

EMC Test Report

According to

Title 47 CFR Part 15 Subpart B

ISED ICES-Gen Issue 2 (February 2024)

ISED ICES-003 Issue 7

ANSI C63.4:2014+A1:2017

DUT Name: Treon Industrial Node C
Model No. : 2311
Customer: Treon Oy
Address: Visiokatu 3, 33720 Tampere
Summary: IN COMPLIANCE
Date of Reception: 16.6.2025
Date(s) of Test(s): 18.6.2025

Tested by (Test Engineer)


Pekka Pulkkinen

Approved by (Technical Manager)


Jukka Rauma

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Document Version History	Date of issue	Comments	Approved by
v0.1	01.07.2025	Initial version	
v1.0	04.07.2025	Approved version	Jukka Rauma

1. General Information

Test Engineer(s): Pekka Pulkkinen

Location:

Test Firm Name	Eurofins Electric & Electronics Finland Oy (EEEF)
Test Site	Yrttipellontie, Peltola
Address of Test Site	Yrttipellonte 6, 90230 Oulu, Finland
FCC Designation number	FI0008
FCC site registration number	771880
ISED number	29576
CAB Identifier	T290

Customer: Treon Oy
Visiokatu 3, 33720 Tampere
Joni Arola
e-mail: joni.arola@treon.fi

Climate Conditions: Temperature: 15 - 35 °C
Air pressure: 860 - 1060 hPa
Humidity: 30-60 rH%
These limits were not exceeded during testing.

2. Test Samples

General description:

Treon Industrial Node C (model number 2311) is a wireless battery-operated sensor device for seamless monitoring in everyday operations. Treon Industrial Node C measures vibration and surface temperature of rotating equipment, such as pumps, bearings motors, gearboxes and conveyors with a frequency range up to 1 kHz.

Test samples:

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version	Comments
2500231805	252249149200106	Treon Oy	Wireless battery operated sensor device	2311	DVT	2.0.0	Emission SW (SW1)

Accessories / Monitoring devices:

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version	Comments
G4CER061	RR620-010668	Advanced Card System Ltd.	nFC reader	ACR1552	NA	NA	
G4CER049	22-031518	Messtechnik	optoUSB Tranceiver		NA	NA	

3. Configuration and Operation Modes

Operation Mode	Description
OM1	EUT battery powered. Bluetooth LE in RX mode at 2442 MHz. nFC tag continuous reading with nFC reader. Power supply: 2 x Lithium Cells (Maxell CR2450HR 3 V)

4. Test sample description

Model	2311	
Additional model(s)	-	
Brand name	-	
FCC ID	2AR86-ND23	
IC	24716-ND23	
Class	Class B	
Radio	Type	2.4 GHz Bluetooth LE
	Model	nRF52840
	Manufacturer	Nordic Semiconductor ASA
	FCC-ID	2AR86-ND23
	IC	24716-ND23
Antenna	Type	Integrated F-antenna integrated to PCB
	Gain	0.0 dBi
	Manufacturer	Treon Oy
Manufacturer	Treon Oy	

Ports	Port			Cable			
	Name and description		Shielded	Specified max length [m]	Attached during test		
			<input type="checkbox"/>		<input type="checkbox"/>		
			<input type="checkbox"/>		<input type="checkbox"/>		
			<input type="checkbox"/>		<input type="checkbox"/>		
			<input type="checkbox"/>		<input type="checkbox"/>		
			<input type="checkbox"/>		<input type="checkbox"/>		
			<input type="checkbox"/>		<input type="checkbox"/>		
Supplementary information to the ports							
Rated power supply	Voltage and Frequency				Reference poles		
					L1	N	PE
	<input type="checkbox"/>	AC 230 V <input type="checkbox"/> 50 Hz <input type="checkbox"/> 60 Hz			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	AC 240 V <input type="checkbox"/> 50 Hz <input type="checkbox"/> 60 Hz			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	AC 110 V <input type="checkbox"/> 50 Hz <input type="checkbox"/> 60 Hz			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	AC 100 V <input type="checkbox"/> 50 Hz <input type="checkbox"/> 60 Hz			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Other:			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	DC: 2 x Lithium Cells (Maxell CR2450HR 3V)					
Rated Power							
Clock frequencies	Processor 32 MHz, BLE 2.4 GHz						
Other parameters							

Dimensions in cm (W x H x D)	52.8 mm x 43.0 mm x 24.9 mm	
Weight	54 g	
Mounting position	<input type="checkbox"/>	Table top equipment
	<input type="checkbox"/>	Wall/Ceiling mounted equipment
	<input type="checkbox"/>	Floor standing equipment
	<input type="checkbox"/>	Hand-held equipment
	<input checked="" type="checkbox"/>	Other: Mounting to the structure under monitoring

5. Test description

5.1. FCC subpart 15B and ICES-003, radiated emission test procedure

Radiated tests were performed in a semi-anechoic chamber that has met NSA requirements (4 dB tolerance) according to

- CISPR 16-1-4 Ed. 4.0 2019-01 Validation of a SAC (6.8) using the Reference Site Method (RSM) (6.6);
- ANSI C63.4a -2017 Validation of radiated emission test sites (30MHz – 1 GHz) (Annex D)
- validation date: 7.11.2024

SVSWR requirements (1 -18 GHz) are met according to

- CISPR 16-1-4 Ed. 4.0 2019-01 SVSWR site validation – standard test procedure (7, 7.6)
- validation date: 14.10.2024

2 different measurement antenna was used, located at a distance of 3 m.

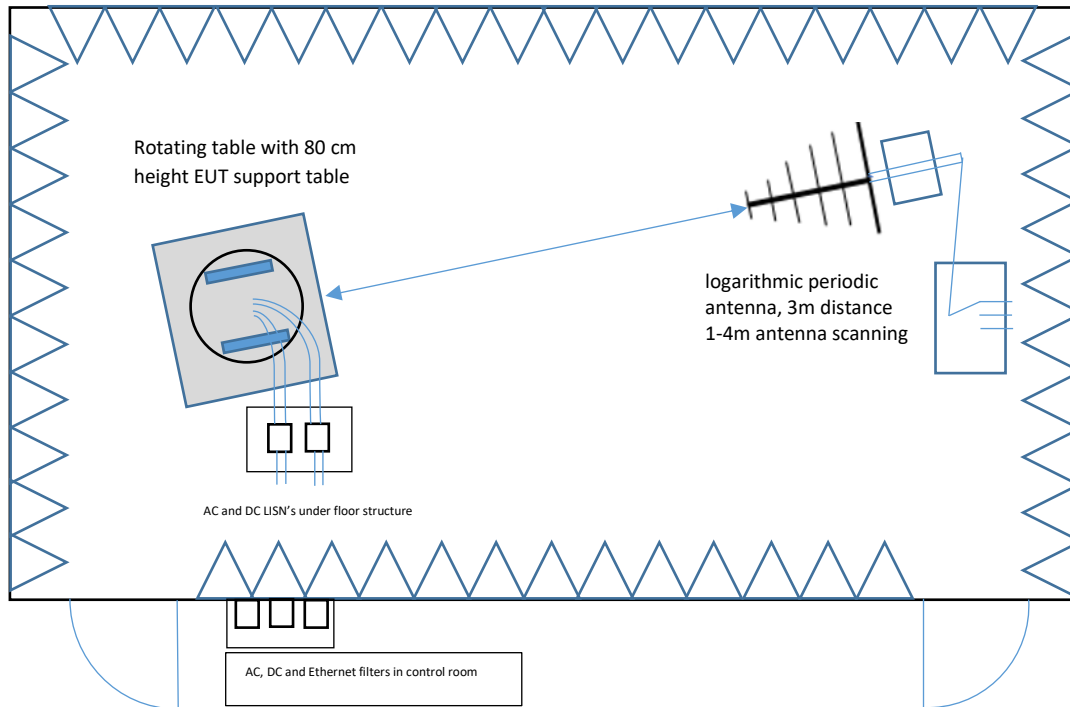
- linear polarized logarithmic periodic antenna for frequency range 30-1000 MHz
- and double-ridged horn antenna for the frequency range 1-18 GHz

The equipment under test was set up on a non-conductive support, 80 cm above the ground plane. EUT power supply LISN's for AC and DC were located under the ground reference plane. The field strength was calculated by adding correction factor to the measured level from the EMI receiver. This correction factor includes antenna factor, cable loss and pre-amplifier gain.

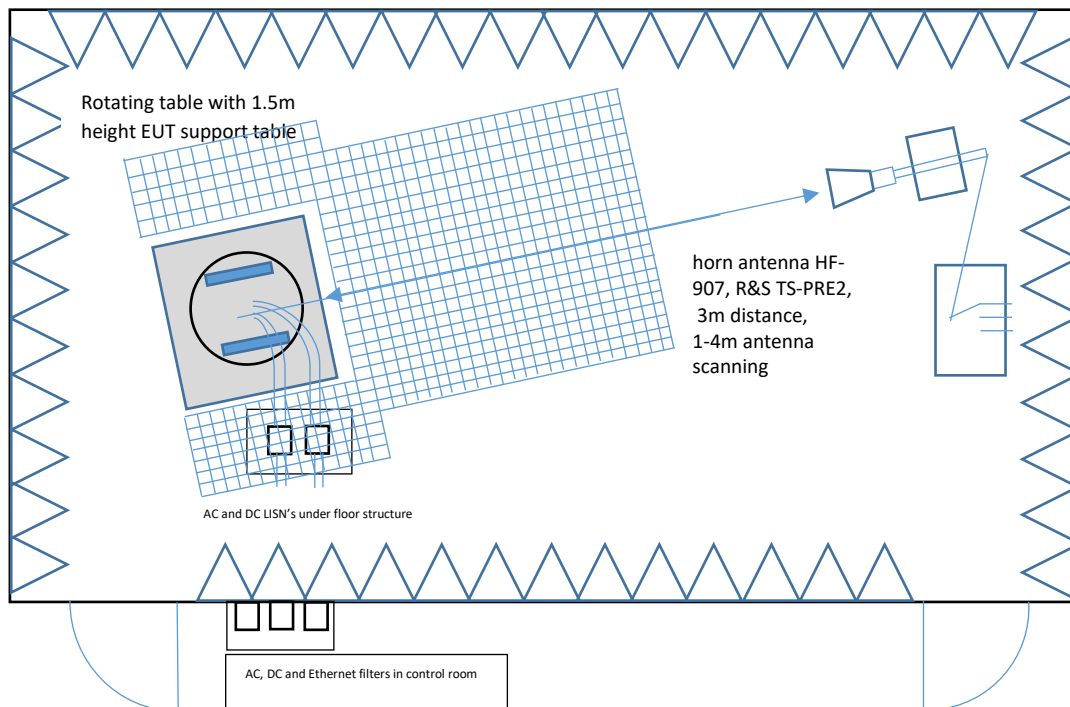
Measurement procedure

- EUT was set in a manner that is most representative of the equipment as typically used (i.e., as specified in the EUT instruction manual)
 - o In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the orientation (attitude) having maximum or near-maximum emission level.
- in exploratory measurements for full frequency range
 - o turntable was rotated with 45° steps (from 0° to 315°)
 - o measurement was done in both vertical and horizontal antenna polarization with antenna height of 1m
 - o measurement was done with peak detector to find the frequencies of maximum emissions and at least six highest peaks related to the limits were chosen
- these peak values were further maximized by scanning the turntable position 0 to 360 degrees and the antenna height 1 to 4m
- for maximized values, final measurement was done with
 - o quasi-peak detector for 30MHz to 1GHz frequency range
 - o with Average detector for 1GHz to 18GHz frequency range

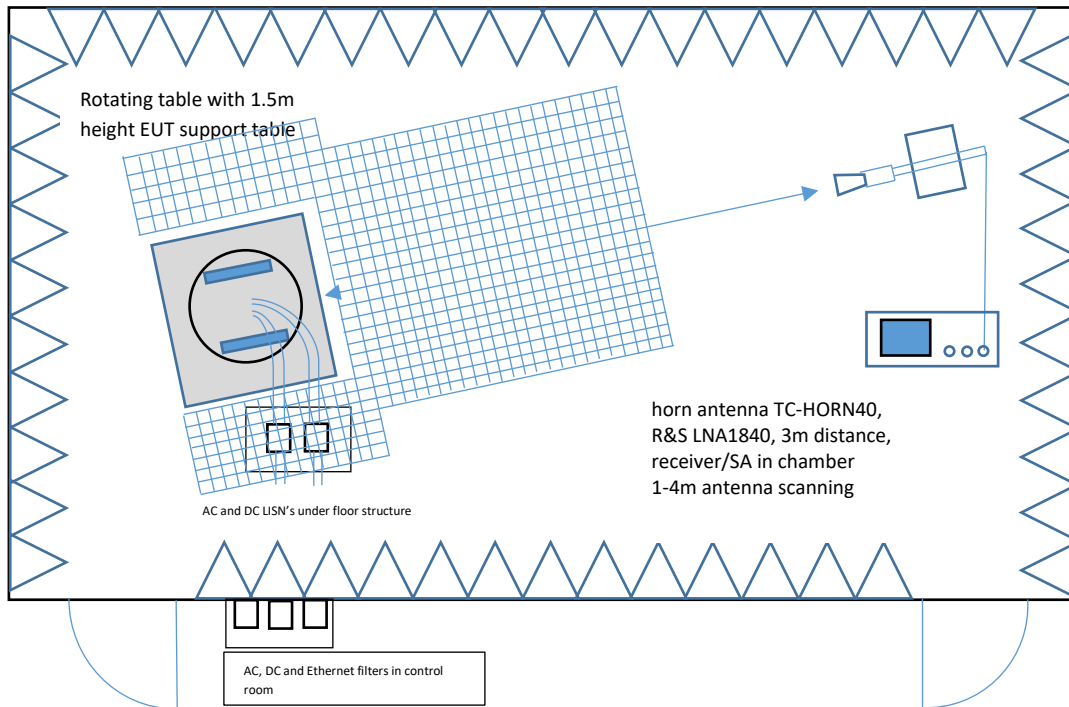
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 18 GHz:



Radiated measurements setup from 18 GHz to 26 / 40 GHz:



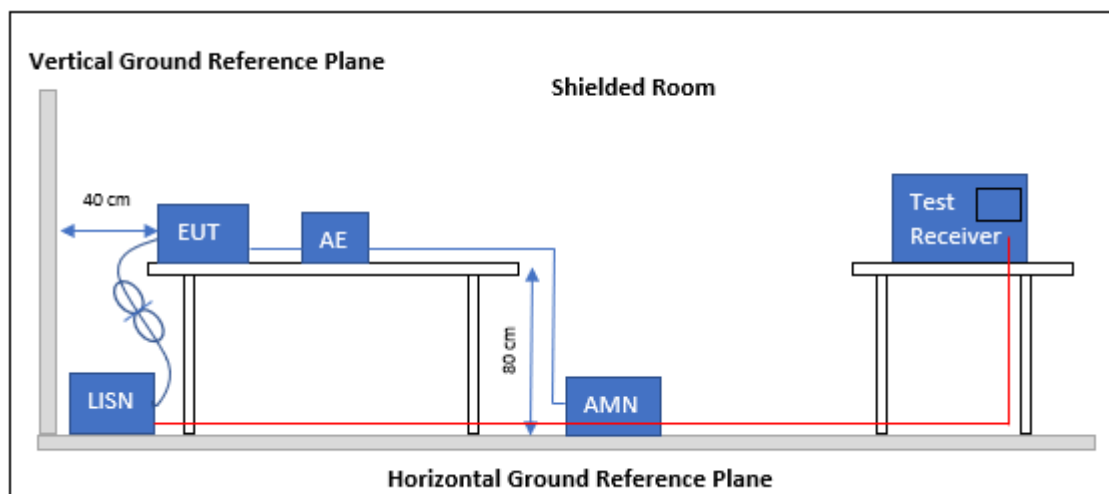
5.2. FCC subpart 15B and ICES-003, conducted emission test procedure

The equipment under test was set up on a non-conductive support, 80 cm above the ground plane and 40 cm distance of vertical ground plane. Test setup is described in pictures below.

Measurement procedure

- EUT was operated in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement
- in exploratory measurements for full frequency range
 - o measurement was done with peak and average detector to find the frequencies of maximum emissions for each current-carrying conductor of each power cord associated with the EUT and at least six highest peaks related to the limits were chosen per conductor
 - o the one configuration and arrangement and mode of operation that produces the highest emissions related to the limit across all the measured conductors was recorded.
- for this configuration and its maximized values, final measurement for each current-carrying conductor was done with quasi-peak detector and average detector

Conducted emission test setup



6. Uncertainties

6.1. Emission measurement uncertainties

Description	Expanded Uncertainty (k=2)
AC conducted emission	2,24
Radiated emission ≤ 1 GHz	4,62
Radiated emission > 1 GHz	5,72

7. Summary

Title 47 CFR 15B, ISSED ICES-003 Issue 7			
Reference	Requirement – Test case	Verdict	Remark
FCC 15.109 ICES-003, 3.2.2	Radiated emission. Electromagnetic field measure (30 MHz – 1000 MHz)	PASS	
FCC 15.109 ICES-003, 3.2.2	Radiated emission. Electromagnetic field measure (1 GHz – 12,75 GHz)	PASS	
FCC 15.109 ICES-003, 3.2.2	Radiated emission. Electromagnetic field measure (12,75 GHz – 18 GHz)	N/R	(1)
FCC 15.107 ICES-003, 3.2.1	Continuous conducted emission (150 kHz – 30 MHz)	N/R	(2)
The DUT has been tested and passes the FCC Part 15 Subpart B without any modifications.		Yes	
<p>Supplementary information and remarks:</p> <p>(1) Range: $f > 12.75$ GHz. Test is required only if the 5th harmonics of the EUT's maximum internal work frequency is higher than 12.75GHz.</p> <p>(2) Not applicable according to Clause 15.107 of the standard if battery powered device.</p> <p>Possible test case verdicts</p> <p>PASS = Test object meet the requirements</p> <p>FAIL = Test object does not meet the requirements</p> <p>N/T = Required by standard but not tested</p> <p>N/R = Not required by standard for the test object</p>			

8. Radiated Emissions

Reference: FCC 15.109, ICES-003, 3.2.2
 Test method: ANSI C63.4:2014+A1:2017 Section 8

The applied limit for radiated emissions, 3 m distance, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B, Secs. 15.109 & ICES-003 Issue 7, section 3.2.2.

FCC part 15, subpart B

Limits, Class B	Quasi-peak Limit for 3m	
Frequency of emission MHz)	(microvolt/meter)	(dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

ICES-003, Issue 7

Limits, Class B	Quasi-peak Limit for 3m	
Frequency of emission MHz)	(microvolt/meter)	(dBuV/m)
30-88	100	40
88-216	150	43.5
216-230	200	46
230-960	223	47
Above 960	500	54

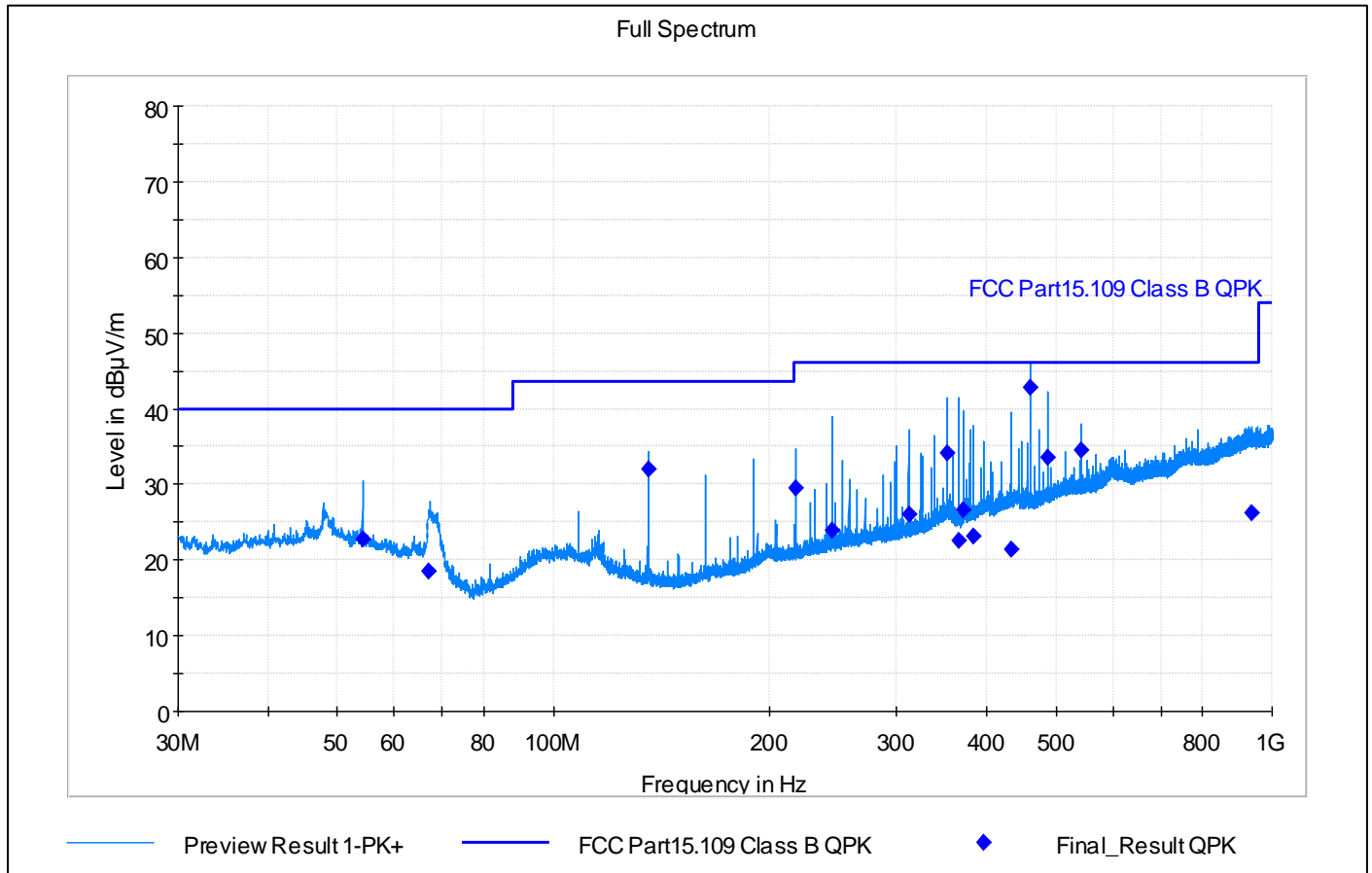
FCC part 15, subpart B and ICES-003, Issue 7

Frequency of emission MHz)	Average Limit for 3m		Peak Limit for 3m
	(microvolt/meter)	(dBuV/m)	(dBuV/m)
Above 1000	500	54	74
Frequencies above 1 GHz, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test, as per §15.35(b)			

Tested sample(s): 2500231805
 Operation mode(s) tested: OM1
 Test results: PASS
 Note:

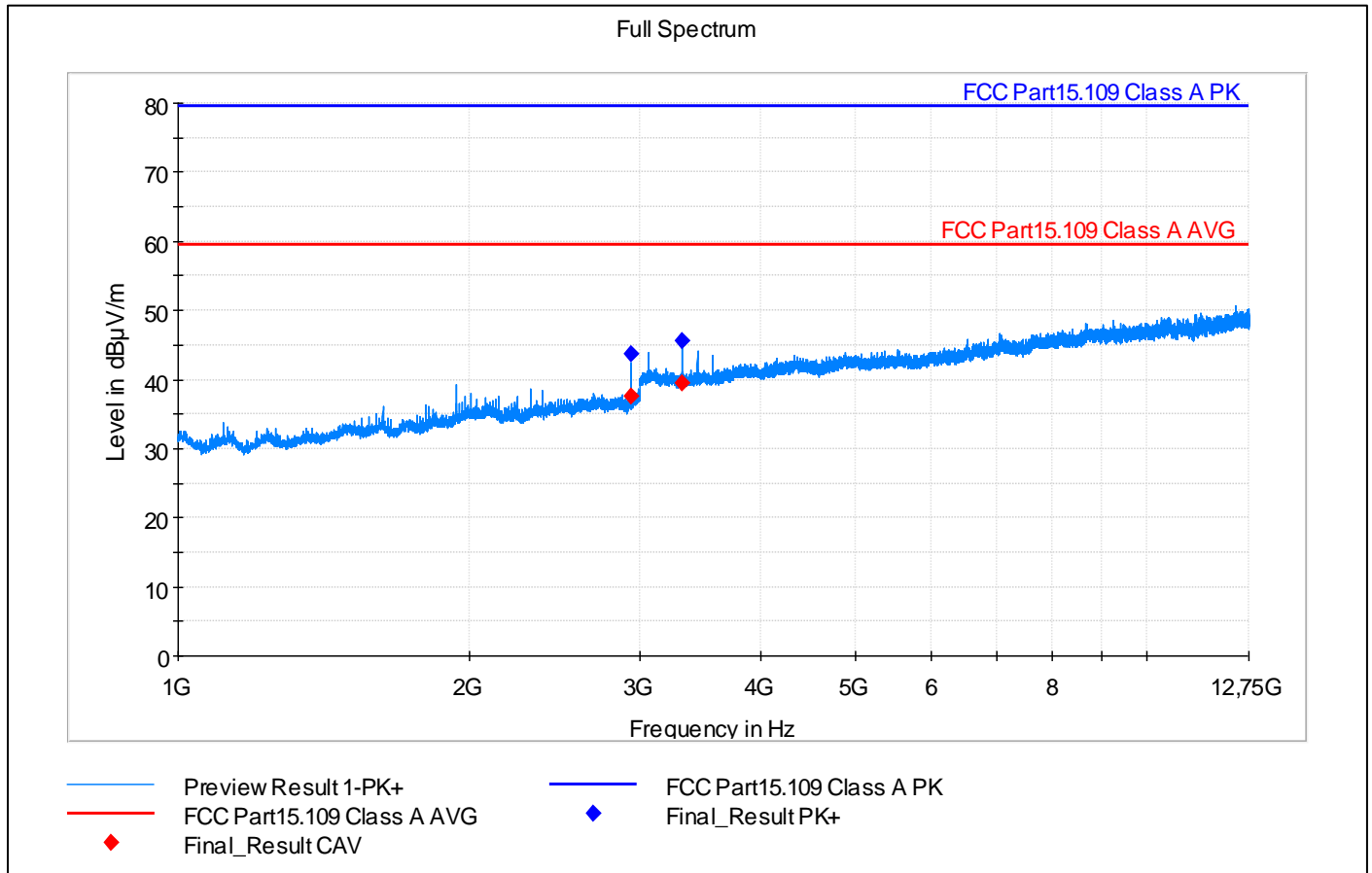
Test data:

Operation mode(s)	Configuration	Test Verdict
OM1	Worst case, Frequency Range: 30 MHz – 1GHz	PASS
OM1	Worst case, Frequency Range: 1 – 12.75 GHz	PASS

FCC part 15, subpart B and ICES-003 Graph and final result table for 30 MHz – 1 GHz, OM1:

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)	Comment
54.270	22.80	40.0	17.20	15000	120	105.0	V	-15	0	20.8	PASS
67.110	18.60	40.0	21.40	15000	120	163.0	V	337	0	18.0	PASS
135.600	31.99	43.5	11.51	15000	120	106.0	V	247	0	16.3	PASS
216.930	29.57	46.0	16.43	15000	120	100.0	V	202	0	19.8	PASS
243.990	23.85	46.0	22.15	15000	120	160.0	H	269	0	21.1	PASS
312.000	25.99	46.0	20.01	15000	120	178.0	H	-21	0	22.6	PASS
352.560	34.07	46.0	11.93	15000	120	100.0	H	126	0	24.7	PASS
366.240	22.60	46.0	23.40	15000	120	108.0	H	323	0	24.0	PASS
371.970	26.51	46.0	19.49	15000	120	106.0	H	302	0	24.3	PASS
384.000	23.14	46.0	22.86	15000	120	124.0	H	318	0	24.7	PASS
433.830	21.31	46.0	24.69	15000	120	131.0	V	247	0	26.0	PASS
461.040	42.80	46.0	3.20	15000	120	107.0	H	118	0	26.2	PASS
488.220	33.54	46.0	12.46	15000	120	147.0	V	131	0	27.0	PASS
542.400	34.42	46.0	11.58	15000	120	121.0	V	155	0	28.1	PASS
938.670	26.21	46.0	19.79	15000	120	116.0	V	147	0	34.1	PASS

FCC part 15 subpart B and ICES-003, Graph and final result table for 1 GHz – 12,75 GHz, OM1:



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
2937.500	---	37.66	59.5	21.84	500	1000	100.0	H	323	2.2	PASS
2937.500	43.80	---	79.5	35.70	500	1000	100.0	H	323	2.2	PASS
3312.500	---	39.40	59.5	20.10	500	1000	300.0	H	327	6.1	PASS
3312.500	45.62	---	79.5	33.88	500	1000	300.0	H	327	6.1	PASS

9. Test Equipment List

New ID	Manufacturer	Equipment type	Description	Serial	Calibration information	Next calibration
G4C265	Rohde & Schwarz	ESW26	EMI test receiver	101324	26.7.2024	26.7.2025
G4C273	Frankonia	ALX-4000E	Broadband Antenna, 25MHz-4GHz with 6dB (50-A-MFN-06) att.	00816+1531	22.1.2024	22.1.2027
G4C292	Rohde & Schwarz	TS-LNA 1840	RF Preamplifier 18 to 40 GHz	100841	12.8.2024	12.8.2026
G4C294	Rohde & Schwarz	TC-HORN40 + WRD180-2.5	Horn Antenna -> 40GHz	101057 + 100667	4.11.2022	4.11.2025
G4C298	Rohde & Schwarz	CMW500	Wideband radio communication tester	170980	29.6.2023	29.6.2025
G4C469	Rohde & Schwarz	TS_PRE2	RF Preamplifier	101541	12.8.2024	12.8.2026
G4C576	Rohde & Schwarz	HF907	Double-Ridged Waveguide Horn Antenna 800MHz-18GHz	100163	9.8.2022	9.8.2025