



Inter**Lab**[®]

FCC Measurement/Technical Report on

Vehicle remote keyless entry transmitter
TFWB1U822

Report Reference: MDE_ALPS_1001_FCCc

Test Laboratory:

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DGA-PL-192/99-02

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 2 (10-1-09 Edition) and 15 (10-1-09 Edition). 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:
none

Summary Test Results:

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

0.2 Measurement Summary

FCC Part 15, Subpart C		§ 15.231	
Spurious Radiated Emissions			
The measurement was performed according to ANSI C63.4		2003	
OP-Mode	Setup	Port	Final Result
op-mode 2	Setup_a01	enclosure	passed
FCC Part 15, Subpart C		§ 15.231	
Duty cycle measurement (based on dwell time measurement)			
The measurement was performed according to FCC § 15.31		10-1-09 Edition	
OP-Mode	Setup	Port	
op-mode 1	Setup_a01	enclosure	
FCC Part 15, Subpart C		§ 15.231	
Peak power output			
The measurement was performed according to FCC § 15.31		10-1-09 Edition	
OP-Mode	Setup	Port	Final Result
op-mode 2	Setup_a01	enclosure	passed
FCC Part 15, Subpart C		§ 15.231	
Occupied Bandwidth			
The measurement was performed according to FCC § 15.31		10-1-09 Edition	
OP-Mode	Setup	Port	Final Result
op-mode 1	Setup_a01	enclosure	passed

This report replaces the test report MDE_ALPS_1001_FCCa and MDE_ALPS_1001_FCCb

Responsible for
Accreditation Scope:



Responsible
for Test Report:



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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. DGA-PL-192/99-02

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

Report Template Version: 2010-01-28

1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Robert Machulec
Date of Test(s): 2010-02-10 and 2010-05-20
Date of Report: 2010-05-25

1.3 Applicant Data

Company Name: ALPS Automotive Inc.
Address: 1500 Atlantic Boulevard
48326 Auburn, Michigan
USA
Contact Person: Mr. John Cabigao

1.4 Manufacturer Data

Company Name: please see applicant data
Address:
Contact Person:



2 Test object Data

2.1 General EUT Description

Equipment under Test	vehicle remote keyless entry transmitter
Type Designation:	TFWB1U822
Kind of Device:	315 MHz transmitter
(optional)	
Voltage Type:	DC
Voltage level:	3.0 V

General product description:

The vehicle remote keyless entry transmitter 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 the EUT are listed and described in Chapter 3.2

2.2 Product labeling

2.2.1 FCC ID label

Please refer to the documentation of the applicant.

2.2.2 Location of the label on the EUT

Please refer to the documentation of the applicant.



2.3 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: 1H031a01)	vehicle remote keyless entry transmitter	TFWB1U822	-	TFWB1U822	3SQ01383T	10-02-2010
Remark: EUT A is equipped with an integral antenna (gain= -15.2 dBi).						

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

2.4 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
-						

2.5 EUT Setups

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

Setup No.	Combination of EUT's	Description
Setup_a01	EUT A	setup for measurements

2.6 Operating Modes

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

Op. Mode	Description of Operating Modes	Remarks
op-mode 1	periodic operation	Transmitter is sending a pulse coded signal
op-mode 2	continues operation	Transmitter is sending a CW signal continuously. Special op mode for test purpose only.

3 Test Results

3.1 Spurious radiated emissions

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: ANSI C 63.4, 2003

3.1.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. 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 the distance of 3 m between the EUT and the receiving antenna.

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 test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. The Equipment Under Test (EUT) was set up on a non-conductive table in the anechoic chamber.

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. The Loop antenna HFH2-Z2 is used.

Step 1: pre measurement

- Anechoic chamber
- Antenna distance: 10m
- 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: 100 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

Measurement 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 μ s
- Turntable angle range: -180 to 180 $^{\circ}$
- Turntable step size: 90°
- Height variation range: 1 – 3m
- Height variation step size: 2m
- 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: 100ms
- Turntable angle range: -180 to 180 $^{\circ}$
- Turntable step size: 45°
- Height variation range: 1 – 4m
- Height variation step size: 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: 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 ± 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: 100ms
- Turntable angle range: -22.5° to $+ 22.5^{\circ}$ around the determined value
- Height variation range: -0.25m 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(< 1GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1s



3. Measurement above 1GHz

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 (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.

EMI receiver settings:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

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.

3.1.2 Test Requirements / 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)	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: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

3.1.3 Test Protocol

Temperature: 23 °C
 Air Pressure: 1008 hPa
 Humidity: 35 %

3.1.3.1 Measurement up to 30 MHz

Op. Mode	Setup	Port
op-mode 2	Setup_a01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
0°	-	-	-	-	-	-	-	-	-
90°	-	-	-	-	-	-	-	-	-

Remark: Because of the kind of EUT, especially the size, which is small related to the wavelength (1/100 lambda), no relevant emissions are expected in the frequency range 9 kHz to 30 MHz (theoretical not possible). Nevertheless a check using a near field probe was performed. No relevant emissions have been observed. Consequently no final measurement was performed.

3.1.3.2 Measurement above 30 MHz

Op. Mode	Setup	Port
op-mode 2	Setup_a01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak measured	AV calculated	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	315	-	80.97	70.53	-	95.6	75.6	5.07	25.07
	630	-	30.85	41.37	-	75.6	55.6	14.23	34.23
	945	-	51.81	40.06	-	75.6	55.6	15.54	35.54
	1260	-	41.31	30.87	-	75.6	55.6	34.29	24.73
	1575	-	52.95	42.51	-	74.0	54.0	21.05	11.49
	1890	-	53.32	42.88	-	75.6	55.6	22.28	12.72
	2205	-	49.31	38.87	-	74.0	54.0	24.69	15.13
	2520	-	51.14	40.70	-	75.6	55.6	24.46	14.90
	2835	-	55.90	45.46	-	74.0	54.0	18.10	8.54
3150	-	61.16	50.72	-	75.6	55.6	14.44	4.88	

Remark: No (further) spurious emissions in the range 20 dB below the limit found. The test was performed in the frequency range from 30MHz to 3.2GHz. For this test a EUT sending a CW signal was used, therefore only the peak detector was used during the measurement. The value listed above as calculated includes the correction factor of the test system and the duty cycle determines by the test "Dwell Time measurement to determine the duty cycle".

3.1.4 Test result: Spurious radiated emissions

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



3.2 Duty cycle measurement (based on dwell time measurement)

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: FCC §15.31,

3.2.1 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.

3.2.2 Test Limits

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

This test is also performed to determine the duty cycle of the transmitter and calculate the correction factor for pulse modulated transmitter. This factor is used as a correction factor for the field strength measurement.

Duty cycle = $((L1*N1) + (L2*N2) + (Ln*Ln)) / 100$ or T, whichever is less

Correction factor = $20 * \text{LOG}(\text{Duty cycle})$

3.2.3 Test Protocol

Temperature: 25 °C
 Air Pressure: 1023 hPa
 Humidity: 33 %

Op. Mode	Setup	Port
op-mode 1	Setup_b01	Enclosure

Step 1	sweep to determine the holdover time	Less then 5s
Step 2	sweep to determine the period length (T).	T=362ms
Step 3	100ms sweep. Cycle to determine the number of pulses (N1).	N1=83ms
Step 4	sweep of a data word to determine the on time for a data word (L1).	L2=0.362ms

3.2.4 Test result: Duty cycle / correction factor

$T > 100\text{ms} \Rightarrow T = 100\text{ms}$; $L1 = 0.362\text{ms}$; $N1 = 83$;

Duty cycle = $(83 * 0.362) / 100 = 0.300$

Correction factor = $20 * \text{LOG}(0.300) = -10.44\text{dB}$

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	This test has no result. It is performed to found the correction factor for the test spurious emissions radiated. As worst case the correction factor is set to -10.44dB



3.3 Peak power output

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: FCC §15.31

3.3.1 Test Description

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

The analyzer settings are the same like for the test spurious radiated emissions.

3.3.2 Test Limits

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

3.3.3 Test Protocol

Temperature: 23 °C
 Air Pressure: 1008 hPa
 Humidity: 35 %

Op. Mode	Setup	Port
op-mode 2	Setup_b01	Enclosure

Output power dBμV/m	Remarks
71.49	The Limit for 315 MHz devices is 75.6 dBμV/m for the field strength of the fundamental frequency

Remark: Please see annex for the measurement plot.

3.3.4 Test result: Peak power output

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



3.4 Occupied bandwidth

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: FCC §15.31

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 MHz 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: 1008 hPa

Humidity: 35 %

Op. Mode	Setup	Port
op-mode 1	Setup_b01	Enclosure

99% bandwidth kHz	20 dB bandwidth kHz	Remarks
20.1	8.3	The limit for 20 dB bandwidth is 315MHz * 0.25% = 787.5 kHz

Remark: Please see annex for the measurement plot.

3.4.4 Test result: Occupied bandwidth

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



4 Test Equipment

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

Test Equipment Anechoic Chamber

Lab ID:	Lab 1		
Manufacturer:	Frankonia		
Description:	Anechoic Chamber for radiated testing		
Type:	10.58x6.38x6		
	<i>Calibration Details</i>	<i>Last Execution</i>	<i>Next Exec.</i>
	IC renewal	2009/01/21	2011/01/20
	FCC renewal	2009/01/07	2011/01/06

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	none	Frankonia
	<i>Calibration Details</i>		<i>Last Execution</i>
	FCC listing 96716 3m Part15/18		2009/01/07
	ANSI C64.3 NSA		2009/01/21
Controller Innco 2000	CO 2000	CO2000/328/12470 406/L	Innco innovative constructions 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	AS 620 P		HD GmbH
Biconical dipole	VUBA 9117	9117108	Schwarzbeck
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2008/10/27 2013/10/26
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
	Path Calibration		2010/05/10 2010/11/09
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
	Path Calibration		2010/05/10 2010/11/09
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
	Path Calibration		2010/05/10 2010/11/09
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01- 2	Kabel Kusch
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
	Path Calibration		2010/05/10 2010/11/09
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02- 2	Rosenberger Micro-Coax
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
	Path Calibration		2010/05/10 2010/11/09
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		2009/04/16 2012/04/15
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		2009/04/28 2012/04/27
Dreheinheit	DE 325		HD GmbH
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
	Path Calibration		2010/05/10 2010/11/09
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
	Path Calibration		2010/05/10 2010/11/09
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration		2009/11/16	2010/05/15
	Path Calibration		2010/05/10	2010/11/09
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration		2009/05/27	2012/05/26
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	DKD calibration		2008/10/07	2011/10/06
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH	
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH	

Test Equipment Auxiliary Test Equipment

Lab ID: Lab 1, Lab 2
Manufacturer: see single devices
Description: Single Devices for various Test Equipment
Type: various
Serial Number: 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 01 (Multimeter)	Voltcraft M-3860M	IJ096055	Conrad Electronics	
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard calibration		2009/10/07	2011/10/06
Digital Oscilloscope [SA2] (Aux)	TDS 784C	B021311	Tektronix GmbH	
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>
	DKD calibration		2008/10/06	2011/10/05
Vector Signal Generator	SMIQ B3	832492/061		

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		2008/08/14 2011/08/13
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		2008/10/07 2010/10/06
Digital Radio Test Set	6103E	2359	Racal Instruments, Ltd.
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/02/16 2011/02/15
	<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		2007/07/16
	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 ---		
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		2008/12/01 2011/11/30
	<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		2007/01/02
	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 ---		
	SW: K62, K69		2008/11/03
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2008/10/28 2011/10/27

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	
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			2007/12/05	2010/12/04
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			2009/12/03	2011/12/02

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 Divider SMA	WA1515	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		Rosenberger Micro-Coax
Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m	FA210A0010003030	54491-2	Rosenberger Micro-Coax
Power Sensor	NRV-Z1	836219/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/10/20 2011/10/19
Powermeter	NRVS	836333/064	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/10/15 2011/10/14
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2008/06/18 2011/06/17
Rubidium Frequency Standard	Datum, Model: MFL	2689/001	Datum-Beverly
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/06/23 2010/06/22
Signal Generator	SMY02	829309/018	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	standard calibration		2008/10/07 2011/10/06
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		2007/02/27 2010/02/26
Spectrum Analyser	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	calibration		2008/10/02 2010/10/01
Temperature Chamber Vötsch 05	VT 4002	58566080550010	Vötsch
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Specific calibration		2009/03/12 2010/03/11
	Specific calibration		2010/03/16 2011/03/15

Single Devices for Radio Lab Test Equipment (continued)

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
Vector Signal Generator	SMIQ 03B	837747/020	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard/DKD Calibration		2008/10/09	2011/10/08

5 Photo Report

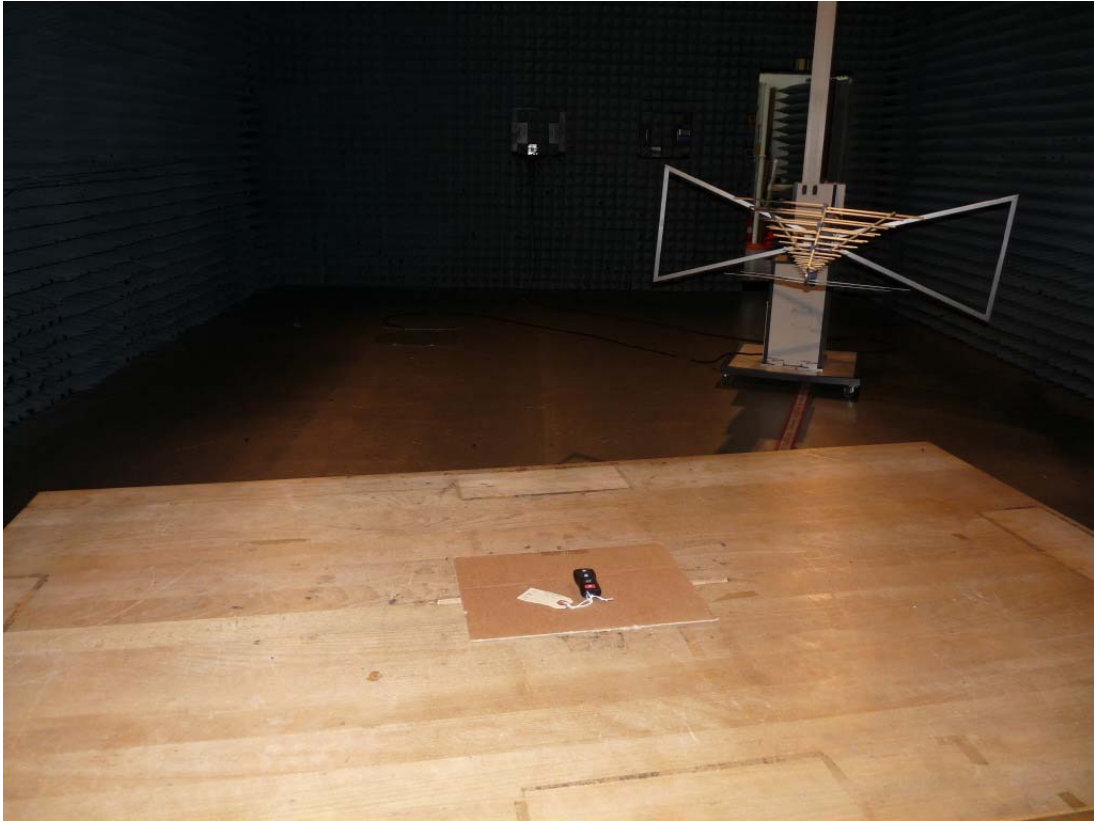


Photo 1: Test setup for radiated measurements below 1GHz

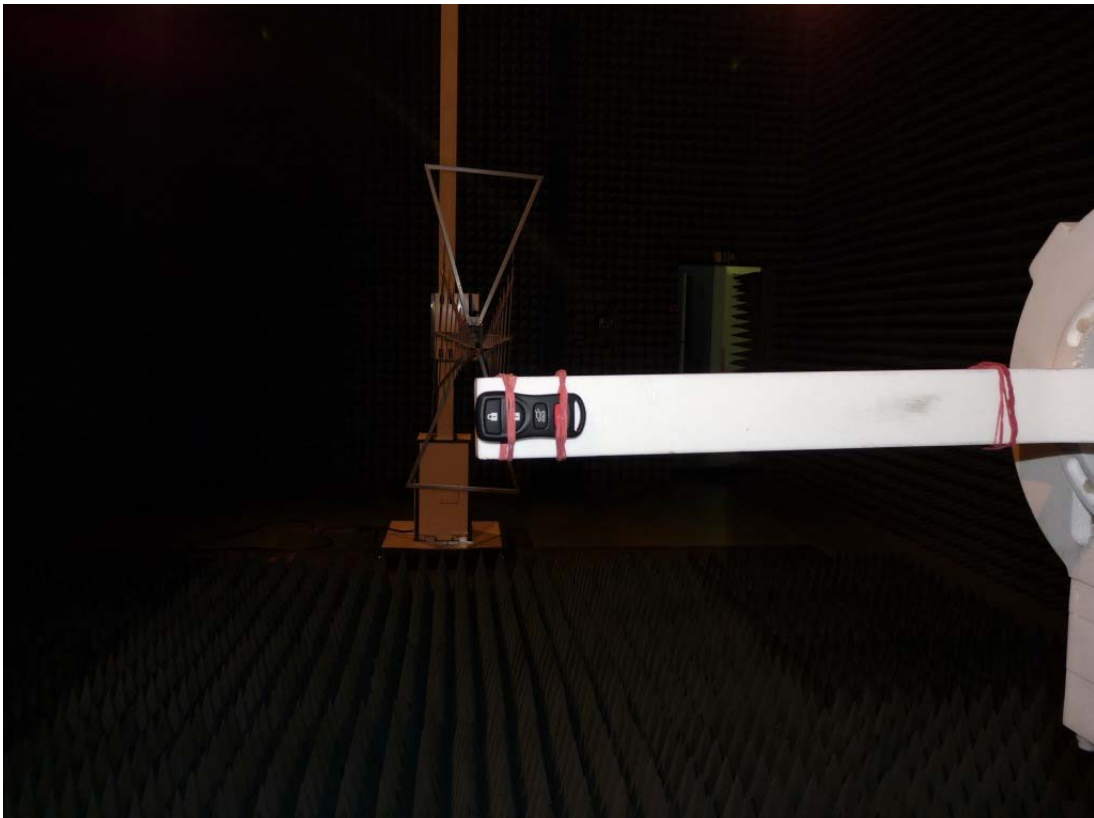


Photo 2: Test setup for radiated measurements above 1GHz



Photo 3: EUT (enclosure open, bottom and top outside view)



Photo 4: EUT (enclosure open, bottom and top, inside view)

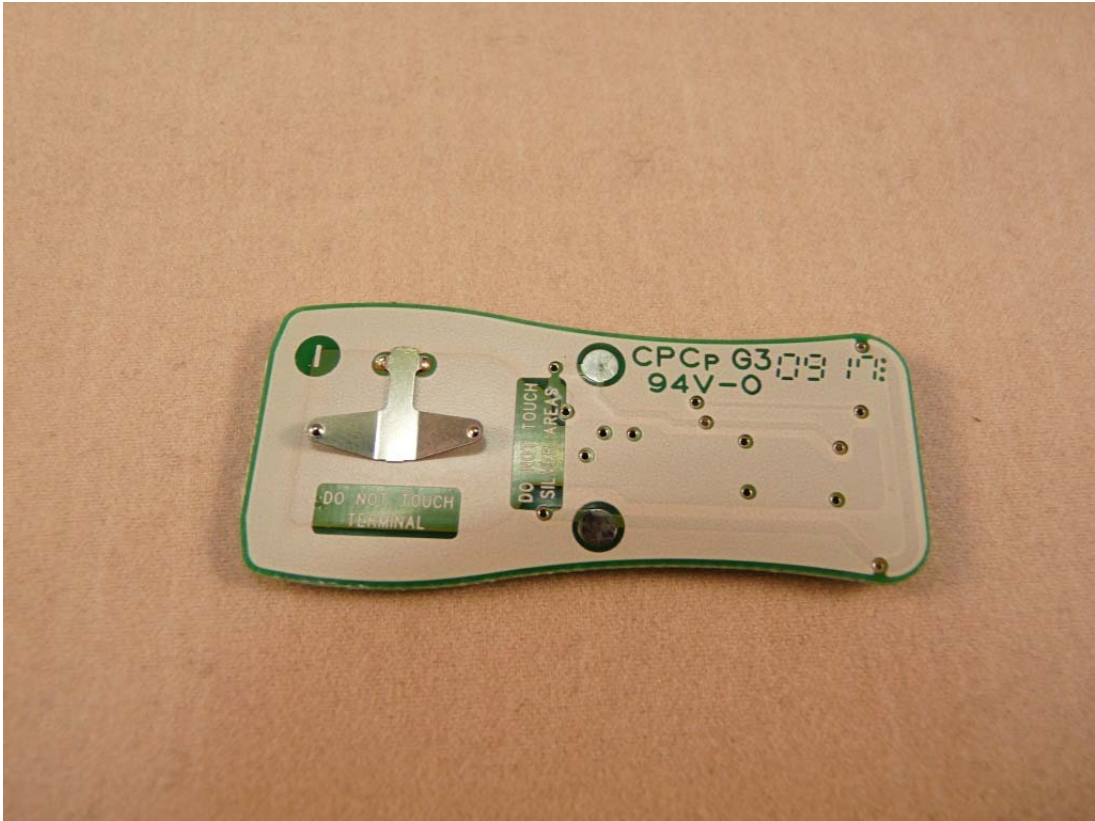


Photo 5: PCB (bottom side)

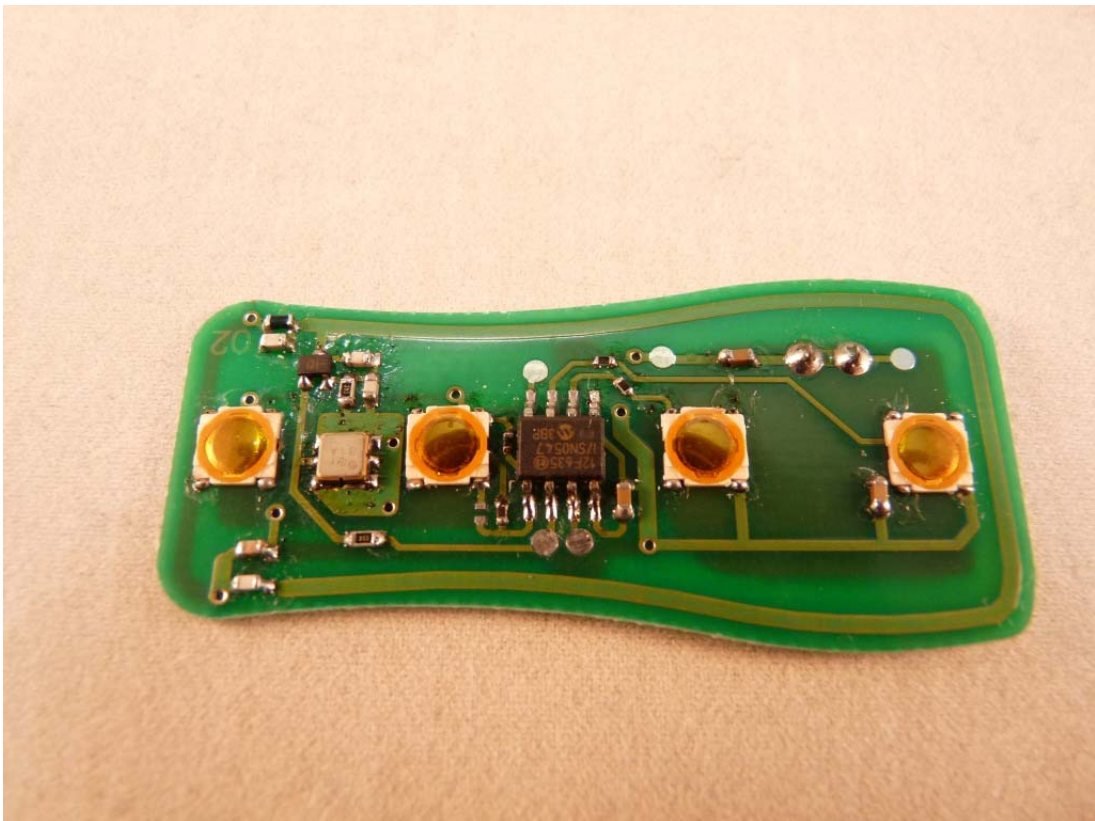
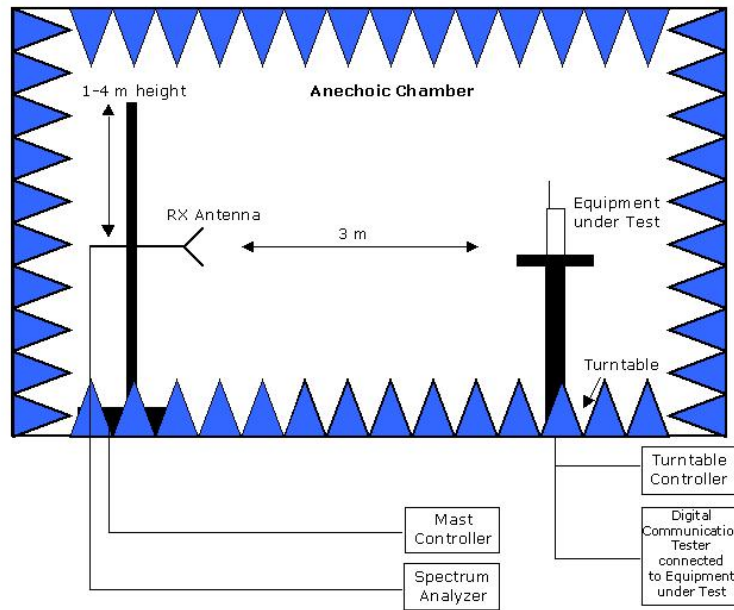


Photo 6: PCB (top side)

6 Setup Drawings



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

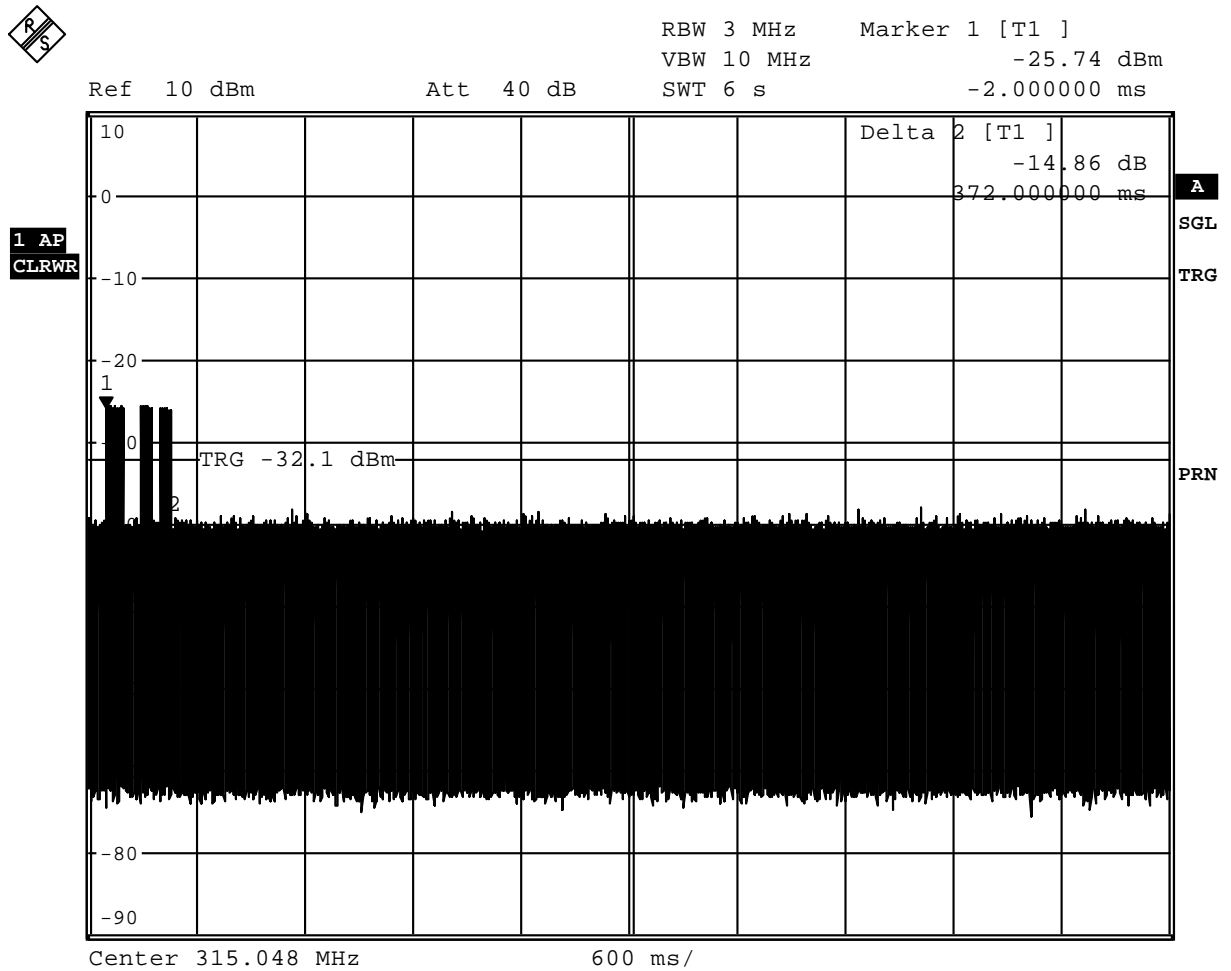
Drawing 1: Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.

7 Annex measurement plots

7.1 Duty cycle measurement (based on dwell time measurement)

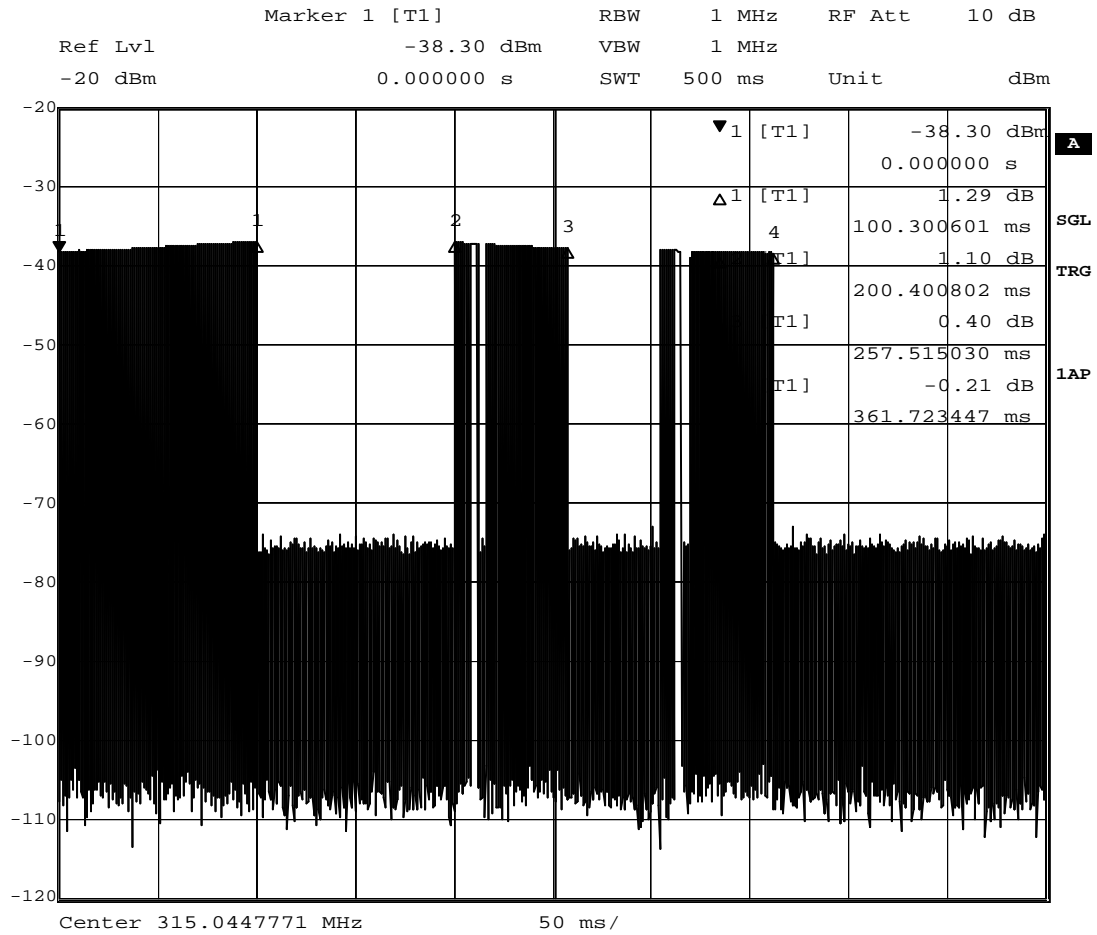
Op. Mode

Op-mode 1



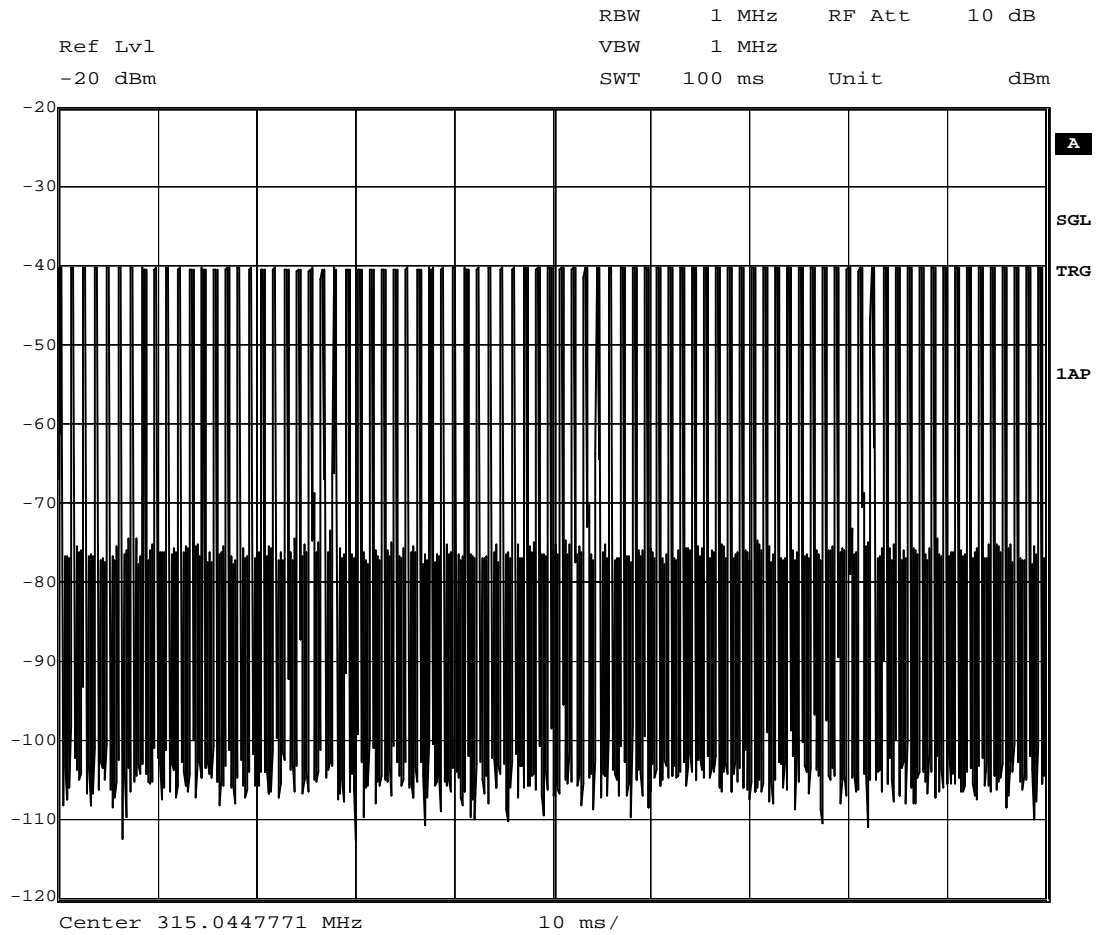
Date: 10.FEB.2010 08:41:13

Step 1: sweep to determine the holdover time.



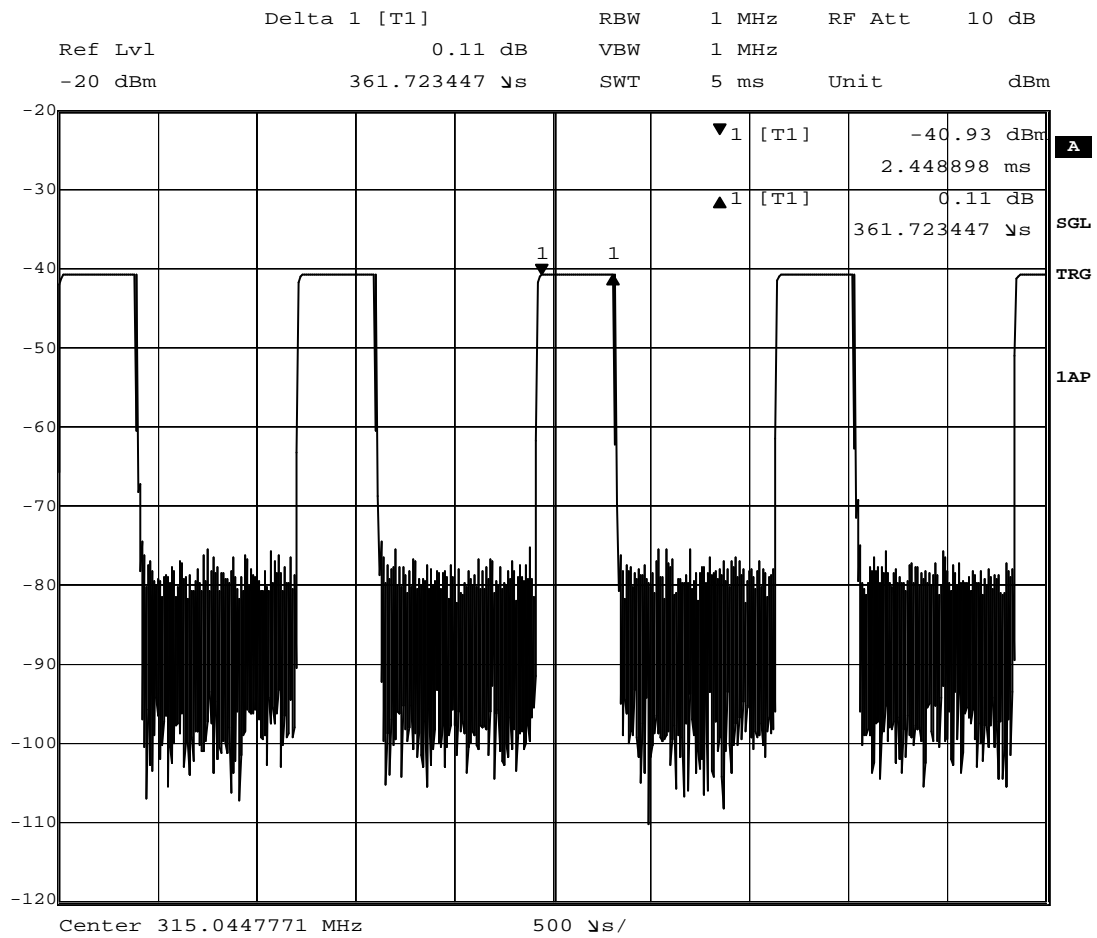
Date: 20.MAY.2010 04:50:03

Step 2: sweep to determine the period length.



Date: 20.MAY.2010 05:19:25

Step 3: 100ms sweep. Cycle to determine the number of pulses (N1).



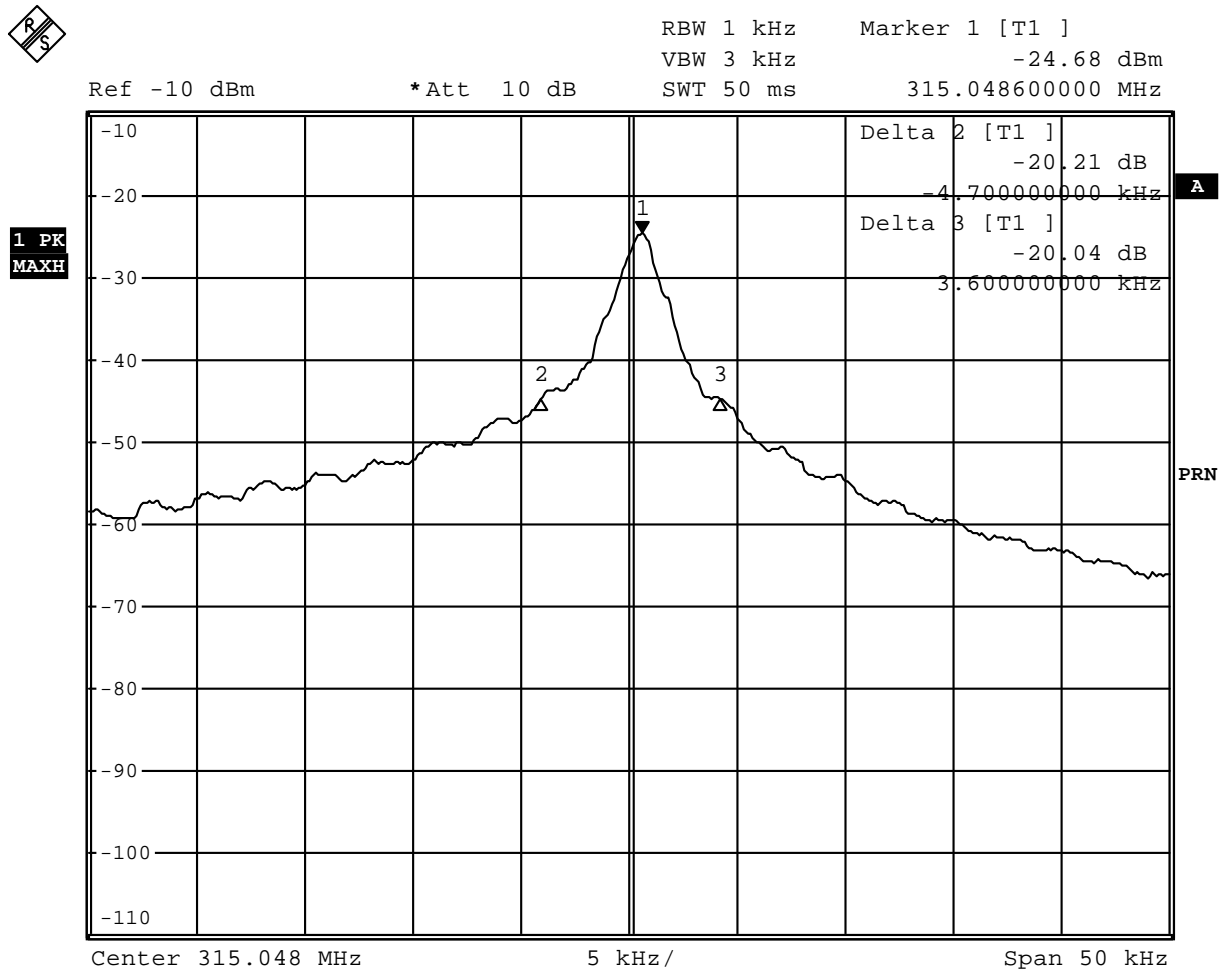
Date: 20.MAY.2010 05:16:22

Step 4: sweep of a data word to determine the on time for a data word (L1).

7.2 Occupied bandwidth

7.2.1 Occupied bandwidth operating mode 1

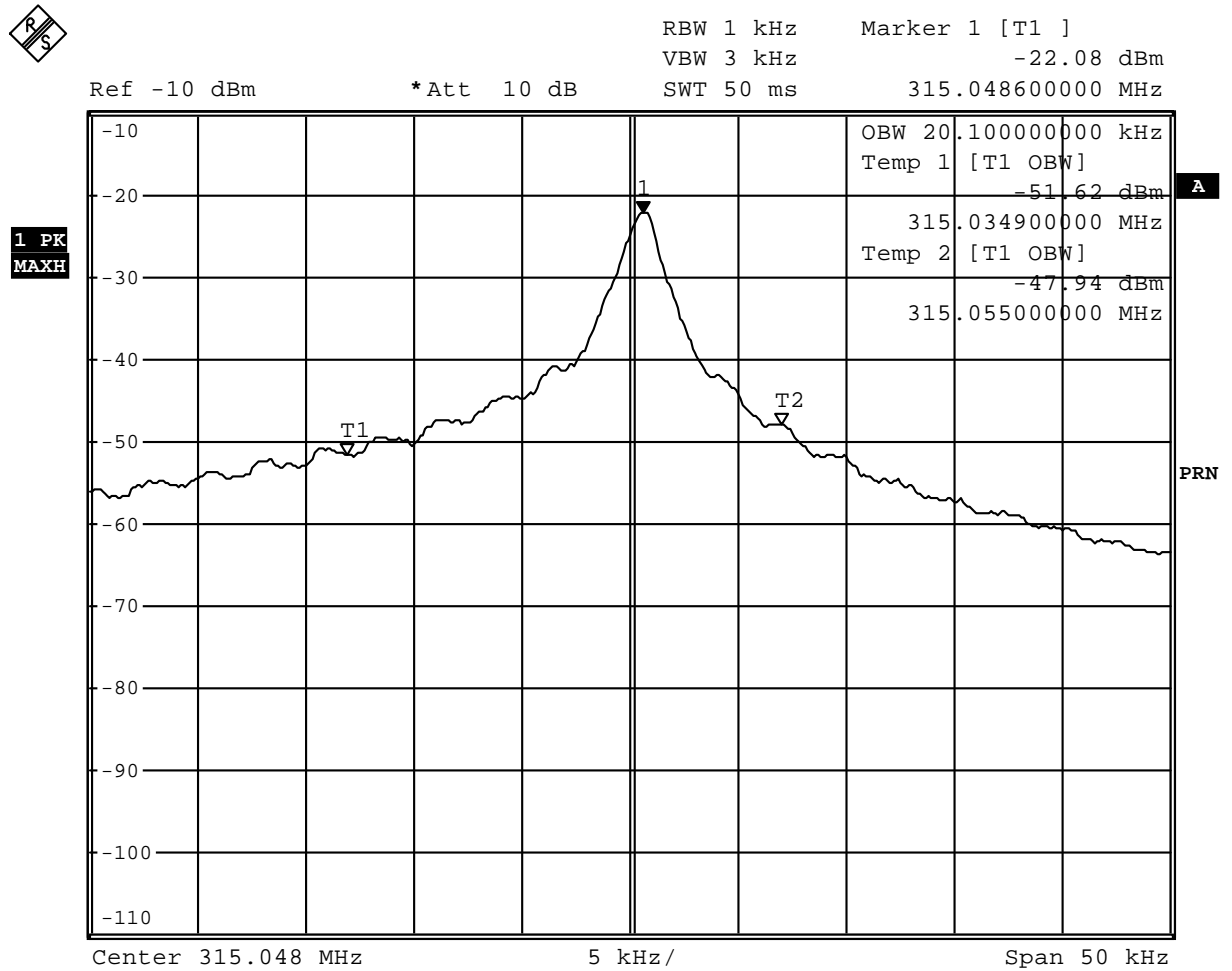
Op. Mode 20 dB bandwidth
op-mode 1



Date: 10.FEB.2010 09:29:45



Op. Mode 99% bandwidth
op-mode 1



Date: 10.FEB.2010 09:31:14