

Test Report

No. 1-9320-25-02-02_TR1-R01

2026-06-29

Applicant	Panasonic Industrial Devices Europe GmbH Zeppelinstrasse 19 21337 Lüneburg/ GERMANY
Product	WiFi / BLE Module
Model	PAN W602-2B
Frequency band	2400 MHz to 2483.5 MHz
Technology	Bluetooth® LE
Test Standard(s)	FCC 47 CFR Part 15 RSS-247:Issue 4 (2025-07) RSS-Gen:Issue 5 (2018-04) + Amendment 1 (2019-03) + Amendment 2 (2021-02)
Verdict	☒ PARTIAL PASS: Subset of applicable Test acc. to the standard(s) are PASS/complies

The test results relate only to devices specified in this document

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1 Disclaimer

The test results of this test report relate exclusively to the test item specified in chapter "Test sample information". cetecom advanced does not assume responsibility for any conclusions and generalizations drawn from the test results regarding other specimens or samples of the type of the equipment represented by the test item.

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2 Related cetecom advanced documents

Document	Content	Reference
Annex 101	External photographs of EUT	1-9320-25-02-01_TR1-A101-R01
Annex 102	Internal photographs of EUT	1-9320-25-02-01_TR1-A102-R01
Annex 103	Test set-up photographs	1-9320-25-02-01_TR1-A103-R01

3 Document history

3.1 Current release

Release No.: R01
 Date of release: 2026-06-29
 Applied changes: Initial release

3.2 Previous releases

Release No.	Applied changes	Date of release
		2026-06-29
-	-	-

4 Test laboratory

4.1 Involved test locations

Saarbruecken lab



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Essen lab



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 e-mail: mail@cetecomadvanced.com

4.2 Subcontracted laboratories

None.

4.3 Common report information

The period is used as a decimal separator and the comma as a thousand separator.

4.4 Abbreviations

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	Combination of Grantee Code and Equipment Product Code
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
ISED	Innovation, Science and Economic Development 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

5 Client information

5.1 Applicant

Name: Panasonic Industrial Devices Europe GmbH
Address: Zeppelinstrasse 19
21337 Lüneburg/ GERMANY

Contact Person: Marcus Nottorf
Contact Person's Email: marcus.nottorf@eu.panasonic.com

5.2 Manufacturer

Name: Panasonic Industrial Devices Europe GmbH
Address: Zeppelinstrasse 19
21337 Lüneburg / GERMANY

6 Test sample information

The data about the test samples is given/supplied by the customer and not under control by cetecom advanced GmbH.

6.1 Equipment under test

6.1.1 EUT

EUT no. *)	Product	Model	Serial number	Hardware version	Software version
EUT 1	WiFi / BLE Module	PAN W602-2B	Host Board No.2 (radiated Sample with Taoglas GW.51.5153)	03	01
EUT 2	WiFi / BLE Module	PAN W602-2B	Host Board No.8 (radiated Sample with 2J Antenna 2JF1002P)	03	01
EUT 3	--	--	--	--	--

*) EUT short description is used to simplify the identification of the EUT in this test report.

6.1.2 Auxiliary equipment from customer

AE *)	Auxiliary equipment	Type	Serial number	Hardware version	Software version
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

6.1.3 Auxiliary equipment from cetecom advanced

AE *)	Auxiliary equipment	Type
--	--	--

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.
 **The model used can be requested if required.

6.1.4 IDs and certification numbers

FCC ID	T7V-W602
ISED certification number	216Q-W602
HMN	-/-
PMN	PAN W602-2C; PAN W602-2B
HVIN	ENWF9215A / ENWF9215C
FVIN	-/-

7 Additional details

7.1 Scheduling

Date of receipt of order: 2026-05-11
 Date of receipt of test item: 2026-05-26
 Start of test:* 2026-05-29
 End of test:* 2026-06-24
 Person(s) present during the test: -/-

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

7.2 Climatic laboratory data

Temperature:	15°C - 35°C
Relative. humidity:	30%rH - 60%rH
Barometric pressure:	860hPa - 1060hPa

7.3 Test environmental EUT

Nominal temperature:	+20
Low temperature:	-40
High temperature:	+85
Nominal voltage:	3.3
Low voltage:	3.1
High voltage:	3.6
Nominal power supply:	DC by PCB
Test power supply:	DC by switching power supply

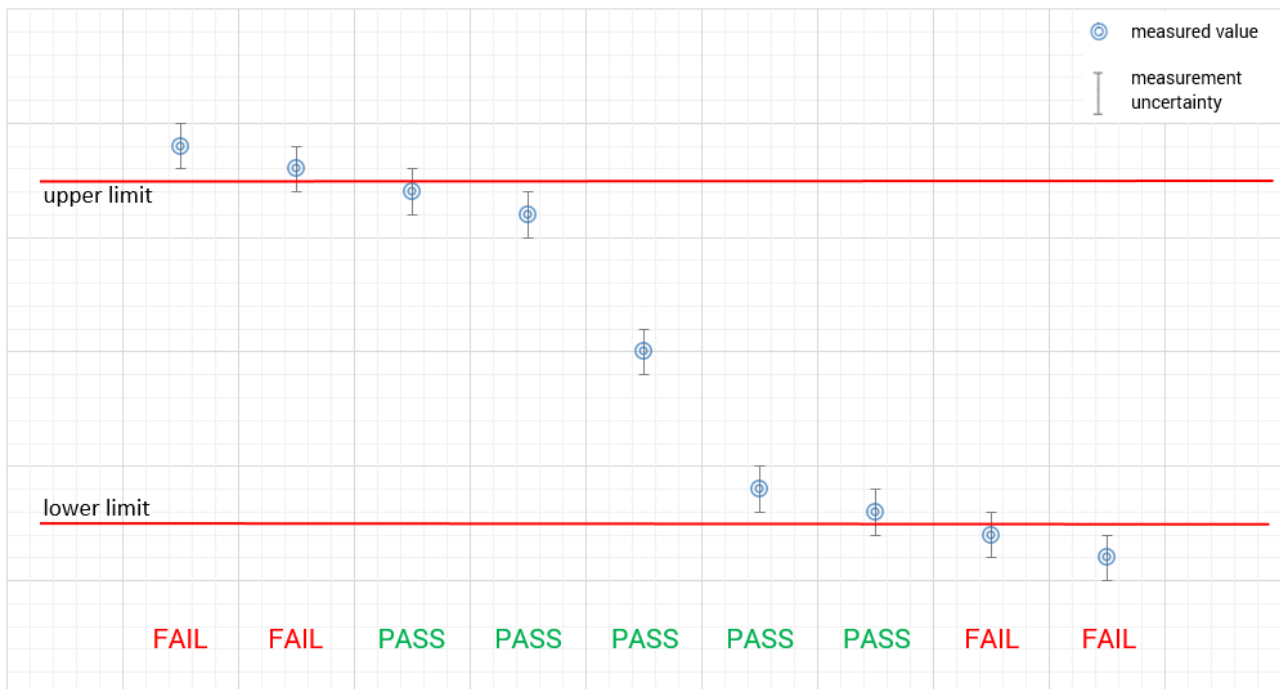
8 Decision rule and plot legend

8.1 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 6.1.1.

The measurement uncertainty is mentioned in this test report, see chapter 15, 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



8.2 Plot legend

Plot legend (radiated plots)	
Blue Trace (Measured Spectrum)	Represents the measured emission levels of the Equipment Under Test (EUT) over the specified frequency range.
Red Line (Limit Line)	Indicates the applicable regulatory limit according to the specified standard Emissions below the limit: compliant Emissions above the limit: non-compliant Emissions above the limit: Peak pre-measurement points may exceed the limit, but should then be evaluated using the method described in the specific standard (see results table)
X-Axis (Frequency)	Shows the frequency range of the measurement
Y-Axis (Level in dBm)	Displays the emission level in dBm.
Marker (yellow)	Indicates a specific frequency of interest for the final measurement the fundamental frequency (wanted signal) or a critical spurious emission
Markers (green)	Green data points indicate the measured level at various polarizations and spatial positions. The highest measured values are recorded in a table. The pre-measurement is always performed as a peak measurement. Once the maximum value has been determined, the measurement procedure specified in the relevant standard is then carried out.

9 Measurement details

9.1 Test methodology

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

Applied test method, standard, rule	Date	Description
FCC 47 CFR Part 15	-/-	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS-247:Issue 4 (2025-07)	2025-07-24	RSS-247 – Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands
RSS-Gen:Issue 5 (2018-04) + Amendment 1 (2019-03) + Amendment 2 (2021-02)	2021-02-01	General Requirements for Compliance of Radio Apparatus
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 C63.10-2020	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI/USEMCSC C63.10a-2024 Amendment 1	2024-08-08	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices Amendment 1
ANSI/USEMCSC C63.10a-2024 Amendment 1 Errata	2024-11-18	Errata to American National Standard for Procedures for Compliance Testing of Unlicensed Wireless Devices Amendment 1 Correction Sheet
KDB 174176 D01	V01r02	AC POWER LINE CONDUCTED EMISSIONS FREQUENTLY ASKED QUESTIONS

10 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).

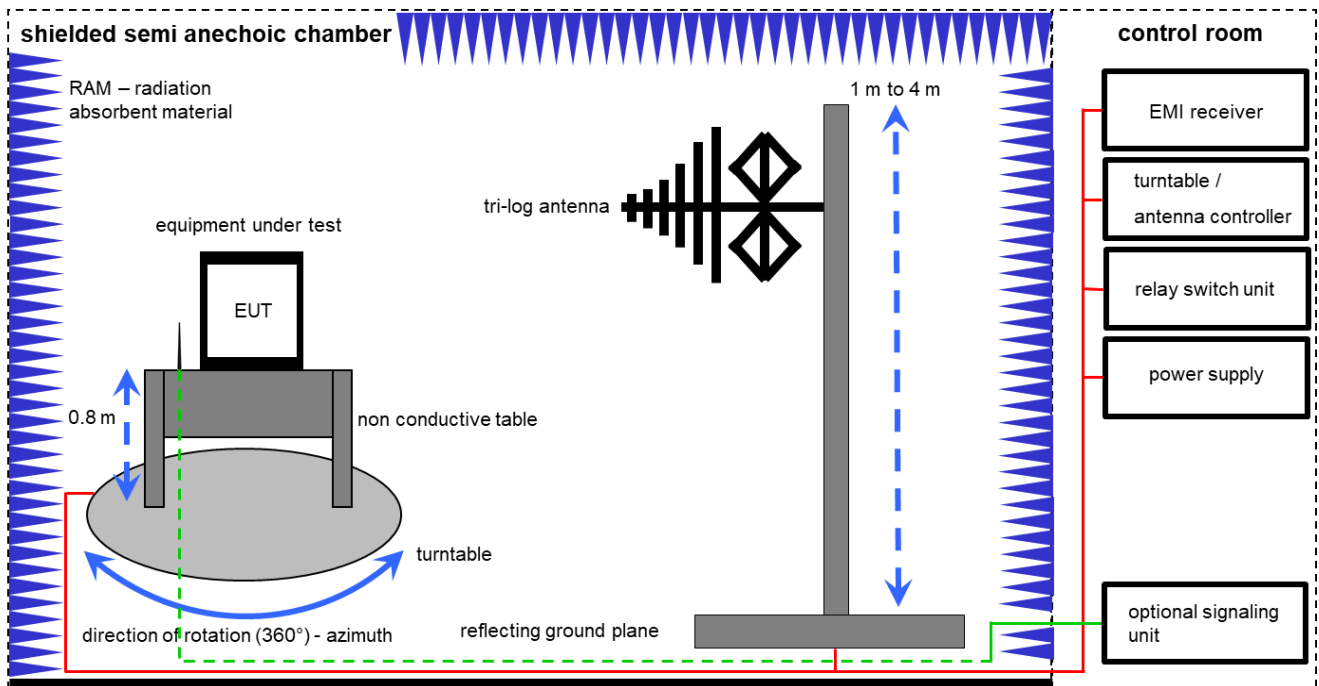
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

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
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress
cpu	check prior usage		

10.1 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)

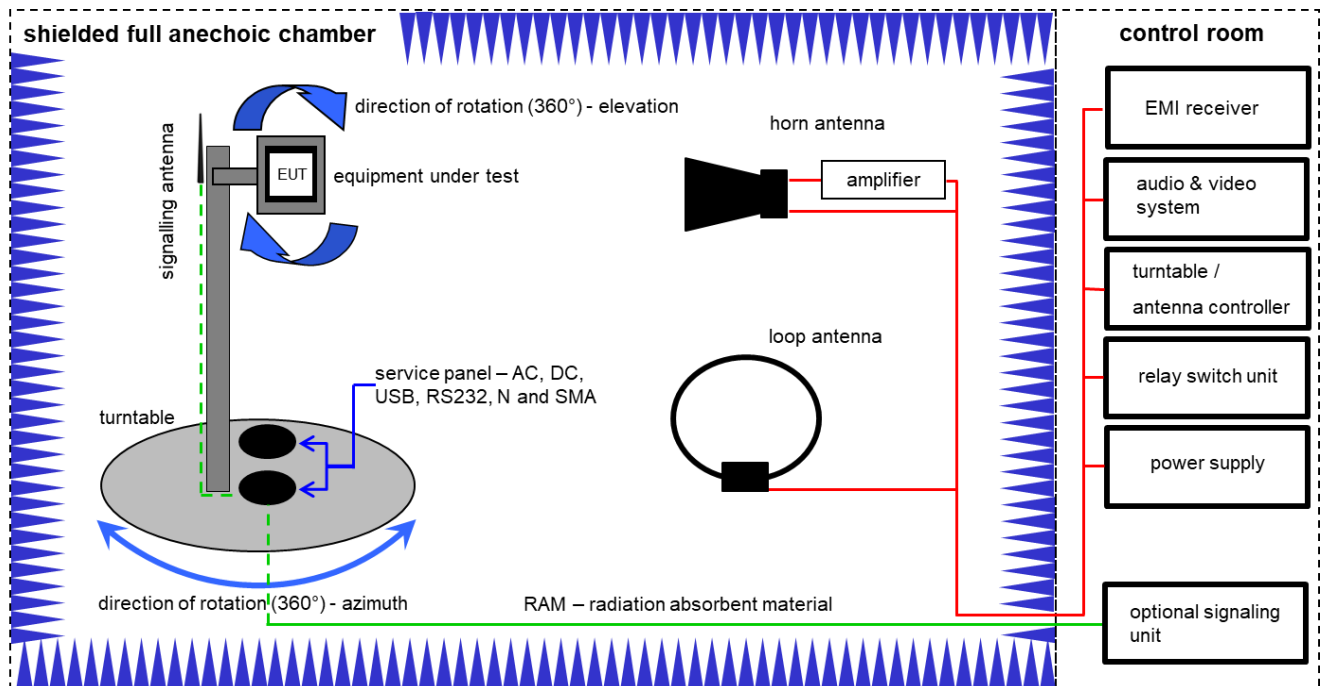
Example calculation:

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

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	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	TRILOG Broadband Antenna	TRILOG Broadband Antenna VULB9163	Schwarzbeck MESS-ELEKTRONIK OHG Schönaun	318	50284	cal	09.02.2026	29.02.2028
5	A	EMI Test Receiver	EMI Test Receiver ESR3 9kHz-3.6GHz	Rohde & Schwarz Messgerätebau GmbH Memmingen	102587	50417	cal	08.12.2025	31.12.2026

10.2 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:

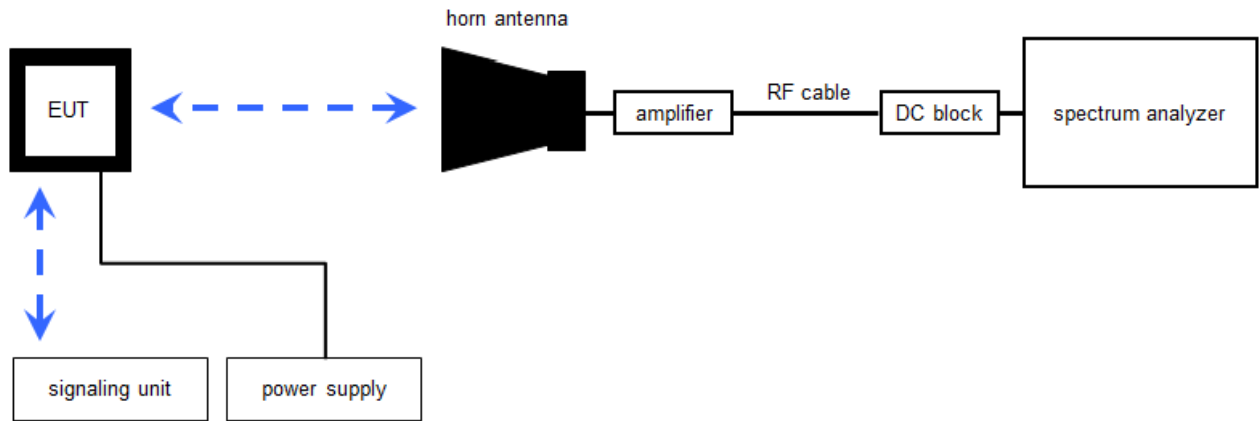
$$FS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB/m]} = 37.1 \text{ [dB}\mu\text{V/m]} \text{ (71.61 } \mu\text{V/m)} @ \text{ distance}$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A,B	Double-Ridged Waveguide Horn Antenna	Double-Ridged Waveguide Horn Antenna 3115	EMCO Elektronik GmbH Gilching	8812-3089	40344	cal	09.07.2024	31.07.2026
2	A	Highpass Filter	Highpass Filter WHKX7.0/18G-8SS	Wainwright Instruments GmbH Andechs	18	40364	cpu	-/-	-/-
3	A	Band Reject Filter	Band Reject Filter WRCG2400/2483-2375/2505-50/10SS	Wainwright Instruments GmbH Andechs	26	40367	cpu	-/-	-/-
4	A	Broadband Amplifier 0.5-18 GHz	Broadband Amplifier 0.5-18 GHz CBLU5184540	CERNEX	22050	40374	cpu	-/-	-/-
5	A,B,C	4U RF Switch Platform	4U RF Switch Platform L4491A	Agilent Technologies Deutschland GmbH Böblingen	MY50000032	40376	cnn	-/-	-/-
6	A,B,C	NEXIO EMV-Software	NEXIO EMV-Software BAT EMC V2022.0.32.0	Nexio	-/-	40383	cnn	-/-	-/-
7	A,B,C	Anechoic chamber	Anechoic chamber	TDK	-/-	40385	cnn	-/-	-/-
8	A,B	RF-Amplifier	RF-Amplifier AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	40400	cpu	-/-	-/-
9	A,B,C	Signal- and Spectrum Analyzer	Signal- and Spectrum Analyzer FSW26	Rohde & Schwarz Messgerätebau GmbH Memmingen	104533	41044	cal	20.03.2026	31.03.2027
10	C	Active Loop Antenna	Active Loop Antenna 6502	EMCO Elektronik GmbH Gilching	2210	50044	cal	07.07.2025	31.07.2027

10.3 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	Low Noise Amplifier, Broadband 18-50 GHz	Low Noise Amplifier, Broadband 18-50 GHz BZT-18005000-550835-SL2525-SL	B&Z Technologies	27888-27890	40788	cpu	-/-	-/-
2	A	Horn Antenna 18,0-40,0 GHz	Horn Antenna 18,0-40,0 GHz LHAF180	MEC Import: Microw.Devel	39180-103-021	40170	cal	16.01.2026	31.01.2028
3	A	RF-Cable	RF-Cable ST18/SMAm/SMAm /72	Huber & Suhner GmbH Unterhaching	Batch no. 699714	40389	cpu	-/-	-/-
4	A	DC-Blocker 0.1-40 GHz	DC-Blocker 0.1-40 GHz 8141A	Inmet	-/-	40390	cpu	-/-	-/-
5	A	Signal- and Spectrum Analyzer	Signal- and Spectrum Analyzer FSW50	Rohde & Schwarz Messgerätebau GmbH Memmingen	101560	40011	cal	18.12.2025	31.12.2026

11 Sequence of testing

11.1 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.

11.2 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.

11.3 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.

11.4 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.

12 Summary of measurement results

☐	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 Part 15 RSS - 247, Issue 4			See table	2026-07-08			Tests according to customer demand!		
Test specification clause	Test case	Guideline	Temperature conditions	Power source voltages	Mode	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 6.3.2	System gain	-/-	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	Declared
§15.247(e) RSS - 247 / 6.3.1 (b)	Power spectral density	KDB 558074 DTS clause: 8.4	Nominal	Nominal	1 Msps 2 Msps	☐	☐	☐	☒	-/-
§15.247(a)(2) RSS - 247 / 6.3.1 (a)	DTS bandwidth – 6 dB bandwidth	KDB 558074 DTS clause: 8.2	Nominal	Nominal	1 Msps 2 Msps	☐	☐	☐	☒	-/-
RSS Gen clause 4.6.1	Occupied bandwidth	-/-	Nominal	Nominal	1 Msps 2 Msps	☐	☐	☐	☒	-/-
§15.247(b)(3) RSS - 247 / 6.3.2	Maximum output power	KDB 558074 DTS clause: 8.3.1.1	Nominal	Nominal	1 Msps 2 Msps	☐	☐	☐	☒	-/-
§15.205 RSS - 247 / 6.6 RSS - Gen	Band edge compliance cond. & rad.	KDB 558074 DTS clause: 8.7.2 or 8.7.3	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 6.6	TX spurious emissions conducted	KDB 558074 DTS clause: 8.5	Nominal	Nominal	1 Msps 2 Msps	☐	☐	☐	☒	-/-
§15.209(a) RSS - Gen	Spurious emissions radiated below 30 MHz	-/-	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 6.6 §15.109 RSS - Gen	Spurious emissions radiated 30 MHz to 1 GHz	-/-	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 6.6 §15.109 RSS - Gen	Spurious emissions radiated above 1 GHz	-/-	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions below 30 MHz (AC conducted)	-/-	Nominal	Nominal	1 Msps	☐	☐	☐	☒	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed
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13 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: Bluetooth® Core Specification

Special test descriptions: None

Configuration descriptions:

Bluetooth Low Energy capabilities	
Longest Supported payload (37 – 255 Byte)	Tx: 255, RX: 255
LE 1M PHY supported	Yes
LE 2M PHY supported	Yes
Stable Modulation Index supported (SMI)	No
LE Coded PHY supported (S=2)	Yes
LE Coded PHY supported (S=8)	Yes

Test mode:

☐ Bluetooth direct test mode enabled
(EUT is controlled via CBT/CMW)

☒ Special software is used.
EUT is transmitting pseudo random data by itself

EUT selection:

☐ Only one device available

☒ Devices selected by the customer

☐ Devices selected by the laboratory (Randomly)

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)

☐ Operating mode 2 (multiple antennas, no beamforming)

- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.

☐ Operating mode 3 (multiple antennas, with beamforming)

- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.
In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

14 Measurement results

14.1 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 Taoglas GW.51.5153		5.2

T _{nom}	V _{nom}	400 MHz to 2483.5 MHz
Gain [dBi] Declared by customer 2J Antennas 2JF1002P		4.2

14.2 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 frequency 2402 MHz for the lower restricted band and 2480 MHz for the upper restricted band. Measurement distance is 3m.

Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Span	Lower Band: 2300 – 2400 MHz higher Band: 2480 – 2500 MHz
Trace mode	Max hold
Test setup	See sub clause 10.2 setup B
Measurement uncertainty	See sub clause 15

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	

Result:

Variant: Taoglas GW.51.5153

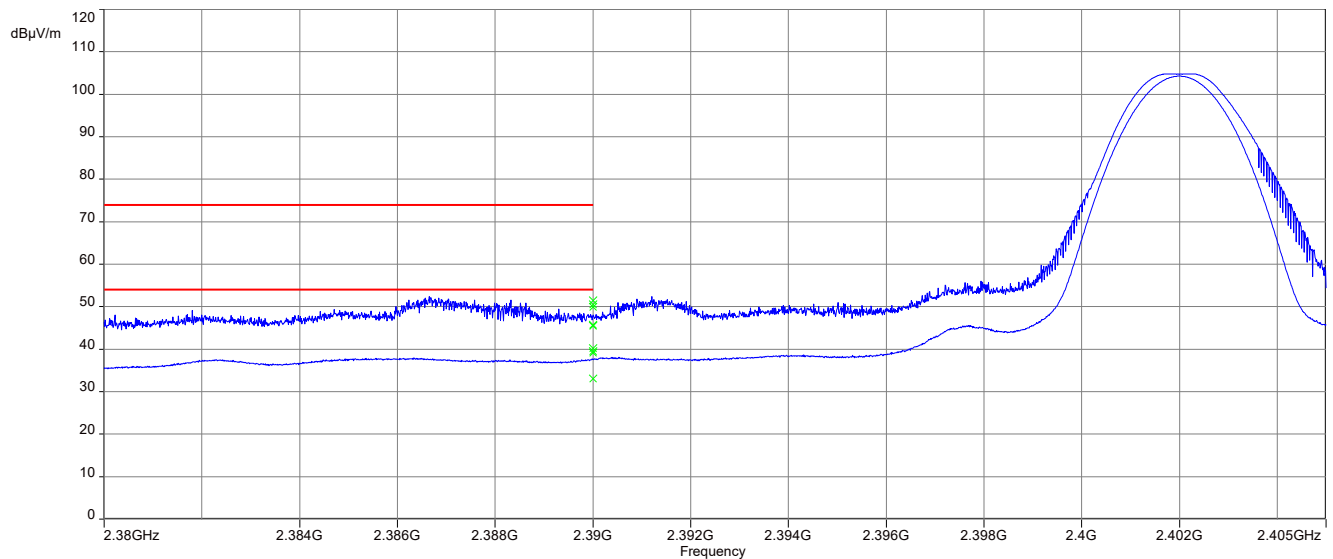
Scenario	Band edge compliance radiated [dBµV/m]	
Data rate	1 Msps	
Lower restricted band	51.4 dBµV/m	Peak
	40.2 dBµV/m	AVG
Upper restricted band	56.9 dBµV/m	Peak
	46.7 dBµV/m	AVG
Data rate	2 Msps	
Lower restricted band	54.9 dBµV/m	Peak
	34.0 dBµV/m	AVG
Upper restricted band	55.8 dBµV/m	Peak
	46.0 dBµV/m	AVG

Variant: 2J Antennas 2JF1002P

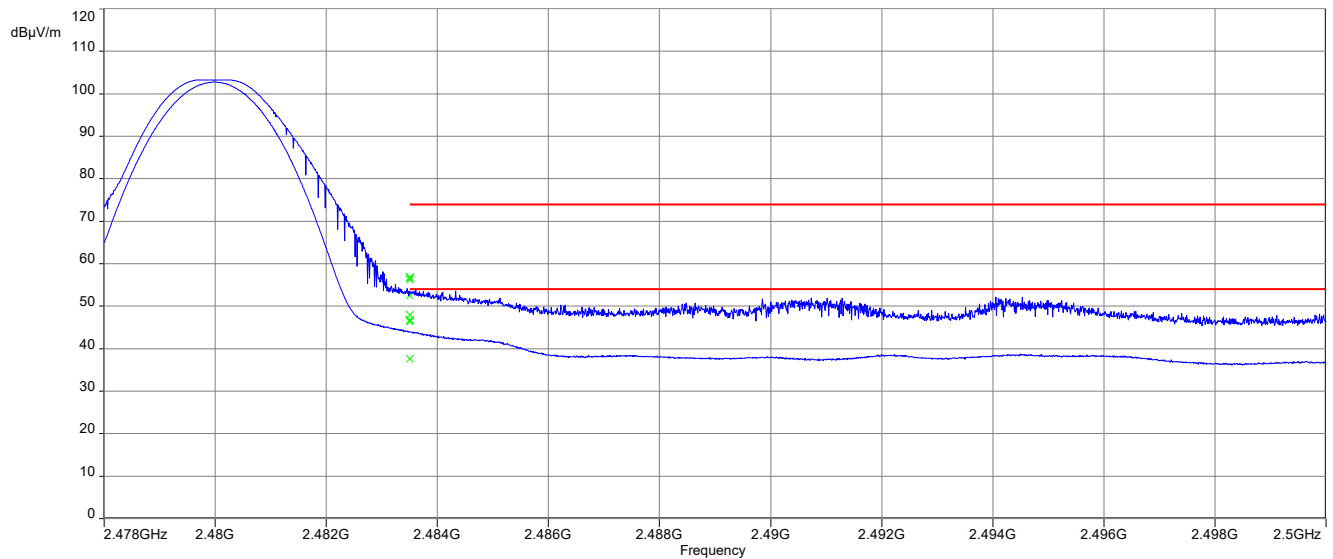
Scenario	Band edge compliance radiated [dB μ V/m]	
Data rate	1 Msps	
Lower restricted band	53.0 dB μ V/m	Peak
	41.6 dB μ V/m	AVG
Upper restricted band	60.0 dB μ V/m	Peak
	49.4 dB μ V/m	AVG
Data rate	2 Msps	
Lower restricted band	56.9 dB μ V/m	Peak
	41.1 dB μ V/m	AVG
Upper restricted band	58.8 dB μ V/m	Peak
	49.7 dB μ V/m	AVG

Plots:

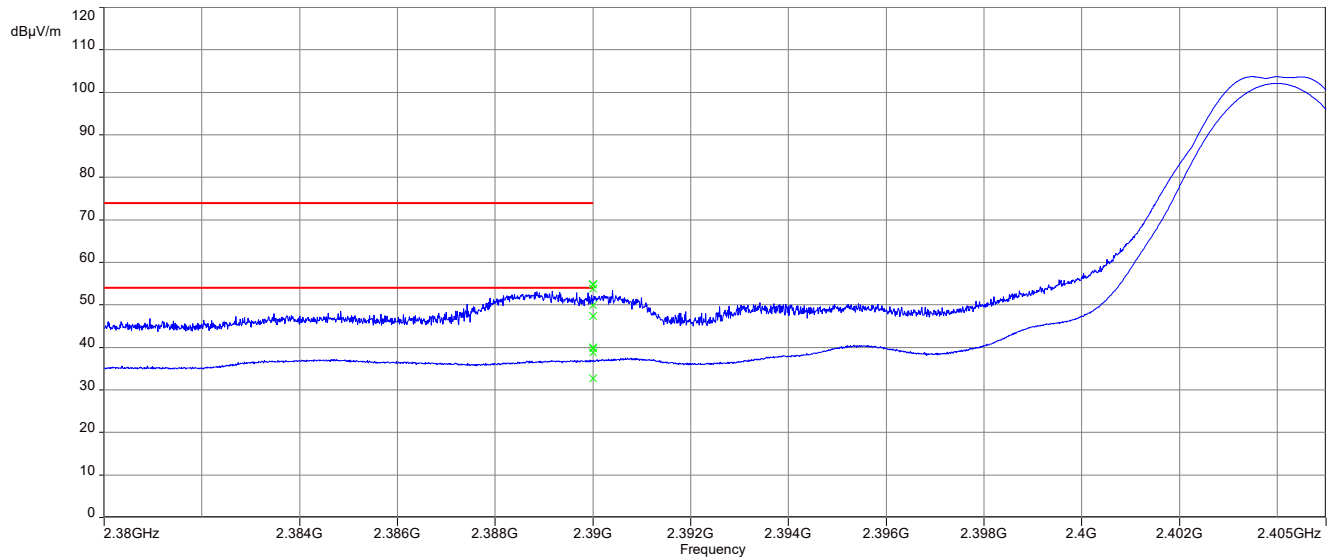
Plot 1: Lower restricted band, 1 Msps, Taoglas GW.51.5153



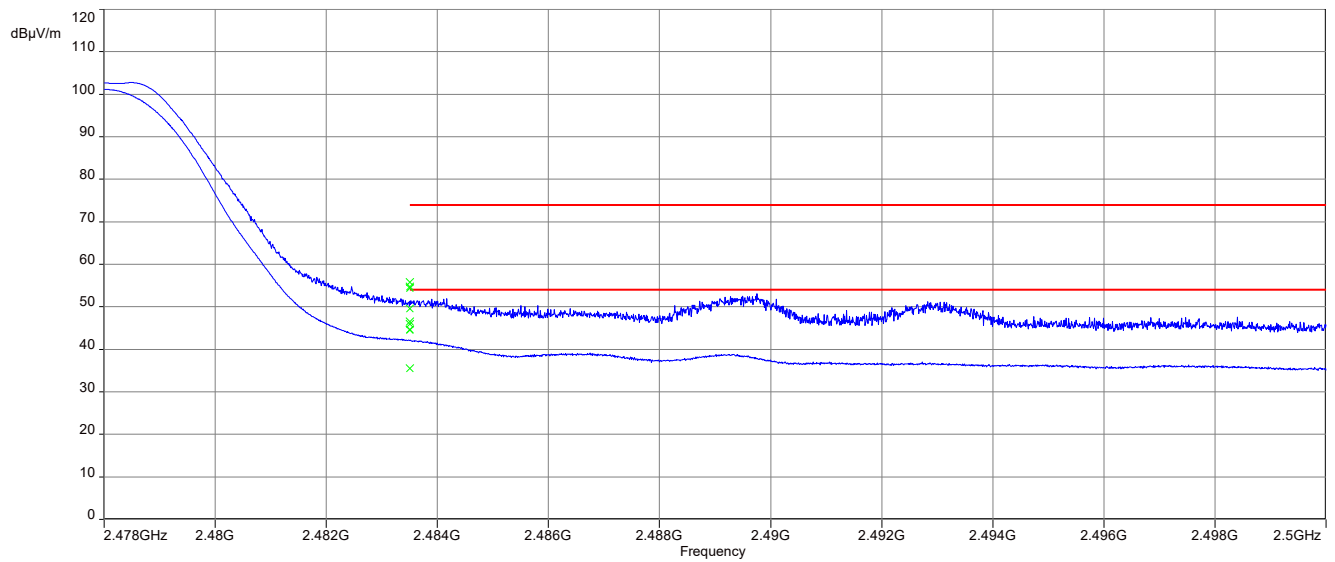
Plot 2: Upper restricted band, 1 Msps, Taoglas GW.51.5153



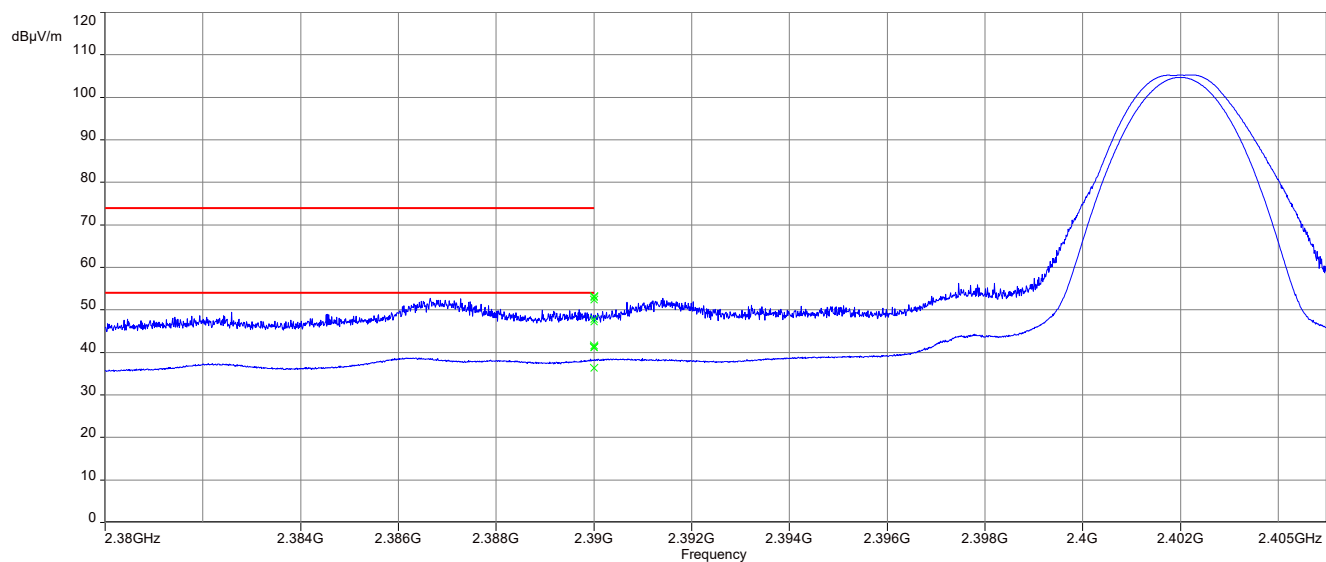
Plot 3: Lower restricted band, 2 Msps, Taoglas GW.51.5153



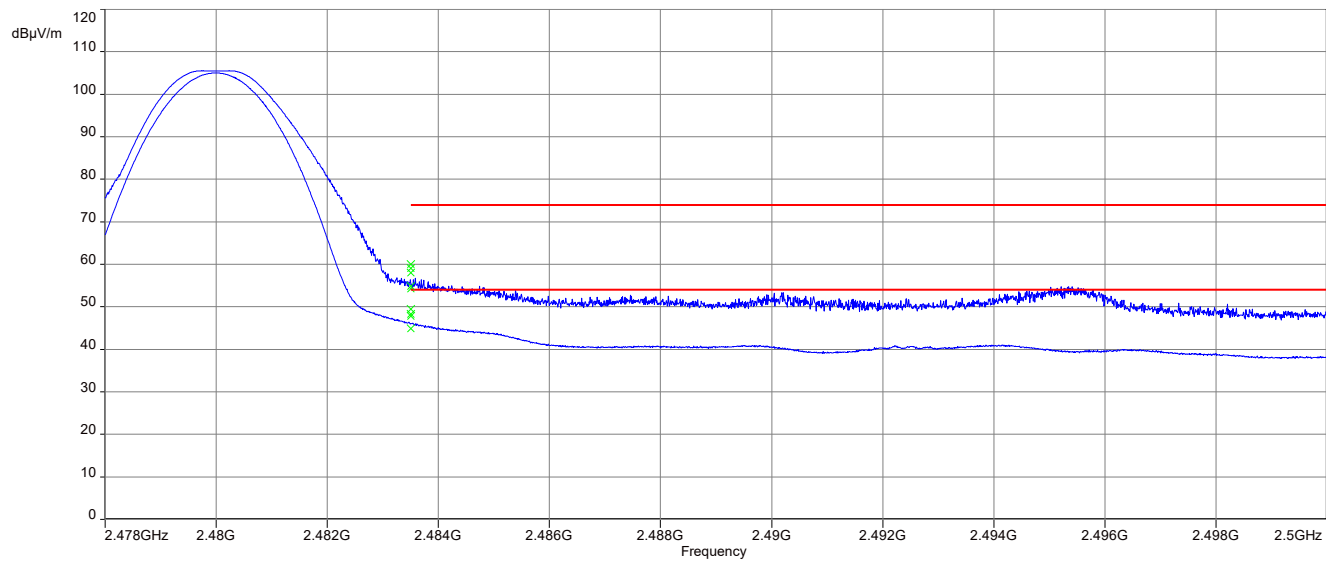
Plot 4: Upper restricted band, 2 Msps, Taoglas GW.51.5153



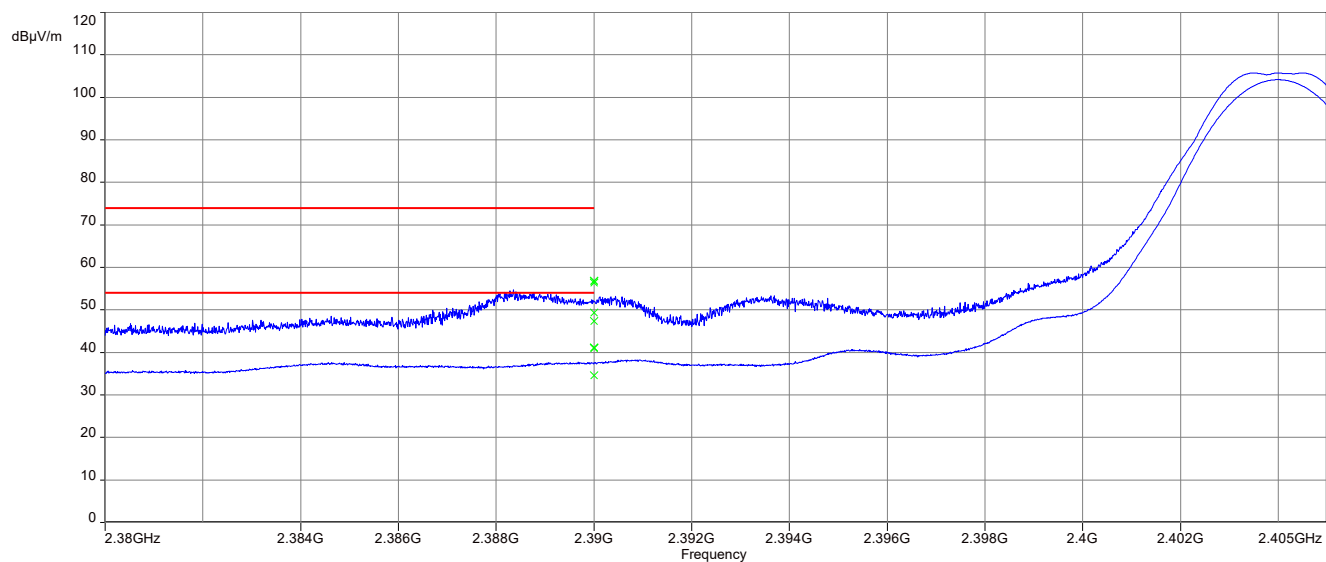
Plot 5: Lower restricted band, 1 Msps, 2J Antennas 2JF1002P



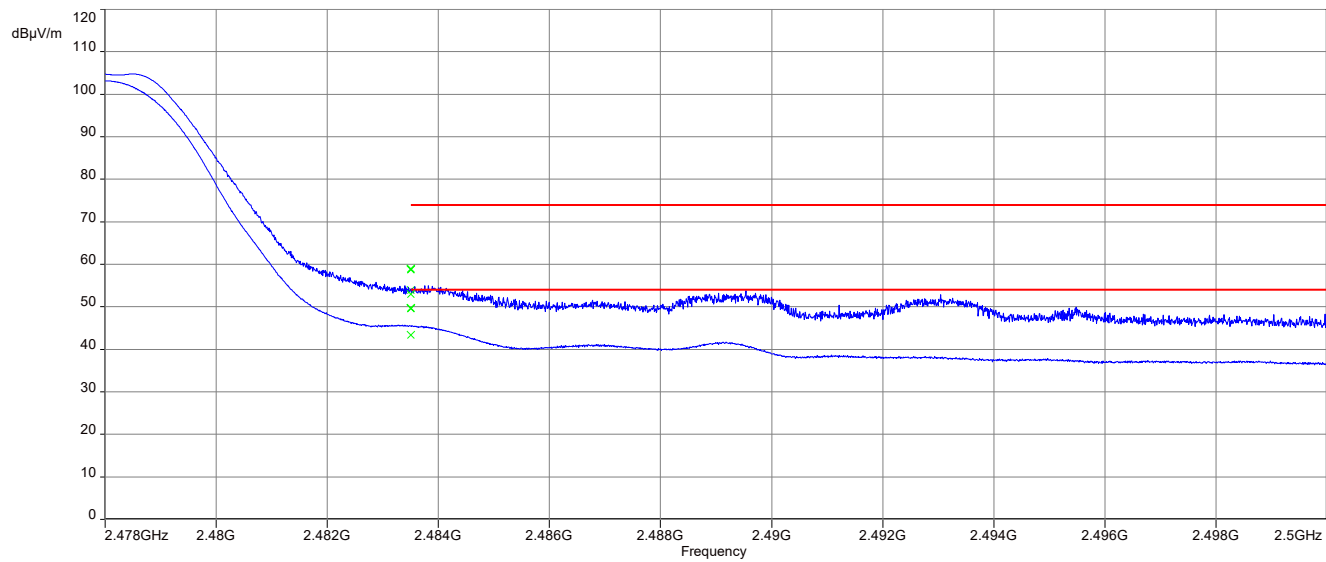
Plot 6: Upper restricted band, 1 Msps, 2J Antennas 2JF1002P



Plot 7: Lower restricted band, 2 Msps, 2J Antennas 2JF1002P



Plot 8: Upper restricted band, 2 Msps, 2J Antennas 2JF1002P



14.3 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 frequencies are 2402 MHz, 2440 MHz and 2480 MHz. The limits are recalculated to a measurement distance of 3 m according to 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: 30 kHz
Span	9 kHz to 30 MHz
Trace mode	Max hold
Test setup	See sub clause 10.2 setup C
Measurement uncertainty	See sub clause 15

Limits:

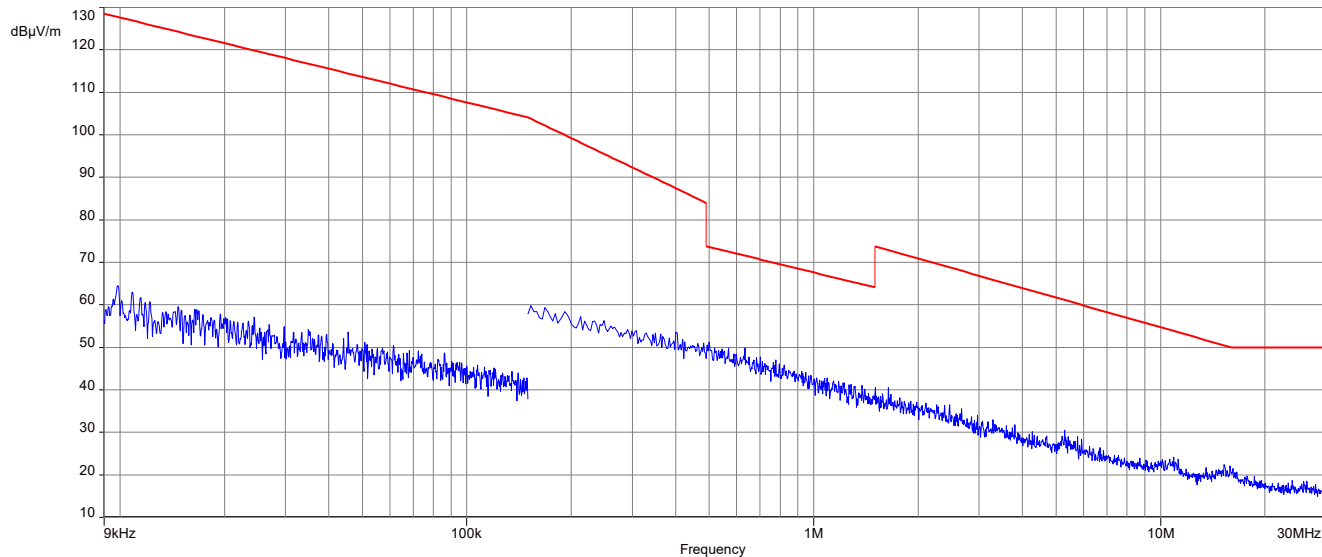
FCC		ISED
TX spurious emissions radiated below 30 MHz		
Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

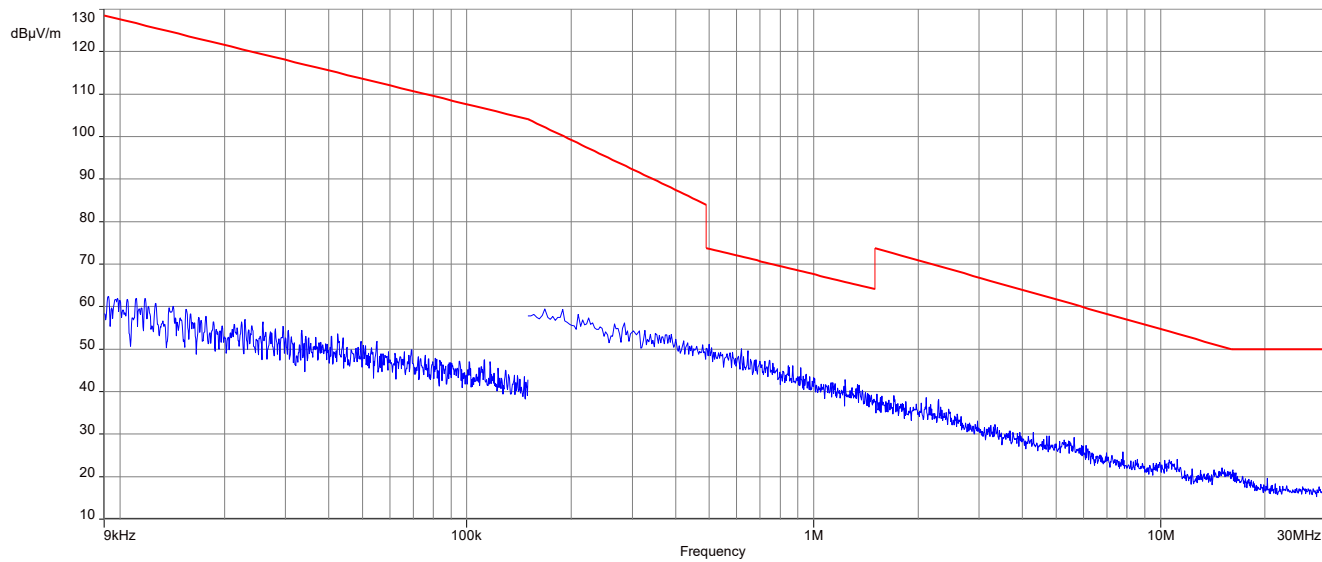
TX spurious emissions radiated below 30 MHz [dBμV/m]			
F [MHz]	Detector	Level [dBμV/m]	Margin [dB]
All detected emissions are more than 20 dB below the limit.			

Plots:

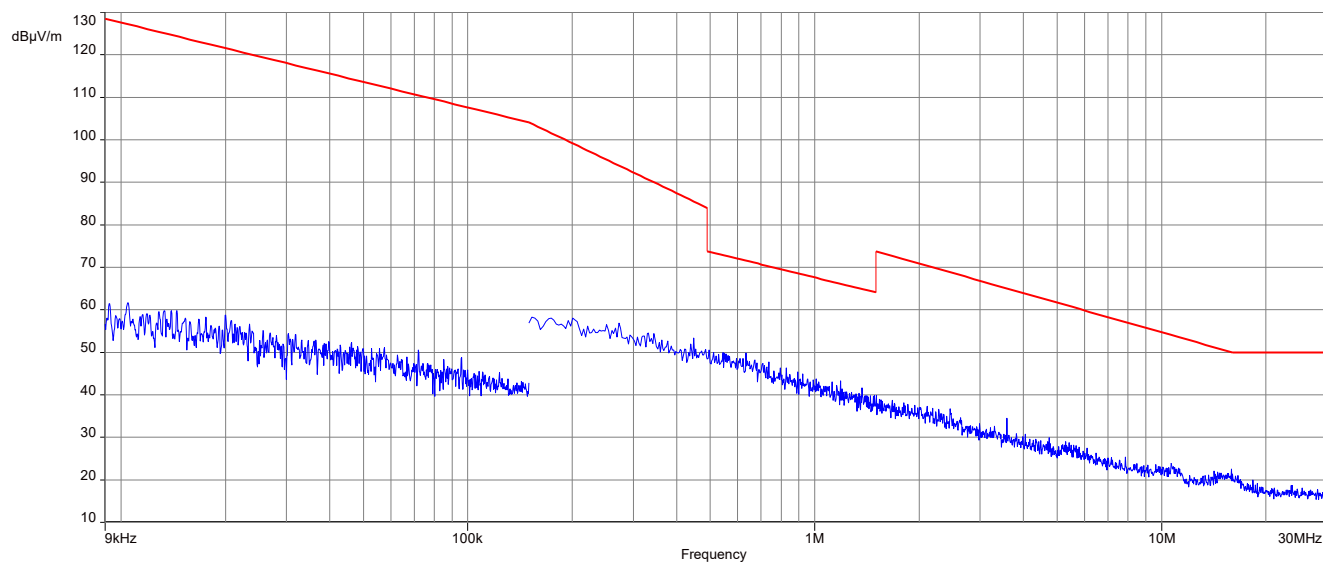
Plot 1: 9 kHz to 30 MHz, 2402 MHz, transmit mode, 1 Msps, Taoglas GW.51.5153



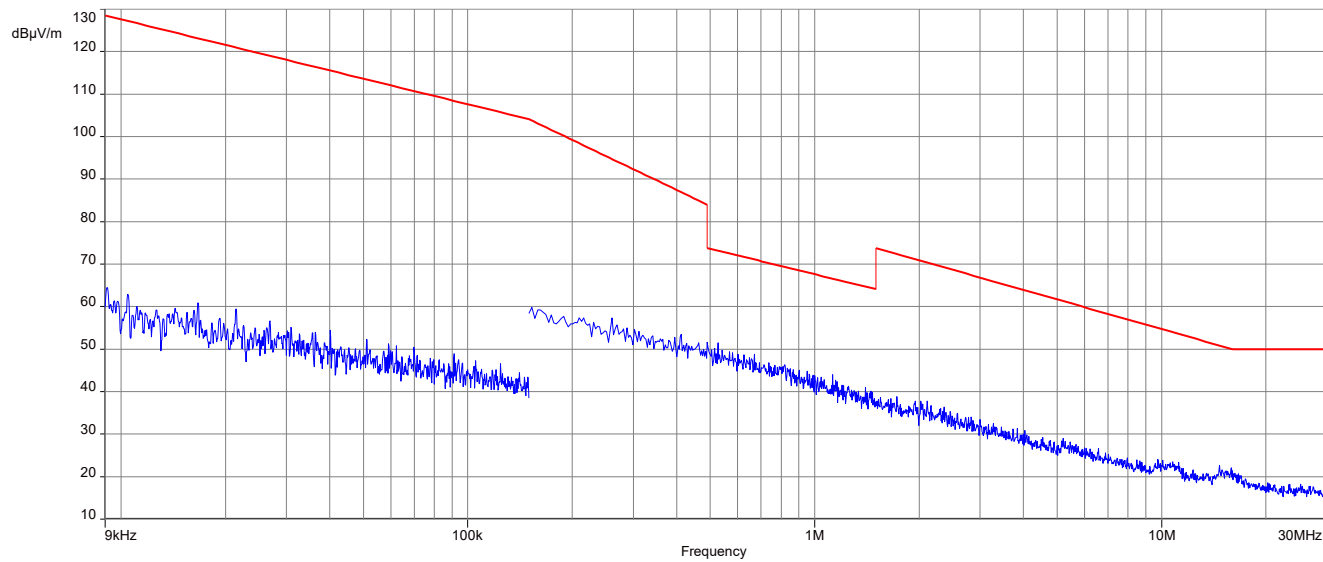
Plot 2: 9 kHz to 30 MHz, 2440 MHz, transmit mode, 1 Msps, Taoglas GW.51.5153



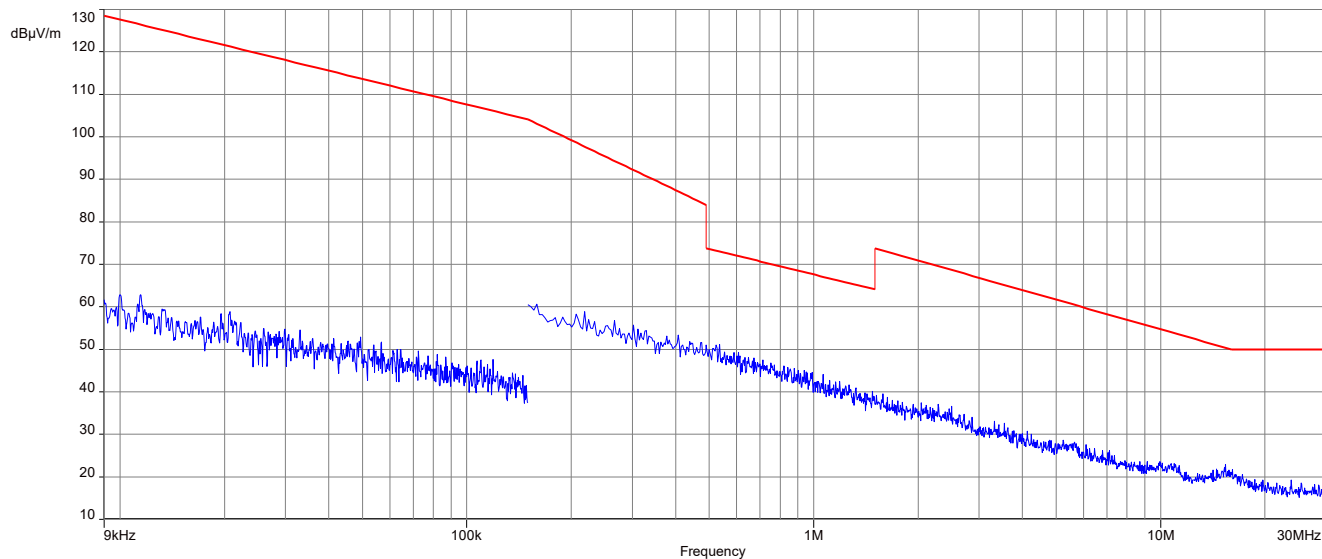
Plot 3: 9 kHz to 30 MHz, 2480 MHz, transmit mode, 1 Msps, Taoglas GW.51.5153



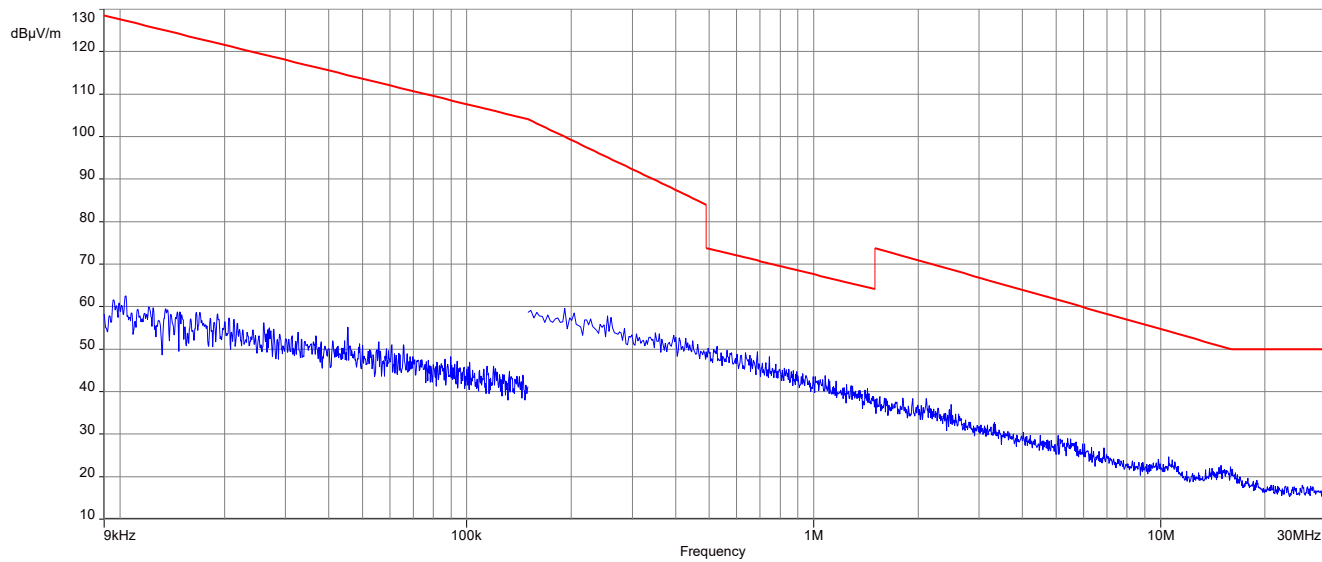
Plot 4: 9 kHz to 30 MHz, 2404 MHz, transmit mode, 2 Msps, Taoglas GW.51.5153



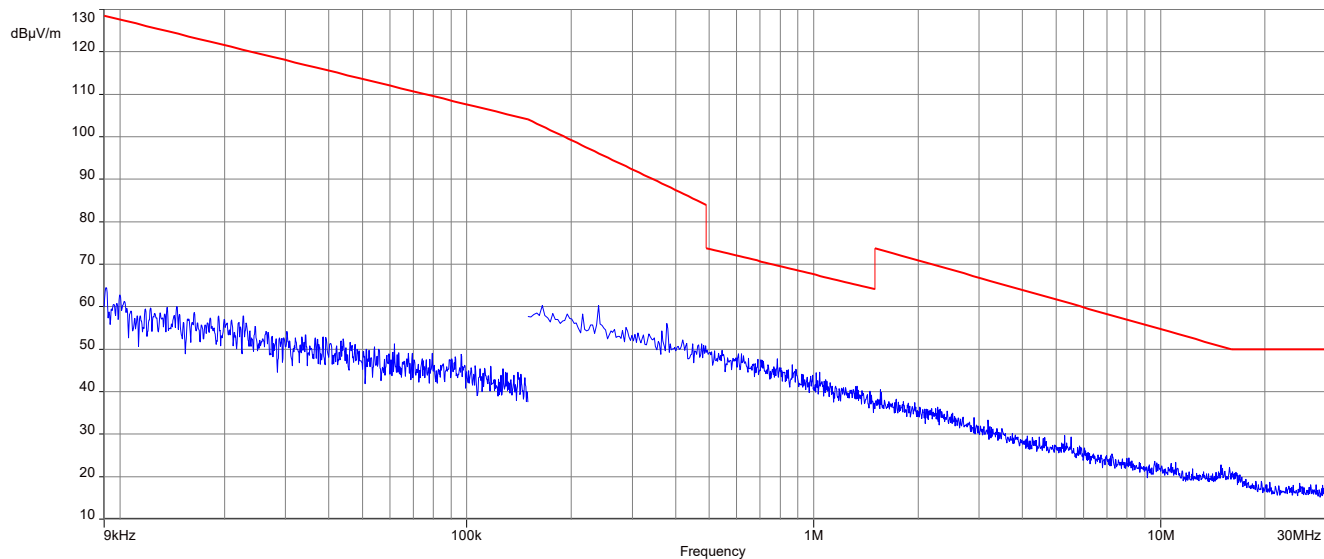
Plot 5: 9 kHz to 30 MHz, 2440 MHz, transmit mode, 2 Msps, Taoglas GW.51.5153



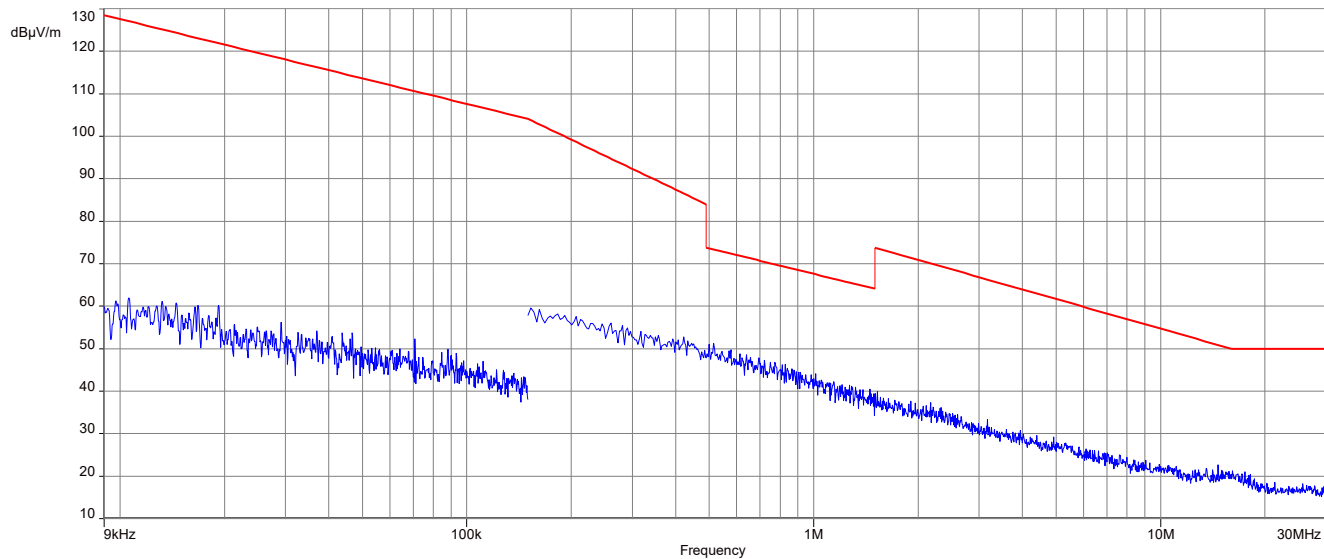
Plot 6: 9 kHz to 30 MHz, 2478 MHz, transmit mode, 2 Msps, Taoglas GW.51.5153



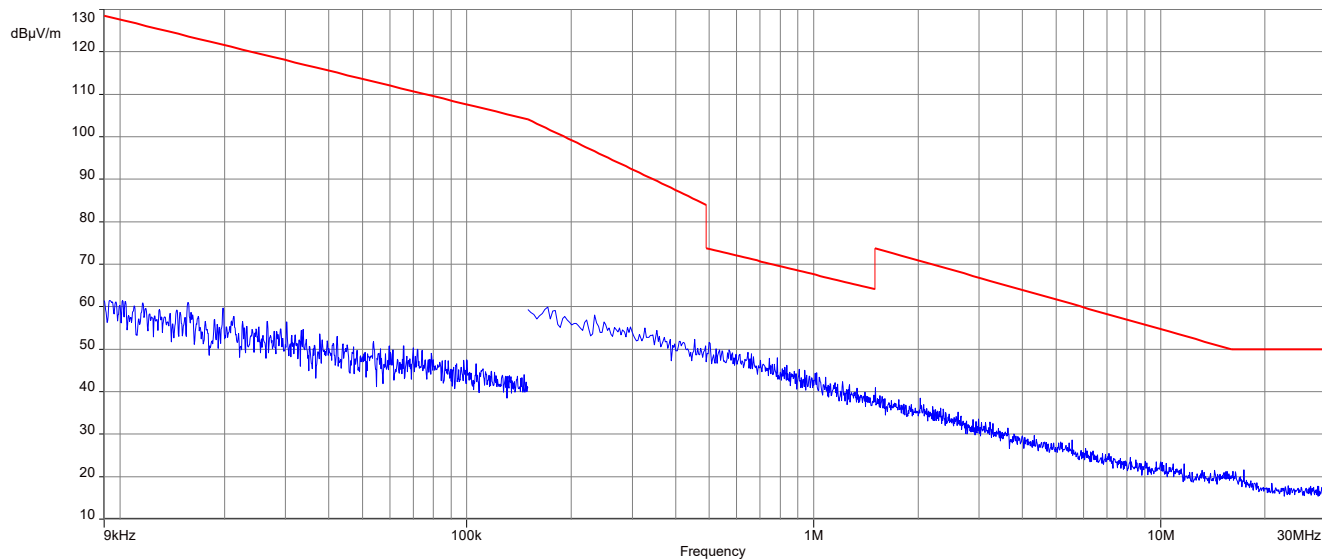
Plot 7: 9 kHz to 30 MHz, 2402 MHz, transmit mode, 1 Msps, 2J Antennas 2JF1002P



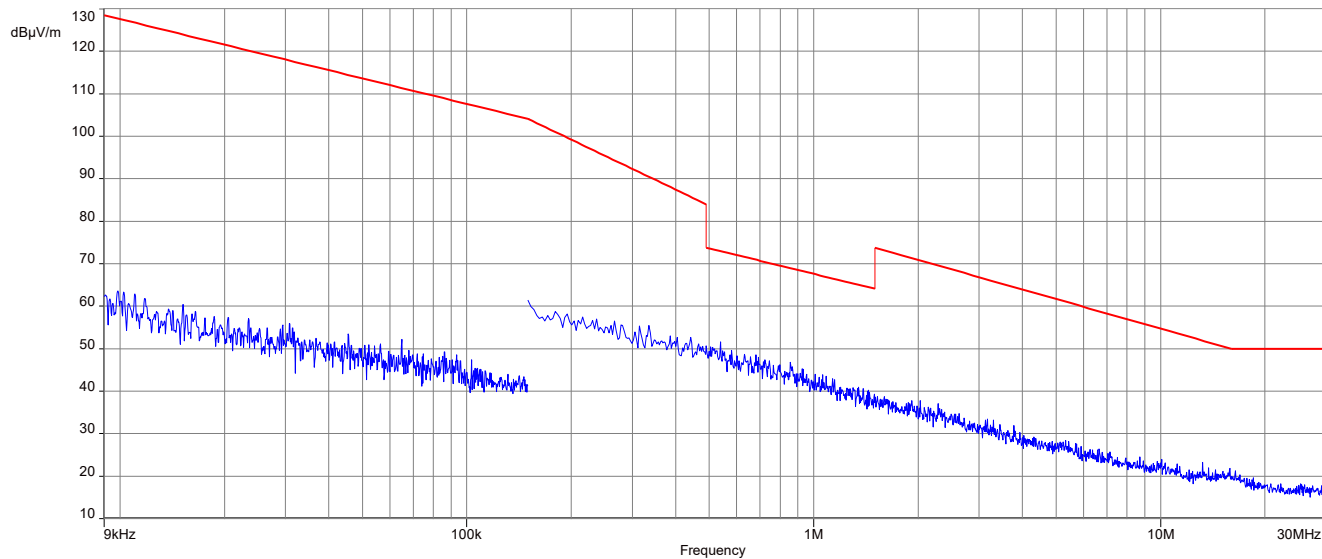
Plot 8: 9 kHz to 30 MHz, 2440 MHz, transmit mode, 1 Msps, 2J Antennas 2JF1002P



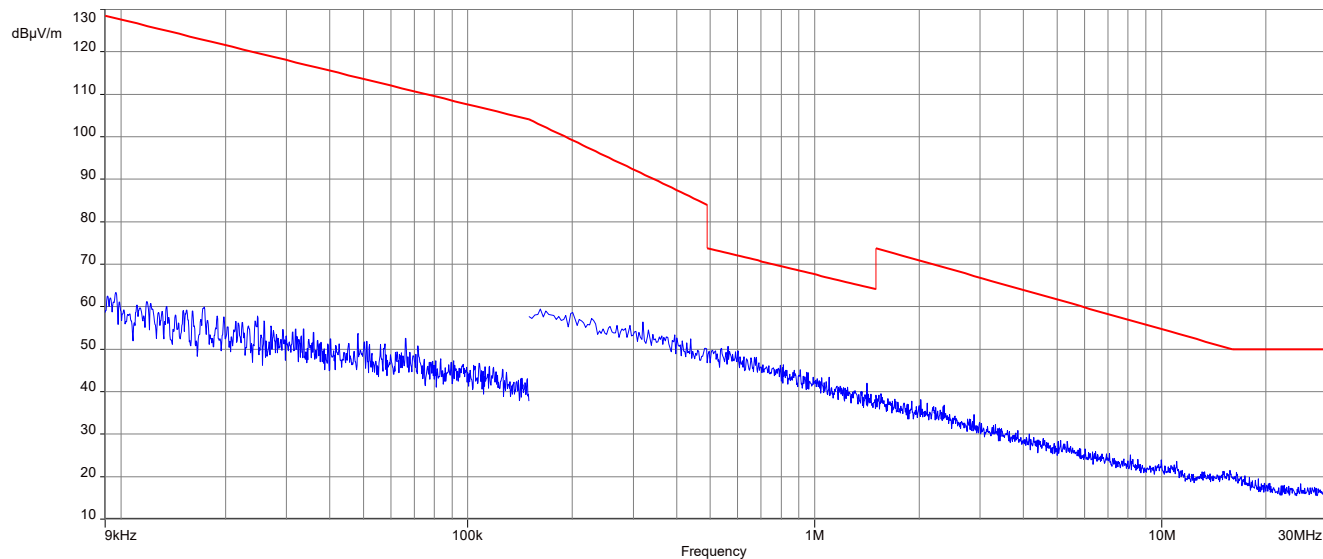
Plot 9: 9 kHz to 30 MHz, 2480 MHz, transmit mode, 1 Msps, 2J Antennas 2JF1002P



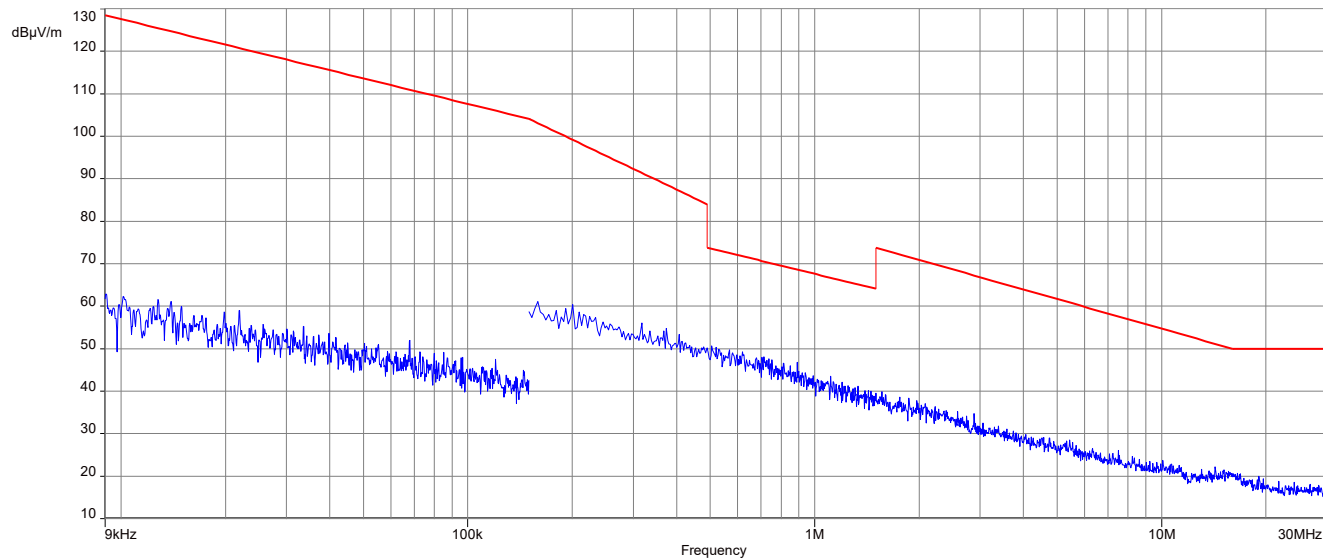
Plot 10: 9 kHz to 30 MHz, 2404 MHz, transmit mode, 2 Msps, 2J Antennas 2JF1002P



Plot 11: 9 kHz to 30 MHz, 2440 MHz, transmit mode, 2 Msps, 2J Antennas 2JF1002P



Plot 12: 9 kHz to 30 MHz, 2478 MHz, transmit mode, 2 Msps, 2J Antennas 2JF1002P



14.4 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 frequencies are 2402 MHz, 2440 MHz and 2480 MHz.

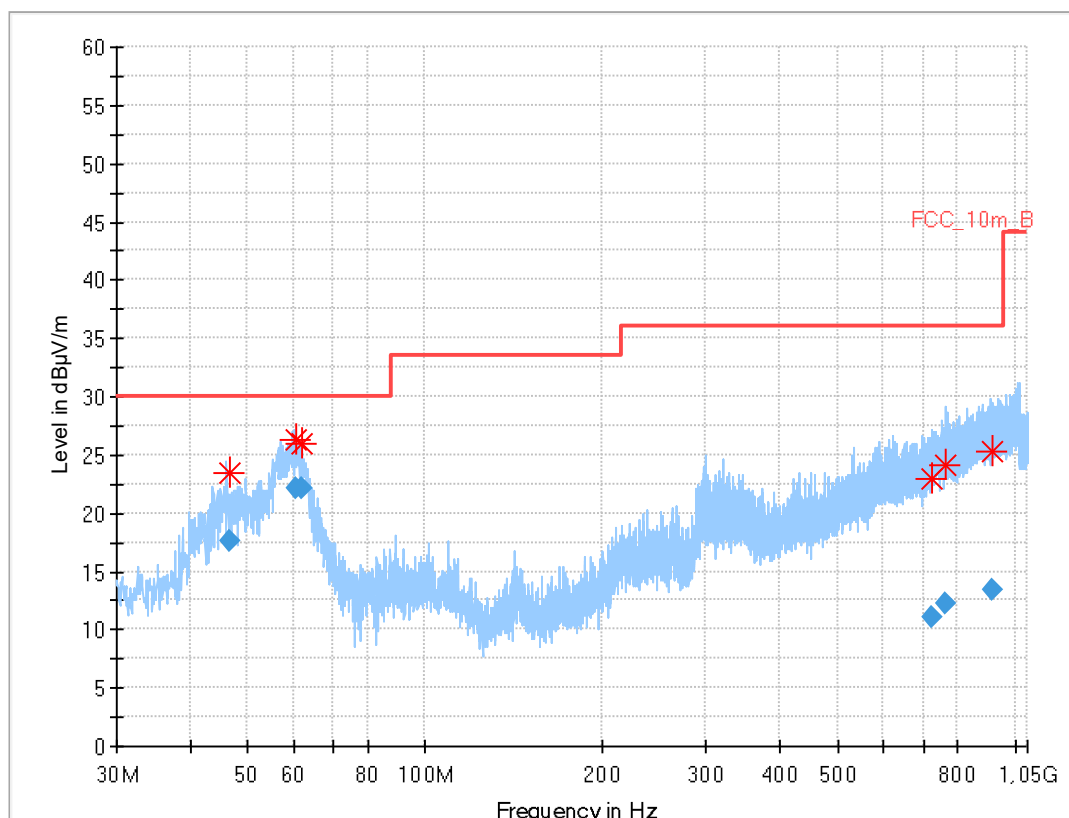
Measurement parameters	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	120 kHz
Video bandwidth	3 x RBW
Span	30 MHz to 1 GHz
Trace mode	Max hold
Measured modulation	GFSK
Test setup	See sub clause 10.1 setup A
Measurement uncertainty	See sub clause 15

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

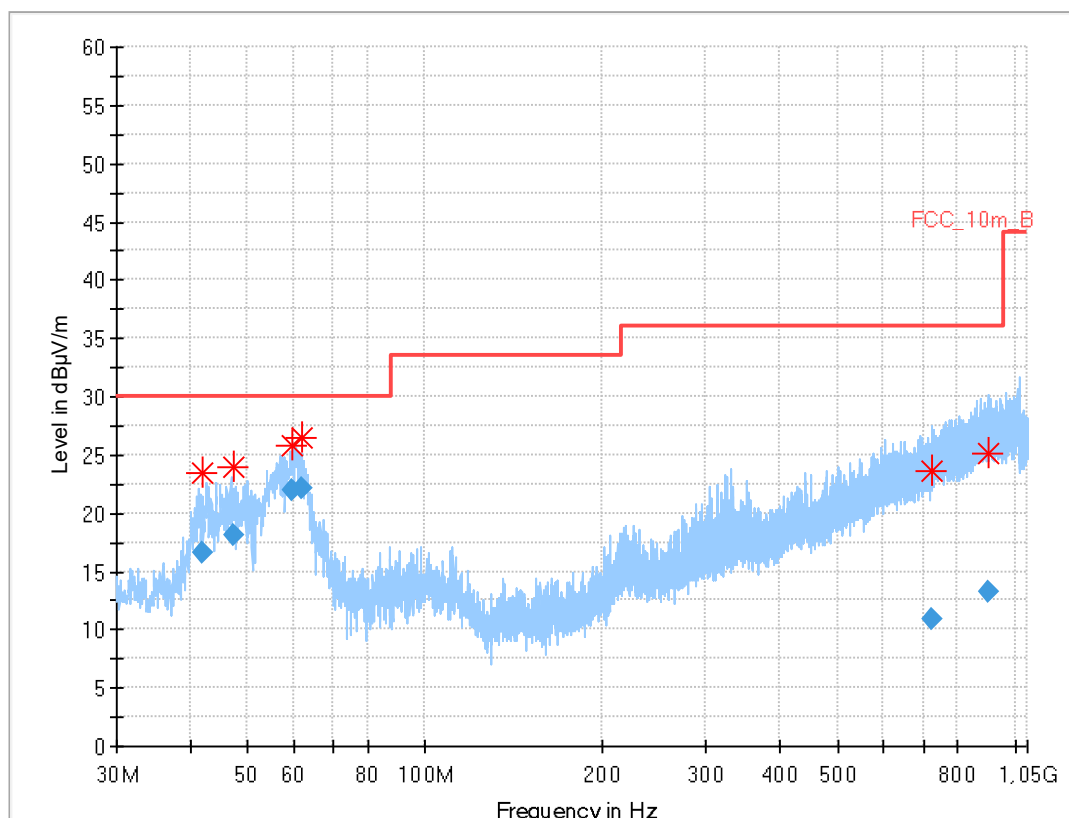
Plot 1: 30 MHz to 1 GHz, TX mode, vertical & horizontal polarization, 1 Msps, valid for all channels, Taoglas GW.51.5153



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)
46.592040	17.60	30.00	12.40	1000.0	120.000	101.0	V	307.0	14.3
60.312600	22.10	30.00	7.90	1000.0	120.000	138.0	V	-34.0	13.5
61.621440	22.11	30.00	7.89	1000.0	120.000	195.0	V	-24.0	12.7
725.465040	11.02	36.00	24.98	1000.0	120.000	195.0	V	180.0	22.4
763.378320	12.18	36.00	23.82	1000.0	120.000	195.0	V	307.0	23.3
912.150360	13.38	36.00	22.62	1000.0	120.000	119.0	H	172.0	24.8

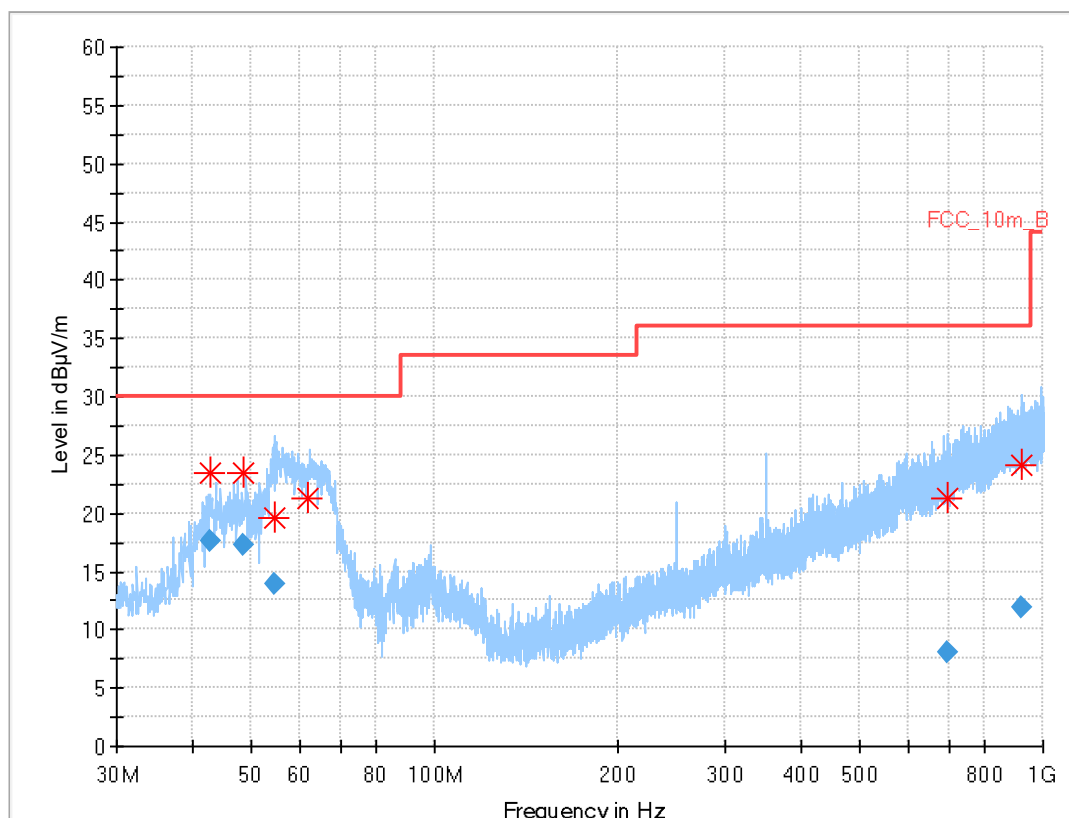
Plot 2: 30 MHz to 1 GHz, TX mode, vertical & horizontal polarization, 2 Msps, valid for all channels, Taoglas GW.51.5153



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)
42.066120	16.61	30.00	13.39	1000.0	120.000	150.0	V	80.0	13.9
47.269800	18.02	30.00	11.98	1000.0	120.000	101.0	V	57.0	14.3
59.646480	21.99	30.00	8.01	1000.0	120.000	109.0	V	162.0	13.9
61.622040	22.18	30.00	7.82	1000.0	120.000	132.0	V	154.0	12.7
720.597600	10.95	36.00	25.05	1000.0	120.000	163.0	H	111.0	22.3
903.381960	13.17	36.00	22.83	1000.0	120.000	195.0	V	191.0	24.8

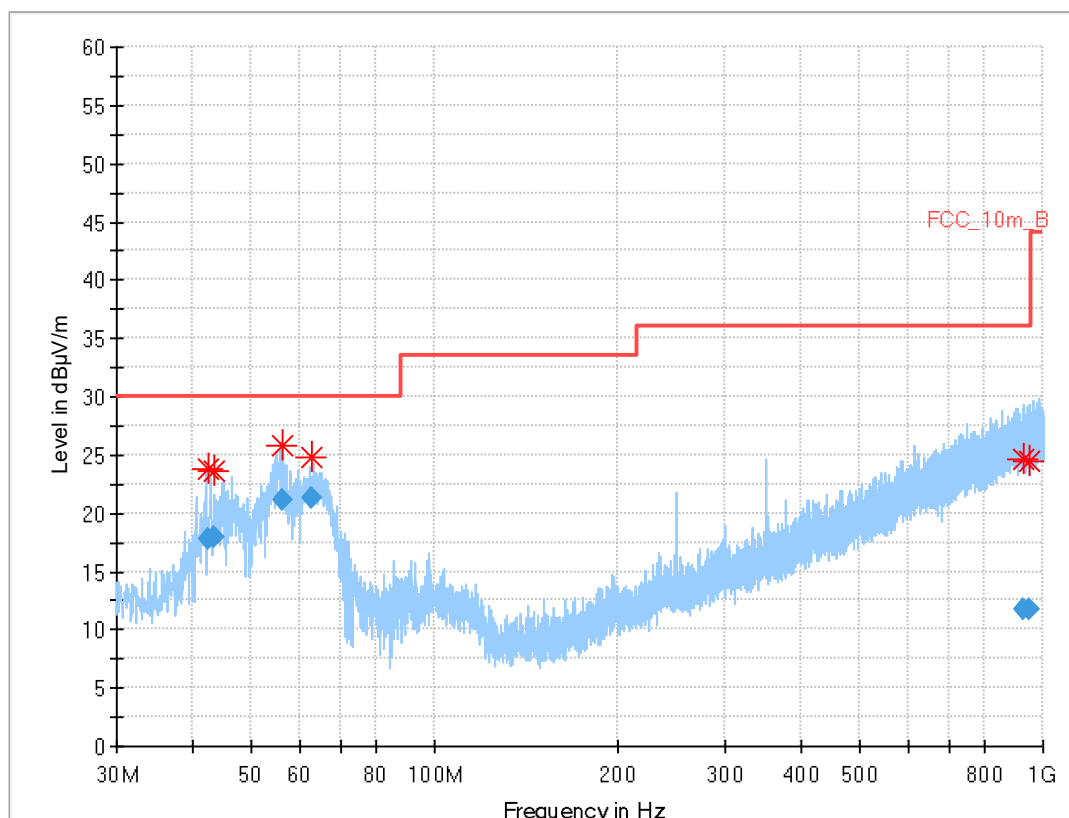
Plot 3: 30 MHz to 1 GHz, TX mode, vertical & horizontal polarization, 1 Msps, valid for all channels, 2J Antennas 2JF1002P



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)
42.611780	17.61	30.00	12.39	1000.0	120.000	109.0	V	10.0	14.0
48.470080	17.33	30.00	12.67	1000.0	120.000	170.0	V	-8.0	14.4
54.722140	13.98	30.00	16.02	1000.0	120.000	170.0	V	10.0	14.6
61.984580	-1.99	30.00	31.99	1000.0	120.000	101.0	V	190.0	12.6
697.279380	7.99	36.00	28.01	1000.0	120.000	170.0	V	84.0	21.8
924.560700	11.87	36.00	24.13	1000.0	120.000	170.0	V	100.0	24.8

Plot 4: 30 MHz to 1 GHz, TX mode, vertical & horizontal polarization, 2 Msps, valid for all channels, 2J Antennas 2JF1002P



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)
42.561980	17.75	30.00	12.25	1000.0	120.000	170.0	V	280.0	14.0
43.339220	17.96	30.00	12.04	1000.0	120.000	170.0	V	262.0	14.1
56.251360	21.19	30.00	8.81	1000.0	120.000	101.0	V	190.0	15.3
62.640600	21.30	30.00	8.70	1000.0	120.000	98.0	V	190.0	12.4
927.924520	11.65	36.00	24.35	1000.0	120.000	170.0	V	-8.0	24.8
947.394040	11.69	36.00	24.31	1000.0	120.000	170.0	V	280.0	24.8

14.5 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 frequencies are 2402 MHz, 2440 MHz and 2480 MHz.

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	GFSK
Test setup	See sub clause 10.2 setup A (1 GHz - 18 GHz) See sub clause 10.3 setup A (18 GHz - 26 GHz)
Measurement uncertainty	See sub clause 15

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 (Average)	3
Above 960	74.0 (Peak)	3

Results: Transmitter mode, 1 Msps, Taoglas GW.51.5153

TX spurious emissions radiated [dBµV/m]											
2402 MHz				2440 MHz				2480 MHz			
F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]
All detected emissions are more than 20 dB below the limit.											
4804	Peak	50.0	24.0	4880	Peak	52.1	21.9	4960	Peak	52.5	21.5
	AVG	41.5	12.5		AVG	45.6	8.4		AVG	45.5	8.5

Results: Transmitter mode, 2 Msps, Taoglas GW.51.5153

TX spurious emissions radiated [dBµV/m]											
2404 MHz				2440 MHz				2478 MHz			
F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]
All detected emissions are more than 20 dB below the limit.											
4808	Peak	52.9	21.1	4880	Peak	53.1	20.9	4956	Peak	52.4	21.6
	AVG	45.1	8.9		AVG	45.3	8.7		AVG	44.0	10.0

Results: Transmitter mode, 1 Msps, 2J Antennas 2JF1002P

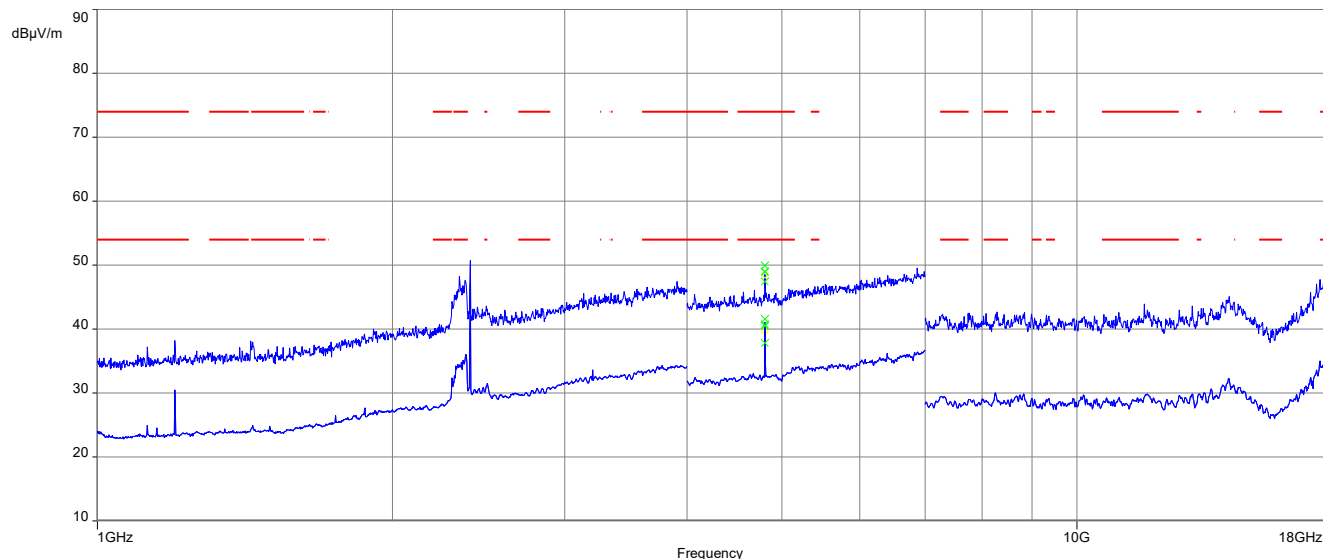
TX spurious emissions radiated [dBµV/m]											
2402 MHz				2440 MHz				2480 MHz			
F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]
All detected emissions are more than 20 dB below the limit.											
4804	Peak	51.8	22.8	4880	Peak	52.3	21.7	4960	Peak	50.9	23.1
	AVG	45.4	8.6		AVG	45.4	8.6		AVG	42.4	11.6

Results: Transmitter mode, 2 Msps, 2J Antennas 2JF1002P

TX spurious emissions radiated [dBµV/m]											
2404 MHz				2440 MHz				2478 MHz			
F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]	F [MHz]	Detector	Level [dBµV/m]	Margin [dB]
All detected emissions are more than 20 dB below the limit.											
4808	Peak	52.6	21.4	4880	Peak	52.8	21.2	4956	Peak	51.4	22.6
	AVG	44.5	9.5		AVG	44.6	9.4		AVG	42.8	11.2

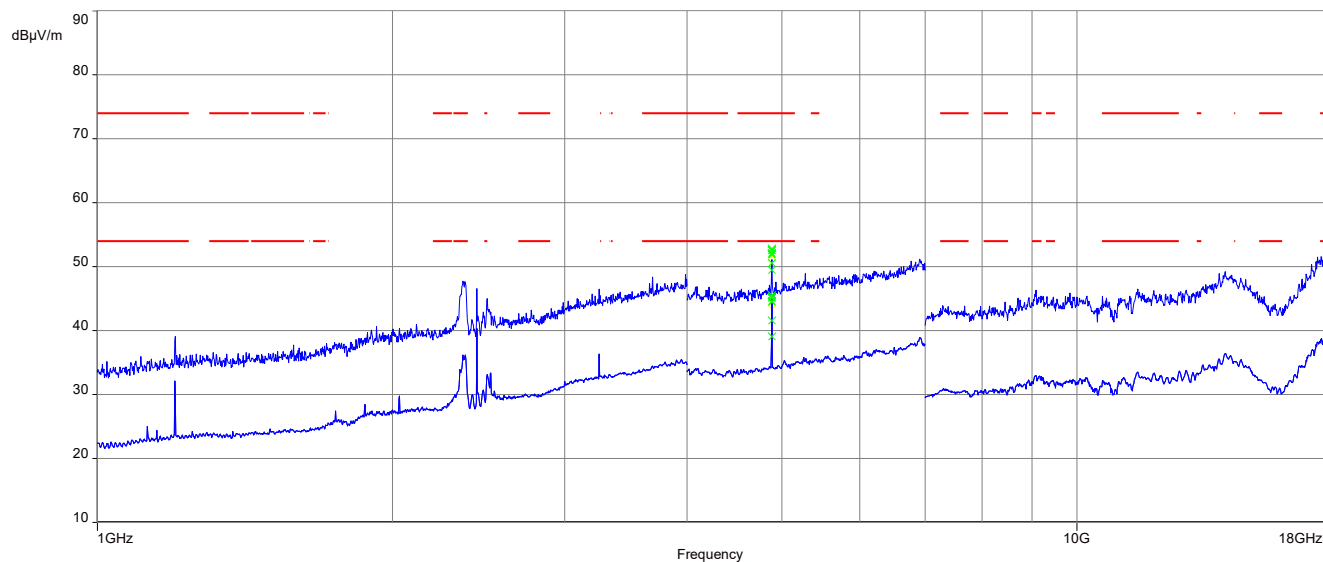
Plots: Transmitter mode

Plot 1: 1 GHz to 18 GHz, TX mode, 2402 MHz, vertical & horizontal polarization, 1 Msps, Taoglas GW.51.5153



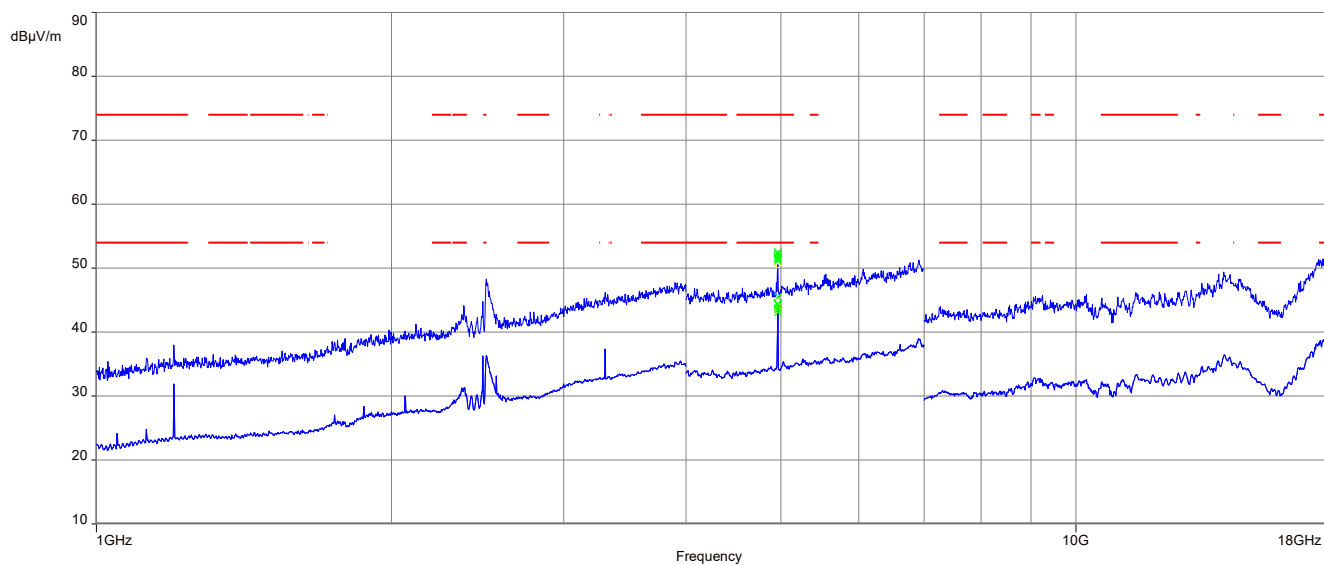
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: 1 GHz to 18 GHz, TX mode, 2440 MHz, vertical & horizontal polarization, 1 Msps, Taoglas GW.51.5153



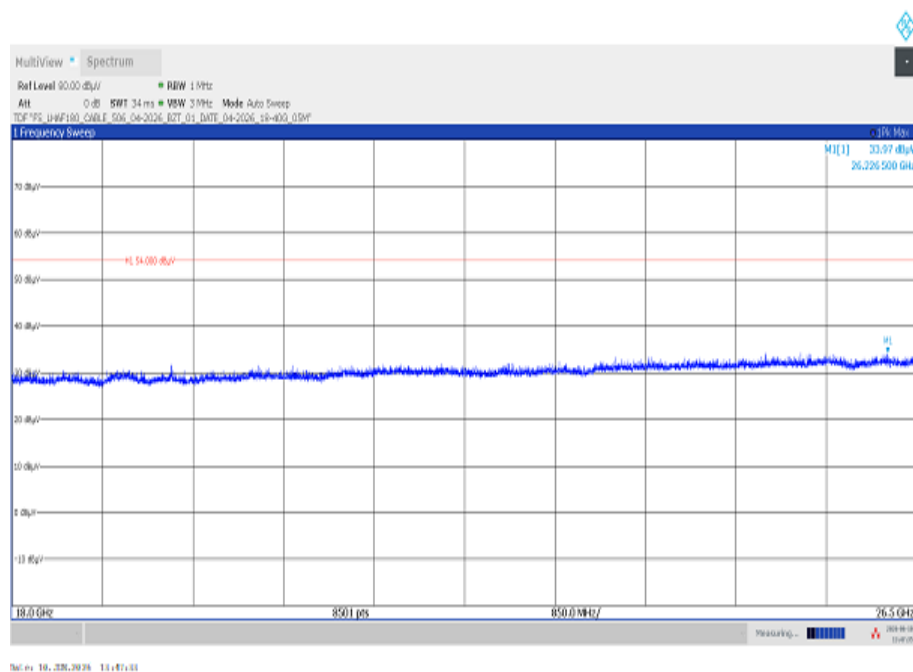
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: 1 GHz to 18 GHz, TX mode, 2480 MHz, vertical & horizontal polarization, 1 Msps, Taoglas GW.51.5153

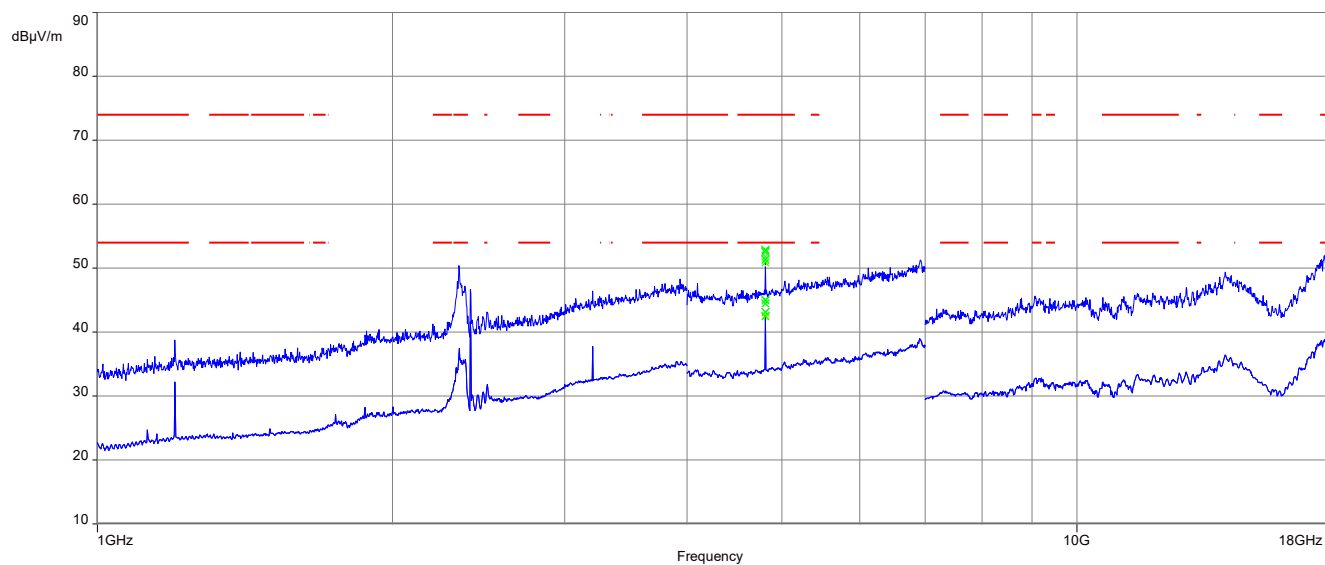


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 18 GHz to 26 GHz, TX mode, 2480 MHz, vertical & horizontal polarization, 1 Msps, Taoglas GW.51.5153

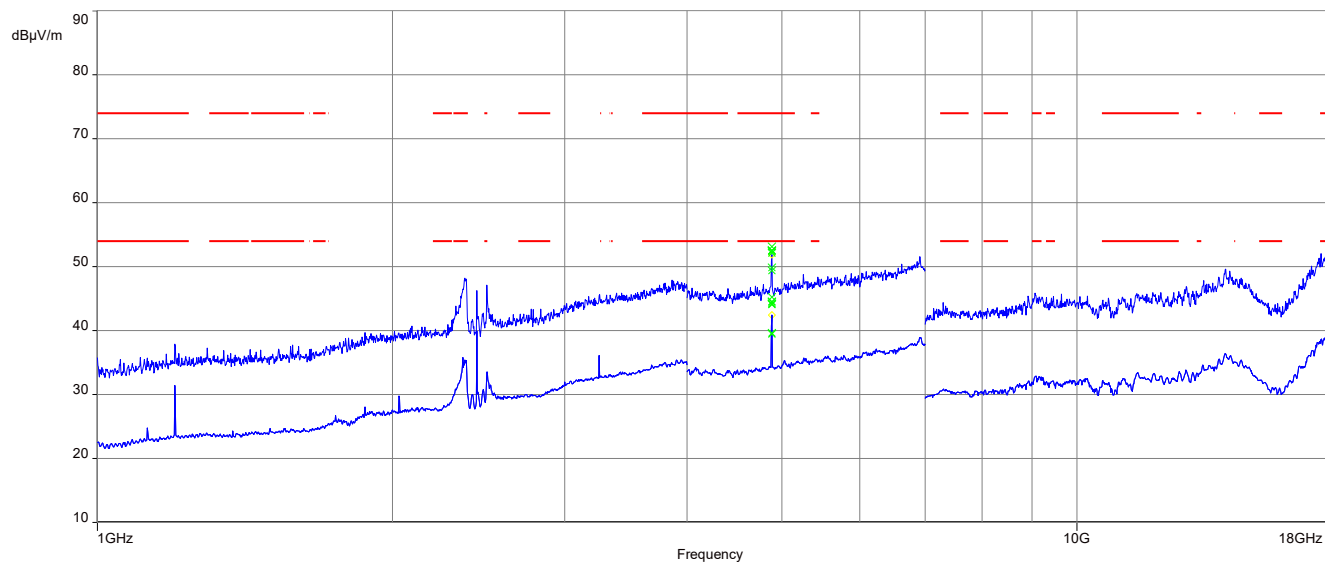


Plot 5: 1 GHz to 18 GHz, TX mode, 2404 MHz, vertical & horizontal polarization, 2 Msps, Taoglas GW.51.5153



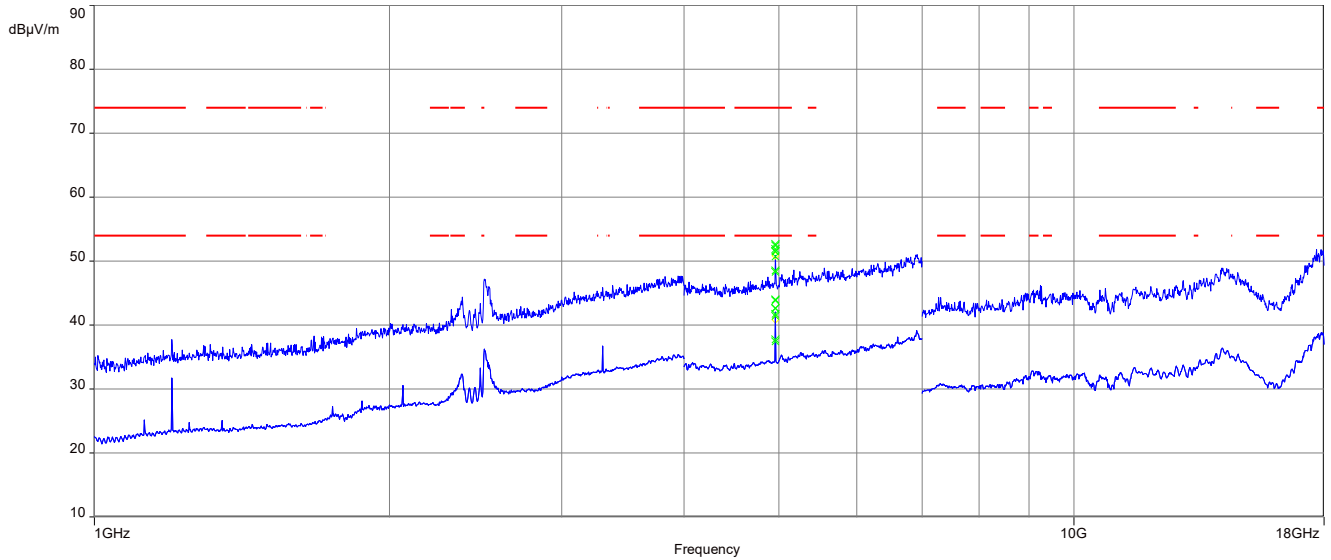
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: 1 GHz to 18 GHz, TX mode, 2440 MHz, vertical & horizontal polarization, 2 Msps, Taoglas GW.51.5153



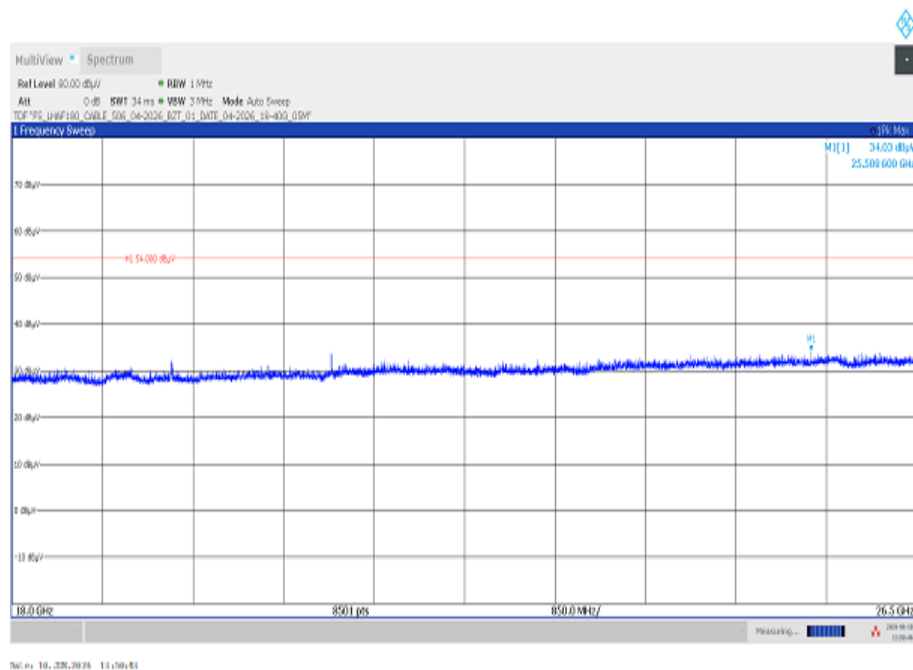
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 7: 1 GHz to 18 GHz, TX mode, 2478 MHz, vertical & horizontal polarization, 2 Msps, Taoglas GW.51.5153

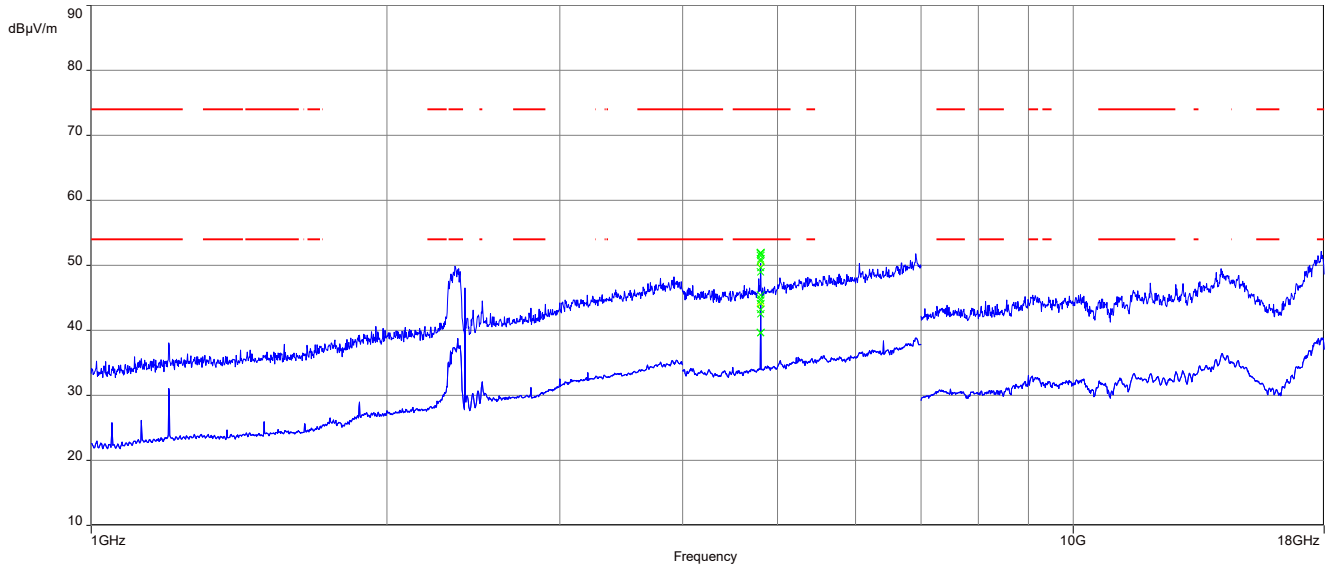


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 8: 18 GHz to 26 GHz, TX mode, 2478 MHz, vertical & horizontal polarization, 2 Msps, Taoglas GW.51.5153

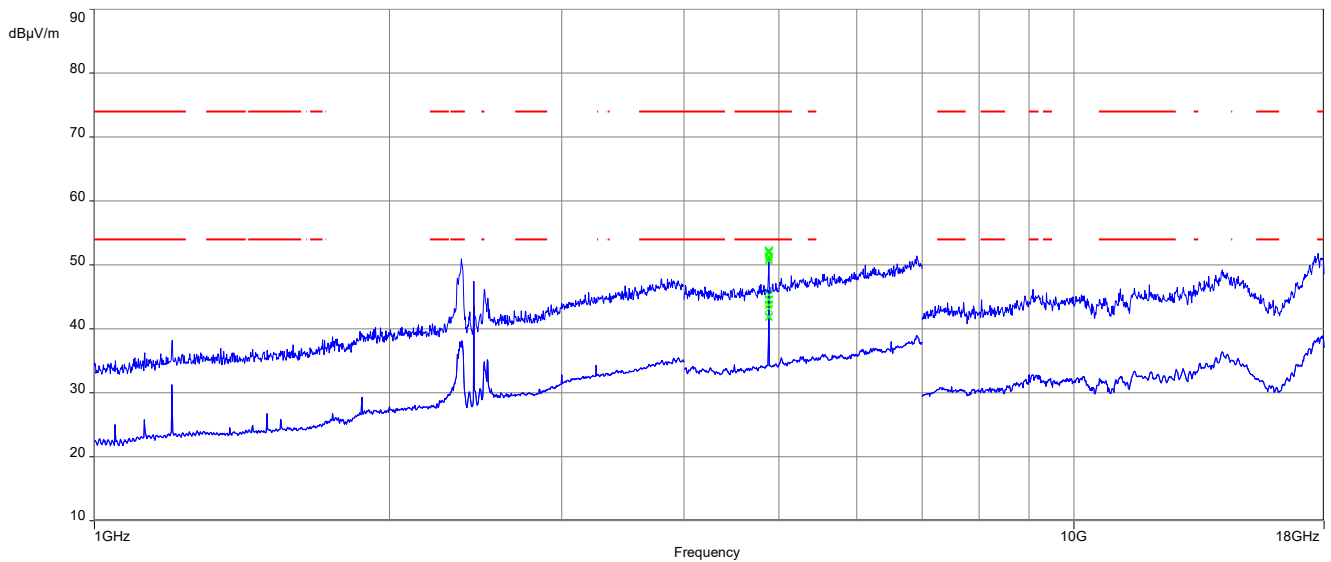


Plot 9: 1 GHz to 18 GHz, TX mode, 2402 MHz, vertical & horizontal polarization, 1 Msps, 2J Antennas 2JF1002P



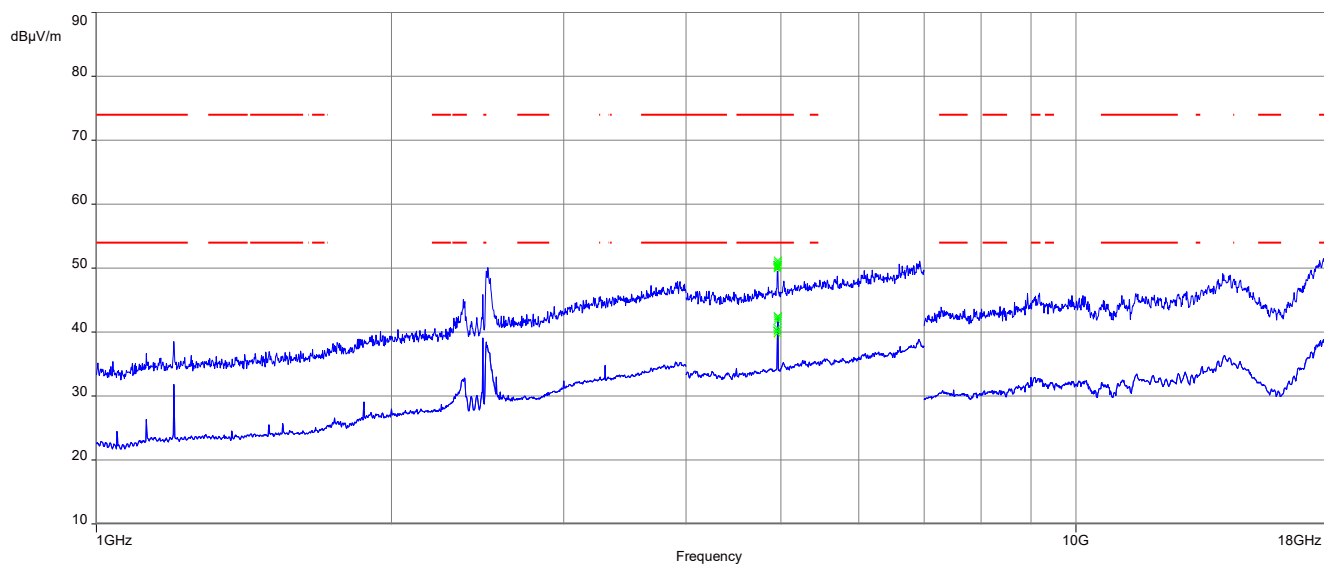
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 10: 1 GHz to 18 GHz, TX mode, 2440 MHz, vertical & horizontal polarization, 1 Msps, 2J Antennas 2JF1002P



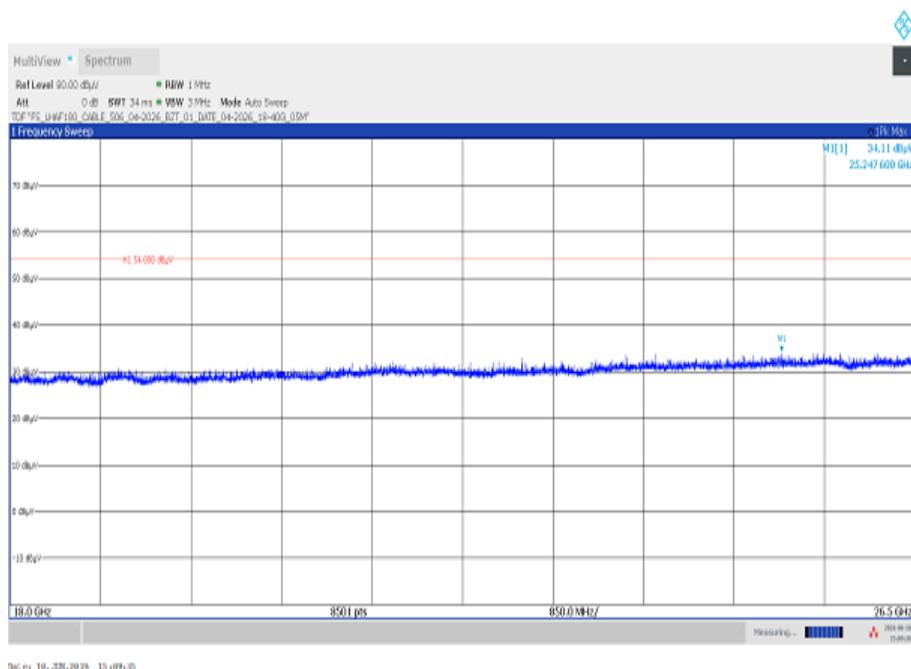
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 11: 1 GHz to 18 GHz, TX mode, 2480 MHz, vertical & horizontal polarization, 1 Msps, 2J Antennas 2JF1002P

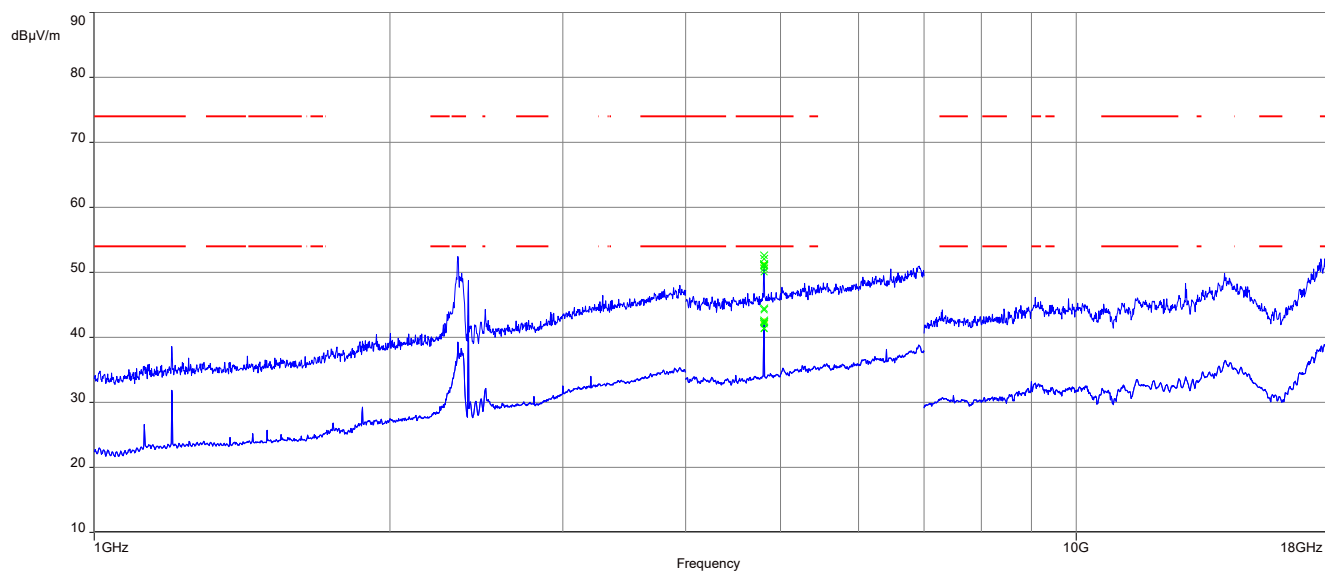


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 12: 18 GHz to 26 GHz, TX mode, 2480 MHz, vertical & horizontal polarization, 1 Msps, 2J Antennas 2JF1002P

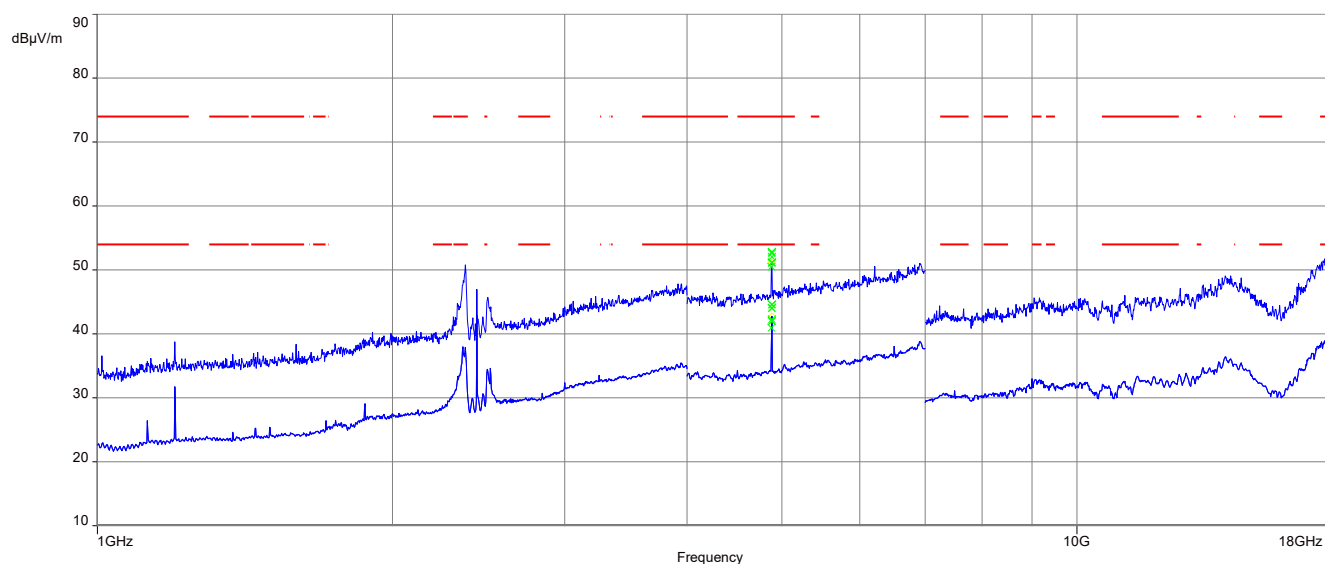


Plot 13: 1 GHz to 18 GHz, TX mode, 2404 MHz, vertical & horizontal polarization, 2 Msps, 2J Antennas 2JF1002P



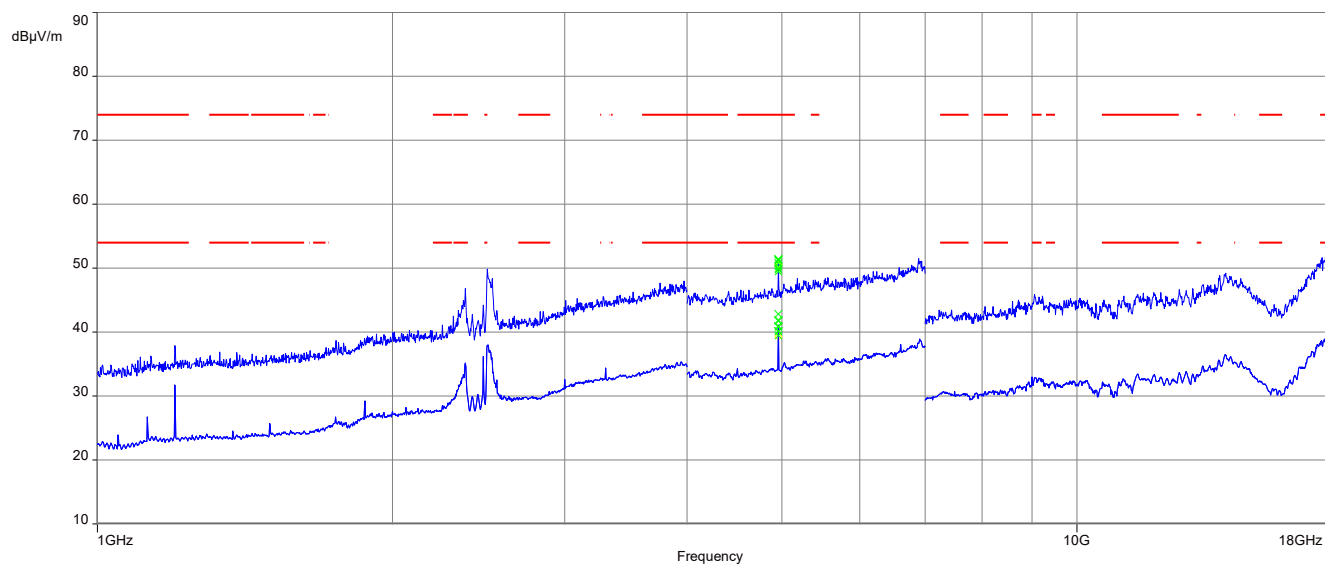
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 14: 1 GHz to 18 GHz, TX mode, 2440 MHz, vertical & horizontal polarization, 2 Msps, 2J Antennas 2JF1002P



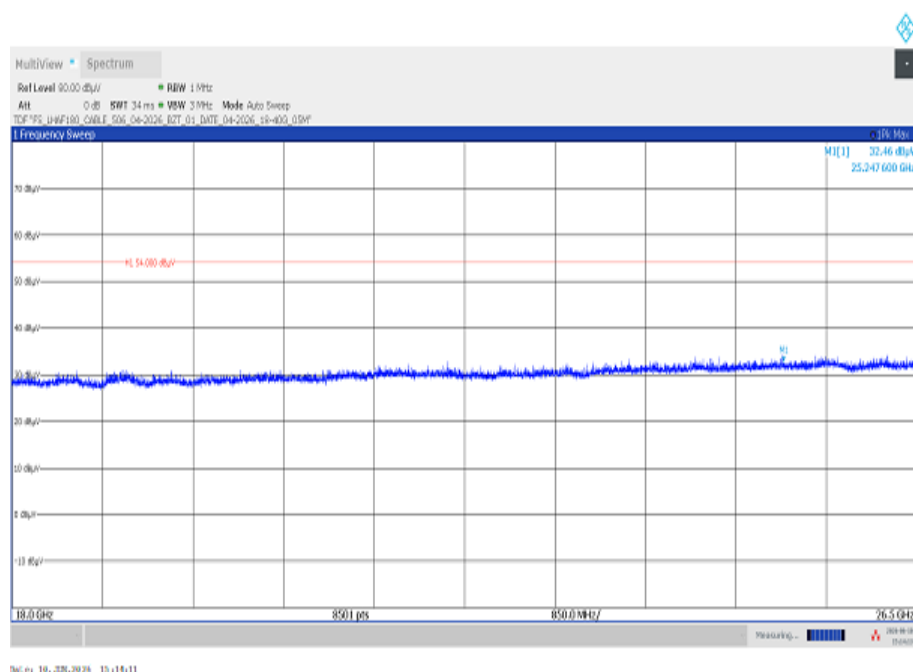
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 15: 1 GHz to 18 GHz, TX mode, 2478 MHz, vertical & horizontal polarization, 2 Msps, 2J Antennas 2JF1002P



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

Plot 16: 18 GHz to 26 GHz, TX mode, 2478 MHz, vertical & horizontal polarization, 2 Msps, 2J Antennas 2JF1002P



15 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Antenna gain	± 3 dB
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
Band edge compliance conducted	± 1.5 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

END OF TEST REPORT