

Product Specification Approval

6301 LDS Antenna + Bracket Assembly

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01

PRODUCT OVERVIEW

6301 LDS ANTENNA ASSEMBLY

Product Overview – Image



6301 LDS Antenna Assembly

This image displays the complete physical assembly of the 6301 LDS Antenna, which is seamlessly integrated onto its custom plastic bracket. The design showcases a compact and robust form factor suitable for modern wireless applications.



Key Identification: The marking "6301-TX" clearly indicates the transmit section of the antenna module, a critical identifier for functional verification and assembly.

Product Overview – Introduction

PRODUCT NAME **6301 LDS Antenna + Bracket Assembly**

OFFICIAL SPECIFICATION

This document serves as the official specification approval for the 6301 LDS (Laser Direct Structuring) Antenna assembly. LDS technology enables the creation of highly precise, three-dimensional antenna structures directly onto molded plastic components, offering excellent RF performance and superior design flexibility.



Core Technology: LDS Process

Laser Direct Structuring enables high-precision, 3D conductive patterns directly on molded plastic substrates.



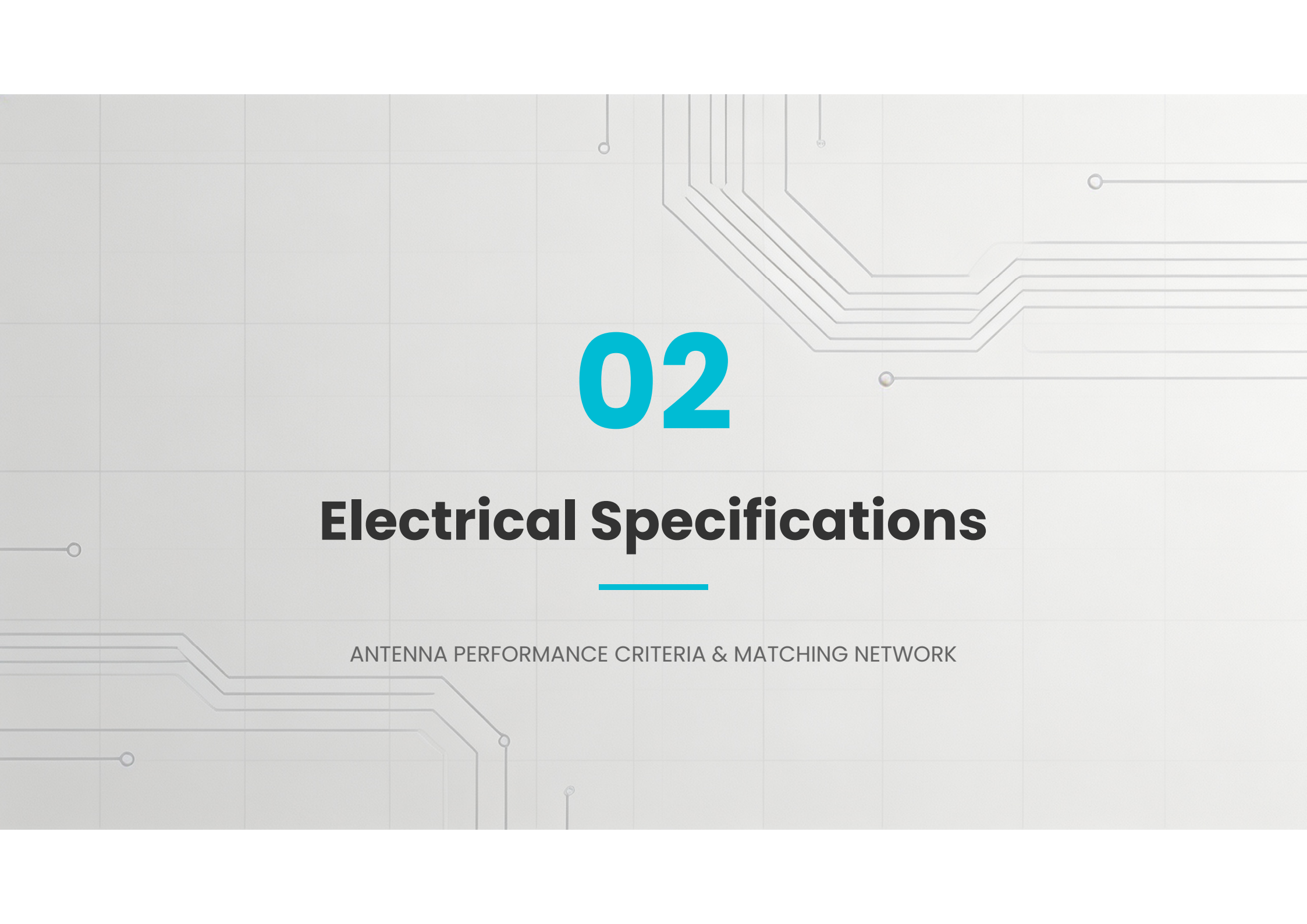
Integrated Form Factor

Seamless integration of the antenna element and mechanical bracket into a single, compact module.



Target Application: BT 2.4GHz

Optimized for Bluetooth (BT) wireless communication within the globally available 2.4GHz ISM band.



02

Electrical Specifications

ANTENNA PERFORMANCE CRITERIA & MATCHING NETWORK

Electrical Specifications – Frequency Band & VSWR

PERFORMANCE TARGETS FOR MASS PRODUCTION

The following criteria define the Voltage Standing Wave Ratio (VSWR) performance for the 6301 antenna, measured across the specified Bluetooth frequency spectrum to ensure production quality.



Operating Band

BT 2.4 GHz

Range: 2400 – 2500 MHz



VSWR (Transmit)

≤ 3.0

Max Limit for TX Path



VSWR (Receive)

≤ 3.0

Max Limit for RX Path



KEY NOTE: VSWR quantifies impedance matching between the antenna and transmission line. A value ≤ 3.0 confirms a high-quality match, which is critical for maximizing power transfer efficiency and minimizing signal reflection loss in the final product.

Electrical Specifications – Matching Circuit



Antenna Matching Network

The antenna is tuned using a compact matching circuit located directly on the main PCB. This configuration ensures optimal signal reception and transmission.



Key Component Values

E1: TBD

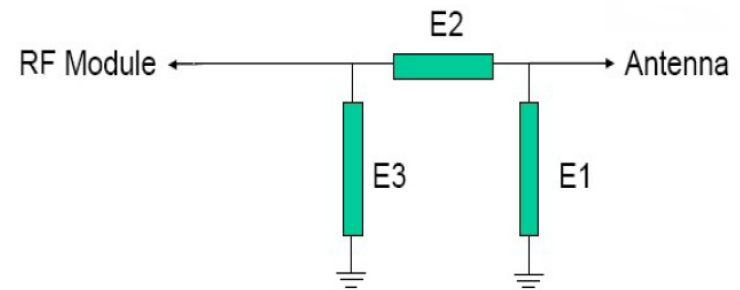
E2: 0 Ohm

E3: TBD



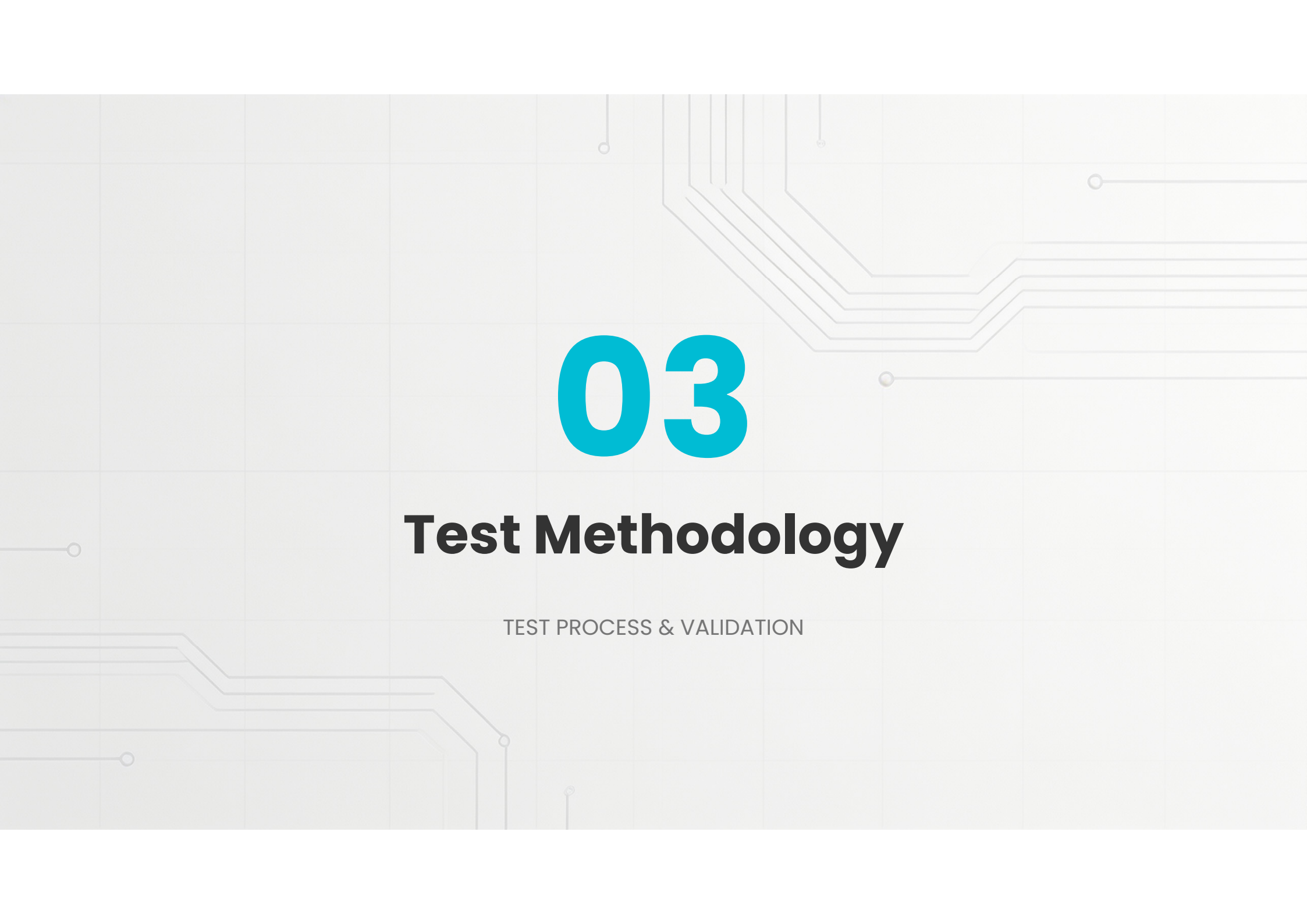
Impedance Transformation

Designed to transform the antenna's impedance to 50 Ohms at 2.4 GHz, optimizing power transfer from the RF Module. E2 acts as a direct connection in this setup.



Schematic Overview

The diagram illustrates the connection path from the RF Module to the Antenna, with E2 (0Ω) forming the central link and E1/E3 providing reactive tuning elements.



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Test Methodology

TEST PROCESS & VALIDATION

Test Methodology – Passive Test Setup

OBJECTIVE

To accurately measure the passive intrinsic parameters of the antenna with high precision, eliminating external signal interferences.

METHODOLOGY

A dedicated 50-ohm coaxial test fixture is connected to the PCB test point (after the matching circuit, before the RF port). The SMA-terminated end interfaces with lab equipment for calibrated S-parameter measurement.

SETUP CONFIGURATION



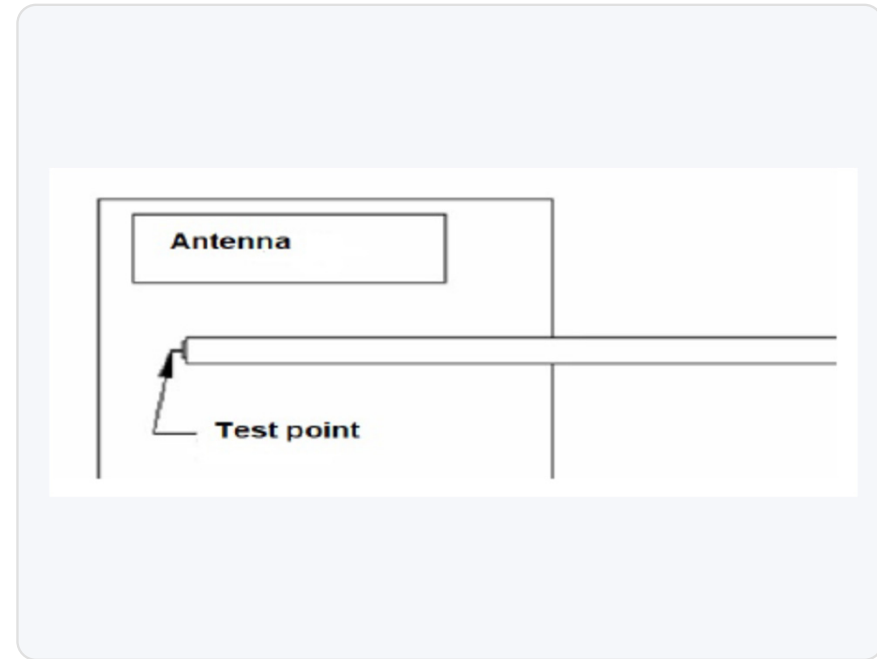
Test Point: Signal tapped post-antenna matching components on PCB.



Cabling: Low-loss 50Ω rigid coaxial cable minimizes signal loss.



Connector: SMA connector ensures reliable interface to Network Analyzer.



SCHEMATIC DIAGRAM

Test Methodology – S11 / VSWR Test Procedure

Test Equipment & Connection Flow

E5071B
Analyzer



50Ω
Coaxial Cable



Test
Fixture

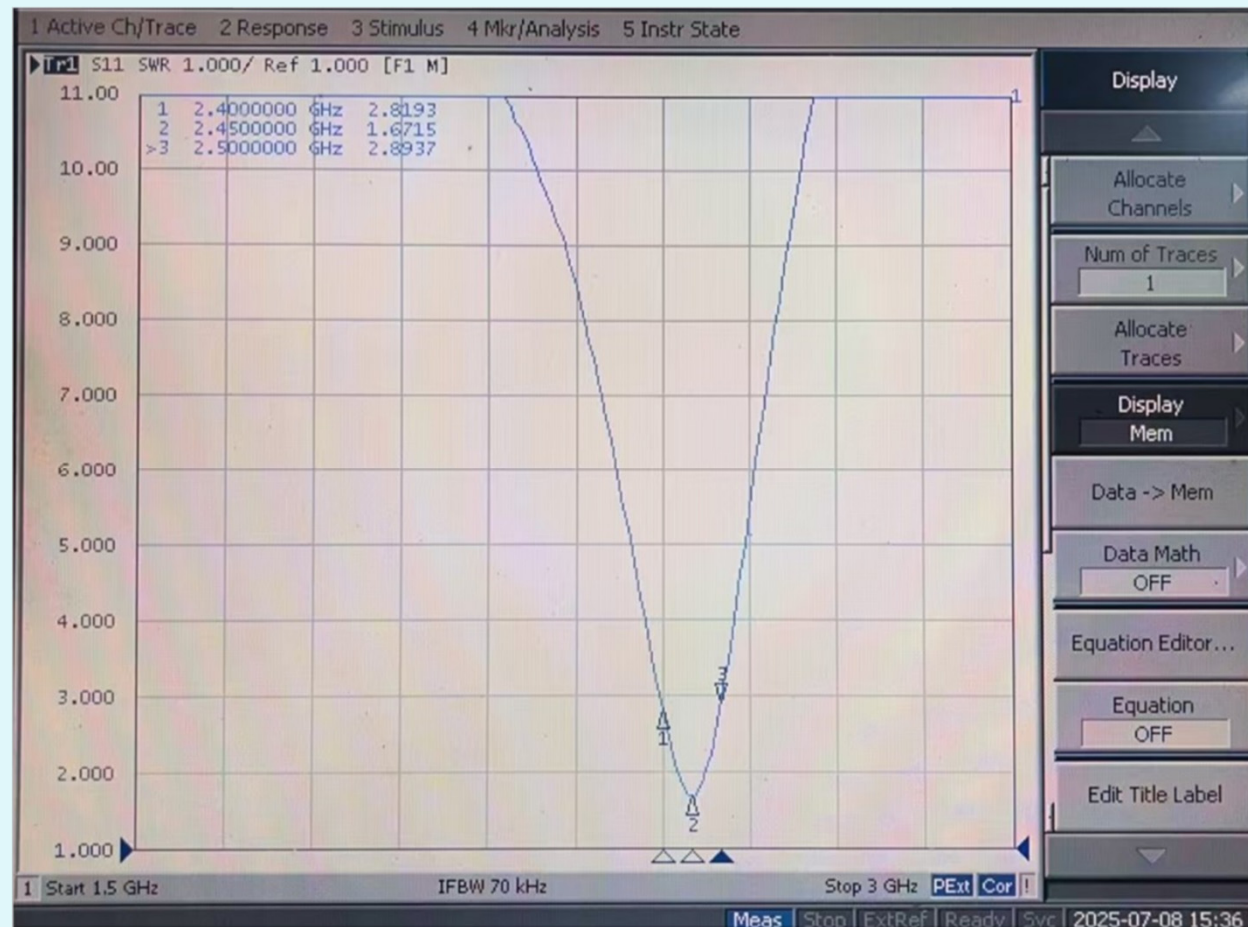
Test Fixture Preparation Steps

- 01** Route a rigid cable from the phone's PCB 50Ω test point to an SMA-J connector.
- 02** Connect the SMA-J to a copper tube with a choke coil to minimize external EMI.



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Test Methodology – S11 / VSWR Test Procedure





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TEST RESULTS

PERFORMANCE DATA ANALYSIS

Test Results – Passive Parameters

Measured Passive Performance (2.4GHz Band)

Freq (MHz)	Gain (dBi)	Eff (dB)	Eff (%)
2400	-2.52	-5.98	26.12
2410	-2.16	-5.67	27.87
2420	-1.71	-5.22	30.73
2450	-1.38	-4.74	34.06
2460	-1.34	-4.74	34.09
2480	-2.11	-5.49	28.97
2500	-2.83	-6.28	24.51



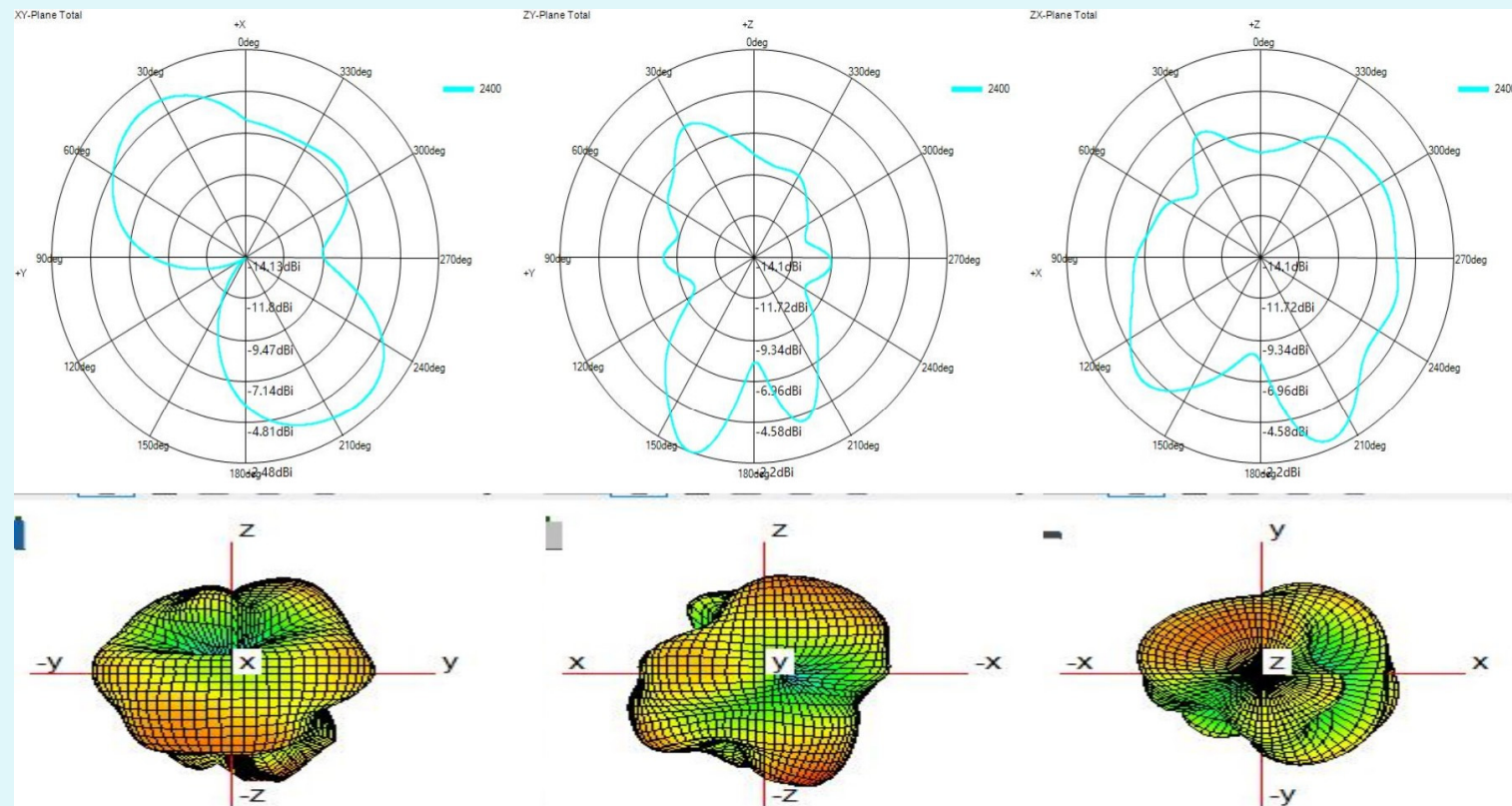
Key Performance Insight

PEAK EFFICIENCY ACHIEVED

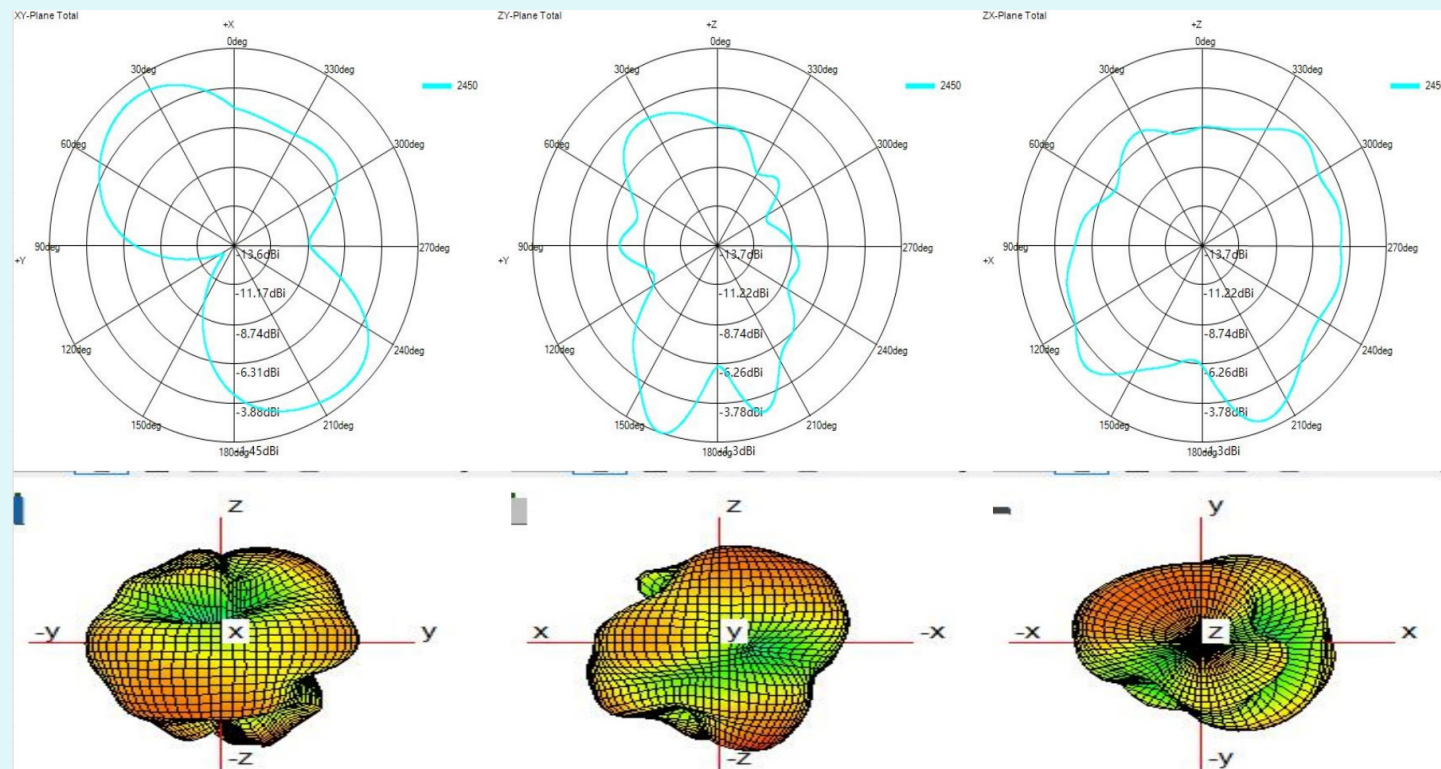
34% @ 2450 MHz

The antenna is optimally tuned for the Bluetooth band, achieving its highest efficiency at the center frequency. The corresponding gain at this peak is **-1.38 dBi**, confirming excellent passive performance.

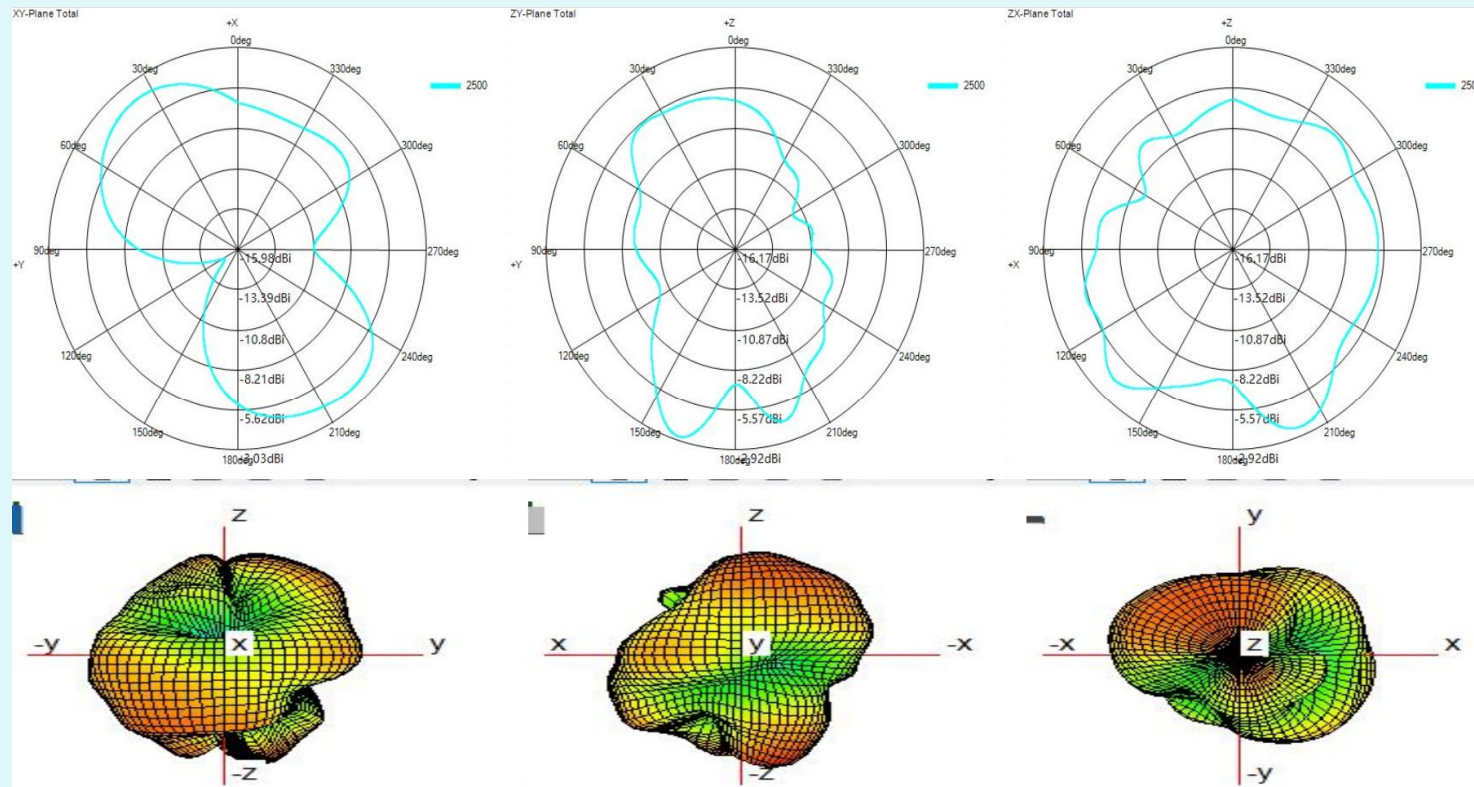
Test Results – Radiation Pattern



Test Results – Radiation Pattern



Test Results – Radiation Pattern



Test Results – Active Parameters

Measured Active Performance (System-Level)

The following data presents active test results across different Bluetooth channels for two devices (BT-4# & BT-5#). Values represent real-world signal performance metrics in a live testing environment.

Device ID	Channel	Reading	Channel	Reading	Chnl	Rd
BT-4#	CH0	6.19 / -90.2	CH78	6.45 / -91.1	-	-
BT-5#	CH0	6.35 / -91.2	-	6.78 / -91.0	-	-
BT-4#	CH39	7.01 / -90.1	CH78	6.47 / -90.9	-	-
BT-5#	CH0	- / -91.1	-	6.84 / -	CH39	-90.9



Data Interpretation

The negative values represent theRSSI (**Received Signal Strength Indicator**). A value closer to zero indicates a stronger signal. Results show**consistent & strong**signal reception across all tested channels and devices in the live environment.

KEY TAKEAWAY: The system demonstrates robust antenna integration with stable performance across varied Bluetooth spectrums.

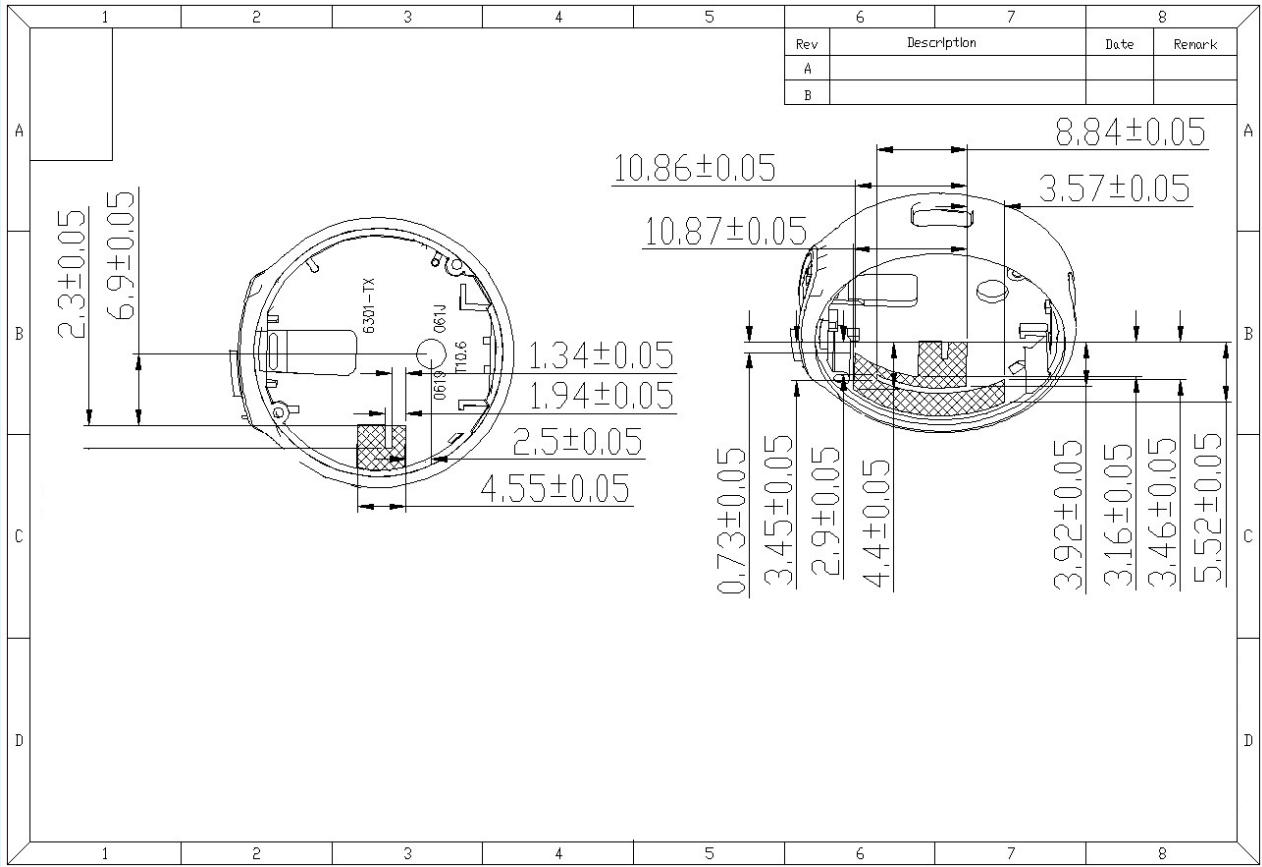


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Mechanical Specifications

PRECISION ENGINEERING & TOLERANCE CONTROL

Mechanical Specifications – Drawing & Dimensions



Mechanical Specifications – Technical Requirements

MANUFACTURING & MATERIAL SPECIFICATIONS



Dimension Compliance

Dimensions marked with "*" are critical and must be strictly adhered to for product integrity.



LDS Surface Quality Standard

Surface must be free of scratches, cracks, blisters, or whitening to ensure electrical performance.



Unmarked Dimensions Tolerance

Default tolerance for all unmarked linear dimensions across the part is set to $\pm 0.20\text{mm}$.



Electroplating Layer Thickness

Cu: $8\text{--}12\text{ }\mu\text{m}$ • Ni: $2\text{--}4\text{ }\mu\text{m}$ • Au: $0.05\text{--}0.1\text{ }\mu\text{m}$
All plating must meet adhesion and corrosion resistance standards.



Positioning Tolerance

Precise location control: The tolerance for all positioning dimensions is specified as $\pm 0.10\text{mm}$.



Material Compliance

All raw materials must fully comply with the latest RoHS directive.

