DAkkS Deutsche Akkreditierungsstelle D-PL-21375-01-00

INGENIEURBÜRO LENHARDT

Bundesnetzagentur

BNetzA-CAB-21/21-21

Test Report

Test report no.: 22128135-30210-2
Date of issue: 2024-05-28

Test result: The test item **- passed - and complies** with below listed standards.

Applicant

Spectra Precision (Kaiserslautern) GmbH

Manufacturer

Spectra Precision (Kaiserslautern) GmbH

Test Item

Atmel RF module

RF-Spectrum Testing according to:

FCC 47 CFR Part 15
Radio Frequency Devices (Subpart C)

RSS-247, Issue 2 (2017-02)
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen, Issue 5 (2018-04)
General Requirements for Compliance of Radio Apparatus

Tested by (name, function, signature)	*Karsten Geraldy* *Lab Manager RF*	signature
Approved by (name, function, signature)	*Andreas Bender* *Deputy Managing Director*	signature

Applicant and Test item details	
Applicant	Spectra Precision (Kaiserslautern) GmbH Am Sportplatz 5 67661, Kaiserslautern, Germany
Manufacturer	Spectra Precision (Kaiserslautern) GmbH Am Sportplatz 5 67661, Kaiserslautern, Germany
Test item description	2.4 GHz ZigBee Module
Model/Type reference	Atmel RF module
Standard specific information	
FCC ID	2BDMX-SP42RF
IC	31440-SP42RF
PMN	SP42RF
HVIN	1.0
FVIN	N/A
HMN	N/A
Frequency	2.400 GHz – 2.4835 GHz
Technology	ZigBee
Antenna	chip antenna
Power supply	3 V DC (2 x AA)
Temperature range	-20 °C – +55 °C

Disclaimer and Notes

The content of this report relates to the mentioned test sample(s) only.
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Within this test report, a ☒ point / ☐ comma is used as a decimal separator.
If otherwise, a detailed note is added adjected to its use.

Decision rule:
Decision rule based on simple acceptance without guard bands, binary statement, based on mutually agreed uncertainty tolerances with expansion factor k=2 according to ILAC-G8:09/2019

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2 GENERAL INFORMATION

2.1 Administrative details

Testing laboratory	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: https://ib-lenhardt.com/ E-Mail: info@ib-lenhardt.com
Accreditation / Designation	The testing laboratory is accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025:2018. Scope of testing and registration number: • Attachment to the accreditation certificate D-PL-21375-01-00 ○ Electronics ○ Electromagnetic Compatibility ○ Radio ○ Electromagnetic Compatibility and Telecommunication (FCC requirements) ○ Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards ○ Automotive EMC Website DAkkS: https://www.dakks.de/ The Deutsche Akkreditierungsstelle GmbH (DAkkS) is also a signatory to the ILAC Mutual Recognition Arrangement. • Designations ○ FCC Testing Laboratory Designation Number DE0024 ○ ISED ISED Company Number 27156 Testing Laboratory CAB Identifier DE0020 ○ Kraftfahrt-Bundesamt KBA-P 00120-23
Testing location	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany
Date of receipt of test samples	2023-01-10
Start – End of tests	2023-06-26 – 2023-10-09 2024-05-28 (AC conducted emissions)

2.2 Possible test case verdicts

Test sample meets the requirements	P (PASS)
Test sample does not meet the requirements	F (FAIL)
Test case does not apply to the test sample	N/A (Not applicable)
Test case not performed	N/P (Not performed)

2.3 Observations

No additional observations other than the reported observations within this test report have been made.

2.4 Opinions and interpretations

No appropriate opinions or interpretations according ISO/IEC 17025:2017 clause 7.8.7 are within this test report.

2.5 Revision history

-0 Initial Version

-1 Revision: changed from partial testing to full testing, FCC ID, IC, PMN, HVIN, … added, editorial changes

-2 Revision: AC conducted emissions and EUT & Setup photos added

This test report 22128135-30210-2 replaces the previous test report 22128135-30210-1.
Utilisation, publication and control of previous report editions is under responsibility of the applicant.

2.6 Further documents

List of further applicable documents belonging to the present test report:
– no additional documents –

3 ENVIRONMENTAL & TEST CONDITIONS

3.1 Environmental conditions

Temperature	20°C ± 5°C
Relative humidity	25-75 % r.H.
Barometric Pressure	860-1060 mbar
Power supply	230 V / 50 Hz

3.2 Normal and extreme test conditions

	minimum	nominal	maximum
Temperature	-/- °C	20 °C	-/- °C
Relative humidity	-/-	45 % r.h.	-/-
Power supply	-/- V DC	3.0 V DC	-/- V DC

4 TEST STANDARDS AND REFERENCES

Test standard (accredited)	Description
FCC 47 CFR Part 15	Radio Frequency Devices (Subpart C)
RSS-247, Issue 2 (2017-02)	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-Gen, Issue 5 (2018-04)	General Requirements for Compliance of Radio Apparatus

Reference	Description
ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
558074 D01 15.247 Meas Guide v05r02	Guidance for compliance measurements on digital transmission systems, frequency hopping spread spectrum systems and hybrid system devices operating under section 15.247 of the FCC rules

5 EQUIPMENT UNDER TEST (EUT)

5.1 Product Description

2.4 GHz ZigBee Module

*: as declared by applicant

5.2 Test Item Description

Model name*	Atmel RF module
Serial number*	proto type
Hardware status*	proto type
Software status*	proto type

*: as declared by applicant

5.3 Technical Data of Equipment

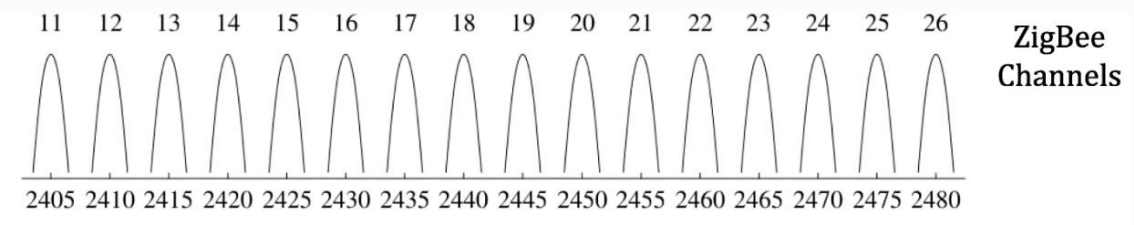
Operational frequency band*	2.400 GHz – 2.4835 GHz
Modulation type*	O-QPSK
Number of channels*	16
Channel bandwidth*	2 MHz
Channel spacing*	5 MHz
Receiver category*	1
Antenna*	chip antenna
Antenna gain*	2.5 dBi
Rated RF Output Power*	< 20 dBm
Power supply*	3 V DC (2 x AA)
Temperature range*	-20 °C – +55 °C

*: as declared by applicant; further details in clause 5.4.1 of test specification

5.4 Additional Information	
Model differences	none
Ancillaries tested with	none
Additional equipment used for testing	test jig EUT (Atmel RF module) is tested together with test jig. Test jig is used to supply module with DC power and to setup test modes, i.e. Tx channels, Tx power, …

5.5 Test modes	
EUT	Power setting: 5 dBm
Low Channel	CH12 = 2410 MHz
Mid Channel	CH18 = 2440 MHz
High Channel	CH24 = 2470 MHz

Channel plan IEEE 802.15.4:



6 SUMMARY OF TEST RESULTS

Test specification
FCC 47 CFR Part 15 **RSS-247, Issue 2 (2017-02) / RSS-Gen, Issue 5 (2018-04)**

Clause	Requirement / Test Case	Remark	Result	Verdict
§15.247(a)(2) RSS-247,5.2 (a)	DTS bandwidth (6 dB)	KDB 558074, clause: 8.2	1700 kHz	- PASS -
RSS Gen, 6.7	Occupied bandwidth (99%)	-/-	2600 kHz	- PASS -
§15.247(b)(3) RSS-247, 5.4 (d)	RF output power (peak power)	KDB 558074, clause: 8.3.1	2.0 dBm	- PASS -
§15.247(b)(4) RSS-247, 5.4 (d)	Antenna gain	-/-	2.5 dBi	- PASS -
§15.247(e) RSS-247, 5.2 (b)	Peak power spectral density	KDB 558074, clause: 8.4	-7.5 dBm	- PASS -
§15.247(d) RSS-247, 5.5	Band edge compliance (BEC), conducted	KDB 558074, clause: 8.5	< limit	- PASS -
§15.247(d) RSS-247, 5.5	Band edge compliance (BEC), radiated	KDB 558074, clause: 8.7	< limit	- PASS -
§15.247(d) RSS-247, 5.5	Conducted spurious emissions	KDB 558074 DTS clause: 8.5	< limit	- PASS -
§15.247(d)/§15.209 RSS-247, 5.5 / RSS-Gen, 8.9	Radiated spurious emissions	-/-	< limit	- PASS -
§15.207 RSS-Gen, 8.8	AC conducted emissions		< limit	- PASS -

Comments and observations
Following pages show requirements and references of FCC Part 15.247, ANSI C63.10 and KDB 558074 only. Same tests are also applicable and valid for RSS-247, with clauses given in the table above.

7 TEST RESULTS

7.1 DTS Bandwidth (6 dB)

Applicability
This requirement applies to all types of DTS equipment.

Description
The DTS Bandwidth is defined as the 6 dB bandwidth.

Limit
§15.247
(a)(2) The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure
ANSI C63.10, 11.8
The steps are as follows:
a) Set RBW = 100 kHz.
b) Set the VBW ≥ [3 × RBW].
c) Detector = peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
The automatic bandwidth measurement capability of an instrument may be employed using the 6 dB bandwidth mode.

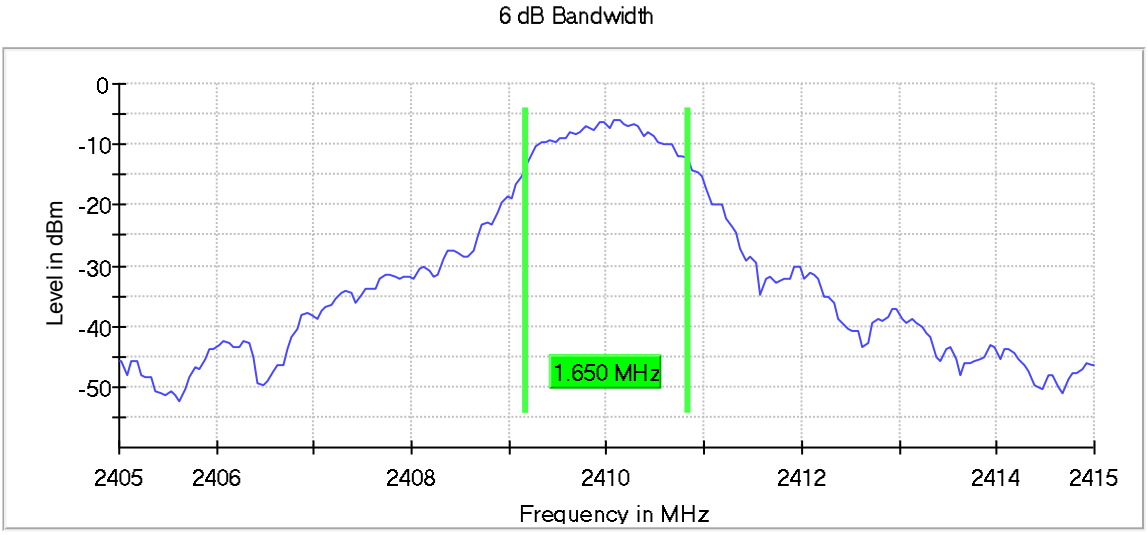
Test setup: 8.4

Test Results

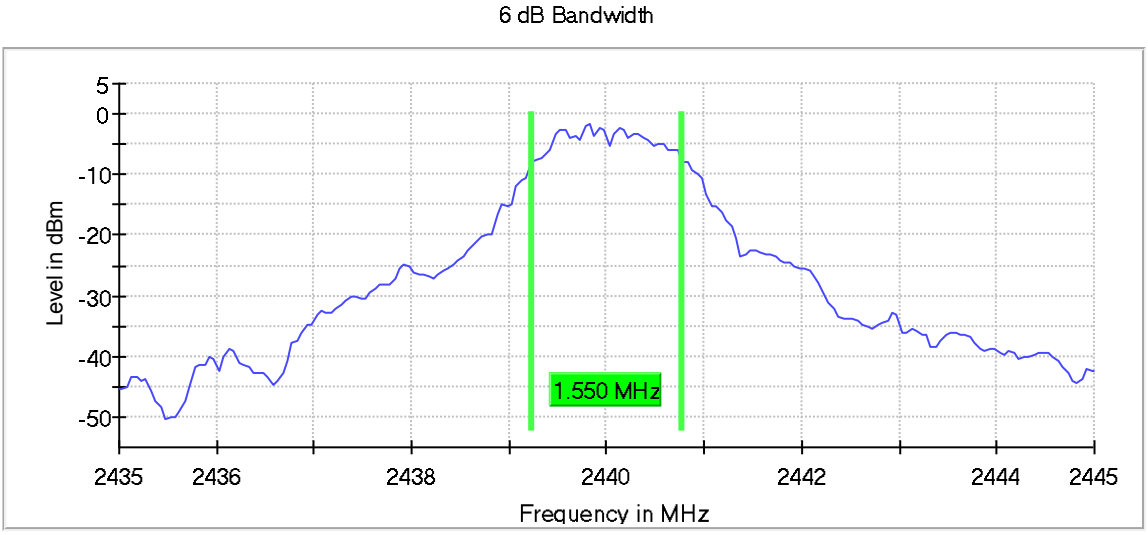
EUT Mode	DTS Bandwidth (6 dB)			Limit [kHz]
	low channel [kHz]	mid channel [kHz]	high channel [kHz]	
Mode 1	1650	1550	**1700**	≥ 500

Comment:	---

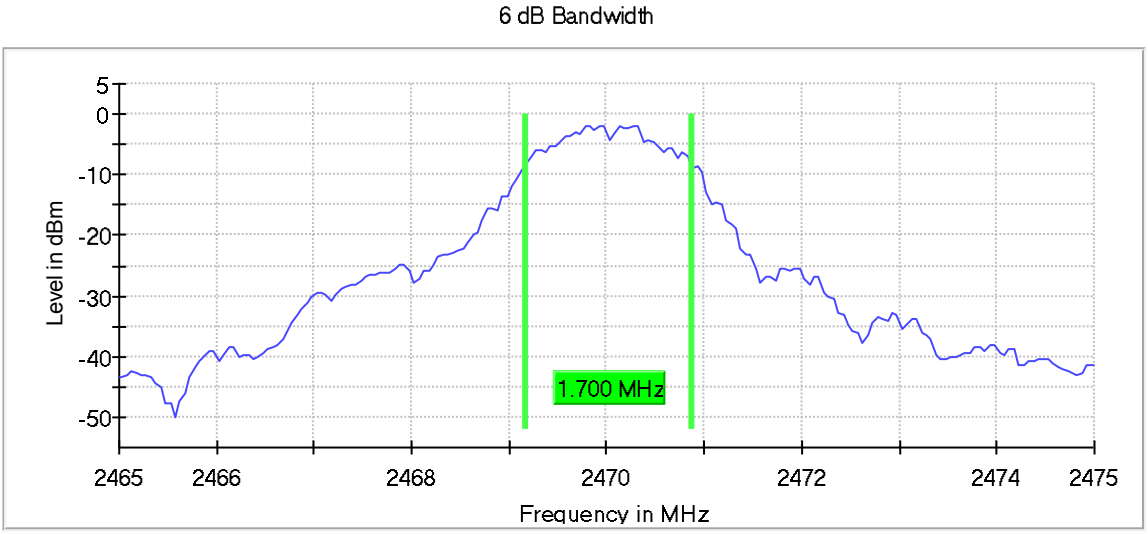
Plot 1: Mode 1, DTS Bandwidth, low channel



Plot 2: Mode 1, DTS Bandwidth, mid channel



Plot 3: Mode 1, DTS Bandwidth, high channel



7.2 Occupied Bandwidth (99% OBW)

Applicability
This requirement applies to all types of DTS equipment.

Description
The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal (RSS-Gen).

Limit
No limit defined.

Test procedure
ANSI C63.10, 6.9.3
The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.
The following procedure shall be used for measuring 99% power bandwidth:
a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
d) Step a) through step c) might require iteration to adjust within the specified range.
e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Note
Measurements with the peak detector are also suitable to demonstrate compliance of an EUT, as long as the required resolution bandwidth is used, because peak detection will yield amplitudes equal to or greater than amplitudes measured with RMS detector. The measurement data from a spectrum analyser peak detector will represent the worst-case results (see ANSI C63.10).

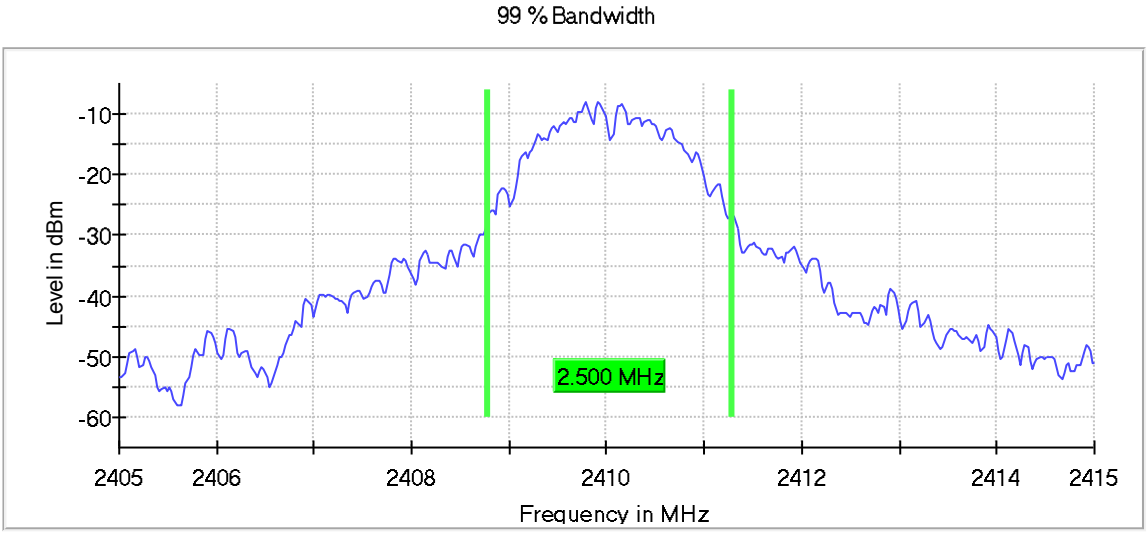
Test setup: 8.4

Test Results

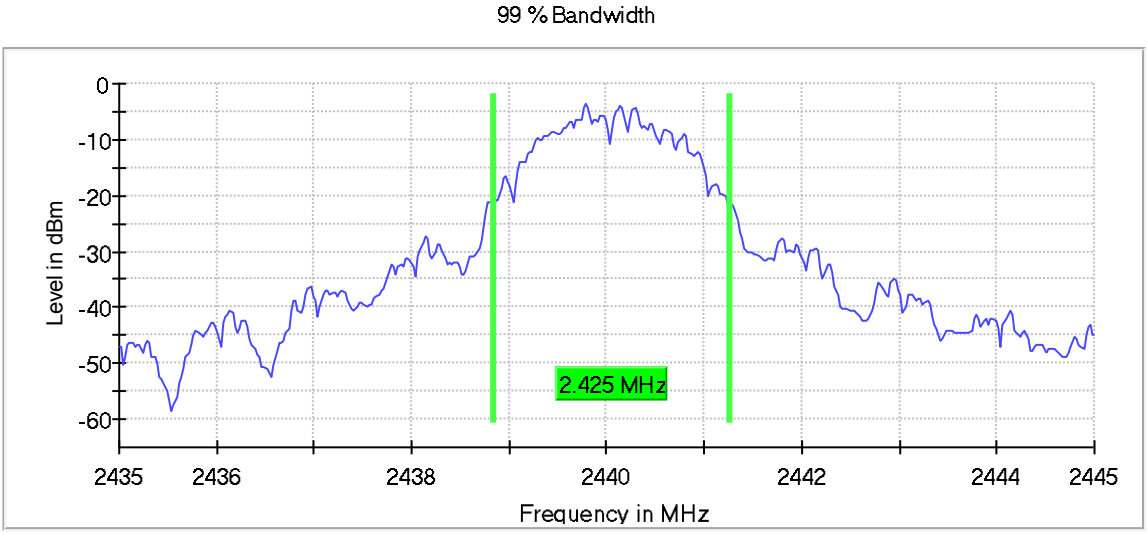
EUT Mode	Occupied Bandwidth (99%)		
	low channel [kHz]	mid channel [kHz]	high channel [kHz]
Mode 1	2500	2425	**2600**

Comment:	---

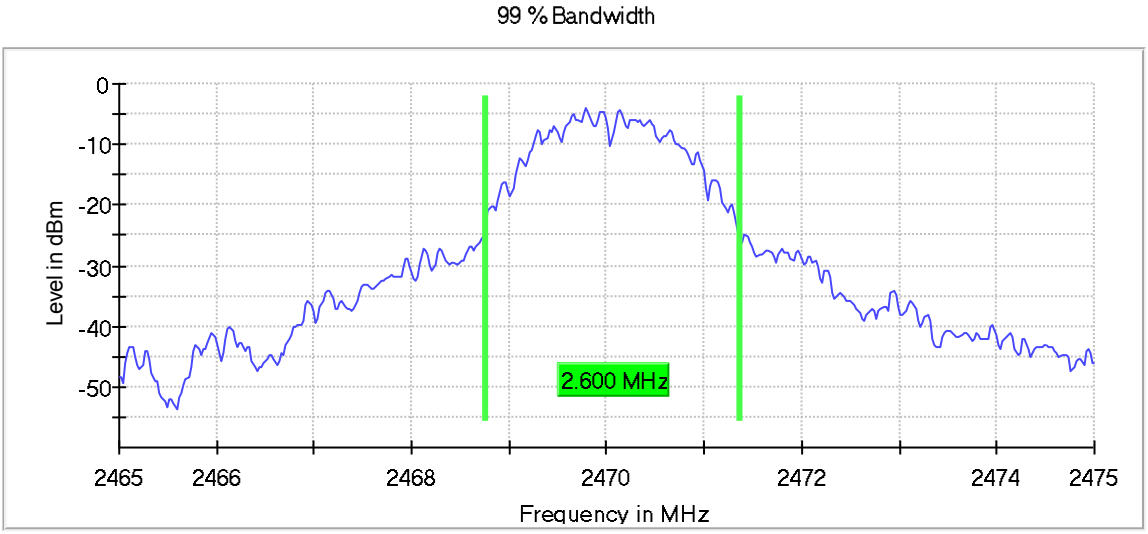
Plot 4: Mode 1, 99% Occupied Bandwidth, low channel



Plot 5: Mode 1, 99% Occupied Bandwidth, mid channel



Plot 6: Mode 1, 99% Occupied Bandwidth, high channel



7.3 RF Output Power (Conducted Peak Power)

Applicability
This requirement applies to all types of DTS equipment.

Description
The RF Output Power is defined as the conducted peak output power.

Limit
§15.247
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.
(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Test procedure
ANSI C63.10, 11.9.1.1
The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:
a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × 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.

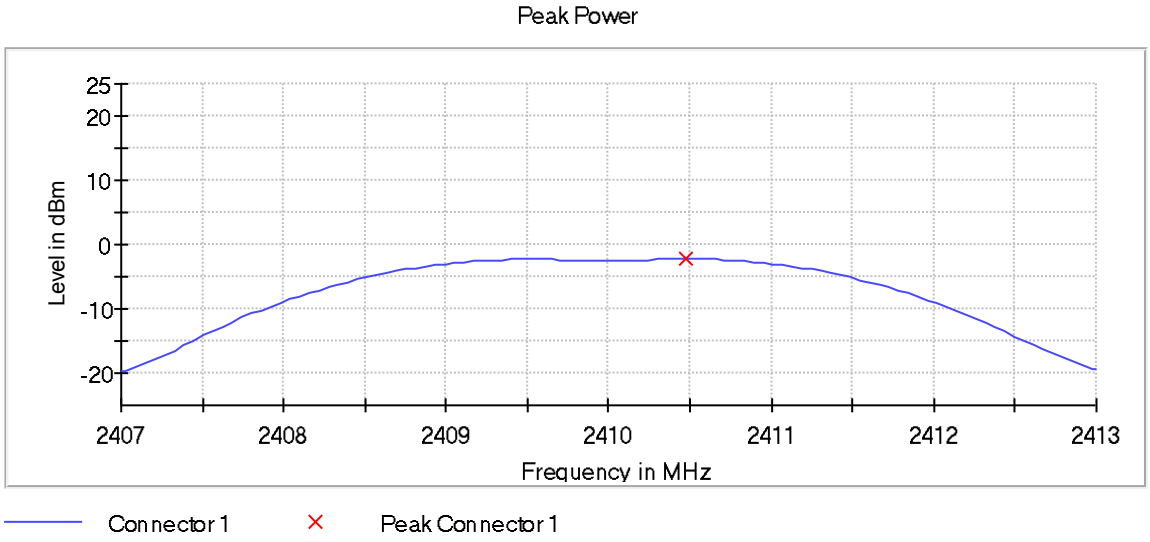
Test setup: 8.4

Test Results

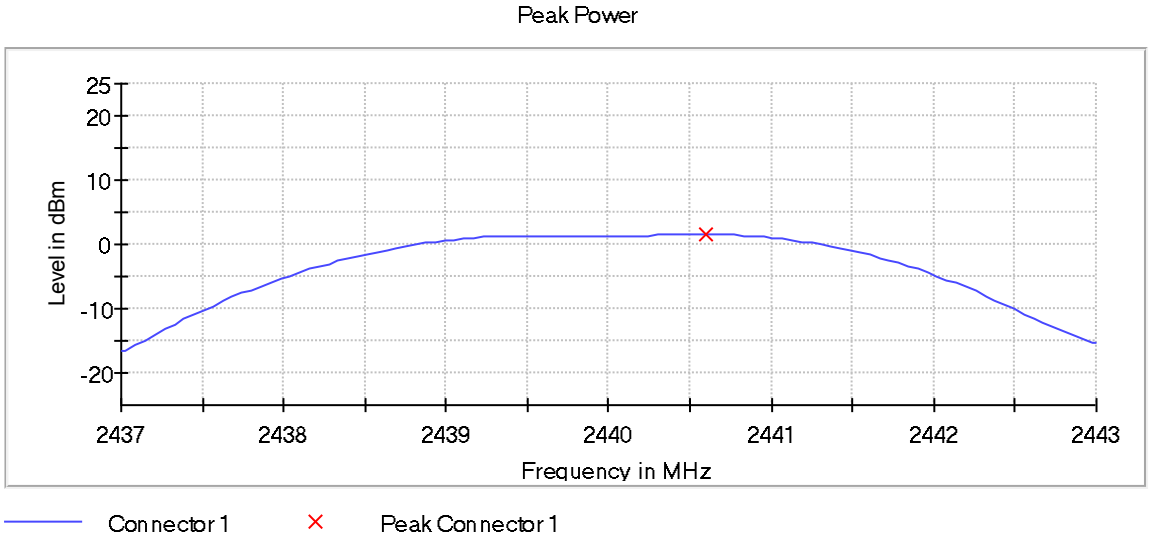
EUT Mode	RF Output Power (Conducted Peak Power)			Limit [dBm]
	low channel [dBm]	mid channel [dBm]	high channel [dBm]	
Mode 1	-2.2	1.5	**2.0**	30

Comment:	---

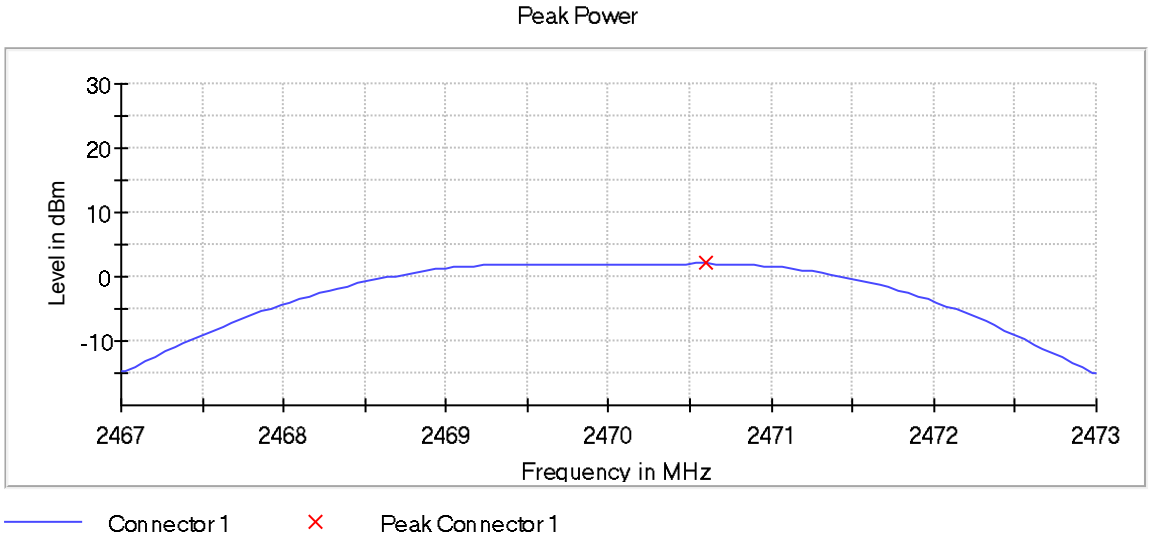
Plot 7: Mode 1, Peak Power, low channel



Plot 8: Mode 1, Peak Power, mid channel



Plot 9: Mode 1, Peak Power, high channel



7.4 Antenna Gain

Applicability
This requirement applies to all types of DTS equipment.

Description
The antenna gain is defined as the difference between radiated peak power (Peak EIRP) substracted by the conducted peak power of the module, given in dBi.

Limit
§15.247
(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Test Results

	low channel	mid channel	high channel	Limit
Specified antenna agin [dBi]	2.5	2.5	2.5	6

Comment:	Antenna gain as specified by applicant.

7.5 Peak Power Spectral Density (PSD)

Applicability
This requirement applies to all types of DTS equipment.

Description
The Power Spectral Density (PSD) is defined as the conducted peak power spectral density in a 3 kHz bandwidth during any time of continuous transmission.

Limits
§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.

Test procedure
ANSI C63.10, 11.10.2
The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:
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 requirement, then reduce RBW (but no less than 3 kHz) and repeat.

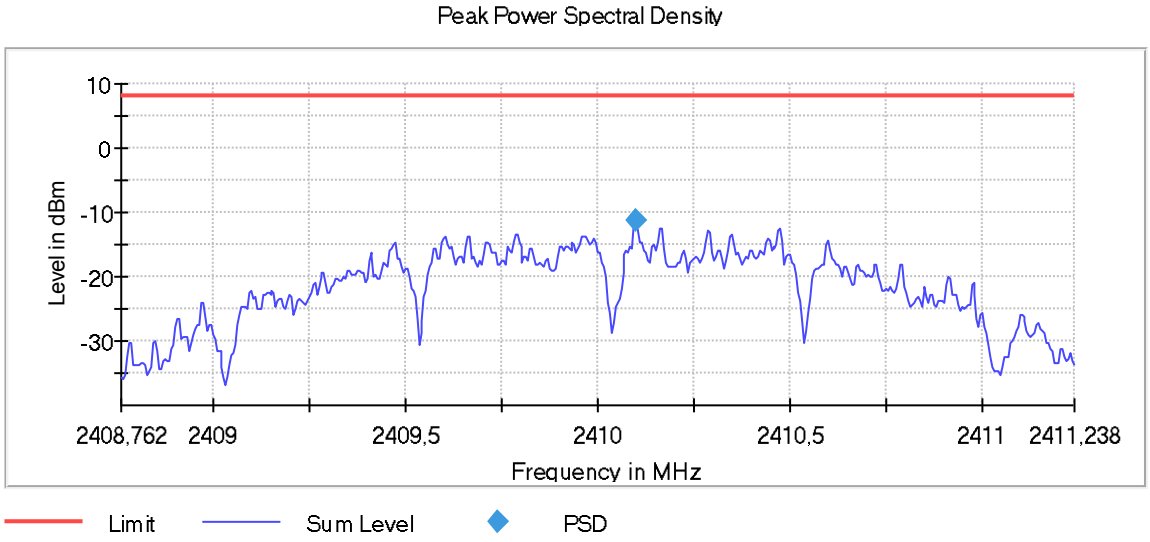
Test setup: 8.4

Test Results

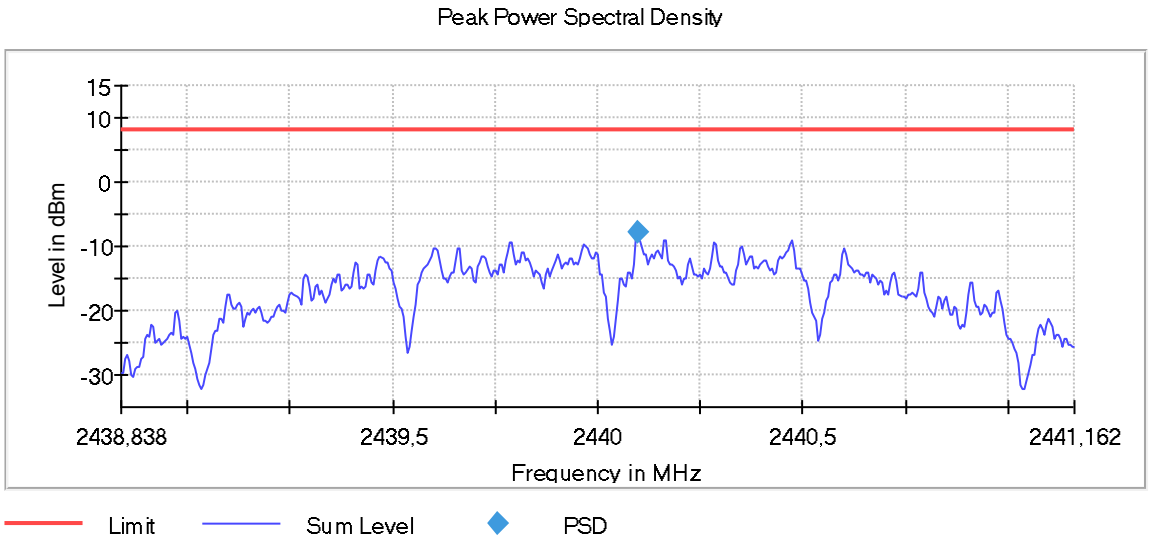
EUT Mode	Peak Power Spectral Density [dBm / 3 kHz]			Limit [dBm / 3 kHz]
	low channel	mid channel	high channel	
Mode 1	-11.2	-7.7	**-7.5**	8

Comment:	---

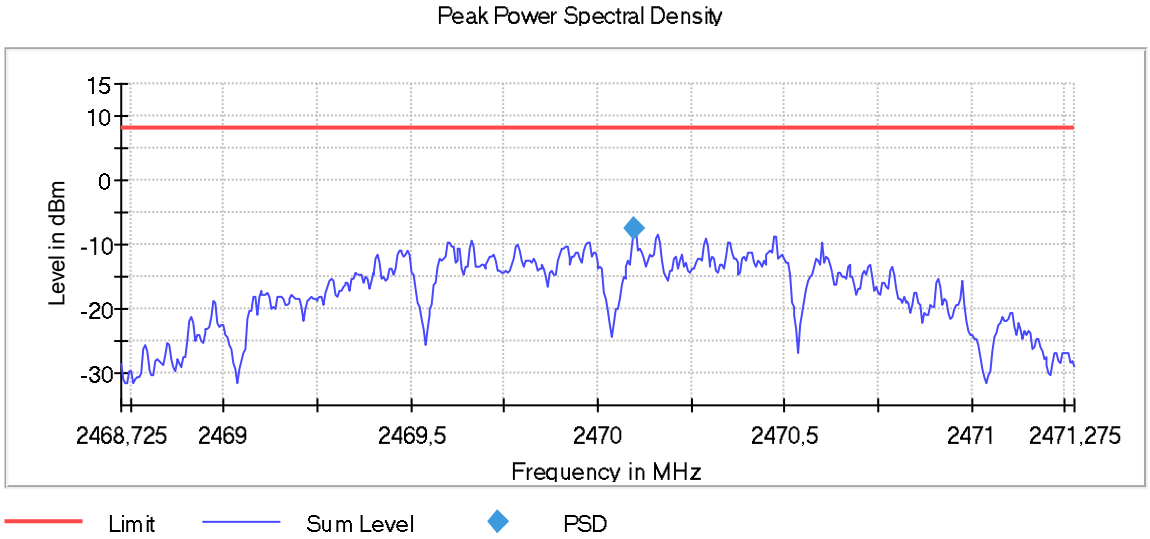
Plot 10: Mode 1, Peak PSD, low channel



Plot 11: Mode 1, Peak PSD, mid channel



Plot 12: Mode 1, Peak PSD, high channel



7.6 Band Edge Compliance (BEC), conducted

Applicability
This requirement applies to all types of DTS equipment.

Description
Emissions within a restricted band and within 2 MHz of an authorized band edge may be measured using either the marker-delta method (ANSI C63.10, 6.10.6) or the integration method (ANSI C63.20, 11.13.3), provided that the DTS bandwidth (or EBW) edge falls within 2 MHz of the band edge. Otherwise, all unwanted emissions measurements shall be performed using the standard methods.

Limits
§15.247
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the 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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in §15.209(a) is not required.

Test procedure
ANSI C63.10, 11.11
Reference level measurement:
Establish a reference level by using the following procedure:
a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the DTS bandwidth.
c) Set the 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 PSD level.
Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Emission level measurement:
Establish an emission level by using the following procedure:
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements as specified (≥ 20 dBc).

The marker-delta method, as described in ANSI C63.10, 6.10.6 can be used to perform measurements of the radiated unwanted emissions level at the band-edges provided that the 99 % OBW of the fundamental emission is within 2 MHz of the authorized band edge.

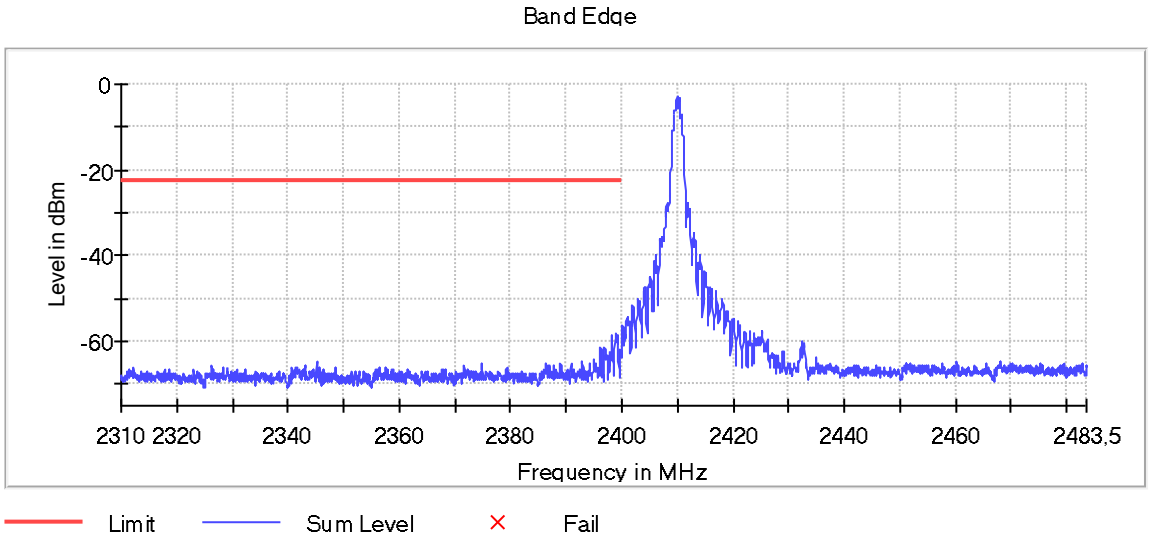
Test setup: 8.4

Test results

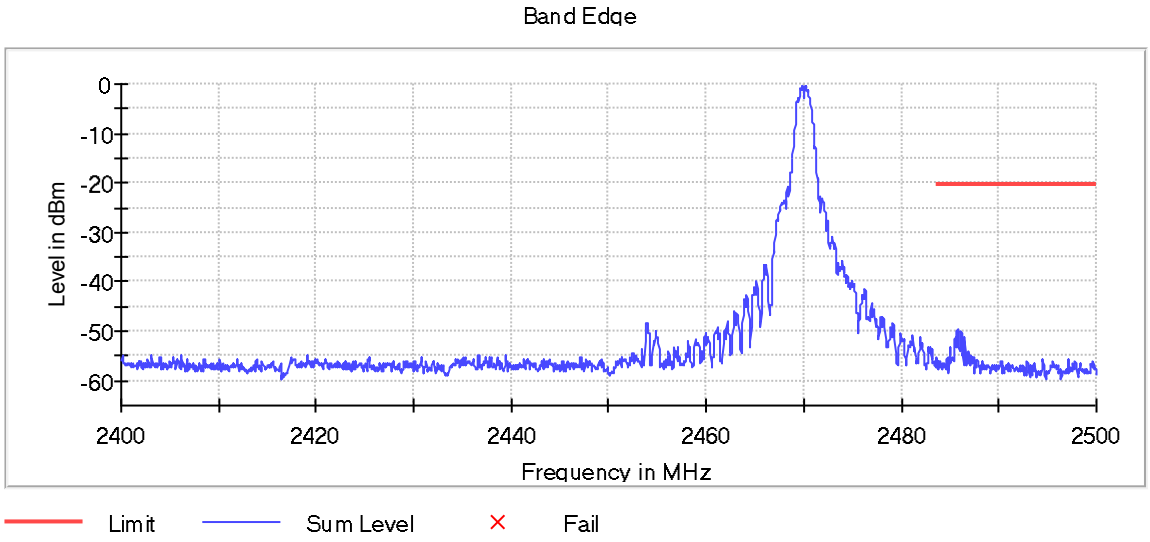
BEC	low channel [dBc]	high channel [dBc]	Limit [dBc]
Mode 1	see plot	see plot	≥ 20

Comment:	---

Plot 13: Mode 1, BEC, low channel



Plot 14: Mode 1, BEC, high channel



7.7 Band Edge Compliance (BEC), radiated

Applicability
This requirement applies to all types of DTS equipment.

Description
Emissions within a restricted band and within 2 MHz of an authorized band edge may be measured using either the marker-delta method (ANSI C63.10, 6.10.6) or the integration method (ANSI C63.20, 11.13.3), provided that the DTS bandwidth (or EBW) edge falls within 2 MHz of the band edge. Otherwise, all unwanted emissions measurements shall be performed using the standard methods.

Limits
§15.247
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the 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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test procedure
The marker-delta method as described in ANSI C63.10, 6.10.6 or the integration methode as described in ANSI C63.10, 11.13.3 can be used to perform measurements of the unwanted emissions level at the band edges.

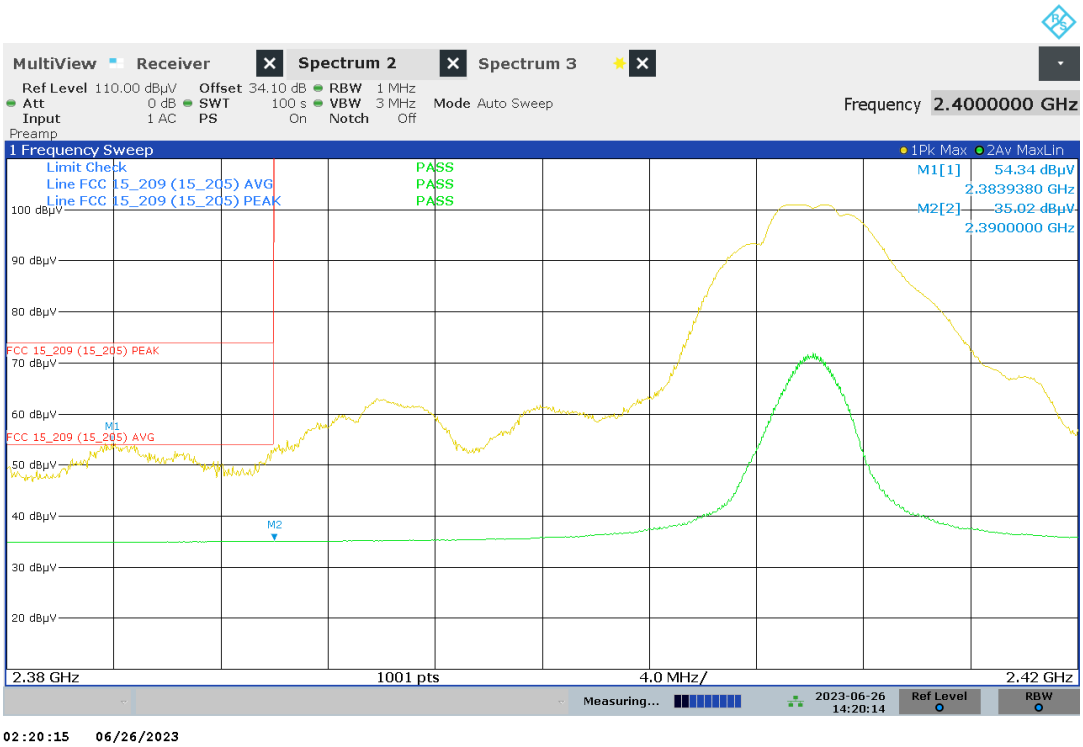
Test setup: 8.2

Test results

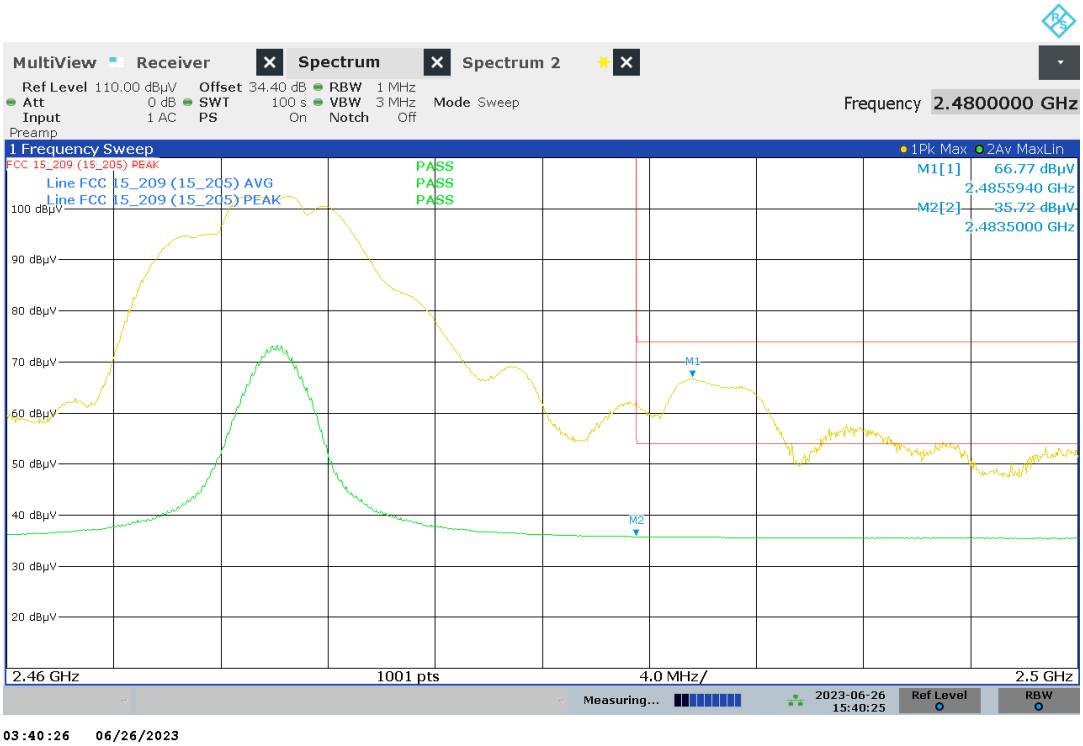
BEC	low channel [dµV/m @3m]	high channel [dµV/m @3m]	Limit [dµV/m @3m]
Mode 1			≤ 54 AVG / ≤ 74 PK

Comment:	---

Plot 15: Mode 1, BEC, low channel



Plot 16: Mode 1, BEC, high channel



7.8 Conducted Spurious Emissions (CSE)

Applicability
This requirement applies to all types of DTS equipment.

Description
Spurious emission / unwanted emissions are emission on a frequency or frequencies which are outside the authorized band and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products.

Limits
§15.247
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the 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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in §15.209(a) is not required.

Test procedure
ANSI C63.10, 11.11
Reference level measurement:
Establish a reference level by using the following procedure:
a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the DTS bandwidth.
c) Set the 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 PSD level.
Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Emission level measurement:
Establish an emission level by using the following procedure:
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements as specified (≥ 20 dBc).

The marker-delta method, as described in ANSI C63.10, 6.10.6 can be used to perform measurements of the radiated unwanted emissions level at the band-edges provided that the 99 % OBW of the fundamental emission is within 2 MHz of the authorized band edge.

Test setup: 8.4

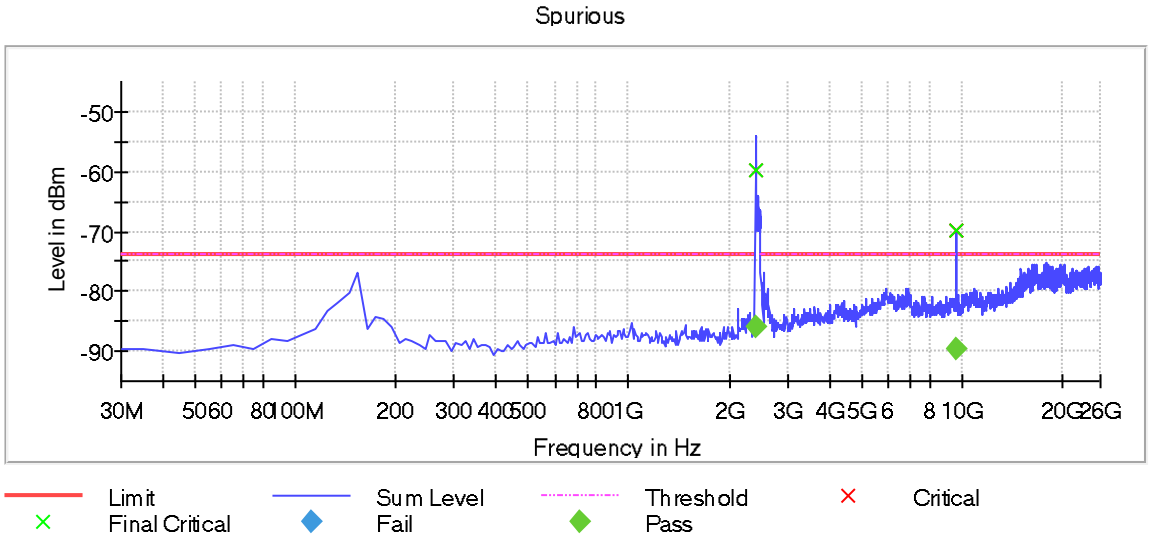
Test results

EUT Mode / Channel	Frequency [MHz]	Peak/RMS Detector	Level [dBm]	Limit [dBm]	Verdict
(see plots)	*(see plots)*	*(see plots)*	*(see plots)*	*(see plots)*	- passed -
(see plots)	*(see plots)*	*(see plots)*	*(see plots)*	*(see plots)*	- passed -
(see plots)	*(see plots)*	*(see plots)*	*(see plots)*	*(see plots)*	- passed -

* all detected peaks are more thean 6 dB below the limit

Comment:	---

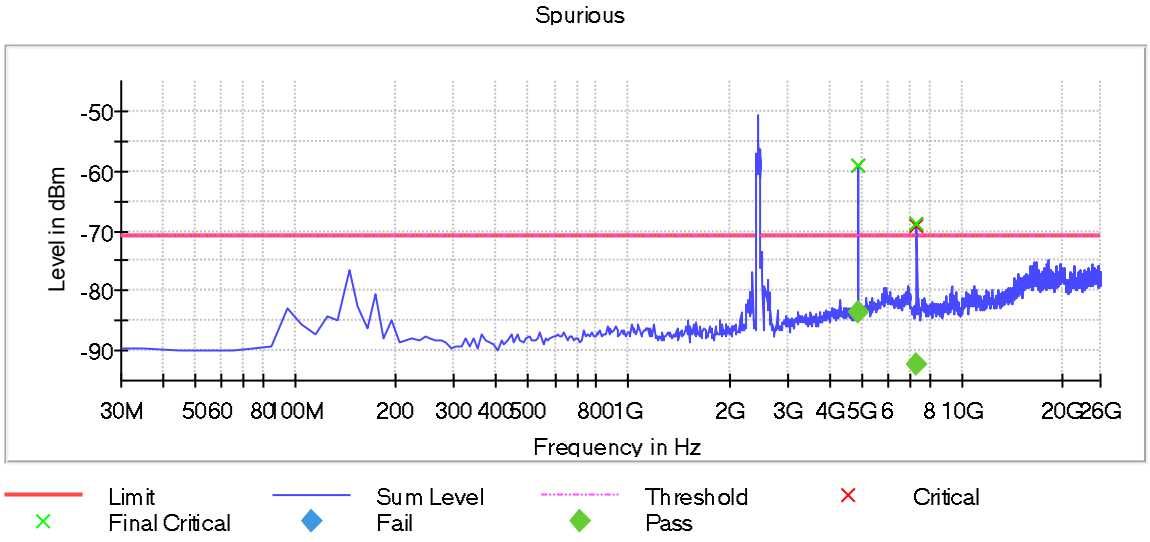
Plot 17: Mode 1, CSE, low channel



Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
2398.761656	-59.9	-85.9	-73.9	12.0	PASS
9642.125594	-69.8	-89.7	-73.9	15.8	PASS

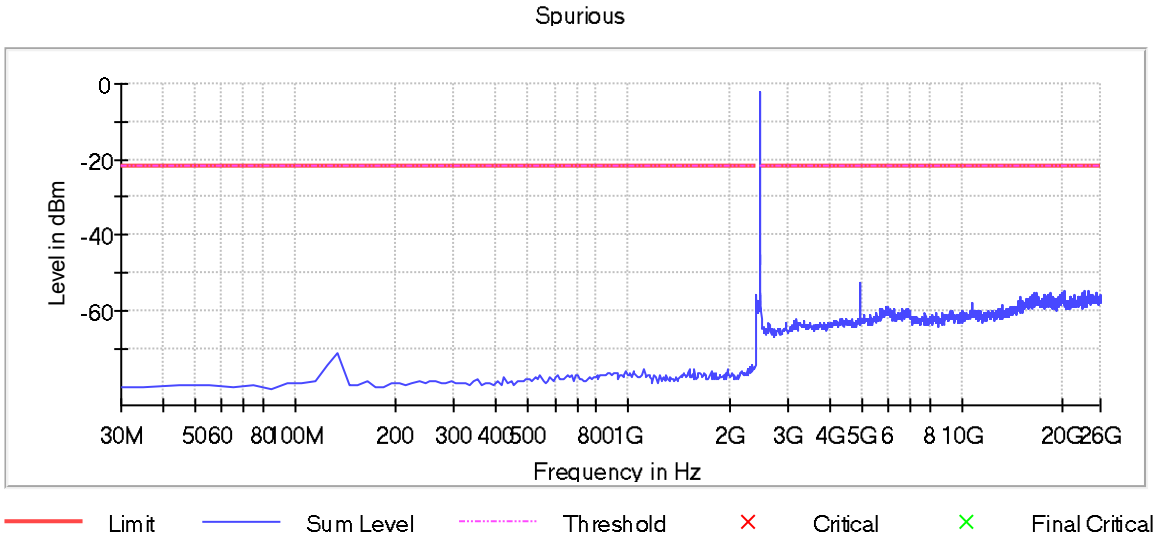
Plot 18: Mode 1, CSE, mid channel



Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
4881.066053	-67.7	-83.5	-70.7	12.8	PASS
7316.424242	-69.0	-92.2	-70.7	21.5	PASS

Plot 19: Mode 1, CSE, high channel



Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
---	---	---	---	---	---

7.9 Radiated Spurious Emissions (RSE)

Applicability
This requirement applies to all types of DTS equipment.

Description
Spurious emission / unwanted emissions are emission on a frequency or frequencies which are outside the authorized band and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products. Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

Limits
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the 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 a 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 §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency [MHz]	Field Strength [µV/m] / [dBµV/m]	Measurement distance [m]
0.009 – 0.490	2400/F[kHz]	300
0.490 – 1.705	24000/F[kHz]	30
1.705 – 30.0	30.0 / 29.5	30
30 – 88	100 / 40.0	3
88 – 216	150 / 43.5	3
216 – 960	200 / 46.0	3
960 – 40 000	500 / 54.0	3

Note
Radiated Spurious Emissions (RSE) are performed for low / mid / high channel and modulation with the highest output power (worst case). In case of spurious other modulations are spot-checked.

Test setup: 8.1, 8.2, 8.3

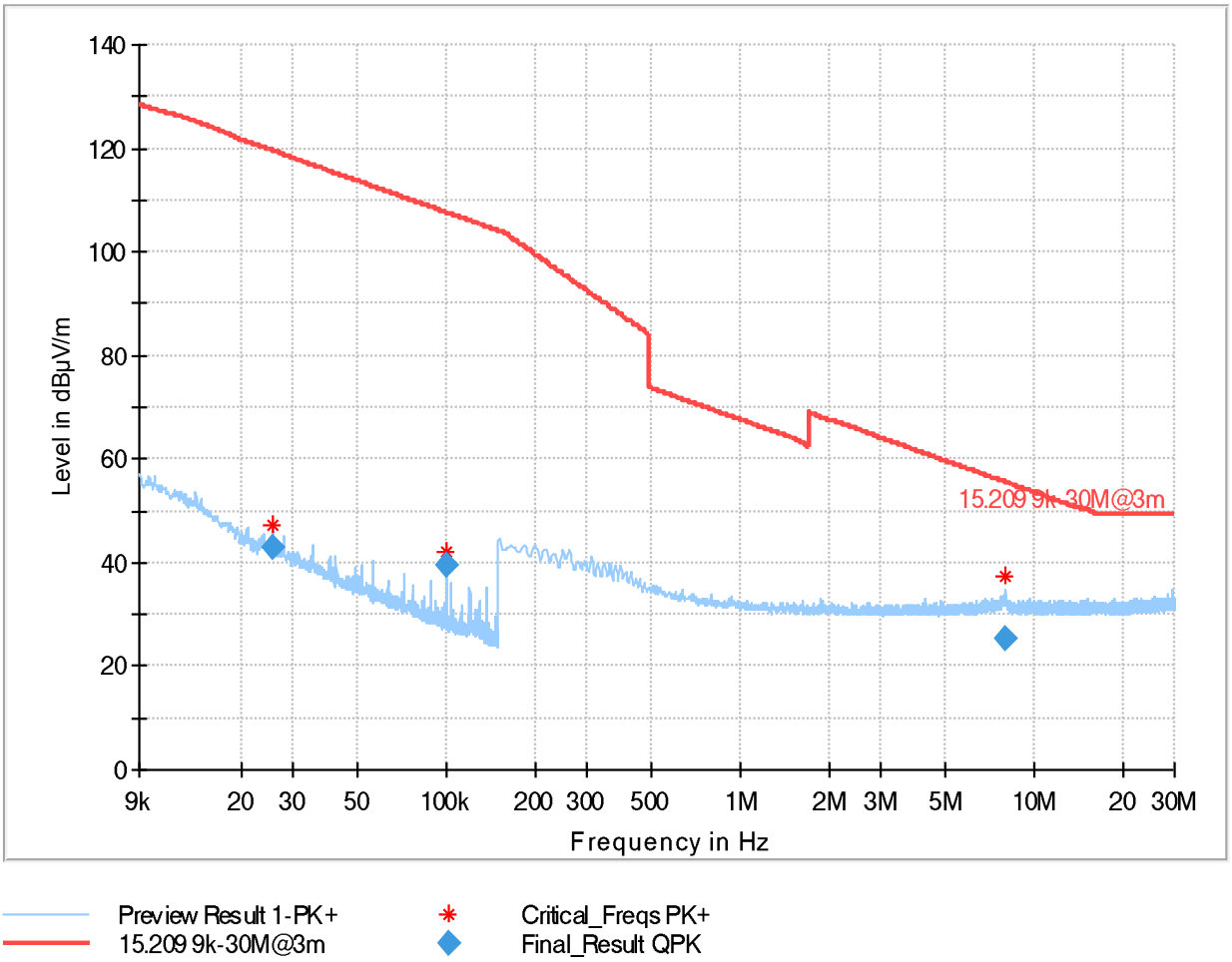
Test results

EUT Mode / Channel	Frequency [MHz]	Peak/RMS Detector	Level [dBm]	Limit [dBm]	Verdict
(see plots)	*(see plots)*	*(see plots)*	*(see plots)*	*(see plots)*	- passed -
(see plots)	*(see plots)*	*(see plots)*	*(see plots)*	*(see plots)*	- passed -
(see plots)	*(see plots)*	*(see plots)*	*(see plots)*	*(see plots)*	- passed -

* all detected peaks are more thean 6 dB below the limit

Comment:	---

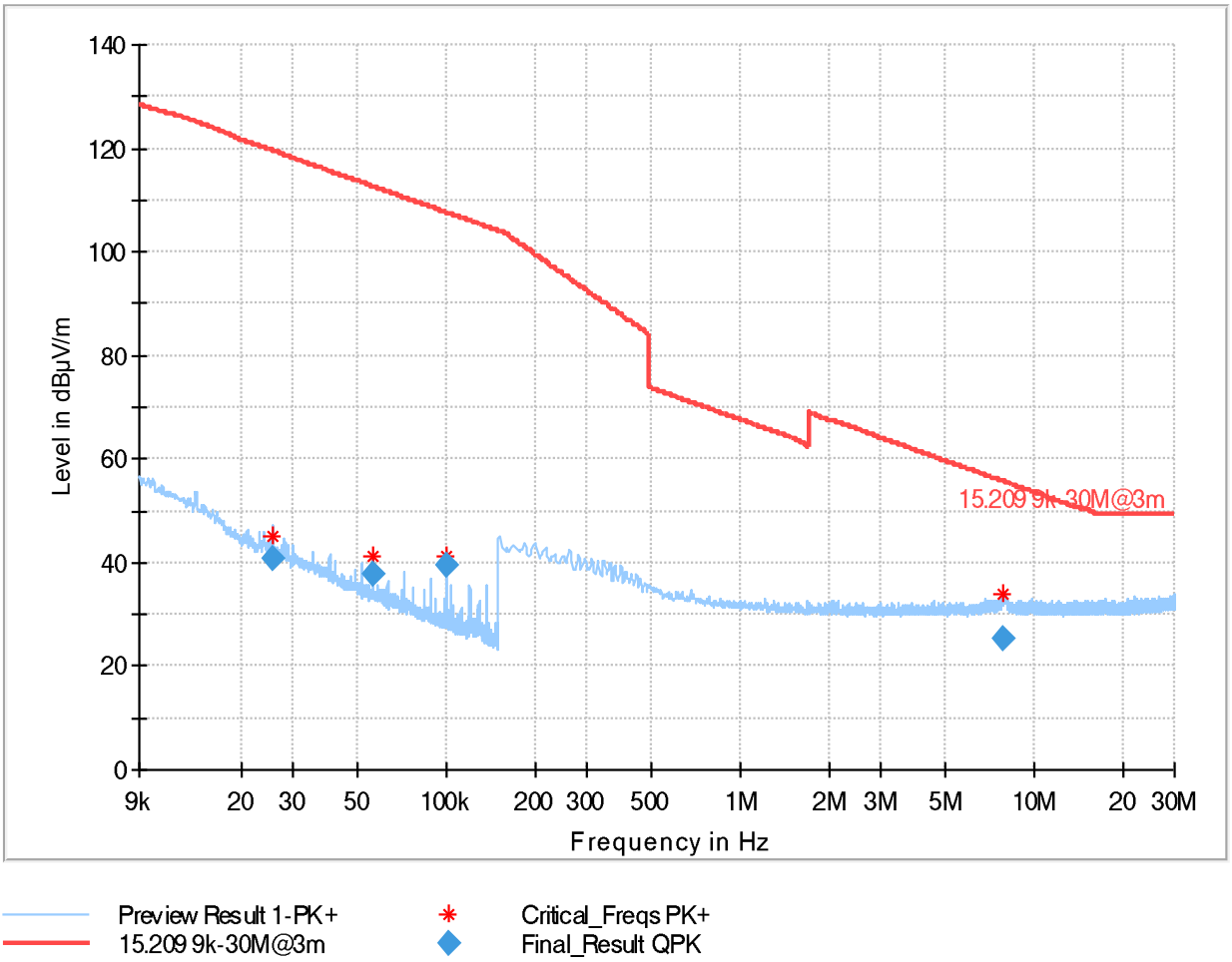
Plot 20: Mode 1, RSE 9 kHz – 30 MHz, low channel, loop antenna



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.025650	42.77	119.59	76.82	100.0	0.200	V	150.0	20.6
0.100050	39.47	107.60	68.13	100.0	0.200	V	-24.0	20.5
7.980000	25.26	55.54	30.28	100.0	9.000	V	156.0	20.5

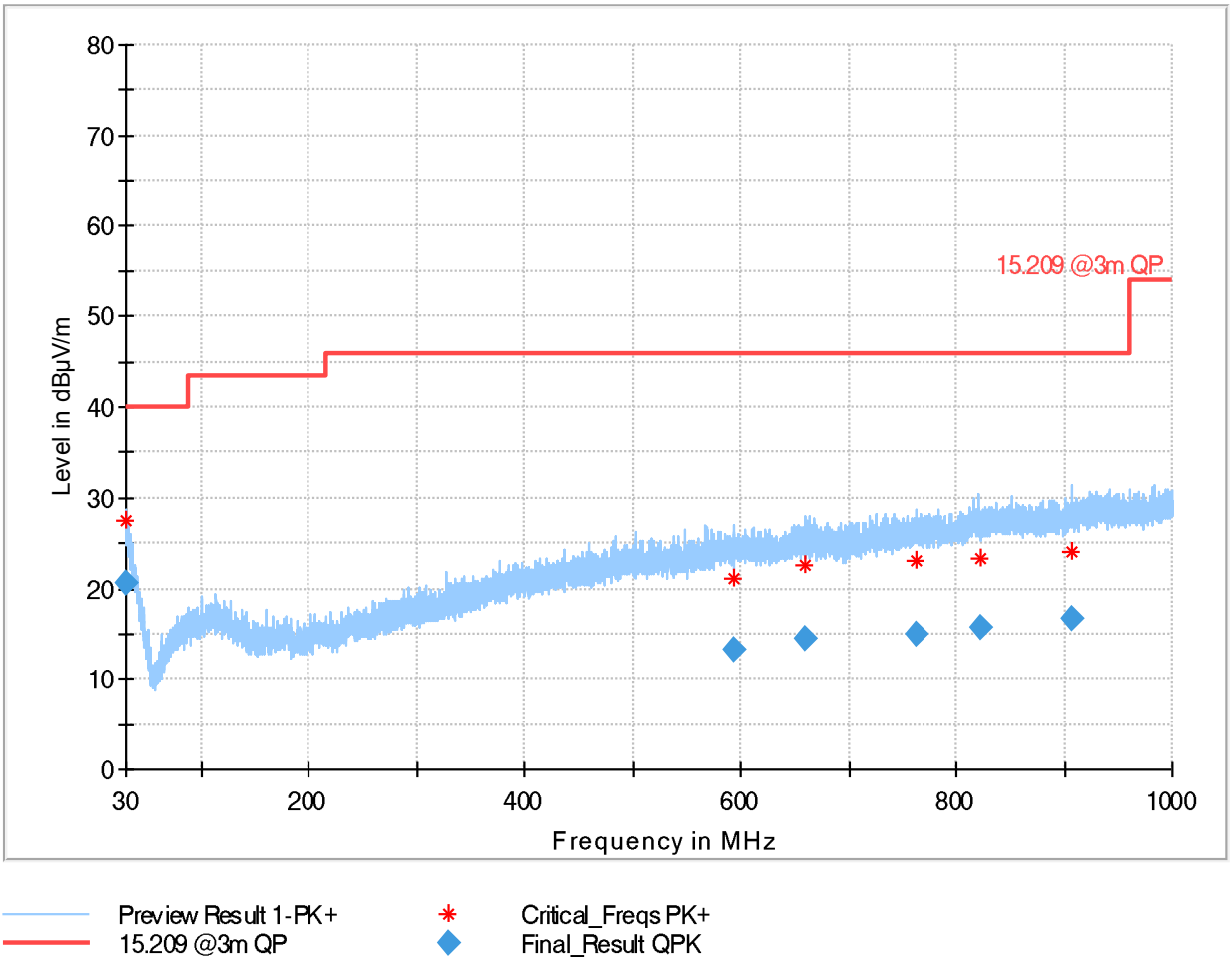
Plot 21: Mode 1, RSE 9 kHz – 30 MHz, high channel, loop antenna



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB)
0.025600	40.66	119.61	78.95	100.0	0.200	V	-30.0	20.6
0.056000	37.86	112.67	74.81	100.0	0.200	V	66.0	20.6
0.100050	39.55	107.60	68.05	100.0	0.200	V	156.0	20.5
7.872000	25.36	55.67	30.31	100.0	9.000	V	21.0	20.5

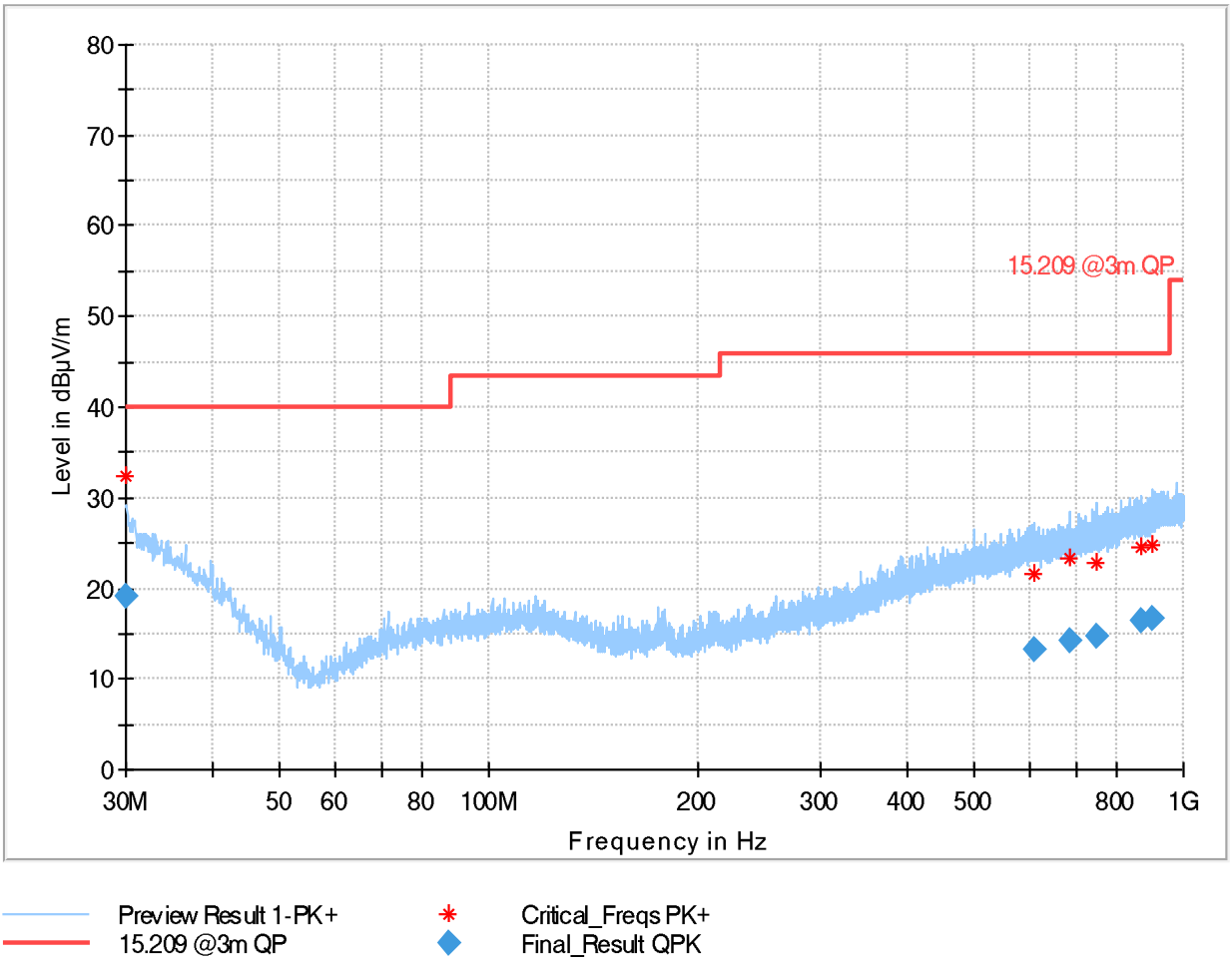
Plot 22: Mode 1, RSE 30 MHz – 1 GHz, low channel, horizontal / vertical polarisation



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.125000	20.56	40.00	19.44	100.0	120.000	342.0	V	186.0
593.950500	13.15	46.00	32.85	100.0	120.000	344.0	H	143.0
658.752500	14.36	46.00	31.64	100.0	120.000	150.0	H	213.0
762.411500	14.87	46.00	31.13	100.0	120.000	350.0	H	206.0
821.577500	15.73	46.00	30.27	100.0	120.000	150.0	H	154.0
906.533000	16.71	46.00	29.29	100.0	120.000	350.0	H	121.0

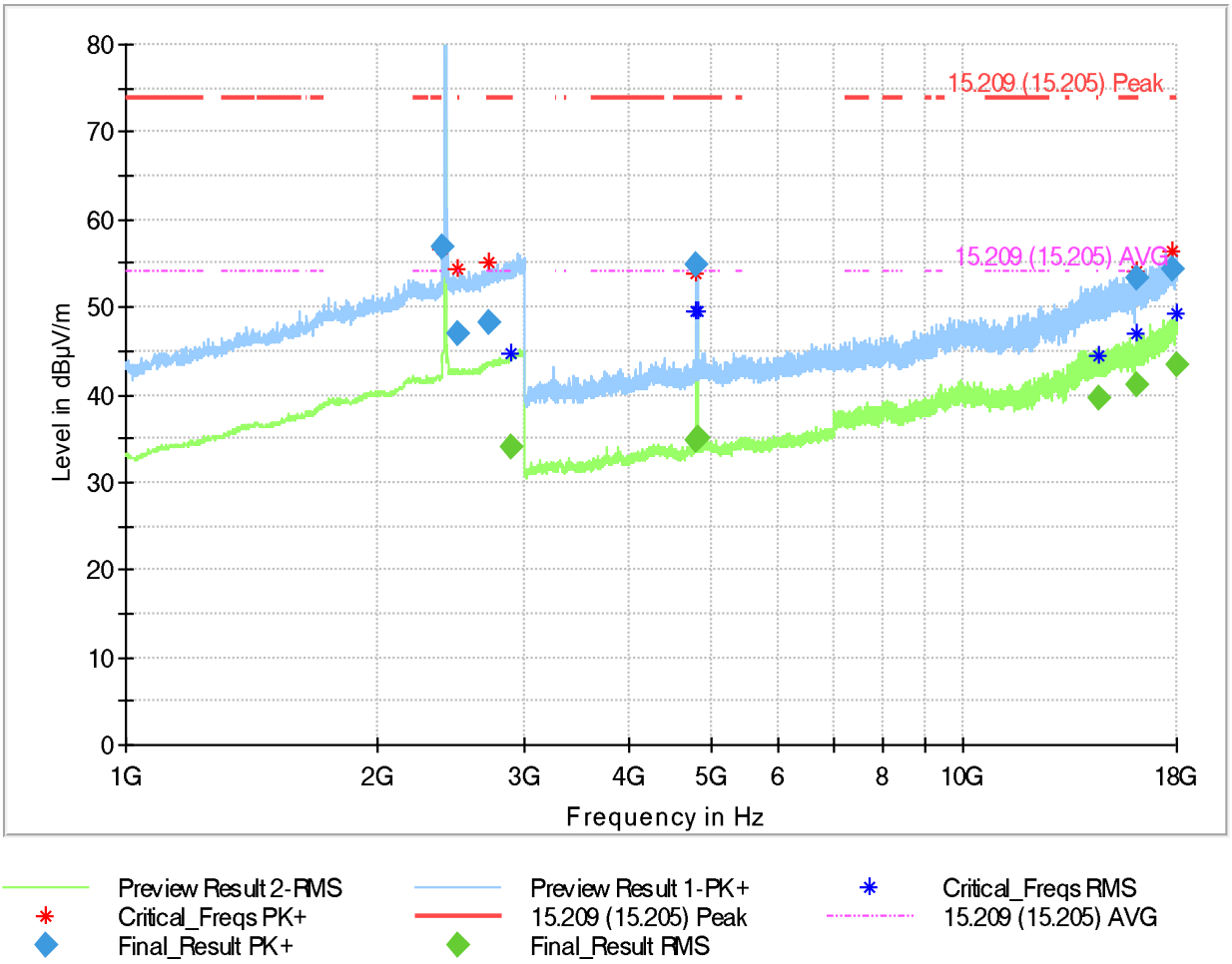
Plot 23: Mode 1, RSE 30 MHz – 1 GHz, high channel, horizontal / vertical polarisation



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.075000	19.03	40.00	20.97	100.0	120.000	148.0	V	100.0
609.883500	13.32	46.00	32.68	100.0	120.000	131.0	H	158.0
684.578000	14.33	46.00	31.67	100.0	120.000	147.0	H	135.0
749.753500	14.78	46.00	31.22	100.0	120.000	346.0	V	58.0
871.429500	16.35	46.00	29.65	100.0	120.000	250.0	H	234.0
904.179000	16.65	46.00	29.35	100.0	120.000	277.0	H	205.0

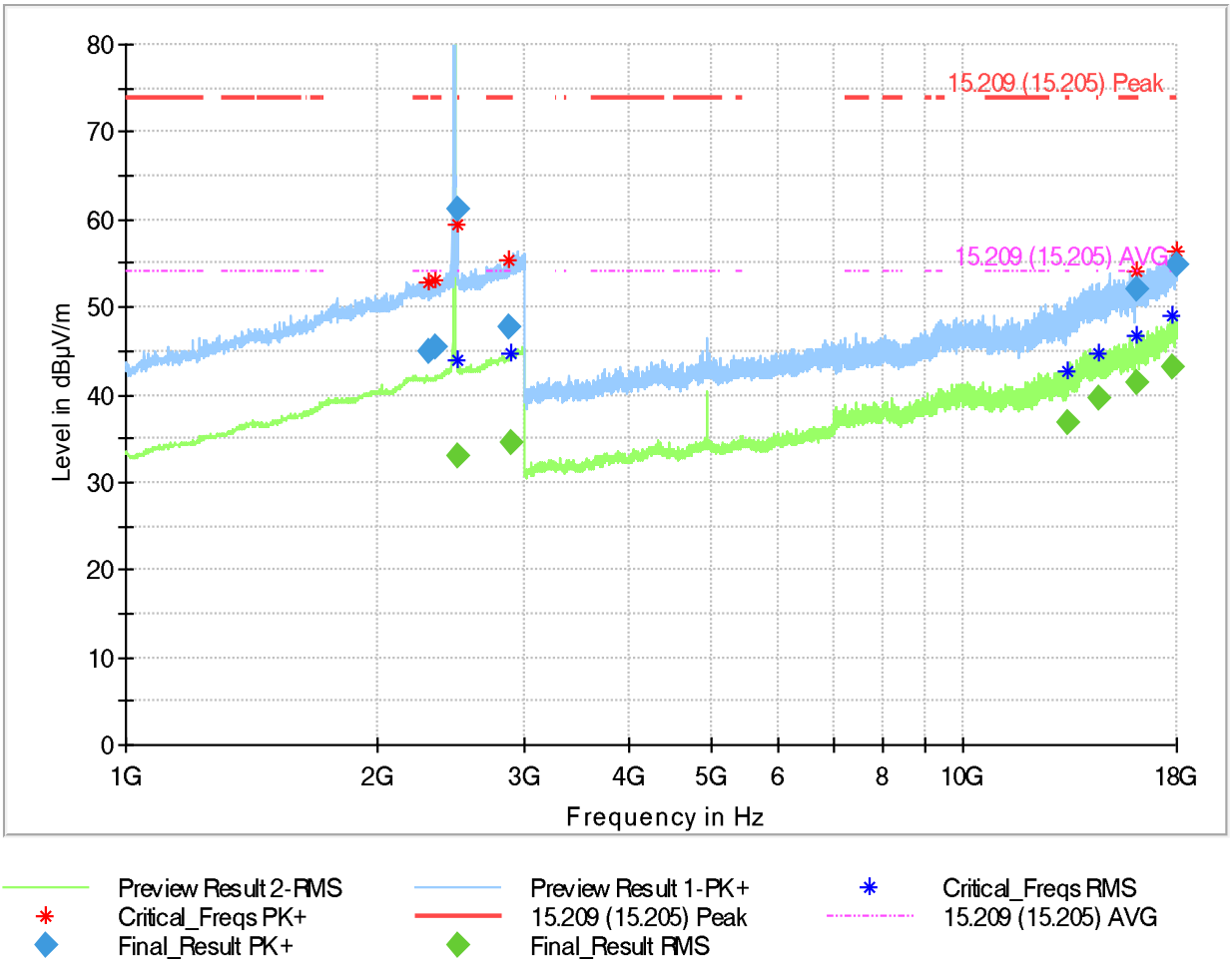
Plot 24: Mode 1, RSE 1 GHz – 18 GHz, low channel, horizontal / vertical polarisation



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
2389.665000	57.01	---	74.00	16.99	100.0	1000.000	150.0	V
2497.720000	47.00	---	74.00	27.00	100.0	1000.000	150.0	V
2717.780000	48.20	---	74.00	25.80	100.0	1000.000	150.0	H
2877.360000	---	34.08	54.00	19.92	100.0	1000.000	150.0	H
4819.062500	54.90	---	74.00	19.10	100.0	1000.000	150.0	H
4820.727500	---	35.14	54.00	18.86	100.0	1000.000	150.0	V
14487.596667	---	39.66	54.00	14.34	100.0	1000.000	150.0	H
16151.435833	---	41.04	54.00	12.96	100.0	1000.000	150.0	V
16154.071667	53.46	---	74.00	20.54	100.0	1000.000	150.0	H
17745.465000	54.29	---	74.00	19.71	100.0	1000.000	150.0	H
17982.529167	---	43.53	54.00	10.47	100.0	1000.000	150.0	V

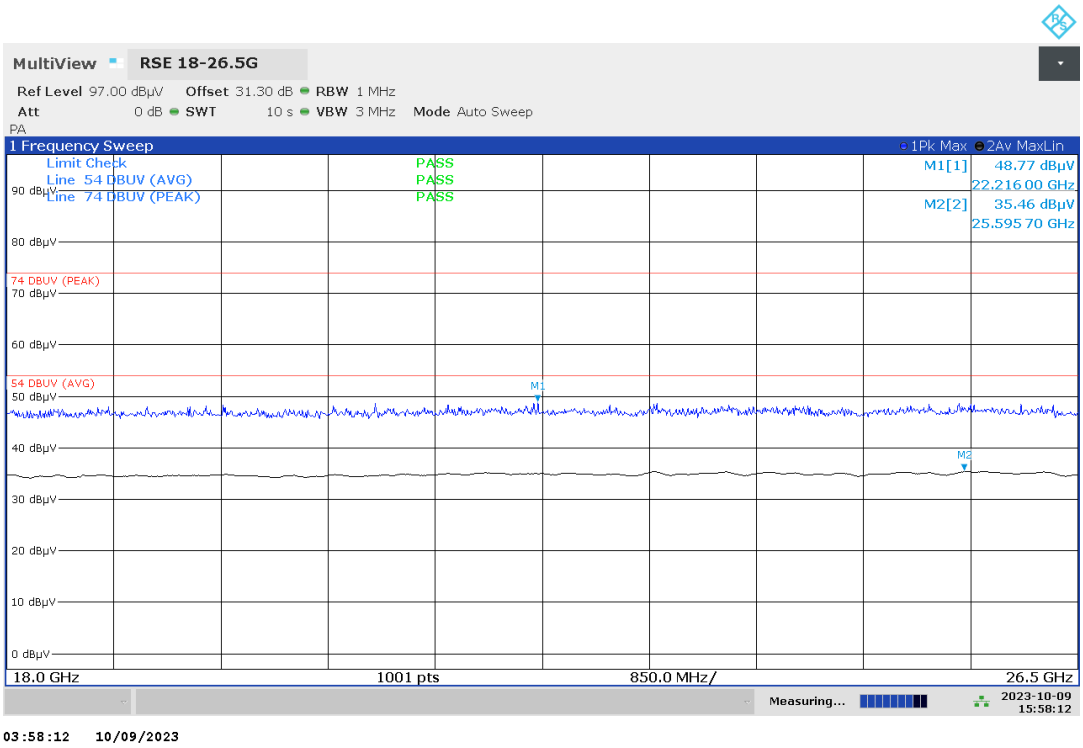
Plot 25: Mode 1, RSE 1 GHz – 18 GHz, high channel, horizontal / vertical polarisation



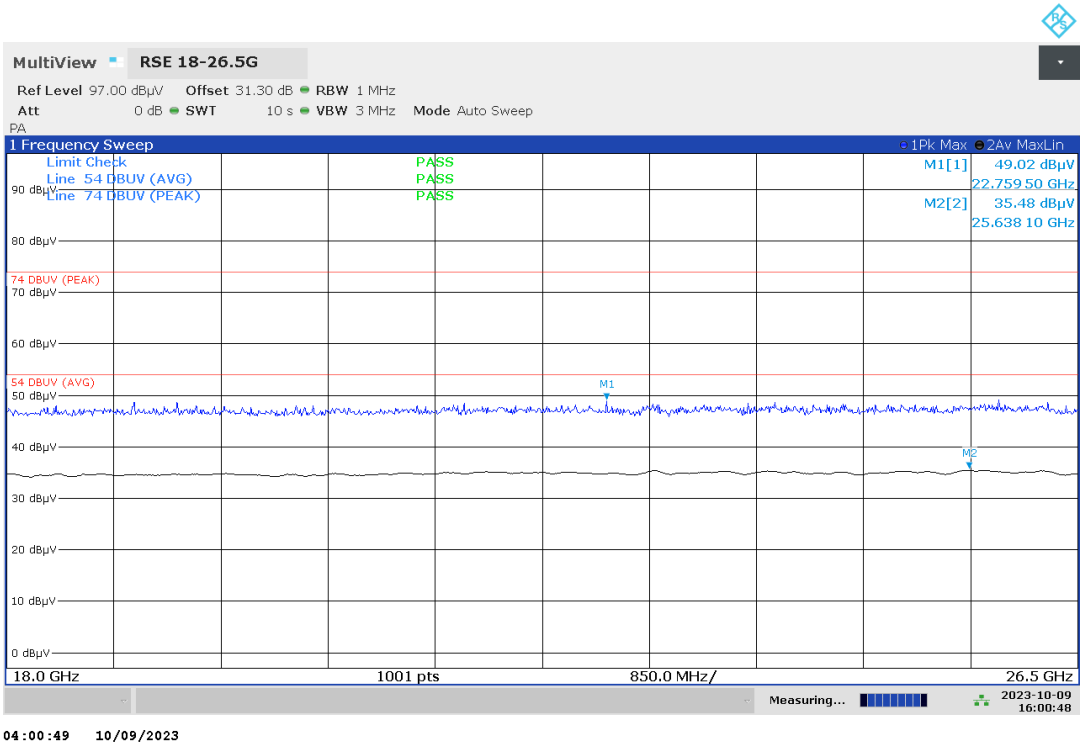
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
2297.220000	45.04	---	74.00	28.96	100.0	1000.000	150.0	H
2346.455000	45.47	---	74.00	28.53	100.0	1000.000	150.0	H
2485.445000	61.31	---	74.00	12.69	100.0	1000.000	150.0	V
2485.550000	---	33.07	54.00	20.93	100.0	1000.000	150.0	V
2871.145000	47.66	---	74.00	26.34	100.0	1000.000	150.0	H
2886.880000	---	34.42	54.00	19.58	100.0	1000.000	150.0	H
13345.745834	---	36.82	54.00	17.18	100.0	1000.000	150.0	V
14484.960000	---	39.58	54.00	14.42	100.0	1000.000	150.0	H
16155.045000	52.13	---	74.00	21.87	100.0	1000.000	150.0	V
16157.439167	---	41.27	54.00	12.73	100.0	1000.000	150.0	V
17744.590834	---	43.11	54.00	10.89	100.0	1000.000	150.0	H
17983.746667	54.90	---	74.00	19.10	100.0	1000.000	150.0	H

Plot 26: Mode 1, RSE 18 GHz – 26 GHz, low channel, horizontal / vertical polarisation



Plot 27: Mode 1, RSE 18 GHz – 26 GHz, high channel, horizontal / vertical polarisation



7.10 AC Conducted Emissions

Description / Limits

§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 limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission [MHz]	Conducted limit [dBµV]	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5.0	56	46
5.0 – 30	60	50
*Decreases with the logarithm of the frequency.		

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

Test setup: see 8.5

Test results

See next pages!

Note:

Batteries are removed from test jig. For testing a standard AC/DC adapter was connected to test jig which was powered with 120V AC / 60 Hz via LISN (see pictures for more details).

Plot no. 28: conducted emissions, line L1

Rg	Frequency [MHz]	QPK Level [dBµV]	QPK Limit [dBµV]	QPK Margin [dB]	AVG Level [dBµV]	AVG: CAV Limit [dBµV]	AVG Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]	Meas. Time [s]
1	0,434	17,91	57,18	39,28	11,05	47,18	36,13	10,16	L1	9,000	15,000
1	0,601	17,72	56,00	38,28	10,93	46,00	35,07	10,14	L1	9,000	15,000
1	1,251	17,47	56,00	38,53	10,62	46,00	35,38	9,94	L1	9,000	15,000
1	5,079	17,60	60,00	42,40	11,14	50,00	38,86	10,02	L1	9,000	15,000
1	7,713	17,73	60,00	42,27	11,20	50,00	38,80	10,11	L1	9,000	15,000
1	26,414	17,66	60,00	42,34	10,79	50,00	39,21	10,51	L1	9,000	15,000

Plot no. 29: conducted emissions, neutral N

Rg	Frequency [MHz]	QPK Level [dBµV]	QPK Limit [dBµV]	QPK Margin [dB]	AVG Level [dBµV]	AVG: CAV Limit [dBµV]	AVG Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]	Meas. Time [s]
1	0,460	22,38	56,70	34,32	13,08	46,70	33,61	10,17	N	9,000	15,000
1	0,900	17,52	56,00	38,48	10,68	46,00	35,32	10,01	N	9,000	15,000
1	1,169	18,33	56,00	37,67	11,10	46,00	34,90	9,96	N	9,000	15,000
1	1,669	17,64	56,00	38,36	10,87	46,00	35,13	9,92	N	9,000	15,000
1	2,557	17,75	56,00	38,25	11,02	46,00	34,98	9,93	N	9,000	15,000
1	27,455	17,76	60,00	42,24	10,93	50,00	39,07	10,73	N	9,000	15,000

8 TEST SETUP DESCRIPTION

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Cyclic chamber inspections and range calibrations are performed. Where possible, RF generating and signalling equipment as well as measuring receivers and analysers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

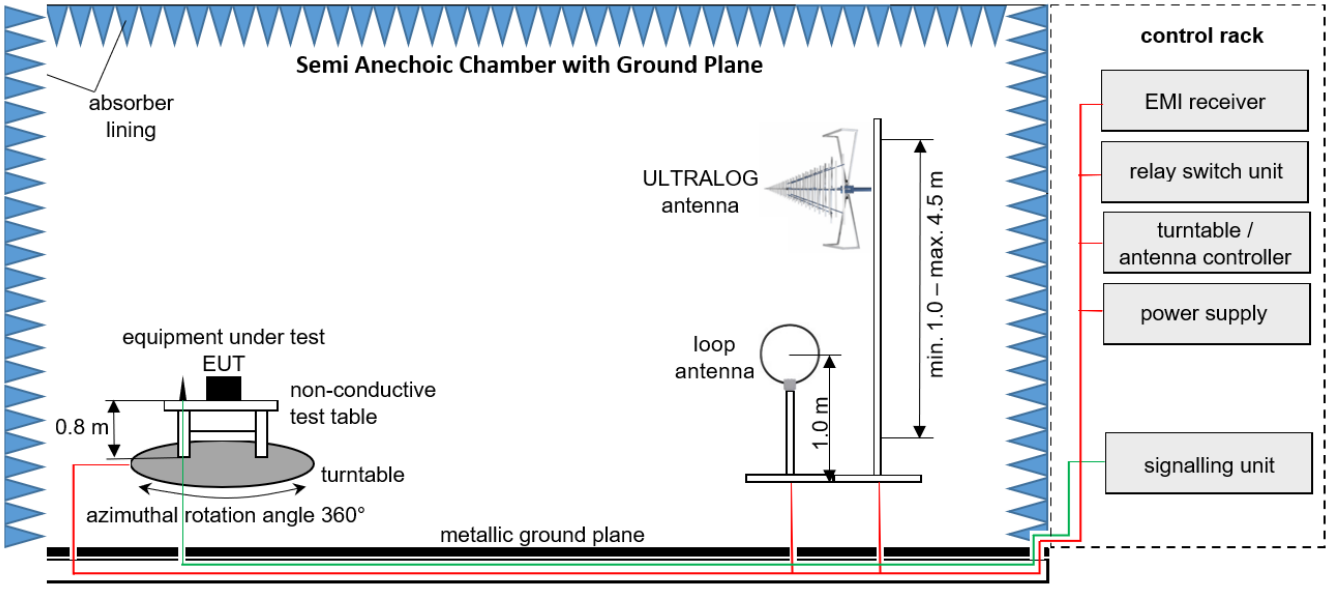
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Kind of calibration (abbreviations):

C = calibrated
CM = cyclic maintenance
NR = not required
L = locked

8.1 Semi Anechoic Chamber with Ground Plane

Radiated measurements are performed in vertical and horizontal plane in the frequency range 30 MHz to 1 GHz in a Semi Anechoic Chamber with a metallic ground plane. The EUT is positioned on a non-conductive test table with a height of 0.80 m above the metallic ground plane that covers the whole chamber. The receiving antennas conform to specification ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. These antennas can be moved over the height range between 1.0 m and 4.5 m in order to search for maximum field strength emitted from the EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by a spectrum analyzer where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: loop antenna at 3 m, ULTRALOG antenna at 3 m
EMC32 software version: 11.20.00

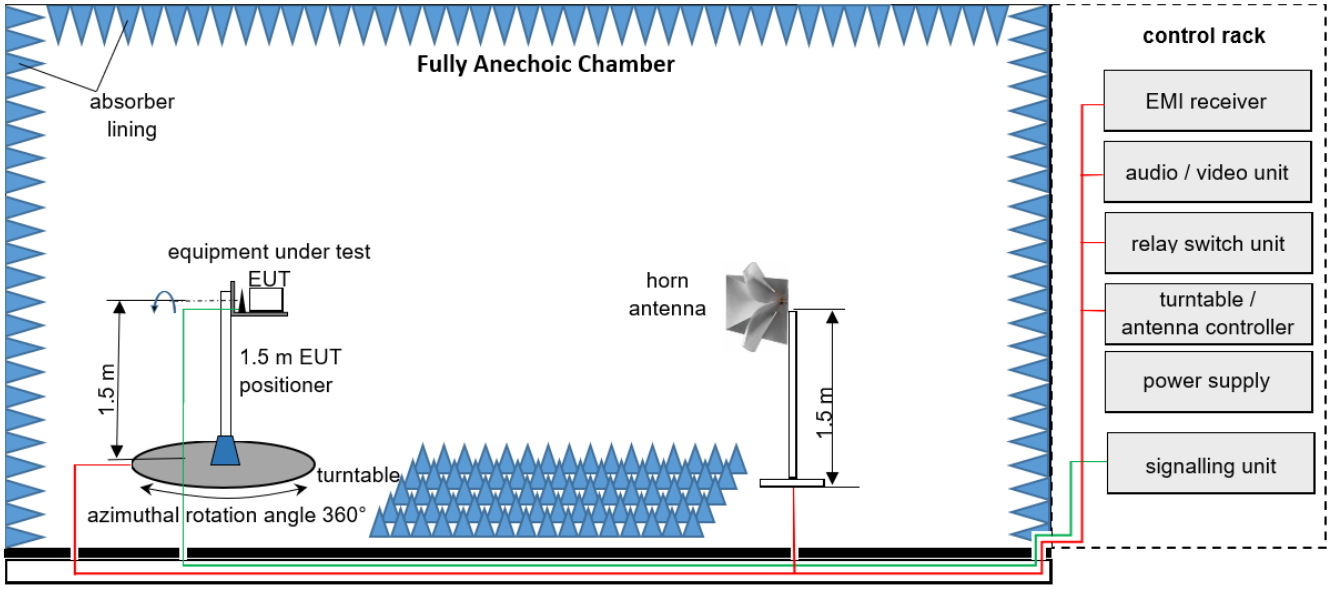
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Last / Next Calibration
1	Power Supply	Rohde & Schwarz	IN 600	101126	LAB000684	NR	–
2	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PSI 9080-40 T	2000230001	LAB000313	NR	–
3	Test table	innco systems GmbH	PT1208-080-RH	-	LAB000306	NR	–
4	Power Supply	Chroma	61604	616040005416	LAB000285	NR	–
5	Positioner	maturo GmbH	TD 1.5-10KG		LAB000258	NR	–
6	Compressed Air	Implotex	1-850-30	-	LAB000256	NR	–
7	EMI Test Receiver	Rohde & Schwarz	ESW26	101481	LAB000236	C	2023-07-04 → 12M → 2024-07-04
8	Semi/Fully Anechoic Chamber	Albatross Projects GmbH	Babylon 5 (SAC 5)	20168.PRB	LAB000235	C	2022-01-31 → 36M → 2025-01-31
9	Measurement Software	Rohde & Schwarz	EMC32 V11.20		LAB000226	NR	–
10	Turntable	maturo GmbH	TT2.0-2t	TT2.0-2t/921	LAB000225	NR	–
11	Antenna Mast	maturo GmbH	CAM4.0-P	CAM4.0-P/316	LAB000224	NR	–
12	Antenna Mast	maturo GmbH	BAM4.5-P	BAM4.5-P/272	LAB000223	NR	–
13	Controller	maturo GmbH	FCU 3.0	10082	LAB000222	NR	–
14	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350292	LAB000191	NR	–
15	Pre-Amplifier	Schwarzbeck Mess-Elektronik OHG	BBV 9718 C	84	LAB000169	CM	2022-05-31 → 36M → 2025-05-31
16	Antenna	Rohde & Schwarz	HF907	102899	LAB000151	C	2023-05-15 → 36M → 2026-05-15
17	Antenna	Rohde & Schwarz	HL562E	102005	LAB000150	C	2022-12-22 → 36M → 2025-12-22
18	Open Switch and Control Platform	Rohde & Schwarz	OSP220 Base Unit 2HU	101748	LAB000149	NR	–
19	Antenna	Rohde & Schwarz	HF907	102898	LAB000124	C	2023-06-13 → 36M → 2026-06-13
20	Antenna	Rohde & Schwarz	HL562E	102001	LAB000123	C	2023-04-05 → 36M → 2026-04-05
21	Antenna	Rohde & Schwarz	HFH2-Z2E	100954	LAB000108	C	2023-05-05 → 36M → 2026-05-05

8.2 Fully Anechoic Chamber



Measurement distance: horn antenna at 3 m
EMC32 software version: 11.20.00

FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

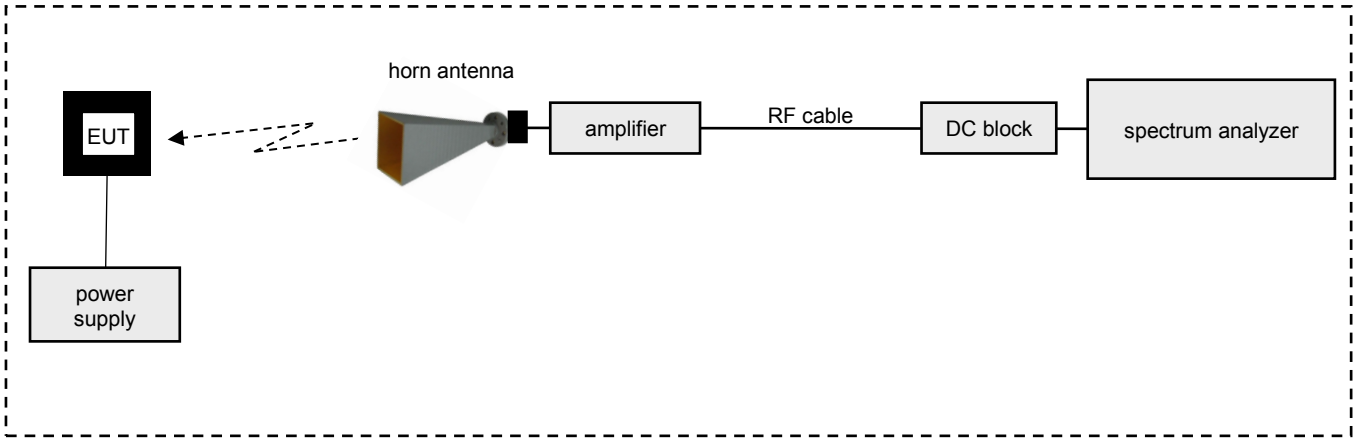
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Last / Next Calibration
1	Power Supply	Rohde & Schwarz	IN 600	101126	LAB000684	NR	–
2	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PSI 9080-40 T	2000230001	LAB000313	NR	–
3	Test table	innco systems GmbH	PT1208-080-RH	-	LAB000306	NR	–
4	Power Supply	Chroma	61604	616040005416	LAB000285	NR	–
5	Positioner	maturo GmbH	TD 1.5-10KG		LAB000258	NR	–
6	Compressed Air	Implotex	1-850-30	-	LAB000256	NR	–
7	EMI Test Receiver	Rohde & Schwarz	ESW26	101481	LAB000236	C	2023-07-04 → 12M → 2024-07-04
8	Semi/Fully Anechoic Chamber	Albatross Projects GmbH	Babylon 5 (SAC 5)	20168.PRB	LAB000235	C	2022-01-31 → 36M → 2025-01-31
9	Measurement Software	Rohde & Schwarz	EMC32 V11.20		LAB000226	NR	–
10	Turntable	maturo GmbH	TT2.0-2t	TT2.0-2t/921	LAB000225	NR	–
11	Antenna Mast	maturo GmbH	CAM4.0-P	CAM4.0-P/316	LAB000224	NR	–
12	Antenna Mast	maturo GmbH	BAM4.5-P	BAM4.5-P/272	LAB000223	NR	–
13	Controller	maturo GmbH	FCU 3.0	10082	LAB000222	NR	–
14	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350292	LAB000191	NR	–
15	Pre-Amplifier	Schwarzbeck Mess-Elektronik OHG	BBV 9718 C	84	LAB000169	CM	2022-05-31 → 36M → 2025-05-31
16	Antenna	Rohde & Schwarz	HF907	102899	LAB000151	C	2023-05-15 → 36M → 2026-05-15
17	Antenna	Rohde & Schwarz	HL562E	102005	LAB000150	C	2022-12-22 → 36M → 2025-12-22
18	Open Switch and Control Platform	Rohde & Schwarz	OSP220 Base Unit 2HU	101748	LAB000149	NR	–
19	Antenna	Rohde & Schwarz	HF907	102898	LAB000124	C	2023-06-13 → 36M → 2026-06-13
20	Antenna	Rohde & Schwarz	HL562E	102001	LAB000123	C	2023-04-05 → 36M → 2026-04-05
21	Antenna	Rohde & Schwarz	HFH2-Z2E	100954	LAB000108	C	2023-05-05 → 36M → 2026-05-05

8.3 Radiated measurements > 18 GHz

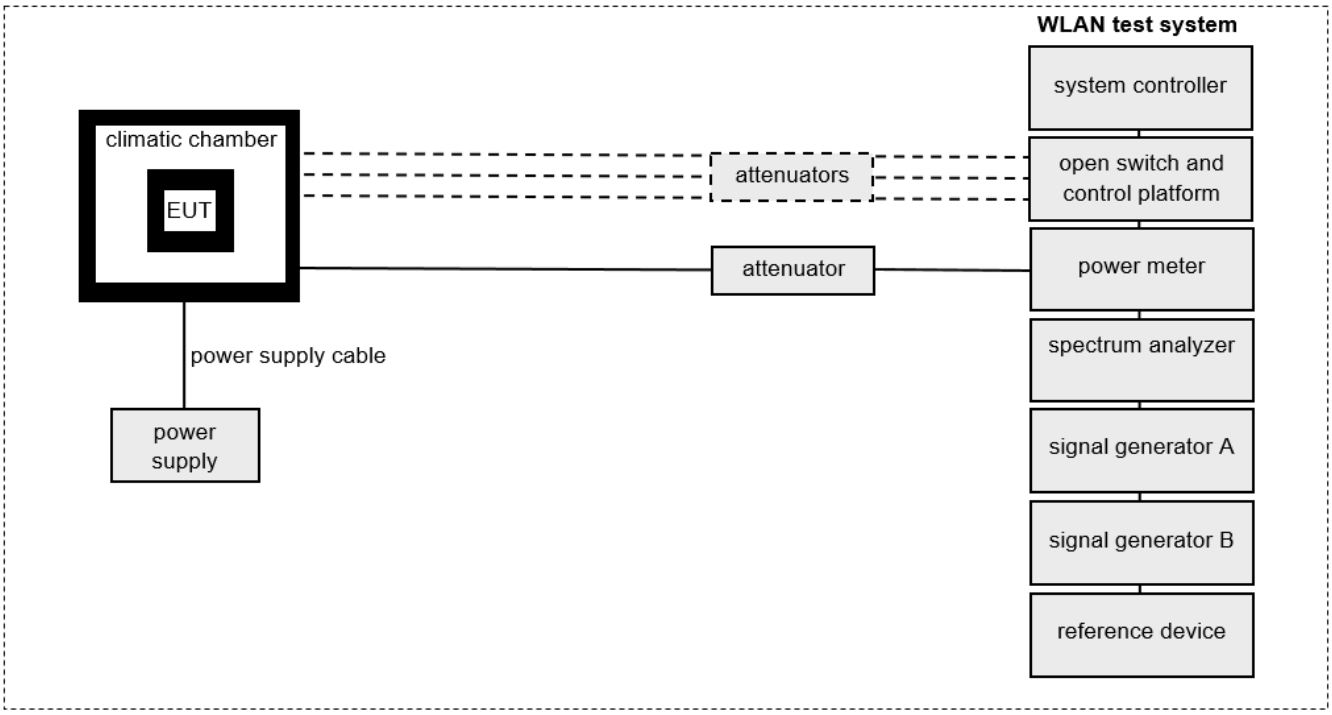


List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Last / Next Calibration
1	Test table	innco systems GmbH	PT0707-RH light	-	LAB000303	NR	–
2	WG-Coax-Adapter	Flann Microwave Ltd	20093-TF30 UBR220	273374	LAB000181	NR	–
3	Coaxial Cable	Huber & Suhner	SF101/1.5m	503987/1	LAB000165	CM	2023-07-17 → 12M → 2024-07-17
4	Antenna	Flann Microwave Ltd	20240-20	266403	LAB000128	CM	2023-07-17 → 12M → 2024-07-17
5	Spectrum Analyser	Rohde & Schwarz	FSW50	101450	LAB000111	C	2023-07-26 → 12M → 2024-07-26

8.4 Conducted measurements WLAN test system R&S TS 8997

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The losses for all signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.

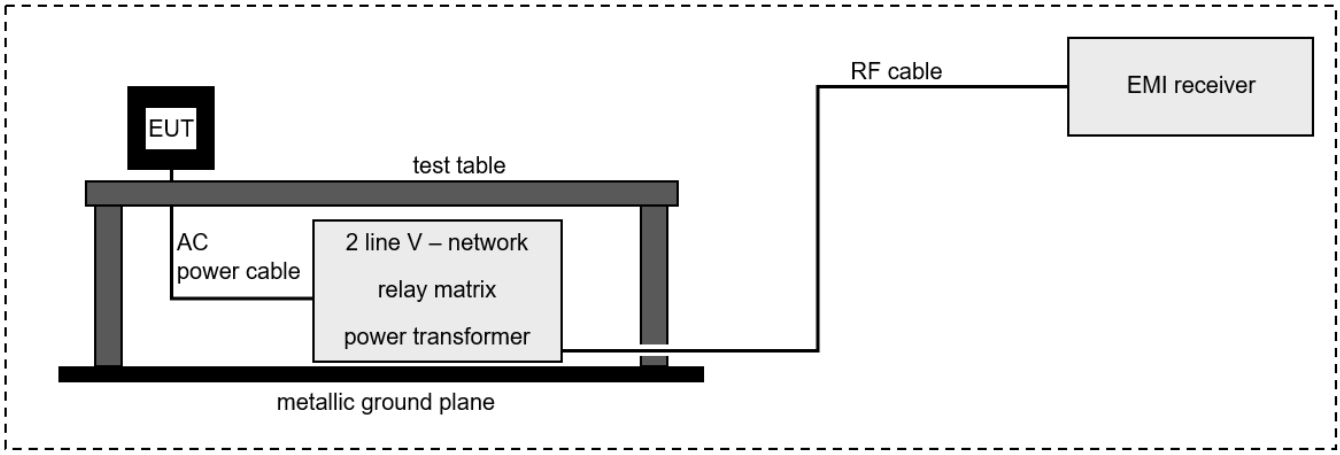


EMC32/WMS32 software version: 11.00.00

List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Last / Next Calibration
1	TS8997	Rohde & Schwarz	TS8997-Rack	100829	LAB000322	NR	–
2	Open Switch and Control Platform	Rohde & Schwarz	OSP-B157WX	101247	LAB000280	NR	–
3	Open Switch and Control Platform	Rohde & Schwarz	OSP-B157W8	100982	LAB000279	NR	–
4	Spectrum Analyser	Rohde & Schwarz	FSV40	101403	LAB000278	C	2021-06-15 → 36M → 2024-06-15
5	Signal Generator	Rohde & Schwarz	SMBV100A	258240	LAB000277	C	2021-08-31 → 36M → 2024-08-31
6	Signal Generator	Rohde & Schwarz	SMB100A-20	178175	LAB000276	C	2021-05-31 → 36M → 2024-05-31
7	Radio Communication Tester	Rohde & Schwarz	CMW270	101479	LAB000275	NR	–
8	Controller	Hewlett Packard	ATS-Z230	101379	LAB000274	NR	–
9	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350263	LAB000190	NR	–
10	Climatic Chamber	CTS GmbH	T-65/50	204002	LAB000110	CM	2023-05-11 → 12M → 2024-05-11

8.5 AC conducted emissions



FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Last / Next Calibration
1	EMI Test Receiver	Rohde & Schwarz	EPL1000	100921	LAB000873	C	2023-12-06 → 12M → 2024-12-06
2	Shielded room	Albatross Projects GmbH	Sputnik 1 (Schirmkabine)		LAB000257	NR	–
3	Open Switch and Control Platform	Rohde & Schwarz	OSP-B200S2	101443	LAB000239	NR	–
4	Two-Line V-Network	Rohde & Schwarz	ENV216	102597	LAB000220	C	2023-11-07 → 12M → 2024-11-07

9 MEASUREMENT UNCERTAINTIES

Radio frequency	≤ ± 1 x 10^{-7}
RF power, conducted	≤ ± 0.75 dB
Power spectral density	≤ ± 3 dB
Maximum frequency deviation	≤ ± 5 %
Deviation limitation Duty Cycle, Tx-sequence, Tx-gap	≤ ± 5 %
Occupied channel bandwidth	≤ ± 5 %
Conducted spurious emission of transmitter	≤ ± 4 dB
Conducted emission of receivers	≤ ± 4 dB
Radiated emission of transmitter	≤ ± 6 dB
Radiated emission of receiver	≤ ± 6 dB
Temperature	≤ ± 2.5 °C
Humidity	≤ ± 10 %

The indicated expanded measurement uncertainty corresponds to the standard measurement uncertainty for the measurement results multiplied by the coverage factor k = 2. It was determined in accordance with EA-4/02 M:2013. The true value is located in the corresponding interval with a probability of 95 %.