REP018386B

Test Report

Product	Electronic Control Unit for vehicle Integration
Name and address of the applicant	CPAC Systems AB Bergskroken 3, 431 37 Mölndal, Sweden
Name and address of the manufacturer	CPAC Systems AB Bergskroken 3, 431 37 Mölndal, Sweden
Model	SID 2.0
Rating	$24V_{DC}$
Trademark	CPAC
Additional information	WIFi 5, BT, BLE, LTE
Tested according to	**ETSI EN 301 893 v.2.1.1 (2017-05)** 5 GHz RLAN; Harmonized Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU
Order number	PRJ0024292
Tested in period	2023-02-20 to 2023-10-25
Issue date	2024-10-25
Name and address of the testing laboratory	Nemko Scandinavia AS Instituttveien 6 2007 Kjeller, Norway www.nemko.com **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [Frode Sveinsen]	Approved by [Jan G Eriksen]

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Revision history

Revision	Date	Comment	Sign
A	2023-11-16	First edition	FS
B	2024-10-25	Added Antenna Data	FS

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to ensure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is solely responsible for any modifications to the product that could result in non-compliance with the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither are opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence, that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in a separate clause in this report.

CONTENTS

1 GENERAL INFORMATION

2 Test Information

2.1 Tested Item

Name	**CPAC Systems AB**
Model/version	**SID 2.0**
Serial number	**23040034**
Hardware identity and/or version	**P-01**
Software identity and/or version	**Hydra_WLANSW_1.0**
Frequency Ranges	**5150 – 5350 MHz** **5470 – 5725 MHz**
Type of Modulation	**802.11a/n/ac (20/40/80 MHz)**
User Frequency Adjustment	**None**
Rated Output Power	**100 mW**
Antenna Connector	**Fakra**
Number of Antennas	**2**
Antenna Diversity Supported	**Yes**
Smart Antennas	**Yes**
Power Source	**External DC Supply (8-32 V_{DC}, 24 V_{DC} Nominal)**

Description of Tested Devices

The tested equipment is an electronic control unit for vehicle integration.

2.2 Model Variants

According to the manufacturer the following models have same RF parts and RF modules.

Model/type	LTE Module mounted	Superseal 26	Tested
SID 2.0 (tested at Nemko)	**Yes**	**version 1**	☒
SID 2.0M	**No (Marine commercial)**	**version 2**	
SID 2.0MLTE	**Yes (Marine leisure)**	**version 2**	
SID 2.0X (EU only)	**Yes**	**version 1**	

2.3 Normal test condition

Temperature	**22 – 25 °C**
Relative humidity	**30 – 50 %**
Normal test voltage	**24 V_{DC}**

The values are the limit registered during the test period.

2.4 Extreme test conditions

	Temperature	Voltage
Minimum	**-40 °C**	**8.0 V DC**
Maximum	**+85 °C**	**32.0 V DC**

Extreme temperatures are the limits specified by the manufacturer.

2.5 Test Engineers

G. Suhantakumar

Frode Sveinsen

2.6 Antenna types

Declared by the manufacturer.

Name	P/N	Max gain (dBi)	Function
2J WiFi 5.0 GHz SISO	**2J #2J4A50PCFa**	**3.6**	**5GHz Wifi**
2J WiFi 5.0 GHz MIMO	**2J #2J4A50PCFa**	**7.1**	**5GHz Wifi**
TE ANTENNA BASE FULL FEAT	**Volvo #23311779**	**7.0**	**5GHz Wifi**
TE ANTENNA INTERIOR WLAN	**Volvo #23311706**	**4.0**	**5GHz Wifi**

2.7 Definition of Test Frequencies

RF Carrier	Test Frequency		
	802.11a 802.11n/ac HT20	802.11n/ac HT40	802.11ac HT80
F1	**5180 MHz**	**5190 MHz**	**5210 MHz**
F2	**5320 MHz**	**5310 MHz**	**5290 MHz**
F3	**5500 MHz**	**5510 MHz**	**5530 MHz**
F4	**5700 MHz**	**5670 MHz**	**5610 MHz**

2.8 Other Comments

This test report covers all relevant tests of EN 301 893 v2.1.1 for the tested equipment.

All tested parameters are within the limits of EN 301 893 v2.1.1.

3 TEST REPORT SUMMARY

3.1 General

The tests were conducted on a sample of the equipment for demonstrating compliance with the following standards:

Standard	Description
EN 301 893 V2.1.1 (2017-05)	**5 GHz RLAN; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU**

The test methods have been in accordance with TM-NO-WLS-500, TM-NO-WLS-204A and EN 300 328 where applicable. Radiated tests were performed is accordance with TM-NO-WLS-500, TM-NO-WLS-204A and EN 301 893.

Radiated emissions are made in a 3m fully-anechoic chamber.

☒ **Production Unit**
☐ **Pre-production Unit**

3.2 Test Summary

Harmonized Standard ETSI EN 301 893				
Technical Reqirement reference		**Technical Requirement Conditionality**		
Description	**Reference: Clause No**	**U/C**	**Condition**	**Verdict**
Carrier frequencies	**4.2.1**	**U**		**Pass**
Nominal and occupied Channel bandwidth	**4.2.2**	**U**		**Pass**
RF output power	**4.2.3**	**U**		**Pass**
Transmit Power Control (TPC)	**4.2.3**	**C**	Not required for devices that operate at a maximum mean e.i.r.p. of 20 dBm when operating in 5 250 MHz to 5350 MHz or 27 dBm when operating in 5470 MHz to 5725 MHz.	
Power Density	**4.2.3**	**U**		**Pass**
Transmitter unwanted emissions outside the 5 GHz RLAN bands	**4.2.4.1**	**U**		**Pass**
Transmitter unwanted emissions within the 5 GHz RLAN bands	**4.2.4.2**	**U**		**Pass**
Receiver spurious emissions	**4.2.5**	**U**		**Pass**
DFS: channel Availability Check	**4.2.6.2.2**	**C**	Not required for client device without radar detection	**N/A**
DFS: Off-Channel CAC	**4.2.6.2.3**	**C**	Not required for client device without radar detection	**N/A**
DFS: In service Monitoring	**4.2.6.2.4**	**C**	Not required for client device without radar detection	**N/A**
DFS: Channel shutdown	**4.2.6.2.5**	**C**	Not required for channels whose nominal bandwidth falls completely within the band 5150 MHz to 5250 MHz.	**Pass**
DFS: Non-occupancy period	**4.2.6.2.6**	**C**	Not required for client device without radar detection	**N/A**
DFS: Uniform spreading	**4.2.6.2.7**	**C**	Not required for client device without radar detection.	**N/A**
Adaptivity (Channel Access Mechanism)	**4.2.7**	**U**		**Pass**
Receiver Blocking	**4.2.8**	**U**		**Pass**
User Access Restrictions	**4.2.9**	**U**		**Pass***
Geo-location capability	**4.2.10**	**C**	Where implemented by the manufacturer	**Pass***

***Requires Manufacturer Declaration**

The EUT was fitted with 50 ohm temporary RF connectors

4 Test Results

4.1 Carrier Frequencies

ETSI EN 301893 subclause 4.2.1

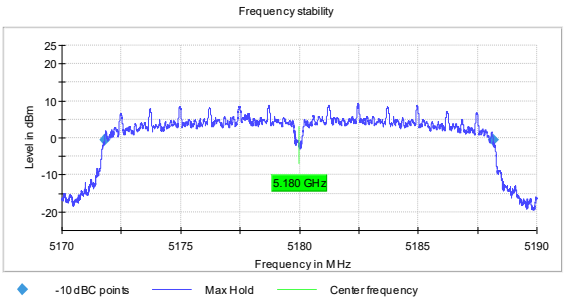
Carrier	Temperature	Voltage	Carrier Frequency (MHz)	Difference (ppm)	Limit (ppm)
F1: 5180 MHz	Nominal	Normal	5179.974	-5.0	20
	Min.	Min.	5180.078	15.1	20
		Max.	5180.072	13.9	
	Max.	Min.	5180.053	10.2	
		Max.	5180.089	17.2	
F2: 5320 MHz	Nominal	Normal	5319.972	-5.3	20
	Min.	Min.	5320.081	15.2	
		Max.	5320.079	14.9	
	Max.	Min.	5320.066	12.4	
		Max.	5320.101	19.0	
F3: 5500 MHz	Nominal	Normal	5499.969	-5.6	20
	Min.	Min.	5500.081	14.7	
		Max.	5500.047	13.5	
	Max.	Min.	5500.072	13.1	
		Max.	5500.106	19.3	
F4: 5700 MHz	Nominal	Normal	5699.963	-6.5	20
	Min.	Min.	5700.078	13.7	
		Max.	5700.076	13.3	
	Max.	Min.	5700.067	11.8	
		Max.	5700.095	16.7	
Measurement Uncertainty U_{95}			±100 Hz		

The Carrier Frequency was measured on a modulated carrier using a spectrum analyzer.

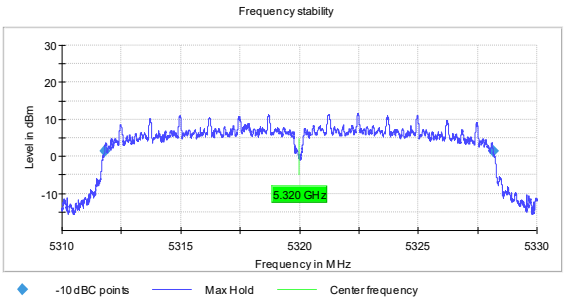
It is not possible to turn off the modulation of the EUT, this test was carried out with 802.11a 6Mbps modulation.

Limits: Clause 4.2.1

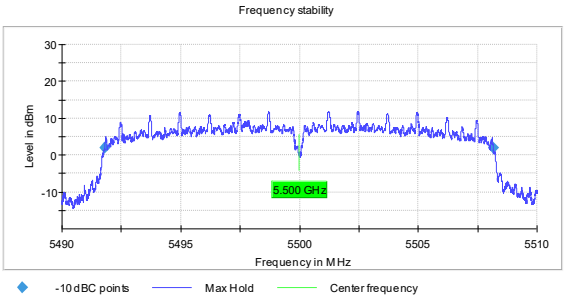
The actual centre frequency for any given channel declared by the manufacturer shall be maintained within the range fc ± 20 ppm



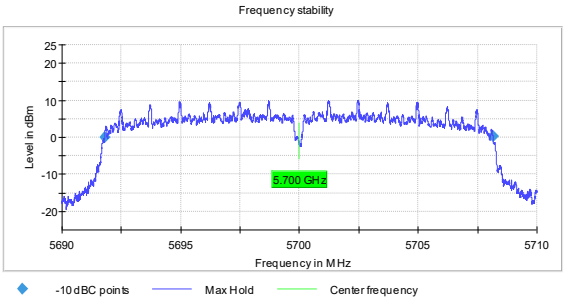
Carrier Frequency, F1: 5180 MHz, Normal conditions



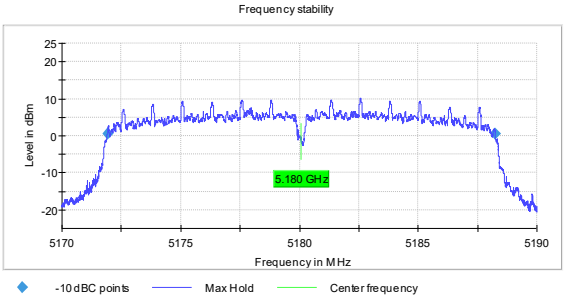
Carrier Frequency, F2: 5320 MHz, Normal conditions



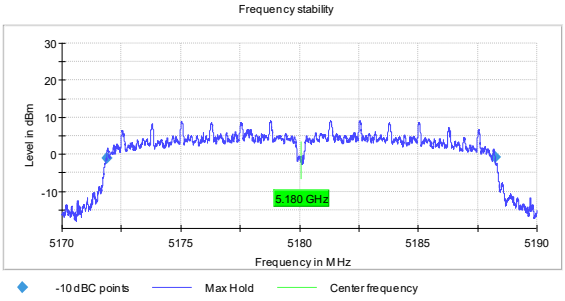
Carrier Frequency, F3: 5500 MHz, Normal conditions



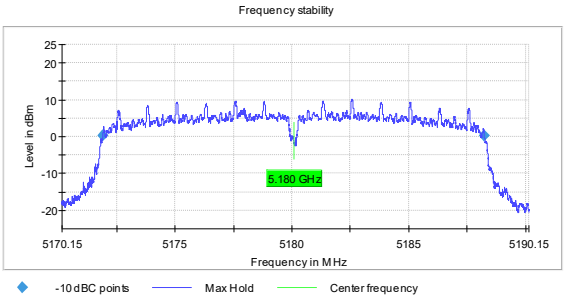
Carrier Frequency, F4: 5700 MHz, Normal conditions



Carrier Frequency, F1: 5180 MHz, Min Temp, Min Voltage



Carrier Frequency, F1: 5180 MHz, Max Temp, Min Voltage



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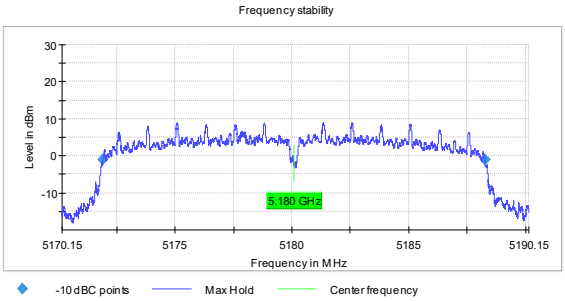
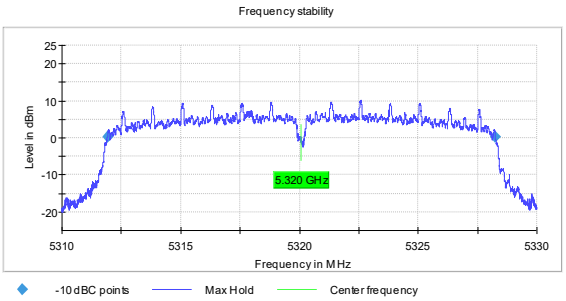
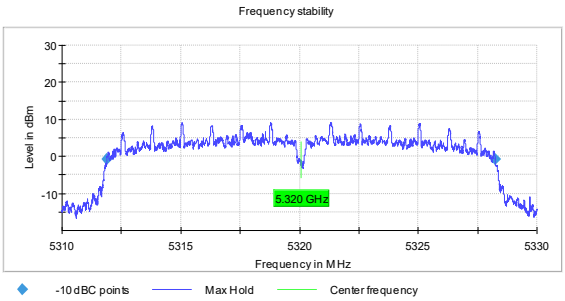


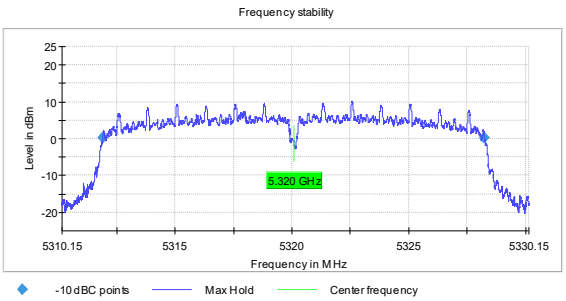
Carrier Frequency, F1: 5180 MHz, Max Temp, Max Voltage



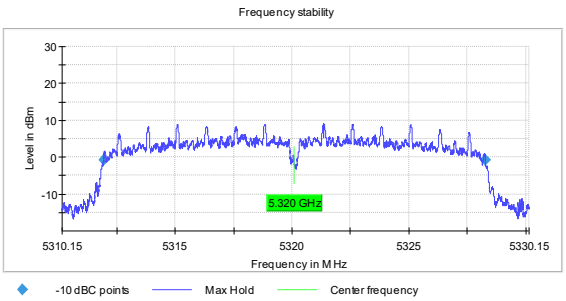
Carrier Frequency, F2: 5320 MHz, Min Temp, Min Voltage



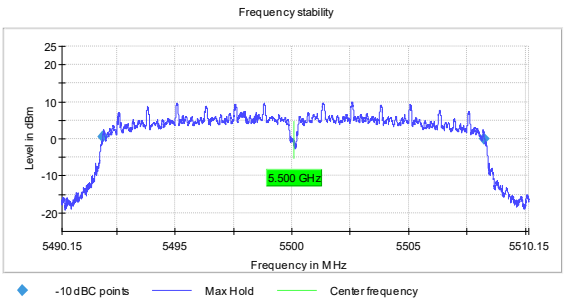
Carrier Frequency, F2: 5320 MHz, Max Temp, Min Voltage



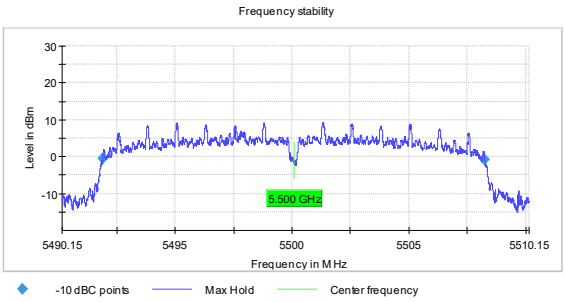
Carrier Frequency, F2: 5320 MHz, Min Temp, Max Voltage



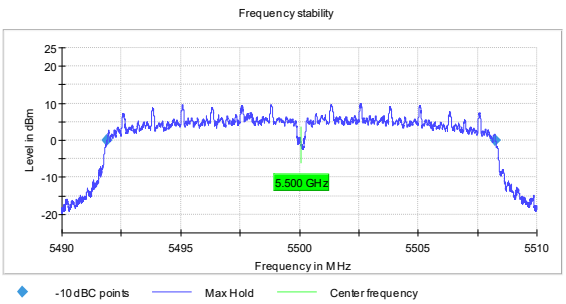
Carrier Frequency, F2: 5320 MHz, Max Temp, Max Voltage



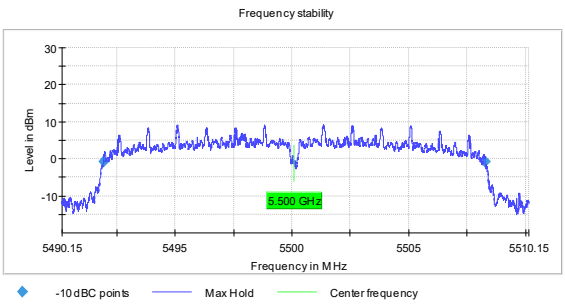
Carrier Frequency, F3: 5500 MHz, Min Temp, Min Voltage



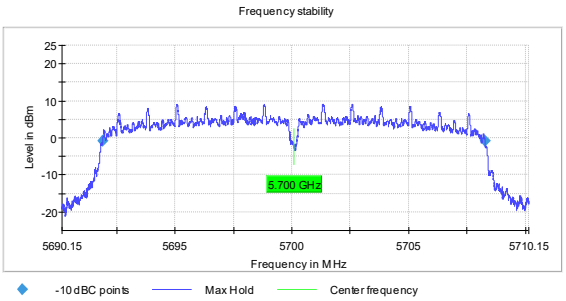
Carrier Frequency, F3: 5500 MHz, Max Temp, Min Voltage



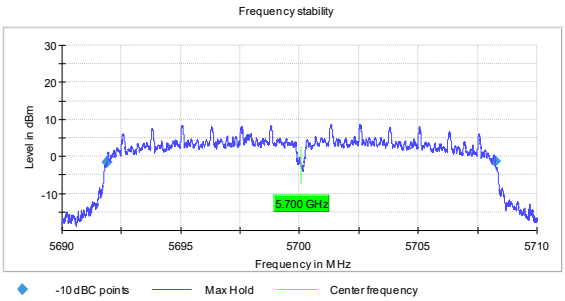
Carrier Frequency, F3: 5500 MHz, Min Temp, Max Voltage



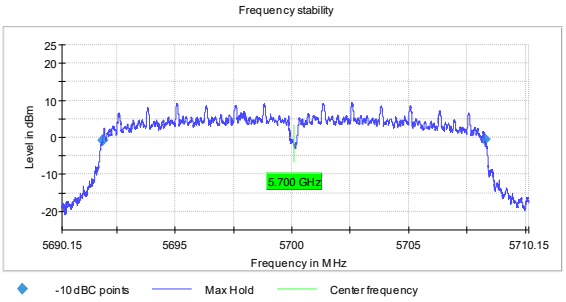
Carrier Frequency, F3: 5500 MHz, Max Temp, Max Voltage



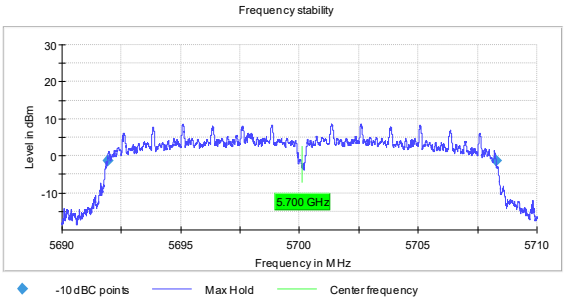
Carrier Frequency, F4: 5700 MHz, Min Temp, Min Voltage



Carrier Frequency, F4: 5700 MHz, Max Temp, Min Voltage



Carrier Frequency, F4: 5700 MHz, Min Temp, Max Voltage



Carrier Frequency, F4: 5700 MHz, Max Temp, Max Voltage

4.2 Nominal Channel Bandwidth and Occupied Bandwidth

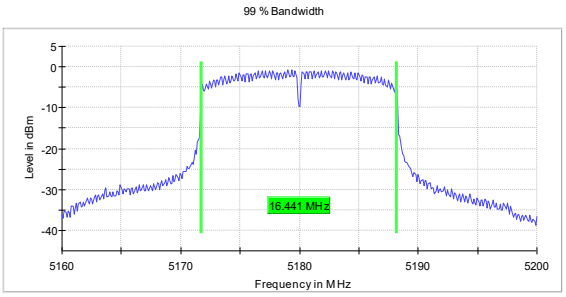
ETSI EN 301893 subclause 4.2.2

RF Carrier	Occupied Channel Bandwidth (MHz)								
	802.11a 6 Mbps	802.11n HT20 MSC0		802.11n HT40 MSC0		802.11ac HT40 MSC0		802.11ac HT40 MSC0	
	SISO	SISO	MIMO	SISO	MIMO	SISO	MIMO	SISO	MIMO
F1	16.4	17.6	17.4	36.0	35.9	36.1	35.9	75.0	75.0
F2	16.4	17.6	17.5	36.1	36.0	36.1	36.0	75.1	75.1
F3	16.5	17.6	17.6	36.2	35.9	36.2	35.9	75.4	75.4
F4	16.4	17.5	17.5	36.1	36.0	36.1	36.0	75.3	75.3
Measurement Uncertainty	±200 kHz								

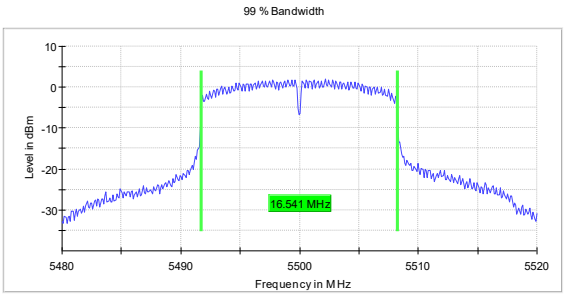
The measurement was performed conducted at normal test conditions.

Limits: Clause 4.2.2

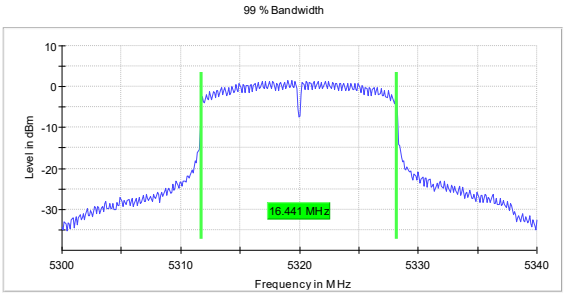
The Nominal Channel Bandwidth shall be in the range from 5 MHz to n*20 MHz (n=1,2,4,8).
The Occupied Channel Bandwidth shall be between 80% and 100% of the Nominal Channel Bandwidth.



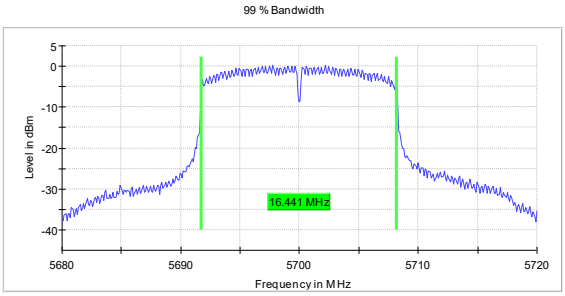
Occupied Bandwidth, F1: 5180 MHz, 802.11a 6Mbps



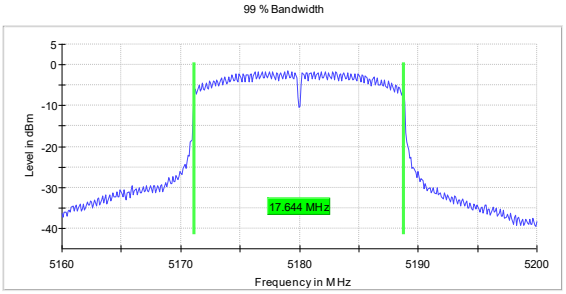
Occupied Bandwidth, F3: 5500 MHz, 802.11a 6Mbps



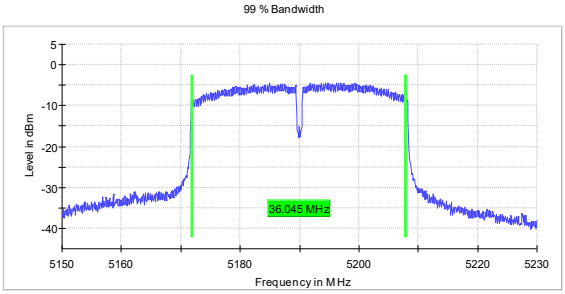
Occupied Bandwidth, F2: 5320 MHz, 802.11a 6Mbps



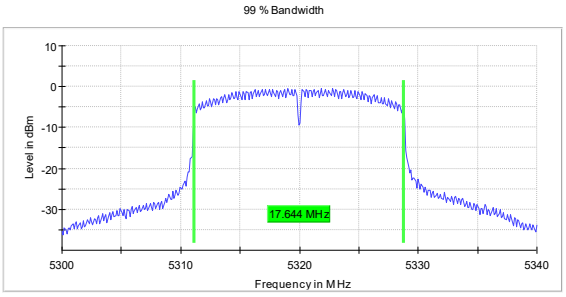
Occupied Bandwidth, F4: 5700 MHz, 802.11a 6Mbps



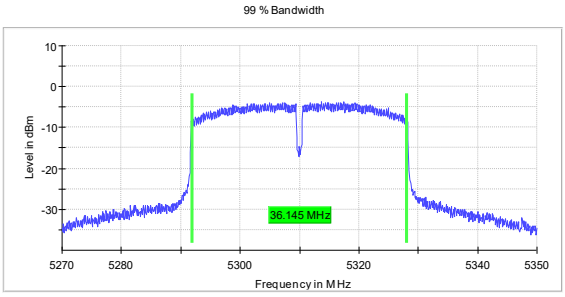
Occupied Bandwidth, F1: 5180 MHz, 802.11n HT20 MCS0, SISO



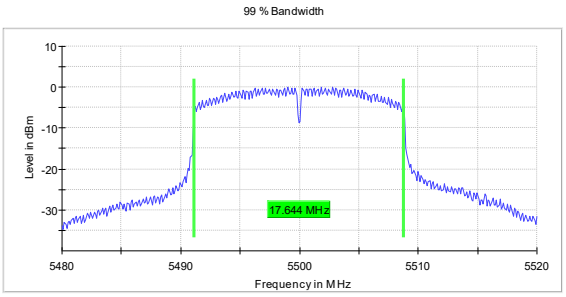
Occupied Bandwidth, F1: 5190 MHz, 802.11n HT40 MCS0, SISO



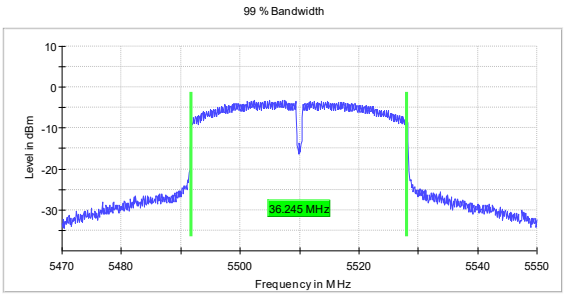
Occupied Bandwidth, F2: 5320 MHz, 802.11n HT20 MCS0, SISO



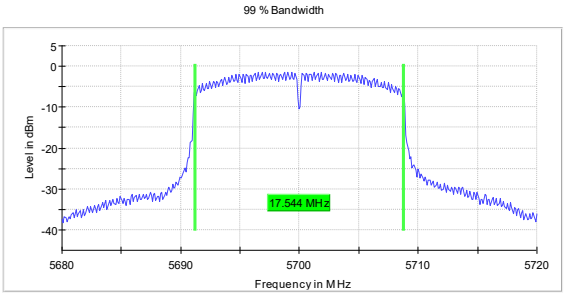
Occupied Bandwidth, F2: 5310 MHz, 802.11n HT40 MCS0, SISO



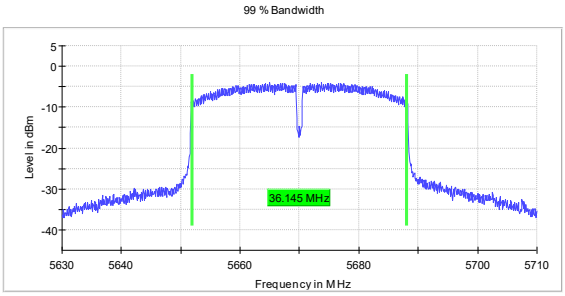
Occupied Bandwidth, F3: 5500 MHz, 802.11n HT20 MCS0, SISO



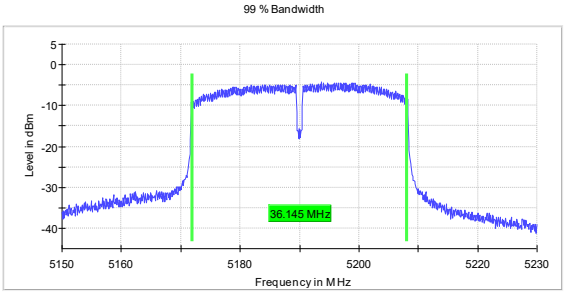
Occupied Bandwidth, F3: 5510 MHz, 802.11n HT40 MCS0, SISO



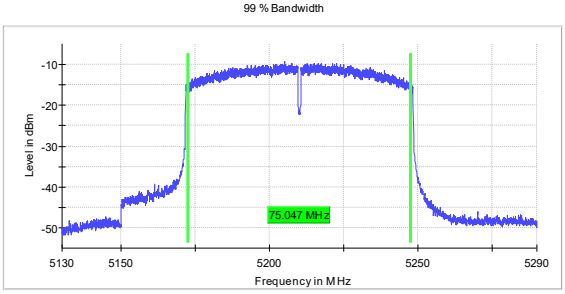
Occupied Bandwidth, F4: 5700 MHz, 802.11n HT20 MCS0, SISO



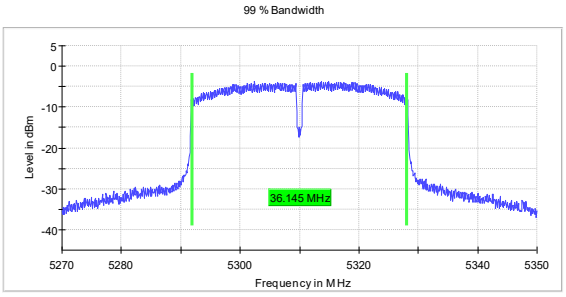
Occupied Bandwidth, F4: 5670 MHz, 802.11n HT40 MCS0, SISO



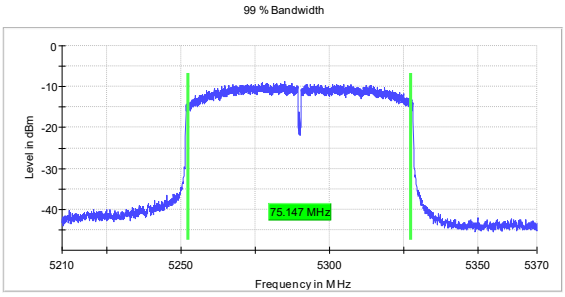
Occupied Bandwidth, F1: 5190 MHz, 802.11ac HT40 MCS0, SISO



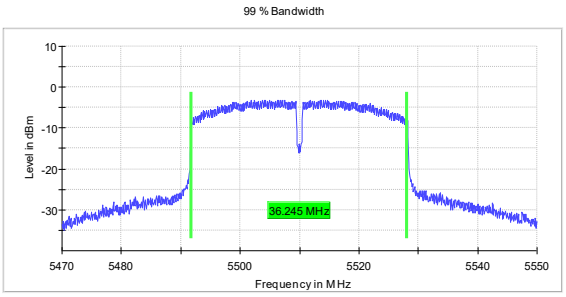
Occupied Bandwidth, F1: 5210 MHz, 802.11ac HT80 MCS0, SISO



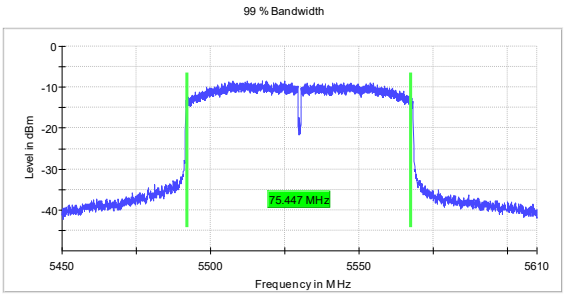
Occupied Bandwidth, F2: 5310 MHz, 802.11ac HT40 MCS0, SISO



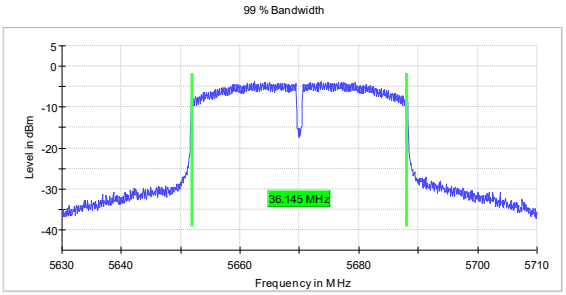
Occupied Bandwidth, F2: 5290 MHz, 802.11ac HT80 MCS0, SISO



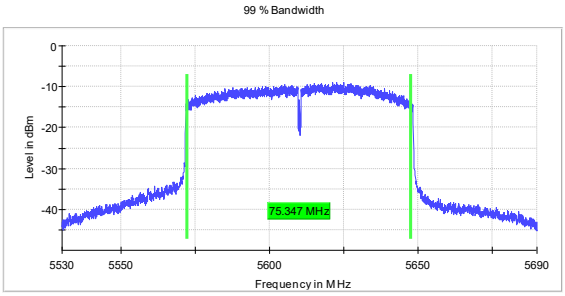
Occupied Bandwidth, F3: 5510 MHz, 802.11ac HT40 MCS0, SISO



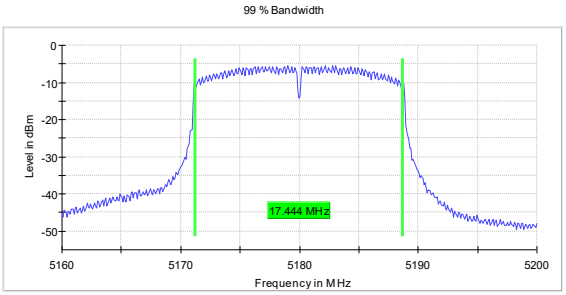
Occupied Bandwidth, F3: 5530 MHz, 802.11ac HT80 MCS0, SISO



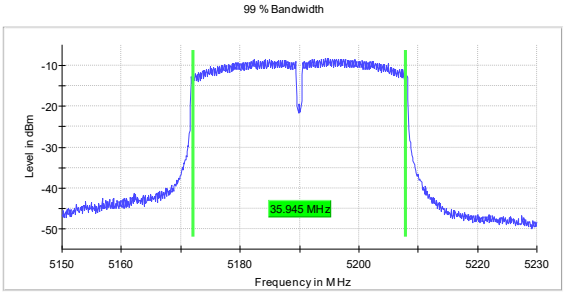
Occupied Bandwidth, F4: 5670 MHz, 802.11ac HT40 MCS0, SISO



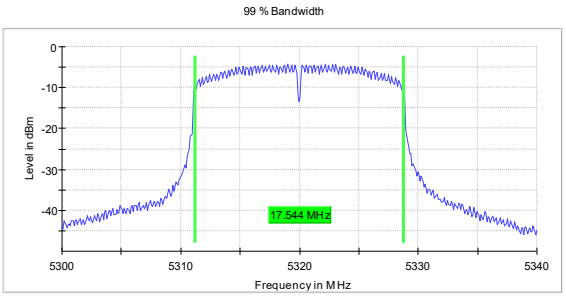
Occupied Bandwidth, F4: 5610 MHz, 802.11ac HT80 MCS0, SISO



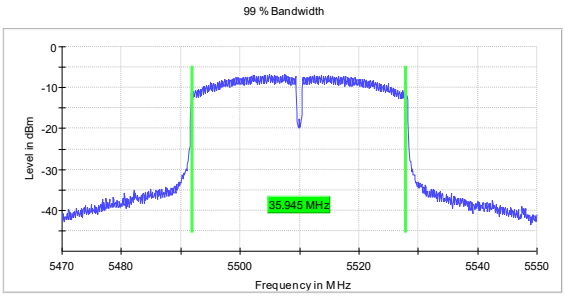
Occupied Bandwidth, F1: 5180 MHz, 802.11n HT20 MCS0, MIMO



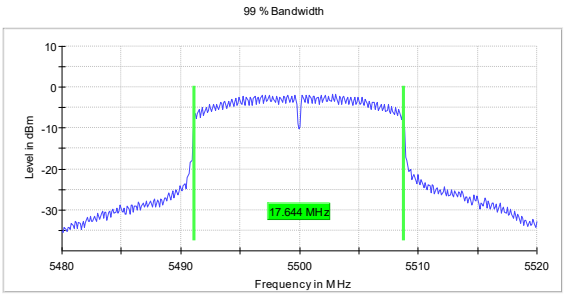
Occupied Bandwidth, F1: 5190 MHz, 802.11n HT40 MCS0, MIMO



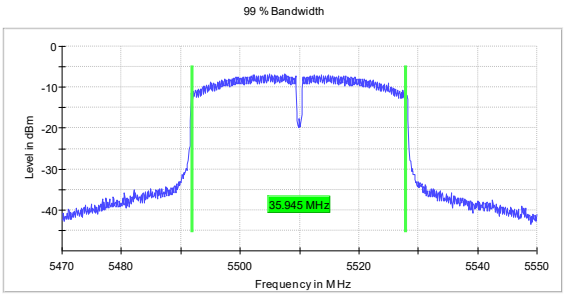
Occupied Bandwidth, F2: 5320 MHz, 802.11n HT20 MCS0, MIMO



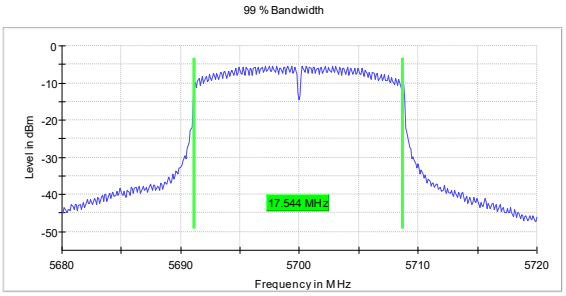
Occupied Bandwidth, F2: 5310 MHz, 802.11n HT40 MCS0, MIMO



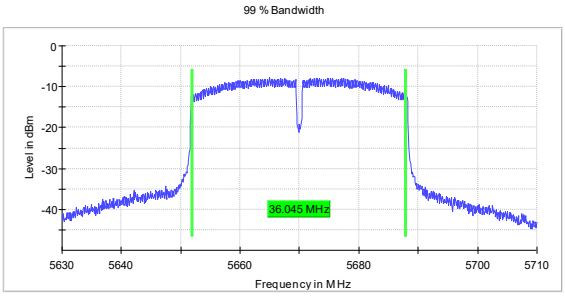
Occupied Bandwidth, F3: 5500 MHz, 802.11n HT20 MCS0, MIMO



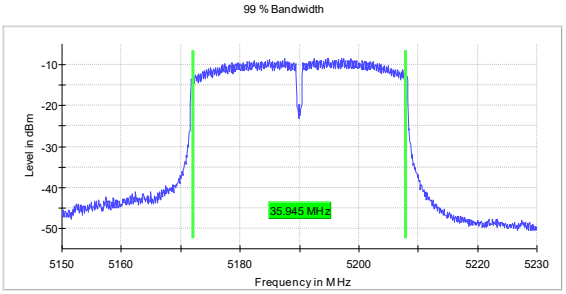
Occupied Bandwidth, F3: 5510 MHz, 802.11n HT40 MCS0, MIMO



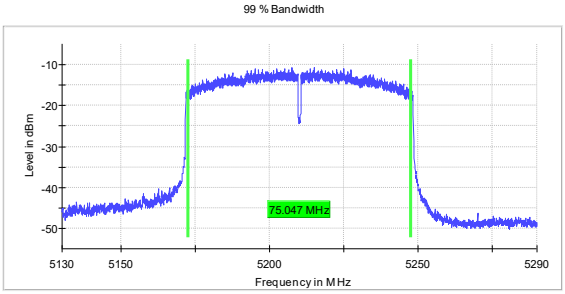
Occupied Bandwidth, F4: 5700 MHz, 802.11n HT20 MCS0, MIMO



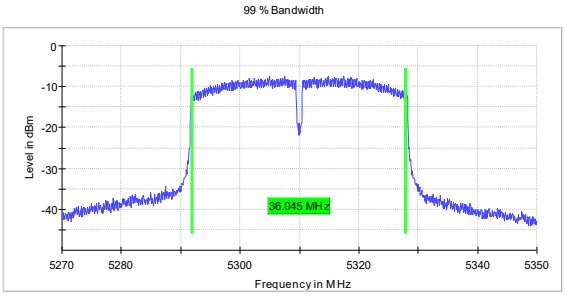
Occupied Bandwidth, F4: 5670 MHz, 802.11n HT40 MCS0, MIMO



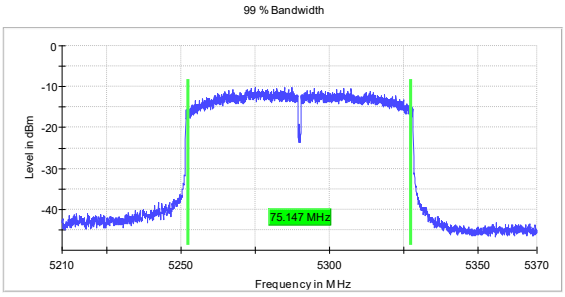
Occupied Bandwidth, F1: 5190 MHz, 802.11ac HT40 MCS0, MIMO



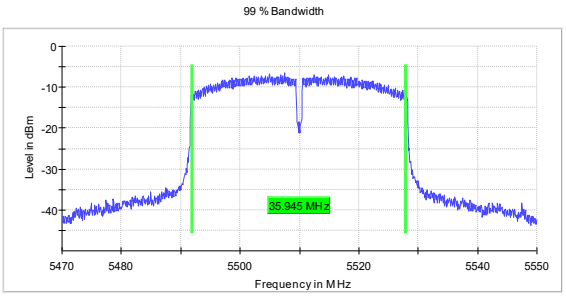
Occupied Bandwidth, F1: 5210 MHz, 802.11ac HT80 MCS0, MIMO



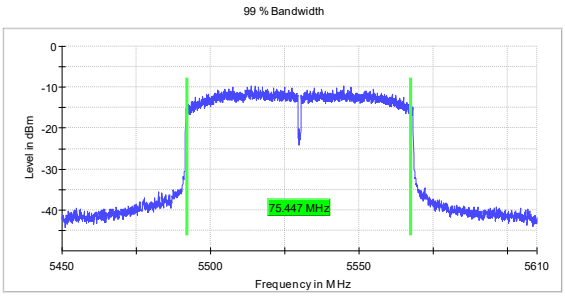
Occupied Bandwidth, F2: 5310 MHz, 802.11ac HT40 MCS0, MIMO



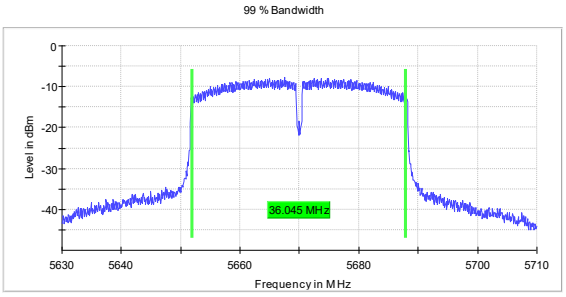
Occupied Bandwidth, F2: 5290 MHz, 802.11ac HT80 MCS0, MIMO



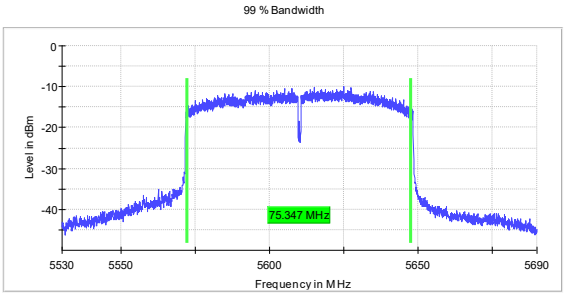
Occupied Bandwidth, F3: 5510 MHz, 802.11ac HT40 MCS0, MIMO



Occupied Bandwidth, F3: 5530 MHz, 802.11ac HT80 MCS0, MIMO



Occupied Bandwidth, F4: 5670 MHz, 802.11ac HT40 MCS0, MIMO



Occupied Bandwidth, F4: 5610 MHz, 802.11ac HT80 MCS0, MIMO

4.3 RF Output Power and Transmit Power Control

ETSI EN 301893 subclause 4.2.3

RF Carrier	Temperature	Voltage	RF Output Power (dBm)								
			802.11a 6M	802.11n HT20 MCS0		802.11n HT40 MCS0		802.11ac HT40 MCS0		802.11ac HT80 MCS0	
			SISO	SISO	MIMO	SISO	MIMO	SISO	MIMO	SISO	MIMO
F1	Nominal	Normal	19.3	18.8	18.7	19.0	18.6	19.2	18.7	19.0	18.6
	Min.	Min.	20.4	20.1	19.4	19.7	19.2	19.7	19.3	19.4	19.1
		Max.	20.4	20.2	19.4	19.8	19.2	19.7	19.2	19.5	19.1
	Max.	Min.	19.2	19.1	17.7	18.8	17.4	18.5	17.6	18.6	17.2
		Max.	19.0	19.0	17.8	18.5	17.5	18.5	17.6	18.4	17.3
F2	Nominal	Normal	21.3	19.7	18.7	19.5	18.5	19.5	18.7	19.5	18.7
	Min.	Min.	20.1	19.9	18.7	19.5	18.8	19.5	18.8	19.2	18.7
		Max.	20.1	20.1	18.7	19.6	18.8	19.5	19.0	19.3	18.7
	Max.	Min.	18.8	19.0	17.0	18.6	17.1	18.4	17.3	19.0	17.5
		Max.	18.7	18.5	17.0	18.4	17.0	18.4	17.3	18.9	17.3
F3	Nominal	Normal	21.6	20.0	18.7	19.8	18.4	20.0	18.6	19.6	18.5
	Min.	Min.	20.0	19.8	17.1	19.5	17.3	19.3	17.4	19.4	16.9
		Max.	20.1	20.0	17.1	19.5	17.3	19.5	17.4	19.5	17.0
	Max.	Min.	18.9	19.0	17.2	18.7	17.2	18.5	17.3	18.6	16.9
		Max.	18.9	18.8	17.2	18.5	17.1	18.5	17.3	18.4	17.0
F4	Nominal	Normal	20.2	18.9	17.6	19.3	18.2	19.5	18.3	19.2	18.2
	Min.	Min.	19.6	19.4	18.8	19.4	18.7	19.4	18.8	19.2	18.5
		Max.	19.6	19.5	18.9	19.5	18.7	19.4	18.8	19.3	18.5
	Max.	Min.	18.6	18.7	17.1	18.8	17.2	18.7	17.3	18.6	17.4
		Max.	18.7	18.5	17.1	18.6	17.1	18.6	17.2	18.5	17.4
Measurement Uncertainty U_{95}			+1.6 / -1.9 dB								

The EUT was programmed to transmit continuously during testing (duty cycle = 100%).

The measurement was performed with an RMS Power Meter.

Limits: Clause 4.2.3

Mean EIRP limits for RF Output Power at the Highest Power Level:

5150 to 5350 MHz: 23 dBm
5470 to 5725 MHz: 30 dBm (for devices with radar detection function)
23 dBm (for Slave devices without radar detection function)

Mean EIRP limits for RF Output Power at the Lowest Power Level of the TPC range:

5150 to 5350 MHz: 17 dBm
5470 to 5725 MHz: 24 dBm (for devices with radar detection function)
17 dBm (for Slave devices without radar detection function)

4.4 Power Density

ETSI EN 301893 subclause 4.2.3

RF Carrier	Power Density (dBm)						
	802.11g 6 Mbps	802.11n HT20 MSC0		802.11ac HT40 MSC0		802.11ac HT80 MSC0	
	SISO	SISO	MIMO	SISO	MIMO	SISO	MIMO
F1	7.9	7.6	7.3	4.9	6.6	3.9	2.9
F2	9.0	8.7	7.5	5.5	6.7	4.4	2.1
F3	9.4	9.0	7.6	6.1	6.9	4.5	2.6
F4	8.0	7.7	6.3	5.5	6.4	3.9	2.4
Measurement Uncertainty U_{95}	+1.6 / -1.9 dB						

The EUT was programmed to transmit continuously during testing (duty cycle = 100%).

The tested EUT is a slave device without radar detection.

Limits: Clause 4.2.3.1.3

Mean EIRP limit for Power Density at the highest Power Level:	
5150 to 5350 MHz:	10 dBm/MHz (EUT with TPC) 7 dBm/MHz (EUT without TPC) 10 dBm/MHz (EUT without TPC, for emissions completely within the 5150-5250 MHz band)
5470 to 5725 MHz:	17 dBm/MHz (for devices with radar detection function) 10 dBm/MHz (for Slave devices without radar detection function)

4.5 Transmitter unwanted emissions outside the 5 GHz RLAN bands

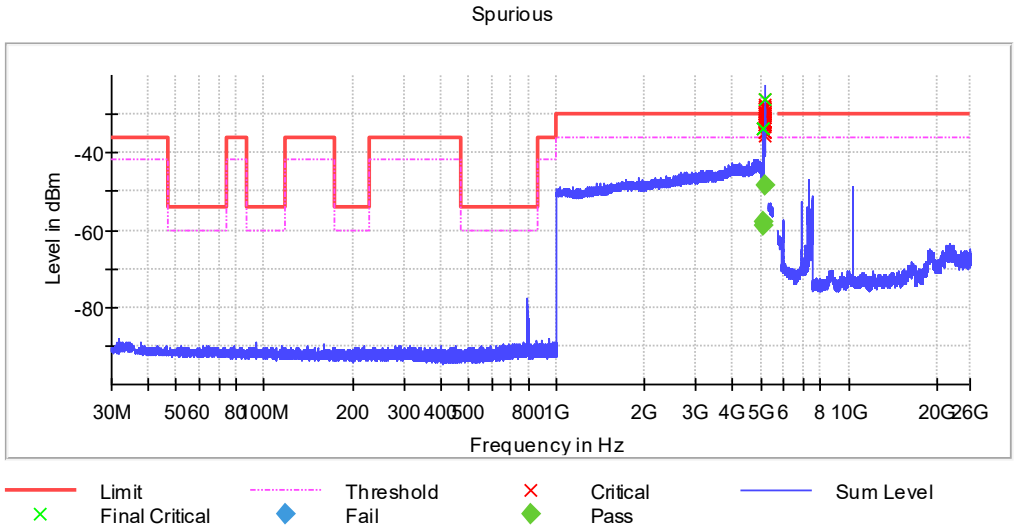
ETSI EN 301893 subclause 4.2.4.1

Frequency	Modulation Type	Spurious Emission Level
30 – 1000 MHz (all limit: -54 dBm)	802.11n HT20	< -54 dBm
30 – 1000 MHz (all limit: -36 dBm)	802.11n HT20	< -36 dBm
1000 – 26000 MHz	802.11n HT20	< -40 dBm
Measurement Uncertainty	25 MHz – 1 GHz - +1,9/-2,4 dB 1 – 8 GHz - +1,8/-2,1 dB 8 – 18 GHz - +1,9/-2,4 dB	

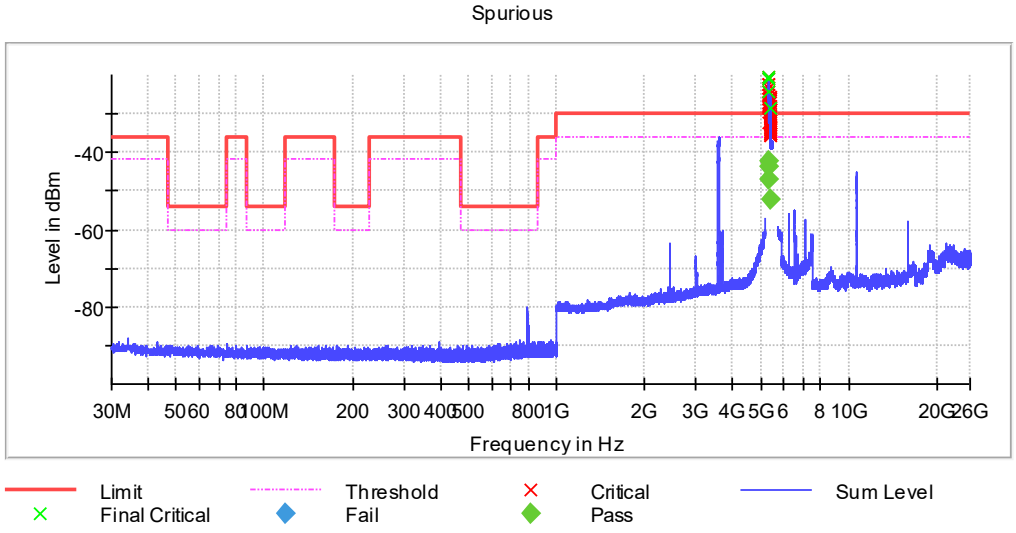
Limits: Clause 4.2.4.1

Frequency Range	Maximum Power	Bandwidth
30 – 1000 MHz	-36 dBm	100 kHz
1 – 5.15 GMHz	-30 dBm	1 MHz
5.35 – 5.47 GHz		
5.725 – 26 GHz		
Except the following bands:		
47 – 74 MHz	-54 dBm	100 kHz
87.5 – 118 MHz		
174 – 230 MHz		
470 – 862 MHz		

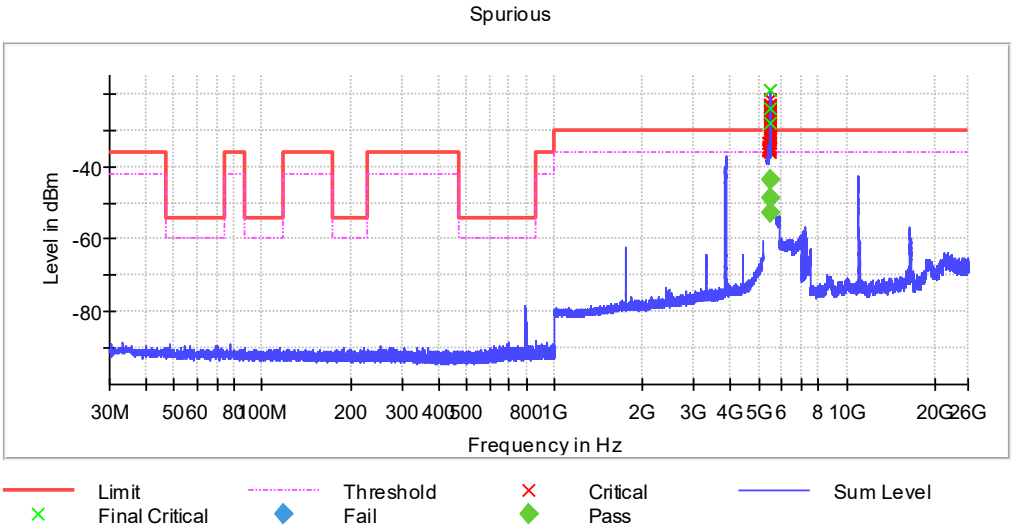
In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.



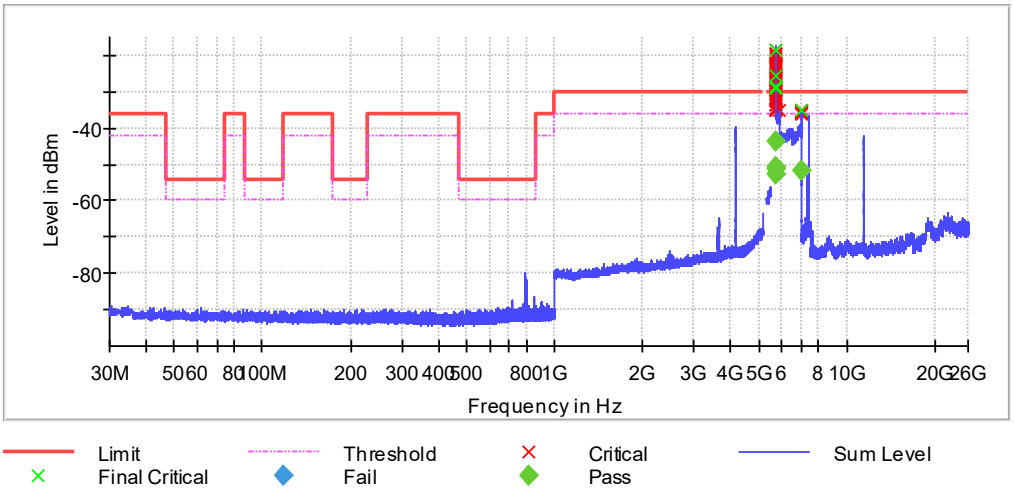
Spurious Emissions, Conducted, 5180 MHz, 802.11a 6M



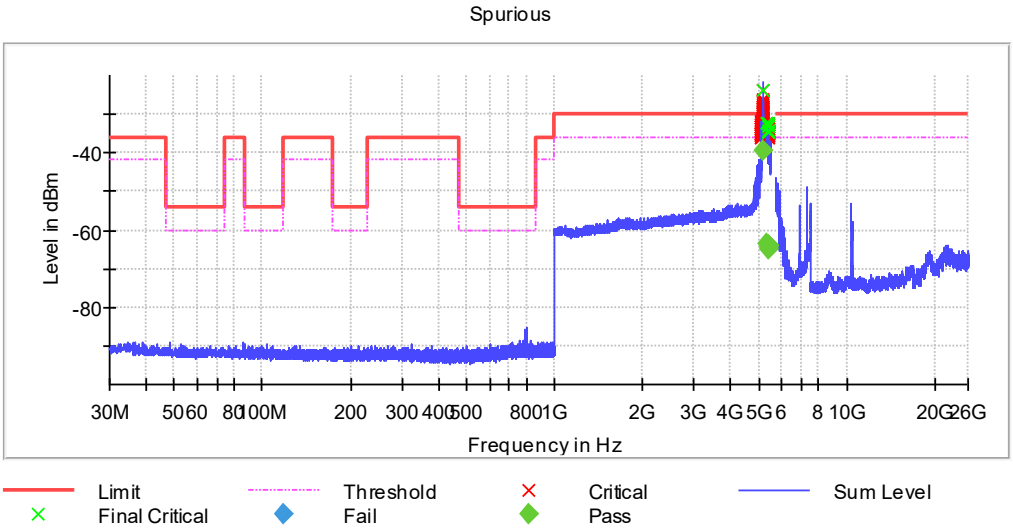
Spurious Emissions, Conducted, 5320 MHz, 802.11a 6M



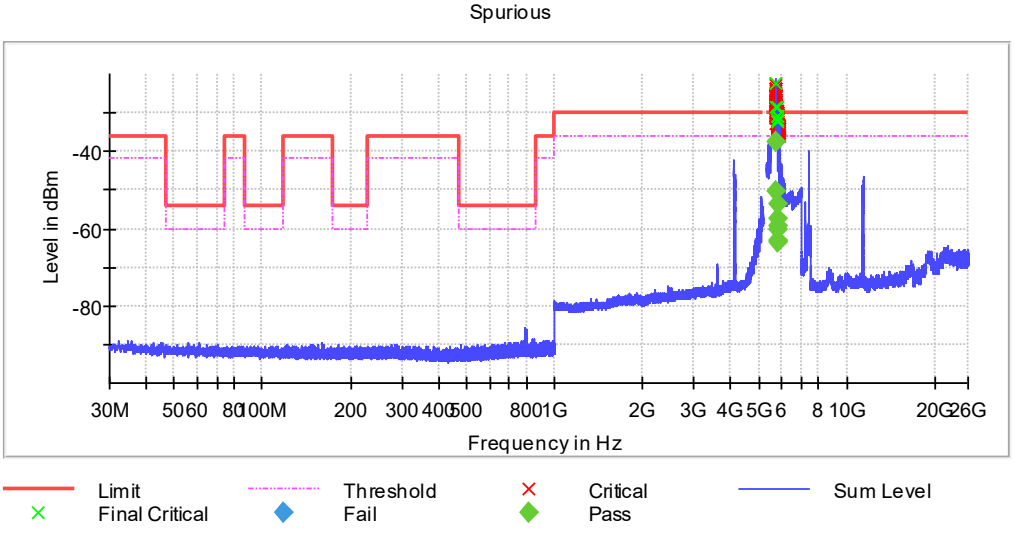
Spurious Emissions, Conducted, 5500 MHz, 802.11a 6M



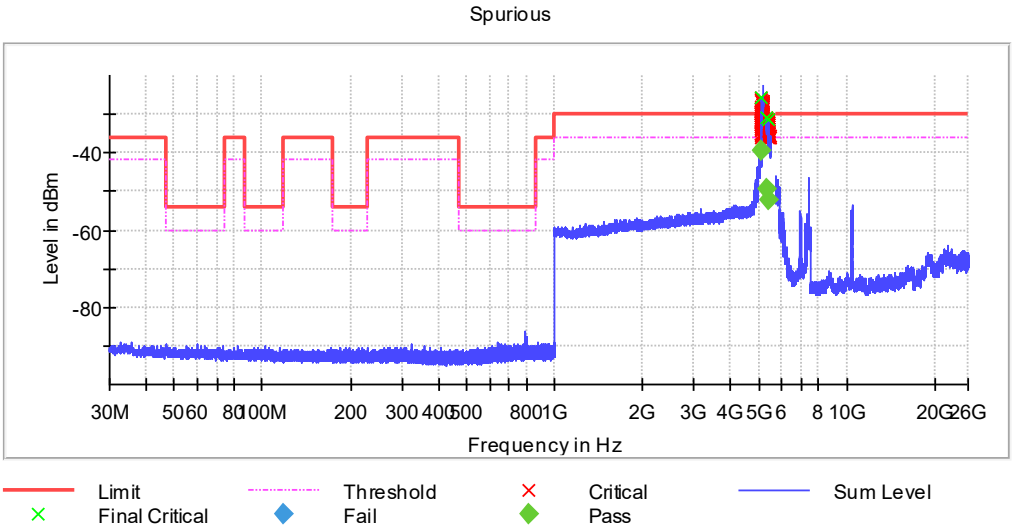
Spurious Emissions, Conducted, 5700 MHz, 802.11a 6M



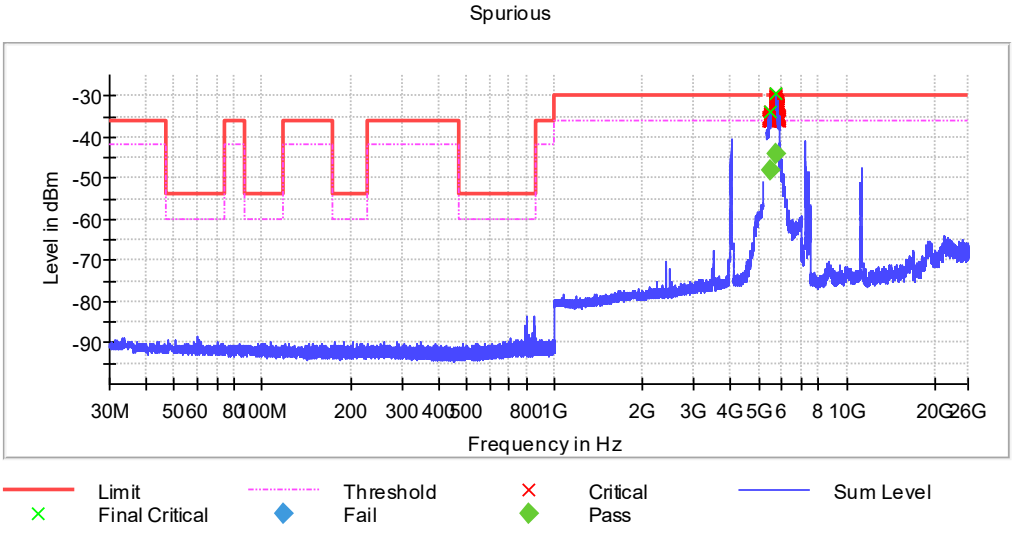
Spurious Emissions, Conducted, 5190 MHz, 802.11ac HT40 MCS0, SISO



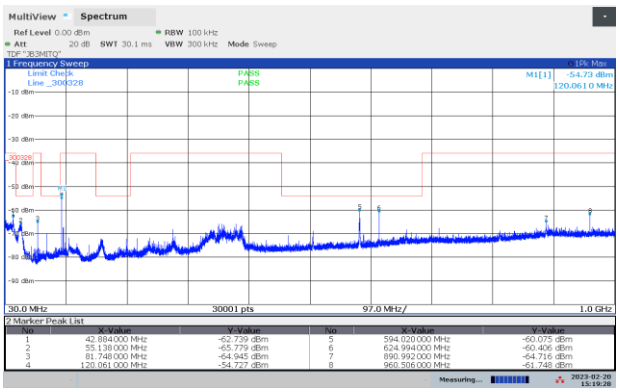
Spurious Emissions, Conducted, 5680 MHz, 802.11ac HT40 MCS0, SISO



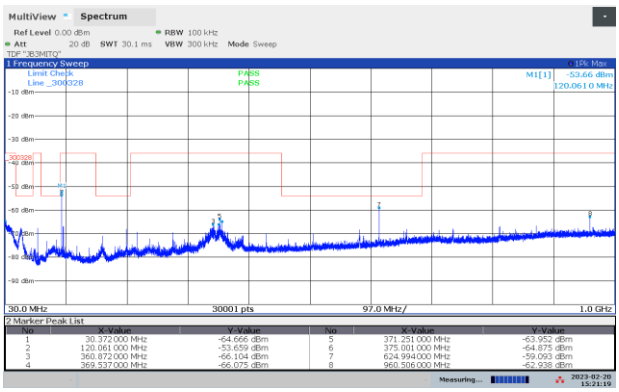
Spurious Emissions, Conducted, 5210 MHz, 802.11ac HT80 MCS0, SISO



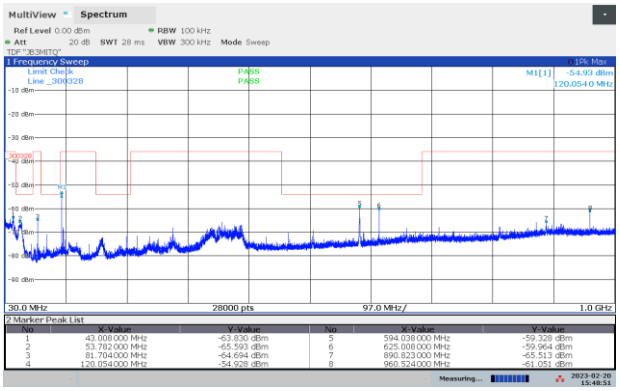
Spurious Emissions, Conducted, 5610 MHz, 802.11ac HT80 MCS0, SISO



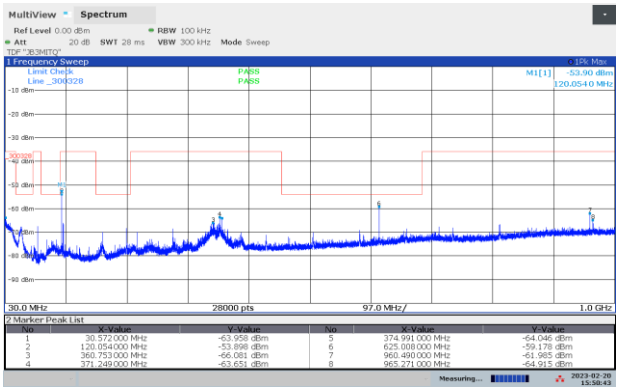
Spurious Emissions, 30 – 1000 MHz, 5180 MHz



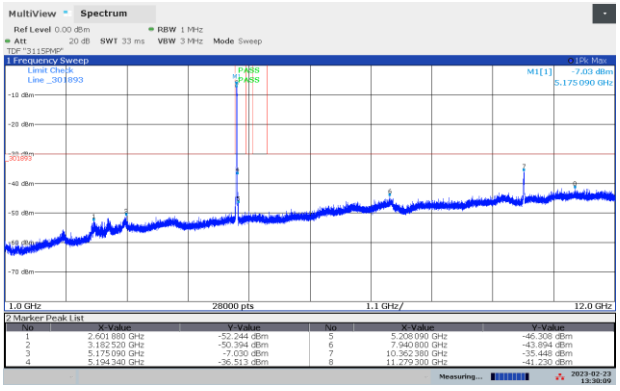
HP



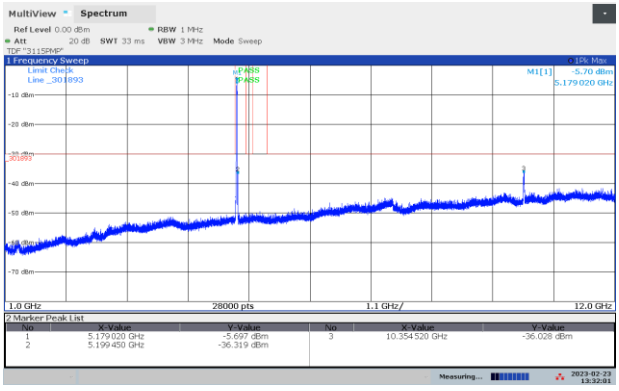
Spurious Emissions, 30 – 1000 MHz, 5700 MHz



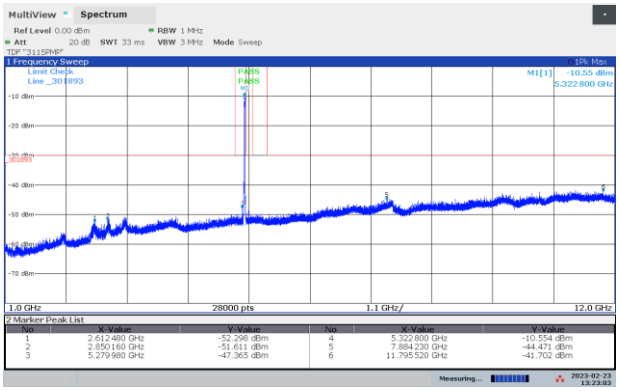
HP



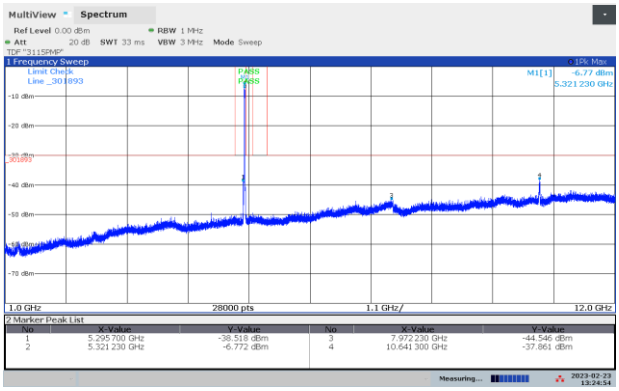
Radiated Emissions, 1000 - 12000 MHz, 5180 MHz, 11a 6M, VP



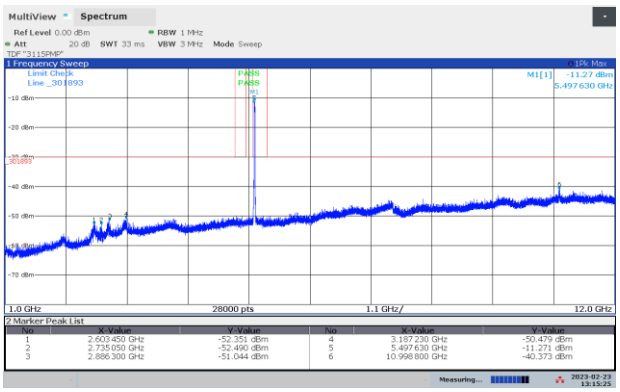
HP



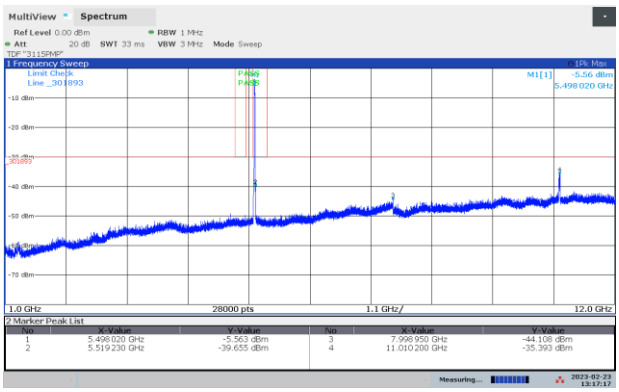
Radiated Emissions, 1000 - 12000 MHz, 5320 MHz, 11a 6M, VP



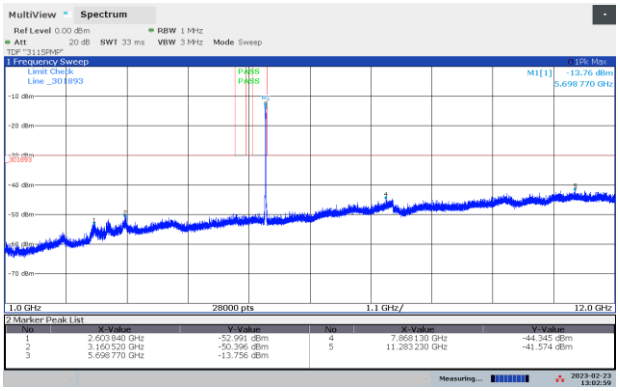
HP



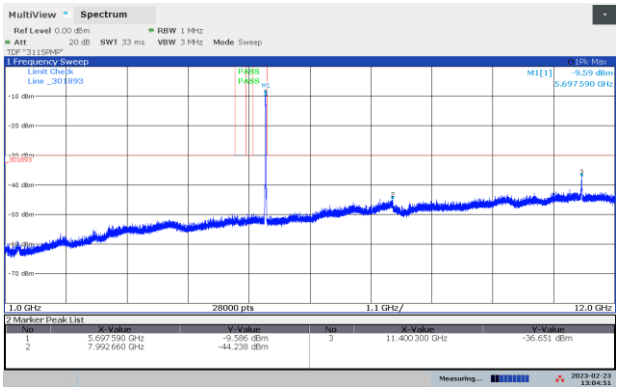
Radiated Emissions, 1000 - 12000 MHz, 5500 MHz, 11a 6M, VP



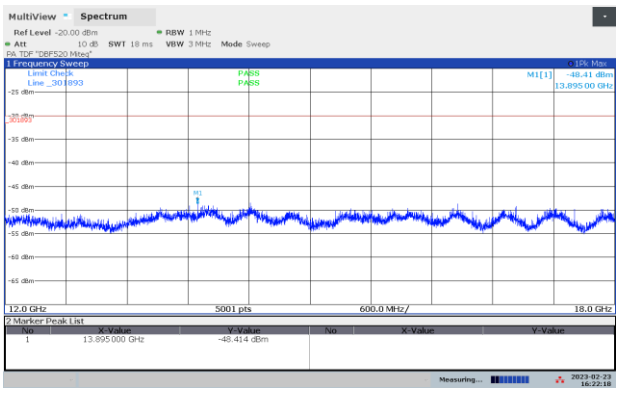
HP



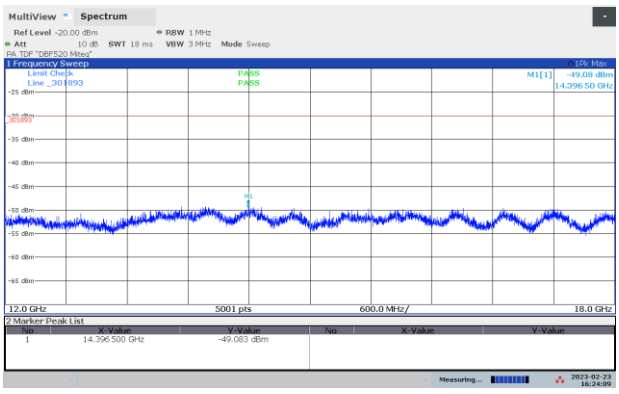
Radiated Emissions, 1000 - 12000 MHz, 5700 MHz, 11a 6M, VP



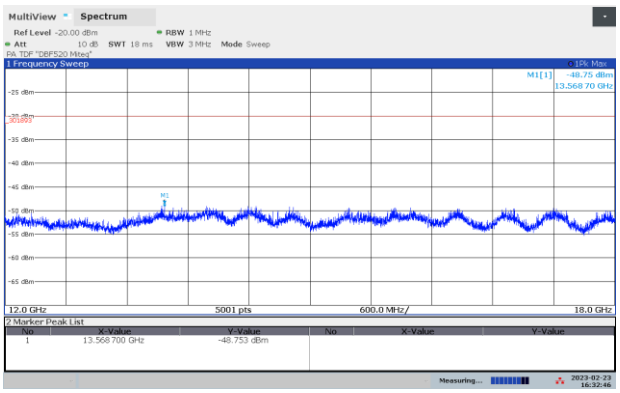
HP



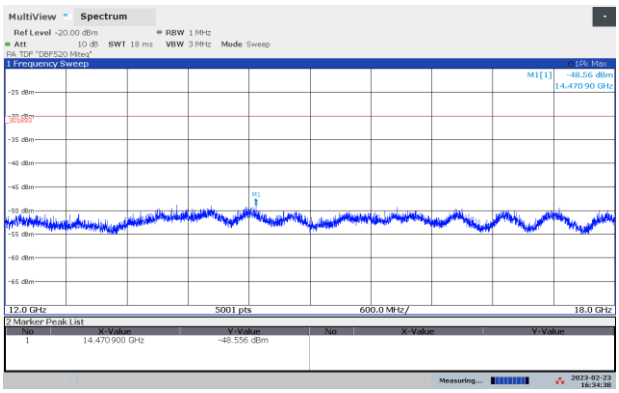
Radiated Emissions, 12000 - 18000 MHz, 5180 MHz, 11a 6M, VP



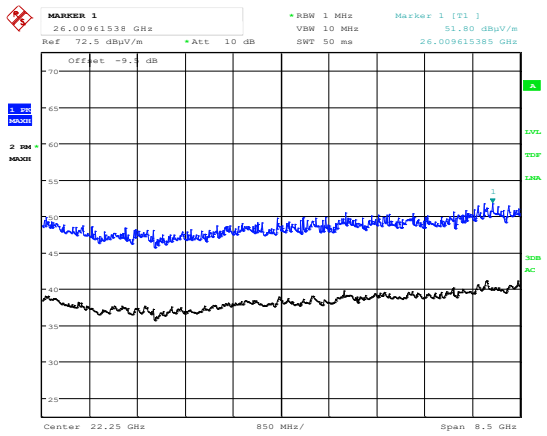
HP



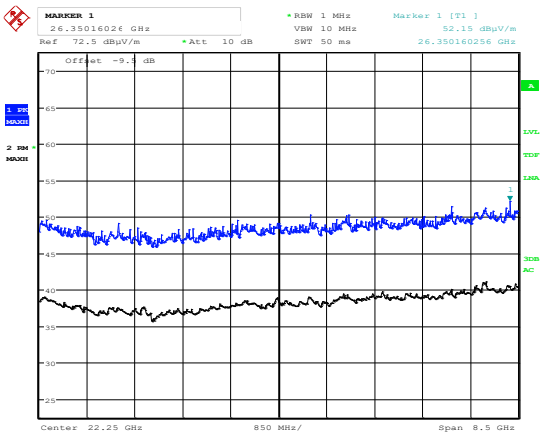
Radiated Emissions, 12000 - 18000 MHz, 5700MHz, 11a 6M, VP



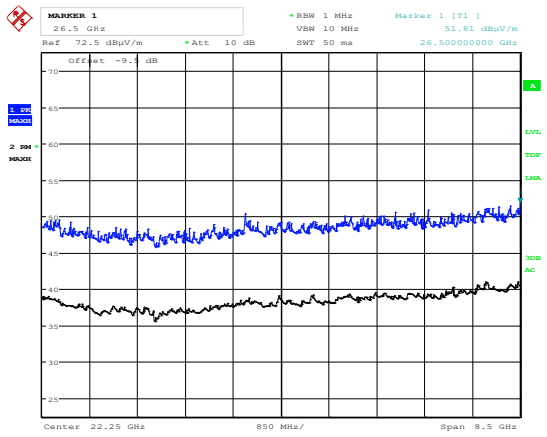
HP



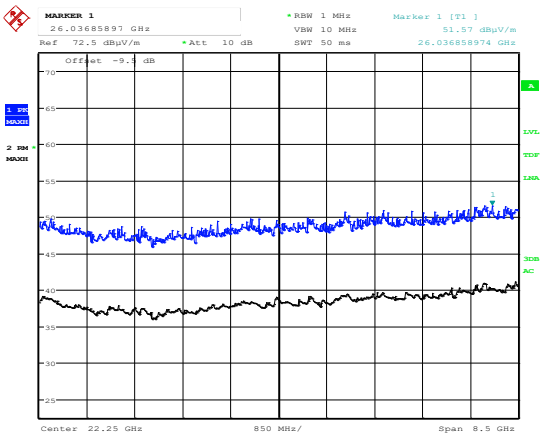
Pre-Scan @1m, 18000 - 26000 MHz, 5280MHz, 11n HT20 MIMO, VP



HP



Pre-Scan @1m, 18000 - 26000 MHz, 5580MHz, 11n HT20 MIMO, VP



HP

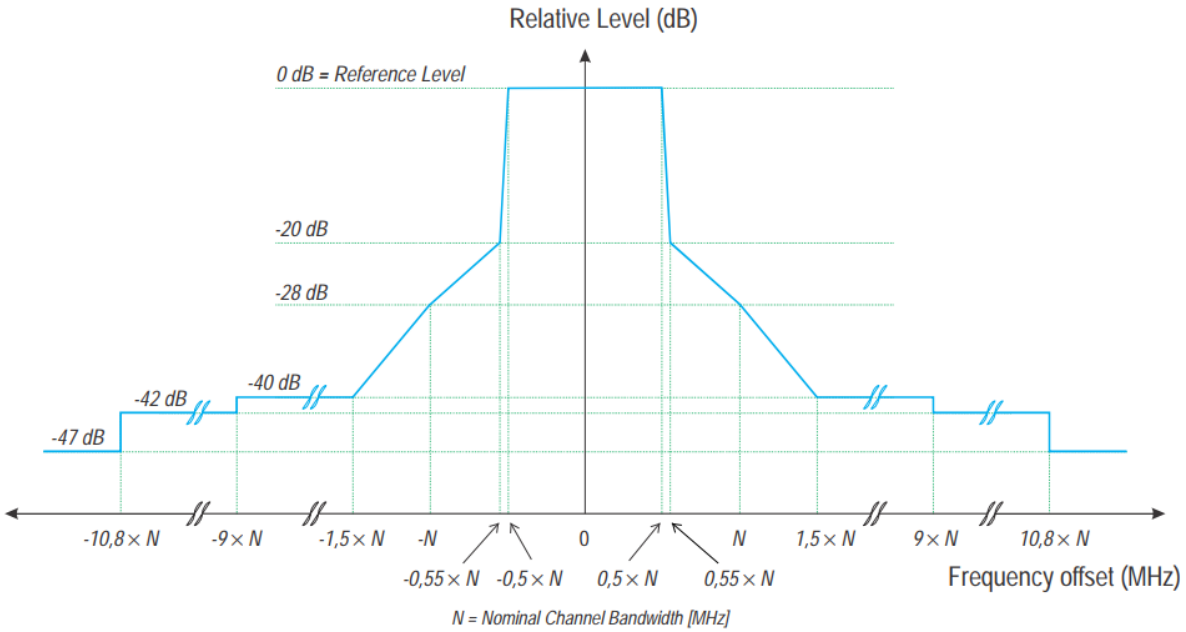
4.6 Transmitter unwanted emissions within the 5 GHz RLAN bands

ETSI EN 301893 subclause 4.2.4.2

All emisisons are below the limit. See plots.

Nominal Channel Bandwidth N = 20/40/80 MHz

Limits: Clause 4.2.4.2



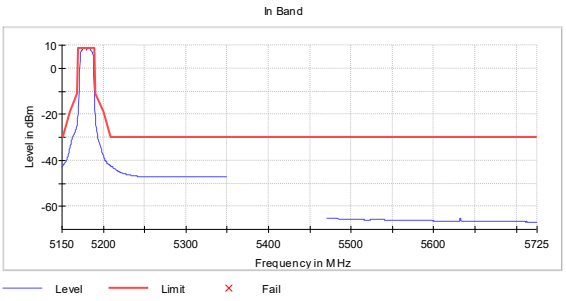
The mean Power Density (measured with a 1 MHz measurement bandwidth) of the transmitter unwanted emissions within the 5 GHz RLAN bands shall not exceed the limits of the mask provided in figure 1 or an absolute level of -30 dBm/MHz, whichever is greater. The limits in figure 1 are relative to the maximum Power Density of the RLAN device when measured with a reference bandwidth of 1 MHz.

The mask is only applicable within the band of operation. Beyond the band edges the requirements of clause 4.2.4.1 apply.

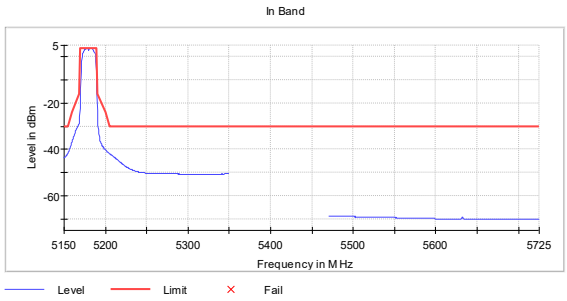
In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet the limits provided in figure 1.

For transmitter unwanted emissions within the 5 GHz RLAN bands, simultaneous transmissions in adjacent channels may be considered as one signal with an actual *Nominal Channel Bandwidth* of "n" times the individual *Nominal Channel Bandwidth* where "n" is the number of adjacent channels used simultaneously.

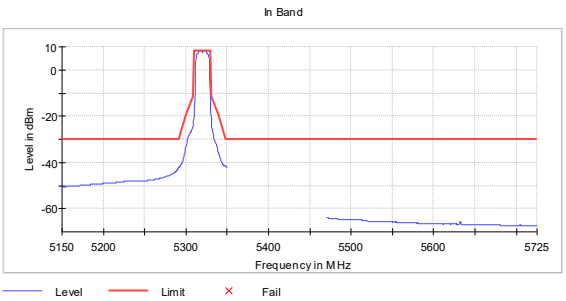
For simultaneous transmissions in multiple non-adjacent channels, the overall transmit spectral power mask is constructed in the following manner. First, a mask as provided in figure 1 is applied to each of the channels. Then, for each frequency point, the greatest value from the spectral masks of all the channels assessed shall be taken as the overall spectral mask requirement at that frequency.



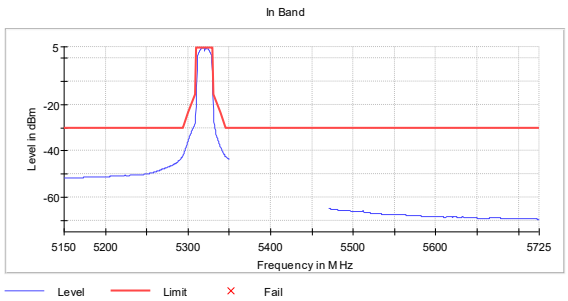
In Band Emissions, F1: 5180 MHz, 802.11a, 6Mbps



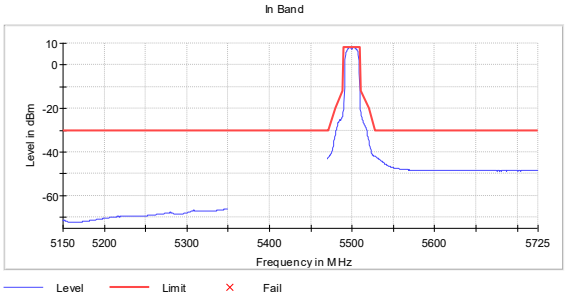
In Band Emissions, F1: 5180 MHz, 802.11n, MCS0, MIMO



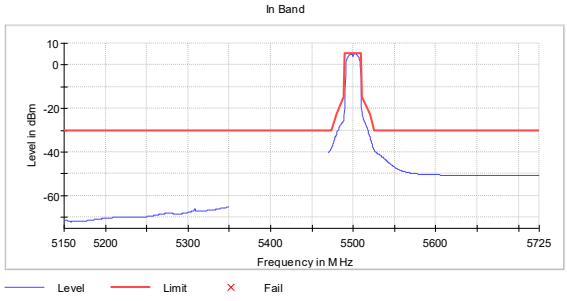
In Band Emissions, F2: 5320 MHz, 802.11a, 6Mbps



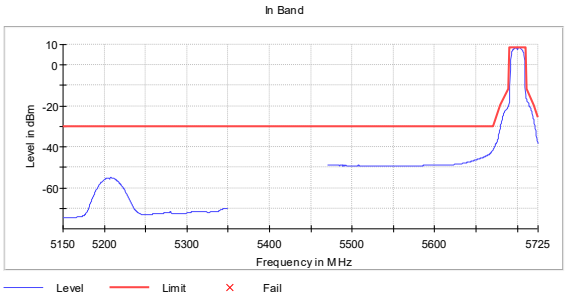
In Band Emissions, F2: 5320 MHz, 802.11n, MCS0, MIMO



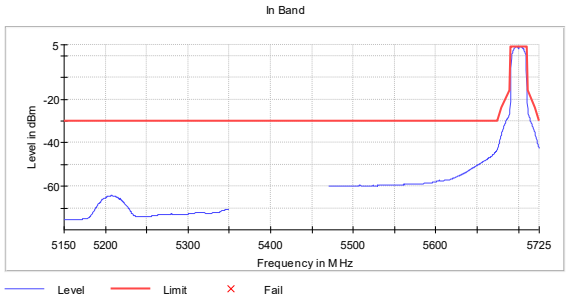
In Band Emissions, F3: 5500 MHz, 802.11a, 6Mbps



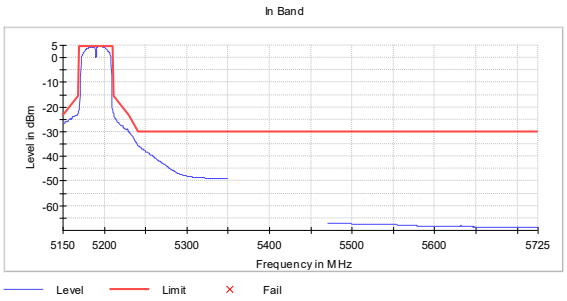
In Band Emissions, F3: 5500 MHz, 802.11n, MCS0, MIMO



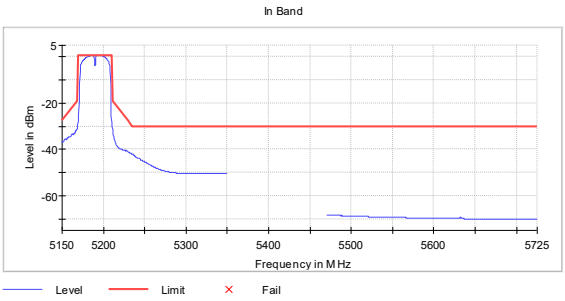
In Band Emissions, F4: 5700 MHz, 802.11a, 6Mbps



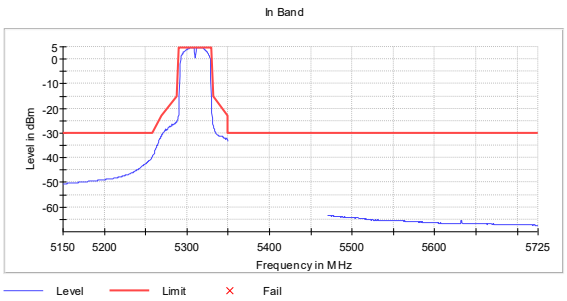
In Band Emissions, F4: 5700 MHz, 802.11n, MCS0, MIMO



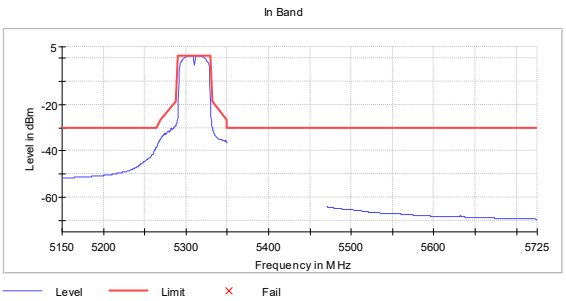
In Band Emissions, F1: 5190 MHz, 802.11ac HT40 MCS0, SISO



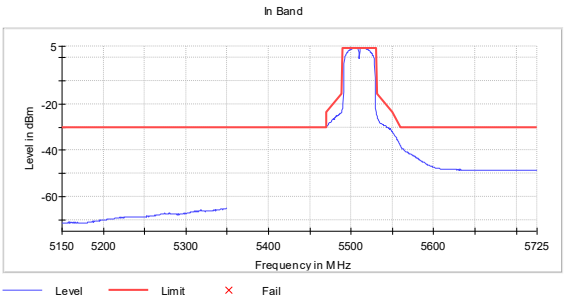
In Band Emissions, F1: 5190 MHz, 802.11n HT40 MCS0, MIMO



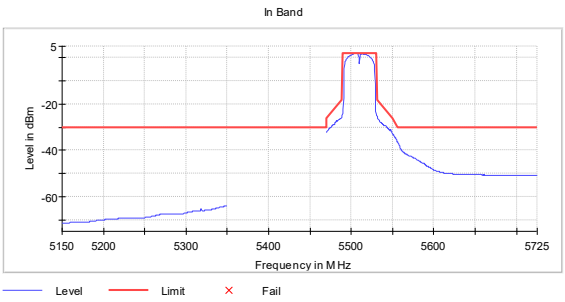
In Band Emissions, F1: 5310 MHz, 802.11ac HT40 MCS0, SISO



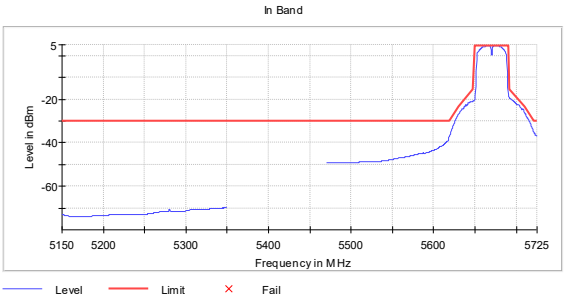
In Band Emissions, F2: 5310 MHz, 802.11n HT40 MCS0, MIMO



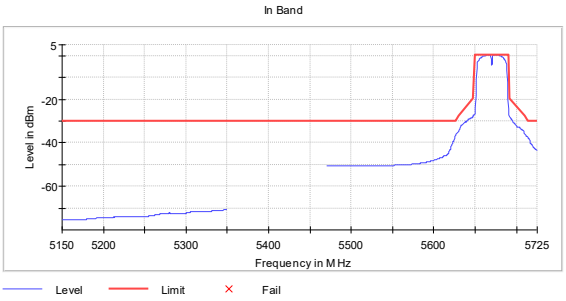
In Band Emissions, F1: 5510 MHz, 802.11ac HT40 MCS0, SISO



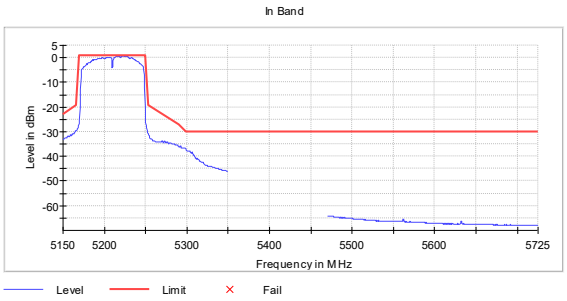
In Band Emissions, F3: 5510 MHz, 802.11n HT40 MCS0, MIMO



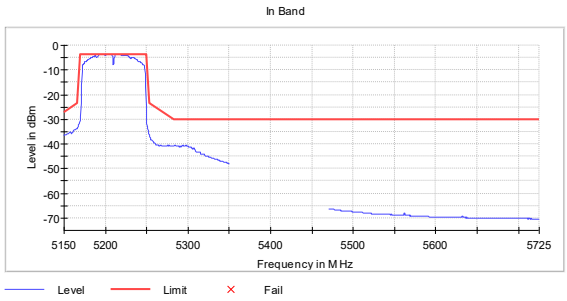
In Band Emissions, F4: 5670 MHz, 802.11ac HT40 MCS0, SISO



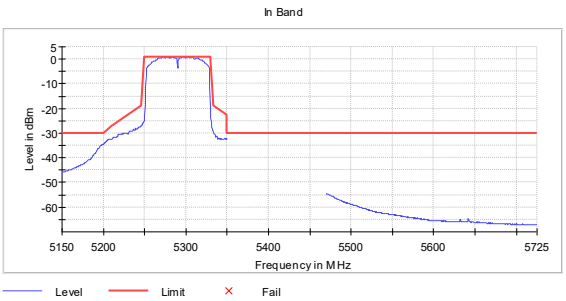
In Band Emissions, F4: 5670 MHz, 802.11ac HT40 MCS0, MIMO



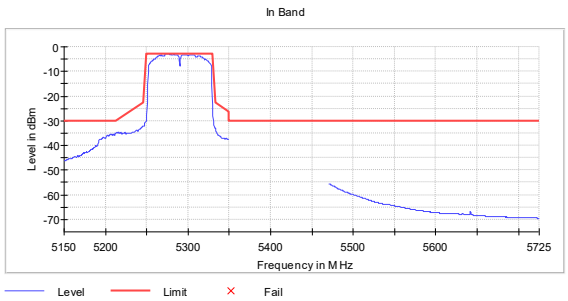
In Band Emissions, F1: 5210 MHz, 802.11ac HT80 MCS0, SISO



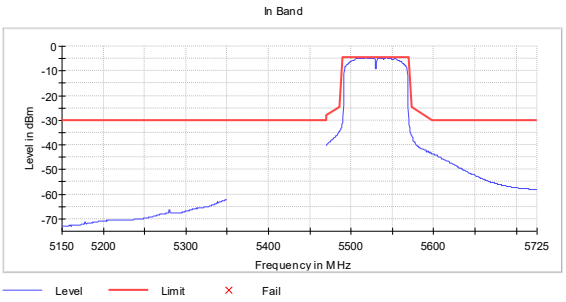
In Band Emissions, F1: 5210 MHz, 802.11ac HT80 MCS0, MIMO



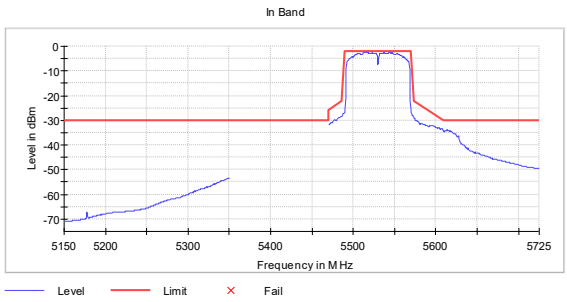
In Band Emissions, F2: 5290 MHz, 802.11ac HT80 MCS0, SISO



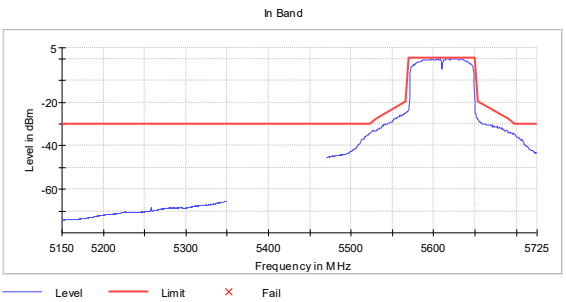
In Band Emissions, F2: 5290 MHz, 802.11ac HT80 MCS0, MIMO



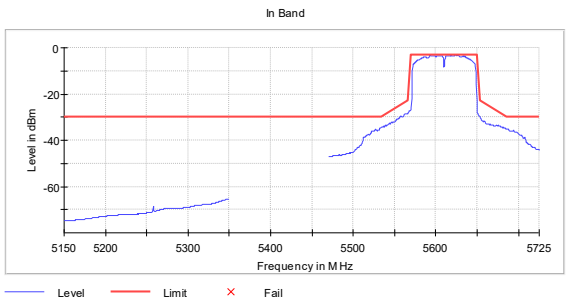
In Band Emissions, F3: 5530 MHz, 802.11ac HT80 MCS0, SISO



In Band Emissions, F3: 5530 MHz, 802.11ac HT80 MCS0, MIMO



In Band Emissions, F4: 5610 MHz, 802.11ac HT80 MCS0, SISO



In Band Emissions, F4: 5610 MHz, 802.11ac HT80 MCS0, MIMO

4.7 Receiver spurious emissions

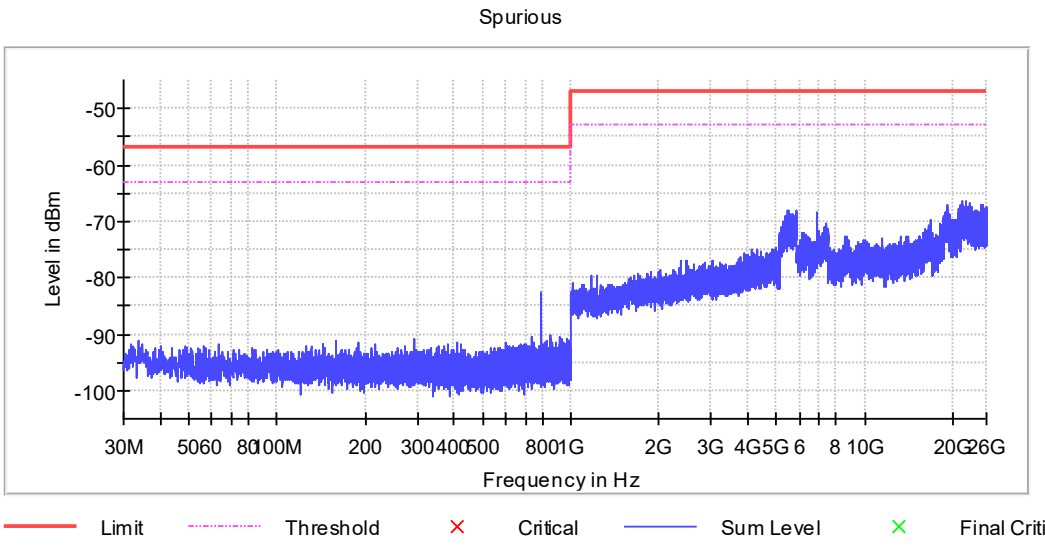
ETSI EN 301893 subclause 4.2.5

Frequency (MHz)	Spurious Emission Level (dBm)
30 – 1000	< -57
1000 - 26000	< -47
Measurement Uncertainty	**25 – 1GHz - +1,9/-2,4 dB 1 – 8 GHz - +1,8/-2,1 dB 8 – 18 GHz - +1,9/-2,4 dB**

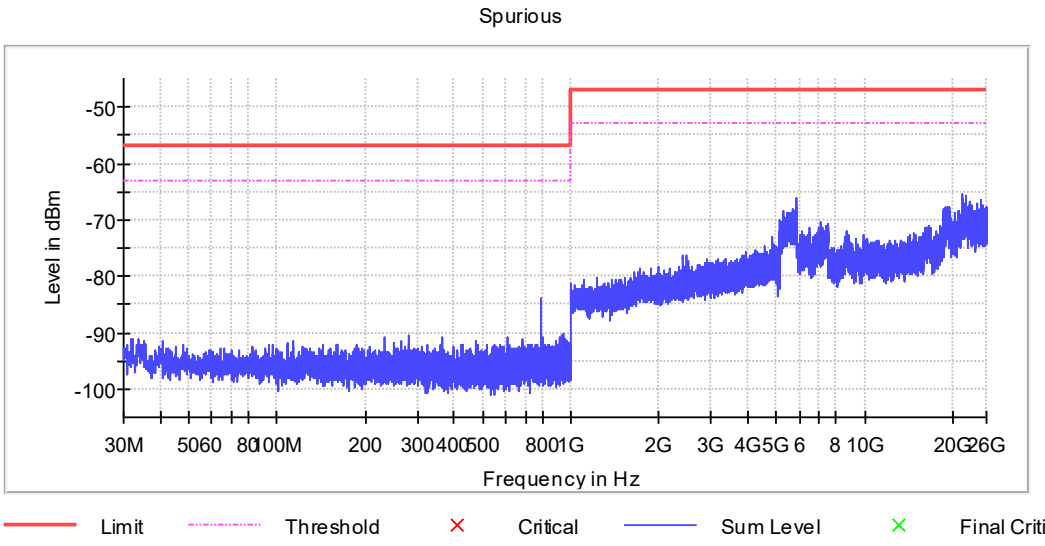
Radiated Tests were perfomed with the antenna connectors terminated in 50 Ohm.

Limits: Clause 4.2.5

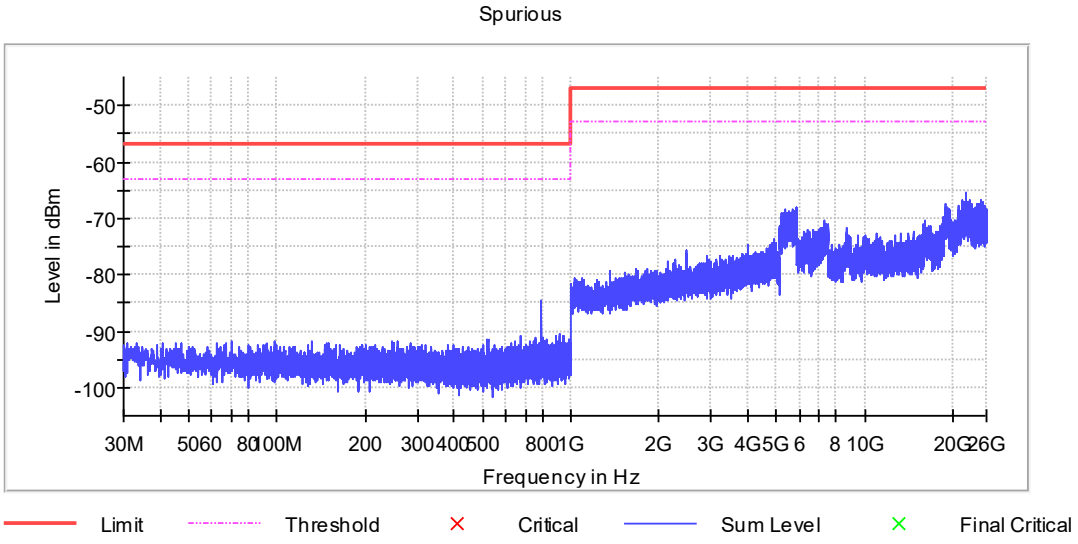
Frequency Range	Limit
30 MHz to 1 GHz	-57 dBm
above 1 GHz to 26 GHz	-47 dBm



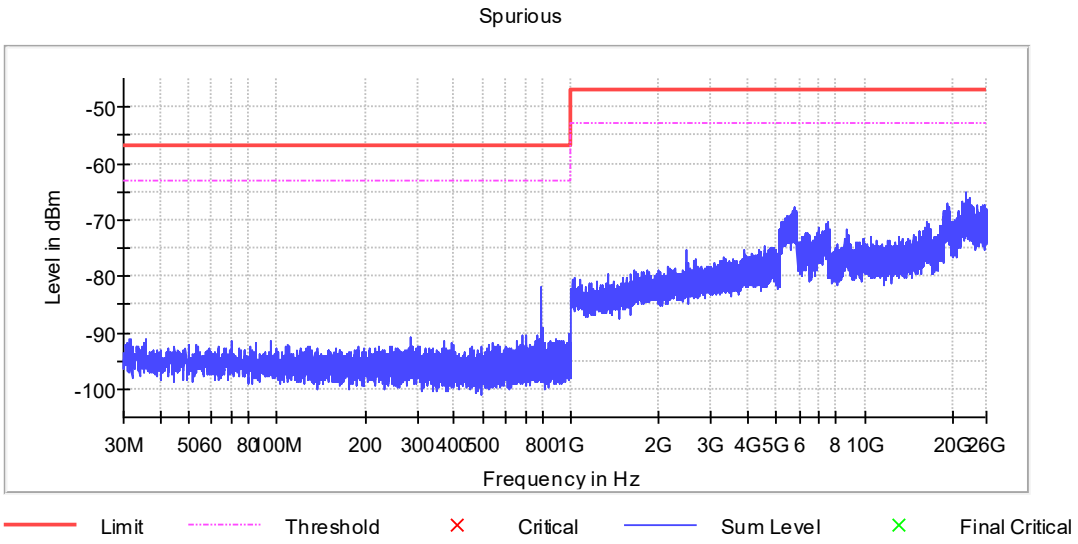
Receiver Spurious Emissions, Conducted, 5180 MHz



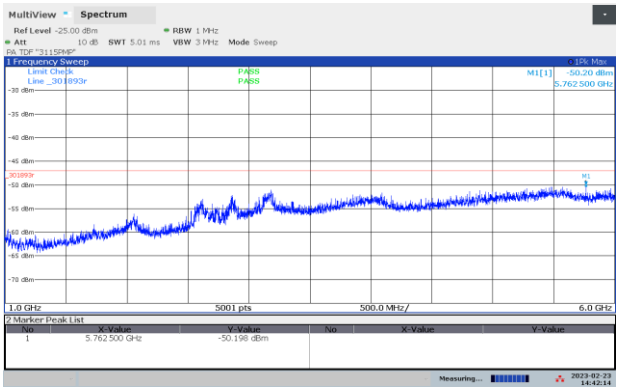
Receiver Spurious Emissions, Conducted, 5320 MHz



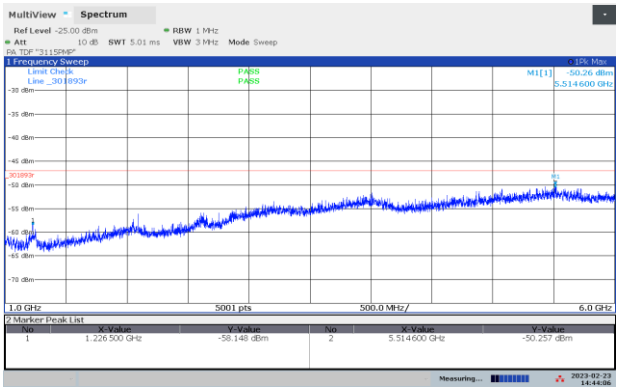
Receiver Spurious Emissions, Conducted, 5500 MHz



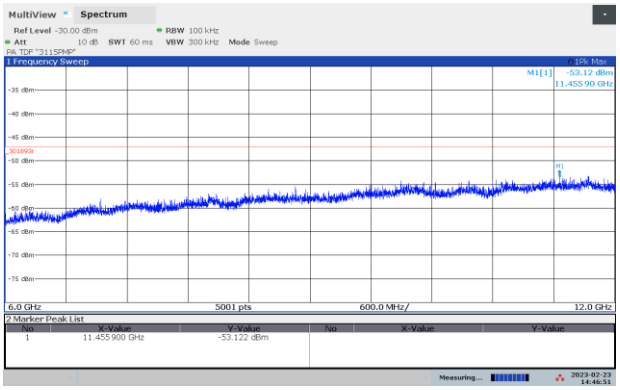
Receiver Spurious Emissions, Conducted, 5700 MHz



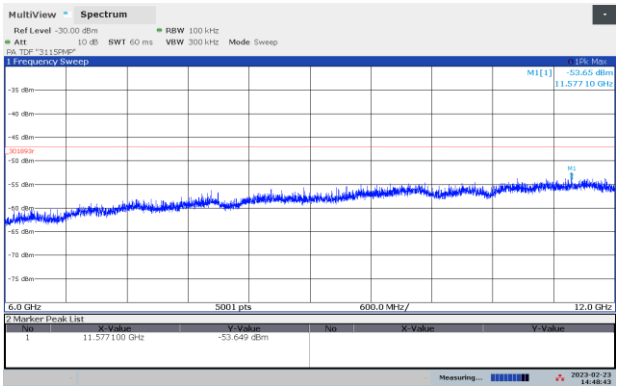
Receiver Emissions, Radiated, 5180 MHz, 802.11a 6M, Ant 0, VP



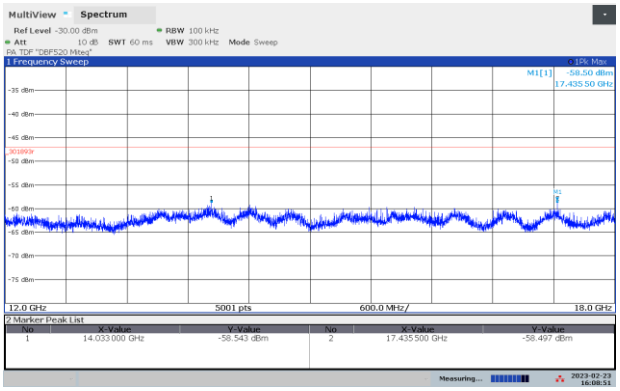
HP



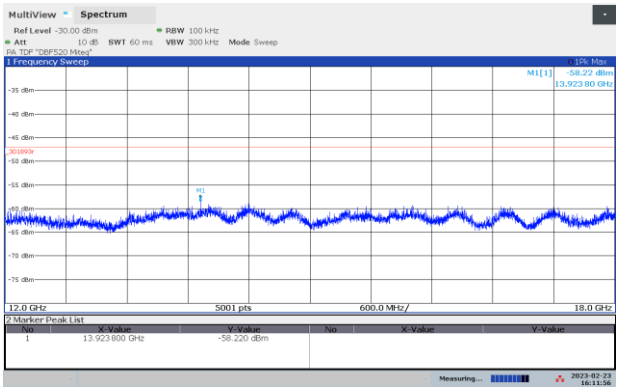
Receiver Emissions, Radiated, 5180 MHz, 802.11a 6M, Ant 0, VP



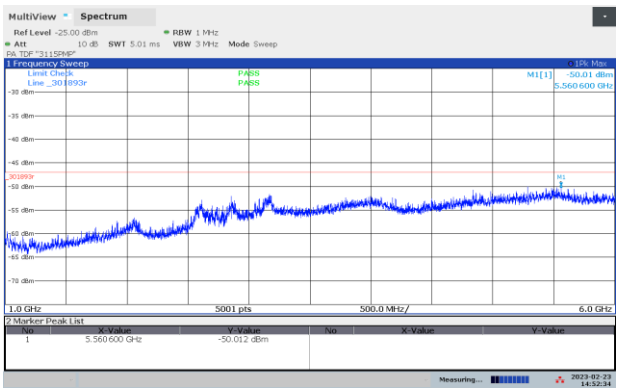
HP



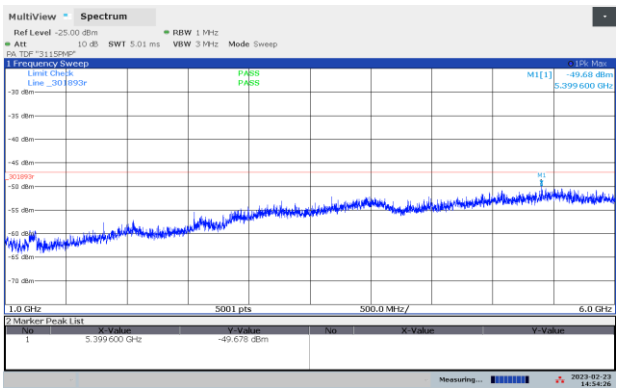
Receiver Emissions, Radiated, 5180 MHz, 802.11a 6M, Ant 0, VP



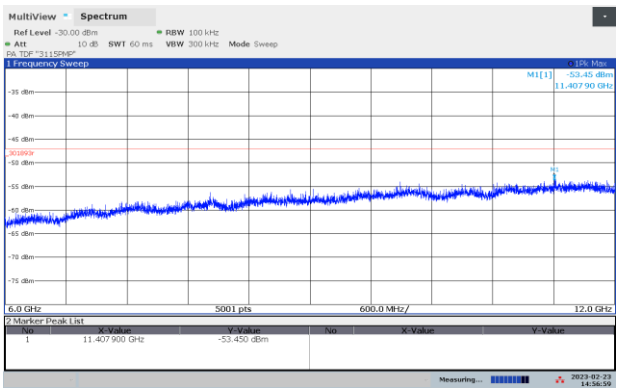
HP



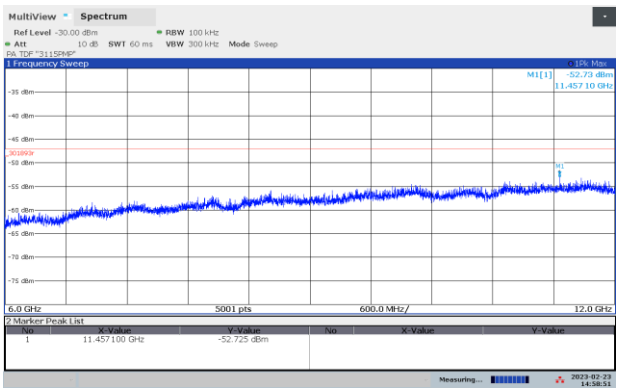
Receiver Emissions, Radiated, 5700 MHz, 802.11a 6M, Ant 0, VP



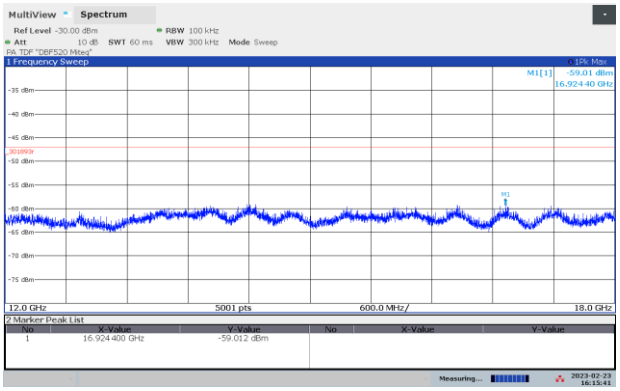
HP



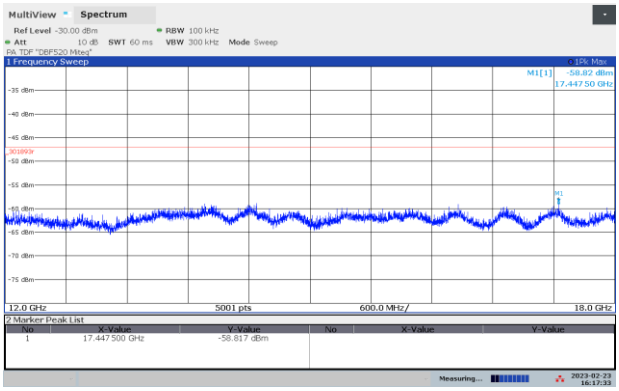
Receiver Emissions, Radiated, 5700 MHz, 802.11a 6M, Ant 0, VP



HP



Receiver Emissions, Radiated, 5700 MHz, 802.11a 6M, Ant 0, VP



HP

4.8 Dynamic Frequency Selection

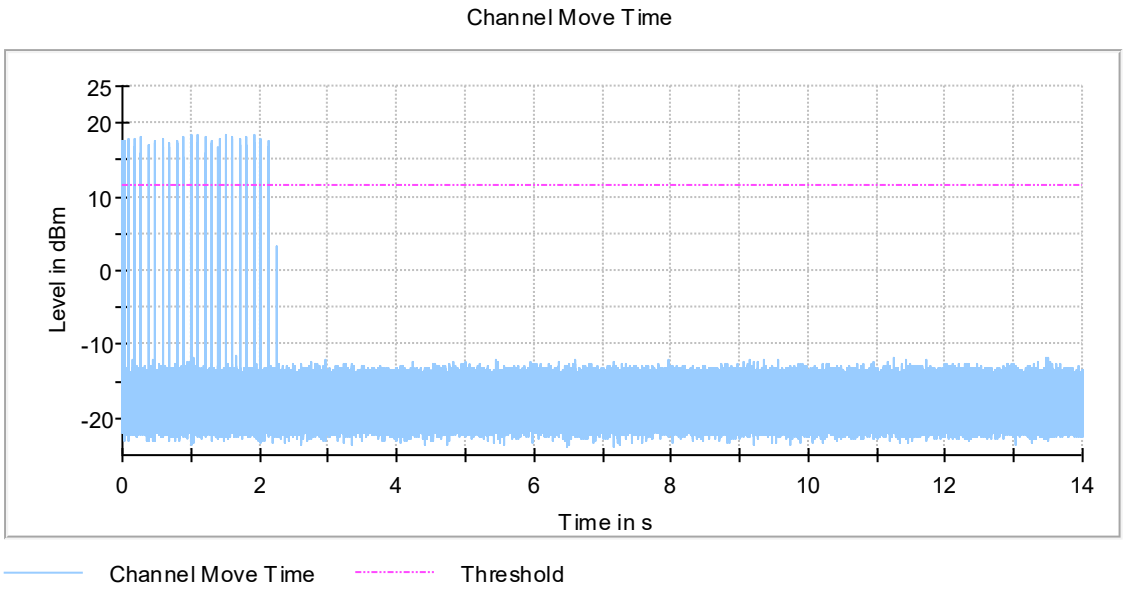
ETSI EN 301893 subclause 4.2.6

Measured values						
Tested Frequency	**5280 MHz**	**5530 MHz HT80**	**5550 MHz HT40**	**5580 MHz**	**5620 MHz**	**5680 MHz**
Channel Closing Time	**11.95 ms**	**1.17 ms**	**4.02 ms**	**9.35 ms**	**11.33 ms**	**11.82 ms**
Channel Move Time	**2.12 s**	**2.06 s**	**2.17 s**	**2.14 s**	**2.07 s**	**2.08 s**
Channel Closing Time Limit	**1 s**	**1 s**	**1 s**	**1 s**	**1 s**	**1 s**
Channel Move Time Limit	**10 s**	**10 s**	**10 s**	**10 s**	**10 s**	**10 s**
Radar Type	**0**	**0**	**0**	**0**	**0**	**0**

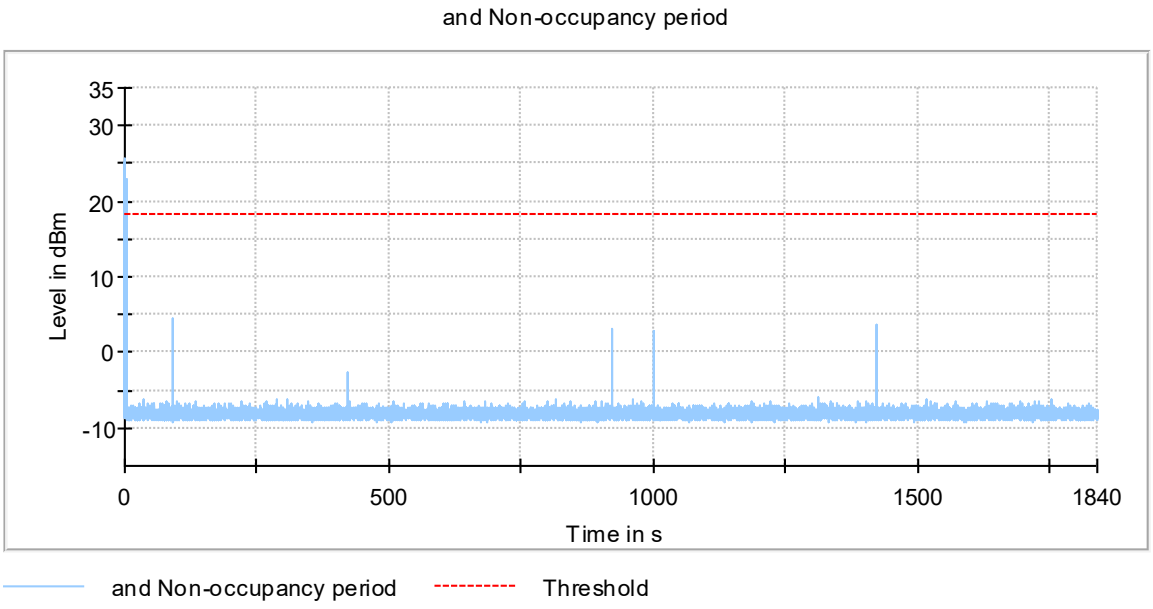
The tested EUT is a slave or client device without radar detection capabilities.

Channel Move Time Limit is < 10 sec according to Table D.1.

The test was performed by setting up a link between the EUT and the access point on the test channel and then applying a radar signal at a RF level according to Table D.2 to the Master device while the channel was monitored on the Spectrum Analyzer. The EUT moves channel with the Master Device.



Channel Shutdown Time



Non-Occupancy Period

4.9 Adaptivity (Channel Access Mechanism)

ETSI EN 301893 subclause 4.2.7

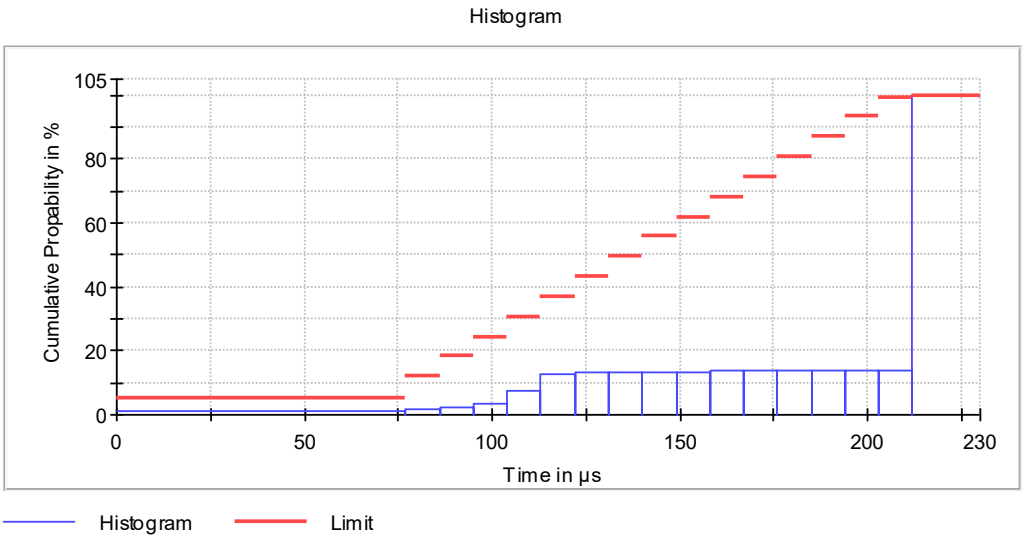
Normal Operation (ch 5240MHz)

DutyCycle DUT (all ports) (%)	Monitoring Length (ms)	COT Max (ms)	Limit Max (ms)	COT Max Start (ms)	COT Min (ms)	Number of COTs	Idle Time Min (ms)	Idle Time Max (ms)	DutyCycle DUT (all ports) (%)	max. allowed gap during COT (ms)	Result
0.335	65000.000	1.305	10.000	598.066	0.002	4827	0.026	37.233	0.335	0.025	PASS

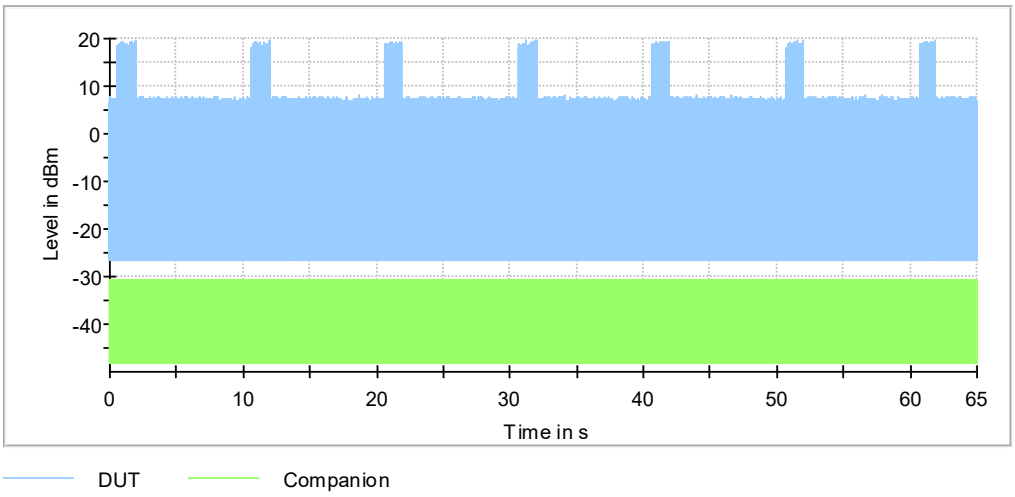
The test was performed with the R&S CMW500 as Companion Device. The CMW500 was sending frames to the EUT contiuously, and the EUT was sending acknowledgements.

Idle Period Probability

Result	Bin	Probability (%)	Limit (%)	Cumulative Probability (%)
PASS	B0	1.017	5.000	1.017
PASS	B1	0.789	12.000	1.806
PASS	B2	0.270	18.250	2.076
PASS	B3	1.557	24.500	3.632
PASS	B4	3.591	30.750	7.223
PASS	B5	5.562	37.000	12.785
PASS	B6	0.270	43.250	13.055
PASS	B7	0.083	49.500	13.138
PASS	B8	0.208	55.750	13.346
PASS	B9	0.166	62.000	13.512
PASS	B10	0.187	68.250	13.699
PASS	B11	0.042	74.500	13.740
PASS	B12	0.062	80.750	13.802
PASS	B13	0.083	87.000	13.885
PASS	B14	0.166	93.250	14.051
PASS	B15	0.083	99.500	14.134
PASS	B16	85.866	100.000	100.000



Cumulative Propability



Normal Operation, Companion and EUT

4.10 Receiver Blocking

ETSI EN 301893 subclause 4.2.8

Blocking Signal Frequency (MHz)	EUT Operating Frequency (MHz)	Wanted Signal Level (P_{min} + 6dB) (dBm)	Blocking Signal Level (dBm)	Packet Loss (%)	Limit (%)	Verdict
5100	5180	-56	-59	< 1	< 10	Pass
4900	5180	-56	-53	< 1	< 10	Pass
5000	5180	-56	-53	< 1	< 10	Pass
5975	5180	-56	-53	< 1	< 10	Pass
5100	5700	-54	-59	< 1	< 10	Pass
4900	5700	-54	-53	< 1	< 10	Pass
5000	5700	-54	-53	< 1	< 10	Pass
5975	5700	-54	-53	< 1	< 10	Pass
Measurement uncertainty		+ 2.0/- 2.5 dB				

The test was performed conducted.

The test was performed manually with the EUT connected to the R&S CMW500 via the Narda Hybrid. The R&S SMB100A was used for the blocking signal and was connected at the other side of the Hybrid.

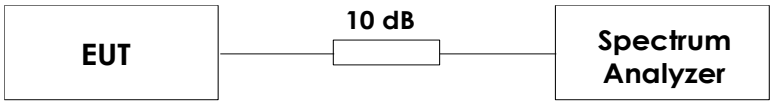
At each blocking frequency 1000 packets were sent, and the number of rejected packets were measured on the CMW500.

(5180 MHz: P_{min} = -62 dBm, 5700 MHz: P_{min} = -60 dBm)

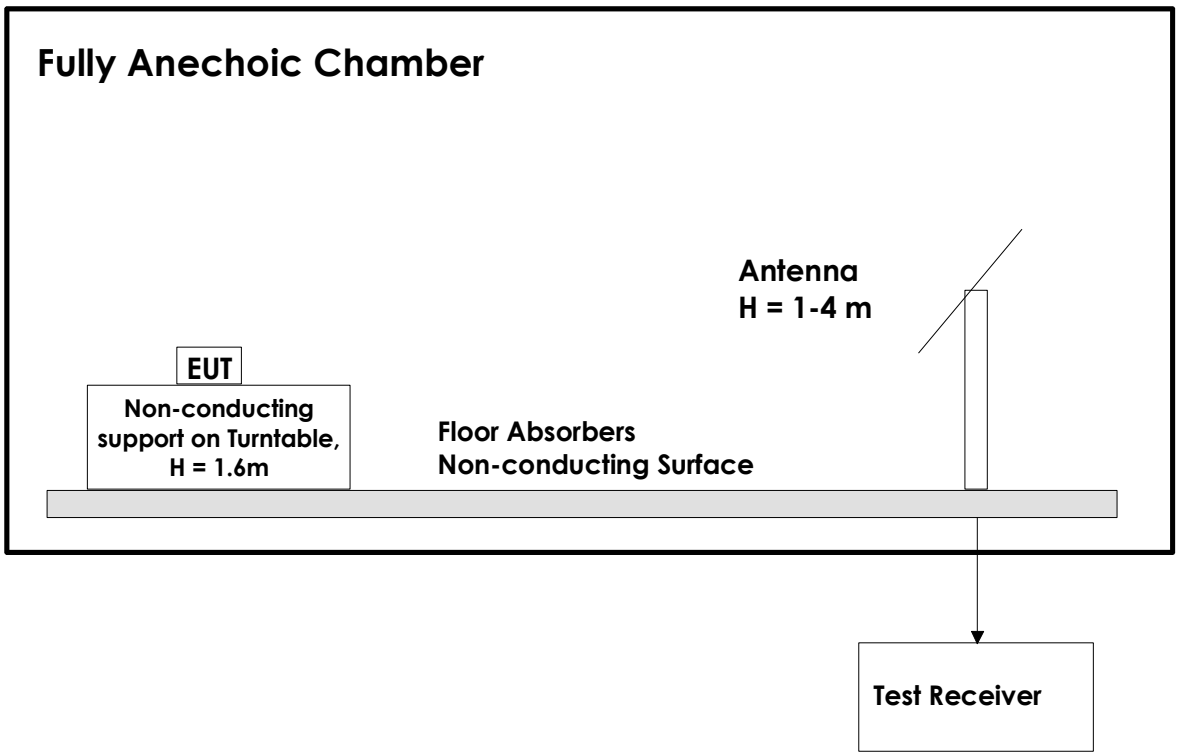
Limits

Wanted signal mean power from companion device	Blocking signal frequency [MHz]	Blocking signal power [dBm]	Type of blocking signal
P_{min} +6 dB	5100	-59	CW
P_{min} +6 dB	4900	-53	
	5000		
	5975		

5 Test Setups



Test set-up for Conducted Measurements. For Power measurements the Spectrum Analyzer is replaced by a Power Meter.



Test set-up for Radiated Measurements. The height of the turntable was 1.6 m for all tests and the antenna height was fixed at 1.75m. A spectrum analyzer was used as test receiver for all tests.

6 Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the testhouse.

No	Ref. No	Description	Manufacturer	Type	Cal. date	Cal. due
1.	LR 1808	Spectrum Analyzer	Rohde & Schwarz	FSVA3044	08.2022	08.2023
2.	LR 1793	Peak Power Meters	Rohde & Schwarz	OSP-B157W8	02.2022	02.2024
3.	LR 1806	Switch and Control Unit	Rohde & Schwarz	OSP-220	08.2022	08.2024
4.	LR 1807	Vector Signal generator	Rohde & Schwarz	SMW200A	08.2022	08.2023
5.	LR 1656	Signal generator	Rohde & Schwarz	SMB100A	01.2023	01.2024
6.	LR 1528	Hybrid	NARDA	4356B	COU	
7.	LR 1640	Spectrum Analyzer	Rohde & Schwarz	FSW26	01.2023	01.2024
8.	LR 1747	Pre-Amplifier	NardaMiteq	LNA-40-00101800-25-10P	08.2022	08.2023
9.	LR 1734	BiLog Antenna	SunAR	JB1	11.2022	11.2025
10.	LR 1330	Double Ridged Horn Antenna	EMCO	3115	11.2022	11.2027
11.	LR 100	Horn Antenna	Systron Donner	DBF520	N/A	
12.	LR 1480	Horn Antenna	Narda	638	N/A	
13.	LR 1785	BandStop filter (2.4 GHz)	Microwave circuits	NO324415	COU	
14.	LR 1083	Climatic Chamber	ACS	TY 80	03.2022	03.2023
15.	LR 1713	Power Supply	TTi	CPX400S	COU	
16.	LR 1598	Multimeter, Digital	Fluke	87 V	04.2022	04.2024
17.	LR 1791	Communication analyser	Rohde & Schwarz	CMW500	01.2022	01.2024
18.	LR 1844	DC Power Supply	BK Precision	9205B	COU	
19.	LR 1813	Microwave Cable	Crystek Corp.	CCK40-MM-16-48	COU	
20.	LR1814	Microwave Cable	Crystek Corp.	CCK40-MM-16-48	COU	