

RF TEST REPORT

Test Report No:	24-4791151465-3-1-1-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 <i>Laboratory Engineer</i> 	
Approved by: (name, function, signature)	Francesco Casati <i>Operations Leader</i> 	
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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:	2024-02-09 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
24-4791151465-3-1-0-RAD-A	Original release	2024-02-22
24-4791151465-3-1-1-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

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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					
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 Bluetooth 2.4 GHz: Channel 0 (Frequency=2402 MHz) GFSK Modulation, maximum power settable (worst case for RSE, Band Edge and Restricted Bands)		
	2	Continuous transmission Bluetooth 2.4 GHz: Channel 76 (Frequency=2478 MHz) GFSK Modulation, maximum power settable (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% $\Rightarrow$ 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

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

☐ Correction of radiated field from 5 m to 3 m

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

☒ Linear to logarithmic conversion

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

☐ 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:

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

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

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

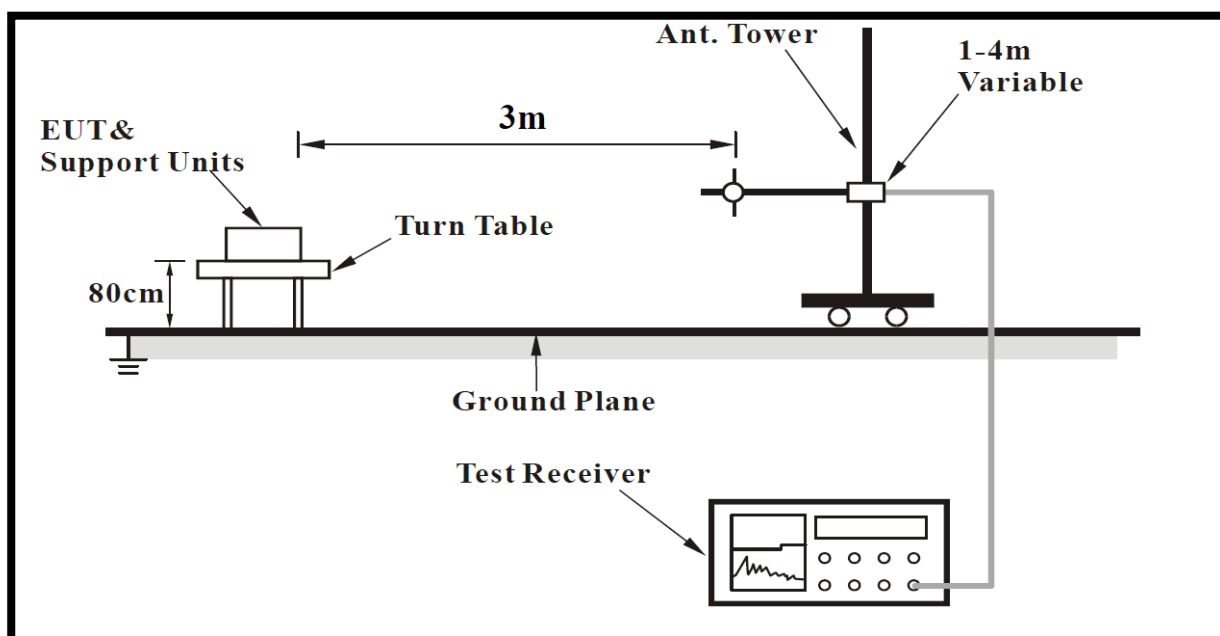
4 Tests

4.1 Radiated emissions & restricted bands emissions

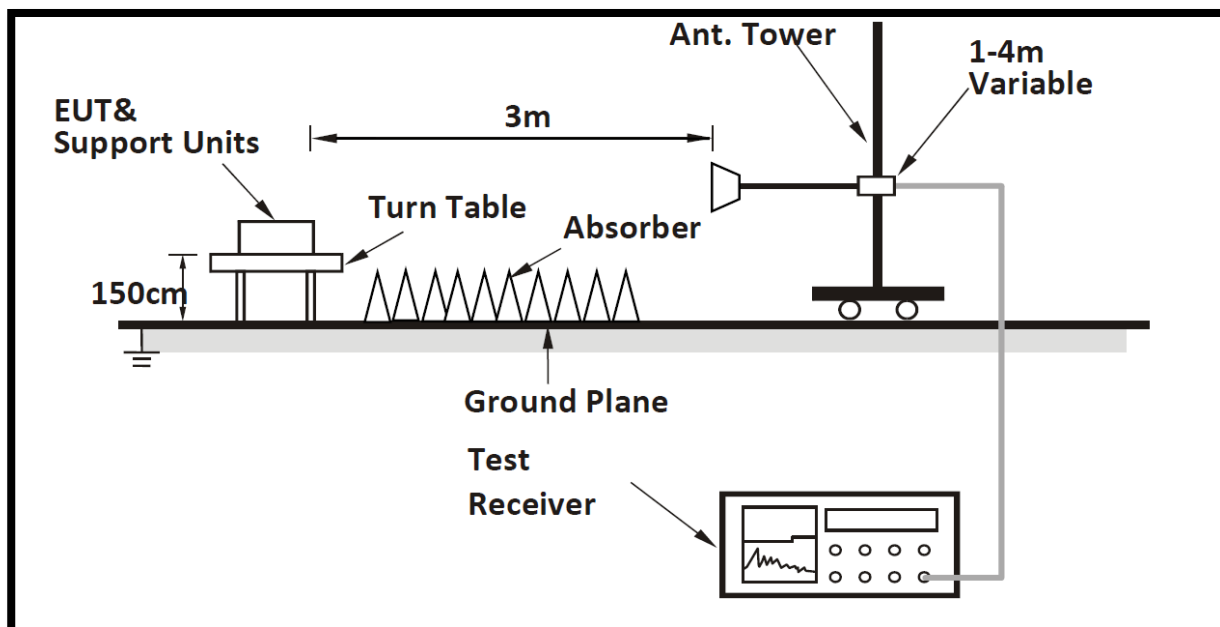
Tested by:	Andrea Giovanni Galbiati	
Test date:	2024-02-09 to 2024-02-16	
Test location (stand):	Area 8: SAC 3-1.2 (RF emission)	
Ambient temperature:	22 °C to 24 °C	
Relative humidity:	40 % to 45 %	
Atmospheric pressure:	999 mbar to 1003 mbar	
FCC requirements (clauses):	15.209(a), 15.247(d)	
ISED requirements (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



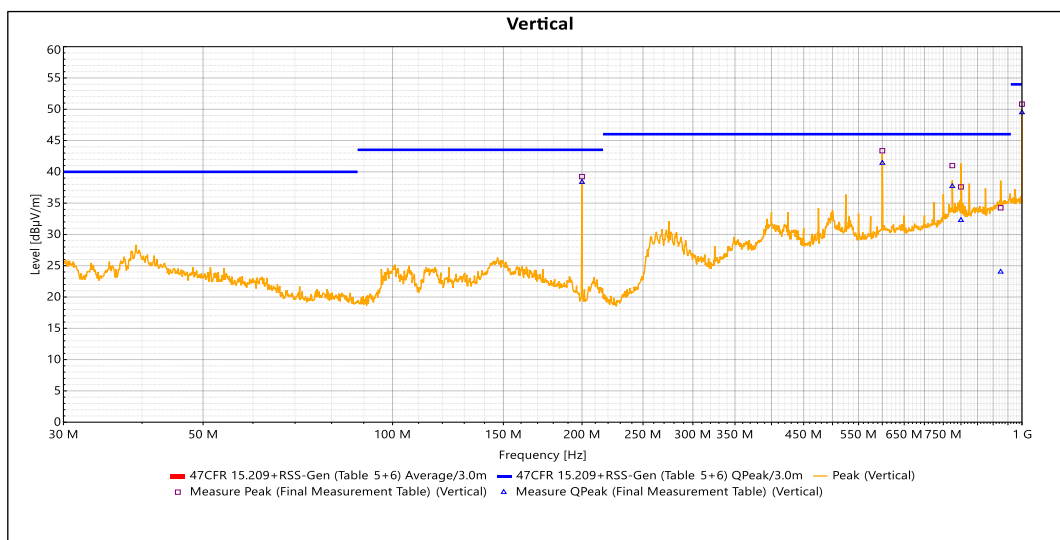
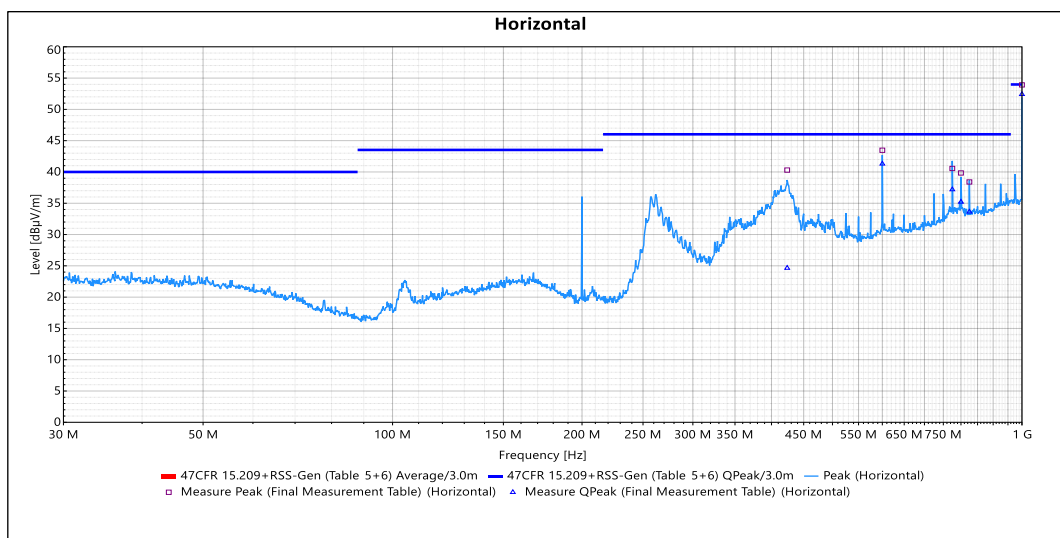
1 GHz to 26 GHz



Results

Operating Mode:	1		
Test result:	Pass	Tested on:	2024-02-09

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



- ☐ 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:

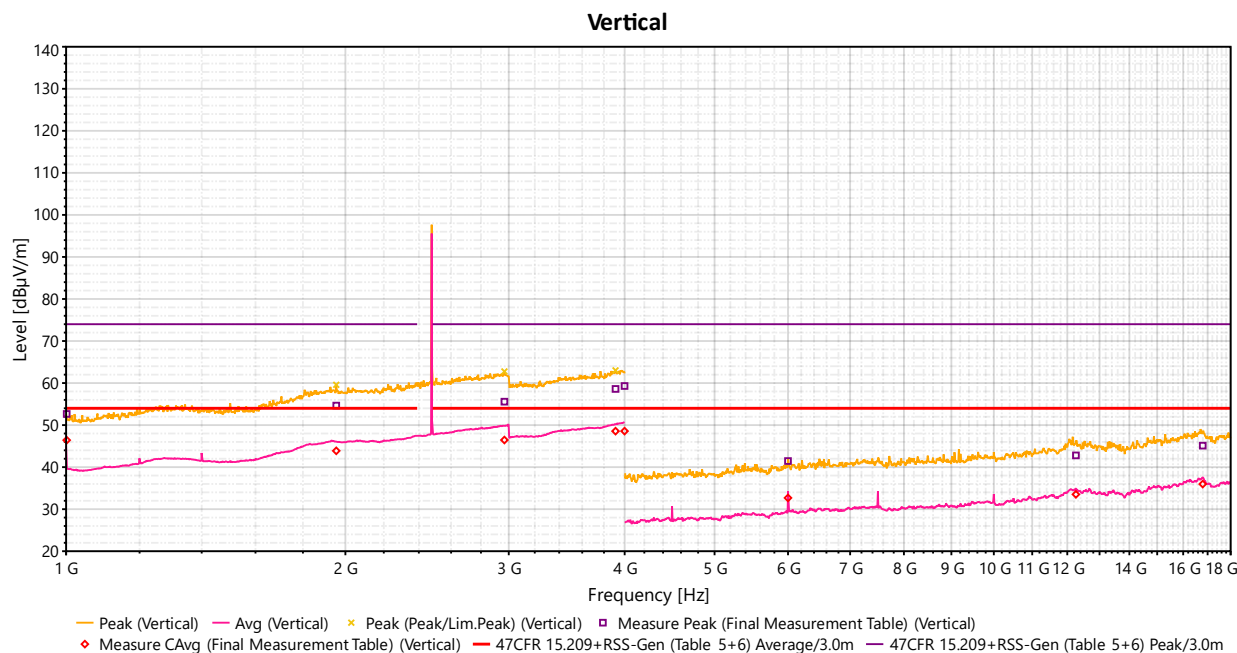
Final Measurement Table

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)
423.6 MHz	1	40.297	24.645	46.02	-21.375	2.14	343.2	Horizontal	120 k	5	Pass	23.454
600 MHz	1	43.472	41.298	46.02	-4.722	1.871	35.9	Horizontal	120 k	5	Pass	27.52
774.99 MHz	1	40.558	37.187	46.02	-8.833	1.254	261.6	Horizontal	120 k	5	Pass	30.175
799.98 MHz	1	39.845	35.211	46.02	-10.809	1.095	200.3	Horizontal	120 k	5	Pass	30.29
825 MHz	1	38.397	33.626	46.02	-12.394	1.521	276.8	Horizontal	120 k	5	Pass	30.54
999.96 MHz	1	53.908	52.424	53.98	-1.556	1.534	114.6	Horizontal	120 k	5	Pass	32.16
199.98 MHz	2	39.241	38.364	43.52	-5.156	1	121.5	Vertical	120 k	5	Pass	16.517
599.97 MHz	2	43.369	41.414	46.02	-4.606	1	177.6	Vertical	120 k	5	Pass	27.519
774.99 MHz	2	41.004	37.689	46.02	-8.331	1	332.3	Vertical	120 k	5	Pass	30.175
799.98 MHz	2	37.592	32.285	46.02	-13.735	1	28.4	Vertical	120 k	5	Pass	30.29
924.99 MHz	2	34.25	24.019	46.02	-22.001	2.71	193.1	Vertical	120 k	5	Pass	31.622
999.96 MHz	2	50.821	49.481	53.98	-4.499	1.399	322.4	Vertical	120 k	5	Pass	32.16

Operating Mode:	1		
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



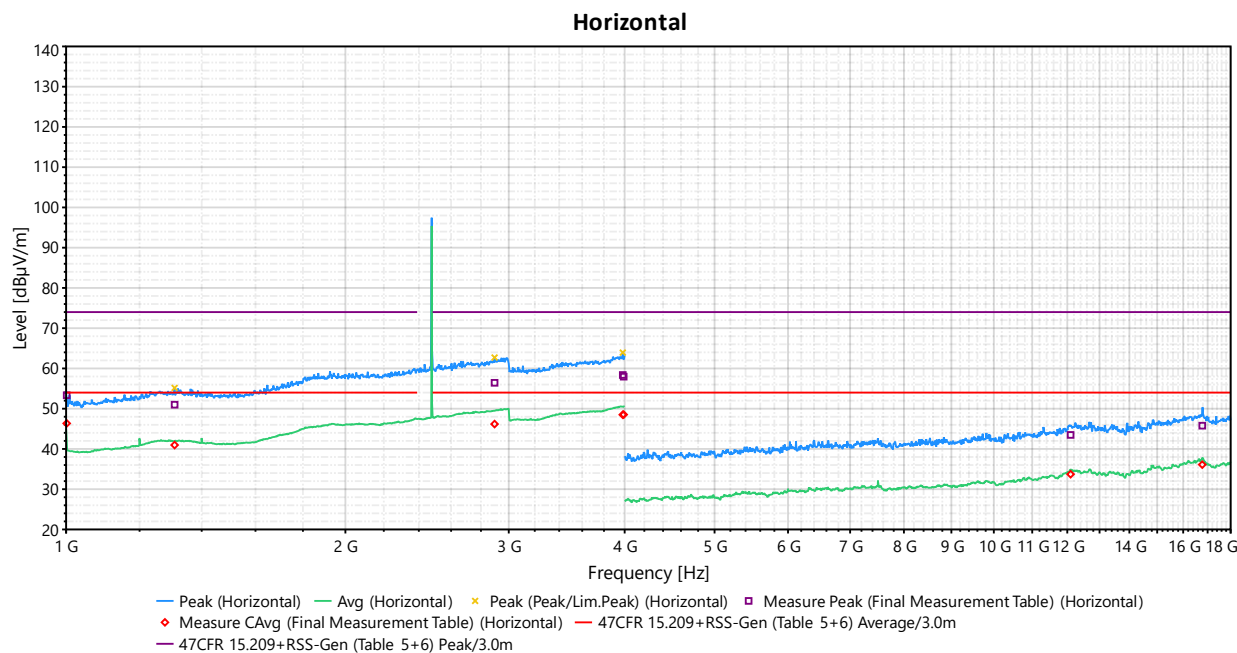
- ☐ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☒ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Final Measurement Table

Frequency	SR #	Measure Peak (dBuV/m)	Limit Peak (dBuV/m)	Margin Peak (dB)	Measure CAvg (dBuV/m)	Limit Avg (dBuV/m)	Margin Avg (dB)	Height (m)	Angle (°)	Polarization	RBW (Hz)	Meas.Time (s)	Comments	Correction (dB)
1 GHz	1	52.647	74	-21.353	46.419	54	-7.581	1.002	0.3	Vertical	1 M	5	Pass	30.2
1.955 GHz	1	54.641	74	-19.359	43.878	54	-10.122	1.498	329.7	Vertical	1 M	5	Pass	35.399
2.968 GHz	1	55.571	74	-18.429	46.448	54	-7.552	3.998	60.4	Vertical	1 M	5	Pass	37.223
3.91 GHz	1	58.601	74	-15.399	48.56	54	-5.44	3.001	60.4	Vertical	1 M	5	Pass	38.535
3.999 GHz	1	59.296	74	-14.704	48.566	54	-5.434	3.001	180.3	Vertical	1 M	5	Pass	38.619
6 GHz	2	41.451	74	-32.549	32.684	54	-21.316	1.498	0.4	Vertical	1 M	5	Pass	0.759
12.26 GHz	2	42.792	74	-31.208	33.518	54	-20.482	2.498	0.4	Vertical	1 M	5	Pass	10.231
16.795 GHz	2	45.114	74	-28.886	35.969	54	-18.031	1.002	29.7	Vertical	1 M	5	Pass	12.731

Operating Mode:	1		
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



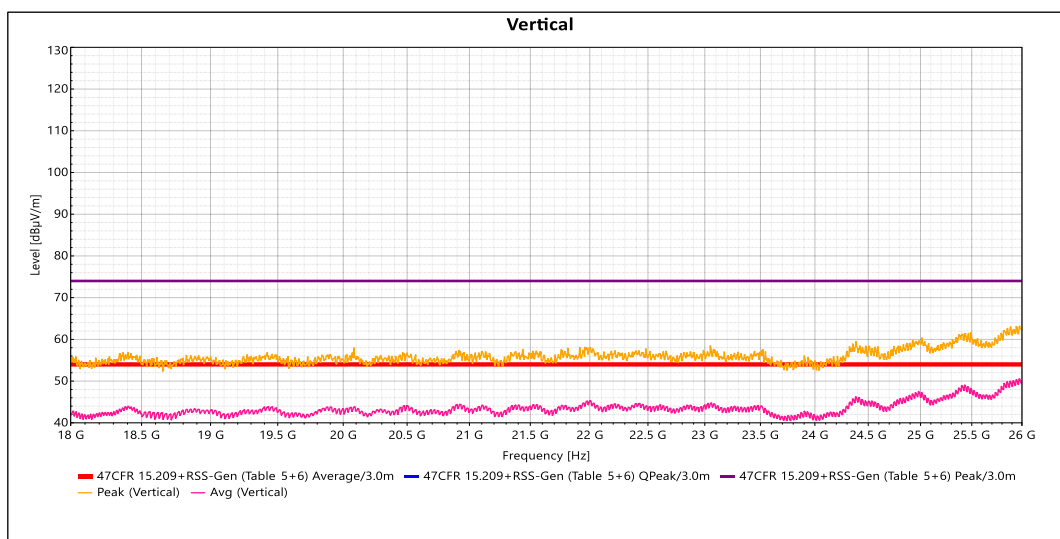
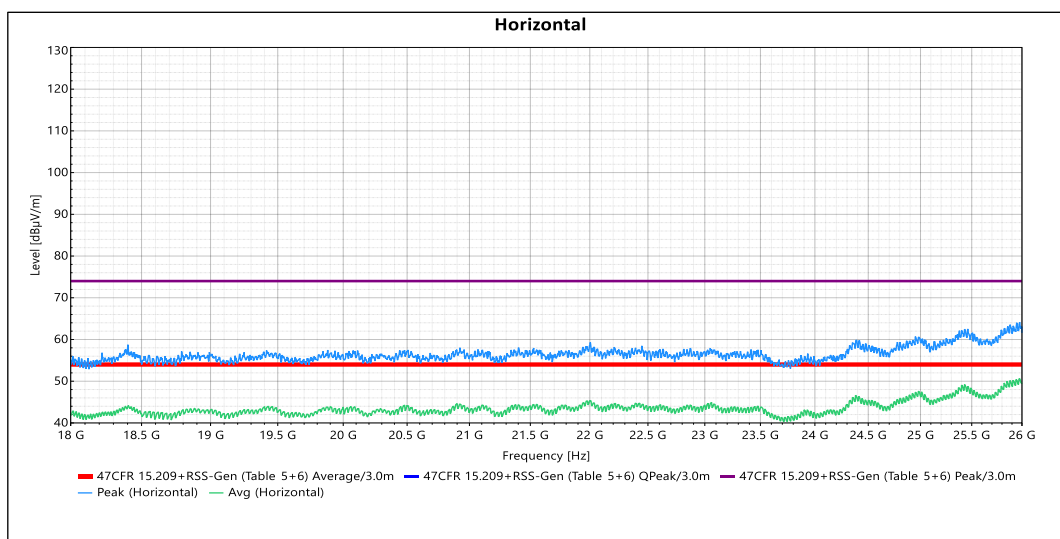
- ☐ The emissions are below the measurement system noise floor or 20 dB or more below the limit
☒ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Final Measurement Table

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	53.343	74	-20.657	46.349	54	-7.651	1.501	120.3	Horizontal	1 M	5	Pass	30.2
1.309 GHz	1	50.991	74	-23.009	40.971	54	-13.029	1.001	300.2	Horizontal	1 M	5	Pass	32.267
2.896 GHz	1	56.427	74	-17.573	46.176	54	-7.824	1.002	150.3	Horizontal	1 M	5	Pass	37.043
3.981 GHz	1	58.372	74	-15.628	48.502	54	-5.498	2.501	240.3	Horizontal	1 M	5	Pass	38.609
3.99 GHz	1	57.96	74	-16.04	48.528	54	-5.472	2.998	270.3	Horizontal	1 M	5	Pass	38.614
12.099 GHz	2	43.48	74	-30.52	33.722	54	-20.278	1.501	89.6	Horizontal	1 M	5	Pass	10.192
16.776 GHz	2	45.777	74	-28.223	36.103	54	-17.897	1.998	59.6	Horizontal	1 M	5	Pass	12.748

Operating Mode:	1	
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

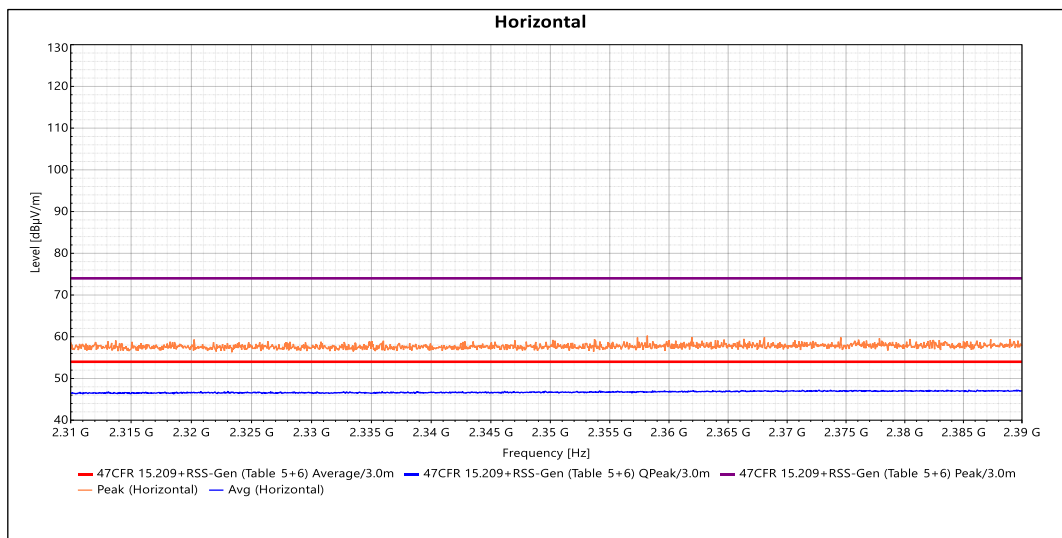
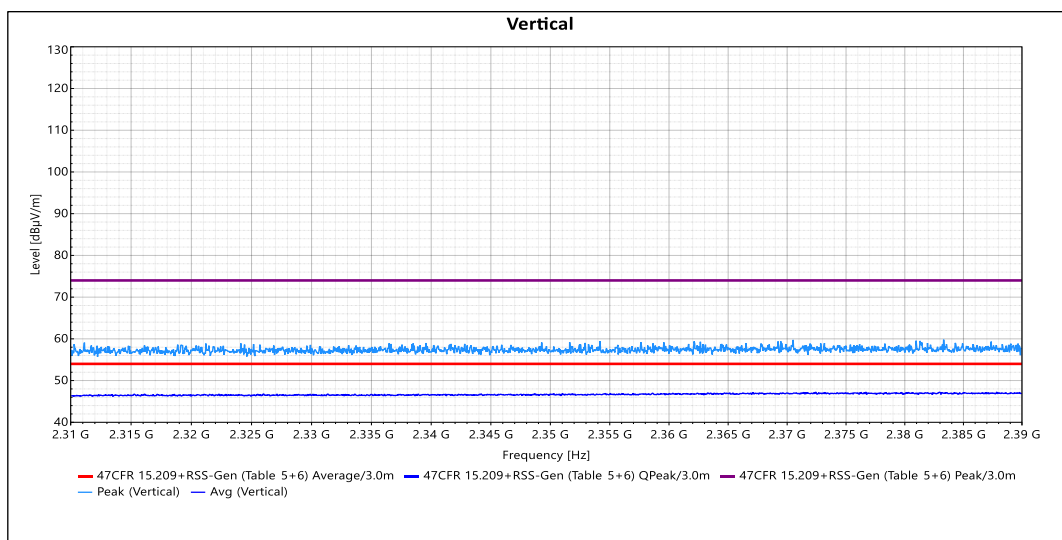


- ☒ The emissions are below the measurement system noise floor or 6 dB or more below the limit
- ☐ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Evaluation of restricted band 2310 MHz to 2390 MHz:

Operating Mode:	1		
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

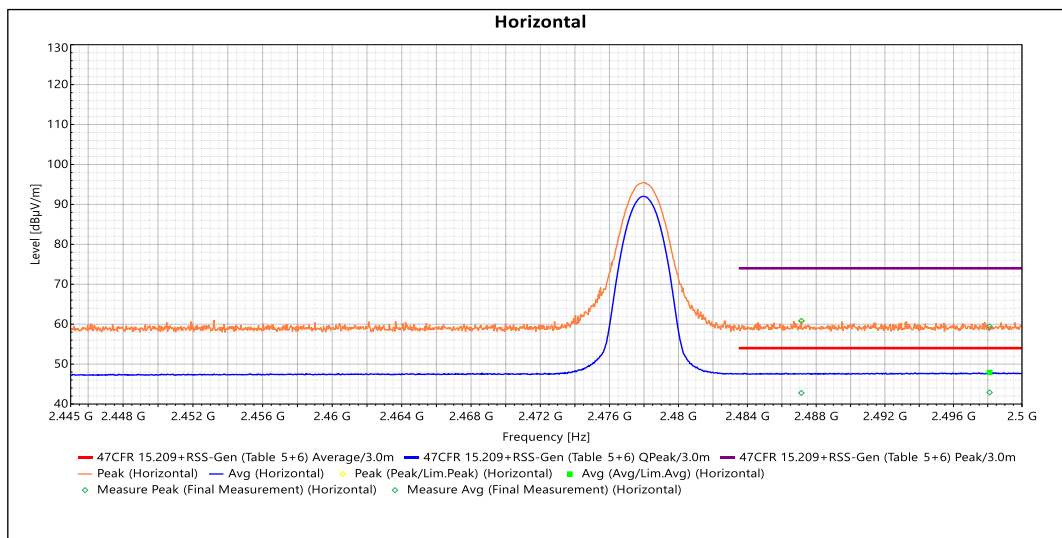
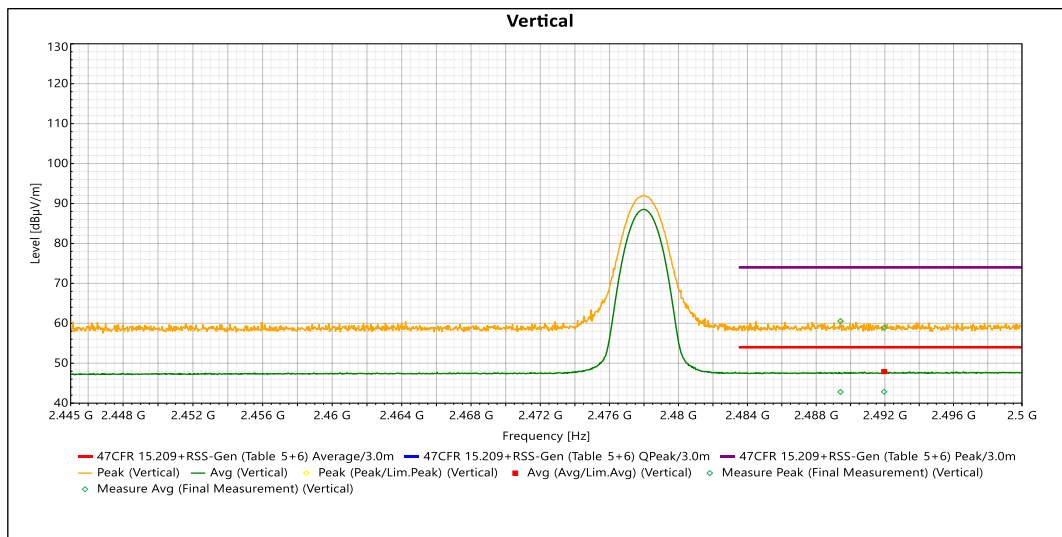


- ☒ The emissions are below the measurement system noise floor or 6 dB or more below the limit
- ☐ The measurement results of highest emissions relative to the limit for each detector type are shown below:

Evaluation of restricted band 2483.5 MHz to 2500 MHz:

Operating Mode:	2		
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



- ☐ 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:

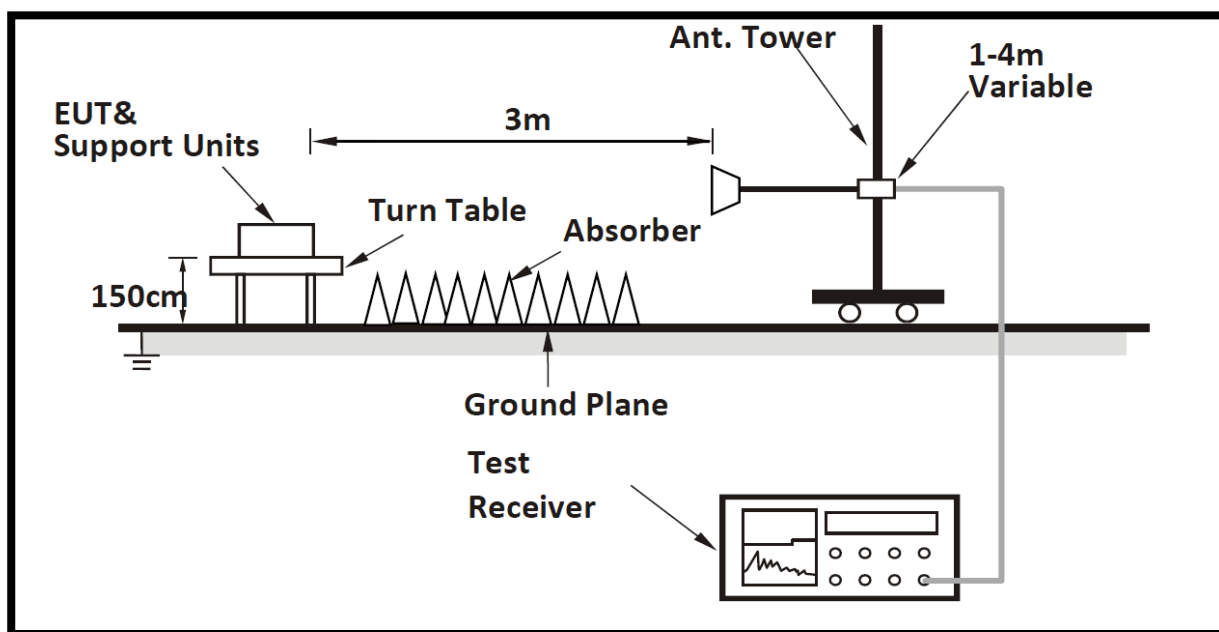
Final Measurement

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)
2.489 GHz	1	60.516	42.809	74	-13.484	54	-11.191	1.498	0.2	1 M	3	Pass	36.28
2.492 GHz	1	58.884	42.839	74	-15.116	54	-11.161	1.998	0.2	1 M	3	Pass	36.293
2.487 GHz	2	60.809	42.776	74	-13.191	54	-11.224	3.001	29.9	1 M	3	Pass	36.276
2.498 GHz	2	59.403	42.908	74	-14.597	54	-11.092	3.001	29.9	1 M	3	Pass	36.329

4.2 Band edge

Tested by:	Andrea Giovanni Galbiati	
Test date:	2024-02-13	
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:	---	

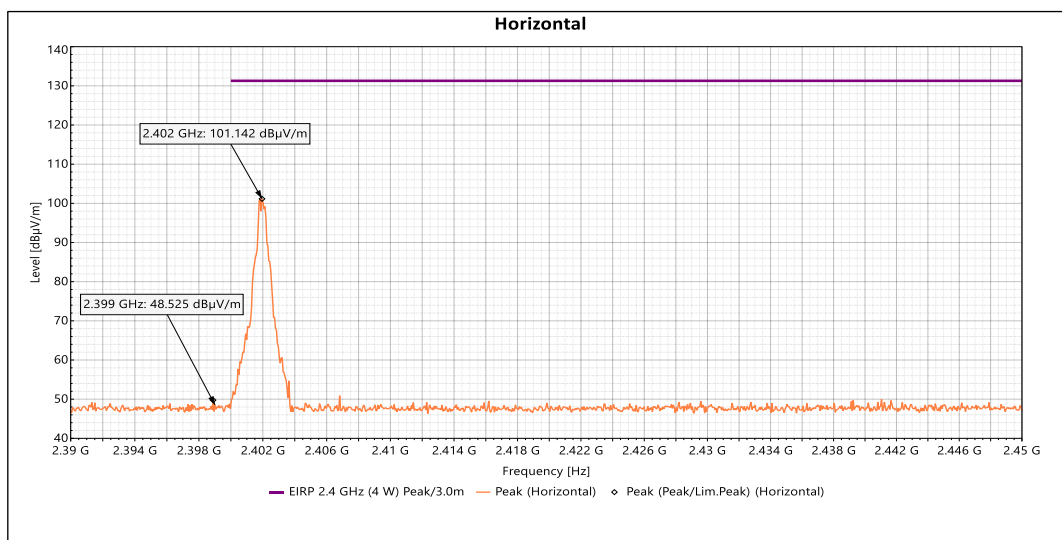
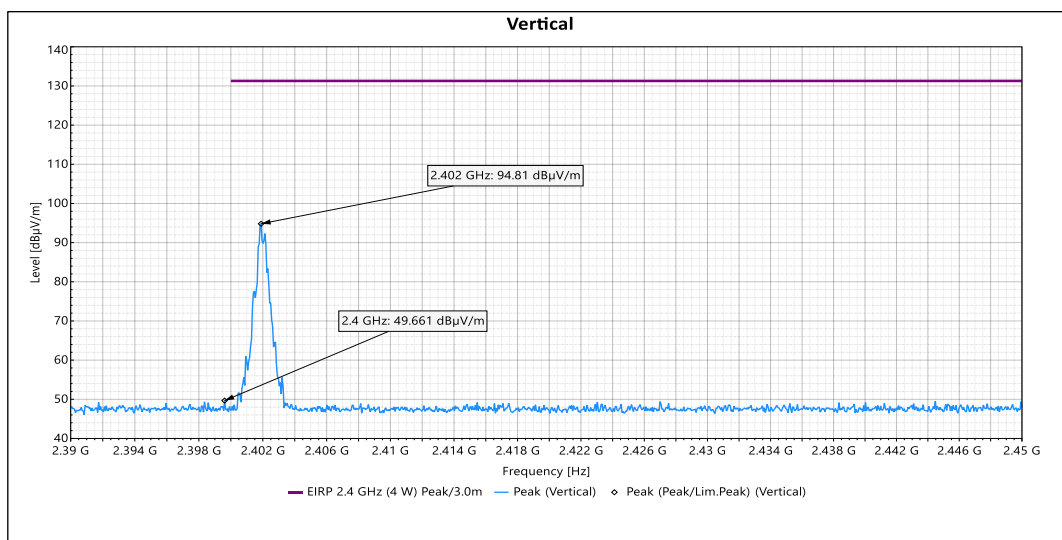
Block diagram of the test setup:



Results

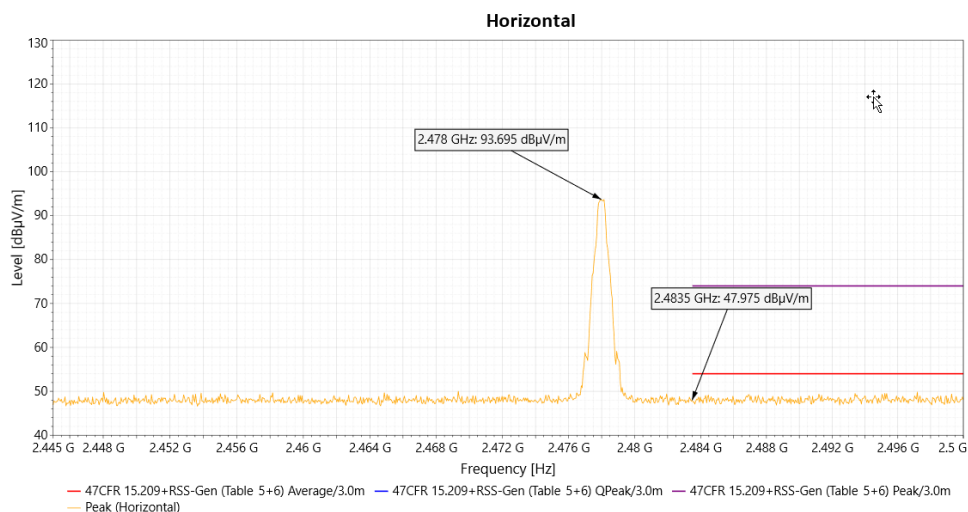
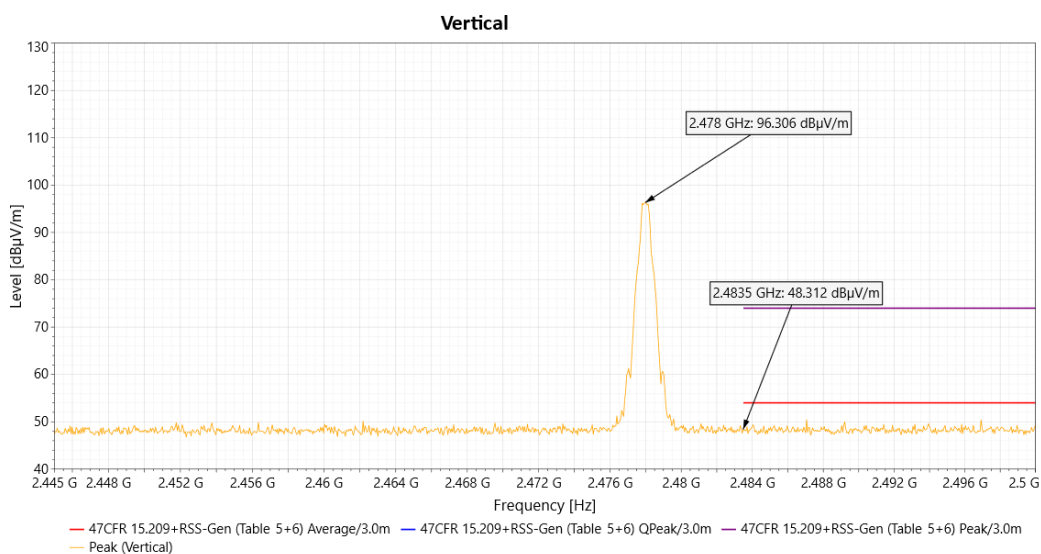
Operating Mode:	1	
Test result:	Pass	Tested on: 2024-02-13

Start Frequency: 2.39 GHz; Stop Frequency: 2.45 GHz; Step: 1000 Pts; Sweep Time: 500 ms; RF Attenuation: 10 dB; RBW: 100 kHz; VBW: 300 kHz; Preamplifier: ON; Preselector: ON



Operating Mode:	2	
Test result:	Pass	Tested on: 2024-02-13

Start Frequency: 2.445 GHz; Stop Frequency: 2.5 GHz; Step: 1000 Pts; Sweep Time: 500 ms; RF Attenuation: 10 dB; RBW: 100 kHz; VBW: 300 kHz; Preamplifier: ON; 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	2402	101.14	2399	48.52	52.62	≥ 20	Pass
High	2478	93.69	2483.5	47.97	45.72	≥ 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	2402	94.81	2400	49.66	45.15	≥ 20	Pass
High	2478	96.30	2483.5	48.31	47.99	≥ 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 " $\pm$ ".			

< END OF TEST REPORT >