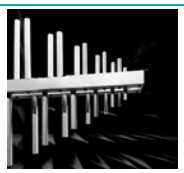
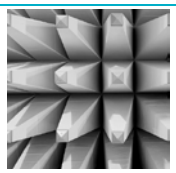

cetecom advanced

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-00

Test report no.: 1-4466_22-03-02-A

Testing laboratory

cetecom advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: https://cetecomadvanced.com
e-mail: mail@cetecomadvanced.com

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

Philips Medizin Systeme Böblingen GmbH
Hewlett-Packard-Strasse 2
71034 Böblingen / GERMANY
Phone: +4970314631122
Contact: Segun Adeniji
e-mail: Segun.Adeniji@philips.com

Manufacturer

Philips Medizin Systeme Böblingen GmbH
Hewlett-Packard-Strasse 2
71034 Böblingen / GERMANY

Test standard/s

FCC - Title 47 CFR Part 27	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services

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

Test Item

Kind of test item:	**Evoline - WMTS Radio Transceiver**
Model name:	**WMTS-BBN1**
FCC ID:	**PQC-WMTS-BBN1**
Frequency:	1390 MHz to 1395 MHz; 1432 MHz to 1435 MHz
Technology tested:	WMTS
Antenna:	Three different external antenna
Power supply:	3.3 V DC by external power supply
Temperature range:	-5°C to +70°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:

cn=Marco Bertolino, o=cetecom advanced GmbH, ou=BTL-230530, email=marco.bertolino@cetecomadvanced.com, c=DE
2024.03.22 09:31:52 +01'00'

Marco Bertolino
Supervisor Radio Services
Radio Labs

Test performed:

cn=Michael Dorongovski, o=cetecom advanced GmbH, ou=DOR-230601, email=michael.dorongovski@cetecomadvanced.com, c=DE
2024.03.22 08:17:51 +01'00'

Michael Dorongovski
Lab Manager
Radio Labs

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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In no case this test report can be considered as a Letter of Approval.

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

This test report replaces the test report no. 1-4466_22-03-02 dated on 2023-10-12.

2.2 Application details

Date of receipt of order:	2023-07-14
Date of receipt of test item:	2023-07-17
Start of test:*	2023-05-23
End of test:*	2023-07-19
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.

2.3 Test laboratories sub-contracted

None

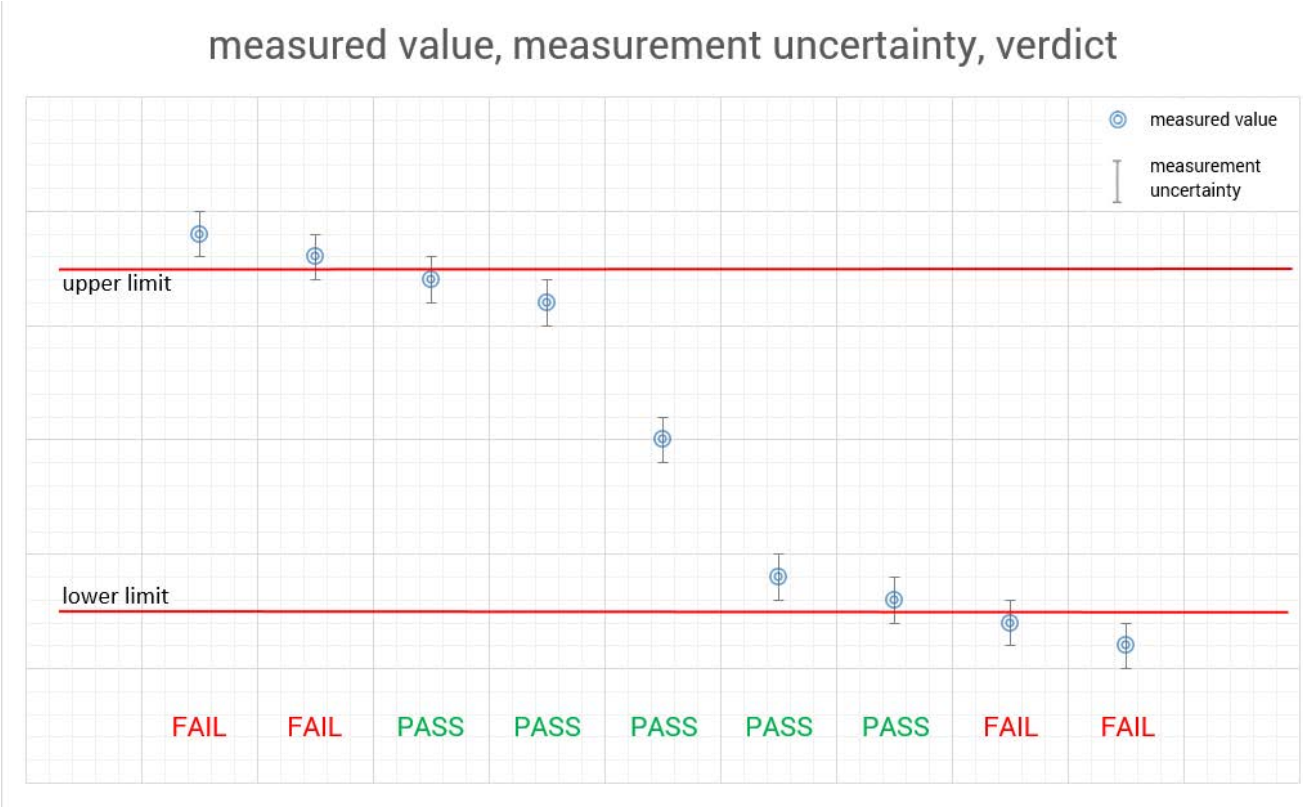
3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 27		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services

Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.26-2015	-/-	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, 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."



5 Test environment

Temperature :	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +55 °C during high temperature tests -30 °C during low temperature tests
Relative humidity content :		55 %
Barometric pressure :		1021 hpa
Power supply :	V_{nom} V_{max} V_{min}	3.3 V DC by external power supply 3.8 V DC by external power supply 2.8 V DC by external power supply

6 Test item

6.1 General description

Kind of test item :	Evoline - WMTS Radio Transceiver
Model name :	WMTS-BBN1
S/N serial number :	Sample #1
Hardware status :	2226
Software status :	N/A
Firmware status :	V0503
Frequency band :	1390 MHz to 1395 MHz; 1432 MHz to 1435 MHz
Type of radio transmission : Use of frequency spectrum :	Modulated carrier
Type of modulation :	DBPSK, DQPSK, D8PSK
Number of channels :	5
Antenna :	Three different external antenna Antenna 1: 453564271931 Antenna 2: 453564682551 Antenna 3: 453564521801 (not tested)
Power supply :	3.3 V DC by external power supply
Temperature range :	-5°C to +70°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: 1-4466_22-03-01_AnnexA
1-4466_22-03-01_AnnexB
1-4466_22-03-01_AnnexD

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 ± 45° 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.

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).

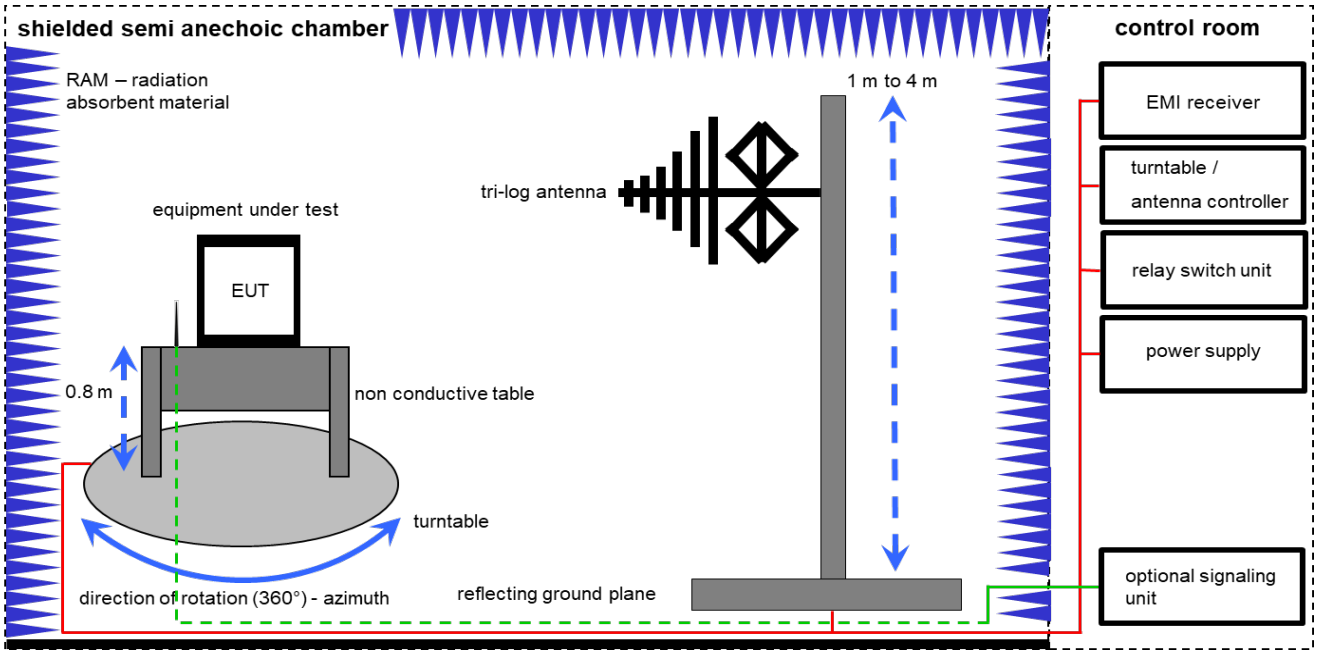
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

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

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

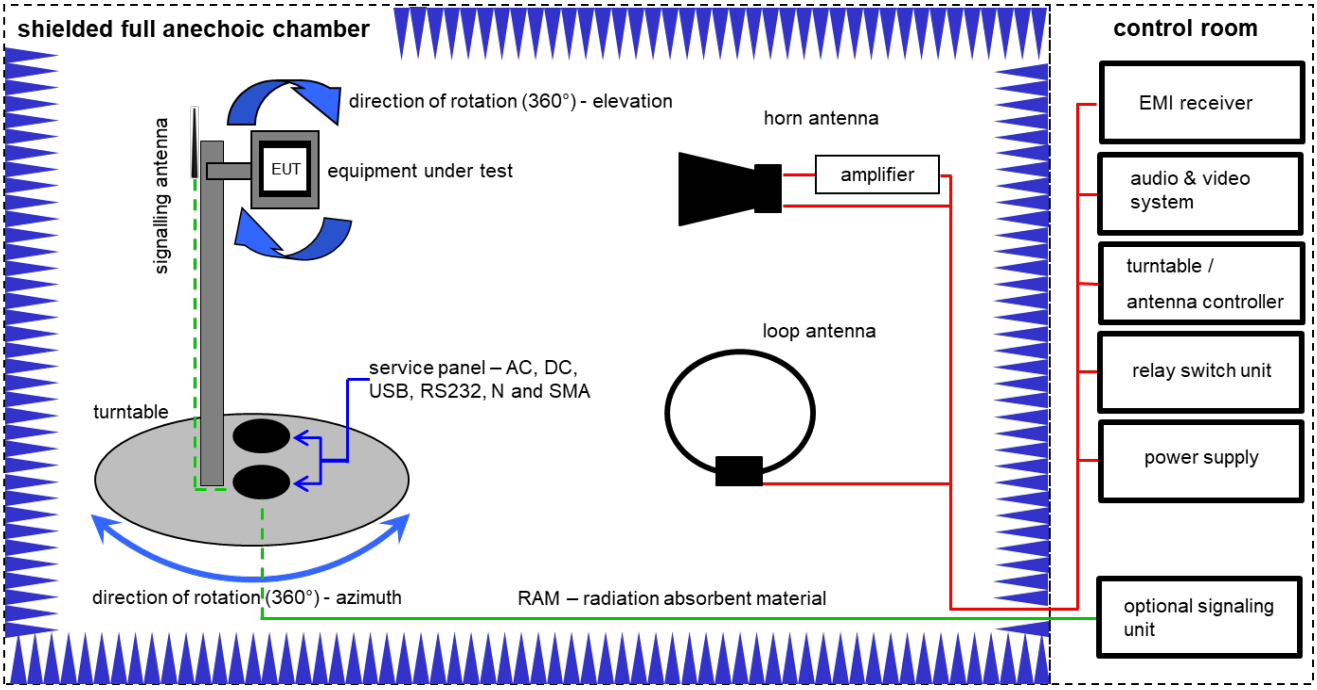
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	Semi anechoic chamber	3000023	MWB AG	-/-	300000551	ne	-/-	-/-
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vlKl!	30.09.2021	29.09.2023
7	A	Turntable	2089-4.0	EMCO	-/-	300004394	ne	-/-	-/-
8	A	PC	TecLine	F+W	-/-	300004388	ne	-/-	-/-
9	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	09.12.2022	31.12.2023

8.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter / 1 meter

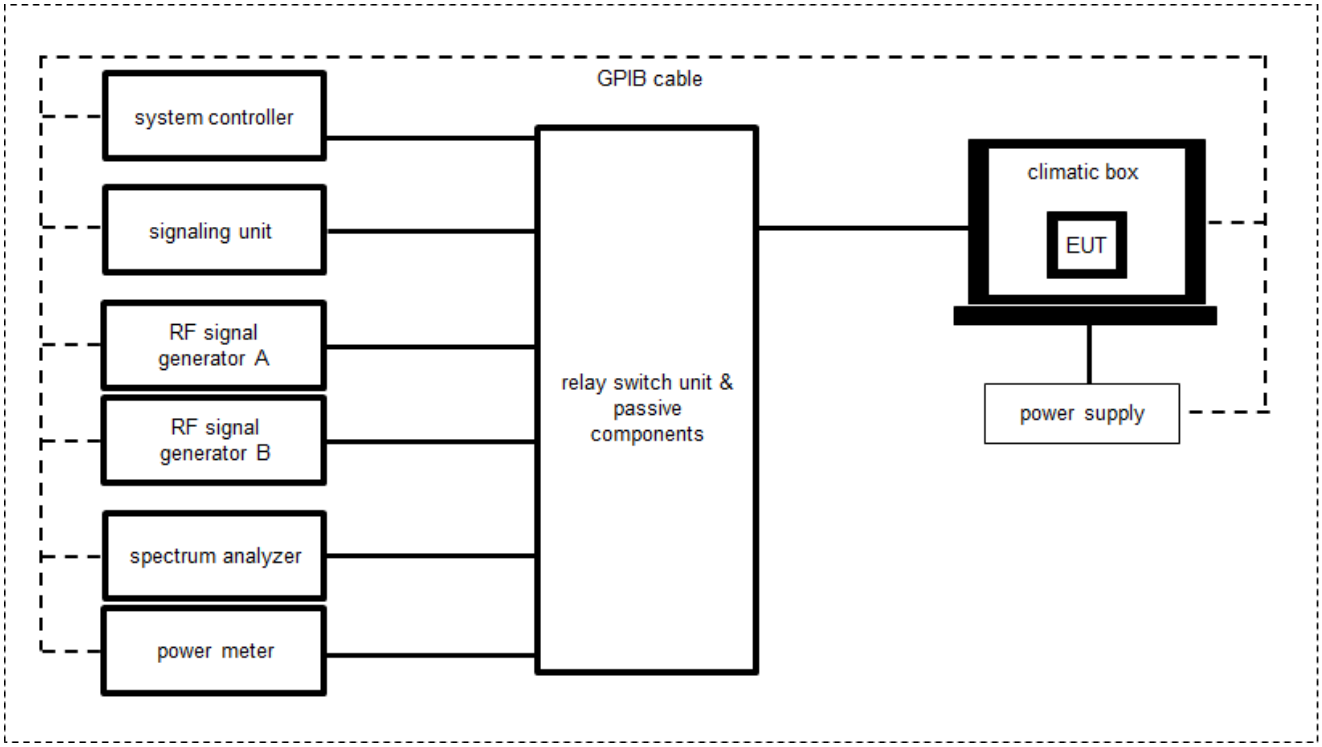
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	02.08.2021	31.08.2023
2	B	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vlKl!	01.07.2021	31.07.2023
3	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
4	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22051	300004483	ev	-/-	-/-
5	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
6	A, B	Computer	Intel Core i3 3220/3,3 GHz, Prozessor	-/-	2V2403033A5421	300004591	ne	-/-	-/-
7	A, B	NEXIO EMV-Software	BAT EMC V2022.0.22.0	Nexio	-/-	300004682	ne	-/-	-/-
8	A, B	Anechoic chamber	-/-	TDK	-/-	300003726	ne	-/-	-/-
9	A, B	EMI Test Receiver 9kHz-26,5GHz	ESR26	Rohde & Schwarz	101376	300005063	k	13.12.2022	31.12.2023
10	A	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011571	300005240	ev	-/-	-/-

8.3 Conducted measurements



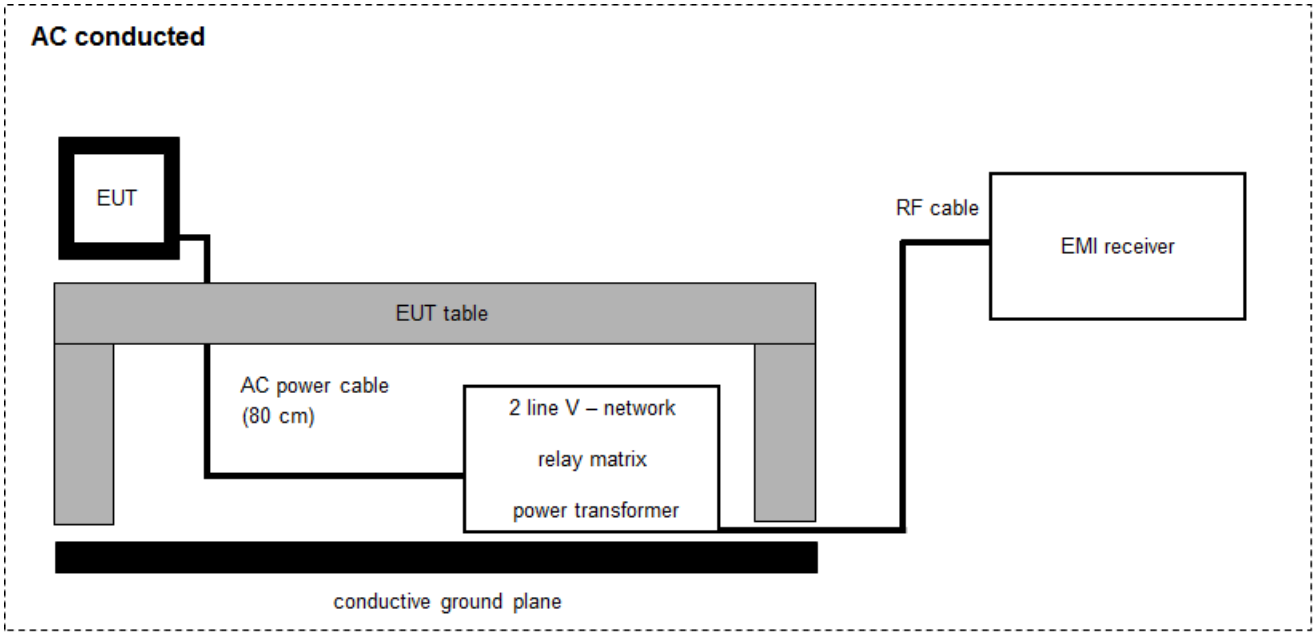
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

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	Switch / Control Unit (including DC-Block, Splitter)	3488A	HP	-/-	300000929	ne	-/-	-/-
2	A	Hygro-Thermometer	-/-, 5-45C, 20-100rF	Thies Clima	-/-	400000080	ev	15.09.2022	14.09.2024
3	A	Signal analyzer	FSV30	Rohde&Schwarz	1321.3008K30/ 103170	300004855	vlKl!	09.12.2022	31.12.2024
4	A	USB-GPIB-Interface	82357B	Agilent Technologies	MY54323070	300004852	ne	-/-	-/-
5	A	Tester Software C.BER	Version 5.0	cetecom advanced GmbH	0001	400001379	ne	-/-	-/-
6	A	Switch matrix	RSM 1.1	cetecom advanced GmbH	31534892	400001456	ev	20.09.2022	19.09.2023

8.4 AC conducted



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

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	Rohde & Schwarz	892475/017	300002209	vlKl!	14.12.2021	13.12.2023
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	NK!	-/-	-/-
4	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-
5	A	PC	TecLine	F+W	-/-	300003532	ne	-/-	-/-
6	A	Netzsimulation 1600/2000 A	ACS-1600-PS	-/-	2002-001247-0	300006074	ev	-/-	-/-
7	A	EMI Test Receiver	ESR	R&S	102981	300006318	k	24.05.2022	23.05.2023

NOTE: These tests were performed before 23.05.2023

9 Measurement uncertainty

Measurement uncertainty		
Test case	**Uncertainty**	
Antenna gain	± 3 dB	
99 % bandwidth	± RBW	
-26 dB bandwidth	± RBW	
Frequency stability	10^{-6}	
Maximum output power conducted	± 1.56 dB	
Block edge compliance	± 1.56 dB	
Spurious emissions conducted	> 3.6 GHz	± 1.56 dB
	> 7 GHz	± 1.56 dB
	> 18 GHz	± 2.31 dB
	≥ 40 GHz	± 2.97 dB
Spurious emissions radiated below 30 MHz	± 3 dB	
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB	
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB	
Spurious emissions radiated above 12.75 GHz	± 4.5 dB	

10 Additional information and comments

Reference documents: Customer_Questionnaire_WMTS (002).docx
IIT Board controller - user guide.docx

Special test descriptions: Channel, frequencies and modulation plan:

Terestrial Mode		
12	1391.452 MHz	DBPSK, DQPSK, D8PSK
13	1393.180 MHz	DBPSK, DQPSK, D8PSK
14	1394.908 MHz	DBPSK, DQPSK, D8PSK
15	1431.969 MHz	DBPSK, DQPSK, D8PSK
16	1433.697 MHz	DBPSK, DQPSK, D8PSK

NOTE: The spectrum of the channels 14 and 15 is not completely covered in the frequency bands according to FCC Part 27. The second part of the spectrum of these channels is in the frequency bands 1395 MHz to 1400 MHz and 1427 MHz to 1432 MHz according to FCC Part 95 Subpart H. The test results according to FCC Part 95 Subpart H are in the test report no. 1-4466_22-01-05.

Configuration descriptions: Radiated tests were performed on both antennas.

EUT selection:

☒ Only one device available

☐ Devices selected by the customer

☐ Devices selected by the laboratory (Randomly)

11 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	FCC: CFR Part 2 & Part 27	See table	2024-03-22	-/-

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power Part 2.1046(a) Part 27.50(e)	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability Part 27.54	Extreme	Extreme	☒	☐	☐	☐	-/-
Spurious Emissions Radiated Part 27.53(j)	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions and band edge Conducted Part 27.53(j)	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth Part 2.1049	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107(a) §15.207 Conducted emissions below 30 MHz (AC conducted)	Nominal	Nominal	☒	☐	☐	☐	-/-

Notes:

C	Compliant	**NC**	Not compliant	**NA**	Not applicable	**NP**	Not performed

12 RF measurements

12.1 RF output power

Measurement parameters	
Detector:	Peak
Resolution bandwidth:	3 MHz
Video bandwidth:	10 MHz
Used equipment:	See chapter 8.3 setup A
Measurement uncertainty:	See chapter 9

Limits:

FCC
Part 2.1046(a) Part 27.50(e)
Mobile stations transmitting in the 1390–1392 MHz and 1432–1435 MHz bands are limited to 4 watts EIRP peak power. Mobile stations transmitting in the1392–1395 MHz band are limited to 1 watt EIRP peak power.
30 dBm e.i.r.p

Results:

Channel	Modulation	Peak conducted output power [dBm]
12	DBPSK	14.4
12	DQPSK	14.6
12	D8PSK	14.1
13	DBPSK	14.5
13	DQPSK	14.3
13	D8PSK	14.2
14	DBPSK	14.9
14	DQPSK	14.8
14	D8PSK	14.6
15	DBPSK	14.9
15	DQPSK	14.8
15	D8PSK	14.6
16	DBPSK	14.7
16	DQPSK	14.6
16	D8PSK	14.4

Channel	Modulation	Peak e.i.r.p. output power [dBm]
12	DBPSK	12.0
12	DQPSK	12.2
12	D8PSK	11.7
13	DBPSK	12.1
13	DQPSK	11.9
13	D8PSK	11.8
14	DBPSK	12.5
14	DQPSK	12.4
14	D8PSK	12.2
15	DBPSK	12.5
15	DQPSK	12.4
15	D8PSK	12.2
16	DBPSK	12.3
16	DQPSK	12.2
16	D8PSK	12.0

NOTE: The maximum antenna gain of -2.4 dBi was declared by the applicant.

12.2 Frequency stability

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Settings:	According to ANSI C63.26-2015 Chapter 5.6
Used equipment:	See chapter 8.3 setup A
Measurement uncertainty:	See chapter 9

Limits:

FCC
§ 27.54
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Results:

Channel 12:

Temperature (°C)	Voltage (V DC)	Lowest frequency (MHz)	Highest frequency (MHz)	Calculated center frequency (MHz)	Tolerance (Hz)	Tolerance (ppm)
-30	3.3	1390.711	1392.161	1391.436	-16	-11
-20	3.3	1390.711	1392.161	1391.436	-16	-11
-10	3.3	1390.711	1392.161	1391.436	-16	-11
0	3.3	1390.711	1392.161	1391.436	-16	-11
10	3.3	1390.711	1392.161	1391.436	-16	-11
20	3.3	1390.711	1392.161	1391.436	-16	-11
30	3.3	1390.711	1392.161	1391.436	-16	-11
40	3.3	1390.711	1392.161	1391.436	-16	-11
50	3.3	1390.711	1392.161	1391.436	-16	-11
20	2.8	1390.705	1392.155	1391.430	-22	-16
20	3.8	1390.728	1392.176	1391.452	0	0

NOTE: The results are valid for all modulations.

Channel 13:

Temperature (°C)	Voltage (V DC)	Lowest frequency (MHz)	Highest frequency (MHz)	Calculated center frequency (MHz)	Tolerance (Hz)	Tolerance (ppm)
-30	3.3	1392.439	1393.886	1393.1625	-17.5	-13
-20	3.3	1392.439	1393.886	1393.1625	-17.5	-13
-10	3.3	1392.439	1393.886	1393.1625	-17.5	-13
0	3.3	1392.439	1393.886	1393.1625	-17.5	-13
10	3.3	1392.439	1393.886	1393.1625	-17.5	-13
20	3.3	1392.439	1393.886	1393.1625	-17.5	-13
30	3.3	1392.439	1393.886	1393.1625	-17.5	-13
40	3.3	1392.439	1393.886	1393.1625	-17.5	-13
50	3.3	1392.439	1393.886	1393.1625	-17.5	-13
20	2.8	1392.432	1393.885	1393.1585	-21.5	-15
20	3.8	1392.464	1393.910	1393.187	7	5

NOTE: The results are valid for all modulations.

Channel 14:

Temperature (°C)	Voltage (V DC)	Lowest frequency (MHz)	Highest frequency (MHz)	Calculated center frequency (MHz)	Tolerance (Hz)	Tolerance (ppm)
-30	3.3	1394.182	1395.626	1394.904	-4	-3
-20	3.3	1394.182	1395.626	1394.904	-4	-3
-10	3.3	1394.182	1395.626	1394.904	-4	-3
0	3.3	1394.182	1395.626	1394.904	-4	-3
10	3.3	1394.182	1395.626	1394.904	-4	-3
20	3.3	1394.182	1395.626	1394.904	-4	-3
30	3.3	1394.182	1395.626	1394.904	-4	-3
40	3.3	1394.182	1395.626	1394.904	-4	-3
50	3.3	1394.182	1395.626	1394.904	-4	-3
20	2.8	1394.175	1395.620	1394.8975	-10.5	-8
20	3.8	1394.177	1395.639	1394.908	0	0

NOTE: The results are valid for all modulations. The parts which are not covered in the FCC Part 27 bands are covered by the FCC Part 95 Subpart H bands which the device also supports.

Channel 15:

Temperature (°C)	Voltage (V DC)	Lowest frequency (MHz)	Highest frequency (MHz)	Calculated center frequency (MHz)	Tolerance (Hz)	Tolerance (ppm)
-30	3.3	1431.243	1432.690	1431.9665	-2.5	-2
-20	3.3	1431.243	1432.690	1431.9665	-2.5	-2
-10	3.3	1431.243	1432.690	1431.9665	-2.5	-2
0	3.3	1431.243	1432.690	1431.9665	-2.5	-2
10	3.3	1431.243	1432.690	1431.9665	-2.5	-2
20	3.3	1431.243	1432.690	1431.9665	-2.5	-2
30	3.3	1431.243	1432.690	1431.9665	-2.5	-2
40	3.3	1431.243	1432.690	1431.9665	-2.5	-2
50	3.3	1431.243	1432.690	1431.9665	-2.5	-2
20	2.8	1431.245	1432.729	1431.987	18	13
20	3.8	1431.245	1432.685	1431.965	-4	-3

NOTE: The results are valid for all modulations. The parts which are not covered in the FCC Part 27 bands are covered by the FCC Part 95 Subpart H bands which the device also supports.

Channel 16:

Temperature (°C)	Voltage (V DC)	Lowest frequency (MHz)	Highest frequency (MHz)	Calculated center frequency (MHz)	Tolerance (Hz)	Tolerance (ppm)
-30	3.3	1432.968	1434.418	1433.693	-4	-3
-20	3.3	1432.968	1434.418	1433.693	-4	-3
-10	3.3	1432.968	1434.418	1433.693	-4	-3
0	3.3	1432.968	1434.418	1433.693	-4	-3
10	3.3	1432.968	1434.418	1433.693	-4	-3
20	3.3	1432.968	1434.418	1433.693	-4	-3
30	3.3	1432.968	1434.418	1433.693	-4	-3
40	3.3	1432.968	1434.418	1433.693	-4	-3
50	3.3	1432.968	1434.418	1433.693	-4	-3
20	2.8	1432.959	1434.409	1433.684	-13	-9
20	3.8	1432.973	1434.421	1433.697	0	0

NOTE: The results are valid for all modulations.

12.3 Spurious emissions radiated

Measurement:

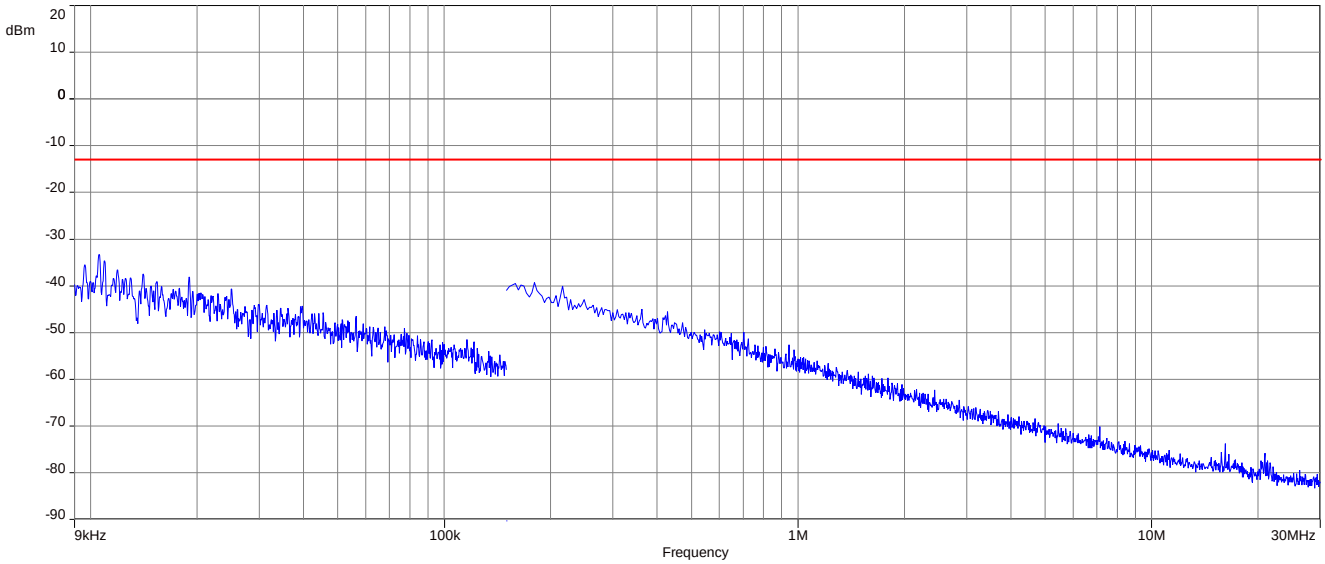
Measurement parameters	
Detector:	Peak
Resolution bandwidth:	9 kHz to 150 kHz: 200 Hz 150 kHz to 30 MHz: 9 kHz 30 MHz to 1 GHz: 120 kHz 1 GHz to 15 GHz: 1 MHz
Video bandwidth:	9 kHz to 150 kHz: 1 kHz 150 kHz to 30 MHz: 30 kHz 30 MHz to 1 GHz: 500 kHz 1 GHz to 15 GHz: 3 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 8.1 setup A See chapter 8.2 setup A + B
Measurement uncertainty:	See chapter 9

Limits:

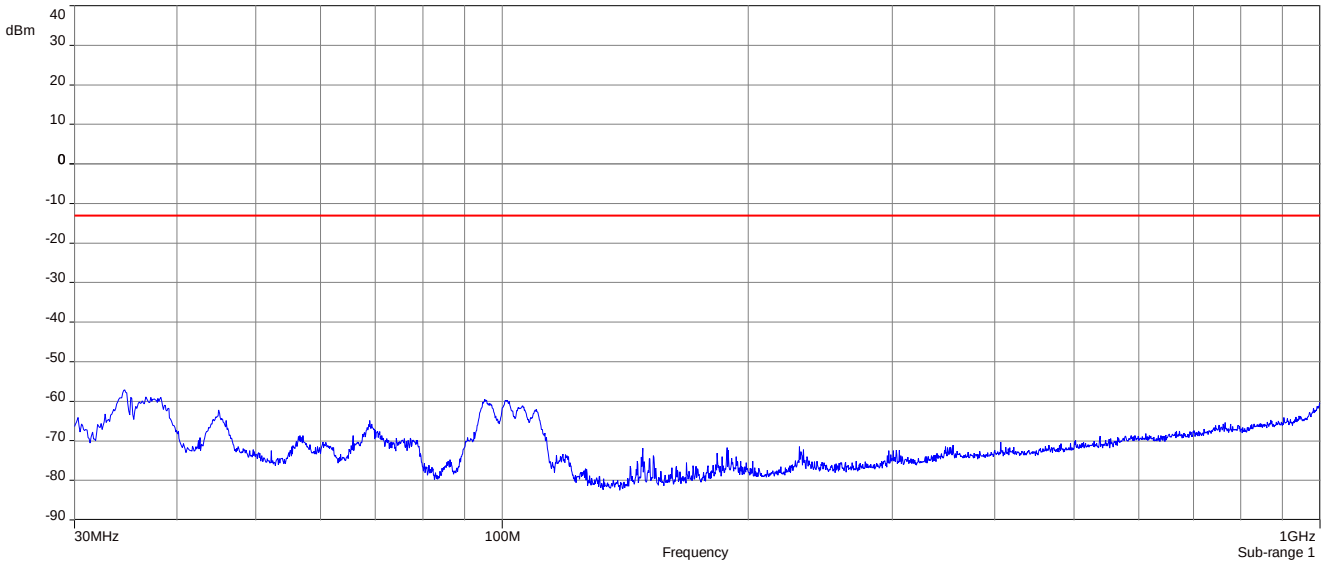
FCC
§ 27.53(j)
For operations in the unpaired 1390–1392 MHz band and the paired 1392–1395 MHz and 1432–1435 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB. Compliance with these provisions is based on the procedures described in paragraph (a)(5) of this section.
-13 dBm

<u>Results:</u> These results are valid for all modulations. The tests have been performed with the modulation which has the highest output power, antenna 1

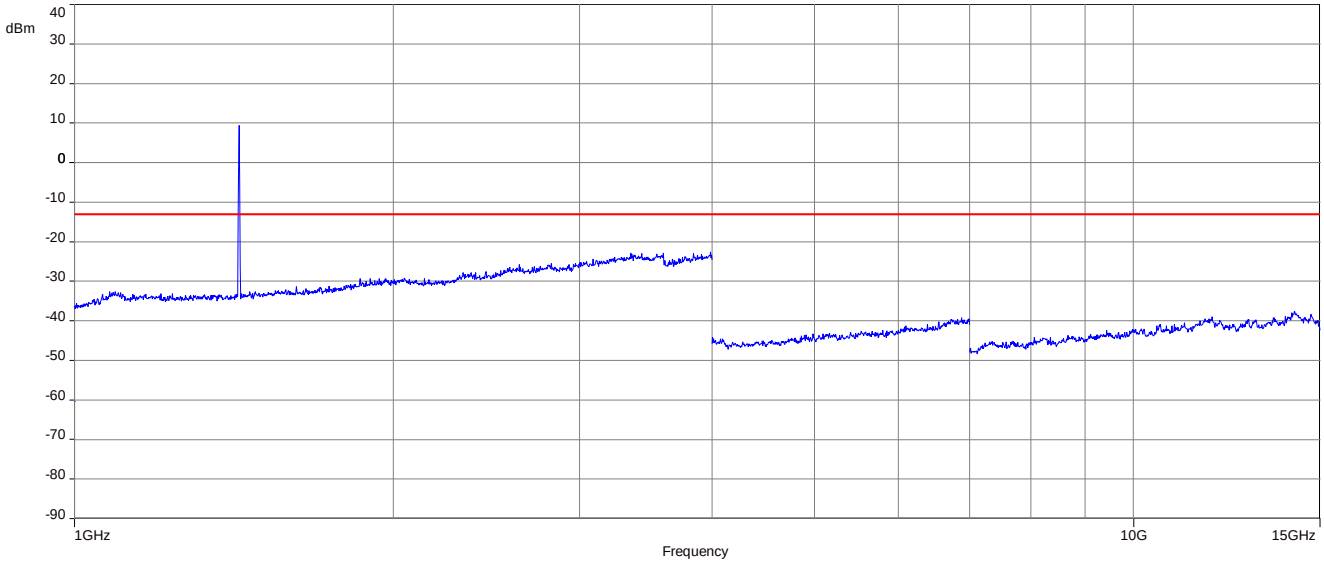
Plot 1: channel 12, 9 kHz to 30 MHz



Plot 2: channel 12, 30 MHz to 1GHz

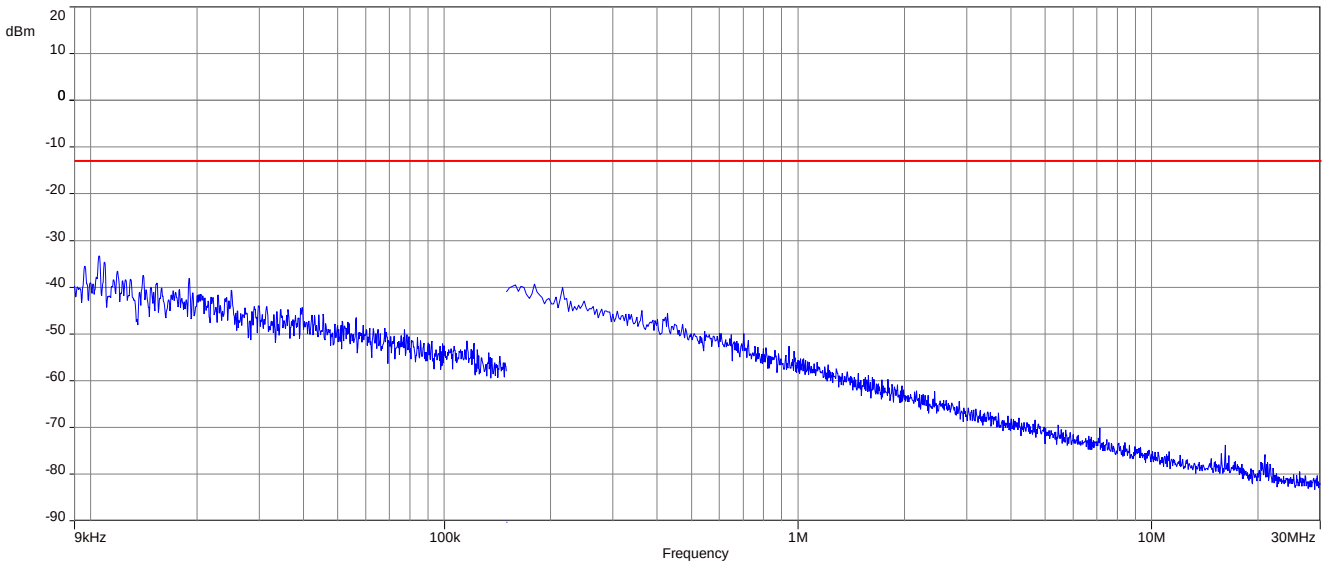


Plot 3: channel 12, 1 GHz to 15 GHz

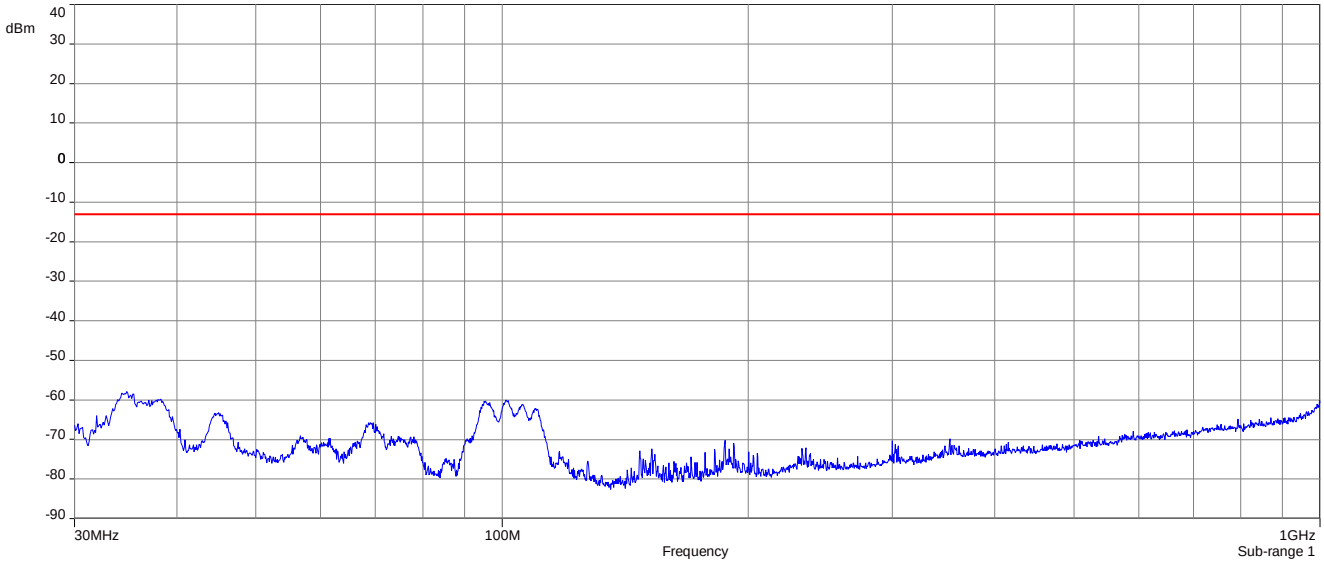


NOTE: The emission above limit is the carrier and therefore not rated.

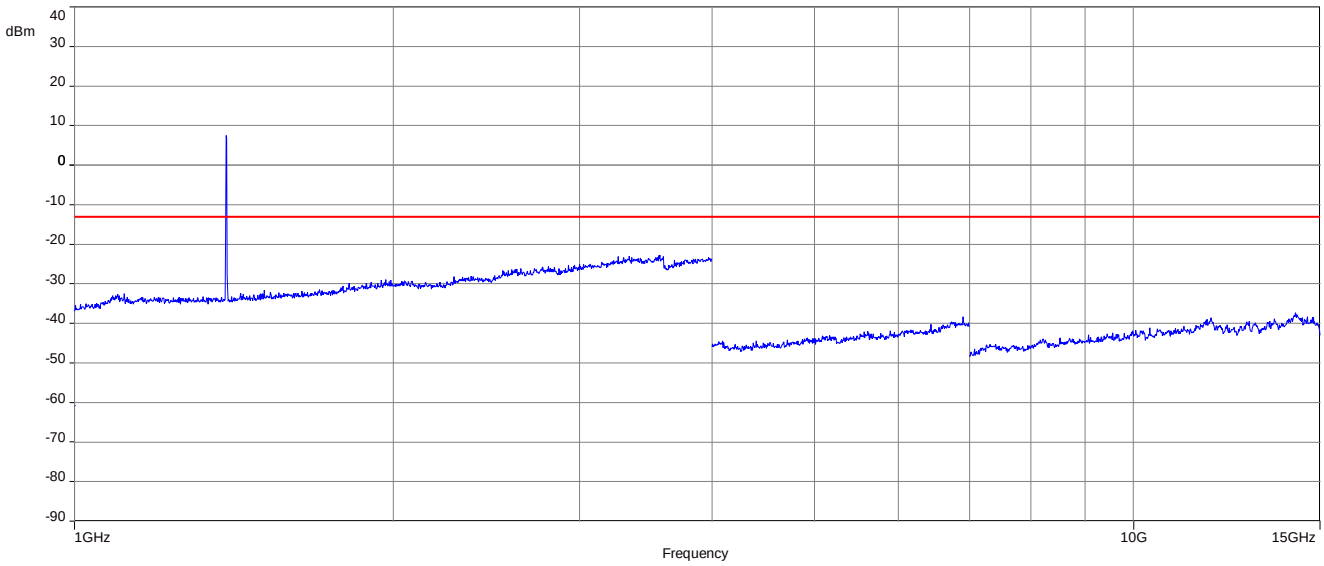
Plot 4: channel 13, 9 kHz to 30 MHz



Plot 5: channel 13, 30 MHz to 1GHz

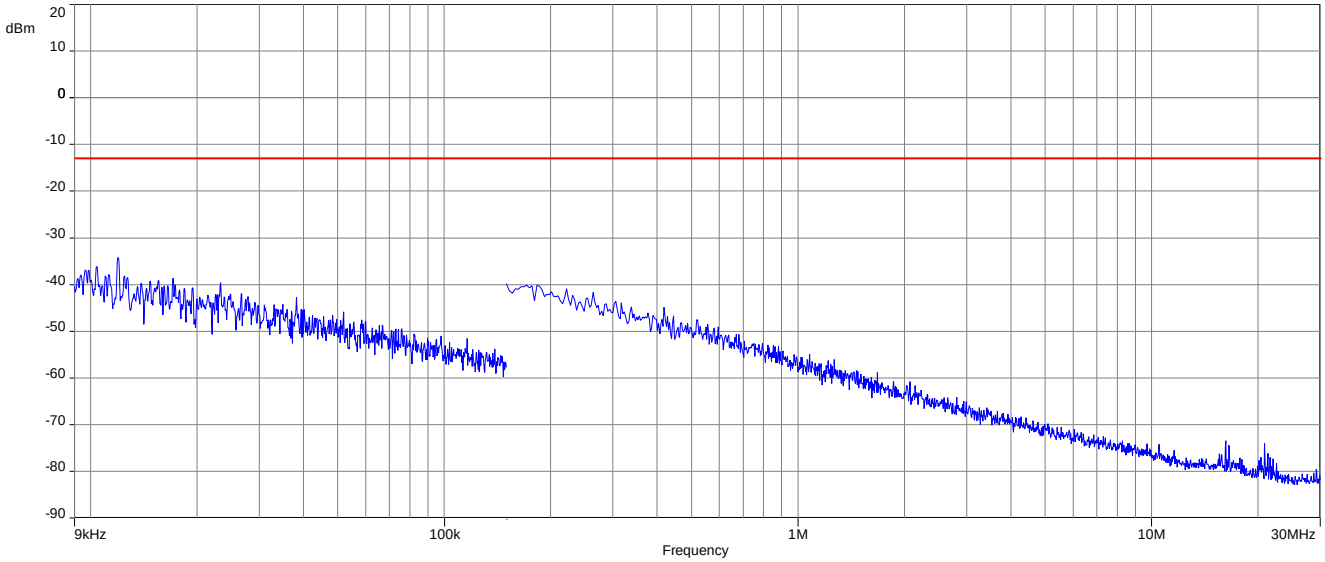


Plot 6: channel 13, 1 GHz to 15 GHz

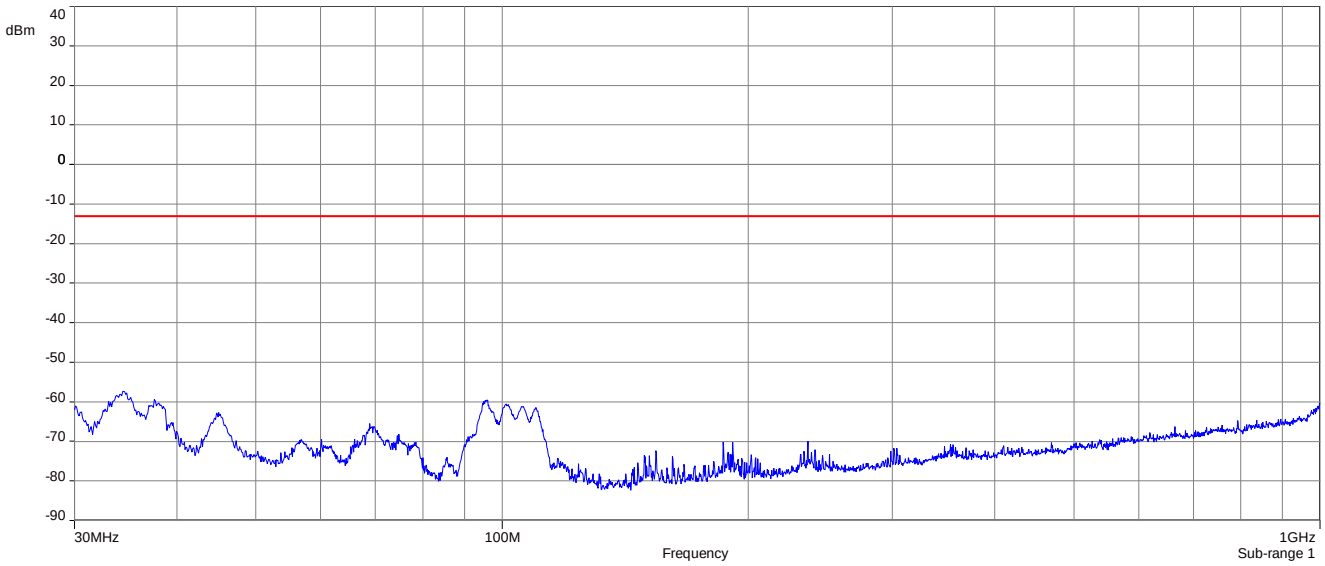


NOTE: The emission above limit is the carrier and therefore not rated.

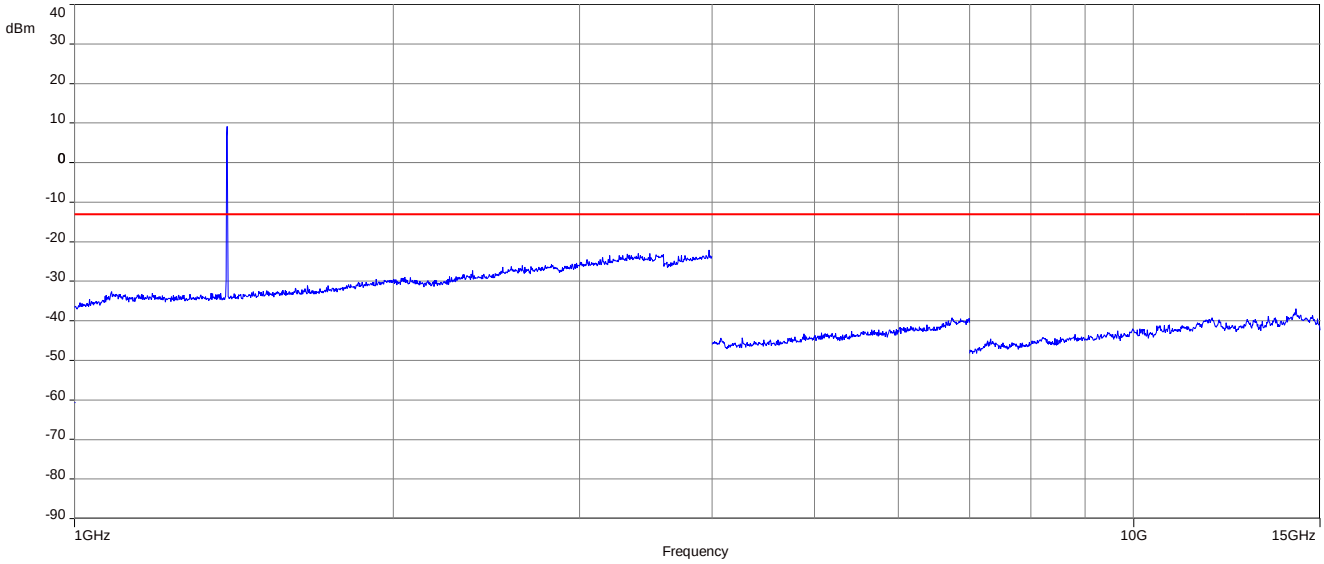
Plot 7: channel 14, 9 kHz to 30 MHz



Plot 8: channel 14, 30 MHz to 1GHz

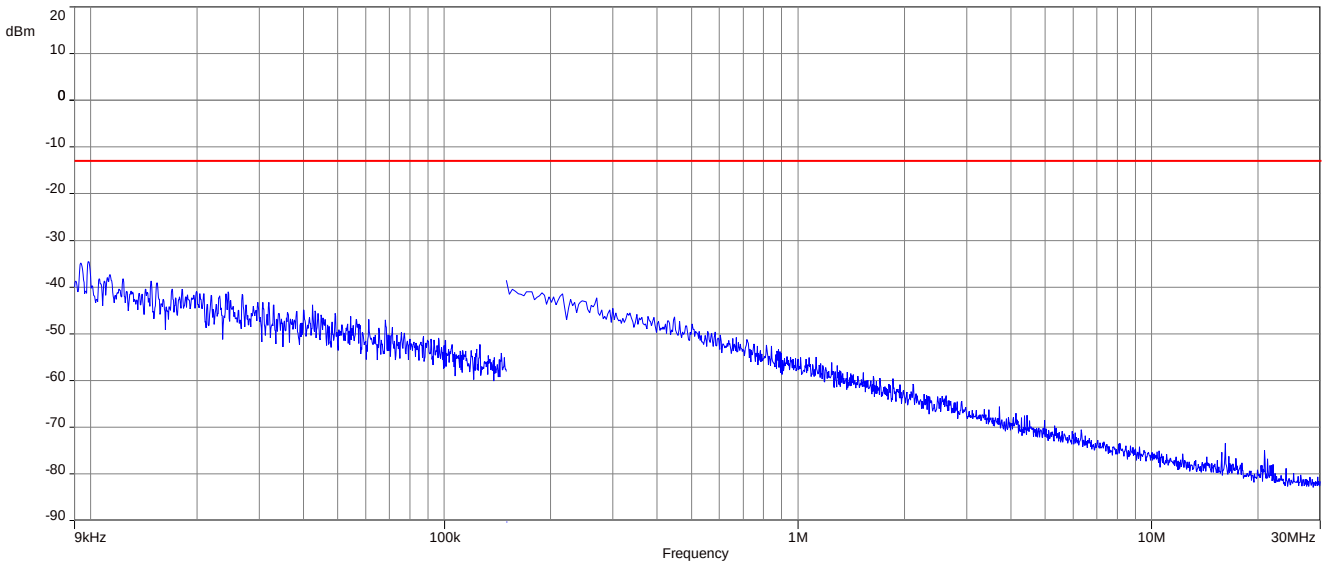


Plot 9: channel 14, 1 GHz to 15 GHz

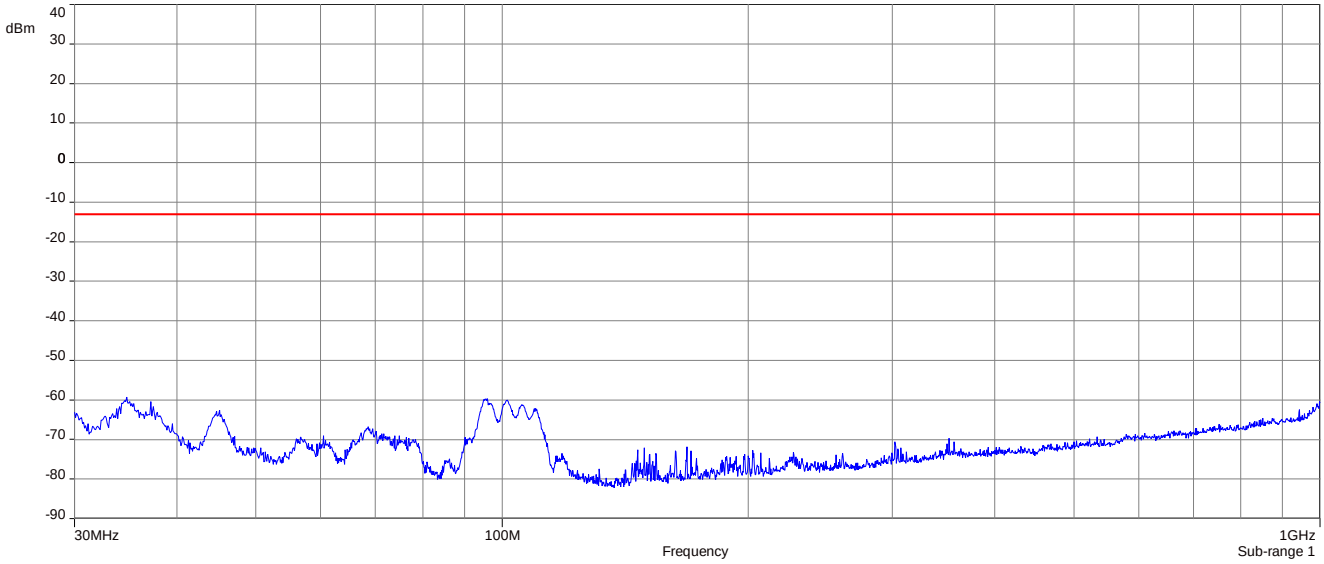


NOTE: The emission above limit is the carrier and therefore not rated.

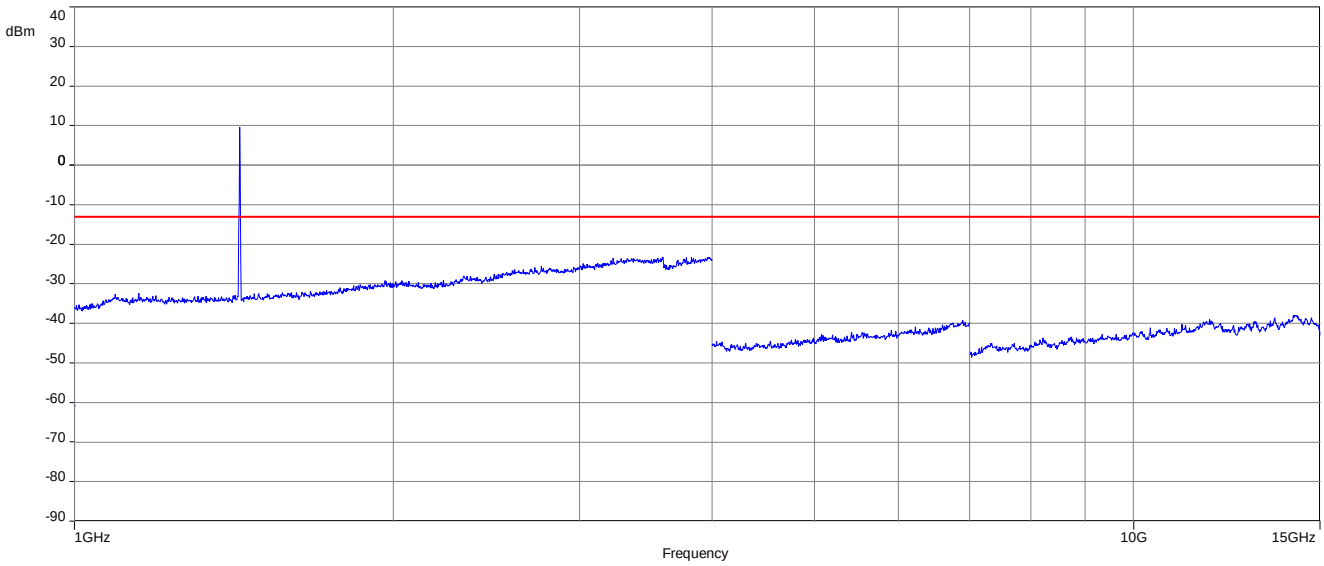
Plot 10: channel 15, 9 kHz to 30 MHz



Plot 11: channel 15, 30 MHz to 1GHz

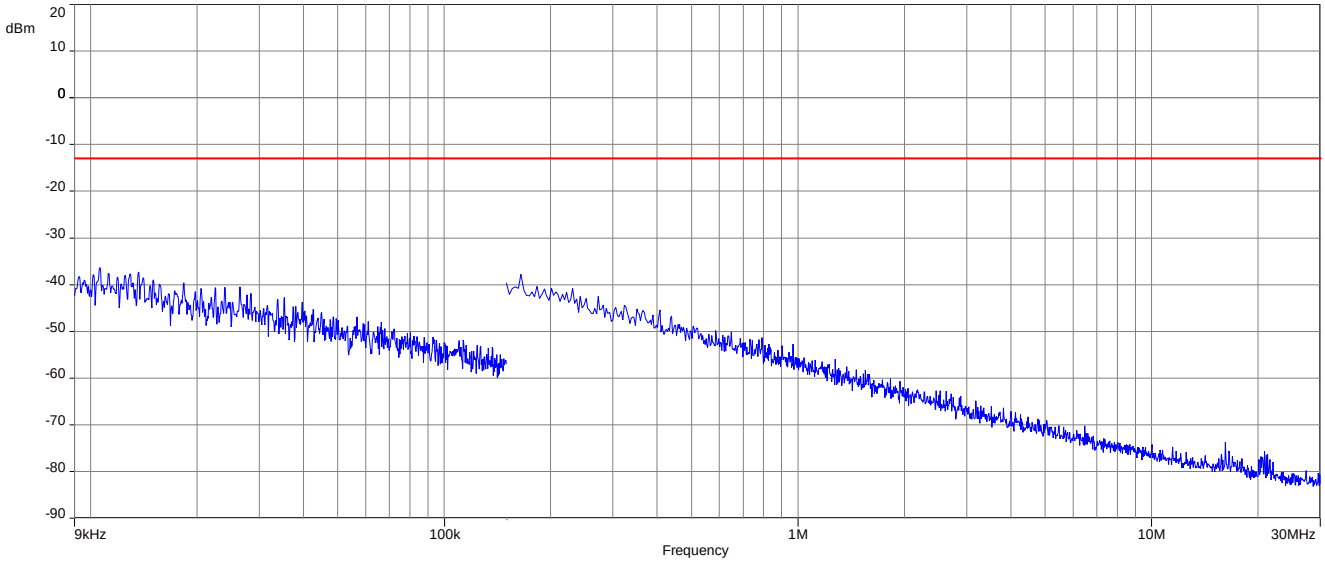


Plot 12: channel 15, 1 GHz to 15 GHz

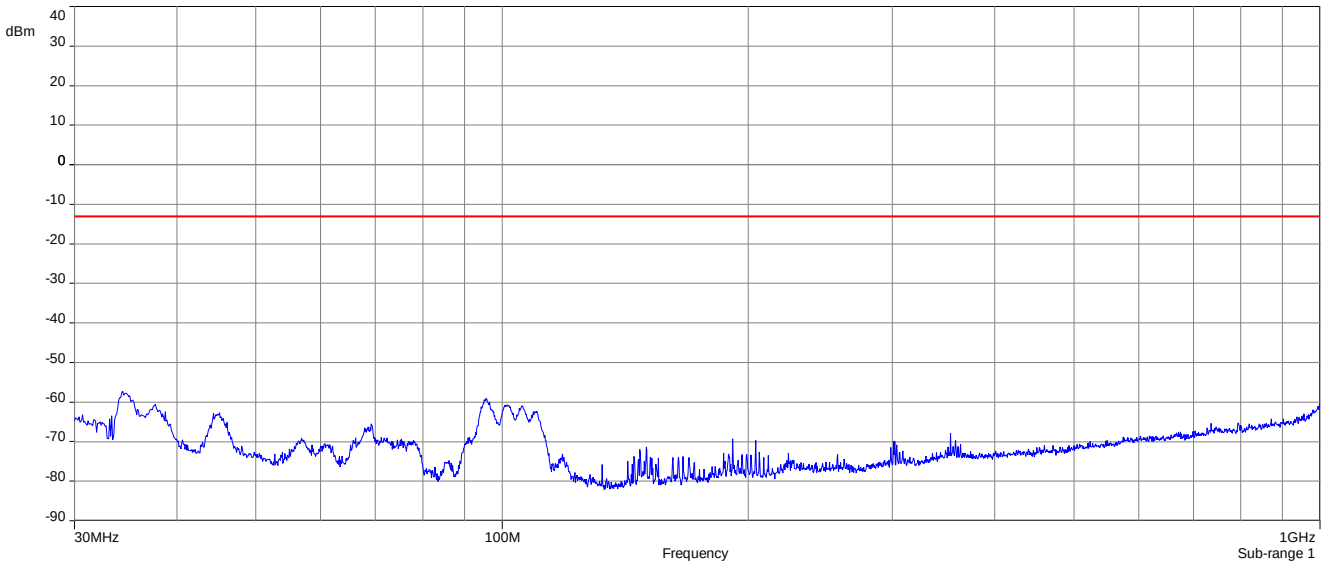


NOTE: The emission above limit is the carrier and therefore not rated.

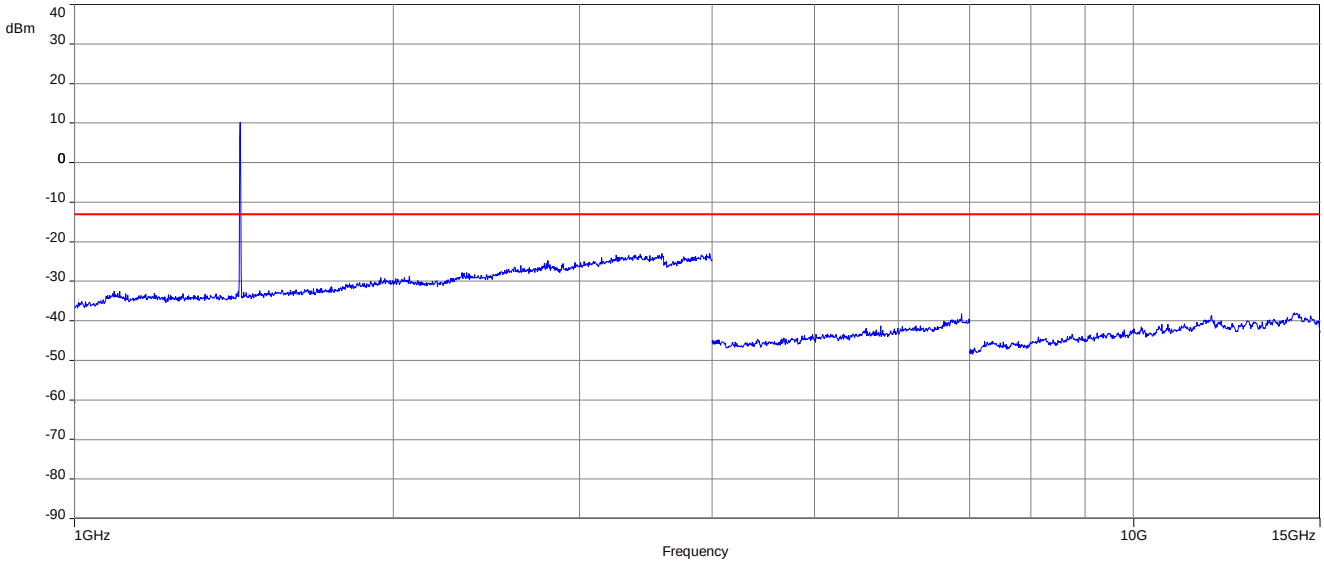
Plot 13: channel 16, 9 kHz to 30 MHz



Plot 14: channel 16, 30 MHz to 1GHz



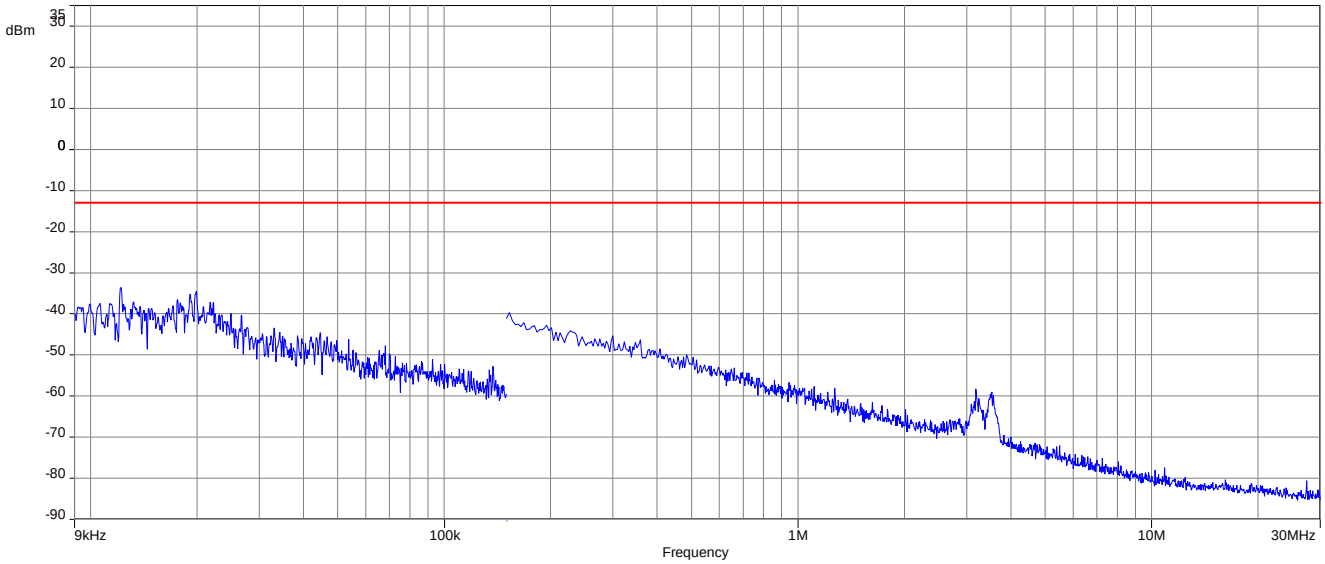
Plot 15: channel 16, 1 GHz to 15 GHz



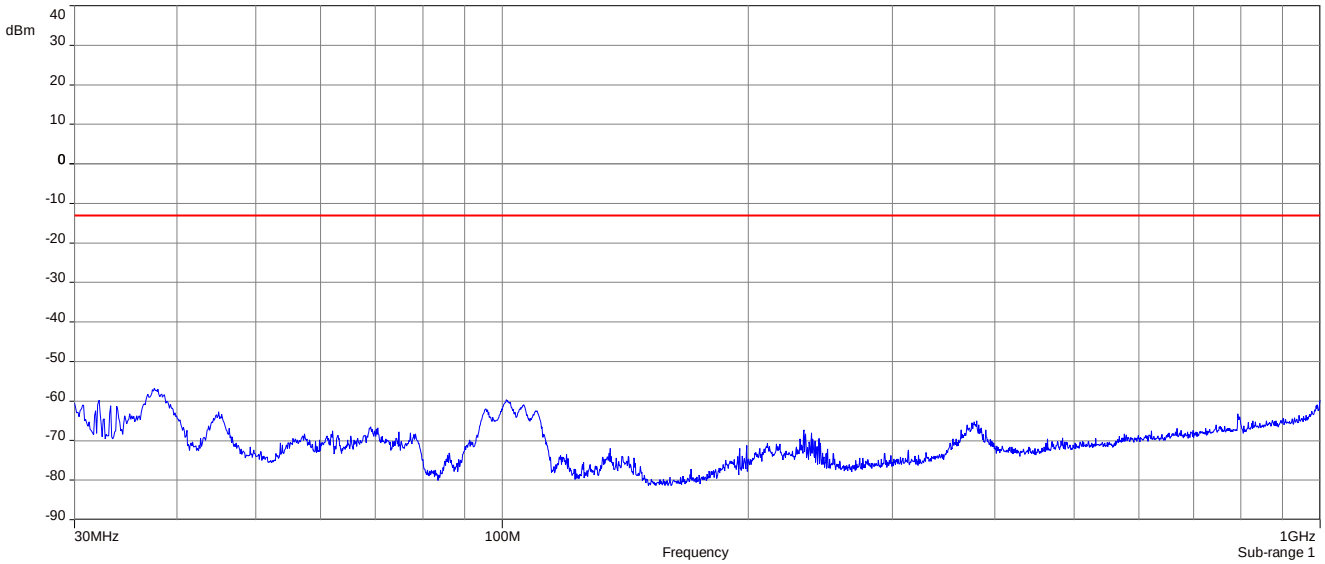
NOTE: The emission above limit is the carrier and therefore not rated.

<u>Results:</u> These results are valid for all modulations. The tests have been performed with the modulation which has the highest output power, antenna 2

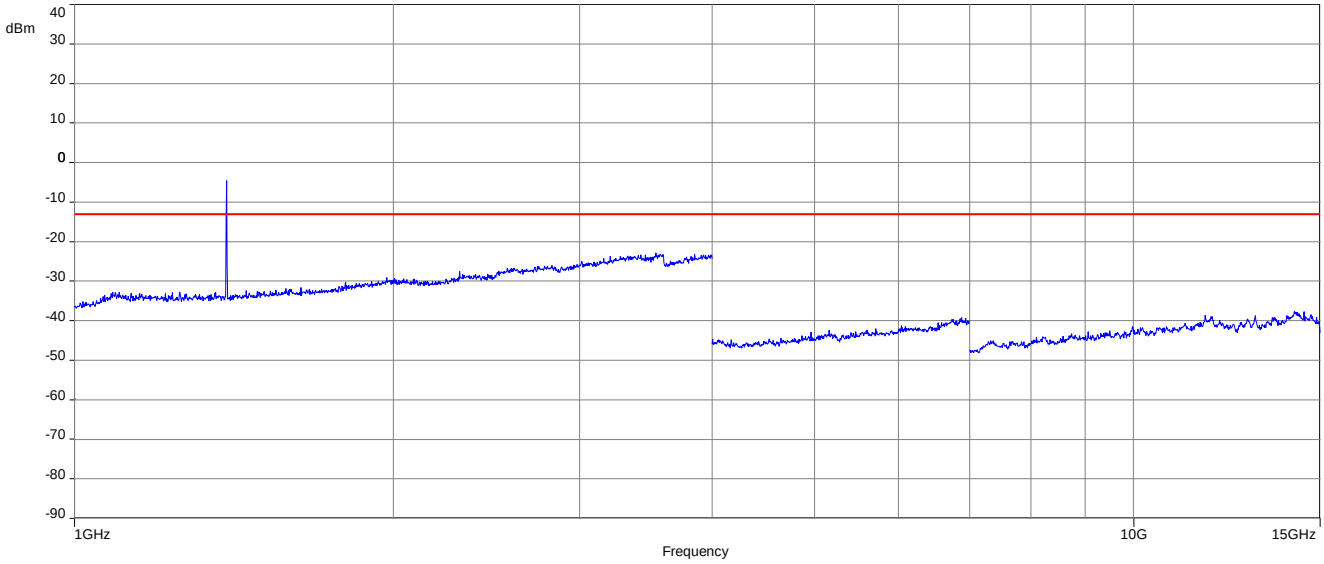
Plot 1: channel 12, 9 kHz to 30 MHz



Plot 2: channel 12, 30 MHz to 1GHz

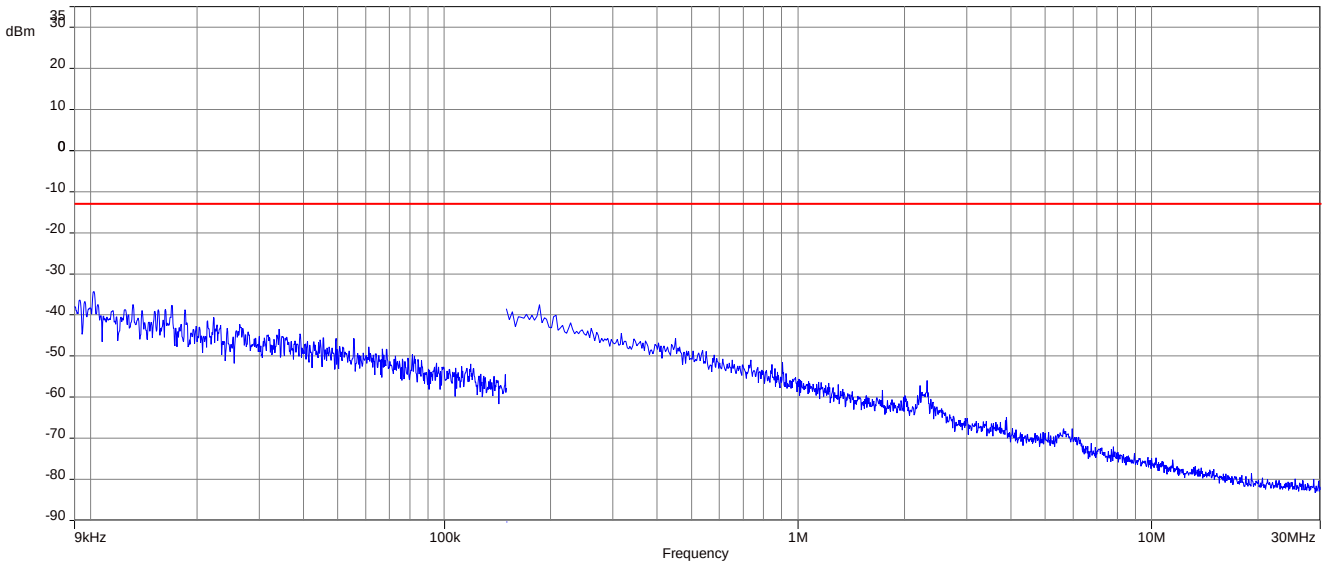


Plot 3: channel 12, 1 GHz to 15 GHz

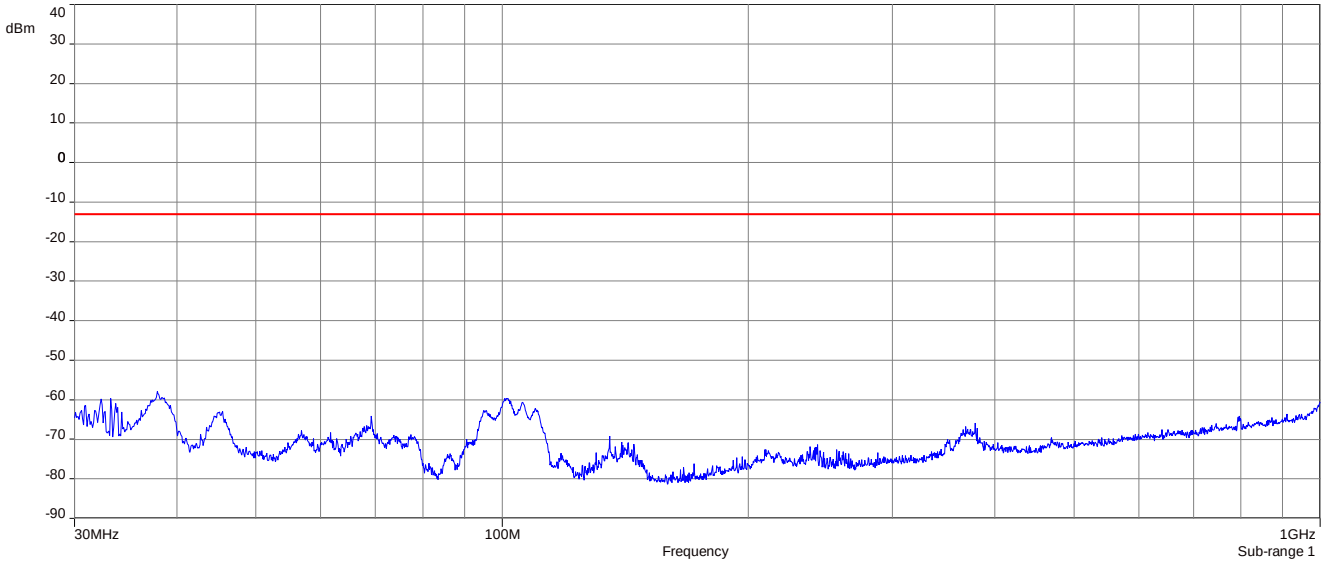


NOTE: The emission above limit is the carrier and therefore not rated.

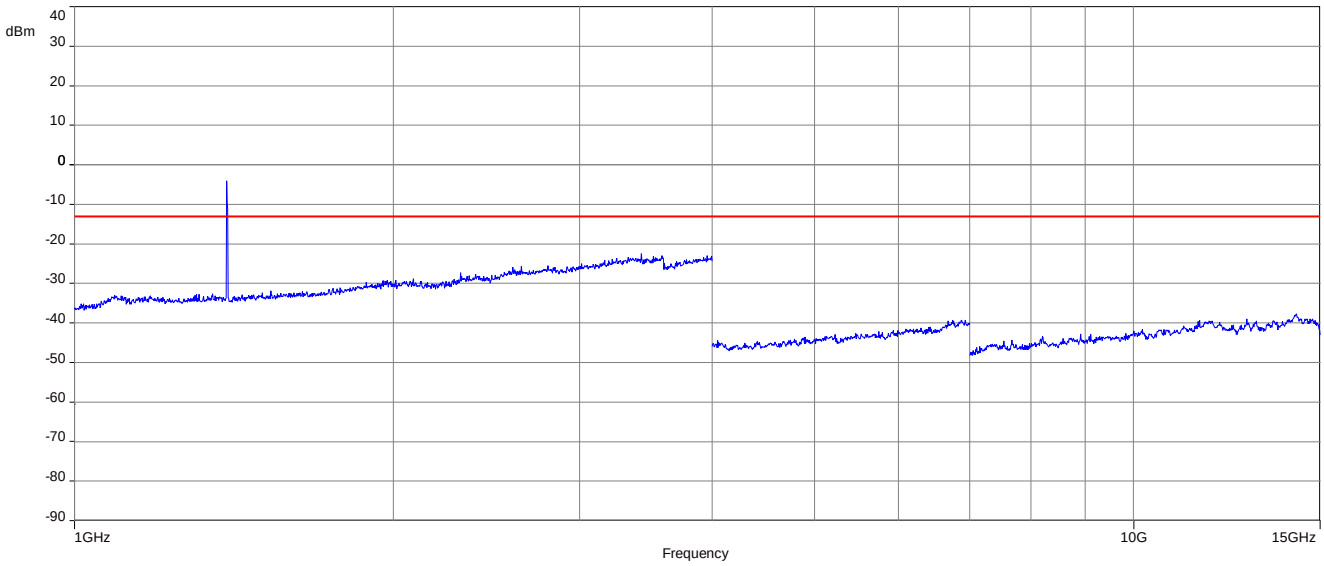
Plot 4: channel 13, 9 kHz to 30 MHz



Plot 5: channel 13, 30 MHz to 1GHz

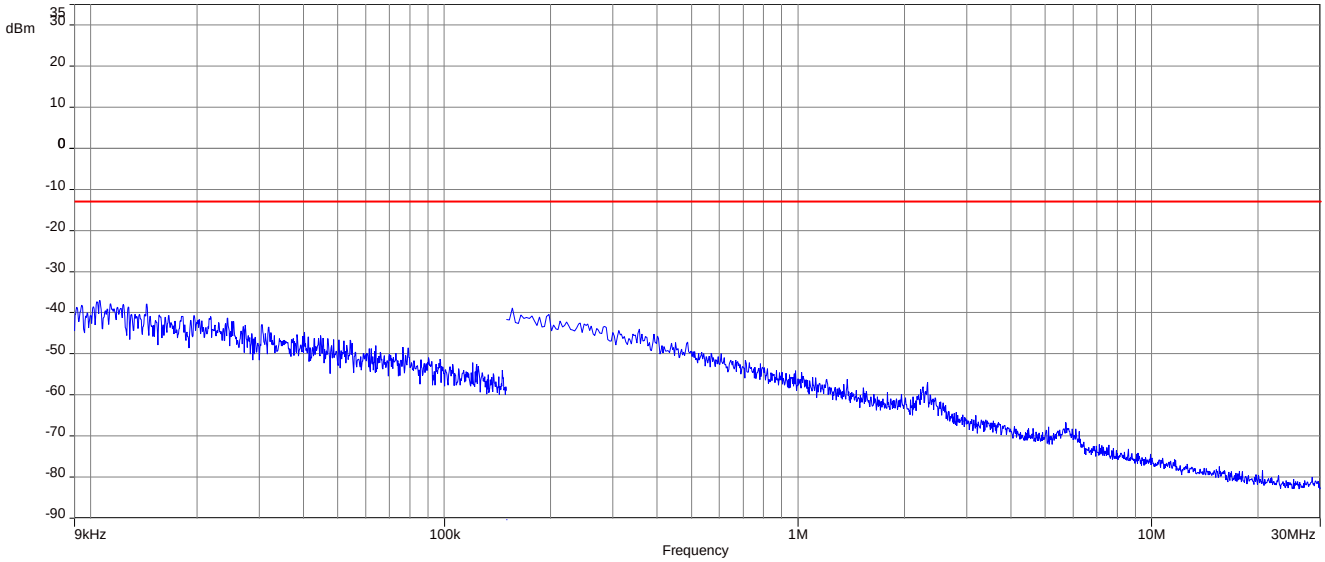


Plot 6: channel 13, 1 GHz to 15 GHz

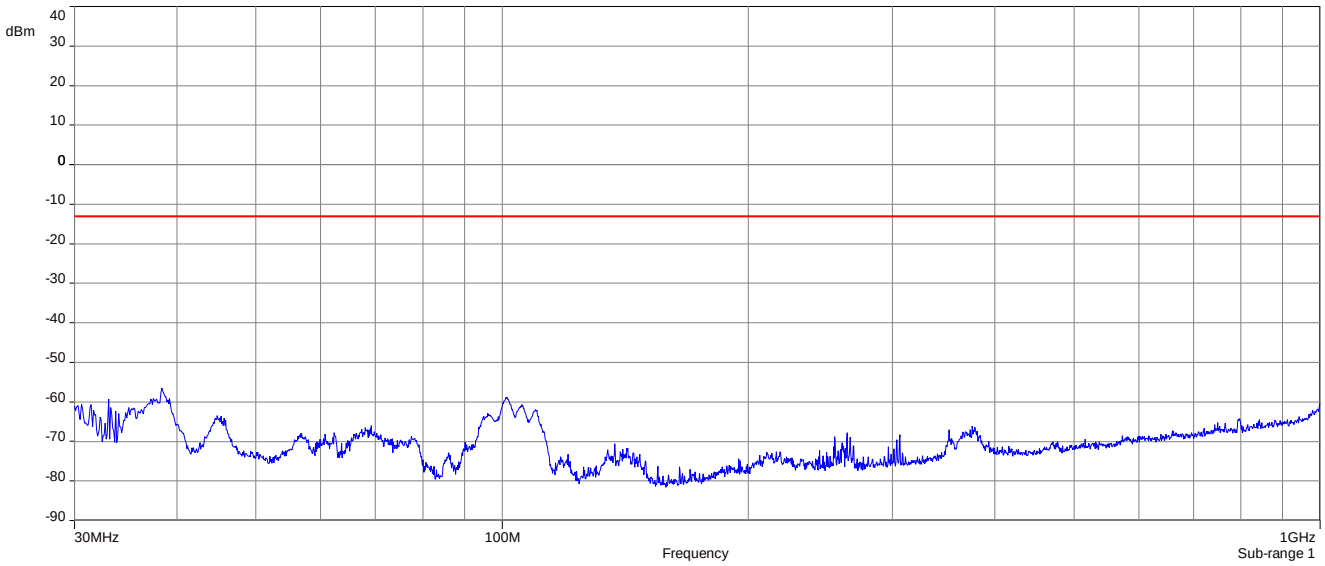


NOTE: The emission above limit is the carrier and therefore not rated.

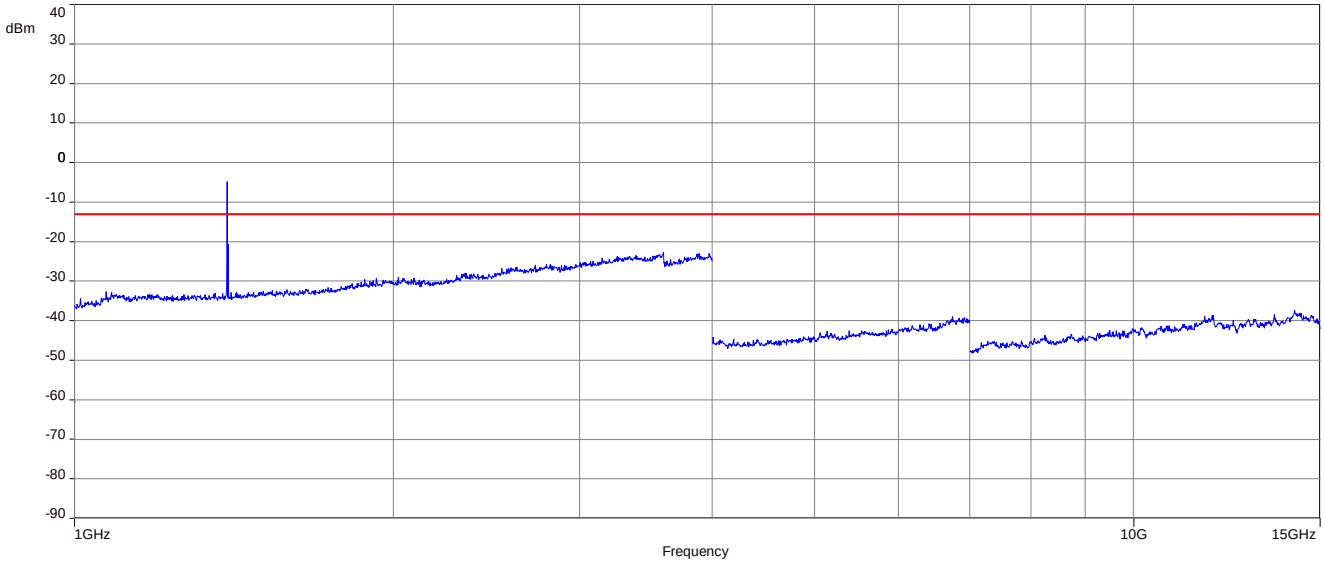
Plot 7: channel 14, 9 kHz to 30 MHz



Plot 8: channel 14, 30 MHz to 1GHz

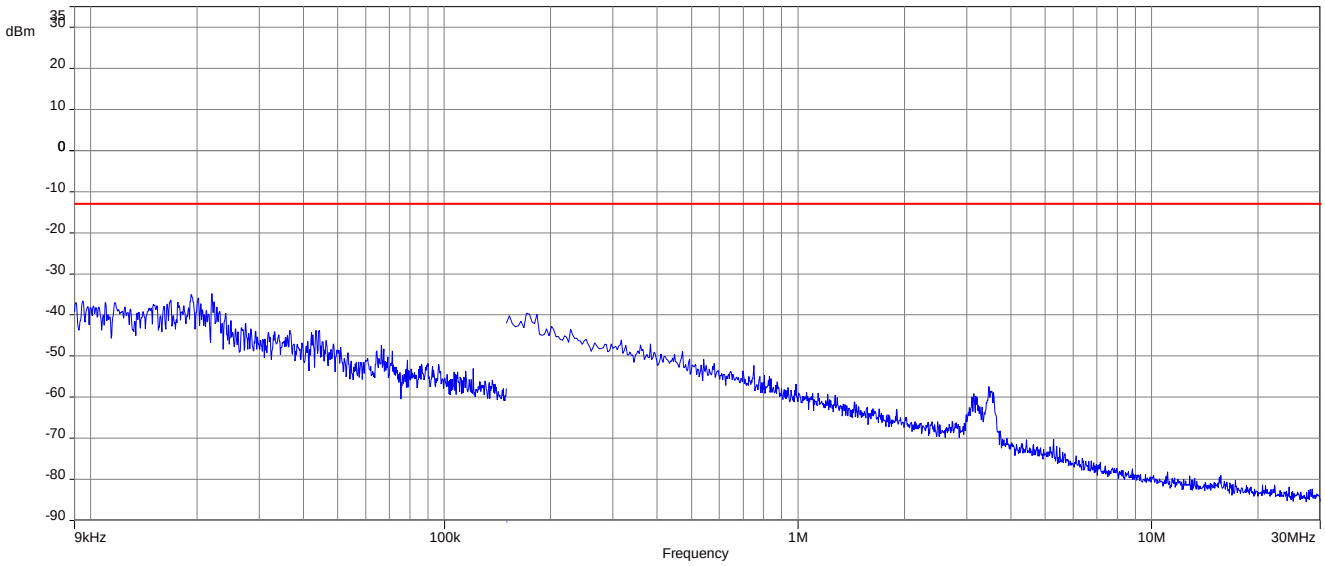


Plot 9: channel 14, 1 GHz to 15 GHz

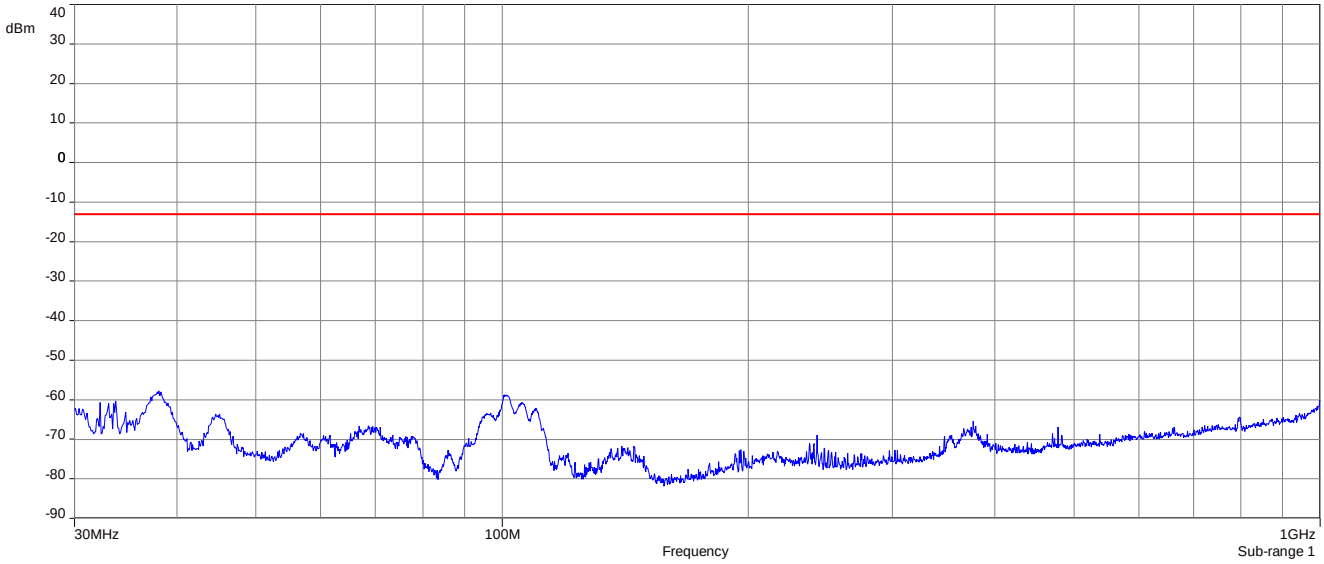


NOTE: The emission above limit is the carrier and therefore not rated.

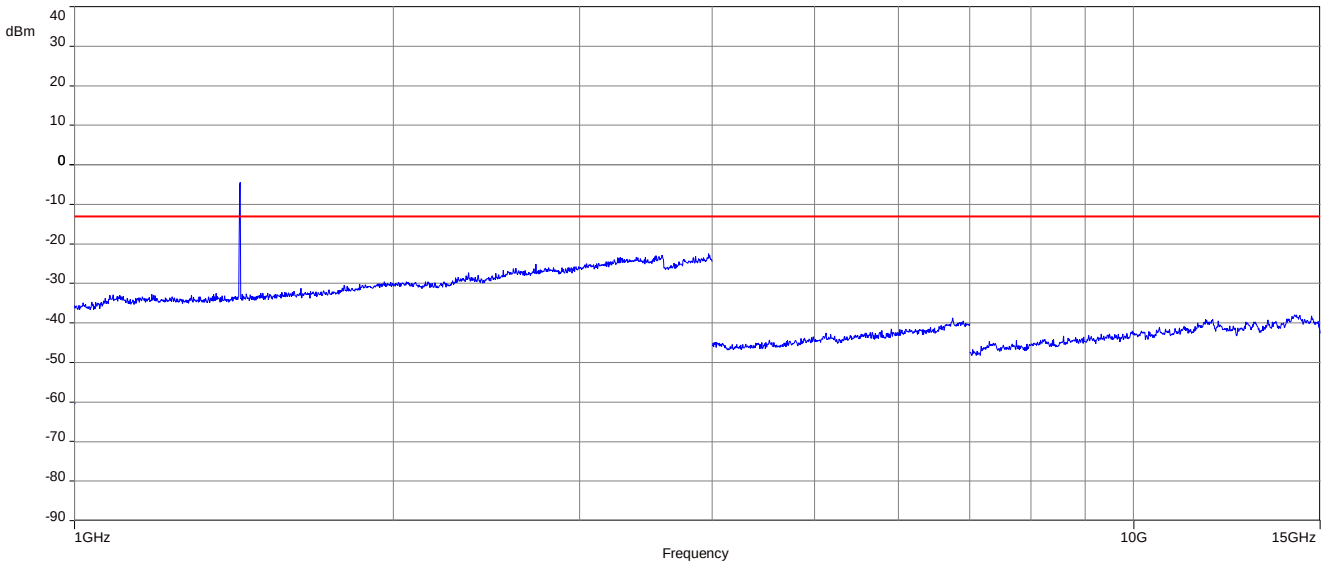
Plot 10: channel 15, 9 kHz to 30 MHz



Plot 11: channel 15, 30 MHz to 1GHz

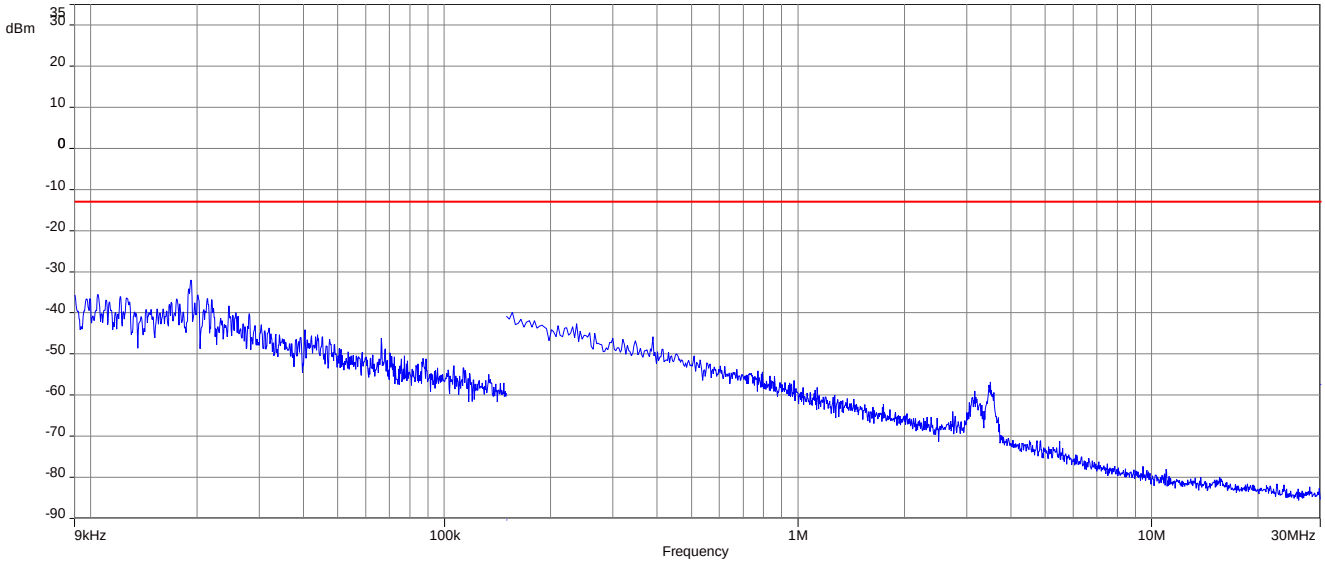


Plot 12: channel 15, 1 GHz to 15 GHz

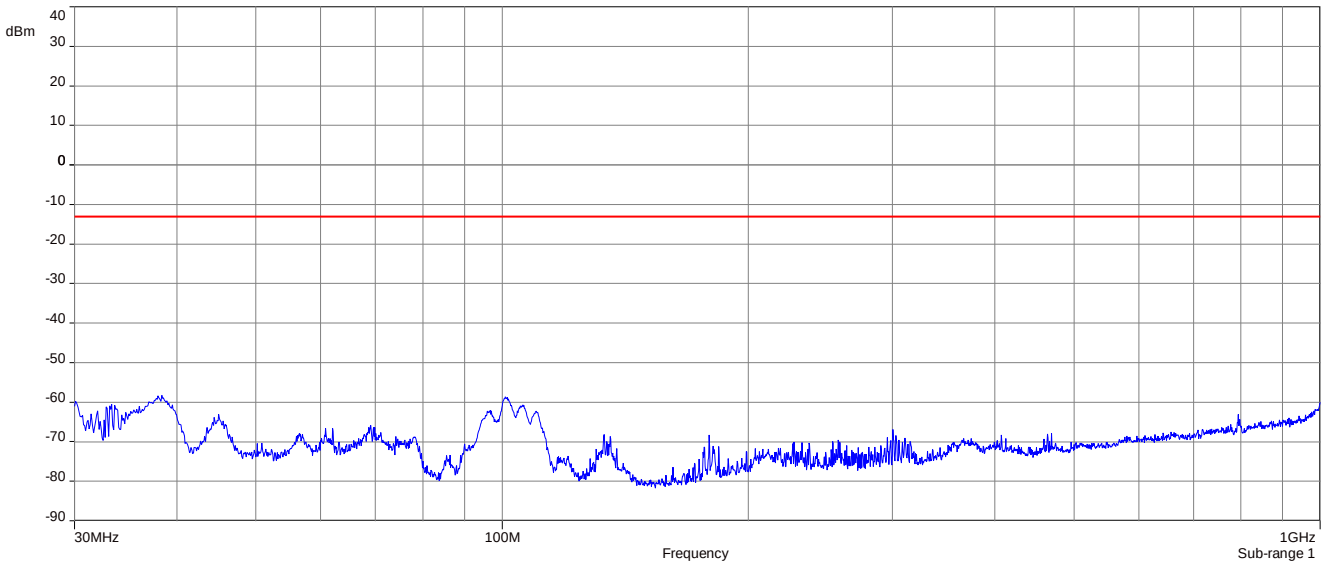


NOTE: The emission above limit is the carrier and therefore not rated.

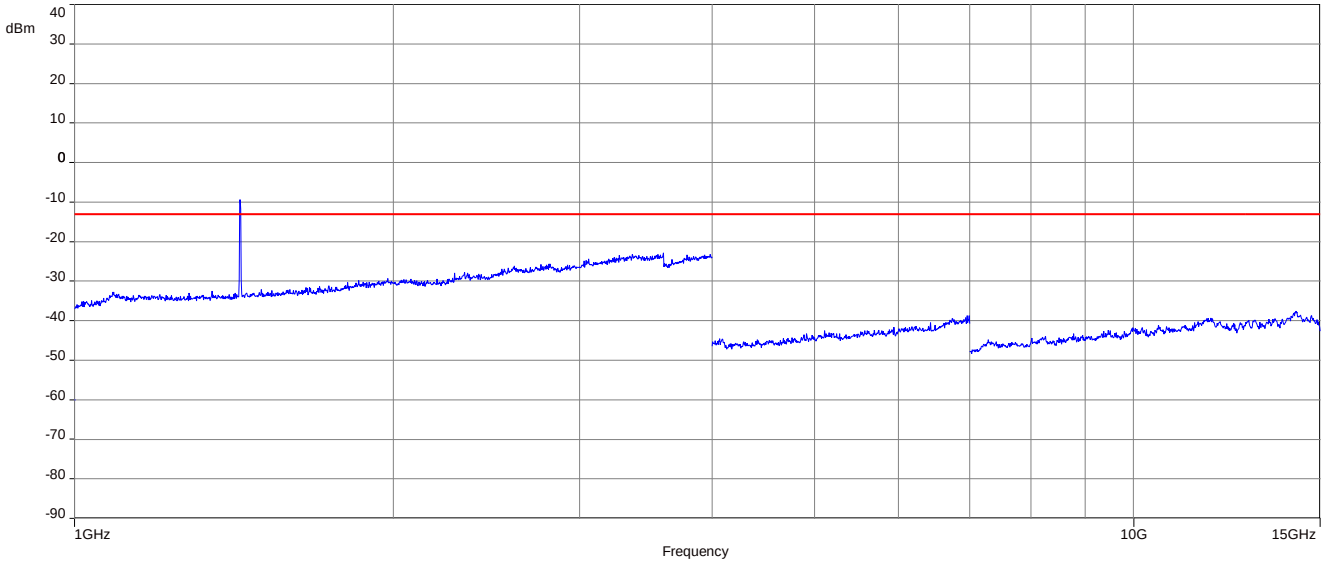
Plot 13: channel 16, 9 kHz to 30 MHz



Plot 14: channel 16, 30 MHz to 1GHz



Plot 15: channel 16, 1 GHz to 15 GHz



NOTE: The emission above limit is the carrier and therefore not rated.

12.4 Spurious emissions conducted

Measurement:

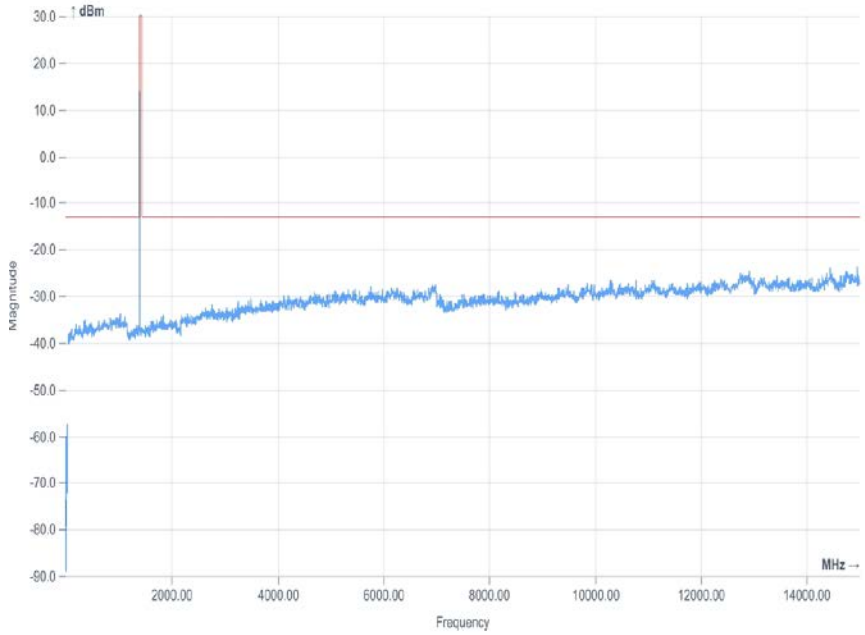
Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	9 kHz to 150 kHz: 1 kHz 150 kHz to 30 MHz: 10 kHz 30 MHz to 15 GHz: 1 MHz
Resolution bandwidth:	9 kHz to 150 kHz: 3 kHz 150 kHz to 30 MHz: 30 kHz 30 MHz to 15 GHz: 3 MHz
Span:	9 kHz – 15 GHz
Trace mode:	Max Hold
Used equipment:	See chapter 8.3 setup A
Measurement uncertainty:	See chapter 9

Limits:

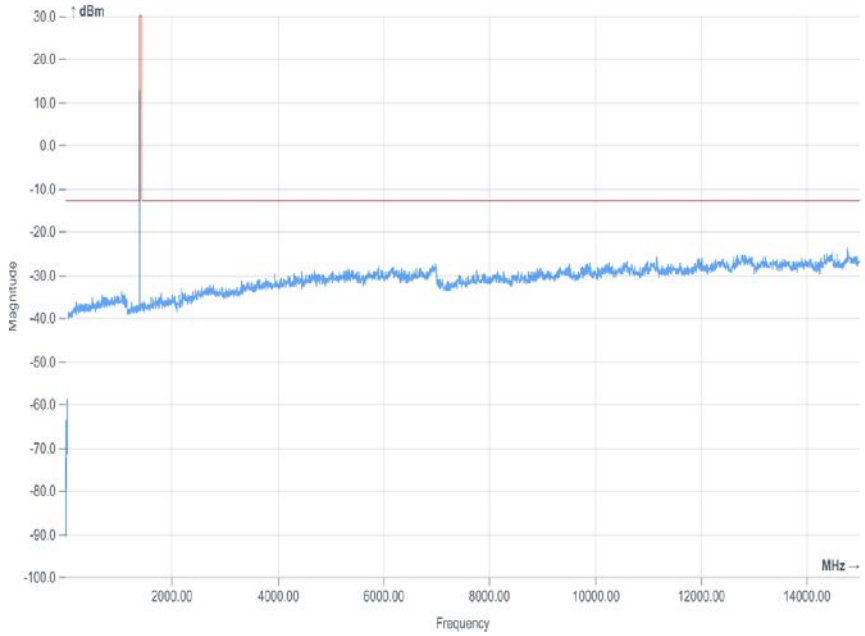
FCC
§ 27.53(j)
For operations in the unpaired 1390–1392 MHz band and the paired 1392–1395 MHz and 1432–1435 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB. Compliance with these provisions is based on the procedures described in paragraph (a)(5) of this section.
-13 dBm

Results: DBPSK modulation

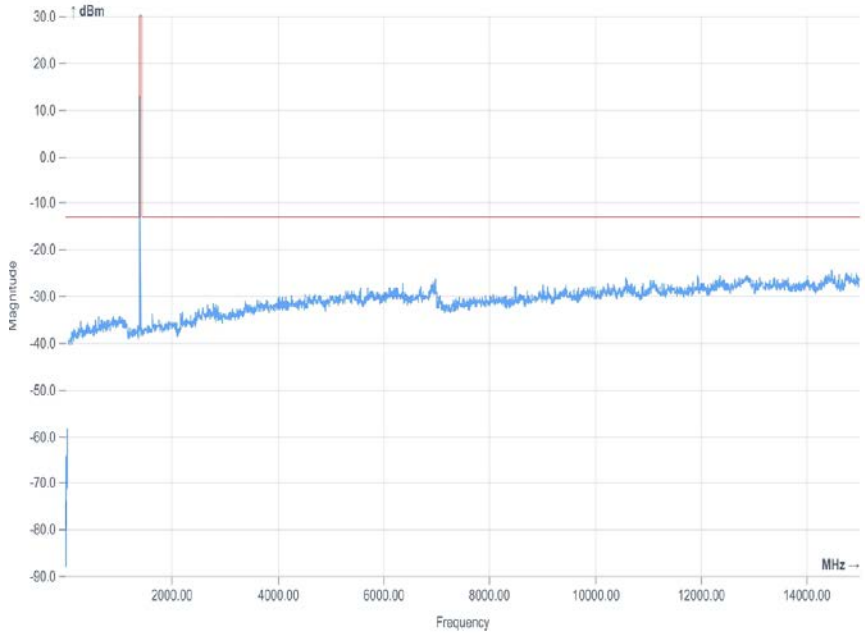
Plot 1: Channel 12, 9 kHz to 15 GHz



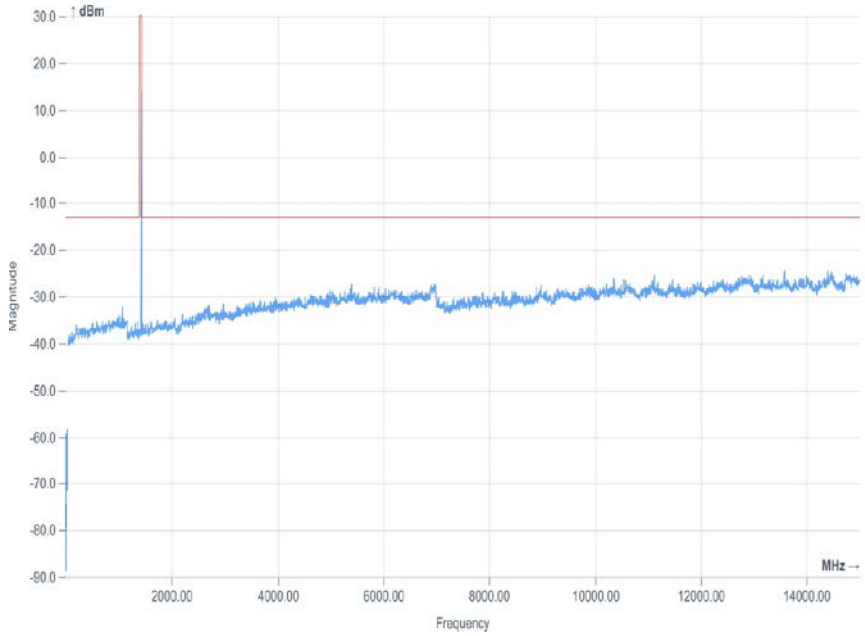
Plot 2: Channel 13, 9 kHz to 15 GHz



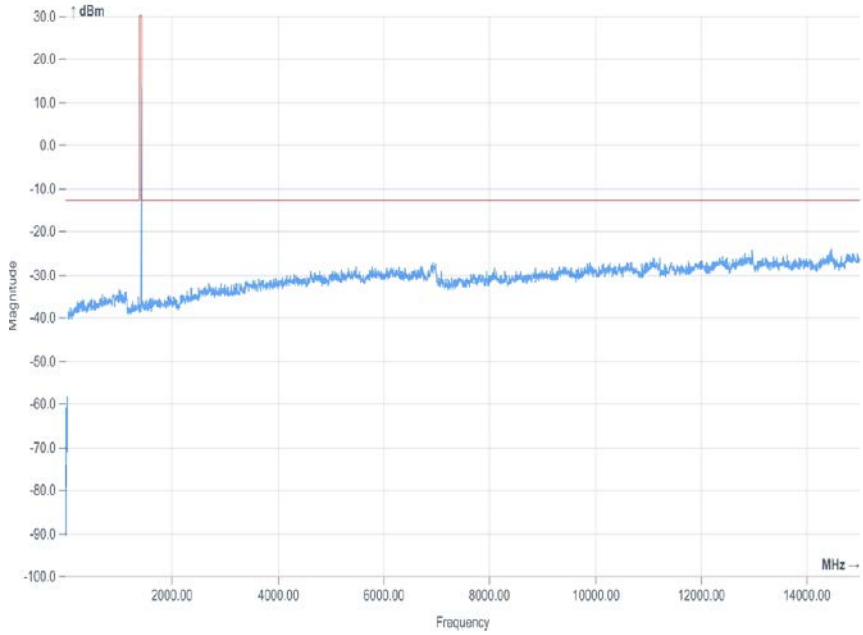
Plot 3: Channel 14, 9 kHz to 15 GHz



Plot 4: Channel 15, 9 kHz to 15 GHz

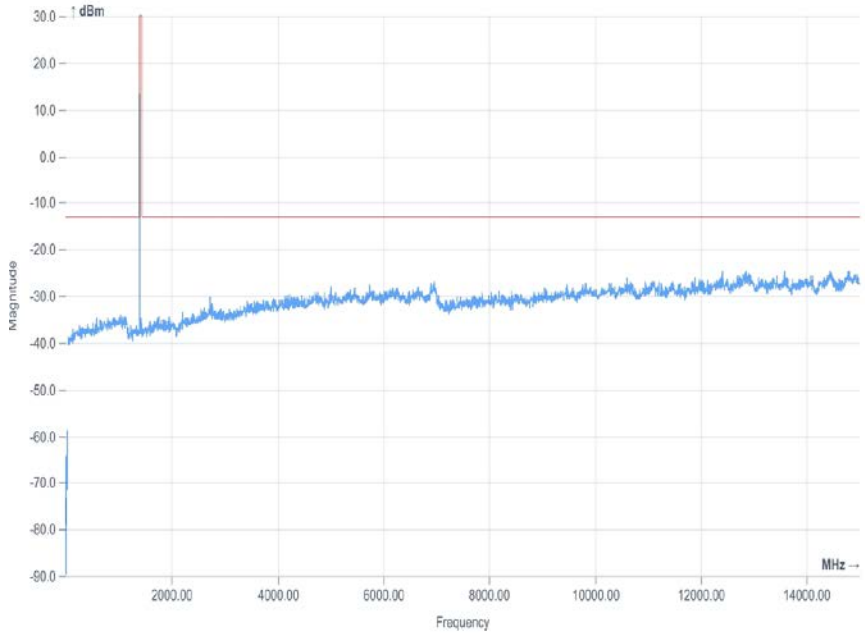


Plot 5: Channel 16, 9 kHz to 15 GHz

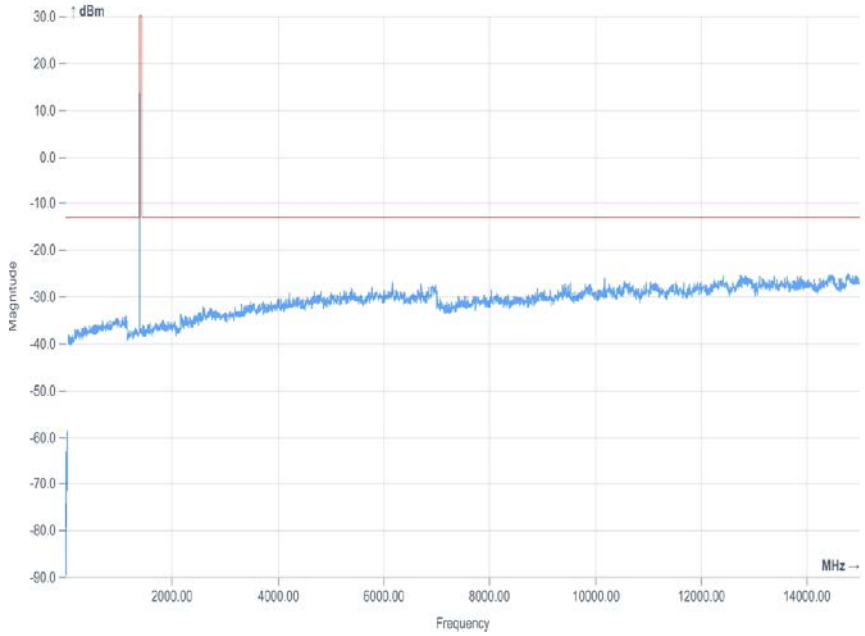


Results: DQPSK modulation

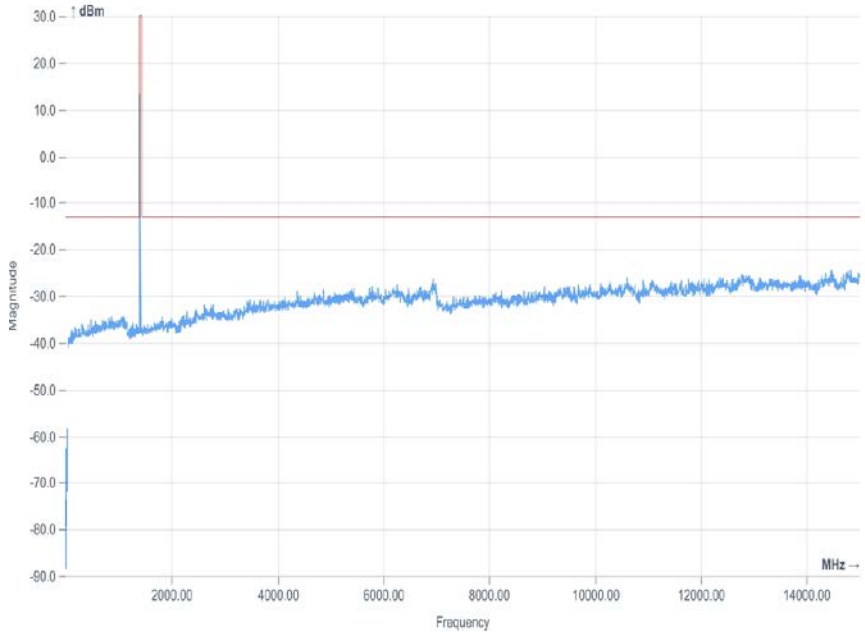
Plot 1: Channel 12, 9 kHz to 15 GHz



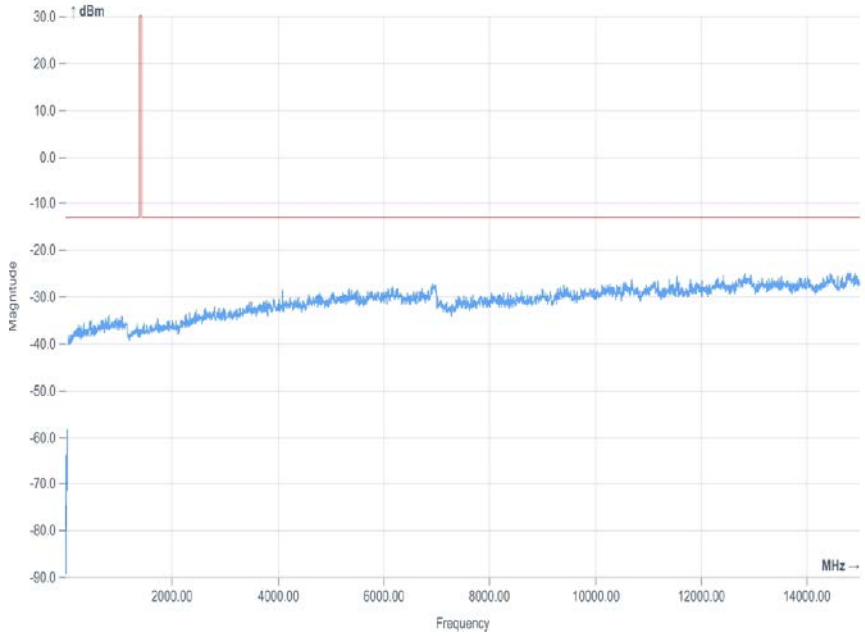
Plot 2: Channel 13, 9 kHz to 15 GHz



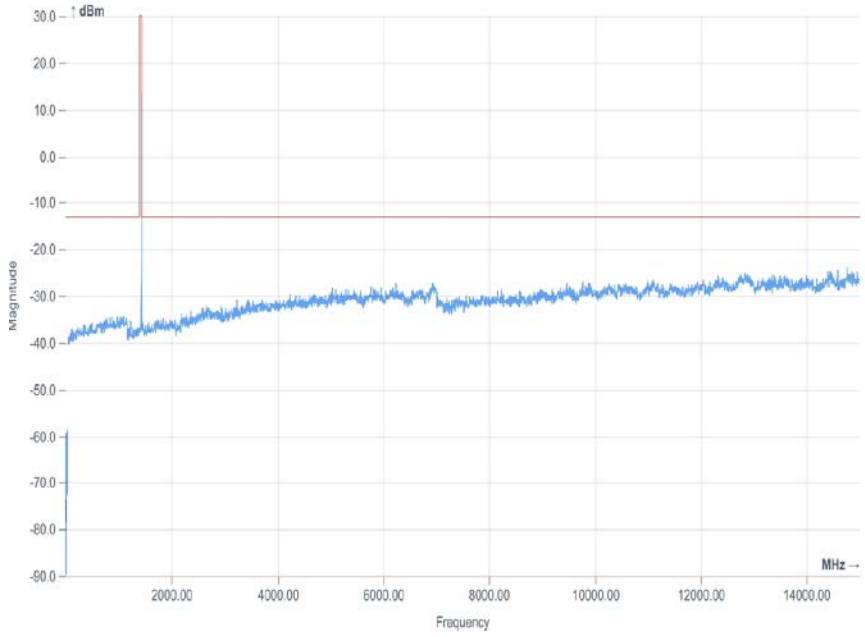
Plot 3: Channel 14, 9 kHz to 15 GHz



Plot 4: Channel 15, 9 kHz to 15 GHz

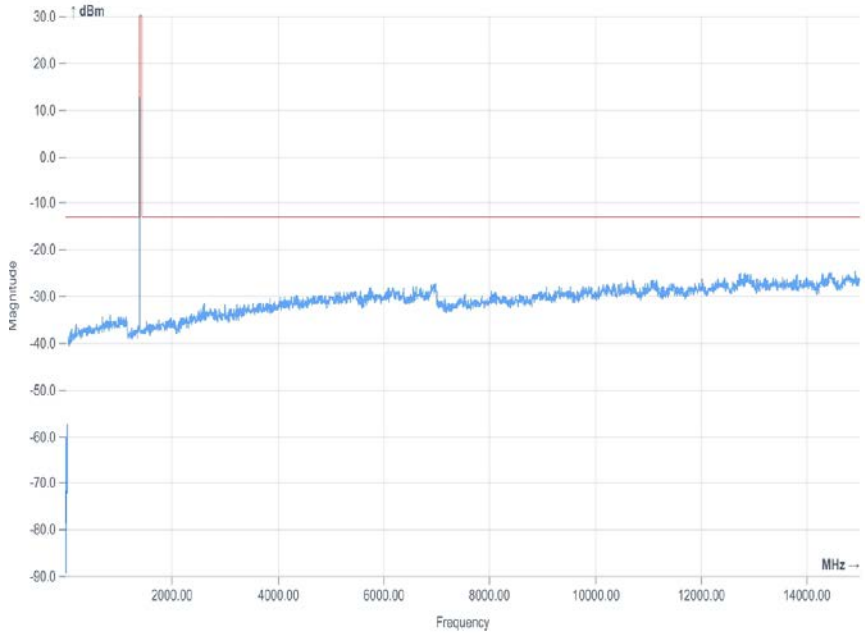


Plot 5: Channel 16, 9 kHz to 15 GHz

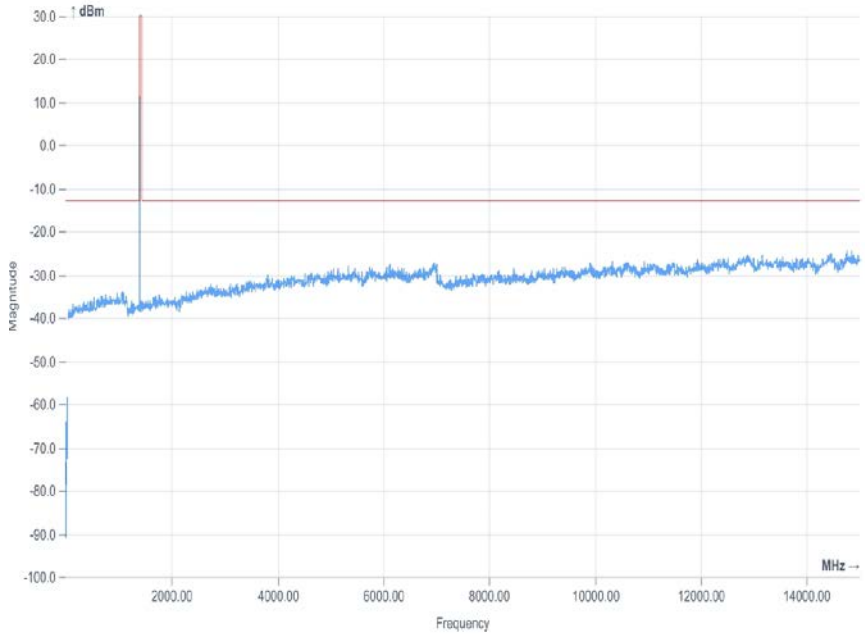


Results: D8PSK modulation

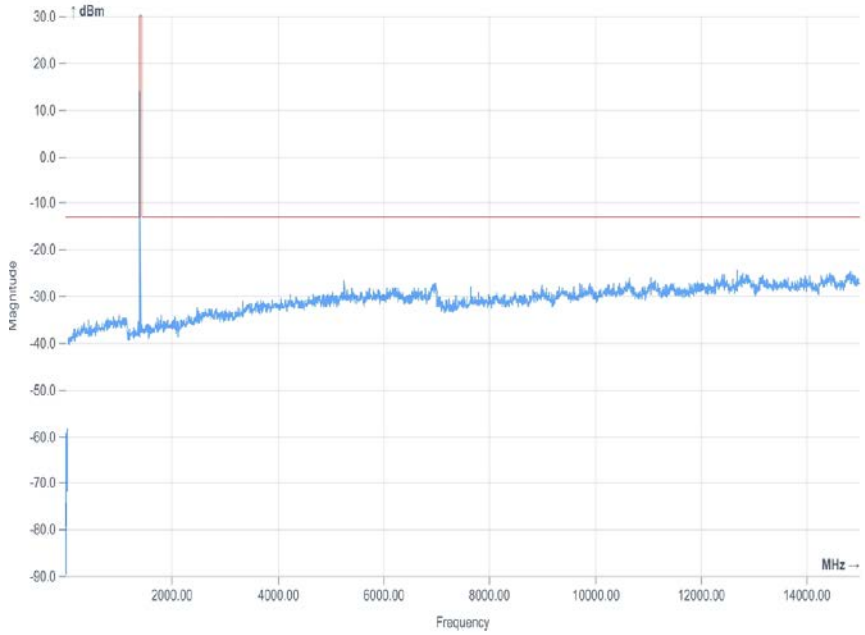
Plot 1: Channel 12, 9 kHz to 15 GHz



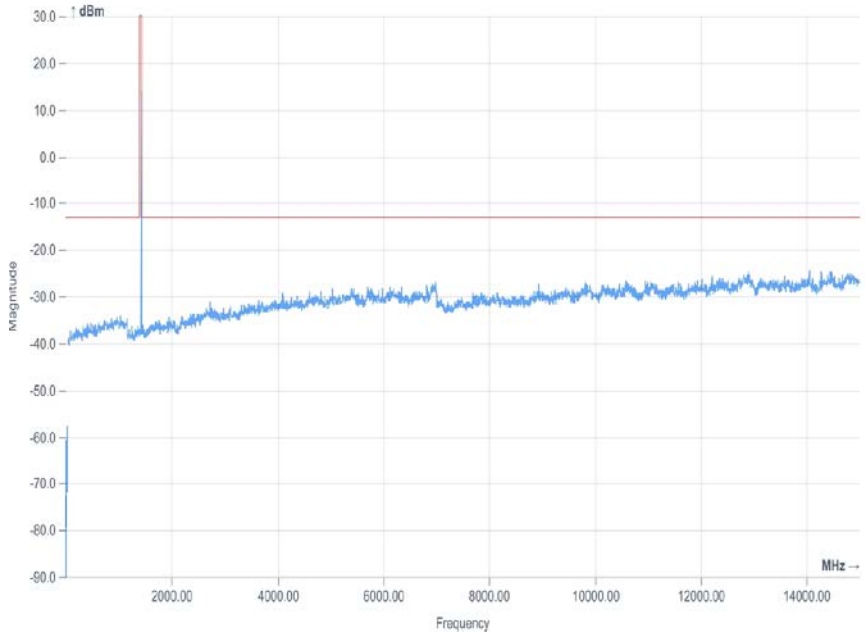
Plot 2: Channel 13, 9 kHz to 15 GHz



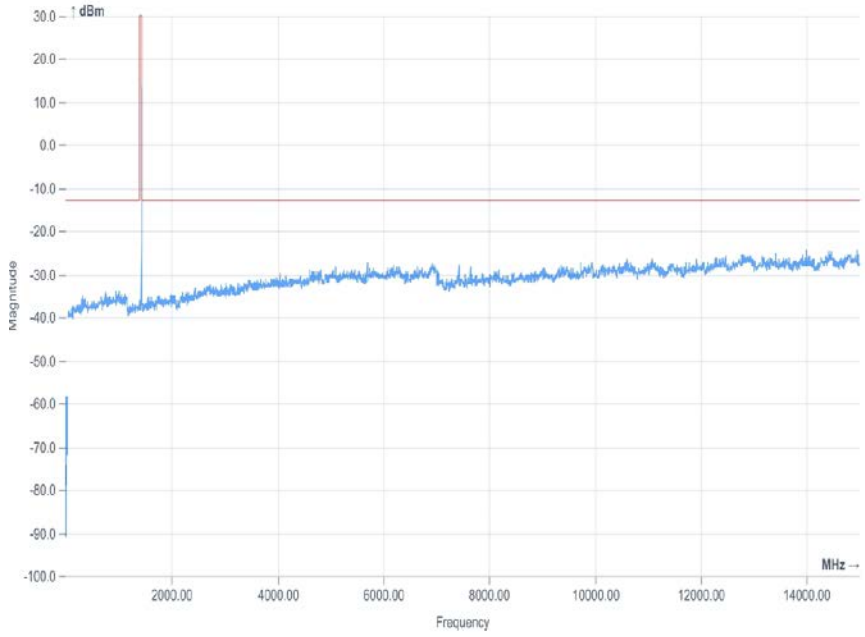
Plot 3: Channel 14, 9 kHz to 15 GHz



Plot 4: Channel 15, 9 kHz to 15 GHz



Plot 5: Channel 16, 9 kHz to 15 GHz



12.5 Occupied bandwidth

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	100 kHz
Resolution bandwidth:	30 kHz
Span:	10 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 8.3 setup A
Measurement uncertainty:	See chapter 9

Limits:

FCC
§ 2.1049
Reporting only

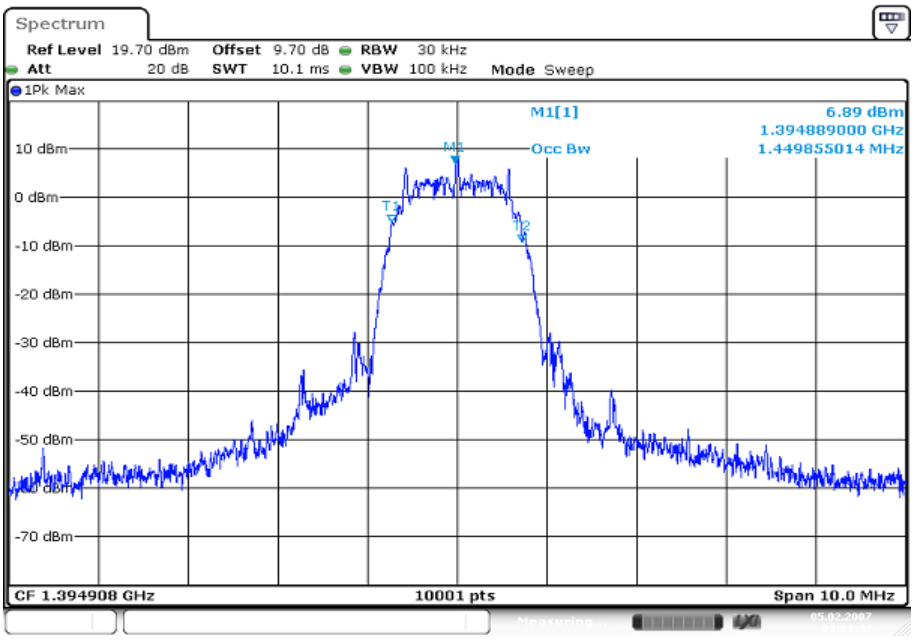
Results:

Channel	Modulation	99% bandwidth [kHz]
12	DBPSK	1441
12	DQPSK	1422
12	D8PSK	1425
13	DBPSK	1448
13	DQPSK	1421
13	D8PSK	1428
14	DBPSK	1450
14	DQPSK	1419
14	D8PSK	1426
15	DBPSK	1446
15	DQPSK	1423
15	D8PSK	1431
16	DBPSK	1439
16	DQPSK	1422
16	D8PSK	1418

Channel	Modulation	26 dB bandwidth [kHz]
12	DBPSK	1696
12	DQPSK	1632
12	D8PSK	1663
13	DBPSK	1686
13	DQPSK	1623
13	D8PSK	1688
14	DBPSK	1688
14	DQPSK	1687
14	D8PSK	1689
15	DBPSK	1682
15	DQPSK	1686
15	D8PSK	1695
16	DBPSK	1689
16	DQPSK	1679
16	D8PSK	1691

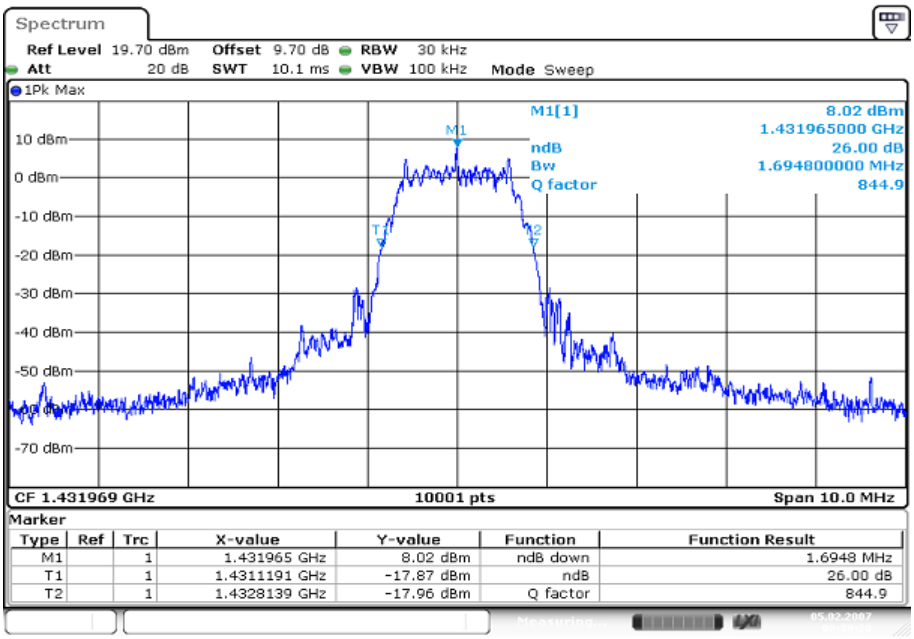
Plots:

Plot 1: Worst case 99% bandwidth plot, channel 14, DBPSK



Date: 5.FEB.2007 00:21:42

Plot 2: Worst case 26 dB bandwidth plot, channel 15, D8PSK



Date: 5.FEB.2007 00:28:20

12.6 Spurious emissions conducted below 30 MHz (AC conducted)

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 7.4 setup A
Measurement uncertainty	See sub clause 9

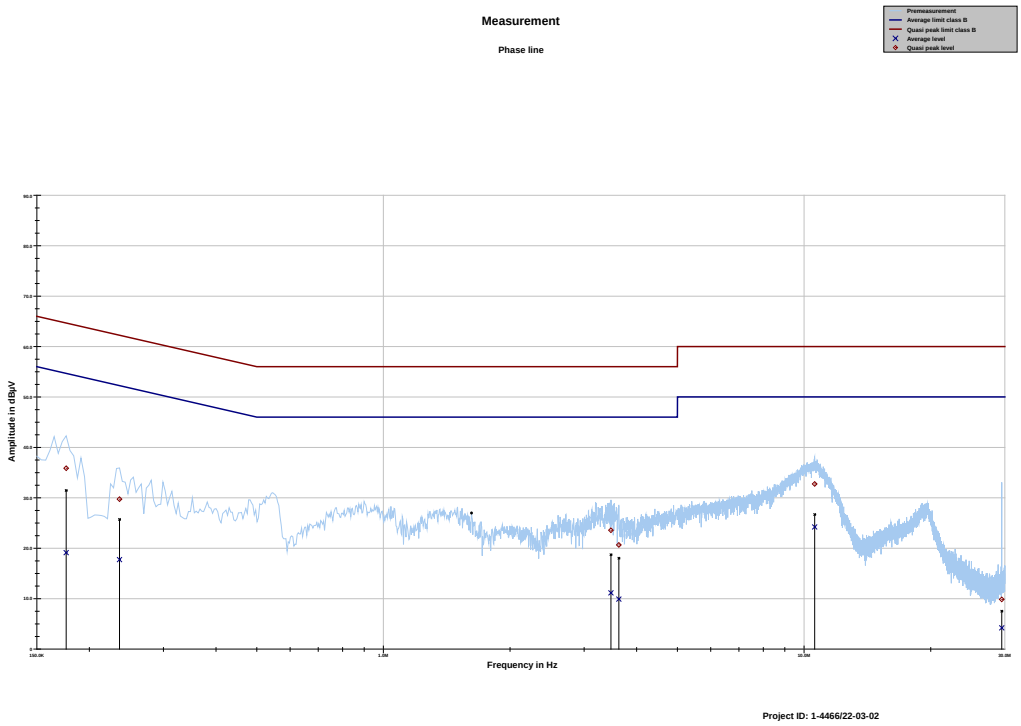
Limits:

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

Plots:

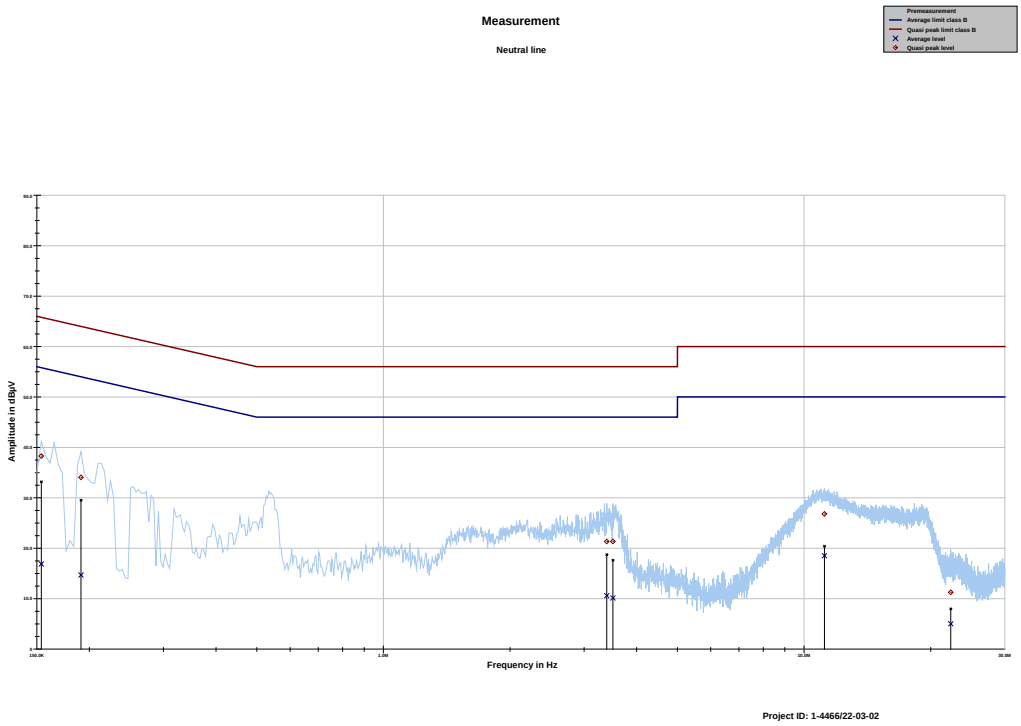
Plot 1: 150 kHz to 30 MHz, phase line



Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.176119	35.86	28.81	64.667	19.12	36.13	55.254
0.235819	29.73	32.51	62.242	17.73	35.82	53.548
3.474544	23.56	32.44	56.000	11.14	34.86	46.000
3.627525	20.64	35.36	56.000	9.90	36.10	46.000
10.597500	32.74	27.26	60.000	24.21	25.79	50.000
29.500013	9.84	50.16	60.000	4.20	45.80	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	38.28	27.52	65.796	16.86	39.04	55.893
0.191044	34.06	29.93	63.991	14.69	40.14	54.827
3.396187	21.34	34.66	56.000	10.59	35.41	46.000
3.511856	21.36	34.64	56.000	10.12	35.88	46.000
11.179575	26.79	33.21	60.000	18.50	31.50	50.000
22.321088	11.26	48.74	60.000	5.01	44.99	50.000

13 Glossary

AVG	Average
C	Compliant
C/N_0	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

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2023-10-12
A	AC conducted results added, antenna information added	2024-03-22

################################ END OF TEST REPORT ################################