



# UMR Antenna Report

2022/08/02

# DUT and Test Environment



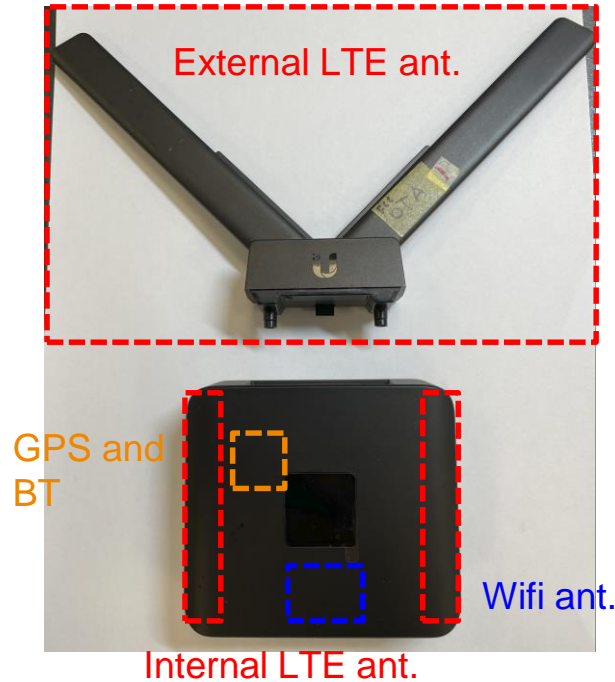
- DUT: UMR, SRT10

- Internal Antenna

- ◆ LETx2
- ◆ Wifi
- ◆ BT
- ◆ GPS

- External Antenna

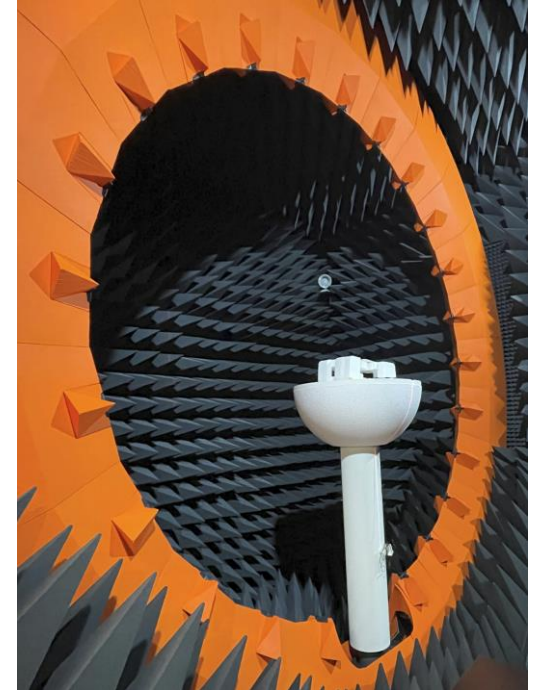
- ◆ LETx2



Mark Hung

- Approver: Mark Hung

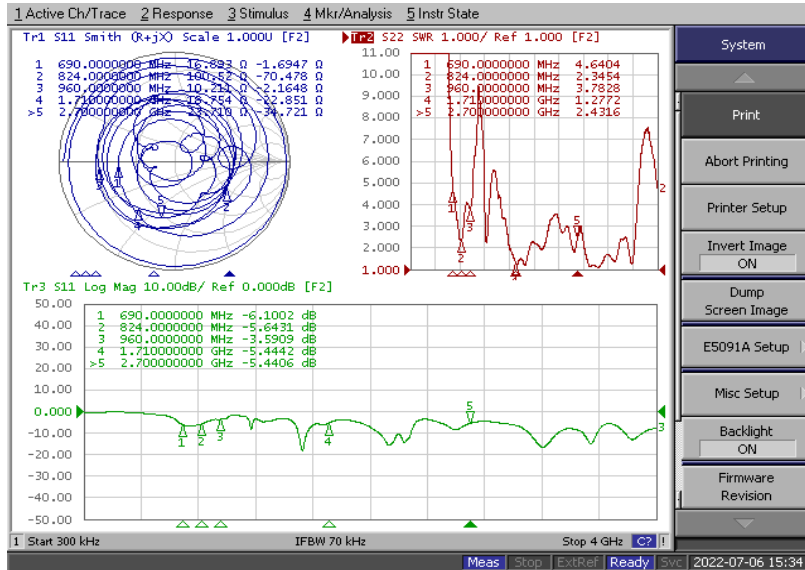
- Chamber: UI SATIMO



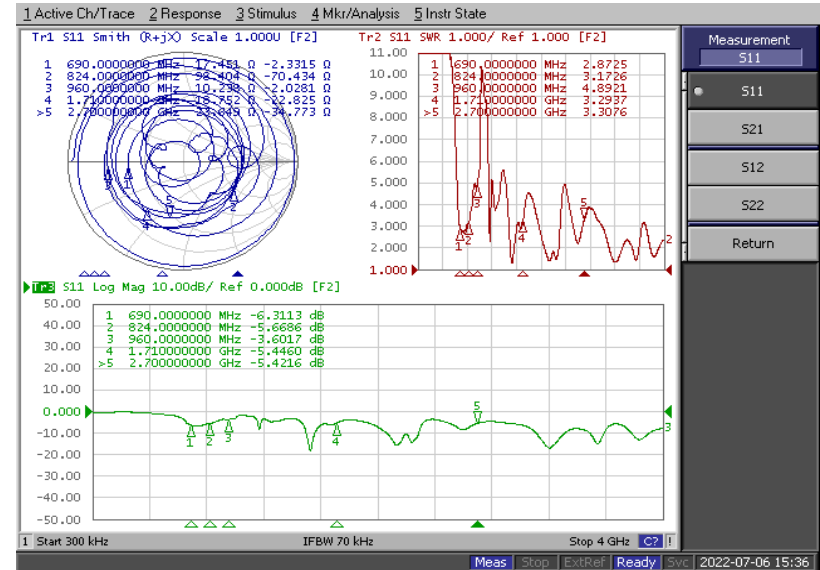
# Internal LTE Antenna\_S Parameters



- Main



- Aux



# Internal LTE Antenna\_Efficiency and Gain



| Frequency (MHz) | Main Efficiency (dB) | Aux Efficiency (dB) | Main Efficiency (%) | Aux Efficiency (%) | Main Gain (dBi) | Aux Gain (dBi) |
|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------|----------------|
| 690             | -4.276               | -4.832              | 37.356              | 32.873             | 0.668           | -0.209         |
| 700             | -4.351               | -4.792              | 36.718              | 33.174             | 0.796           | -0.155         |
| 710             | -4.02                | -4.757              | 39.628              | 33.44              | 1.051           | -1.81          |
| 720             | -3.962               | -4.712              | 40.163              | 33.792             | 0.96            | -2.055         |
| 730             | -4.152               | -4.727              | 38.439              | 33.677             | -0.394          | -1.905         |
| 740             | -3.949               | -4.729              | 40.279              | 33.656             | -0.269          | -1.808         |
| 750             | -4.008               | -4.768              | 39.735              | 33.356             | 0.983           | -0.199         |
| 760             | -4.015               | -5.005              | 39.672              | 31.589             | 1.13            | -0.331         |
| 770             | -4.226               | -5.167              | 37.792              | 30.427             | 0.922           | -1.912         |
| 780             | -4.367               | -5.306              | 36.589              | 29.473             | 0.673           | -2.312         |
| 790             | -4.282               | -5.49               | 37.31               | 28.246             | 0.714           | -1.242         |
| 800             | -4.271               | -5.417              | 37.406              | 28.727             | 0.746           | -2.188         |
| 810             | -4.188               | -5.538              | 38.123              | 27.938             | 0.751           | -2.486         |
| 820             | -4.127               | -5.733              | 38.667              | 26.715             | -0.719          | -2.536         |
| 830             | -4.115               | -5.893              | 38.767              | 25.746             | -0.81           | -2.635         |
| 840             | -4.122               | -6.263              | 38.71               | 23.641             | -0.8            | -2.003         |
| 850             | -4.075               | -6.467              | 39.125              | 22.556             | 0.59            | -2.085         |
| 860             | -4.157               | -6.753              | 38.397              | 21.119             | 0.785           | -2.307         |
| 870             | -4.123               | -6.961              | 38.696              | 20.133             | 0.784           | -3.995         |
| 880             | -4.046               | -7.057              | 39.391              | 19.693             | -0.662          | -4.334         |
| 890             | -4.143               | -7.42               | 38.525              | 18.114             | -1.118          | -4.662         |
| 900             | -4.186               | -7.475              | 38.141              | 17.883             | -1.016          | -4.682         |
| 910             | -4.334               | -7.615              | 36.861              | 17.319             | 0.222           | -3.273         |
| 920             | -4.496               | -7.931              | 35.514              | 16.101             | 0.238           | -3.476         |
| 930             | -4.769               | -8.146              | 33.348              | 15.325             | 0.003           | -4.27          |
| 940             | -5.006               | -8.167              | 31.582              | 15.252             | -0.394          | -4.418         |
| 950             | -5.067               | -8.002              | 31.139              | 15.841             | -1.774          | -5.151         |
| 960             | -5.17                | -7.983              | 30.412              | 15.91              | -0.395          | -5.037         |
| 970             | -5.125               | -7.832              | 30.727              | 16.474             | -0.107          | -3.686         |
| 980             | -5.135               | -7.742              | 30.653              | 16.821             | 0.036           | -3.469         |

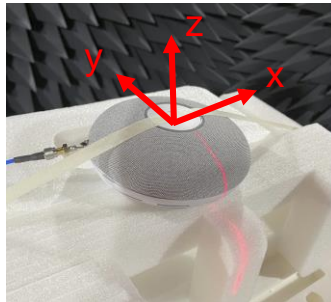
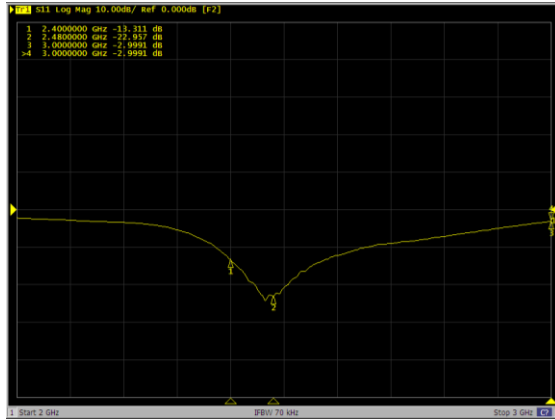
| Frequency (MHz) | Main Efficiency (dB) | Aux Efficiency (dB) | Main Efficiency (%) | Aux Efficiency (%) | Main Gain (dBi) | Aux Gain (dBi) |
|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------|----------------|
| 1690            | -4.682               | -6.038              | 34.024              | 24.898             | 1.493           | -1.749         |
| 1710            | -4.858               | -6.415              | 32.676              | 22.828             | 1.088           | -2.141         |
| 1730            | -4.632               | -6.375              | 34.416              | 23.039             | 0.612           | -1.933         |
| 1750            | -4.399               | -6.171              | 36.316              | 24.148             | 0.553           | -1.553         |
| 1770            | -4.396               | -5.981              | 36.345              | 25.226             | 1.107           | -1.479         |
| 1790            | -4.704               | -5.948              | 33.852              | 25.424             | 0.881           | -1.74          |
| 1810            | -4.981               | -5.818              | 31.763              | 26.191             | 0.625           | -1.844         |
| 1830            | -5.197               | -5.678              | 30.218              | 27.054             | 0.609           | -1.963         |
| 1850            | -5.389               | -5.656              | 28.915              | 27.192             | 0.229           | -1.927         |
| 1870            | -5.38                | -5.35               | 28.973              | 29.174             | 0.326           | -1.57          |
| 1890            | -5.451               | -5.305              | 28.504              | 29.48              | 0.198           | -1.735         |
| 1910            | -5.439               | -5.065              | 28.58               | 31.151             | 0.063           | -1.563         |
| 1930            | -5.356               | -4.938              | 29.135              | 32.08              | -0.314          | -1.363         |
| 1950            | -5.231               | -4.578              | 29.988              | 34.851             | -0.799          | -0.874         |
| 1970            | -5.06                | -4.404              | 31.187              | 36.272             | -0.932          | -0.761         |
| 1990            | -4.834               | -4.268              | 32.858              | 37.43              | -0.803          | -0.649         |
| 2010            | -4.776               | -4.285              | 33.3                | 37.281             | -1.009          | -0.759         |
| 2030            | -4.648               | -4.352              | 34.293              | 36.715             | -1.23           | -0.198         |
| 2050            | -4.479               | -4.452              | 35.654              | 35.879             | -1.64           | -0.405         |
| 2070            | -4.356               | -4.594              | 36.673              | 34.723             | -1.751          | -1.092         |
| 2090            | -4.407               | -4.96               | 36.248              | 31.915             | -1.539          | -1.624         |
| 2110            | -4.79                | -5.324              | 33.19               | 29.35              | -2.062          | -1.986         |
| 2130            | -4.815               | -5.501              | 32.995              | 28.176             | -1.607          | -2.359         |
| 2150            | -4.709               | -5.29               | 33.814              | 29.582             | -1.262          | -2.517         |
| 2170            | -4.736               | -5.034              | 33.606              | 31.377             | -0.837          | -1.668         |
| 2190            | -4.756               | -4.695              | 33.453              | 33.925             | -0.449          | -0.483         |

\* Antenna gain data were measured by UI chamber

# Antenna Performance



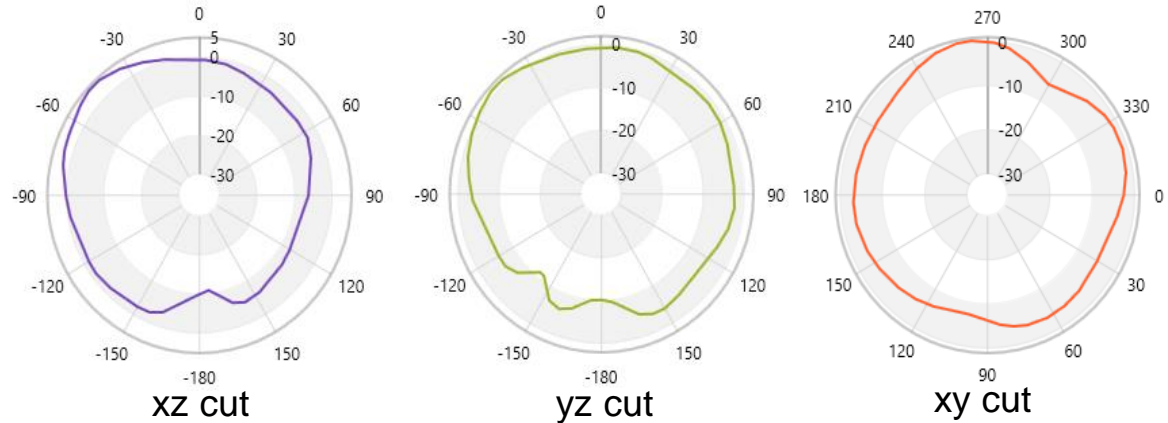
- Return loss



- Gain and Efficiency

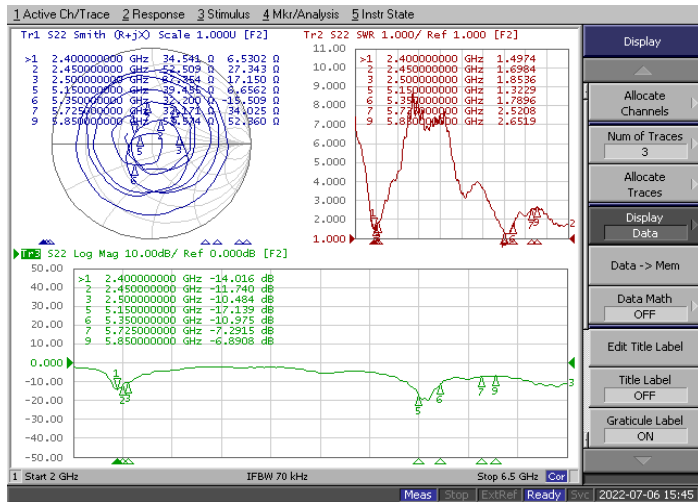
| Frequency | Gain (dBi) | Efficiency (%) |
|-----------|------------|----------------|
| 2400 MHz  | 4.66       | 58             |
| 2420 MHz  | 4.78       | 59             |
| 2440 MHz  | 4.96       | 62             |
| 2450 MHz  | 5.04       | 62             |
| 2480 MHz  | 5.11       | 62             |
| 2500 MHz  | 5.32       | 64             |

- Radiation pattern



\* Antenna gain data were measured by UI chamber

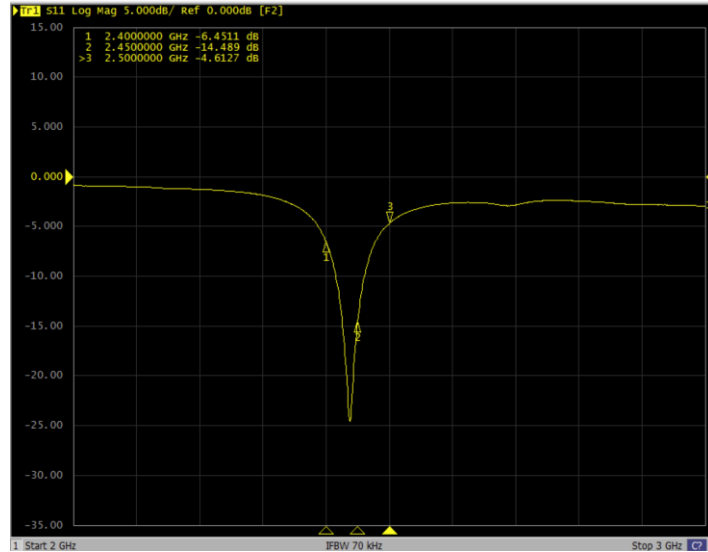
# Internal wifi Antenna



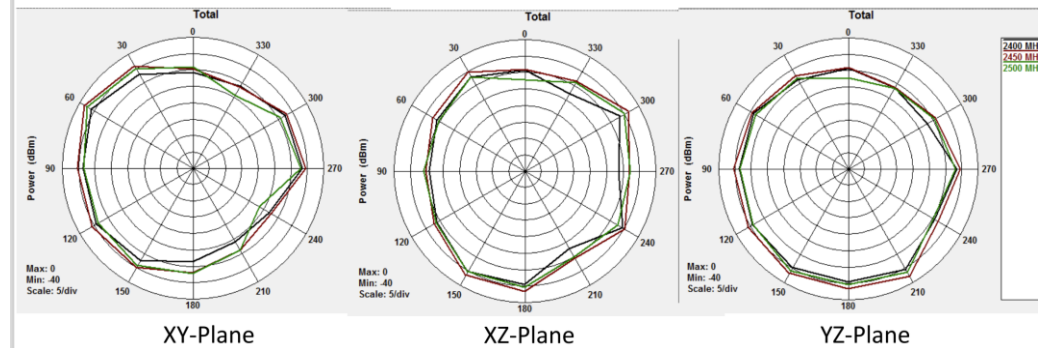
| Frequency (MHz) | Efficiency (dB) | Efficiency (%) | Gain (dBi) |
|-----------------|-----------------|----------------|------------|
| 2400            | -5.2            | 30.0           | 2.6        |
| 2410            | -5.1            | 30.7           | 2.7        |
| 2420            | -5.1            | 30.7           | 2.7        |
| 2430            | -5.1            | 30.6           | 2.7        |
| 2440            | -5.2            | 30.0           | 2.7        |
| 2450            | -5.2            | 30.0           | 2.7        |
| 2460            | -5.1            | 30.6           | 2.7        |
| 2470            | -5.0            | 31.4           | 2.6        |
| 2480            | -5.0            | 31.7           | 2.5        |
| 2490            | -5.0            | 31.3           | 2.4        |
| 2500            | -5.1            | 30.7           | 2.3        |

\* Antenna gain data were measured by UI chamber

# Internal BT Antenna

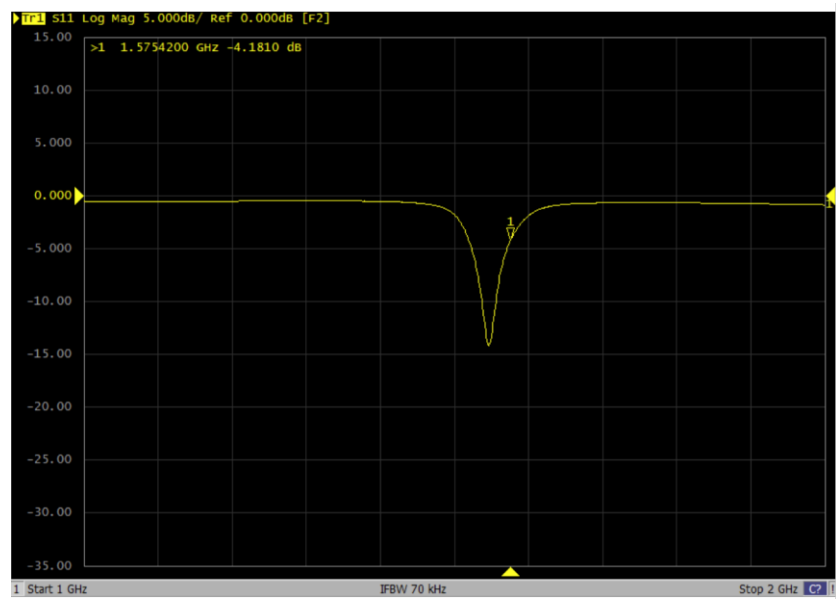


| Frequency (MHz) | Efficiency (%) | Gain (dBi) |
|-----------------|----------------|------------|
| 2400            | 16             | -3.43      |
| 2450            | 24             | -1.08      |
| 2500            | 18             | -2.61      |

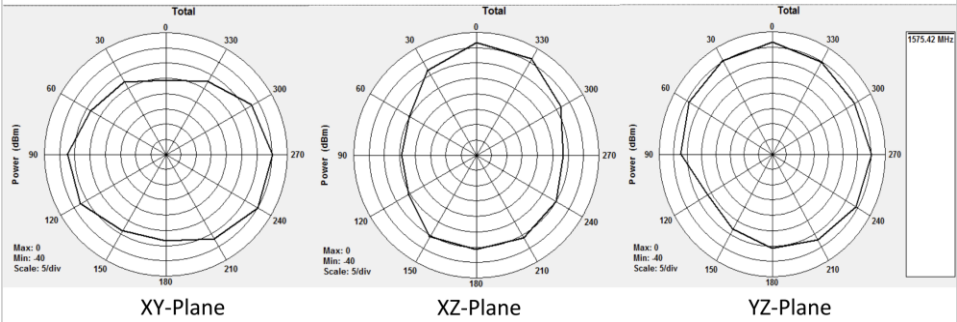


\* Antenna gain data were measured by UI chamber

# Internal GPS Antenna



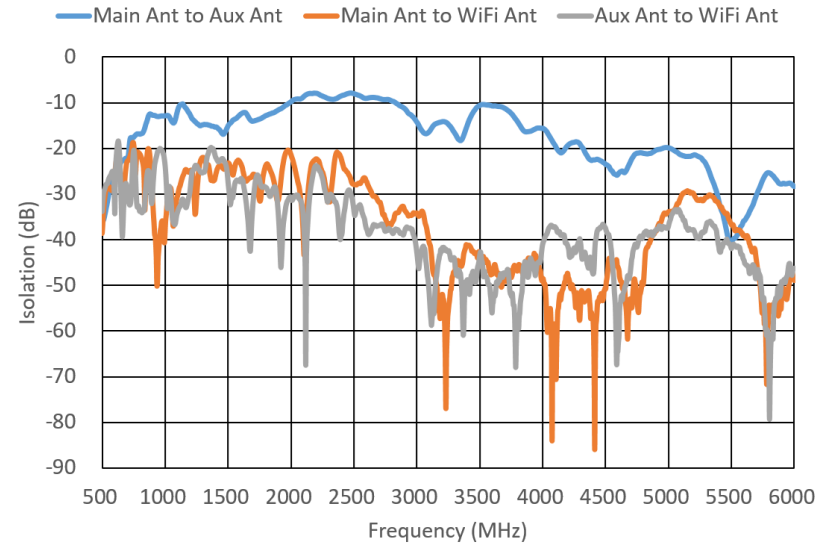
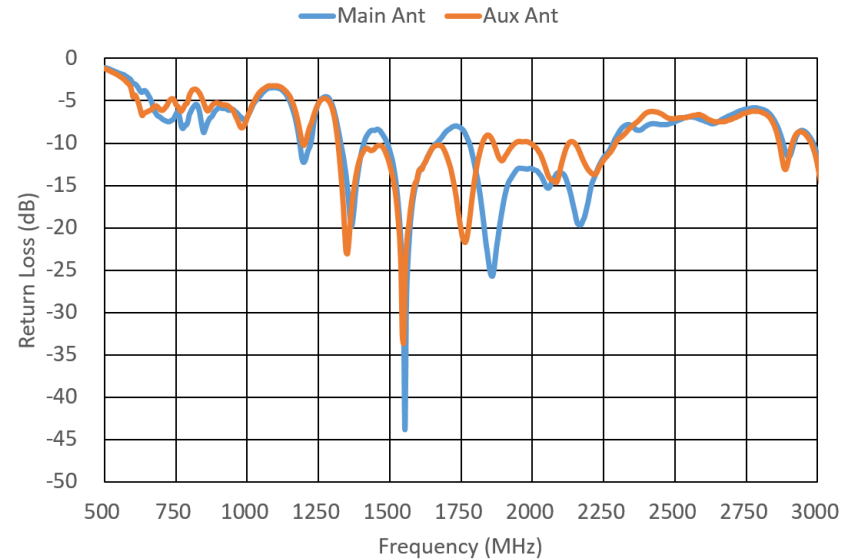
| Frequency (MHz) | Efficiency (%) | Gain (dBi) |
|-----------------|----------------|------------|
| 1575.42         | 10             | -5.33      |



\* Antenna gain data were measured by UI chamber



# External LTE Antenna\_S Parameters



# External LTE Antenna\_Efficiency and Gain



|                 | Main       | Aux        | Main       | Aux        |
|-----------------|------------|------------|------------|------------|
| Frequency (MHz) | Efficiency | Efficiency | Gain (dBi) | Gain (dBi) |
| 690             | 55%        | 49%        | 1.92       | 1.22       |
| 700             | 52%        | 41%        | 0.45       | -0.39      |
| 710             | 52%        | 42%        | 0.72       | -0.30      |
| 720             | 46%        | 38%        | 0.35       | -0.32      |
| 730             | 45%        | 38%        | 0.90       | -0.86      |
| 740             | 44%        | 39%        | 1.31       | 0.23       |
| 750             | 44%        | 39%        | 1.48       | -0.05      |
| 760             | 40%        | 37%        | 0.94       | -0.58      |
| 770             | 36%        | 35%        | 0.34       | -0.90      |
| 780             | 32%        | 33%        | -0.58      | -1.06      |
| 790             | 23%        | 29%        | -1.72      | -1.38      |
| 800             | 17%        | 27%        | -2.49      | -0.66      |
| 810             | 18%        | 28%        | -1.38      | -0.56      |
| 820             | 25%        | 30%        | 0.21       | -0.95      |
| 830             | 31%        | 30%        | 0.84       | -0.90      |
| 840             | 30%        | 26%        | 0.82       | -1.85      |
| 850             | 29%        | 25%        | 0.37       | -1.54      |
| 860             | 31%        | 25%        | 0.80       | -2.03      |
| 870             | 30%        | 24%        | 0.78       | -2.66      |
| 880             | 31%        | 24%        | 0.26       | -2.60      |
| 890             | 33%        | 25%        | 0.03       | -2.29      |
| 900             | 34%        | 25%        | 0.41       | -1.90      |
| 910             | 35%        | 24%        | 0.55       | -1.36      |
| 920             | 36%        | 23%        | 1.13       | -2.54      |
| 930             | 38%        | 23%        | 0.73       | -2.90      |
| 940             | 37%        | 20%        | 0.11       | -3.37      |
| 950             | 36%        | 19%        | 0.20       | -3.18      |
| 960             | 34%        | 17%        | 0.35       | -4.15      |
| 970             | 32%        | 15%        | -0.18      | -4.32      |
| 980             | 32%        | 14%        | -0.49      | -4.01      |

| Frequency (MHz) | Efficiency | Efficiency | Gain (dBi) | Gain (dBi) |
|-----------------|------------|------------|------------|------------|
| 1690            | 32%        | 15%        | 0.19       | -3.00      |
| 1710            | 31%        | 18%        | 0.06       | -2.11      |
| 1730            | 28%        | 19%        | -0.56      | -2.62      |
| 1750            | 27%        | 20%        | -0.81      | -2.74      |
| 1770            | 25%        | 22%        | -0.78      | -2.27      |
| 1790            | 25%        | 26%        | 0.39       | -1.50      |
| 1810            | 25%        | 29%        | 1.18       | -0.94      |
| 1830            | 26%        | 33%        | 1.07       | -0.48      |
| 1850            | 23%        | 37%        | 0.30       | -0.29      |
| 1870            | 20%        | 40%        | -0.52      | 0.46       |
| 1890            | 17%        | 43%        | -1.40      | 0.91       |
| 1910            | 16%        | 44%        | -1.66      | 0.87       |
| 1930            | 17%        | 44%        | -1.22      | 0.81       |
| 1950            | 19%        | 42%        | -0.15      | 0.60       |
| 1970            | 21%        | 42%        | -1.03      | 0.56       |
| 1990            | 25%        | 40%        | -0.16      | 0.38       |
| 2010            | 29%        | 35%        | 0.07       | -0.68      |
| 2030            | 33%        | 32%        | 0.84       | -1.28      |
| 2050            | 32%        | 27%        | 0.47       | -2.51      |
| 2070            | 33%        | 25%        | 0.18       | -3.12      |
| 2090            | 32%        | 25%        | -0.16      | -3.23      |
| 2110            | 29%        | 24%        | -0.32      | -3.27      |
| 2130            | 29%        | 28%        | 0.30       | -2.53      |
| 2150            | 28%        | 31%        | -0.29      | -1.96      |
| 2170            | 26%        | 31%        | -1.56      | -0.70      |
| 2190            | 26%        | 33%        | -1.72      | 0.02       |

\* Antenna gain data were measured by UI chamber

