



Inter**Lab**[®]

FCC Measurement/Technical Report on

Vehicle remote keyless entry transmitter
Ford IKEY

Report Reference: MDE_ALPS_0602_FCCa

Test Laboratory:

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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 (10-1-06 Edition) and 15 (10-1-06 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.

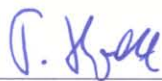
0.2 Measurement Summary

| FCC Part 15, Subpart C | | | § 15.231 |
|--|--------------|-------------|---------------------|
| Spurious Radiated Emissions | | | |
| The measurement was performed according to ANSI C63.4 | | | |
| OP-Mode | Setup | Port | Final Result |
| op-mode 2 | setup_b01 | Enclosure | 2003 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 | | | |
| OP-Mode | Setup | Port | Final Result |
| op-mode 1 | setup_a01 | Enclosure | 10-1-06 - |
| FCC Part 15, Subpart C | | | § 15.231 |
| Peak power output | | | |
| The measurement was performed according to FCC § 15.31 | | | |
| OP-Mode | Setup | Port | Final Result |
| op-mode 2 | setup_b01 | Enclosure | 10-1-06 passed |
| FCC Part 15, Subpart C | | | § 15.231 |
| Occupied Bandwidth | | | |
| The measurement was performed according to FCC § 15.31 | | | |
| OP-Mode | Setup | Port | Final Result |
| op-mode 1 | setup_a01 | Enclosure | 10-1-06 passed |



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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. DAT-P-192/99-01

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka
Dipl.-Ing. Robert Machulec
Dipl.-Ing. Thomas Hoell

Report Template Version: 2006-12-18

1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Andreas Petz
Date of Test(s): 2007-02-08 to 2007-03-09
Date of Report: 2007-03-20

1.3 Applicant Data

Company Name: Alps Automotive, Inc.
Address: 1500 Atlantic Boulevard
Auburn Hills, Michigan 48326
USA
Contact Person: Mr. Joseph Keller

1.4 Manufacturer Data

Company Name: please see applicant data

Address:

Contact Person:



2 Product labelling

2.1 FCC ID label

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

2.2 Location of the label on the EUT

see above



3 Test object Data

3.1 General EUT Description

| | |
|-----------------------------|--|
| Equipment under Test | Vehicle remote keyless entry transmitter |
| Type Designation: | Ford IKEY |
| 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



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 (Code: 1H019b01) | vehicle remote keyless entry transmitter | Ford IKEY | - | 2.0 | 2.0 | 2007-02-02 |
| Remark: EUT A is equipped with an integral antenna. | | | | | | |
| EUT B (Code: 1H019e04) | vehicle remote keyless entry transmitter | Ford IKEY | - | 3.0 | 2.0 | 2007-03-04 |
| Remark: EUT B is equipped with an integral antenna. | | | | | | |

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 |
|-------------------|----------------------|------------------|-----------|-----------|------------|--------|
| - | - | - | - | - | - | - |

3.4 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 besides rad. (spurious) emissions |
| Setup_b01 | EUT B | setup for radiated (spurious) emissions measurements |

3.5 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 | continuous operation | Transmitter is sending a CW signal continuously. Special op-mode for test purpose only. |

4 Test Results

4.1 Spurious radiated emissions

Standard FCC Part 15, 10-1-06
Subpart C

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

4.1.1 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 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 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 the turntable azimuth and antenna height, which was determined in step 3, 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 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.

- 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 value determined in step 2
- Height variation range: -0.25m to $+ 0.25$ m around the value determined in step 2

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



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
- RBW = VBW = 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.

4.1.2 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)

4.1.3 Test Protocol

Temperature: 21..23 °C
 Air Pressure: 1013..1025 hPa
 Humidity: 32..38 %

4.1.3.1 Measurement up to 30 MHz

| Op. Mode | Setup | Port |
|-----------|-----------|-----------|
| op-mode 2 | setup_b01 | 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: No (further) spurious emissions within restricted bands in the range 20 dB below the limit found therefore step 2 was not performed.
 The found peak at 91.2 kHz is emission from loop antenna power supply.

4.1.3.2 Measurement above 30 MHz

| Op. Mode | Setup | Port |
|-----------|-----------|-----------|
| op-mode 2 | setup_b01 | 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 |
| Vertical + horizontal | 315 | 67.1 | | | 75.6 | | | 8.5 | |
| | 1260 | | 58.3 | 45.5 | | 75.6 | 55.6 | 17.3 | 10.1 |
| | 1575 | | 66.5 | 53.7 | | 74 | 54.0 | 7.5 | 0.3 |
| | 1890 | | | 39.9 | | | 55.6 | | 15.7 |
| | 2205 | | | 39.1 | | | 54.0 | | 14.9 |
| | 2520 | | | 38.4 | | | 55.6 | | 17.2 |
| | 2835 | | 55.6 | 42.7 | | 74.0 | 54.0 | 18.4 | 11.3 |
| | 3150 | | | 37.6 | | | 55.6 | | 18.0 |

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 3.2 GHz. For this test the EUT sending a CW signal was used. The values listed above include the correction factor of the test system and the duty cycle determined by the test "Dwell Time measurement to determine the duty cycle".

4.1.4 Test result: Spurious radiated emissions

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



4.2 Duty cycle measurement (based on dwell time measurement)

Standard FCC Part 15, 10-1-06
Subpart C

The test was performed according to: FCC §15.31, 10-1-06

4.2.1 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.

4.2.2 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 = $((L1*N1) + (L2*N2) + \dots + (Ln*NN)) / 100$ or T, whichever is less

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

4.2.3 Test Protocol

Temperature: 21 °C
Air Pressure: 996 hPa
Humidity: 41 %

| Op. Mode | Setup | Port |
|-----------|-----------|-----------|
| op-mode 1 | setup_a01 | Enclosure |

| | | |
|--------|---|----------------------------|
| 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=0.512 ms L2=0.252 ms |
| Step 4 | determine the number of pulses (N1..NN) | N1=23 N2=44 |

4.2.4 Test result: Duty cycle / correction factor

T=100ms; L1=0.512ms; L2=0.252ms; N1=23; N2=44;

Duty cycle = $((23*0.512\text{ms}) + (44*0.252\text{ms})) / 100 = 0.2286$ ms

Correction factor = $20 * \text{LOG}(0.2286) = -12.82$ dB

| FCC Part 15, Subpart C | Op. Mode | Result |
|------------------------|-----------|--|
| | op-mode 1 | This test has no result. It is performed to find the correction factor for the test spurious emissions radiated. |



4.3 Peak power output

Standard FCC Part 15, 10-1-06
Subpart C

The test was performed according to: FCC §15.31, 10-1-06

4.3.1 Test Description

The result is obtained during the test "Spurious radiated emissions".

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

4.3.3 Test Protocol

Temperature: 23 °C
Air Pressure: 1025 hPa
Humidity: 38 %

| Op. Mode | Setup | Port |
|-----------|-----------|-----------|
| op-mode 2 | setup_b01 | Enclosure |

| Output power dB μ V/m | Remarks |
|------------------------------|--|
| 67.1 | The Limit for 315 MHz devices is 75.6 dB μ V/m for the field strength of the fundamental frequency |

Remark: Please see annex for the measurement plot.

4.3.4 Test result: Peak power output

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



4.4 Occupied bandwidth

Standard FCC Part 15, 10-1-06
Subpart C

The test was performed according to: FCC §15.31, 10-1-06

4.4.1 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.

4.4.2 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

4.4.3 Test Protocol

Temperature: 21 °C

Air Pressure: 996 hPa

Humidity: 41 %

| Op. Mode | Setup | Port |
|-----------|-----------|-----------|
| op-mode 1 | setup_a01 | Enclosure |

| 99% bandwidth kHz | 20 dB bandwidth kHz | Remarks |
|----------------------|------------------------|--|
| 40.8 | 17.4 | The limit for 20 dB bandwidth is 315MHz * 0.25% = 787.5 kHz |

Remark: Please see annex for the measurement plot.

4.4.4 Test result: Occupied bandwidth

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

5 Test Equipment

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 | 849785 | Miteq |
| Broadband Amplifier 30MHz-18GHz | JS4-00101800-35 | 896037 | Miteq |
| Broadband Amplifier 45MHz-27GHz | JS4-00102600-42 | 619368 | 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-Microcoax |
| Double-ridged horn | HF 906 | 357357/002 | Rohde & Schwarz |
| Double-ridged horn | HF 906 | 357357/001 | Rohde & Schwarz |
| High Pass Filter | 5HC3500/12750-1.2-KK | 200035008 | Trilithic |
| High Pass Filter | 5HC2700/12750-1.5-KK | 9942012 | Trilithic |
| High Pass Filter | 4HC1600/12750-1.5-KK | 9942011 | 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

| Equipment | Type | Serial No. | Manufacturer |
|---------------------|----------|---------------|-----------------|
| 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

| Equipment | Type | Serial No. | Manufacturer |
|--|----------------------|----------------|--------------------------------------|
| 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 | WRCA800/960-6E | 24 | Wainwright |
| Spectrum Analyzer 9 kHz to 3 GHz | FSP3 | 838164/004 | Rohde & Schwarz |
| Temperature Chamber | VT 4002 | 58566002150010 | Vötsch |
| Temperature Chamber | KWP 120/70 | 59226012190010 | Weiss |
| ThermoHygro Datalogger 03 | Opus10 THI (8152.00) | 7482 | Lufft Mess- und Regeltechnik GmbH |

Anechoic Chamber

| Equipment | Type | Serial No. | Manufacturer |
|--------------------------------------|----------------|---------------------------|--|
| Air Compressor (pneumatic) | | | Atlas Copco |
| Controller | CO 2000 | CO2000/328/12470406 /L | Innco innovative constructions GmbH |
| 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

| Equipment | Type | Serial No. | Manufacturer |
|---|------------------|-------------------|---------------------|
| 10 MHz 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 Analyzer FS1Q26 832695/007 | FS1Q26 | 832695/007 | 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 Photo Report



Photo 1: Test setup for radiated measurements

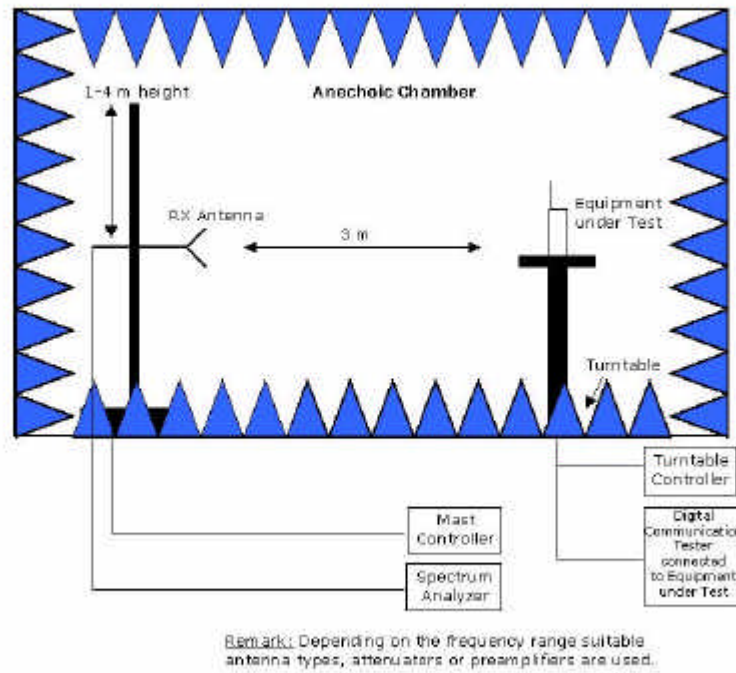


Photo 2: EUT A + B (front side)



Photo 3: EUT A + B (rear side)

7 Setup Drawings



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

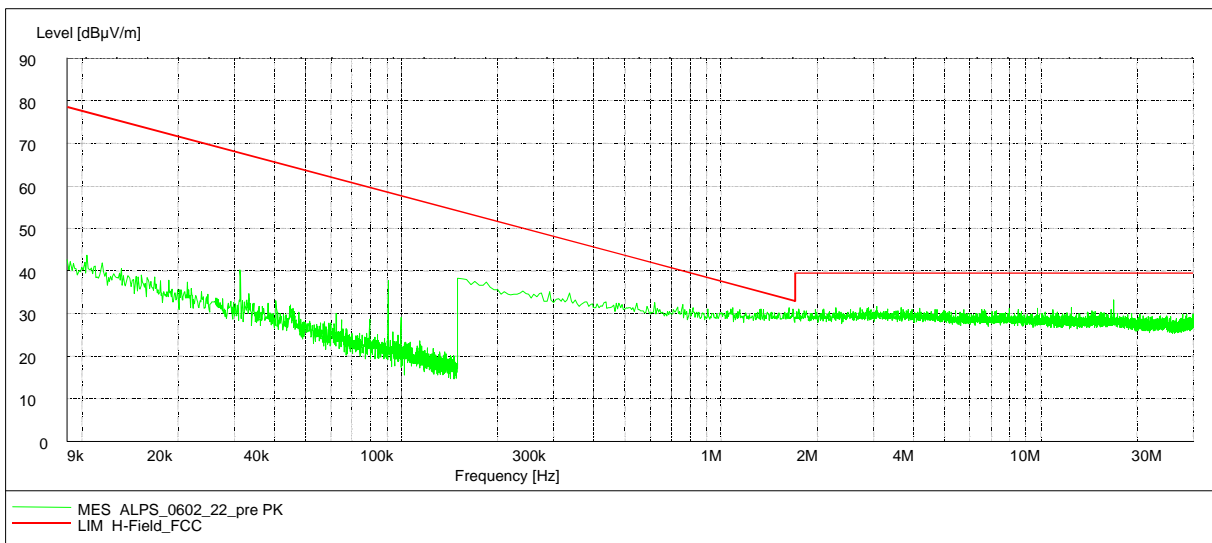
8 Annex measurement plots

8.1 Radiated emissions (f<30MHz)

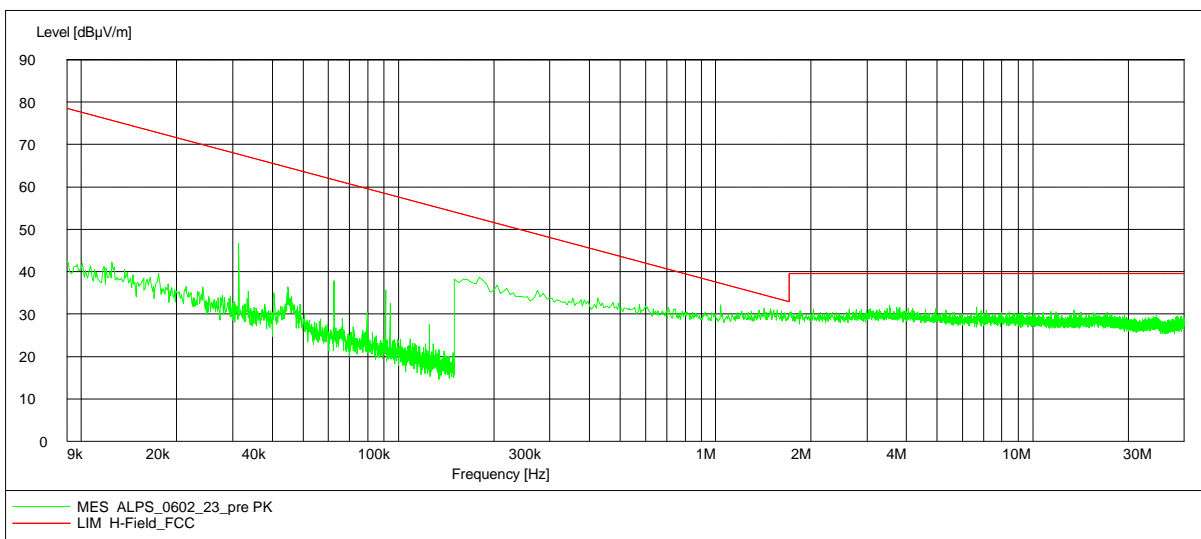
Op. Mode

op-mode 2

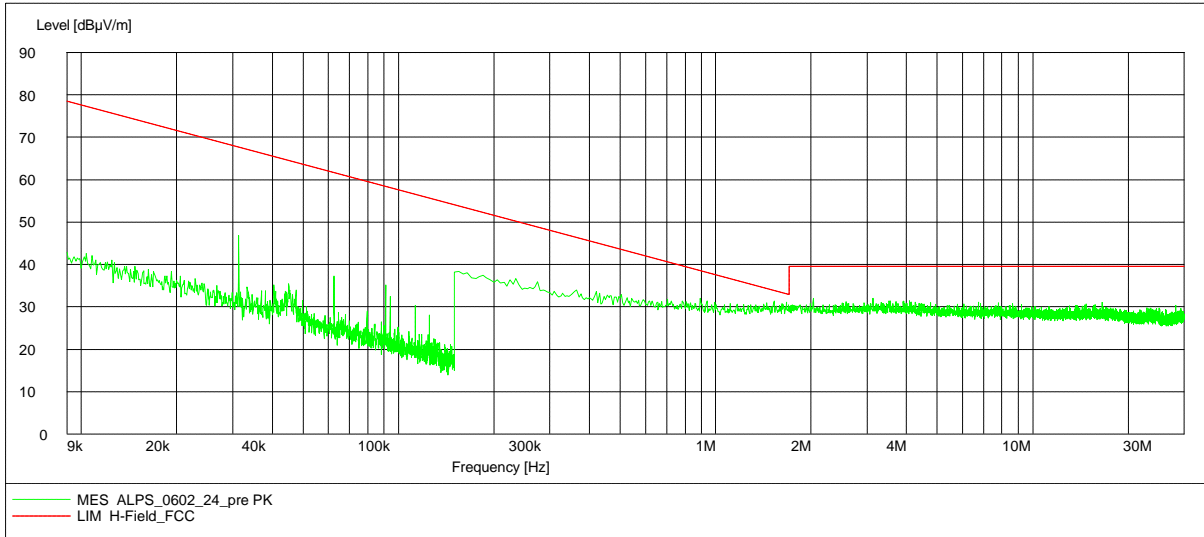
Antenna position 90°
EUT position front side



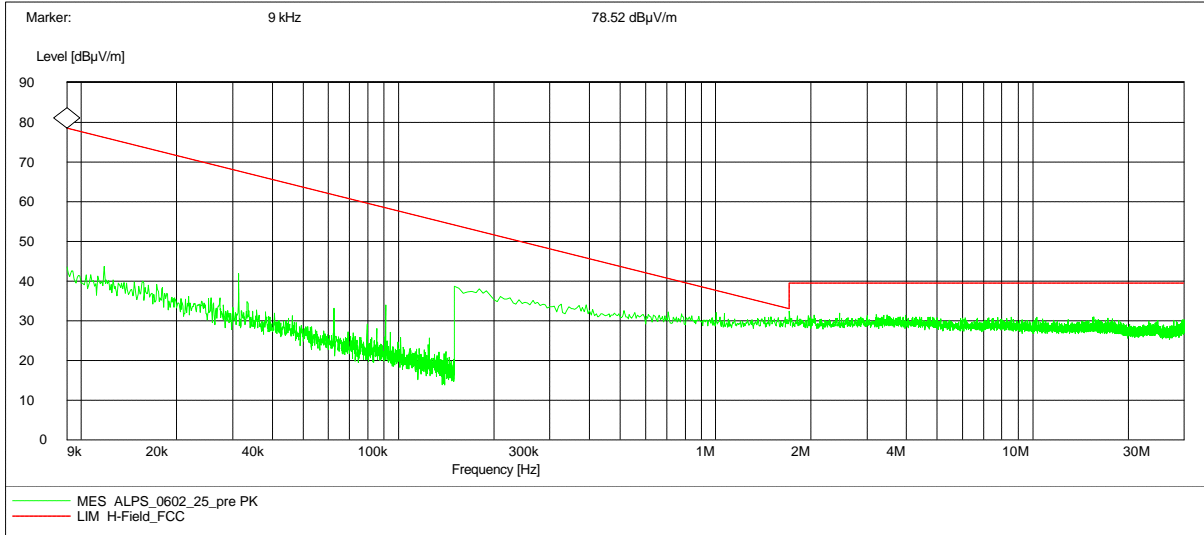
Antenna position 90°
EUT position left side



Antenna position 0°
EUT position front side



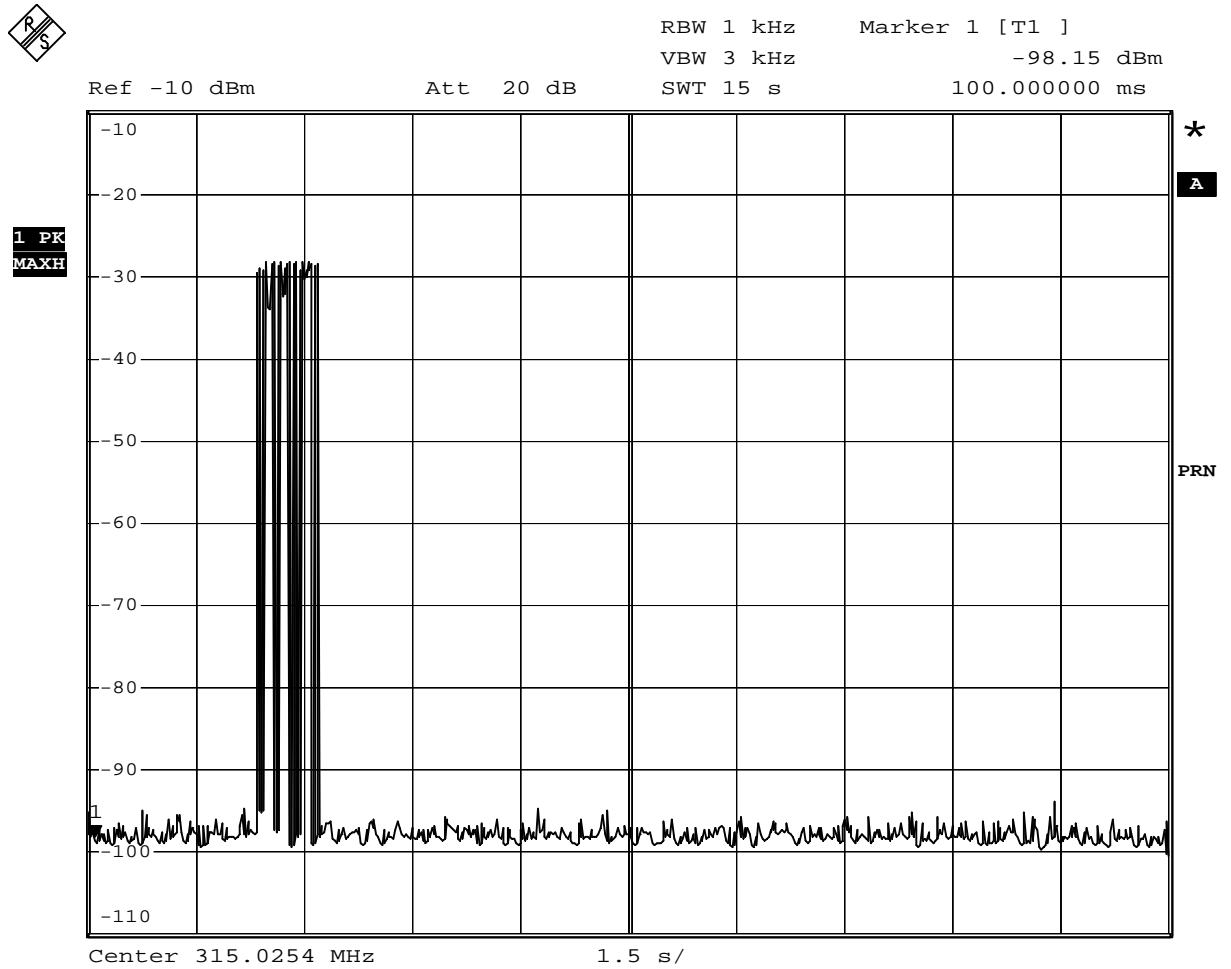
Antenna position 0°
EUT position left side



8.2 Duty cycle measurement (based on dwell time measurement)

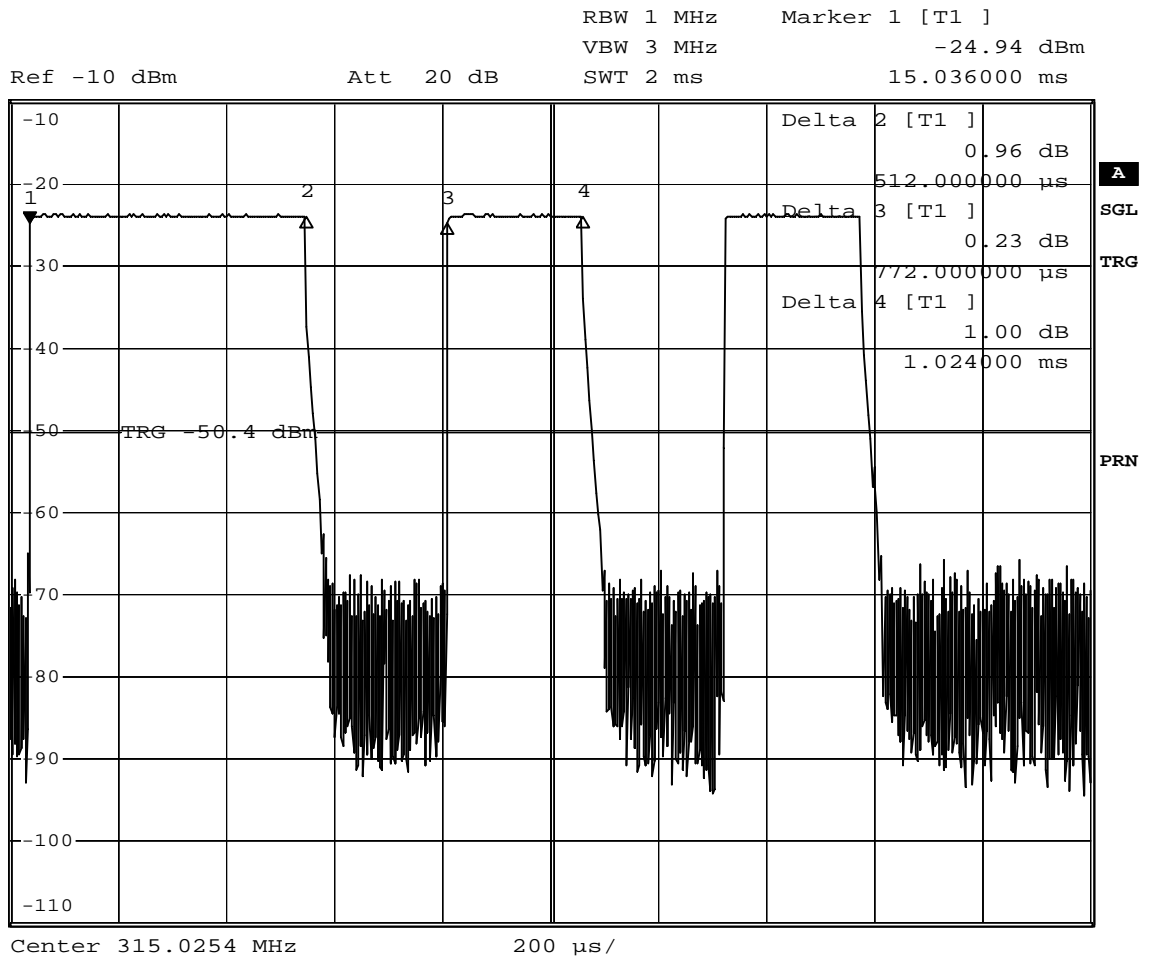
Op. Mode

op-mode 1



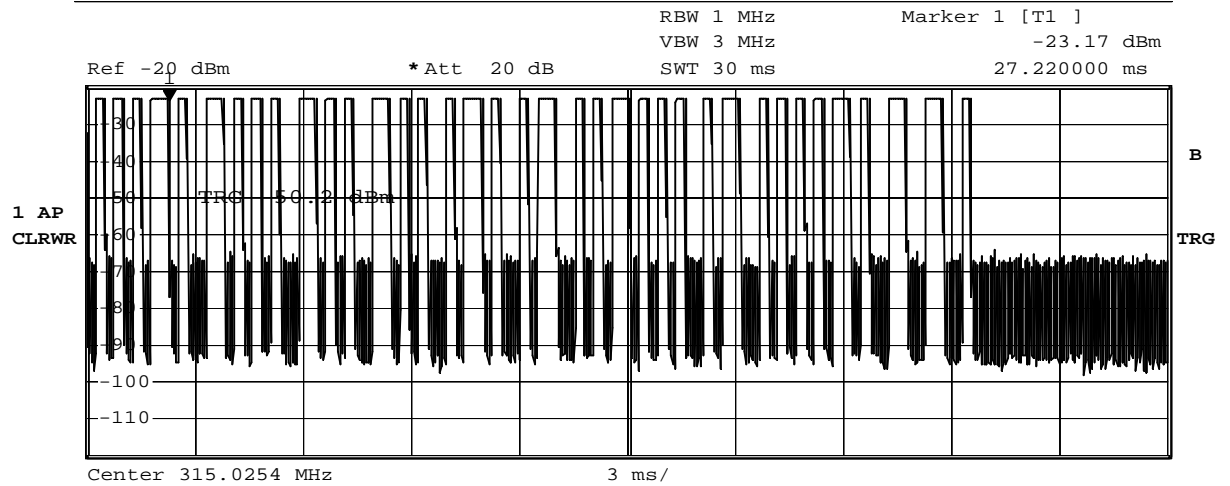
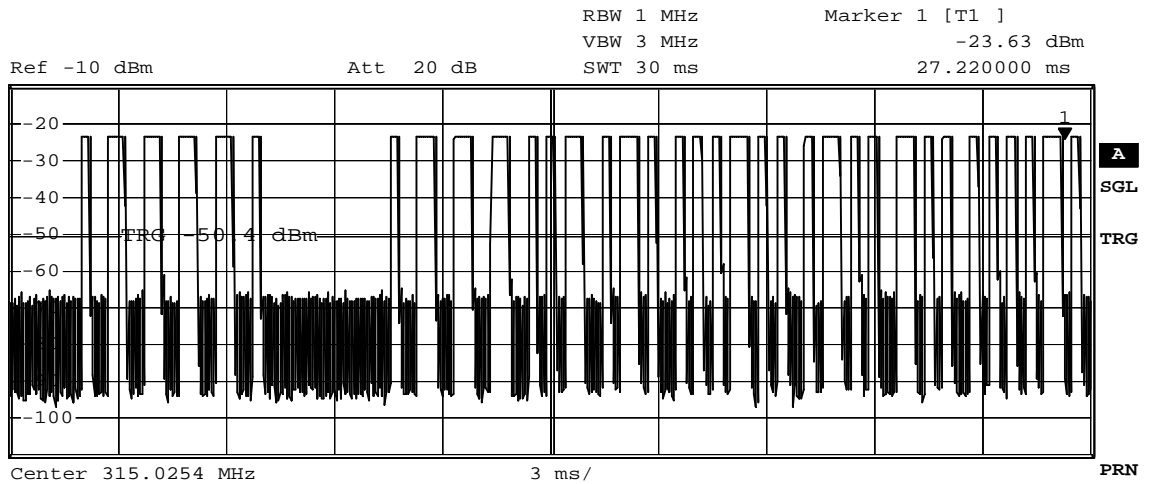
Date: 8.FEB.2007 13:23:00

Step 1: holdover time.



Date: 8.FEB.2007 13:46:09

Step 2: sweep of a data word to determine the on time within a data word (L1 to LN).



Date: 8.FEB.2007 13:35:13

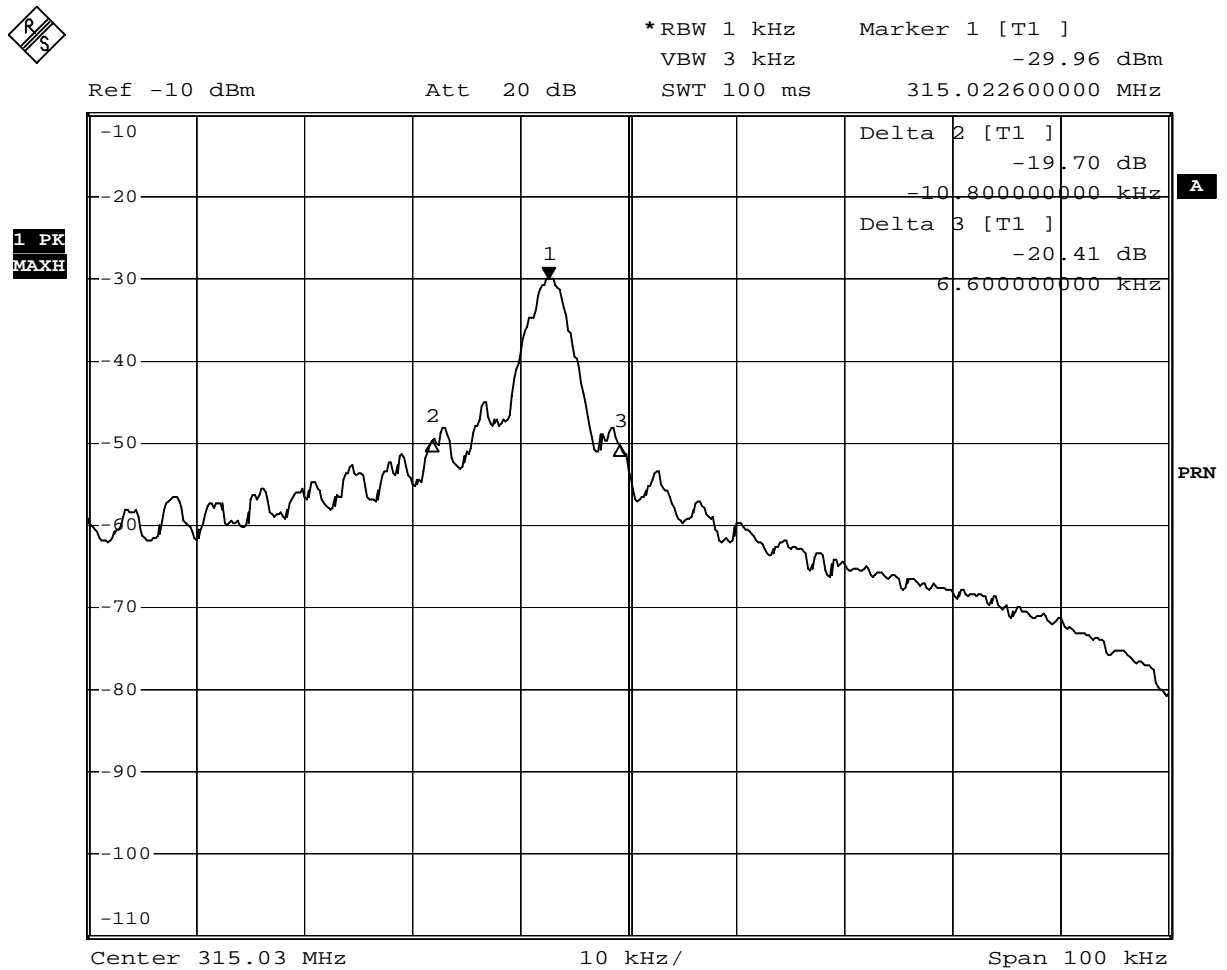
Step 3: determine the number of pulses (N1-NN).



8.3 Occupied bandwidth

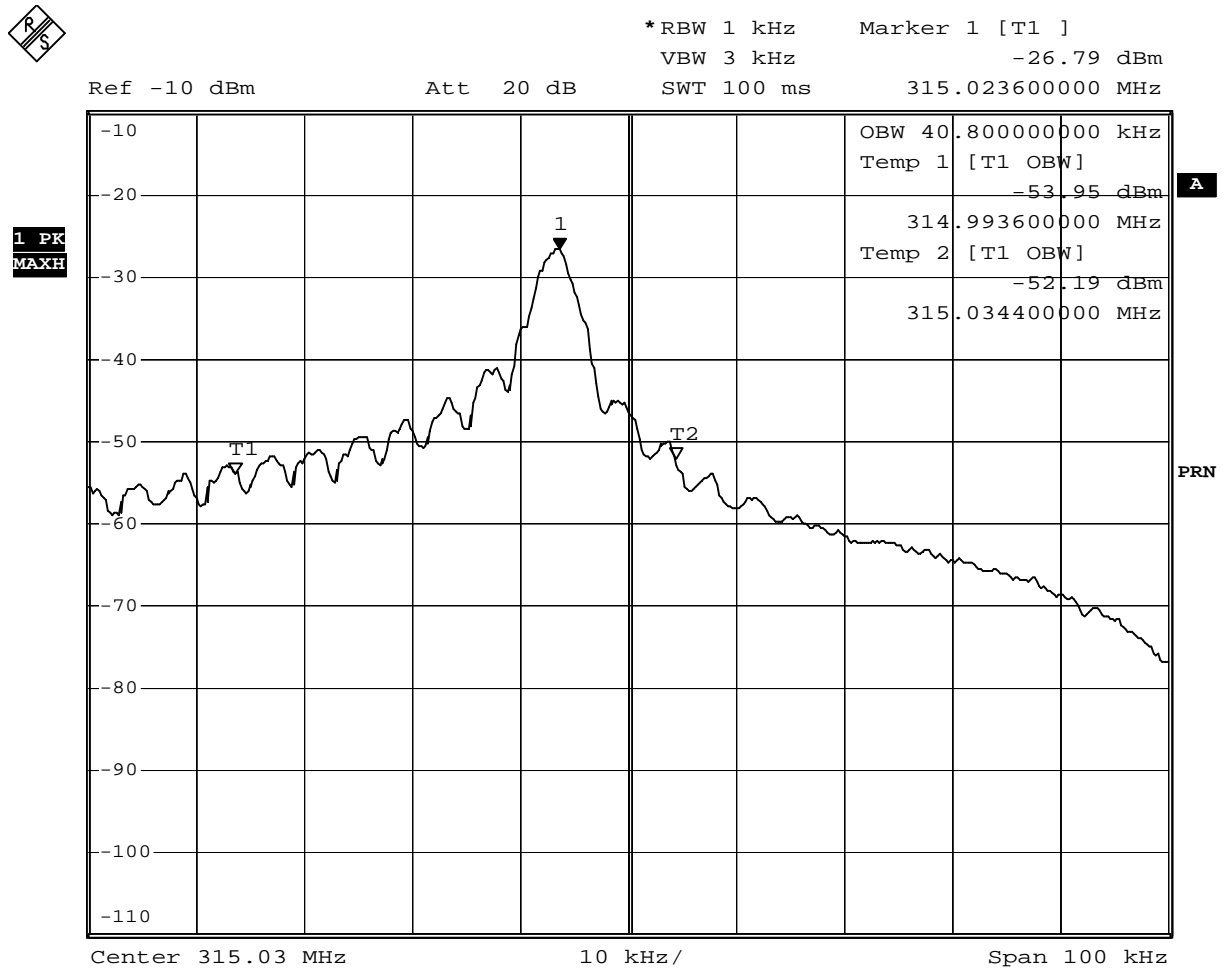
8.3.1 Occupied bandwidth operating mode 1

Op. Mode 20 dB bandwidth
op-mode 1



Date: 8.FEB.2007 13:16:56

Op. Mode 99% bandwidth
op-mode 1



Date: 8.FEB.2007 13:20:26