

Antenna Datasheet

Product: H2411 Remote & Controller **Antenna:**
Integrated PCB Trace Monopole

1. Manufacturer Information

- **Manufacturer:** Glen Dimplex Americas
 - **Address:** 1367 Industrial Rd, Cambridge, ON N3H 4W3, CANADA
 - **Project Name:** H2411 (Remote & Power Board Controller)
 - **Antenna Model ID (internal):** H2411-ANT-01
-

2. Antenna Description

- **Antenna Type:** Integrated PCB trace monopole (“tilted whip” L-shape)
- **Electrical Type:** Quarter-wave monopole above ground plane
- **Frequency Band:** 2.400–2.4835 GHz ISM (BLE / 2.4 GHz)
- **Radio IC:** Nordic Semiconductor nRF52832
- **Location:**
 - Antenna copper is routed around the perimeter of the PCB (top side), forming an L-shape trace labeled “ANT”.
 - Ground is cleared underneath the antenna region; RF feed is via a 50 Ω microstrip from the nRF52832 with a PI matching network.
- **Integration:**
 - The antenna is **etched directly on the main PCB**.
 - There is **no RF connector and no external antenna**; the antenna is **non-removable** and cannot be replaced by the user.

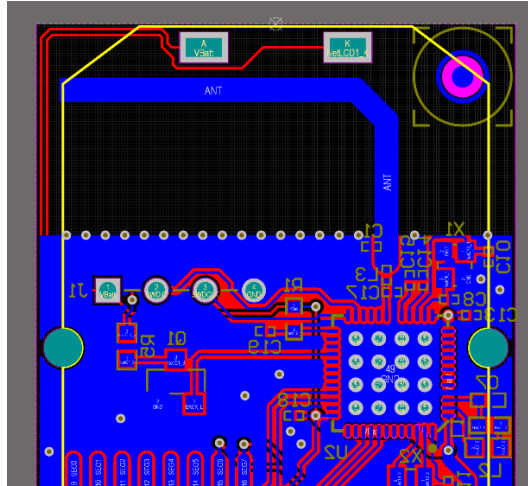


Figure 1 – H2411 Remote PCB, top view with integrated L-shaped PCB antenna

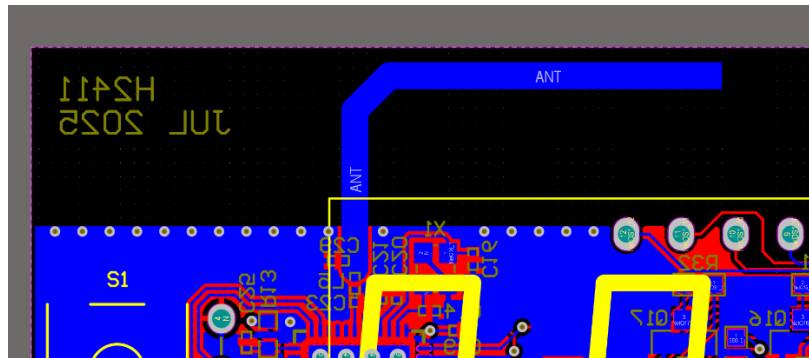


Figure 2 – H2411 Controller/Power Board PCB, top view with integrated L-shaped PCB antenna

3. Mechanical / Layout Summary

- **PCB material:** FR-4, thickness 1.6 mm
 - **Copper thickness:** 35 μm
 - **Antenna trace width:** 1.27mm (single layer)
 - **Total antenna electrical length:** $\approx \frac{1}{4} \lambda$ at 2.44 GHz (bent L-shape)
 - **Ground clearance below antenna:** full keep-out on top layer under the antenna, with ground plane starting at the “feed” end of the trace.
-

4. Electrical Performance

The H2411 antenna is a **printed quarter-wave monopole**

Because the basic geometry and operating conditions match (FR-4, 1.6 mm, 2.4 GHz ISM band), the application note's measured/simulated results are representative for this design.

4.1 Impedance and Matching

- **Nominal impedance:** 50 Ω at the feed (with PI matching network).
- **Matching network:** 3-element PI network (series inductor / shunt capacitors) between radio output and antenna feed pad.
- **Typical S11 / return loss:**
 - For a comparable 2.4 GHz IFA / meander monopole on FR-4, AN2731 shows:
 - S11(2.40 GHz) $\approx$ **-10.5 dB** (measured IFA)
 - Simulated monopole/meander example: S11 in the **-4 to -5 dB** range across 2.35–2.51 GHz, with tuning around 2.40 GHz.

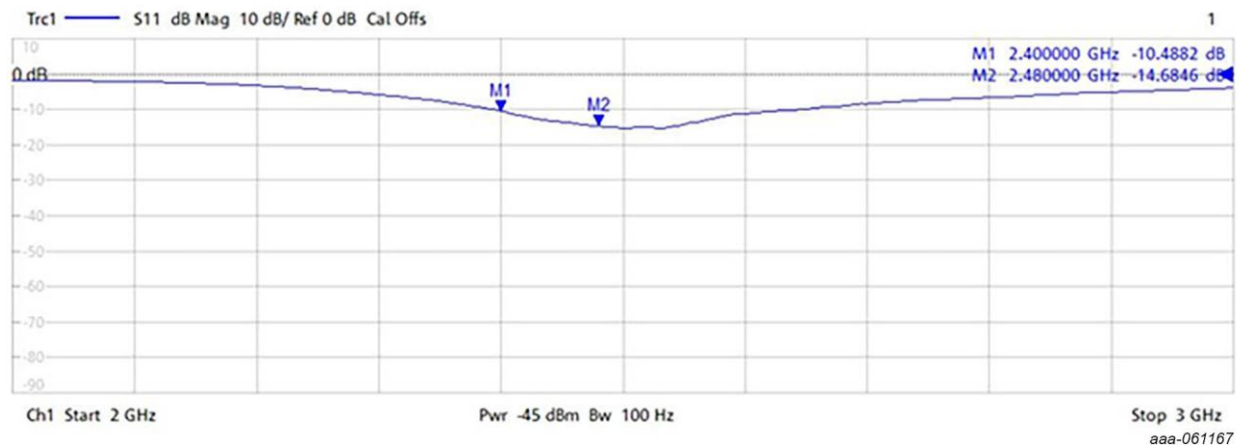


Figure 3 – Reflection coefficient S11

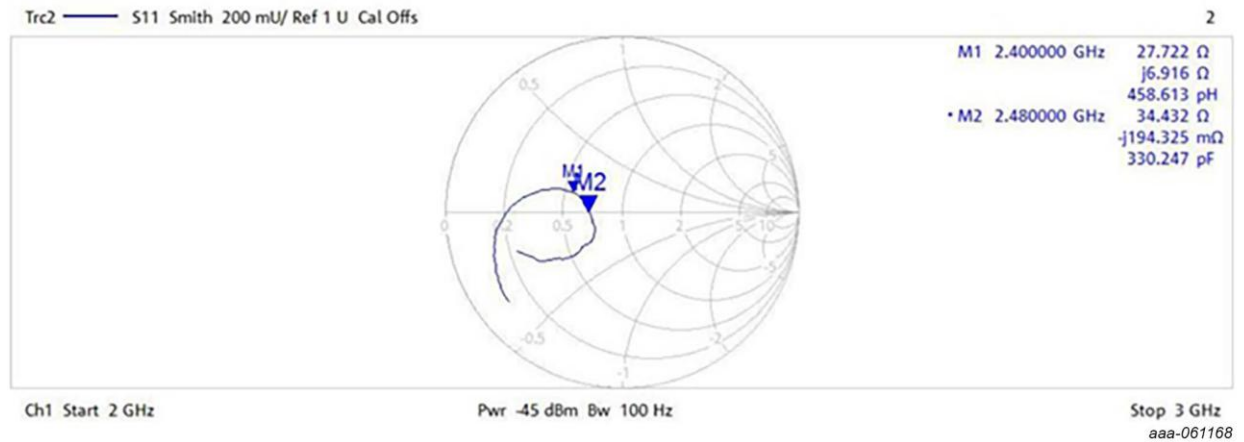


Figure 4 – S11 Smith chart

Typical S11 and impedance characteristics for a 2.4 GHz PCB monopole antenna on FR-4, used as representative data for the H2411 PCB antenna.

Final tuned impedance: approximately 50 Ω at 2.44 GHz after matching.

4.2 Gain and Radiation Pattern

- For PCB IFA on the FRDM board (measured):
 - **Maximum gain:** approximately **0 dBi** for both horizontal and vertical polarizations.
- For 2.4 GHz meander monopole simulation:
 - **Maximum gain:** $\approx +1.2$ dBi at $\theta \approx 13^\circ$
 - Radiation efficiency at 2.4 GHz: $\approx 87\%$

Given that the H2411 antenna is a bent quarter-wave PCB monopole driven by a low-power BLE radio, a **conservative and realistic value** is:

- **Declared typical peak gain:** **+1.0 dBi**
- **Gain range (production variation):** -1.0 to +1.5 dBi

2400MHz

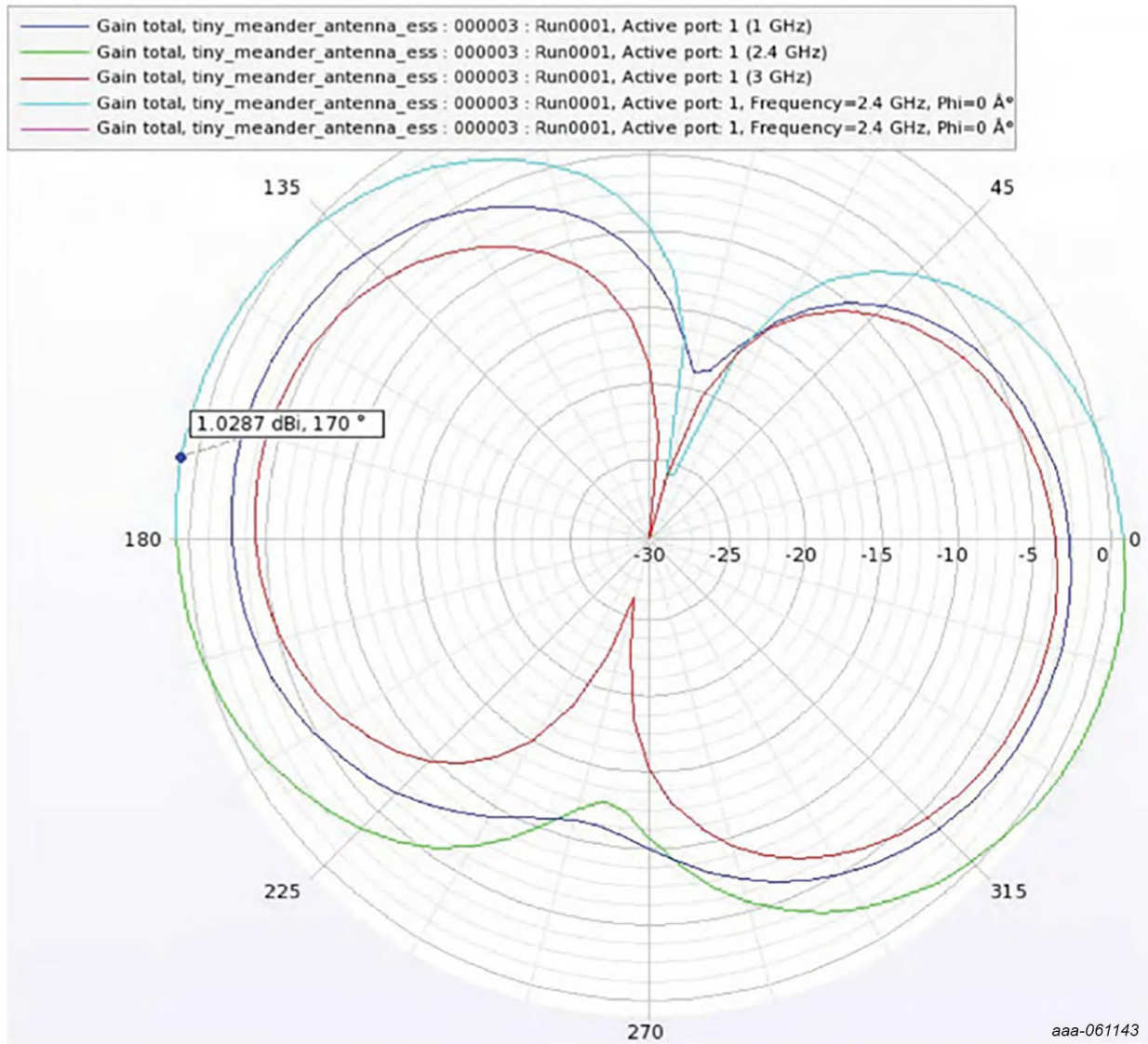


Figure 5 – Gain in θ direction

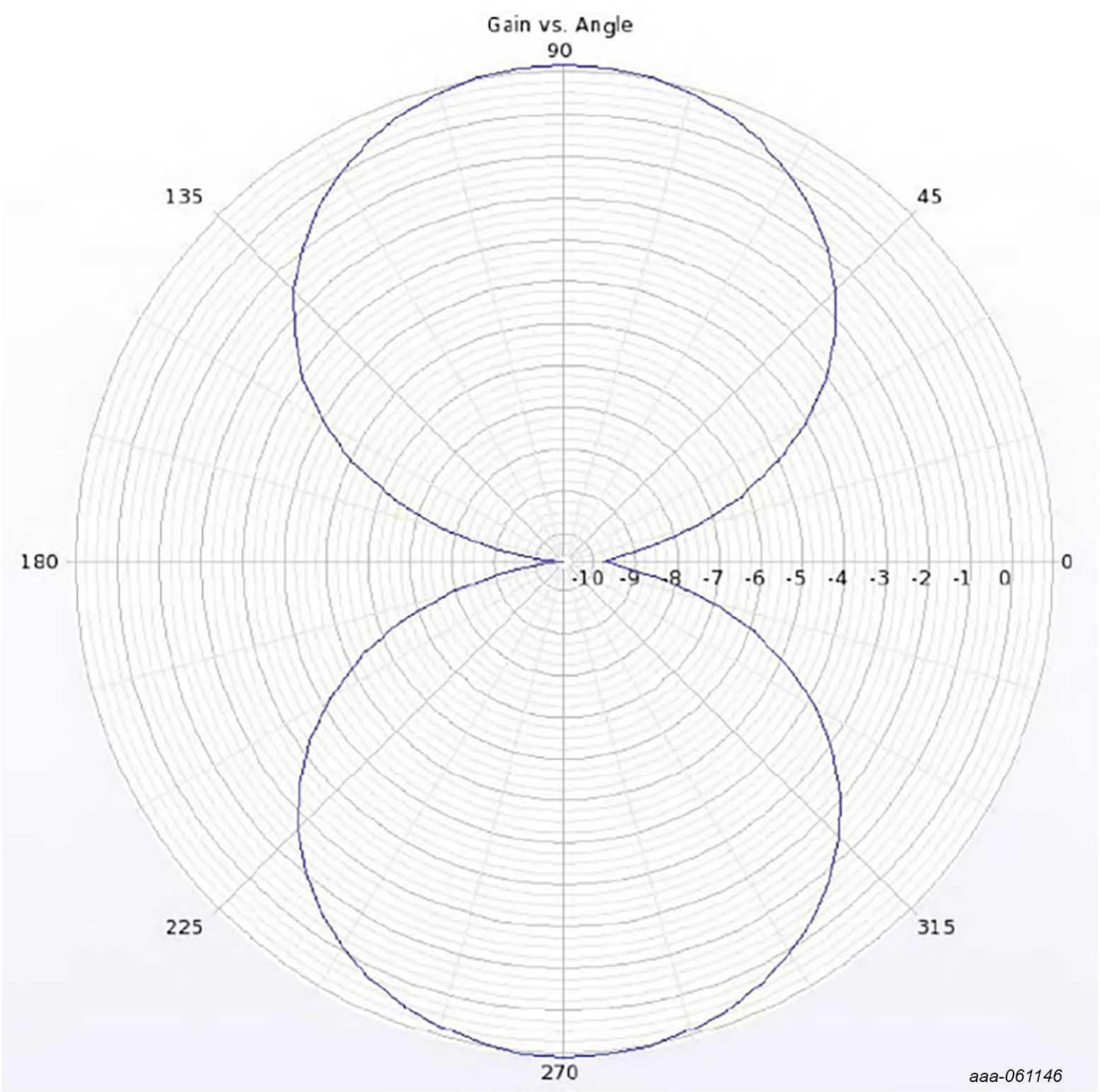


Figure 6 – Gain vs ϕ direction (from NXP AN2731)

2480 MHz

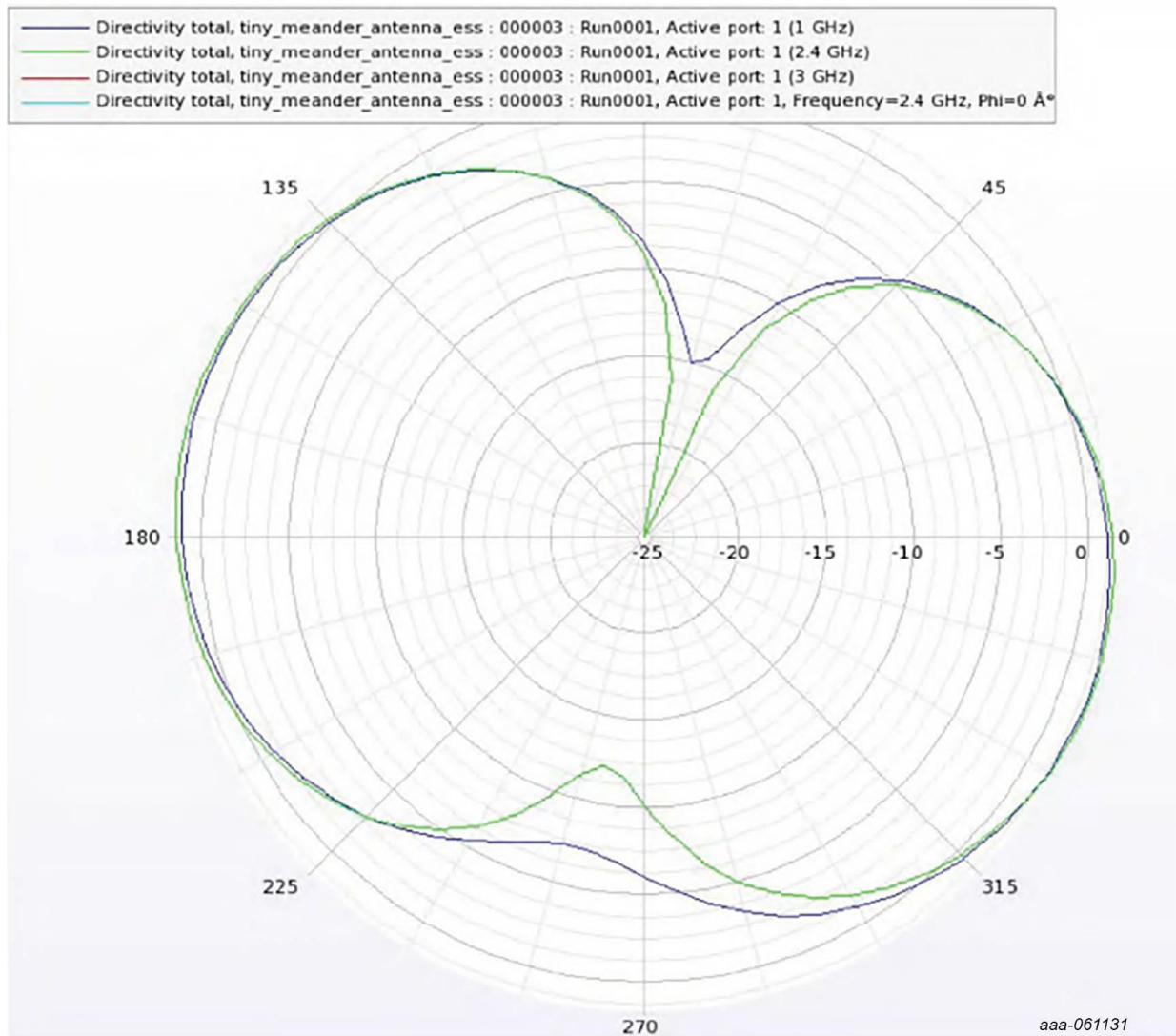


Figure 7 – Directivity vs θ direction

Frequency (MHz)	Gain (dBi)	Effciency (%)
2400	1.20	86.99%
2440	1.08	85.00%
2480	1.13	86.89%

5. Regulatory & Integration Notes

- The antenna is **integral** to the PCB and **cannot be replaced** by the user or installer.
- There is **no RF connector** available to attach a different antenna.
- All FCC/ISED radiated measurements (fundamental and spurious) for H2411 are performed with this antenna in its final product configuration.
- The antenna is evaluated in the final product enclosure and PCB configuration used during FCC and ISED radiated measurements.
- Because the antenna is integral and not user-replaceable, antenna gain and radiation patterns are not configurable by the end user.