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TEST REPORT

Test report no.: 1-3065/16-01-07-B

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing laboratory

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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) 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-12076-01-01

Applicant

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Manufacturer

RSI Video Technologies SA
Siège Social -Headquarters
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Test standard/s

47 CFR Part 15	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
RSS - Gen Issue 4	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

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

Test Item

Kind of test item:	**Alarm panel**
Model name:	**WIP630**
FCC ID:	**X46WP02**
IC:	**8816A-WP02**
Frequency:	DTS band 902 MHz to 928 MHz
Technology tested:	Proprietary FHSS system
Antenna:	1 internal wire antenna
Power supply:	3.6 V DC by Li-Ion battery (1UR18650A-C00BB) and 5 DC / 115 V AC by mains adapter FW7601/05
Temperature range:	-10°C to +55°C

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

Test report authorized:

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Stefan Bös
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Radio Communications & EMC

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Marco Bertolino
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1 Table of contents

2 General information

2.1 Notes and disclaimer

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This test report replaces the test report with the number 1-3065/16-01-07-A and dated 2017-06-22

2.2 Application details

Date of receipt of order:	2017-01-16
Date of receipt of test item:	2017-01-16
Start of test:	2017-01-16
End of test:	2017-02-23
Person(s) present during the test:	-/-

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	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 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

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 C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+20 °C during room temperature tests No tests under extreme conditions required. No tests under extreme conditions required.
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	3.6 V DC by Li-Ion battery (1UR18650A-C00BB) and 5 DC / 115 V AC by mains adapter FW7601/05 No tests under extreme conditions required. No tests under extreme conditions required.

5 Test item

5.1 General description

Kind of test item	:	Alarm panel
Type identification	:	WIP630
HMN	:	-/-
PMN	:	WIP630
HVIN	:	WIP630-2
FVIN	:	-/-
S/N serial number	:	Radiated unit: F7204916E30A0108 Conducted unit: F7204916E30A0105 Internal photos: F7204916E30A0105
HW hardware status	:	5CA1291C-1B2
FW firmware status	:	V.08.14.03.03859D
Frequency band	:	DTS band 902 MHz to 928 MHz (lowest channel 904.5 MHz, highest channel 926.1 MHz)
Type of radio transmission Use of frequency spectrum	: :	FHSS
Type of modulation	:	GFSK
Number of channels	:	25 (with a channel spacing of 900 kHz)
Antenna	:	1 internal wire antenna
Power supply	:	3.6 V DC by Li-Ion battery (1UR18650A-C00BB) and 5 DC / 115 V AC by mains adapter FW7601/05
Temperature range	:	-10°C to +55°C

5.2 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: 1-3065/16-01-08_AnnexA
1-3065/16-01-08_AnnexB
1-3065/16-01-08_AnnexD

6 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).

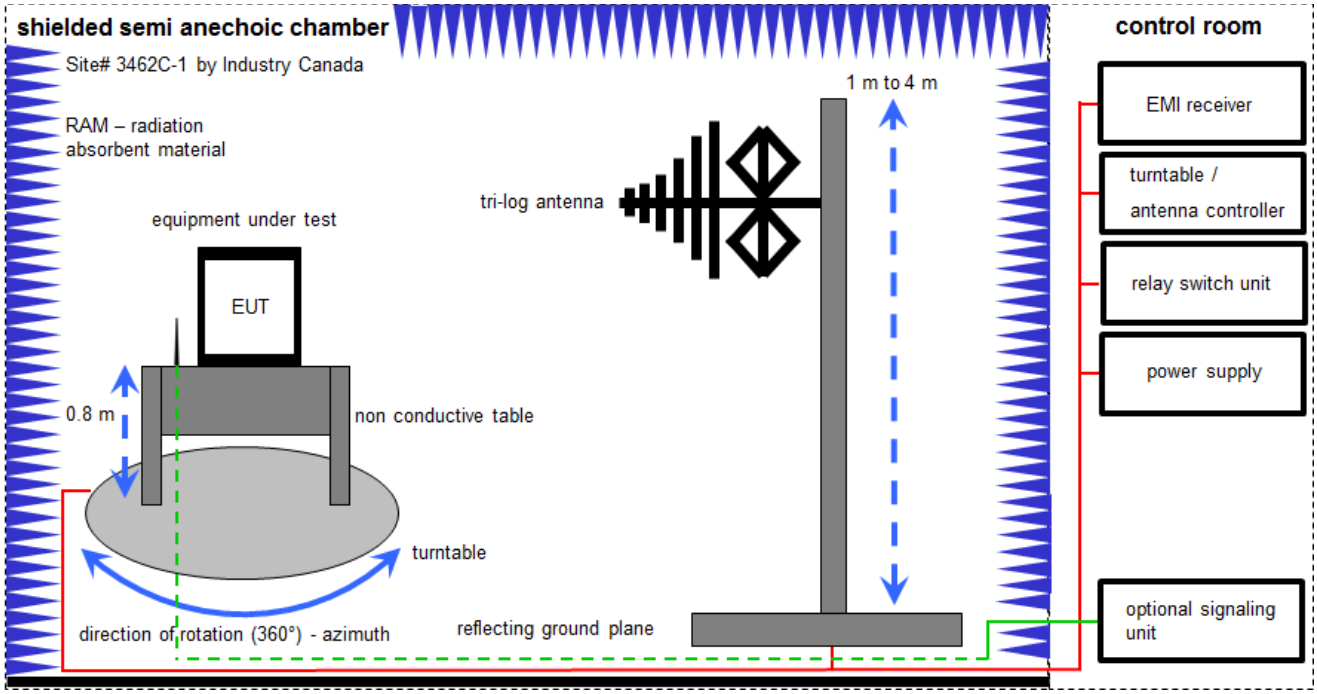
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz 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 confirmed with 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

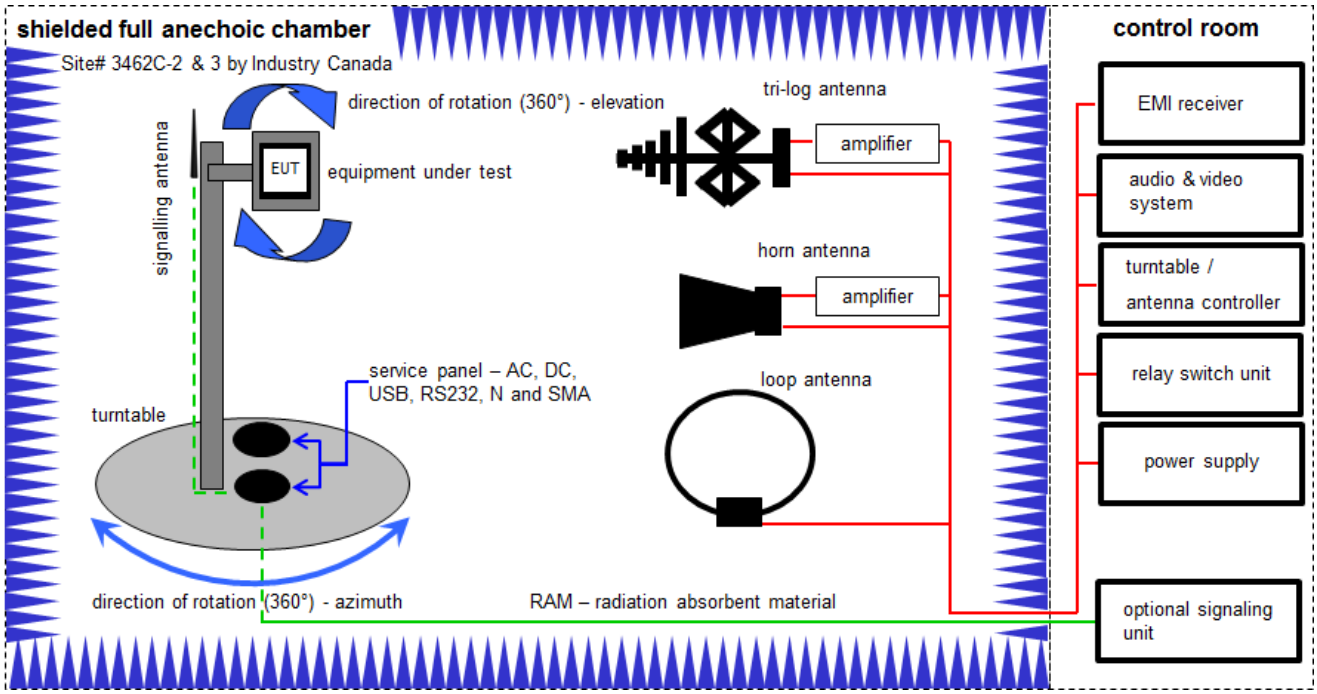
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
4	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
7	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018

6.2 Shielded fully anechoic chamber



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

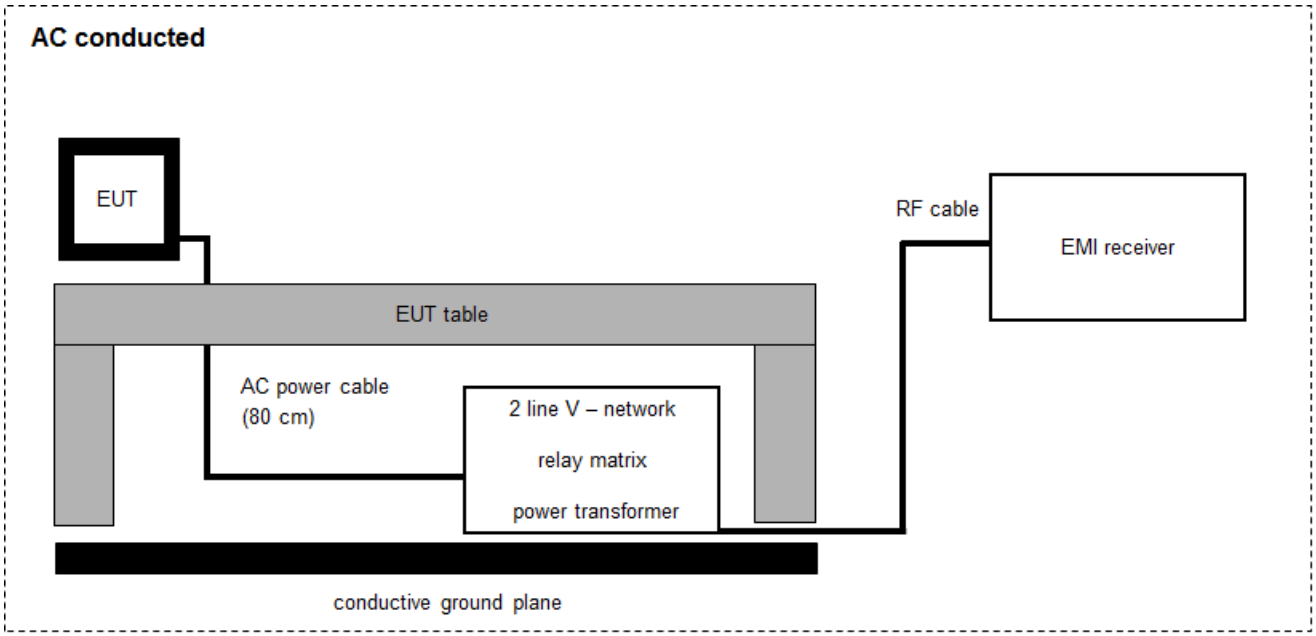
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/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	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	13.08.2015	13.08.2017
2	C	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne	-/-	-/-
3	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	318	300003696	k	22.04.2014	22.04.2017
4	C	Amplifier	AFS44-00101800-25-10P-44	MITEQ	1275947	300004046	g	-/-	-/-
5	A, B, C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
6	A, B, C	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A5421	300004591	ne	-/-	-/-
7	A, B, C	Nexio Modul RE Radiated Emission	BAT-EMC Modul RE	EMCO	2V2403033A5421	300004603	ne	-/-	-/-
8	A, B, C	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A5421	300004682	ne	-/-	-/-
9	A, B, C	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	vlKl!	13.09.2016	13.03.2018
10	B	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO	2210	300001015	k	20.05.2015	20.05.2017
11	A, B, C	HF-Schaltmatrixgrundgerät	TS-RSP 1144.1500K03	R&S	100300	300003556	ev	-/-	-/-
12	A, B, C	Anechoic chamber	TS-RSP 1144.1500K03	TDK	100300	300003726	ne	-/-	-/-

6.3 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)

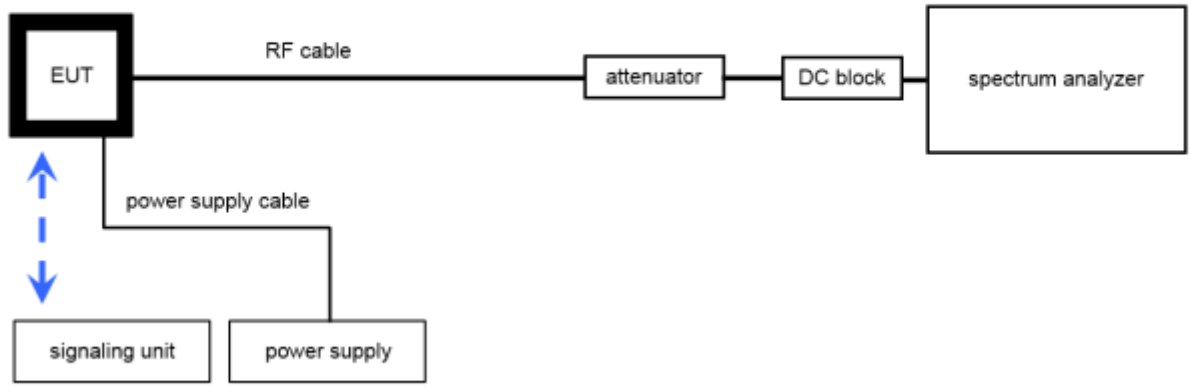
Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

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	893045/004	300000584	k	02.02.2016	02.02.2017
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	k	27.11.2006	-/-
3	A	AC-Spannungsquelle variabel	MV2616-V	EM-Test	0397-12	300003259	k	11.12.2015	11.12.2017
4	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	08.04.2008	-/-
5	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	16.08.2016	16.08.2017
6	A	AF Relays Matrix w. eight Relays f.DC a. AF Signals	PSN	R&S	860673/009	300001385	ne	-/-	-/-

6.4 Conducted measurements

Conducted measurements normal conditions



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	Isolating Transformer	RT5A	Grundig	12780	300001166	ev	-/-	-/-
2	A	Switch / Control Unit	3488A	HP	2719A15013	300000151	ne	-/-	-/-
3	A	Signal- and Spectrum Analyzer	FSW26	R&S	101455	300004528	k	14.03.2016	14.03.2017
4	A	RF-Cable	ST18/SMAm/SMAm/60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
5	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 606844	400001185	ev	-/-	-/-
6	A	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits	Batch no. 606844	400001186	ev	-/-	-/-

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, 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 height is 1.5 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 premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- 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.

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 Measurement uncertainty

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

9 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	Passed	2017-06-29	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Mode	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4 (b)	Antenna gain	Nominal	Nominal	Modulated carrier	☒	☐	☐	☐	-/-
§15.247(a)(1) RSS - 247 / 5.1 (b)	Carrier frequency separation	Nominal	Nominal	TX hopping	☒	☐	☐	☐	-/-
§15.247(a)(1) RSS - 247 / 5.1 (d)	Number of hopping channels	Nominal	Nominal	TX hopping	☒	☐	☐	☐	-/-
§15.247(a)(1) (iii) RSS - 247 / 5.1 (d)	Time of occupancy (dwell time)	Nominal	Nominal	TX hopping	☒	☐	☐	☐	-/-
§15.247(a)(1) RSS - 247 / 5.1 (a)	Spectrum bandwidth of a FHSS system bandwidth	Nominal	Nominal	Modulated carrier	☒	☐	☐	☐	-/-
§15.247(b)(1) RSS - 247 / 5.4 (b)	Maximum output power	Nominal	Nominal	Modulated carrier	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5	Detailed spurious emissions @ the band edge - conducted	Nominal	Nominal	TX hopping	☒	☐	☐	☐	-/-
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance radiated	Nominal	Nominal	-/-	☐	☐	☒	☐	No RB within ± 2*OBW
§15.247(d) RSS - 247 / 5.5	Spurious emissions conducted	Nominal	Nominal	Modulated carrier	☒	☐	☐	☐	-/-
§15.209(a) RSS - Gen	Spurious emissions radiated below 30 MHz	Nominal	Nominal	Modulated carrier	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated 30 MHz to 1 GHz	Nominal	Nominal	Modulated carrier	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated above 1 GHz	Nominal	Nominal	Modulated carrier / RX mode	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions below 30 MHz (AC conducted)	Nominal	Nominal	Modulated carrier	☒	☐	☐	☐	-/-

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

10 RF measurements

10.1 Additional comments

Reference documents: Centrale WIP630 - Block Diagram

Customer Questionnaire_WIP630

W Panel - SI4463 - Test operating manual - V1.0

Special test descriptions: None

Configuration descriptions: EUT configured with the emission type wiselink

Test mode:

☐ No test mode available.
Iperf was used to ping another device with the largest support packet size

☒ 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.

11 Measurement results

11.1 Antenna gain

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Measurement parameters	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	10 MHz
Span	5 MHz
Trace mode	Max hold
Test setup	See sub clause 6.2 – A (radiated) See sub clause 6.4 – A (conducted)
Measurement uncertainty	See sub clause 8

Limits:

FCC	IC
Antenna gain	
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	

Results:

	Low channel	Middle channel	High channel
Conducted power [dBm]	17.3	17.8	18.1
Radiated power [dBm]	18.9	18.1	16.8
Gain [dBi] Calculated	1.6	0.3	-1.3

11.2 Carrier Frequency Separation

Description:

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

Measurement parameters	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Span	2 MHz
Trace mode	Max hold
Test setup	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

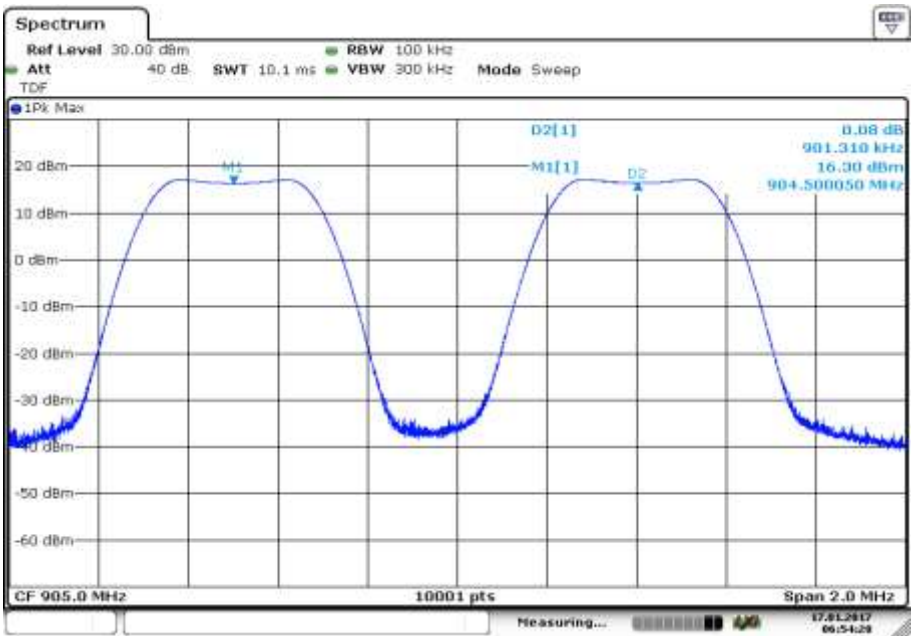
Limit:

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

Result: The channel separation is ~900 kHz

Plots:

Plot 1: Frequency separation



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11.3 Number of Hopping Channels

Description:

Measurement of the total number of used hopping channels.

Measurement parameters	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Span	30 MHz
Trace mode	Max hold
Test setup	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

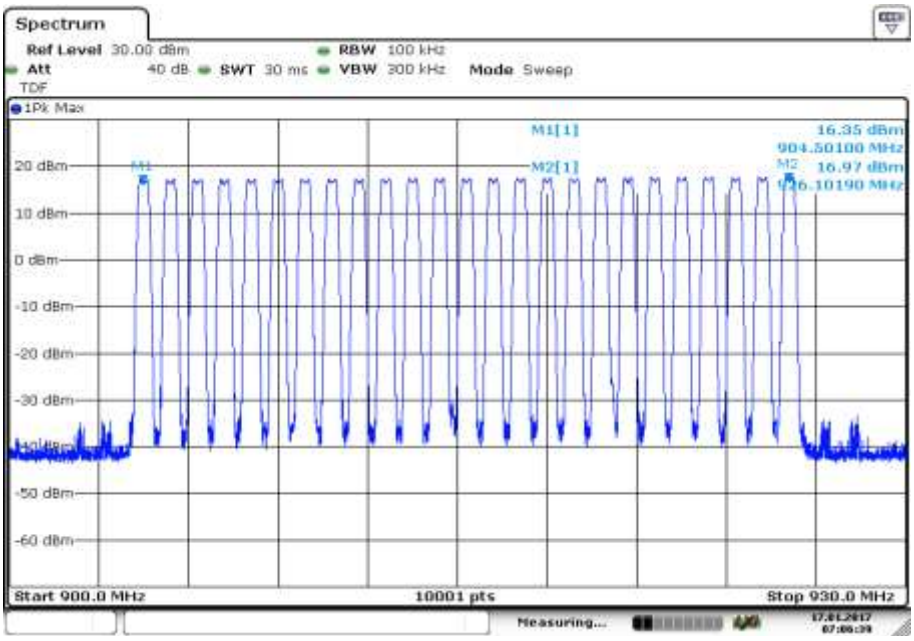
Limits:

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

Result: The EUT uses 25 channels.

Plots:

Plot 1: Number channels



11.4 Average Time of Occupancy (dwell time)

Measurement:

The measurement is performed in zero span mode to show that none of the 25 used channels is allocated more than 0.4 seconds within a 10 seconds interval.

Limits:

FCC	IC
Average time of occupancy	
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within 10 second period.	

Results:

Wiselink mode:

The time slot length is	= 2.2 ms
Burst repetition rate	= 56.8 ms
Within 10 s period, the average time of occupancy	= 177 * 2.2 ms
→ The average time of occupancy	= 389.4 ms (Limit: ≤ 400 ms)

XPAQ mode:

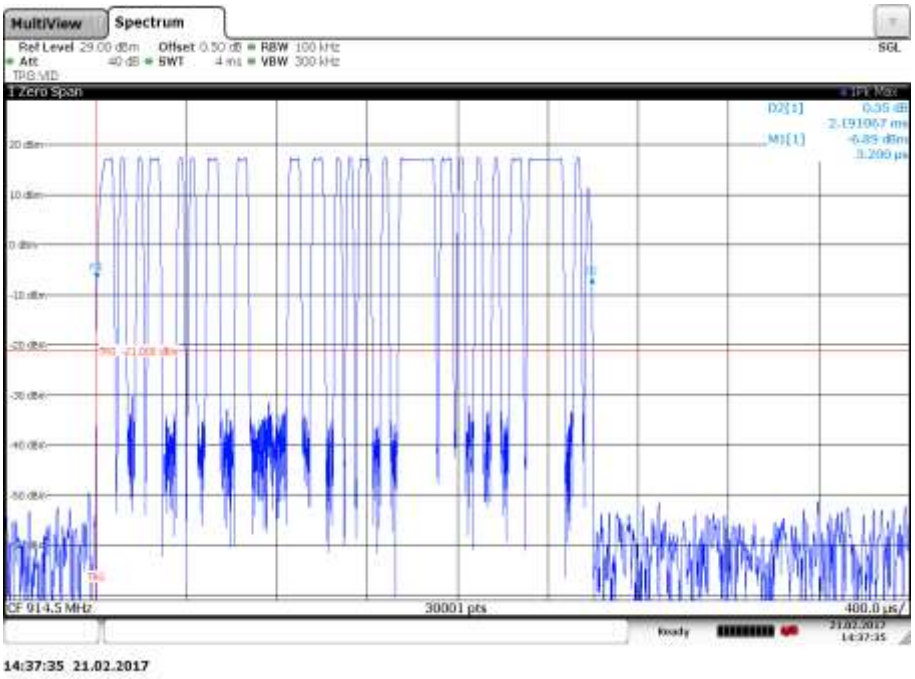
The time slot length is	= 4.5 ms
Burst repetition rate	= 113.8 ms
Within 10 s period, the average time of occupancy	= 88 * 4.5 ms
→ The average time of occupancy	= 396 ms (Limit: ≤ 400 ms)

Streaming mode:

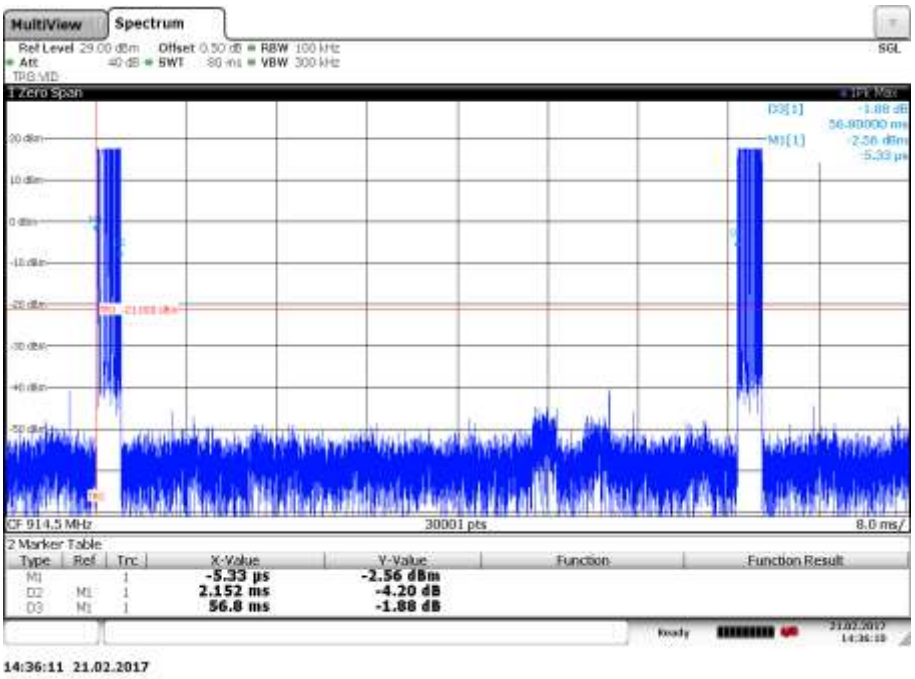
The time slot length is	= 9.6 ms
Burst repetition rate	= 250 ms
Within 10 s period, the average time of occupancy	= 40 * 9.6 ms
→ The average time of occupancy	= 384 ms (Limit: ≤ 400 ms)

Plots: (Wiselink mode)

Plot 1: Time slot length = 2.2 ms

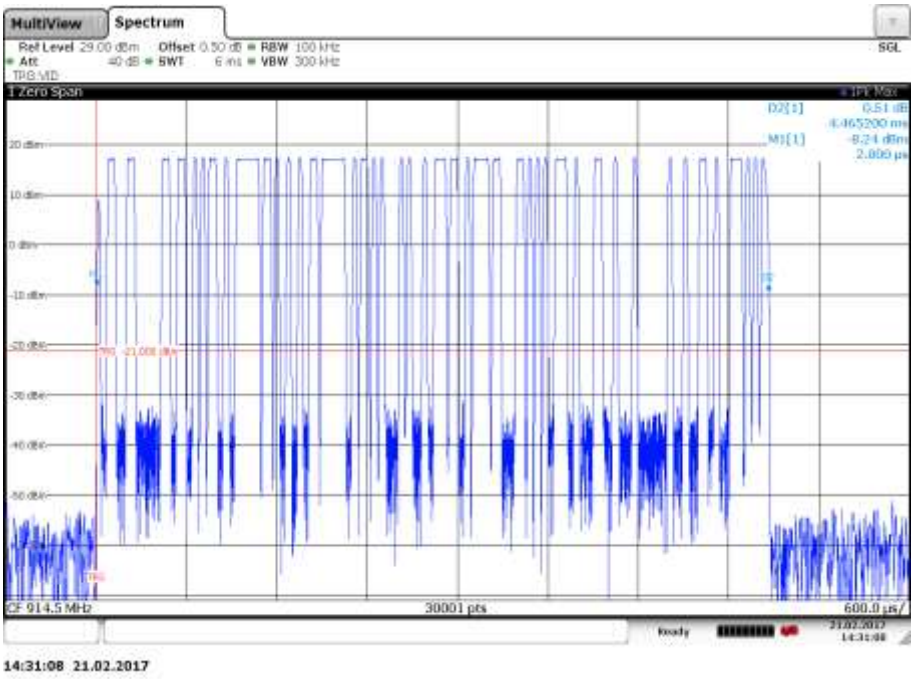


Plot 2: Burst repetition rate = 56.8 ms

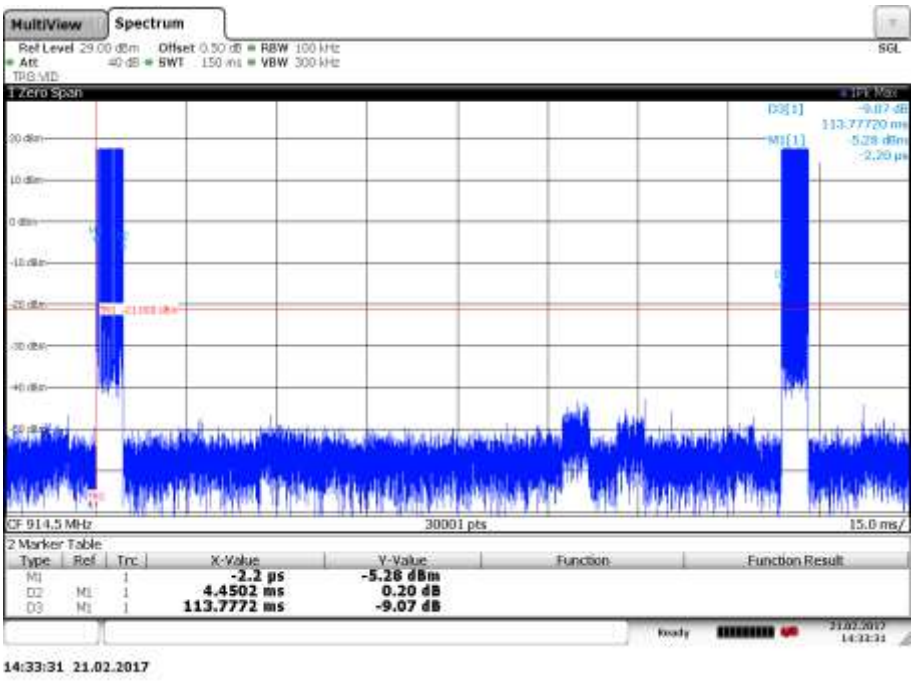


Plots: (XPAQ mode)

Plot 1: Time slot length = 4.5 ms

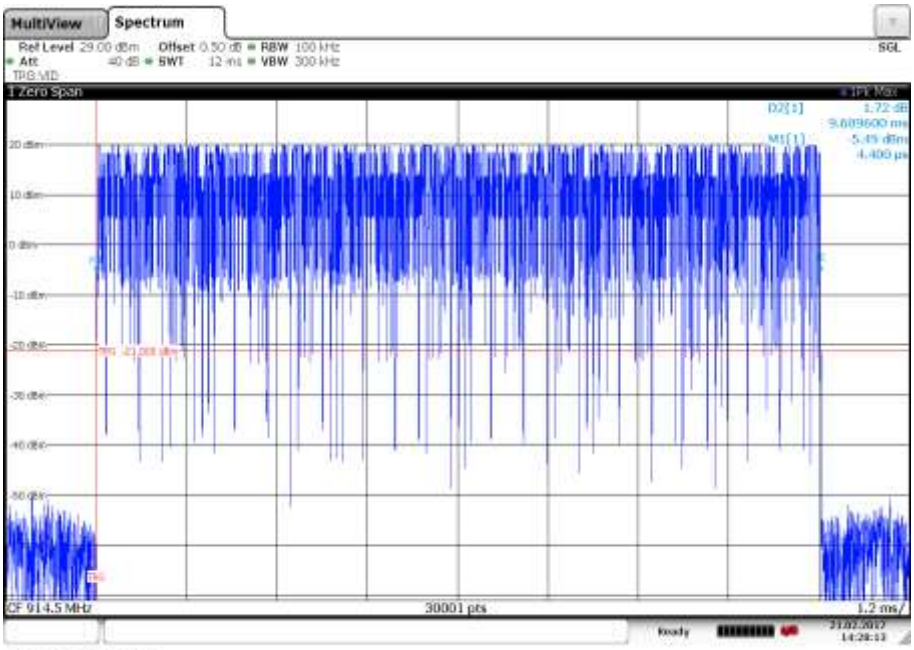


Plot 2: Burst repetition rate = 113.8 ms



Plots: (Streaming mode)

Plot 1: Time slot length = 9.6 ms



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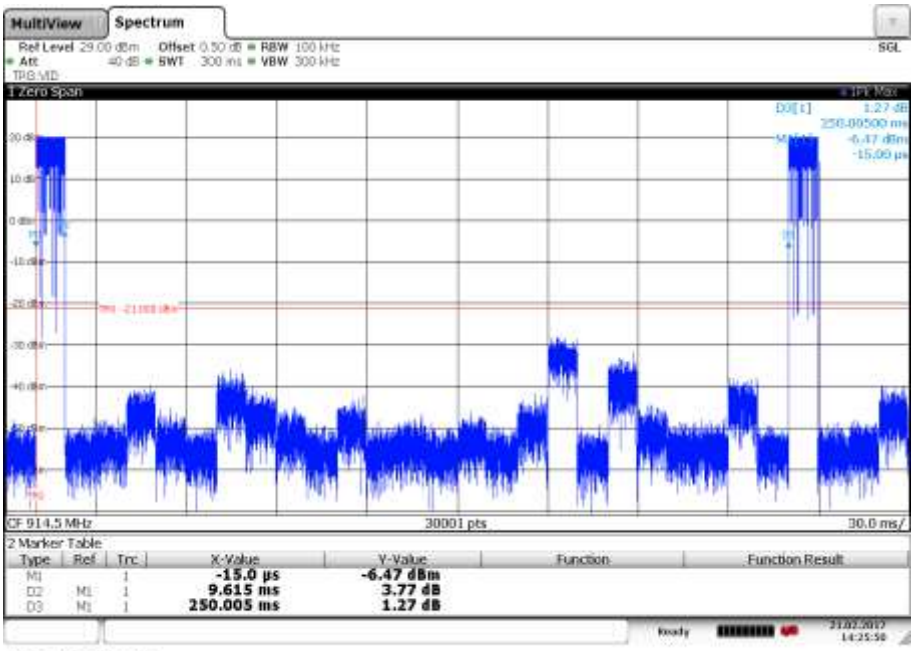
Plot 2: Burst repetition rate = 250 ms



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11.5 Spectrum bandwidth of a FHSS system

Description:

Measurement of the 20 dB bandwidth and 99% bandwidth of the modulated signal. The measurement is performed according to the “Measurement Guidelines” (DA 00-705, March 30, 2000). EUT in single channel mode.

Measurement:

Measurement parameters	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	10 kHz
Video bandwidth	30 kHz
Span	1 MHz
Trace mode	Max hold
Test setup	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

Limits:

FCC	IC
Spectrum bandwidth of a FHSS system	
DBPSK < 1500 kHz	

Result:

Mode	20 dB bandwidth [kHz]		
	Low channel	Middle channel	High channel
Wiselink mode	288	288	289
XPAQ mode	288	288	289
Streaming mode	361	361	361

Mode	99% bandwidth [kHz]		
	Low channel	Middle channel	High channel
Wiselink mode	274	274	274
XPAQ mode	274	274	274
Streaming mode	339	340	339

Plots: (Wiselink mode)

Plot 1: Low channel; 20 dB bandwidth and 99 % occupied bandwidth

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Plot 2: Mid channel; 20 dB bandwidth and 99 % occupied bandwidth

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Plot 3: High channel; 20 dB bandwidth and 99 % occupied bandwidth

Plots: (XPAQ mode)

Plot 1: Low channel; 20 dB bandwidth and 99 % occupied bandwidth

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Plot 2: Mid channel; 20 dB bandwidth and 99 % occupied bandwidth

11:37:29 21.02.2017

Plot 3: High channel; 20 dB bandwidth and 99 % occupied bandwidth

Plots: (Streaming mode)

Plot 1: Low channel; 20 dB bandwidth and 99 % occupied bandwidth

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Plot 2: Mid channel; 20 dB bandwidth and 99 % occupied bandwidth

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Plot 3: High channel; 20 dB bandwidth and 99 % occupied bandwidth

11.6 Maximum Output Power

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	3 MHz
Video bandwidth:	10 MHz
Span:	5 MHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 6.2 – A See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Maximum Output Power Conducted	
For frequency hopping systems operating in the 902–928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.	

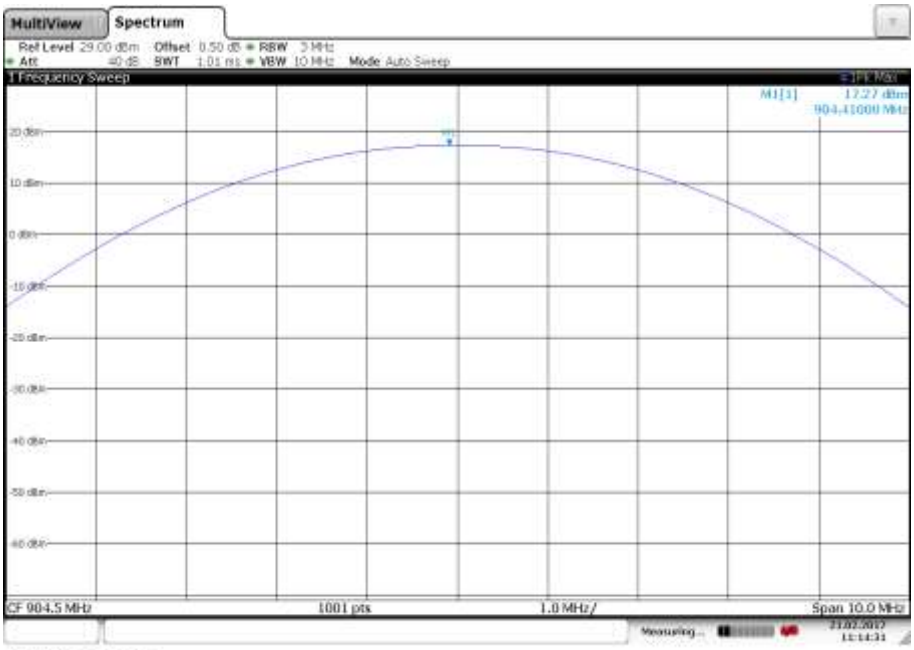
Result:

Mode	Maximum output power conducted [dBm]		
	Low channel	Middle channel	High channel
Wiselink mode	17.3	17.8	18.1
XPAQ mode	17.3	17.8	18.1
Streaming mode	20.3	20.3	20.2

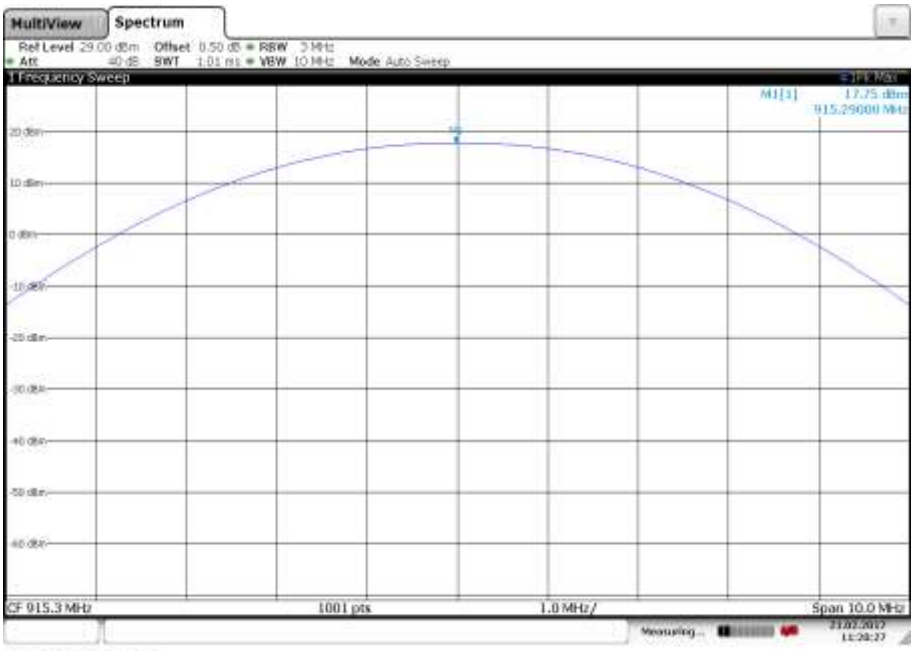
Mode	ERP [dBm]		
	Low channel	Middle channel	High channel
Wiselink mode	18.9	18.1	16.8
XPAQ mode	18.9	18.1	16.8
Streaming mode	21.9	20.6	18.9

Plots: (Wiselink mode)

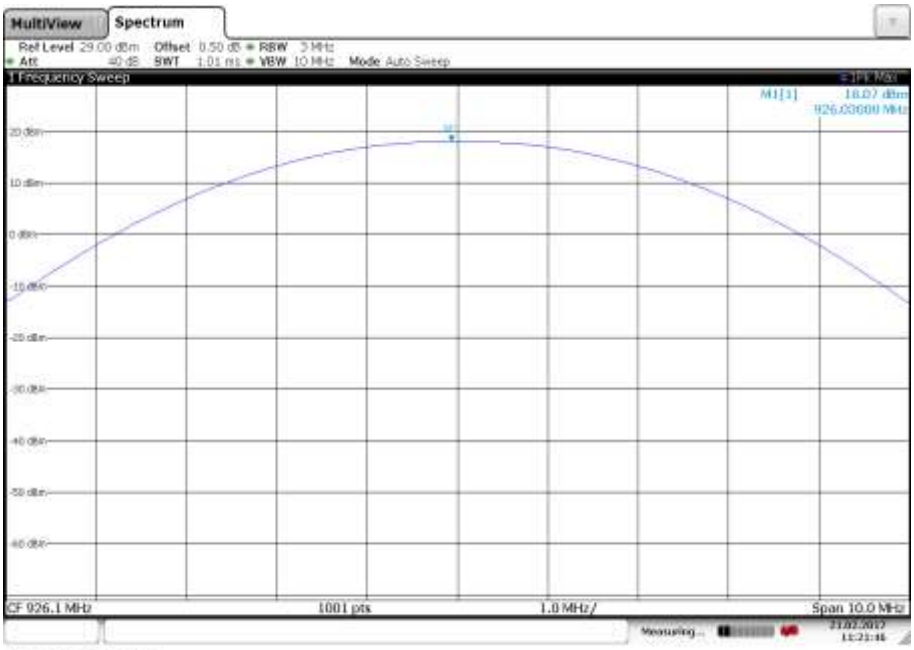
Plot 1: Low channel



Plot 2: Middle channel

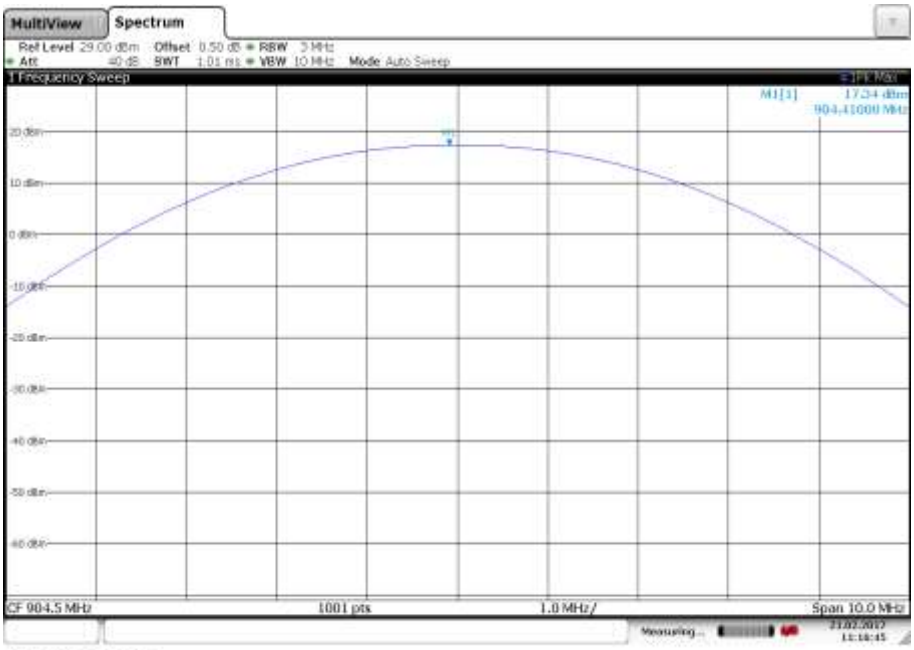


Plot 3: High channel

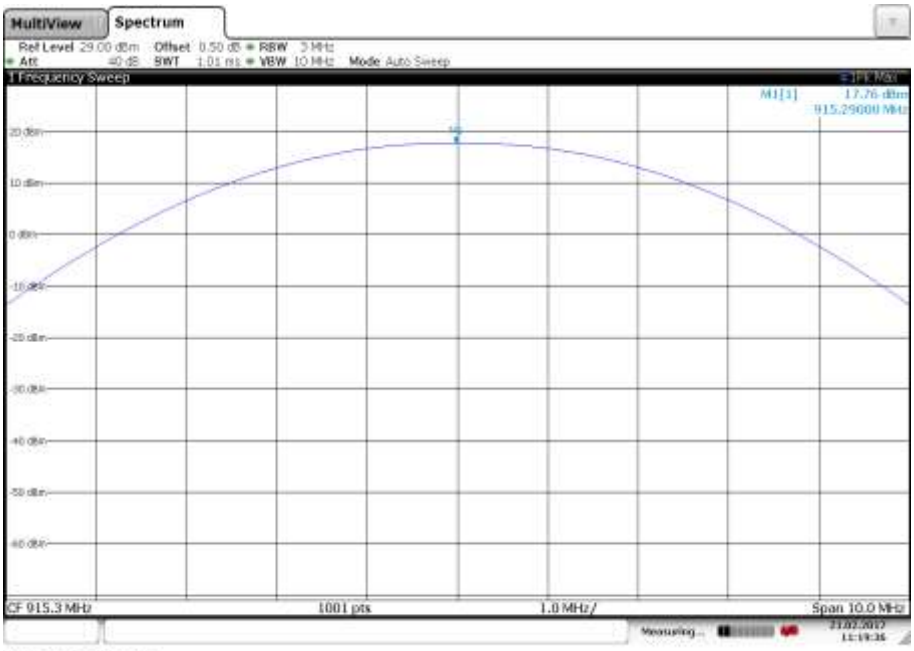


Plots: (XPAQ mode)

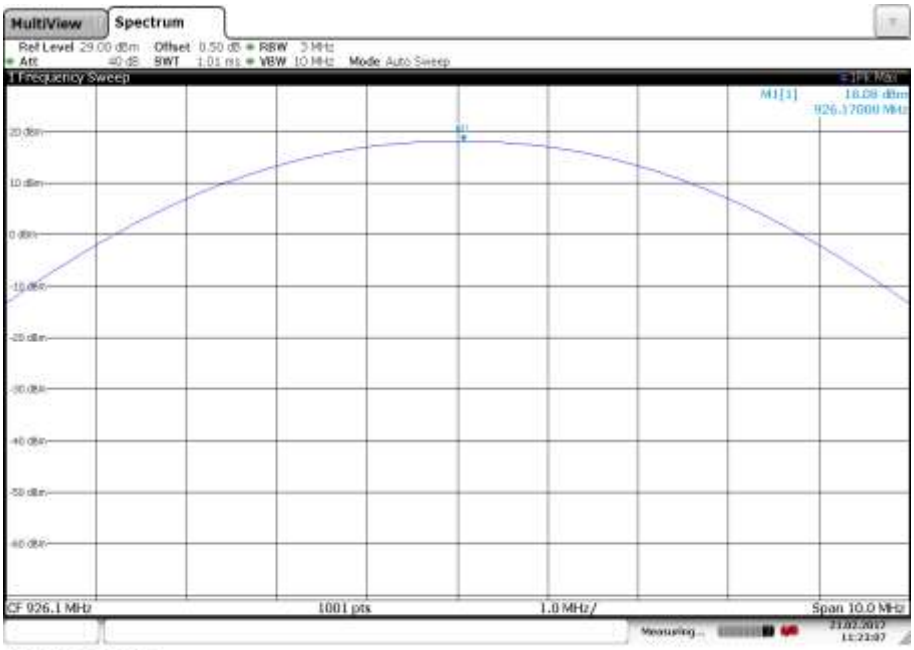
Plot 1: Low channel



Plot 2: Middle channel

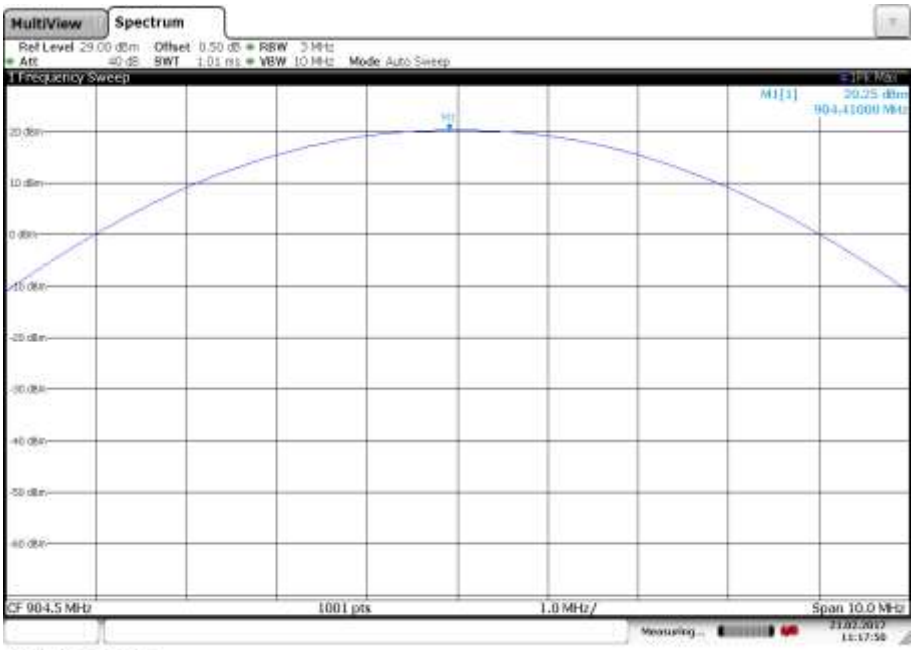


Plot 3: High channel

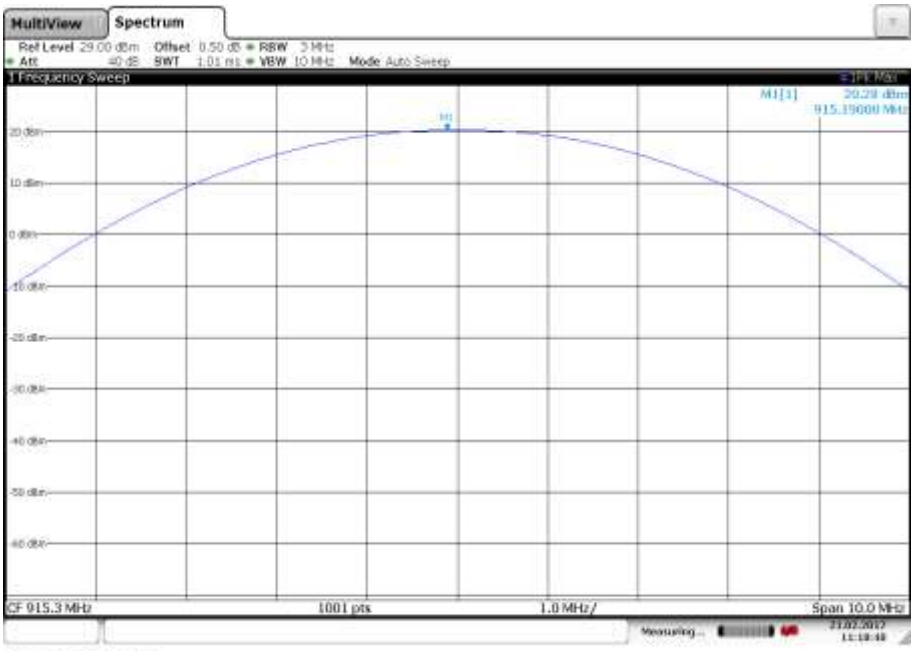


Plots: (Streaming mode)

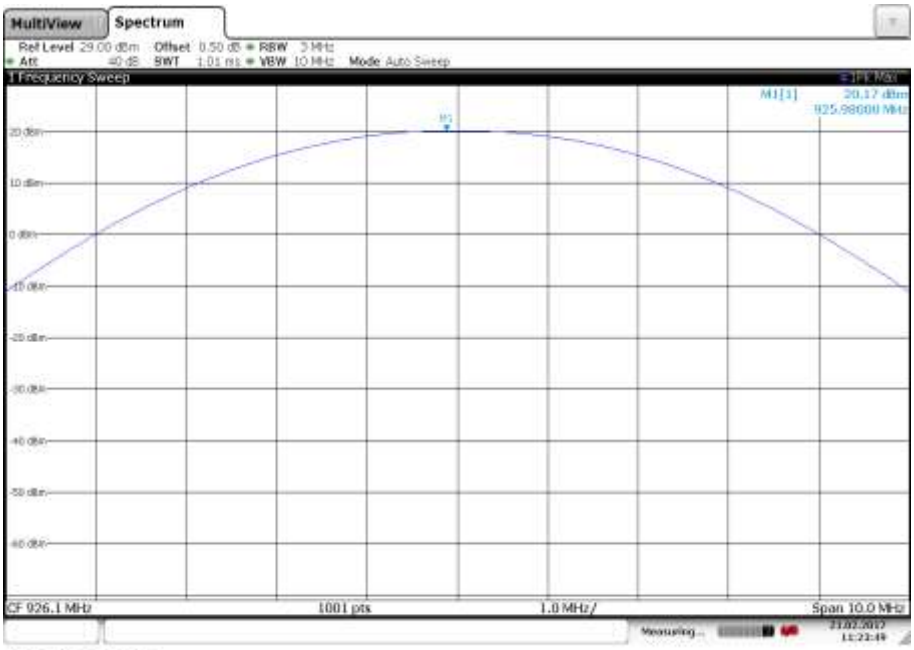
Plot 1: Low channel



Plot 2: Middle channel



Plot 3: High channel



11.7 Detailed spurious emissions @ the band edge – conducted and radiated

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge in single channel and hopping mode. The measurement is repeated for all modulations.

Measurement parameters	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Span	Lower Band Edge: 902 MHz Upper Band Edge: 928 MHz
Trace mode	Max hold
Test setup	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

Limits:

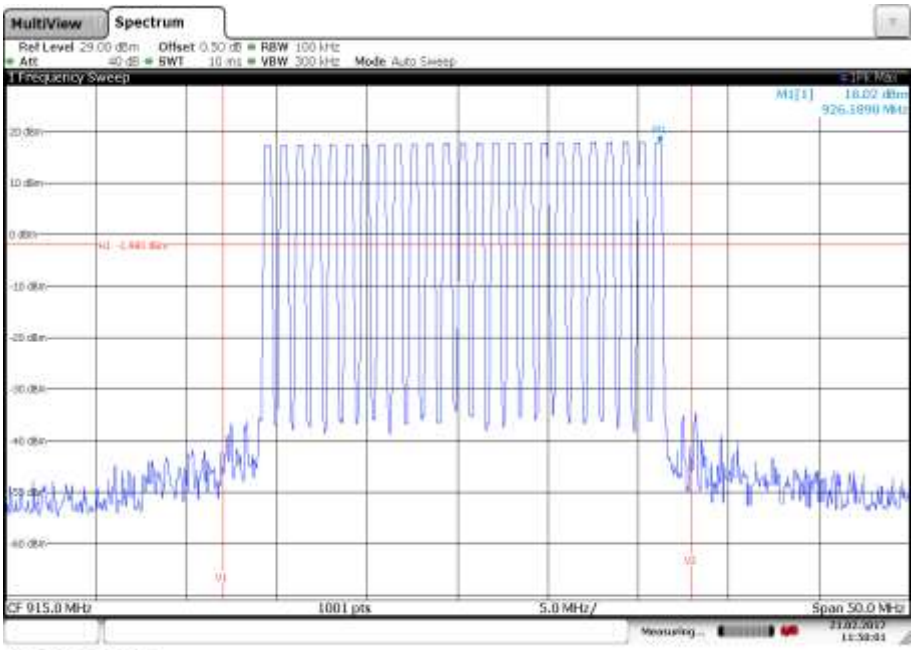
FCC	IC
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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 conducted:

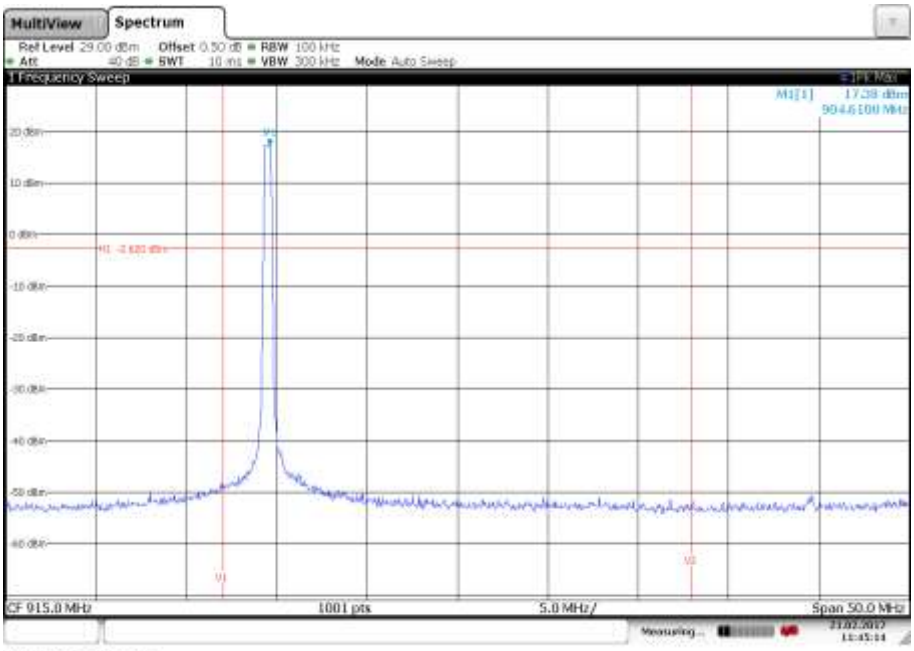
Scenario	Spurious band edge conducted [dB]		
Modulation	lowest channel	middle channel	highest channel
Lower band edge – hopping on	> 20 dB	> 20 dB	> 20 dB
Upper band edge – hopping on	> 20 dB	> 20 dB	> 20 dB

Plots: (Wiselink mode)

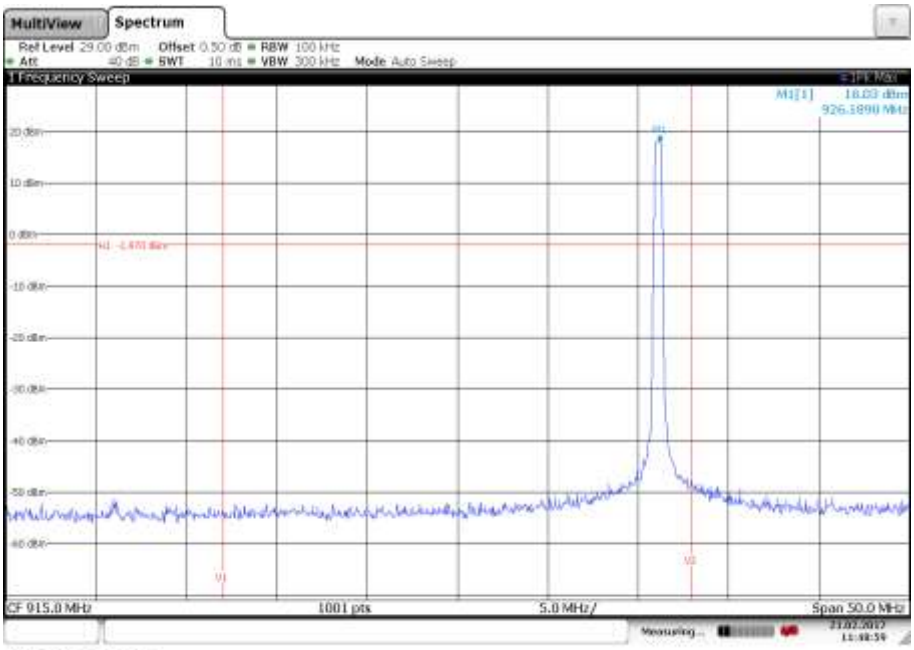
Plot 1: 20 dB – hopping



Plot 2: 20 dB – no hopping, low channel

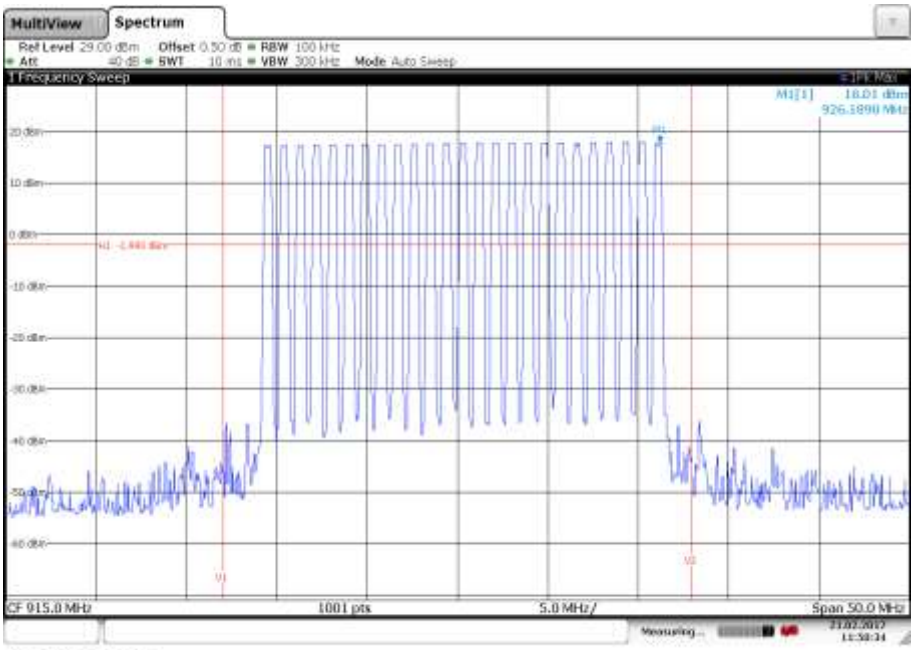


Plot 3: 20 dB – no hopping, high channel



Plots: (XPAQ - mode)

Plot 1: 20 dB – hopping



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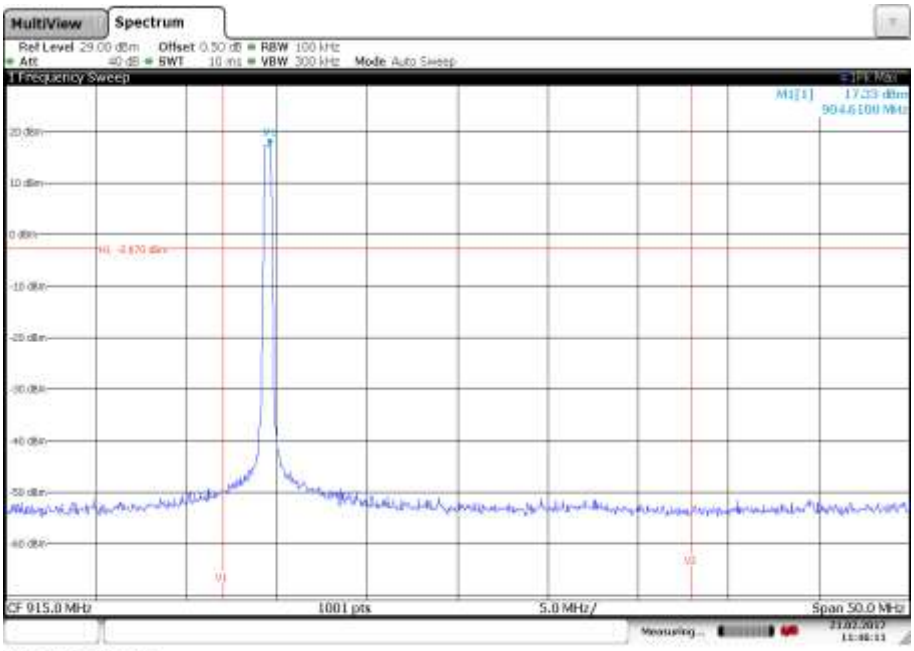
Plot 2: 20 dB – no hopping, low channel



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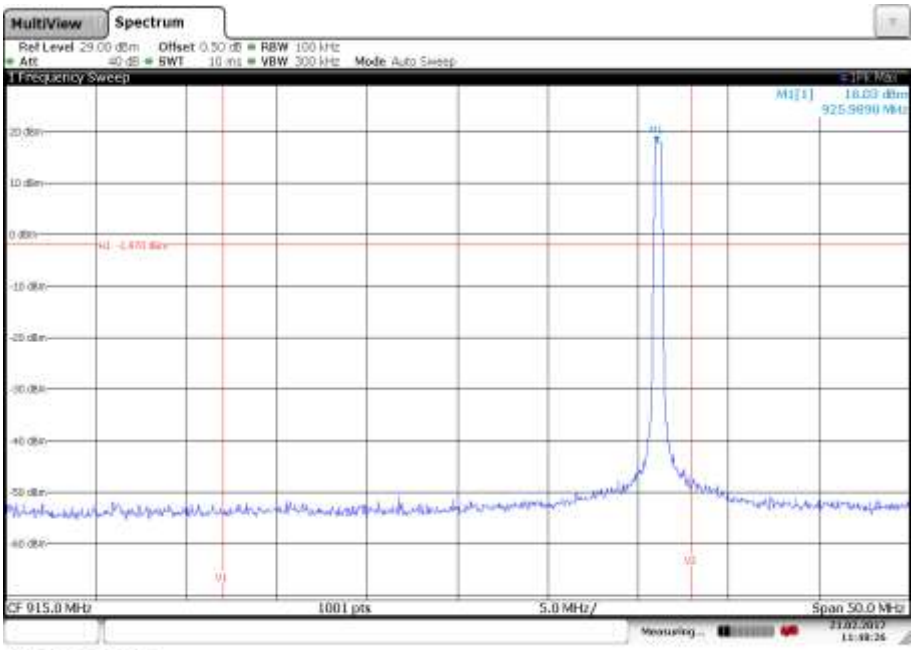
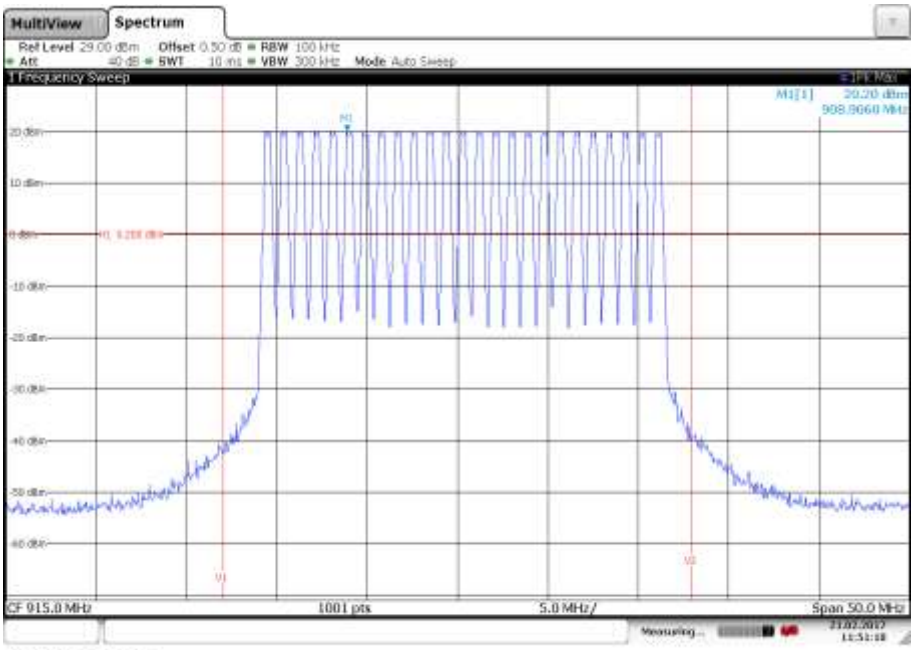
Plot 3: 20 dB – no hopping, high channel



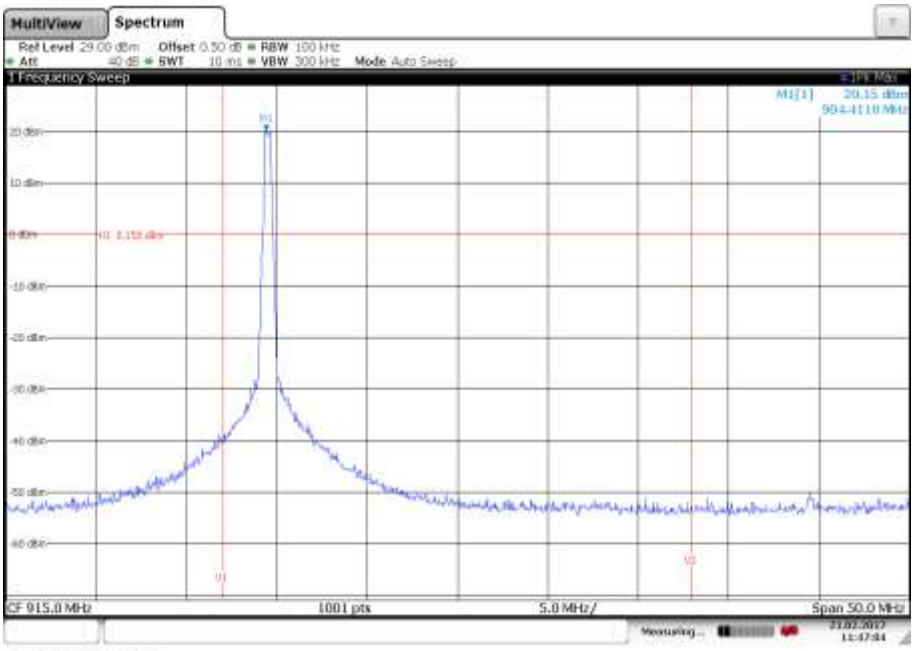
Plots: (Streaming - mode)

Plot 1: 20 dB – hopping



11:51:18 21.02.2017

Plot 2: 20 dB – no hopping, low channel



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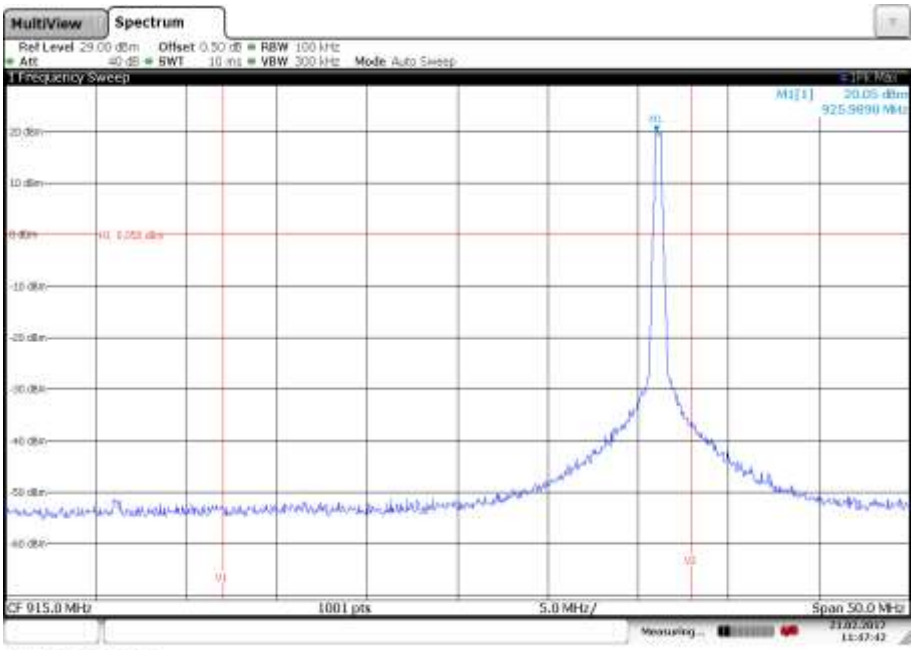
Plot 3: 20 dB – no hopping, high channel



Results radiated:

No restricted band in the range ± 2 channel bandwidths of the Band-edges of the specified emission band! (608 MHz – 614 MHz and 960 MHz – 1240 MHz).

Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

11.8 Spurious Emissions Conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The EUT is set to single channel mode. The measurement is repeated for low, mid and high channel.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	180 s
Video bandwidth:	F < 1 GHz: 500 kHz F > 1 GHz: 500 kHz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 100 kHz
Span:	9 kHz to 18 GHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

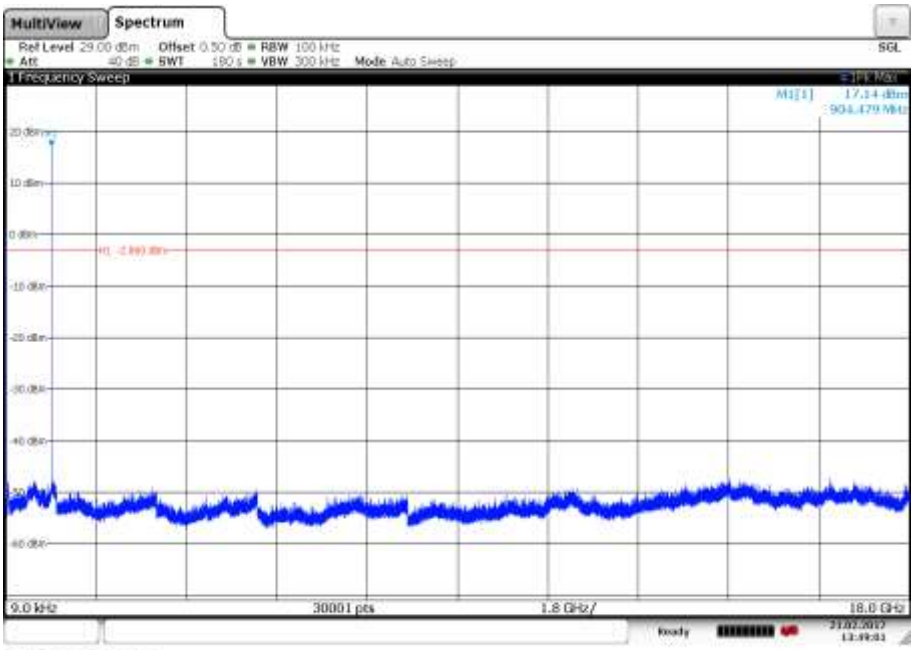
FCC	IC
TX spurious emissions conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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	

Result:

Emission Limitation					
Channel	Mode	Amplitude of emission [dBm]	Limit max. allowed emission power	actual attenuation below frequency of operation [dB]	Results
Lowest	Wiselink	17.14	24 dBm		Operating frequency
Lowest	XPAQ	17.12	24 dBm		Operating frequency
Lowest	Streaming	19.97	24 dBm		Operating frequency
See plot			-20 dBc		Compliant
Middle	Wiselink	17.53	24 dBm		Operating frequency
Middle	XPAQ	17.51	24 dBm		Operating frequency
Middle	Streaming	19.94	24 dBm		Operating frequency
See plot			-20 dBc		Compliant
Highest	Wiselink	17.82	24 dBm		Operating frequency
Highest	XPAQ	17.82	24 dBm		Operating frequency
Highest	Streaming	19.89	24 dBm		Operating frequency
See plot			-20 dBc		Compliant

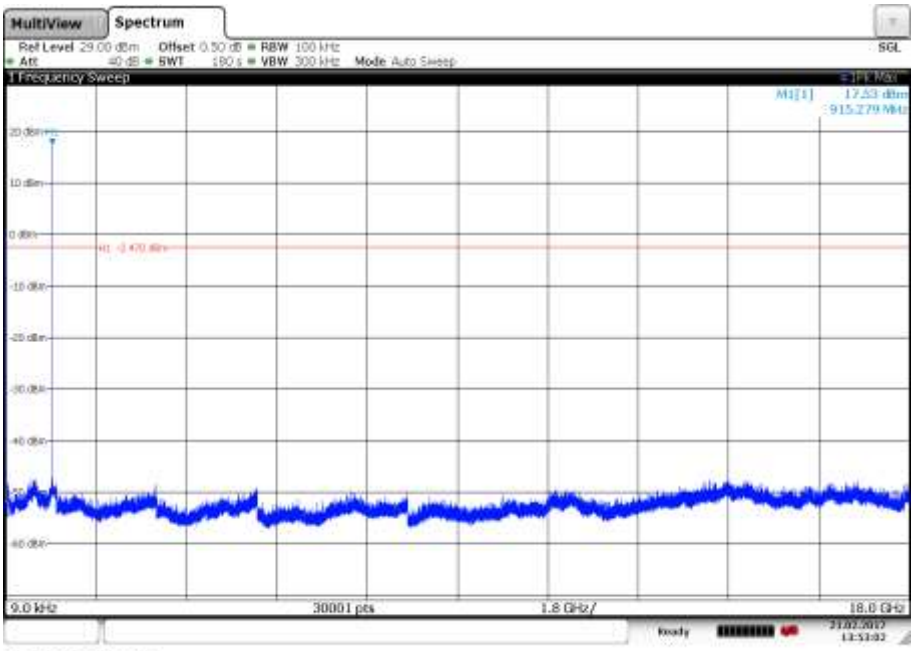
Plots: (Wiselink mode)

Plot 1: Low channel, 9 kHz – 18 GHz



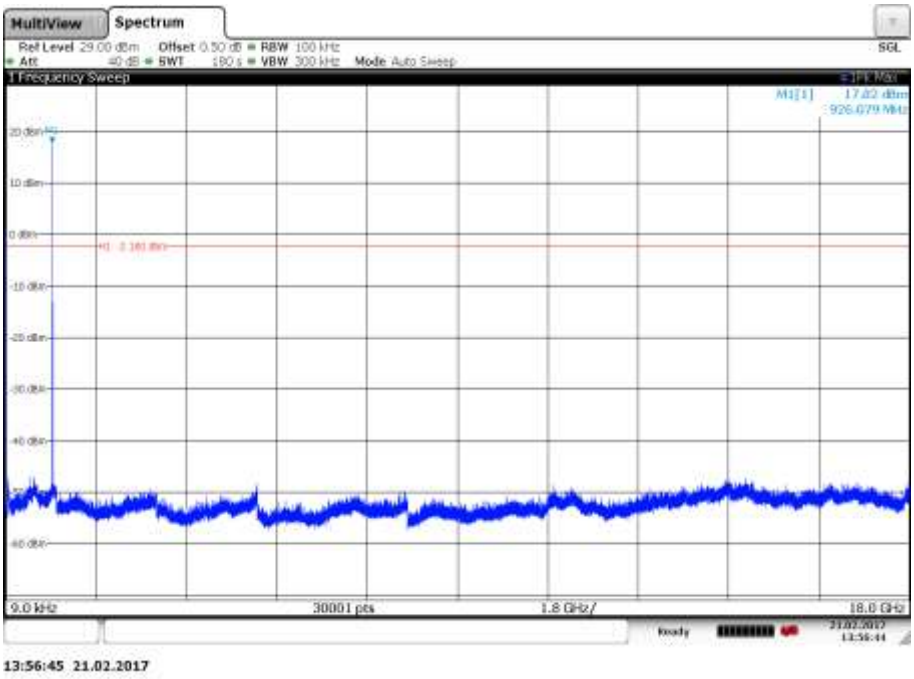
13:49:01 21.02.2017

Plot 2: Middle channel, 9 kHz – 18 GHz



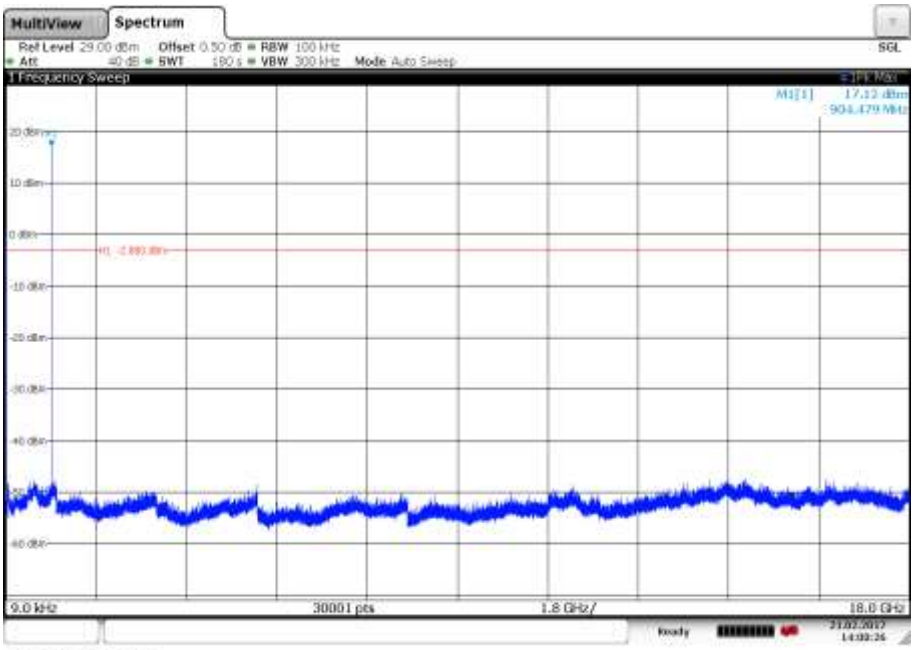
13:53:02 21.02.2017

Plot 3: High channel, 9 kHz – 18 GHz



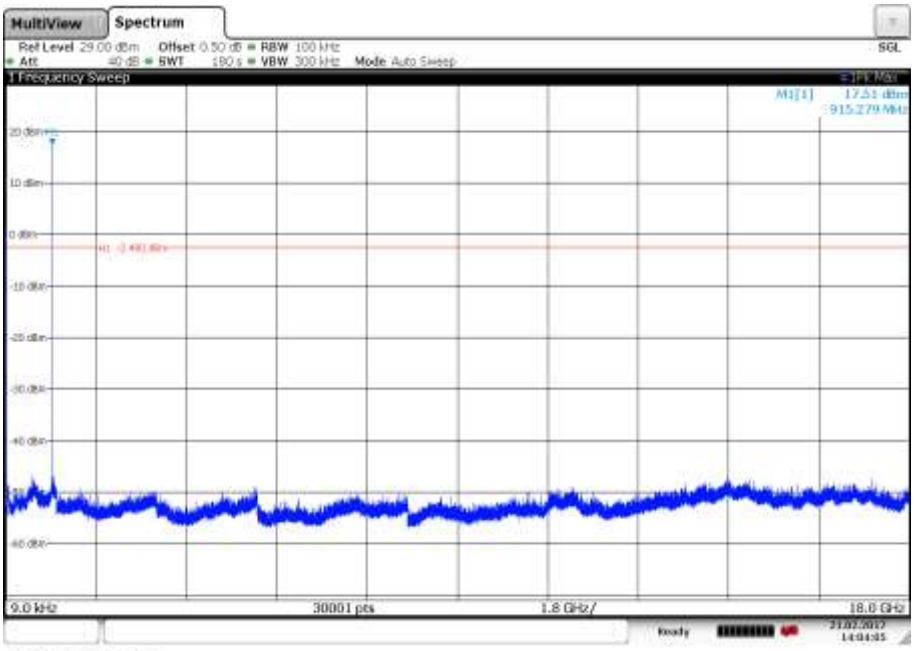
Plots: (XPAQ mode)

Plot 1: Low channel, 9 kHz – 18 GHz



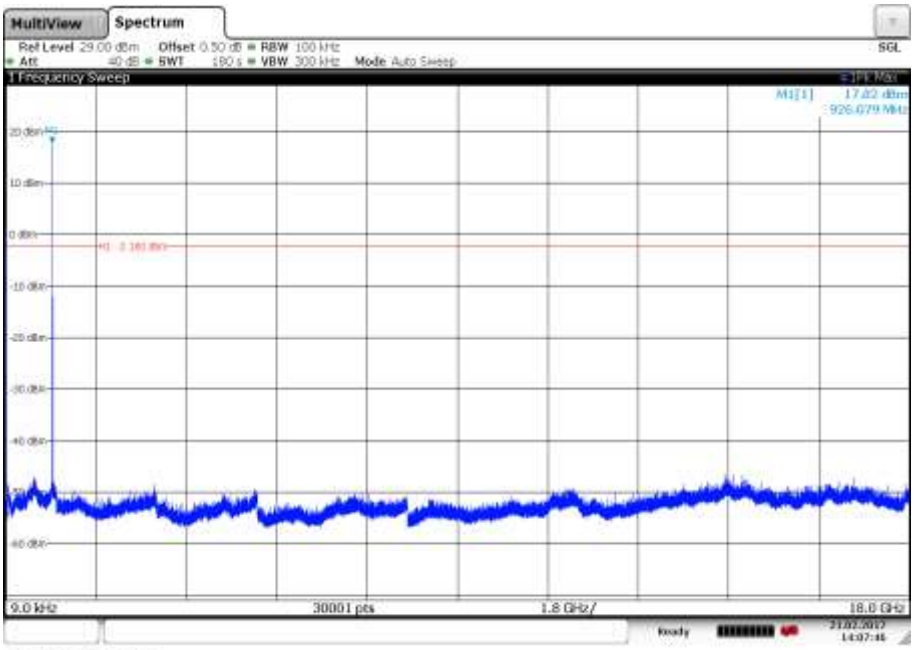
14:00:27 21.02.2017

Plot 2: Middle channel, 9 kHz – 18 GHz



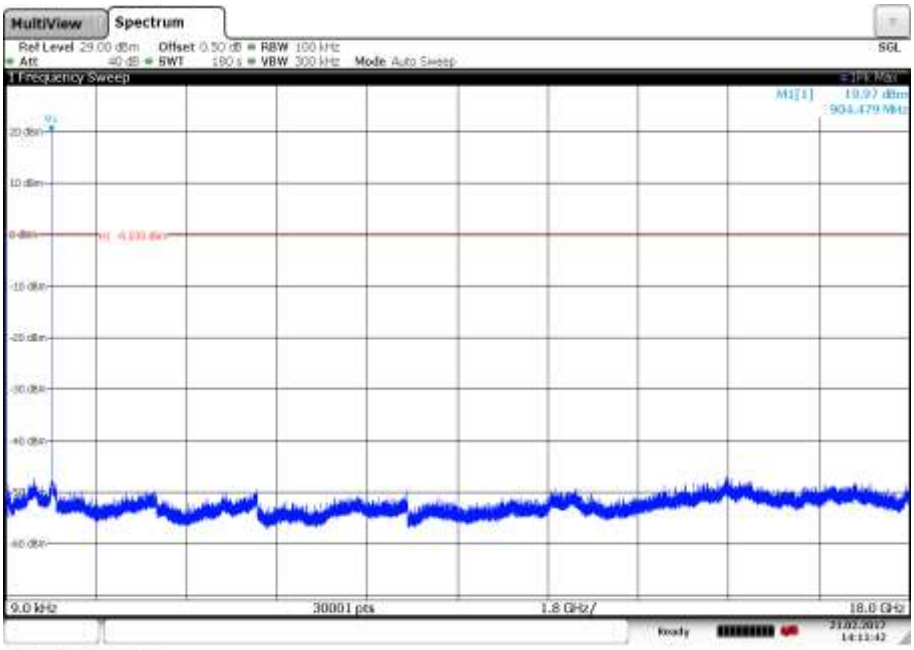
14:04:06 21.02.2017

Plot 3: High channel, 9 kHz – 18 GHz



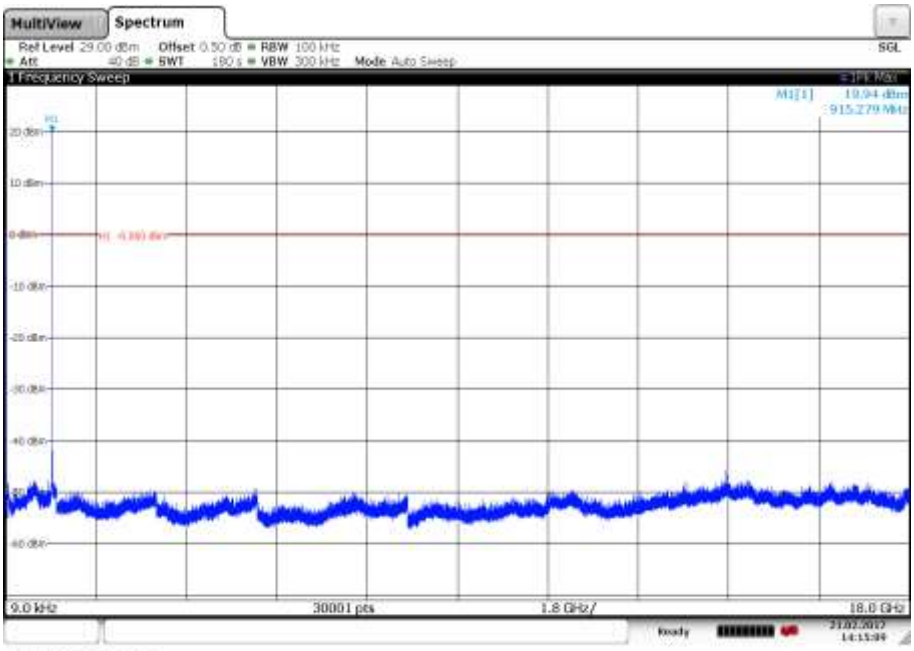
Plots: (Streaming mode)

Plot 1: Low channel, 9 kHz – 18 GHz



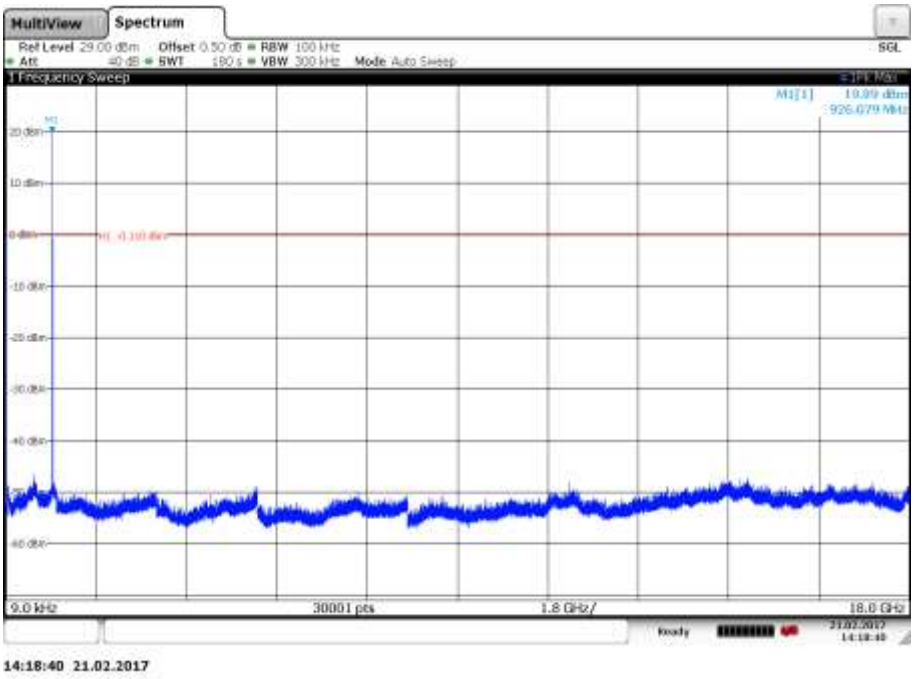
14:11:42 21.02.2017

Plot 2: Middle channel, 9 kHz – 18 GHz



14:15:10 21.02.2017

Plot 3: High channel, 9 kHz – 18 GHz



11.9 Spurious Emissions Radiated < 30 MHz

Description:

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

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 6.2 – B
Measurement uncertainty:	See chapter 8

Limits:

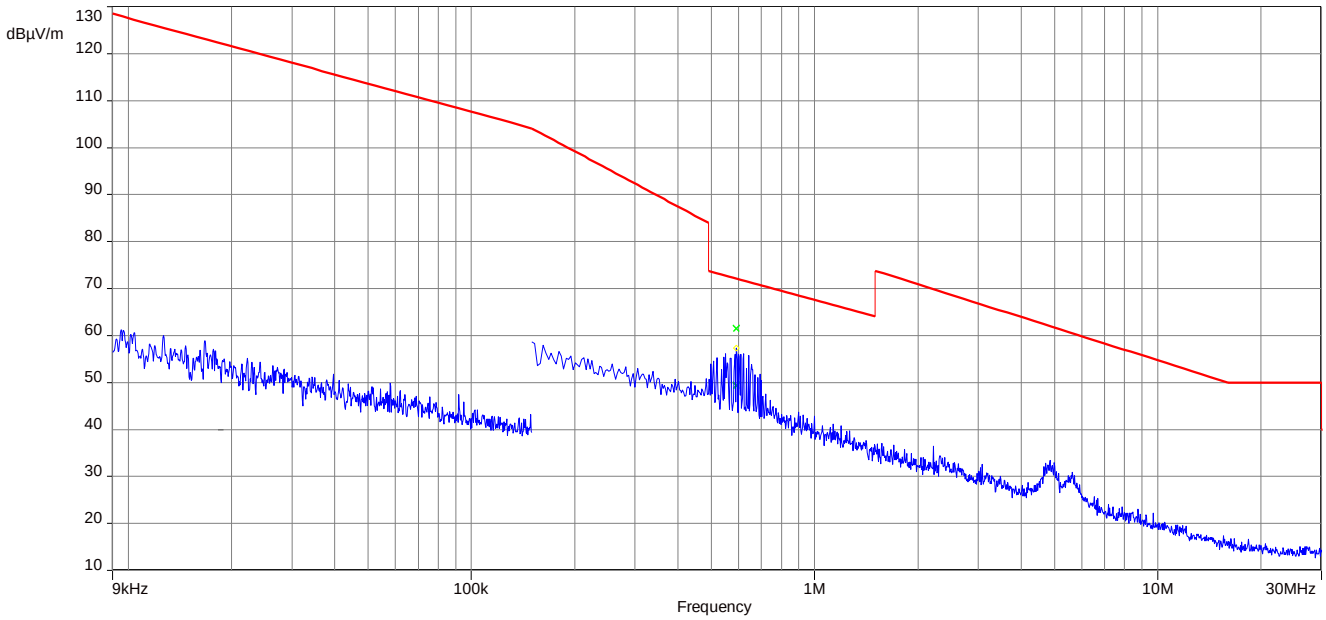
FCC		IC
TX spurious emissions radiated < 30 MHz		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Result:

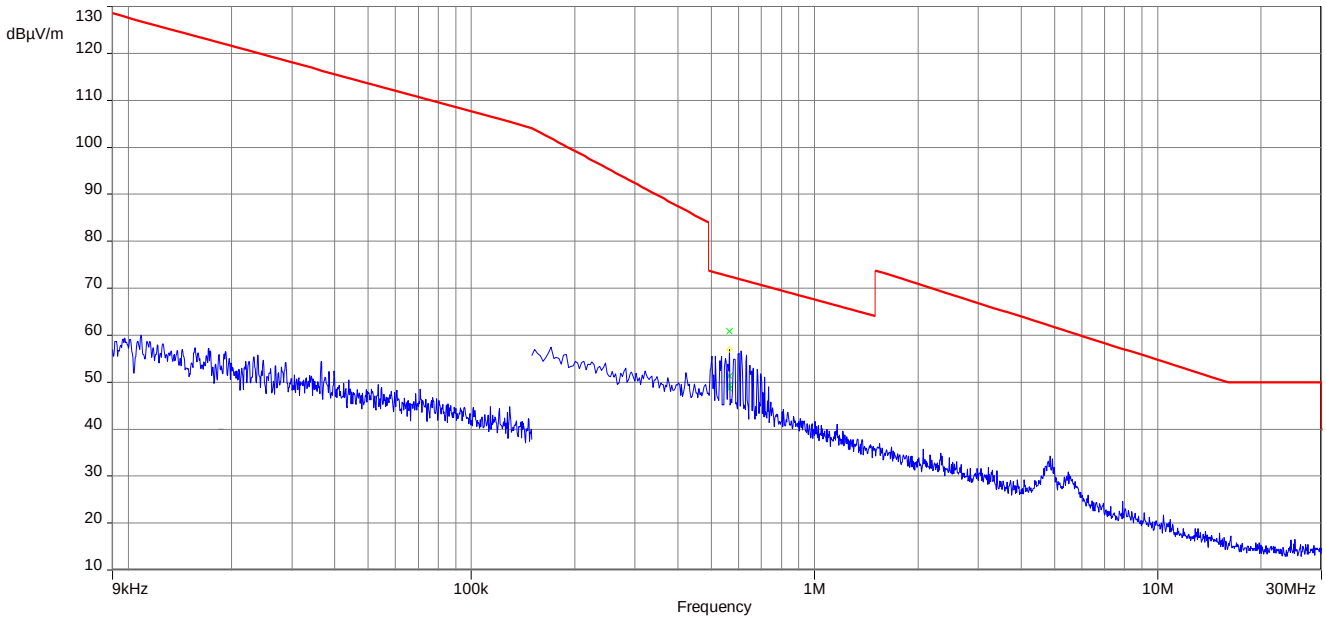
SPURIOUS EMISSIONS LEVEL [dBµV/m]								
Lowest channel			Middle channel			Highest channel		
Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]
0.6	Peak	61.5	0.6	Peak	60.8	4.8	Peak	37.6

Plots: (valid for all modes)

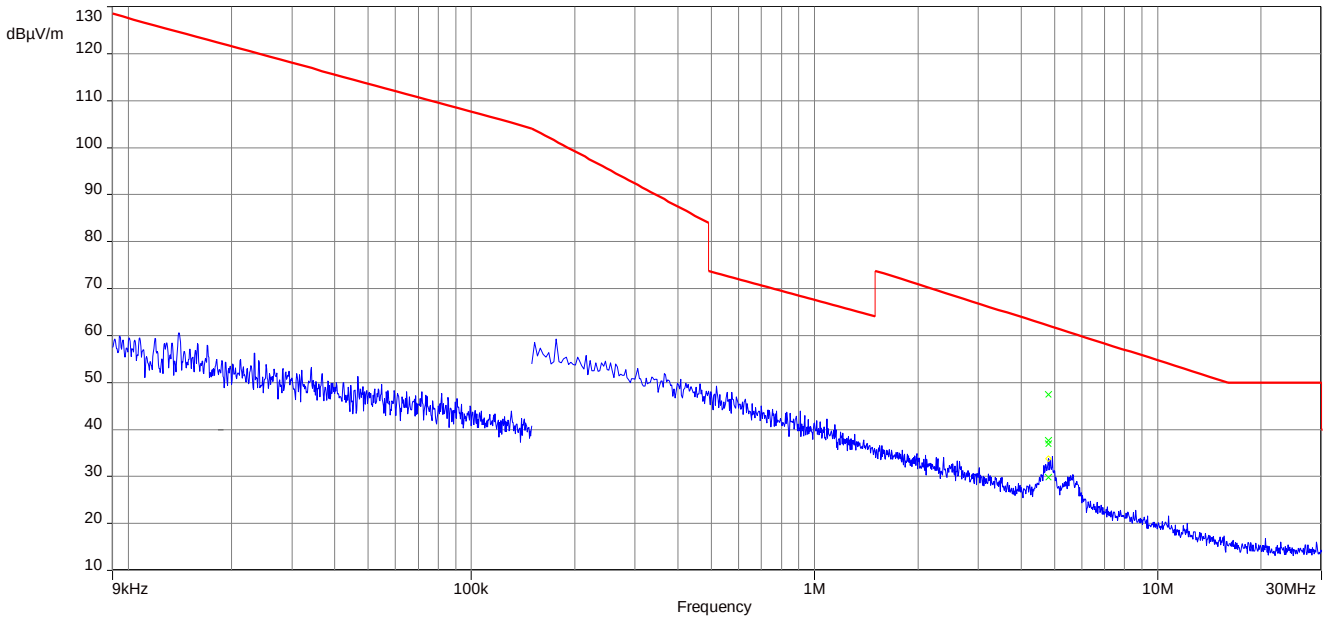
Plot 1: low channel



Plot 2: mid channel



Plot 3: high channel



11.10 Spurious Emissions Radiated > 30 MHz

11.10.1 Spurious emissions radiated 30 MHz to 1 GHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at channel low, mid and high.

Measurement:

Measurement parameters	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	3 x VBW
Video bandwidth	120 kHz
Span	30 MHz to 1 GHz
Trace mode	Max hold
Measured modulation	DBPSK
Test setup	See sub clause 6.1 – A
Measurement uncertainty	See sub clause 8

Limits:

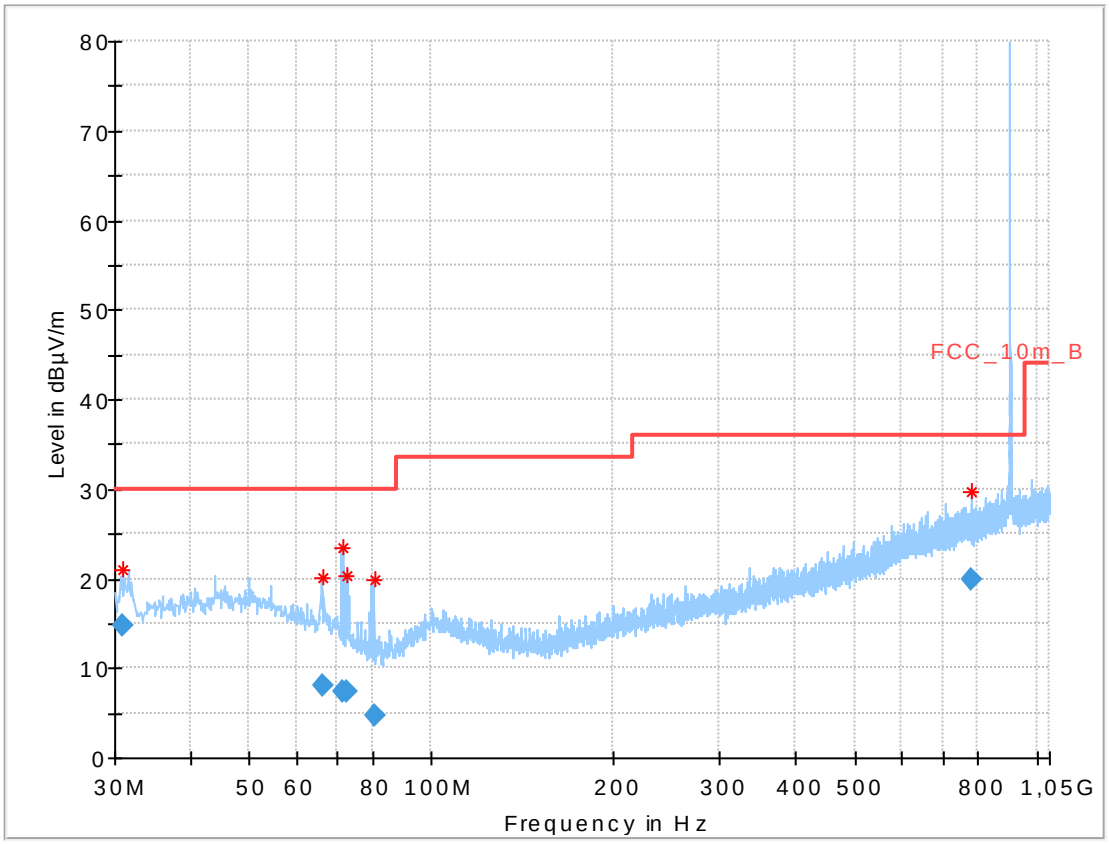
FCC	IC	
Band-edge Compliance of conducted and radiated emissions		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §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)).		
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

Result:

See result table below the plots.

Plots: (Wiselink-/XPAQ mode)

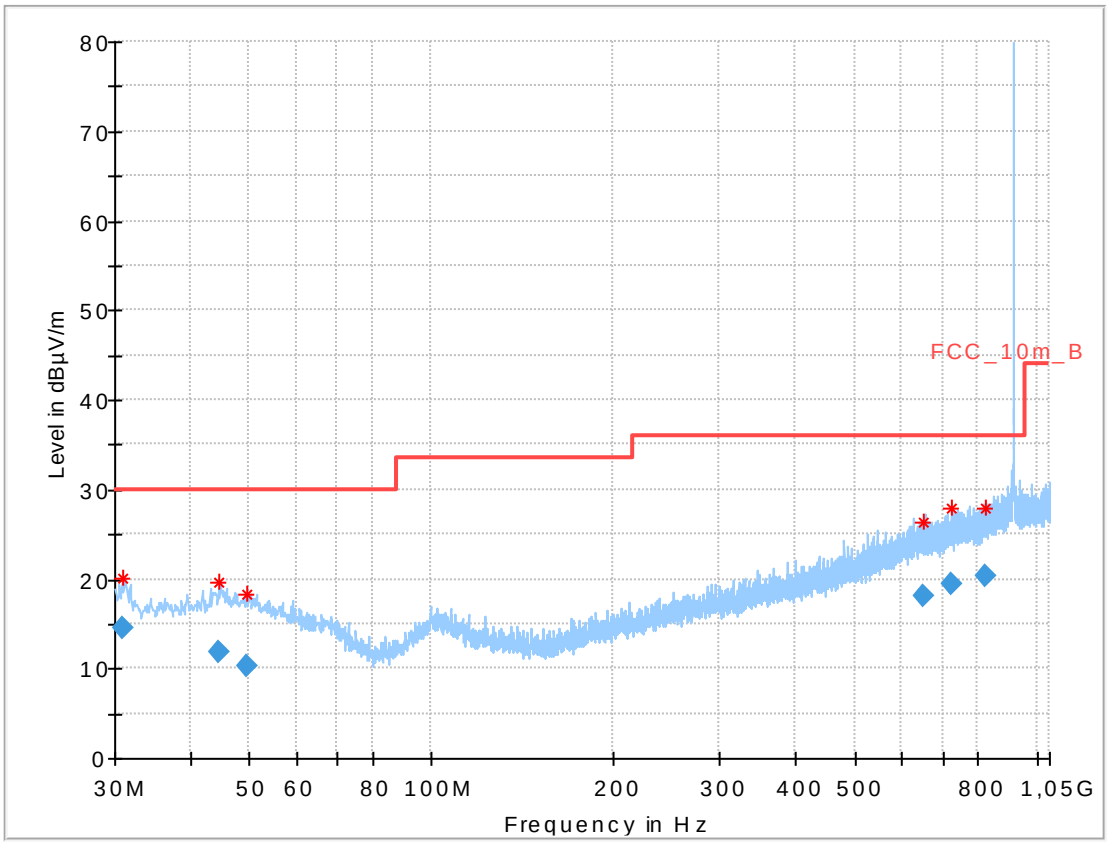
Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarization (lowest channel)



Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.940650	14.73	30.00	15.27	1000.0	120.000	100.0	V	17.0	12.0
66.430200	8.00	30.00	22.00	1000.0	120.000	185.0	V	82.0	10.5
71.370600	7.42	30.00	22.58	1000.0	120.000	100.0	V	25.0	9.5
72.415200	7.44	30.00	22.56	1000.0	120.000	101.0	V	25.0	9.3
80.549700	4.75	30.00	25.25	1000.0	120.000	179.0	V	25.0	8.2
781.741050	19.80	36.00	16.20	1000.0	120.000	185.0	V	142.0	22.7

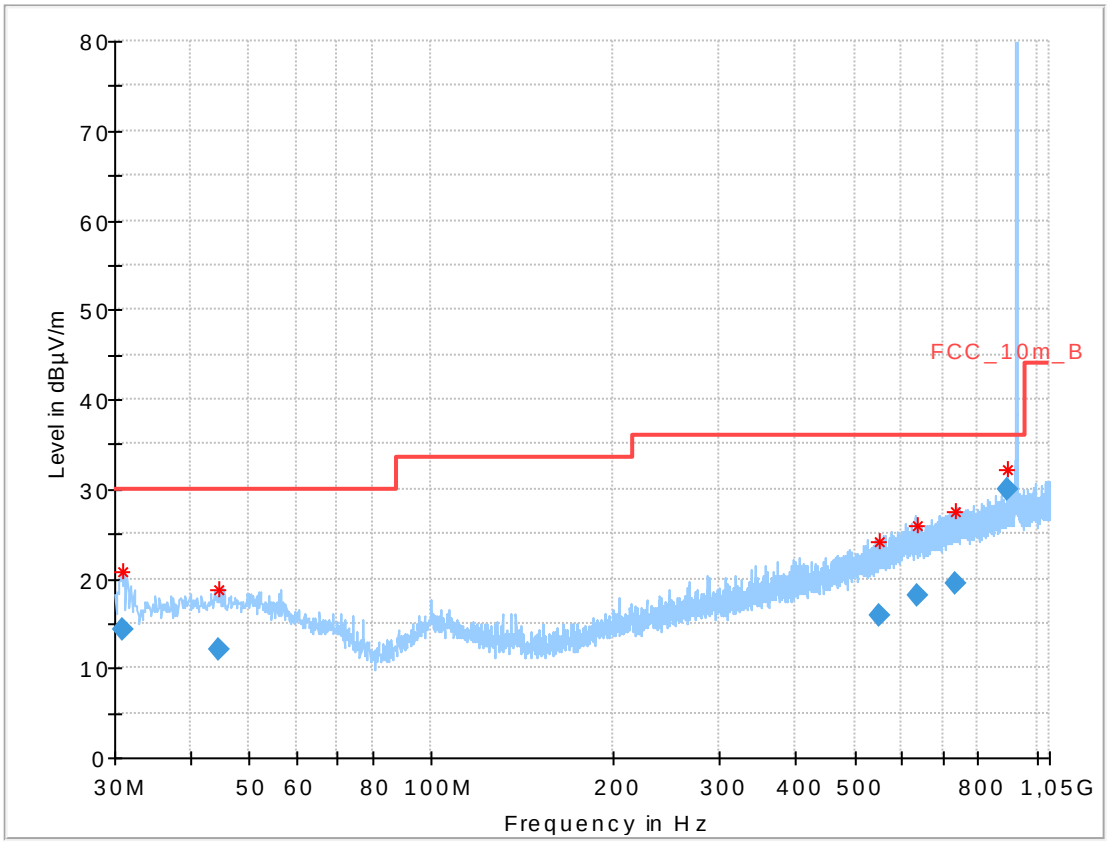
Plot 2: 30 MHz – 1 GHz, horizontal & vertical polarization (middle channel)



Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.932850	14.53	30.00	15.47	1000.0	120.000	101.0	V	261.0	12.0
44.487000	11.88	30.00	18.12	1000.0	120.000	101.0	V	41.0	13.6
49.668450	10.26	30.00	19.74	1000.0	120.000	98.0	V	89.0	13.7
652.030650	18.18	36.00	17.82	1000.0	120.000	101.0	V	353.0	21.1
722.679900	19.37	36.00	16.63	1000.0	120.000	185.0	H	286.0	22.1
822.464400	20.30	36.00	15.70	1000.0	120.000	101.0	V	353.0	23.1

Plot 3: 30 MHz – 1 GHz, horizontal & vertical polarization (highest channel)

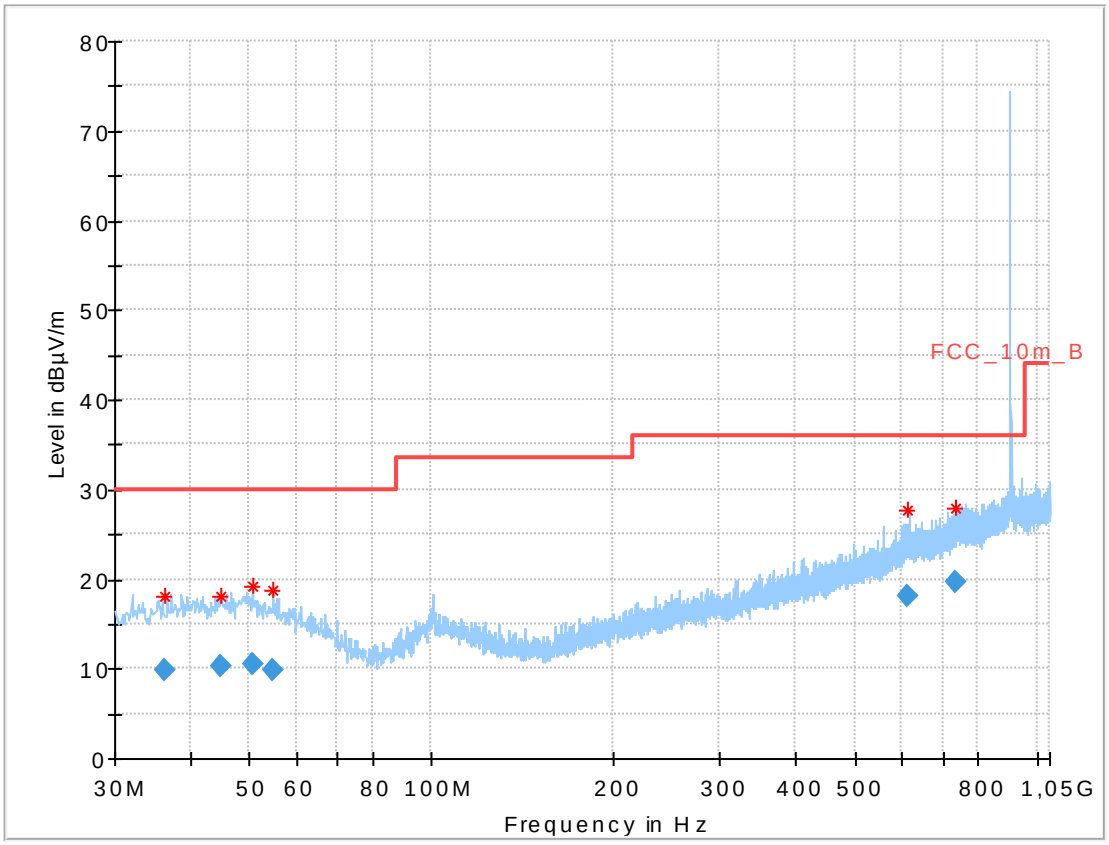


Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.927300	14.19	30.00	15.81	1000.0	120.000	98.0	V	0.0	12.0
44.553900	11.97	30.00	18.03	1000.0	120.000	98.0	V	103.0	13.6
551.161650	15.76	36.00	20.24	1000.0	120.000	185.0	V	212.0	19.4
636.842250	18.17	36.00	17.83	1000.0	120.000	185.0	V	244.0	21.0
733.214100	19.54	36.00	16.46	1000.0	120.000	101.0	H	0.0	22.3
896.239350	29.89	36.00	6.11	1000.0	120.000	98.0	H	0.0	24.1

Plots: (Streaming mode)

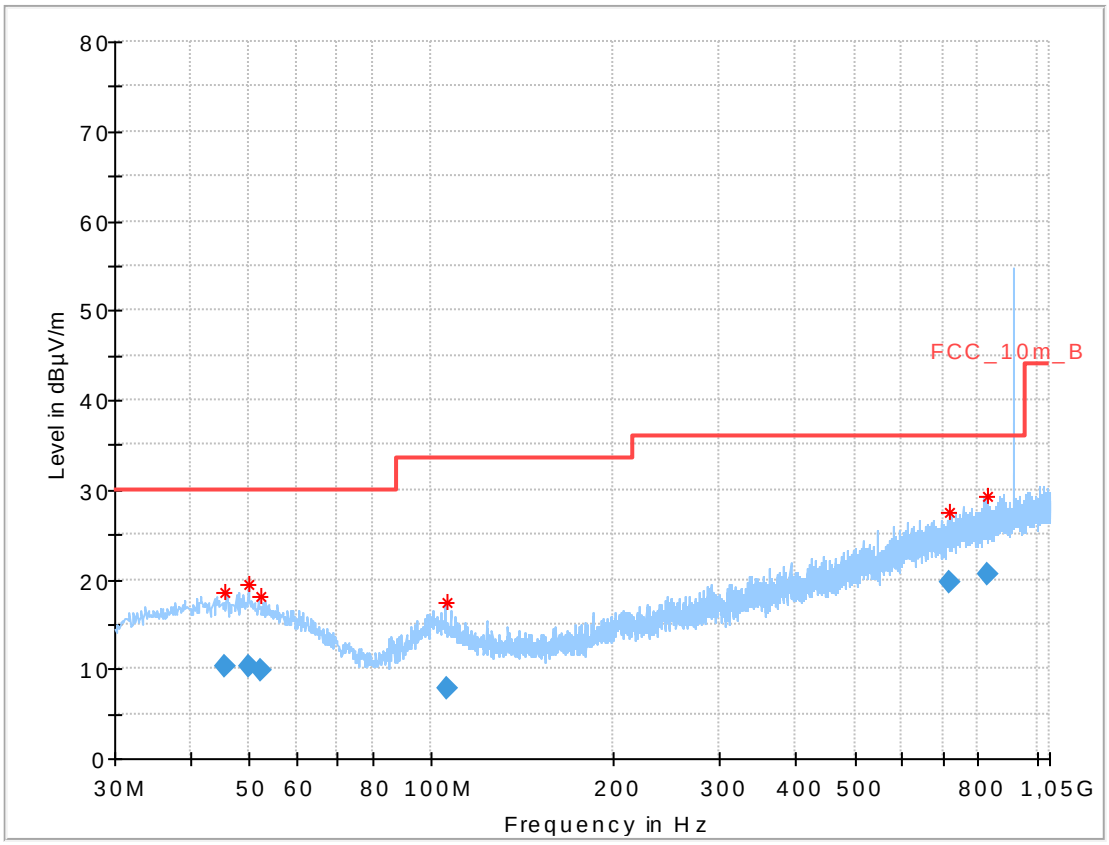
Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarization (lowest channel)



Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.333000	9.78	30.00	20.22	1000.0	120.000	101.0	V	-10.0	12.8
44.783700	10.21	30.00	19.79	1000.0	120.000	98.0	V	170.0	13.6
50.721150	10.51	30.00	19.49	1000.0	120.000	101.0	V	-10.0	13.6
54.621600	9.74	30.00	20.26	1000.0	120.000	98.0	V	280.0	13.1
613.498950	18.02	36.00	17.98	1000.0	120.000	101.0	V	10.0	20.8
735.393450	19.71	36.00	16.29	1000.0	120.000	170.0	V	172.0	22.4

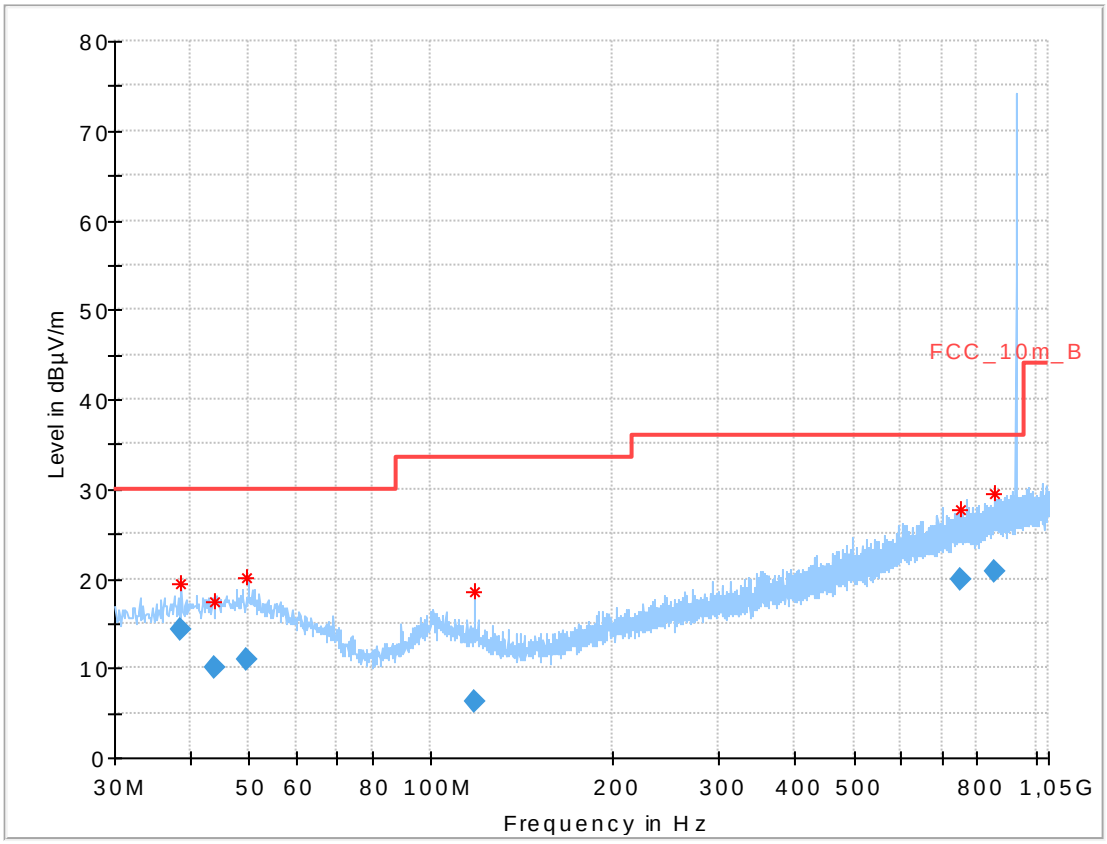
Plot 2: 30 MHz – 1 GHz, horizontal & vertical polarization (middle channel)



Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
45.723750	10.35	30.00	19.65	1000.0	120.000	170.0	H	261.0	13.6
49.822050	10.22	30.00	19.78	1000.0	120.000	98.0	H	190.0	13.7
52.197750	9.75	30.00	20.25	1000.0	120.000	98.0	V	-10.0	13.4
105.892500	7.74	33.50	25.76	1000.0	120.000	170.0	H	190.0	11.5
720.218850	19.63	36.00	16.37	1000.0	120.000	101.0	V	80.0	22.0
828.372900	20.59	36.00	15.41	1000.0	120.000	170.0	H	260.0	23.2

Plot 3: 30 MHz – 1 GHz, horizontal & vertical polarization (highest channel)

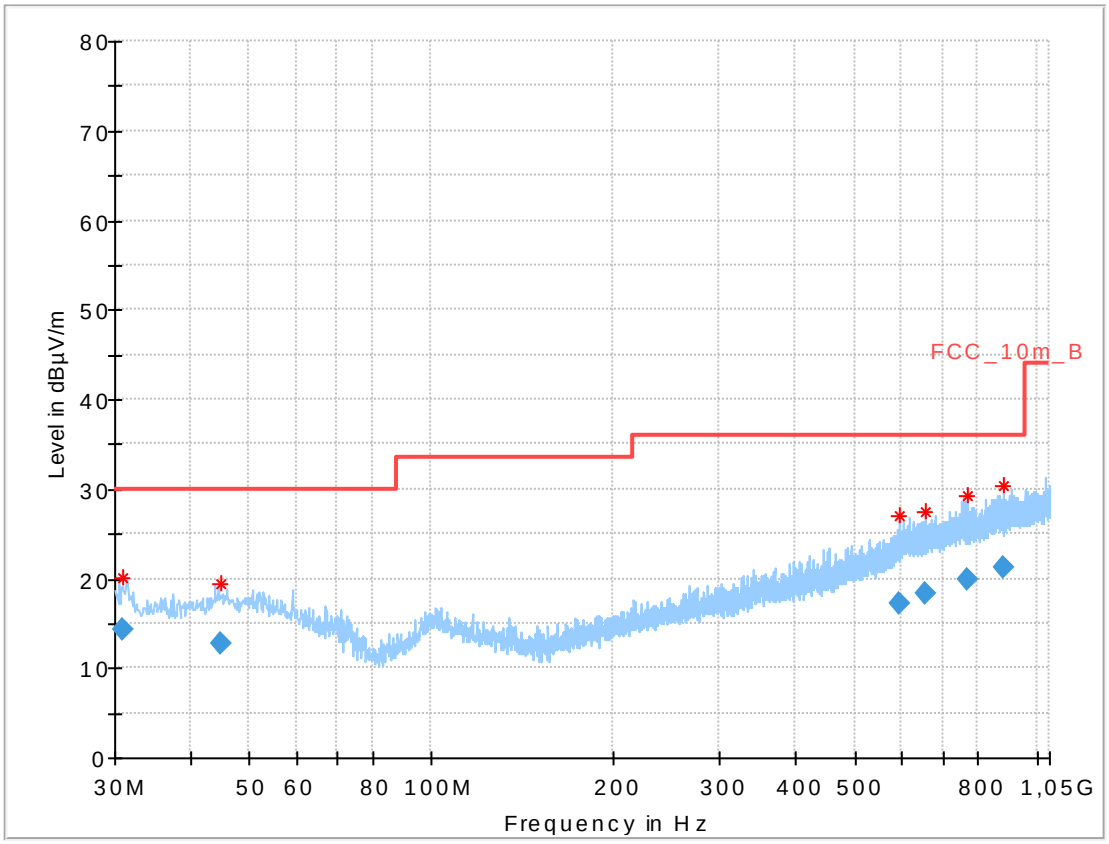


Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.685300	14.21	30.00	15.79	1000.0	120.000	98.0	V	280.0	13.1
43.842300	10.05	30.00	19.95	1000.0	120.000	101.0	V	81.0	13.5
49.620150	10.93	30.00	19.07	1000.0	120.000	98.0	V	260.0	13.7
118.277700	6.33	33.50	27.17	1000.0	120.000	98.0	V	100.0	10.4
750.009900	19.86	36.00	16.14	1000.0	120.000	170.0	V	171.0	22.7
852.133650	20.81	36.00	15.19	1000.0	120.000	170.0	H	262.0	23.6

Plot: (RX mode)

Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarization (RX-Mode)



Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.981750	14.26	30.00	15.74	1000.0	120.000	101.0	V	266.0	12.0
44.839350	12.76	30.00	17.24	1000.0	120.000	100.0	V	170.0	13.6
592.396800	17.21	36.00	18.79	1000.0	120.000	98.0	V	196.0	20.5
654.522150	18.26	36.00	17.74	1000.0	120.000	98.0	V	108.0	21.2
766.245900	19.78	36.00	16.22	1000.0	120.000	185.0	H	108.0	22.7
880.615500	21.30	36.00	14.70	1000.0	120.000	98.0	H	7.0	23.9

11.10.2 Spurious emissions radiated above 1 GHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed in the mode with the highest output power.

Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 x RBW
Span	1 GHz to 18 GHz
Trace mode	Max hold
Test setup	See sub clause 6.2 – C
Measurement uncertainty	See sub clause 8

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

Limits:

ANSI C63.10 – FCC Public Notice DA 00-705
The average emission shall be determined by using RMS detector. If the dwell time of the hopping signal is less than 100 ms (per channel), the RMS reading may be adjusted by a factor: F = 20log (dwell time/100 ms)

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 (AVG)	3
	74.0 (Peak)	

Result:

All transmit parameter in testmode of the Wiselink- and XPAQ-mode are identical. They differ only in the burst timings in the final application. Therefore the results for these modes only have different correction factors. In the table below we used the smallest correction factor of both modes to show worst case results.
Thr Streaming-mode has different power settings and was tested separately.

For radiated spurious emission the limits of 15.209 applies for all frequencies mentioned in 15.205. According to FCC Public Notice DA 00-705 (ANSI C63.10) the average emission shall be determined by using RMS detector. If the dwell time of the hopping signal is less than 100 ms (per channel), the RMS reading may be adjusted by a factor:

F = 20*log (dwell time/100 ms)

Wiselink-Mode:
In a period of 100 ms, we have a maximum of 2 transmissions and that gives the correction factor for spurious measurement.

F = 20*log (2*2.2/100) = -27.1 dB

XPAQ-Mode:
In a period of 100 ms, we have a maximum of 1 transmission and that gives the correction factor for spurious measurement.

F = 20*log (4.5/100) = -26.9 dB

Streaming-Mode:
In a period of 100 ms, we have a maximum of 2 transmissions and that gives the correction factor for spurious measurement.

F = 20*log (9.6/100) = -20.4 dB

Results: (Wiselink-/XPAQ mode)

TX spurious emissions radiated [dBµV/m]								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
1809	Peak	No RB!	1830.6	Peak	No RB!	1852.2	Peak	No RB!
	AVG			AVG			AVG	
2713.5	Peak	53.3	2746.9	Peak	53.6	2778.3	Peak	52.2
	AVG	-/-		AVG	-/-		AVG	-/-
3618	Peak	54.1	3661.2	Peak	54.4	3704.4	Peak	53.6
	AVG	27.2		AVG	27.5		AVG	-/-
4522.5	Peak	46.9	4576.5	Peak	45.9	4630.5	Peak	47.0
	AVG	-/-		AVG	-/-		AVG	-/-
5427	Peak	52.6	5491.8	Peak	No RB!	5556.6	Peak	No RB!
	AVG	-/-		AVG			AVG	
6331.5	Peak	No RB!	6407.1	Peak	No RB!	6482.7	Peak	No RB!
	AVG			AVG			AVG	
7236	Peak	No RB!	7322.4	Peak	59.0	7408.8	Peak	46.8
	AVG			AVG	32.1		AVG	-/-
8140.5	Peak	42.3	8237.7	Peak	49.0	8334.9	Peak	45.0
	AVG	-/-		AVG	-/-		AVG	-/-

Results: (Streaming mode)

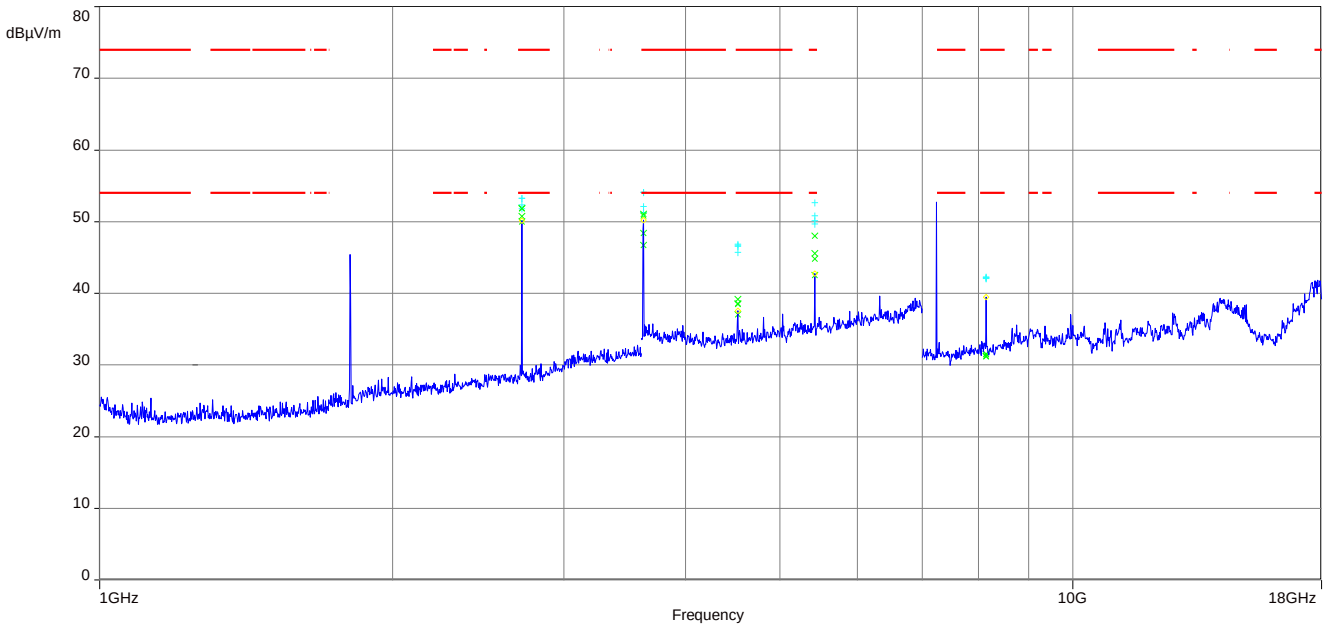
TX spurious emissions radiated [dBµV/m]								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
1809	Peak	No RB!	1830.6	Peak	No RB!	1852.2	Peak	No RB!
	AVG			AVG			AVG	
2713.5	Peak	58.3	2746.9	Peak	58.9	2778.3	Peak	59.6
	AVG	37.9		AVG	38.5		AVG	39.2
3618	Peak	59.2	3661.2	Peak	57.4	3704.4	Peak	59.5
	AVG	38.8		AVG	37.0		AVG	39.1
4522.5	Peak	51.2	4576.5	Peak	51.9	4630.5	Peak	51.1
	AVG	-/-		AVG	-/-		AVG	-/-
5427	Peak	52.8	5491.8	Peak	No RB!	5556.6	Peak	No RB!
	AVG	-/-		AVG			AVG	
6331.5	Peak	No RB!	6407.1	Peak	No RB!	6482.7	Peak	No RB!
	AVG			AVG			AVG	
7236	Peak	No RB!	7322.4	Peak	60.3	7408.8	Peak	61.5
	AVG			AVG	39.9		AVG	41.1
8140.5	Peak	55.0	8237.7	Peak	51.1	8334.9	Peak	47.2
	AVG	34.8		AVG	-/-		AVG	-/-

Results: RX mode

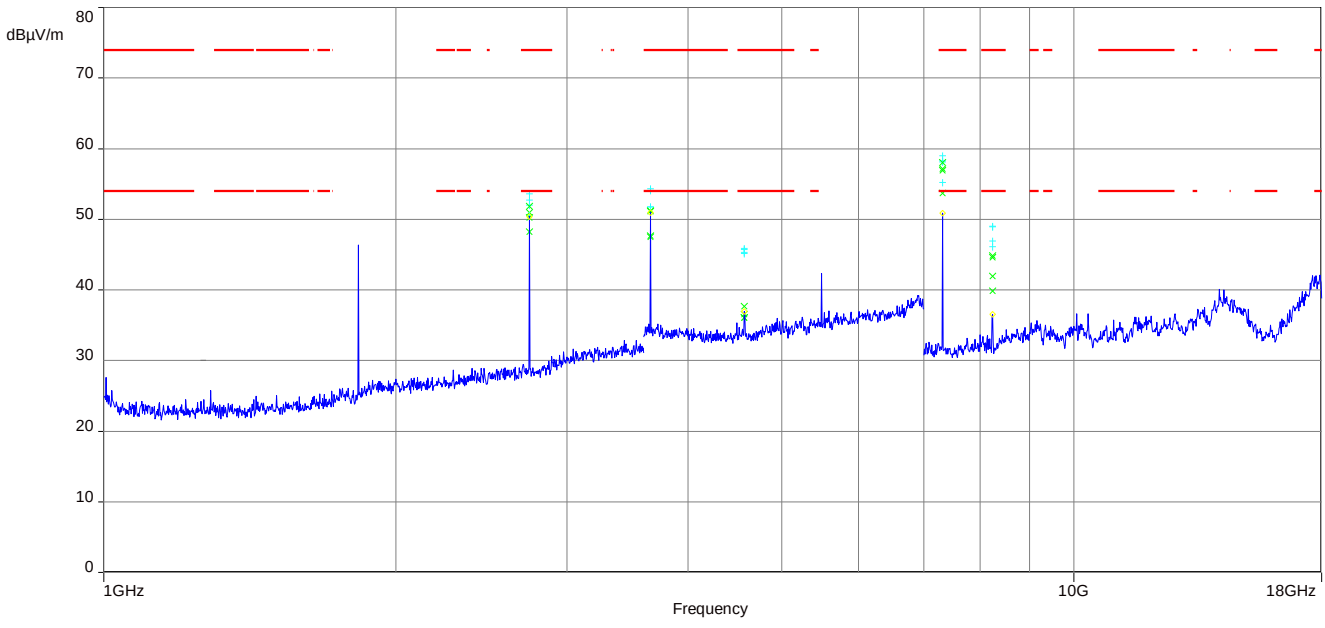
RX spurious emissions radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
3655.4	Peak	49.6
	AVG	-/-
-/-	Peak	-/-
	AVG	-/-
-/-	Peak	-/-
	AVG	-/-
-/-	Peak	-/-
	AVG	-/-

Plots: (Wiselink-/XPAQ-Mode)

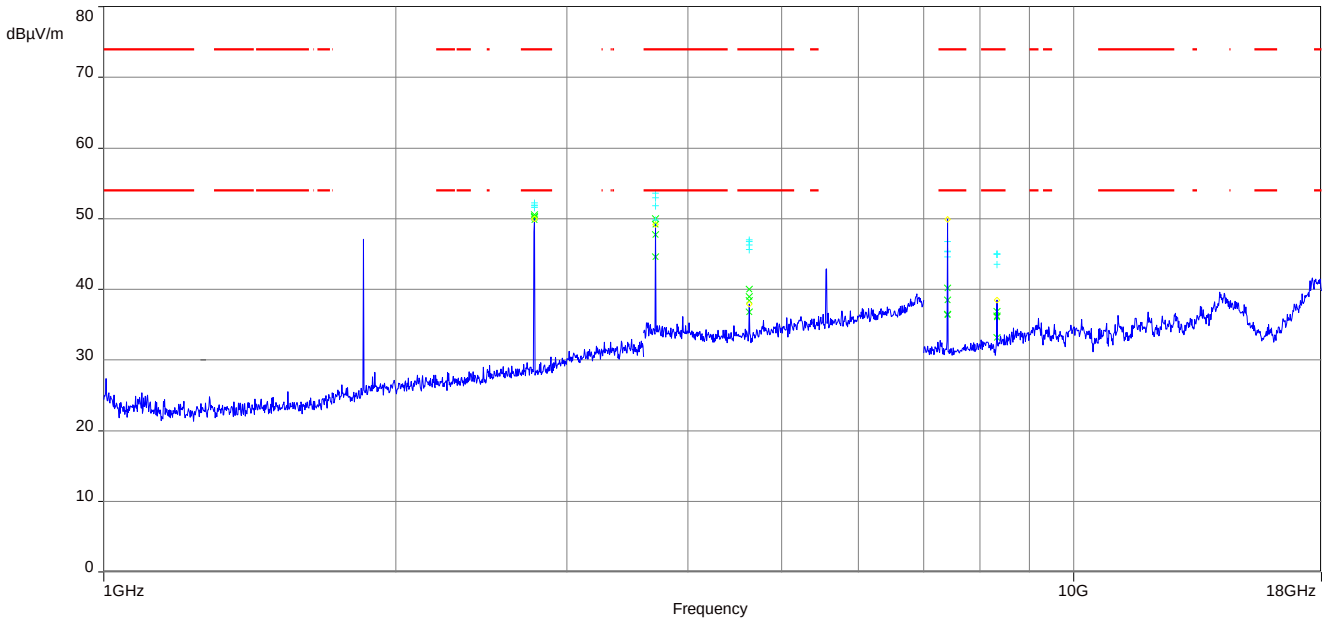
Plot 1: 1 GHz – 18 GHz, horizontal & vertical polarization (lowest channel)



Plot 2: 1 GHz – 18 GHz, horizontal & vertical polarization (middle channel)

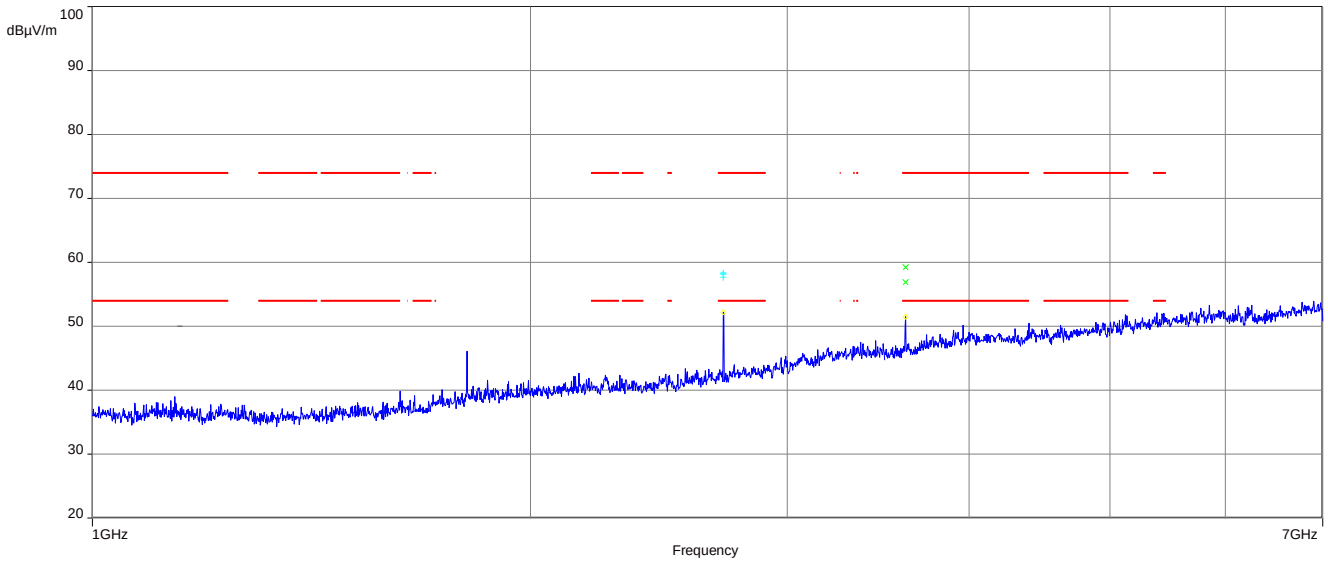


Plot 3: 1 GHz – 18 GHz, horizontal & vertical polarization (highest channel)

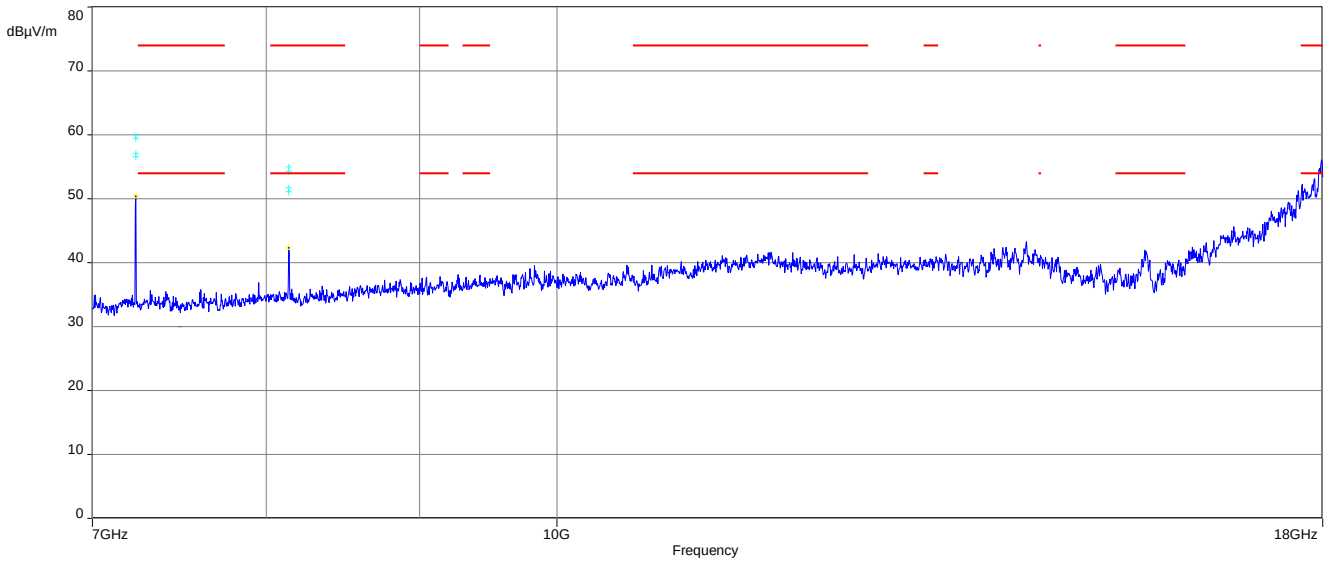


Plots: (Streaming-Mode)

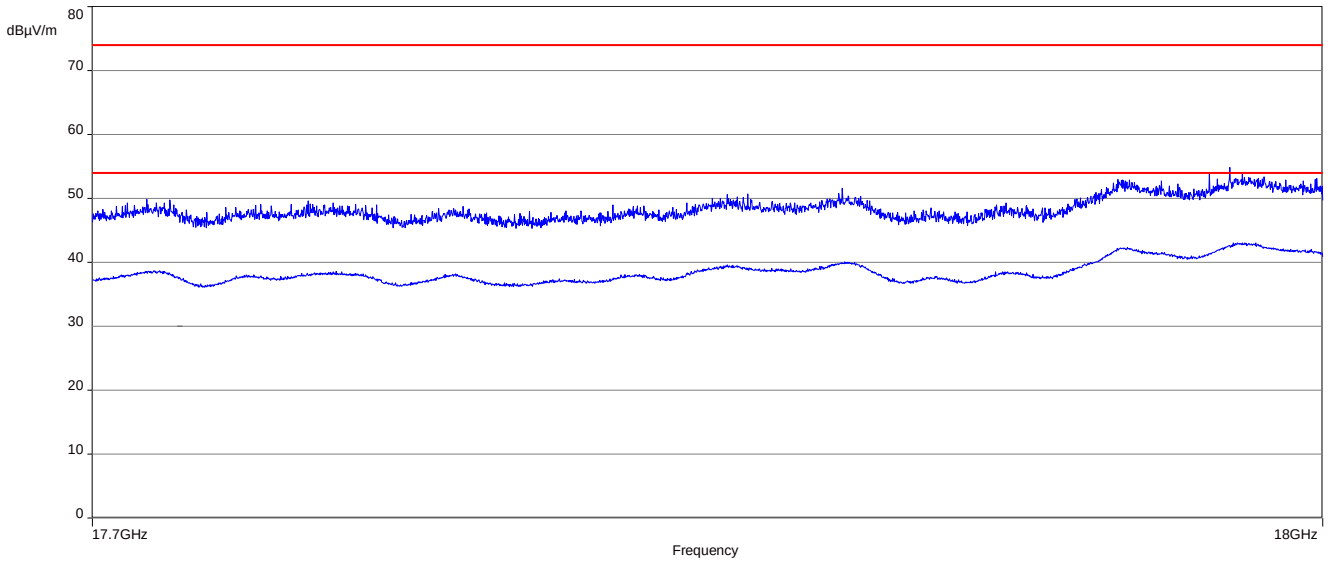
Plot 1: 1 GHz – 7 GHz, horizontal & vertical polarization (lowest channel)



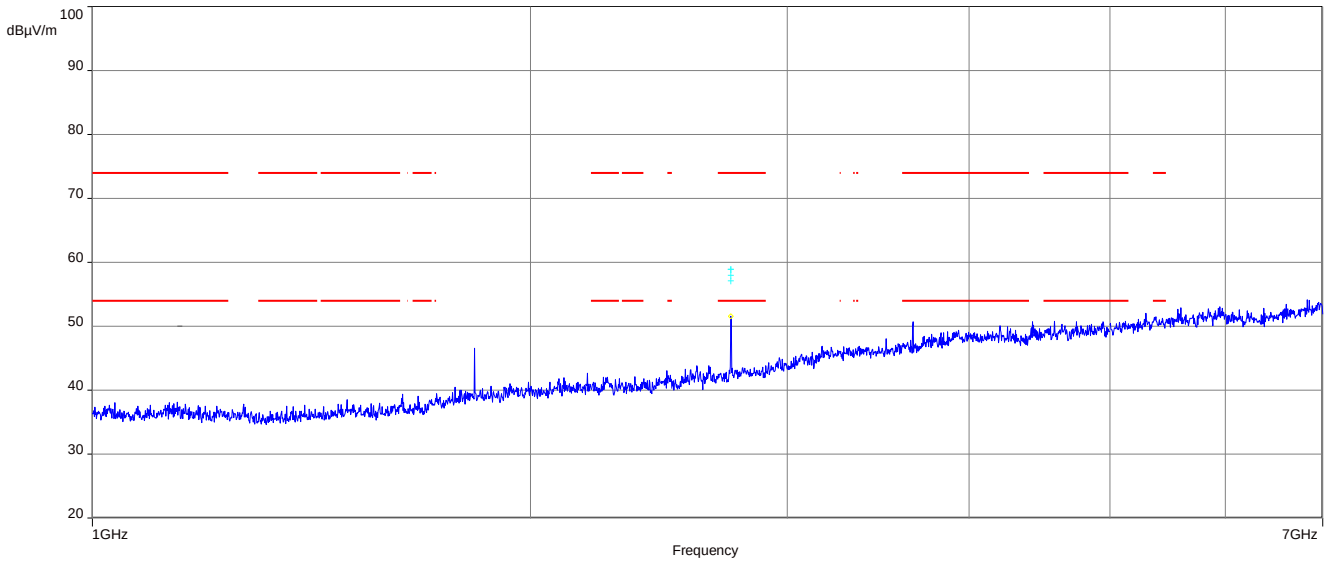
Plot 2: 7 GHz – 18 GHz, horizontal & vertical polarization (lowest channel)



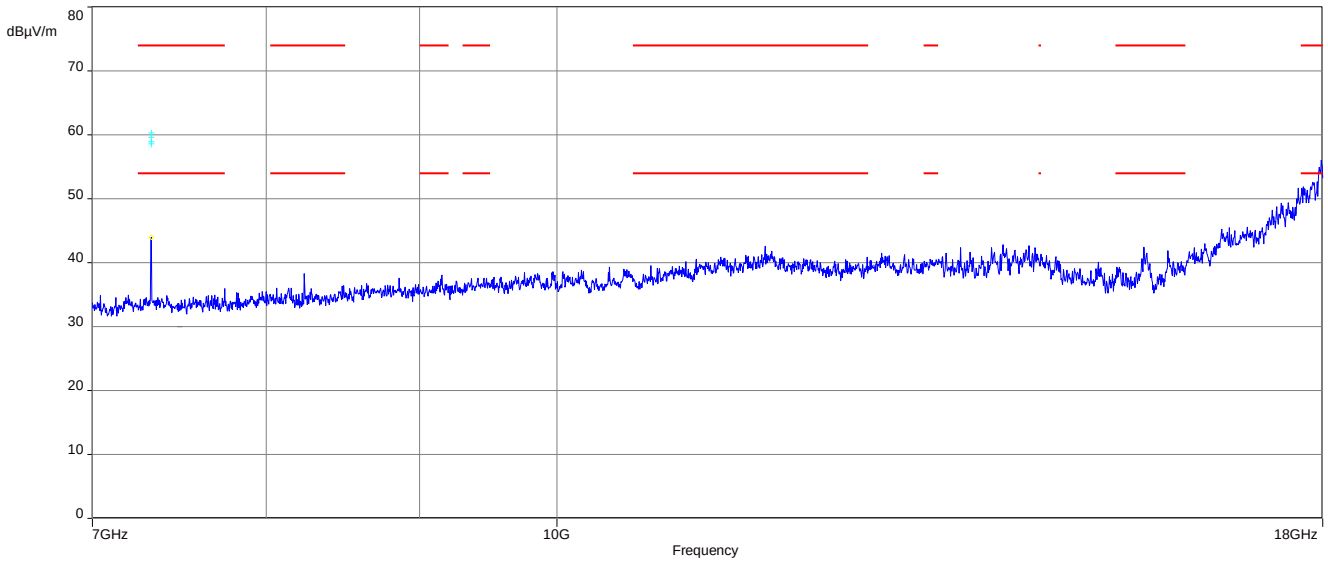
Plot 3: 17.7 GHz – 18 GHz, horizontal & vertical polarization (lowest channel)



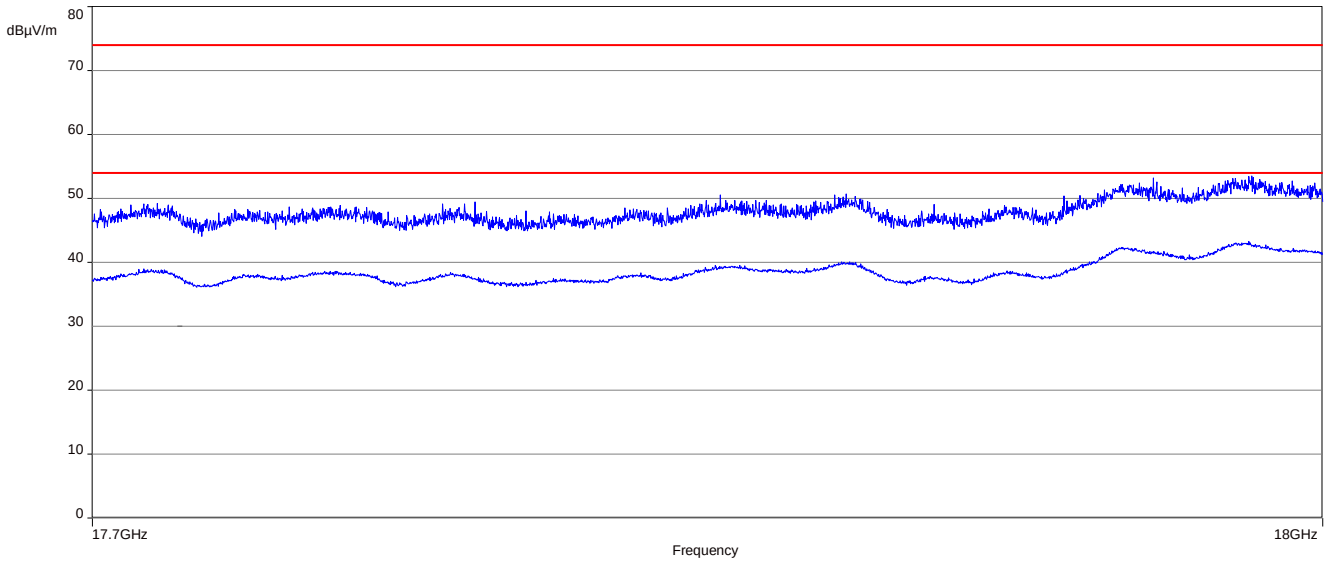
Plot 4: 1 GHz – 7 GHz, horizontal & vertical polarization (middle channel)



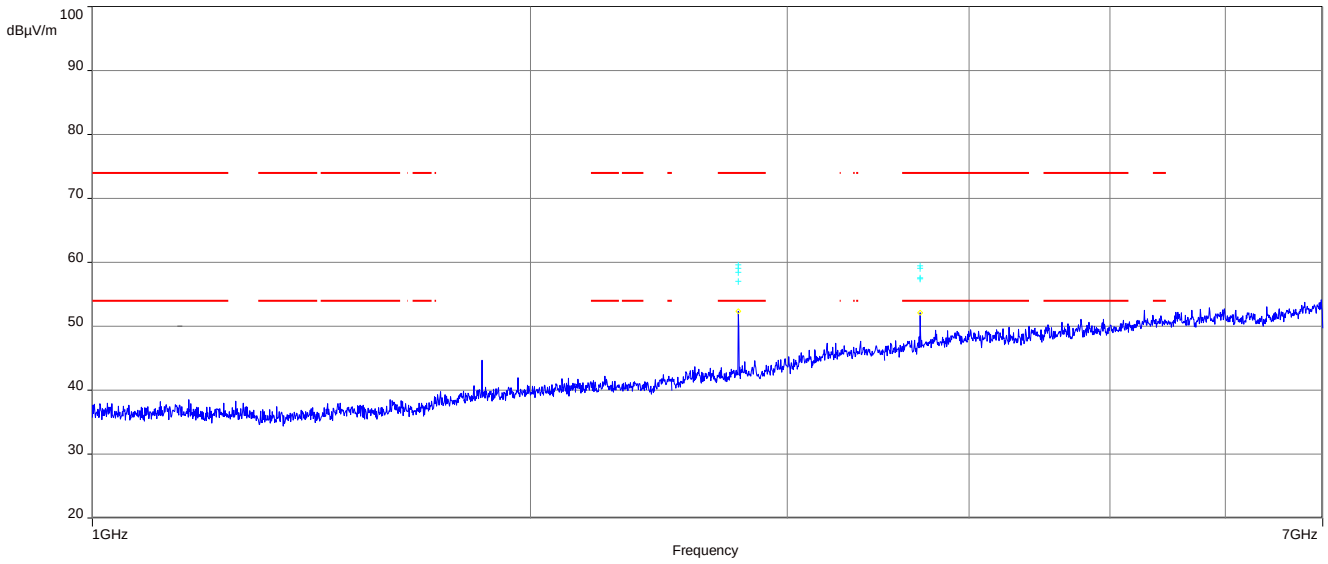
Plot 5: 7 GHz – 18 GHz, horizontal & vertical polarization (middle channel)



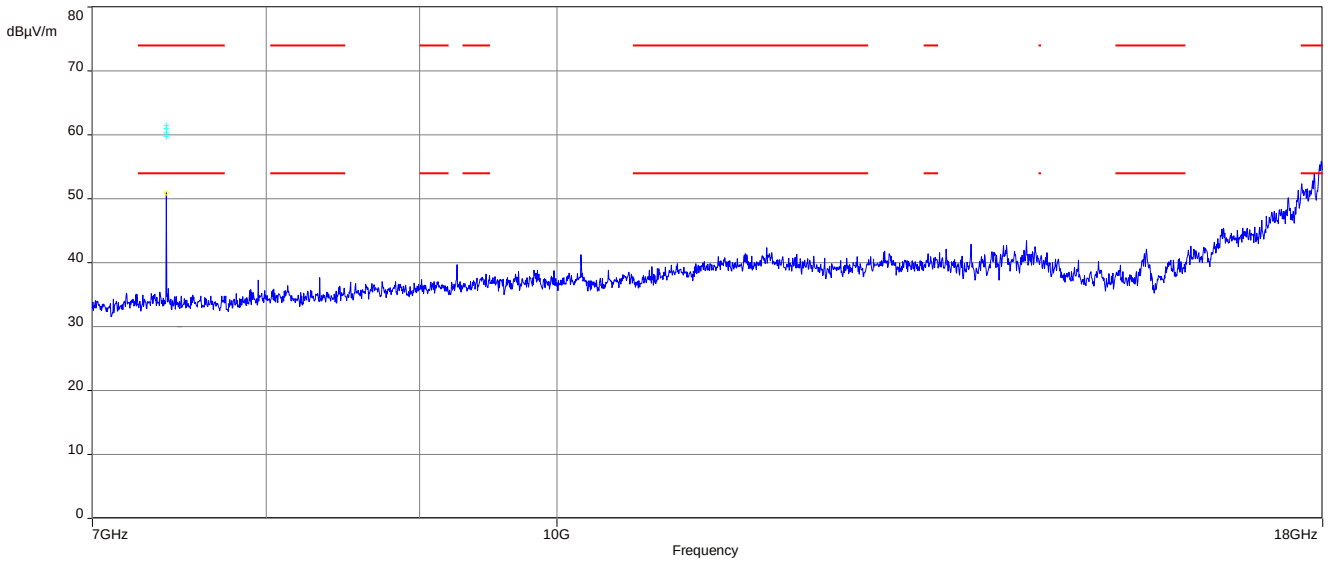
Plot 6: 17.7 GHz – 18 GHz, horizontal & vertical polarization (middle channel)



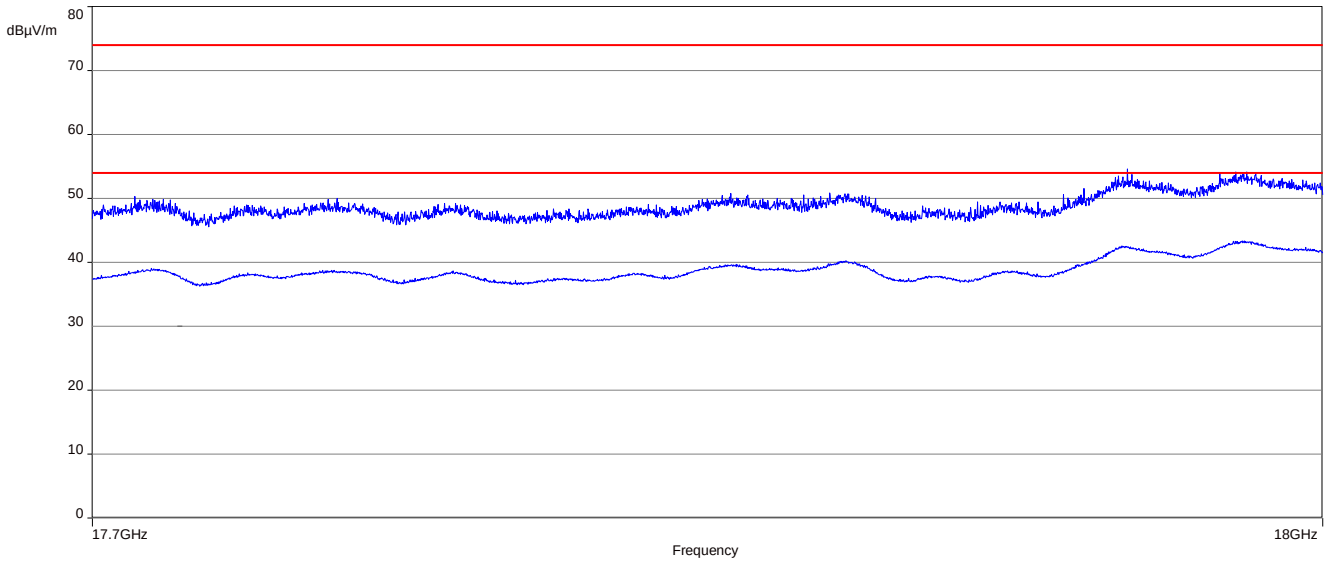
Plot 7: 1 GHz – 7 GHz, horizontal & vertical polarization (highest channel)



Plot 8: 7 GHz – 18 GHz, horizontal & vertical polarization (highest channel)

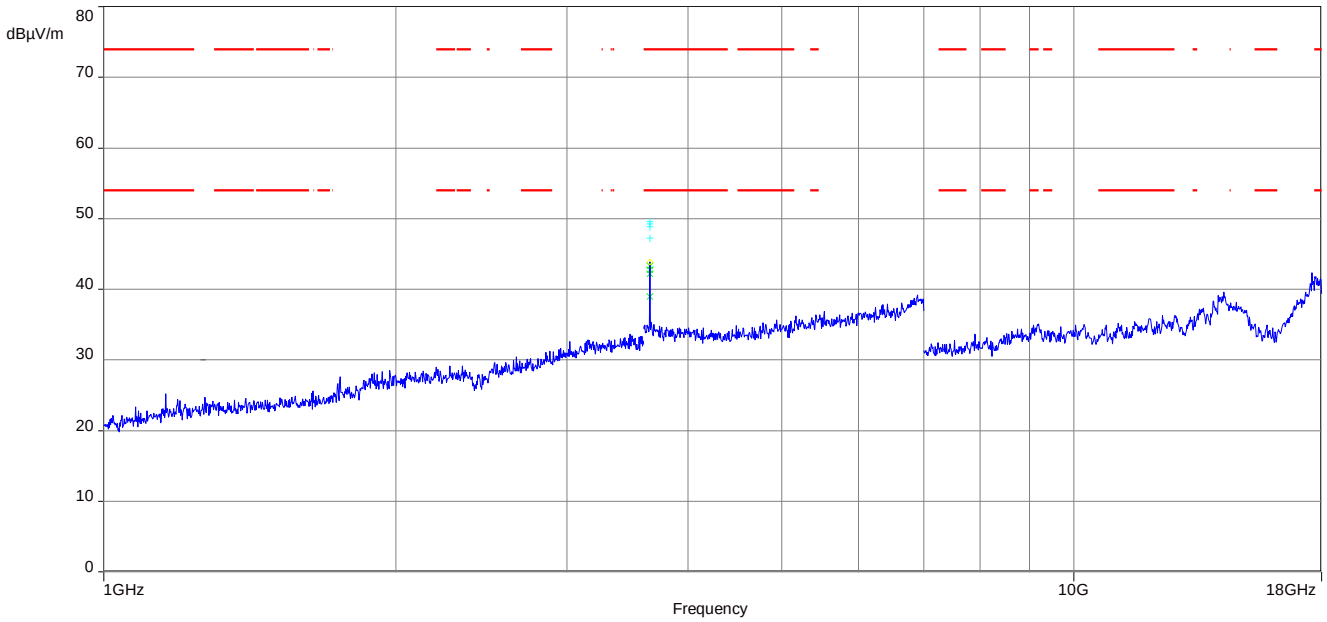


Plot 9: 17.7 GHz – 18 GHz, horizontal & vertical polarization (highest channel)



Plot: (RX-Mode)

Plot 1: 1GHz – 18 GHz, RX-Mode, horizontal & vertical polarization



11.11 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 channel 6. This measurement is repeated for DSSS and OFDM modulation. If peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing 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:

Measurement parameter	
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 6.3 – A
Measurement uncertainty:	See sub clause 8

Limits:

FCC		IC
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

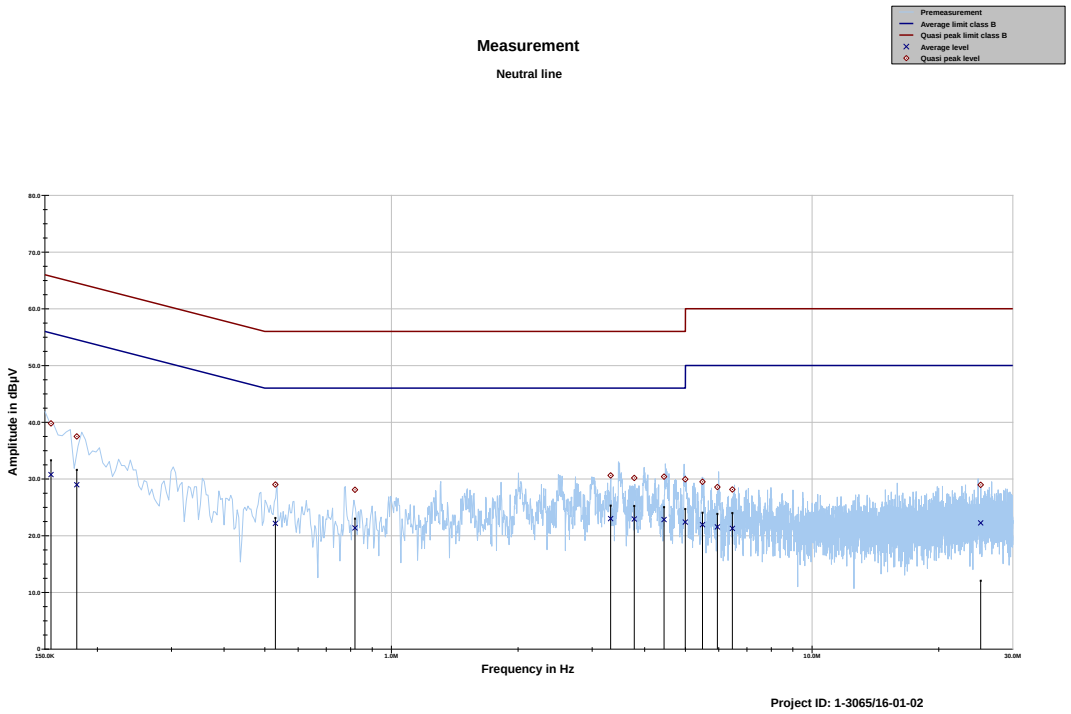
*Decreases with the logarithm of the frequency

Results: (valid for all modes)

TX Spurious Emissions Conducted < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 20 dB below the limit.		

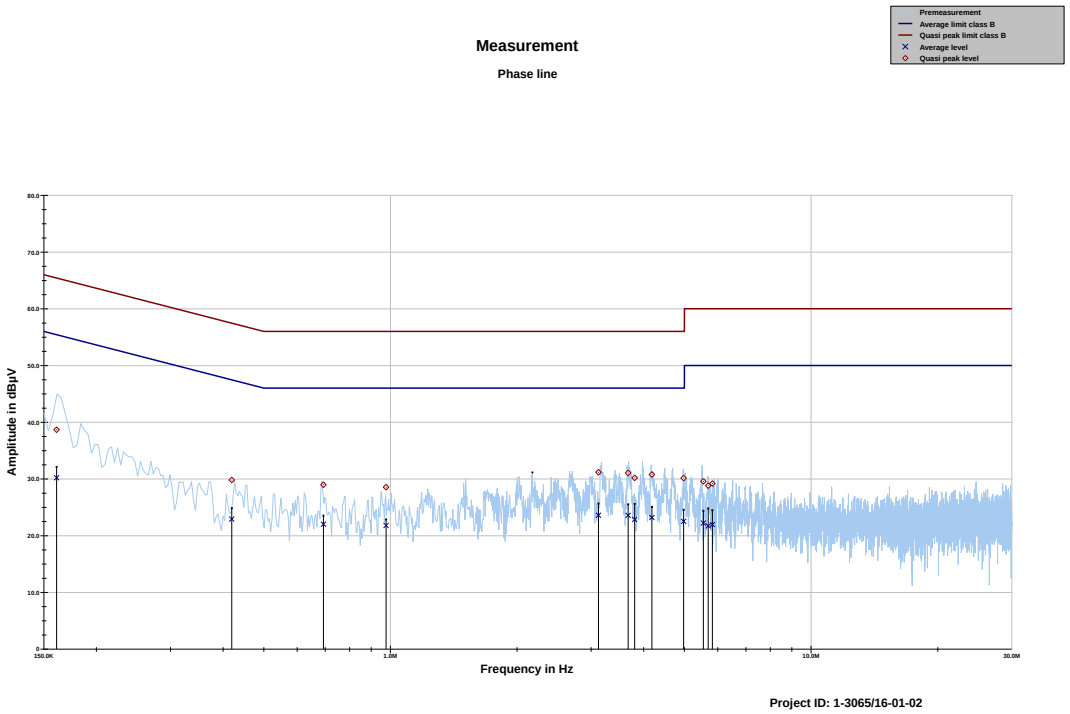
Plots:

Plot 1: 150 kHz to 30 MHz, phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.155142	39.79	25.93	65.720	30.77	25.09	55.853
0.178644	37.48	27.07	64.548	28.97	26.21	55.182
0.530045	29.01	26.99	56.000	22.17	23.83	46.000
0.819244	28.08	27.92	56.000	21.35	24.65	46.000
3.319862	30.61	25.39	56.000	23.00	23.00	46.000
3.779189	30.17	25.83	56.000	22.93	23.07	46.000
4.447912	30.40	25.60	56.000	22.84	23.16	46.000
4.997313	29.95	26.05	56.000	22.39	23.61	46.000
5.488759	29.50	30.50	60.000	21.94	28.06	50.000
5.957042	28.57	31.43	60.000	21.54	28.46	50.000
6.464777	28.14	31.86	60.000	21.28	28.72	50.000
25.168331	28.96	31.04	60.000	22.24	27.76	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.160853	38.68	26.74	65.420	30.20	25.49	55.690
0.419681	29.81	27.64	57.454	22.92	25.37	48.295
0.693333	28.97	27.03	56.000	22.02	23.98	46.000
0.976782	28.55	27.45	56.000	21.78	24.22	46.000
3.124270	31.17	24.83	56.000	23.58	22.42	46.000
3.675008	31.06	24.94	56.000	23.57	22.43	46.000
3.808381	30.18	25.82	56.000	22.86	23.14	46.000
4.185042	30.77	25.23	56.000	23.20	22.80	46.000
4.979311	30.15	25.85	56.000	22.52	23.48	46.000
5.546994	29.56	30.44	60.000	22.22	27.78	50.000
5.696581	28.81	31.19	60.000	21.72	28.28	50.000
5.828502	29.18	30.82	60.000	21.97	28.03	50.000

12 Observations

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

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2017-04-06
A	New FCC ID and IC number added	2017-06-22
B	IC number and HVIN changed	2017-06-29

Annex B Further information

Glossary

AVG - Average
DUT - Device under test
EMC - Electromagnetic Compatibility
EN - European Standard
EUT - Equipment under test
ETSI - European Telecommunications Standard Institute
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software
PMN - Product marketing name
HMN - Host marketing name
HVIN - Hardware version identification number
FVIN - Firmware version identification number
OBW Occupied Bandwidth
OC Operating Channel
OCW Operating Channel Bandwidth
OOB Out Of Band

Annex C Accreditation Certificate

first page

Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CTC advanced GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

Funk
Mobilfunk (GSM / DCS) + OTA
Elektromagnetische Verträglichkeit (EMV)
Produktsicherheit
SAR / EMF
Umwelt
Smart Card Technology
Bluetooth®
Automotive
Wi Fi-Services
Kanadische Anforderungen
US-Anforderungen
Akustik
Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-01

Frankfurt, 25.11.2016

Im Auftrag Dipl.-Ing. Ralf Egner
Abteilungsleiter

last page

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Note:
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