



Inter**Lab**[®]

FCC Measurement/Technical Report on

Door Control System Scania DCS

Report Reference: MDE_BROSE_1401_FCCa

FCC ID: 2AHV8-C31859

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 test 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

Edition of FCC Rules: October 1, 2014

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:
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 § 15.207

Conducted emissions (AC power line)

The measurement was performed according to ANSI C63.10

OP-Mode	Setup	Port	2013 Final Result
		AC Port (power line)	N/A

FCC Part 15, Subpart C § 15.231

Duty cycle measurement (based on dwell time measurement)

The measurement was performed according to ANSI C63.10

OP-Mode	Setup	Port	2013 Final Result
op-mode 2	Setup_02	Enclosure	passed

FCC Part 15, Subpart C § 15.231

Spurious Radiated Emissions

The measurement was performed according to ANSI C63.10

OP-Mode	Setup	Port	2013 Final Result
op-mode 1	Setup_01	Enclosure	passed

FCC Part 15, Subpart C § 15.231

Maximum radiated field strength at fundamental frequency

The measurement was performed according to ANSI C63.10

OP-Mode	Setup	Port	2013 Final Result
op-mode 1	Setup_01	Enclosure	passed

FCC Part 15, Subpart C § 15.231

Occupied Bandwidth

The measurement was performed according to ANSI C63.10

OP-Mode	Setup	Port	2013 Final Result
op-mode 1	Setup_01	Enclosure	passed

N/A not applicable (the EUT is powered by DC vehicle lead-acid battery)

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: 2014-04-02

1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Dobrin Dobrinov
Date of Test(s): 2016-02-10 to 2016-02-19
Date of Report: 2016-07-25

1.3 Applicant Data

Company Name: Brose Fahrzeugteile GmbH & Co.
Kommanditgesellschaft, Bamberg
Address: Berliner Ring 1
D-96052 Bamberg
Germany
Contact Person: Mr. Christoph Hausner

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	Door Control System
Type Designation:	Scania DCS
Kind of Device:	433.92 MHz transceiver
(optional)	
Voltage Type:	DC vehicle lead-acid battery
Voltage level:	24.0 V
Repeated Operation:	Automatic
The EUT is part of a security or safety system:	No

General product description:

The Equipment Under Test (EUT) is a transceiver for non-periodic operation in the band above 70 MHz. The operating frequency is in the 433 MHz ISM band.

Specific product description for the EUT:

The main functionality of the DCS is to handle the electrical functions (e.g. window regulator, mirrors, latches etc.) in the doors and the wireless communication with the remote control key fob to open and close the vehicle.

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: DE11 70000ac01)	Door Control System	Scania DCS	90022	HW ASSY: 2486735 2306116	Main-µC: C2_swr1_2_ patch004, Sub-µC: main_1.0_23	-

Remark: EUT A is equipped with an integral antenna (gain = -12.2 dBi).

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
AE 1	Cable Harness	-	-	-	-	-

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	HW Status	SW Status	Serial no.	FCC ID
AUX 1	Loadbox	Scania DCS Light	A131331.1	-	Nr. 09	-
AUX 2	Remote Keyless entry Transceiver	SCANIA 900273	1R14	-	1315418D	-



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 + AE 1	Setup for radiated measurements
Setup_02	EUT A + AE 1+ AUX1 + AUX 2	Setup for Duty Cycle measurements

2.6 Operating Modes

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

Op. Mode	Description of Operating Modes	Remarks
op-mode 1	Continuous modulated	Transmitter sends continuously modulated signal
op-mode 2	Single pulse	Transmitter sends single pulse after a key fob interrogation

Remark: The special test software provided by applicant was used.

2.7 Product labelling

2.7.1 FCC ID label

2AHV-C31859

2.7.2 IC ID Label

-

2.7.3 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 Maximum radiated field strength at fundamental frequency.



3.1.3 Test Protocol

Temperature: 23 °C
Air Pressure: 1009 hPa
Humidity: 38 %

Op. Mode	Setup	Port
op-mode 2	Setup_02	Enclosure

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

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

Step 1	Holdover time	Less than 5s
Step 2	Cycle to determine the on/off ratio within a cycle (period T)	24.6 ms
Step 3	Sweep of a data word to determine the on time within a data word (L1-LN).	L1 = 24.6 ms

Calculation of Duty Cycle / Correction Factor:

If $T > 100 \text{ ms} \Rightarrow T = 100 \text{ ms}$; $L1 = 24.6 \text{ ms}$; $N1 = 1$;

In 100 ms $T_{\text{on}} = 1 \cdot 24.6 \text{ ms} = 24.6 \text{ ms}$

Duty cycle = $24.6 / 100 = 0.246$

Correction factor = $20 \cdot \text{LOG}(0.246) = -12.2 \text{ dB}$

b) Determine the period of periodic re-transmission, if any, or cease (deactivation) time:

No period of retransmission found

Deactivation after **$T_c = 0.024 \text{ s}$** , **Limit: $\leq 5 \text{ s}$**

c) Determine the total duration of periodic transmissions within 1 hour, if any:

Duration t_d of all pulses/bursts during T_R ("on-time"):

t_d depends on the number of interrogation messages sent by Remote Controller.
On each interrogation message, the **$t_d = 0.024 \text{ s}$** .

d) If the result of c) exceeds 2 seconds/hour then paragraph (e) applies:

Determine the duration of each transmission (one complete pulse train) and silent time:

Duration t_{PT} , Limit: $\leq 1 \text{ s}$ (Remark: t_{PT} is identical to t_d if $T \leq 100 \text{ ms}$)

Silent time between transmissions t_s = , Limit: $\leq \text{Maximum}(10 \text{ s and } 30 \cdot t_{PT})$.

3.1.4 Test result: Duty cycle / correction factor

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

3.2 Spurious radiated emissions

Standard FCC Part 15, 10-1-14 Edition Subpart C

The test was performed according to: ANSI C63.10-2013

3.2.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used between 30-1000 MHz was evaluated.

The measurement procedure is implemented into the EMI test software EMC32 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered from a DC power source.

1. Measurement up to 30 MHz

The Loop antenna HFH2-Z2 is used.

Step 1: pre measurement

- Anechoic chamber
- Antenna distance: 3 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 MHz and 0.15 - 30 MHz
- Frequency steps: 0.05 kHz and 2.25 kHz
- IF-Bandwidth: 0.2 kHz and 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)

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: 0.2 - 10 kHz
- Measuring time / Frequency step: 1 s

2. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan

This is a preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Antenna distance: 3 m
- Detector: Peak-Maxhold / Quasipeak (FFT-based)



- Frequency range: 30 – 1000 MHz
- Frequency steps: 30 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 ms
- Turntable angle range: -180° to 90°
- Turntable step size: 90°
- 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: Adjustment 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 slowly vary by $\pm 45^{\circ}$ 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 will also slowly vary by ± 100 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: $\pm 45^{\circ}$ around the determined value
- Height variation range: ± 100 cm around the determined value
- Antenna Polarisation: max. value determined in step 1

Step 3: 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

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. Measurement above 1 GHz

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

Step 1:

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height of the receiving antenna only.

The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90° .

The turn table step size (azimuth angle) for the preliminary measurement is 45° .

Step 2:

Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna in step 2 is omitted. Instead of this, a maximum search with a step size $\pm 45^{\circ}$ for the elevation axis is performed.



The turn table azimuth will slowly vary by $\pm 22.5^\circ$.

The elevation angle will slowly vary by $\pm 45^\circ$

EMI receiver settings (for all steps):

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

Step 3:

Spectrum analyser settings for step 3:

- Detector: Peak / Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

3.2.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency in MHz	Limit ($\mu\text{V/m}$)	Measurement distance (m)	Calculate Limit(dB $\mu\text{V/m}$ @10m)	Limit (dB $\mu\text{V/m}$) @10m
0.009 – 0.49	2400/F (kHz)	300	(48.5 – 13.8) + 59.1 dB	107.6 – 72.9
0.49 – 1.705	24000/F (kHz)	30	(33.8 – 23.0) + 19.1 dB	52.9 – 42.1
1.705 – 30	30	30	29.5 + 19.1 dB	39.5

Frequency in MHz	Limit ($\mu\text{V/m}$)	Measurement distance (m)	Limit (dB $\mu\text{V/m}$)
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: Limit (dB $\mu\text{V/m}$) = 20 log (Limit ($\mu\text{V/m}$)/1 $\mu\text{V/m}$)

§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 (dB $\mu\text{V/m}$) = 20 log (Limit ($\mu\text{V/m}$)/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 last 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: 35 %

Op. Mode	Setup	Port
op-mode 1	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
0°	–	–	–	–	–	–	–	–	–
90°	–	–	–	–	–	–	–	–	–

Remark: In step 1 no spurious emissions above the limit were found using a peak detector, therefore step 2 (using a QP-detector) was not performed. For this test an EUT sending a CM signal was used. Please see the measurement plots in annex.

The EUT is tested in working position as installed into the vehicle's door.

3.2.3.2 Measurement 30 MHz – 1 GHz

Temperature: 24 °C
Air Pressure: 1006 hPa
Humidity: 32 %

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

Polarisation of the antenna and the EUT	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
–	–	–	–	–	–	–	–	–	–

Remark: No spurious emissions in the range 15 dB below the limit found. The test was performed in the frequency range from 30 MHz to 1 GHz. For this test an EUT sending a CW signal was used. Please see measurement plot.

The EUT is tested in working position as installed into the vehicle's door.

3.2.3.3 Measurement above 1 GHz

Temperature: 24 °C
 Air Pressure: 1006 hPa
 Humidity: 32 %

Op. Mode	Setup	Port
op-mode 1	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
vert./horiz.	–	–	–	–	–	–	–	–	–

Remark: The test was performed in the frequency range from 1 GHz to 6 GHz. For this test an EUT sending a continuously modulated signal was used. Please see measurement plots.

The EUT is tested in working position, as it installed into the vehicle's door.

3.2.4 Test result: Spurious radiated emissions

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



3.3 Maximum radiated field strength at fundamental frequency

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31, §15.231, ANSI C 63.4, 2014

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

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

Output power dBμV/m	Frequency MHz	Limit dBμV/m	Remarks
74.6	433.92	80.83	Maximum radiated field strength at fundamental frequency

Notes: - The value shown in the table above is corrected by using the Duty Cycle Correction Factor, calculated in 3.1.3.

3.3.4 Test result: Maximum radiated field strength at fundamental frequency

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	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 the 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: 1009 hPa

Humidity: 42 %

Op. Mode	Setup	Port
op-mode 2	Setup_01	Enclosure

Channel	20 dB bandwidth kHz	99% bandwidth kHz	Limit kHz	Remarks
1	9.9	9.6	1084.8	The limit is calculated as: 433.92 MHz (declared by applicant) * 0.25% = 1084.8 kHz.

Remark: The analyser settings are consistent with the recommendations of ANSI C63.10-2013 section 6.9.2 where is stated, that the resolution bandwidth should be between 1% and 5% of the actual signal bandwidth.

As an actual signal bandwidth the limit of 9.6 kHz is considered. According to ANSI C63.10-2013 section 6.9.2, the analyser RBW should be between 96 Hz and 480 Hz. The RBW of 300 Hz was chosen.

Please see annex for the measurement plots.

3.4.4 Test result: Occupied bandwidth

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

4 Test Equipment

Radiated Emissions

Lab to perform radiated emission tests

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Calibration Due
1.1	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069	
1.2	Fully Anechoic Room	8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	
1.3	AM 4.0	Antenna mast	Maturo GmbH	AM4.0/180/11920513	
1.4	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz	101424	2016-11-13
1.5	Anechoic Chamber	10.58 x 6.38 x 6.00 m ³	Frankonia	none	2017-01-09
1.6	ESIB 26	Spectrum Analyzer	Rohde & Schwarz	830482/004	2017-12-08
1.7	Tilt device Maturo (Rohacell)	Antrieb TD1.5- 10kg	Maturo GmbH	TD1.5- 10kg/024/3790709	
1.8	AS 620 P	Antenna mast	HD GmbH	620/37	
1.9	NRV-Z1	Sensor Head A	Rohde & Schwarz	827753/005	2016-05-11
1.10	JS4-18002600-32- 5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785	
1.11	JS4-00101800-35- 5P	Broadband Amplifier 30 MHz - 18 GHz	Miteq	896037	2012-11-24
1.12	HL 562	Ultralog new biconicals	Rohde & Schwarz GmbH & Co. KG	830547/003	2018-06-30
1.13	Opus10 THI (8152.00)	ThermoHygro Datalogger 12 (Environ)	Lufft Mess- und Regeltechnik GmbH	12482	2017-03-10
1.14	HFH2-Z2	Loop Antenna	Rohde & Schwarz GmbH & Co. KG	829324/006	2017-11-27
1.15	FSW 43	Spectrum Analyzer	Rohde & Schwarz	103779	2016-11-17
1.16	Opus10 TPR (8253.00)	ThermoAirpressure Datalogger 13 (Environ)	Lufft Mess- und Regeltechnik GmbH	13936	2017-02-27
1.17	Chroma 6404	AC Power Source	Chroma ATE INC.	64040001304	
1.18	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronik GmbH	00086675	
1.19	HL 562 Ultralog	Log.-per. Antenna	Rohde & Schwarz GmbH & Co. KG	100609	2015-12-18
1.20	HF 907	Double-ridged horn	Rohde & Schwarz GmbH & Co. KG	102444	2018-05-11
1.21	DE 325	Dreheinheit	HD GmbH		



Radio Lab

Conducted Radio Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Calibration Due
1.22	A8455-4	4 Way Power Divider (SMA)		-	
1.23	SMB100A	Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz GmbH & Co. KG	107695	2017-06-06
1.24	VT 4002	Climatic Chamber	Vötsch	58566002150010	2016-03-11
1.25	SMP03	Signal Generator 2 GHz - 27 GHz 1035.5005.03	Rohde & Schwarz GmbH & Co. KG	833680/003	2016-10-29
1.26	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2016-02-10
1.27	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz GmbH & Co. KG	259291	2016-08-23
1.28	Voltcraft M-3860M	Digital Multimeter 01 (Multimeter)	Voltcraft	IJ096055	
1.29	Chroma 6404	AC Power Source	Chroma ATE INC.	64040001304	
1.30	Datum, Model: MFS	Rubidium Frequency Standard	Datum-Beverly	5489/001	2016-06-25
1.31	WA1515	Broadband Power Divider SMA	Weinschel Associates	A855	
1.32	FSIQ26	Spectrum Analyzer 7layers, Ratingen OIL_RE	Rohde & Schwarz GmbH & Co. KG	840061/005	2017-04-02

R&S TS8997

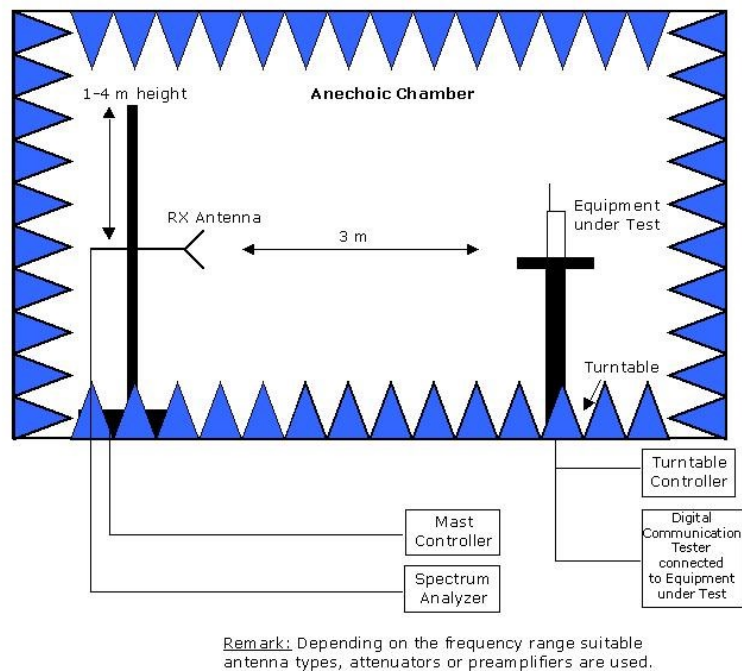
EN300328/301893 Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Calibration Due
1.33	OSP120	Switching Unit with integrated power meter	Rohde & Schwarz GmbH & Co. KG	101158	2016-08-21
1.34	A8455-4	4 Way Power Divider (SMA)		-	
1.35	Opus10 THI (8152.00)	ThermoHygro Datalogger 03 (Environ)	Lufft Mess- und Regeltechnik GmbH	7482	2017-02-27
1.36	SMB100A	Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz GmbH & Co. KG	107695	2017-06-06
1.37	VT 4002	Climatic Chamber	Vötsch	58566002150010	2016-03-11
1.38	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2016-02-10
1.39	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz GmbH & Co. KG	259291	2016-08-23
1.40	Voltcraft M-3860M	Digital Multimeter 01 (Multimeter)	Voltcraft	IJ096055	
1.41	1515 / 93459	Broadband Power Divider SMA (Aux)	Weinschel Associates	LN673	
1.42	Datum, Model: MFS	Rubidium Frequency Standard	Datum-Beverly	5489/001	2016-06-25

5 Photo Report

Photos are included in an external report.

6 Setup Drawings



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

7 Correlation table FCC-IC

Correlation of measurement requirements for Momentarily (incl. Periodically) Operated Devices and Remote Control from FCC and IC

Radio equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 4: 8.8
Transmitter spurious radiated emissions	§ 15.231 (b) / (e)	RSS Gen Issue 4: 6.10/6.13/8.9/8.10; RSS-210 Issue 8: A1.1.2, A1.1.5
Duty cycle measurement (based on dwell time measurement)	§ 15.231 (a)	RSS-210 Issue 8: A1.1.1, A1.1.5
Maximum radiated field strength at fundamental frequency	§ 15.231 (b) / (e)	RSS-210 Issue 8: A1.1.2, A1.1.5; RSS Gen Issue 4: 6.12
Occupied bandwidth	§ 15.231 (c)	RSS-210 Issue 8: A1.1.3
Frequency Stability	§ 15.231 (d)	RSS-210 Issue 8: A1.1.4
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 4: 8.3
Receiver spurious emissions	–	RSS-210 Issue 8: 2.3 RSS Gen Issue 4: 5/7 *)

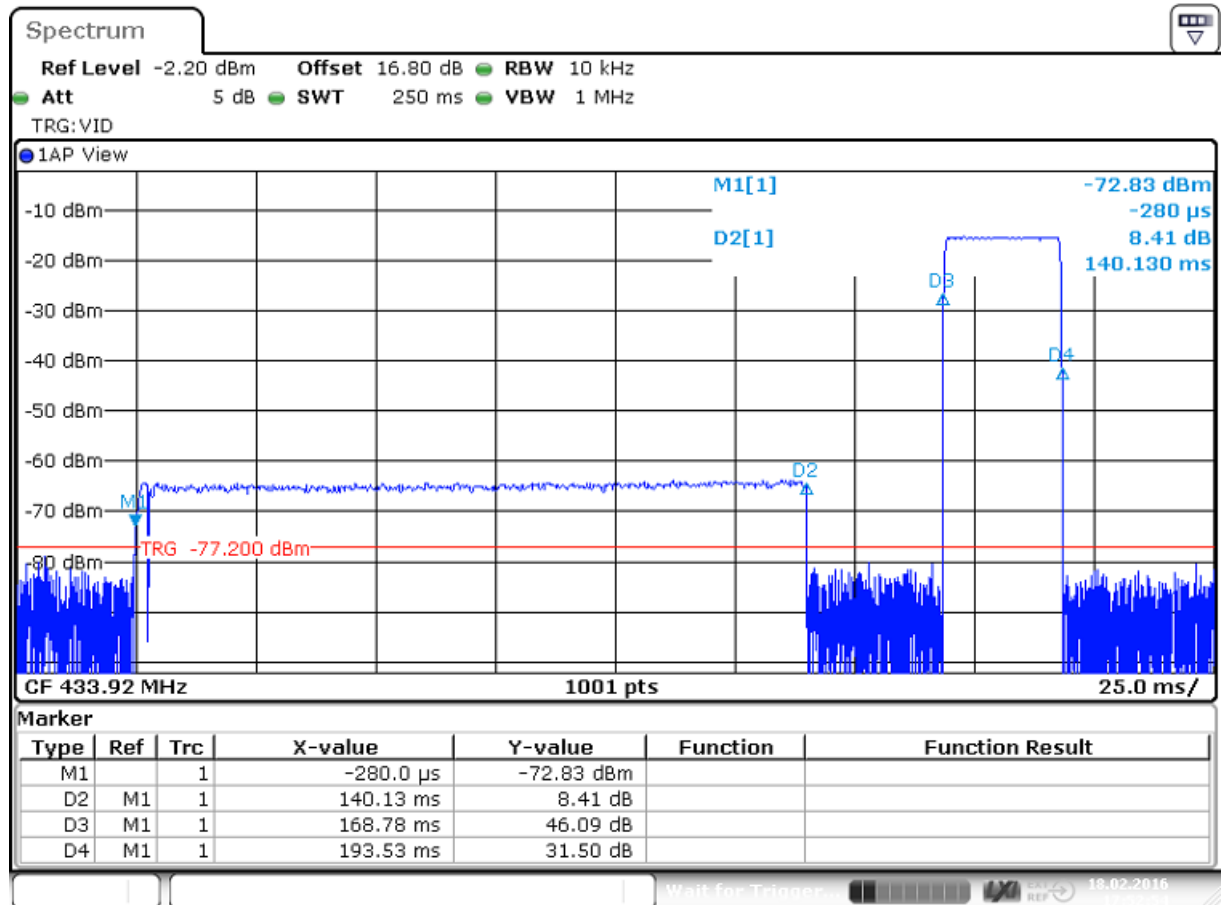
*) Receivers are exempted from certification besides if operating in stand-alone mode in the frequency range 30–960 MHz or if these are scanner receivers.

8 Annex measurement plots

8.1 Duty cycle measurement (based on dwell time measurement)

Op. Mode

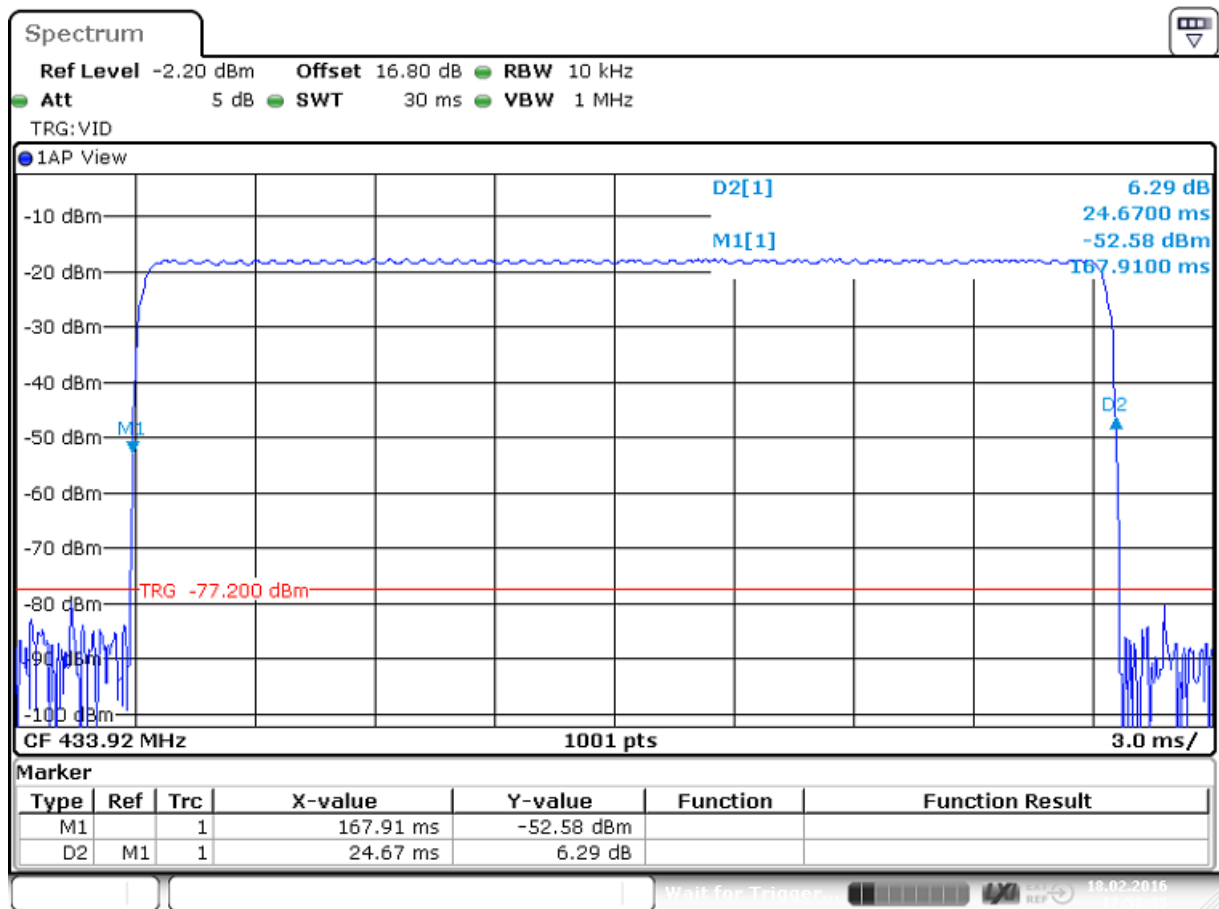
op-mode 1 Setup_01 enclosure



Date:18.FEB 2016 17:52:54

The interrogation message sent by Remote Control – M1 to D2 and EUT answer – pulse between D3 to D4.

Each time the RC sends an interrogation message, the EUT transmitter transmits single pulse answer of 24.7 ms, after 28.7 ms.



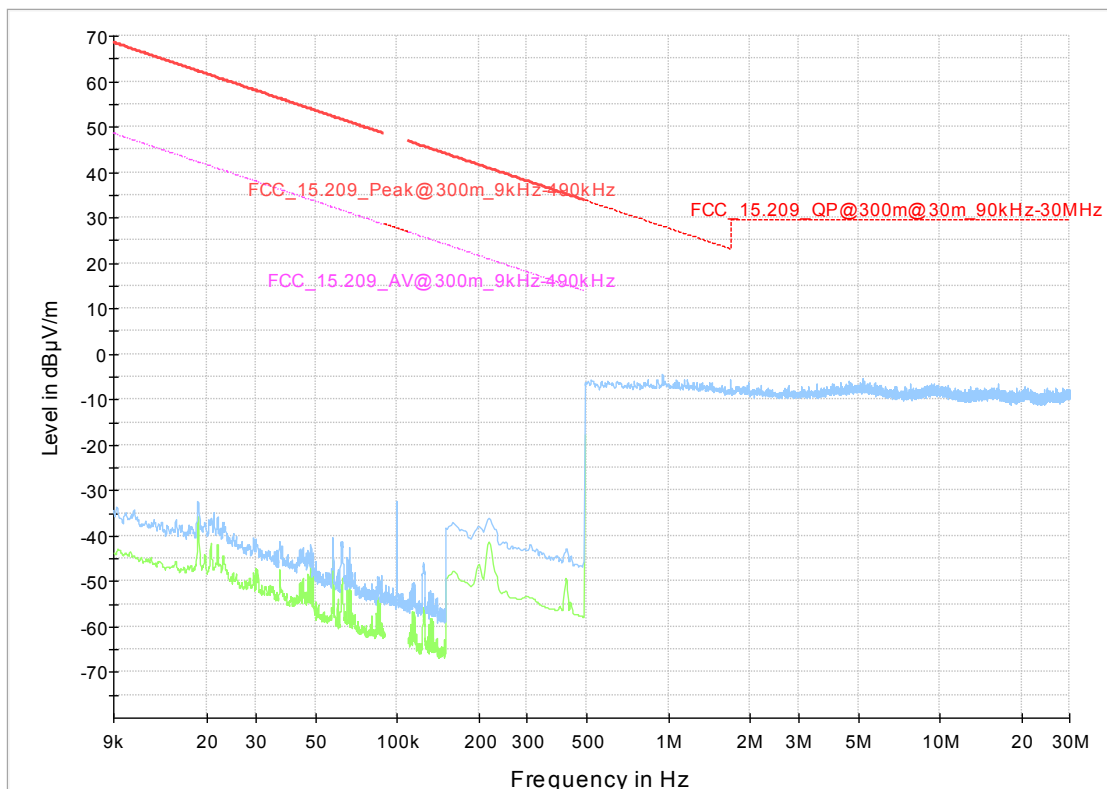
Date:18.FEB 2016 17:58:36

The EUT single pulse. Length = 24.7 ms

8.2 Radiated emissions

8.2.1 Radiated emissions ($f < 30$ MHz)

EUT: (DE1170000ac01)
 Manufacturer: Brose Fahrzeugteile GmbH & Co. KG
 Operating Condition: TX on 433,92 MHz
 Test Site: 7 layers, Ratingen
 Test Specification: FCC 15.231
 Comment: Vertical (working) EUT position;
 0° and 90° antenna position
 Start of Test: 19.02.2016 / 11:43:48

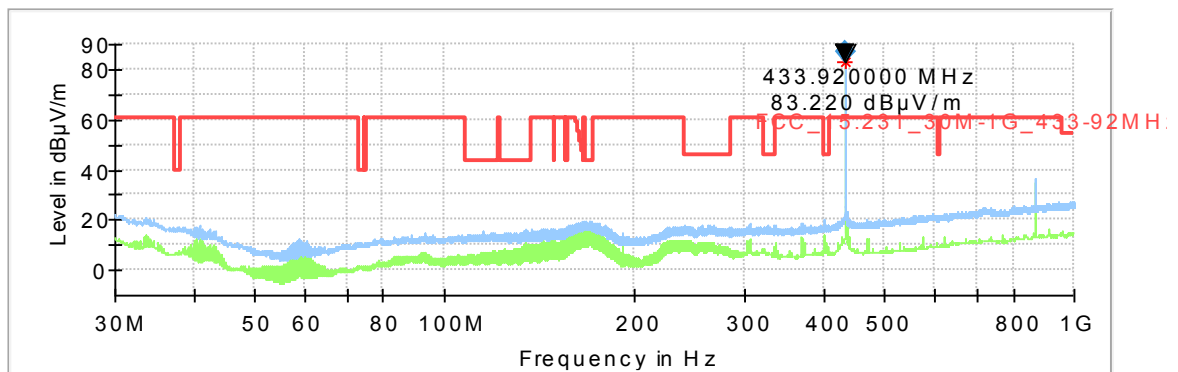


8.2.2 Radiated emissions 30 MHz < f < 1 GHz

EUT: (DE1170000ac01)
 Manufacturer: Brose Fahrzeugteile GmbH & Co. KG
 Operating Condition: TX on 433,92 MHz
 Test Site: 7 layers, Ratingen
 Test Specification: FCC 15.231
 Comment: Horizontal EUT position, Horiz.+Vert. antenna polarization
 Start of Test: 11.02.2016 / 16:55:16

SCAN TABLE: "FCC 15.231"

Short Description:			FCC part 15 c				Transducer
Start	Stop	Step	Detector	Meas. Time	IF Bandw.		
Frequency	Frequency	Width					
30.0 MHz	1.0 GHz	60.0 kHz	MaxPeak	1000.0 ms	120 kHz	HL562	



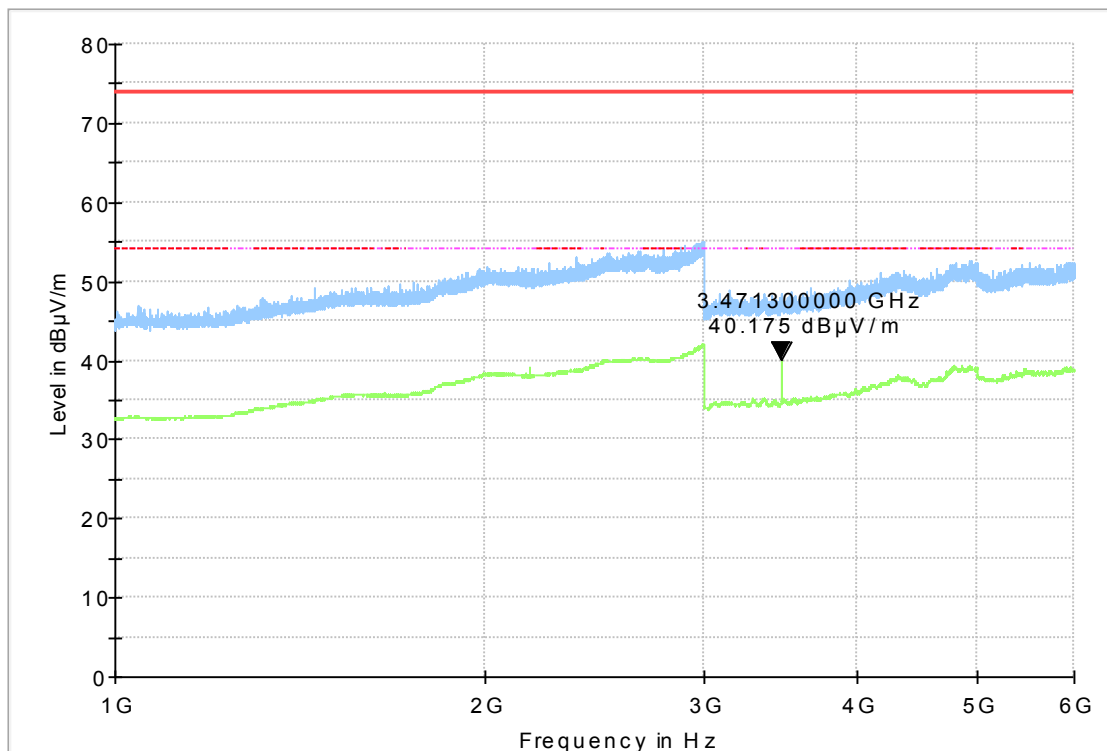
Remark: Peak value 433.920 MHz is at the carrier frequency

8.2.3 Radiated emissions f > 1 GHz

EUT: (DE1170000ac01)
 Manufacturer: Brose Fahrzeugteile GmbH & Co. KG
 Operating Condition: TX on 433,92 MHz
 Test Site: 7 layers, Ratingen
 Test Specification: FCC 15.231
 Comment: Horizontal EUT position, Horiz.+Vert. antenna polarization
 Start of Test: 18.02.2016 / 14:55:38

SCAN TABLE: "FCC 15.231"

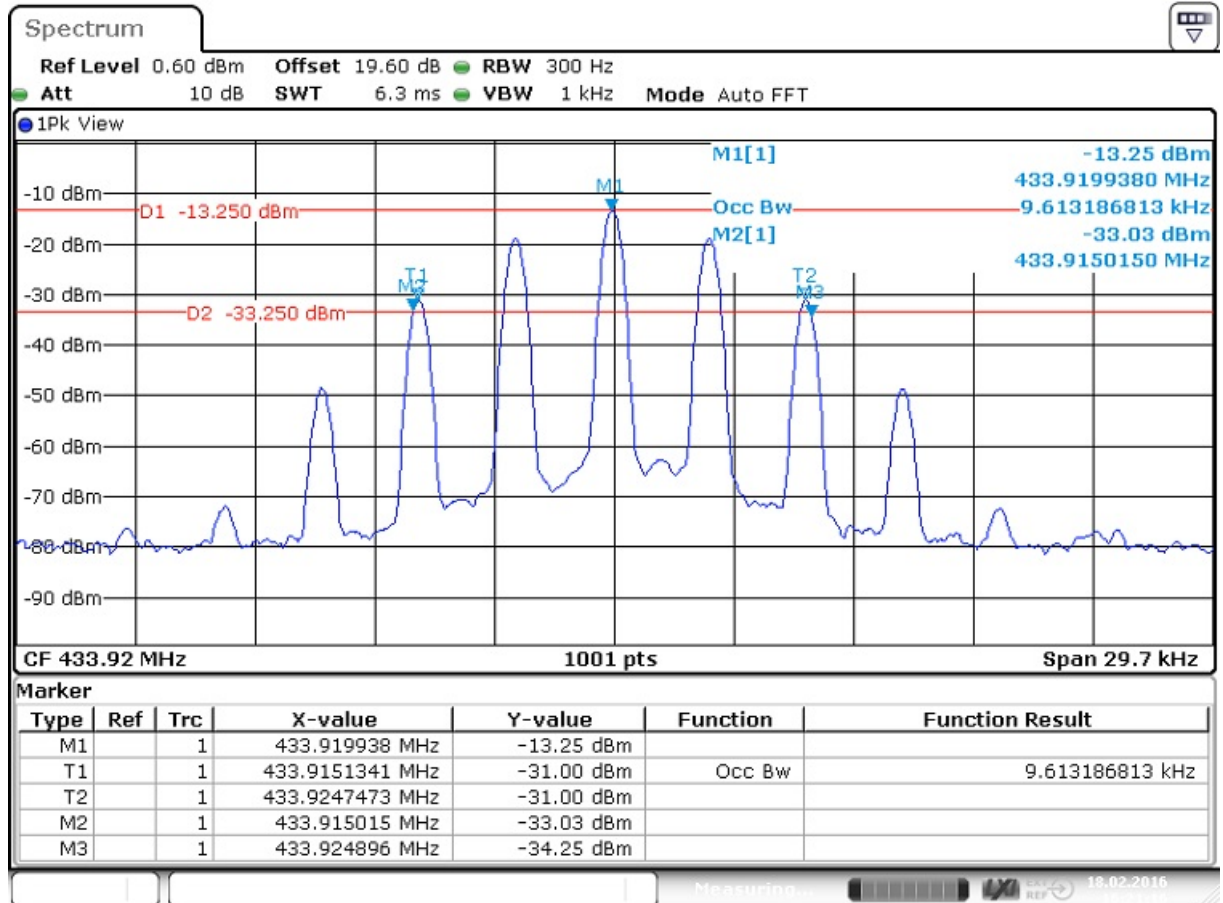
Short Description:			FCC part 15 c				
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer	
Frequency	Frequency	Width					
30.0 MHz	1.0 GHz	60.0 kHz	MaxPeak	1000.0 ms	1000 kHz	HF907	



8.3 Occupation bandwidth

Op. Mode

op-mode 1



Date: 18.FEB 2016 16:21:16

20 dB occupied bandwidth between M2 and M3 = 9.9 kHz

99% occupied bandwidth between T2 and T1 = 9.6 kHz