**HELLA GmbH & Co. KGaA**
59552 Lippstadt

# FS197R

# UHF, UWB and LF Antenna Description

| Date:<br>2024-03-19 | Processed:<br>O. Kushova E-CA-D-HW | Revision: 1.1 | Page 1 of 12 |
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## Document History

| PTC version | Date | Description |
|---|---|---|
| 1.1 | 2024-03-19 | Released version |
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# Content

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## 1    PCB integrated Loop UHF Antenna Description

The following pictures show the PCB integrated loop UHF antenna of the FS197R devices which is routed partially on the top layer and the inner layers #1 and #2 of the PCB visualised as blue line in the PCB layout pictures below:
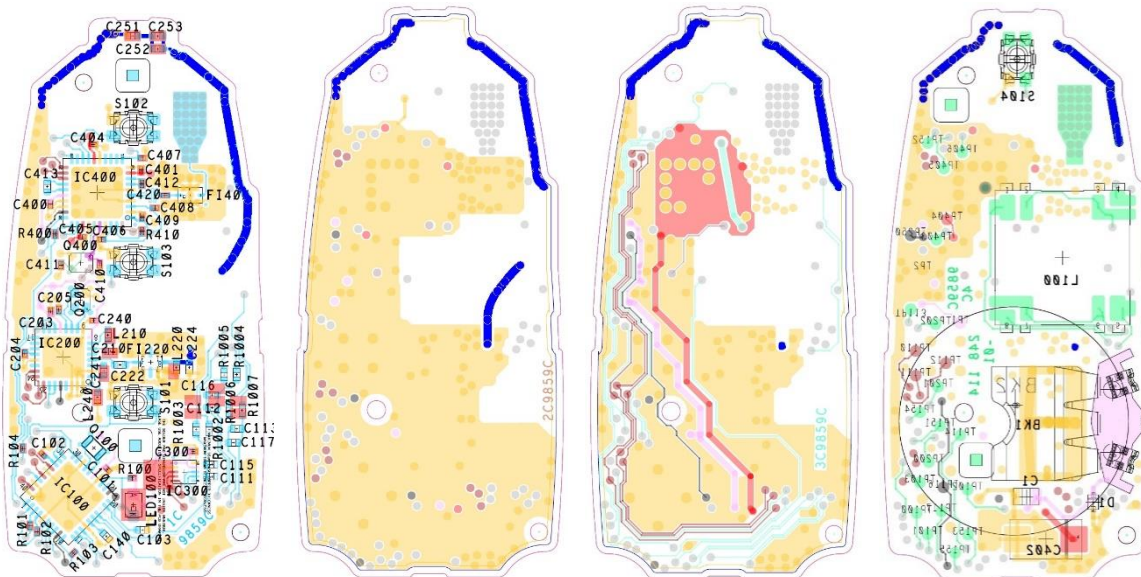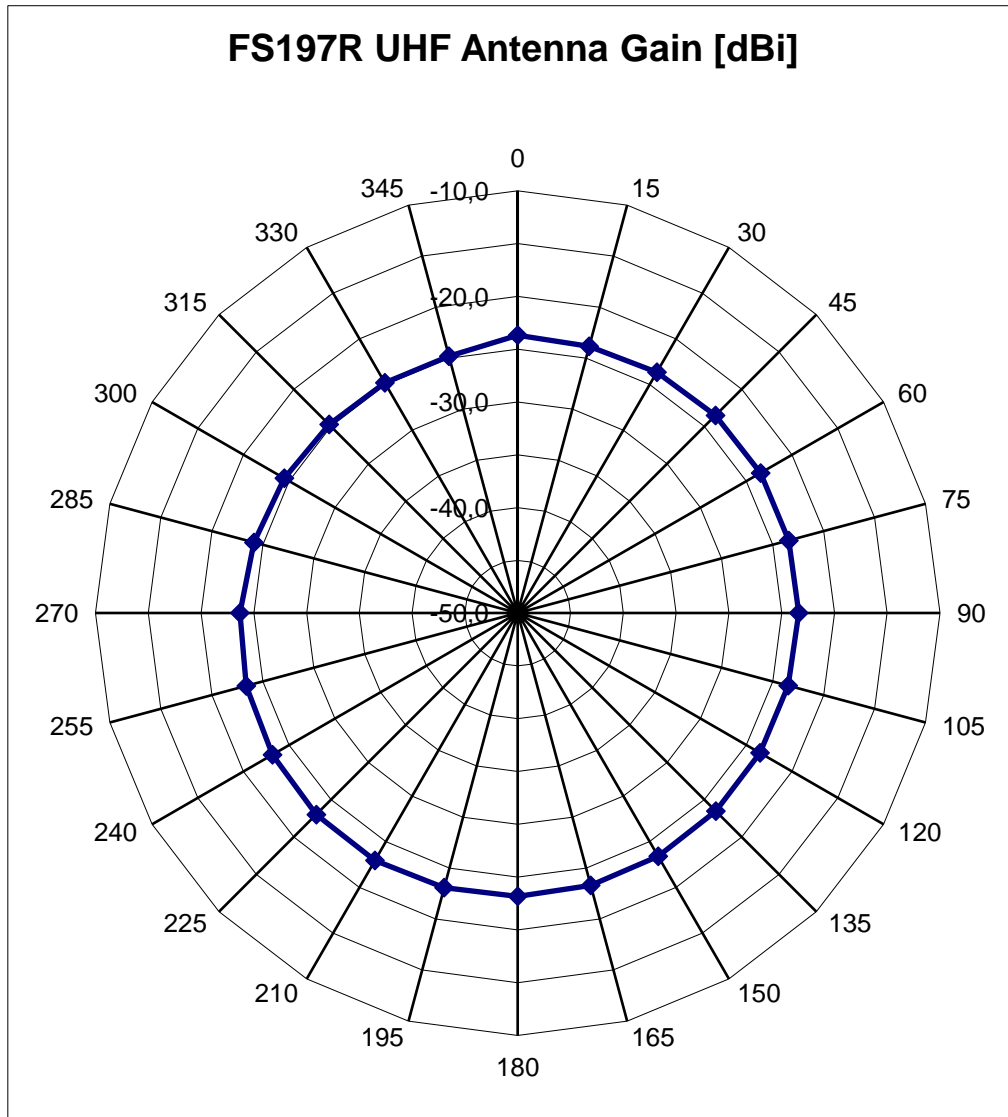


**Picture 1: Integrated PCB loop UHF antenna (top layer, inner layer #1 & #2 and bottom layer)**

### 1.1    UHF Antenna Electrical Specification

| No | Item | Spec. |
|---|---|---|
| 1 | VSWR | Max 2.0 : 1 |
| 2 | Polarization | Linear |
| 3 | Impedance [Ω] | Nominal 50 |

Maximal antenna gain is approx. -23 dBi

Average antenna gain is approx. -23.6 dBi

# FS197R UHF Antenna Gain [dBi]



**Picture 2: UHF antenna radiation diagram**

## UHF antenna dimensions
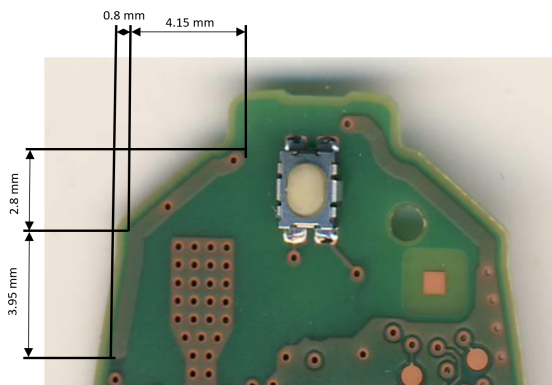
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## 2    PCB integrated Monopole UWB Antenna Description

The following pictures show the PCB integrated monopole UWB antenna of the FS197R devices which is realized as an PCB integrated monopole antenna routed partially on the top layer (left side picture) and on the bottom layer (right side picture) of the PCB (indicated by the blue box).



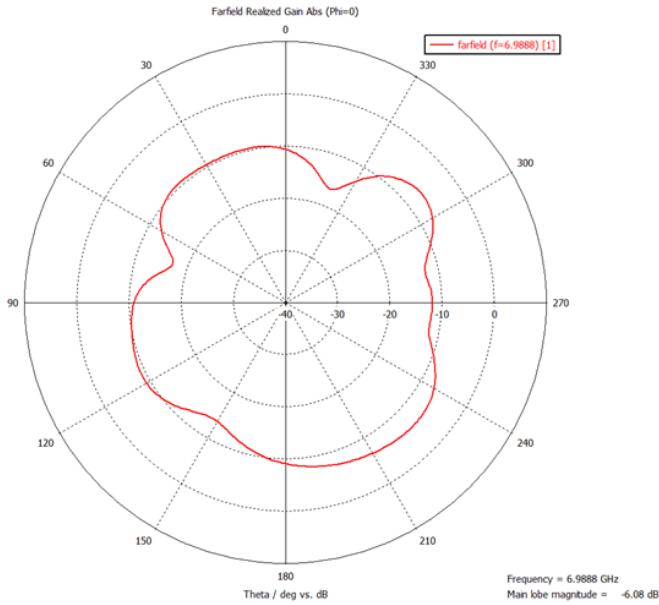**Picture 3: PCB integrated monopole UWB antenna**
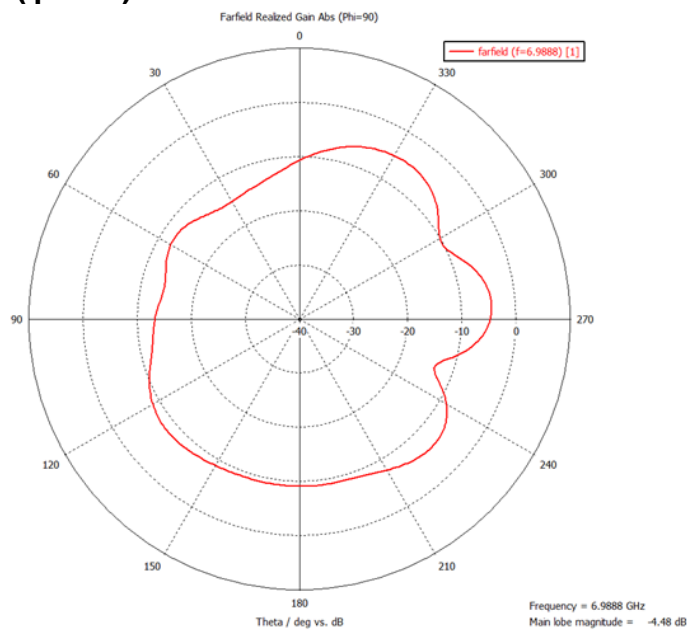
### UWB antenna dimensions
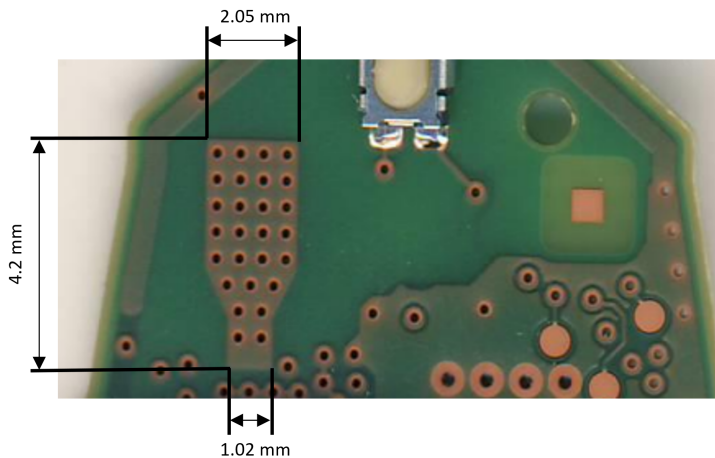
## 2.1  UWB Antenna Pattern at 6988.8 MHz (Ch6)

The following pictures show the UWB antenna pattern at the operating frequency of 6988.8 MHz.

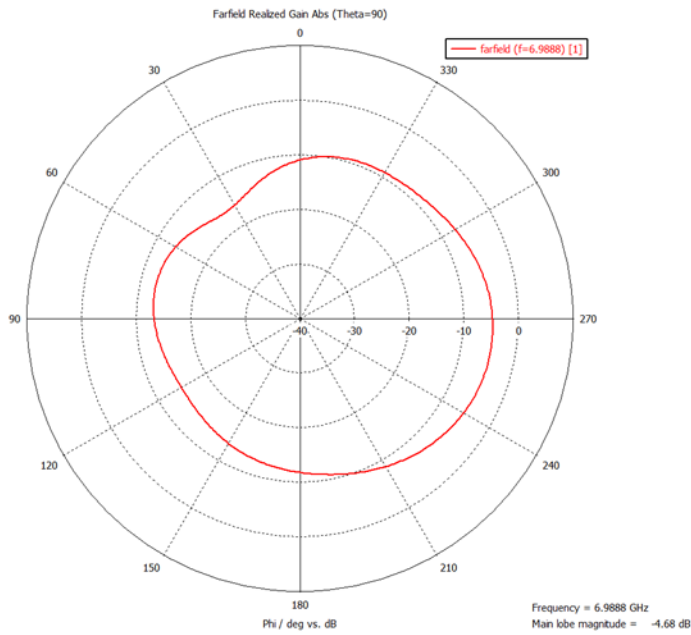### E1-Cut (φ = 0)



### E2-Cut (φ = 90)

## H-Cut (θ = 90)

Farfield Realized Gain Abs (Theta=90)

farfield (f=6.9888) [1]

Phi / deg vs. dB

Frequency = 6.9888 GHz
Main lobe magnitude = -4.68 dB

## 3D



farfield (f=6.9888) [1]
Type           Farfield
Approximation  enabled (kR >> 1)
Component      Abs
Output         Realized Gain
Frequency      6.9888 GHz
Rad. Effic.    -3.308 dB
Tot. Effic.    -4.037 dB
Rlzd. Gain     -4.395 dB

dB
-4.39
-6.82
-9.24
-11.7
-14.1
-16.5
-18.9
-21.4
-23.8
-26.2
-28.6
-31.1
-33.5
-35.9
-38.3
-40.8
-44.4

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## 2.2 UWB Antenna Pattern at 7488.0 MHz (Ch8)

The following pictures show the UWB antenna pattern at the operating frequency of 7488.0 MHz.
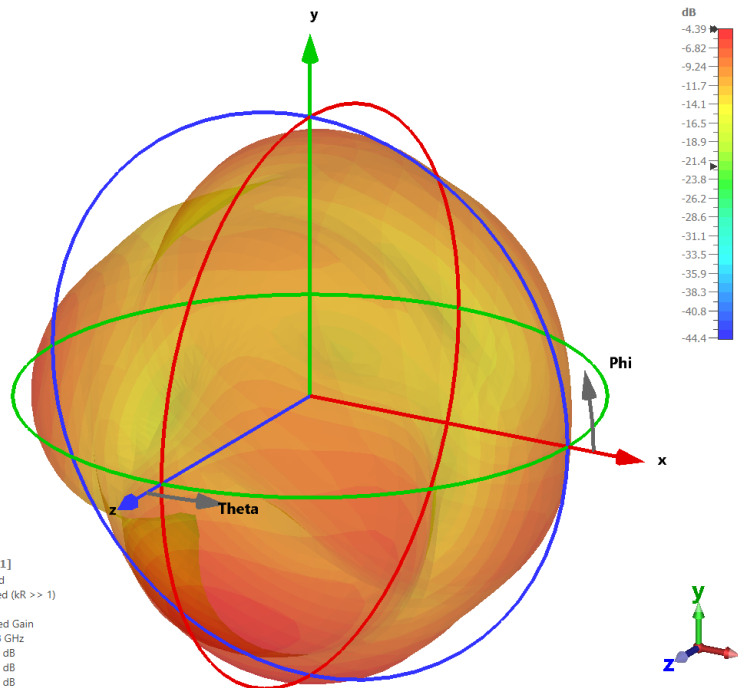
### E1-Cut (φ = 0)



### E2-Cut (φ = 90)

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## H-Cut (θ = 90)



Farfield Realized Gain Abs (Theta=90)

— farfield (f=7.488) [1]

Phi / deg vs. dB

Frequency = 7.488 GHz
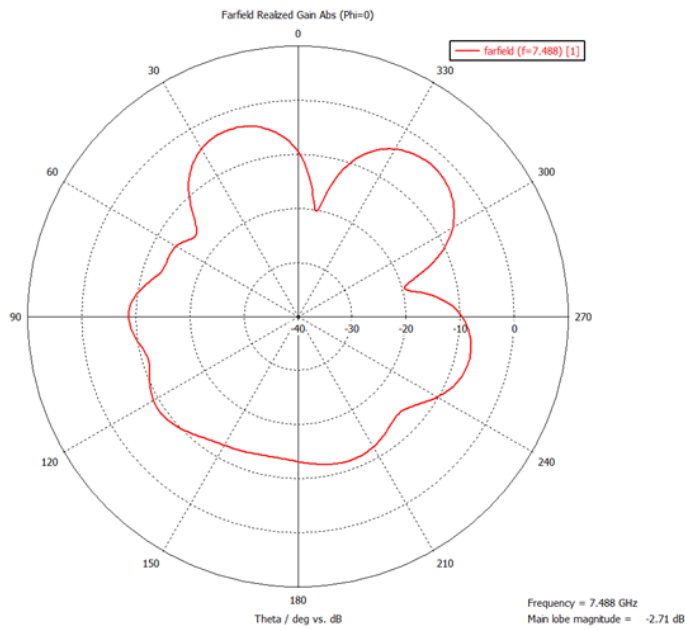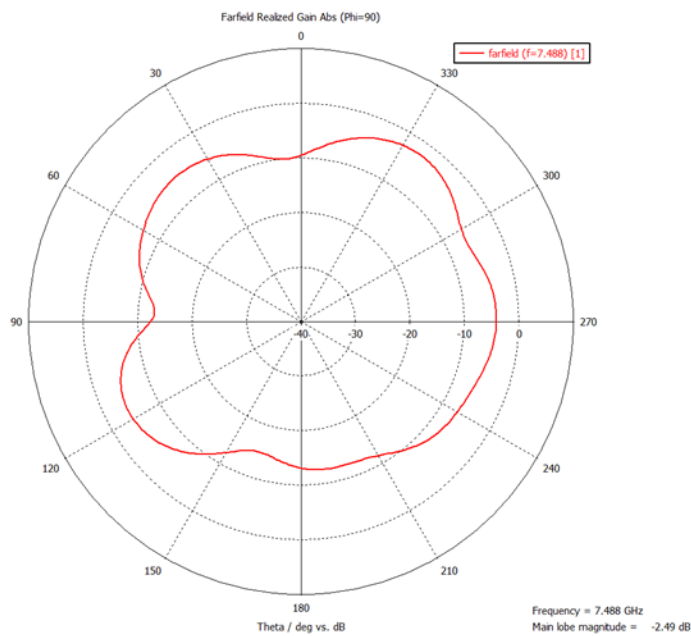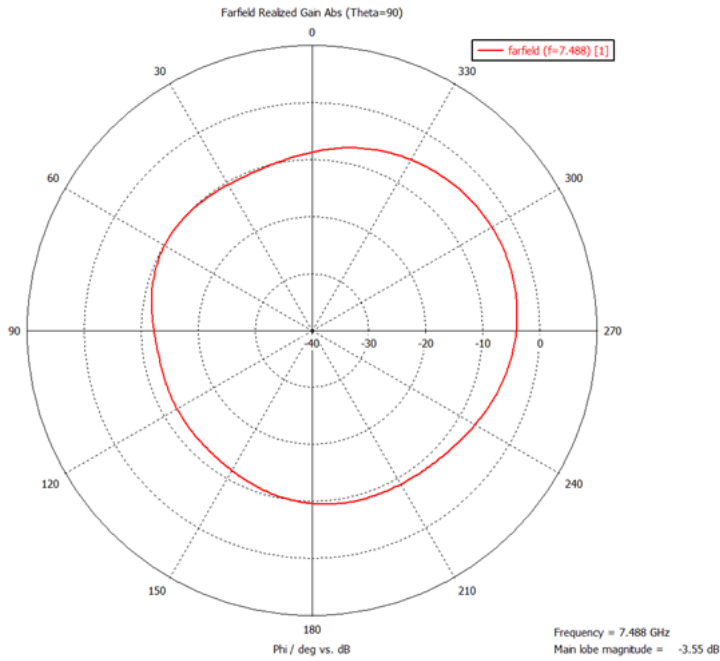Main lobe magnitude = -3.55 dB

## 3D



farfield (f=7.488) [1]
Type          Farfield
Approximation  enabled (kR >> 1)
Component     Abs
Output        Realized Gain
Frequency     7.488 GHz
Rad. Effic.   -1.974 dB
Tot. Effic.   -2.249 dB
Rlzd. Gain    -1.632 dB

dB
-1.63
-4.06
-6.48
-8.91
-11.3
-13.8
-16.2
-18.6
-21
-23.5
-25.9
-28.3
-30.7
-33.1
-35.6
-38
-41.6

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## 2.3 UWB Antenna Electrical Specification

| No | Item | Spec. |
|----|------|-------|
| 1 | VSWR | Max 2.0 : 1 |
| 2 | Polarization | Linear |
| 3 | Impedance [Ω] | Nominal 50 |

| Freq. [MHz] | Peak Gain [dBi] | Avg. Gain [dBi] | Efficiency [%] |
|-------------|-----------------|-----------------|----------------|
| 30 | -97,80 | -100,92 | 0 |
| 1000 | -37,84 | -39,98 | 0.029 |
| 2000 | -23,74 | -26,16 | 0.80 |
| 3000 | -5,15 | -10,40 | 32.03 |
| 5000 | -4,73 | -10,89 | 27.66 |
| 6000 | 0,00 | -7,34 | 62.92 |
| 6500 | -4,45 | -11,00 | 26.78 |
| 6988.8 | -4,39 | -9,37 | 39.47 |
| 7000 | -4,39 | -9,33 | 39.83 |
| 7488 | -1,62 | -7,56 | 59.58 |
| 7500 | -1,65 | -7,53 | 60.07 |
| 7987.2 | -1,89 | -8,62 | 46.99 |
| 8000 | -2,01 | -8,64 | 46.81 |
| 10000 | -1,54 | -8,98 | 43.19 |
| 20000 | -2,50 | -10,92 | 27.48 |

## 3    Magnetic Coil LF Antenna Description

Depicted below is the position of the magnetic coil LF antenna used for the detection of a 125 kHz signal to wake the key. The magnetic coil is located on the bottom side of the PCB and only used as part of the low frequency 125 kHz detector circuit. Hence no antenna radiation patter will be provided.
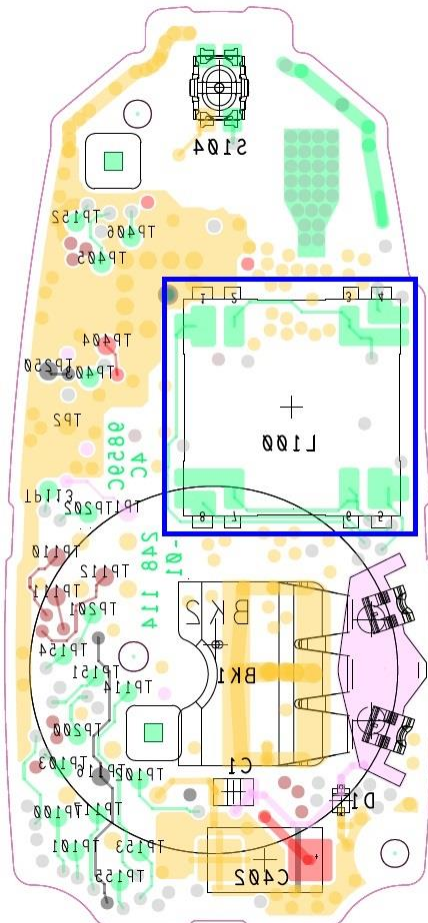


**Picture 5: Magnetic coil antenna**

**LF antenna dimesions:**

16.2x16.2 mm