

# Antenna Gain R E P O R T

- 315 MHz, 433 MHz -

**Test Report No. :**           **T36036-11-00HS**

05. November 2013

Date of issue

**Type / Model Name**       : Window antenna X218

**Product Description**     : Dedicated antenna for keyless entry system

**Applicant**               : Delphi Deutschland GmbH

**Address**                 : TecCenter

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Deutsche  
Akkreditierungsstelle  
D-PL-12030-01-01  
D-PL-12030-01-02

The test report merely corresponds to the test sample.  
It is not permitted to copy extracts of these test results  
without the written permission of the test laboratory.

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# **1 SUMMARY**

## **1.1 GENERAL REMARKS:**

### Variants of the EUT

The EUT is always the same only the output impedance is matched to the appropriate antenna.

### Operation frequency

The Antenna gain is evaluated at 315 MHz and 433 MHz.

### Antenna

The dedicated antenna is realised for the several types of cars as rear window antenna  
The EUT has individual impedance for the special antenna to optimise the transmission ability.

## **1.2 FINAL ASSESSMENT**

Date of receipt of test sample : acc. to storage records

Testing commenced on : 23 April 2013

Testing concluded on : 24 April 2013

Checked by:

Tested by:

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Klaus Gegenfurtner  
Dipl.-Ing.(FH)  
Manager: Radio Group

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Hermann Smetana  
Dipl.-Ing.(FH)  
Radio Senior Expert

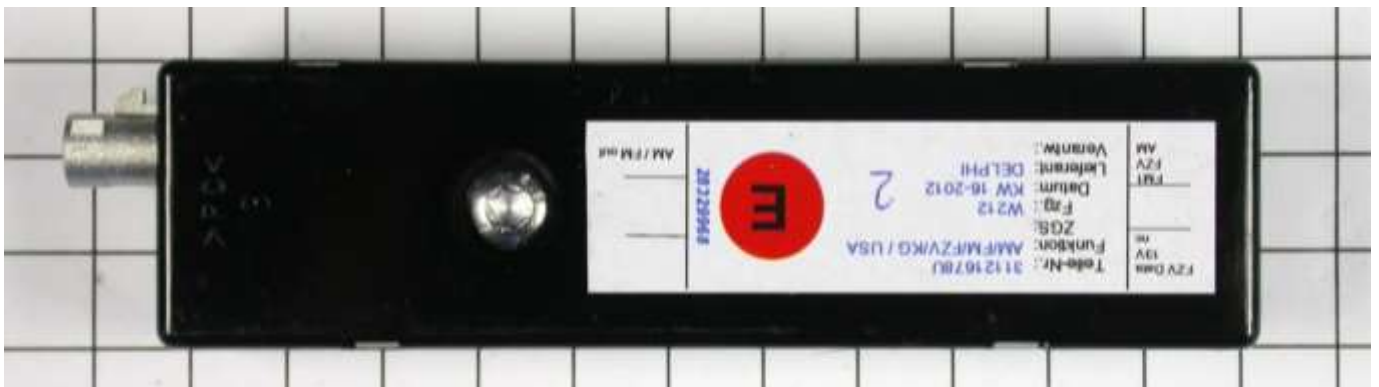
## 2 EQUIPMENT UNDER TEST

### 2.1 Photo documentation of the EUT

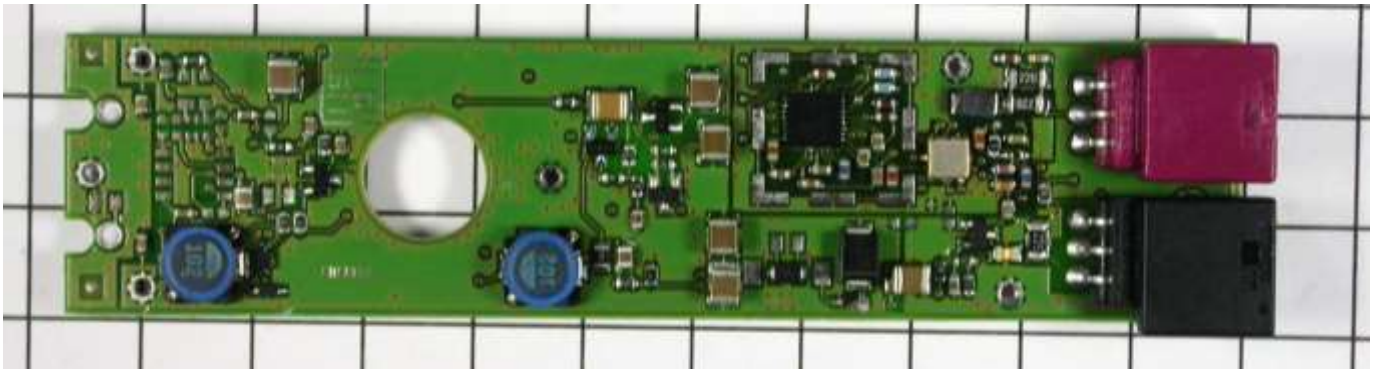
433 MHz:



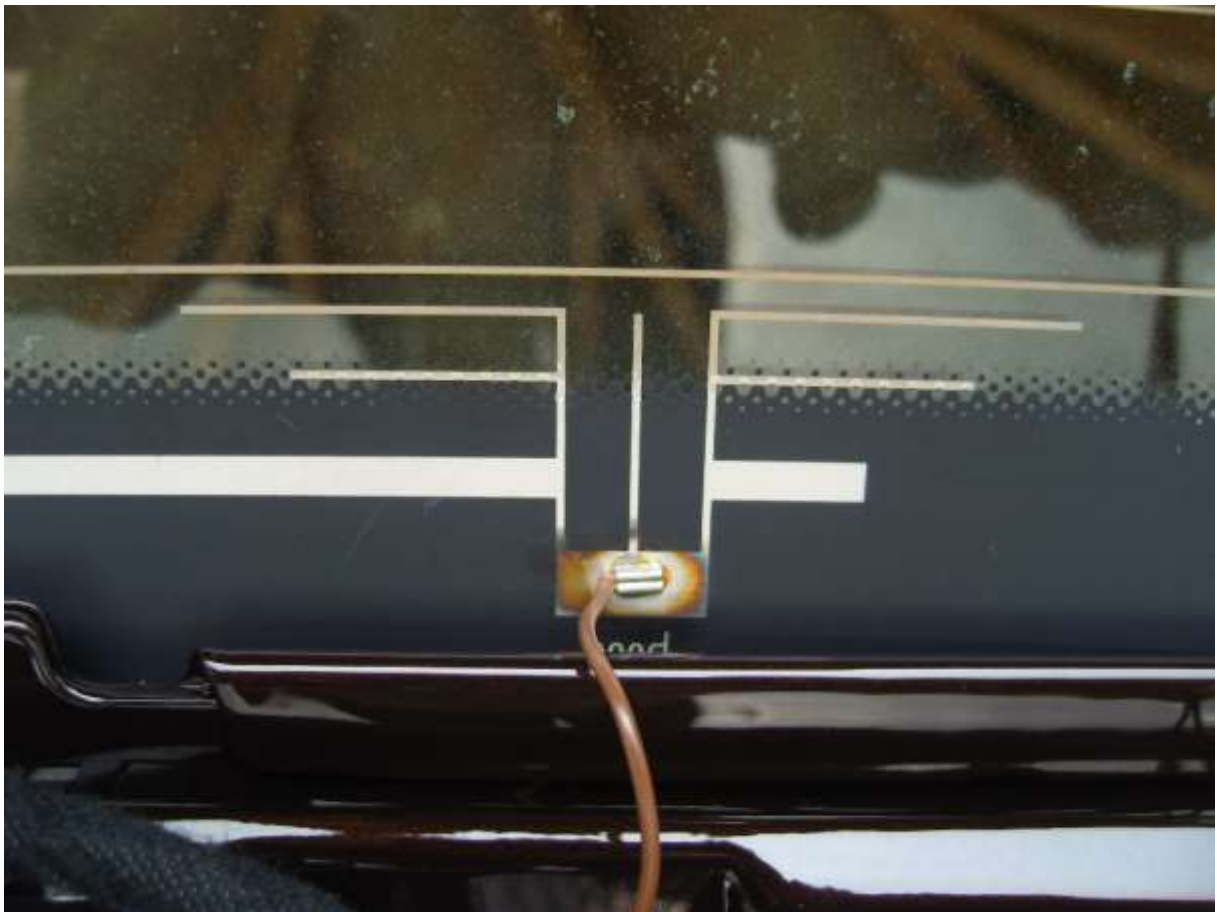
315 MHz, FCC:



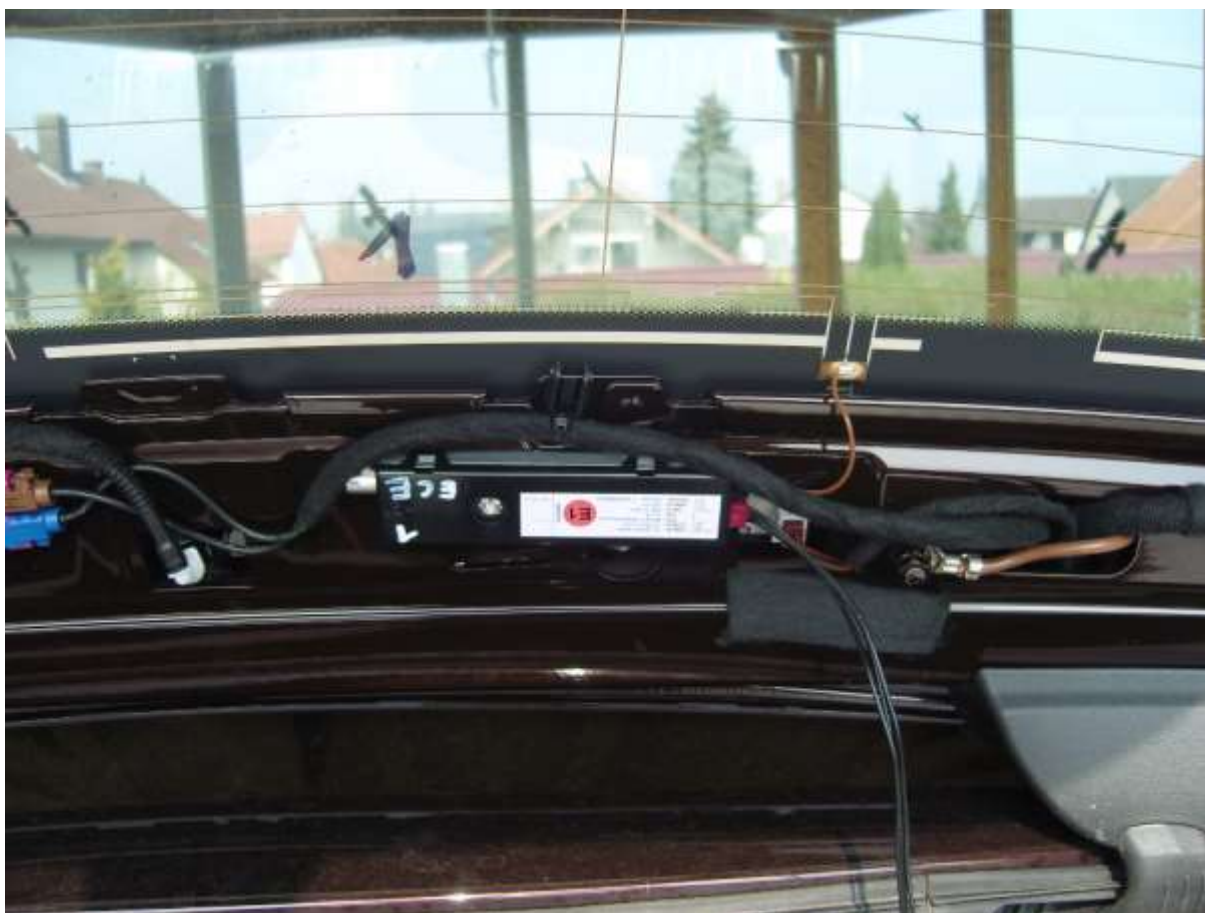




## 2.2 Photo documentation of rear antenna



UT connected to the dedicated window antenna in the original integration of a car.



### **3 TEST CONDITIONS AND RESULTS**

#### **3.1 Equivalent isotropic radiated power**

For test instruments and accessories used see section 6 Part CPR2.

##### **3.1.1 Description of the test location**

Test location: OATS 1



##### **3.1.1 Description of measurement**

The radiated power of the fundamental wave from the EUT is measured in the frequency range of 30 to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas at an OATS. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and peak detection. The antenna was positioned 10 m horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 m, measurement scans are made in horizontal and vertical antenna polarization and the EUT is rotated 360 degrees. The higher value is recorded.

The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz: RBW: 120 kHz



### 3.1.2 Test result

Polarisation of the antenna for the highest emission level:

Type of signal:

Power setting

Vertical

Unmodulated

0x20

Test conditions		Transmitter power EIRP (dBm)		
			315 MHz	
$T_{nom}$ (20°C)	$V_{nom}$ (12 V)		-4.1	
Measurement uncertainty		$\pm 0.75$ dB		

Polarisation of the antenna for the highest emission level:

Type of signal:

Power setting

Vertical

Unmodulated

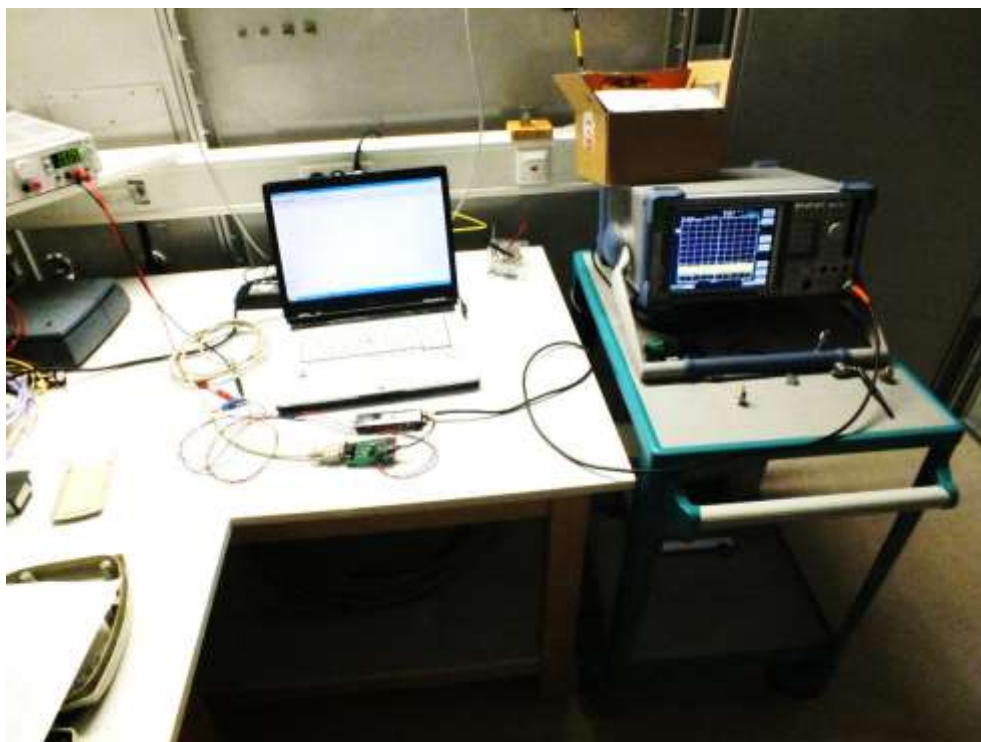
0x38

Test conditions		Transmitter power EIRP (dBm)		
			433 MHz	
$T_{nom}$ (20°C)	$V_{nom}$ (12 V)		-2.6	
Measurement uncertainty		$\pm 0.75$ dB		

## 3.2 Carrier power conducted

For test instruments and accessories used see section 6 Part CPC2.

### 3.2.1 Description of the test location





### 3.2.2 Description of measurement

The carrier power have been measured conducted at the antenna connector using a spectrum analyser as an artificial antenna producing a smaller VSWR than 1.2:1. The marker is set to peak determining the output power. The measurement is performed in TX continuous mode without modulation.

### 3.2.3 Test result

Polarisation of the antenna for the highest emission level:

Type of signal:

Power setting

Vertical

Unmodulated

0x20

Test conditions		Transmitter power (dBm)		
			315 MHz	
$T_{nom}$ (20°C)	$V_{nom}$ (12 V)		-1.6	
Measurement uncertainty		$\pm 0.75$ dB		

Polarisation of the antenna for the highest emission level:

Type of signal:

Power setting

Vertical

Unmodulated

0x38

Test conditions		Transmitter power (dBm)		
			433 MHz	
$T_{nom}$ (20°C)	$V_{nom}$ (12 V)		4.1	
Measurement uncertainty		$\pm 0.75$ dB		

**Remarks:** A cable loss of 1.0 dB is taken into account.

### 3.3 Determination of the antenna gain

#### 3.3.1 Description of measurement procedure

The antenna gain is determined in the OATS with the substitution method. First the antenna power was measured in the original setup than the substitution antenna and a signal generator was used to generate the same power level. This power level is used to calculate the antenna gain.

#### 3.3.2 Calculation of the antenna gain

Substitution antenna: UHALP 9108

Gain  $G_s = 6.6$  dBi at 325 MHz

Substitution antenna: UHALP 9108

Gain  $G_s = 6.5$  dBi at 425 MHz

For the determination of the antenna gain the following formula is used:

$$G = (P_s + G_s) - (P_c + I_c);$$

Where

$G$  is the antenna gain of the EUT (dBi).

$G_s$  is the antenna gain of the substitution antenna.

$P_c$  is the output power conducted.

$P_s$  is the output power of the generator at the same output power level as the original setup.

$I_c$  is an impedance correction factor due to the mechanical design of the antenna.

**Rear antenna unit:**

f (MHz)	Ic (dB)	$P_c$ (dBm)	$G_s$ (dBi)	$P_s$ (dBm)	G (dBi)
315	1.0	-1.6	6.6	-9.1	-1.9
433	2.2	4.1	6.5	-6.9	-6.7

## **4 USED TEST EQUIPMENT AND ACCESSORIES**

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

<b>Test ID</b>	<b>Model Type</b>	<b>Equipment No.</b>	<b>Next Calib.</b>	<b>Last Calib.</b>	<b>Next Verif.</b>	<b>Last Verif.</b>
CPC 2	FSP 40	02-02/11-11-001	18/09/2013	18/09/2012		
CPR 2	ESVS 30	02-02/03-05-006	26/06/2013	26/06/2012		
	UHALP 9108 A	02-02/24-05-003			18/09/2013	18/03/2013
	VULB 9165	02-02/24-05-017	10/05/2013	10/05/2012		
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				