

TEST REPORT

Test report no.: 1-0696-25-01-02-TR1-R01



Testing laboratory

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Accredited Testing Laboratory

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00

Applicant

Anschütz GmbH

Zeyestraße 16-24

24106 Kiel / GERMANY

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Manufacturer

Anschütz GmbH

Zeyestraße 16-24

24106 Kiel / GERMANY

Test standard/s

FCC - Title 47 CFR Part 80

FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 80 - Stations in the Maritime Services

FCC - Title 47 CFR Part 15B

FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Subpart B - Unintentional Radiators

Test Item

Kind of test item: Shipborne Radar S-Band System

Model name: Anschütz SST(S-Band)

FCC-ID: ASL-SST3051S

Frequency range: 2.9 – 3.1 GHz

Tx power conducted: 200 W (nominal peak power)

Power Supply: 100-240 V AC

Temperature Range: -30°C to +55°C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

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Radio Labs

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Thomas Vogler
Lab Manager
Radio Labs

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2025-08-06
Date of receipt of test item:	2025-09-15
Start of test:*	2025-09-15
End of test:*	2025-09-26
Person(s) present during the test:	Mr. Carsten Reiter (during set-up)

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Involved test locations

	Saarbruecken lab		Essen lab
☒	Untertuerkheimer Str. 6-10 66117 Saarbruecken Germany	☐	Im Teelbruch 116 45219 Essen Germany

2.4 Test laboratories sub-contracted

None

2.5 Laboratory listings and recognitions

	Saarbruecken	Essen
FCC	DE0002	DE0003
ISED	DE0001 3462C	DE0001 3462D

3 Test standards and references

3.1 Test standards

Test standard	Date	Test standard description
FCC - Title 47 CFR Part 80		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 80 - Stations in the Maritime Services
FCC - Title 47 CFR Part 15B		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Subpart B - Unintentional Radiators

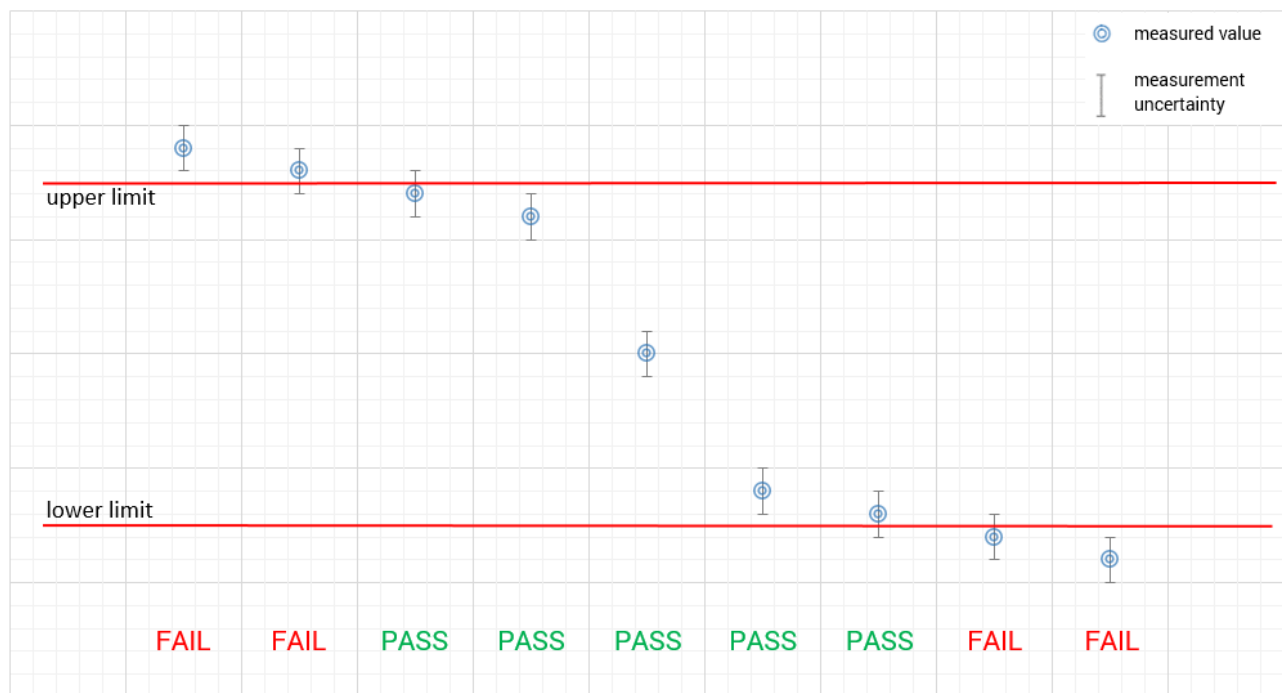
References	Date	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2020	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices
ANSI C63.26-2015	-/-	American National Standard for Compliance Testing of Transmitters used in Licensed Radio Services

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



5 Test environment

Temperature	:	T_{nom} T_{min} T_{max}	+22 °C during room temperature tests -30 °C +55 °C
Relative humidity content	:		45 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom}	115 V AC $\pm$ 10%

6 Test item

6.1 General Description

Kind of test item	:	Anschütz SST S-Band Radar-Pedestal
Model name	:	AN3051SST
S/N serial number	:	244300006
HW hardware status	:	Coded in serial number
SW software status	:	SSR-S-2.1.1.30-Build3053
Frequency band	:	2.9 to 3.1 GHz
Type of modulation	:	sequence of unmodulated pulses and pulse compression (see table below)
Emission Designator	:	P0N
Number of channels	:	8
Channel spacing	:	30 MHz
Power supply	:	115 V AC
Temperature range	:	-30°C to +55°C

6.2 List of components

- Computer Phantom-6001M/V1.0/RAn; S/N I531ES6039; SW Synapsis 05.08.02
- Lantech LGS-2624C Industrial ETH Switch S/N 822011140300035

6.3 Antenna system(s)

Antenna size	Concept	Manufacturer	Type	TX gain dBi (mid)	Polarization	pattern / test report
14'	End fired slotted waveguide array	Wärtsilä SAM / ANCS	GR3021G090	28.2	horizontal	Wärtsilä report ANC-I-0001-3771 Rev. 03

6.4 Operating conditions

Operating condition 1: CH0 = 2.930 GHz , CH3= 2.990 GHz, CH7= 3.070 GHz

For all operating modes a pulse train consisting of up to three pulses is used. The 12NM operating mode is using S1, M1 and L3 pulse. The 24NM operating mode is using the S1, M1 and L1 pulse. The 48NM operating mode is using the S1, M2 and L2 pulse. The BEACON mode is using the S2 pulse only. The energy on target depends on the transmitted pulse amplitude, multiplied by the pulse length and the number of pulses.

The RF input power corresponding to the sample values can be found in the table below.

Pulse	Pulse length	Bandwidth	Compressed Pulse Length	RF Range Resolution	BB Sample Rate	PPI Sample Log Scale [dB/LSB]	PPI Sample for -76dBm RF power
S1	0.1 μ s	-	100 ns	15 m	2.89m	0.373	78
S2	0.3 μ s	-	300 ns	45 m	2.89m	0.373	65
M1	4 μ s	10 MHz	100 ns	15 m	2.89m	0.373	138
M2	6 μ s	10 MHz	100 ns	15 m	5.78m	0.373	133
L1	25 μ s	5 MHz	200 ns	30 m	11.57m	0.373	165
L2	55 μ s	2.5 MHz	400 ns	60 m	23.13m	0.373	155
L3	25 μ s	5 MHz	200 ns	30 m	5.78m	0.373	165

The short pulse (S1 and S2) is located always 13.3MHz below the carrier frequency. The medium pulse (M1 and M2) is located always 18.8325 MHz above the carrier frequency. The long pulse (L1, L2 and L3) is located always 9.1125 MHz above the carrier frequency.

Antenna squint compensation will be applied automatically by the radar based on radar configuration.

The Table 4 shows the different operating modes. The PTRF is a theoretically calculated value with a PTRF deviation of 0%. In practice, they may deviate slightly. Due to PTRF deviation configuration the real PTRF might be up to 5% higher or lower. This will then have a corresponding effect on the number of sweeps per antenna rotation and the hits per scan. The number of sweeps per revolution in Table 4 is based on an antenna revolution duration of 2.5 seconds.

OperatingMode	PTRF (Max)	PTRF (@0% PTRF deviation)	Sweep per revolution Transferred via network	Cell resolution	Number of cells per sweep	Number of sweeps used for coherent integration		
						5ft antenna X-band	8ft antenna X-band	14 ft antenna S-band
12 NM	3163 Hz	3954 Hz	2048	5.78m	3843	16	16	16
24 NM	2345 Hz	2796 Hz	2048	11.57m	3843	16	15	16
48 NM	1145 Hz	1279 Hz	2048	23.13m	3843	11	7	15

6.5 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:

- 1-0696-25-01-01_TR1-A101-R01 (External photographs of EUT)
- 1-0696-25-01-01_TR1-A102-R01 (Internal photographs of EUT)
- 1-0696-25-01-01_TR1-A103-R01 (Test set-up photographs)
- Note: The referenced photos show EUT delivered by the customer in this project, not necessarily the exact one used for the specific tests. EUT identification shown in the photos may differ.

Additional measurement reports:

- 1-0697-25-01-02_TR1-A201-R01

Additional manufacturer's documentation:

- 1-0696-25-01-01_TR1-A301-R01 (General Product Information)

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

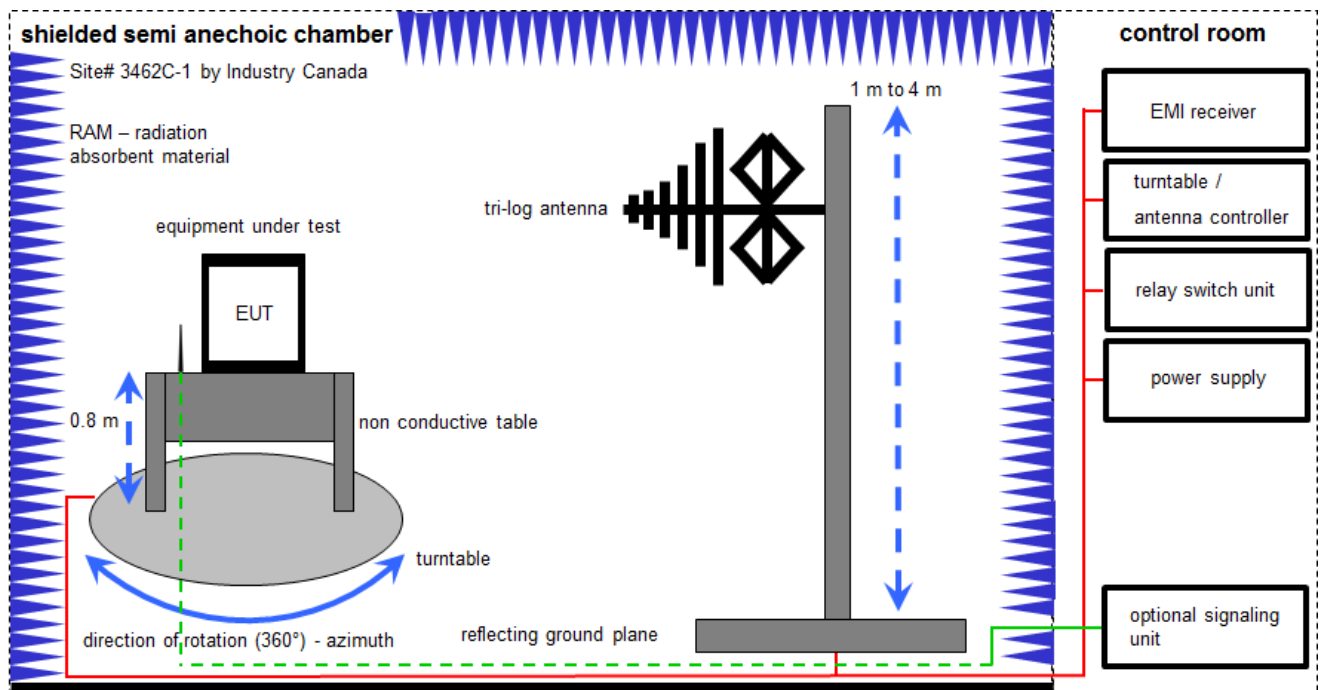
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated		EK	limited calibration
ne	not required (k, ev, izw, zw not required)		zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification		izw	internal cyclical maintenance
Ve	long-term stability recognized		g	blocked for accredited testing
vlk!	Attention: extended calibration interval			
NK!	Attention: not calibrated		*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter
EMC32 software version: 10.30.0

$FS = UR + CL + AF$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

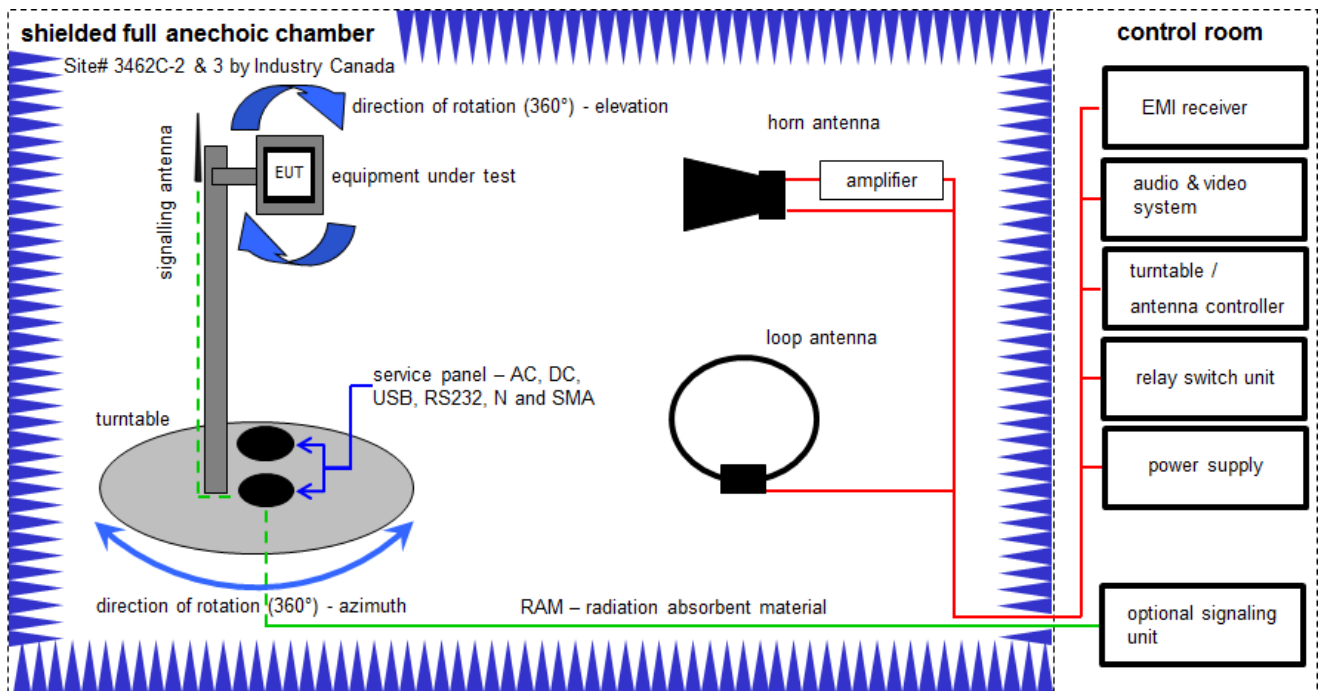
Example calculation:

$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
2	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	n. a.	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	05.12.2024	31.12.2025
4	n. a.	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	n. a.	Semi anechoic chamber	3000023	MWB AG		300000551	ne	-/-	-/-
6	n. a.	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
7	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	371	300003288	vKI!	11.07.2024	31.07.2026
8	n. a.	Turntable	2089-4.0	EMCO		300004394	ne	-/-	-/-
9	n. a.	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter

BAT-EMC software version: 3.16.0.49

FS = UR + CA + AF

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

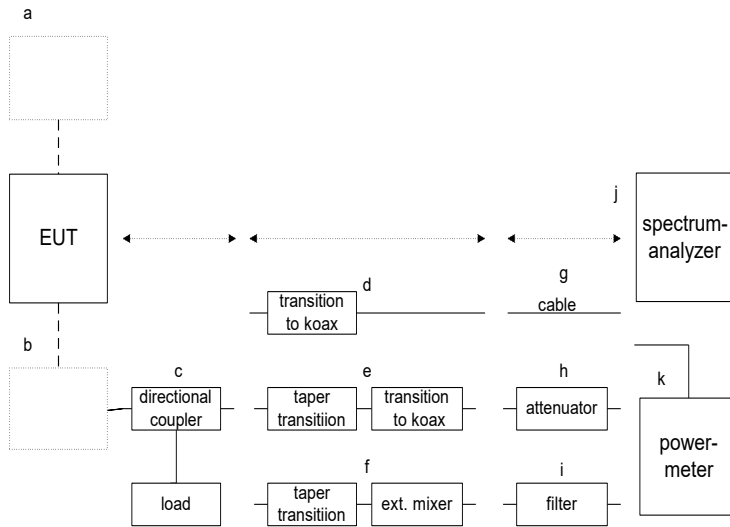
Example calculation:

FS [dBμV/m] = 40.0 [dBμV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBμV/m] (71.61 μV/m)

Equipment table:

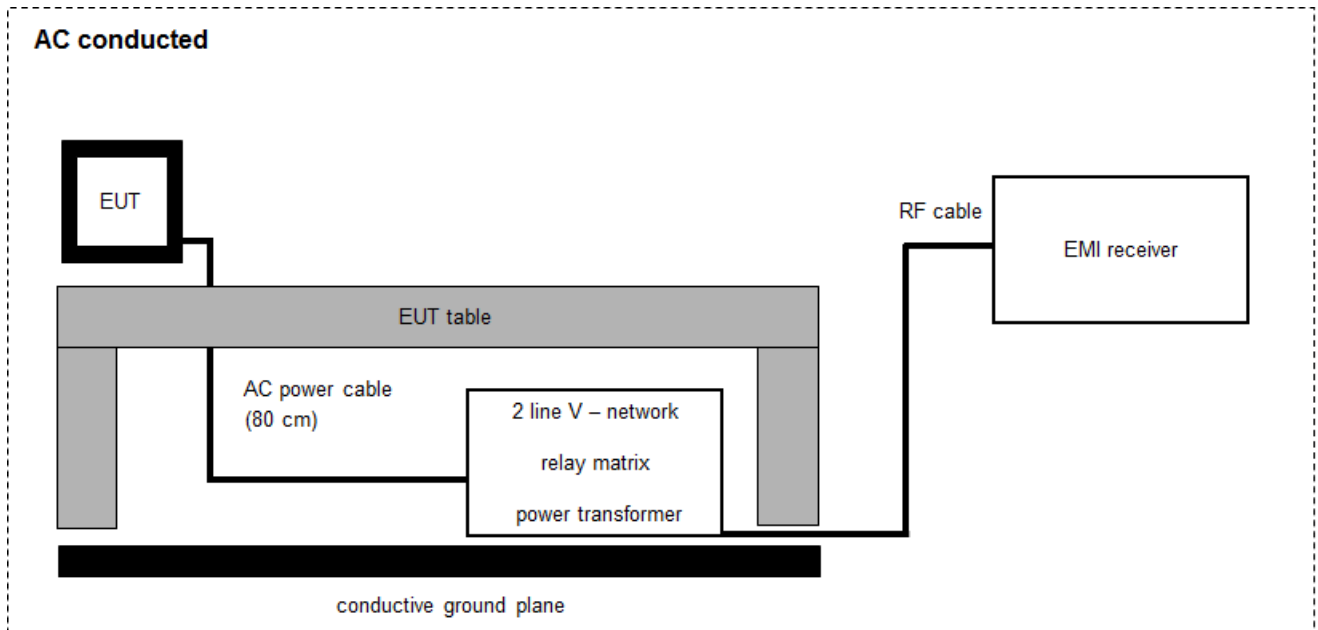
No.	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	Double-Ridged Waveguide Horn Antenna	Double-Ridged Waveguide Horn Antenna 3115	EMCO Elektronik GmbH / Gilching	9107-3696	300001604	k	15.04.2025	30.04.2027
2	Anechoic chamber	Anechoic chamber FAC 3/5m	MWB / TDK	87400/02	300000996	ne	-/-	-/-
3	Switch / Control Unit	Switch / Control Unit 3488A	Hewlett Packard	*	300000199	ne	-/-	-/-
4	Highpass Filter	Highpass Filter WHKX7.0/18G-8SS	Wainwright Instruments GmbH / Andechs	19	300003790	ne	-/-	-/-
5	Broadband Amplifier 0.5-18 GHz	Broadband Amplifier 0.5-18 GHz CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
6	4U RF Switch Platform	4U RF Switch Platform L4491A	Agilent Technologies Deutschland GmbH / Böblingen	MY50000037	300004509	ne	-/-	-/-
7	NEXIO EMV-Software	NEXIO EMV-Software BAT EMC V2022.0.32.0	Nexio	*	300004682	ne	-/-	-/-
8	RF-Amplifier	RF-Amplifier AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-
9	EMI Test Receiver	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100037	300003555	k	10.12.2024	31.12.2025
10	TRILOG Broadband Antenna	TRILOG Broadband Antenna VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönaun	295	300003787	k	03.06.2025	30.06.2027

7.3 Conducted measurements



No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1		RF Peak Power Analyzer+ PPA Sensor	4500B + 58318	Boonton Electronics	12331 + 6276	300003871	k	05.12.2024	31.12.2025
2	C107	2m / 2.4mm coaxial cable	SF101	Huber & Suhner	3054/1	-/-	ev	-/-	-/-
3	R001	Signal & Spectrum Analyzer	FSW50	Rohde & Schwarz	101560	300006179	k	27.12.2024	31.12.2025
4	U023	Attenuator 10 dB, k	40A-10dB	Inmet	-/-	-/-	ev	-/-	-/-
5	U311	Attenuator 10 dB / 100W, N	WA91-10-34	Weinschel Associates	A514	300004824	ev	-/-	-/-
6	U313	Attenuator 10 dB / 5W, N	BW-N10W5	MCL	n.a.	-/-	ev	-/-	-/-
7	U314	Attenuator 20 dB / 5W, N	BW-N20W5	MCL	n.a.	-/-	ev	-/-	-/-
8	U315	Attenuator 20 dB / 300W, N	WA36-20-34	Weinschel Associates	A1703	300004267	ev	-/-	-/-
9	R011	Dual-channel power meter	438A	HP	2730U00683	300000852	vIKI!	05.12.2024	31.12.2026
10	R008	Power Sensor	8485A	HP	2238A00798	300000511	vIKI!	10.12.2024	31.12.2026
11		Climatic chamber	CW-60/5	CTS GmbH	094007	300003877	k	12.07.2024	31.07.2026

7.4 AC conducted



$$FS = UR + CF + VC$$

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:

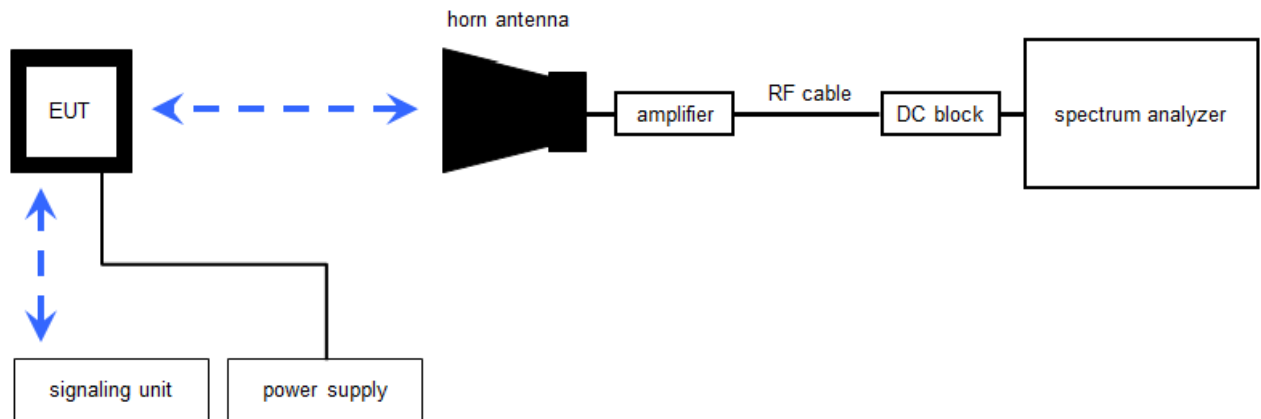
$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m)$$

Equipment table:

No.	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	EMI Test Receiver	EMI Test Receiver ESR3	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102981	300006318	cal	03.12.2024	31.12.2025
2	Analyzer-Impedance-System	Analyzer-Impedance-System AIS16/1	MEC Import: Spitzenberger + Spies GmbH & Co. KG	U02076 07/0 1023	400001751	cal	19.10.2023	31.10.2025
3	Two-Line V-Network (LISN)	Two-Line V-Network (LISN) ESH3-Z5	Rohde & Schwarz Messgerätebau GmbH / Memmingen	892475/017	300002209	cal	12.12.2023	31.12.2025
4	Hochpass 150 kHz	Hochpass 150 kHz EZ-25	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100010	300003798	cpu	-/-	-/-

7.5 Radiated measurements > 18 GHz

Radiated measurements > 18 GHz



Measurement distance: horn antenna e.g. 50 cm

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance;
G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:

$$OP \text{ [dBm]} = -59.0 \text{ [dBm]} + 44.0 \text{ [dB]} - 20.0 \text{ [dBi]} + 5.0 \text{ [dB]} = -30 \text{ [dBm]} (1 \mu\text{W})$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	C107	2m / 2.4mm coaxial cable	SF101	Huber & Suhner	3054/1	-/-	ev	-/-	-/-
2	R001	Signal & Spectrum Analyzer	FSW50	Rohde & Schwarz	101560	300006179	k	27.12.2024	31.12.2025
3	U311	Attenuator 10 dB / 100W, N	WA91-10-34	Weinschel Associates	A514	300004824	ev	-/-	-/-
4	U314	Attenuator 20 dB / 5W, N	BW-N20W5	MCL	n.a.	-/-	ev	-/-	-/-
5	A019	Std. Gain Horn Antenna 17.6-26.7 GHz	2024-20	Flann	156	300001968	ev	-/-	-/-
6	A021	Std. Gain Horn Antenna 26.4-40.1 GHz	2224-20	Flann	233	300001973	ev	-/-	-/-

7.6 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*Note: The sequence will be repeated three times with different EUT orientations.

7.7 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

7.8 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

7.9 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

7.10 EUT set-up

See photo documentation for details.

7.11 Test environment

The environment conditions are documented with each test (see annex(e) with measurement results).

7.12 Measurement uncertainties

The measurement and test setup is in accordance to the specification and schematically shown in 7.1. The reference to each test is shown in annex(e) with measurement results.

Measurement uncertainties: Potential error sources/effects in that setup:

- mismatch HF Cable - RF Input of Analyzer
- mismatch Waveguide Adaptor - HF Cable
- mismatch Waveguide Adaptor - Directional Coupler
- mismatch Pedestal Flange - Directional Coupler
- Spectrum Analyzer frequency response
- Spectrum Analyzer IF gain uncertainty
- HF-Cable frequency response calibration uncertainty
- HF-Cable frequency response data conversion uncertainty
- Directional Coupler frequency response calibration uncertainty
- Directional Coupler frequency response data conversion uncertainty
- Attenuator frequency response calibration uncertainty
- Attenuator frequency response data conversion uncertainty

The total uncertainty for above listed factors with a 95% confidence level (acc. UKAS, ETSI) is $\leq \pm 1.5\text{dB}$.

8 Measurement results

8.1 Summary

The present test report:

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	Verdict	Date	Remark
RF-Testing	CFR 47 Part 80	PASS	2026-04-14	-/-

Test Specification Clause	Test Case	C	NC	N/A	N/P	Results
§2.1046 / §80.215	Measurements required: RF power output / Transmitter power.	X				pk: 51.0 dBm avg: 34.8 dBm
§2.1047 / §80.213	Measurements required: Modulation characteristics / Modulation requirements	X				complies
§2.1049	Measurements required: Occupied bandwidth	X				max 44.1 MHz
§2.1051 / §80.211	Measurements required: Spurious emissions at antenna terminals / Emission limitations (conducted emissions)	X				complies
§2.1053 / §80.211	Measurements required: Field strength of spurious radiation / Emission limitations (radiated emissions)	X				complies
§2.1055 / §80.209	Measurements required: Frequency stability / Transmitter frequency tolerances	X				+1.47 ppm -0.58 ppm
§15B	Unintentional Radiators	X				complies

Note: C = compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

8.2 Transmitter characteristics / output power

Description / Limit:

§ 80.215

(a) Transmitter power shown on the radio station authorization is the maximum power the licensee is authorized to use. Power is expressed in the following terms:

(3) For PON and F3N emission: Mean power.

Limit: no limitations

Test setup: no. 7.3

Measurement results:

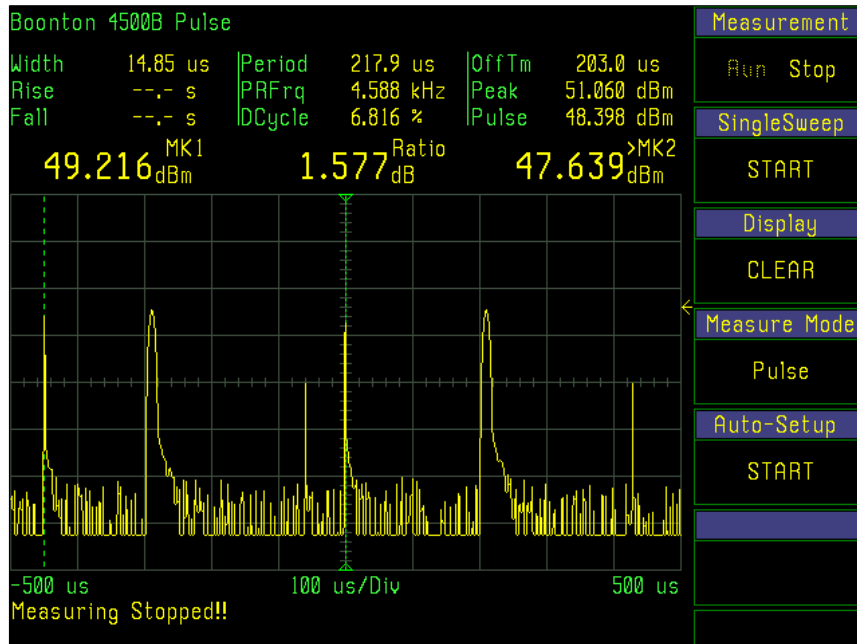
Mode	P _{out peak} [dBm]	P _{out mean} [dBm]		
	CH3	CH0	CH3	CH7
12 NM	51.0	34.8	32.4	33.6
24 NM	50.6	33.2	31.3	32.4
48 NM	50.6	34.3	32.3	34.2

Note:

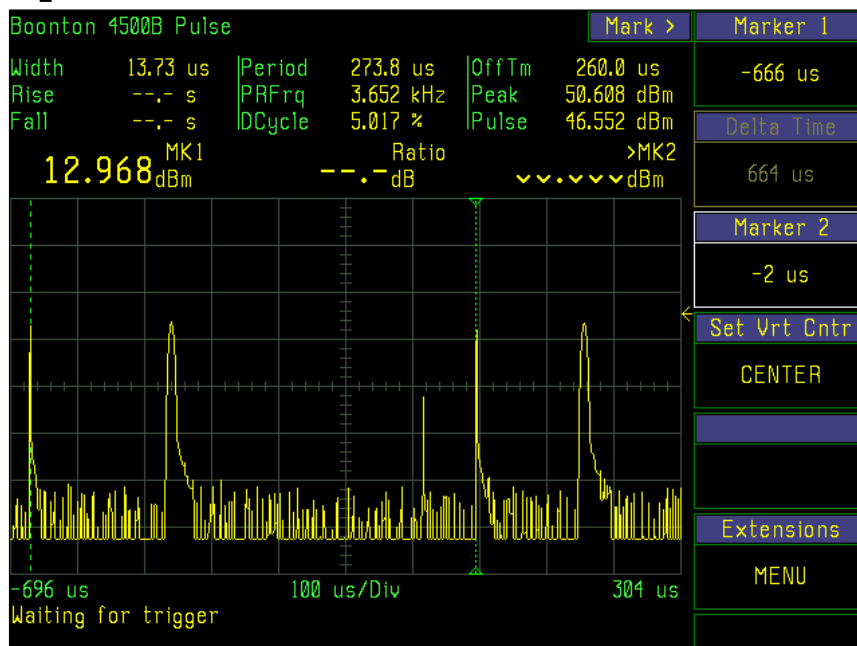
P_{out peak} is measured with peak power analyzer.

P_{out mean} is measured with thermal power sensor.

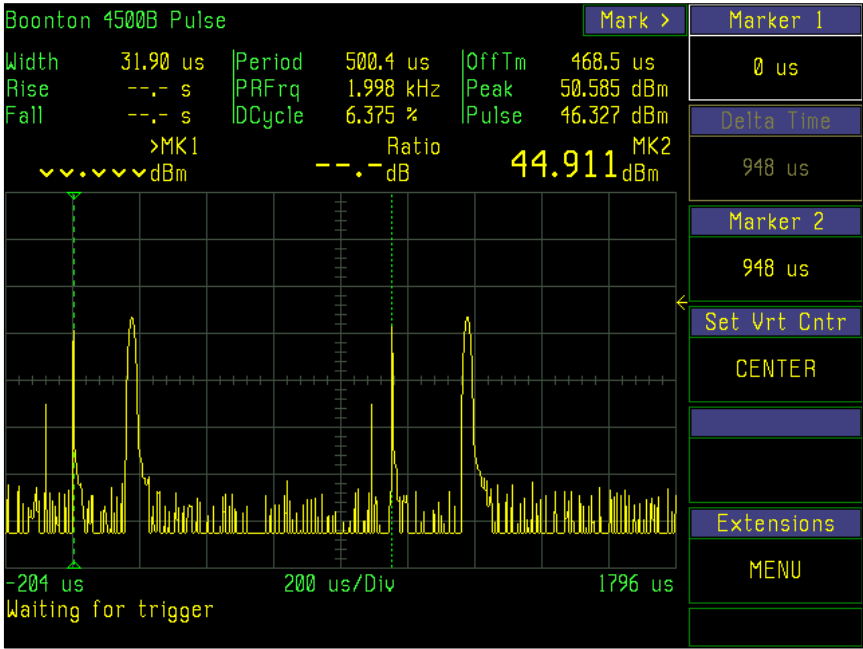
PP_12NM



PP_24NM



PP48_NM



8.3 Modulation requirements

Description / Limit:

§ 80.213

(a) Transmitters must meet the following modulation requirements:

(g) Radar stations operating in the bands above 2.4 GHz may use any type of modulation consistent with the bandwidth requirements in § 80.209(b).

§ 80.209

(b) When pulse modulation is used in land and ship radar stations operating in the bands above 2.4 GHz the frequency at which maximum emission occurs must be within the authorized bandwidth and must not be closer than $1.5/T$ MHz to the upper and lower limits of the authorized bandwidth where "T" is the pulse duration in microseconds.

Test setup: no. 7.3

Measurement results:

see section 8.8 Transmitter frequency tolerance

8.4 Occupied bandwidth

Description / Limit:

§ 2.1049

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

Limit: no limitations

Test setup: no. 7.3

Measurement results:

Mode	occupied bandwidth [MHz]		
	CH0	CH3	CH7
12 NM	43.8	44.1	43.8
24 NM	43.9	44.1	43.7
48 NM	43.4	44.0	43.3

Note:

see also Annex A201 section 2, plots 4 – 12

8.5 Emission limits (RF spectrum mask)

Description / Limit:

§ 80.212

The emissions must be attenuated according to the following schedule:

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

- (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
- (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

Test setup: no. 7.3

Measurement results:

see also Annex A201 section 2, plots 13 – 21

8.6 Emissions limits (conducted emissions)

Description / Limit:

§ 80.212

The emissions must be attenuated according to the following schedule:

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

Test setup: no. 7.3

Measurement results:

Conducted Spurious Emissions [dBm]								
CH0			CH3			CH7		
F [GHz]	Detector	Level [dBm]	F [GHz]	Detector	Level [dBm]	F [GHz]	Detector	Level [dBm]
2.99	RMS	-15.1 Limit: -5	3.05	RMS	-14.6 Limit: -5	3.11	RMS	-2.46 Limit: 6.5
5.82	RMS	-31.7	6.00	RMS	-28.8	6.17	RMS	-30.4
8.85	RMS	-29.8						
Measurement uncertainty			± 1.5 dB					

n.f. = nothing found

Note:

see also Annex A201 section 2, plots 22 – 39

8.7 Emissions limits (radiated emissions)

Description / Limit:

§ 80.212

The emissions must be attenuated according to the following schedule:

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

Test setup: no. 7.1, 7.2, 7.5

Measurement results:

Radiated Spurious Emissions [dBm]		
F [GHz]	Detector	Level [dBm]
Low channel		
5.900	RMS	-38.0
8.848	RMS	-40.6
11.795	RMS	-55.1
Mid channel		
6.019	RMS	-34.8
9.028	RMS	-50.1
12.038	RMS	-56.2
High channel		
5.201	RMS	-45.6
6.177	RMS	-27.3
9.268	RMS	-45.4
12.353	RMS	-52.44
Measurement uncertainty		
		± 3 dB

n.f. = nothing found

Note:

see also Annex A201, section 2, plots 40 – 41

see also Annex A201, section 3, plots 1, 2 – 5

8.8 Transmitter frequency tolerance

Description / Limit:

§ 80.209

(b) When pulse modulation is used in land and ship radar stations operating in the bands above 2.4 GHz the frequency at which maximum emission occurs must be within the authorized bandwidth and must not be closer than $1.5/T$ MHz to the upper and lower limits of the authorized bandwidth where "T" is the pulse duration in microseconds.

T_{pulse}	$1.5/T$	DUT CH0	DUT CH7
~74 ns	13.5 MHz	2.930 GHz (lower band edge + 30 MHz)	3.070 GHz (upper band edge - 30 MHz)

Test setup: no. 7.3

Measurement results:

Temperature	Voltage	Reference Frequency	Measured Frequency	Deviation [MHz]	Deviation [ppm]
-30	V nom	2.929984000	2.929987697	3.70	1.262
-20	V nom	2.929984000	2.929986177	2.18	0.743
-10	V nom	2.929984000	2.929984149	0.15	0.051
0	V nom	2.929984000	2.929983264	-0.74	-0.251
10	V nom	2.929984000	2.929983053	-0.95	-0.323
20	V min	2.929984000	2.929983416	-0.58	-0.199
20	V nom	2.929984000	2.929982944	-1.06	-0.360
20	V max	2.929984000	2.929982307	-1.69	-0.578
30	V nom	2.929984000	2.929983773	-0.23	-0.077
40	V nom	2.929984000	2.929982807	-1.19	-0.407
50	V nom	2.929984000	2.929983426	-0.57	-0.196
55	V nom	2.929984000	2.929982897	-1.10	-0.376

Temperature	Voltage	Reference Frequency	Measured Frequency	Deviation [MHz]	Deviation [ppm]
-30	V nom	3.009982450	3.009986609	4.16	1.382
-20	V nom	3.009982450	3.009985943	3.49	1.160
-10	V nom	3.009982450	3.009983773	1.32	0.440
0	V nom	3.009982450	3.009982798	0.35	0.116
10	V nom	3.009982450	3.009982825	0.37	0.125
20	V min	3.009982450	3.009982373	-0.08	-0.025
20	V nom	3.009982450	3.009982385	-0.07	-0.022
20	V max	3.009982450	3.009982768	0.32	0.106
30	V nom	3.009982450	3.009982443	-0.01	-0.002
40	V nom	3.009982450	3.009983479	1.03	0.342
50	V nom	3.009982450	3.009982707	0.26	0.085
55	V nom	3.009982450	3.009982419	-0.03	-0.010

Temperature	Voltage	Reference Frequency	Measured Frequency	Deviation [MHz]	Deviation [ppm]
-30	V nom	3.069982200	3.069986713	4.51	1.470
-20	V nom	3.069982200	3.069984098	1.90	0.618
-10	V nom	3.069982200	3.069982911	0.71	0.232
0	V nom	3.069982200	3.069982153	-0.05	-0.015
10	V nom	3.069982200	3.069982265	0.07	0.021
20	V min	3.069982200	3.069982057	-0.14	-0.047
20	V nom	3.069982200	3.069982518	0.32	0.104
20	V max	3.069982200	3.069982685	0.48	0.158
30	V nom	3.069982200	3.069982936	0.74	0.240
40	V nom	3.069982200	3.069982998	0.80	0.260
50	V nom	3.069982200	3.069982629	0.43	0.140
55	V nom	3.069982200	3.069981997	-0.20	-0.066

8.9 AC Power Line Conducted Emission Limits

Description / Limit:

§15.107 (§15.207)

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of emission [MHz]	Conducted limit [dB μ V]	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

*Decreases with the logarithm of the frequency.

Test setup: 7.4

Measurement results:

AC conducted emissions < 30 MHz [dB μ V/m]		
Frequency [MHz]	Detector	Level [dB μ V/m]
All detected peak values are below the average limits.		
Measurement uncertainty	± 3 dB	

Note:

see also Annex A201, section 4, plots 1 – 2

8.10 Radiated emission limits (receiver spurious)

Description / Limit:

§15.109 (§15.209)

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission [MHz]	Field strength [microvolts/meter]	Field strength [dBμV/meter]	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)		300
0.490 – 1.705	24000/F(kHz)		30
1.705 – 30	30	29.5	30
30 – 88	100	40.0	3
88 – 216	150	43.5	3
216 – 960	200	46.0	3
above 960	500	54.0	3

Test setup: 7.1, 7.2

Measurement results:

Spurious Emissions Radiated [dBμV/m]		
Frequency [GHz]	Detector	Level [dBμV/m]
All detected peak values are below the average limits.		
Measurement uncertainty	± 3 dB	

Note:

see test report 1-0696-25-01-06_TR1-R01

see also Annex A201, section 3, plots 2

Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
GNSS	Global Navigation Satellite System
C/N₀	Carrier to noise-density ratio, expressed in dB-Hz

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release - DRAFT	2025-10-12
	Initial release	2026-04-14

END OF TEST REPORT