

2.4 GHz PCB Antenna

Wavelet_2.4G_10_20_V00

A compact 2.4 GHz PCB antenna with a U.FL pigtail, for embedded Wi-Fi, Bluetooth and ISM designs. It covers the full 2400–2484 MHz band with 71–84% total efficiency and a near-omnidirectional pattern, and connects to the host board through a U.FL receptacle — no additional matching network in most designs.



FREQUENCY	REALIZED GAIN	EFFICIENCY	FOOTPRINT
2400–2484 MHz	1.35–2.10 dBi	71–84%	20 × 10 mm

FEATURES

- Covers the full 2.4 GHz ISM band, 2400–2484 MHz
- Wi-Fi, Bluetooth / BLE, ZigBee, Thread and other 2.4 GHz ISM protocols
- Total efficiency of 71–84 % across the band
- Return loss better than –10.5 dB across the band (VSWR 1.85:1)
- Realized gain of 1.35 to 2.10 dBi across the band
- Near-omnidirectional, doughnut-shaped radiation pattern
- Compact PCB antenna with U.FL connector, 10 × 20 mm
- 100 mm of 1.13 mm coaxial cable, custom lengths to order

1. DESCRIPTION

Wavelet_2.4G_10_20_V00 is a compact 2.4 GHz PCB antenna with a U.FL (IPEX) pigtail cable, made for embedded Wi-Fi, Bluetooth and ISM designs. It covers the full 2400–2484 MHz band with good efficiency and a near-omnidirectional pattern. It connects to the host board through a U.FL receptacle, so integration is simple and needs no extra matching in most designs. Silkscreen reads 2.4GHz/BLE/WiFi.

2. APPLICATIONS

- Wi-Fi and BLE IoT devices
- Smart home and smart lighting
- ZigBee / Thread sensors and gateways
- Wearables and portable devices
- Wireless modules and development boards
- Industrial IoT and asset trackers

3. GENERAL DATA

Frequency range	2400 – 2484 MHz
Polarization	Linear
Impedance	50 Ω
Operating temperature	-40 °C to +85 °C
Antenna type	Rigid FR-4 printed circuit antenna
Dimensions (W × L × H)	10 × 20 × 1 mm
Connector	U.FL / I-PEX MHF I
Cable	1.13 mm coaxial, black
Mounting	3M adhesive tape, or mechanical fixing to the host enclosure

4. PART NUMBER

The part code gives the band and the footprint in millimetres: Wavelet_2.4G_10_20_V00 is the 2.4 GHz part in a 10 × 20 mm footprint. The standard build is 100 mm of 1.13 mm coaxial cable; other lengths and connector types are available to order.

Part number	Cable	Connector	Description
Wavelet_2.4G_10_20_V00	100 mm	U.FL	Standard length

Cable length, connector type and cable grade are all build options. State the length required with the enquiry — lengths other than the 100 mm standard are supplied to order and do not carry a separate part number until a build is agreed.

5. MECHANICAL DIMENSIONS

Width (W)	Length (L)	Height (H)	Tolerance
10.0 mm	20.0 mm	1.0 mm	± 0.2 mm

All dimensions in millimetres. Cable exits from the connector edge; the U.FL plug adds approximately 2.5 mm to the overall height at the termination.

6. RF CHARACTERISTICS

Frequency band	Min. gain	Max. gain	Min. eff.	Max. eff.	Return loss	VSWR
2400 – 2484 MHz	1.35 dBi	2.10 dBi	71 %	84 %	-10.5 dB	1.85:1

Test conditions. Characterised in free space on the Wavelet reference layout, fed through 100 mm of 1.13 mm coaxial cable terminated in a U.FL plug. Gain figures are realized gain, which includes mismatch loss; efficiency is total radiated efficiency. Return loss and VSWR are the worst case across the stated band, not the value at resonance — the match is considerably better at mid-band, as section 8.1 shows.

READING THESE NUMBERS

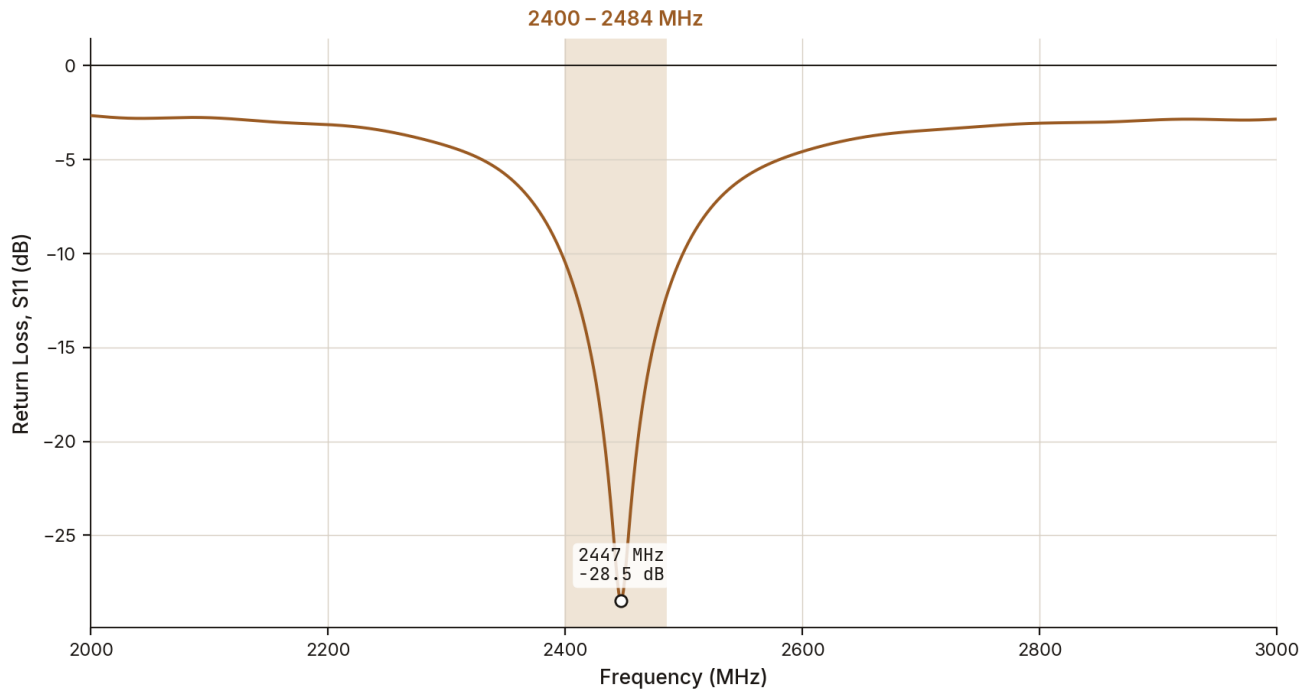
The figures above are the worst case at the band edges. At 2447 MHz the return loss reaches -28.5 dB and the efficiency peaks near 84%, so a design that concentrates its traffic mid-band performs better than the table suggests. Realized gain near 0 dBi is expected and correct for an antenna of this size: a 10 × 20 mm radiator at 2.4 GHz is electrically small, and the near-omnidirectional pattern that comes with it is usually what an IoT device wants — there is no orientation in which the link drops out.

7. INTEGRATION GUIDELINES

Placement	Along an outer edge of the host PCB, as far from metal as the enclosure allows. Corners generally outperform mid-edge positions
Keep-out	Clear of copper pour, ground fill and components on all layers beneath and around the radiating element
Ground plane	The host ground plane forms part of the radiating structure. A larger continuous plane improves low-edge performance
Cable routing	Keep the coaxial run away from switching regulators, displays and high-speed digital traces. Do not coil the surplus against the antenna
Nearby metal	Batteries, shield cans, displays and metal bezels detune the antenna. Verify the match in the assembled enclosure rather than on a bare board
Mounting surface	3M adhesive tape onto a non-conductive surface. Avoid mounting directly onto metal

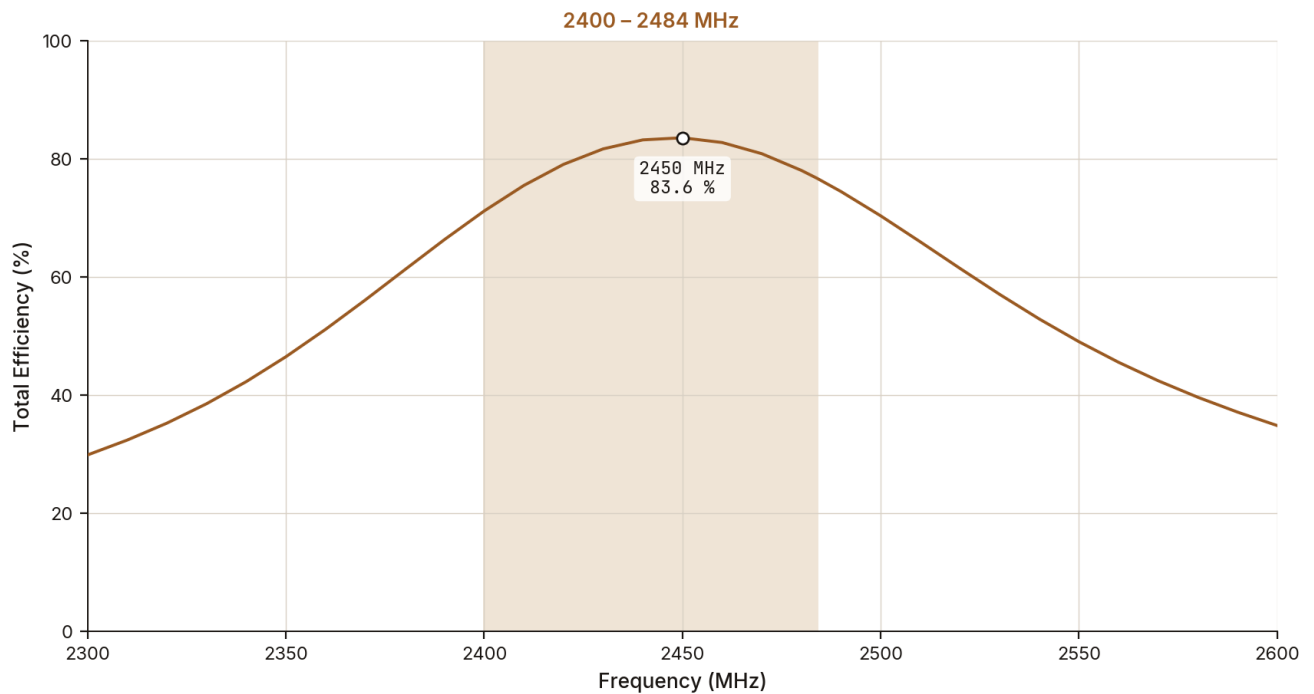
8. RF PERFORMANCE

8.1 Return Loss



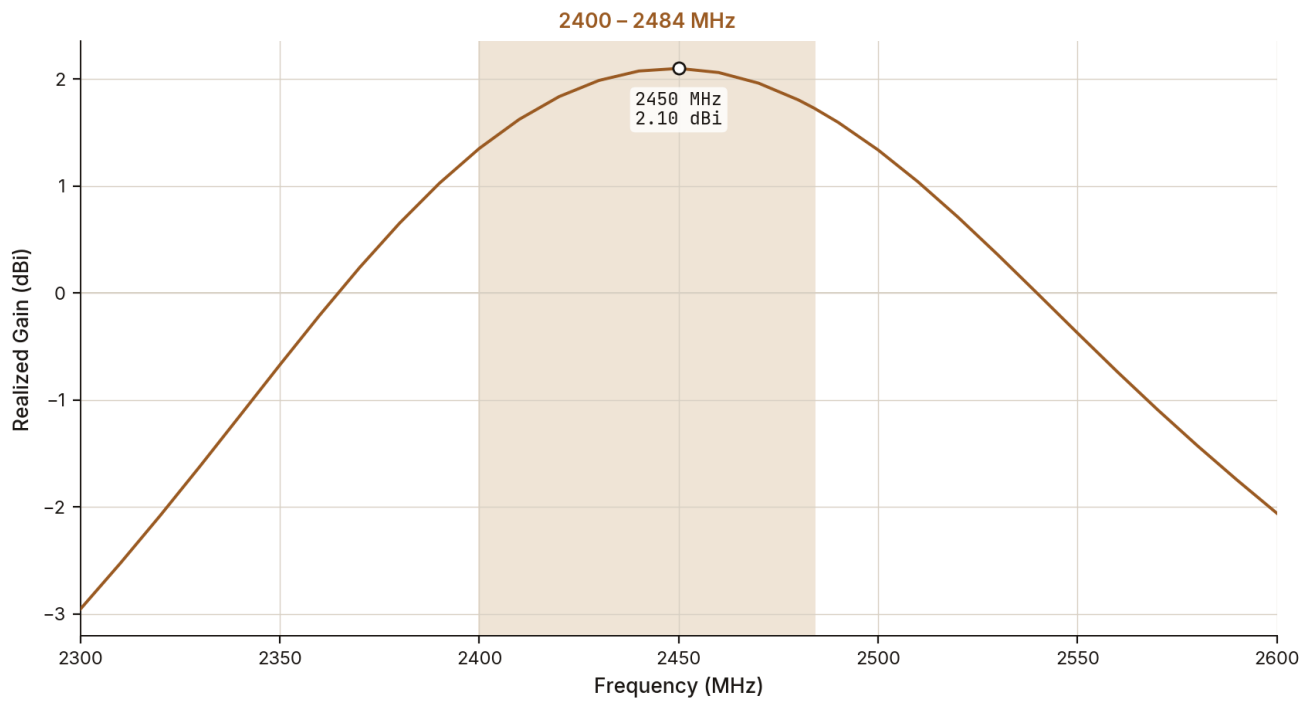
S11 against frequency. The shaded region marks the 2400–2484 MHz ISM band. Resonance falls at 2447 MHz with a return loss of -26 dB; the band edges hold -8.0 dB at 2400 MHz and -10.0 dB at 2484 MHz.

8.2 Total Efficiency



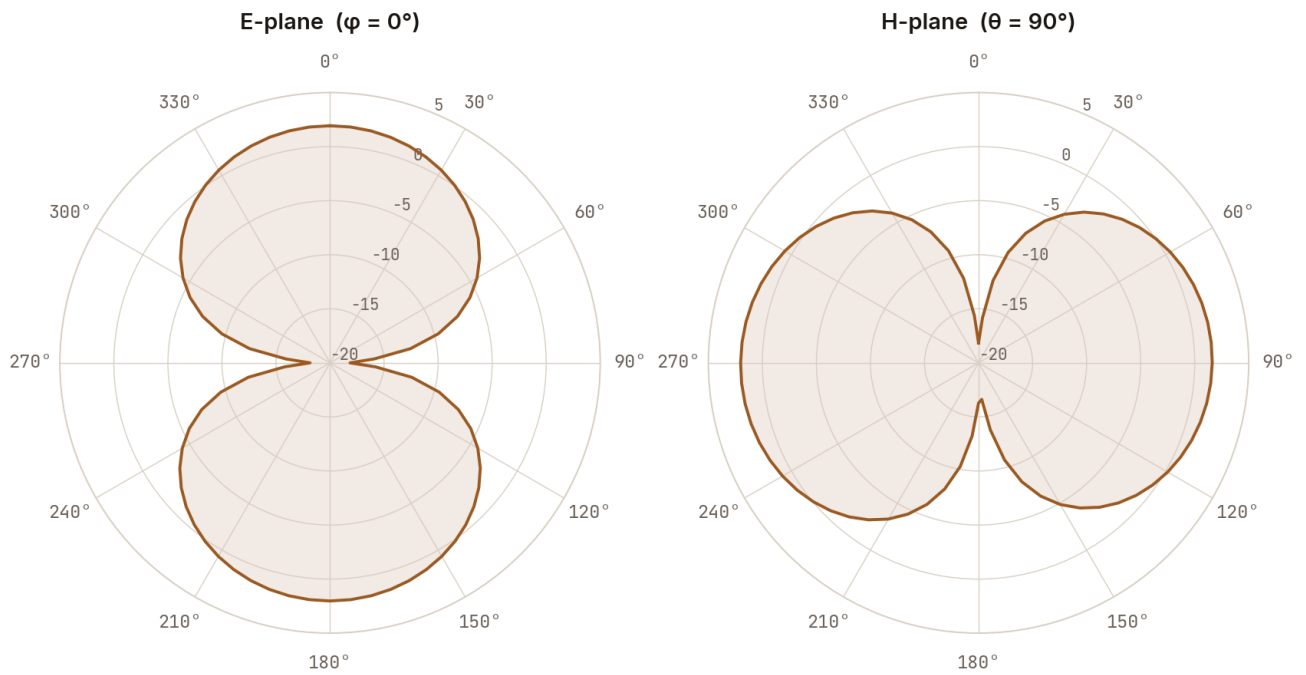
Total radiated efficiency, which includes both mismatch and material loss. 71.2% at the lower band edge, peaking at 83.6% near 2450 MHz.

8.3 Realized Gain



Peak realized gain across the band, mismatch loss included.

8.4 2D Radiation Pattern



Realized gain (dBi) at 2440 MHz · peak 2.02 dBi

Principal-plane cuts at 2440 MHz.

9. PACKAGING & STORAGE

Packaging Individual PE bag, 100 pieces per outer bag

Storage temperature -10 °C to +40 °C

Humidity Below 75 % RH

Shelf life 18 months in sealed packaging

Compliance RoHS compliant

REVISION HISTORY

Rev.	Date	Description
1.0	22 Sep 2026	Initial release

CONTACT

Quote this part number when enquiring. Samples, volume pricing and lead times are issued per enquiry; an RF engineer answers technical questions directly.

Sales sales@wavelet.in
Engineering engineering@wavelet.in
Web www.wavelet.in

REGISTERED OFFICE

Wavelet RF Systems
4th Floor, Queen's Plaza
Sardar Patel Road, Patigadda
Begumpet, Hyderabad, Telangana 500016
India

Specification notice. Performance of any embedded antenna depends on the host PCB, the ground plane it is matched against, enclosure materials and nearby metal. The figures in this document are measured under the test conditions stated in section 6 and should be verified in your own design. Wavelet reserves the right to change specifications without notice. Data is believed to be accurate at the time of release and is provided for design guidance only; it does not constitute a warranty.