

Inter|**Lab**<sup>®</sup>

# EMC Measurement/Technical Report on vehicle remote keyless entry transmitter

**Report Reference:** 2\_VISGE\_0102\_TAS\_FCCa

## **Test Laboratory (Headquarter):**

7 Layers AG  
Borsigstr. 11  
40880 Ratingen  
Germany



TTI-P-G 178/99

### Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the testing laboratory.

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## **0 Summary**

### **0.1 Technical Report Summary**

#### **Type of Authorization:**

Certification for an Intentional Radiator (Periodic operation in the band above 70 MHz)

#### **Applicable FCC Rules:**

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 19 (10-1-98 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification Sections

Part 15, Subpart C - Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits (not applicable for battery powered equipment)

§ 15.209 Radiated emission limits; general requirements

§ 15.231 Periodic operation in the band 40.66-40.70 MHz, above 70 MHz

Note:  
none

#### **Summary Test Results:**

**The EUT complied with all the applicable FCC rules as listed above.**



## 0.2 Measurement Summary

### **FCC Part 15, Subpart C,231 § 15.231(a)**

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#### Occupied Bandwidth

The measurement was performed according to ANSI C63.4 1992

OP-Mode	Setup	Port	Final Result
op-mode 1	setup 1	enclosure	passed
op-mode 2	setup 1	enclosure	passed

### **FCC Part 15, Subpart C,231 § 15.231(b)**

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#### Spurious Radiated Emissions

The measurement was performed according to ANSI C63.4 1992

OP-Mode	Setup	Port	Final Result
op-mode 3	setup 1	enclosure	passed
op-mode 4	setup 1	enclosure	passed

Responsible for  
Accreditation Scope: \_\_\_\_\_

Responsible  
for Test Report: \_\_\_\_\_



## 1. Administrative Data

### 1.1 Testing Laboratory

Company Name: 7 Layers AG  
Address: Borsigstr. 11  
40880 Ratingen  
Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716.

The test facility is also accredited by the following accreditation organisation:

- Deutscher Akkreditierungs Rat                      DAR-Registration no. TTI-P-G 178/99

Responsible for Accreditation Scope: Dipl.-Ing Bernhard Retka  
Dipl.-Ing Arndt Stöcker  
Dipl.-Ing Thomas Hoell

### 1.2 Project Data

Responsible for testing and report: Robert Machulec  
Receipt of EUT: 15.12.2003  
Date of Test(s): 15.12.2003 - 08.01.2004  
Date of Report: 13.01.2004

### 1.3 Applicant Data

Company Name: Visteon Deutschland GmbH  
Body&Security Electronics  
Address: Visteonstraße 4-10  
  
D-50170 Kerpen  
Germany  
Contact Person: Werner Löbach

### 1.4 Manufacturer Data

Company Name: please see Applicant data  
Address:

Contact Person:



## **2.0 Product Labeling**

### **2.1 FCC ID Label:**

At the time of the test report there was no FCC label available

### **2.2 Location of Label on the EUT:**

see above

### 3. Testobject Data

#### 3.1 General EUT Description

<b>Equipment under Test:</b>	vehicle remote keyless entry transmitter
<b>Type Designation:</b>	
<b>Kind of Device: (optional)</b>	315 MHz transmitter
<b>Voltage Type:</b>	DC
<b>Voltage level:</b>	3.0 V

#### General product description:

The vehicle remote keyless entry transmitter VP4CFF-15K601-BC is a wireless handheld remote control unit.  
(Transmitter only, periodic operation in the band above 70 MHz)  
the operating frequency is 315 MHz.  
The transmitter is activated manually by a switch and is deactivated automatically within 5 seconds after release of the switch.

#### The EUT provides the following ports:

##### Ports

enclosure

**The main components of EUT are listed and described in Chapter 3.2**



### 3.2 EUT Main components: Type, S/N, Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status	Date of Receipt
EUT A	vehicle remote keyless entry transmitter	-	-	VP4CFF- 15K601-BC	-	15.12.2003

wireless handheld remote control unit, transmitter only

**NOTE: The short description is used to simplify the identification of the EUT in this test report**

### 3.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	HW Status	SW Status	Serial No.	FCC Id
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### 3.4 EUT Setups

This chapter describes the combination of EUT's and ancillary equipment used for testing.

Setup No.	Combination of EUTs	Description
setup 1	EUT A	



### 3.5 Operating Modes

This chapter describes the operating modes of the EUT's used for testing.

<b>Op. Mode</b>	<b>Description of Operating Modes</b>	<b>Remarks</b>
op-mode 1	periodic operation	Transmitter is sending a pulse coded signal TX on 314.92 MHz. (periodic operation)
op-mode 2	periodic operation	Transmitter is sending a pulse coded signal TX on 315.16 MHz. (periodic operation)
op-mode 3	continuous operation	Transmitter is sending a CW signal TX on 314.92 MHz. (continuous operation)
op-mode 4	continuous operation	Transmitter is sending a CW signal TX on 315.16 MHz. (continuous operation)

## 4. Test Results

### 4.1 Occupied Bandwidth

**Standard** FCC Part 15, 10-1-98  
Subpart C,231

**The test was performed according to:** ANSI C63.4 1992

#### 4.1.1 Test Description

The Equipment Under Test (EUT) was set up in a shielded room.

For analyzer settings please see measurement plots in annex.

#### 4.1.2 Test Limits

FCC Part 15, Subpart C, §15.231 (c)

The maximum 20 dB bandwidth of a transmitter operating at a frequency range:

70 MHz to 900 MHz is 0.25% of the center frequency

above 900 MHz : is 0.5% of the center frequency

#### 4.1.3 Test Protocol

Temperature: 25 °C

Air Pressure: 1030 hPa

Humidity: 34 %

Op. Mode	Setup	Port	Test Parameter
op-mode 1	setup 1	enclosure	
<b>20 dB Bandwidth MHz</b>		<b>Remarks</b>	
0,049		Please see annex for the measurement plot.	

Remark: none

Temperature: 25 °C

Air Pressure: 1030 hPa

Humidity: 34 %

Op. Mode	Setup	Port	Test Parameter
op-mode 2	setup 1	enclosure	
<b>20 dB Bandwidth MHz</b>		<b>Remarks</b>	
0,045		Please see annex for the measurement plot.	

Remark: none

#### 4.1.3 Test result: Occupied Bandwidth

FCC Part 15, Subpart C,231	Op. Mode	Setup	Port	Result
	op-mode 1	setup 1	enclosure	<b>passed</b>
	op-mode 2	setup 1	enclosure	<b>passed</b>

## 4.2 Spurious Radiated Emissions

**Standard** FCC Part 15, 10-1-98  
Subpart C,231

**The test was performed according to:** ANSI C63.4 1992

### 4.2.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4-1992.

The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The test was performed at an EUT to receiving antenna distance of 3m.

The radiated emissions measurements were made in a typical installation configuration.

The measurement procedure consists of four steps. It is implemented into EMI test software ES-K1 from R&S.

Step 1: Preliminary scan

Preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100  $\mu$ s
- Turntable angle range:  $-180$  to  $180$  °
- Turntable stepsize:  $90$ °
- Height variation range: 1 – 3m
- Height variation stepsize: 2m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. With this data, the test system performs ( to reduce the number of final measurements) a data reduction with the following parameters:

- Offset for acceptance analysis: Limit line – 10 dB
- Maximum number of final measurements: 12

Step 2:

With the frequencies determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

Settings for step 2:

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100ms
- Turntable angle range:  $-180$  to  $180$  °
- Turntable stepsize:  $45$ °
- Height variation range: 1 – 4m
- Height variation stepsize: 0,5m

- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45°
- Antenna height: 0,5m

#### Step 3:

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency the turntable azimuth and antenna height, which was determined in step 3, will be adjusted.

The turntable azimuth will be slowly varied by +/- 22,5° around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by +/- 25 cm around the antenna height determined in step 3. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

#### Settings for step 3:

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100ms
- Turntable angle range: -22,5° to + 22,5 ° around the value determined in step 2
- Height variation range: -0,25m to + 0,25m around the value determined in step 2

#### Step 4:

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak(< 1GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1s

The following modifications apply to the measurement procedure for the frequency range

above 1 GHz:

The measurement distance was reduced to 1m. The results were extrapolated by the extrapolation factor of 20 dB/decade (invers linear-distance for field strength measurements, invers linear-distance squared for the power reference level measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 Ghz) and a horn antenna (18-25 GHz) are used, the steps 2-4 are omitted. Step 1 was performed with one height of the receiving antenna only.

Detector: Peak, Average

RBW = VBW = 1 MHz, above 7 GHz 100 kHz

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

#### 4.2.2 Test Limits

FCC Part 15, Subpart C, §15.231(b)

(1) A radiated emission test applies to the fundamental frequency.

Frequency Range (MHz):	Limit (dBµV/m)
40.66 – 40.70	67,04
70 – 130	67,04
130 – 174	67,04 – 71.48
174 – 260	71.48
260 – 470	71.48 – 81.93
above 470	81.93

(2) A radiated emission test applies to harmonic/spurs that fall in the restricted bands as listed in § 15.205(a). The maximum permitted QP (< 1GHz) and average (> 1GHz) field strength is listed in § 15.209(a).

(3) FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency Range (MHz):	Class B Limit (dBµV/m)
30 – 88	40,0
88 – 216	43,5
216 – 960	46,0
above 960	54,0

§15.35(b)

..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor:  $\text{Limit (dB}\mu\text{V/m)} = 20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$

#### 4.2.3 Test Protocol

Temperature: 23°C  
 Air Pressure: 1028 hPa  
 Humidity: 35%

Op. Mode	Setup	Port	Test Parameter					
op-mode 3	setup 1	enclosure						
Polarisation	Frequency MHz	Corrected Value dBµV/m			Limit QP/AV dBµV/m	Limit Peak dBµV/m	Delta to AV/QP Limit/dB	Delta to Peak Limit dB
		QP	Peak	AV				
Vertical	314,90		73,93			75,60		1,67
Vertical	629,80		52,63			55,60		2,97
Vertical	944,70		49,54			55,60		6,06
Vertical	1890,00		43,41			55,60		12,19
Vertical	2204,00		36,49			54,00		17,51
Vertical	2519,50		28,88			55,60		26,72
Vertical	2834,00		25,25			54,00		28,75
Vertical	3149,00		26,41			55,60		29,19

Remark: The test was performed in the frequency range from 30MHz to 3.2GHz.  
 For this test a EUT sending a CW signal was used.  
 The values listed above are peak values.

Temperature: 23 °C  
 Air Pressure: 1028 hPa  
 Humidity: 35 %

Op. Mode	Setup	Port	Test Parameter					
op-mode 4	setup 1	enclosure						
Polarisation	Frequency MHz	Corrected Value dBµV/m			Limit QP/AV dBµV/m	Limit Peak dBµV/m	Delta to AV/QP Limit/dB	Delta to Peak Limit dB
		QP	Peak	AV				
Vertical	315,10		74,08			75,60		1,52
Vertical	630,30		52,64			55,60		2,96
Vertical	945,40		50,20			55,60		5,40
Vertical	1891,00		39,59			55,60		16,01
Vertical	2206,00		53,74			54,00		0,26
Vertical	2520,10		28,19			55,60		27,41
Vertical	2836,50		47,91			54,00		6,09
Vertical	3149,00		26,41			55,60		29,19

Remark: The test was performed in the frequency range from 30MHz to 3.2GHz.  
 For this test a EUT sending a CW signal was used.  
 The values listed above are peak values.

#### 4.2.3 Test result: Spurious Radiated Emissions

FCC Part 15, Subpart C,231	Op. Mode	Setup	Port	Result
	op-mode 3	setup 1	enclosure	<b>passed</b>
	op-mode 4	setup 1	enclosure	<b>passed</b>

## 5. Testequipment

### *EUT Digital Signalling System*

Equipment	Type	Serial No.	Manufacturer
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz
Signalling Unit for Bluetooth Spurious Emissions	PTW60	100004	Rohde & Schwarz
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz

### *EMI Test System*

Equipment	Type	Serial No.	Manufacturer
Comparison Noise Emitter	CNE III	99/016	York
EMI Analyzer	ESI 26	830482/004	Rohde & Schwarz
Signal Generator	SMR 20	846834/008	Rohde & Schwarz

### *EMI Radiated Auxiliary Equipment*

Equipment	Type	Serial No.	Manufacturer
Antenna mast 4m	MA 240	240/492	HD GmbH H. Deisel
Biconical dipole	VUBA 9117	9117108	Schwarzbeck
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq
Broadband Amplifier 45MHz-27GHz	JS4-00102600-42-5A	619368	Miteq
Cable "ESI to EMI Antenna"	RTK081+Aircell7	W18.01+W38.01a	Huber+Suhner
Cable "ESI to Horn Antenna"	RTK 081	W18.04+3599/001	Rosenberger
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic
KUEP pre amplifier	Kuep 00304000	001	7layers
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz
Pyramidal Horn Antenna 26,5 GHz	Model 3160-09	9910-1184	EMCO

### *EMI Conducted Auxiliary Equipment*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber+Suhner
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz

### *Auxiliary Test Equipment*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>
Broadband Resist. Power Divider N	1506A / 93459	LM390	Weinschel
Broadband Resist. Power Divider SMA	1515 / 93459	LN673	Weinschel
Digital Multimeter 01	Voltcraft M-3860M	IJ096055	Conrad
Digital Multimeter 02	Voltcraft M-3860M	IJ095955	Conrad
Digital Oscilloscope	TDS 784C	B021311	Tektronix
Fibre optic link Satellite	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver	FO RS232 Link	182-018	Pontis
I/Q Modulation Generator	AMIQ-B1	832085/018	Rohde & Schwarz
Notch Filter ultra stable	WRCA800/960-6EEK	24	Wainwright
Temperature Chamber	KWP 120/70	59226012190010	Weiss
Temperature Chamber	VT 4002	58566002150010	Vötsch
ThermoHygro_01	430202		Fischer

### *Anechoic Chamber*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>
Air Compressor (pneumatic)			Atlas Copco
Controller	HD 100	100/603	HD GmbH H. Deisel
EMC Camera	CE-CAM/1		CE-SYS
EMC Camera for observation of EUT	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter telephone systems / modem	B84312-C40-B1		Siemens&Matsushita
Filter Universal 1A	B84312-C30-H3		Siemens&Matsushita
Fully/Semi AE Chamber	10.58x6.38x6		Frankonia
Turntable	DS 420S	420/573/99	HD GmbH, H. Deisel
Valve Control Unit (pneum.)	VE 615P	615/348/99	HD GmbH, H. Deisel





*7 layers Bluetooth™ Full RF Test Solution*

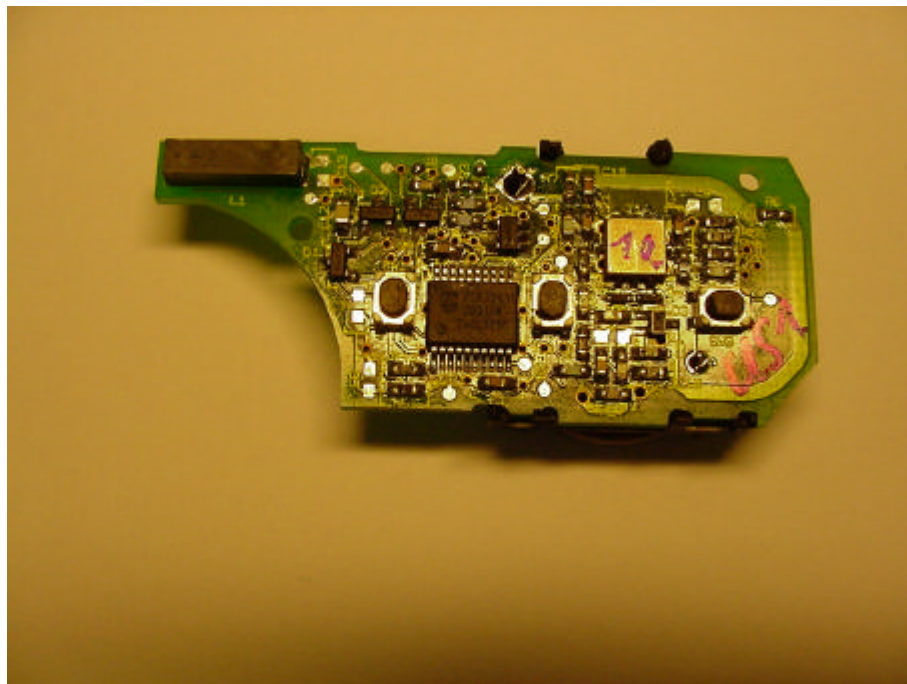
*Bluetooth RF Conformance Test System TS8960*

<b>Equipment</b>	<b>Type</b>	<b>Serial No.</b>	<b>Manufacturer</b>
10MHz Reference	MFS	5489/001	Efratom
Power Meter 832025/059	NRVD	832025/059	Rohde & Schwarz
Power Sensor A 832279/013	NRV-Z1	832279/013	Rohde & Schwarz
Power Sensor B 832279/015	NRV-Z1	832279/015	Rohde & Schwarz
Power Supply	E3632A	MY40003776	Agilent
Power Supply	PS-2403D	-	Conrad
RF Step Attenuator 833695/001	RSP	833695/001	Rohde & Schwarz
Rubidium Frequency Normal	MFS	002	Efratom
Signal Analyser FSIQ26 832695/007	FSIQ26	832695/007	Rohde & Schwarz
Signal Analyser FSP30 100051	FSP30	100051	Rohde & Schwarz
Signal Generator 101175	SMIQ03B	101175	Rohde & Schwarz
Signal Generator 833680/003	SMP 03	833680/003	Rohde & Schwarz
Signal Generator A 834344/002	SMIQ03B	834344/002	Rohde & Schwarz
Signal Generator B 832870/017	SMIQ03B	832870/017	Rohde & Schwarz
Signal Switching and Conditioning Unit	SSCU	338826/005	Rohde & Schwarz
Signalling Unit PTW60 838312/014	PTW60 for TS8960	838312/014	Rohde & Schwarz
System Controller 829323/008	PSM12	829323/008	Rohde & Schwarz

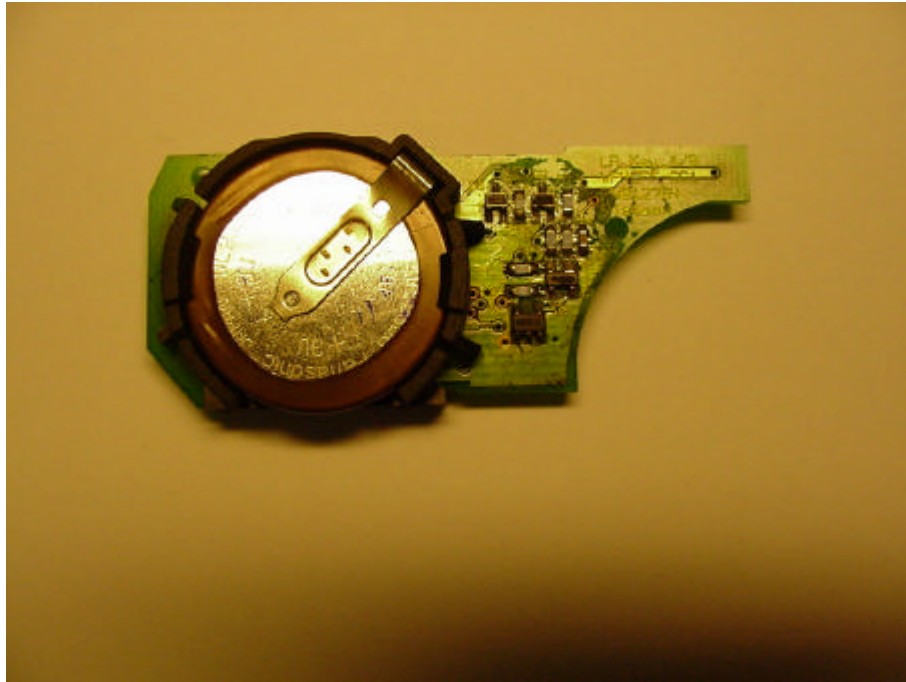
## 6. Foto Report



**Picture 1** : vehicle remote keyless entry transmitter, view to the enclosure



**Picture 2** : vehicle remote keyless entry transmitter, view to the front side of the PCB



**Picture 3** : vehicle remote keyless entry transmitter, view to the rear side of the PCB



## **7. Setup Drawings**

## 8. Annex

-

### Occupied Bandwidth

#### Op. Mode


op-mode 1 periodic operation

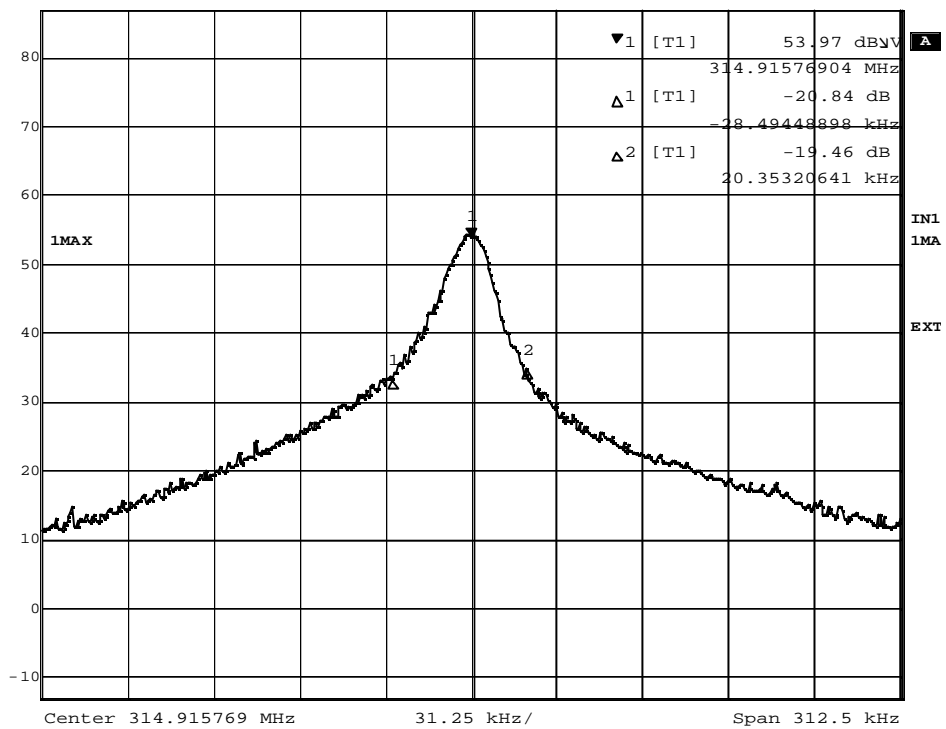
#### Setup

setup 1

#### Port

enclosure

	Marker 1 [T1]	RBW	10 kHz	RF Att	10 dB
	Ref Lvl	53.97 dB $\mu$ V	VBW	10 kHz	
	87 dB $\mu$ V	314.91576904 MHz	SWT	15 ms	Unit dB $\mu$ V



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20 dB bandwidth

## Occupied Bandwidth

### Op. Mode


op-mode 2 periodic operation

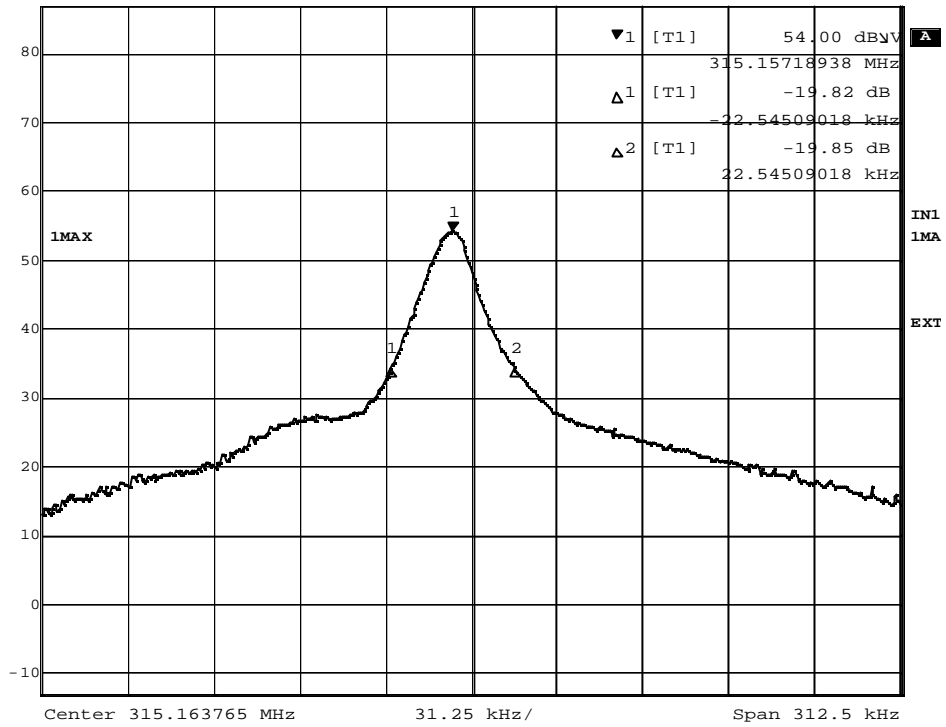
### Setup

setup 1

### Port

enclosure

	Marker 1 [T1]	RBW	10 kHz	RF Att	10 dB
	Ref Lvl	54.00 dB $\mu$ V	VBW	10 kHz	
	87 dB $\mu$ V	315.15718938 MHz	SWT	15 ms	Unit dB $\mu$ V



Date: 8.JAN.2004 09:15:49

**20 dB bandwidth**