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DEKRA

ACCREDITED
Test Lab
Cert 2764.01

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test report No:
2817ERM.006

Partial Test report

USA FCC Part 15.407 (U-NII), 15.209
CANADA RSS-210, RSS-Gen
Unlicensed National Information Infrastructure Devices. General technical requirements.
Licence-Exempt Radio Apparatus (All Frequency Bands): Category I Equipment. General Requirements and Information for the Certification of Radio Apparatus.

Identification of item tested	Automotive infotainment System
Trademark	Mercedes-Benz
Model and /or type reference	NTG7 PREMIUM LFT2
Other identification of the product	FCC ID: 2AOUZNTG7PREMIUMLFT2 IC: 23650-NTG7PREMIUMLFT2
Features	FM/AM/DAB/DVBT, USB, Bluetooth, WLAN, GNSS.
Manufacturer	CONTINENTAL AUTOMOTIVE GMBH VDO-Strasse 1, 64832 Babenhausen, GERMANY.
Test method requested, standard	USA FCC Part 15.407 10-1-19 Edition: Unlicensed National Information Infrastructure Devices. General technical requirements. USA FCC Part 15.209 10-1-19 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). 789033 D02 General UNII Test Procedures New Rules v02r01 KDB 662911 D01 Multiple Transmitter Output v02r01: Emissions Testing of Transmitters with Multiple Outputs in the Same Band Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=DEKRA Certification Inc., ou=Regulatory Lab, email=dgalvez@dekra.com, c=US Date: 2020.08.13 22:24:21 -04'00'
Date of issue	08-13-2020
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Certification Inc. has a calibration and maintenance program for its measurement equipment.

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification at the time of performance of the test.

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Certification Inc.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Certification internal document PODT000.

Frequency (MHz)	U(k=2)	Units
0,009 - 30	2.69	dB
30-180	3.82	dB
180-1000	2.61	dB
1000-18000	2.92	dB
18000-40000	2.15	dB

Data provided by the client

The test sample consist of an automotive head unit to be installed in cars with the following features: FM/AM/DAB/DVBT, USB, Bluetooth, WLAN and GNSS.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
2817/01	Automotive Infotainment System	NTG7 PREMIUM LFT2	COM657LB0000002	04/07/2020

Sample S/01 has undergone following test(s):

All radiated tests indicated in appendix B & C.

Accessory elements used for Testing with S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
2817/03	SMA adapter cable	--	--	04/07/2020
2817/04	Harness	--	--	04/07/2020

1. Accessory elements were used for the following test(s):

All radiated tests indicated in appendix B & C.

Test sample description

Ports…… :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	Car Connector A	>3m(x1)	☒	☐	☐
	Car Connector B	>3m(x1)	☒	☐	☐
	Display Connector CID/PIP / RVC	>3m(x1)	☒	☒	☐
	USB Connector	<3m(x2)	☒	☒	☐
	Eth Connector	>3m(x1)	☒	☐	☐
	BT/WLAN-Antenna	>3m(x1)	☒	☒	☐
	FM/AM, TV/SDARS Ant	>3m(x1)	☒	☒	☐
	GNSS Antenna	>3m(x1)	☒	☒	☐
Supplementary information to the ports…… :					

Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 12V Car battery / attenuator (9,5-15,5V normal operation)					
	☐	DC:					

Rated Power .....:	9,5-15,5V normal operation
Clock frequencies .....:	see schematics
Other parameters.....:	See Technical Description
Software version .....:	**E17.100**

Hardware version.....:	**D5**		
Dimensions in cm (W x H x D)....:	182 x 78 x 160 mm		
Mounting position.....:	☐	Table top equipment	
	☐	Wall/Ceiling mounted equipment	
	☐	Floor standing equipment	
	☐	Hand-held equipment	
	☒	Other: automotive headunit	
Modules/parts .....:	Module/parts of test item	Type	Manufacturer
	n/a	-	
		-	
		-	
		-	
Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	Display	-	LG.
	HARMANeco RasPi / headless	-	HBAS
	Cable harness	-	HBAS
	BT/WLAN-Antenna	-	Hirschmann

Documents as provided by the applicant.....:	Description	File name	Issue date
	Technical Description	Technical Description NTG7_A15 200324 SOP2 AllVariant.doc	

Copy of marking plate:

Identification of the client

CONTINENTAL AUTOMOTIVE GMBH
VDO-Strasse 1, 64832 Babenhausen, GERMANY.

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	04-30-2019
Date (finish)	05-07-2019

Document history

Report number	Date	Description
2817ERM.006	08-13-2020	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the semi-anechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Bhagyashree Chaudhary, Laxmi Gollamudi, Koji Nishimoto and Lourdes Maria Valverde.

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Summary

FCC PART 15 PARAGRAPH / RSS-247 (WIFI 5GHz) 5.15 GHz -5.25 GHz Band					
Report Section	**FCC Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
--	§ 15.403 (i) KDB 789033 D02	RSS 247 6.2.1	26dB Emission Bandwidth & Occupied Bandwidth	N/M	Refer 2
--	§ 15.407 (a) (1) (4) KDB 662911 D01 E (1)	RSS 247 6.2.1.1	Power Limits. Maximum Output Power	N/M	Refer 2
--	§ 15.407 (a) (1) (5)	RSS-247 6.2.1.1	Maximum Power Spectral Density	N/M	Refer 2
--	§ 15.407 (b) (1)	RSS-247 6.2.1.2	Band-edge radiated emissions compliance (Transmitter)	N/M	Refer 2
--	§ 15.407 (b)(6) § 15.207	RSS-Gen 8.8	Emission limitations Conducted (Transmitter)	N/M	Refer 2
B.1	§ 15.407 (b)(1)(6)(7) § 15.209 § 15.205	RSS-247 6.2.1.2 RSS-Gen 8.9 & 8.10	Undesirable radiated emissions (Transmitter)	P	N/A
--	§ 15.407 (g)	RSS-Gen 6.11 & 8.11	Frequency Stability	N/M	Refer 1

Supplementary information and remarks:

The test set-up was made in accordance to the general provisions of ANSI C63.10: 2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 dated 12/14/2017

1) The compliance is checked through a description of how this requirement is met that is provided by the applicant.

2) Test not performed. Only Radiated Spurious tests were requested.

FCC PART 15 PARAGRAPH / RSS-247 (WIFI 5GHz) 5.725 GHz -5.85 GHz Band					
Report Section	**FCC Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
--	§ 15.403 (i) KDB 789033 D02	RSS 247 6.2.4	26dB Emission Bandwidth & Occupied Bandwidth	N/M	Refer 2
--	§ 15.407 (e)	RSS 247 6.2.4.1	6 dB Emission	N/M	Refer 2
--	§ 15.407 (a)(3)(4) KDB 662911 D01 E (1)	RSS 247 6.2.4.1	Power Limits. Maximum Output Power	N/M	Refer 2
--	§ 15.407 (a)(3)(5)	RSS-247 6.2.4.1	Maximum Power Spectral Density	N/M	Refer 2
--	§ 15.407 (b)(4)	RSS-247 6.2.4.2	Band-edge radiated emissions compliance (Transmitter)	N/M	Refer 2
--	§ 15.407 (b)(6) § 15.207	RSS-Gen 8.8	Emission limitations Conducted (Transmitter)	N/M	Refer 2
C.1	§ 15.407 (b)(4)(6)(7) § 15.209 § 15.205	RSS-247 6.2.4.2 RSS-Gen 8.9 & 8.10	Undesirable radiated emissions (Transmitter)	P	N/A
--	§ 15.407 (g)	RSS-Gen 6.11 & 8.11	Frequency Stability	N/M	Refer 1

Supplementary information and remarks:

The test set-up was made in accordance to the general provisions of ANSI C63.10: 2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 dated 12/14/2017

1) The compliance is checked through a description of how this requirement is met that is provided by the applicant.
2) Test not performed. Only Radiated Spurious tests were requested.

FCC PART 15 PARAGRAPH / RSS-247 (WIFI 5GHz) Common Requirements for all bands					
Report Section	**FCC Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
--	§ 15.407 (c)	--	Transmission in case of absence of information to transmit, or operational failure.	N/M	Refer 1

Supplementary information and remarks:

1) The compliance is checked through a description of how this requirement is met that is provided by the applicant.

List of equipment used during the test

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
1179	Semi anechoic Absorber Lined Chamber	Frankonia	SAC 3 plus “L”	N/A	N/A
1064	Biconical Log antenna	ETS LINDGREN	3142E	2018/01	2021/01
1057	Double-ridge Waveguide Horn antenna 1-18 GHz	ETS LINDGREN	3115	2017/05	2020/05
1056	Double-ridge Waveguide Horn antenna	ETS LINDGREN	3116C	2020/01	2023/01
1014	Spectrum analyzer	Rohde & Schwarz	FSV40	2019/04	2021/04
1012	EMI TEST RECEIVER	Rohde & Schwarz	ESR 26	2019/12	2021/12
0981	RF pre-amplifier 1-18 GHz	Bonn Elektronik	BLMA 0118-2A	2018/10	2021/10

Appendix A: DUT Description

DUT Description

The following information is provided by the client

Information	Description
Equipment type	WIFI 5GHz
Antenna Specification	Equipment with only one antenna
Operating Frequency Range	5150 - 5250 MHz / 5725- 5850 MHz
Nominal Channel Bandwidth	20 MHz/40MHz/80MHz
Max RF Output Power	<20 dBm
Antenna type	Dedicated antenna (single)
Antenna gain	2.5 dBi
Supply Voltage	13.2 Vdc
Transmit Data Rate:	IEEE 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps IEEE 802.11n HT20/HT40: 0-7 -SISO 8-15- MIMO IEEE 802.11ac VHT20: (0-8)-SISO (0x2-8x2)- MIMO IEEE 802.11ac VHT40-/VHT80: (0-9)-SISO (0x2-9x2)- MIMO
Geo-location capability	No

1. TPC not required if Max EIRP < 500mW (27 dBm)

Appendix B: Test results
5.15 GHz – 5.25 GHz Band

Appendix B Content

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TEST B.1: UNDESIRABLE RADIATED EMISSIONS (TRANSMITTER) 17

DESCRIPTION OF TEST CONDITIONS

TEST CONDITIONS	DESCRIPTION
TC#01(1) **(a mode)**	Power supply (V): $V_{nominal}$ = 13.2 Vdc Test Frequencies for Radiated tests: **(20 MHz)** Lowest range: 5180 MHz Middle channel: 5200 MHz Highest range: 5240 MHz
TC#02(1) **(n mode)**	Power supply (V): $V_{nominal}$ = 13.2 Vdc Test Frequencies for Radiated tests: **(20 MHz)** Lowest channel: 5180 MHz Middle channel: 5200 MHz Highest channel: 5240 MHz Test Frequencies for Radiated tests: **(40 MHz)** Lowest channel: 5190 MHz Highest channel: 5230 MHz
TC#03(1) **(ac mode)**	Power supply (V): $V_{nominal}$ = 13.2 Vdc Test Frequencies for Radiated tests: **(20 MHz)** Lowest channel: 5180 MHz Middle channel: 5200 MHz Highest channel: 5240 MHz Test Frequencies for Radiated tests: **(40 MHz)** Lowest channel: 5190 MHz Highest channel: 5230 MHz Test Frequencies for Radiated tests: **(80 MHz)** Lowest channel: 5210

Note (1): For spurious emissions for OFDM modes 802.11a, 802.11n20, 802.11n40, 802.11ac80 a preliminary scan was performed to determine the worst case.
The data rates of 6 Mbps for 802.11a,MCS0 for 802.11n20/n40 and MCS 0 for 802.11ac20/ac40/ac80 were selected based on preliminary testing that identified those rates corresponding to the worst cases.

TEST B.1: UNDESIRABLE RADIATED EMISSIONS (TRANSMITTER)

LIMITS:	Product standard:	Part 15 Subpart C §15.407 and RSS-247
	Test standard:	Part 15 Subpart C §15.407(b) (1)(6)(7) and RSS-247 6.2.1.2

LIMITS

For transmitters operating in the 5.15 – 5.25 GHz band: all emissions outside of the 5.15 – 5.25 GHz band shall not exceed an EIRP of -27 dBm/MHz (68.23 dBµ V/m at 3m distance).

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) / RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function

TEST SETUP

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and at 1m for the frequency range 1-40 GHz (1 GHz-18 GHz and 18 GHz-40 GHz Double ridge horn antennas).

For radiated emissions in the range 1-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

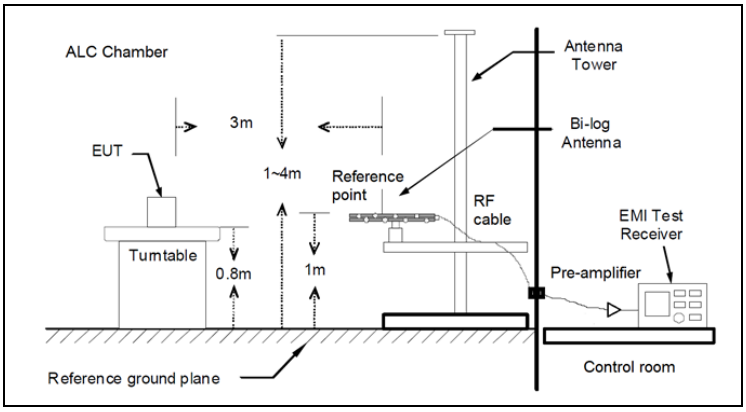
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

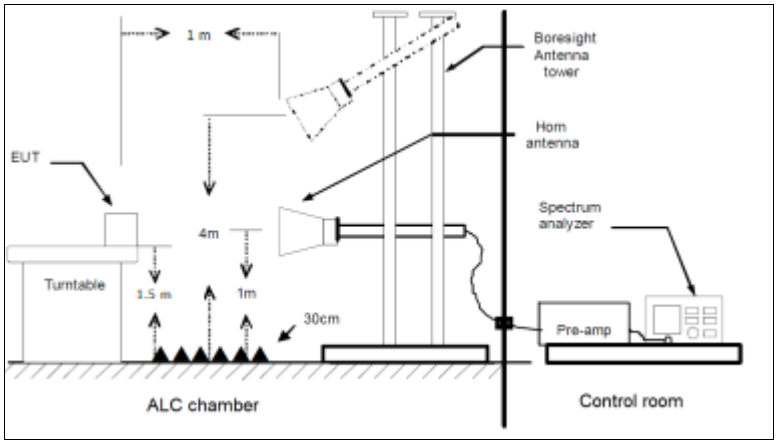
The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

TEST SETUP (CONT.)	

Radiated measurements Setup f < 1 GHz



Radiated measurements setup f > 1 GHz



TESTED SAMPLES:	S/02
TESTED CONDITIONS MODES:	TC#01 **(a mode)**
TEST RESULTS:	PASS

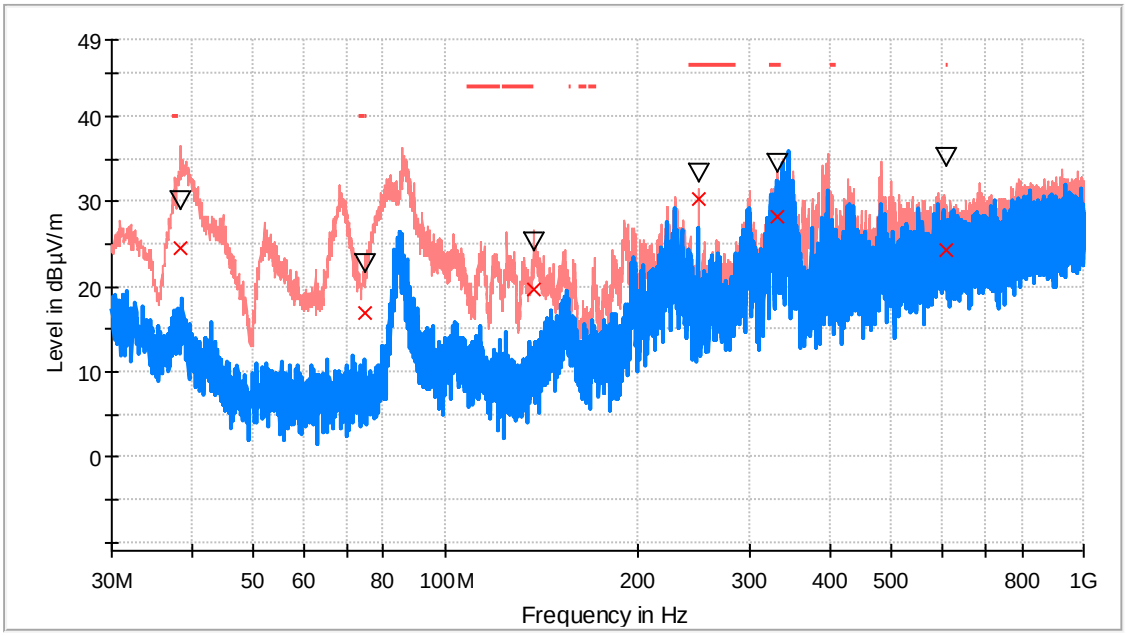
Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT. See worst operation a mode selected for all channels as a worst case.

Frequency range 1 GHz – 40 GHz
The results and plots below show the maximum measured levels in the 1- 40 GHz range.

TEST RESULTS (Cont.)	
FREQUENCY RANGE	**30MHz – 1 GHz**

Middle Channel

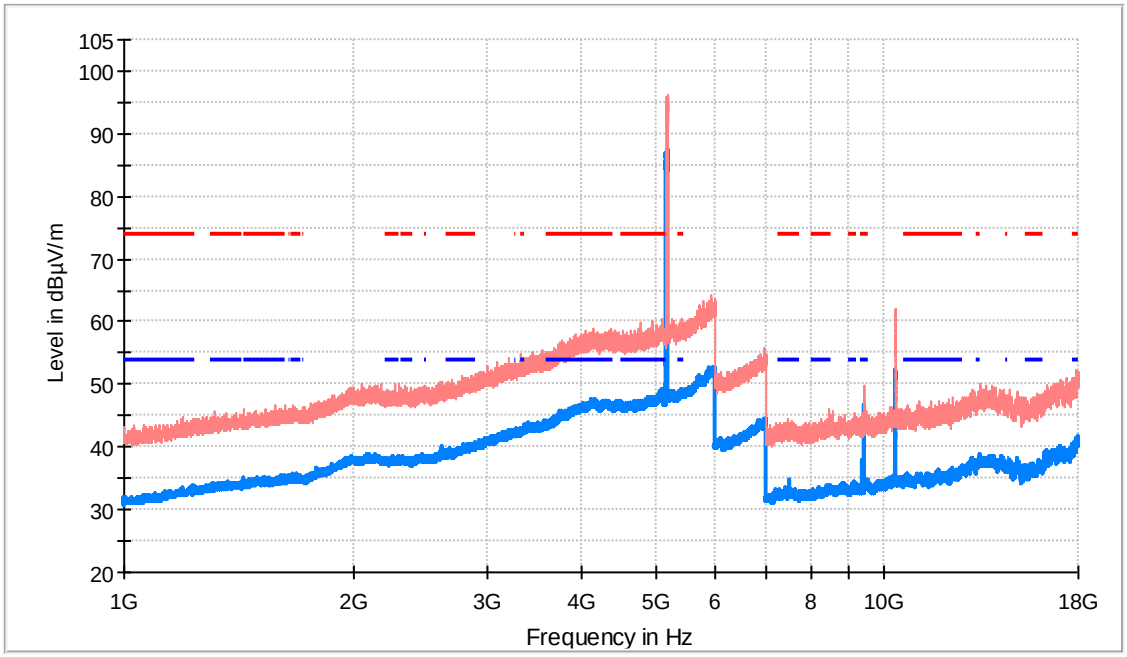


PK+_MAXH
PK+_CLRWR
MaxPeak-PK+ (Single)
QuasiPeak-QPK (Single)
TX limits to Spurious Emission FCC15.407 (30MHz to 1GHz) Restricted Bands QPK Limit

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Azimuth (deg)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
38.455000	30.1	24.5	V	-145.0	---	---
74.871250	22.8	16.9	V	-23.0	23.1	40.0
137.417500	25.1	19.8	V	-61.0	23.7	43.5
249.981250	33.3	30.2	H	-70.0	15.8	46.0
332.173750	34.4	28.2	H	-180.0	17.8	46.0
610.000000	35.2	24.4	V	73.0	21.6	46.0

TEST RESULTS (Cont.)	
FREQUENCY RANGE	**1 GHz – 18 GHz**

Lowest Channel

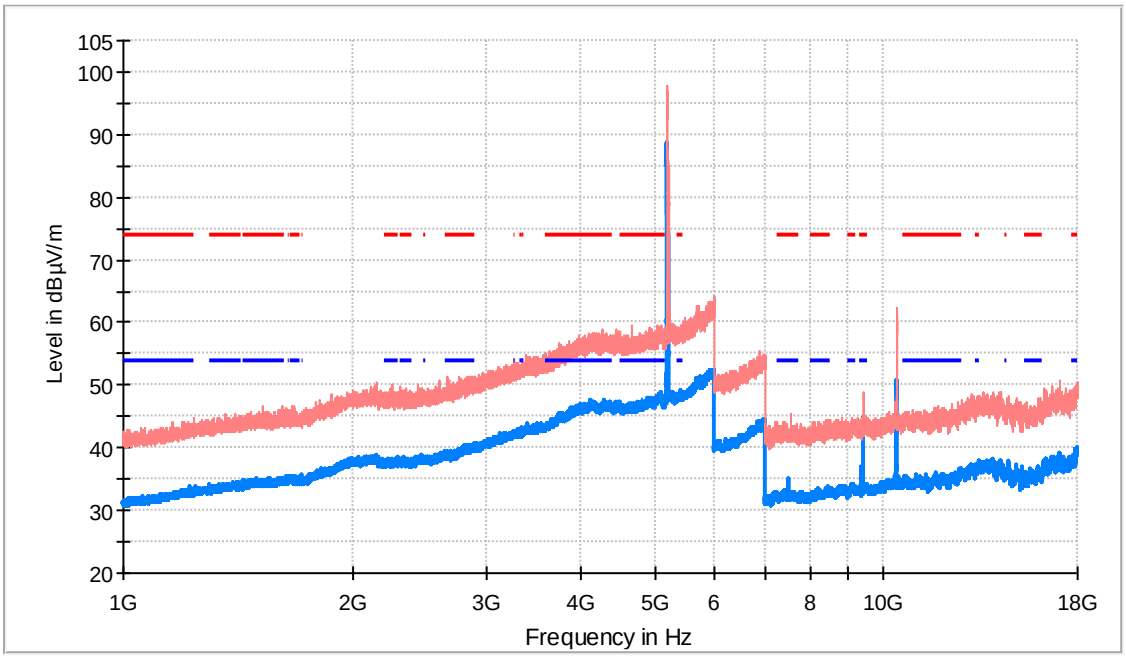


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5178.863636	96.2	87.4	V	---	---	Fundamental
7500.000000	43.4	34.7	V	19.3	54.0	
9389.454546	49.9	46.7	V	7.3	54.0	
10359.272727	62.1	51.5	H	---	---	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	1 GHz – 18 GHz

Middle Channel

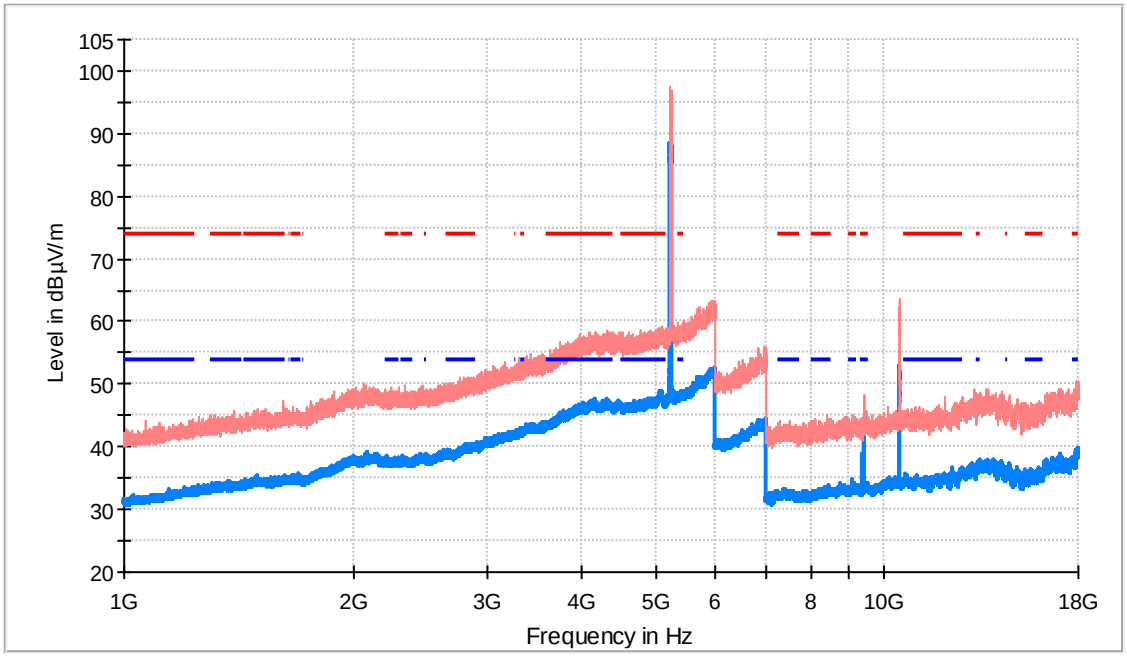


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5198.863636	97.8	88.2	H	---	---	Fundamental
7500.000000	41.7	35.1	V	18.9	54.0	
9388.909091	48.8	42.1	V	11.9	54.0	
10398.000000	62.3	50.1	H	---	---	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	1 GHz – 18 GHz

Highest Channel

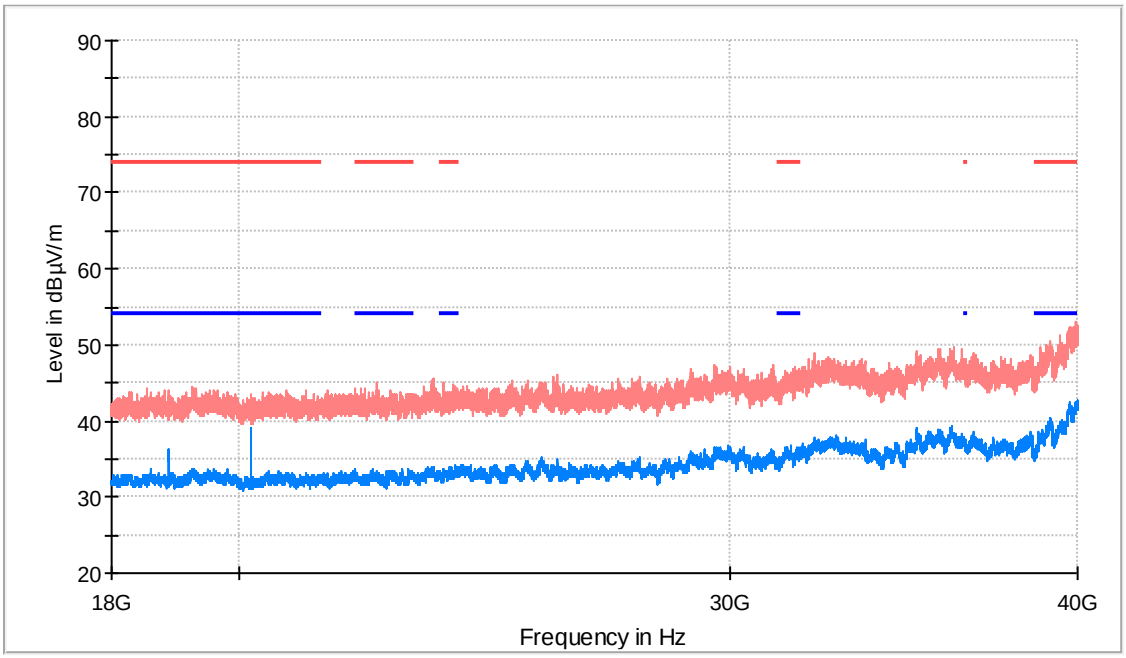


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5238.863636	97.5	88.5	H	---	---	Fundamental
9389.454546	48.3	44.3	V	9.7	54.0	
10480.909091	63.7	52.1	H	---	---	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Lowest Channel

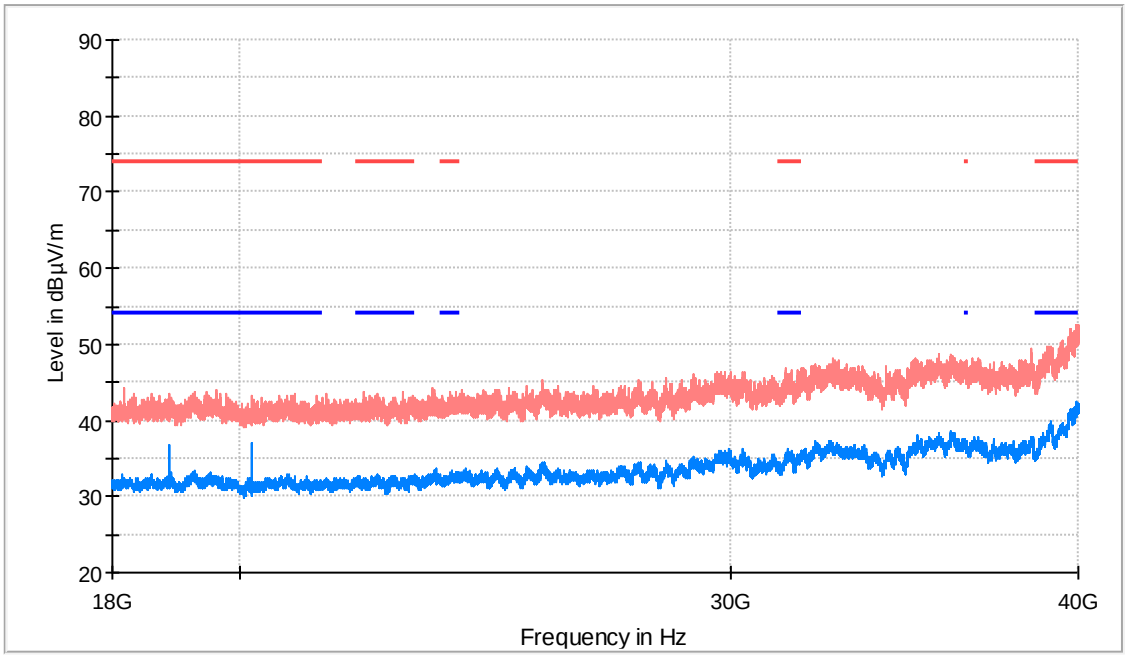


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18871.062500	42.8	36.1	H	17.9	54.0
20203.437500	43.2	39.0	V	15.0	54.0

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Middle Channel

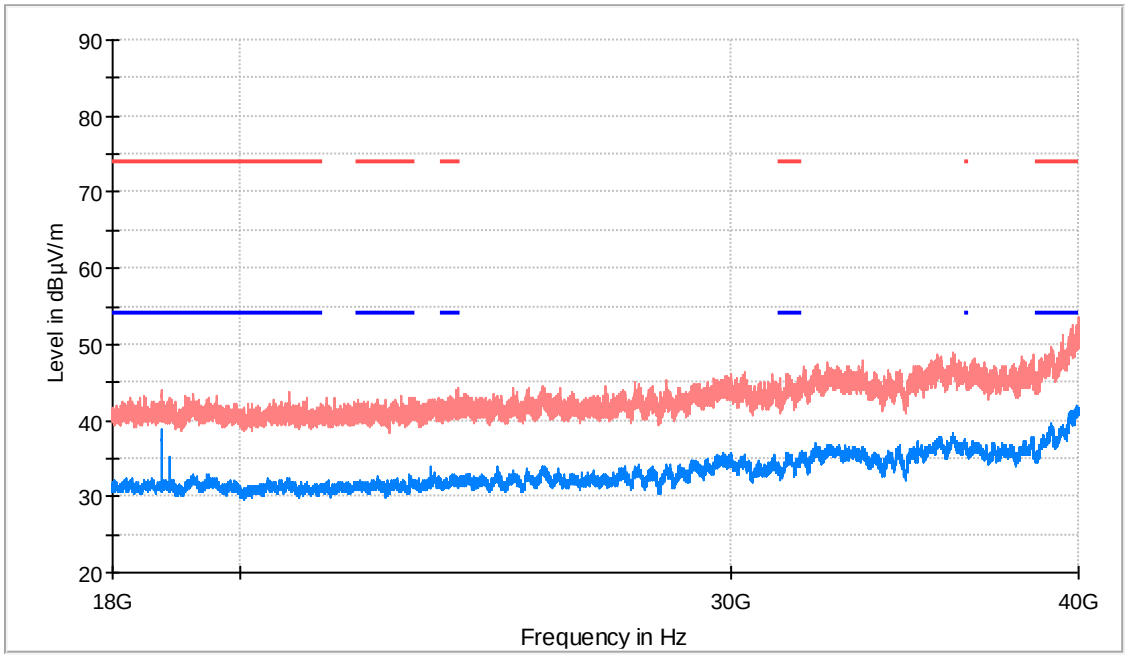


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18875.875000	43.6	36.7	H	17.3	54.0
20204.812500	43.1	37.2	V	16.8	54.0

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Highest Channel

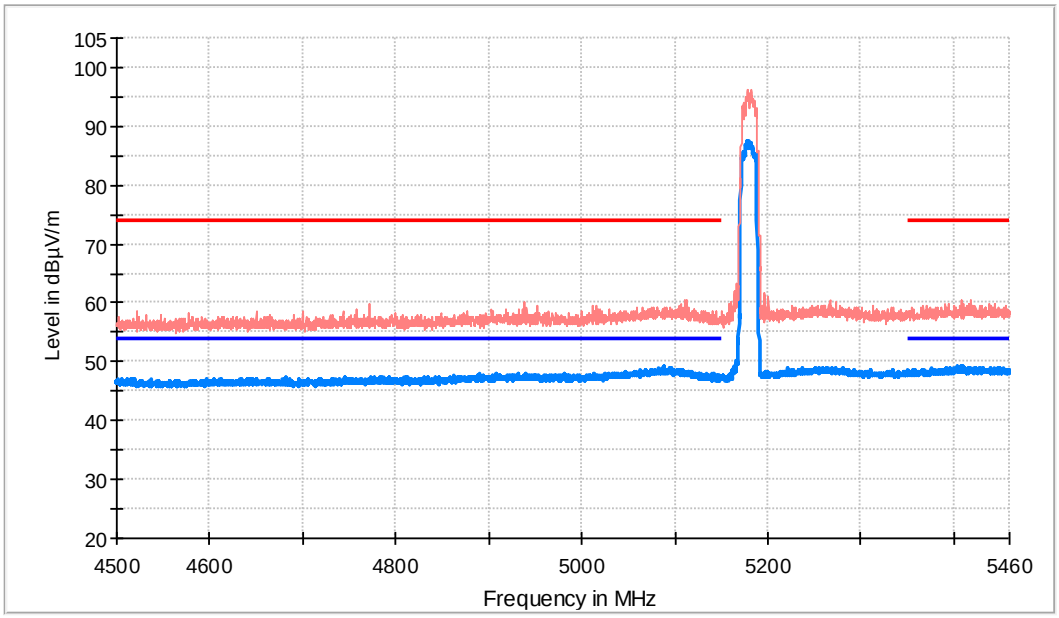


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18743.187500	43.9	38.9	H	15.1	54.0
18877.250000	41.9	35.4	V	18.6	54.0

RESTRICTED BANDS	4.5 GHz – 5.46 GHz

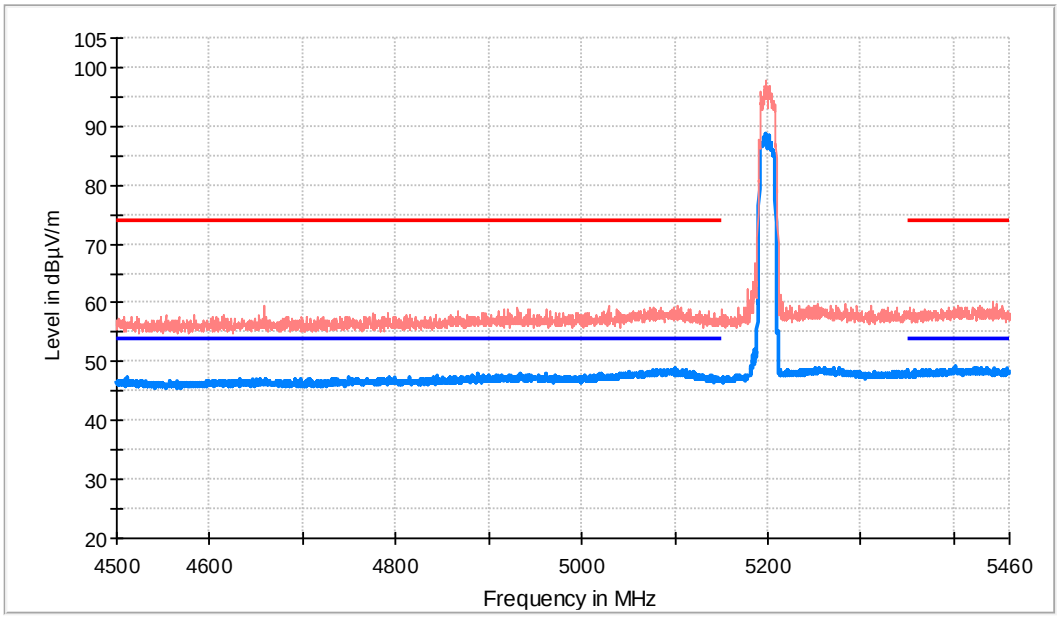
Low Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

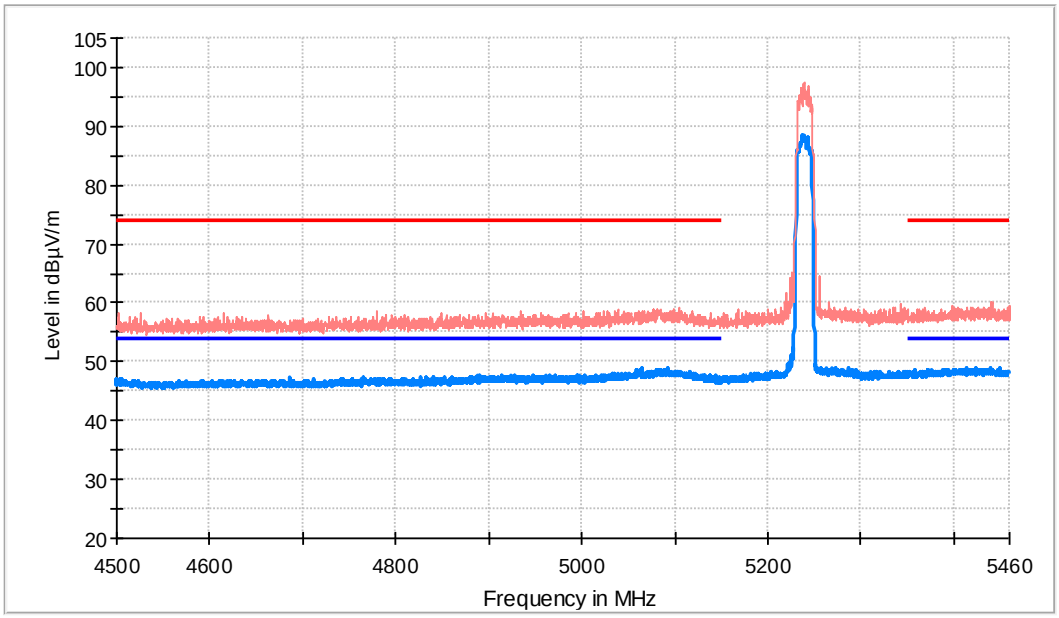
TEST RESULTS (Cont.)	

Mid Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

High Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#02 **(n mode 40MHz)**
TEST RESULTS:	PASS

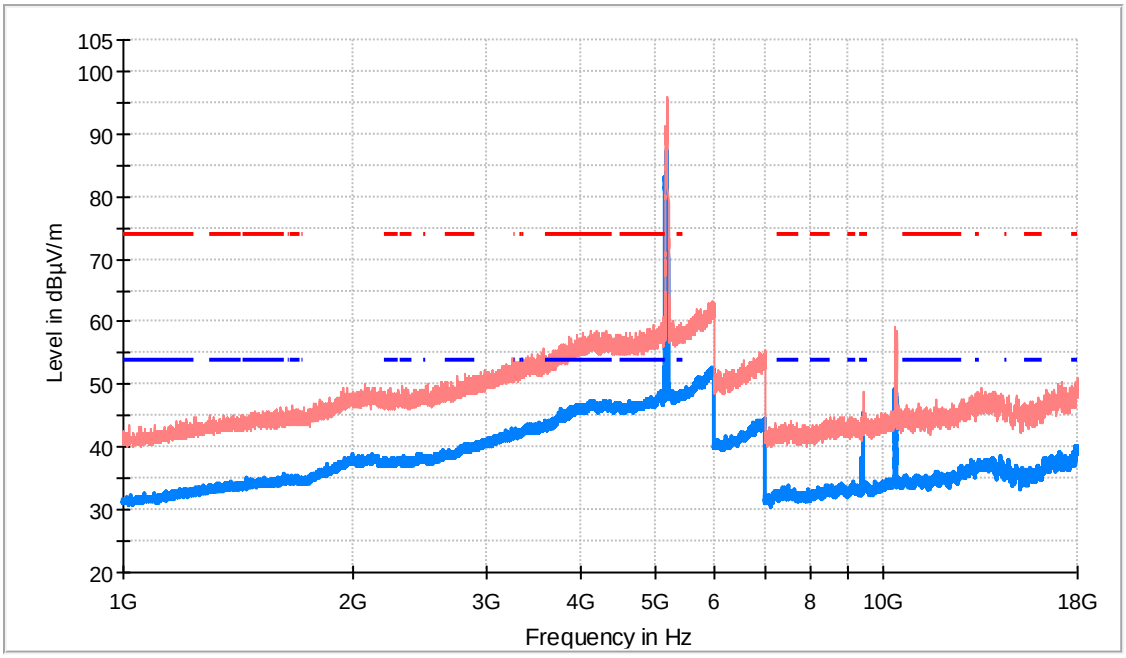
Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT. See worst operation a mode selected for all channels as a worst case.

Frequency range 1 GHz – 40 GHz
The results and plots below show the maximum measured levels in the 1- 40 GHz range.

FREQUENCY RANGE 1 GHz – 18 GHz

Lowest Channel

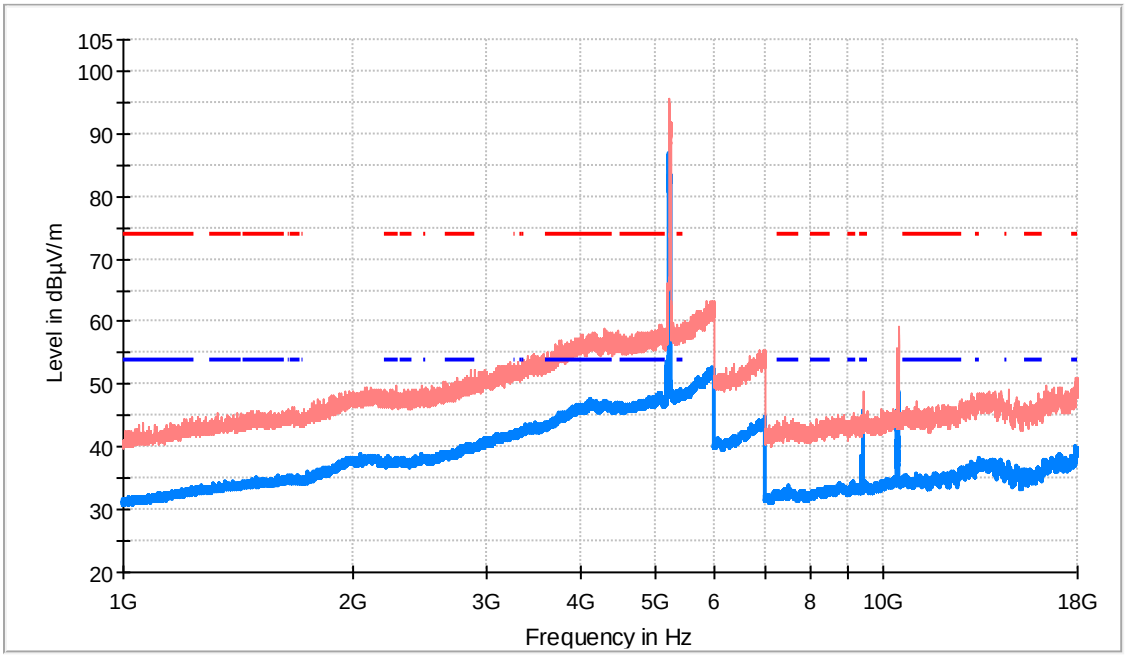


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5188.409091	95.8	86.4	H	---	---	Fundamental
9390.545455	48.9	45.4	V	8.6	54.0	
10382.181818	59.1	49.1	H	---	---	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	**1 GHz – 18 GHz**

Highest Channel

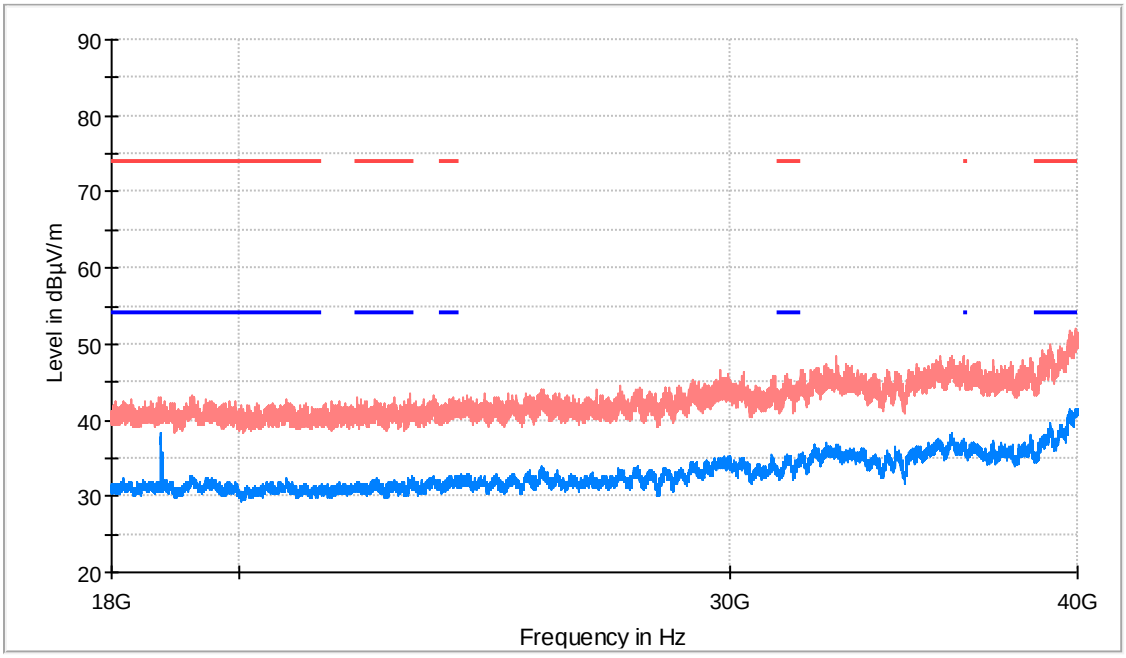


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5232.045455	95.7	86.4	H	---	---	Fundamental
9388.909091	48.9	45.6	V	8.4	54.0	
10466.727273	59.2	48.0	H	---	---	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Lowest Channel

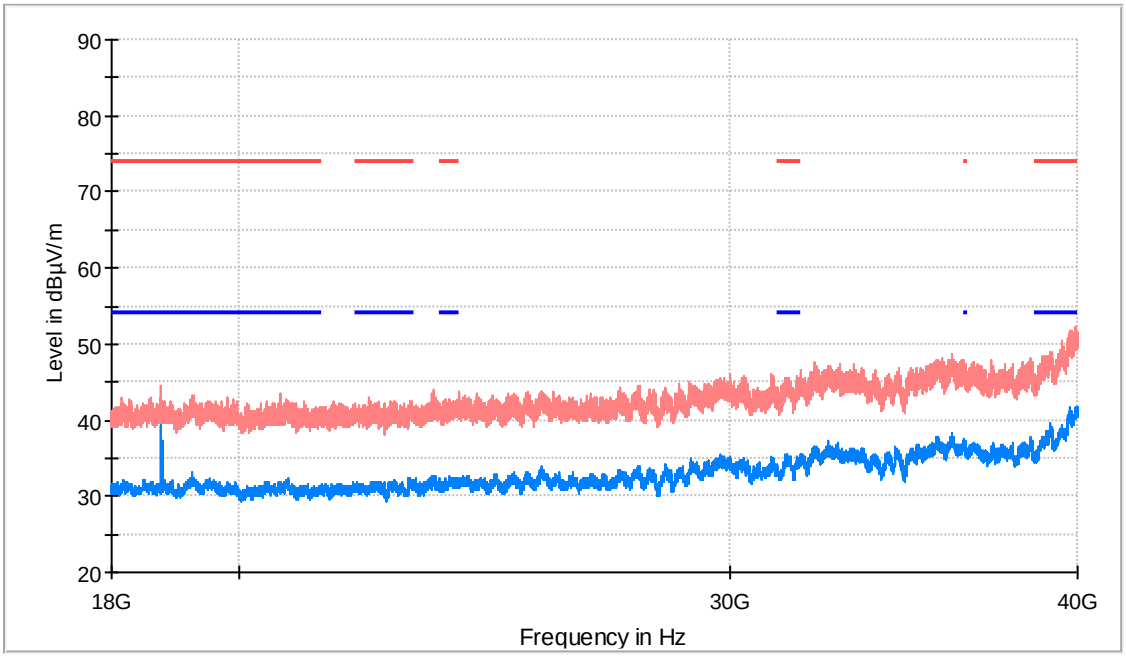


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18750.750000	42.9	38.4	H	15.6	54.0
18778.937500	41.8	35.8	H	18.3	54.0

TEST RESULTS (Cont.)	
FREQUENCY RANGE	**18 GHz – 40 GHz**

Highest Channel

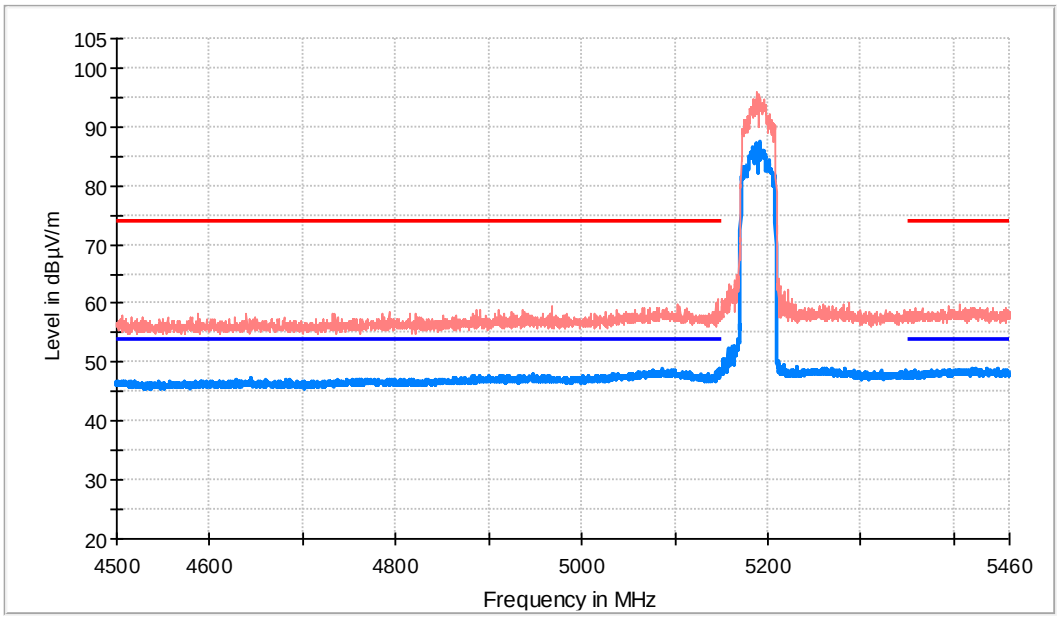


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18752.812500	44.6	39.3	H	14.7	54.0
18780.312500	42.4	37.2	V	16.8	54.0

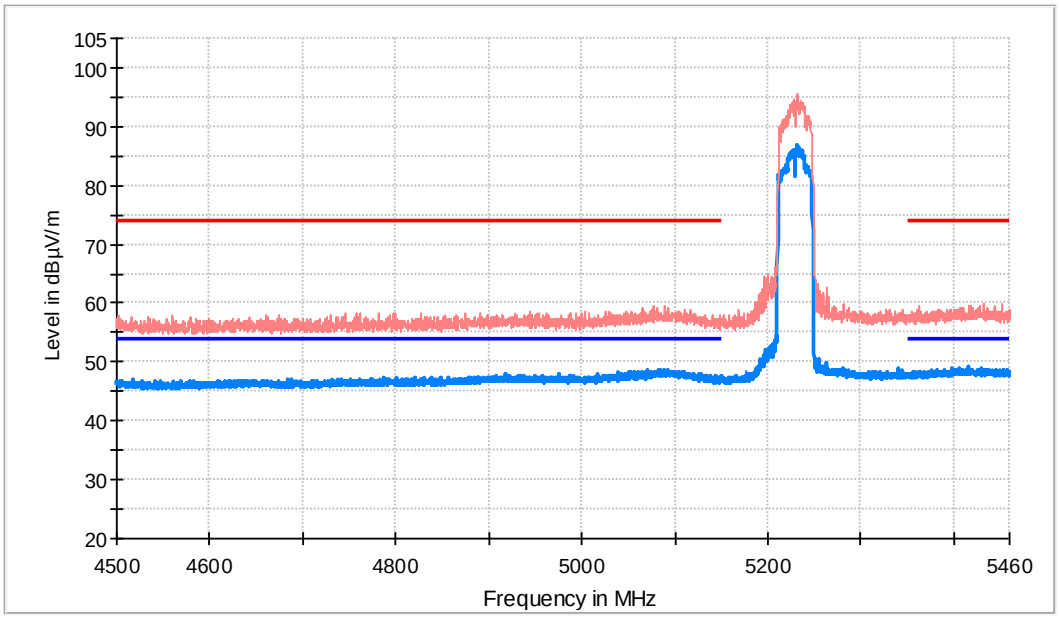
RESTRICTED BANDS	4.5 GHz – 5.46 GHz

Low Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

High Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#03 **(ac mode 80MHz)**
TEST RESULTS:	PASS

Frequency range 30 MHz – 1000 MHz

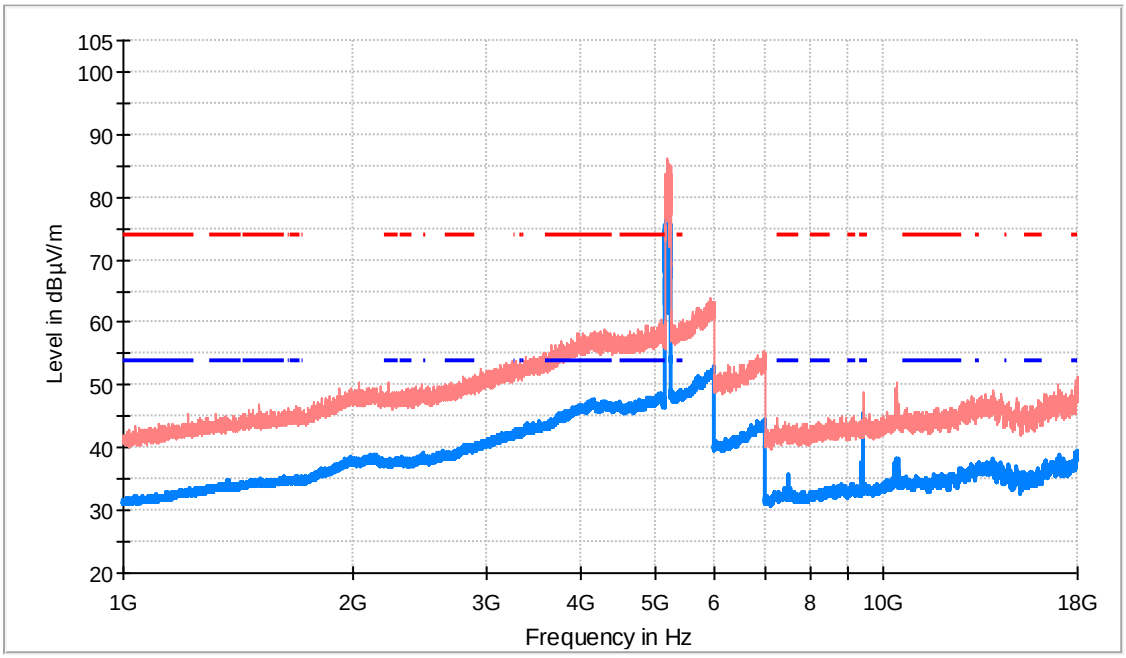
The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT. See worst operation a mode selected for all channels as a worst case.

Frequency range 1 GHz – 40 GHz

The results and plots below show the maximum measured levels in the 1- 40 GHz range.

FREQUENCY RANGE 1 GHz – 18 GHz

Lowest Channel

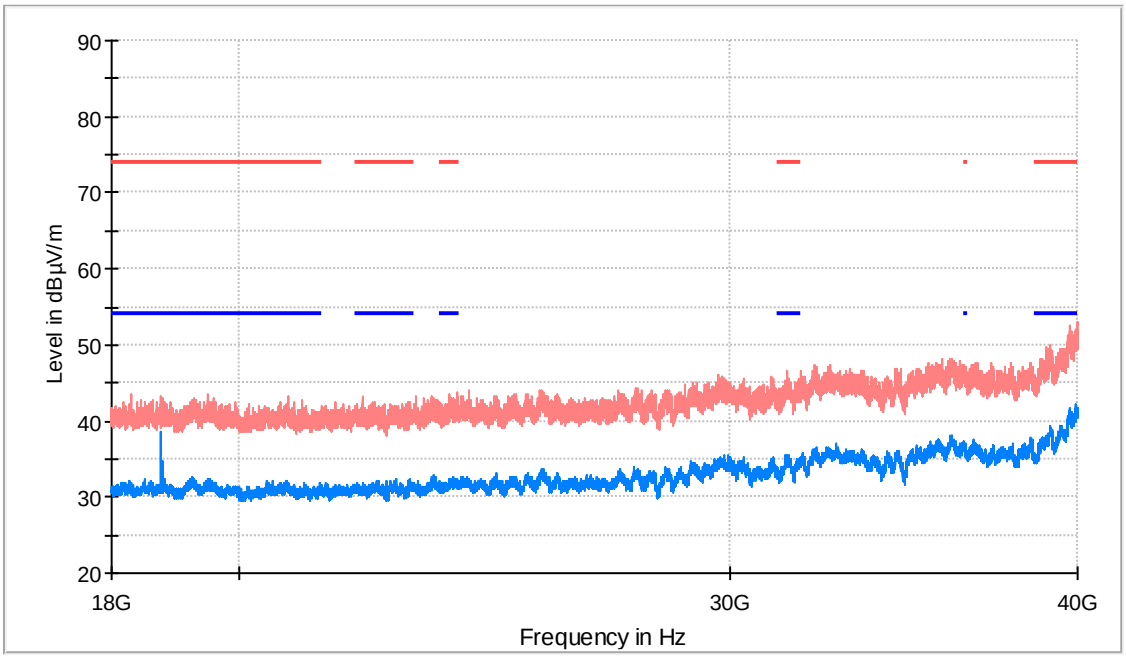


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5192.272727	86.3	73.3	H	---	---	
5210.681818	83.4	71.1	H	---	---	Fundamental
7500.000000	44.0	35.7	V	18.3	54.0	
9390.000000	48.8	44.0	V	10.0	54.0	
10443.272727	50.6	36.4	V	---	---	
17964.000000	51.4	39.0	V	15.0	54.0	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

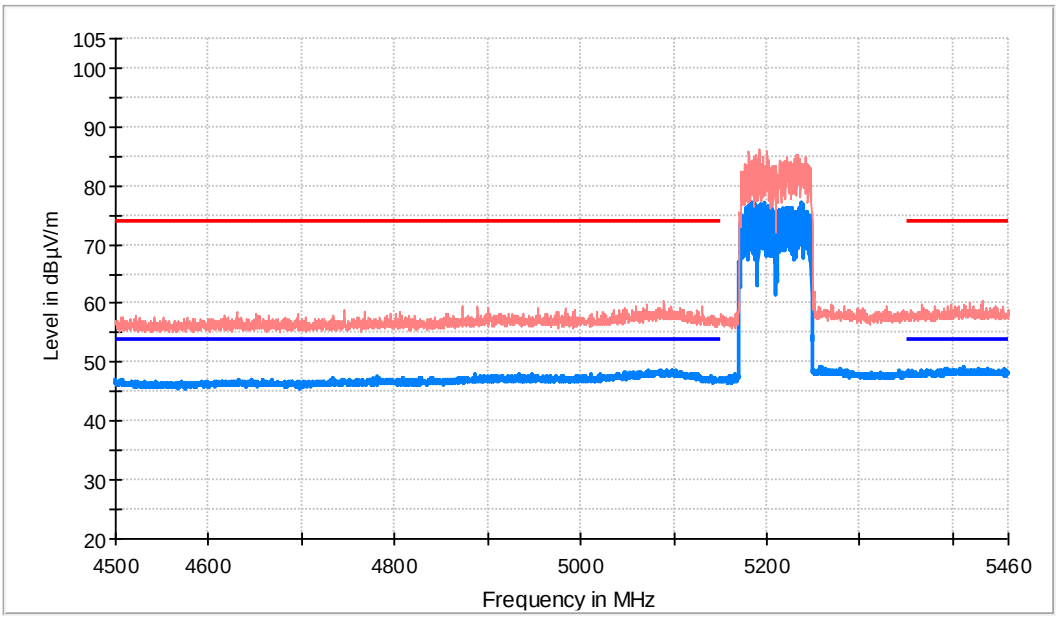
Lowest Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18753.500000	43.4	38.6	H	15.4	54.0
18782.375000	42.9	34.8	H	19.2	54.0

TEST RESULTS (Cont.)	Restricted Bands 4.5 GHz – 5.46 GHz



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Appendix C: Test results
5.725 GHz – 5.850 GHz Band

Appendix C Content

DESCRIPTION OF TEST CONDITIONS 38
TEST C.1: UNDESIRABLE RADIATED EMISSIONS (TRANSMITTER) 39

DESCRIPTION OF TEST CONDITIONS

TEST CONDITIONS	DESCRIPTION
TC#01(1) **(a mode)**	Power supply (V): $V_{nominal}$ = 13.2 Vdc Test Frequencies for Radiated tests**: (20 MHz)** Lowest range: 5745 MHz Middle channel: 5785 MHz Highest range: 5825 MHz
TC#02(1) **(n mode)**	Power supply (V): $V_{nominal}$ = 13.2 Vdc Test Frequencies for Radiated tests: **(20 MHz)** Lowest channel: 5745 MHz Middle channel: 5785 MHz Highest channel: 5825 MHz Test Frequencies for Conducted/Radiated tests**: (40 MHz)** Lowest channel: 5755 MHz Highest channel: 5795 MHz
TC#03(1) **(ac mode)**	Power supply (V): $V_{nominal}$ = 13.2 Vdc Test Frequencies for Radiated tests**: (20 MHz)** Lowest channel: 5745 MHz Middle channel: 5785 MHz Highest channel: 5825 MHz Test Frequencies for Radiated tests: **(40 MHz)** Lowest channel: 5755 MHz Highest channel: 5795 MHz Test Frequencies for Radiated tests: **(80 MHz)** Lowest channel: 5775

Note (1): For spurious emissions for OFDM modes 802.11a, 802.11n20, 802.11n40, 802.11ac80 a preliminary scan was performed to determine the worst case.
The data rates of 6 Mbps for 802.11a,MCS0 for 802.11n20/n40 and MCS 0 for 802.11ac20/ac40/ac80 were selected based on preliminary testing that identified those rates corresponding to the worst cases.

TEST C.1: UNDESIRABLE RADIATED EMISSIONS (TRANSMITTER)

LIMITS:	Product standard:	Part 15 Subpart C §15.407 and RSS-247
	Test standard:	Part 15 Subpart C §15.407(b) (1)(6)(7) and RSS-247 6.2.1.2

LIMITS

For transmitters operating in the 5.15 – 5.25 GHz band: all emissions outside of the 5.15 – 5.25 GHz band shall not exceed an EIRP of -27 dBm/MHz (68.23 dBµ V/m at 3m distance).

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) / RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function

TEST SETUP

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and at 1m for the frequency range 1-40 GHz (1 GHz-18 GHz and 18 GHz-40 GHz Double ridge horn antennas).

For radiated emissions in the range 1-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

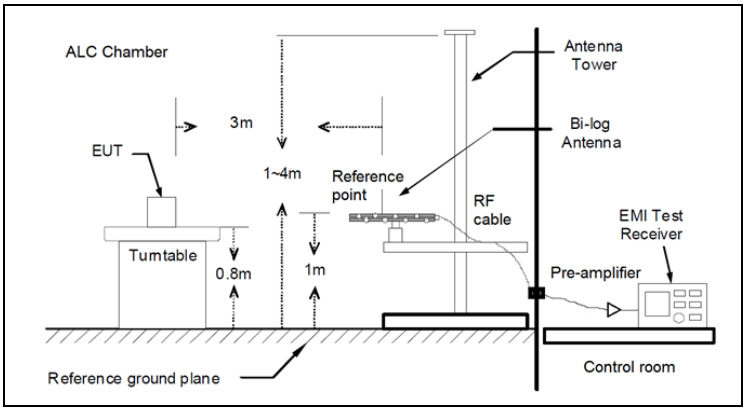
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

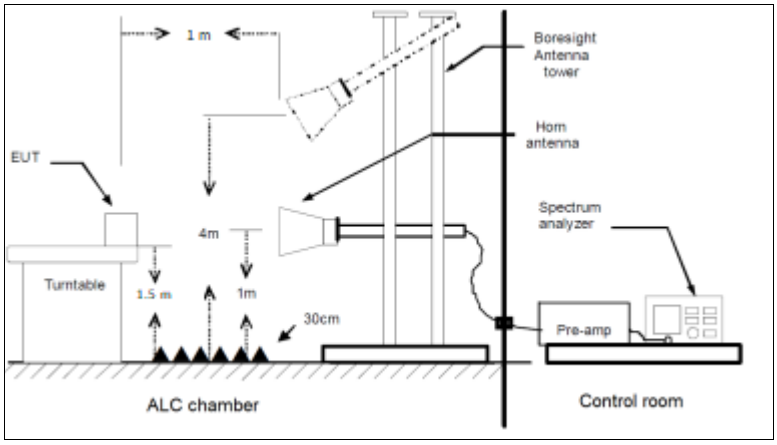
The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

TEST SETUP (CONT.)	

Radiated measurements Setup f < 1 GHz



Radiated measurements setup f > 1 GHz



TESTED SAMPLES:	S/02
TESTED CONDITIONS MODES:	TC#01 **(a mode)**
TEST RESULTS:	PASS

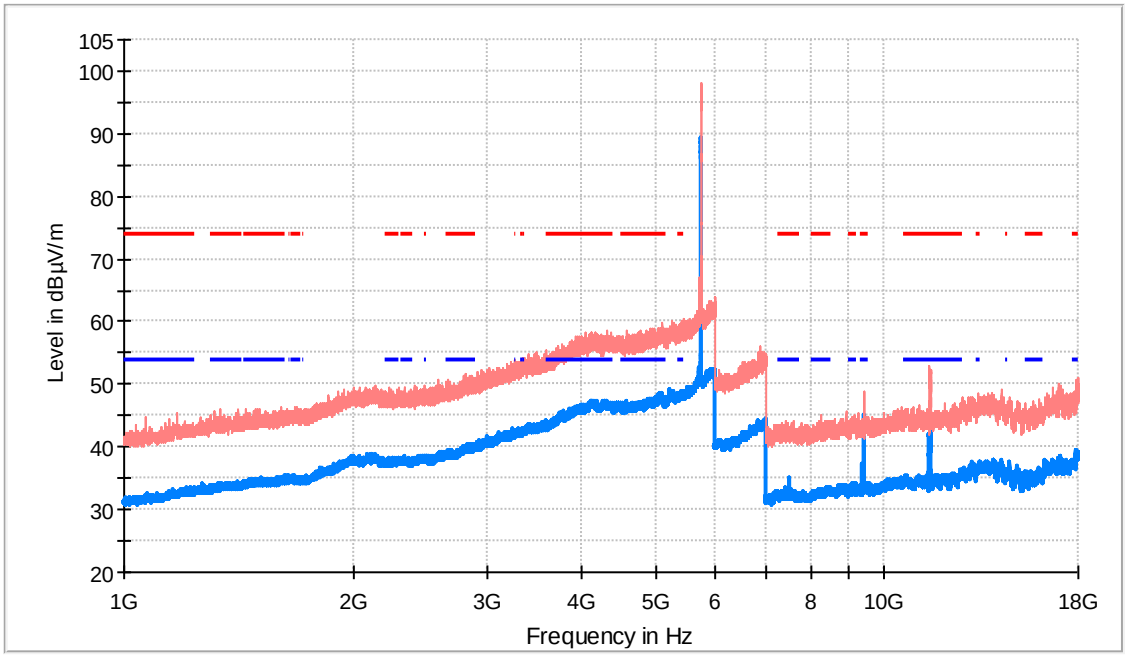
Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT. See worst operation a mode selected for all channels as a worst case.

Frequency range 1 GHz – 40 GHz
The results and plots below show the maximum measured levels in the 1- 40 GHz range.

TEST RESULTS (Cont.)	
FREQUENCY RANGE	1 GHz – 18 GHz

Lowest Channel

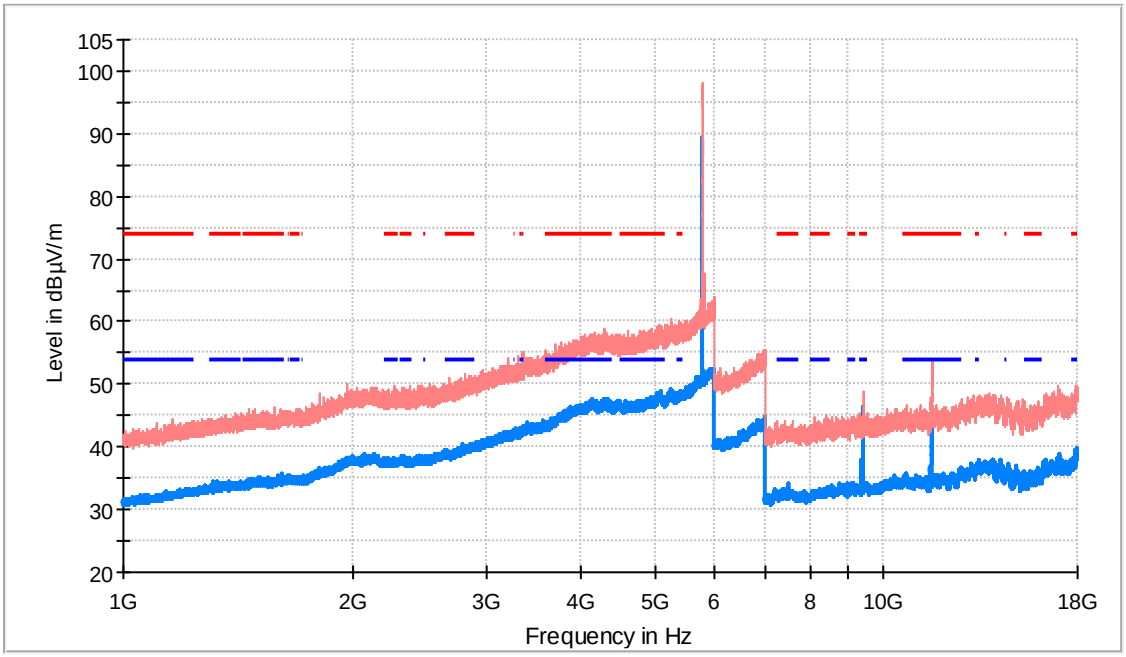


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5746.136364	98.0	89.1	H	---	---	Fundamental
7500.000000	41.9	35.0	V	19.0	54.0	
9389.454546	48.7	45.2	H	8.8	54.0	
11487.272727	52.9	41.7	H	12.3	54.0	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	1 GHz – 18 GHz

Middle Channel

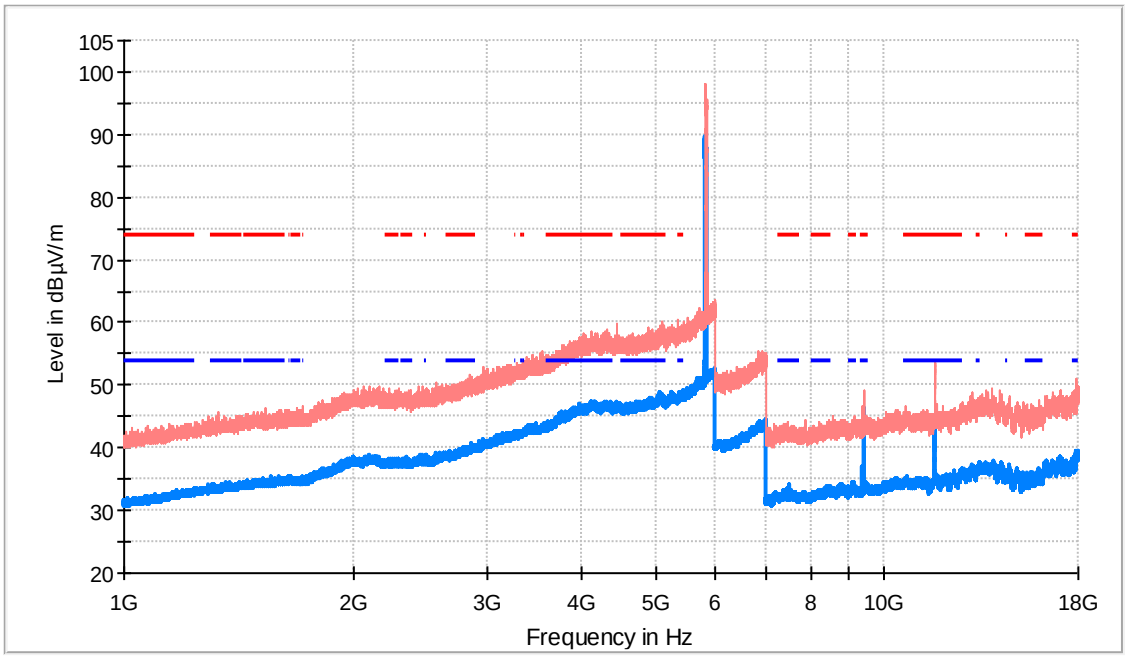


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5786.590909	98.0	88.4	H	---	---	Fundamental
9389.454546	48.8	46.2	V	7.8	54.0	
11568.000000	54.0	43.0	V	11.0	54.0	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	1 GHz – 18 GHz

Highest Channel

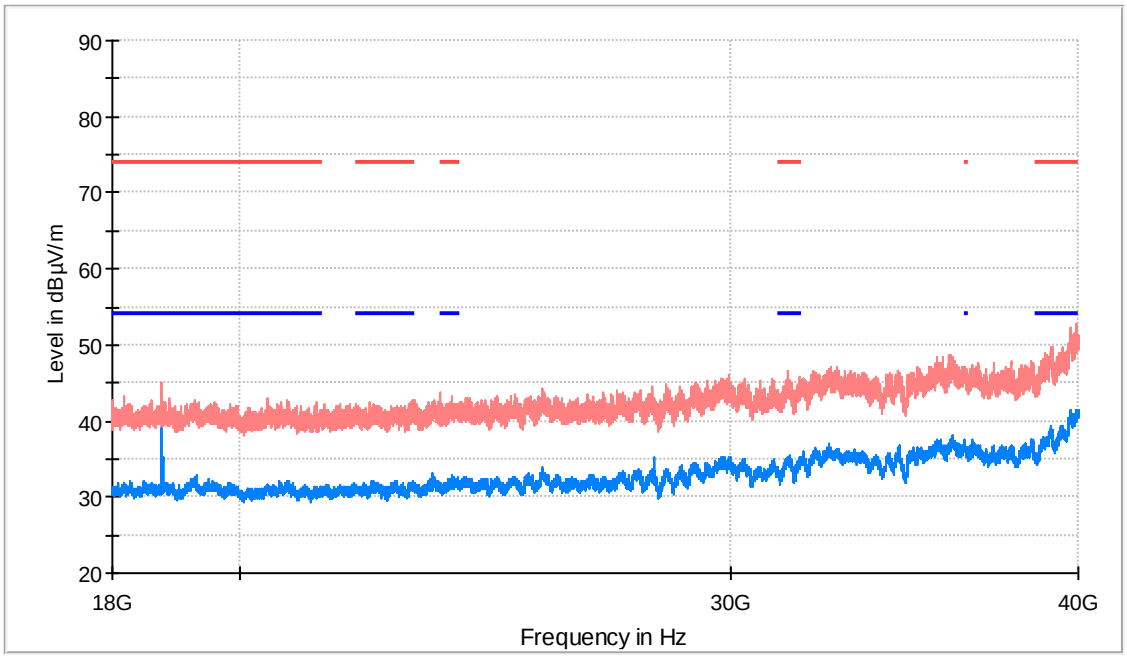


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5823.863636	98.1	89.3	V	---	---	Fundamental
9389.454546	49.2	46.5	V	7.5	54.0	
11648.727273	54.0	42.5	H	11.5	54.0	
11649.818182	52.3	44.3	H	9.7	54.0	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Lowest Channel

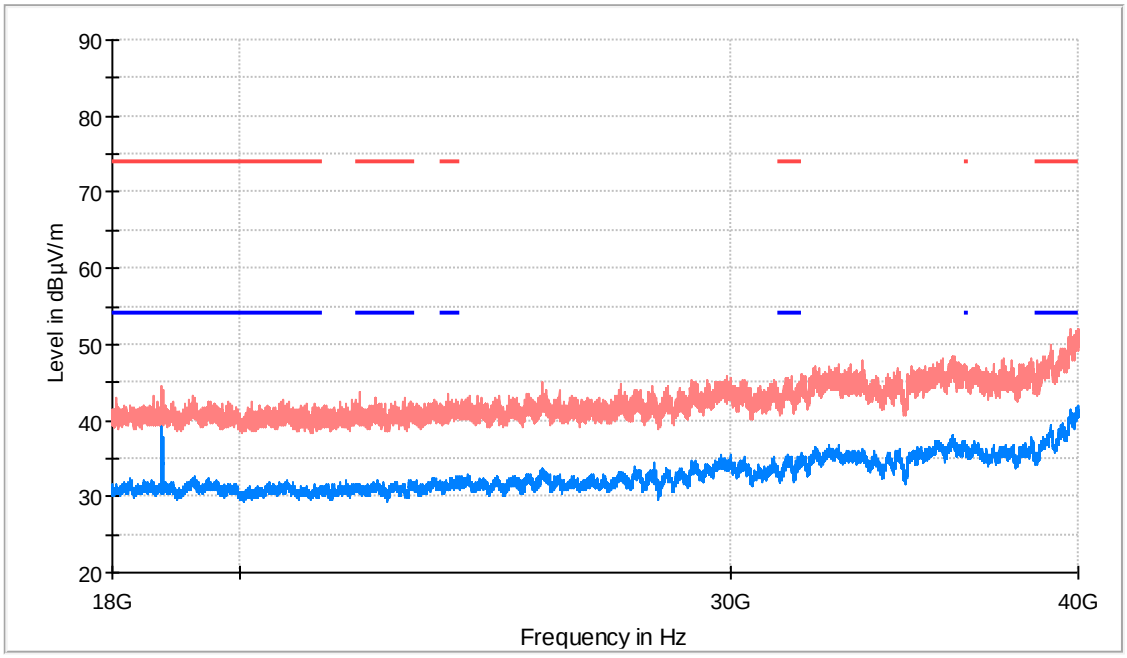


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18752.125000	43.9	39.2	V	14.8	54.0
18779.625000	41.8	35.3	H	18.7	54.0

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Middle Channel

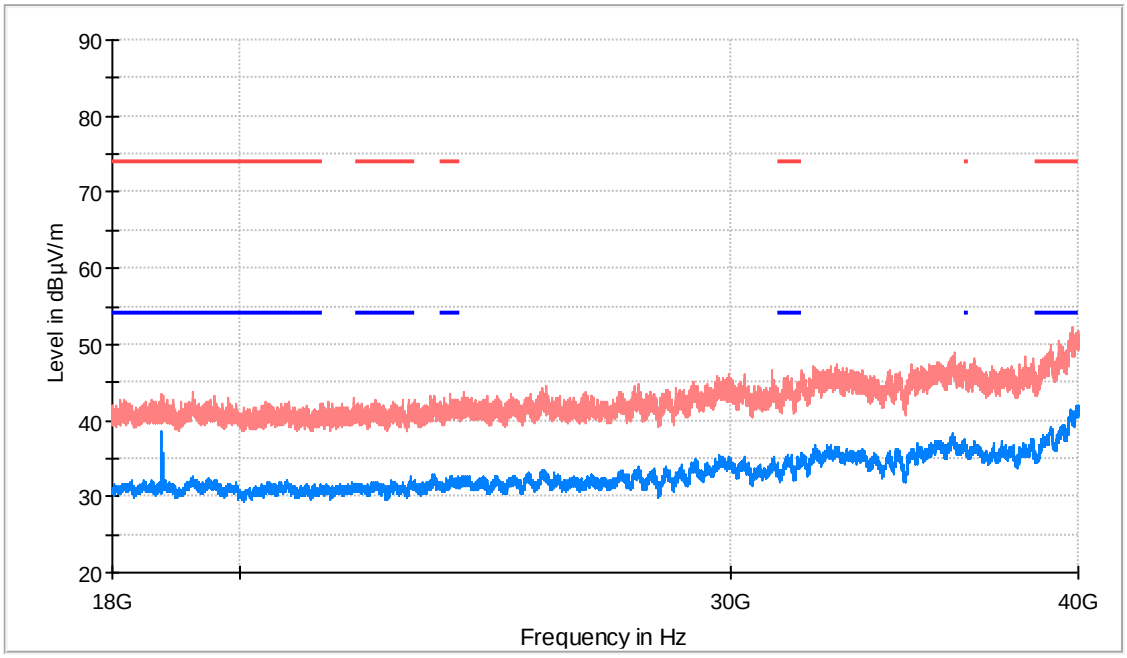


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18752.125000	44.2	40.0	V	14.0	54.0
18780.312500	44.0	37.7	V	16.3	54.0

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Highest Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18753.500000	43.3	38.5	V	15.5	54.0
18781.000000	43.4	35.8	H	18.2	54.0

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#02 **(n mode 40MHz)**
TEST RESULTS:	PASS

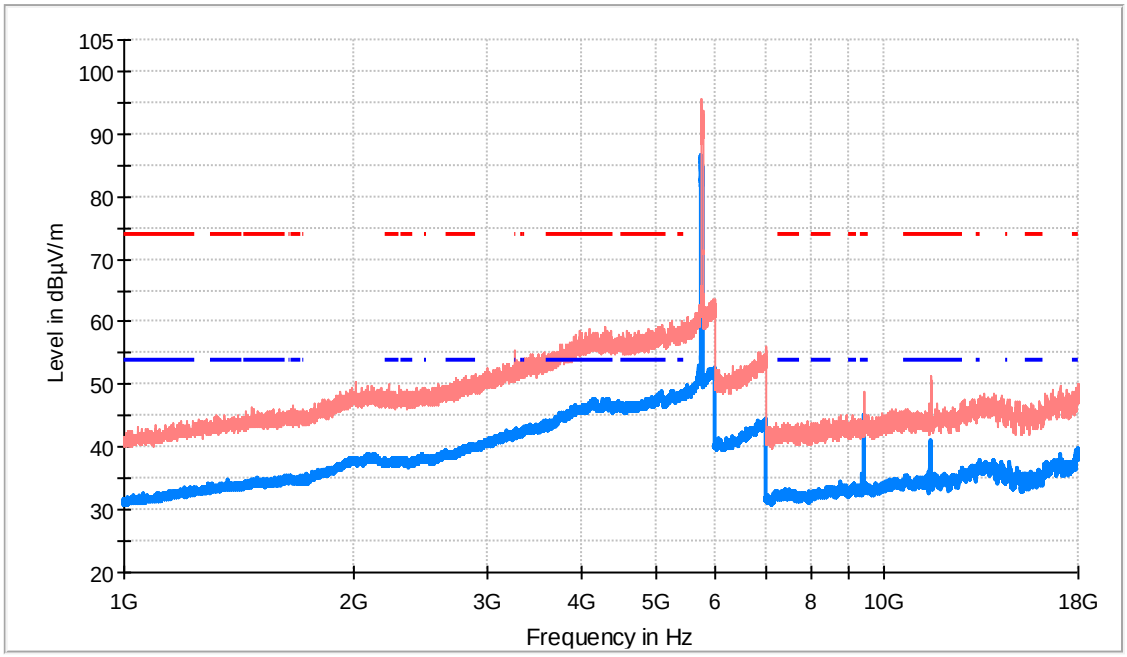
Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT. See worst operation a mode selected for all channels as a worst case.

Frequency range 1 GHz – 40 GHz
The results and plots below show the maximum measured levels in the 1- 40 GHz range.

FREQUENCY RANGE 1 GHz – 18 GHz

Lowest Channel

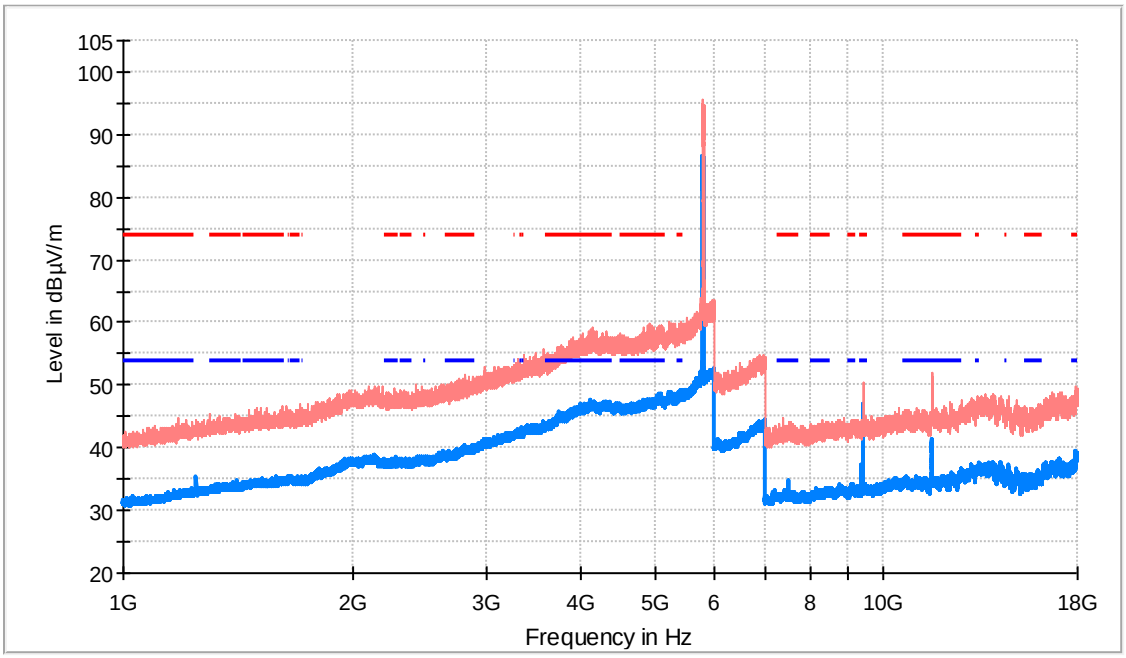


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5757.045455	95.6	86.1	H	---	---	Fundamental
9390.000000	48.9	45.0	V	9.0	54.0	
11509.636364	49.3	41.0	H	13.0	54.0	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	1 GHz – 18 GHz

Highest Channel

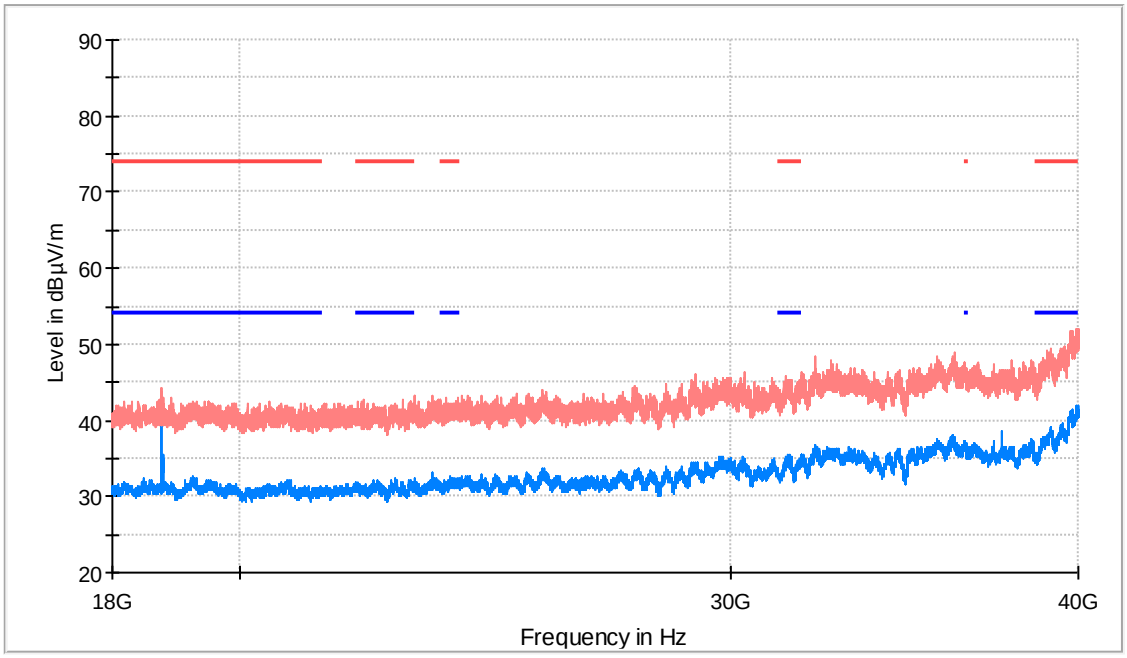


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5797.045455	95.6	86.1	V	---	---	Fundamental
9391.090909	50.3	46.9	V	7.1	54.0	
11591.454546	50.1	41.2	H	12.8	54.0	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Lowest Channel

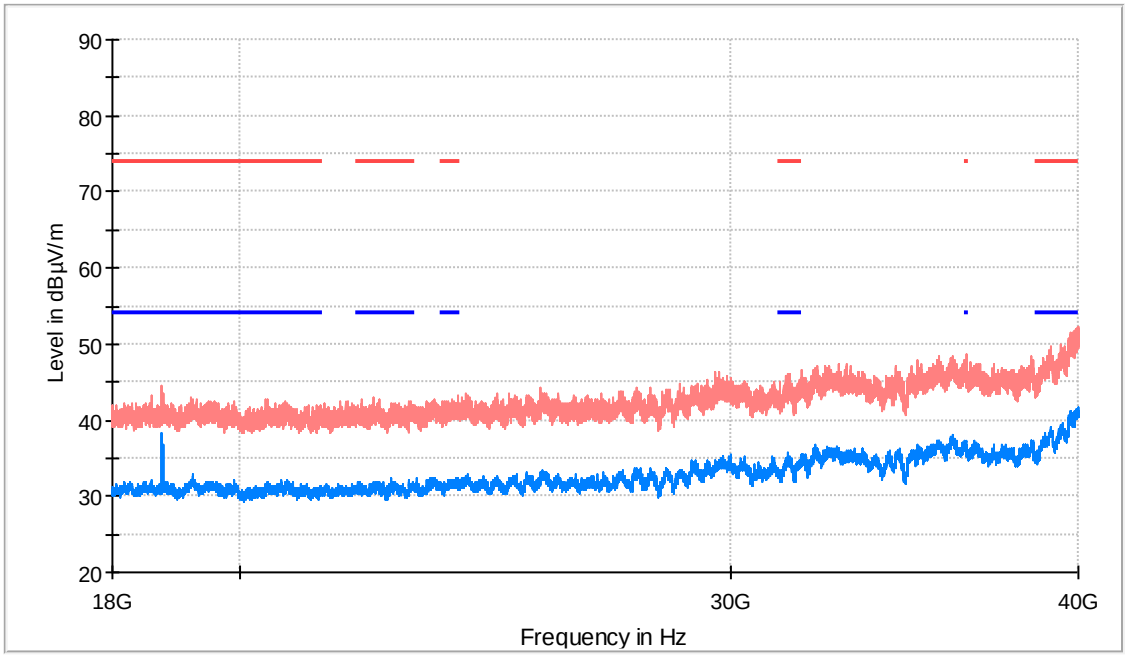


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18751.437500	44.2	39.9	H	14.1	54.0
18778.250000	42.3	35.5	H	18.5	54.0

TEST RESULTS (Cont.)	
FREQUENCY RANGE	**18 GHz – 40 GHz**

Highest Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18753.500000	44.5	38.3	H	15.7	54.0
18781.687500	43.6	36.8	H	17.2	54.0

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#03 **(ac mode 80MHz)**
TEST RESULTS:	PASS

Frequency range 30 MHz – 1000 MHz

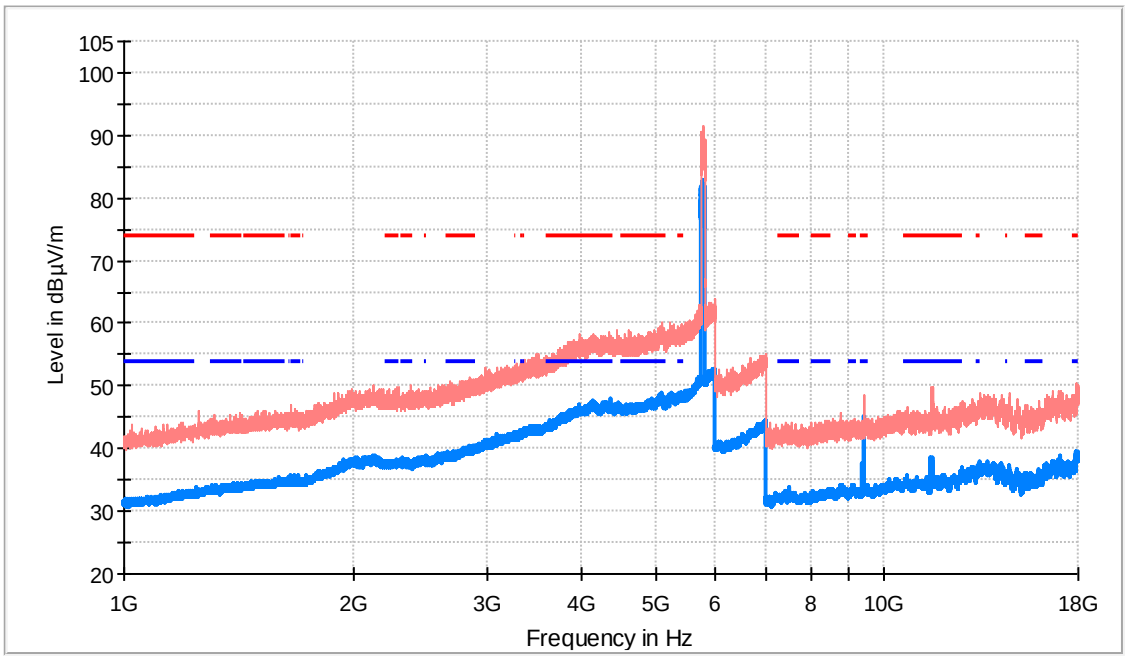
The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT. See worst operation a mode selected for all channels as a worst case.

Frequency range 1 GHz – 40 GHz

The results and plots below show the maximum measured levels in the 1- 40 GHz range.

FREQUENCY RANGE 1 GHz – 18 GHz

Lowest Channel

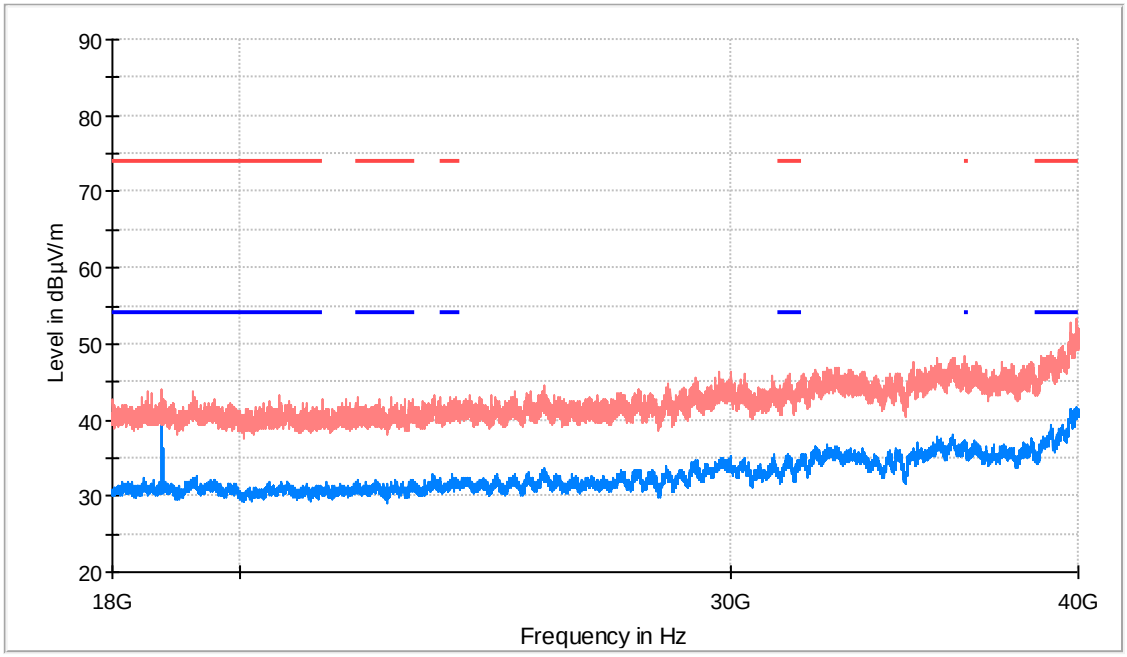


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)	Comment
5776.818182	91.5	82.6	H	---	---	Fundamental
9391.090909	48.6	45.2	H	8.8	54.0	
11566.363636	49.9	37.1	H	16.9	54.0	

TEST RESULTS (Cont.)	
FREQUENCY RANGE	18 GHz – 40 GHz

Lowest Channel



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1GHz to 40 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG	Limit - AVG (dBµV/m)
18751.437500	43.9	39.4	H	14.6	54.0
18778.250000	42.8	36.2	V	17.8	54.0