element

Radio Radio Radio Radio Radio Radio Radio Radio Radio Radio Radio

Applicant:

FEIG ELECTRONIC GmbH
Industriestraße 1a
35781 Weilburg
Tel.: +49 647131090

Test report no.:

240410-AU01+W02

for:

FEIG ELECTRONIC GmbH
BLE Module
TST RBA-A

according to:

47 CFR Part 15, §15.247 (partly)
RSS-247 (partly)

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12155-01-00

Accreditation:

FCC test firm accreditation expiration date: 2025-09-19
MRA US-EU, FCC designation number: DE0010
Test firm registration number: 997268
FCC Registration Number (FRN): 0032245045
BNetzA-CAB-02/21-02/7 Valid until 2028-11-26

Recognized until 2025-03-16 by the
Department of Innovation, Science and Economic Development Canada (ISED)
as a recognized testing laboratory
CAB identifier: DE0011
Company number: 3472A

Location of Testing:

Element Materials Technology Straubing GmbH
Tel.: +49 9421 56868-0
Fax: +49 9421 56868-100
Email: info.straubing@element.com
Gustav-Hertz-Straße 35
94315 Straubing, Germany

The technical accuracy is guaranteed through the quality management of Element Materials Technology Straubing GmbH.

Table of contents

List of figures

List of tables

1 General remark

This test report shows only partly tests as requested by the customer.

2 Summary of test results

System type: Digital transmission system (DTS)

47 CFR part and section	*Test*	*Equivalent to IC radio standard(s)*	*Result*	*Note(s)*	*Page*
15.207	AC power line conducted emissions 150 kHz to 30 MHz	RSS-Gen, section 8.8	Passed	2	29
---	Duty cycle	---	Recorded	4	---
15.247(a)(2)	6 dB bandwidth	RSS-247, section 5.2(a)	Not performed	4	---
---	Occupied bandwidth	RSS-Gen, section 6.7	Not performed	4	---
15.247(b)	Calculated conducted output power	RSS-247, section 5.4	Passed	---	33
15.247(e)	Power spectral density	RSS-247, section 5.2(b)	Not performed	4	---
15.247(d)	Band-edge measurements	RSS-247, section 5.5	Passed	---	36
15.247(d)	Antenna-port conducted measurements	RSS-247, section 5.5	Not applicable	3	---
15.247(d)	Radiated emissions below 30 MHz	RSS-247, section 5.5	Passed	---	42
15.247(d)	Radiated emissions from 30 MHz to 1 GHz	RSS-247, section 5.5	Passed	---	47
15.247(d)	Radiated emissions from 1 GHz to 25 GHz (10th harmonic)	RSS-247, section 5.5	Passed	---	51
15.247(i)	Radio frequency radiation exposure	RSS-Gen, Section 3.4	Not performed	4	---

Note(s):
1 For information about EUT see clause 4.
2 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.
3 If antenna port conducted tests cannot be performed (e.g. for portable or handheld devices with integral antenna), then radiated tests are performed for demonstrating compliance to the conducted emission requirements (see “Spurious radiated emissions 9 kHz to 10th harmonic”).
4 Not requested by the customer

Straubing, March 20, 2025

Tested by
Patricio Montenegro, M.Sc.-Ing.
Radio Test Engineer

Approved by
Konrad Graßl
Reviewer

3 Referenced publications

Publication	*Title*
CFR 47 Part 2 October 2024	Code of Federal Regulations, Title 47 (Telecommunication), Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
CFR 47 Part 15 October 2024	Code of Federal Regulations, Title 47 (Telecommunication), Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
KDB Publication no. 412172 August 7, 2015	Guidelines for determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of an RF transmitting system
KDB Publication no. 558074 April 02, 2019	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS), Frequency Hopping Spread Spectrum Sytem, and Hybrid System Devices Operating Under §15.247 of the FCC Rules
ANSI C63.10 June 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-Gen Issue 5 April 2018 Amendment 1 (March 2019) Amendment 2 (February 2021)	Spectrum Management and Telecommunications - Radio Standards Specification - General Requirements for Compliance of Radio Apparatus
RSS-247, Issue 3 August 2023	Spectrum Management and Telecommunications - Radio Standards Specification - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

4 Equipment under test (EUT)

All Information in this clause is declared by customer.

4.1 General information

Product type:	BLE Module		
Model name:	TST RBA-A		
Serial number(s):	202435040		
Manufacturer:	FEIG ELECTRONIC GmbH		
Hardware version:	FE1218-1-A		
Software version:	TST RBA BLE-PER V01.01 / TST RBA BLE-DTM V01.01		
Short description:	Extension Board connects the controller to a smartphone via Bluetooth LE (2.4 GHz) to transmit data.		
Additional modifications:	See clause: 4.3		
FCC ID:	PJMTSTRBA		
IC registration number:	6633A-TSTRBA		
Power supply:	DC supply		
	Nominal voltage:	3.3 V	
Device type:	☐ Portable	☒ Mobile	☐ Fixed

4.2 Radio specifications

System type (Note 1):	Digital transmission system (DTS)		
Application frequency band:	2400.0 MHz - 2483.5 MHz		
Number of RF channels:	40		
Nominal bandwidth:	2 MHz		
Modulation(s):	GFSK		
Antenna:	Type:	PCB antenna	
	Gain:	3.3 dBi (maximum)	
	Model:	2.4-GHz Inverted F Antenna	
	Manufacturer:	Texas Instruments	
	Connector:	☐ external	☐ internal
		☐ temporary	☒ none (integral antenna)

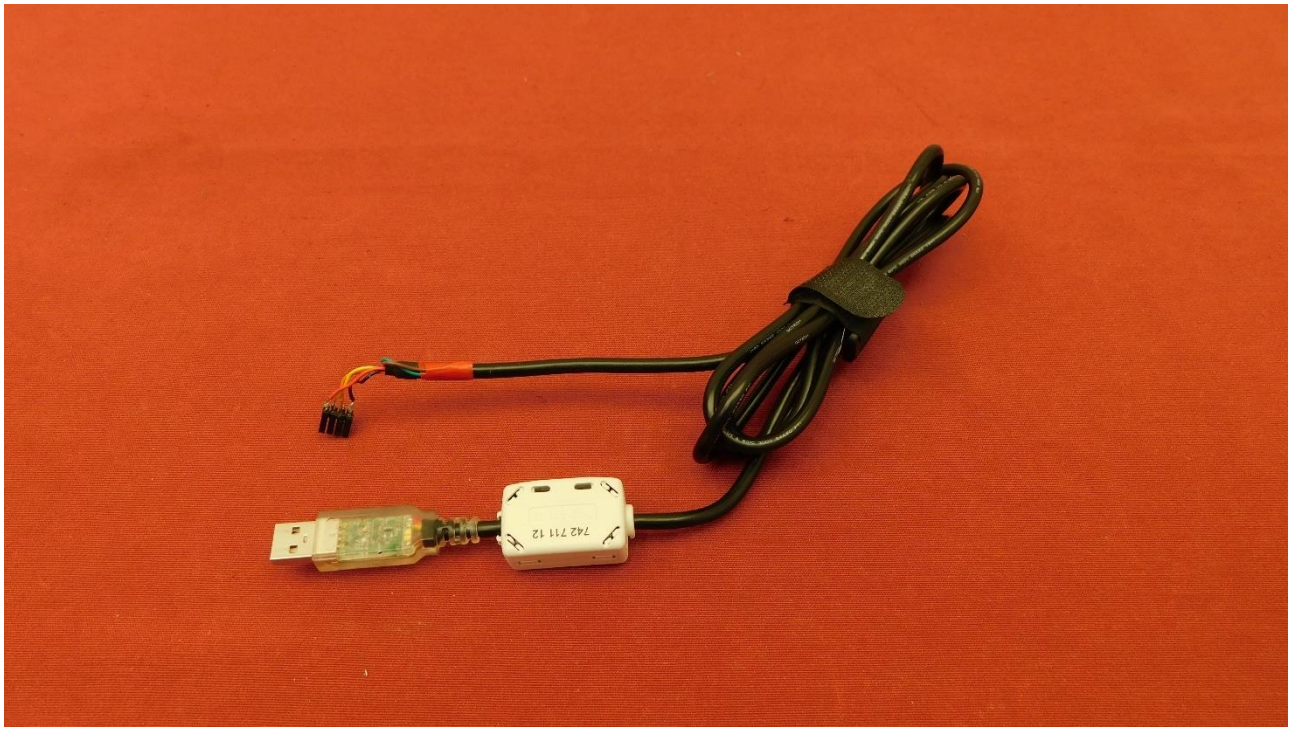
Note(s):
1. "DTS" is the equipment class for digital transmission systems, "DSS" for all other Part 15 spread spectrum transmitters as used for equipment authorization system form 731.

Channel no.	*Operating frequency*	*Channel no.*	*Operating frequency*
37	2402 MHz	18	2442 MHz
0	2404 MHz	19	2444 MHz
1	2406 MHz	20	2446 MHz
2	2408 MHz	21	2448 MHz
3	2410 MHz	22	2450 MHz
4	2412 MHz	23	2452 MHz
5	2414 MHz	24	2454 MHz
6	2416 MHz	25	2456 MHz
7	2418 MHz	26	2458 MHz
8	2420 MHz	27	2460 MHz
9	2422 MHz	28	2462 MHz
10	2424 MHz	29	2464 MHz
38	2426 MHz	30	2466 MHz
11	2428 MHz	31	2468 MHz
12	2430 MHz	32	2470 MHz
13	2432 MHz	33	2472 MHz
14	2434 MHz	34	2474 MHz
15	2436 MHz	35	2476 MHz
16	2438 MHz	36	2478 MHz
17	2440 MHz	39	2480 MHz

Table 1: Radio specifications of EUT

4.3 Equipment modifications

1 ferrite with the item number 742 711 12 of the manufacturer Würth was fixed around the USB cable. The ferrite was attached to the end of the cable that is plugged into the laptop



Picture 1: Modification of EUT

4.4 Photo documentation

Photos taken during testing including EUT positions can be found in annex A.
For internal photos of the EUT see annex B.

5 Test configuration and mode of operation

5.1 Test configuration

Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
BLE Module	TST RBA-A	N/A	FEIG ELECTRONIC GmbH

Table 2: EUT used for testing

Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
Laptop	Latitude 3410	9BDY103	DELL
Power supply for laptop	LA65NS2-01	---	DELL

Table 3: Support equipment used for testing

5.2 Mode of operation

- The EUT was connected to a laptop via a USB to TTL cable.
- All measurements were performed with a power setting of 8 dBm.
- By means of the software “BTool_Bluetooth Low Energy Application_V1.44.03” the EUT could be set to transmit continuously a modulated signal with a data rate of 1 Mbit/s.
- For configuration the following commands were used:
    - HCIExt_ModemTestTxCmd -> cwMode: HCI_EXT_TX_MODULATED_CARRIER / txRfChannel: 0,19, oder 39
    - HCIExt_EndModemTestCmd
    - HCIExt_SetMaxDtmTxPowerCmd -> HCI_EXT_TX_POWER_4_DBM
    - HCIExt_SetMaxDtmTxPowerDbmCmd -> dBm = 8 / fraction = False
    - HCIExt_SetTxPowerDbmCmd-> dBm = 8 / fraction = False
    - HCIExt_ModemTestTxCmd -> cwMode: HCI_EXT_TX_MODULATED_CARRIER / txRfChannel: 0,19, oder 39
- During the test: “Band-edge measurements” the EUT was set on channel 0 (2402 MHz) and channel 39 (2480 MHz), for lower band-edge and upper band-edge respectively. During the rest of the tests The EUT was set on channel 39 (2480 MHz)

Channel	*Frequency (MHz)*
Low	2402
High	2480

Table 4: Tested channel(s)

6 Test procedures

6.1 General specifications

6.1.1 Test setups

Tabletop devices are placed on a non-conductive table with a height of 0.8 m. In case of AC power-line conducted emissions test, the rear of the EUT is located 40 cm to the vertical wall of the RF-shielded (screened) room which is used as vertical conducting plane. For radiated emission measurements above 1 GHz, tabletop devices are placed at a height of 1.5 m above the floor using a support made of styrene placed on top of the non-conductive table.

All other surfaces of tabletop or floor-standing EUTs are at least 80 cm from any other grounded conducting surface. This includes the case or cases of one or more LISNs when performing an AC power-line conducted emissions test.

Radiated emission measurements of equipment that can be used in multiple orientations (e.g. portable or handheld devices) are performed with the EUT in each of three orthogonal axis positions.

6.1.2 Conversion to conducted test results

If test procedures described herein are based on the use of an antenna-port conducted test configuration, but the EUT cannot provide such a configuration (e.g., portable or handheld devices with integral antenna), radiated tests are performed for demonstrating compliance to the conducted requirements.

If a radiated test configuration has to be used, then the measured power or field strength levels are converted to equivalent conducted power levels for comparison to the applicable limit. For this purpose, at first the radiated field strength or power levels are converted to EIRP as described in annex G of ANSI C63.10 and KDB Publication 412172, document D01. The equivalent conducted power is then determined by subtracting the EUT transmit antenna gain from the EIRP (assuming logarithmic representation).

For devices utilizing multiple antenna technologies, KDB Publication 662911 applies.

6.2 Antenna-port conducted measurements

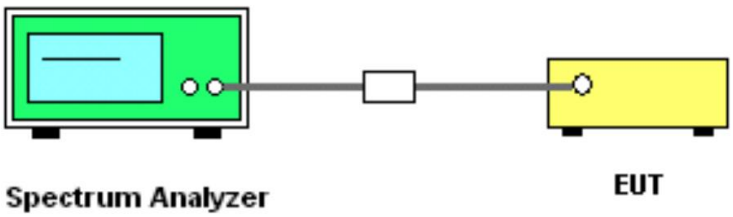


Figure 1: Setup for antenna-port conducted measurements

The RF signal of the EUT is measured conducted at the antenna port. In case of no permanent antenna connector available, a temporary antenna connector should be supplied by the manufacturer. The specific insertion loss of the signal path, which is matched to 50 Ohm, is determined. The test receiver is set to analyzer mode with pre-selector activated. The measurement readings on the test receiver are corrected by the signal path loss.

For frequency hopping systems (FHSS) and digital transmission systems (DTS) the settings as specified by KDB Publication 558074, document D01, are used.

If a radiated test configuration has to be used, conversion to conducted test results is performed according to clause 6.1.2.

6.3 AC powerline conducted emissions

AC power-line conducted emissions are measured according to clause 6.2 of ANSI C63.10 over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network. The tests are performed in a shielded room.

If the EUT normally receives power from another device that in turn connects to the public utility ac power lines, measurements are made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.
For direct current (dc) powered devices where the ac power adapter is not supplied with the device, an “off-the-shelf” unmodified ac power adapter is used. If the device is supposed to be installed in a host (e.g., the device is a module or PC card), then it is tested in a typical compliant host.

Frequency (f)	*Measurement receiver bandwidth*	*Step size*	*Detector type*		
			Prescan	*Prescan with FFT*	*Final scan*
150 kHz ≤ f < 30 MHz	9 kHz	≤ 4.5 kHz	Peak, Average	Quasi-peak, Average	Quasi-peak, Average

Table 5: Bandwidth and detector type for AC power-line conducted emissions test

The AC power-line conducted emissions test is performed in the following steps:
a) The EUT is arranged as tabletop or floor-standing equipment, as applicable, and connected to a line impedance stabilization network (LISN) with 50 µH / 50 Ω. If required, a second LISN of the same type and terminated by 50 Ω is used for peripheral devices. The EUT is switched on.

b) The measurement equipment is connected to the LISN for the EUT and set-up according to the specifications of the test (see table 5). At the LISN, the neutral line is selected to be tested.
c) The prescan is performed with both detectors activated at the same time. If the test receiver is capable of FFT analysis, it is used for prescan, but not for final scan.
d) When the prescan is completed, maximum levels with less margin than 10 dB or exceeding the limit are determined and collected in a list.
e) With the first frequency of the list selected, a frequency zoom over a range of ten times of the measurement receiver bandwidth around this frequency is performed. If the EUT has no significant drift in frequency, the frequency zoom can be skipped.
f) For final scan, the emission level is measured and the maximum is recorded.
g) Steps e) to f) are repeated for all other frequencies in the list. At least the six highest EUT emissions relative to the limit have to be recorded.
h) Steps c) to g) are repeated for all current-carrying conductors of all of the power cords of EUT, i.e. all phase and (if used) neutral line(s).

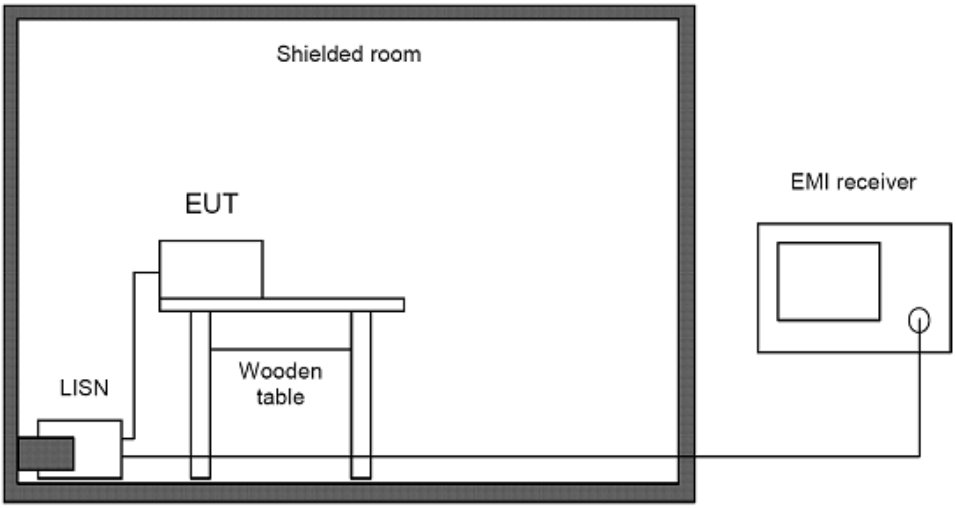


Figure 2: Setup for AC power-line conducted emissions test from 150 kHz to 30 MHz

Phase	*Frequency (MHz)*	*Reading value (dBµV)*	*AMN correction (dB)*	*Cable attenuation + 10 dB attenuator (dB)*	*Correction factor (Corr.) (dB)*	*Level (dBµV)*
L 1	10	10	0.6	10.9	11.5	21.5
N	10	10	1.0	10.9	11.9	21.9

Table 6: Sample calculation

Correction factor = Artifical mains network correction + Cable attenuation + 10 dB

Level = Reading value + Correction factor = 10 dBµV + 11.5 dB = 21.5 dBµV

Prescans are performed with all detectors activated at the same time. If the test receiver is capable of FFT analysis, it is used for prescans, but not for final scans. If no limit is specified for certain detectors, final scan measurement with these detectors may be omitted.

6.4 Radiated emissions below 30 MHz

Radiated emissions below 30 MHz are measured according to clause 6.4 of ANSI C63.10 using an inductive shielded loop antenna. As this antenna measures the magnetic field only, its antenna factors are converted to electric field strength values assuming a free space impedance of 377 Ω as described in clause 4.3.1 of ANSI C63.10. This results in an additional correction of 51.53 dB.

According to clause 6.4.3 of ANSI C63.10, at frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements. In this case, the results are extrapolated to the specified distance by using a recalculation factor determined according to one of the methods described in clause 6.4.4 of ANSI C63.10, provided that the maximum dimension of the device is equal to or less than 0.625 times the wavelength at the frequency being measured. As the minimum wavelength is 10 meters corresponding to the maximum frequency of 30 MHz, this requirement is fulfilled if the maximum dimension of the device is equal to or less than 6.25 meters.

Unless otherwise stated, the recalculation factor is determined according to clause 6.4.4.2 “Extrapolation from the measurement of a single point” of ANSI C63.10:

$d_{near\ field}$ = 47.77 / f_{MHz}, or
f_{MHz} = 47.77 / $d_{near\ field}$

The frequency f_{MHz} at which the near field distance is equal to the limit and/or test distance is important for selection of the right formula to determine the recalculation factor:

f_{MHz}(300 m) ≈ 0.159 MHz
f_{MHz}(30 m) ≈ 1.592 MHz
f_{MHz}(3 m) ≈ 15.923 MHz

Based on the test distances for the general radiated emission limits as specified in §15.209 of 47 CFR Part 15 or RSS-Gen, the following formulas are used to determine the recalculation factor:

Frequency (f)	d_{limit}	$d_{measure}$	*Formula for recalculation factor*
9 kHz ≤ f ≤ 159 kHz 490 kHz < f ≤ 1.592 MHz	300 m 30 m	3 m	-40 log(d_{limit} / $d_{measure}$)
159 kHz < f ≤ 490 kHz 1.592 MHz < f ≤ 15.923 MHz	300 m 30 m	3 m	-40 log($d_{near\ field}$ / $d_{measure}$) - 20 log(d_{limit} / $d_{near\ field}$)
f > 15.923 MHz	30 m	3 m	-20 log(d_{limit} / $d_{measure}$)

Table 7: Recalculation factors for extrapolation

The radiated measurements below 30 MHz are performed in a fully anechoic room (called “CDC”). The measurement distance is 3 meters. The emissions of the EUT are recorded with an EMI test receiver configured as described in table 8.

Frequency (f)	*Measurement receiver bandwidth*	*Step size*	*Detector type*
9 kHz ≤ f < 150 kHz	200 Hz	≤ 100 Hz	Peak Quasi-peak Aerage
150 kHz ≤ f < 30 MHz	9 kHz	≤ 4.5 kHz	Peak Quasi-peak Aerage

Table 8: Bandwidth and detector type for radiated emissions test below 30 MHz

Frequency (MHz)	*Reading value (dBµV)*	*Antenna correction (dB/m)*	*Cable attenuation (dB)*	*Correction factor (Corr.) (dB)*	*Level (dBµV/m)*
10	20.00	19.59	0.33	19.92	39.92

Table 9: Sample calculation

Correction factor = Antenna correction + Cable attenuation

Level = Reading value + Correction factor = 20 dBµV + 19.92 dB = 39.92 dBµV/m

Prescans are performed with all detectors activated at the same time. If the test receiver is capable of FFT analysis, it is used for prescans, but not for final scans. If no limit is specified for certain detectors, final scan measurement with these detectors may be omitted.

The radiated emissions test below 30 MHz is performed in the following steps:

6.4.1 Automatic test method

a) The loop antenna is positioned with its plane perpendicular to the ground with the lowest height of the antenna 1 m above the ground.
b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
c) The measurement equipment is connected to the loop antenna and set-up according to the specifications of the test (see table 8).
d) The table position is set to 0°. The table step is defined as 20°.
e) The loop antenna is aligned along the test axis (in line).
f) Then the EUT is rotated in a horizontal plane through 360° in steps as defined in step d). Starting at 0°, at each table position the spectrum for the full frequency range is recorded. If the emission at a certain frequency is higher than the levels already recorded, the current table position is noted as the maximum position.
g) The loop antenna is aligned orthogonal to the test axis (parallel).
h) Then the EUT is rotated in a horizontal plane through 360° in steps as defined in step d). Starting at 0°, at each table position the spectrum for the full frequency range is recorded. If the emission at a certain frequency is higher than the levels already recorded, the current table position is noted as the maximum position.
i) After the last prescan, the significant maximum emissions, the antenna position and their table positions are determined and collected in a list.
j) For maximization, the EUT is rotated clockwise and counterclockwise by the table step as defined in step d) while measuring the emission level continuously.
k) The worst case positions of the table and the maximum emission levels are recorded.
l) Steps j) to k) are repeated for all other frequencies in the list.

If the EUT may be used in various positions, steps d) to l) are repeated in two other orthogonal positions.

6.4.2 Manual test method

a) The loop antenna is positioned with its plane perpendicular to the ground with the lowest height of the antenna 1 m above the ground.
b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
c) The measurement equipment is connected to the loop antenna and set-up according to the specifications of the test (see table 8).
d) The table position is set to 0°.
e) The loop antenna is aligned along the test axis (in line).
f) Then the EUT is rotated in a horizontal plane through 360° continuously. The scan table method in receiver mode of the measurement instrument is used for pre-measurements. The max hold function is used. The significant maximum emissions are determined and collected in a list.
g) The loop antenna is aligned orthogonal to the test axis (parallel).
h) Then the EUT is rotated in a horizontal plane through 360° continuously. The scan table method in receiver mode of the measurement instrument is used for pre-measurements. The max hold function is used. The significant maximum emissions are determined and collected in a list.
i) Final scan: the test receiver is set in the bargraph max hold function and is set to the first frequency of the list, the EUT is rotated by 360° while measuring the emission level continuously. The worst-case table position and the maximum emission level is recorded.
j) Step i) is repeated for all other frequencies in the list.

If the EUT may be used in various positions, steps d) to j) are repeated in two other orthogonal positions.

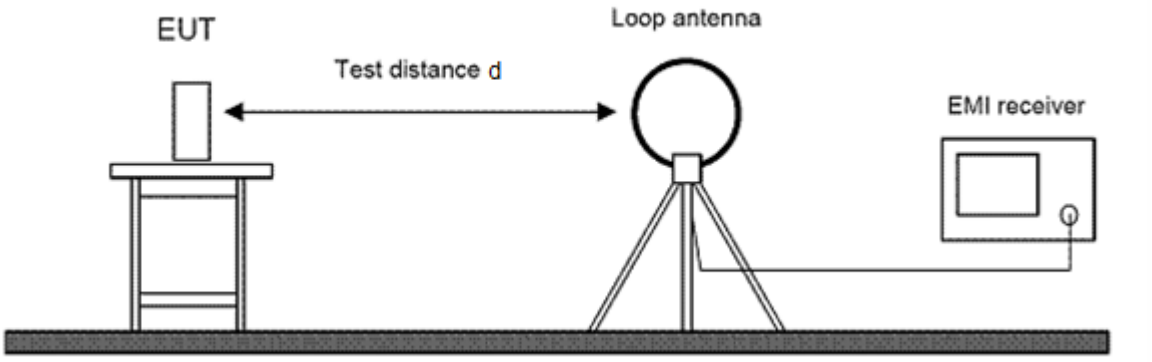


Figure 3: Setup for radiated emissions test below 30 MHz

6.5 Radiated emissions from 30 MHz to 1 GHz

Radiated emissions in the frequency range 30 MHz to 1 GHz are measured according to clause 6.5 of ANSI C63.10 using a semi-anechoic chamber (SAC) with a ground plane on the floor. The measurement distance is 3 meters. The emissions of the EUT are recorded with an EMI test receiver configured as described in table 10.

Frequency (f)	*Measurement receiver bandwidth*	*Step size*	*Detector type*		
			Prescan	*Prescan with FFT*	*Final scan*
30 MHz ≤ f ≤ 1 GHz	120 kHz	≤ 60 kHz	Peak	Quasi-peak	Quasi-peak

Table 10: Bandwidth and detector type for radiated emissions test from 30 MHz to 1 GHz

Frequency (MHz)	*Reading value (dBµV)*	*Antenna correction (dB/m)*	*Cable attenuation (dB)*	*Correction factor (Corr.) (dB)*	*Level (dBµV/m)*
100	30.00	11.71	1.06	12.77	42.77

Table 11: Sample calculation

Correction factor = Antenna correction + Cable attenuation

Level = Reading value + Correction factor = 30 dBµV + 12.77 dB = 42.77 dBµV/m

The measurement antenna is a combination of a biconical antenna and a logarithmic-periodic dipole array antenna. It is mounted on a support capable of allowing the antenna to be used in either horizontal or vertical polarization and in a height between 1 m and 4 m above the ground plane.

If the test receiver is capable of FFT analysis, it is used for prescans, but not for final scans.

The radiated emissions test from 30 MHz to 1 GHz is performed in the following steps:

6.5.1 Automatic test method

a) The measurement antenna is oriented initially for vertical polarization.
b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
c) The measurement equipment is connected to the measurement antenna and set-up according to the specifications of the test (see table 10).
d) The table position is set to 0°. The table step is defined as 20°.
e) The antenna height is set to 1 m. The antenna step is defined as 50 cm.
f) The spectrum for the full frequency range is recorded. If the emission at a certain frequency is higher than the levels already recorded, the polarization and height of the measurement antenna as well as the current table position are noted as the maximum position.
g) The antenna height is increased to 4 m in antenna steps as defined in step e). At each height, step f) is repeated.
h) The polarization of the measurement antenna is changed to horizontal.
i) The antenna height is decreased from 4 m to 1 m in antenna steps as defined in step e). At each height, step f) is repeated.
j) The EUT is rotated in a horizontal plane through 360° in table steps as defined in step d). At each table position, steps e) to i) are repeated.
k) After the last prescan, the significant maximum emissions with their polarizations and heights of the measurement antenna as well as their table positions are determined and collected in a list.
l) With the test receiver set to the first frequency of the list, the measurement antenna is set to the polarization and height and the table is moved to the position as determined during prescans.
m) For maximization, the antenna is moved up and down by the antenna step as defined in step e) and the EUT is rotated clockwise and counterclockwise by the table step as defined in step d) while measuring the emission level continuously.
n) The worst-case positions of antenna and table and the maximum emission level are recorded.
o) Steps l) to n) are repeated for all other frequencies in the list.

If the EUT may be used in various positions, steps a) to o) are repeated in two other orthogonal positions.

6.5.2 Manual test method

a) The measurement antenna is oriented initially for vertical polarization.
b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
c) The measurement equipment is connected to the measurement antenna and set-up according to the specifications of the test (see table 10).
d) The table position is set to 0°.
e) The antenna height is set to 1 m.
f) The spectrum for the full frequency range is recorded while the EUT is rotated in a horizontal plane through 360° continuously. The measurement is performed with peak detector and max hold.
g) The antenna height is increased to 4 m in steps of 50 cm. At each height, step f) is repeated.
h) The polarization of the measurement antenna is changed to horizontal.
i) The antenna height is decreased from 4 m to 1 m in steps of 50 cm. At each height, step f) is repeated.
j) After the last prescan, the significant maximum emissions with their polarizations and heights of the measurement antenna are determined and collected in a list.
k) For the final scan the test receiver is set to the first frequency of the list. By using the bargraph max hold function of the measurement receiver the emission in consideration is maximised by rotating the EUT in the horizontal plane through 360° and moving the antenna from 1 m to 4 m.
l) The worst-case positions of antenna and table and the maximum emission level are recorded.
m) Steps k) to l) are repeated for all other frequencies in the list.

If the EUT may be used in various positions, steps a) to m) are repeated in two other orthogonal positions.

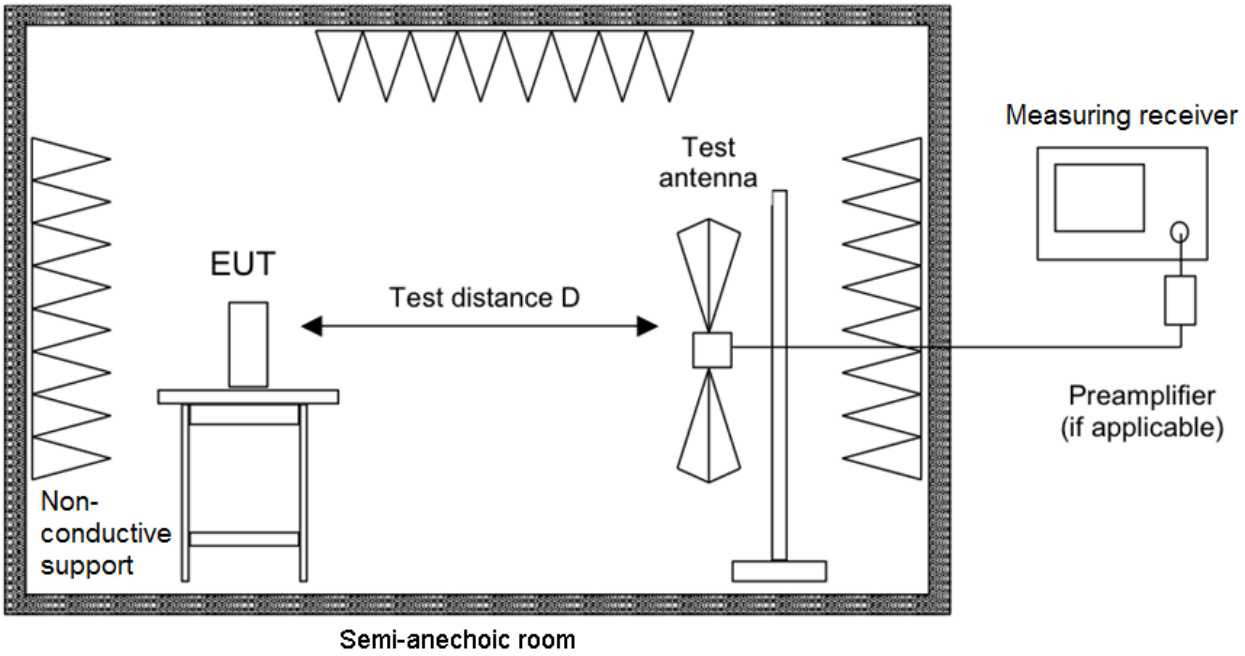


Figure 4: Setup for radiated emissions test from 30 MHz to 1 GHz

6.6 Radiated emissions above 1 GHz

Radiated emissions above 1 GHz are measured according to clause 6.6 of ANSI C63.10 by conducting exploratory and final radiated emission tests. According to clause 6.6.4.1 of ANSI C63.10, measurements may be performed at a distance closer than that specified in the requirements. However, an attempt shall be made to avoid making final measurements in the near field of both the measurement antenna and the EUT.

For measurement of radiated emissions above 1 GHz, horn antennas are used.

Test chamber	*Frequency (MHz)*	*Reading value (dBµV)*	*Antenna correction (dB/m)*	*Correction pre-amplifier (dB)*	*Cable attenuation (dB)*	*Correction factor (Corr.) (dB)*	*Level (dBµV/m)*
SAC3	2400	50.00	27.76	-47.91	5.24	-14.92	35.08
FS-SAC	2400	50.00	27.76	-34.57	3.51	-3.30	46.70

Table 12: Sample calculation

Correction factor = Antenna correction + Correction pre-amplifier + Cable attenuation

SAC3:
Level = Reading value + Correction factor = 50.00 dBµV - 14.92 dB/m = 35.08 dBµV/m

FS-SAC:
Level = Reading value + Correction factor = 50.00 dBµV - 3.30 dB/m = 46.70 dBµV/m

6.6.1 Exploratory radiated emissions measurements

Exploratory radiated emissions above 1 GHz are measured in a semi-anechoic chamber with RF absorbing material on the floor or a fully anechoic room. They are performed by moving the receiving antenna over all sides of the EUT at a closer distance (e.g. 0.5 or 1 m) while observing the display of the test receiver to find the emissions to be re-tested during final radiated emission measurements.

According to clause 5.3.3 of ANSI C63.10, when performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade of distance (inverse of linear distance for field-strength measurements). To simplify testing and documentation, the limits are increased accordingly instead of decreasing the results.

The emissions of the EUT are displayed and recorded with an EMI test receiver operating in the spectrum analyzer mode using the settings as described in table 13.

Frequency (f)	*Resolution bandwidth*	*Video bandwidth*	Sweep time	*Trace detector(s)*
f ≥ 1 GHz	1 MHz	3 MHz	AUTO	Max Peak, Average

Table 13: Bandwidth and trace settings for exploratory radiated emissions test above 1 GHz

If during exploratory radiated emissions measurements no levels to be re-tested are found, the final radiated emissions measurement may be omitted. In this case, the chart of the exploratory radiated emissions measurements has to be reported.

6.6.2 Final radiated emissions measurements

Final radiated emissions above 1 GHz are measured in the semi-anechoic chamber (SAC3) or Free space semi-anechoic chamber (FS-SAC) with RF absorbing material on the floor between measurement antenna and EUT. The measurement distance is 3 meters in the semi-anechoic chamber (SAC3) or 1.5 m in the Free space semi-anechoic chamber (FS-SAC). The emissions of the EUT are recorded with an EMI test receiver configured as described in table 14.

Frequency (f)	*Measurement receiver bandwidth*	*Step size*	*Detector type*	
			Prescan	*Final scan*
f ≥ 1 GHz	1 MHz	≤ 500 kHz	Peak, Average	Peak, Average

Table 14: Bandwidth and detector type for final radiated emissions test above 1 GHz

Prescans are performed with both detectors activated at the same time. If the test receiver is capable of FFT analysis, it is used for prescans, but not for final scans.

The horn antenna is mounted on a support capable of allowing the antenna to be used in either horizontal or vertical polarization and to be moved in a scan height range between 1 m and the scan height upper range defined in clause 6.6.3.3 of ANSI C63.10. When the EUT is manipulated through three different orientations, the scan height upper range for the measurement antenna is limited to 2.5 m above the ground plane.or 0.5 m above the top of the EUT, whichever is higher. Otherwise, the scan height upper range is 4 m above the ground plane.
To keep the emission signal within the illumination area of the 3 dB beamwidth of the measurement antenna, the automatic tilt function of the antenna support device is used to point the antenna at an angle toward the source of the emission.

The final radiated emissions test above 1 GHz is performed in the following steps:

6.6.2.1 Automatic measurement method

a) The measurement antenna is oriented initially for vertical polarization.
b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
c) The measurement equipment is connected to the measurement antenna and set-up according to the specifications of the test (see table 14).
d) The table position is set to 0°. The table step is defined as 20°.
e) The antenna height is set to 1 m. The antenna step is defined as 50 cm.
f) The spectrum for the full frequency range is recorded. If the emission at a certain frequency is higher than the levels already recorded, the polarization and height of the measurement antenna as well as the current table position are noted as the maximum position.
g) The antenna height is increased to the scan height upper range in antenna steps as defined in step e). At each height, step f) is repeated.
h) The polarization of the measurement antenna is changed to horizontal.
i) The antenna height is decreased from the scan height upper range to 1 m in antenna steps as defined in step e). At each height, step f) is repeated.
j) The EUT is rotated in a horizontal plane through 360° in table steps as defined in step d). At each table position, steps e) to i) are repeated.
k) After the last prescan, the significant maximum emissions with their polarizations and heights of the measurement antenna as well as their table positions are determined and collected in a list.
l) With the test receiver set to the first frequency of the list, the measurement antenna is set to the polarization and height and the table is moved to the position as determined during prescans.
m) For maximization, the antenna is moved up and down by the antenna step as defined in step e) and the EUT is rotated clockwise and counterclockwise by the table step as defined in step d) while measuring the emission level continuously.
n) The worst-case positions of antenna and table and the maximum emission level are recorded.
o) Steps l) to n) are repeated for all other frequencies in the list.

If the EUT may be used in various positions, steps a) to o) are repeated in two other orthogonal positions.

6.6.2.2 Manual measurement method

a) The measurement antenna is oriented initially for vertical polarization.
b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
c) The measurement equipment is connected to the measurement antenna and set-up according to the specifications of the test (see table 14).
d) The table position is set to 0°.
e) The antenna height is set to 1 m.
f) The spectrum for the full frequency range is recorded while the EUT is rotated in a horizontal plane through 360° continuously. The measurement is performed with peak detector and max hold.
g) The antenna height is increased to the scan height upper range in steps of 50 cm. At each height, step f) is repeated.
h) The polarization of the measurement antenna is changed to horizontal.
i) The antenna height is decreased from the scan height upper range to 1 m in steps of 50 cm. At each height, step f) is repeated.
j) After the last prescan, the significant maximum emissions with their polarizations are determined and collected in a list.
k) For the final scan the test receiver is set to the first frequency of the list. By using the bargraph max hold function of the measurement receiver the emission in consideration is maximised by rotating the EUT in the horizontal plane through 360° and moving the antenna from 1 m to 4 m (2.5 m).
l) The worst-case positions of antenna and table and the maximum emission level are recorded.
m) Steps k) to l) are repeated for all other frequencies in the list.

If the EUT may be used in various positions, steps a) to m) are repeated in two other orthogonal positions.

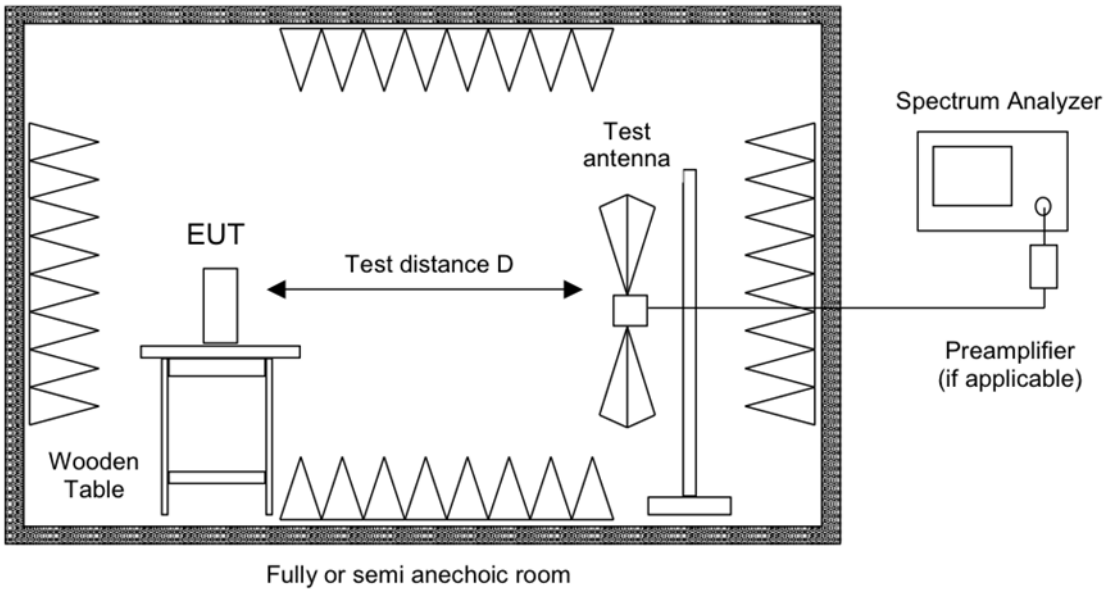


Figure 5: Setup for radiated emissions test above 1 GHz

6.7 Bandwidth measurements

In case of antenna-port conducted tests as described in clause 6.2 cannot be performed, according to section 3.0 of KDB 558074 D01, results of radiated tests are used for demonstrating compliance to the conducted emission requirements. For details about conversion see clause 6.1.2

6.7.1 6 dB bandwidth (DTS bandwidth)

The 6 dB bandwidth or DTS bandwidth is measured according to clause 8.0 of KDB Publication 558074, document D01, using the following settings:

a) Resolution bandwidth RBW = 100 kHz
b) Video bandwidth (VBW) ≥ 3 x RBW
c) Detector = Peak
d) Trace mode = max hold
e) Sweep = auto couple

After the trace is stabilized, 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.

If using the automatic bandwidth measurement capability of the test instrument (6 dB down function), care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB. In addition, it has to be checked that this function delivers the two outermost amplitude points.

6.7.2 99 % occupied bandwidth

According to section 6.7 of RSS-Gen, the occupied bandwidth (OBW) is defined as the 99 % emission bandwidth.

The span of the spectrum analyzer is set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
The resolution bandwidth is in the range of 1 % to 5 % of the occupied bandwidth and the video bandwidth is not smaller than three times the resolution bandwidth. Video averaging is not permitted.
If possible, the detector of the spectrum analyzer is set to “Sample”. However, if the device is not transmitting continuously, a peak, or peak hold is used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement).

To measure the 99 % emission bandwidth, the OBW function of the test receiver is used with the power bandwidth set to 99 %. This function indicates the lowest frequency (starting from the left side of the span) and the highest frequency (starting from the right side of the span) where 0.5% of the total sum is reached. The difference between the two frequencies is the 99 % occupied bandwidth.

6.8 Maximum peak conducted output power

In case of antenna-port conducted tests as described in clause 6.2 cannot be performed, according to section 3.0 of KDB 558074 D01, results of radiated tests are used for demonstrating compliance to the conducted emission requirements. For details about conversion see clause 6.1.2

The maximum conducted output power test method for digital transmission systems (DTS) refers to section 8.3.1.1 of KDB Publication 558074, document D01.

The spectrum analyzer settings are as follows:

a) Span ≥ 3 x RBW, centered on a channel
b) RBW ≥ DTS bandwidth
c) VBW ≥ 3 x RBW
d) Sweep time = auto coupled
e) Detector function = peak
f) Trace mode = max hold
g) Reference level = more than 10·log(OBW/RBW) dB above peak of spectral envelope

After the trace is stabilized, the marker-to-peak function is used to set the marker to the peak of the emission. The indicated level is the maximum peak conducted output power.

6.9 Power spectral density

The power spectral density test method for DTS systems refers to section 8.4 of KDB Publication 558074, document D01.

The spectrum analyzer settings are as follows:

a) Span = 1.5 times the DTS bandwidth, centered on a channel
b) RBW: 3 kHz ≤ RBW ≤ 100 kHz
c) VBW ≥ 3 x RBW
d) Sweep time = auto coupled or ≥ span/RBW in seconds, whichever is greater
e) Detector function = peak
f) Trace mode = max hold
g) Reference level = more than 10·log(OBW/RBW) dB above peak of spectral envelope

After the trace is stabilized, the marker-to-peak function is used to set the marker to the peak of the emission. The indicated level is the power spectral density.

In case of antenna-port conducted tests as described in clause 6.2 cannot be performed, according to section 3.0 of KDB 558074 D01, results of radiated tests are used for demonstrating compliance to the conducted emission requirements. For details about conversion see clause 6.1.2

7 Test results

This clause gives details about the test results as collected in the summary of test results on page 6.

For information about measurement uncertainties see page 57.

The climatic conditions are recorded during the tests. It is ensured that the climatic conditions are within the following ranges:

Ambient temperature	*Ambient humidity*	*Ambient pressure*
15°C to 35°C	30 % to 75 %	86 kPa to 106 kPa

7.1 AC powerline conducted emissions

Section(s) in 47 CFR Part 15:	Requirement(s):	15.207(a)
	Reference(s)	ANSI C63.10, clause 6.2
Section(s) in RSS:	Requirement(s):	RSS-Gen, section 8.8
	Reference(s):	ANSI C63.10, clause 6.2

Performed by:	Patricio Montenegro, M.Sc.-Ing.	Date(s) of test:	February 17, 2025
Result:	☒ Test passed	☐ Test not passed	

7.1.1 Test equipment

Description	*Designation*	*Manufacturer*	*Inventory number(s)*	*Last check*	*Next check*	*Check type*
Shielded room	P92007	S+M Components	E00107	---	---	N/A
EMI test receiver	ESR7	Rohde & Schwarz	E01549	2024-08-16	2025-08-16	C
Attenuator (10 dB)	HFP 50	Trilithic	E00355	2024-06-18	2025-12-18	V
Artificial mains network (AMN) with artificial hand connection	ENV432	Rohde & Schwarz	E01733	2024-12-19	2025-12-19	C
Cable set no. 1 for shielded room	RG 223/U	Huber & Suhner	E00741	2024-06-18	2025-12-18	V
	RG 223/U	Huber & Suhner	E00804	2024-06-18	2025-12-18	V
Test software	EMC32-EB (V10.60.20)	Rohde & Schwarz	E00777	---	---	N/A

Note(s)
1. C = Calibration
2. V = Verification

7.1.2 Limits

According to §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.

According to §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.

According to RSS-Gen, section 8.8:
Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in of the following table, as measured using a 50 µH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in the following table shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

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

Table 15: Limits for AC powerline conducted emissions according to 15.207(a) and RSS-Gen, section 8.8

*Decreases with the logarithm of the frequency

7.1.3 Test procedure

The AC powerline conducted emissions are measured using the test procedure as described in clause 6.3.

7.1.4 Test results

Note(s):
1. The test was performed at 120 V and 60 Hz.

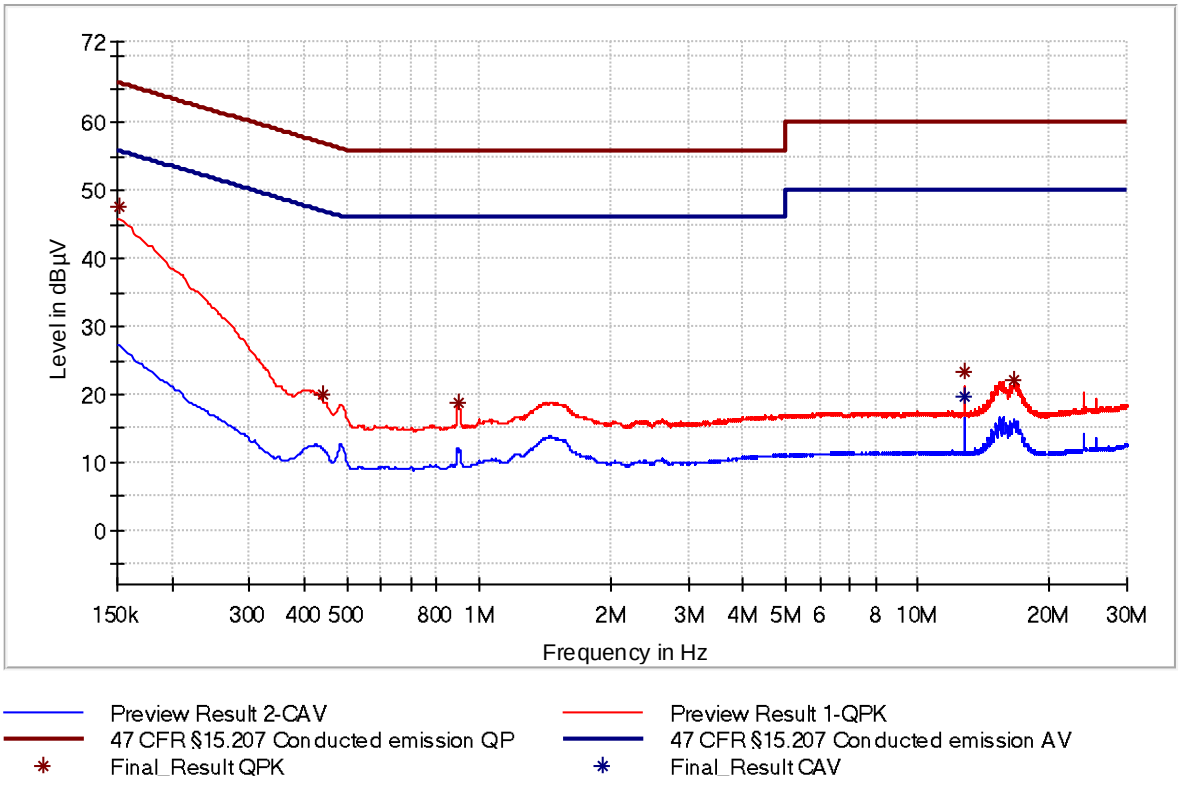


Figure 6: Chart of AC powerline conducted emissions on L1

Frequency (MHz)	*QuasiPeak (dBµV)*	*Average (dBµV)*	*Limit (dBµV)*	*Margin (dB)*	*Line*	*PE*	*Corr. (dB)*	*Result*
0.152	47.6	---	65.9	18.3	L1	GND	20.3	Passed
0.440	20.1	---	57.1	37.0	L1	GND	20.3	Passed
0.895	18.9	---	56.0	37.1	L1	GND	20.3	Passed
12.800	---	19.8	50.0	30.2	L1	GND	20.9	Passed
12.800	23.3	---	60.0	36.7	L1	GND	20.9	Passed
16.562	22.2	---	60.0	37.8	L1	GND	21.0	Passed

Table 16: Results of AC powerline conducted emissions on L1

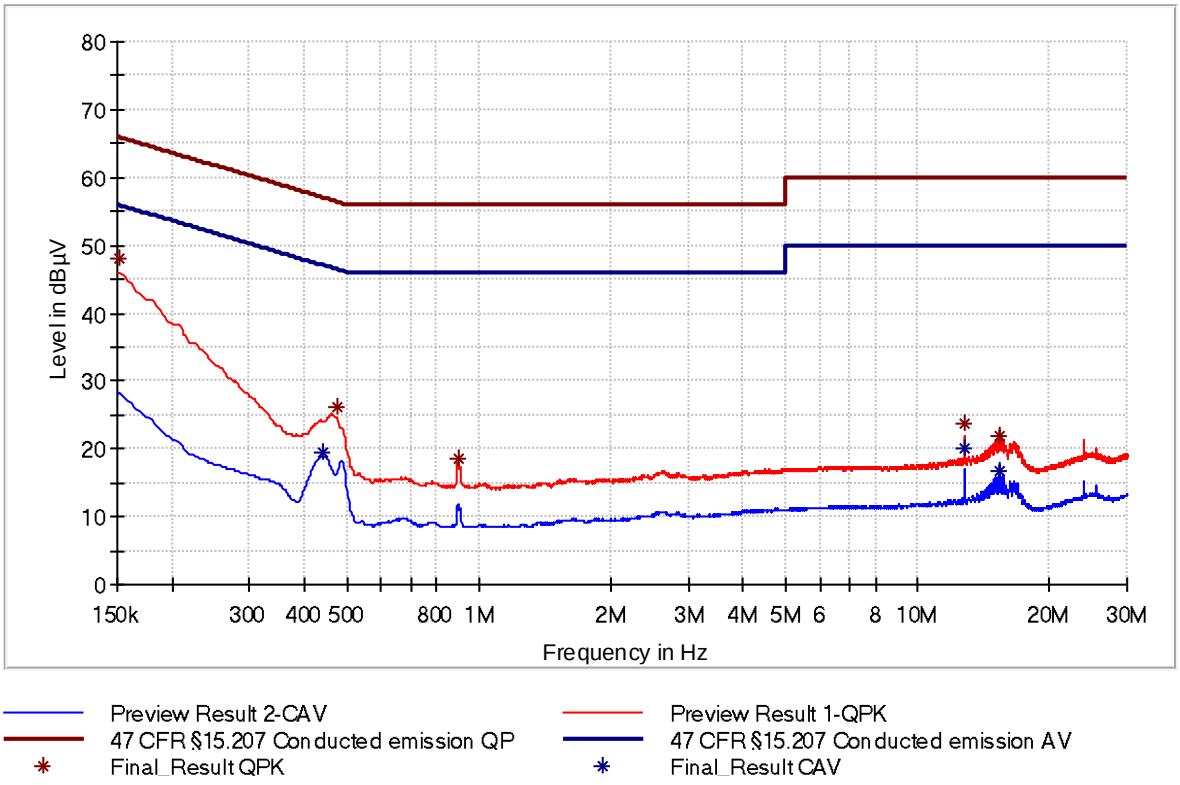


Figure 7: Chart of AC powerline conducted emissions on N

Frequency (MHz)	*QuasiPeak (dBµV)*	*Average (dBµV)*	*Limit (dBµV)*	*Margin (dB)*	*Line*	*PE*	*Corr. (dB)*	*Result*
0.152	48.0	---	65.9	17.9	N	GND	20.2	Passed
0.440	---	19.6	47.1	27.5	N	GND	20.3	Passed
0.474	26.0	---	56.4	30.4	N	GND	20.3	Passed
0.895	18.6	---	56.0	37.4	N	GND	20.3	Passed
12.800	---	20.1	50.0	29.9	N	GND	21.1	Passed
12.800	23.8	---	60.0	36.2	N	GND	21.1	Passed
15.311	---	16.6	50.0	33.4	N	GND	21.2	Passed
15.311	21.8	---	60.0	38.2	N	GND	21.2	Passed

Table 17: Results of AC powerline conducted emissions on N

7.2 Calculated conducted output power

Section(s) in 47 CFR Part 15:	Requirement(s):	15.247(b)
	Reference(s):	KDB 558074 D01, clause 8.3 ANSI C63.10, clause 11.9
Section(s) in RSS:	Requirement(s):	RSS-247, section 5.4(d)
	Reference(s):	KDB 558074 D01, clause 8.3 ANSI C63.10, clause 11.9

Performed by:	Patricio Montenegro, M.Sc.-Ing.	Date(s) of test:	February 12, 2025
Result:	☒ Test passed	☐ Test not passed	

7.2.1 Test equipment

Description	*Designation*	*Manufacturer*	*Inventory number*	*Last check*	*Next check*	*Check type*
Semi-anechoic chamber (FS-SAC) with floor absorbers	FS-SAC	Element Materials Technology Straubing	E00100	2024-02-21	2027-02-21	V
EMI test receiver	ESW44	Rohde & Schwarz	E00895	2025-01-09	2026-01-09	C
Double ridged broadband horn antenna	BBHA 9120D	Schwarzbeck Mess-Elektronik	W00053	2022-09-27	2025-09-27	C
Cable set anechoic chamber (FS-SAC) (1 GHz to 26.5 GHZ)	262-0942-1500	Teledyne Storm Microwave	E00435	2024-02-19	2025-08-19	V
	SF104EA/11PC35/11PC35/5000MM	Huber & Suhner	E01032	2023-08-29	2025-02-28	V
	262-0942-1500	Teledyne Storm Microwave	E00433	2024-02-19	2025-08-19	V

Note(s)
1. C = Calibration
2. V = Verification

7.2.2 Limits

According to §15.247(b)(3):
For systems using digital modulation in the 2400-2483.5 MHz band: 1 Watt (30 dBm).
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.

According to §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. 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 the intentional radiator shall be reduced below the stated values in paragraphs (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.

According to RSS-247, section 5.4(d):
For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling 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 transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

7.2.3 Test procedure

The maximum peak conducted output power is measured using the test procedure as described in clause 6.8 and referring to the

☐ test method for conducted measurements as described in clause 6.2.
☒ test method for radiated measurements as described in clause 6.6.

7.2.4 Test results

Note(s):
1. The gain of the antenna is below 6 dBi, therefore a reduction of the conducted limit was not applied.
2. Pre-measurements were performed to declare the worst case which is documented below.
3. EIRP is calculated as defined in clause 9.5 of ANSI C63.10-2013.
4. Conducted output power is calculated by subtracting the gain of the EIRP.

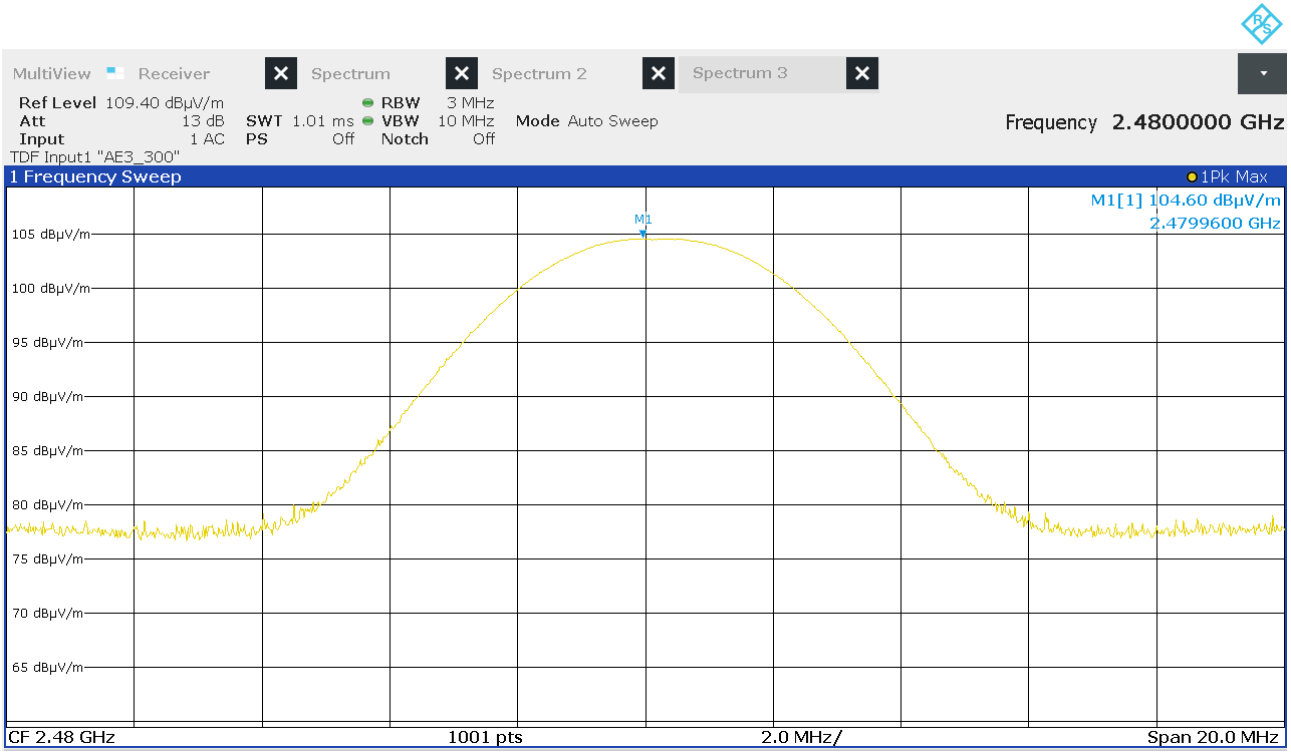


Figure 8: Chart of field strength at 3 m on highest channel, EUT position X, antenna polarization horizontal

Channel	*EUT Pos.*	*Field strength (dBµV/m) at 3 m*	*Detector*	*Height (cm)*	*Pol.*	*Azimuth (deg)*	*Corr. (dB/m)*	*EIRP (dBm)*
High	X	104.6	Pk	192	H	176	31.4	9.4

Table 18: Results of field strength at 3 m on middle channel

Channel	*EIRP (dBm)*	*Antenna gain (dBi)*	*Calculated conducted output power (dBm)*	*Limit*		*Margin (dB)*	*Results*
				(dBm)	*(W)*		
High	9.4	3.3	6.1	30.0	1.0	23.9	Passed

Table 19: Results of calculated conducted output power on highest channel with peak-detector

7.3 Band-edge measurements

Section(s) in 47 CFR Part 15:	Requirement(s):	15.247(d)
	Reference(s):	KDB 558074 D01, clauses 8.5, 8.6 and 8.7 ANSI C63.10, clauses 11.11 and 11.12
Section(s) in RSS:	Requirement(s):	RSS-247, section 5.5
	Reference(s):	KDB 558074 D01, clauses 8.5, 8.6 and 8.7 ANSI C63.10, clauses 11.11 and 11.12

Performed by:	Patricio Montenegro, M.Sc.-Ing.	Date(s) of test:	February 13, 2025
Result:	☒ Test passed	☐ Test not passed	

7.3.1 Test equipment

Description	*Designation*	*Manufacturer*	*Inventory number*	*Last check*	*Next check*	*Check type*
Semi-anechoic chamber (FS-SAC) with floor absorbers	FS-SAC	Element Materials Technology Straubing	E00100	2024-02-21	2027-02-21	V
EMI test receiver	ESW44	Rohde & Schwarz	E00895	2025-01-09	2026-01-09	C
Double ridged broadband horn antenna	BBHA 9120D	Schwarzbeck Mess-Elektronik	W00053	2022-09-27	2025-09-27	C
Cable set anechoic chamber (FS-SAC) (1 GHz to 26.5 GHZ)	262-0942-1500	Teledyne Storm Microwave	E00435	2024-02-19	2025-08-19	V
	SF104EA/11PC35/11PC35/5000MM	Huber & Suhner	E01032	2023-08-29	2025-02-28	V
	262-0942-1500	Teledyne Storm Microwave	E00433	2024-02-19	2025-08-19	V

Note(s)
1. C = Calibration
2. V = Verification

7.3.2 Limits

According to §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)).

According to RSS-247 section 5.5:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d) of RSS-247, the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen section 8.9:
Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6 of RSS-Gen. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission

According to RSS-Gen section 8.10:
Restricted frequency bands, identified in table 7 of RSS-Gen, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

a The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
b Unwanted emissions that fall into restricted frequency bands listed in table 7 of RSS-Gen shall comply with the limits specified in table 5 and table 6 of RSS-Gen.
c Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 of RSS-Gen shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6 of RSS-Gen.

Frequency	*Field strength*		*Measurement distance*
(MHz)	*(µV/m)*	*(dBµV/m)*	*(m)*
Above 960	500	54	3

Table 20: General radiated emission limits above 960 MHz according to §15.209 and RSS-Gen

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
13.36-13.41			

Table 21: Restricted bands of operation according to §15.205 and RSS-Gen section 8.10

7.3.3 Test procedure

The band-edge is measured using the test procedure as described in clauses 11.11 and 11.12 of ANSI C63.10-2013 and referring to the

The band-edge measurements are performed using the

☐ test procedure for conducted measurements as described in clause 6.2.
☐ test procedure for automatic radiated measurements as described in clause 6.6.2.1.
☒ test procedure for manual radiated measurements as described in clause 6.6.2.2.

7.3.4 Test results

Test distance:	Final tests:	☒ 3 m	☐ 1.5 m
Polarization:	☒ horizontal	☒ vertical	
EUT position:	☒ Position X	☒ Position Y	☒ Position Z

7.3.4.1 Lower band edge

Note(s):
1 Pre-measurements were performed to declare the worst case which is documented below.

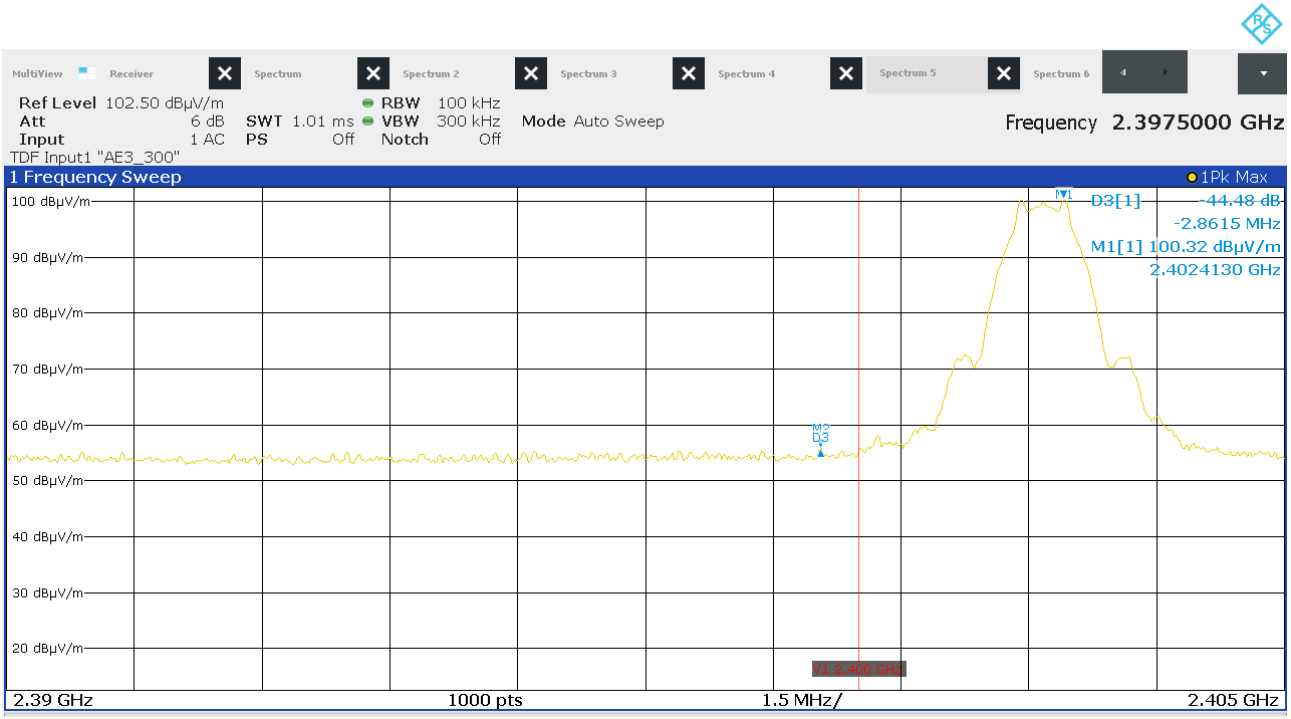


Figure 9: Chart of lower band-edge measurement on lowest channel, EUT position X, antenna polarization horizontal

Frequency (MHz)	*EUT Pos.*	*Det.*	*Measured Margin (dB)*	*Limit of minimum margin*	*Margin (dB)*	*Height (cm)*	*Pol.*	*Azimuth (deg)*	*Corr. (dB/m)*	*Result*
2399.551	X	Pk	44.5	≥ 20.0	24.5	192	H	176	31.3	Passed

Table 22: Test results of lower band-edge measurements on lowest channel, EUT position X, antenna polarization horizontal

7.3.4.2 Upper band edge

Note(s):
1 Pre-measurements were performed to declare the worst case which is documented below.
2 The average measurement was performed according to clause 11.12.2.5.2 of ANSI C63.10.

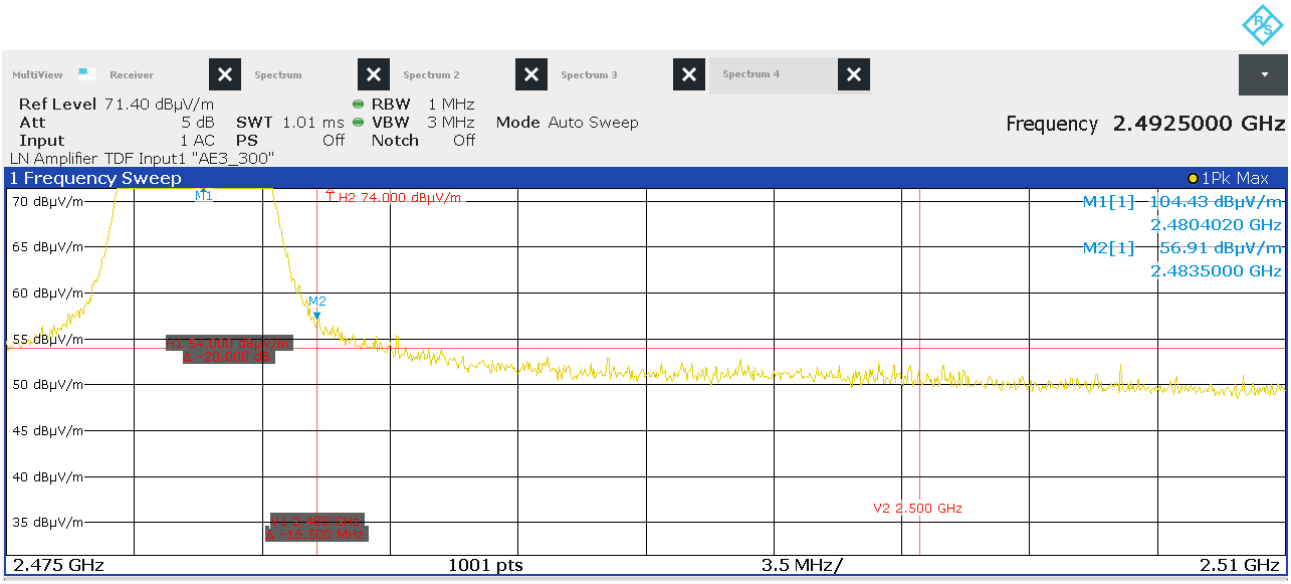


Figure 10: Chart of higher band-edge measurement on highest channel (PK), EUT position X, antenna polarization horizontal

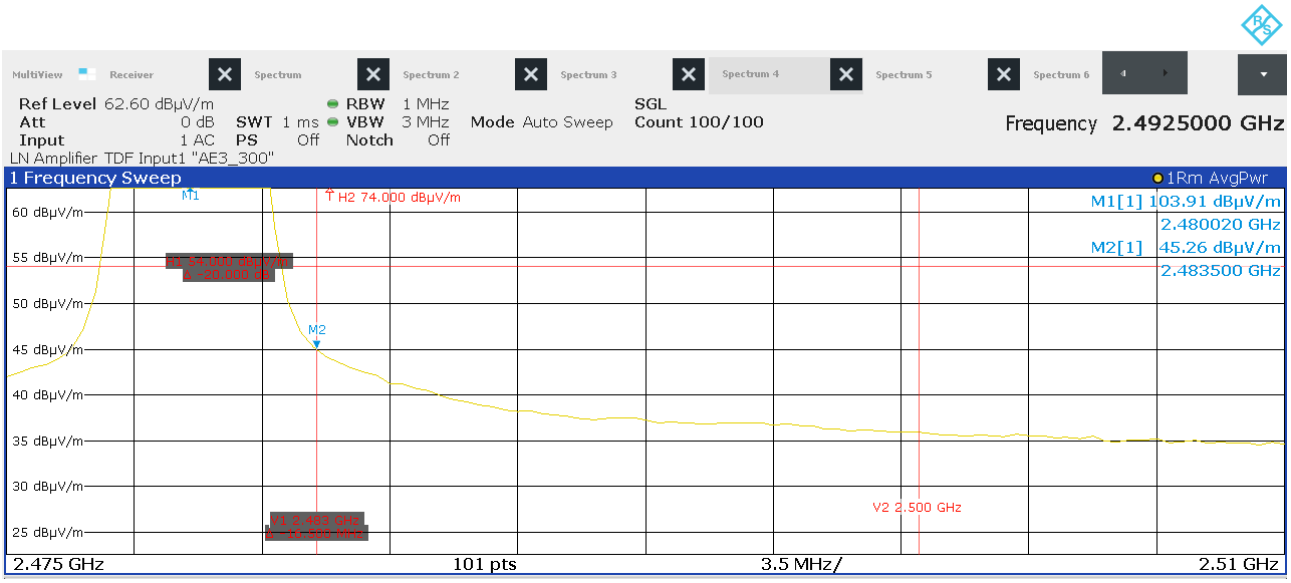


Figure 11: Chart of higher band-edge measurement on highest channel (AV), EUT position X, antenna polarization horizontal

Freq. (MHz)	*EUT Pos.*	*Det.*	*Level (dBµV/m) at 3 m*	*Peak limit (dBµV/m) at 3 m*	*Mar. (dB)*	*Average limit (dBµV/m) at 3 m*	*Mar. (dB)*	*Height (cm)*	*Pol.*	*Azim. (deg)*	*Corr. (dB/m)*	*Res.*
2483.500	X	Pk	56.9	74.0	17.1	---	---	192	H	176	31.4	P
2483.500	X	AV	45.3	---	---	54.0	8.7	192	H	176	31.4	P

Table 23: Test results of higher band-edge measurements on highest channel

with:
Freq. = Frequency
EUT Pos. = EUT Position
Det. = Detector
Mar. = Margin
Pol. = Polarization of the measurement antenna
Azim. (deg) = Azimuth (degree)
Corr. = Correction factor
Res. = Result
P = Passed
Np = Not passed

7.4 Radiated emissions below 30 MHz

Section(s) in 47 CFR Part 15:	Requirement(s):	15.247(d)
	Reference(s):	KDB 558074 D01, clauses 8.5 and 8.6 ANSI C63.10, clauses 11.11 and 11.12
Section(s) in RSS:	Requirement(s):	RSS-247, section 5.5
	Reference(s):	KDB 558074 D01, clauses 8.5 and 8.6 ANSI C63.10, clauses 11.11 and 11.12

Performed by:	Patricio Montenegro, M.Sc.-Ing.	Date(s) of test:	March 3, 2025
Result:	☒ Test passed	☐ Test not passed	

7.4.1 Test equipment

Description	*Designation*	*Manufacturer*	*Inventory number*	*Last check*	*Next check*	*Check type*
Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716	2023-01-03	2026-01-03	V
EMI test receiver	ESR7	Rohde & Schwarz	E00739	2024-03-08	2025-03-08	C
Loop antenna	HFH2-Z2	Rohde & Schwarz	E00060	2024-11-28	2025-11-28	C
Cable set no. 1 for semi-anechoic chamber SAC3	S04272B - 200cm	AME HF-Technik	E01285	2024-08-22	2026-02-22	V
	SF104E/11PC35/11PC35/2000MM	Huber & Suhner	E01435	2024-08-21	2026-02-21	V
	SF104EA/11PC35/11PC35/10000MM	Huber & Suhner	E01439	2024-05-06	2025-11-06	V

Note(s)
1. C = Calibration
2. V = Verification

7.4.2 Limits

According to §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)).

Frequency	*Field strength*		*Measurement distance*
(MHz)	*(µV/m)*	*(dBµV/m)*	*(m)*
0.009 – 0.490	2400/F(kHz) (266.67 – 4.90)	48.52 – 13.80	300
0.490 – 1.705	24000/F(kHz) (48.98 – 14.08)	33.80 – 22.97	30
1.705 – 30	30	29.54	30

Table 24: General radiated emission limits up to 30 MHz according to §15.209

According to RSS-247 section 5.5:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d) of RSS-247, the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen section 8.9:
Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6 of RSS-Gen. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission

According to RSS-Gen section 8.10:
Restricted frequency bands, identified in table 7 of RSS-Gen, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

a The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
b Unwanted emissions that fall into restricted frequency bands listed in table 7 of RSS-Gen shall comply with the limits specified in table 5 and table 6 of RSS-Gen.
c Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 of RSS-Gen shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6 of RSS-Gen.

Frequency	*Magnetic field strength*		*Measurement distance*
(MHz)	*(µA/m)*	*(dBµA//m)*	*(m)*
0.009 – 0.490	6.37/F(kHz)	-2.999 – -37.721	300
0.490 – 1.705	63.7/F(kHz)	-17.721 – -28.636	30
1.705 – 30	0.08	-21.94	30

Table 25: General radiated emission limits from 9 kHz to 30 MHz according to section 8.9 of RSS-Gen

Note:
1. In case of measurements that are performed at other distances than that specified in the requirements, the limits in the charts and tables reported with the test results are derived from the general radiated emission limits as listed in table 24 using the recalculation factor as described in clause 6.3.

7.4.3 Test procedure

The radiated emissions below 30 MHz are measured using the test procedure as described in clauses 11.11 and 11.12 of ANSI C63.10-2013 and referring to the

☐ test procedure for automatic radiated measurements as described in clause 6.4.
☒ test procedure for manual radiated measurements as described in clause 6.4.

7.4.4 Test results

Test distance:	☒ 3 m		
Antenna alignment:	☒ in parallel	☒ in line	☐ angle ….. °
EUT position:	☒ Position X	☒ Position Y	☒ Position Z

Note(s):

1 Pre-measurements were performed to declare the worst case which is documented below.

2 Pre-measurements have shown that there are no differences between the tested channels below 30 MHz, so the final measurement was only performed on channel high.

3 The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to Y – 51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-210 limit as it has to 15.209(a) limit.

4 Apart from the documented emissions, all other emissions were greater than 20 dB below the limit.

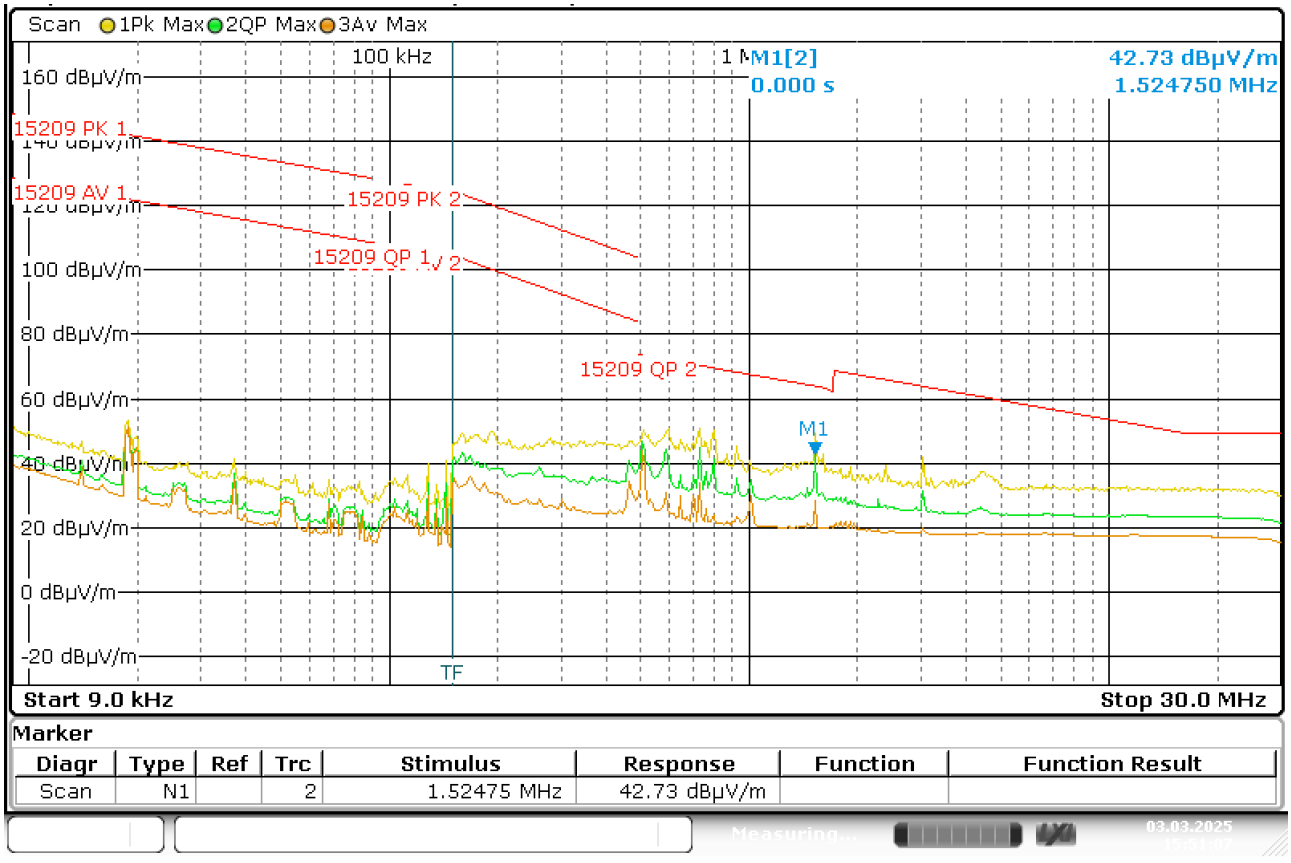


Figure 12: Chart of emissions test below 30 MHz on highest channel, EUT position X, antenna parallel

Freq. (MHz)	*EUT Pos.*	*Det.*	*Field strength (dBµV/m at 3 m)*	*Rec. factor*	*Calc. field strength (dBµV/m)*	*at dist. (m)*	*Limit (dBµV/m)*	*at dist. (m)*	*Mar. (dB)*	*Pol*	*Azim. (deg)*	*Corr. (dB/m)*	*Res*
1.525	X	QP	42.7	-40.0	2.7	30	23.9	30	21.2	O	67	19.7	P

Table 26: Final results of radiated emissions test below 30 MHz on highest channel according to § 15.209

with:
Freq. = Frequency
EUT Pos. = EUT Position
Det. = Detector
Rec. factor = Recalculation factor
Calc. = Calculated
at dis = at distance
Mar. = Margin
Pol. = Polarization of the measurement antenna
I = Polarization of the measurement antenna in line
O = Polarization of the measurement antenna parallel
Azim. (deg) = Azimuth (degree)
Corr. = Correction factor
Res. = Result
P = Passed
Np = Not passed

Freq. (MHz)	*EUT Pos.*	*Det.*	*Calc. field strength (dBµA/m at 3 m)*	*Rec. factor*	*Calc. field strength (dBµA/m)*	*at dist. (m)*	*Limit (dBµA/m)*	*at dist. (m)*	*Mar. (dB)*	*Pol*	*Azim. (deg)*	*Corr. (dB/m)*	*Res*
1.525	X	QP	-8.8	-40.0	-48.8	30	-27.6	30	21.2	O	67	-31.8	P

Table 27: Final results of radiated emissions test below 30 MHz on highest channel according to RSS-210

Note:
1. The calculated field strength (dBµA/m at 3 m) is the measured field strength (dBµV/m at 3 m) minus 51.5 dB.

with:
Freq. = Frequency
EUT Pos. = EUT Position
Det. = Detector
Rec. factor = Recalculation factor
Calc. = Calculated
at dis = at distance
Mar. = Margin
Pol. = Polarization of the measurement antenna
I = Polarization of the measurement antenna in line
O = Polarization of the measurement antenna parallel
Azim. (deg) = Azimuth (degree)
Corr. = Correction factor
Res. = Result
P = Passed
Np = Not passed

7.5 Radiated emissions from 30 MHz to 1 GHz

Section(s) in 47 CFR Part 15:	Requirement(s):	15.247(d)
	Reference(s):	KDB 558074 D01, clauses 8.5 and 8.6 ANSI C63.10, clauses 11.11 and 11.12
Section(s) in RSS:	Requirement(s):	RSS-247, section 5.5
	Reference(s):	KDB 558074 D01, clauses 8.5 and 8.6 ANSI C63.10, clauses 11.11 and 11.12

Performed by:	Patricio Montenegro, M.Sc.-Ing.	Date(s) of test:	February 26, 2025
Result:	☒ Test passed	☐ Test not passed	

7.5.1 Test equipment

Description	*Designation*	*Manufacturer*	*Inventory number*	*Last check*	*Next check*	*Check type*
Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716	2023-01-03	2026-01-03	V
EMI test receiver	ESW44	Rohde & Schwarz	E00895	2025-01-09	2026-01-09	C
TRILOG broadband antenna	VULB 9162	Schwarzbeck Mess-Elektronik	E00643	2024-04-17	2027-04-17	C
Cable set no. 1 for semi-anechoic chamber SAC3	S04272B - 200cm	AME HF-Technik	E01285	2024-08-22	2026-02-22	V
	SF104E/11PC35/11PC35/2000MM	Huber & Suhner	E01435	2024-08-21	2026-02-21	V
	SF104EA/11PC35/11PC35/10000MM	Huber & Suhner	E01439	2024-05-06	2025-11-06	V
Test software	EMC32-MEB (V10.60.20)	Rohde & Schwarz	E01073	---	---	N/A

Note(s)
1. C = Calibration
2. V = Verification

7.5.2 Limits

According to §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)).

According to RSS-247 section 5.5:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d) of RSS-247, the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen section 8.9:
Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6 of RSS-Gen. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission

According to RSS-Gen section 8.10:
Restricted frequency bands, identified in table 7 of RSS-Gen, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

a The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
b Unwanted emissions that fall into restricted frequency bands listed in table 7 of RSS-Gen shall comply with the limits specified in table 5 and table 6 of RSS-Gen.
c Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 of RSS-Gen shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6 of RSS-Gen.

Frequency	*Field strength*		*Measurement distance*
(MHz)	*(µV/m)*	*(dBµV/m)*	*(m)*
30 – 88	100	40.0	3
88 – 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

Table 28: General radiated emission limits ≥ 30 MHz according to §15.209 and RSS-Gen section 8.9

7.5.3 Test procedure

The radiated emissions from 30 MHz to 1 GHz are measured using the test procedure as described in clauses 11.11 and 11.12 of ANSI C63.10-2013 and referring to the

☒ test procedure for automatic radiated measurements as described in clause 6.5.
☐ test procedure for manual radiated measurements as described in clause 6.5.

7.5.4 Test results

Test distance:	☒ 3 m		
Polarization:	☒ horizontal	☒ vertical	
EUT position:	☒ Position X	☒ Position Y	☒ Position Z

Note(s)
1 Pre-measurements were performed to declare the worst case which is documented below.
2 Pre-measurements have shown that there are no differences between the tested channels in the range of 30 MHz to 1 GHz, so the final measurement was only performed on channel high.

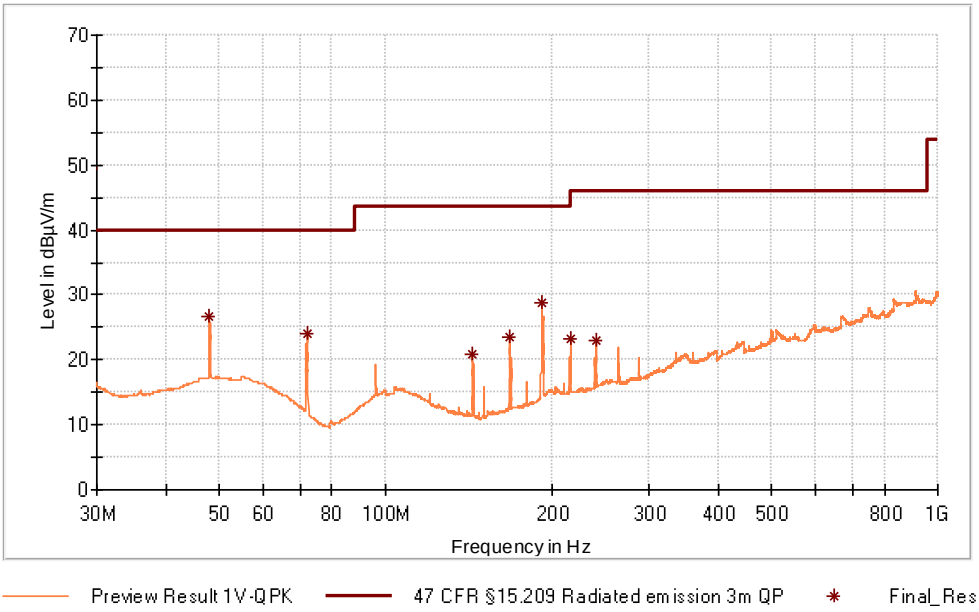


Figure 13: Chart of radiated emissions test from 30 MHz to 1 GHz on highest channel, EUT position X, antenna polarization vertical

Freq. (MHz)	*EUT Pos.*	*Det.*	*Field strength (dBµV/m at 3 m)*	*Limit (dBµV/m) at 3 m*	*Margin (dB)*	*Height (cm)*	*Pol.*	*Azim. (deg)*	*Corr. (dB/m)*	*Result*
48.00	X	QP	26.8	40.0	13.2	101	V	275	14.7	Passed
72.00	X	QP	24.0	40.0	16.0	100	V	163	9.9	Passed
144.00	X	QP	21.0	43.5	22.5	100	V	205	9.2	Passed
168.03	X	QP	23.4	43.5	20.1	100	V	155	10.1	Passed
192.03	X	QP	28.9	43.5	14.6	100	V	111	12.2	Passed
216.00	X	QP	23.2	43.5	20.3	100	V	68	12.7	Passed
240.00	X	QP	22.9	46.0	23.1	101	V	291	13.9	Passed

Table 29: Results of radiated emissions test from 30 MHz to 1 GHz on highest channel

with:
Freq. = Frequency
EUT Pos. = EUT Position
Det. = Detector
Pol. = Polarization of the measurement antenna
Azim. (deg) = Azimuth (degree)
Corr. = Correction factor

7.6 Radiated emissions from 1 GHz to 25 GHz (10th harmonic)

Section(s) in 47 CFR Part 15:	Requirement(s):	15.247(d)
	Reference(s):	KDB 558074 D01, clauses 8.5 and 8.6 ANSI C63.10, clauses 11.11 and 11.12
Section(s) in RSS:	Requirement(s):	RSS-247, section 5.5
	Reference(s):	KDB 558074 D01, clauses 8.5 and 8.6 ANSI C63.10, clauses 11.11 and 11.12

Performed by:	Patricio Montenegro, M.Sc.-Ing.	Date(s) of test:	February 13, 2025
Result:	☒ Test passed	☐ Test not passed	

7.6.1 Test equipment

Description	*Designation*	*Manufacturer*	*Inventory number*	*Last check*	*Next check*	*Check type*
Semi-anechoic chamber (FS-SAC) with floor absorbers	FS-SAC	Element Materials Technology Straubing	E00100	2024-02-21	2027-02-21	V
EMI test receiver	ESW44	Rohde & Schwarz	E00895	2025-01-09	2026-01-09	C
Preamplifier (1 GHz to 18 GHz)	ALS05749	Aldetec	W01007	2024-06-17	2025-06-17	V
Preamplifier (18 GHz to 40 GHz)	BBV 9721	Schwarzbeck Mess-Elektronik	W01350	2024-11-13	2025-11-13	V
Highpass filter (3-10 GHz)	WHK10-2700-3000-10000-40SS	Wainwright Instruments	W00774	2024-10-28	2026-04-28	V
Highpass filter (6.5-18 GHz)	WHKX10-5850-6500-18000-40SS	Wainwright Instruments	W00699	2024-10-28	2026-04-28	V
Double ridged broadband horn antenna	BBHA 9120D	Schwarzbeck Mess-Elektronik	W00053	2022-09-27	2025-09-27	C
Broadband Horn Antenna	BBHA 9170	Schwarzbeck Mess-Elektronik	W00055	2022-08-26	2025-08-26	C

Description	*Designation*	*Manufacturer*	*Inventory number*	*Last check*	*Next check*	*Check type*
Cable set anechoic chamber (FS-SAC) (1 GHz to 26.5 GHZ)	262-0942-1500	Teledyne Storm Microwave	E00435	2024-02-19	2025-08-19	V
	SF104EA/11PC35/11PC35/5000MM	Huber & Suhner	E01032	2023-08-29	2025-02-28	V
	262-0942-1500	Teledyne Storm Microwave	E00433	2024-02-19	2025-08-19	V
Cable for testing up to 40 GHz (exploratory testing)	SF102/11SK/11SK/2000MM	Huber & Suhner	E01441	2024-08-23	2026-02-23	V

Note(s)
1. C = Calibration
2. V = Verification

7.6.2 Limits

According to §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)).

According to RSS-247 section 5.5:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d) of RSS-247, the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen section 8.9:
Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6 of RSS-Gen. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission

According to RSS-Gen section 8.10:
Restricted frequency bands, identified in table 7 of RSS-Gen, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

a The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
b Unwanted emissions that fall into restricted frequency bands listed in table 7 of RSS-Gen shall comply with the limits specified in table 5 and table 6 of RSS-Gen.
c Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 of RSS-Gen shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6 of RSS-Gen.

Frequency	*Field strength*		*Measurement distance*
(MHz)	*(µV/m)*	*(dBµV/m)*	*(m)*
Above 960	500	54	3

Table 30: General radiated emission limits above 960 MHz according to §15.209 and RSS-Gen

7.6.3 Test procedure

The radiated emissions from 1 GHz to 25 GHz are measured using the test procedure as described in clauses 11.11 and 11.12 of ANSI C63.10-2013 and referring to the

☐ test procedure for automatic radiated measurements as described in clause 6.6.
☒ test procedure for manual radiated measurements as described in clause 6.6.

7.6.4 Test results

Test distance:	Exploratory tests: Final tests:	☐ 1 m ☒ 3 m	☒ 0.5 m ☐ 1.5 m
Polarization:	☒ horizontal	☒ vertical	
EUT position:	☒ Position X	☒ Position Y	☒ Position Z

Note(s):
1 The exploratory measurements from 17 GHz to 25 GHz are made at a measurement distance of 0.5 m. However, the limit lines for these tests are referenced to the limit lines at a measurement distance of 3 m (Offset – 15.6 dB).
2 Pre-measurements were performed to declare the worst case which is documented below. The table results show the final measurements of the emissions detected in the pre-measurements which are shown in this test report.
3 According to clause 6.6.4.3, note 1 of ANSI C63.10, if the maximized peak measured value complies with the average limit, than it is unnecessary to perform an average measurement.

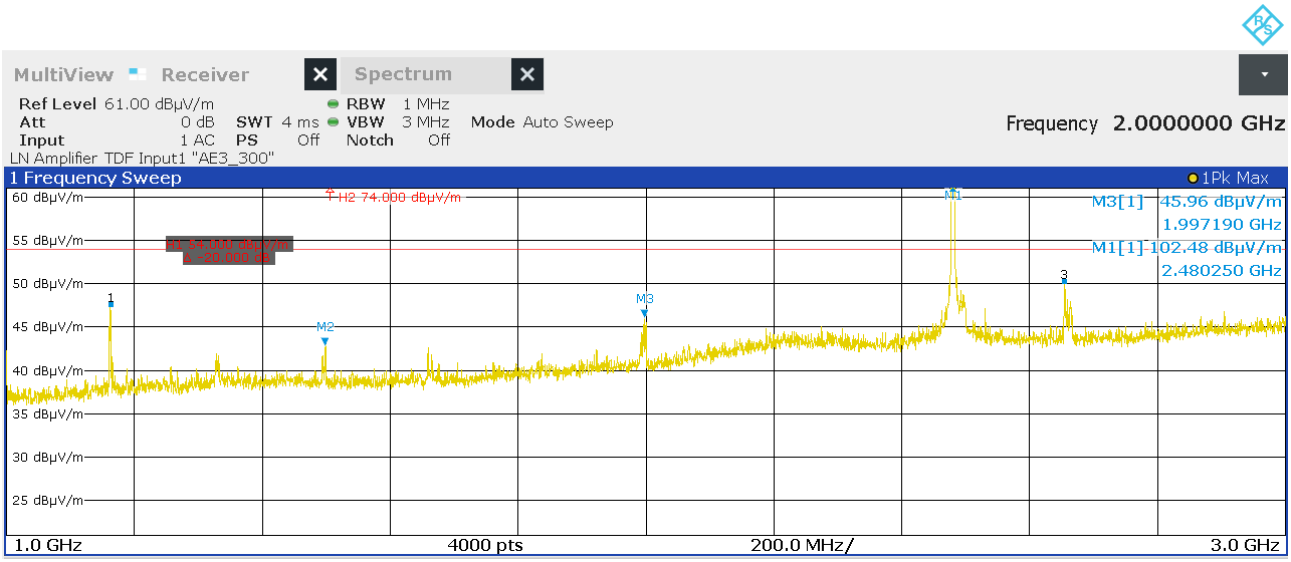


Figure 14: Chart of emissions test from 1 GHz to 3 GHz on highest channel, EUT position Y, antenna polarization vertical

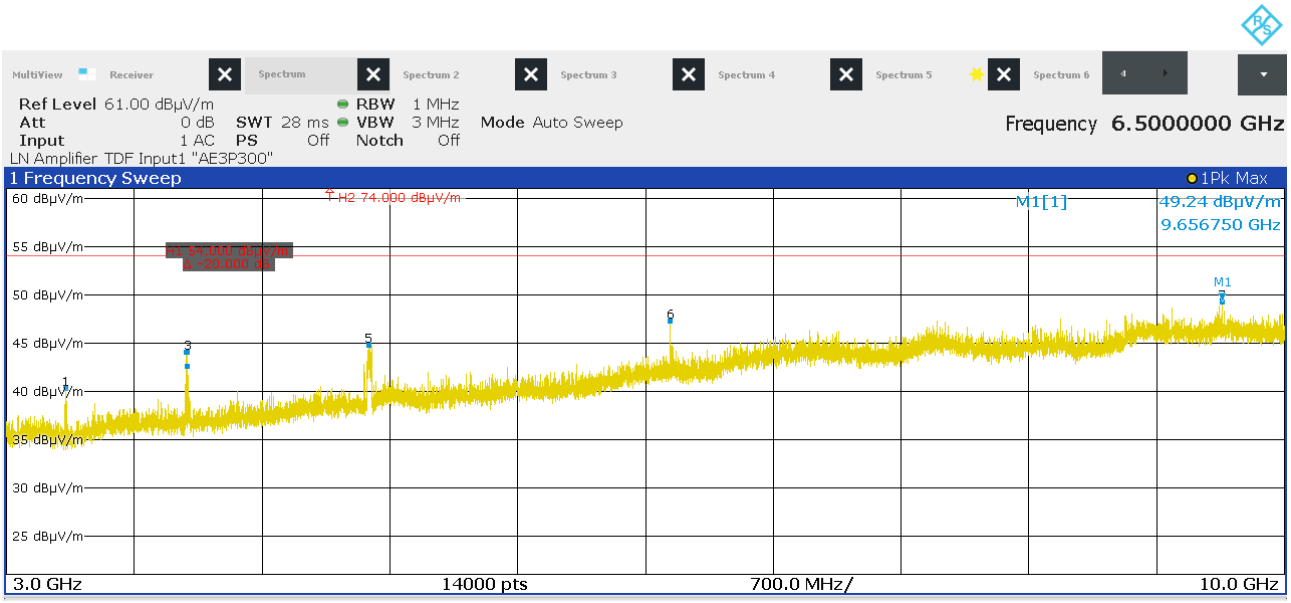


Figure 15: Chart of emissions test from 3 GHz to 10 GHz on highest channel, EUT position X, antenna polarization vertical

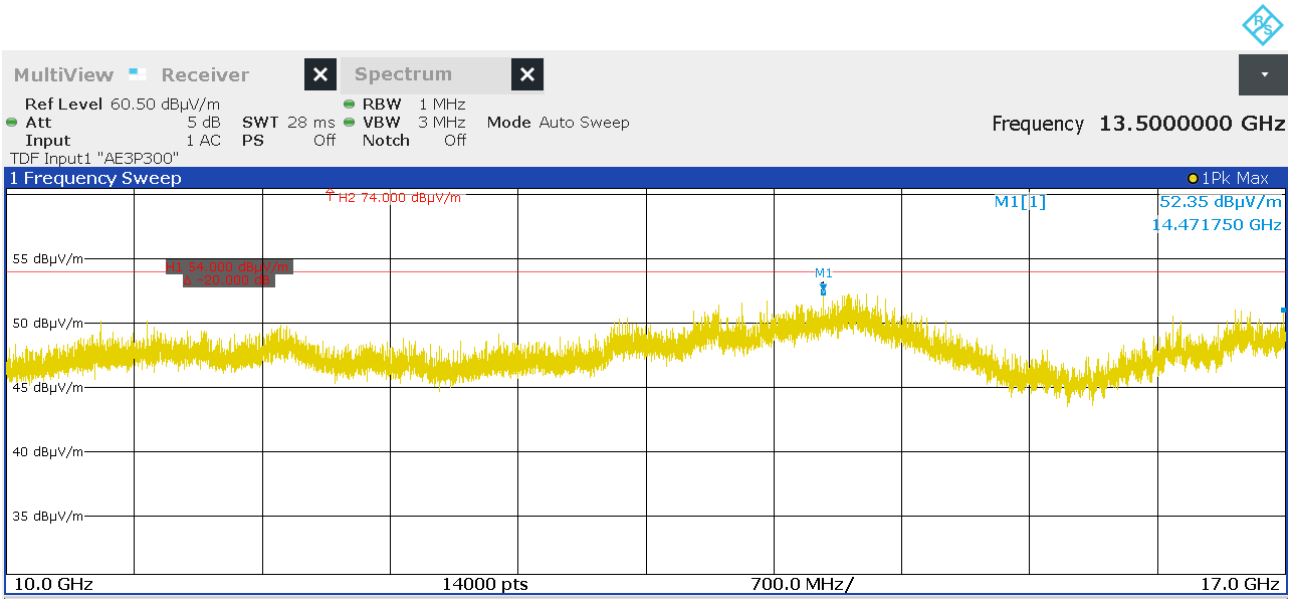


Figure 16: Chart of emissions test from 10 GHz to 17 GHz on highest channel, EUT position X, antenna polarization vertical

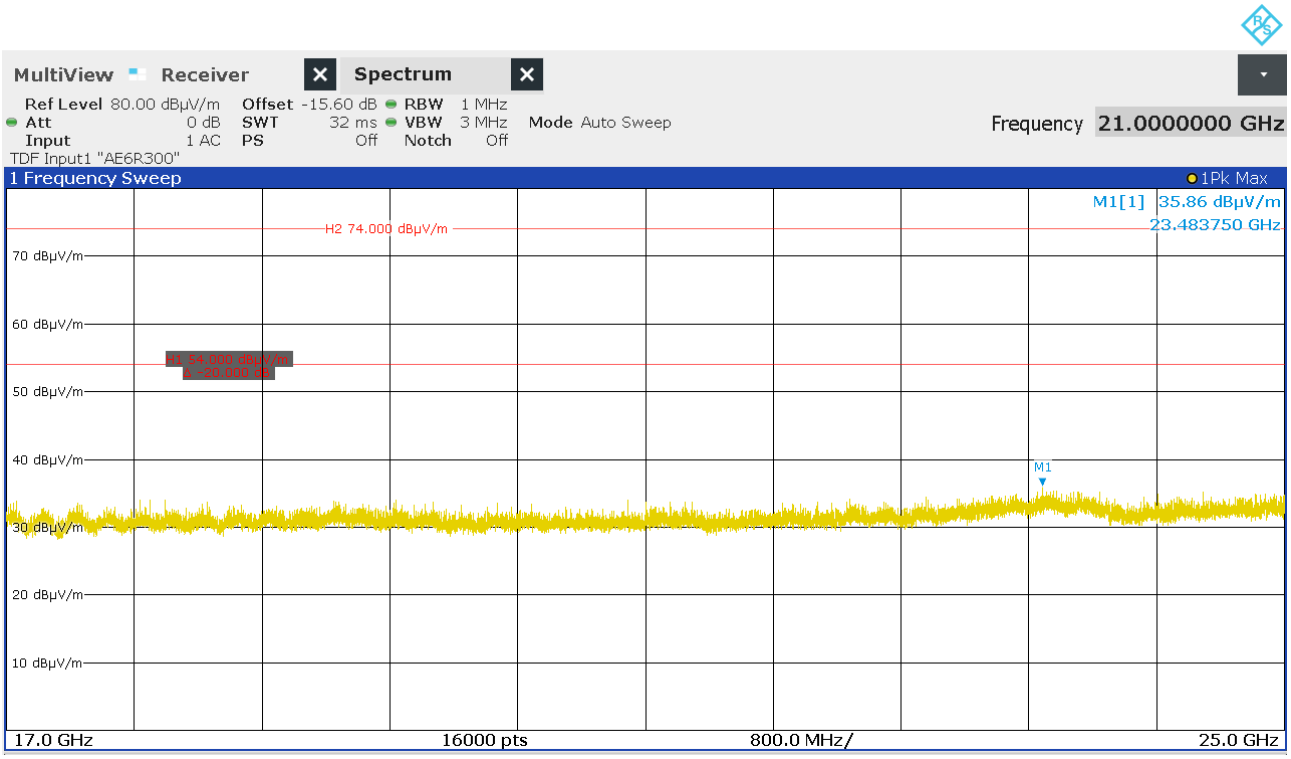


Figure 17: Chart of exploratory emission test from 17 GHz to 25 GHz on highest channel at 0.5 m, EUT position X, antenna polarization vertical

Freq. (MHz)	*EUT Pos.*	*Det*	*Level (dBµV/m) at 3 m*	*Peak limit (dBµV/m) at 3 m*	*Mar. (dB)*	*Average limit (dBµV/m) at 3 m*	*Mar. (dB)*	*Height (cm)*	*Pol.*	*Azim. (deg)*	*Corr. (dB/m)*	*Res.*
1162.750	Y	Pk	52.3	74.0	21.7	54.0	1.7	132	V	338	27.3	P
1498.110	Y	Pk	48.0	74.0	26.0	54.0	6.0	233	V	0	28.1	P
1997.190	Y	Pk	51.5	74.0	22.5	54.0	2.5	199	V	306	29.6	P
2654.250	Y	Pk	54.9	74.0	19.1	---	---	151	V	280	31.9	P
2654.250	Y	AV	37.1	---	---	54.0	16.9	151	V	280	31.9	P
3323.750	X	Pk	43.2	74.0	30.8	54.0	10.8	192	V	6	-14.1	P
3990.250	X	Pk	48.6	74.0	25.4	54.0	5.4	100	V	222	-11.4	P
4982.750	X	Pk	47.1	74.0	26.9	54.0	6.9	100	V	242	-8.9	P
6635.750	X	Pk	57.4	74.0	16.6	---	---	100	V	312	-5.3	P
6635.750	X	AV	30.3	---	---	54.0	23.7	100	V	312	-5.3	P
9656.750	X	Pk	47.2	74.0	26.8	54.0	6.8	132	V	103	1.1	P

Table 31: Results of radiated emissions test from 1 GHz to 25 GHz on highest channel

with:
Freq. = Frequency
EUT Pos. = EUT Position
Det = Detector
Mar. = Margin
Pol. = Polarization of the measurement antenna
Azim. (deg) = Azimuth (degree)
Corr. = Correction factor
Res. = Result
P = Passed
Np = Not passed

8 Measurement uncertainties

Description	*Uncertainty*	U_{Limit}	*Note(s)*	*k=*
AC power line conducted emission	± 3.0 dB	± 3.4 dB	2b), 3b)	2
Carrier frequency separation	± 1.5 %	± 5 %	2a), 3a)	2
Number of hopping frequencies	± 1.5 %	± 5 %	2a), 3a)	2
Time of occupancy (dwell time)	± 1.5 %	± 5 %	2a), 3a)	2
Bandwidth tests	± 2.0 %	± 5 %	2a), 3a)	2
Maximum conducted output power (conducted)	± 2.9 dB	± 3.0 dB	2a), 3a)	2
Power spectral density (conducted)	± 2.9 dB	± 3.0 dB	2a), 3a)	2
Conducted spurious emissions	± 2.9 dB	± 3.0 dB	2a), 3a)	2
Radiated emissions				
from 9 kHz to 30 MHz	± 3.8 dB	± 4.0 dB	2b), 3b)	2
from 30 MHz to 1 GHz	± 6.1 dB	± 6.3 dB	2b), 3b)	2
from 1 GHz to 6 GHz	± 4.6 dB	± 5.2 dB	2b), 3b)	2
from 6 GHz to 18 GHz	± 5.0 dB	± 5.5 dB	2b), 3b)	2
from 18 GHz to 26.5 GHz	± 5.4 dB	± 6.0 dB	2b), 3c)	2
from 26.5 GHz to 40 GHz	± 6.2 dB	± 6.5 dB	2b), 3c)	2

Note(s):

1 The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. For a confidence level of 95 % the coverage factor k is 2.

2 The values of the measurement uncertainty as listed above are calculated according to
   a) ETSI TR 100 028-1 V1.4.1 and ETSI TR 100 028-2 V1.4.1
   b) CISPR 16-4-2:2011-06 + A1:2014-02 + A2:2018-08

3 The limits for the measurement uncertainty as listed above are
   a) derived from ETSI EN 300 328 V2.1.1
   b) equal to U_{CISPR} taken from CISPR 16-4-2:2011-06 + A1:2014-02 + A2:2018-08
   c) defined by the test laboratory

4 Simple acceptance is applied as the decision rule while keeping the specified limits (U_{Limit}) for the expanded measurement uncertainty (i.e. Test Uncertainty Ratio TUR ≥ 1:1). That means, compliance is based on the recorded level by the lab irrespective of the expanded measurement uncertainty value but with a limitation to it. For details on simple acceptance and the level of risk (such as false accept, false reject and false statistical assumptions) associated with this decision rule see ISO/IEC Guide 98-4:2012 and ILAC G8:09/2019 “Guidelines on Decision Rules and Statements of Conformity” (“Binary Statement for Simple Acceptance Rule” according to clause 4.2.1).

5 All used test instruments as well as the test accessories are calibrated at regular intervals.

9 Revision history

Revision	*Date*	*Issued by*	*Description of modifications*
0	2025-03-20	Patricio Montenegro, M.Sc.-Ing.	First edition

Template: RF_15.247_RSS-247_V1.12