FCC ID: 2AAREML5WR10
IC ID: 11303A-ML5WR10

EMI – TEST REPORT

- FCC Part 15.247, RSS210 -

Test Report No. :	**T37115-00-00HU**	02. October 2013 Date of issue

Type / Model Name : LOG-PT1000, LOG-PT1000-30, LOG-HC2

Product Description : Wireless Data Logger Family

Applicant : GeoPrecision GmbH

Address : Am Dickhäuterplatz 8

D – 76275 Ettlingen

Manufacturer : GeoPrecision GmbH

Address : Am Dickhäuterplatz 8

D – 76275 Ettlingen

Licence holder : GeoPrecision GmbH

Address : Am Dickhäuterplatz 8

D – 76275 Ettlingen

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Deutsche Akkreditierungsstelle D-PL-12030-01-01 D-PL-12030-01-02

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2012)

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 B - Unintentional Radiators (September, 2012)

Part 15, Subpart B, Section 15.107	AC Line conducted emission ☐ Class A device ☒ Class B device
Part 15, Subpart B, Section 15.109	Radiated emission, general requirements

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 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

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.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment
KDB 558074 D01	Guidance for performing compliance measurements on DTS operating under Section 15.247, v03r01 of April 9, 2013.

2 SUMMARY

2.1 Test result summery

Operating at 905 MHz:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 7.2.4.	AC power line conducted emissions	passed
15.247(a)(2)	RSS210, A8.2(a)	-6 dB EBW	passed
15.247(b)(3)	RSS-210, A8.4(4)	Peak power	passed
15.247(d)	RSS-210, A8.5	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 7.2.2	Emissions in restricted bands	passed
15.247(e)	RSS-210, A8.2(b)	PSD	passed
15.35(c)	RSS-Gen, 4.5	Pulsed operation	not applicable
15.247(i)	RSS 102, 2.5.2	MPE	passed
15.247(b)(4)	RSS-Gen, 7.1.2	Antenna requirement	passed
15.107	RSS Gen, 7.2.4.	AC power line conducted emissions	passed
15.109(a)	RSS-Gen, 6.1	Receiver spurious emissions, radiated	passed
	RSS-Gen, 7.2.6	Transmitter frequency stability	not applicable
	RSS-Gen, 4.6.1	99 % Bandwidth	passed
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	not applicable

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

2.2 General remarks

The EuT is capable to exchange data with a LAN-Interface or USB Dongle (Log-DS-EXT-US) via wireless connection.

For activating the test mode, the USB Dongle with test software on a Lap Top was used.

The complete tests were performed with a sample without housing and an external antenna connector.
The cable loss was taken into account in the measured values.
Radiated tests were performed with an original sample without housing and original antenna.

The EuT has an internal fixed antenna with 0.0 dBi antenna gain.

The EuT works with a fixed output power.

The test report covers complete testing on LOG-HC2 PCB.
On LOG-PT1000 PCB following tests were performed to show compliance:

- Maximum peak conducted output power
- Emission bandwidth
- Occupied bandwidth
- Maximum permissible exposure (MPE)

⇨ For detailed information see 4.5 “Determination of worst case measurement conditions” of this test report.

2.3 Declaration of manufacturer:

- Comparison of:
  - LOG-PT1000 Wireless temperature data logger with internal sensor
  - LOG-PT1000-30 Wireless temperature Data Logger with 30 cm sensor cable
  - LOG-HC2 Wireless temperature and humidity data logger

- The devices:

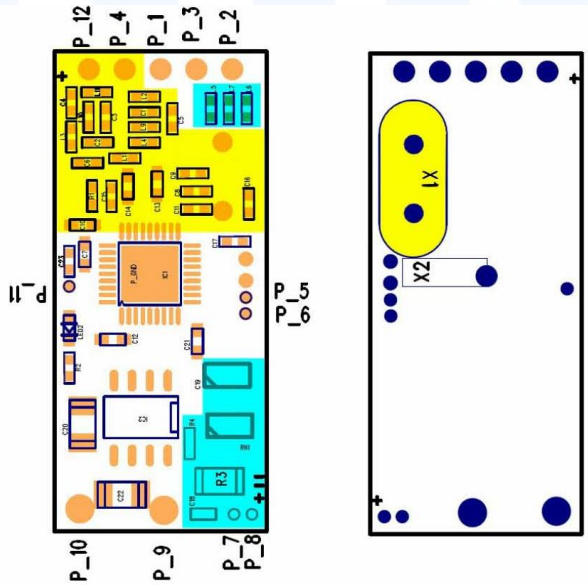
- The basic layout of all the systems (including the USB-dongle and LAN Interface) is always based on a CC1110F32 CPU with 8051-core and SoC Radio (see document "general overview radio.pdf"). The 3 loggers LOG-PT1000, LOG-PT1000-30 and LOG-HC2 also share almost the same electrical and physical layout. The differences concern only a small number of parts for the analog interface, all digital parts (hf capacitors, crystals, and hf inductors) are identical. So we see all these 3 loggers as variants of the same system.

- **Differences LOG-PT1000 to LOG-PT1000-30**
  The only difference between the two version is the length of the sensor cable: For the LOG-PT1000 a platinum temperature sensor (industrial standard PT1000) is soldered directly to the PCB (thus sensor cable length is "zero"), whereas for the LOG-PT1000-30 the PT1000 is connected to the PCB over a cable of 30 cm length. (Theoretically other length from 10-200 cm are possible too on demand, but 30 cm is the production standard). The differences are also shown in the schematics, both variants share the same schematics. For this variant, 4 I/O-pins are set to Analog-Input-Mode.

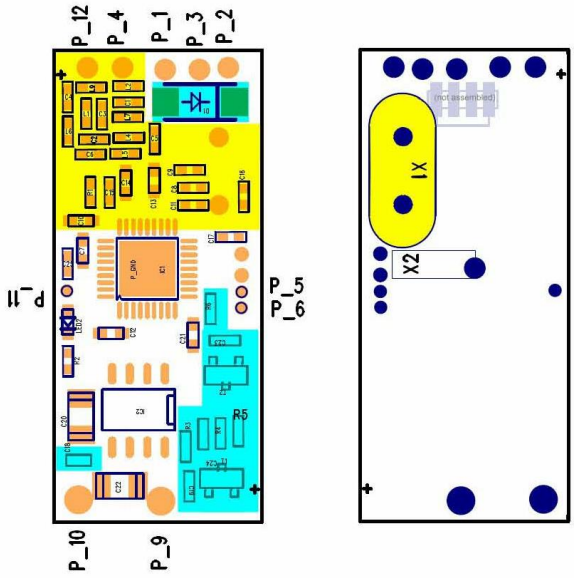
- **Differences LOG-PT1000 / LOG-PT1000-30 to LOG-HC2**
  For the digital sensor Hydroclip 2 ("HC2") from Rotronic AG, the CPU of the logger communicates with the sensor over a 4 line binary interface (9600 Baud, Levels: 3-3.6V), separate TX and RX lines, GND and switchable power (3-3-6V).

- **Schematics**
  There are two different schematics. The yellow block is the block with the components for the radio and frequency generation. the block in light blue holds the analog differences.

- **Layout**
  The basic and radio layout for all 2+1 versions are the same, the differences are marked as above and concern only the layout of the analog interface.



PCB LOG-PT1000 and LOG-PT1000-30



LOG-HC2 (Grey part not assembled)

2.4 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 : 21. August 2013

Testing concluded on : 22. August 2013

Checked by:

Klaus Gegenfurtner
I confirm the correctness and Integrity of this documents
2013.10.02 11:46:04 +02'00'

Klaus Gegenfurtner
Dipl. Ing.(FH)
Manager: Radio Group

Tested by:

Markus Huber
I'm the author of this document
2013.10.02 11:42:48 +02'00'

Markus Huber

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Detailed photos see attachment A

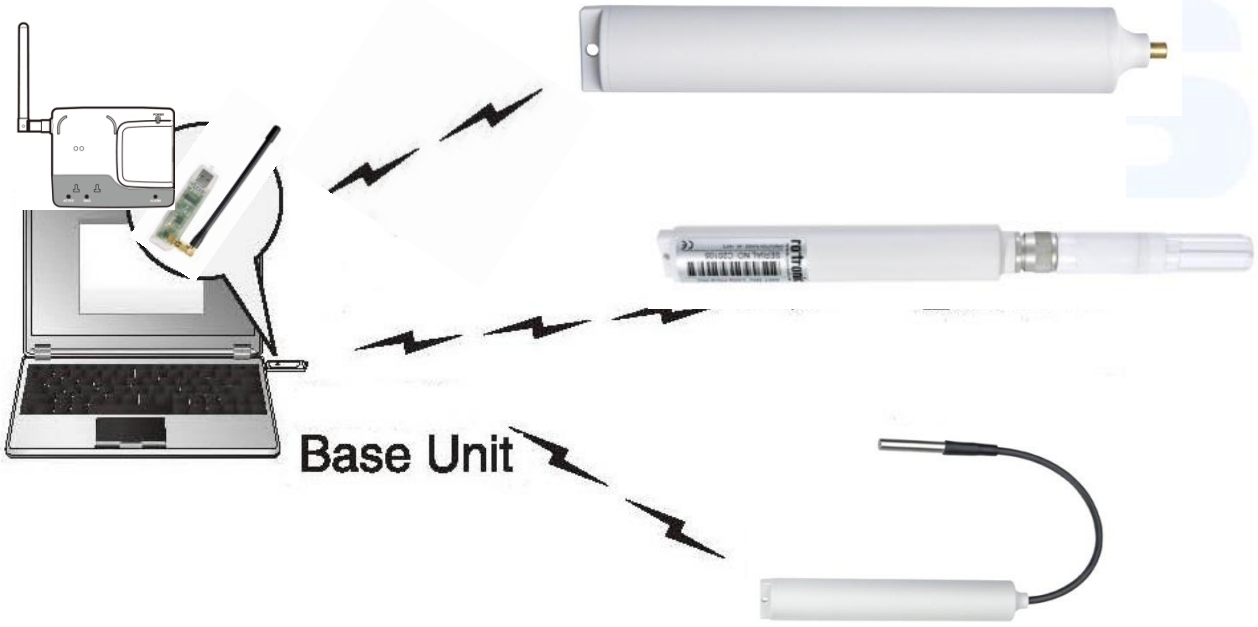
3.2 Power supply system utilised

Power supply voltage, V_{nom} : 3.6 V / DC Lithium Battery

3.3 Test configuration

The EuT's are Wireless Data Loggers. The data loggers allows wireless communication with a LAN-Interface or an USB Dongle (Log-DS-EXT-US).

Wireless Communication Image



3.4 Short description of the equipment under test (EUT)

The EuT's are Wireless Data Loggers. The data loggers allows wireless communication with a LAN-Interface or an USB Dongle (Log-DS-EXT-US).
Number of tested samples: 2
Serial number: Test Sample

EUT operation mode:

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

- TX continuous mode, modulated at 905 MHz

- RX mode at 905 MHz

EUT configuration:

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

-	Testsoftware	Model :	Supplied by GeoPrecision
-	Lap Top	Model :	Supplied by mikes-testingpartners
-	USB Dongle (Log-DS-EXT-US)	Model :	Supplied by GeoPrecision
-		Model :	
-		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 is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the 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 and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

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 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 dBµV, 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 dBµV and µV, the following conversion formula apply:

$$dB\mu V = 20*\log(\mu V)$$
$$\mu V = 10^{(dB\mu V/20)}$$

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 µH (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.

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

Spurious emission from the EUT is 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 (MHz)	Reading level (dBµV)	+	Correction Factor (dB/m)	=	Level (dBµV/m)	-	CISPR Limit (dBµV/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

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

4.4.2.1 Description of measurement

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

Pre-measurements in anechoic chamber with the different logger types are shown that the plastic housing of the logger has no influence to the transmit power and the spurious emission.
Also the type of sensor has no influence to the transmit power and the spurious emission.

The loggers in original state were sealed and can not open easily. In this case the logger will be destroyed.
Only the battery cover can be open to replace the battery.

So the tests were performed on LOG-HC2 PCB and LOG-PT1000 PCB because without housing there was the possibility to connect a external power supply and a external antenna.

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: NONE

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:

Min. limit margin

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

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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

Remarks: The measurement is not applicable.

The device is battery powered (3.6 V/DC Lithium Battery)

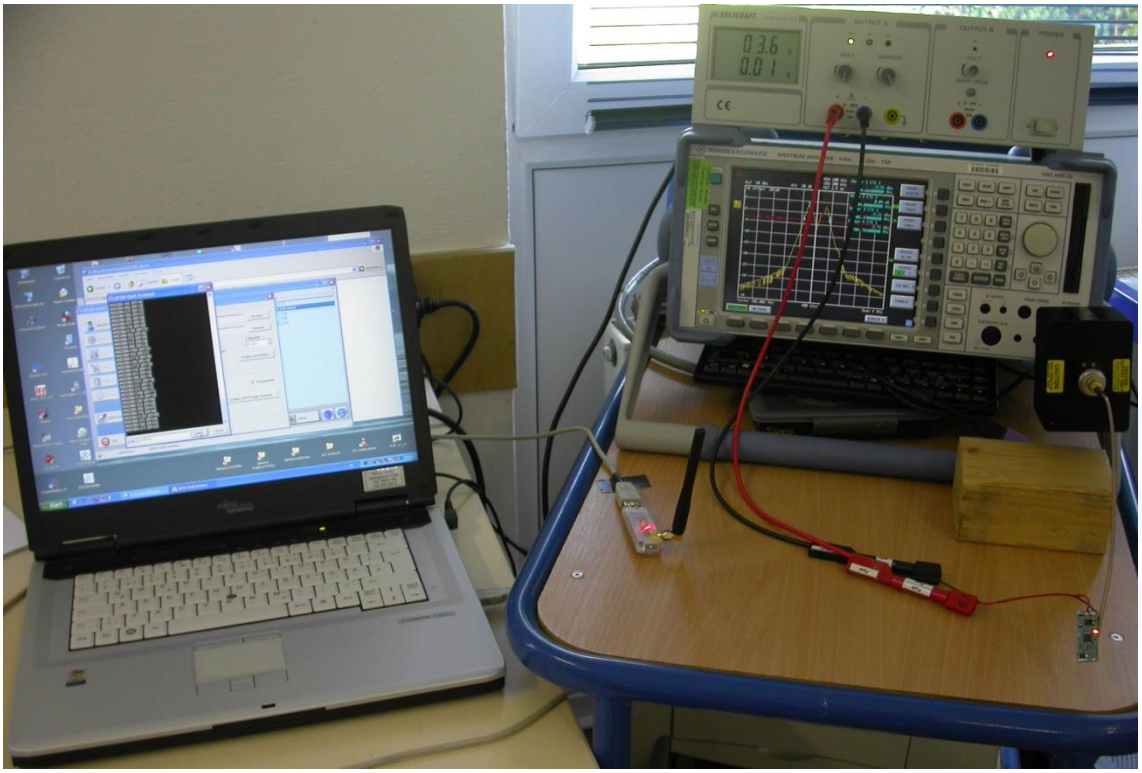
5.2 Emission bandwidth

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

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(2):
Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyser.

Spectrum analyser settings:
RBW: 100 kHz, VBW: 300 kHz, Detector: Peak, Sweep time: auto couple

5.2.5 Test result

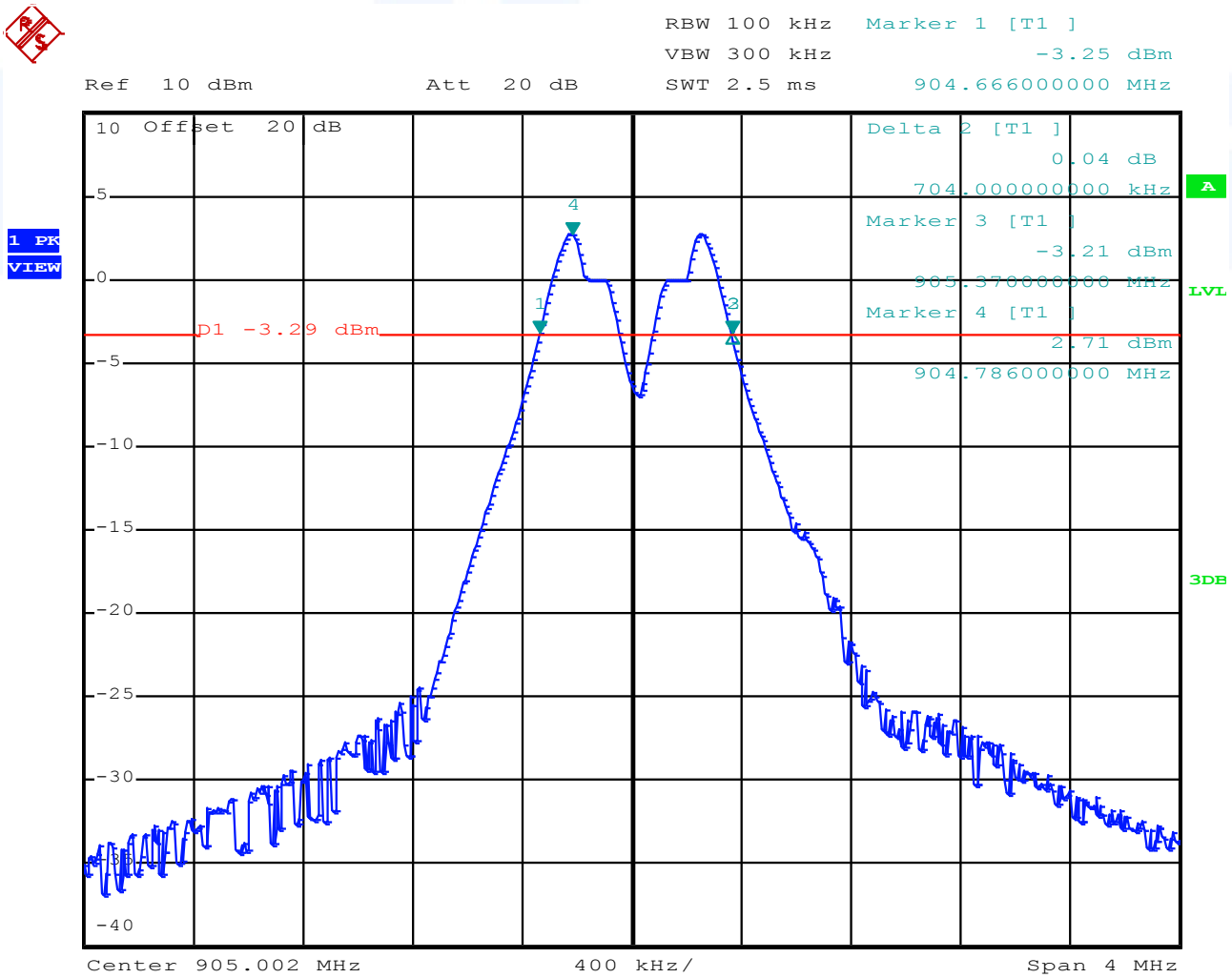
PCB type	Fundamental frequency (MHz)	6 dB Bandwidth (kHz)	Minimum limit (kHz)
LOG-HC2	905.0	704.0	500.0
LOG-PT1000 and LOG-PT1000-30	905.0	728.0	500.0

The requirements are **FULFILLED.**

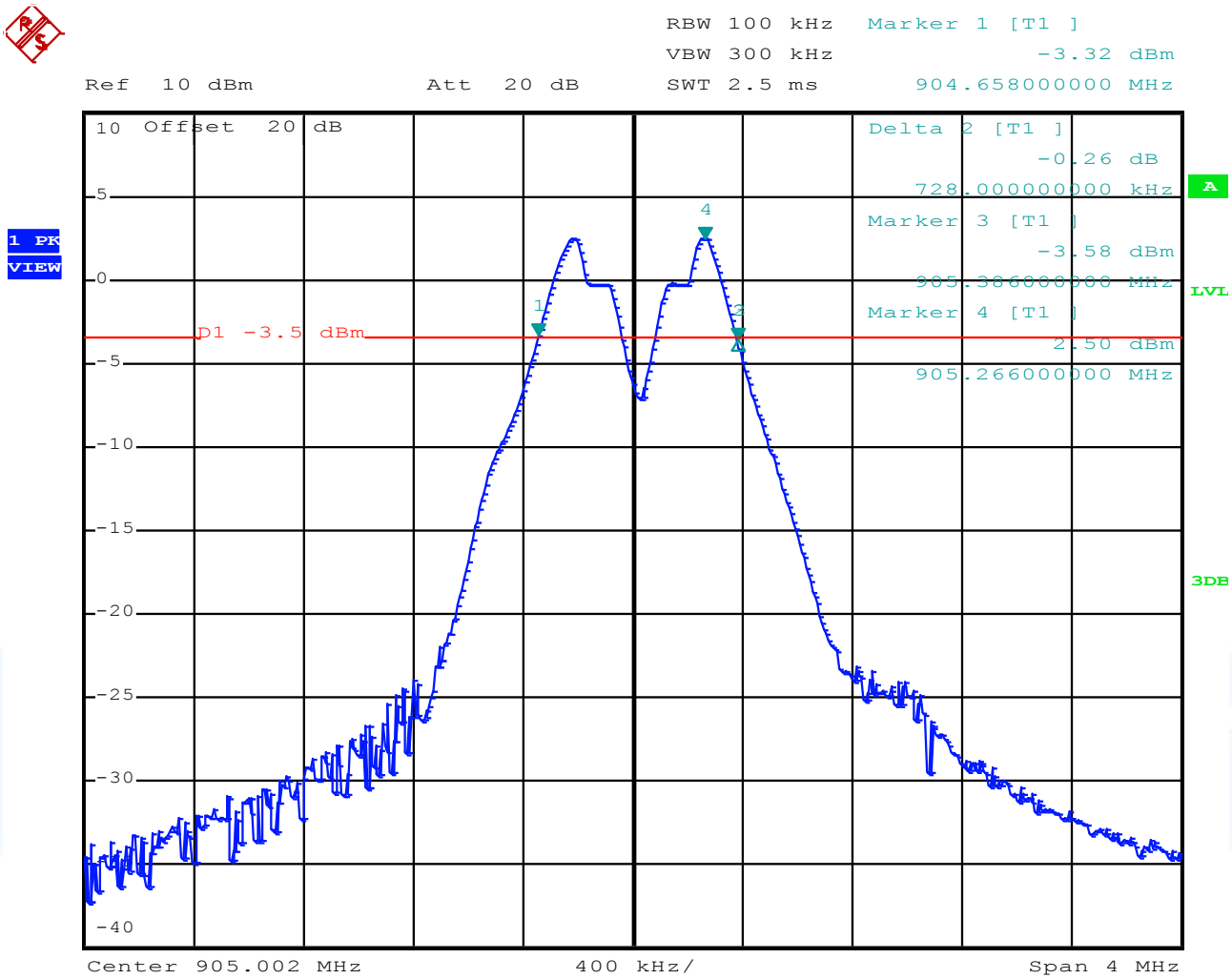
Remarks: For detailed test results please refer to following test protocols.

5.2.6 Test protocols

PCB LOG-HC2:



PCB LOG-PT1000 and LOG-PT1000-30:



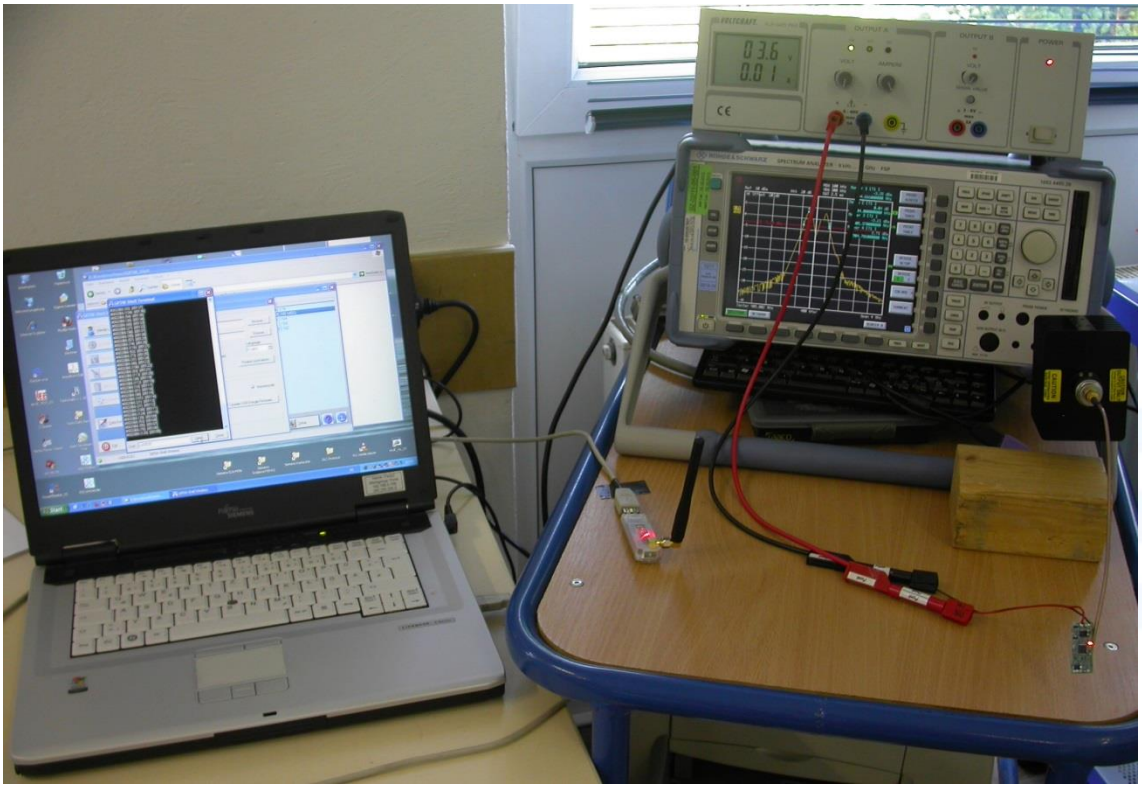
5.3 Occupied bandwidth

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

5.3.1 Description of the test location

Test location: AREA4

5.3.2 Photo documentation of the test set-up



5.3.1 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.

5.3.2 Description of Measurement

The bandwidth was measured with the function “bandwidth measurement” of the spectrum analyser. The EUT is connected via suitable attenuator at the spectrum analyser. The measurement is repeated for every different modulation standard of the EUT and recorded.

Spectrum analyser settings:
RBW: 300 kHz, VBW: 1 MHz, Detector: Peak, Sweep time: auto

5.3.3 Test result

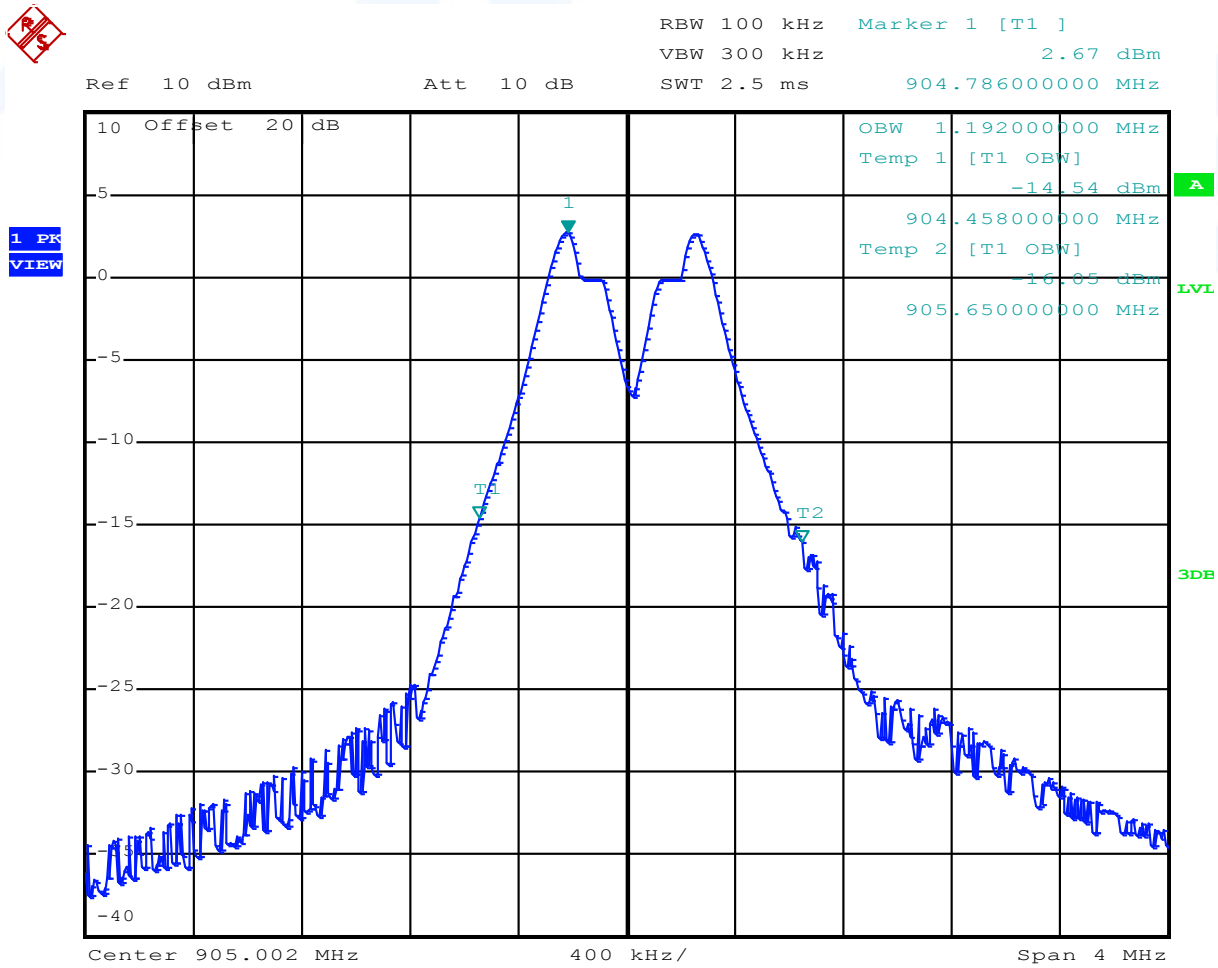
PCB type:	Fundamental frequency (MHz)	99 % Bandwidth (MHz)
LOG-HC2	905.0	1.192
LOG-PT1000 and LOG-PT1000-30	905.0	1.184

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

The Rhode & Schwarz analyzer which we used for this measurement calculates automatically the 99 % emission bandwidth.

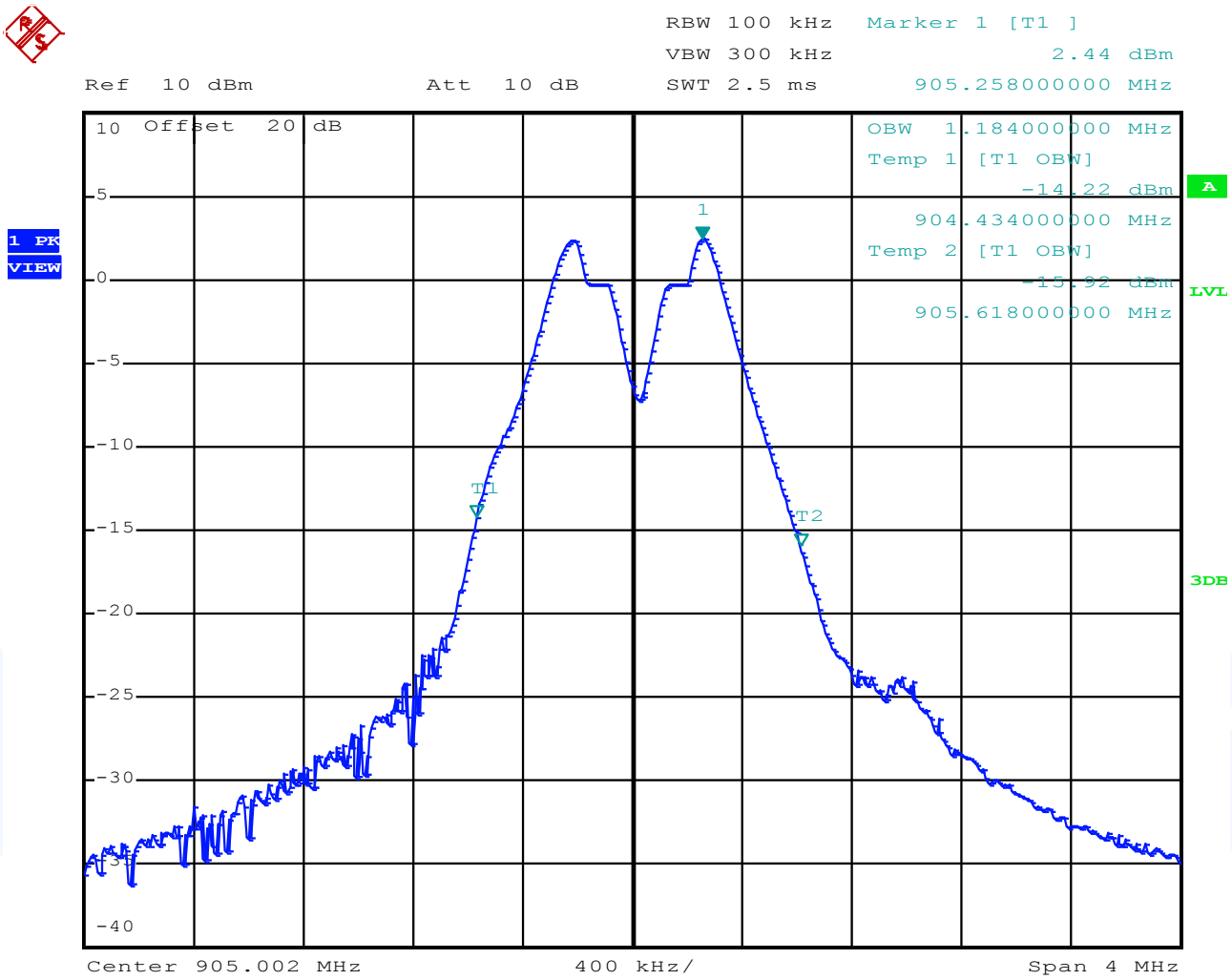
5.3.4 Test protocols

PCB LOG-HC2:



The 99 % emission bandwidth was automatically calculated by the used Rhode & Schwarz analyzer.

PCB LOG-PT1000 and LOG-PT1000-30:



The 99 % emission bandwidth was automatically calculated by the used Rhode & Schwarz analyzer.

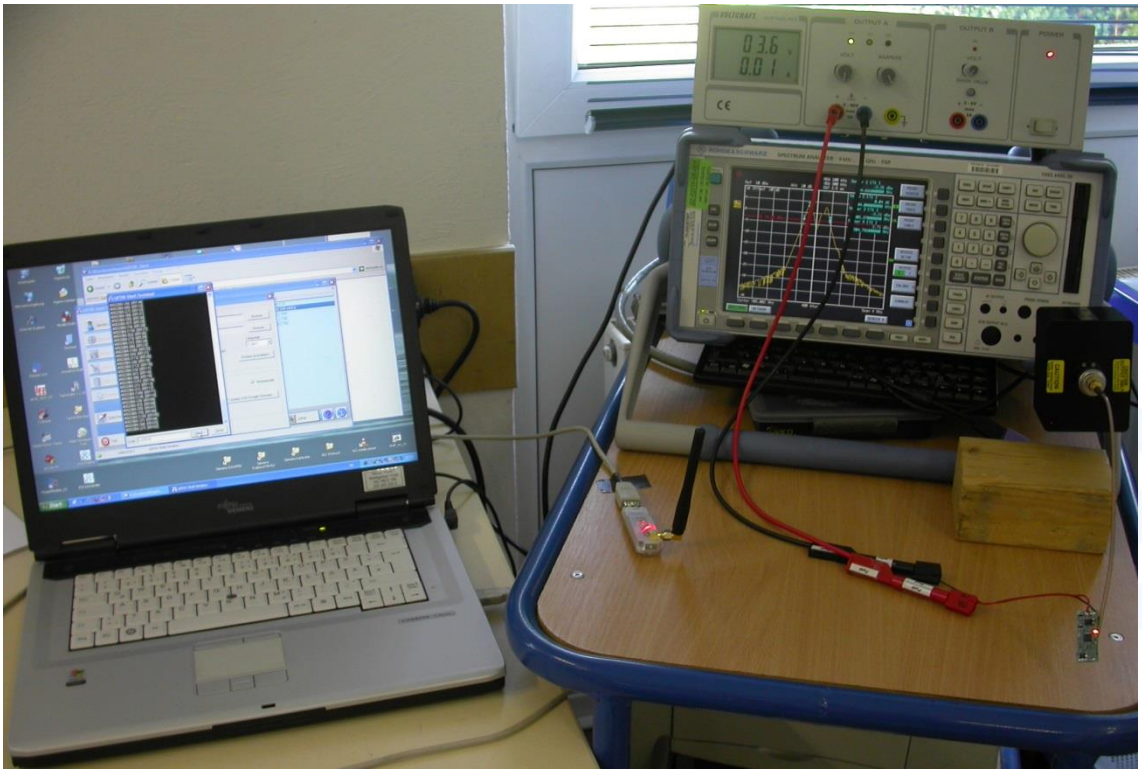
5.4 Maximum peak conducted output power

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

5.4.1 Description of the test location

Test location: AREA4

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):
For systems using digital modulation in the 902 – 928 MHz, 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

5.4.4 Description of Measurement

The EuT was fixed mounted on the receiving antenna of the spectrum analyzer to find out the maximum power.
An analyzer offset was tried to see the compliance to the measured radiated value.

The transmitter output was directly connected to the spectrum analyzer. The center frequency of the spectrum analyzer is set to the fundamental frequency. The span of the spectrum analyzer should be larger than the emission bandwidth (EBW). The channel bandwidth has been set to EBW. With peak detector and power mode “Max Hold” the result is the summed maximum output power of the EBW.

Spectrum analyser settings:

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a) Set the RBW ≥ *DTS bandwidth*.
b) Set VBW ≥ 3 × RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

5.4.5 Test result

PCB LOG-HC2:

Channel	Frequency (MHz)	Measured power (dBm)	Peak power limit (dBm)	Delta (dB)
1	905.0	2.74	30.0	-27.3

PCB LOG-PT1000 and LOG-PT1000-30:

Channel	Frequency (MHz)	Measured power (dBm)	Peak power limit (dBm)	Delta (dB)
1	905.0	2.47	30.0	-27.5

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

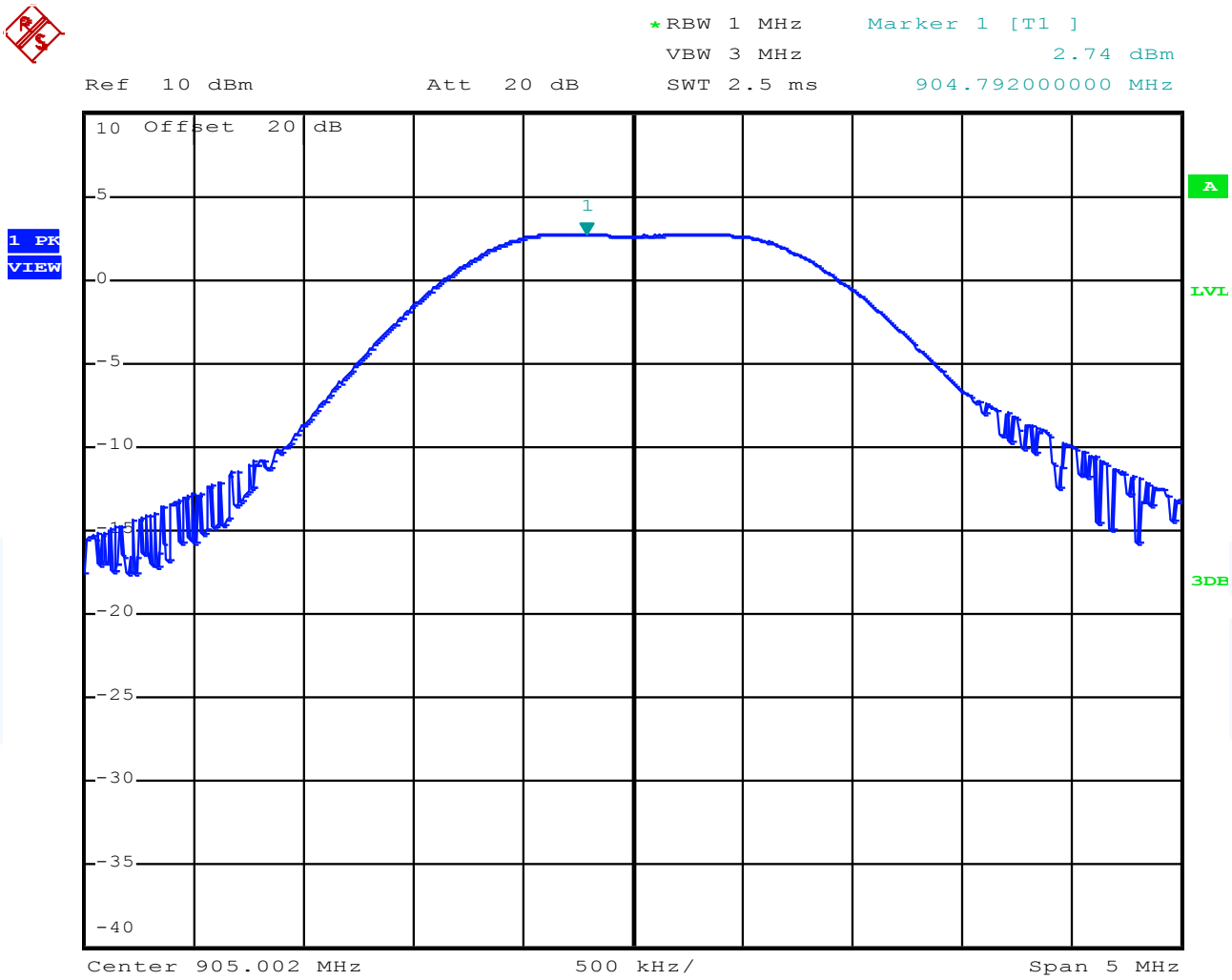
Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	**30**	**1.0**
2400-2483.5	30	1.0
5725-5850	30	1.0

The requirements are **FULFILLED.**

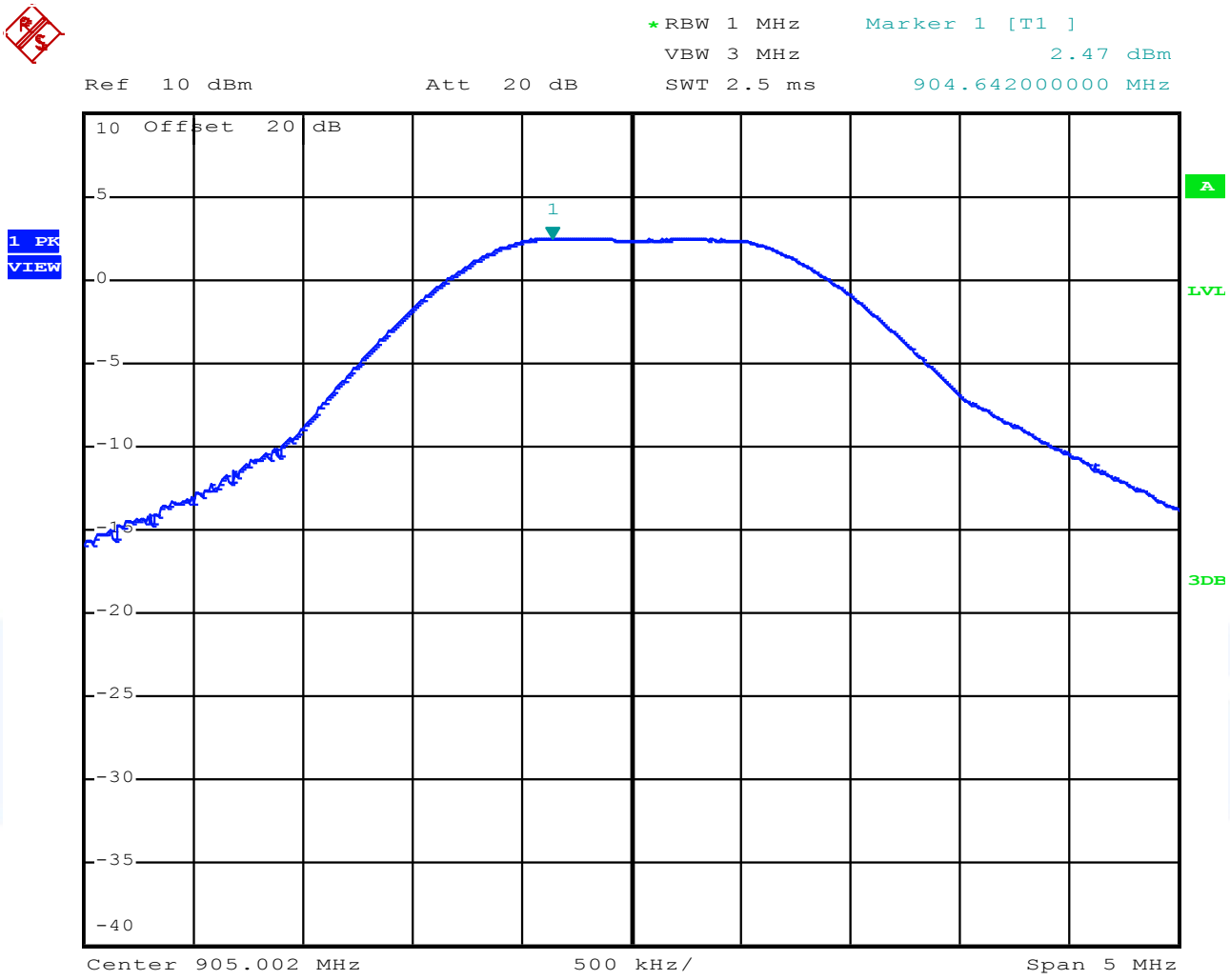
Remarks: For detailed test results please refer to following test protocols.

5.4.6 Test protocols

PCB LOG-HC2:



PCB LOG-PT1000 and LOG-PT1000-30:



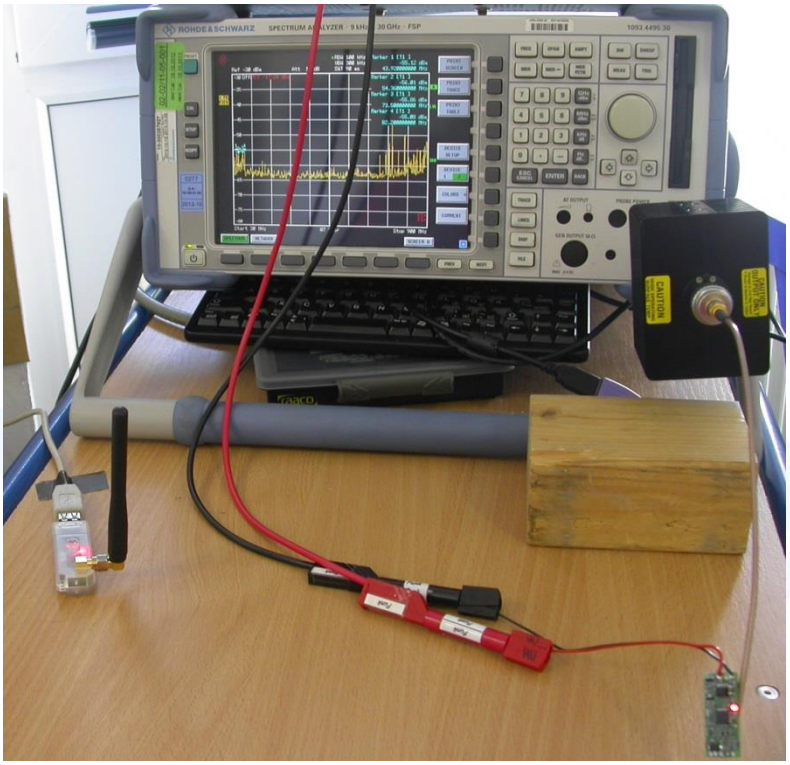
5.5 Spurious emissions conducted

For test instruments and accessories used see section 6 Part **SEC 1, SEC 2** and **SEC 3**.

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

According to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency band 902 to 928 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

5.5.4 Description of measurement

A spectrum analyzer is connected to the output of the transmitter while EUT was operating in transmit mode at the assigned frequency.

5.5.5 Test result

Tx mode @ CH1, max. level 2.72 dBm			
Frequency (MHz)	Peak power * (dBm)	Limit (-20 dB) (dBm)	Delta (dB)
73.5	-55.86	-17.28	-38.7
162.2	-58.62	-17.28	-41.3
743.40	-46.72	-17.28	-29.4
2435.6	-56.67	-17.28	-39.4
2707.7	-38.87	-17.28	-21.6
3614.7	-46.18	-17.28	-28.9
4521.7	-48.27	-17.28	-31.0
5428.7	-53.99	-17.28	-36.7
10900.0	-54.37	-17.28	-37.1
18010.0	-46.67	-17.28	-29.4

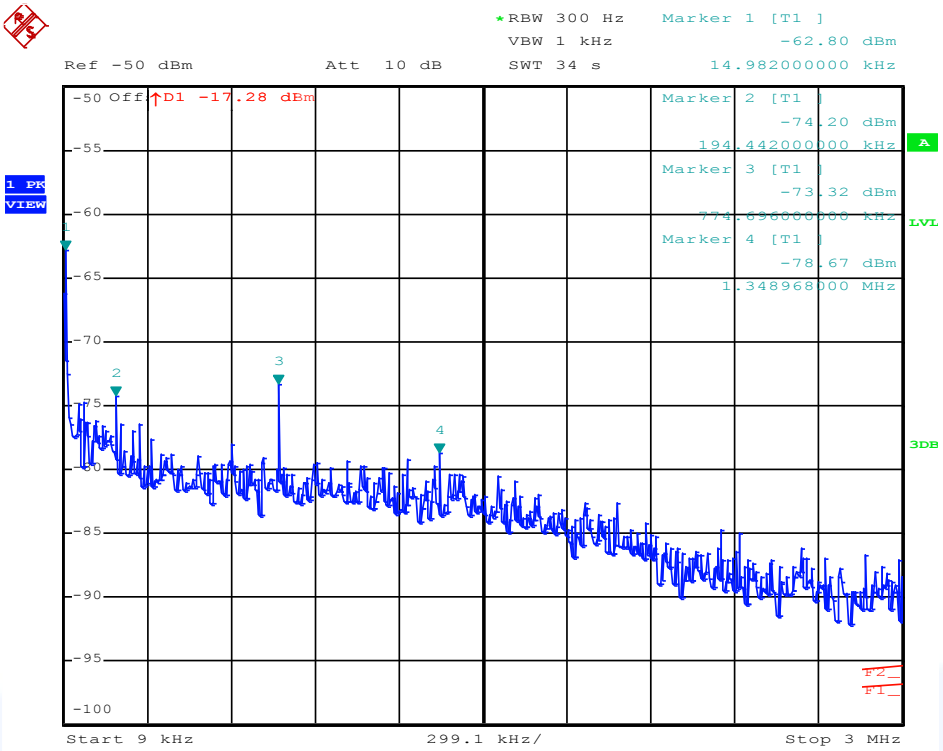
The requirements are **FULFILLED.**

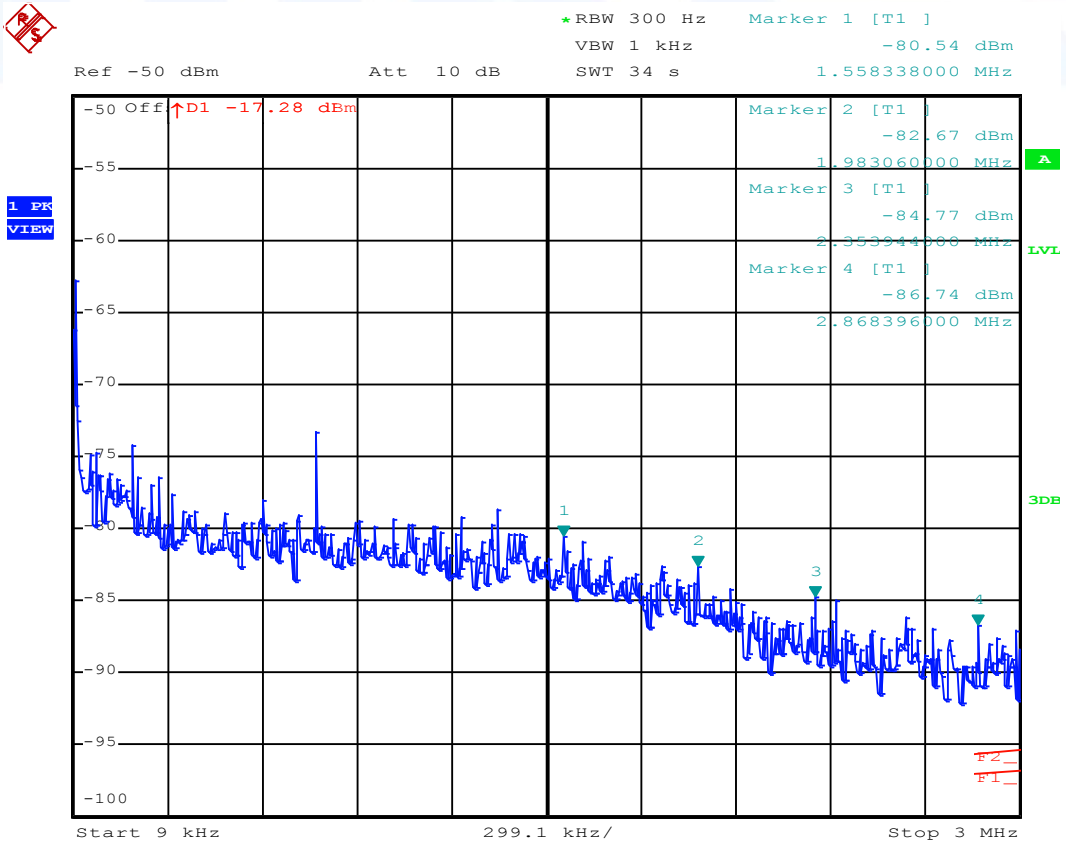
Remarks: All spurious emissions falling in restricted bands have been measured radiated.

For detailed results please refer to following test protocol.

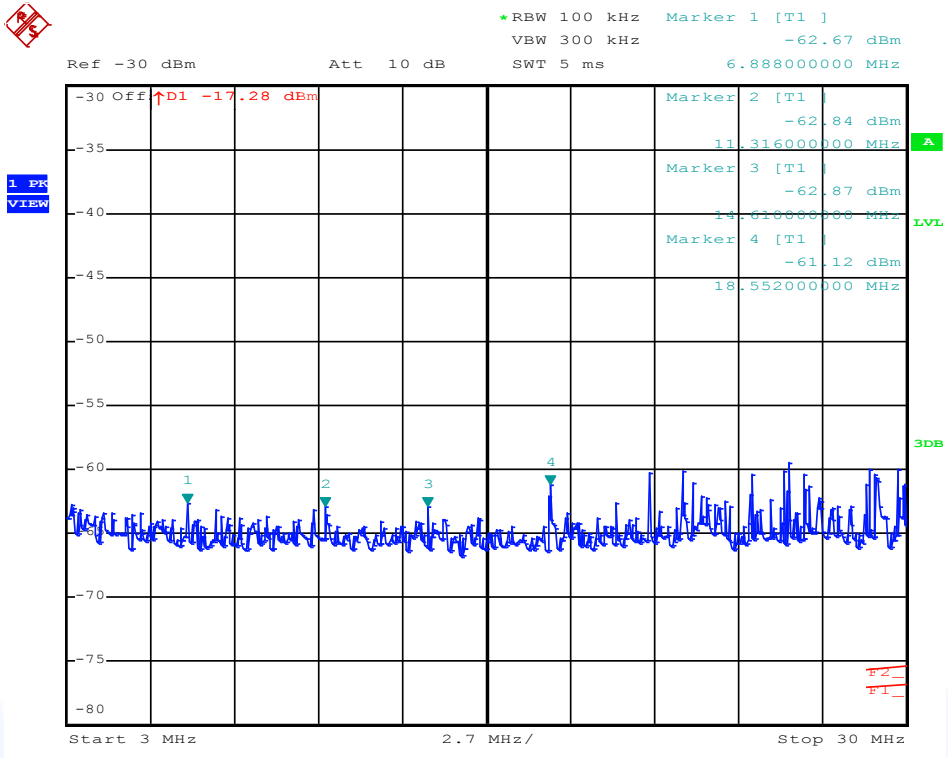
5.5.6 Test protocols

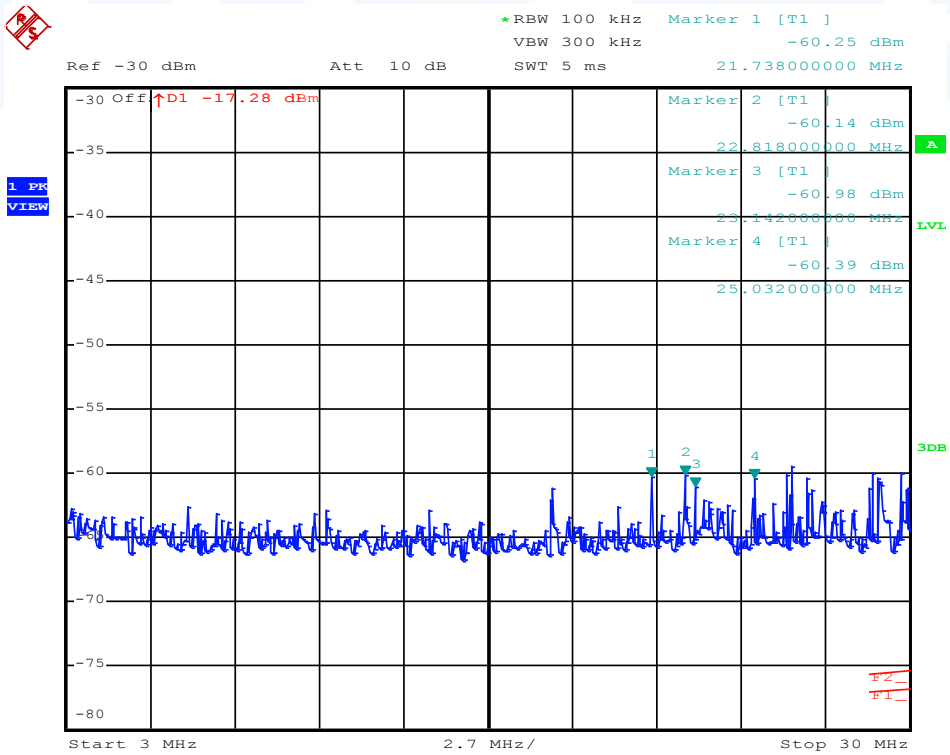
Conducted RF emission from 9 kHz to 30 MHz

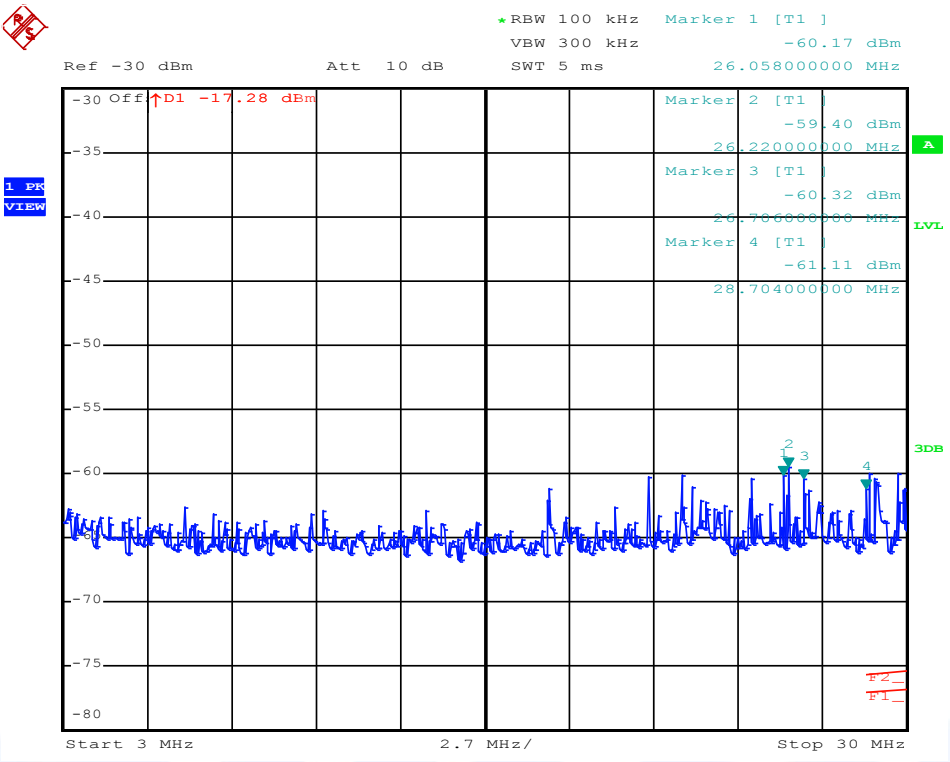


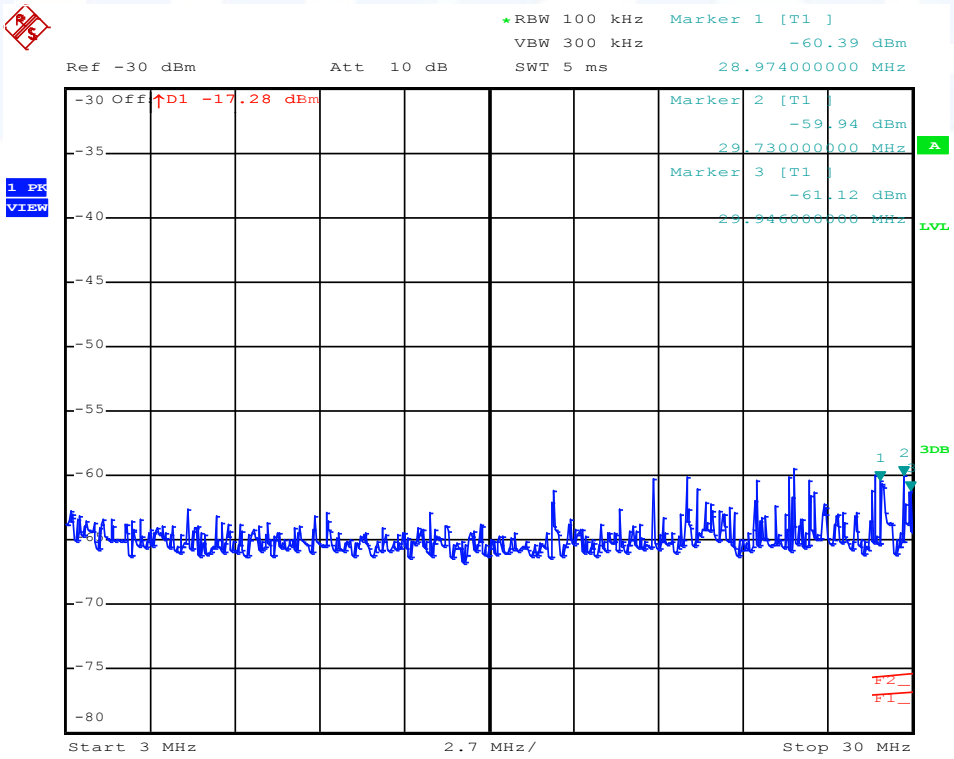


Conducted RF emission from 3 to 30 MHz

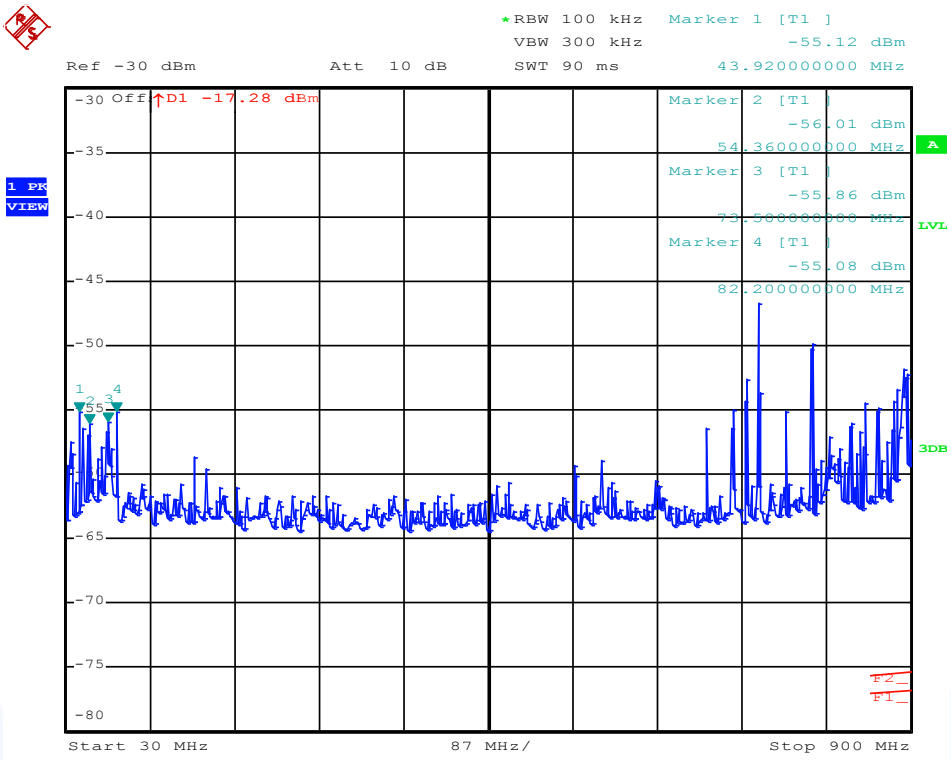




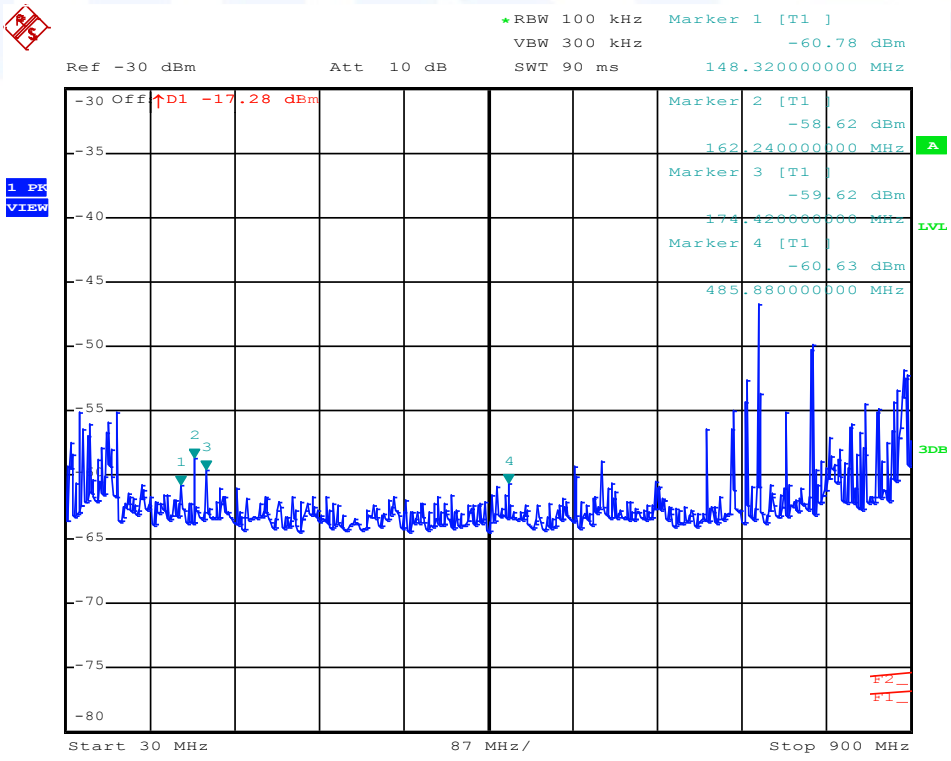

RBW 100 kHz
VBW 300 kHz
SWT 5 ms
Marker 1 [T1]
-60.17 dBm
26.058000000 MHz
Ref -30 dBm
Att 10 dB
-30 Off D1 -17.28 dBm
Marker 2 [T1]
-59.40 dBm
26.220000000 MHz
Marker 3 [T1]
-60.32 dBm
26.786000000 MHz
Marker 4 [T1]
-61.11 dBm
28.704000000 MHz
1 PK VIEW
A
LVL
3DB
-35
-40
-45
-50
-55
-60
-70
-75
-80
F2
F1
Start 3 MHz
2.7 MHz/
Stop 30 MHz


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
Marker 1 [T1]
-60.39 dBm
28.974000000 MHz
Ref -30 dBm
Att 10 dB
-30 Off D1 -17.28 dBm
Marker 2 [T1]
-59.94 dBm
29.730000000 MHz
Marker 3 [T1]
-61.12 dBm
29.946000000 MHz
1 PK VIEW
A
LVL
3DB
-35
-40
-45
-50
-55
-60
-70
-75
-80
F2
F1
Start 3 MHz
2.7 MHz/
Stop 30 MHz

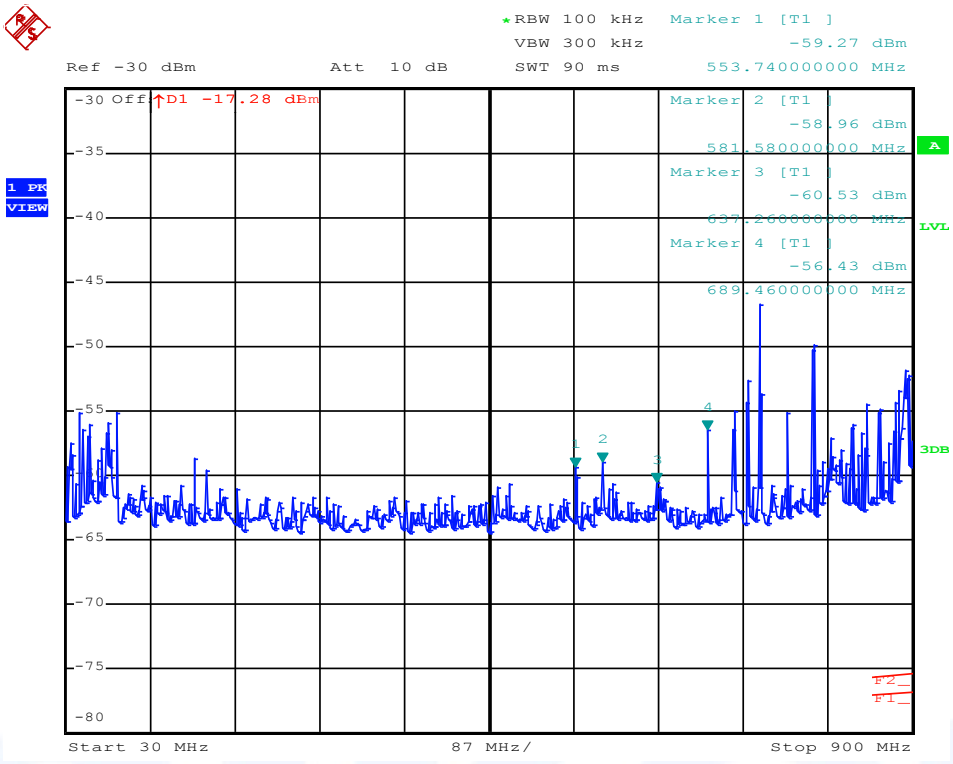
Conducted RF emission from 30 to 1000 MHz

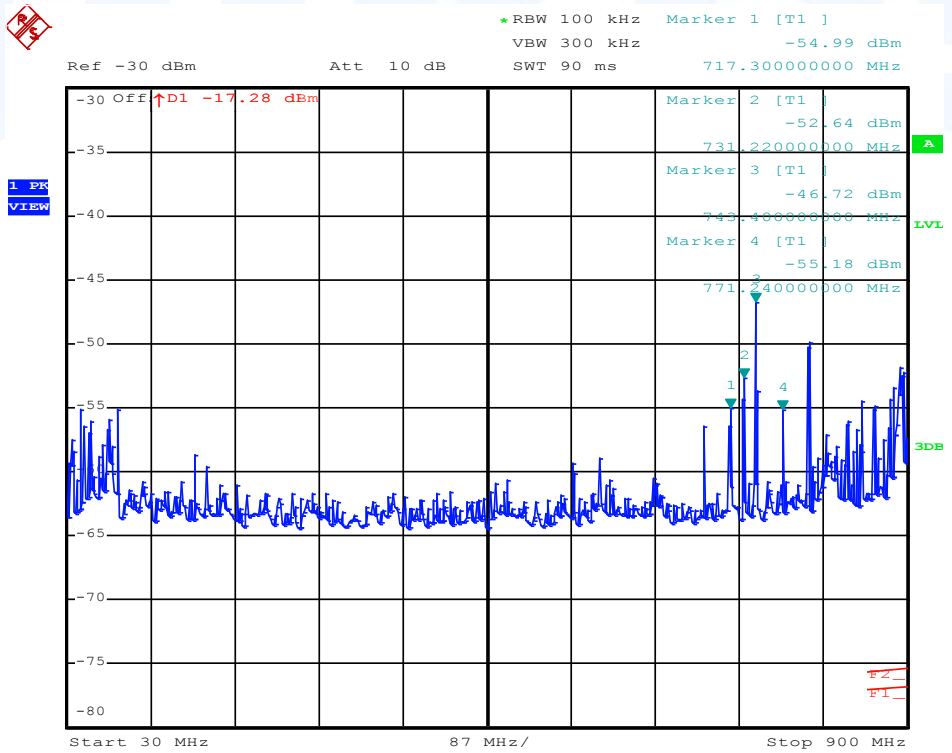


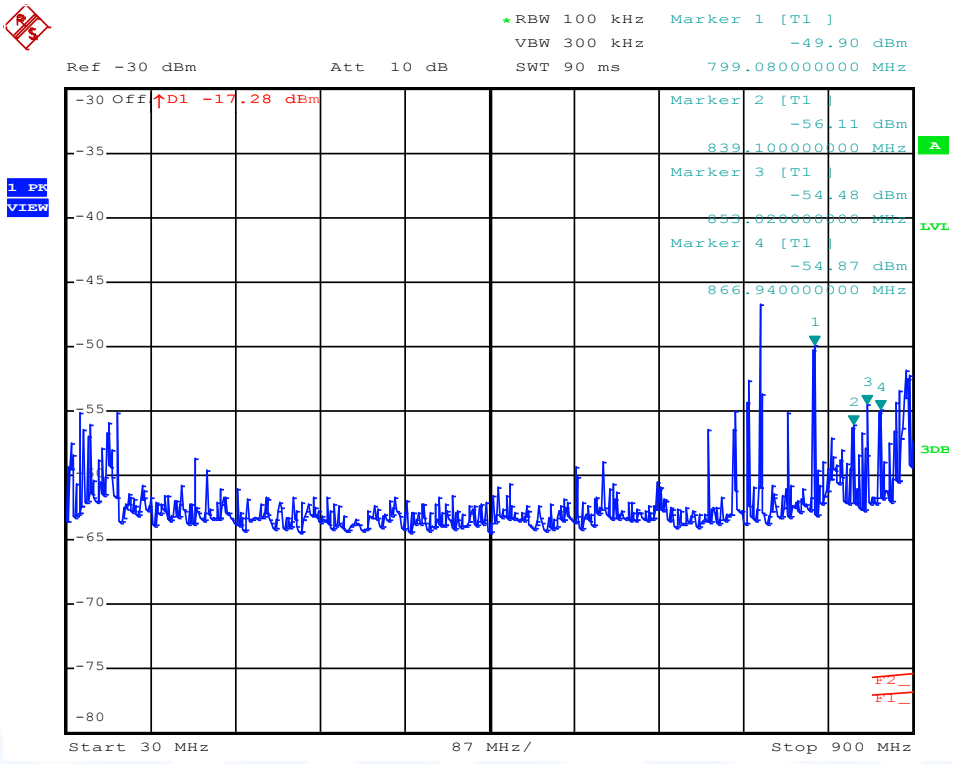
Note: Signal level no. 3 is located in restricted band.

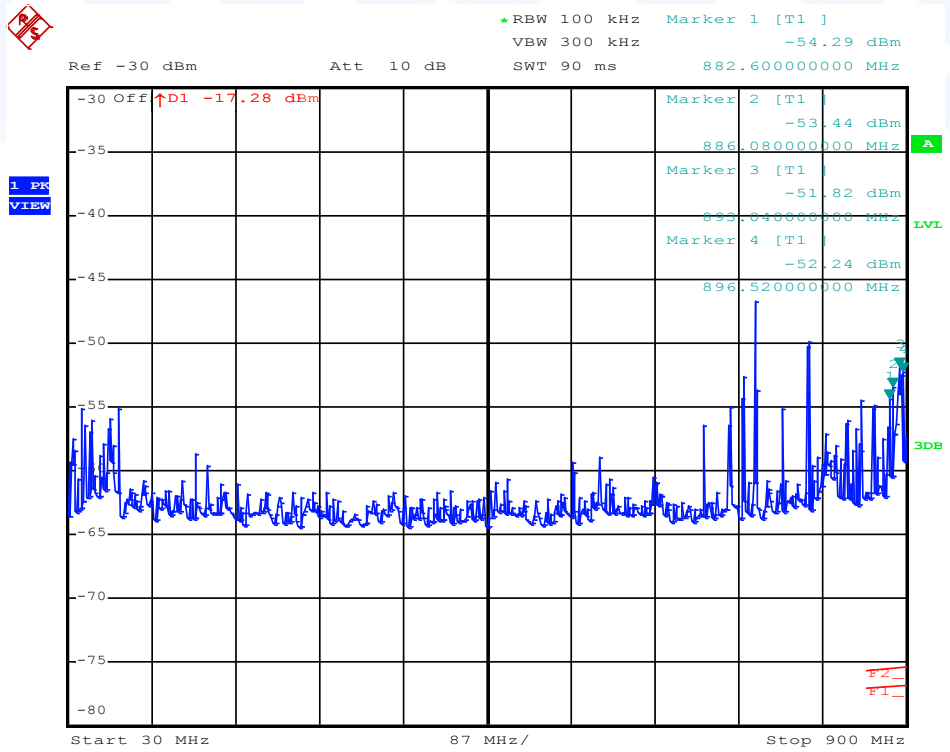


Note: Signal level no. 2 is located in restricted band.

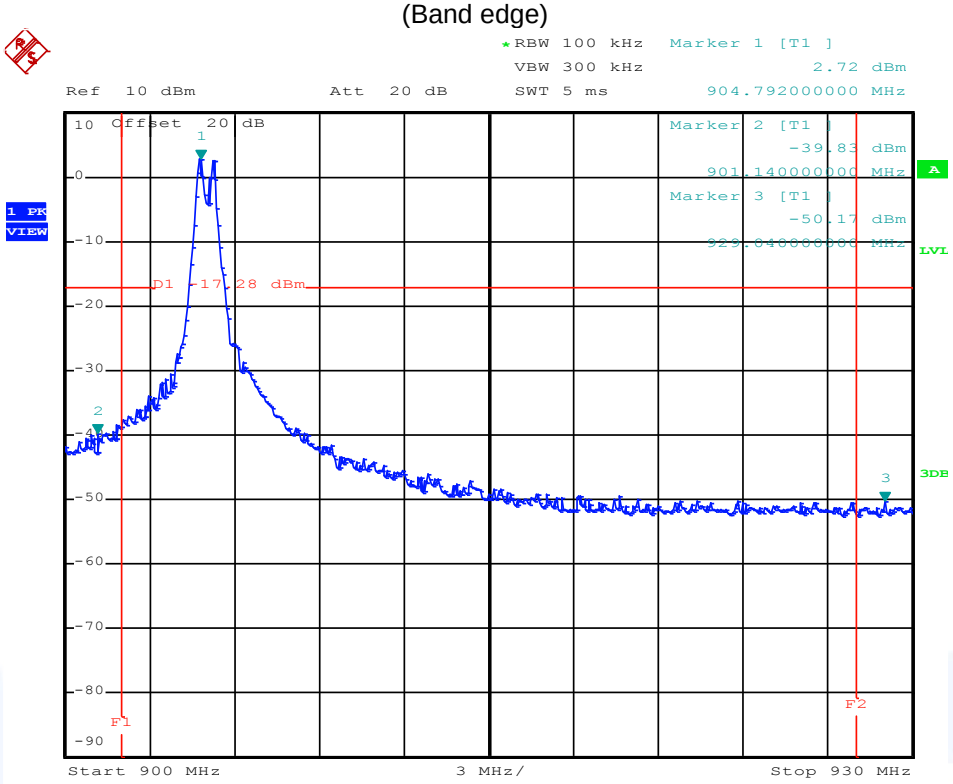

RBW 100 kHz
VBW 300 kHz
SWT 90 ms
Marker 1 [T1]
-59.27 dBm
553.740000000 MHz
Ref -30 dBm
Att 10 dB
-30 Off D1 -17.28 dBm
Marker 2 [T1]
-58.96 dBm
581.580000000 MHz
Marker 3 [T1]
-60.53 dBm
637.260000000 MHz
Marker 4 [T1]
-56.43 dBm
689.460000000 MHz
1 PK VIEW
A
LVL
3DB
-35
-40
-45
-50
-55
-65
-70
-75
-80
Start 30 MHz
87 MHz/
Stop 900 MHz


RBW 100 kHz
VBW 300 kHz
SWT 90 ms
Marker 1 [T1]
-54.99 dBm
717.300000000 MHz
Ref -30 dBm
Att 10 dB
-30 Off D1 -17.28 dBm
Marker 2 [T1]
-52.64 dBm
731.220000000 MHz
Marker 3 [T1]
-46.72 dBm
743.400000000 MHz
Marker 4 [T1]
-55.18 dBm
771.240000000 MHz
1 PK VIEW
A
LVL
3DB
-35
-40
-45
-50
-55
-65
-70
-75
-80
Start 30 MHz
87 MHz/
Stop 900 MHz

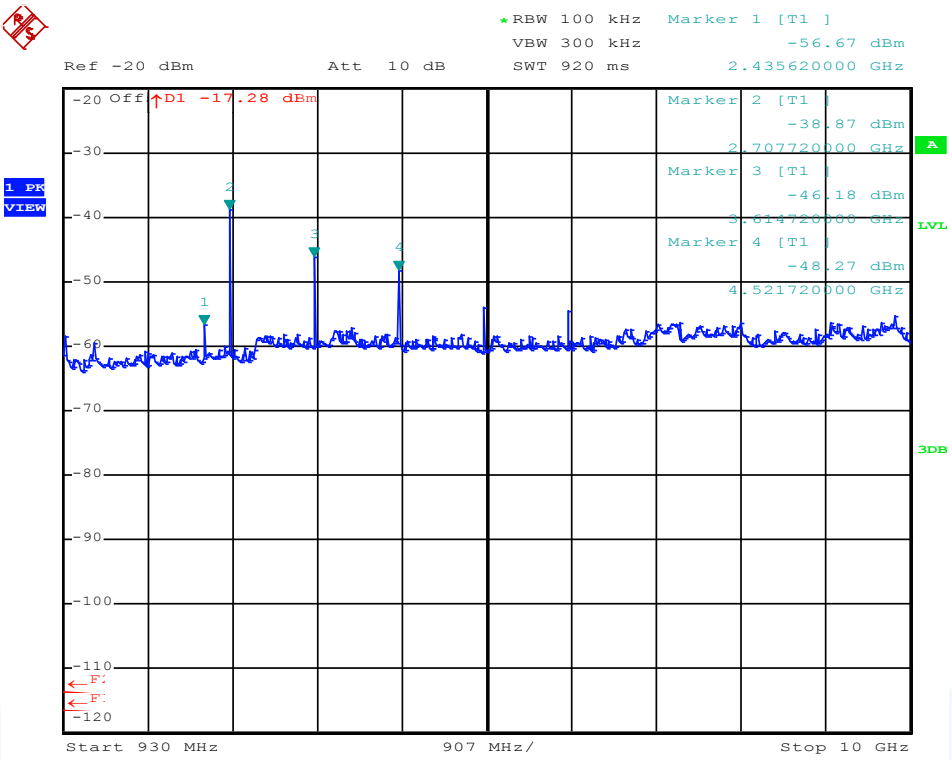

RBW 100 kHz
VBW 300 kHz
SWT 90 ms
Marker 1 [T1]
-49.90 dBm
799.080000000 MHz
Ref -30 dBm
Att 10 dB
-30 Off D1 -17.28 dBm
Marker 2 [T1]
-56.11 dBm
839.100000000 MHz
Marker 3 [T1]
-54.48 dBm
853.020000000 MHz
Marker 4 [T1]
-54.87 dBm
866.940000000 MHz
1 PK VIEW
A
LVL
3DB
F2
F1
Start 30 MHz
87 MHz/
Stop 900 MHz


RBW 100 kHz
VBW 300 kHz
SWT 90 ms
Marker 1 [T1]
-54.29 dBm
882.600000000 MHz
Ref -30 dBm
Att 10 dB
-30 Off D1 -17.28 dBm
Marker 2 [T1]
-53.44 dBm
886.080000000 MHz
Marker 3 [T1]
-51.82 dBm
893.040000000 MHz
Marker 4 [T1]
-52.24 dBm
896.520000000 MHz
1 PK VIEW
A
LVL
3DB
F2
F1
Start 30 MHz
87 MHz/
Stop 900 MHz

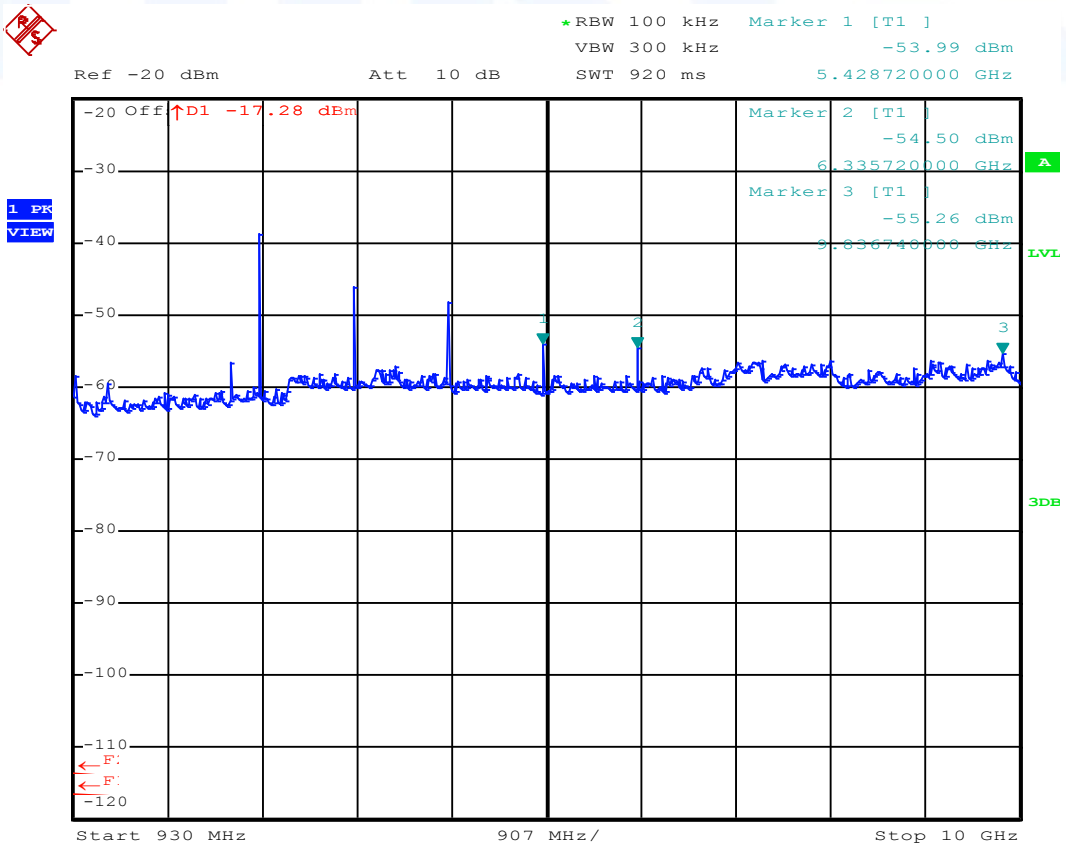
Conducted RF emission from 902 to 928 MHz
(Band edge)



Conducted RF emission from 1 to 10 GHz

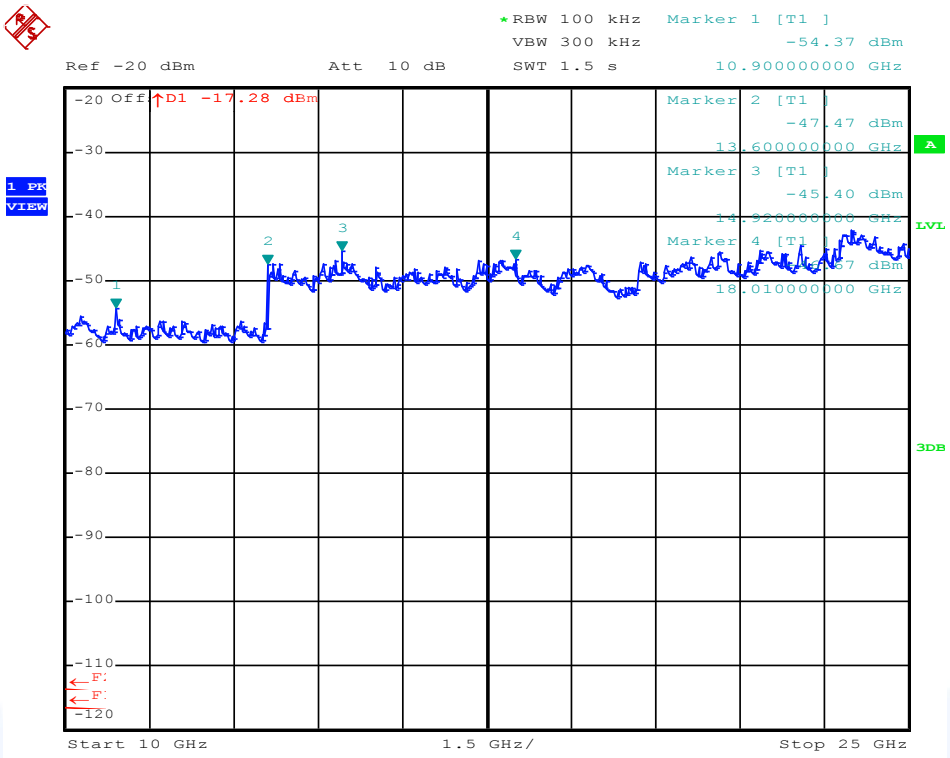


Note: Signal level no.1, no.3 and no. 4 are located in restricted band.



Note: Signal level no. 1 is located in restricted band.

Conducted RF emission from 10 to 25 GHz



Note: Signal level no. 1 and no. 4 are located in restricted band.

5.7 Spurious emissions radiated

For test instruments and accessories used see section 6 Part **SER 1, SER 2, SER 3**.

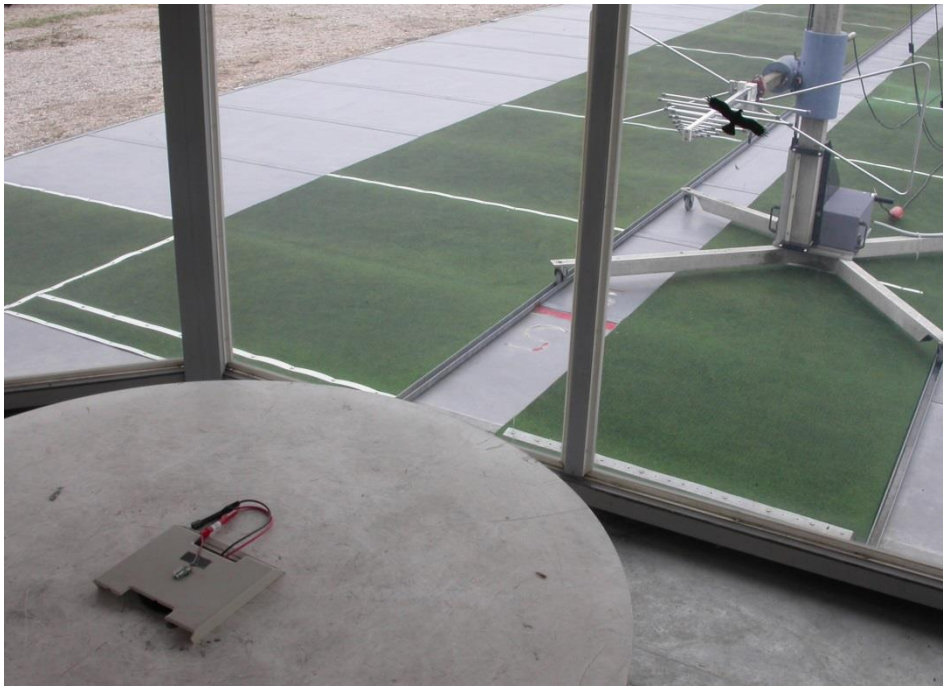
5.7.1 Description of the test location

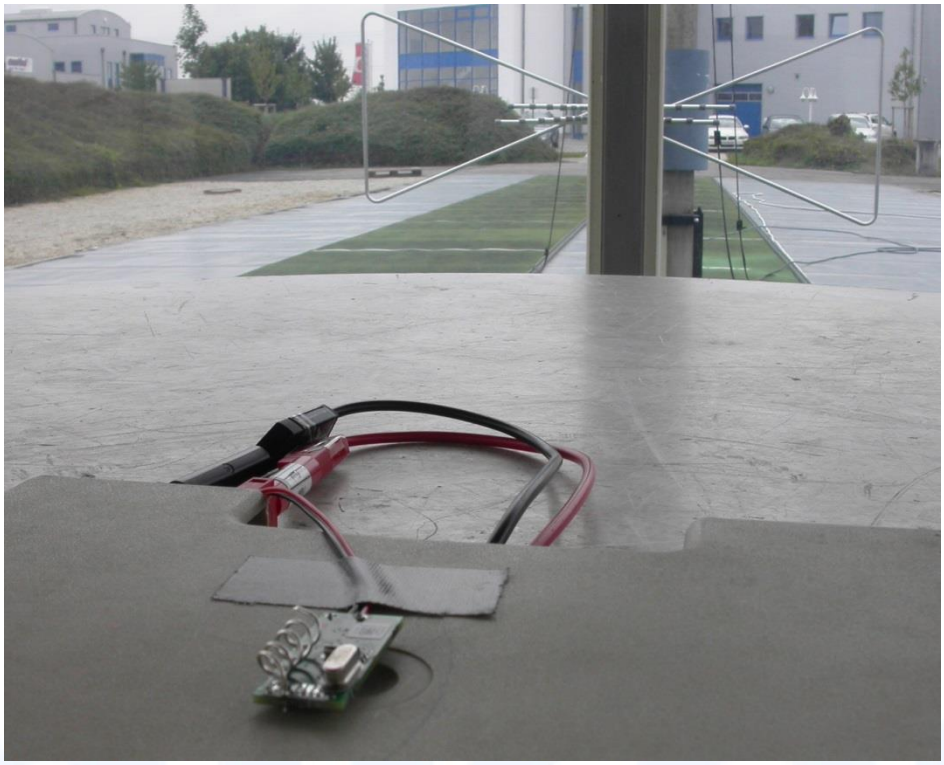
Test location: OATS 1
Test location: Anechoic chamber 2

Test distance: 3 m

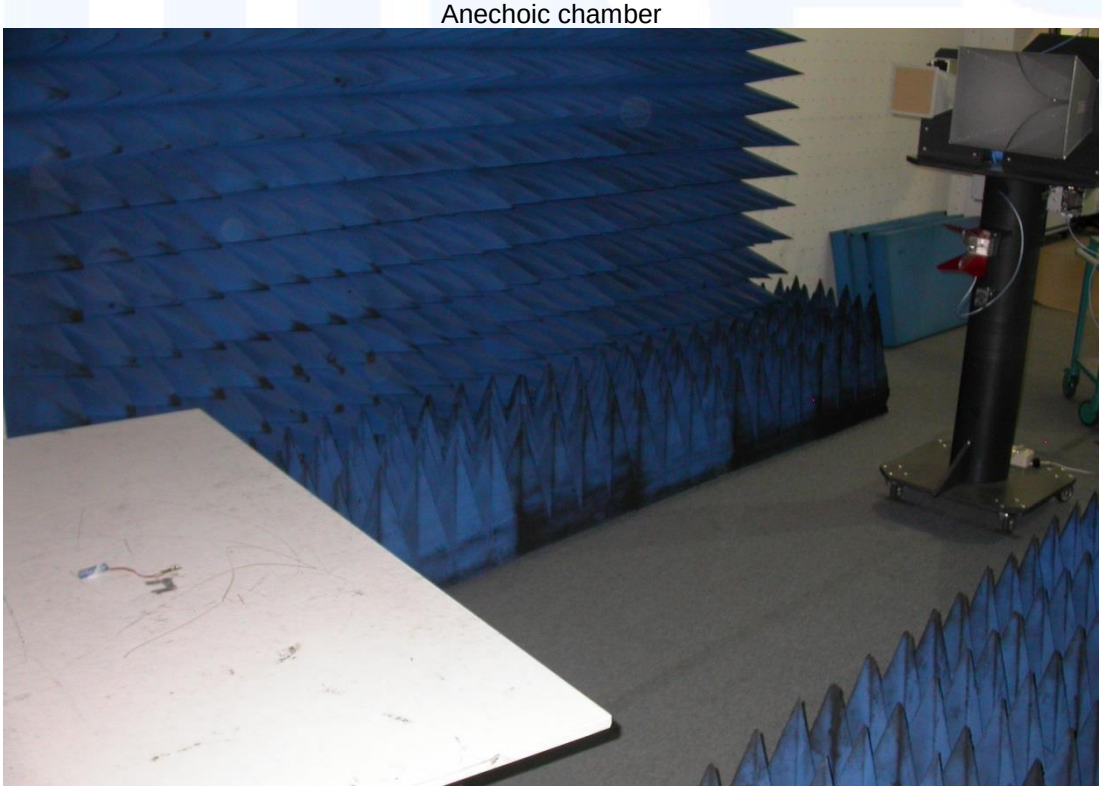
5.7.2 Photo documentation of the test set-up

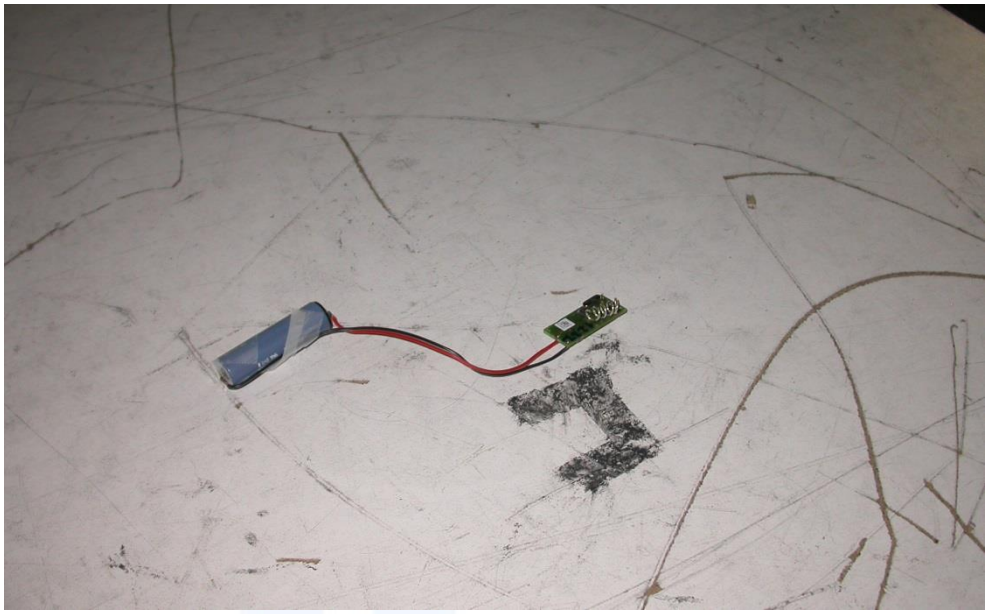
Open area test site





Anechoic chamber





5.7.3 Applicable standard

According to FCC Part 15, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 902 – 928 MHz, 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.7.4 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, 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.

5.7.5 Test result radiated emissions

5.7.5.1 Radiated emission test f < 1 GHz

Frequency [kHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
536.8	24.1	19.7	9.0	20	44.1	39.7	73.0	-33.3
1073.6	23.4	18.0	9.0	20	43.4	38.0	67.0	-29.0
1342.0	21.6	15.9	9.0	20	41.6	35.9	65.0	-29.1

Frequency [MHz]	L: QP [dBµV]	Correct. [dB]	L: QP [dBµV/m]	Limit [dBµV/m]	Delta [dB]
73.50	2.8	12.0	14.8	40.0	-22.9
162.20	6.9	14.6	21.5	43.5	-21.3

In both frequency ranges only ambient noises could be detected.

5.7.5.2 Radiated emission test f > 1GHz

Tx mode @ CH1

Frequency (GHz)	L: PK (dBµV)	L: AV (dBµV)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(µV/m)	L: AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
2.44	26.7	18.5	1000	4.2	30.9	22.7	54.0	-31.3
2.71	36.0	32.1	1000	3.7	39.7	35.8	54.0	-18.2
3.61	33.6	27.6	1000	2.5	36.1	30.1	54.0	-23.9
4.52	30.4	26.3	1000	3.1	33.5	29.4	54.0	-24.6
5.43	25.6	21.1	1000	4.0	29.6	25.1	54.0	-28.9
10.90	19.0	14.9	1000	9.4	28.4	24.3	54.0	-29.7
18.01	24.1	22.9	1000	5.7	32.8	28.6	54.0	-25.4

Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED.**

Remarks: The measurement was performed up to 25 GHz. All emissions not reported in this test report are more than 20 dB below the specified limit.

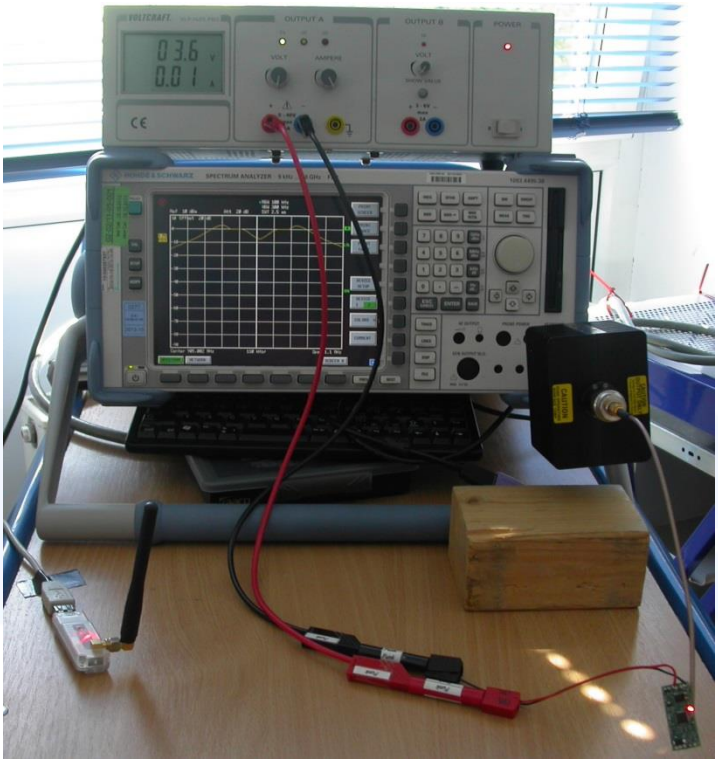
5.8 Power spectral density

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

5.8.1 Description of the test location

Test location: AREA4

5.8.2 Photo documentation of the test set-up



5.8.3 Applicable standard

According to FCC Part 15, Section 15.247(e):
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.8.4 Description of Measurement

The measurement is performed using the procedure set out in KDB-558074. This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

Spectrum analyser settings:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the *DTS bandwidth*.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 × RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.8.5 Test result

Channel	Frequency (MHz)	Reading (dBm)	Limit (dBm)
1	905.0	2.63	8

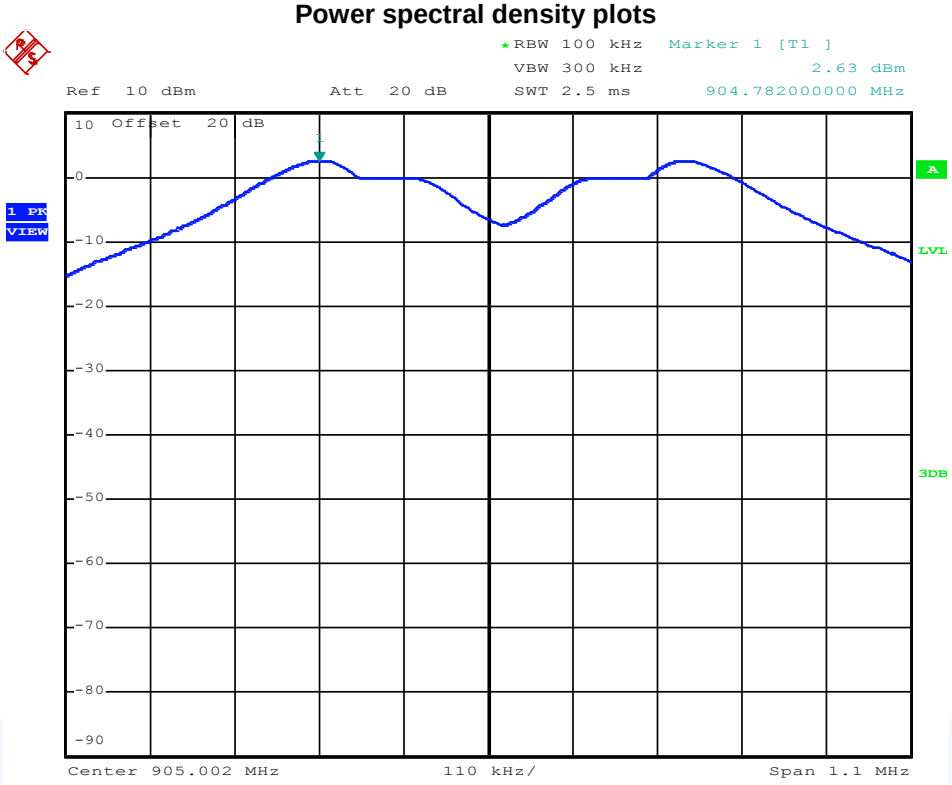
Power spectral density limit according to FCC Part 15, Section 15.247(e):

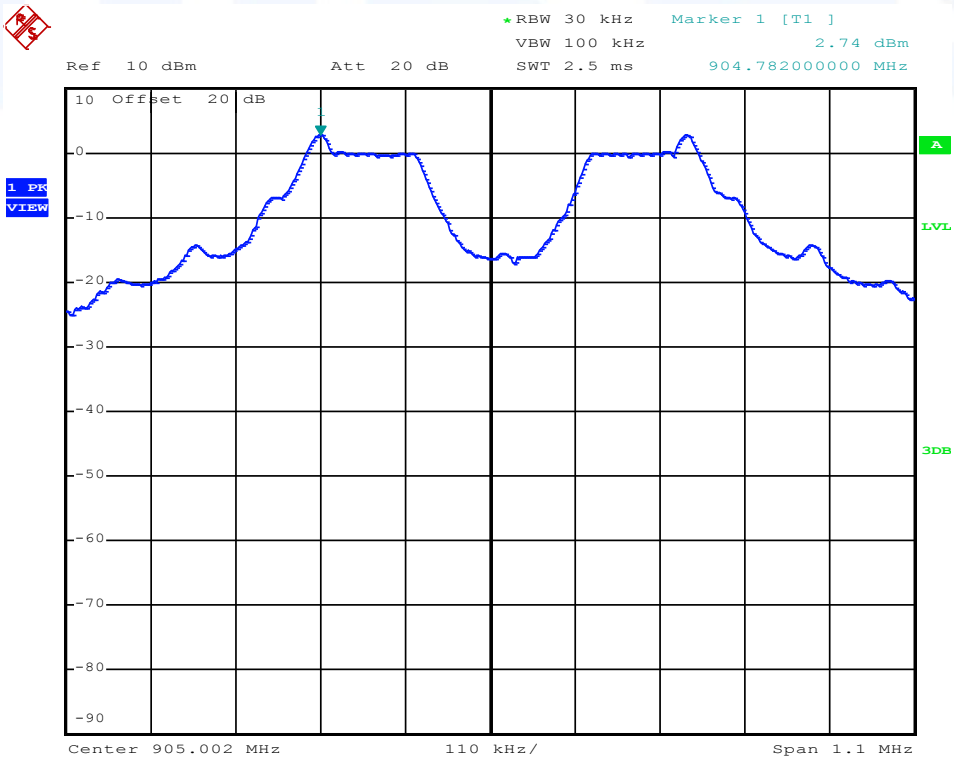
Frequency (MHz)	Power spectral density limit (dBm/3 kHz)
902 - 928	8

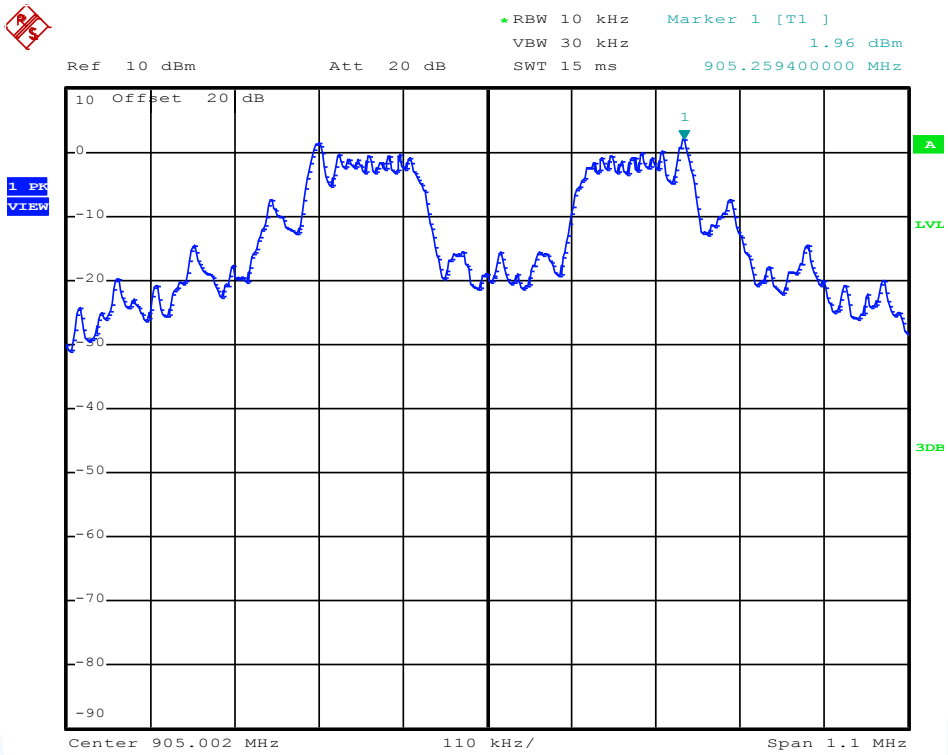
The requirements are **FULFILLED.**

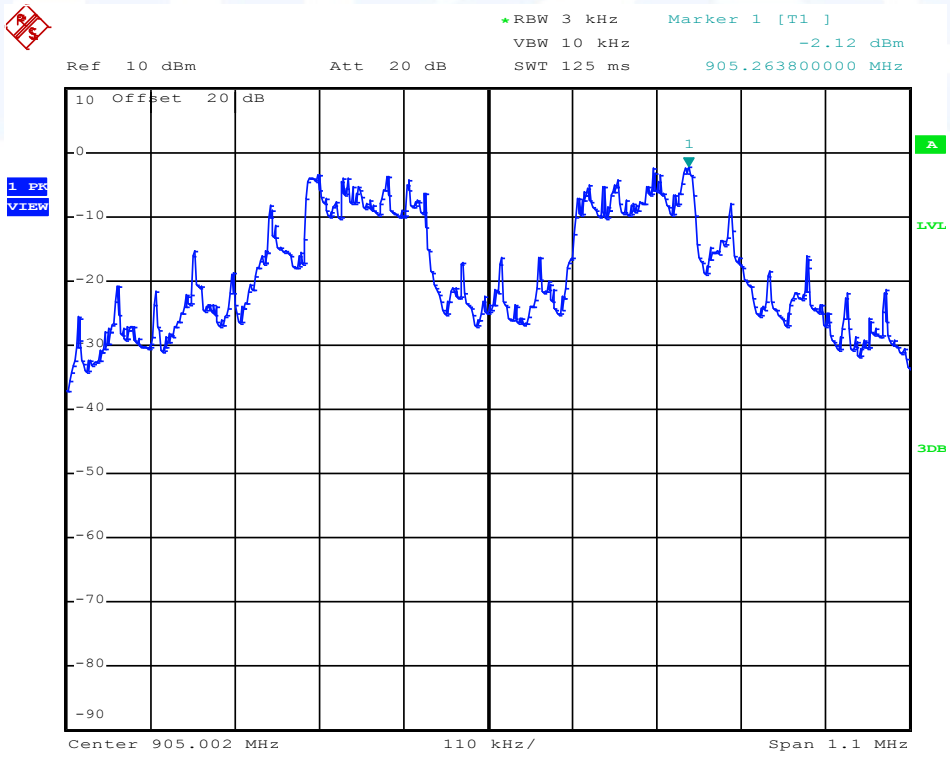
Remarks: For detailed test results please refer to following test protocols.

Power spectral density plots






RBW 10 kHz
VBW 30 kHz
SWT 15 ms
Marker 1 [T1]
1.96 dBm
905.259400000 MHz
Ref 10 dBm
Att 20 dB
Offset 20 dB
1 PK VIEW
A
LVL
3DB
Center 905.002 MHz
110 kHz/
Span 1.1 MHz


RBW 3 kHz
VBW 10 kHz
SWT 125 ms
Marker 1 [T1]
-2.12 dBm
905.263800000 MHz
Ref 10 dBm
Att 20 dB
Offset 20 dB
1 PK VIEW
A
LVL
3DB
Center 905.002 MHz
110 kHz/
Span 1.1 MHz

5.9 Maximum permissible exposure (MPE)

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

5.9.1 Description of the test location

Test location: AREA4

5.9.2 Applicable standard

According to KDB 447498 D01 General Exposure Guidance v05r01:

- Section 4.3. General SAR test reduction and exclusion guidance
- Section 4.3.1. Standalone SAR test exclusion considerations

5.9.3 Description of Measurement

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[24] where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[25]
   - The result is rounded to one decimal place for comparison
   - 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

   The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

2) At 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B:[26]

   a) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·($f_{(MHz)}$/150)] mW, at 100 MHz to 1500 MHz

   b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

5.9.4 Test result

PCB type:	Frequency	Max power output to antenna		Test separation Distance accd. Annex A	SAR Test Exclusion Threshold
	(MHz)	(dBm)	(mW)	(mm)	(mW)
LOG-HC2	905.0	2.74	1.88	5.0	10
PCB LOG-PT1000 and LOG-PT1000-30	905.0	2.47	1.77	5.0	10

Limits for maximum permissible exposure (MPE), KDB 447498, Annex A:

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table. The equation and threshold in section 4.3.1 must be applied to determine SAR test exclusion.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	SAR Test Exclusion Threshold (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Note: 10-g Extremity SAR Test Exclusion Power Thresholds are 2.5 times higher than the 1-g SAR Test Exclusion Thresholds indicated above. These thresholds do not apply, by extrapolation or other means, to occupational exposure limits.

Limits for maximum permissible exposure (MPE), KDB 447498, Annex B:

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in section 4.3.1 must be applied to determine SAR test exclusion.

MHz	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	
150	387	397	407	417	427	437	447	457	467	477	487	497	507	517	527	
300	274	294	314	334	354	374	394	414	434	454	474	494	514	534	554	
450	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644	
835	164	220	275	331	387	442	498	554	609	665	721	776	832	888	943	
900	158	218	278	338	398	458	518	578	638	698	758	818	878	938	998	
1500	122	222	322	422	522	622	722	822	922	1022	1122	1222	1322	1422	1522	mW
1900	109	209	309	409	509	609	709	809	909	1009	1109	1209	1309	1409	1509	
2450	96	196	296	396	496	596	696	796	896	996	1096	1196	1296	1396	1496	
3600	79	179	279	379	479	579	679	779	879	979	1079	1179	1279	1379	1479	
5200	66	166	266	366	466	566	666	766	866	966	1066	1166	1266	1366	1466	
5400	65	165	265	365	465	565	665	765	865	965	1065	1165	1265	1365	1465	
5800	62	162	262	362	462	562	662	762	862	962	1062	1162	1262	1362	1462	

The requirements are **FULFILLED.**

Remarks: _____

5.11 Antenna application

5.11.1 Applicable standard

According to FCC Part 15C, Section 15.203:
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 that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has an external antenna connector. Only the delivered antenna type should be used.
For detailed information please refer to the user manual.

All supplied antennas meet the requirements of part 15.203 and 15.204.

5.11.2 Antenna requirements

According to FCC Part 15C, Section 15.247(b)(4):
The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The output power has not to be reduced using the antenna type ANT-900MR Right angle from Low Power Radio Solutions Ltd.

5.13 Receiver radiated emissions

For test instruments and accessories used see section 6 Part **SER 1, SER2** and **SER3**.

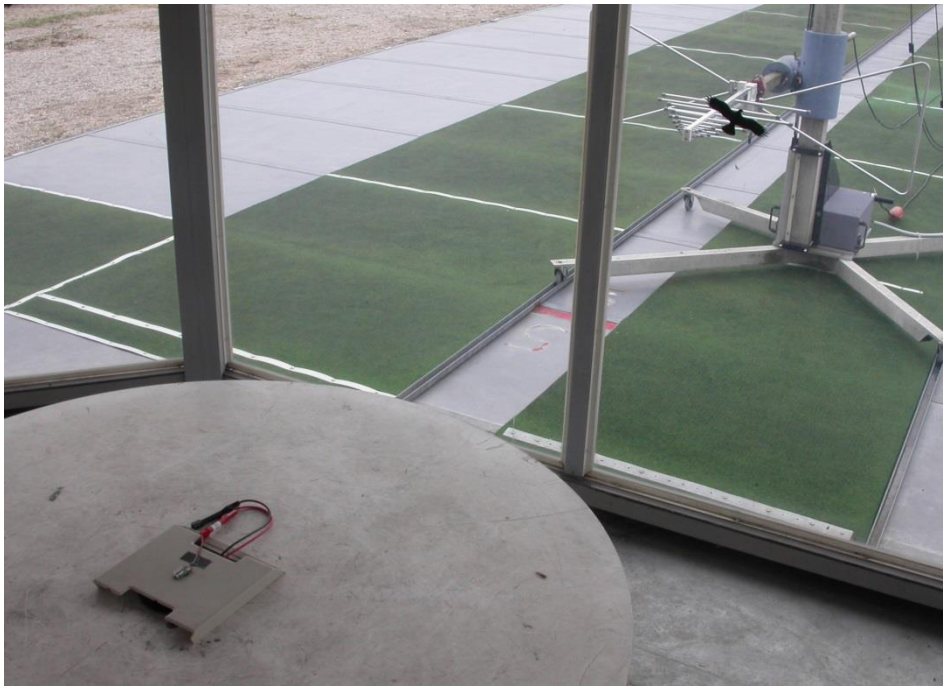
5.13.1 Description of the test location

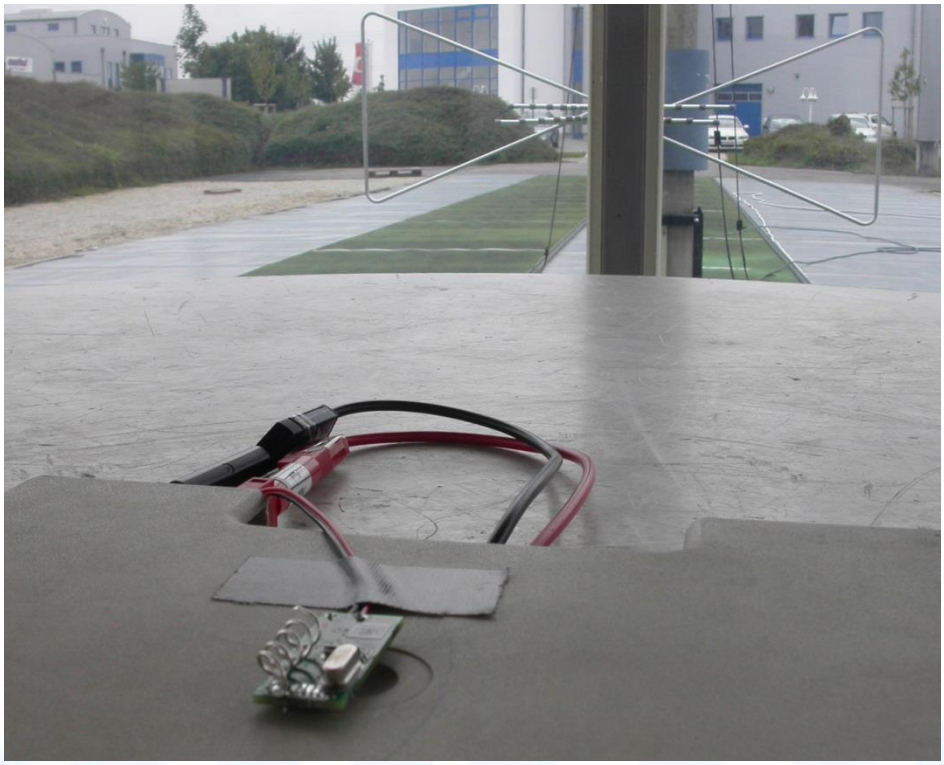
Test location: OATS 1
Test location: Anechoic chamber 2

Test distance: 3 m

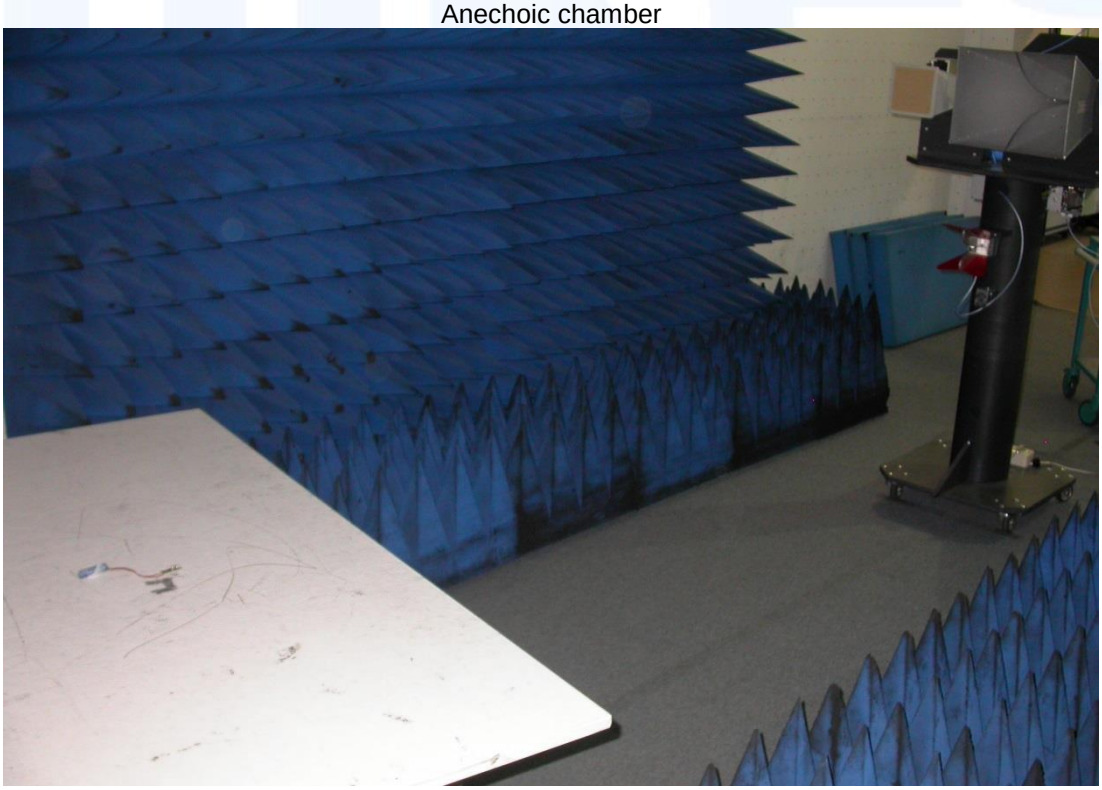
5.13.2 Photo documentation of the test set-up

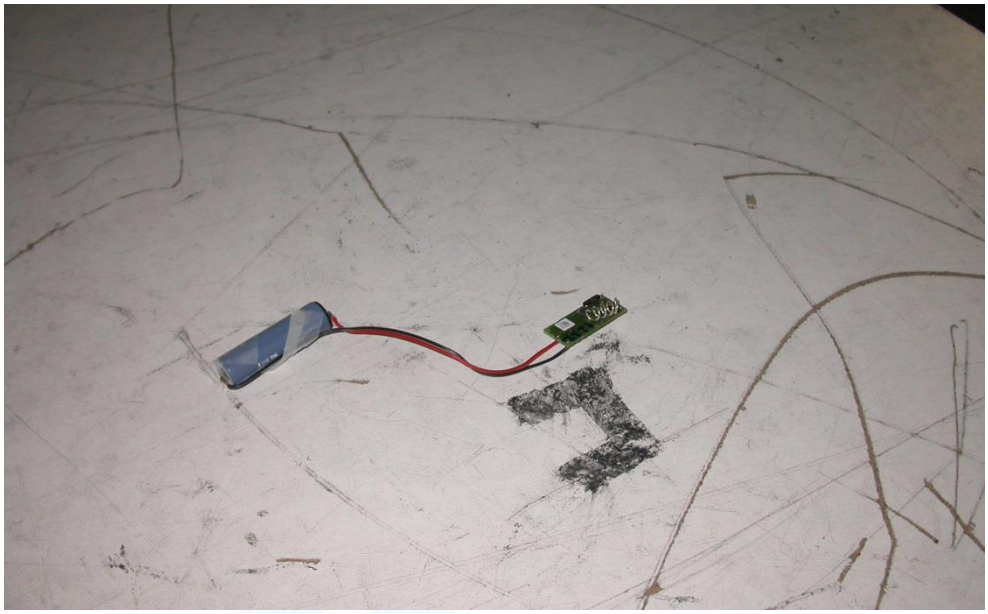
Open area test site





Anechoic chamber





5.13.3 Applicable standard

According to FCC Part 15, Section 15.109 (a):
Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 m shall not exceed the given limit.

5.13.4 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, 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.

5.13.5 Test result

5.13.5.1 f < 1 GHz)

Frequency [kHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
536.8	24.1	19.7	9.0	20	44.1	39.7	73.0	-33.3
1073.6	23.4	18.0	9.0	20	43.4	38.0	67.0	-29.0
1342.0	21.6	15.9	9.0	20	41.6	35.9	65.0	-29.1

Frequency [MHz]	L: QP [dBµV]	Correct. [dB]	L: QP [dBµV/m]	Limit [dBµV/m]	Delta [dB]
33.78	3.7	13.4	17.1	40.0	-22.9
118.54	9.3	12.9	22.2	43.5	-21.3
517.43	4.8	21.9	26.7	46.0	-19.3

In both frequency ranges only ambient noises could be detected.

5.13.5.2 f > 1GHz

Tx mode @ CH1

Frequency (GHz)	L: PK (dBµV)	L: AV (dBµV)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(µV/m)	L: AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
3761.0	26.2		1000	3.3	29.5		54.0	-24.5
8536.0	23.2		1000	7.5	30.7		54.0	-23.3

In the frequency range from 1 GHz up to 25 GHz only ambient noises could be detected.

Limit according to FCC Section 15.109(a)

Frequency of emission (MHz)	Field strength limit (µV/m)	Field strength limit dB(µV/m)
0.009-0.490	2400/F(kHz)	
0.490-1.705	24000/F (kHz)	
1.705-30.0	30	
30-88	100	40
88-216	150	44
216-960	200	46
Above 960	500	54

The requirements are **FULFILLED.**

Remarks: During the test, the EUT was set into continuous receiving mode.

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	16/07/2014	16/07/2013		
	ESH 2 - Z 5	02-02/20-05-004	06/06/2015	06/06/2014	06/12/2013	06/06/2013
	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			05/10/2013	05/04/2013
	SP 103 /3.5-60	02-02/50-05-182				
CPC 3	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	18N50W-20 dB	02-02/50-09-017				
MB	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	18N50W-20 dB	02-02/50-09-017				
SEC 1-3	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	18N50W-20 dB	02-02/50-09-017				
SER 1	ESR7	02-02/03-13-001	21/05/2014	21/05/2013		
	HFH 2 - Z 2	02-02/24-05-020	23/08/2014	23/08/2013	14/02/2014	14/02/2013
	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	28/06/2014	28/06/2013		
	VULB 9168	02-02/24-05-005	11/04/2014	11/04/2013	11/10/2013	11/04/2013
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 3	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	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	04/04/2014	04/04/2013		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				