



RF - TEST REPORT
- Jp ORRE 49.20 -

Type / Model Name : HPR Display V04

Product Description : Central control unit of e-bike system

Applicant : TQ-Systems GmbH

Address : Gut Delling, Muehlstrasse 2
82229 SEEFELD

Manufacturer : TQ-Systems GmbH

Address : Gut Delling, Muehlstrasse 2
82229 SEEFELD

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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Test Report No. : 80237318-06 Rev_0	06. May 2025 Date of issue
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ATTACHMENT A2 as separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

Radio Law (Law No. 131 of May 1950). Amended last by Law 21 of 2005.

Chapter III, Radio Equipment, Article 28 Quality of Radio Waves

Chapter III, Radio Equipment, Article 29 Requirements for receiving equipment

Radio Law Enforcement Regulations Abstract Article 6, Item 4, 4(1)

Latest revision – Law 91 on 31.May 2006

Ordinance concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment (Ordinance No. 122 as of 2013), Chapter 1, Article 2, Item 19

Ordinance Regulating Radio Equipment Chapter IV, Section 4.17 Radio Equipment of Radio Stations of a Low-Power Data Communication System based on the provisions of Article 49-20, Items 1

Public notice no. 88/2004

Table No.1

Measuring Method for Intensity of Spurious Emission or Extraneous Emission

Table No.43

Test Method for Radio Equipment specified in No.19, Clause 1, Item 2 of Regulations for Certification

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.

2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

2.3 General remarks

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

2.5 Equipment type

BLE device, ANT+ device

2.6 Short description of the equipment under test (EUT)

The EUT "HPR Display V04" is a Bluetooth Low Energy wireless bike computer. It is the central control and information unit of the TQ HPR e-bike system. The modulation used by the EUT is GFSK.

Number of tested samples : 1 (conducted sample)
Article number : 356974.0100
Serial number : 20240819/00056/23#
Firmware number : 1.0.0
Name of sample : HPR-DISP04-CON-SMA-003

Items	Description
BT type	5.4 Low Energy
BT chipset type	nRF 52840
Modulation	GFSK
Frequency range	2400 MHz to 2483.5 MHz
Channel numbers	40
Data rate (Mbps)	1
Power setting	Default (0)
Antenna type	PCB

2.7 Variants of the EUT

There are no variants.

2.8 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	18	2442
0	2404	19	2444
1	2406	20	2446
2	2408	21	2448
3	2410	22	2450
4	2412	23	2452
5	2414	24	2454
6	2416	25	2456
7	2418	26	2458
8	2420	27	2460
9	2422	28	2462
10	2424	29	2464
38	2426	30	2466
11	2428	31	2468
12	2430	32	2470
13	2432	33	2472
14	2434	34	2474
15	2436	35	2476
16	2438	36	2478
17	2440	39	2480

Note: the marked frequencies are determined for final testing.

Channel frequency ANT+: 2457 MHz

2.9 Transmit operating modes

The EUT use GFSK modulation and may provide the following data rates:

- 1 Mbps for BLE
- 0.025 Mbps for ANT+

(Mbps = Megabits per second)

2.10 Antenna

The following antennas shall be used with the EUT:

A single PCB antenna is used within the system. The EUT has only one integrated antenna.

Number	Characteristic	Frequency band (GHz)	Gain (dBi)
1	omnidirectional	2.4 – 2.5	0

2.11 Power supply system utilised

Power supply voltage, V_{nom} : 13.3 V_{DC}

2.12 Peripheral devices and interface cables

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

- _____ Model : - _____
- _____ Model : - _____

2.13 Determination of worst-case conditions for final measurement

For the final test the following channels and test modes are selected:

Technology	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.15.1 BLE	37 - 39	37, 18, 39	P0	DSSS	GFSK	1 Mbps
802.15.1 ANT+	2457 MHz	2457 MHz	P0	DSSS	GFSK	0.025 Mbps

- TX continuous mode, 802.15.1
- RX continuous mode

2.13.1 Test jig

The conducted measurements are performed under the support of a test jig.

2.13.2 Test software

The EUT has a special firmware that allows a continuous modulated wave on the different channels and a receive mode.

3 TEST RESULT SUMMARY

ORRE Article Reference	Report chapter	Test items	Test Results
Chapter I General Provisions, Section 2 Quality of Emissions			
5	5.1	Frequency tolerance	passed
6	5.2	Occupied bandwidth	passed
7	0	Spurious emissions	passed
Chapter I General Provisions, Section 5 Interference Prevention Function			
9.4 (11)	5.4	Interference prevention function	passed
Chapter II Transmitting Equipment, Section 1 General			
14	5.6	Antenna power tolerance	passed
14.2		SAR at human head	not applicable
Chapter II Transmitting Equipment, Section 3 Transmitting Antenna			
20		Type, configuration of transmitting antenna	not applicable
Chapter III – Receiving Equipment			
24 (2)	5.16	Limit on secondary radiated emissions	passed
Chapter IV – Section 4.17 Radio Equipment of Radio Stations of a Low-Power Data Communication System			
49.20 1a)	0	High frequency section	passed
49.20 1b)	5.8	Communication method	passed
49.20 1c)	5.9	Modulation method	passed
49.20 1d)	5.10	Spread spectrum method	passed
49.20 1e)	5.5	Antenna power	passed
49.20 1f(1)	5.11	Transmitting antenna, EIRP	passed
49.20 1f(2)	5.12	Angular width of principal radiation	not applicable
49.20 1g)	5.13	Number of carriers	not applicable
49.20 1h)	5.14	Diffusion bandwidth	passed
49.20 1i)	5.15	Diffusion rate	passed
49.20 1j)		Frequency retention time (FH employed)	not applicable
49.20 1k)	5.17	Carrier sense function	passed
		Transmitting antenna assembly gain	not applicable

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.

3.1 Final assessment

The equipment under test fulfils the requirements cited in clause 1 test standards.

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

Testing commenced on : 31 March 2025

Testing concluded on : 08 April 2025

Checked by:

Jürgen Pessinger
**Jürgen
Pessinger**
2025.05.06
09:07:11 +02'00'

Jürgen Pessinger
Radio Team

Tested by:

C. Thaller
Christopher Thaller
I am the author of
the testreport.
2025.05.06
07:54:20 +02'00'

Christopher Thaller
Radio Team

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.

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Straubinger Straße 100
94447 PLATTLING
GERMANY**

4.2 Environmental conditions

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

Temperature: 5 - 35 ° C

Humidity: 45 - 85 %

Atmospheric pressure: 86 - 106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 2011 + A1 / 2014 „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, CSA Group Bayern 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.

Measurement uncertainty table	
Measurement output power, conducted	±1.5 dB
Measurement output power, radiated	±3.0 dB
Measurement PSD, conducted	±1.5 dB
Measurement PSD, radiated	±3.0 dB
Measurement spurious emissions, conducted	±3.0 dB
Measurement spurious emissions, radiated	±6.0 dB
Measurement frequency	±1 x 10 ⁻⁸

4.4 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

4.5 Measurement protocol

4.5.1 General information

4.5.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures of the Table No 43 as shown under section 1 of this test report.

4.5.1.2 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 into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum disturbances from the unit.

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.

5 TEST CONDITIONS AND RESULTS

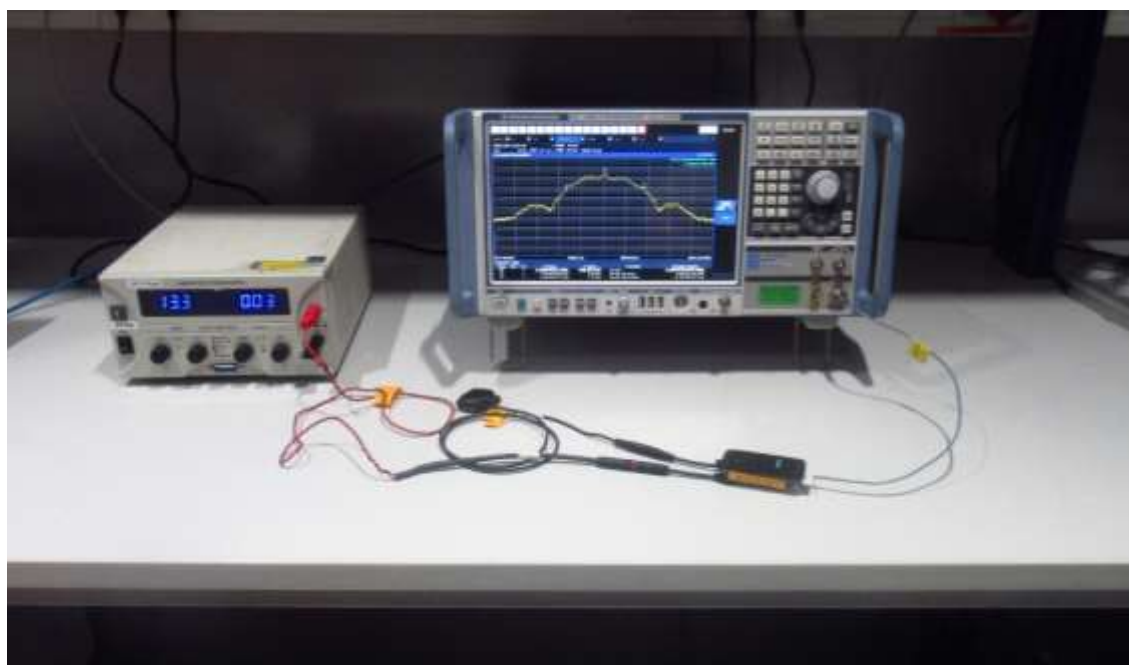
5.1 Frequency tolerance

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

5.1.1 Description of the test location

Test location: Shielded Room SR6

5.1.1 Photo documentation of the test set-up



5.1.2 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter I, Section 2, Article 5:
The tolerance of frequencies used in transmitting equipment shall be as stipulated in Table 1.

5.1.3 Description of Measurement

The EUT is operated in unmodulated mode. The transmitter output is connected to the spectrum analyser through an attenuator. The centre frequency of the spectrum analyser is set to the fundamental frequency.

Spectrum analyser settings:
RBW: 30 kHz, VBW: 100 kHz, SPAN: 1 MHz

5.1.4 Test result

NOTE: Due to the modulation the OBW is measured and the centre frequency calculated from the upper and lower marker set on the 0.5% band power.

BLE:

Test conditions		Frequency (MHz)		
Power set P=0, 1 M		2402	2440	2480
T_{nom}	V_{nom}	2402.022	2440.022	2480.022
T_{nom}	$V_{-10\%}$	2402.021	2440.022	2480.022
T_{nom}	$V_{+10\%}$	2402.021	2440.021	2480.022

Determination of the limit in kHz, 50 ppm =	120.100	122.000	124.000
Maximum frequency drift in kHz, $f_e - f =$	21.459	21.555	21.916
Maximum frequency drift in ppm	8.9	8.8	8.8

ANT+:

Test conditions		Frequency (MHz)
Power set P=0, 25 k		2457
T_{nom}	V_{nom}	2457.028
T_{nom}	$V_{-10\%}$	2457.029
T_{nom}	$V_{+10\%}$	2457.029

Determination of the limit in kHz, 50 ppm =	122.850
Maximum frequency drift in kHz, $f_e - f =$	28.524
Maximum frequency drift in ppm	11.6

Limit according to Ordinance Regulating Radio Equipment, Chapter I, Section 2, Article 5:

Table 1, 7.8

Frequency tolerance limit (ppm)
± 50

The requirements are **FULFILLED**.

Remarks:

-

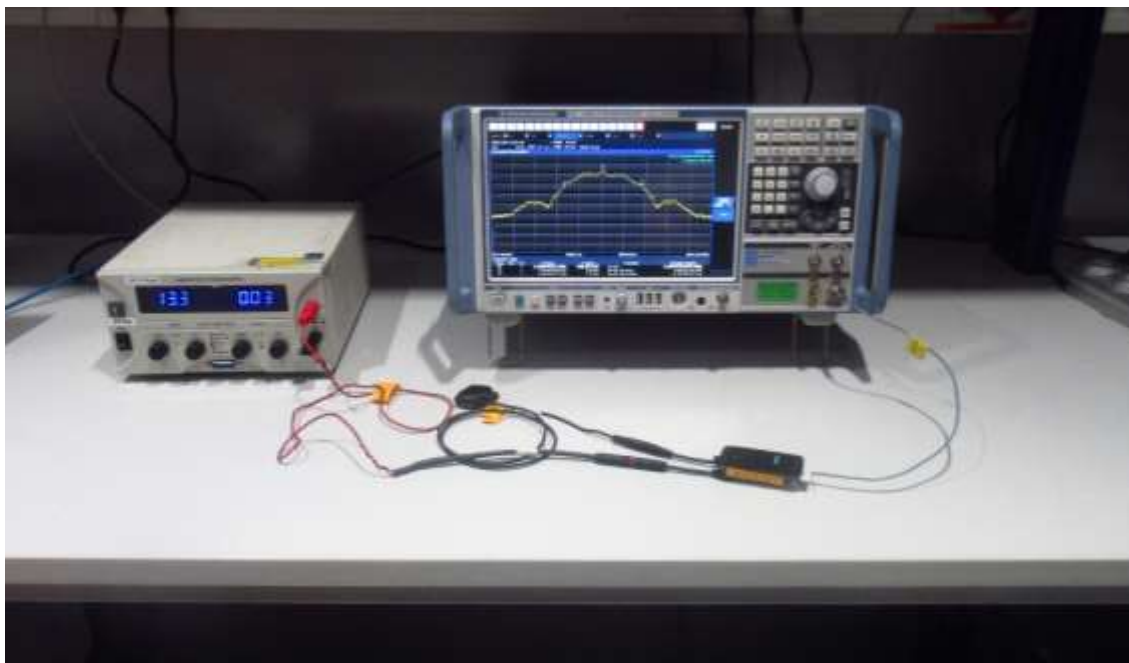
5.2 Occupied bandwidth

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

5.2.1 Description of the test location

Test location: Shielded Room SR6

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter I, Section 2, Article 6:
Permissible value for a bandwidth occupied by emissions shall be as stipulated in Table 2.

5.2.1 Description of Measurement

The transmitter output is connected to the spectrum analyser through an attenuator. The centre frequency of the spectrum analyser was set to the fundamental frequency. To get the value of the occupied bandwidth the function "% Power Bandwidth" of the analyser is used. The channel power is the same as described in item 5.5.

Analyser settings:

RBW: 30 kHz VBW: 100 kHz SPAN: 3 MHz Detector: PK Trace: max hold

5.2.2 Test result

BLE 1M:

Channel	Centre frequency (MHz)	99% OBW, 1 M		OBW (MHz)	Limit (MHz)
		f1 (MHz)	f2 (MHz)		
CH37	2402.0	2401.494	2402.549	1.055	≤ 26
CH17	2440.0	2439.494	2440.549	1.055	≤ 26
CH39	2480.0	2479.494	2480.550	1.055	≤ 26

ANT+ 25k

Channel	Centre frequency (MHz)	99% OBW, 25 k		OBW (MHz)	Limit (MHz)
		f1 (MHz)	f2 (MHz)		
ANT+	2457.028	2456.509	2457.548	1.039	≤ 26

Limit according to Ordinance Regulating Radio Equipment, Table 2, Item XXX.:

Notwithstanding the values prescribed in I to IV, the tolerance value for occupied bandwidth of the radio equipment of radio stations of low-power data-based communication systems shall be as follows:

- 1) Radio equipment that uses 2400 MHz to 2483.5 MHz and uses frequency hopping method, and a combination of the frequency hopping method and direct spread method 83.5 MHz
- 2) Radio equipment that uses OFDM method and other than those specified in (1) above 38 MHz
- 3) Radio equipment that uses methods other than those specified in (1) and (2) above 26 MHz

The requirements are **FULFILLED**.

Remarks: For detailed results, please see the test protocol below.

5.2.3 Test protocols OBW99

BLE 1 Mbps

CH37



CH17



CH39



ANT+ 25 kbps



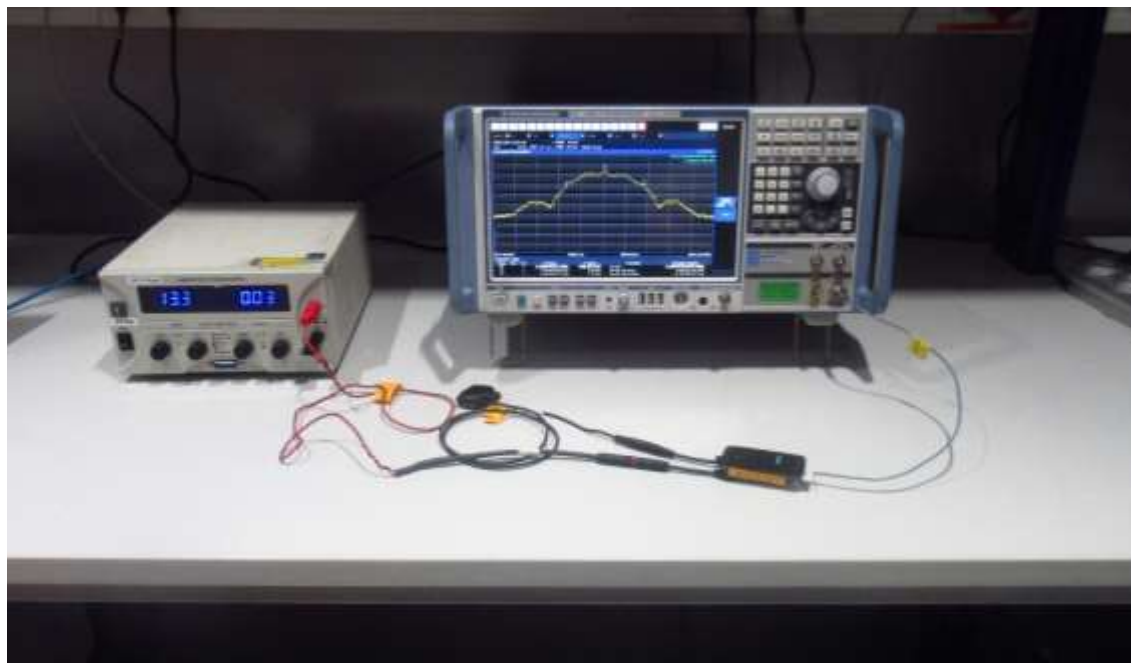
5.3 Spurious emissions conducted

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

5.3.1 Description of the test location

Test location: Shielded Room SR6

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

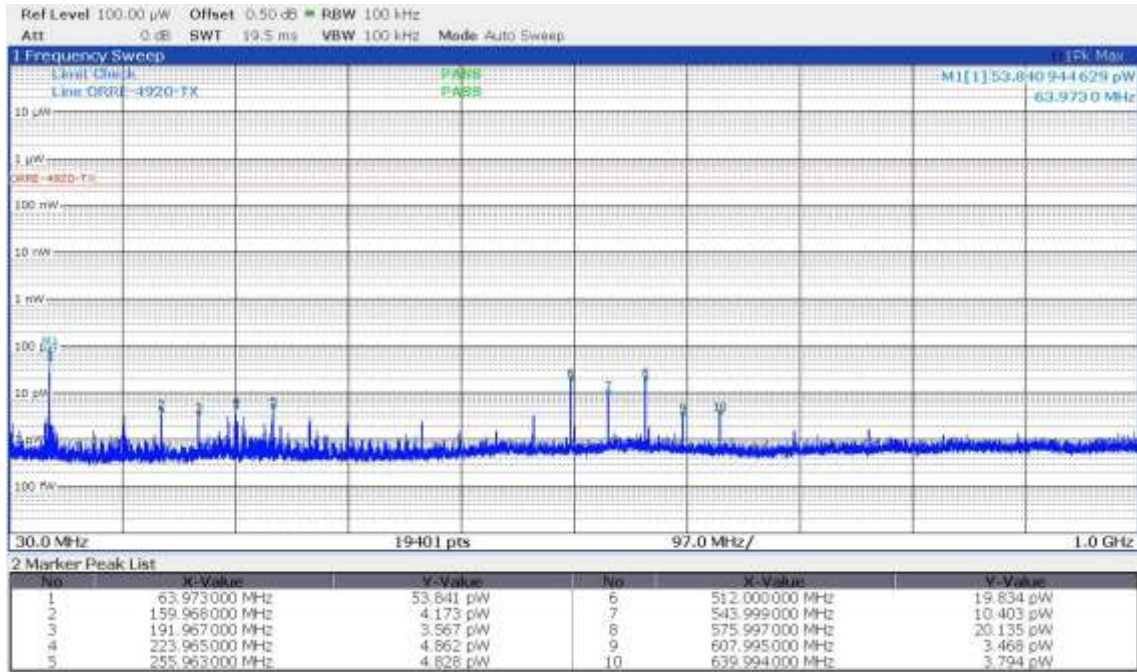
According to Ordinance Regulating Radio Equipment, Chapter I, Section 2, Article 7:
The permissible value for the intensity of spurious or unwanted emissions shall be as stipulated in Table 3.

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.

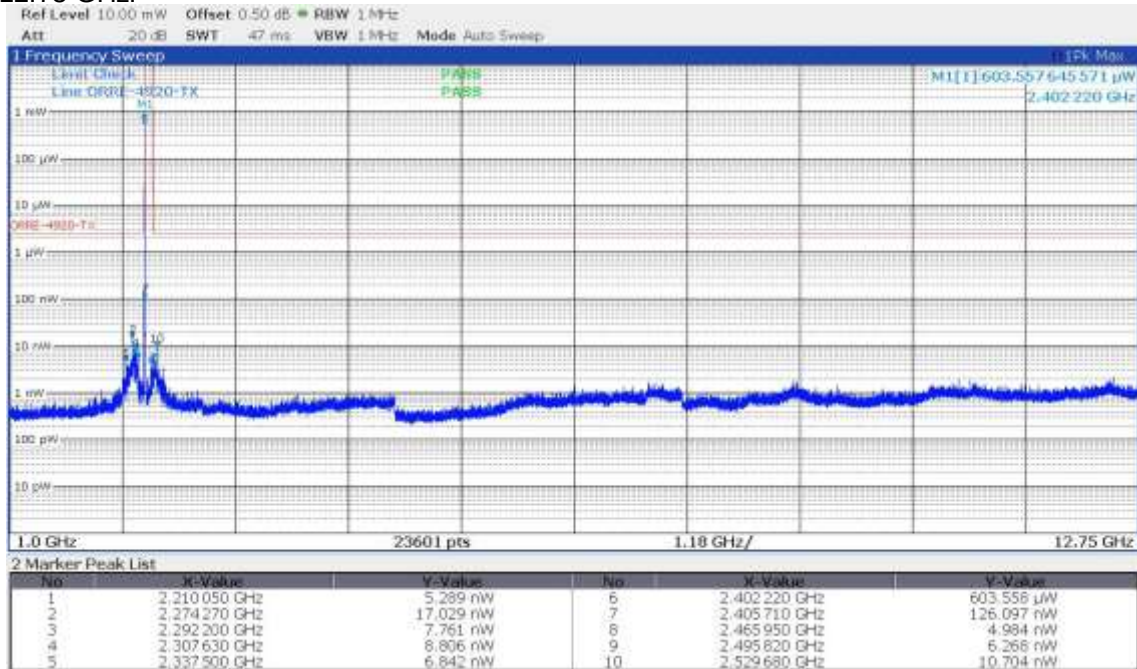
5.3.4 Test result

CH37: 2402 MHz

30 MHz – 1 GHz:

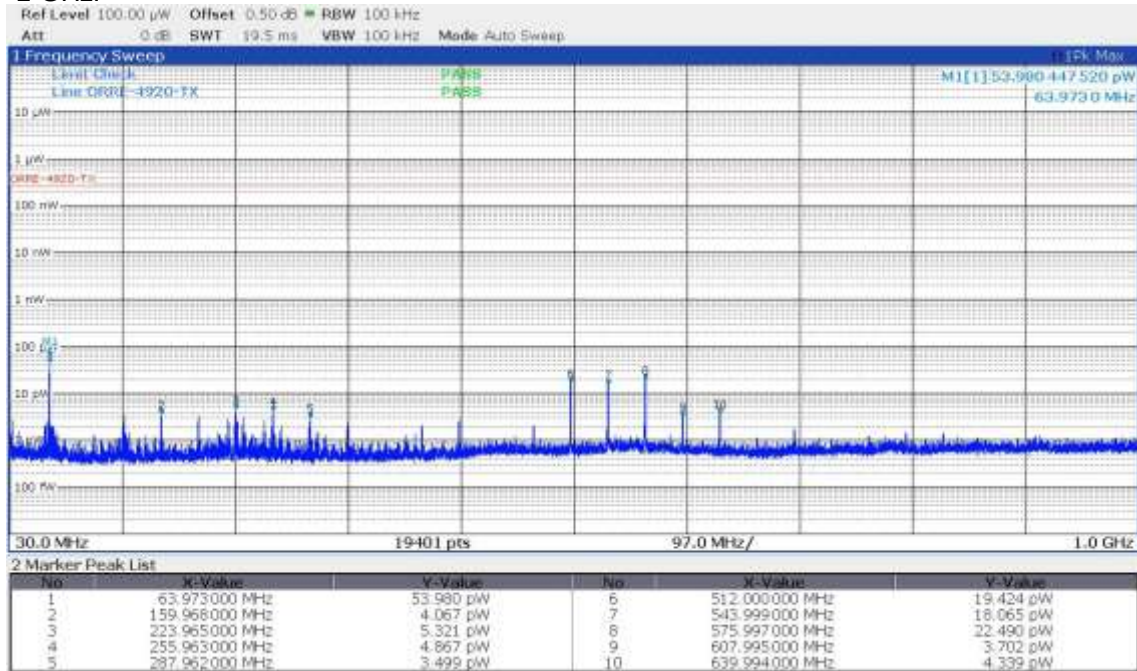


1 GHz – 12.75 GHz:

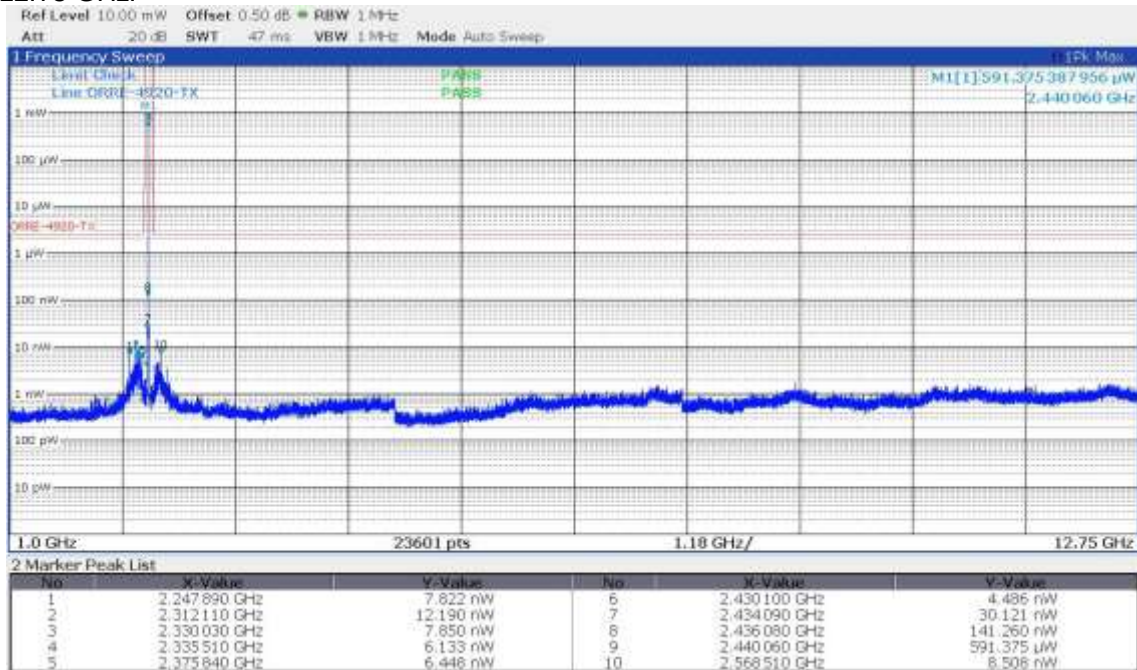


CH17: 2440 MHz

30 MHz – 1 GHz:

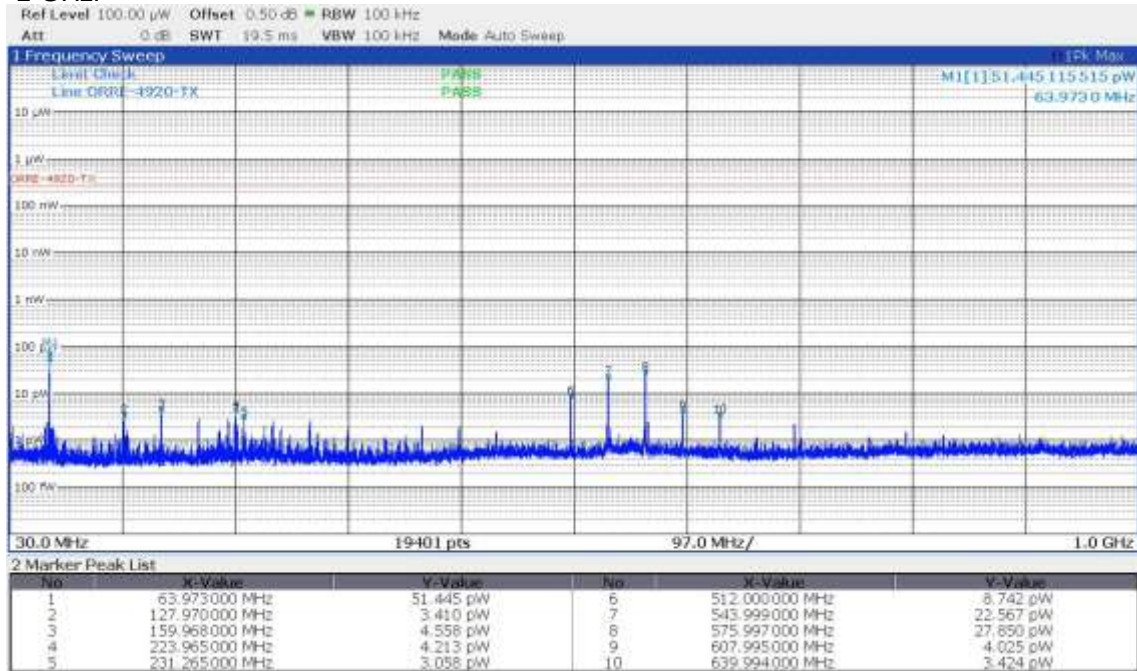


1 GHz – 12.75 GHz:

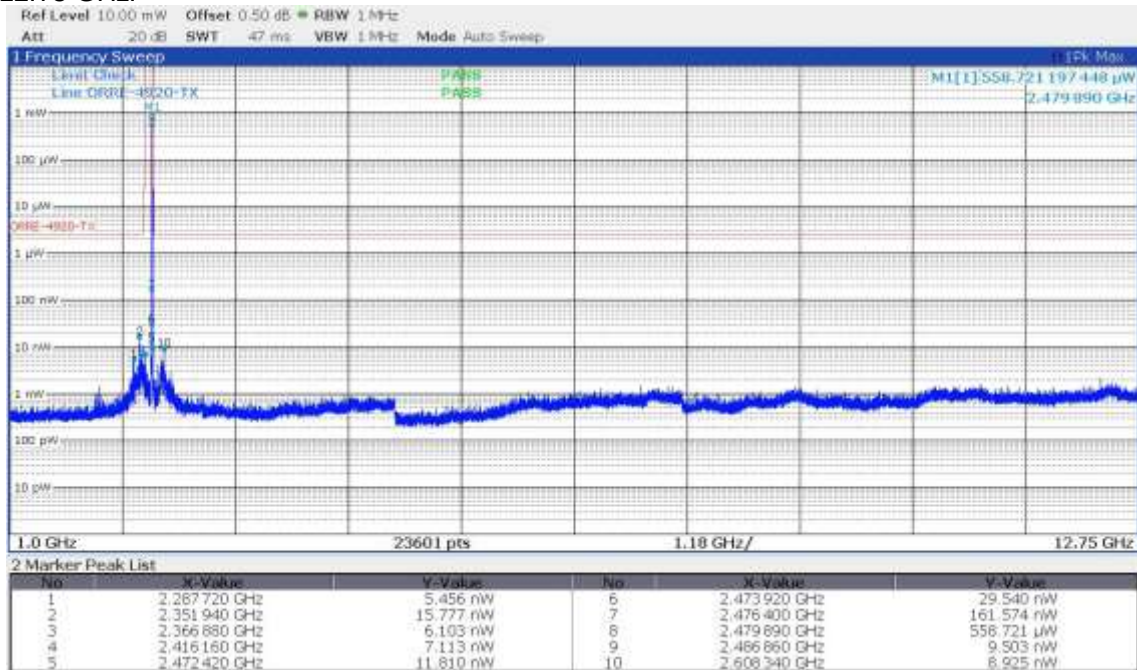


CH39: 2480 MHz

30 MHz – 1 GHz:



1 GHz – 12.75 GHz:



Limit according to Ordinance Regulating Radio Equipment, Chapter I, Section 2, Article 7:
Table 3, Item 25

Frequency range	Limit
30 to 1000 MHz	0.25 μ W
1000 to 2387 MHz	2.5 μ W
2387 MHz to 2400 MHz	25.0 μ W
2483.5 MHz to 2496.5 MHz	25.0 μ W
Higher than 2496.5 MHz	2.5 μ W

The requirements are **FULFILLED**.

Remarks:

-

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.

5.4 Interference prevention function (identification code)

Requirement according to Ordinance Regulating Radio Equipment, Chapter I, Section 5, Article 9.4, 9c):
The radio stations shall be equipped with the interference prevention function stated in Article 6-2, Item 3 of the Enforcement Regulations:
Radio equipment of radio stations used in the same premises that automatically transmits or receives identification code.

The transmitted and received identification of the EUT is according to 802.15.1 using the 48-bit MAC address for identification.

The identification process works “good”.

Remarks:

-

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.

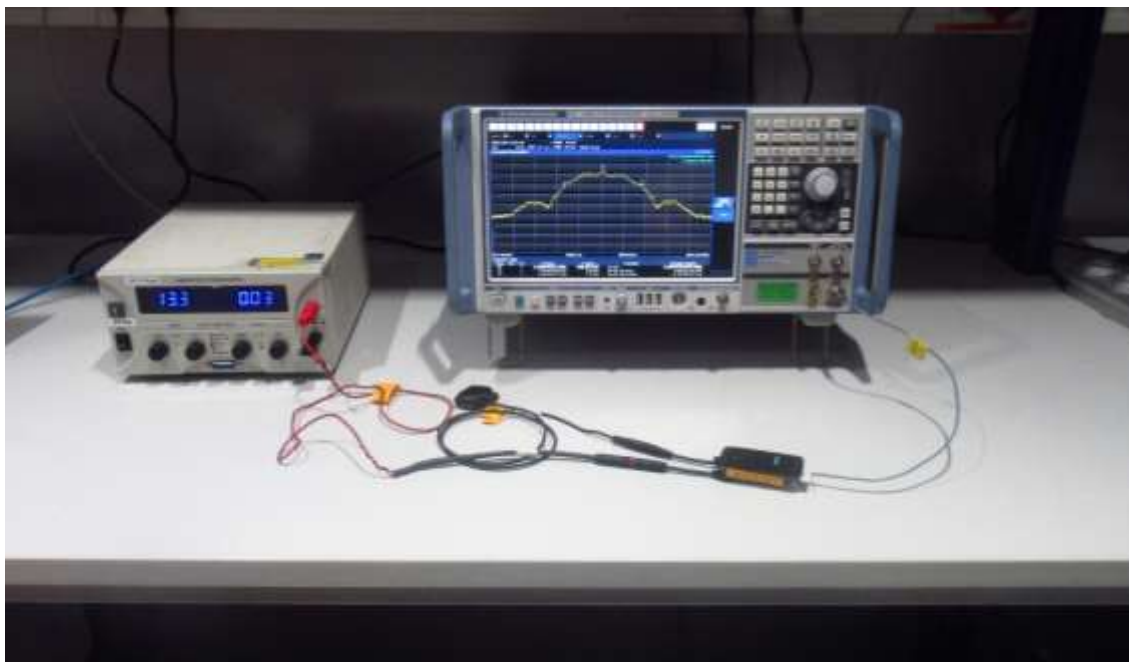
5.5 Antenna power

For test instruments and accessories used see section 6 Part **CPC3**.

5.5.1 Description of the test location

Test location: Shielded Room SR6

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1e(3):
In the case of a transmitter with an occupied frequency bandwidth of 26 MHz or less, the average power in the bandwidth of 1 MHz shall be 10 milliwatts or less.

5.5.4 Description of Measurement

A spectrum analyser is used for measurement with the settings below. With the marker function "max peak" the maximum amplitude is determined.

Analyser settings:

RBW: 1 MHz, VBW: 3 MHz, Detector: RMS, Trace mode: Max hold, Span: 2 times OBW;

5.5.5 Test result

BLE:

Test conditions: 1000 kbps, P0		Measured antenna power (mW)		
		CH37	CH17	CH39
T_{nom}	V_{nom}	0.607	0.588	0.540

Note: The measurement cable is taken into account with +0.5 dB.

ANT+:

Test conditions: 25 kbps, P0		Measured antenna power (mW)	
		2457MHz	
T_{nom}	V_{nom}	0.584	

Note: The measurement cable is taken into account with +0.5 dB.

Limit according to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1e(3):

Method of modulation	Limit
DSSS	≤ 10 mW/MHz

The requirements are **FULFILLED**.

Remarks:

-

5.6 Antenna power tolerance

5.6.1 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter II, Section 1, Article 14, Item 7(5):
The tolerance for antenna power of the transmitter shall be as stipulated in the table below.

5.6.2 Calculation of the tolerance

Rated mean antenna power level	$P_R =$	1.00	(mW)
Measured output power maximum	$P_{max} =$	0.61	(mW)
Measured output power minimum	$P_{min} =$	0.54	(mW)
Maximum deviation +	$P_{Max} - P_R =$	-0.39	(mW)
Maximum deviation -	$P_{Min} - P_R =$	-0.46	(mW)
Maximum power tolerance +		0.0	%

Limit according to Ordinance Regulating Radio Equipment, Chapter II, Section 1, Article 14, Item 7(3):

The measured antenna power has to be up to +20 % of declared power

The requirements are **FULFILLED**.

Remarks:

-

5.7 High-frequency section

5.7.1 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1a:
The high-frequency section and modulation section (except for the antenna system) shall not be capable of being opened easily.

The RF and modulation section is built with SMD devices and have no devices, which are adjustable. A handle of the devices can only be done by special tools. This avoids manipulation.

The requirements are **FULFILLED**.

Remarks:

-

5.8 Communication method

5.8.1 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1b):
The communication method shall be one-way communication, simplex operation, half duplex operation, or duplex operation.

The EUT complies with the Standard 802.15.1 and uses half-duplex method.

The requirements are **FULFILLED**.

Remarks:

-

5.9 Modulation method

5.9.1 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1c):

The modulation method shall be one of the items below:

- (1) Orthogonal frequency division multiplexing (OFDM) or spread spectrum method.
- (2) Digital modulation method other than (1) above.

The EUT complies with the Standard 802.15.1 and use spread spectrum method.

The requirements are **FULFILLED**.

Remarks:

-

5.10 Spread spectrum method

5.10.1 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1d):

The spread spectrum method shall be the direct spread method, frequency hopping method, or a combination of the direct spread method and frequency hopping method, or a combination of OFDM and frequency hopping method.

The EUT complies with the Standard 802.15.1 and uses direct spread spectrum method.

The requirements are **FULFILLED**.

Remarks:

-

5.11 Transmitting antenna, EIRP

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

5.11.1 Description of the test location

Test location: Shielded Room SR6

5.11.2 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1f(1):
The absolute gain of a transmitting antenna shall be 12.14 dB or less.

5.11.1 Calculation of the EIRP

Regarding the data sheet of the used antenna, the absolute gain is calculated using the following formula.

$$P = A + G$$

Where:

P: Antenna power (EIRP)

D: Antenna power (max measured power conducted)

G: Antenna gain (dBi)

The measured output power of item 5.5 is calculated from linear to logarithmic values by applying the following formula:

$$A = 10\log(A(\text{lin}))$$

For example:

125k

Pch37 = $10\log(2.82)$ = 4.5 dBm;

Pch17 = $10\log(2.24)$ = 3.5 dBm;

Pch39 = $10\log(1.93)$ = 2.9 dBm;

BLE

Channel	Antenna	effektive Gain (dBi)	A (dBm)	P (dBm)	EIRP Limit (dBm)	Margin (dB)
CH37	PCB, omnidirectional	0.0	-2.2	-2.2	12.14	-14.3
CH17	PCB, omnidirectional	0.0	-2.3	-2.3	12.14	-14.4
CH39	PCB, omnidirectional	0.0	-2.7	-2.7	12.14	-14.8

ANT+

Channel	Antenna	effektive Gain (dBi)	A (dBm)	P (dBm)	EIRP Limit (dBm)	Margin (dB)
2457 MHz	PCB, omnidirectional	0.0	-2.3	-2.3	12.14	-14.4

Limit according to Certification Regulation, Chapter IV, Section 4.17, Article 49.20, Item 1f(1):

The absolute gain of the transmitting antenna shall be 12.14 dB or less. However, when the equivalent isotropic radiated power (for the transmitting antenna that uses the modulation method prescribed in c (1) above, the equivalent isotropic radiated power within a bandwidth of 1 MHz; the same applies in c (2)) is equal to or lower than the value obtained by applying an antenna power with the mean power of 10 mW (for the transmitting antenna that uses the modulation method prescribed in c (1) above, the mean power within a bandwidth of 1 MHz shall be 10 mW. However, for the transmitting antenna that uses the frequency hopping method, a combination of the direct spread method and frequency hopping method, or a combination of OFDM and frequency hopping method and that uses emissions of a frequency from 2,427 MHz to 2,470.75 MHz, the mean power within a bandwidth of 1 MHz shall be 3 mW; the same applies in c (2)) to the transmitting antenna with its absolute gain being 12.14 dB, the shortage shall be compensated for by the gain of the transmitting antenna.

The requirements are **FULFILLED**.

Remarks:

-

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.

5.12 Angular width of principal radiation

5.12.1 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1f(2):
The angular width of principal radiation of transmitting antenna shall not exceed the value by the following expression:
 $360/A$ (degree).

Remarks: Not applicable, because the EIRP is less than 12.14 dBm/MHz.

5.13 Number of carriers

5.13.1 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1g):
The number of carriers within a bandwidth of 1 MHz in OFDM shall be 1 or more.

Remarks: Not applicable because the EUT does not use OFDM modulation.

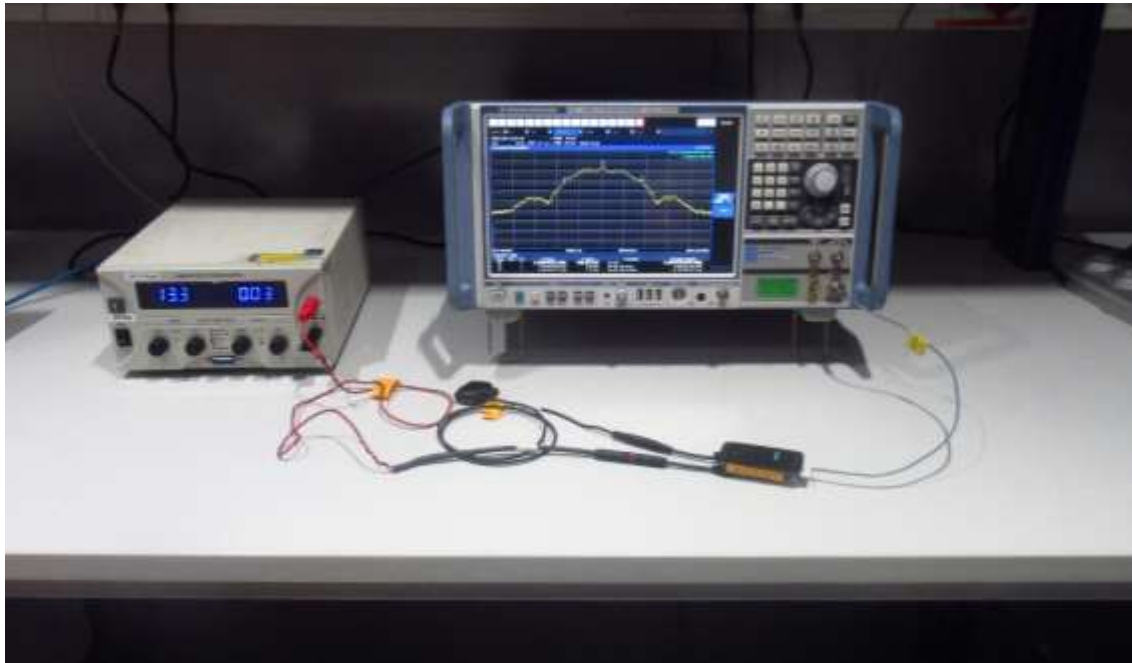
5.14 Diffusion bandwidth

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

5.14.1 Description of the test location

Test location: Shielded Room SR6

5.14.2 Photo documentation of the test set-up



5.14.3 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1h):
The diffusion bandwidth of the radio equipment that uses spread spectrum method shall be 500 kHz or more.

5.14.4 Description of Measurement

The transmitter output is connected to the spectrum analyser. The centre frequency of the spectrum analyser is set to the fundamental frequency. The value of the diffusion bandwidth is determined using the function “% Power Bandwidth” of the analyser. It is set to 90 %.

Analyser settings:

RBW: 30 kHz

VBW:

100 kHz

SPAN:

3 MHz

5.14.5 Test result

BLE:

Channel	Centre frequency (MHz)	90% OBW, 1 M		DBW (MHz)	Limit (kHz)
		f1 (MHz)	f2 (MHz)		
CH37	2402	2401.667	2402.349	0.682	≥ 500
CH17	2440	2439.666	2440.349	0.683	≥ 500
CH39	2480	2479.666	2480.349	0.682	≥ 500

ANT+:

Channel	Centre frequency (MHz)	90% OBW, 25 k		DBW (MHz)	Limit (kHz)
		f1 (MHz)	f2 (MHz)		
2457 MHz	2457.014	2456.681	2457.348	0.667	≥ 500

Limit according to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1h):
The diffusion bandwidth (90 %) of the radio equipment that uses spread spectrum method shall be 500 kHz or more.

The requirements are **FULFILLED**.

Remarks:

5.14.1 Test protocol diffusion bandwidth

BLE 1 M

CH37



CH17



ANT+ 0.025 M



5.15 Diffusion rate

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

5.15.1 Description of the test location

Test location: Shielded Room SR6

5.15.2 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1i):
The diffusion rate of the radio equipment that uses spread spectrum method shall be 5 or more.

5.15.3 Test result

The process gain is calculated using the following formulas:

$$PG = SBW / MR$$

and

$$SBW = \text{Number of used channels} * DBW$$

Where:

PG Process gain (diffusion rate)
SBW Spread bandwidth (MHz)
MR Maximum modulation rate (Mbps)
DBW Maximum diffusion bandwidth (MHz)

1 M

No. of data channels	DBW (MHz)	SBW (MHz)
37	0.683	25.255

SBW (MHz)	MR (Mbps)	Calculated PG	Limit
25.255	1.000	25.255	≥ 5

Limit according to Ordinance Regulating Radio Equipment, Chapter IV, Section 4.17, Article 49.20, Item 1i):
The diffusion rate of the radio equipment that uses spread spectrum method (which refers to the value obtained by dividing the diffusion bandwidth by a frequency equal to the transmission rate of the modulation signal, this apply hereafter) shall be 5 or more.

The requirements are **FULFILLED**.

Remarks:

-

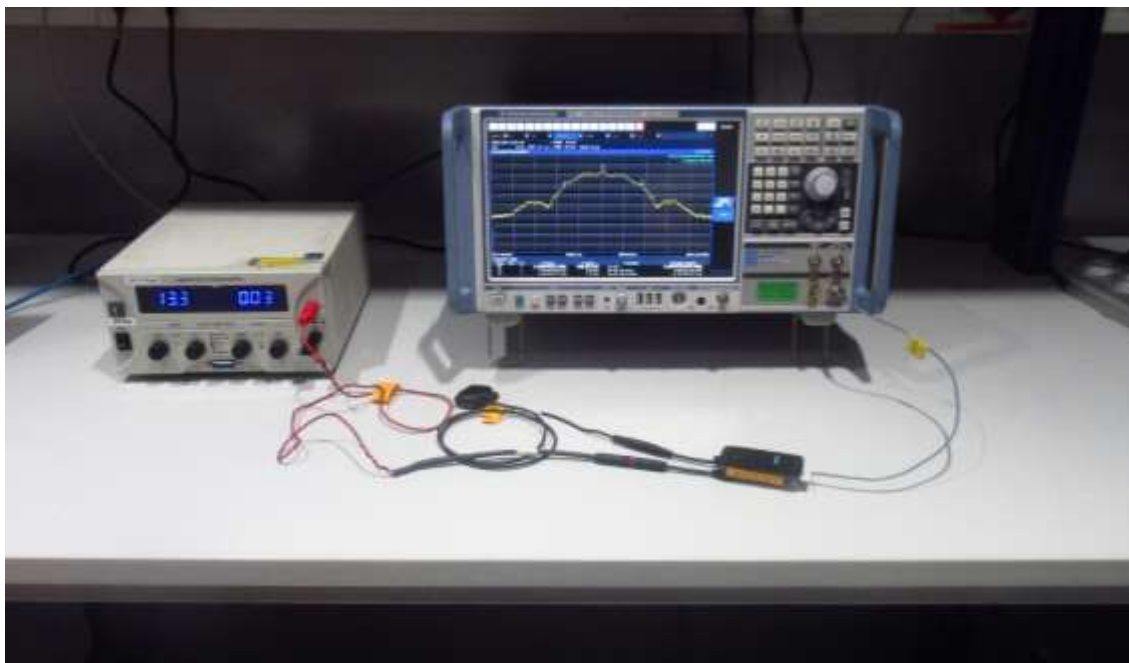
5.16 Limit on secondary radiated emissions

For test instruments and accessories used see section 6 Part **SEC1-3**.

5.16.1 Description of the test location

Test location: Shielded Room SR6

5.16.2 Photo documentation of the test set-up



5.16.3 Applicable standard

According to Ordinance Regulating Radio Equipment, Chapter III, Article 24, Item 2:

The limit on secondary emissions radiated from the receiving equipment shall be as stipulated in the Table below.

5.16.4 Description of Measurement

A Spectrum analyser is connected to the output of the transmitter while the EUT was in continuous receive mode at the assigned frequency.

Analyser Settings:

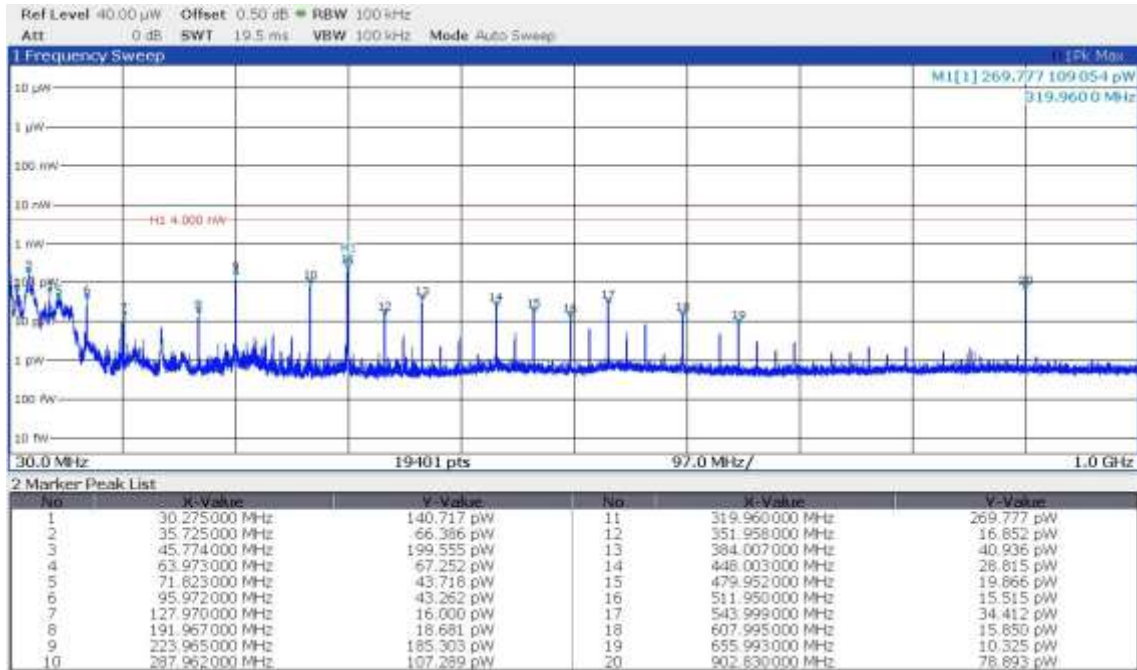
$f < 1 \text{ GHz}$ RBW = VBW = 100 kHz,
 $f > 1 \text{ GHz}$ RBW = VBW = 1 MHz,

Detector: Max peak
 Detector: Max peak

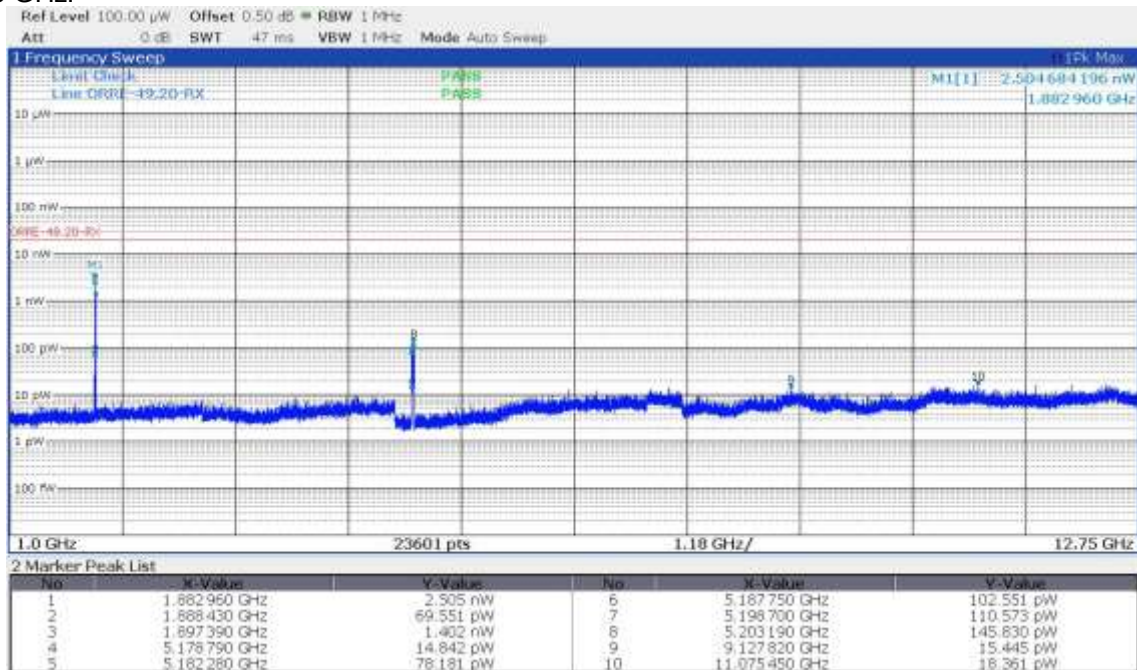
5.16.5 Test result

BLE:

30 MHz – 1 GHz:

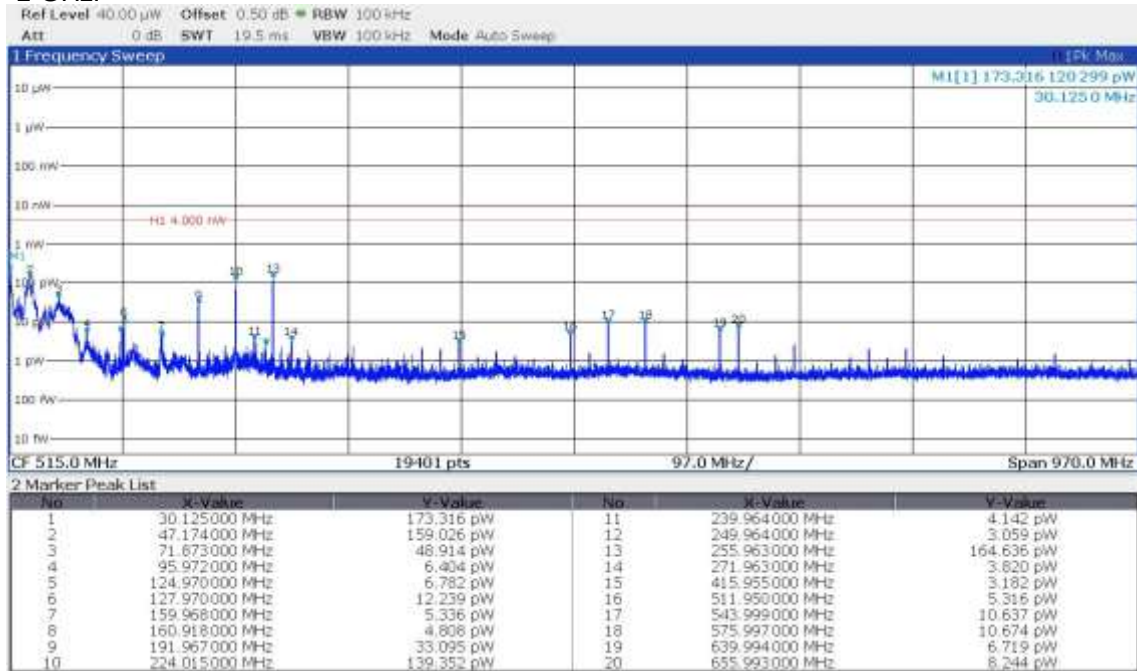


1 – 12.75 GHz:

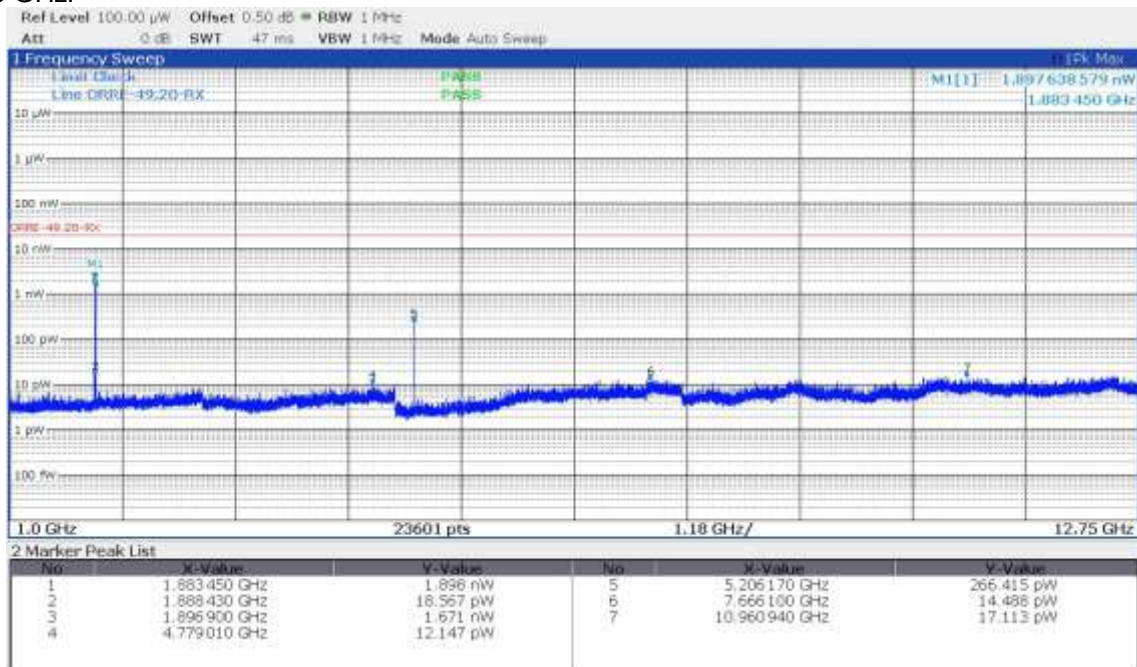


ANT+:

30 MHz – 1 GHz:



1 – 12.75 GHz:



Limit according to Ordinance Regulating Radio Equipment, Chapter III, Article 24, Item 2:

Frequency	Limit
Lower than 1 GHz	4 nW
Higher than 1 GHz	20 nW

The requirements are **FULFILLED**.

Remarks: -

5.17 Carrier sense function

5.17.1 Description of the test location

Test location: NONE

Remarks: Not applicable because the occupied bandwidth is less than 26 MHz.

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.

6 USED TEST EQUIPMENT AND ACCESSORIES

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

6.1 Full name of calibration companies

- Rohde & Schwarz GmbH & Co. KG

6.2 Calibration information

The calibrations are conducted in foreign countries, which is equivalent to calibration conducted by the NICT or a designated calibration agency under Article 102-18-1 of the Radio Act.

6.3 Test systems

Test ID	Model Type	Kind of Equipment	Manufacturer	Equipment No.	Next Calib.	Last Calib.
CPC 3	FSW43	Spectrum Analyser	Rohde & Schwarz München	02-02/11-15-001	19/08/2025	19/08/2024
FE	FSW43	Spectrum Analyser	Rohde & Schwarz München	02-02/11-15-001	19/08/2025	19/08/2024
	EA-PS 3032-05 B	Laboratory Power Supply	EA-Elektro Automatik GmbH & Co. KG	02-02/50-20-008		
MB	FSW43	Spectrum Analyser	Rohde & Schwarz München	02-02/11-15-001	19/08/2025	19/08/2024
SEC 1-3	FSW43	Spectrum Analyser	Rohde & Schwarz München	02-02/11-15-001	19/08/2025	19/08/2024

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.