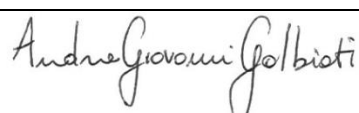
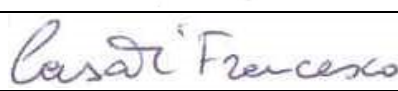


RF TEST REPORT

Test Report No:	24-4791151465-4-1-1-RAD-A	
UL Project No:	4791151465	
Date of issue:	2024-07-11	
Total number of pages:	26	
Applicant:	SECO S.p.A. Via Achille Grandi, 20 52100 Arezzo (AR) – Italy	
Contact's person:	Giacomo Martini (Giacomo.Martini@seco.com)	
Testing Laboratory:	UL International Italia S.r.l. Via delle Industrie, 6 (Sede A) 20061 Carugate (MI) – Italy	
Testing location:	UL International Italia S.r.l. Via delle Industrie, 6 20061 Carugate (MI) – Italy	
Test specification:		
Regulations:	FCC/ISED	
Standards:	FCC CFR 47 - Part 15 Subpart C RSS-247 Issue 3:2023 RSS-Gen Issue 5:2021	
Non-standard test method:	N/A	
Scope of testing:	Wireless - New testing	
TRF No.:	TRF_FCC 15C/RSS-247_Accredia_rev 0	
Test Report Form(s) Originator:	UL International Italia S.r.l.	
Master TRF	2023-03 .	
Compiled by: (name, function, signature)	Andrea Giovanni Galbiati Laboratory Engineer 	
Approved by: (name, function, signature)	Francesco Casati Operations Leader 	
General disclaimer: The test results presented in this test report relate only to the object tested, not selected by UL International Italia S.r.l.. This report shall not be reproduced, except in full, without the written approval of the issuing Testing Laboratory. This document contains data (of information) using color and if printed, should be printed in color to retain legibility and the information represented by the color.		
Declination of responsibility: Data provided by the customer are clearly identified with (*). UL International Italia S.r.l. cannot be considered responsible for this information, for any other document sent by the Applicant/Manufacturer and for any difference between the software version present in the tested sample and that present in the object intended for final sale. In some cases, the software in the tested sample is in a version dedicated exclusively to the test, and therefore does not represent the software installed in the final version of the product.		

Test Item Description:	HMI display
Trade Mark: (*)	 Itama (Logo:
Manufacturer: (*)	SECO S.p.A. Via Achille Grandi, 20 52100 Arezzo (AR) – Italy
Host Product Name (HMN)	SYS-D90-ITE
FCC ID:	Contains FCC ID: 2ALZB-MU1MWMO146
IC number:	Contains 22688-MU1MWMO146
FCC ID Host product:	2ALZB-7150PN
IC number Host product:	22688-7150PN
Ratings: (*)	24 Vdc $\pm 10\%$; 2.5 A max (EUT) 100-240 Vac; 50/60 Hz; 1.3-0.6 A (AC/DC medical adaptor)
Testing:	
Type of equipment considered in the present document:	☐ Non-radio product ☐ Non-radio product combined with one radio technology ☐ Non-radio product combined with more radio technologies, only capable of independent transmission ☒ Non-radio product combined with more radio technologies, capable of simultaneous transmission ☐ Radio product with one radio technology ☐ Radio product with more radio technologies, only capable of independent transmission ☐ Radio product with more radio technologies, capable of simultaneous transmission
Date of receipt of test item:	2024-01-26
UL Sample Tag No.:	6823276
Status of sample upon receipt:	☒ New and operational ☐ Reconditioned ☐ Damaged
Date(s) of performance of tests:	2024-02-12 to 2024-02-16
Name and address of factory(ies): (*)	SECO S.p.A. Via Achille Grandi, 20 52100 Arezzo (AR) - Italy
General remarks: A cross ☒ in a rectangular shape means that this option is applied. ☒ Indicates that the listed condition, standard or equipment is applicable for this report. ☐ Indicates that the listed condition, standard or equipment is not applicable for this report. Throughout this report a ☐ comma / ☒ point is used as decimal separator. Where not otherwise specified or communicated in writing, statements of conformity (e.g. Pass/Fail) are established according to the following decision rule: considering that the applied test standards take measurement uncertainty into account, acceptance limit equals the tolerance limit (simple acceptance). This leads to a maximum 50% of false accept or false reject when the measured value equals the tolerance limit. See ILAC-G8:09/2019 for further details.	

General product information: (*)

HMI touchscreen for configuring and interacting with a weaving loom, fully controlling the operating parameters and collecting data for statistical purposes

Document history

Test Report No.	Reason for change	Date of issue
24-4791151465-4-1-0-RAD-A	Original release.	2024-02-20
24-4791151465-4-1-1-RAD-A	Standard edition updated from RSS-247 issue 2 to RSS-247 issue 3. No testing is needed	2024-07-11

NOTE: New test report issue cancels and replaces the previous one.

Laboratory Accreditation

FCC Accredited Test Firm

Accreditation	MRA	Designation Number	Expiration Date
Ministero dello Sviluppo Economico- Direzione Generale Pianificazione e Gestione dello Spettro Radioelettrico <u>Scope:</u> - Unintentional Radiators - FCC Part 15 Subpart B - Industrial, Scientific, and Medical Equipment - FCC Part 18 - Intentional Radiators - FCC Part 15 Subpart C	US-EU	IT0010	2025-06-25

ISED Wireless Device Testing Laboratory

Company Number	CAB Identifier	Scope/Recognition Date	Expiration Date
UL INTERNATIONAL ITALIA S.R.L.	IT0008	RSS-GEN (2023-10-06) RSS-247 (2023-10-06)	RECOGNIZED UNTIL: 2025-06-16 ACCREDIA ISO/IEC 17025:2017 Expires: 2025-06-16

Table of Contents

Laboratory Accreditation.....	4
1 Test Item Description	6
1.1 Additional information of antennas used (*).....	8
2 Verdict summary section.....	9
3 Formulas used	9
4 Tests	11
4.1 Radiated emissions & restricted bands emissions	11
4.2 Band edge.....	20
5 List of test equipment.....	24
6 Measurement instrumentation uncertainties	26

1 Test Item Description

Serial number: (*)	230202056							
Date of production: (*)	---							
Ports: (*)	Port name and description	Cable						
		Specified length(m)	Attached during test	Shielded				
	DC Mains	> 3	☒	☐				
	Wired network port (Ethernet)	> 3	☒	☐				
	USB	< 3	☒	☐				
	RS 232	< 3	☒	☐				
	AC Mains (*)	---	☒	☐				
Supplementary information to the ports:	(*) Input of external power supply							
Rated power supply: (*)		Voltage and frequency		Reference poles				
			N	L1	L2	L3		
	☒	AC: 100-240 V; 50/60 Hz	☒	☒	☐	☐		
	☒	DC: 24 V						
Working frequencies: (*)	Clock frequency: 20 MHz, 24 MHz, 25 MHz Other: 1.8 MHz WLAN/Bluetooth: 2.4 GHz band							
Firmware/Software version (original): (*)	U-Boot 2020.04 Linux seco-imx8mm-c61 5.4.70							
Firmware/Software version (used for testing): (*)	U-Boot 2020.04 Linux seco-imx8mm-c61 5.4.70							
Hardware version: (*)	main board: CD90-1532-0886-C0 System: SYS-D90-ITE-00-C0							
Mounting position: (*)	☒	Table top equipment						
	☐	Wall/Ceiling mounted equipment						
	☐	Floor standing equipment						
	☐	Hand-held equipment						
	☐	Other:						
Dimensions in cm (W x H x D): (*)	25 x 6.7 x 40							

Operating modes:	No.	Operating mode of test item	
	1	Continuous transmission WLAN 2.4 GHz: Channel 6 (frequency= 2437 MHz), Data rate: 1 Mbps Mode: 802.11b, Power set via software at 31 (worst case for RSE)	
	2	Continuous transmission WLAN 2.4 GHz: Channel 1 (frequency= 2412 MHz), Data rate: 1 Mbps Mode: 802.11b, Power set via software at 19 (worst case for Band Edge and Restricted Bands)	
	3	Continuous transmission WLAN 2.4 GHz: Channel 11 (frequency= 2462 MHz), Data rate: 1 Mbps Mode: 802.11b, Power set via software at 19 (worst case for Band Edge and Restricted Bands)	
Supplemental information to the operating mode:	Pre-scan in the X,Y and Z axes of orientation was performed in order to select the worst case.		
Auxiliary equipment (AuxEq): <i>Peripheral equipment that is part of the system under test</i>	Description	Manufacturer	Type
	---	---	---
Associated equipment (AE): <i>Equipment that is not part of the system under test but needed to exercise and/or monitor the EUT</i>	Description	Manufacturer	Type
	---	---	---
Documents as provided by the applicant: (*)	Description	File name	Issue date
	---	---	---
Modifications to the test item during testing:	---		

Copy of marking plate: (*)









Itema P/N: 151282058

P/N:SYS-D90-ITE-XX-XX

S/N:YYMMXXXXX



Input: 24 V_{DC} ±10% $\overline{\text{---}}$ MAX 2,5 A

SYS-D90-ITE

FCC ID: 2ALZB-7150PN

IC: 22688-7150PN

Contains FCC ID: 2ALZB-MU1MWMO146

Contains IC: 22688-MU1MWMO146

Manufactured by SECO S.p.A. Via Achille Grandi n°20, 52100 Arezzo, Italy

1.1 Additional information of antennas used (*)

Bluetooth/WLAN Radio module (Antenna Characteristic)	
Manufacturer:	Molex
Model/Type reference:	Molex Series 146187
Mounting:	Integral
Type:	Dipole antenna
Gain:	2.8 dBi max @ 2.4 GHz 4 dBi max @ 5GHz
Other information can be taken from the test reports of module certification and/or from manufacturer's data sheet.	

NFC module	
Manufacturer:	NXP Semiconductors
Model/Type reference:	PN7150
Mounting:	Integral
Other information can be taken from the test reports of module certification and/or from manufacturer's data sheet.	

2 Verdict summary section

Standard clause		Description	Accreditation	Verdict	Note
FCC	ISED				
15.203	RSS-Gen 6.8	Antenna requirements	Accredia	N/P	
15.207	RSS-Gen 8.8	AC power-line conducted emissions	Accredia	N/P	
15.209 15.247(d)	RSS-Gen 6.13 RSS-Gen 8.9 RSS-Gen 8.10	Radiated emissions & restricted bands emissions	Accredia	P	1
15.247(a)(1)	RSS-247 5.1	20 dB emission bandwidth	Accredia	N/P	
15.247(a)(1)	RSS-247 5.1(b)	Carrier frequency separation	Accredia	N/P	
15.247(a)(1)(iii)	RSS-247 5.1(d)	Quantity of hopping channels	Accredia	N/P	
15.247(a)(1)(iii)	RSS-247 5.1(d)	Time of occupancy (dwell time)	Accredia	N/P	
15.247(a)(2)	RSS-247 5.2(a)	6 dB emission bandwidth	Accredia	N/P	
---	RSS-Gen 6.7	99% emission bandwidth	Accredia	N/P	
15.247(b)(1) 15.247(b)(3) 15.247(b)(4)	RSS-247 5.4(b) RSS-247 5.4(d) RSS-247 5.4(f)	Maximum peak conducted output power	Accredia	N/P	
15.247(d)	RSS-247 5.5	Band edge	Accredia	P	
15.247(e)	RSS-247 5.2(b)	Power spectral density	Accredia	N/P	
Test method: ANSI C63.10-2013 Test guide: FCC/KDB-558074 D01 15.247 Meas Guidance v05r02 Notes: 1. The frequencies range from 9 kHz to 30 MHz is cover by test report UL-RPT-RP15124648-516A					

Possible test case verdicts:

Test case not performed: N/P

Test case does not apply to test object: N/A

Test object does meet requirement: Pass (P)

Test object does not meet requirement: Fail (F)

3 Formulas used

☐ Disturbance voltage

$$V \text{ (dB}\mu\text{V)} = V \text{ receiver (dB}\mu\text{V)} + \text{Correction (dB)}$$

where:

$$\text{Correction (dB)} = \text{I.L. transducer (dB)} + \text{I.L. cable (dB)}$$

☐ Magnetic field

$$H \text{ (dB}\mu\text{A/m)} = V \text{ receiver (dB}\mu\text{V)} + \text{Correction (dB)}$$

where:

$$\text{Correction (dB)} = \text{Magnetic antenna factor (dB}/\Omega\text{m)} + \text{I.L. cables (dB)}$$

☒ Electric field

$$E \text{ (dB}\mu\text{V/m)} = V \text{ receiver (dB}\mu\text{V)} + \text{Correction (dB)}$$

where:

$$\text{Correction (dB)} = \text{Electric antenna factor (dB/m)} - \text{Gain external preamplifier (dB)} + \text{I.L. external filter (dB)} + \text{I.L. cables (dB)}$$

Note: external preamplifier and external filter are optional and, if used, are indicated in the list of test equipment

☒ Margin

$$\text{Margin (dB)} = \text{Measure} - \text{Limit}$$

☐ Radiated emission limit conversion for a different measuring distance

$$40 \text{ dB/decade (f<30 MHz); } 20 \text{ dB/decade (f}\geq\text{30 MHz)}$$

☐ Correction of radiated field from 5 m to 3 m

$$+8.87 \text{ dB (f<30 MHz); } +4.44 \text{ dB (f}\geq\text{30 MHz)}$$

☒ Linear to logarithmic conversion

$$\text{Log} = 20 \cdot \log(\text{Lin}) \text{ for voltage and current; } \text{Log} = 10 \cdot \log(\text{Lin}) \text{ for power}$$

☐ Conducted Radio Measurements

$$P_{\text{out_EUT}} = P_{\text{read_Amplifier}} \text{ (dBm)} + \text{Cable Losses (dB)} + \text{Attenuator (dB)}$$

☐ Duty Cycle

$$\text{Duty Cycle (\%)} = 100 \times [\text{On Time (TON)}] / [\text{Period(TON+ TOFF)}]$$

$$\text{Duty Cycle Correction Factor} = 10 \log 1 / [\text{On Time (TON)}] / [\text{Period(TON+ TOFF)}]$$

$$P_{\text{out_AVGcorr}} = P_{\text{out_AVG}} + \text{Duty Cycle Correction Factor}$$

☐ Average time of occupancy:

$$\text{Number of hops in the period specified in the requirements} =$$

$$(\text{number of hops on spectrum analyzer}) \times (\text{period specified in the requirements} / \text{analyzer sweep time})$$

$$\text{Average time of occupancy} = \text{transmit time per hop} \times \text{number of hops in the period specified in the requirements}$$

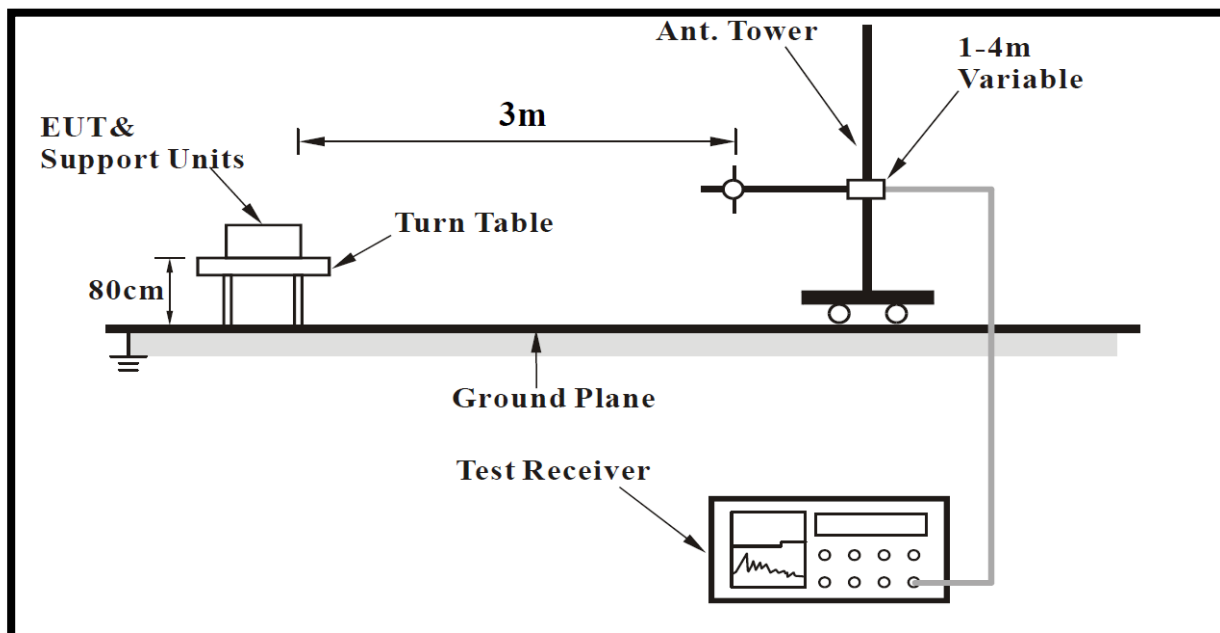
4 Tests

4.1 Radiated emissions & restricted bands emissions

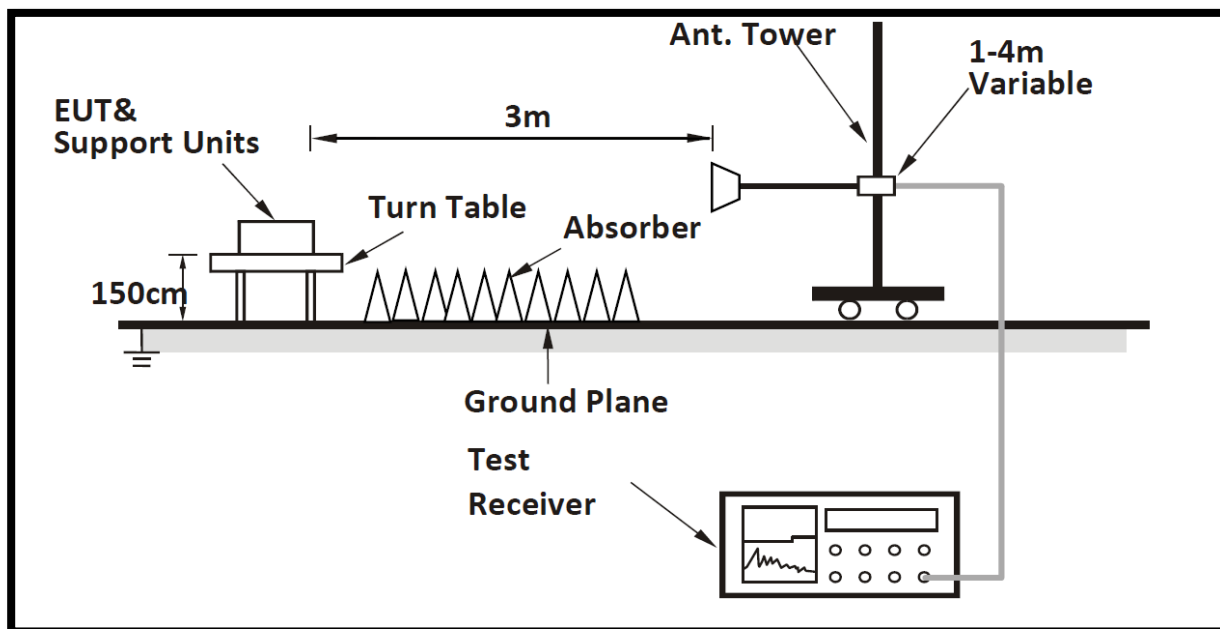
Tested by:	Andrea Giovanni Galbiati	
Test date:	2024-02-12 to 2024-02-16	
Test location (stand):	Area 8: SAC 3-1.2 (RF emission)	
Ambient temperature:	22 °C to 24 °C	
Relative humidity:	40 % to 45 %	
Atmospheric pressure:	999 mbar to 1003 mbar	
FCC requirements (clauses):	15.209(a), 15.247(d)	
ISED requirements (clauses):	RSS-Gen 6.13, RSS-Gen 8.9, RSS-Gen 8.10	
ANSI C63.10 test method (clause):	6.3, 6.5, 6.6	
EUT Test set-up:	☒	<u>Table-top equipment</u> EUT on nonconducting support of 80 cm height above the floor for measurements at or below 1 GHz
	☒	<u>Table-top equipment</u> EUT on nonconducting support of 1.5 m height above the floor for measurements above 1 GHz
	☐	<u>Floor-standing equipment</u> EUT on nonconducting support of 10 cm height above the floor
	☐	<u>Floor-standing equipment</u> If possible, the antenna(s) of the EUT is located at a height of 1.5 m above the floor, and the intentional radiator circuitry is located within the system at a height of at least 0.8 m above the floor.
	☐	Use of LISN on the floor for measurements between 30 MHz and 1000 MHz (optional)
	☐	Other:
Supplementary test set-up description:	EUT positioned as installed in the final application	
Test facility:	☐	<u>Range: 9 kHz to 30 MHz</u> OATS or SAC using active loop antenna (distance: 3 m; height: 1 m from the loop center)
	☒	<u>Range: 30 MHz to 1 GHz</u> OATS or SAC using hybrid (bicon/log) antenna (distance: 3 m; height: 1 m to 4 m)
	☒	<u>Range: 1 GHz to 26 GHz</u> FSOATS using double-ridged guide horn antenna (distance: 3 m; height: 1 m to 4 m)
	☐	<u>Range: 26 GHz to 40 GHz</u> FSOATS using double-ridged guide horn antenna (distance: 1 m; height: 1 m to 4 m)
Used mains voltage/frequency:	120 V; 60 Hz	
Supplementary information:	The frequencies range from 9 kHz to 30 MHz is cover by test report UL-RPT-RP15124648-516A The channel tested represent the worst case condition. The worst case condition has been evaluated by preliminary scan performed on all channels (Bottom, middle and top)	

Block diagram of the test setup:

30 MHz to 1 GHz



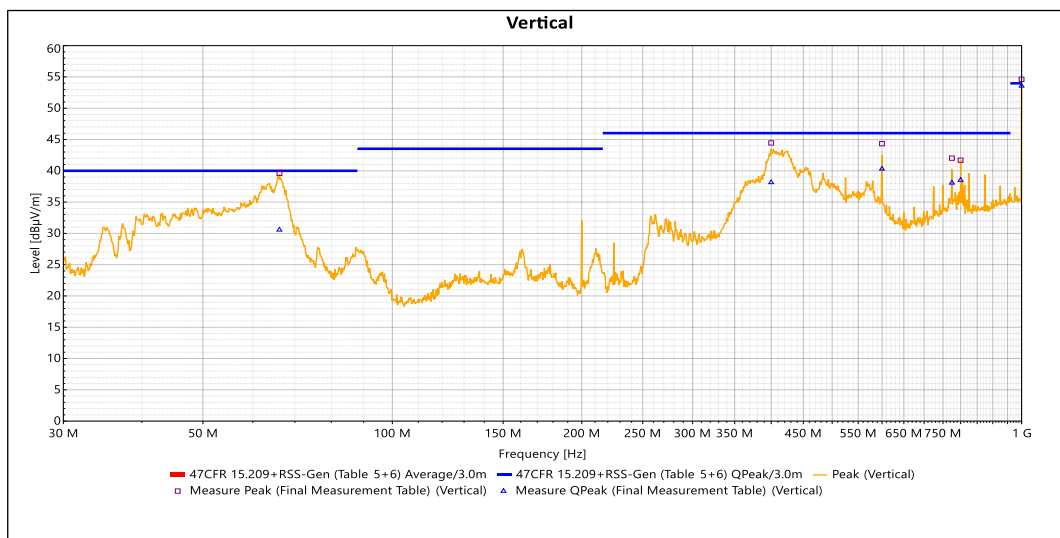
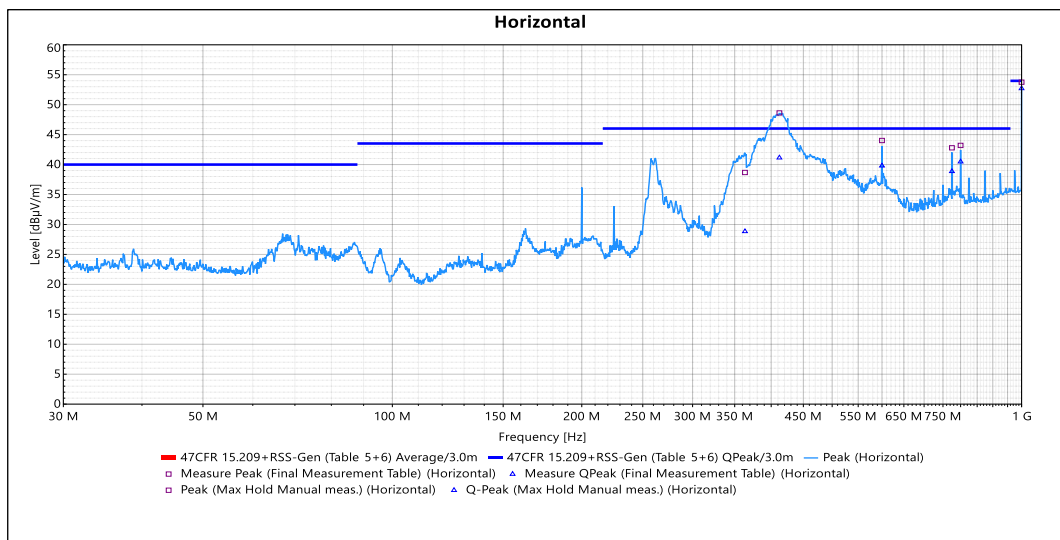
1 GHz to 26 GHz



Results

Operating Mode:	1 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)		
Test result:	Pass	Tested on:	2024-02-12

Start Frequency: 30 MHz; Stop Frequency: 1 GHz; Step: 30 kHz; Sweep Time: 20 ms/Step; RF Attenuation: Auto; RBW: 120 kHz; VBW: Auto; Preamplifier: ON; Preselector: ON



Final Measurement

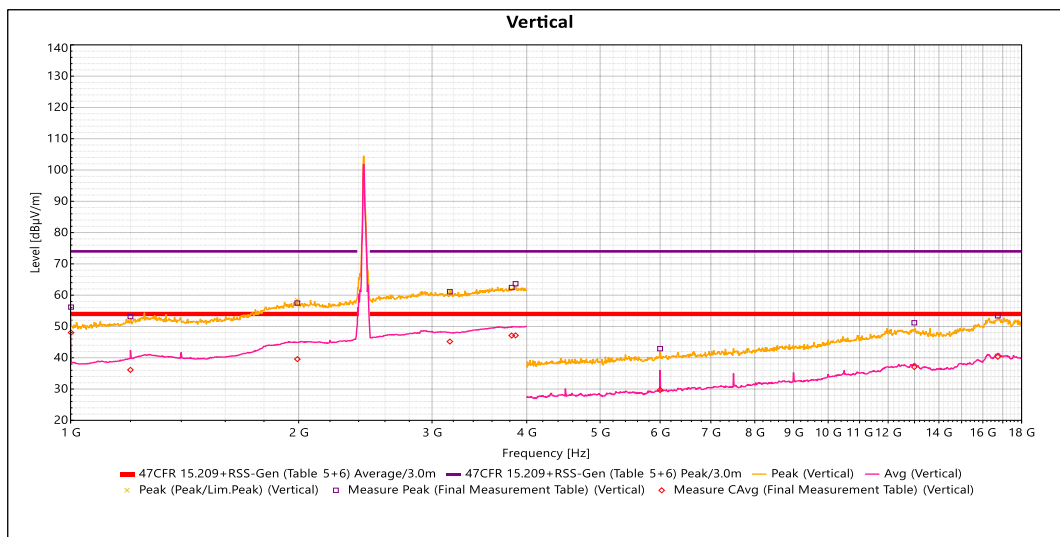
- ☐ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☒ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Frequency	SR #	Measure Peak (dBμV/m)	Measure QPeak (dBμV/m)	Limit QPeak (dBμV/m)	Margin QPeak (dB)	Max height (m)	Max angle (°)	Polarization	RBW (Hz)	Meas.Time (s)	Comments	Correction (dB)
363.39 MHz	1	38.684	28.844	46.02	-17.176	1	62.3	Horizontal	120 k	5	Pass	21.845
412.2 MHz	1	48.621	41.143	46.02	-4.877	1.496	128.7	Horizontal	120 k	5	Pass	23.206
600 MHz	1	44.015	39.797	46.02	-6.223	1.684	216.2	Horizontal	120 k	5	Pass	27.52
774.99 MHz	1	42.802	38.87	46.02	-7.15	1.124	204	Horizontal	120 k	5	Pass	30.175
799.98 MHz	1	43.195	40.475	46.02	-5.545	1.091	114	Horizontal	120 k	5	Pass	30.29
999.99 MHz	1	53.762	52.705	53.98	-1.275	1.008	98.9	Horizontal	120 k	5	Pass	32.16
66.15 MHz	2	39.595	30.563	40	-9.437	1	188.9	Vertical	120 k	5	Pass	18.532
399.99 MHz	2	44.454	38.14	46.02	-7.88	1.759	147.7	Vertical	120 k	5	Pass	23.05
599.97 MHz	2	44.327	40.304	46.02	-5.716	1	176.5	Vertical	120 k	5	Pass	27.519
774.99 MHz	2	42.021	38.068	46.02	-7.952	1.006	309.1	Vertical	120 k	5	Pass	30.175
799.98 MHz	2	41.689	38.518	46.02	-7.502	1.029	358	Vertical	120 k	5	Pass	30.29
999.96 MHz	2	54.617	53.569	53.98	-0.411	1.057	146.6	Vertical	120 k	5	Pass	32.16

Operating Mode:	1 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)		
Test result:	Pass	Tested on:	2024-02-13

Start Frequency: 1 GHz; Stop Frequency: 4 GHz; Step: 6000 Pts; Sweep Time: 3 s; RF Attenuation: 10 dB; RBW: 1 MHz; VBW: 3 MHz; Preamplifier: ON; Preselector: ON

Start Frequency: 4 GHz; Stop Frequency: 18 GHz; Step: 28000 Pts; Sweep Time: 3 s; RF Attenuation: 0 dB; RBW: 1 MHz; VBW: 3 MHz; Preamplifier: OFF; Preselector: ON



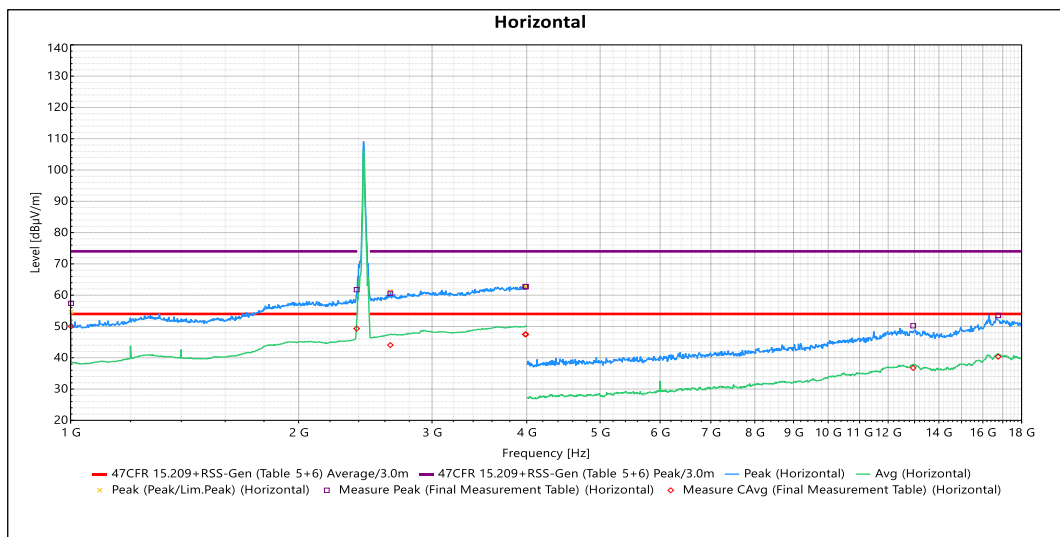
Final Measurement

- ☐ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☒ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Frequency	SR #	Measure Peak (dBμV/m)	Limit Peak (dBμV/m)	Margin Peak (dB)	Measure CAvg (dBμV/m)	Limit Avg (dBμV/m)	Margin Avg (dB)	Height (m)	Angle (°)	Polarization	RBW (Hz)	Meas.Time (s)	Comments	Correction (dB)
1 GHz	1	56.191	74	-17.809	48.028	54	-5.972	1.998	59.9	Vertical	1 M	5	Pass	30.2
1.2 GHz	1	53.146	74	-20.854	36.121	54	-17.879	2.001	89.9	Vertical	1 M	5	Pass	31.693
1.992 GHz	1	57.488	74	-16.512	39.557	54	-14.443	3.501	29.9	Vertical	1 M	5	Pass	35.247
3.167 GHz	1	61.092	74	-12.908	45.182	54	-8.818	3.501	89.9	Vertical	1 M	5	Pass	37.136
3.822 GHz	1	62.438	74	-11.562	47.11	54	-6.89	1.998	59.9	Vertical	1 M	5	Pass	38.416
3.867 GHz	1	63.65	74	-10.35	47.146	54	-6.854	1	0.1	Vertical	1 M	5	Pass	38.523
6 GHz	2	42.904	74	-31.096	29.7	54	-24.3	1.498	59.9	Vertical	1 M	5	Pass	0.759
12.992 GHz	2	51.165	74	-22.835	37.033	54	-16.967	2.498	0.1	Vertical	1 M	5	Pass	10.305
16.746 GHz	2	53.428	74	-20.572	40.305	54	-13.695	2.498	59.9	Vertical	1 M	5	Pass	12.773

Operating Mode:	1 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)		
Test result:	Pass	Tested on:	2024-02-16

Start Frequency: 1 GHz; Stop Frequency: 4 GHz; Step: 6000 Pts; Sweep Time: 3 s; RF Attenuation: 10 dB; RBW: 1 MHz; VBW: 3 MHz; Preamplifier: ON; Preselector: ON
Start Frequency: 4 GHz; Stop Frequency: 18 GHz; Step: 28000 Pts; Sweep Time: 3 s; RF Attenuation: 0 dB; RBW: 1 MHz; VBW: 3 MHz; Preamplifier: OFF; Preselector: ON



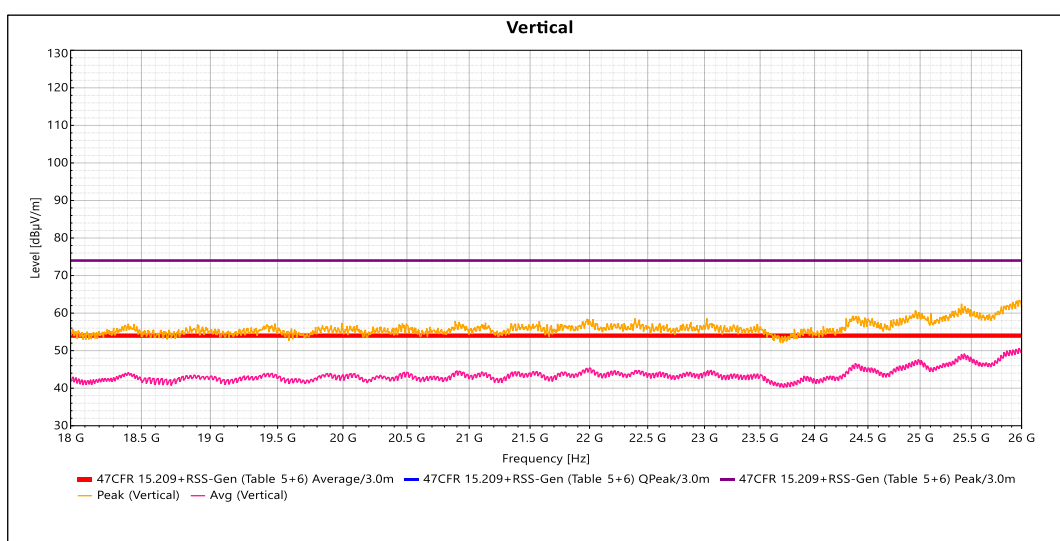
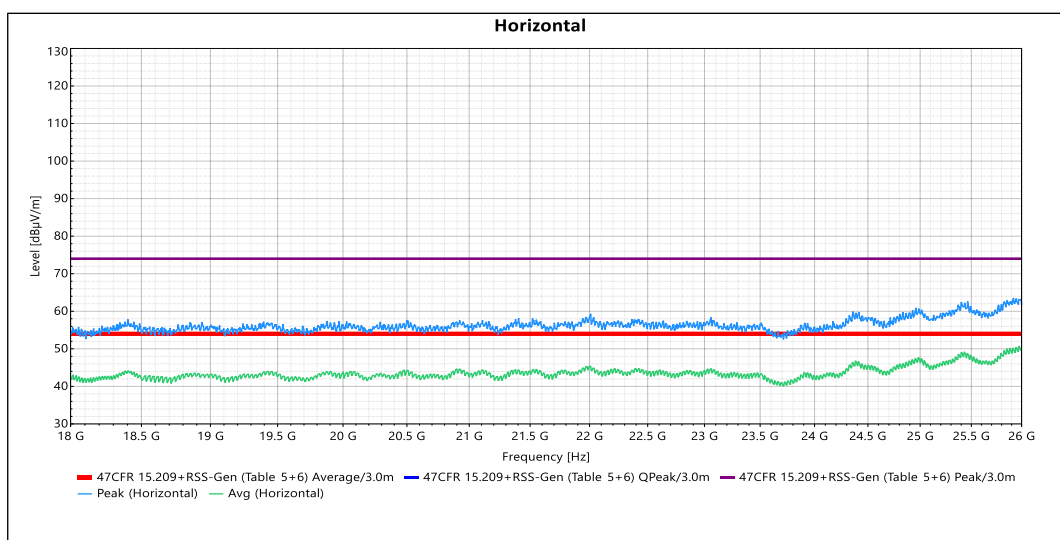
Final Measurement

- ☐ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☒ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Frequency	SR #	Measure Peak (dBμV/m)	Limit Peak (dBμV/m)	Margin Peak (dB)	Measure CAvg (dBμV/m)	Limit Avg (dBμV/m)	Margin Avg (dB)	Height (m)	Angle (°)	Polarization	RBW (Hz)	Meas.Time (s)	Comments	Correction (dB)
1 GHz	1	57.394	74	-16.606	50.03	54	-3.97	1.998	119.9	Horizontal	1 M	5	Pass	30.2
2.386 GHz	1	61.773	74	-12.227	49.301	54	-4.699	1.002	239.9	Horizontal	1 M	5	Pass	36.02
2.643 GHz	1	60.579	74	-13.421	44.048	54	-9.952	2.001	29.9	Horizontal	1 M	5	Pass	36.778
3.982 GHz	1	62.681	74	-11.319	47.483	54	-6.517	1.498	179.9	Horizontal	1 M	5	Pass	38.609
3.99 GHz	1	62.762	74	-11.238	47.48	54	-6.52	2.998	59.9	Horizontal	1 M	5	Pass	38.614
12.947 GHz	2	50.224	74	-23.776	36.746	54	-17.254	3.498	0.1	Horizontal	1 M	5	Pass	10.335
16.764 GHz	2	53.521	74	-20.479	40.335	54	-13.665	3.501	29.9	Horizontal	1 M	5	Pass	12.758

Operating Mode:	1 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)		
Test result:	Pass	Tested on:	2024-02-16

Start Frequency: 18 GHz; Stop Frequency: 26 GHz; Step: 250 kHz; Sweep Time: 20 ms/Step; RF Attenuation: Auto; RBW: 1 MHz; VBW: Auto; Preamplifier: OFF; Preselector: ON



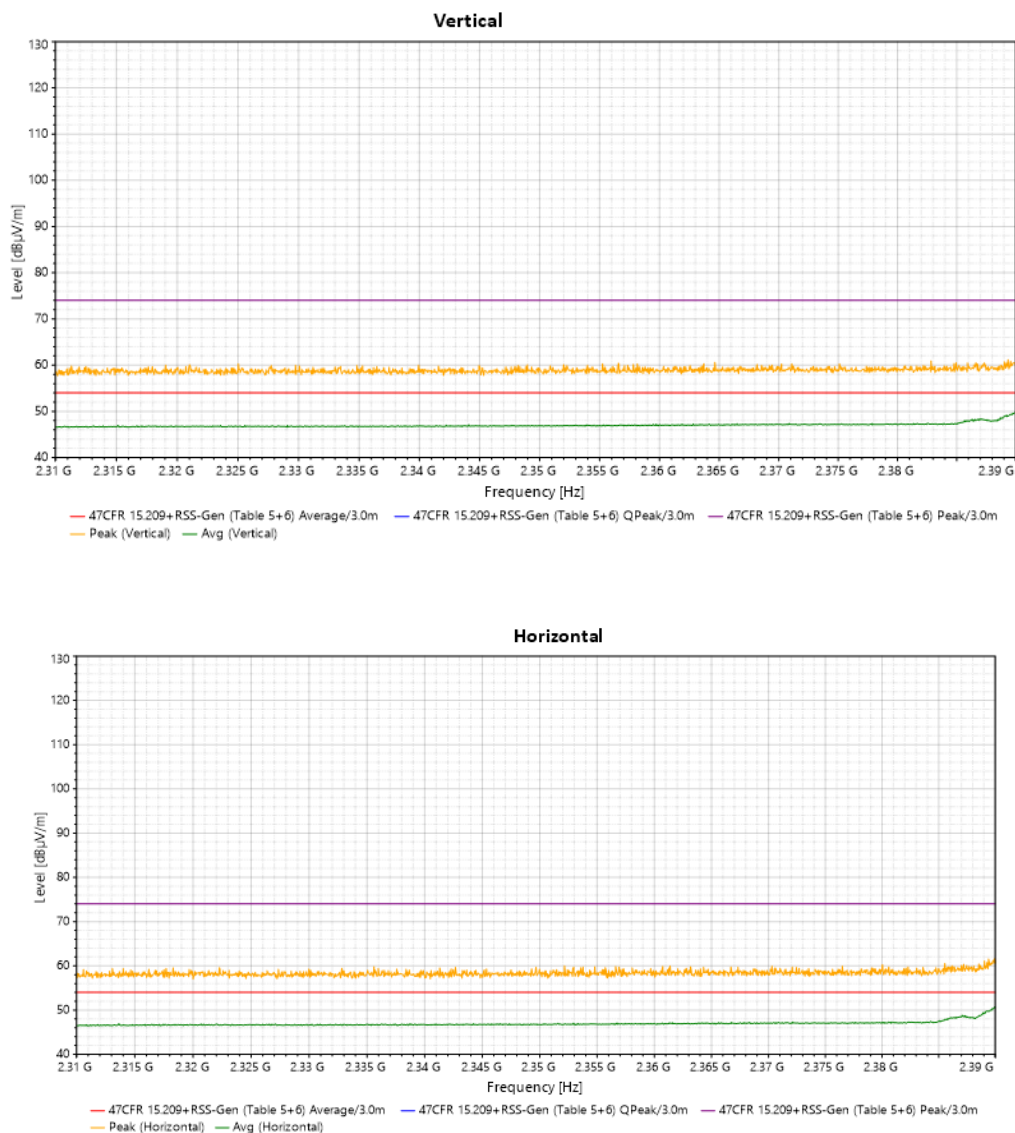
Final Measurement

- ☒ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☐ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Evaluation of restricted band 2310 MHz to 2390 MHz:

Operating Mode:	2 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)		
Test result:	Pass	Tested on:	2024-02-16

Start Frequency: 2.31 GHz; Stop Frequency: 2.39 GHz; Step: 5000 Pts; Sweep Time: 3 s; RF Attenuation: 10 dB; RBW: 1 MHz; VBW: 3 MHz; Preamplifier: ON; Preselector: ON



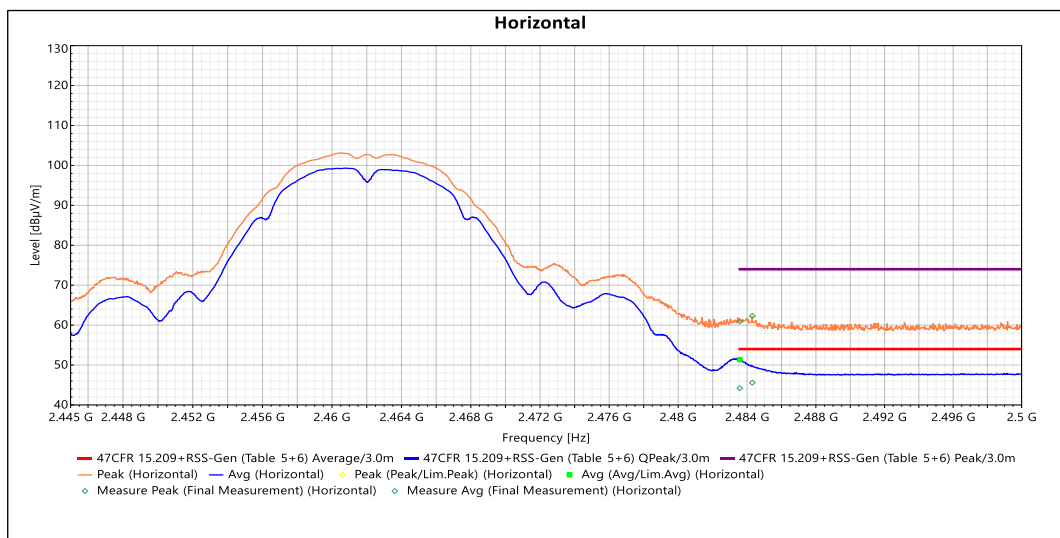
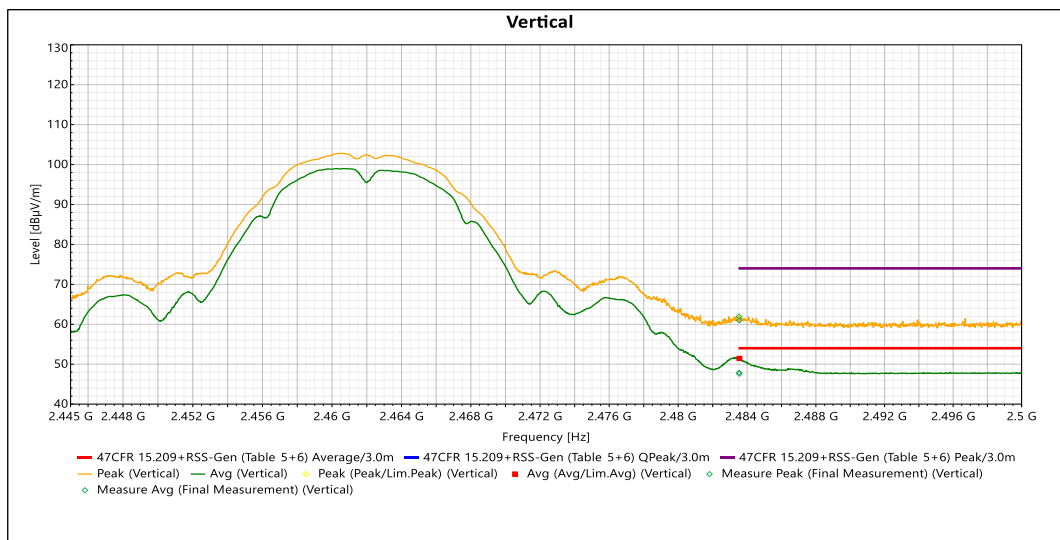
Final Measurement

- ☒ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☐ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Evaluation of restricted band 2483.5 MHz to 2500 MHz:

Operating Mode:	3 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)		
Test result:	Pass	Tested on:	2024-02-16

Start Frequency: 2.445 GHz; Stop Frequency: 2.5 GHz; Step: 5000 Pts; Sweep Time: 3 s; RF Attenuation: 10 dB; RBW: 1 MHz; VBW: 3 MHz; Preamplifier: ON; Preselector: ON



Final Measurement

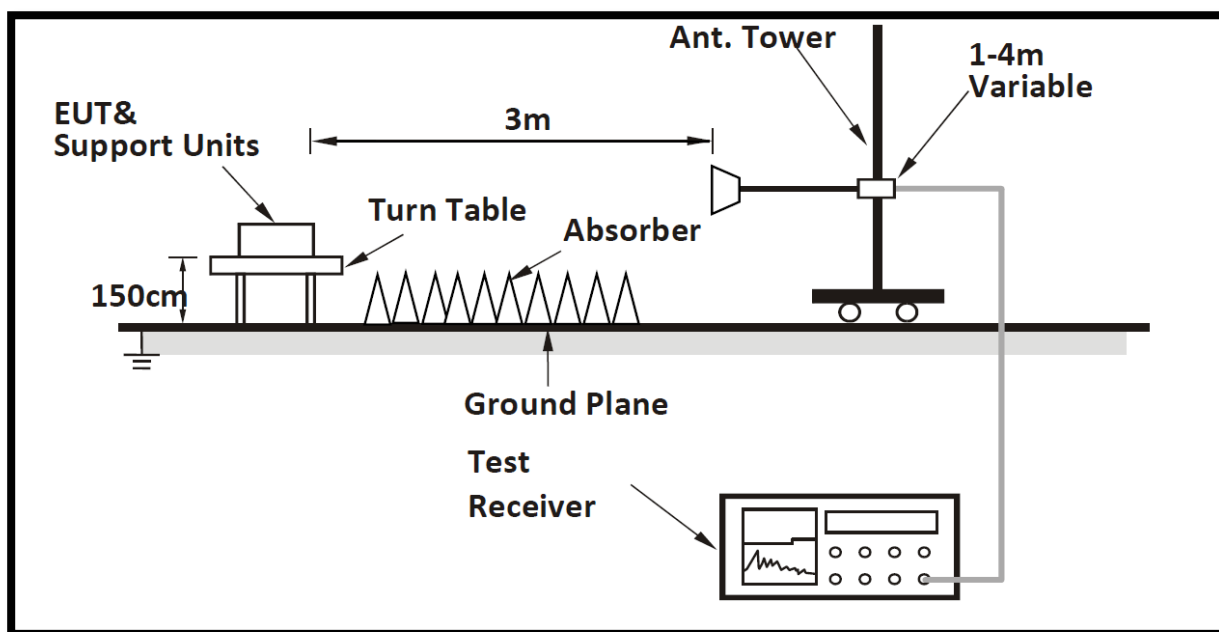
- ☐ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☒ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Frequency	SR #	Measure Peak (dBμV/m)	Measure Avg (dBμV/m)	Limit Peak (dBμV/m)	Margin Peak (dB)	Limit Avg (dBμV/m)	Margin Avg (dB)	Max height (m)	Max angle (°)	RBW (Hz)	Meas.Time (s)	Comments	Correction (dB)
2.484 GHz	1	61.948	47.885	74	-12.052	54	-6.115	1.002	30	1 M	5	Pass	36.269
2.484 GHz	1	60.969	47.58	74	-13.031	54	-6.42	1.002	60.1	1 M	5	Pass	36.269
2.484 GHz	2	60.972	44.196	74	-13.028	54	-9.804	0.999	0.1	1 M	5	Pass	36.269
2.484 GHz	2	62.287	45.577	74	-11.713	54	-8.423	1.498	0.1	1 M	5	Pass	36.27

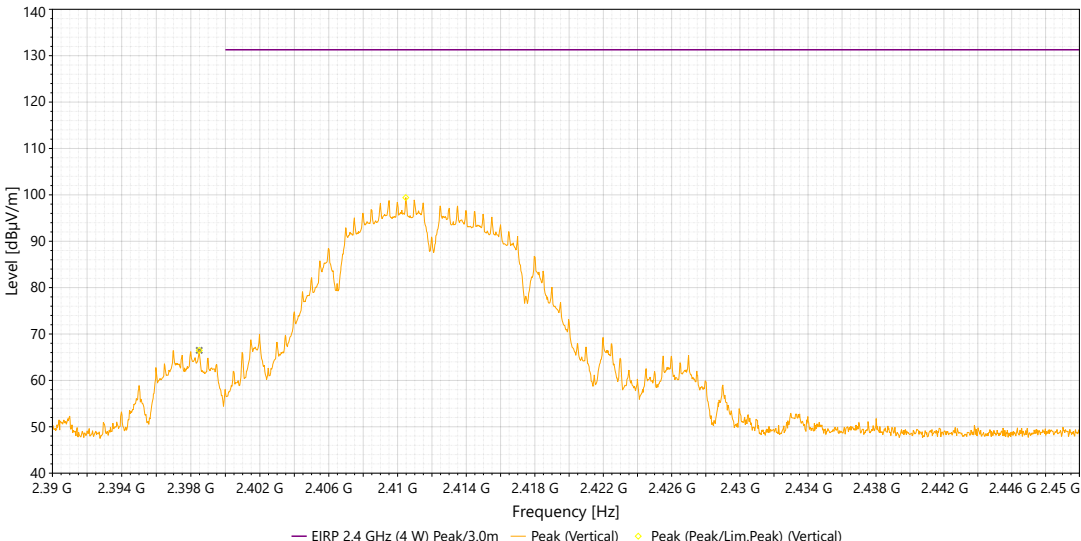
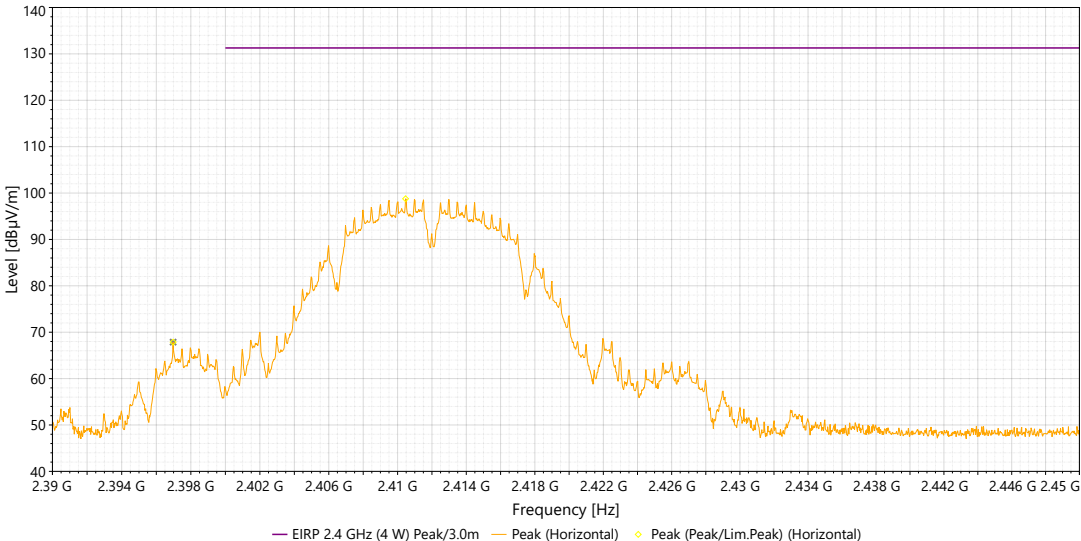
4.2 Band edge

Tested by:	Andrea Giovanni Galbiati	
Test date:	2024-02-16	
Test location (stand):	☐	Laboratory area (conducted)
	☐	Climatic chamber (conducted or radiated)
	☒	SAC/OATS (radiated)
Ambient temperature:	22 °C	
Relative humidity:	40 %	
Atmospheric pressure:	1006 mbar	
FCC requirements (clauses):	15.247(d)	
ISED requirements (clauses):	RSS-247 5.5	
ANSI C63.10 test method (clause):	6.10.4	
EUT Test set-up:	As indicated in clause 5.1 of this test report	
Supplementary test set-up description:	---	
Used mains voltage/frequency:	120 V; 60 Hz	
Supplementary information:	---	

Block diagram of the test setup:

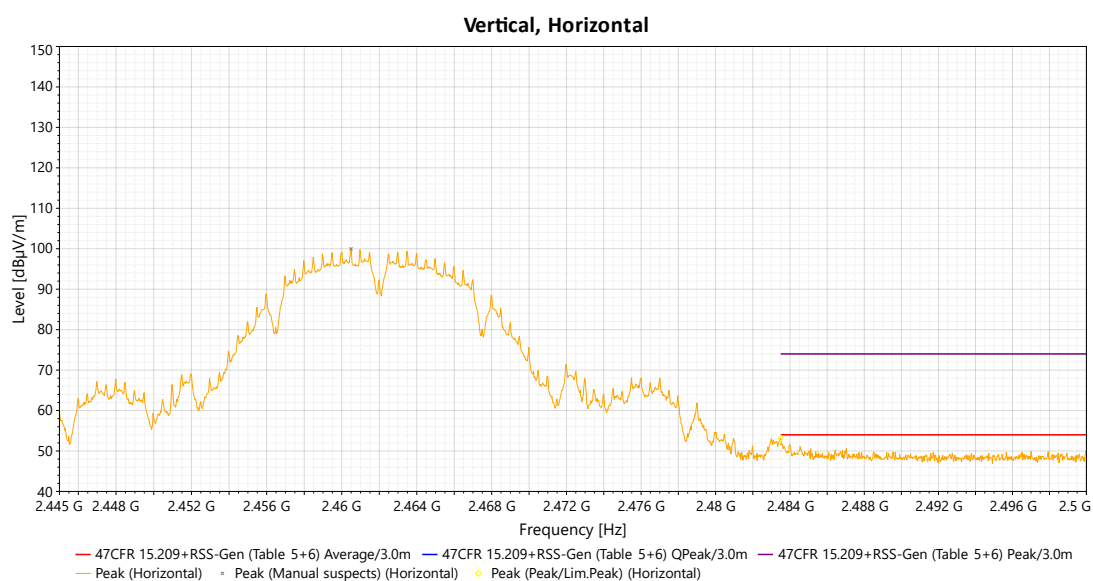
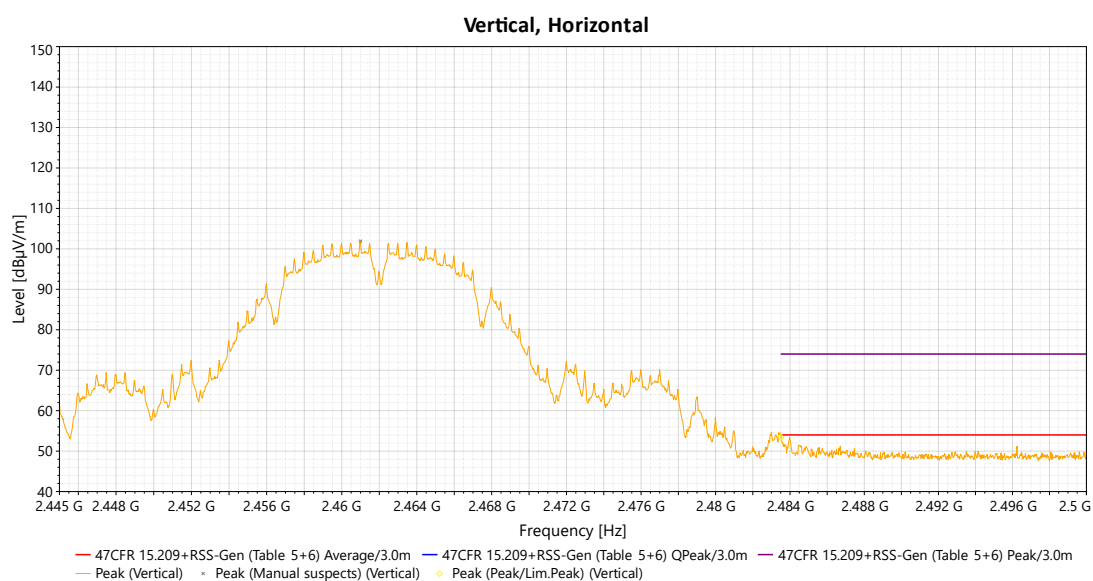


Results

Operating mode.....	2 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)
Used mains voltage/frequency...	120 V; 60 Hz
Verdict	Pass
Frequencies: 2.39 GHz - 2.45 GHz (Analyzer mode - Step : 5000 pts) Settings: RBW: 100kHz; VBW: 300kHz; Sweep time: 3e+03 ms; Attenuation: 10 dB; Sweep count: 1; Preamp: On; LN Preamp: Off; Preselector: On	
Vertical, Horizontal  — EIRP 2.4 GHz (4 W) Peak/3.0m — Peak (Vertical) ◆ Peak (Peak/Lim.Peak) (Vertical)	
Vertical, Horizontal  — EIRP 2.4 GHz (4 W) Peak/3.0m — Peak (Horizontal) ◆ Peak (Peak/Lim.Peak) (Horizontal)	

Operating mode.....	3 (Worst case condition resulting from pre-scan in the X,Y and Z axes of orientation)
Used mains voltage/frequency ...	120 V; 60 Hz
Verdict	Pass

Frequencies: 2.445 GHz - 2.5 GHz (Analyzer mode - Step : 5000 pts)
Settings: RBW: 100kHz; VBW: 300kHz; Sweep time: 3e+03 ms; Attenuation: 10 dB; Sweep count: 1; Preamp: On;
LN Preamp: Off; Preselector: On



Final measurement table (Horizontal polarization)

Channel	Max carrier frequency		Max band edge frequency		Delta (dB)	Limit (*) (dB)	Result
	MHz	dBm	MHz	dBm			
Low	2410.5	98.77	2397.0	67.86	30.91	≥ 20	Pass
High	2460.5	99.99	2483.5	53.15	46.84	≥ 20	Pass

Final measurement table (vertical polarization)

Channel	Max carrier frequency		Max band edge frequency		Delta (dB)	Limit (*) (dB)	Result
	MHz	dBm	MHz	dBm			
Low	2410.5	99.41	2398.5	66.48	32.93	≥ 20	Pass
High	2461.0	101.91	2483.5	53.48	48.43	≥ 20	Pass

(*): 20 dB margin applied because conducted output power was measured using Peak detector.

5 List of test equipment

Equipment	Type	Inventory number	Manufacturer	Serial Number	Last calibration date	Calibration due date
Test Stand: Radiated emission 30 MHz to 1 GHz						
EMI TEST RECEIVER	ESW26	207263	Rohde & Schwarz (Koeln) GmbH & Co. KG	101512	2023-05-23	2024-05-28
SEMI-ANECHOIC CHAMBER	FACT3-1.2 STD	210407	ETS-Lindgren	-	-	-
Tilting Antenna Mast Positioning Tower	2171B/2170B	135821	ETS-Lindgren (Cedar Park, Texas)	-	-	-
NSA Normalized Site Attenuation	NSA FACT3-1.2 STD	210410	ETS-Lindgren	NSA FACT3-1.2 STD	2022-04-12	2025-04-28
Software - EMC	BAT-EMC	156535	Nexio Technologies		-	-
Trilog-Broadband Antenna	VULB 9168	210290	Schwarzbeck Mess-Elektronik OHG	1244	2023-08-25	2025-08-28
Center, Modular RF Platform	7000-011	210859	ETS-Lindgren	00231682	-	-
Cable 2000mm - 18 GHz	SF126/11SMA/11N/2000	220503	Huber+Suhner	554756/126	2023-05-03	2024-05-28
6dB Attenuator	DGA 9552 N	210263	Schwarzbeck Mess-Elektronik OHG	CH9006	2023-09-06	2024-09-28
Cable 8000mm - 18 GHz	SF126/11N/11N/8000	220502	Huber+Suhner	556226/126	2023-05-03	2024-05-28
Test Stand: Radiated emission 1 GHz to 18 GHz + Band Edge						
Software - EMC	BAT-EMC	156535	Nexio Technologies		-	-
Signal and Spectrum Analyzer 44 GHz	FSV3044	213658	Rohde & Schwarz	-	2024-01-26	2024-03-28
SVSWR Voltage Standing Wave Ratio	SVSWR FACT3-1.2 STD	210409	ETS-Lindgren	SVSWR FACT3-1.2 STD	2022-04-12	2025-04-28
Highpass Filter	WHKX12-2520-2800-18000-60ST	154712	Wainwright Instruments GmbH	1	2023-10-27	2024-10-28
Microwave Coaxial Cable N to Sma-M	AK 9515 H	213198	Schwarzbeck Mess-Elektronik OHG	00168	2023-05-02	2024-05-28
EMI TEST RECEIVER	ESW26	207263	Rohde & Schwarz (Koeln) GmbH & Co. KG	101512	2023-05-23	2024-05-28
Low Noise Preamplifier	BLMA 0118-4A	209025	BONN Elektronik	2113244A	2023-03-09	2024-03-28
Tilting Antenna Mast Positioning Tower	2171B/2170B	135821	ETS-Lindgren (Cedar Park, Texas)	-	-	-
Cable 2000mm - 18 GHz	SF126/11SMA/11N/2000	220503	Huber+Suhner	554756/126	2023-05-03	2024-05-28
Cable 8000mm - 18 GHz	SF126/11N/11N/8000	220502	Huber+Suhner	556226/126	2023-05-03	2024-05-28
Double-Ridged Waveguide Horn Antennas 1-18GHz	3117	138662	ETS-Lindgren (Cedar Park, Texas)	00208482	2023-01-20	2025-01-28
Absorber High Frequency	EHP-12	212616	ETS-Lindgren	-	-	-
SEMI-ANECHOIC CHAMBER	FACT3-1.2 STD	210407	ETS-Lindgren	-	-	-
Center, Modular RF Platform	7000-011	210859	ETS-Lindgren	00231682	-	-

Test Stand: Radiated emission 18 GHz to 26 GHz						
Tilting Antenna Mast Positioning Tower	2171B/2170B	135821	ETS-Lindgren (Cedar Park, Texas)	-	-	-
SEMI-ANECHOIC CHAMBER	FACT3-1.2 STD	210407	ETS-Lindgren	-	-	-
Software - EMC	BAT-EMC	156535	Nexio Technologies	-	-	-
Cable 500mm - 0.04 to 40 GHz	SF102E-50-2X11SK252	216877	Huber+Suhner	536580/2E	2023-03-09	2024-03-28
Absorber High Frequency	EHP-12	212616	ETS-Lindgren	-	-	-
Cable 7000mm - 0.04 to 26.5 GHz	SF526S/700-11PC35501-21PC35501	216874	Huber+Suhner	2717235001	2023-03-09	2024-03-28
Center, Modular RF Platform	7000-011	210859	ETS-Lindgren	00231682	-	-
EMI TEST RECEIVER	ESW26	207263	Rohde & Schwarz (Koeln) GmbH & Co. KG	101512	2023-05-23	2024-05-28
Low Noise Preamplifier	BLMA 1840-1A	209026	BONN Elektronik	2113244B	2023-06-27	2024-06-28
Red Horn Antenna 18-40GHz	3116C	210452	ETS-Lindgren	00240011	2021-04-26	2024-04-28
Auxiliary equipment						
Mini Datalogger	174H	211146	Testo	83293175	2023-10-18	2024-10-28
FREQUENCY CONVERTER	FWW-SFUP 40kVA	37730	GUSTAV KLEIN	-	-	-
Laser Measure	RSLDM-50H	224436	RS Pro	210743764	2023-11-10	2024-11-28
Mini Datalogger	174H	211147	Testo	83306371	2023-10-18	2024-10-28
MAIN SUPPLY VARIAC	T40NC-6	80699	BELOTTI VARIATORI	-	-	-

6 Measurement instrumentation uncertainties

The Uncertainty of Measurement (UoM) for each unit measured in this Test Report was estimated in accordance with the UL International Italia document No. 23-CL-G0025 and is retained on file. Details of the estimation of UoM may be made available upon request, in particular for quantities not listed.

Measurement	Range	Ulab	Unit
Frequency	9 kHz to 40 GHz	0.5	kHz
Time	0.7 μ s to 16000 s	3.00	%
Conducted power, by spectrum analyzer	9 kHz to 40 GHz	0.45	dB
Conducted power, by fast power meter	9 kHz to 8 GHz	0.41	dB
Temperature (ambient)	15 to 35 °C	0.72	°C
Temperature (climatic chamber)	-40 to 100 °C	1.63	°C
Humidity (ambient)	30 to 70 %	5.76	%RH
Humidity (climatic chamber)	30 to 95 %	3.95	%RH
Supply voltage (AC)	0 to 500 V	3.00	%
Supply voltage (DC)	0 to 15 V	0.28	%
Conducted disturbance at mains and other port power using V-AMN	9 kHz to 150 kHz	3.71	dB
Conducted disturbance at mains and other port power using V-AMN	150 kHz to 30 MHz	3.32	dB
Radiated disturbance (magnetic field using a loop antenna)	9 kHz to 30 MHz	3.16	dB
Radiated disturbance (electric field strength in SAC 3, hybrid antenna, Hor)	30 MHz to 1000 MHz	4.22	dB
Radiated disturbance (electric field strength in SAC 3, hybrid antenna, Ver)	30 MHz to 1000 MHz	5.64	dB
Radiated disturbance (electric field strength in SAC 5, hybrid antenna, Hor)	30 MHz to 1000 MHz	3.98	dB
Radiated disturbance (electric field strength in SAC 5, hybrid antenna, Ver)	30 MHz to 1000 MHz	5.66	dB
Radiated disturbance (electric field strength in FSOATS 3) (1)	1 GHz to 6 GHz	5.43	dB
Radiated disturbance (electric field strength in FSOATS 3) (2)	1 GHz to 6 GHz	4.29	dB
Radiated disturbance (electric field strength in FSOATS 3) (1)	6 GHz to 18 GHz	5.18	dB
Radiated disturbance (electric field strength in FSOATS 3) (2)	6 GHz to 18 GHz	4.22	dB
Radiated disturbance (electric field strength in FSOATS 5) (1)	1 GHz to 6 GHz	5.12	dB
Radiated disturbance (electric field strength in FSOATS 5) (2)	1 GHz to 6 GHz	4.13	dB
Radiated disturbance (electric field strength in FSOATS 5) (1)	6 GHz to 18 GHz	5.63	dB
Radiated disturbance (electric field strength in FSOATS 5) (2)	6 GHz to 18 GHz	4.54	dB
Radiated disturbance (electric field strength in FSOATS 3) (1)	18 GHz to 40 GHz	7.63	dB
Radiated disturbance (electric field strength in FSOATS 5) (1)	18 GHz to 40 GHz	7.63	dB
Radiated Spurious Emission (ERP/EIRP, Substitution Method)	25 MHz to 26 GHz	5.97	dB
Legend/Remarks: n.d.: not defined (1) Using external EMI preamplifier. (2) Not using external EMI preamplifier. Supplementary information: - The measurement uncertainty values are calculated and correspond to an expansion factor (coverage factor) $k = 2$ (which provide confidence level of 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). - Listed values are intended with prefix "±".			

< END OF TEST REPORT >