TEST REPORT

Applicant:	Jingrui Inspire Co., Ltd.
Address:	RM1306, Block 3 (C-1), Runhui Science Park,18 Shenzhou Rd., Huangpu Dist., Guangzhou, Guangdong Prov., P.R. China, 510663
Equipment Type:	nRF52840 Module
Model Name:	VMZ-nRF52840-1
Brand Name:	V-MARK
Test Standard:	ANSI/IEEE Std 149-1979 (refer section 3.1)
Test Date:	Nov. 14, 2022
Date of Issue:	Nov. 21, 2022

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Mai Jintian **Checked by:** Tolan Tu **Approved by:** Wei Yanquan (Chief Engineer)

Revision History

Version	Issue Date	Revisions
Rev. 01	Nov. 21, 2022	Added the test method and test data of return loss. This report replaces BL-SZ22B0596-901 which was issued by BALUN on Nov. 18, 2022, the original report is invalid.

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☑ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☐ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Jingrui Inspire Co., Ltd.
Address	RM1306, Block 3 (C-1), Runhui Science Park,18 Shenzhou Rd., Huangpu Dist., Guangzhou, Guangdong Prov., P.R. China, 510663
Contact Person	Qin Han
Telephone Number	15915864013
E-mail Address	hans@v-mark.com

2.2 Manufacturer Information

Manufacturer	Jingrui Inspire Co., Ltd.
Address	RM1306, Block 3 (C-1), Runhui Science Park,18 Shenzhou Rd., Huangpu Dist., Guangzhou, Guangdong Prov., P.R. China, 510663

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	nRF52840 Module
Model Name Under Test	VMZ-nRF52840-1
Antenna Type	PCB Antenna
Dimensions	14*5 mm

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Frequency Range	2400MHz ~ 2480MHz
Test Frequencies	2400MHz, 2402MHz, 2404MHz, 2406MHz, 2408MHz, 2410MHz, 2412MHz, 2414MHz, 2416MHz, 2418MHz, 2420MHz, 2422MHz, 2424MHz, 2426MHz, 2428MHz, 2430MHz, 2432MHz, 2434MHz, 2436MHz, 2438MHz, 2440MHz, 2442MHz, 2444MHz, 2446MHz, 2448MHz, 2450MHz, 2452MHz, 2454MHz, 2456MHz, 2458MHz, 2460MHz, 2462MHz, 2464MHz, 2466MHz, 2468MHz, 2470MHz, 2472MHz, 2474MHz, 2476MHz, 2478MHz, 2480MHz

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	ANSI/IEEE Std 149-1979	IEEE Standard Test Procedures for Antennas
2	Enterprise Technology Method	Enterprise Technology Method refer Section 4.3

3.2 Test Verdict

Report Section	Description	Remark
ANNEX A.1	Gain and Efficiency	--
ANNEX A.2	VSWR	--
ANNEX A.3	Return Loss	Note#1
ANNEX B	Radiation Pattern	--

Note#1: The return loss test method is based on Section 4.3.3 of this report.

3.3 Test Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Item	Uncertainty
VSWR(S11)	±0.61
Gain	±1.92dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Condition

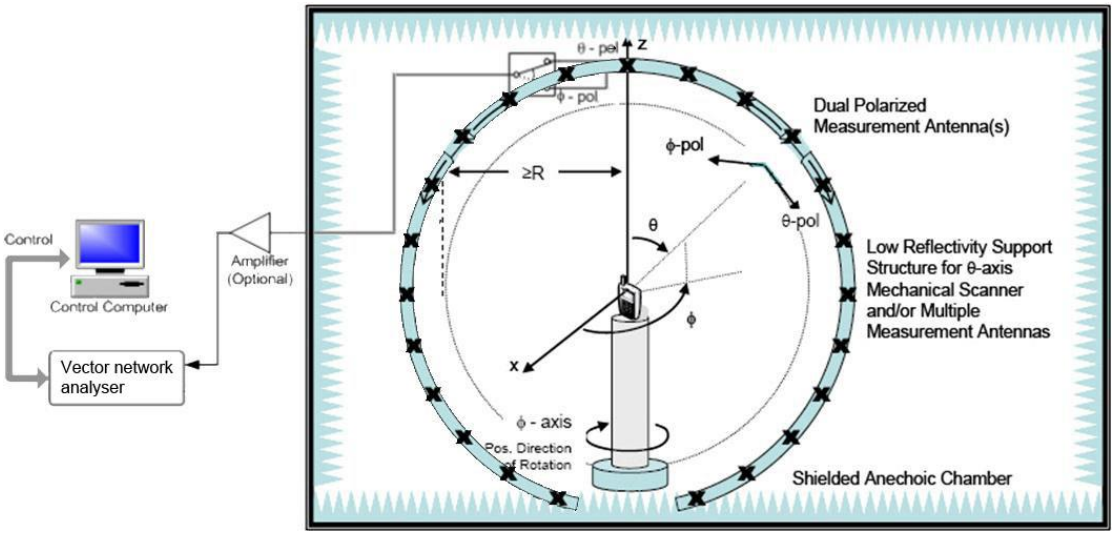
Environment Parameter	Selected Values During Tests			
	Ambient Pressure(KPa)	Temperature(℃)	Voltage	Relative Humidity (%)
Normal Temperature, Normal Voltage (NTNV)	101	21.9	N/A	63

4.2 Test Equipment List

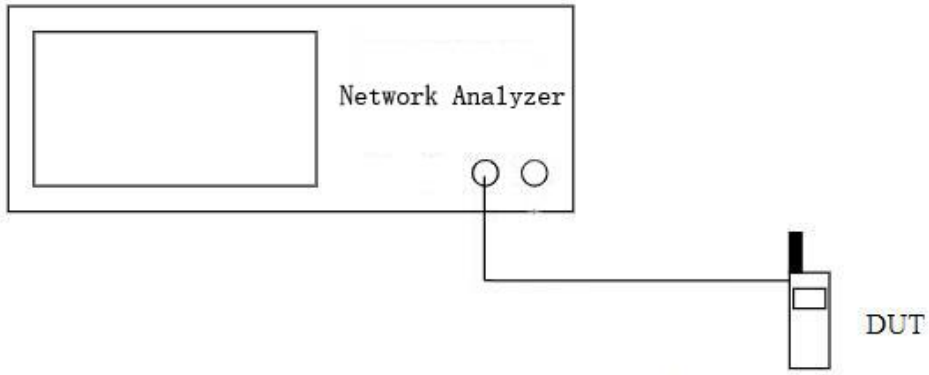
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
SG24 Multi-probe Antenna Measurement System	SATIMO	SG24-L	1101855-0001	2021.11.12	2024.11.11
Vector Network Analyzer	Agilent	E5071B	MY42404001	2022.04.02	2023.04.01
Description	Manufacturer	Name		Version	
Test Software	MVG	SPM		V 1.8	

4.3 Test Setup

4.3.1 Antenna gain, efficiency and radiation pattern test setup



4.3.2 S11 parameter test setup



4.3.3 Return Loss Test Method

1) The connection diagram between the antenna under test and the measuring system is shown in Chapter 4.3.2. The nominal impedance of return loss measuring equipment is 50 Ω;

2) Calibration of the measuring system: perform system calibration according to the calibration steps of the test instrument, and the interface of the test end shall match the interface of the antenna under test;

3) Connect the measuring system with the antenna under test, and measure the return loss within the working frequency range. The measured loss reading is the return loss of the measured antenna port.

ANNEX A TEST RESULTS

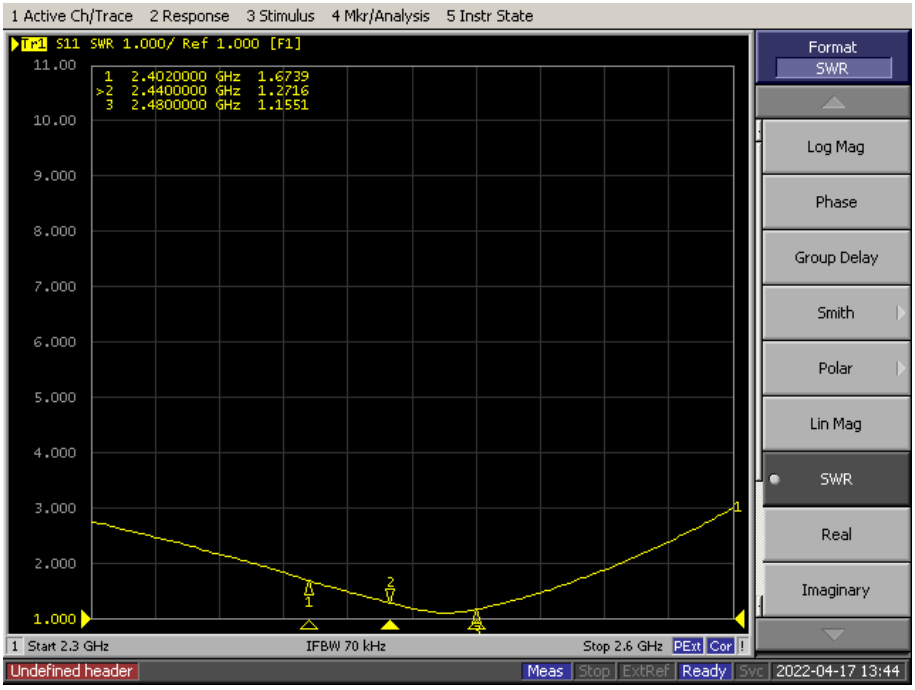
A.1 Gain and Efficiency

Frequency	Gain (dBi)	Efficiency (%)
2400MHz	0.98	39
2402MHz	0.99	39
2404MHz	0.99	39
2406MHz	0.99	39
2408MHz	1.00	39
2410MHz	1.00	39
2412MHz	0.98	39
2414MHz	0.94	38
2416MHz	**1.06**	39
2418MHz	1.03	39
2420MHz	0.97	38
2422MHz	0.94	38
2424MHz	0.93	38
2426MHz	1.05	39
2428MHz	1.03	39
2430MHz	1.02	39
2432MHz	1.04	39
2434MHz	1.05	**40**
2436MHz	0.97	40
2438MHz	0.95	40
2440MHz	0.95	40
2442MHz	0.95	40
2444MHz	0.97	40
2446MHz	0.94	40
2448MHz	0.94	40
2450MHz	0.95	40
2452MHz	0.94	40
2454MHz	0.92	39
2456MHz	0.85	39
2458MHz	0.83	39
2460MHz	0.80	39
2462MHz	0.77	38
2464MHz	0.75	38
2466MHz	0.73	38
2468MHz	0.69	38
2470MHz	0.64	38
2472MHz	0.60	38
2474MHz	0.57	38

2476MHz	0.52	38
2478MHz	0.45	37
2480MHz	0.38	37

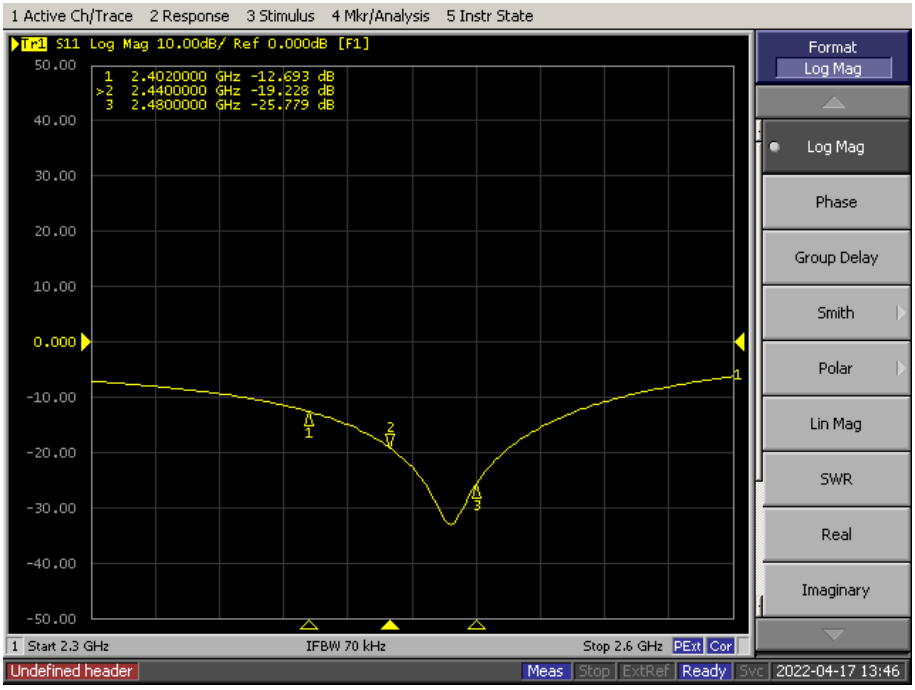
A.2 VSWR

Frequency	VSWR
2402MHz	1.67
2440MHz	1.27
2480MHz	1.16



A.3 Return Loss

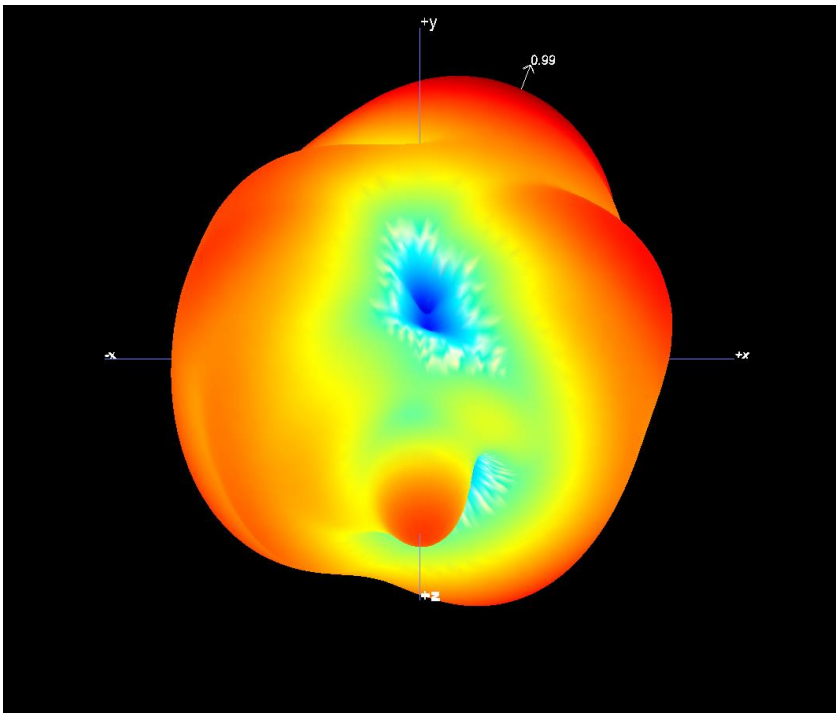
Frequency	Return Loss (dB)
2402MHz	-12.69
2440MHz	-19.23
2480MHz	-25.78



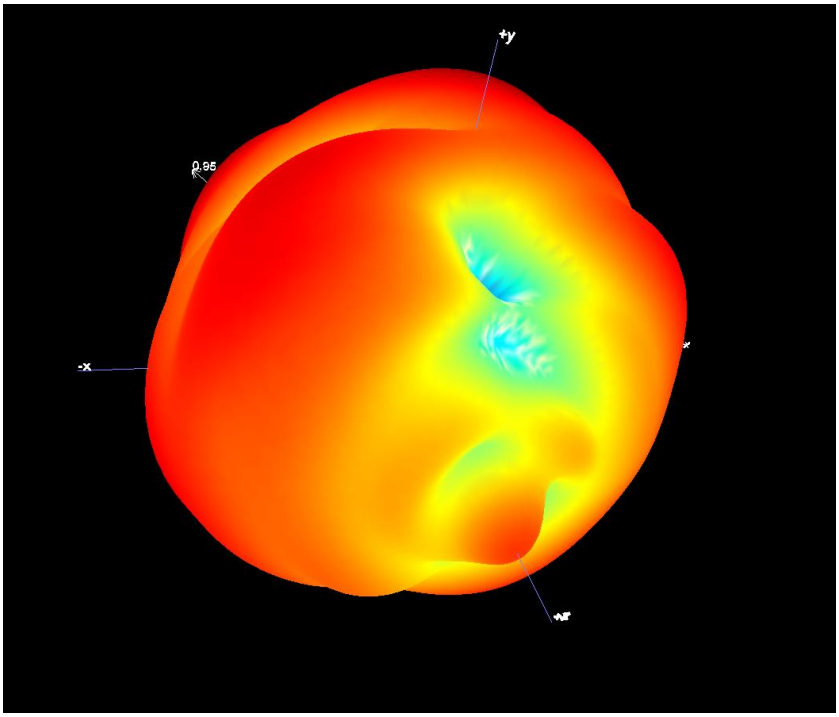
ANNEX B RADIATION PATTERN

B.1 3D Pattern

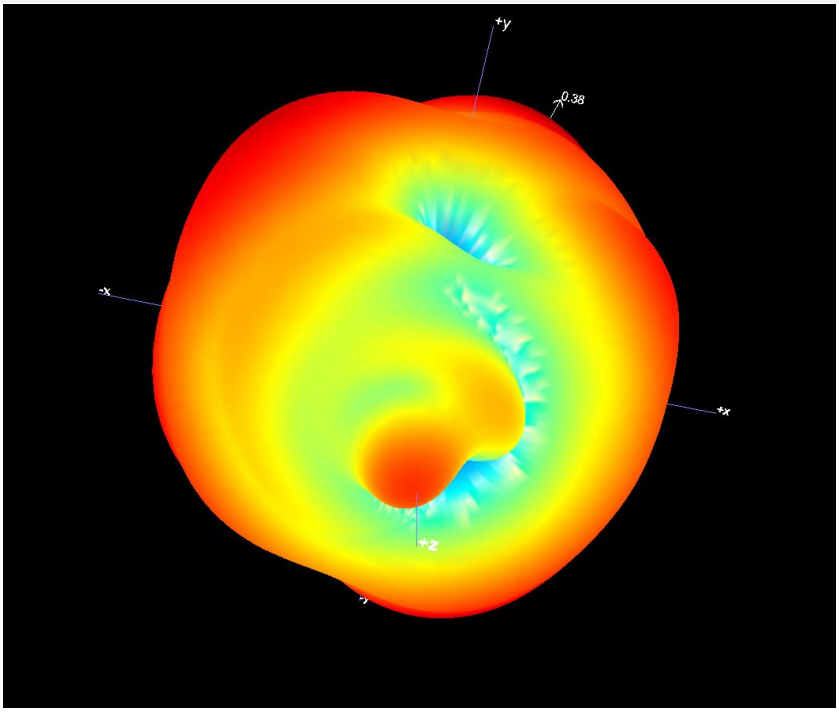
B1.1 3D Pattern for 2402MHz



B1.2 3D Pattern for 2440MHz

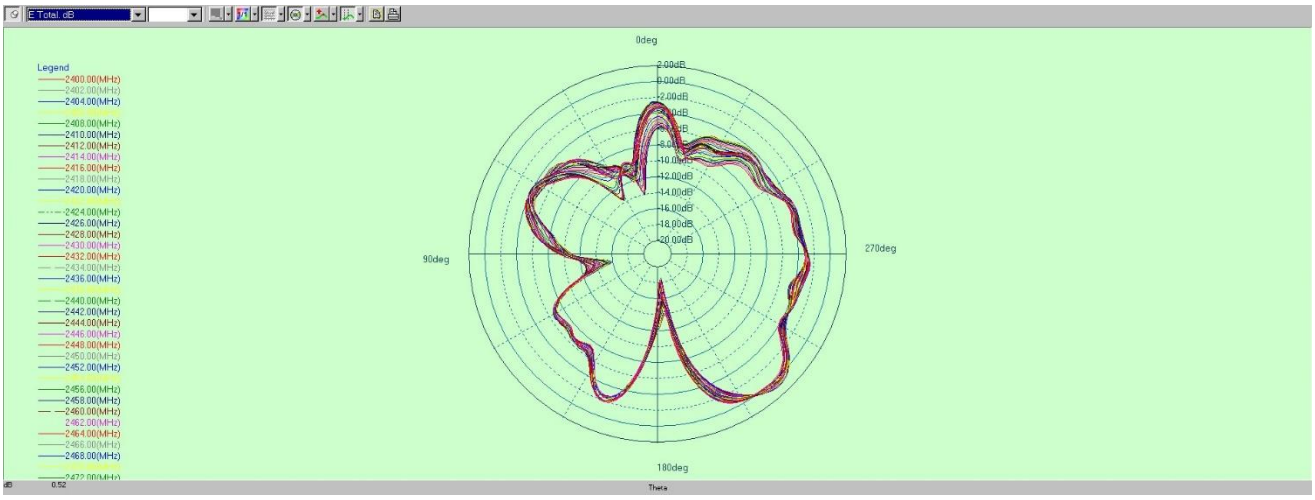


B1.3 3D Pattern for 2480MHz

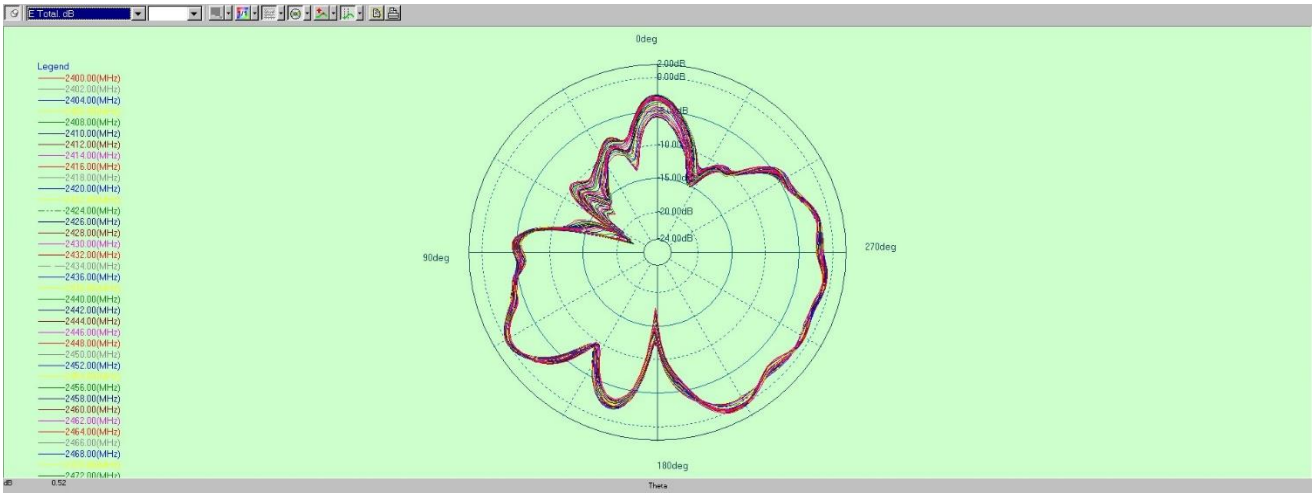


B.2 1D Radiation Pattern

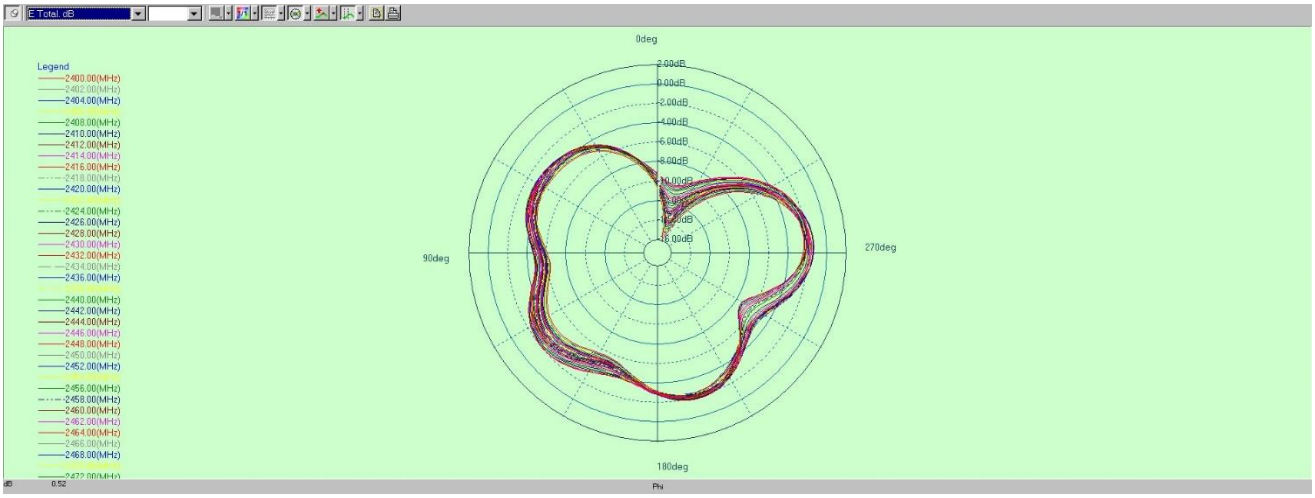
B2.1 PHI=0



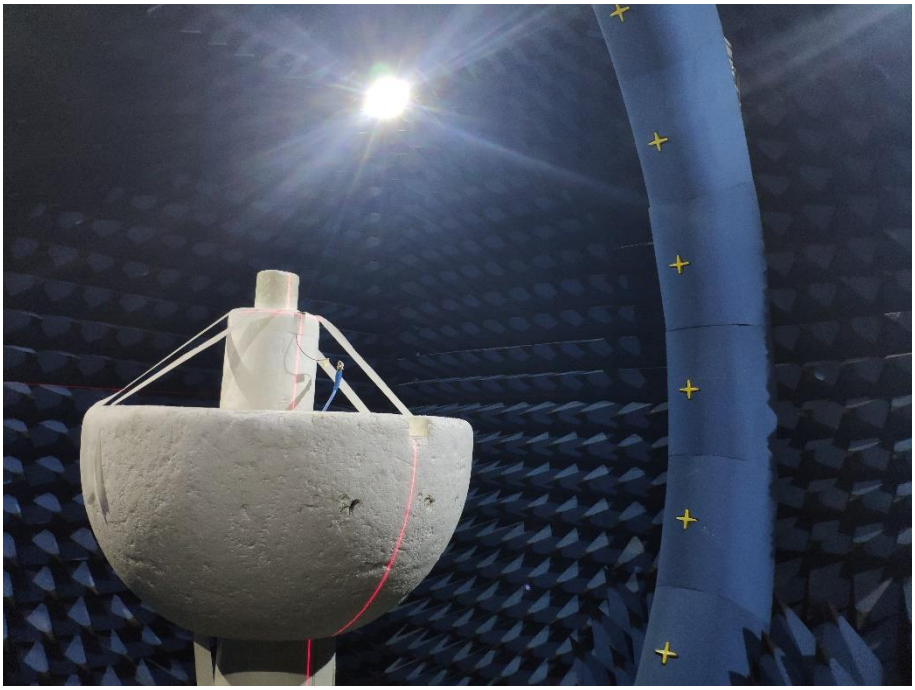
B2.2 PHI=90

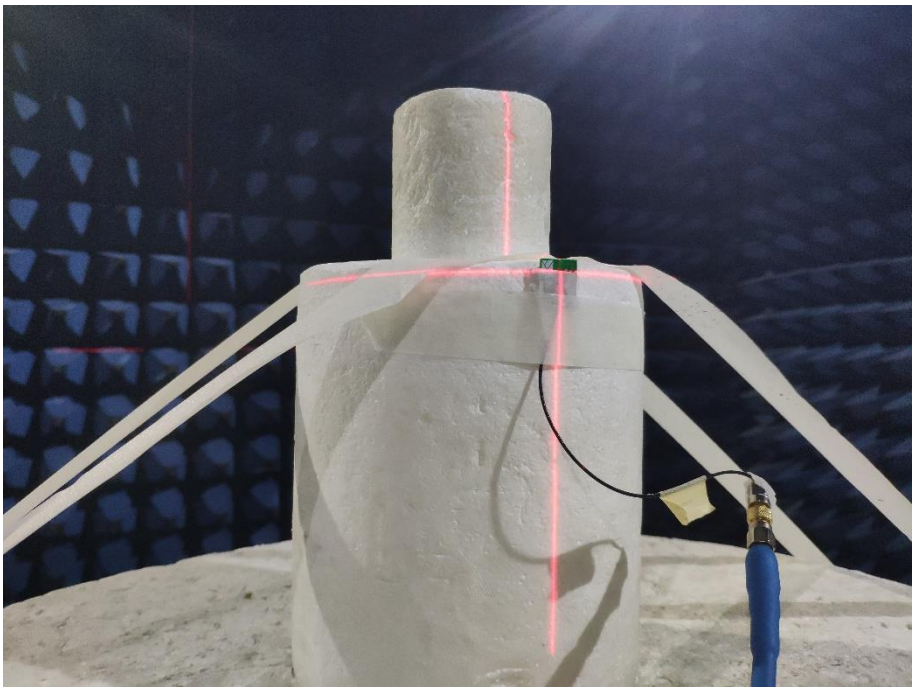


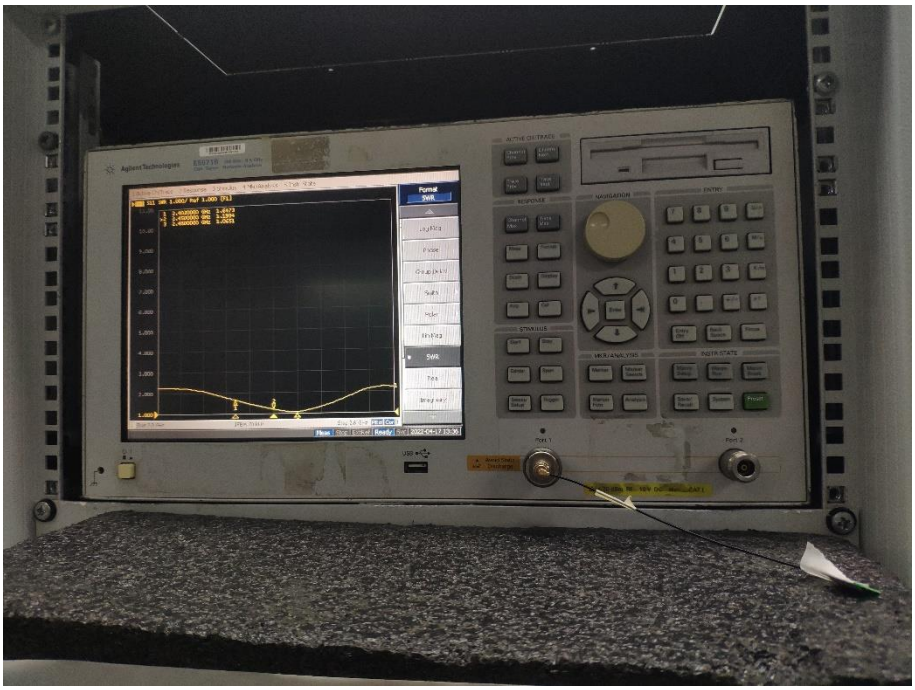
B2.3 THETA=90



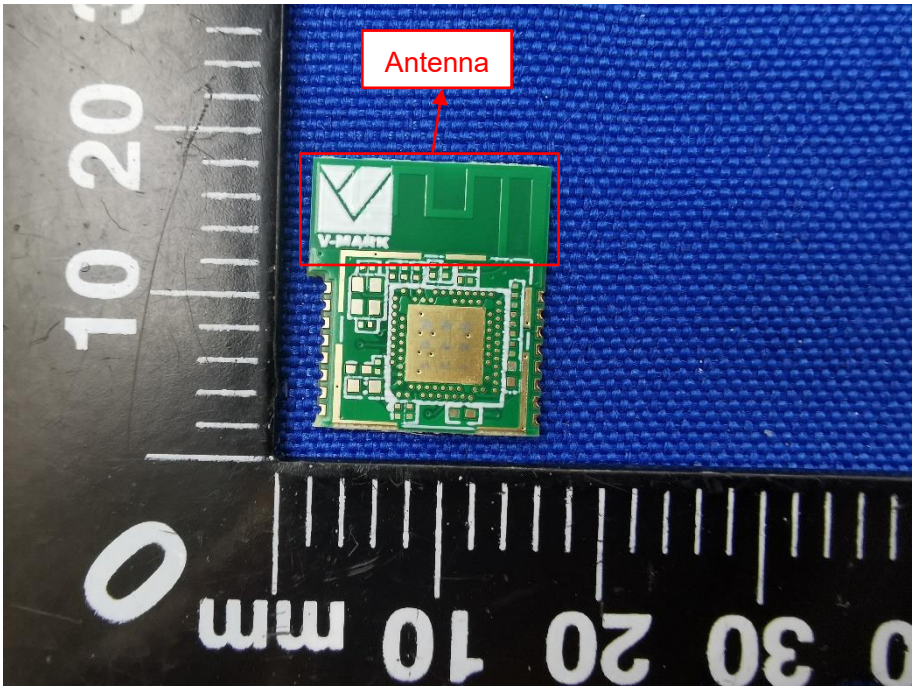
ANNEX C TEST SETUP PHOTO







ANNEX D EUT PHOTO



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