

Antenna report

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1. Introduction

This document describes the design verification test in order to determine the antenna gain.

1.1 Antenna information

This antenna is PCB antenna, and it's formed as a part of the PCB board pattern when the WLAN module shown in Fig 1 is fabricated. Thus, the manufacturer of the antenna is same as that of the module. The manufacturer of the module is:

Company:

Panasonic Electric Works Electrical Construction Materials Mie Co., Ltd.

Address: 1668, Fujikata, Tsu Mie 514-8555, Japan

The antenna itself is not assigned model name, but the module name is:

Module name: when it's incorporated in EYFNH1WC and EYFNH1WP impact

wrench

*Both modules are identical, but two product name is assigned for production management purpose.

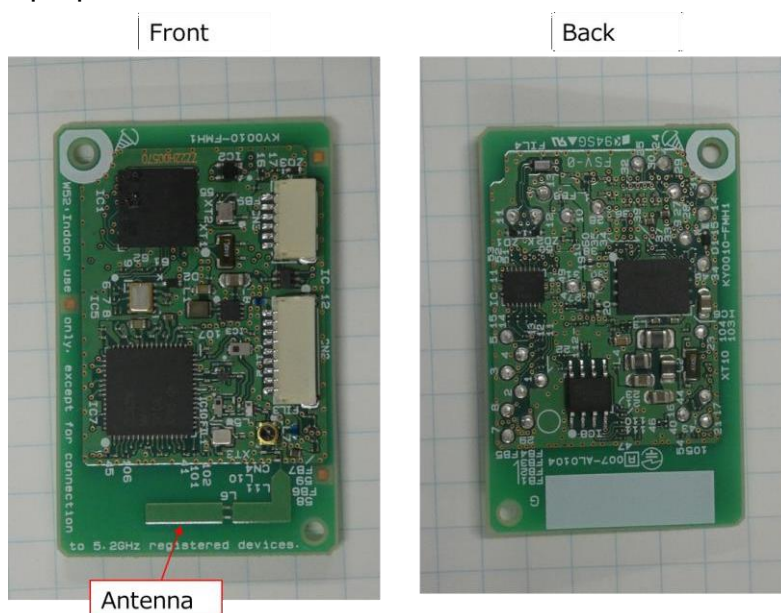


Fig. 1 PCB antenna on WLAN module

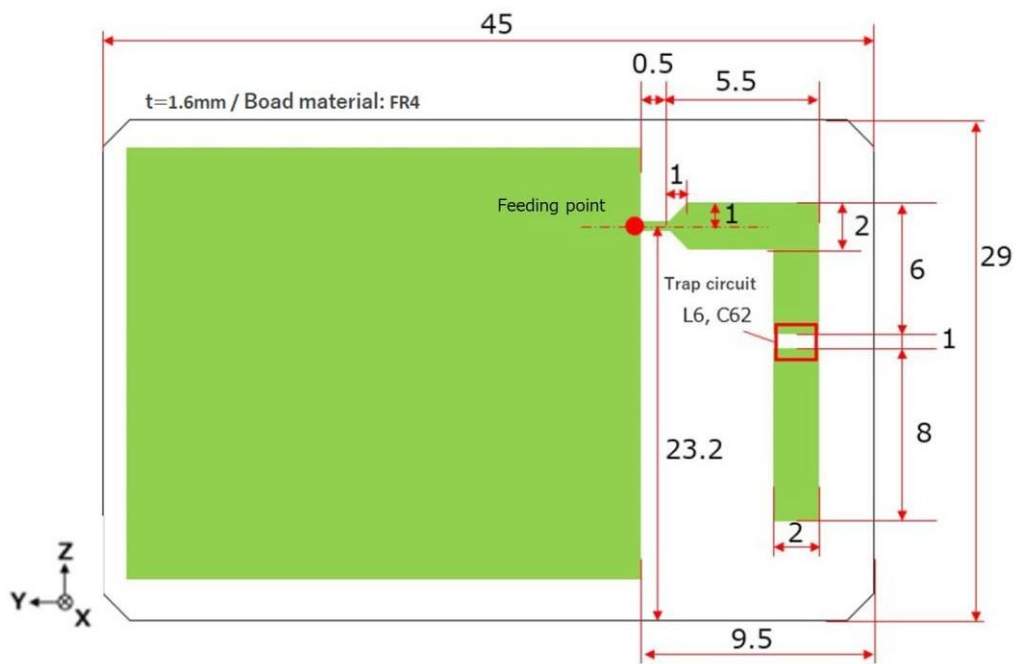


Fig. 2 PCB board pattern

1.2 Test equipment

Following equipment were used.

- Anritsu MT8852B
- Agilent N9322C

1.3 Test Setup

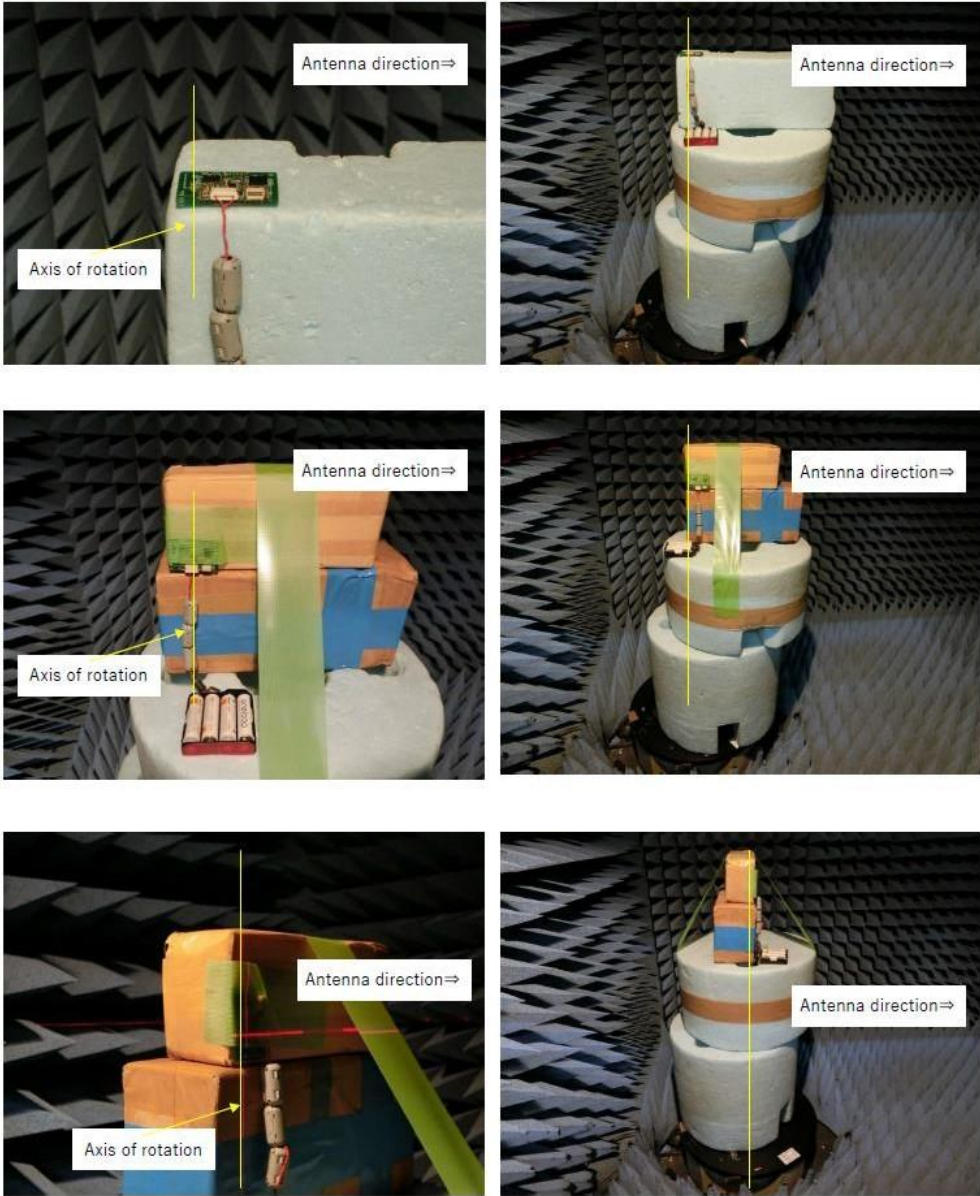


Fig. 3 Photo of test setup

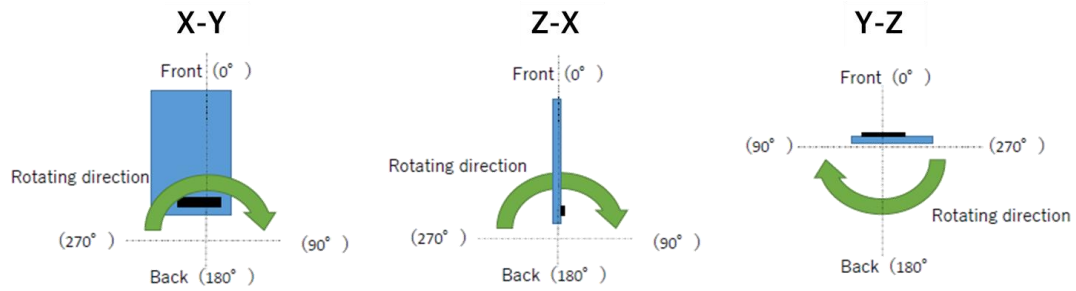
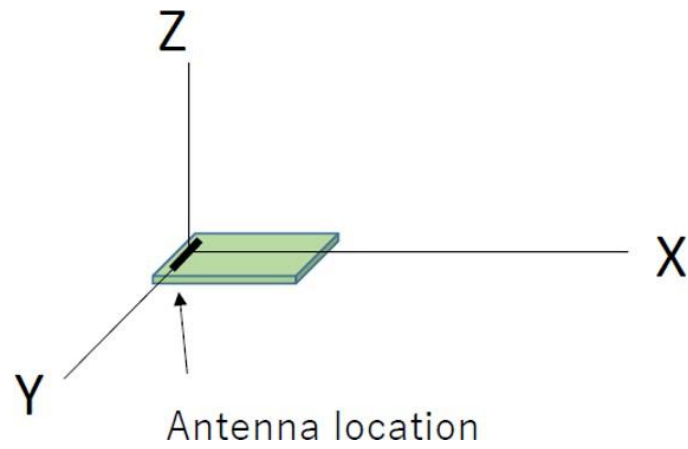


Fig. 4 Antenna location

2 Test result

2.1 Maximum gain

Antenna max gain is:

2,4GHz: 1.25dBi

5GHz: -0.97dBi

2.2 Test data for 2,4 GHz

Test data for 2,4GHz is shown Fig. 5 through 8.

| X-Y | X-Z |
|--------|-----|
| -16.52 | |

Fig. 5 Maximum antenna gain for 2,4 GHz (dBi)

| (deg) | X-Y | | X-Z | | Y-Z | |
|-------|--------|--------|--------|--------|-------|--------|
| 0 | -20.41 | -8.41 | -9.59 | -22.21 | -2.45 | -19.08 |
| 45 | -17.73 | -6.74 | -12.4 | -3.63 | -3.53 | -14.55 |
| 90 | -31.89 | -0.59 | -15.02 | -2.72 | -3.46 | -21.91 |
| 135 | -18.8 | -1.84 | -11.63 | -7.29 | -4.29 | -28.35 |
| 180 | -20.54 | -15.41 | -9.69 | -26.36 | -1.74 | -20.31 |
| 225 | -22.33 | -9.54 | -12.2 | -4.09 | 0.02 | -17.21 |
| 270 | -27.32 | -0.66 | -16 | 1.15 | 0.28 | -24.82 |
| 315 | -21.33 | -1.69 | -13.23 | -4.52 | -0.39 | -15.54 |
| Ave | -20.99 | -3.52 | -11.97 | -3.97 | -1.64 | -18.43 |

Fig. 6 Antenna gain for 2,4 GHz (dBi)

| (deg) | X-Y | | X-Z | | Y-Z | |
|-------|-------|--------|-------|--------|--------|-------|
| 0 | 85.93 | 97.93 | 96.75 | 84.13 | 103.89 | 87.26 |
| 45 | 88.61 | 99.6 | 93.94 | 102.71 | 102.81 | 91.79 |
| 90 | 74.45 | 105.75 | 91.32 | 103.62 | 102.88 | 84.43 |
| 135 | 87.54 | 104.5 | 94.71 | 99.05 | 102.05 | 77.99 |
| 180 | 85.8 | 90.93 | 96.65 | 79.98 | 104.6 | 86.03 |
| 225 | 84.01 | 96.8 | 94.14 | 102.25 | 106.36 | 89.13 |
| 270 | 79.02 | 105.68 | 90.34 | 107.49 | 106.62 | 81.52 |
| 315 | 85.01 | 104.65 | 93.11 | 101.82 | 105.94 | 90.8 |
| Ave | 84.73 | 101.97 | 94.12 | 100.96 | 104.55 | 87.13 |

Fig. 7 Field intensity for 2,4 GHz (dB μ V/m)

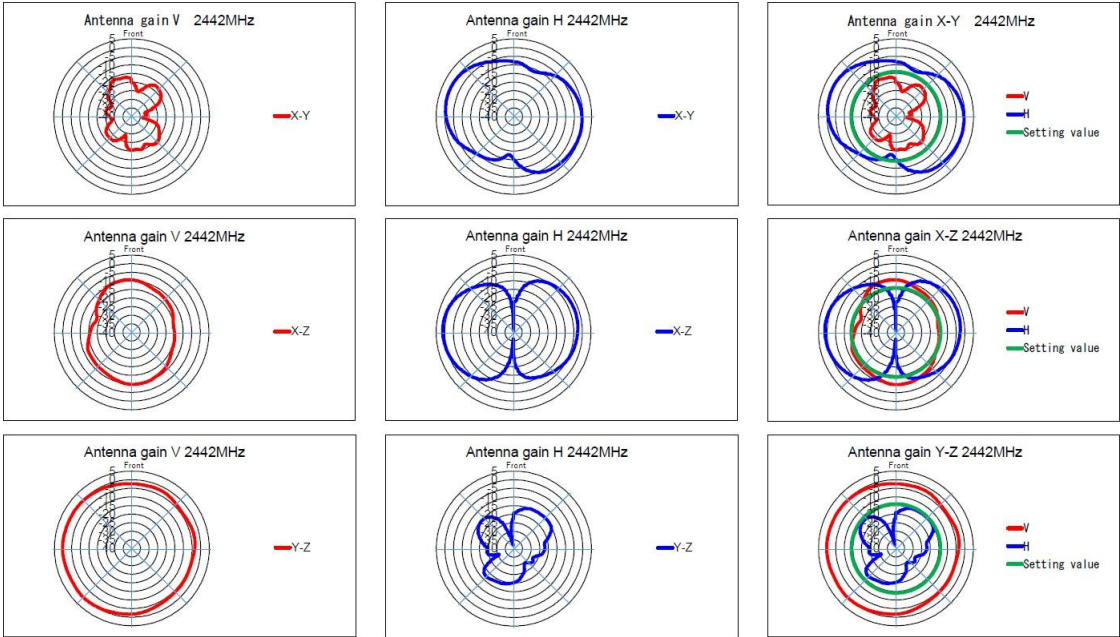


Fig. 8 Antenna gain for 2,4 GHz (dBi)

2.3 Test data for 5 GHz

Test data for 5 GHz is shown Fig. 9 through 12.

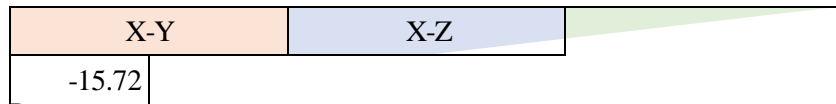


Fig. 9 Maximum antenna gain for 5 GHz (dBi)

| (deg) | X-Y | | X-Z | | Y-Z | |
|-------|--------|--------|-------|--------|--------|--------|
| | 0 | -23.21 | -4.27 | -2.79 | -19.14 | -24.46 |
| 45 | -20.24 | -18.81 | -3.52 | -5.24 | -10.29 | -8.75 |
| 90 | -17.25 | -2.4 | -5.99 | -6.84 | -4.31 | -26.99 |
| 135 | -21.51 | -8.72 | -2.9 | -12.41 | -6.08 | -11.98 |
| 180 | -15.75 | -1.37 | -1.01 | -30.85 | -22.96 | -7.14 |
| 225 | -18.11 | -4.41 | -2.73 | -13.03 | -5.01 | -12.7 |
| 270 | -24.11 | -3.81 | -5.84 | -16.2 | -2.81 | -33.92 |
| 315 | -18.24 | -8.47 | -3.41 | -9.43 | -5.44 | -11.5 |
| Ave | -18.99 | -4.64 | -3.26 | -10.2 | -6.37 | -10.53 |

Fig. 10 Antenna gain for 5 GHz (dBi)

| (deg) | X-Y | | X-Z | | Y-Z | |
|-------|-------|--------|--------|--------|--------|-------|
| | 0 | 82.26 | 101.2 | 102.68 | 86.33 | 81.01 |
| 45 | 85.23 | 86.66 | 101.95 | 100.23 | 95.18 | 96.72 |
| 90 | 88.22 | 103.07 | 99.48 | 98.63 | 101.16 | 78.48 |
| 135 | 83.96 | 96.75 | 102.57 | 93.06 | 99.39 | 93.49 |
| 180 | 89.72 | 104.1 | 104.46 | 74.62 | 82.51 | 98.33 |
| 225 | 87.36 | 101.06 | 102.74 | 92.44 | 100.46 | 92.77 |
| 270 | 81.36 | 101.66 | 99.63 | 89.27 | 102.66 | 71.55 |
| 315 | 87.23 | 97 | 102.06 | 96.04 | 100.03 | 93.97 |
| Ave | 86.09 | 100.14 | 102.08 | 93.84 | 97.94 | 93.67 |

Fig. 11 Field intensity for 5 GHz (dB μ V/m)

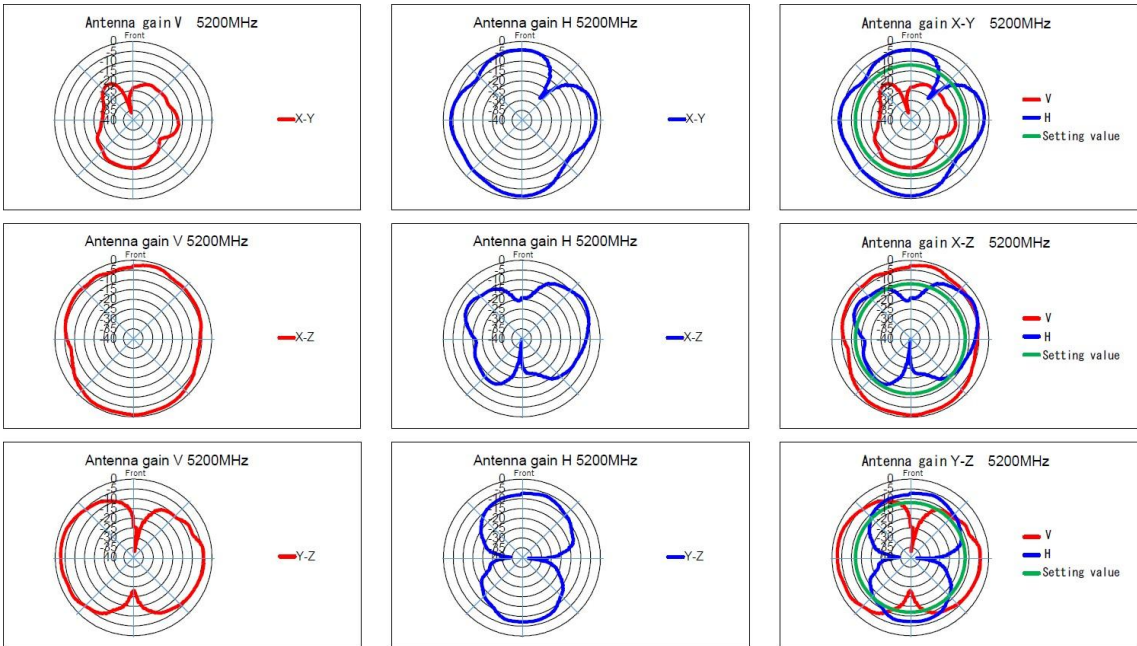


Fig. 12 Antenna gain for 5 GHz (dBi)