
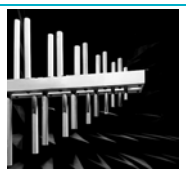
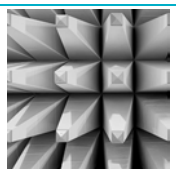

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-1037/20-01-02-B

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: https://www.ctcadvanced.com
e-mail: mail@ctcadvanced.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 starting with the registration number: D-PL-12076-01.

Applicant

Philips Medizin Systeme Böblingen GmbH
Hewlett-Packard-Strasse 2
71034 Böblingen / GERMANY
Phone: +49 7031 463 1879
Contact: Hansjörg Geywitz
e-mail: hansjoerg.geywitz@philips.com
Phone: -/-

Manufacturer

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

Test standard/s

FCC - Title 47 CFR Part 15	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

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

Test Item

Kind of test item:	**2.4G Radio Module**
Model name:	**IITBV1**
FCC ID:	**PQC-IITBV1**
IC:	**3549C-IITBV1**
Frequency:	DTS band 2400 MHz to 2483.5 MHz
Technology tested:	Proprietary
Antenna:	External Antenna
Power supply:	3.3 V DC by external power supply
Temperature range:	0°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=Andreas Luckenbill, o=CTC advanced GmbH, ou=LUC-180217, email=andreas.luckenbill@ctcadvanced.com, c=DE
2021.02.26 10:03:10 +01'00'

Andreas Luckenbill
Head of Department
Radio Communications

Test performed:

cn=Michael Dorongovski, o=CTC Advanced GmbH, ou=RCE-201118, email=Michael.Dorongovski@ctcadvanced.com, c=DE
2021.02.22 12:56:00 +01'00'

Michael Dorongovski
Lab Manager
Radio Communications

1 Table of contents

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. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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This test report 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 with the number 1-1037/20-01-02-A and dated 2021-02-12.

2.2 Application details

Date of receipt of order:	2020-08-26
Date of receipt of test item:	2020-10-05
Start of test:	2020-10-05
End of test:	2020-10-19
Person(s) present during the test:	Mr. Segun Adeniji

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

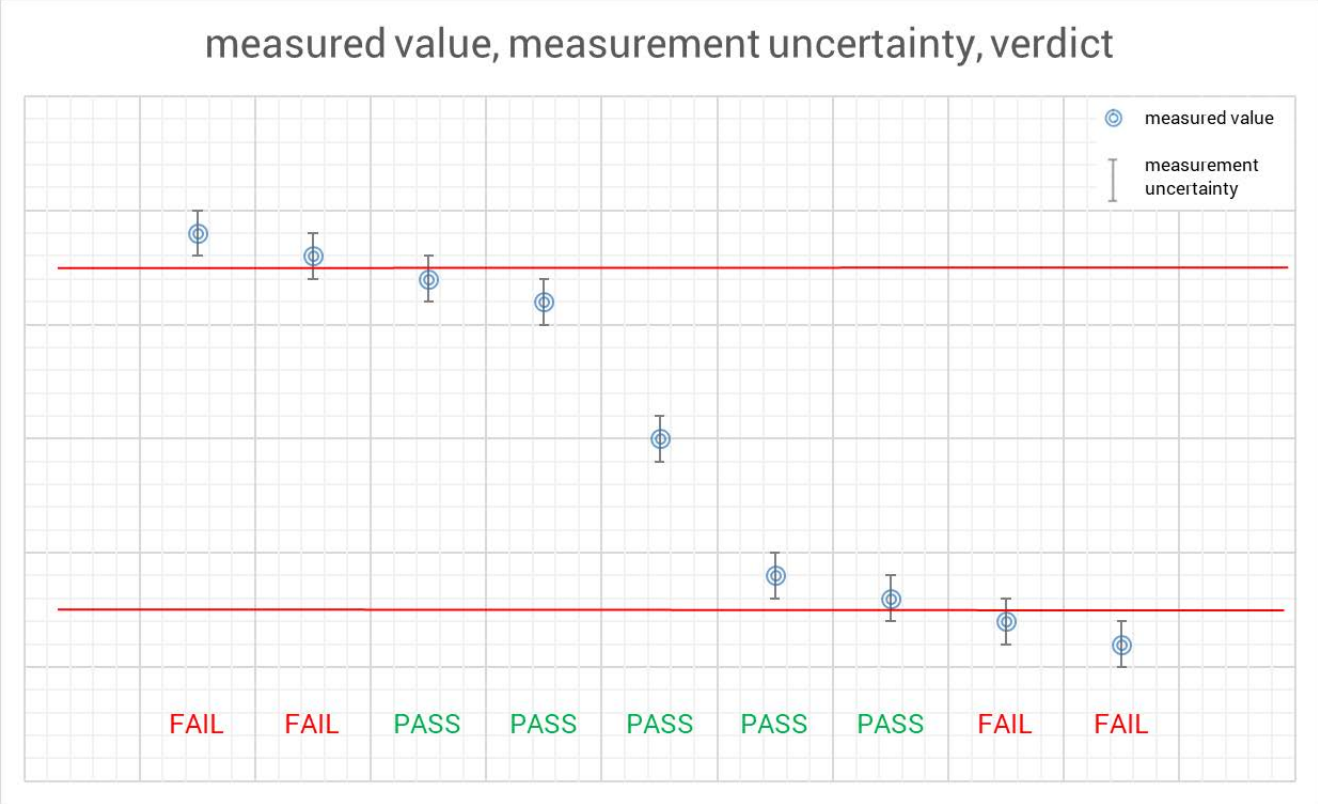
Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 2	February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices
RSS - Gen Issue 5 incl. Amendment 1	March 2019	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
KDB 558074 D01	v05r02	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Accreditation	Description
D-PL-12076-01-04	Telecommunication and EMC Canada https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf

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 No tests under extreme environmental conditions required. No tests under extreme environmental conditions required.
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	3.3 V DC by external power supply No tests under extreme environmental conditions required. No tests under extreme environmental conditions required.

6 Test item

6.1 General description

Kind of test item	:	2.4G Radio Module
Model name	:	IITBV1
HMN	:	n/a
PMN	:	IITBV1
HVIN	:	IITBV1
FVIN	:	3.02
S/N serial number	:	Rad. 2016 RX 021 000338 2016 RX 021 000378 (Only for radiated band edge compliance tests for channel 47) Cond. 2016 RX 021000378
Hardware status	:	2016
Software status	:	-/-
Firmware status	:	3.02
Frequency band	:	DTS band 2400 MHz to 2483.5 MHz
Type of radio transmission Use of frequency spectrum	: :	DTS*
Type of modulation	:	GFSK
Number of channels	:	48
Antenna	:	External Antenna
Power supply	:	3.3 V DC by external power supply
Temperature range	:	0°C to +70°C

*:**Philips Statement to Type of Radio Transmission**
According to KDB 558074 D01 15.247 Meas Guidance v05r02, “for a device using digital modulation and frequency hopping, compliance demonstration for both the FHSS requirements and the DTS requirements is not needed. Instead, such a device could be certified by complying with either all the FHSS requirements, or all of the DTS requirements, or all of the hybrid system requirements.”

Philips declares the radio as a DECT based smart hopping system. Only 3 to 6 channels can be pre-configured and only one can be used at a time. The radio remains in the active channel until a stronger interferer is seen in the current channel and then changes to one of the other preconfigured channels. For test purposes, this DECT based radio can be configured to a specific channel and therefore the test can be performed with DTS requirements. The results are also valid for this DECT based radio.

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:	1-1037/20-01-01_AnnexA 1-1037/20-01-01_AnnexB 1-1037/20-01-01_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.

7.4 Sequence of testing radiated spurious above 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

8 Description of the test setup

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

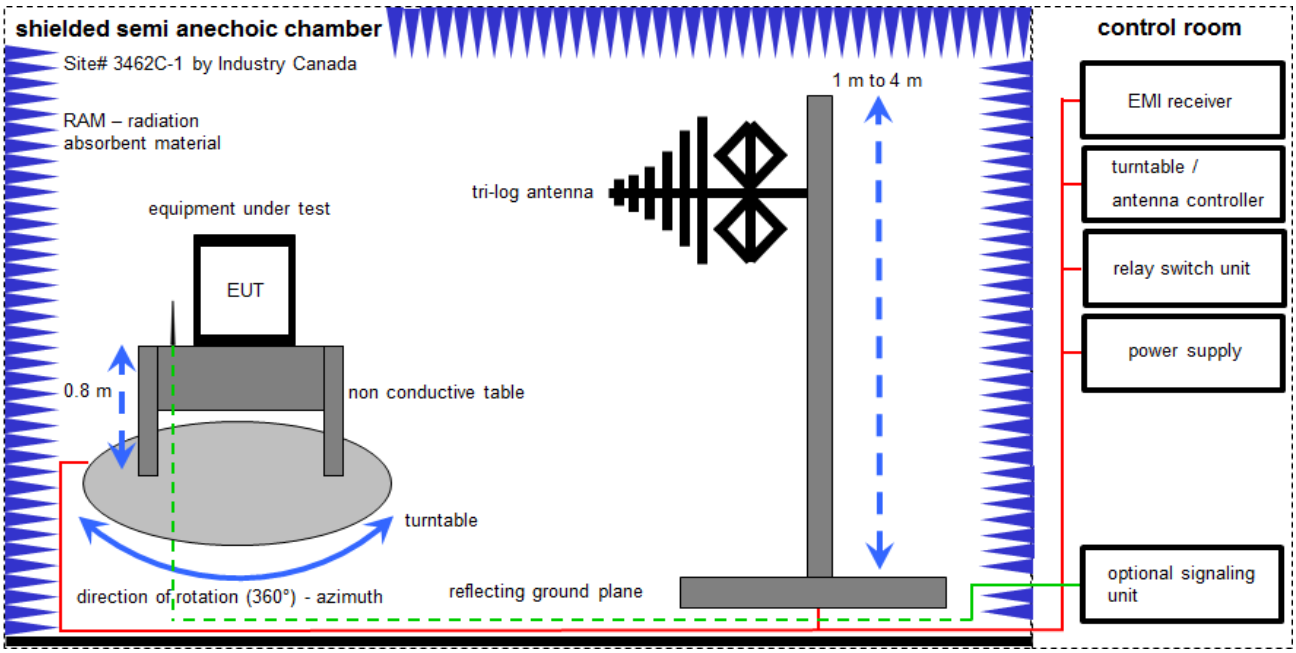
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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: 10.30.0

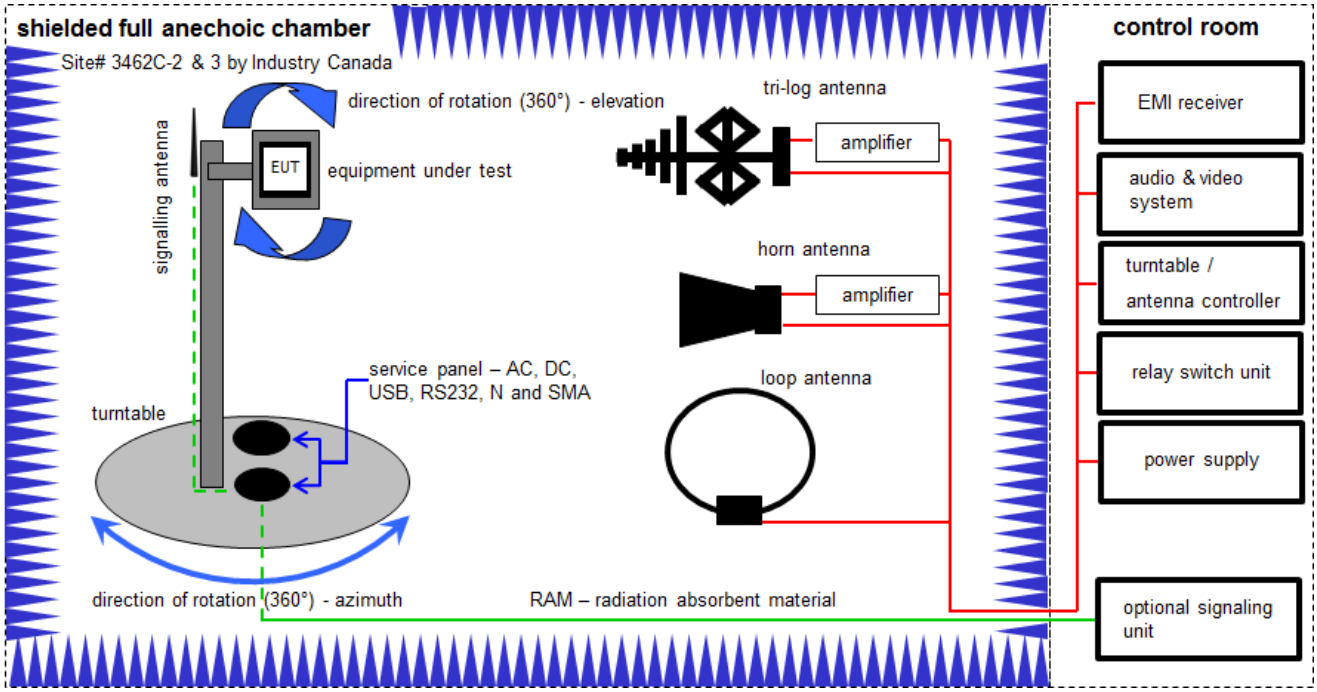
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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

Equipment table:

No.	Lab / Item	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	Meßkabine 1	HF-Absorberhalle	MWB AG 300023		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	295	300003787	vlKI!	19.02.2019	18.02.2021
7	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	21.05.2019	20.11.2020

8.2 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter / 1 meter

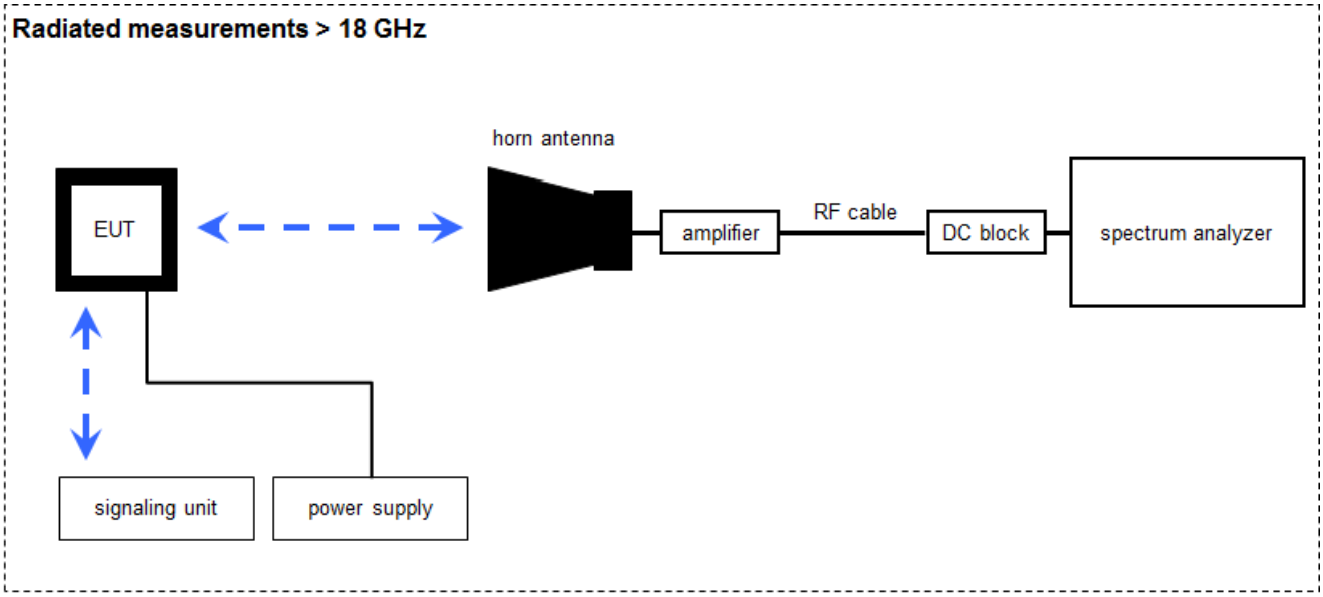
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	C	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	13.06.2019	12.06.2021
2	A, B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3696	300001604	vIKI!	27.02.2019	26.02.2021
3	A, B	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
4	A	Band Reject Filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	26	300003792	ne	-/-	-/-
5	A, B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22051	300004483	ev	-/-	-/-
6	A, B, C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
7	A, B, C	Computer	Intel Core i3 3220/3,3 GHz, Prozessor		2V2403033A5421	300004591	ne	-/-	-/-
8	A	Highpass Filter	WHKX2.6/18G-10SS	Wainwright	12	300004651	ne	-/-	-/-
9	A, B, C	NEXIO EMV-Software	BAT EMC V3.20.06	EMCO		300004682	ne	-/-	-/-
10	A, B, C	Anechoic chamber		TDK		300003726	ne	-/-	-/-
11	A, B, C	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	10.12.2019	09.12.2020
12	A, B	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011571	300005240	ev	-/-	-/-

8.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

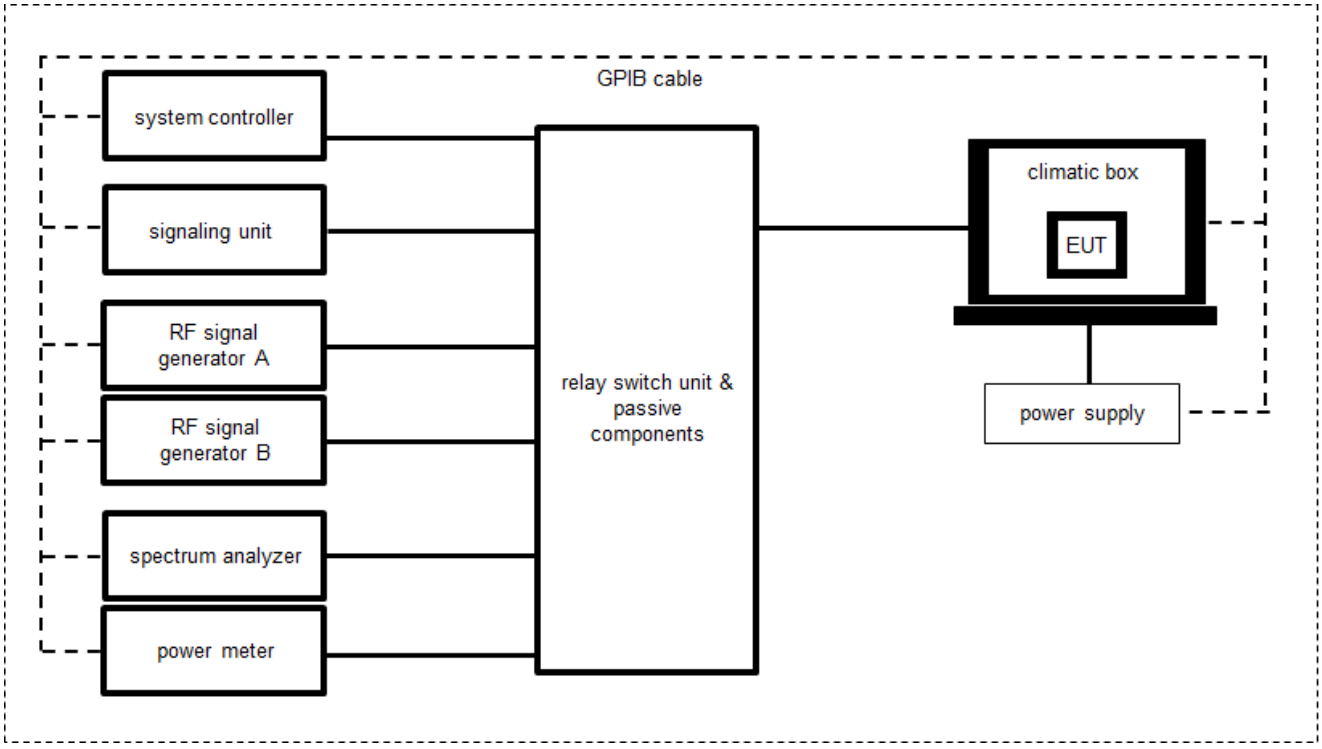
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Spectrum Analyzer	FSV30	Rohde & Schwarz	103170	300004855	vIKI!	11.12.2018	10.12.2020
2	A	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev	-/-	-/-
3	A	Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda	01096	300000486	vIKI!	21.01.2020	20.01.2022
4	A	RF-Cable	ST18/SMAm/SMAm /48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
5	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	-/-	400001185	ev	-/-	-/-

8.4 Conducted measurements Test system



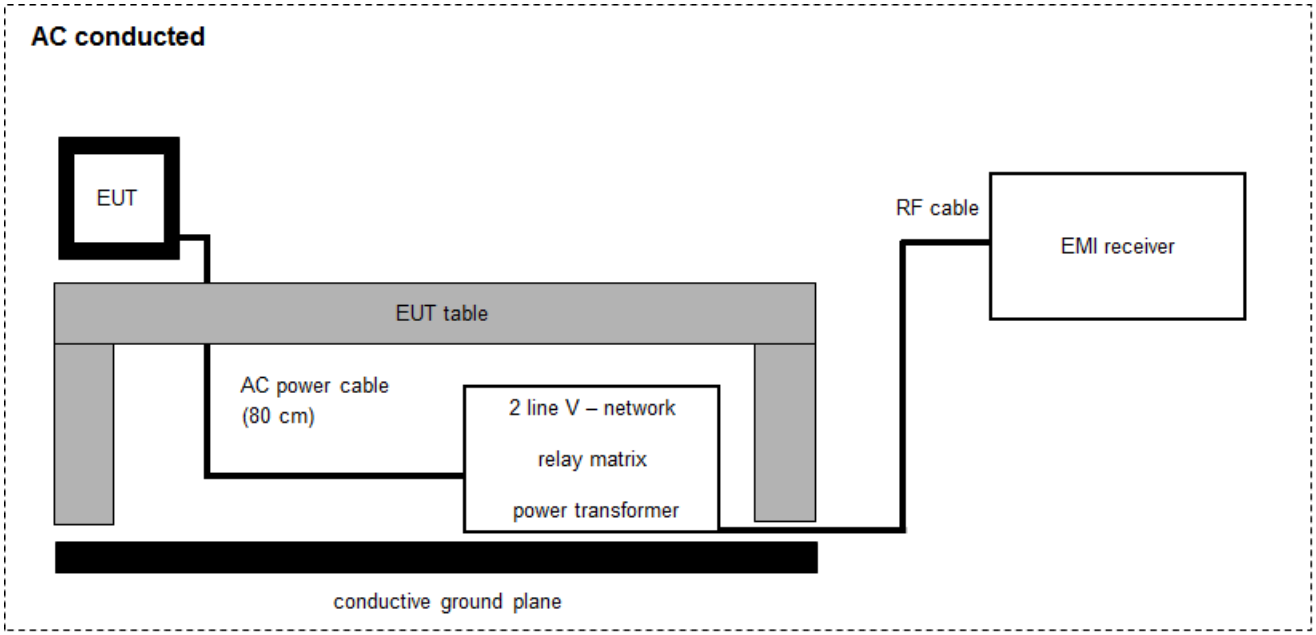
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Hygro-Thermometer	-/-, 5-45°C, 20-100%rF	Thies Clima	-/-	400000109	ev	13.08.2020	12.08.2022
2	A	USB/GPIB interface	82357B	Agilent Technologies	MY52103346	300004390	ne	-/-	-/-
3	A	PC Laboratory	Exone	Fröhlich + Walter	S2642279-03 / 10	300004179	ne	-/-	-/-
4	A	Spectrum Analyzer	FSV30	Rohde & Schwarz	103170	300004855	vlKl!	11.12.2018	10.12.2020
5	A	Relay Switch Matrix	RSM-1	CTC advanced GmbH	0001	400001355	ev	07.01.2020	06.01.2021
6	A	Tester Software RadioStar (C.BER2 for BT Conformance)	Version 1.0.0.X	CTC advanced GmbH	0001	400001380	ne	-/-	-/-

8.5 AC conducted



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

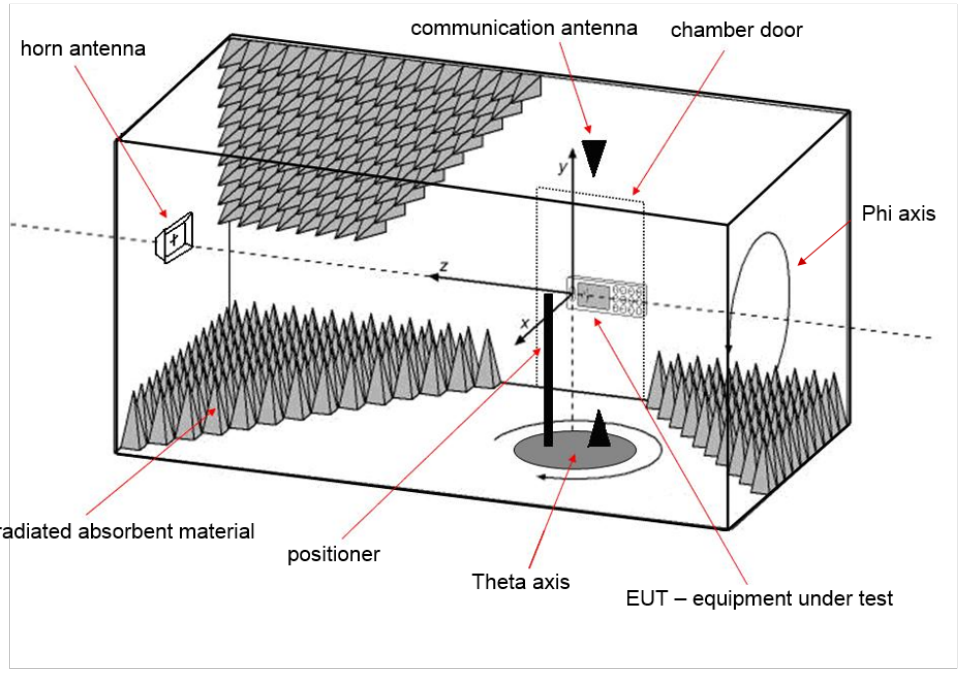
Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	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	R&S	892475/017	300002209	vIKI!	11.12.2019	10.12.2021
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	10.12.2019	09.12.2020
4	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-

8.6 Shielded fully anechoic chamber

OTA – over the air performance



Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	CTIA-Chamber	CTIA-Chamber AMS 8500	ETS-Lindgren Finnland	-/-	300003327	ne	-/-	-/-
2	A	CTIA-Chamber - Positioning Equipment	CTIA-Chamber - Positioning Equipment	EMCO/2	-/-	300003328	ne	-/-	-/-
3	A	CTIA-Chamber - Software	CTIA-Chamber - Software	EMCO/2	-/-	300003328	ne	-/-	-/-
4	A	CTIA-Chamber - Antenna	3164-04	EMCO/2	00041915	300003328	ne	-/-	-/-
5	A	Spectrum Analyzer 9kHz - 30 GHz	FSP30	R&S	100623	300003464	vIKI!	13.12.2018	12.12.2020
6	A	MXG Microwave Analog Signal Generator	N5183A	R&S	MY47420220	300003813	k	12.12.2019	11.12.2022

9 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	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

10 Summary of measurement results

☒	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 2	See table!	2021-02-22	-/-

Test specification clause	Test case	Guideline	Temperature conditions	Power source voltages	Mode	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4 (4)	System gain	-/-	Nominal	Nominal	GFSK	☒	☐	☐	☐	*1
§15.247(e) RSS - 247 / 5.2 (b)	Power spectral density	KDB 558074 DTS clause: 8.4	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(a)(2) RSS - 247 / 5.2 (a)	DTS bandwidth – 6 dB bandwidth	KDB 558074 DTS clause: 8.2	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
RSS Gen clause 4.6.1	Occupied bandwidth	-/-	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(b)(3) RSS - 247 / 5.4 (4)	Maximum output power	KDB 558074 DTS clause: 8.3.1.1	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance cond. & rad.	KDB 558074 DTS clause: 8.7.2 or 8.7.3	Nominal	Nominal	GFSK	☒	☐	☐	☐	see chapter 11
§15.247(d) RSS - 247 / 5.5	TX spurious emissions conducted	KDB 558074 DTS clause: 8.5	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.209(a) RSS - Gen	Spurious emissions radiated below 30 MHz	-/-	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated 30 MHz to 1 GHz	-/-	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated above 1 GHz	-/-	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions below 30 MHz (AC conducted)	-/-	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-

*1: The antenna gain was measured in a stand-alone configuration with a signal generator as signal source.

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

11 Additional comments

Reference documents: 1-1037_20-01-02_log1_conducted.pdf

Special test descriptions: None

Configuration descriptions: All radiated tests were performed with both antennas. The used antennas are:
1. Philips 453564817421 Antenna, for X3 and MX100
2. Philips 453564271931 Antenna, for MX400, MX450, MX500, MX550

For all tests the following power settings were used:
Channels 0 to 47: Power setting 16 (453564271931 antenna)
Channels 0 to 46: Power setting 16 (453564817421 antenna)
Channel 47: Power setting 14 (453564817421 antenna)
The power setting on the highest channel has to be reduced to 14 when using the 453564817421 antenna in order to comply with the band edge compliance requirements.

All conducted tests were performed on channels 0 (2401.056 MHz), 23 (2440.8 MHz), 46 (2480.544 MHz) and 47 (2482.272 MHz).
The radiated spurious emissions tests for both antennas were performed on channels 0 (2401.056 MHz), 23 (2440.8 MHz) and 46 (2480.544 MHz).
Radiated band edge compliance tests for both antennas were performed on channels 0 (2401.056 MHz), 46 (2480.544 MHz) and 47 (2482.272 MHz)

Due to a low duty cycle during tests (around 8%), the sweep times during all tests were adjusted accordingly.

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

Antennas and transmit operating modes:

☒ Operating mode 1 (single antenna)
- *Equipment with 1 antenna,*
- *Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,*
- *Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)*

☐ 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.

12 Measurement results

12.1 System gain

Measurement parameters (radiated)	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz
Span	5 MHz
Trace mode	Max hold
Test setup	See sub clause 8.6 A
Measurement uncertainty	See sub clause 9

Limits:

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

Results: Philips 453564817421 Antenna for X3 and MX100

	Low channel (2401 MHz)	Mid channel (2440 MHz)	High channel (2481 MHz)
Gain [dBi] measured	-0.5	1.1	1.0

Results: Philips 453564271931 Antenna for MX400, MX450, MX500, MX550

	Low channel (2401 MHz)	Mid channel (2440 MHz)	High channel (2481 MHz)
Gain [dBi] measured	2.5	3.7	1.6

12.2 Power spectral density

Description:

Measurement of the power spectral density of a digital modulated system.

Measurement parameters	
External result file	1-1037_20-01-02_log1_conducted.pdf FCC Part 15.247 Peak Power Spectral Density DTS
Test setup	See sub clause 8.4 A
Measurement uncertainty	See sub clause 9

Limits:

FCC	IC
Power spectral density	
For digitally modulated systems the transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration.	

Results:

	Frequency		
	2401.056 MHz	2440.8 MHz	2480.544 MHz
Power spectral density [dBm / 3kHz] GFSK	-3.2	-3.1	-3.3

	Frequency	
	2482.272 MHz PS 16	2482.272 MHz PS 14
Power spectral density [dBm / 3kHz] GFSK	-3.2	-4.6

12.3 DTS bandwidth – 6 dB bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement parameters	
External result file	1-1037_20-01-02_log1_conducted.pdf FCC Part 15.247 Bandwidth 6dB DTS
Test setup	See sub clause 8.4 A
Measurement uncertainty	See sub clause 9

Limits:

FCC	IC
DTS bandwidth – 6 dB bandwidth	
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Results:

	Frequency		
	2401.056 MHz	2440.8 MHz	2480.544 MHz
6 dB bandwidth [kHz] GFSK	806	806	787

	Frequency	
	2482.272 MHz PS 16	2482.272 MHz PS 14
6 dB bandwidth [kHz] GFSK	794	794

12.4 Occupied bandwidth – 99% emission bandwidth

Description:

Measurement of the 99% bandwidth of the modulated signal acc. RSS-GEN.

Measurement parameters	
External result file	1-1037_20-01-02_log1_conducted.pdf FCC Part 15.247 Bandwidth 99PCT-20dB
Test setup	See sub clause 8.4 A
Measurement uncertainty	See sub clause 9

Usage:

-/-	IC
Occupied bandwidth – 99% emission bandwidth	
OBW is necessary for emission designator	

Results:

	Frequency		
	2401.056 MHz	2440.8 MHz	2480.544 MHz
99% bandwidth [kHz] GFSK	1210	1208	1196

	Frequency	
	2482.272 MHz PS 16	2482.272 MHz PS 14
99% bandwidth [kHz] GFSK	1191	1195

12.5 Maximum output power

Description:

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

Measurement parameters	
External result file	1-1037_20-01-02_log1_conducted.pdf FCC Part 15.247 Maximum Peak Conducted Output Power DTS
Test setup	See sub clause 8.4 A
Measurement uncertainty	See sub clause 9

Limits:

FCC	IC
Maximum output power	
Conducted: 1.0 W – antenna gain max. 6 dBi	

Results:

	Frequency		
	2401.056 MHz	2440.8 MHz	2480.544 MHz
Maximum output power conducted [dBm] GFSK	14.6	14.2	14.2

	Frequency	
	2482.272 MHz PS 16	2482.272 MHz PS 14
Maximum output power conducted [dBm] GFSK	14.4	12.7

12.6 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 2401.056 MHz for the lower restricted band and 2480.544 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 8.2 B
Measurement uncertainty	See sub clause 9

Limits:

FCC	IC
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	

In order to show the compliance on channel 47, the marker-delta procedure was used according to ANSI 63.10 chapter 6.10.6.2.

Results: Philips 453564817421 Antenna for X3 and MX100

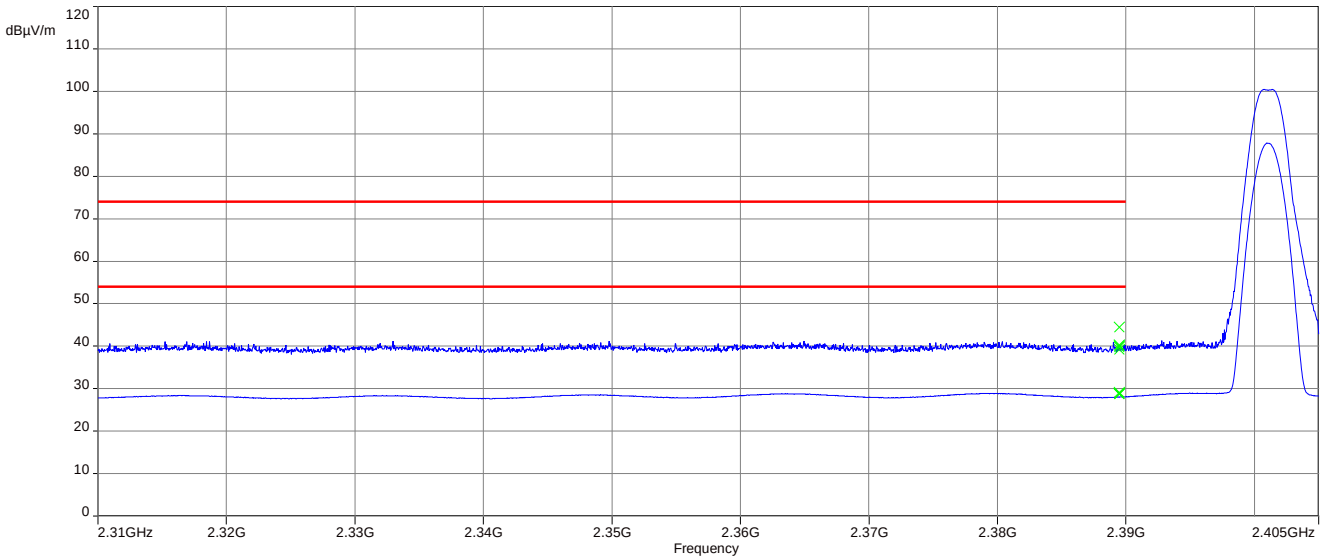
Scenario	Band edge compliance radiated [dBµV/m]
Data rate	GFSK
Lower restricted band Channel 0	29.1 dBµV/m AVG 44.5 dBµV/m Peak
Upper restricted band Channel 46	31.6 dBµV/m AVG 43.4 dBµV/m Peak
Upper restricted band Channel 47	82.9 dBµV/m – 38.5 dB = 44.4 dBµV/m AVG 109.3 dBµV/m – 38.5 dB = 70.8 dBµV/m Peak

Results: Philips 453564271931 Antenna for MX400, MX450, MX500, MX550

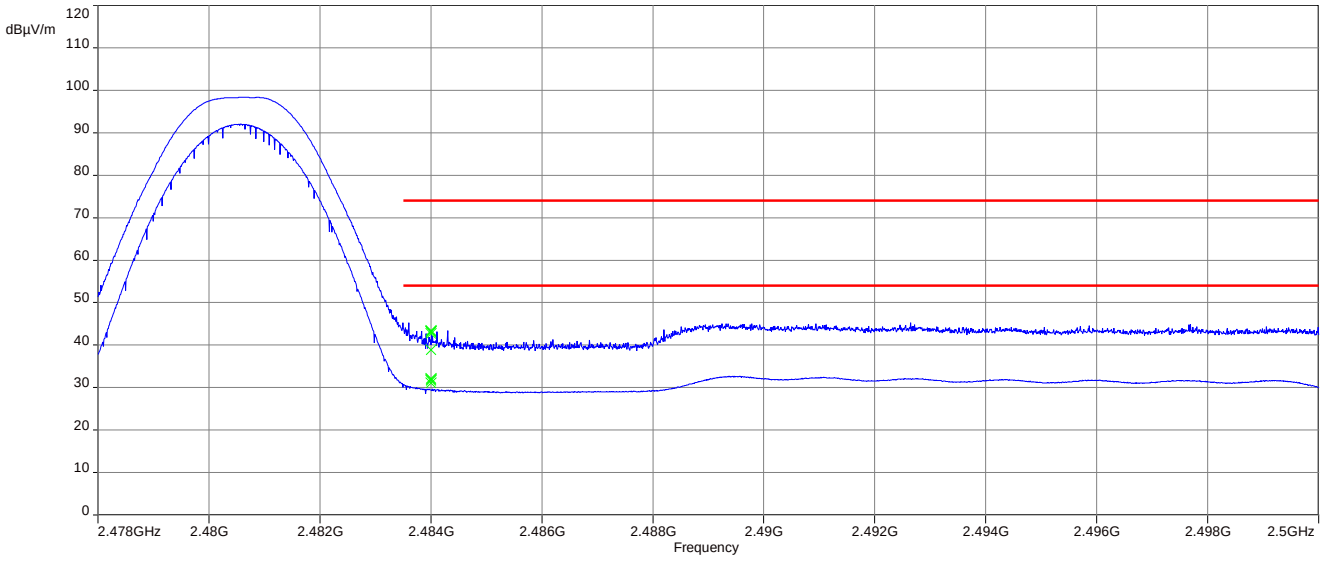
Scenario	Band edge compliance radiated [dBµV/m]
Data rate	GFSK
Lower restricted band Channel 0	28.8 dBµV/m AVG 44.8 dBµV/m Peak
Upper restricted band Channel 46	32.3 dBµV/m AVG 43.4 dBµV/m Peak
Upper restricted band Channel 47	84.0 dBµV/m – 37.9 dB = 46.1 dBµV/m AVG 110.2 dBµV/m – 37.9 dB = 72.3 dBµV/m Peak

Plots:

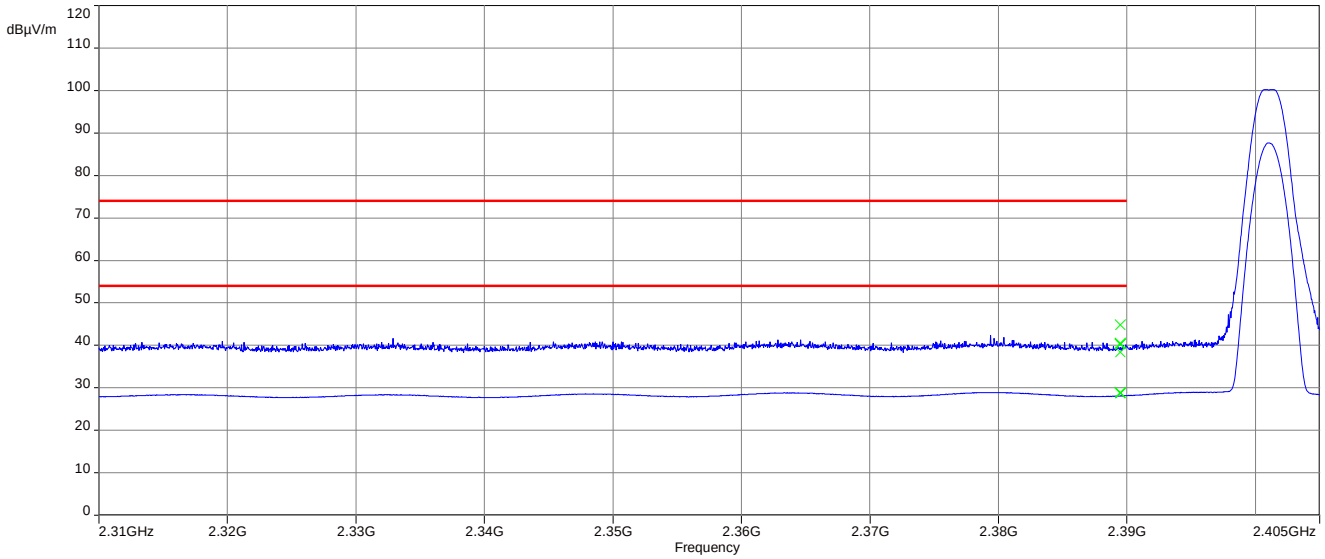
Plot 1: Lower restricted band, Channel 0, GFSK, Philips 453564817421 Antenna for X3 and MX100



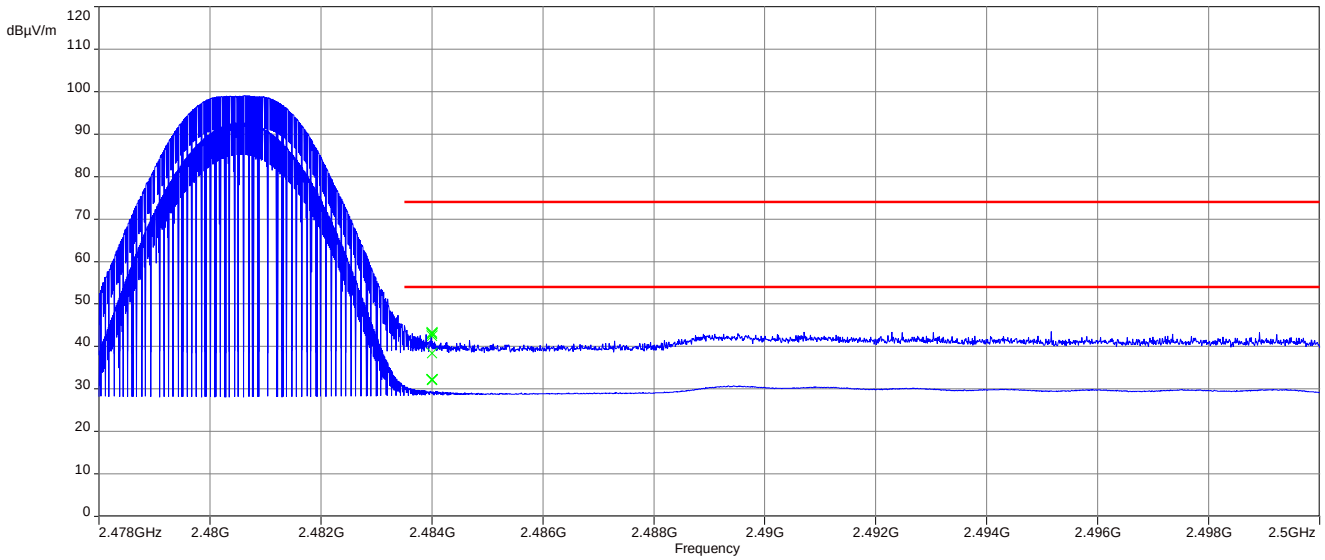
Plot 2: Upper restricted band, Channel 46, GFSK, Philips 453564817421 Antenna for X3 and MX100



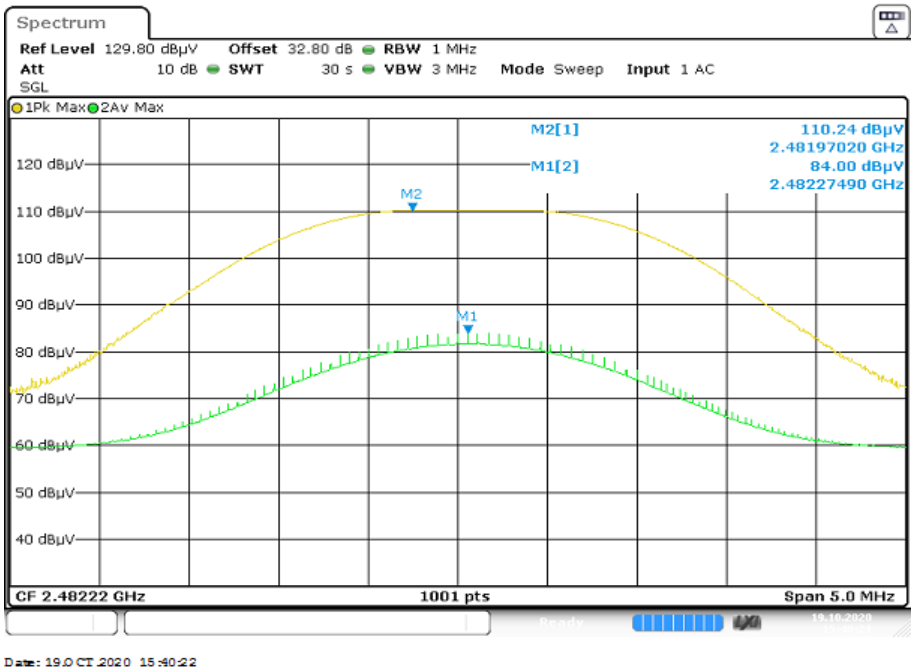
Plot 3: Lower restricted band, Channel 0, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550



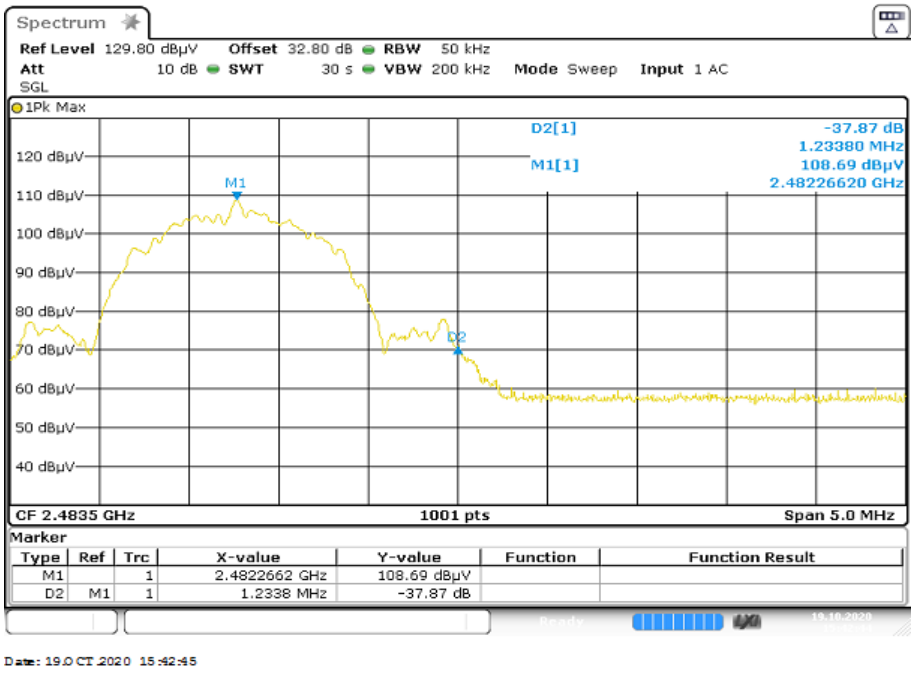
Plot 4: Upper restricted band, Channel 46, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550



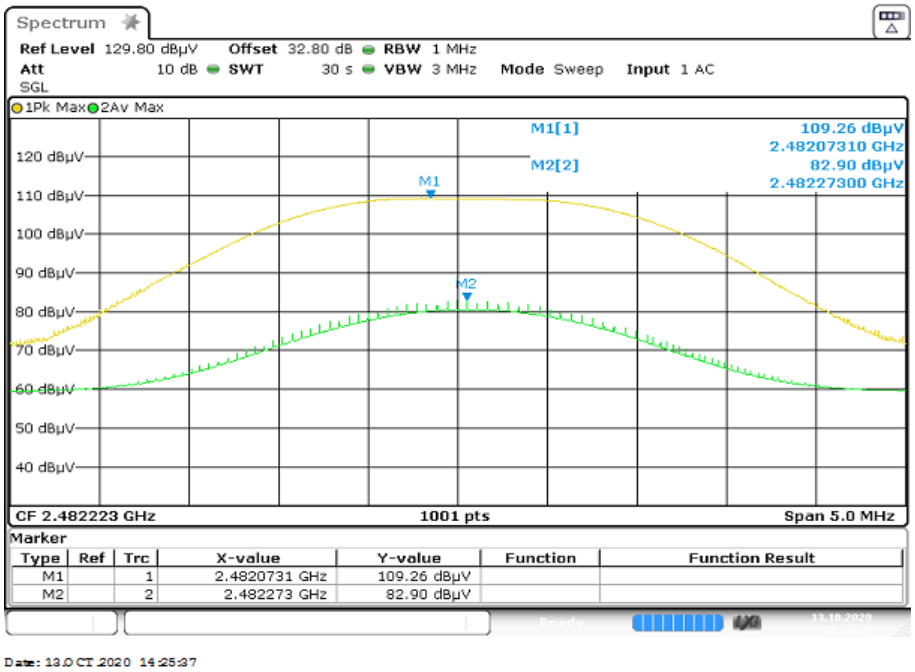
Plot 5: Upper restricted band, Channel 47, GFSK, Philips 453564817421 Antenna for X3 and MX100, field strength



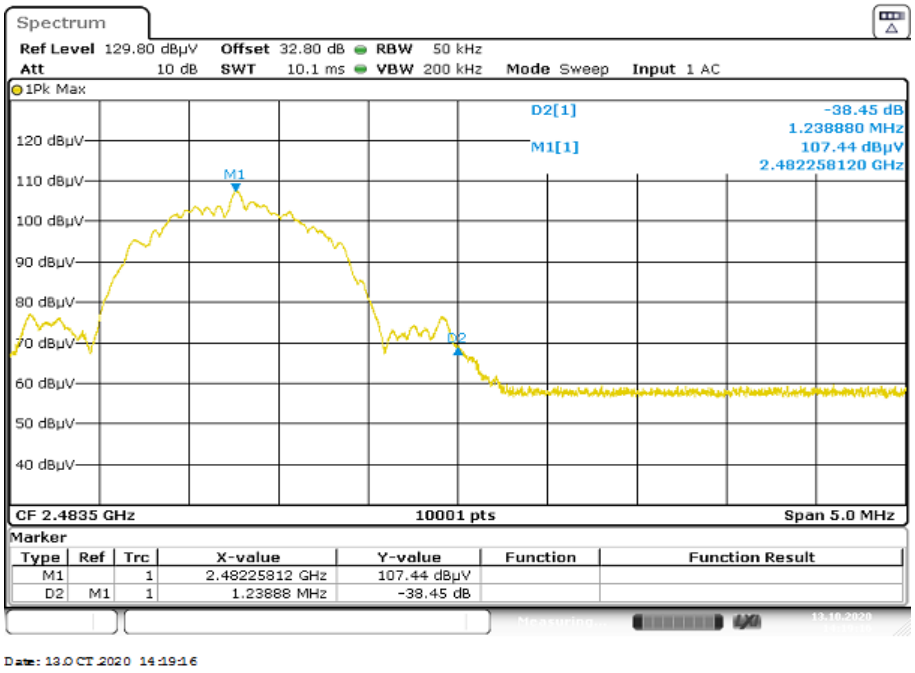
Plot 6: Upper restricted band, Channel 47, GFSK, Philips 453564817421 Antenna for X3 and MX100, relative measurement



Plot 7: Upper restricted band, Channel 47, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550, field strength



Plot 8: Upper restricted band, Channel 47, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550, relative measurement



12.7 TX spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit frequencies are 2401.056 MHz, 2440.8 MHz and 2480.544 MHz.

Measurement parameters	
External result file	1-1037_20-01-02_log1_conducted.pdf FCC Part 15.247 TX Spurious Conduced
Test setup	See sub clause 8.4 A
Measurement uncertainty	See sub clause 9

Limits:

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

Results: GFSK

TX spurious emissions conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2401.056	-/-	11.5	30 dBm	-/-	Operating frequency
All detected emissions are compliant with the -20 dBc limit!			-20 dBc		compliant
-/-	-/-	-/-		-/-	-/-
-/-	-/-	-/-		-/-	-/-
2440.8	-/-	10.5	30 dBm	-/-	Operating frequency
All detected emissions are compliant with the -20 dBc limit!			-20 dBc		compliant
-/-	-/-	-/-		-/-	-/-
-/-	-/-	-/-		-/-	-/-
2480.544	-/-	13.8	30 dBm	-/-	Operating frequency
All detected emissions are compliant with the -20 dBc limit!			-20 dBc		compliant
-/-	-/-	-/-		-/-	-/-
-/-	-/-	-/-		-/-	-/-
2482.272 (PS16)	-/-	10.9	30 dBm	-/-	Operating frequency
All detected emissions are compliant with the -20 dBc limit!			-20 dBc		compliant
-/-	-/-	-/-		-/-	-/-
-/-	-/-	-/-		-/-	-/-
2482.272 (PS14)	-/-	9.3	30 dBm	-/-	Operating frequency
All detected emissions are compliant with the -20 dBc limit!			-20 dBc		compliant
-/-	-/-	-/-		-/-	-/-
-/-	-/-	-/-		-/-	-/-

12.8 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 2401.056 MHz, 2440.8 MHz and 2480.544 MHz. The limits are recalculated to a measurement distance of 3 m according the ANSI C63.10.

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

Limits:

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

Results: Philips 453564817421 Antenna for X3 and MX100

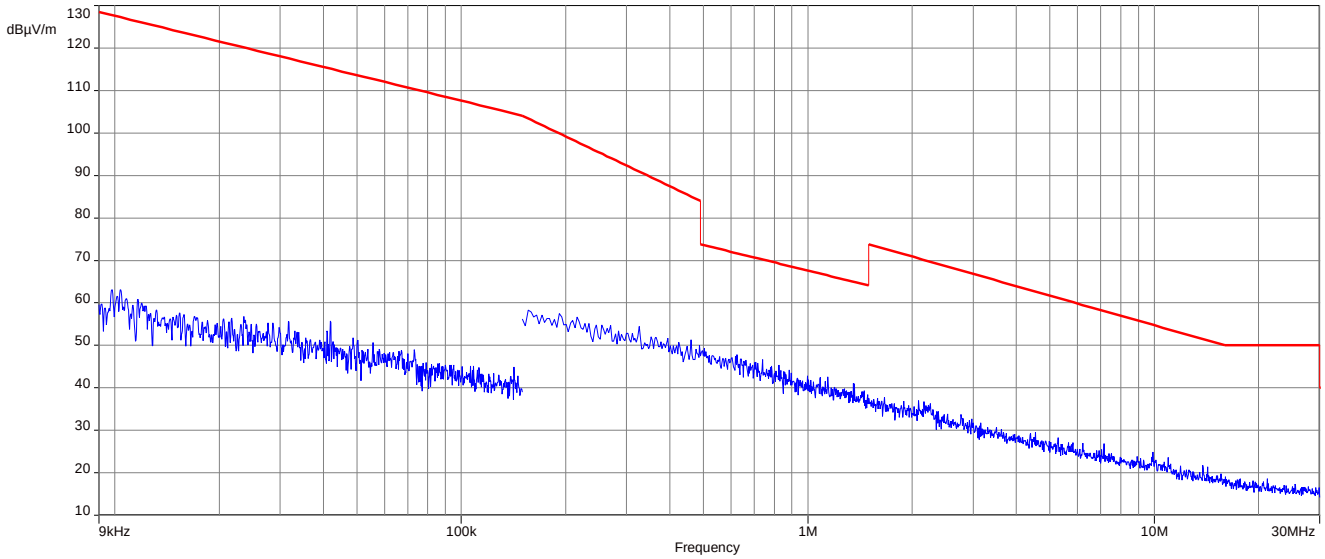
TX spurious emissions radiated below 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.		
-/-	-/-	-/-
-/-	-/-	-/-

Results: Philips 453564271931 Antenna for MX400, MX450, MX500, MX550

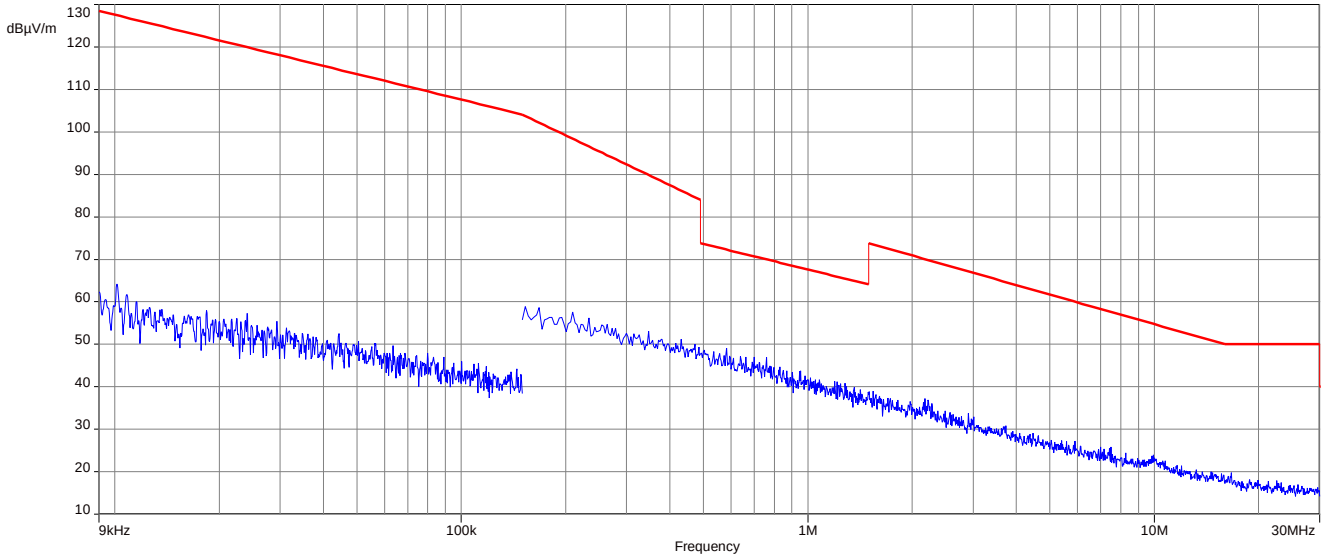
TX spurious emissions radiated below 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.		
-/-	-/-	-/-
-/-	-/-	-/-

Plots:

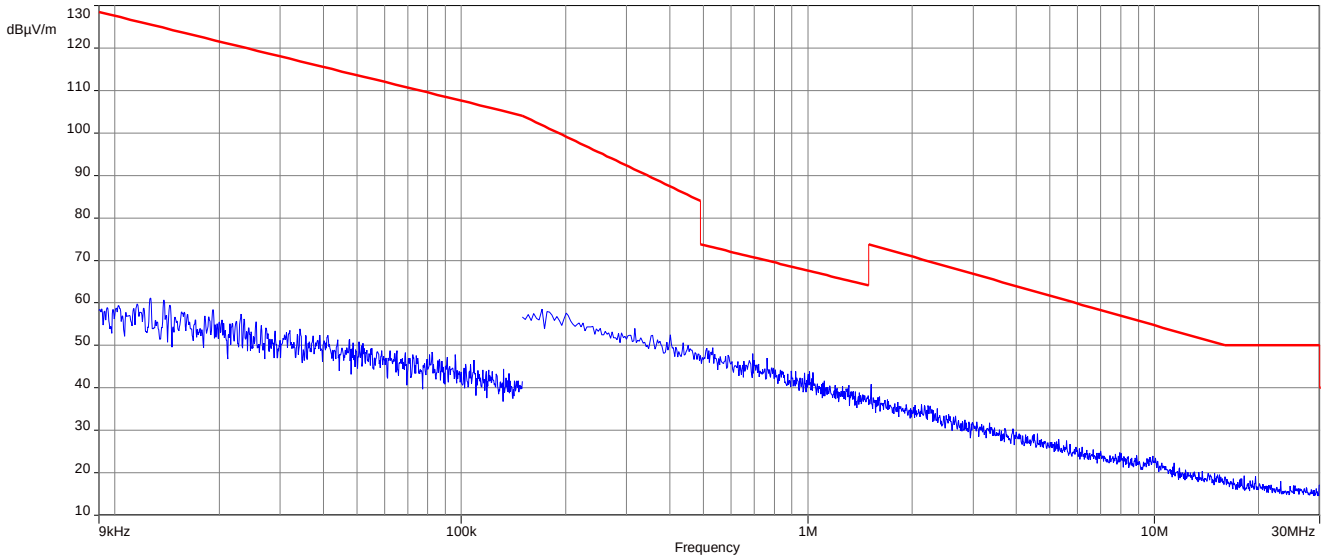
Plot 1: 9 kHz to 30 MHz, 2401.056 MHz, transmit mode, GFSK, Philips 453564817421 Antenna for X3 and MX100



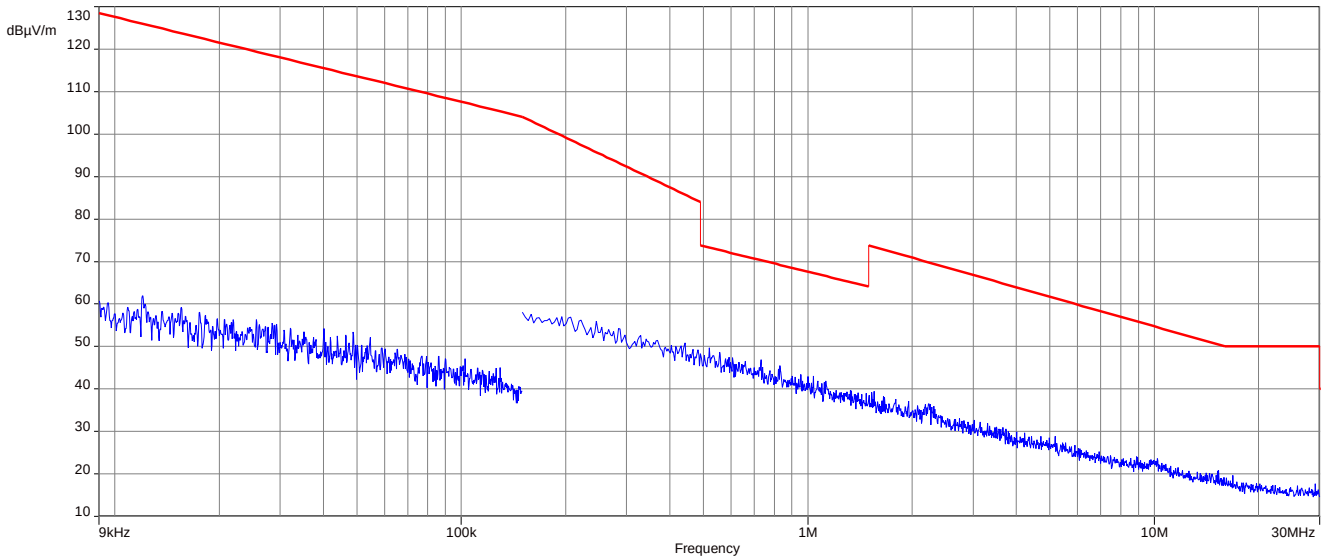
Plot 2: 9 kHz to 30 MHz, 2440.8 MHz, transmit mode, GFSK, Philips 453564817421 Antenna for X3 and MX100



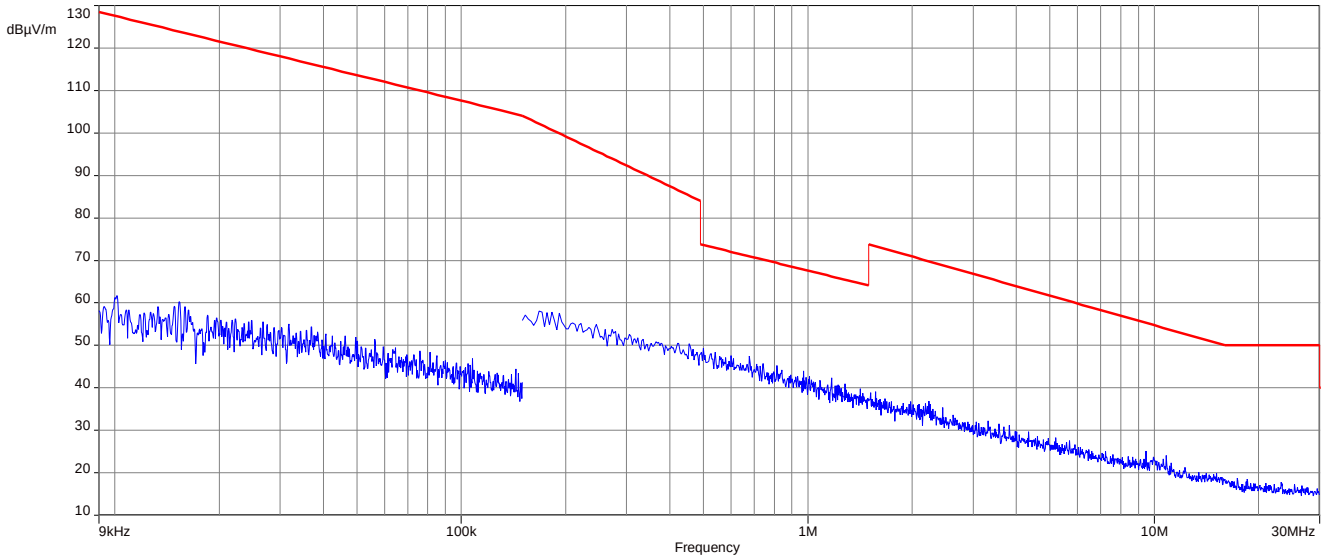
Plot 3: 9 kHz to 30 MHz, 2480.544 MHz, transmit mode, GFSK, Philips 453564817421 Antenna for X3 and MX100



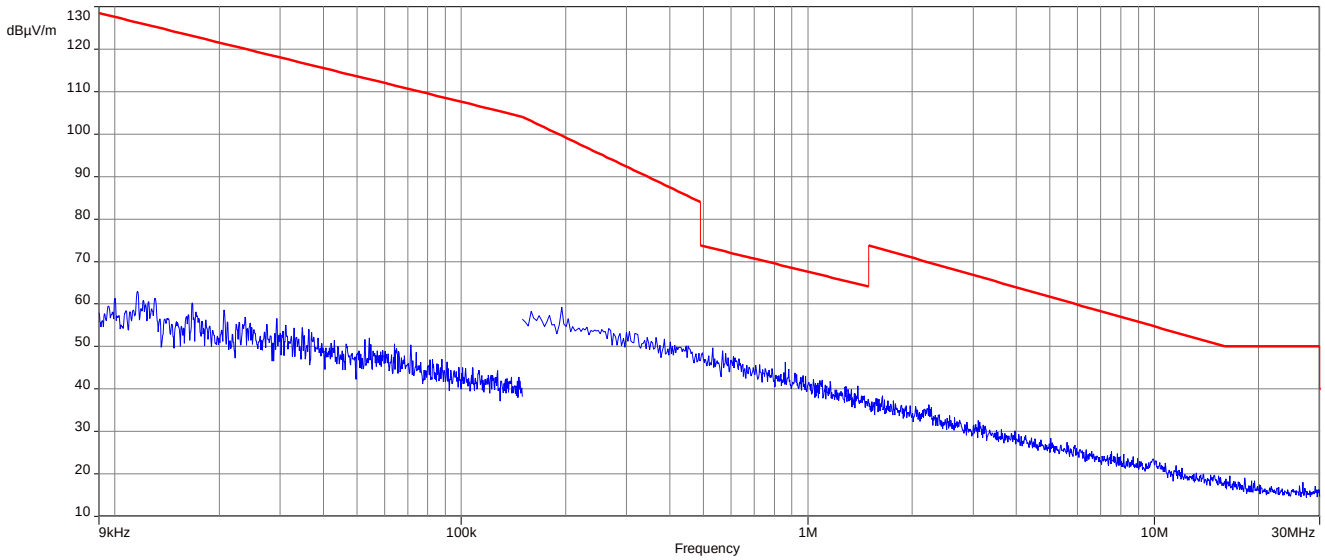
Plot 4: 9 kHz to 30 MHz, 2401.056 MHz, transmit mode, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550



Plot 5: 9 kHz to 30 MHz, 2440.8 MHz, transmit mode, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550



Plot 6: 9 kHz to 30 MHz, 2480.544 MHz, transmit mode, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550



12.9 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 2401.056 MHz, 2440.8 MHz and 2480.544 MHz.

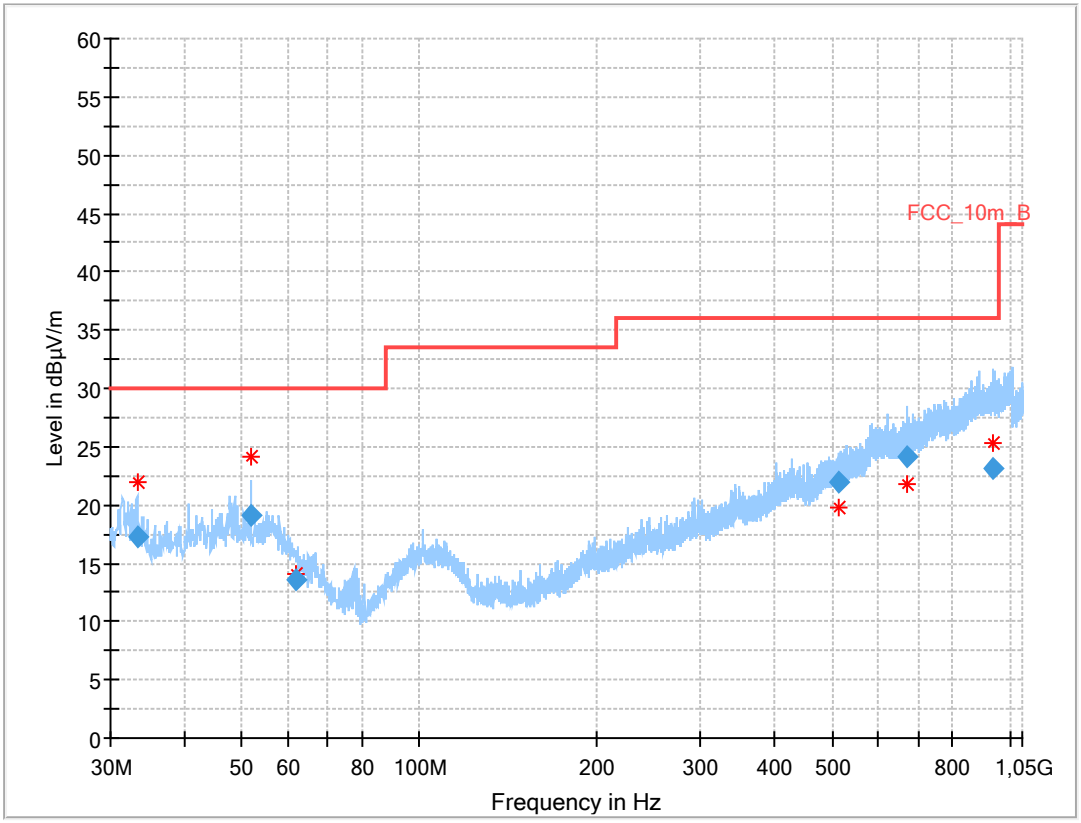
Measurement parameters	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	120 kHz
Video bandwidth	3 x RBW
Span	30 MHz to 1 GHz
Trace mode	Max hold
Measured modulation	GFSK
Test setup	See sub clause 8.1 A
Measurement uncertainty	See sub clause 9

Limits:

FCC	IC	
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
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Plots: Transmit mode, Philips 453564817421 Antenna for X3 and MX100

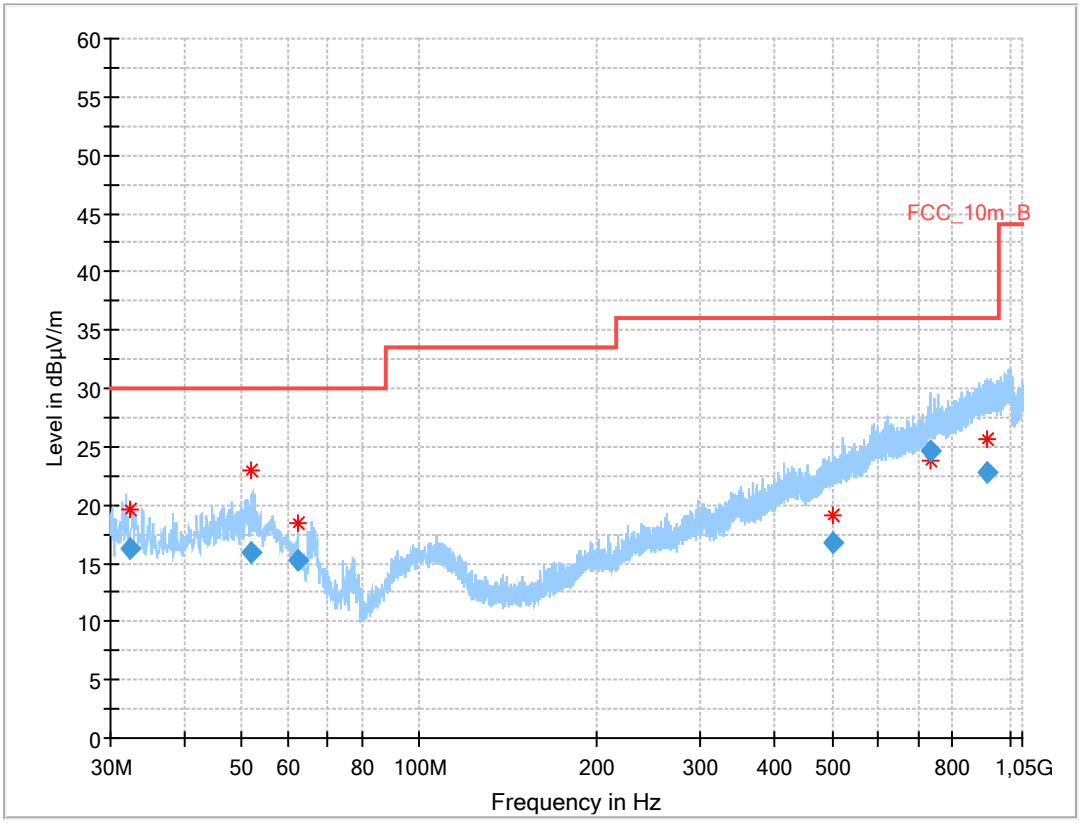
Plot 1: 30 MHz to 1 GHz, TX mode, 2401.056 MHz, vertical & horizontal polarization, GFSK,



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.302	17.18	30.0	12.8	1000	120.0	104.0	V	247	12
51.848	19.05	30.0	11.0	1000	120.0	98.0	V	-13	14
61.981	13.64	30.0	16.4	1000	120.0	170.0	H	157	12
513.882	21.88	36.0	14.1	1000	120.0	170.0	H	247	19
669.858	24.21	36.0	11.8	1000	120.0	170.0	H	247	21
940.163	23.06	36.0	12.9	1000	120.0	170.0	H	-3	24

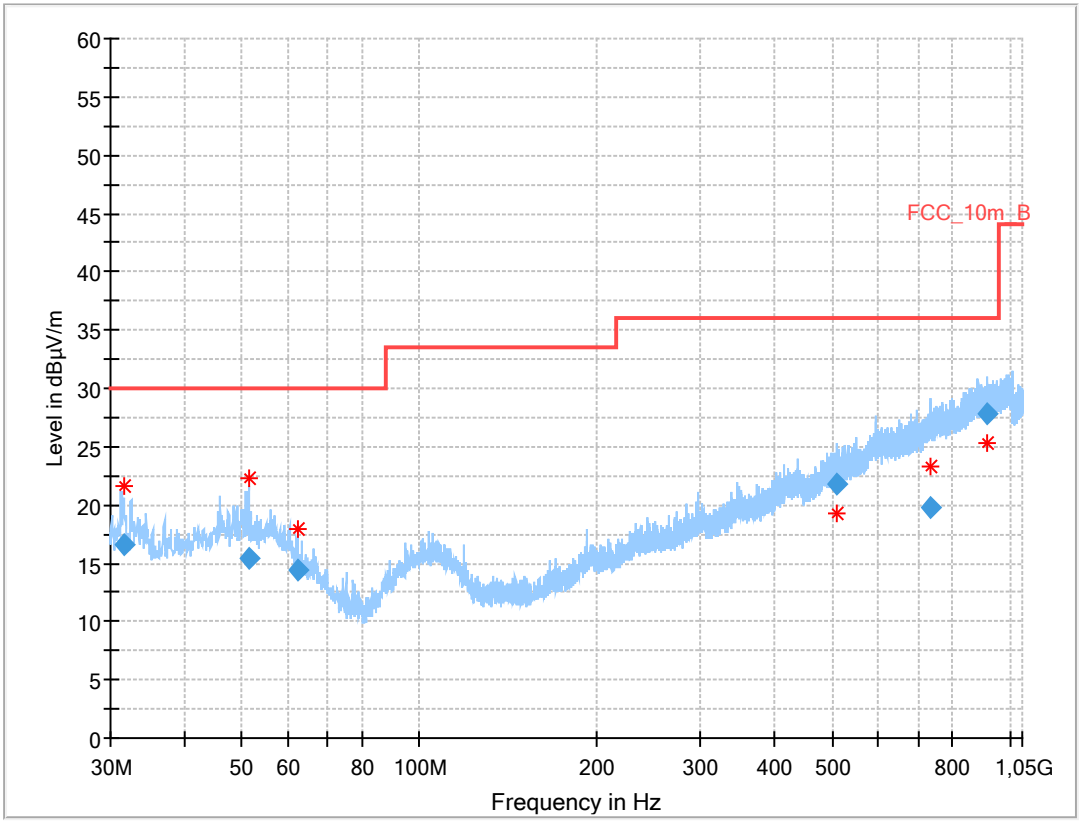
Plot 2: 30 MHz to 1 GHz, TX mode, 2440.8 MHz, vertical & horizontal polarization, GFSK



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.381	16.31	30.0	13.7	1000	120.0	124.0	V	99	12
52.020	15.89	30.0	14.1	1000	120.0	159.0	V	271	14
62.193	15.28	30.0	14.7	1000	120.0	122.0	V	22	12
503.205	16.71	36.0	19.3	1000	120.0	170.0	H	67	18
734.262	24.71	36.0	11.3	1000	120.0	170.0	H	67	22
915.058	22.82	36.0	13.2	1000	120.0	170.0	H	67	24

Plot 3: 30 MHz to 1 GHz, TX mode, 2480.544 MHz, vertical & horizontal polarization, GFSK

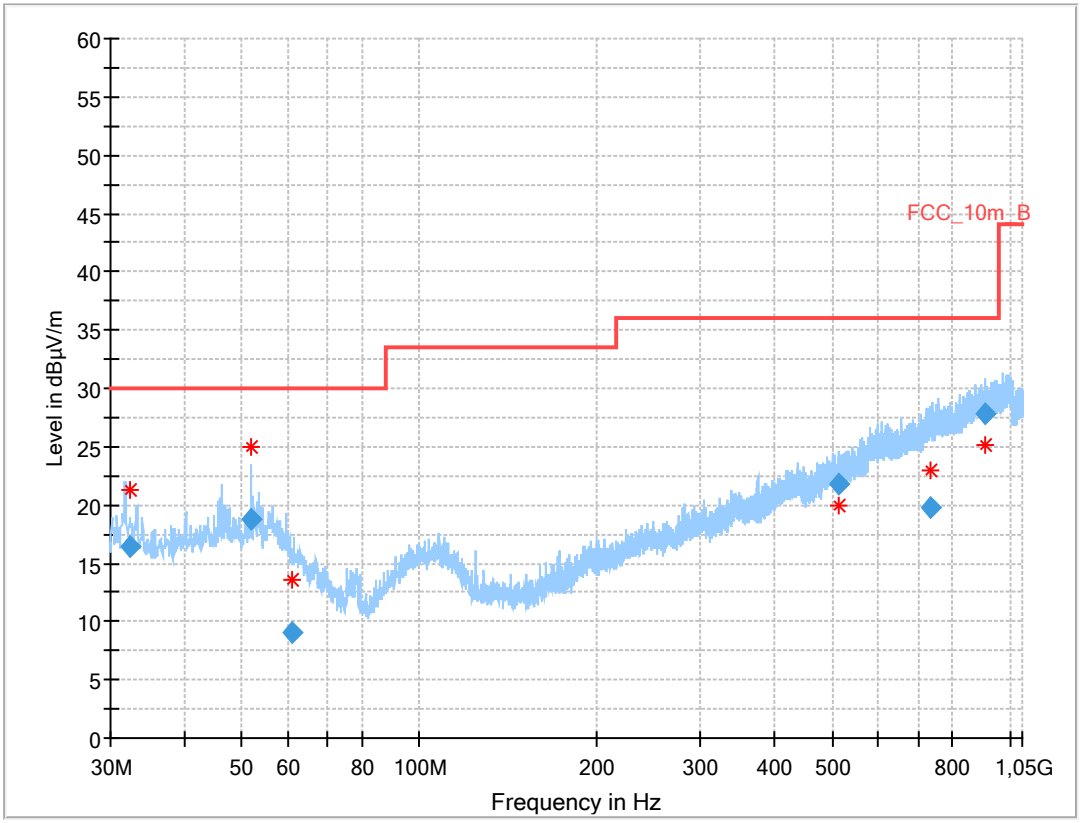


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.573	16.62	30.0	13.4	1000	120.0	117.0	V	160	12
51.411	15.42	30.0	14.6	1000	120.0	163.0	V	292	14
62.173	14.41	30.0	15.6	1000	120.0	170.0	V	180	12
509.145	21.81	36.0	14.2	1000	120.0	170.0	V	247	18
733.639	19.73	36.0	16.3	1000	120.0	170.0	V	278	22
913.564	27.79	36.0	8.2	1000	120.0	133.0	V	157	24

Plots: Transmit mode, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550

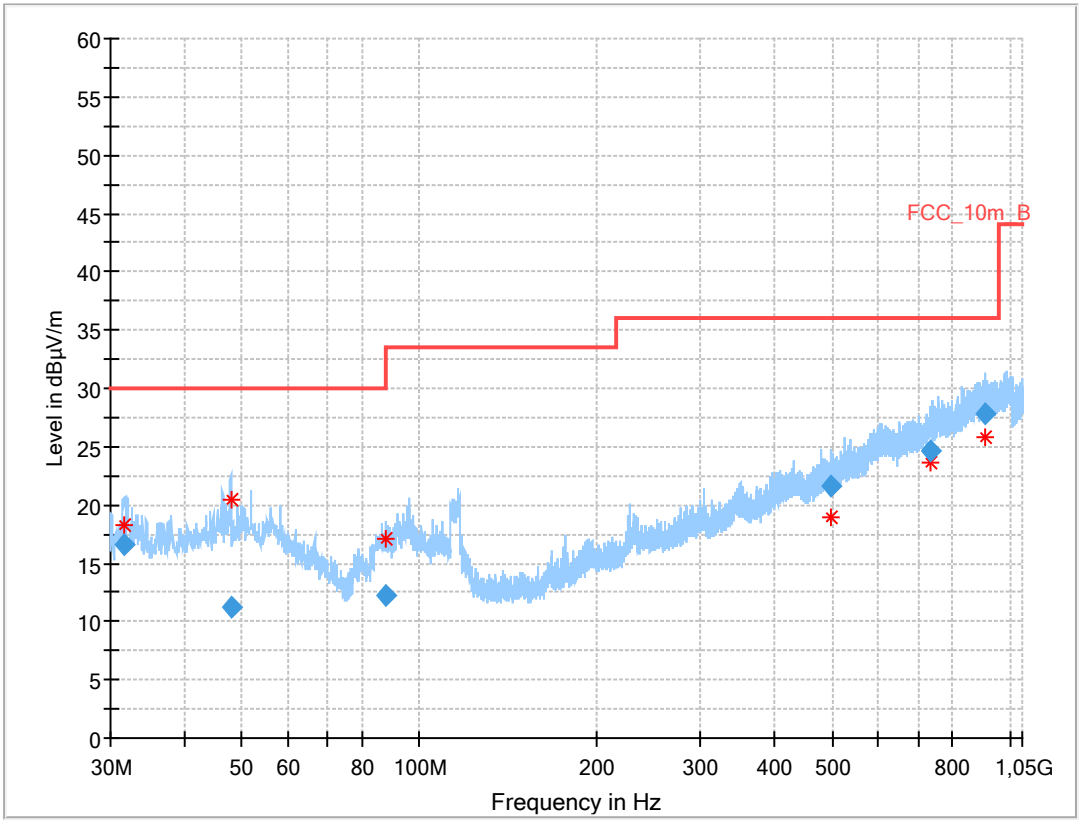
Plot 1: 30 MHz to 1 GHz, TX mode, 2401.056 MHz, vertical & horizontal polarization, GFSK,



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.288	16.42	30.0	13.6	1000	120.0	112.0	V	68	12
51.835	18.78	30.0	11.2	1000	120.0	101.0	V	81	14
60.869	9.04	30.0	21.0	1000	120.0	170.0	V	16	13
514.884	21.87	36.0	14.1	1000	120.0	170.0	H	-4	19
734.703	19.79	36.0	16.2	1000	120.0	170.0	V	67	22
911.981	27.76	36.0	8.2	1000	120.0	170.0	H	67	24

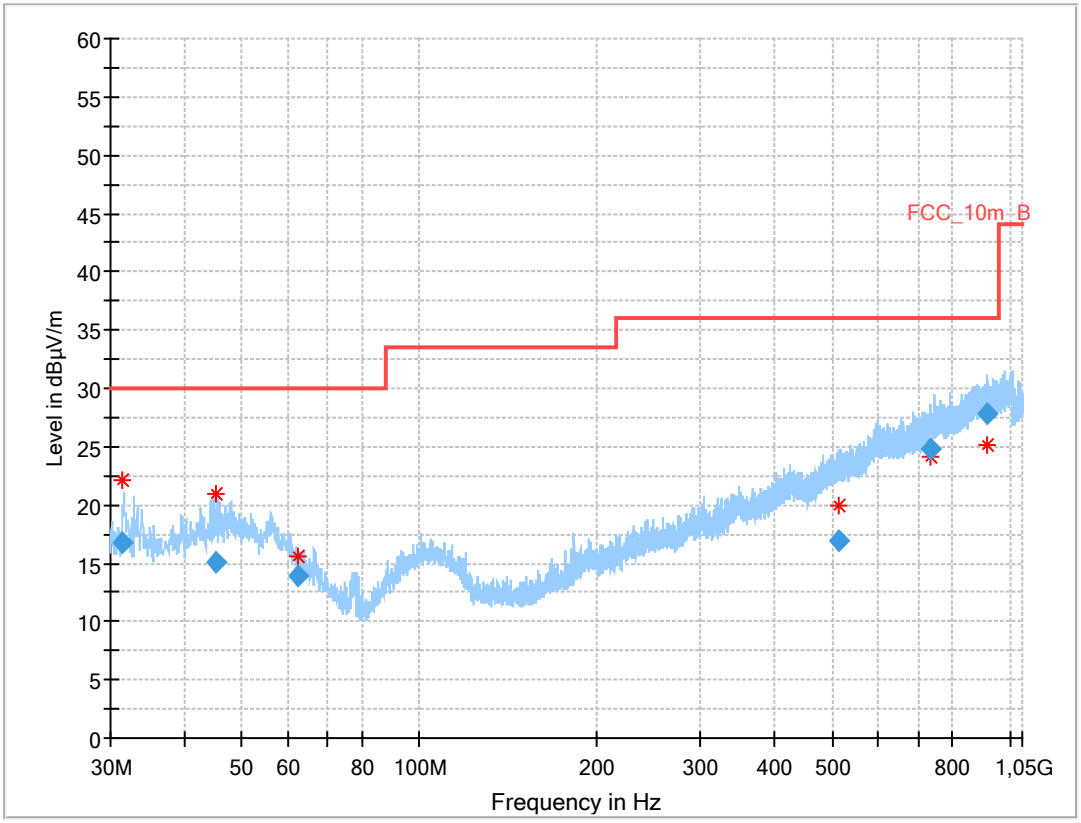
Plot 2: 30 MHz to 1 GHz, TX mode, 2440.8 MHz, vertical & horizontal polarization, GFSK



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.599	16.61	30.0	13.4	1000	120.0	170.0	V	247	12
48.035	11.23	30.0	18.8	1000	120.0	121.0	V	247	14
87.920	12.16	30.0	17.8	1000	120.0	170.0	V	-8	10
497.849	21.61	36.0	14.4	1000	120.0	98.0	H	68	18
734.036	24.66	36.0	11.3	1000	120.0	170.0	H	5	22
911.857	27.80	36.0	8.2	1000	120.0	170.0	V	67	24

Plot 3: 30 MHz to 1 GHz, TX mode, 2480.544 MHz, vertical & horizontal polarization, GFSK



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.418	16.72	30.0	13.3	1000	120.0	98.0	V	79	12
45.115	15.05	30.0	15.0	1000	120.0	98.0	V	85	14
62.173	13.92	30.0	16.1	1000	120.0	170.0	V	-22	12
513.206	16.97	36.0	19.0	1000	120.0	104.0	H	67	19
735.047	24.80	36.0	11.2	1000	120.0	146.0	H	-15	22
916.766	27.79	36.0	8.2	1000	120.0	104.0	H	-22	24

12.10 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 2401.056 MHz, 2440.8 MHz and 2480.544 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 8.2 A (1 GHz - 18 GHz) See sub clause 8.3 A (18 GHz - 26 GHz)
Measurement uncertainty	See sub clause 9

Limits:

FCC		IC
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
Above 960	54.0 (Average)	3
Above 960	74.0 (Peak)	3

Results: Transmitter mode, GFSK, Philips 453564817421 Antenna for X3 and MX100

TX spurious emissions radiated [dBµV/m]								
2401.056 MHz			2440.8 MHz			2480.544 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
4801	Peak	61.5	4882	Peak	61.7	4961	Peak	58.7
	AVG	31.0*		AVG	31.2*		AVG	28.2*
7204	Peak	51.1	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	20.6*		AVG	-/-		AVG	-/-

Results: Transmitter mode, GFSK, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550

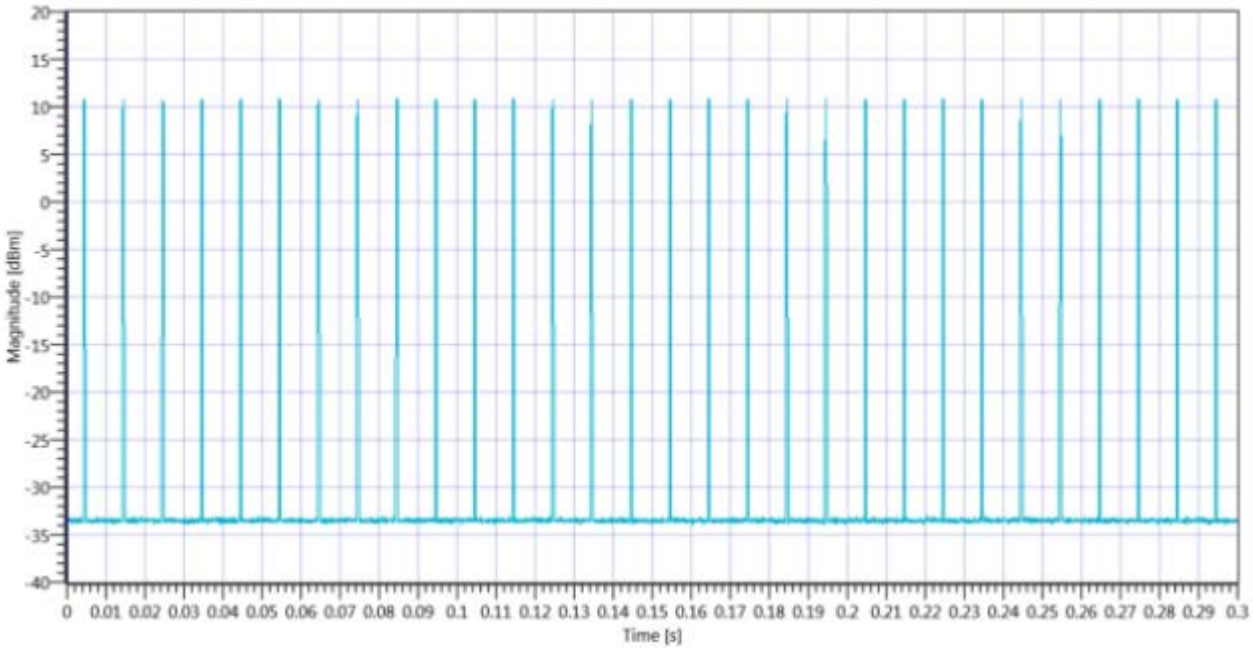
TX spurious emissions radiated [dBµV/m]								
2401.056 MHz			2440.8 MHz			2480.544 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
4802	Peak	62.6	4881	Peak	59.8	4961	Peak	61.7
	AVG	32.1*		AVG	29.3*		AVG	31.2*
7204	Peak	53.6	7321	Peak	52.5	-/-	Peak	-/-
	AVG	23.1*		AVG	21.0*		AVG	-/-

*) Average emission adjusting factor:

F = 20 * log (duty cycle / 100 ms) = 20 * log (3ms / 100 ms) = -30.5 dB

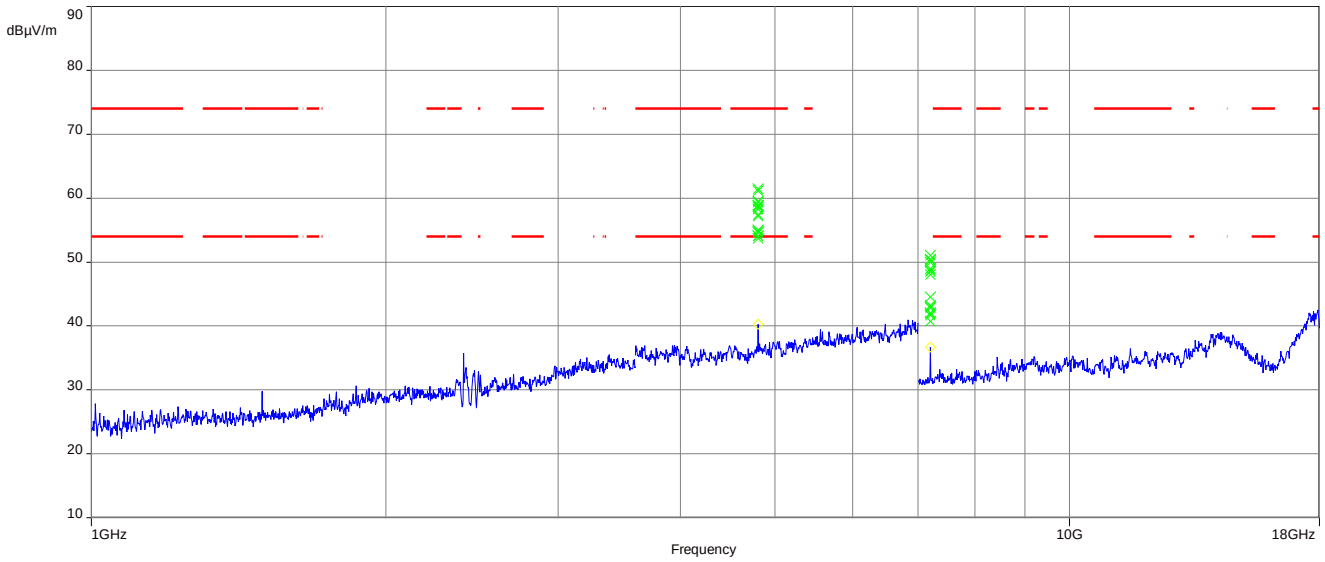
In 100 ms there are 10 bursts (see plot below). Each burst has a length of 0.3 ms. This leads to a duty cycle of 3 ms in 100 ms.

Duty cycle plot:



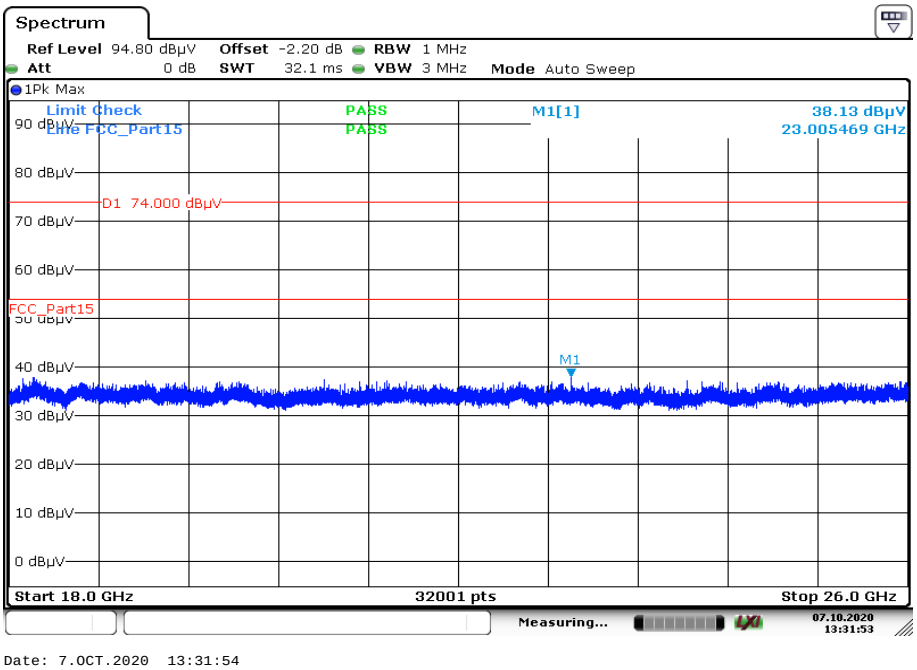
Plots: Transmitter mode, Philips 453564817421 Antenna for X3 and MX100

Plot 1: 1 GHz to 18 GHz, TX mode, 2401.056 MHz, vertical & horizontal polarization, GFSK

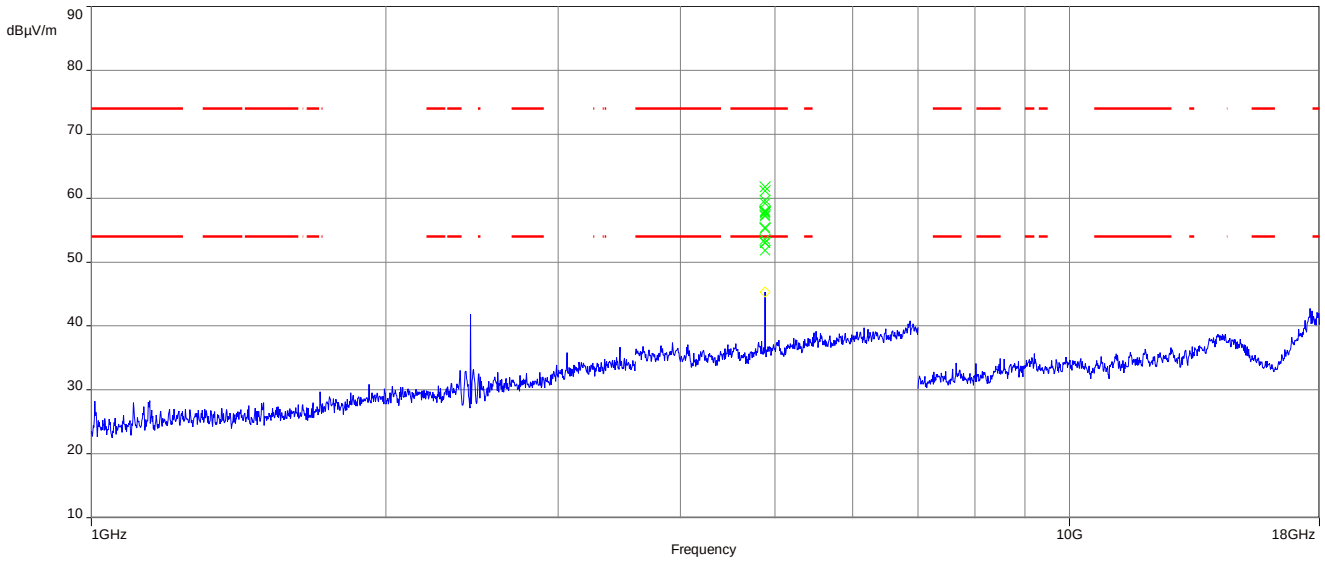


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: 18 GHz to 26 GHz, TX mode, 2401.056 MHz, vertical & horizontal polarization, GFSK

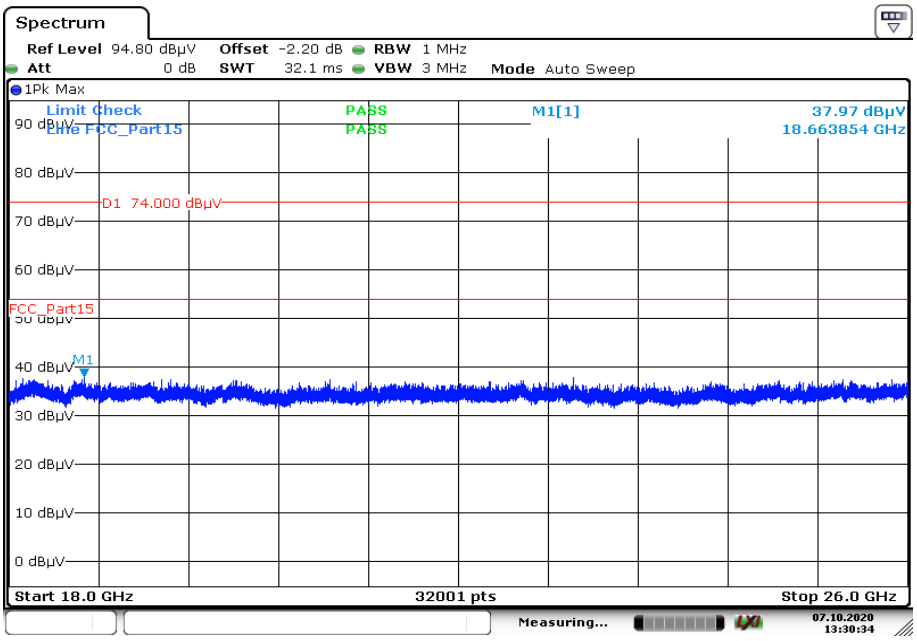


Plot 3: 1 GHz to 18 GHz, TX mode, 2440.8 MHz, vertical & horizontal polarization, GFSK

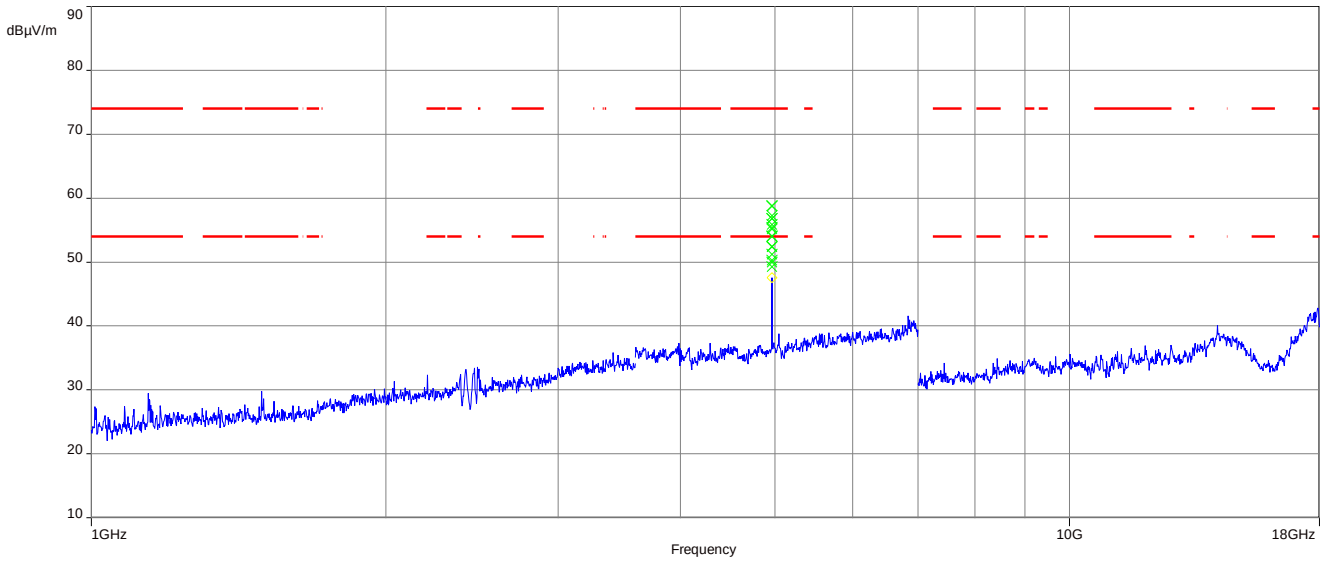


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 18 GHz to 26 GHz, TX mode, 2440.8 MHz, vertical & horizontal polarization, GFSK

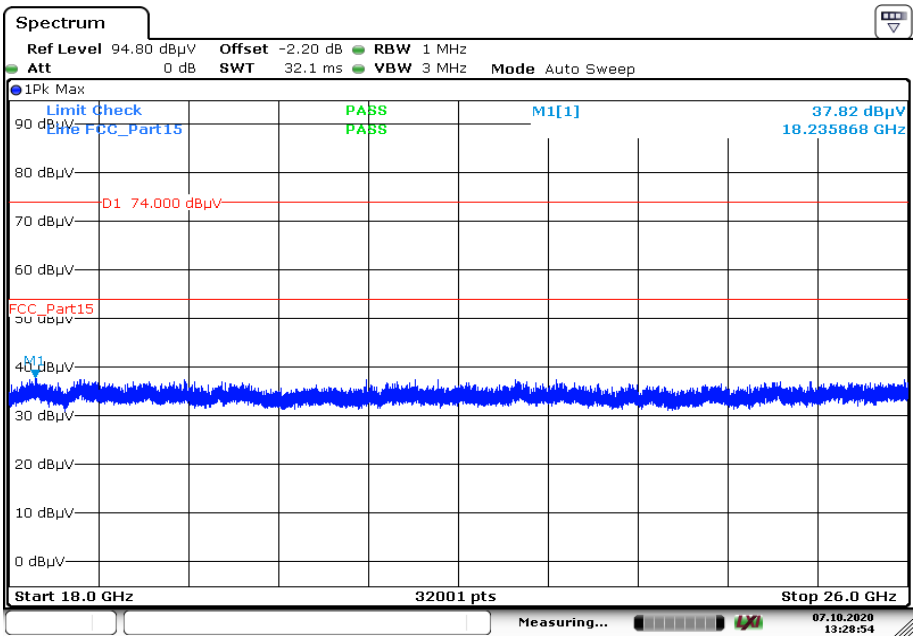


Plot 5: 1 GHz to 18 GHz, TX mode, 2480.544 MHz, vertical & horizontal polarization, GFSK



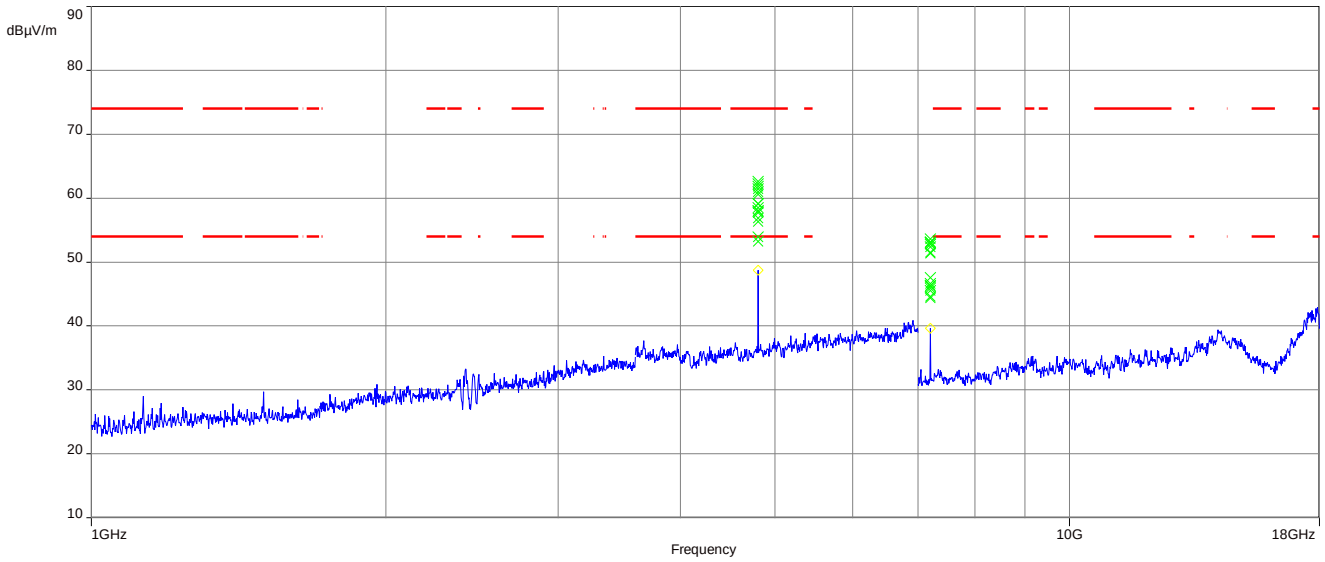
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: 18 GHz to 26 GHz, TX mode, 2480.544 MHz, vertical & horizontal polarization, GFSK



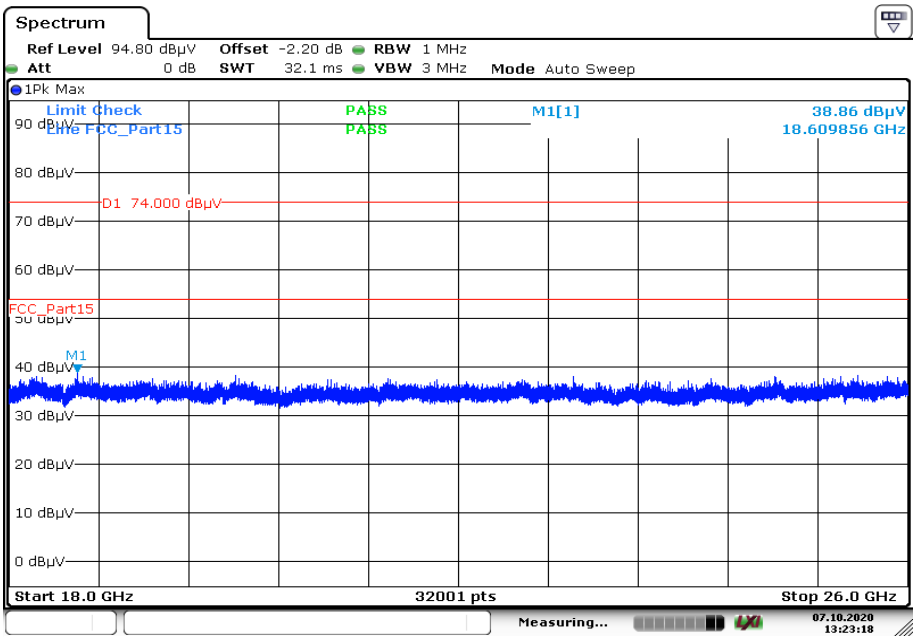
Plots: Transmitter mode, Philips 453564271931 Antenna for MX400, MX450, MX500, MX550

Plot 1: 1 GHz to 18 GHz, TX mode, 2401.056 MHz, vertical & horizontal polarization, GFSK

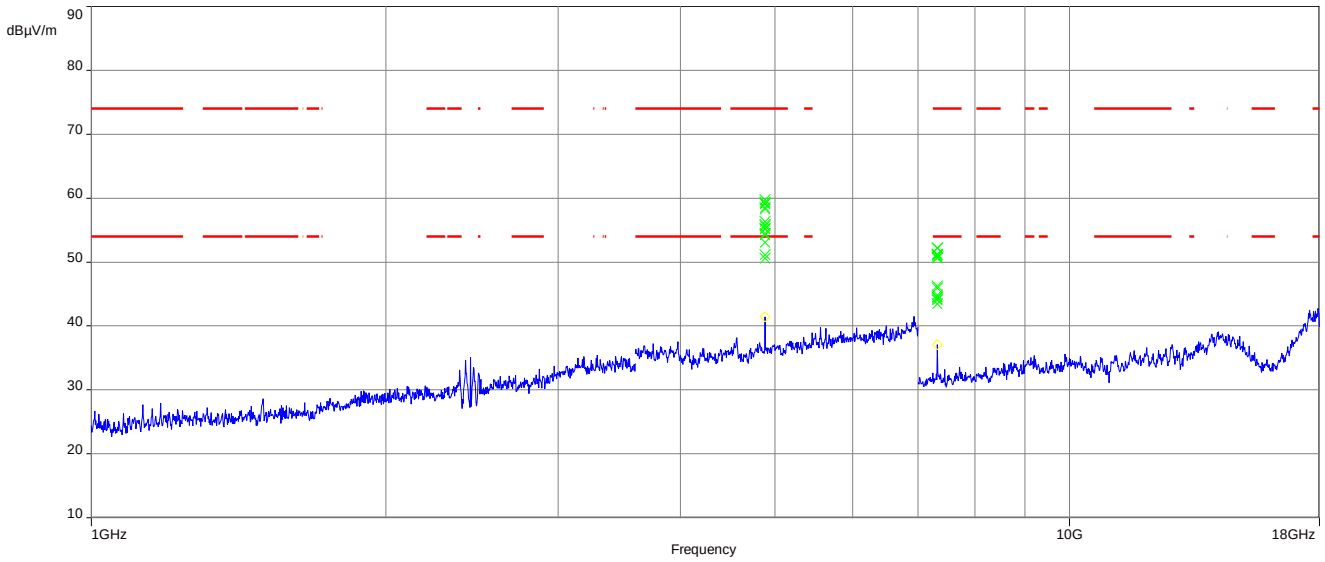


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: 18 GHz to 26 GHz, TX mode, 2401.056 MHz, vertical & horizontal polarization, GFSK

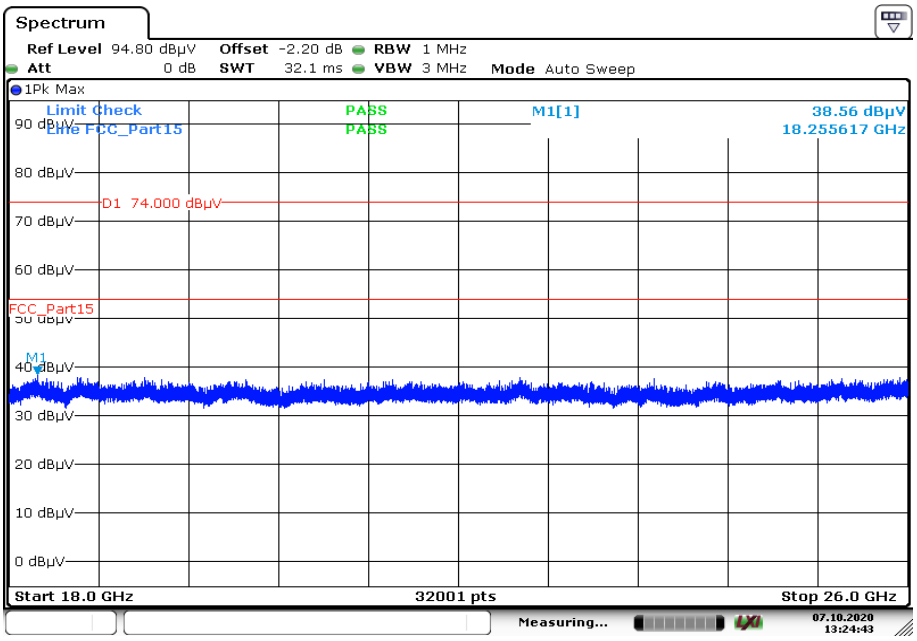


Plot 3: 1 GHz to 18 GHz, TX mode, 2440.8 MHz, vertical & horizontal polarization, GFSK

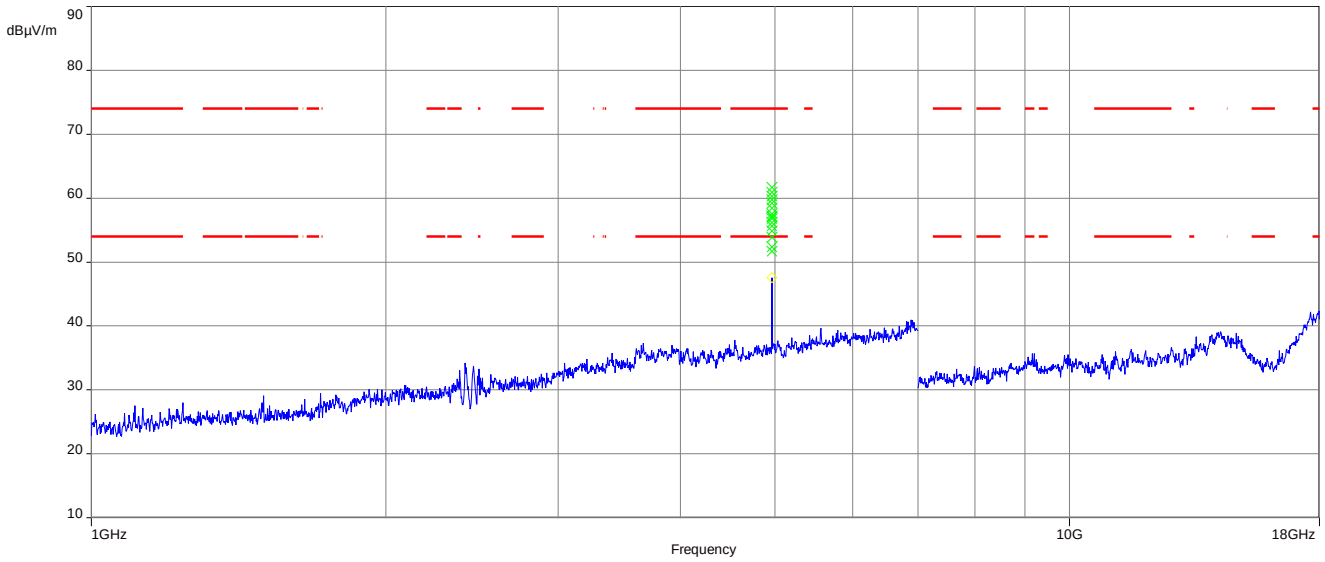


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 18 GHz to 26 GHz, TX mode, 2440.8 MHz, vertical & horizontal polarization, GFSK

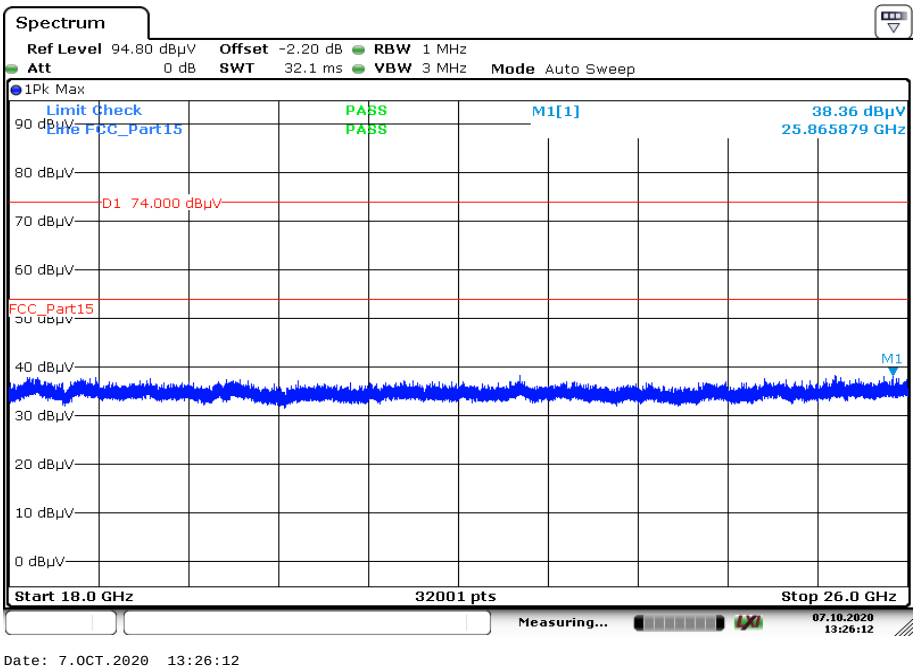


Plot 5: 1 GHz to 18 GHz, TX mode, 2480.544 MHz, vertical & horizontal polarization, GFSK



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

Plot 6: 18 GHz to 26 GHz, TX mode, 2480.544 MHz, vertical & horizontal polarization, GFSK



12.11 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit frequency is 2440.8 MHz. This measurement is representative for all channels and modes. If critical peaks are found frequency 2401.056 MHz and 2480.544 MHz will be measured too. The measurement is performed in the mode with the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

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

Limits:

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

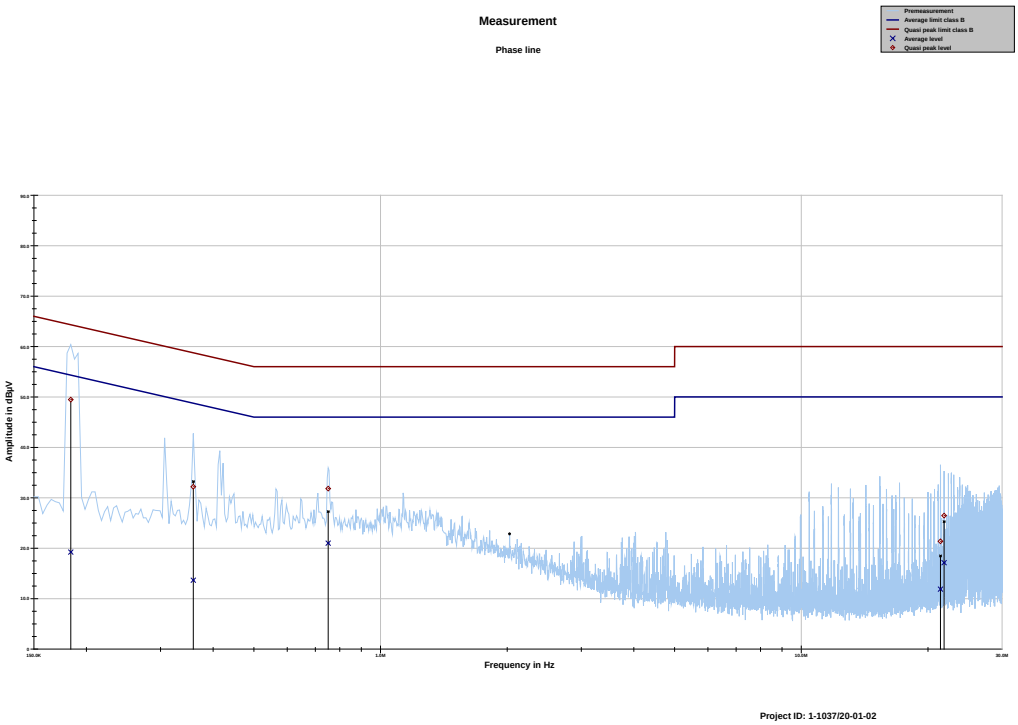
*Decreases with the logarithm of the frequency

Results:

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

Plots:

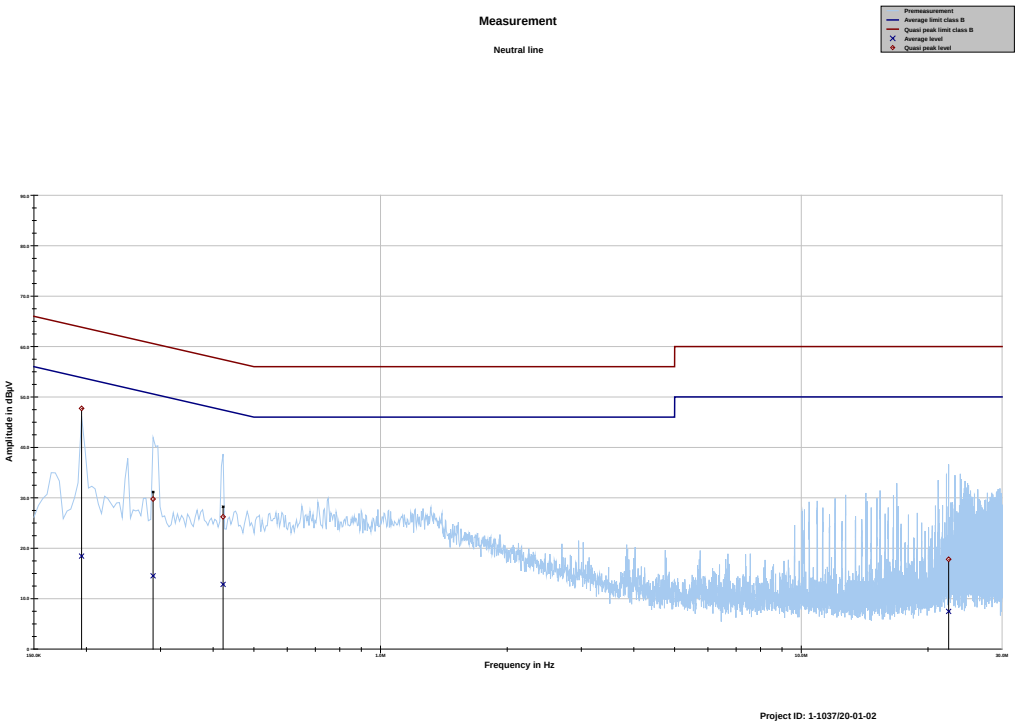
Plot 1: 150 kHz to 30 MHz, phase line



Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.183581	49.46	14.86	64.322	19.23	35.81	55.041
0.358950	32.19	26.56	58.753	13.65	36.38	50.030
0.750731	31.82	24.18	56.000	21.00	25.00	46.000
21.421856	21.37	38.63	60.000	11.88	38.12	50.000
21.847219	26.46	33.54	60.000	17.12	32.88	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
0.194775	47.73	16.10	63.830	18.43	36.29	54.721
0.288056	29.76	30.82	60.580	14.52	37.54	52.056
0.422381	26.23	31.17	57.401	12.83	35.39	48.218
22.399444	17.81	42.19	60.000	7.46	42.54	50.000

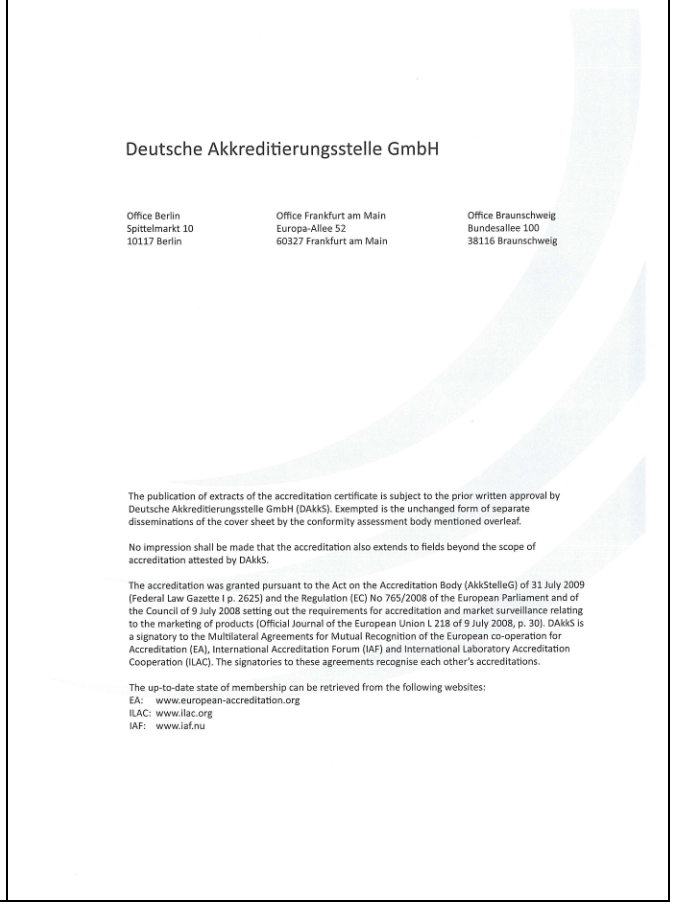
13 Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2021-02-08
A	Editorial changes	2021-01-12
B	Editorial changes	2021-02-22

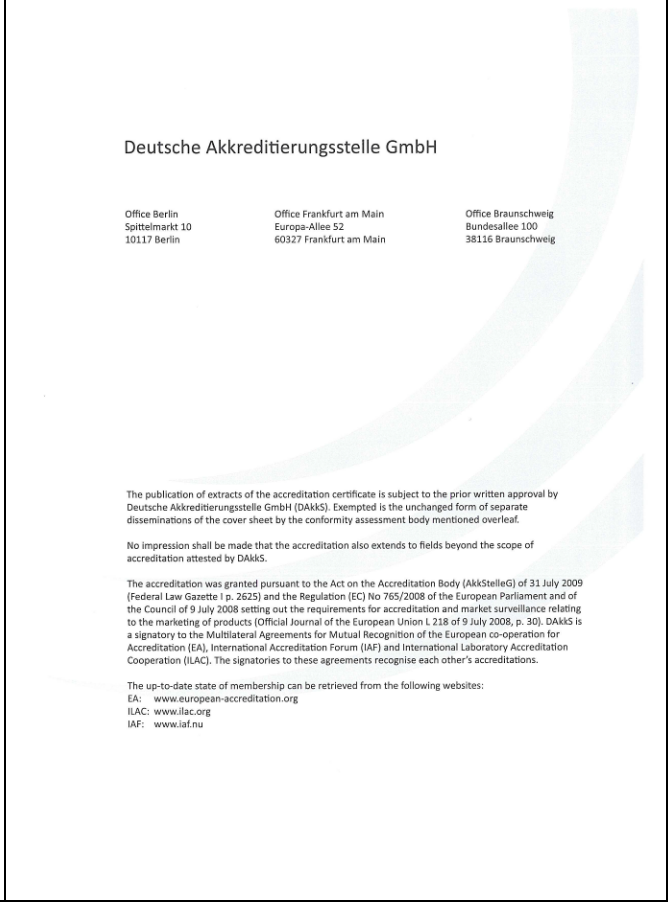
15 Accreditation Certificate – D-PL-12076-01-04

first page	last page
	

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf

16 Accreditation Certificate – D-PL-12076-01-05

first page	last page
	

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

CTC advanced GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields:

Telecommunication (FCC Requirements)

The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 05 pages.

Registration number of the certificate: **D-PL-12076-01-05**

Frankfurt am Main, 09.06.2020

by order Dipl.-Ing. (FH) Ralf Egner
Head of Division

The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH.
https://www.dakks.de/en/content/accredited-bodies-dakks

See notes overleaf.

Deutsche Akkreditierungsstelle GmbH

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60327 Frankfurt am Main

Office Braunschweig
Bundesallee 100
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The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkkS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkkS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf

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