



TEST REPORT

Test report no.: 1-8481-24-01-14_TR1-R02



Deutsche
Akkreditierungsstelle
D-PL-12047-01-00

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.

ISED Testing Laboratory Recognized Listing Number: DE0001

FCC designation number: DE0002

Applicant

FLIR Systems AB

Antennvägen 6

187 66 Täby / SWEDEN

Phone: +46 87 53 25 00

Contact: Jacob Waernlund

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Manufacturer

FLIR Systems AB

Antennvägen 6

187 66 Täby / SWEDEN

Test standard/s

FCC - Title 47 CFR Part 15 FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: Infrared Camera
Model name: FLIR-I1845
FCC ID: ZLV-FLIRI1845
ISED certification number: 5306A-FLIRI1845
Frequency: 2400 MHz to 2483.5 MHz
Technology tested: Bluetooth® + EDR
Antenna: Integrated antenna
Power supply: 3.65 V DC by rechargeable battery
Temperature range: -15°C to +45°C

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.

Test report authorized:

On behalf of

Michael Dorongovski
Lab Manager
Radio Labs

Test performed:

On behalf of

Andreas Curette
Lab Manager
Radio Labs

1 Table of contents

1	Table of contents.....	2
2	General information.....	3
2.1	Notes and disclaimer	3
2.2	Application details	3
2.3	Test laboratories sub-contracted	3
3	Test standard/s, references and accreditations	4
4	Reporting statements of conformity – decision rule	5
5	Test environment	6
6	Test item	6
6.1	General description	6
6.2	Additional information	6
7	Sequence of testing.....	7
7.1	Sequence of testing radiated spurious 9 kHz to 30 MHz	7
7.2	Sequence of testing radiated spurious 30 MHz to 1 GHz	8
7.3	Sequence of testing radiated spurious 1 GHz to 18 GHz	9
7.4	Sequence of testing radiated spurious above 18 GHz.....	10
8	Description of the test setup.....	11
8.1	Shielded semi anechoic chamber	12
8.2	Shielded fully anechoic chamber.....	13
8.3	Radiated measurements > 18 GHz	14
8.4	Conducted measurements Bluetooth system	15
8.5	AC conducted.....	16
9	Measurement uncertainty	17
10	Summary of measurement results	18
11	Additional comments	19
12	Measurement results	20
12.1	Antenna gain	20
12.2	Carrier frequency separation	21
12.3	Number of hopping channels	22
12.4	Time of occupancy (dwell time)	23
12.5	Spectrum bandwidth of a FHSS system	24
12.6	Maximum output power	25
12.7	Band edge compliance radiated.....	26
12.8	Spurious emissions conducted	30
12.9	Spurious emissions radiated below 30 MHz	31
12.10	Spurious emissions radiated 30 MHz to 1 GHz	34
12.11	Spurious emissions radiated above 1 GHz	36
12.12	Spurious emissions conducted below 30 MHz (AC conducted).....	39
13	Observations.....	41
14	Glossary.....	42
15	Document history	43

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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This test report replaces the test report with the number 1-8481-24-01-14_TR1-R01 and dated 2025-08-07.

2.2 Application details

Date of receipt of order: 2025-07-08

Date of receipt of test item: 2025-07-08

Start of test:* 2025-07-15

End of test:* 2025-07-28

Person(s) present during the test: Mr. Jacob Waernlund, Mr. Jonnie Larsson

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

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 3	August 2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS - Gen Issue 5 incl. Amendment 1 & 2	February 2021	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
KDB 558074 D01	v05r02	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES
ANSI C63.4a-2017	-/-	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

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, see chapter 9, 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_{max} T_{min}	20 °C during room temperature tests No tests under extreme temperature conditions required. No tests under extreme temperature conditions required.
Relative humidity content	:		59 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	3.65 V DC by rechargeable battery No tests under extreme voltage conditions required. No tests under extreme voltage conditions required.

6 Test item

6.1 General description

Kind of test item	:	Infrared Camera
Model name	:	FLIR-I1845
HMN	:	-/-
PMN	:	FLIR i34, FLIR i35, FLIR i64, FLIR i65
HVIN	:	FLIR-i1845
FVIN	:	ace_14 ace_14_wlan_only
S/N serial number	:	Rad.: Prototype 3:3; Cond.: Prototype 3:6
Hardware status	:	T300960-A
Software status	:	14-0.5.0-167
Firmware status	:	WLAN.TFH.3.6-00157-QCATFSWPZ-2
Frequency band	:	2400 MHz to 2483.5 MHz
Type of radio transmission	:	FHSS
Use of frequency spectrum	:	
Type of modulation	:	GFSK, Pi/4 DQPSK, 8 DPSK
Number of channels	:	79
Antenna	:	Integrated antenna
Power supply	:	3.65 V DC by rechargeable battery
Temperature range	:	-15°C to +45°C

6.2 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:

1-8481-24-01-01_TR1-A101-R01
 1-8481-24-01-01_TR1-A102-R02
 1-8481-24-01-01_TR1-A104-R01

7 Sequence of testing

7.1 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.

7.2 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.

7.3 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.

7.4 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.

8 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).

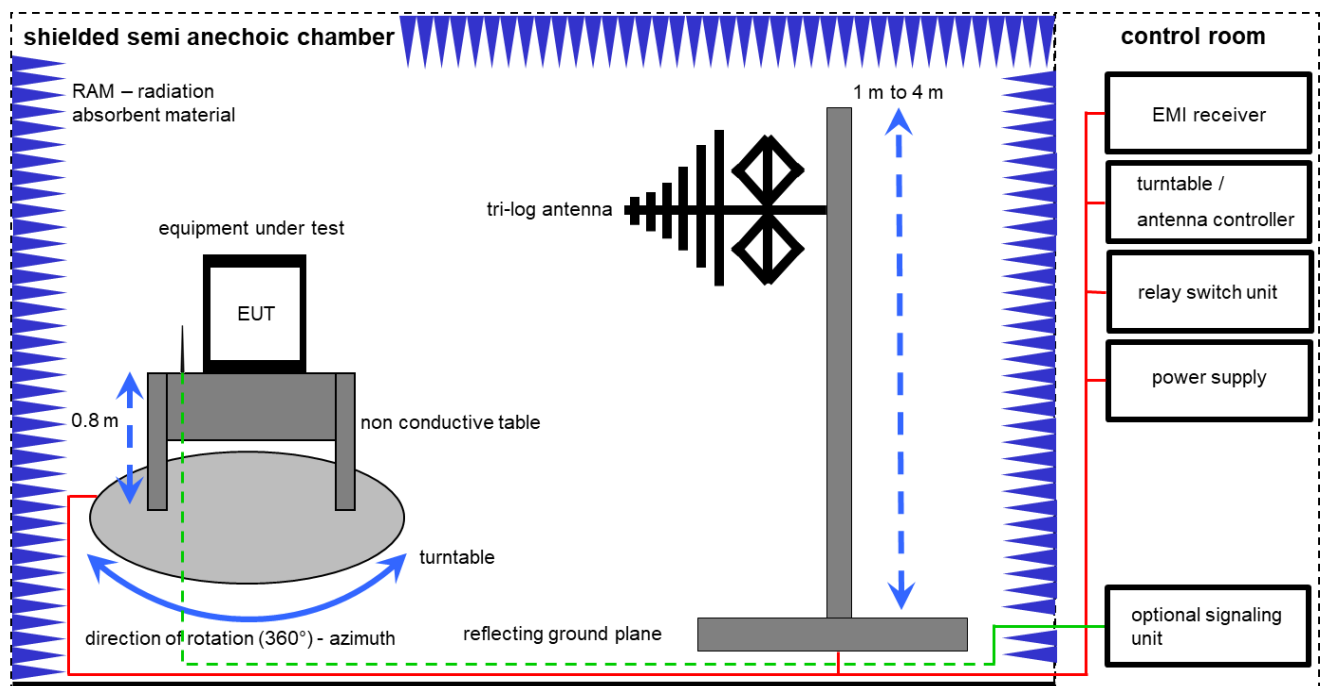
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

k/cal	calibration / calibrated	EK	limited calibration
Ne/cnn	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
Ev/chk	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
cpu	check prior usage		

8.1 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: 10.59.00

$$FS = UR + CL + AF$$

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

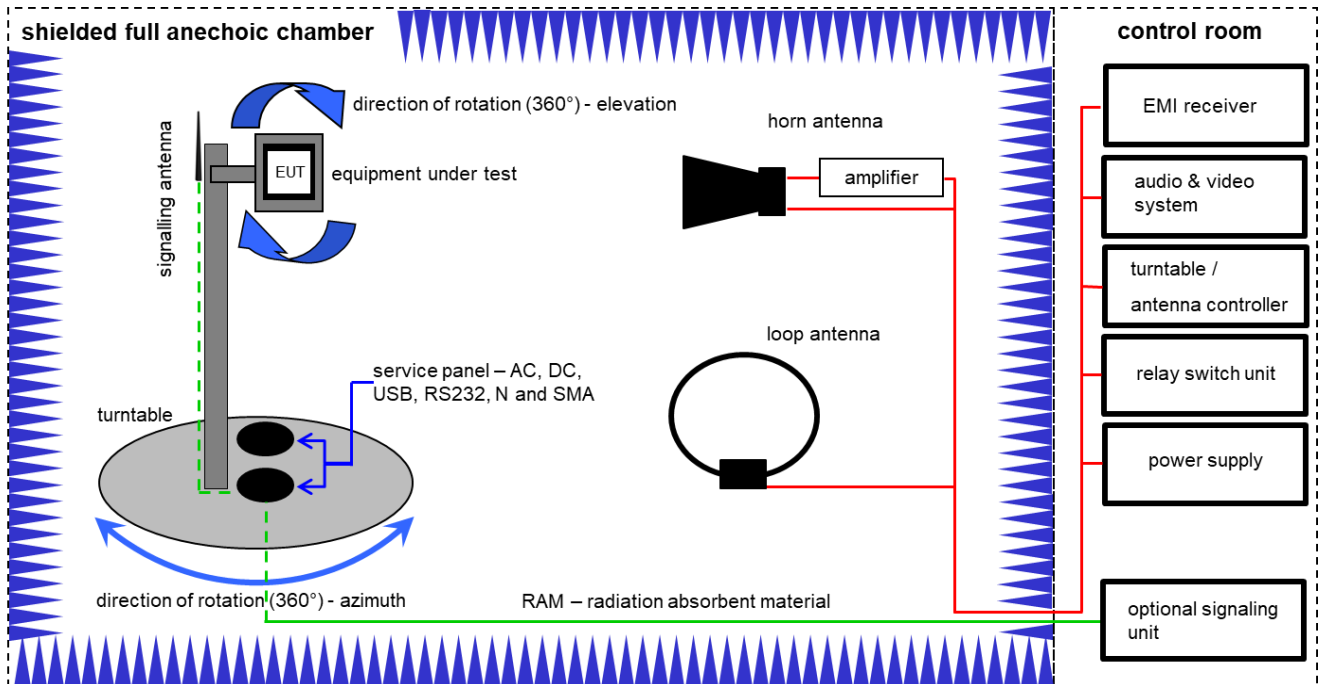
Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] \text{ (35.69 } \mu V/m) @ \text{ distance}$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Semi anechoic chamber	Semi anechoic chamber 3000023	MEC Import: MWB AG		40797	cnn	-/-	-/-
2	A	Turntable	Turntable 2089-4.0	EMCO Elektronik GmbH / Gilching		40799	cnn	-/-	-/-
3	A	Switch-Unit	Switch-Unit 3488A	Hewlett Packard	2719A14505	50160	cpu	-/-	-/-
4	A	Antenna Tower	Antenna Tower 2175	ETS-Lindgren GmbH / Taufkirchen	64762	50279	cnn	-/-	-/-
5	A	Positioning Controller	Positioning Controller 2090	ETS-Lindgren GmbH / Taufkirchen	64672	50280	cnn	-/-	-/-
6	A	TRILOG Broadband Antenna	TRILOG Broadband Antenna VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönaun	1029	50403	cal	25.09.2023	30.09.2025
7	A	EMI Test Receiver	EMI Test Receiver ESR3	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102587	50417	cal	05.12.2024	05.12.2025

8.2 Shielded fully anechoic chamber



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

FS = UR + CA + AF

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

Example calculation:

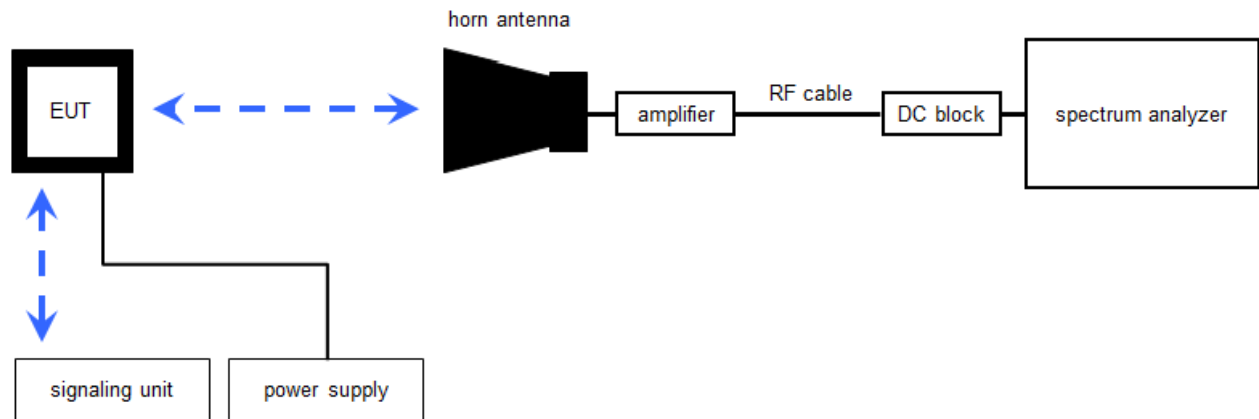
FS [dBμV/m] = 40.0 [dBμV] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBμV/m] (71.61 μV/m) @ distance

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A,B,C	EMI Test Receiver	EMI Test Receiver ESR26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101376	40301	cal	06.12.2024	06.12.2025
2	A,B	Double-Ridged Waveguide Horn Antenna	Double-Ridged Waveguide Horn Antenna 3115	EMCO Elektronik GmbH / Gilching	8812-3089	40344	cal	09.07.2024	09.07.2026
3	A	Highpass Filter	Highpass Filter WHKX7.0/18G-8SS	Wainwright Instruments GmbH / Andechs	18	40364	cpu	-/-	-/-
4	A	Band Reject Filter	Band Reject Filter WRCG2400/2483-2375/2505-50/10SS	Wainwright Instruments GmbH / Andechs	26	40367	cpu	-/-	-/-
5	A,B	Broadband Amplifier 0.5-18 GHz	Broadband Amplifier 0.5-18 GHz CBLU5184540	MEC Import: CERNEX	22050	40374	cpu	-/-	-/-
6	A,B,C	4U RF Switch Platform	4U RF Switch Platform L4491A	Agilent Technologies Deutschland GmbH / Böblingen	MY50000032	40376	cnn	-/-	-/-
7	A,B,C	NEXIO EMV-Software	NEXIO EMV-Software BAT EMC V2022.0.32.0	MEC Import: Nexio		40383	cnn	-/-	-/-
8	A,B,C	Anechoic chamber	Anechoic chamber	MEC Import: TDK		40385	cnn	-/-	-/-
9	C	Active Loop Antenna	Active Loop Antenna 6502	EMCO Elektronik GmbH / Gilching	2210	50044	cal	07.07.2025	07.07.2027

8.3 Radiated measurements > 18 GHz

Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

FS = UR + CA + AF

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

Example calculation:

FS [dBμV/m] = 40.0 [dBμV] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBμV/m] (6.79 μV/m) @ distance

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal analyzer	Signal analyzer FSV30	Rohde & Schwarz Messgerätebau GmbH / Memmingen	1321.3008K30/103170	18373	cal	15.01.2025	15.01.2027
2	A	Microwave System Amplifier, 0.5-26.5 GHz	Microwave System Amplifier, 0.5-26.5 GHz 83017A	Hewlett Packard	00419	40014	cpu	-/-	-/-
3	A	Std. Gain Horn Antenna 18.0-26.5 GHz	Std. Gain Horn Antenna 18.0-26.5 GHz 638	Narda Microwave	8205	40085	cal	24.01.2024	31.01.2026
4	A	RF-Cable	RF-Cable ST18/SMAM/SMAM /72	Huber & Suhner GmbH / Unterhaching	Batch no. 699714	40389	cpu	-/-	-/-
5	A	DC-Blocker 0.1-40 GHz	DC-Blocker 0.1-40 GHz 8141A	MEC Import: Inmet		40390	cpu	-/-	-/-

8.4 Conducted measurements Bluetooth system



OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

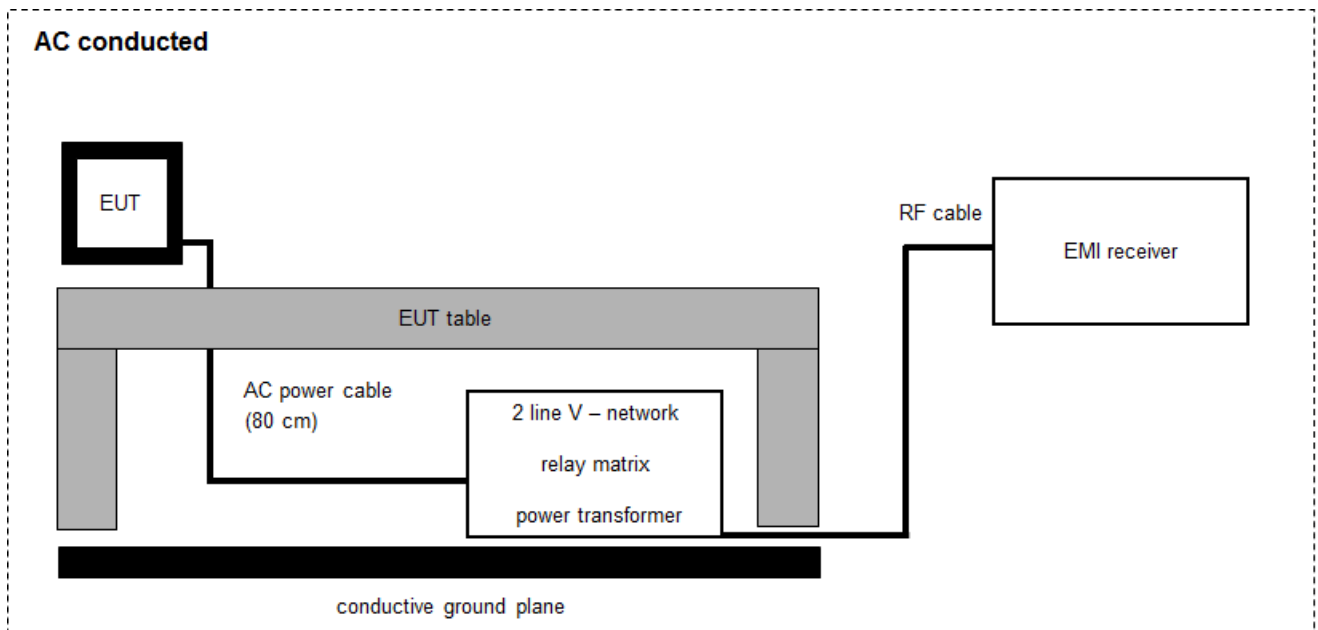
Example calculation:

OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal analyzer	Signal analyzer FSV30	Rohde & Schwarz Messgerätebau GmbH / Memmingen	1321.3008K30/103170	18373	cal	15.01.2025	15.01.2027
2	A	Wideband Radio Communication Tester	Wideband Radio Communication Tester CMW270	Rohde & Schwarz Messgerätebau GmbH / Memmingen	1201.0002k75/102550	40329	cal	06.12.2023	31.12.2025
3	A	Switch Matrix	USM Switch Matrix	cetecom advanced GmbH / Saarbrücken	A001	40338	chk	30.01.2025	31.01.2026
4	A	Tester Software RadioStar (C.BER2 for BT LE Conformance)	Tester Software RadioStar (C.BER2 for BT LE Conformance) System V 5.x, C.BER2 V 1.2.x.x	cetecom advanced GmbH / Saarbrücken	1	40407	cnn	-/-	-/-

8.5 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:

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

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	EMI Test Receiver	EMI Test Receiver ESR3	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102981	40332	cal	03.12.2024	03.12.2025
2	A	Analyzer-Impedance-System	Analyzer-Impedance-System AIS16/1	MEC Import: Spitzenberger + Spies GmbH & Co. KG	U02076 07/0 1023	40808	cal	19.10.2023	31.10.2025
3	A	Two-Line V-Network (LISN)	Two-Line V-Network (LISN) ESH3-Z5	Rohde & Schwarz Messgerätebau GmbH / Memmingen	892475/017	50005	cal	12.12.2023	31.12.2025
4	A	Power Supply	Power Supply 6032A	Hewlett Packard	2920A04466	50161	cnn	-/-	-/-
5	A	Hochpass 150 kHz	Hochpass 150 kHz EZ-25	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100010	50286	cpu	-/-	-/-

9 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Antenna gain	± 3 dB
Carrier frequency separation	± 21.5 kHz
Number of hopping channels	-/-
Time of occupancy	According BT Core specification
Spectrum bandwidth	± 21.5 kHz absolute; ± 15.0 kHz relative
Maximum output power	± 1 dB
Detailed conducted spurious emissions @ the band edge	± 1 dB
Band edge compliance radiated	± 3 dB
Spurious emissions conducted	± 3 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 4.1 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

10 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	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 Part 15 RSS - 247, Issue 3	See table!	2025-09-23	-/-

Test specification clause	Test case	Temperature & voltage conditions	Mode	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4.(f)(ii)	Antenna gain	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§15.247(a)(1) RSS - 247 / 5.1.(b)	Carrier frequency separation	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§15.247(a)(1) RSS - 247 / 5.1 (d)	Number of hopping channels	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§15.247(a)(1) (iii) RSS - 247 / 5.1 (c)	Time of occupancy (dwell time)	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
			Pi/4 DQPSK	<input checked="" type="checkbox"/>				
			8 DPSK	<input checked="" type="checkbox"/>				
§15.247(a)(1) RSS - 247 / 5.1 (a)	Spectrum bandwidth of a FHSS system bandwidth	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
			Pi/4 DQPSK	<input checked="" type="checkbox"/>				
			8 DPSK	<input checked="" type="checkbox"/>				
§15.247(b)(1) RSS - 247 / 5.4 (b)	Maximum output power	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
			Pi/4 DQPSK	<input checked="" type="checkbox"/>				
			8 DPSK	<input checked="" type="checkbox"/>				
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance radiated	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
			Pi/4 DQPSK	<input checked="" type="checkbox"/>				
			8 DPSK	<input checked="" type="checkbox"/>				
§15.247(d) RSS - 247 / 5.5	Spurious emissions conducted	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
			Pi/4 DQPSK	<input checked="" type="checkbox"/>				
			8 DPSK	<input checked="" type="checkbox"/>				
§15.209(a) RSS - Gen	Spurious emissions radiated below 30 MHz	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated 30 MHz to 1 GHz	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated above 1 GHz	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§15.107(a) §15.207	Conducted emissions below 30 MHz (AC conducted)	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed
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11 Additional comments

The Bluetooth® word mark and logos are owned by the Bluetooth SIG Inc. and any use of such marks by cetecom advanced GmbH is under license.

- Reference documents: 3-3-TR-587 982-01 Flir i1845 - Antenna characterization_A.pdf
Customer Questionnaire FLIR-i1845.docx
- Co-applicable documents: 1-8481-24-01-14_TR1-A201-R01.pdf
- Special test descriptions: None
- Configuration descriptions: TX tests: were performed with x-DH5 packets and static PRBS pattern payload.
RX/Standby tests: BT test mode enabled, scan enabled, TX Idle
- EUT selection: ☒ Only one device available
☐ Devices selected by the customer
☐ Devices selected by the laboratory (Randomly)
- Test mode: ☒ Bluetooth Test mode loop back enabled
(EUT is controlled over CBT/CMU/CMW)
☐ Special software is used.
EUT is transmitting pseudo random data by itself
- Antennas and transmit operating modes: ☒ Operating mode 1 (single antenna)
 - Equipment with 1 antenna,
 - Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,
 - Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)

12 Measurement results

12.1 Antenna gain

Limits:

FCC	ISED
6 dBi / > 6 dBi output power and power density reduction required	

Results:

T _{nom}	V _{nom}	2400 MHz to 2483.5 MHz
Gain [dBi]*) Declared by customer		1.9

NOTE: *)Peak gain for given sub-band.

Refer to document "3-3-TR-587 982-01 Flir i1845 - Antenna characterization_A.pdf"

12.2 Carrier frequency separation

Description:

Measurement of the carrier frequency separation of a hopping system. The carrier frequency separation is constant for all modulation-modes. We use GFSK-modulation to show compliance. EUT in hopping mode.

Measurement parameters	
External result file	1-8481-24-01-14_TR1-A201-R01.pdf FCC Part 15.247 Carrier Frequency Separation FHSS
Test setup	See sub clause 8.4 setup A
Measurement uncertainty	See sub clause 9

Limits:

FCC	ISED
Carrier frequency separation	
Minimum 25 kHz or two-thirds of the 20 dB bandwidth of the hopping system whichever is greater.	

Result:

Carrier frequency separation	~ 1 MHz
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12.3 Number of hopping channels

Description:

Measurement of the total number of used hopping channels. The number of hopping channels is constant for all modulation-modes. We use GFSK-modulation to show compliance. EUT in hopping mode.

Measurement parameters	
External result file	1-8481-24-01-14_TR1-A201-R01.pdf FCC Part 15.247 Number Of Hopping Channels FHSS
Test setup	See sub clause 8.4 setup A
Measurement uncertainty	See sub clause 9

Limits:

FCC	ISED
Number of hopping channels	
At least 15 non overlapping hopping channels	

Result:

Number of hopping channels	79
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12.4 Time of occupancy (dwell time)

Measurement:

For Bluetooth® devices no measurements mandatory depending on the fixed requirements according to the Bluetooth® Core Specifications!

For Bluetooth® devices:

The channel staying time of 0.4 s within a 31.6 second period in data mode is constant for Bluetooth® devices and independent from the packet type (packet length). The calculation for a 31.6 second period is as follows:

Channel staying time = time slot length * hop rate / number of hopping channels * 31.6 s

Example for a DH1 packet (with a maximum length of one time slot)

Channel staying time = $625 \mu\text{s} * 1600 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

For multi-slot packets the hopping is reduced according to the length of the packet.

Example for a DH3 packet (with a maximum length of three time slots)

Channel staying time = $3 * 625 \mu\text{s} * 1600/3 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

Example for a DH5 packet (with a maximum length of five time slots)

Channel staying time = $5 * 625 \mu\text{s} * 1600/5 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

This is according to the Bluetooth® Core Specification 5.3 (and lower) for all Bluetooth® devices and all modulations.

The following table shows the relations:

Packet Size	Pulse Width [ms] *	Max. number of transmissions per channel in 31.6 sec
DH1	0.366	640
DH3	1.622	214
DH5	2.870	128

* according Bluetooth® specification

Results:

Packet Size	Pulse Width [ms]*	Max. number of transmissions in 31.6 sec	Time of occupancy (dwell time) [Pulse width * Number of transmissions]
DH1	0.366	640	234.2 ms
DH3	1.622	214	347.1 ms
DH5	2.870	128	367.4 ms

Limits:

FCC	ISED
Time of occupancy (dwell time)	
The frequency hopping operation shall have an average time of occupancy on any frequency not exceeding 0.4 seconds within a duration in seconds equal to the number of hopping frequencies multiplied by 0.4.	

12.5 Spectrum bandwidth of a FHSS system

Description:

Measurement of the 20dB bandwidth and 99% bandwidth of the modulated signal. EUT in single channel mode.

Measurement parameters	
External result file	1-8481-24-01-14_TR1-A201-R01.pdf FCC Part 15.247 Bandwidth 99PCT
Test setup	See sub clause 8.4 setup A
Measurement uncertainty	See sub clause 9

Limits:

FCC	ISED
Spectrum bandwidth of a FHSS system	
The complete bandwidth has to be within the frequency range of the band.	

Results:

Modulation	20 dB bandwidth [kHz]		
Frequency	2402 MHz	2441 MHz	2480 MHz
GFSK	869	866	867
Pi/4 DQPSK	1278	1278	1278
8DPSK	1267	1272	1266

Results:

Modulation	99 % bandwidth [kHz]		
Frequency	2402 MHz	2441 MHz	2480 MHz
GFSK	884	886	882
Pi/4 DQPSK	1180	1180	1178
8DPSK	1183	1181	1182

12.6 Maximum output power

Description:

Measurement of the maximum output power conducted. EUT in single channel mode.

Measurement parameters	
External result file	1-8481-24-01-14_TR1-A201-R01.pdf FCC Part 15.247 Maximum Peak Conducted Output Power FHSS
Test setup	See sub clause 8.4 setup A
Measurement uncertainty	See sub clause 9

Limits:

FCC	ISED
Maximum output power	
[Conducted: 0.125 W – antenna gain max. 6 dBi] Systems using more than 75 hopping channels: Conducted: 1.0 W – antenna gain max. 6 dBi	

Results:

Modulation	Maximum output power conducted [dBm]		
Frequency	2402 MHz	2441 MHz	2480 MHz
GFSK	9.7	9.6	8.7
Pi/4 DQPSK	8.9	8.8	7.8
8 DPSK	9.2	9.2	8.2

12.7 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to single channel mode and the transmit channel is channel 00 for the lower restricted band and channel 78 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3m.

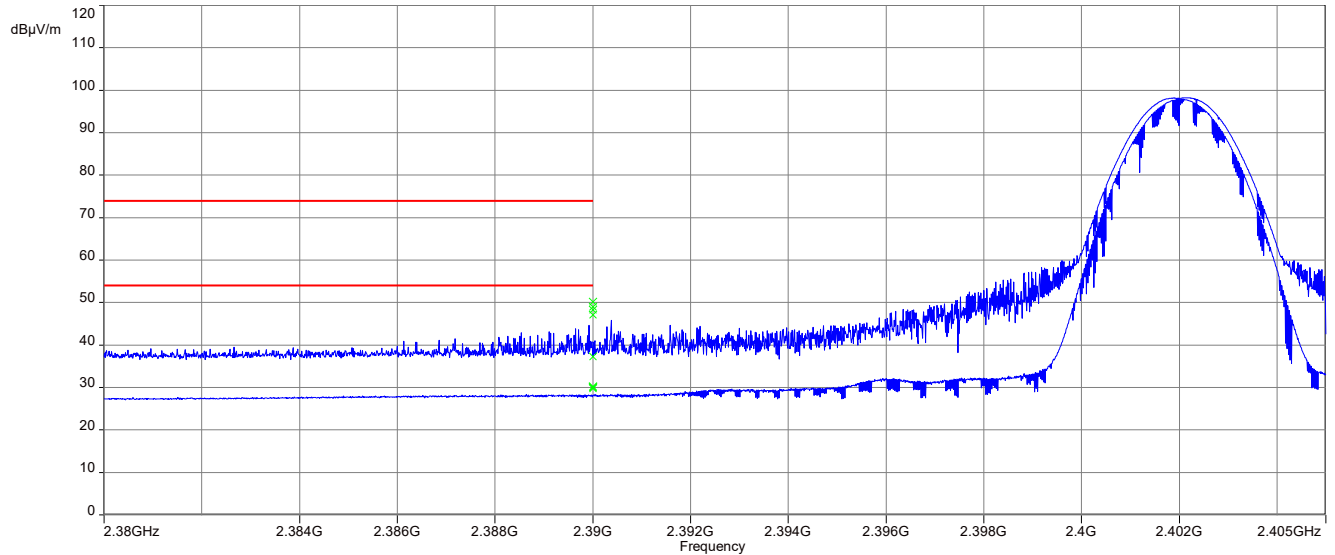
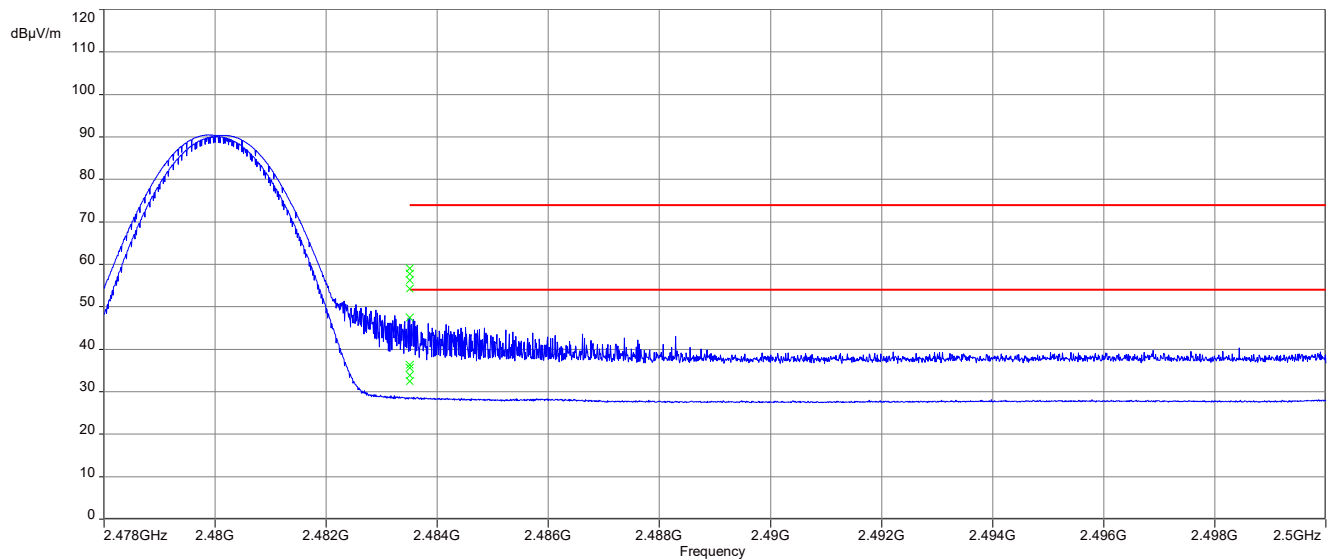
Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Span	Lower Band: 2370 – 2400 MHz Upper Band: 2480 – 2500 MHz
Trace mode	Max hold
Test setup	See sub clause 8.2 setup B
Measurement uncertainty	See sub clause 9

Limits:

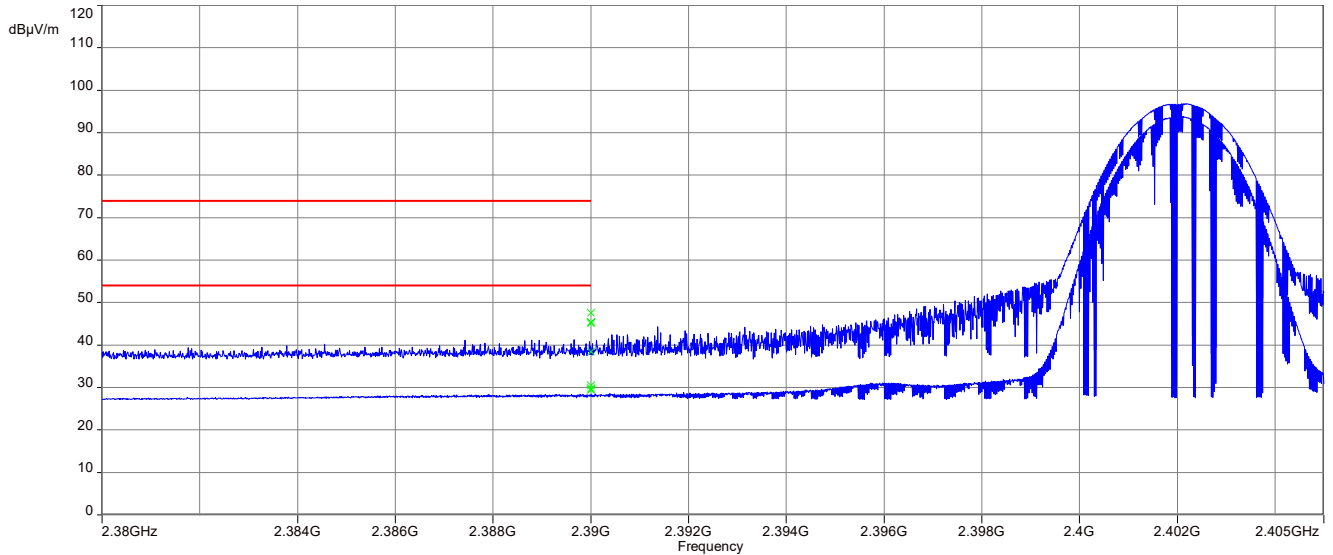
FCC	ISED
Band edge compliance radiated	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).	
54 dBµV/m AVG 74 dBµV/m Peak	

Results:

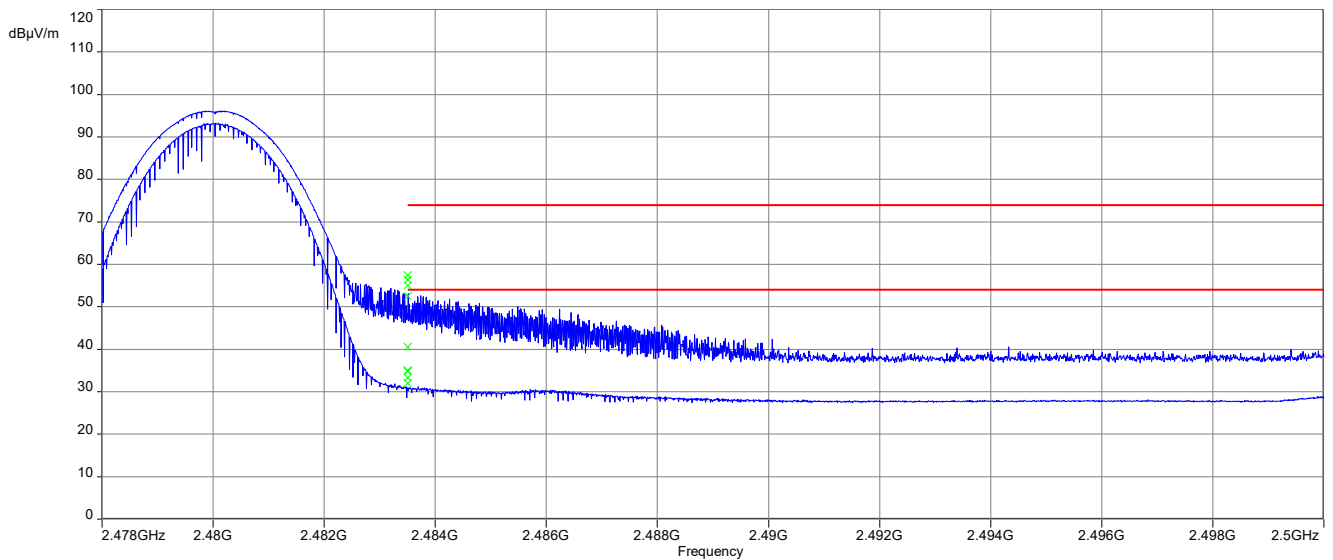
Scenario	Band edge compliance radiated [dBµV/m]		
Modulation	GFSK	Pi/4 DQPSK	8DPSK
Lower restricted band	30.2 dBµV/m AVG 50.1 dBµV/m Peak	30.5 dBµV/m AVG 47.6 dBµV/m Peak	30.7 dBµV/m AVG 50.4 dBµV/m Peak
Upper restricted band	36.4 dBµV/m AVG 59.1 dBµV/m Peak	35.1 dBµV/m AVG 57.5 dBµV/m Peak	36.2 dBµV/m AVG 58.1 dBµV/m Peak

Plots:**Plot 1:** Lower band edge, GFSK modulation, vertical & horizontal polarization**Plot 2:** Upper band edge, GFSK modulation, vertical & horizontal polarization

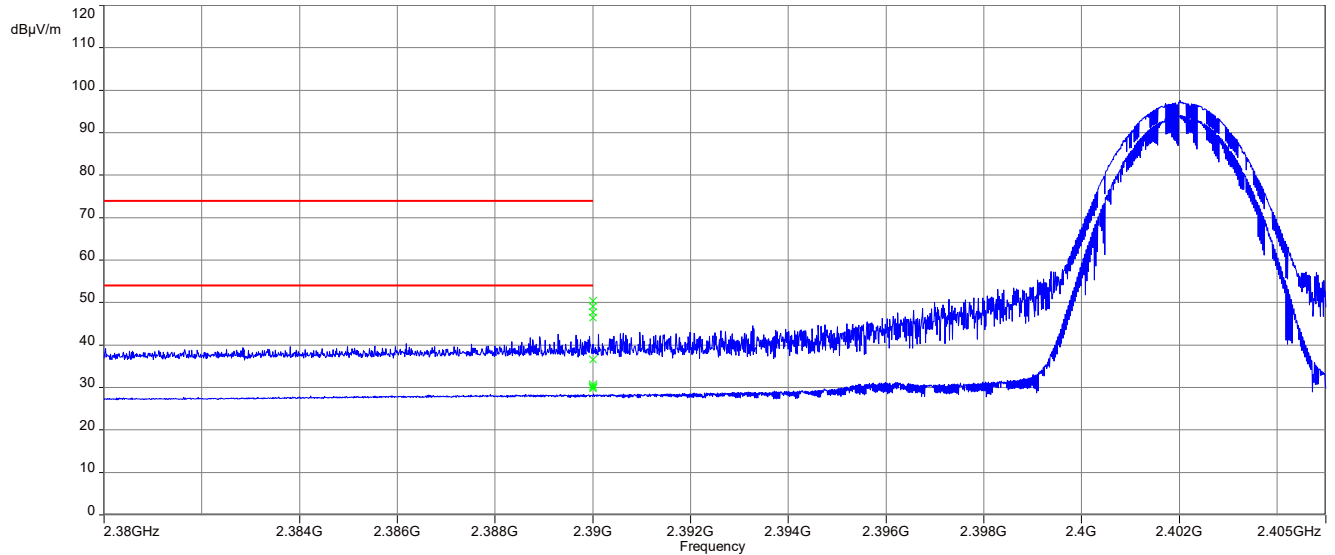
Plot 3: Lower band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization



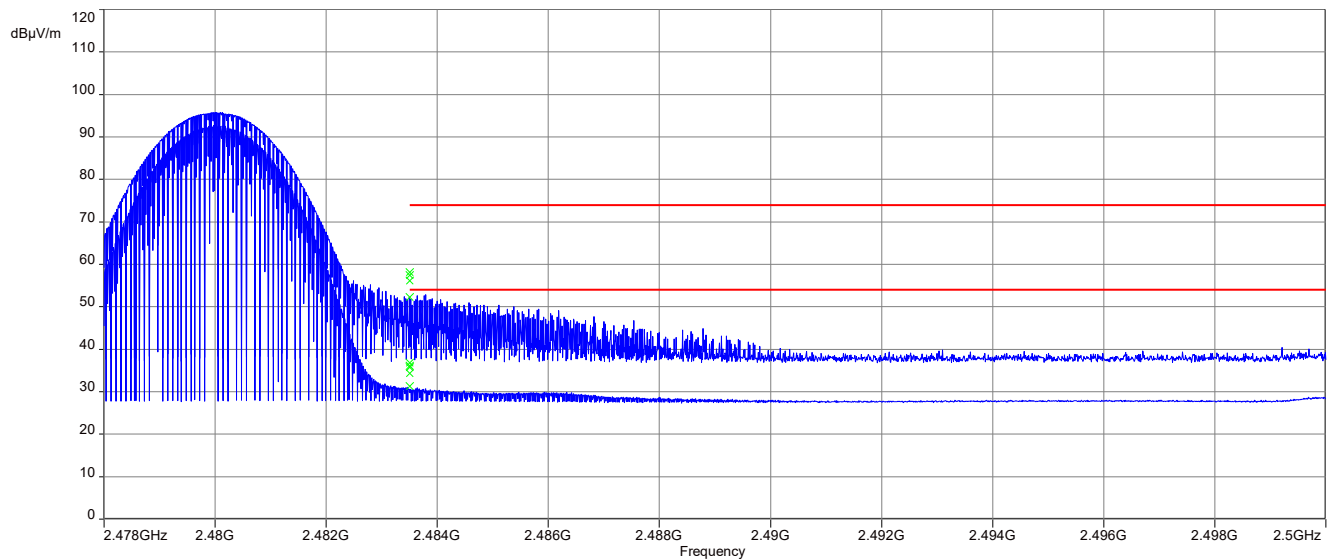
Plot 4: Upper band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization



Plot 5: Lower band edge, 8 DPSK modulation, vertical & horizontal polarization



Plot 6: Upper band edge, 8 DPSK modulation, vertical & horizontal polarization



12.8 Spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit channel is channel 00, channel 39 and channel 78. The measurement is repeated for all modulations.

Measurement parameters	
External result file	1-8481-24-01-14_TR1-A201-R01.pdf FCC Part 15.247 TX Spurious Conducted
Test setup	See sub clause 8.4 setup A
Measurement uncertainty	See sub clause 9

Limits:

FCC	ISED
TX spurious emissions conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required	

Results: Compliant (See log file)

12.9 Spurious emissions radiated below 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channels are 00; 39 and 78. The measurement is performed in the mode with the highest output power. The limits are recalculated to a measurement distance of 3 m according the ANSI C63.10.

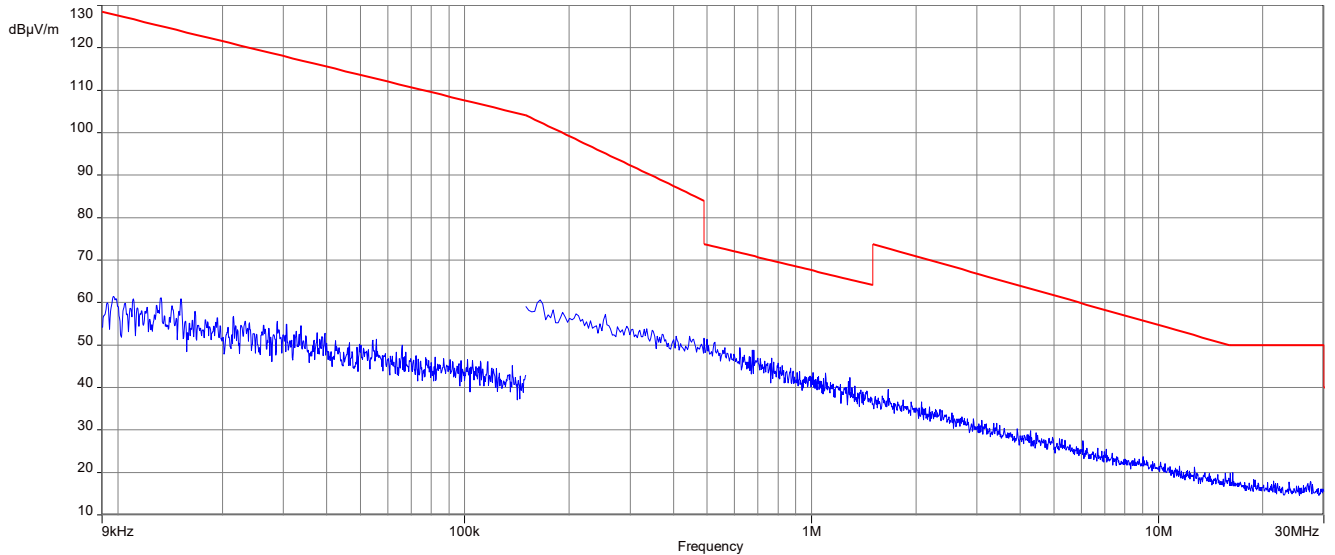
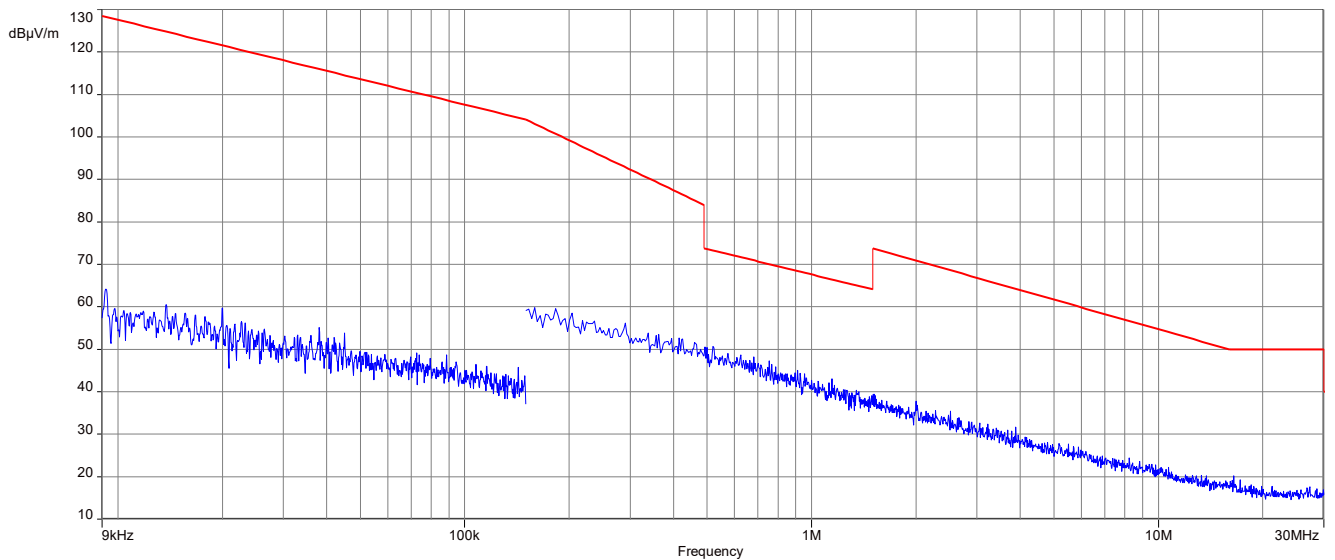
Measurement parameters	
Detector	Peak / Quasi peak
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span	9 kHz to 30 MHz
Trace mode	Max hold
Test setup	See sub clause 8.2 setup C
Measurement uncertainty	See sub clause 9

Limits:

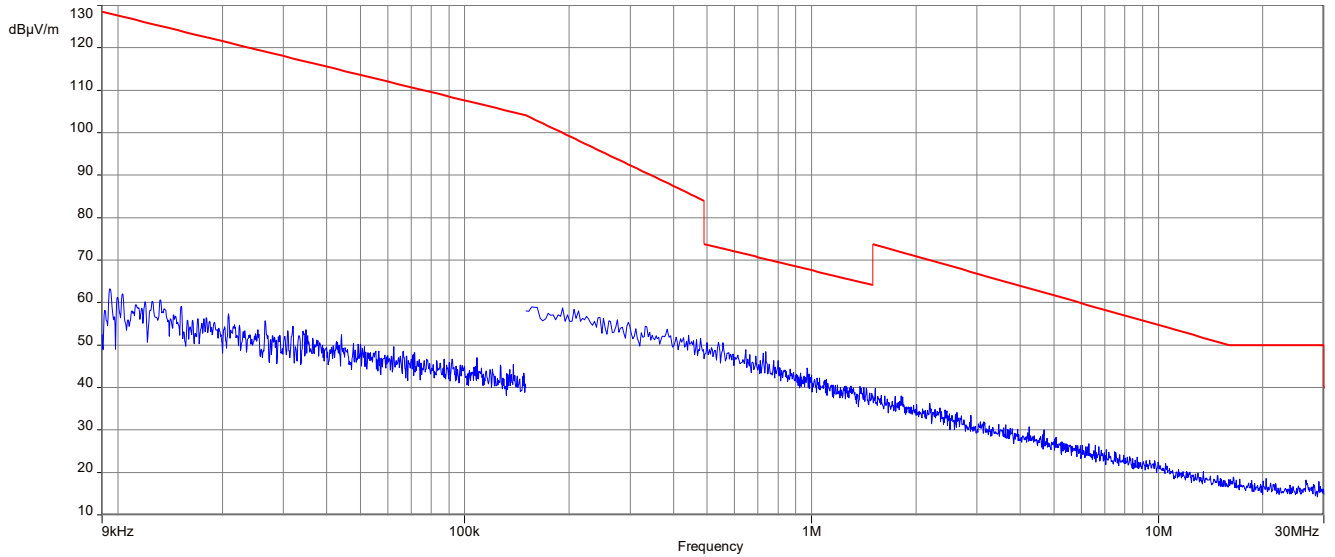
FCC		ISED
TX spurious emissions radiated below 30 MHz		
Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

TX spurious emissions radiated below 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
All detected emissions are more than 20 dB below the limit.		

Plots:**Plot 1:** 9 kHz to 30 MHz, channel 00, transmit mode**Plot 2:** 9 kHz to 30 MHz, channel 39, transmit mode

Plot 3: 9 kHz to 30 MHz, channel 78, transmit mode



12.10 Spurious emissions radiated 30 MHz to 1 GHz

Description:

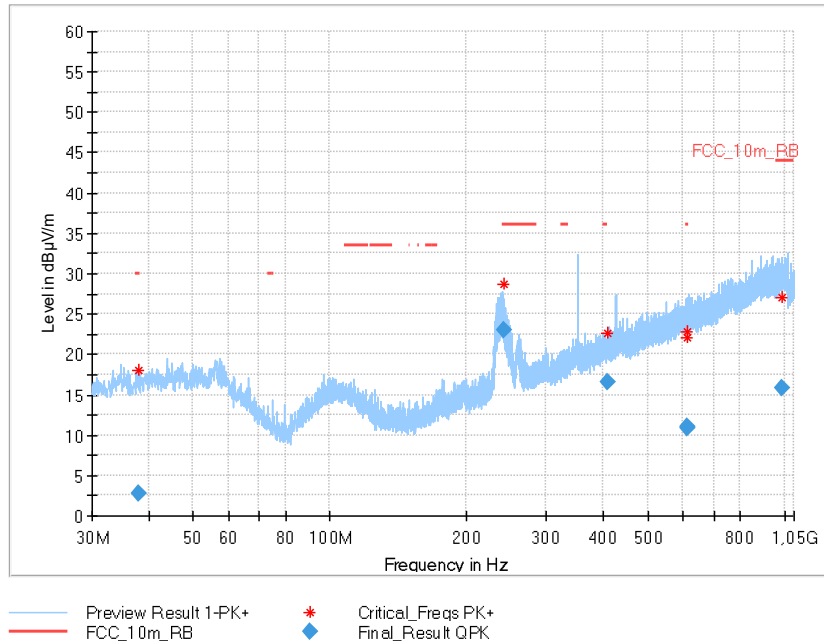
Measurement of the radiated spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit channel is channel 00, channel 39 and channel 78. The measurement is performed in the mode with the highest output power.

Measurement parameters	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	120 kHz
Video bandwidth	3 x RBW
Span	30 MHz to 1 GHz
Trace mode	Max hold
Measured modulation	<input checked="" type="checkbox"/> GFSK <input type="checkbox"/> Pi/4 DQPSK <input type="checkbox"/> 8DPSK
Test setup	See sub clause 8.1 setup A
Measurement uncertainty	See sub clause 9

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

FCC		ISED
TX spurious emissions radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
§15.209		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
30 - 88	30.0	10
88 - 216	33.5	10
216 - 960	36.0	10
Above 960	54.0	3

Plots: Transmit mode**Plot 1:** 30 MHz to 1 GHz, TX mode, vertical & horizontal polarization, valid for all channels**Final results:**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
37.877	2.76	30.0	27.2	1000	120.0	204.0	H	74	14
242.231	23.01	36.0	13.0	1000	120.0	102.0	V	101	14
408.012	16.52	36.0	19.5	1000	120.0	400.0	V	270	18
609.477	10.78	36.0	25.2	1000	120.0	144.0	V	301	22
612.573	11.13	36.0	24.9	1000	120.0	155.0	H	122	22
986.777	15.79	44.0	28.2	1000	120.0	315.0	V	51	26

12.11 Spurious emissions radiated above 1 GHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit channel is channel 00, channel 39 and channel 78. The measurement is performed in the mode with the highest output power.

Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 x RBW
Span	1 GHz to 26 GHz
Trace mode	Max hold
Measured modulation	<input checked="" type="checkbox"/> GFSK <input type="checkbox"/> Pi/4 DQPSK <input type="checkbox"/> 8DPSK
Test setup	See sub clause 8.2 setup A (1 GHz - 18 GHz) See sub clause 8.3 setup A (18 GHz - 26 GHz)
Measurement uncertainty	See sub clause 9

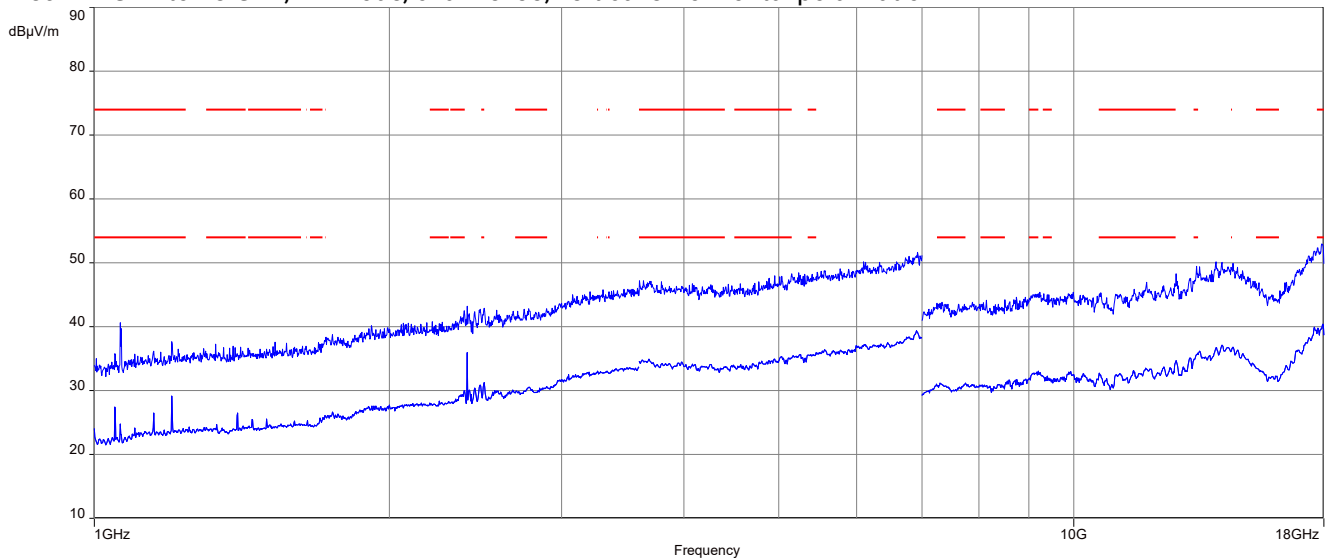
The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

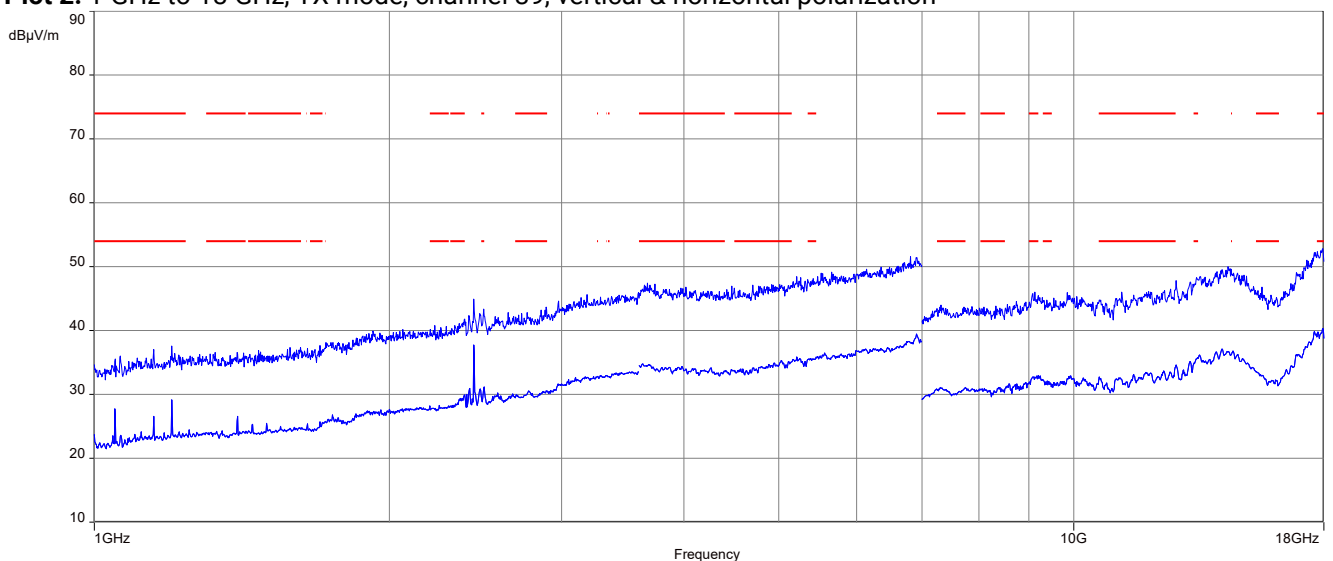
FCC		ISED	
TX spurious emissions radiated			
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).			
§15.209			
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)	
Above 960	54.0	3	

Results: Transmitter mode

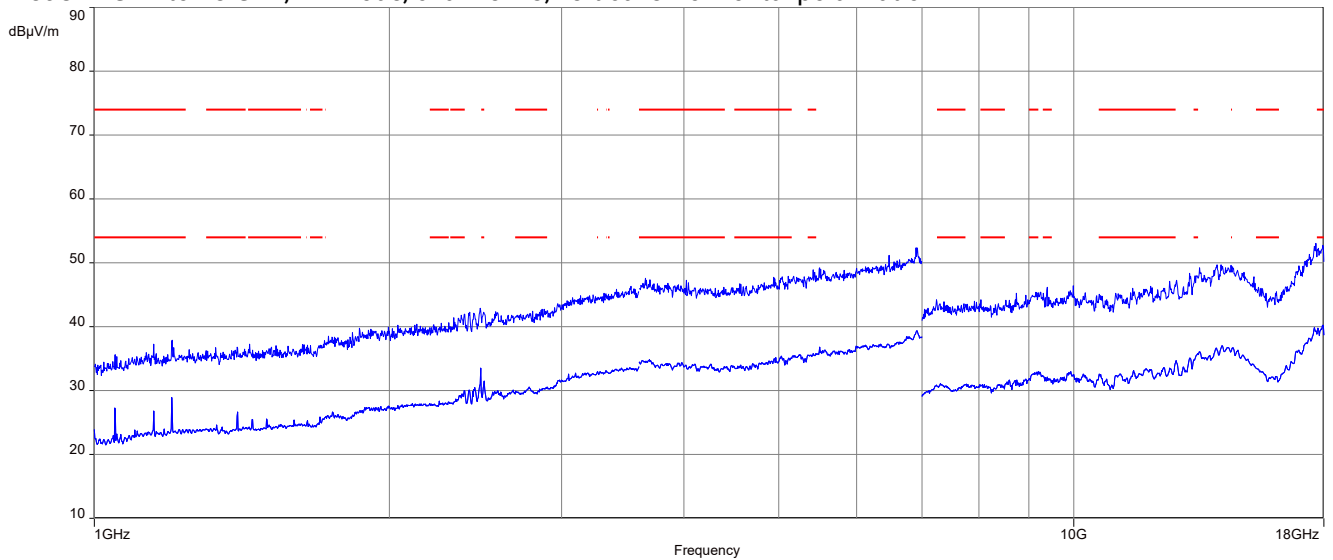
TX spurious emissions radiated [dBµV/m]								
2402 MHz			2441 MHz			2480 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.								
-/-	Peak	-/-	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	-/-		AVG	-/-		AVG	-/-

Plots: Transmitter mode**Plot 1:** 1 GHz to 18 GHz, TX mode, channel 00, vertical & horizontal polarization

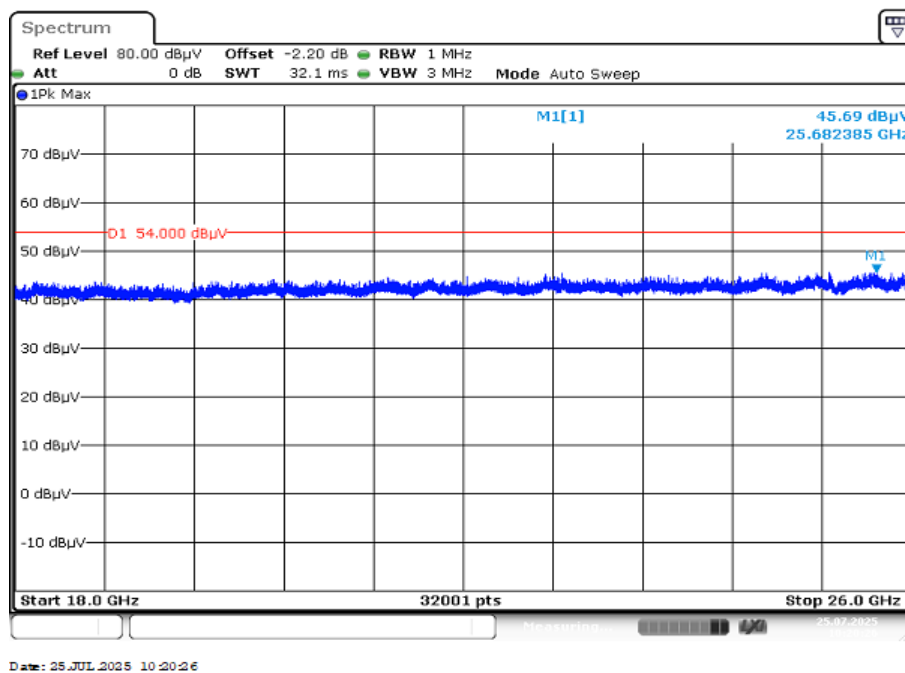
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: 1 GHz to 18 GHz, TX mode, channel 39, vertical & horizontal polarization

The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: 1 GHz to 18 GHz, TX mode, channel 78, vertical & horizontal polarization

The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 18 GHz to 26 GHz, TX mode, vertical & horizontal polarization, valid for all channels

12.12 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channel is channel 39. This measurement is representative for all channels and modes. If critical peaks are found channel 00 and channel 78 will be measured too. The measurement is performed in the mode with the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

Measurement parameters	
Detector	Peak - Quasi peak / average
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span	9 kHz to 30 MHz
Trace mode	Max hold
Test setup	See sub clause 8.5 setup A
Measurement uncertainty	See sub clause 9

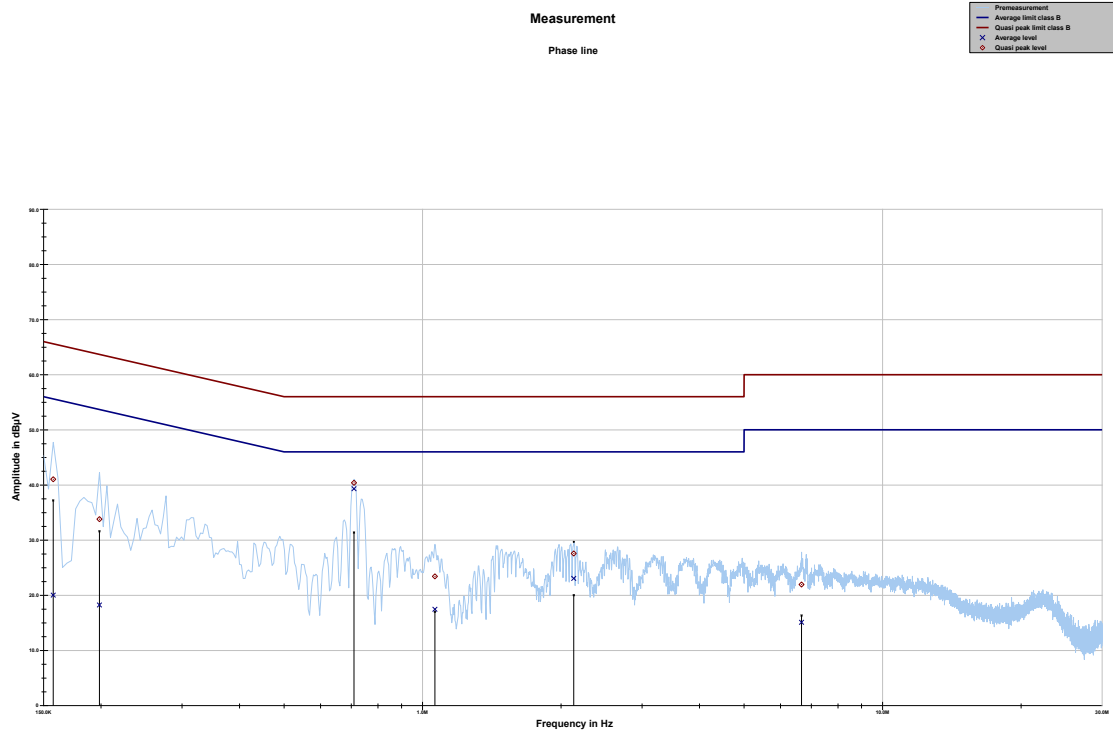
Limits:

FCC		ISED
TX spurious emissions conducted < 30 MHz		
Frequency (MHz)	Quasi-peak (dBμV/m)	Average (dBμV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

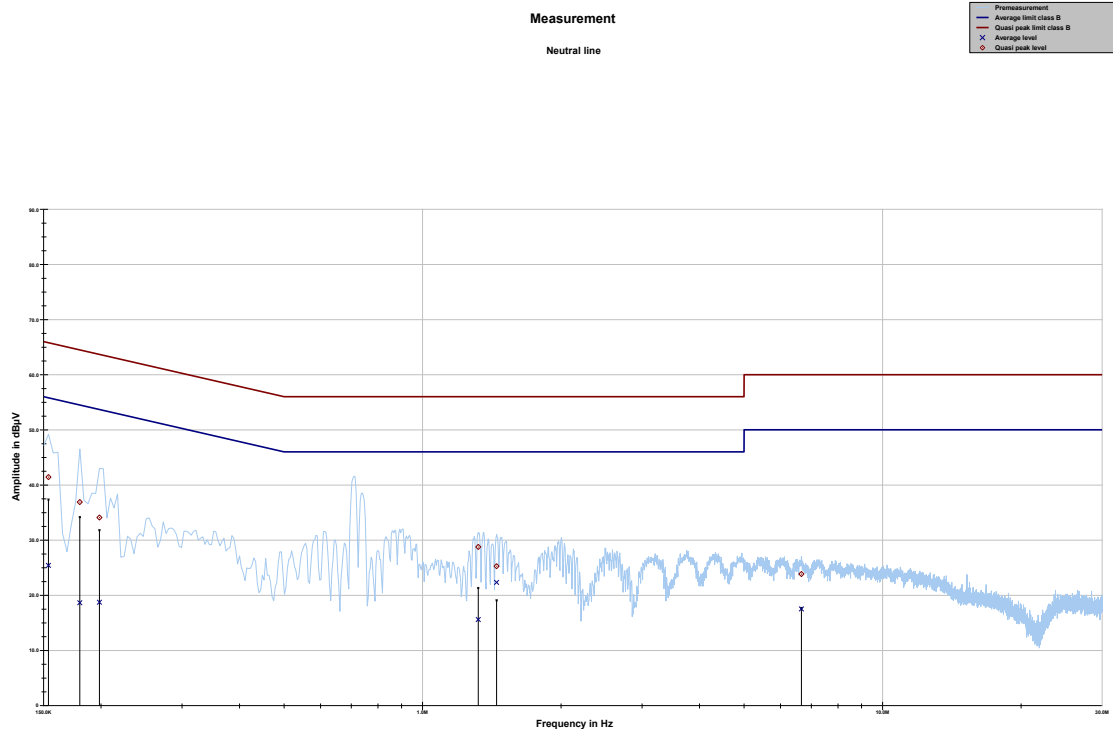
*Decreases with the logarithm of the frequency

Results:

Spurious emissions conducted < 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
No emissions detected		

Plots:**Plot 1:** 150 kHz to 30 MHz, phase line**Final results:**

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.157463	41.03	24.56	65.597	20.03	35.76	55.787
0.198506	33.80	29.87	63.673	18.23	36.38	54.614
0.709688	40.38	15.62	56.000	39.31	6.69	46.000
1.064156	23.41	32.59	56.000	17.46	28.54	46.000
2.131294	27.57	28.43	56.000	23.05	22.95	46.000
6.664763	21.93	38.07	60.000	15.10	34.90	50.000

Plot 2: 150 kHz to 30 MHz, neutral line**Final results:**

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153731	41.41	24.38	65.796	25.41	30.48	55.893
0.179850	36.90	27.59	64.493	18.64	36.51	55.147
0.198506	34.09	29.58	63.673	18.73	35.88	54.614
1.321613	28.75	27.25	56.000	15.58	30.42	46.000
1.448475	25.26	30.74	56.000	22.33	23.67	46.000
6.661031	23.85	36.15	60.000	17.51	32.49	50.000

13 Observations

No observations except those reported with the single test cases have been made.

14 Glossary

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

15 Document history

Version	Applied changes	Date of release
R01	Initial release	2025-08-07
R02	Added FVIN information	2025-09-23

END OF TEST REPORT