

TEST REPORT

Reference No..... : WTS20S06036686W001
FCC ID : ZLZTDBTSE
Applicant..... : Shenzhen Mindray Bio-Medical Electronics Co., Ltd.
Address..... : Mindray Building, Keji 12th Road South, High-tech Industrial Park,
Nanshan, Shenzhen 518057, PEOPLE'S REPUBLIC OF CHINA
Manufacturer : The same as above
Address..... : The same as above
Product..... : wireless module
Model(s) : Panlink2
Brand Name : Mindray
Standards..... : FCC CFR47 Part 15.247:2018
Date of Receipt sample : 2020-06-13
Date of Test : 2020-06-14 to 2020-06-28
Date of Issue..... : 2020-06-30
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.

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS20S06036 686W001	2020-06-13	2020-06-14 to 2020-06-28	2020-06-30	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	wireless module
Model(s):	Panlink2
Model Description:	N/A
Bluetooth Version:	Bluetooth v4.0 BLE
Hardware Version:	01-01-/
Software Version:	1.0

4.2 Details of E.U.T.

Operation Frequency:	2402-2480MHz
Max. RF output power:	1.96dBm
Type of Modulation:	GFSK
Change Antenna installation:	ANT1 FPC PIFA Antenna ANT2 PCB PIFA Antenna
Change Antenna Gain:	ANT1: 0.64dBi ANT2: 1.0dBi
Original Antenna installation:	ANT1 FPC dipole Antenna ANT2 Copper pipe dipole Antenna ANT3 FPC PIFA Antenna
Original Antenna Gain:	ANT1: 2.0dBi ANT2: 3.53dBi ANT3: 1.0dBi
Ratings:	DC 3.3V

4.3 Channel List

BLE

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	1	2404	2	2406	3	2408
4	2410	5	2412	6	2414	7	2416
8	2418	9	2420	10	2422	11	2424
12	2426	13	2428	14	2430	15	2432
16	2434	17	2436	18	2438	19	2440
20	2442	21	2444	22	2446	23	2448
24	2450	25	2452	26	2454	27	2456
28	2458	29	2460	30	2462	31	2464
32	2466	33	2468	34	2470	35	2472
36	2474	37	2476	38	2478	39	2480

4.4 Test Mode

Table 1 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	BLE	1 Mbps	0/19/39	TX
Power Spectral Density	BLE	1 Mbps	0/19/39	TX
6dB Bandwidth	BLE	1 Mbps	0/19/39	TX
Band Edge	BLE	1 Mbps	0/19/39	TX
Transmitter Spurious Emissions	BLE	1 Mbps	0/19/39	TX

Note :Parameters set by test software during channel & power tests, the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product .

5 Test Facility

The test facility has a test site registered with the following organizations:

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

6 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.247(d) 15.205(a) 15.209(a)	PASS
Antenna Requirement	15.203	PASS

Note: All test were performed that the device transmit continue of the 100% duty cycle.

7 Equipment Used during Test

7.1 Equipments List

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	2020-04-20	2021-04-19
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2020-04-20	2021-04-19
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2019-08-11	2020-08-10
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2019-09-17	2020-09-16
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2020-04-19	2021-04-18
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2020-04-20	2021-04-19
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2020-04-20	2021-04-19
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2020-04-20	2021-04-19
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	2020-04-20	2021-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2020-04-25	2021-04-24
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2020-04-20	2021-04-19
4	Cable	HUBER+SUHNER	CBL2	525178	2020-04-20	2021-04-19

7.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
/	/	/	/

7.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Spurious Emissions	± 5.08 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Confidence interval: 95%. Confidence factor:k=2	

7.4 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

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(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: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

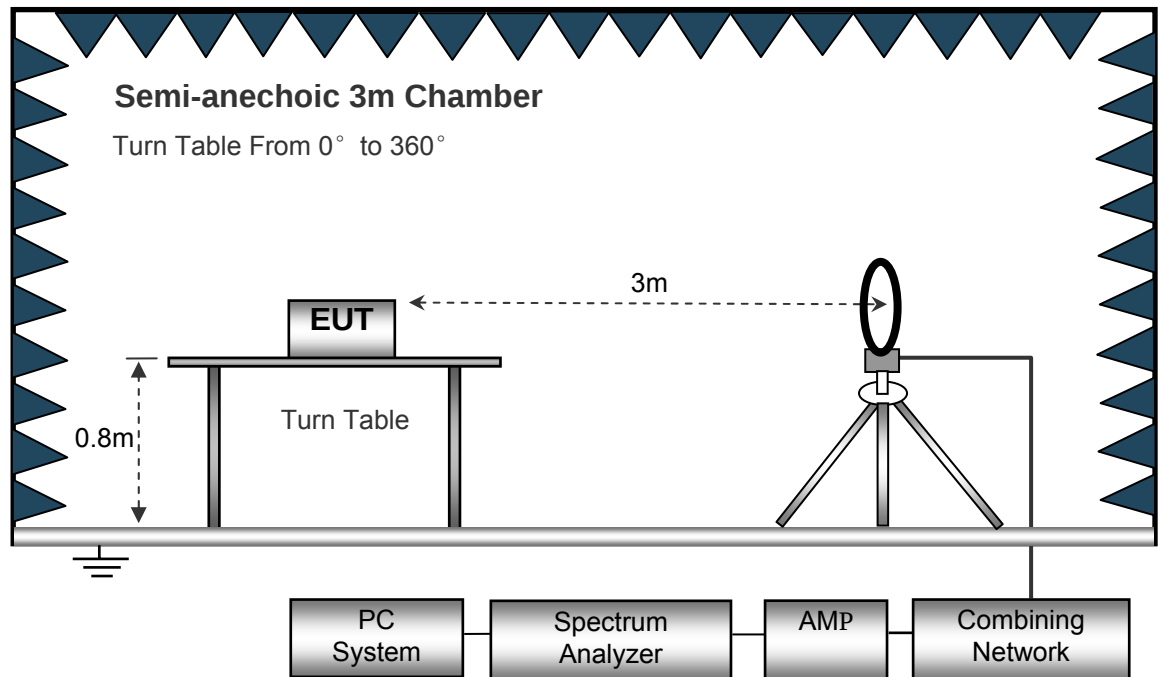
EUT Operation :

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

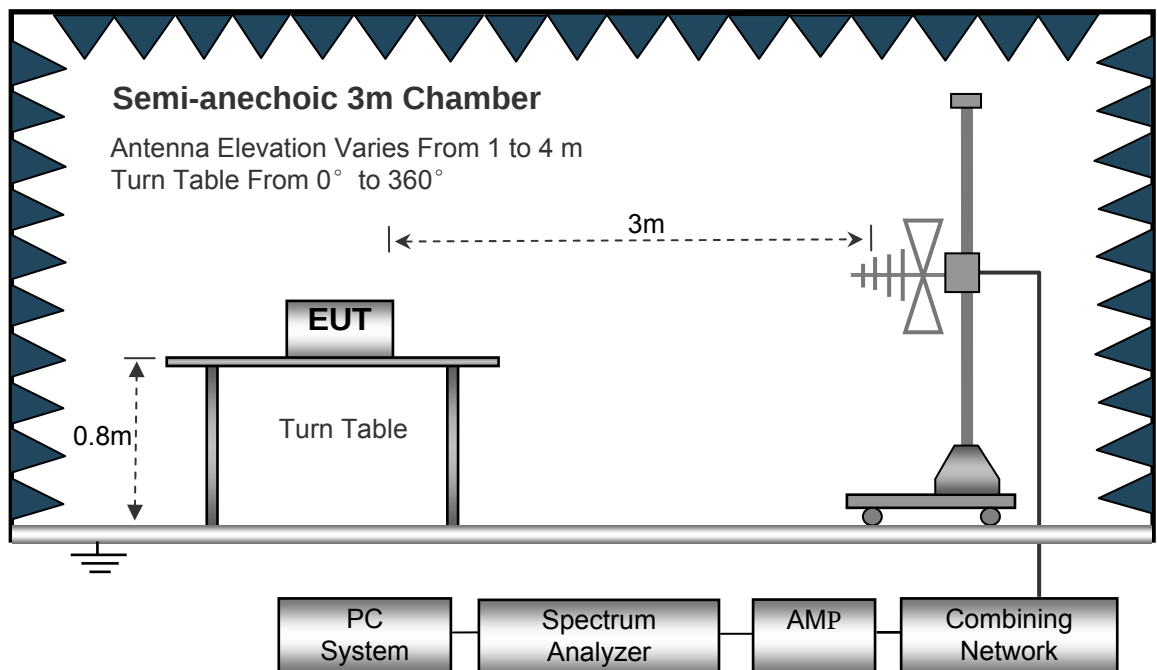
8.2 Test Setup

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

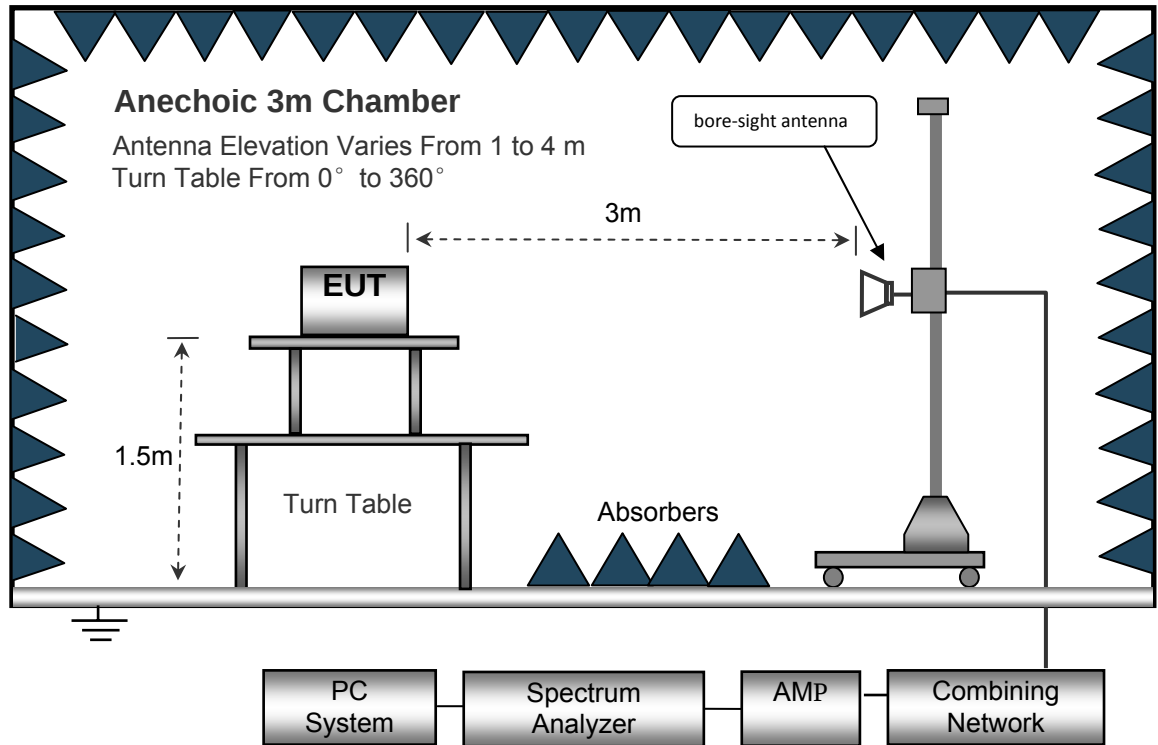
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 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
 DetectorPK
 Resolution Bandwidth.....100kHz
 Video Bandwidth.....300kHz

Above 1GHz

Sweep Speed Auto
 DetectorPK
 Resolution Bandwidth.....1MHz
 Video Bandwidth.....3MHz
 DetectorAve.
 Resolution Bandwidth.....1MHz
 Video Bandwidth.....10Hz

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.
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 performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in Z axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used during radiated emissions above 1GHz measurement.

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

BT BLE:

Test Frequency: 9KHz~30MHz

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

Test Frequency : 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2402MHz									
834.78	41.12	QP	259	1.8	H	-13.35	27.77	46.00	-18.23
834.78	43.18	QP	42	1.4	V	-13.35	29.83	46.00	-16.17
4804.00	53.03	PK	188	1.2	V	-1.06	51.97	74.00	-22.03
4804.00	42.18	Ave	188	1.2	V	-1.06	41.12	54.00	-12.88
7206.00	47.20	PK	348	1.3	H	1.33	48.53	74.00	-25.47
7206.00	36.33	Ave	348	1.3	H	1.33	37.66	54.00	-16.34
2320.01	48.76	PK	221	1.1	V	-13.19	35.57	74.00	-38.43
2320.01	39.61	Ave	221	1.1	V	-13.19	26.42	54.00	-27.58
2354.04	44.88	PK	246	1.6	H	-13.14	31.74	74.00	-42.26
2354.04	36.85	Ave	246	1.6	H	-13.14	23.71	54.00	-30.29
2498.28	43.35	PK	166	2.0	V	-13.08	30.27	74.00	-43.73
2498.28	36.78	Ave	166	2.0	V	-13.08	23.70	54.00	-30.30

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2440MHz									
834.78	41.34	QP	125	1.7	H	-13.35	27.99	46.00	-18.01
834.78	42.84	QP	117	1.7	V	-13.35	29.49	46.00	-16.51
4880.00	43.46	PK	212	1.3	V	-0.62	42.84	74.00	-31.16
4880.00	40.78	Ave	212	1.3	V	-0.62	40.16	54.00	-13.84
7320.00	46.40	PK	58	2.0	H	2.21	48.61	74.00	-25.39
7320.00	35.60	Ave	58	2.0	H	2.21	37.81	54.00	-16.19
2345.46	46.60	PK	181	1.4	V	-13.19	33.41	74.00	-40.59
2345.46	38.57	Ave	181	1.4	V	-13.19	25.38	54.00	-28.62
2385.76	42.18	PK	109	1.8	H	-13.14	29.04	74.00	-44.96
2385.76	37.30	Ave	109	1.8	H	-13.14	24.16	54.00	-29.84
2484.36	44.47	PK	122	2.0	V	-13.08	31.39	74.00	-42.61
2484.36	37.12	Ave	122	2.0	V	-13.08	24.04	54.00	-29.96

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK High Channel 2480MHz									
834.78	42.00	QP	163	1.4	H	-13.35	28.65	46.00	-17.35
834.78	38.46	QP	35	1.3	V	-13.35	25.11	46.00	-20.89
4960.00	43.40	PK	253	1.5	V	-0.24	43.16	74.00	-30.84
4960.00	41.22	Ave	253	1.5	V	-0.24	40.98	54.00	-13.02
7440.00	46.30	PK	254	1.7	H	2.84	49.14	74.00	-24.86
7440.00	36.29	Ave	254	1.7	H	2.84	39.13	54.00	-14.87
2315.21	46.55	PK	51	1.1	V	-13.19	33.36	74.00	-40.64
2315.21	37.06	Ave	51	1.1	V	-13.19	23.87	54.00	-30.13
2361.96	44.50	PK	37	1.4	H	-13.14	31.36	74.00	-42.64
2361.96	37.69	Ave	37	1.4	H	-13.14	24.55	54.00	-29.45
2497.70	43.95	PK	335	1.7	V	-13.08	30.87	74.00	-43.13
2497.70	38.64	Ave	335	1.7	V	-13.08	25.56	54.00	-28.44

Test Frequency: 18GHz~25GHz

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

9 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 an FPC(ANT1) or PCB(ANT2) antenna fulfill the requirement of this section.

10 RF Exposure

Remark: refer to MPE test report: WTS20S06036686W001.

11 Photographs of test setup and EUT.

Note: Please refer to appendix: Panlink2_Photo.

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