Intertek

Test Report

Electromagnetic Compatibility

Test Report - Nr.: 07KFE007857-R-FCC-03

Date: 2008-02-28

Type:	RC-85
Description:	Transmitter
Serial number:	0705391-004

Manufacturer:	Jablotron s.r.o.
Customer:	Jablotron s.r.o.
Address (Customer):	Pod Skalkou 33 CZ 646601 Jablonec nad Nisou Czech Republic

Test Laboratory:	Intertek Deutschland GmbH, Innovapark 20, D- 87600 Kaufbeuren
FCC registration number:	90714
Compiled by:	Marek Svoboda Technical Leader
Approved by:	R. Dressler Project Engineer

Intertek Deutschland GmbH

Table of Contents

1. General description

1.1. Product description

The RC-85 is a component of Jablotron's Oasis 80 alarm system. It is designed to be installed inside cars with a voltage supply of 12 to 24 V to remotely control electrical appliances (e.g. garage doors or parking gates), in a similar way to the RC-80 keyfob. It can also be used for sending an alarm signal from a car.
The transmitter is not continuously powered and only transmits a signal when connected to the power supply. It can be configured whether a signal is sent instantly or only after two applications of the power supply within 2 seconds.

It is activated to transmitting state by switching on the source voltage.
The wireless transmitter (connection to control unit) has operating frequency f = 868.5 MHz.

The device is battery operated. The power source delivered by producer and used for testing was a fully charged 12 V accumulator battery.

Antenna type : DC leads serve as antenna.

1.2. Related submittal(s) Grants

This is application for certification of the transmitter.
No related devices are present.

1.3. Test Methodology

☒ The test setup and test was done according to: **ANSI C63.4: 2003**
American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
The open area testing was performed according to FCC Publication number 470998 (device was mounted into 3 different cars and radiated emissions were measured in 8 directions (45 degrees step) around.

☐ The test setup and test was done according to: **CISPR 22: 1998 + Corrigendum: 2003 + A1: 2000 + A2: 2003 and ANSI C63.4: 2003**
Compliance with CISPR 22 is being used to demonstrate conformity with FCC DoC requirements. This conforms with FCC Part 15.109(g).

The test results detailed in this report apply only to the RC-85 with the test setup described. Any modification such as a change, addition to or inclusion of another device into this product will require an additional evaluation.
The support equipment listed as part of the emission tests is required to properly exercise and test the device under test.

1.4. Test Facility

The test site was semi-anechoic chamber Intertek Germany (PM KF 1150). Measurement distance EUT – Antenna was d = 3 m.
The open area measurements were performed at open field close to the laboratory.

1.5. List of exhibits

Following exhibits are delivered as separate pdf files. The name of file corresponds with description of exhibit with extension **.pdf**

EXHIBIT 1	Test setup photo documentation
EXHIBIT 2	External Photos
EXHIBIT 3	Internal Photos
EXHIBIT 4	Operational description
EXHIBIT 5	Block diagram
EXHIBIT 6	Circuit diagram
EXHIBIT 7	Instruction manual
EXHIBIT 8	Product label
EXHIBIT 9	Confidentiality request

2. Measurements And Test Specifications

Emission - Requirements according to

☐ FCC, Part 15, Class A, verification

☐ FCC, Part 15, Class B, DoC

☐ FCC, Part 15, Class B, certification
☒ FCC, Part 15, intentional radiator, certification

2.1. Changes to Test Report 07KFE007857-R-FCC-01

Corrected number in calculation of averaging factor in Ch. 5 (Result unchanged) :

From : The Averaging factor is:
20* log (65.13/100) = -11,82 dB.

To : **The Averaging factor is:**
20* log (25.65/100) = -11,82 dB.

2.2. Changes to Test Report 07KFE007857-R-FCC-02

Chapter 3.1 (Operating conditions):
Description of measurement at open field site included;
description of mounting the device into vehicles included.

Chapter 5.3 (Radiated measurements):
Open-field testing was performed and documented in the report.

Chapter 6 (Test setup photo documentation):
Extended documentation.

3. Description Of EUT

3.1. Configuration / Operating Conditions

☒ table-top EUT ☐ floor-standing EUT

The device is battery operated. The power source used for testing was a freshly charged laboratory accumulator battery.

There were two samples of the device delivered :

Sample 1: was modified by manufacturer to transmit continuously. This sample was used for field strength measurement;
Sample 2 : has normal operation as specified by manufacturer . It was used for measurement of the BW and duty cycle.
Normal operation of the device after pressing the button is transmission of 1 data pulse of length approximately 30 ms.

During measurements in anechoic hall was the equipment under test (EUT) placed on wooden table 0,8 m above ground plane.

At all interference frequencies the height of the antenna is scanned in the range 1 m to 4 m with horizontal and vertical polarization and the turntable is rotated in the range 0° to 360° to obtain the highest field strength.

During open field measurements the device was mounted in 3 different cars:

VW Polo	(dimensions LxWxH : 3,7 m x 1,5 m x 1,4 m)
Toyota Corolla	(dimensions LxWxH : 4,4 m x 1,7 m x 1,5 m)
VW Multivan	(dimensions LxWxH : 4,9 m x 1,9 m x 2,0 m)

According to producers recommendation the device was mounted in all cases below the car dash-board. The device was powered (connected to vehicle´s wiring) from the lighter socket.

The open field measurements were performed with vertical and horizontal polarization of receiving antennas with height scan 1 m – 4 m with max-hold function of the spectrum analyser.

The measuring distance was 3 m; measurements were performed at 8 directions.

Measurements in frequency range 30 MHz – 3 GHz were performed with bilog antenna HL 562, measurements in frequency range 3 GHz – 10 GHz were performed with horn antenna HF 906 with preamplifier.

3.2. Major Subassemblies Or Internal Peripherals

Device	Manufacturer	Type	SN	FCC ID
none				

3.3. Peripheral Devices Used For Testing

Device	Manufacturer	Type	SN	FCC ID
none				

3.4. Supply- And Interconnecting Cables

Line	Length	shielded	non shielded	Shield on GND / PE
Supply cable	0,7 m	☐	☒	

4. Test Results - Overview

	required	passed	passed with modification	not passed
Bandwidth	< 2.17 MHz, 0.25 % f_{op}	☒	☐	☐
Duty cycle	< 2 s in 1 hour	☒	☐	☐
Emission				
30 MHz - 3000 MHz	FCC 15.231	☒	☐	☐
3 GHz – 10 GHz	FCC 15.231	☒	☐	☐

5. Measurement results detailed

5.1. Duty cycle and Averaging factor

The averaging factor was measured by means of the measuring receiver/spectrum analyzer ESIB 26 in “Analyzer mode”.

Fig. 1 shows the length of single data pulse in 200 ms window.

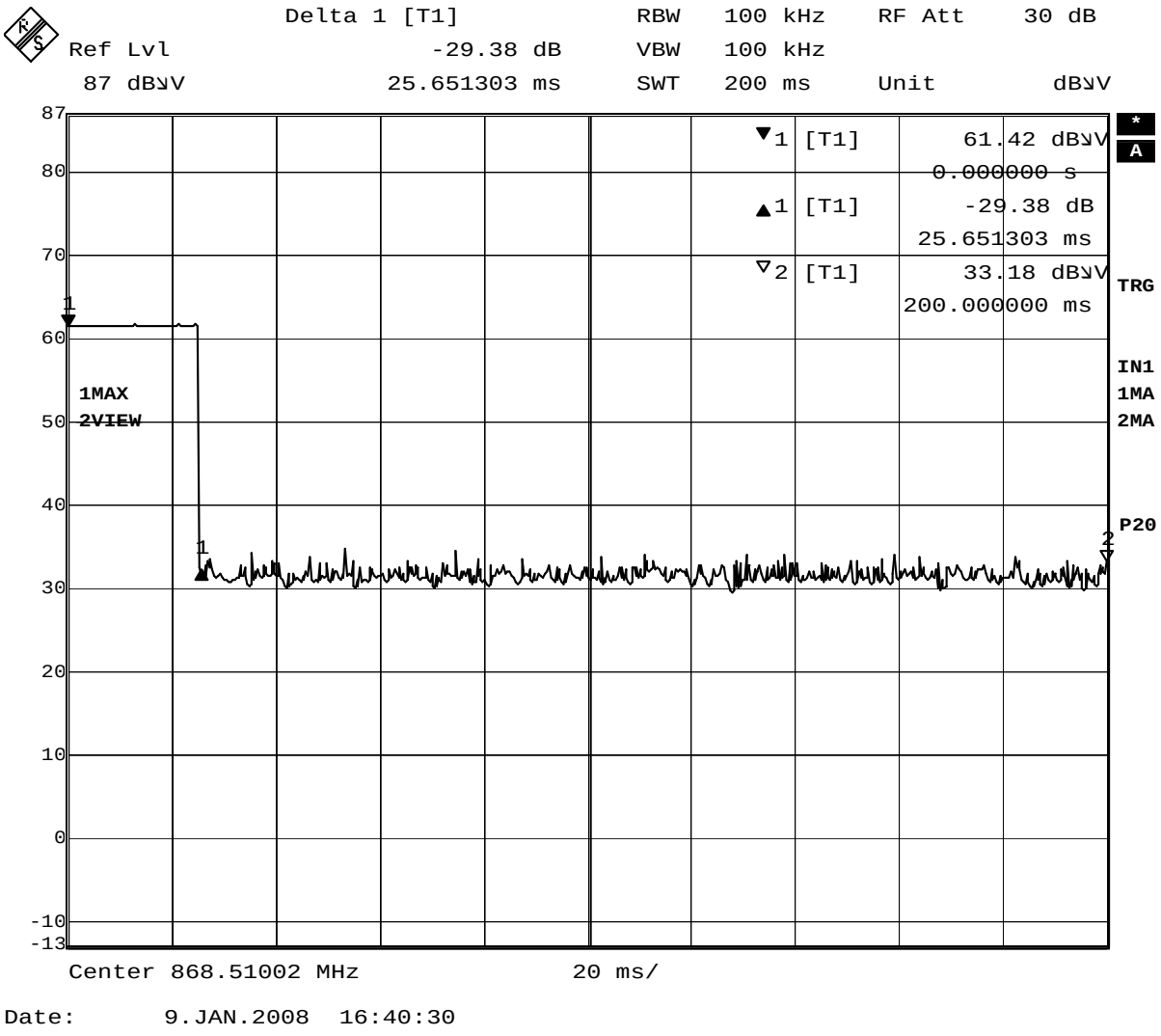


Fig .1

Total transmission time in period T = 100 ms is t = 25,65 ms.

The Averaging factor is:

20* log (25.65/100) = -11,82 dB.

The measured peak values are to be reduced by averaging factor to obtain average values.

Transmission time in 1 hour period is : no periodic transmission

5.2. Bandwidth

The measured 20 dB bandwidth is shown on Fig. 2

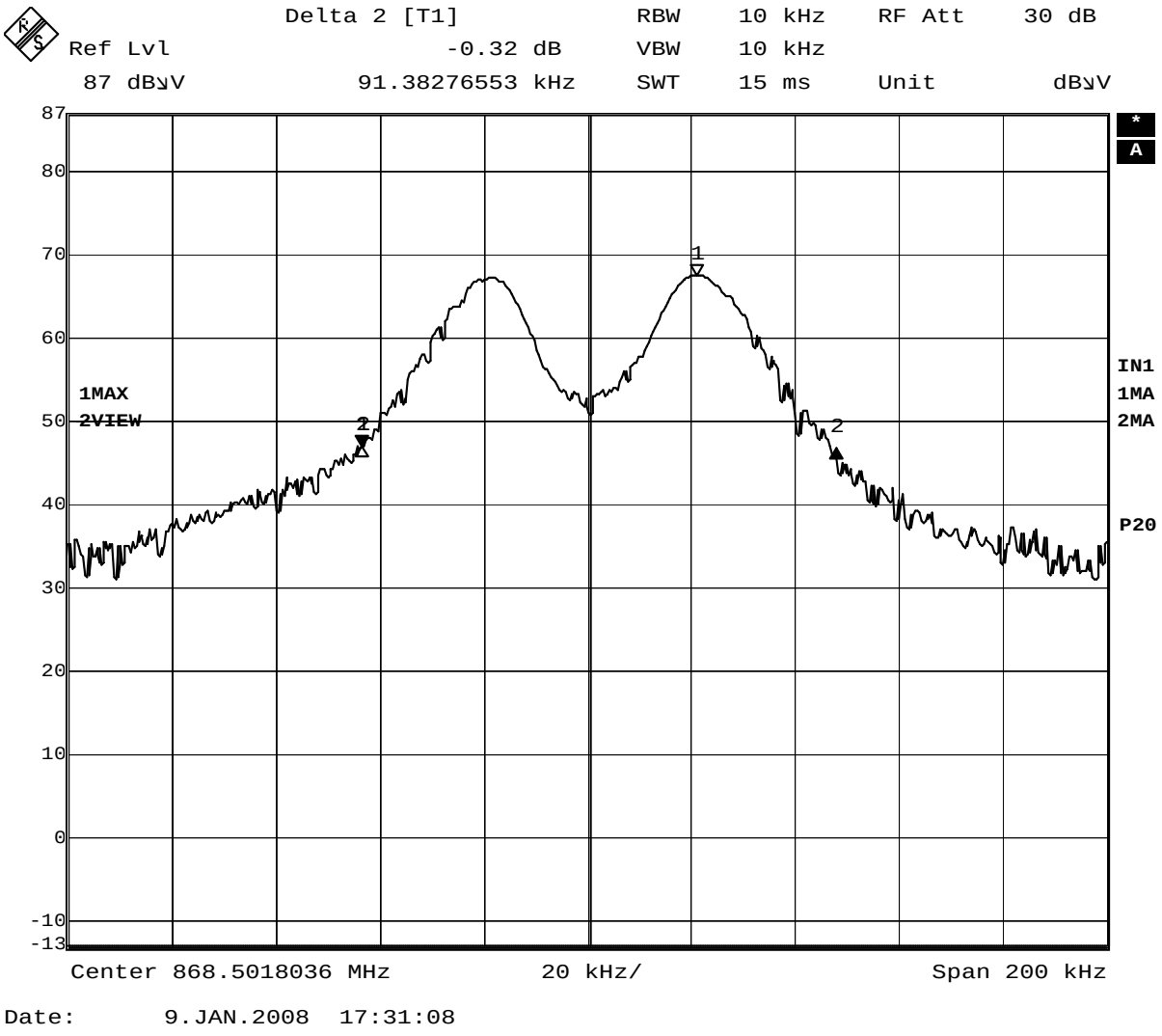


Fig .2

The BW is 91,38 kHz, operating frequency f = 868.5 MHz.

5.3. Radiated Emission 30 MHz – 10 GHz

Data was measured for worst case configuration which resulted in highest emission levels. A sample calculation, configuration photographs and data tables of emissions are included.
The detector used was PEAK.
Attempt was made to maximize the radiation in the anechoic hall on frequency f = 868.5 MHz by changing the supply cable length. The maximum radiation was found to be with the length 0.7 m .

5.3.1. Field strength calculation

The field strength is calculated by adding the reading on the measuring receiver to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitation and average factors (when the specified limit is related to average detector and measurements are made with peak detector.
A sample of calculation is included below :

E = RR + AF + CF – AG + PD + AV

Where

E	field strength in dBμV/m
RR	receiver reading including preamplifier in dBμV
CF	cable attenuation factor in dB
AF	antenna factor in dB/m
AG	amplifier gain in dB
PD	pulse desensitization in dB
AV	average factor in dB

Example :

Asssume that measured values and factors are as follows :

RR	= 60 dBμV
CF	= 1.2 dB
AF	= 12.6 dB/m
AG	= 20 dB
PD	= 0 dB
AV	= -10 dB

Then

E = 60 + 1.2 + 12.6 – 20 + 0 -10 = 43.8 dBμV/m

The radiated emission tables which follow the graphical presentation of results were created by the EMC 32 software by Rohde-Schwarz. The data of field strength (peak detector) include the components given above with the exception of PD and AV.

5.3.2. Normative references

Limits equivalent:	**FCC, Part 15.231, Part 15.209 where appropriate**
Methods of Measurement equivalent:	**ANSI C63.4, CISPR 22**

Test requirement

Class	B
Distance Antenna – EUT	3 m
Frequency range	30 MHz - 10000 MHz

Place of measurement

☒ Semi anechoic chamber Intertek Germany PM KF 1150.
☐ Open Area Test Site

Measurement devices

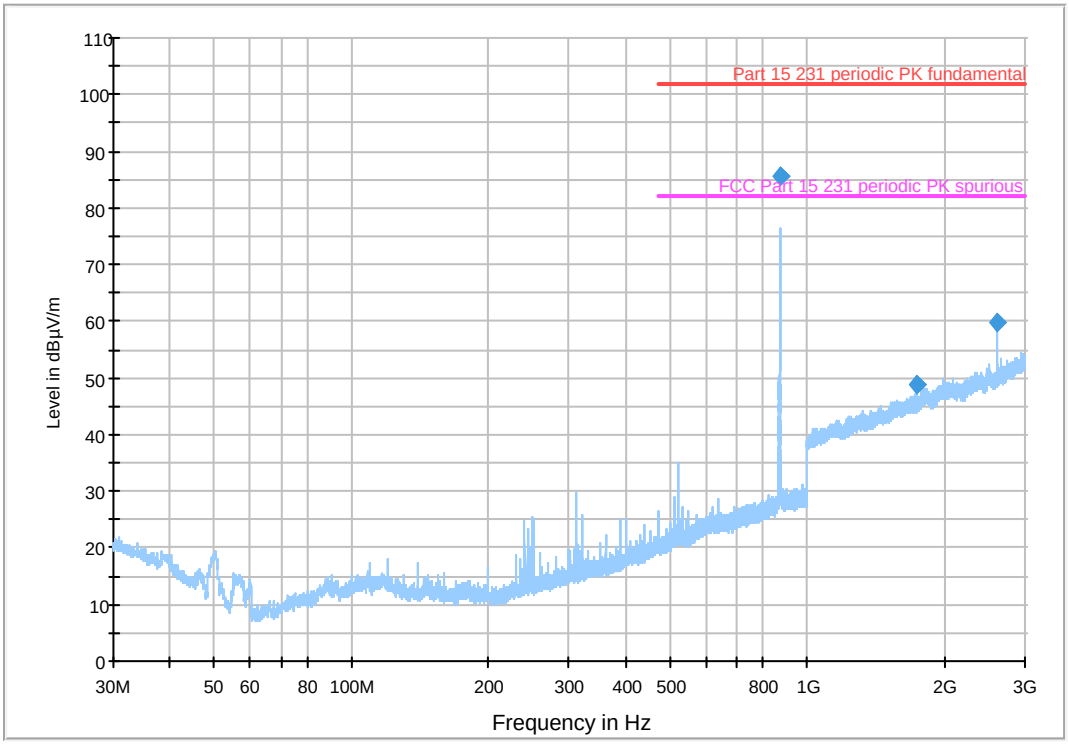
Measurement device	Manufacturer	Type	SN	Asset No.	Last Calibr.ation	Inter-val
☒ Test receiver, 20Hz-26GHz	ESIB26	Rohde & Schwarz	100150	PM KF 0948	07-03	1
☒ Antenna, 30-3000 MHz	HL562	Rohde & Schwarz	100354	PM KF 1123	07-03	2
☒ Horn antenna, 1-18 GHz	Rohde & Schwarz	HF906	100188	PM KF 0947	07-05	2
☒ Horn antenna preamp.	Bonn	BLMA0118 -4A	35352	PM KF 0946	07-05	2

5.3.3. Emission Test results

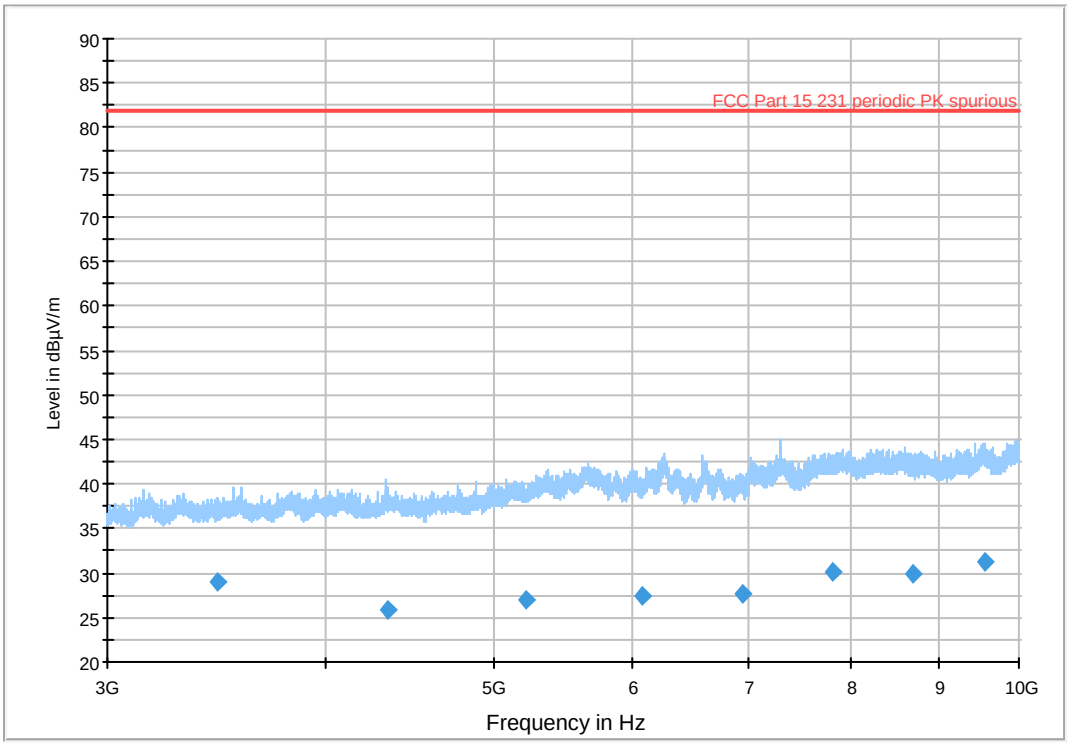
Test requirements	☒ **passed**	☐ **passed with modification**	☐ **not passed**

Comment:
The radiated emissions between 30 MHz and 10 000 MHz are under the limit specified in FCC 15.231

5.3.3.1 Radiated Emission 30 MHz – 3 GHz anechoic hall



5.3.3.2 Radiated Emission 3 GHz – 10 GHz anechoic hall



5.3.3.3 Radiated Emission : table 30 MHz – 10 GHz anechoic hall

Measurements based on a measurement time of 10 ms unless otherwise noted.
Measurement bandwidth is 120 kHz bellow 1 MHz, and 1 MHz above 1000 MHz.

Frequency (MHz)	MaxPeak (dBµV/m)	Averaging factor (dB)	Average value E (dB)	Limit Average (dBµV/m)	Margin average (dB)	Limit peak (dBµV/m)	Margin peak (dB)
868,48	85,7	-11,82	73,88	82	-8,12	102	-16,3
1736,9	48,9	-11,82	37,08	62	-24,92	82	-33,1
2605,4	59,6	-11,82	47,78	62	-14,22	82	-22,4

No emissions above noise level were found above 3 GHz.

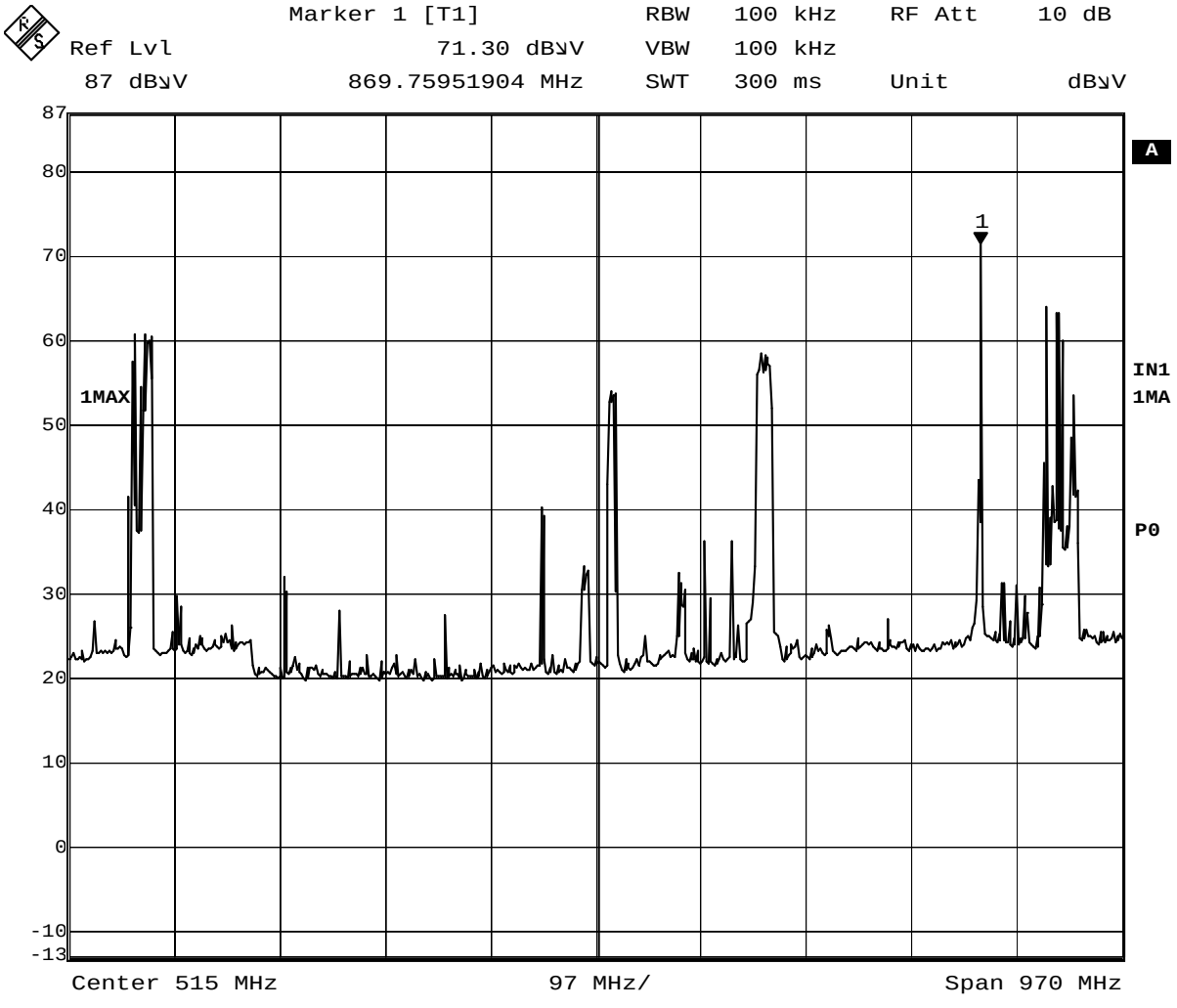
*) Frequencies governed by 15.209

5.3.3.4 Radiated Emission : device mounted in vehicles : open field

Frequency range 30 MHz – 1 GHz

No emissions exceeding noise level except at operating frequency transmission were found at any vehicle mount .

The radiation including backround noise is demonstrated for Toyota Corolla device mount at azimuth 0^0 .

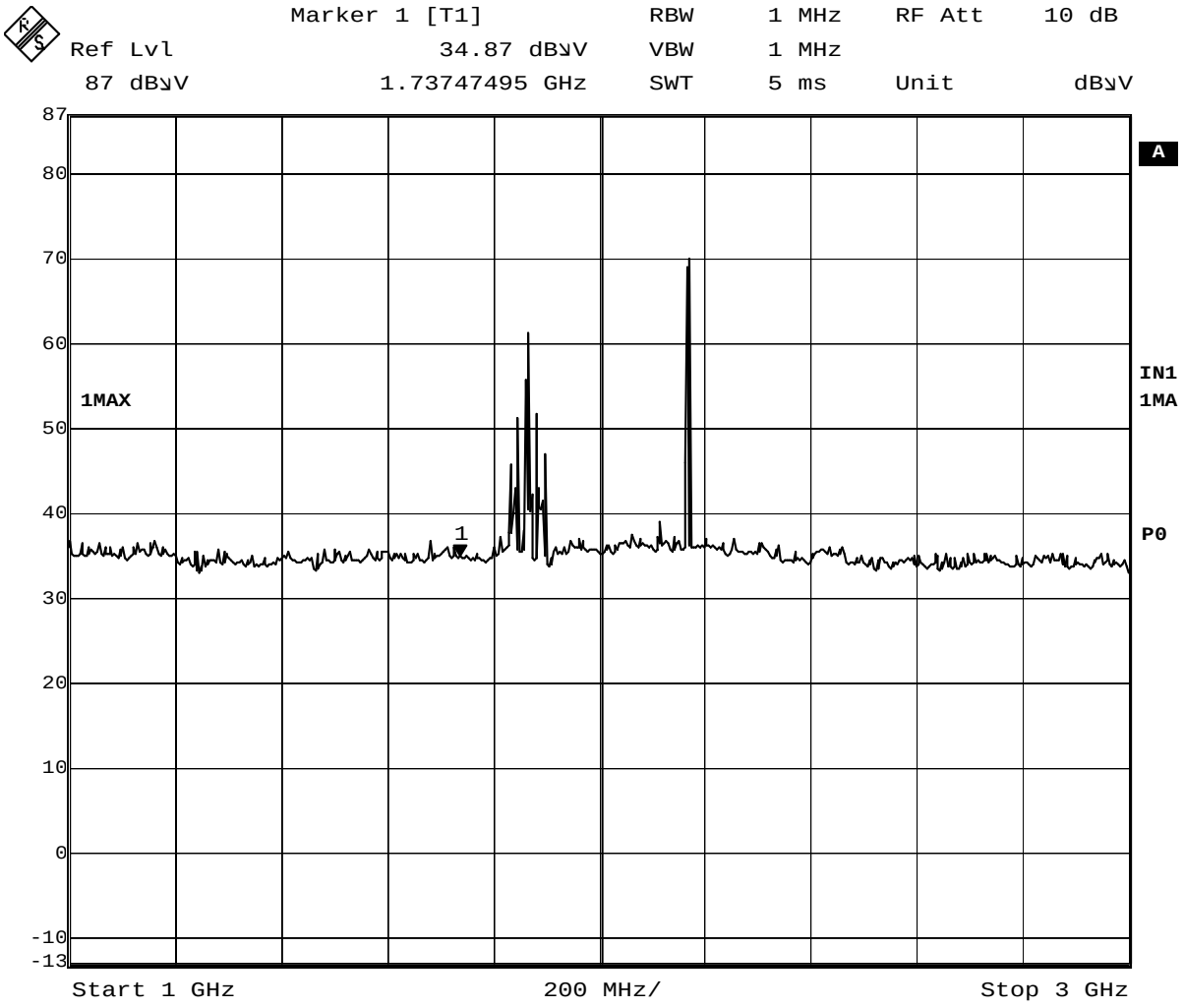


Toyota Corolla Azimuth 0^0 , Max hold function Vertical and horizontal polarization

Frequency range 1 GHz – 3 GHz

No emissions exceeding noise level were found at any vehicle mount

The radiation including backround noise is demonstrated for VW Polo device mount at azimuth 0^0.



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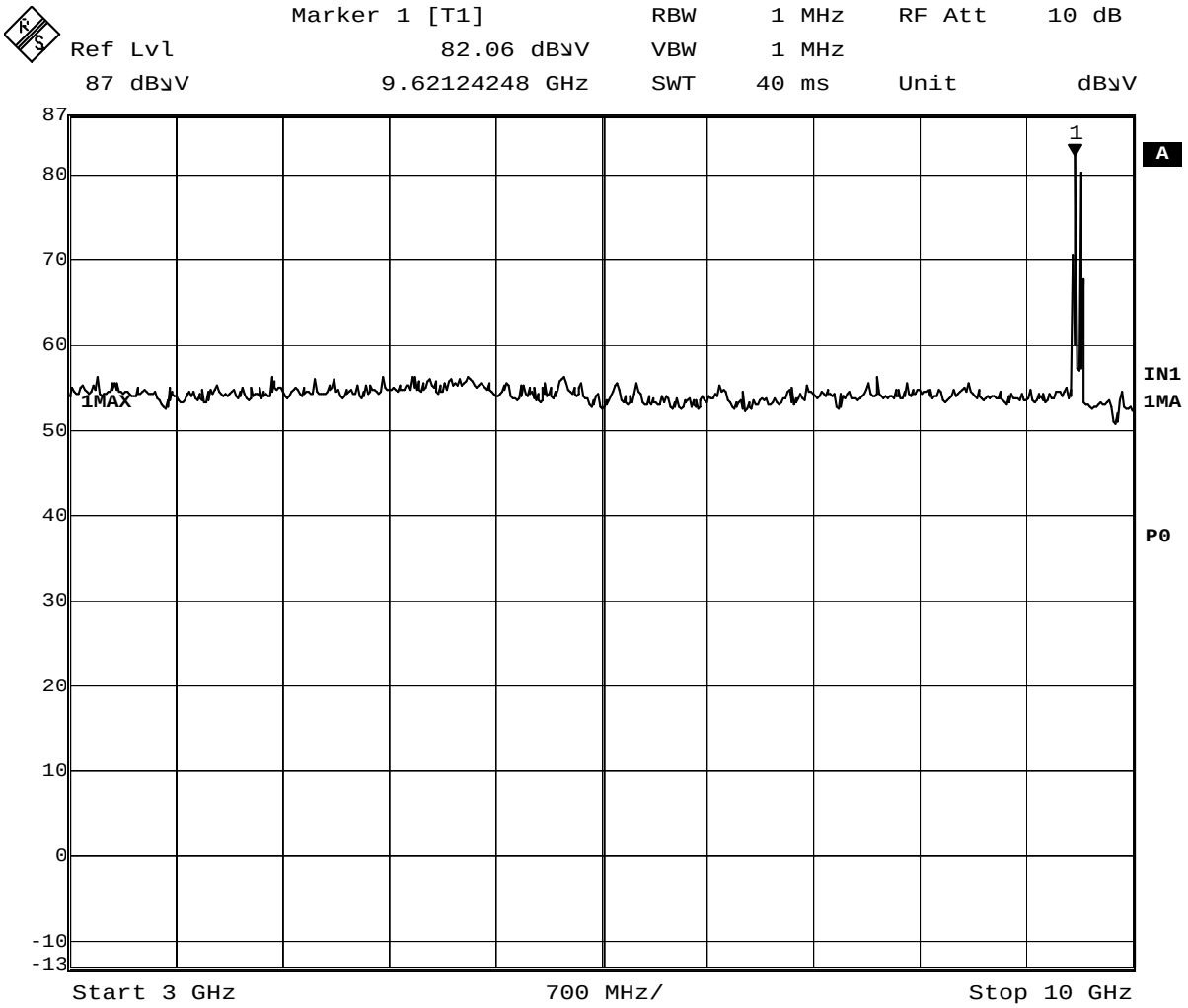
VW Polo Azimuth 0^0 , Max hold function Vertical and horizontal polarization.

Frequency range 3 GHz – 10 GHz

No emissions exceeding noise level were found at any vehicle mount
The radiation including backround noise is demonstrated for VW Polo device mount at azimuth 0^0.



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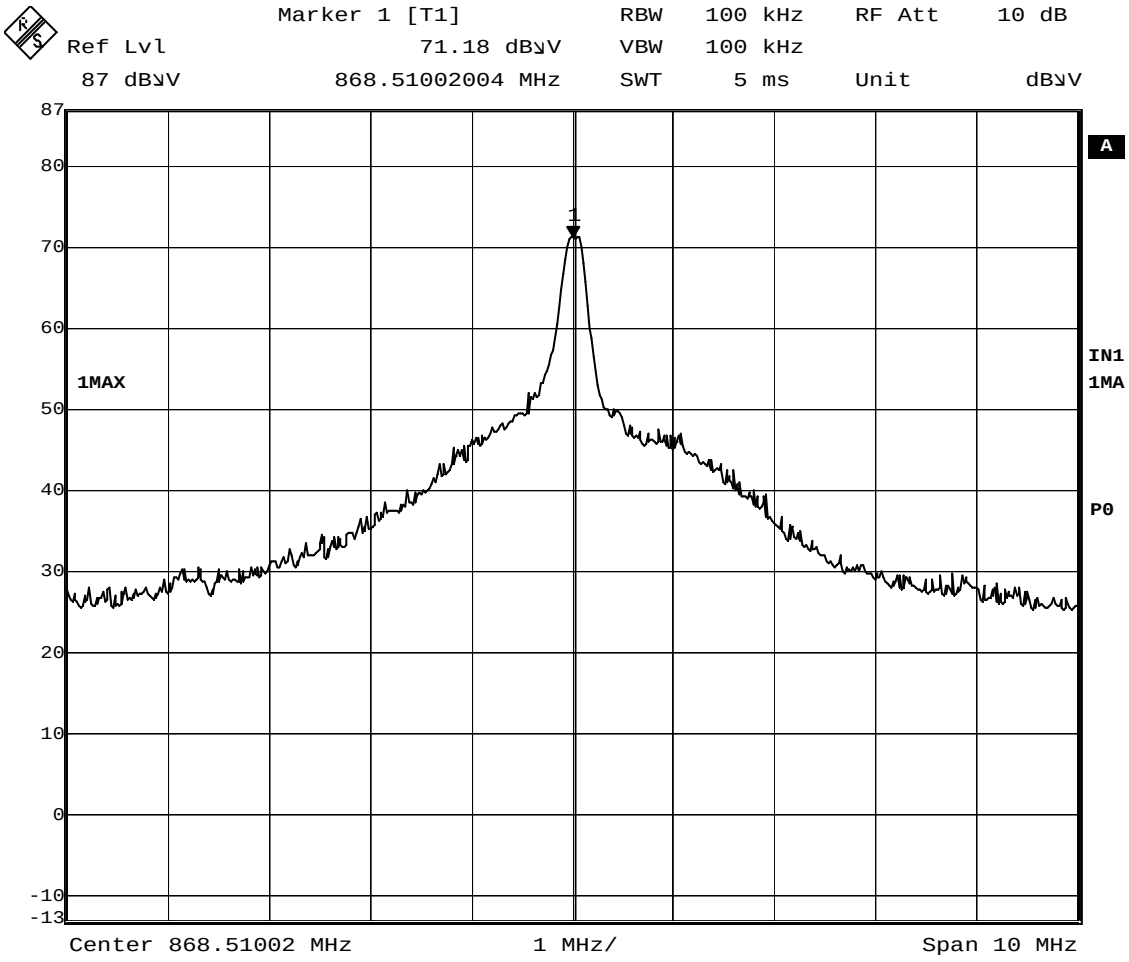
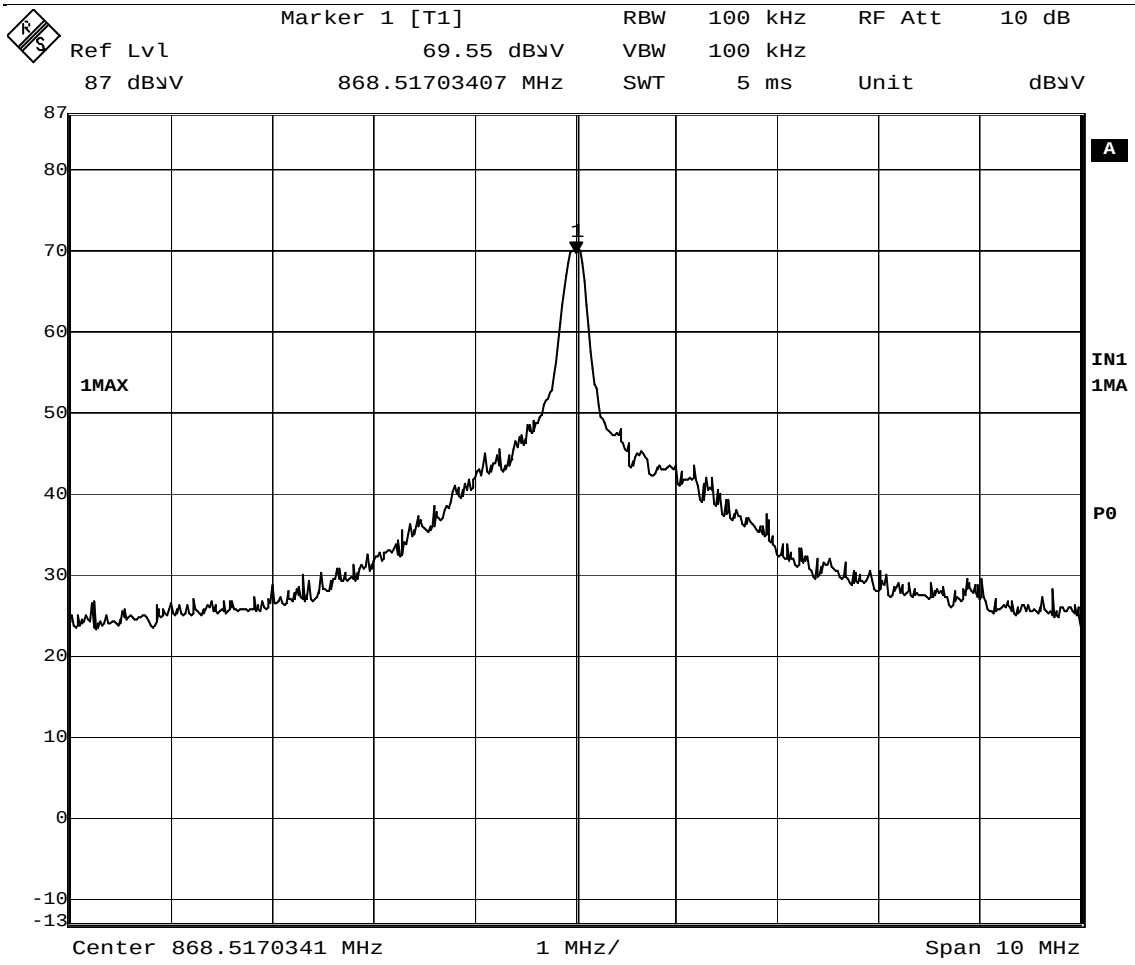
VW Polo Azimuth 0^0 , Max hold function Vertical and Horizontal polarization.

5.3.3.5 Radiated Emission : operating frequency f = 868.5 MHz : worst case; open field



VW Polo: 225 degrees Horizontal polarization



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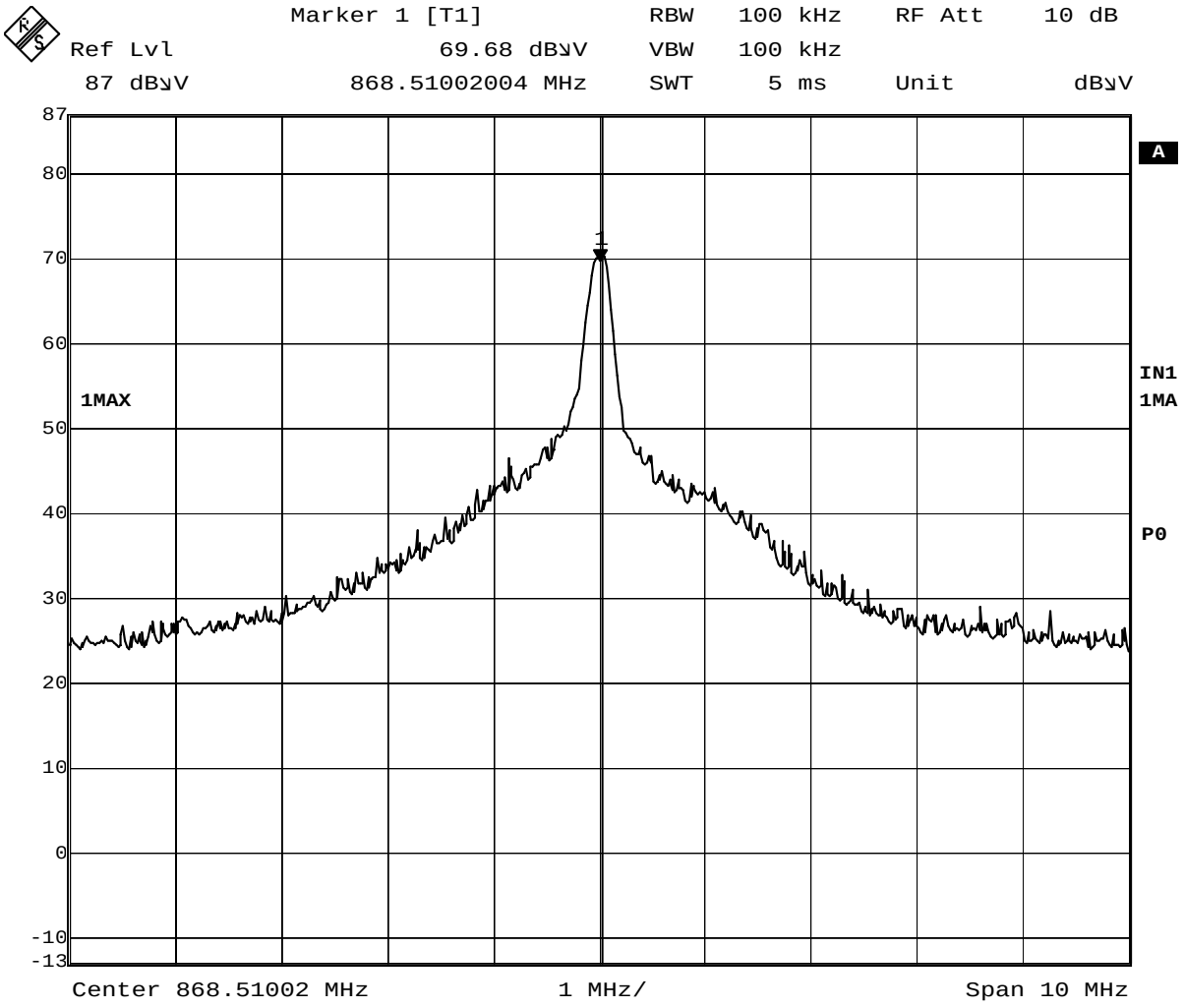
Toyota Corolla : 270 degrees Horizontal polarization



VW Multivan 135 degrees vertical polarization

5.3.3.6 Radiated Emissions : f = 868,5 MHz table E vs. Azimuth; open field

Measurement bandwidth is 100 kHz bellow 1 MHz, and 1 MHz above 1000 MHz.

Field strength given in table bellow was calculated from values measured by spectrum analyzer in (dBµV) according to Ch. 5.3.1, taking into account

Antenna factor : AF = 20.2 dB/m (f = 868 MHz)
Cable attenuation : CF = 2.1 dB

Volkswagen Polo

Azimuth degrees	MaxPeak (dBµV/m)	Averaging factor (dB)	Average value E (dB)	Limit Average (dBµV/m)	Margin average (dB)	Limit peak (dBµV/m)	Margin peak (dB)
0	81,43	-11,82	69,61	82	-12,39	102	-20,57
45	88,86	-11,82	77,04	82	-4,96	102	-13,14
90	90,57	-11,82	78,75	82	-3,25	102	-11,43
135	91,93	-11,82	80,11	82	-1,89	102	-10,07
180	92,11	-11,82	80,29	82	-1,71	102	-9,89
225	93,48	-11,82	81,66	82	-0,34	102	-8,52
270	81,8	-11,82	69,98	82	-12,02	102	-20,2
315	88,73	-11,82	76,91	82	-5,09	102	-13,27

Toyota Corolla

Azimuth degrees	MaxPeak (dBµV/m)	Averaging factor (dB)	Average value E (dB)	Limit Average (dBµV/m)	Margin average (dB)	Limit peak (dBµV/m)	Margin peak (dB)
0	93,6	-11,82	81,78	82	-0,22	102	-8,4
45	92,05	-11,82	80,23	82	-1,77	102	-9,95
90	84,9	-11,82	73,08	82	-8,92	102	-17,1
135	87,04	-11,82	75,22	82	-6,78	102	-14,96
180	91,97	-11,82	80,15	82	-1,85	102	-10,03
225	91,05	-11,82	79,23	82	-2,77	102	-10,95
270	92,93	-11,82	81,11	82	-0,89	102	-9,07
315	92,03	-11,82	80,21	82	-1,79	102	-9,97

Volkswagen Multivan

Azimuth degrees	MaxPeak (dBµV/m)	Averaging factor (dB)	Average value E (dB)	Limit Average (dBµV/m)	Margin average (dB)	Limit peak (dBµV/m)	Margin peak (dB)
0	84,05	-11,82	72,23	82	-9,77	102	-17,95
45	91,47	-11,82	79,65	82	-2,35	102	-10,53
90	89,28	-11,82	77,46	82	-4,54	102	-12,72
135	91,98	-11,82	80,16	82	-1,84	102	-10,02
180	81,22	-11,82	69,4	82	-12,6	102	-20,78
225	90,01	-11,82	78,19	82	-3,81	102	-11,99
270	90,79	-11,82	78,97	82	-3,03	102	-11,21
315	82,2	-11,82	70,38	82	-11,62	102	-19,8

Test setup Photo documentation
EXHIBIT 1

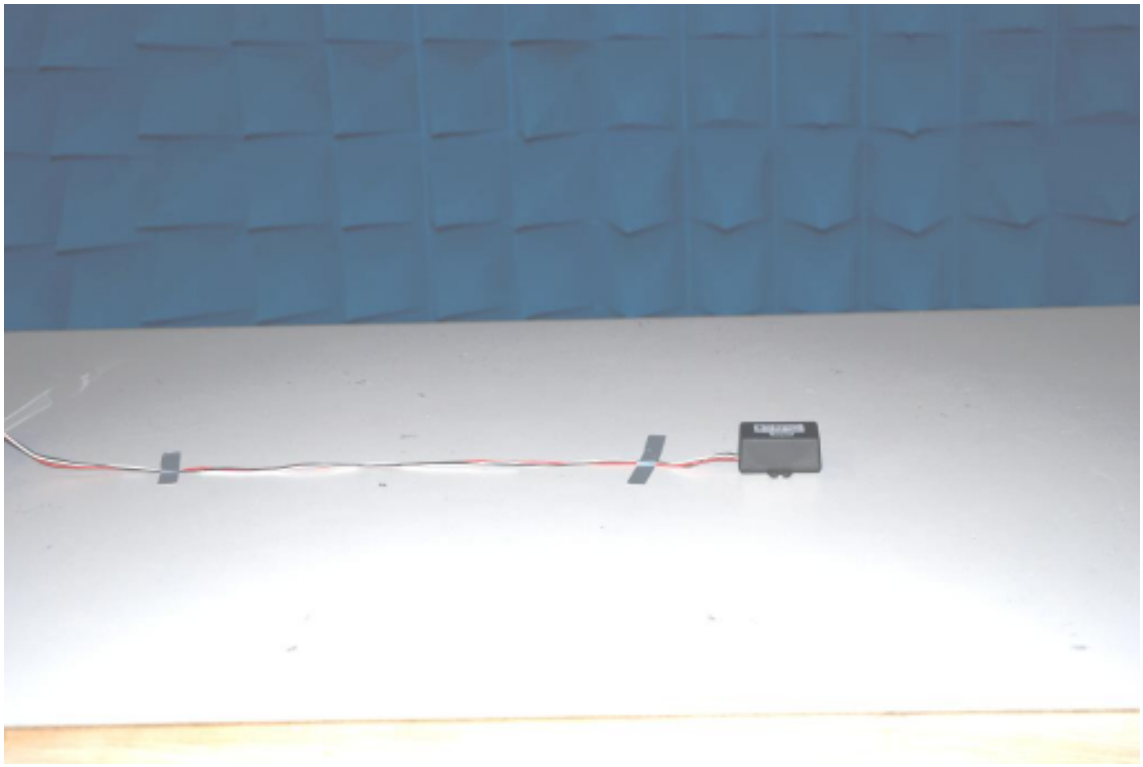


Fig. 1 Front view

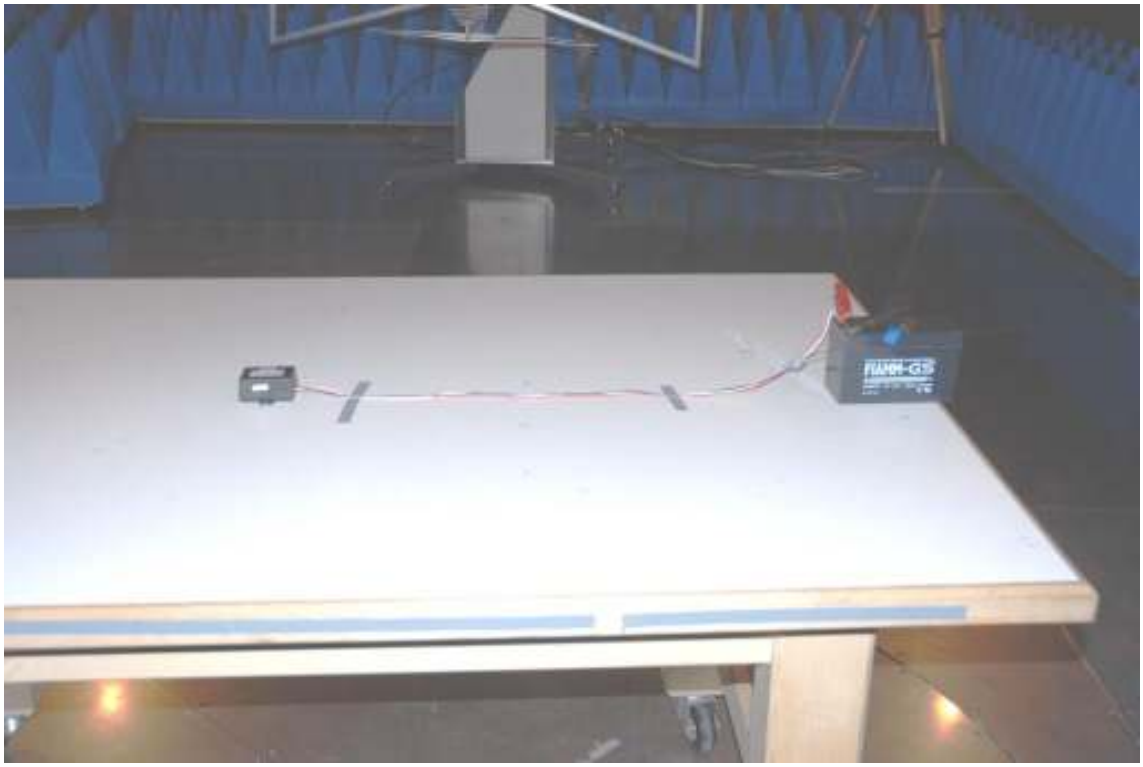


Fig. 2 Rear view

Fig. 3 VW Polo test setup 315^0

Fig. 4 Device mount in the car VW Polo

Fig. 5 Toyota Corolla test setup Az = 90^0

Fig. 6 Device mount in the car Toyta Corolla

Fig. 7 VW Multivan test setup 0^0

Fig. 6 Device mount in the car VW Multivan

6. EUT Photo documentation

External Photos : **EXHIBIT 2**
Internal Photos : **EXHIBIT 3**

7. Technical specification

Operational description : **EXHIBIT 4**

7.1. Block Diagram Of The EUT

EXHIBIT 5

7.2. Circuit Diagram Of The Layout

EXHIBIT 6

7.3. Instruction manual

EXHIBIT 7

7.4. Product Labelling

EXHIBIT 8