



Inter**Lab**<sup>®</sup>

FCC Measurement/Technical Report on

Radio Identification Device

KRS

**Report Reference:** MDE\_HUF\_1302\_FCCa

**Test Laboratory:**

Borsigstr. 11  
Germany  
7Layers AG  
40880 Ratingen



**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 test laboratory.

7 layers AG  
Borsigstrasse 11  
40880 Ratingen, Germany  
Phone: +49 (0) 2102 749 0  
Fax: +49 (0) 2102 749 350  
www.7Layers.com

Aufsichtsratsvorsitzender •  
Chairman of the Supervisory Board:  
Peter Mertel  
Vorstand • Board:  
Dr. H.-J. Meckelburg

Registergericht • registered in:  
Düsseldorf, HRB 44096  
USt-IdNr • VAT No.:  
DE 203159652  
TAX No. 147/5869/0385



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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**

Edition of FCC Rules: 10-1-12

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15. The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

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

Note: The newer version of ANSI C63.4–2009 is applied.

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

The EUT complied with all performed tests as listed in chapter 0.2 Measurement Summary.



## 0.2 Measurement Summary

<b>FCC Part 15, Subpart C</b>		<b>§ 15.231</b>	
Duty cycle measurement (based on dwell time measurement)			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 1	Setup_a02	Enclosure	10-1-12 Edition passed
<b>FCC Part 15, Subpart C</b>		<b>§ 15.231</b>	
Spurious Radiated Emissions			
The measurement was performed according to ANSI C63.4			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 2	Setup_a01	Enclosure	2009 passed
<b>FCC Part 15, Subpart C</b>		<b>§ 15.231</b>	
Peak power output			
The measurement was performed according to ANSI C63.4			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 3	Setup_a01	Enclosure	2009 passed
<b>FCC Part 15, Subpart C</b>		<b>§ 15.231</b>	
Occupied Bandwidth			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 2	Setup_a01	Enclosure	10-1-12 Edition passed

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

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



## **1 Administrative Data**

### **1.1 Testing Laboratory**

Company Name: 7Layers 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:  
Laboratory accreditation no.: DAkkS D-PL-12140-01-01

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka  
Dipl.-Ing. Robert Machulec  
Dipl.-Ing. Andreas Petz  
Dipl.-Ing. Marco Kullik

Report Template Version: 2012-03-14

### **1.2 Project Data**

Responsible for testing and report: Dipl.-Ing. Marco Kullik  
Date of Test(s): 2010-07-09 to 2010-08-08  
Date of Report: 2010-09-24

### **1.3 Applicant Data**

Company Name: Huf Hülbeck & Fürst GmbH & Co. KG  
Address: Steeger Straße 17  
42 551, Velbert  
Germany  
Contact Person: Mr. Thomas Herzog

### **1.4 Manufacturer Data**

Company Name: please see applicant data

Address:

Contact Person:

## 2 Test object Data

### 2.1 General EUT Description

<b>Equipment under Test</b>	Vehicle remote keyless entry transmitter
<b>Type Designation:</b>	KRS
<b>Kind of Device:</b>	433 MHz ISM Band transmitter operating at 434.42 MHz $\pm$ 20kHz
<b>Voltage Type:</b>	DC / Li non rechargeable battery
<b>Voltage level:</b>	3.0 V
<b>Repeated Operation:</b>	Manually
<b>The EUT is part of a security or safety system:</b>	No

#### General product description:

The EUT is a wireless handheld remote control unit (transmitter only, non-periodic operation in the band above 70 MHz). The operating frequency is 434.42 MHz.

#### Specific product description for the EUT:

The EUT is a vehicle remote keyless entry transmitter which uses Manchester coded FSK modulation. The transmitter is activated manually by a command button and is deactivated automatically within 5 seconds after release of the same button.

#### The EUT provides the following ports:

##### Ports

Enclosure

**The main components of the EUT are listed and described in Chapter 2.2.**



## 2.2 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 (Code: UG050a01)	Transmitter with modified SW for CW or CM RF carrier	KRS	1/001/13/13	05.750.600	01.10 REV 002	-
EUT B (Code: UG050b01)	Transmitter with not modified SW	KRS	1/002/13/13	05.750.600	01.10 REV 002	-

Remarks: EUT A and EUT B are equipped with an integral antenna (gain= -23.8 dBi).  
CW = Continuous Wave; CM = Continuously Modulated

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

## 2.3 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
-	-	-	-	-	-	-

## 2.4 Auxiliary Equipment

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial no.	HW Status	SW Status	FCC ID
-	-	-	-	-	-	-

## 2.5 EUT Setups

This chapter describes the combination of EUTs and ancillary equipment used for testing.

Setup No.	Combination of EUTs	Description
Setup_01	EUT A	setup for radiated measurements
Setup_02	EUT B	setup for Duty Cycle measurements



## 2.6 Operating Modes

This chapter describes the operating modes of the EUTs used for testing.

<b>Op. Mode</b>	<b>Description of Operating Modes</b>	<b>Remarks</b>
op-mode 1	normal operation	Transmitter sending shortly a Manchester coded FSK modulated signal. Normal operating mode.
op-mode 2	continuous modulated operation	Special operating mode for test purpose only.
op-mode 3	continuous unmodulated operation	Special operating mode for test purpose only.

## 2.7 Product labeling

### 2.7.1 FCC ID label

Please refer to the documentation of the applicant.

### 2.7.2 Location of the label on the EUT

Please refer to the documentation of the applicant.





## 3 Test Results

### 3.1 Duty cycle measurement (based on dwell time measurement)

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.35, §15.231

#### 3.1.1 Test Description

The Equipment Under Test (EUT) was setup in a shielded room to perform the dwell time measurements. For analyzer settings please see measurement plots in annex.

#### 3.1.2 Test Limits

Depending on the function of the EUT different paragraphs of FCC §15.231 apply:

Either

(a)(1): A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Or

(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

And

(a)(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

Otherwise

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation [...]. In addition, [...] the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

This test is also performed to determine the pulse train of the transmitter and calculate the correction factor for pulse modulated transmitters according to FCC §15.35. This factor is used as a correction factor for the field strength measurements, both for Spurious radiated emissions and Peak power output.



### 3.1.3 Test Protocol

Temperature: 23 °C  
 Air Pressure: 1014 hPa  
 Humidity: 39 %

Op. Mode	Setup	Port
op-mode 1	Setup_02	Enclosure

a) Determine the total duration of a transmission within 100 ms:

Duty cycle =  $(L1*N1) + (L2*N2) + \dots + (Ln*NN) / 100$  ms or T, whichever is less  
 Correction factor =  $20 * \text{LOG}(\text{Duty cycle})$  [dB]

Step 1	Holdover time	Less than 5s
Step 2	Cycle to determine the on/off ratio within a cycle (period T)	100 ms
Step 3	Sweep of a data word to determine the on time within a data word (L1-LN).	L1 = 52 ms
Step 4	Determine the number of pulses (N1-NN). First range (trigger delay = - 2 ms; sweep time = 100 ms).	N1 = 1

Calculation of Duty Cycle / Correction Factor:

If  $T > 100$  ms =>  $T = 100$  ms;  $L1 = 52$  ms;  $N1 = 1$ ;

Duty cycle =  $1*52 / 100 = 0.52$

Correction factor =  $20*LOG(0.52) = -5.7$  dB

Please see annex for the measurement plots.

### 3.1.4 Test result: Duty cycle / correction factor

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	passed

## 3.2 Spurious radiated emissions

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.31, ANSI C 63.4

### 3.2.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4. The radiated emissions measurements were made in a typical installation configuration. The measurement procedure is implemented into the EMI test software ES-K1 from R&S.

#### 1. Measurement up to 30 MHz

The Equipment Under Test (EUT) was set up on a non-conductive table in the anechoic chamber.

The Loop antenna HFH2-Z2 is used.

**Step 1:** pre measurement

- Anechoic chamber
- Antenna distance: 10 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 – 0.15 and 0.15 – 30 MHz
- Frequency steps: 0.1 kHz and 5 kHz
- IF-Bandwidth: 0.2 kHz and 10 kHz
- Measuring time / Frequency step: 10 ms

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

**Step 2:** final measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.

- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF-Bandwidth: 200 Hz - 10 kHz
- Measuring time / Frequency step: 100 ms

#### 2. Measurement above 30 MHz and up to 1 GHz

**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  $180^\circ$
- Turntable step size:  $90^\circ$
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the

relevant emissions for the final measurement are identified.

**Step 2:** second measurement

For the relevant emissions 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.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range:  $-180$  to  $180^\circ$
- Turntable step size:  $45^\circ$
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- 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):  $45^\circ$
- Antenna height: 0.5 m

**Step 3:** final measurement

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, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by  $\pm 22.5^\circ$  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  $\pm 25$  cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range:  $-22.5^\circ$  to  $+ 22.5^\circ$  around the determined value
- Height variation range:  $-0.25$  m to  $+0.25$  m around the determined value

**Step 4:** final measurement with QP detector

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

EMI receiver settings for step 4:

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

### 3. Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:

The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements, inverse 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.

Important EMI receiver settings:

- Detector: Peak, Average
- RBW = 1 MHz, VBW = 3 MHz
- Sweep time = 1 ms

#### 3.2.2 Test Requirements / Limits

1) A radiated emission test is relating to the fundamental frequency.

a) Either for "non-periodic" operation of the EUT as defined in §15.231(a) the limits for the average field strength apply according to FCC Part 15, Subpart C, §15.231(b):

For fundamental frequency (MHz)	Limit Fundamental (dBµV/m)	Limit Spurious (dBµV/m)
40.66 – 40.70	67.0	47.0
70 – 130	67.0	47.0
130 – 174	67.0 – 71.5	47.0 – 51.5 *)
174 – 260	71.5	51.5
260 – 470	71.5 – 81.9	51.5 – 61.9 *)
above 470	81.9	61.9

b) Or for "periodic" operation of the EUT the limits for the average field strength apply according to FCC Part 15, Subpart C, §15.231(e):

For fundamental frequency (MHz)	Limit Fundamental (dBµV/m)	Limit Spurious (dBµV/m)
40.66 – 40.70	60.0	40.0
70 – 130	54.0	34.0
130 – 174	54.0 – 63.5	34.0 – 43.5 *)
174 – 260	63.5	43.5
260 – 470	63.5 – 74.0	43.5 – 54.0 *)
above 470	74.0	54.0

\*) linear interpolation



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 (< 1 GHz) and Average (> 1GHz) field strength is listed in § 15.209(a):

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Calculate Limit(dBµV/m @10m)	Limit (dBµV/m) @10m
0.009 – 0.49	2400/F (kHz)	300	(48.5 – 13.8) + 30 dB	78.5 – 46.8
0.49 – 1.705	24000/F (kHz)	30	(48.9 – 23.0) + 10 dB	58.9 – 33.0
1.705 – 30	30	30	29.5 + 10 dB	39.5

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limit (dBµV/m)
30 – 88	100	3	40.0
88 – 216	150	3	43.5
216 – 960	200	3	46.0
above 960	500	3	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:  $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)}/1\mu\text{V/m})$

§15.35(c):

[...] when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted [...].

§15.231(b)(3)

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator.

Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

Interpretation of the test laboratory:

The lats subordinate clause of §15.231(b)(3) is overruled by §15.205/209, therefore within the restricted bands the limits defined at §15.205/209 and outside the restricted bands the limits defined at §15.231(b) resp. §15.231(e) are applied.

### 3.2.3 Test Protocol

#### 3.2.3.1 Measurement up to 30 MHz

Temperature: 24 °C  
 Air Pressure: 1009 hPa  
 Humidity: 38 %

Op. Mode	Setup	Port
op-mode 2	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dB $\mu$ V/m			Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin to limit dB	Margin to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
-	-	-	-	-	-	-	-	-	-

Remark: No spurious emissions in the range 20 dB below the limit found.

#### 3.2.3.2 Measurement 30 MHz – 1 GHz

Temperature: 24 °C  
 Air Pressure: 1009 hPa  
 Humidity: 38 %

Op. Mode	Setup	Port
op-mode 2	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dB $\mu$ V/m			Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin to limit dB	Margin to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical	30.7	23.9	-	-	40.0	-	-	16.1	-
Horizontal	447.5	36.4	-	-	46.0	-	-	9.6	-
Vertical	936.0	23.9	-	-	46.0	-	-	22.1	-

Remark: No further spurious emissions in the range 20 dB below the limit found. The test was performed in the frequency range from 30 MHz to 1 GHz.



**3.2.3.3 Measurement above 1 GHz**

Temperature: 25 °C  
 Air Pressure: 1012 hPa  
 Humidity: 37 %

<b>Op. Mode</b>	<b>Setup</b>	<b>Port</b>
op-mode 2	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Margin to limit dB	Margin to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
horizontal	2172.0	-	49.1	47.9	-	74.0	54.0	24.9	6.1

Remark: No further spurious emissions in the range 20 dB below the limit found. The test was performed in the frequency range from 1 GHz to 6 GHz

**3.2.4 Test result: Spurious radiated emissions**

FCC Part 15, Subpart C	<b>Op. Mode</b>	<b>Result</b>
	op-mode 2	passed





### 3.3 Peak power output

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.31, §15.231, ANSI C 63.4, 2009

#### 3.3.1 Test Description

Please refer to sub-clause 3.2.1.

#### 3.3.2 Test Limits

Please refer to sub-clause 3.2.2.

#### 3.3.3 Test Protocol

Temperature: 25 °C  
 Air Pressure: 1012 hPa  
 Humidity: 38 %

Op. Mode	Setup	Port
op-mode 3	Setup_01	Enclosure

Output power dBµV/m	Corrected Output Power dBµV/m	Margin to limit dB	Remarks
78.3	72.6	8.2	Maximum radiated field strength at fundamental frequency is corrected by the Duty Cycle correction factor measured and calculated in 3.1.3 = -5.7 dB.

#### 3.3.4 Test result: Peak power output

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 3	passed



### 3.4 Occupied bandwidth

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.231

#### 3.4.1 Test Description

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.

For analyzer settings please see measurement plots in annex.

#### 3.4.2 Test Limits

FCC Part 15, Subpart C, §15.231(c)

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

70 to 900 MHz is 0.25% of the centre frequency

above 900 MHz is 0.5% of the centre frequency

#### 3.4.3 Test Protocol

Temperature: 23 °C

Air Pressure: 1014 hPa

Humidity: 38 %

Op. Mode	Setup	Port
op-mode 2	Setup_01	Enclosure

20 dB bandwidth kHz	Limit kHz	Remarks
430.9	1086.1	The limit is calculated as 434.42 MHz * 0.25% = 1086.1 kHz.

Remark: Please see annex for the measurement plots.

For information: The 99% Bandwidth is 386.8 kHz.

#### 3.4.4 Test result: Occupied bandwidth

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 2	passed



## 4 Test Equipment

The calibration, hardware and software states are shown for the testing period.

### Test Equipment Anechoic Chamber

<b>Lab ID:</b>	<b>Lab 1</b>		
<i>Manufacturer:</i>	Frankonia		
<i>Description:</i>	Anechoic Chamber for radiated testing		
<i>Type:</i>	10.58x6.38x6.00 m <sup>3</sup>		
	<i>Calibration Details</i>	<i>Last Execution</i>	<i>Next Exec.</i>
	NSA (FCC, IC)	2011/01/10	2014/01/10

### Single Devices for Anechoic Chamber

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m <sup>3</sup>	none	Frankonia
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18		2011/01/11 2014/01/10
	IC listing 3699A-1 3m		2011/02/07 2014/02/06
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita



### Test Equipment Auxiliary Equipment for Radiated emissions

**Lab ID:** Lab 1  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

#### Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer		
Antenna mast	AM 4.0	AM4.0/180/119205	Maturo GmbH		
Antenna mast	AS 620 P	620/37	HD GmbH		
Biconical Broadband Antenna	SBA 9119	9119-005	Schwarzbeck		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2009/06/04	2014/06/03
Biconical dipole	VUBA 9117	9117-108	Schwarzbeck		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2008/10/27	2013/10/26
	Standard Calibration			2012/01/18	2015/01/17
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq		
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq		
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq		
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01-2	Kabel Kusch		
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02-2	Rosenberger Micro-Coax		
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2012/05/18	2015/05/17
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2012/06/26	2015/06/25
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		
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright		
Horn Antenna Schwarzbeck 15-26 GHz BBHA 9170	BBHA 9170				
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2012/12/18	2015/12/17
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG		
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard calibration			2011/10/27	2014/10/26

### Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5- 10kg/024/3790709	Maturo GmbH

### Test Equipment Auxiliary Test Equipment

<b>Lab ID:</b>	<b>Lab 1, Lab 2</b>
<b>Manufacturer:</b>	see single devices
<b>Description:</b>	Single Devices for various Test Equipment
<b>Type:</b>	various
<b>Serial Number:</b>	none

### Single Devices for Auxiliary Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Customized calibration		2011/10/19   2013/10/18
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorenwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard		2012/06/13   2015/06/12
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG



## Test Equipment Digital Signalling Devices

**Lab ID:** Lab 1, Lab 2  
**Description:** Signalling equipment for various wireless technologies.

### Single Devices for Digital Signalling Devices

Single Device Name	Type	Serial Number	Manufacturer
Bluetooth Signalling Unit CBT	CBT	100589	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/24    2014/11/23
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Initial factory calibration		2012/01/26    2014/01/25
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/28    2014/11/27
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Hardware: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04 Software: K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22 Firmware: µP1 8v50 02.05.06 ---		2007/07/16
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/12/07    2014/12/06
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	HW options: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02 SW options: K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10, Firmware: µP1 8v40 01.12.05 ---		2007/01/02
	SW: K62, K69		2008/11/03
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG



**Test Equipment Emission measurement devices**

**Lab ID:** Lab 1  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

**Single Devices for Emission measurement devices**

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
Personal Computer	Dell	30304832059	Dell	
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard calibration		2013/05/03	2014/05/02
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard calibration		2013/04/30	2014/04/29
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	standard calibration		2011/05/12	2014/05/11
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration		2011/12/05	2013/12/04
	<i>HW/SW Status</i>		<i>Date of Start</i>	<i>Date of End</i>
	Firmware-Update 4.34.4 from 3.45 during calibration		2009/12/03	



## Test Equipment Radio Lab Test Equipment

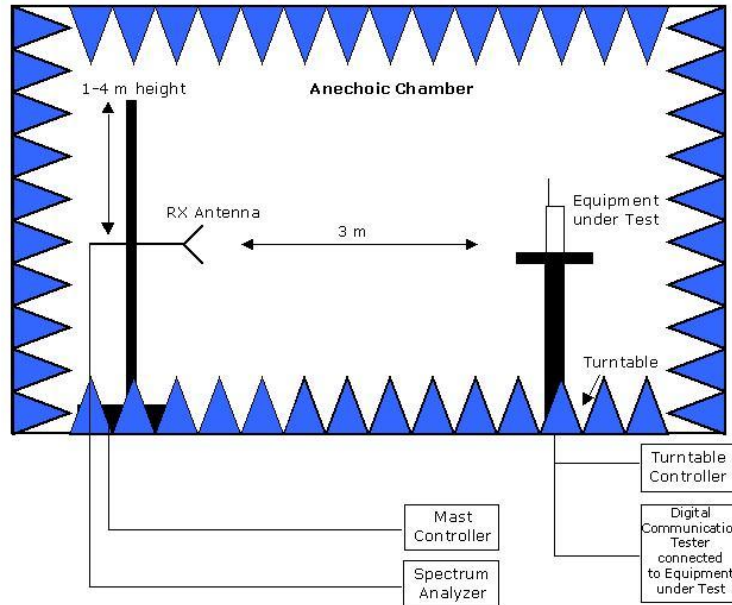
**Lab ID:** Lab 2  
**Description:** Radio Lab Test Equipment

### Single Devices for Radio Lab Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
Broadband Power DividerWA1515 SMA		A856	Weinschel Associates
Coax Attenuator 10dB SMA 2W	4T-10	F9401	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3702	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3711	Weinschel Associates
Coax Cable Huber&Suhner	Sucotest 2,0m		Huber&Suhner
Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m	FA210A0010003030	54491-2	Rosenberger Micro-Coax
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/05/03   2014/05/02
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co.KG
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	Datum-Beverly
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2012/06/21   2013/06/23
	Standard calibration		2013/06/24   2014/06/23
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/04/30   2014/04/29
Signal Generator SME	SME03	827460/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/25   2014/11/24
Signal Generator SMP	SMP02	836402/008	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/05/06   2016/05/05
Spectrum Analyser	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2013/02/12   2015/02/11
Temperature Chamber Vötsch 03	VT 4002	58566002150010	Vötsch
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Customized calibration		2012/03/12   2014/03/11



## 5 Setup Drawings



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

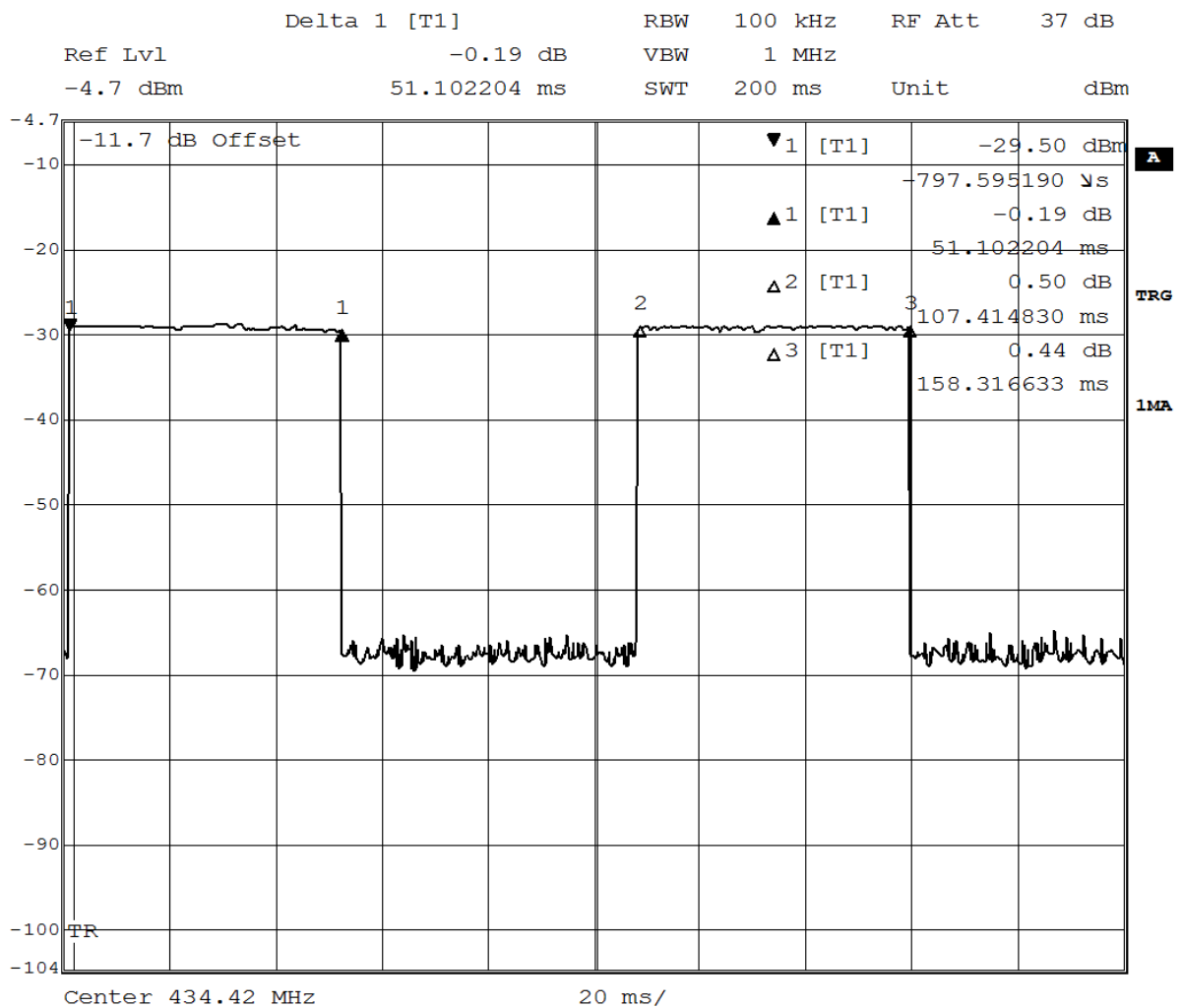
**Drawing 1:** Setup in the Anechoic Chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.

## 6 Annex measurement plots

### 6.1 Duty cycle measurement (based on dwell time measurement)

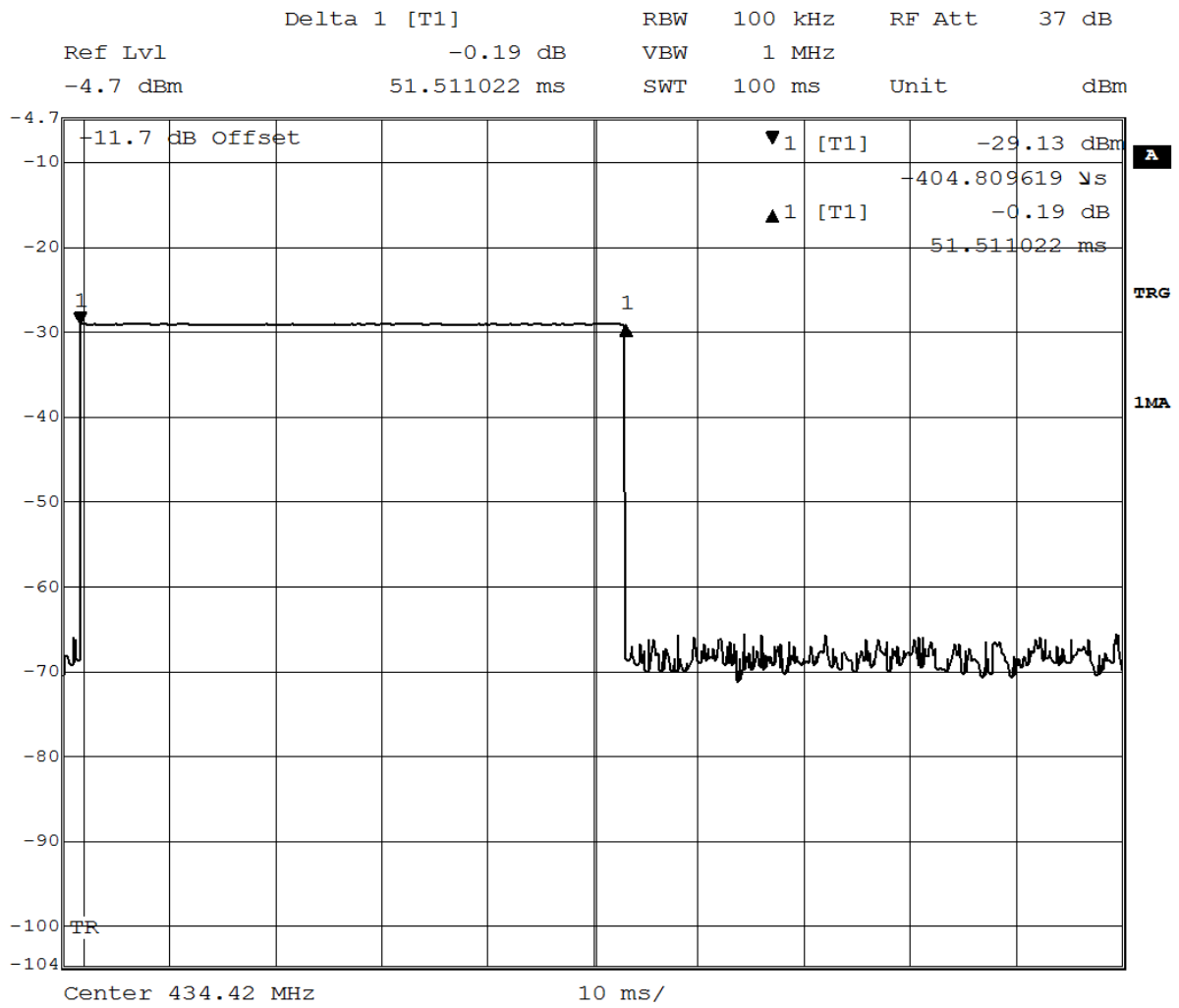
#### Op. Mode

Op-mode 1



Date: 9.JUL.2013 14:17:51

**Fig 1:** 200 ms sweep cycle to determine the "on/off" ratio within a period of 100 ms

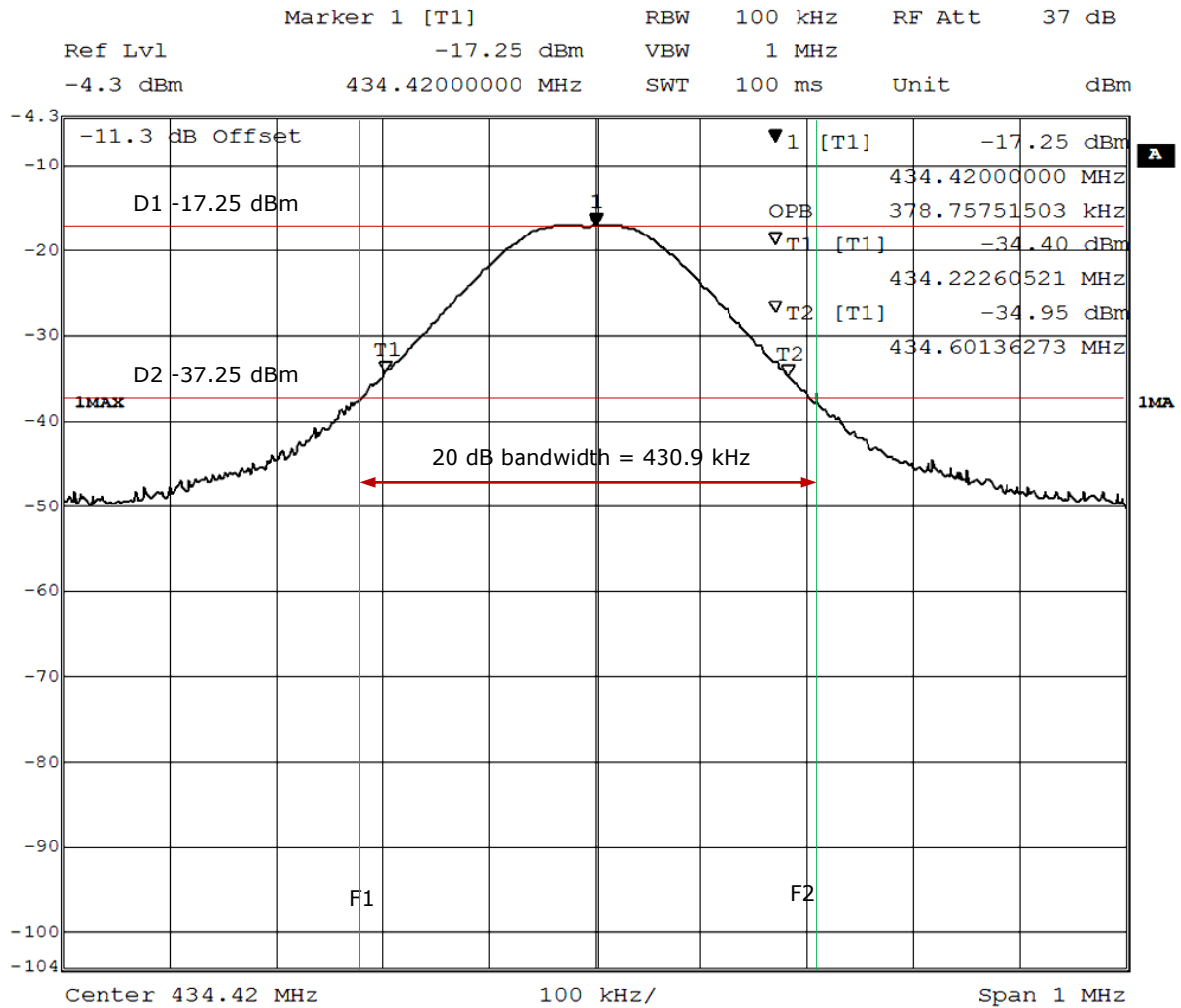


Date: 9.JUL.2013 14:11:49

**Fig. 2:** Sweep to determine the "on" time within a 100 ms.  
 After the command button is released, the EUT automatically stops transmitting in 52 ms.



## 6.2 Occupied bandwidth



Date: 9.JUL.2013 12:31:18