EUT: UMRR-0Axxxx
FCC ID: W34UMRROA

Date of issue: 2012-01-04

Deutsche Akkreditierungsstelle D-PL-12053-01-01

Test Report acc. to FCC Title 47 CFR Part 15
relating to
s.m.s. smart microwave sensors GmbH
UMRR-0Axxxx
Variants
UMRR-0Axxxx-1Exxxx-0306xx
UMRR-0Axxxx-1Dxxxx-05xxxx
UMRR-0Axxxx-22xxxx-05xxxx

Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
Measurement Procedure:
ANSI C63.4-2009

m. dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

Manufacturer's details	
Manufacturer	s.m.s. smart microwave sensors GmbH
Manufacturer's grantee code	**W34**
Manufacturer's address	s.m.s. smart microwave sensors GmbH
	Mittelweg 7
	D-38106 Braunschweig
	Germany
	Phone: + 49 (0) 531 290 23 0
	Fax: + 49 (0) 531 290 23 599
	Email: ralph.mende@smartmicro.de
Relevant standard used	47 CFR Part 15C - Intentional Radiators
	ANSI C63.4-2009

Test Report prepared by	
Technical engineer	Ralf Trepper
	m. dudde hochfrequenz-technik (laboratory)
	Rottland 5a
	51429 Bergisch Gladbach
	Germany
	Phone: +49 2207 96890
	Fax: +49 2207 968920
	Email: m.duddelabor@dudde.com

Equipment **U**nder **T**est **(EUT)**	
Equipment category	Field Disturbance Sensor
Trade name	smartmicro
Type designation	UMRR-0Axxxx
Serial no.	#0x0002148D
Variants	UMRR-0Axxxx-1Dxxxx 05xxxx
	UMRR-0Axxxx-22xxxx 05xxxx

1. Test results

Clause	Requirements headline	Test result			Report page number
8.1	Antenna Requirement	**Pass**	~~Fail~~	~~N.t.*~~	9
8.2	Conducted limits	**Pass**	~~Fail~~	~~N.t.*~~	10 to 12
8.3	Radiated emission limits	**Pass**	~~Fail~~	~~N.t.*~~	13 to 20
8.4	Bandwidth (20 dB)	**Pass**	~~Fail~~	~~N.t.*~~	21 to 22

* Not tested

The equipment meets the requirements	**Yes**	~~No~~

Signature: ..... (Technician)

Signature: ..... (Manager)

Table of contents

m. dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

2. Introduction

This test report consists of:

- Test result summary
- List of contents
- Introduction and further information
- Performance assessment
- Detailed test information

All pages have been numbered consecutively and bear the m. dudde hochfrequenz-technik logo, the test report number, the date, the test specification in its current version as well as the type designation of the EUT. The total number of pages in this report is **27**.

The tests were carried out at:

- m. dudde hochfrequenz-technik, D-51429 Bergisch Gladbach

in a representative assembly and in accordance with the test methods and/or requirements stated in:

FCC Title 47 CFR Part 15 Subpart C & ANSI C63.4-2009

The sample of the product was received on:

- 2011-10-28

The tests were carried out in the following period of time:

- 2012-01-03 – 2012-01-04

3. Testing laboratory

m. dudde hochfrequenz-technik
Rottland 5a, 51429 Bergisch Gladbach, Germany

Phone: +49 - (0) 22 07 / 96 89-0
Fax: +49 - (0) 22 07 / 96 89-20

- FCC Registration Number: **699717**

Accredited by:

DAkkS Deutsche Akkreditierungsstelle GmbH
DAkkS accreditation number: D-PL-12053-01

4. Applicant

Company name	: s.m.s. smart microwave sensors GmbH
Address	: Mittelweg 7
	38106 Braunschweig
Country	: Germany
Telephone	: + 49 (0) 531 290 23 0
Fax	: + 49 (0) 531 390 23 599
Email	: ralph.mende@smartmicro.de
Date of order	: 2011-08-17
References	: Mr. Ralph Mende

5. Product and product documentation

Samples of the following apparatus were submitted for testing:

Manufacturer	: s.m.s. smart microwave sensors GmbH
Trademark	: smartmicro
Type designation	: **UMRR-0Axxxx**
Hardware versions	: UMRR-0Axxxx
Variants	: UMRR-0Axxxx-1Dxxxx 05xxxx / UMRR-0Axxxx-22xxxx 05xxxx
	UMRR-0Axxxx-1Exxxx-0306xx
Serial number	: #0x0002148D
Software release	: ---
Type of equipment	: Transceiver
Power used	: 12.0 V DC
Frequency used	: 24.075 GHz - 24.175 GHz
Generated or used frequencies	: 30MHz (crystal)
	24.075 GHz - 24.175 GHz (carrier)
ITU emission class	: **94M2 F0N**
FCC ID	**: W34UMRROA**

For issuing this report the following product documentation was used:

Description	**Date**	**Identifications**
External photographs of the **E**quipment **U**nder **T**est (EUT)	2012-01-04	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2012-01-04	Annex no. 2
Channel occupancy / bandwidth	2012-01-04	Annex no. 3
Label sample	2012-01-04	Annex no. 4
Functional description / User manual	2012-01-04	Annex no. 5
Test setup photos	2012-01-04	Annex no. 6
Block diagram	2012-01-04	Annex no. 7
Operational description	2012-01-04	Annex no. 8
Schematics	2012-01-04	Annex no. 9
Parts list	2012-01-04	Annex no. 10

6. Conclusions, observations and comments

The test report will be filed at m. dudde hochfrequenz-technik for a period of 10 years following the issue of this report. It may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of m. dudde hochfrequenz-technik.

The results of the tests as stated in this report are exclusively applicable to the EUT as identified in this report. m. dudde hochfrequenz-technik cannot be held liable for properties of the EUT that have not been observed during these tests.

m. dudde hochfrequenz-technik assumes the sample to comply with the requirements of FCC Title 47 CFR Part 15 for the respective test sector, if the test results turn out positive.

Comments: ---

Date	: 2012-01-04	Date	: 2012-01-04
Name	: Ralf Trepper	Name	: Manfried Dudde
Function	: Technician	Function	: Manager
Signature	:	Signature	: .....

m. dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

7. Operational description

7.1 EUT details

Transceiver, Field disturbance sensor,
The main task of the UMRR is the detection of any reflectors in the field of view, to measure the distance, the relative speed and the angle to the shortest reflector (and to other reflectors), to detect motion and to track (filter) the results over time.
For this **general purpose measurement application**, range and relative radial speed and the angle value of each reflector inside the antenna beam are measured and the results are reported via the communication links cycle by cycle.

„**The RF Board types 1Dxxxx, 1Exxxx and 22xxxx have smaller differences in the schematics and parts list of the receiver part of the RF circuitry. 22xxxx uses an additional LNA in its only one receive antenna and amplifier channel, while 1Dxxxx and 1Exxxx are very similar dual receiver designs but only have different baseband amplifier components.“**

7.2 EUT configuration

Operation:	:	As soon as the equipment is powered up, TX start operating
Purpose of operation	:	see User Manual

7.3 EUT measurement description

Radiated emissions
All variants will be tested as stand alone device. In order to establish the maximum radiation, firstly, there have been viewed all orthogonal adjustments of the test samples. Secondly the test sample with the worst case radiations (UMRR-0Axxxx-1Exxxx-0306xx) have been rotated at all adjustments around the own axis between 0° and 360°, and thirdly, the antenna polarization between horizontal and vertical has been varied. All generated frequencies, the lowest and the highest frequency of the **UMRR-0Axxxx-1Exxxx-0306xx,** have been viewed. The device was tested on a standalone basis.
The spurious emission was measured up to 120 GHz!

In all measurement distances the 3 dB beam width of the measuring antenna, for measurements above 1 GHz, is greater than the EUT's dimensions.

m. dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

8. Compliance assessment

8.1 Antenna requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

8.1.2 Result

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

Integrated linear polarized micro strip patch array antenna

N.t.* See page no. 23

8.2 Conducted limits

(a) For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50µH/50ohms line impedance stabilization network (LISN). Compliance with this provision of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.
The lower limit applies at the boundary between the frequency ranges.

Frequency of emission(MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	**Average**
0.15-0.50	66 to 56*	56 to 46*
0.50-5.0	56	46
5.0-30.0	60	50

*Decreases with the logarithm of the frequency

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or connected to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

8.2.1 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Calibration executed by
Receiver (9 kHz - 30MHz)	Schwarzbeck FMLK 1518 (428)	1518294 9360	08/2010	08/2013	Schrarzbeck
Panorama- Monitor FMLK / VUMA	PAZ1550 (429)	---	---	---	---
Protector limiter 9 kHz - 30MHz 10 dB	Rhode & Schwarz ESH 3Z2 (272)	357,881052	09/2011	09/2013	Dudde
V-LISN 50 ohms//(50 uH+5 ohms)	RFT NNB 11 (72)	13835240	07/2010	07/2013	Dudde
V-LISN 50 ohms//(50 uH+5 ohms)	EMCO (49b)	9512-1227	07/2010	07/2014	Dudde
RF- cable	Aircell 1.5m [BNC/N]	K30	09/2011	09/2012	Dudde
Power supply	Heiden Type:1108-32	005504	2010/09	2012/09	Dudde

8.2.2 Test procedures

The EUT and the additional equipment (if required) are connected to the main power through a line impedance stabilization network (LISN). The LISN must be appropriate to ANSI C63.4-2009 Section 7.
Additional equipment must also be connected to a second LISN with the same specifications described in the above sentence (if required).

8.2.3 Result

Tested with external AC power supply (UMRR-0Axxxx-1exxxx-0306xx inactive)

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	0.181	9	-2	55.8	57.8	*[1]
N	0.181	9	-2	55.8	57.8	*[1]
L1	0.301	9	-2	51.7	53.7	*[1]
N	0.301	9	-2	51.7	53.7	*[1]
L1	0.475	9	-2	47	49.0	*[1]
N	0.475	9	-2	47	49.0	*[1]
L1	0.600	9	-2	46	48.0	*[1]
N	0.600	9	-2	46	48.0	*[1]
L1	0.775	9	-2	46	48.0	*[1]
N	0.775	9	-2	46	48.0	*[1]
L1	0.850	9	-2	46	48.0	*[1]
N	0.850	9	-2	46	48.0	*[1]
L1	1.000	9	-2	46	48.0	*[1]
N	1.000	9	-2	46	48.0	*[1]
L1	1.254	9	-2	46	48.0	*[1]
N	1.254	9	-2	46	48.0	*[1]
L1	2.000	9	-2	46	48.0	*[1]
N	2.000	9	-2	46	48.0	*[1]
L1	4.000	9	-2	46	48.0	*[1]
N	4.000	9	-2	46	48.0	*[1]
L1	6.7644	9	-2	50	52.0	*[1]
N	6.7644	9	-2	50	52.0	*[1]
L1	13.5288	9	-2	50	52.0	*[1]
N	13.5288	9	-2	50	52.0	*[1]
Measurement uncertainty: < ± 2 dB						

Remark: *[1] Noise level of the measuring instrument ≤ -2dBµV (0.009 – 30MHz)
Remark: *[2] Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 23

Tested with external AC power supply (UMRR-0Axxxx-1exxxx-0306xx active)

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	**0.1650**	**9**	**33.0**	**55.8**	**22.8**	***2**
N	**0.1650**	**9**	**33.0**	**55.8**	**22.8**	***2**
L1	0.250	9	-2	51.7	53.7	*1
N	0.250	9	-2	51.7	53.7	*1
L1	0.475	9	-2	47	49.0	*1
N	0.475	9	-2	47	49.0	*1
L1	**0.5525**	**9**	**22.0**	**46**	**24.0**	***2**
N	**0.5525**	**9**	**22.0**	**46**	**24.0**	***2**
L1	0.775	9	-2	46	48.0	*1
N	0.775	9	-2	46	48.0	*1
L1	0.850	9	-2	46	48.0	*1
N	0.850	9	-2	46	48.0	*1
L1	1.000	9	-2	46	48.0	*1
N	1.000	9	-2	46	48.0	*1
L1	1.254	9	-2	46	48.0	*1
N	1.254	9	-2	46	48.0	*1
L1	2.000	9	-2	46	48.0	*1
N	2.000	9	-2	46	48.0	*1
L1	4.000	9	-2	46	48.0	*1
N	4.000	9	-2	46	48.0	*1
L1	6.7644	9	-2	50	52.0	*1
N	6.7644	9	-2	50	52.0	*1
L1	13.5288	9	-2	50	52.0	*1
N	13.5288	9	-2	50	52.0	*1
Measurement uncertainty: < ± 2 dB						

Remark: *[1] Noise level of the measuring instrument ≤ -2dBµV (0.009 – 30MHz)
Remark: *[2] Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 23

8.3 Radiated emission limits

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902-928 MHz	500	1.6
2400-2483.5 MHz	500	1.6
5725-5875 MHz	500	1.6
10.5-10.55 GHz	2500	25.0
24.0-24.25 GHz	2500	25.0

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in § 15.205, shall not exceed the field strength limits shown in § 15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully complywith the limits given in § 15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

(2) Field strength limits are specified at a distance of 3 meters.

(3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

(4) The emission limits shown in the above table are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

8.3.1 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Calibration executed by
Receiver (9 kHz –40.0 GHz) (40.0 GHz -110 GHz)	Anritsu Spectrum Analyzer MS2668 (359a)	6200163244	2011/02	2014/02	Rohde & Schwarz
Receiver (9 kHz –30.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSV 30 (502)	100932	2010/04	2013/04	Rohde & Schwarz
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2010/02	2013/02	Dudde
Pre-amplifier (1GHz - 18GHz)	Narda --- (345)	---	2010/02	2013/02	Dudde
Magnetic loop antenna (9 kHz - 30 MHz)	Schwarzbeck FMZB 1516 (23)	---	2010/09	2013/09	Dudde
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)	---	2011/05	2014/05	Schwarzbeck
Bilog antenna (1- 18 GHz)	Schwarzbeck VULP 9168 (408)	---	2010/05	2013/05	Dudde
Horn antenna (15.0-40.0 GHz)	Schwarzbeck BBHA 9170 (442)	BBHA9170378	2010/02	2013/02	Schwarzbeck
Horn antenna (2.0-14.0 GHz)	Schwarzbeck BBHA 9120 C (169)	305	2010/02	2013/02	Dudde
Gain Horn antenna (33-50 GHz)	Dorado GH-22-25 (383)	040810	2010/04	2013/04	Dudde
Gain Horn antenna (40-60 GHz)	Dorado GH-19-20 (518)	070106	2010/04	2013/04	Dudde
Gain Horn antenna (50-75 GHz)	Dorado GH-15-25 (384)	031003	2010/04	2013/04	Dudde
Gain Horn antenna (75-110 GHz)	Dorado GH-10-25 (385)	040808	2010/04	2013/04	Dudde
Mixer WR22 Q-Band (33-50 GHz)	OM Labs MA2742A (269a)	Q40512-1	2010/04	2013/04	Dudde
Mixer U-Band (40-60 GHz)	Rohde & Schwarz FSZ-60 (515)	100037	2011/03	2014/03	Dudde
Mixer WR15 V-Band (50-75 GHz)	OM Labs MA2744A (295a)	V41027-1	2010/04	2013/04	Dudde
Mixer E-Band (60-90 GHz)	Rohde & Schwarz FSZ-90 (501)	100062	2010/08	2013/08	Dudde
Mixer WR10 W-Band (75-110 GHz)	OM Labs MA2746A (296a)	W40706-2	2010/04	2013/04	Dudde
RF- cable	Kabelmetal 18m [N]	K1	2011/02	2012/02	Dudde
RF- cable	Aircell 0.5m [BNC]	K40	2011/02	2012/02	Dudde
RF- cable	Aircell 1m [BNC/N]	K56	2011/02	2012/02	Dudde
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	2011/02	2012/02	Dudde
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	2011/02	2012/02	Dudde
RF- cable	Sucoflex 104 2m [APC]	K17a	2011/02	2012/02	Dudde
RF- cable	Sucoflex 104 2m [APC]	K18a	2011/02	2012/02	Dudde

8.3.2 Test procedure

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4-2009 Section 8 "Radiated Emissions Testing"

Measurement procedures for electric field radiated emissions above 1 GHz are covered in Clause 8 of ANSI C63.4-2009. The ANSI C63.4-2009 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Subclause 8.3.1.2 of ANSI C63.4-2009 states that the measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." We consider the "cone of radiation" to be the 3 dB beam width of the measurement antenna.

While the "bore-sighting" technique is not explicitly mentioned in ANSI C63.4-2009, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTS, measuring system sensitivity, etc.

ANSI C63.4-2009 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

Radiated emissions test characteristics	
Frequency range	30 MHz - 40,000 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 40,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/horizontal

* According to Section 15.31 (f) (1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

8.3.3 Calculation of the field strength

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For example:
The receiver reading is 32.7 dBµV. The antenna factor for the measured frequency is +2.5 dB (1/m) and the cable factor for the measured frequency is 0.71 dB, giving a field strength of 35.91dBµV/m.
The 35.91dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm (35.91/20) = 39.8

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements).

m. dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

8.3.4 Result

FUNDAMENTAL EMISSIONS (Section 15.245)										
f (GHz)	Bandwidth (kHz), Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Peak Limit **dBµV/m @ meter**	Margin **dBµV/m**	Polaris. EUT / antenna orientation	height/cm
24.08860	PK/1MHz	**67.8**	3	18.6	0	**86.4**	147.9	**61.5**	V, 0°/H	100
24.12140	PK/1MHz	**67.8**	3	19.2	0	**87.0**	147.9	**60.9**	V, 0°/H	100
24.16540	PK/1MHz	**67.1**	3	19.4	0	**86.5**	147.9	**61.4**	V, 0°/H	100
24.08998	PK/1MHz	**100.1**	3	18.6	0	**118.7**	147.9	**29.2**	V, 2°/V	104
24.12940	PK/1MHz	**99.4**	3	19.2	0	**118.6**	147.9	**29.3**	V, 2°/V	104
24.16420	PK/1MHz	**99.3**	3	19.4	0	**118.7**	147.9	**29.2**	V, 2°/V	104
Measurement uncertainty			± 6 dB							

Bandwidth = the measuring receiver bandwidth

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

FUNDAMENTAL EMISSIONS (Section 15.245)										
f (GHz)	Bandwidth (kHz), Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Average Limit **dBµV/m @ meter**	Margin **dBµV/m**	Polaris. EUT / antenna orientation	height/cm
24.08112	AV/1MHz	**86.8**	3	18.6	0	**105.4**	127.9	**22.5**	V, 3°/V	102
24.08872	AV/1MHz	**55.4**	3	18.6	0	**74.0**	127.9	**53.9**	V, 3°/V	102
24.15680	AV/1MHz	**37.8**	3	19.4	0	**57.2**	127.9	**70.7**	V, 3°/V	102
Measurement uncertainty			± 6 dB							

Bandwidth = the measuring receiver bandwidth

Measurement uncertainty	± 6 dB

Bandwidth = the measuring receiver bandwidth

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 23

HARMONICS (Section 15.245)										
f (GHz)	Bandwidth (kHz), Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Peak Limit **dBµV/m @ meter**	Margin **dBµV/m**	Polaris. EUT / antenna orientation	height/cm
48.1770	PK/1MHz	**43.0**	0.50	32.7	-15.5	**60.2**	97.5	**37.3**	V, 0°/V	102
49.7685	PK/1MHz	**43.5**	0.50	32.9	-15.5	**60.9**	97.5	**36.6**	V, 0°/V	102
72.4380	PK/1MHz	**46.6**	0.50	34.3	-15.5	**65.4**	97.5	**32.1**	V, 0°/V	102
73.7840	PK/1MHz	**48.7**	0.50	34.3	-15.5	**67.5**	97.5	**30.0**	V, 0°/V	102
Measurement uncertainty			± 6 dB							

Bandwidth = the measuring receiver bandwidth

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	**Yes**	~~No~~	Page no. **25**

N.t.* See page no. 23

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SPURIOUS EMISSIONS (Section 15.209)									
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation/height
0.1200	0.2, QPK	< 4.0	10	20.2	-59.1	-34.9	26.0 @ 300 m	80.90	V, H/0-360°
0.5000	0.2, QPK	< 4.0	10	20.2	-19.1	5.1	33.6 @ 30 m	28.5	V, H/0-360°
1.5000	0.2, QPK	< 4.0	10	20.2	-19.1	5.1	24.1 @ 30 m	19.00	V, H/0-360°
3.0000	9, QPK	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
5.0000	9, QPK	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
8.0000	9, QPK	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
10.0000	9, QPK	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
20.0000	9, QPK	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
30.0000	9, QPK	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
35.0000	100, QPK	≤ 3.5	3	-3.1*[6]	0	0	0.4	40.0	H,V/H,V
88.0000	100, QPK	≤ 3.5	3	-10.8*[6]	0	-7.3	40.0	47.3	H,V/H,V
216.0000	100, QPK	≤ 3.5	3	-10.3*[6]	0	-6.8	43.5	50.3	H,V/H,V
960.0000	100, QPK	≤ 3.5	3	8.5*[6]	0	12.0	43.5	31.5	H,V/H,V
1700.0000	1000, AV	≤ 4.5	3	3.8*[7]	0	8.3	54.0	45.7	H,V/H,V
2250.0000	1000, AV	≤ 10	3	8.0*[7]	0	18.0	54.0	36.0	H,V/H,V
4000.0000	1000, AV	≤ 10	3	8.4*[7]	0	18.4	54.0	35.6	H,V/H,V
5000.0000	1000, AV	≤ 10	3	9.1*[7]	0	19.4	54.0	34.6	H,V/H,V
7500.0000	1000, AV	≤ 14	3	12.9*[7]	0	26.9	54.0	27.1	H,V/H,V
9400.0000	1000, AV	≤ 14	3	16.0*[7]	0	30.0	54.0	24.0	H,V/H,V
17092.600	**1000, AV**	**18.1**	**3**	**21.5*[7]**	**0**	**39.6**	**77.5**	**37.9**	**V, 5°/V; 152cm**
25457.430	**1000, AV**	**28.5**	**3**	**19.6*[8]**	**0**	**48.1**	**77.5**	**29.4**	**V, 5°/V; 157cm**
29903.100	1000, AV	≤ 21	3	21.8	0	42.8	77.5	34.7	H,V/H,V
All other emissions than harmonics are lower than the noise level of the measuring equipment!									
Measurement uncertainty	4 dB								

Blue marked: restricted bands
Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] noise floor noise level of the measuring instrument ≤ 17dBµV @ 3m distance (14,500 – 20,500 MHz)
Remark: *[6] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[7] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz
Remark: *[8] for using a pre-amplifier in the range between 18.0 GHz and 30.0 GHz

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	**Yes**	~~No~~	Page no. **23-25**

N.t.* See page no. 23

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8.4 Bandwidth (20 dB)

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

8.4.1 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Calibration executed by
Receiver (9 kHz –30.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSV 30 (502)	100932	2010/04	2013/04	Rohde & Schwarz
Pre-amplifier (18GHz - 26GHz)	Miteq --- (433)	---	2011/03	2014/03	Dudde
Horn antenna (15.0-40.0 GHz)	Schwarzbeck BBHA 9170 (442)	BBHA9170378	2010/02	2013/02	Schwarzbeck
Frequency reference	Schomandl Frequency normal FN77-OCXO	F-Nr. 10-025	2010/03	2013/03	Dudde
RF- cable	Sucoflex 104 P Suhner 2,13m [APC 3.5]	K17a	2011/03	2012/03	Dudde
RF- cable	Sucoflex 104 P Suhner 2,13m [APC 3.5]	K18a	2011/03	2012/03	Dudde

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8.4.2 Test procedure

ANSI C63.4-2009 Section 13.1.7 Occupied bandwidth measurements. The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce worst-case (i.e., the widest) bandwidth. In order to measure the modulated signal properly, a resolution bandwidth that is small compared to the bandwidth required by the procuring or regulatory agency shall be used on the measuring instrument. However, the 6 dB resolution bandwidth of the measuring instrument shall be set to a value greater than 5 % of the bandwidth requirements.

8.4.3 Calculation of the 20 dB bandwidth limit

The 20 dB bandwidth limit = 100 MHz

8.4.4 Result

The maximum measured 20 dB bandwidth is: **94.17 MHz**

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	**Annex No. 3**

N.t.* See page no. 23

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9. Additional information to the test report

Remarks

N.t.[1]	Not tested, because the antenna is part of the PCB
N.t.[2]	Not tested, because the EUT is directly car battery powered
N.t.[3]	Not tested, because not applicable to the EUT
N.t.[4]	Not tested, because not ordered

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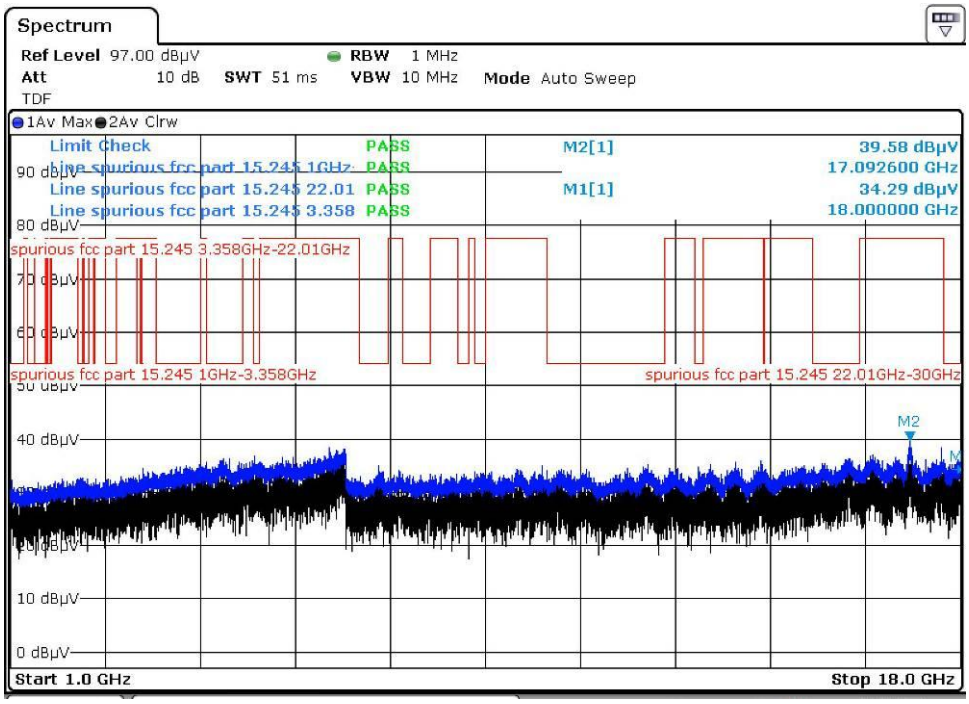
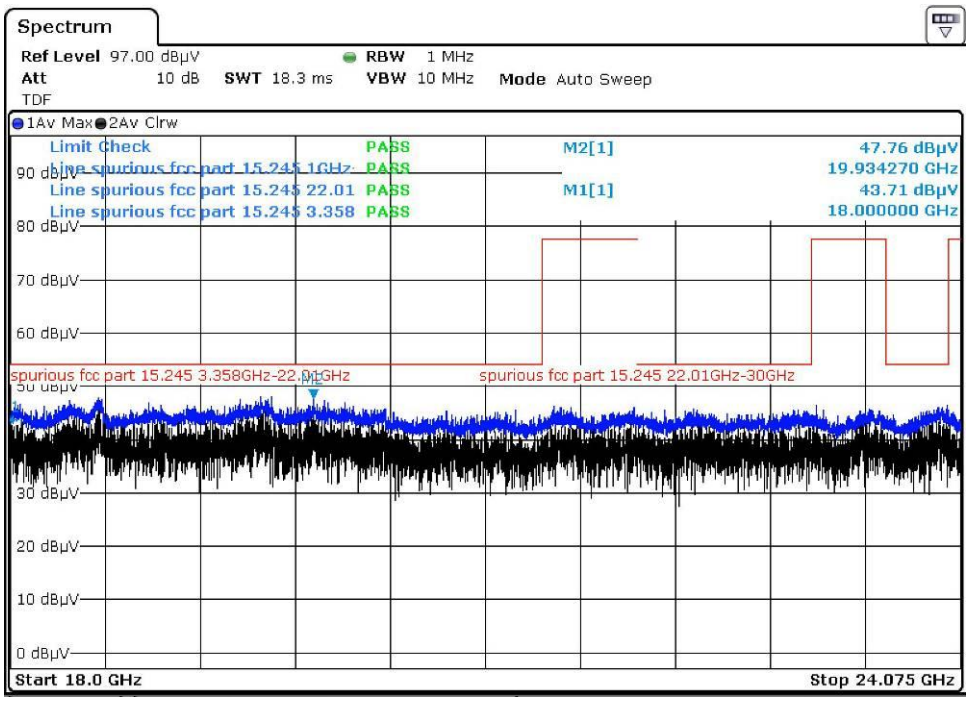
Test result: Spurious emissions





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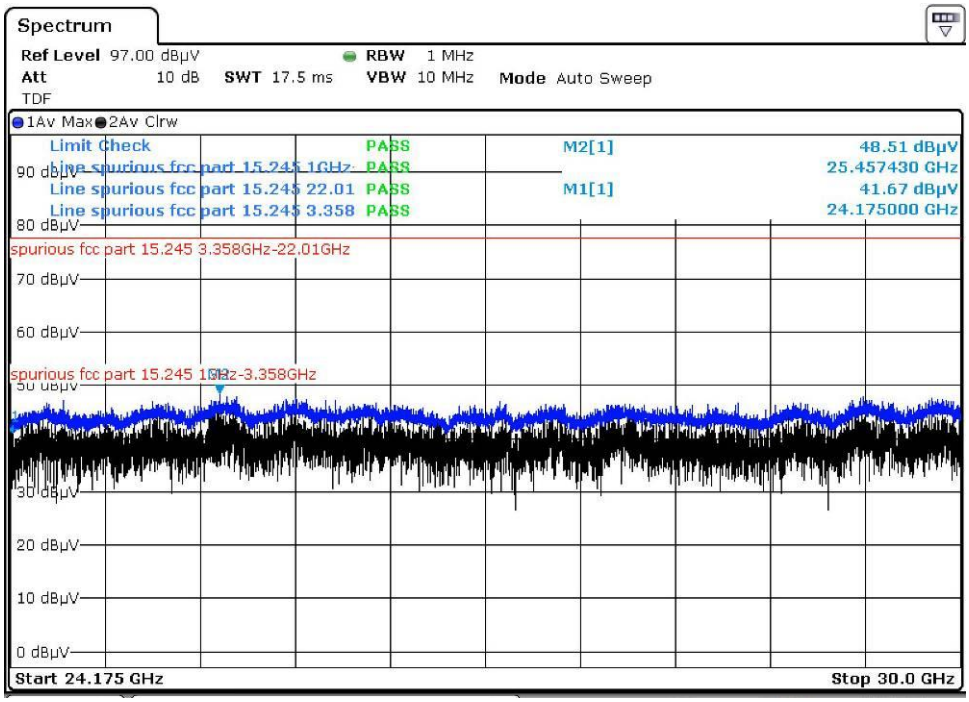

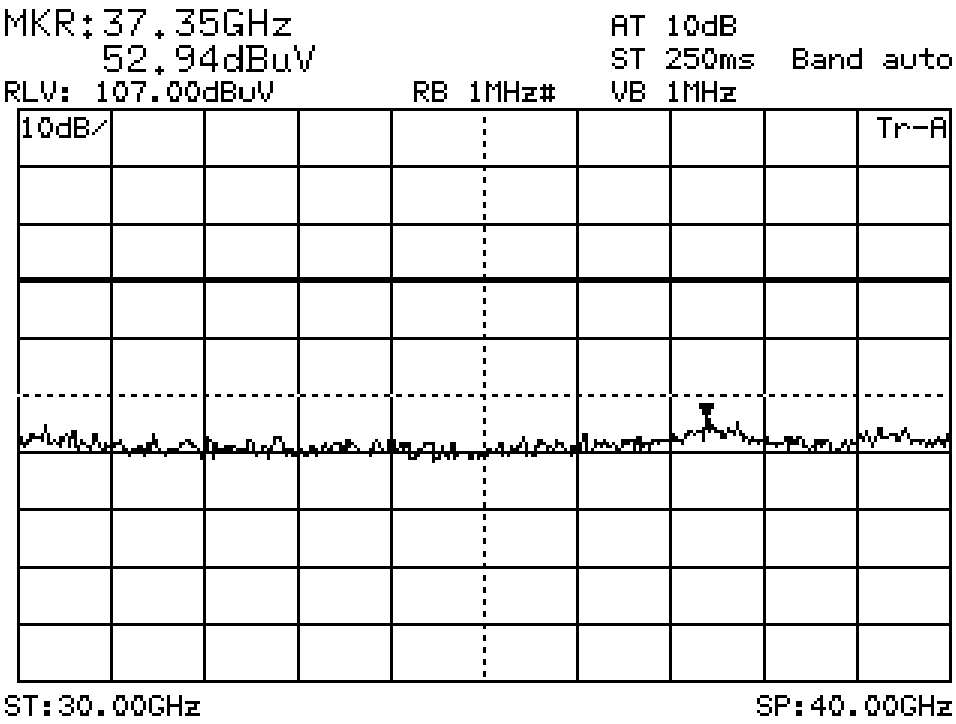

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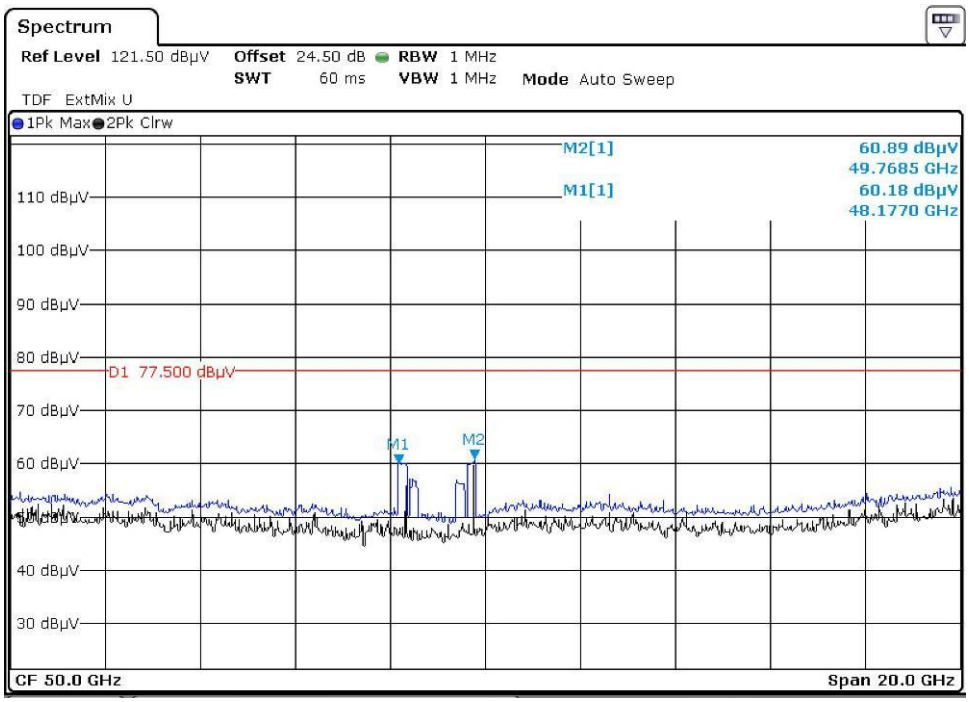
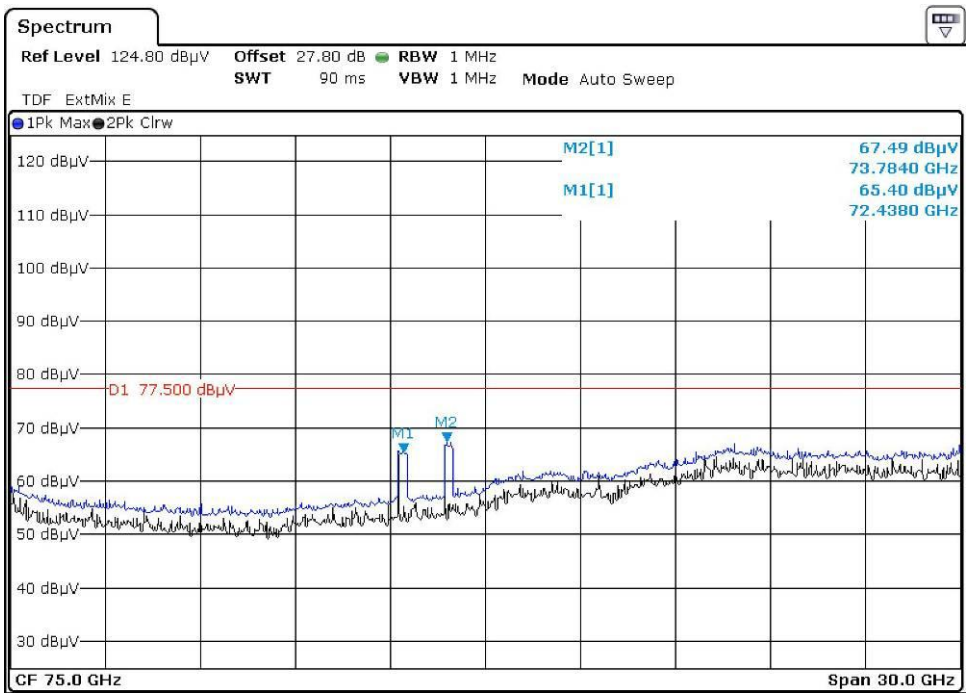
Date of issue: 2012-01-04

Test result: Spurious emissions, harmonics





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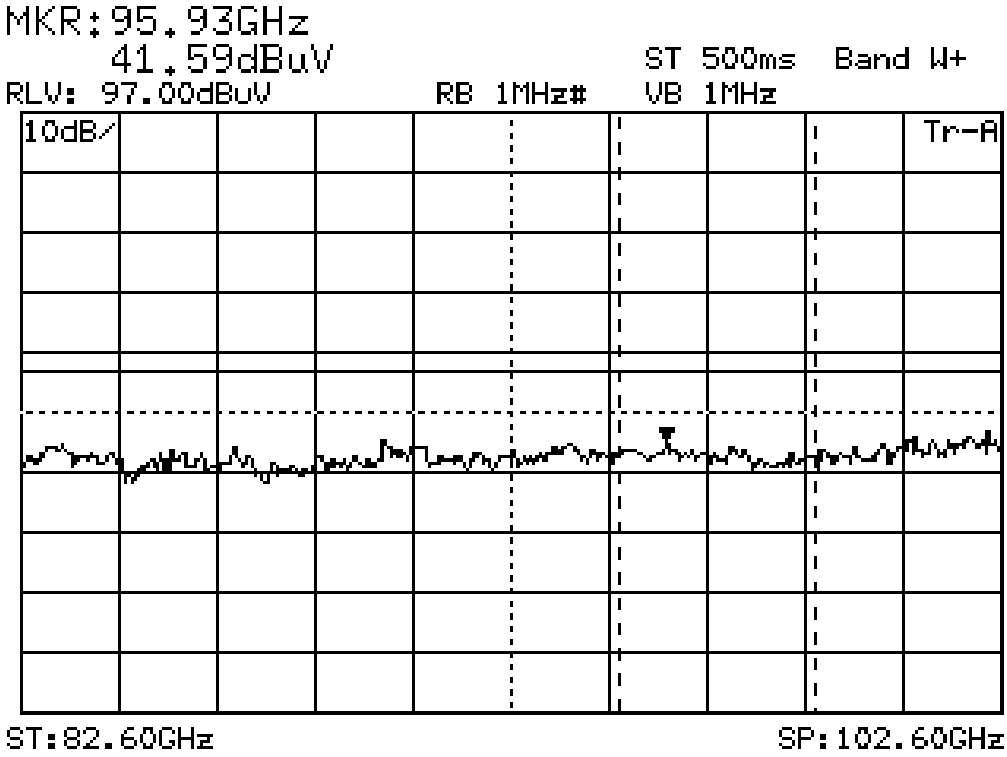

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End of test report

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