

RF TEST REPORT

Test Report No:	24-4791151465-2-1-1-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 
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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:	2024-02-12 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
24-4791151465-2-1-0-RAD-A	Original release	2024-02-23
24-4791151465-2-1-1-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 BLE 2.4 GHz: Channel 0 (Frequency=2402 MHz) GFSK Modulation (worst case)	
	2	Continuous transmission BLE 2.4 GHz: Channel 39 (Frequency=2480 MHz) GFSK Modulation (worst case)	
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:	None		

Copy of marking plate: (*)






Itema P/N: 151282058
P/N:SYS-D90-ITE-XX-XX
S/N:YYMMXXXXX
Input: 24 V_{DC} ±10% --- 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

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

☐ 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:

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

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

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

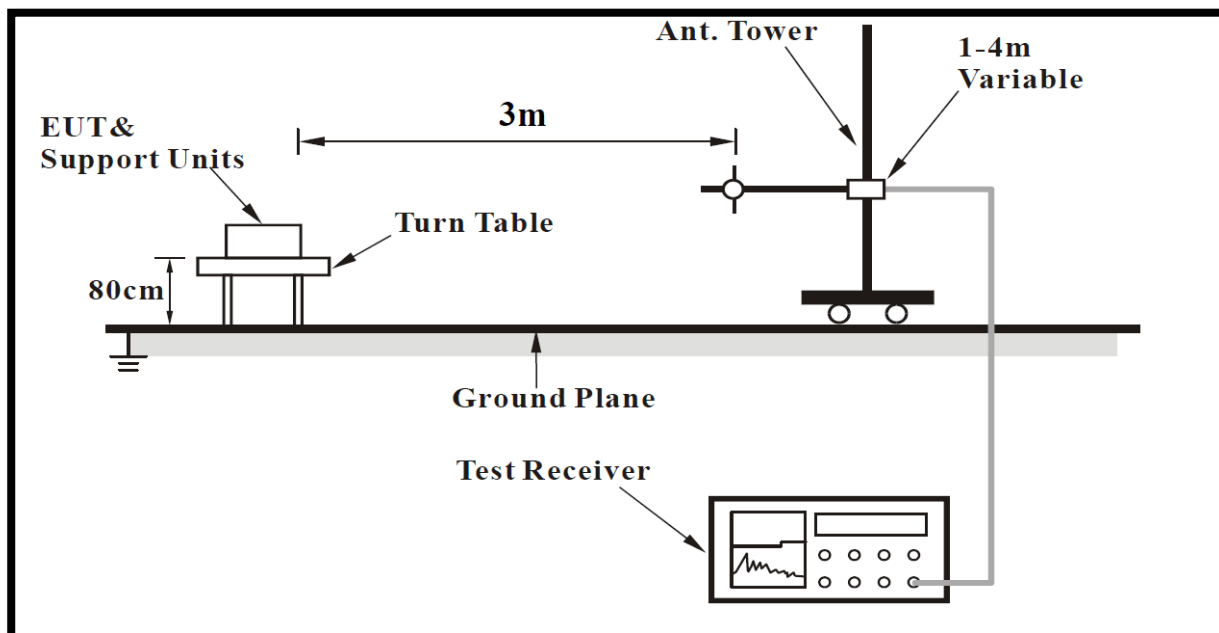
4 Tests

4.1 Radiated emissions & restricted bands emissions

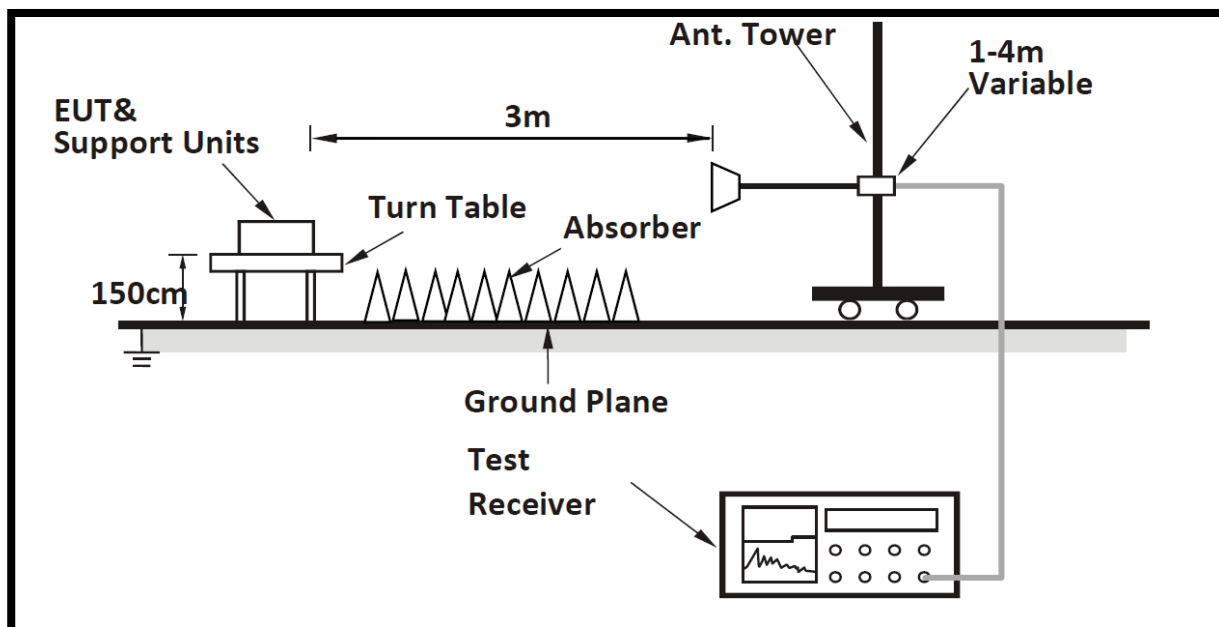
Tested by:	Andrea Giovanni Galbiati	
Test date:	2024-02-12 to 2024-02-16	
Test location (stand):	Area 8: SAC 3-1.2 (RF emission)	
Ambient temperature:	22 °C to 24 °C	
Relative humidity:	40 % to 45 %	
Atmospheric pressure:	999 mbar to 1003 mbar	
FCC requirements (clauses):	15.209(a), 15.247(d)	
ISED requirements (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



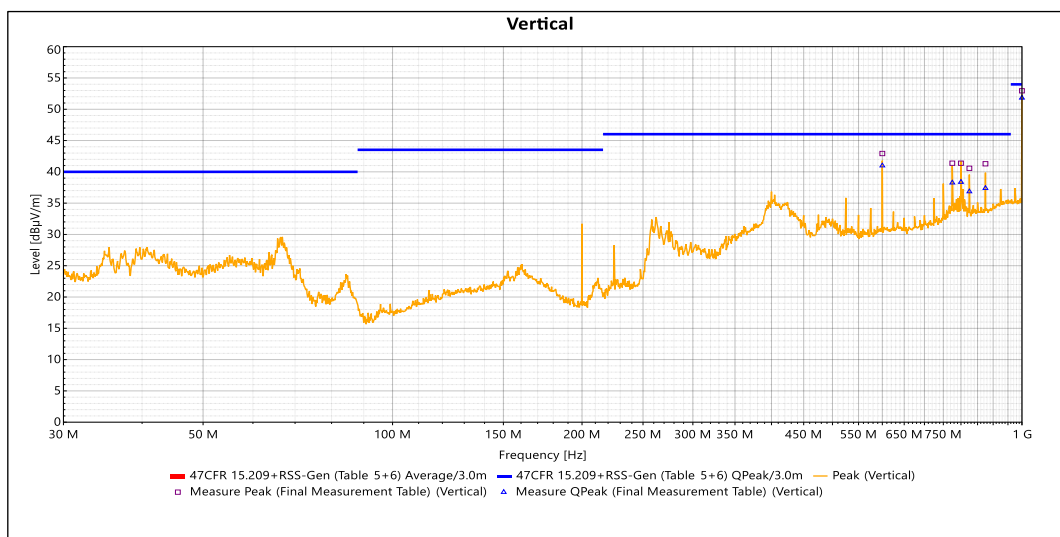
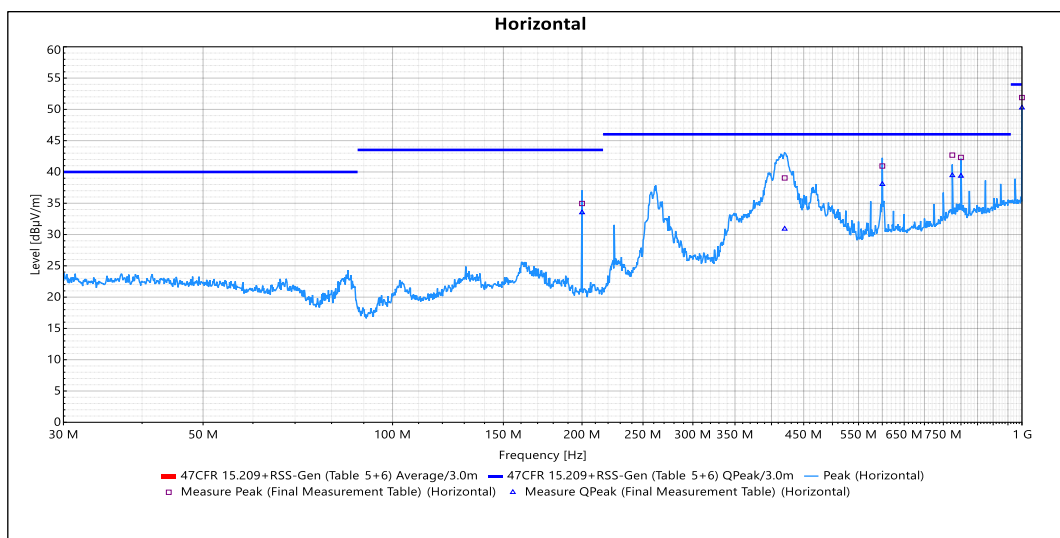
1 GHz to 26 GHz



Results

Operating Mode:	1	
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



- ☐ 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:

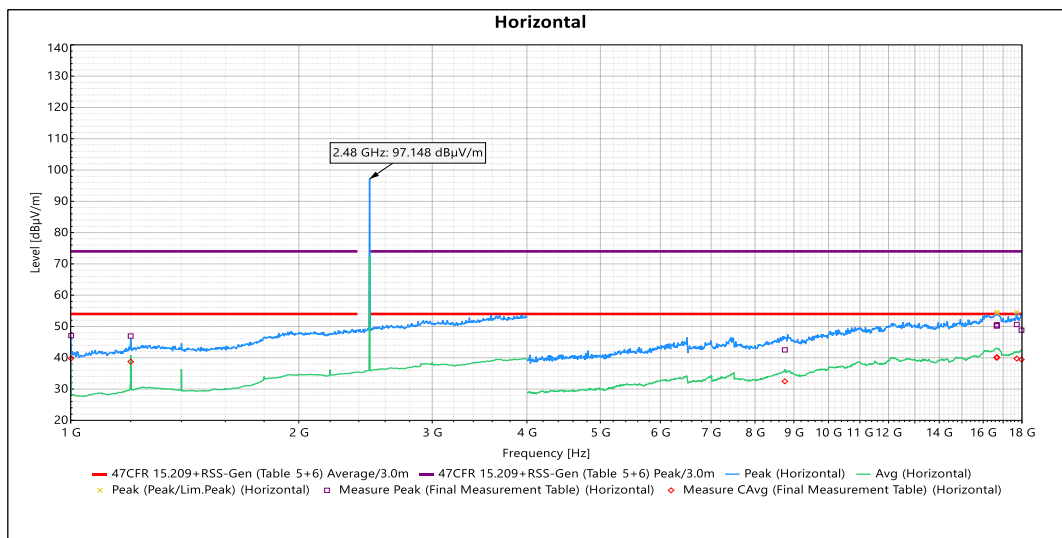
Final Measurement Table

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)
200.01 MHz	1	34.964	33.52	43.52	-10	1.415	293.2	Horizontal	120 k	5	Pass	16.52
419.79 MHz	1	39.04	30.9	46.02	-15.12	1.023	333.5	Horizontal	120 k	5	Pass	23.362
599.97 MHz	1	40.948	38.042	46.02	-7.978	1.619	70.1	Horizontal	120 k	5	Pass	27.519
774.99 MHz	1	42.693	39.448	46.02	-6.572	1.124	113.3	Horizontal	120 k	5	Pass	30.175
799.98 MHz	1	42.316	39.364	46.02	-6.656	1.028	121	Horizontal	120 k	5	Pass	30.29
999.96 MHz	1	51.893	50.26	53.98	-3.72	2.097	125.9	Horizontal	120 k	5	Pass	32.16
599.97 MHz	2	42.929	40.987	46.02	-5.033	1.023	162.9	Vertical	120 k	5	Pass	27.519
774.99 MHz	2	41.377	38.259	46.02	-7.761	1.015	310.1	Vertical	120 k	5	Pass	30.175
799.98 MHz	2	41.379	38.372	46.02	-7.648	1.019	354.3	Vertical	120 k	5	Pass	30.29
824.97 MHz	2	40.572	36.852	46.02	-9.168	1.498	176.3	Vertical	120 k	5	Pass	30.539
874.98 MHz	2	41.286	37.394	46.02	-8.626	1.429	150.1	Vertical	120 k	5	Pass	30.775
999.96 MHz	2	52.949	51.815	53.98	-2.165	1.059	143.7	Vertical	120 k	5	Pass	32.16

Operating Mode:	2	
Test result:	Pass	Tested on: 2024-02-12

Start Frequency: 1 GHz; Stop Frequency: 4 GHz; Step: 250 kHz; Sweep Time: 20 ms/Step; RF Attenuation: Auto; RBW: 1 MHz; VBW: Auto; 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:

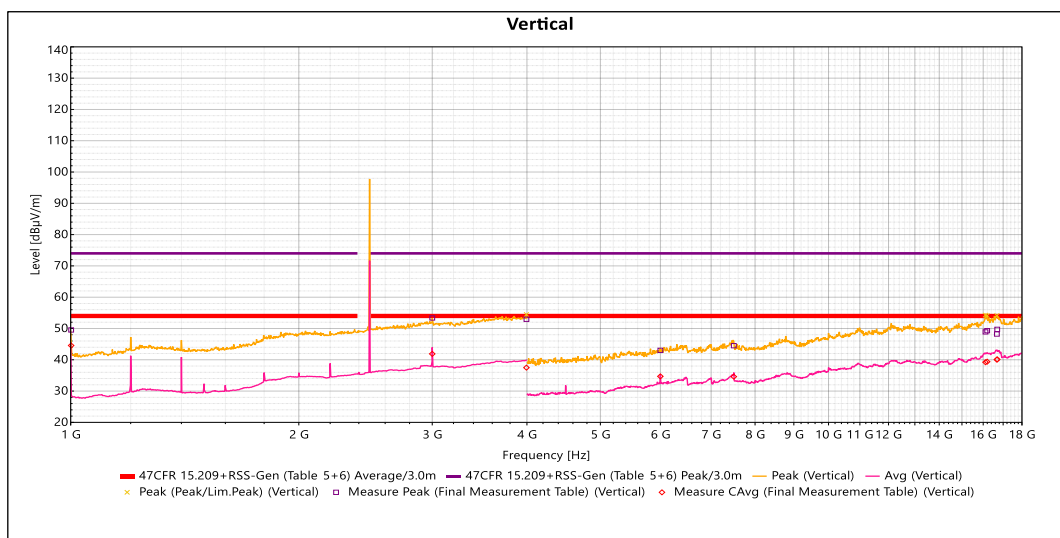
Final Measurement Table

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	47.104	74	-26.896	39.819	54	-14.181	1.477	324.2	Horizontal	1 M	5	Pass	30.2
1.2 GHz	1	46.954	74	-27.046	38.749	54	-15.251	2.139	300.5	Horizontal	1 M	5	Pass	31.7
8.758 GHz	2	42.516	74	-31.484	32.469	54	-21.531	2.501	29.6	Horizontal	1 M	5	Pass	4.416
16.665 GHz	2	50.198	74	-23.802	40.074	54	-13.926	2.501	29.6	Horizontal	1 M	5	Pass	12.792
16.679 GHz	2	50.55	74	-23.45	40.107	54	-13.893	2.501	29.6	Horizontal	1 M	5	Pass	12.8
16.69 GHz	2	50.216	74	-23.784	40.096	54	-13.904	2.999	0.4	Horizontal	1 M	5	Pass	12.806
17.717 GHz	2	50.626	74	-23.374	39.762	54	-14.238	2.498	0.4	Horizontal	1 M	5	Pass	12.499
17.974 GHz	2	48.818	74	-25.182	39.448	54	-14.552	1.501	29.6	Horizontal	1 M	5	Pass	12.776

Operating Mode:	2
Test result:	Pass
Tested on:	2024-02-12

Start Frequency: 1 GHz; Stop Frequency: 4 GHz; Step: 250 kHz; Sweep Time: 20 ms/Step; RF Attenuation: Auto; RBW: 1 MHz; VBW: Auto; 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



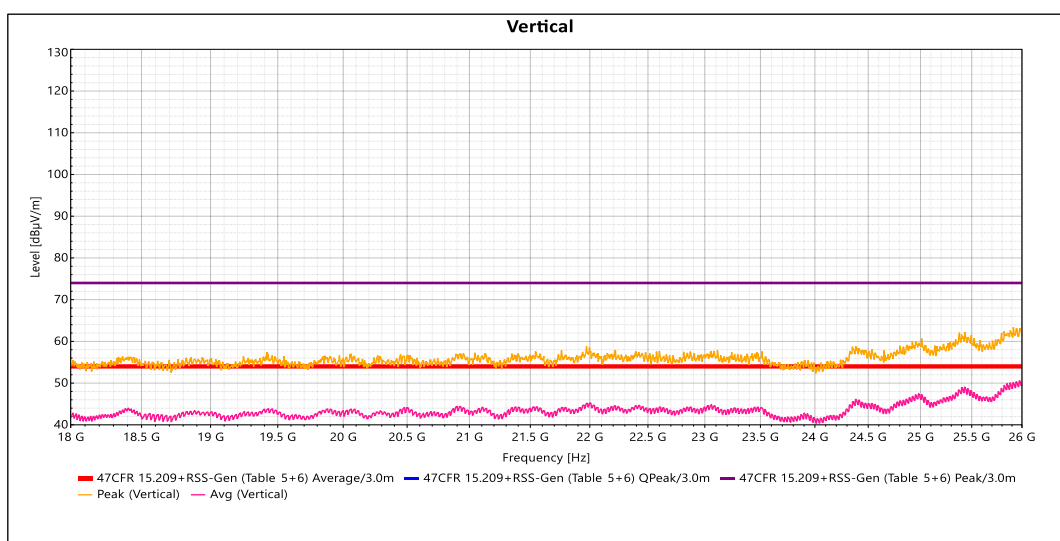
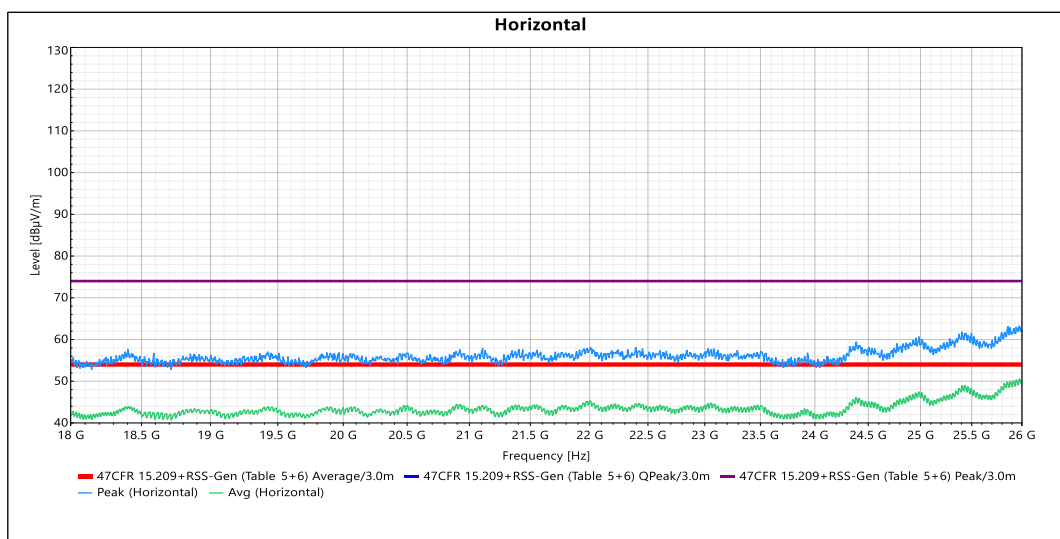
- ☐ The emissions are below the measurement system noise floor or 20 dB or more below the limit
- ☒ The measurement results of highest emissions relative to the limit for each detector type are shown below:

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	49.533	74	-24.467	44.557	54	-9.443	1.778	173.4	Vertical	1 M	5	Pass	30.2
3 GHz	1	53.358	74	-20.642	41.88	54	-12.12	1.186	325	Vertical	1 M	5	Pass	37.25
3.994 GHz	1	52.952	74	-21.048	37.477	54	-16.523	1.978	260.8	Vertical	1 M	5	Pass	38.616
6 GHz	2	43.007	74	-30.993	34.702	54	-19.298	1.001	0.4	Vertical	1 M	5	Pass	0.759
7.5 GHz	2	44.496	74	-29.504	34.604	54	-19.396	1.498	0.4	Vertical	1 M	5	Pass	2.939
16.112 GHz	2	48.908	74	-25.092	39.222	54	-14.778	2.498	0.4	Vertical	1 M	5	Pass	11.569
16.194 GHz	2	49.303	74	-24.697	39.391	54	-14.609	1.998	0.4	Vertical	1 M	5	Pass	11.706
16.679 GHz	2	48.222	74	-25.778	40.035	54	-13.965	3.998	0.4	Vertical	1 M	5	Pass	12.8
16.696 GHz	2	49.719	74	-24.281	40.137	54	-13.863	1.001	0.4	Vertical	1 M	5	Pass	12.809

Operating Mode:	2	
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

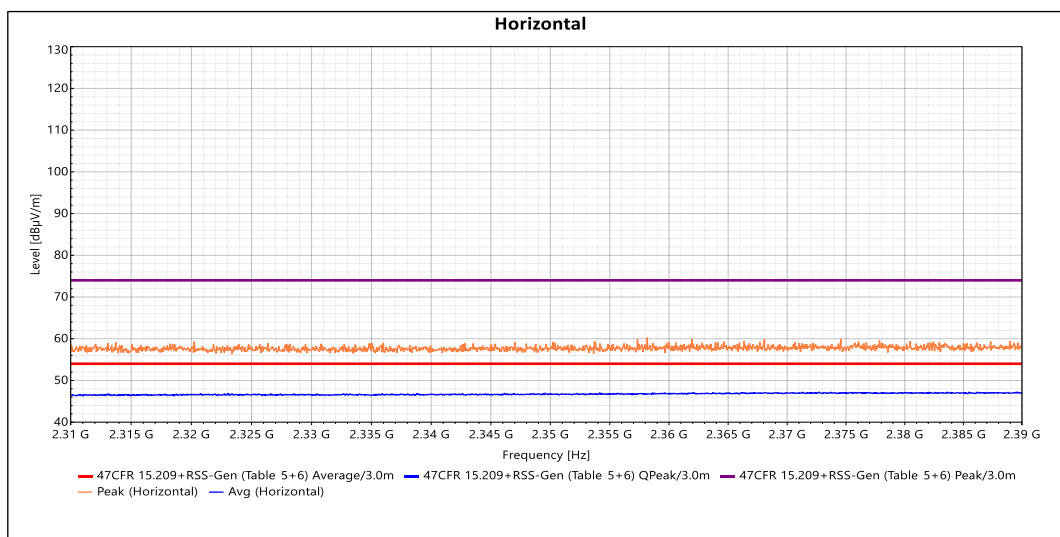
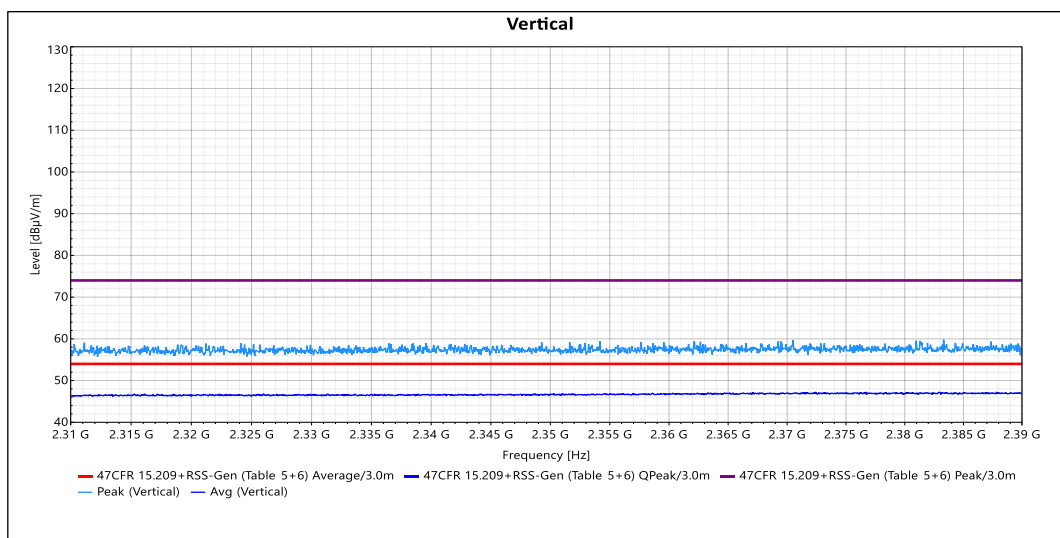


- ☒ The emissions are below the measurement system noise floor or 6 dB or more below the limit
- ☐ The measurement results of highest emissions relative to the limit for each detector type are shown below:

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

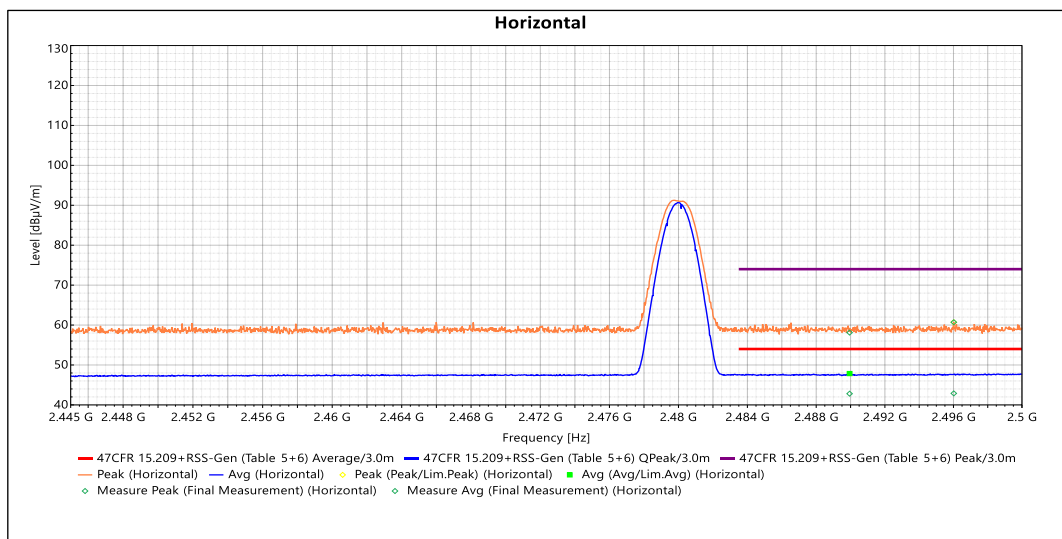
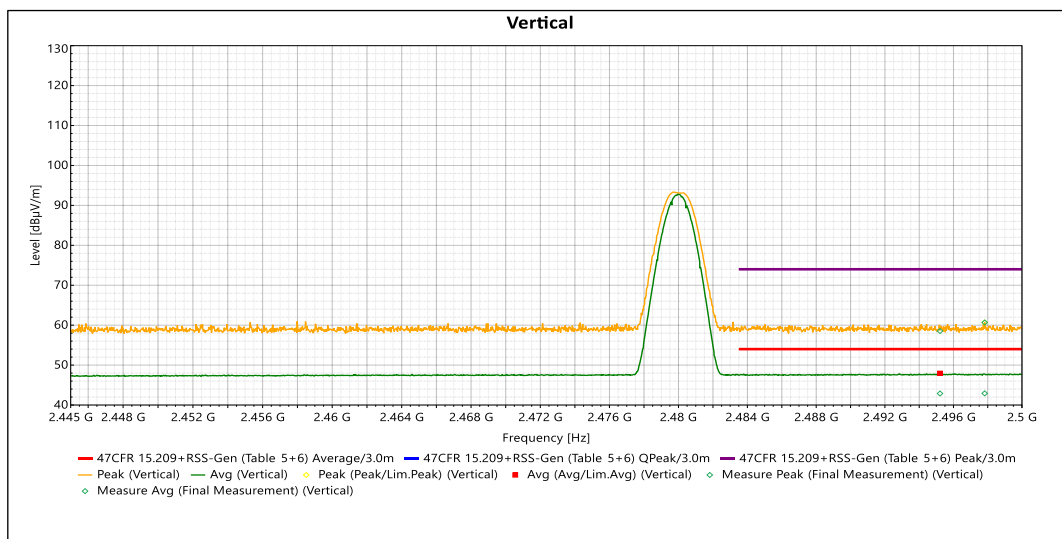


- ☒ The emissions are below the measurement system noise floor or 6 dB or more below the limit
- ☐ The measurement results of highest emissions relative to the limit for each detector type are shown below:

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:

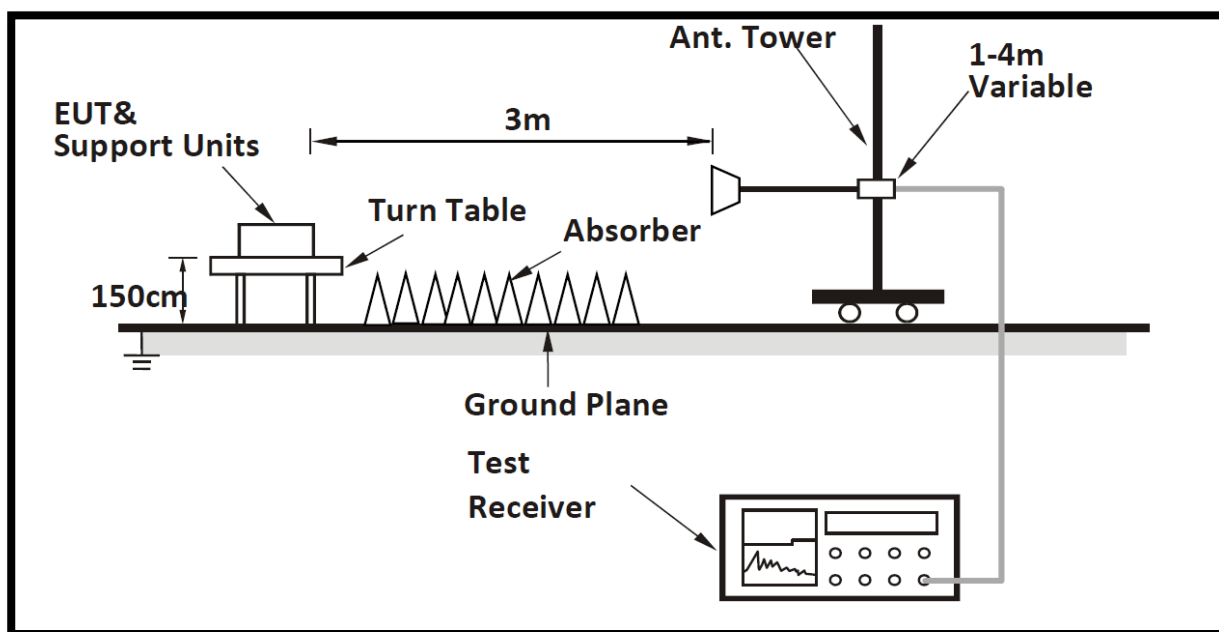
Final Measurement

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:

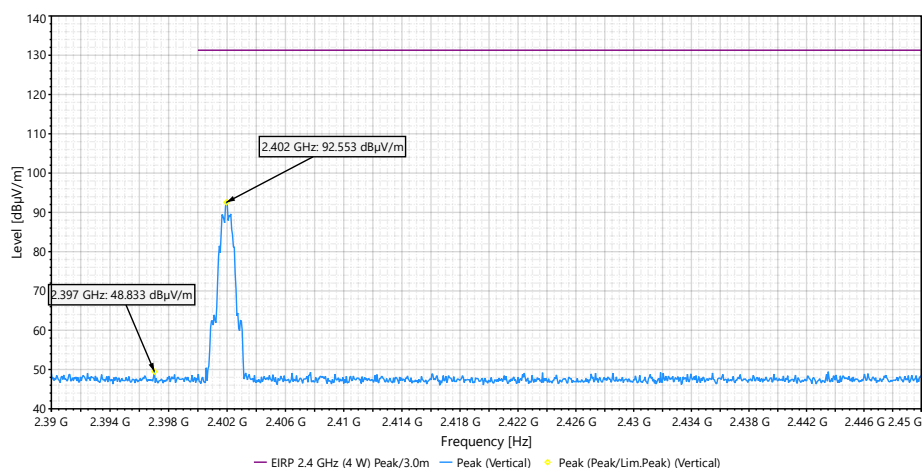


Results

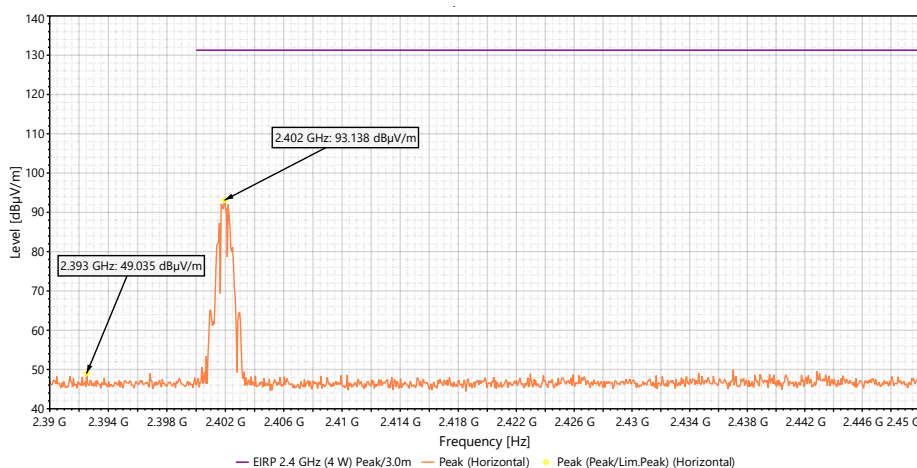
Operating Mode:	1		
Test result:	Pass	Tested on:	2024-02-13

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

Vertical



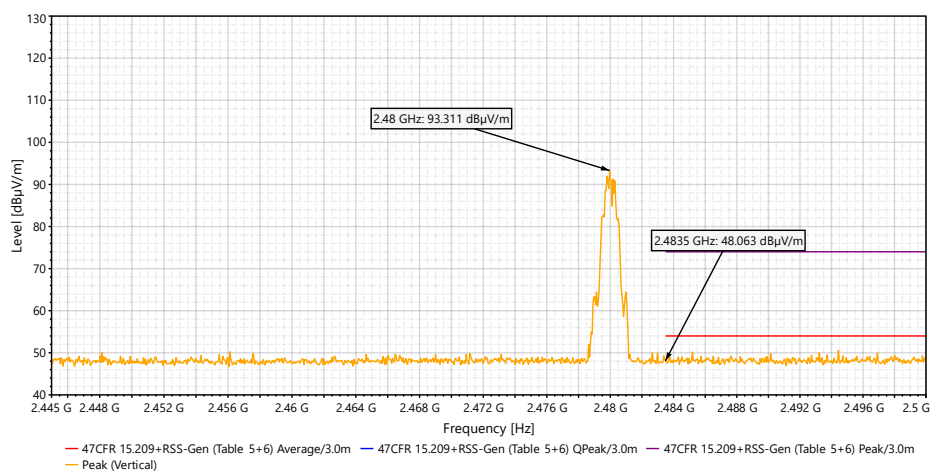
Horizontal



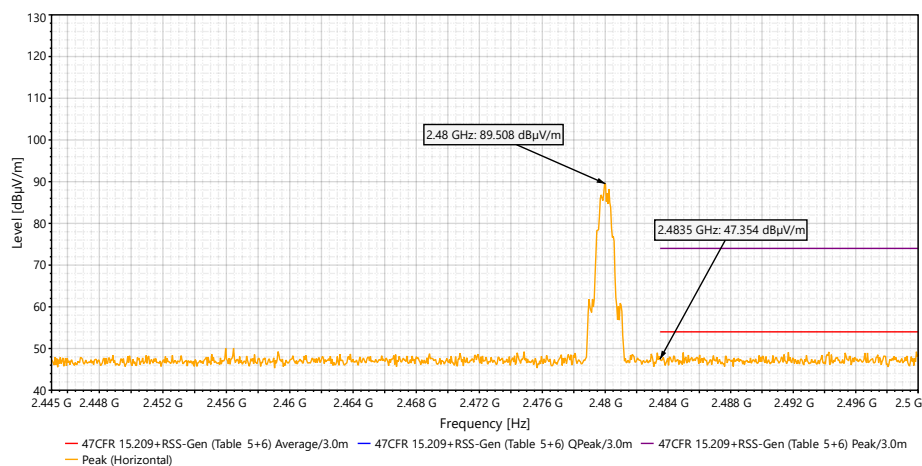
Operating Mode:	2	
Test result:	Pass	Tested on: 2024-02-13

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

Vertical



Horizontal



Final measurement table (Horizontal polarization)

Channel	Max carrier frequency		Max band edge frequency		Delta (dB)	Limit (*) (dB)	Result
	MHz	dBm	MHz	dBm			
Low	2402	93.14	2393	49.04	44.10	≥ 20	Pass
High	2480	89.51	2483.5	47.35	42.16	≥ 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	94.55	2397	48.83	45.72	≥ 20	Pass
High	2480	93.31	2483.5	48.06	45.25	≥ 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 >