



Part No. 1004795 / 1004796

Universal Broadband FR4 Embedded LTE / LPWA Antenna

600 / 700 / 750 / 850 / 900 / 1800 / 1900 / 2100 / 2700 MHz

Supports: Broadband LTE (OCTA-BAND), LTE CAT-M, NB-IoT, SigFox, LoRa, Cellular LPWA, RPMA



*Mirrored version offered as 1004796

Universal Broadband FR4 Embedded LTE Antenna

Low Band 600 – 1000 MHz
High Band 1700 - 2200 MHz
High High Band 2500 - 2700 MHz

KEY BENEFITS

Reduced Costs and Time-to-Market

Standard antenna eliminates design fees and cycle time associated with a custom solution; getting products to market faster.

Greater Flexibility with Unique Form Factors

Ethertronics' technology helps you deliver more advanced ergonomic designs without adverse impact on product performance.

Reliability

Comply with latest RoHS requirements

APPLICATIONS

- Medical applications
- Wearables
- Smart metering
- M2M, Industrial devices
- IoT
- Firstnet
- Automotive
- Healthcare Point of Sale
- Tracking
- NB-IoT
- Sigfox
- LoRa
- Cellular LPWA
- RPMA
- LTE CAT-M

Ethertronics' Universal Broadband Embedded LTE/LPWA antennas utilize IMD technology, which offers a reduced electrical footprint on any circuit board and independent tuning capabilities for performance optimization. This low profile FR4 antenna encapsulates IMD's high performance and isolation characteristics offering better connectivity and minimal interference

High Performance LTE in Small form factor

The 1004795/1004796 LTE antenna is designed to support CAT-M and Narrowband-IoT applications. This antenna is the perfect solution CAT-M and NB-IoT enabled devices, offering high efficiency and peak gain in a miniature form factor, and with a reduced ground plane size requirement. The 1004795/1004796 LTE CAT-M/NB-IoT antenna allows wideband coverage, supporting all US and Worldwide major carriers.

Electrical Specifications

Typical 1004795 performance 125 x 45 mm PCB

| Frequency (MHz) | 600-698 | 698-960 | 1710-2200 | 2500-2700 |
|----------------------|---------------------|-----------|-----------|-----------|
| Peak Gain | | 1.6 dBi | 3.1 dBi | 1.7 dBi |
| Average Efficiency | | 64% | 55% | 53% |
| VSWR Match | Refer to Appendix 1 | < 2.5:1 | | < 3.0:1 |
| Polarization | | Linear | | |
| Power Consumption | | 2 Watt CW | | |
| Feed Point Impedance | 50 Ω unbalanced | | | |

Mechanical Specifications & Ordering Part Number

| Ordering Part # | 1004795 | 1004796 |
|--|--|------------------|
| Dimensions (mm) | 36.0 x 9.0 x 3.2 | 36.0 x 9.0 x 3.2 |
| Mounting Type | SMT (P&P) | |
| Variant | 1004796 : Mirrored version of 1004795 | |
| Weight (grams) | 2.1 | |
| Packaging | Tape and Reel | |
| Storage Temperature/ Humidity <small>(Sealed shipping package)</small> | +5°C to +35°C 45~75% | |
| Operating Temperature | -40 to +85 C | |
| Demo Board | 1004795-01 (1004795) 1004796-01 (1004796) | |

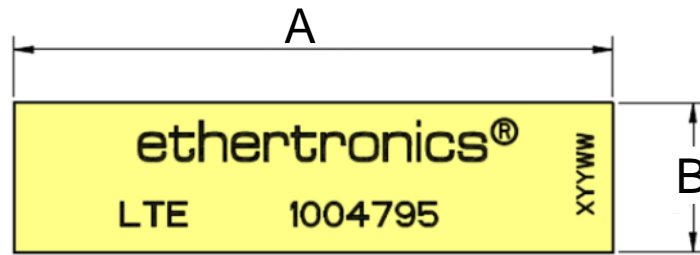
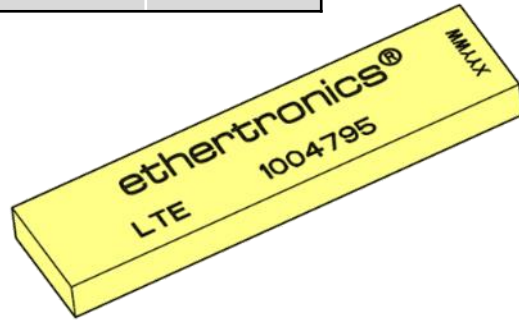


1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
Ethertronics produces a wide variety of standard and custom antennas to meet user needs.

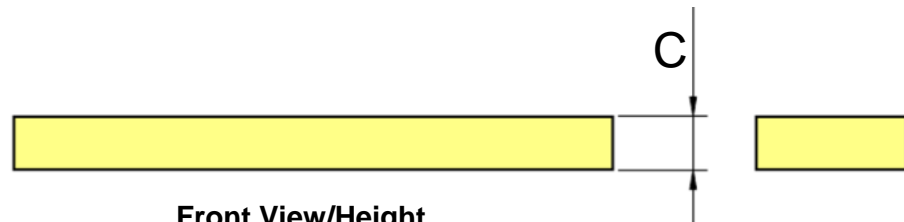
Antenna Dimensions (1004795)

Typical antenna dimensions (mm)

| Part Number | A (mm) | B (mm) | C (mm) |
|-------------|------------|-----------|-----------|
| 1004795 | 36.0 ± 0.3 | 9.0 ± 0.2 | 3.2 ± 0.3 |

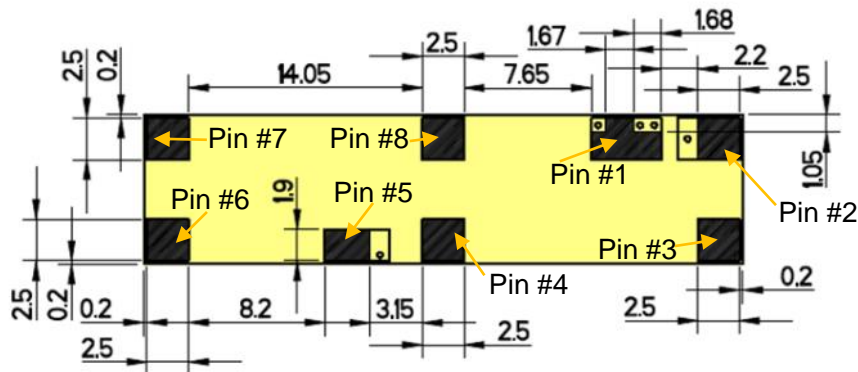


Top View



Front View/Height

| Pin# | Description |
|------|----------------|
| 1 | Feed |
| 2 | Antenna Tuning |
| 3 | Dummy Pad |
| 4 | Dummy Pad |
| 5 | Antenna Tuning |
| 6 | Dummy Pad |
| 7 | Dummy Pad |
| 8 | Dummy Pad |



Bottom View

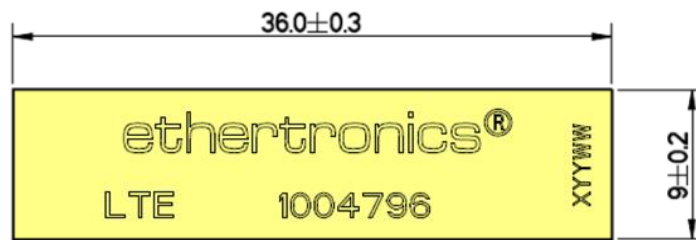
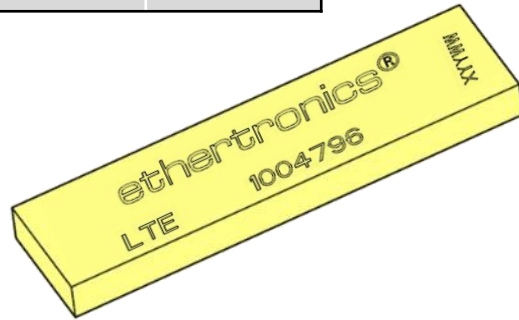


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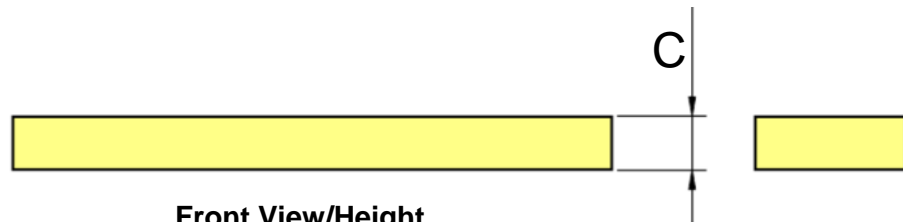
Antenna Dimensions (1004796)

Typical antenna dimensions (mm)

| Part Number | A (mm) | B (mm) | C (mm) |
|-------------|------------|-----------|-----------|
| 1004796 | 36.0 ± 0.3 | 9.0 ± 0.2 | 3.2 ± 0.3 |

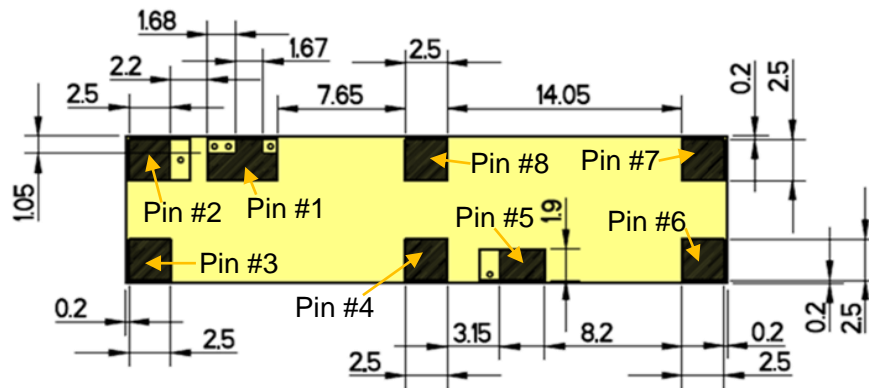


Top View



Front View/Height

| Pin# | Description |
|------|----------------|
| 1 | Feed |
| 2 | Antenna Tuning |
| 3 | Dummy Pad |
| 4 | Dummy Pad |
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| 6 | Dummy Pad |
| 7 | Dummy Pad |
| 8 | Dummy Pad |



Bottom View

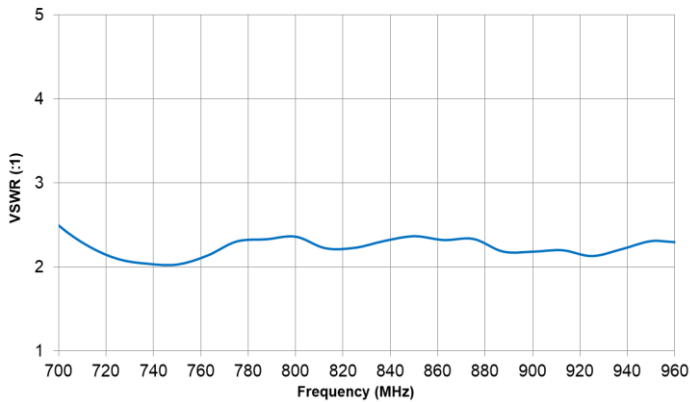


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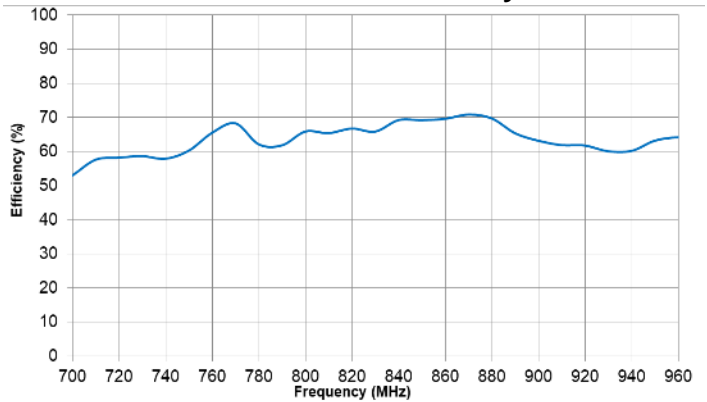
VSWR and Efficiency Plots

Typical 1004795/1004796 performance 125 x 45 mm PCB

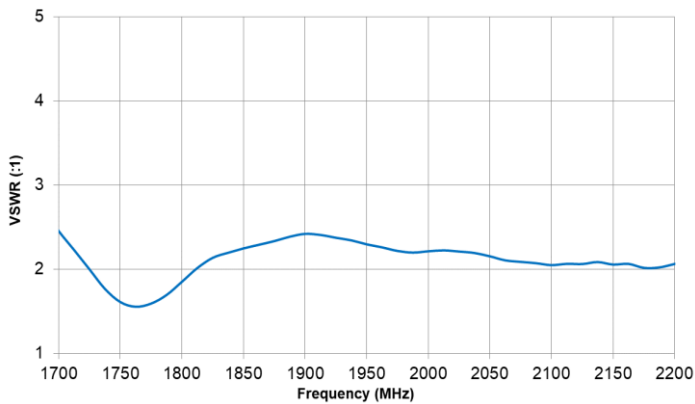
Low Band VSWR



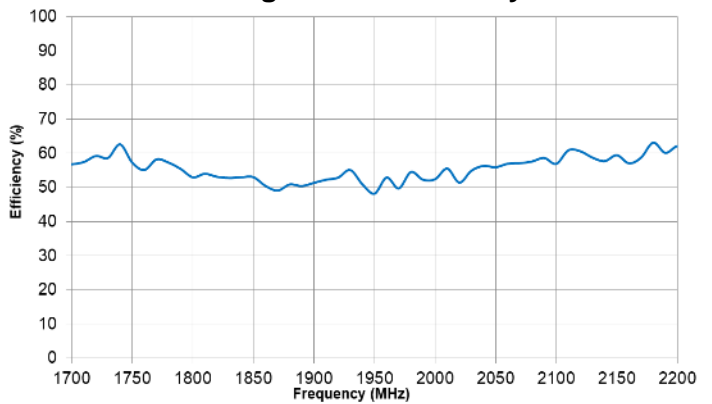
Low Band Efficiency



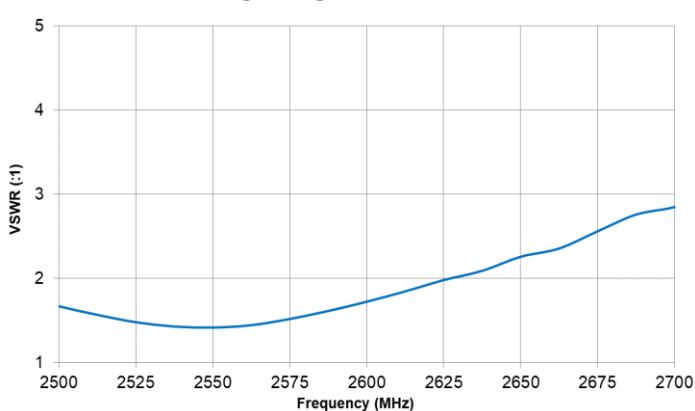
High Band VSWR



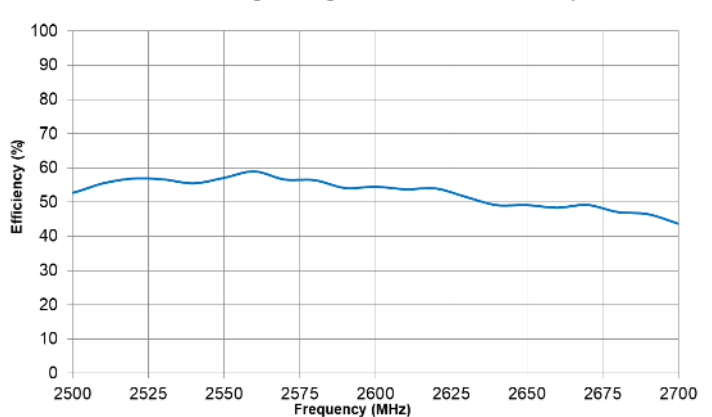
High Band Efficiency



High High Band VSWR



High High Band Efficiency

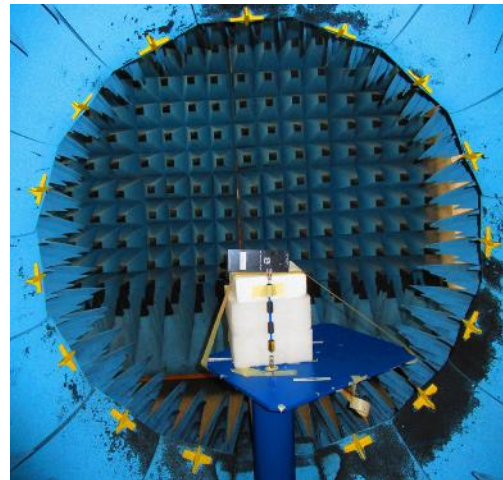
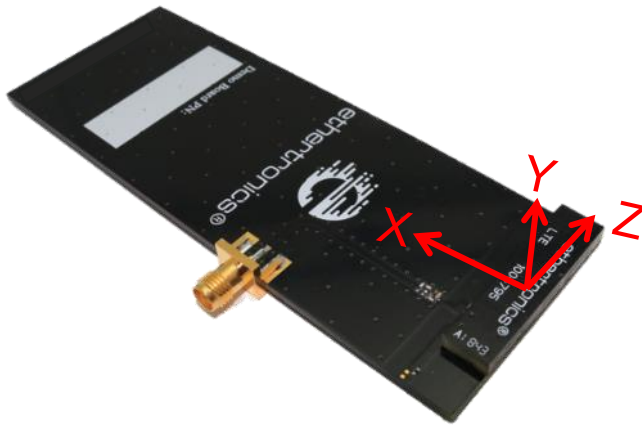




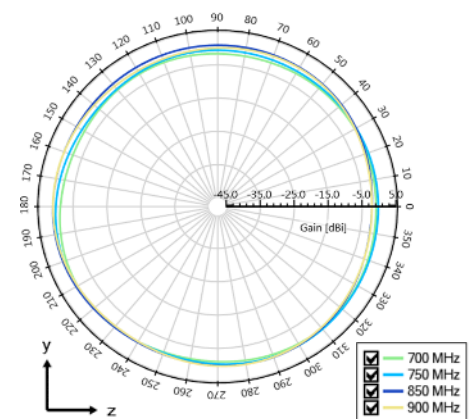
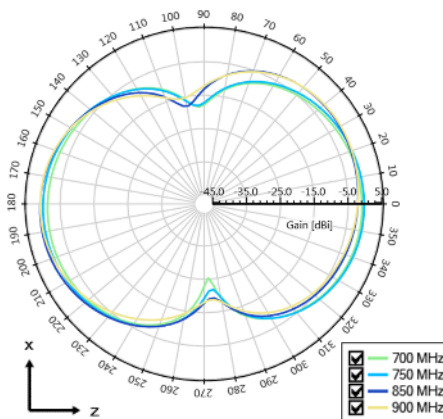
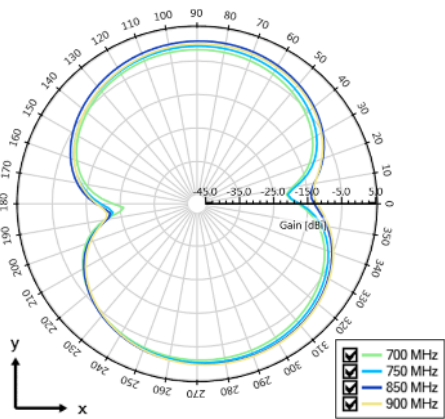
1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
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Antenna Radiation Patterns – Low / High Band

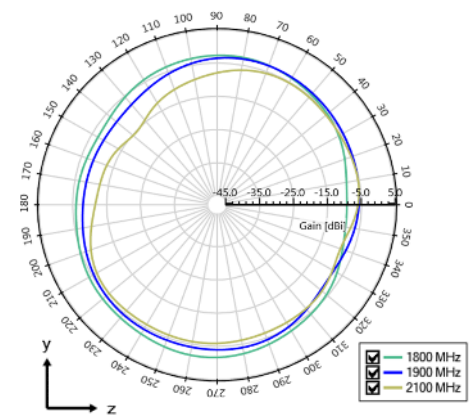
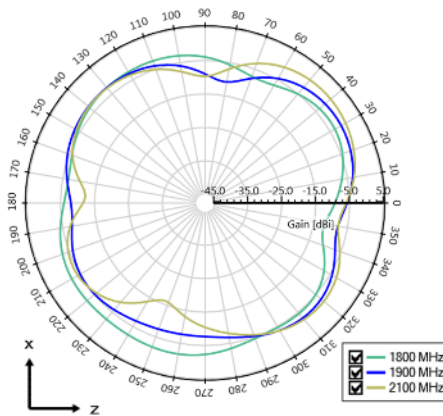
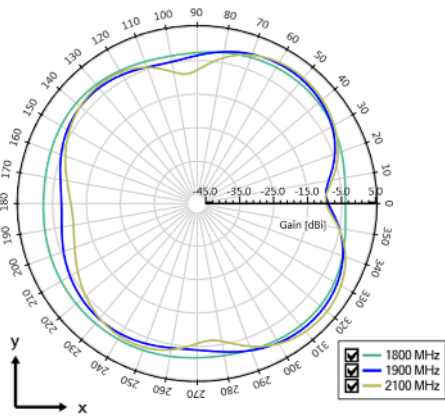
Typical 1004795/1004796 performance 125 x 45 mm PCB



Low Band measured at
700, 750, 850, 900 MHz



High Band measured at
1800, 1900, 2100 MHz

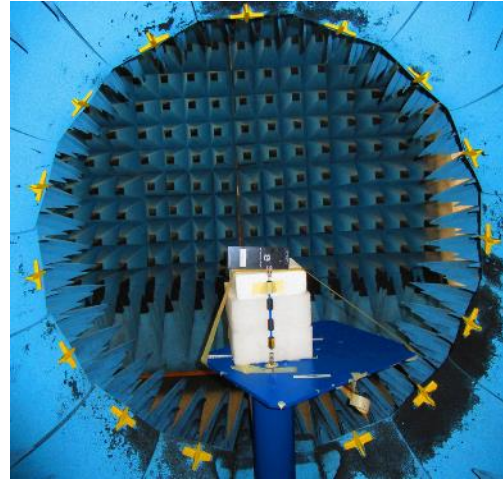
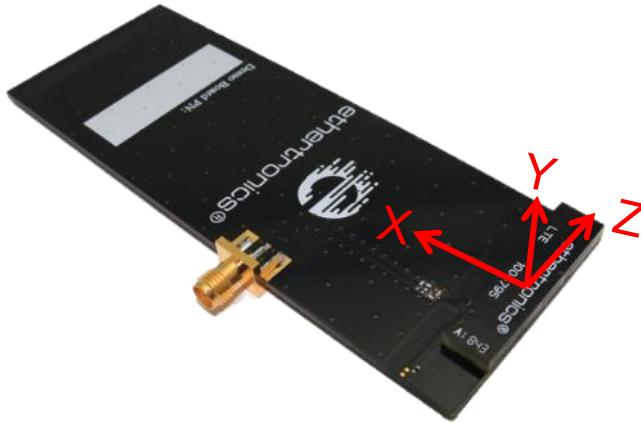




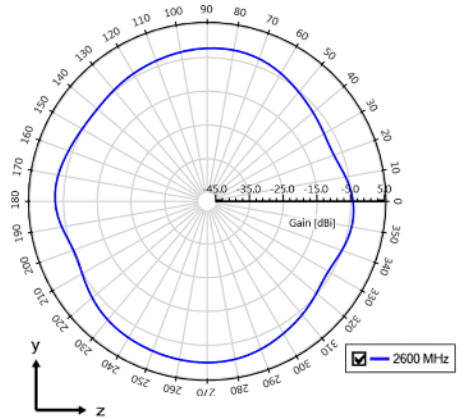
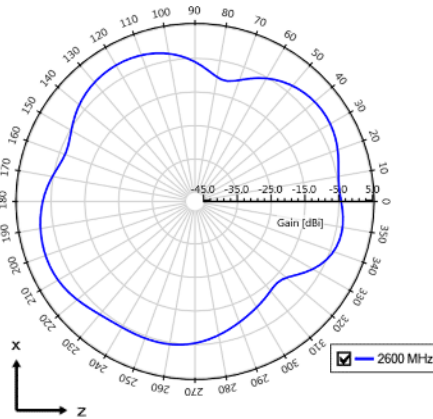
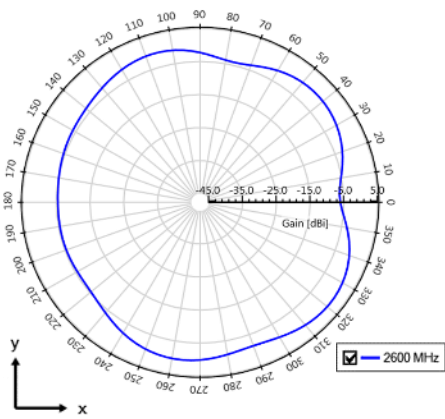
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Antenna Radiation Patterns – High High Band

Typical 1004795/1004796 performance 125 x 45 mm PCB



High High Band measured at
2600 MHz

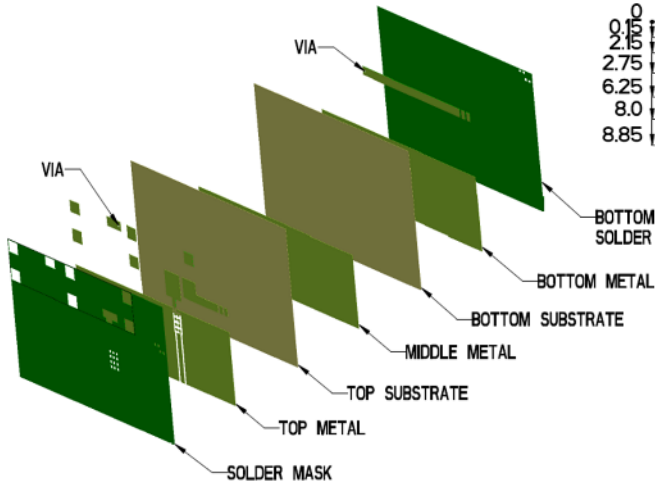




1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
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Antenna Layout (1004795)

Typical layout dimensions (mm)



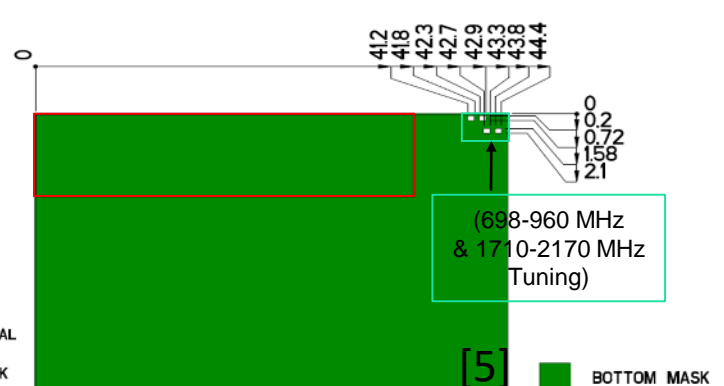
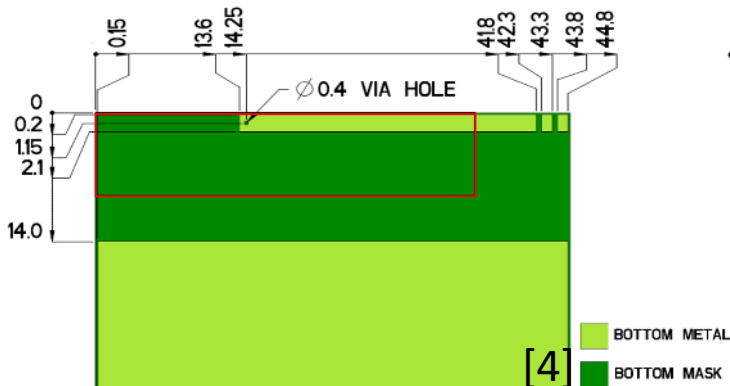
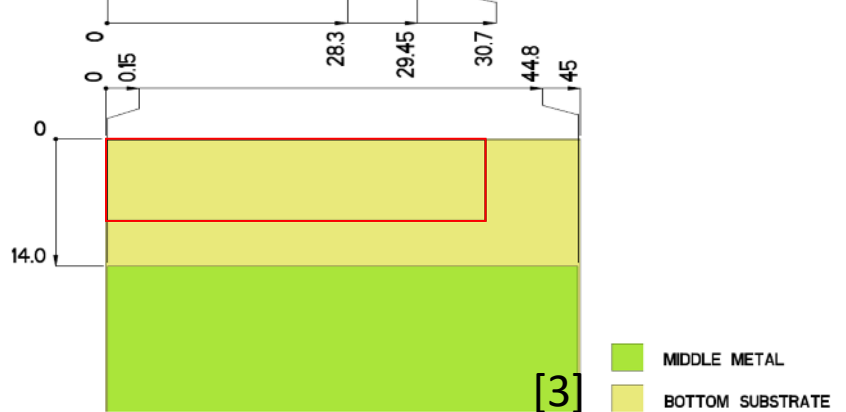
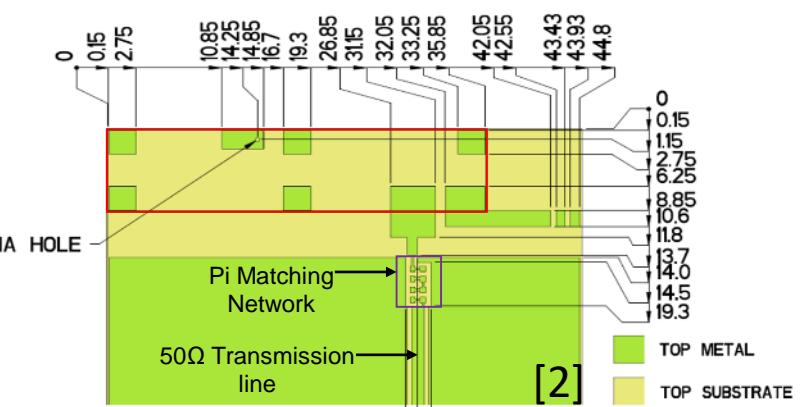
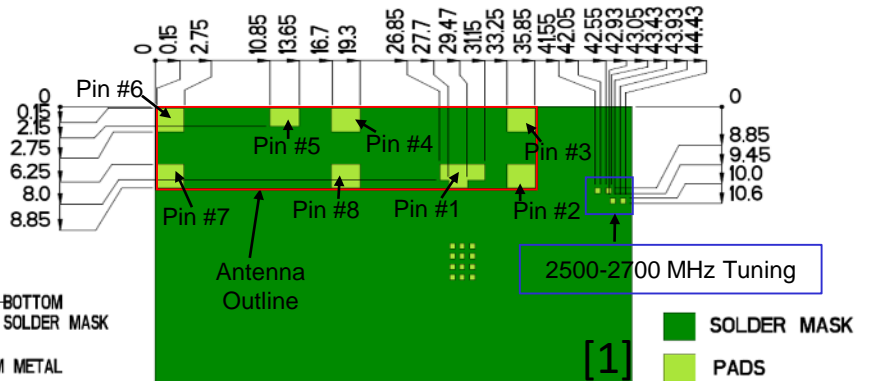
- Additional VIAS: Diam. 0.4mm to be placed around antenna, (no vias on transmission lines).
- Via holes must be covered by solder mask

Pin Descriptions

| Pin# | Description |
|------|----------------|
| 1 | Feed |
| 2 | Antenna Tuning |
| 3 | Dummy Pad |
| 4 | Dummy Pad |
| 5 | Antenna Tuning |
| 6 | Dummy Pad |
| 7 | Dummy Pad |
| 8 | Dummy Pad |

*1004796 uses the same layout but mirrored.

Default Pi Matching Network values with instructions can be found under Antenna Matching Network.

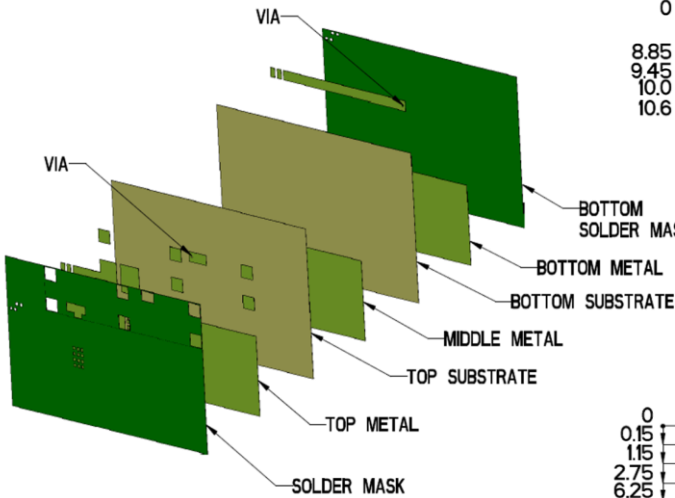




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Antenna Layout (1004796)

Typical layout dimensions (mm)



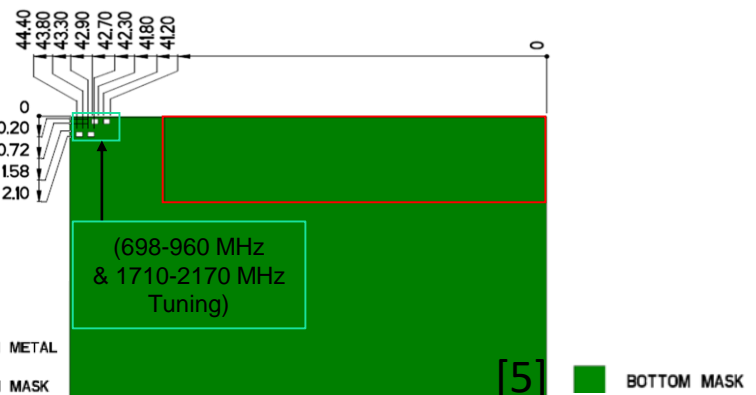
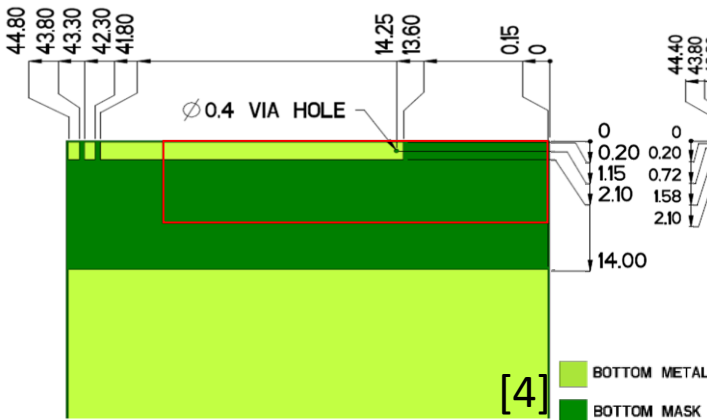
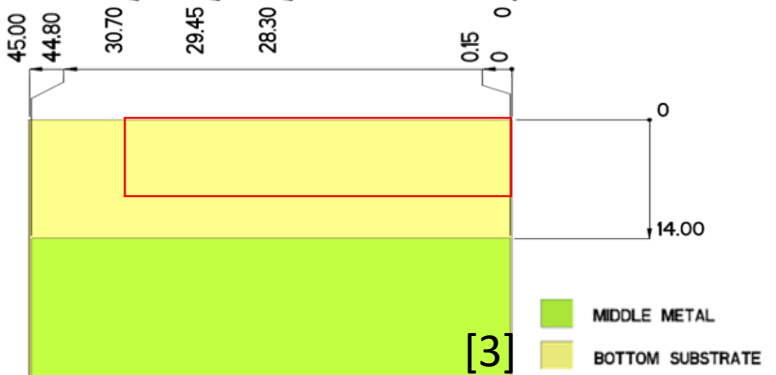
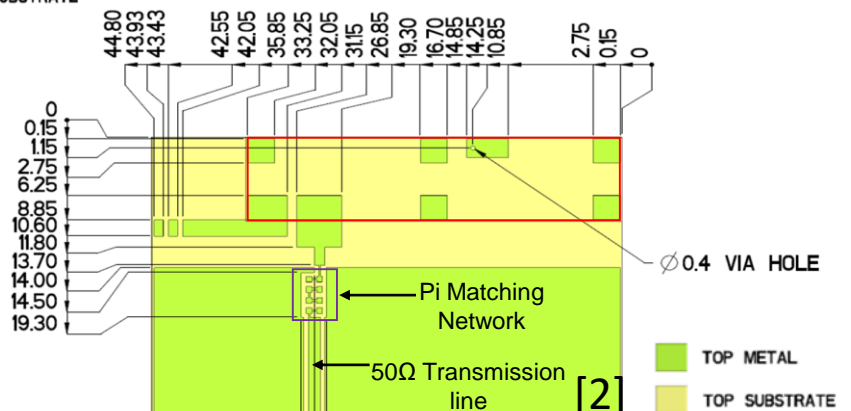
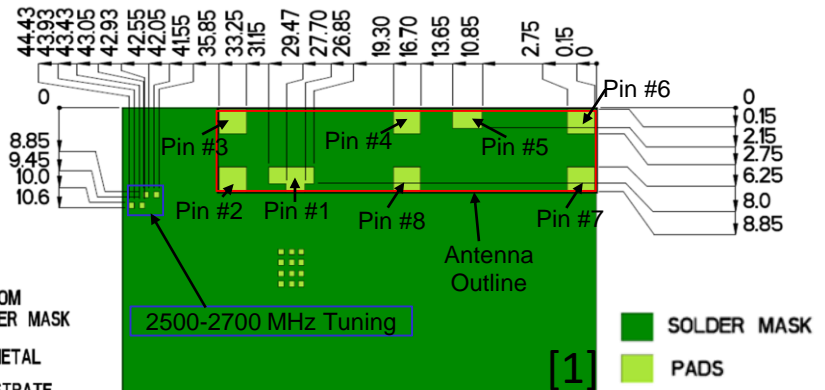
- Additional VIAS: Diam. 0.4mm to be placed around antenna, (no vias on transmission lines).
- Via holes must be covered by solder mask

Pin Descriptions

| Pin# | Description |
|------|----------------|
| 1 | Feed |
| 2 | Antenna Tuning |
| 3 | Dummy Pad |
| 4 | Dummy Pad |
| 5 | Antenna Tuning |
| 6 | Dummy Pad |
| 7 | Dummy Pad |
| 8 | Dummy Pad |

*1004795 uses the same layout but mirrored.

Default Pi Matching Network values with instructions can be found under Antenna Matching Network.





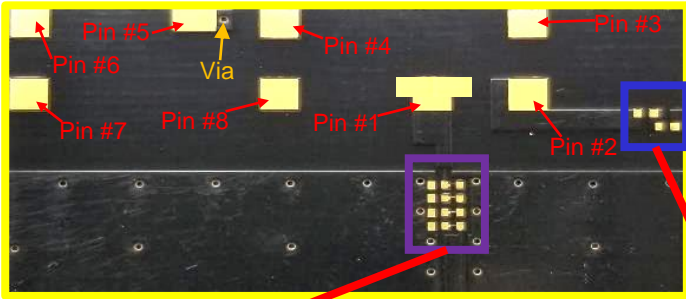
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Antenna Matching Structure (1004795)

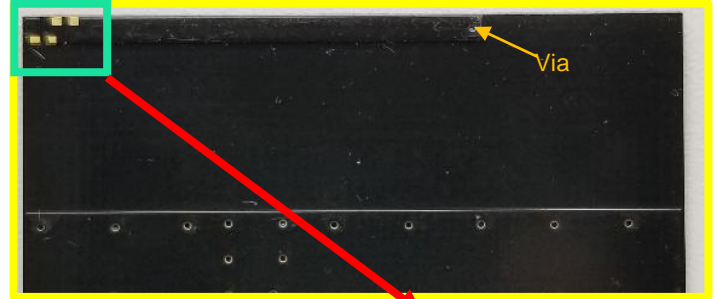
Typical matching values on 125 x 45 mm PCB

*Also applies to mirrored layout 1004796

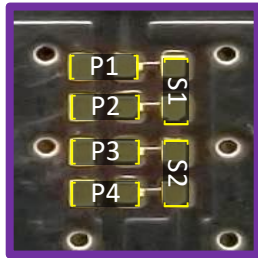
Demo Board Front View



Demo Board Back View

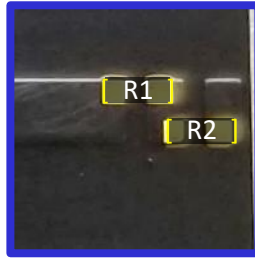


Antenna Matching

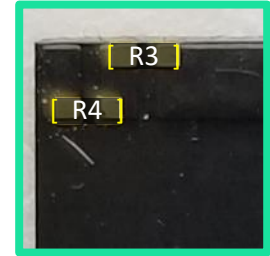


(Antenna Matching):
pads are directly inline with
the antenna feed trace.

2500-2700 MHz Tuning

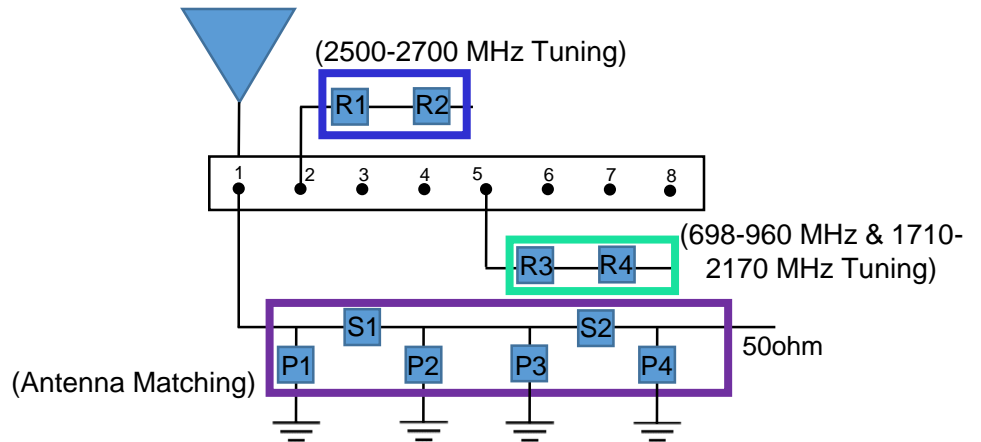


698-960 MHz
& 1710-2170 MHz Tuning



Pin Descriptions

| Pin# | Description |
|------|----------------|
| 1 | Feed |
| 2 | Antenna Tuning |
| 3 | Dummy Pad |
| 4 | Dummy Pad |
| 5 | Antenna Tuning |
| 6 | Dummy Pad |
| 7 | Dummy Pad |
| 8 | Dummy Pad |



| | P1 | S1 | P2 | P3 | S2 | P4 | R1 | R2 | R3-R4 |
|-------------------------|---------|----------|----------|-----|-------|----------|-------|-----|-------|
| Default Matching | 8.2nH | 4.7pF | 0.3pF | DNI | 0 Ohm | 0.5pF | 0 Ohm | DNI | 0 Ohm |
| Tolerance | ± 0.1nH | ± 0.05pF | ± 0.05pF | N/A | | ± 0.05pF | | N/A | |



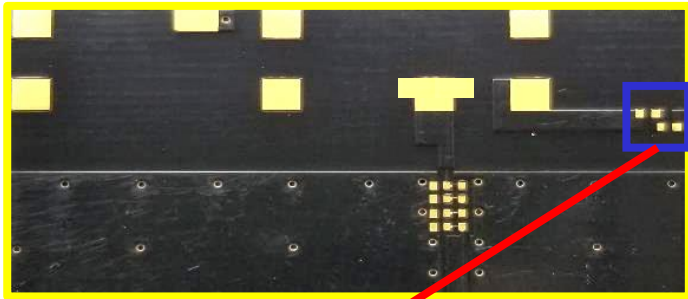
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Antenna Tuning Options (1004795)

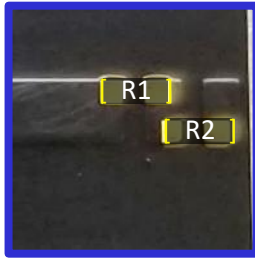
Typical matching values on 125 x 45 mm PCB

*Also applies to mirrored layout 1004796

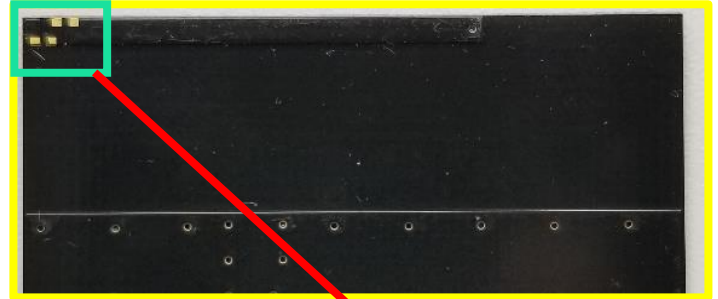
Demo Board Front View



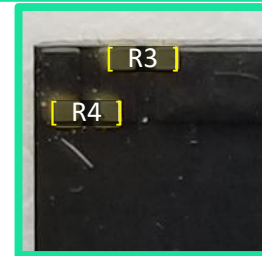
2500-2700 MHz Tuning



Demo Board Back View



698-960 MHz
& 1710-2170 MHz Tuning



Options for Tuning: "698-960 MHz & 1710-2170 MHz"

| MODE | T1 | T2 | | T3 | |
|-----------------------------|------------------|--|--|--|--|
| PADS | Connect: R3 & R4 | Remove: R4 | | Remove: R4 & R3 | |
| Outcome: (Ref: Baseline) | BASELINE | (698-960 MHz) ~20 MHz shift high | (1710-2170 MHz) ~20 MHz shift high | (698-960 MHz) ~30 MHz shift high | (1710-2170 MHz) ~35 MHz shift high |

*R= 0 Ohm

Options for Tuning: "2500-2700 MHz"

| MODE | T4 | T5 | T6 |
|-----------------------------|-------------|----------------------|-----------------------|
| PADS | Connect: R1 | Connect: R1 & R2 | Remove: R1 & R2 |
| Outcome: (Ref: Baseline) | BASELINE | ~60 MHz shift low | ~70 MHz shift high |

*R= 0 Ohm



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Antenna Demo Board (1004795)

Demo Board Front/Back View (mm)





1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
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Appendix 1

Appendix 1 gives instructions on how to achieve increased bandwidth to cover 600-960 MHz through impedance matching network.

(600-960 MHz)
(1710-2170 MHz)
(2500-2700 MHz)

| Frequency (MHz) | 600-698 | 698-960 | 1710-2200 | 2500-2700 |
|----------------------|------------------------|---------|-----------|-----------|
| Peak Gain | 1.5 dBi | 1.2 dBi | 2.4 dBi | 0.9 dBi |
| Average Efficiency | 61% | 55% | 52% | 48% |
| VSWR Match | < 5.5:1 | < 3.7:1 | < 2.5:1 | < 3.0:1 |
| Polarization | Linear | | | |
| Power Consumption | 2 Watt CW | | | |
| Feed Point Impedance | 50 Ω unbalanced | | | |

*Data shown above has Appendix 1 matching applied on 125 x 45 mm pcb.



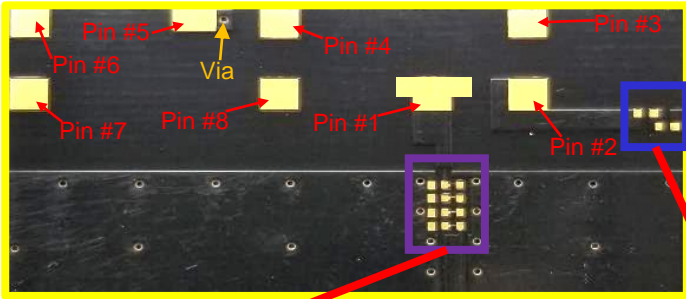
1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
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Appendix 1: Antenna Matching Structure (1004795)

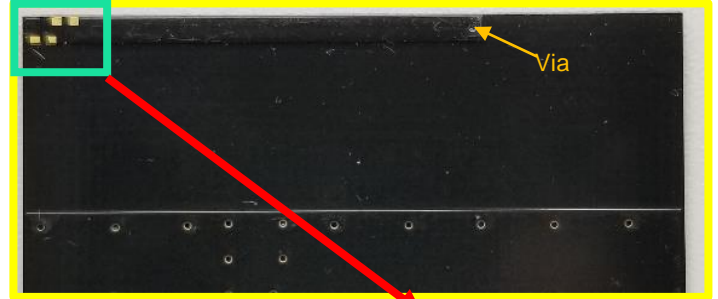
Typical matching values on 125 x 45 mm PCB

*Also applies to mirrored layout 1004796

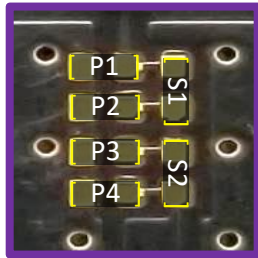
Demo Board Front View



Demo Board Back View

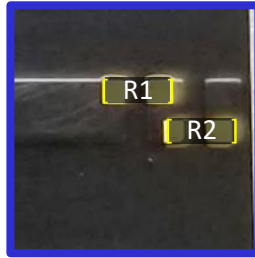


Antenna Matching

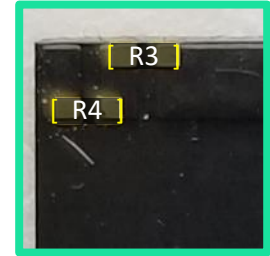


(Antenna Matching):
pads are directly inline with
the antenna feed trace.

2500-2700 MHz Tuning

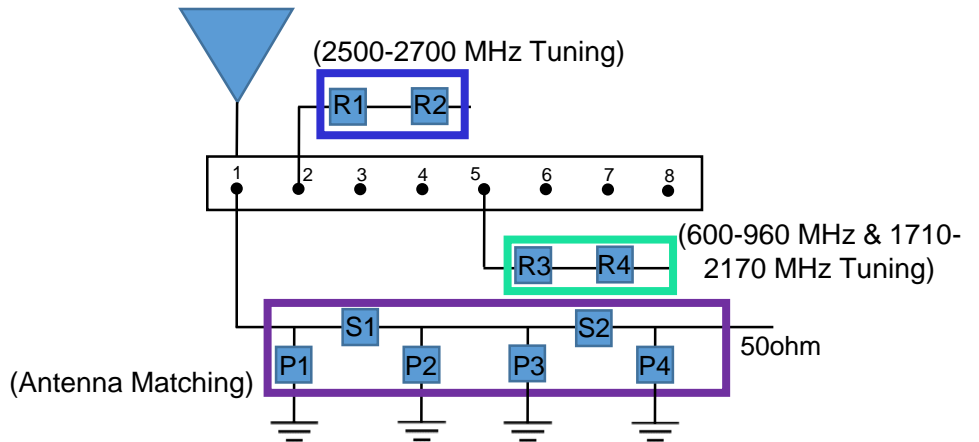


600-960 MHz
& 1710-2170 MHz Tuning



Pin Descriptions

| Pin# | Description |
|------|----------------|
| 1 | Feed |
| 2 | Antenna Tuning |
| 3 | Dummy Pad |
| 4 | Dummy Pad |
| 5 | Antenna Tuning |
| 6 | Dummy Pad |
| 7 | Dummy Pad |
| 8 | Dummy Pad |



| | P1 | S1 | P2 | P3 | S2 | P4 | R1 | R2 | R3-R4 |
|-------------------------|---------|---------|-----|-----|-------|-----|-------|-----|-------|
| Default Matching | 10nH | 3.3pF | DNI | DNI | 0 Ohm | DNI | 0 Ohm | DNI | 0 Ohm |
| Tolerance | ± 0.1nH | ± 0.1pF | N/A | N/A | | N/A | | N/A | |



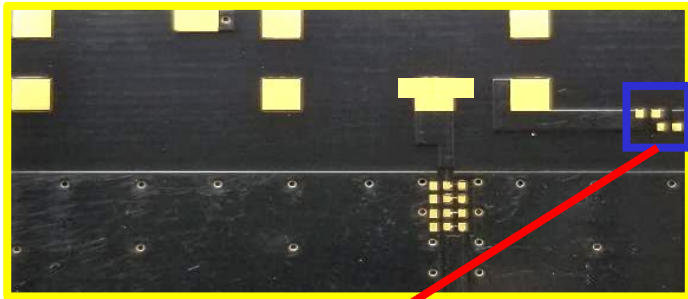
1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
Ethertronics produces a wide variety of standard and custom antennas to meet user needs.

Appendix 1: Antenna Tuning Options (1004795)

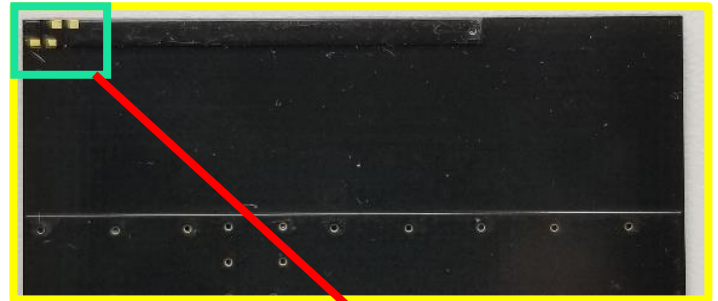
Typical matching values on 125 x 45 mm PCB

*Also applies to mirrored layout 1004796

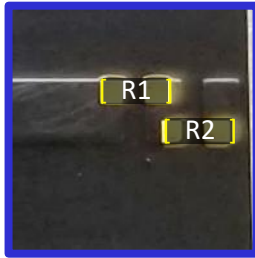
Demo Board Front View



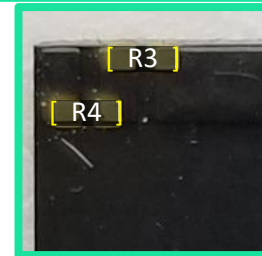
Demo Board Back View



2500-2700 MHz Tuning



600-960 MHz & 1710-2170 MHz Tuning



Options for Tuning: "600-960 MHz & 1710-2170 MHz"

| MODE | T1 | T2 | | T3 | |
|-----------------------------|------------------|--|--|--|--|
| PADS | Connect: R3 & R4 | Remove: R4 | | Remove: R4 & R3 | |
| Outcome: (Ref: Baseline) | BASELINE | (600-960 MHz) ~20 MHz shift high | (1710-2170 MHz) ~20 MHz shift high | (600-960 MHz) ~30 MHz shift high | (1710-2170 MHz) ~35 MHz shift high |

*R= 0 Ohm

Options for Tuning: "2500-2700 MHz"

| MODE | T4 | T5 | T6 |
|-----------------------------|-------------|----------------------|-----------------------|
| PADS | Connect: R1 | Connect: R1 & R2 | Remove: R1 & R2 |
| Outcome: (Ref: Baseline) | BASELINE | ~60 MHz shift low | ~70 MHz shift high |

*R= 0 Ohm

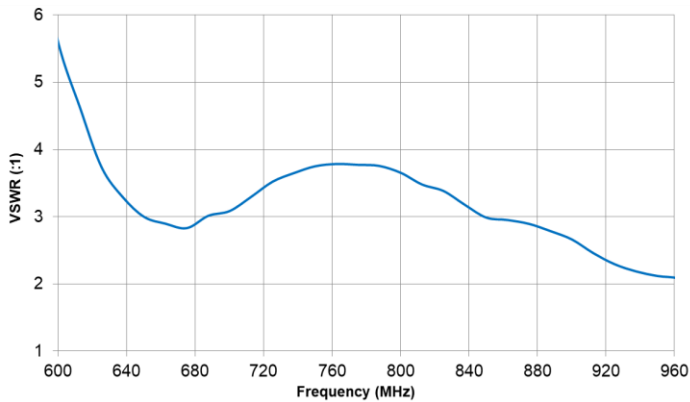


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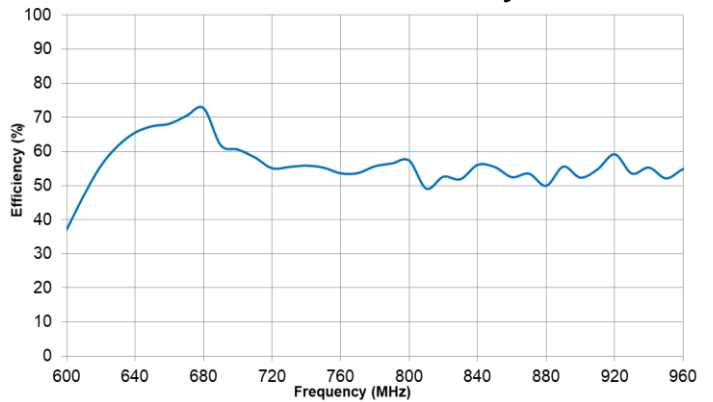
Appendix 1: VSWR and Efficiency Plots

Typical 1004795/1004796 performance 125 x 45 mm PCB

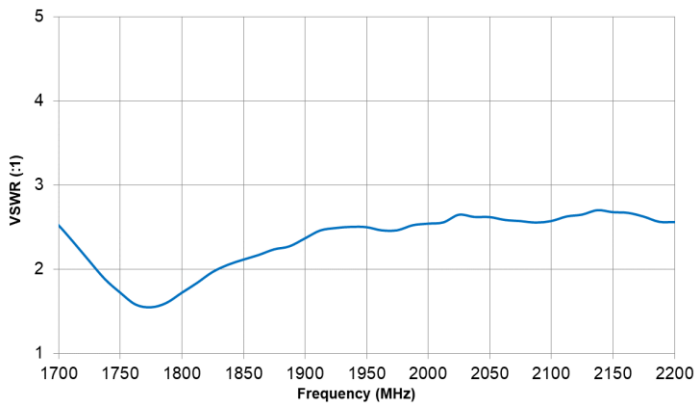
Low Band VSWR



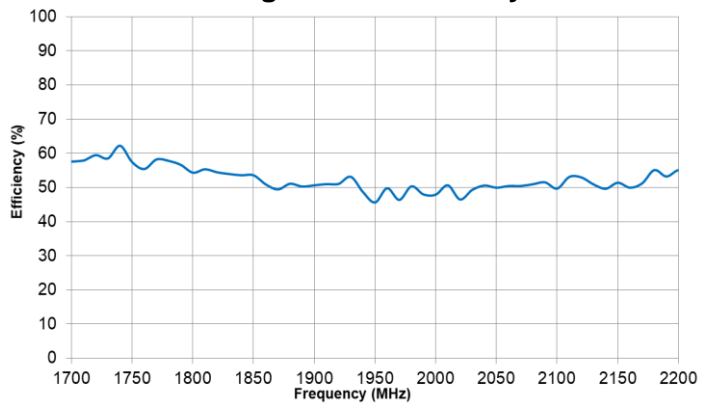
Low Band Efficiency



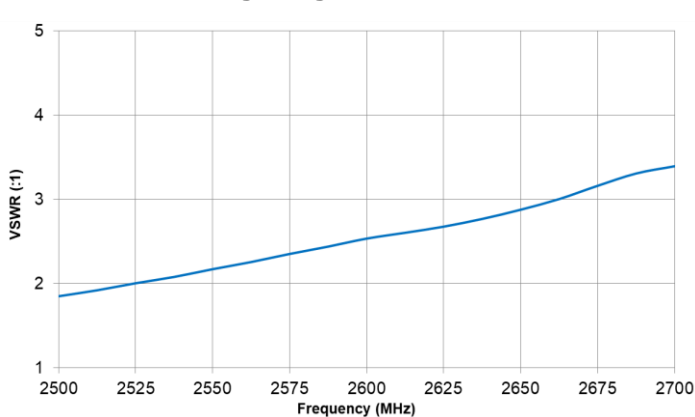
High Band VSWR



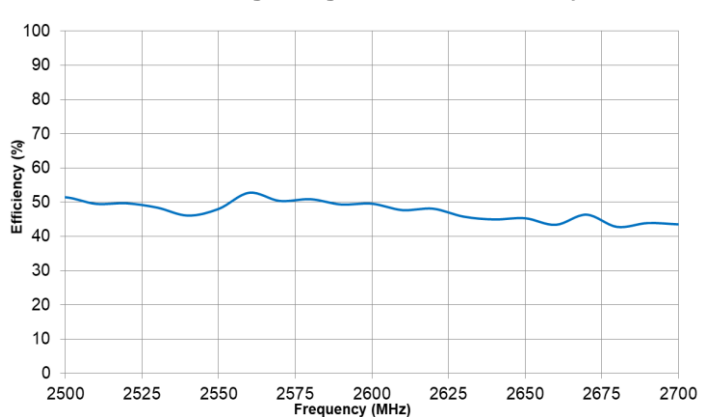
High Band Efficiency



High High Band VSWR



High High Band Efficiency

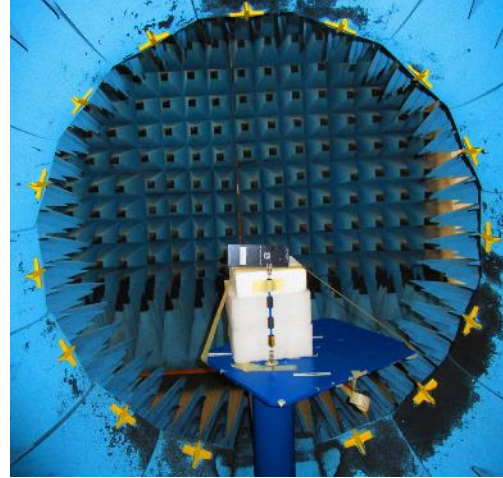
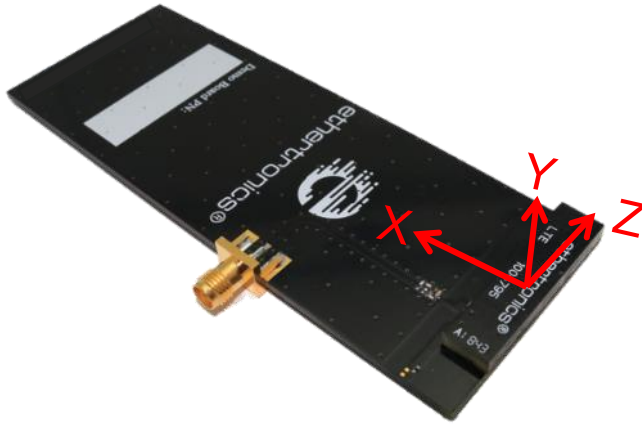




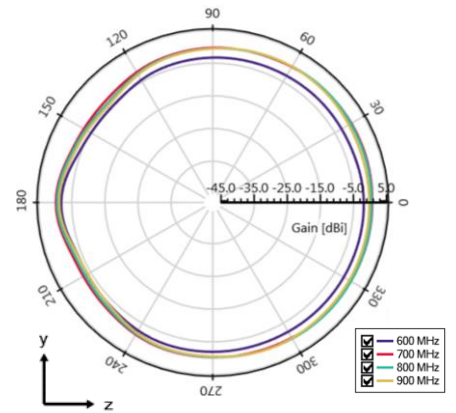
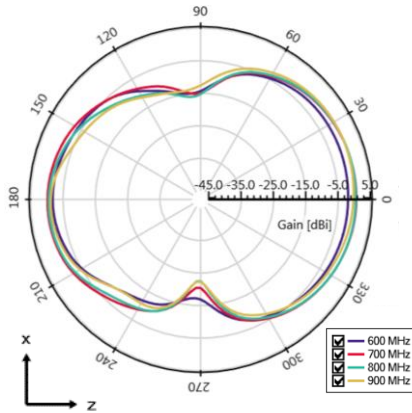
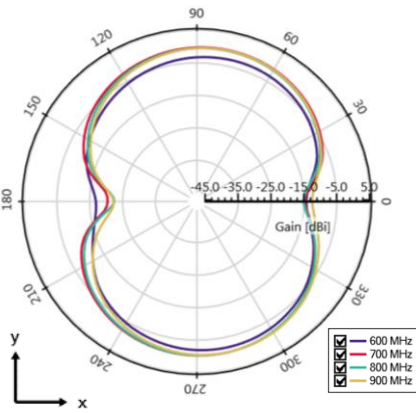
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Appendix 1: Antenna Radiation Patterns – Low / High Band

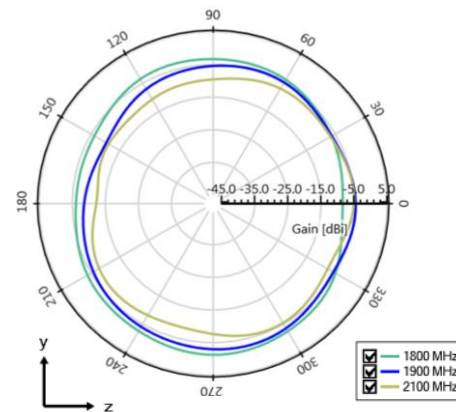
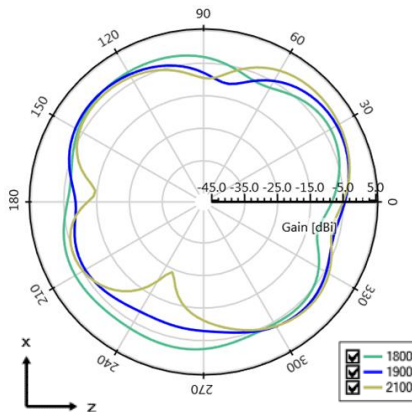
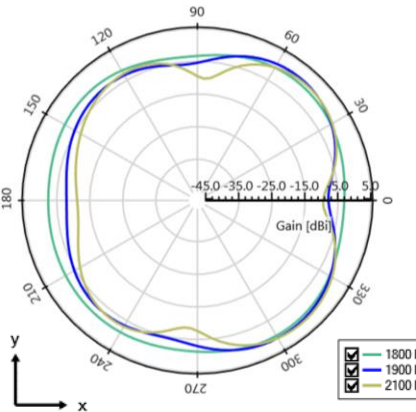
Typical 1004795/1004796 performance 125 x 45 mm PCB



Low Band measured at
600, 700 800, 900 MHz



High Band measured at
1800, 1900, 2100 MHz

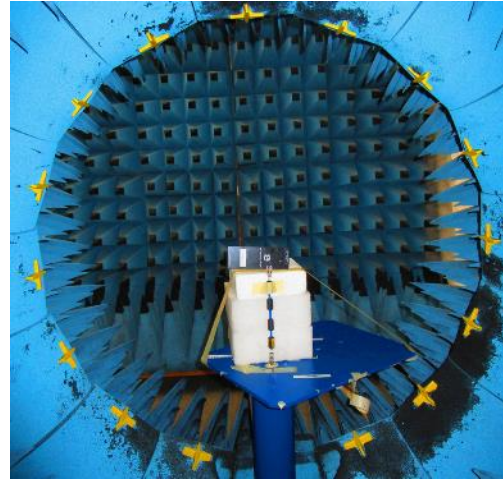
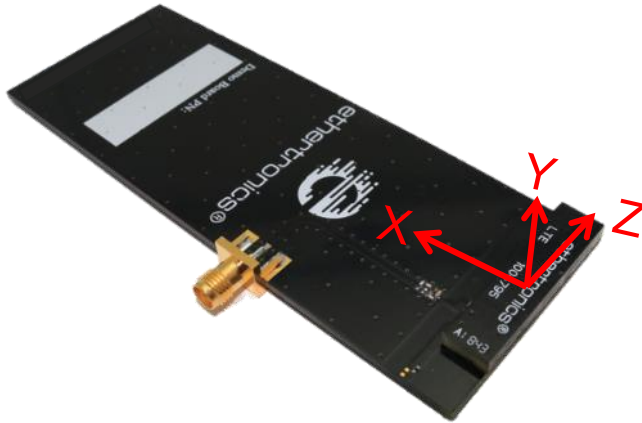




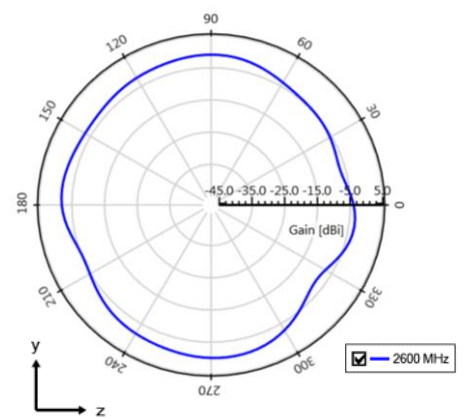
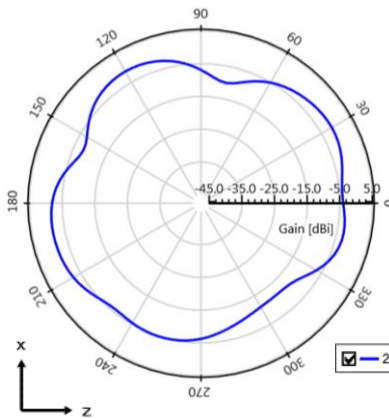
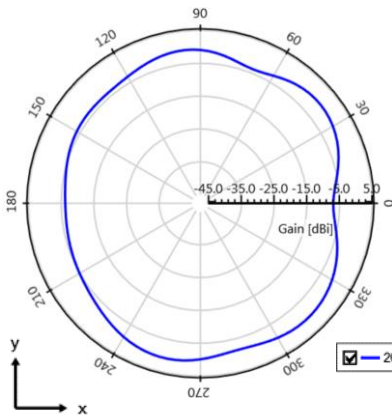
1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
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Appendix 1: Antenna Radiation Patterns – High High Band

Typical 1004795/1004796 performance 125 x 45 mm PCB



High High Band measured at
2600 MHz

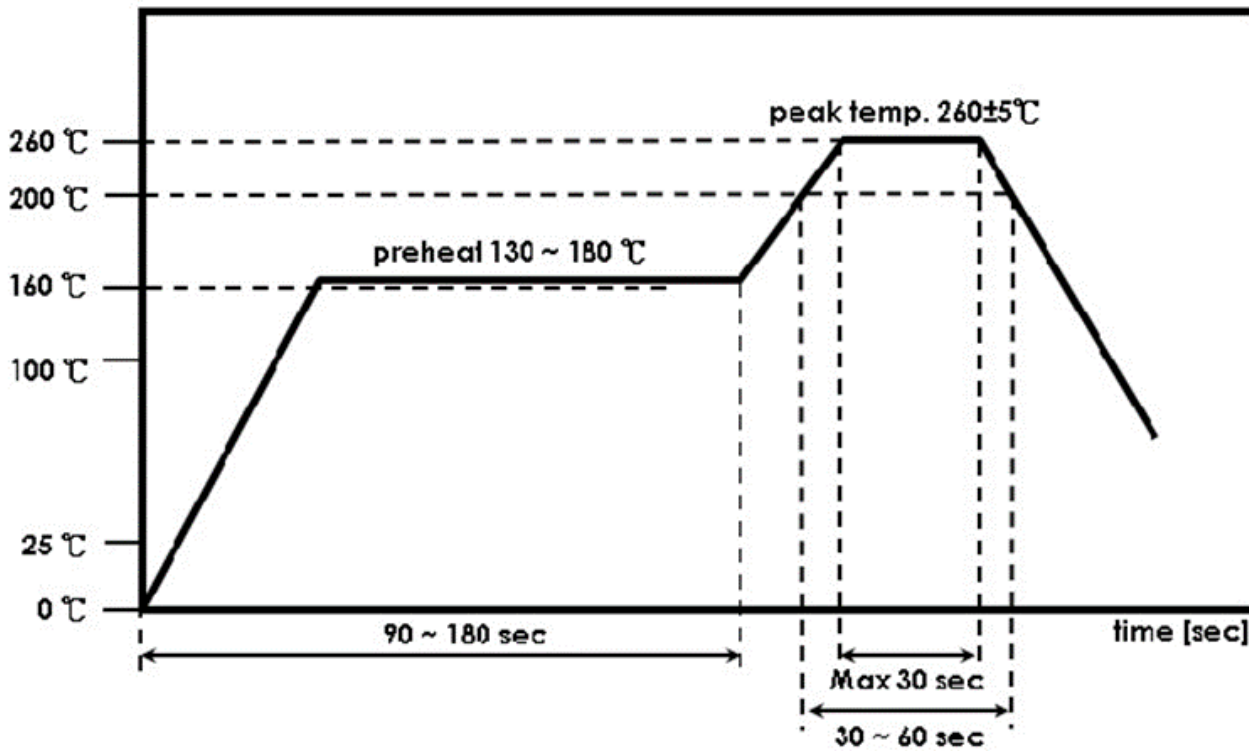




1004795 / 1004796 Universal Broadband Embedded LTE Antenna Specifications.
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Recommended Reflow Soldering Profile

The recommended method for soldering the antenna to the board is forced convection reflow soldering. The following suggestions provide information on how to optimize the reflow process for the FR4 antenna:



*Adjust the reflow duration to create good solder joints without raising the antenna temperature beyond the allowed maximum of 260° C.

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