

FCC ID:SDL-PRA90R01

EMI - TEST REPORT

- FCC Part 15.249, RSS210 -



Test Report No. : T33893-02-02HS	21. November 2011 Date of issue
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Type / Model Name : PRA90

Product Description : Radio remote controlled automated tripod

Applicant : Hilti AG

Address : Feldkircherstrasse 100

9494 SCHAAN, FUERSTENTUM LIECHTENSTEIN

Manufacturer : NEDO GmbH&Co.KG

Address : Hochgerichtstr. 39-43

72280 DORNSTETTEN, GERMANY

Licence holder : Hilti AG

Address : Feldkircherstrasse 100

9494 SCHAAN, FUERSTENTUM LIECHTENSTEIN

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>SUMMARY</u>	4
2.1	Test result summery	4
3	<u>EQUIPMENT UNDER TEST</u>	6
3.1	Photo documentation of the EUT	6
3.2	Power supply system utilised	14
3.3	Short description of the equipment under test (EUT)	17
4	<u>TEST ENVIRONMENT</u>	18
4.1	Address of the test laboratory	18
4.2	Environmental conditions	18
4.3	Statement of the measurement uncertainty	18
4.4	Measurement protocol for FCC and IC	19
4.5	Determination of worst case measurement conditions	20
5	<u>TEST CONDITIONS AND RESULTS</u>	21
5.1	Conducted emissions	21
5.2	Field strength of the fundamental wave	27
5.3	Spurious emissions radiated	29
5.4	20 dB bandwidth	39
5.5	Antenna application	41
5.6	Occupied bandwidth	42
5.7	Frequency range	44
5.8	Receiver radiated emissions	45
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	49

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2010)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2010)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.249	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
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ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
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CISPR 16-4-2: 2003	Uncertainty in EMC measurement
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CISPR 22: 2005 EN 55022: 2006	Information technology equipment
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2 SUMMARY

GENERAL REMARKS:

The EUT is equipped with an RF transceiver operating within the 2.4 GHz ISM band. Only one channel is supported at 2405 MHz. The EUT provides a test mode for TX continuous with a duty cycle, $x = 1$, and for RX only. The frequency range was scanned from 9 kHz to 26000 MHz. All emissions not reported in this test report are more than 20 dB below the specified limit.

2.1 Test result summary

FCC to Canada standard correlation Matrix:

Operating in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
Intentional radiator			
15.207(a)	RSS Gen, 7.2.4.	AC power line conducted emissions	passed
15.249(a)(2)	RSS210, A2.9(a)	Field strength	passed
15.249(d)	RSS210, A2.9(b)	Out-of-band emission, radiated	passed
15.249(e)		Peak field strength limit	passed
15.35(c)	RSS-Gen, 4.5	Pulsed operation	passed
15.203	RSS-Gen, 7.1.4	Antenna requirement	passed
15.204	RSS-Gen, 7.1.3	Antenna requirement	passed
	RSS-Gen, 4.6.1	OBW99	passed
	RSS-Gen, 7.2.6	Transmitter frequency stability	not required
Unintentional radiator			
	RSS Gen, 7.2.4.	AC power line conducted emissions	not applicable
	RSS-Gen, 6.1	Receiver spurious emissions, radiated	passed

The mentioned RSS Rule Parts in the above table are related to:

RSS Gen, Issue 3, December 2010

RSS 210, Issue 8, December 2010

RSS 102, Issue 4, March 2010

FCC ID:SDL-PRA90R01

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 02 March 2011

Testing concluded on : 08 May 2011

Checked by:

Tested by:

Thomas Weise
Dipl. Ing.(FH)
Laboratory Manager

Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

FCC ID:SDL-PRA90R01

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT

External view:



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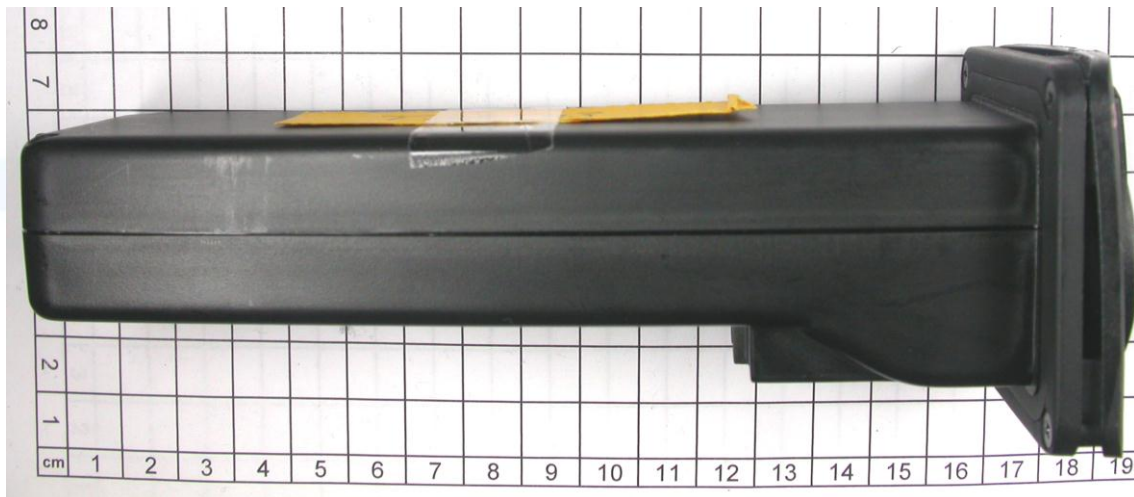
Power supply:



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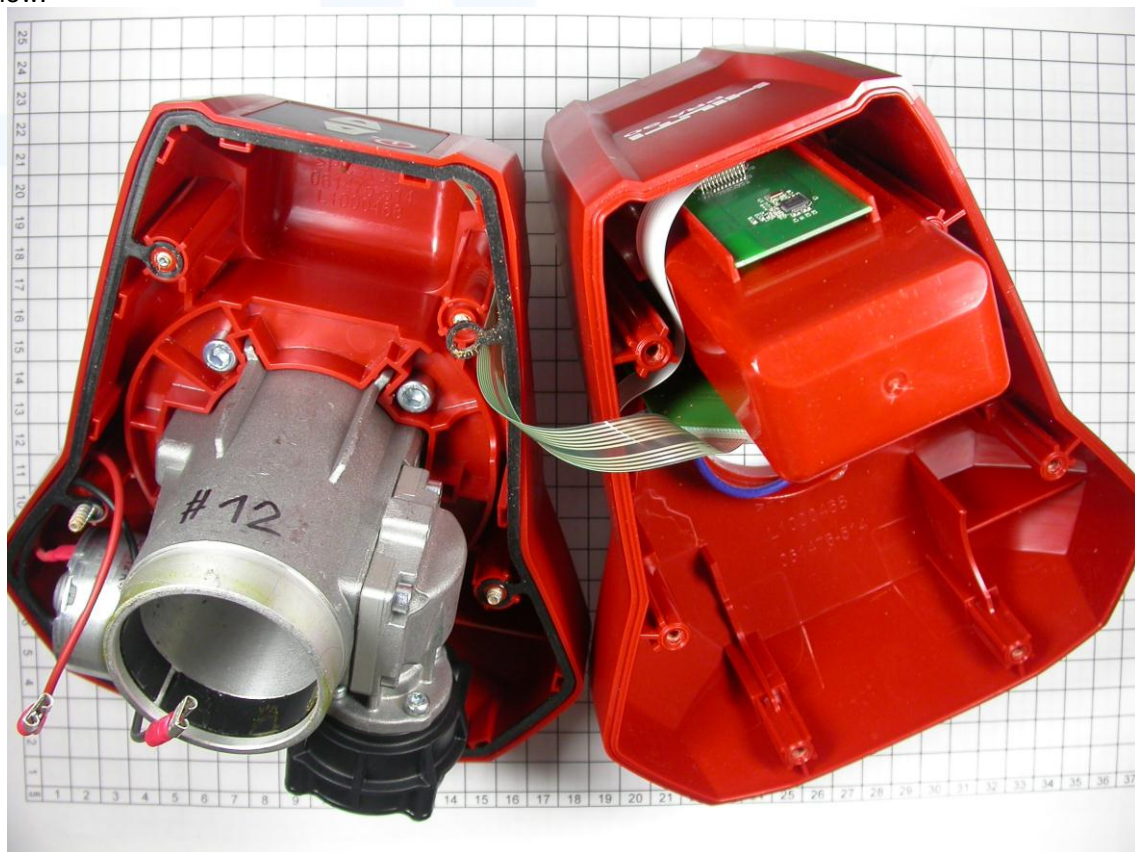
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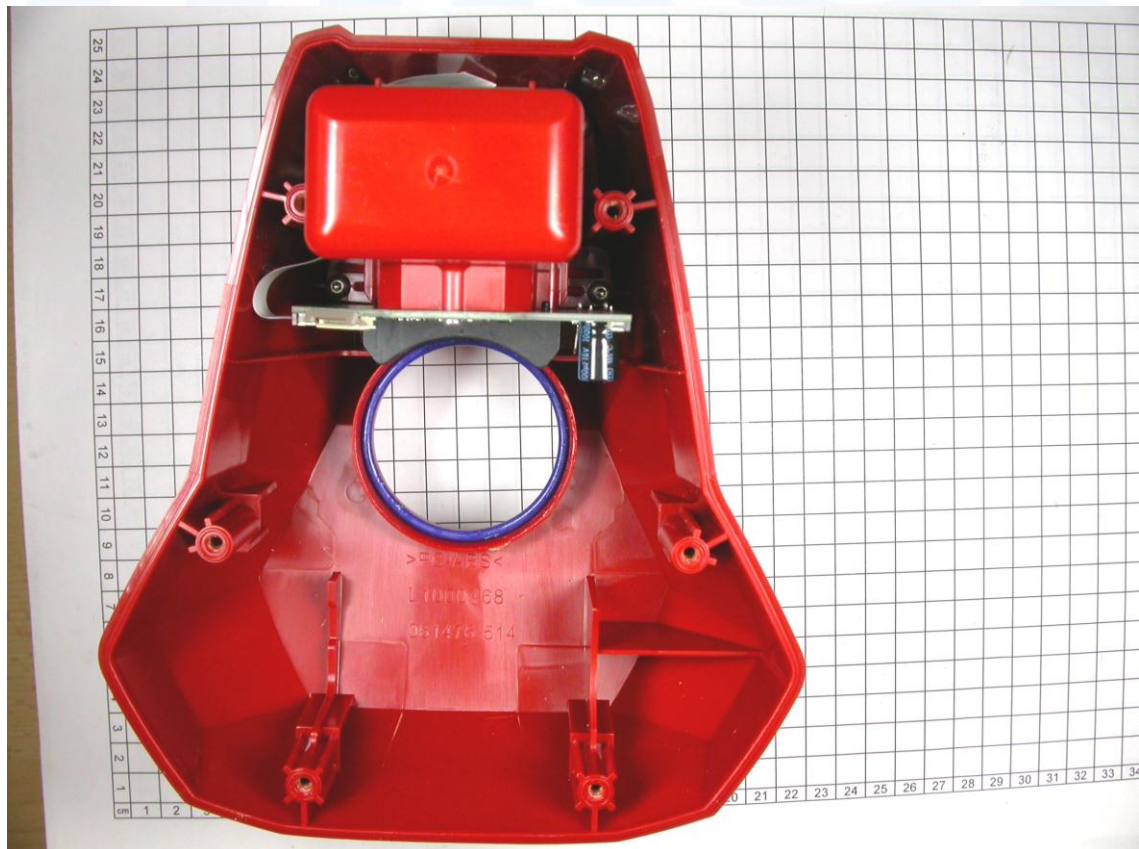
FCC ID:SDL-PRA90R01



Internal view:

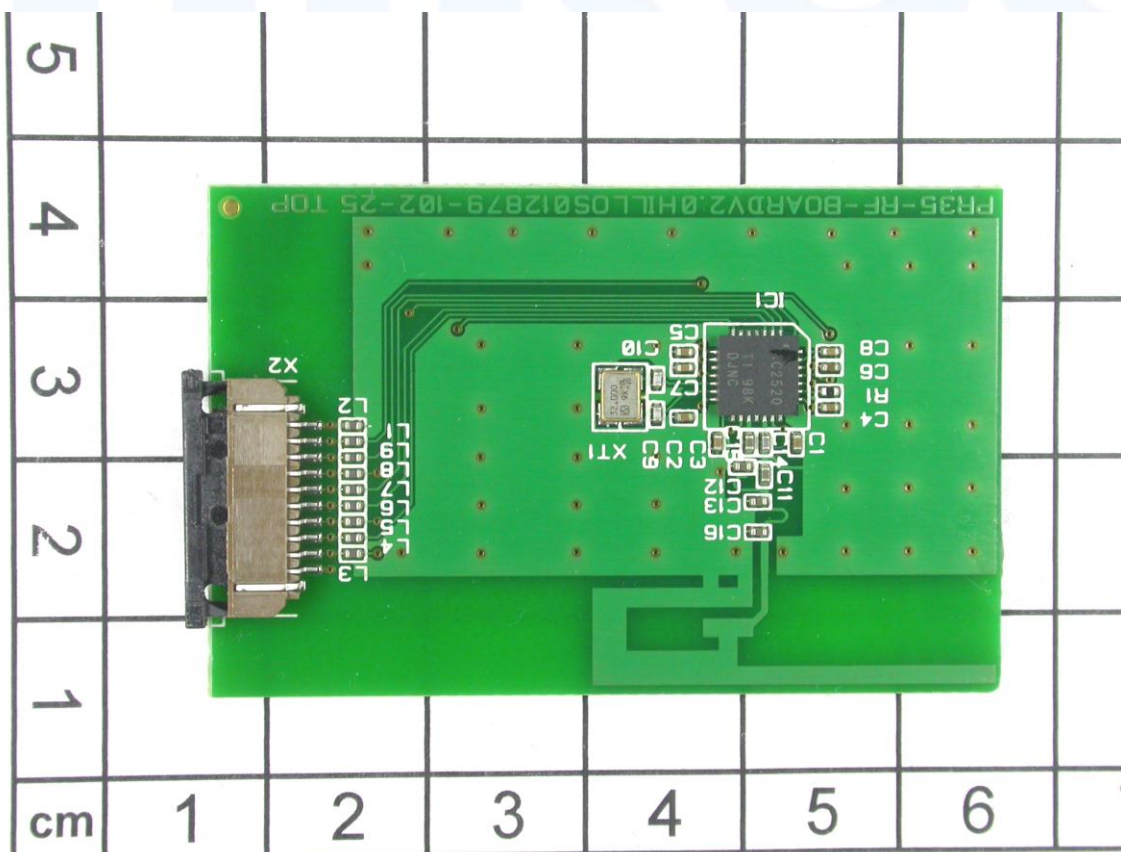
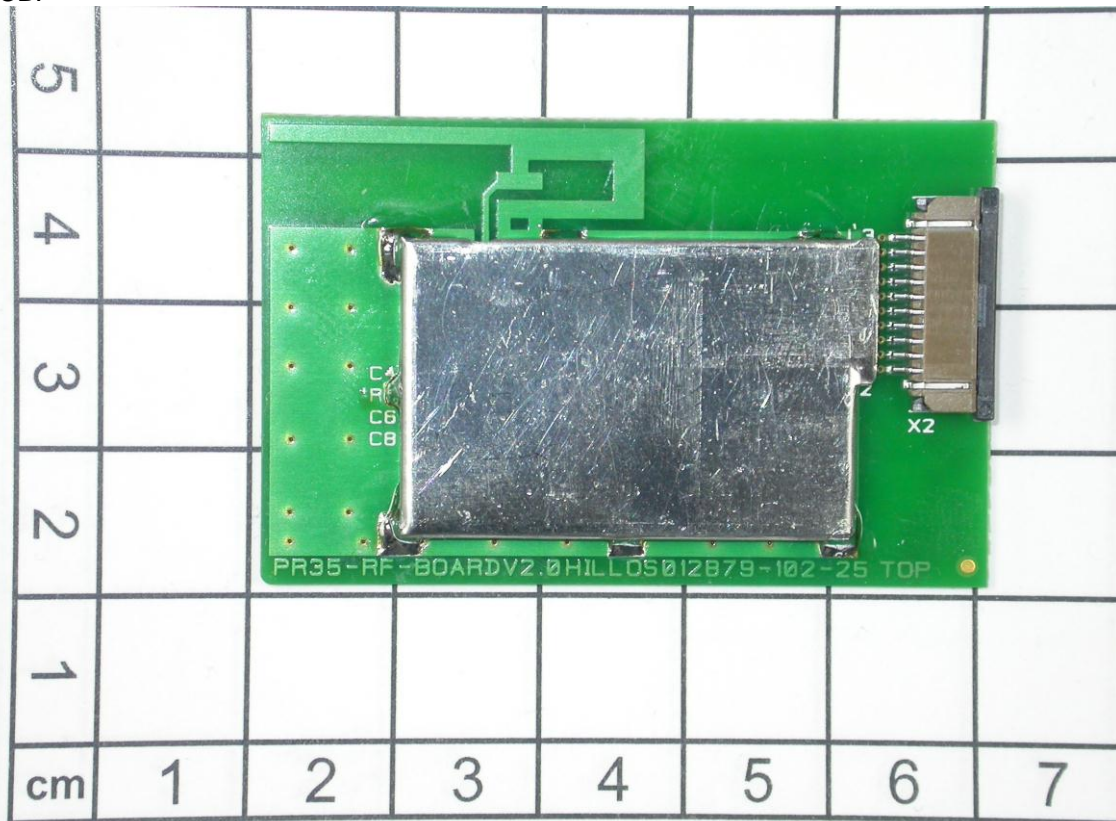


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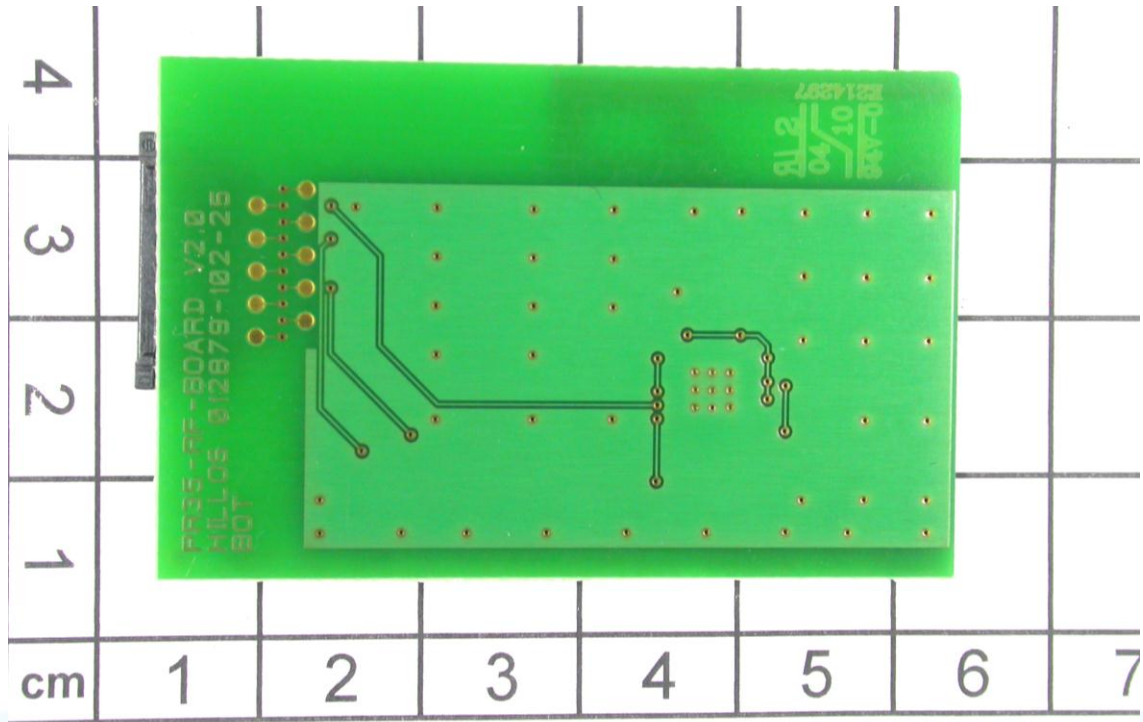


FCC ID:SDL-PRA90R01

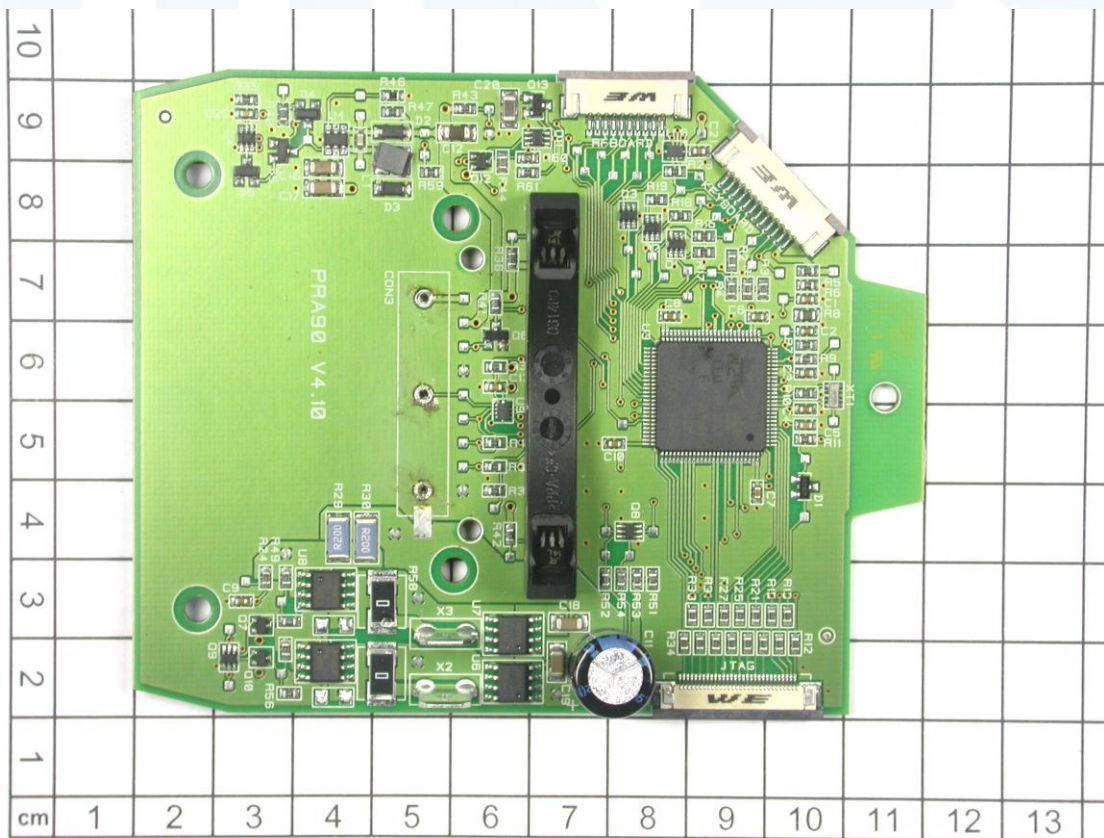
Wireless PCB:



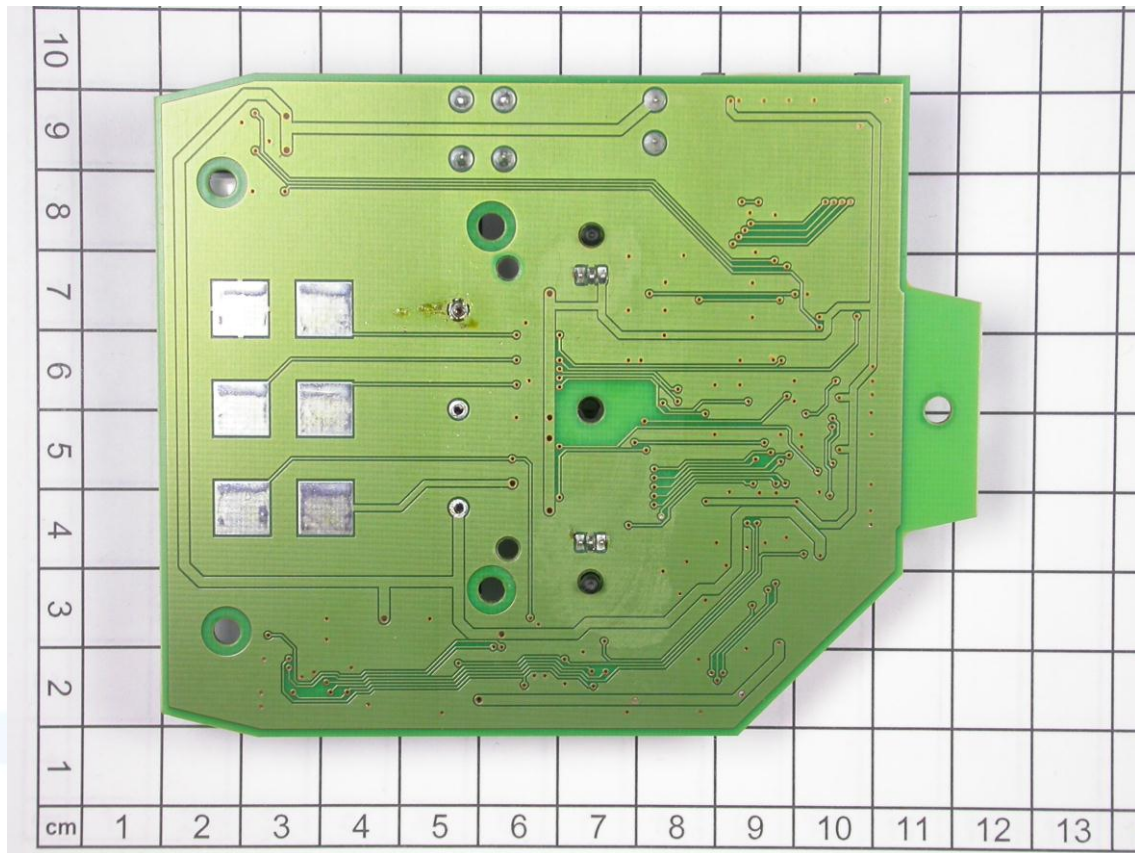
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Control PCB:



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FCC ID:SDL-PRA90R01

3.2 Power supply system utilised

Power supply voltage : 7.2 V DC Lithium ion battery, 100 V AC – 240 V AC charging;

3.3 Short description of the equipment under test (EUT)

The EUT is a height adjustable tripod with transceiver for radio remote control. The EUT operates at 2405 MHz. It can operate while charging the battery.

Number of tested samples: 1
Serial number: 12

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- TX continuous mode at 2405 MHz

- RX mode

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- Power supply, 100 VAC – 240 VAC Model : HILTI PRA85, S/N: H00000059
- _____ Model : _____
- _____ Model : _____

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production processes may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the EUT.

4.4 Measurement protocol for FCC and IC

4.4.1 GENERAL INFORMATION

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 210 Issue 8 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.1.3 Details of test procedures

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.4 Conducted emission

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversion formula apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}); \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)}; \end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

FCC ID:SDL-PRA90R01

4.4.1.5 Radiated emission (electrical field 30 MHz - 1 GHz)

Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 cm to the ground plane are bundled in the center in a serpentine fashion so that they are at least 40 cm from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 m horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 m and the EUT is rotated 360 degrees.

The final level in dBµV/m is calculated by add on the reading value from the EMI receiver (level dBµV) the correction factor. The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency	Level	+	Factor	=	Level	-	CISPR Limit	=
Delta								
(MHz)	(dBµV)		(dB)		(dBµV/m)		(dBµV/m)	(dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	= -2.4

4.4.1.6 Radiated emission (electrical field 1 GHz - 40 GHz)

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

4.5 Determination of worst case measurement conditions

Measurements have been made in all three orthogonal axes. There is no access to any setting of the EUT. The EUT is preset for testing in TX continuous mode with max output power. The user is not able to change any setting and can operate the EUT only manually. For the further measurement the EUT is set in X position.

FCC ID:SDL-PRA90R01

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that 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 given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz
Min. limit margin -22.1 dB at 15.265 MHz

FCC ID:SDL-PRA90R01

Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.

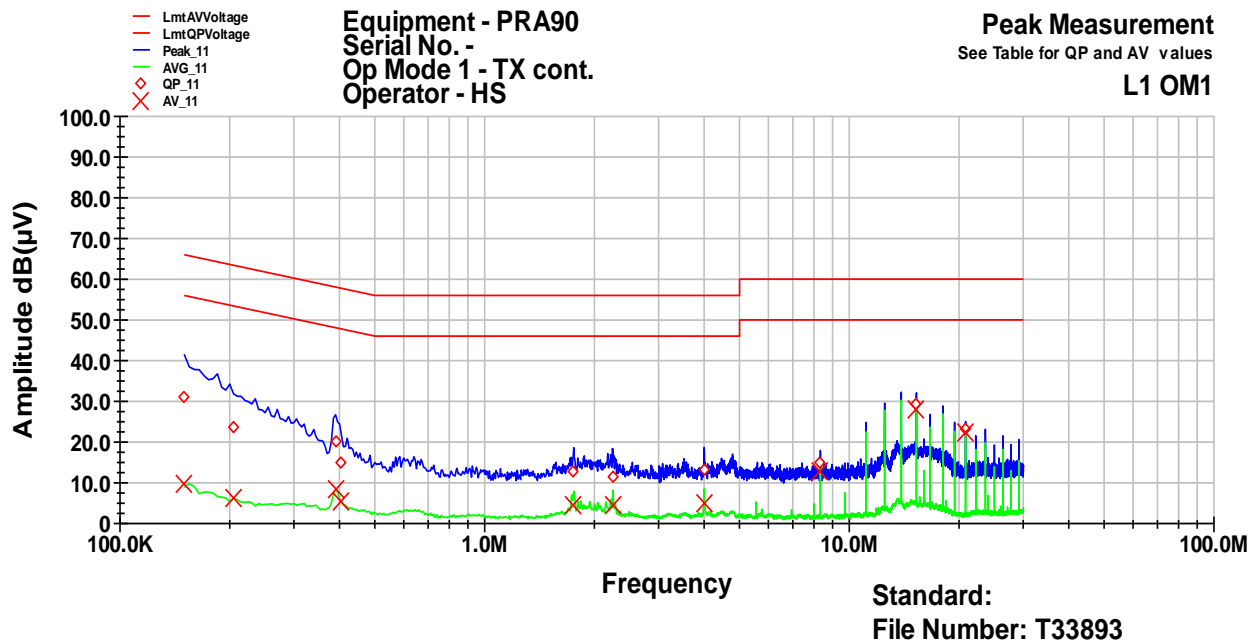
Remarks: For detailed test result please see following test protocols.



FCC ID:SDL-PRA90R01

5.1.6 Test protocol

Test point L1 Result: passed
 Operation mode: TX continuous mode at 2405 MHz
 Remarks: Charging the battery, AC mains 110 V.

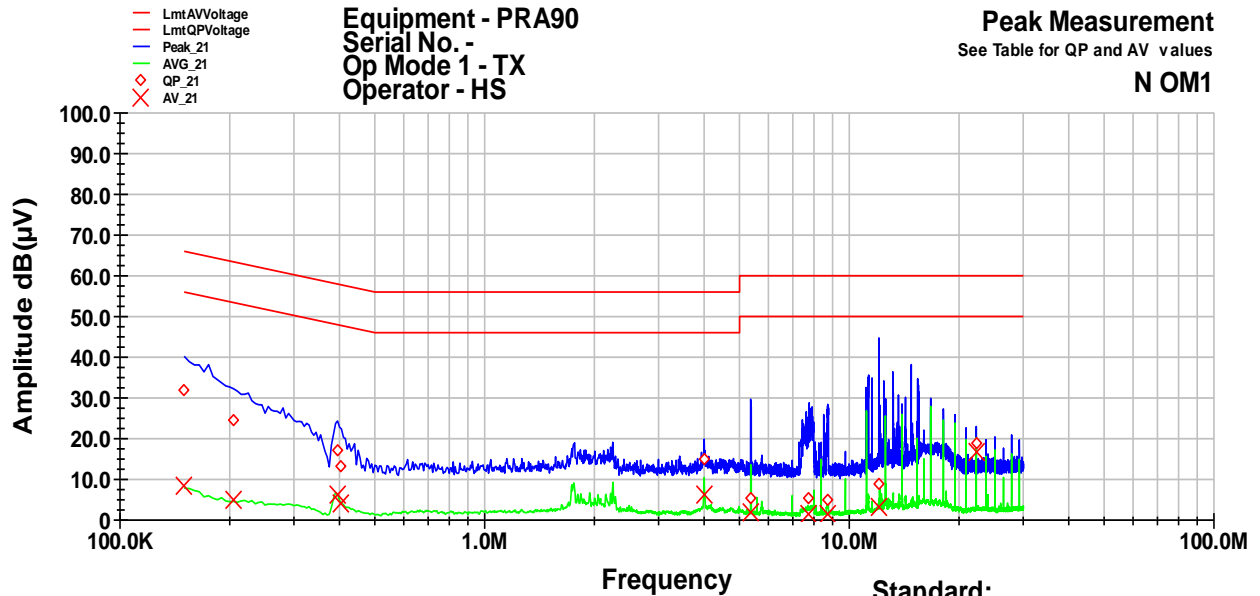


Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.15	31.0	-35.0	66.0	9.8	-46.2	56.0
0.205	23.5	-39.9	63.4	6.1	-47.3	53.4
0.39	20.0	-38.0	58.1	8.6	-39.5	48.1
0.405	15.1	-42.6	57.8	5.2	-42.5	47.8
1.755	12.7	-43.3	56.0	4.6	-41.4	46.0
2.24	11.6	-44.4	56.0	4.4	-41.6	46.0
4	13.1	-42.9	56.0	4.8	-41.2	46.0
8.325	14.8	-45.2	60.0	12.8	-37.2	50.0
15.265	29.4	-30.6	60.0	27.9	-22.1	50.0
20.82	23.1	-36.9	60.0	22.3	-27.7	50.0

FCC ID:SDL-PRA90R01

Test point: N
 Operation mode: TX continuous mode at 2405 MHz
 Remarks: Charging the battery, AC mains 110 V.

Result: passed



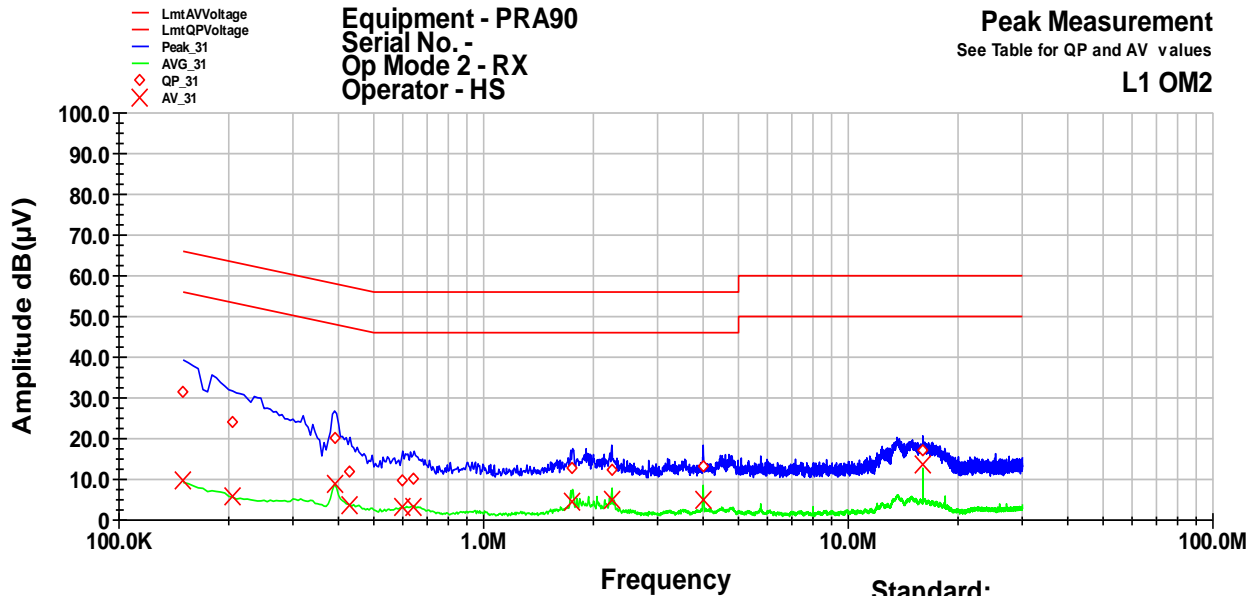
Standard:
 File Number: T33893

Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.15	31.8	-34.2	66.0	8.5	-47.5	56.0
0.205	24.4	-39.0	63.4	4.9	-48.5	53.4
0.395	17.0	-40.9	58.0	6.1	-41.8	48.0
0.405	13.4	-44.4	57.8	4.1	-43.6	47.8
4	15.1	-40.9	56.0	6.1	-40.0	46.0
5.365	5.5	-54.5	60.0	1.8	-48.2	50.0
7.76	5.3	-54.7	60.0	1.5	-48.5	50.0
8.725	5.1	-54.9	60.0	1.6	-48.4	50.0
12.045	8.9	-51.0	60.0	3.1	-46.9	50.0
22.28	18.8	-41.2	60.0	16.9	-33.1	50.0

FCC ID:SDL-PRA90R01

Test point: L1
 Operation mode: RX mode
 Remarks: Charging the battery, AC mains 110 V.

Result: passed



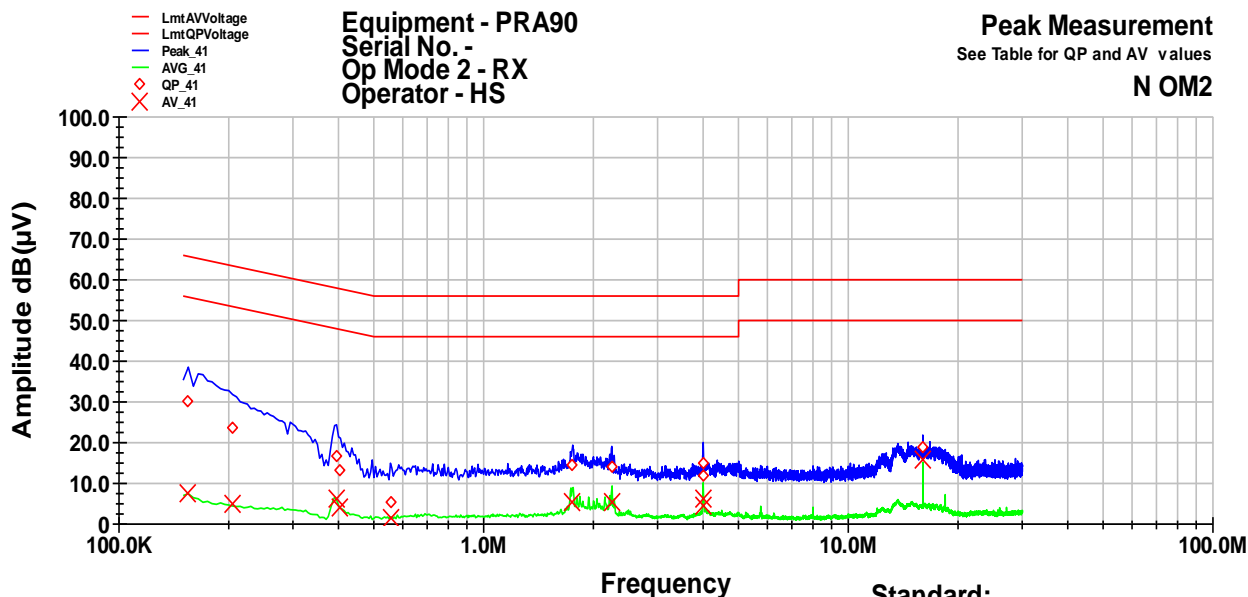
Standard:
File Number: T33893

Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.15	31.3	-34.7	66.0	9.7	-46.3	56.0
0.205	23.9	-39.5	63.4	5.8	-47.6	53.4
0.39	20.1	-37.9	58.1	8.7	-39.4	48.1
0.43	12.0	-45.3	57.3	3.7	-43.5	47.3
0.6	9.8	-46.2	56.0	3.0	-43.0	46.0
0.645	10.3	-45.7	56.0	3.2	-42.8	46.0
1.755	12.6	-43.4	56.0	4.5	-41.5	46.0
2.245	12.3	-43.7	56.0	4.8	-41.2	46.0
4	13.3	-42.7	56.0	4.8	-41.2	46.0
16	17.3	-42.7	60.0	13.5	-36.5	50.0

FCC ID:SDL-PRA90R01

Test point: N
 Operation mode: RX mode
 Remarks: Charging the battery, AC mains 110 V.

Result: passed



Standard:
 File Number: T33893

Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.155	30.3	-35.5	65.7	7.6	-48.1	55.7
0.205	23.6	-39.8	63.4	4.8	-48.6	53.4
0.395	16.9	-41.1	58.0	6.1	-41.8	48.0
0.405	13.3	-44.4	57.8	4.0	-43.8	47.8
0.555	5.3	-50.7	56.0	1.6	-44.4	46.0
1.755	14.4	-41.6	56.0	5.6	-40.4	46.0
2.25	14.1	-41.9	56.0	5.5	-40.5	46.0
4	15.1	-40.9	56.0	6.1	-39.9	46.0
4.005	11.9	-44.0	56.0	4.3	-41.7	46.0
16	18.7	-41.3	60.0	15.8	-34.2	50.0

5.2 Field strength of the fundamental wave

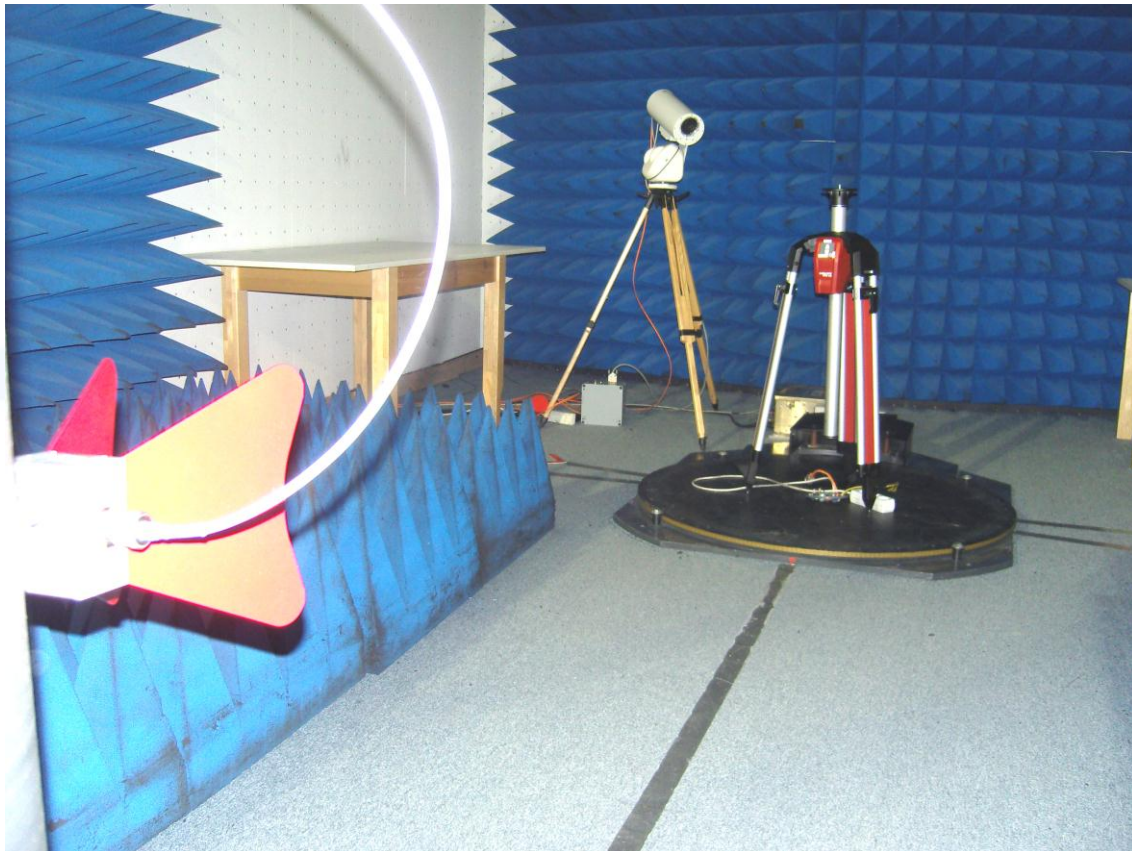
For test instruments and accessories used see section 6 Part CPR 3.

5.2.1 Description of the test location

Test location: Anechoic Chamber A2

Test distance: 3 metres

5.2.2 Photo documentation of the test set-up



5.2.1 Applicable standard

According to FCC Part 15C, Section 15.249(a):

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the effective limits.

5.2.2 Description of Measurement

The radiated emission of the fundamental wave from the EUT is measured using a spectrum analyzer and appropriate linear polarized antennas.

Analyser settings:

Peak measurement:	RBW: 1 MHz	VBW: 3 MHz	Detector:	Max peak
AV measurement:	RBW: 1 MHz	VBW: 10 Hz	Detector:	Max peak

FCC ID:SDL-PRA90R01

5.2.3 Test result

Frequency (MHz)	Reading level PK (dBµV)	Bandwidth (kHz)	Correction factor (dB)	Corrected level PK dB(µV/m)	Limit PK dB(µV/m)	Delta (dB)
2405	-	1000	-	94.4	114	-19.6

Note: The correction factor includes cable loss and antenna factor.

Frequency (MHz)	Reading level AV (dBµV)	Bandwidth (kHz)	Correction factor (dB)	Corrected level AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
2405	-	1000	-	42.3	94	-51.7

Note: The correction factor includes cable loss and antenna factor.

Average-Limit according to FCC Part 15C, Section 15.249(a):

Frequency (MHz)	Field strength of fundamental	
	(mV/m)	dB(µV/m)
902 - 928	50	94
2400 - 2483.5	50	94
5725-5875	50	94
24000 - 24250	250	108

Peak-Limit according to FCC Part 15C, Section 15.249(e):

However the peak field strength shall not exceed the maximum permitted average limit by more than 20 dB.

The requirements are **FULFILLED**.

Remarks:

FCC ID:SDL-PRA90R01

5.3 Spurious emissions radiated

For test instruments and accessories used see section 6 Part **SER1**, **SER 2**, **SER 3**.

5.3.1 Description of the test location

Test location: OATS1
Test location: Anechoic Chamber A2
Test distance: 3 metres

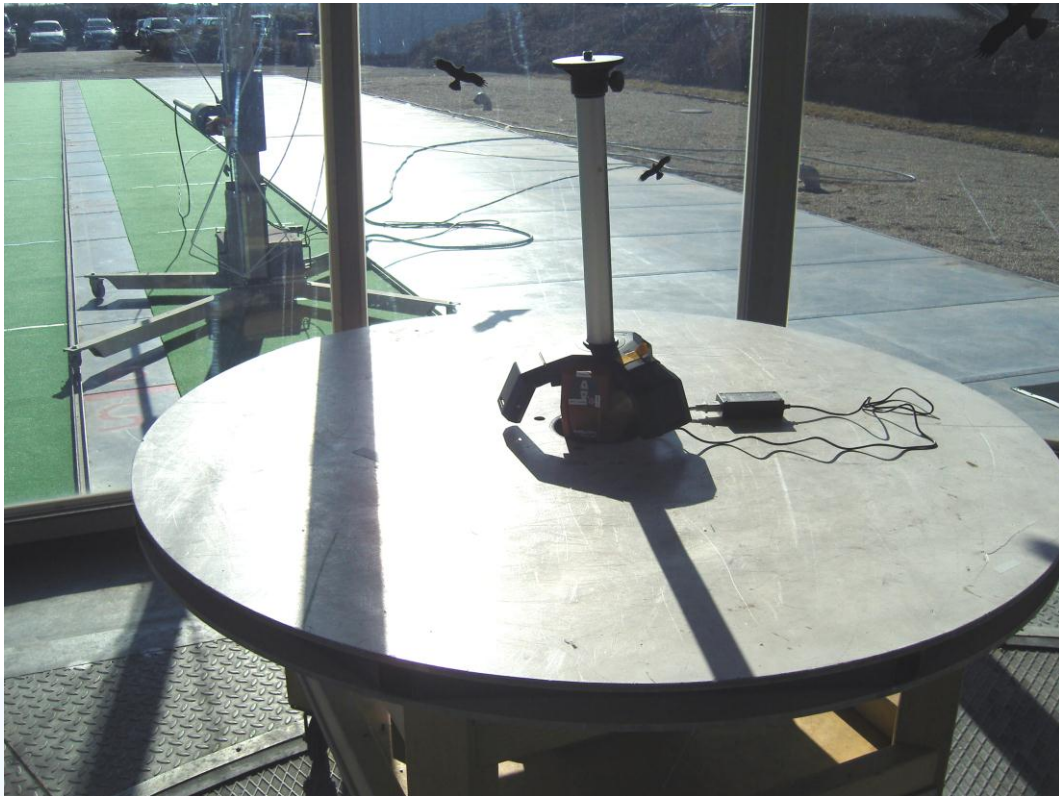
5.3.2 Photo documentation of the test set-up

Test setup 9 kHz to 30 MHz

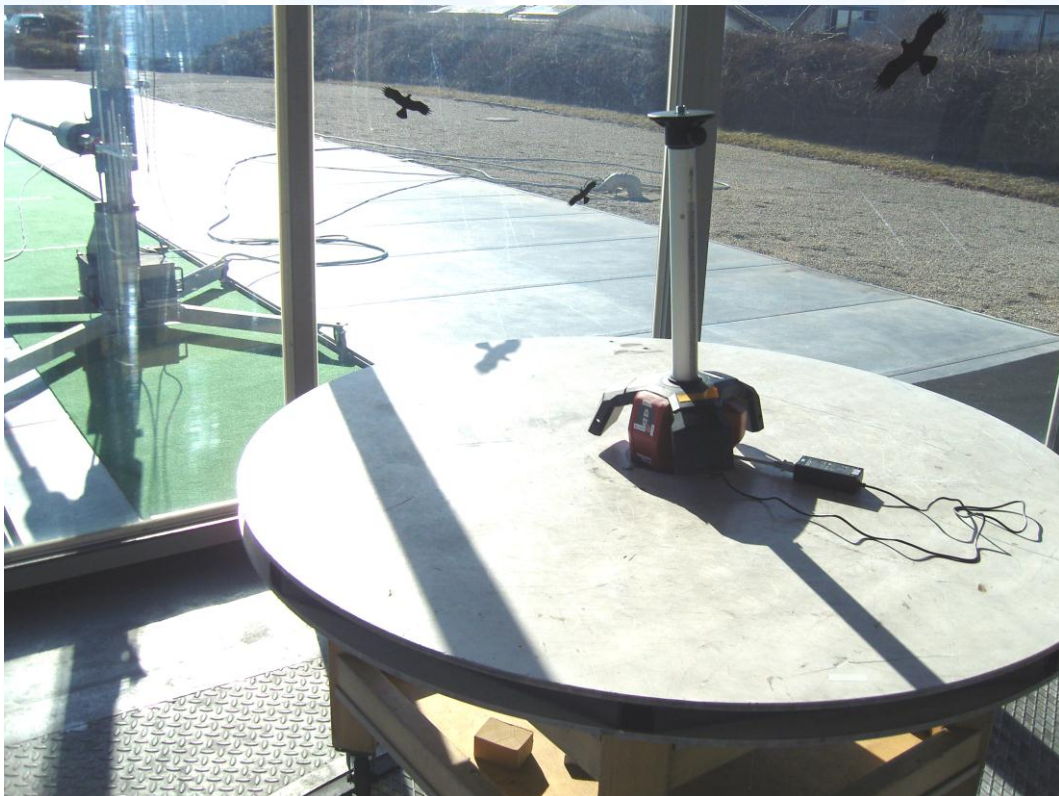


FCC ID:SDL-PRA90R01

Test setup 30 MHz to 300 MHz

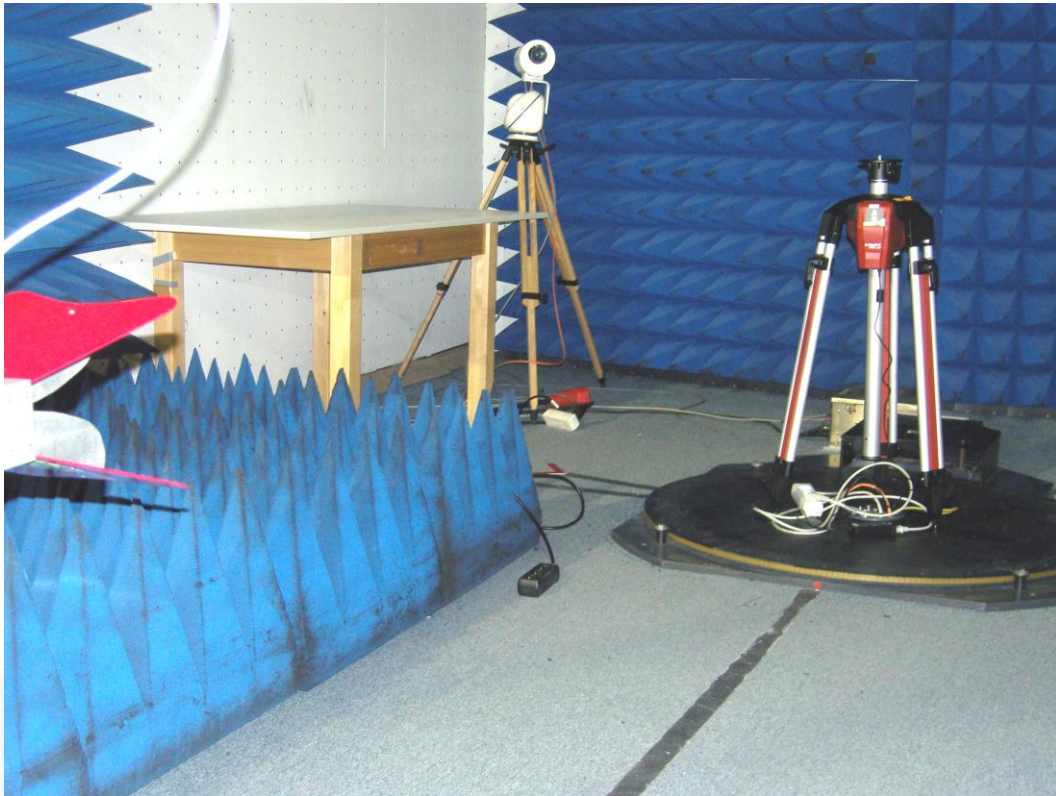


Test setup 300 MHz to 1000 MHz



FCC ID:SDL-PRA90R01

Test setup 1 GHz to 18 GHz



Test setup 18 GHz to 26 GHz



FCC ID:SDL-PRA90R01

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.249 (d):

Emission radiated outside of the specified frequency bands, except harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limit in FCC Part 15C, Section 15.209, whichever is the lesser attenuation.

5.3.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 9 kHz to 1000 MHz using a tuned receiver and above 1 GHz a spectrum analyser is used. The set up is in accordance to ANSI C63.4. If the emission level in peak mode complies with the average limit then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported. During the test, the EUT was set into continuous transmitting mode modulated.

Instrument settings:

9 kHz – 150 kHz	RBW:	200 Hz
150 kHz - 30 MHz	RBW:	9 kHz
30 MHz – 1000 MHz:	RBW:	120 kHz
1000 MHz – 26 GHz	RBW:	1 MHz

5.3.5 Test result

f < 1 GHz

Channel 1

Frequency (MHz)	Reading level QP (dBµV)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level QP dB(µV/m)	Limit dB(µV/m)	Delta (dB)
-	-					

f > 1 GHz

Channel 1

Frequency (MHz)	Level PK (dBµV)	Correction factor (dB/m)	Corrected level PK dB(µV/m)	Limit PK dB(µV/m)	Delta (dB)
2350	-	-	47.1	74.0	-26.9
4800	-	-	55.7	74.0	-18.3
7216	-	-	55.9	74.0	-18.1
12024 H	-	-	56.3	74.0	-17.7
12024 V			55.8	74.0	-18.2

Note: The correction for antenna and insertion losses is done by set the transducer factor on the instrument.

Channel 1

Frequency (MHz)	Level AV (dBµV)	Correction factor (dB/m)	Corrected level AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
4800	-	-	53.8	54.0	-0.2
7216	-	-	52.3	54.0	-1.7
12024 H	-	-	52.0	54.0	-2.0
12024 V	-	-	51.3	54.0	-2.7

Note: The correction for antenna and insertion loss is done by set the transducer factor on the instrument.

FCC ID:SDL-PRA90R01

Limit according to FCC Part 15C, Section 15.209:

Frequency (MHz)	15.209 Limits dB(μV/m)	Measurement distance (m)
0.009 - 0.49	2400/f(kHz)	300
0.49 – 1.705	24000/f(kHz)	30
1.705 – 30.0	30	30
30 - 88	40	3
88 - 216	43.5	3
216 - 960	46	3
Above 960	54	3

Average limit according to FCC Part 15C, Section 15.249(a):

Fundamental frequency (MHz)	Field strength of harmonics	
	(μV/m)	dB(μV/m)
902 - 928	500	54
2400 - 2483.5	500	54
5725 - 5875	500	54
24000 - 24250	2500	68

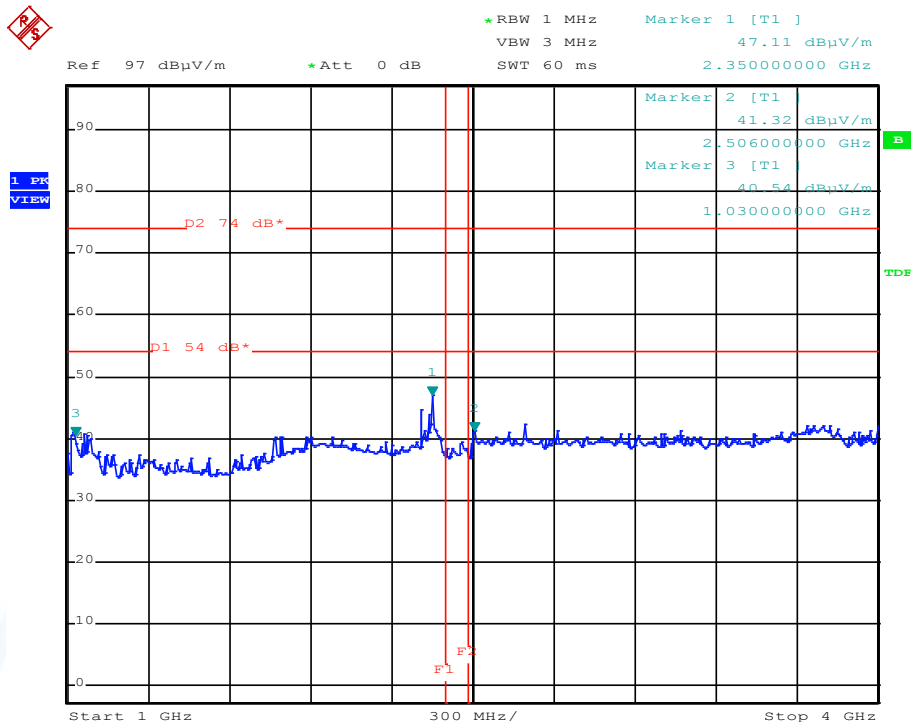
The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic (26000 MHz). For detailed test result please see following test protocols. Only the worst cases of the plots are listed.

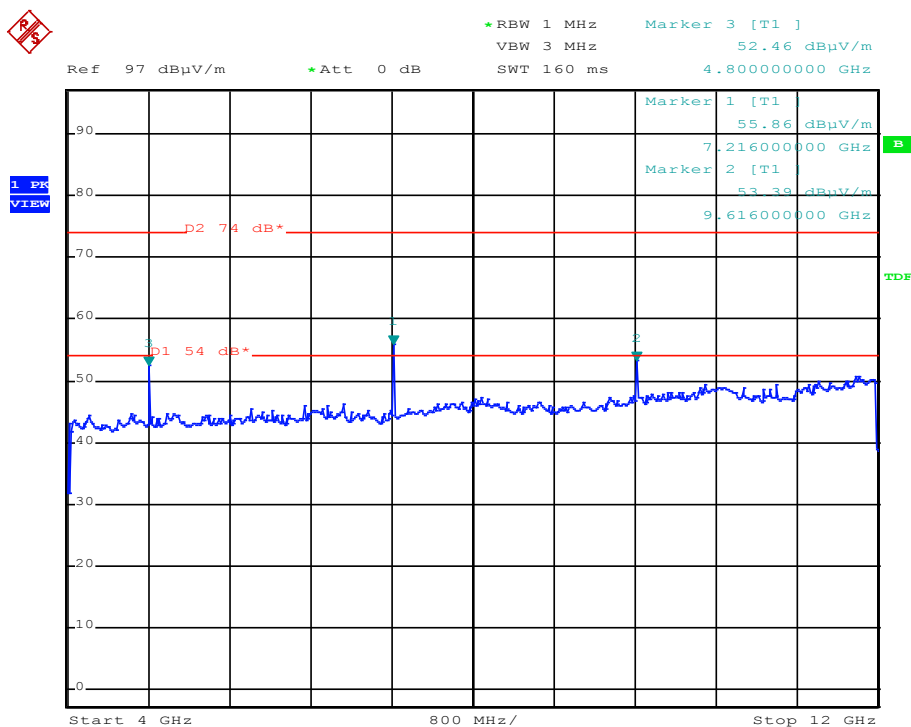
FCC ID:SDL-PRA90R01

5.3.6 Test protocols

Spurious emissions from 1 to 4 GHz
(Band pass filter 2.4 GHz to 2.4835 GHz used.)

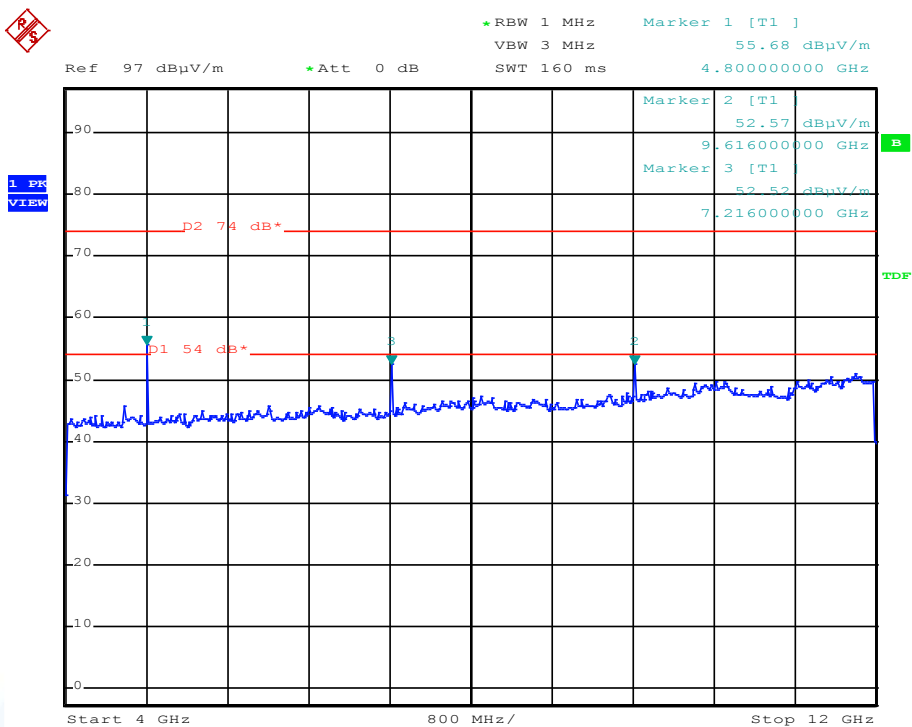


Spurious emissions from 4 to 12 GHz, horizontal

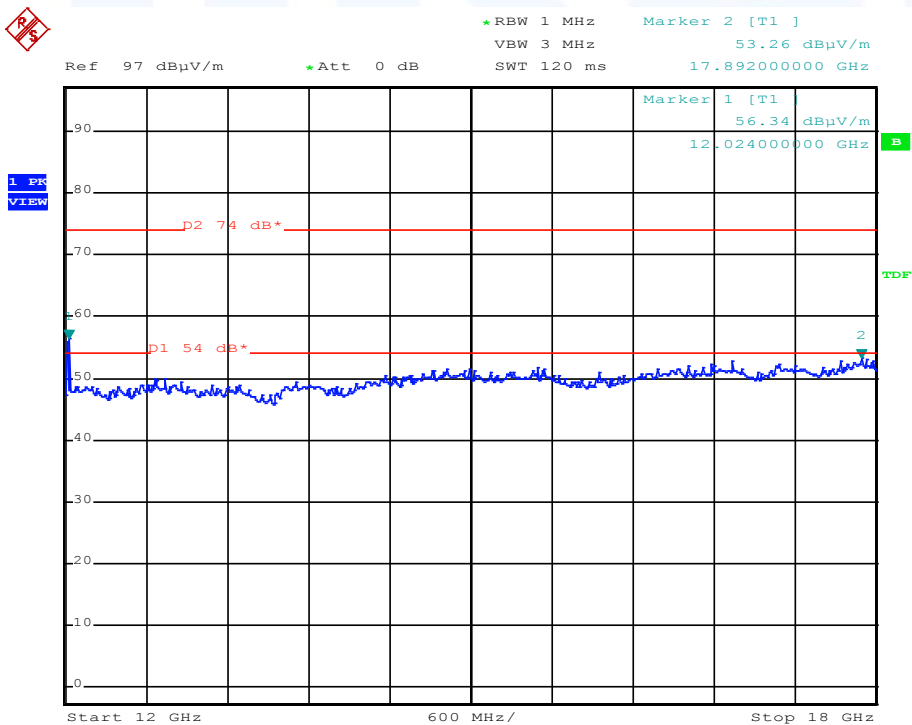


FCC ID:SDL-PRA90R01

Spurious emissions from 4 to 12 GHz, vertical

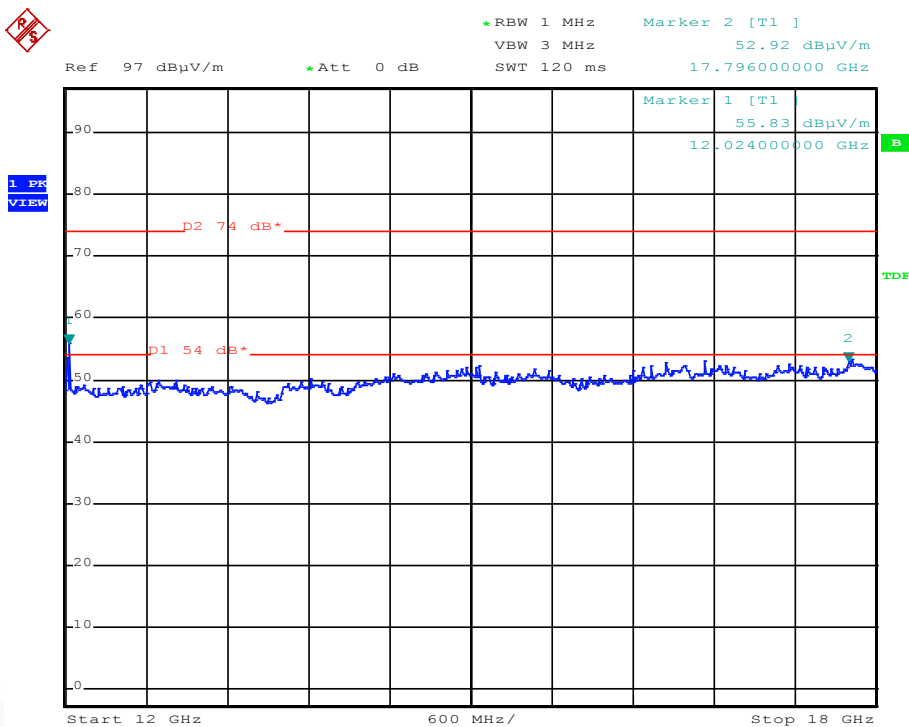


Spurious emissions from 12 to 18 GHz, horizontal

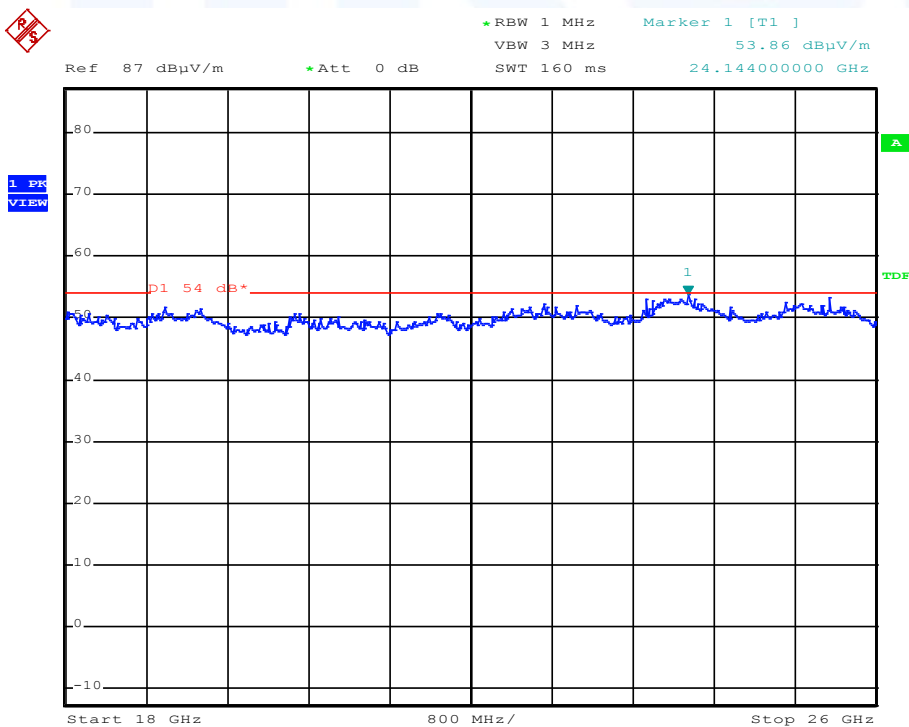


FCC ID:SDL-PRA90R01

Spurious emissions from 12 to 18 GHz, vertical



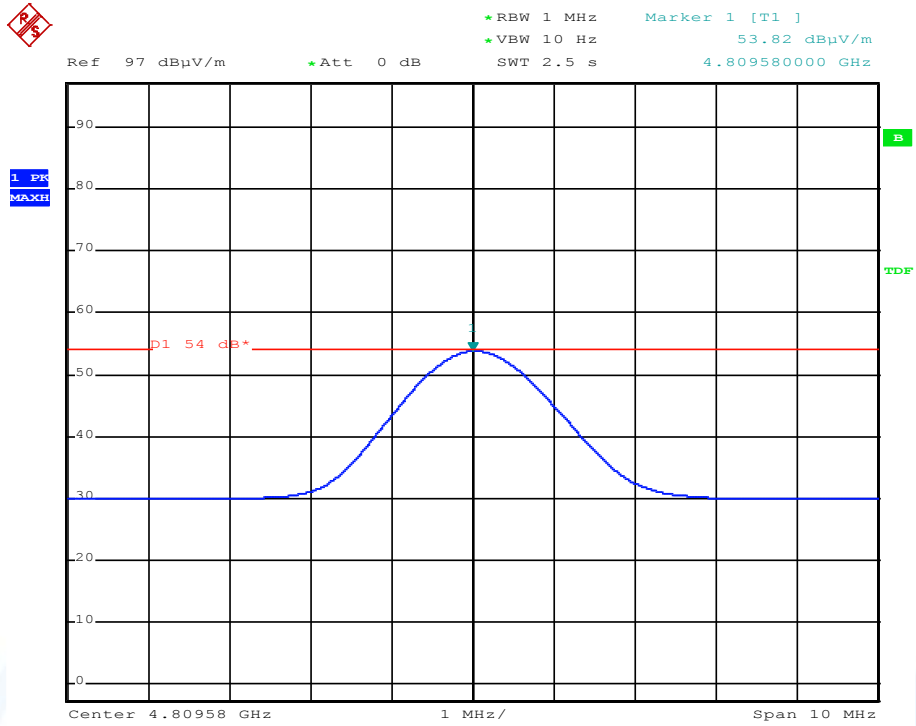
Spurious emissions from 18 to 26 GHz



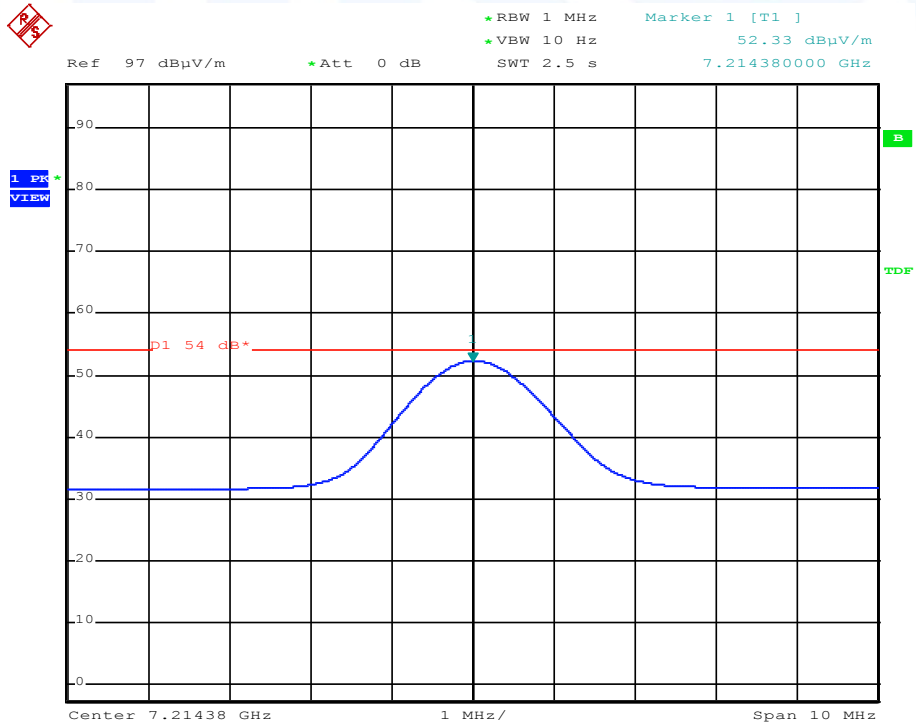
FCC ID:SDL-PRA90R01

AV-Measurement

4809 MHz:



7214 MHz:

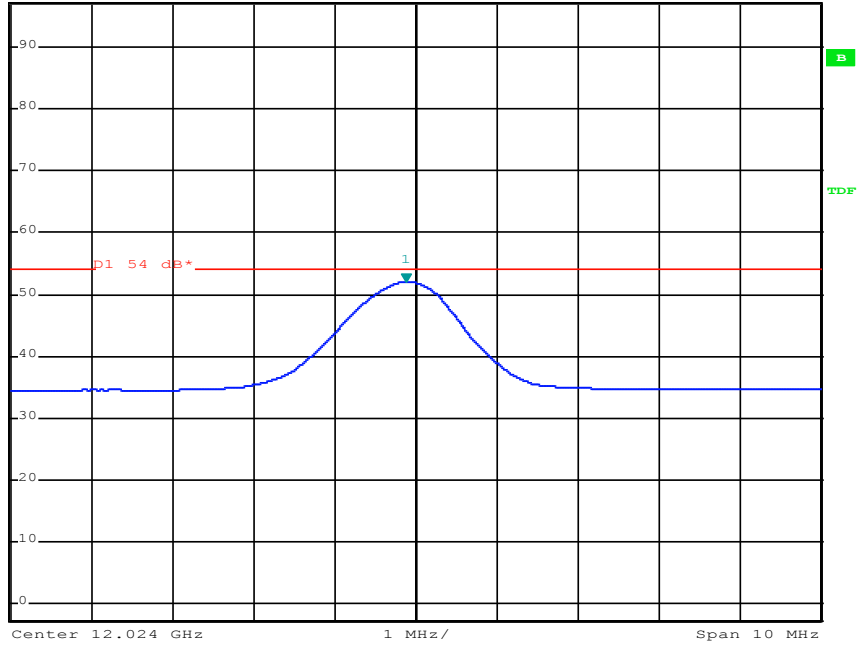


FCC ID:SDL-PRA90R01

12024 MHz, horizontal:



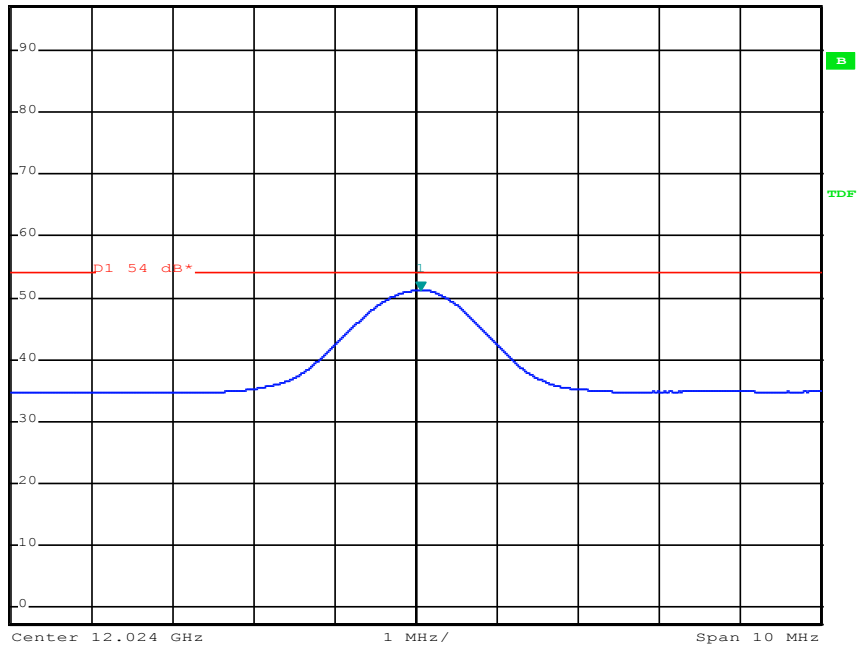
*RBW 1 MHz Marker 1 [T1]
 *VBW 10 Hz 52.03 dBuV/m
 Ref 97 dBuV/m *Att 0 dB SWT 2.5 s 12.023880000 GHz



12024 MHz, vertical:



*RBW 1 MHz Marker 1 [T1]
 *VBW 10 Hz 51.27 dBuV/m
 Ref 97 dBuV/m *Att 0 dB SWT 2.5 s 12.024060000 GHz



FCC ID:SDL-PRA90R01**5.4 20 dB bandwidth**

For test instruments and accessories used see section 6 Part MB.

5.4.1 Description of the test location

Test location: AREA 4

5.4.2 Photo documentation of the test set-up**5.4.3 Applicable standard**

According to FCC Part 15, Section 15.215(c):

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Section 15.217 through Section 15.257, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated.

5.4.4 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB. The reference level is the level of the highest signal amplitude observed from the transmitter at the fundamental frequency. Alternative is the x-dB-down function of the analyser used. The EBW is then directly shown in the marker display. The measurement is performed with normal modulation and a transfer rate means the worst case.

Spectrum analyser settings:

RBW: 100 kHz, VBW: 300 kHz;

FCC ID:SDL-PRA90R01

5.4.5 Test result

Operating frequency band (MHz)	20 dB Bandwidth (MHz)
$f_{low} > 2400$	$f_{low} = 2404.660$
$f_{high} < 2483.5$	$f_{high} = 2404.928$

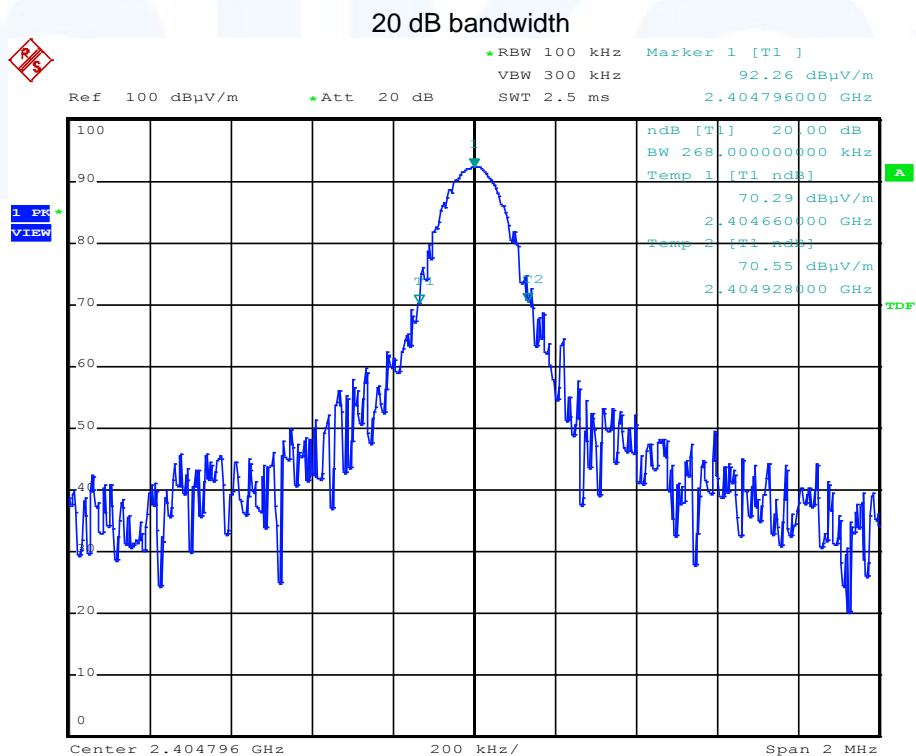
Limit according to FCC Part 15C, Section 15.215(c):

If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

The requirements are **FULFILLED**.

Remarks: For detailed test result please refer to following test protocols.

5.4.6 Test protocols



5.5 Antenna application

5.5.1 Applicable standard

According to FCC Part 15C, Section 15.203(a):

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.

5.5.2 Result

The EUT use an integrated PCB antenna. No other antenna than that furnished by the responsible party or external power amplifier can be applied by a customer.

The antenna of the EUT meets the requirement of FCC Part 15C, Section 15.203 and 15.204.

Remarks:

FCC ID:SDL-PRA90R01

5.6 Occupied bandwidth

For test instruments and accessories used see section 6 Part MB.

5.6.1 Description of the test location

Test location: AREA 4

5.6.2 Photo documentation of the test set-up



5.6.3 Applicable standard

According to RSS-Gen, 4.6.1:

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

5.6.4 Description of Measurement

The bandwidth was measured with the function "bandwidth measurement" of the spectrum analyser and recorded. Spectrum analyser settings: RBW: 100 kHz, VBW: 300 kHz;

FCC ID:SDL-PRA90R01

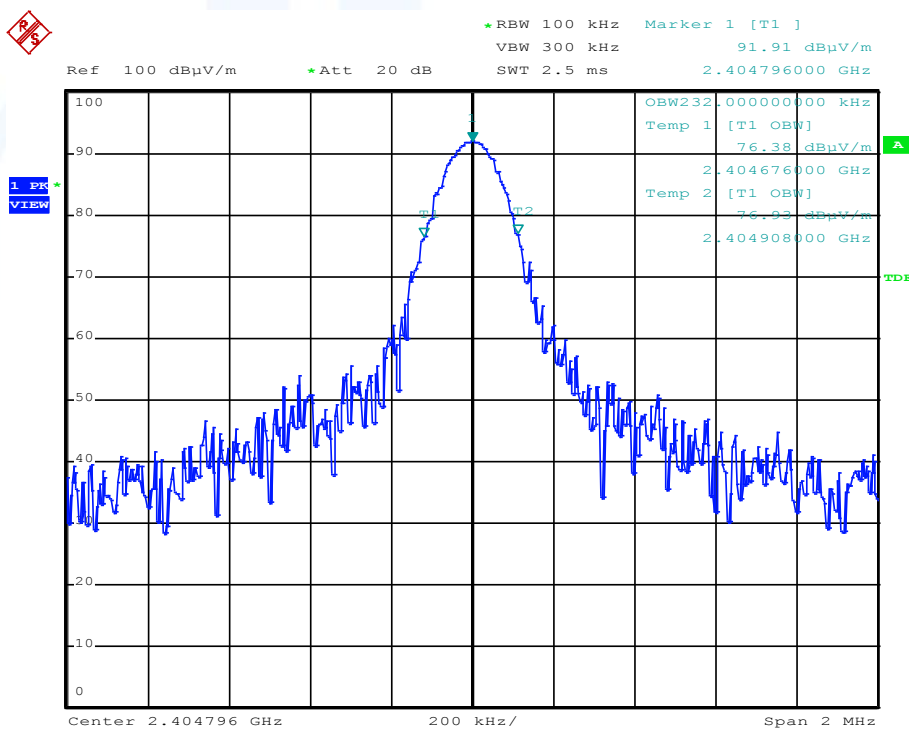
5.6.5 Test result

Channel number	Fundamental frequency (MHz)	99 % Bandwidth (MHz)
1	2405	0.232

Remarks: For detailed test result please refer to following test protocols. The RSS Gen defines no limit for the occupied bandwidth!

5.6.6 Test protocols

Channel 1 (2405 MHz)



FCC ID:SDL-PRA90R01

5.7 Frequency range

For test instruments and accessories used see section 6 Part **MB**.

5.7.1 Description of the test location

Test location: NONE

5.7.2 Applicable standard

According to RSS-Gen, Section 7.2.6:

Transmitter frequency stability for licence-exempt LPDs shall be measured at temperature range of -20°C, 20°C and +50°C.

If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standards, measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands of Table 1 and the prohibited TV bands of 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz, 470 - 608 MHz and 614 - 806 MHz.

Remarks: The measurement is not required. The occupied bandwidth lies entirely outside the restricted
bands of Table 1.

FCC ID:SDL-PRA90R01

5.8 Receiver radiated emissions

For test instruments and accessories used see section 6 Part **SER2** and **SER3**.

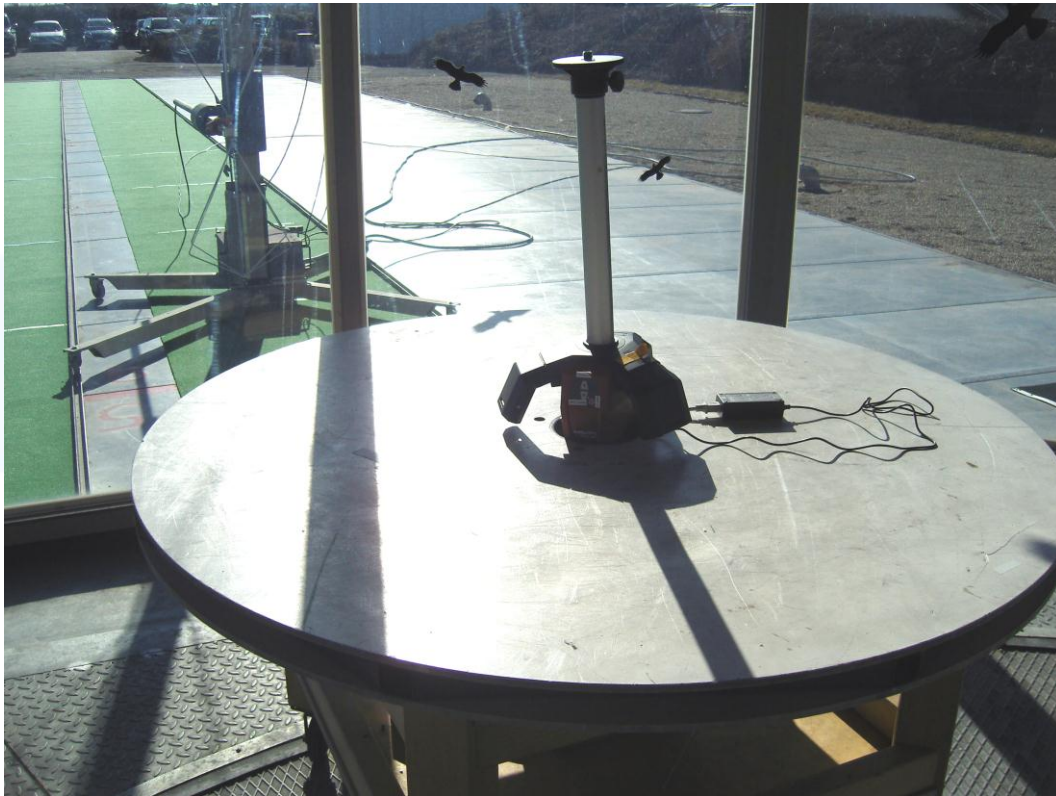
5.8.1 Description of the test location

Test location: OATS 1
Test location: Anechoic Chamber A2

Test distance: 3 metres

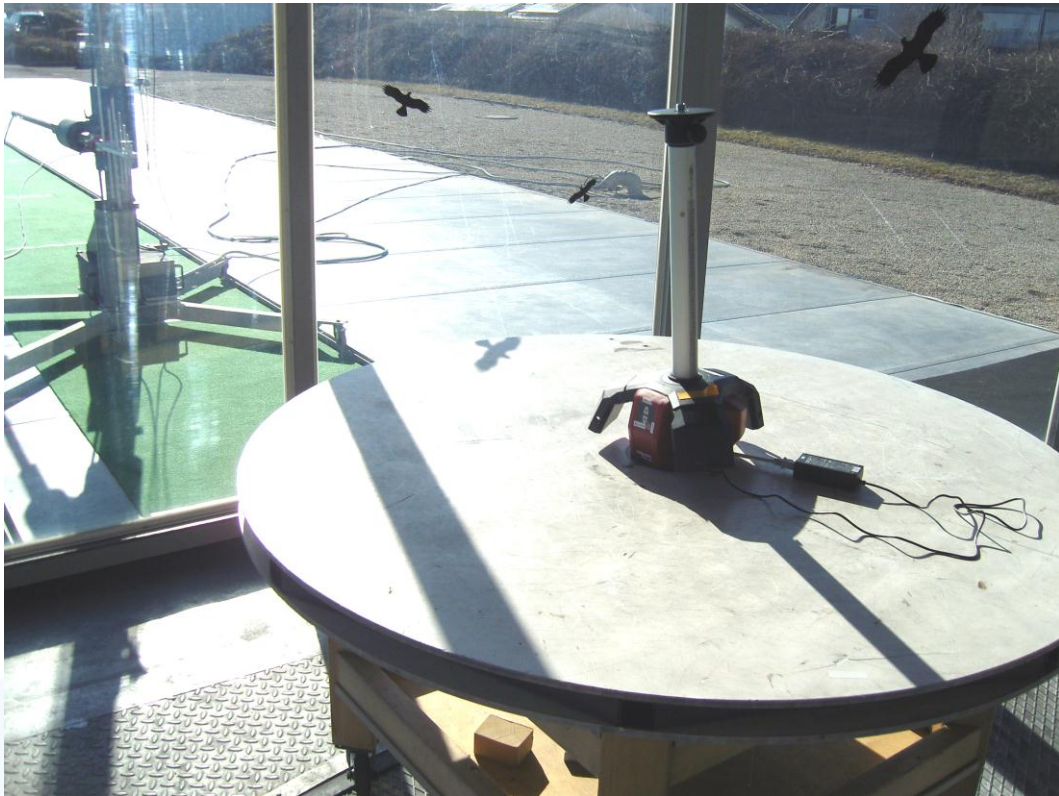
5.8.2 Photo documentation of the test set-up

Test setup 30 MHz to 300 MHz

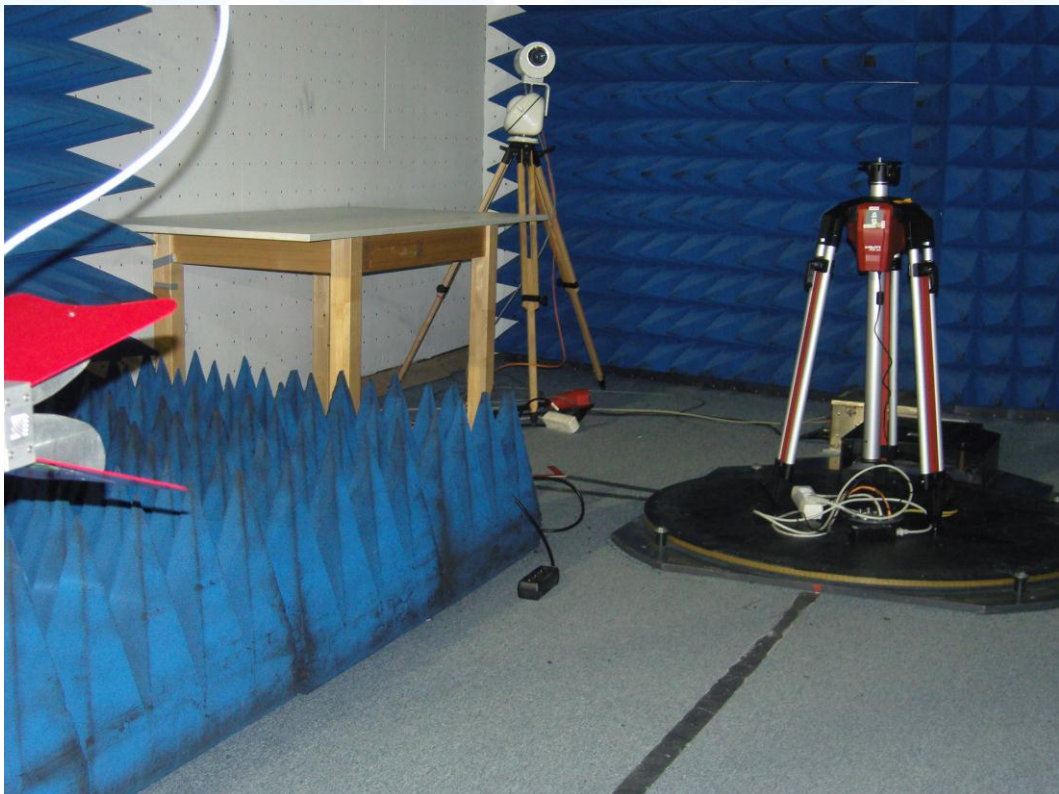


FCC ID:SDL-PRA90R01

Test setup 300 MHz to 1000 MHz



Test setup 1 GHz to 7.5 GHz



FCC ID:SDL-PRA90R01

5.8.3 Applicable standard

According to RSS-Gen, Item 6.4:
Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10.

5.8.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and above 1 GHz a spectrum analyser. The set up of the EUT will be in accordance to ANSI C63.4. If the emission level in peak mode complies with the average limit then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported. During the test, the EUT was set into RX mode.

Instrument settings:

9 kHz – 150 kHz	RBW:	200 Hz;
150 kHz - 30 MHz	RBW:	9 kHz;
30 MHz – 1000 MHz:	RBW:	120 kHz;
1000 MHz – 7.5 GHz	RBW:	1 MHz;

5.8.5 Test result

f < 1 GHz:

Frequency (MHz)	Reading level QP (dBµV)	Correction factor (dB/m)	Corrected level QP dB(µV/m)	Limit dB(µV/m)	Delta (dB)
-	-				

f > 1 GHz:

Frequency (MHz)	Reading level PK (dBµV)	Bandwidth (kHz)	Correct. factor (dB/m)	Corrected level PK dB(µV/m)	Limit dB(µV/m)	Delta (dB)
1990		1000		42.7	74.0	-31.3
4800		1000		53.4	74.0	-20.6

Note: The correction for antenna and insertion loss is done by set the transducer factor on the instrument.

Limit according to RSS-Gen, Item 6.4.1:

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
Above 960	500 (54 dBµV/m)	3

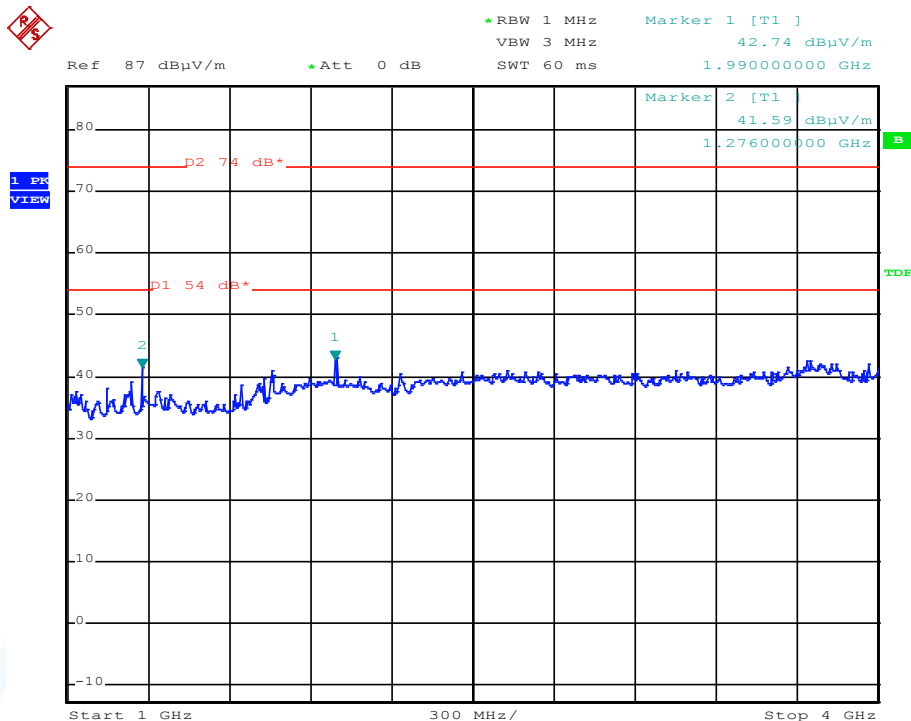
The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 3rd harmonic (7500 MHz). For detailed test result see following test protocols. Only the worst case of the plots is listed.

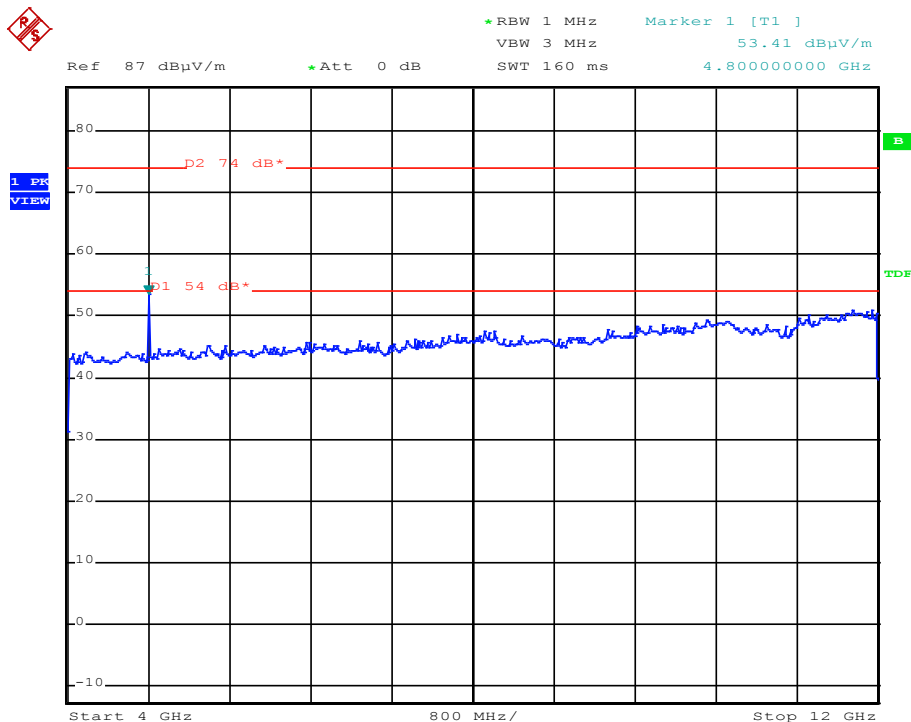
FCC ID:SDL-PRA90R01

5.8.6 Test protocols

Spurious emissions from 1 to 4 GHz



Spurious emissions from 4 to 12 GHz



FCC ID:SDL-PRA90R01

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	18/06/2011	18/06/2010		
	ESH 2 - Z 5	02-02/20-05-004	12/05/2013	12/05/2011	12/11/2011	12/05/2011
	EMV D 30000/PAS	02-02/30-05-006				
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	06/10/2011	06/04/2011		
CPR 3	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	11/02/2012	11/02/2011		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
MB	ESCI	02-02/03-05-005	19/11/2011	19/11/2010		
	WK-340/40	02-02/45-05-001	17/06/2011	17/06/2009	22/06/2011	22/12/2010
	6543A	02-02/50-05-157				
SER 1	FMZB 1516	01-02/24-01-018	16/02/2012	16/02/2011		
	ESCI	02-02/03-05-005	19/11/2011	19/11/2010		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	11/06/2011	11/06/2010		
	VULB 9168	02-02/24-05-005	07/03/2012	07/03/2011	17/09/2011	17/03/2011
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 3	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	11/02/2012	11/02/2011		
	R1 _ 18 - 30 GHz	02-02/30-09-002	02/02/2012	02/02/2011		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				