Prüfbericht-Nr.: *Test report no.:*	**DE244R13 001**	**Auftrags-Nr.:** *Order no.:*	1140885 110	
Kunden-Referenz-Nr.: *Client reference no.:*	41373134	**Auftragsdatum:** *Order date:*	2023-05-25	
Auftraggeber: *Client:*	INFICON GmbH, Bonner Str. 498, 50968 Köln, Deutschland			
Prüfgegenstand: *Test item:*	SMART-Spray			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	551-051			
Auftrags-Inhalt: *Order content:*	Prüfung der Funkparameter nach FCC & ISED *Test of radio parameters acc. to FCC & ISED*			
Prüfgrundlage: *Test specification:*	Teilprüfung / Partial test FCC CFR 47 Part 15 Subpart C- §15.247 ISED RSS-247:2017			
Wareneingangsdatum: *Date of sample receipt:*	2023-07-13	There are no photos of the EUT in this report acc. to the confidentiality letter. For EUT- and test setup photos please see the Photo Documentation to this report Number		
Prüfmuster-Nr.: *Test sample no:*	A003668536-005 to 008			
Prüfzeitraum: *Testing period:*	2024-03-04 - 2024-03-06			
Ort der Prüfung: *Place of testing:*	Nürnberg *Nuremberg*			
Prüflaboratorium: *Testing laboratory:*	Wireless Labor *Wireless Test Lab*			
Prüfergebnis*: *Test result*:*	Pass			
geprüft von: *tested by:*	X Signiert von: Primoz Erzen	**genehmigt von:** *authorized by:*	X Signiert von: Matthias Kraeutlein	
Datum: *Date:* 2024-05-02		**Ausstellungsdatum:** *Issue date:* 2024-05-02		
Stellung / Position:	Sachverständige(r)/Expert	**Stellung** / Position:	Sachverständige(r)/Expert	
Sonstiges / *Other:*	USA/FCC: C2PC for add new host system Canada/ISED: C4PC add new host system Host device integrated with FCC & IC certificate radio module.			
Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:*	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*			

* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*P(ass) = passed a.m. test specification(s)*	*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

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This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.

Anmerkungen
Remarks

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Produktbeschreibung
Product description

1	**Test item**	SMART-Spray
2	**Typ-No.**	551-051
3	**Test sample obtaining**	☒ Sampling by customer ☐ Sampling by TÜV Rheinland Group ☐ others:
4	**Supported radio technologies**	BLE
5	**Description of EUT**	The device is a helium spray gun. This allows you to pressurise the test specimen with helium and, in the event of a leak, this is displayed.
6	**Max RF output power (measured)**	3.4dBm
7	**Operating Frequency (declared)**	BLE: 2402-2480MHz
8	**Channel Bandwidth (declared)**	BLE: 2MHz
9	**Number of Channels**	BLE: 40
10	**Modulation**	BLE: GFSK
11	**Rated Voltage / Frequency**	3,65V DC Battery Powered
12	**FCC-ID (Radio module)**	2BFIX-1101102
13	**IC (Radio module)**	32279-1101102
14	**Antenna Type**	☒ Integral antenna (designed as a fixed part of the EUT) ☐ Dedicated antenna (removable, obligation to be used) ☐ Permanent antenna connector
15	**Antenna number of chains**	1
16	**Antenna Gain (declared)**	2402MHz:-2.6dBi 2440MHz:-1.6dBi 2480MHz:-2.8dBi
17	**Software / Firmware**	BootloaderSMART-Spray V0.5.0 Bluetooth Firmware WürthSMART-Spray 1.4 Bluetooth Config Version InficonSMART-Spray 1.4.2 SoftwareSMART-Spray 0.12.13
18	**Hardware**	FBG Pushbutton SmartG: v.01 FBG Mainboard SMART-Spray: v.05
19	**Provided Samples**	A003668536-005 to 008
20	**Conducted measurements sample**	A003668536-006 (cond. sample)
21	**Radiated measurements sample**	A003668536-008 (rad. sample)
22	**Companion Device** used for radio connection with the EUT	EUT in Test Mode. Therefore, no Companion Device was used.
23	**Auxiliary equipment** used to set up the EUT	-
24	**Accessory Devices** used together with the EUT	-

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Bemerkungen/** *Remarks*	**Ergebnis** *Result*
FCC 15.247 (a)(1) RSS-247 sec. 5.1	20 dB Bandwidth	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1) RSS-247 sec. 5.1	Number of Hopping Frequencies	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1) RSS-247 sec. 5.1	Time of Occupancy	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1) RSS-247 sec. 5.1	Carrier Frequency Separation	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (b) RSS-247 sec. 5.4	Maximum Output Power	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (e) RSS-247 sec. 5.2 (b)	Power Spectral Density	-	P ☐ F ☐ N/A ☐ N/T ☒
FCC 15.247 (a)(2) RSS-247 sec. 5.2 (a)	6dB Bandwidth	-	P ☐ F ☐ N/A ☐ N/T ☒
FCC 15.247 (d) RSS-247 sec. 5.5	Unwanted Emissions	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.207 RSS-Gen sec. 8.8	AC Power Conducted Emissions	Does not apply for equipment with DC supply voltage	P ☐ F ☐ N/A ☒ N/T ☐

Prüfdokumentation
Test documentation

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1 Registration

The measurement facilities for conducted and radiated disturbance measurements of the TÜV Rheinland LGA Products have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules. Measurement data will be accepted in conjunction with applications for Certification under Parts 15 and 18 of the Commission's Rules.
FCC Registration Number: 939976
Bundesnetzagentur Registration Number: BNetzA-CAB-17/21-16
The measurement facilities are also recognized by Innovation, Science and Economic Development (ISED) Canada to test to Canadian radio equipment requirements.
Company Number: 11235A
CAB Identifier: DE0018

2 EUT Classification

2.1 Wireless technologies and frequencies supported by the EUT.

The named technologies are only those falling in the specification of the applied standard.

Technology	Frequency Range (TX)	TX Function	Supported by the EUT	Evaluated in this report
BLE	2400 – 2483.5 MHz	SISO	☒	☒

SISO: Single Input Single Output

2.2 Standard specific classification of the EUT

2.2.1 Applied standards

FCC CFR 47 Part 15 Subpart C - §15.247
ISED RSS-247:2017

2.2.2 Test Methods and Guidance Documents

ANSI C63.10:2013
KDB 558074 D01 DTS Measurement Guidance v05
KDB 996369 D04 Module Integration Guide v01

2.3 System Type

DTS (Digital Transmission System)

2.3.1 Type of equipment

Hand held Equipment

3 Test conditions and configurations

3.1 Normal environmental test conditions

Environmental condition	Parameter	Range during test
Temperature	°C	21-24
Relative humidity	%	20-60
Supply voltage		3,65V DC Battery Powered

3.2 Equipment modifications

No modifications were found to be necessary to perform the tests or to achieve compliance.

3.3 Antenna assemblies

Antenna connector is prepared so tests were done in conducted and radiated mode.

3.4 Test modes

Mode description	Mode configuration
All Modes	The auxiliary equipment was connected to the EUT during the tests. DTM Mode was used and the payload was set to PRBS9 for the Test.
Mode 1: TX-Mode	TX mode on 2402MHz, 2440MHz and 2480MHz.
Mode 2: N/A	
Mode 3: N/A	
Mode 4: N/A	

3.5 Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to ETSI TR 100 028-1/-2 and ETSI TS 103 051 (radiated measurements) and is documented in the quality system acc. to ISO/IEC 17025:2017.
Furthermore, component and process variability of devices similar to that tested may result in additional deviation.
The stated values are the expanded uncertainty values, the measured value lies within the assigned range of values with a probability of 95% (k = 1.96).
The manufacturer has the sole responsibility of continued compliance of the device.

Test	Value	Unit	Range
Frequency Error	$2.7 * 10^{-8}$	Hz	-
Frequency Stability under low voltage conditions			
Time	$1.1 * 10^{-9}$	s	-
Conducted Carrier Power Conducted Spurious Emissions (RX/TX)	1.0	dB	9k-1GHz
	1.7	dB	1GHz-6GHz
	2.8	dB	6GHz-40GHz
Occupied Bandwidth (OBW)	0.1	%	-
TX Power Spectral Density	4.2	mW	9kHz - 6GHz
	1.6	dB	9kHz - 6GHz
Dwell Time	$4.6 * 10^{-7}$	Hz	-
Frequency Separation			-
Measurement of conducted emissions at the power supply connection to LISN	2.3	dB	9kHz – 150kHz
	2.2	dB	150kHz – 30MHz
Measurement of the field strength at distance 3m	1.6	dB	9k-150kHz
	4.5	dB	30-1000MHz
	5	dB	1-6GHz
	5.3	dB	6-40GHz
Temperature	0.8	K	-
Humidity	4	%	-
Voltage (AC/DC)	1.0	%	-

4 Test results in detail

4.1 Maximum Output Power

4.1.1 Requirements / Limits

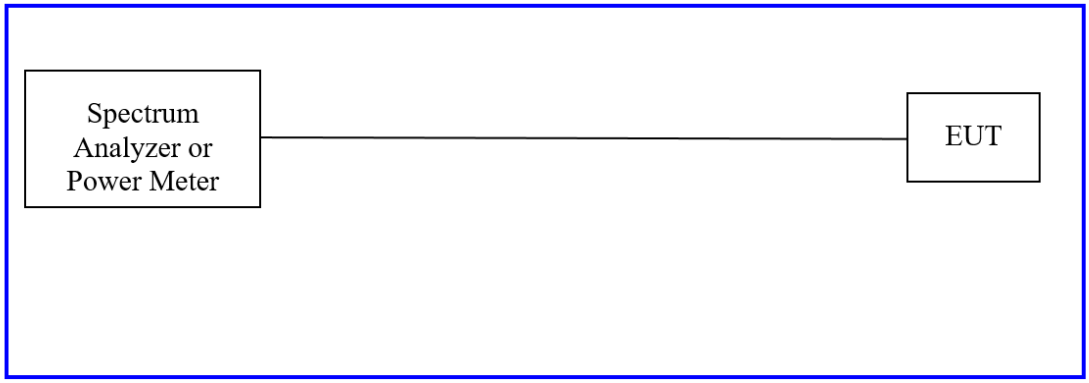
The maximum output power limit is expressed in terms of either maximum peak conducted output power or maximum conducted output power.
The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the full signal bandwidth.
The 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.

	Condition		Limit
☒	Systems using digital modulation techniques in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands		*FCC Part 15, Subpart C, §15.247 (b) (3)* 1 watt = 30dBm. Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).
☐	Frequency hopping systems operating 2400-2483.5 MHz band.	Employing less than 75 non-overlapping hopping channels	*FCC Part 15, Subpart C, §15.247 (b) (1)* 0.125 watt = 21dBm.
☐		Employing at least 75 non-overlapping hopping channels	*FCC Part 15, Subpart C, §15.247 (b) (1)* 1 watt = 30dBm.
☐	Frequency hopping systems operating 5725-5850 MHz band.		*FCC Part 15, Subpart C, §15.247 (b) (1)* 1 watt = 30dBm.
☐	Frequency hopping systems operating 902-928 MHz band.	Employing less than 50 but at least 25 hopping channels	*FCC Part 15, Subpart C, §15.247 (b) (2)* 0.25 watt = 24dBm.
☐		Employing at least 50 hopping channels	*FCC Part 15, Subpart C, §15.247 (b) (2)* 1 watt = 30dBm
☐	Antenna gain greater than 6dBi		*FCC Part 15, Subpart C, §15.247 (b) (4)* The conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3), as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

4.1.2 Test Method (Maximum Output Power)

4.1.2.1 Conducted measurements

Measurements were done according to ANSI C63.10:2013 clause 11.9.1.1 peak power (RBW > DTS bandwidth).
The EUT was connected to the spectrum analyzer or Power Meter via a coax cable with a known loss.



4.1.2.2 Radiated measurements

Measurements were done according to ANSI C63.10:2013 clause 11.9.1.1 peak power (RBW > DTS bandwidth).
The equivalent conducted output power is calculated as follows:

$$P_{Out} = P_{Rad} - G$$

Where:
P_{Out} is the maximum conducted output power in dBm,
P_{Rad} is the maximum radiated output power in dBm EIRP,
G is the antenna directional gain in dBi.

4.1.3 Test setup (Maximum Output Power)

4.1.3.1 Conducted measurements

EUT		A003668536-006 (cond. sample)
Chamber details		Shielded room
Companion device		EUT in Test Mode. Therefore, no Companion Device was used.
Operation mode		☒ 1: TX-Mode ☐ 2: N/A ☐ 3: N/A ☐ 4: N/A
Spectrum Analyzer	**Resolution Bandwidth**	3MHz
	Video Bandwidth	10MHz
	Sweep Time	1,271µs (Max Hold until stable)
	Detector	Peak
Further parameters		-
Test engineer		Dipl. Ing. Primoz Erzen

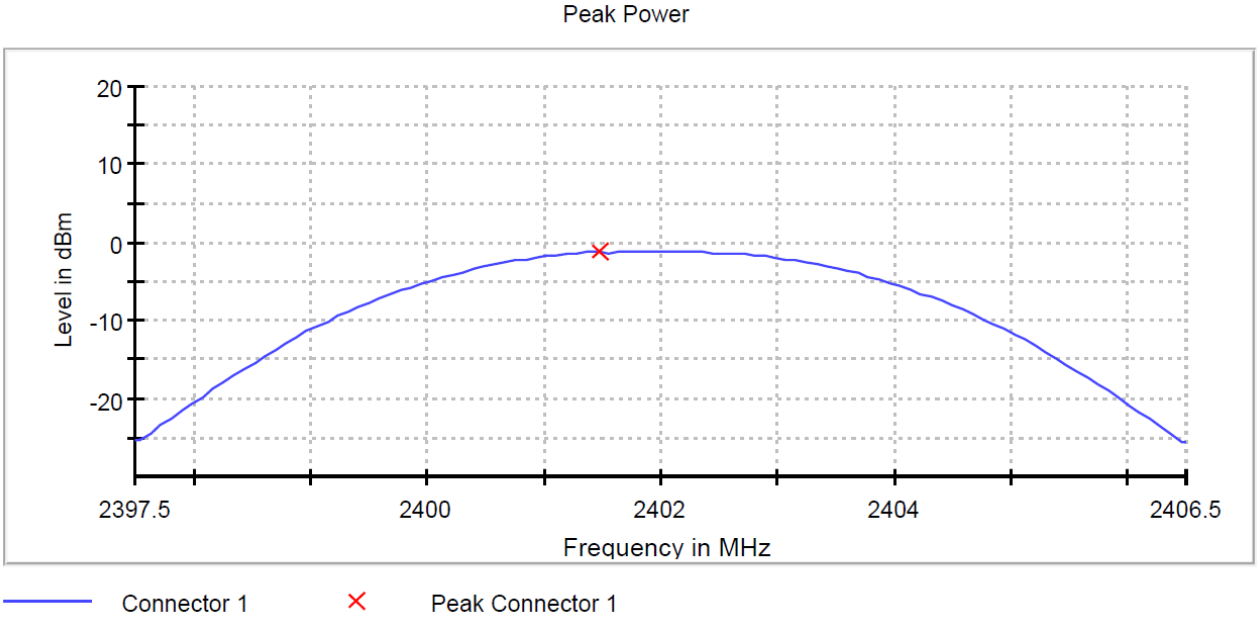
4.1.3.2 Radiated measurements

EUT		A003668536-008 (rad. sample)
Chamber details		☒ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☐ Shielded room
Measurement positioning		Distance: ☒ 3m ☐ 10m EUT height: ☒ 1.5m ☐ 0.8m Antenna height: ☒ 1.5m ☐ 1m to 4m – height scan
Companion device		EUT in Test Mode. Therefore, no Companion Device was used.
Operation mode		☒ 1: TX-Mode ☐ 2: N/A ☐ 3: N/A ☐ 4: N/A
Spectrum Analyzer	**Resolution Bandwidth**	100kHz during exploratory tests 2MHz for final measurements
	Video Bandwidth	300kHz during exploratory tests 10MHz for final measurements
	Measurement Time	2s during exploratory tests 10s for final measurements
	Span	93,5MHz during exploratory tests Zero Span for final measurements
	Detector	Peak and RMS during exploratory tests Peak for final measurements
Further parameters		-
Test engineer		Dipl. Ing. Primoz Erzen

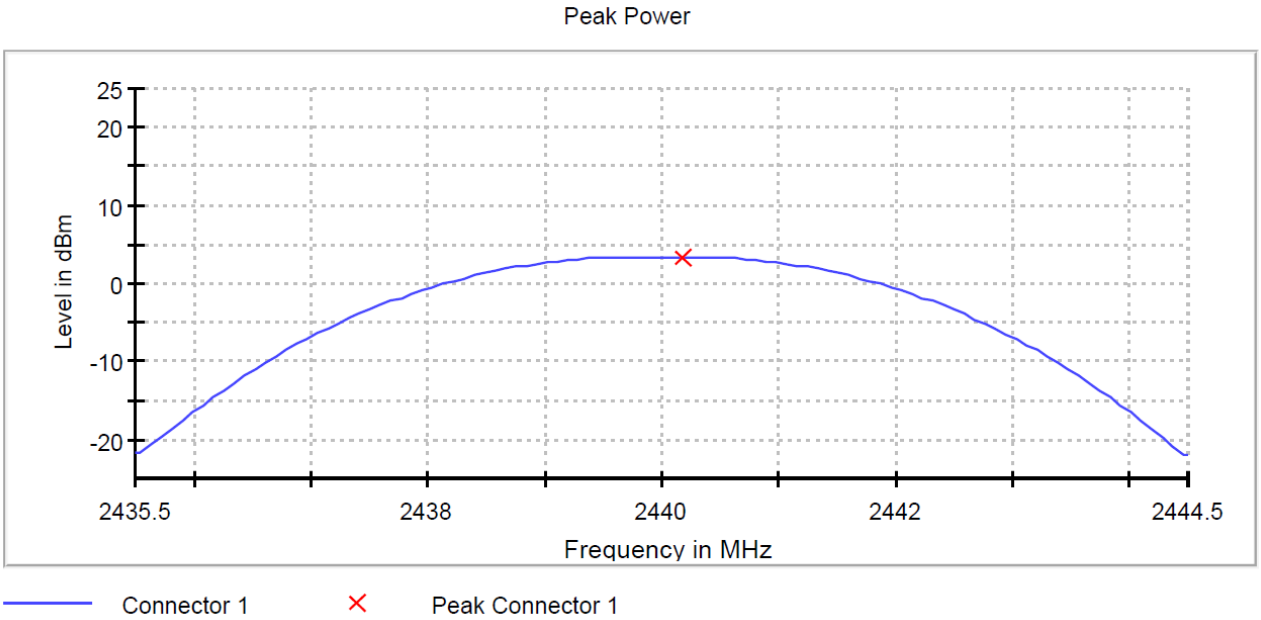
4.1.4 Test results (Maximum Output Power)

4.1.4.1 Conducted measurements

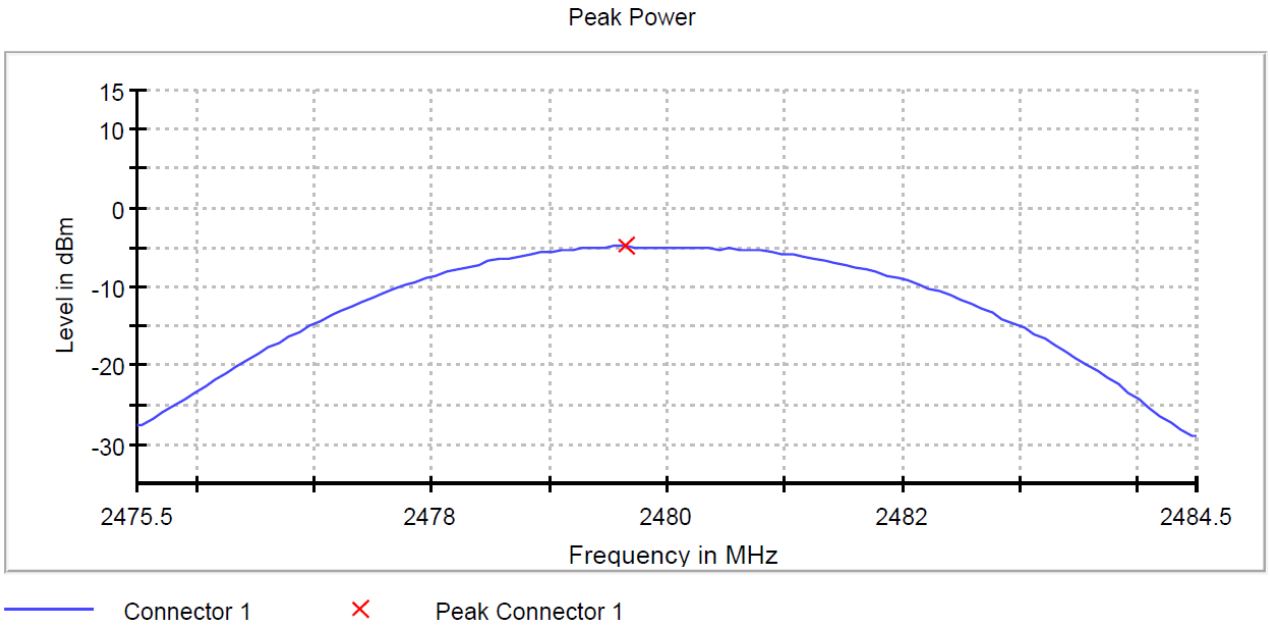
4.1.4.1.1 Lowest Channel 2402MHz



4.1.4.1.2 Middle Channel 2440MHz



4.1.4.1.3 Highest Channel 2480MHz

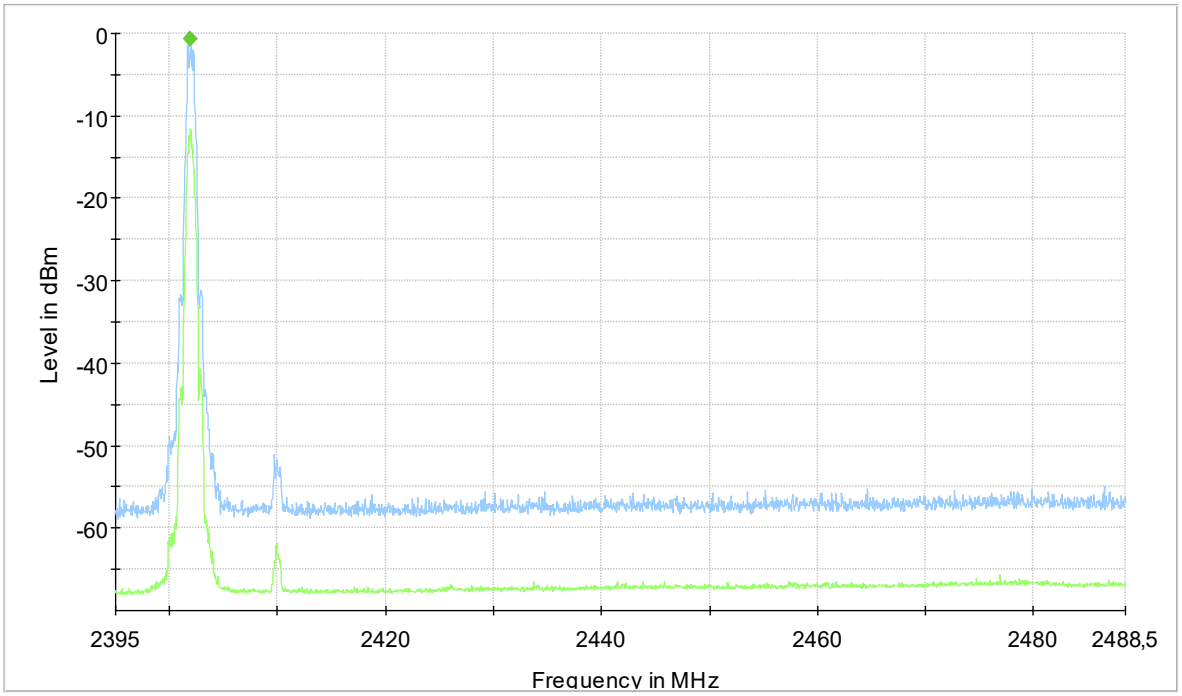


4.1.4.1.4 **Conducted measurements summary** (Maximum Output Power)

Frequency	Peak conducted output power (dBm)	Limit (dBm)	Margin (dB)	Test Result
Lowest	-1.2	30	31.2	Pass
Middle	3.4		26.6	Pass
Highest	-4.9		34.9	Pass

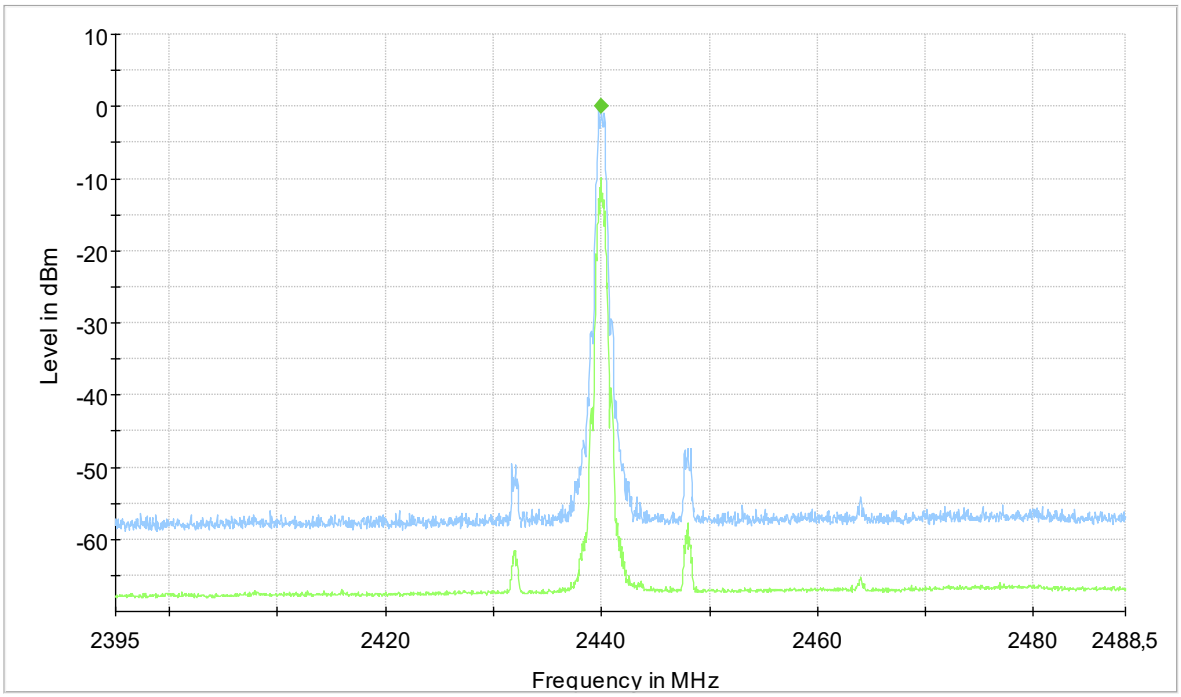
4.1.4.2 **Radiated measurements** (Maximum Output Power)

4.1.4.2.1 Lowest Channel



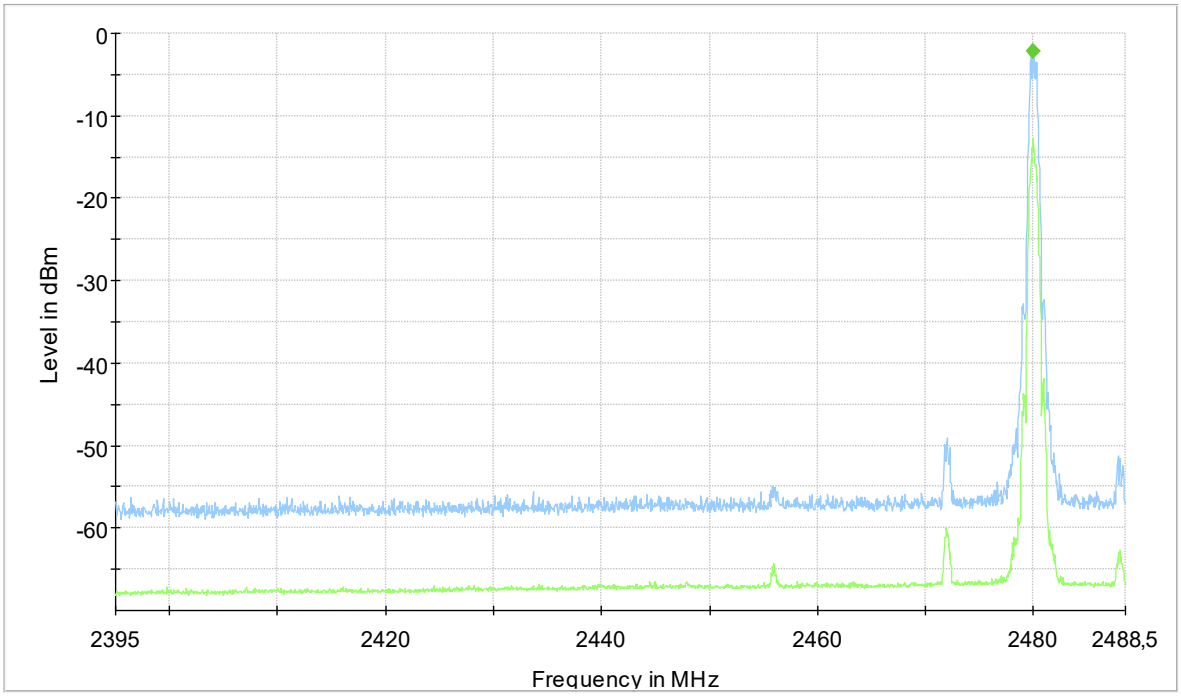
Preview Result 2-RMS
Preview Result 1-PK+
PK+
RMS
Final_Result RMS
Final_Result PK+

4.1.4.2.2 Middle Channel



Preview Result 2-RMS
Preview Result 1-PK+
PK+
RMS
Final_Result RMS
Final_Result PK+

4.1.4.2.3 Highest Channel



Preview Result 2-RMS
Preview Result 1-PK+
PK+
RMS
Final_Result RMS
Final_Result PK+

4.1.4.2.4 **Radiated measurements summary** (Maximum Output Power)

Frequency [MHz]	P_{Rad} Peak [dBm] EIRP	Height [cm]	Pol.	Azimuth [deg]	Elevation [deg]	Corr. [dB]	Ant. Gain [dBi]	P_{out} Peak [dBm]
2401.9	-0.61	150.0	H	269.0	7.0	-82.7	-2.6	1.99
2439.96	0.02	150.0	H	266.0	4.0	-82.1	-1.6	1.62
2479.95	-2.12	150.0	H	269.0	3.0	-81.6	-2.8	0,68

4.1.5 Final test result (Maximum Output Power)

Final test result	Pass

4.2 Unwanted emissions

4.2.1 Requirements / Limits

☒	FCC Part 15, Subpart C, §15.247 (d); [RSS-247 sec. 5.5]: 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 § 15.209(a) [RSS-Gen sec. 8.9] is not required. Radiated emissions which fall in the restricted bands, as defined in § 15.205(a) [RSS-Gen sec.8.10], must comply with the radiated emission limits specified in § 15.209(a) [RSS-Gen sec. 8.9].
☐	FCC Part 15, Subpart C, §15.247 (d); [RSS-247 sec. 5.5]: If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this test shall be 30 dB instead of 20 dB.

FCC Part 15, Subpart C, §15.209; [RSS-Gen sec. 8.9]; Radiated Emission Limits

Frequency [MHz]	Measurement distance [m]	Limit [µV/m]	Limits [dBµV/m]	Limits @3m [dBµV/m]
0.009 – 0.49	300	2400/F(kHz)	48.5 … 13.8	128.5 … 93.8
0.49 – 1.705	30	24000/F(kHz)	33.8 … 23.0	73.8 … 63.0
1.705 – 30	30	30	29.5	69.5
30 – 88	3	100	40.0	40.0
88 – 216	3	150	43.5	43.5
216 – 960	3	200	46.0	46.0
960 - 40000	3	500	54.0	54.0

Used conversion factor µV/m->dBµV/m: $\text{Limit}\,[\text{dB}\mu\text{V/m}] = 20\log(\text{Limit}\,[\mu\text{V/m}]\,/\,1\mu\text{V/m})$
At frequencies below 30MHz, the measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according to FCC 15.31 (f)(2).

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing a linear average detector.

FCC Part 15, Subpart C, §15.35(b) [RSS-Gen sec. 8.1]:
..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

ANSI C63.10:2013 clause 5.5:
The spectrum shall be investigated from the lowest radio frequency signal generated in the device and up to at least the frequency shown in Table 2. However, frequencies below 9 kHz do not need to be investigated.

Table 2—Frequency range of measurements for unlicensed wireless device

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

4.2.2 Radiated measurements with general limit (Unwanted emissions)

4.2.2.1 Test Method

Radiated unwanted Emissions were tested against the general limits specified in § 15.209(a) [RSS-Gen sec. 8.9]. Emissions that fall inside the frequency band in which the intentional radiator is operating were excluded.
Emissions that exceed the general limits were additionally tested for the further requirements of §15.247 (d); [RSS-247 sec. 5.5]

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure.

Testing was performed inside an anechoic chamber. The receiving antenna was placed at a distance of 3m for all measurements. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT. The different measurement setups for each frequency range are shown below.

For the final testing, the placement of EUT and cables were the same as for preliminary testing. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked. For the measurements in the frequency range 30 MHz to 1 GHz for each measured frequency the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation.

For measurement above 1 GHz the turntable and positioner step sizes were set to a range of 22° and the antenna height is fixed.

For the measurements in the frequency ranges (90-110kHz, 490 kHz-1 GHz) quasi-peak detector is used, while average and peak detectors are used in other ranges.

Final testing was performed on an SVSWR compliant test site.
The final average electric field value (E_{final}) is calculated in the final measurement table using the following equation:

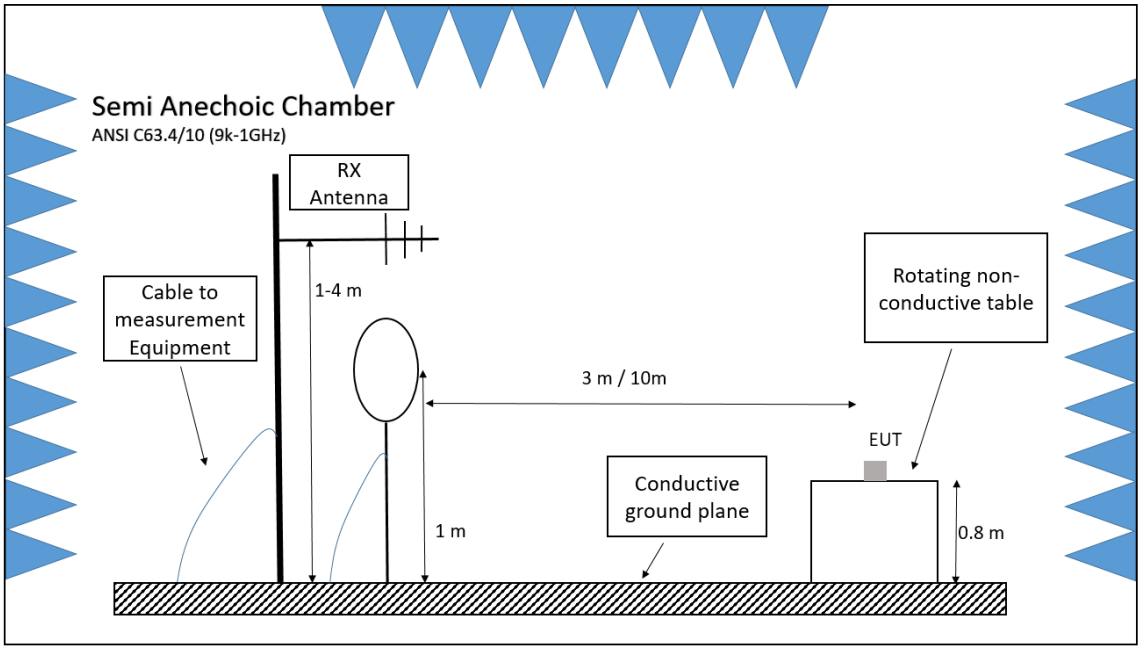
$$E_{final} = \text{RawRec} + \text{Corr.}$$

While

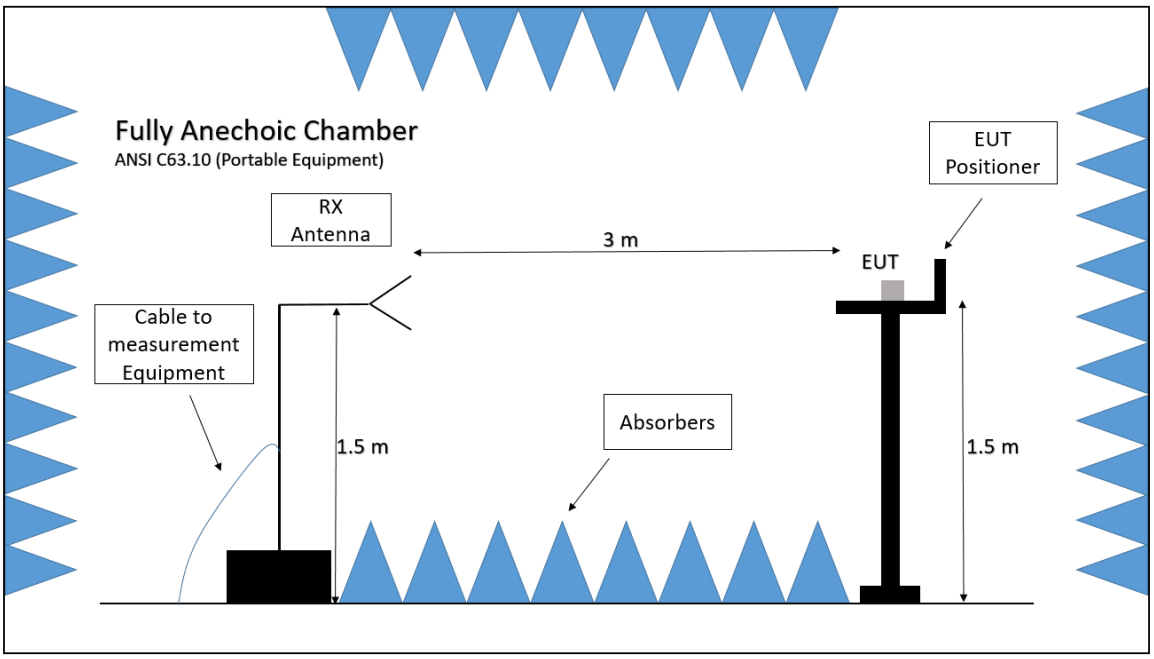
$$\text{Corr.} = \text{Trd. Corr.} + \text{Sig Path} + \text{Preamp}$$

4.2.2.2 EUT positioning (Radiated measurements with general limit; Unwanted emissions)

4.2.2.2.1 EUT positioning below 1GHz



4.2.2.2.2 EUT positioning above 1GHz; portable Device



4.2.2.3 **Measurement Setup** (Radiated measurements with general limit; Unwanted emissions)

4.2.2.3.1 Measurement Setup 9 kHz - 30 MHz

Test Site	SAC (Semi Anechoic Chamber)
Receiving Antenna	Loop antenna (HFH 2)
Receiving Antenna Height	1m (center of Loop antenna)
Receiving Antenna Polarization	Parallel and perpendicular to the EUT (EUT without Loop antenna) According to ANSI C63.10:2013 clause 6.4.6
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	22.5° during exploratory tests Linear during maximizations for final measurements
Receiver Configurations	Average and peak detector (9-90kHz and 110-490kHz) Quasi Peak detector (90-110kHz and 490kHz-30MHz)
	RBW: 200Hz (9 - 150 kHz) and 9 kHz (150 kHz – 30 MHz)
	Step Size: 50Hz (9-150kHz) and 2.25kHz (150k-30MHz)
	Sweep Time: 100ms (FFT) during exploratory tests Sweep Time: 1s for final measurements

4.2.2.3.2 Measurement Setup 30 MHz - 1 GHz

Test Site	SAC (Semi Anechoic Chamber)
Receiving Antenna	Hybrid Antenna VULB 9168
Receiving Antenna height	Varied (1m to 4m, step size 1m) during exploratory tests Linear during maximizations for final measurements
Receiving Antenna Polarization	Horizontal and Vertical
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	45° during exploratory tests Linear during maximizations for final measurements
Receiver Configurations	Average and peak detector
	RBW :120 kHz
	Step Size: 30kHz (30-1000MHz)
	Sweep Time: 100ms (FFT) during exploratory tests Sweep Time: 1s for final measurements

4.2.2.3.3 Measurement Setup above 1GHz; portable Device

Test Site	Fully-anechoic chamber
Receiving Antenna	Horn Antenna HF907 (1-18GHz), 3116C-PA (18-40GHz)
Receiving Antenna Height	1.5m
Receiving Antenna Polarization	Horizontal and Vertical
EUT Positioner	40cm x 60cm non-conductive positioner 1.5m above the floor Step size elevation angle 45° during exploratory tests Linear during maximizations for final measurements
EUT Turn Table Step Size	45° during exploratory tests Linear during maximizations for final measurements
Spectrum Analyzer	Average and peak detector
	RBW: 1MHz
	Sweep Time: 50s during exploratory tests Sweep Time: 10s for final measurements

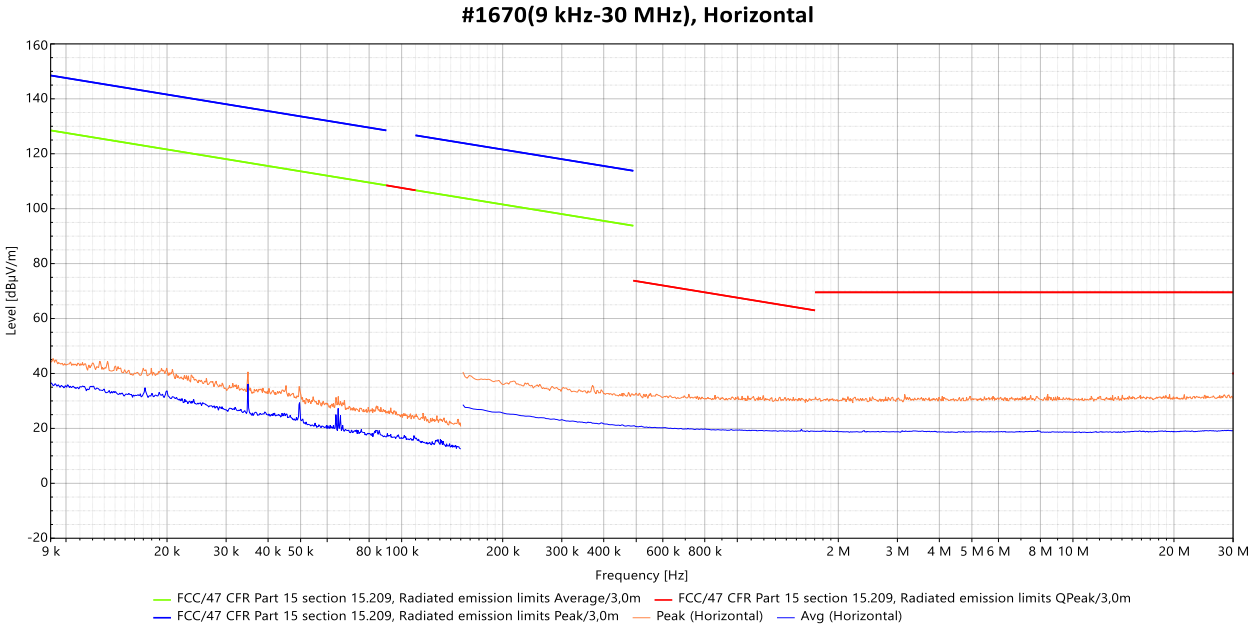
4.2.2.4 Test Setup (Radiated measurements with general limit; Unwanted emissions)

EUT	A003668536-008 (rad. sample)	
Companion device	EUT in Test Mode. Therefore, no Companion Device was used.	
Operation mode	☒ 1: TX-Mode	☐ 2: N/A
	☐ 3: N/A	☐ 4: N/A
Further parameters	-	
Test engineer	Dipl. Ing. Primoz Erzen	

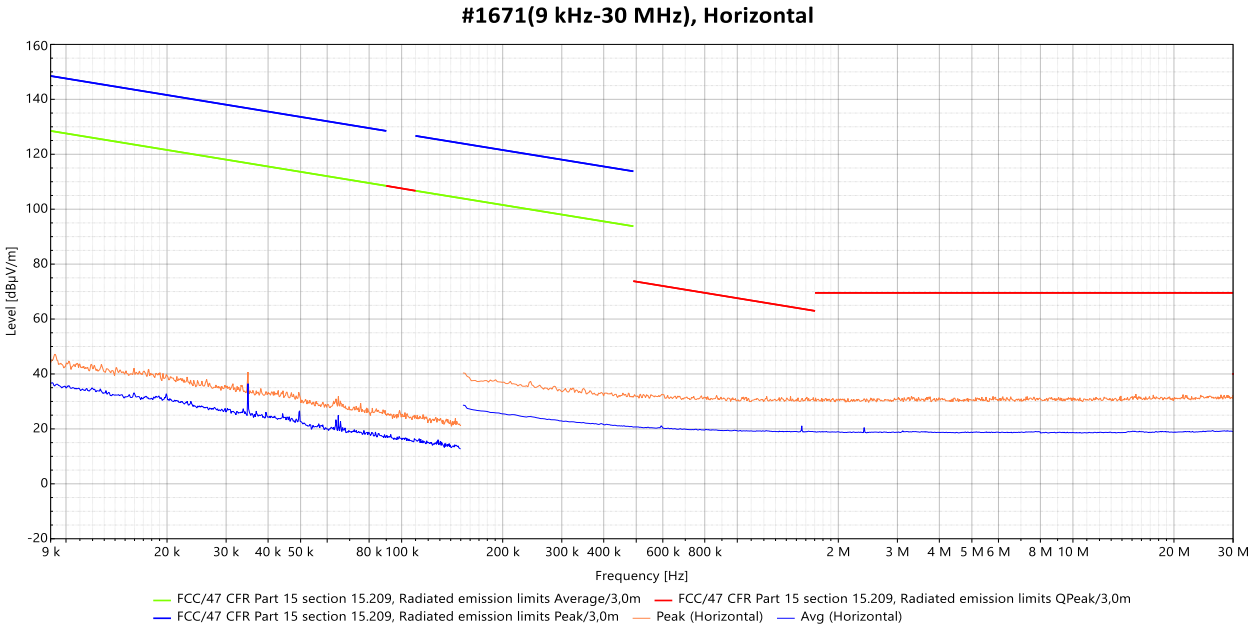
4.2.3 Test results (Radiated measurements with general limit; Unwanted emissions)

4.2.3.1 9 kHz to 30 MHz, lowest Channel

4.2.3.1.1 Perpendicular Polarization

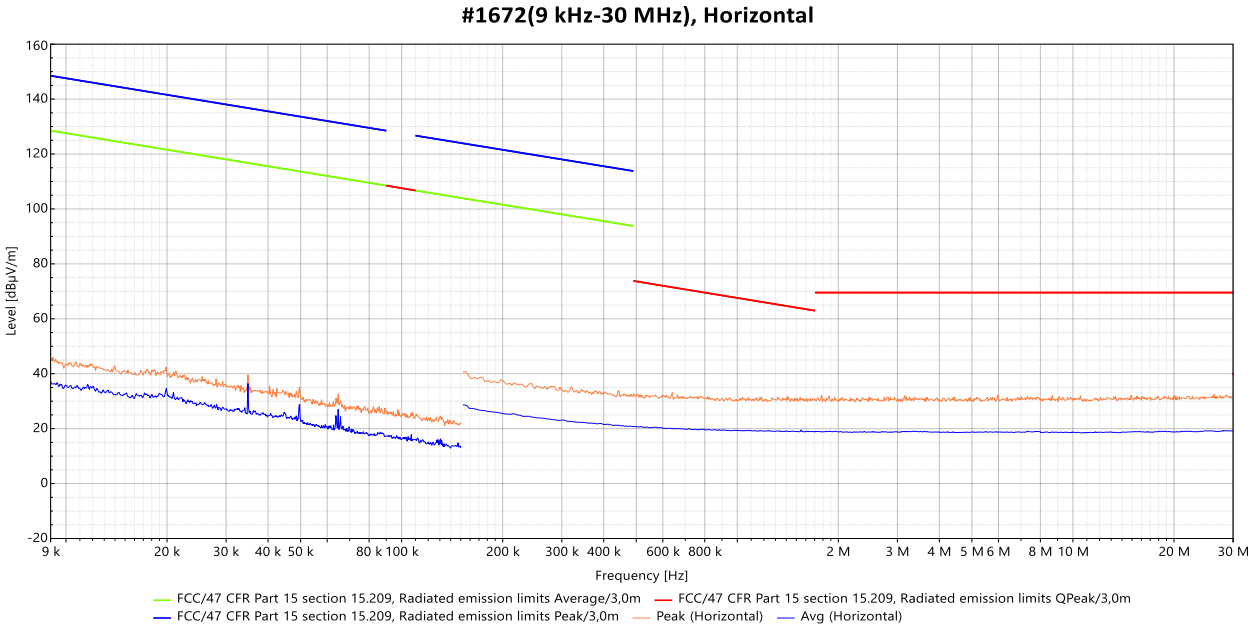


4.2.3.1.2 Parallel Polarization

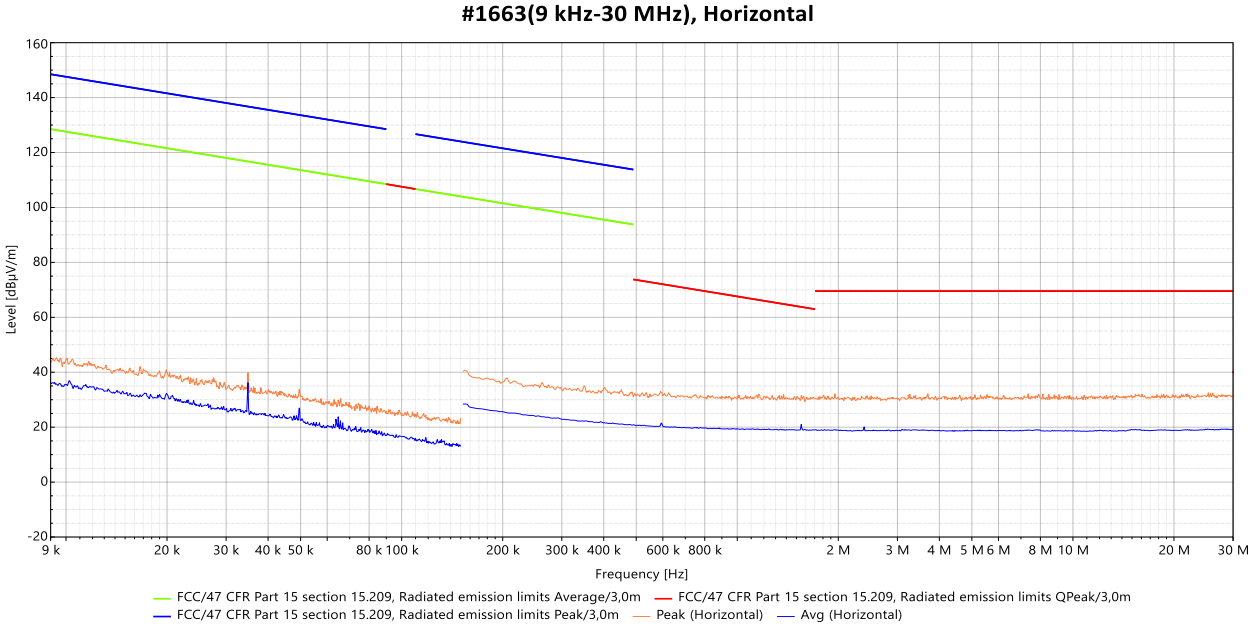


4.2.3.2 9 kHz to 30 MHz, middle Channel

4.2.3.2.1 Perpendicular Polarization

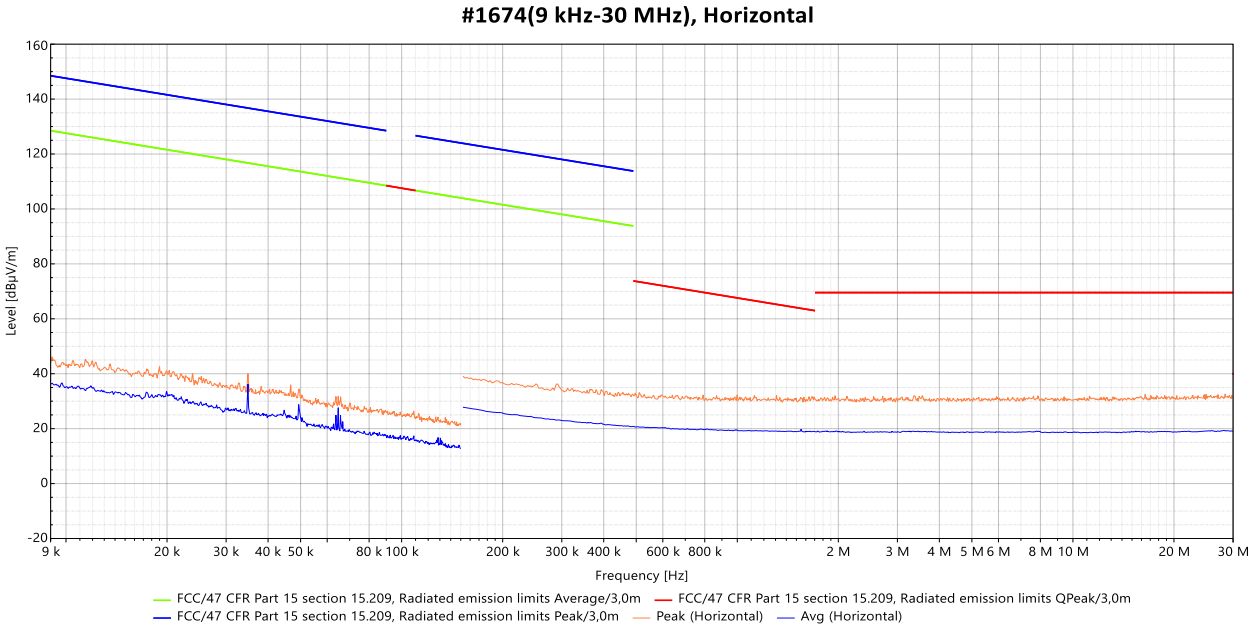


4.2.3.2.2 Parallel Polarization

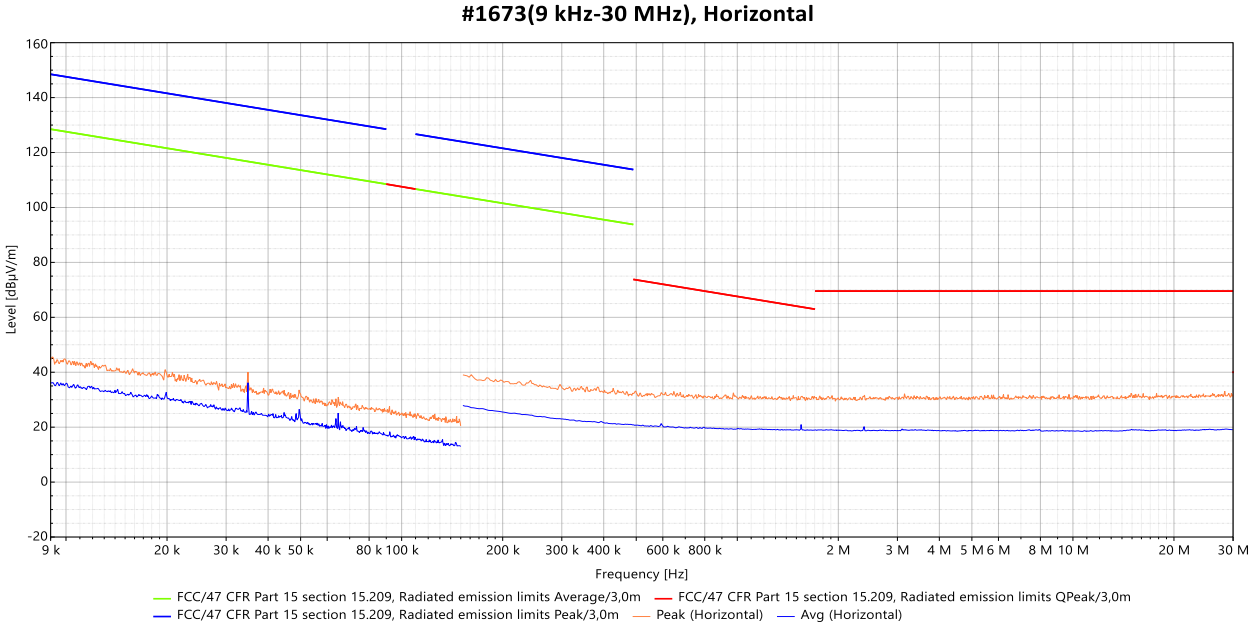


4.2.3.3 9 kHz to 30 MHz, highest Channel

4.2.3.3.1 Perpendicular Polarization

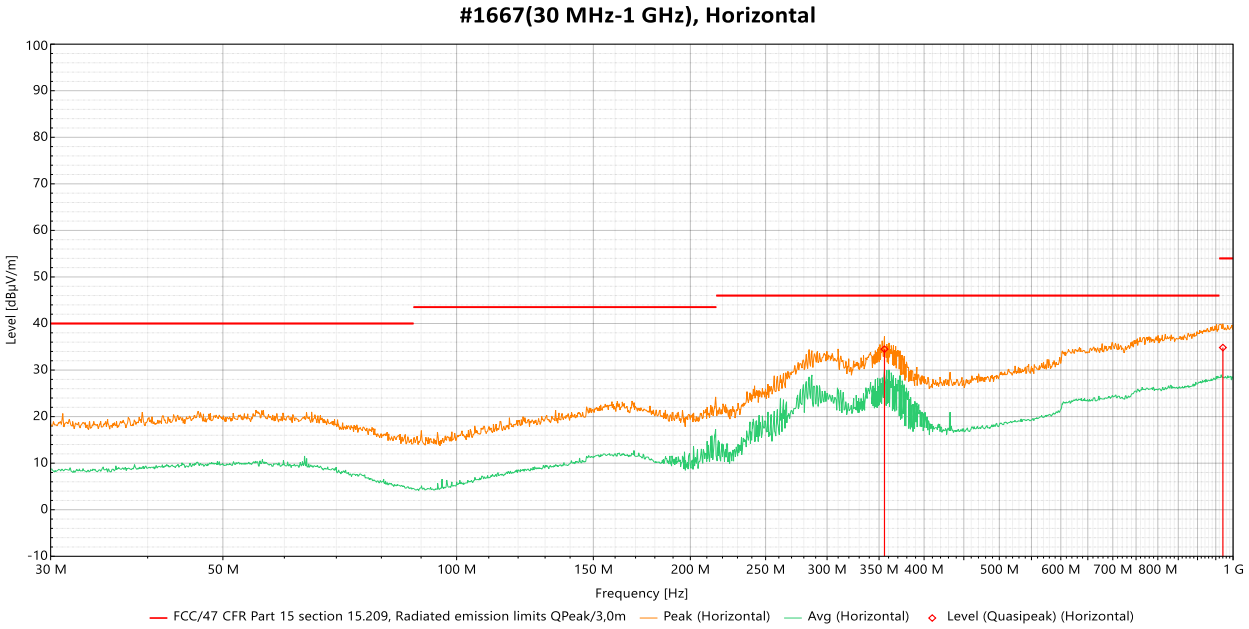


4.2.3.3.2 Parallel Polarization

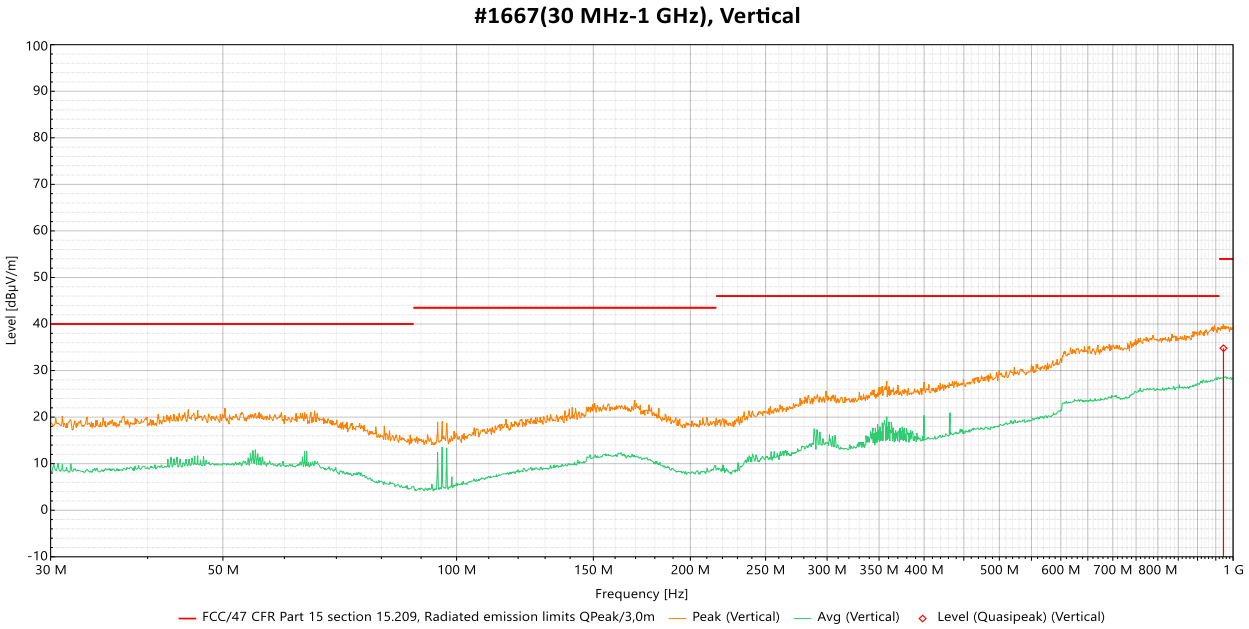


4.2.3.4 30 MHz to 1 GHz, lowest Channel

4.2.3.4.1 Horizontal Polarization



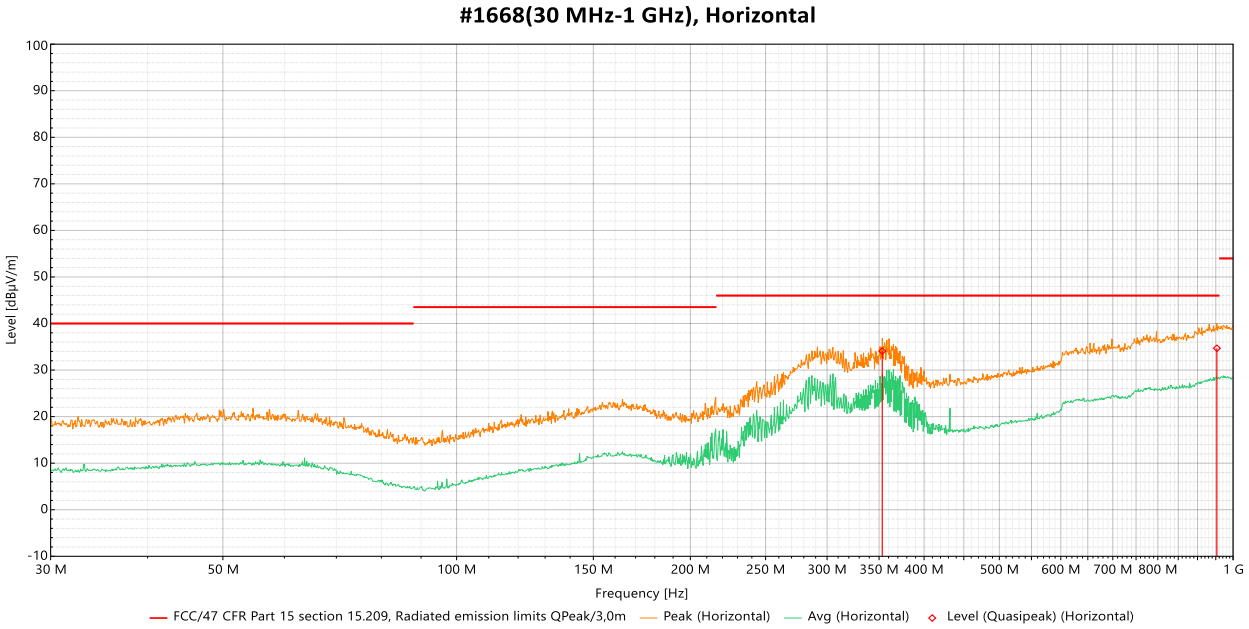
4.2.3.4.2 Vertical Polarization



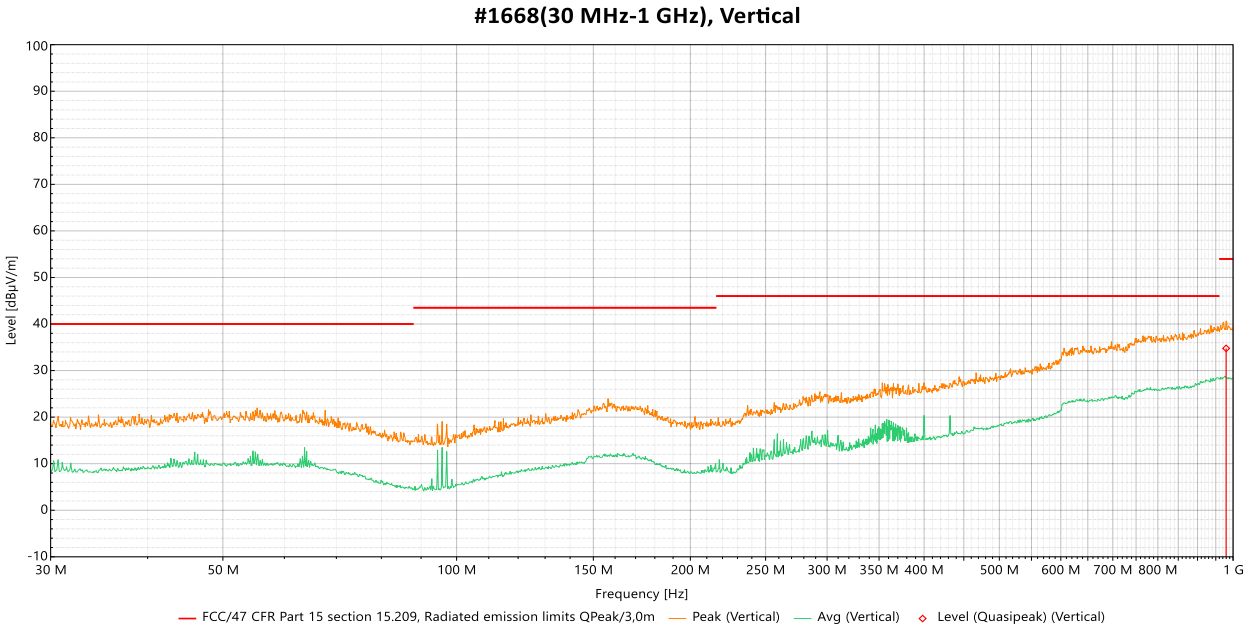
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Height (m)	Corr. (dB)
971.975	34.8	54.0	-19.2	V	260.7	1.52	34.9
970.275	34.8	54.0	-19.2	H	140.1	2.16	34.9
355.675	34.5	46.0	-11.5	H	299.6	1.00	23.3

4.2.3.5 30 MHz to 1 GHz, middle Channel

4.2.3.5.1 Horizontal Polarization



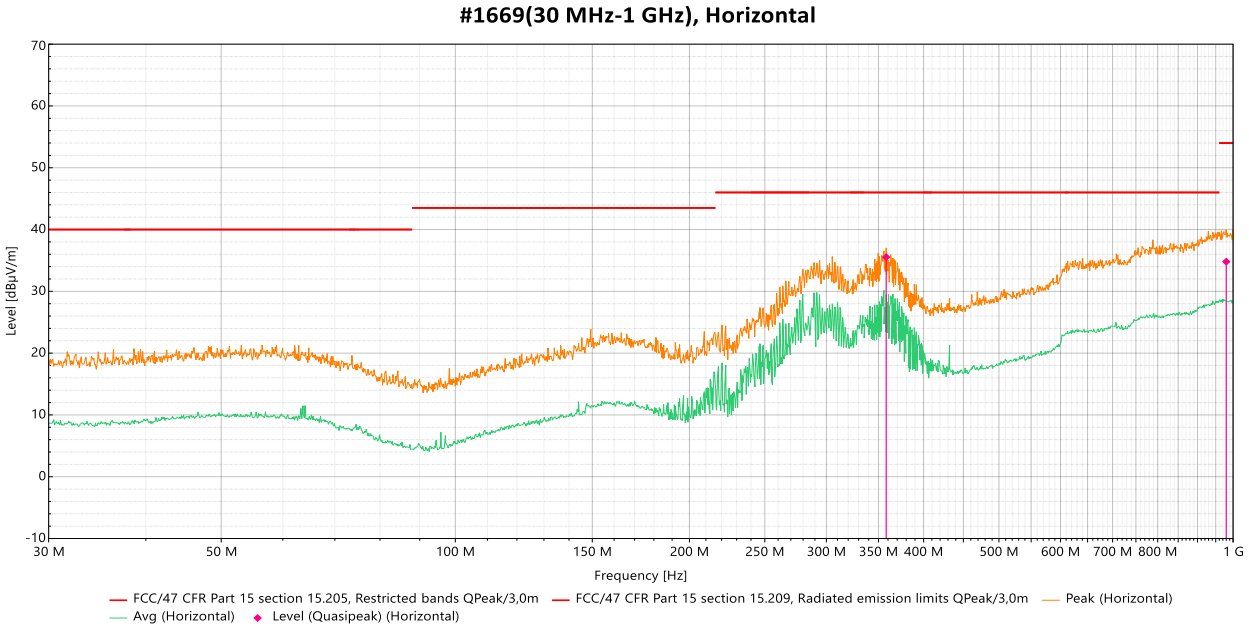
4.2.3.5.2 Vertical Polarization



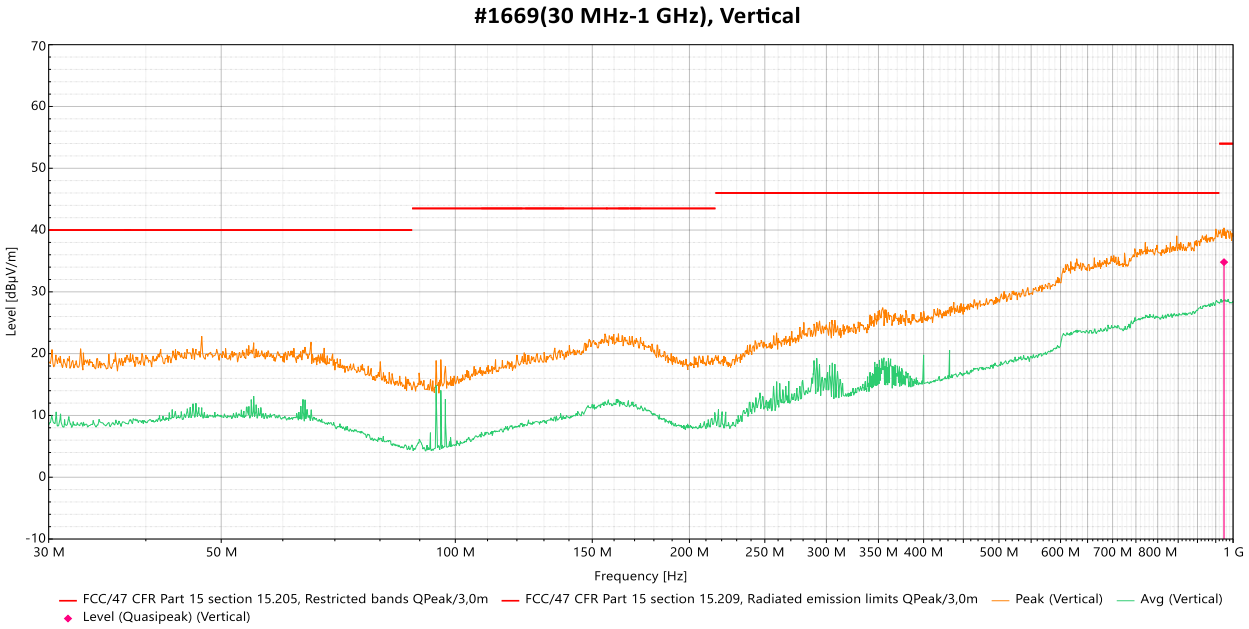
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Height (m)	Corr. (dB)
979.65	34.8	54.0	-19.2	V	226.3	2.00	34.9
353.325	34.1	46.0	-11.9	H	260.2	1.00	23.2
953.125	34.7	46.0	-11.3	H	83.2	1.27	34.8

4.2.3.6 30 MHz to 1 GHz, highest Channel

4.2.3.6.1 Horizontal Polarization

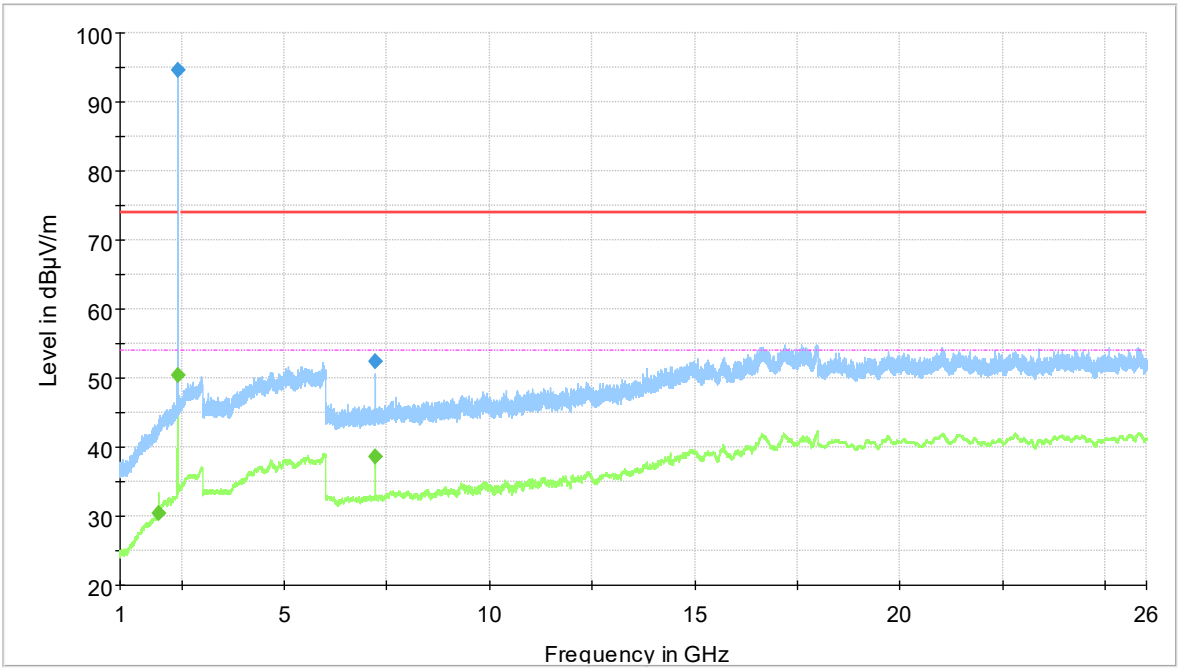


4.2.3.6.2 Vertical Polarization



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Height (m)	Corr. (dB)
980.05	34.8	54.0	-19.2	H	106.6	1.27	34.9
973.575	34.8	54.0	-19.2	V	138.5	1.22	34.9
358.1	35.5	46.0	-10.5	H	298.4	1.06	23.3

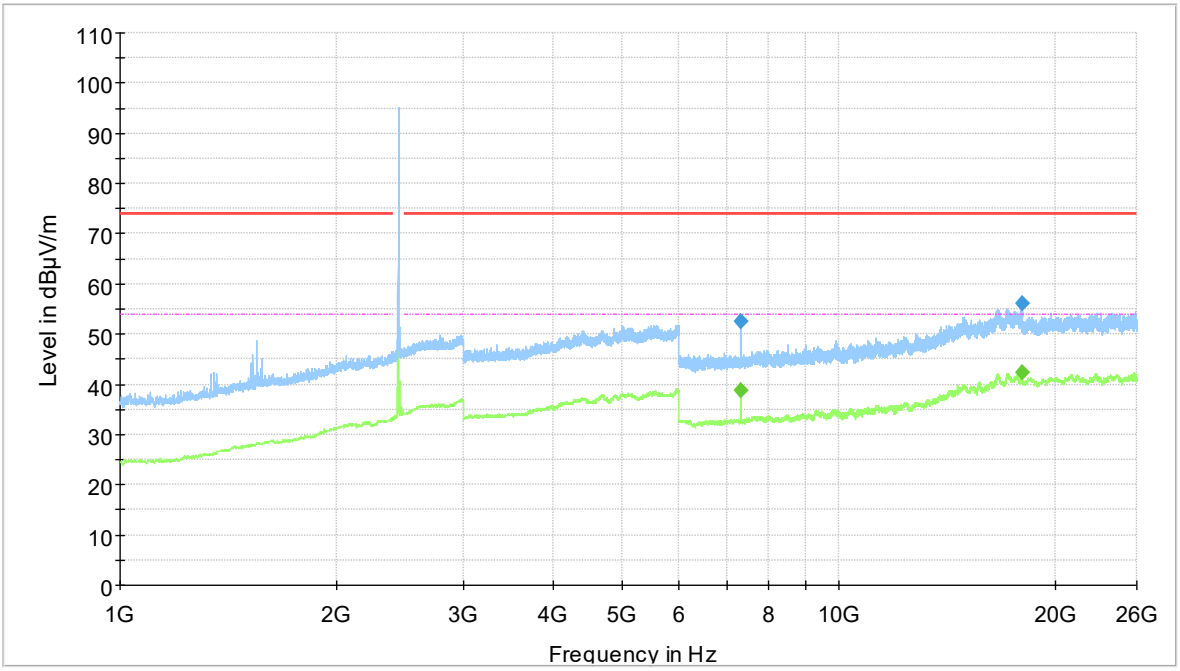
4.2.3.7 **1 to 26GHz, lowest Channel, elevation 7deg**



Preview Result 2-AVG
FCC_15C_15.209_Radiated Emissions_Peak
Final_Result PK+
Preview Result 1-PK+
FCC_15C_15.209_Radiated Emissions_Avg
Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1927.383	---	30.34	54.00	23.66	10000.0	1000.000	150.0	H	346.0	10.6
2399.500	---	50.38	54.00	3.62	10000.0	1000.000	150.0	H	278.0	12.5
2401.980	TX-Signal				10000.0	1000.000	150.0	H	270.0	12.5
7205.285	---	38.60	54.00	15.40	10000.0	1000.000	150.0	V	217.0	-2.9
7205.506	52.39	---	74.00	21.61	10000.0	1000.000	150.0	V	216.0	-2.9

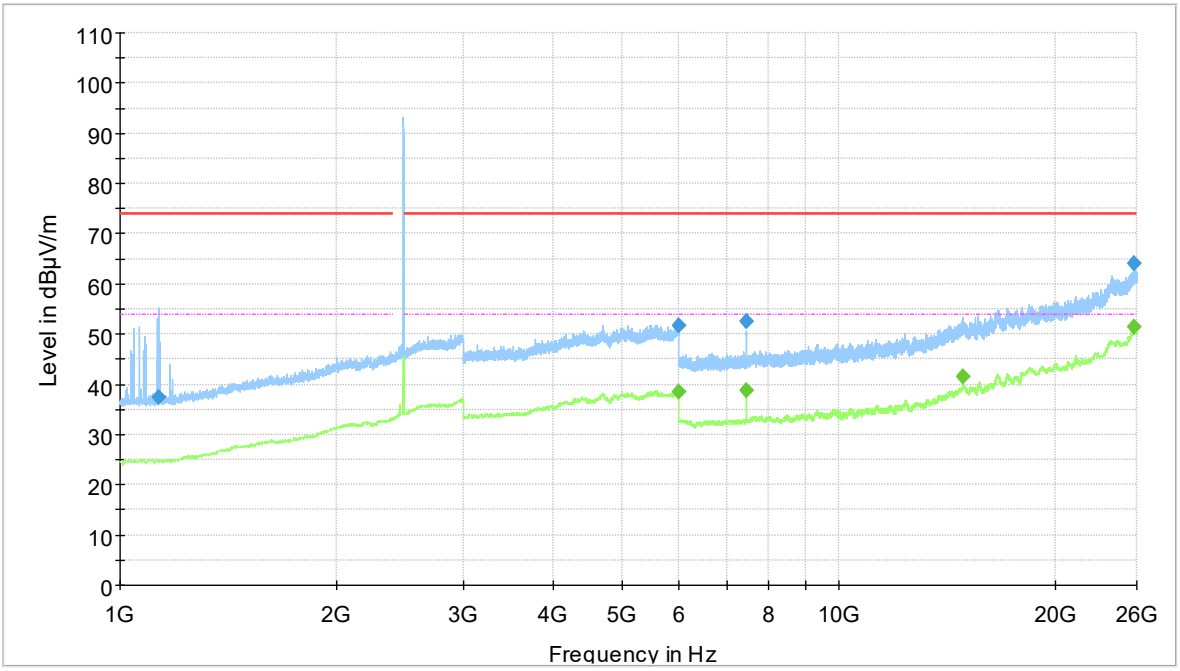
4.2.3.8 1 to 26GHz, middle Channel, elevation 4deg



Preview Result 2-AVG
FCC_15C_15.209_Radiated Emissions_Peak
Final_Result PK+
Preview Result 1-PK+
FCC_15C_15.209_Radiated Emissions_Avg
Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7319.240	52.56	---	74.00	21.44	10000.0	1000.000	150.0	V	214.0	-3.1
7319.480	---	38.83	54.00	15.17	10000.0	1000.000	150.0	V	215.0	-3.1
17976.12	56.04	---	74.00	17.96	10000.0	1000.000	150.0	H	25.0	12.2
17990.81	---	42.43	54.00	11.57	10000.0	1000.000	150.0	V	284.0	12.3

4.2.3.9 1 to 26GHz, highest Channel, elevation 3deg



Preview Result 2-AVG
FCC_15C_15.209_Radiated Emissions_Peak
Final_Result PK+
Preview Result 1-PK+
FCC_15C_15.209_Radiated Emissions_Avg
Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1130.863	37.34		74.00	36.66	10000.0	1000.000	150.0	H	348.0	4.5
5993.415	---	38.49	54.00	15.51	10000.0	1000.000	150.0	H	76.0	13.2
5999.753	51.76		74.00	22.24	10000.0	1000.000	150.0	H	271.0	13.3
7439.532	---	38.78	54.00	15.22	10000.0	1000.000	150.0	H	244.0	-3.2
7440.564	52.63		74.00	21.37	10000.0	1000.000	150.0	H	245.0	-3.2
14878.48	---	41.59	54.00	12.41	10000.0	1000.000	150.0	H	24.0	5.5
25792.26	63.99		74.00	10.01	10000.0	1000.000	150.0	V	48.0	23.2
25806.16	---	51.29	54.00	2.71	10000.0	1000.000	150.0	H	18.0	23.2

4.2.4 Band Edge Measurement (Unwanted emissions)

4.2.4.1 Test Method

Unwanted emissions close to the operating band were additionally tested here.
Antenna connector is prepared, so conducted method was used according to ANSI C63.10:2013 clause 6.10. The maximum in-band antenna gain, or 2 dBi, whichever is greater was used outside the operating band.
The EUT was connected to the spectrum analyzer via a coax cable with a known loss. The measurements were done with EUT configured to the lowest and highest channels.

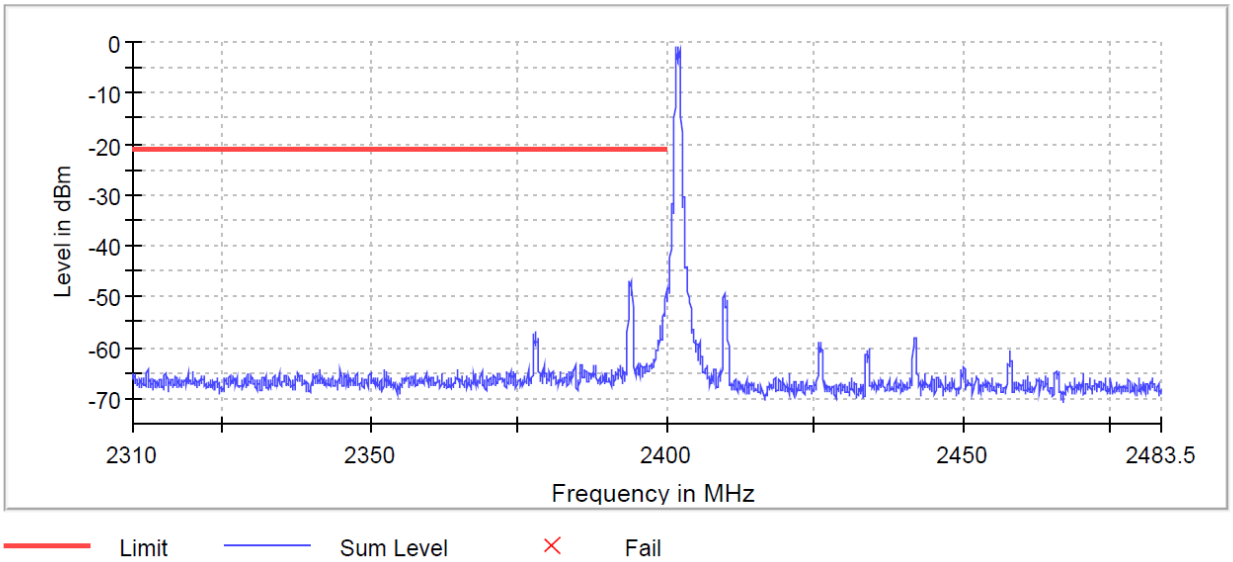
4.2.4.2 Test Setup

EUT		A003668536-006 (cond. sample)
Chamber details		Shielded room
Companion device		EUT in Test Mode. Therefore, no Companion Device was used.
Operation mode		☒ 1: TX-Mode ☐ 2: N/A ☐ 3: N/A ☐ 4: N/A
Spectrum Analyzer	**Resolution Bandwidth**	100kHz
	Video Bandwidth	300kHz
	Sweep time	200µs (max hold until stable)
Further parameters		-
Test engineer		Dipl. Ing. Primoz Erzen

4.2.4.3 **Test results** (Unwanted emissions; Band Edge Measurement)

4.2.4.3.1 Lowest Channel

Band Edge



Inband Peak

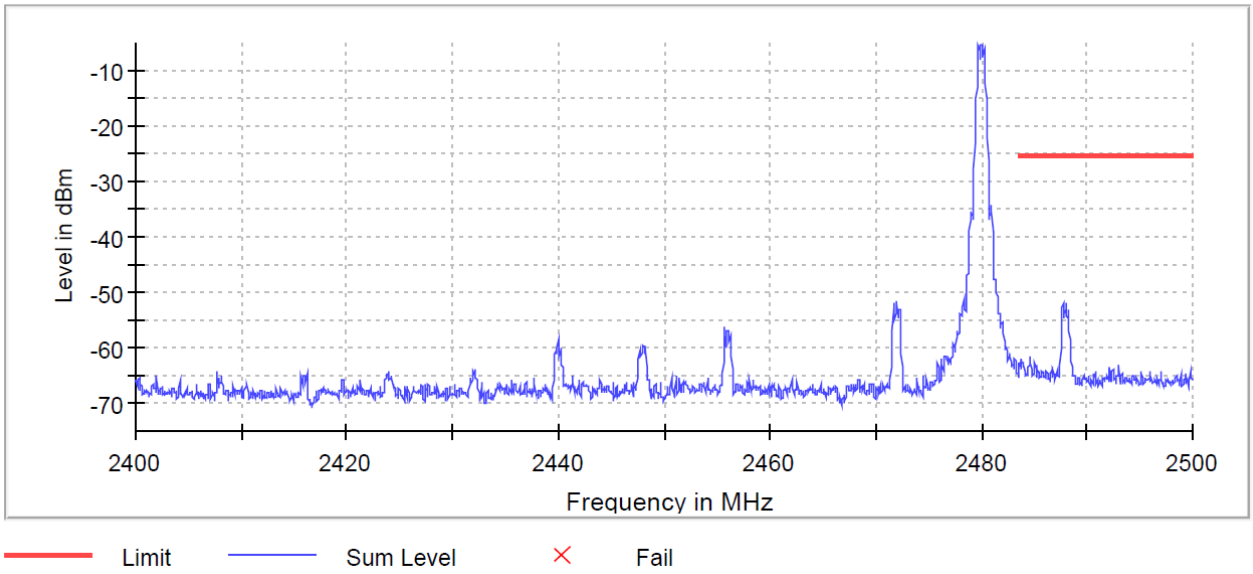
Frequency [MHz]	Level [dBm]
2401.975	-0.9

Measurements

Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2393.975000	**-46.9**	**26.0**	**-20.9**	Pass

4.2.4.3.2 Highest Channel

Band Edge



Inband Peak

Frequency [MHz]	Level [dBm]
2479.725000	**-5.2**

Measurements

Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2487.975000	**-52.1**	**26.8**	**-25.2**	Pass

4.2.5 **Final test result** (Unwanted emissions)

Final test result	Pass

5 Test Setup Photo

There are no photos of the EUT in this report acc. to the confidentiality letter.
For EUT and test setup photos please see the Photo Documentation to this report Number.

6 Application form

The following information was provided by the customer and form the basis for the execution of the tests and the assessment of conformity. The given information can affect the results of both.

No application form was provided.

Liste der verwendeten Prüfmittel
List of used test equipment

7 Equipment List

7.1 Hardware

Prüfmittel Test equipment			**Prüfmittel-Nr. / ID-Nr.** Equipment No. / ID-No.	**Letzte Kalibrierung** Last calibration	**Nächste Kalibrierung** Next calibration	
TS8997	**OSP-B157 WX**. (with integrated power meter)	Rohde & Schwarz	9000266	08.09.2022	08.09.2024	
	OSP-B157W8	Rohde & Schwarz	9000267	07.09.2022	07.09.2024	
	Spectrum Analyzer: FSV-30	Rohde & Schwarz	9000268	10.08.2023	10.08.2025	
	Humidity / Baro / Temp. Data Recorder	PCE Instruments	9000207	08.08.2023	08.08.2024	
Fully Anechoic Room		Albatross Projects GmbH	2959749	08.10.2021	08.10.2024	*
Signal Analyzer FSU 26		Rohde & Schwarz	2844118	04.08.2023	04.08.2025	
Signal Analyzer UXA N9041B		Keysight	2971644	06.04.2022	06.04.2024	
RSE-Filtersystem		Rohde & Schwarz	9002802	06.02.2024	06.02.2025	*
Antenna CBL 6111D 25MHz-1GHz		CHASE	2815644	06.09.2021	06.09.2024	
Antenna HF907 1-18GHz		Rohde & Schwarz	2856263	01.09.2021	01.09.2024	
Horn Antenna 3116C-PA 18-40GHz		ETS LINDGREN	2900393	19.12.2022	19.12.2025	
Semi-Anechoic Chamber 30-1000 MHz		Siemens	2729645	15.06.2022	15.06.2025	*
Receiver ESU 8		Rohde & Schwarz	2728844	23.02.2024	23.02.2025	
Antenna HFH 2 (Loop) 9kHz-30MHz		Rohde & Schwarz	2728893	09.07.2021	09.07.2024	
Antenna VULB 9168 30MHz – 1GHz		Schwarzbeck	2728136	05.10.2023	05.10.2026	

*Equipment only verified and not calibrated

7.2 Software

Test Software	Developer	Version
EMC32	Rohde & Schwarz	10.60.20
WMS32	Rohde & Schwarz	10.60.10
BAT-EMC	NEXIO	2022.0.8.0

8 Change history

Revision Number	List of revisions	Date of issue
001	Initial Release	2024-05-02
Note: Latest revision report will replace all previous reports.		

Ende des Prüfberichts
End of Test Report