

Antenna Specification

ODU302 2.4 GHz WiFi Antenna Specification

Product Model	ODU302
Document Type	Antenna Specification
Antenna Type	Internal PCB Antenna
Measured Freq Range	2300 – 2800 MHz
Operating Band	2400 – 2500 MHz (2.4 GHz ISM)
Designed By	Beijing InHand Networks Technology Co., Ltd.
Document Version	V1.0
Date	2026-07-23

1. General Description

This specification describes the electrical performance, mechanical characteristics and measured data of the 2.4 GHz WiFi antenna used in the ODU302 wireless product. The antenna is an internal PCB antenna operating in the 2400–2500 MHz ISM band; measured data cover 2300–2800 MHz. It supports IEEE 802.11 b/g/n WLAN applications. All electrical data are derived from anechoic-chamber passive measurements and Vector Network Analyzer (Keysight E5071C) measurements.

2. Electrical Specifications

Parameter	Specification	Remark
Measured Freq Range	2300 – 2800 MHz	Anechoic chamber measurement
Operating Frequency Band	2400 – 2500 MHz	2.4G WiFi operating band
Nominal Impedance	50 Ω	
Peak Gain (2400-2500)	2.7 dBi (Typ. 1.2 dBi)	Measured
Peak Gain (2300-2800)	3.27dBi	Measured
Average Efficiency	$\geq 50\%$ (Typ. 55 %)	2400-2500 measured
VSWR (2400-2500)	$\leq 2.0 : 1$ (Typ. ≤ 1.3)	Derived from S11, see Section 5
Return Loss (2400-2500)	≤ -17 dB (Typ.)	S11, see Section 5
Polarization	Linear	
Radiation Pattern	Near Omni-directional	See Section 6
Directivity	≈ 3.8 dB (2400-2500)	Measured
Max Input Power	Per system design	

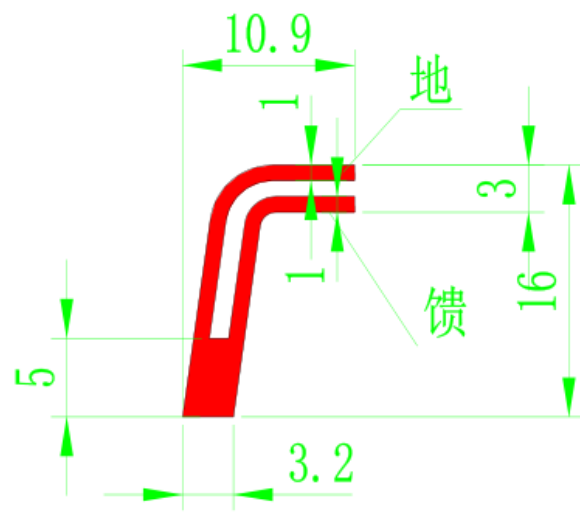
3. Mechanical & Environmental

Parameter	Specification
Antenna Form	Internal PCB printed antenna
Connector	On-board feed / IPEX (per system design)
Operating Temperature	-40 °C ~ +85 °C
Storage Temperature	-40 °C ~ +85 °C
RoHS	Compliant

3.1 Antenna Dimensions

The antenna is a PCB printed antenna mounted in the designated area of the ODU302 main board. The detailed dimensions and mechanical drawing are listed below and shall be completed after the DXF / PCB structure drawing is available.

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4. Passive Test Data (Anechoic Chamber)

The following table shows the measured peak gain and efficiency across the full 2300–2800 MHz band. The 2.4 GHz WiFi operating band (2400–2500 MHz) is highlighted.

Freq (MHz)	Peak Gain (dBi)	Efficiency (%)
2300	2.02	49.7
2310	1.91	50.1
2320	1.57	48.8
2330	1.49	50.3
2340	1.39	49.5
2350	1.48	49.5
2360	1.61	49.3
2370	1.78	49.6
2380	1.8	49.9
2390	1.84	51.1
2400	1.92	50.9
2410	2.08	52.9
2420	2.09	53.7
2430	2.09	54.0
2440	2.34	56.3
2450	2.28	55.3
2460	2.7	57.3
2470	2.21	57.4
2480	2.16	56.7
2490	2.52	58.5
2500	2.44	55.9
2510	2.5	56.5
2520	2.47	55.9
2530	2.47	55.1
2540	2.82	55.4
2550	2.98	53.6
2560	3.11	53.6
2570	3.14	53.8
2580	3.07	54.0
2590	3.27	54.6
2600	3.24	54.4
2610	3.09	54.2
2620	3.01	53.7
2630	3.23	54.7
2640	3.27	54.2
2650	3.26	54.6
2660	3.01	53.8
2670	2.6	52.1
2680	2.45	52.4
2690	2.26	51.0
2700	2.28	51.8
2710	2.12	51.7
2720	2.16	50.5
2730	2.37	51.4
2740	2.18	48.4
2750	2.2	49.4
2760	1.95	48.3
2770	1.87	48.0
2780	1.93	47.9
2790	1.93	46.6
2800	2.0	46.3

Full-band statistics (2300-2800 MHz): gain 0.39–2.27 dBi; efficiency 46.3%–58.5%.

2.4G WiFi operating band statistics (2400-2500 MHz): gain 0.92–1.52 dBi (avg. 1.23 dBi); efficiency 50.9%–58.5% (avg. 55.4%).

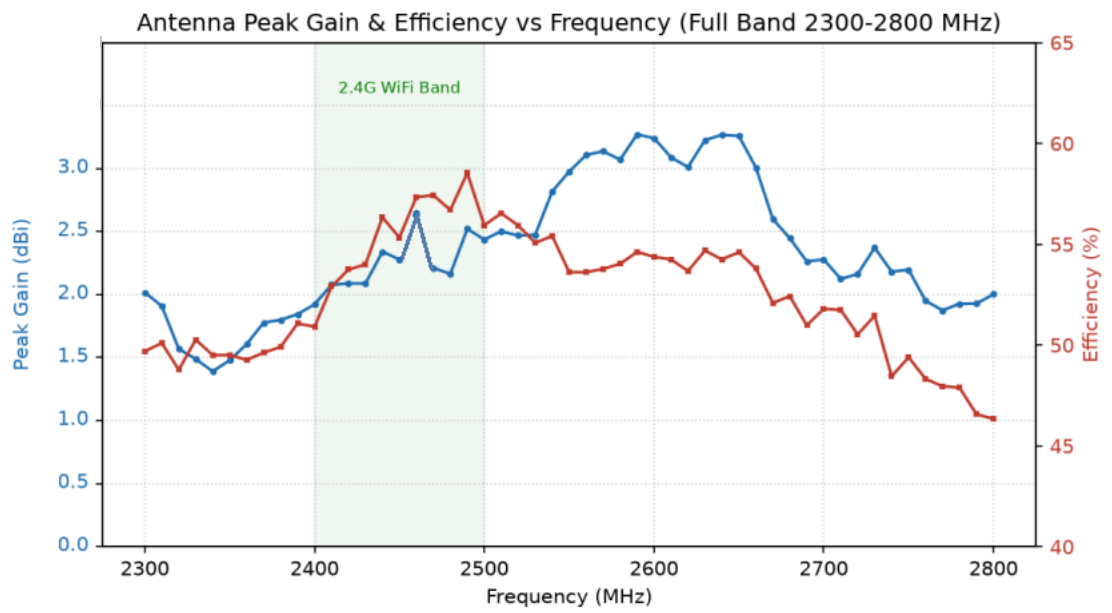


Figure 1 Peak Gain & Efficiency vs Frequency (2300-2800 MHz)

5. VSWR & Return Loss

The S11 of the antenna port was measured with a Keysight E5071C VNA. The table below gives the measured return loss at typical frequencies across 2300–2800 MHz and the corresponding VSWR. 2400, 2450, 2500 and 2522 MHz are VNA marker readings; other frequencies are typical values read from the S11 trace (Figure 3a).

Freq (MHz)	Return Loss (dB)	VSWR
2300	-5.0	3.57
2350	-7.0	2.61
2400	-17.36	1.31
2450	-27.69	1.09
2500	-24.49	1.13
2522	-22.59	1.16
2550	-12.0	1.67
2600	-8.0	2.32
2650	-7.0	2.61
2700	-7.5	2.46
2750	-8.0	2.32
2800	-7.0	2.61

Within the 2.4G WiFi operating band 2400–2500 MHz, return loss is better than -17 dB, corresponding to $VSWR \leq 1.31$, meeting the $VSWR \leq 2.0$ requirement. Across the full 2300–2800 MHz range, the antenna resonant frequency is near 2.45 GHz and VSWR rises at the band edges.

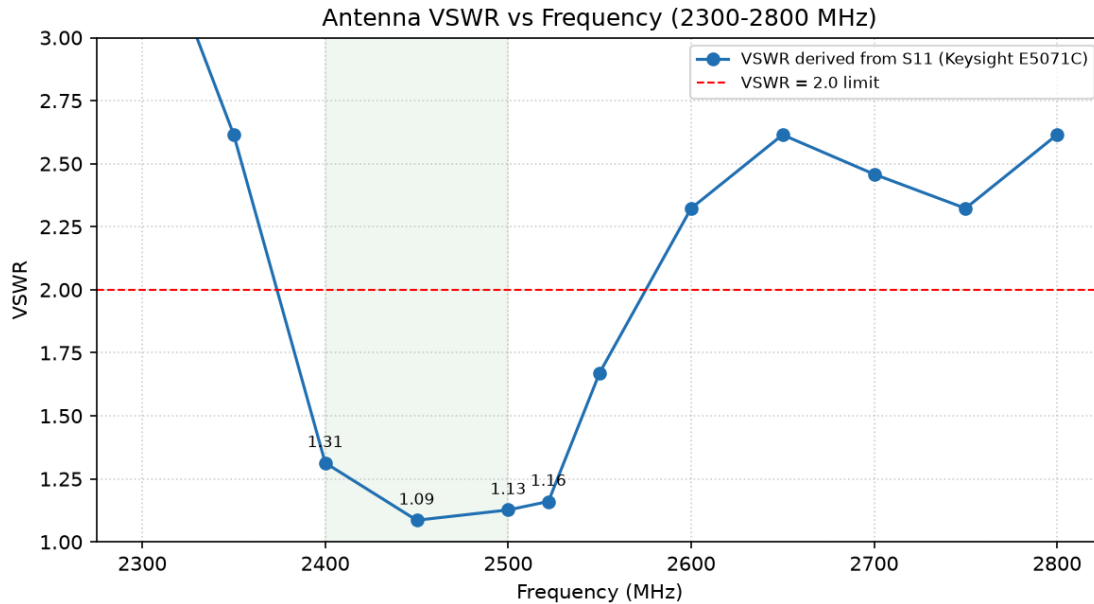


Figure 2 VSWR vs Frequency (2300-2800 MHz)

Measured S11 traces:

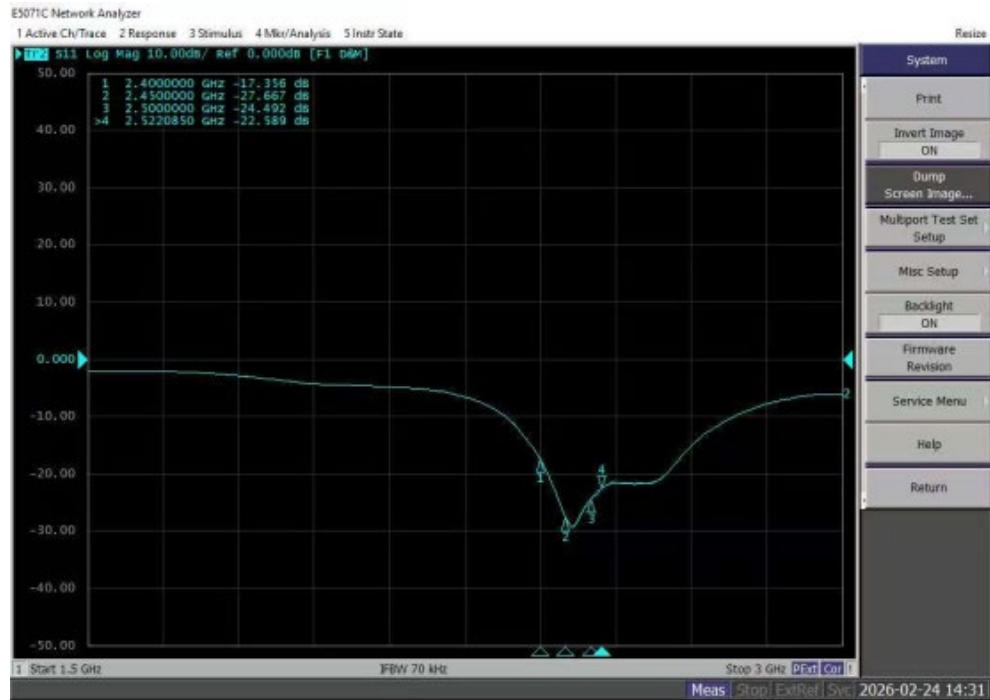


Figure 3a Return Loss (Log Mag)

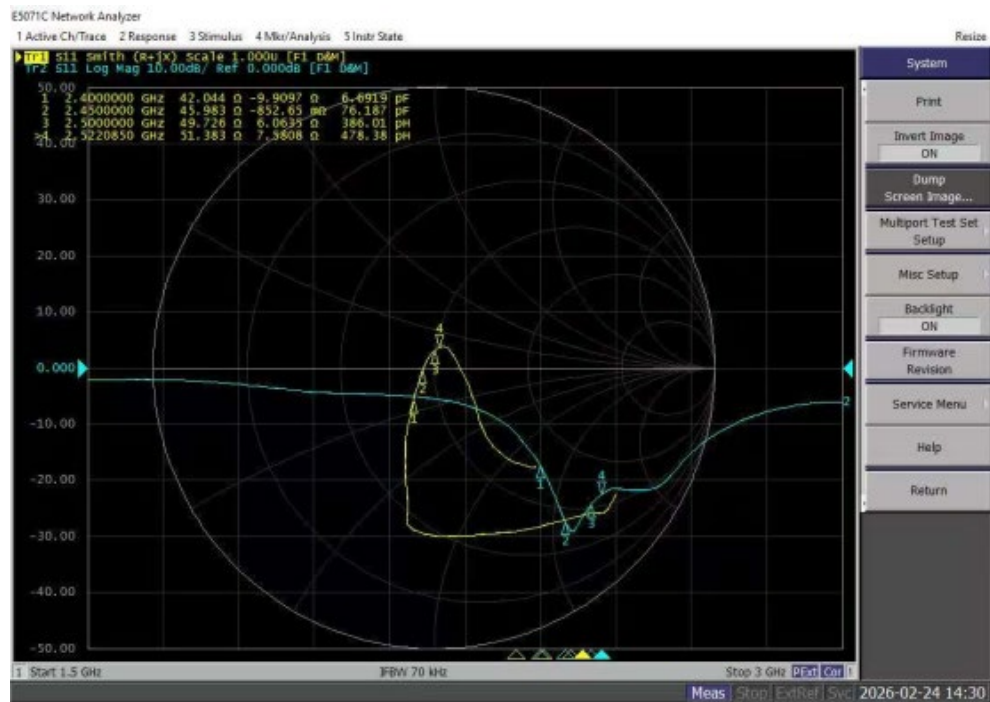


Figure 3b Smith Chart (1)

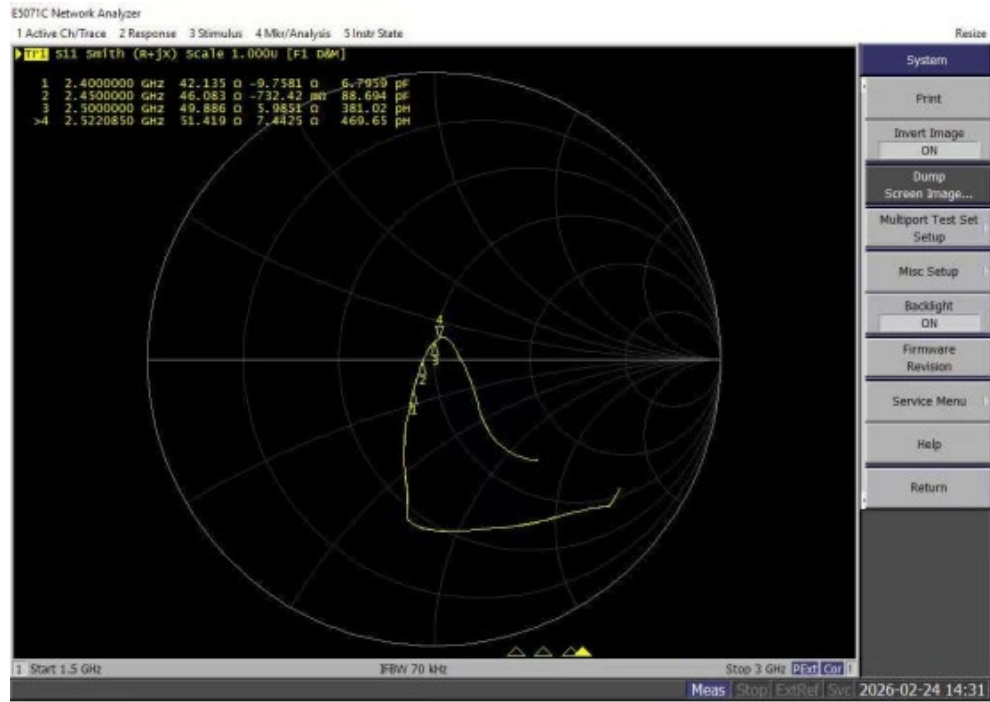
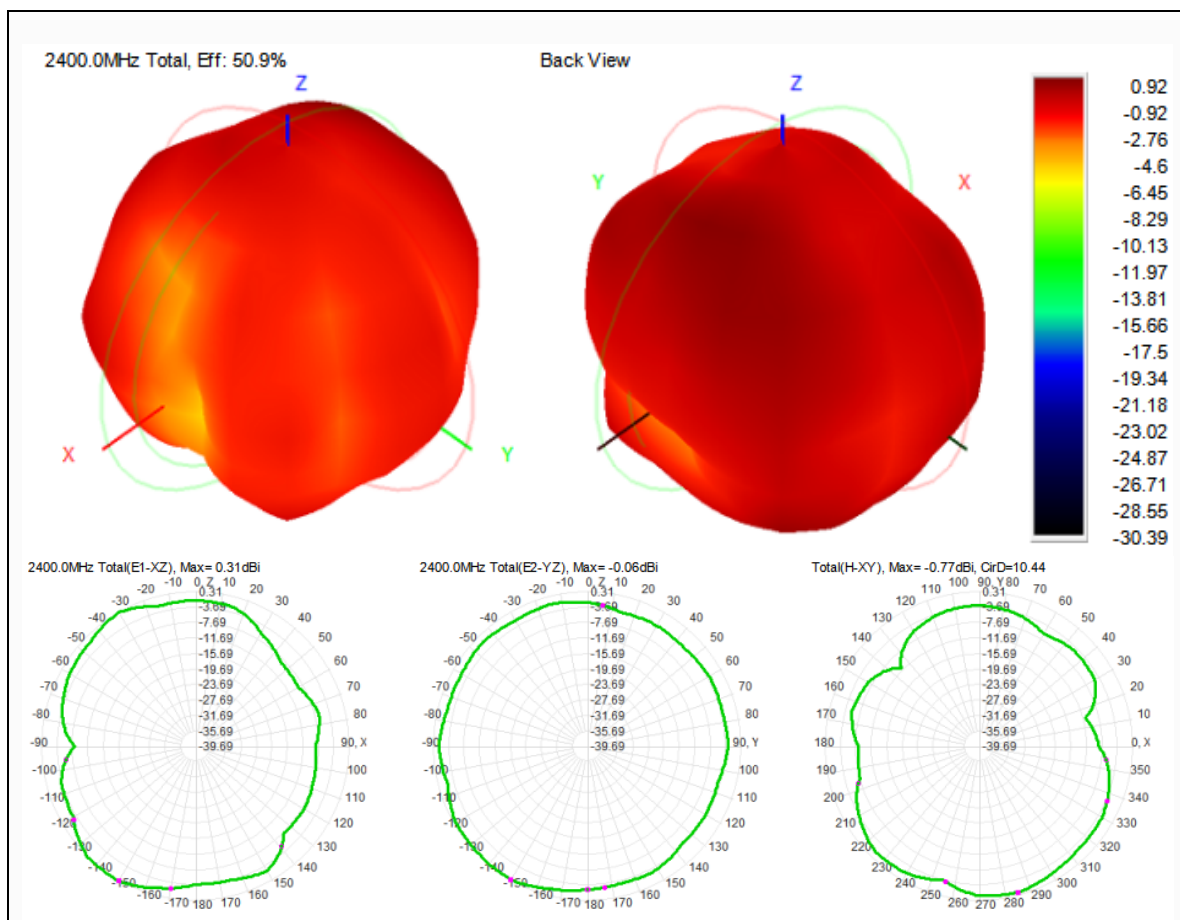


Figure 3c Smith Chart (2)

6. Radiation Pattern

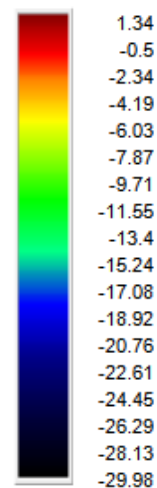
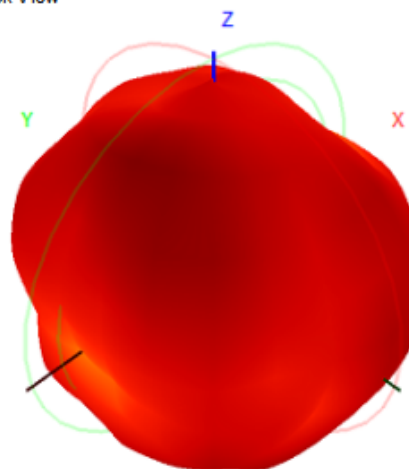
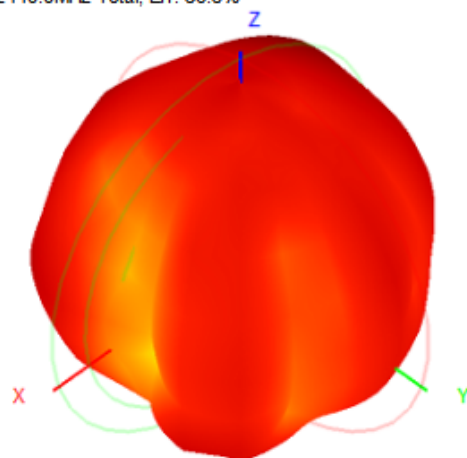
The antenna exhibits a near omni-directional pattern with directivity of about 3.8 dB. The table below lists the peak gain of the E1 (XZ) and E2 (YZ) cuts for each frequency across the 2400–2500 MHz band.

Freq (MHz)	E1 Cut (XZ) Max (dBi)	E2 Cut (YZ) Max (dBi)
2400	0.31	-0.06
2410	0.43	0.29
2420	0.57	0.52
2430	0.73	0.60
2440	1.03	0.69
2450	1.00	0.44
2460	1.12	0.34
2470	1.06	0.34
2480	0.93	0.55
2490	1.00	0.96
2500	0.88	0.97

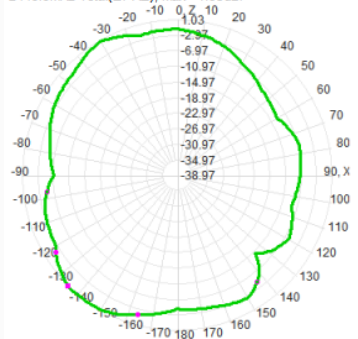


2440.0MHz Total, Eff: 56.3%

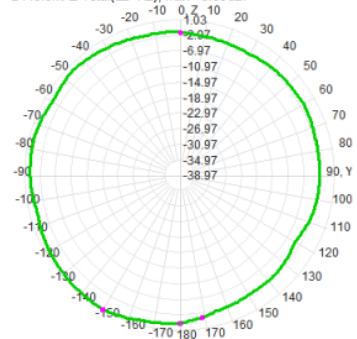
Back View



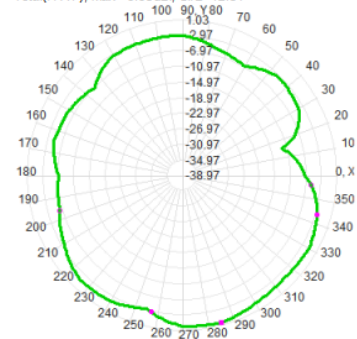
2440.0MHz Total(E1-XZ), Max= 1.03dBi



2440.0MHz Total(E2-YZ), Max= 0.69dBi

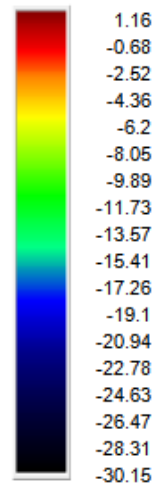
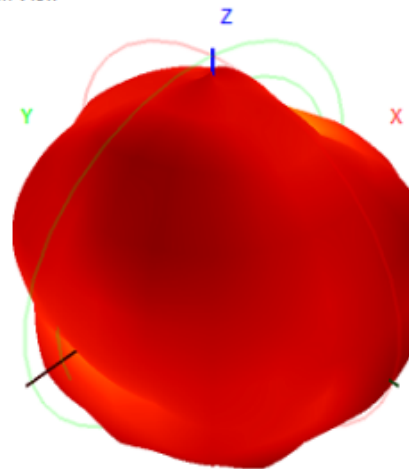
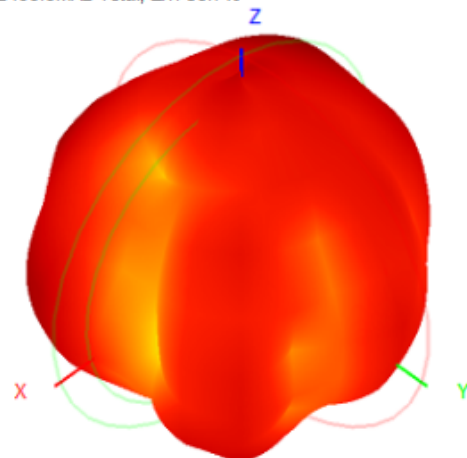


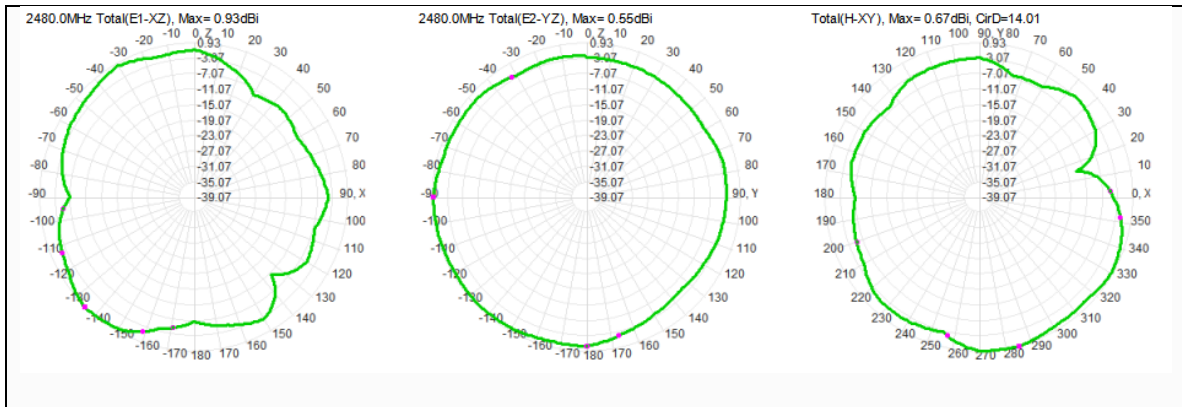
Total(H-XY), Max= 0.03dBi, CirD=12.51



2480.0MHz Total, Eff: 56.7%

Back View





7. Manufacturer Information

Design Company	Beijing InHand Networks Technology Co., Ltd.
Address	Beijing, China (refer to company registration)
Application	ODU302 wireless product 2.4 GHz WiFi

8. Test Information

Passive Test: Anechoic chamber (passive antenna measurement system)

VNA: Keysight E5071C Vector Network Analyzer

Setup: Frequency range 1.5–3.0 GHz, IFBW 70 kHz, port impedance 50 Ω

Note: If submitted as an Antenna Report, append the test laboratory name, address, accreditation number and test date.

— Data from measurement, for FCC certification —