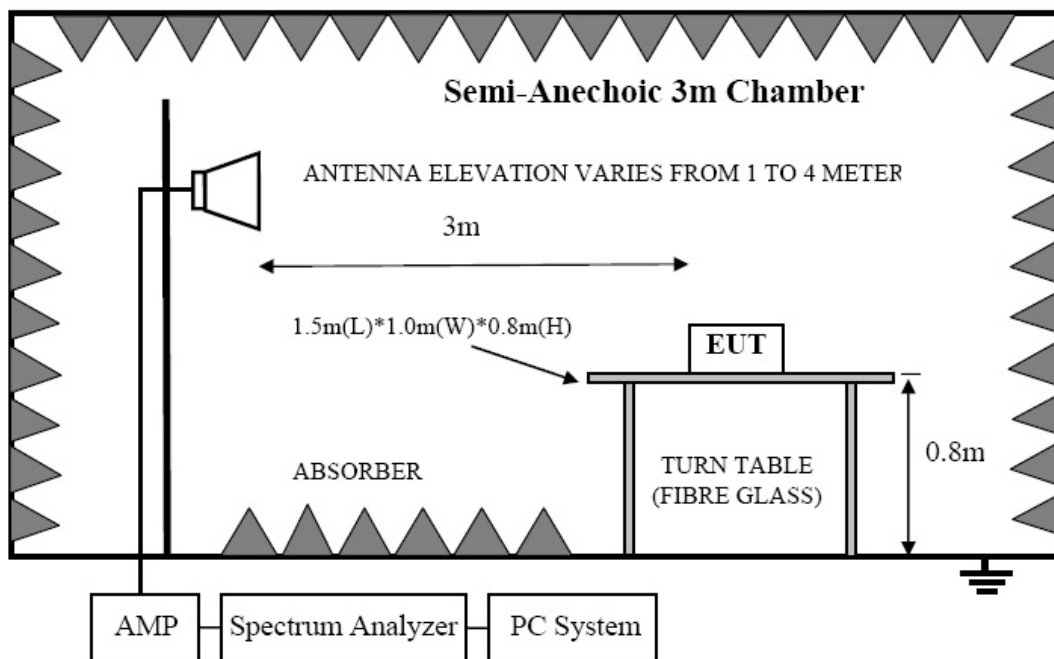
8.2.1. In 3m Anechoic Chamber Test Setup Diagram for below 30MHz



8.2.2. In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



8.2.3. In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

8.3. Test Procedure

- (1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.
- (2) Setup EUT and simulator as shown in section 1.4 and 6.1
- (3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
 - (a) Change work frequency or channel of device if practicable.
 - (b) Change modulation type of device if practicable.
 - (c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
- (4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated
- (5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.4 2009 on Radiated Emission test.

(6) For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

(7) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure.

8.4. Test Result

We have scanned the 10th harmonic from 9KHz to the EUT.

Detailed information please see the following page.

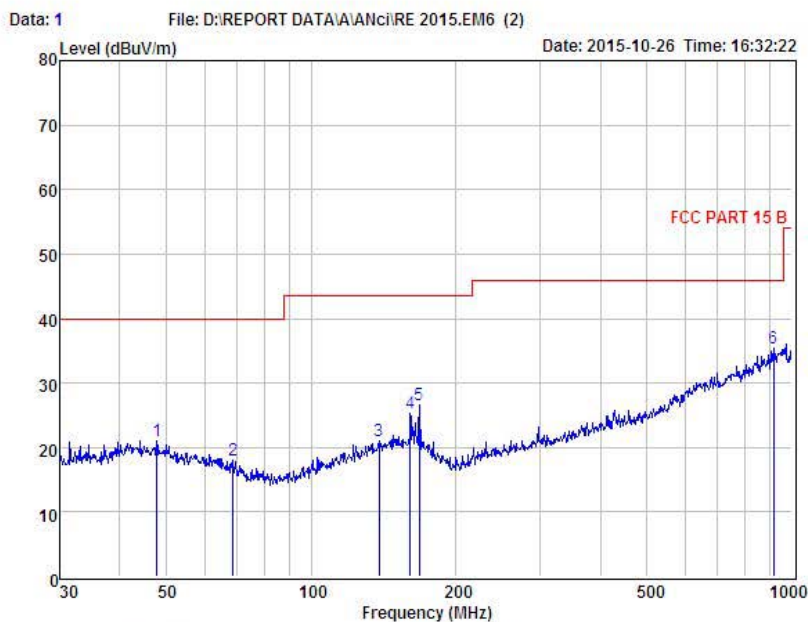
From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

From 30MHz to 1000MHz: Conclusion: PASS



Shenzhen Alpha Product Testing Co., Ltd
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```

Condition      : FCC PART 15 B      3m      POL: VERTICAL
EUI           : Digital High Response Telemetry System
Model No      : 90478
Test Mode     : TX 2410MHz
Power         : DC 6V from battery
Test Engineer : Peter
Remark        :
Temp          : 24.2°C
Hum           : 54%
    
```

Item	Freq MHz	Read Level dBuV	Antenna Factor dB	Preamp Factor dB	Cable Loss dB	Level dBuV	Limit dBuV	Margin dBuV	Remark
1	47.83	37.63	13.59	30.25	0.08	21.05	40.00	-18.95	Peak
2	68.87	37.17	10.82	30.26	0.30	18.03	40.00	-21.97	Peak
3	138.39	36.70	13.37	29.36	0.38	21.09	43.50	-22.41	Peak
4	160.91	39.89	14.14	29.16	0.46	25.33	43.50	-18.17	Peak
5	167.82	42.03	13.37	29.13	0.42	26.69	43.50	-16.81	Peak
6	916.07	36.72	21.87	25.08	1.82	35.33	46.00	-10.67	Peak

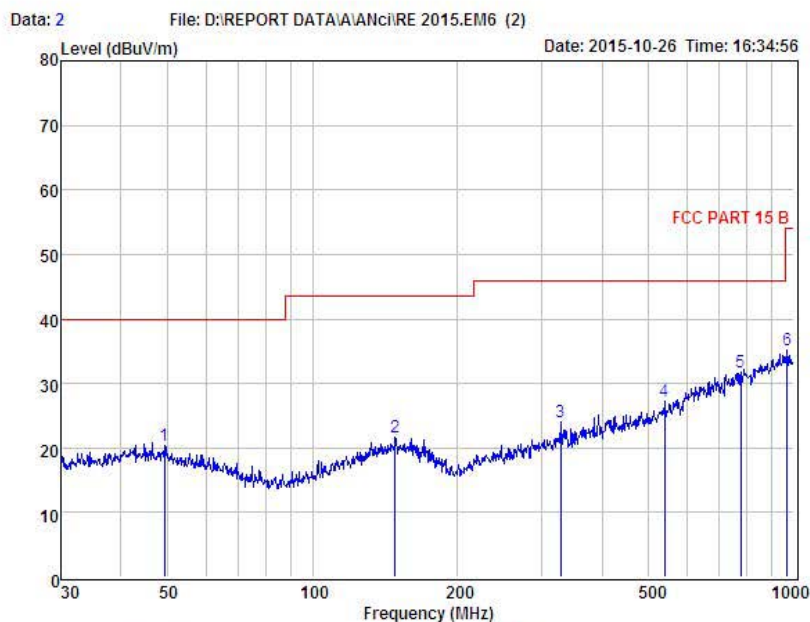
Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss

Remark1: All modes have been tested, and only worst data, Channel 2410MHz was listed in this report.

Remark2: Test for all x, y, z axes is performed and only the worst case of y axes was recorded in the test report.



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Condition : FCC PART 15 B 3m POL: HORIZONTAL
 EUT : Digital High Response Telemetry System
 Model No : 90478
 Test Mode : TX 2410MHz
 Power : DC 6V from battery
 Test Engineer : Peter
 Remark :
 Temp : 24.2°C
 Hum : 54%

Item	Freq MHz	Read Level dBuV	Antenna Factor dB	Preamp Factor dB	Cable Loss dB	Level dBuV	Limit dBuV	Margin dBuV	Remark
1	49.19	36.92	13.54	30.25	0.10	20.31	40.00	-19.69	Peak
2	148.44	36.83	14.03	29.45	0.32	21.73	43.50	-21.77	Peak
3	327.89	37.74	13.46	27.86	0.72	24.06	46.00	-21.94	Peak
4	539.48	36.00	17.19	27.02	0.99	27.16	46.00	-18.84	Peak
5	776.88	35.38	20.55	25.35	1.11	31.69	46.00	-14.31	Peak
6	968.93	36.24	22.19	25.07	1.72	35.08	54.00	-18.92	Peak

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

Remark1: All modes have been tested, and only worst data, Channel 2410MHz was listed in this report.

Remark2: Test for all x, y, z axes is performed and only the worst case of y axes was recorded in the test report.

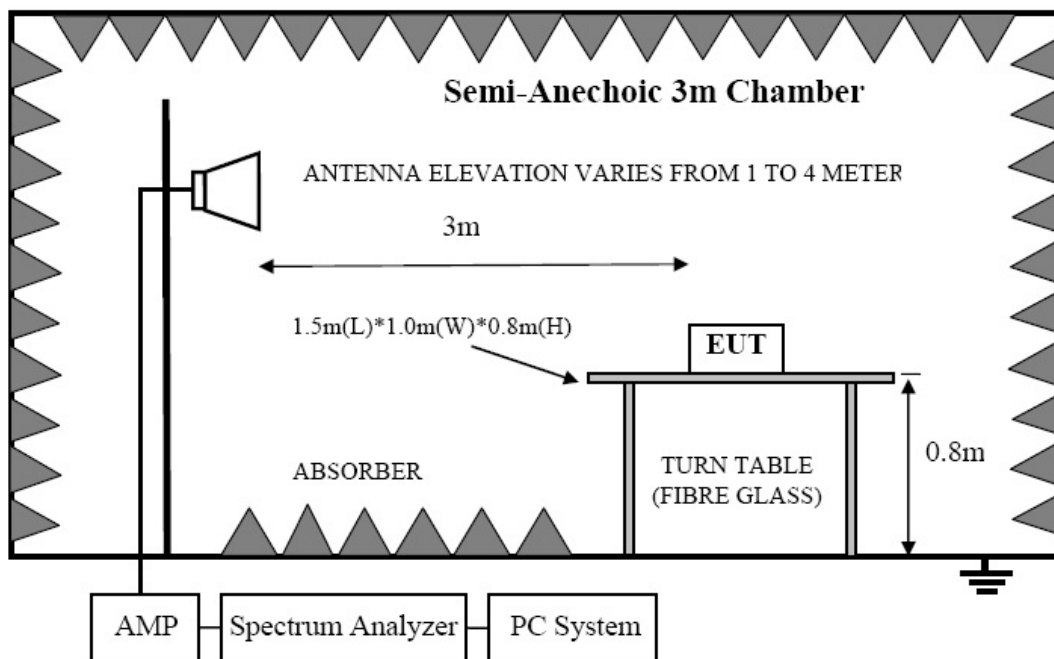
1GHz—25GHz Radiated emission Test result									
EUT: Digital High Response Telemetry System					M/N: 90478				
Power: DC 6.0V From battery									
Test date: 2015-10-26 Test site: 3m Chamber Tested by: Peter									
Test mode: Tx CH1 2410MHz									
Antenna polarity: Vertical									
No	Freq (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable loss (dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4820	51.73	31.26	5.70	34.20	54.49	74	19.51	PK
2	4820	44.52	31.26	5.70	34.20	47.28	54	6.72	AV
3	7230	/							
4	9640	/							
5	12050	/							
Antenna Polarity: Horizontal									
1	4820	47.36	31.26	5.70	34.20	50.12	74	23.88	PK
2	4820	42.25	31.26	5.70	34.20	45.01	54	8.99	AV
3	7230	/							
4	9640	/							
5	12050	/							
Note:									
1, Measuring frequency from 1GHz to 25GHz									
2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK									
2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK									
3, Result = Read level + Antenna factor + cable loss-Amp factor									
4, All the other emissions not reported were too low to read and deemed to comply with FCC limit.									

1GHz—25GHz Radiated emission Test result									
EUT: Digital High Response Telemetry System					M/N: 90478				
Power: DC 6.0V From battery									
Test date: 2015-10-26 Test site: 3m Chamber Tested by: Peter									
Test mode: Tx CH28 2437MHz									
Antenna polarity: Vertical									
No	Freq (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable loss (dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4874	48.32	31.38	5.75	34.14	51.31	74	22.69	PK
2	4874	42.07	31.38	5.75	34.14	45.06	54	8.94	AV
3	7311	/							
4	9748	/							
5	12185	/							
Antenna Polarity: Horizontal									
1	4874	47.53	31.38	5.75	34.14	50.52	74	23.48	PK
2	4874	41.35	31.38	5.75	34.14	44.34	54	9.66	AV
3	7311	/							
4	9748	/							
5	12185	/							
Note:									
1, Measuring frequency from 1GHz to 25GHz									
2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK									
2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK									
3, Result = Read level + Antenna factor + cable loss-Amp factor									
4, All the other emissions not reported were too low to read and deemed to comply with FCC limit.									

1GHz—25GHz Radiated emission Test result									
EUT: Digital High Response Telemetry System					M/N: 90478				
Power: DC 6.0V From battery									
Test date: 2015-10-26 Test site: 3m Chamber Tested by: Peter									
Test mode: Tx CH56 2465MHz									
Antenna polarity: Vertical									
No	Freq (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable loss (dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4930	46.68	31.50	5.79	34.06	49.91	74	24.09	PK
2	4930	41.75	31.50	5.79	34.06	44.98	54	9.02	AV
3	7395	/							
4	9860	/							
5	12325	/							
Antenna Polarity: Horizontal									
1	4930	45.92	31.50	5.79	34.06	49.15	74	24.85	PK
2	4930	40.05	31.50	5.79	34.06	43.28	54	10.72	AV
3	7395	/							
4	9860	/							
5	12325	/							
Note:									
1, Measuring frequency from 1GHz to 25GHz									
2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK									
2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK									
3, Result = Read level + Antenna factor + cable loss-Amp factor									
4, All the other emissions not reported were too low to read and deemed to comply with FCC limit.									

9. Band Edge Compliance

9.1. Block Diagram of Test Setup



9.2. Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

9.3. Test Procedure

Same with clause 6.3 except change investigated frequency range from 2310MHz to 2415MHz, 2475MHz to 2500MHz.

Note: 1 Spectrum Set for Non-restricted band PK measure: RBW100Khz VBW=100KHz

2 Spectrum Set for Restricted band set PK measure:: RBW 1MHz, VBW=3MHz

3 Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK

9.4. Test Result

PASS.

Band Edge Test result								
EUT: Digital High Response Telemetry System					M/N: 90478			
Power: DC 6.0V From battery								
Test date: 2015-10-26 Test site: 3m Chamber Tested by: Peter								
Test mode: Tx CH1 2410MHz								
Antenna polarity: Vertical								
Freq (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable loss (dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2390	46.83	27.62	3.92	34.97	43.40	74	30.60	PK
2390	/	27.62	3.92	34.97	/	54	/	AV
2400	47.48	27.62	3.94	34.97	44.07	74	29.93	PK
2400	/	27.62	3.94	34.97	/	54	/	AV
Antenna Polarity: Horizontal								
2390	44.93	27.62	3.92	34.97	41.50	74	32.50	PK
2390	/	27.62	3.92	34.97	/	54	/	AV
2400	46.02	27.62	3.94	34.97	42.61	74	31.39	PK
2400	/	27.62	3.94	34.97	/	54	/	AV
Note:								
1, Result = Read level + Antenna factor + cable loss-Amp factor								
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.								

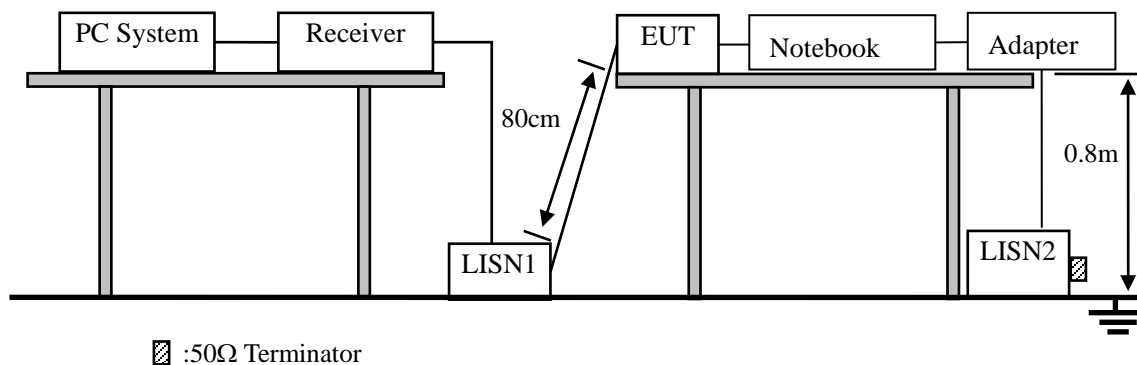
Band Edge Test result								
EUT: Digital High Response Telemetry System					M/N: 90478			
Power: DC 6.0V From battery								
Test date: 2015-10-26 Test site: 3m Chamber Tested by: Peter								
Test mode: Tx CH56 2465MHz								
Antenna polarity: Vertical								
Freq (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable loss (dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2483.5	47.89	27.59	4.00	34.97	44.51	74	29.49	PK
2483.5	/	27.59	4.00	34.97	/	54	/	AV
Antenna Polarity: Horizontal								
2483.5	45.68	27.59	4.00	34.97	42.30	74	31.70	PK
2483.5	/	27.59	4.00	34.97	/	54	/	AV
Note:								
1, Result = Read level + Antenna factor + cable loss-Amp factor								
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.								

Band Edge Test result								
EUT: Digital High Response Telemetry System					M/N: 90478			
Power: DC 6.0V From battery								
Test date: 2015-10-26 Test site: 3m Chamber Tested by: Peter								
Test mode: Hopping								
Antenna polarity: Vertical								
Freq (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable loss (dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2390	45.35	27.62	3.92	34.97	41.92	74	32.08	PK
2390	/	27.62	3.92	34.97	/	54	/	AV
2400	42.88	27.62	3.94	34.97	39.47	74	34.53	PK
2400	/	27.62	3.94	34.97	/	54	/	AV
Antenna Polarity: Horizontal								
2390	46.14	27.62	3.92	34.97	42.71	74	31.29	PK
2390	/	27.62	3.92	34.97	/	54	/	AV
2400	45.37	27.62	3.94	34.97	41.96	74	32.04	PK
2400	/	27.62	3.94	34.97	/	54	/	AV
Note:								
1, Result = Read level + Antenna factor + cable loss-Amp factor								
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.								

Band Edge Test result								
EUT: Digital High Response Telemetry System					M/N: 90478			
Power: DC 6.0V From battery								
Test date: 2015-10-26 Test site: 3m Chamber Tested by: Peter								
Test mode: Hopping								
Antenna polarity: Vertical								
Freq (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable loss (dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2483.5	46.24	27.59	4.00	34.97	42.86	74	31.14	PK
2483.5	/	27.59	4.00	34.97	/	54	/	AV
Antenna Polarity: Horizontal								
2483.5	44.87	27.59	4.00	34.97	41.49	74	32.51	PK
2483.5	/	27.59	4.00	34.97	/	54	/	AV
Note:								
1, Result = Read level + Antenna factor + cable loss-Amp factor								
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.								

10. Power Line Conducted Emissions

10.1. Block Diagram of Test Setup



10.2. Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μ V)	Average Level dB(μ V)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

10.3. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80cm above the ground plane.
- (2) Setup the EUT and simulator as shown in 10.1.
- (3) The EUT Power connected to the power mains through a notebook and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N2), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.4:2003 on conducted Emission test.
- (4) The bandwidth of test receiver is set at 10KHz.
- (5) The frequency range from 150 KHz to 30MHz is checked.

10.4. Test Result

EUT power supply by battery, so this test item not applicable.

11. Antenna Requirements

11.1. Limit

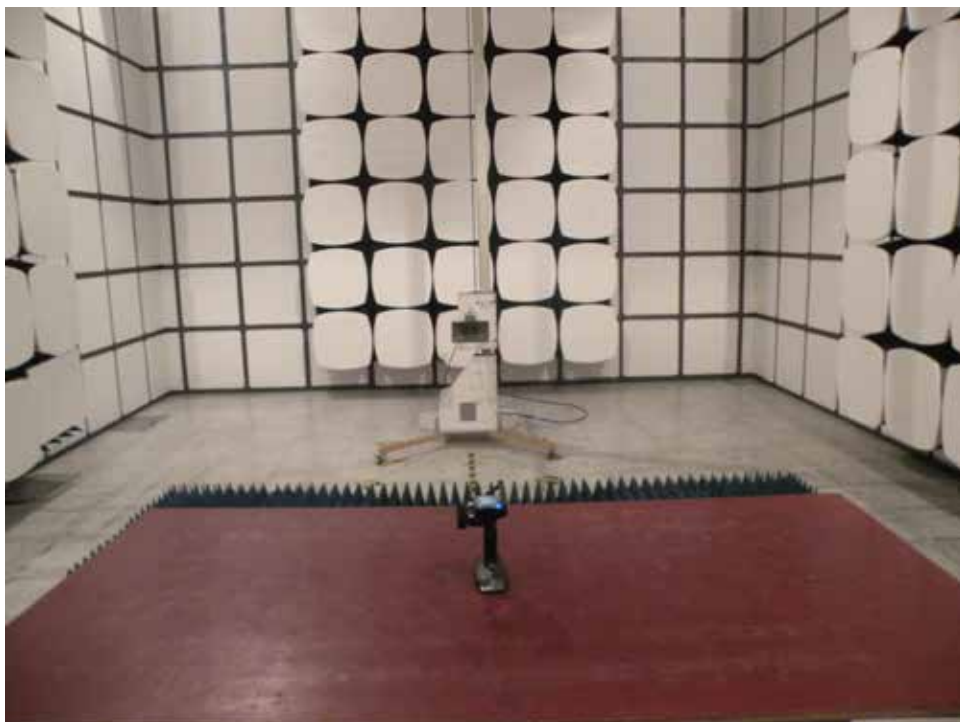
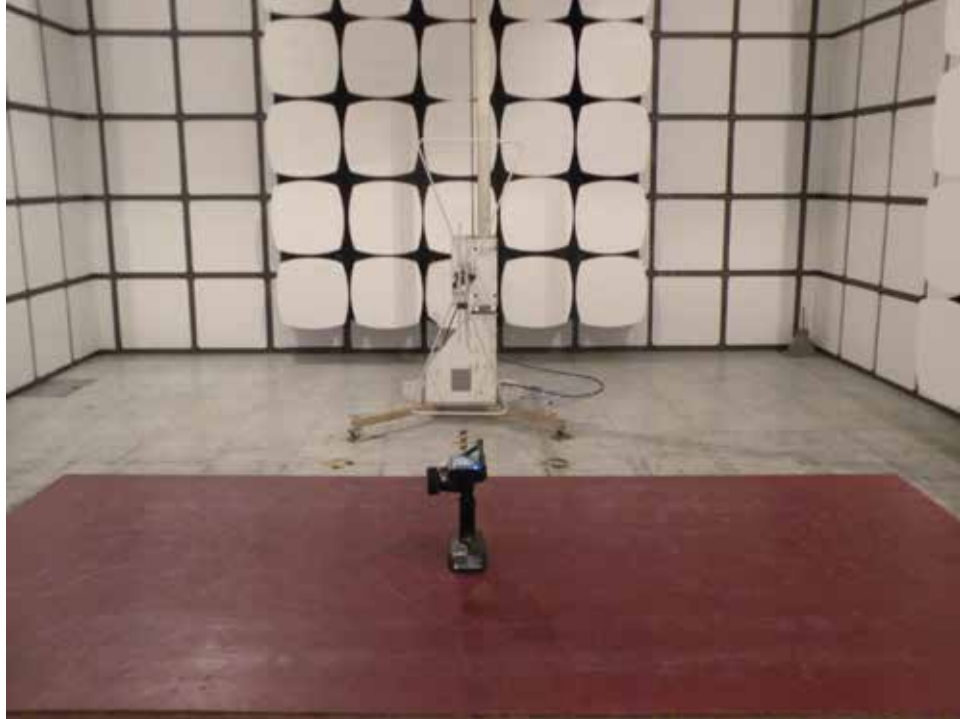
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Result

The antenna used is a detachable antenna, using a Reverse ipex connector, and the maximum peak gain of the transmit antenna is only 3.14dBi, considered a special connector accepted by the FCC to comply with rule part 15.203. Please see EUT photos for details, it comply with the standard requirement.

12. Test setup photo

12.1. Photos of Radiated emission



Direct Connect setup photo



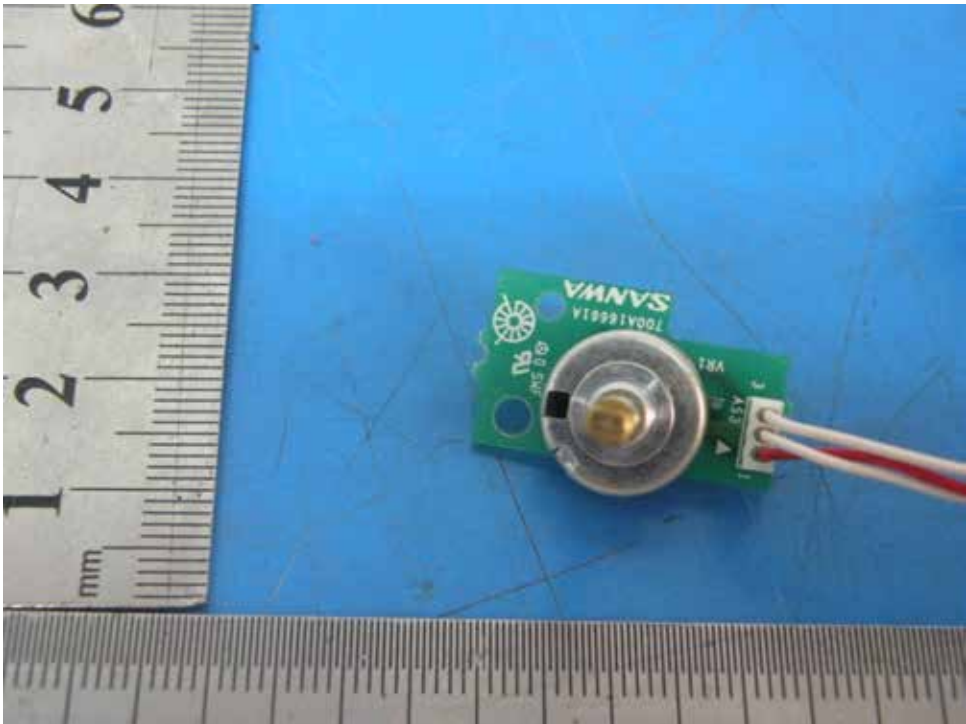
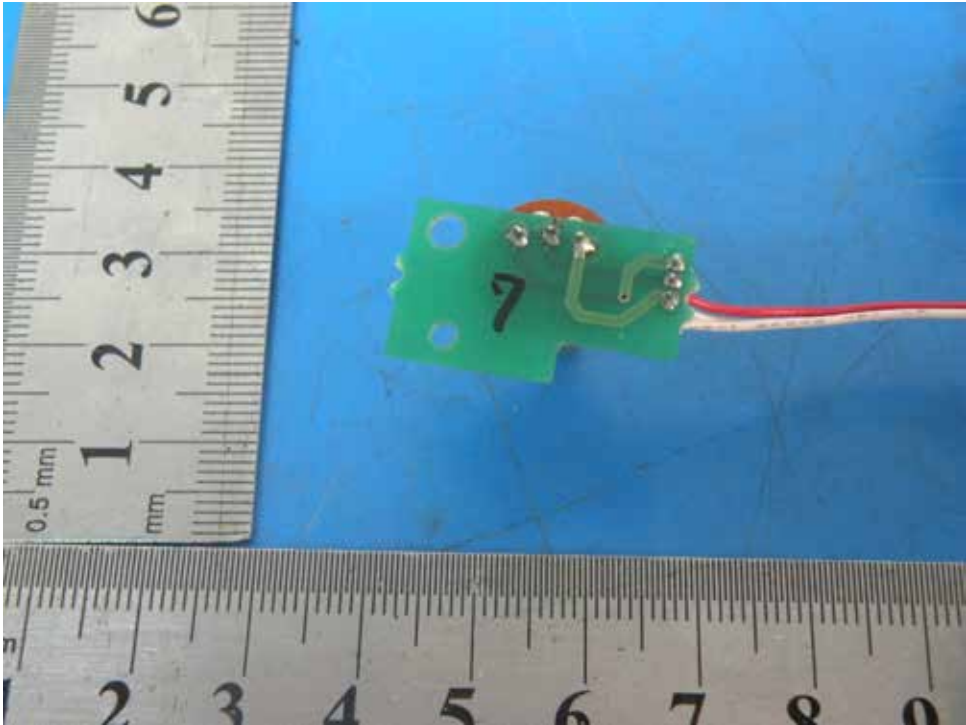
13.Photos of EUT

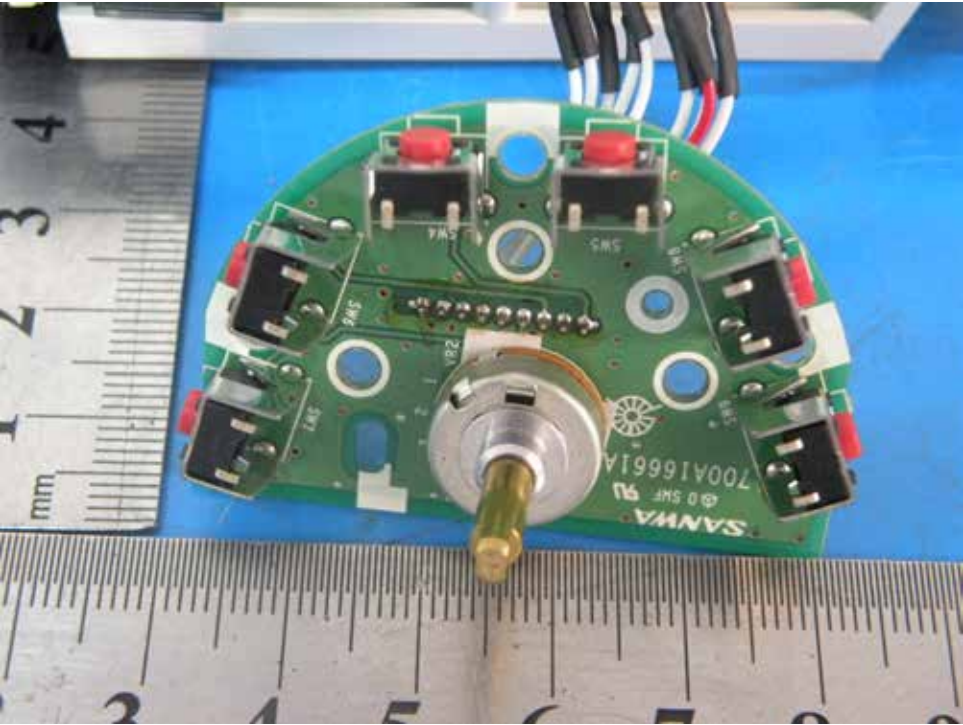
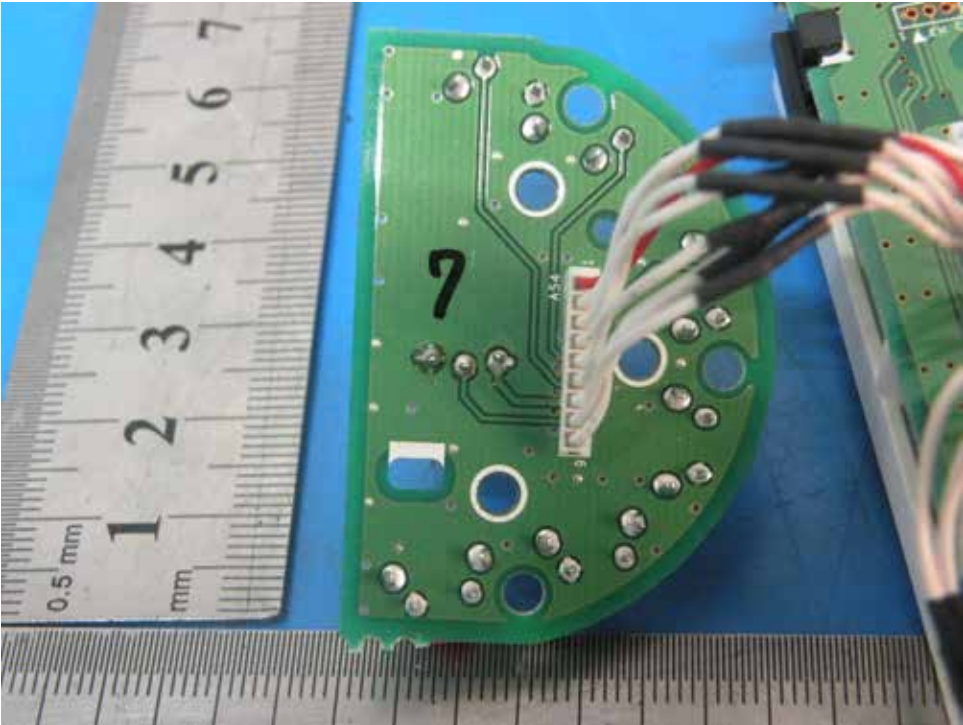


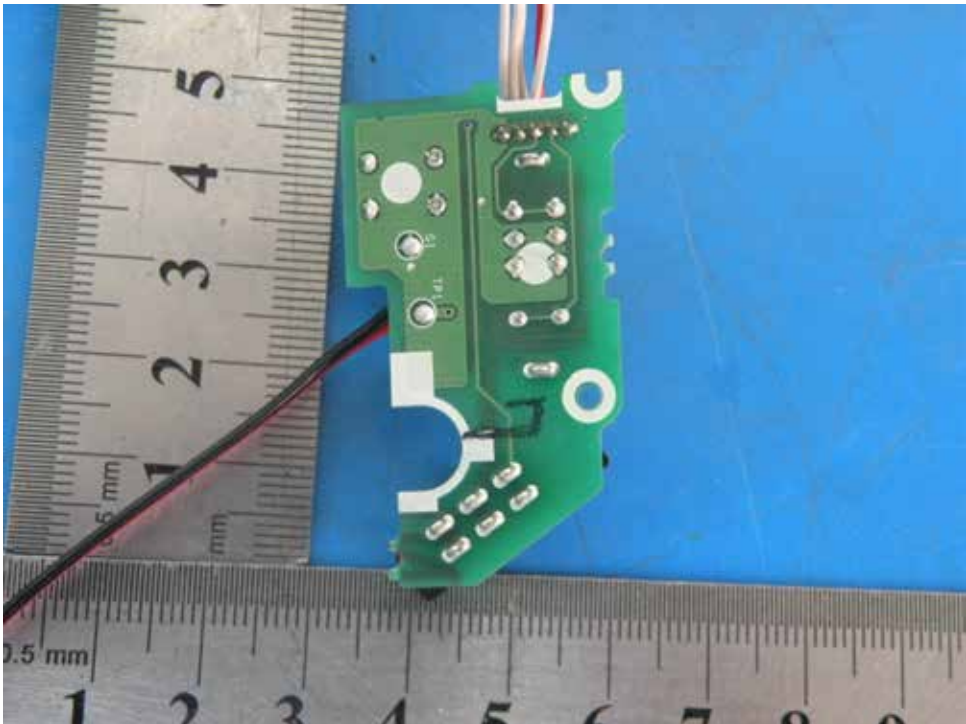
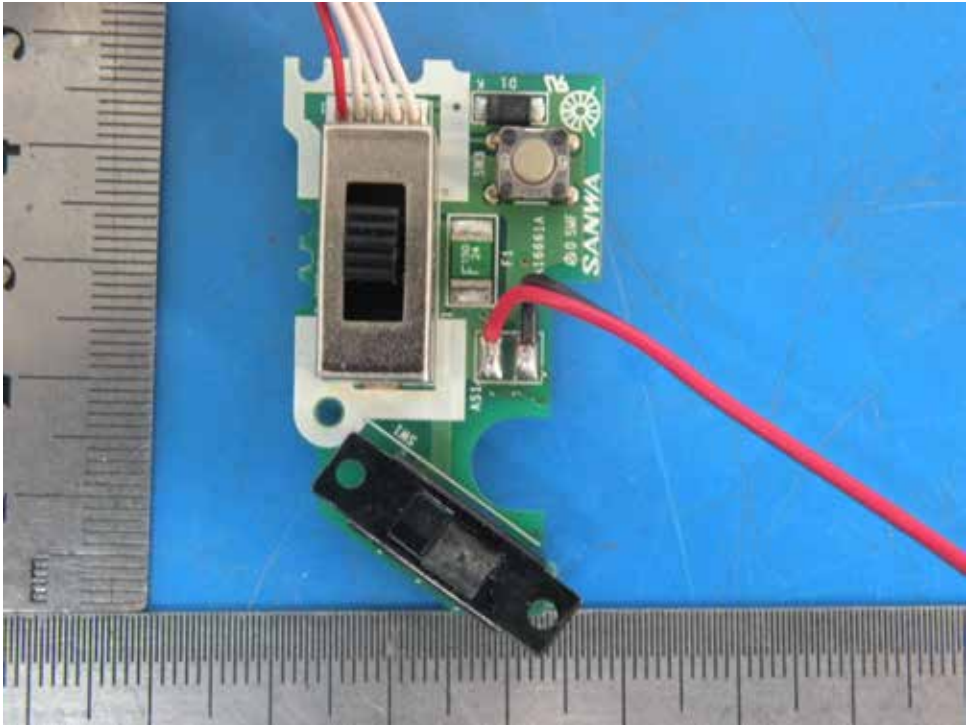




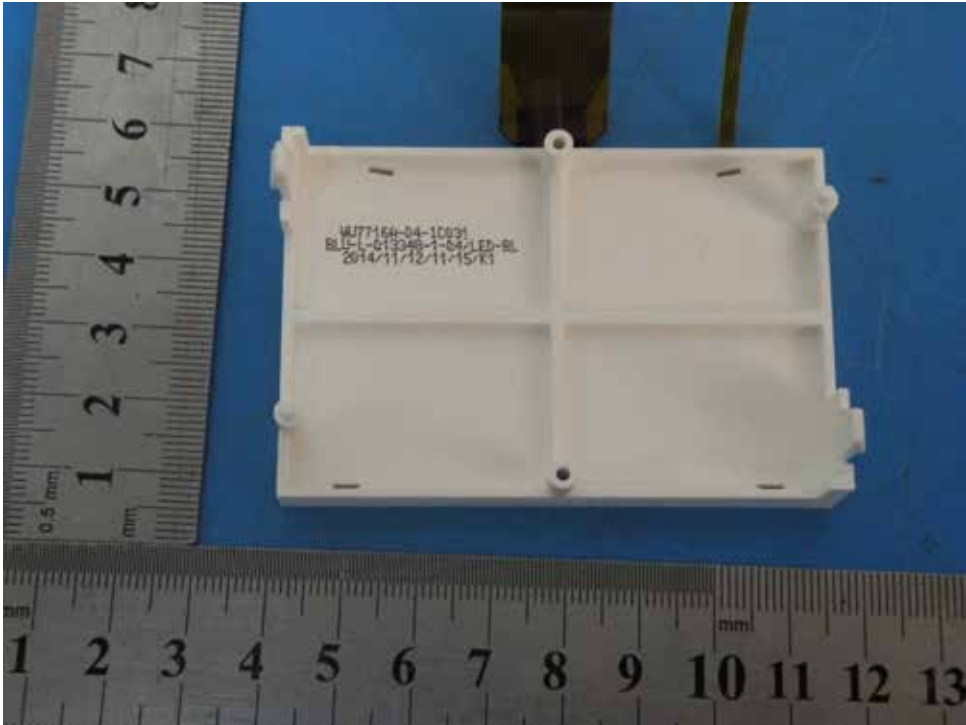


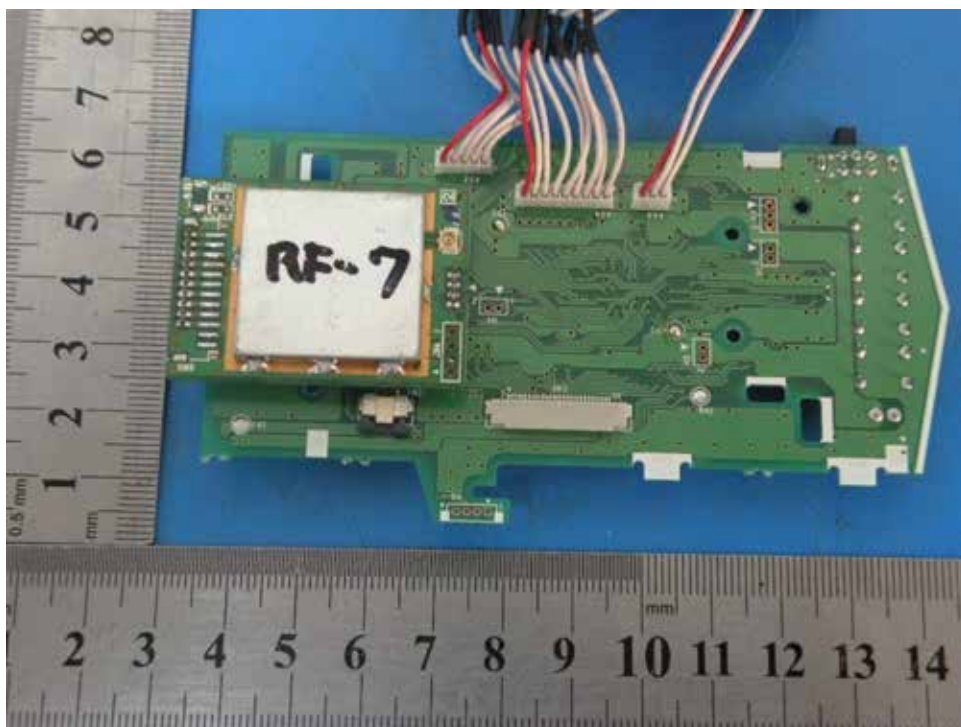
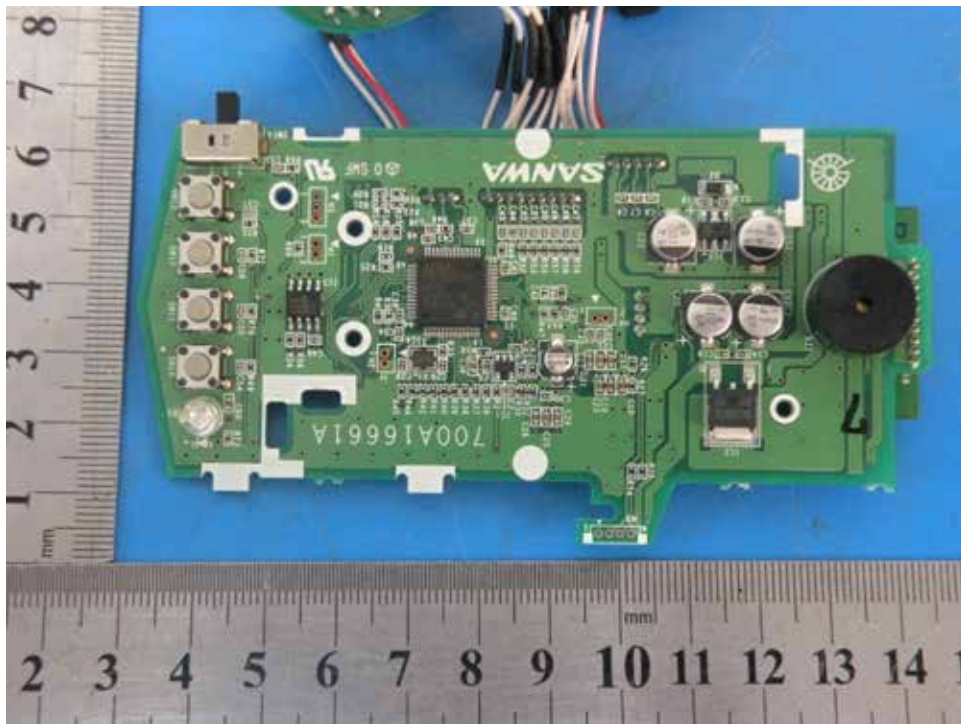


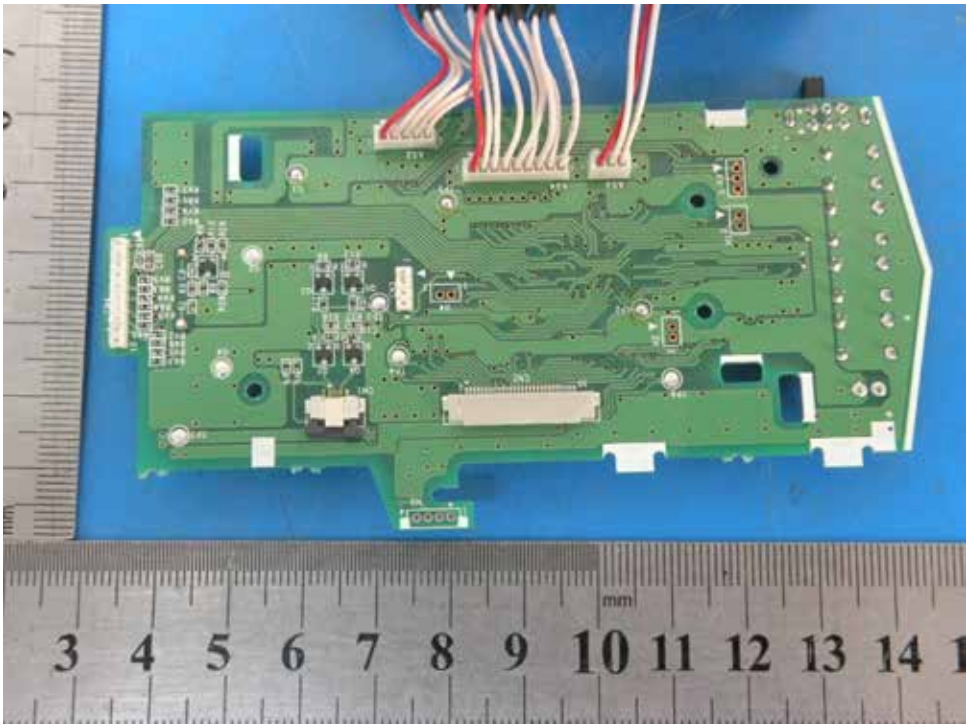
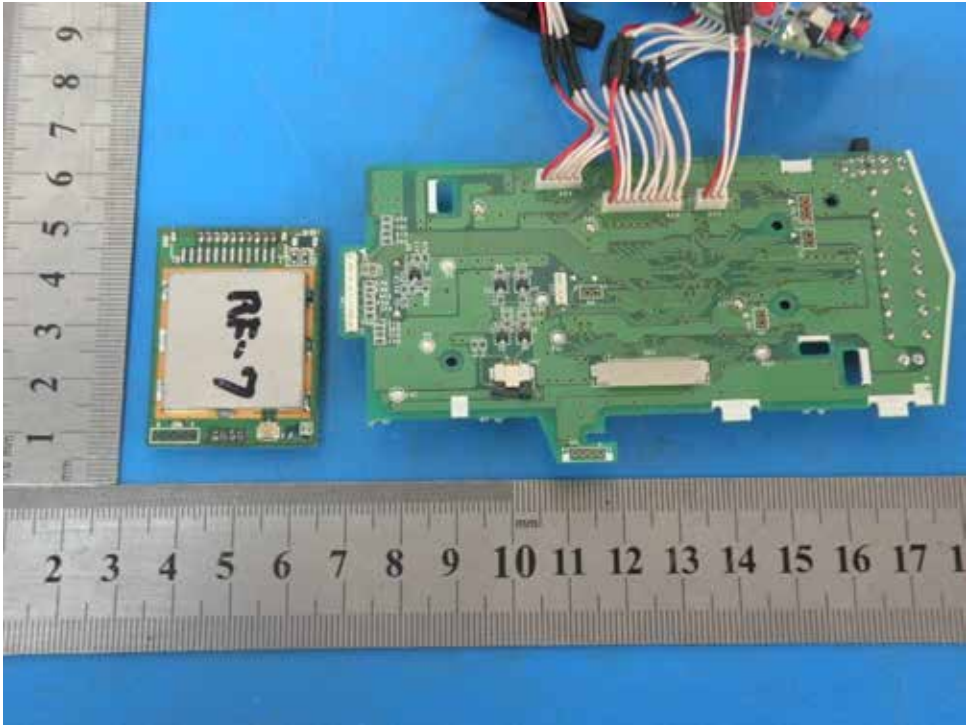


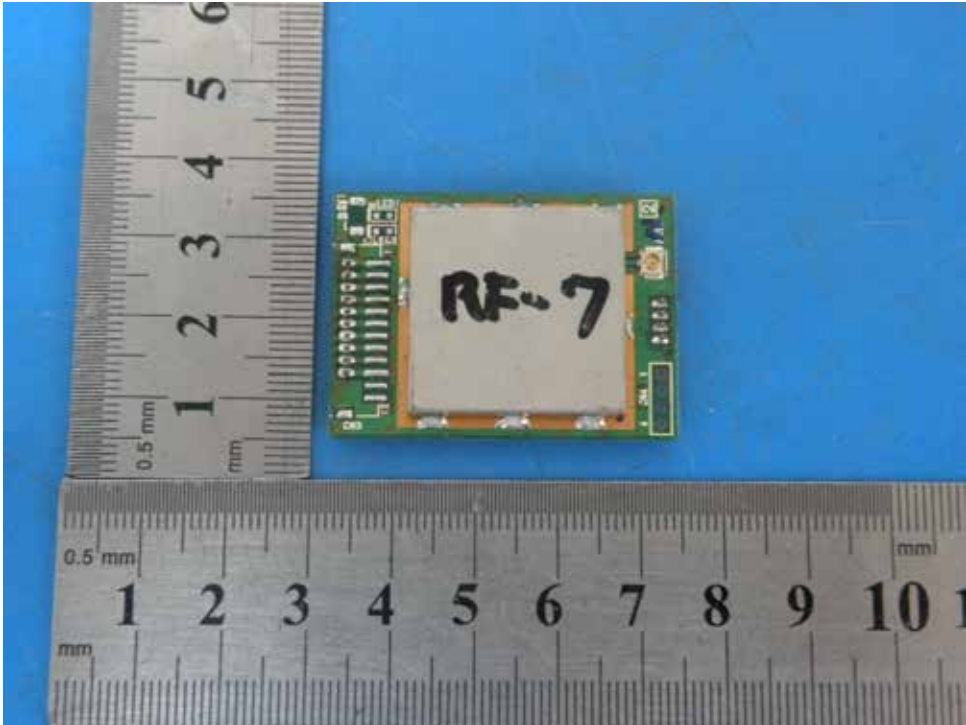




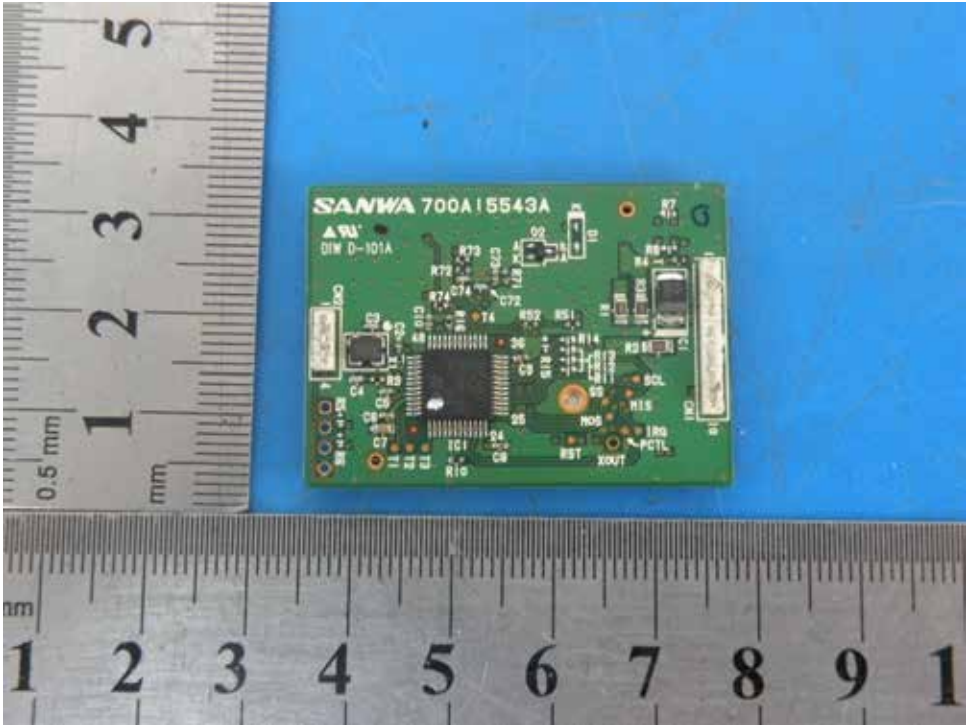












-----END OF REPORT-----