# Porsche P0426

# 5G-Antenna Datasheet

27.07.2021

M. Düring / M.Schöneberg

Fuba Electrical Engineering

# Documentation Of Changes

| Date | Chapter | Changes | Author |
|---|---|---|---|
| 15.03.2021 | 1-2 | Initial Version | M. Harms |
| 25.03.2021 | 2 | Additional Information | M. Düring |
| 27.07.2021 | | New measurements C-sample | M.Schöneberg/ M-Düring |
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- 1. Overview
- 2. 5G Antenna Performance
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# 1. Overview

- In this datasheet the typical performance of the PO426 5G-Antenna C-Sampleis given
- Data is shown for all 5G frequency-ranges, with 10K diagnosis resistor
- Measurements were taken with direct connection to AUT
- The Sample is C-Sample part from production
- Fuba Part Number and description **30006702/001-ANT-ASM,PO426,5G-ANT**
- Customer Part Number **95C 035 503**


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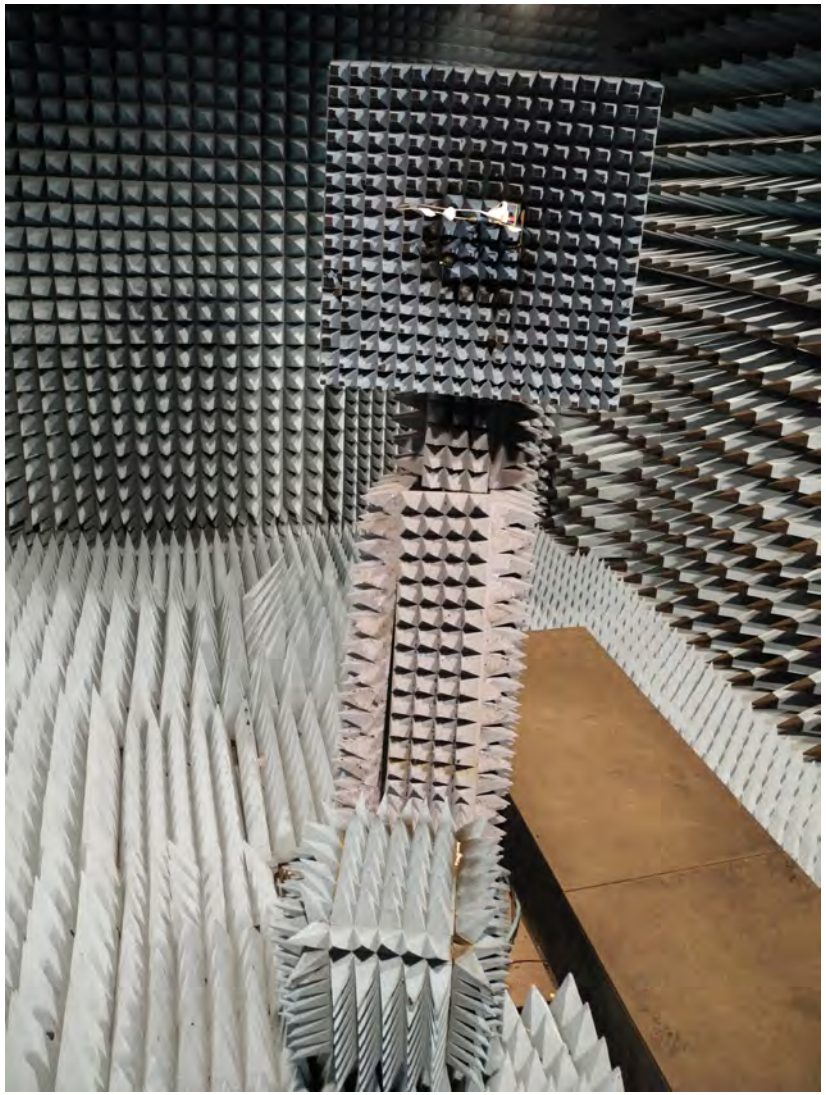
# 1. Overview
# Anechoic Chamber with AUT

- Measurements were done in anechoic chamber
- the antenna under test (AUT) placed on an adapter in the center
- All depicted field data is farfield data calibrated to dBi

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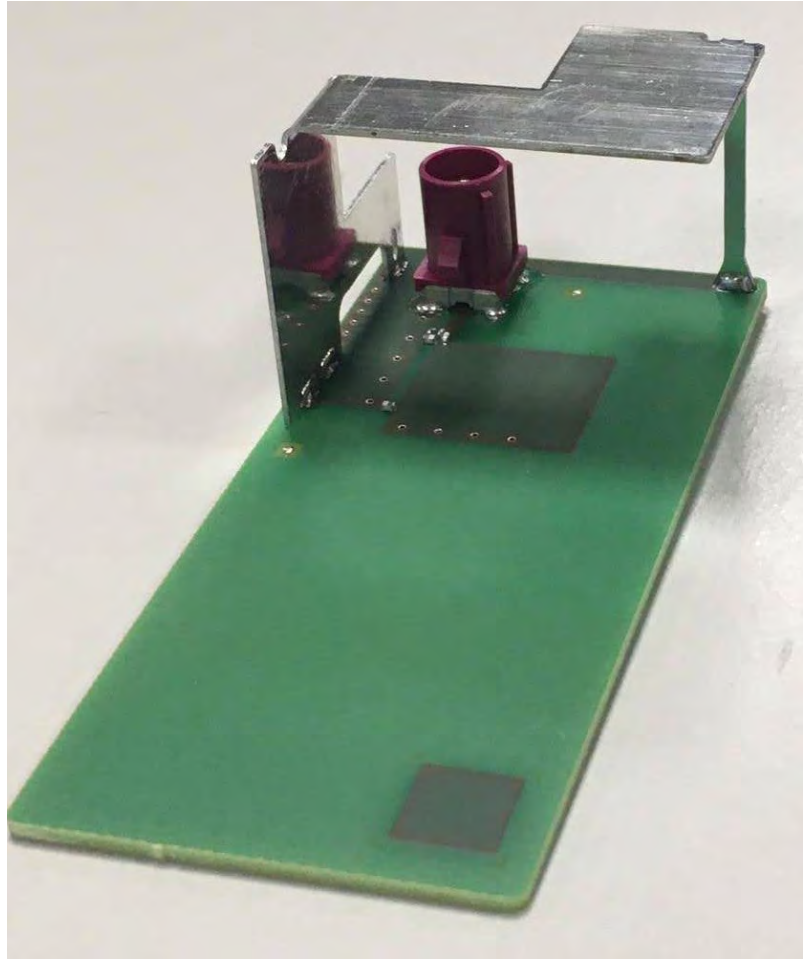
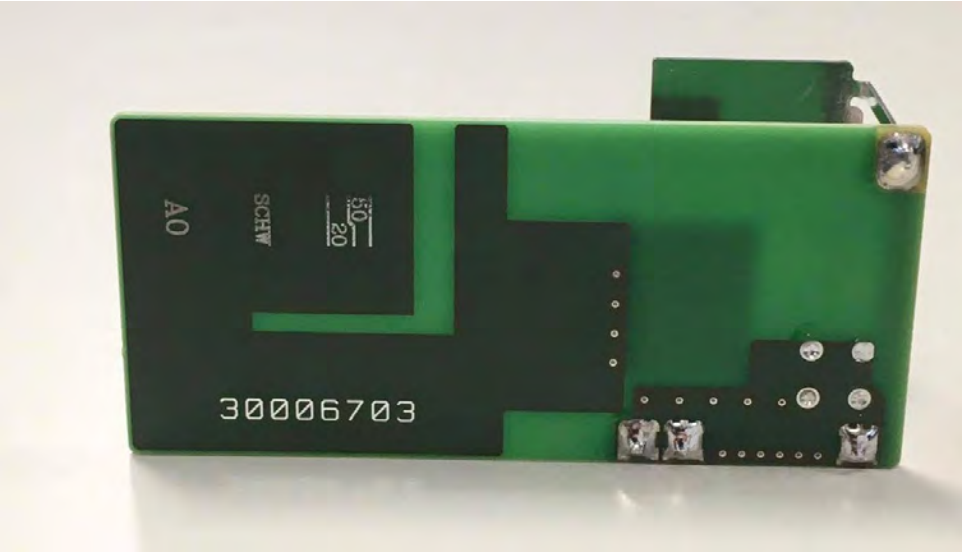
# 1. Overview
# AUT





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# 2. 5G Antenna Performance



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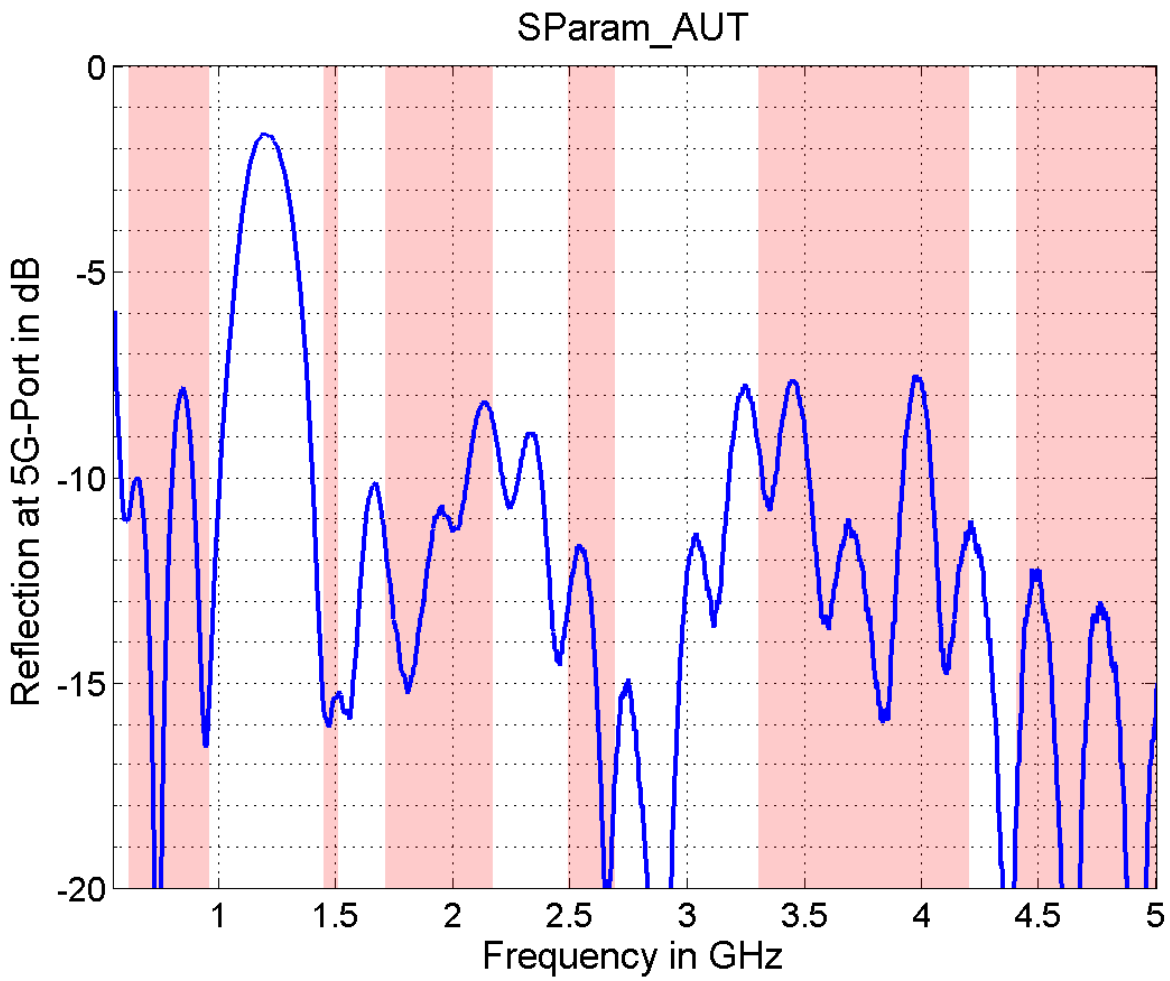
# 2. 5G Antenna Performance Matching

Chamber



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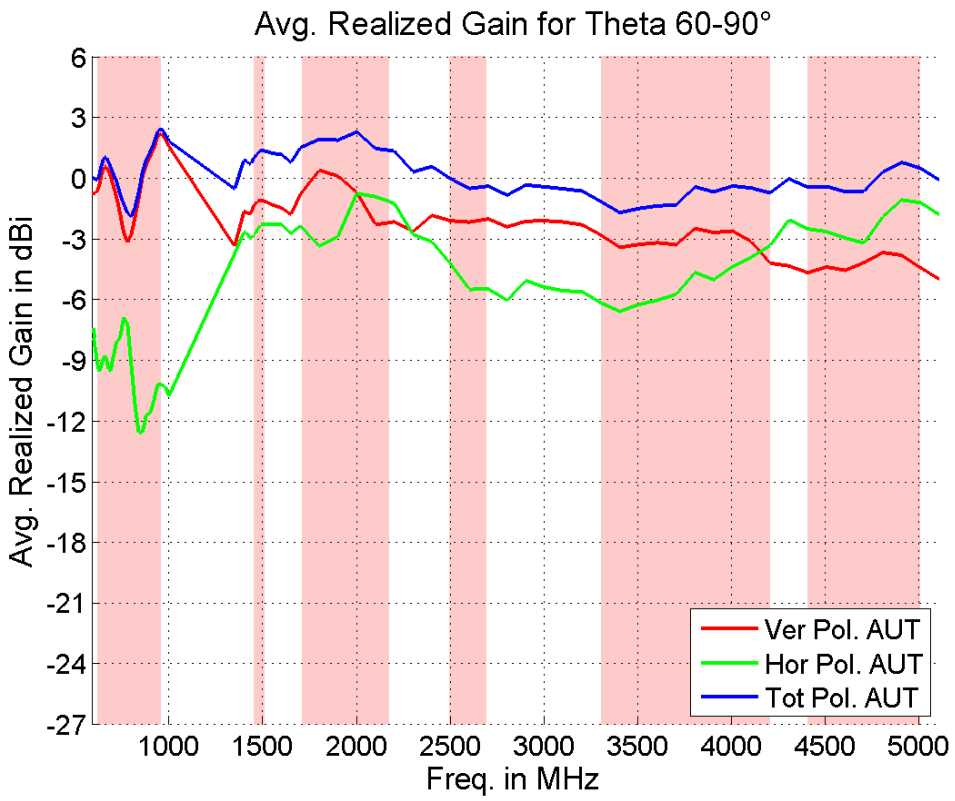
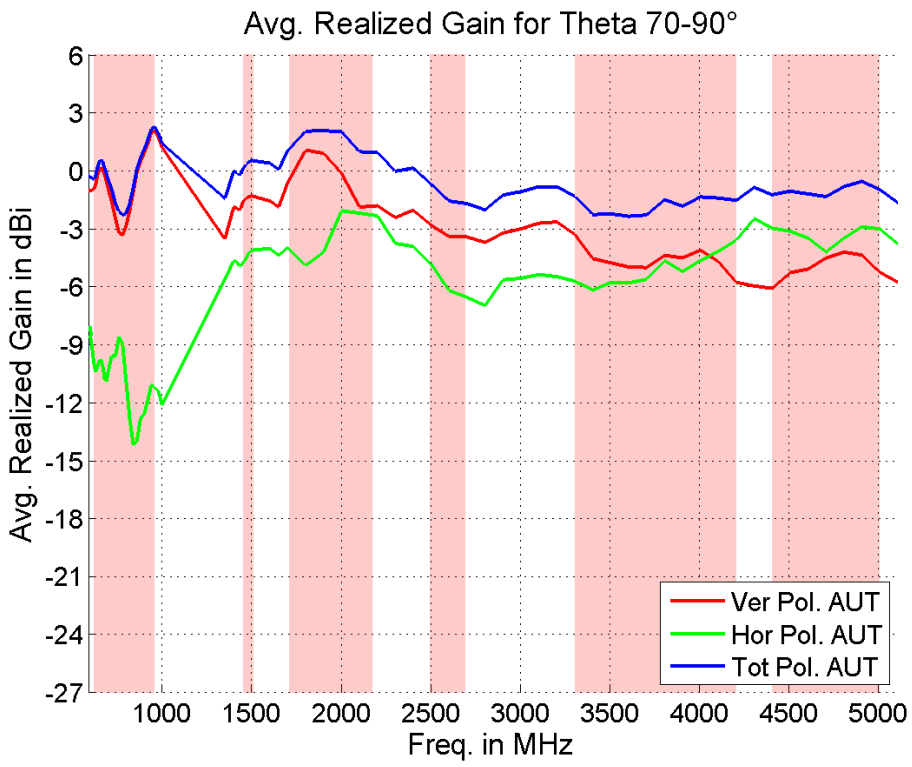
# 2. 5G Antenna Performance in Chamber

Chamber



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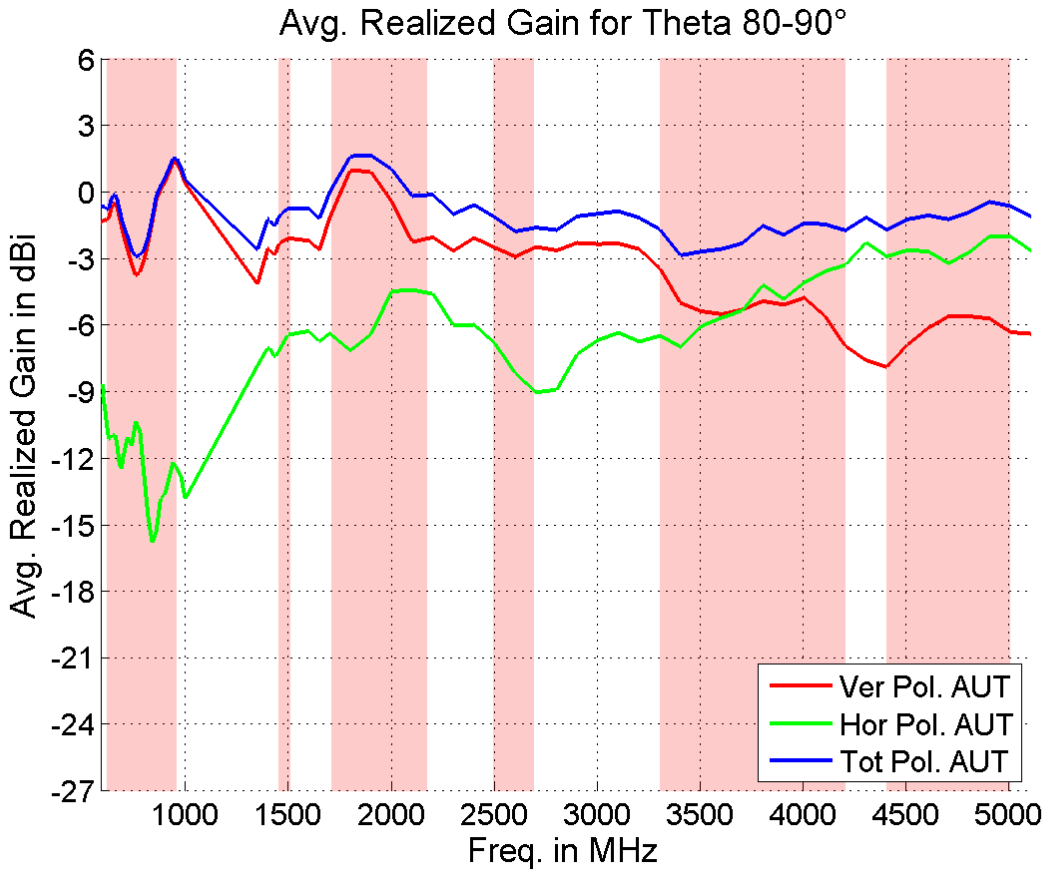
# 2. 5G Antenna Performance in Chamber

Chamber



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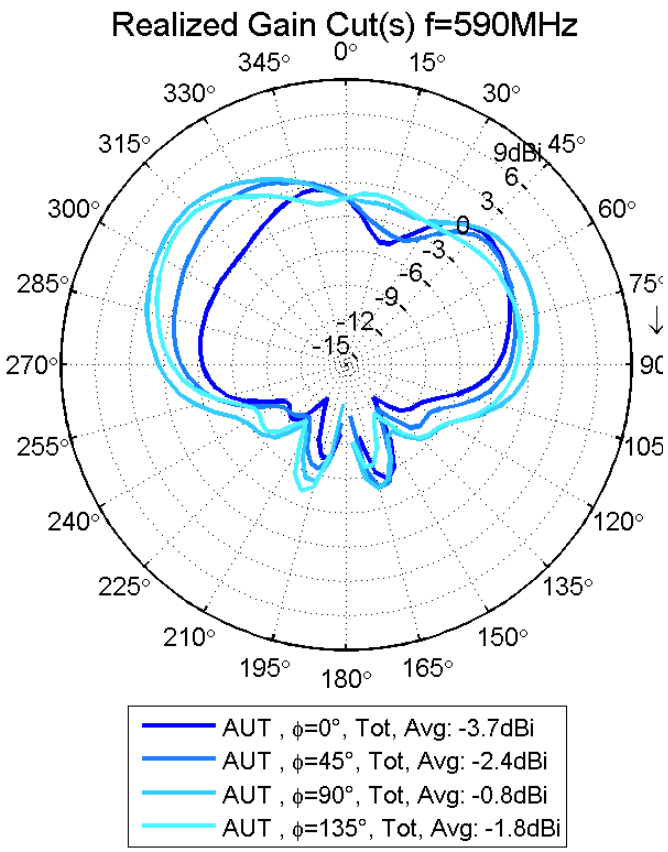
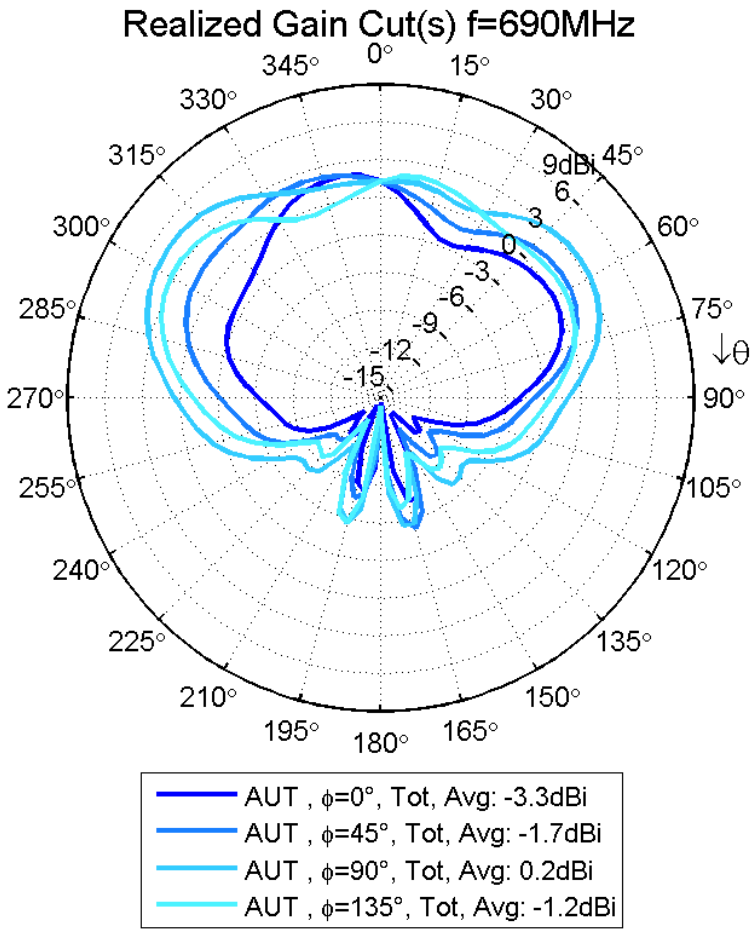
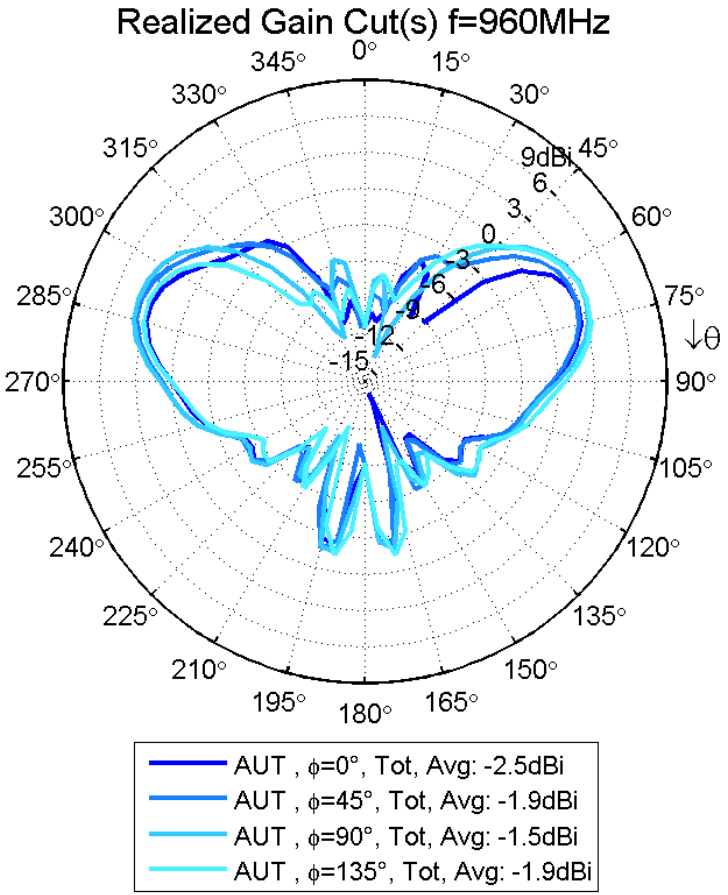
# 2. 5G Antenna Performance in Chamber

Chamber



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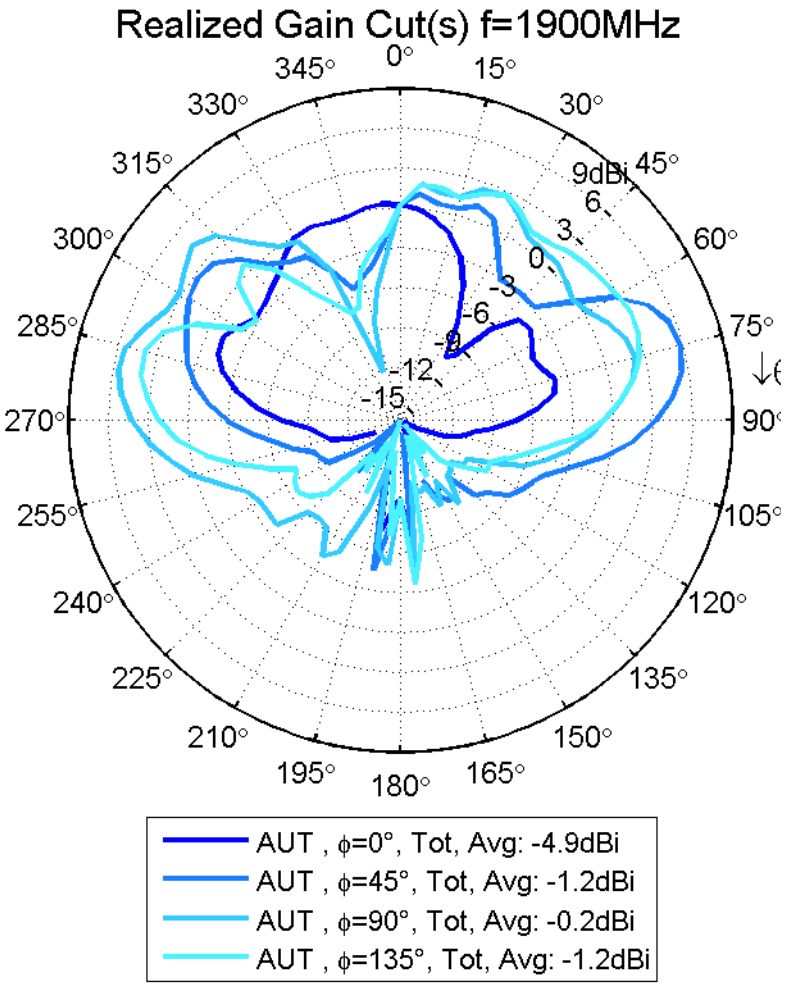
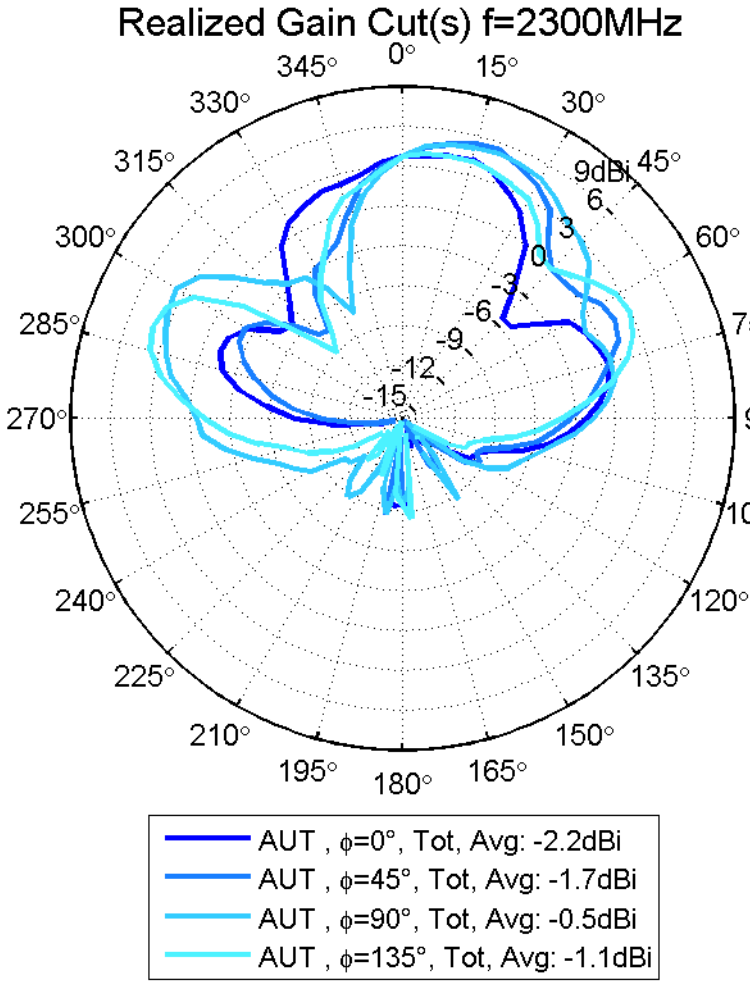
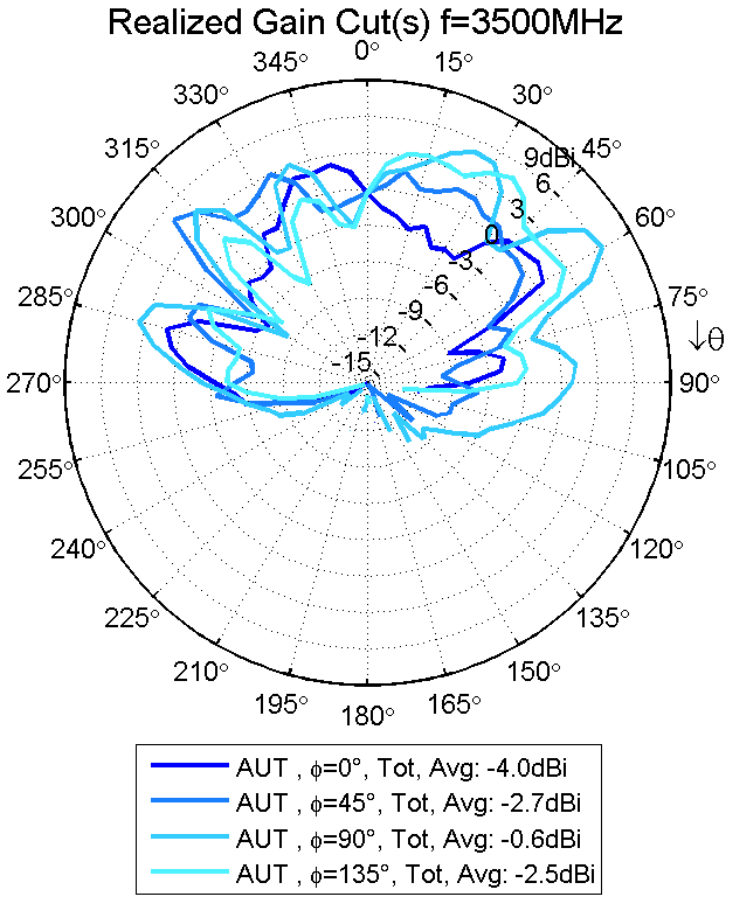
# 2. 5G Antenna Performance in Chamber

Chamber



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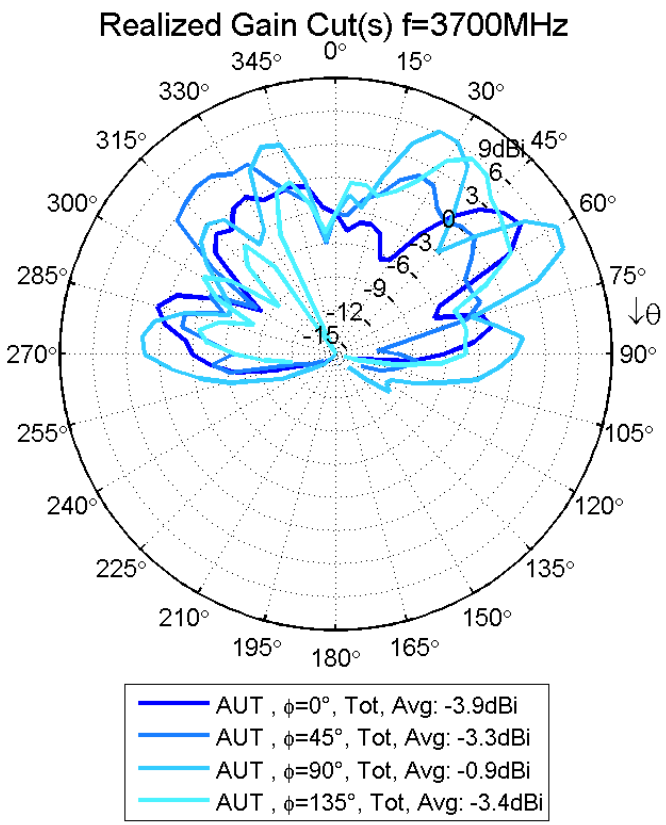
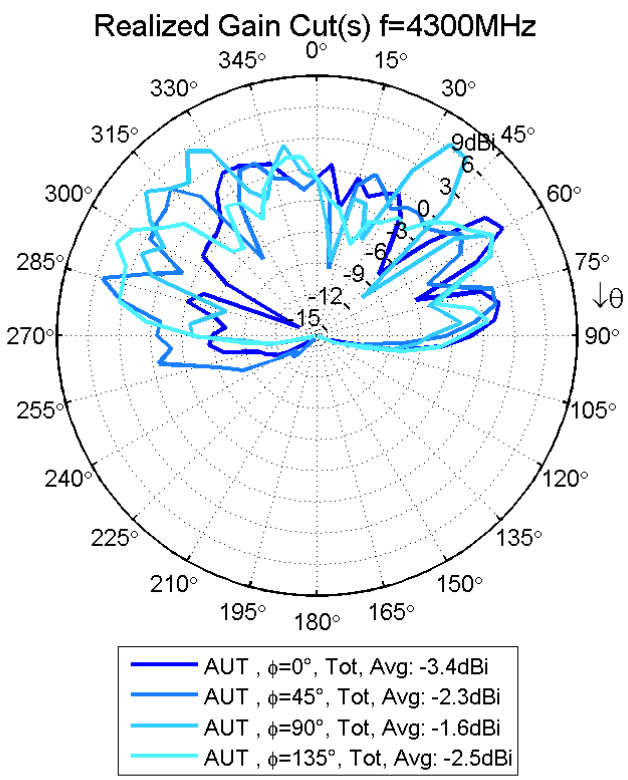
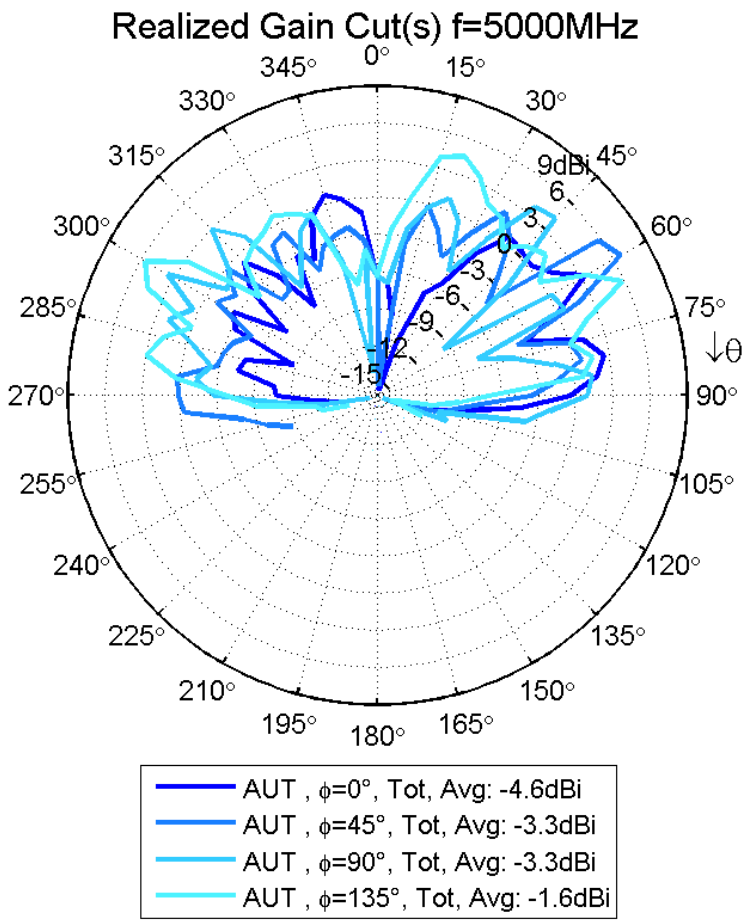
# 2. 5G Antenna Performance in Chamber

Chamber



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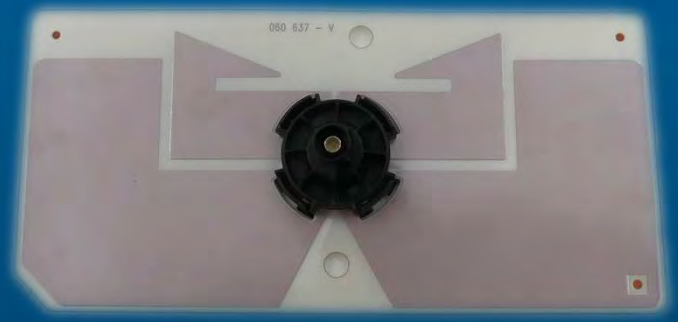
# ANNEX

Cable: 1.5m RTK031

| Frequency(MHz) | MaxGain(dBi) | Theta(°) | Phi(°) |
|---|---|---|---|
| 590 | 3.50 | 45 | 285 |
| 600 | 2.92 | 50 | 285 |
| 610 | 2.78 | 50 | 285 |
| 620 | 2.83 | 50 | 285 |
| 630 | 3.20 | 55 | 280 |
| 640 | 3.77 | 55 | 280 |
| 650 | 4.80 | 55 | 280 |
| 660 | 4.21 | 55 | 280 |
| 670 | 4.21 | 55 | 280 |
| 680 | 4.18 | 55 | 280 |
| 690 | 4.20 | 55 | 280 |
| 700 | 4.23 | 55 | 280 |
| 720 | 4.53 | 50 | 275 |
| 740 | 4.50 | 45 | 270 |
| 760 | 4.28 | 40 | 265 |
| 780 | 3.84 | 20 | 155 |
| 800 | 2.73 | 20 | 165 |
| 820 | 1.36 | 15 | 180 |
| 840 | 1.60 | 60 | 120 |
| 860 | 1.82 | 60 | 245 |
| 880 | 2.46 | 60 | 245 |
| 900 | 2.20 | 60 | 245 |
| 920 | 2.29 | 65 | 250 |
| 940 | 3.90 | 70 | 255 |
| 960 | 3.43 | 70 | 260 |
| 980 | 3.26 | 70 | 260 |
| 1000 | 3.13 | 65 | 110 |
| 1350 | 3.21 | 45 | 265 |
| 1400 | 3.97 | 45 | 265 |
| 1410 | 3.85 | 45 | 265 |
| 1420 | 3.66 | 45 | 265 |
| 1430 | 3.40 | 45 | 265 |
| 1440 | 3.34 | 45 | 265 |
| 1450 | 3.42 | 45 | 265 |
| 1460 | 3.45 | 45 | 265 |
| 1470 | 3.50 | 45 | 265 |
| 1480 | 3.59 | 55 | 125 |
| 1490 | 3.64 | 55 | 125 |
| 1500 | 3.62 | 55 | 125 |
| 1550 | 3.51 | 60 | 345 |
| 1600 | 3.42 | 60 | 345 |
| 1650 | 3.40 | 65 | 340 |
| 1700 | 3.68 | 65 | 110 |
| 1800 | 5.50 | 80 | 265 |
| 1900 | 5.18 | 80 | 260 |

| | | | |
|---|---|---|---|
| 2000 | 5.13 | 75 | 260 |
| 2100 | 4.37 | 75 | 310 |
| 2200 | 5.20 | 15 | 45 |
| 2300 | 4.46 | 20 | 50 |
| 2400 | 5.30 | 15 | 60 |
| 2500 | 4.38 | 50 | 90 |
| 2600 | 5.95 | 50 | 80 |
| 2700 | 6.81 | 50 | 80 |
| 2800 | 6.47 | 55 | 90 |
| 2900 | 6.71 | 55 | 90 |
| 3000 | 6.16 | 55 | 95 |
| 3100 | 5.61 | 10 | 160 |
| 3200 | 4.75 | 55 | 110 |
| 3300 | 4.51 | 60 | 110 |
| 3400 | 4.80 | 60 | 110 |
| 3500 | 5.20 | 60 | 105 |
| 3600 | 5.64 | 60 | 90 |
| 3700 | 5.61 | 60 | 90 |
| 3800 | 6.26 | 65 | 90 |
| 3900 | 5.76 | 60 | 90 |
| 4000 | 4.77 | 55 | 0 |
| 4100 | 5.13 | 50 | 285 |
| 4200 | 4.60 | 50 | 285 |
| 4300 | 5.23 | 35 | 80 |
| 4400 | 4.76 | 35 | 260 |
| 4500 | 4.43 | 55 | 330 |
| 4600 | 4.40 | 55 | 330 |
| 4700 | 4.10 | 55 | 330 |
| 4800 | 5.22 | 60 | 25 |
| 4900 | 5.95 | 60 | 330 |
| 5000 | 5.16 | 60 | 325 |
| 5100 | 5.17 | 60 | 40 |

# LTE2_LTE4_antenna



## Porsche Messkampagne
## April 2021

***3D Messungen:*** C-Muster Konformitätsmessungen

**Porsche Teilenummer:** 95C.051.502

Bearbeitet / edit by: Daniel Dogaru
Datum / date: 4_2021

# Entwicklungsbegleitende Messungen
## Folienantenne 5G – Thema

Es werden Konformitätsmessungen gemacht, mit einem von PAG vorgegebenen Messplatz-Setup (siehe Mail vom 24.02.2021).

Hallo Herr Christ, Hallo Herr Dogaru,

heute morgen hatten wir noch über die Anforderungen bei der Chambermessung gesprochen.
Zwecks Vergleichbarkeit sollte die Messung mit folgenden Einstellungen stattfinden:

- Winkelauflösung
  Standard => Theta; Phi => 5°
- Frequenzbereiche entsprechend Fahrzeugmessung
- Frequenzauflösung
  600-700 MHz =>10 MHz
  700-1000 MHz => 20 MHz
  1400-1500 MHz => 10 MHz
  1500-1700 MHz => 50MHz
  1700-5000 MHz => 100 MHz
- Halbkugel

Mit freundlichen Grüßen

**Jan Schmedding**
Dr. Ing. h.c. F. Porsche AG

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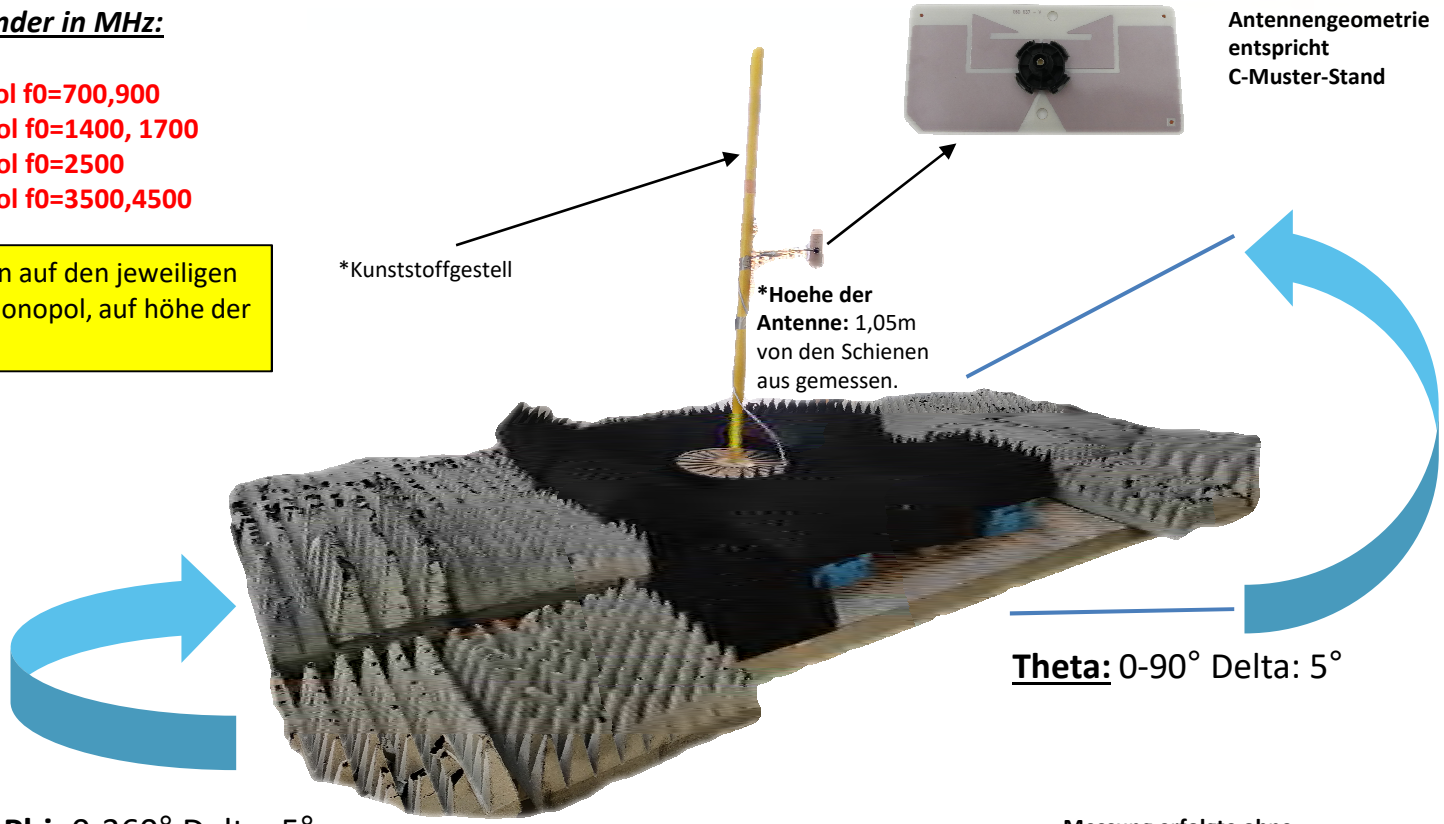
# Entwicklungsbegleitende Messungen
## Folienantenne 5G – Messaufbau

***Gemessene Frequenzbänder in MHz:***

**617-1000 Ref = Monopol f0=700,900**
**1400-2200 Ref = Monopol f0=1400, 1700**
**2300-2700 Ref = Monopol f0=2500**
**3300-5000 Ref = Monopol f0=3500,4500**

Gemessen wird immer gegen einen auf den jeweiligen Frequenzbereich abgestimmten Monopol, auf höhe der Testantenne.




**Antennengeometrie entspricht C-Muster-Stand**

**Messung erfolgte ohne serienmäßigen Leitungssatz des Fahrzeugs**

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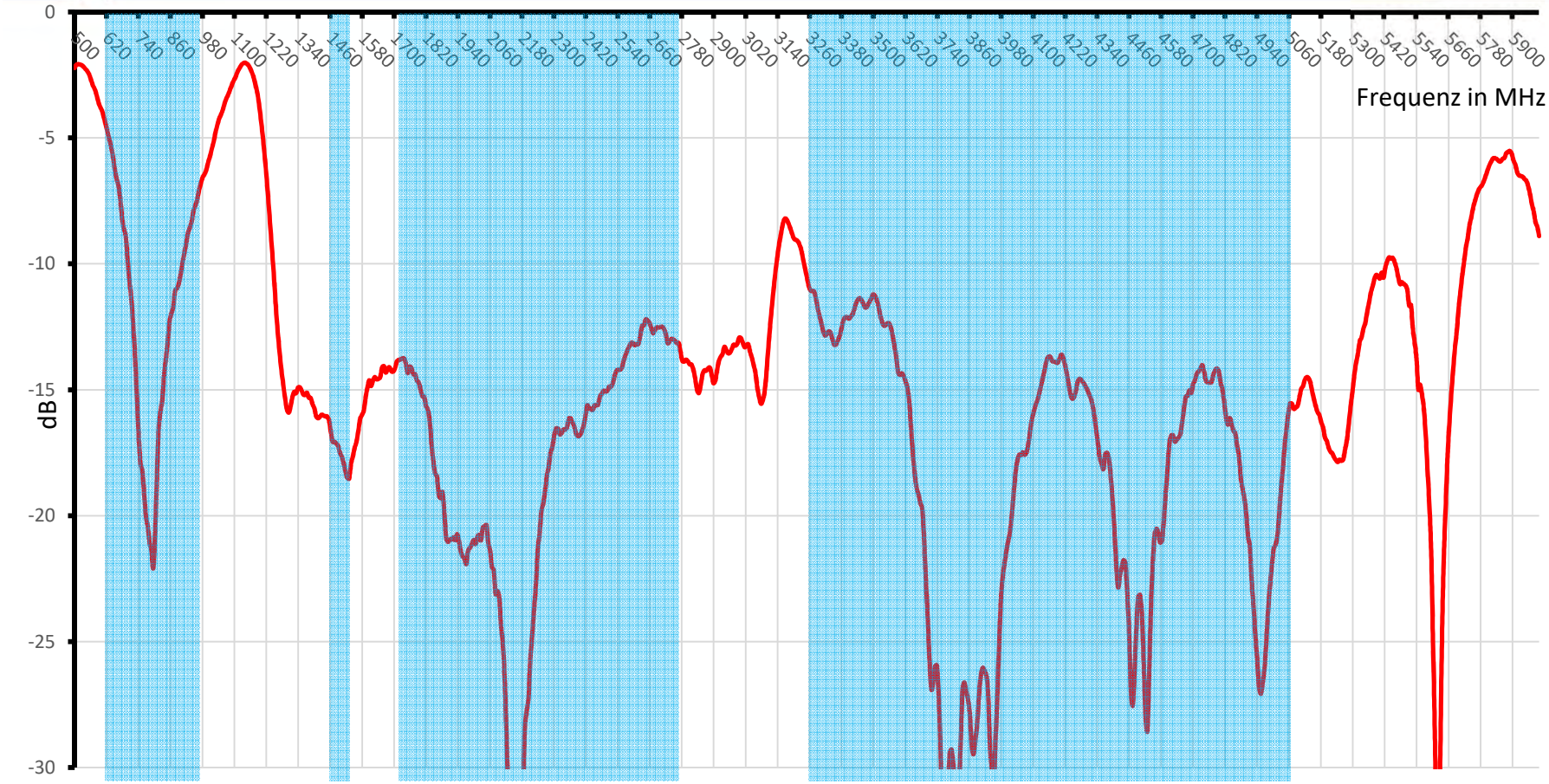
# Entwicklungsbegleitende Messungen

## Folienantenne 5G (B2 Muster auf Halter in Luft– S-Parameter)

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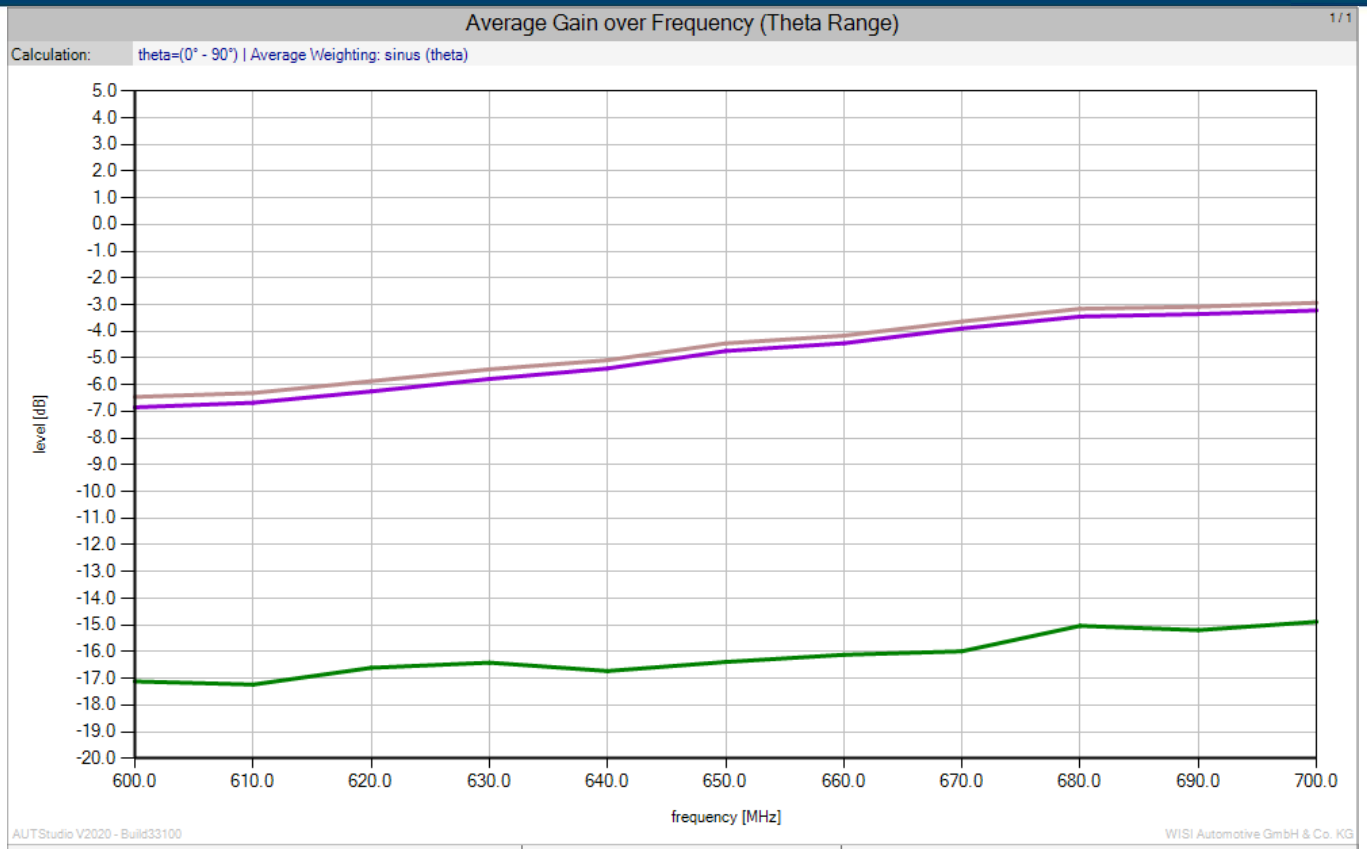
# Start der Auswertung

# Entwicklungsbegleitende Messungen

## Folie B2-Muster Gain total 600-700MHz Avg Gain 0-90°




| | min | max | avg | | min | max | avg | | min | max | avg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| H avg | -17.23 | -14.88 | -16.08 | V avg | -6.85 | -3.22 | -4.73 | f(x)H+V avg | -6.46 | -2.93 | -4.42 |

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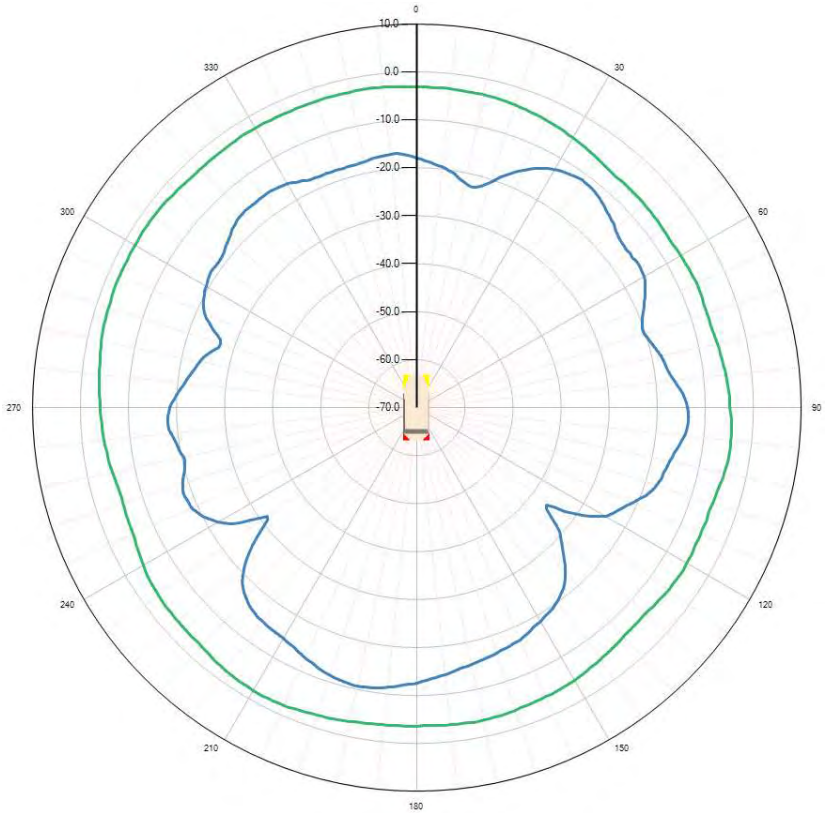
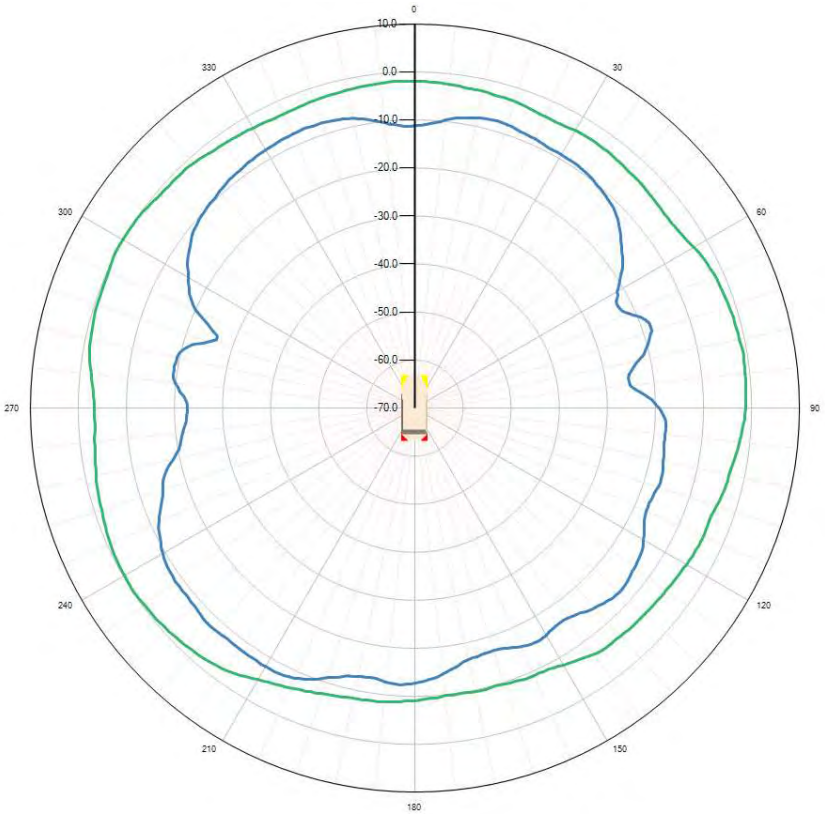
# Entwicklungsbegleitende Messungen
## Folie B2-Muster Richtdiagramme 0-90°

Grün = Vertikale Polarisation
Blau = Horizontale Polarisation

620 MHz @ 45° Elev




700 MHz @ 45° Elev

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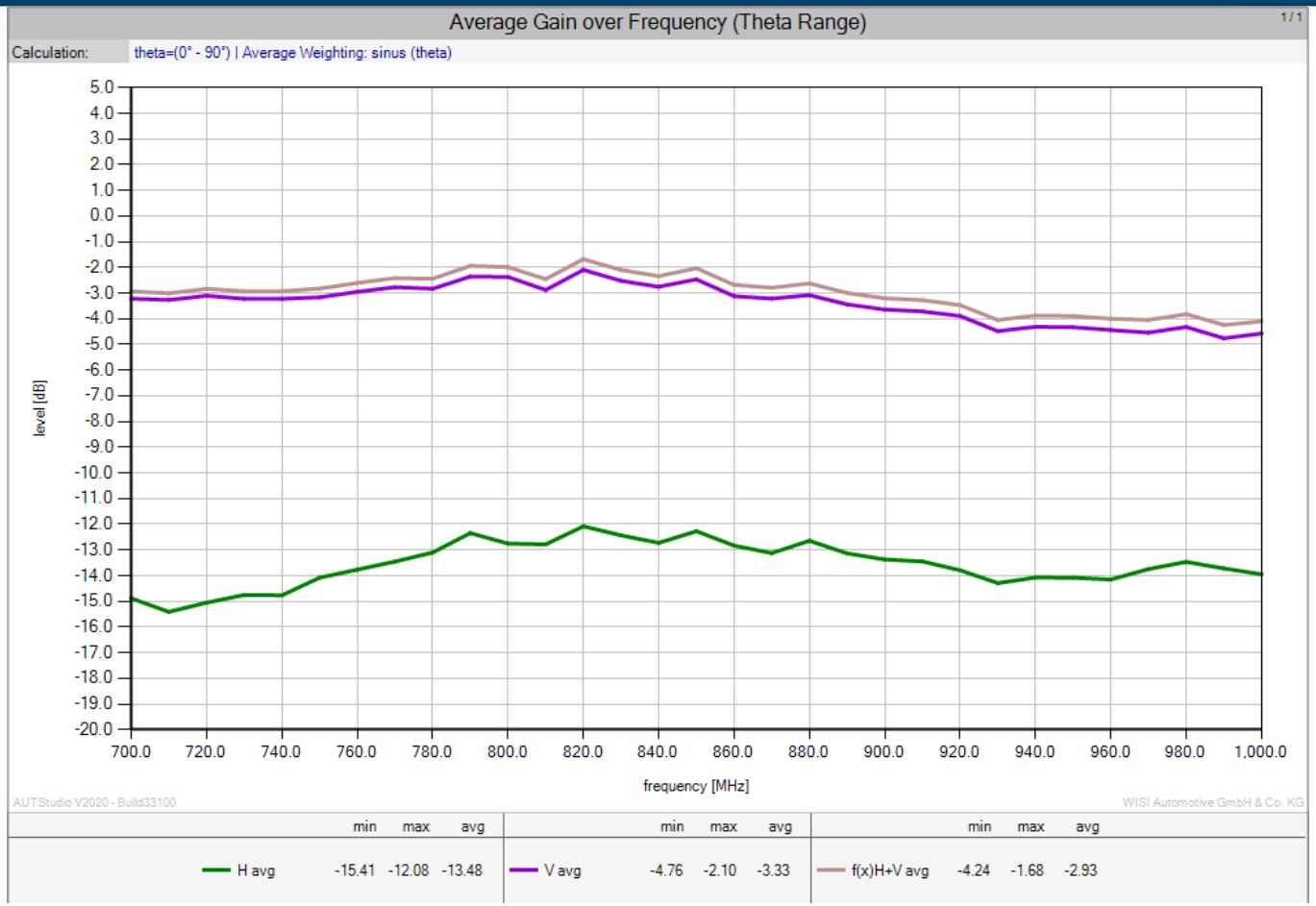
# Entwicklungsbegleitende Messungen

## Folie B2-Muster Gain total 700-1000MHz Avg Gain 0-90°

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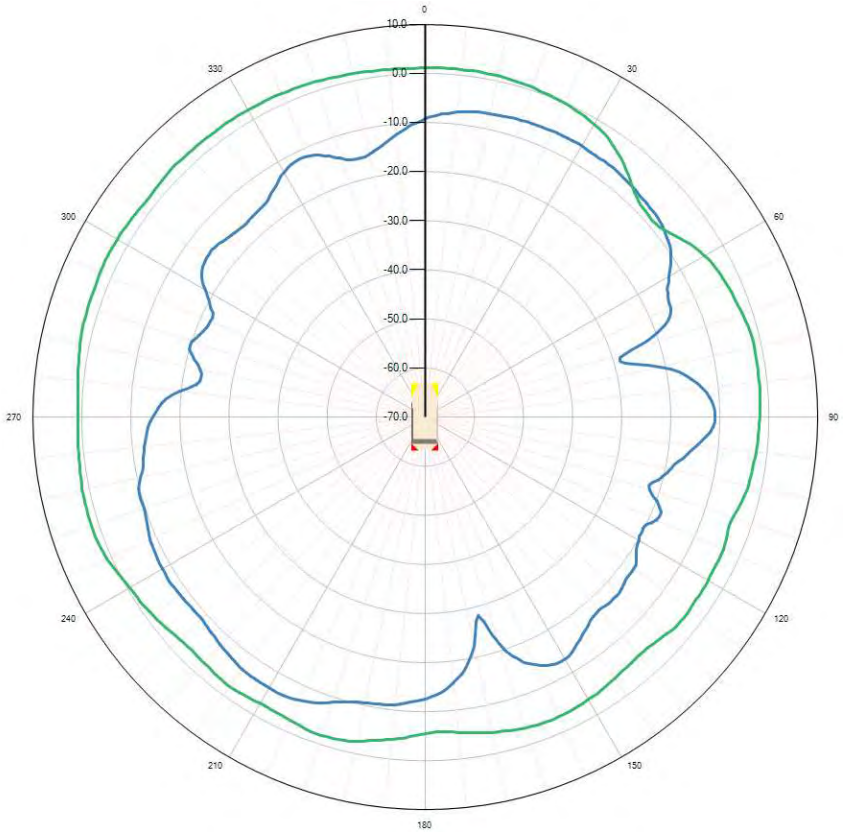
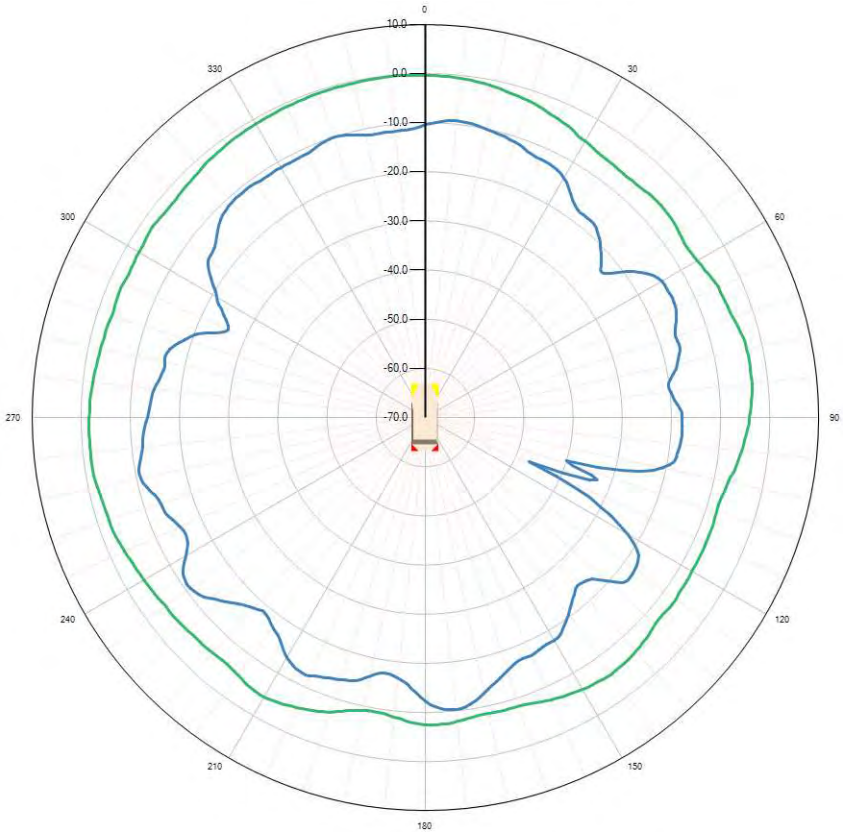
# Entwicklungsbegleitende Messungen
## Folie B2-Muster Richtdiagramme 0-90°

Grün = Vertikale Polarisation
Blau = Horizontale Polarisation

800 MHz @ 45° Elev




960 MHz @ 45° Elev

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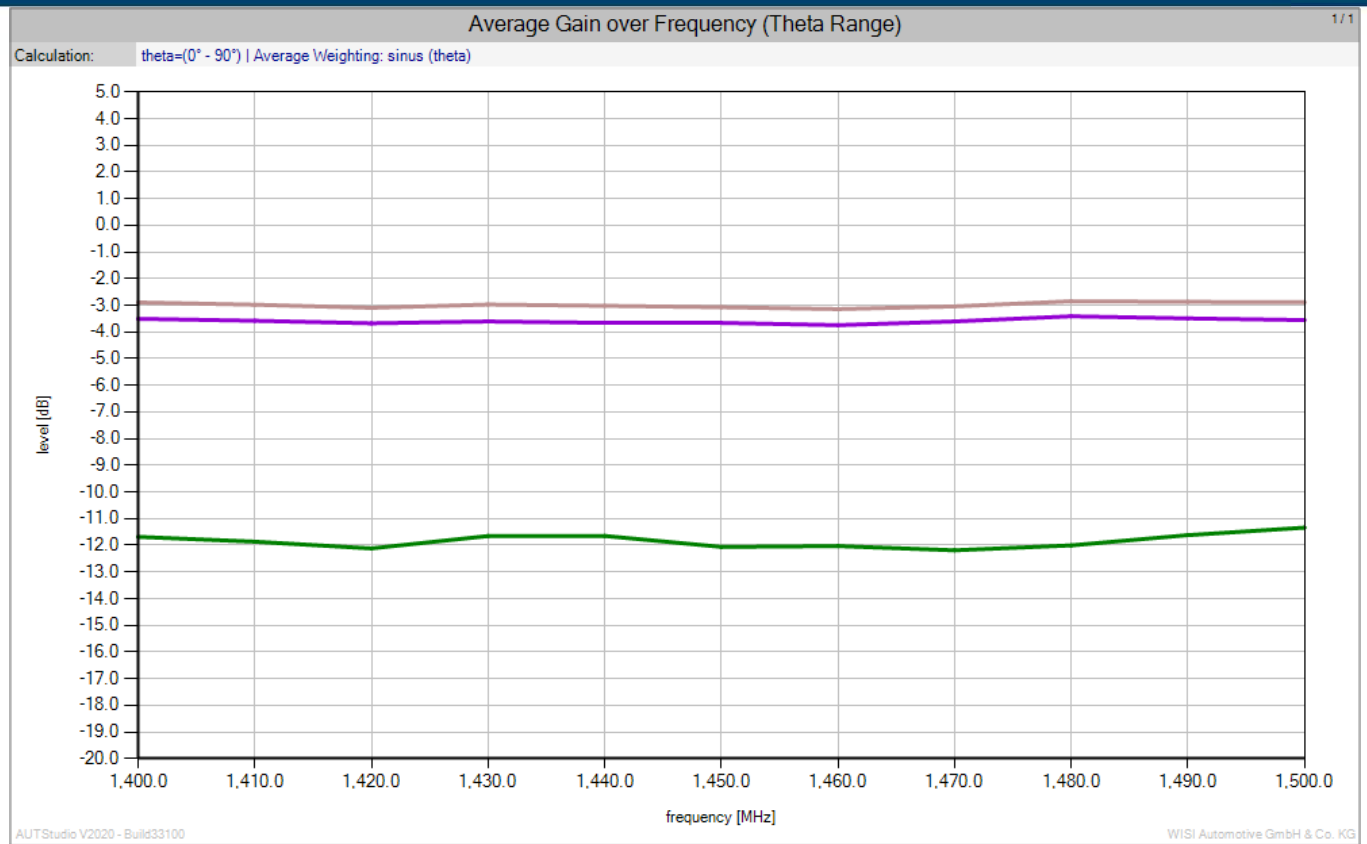
# Entwicklungsbegleitende Messungen

## Folie B2-Muster Gain total 1400-1500MHz Avg Gain 0-90°




| | min | max | avg | | min | max | avg | | min | max | avg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| H avg | -12.19 | -11.34 | -11.83 | V avg | -3.74 | -3.41 | -3.59 | f(x)H+V avg | -3.14 | -2.85 | -2.98 |

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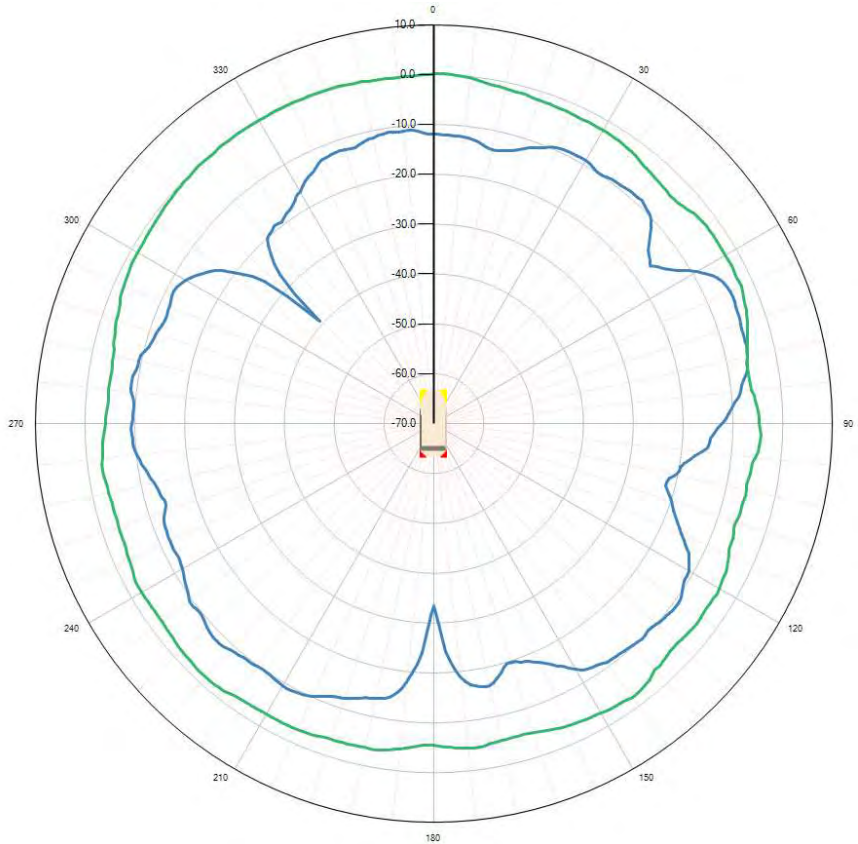
# Entwicklungsbegleitende Messungen
## Folie B2-Muster Richtdiagramme 0-90°

Grün = Vertikale Polarisation
Blau = Horizontale Polarisation

1450 MHz @ 45° Elev

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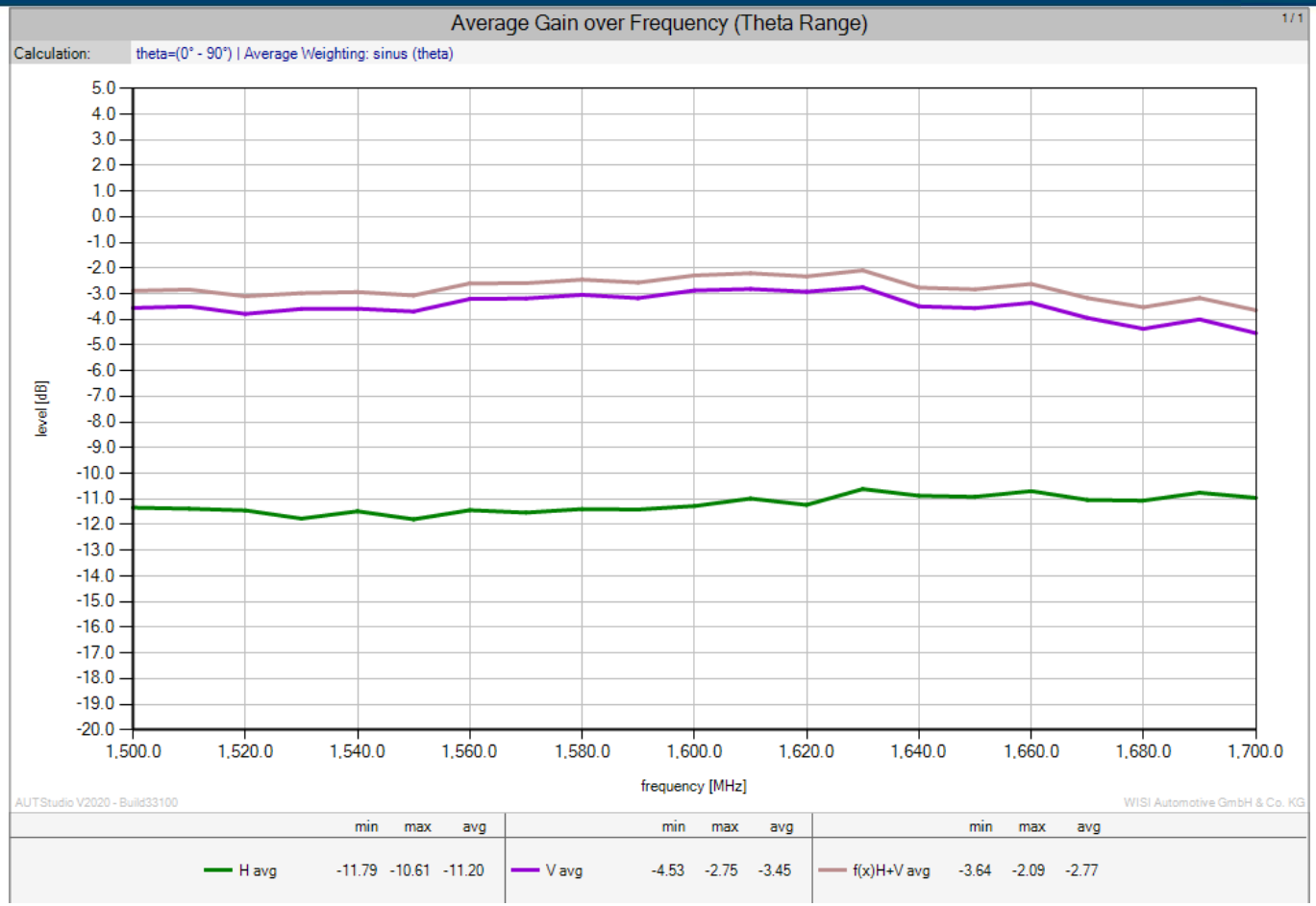
# Entwicklungsbegleitende Messungen

## Folie B2-Muster Gain total 1500-1700MHz Avg Gain 0-90°

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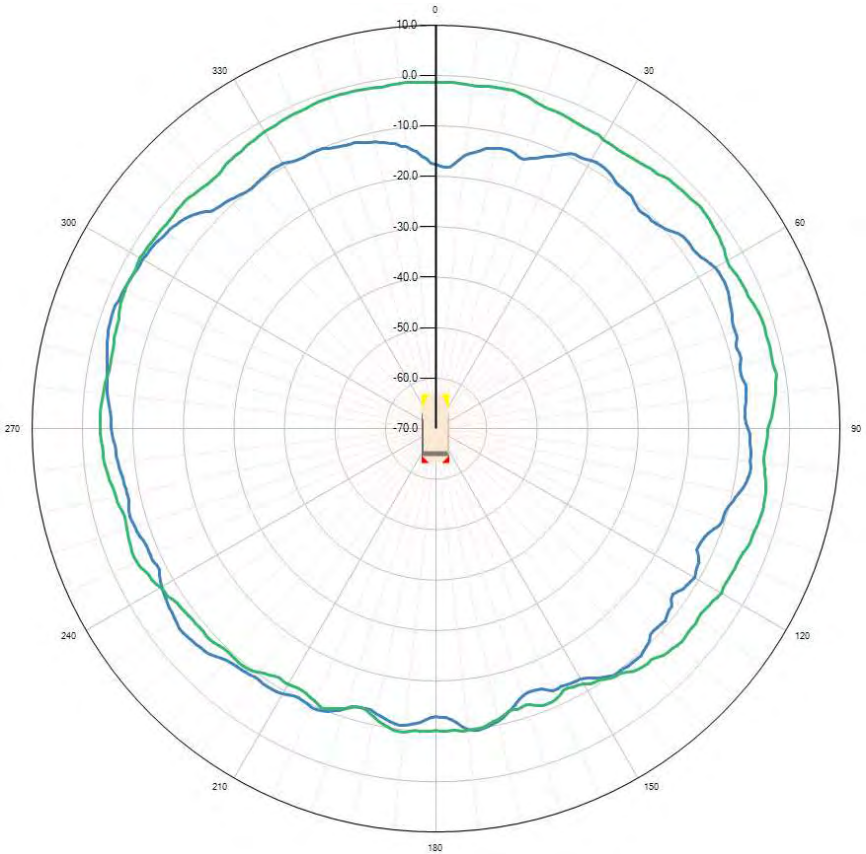
# Entwicklungsbegleitende Messungen
## Folie B2-Muster Richtdiagramme 0-90°

Grün = Vertikale Polarisation
Blau = Horizontale Polarisation

1700 MHz @ 45° Elev

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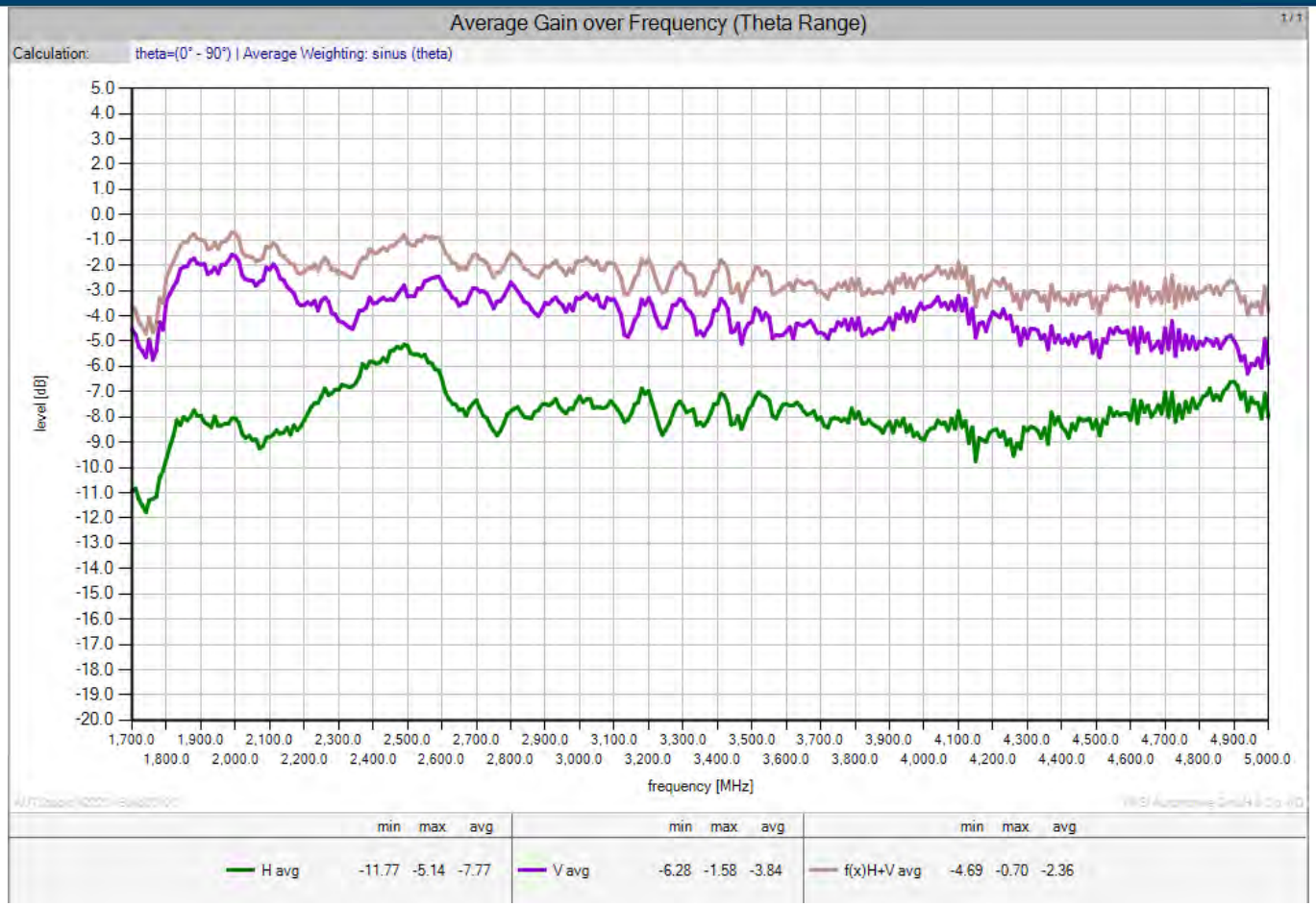
# Entwicklungsbegleitende Messungen

## Folie B2-Muster Gain total 1700-5000MHz Avg Gain 0-90°

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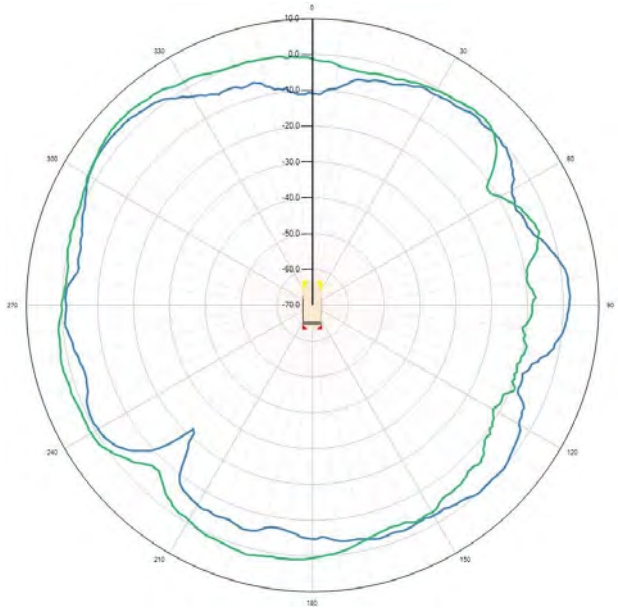
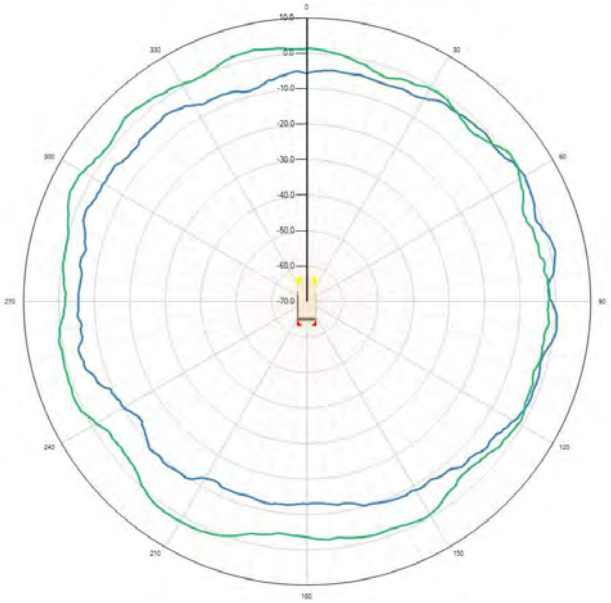
# Entwicklungsbegleitende Messungen
## Folie B2-Muster Richtdiagramme 0-90°

Grün = Vertikale Polarisation
Blau = Horizontale Polarisation

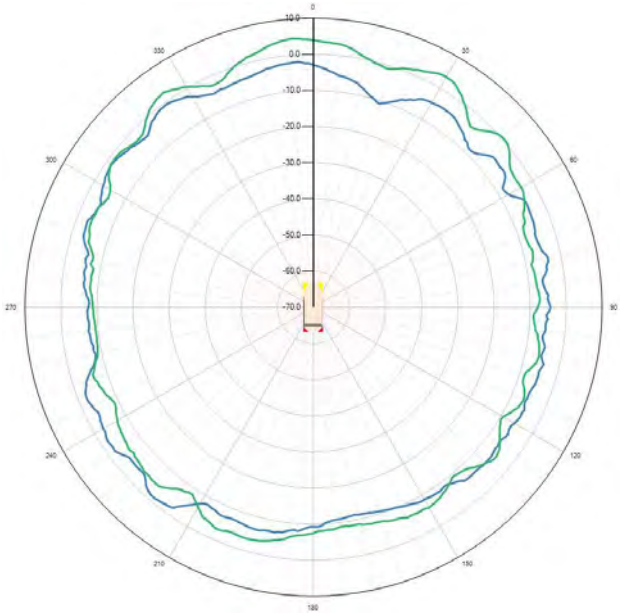
2500 MHz @ 45° Elev



3500 MHz @ 45° Elev



4500 MHz @ 45° Elev



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# ANNEX

Wandlungsparameter: MeanMean
Für die Berechnung tatsächlich betrachteter Winkelbereich (0-90°)

| Frequenz in MHz | Mittelwert V | Mittelwert H | Mittelwert H+V | Maximalwert V | Maximalwert H | Maximalwert H+V |
|---|---|---|---|---|---|---|
| **600** | -5.93 | -15.39 | -5.47 | -0.08 | -5.39 | 0.13 |
| **610** | -5.69 | -15.27 | -5.24 | -0.39 | -5.26 | -0.21 |
| **620** | -5.26 | -14.55 | -4.77 | 0.09 | -4.98 | 0.10 |
| **630** | -4.73 | -13.99 | -4.25 | 0.30 | -4.59 | 0.35 |
| **640** | -4.32 | -13.99 | -3.87 | 1.45 | -4.43 | 1.51 |
| **650** | -3.68 | -13.75 | -3.27 | 1.20 | -4.62 | 1.28 |
| **660** | -3.45 | -13.56 | -3.04 | 1.10 | -4.95 | 1.15 |
| **670** | -2.91 | -13.61 | -2.56 | 1.96 | -5.39 | 2.12 |
| **680** | -2.56 | -13.00 | -2.19 | 2.32 | -4.77 | 2.44 |
| **690** | -2.47 | -13.00 | -2.10 | 3.69 | -5.50 | 3.71 |
| **700** | -2.32 | -12.92 | -1.96 | 3.44 | -5.28 | 3.49 |
| **710** | -2.40 | -13.16 | -2.05 | 3.17 | -5.74 | 3.24 |
| **720** | -2.29 | -12.74 | -1.91 | 2.97 | -5.16 | 3.08 |
| **730** | -2.35 | -12.48 | -1.95 | 3.60 | -4.92 | 3.66 |
| **740** | -2.32 | -12.60 | -1.93 | 3.81 | -5.77 | 3.82 |
| **750** | -2.25 | -12.05 | -1.81 | 3.42 | -4.35 | 3.48 |
| **760** | -2.05 | -11.86 | -1.62 | 4.15 | -3.04 | 4.23 |
| **770** | -1.92 | -11.58 | -1.47 | 3.32 | -2.68 | 3.71 |
| **780** | -1.97 | -11.21 | -1.48 | 3.74 | -1.97 | 3.88 |
| **790** | -1.49 | -10.35 | -0.96 | 4.72 | -1.31 | 4.74 |
| **800** | -1.57 | -10.54 | -1.05 | 4.14 | -2.54 | 4.61 |
| **810** | -2.04 | -10.48 | -1.46 | 3.68 | -1.69 | 3.78 |
| **820** | -1.25 | -9.83 | -0.69 | 4.48 | -0.67 | 5.10 |
| **830** | -1.70 | -10.49 | -1.16 | 3.87 | -2.07 | 4.06 |
| **840** | -1.96 | -10.76 | -1.42 | 4.49 | -2.08 | 4.51 |
| **850** | -1.69 | -10.22 | -1.12 | 4.30 | -2.52 | 4.42 |
| **860** | -2.39 | -10.99 | -1.83 | 3.59 | -2.90 | 3.94 |
| **870** | -2.45 | -11.55 | -1.94 | 3.96 | -3.33 | 4.00 |
| **880** | -2.32 | -11.13 | -1.78 | 3.65 | -3.15 | 3.75 |
| **890** | -2.71 | -11.66 | -2.19 | 3.22 | -3.80 | 3.39 |
| **900** | -2.93 | -11.52 | -2.37 | 3.75 | -3.93 | 3.78 |
| **910** | -2.95 | -11.50 | -2.38 | 2.63 | -3.52 | 2.82 |
| **920** | -3.16 | -12.16 | -2.65 | 4.09 | -4.07 | 4.10 |
| **930** | -3.77 | -12.62 | -3.24 | 3.02 | -5.40 | 3.09 |
| **940** | -3.60 | -12.29 | -3.05 | 2.36 | -3.11 | 2.40 |
| **950** | -3.61 | -12.14 | -3.04 | 2.48 | -4.29 | 2.49 |
| **960** | -3.71 | -12.28 | -3.14 | 2.16 | -3.89 | 2.47 |
| **970** | -3.75 | -11.94 | -3.14 | 2.42 | -2.57 | 2.46 |
| **980** | -3.56 | -11.76 | -2.95 | 3.03 | -3.19 | 3.21 |
| **990** | -3.97 | -12.09 | -3.34 | 2.65 | -3.93 | 2.66 |
| **1000** | -3.77 | -12.49 | -3.22 | 2.79 | -2.10 | 2.81 |
| **1010** | -4.11 | -12.93 | -3.58 | 3.08 | -2.62 | 3.14 |
| **1020** | -4.43 | -13.74 | -3.95 | 1.88 | -5.91 | 2.32 |
| **1030** | -4.71 | -14.18 | -4.24 | 1.24 | -6.09 | 1.25 |
| **1040** | -4.65 | -13.73 | -4.14 | 0.87 | -7.27 | 0.97 |
| **1050** | -5.07 | -13.34 | -4.47 | 0.70 | -6.83 | 0.71 |
| **1060** | -5.23 | -12.67 | -4.51 | 0.71 | -5.08 | 0.73 |
| **1070** | -5.31 | -12.33 | -4.52 | 1.27 | -5.53 | 1.30 |
| **1080** | -6.25 | -12.39 | -5.31 | -0.20 | -5.59 | -0.14 |
| **1090** | -6.62 | -11.88 | -5.49 | 0.75 | -4.95 | 0.88 |
| **1100** | -7.79 | -12.25 | -6.46 | 0.19 | -5.21 | 0.24 |
| **1110** | -9.00 | -13.11 | -7.58 | -0.97 | -5.64 | -0.67 |
| **1120** | -9.98 | -13.19 | -8.29 | -1.73 | -5.39 | -1.63 |
| **1130** | -10.54 | -13.50 | -8.76 | -1.05 | -5.87 | -1.00 |
| **1140** | -11.23 | -14.44 | -9.53 | -2.36 | -6.75 | -2.26 |
| **1150** | -11.53 | -15.20 | -9.98 | -2.96 | -6.51 | -2.95 |
| **1160** | -10.59 | -15.93 | -9.48 | -3.21 | -8.25 | -3.13 |
| **1170** | -8.97 | -16.55 | -8.27 | -1.99 | -9.06 | -1.86 |
| **1180** | -7.55 | -16.78 | -7.06 | -1.61 | -9.95 | -1.51 |
| **1190** | -5.74 | -16.60 | -5.39 | 0.20 | -9.44 | 0.23 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **1200** | -5.02 | -16.44 | -4.72 | 1.12 | -9.76 | 1.19 |
| **1210** | -4.00 | -15.70 | -3.71 | 1.64 | -9.21 | 1.65 |
| **1220** | -3.36 | -14.22 | -3.02 | 1.89 | -7.43 | 1.91 |
| **1230** | -3.47 | -13.80 | -3.09 | 1.81 | -6.69 | 1.89 |
| **1240** | -2.76 | -12.89 | -2.36 | 2.42 | -5.91 | 2.49 |
| **1250** | -2.19 | -11.98 | -1.76 | 2.66 | -5.38 | 2.70 |
| **1260** | -2.94 | -12.17 | -2.45 | 2.36 | -5.02 | 2.37 |
| **1270** | -2.45 | -11.38 | -1.93 | 2.42 | -4.54 | 2.46 |
| **1280** | -2.08 | -10.54 | -1.50 | 3.37 | -3.45 | 3.64 |
| **1290** | -2.17 | -10.14 | -1.53 | 3.08 | -3.53 | 3.33 |
| **1300** | -2.04 | -9.41 | -1.31 | 3.76 | -2.65 | 3.95 |
| **1310** | -2.02 | -9.03 | -1.23 | 3.56 | -1.88 | 3.67 |
| **1320** | -1.90 | -9.36 | -1.18 | 3.46 | -2.92 | 3.47 |
| **1330** | -1.55 | -9.05 | -0.84 | 3.62 | -1.95 | 3.78 |
| **1340** | -1.65 | -8.58 | -0.85 | 3.25 | -1.20 | 3.44 |
| **1350** | -1.93 | -8.90 | -1.13 | 3.36 | -0.61 | 3.75 |
| **1360** | -1.80 | -8.86 | -1.02 | 3.39 | -1.53 | 3.71 |
| **1370** | -1.74 | -9.19 | -1.02 | 3.29 | -1.35 | 3.47 |
| **1380** | -1.91 | -9.47 | -1.21 | 3.90 | -1.51 | 4.06 |
| **1390** | -1.95 | -9.12 | -1.19 | 3.23 | -2.44 | 3.55 |
| **1400** | -2.43 | -9.12 | -1.59 | 2.63 | -2.05 | 3.17 |
| **1410** | -2.48 | -9.21 | -1.65 | 3.03 | -2.72 | 3.19 |
| **1420** | -2.66 | -9.36 | -1.82 | 3.08 | -2.57 | 3.24 |
| **1430** | -2.62 | -9.24 | -1.76 | 3.32 | -2.52 | 3.56 |
| **1440** | -2.70 | -9.45 | -1.87 | 2.94 | -2.98 | 3.07 |
| **1450** | -2.68 | -9.94 | -1.93 | 2.78 | -2.92 | 2.99 |
| **1460** | -2.74 | -9.92 | -1.98 | 3.33 | -2.94 | 3.52 |
| **1470** | -2.60 | -10.00 | -1.87 | 2.65 | -3.07 | 2.97 |
| **1480** | -2.42 | -9.64 | -1.66 | 3.51 | -2.02 | 3.65 |
| **1490** | -2.51 | -9.20 | -1.67 | 3.47 | -2.55 | 3.87 |
| **1500** | -2.55 | -8.74 | -1.61 | 3.61 | -2.19 | 3.76 |
| **1510** | -2.48 | -8.62 | -1.53 | 3.48 | -1.75 | 3.68 |
| **1520** | -2.74 | -8.82 | -1.78 | 3.47 | -1.77 | 3.75 |
| **1530** | -2.54 | -9.00 | -1.65 | 3.41 | -1.76 | 3.46 |
| **1540** | -2.43 | -8.91 | -1.55 | 3.13 | -1.78 | 3.26 |
| **1550** | -2.50 | -9.14 | -1.65 | 4.16 | -1.73 | 4.22 |
| **1560** | -2.03 | -8.64 | -1.17 | 3.72 | -1.61 | 3.78 |
| **1570** | -2.02 | -8.81 | -1.19 | 3.68 | -1.57 | 3.68 |
| **1580** | -1.88 | -8.74 | -1.06 | 3.74 | -0.97 | 3.74 |
| **1590** | -1.96 | -8.67 | -1.12 | 3.78 | -1.39 | 3.96 |
| **1600** | -1.78 | -8.49 | -0.94 | 3.69 | -0.92 | 3.85 |
| **1610** | -1.76 | -8.31 | -0.89 | 4.48 | -0.95 | 4.56 |
| **1620** | -1.90 | -8.47 | -1.04 | 4.12 | -0.82 | 4.20 |
| **1630** | -1.76 | -7.88 | -0.81 | 4.38 | -0.70 | 4.43 |
| **1640** | -2.50 | -8.17 | -1.46 | 4.59 | -1.15 | 4.78 |
| **1650** | -2.62 | -8.36 | -1.60 | 3.14 | -1.29 | 3.51 |
| **1660** | -2.44 | -8.02 | -1.38 | 4.48 | -0.63 | 4.54 |
| **1670** | -3.04 | -8.62 | -1.98 | 3.93 | -1.35 | 4.11 |
| **1680** | -3.39 | -8.66 | -2.26 | 4.10 | -0.99 | 4.30 |
| **1690** | -2.98 | -8.38 | -1.88 | 3.85 | -0.90 | 4.11 |
| **1700** | -3.47 | -8.76 | -2.35 | 3.27 | -1.42 | 3.33 |
| **1710** | -3.54 | -8.66 | -2.38 | 3.37 | -1.34 | 3.56 |
| **1720** | -4.00 | -8.91 | -2.78 | 2.05 | -1.85 | 2.12 |
| **1730** | -4.23 | -9.10 | -3.01 | 1.83 | -2.55 | 2.12 |
| **1740** | -4.41 | -9.19 | -3.16 | 2.80 | -2.32 | 2.94 |
| **1750** | -3.84 | -8.59 | -2.59 | 2.75 | -1.43 | 2.95 |
| **1760** | -4.62 | -8.63 | -3.17 | 2.71 | -0.98 | 2.85 |
| **1770** | -4.32 | -8.44 | -2.90 | 2.16 | -1.68 | 2.52 |
| **1780** | -3.23 | -7.94 | -1.97 | 4.07 | 0.21 | 4.43 |
| **1790** | -3.46 | -7.86 | -2.11 | 3.20 | -0.93 | 3.30 |
| **1800** | -2.20 | -7.33 | -1.04 | 4.60 | -0.28 | 4.71 |
| **1810** | -1.85 | -6.69 | -0.62 | 4.57 | 0.84 | 5.02 |
| **1820** | -1.57 | -6.22 | -0.29 | 4.73 | 0.90 | 4.88 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **1830** | -1.31 | -5.41 | 0.12 | 5.17 | 2.24 | 5.39 |
| **1840** | -0.99 | -5.55 | 0.32 | 6.87 | 1.18 | 7.22 |
| **1850** | -0.92 | -5.27 | 0.44 | 6.83 | 1.96 | 7.09 |
| **1860** | -0.76 | -5.47 | 0.50 | 6.01 | 1.45 | 6.31 |
| **1870** | -0.51 | -5.54 | 0.68 | 6.33 | 2.04 | 6.71 |
| **1880** | -0.48 | -5.45 | 0.72 | 7.11 | 1.25 | 7.33 |
| **1890** | -0.56 | -5.57 | 0.63 | 5.77 | 1.49 | 6.27 |
| **1900** | -0.66 | -5.72 | 0.52 | 6.25 | 0.52 | 6.51 |
| **1910** | -0.64 | -5.76 | 0.52 | 6.63 | 0.50 | 6.71 |
| **1920** | -0.93 | -5.63 | 0.34 | 6.58 | 2.53 | 6.64 |
| **1930** | -0.97 | -5.85 | 0.26 | 5.27 | 1.42 | 5.47 |
| **1940** | -0.77 | -5.39 | 0.52 | 6.10 | 1.82 | 6.18 |
| **1950** | -0.98 | -5.66 | 0.29 | 6.59 | 1.53 | 6.82 |
| **1960** | -0.78 | -5.68 | 0.43 | 6.08 | 1.80 | 6.46 |
| **1970** | -0.76 | -5.66 | 0.45 | 6.14 | 1.93 | 6.30 |
| **1980** | -0.58 | -5.78 | 0.56 | 6.73 | 2.08 | 6.77 |
| **1990** | -0.34 | -5.70 | 0.77 | 6.62 | 1.95 | 6.85 |
| **2000** | -0.46 | -5.72 | 0.68 | 6.65 | 1.39 | 7.11 |
| **2010** | -0.56 | -5.76 | 0.59 | 6.29 | 2.11 | 6.43 |
| **2020** | -1.13 | -5.90 | 0.12 | 6.86 | 1.93 | 6.90 |
| **2030** | -1.30 | -5.92 | -0.01 | 6.19 | 1.49 | 6.20 |
| **2040** | -1.33 | -5.82 | -0.01 | 5.71 | 3.13 | 5.79 |
| **2050** | -1.50 | -5.79 | -0.12 | 6.50 | 2.63 | 6.53 |
| **2060** | -1.65 | -5.64 | -0.19 | 5.81 | 2.38 | 6.01 |
| **2070** | -1.52 | -5.97 | -0.19 | 5.69 | 2.62 | 5.72 |
| **2080** | -1.47 | -6.19 | -0.21 | 5.78 | 1.92 | 5.81 |
| **2090** | -0.94 | -6.21 | 0.19 | 5.46 | 1.06 | 5.64 |
| **2100** | -0.91 | -6.33 | 0.19 | 6.58 | 1.12 | 6.60 |
| **2110** | -0.70 | -6.08 | 0.40 | 5.60 | 1.08 | 5.83 |
| **2120** | -0.83 | -5.72 | 0.39 | 5.90 | 0.72 | 6.10 |
| **2130** | -1.19 | -5.66 | 0.14 | 6.26 | 1.83 | 6.54 |
| **2140** | -1.21 | -5.54 | 0.15 | 5.50 | 3.13 | 5.55 |
| **2150** | -1.38 | -5.21 | 0.12 | 6.31 | 2.85 | 6.37 |
| **2160** | -1.61 | -5.39 | -0.09 | 6.09 | 2.47 | 6.24 |
| **2170** | -1.65 | -5.23 | -0.07 | 5.47 | 2.33 | 5.55 |
| **2180** | -1.79 | -5.49 | -0.24 | 5.17 | 1.95 | 5.38 |
| **2190** | -1.74 | -5.61 | -0.25 | 5.48 | 2.04 | 5.62 |
| **2200** | -1.73 | -5.40 | -0.18 | 4.72 | 1.34 | 4.74 |
| **2210** | -1.60 | -5.02 | 0.03 | 5.43 | 1.76 | 5.60 |
| **2220** | -1.57 | -4.63 | 0.17 | 6.68 | 3.65 | 6.87 |
| **2230** | -1.50 | -4.22 | 0.36 | 6.83 | 3.67 | 7.14 |
| **2240** | -1.88 | -4.17 | 0.13 | 5.54 | 3.96 | 5.65 |
| **2250** | -1.66 | -3.88 | 0.38 | 6.15 | 4.49 | 6.39 |
| **2260** | -1.50 | -3.72 | 0.54 | 6.65 | 4.46 | 6.75 |
| **2270** | -1.62 | -4.21 | 0.29 | 5.68 | 2.77 | 5.91 |
| **2280** | -2.01 | -4.34 | -0.01 | 4.89 | 3.21 | 5.51 |
| **2290** | -2.03 | -4.18 | 0.04 | 5.30 | 2.49 | 5.53 |
| **2300** | -2.15 | -4.24 | -0.06 | 4.59 | 3.10 | 5.17 |
| **2310** | -2.07 | -3.99 | 0.09 | 5.21 | 2.90 | 5.58 |
| **2320** | -2.24 | -3.76 | 0.07 | 4.77 | 3.98 | 5.70 |
| **2330** | -2.24 | -3.52 | 0.18 | 5.19 | 4.86 | 5.99 |
| **2340** | -2.28 | -3.48 | 0.17 | 5.38 | 5.58 | 5.67 |
| **2350** | -2.00 | -3.20 | 0.45 | 5.83 | 5.78 | 6.56 |
| **2360** | -1.72 | -2.92 | 0.73 | 6.05 | 6.13 | 6.60 |
| **2370** | -1.69 | -2.69 | 0.85 | 4.78 | 5.88 | 5.98 |
| **2380** | -1.56 | -3.10 | 0.75 | 4.84 | 4.71 | 6.21 |
| **2390** | -1.15 | -3.12 | 0.99 | 4.87 | 4.02 | 6.22 |
| **2400** | -1.36 | -3.13 | 0.86 | 4.74 | 4.76 | 6.62 |
| **2410** | -1.32 | -3.06 | 0.90 | 4.31 | 4.98 | 6.15 |
| **2420** | -1.13 | -2.96 | 1.06 | 5.40 | 3.84 | 7.02 |
| **2430** | -1.05 | -2.82 | 1.17 | 5.31 | 4.64 | 6.46 |
| **2440** | -1.15 | -2.70 | 1.16 | 4.53 | 5.52 | 6.86 |
| **2450** | -1.14 | -2.24 | 1.36 | 5.04 | 5.00 | 7.04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2460** | -1.12 | -2.25 | 1.36 | 5.93 | 5.46 | 6.85 |
| **2470** | -0.92 | -2.29 | 1.46 | 5.62 | 5.86 | 7.30 |
| **2480** | -0.83 | -2.55 | 1.40 | 5.65 | 4.75 | 6.57 |
| **2490** | -0.68 | -2.46 | 1.53 | 5.74 | 4.63 | 6.74 |
| **2500** | -1.07 | -2.64 | 1.22 | 4.55 | 4.79 | 6.86 |
| **2510** | -1.13 | -2.99 | 1.05 | 4.47 | 4.17 | 6.41 |
| **2520** | -1.10 | -3.11 | 1.02 | 5.08 | 4.24 | 6.75 |
| **2530** | -0.98 | -3.07 | 1.11 | 4.56 | 3.89 | 6.30 |
| **2540** | -0.99 | -3.13 | 1.08 | 5.10 | 2.91 | 6.24 |
| **2550** | -0.73 | -3.14 | 1.24 | 5.07 | 3.80 | 6.19 |
| **2560** | -0.80 | -3.43 | 1.09 | 5.66 | 3.09 | 6.10 |
| **2570** | -0.76 | -3.61 | 1.06 | 5.41 | 3.00 | 6.54 |
| **2580** | -0.75 | -3.83 | 0.99 | 5.08 | 2.88 | 6.43 |
| **2590** | -0.68 | -3.90 | 1.01 | 5.02 | 2.88 | 6.24 |
| **2600** | -0.80 | -4.27 | 0.82 | 5.26 | 1.66 | 5.91 |
| **2610** | -1.11 | -4.60 | 0.50 | 4.99 | 1.63 | 6.09 |
| **2620** | -1.19 | -4.86 | 0.36 | 4.69 | 3.46 | 5.55 |
| **2630** | -1.41 | -4.87 | 0.21 | 5.54 | 1.59 | 6.04 |
| **2640** | -1.55 | -4.93 | 0.09 | 4.46 | 2.40 | 5.35 |
| **2650** | -1.84 | -5.11 | -0.16 | 4.80 | 1.32 | 5.45 |
| **2660** | -1.73 | -5.05 | -0.07 | 5.26 | 2.12 | 5.29 |
| **2670** | -1.76 | -5.33 | -0.18 | 5.55 | 1.52 | 5.69 |
| **2680** | -1.52 | -5.16 | 0.04 | 4.79 | 2.06 | 5.74 |
| **2690** | -1.16 | -5.06 | 0.32 | 6.33 | 1.63 | 6.47 |
| **2700** | -1.14 | -5.06 | 0.34 | 6.56 | 1.37 | 6.71 |
| **2710** | -1.17 | -5.24 | 0.27 | 6.66 | 1.33 | 6.82 |
| **2720** | -1.08 | -5.37 | 0.29 | 5.63 | 1.65 | 5.93 |
| **2730** | -1.25 | -5.30 | 0.19 | 5.26 | 2.10 | 6.05 |
| **2740** | -1.55 | -5.43 | -0.06 | 5.52 | 2.67 | 6.16 |
| **2750** | -1.85 | -5.78 | -0.38 | 4.36 | 1.56 | 4.59 |
| **2760** | -1.55 | -5.74 | -0.15 | 4.96 | 2.62 | 5.31 |
| **2770** | -1.47 | -5.63 | -0.06 | 5.76 | 2.50 | 5.83 |
| **2780** | -1.28 | -5.42 | 0.14 | 6.31 | 2.68 | 6.35 |
| **2790** | -0.96 | -5.27 | 0.41 | 5.90 | 2.45 | 6.22 |
| **2800** | -0.56 | -5.34 | 0.68 | 7.17 | 2.06 | 7.26 |
| **2810** | -0.66 | -5.32 | 0.62 | 6.50 | 1.36 | 6.73 |
| **2820** | -0.83 | -5.31 | 0.49 | 5.47 | 2.40 | 6.49 |
| **2830** | -1.00 | -5.37 | 0.35 | 6.80 | 1.60 | 7.03 |
| **2840** | -1.24 | -5.54 | 0.13 | 5.96 | 1.31 | 6.27 |
| **2850** | -1.30 | -5.51 | 0.10 | 5.47 | 1.41 | 5.84 |
| **2860** | -1.62 | -5.53 | -0.14 | 4.32 | 1.72 | 5.07 |
| **2870** | -1.80 | -5.37 | -0.22 | 4.10 | 1.53 | 4.67 |
| **2880** | -1.89 | -5.34 | -0.27 | 5.21 | 1.99 | 5.65 |
| **2890** | -1.75 | -5.38 | -0.19 | 6.26 | 1.72 | 6.39 |
| **2900** | -1.47 | -5.48 | -0.02 | 5.72 | 0.01 | 5.87 |
| **2910** | -1.56 | -5.39 | -0.05 | 5.26 | 0.62 | 5.35 |
| **2920** | -1.42 | -5.16 | 0.11 | 6.84 | 1.02 | 7.02 |
| **2930** | -1.27 | -5.04 | 0.25 | 7.70 | 1.88 | 7.86 |
| **2940** | -1.54 | -5.15 | 0.03 | 6.96 | 1.92 | 7.04 |
| **2950** | -1.50 | -5.24 | 0.03 | 6.86 | 2.35 | 6.98 |
| **2960** | -1.75 | -5.45 | -0.21 | 6.46 | 3.90 | 6.59 |
| **2970** | -1.48 | -5.38 | 0.00 | 6.80 | 2.21 | 6.89 |
| **2980** | -1.59 | -5.50 | -0.11 | 6.42 | 1.79 | 6.61 |
| **2990** | -1.16 | -5.19 | 0.28 | 6.39 | 1.62 | 6.50 |
| **3000** | -1.16 | -4.97 | 0.35 | 7.39 | 2.89 | 7.49 |
| **3010** | -1.16 | -5.16 | 0.30 | 6.64 | 2.30 | 6.89 |
| **3020** | -1.09 | -4.95 | 0.40 | 7.16 | 1.74 | 7.34 |
| **3030** | -1.21 | -4.81 | 0.36 | 7.24 | 3.16 | 7.27 |
| **3040** | -1.30 | -5.17 | 0.20 | 5.75 | 2.49 | 5.99 |
| **3050** | -1.12 | -5.17 | 0.32 | 6.23 | 2.33 | 6.36 |
| **3060** | -1.46 | -5.27 | 0.05 | 5.40 | 2.00 | 5.44 |
| **3070** | -1.55 | -5.28 | -0.02 | 4.81 | 1.72 | 5.05 |
| **3080** | -1.22 | -5.36 | 0.20 | 5.44 | 0.94 | 5.74 |

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|---|---|---|---|---|---|---|
| **3090** | -1.22 | -5.02 | 0.30 | 5.45 | 2.12 | 5.71 |
| **3100** | -1.18 | -4.91 | 0.35 | 5.58 | 2.67 | 5.90 |
| **3110** | -1.37 | -4.98 | 0.20 | 6.43 | 2.15 | 6.46 |
| **3120** | -1.62 | -4.88 | 0.06 | 5.91 | 3.71 | 5.94 |
| **3130** | -2.23 | -4.96 | -0.37 | 6.17 | 3.41 | 6.40 |
| **3140** | -2.26 | -4.86 | -0.35 | 4.81 | 2.88 | 5.55 |
| **3150** | -1.95 | -4.48 | -0.02 | 4.42 | 3.61 | 5.70 |
| **3160** | -1.61 | -4.04 | 0.35 | 5.94 | 3.61 | 6.98 |
| **3170** | -1.41 | -4.00 | 0.50 | 4.88 | 3.34 | 6.50 |
| **3180** | -0.94 | -3.44 | 1.00 | 6.52 | 5.16 | 6.74 |
| **3190** | -1.16 | -3.73 | 0.75 | 5.64 | 3.85 | 6.38 |
| **3200** | -0.92 | -3.67 | 0.93 | 6.08 | 4.41 | 6.72 |
| **3210** | -1.25 | -4.03 | 0.59 | 4.96 | 3.86 | 5.50 |
| **3220** | -1.69 | -4.51 | 0.14 | 5.26 | 2.60 | 5.60 |
| **3230** | -1.99 | -4.98 | -0.23 | 4.98 | 2.51 | 5.75 |
| **3240** | -2.14 | -5.09 | -0.36 | 5.51 | 3.15 | 6.10 |
| **3250** | -2.07 | -4.91 | -0.25 | 6.14 | 3.09 | 6.31 |
| **3260** | -1.70 | -4.66 | 0.08 | 6.94 | 3.84 | 7.03 |
| **3270** | -1.21 | -4.39 | 0.50 | 6.93 | 3.34 | 7.16 |
| **3280** | -1.09 | -4.18 | 0.65 | 7.73 | 3.40 | 7.81 |
| **3290** | -0.93 | -4.06 | 0.79 | 7.81 | 4.57 | 7.95 |
| **3300** | -1.06 | -4.22 | 0.65 | 7.34 | 3.50 | 7.45 |
| **3310** | -1.27 | -4.53 | 0.41 | 7.33 | 3.30 | 7.36 |
| **3320** | -1.45 | -4.39 | 0.33 | 6.73 | 5.18 | 6.76 |
| **3330** | -1.68 | -4.25 | 0.23 | 6.99 | 4.60 | 7.05 |
| **3340** | -2.31 | -4.87 | -0.39 | 5.84 | 4.07 | 5.92 |
| **3350** | -2.26 | -4.79 | -0.33 | 5.54 | 3.01 | 5.83 |
| **3360** | -2.43 | -4.98 | -0.51 | 5.63 | 2.95 | 5.76 |
| **3370** | -2.23 | -4.96 | -0.38 | 5.65 | 2.68 | 5.71 |
| **3380** | -2.03 | -4.73 | -0.16 | 6.05 | 2.77 | 6.09 |
| **3390** | -1.56 | -4.40 | 0.26 | 5.74 | 2.73 | 5.79 |
| **3400** | -1.55 | -4.34 | 0.29 | 5.44 | 3.16 | 5.62 |
| **3410** | -1.20 | -3.97 | 0.64 | 5.69 | 3.20 | 5.97 |
| **3420** | -1.31 | -4.18 | 0.50 | 5.78 | 3.37 | 6.29 |
| **3430** | -1.65 | -4.53 | 0.15 | 4.62 | 2.15 | 5.47 |
| **3440** | -2.57 | -5.28 | -0.70 | 3.11 | 2.05 | 4.65 |
| **3450** | -2.42 | -5.32 | -0.62 | 4.66 | 1.86 | 5.60 |
| **3460** | -2.10 | -4.98 | -0.29 | 4.61 | 2.53 | 5.06 |
| **3470** | -2.85 | -5.41 | -0.93 | 3.93 | 1.90 | 4.24 |
| **3480** | -2.37 | -5.08 | -0.50 | 3.49 | 3.04 | 4.53 |
| **3490** | -2.14 | -4.71 | -0.23 | 5.95 | 3.96 | 6.22 |
| **3500** | -1.99 | -4.52 | -0.07 | 6.41 | 2.57 | 6.64 |
| **3510** | -1.62 | -4.17 | 0.30 | 5.49 | 3.55 | 5.62 |
| **3520** | -1.77 | -3.93 | 0.29 | 5.90 | 3.51 | 6.06 |
| **3530** | -2.05 | -4.16 | 0.03 | 7.23 | 3.59 | 7.32 |
| **3540** | -1.78 | -4.27 | 0.16 | 6.67 | 3.17 | 6.76 |
| **3550** | -1.97 | -4.37 | 0.00 | 6.19 | 3.05 | 6.34 |
| **3560** | -2.73 | -4.95 | -0.69 | 5.06 | 3.02 | 5.21 |
| **3570** | -2.65 | -4.99 | -0.65 | 4.53 | 3.03 | 4.83 |
| **3580** | -2.66 | -4.72 | -0.55 | 5.03 | 2.15 | 5.26 |
| **3590** | -2.68 | -4.46 | -0.47 | 4.82 | 2.54 | 4.99 |
| **3600** | -2.50 | -4.42 | -0.35 | 3.81 | 2.86 | 5.10 |
| **3610** | -2.36 | -4.52 | -0.30 | 3.69 | 2.45 | 4.46 |
| **3620** | -2.84 | -4.56 | -0.60 | 4.03 | 2.90 | 5.08 |
| **3630** | -2.30 | -4.57 | -0.28 | 4.06 | 2.23 | 4.53 |
| **3640** | -2.34 | -4.82 | -0.40 | 4.08 | 2.43 | 4.51 |
| **3650** | -2.40 | -5.16 | -0.55 | 4.40 | 1.73 | 5.09 |
| **3660** | -2.34 | -5.32 | -0.57 | 4.83 | 1.37 | 5.07 |
| **3670** | -2.17 | -5.18 | -0.41 | 5.06 | 1.98 | 5.31 |
| **3680** | -2.36 | -5.05 | -0.49 | 4.38 | 1.92 | 4.59 |
| **3690** | -2.59 | -5.34 | -0.74 | 4.25 | 1.79 | 4.88 |
| **3700** | -2.51 | -5.22 | -0.65 | 5.59 | 1.86 | 6.39 |
| **3710** | -2.63 | -5.59 | -0.85 | 5.05 | 1.48 | 5.68 |

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|---|---|---|---|---|---|---|
| **3720** | -2.78 | -5.68 | -0.98 | 4.44 | 0.73 | 5.24 |
| **3730** | -2.40 | -5.29 | -0.60 | 4.74 | 2.22 | 5.31 |
| **3740** | -2.50 | -5.24 | -0.65 | 3.62 | 2.04 | 4.85 |
| **3750** | -2.17 | -5.34 | -0.46 | 4.92 | 1.57 | 5.18 |
| **3760** | -2.33 | -5.34 | -0.57 | 4.48 | 1.98 | 4.82 |
| **3770** | -2.17 | -5.32 | -0.45 | 5.21 | 1.46 | 5.62 |
| **3780** | -2.59 | -5.40 | -0.76 | 4.59 | 1.75 | 5.04 |
| **3790** | -2.13 | -4.84 | -0.27 | 5.19 | 0.90 | 5.67 |
| **3800** | -2.55 | -5.26 | -0.69 | 4.62 | 1.21 | 5.13 |
| **3810** | -2.12 | -4.90 | -0.28 | 4.59 | 1.67 | 5.17 |
| **3820** | -2.82 | -5.37 | -0.90 | 3.48 | 0.95 | 4.15 |
| **3830** | -2.79 | -5.40 | -0.89 | 4.47 | 0.89 | 4.76 |
| **3840** | -2.60 | -5.25 | -0.72 | 4.29 | 1.58 | 4.93 |
| **3850** | -2.82 | -5.43 | -0.92 | 4.76 | 1.94 | 5.23 |
| **3860** | -2.76 | -5.50 | -0.91 | 4.16 | 1.97 | 4.88 |
| **3870** | -2.63 | -5.63 | -0.86 | 5.67 | 2.11 | 5.96 |
| **3880** | -2.68 | -5.79 | -0.95 | 4.97 | 1.79 | 5.52 |
| **3890** | -2.50 | -5.51 | -0.74 | 5.58 | 2.38 | 5.91 |
| **3900** | -2.29 | -5.47 | -0.59 | 6.06 | 1.58 | 6.43 |
| **3910** | -2.70 | -5.80 | -0.97 | 4.66 | 1.23 | 4.89 |
| **3920** | -2.09 | -5.39 | -0.43 | 5.16 | 1.41 | 5.31 |
| **3930** | -2.25 | -5.63 | -0.61 | 5.00 | 1.79 | 5.24 |
| **3940** | -1.96 | -5.36 | -0.33 | 5.29 | 1.12 | 5.74 |
| **3950** | -2.50 | -5.87 | -0.86 | 4.99 | 1.08 | 5.16 |
| **3960** | -2.10 | -5.64 | -0.51 | 5.35 | 1.88 | 5.93 |
| **3970** | -2.54 | -5.94 | -0.91 | 5.44 | 1.89 | 5.64 |
| **3980** | -2.13 | -5.85 | -0.59 | 6.01 | 0.86 | 6.35 |
| **3990** | -1.85 | -6.05 | -0.45 | 5.76 | 1.32 | 6.29 |
| **4000** | -2.08 | -6.07 | -0.62 | 6.16 | 1.01 | 6.72 |
| **4010** | -1.97 | -5.82 | -0.47 | 6.27 | 0.63 | 6.77 |
| **4020** | -1.87 | -5.64 | -0.35 | 5.69 | 1.73 | 6.08 |
| **4030** | -1.76 | -5.77 | -0.31 | 6.20 | -0.10 | 6.51 |
| **4040** | -1.62 | -5.57 | -0.15 | 6.45 | 0.01 | 6.76 |
| **4050** | -1.94 | -5.54 | -0.36 | 5.66 | 1.34 | 6.03 |
| **4060** | -1.83 | -5.45 | -0.26 | 6.13 | 1.35 | 6.65 |
| **4070** | -2.07 | -5.74 | -0.52 | 5.84 | 2.13 | 6.43 |
| **4080** | -1.77 | -5.29 | -0.17 | 5.54 | 1.84 | 6.04 |
| **4090** | -2.15 | -5.72 | -0.57 | 5.57 | 1.58 | 6.15 |
| **4100** | -1.56 | -4.97 | 0.08 | 6.63 | 3.47 | 7.13 |
| **4110** | -2.10 | -5.67 | -0.52 | 5.77 | 2.13 | 6.65 |
| **4120** | -1.71 | -5.53 | -0.20 | 6.52 | 2.49 | 6.93 |
| **4130** | -2.70 | -6.44 | -1.17 | 5.77 | 1.43 | 6.34 |
| **4140** | -2.08 | -5.83 | -0.55 | 7.49 | 1.46 | 7.90 |
| **4150** | -3.26 | -7.22 | -1.79 | 5.18 | -0.33 | 5.76 |
| **4160** | -2.71 | -6.35 | -1.15 | 5.66 | 0.74 | 6.28 |
| **4170** | -2.69 | -6.38 | -1.14 | 5.55 | 0.32 | 5.86 |
| **4180** | -2.97 | -6.34 | -1.33 | 5.46 | 0.42 | 5.83 |
| **4190** | -2.55 | -6.00 | -0.94 | 5.96 | -0.25 | 6.31 |
| **4200** | -2.29 | -5.93 | -0.73 | 7.02 | 1.12 | 7.27 |
| **4210** | -2.36 | -5.92 | -0.77 | 6.07 | 0.49 | 6.74 |
| **4220** | -2.47 | -6.33 | -0.98 | 7.33 | 0.40 | 7.73 |
| **4230** | -2.15 | -5.98 | -0.65 | 7.26 | 1.32 | 7.55 |
| **4240** | -2.53 | -6.44 | -1.05 | 6.20 | 0.67 | 6.82 |
| **4250** | -2.38 | -6.19 | -0.87 | 6.25 | 1.03 | 6.74 |
| **4260** | -3.04 | -6.75 | -1.50 | 4.77 | 0.91 | 5.17 |
| **4270** | -2.82 | -6.21 | -1.18 | 5.34 | 1.51 | 5.98 |
| **4280** | -3.46 | -6.50 | -1.71 | 4.43 | 0.59 | 5.04 |
| **4290** | -2.74 | -5.62 | -0.94 | 5.12 | 2.14 | 5.73 |
| **4300** | -3.08 | -5.83 | -1.23 | 4.89 | 2.48 | 5.81 |
| **4310** | -2.68 | -5.74 | -0.94 | 4.97 | 1.78 | 5.89 |
| **4320** | -2.68 | -5.83 | -0.97 | 5.12 | 1.15 | 5.75 |
| **4330** | -2.74 | -5.95 | -1.05 | 4.90 | 1.55 | 5.84 |
| **4340** | -3.15 | -6.18 | -1.39 | 5.03 | 0.77 | 5.65 |

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|---|---|---|---|---|---|---|
| **4350** | -3.04 | -5.87 | -1.22 | 5.40 | 0.50 | 5.92 |
| **4360** | -3.67 | -6.50 | -1.85 | 4.71 | 1.44 | 6.06 |
| **4370** | -2.74 | -5.19 | -0.79 | 6.04 | 2.38 | 6.76 |
| **4380** | -3.36 | -5.72 | -1.37 | 5.06 | 0.78 | 5.87 |
| **4390** | -3.09 | -5.51 | -1.13 | 5.59 | 0.41 | 6.64 |
| **4400** | -3.42 | -5.98 | -1.51 | 4.88 | 0.30 | 6.09 |
| **4410** | -3.20 | -6.10 | -1.41 | 4.31 | 1.05 | 5.21 |
| **4420** | -3.44 | -6.32 | -1.63 | 4.28 | 0.02 | 5.10 |
| **4430** | -3.02 | -5.75 | -1.16 | 5.22 | 0.84 | 6.26 |
| **4440** | -3.44 | -5.91 | -1.49 | 3.64 | 1.13 | 5.12 |
| **4450** | -3.04 | -5.47 | -1.08 | 4.57 | 1.65 | 5.57 |
| **4460** | -3.16 | -5.55 | -1.18 | 4.71 | 1.27 | 5.82 |
| **4470** | -3.12 | -5.42 | -1.11 | 4.47 | 2.59 | 6.38 |
| **4480** | -2.94 | -5.40 | -0.99 | 5.04 | 2.75 | 6.56 |
| **4490** | -3.73 | -5.77 | -1.62 | 4.39 | 1.77 | 5.40 |
| **4500** | -3.26 | -5.37 | -1.18 | 5.04 | 2.01 | 5.78 |
| **4510** | -3.89 | -6.04 | -1.83 | 4.60 | 1.16 | 5.19 |
| **4520** | -3.20 | -5.46 | -1.17 | 4.94 | 1.87 | 5.95 |
| **4530** | -3.29 | -5.64 | -1.30 | 5.29 | 1.45 | 5.85 |
| **4540** | -2.74 | -5.04 | -0.73 | 5.87 | 3.03 | 6.78 |
| **4550** | -2.94 | -5.39 | -0.98 | 5.00 | 2.85 | 6.34 |
| **4560** | -2.67 | -5.24 | -0.76 | 5.42 | 2.52 | 5.92 |
| **4570** | -2.91 | -5.41 | -0.97 | 5.32 | 1.49 | 5.92 |
| **4580** | -2.93 | -5.39 | -0.98 | 5.32 | 1.66 | 6.76 |
| **4590** | -2.91 | -5.43 | -0.98 | 5.89 | 1.46 | 6.48 |
| **4600** | -3.41 | -5.67 | -1.39 | 5.00 | 0.91 | 5.56 |
| **4610** | -2.74 | -4.95 | -0.69 | 5.08 | 2.04 | 6.14 |
| **4620** | -3.72 | -5.89 | -1.66 | 5.11 | 0.55 | 5.67 |
| **4630** | -2.73 | -5.10 | -0.74 | 6.06 | 1.42 | 6.78 |
| **4640** | -3.28 | -5.47 | -1.23 | 5.57 | 2.64 | 6.25 |
| **4650** | -3.00 | -5.13 | -0.92 | 5.84 | 1.91 | 6.51 |
| **4660** | -3.62 | -5.51 | -1.45 | 4.69 | 1.10 | 5.25 |
| **4670** | -3.49 | -5.29 | -1.29 | 4.50 | 1.85 | 5.54 |
| **4680** | -3.31 | -4.91 | -1.03 | 4.92 | 1.67 | 5.91 |
| **4690** | -3.69 | -5.30 | -1.41 | 4.29 | 2.04 | 5.41 |
| **4700** | -2.66 | -4.52 | -0.48 | 5.20 | 2.45 | 6.34 |
| **4710** | -3.44 | -5.48 | -1.33 | 3.70 | 1.36 | 5.12 |
| **4720** | -2.33 | -4.50 | -0.27 | 5.47 | 3.37 | 6.37 |
| **4730** | -3.69 | -5.70 | -1.57 | 3.56 | 1.34 | 4.93 |
| **4740** | -2.68 | -5.08 | -0.71 | 4.66 | 1.69 | 5.47 |
| **4750** | -3.46 | -5.72 | -1.44 | 3.84 | 1.71 | 4.83 |
| **4760** | -2.88 | -5.04 | -0.82 | 4.99 | 2.95 | 5.26 |
| **4770** | -3.40 | -5.39 | -1.27 | 4.38 | 1.86 | 4.87 |
| **4780** | -2.99 | -4.87 | -0.82 | 5.33 | 2.61 | 5.68 |
| **4790** | -3.49 | -5.22 | -1.26 | 4.86 | 1.80 | 5.33 |
| **4800** | -3.18 | -5.07 | -1.01 | 4.93 | 2.58 | 5.37 |
| **4810** | -3.32 | -4.77 | -0.98 | 4.63 | 1.63 | 5.13 |
| **4820** | -3.04 | -4.75 | -0.80 | 5.15 | 1.73 | 5.50 |
| **4830** | -3.10 | -4.52 | -0.74 | 5.43 | 3.24 | 5.88 |
| **4840** | -3.35 | -4.96 | -1.07 | 4.61 | 2.98 | 4.95 |
| **4850** | -3.09 | -4.72 | -0.82 | 5.05 | 2.34 | 6.22 |
| **4860** | -3.44 | -4.96 | -1.12 | 4.99 | 2.85 | 6.05 |
| **4870** | -3.25 | -4.59 | -0.86 | 4.30 | 2.92 | 5.43 |
| **4880** | -3.12 | -4.43 | -0.72 | 5.03 | 2.85 | 5.73 |
| **4890** | -3.04 | -4.18 | -0.56 | 5.03 | 3.61 | 5.74 |
| **4900** | -3.18 | -4.23 | -0.67 | 4.98 | 2.87 | 5.42 |
| **4910** | -3.41 | -4.35 | -0.84 | 4.07 | 1.99 | 4.97 |
| **4920** | -3.95 | -4.76 | -1.32 | 3.95 | 1.97 | 4.78 |
| **4930** | -3.75 | -4.49 | -1.10 | 3.68 | 2.83 | 5.00 |
| **4940** | -4.37 | -5.21 | -1.76 | 3.65 | 1.40 | 4.46 |
| **4950** | -3.89 | -4.71 | -1.27 | 3.48 | 1.82 | 4.94 |
| **4960** | -3.95 | -4.95 | -1.41 | 3.06 | 3.54 | 4.56 |
| **4970** | -3.68 | -4.93 | -1.25 | 3.69 | 2.85 | 5.16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **4980** | -4.05 | -5.60 | -1.74 | 2.49 | 1.32 | 3.52 |
| **4990** | -2.89 | -4.60 | -0.65 | 4.88 | 2.35 | 5.41 |
| **5000** | -3.92 | -5.50 | -1.63 | 4.14 | 1.17 | 4.66 |

Innovative Technology for a Connected World

# LTE3 antenna

# certification report

## LTE / eCall antenna

| Audi part number | Laird part number | description |
|---|---|---|
| **4M0 035 504** | 9 40 08 | ecall antenna |

## manufacturer

Jebsee Electronics Shenzhen Co., ltd.
NO166,Hang Cheng RD,
Hang Cheng Street,
Baoan Zone,
ShenZhen City,
Postal Code: 518102
PR CHINA

## supplier

**Laird** Hildesheim GmbH
Daimlerring 31
31135 Hildesheim
Deutschland

## changes

| version | author | date |
|---|---|---|
| **A0** | Nima Kiaei-Lochte | 21.09.2018 |

## Contents


manufacturer ..... 1
supplier ..... 1
changes ..... 1
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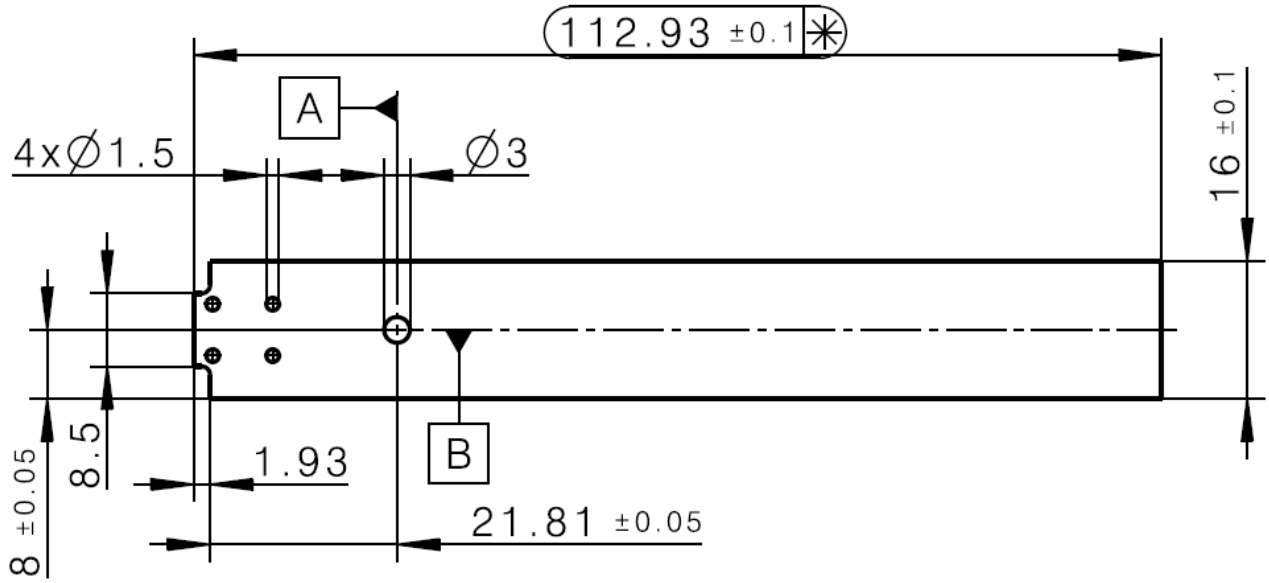
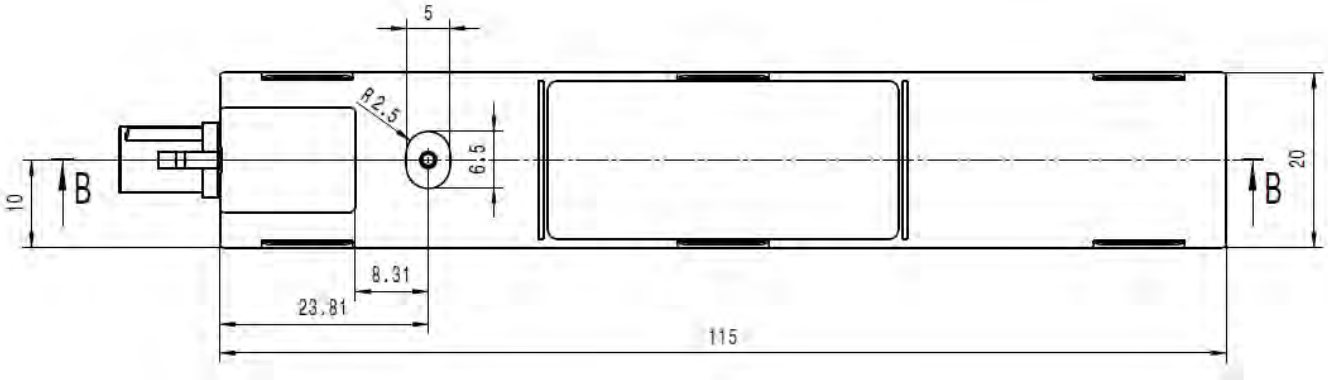
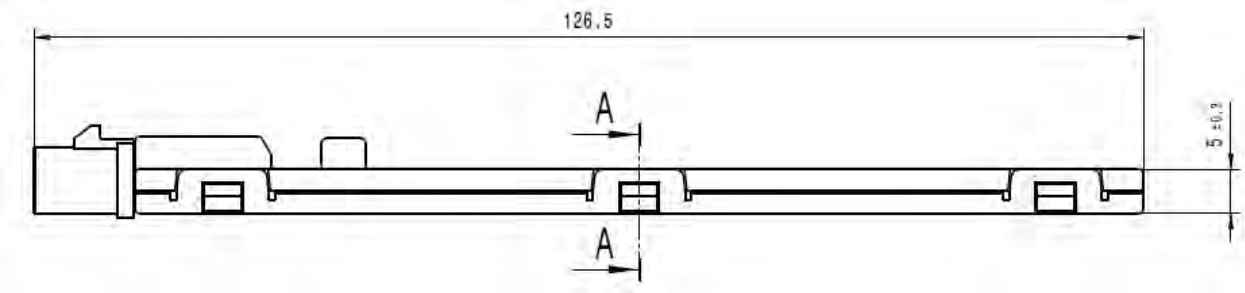
dimensions component ..... 3
antenna electrical characteristics ..... 4
antenna peak values ..... 5

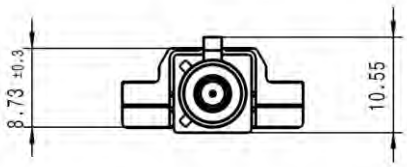
## dimensions antenna itself



## dimensions component



## antenna electrical characteristics

free air mount, distance to ground min. 10mm

**Technische Daten / *Technical Data***

| | |
|---|---|
| Frequenzbereich / *Frequency Range* | *698 – 2690 MHz* |
| Impedanz / *Impedance* | *50Ω* |
| Gewinn / *Gain* | *2dB* |
| Max. Gewinn / Peak Gain | *2,86dBi* |
| Belastbarkeit / *Max. Power* | *10W gepulst / pulsed* |
| Dimensionen der Antenne / *Dimensions of Antenna* | *126,50 x 20,00 x 10,55mm* |
| Anschluss / *Connector* | *Fakra Kodierung D / code D* |

## Polar Plot Horizontal Cut

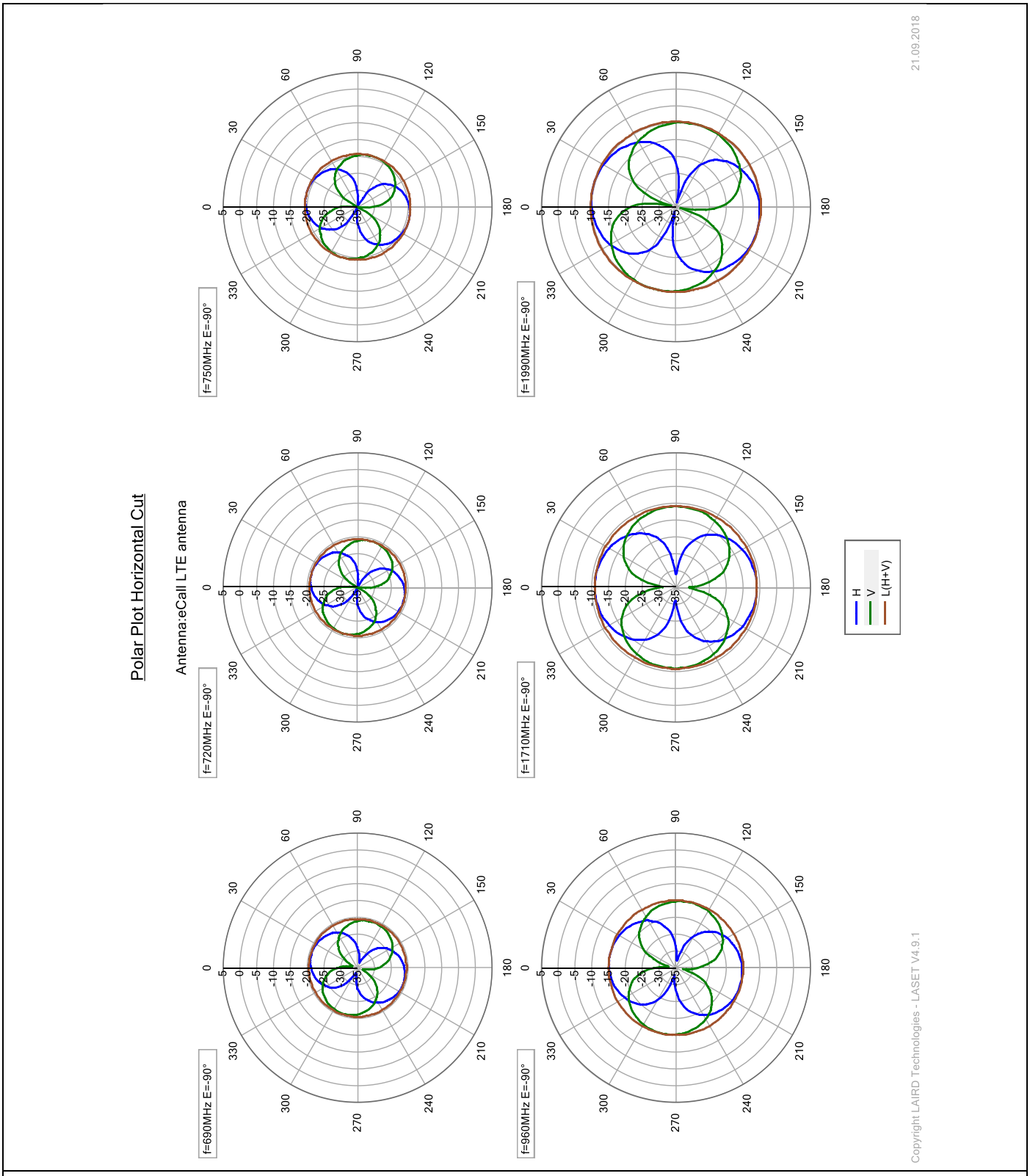



Figure 1 - eCall LTE antenna, Polar Plot Horizontal Cut, E=-90°

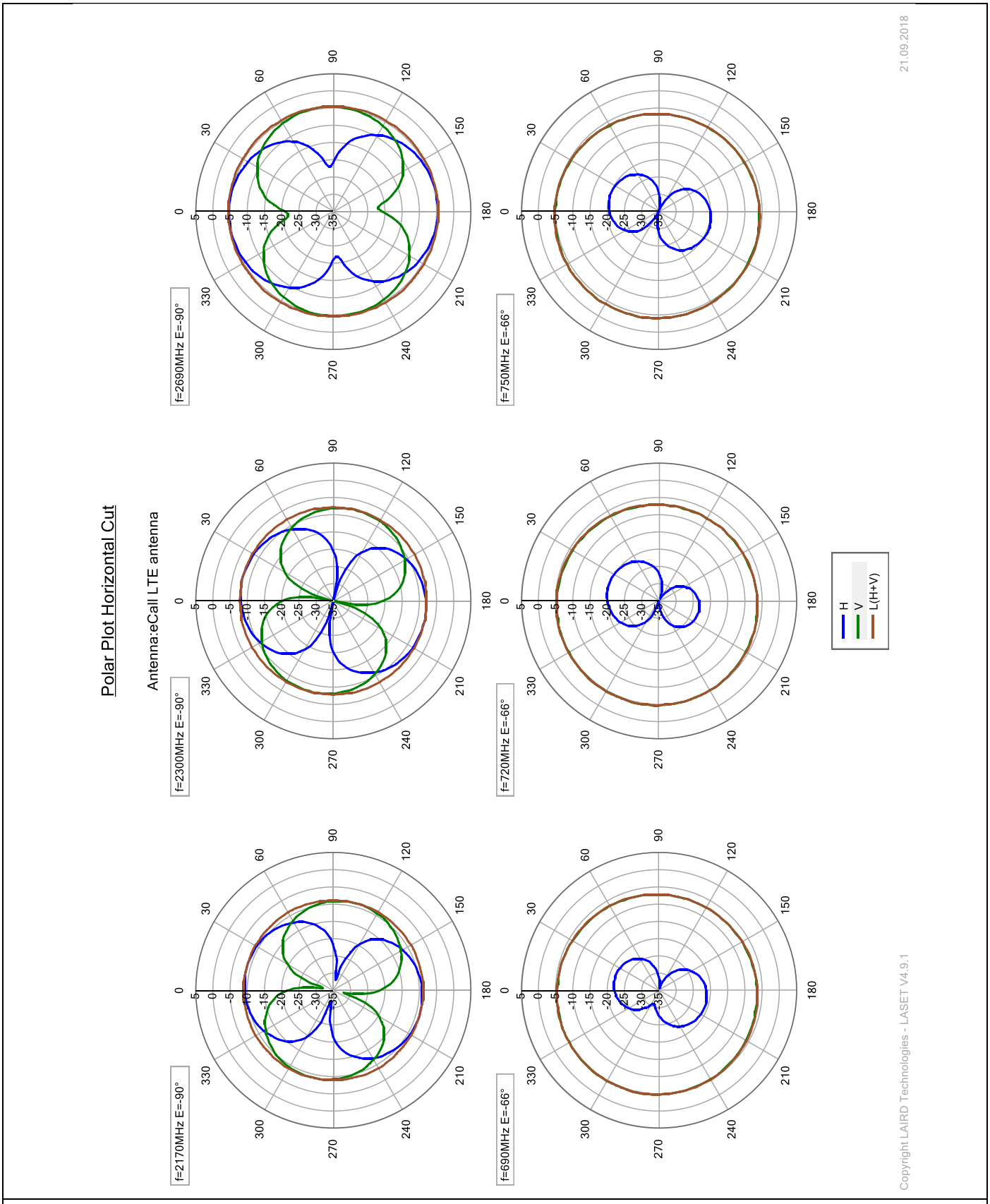



Figure 2 - eCall LTE antenna, Polar Plot Horizontal Cut

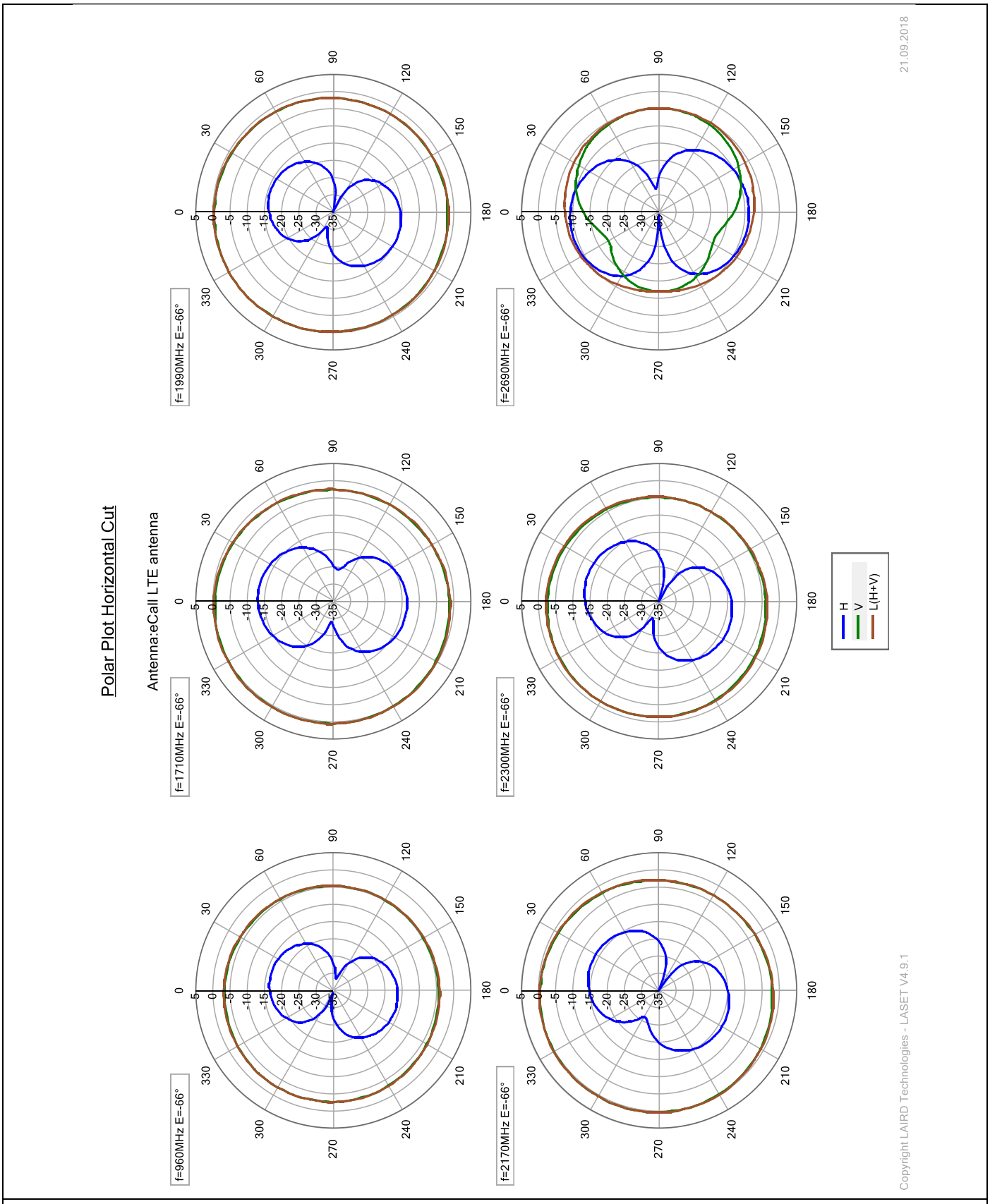



Figure 3 - eCall LTE antenna, Polar Plot Horizontal Cut, E=-66°

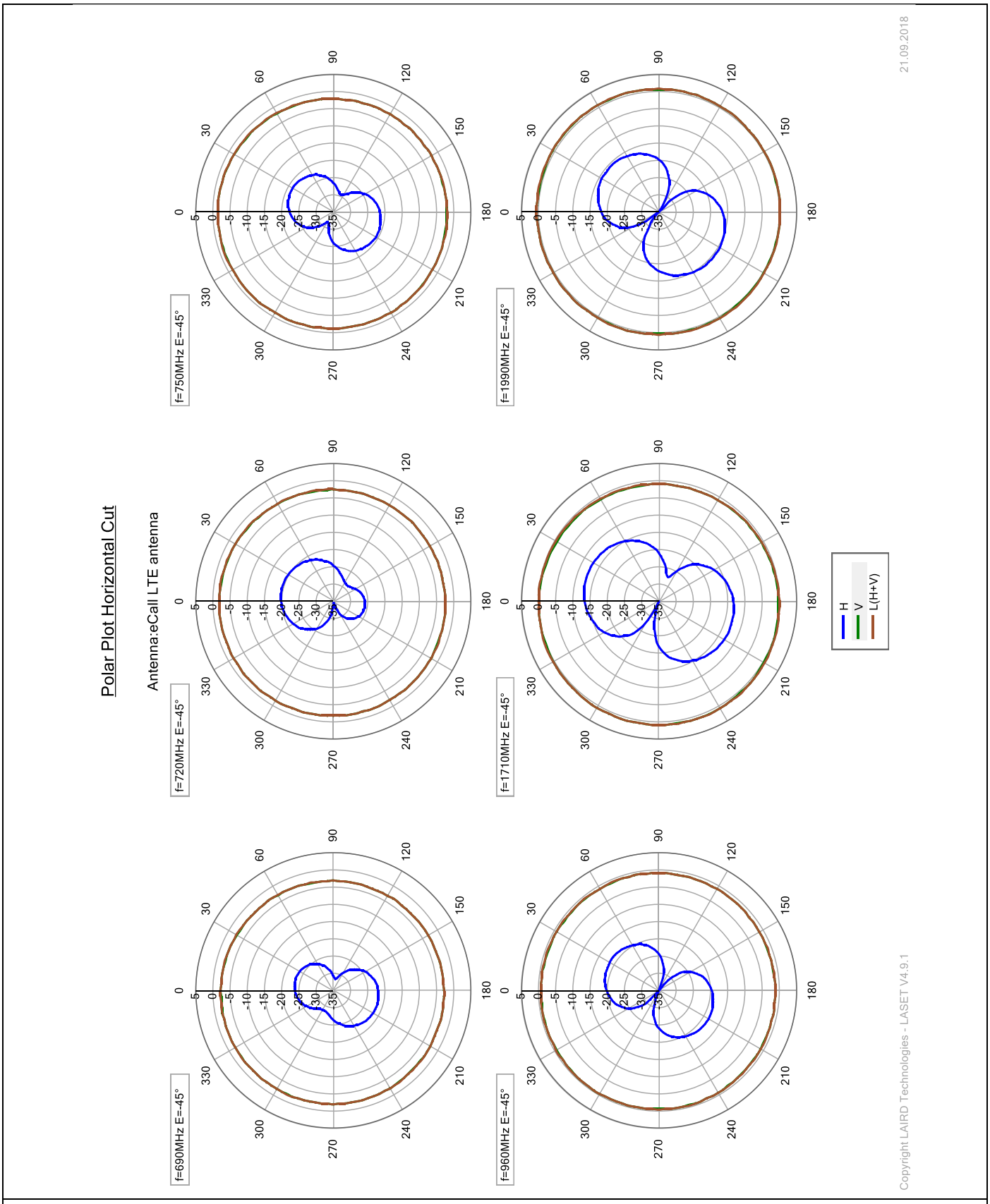



Figure 4 - eCall LTE antenna, Polar Plot Horizontal Cut, E=-45°

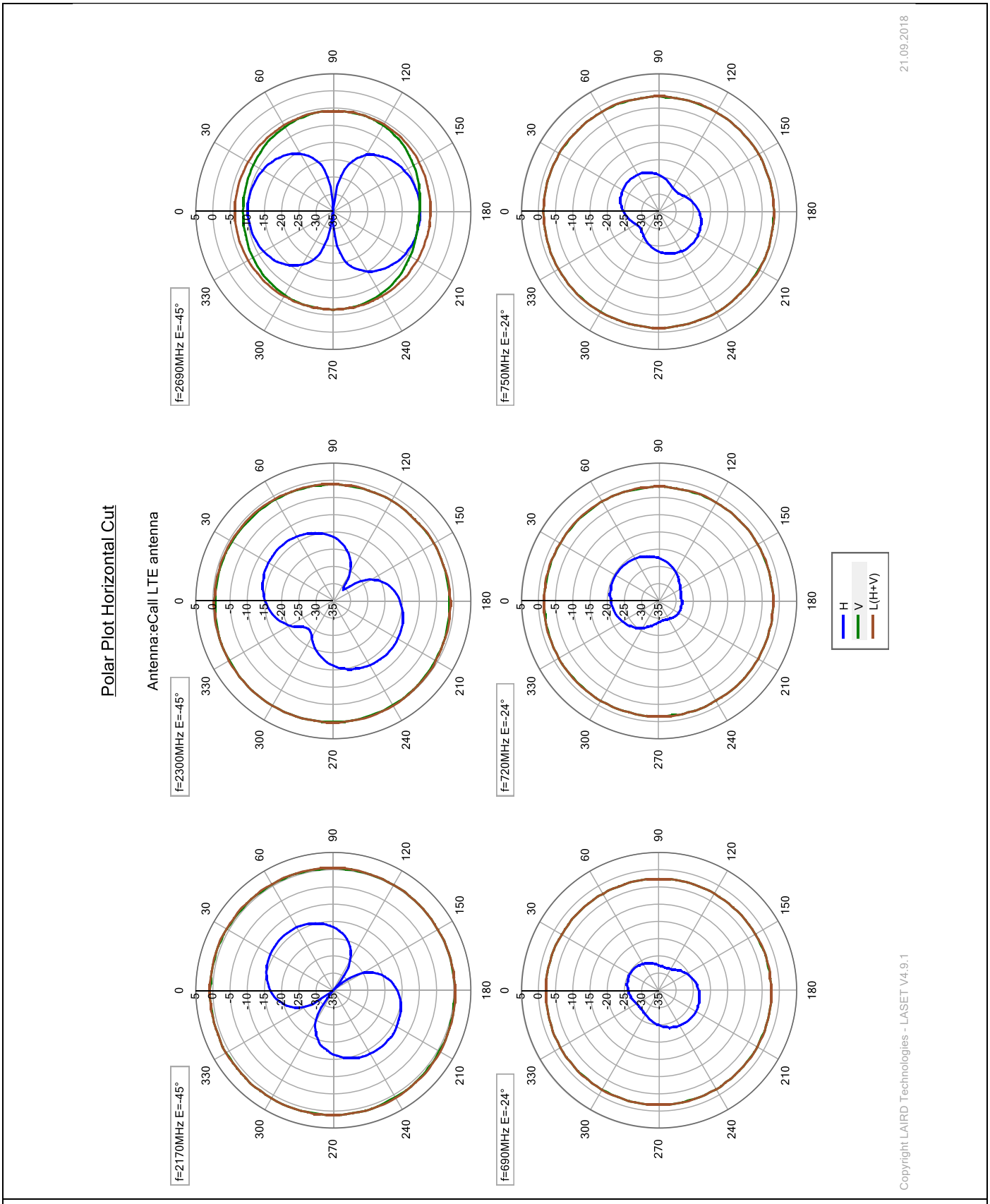



Figure 5 - eCall LTE antenna, Polar Plot Horizontal Cut

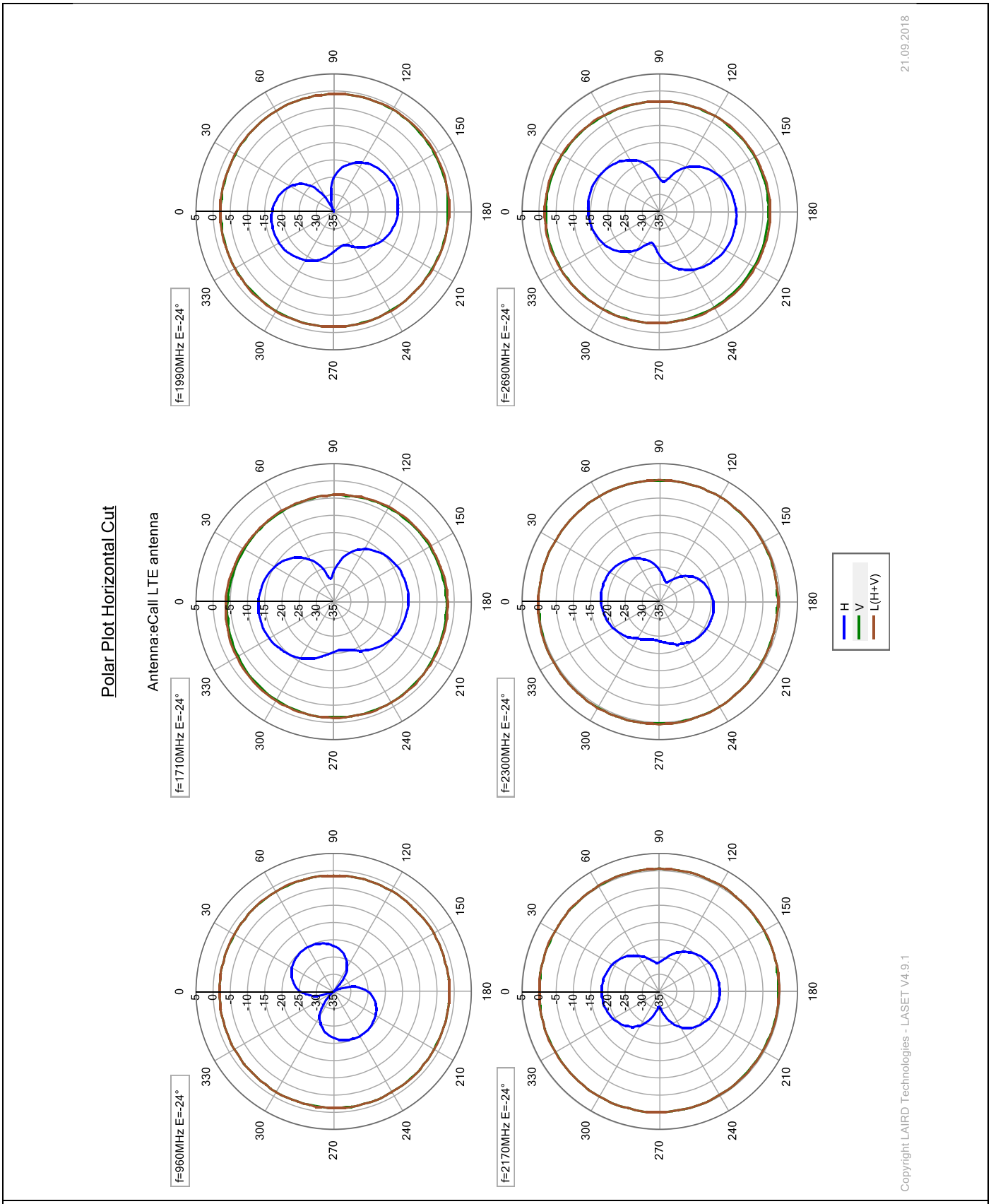



Figure 6 - eCall LTE antenna, Polar Plot Horizontal Cut, E=-24°

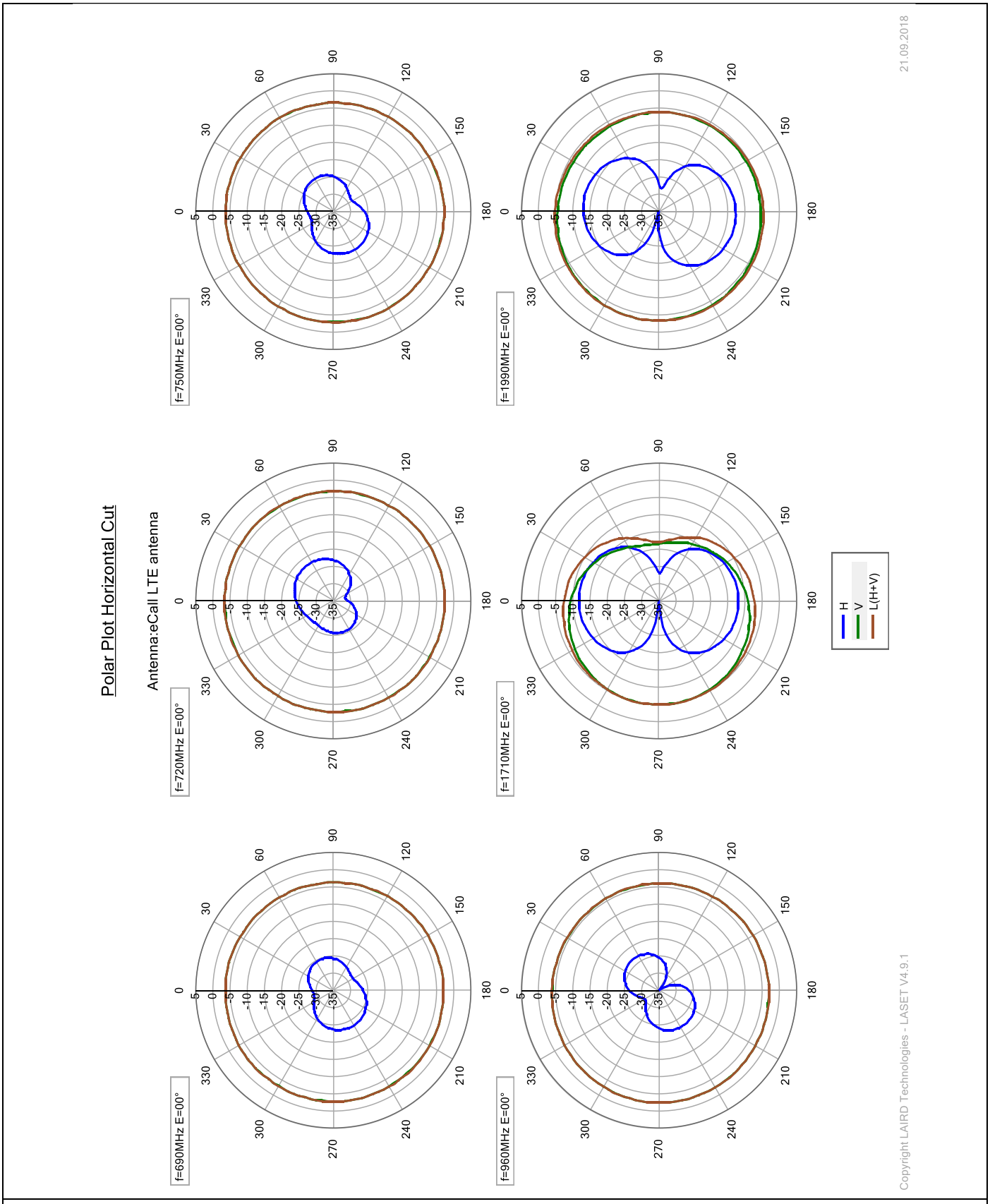



Figure 7 - eCall LTE antenna, Polar Plot Horizontal Cut, E=0°

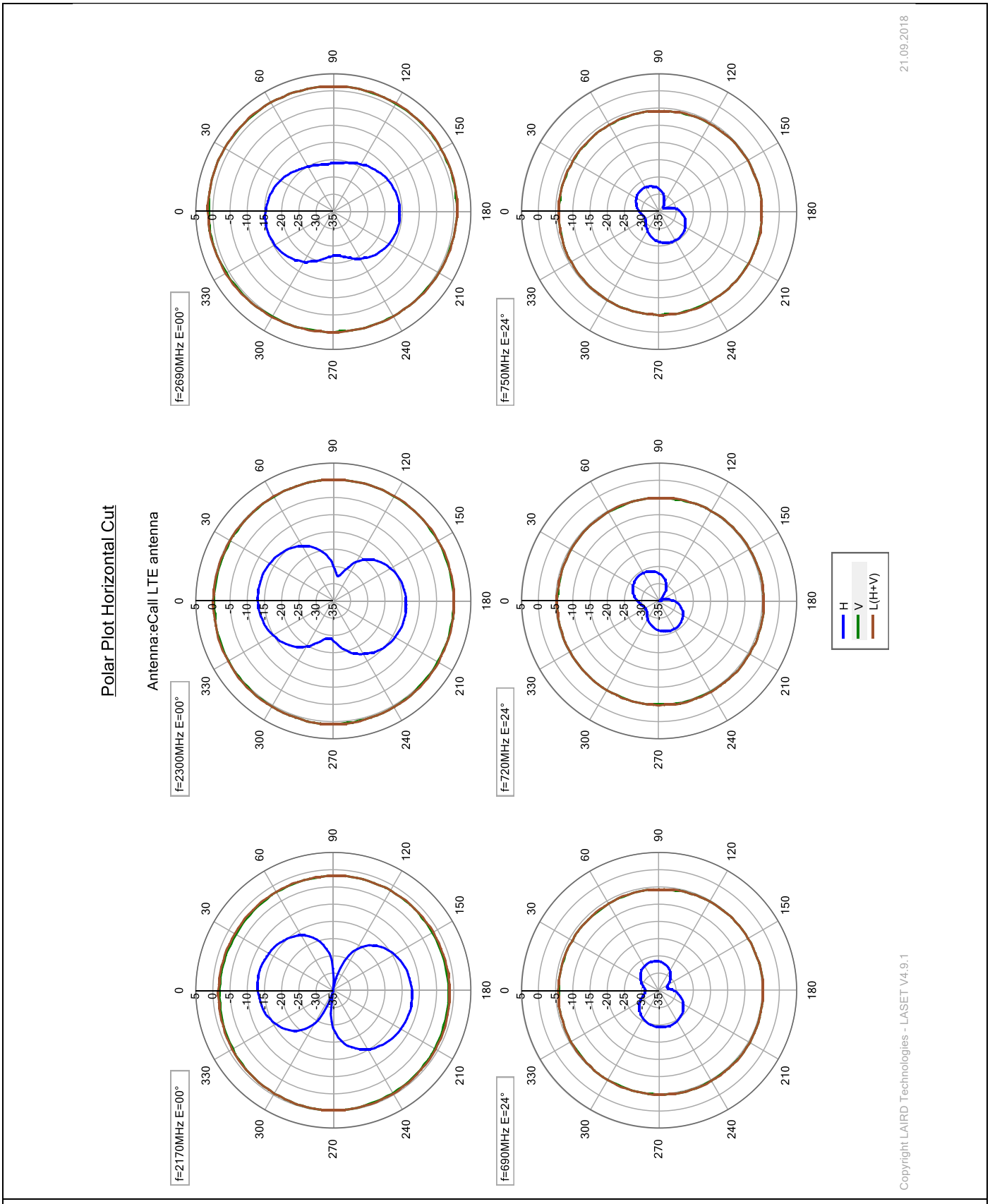



Figure 8 - eCall LTE antenna, Polar Plot Horizontal Cut

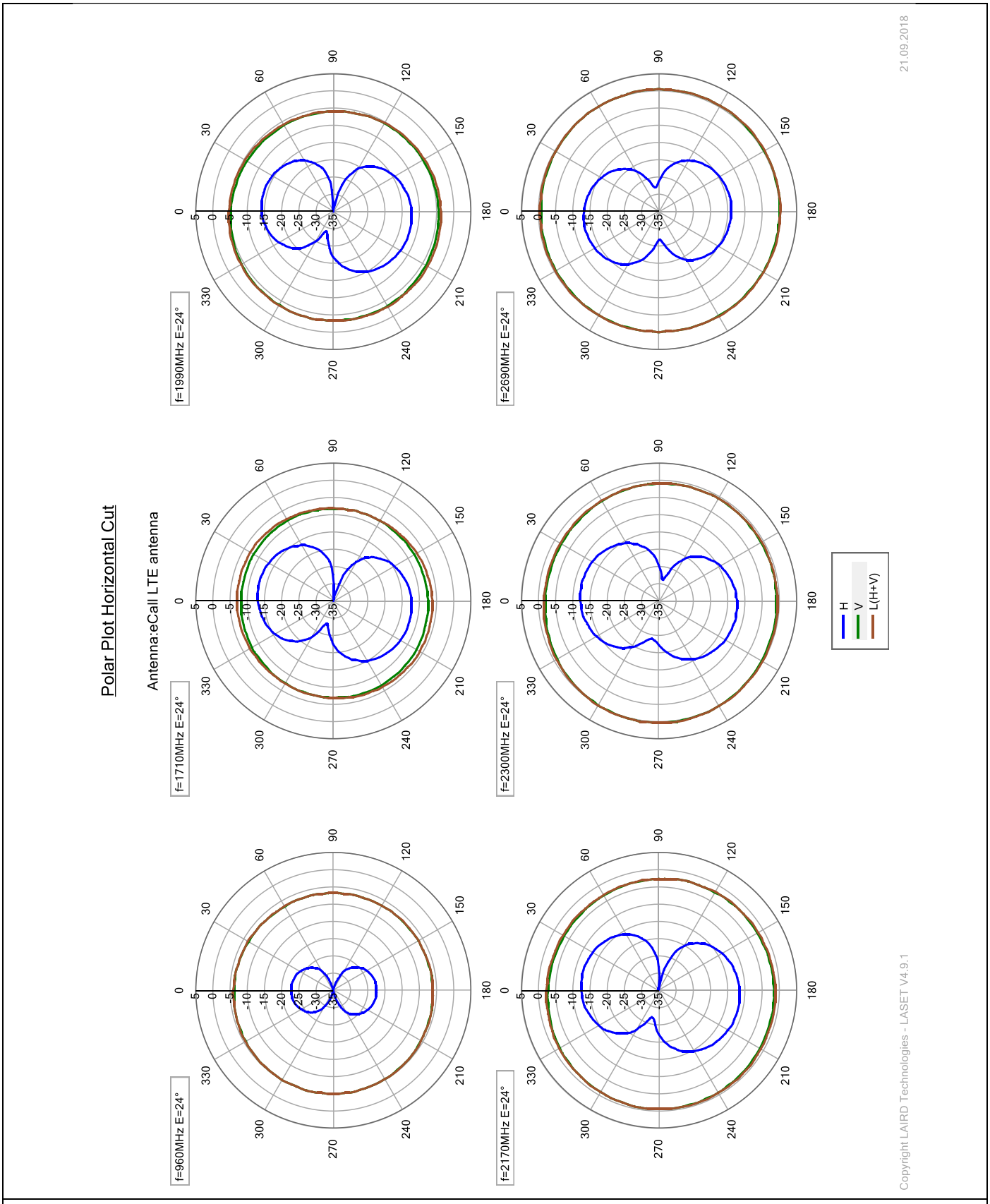



Figure 9 - eCall LTE antenna, Polar Plot Horizontal Cut, E=24°

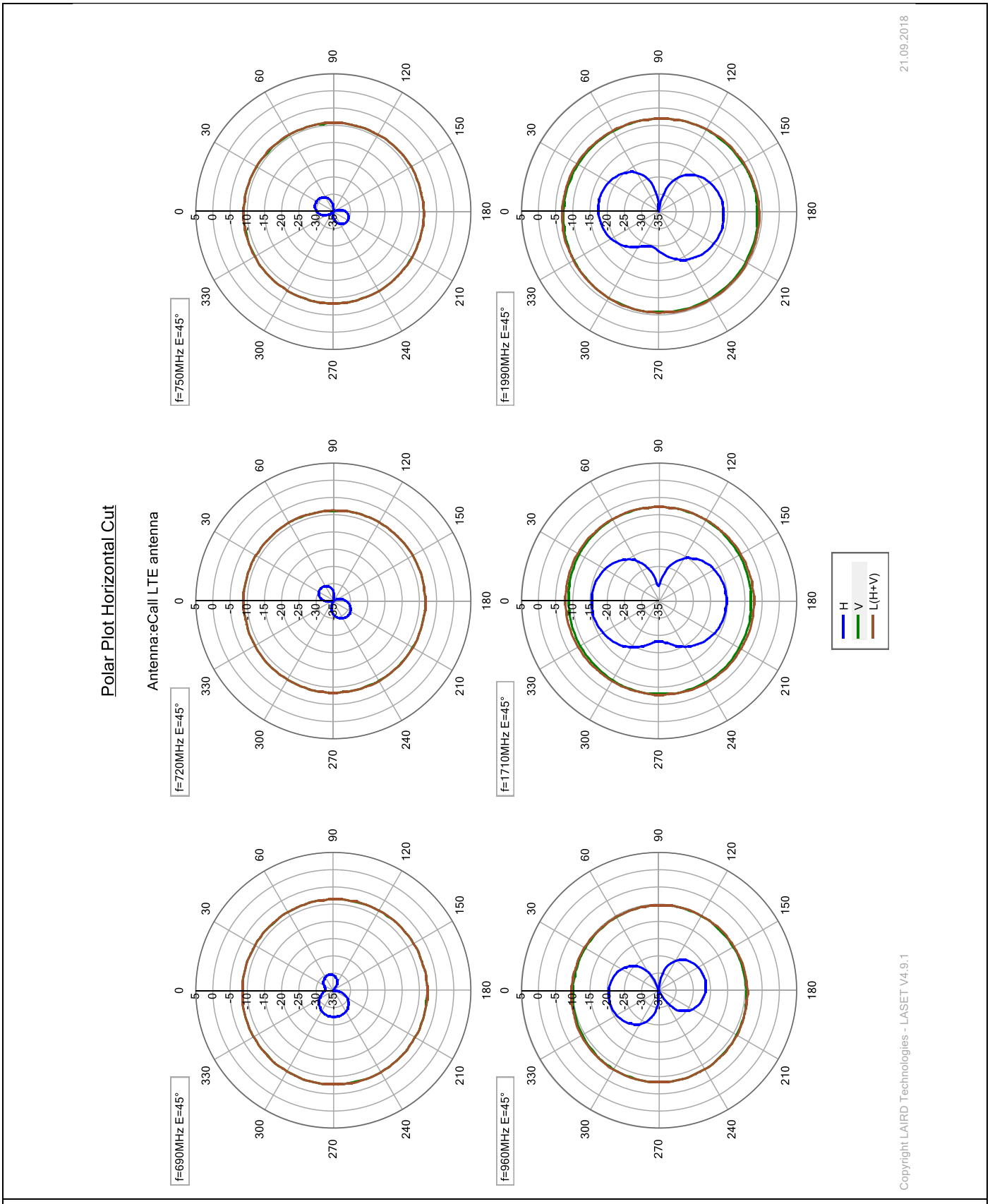



Figure 10 - eCall LTE antenna, Polar Plot Horizontal Cut, E=45°

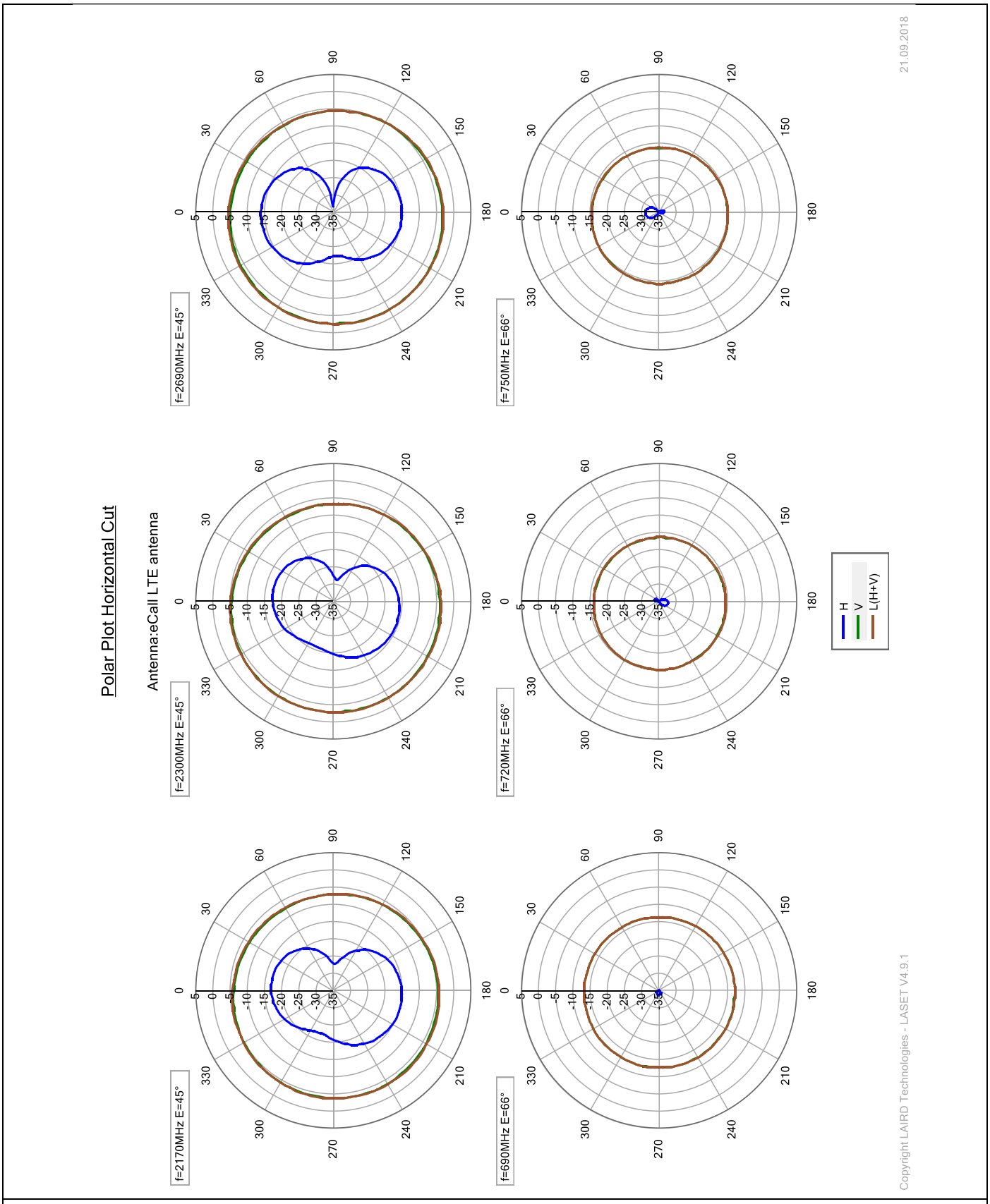



Figure 11 - eCall LTE antenna, Polar Plot Horizontal Cut