Shenzhen Global Test Service Co.,Ltd.
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TEST REPORT
ETSI EN 301 893 V2.1.1 (2017-05)

Report Reference No. ..... :	**GTS20240426022-1-18**
Compiled by (position+printed name+signature):	File administrators Peter Xiao
Supervised by (position+printed name+signature):	Test Engineer Evan Ouyang
Approved by (position+printed name+signature):	Manager Jason Hu
Date of issue ..... :	Jun.21, 2024
Representative Laboratory Name ..... :	**Shenzhen Global Test Service Co.,Ltd.**
Address ..... :	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong
Applicant's name..... :	**Shenzhen Techtion Smart Electronics Co., Ltd**
Address ..... :	Room 902, 8th Floor, Unit 1, Building No. 2, Xintianxia Chengyun Factory District, Vanke City Community, Bantian Street, Longgang District, Shenzhen, China
Test specification ..... **:**	
Standard ..... :	**ETSI EN 301 893 V2.1.1 (2017-05)**
TRF Originator..... :	Shenzhen Global Test Service Co.,Ltd.
Master TRF ..... :	Dated 2014-12

Test item description ..... :	**Outdoor Reflective Display Terminal**
Trade Mark ..... :	N/A
Manufacturer ..... :	Shenzhen Techtion Smart Electronics Co., Ltd
Model/Type reference ..... :	TS-156PHD
List Model ..... :	TS-780PHD, TS-101PHD, TS-105PHD, TS-133PHD, TS-215PHD, TS-286THD, TS-298THD, TS-280THD, TS-320PHD, TS-362THD, TS-401THD, TS-430PHD, TS-434THD, TS-500THD, TS-550PHD, TS-650THD, TS-750THD, TS-850THD, TS-860THD, TS-980THD, TS-XXXPHD, TS-XXXTHD(X=0-9,X=A-Z)
Operation Frequency ..... :	From 5180MHz-5240MHz
Ratings ..... :	DC 12.0V/4.0A by Adapter
Result ..... :	**PASS**

T E S T R E P O R T

Test Report No. :	**GTS20240426022-1-18**	Jun. 21, 2024 Date of issue

Equipment under Test	:	Outdoor Reflective Display Terminal
Model /Type	:	TS-156PHD
Listed model	:	TS-780PHD, TS-101PHD, TS-105PHD, TS-133PHD, TS-215PHD, TS-286THD, TS-298THD, TS-280THD, TS-320PHD, TS-362THD, TS-401THD, TS-430PHD, TS-434THD, TS-500THD, TS-550PHD, TS-650THD, TS-750THD, TS-850THD, TS-860THD, TS-980THD, TS-XXXPHD, TS-XXXTHD(X=0-9,X=A-Z)
Applicant	:	**Shenzhen Techtion Smart Electronics Co., Ltd**
Address	:	Room 902, 8th Floor, Unit 1, Building No. 2, Xintianxia Chengyun Factory District, Vanke City Community, Bantian Street, Longgang District, Shenzhen, China
Manufacturer	:	**Shenzhen Techtion Smart Electronics Co., Ltd**
Address	:	Room 902, 8th Floor, Unit 1, Building No. 2, Xintianxia Chengyun Factory District, Vanke City Community, Bantian Street, Longgang District, Shenzhen, China

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

ETSI 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

2 . SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	May. 10, 2024
Testing commenced on	:	May. 10, 2024
Testing concluded on	:	Jun. 20, 2024

2.2. Product Description

Product Name:	Outdoor Reflective Display Terminal
Trade Mark:	N/A
Model/Type reference:	TS-156PHD
List Model:	TS-780PHD, TS-101PHD, TS-105PHD, TS-133PHD, TS-215PHD, TS-286THD, TS-298THD, TS-280THD, TS-320PHD, TS-362THD, TS-401THD, TS-430PHD, TS-434THD, TS-500THD, TS-550PHD, TS-650THD, TS-750THD, TS-850THD, TS-860THD, TS-980THD, TS-XXXPHD, TS-XXXTHD(X=0-9,X=A-Z)
Model Declaration	PCB board, structure and internal of these model(s) are the same, Only the model name different , So no additional models were tested.
Power supply:	DC 12.0V/4.0A by Adapter
Hardware Version	N/A
Software Version	N/A
Bluetooth	
Frequency Range	2402MHz ~ 2480MHz
Channel Number	79 channels for Bluetooth (DSS) 40 channels for Bluetooth (DTS)
Channel Spacing	1MHz for Bluetooth (DSS) 2MHz for Bluetooth (DTS)
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth (DSS) GFSK for Bluetooth (DTS)
2.4GWLAN	
WLAN CE Operation frequency	IEEE 802.11b:2412-2472MHz IEEE 802.11g:2412-2472MHz IEEE 802.11n HT20:2412-2472MHz IEEE 802.11n HT40:2422-2462MHz
WLAN CE Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Channel number:	13 Channel for IEEE 802.11b/g/n (HT20) 9 Channel for IEEE 802.11n (HT40)
Channel separation:	5MHz
WIFI (5G Band)	
WLAN CE Operation frequency	5180-5240MHz
WLAN CE Modulation Type	802.11a/n/ac: OFDM
Channel number:	4 Channels for 20MHz bandwidth(5180-5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)

SRD (5.8G Band)	
WLAN CE Operation frequency	5745-5825MHz
WLAN CE Modulation Type	802.11a/n/ac: OFDM
Channel Number	5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Antenna Description	Two External antenna respectively. WLAN not support 2*2MIMO technology. ANT0 used for WIFI TX/RX, 2.0 dBi(Max.) for 2.4GWLAN; ANT1 used for BT&WIFI TX/RX, 2.0 dBi(Max.) for BT and 2.0dBi (Max.) for 5GWLAN;

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V/ 50 Hz	○	120V/60Hz
		●	12 V DC	○	24 V DC
		○	Other (specified in blank below)		

DC 12.0V

Channel list:

Channel	Frequency (MHz)
36	5180
38	5190
40	5200
42	5210
44	5220
46	5230
48	5240

2.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

●	Adapter	M/N:	ADP-48D12
		Manufacturer:	Hunan Dajing Technology Co., Ltd
○	PC	M/N:	DESKYOP-EUIVCNR
		Manufacturer:	LENOVO
○	Display	M/N:	LE23CW-D
		Manufacturer:	THTF
○	Keyboard	M/N:	T460S
		Manufacturer:	LENOVO
○	Mouse	M/N:	Howard
		Manufacturer:	LENOVO
○	Earphone	M/N:	MDR-XB550AP
		Manufacturer:	SONY
○	USB flash disk	M/N:	U330
		Manufacturer:	aigo

2.5. Test summary

Test Item	Test Requirement ESTI EN301983	Verdict
Centre frequencies	Section 5.4.2	Pass
Nominal Channel Bandwidth and Occupied Channel Bandwidth	Section 5.4.3	Pass
RF output power, Transmit Power Control (TPC) and power density	Section 5.4.4	Pass
Transmitter unwanted emissions	Section 5.4.5& Section 5.4.6	Pass
Receiver spurious emissions	Section 5.4.7	Pass
Dynamic Frequency Selection (DFS)	Section 5.4.8	N/A
Adaptivity	Section 5.4.9	Pass
Receiver Blocking	Section 5.4.10	Pass
User Access Restrictions	Section 4.2.9	Pass
Geo-location capability	Section 4.2.10	N/A
Note:N./A Stands for “Not applicable”		

Remark: The measurement uncertainty is not included in the test result.

2.6. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L8169)
Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.
A2LA (Certificate No. 4758.01)
Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.
Industry Canada Registration Number. is 24189.
FCC Designation Number is CN1234.
FCC Registered Test Site Number is165725.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature: 25 °C
High Temperature: 45 °C
Low Temperature: -20 °C
Normal Voltage : DC 12.0V
High Voltage: DC 13.2V
Low Voltage: DC10.8V
Relative Humidity: 55 %
Air Pressure: 989 hPa

3.4. Test Channels：

Test	Clause	Test channels		
		Lower sub-band (5 150 MHz to 5 350 MHz)		Higher sub-band 5 725 MHz to 5 850 MHz
		5 150 MHz to 5 250 MHz	5 250 MHz to 5 350 MHz	
Centre frequencies	5.3.2	C7 (see note 1)		C8 (see note 1)
Occupied Channel Bandwidth	5.3.3	C7		C8
Power, power density	5.3.4	C1	C2	C3, C4
Transmitter unwanted emissions outside the 5 GHz RLAN bands	5.3.5	C7 (see note 1)		C8 (see note 1)
Transmitter unwanted emissions within the 5 GHz RLAN bands	5.3.6	C1	C2	C3, C4
Receiver spurious emissions	5.3.7	C7 (see note 1)		C8 (see note 1)
Transmit Power Control (TPC)	5.3.4	n.a. (see note 2)	C2 (see note 1)	C3, C4 (see note 1)
Dynamic Frequency Selection (DFS)	5.3.8	n.a. (see note 2)	C5	C6 (see note 3)
Adaptivity	5.3.9	C7		C8

C1, C3: The lowest declared channel for every declared nominal channel bandwidth within this band. For the power density testing, it is sufficient to only perform this test using the lowest nominal channel bandwidth.
C2, C4: The highest declared channel for every declared nominal channel bandwidth within this band. For the power density testing, it is sufficient to only perform this test using the lowest nominal channel bandwidth.
C5, C6: One channel out of the declared channels for this frequency range. If more than one nominal channel bandwidth has been declared for this sub-band, testing shall be performed using the lowest and highest nominal channel bandwidth.
C7, C8: One channel out of the declared channels for this sub-band. For Occupied Channel Bandwidth, testing shall be repeated for every declared nominal channel bandwidth within this sub-band. For Adaptivity, testing shall be performed using the highest nominal channel bandwidth.

NOTE 1: In case of more than one channel plan has been declared, testing of these specific requirements need only be performed using one of the declared channel plans.
NOTE 2: Testing is not required for nominal channel bandwidths that fall completely within the frequency range 5 150 MHz to 5 250 MHz.
NOTE 3: Where the declared channel plan includes channels whose nominal channel bandwidth falls completely or partly within the 5 600 MHz to 5 650 MHz band, the tests for the *Channel Availability Check* (and where implemented, for the *Off-Channel CAC)* shall be performed on one of these channels in addition to a channel within the band 5 470 MHz to 5 600 MHz or within the band 5 650 MHz to 5 725 MHz.

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics;Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics;Part 2 " and is documented in the Shenzhen Global Test Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Frequency error	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission	1.60 dB	(1)
Radiated spurious emission	2.20 dB	(1)

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6. Equipments Used during the Test

RF output power&PSD&OOB&OBW &Hoping &Duty Cycle, Tx-sequence, Tx-gap&Adaptively& ReceiverBlocking& Centre frequencies & TPC						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Spectrum Analyzer	Agilent	N9020A	MY48010425	2023/09/08	2024/09/07
2	Vector Signal generator	Agilent	N5181A	MY49060502	2023/07/13	2024/07/12
3	Signal generator	Agilent	E4421B	3610AO1069	2023/09/08	2024/09/07
4	4 Ch. Simultaneous Sampling 14 Bits 2 MS/s	Agilent	U2531A	TW53323507	2023/09/08	2024/09/07
5	X-series USB Peak and Average Power Sensor	Agilent	U2021XA	MY5365004	2023/09/08	2024/09/07
6	Climate Chamber	ESPEC	EL-10KA	A20120523	2023/09/08	2024/09/07
7	Spectrum Analyzer	R&S	FSV40	100019	2023/07/13	2024/07/12
8	Universal Radio Communication	Rohde&Schwarz	CMU200	114353	2023/09/08	2024/09/07
9	Wireless Commnunication Tester	Rohde&Schwarz	CMW500	125408	2023/07/13	2024/07/12
10	Test Control Unit	Tonscend	JS0806-1	178060067	2023/07/13	2024/07/12
11	Automated filter bank	Tonscend	JS0806-F	19F8060177	2023/07/13	2024/07/12
12	EMI Test software	Tonscend	JS1120-1	Ver 2.6.8.0518	/	/
13	EMI Test software	Tonscend	JS1120-3	Ver 2.5.77.0418	/	/

Transmitter spurious emissions & Receiver spurious emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	EMI Test Receiver	ROHDE & SCHWARZ	ESCI 7	101102	2023/09/08	2024/09/07
2	Spectrum Analyzer	Agilent	N9020A	MY480 10425	2023/09/08	2024/09/07
3	Spectrum Analyzer	R&S	FSV40	100019	2023/07/13	2024/07/12
4	By-log Antenna	SCHWARZBECK	VULB9163	000976	2023/07/13	2024/07/12
5	Double Ridged Horn Antenna (1~18GHz)	SCHWARZBECK	BBHA 9120D	01622	2023/09/08	2024/09/07
6	Horn Antenna (18GHz~40GHz)	Schwarzbeck	BBHA9170	791	2023/09/08	2024/09/07
7	Amplifier (30MHz~1GHz)	Schwarzbeck	BBV 9743	#202	2023/07/13	2024/07/12
8	Amplifier (1GHz~18GHz)	Taiwan Chengyi	EMC051845 B	980355	2023/07/13	2024/07/12
9	Amplifier (26.5GHz~40GHz)	Schwarzbeck	BBV9179	9719-025	2023/07/13	2024/07/12
10	High-Pass Filter	K&L	9SH10-2700/X1275 0-O/O	KL1420 31	2023/07/13	2024/07/12
11	High-Pass Filter	K&L	41H10-1375/U1275 0-O/O	KL1420 32	2023/07/13	2024/07/12
12	High pass filter	Compliance Direction systems	BSU-6	34202	2023/07/13	2024/07/12
13	RF Cable	HUBER+SUHNE R	RG214	N/A	2023/07/13	2024/07/12
14	EMI Test software	Tonscend	JS32-RE	Ver 2.5.1.8	/	/

The calibration interval is 1 year.

4. TEST CONDITIONS AND RESULTS

4.1. Centre frequencies

Limit

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

Test Procedure

Refer to ETSI EN 301 908 V2.1.1 (2017-05) Clause 5.4.2

1. For equipment can operating without modulation
   a This test method requires that the UUT can be operated in an unmodulated test mode.
   b The UUT shall be connected to a suitable frequency measuring device (e.g. a frequency counter or a spectrum analyser) and operated in an unmodulated mode.
   c The result shall be recorded.
2. For equipment operating with modulation
   a This method is an alternative to the above method in case the UUT cannot be operated in an un-modulated mode.
   b The UUT shall be connected to spectrum analyser.
   c Max Hold shall be selected and the centre frequency adjusted to that of the UUT.
   d The peak value of the power envelope shall be measured and noted. The span shall be reduced and the marker moved in a positive frequency increment until the upper, (relative to the centre frequency), -10 dBc point is reached. This value shall be noted as f_H.
   e The marker shall then be moved in a negative frequency increment until the lower, (relative to the centre frequency), -10 dBc point is reached. This value shall be noted as f_L.
   f The centre frequency is calculated as $(f_H + f_L) / 2$.
3. These measurements shall be performed under both normal and extreme test conditions.
4. One channel out of the declared channels for each sub-band shall be tested.

Test Results

Reference Frequency: 5180 MHz 802.11a				
Test conditions		Test Channel / Frequency	Measured Result (MHz)	Frequency Deviation (ppm)
Voltage (V)	Temperature (℃)			
DC 12.0	+25	CH36/ 5180MHz	5179.994300	-1.10
DC 13.2	-20		5180.037980	7.33
	+45		5179.994276	-1.10
DC 10.8	-20		5180.023805	4.60
	+45		5179.998700	-0.25
Limit			±20 ppm	
Result			PASS	

Reference Frequency: 5180 MHz 802.11n(20MHz)				
Test conditions		Test Channel / Frequency	Measured Result (MHz)	Frequency Deviation (ppm)
Voltage (V)	Temperature (℃)			
DC 12.0	+25	CH36/ 5180MHz	5180.019521	3.77
DC 13.2	-20		5180.009443	1.82
	+45		5179.990728	-1.79
DC 10.8	-20		5180.010871	2.10
	+45		5179.997819	-0.42
Limit			±20 ppm	
Result			PASS	

Reference Frequency: 5190 MHz 802.11n(40MHz)				
Test conditions		Test Channel / Frequency	Measured Result (MHz)	Frequency Deviation (ppm)
Voltage (V)	Temperature (℃)			
DC 12.0	+25	CH38/ 5190MHz	5189.967283	-6.30
DC 13.2	-20		5189.974080	-4.99
	+45		5190.019063	3.67
DC 10.8	-20		5189.980304	-3.79
	+45		5190.011289	2.18
Limit			±20 ppm	
Result			PASS	

Reference Frequency: 5210 MHz 802.11ac(80MHz)				
Test conditions		Test Channel / Frequency	Measured Result (MHz)	Frequency Deviation (ppm)
Voltage (V)	Temperature (℃)			
DC 12.0	+25	CH42/ 5210MHz	5210.027059	5.19
DC 13.2	-20		5209.994116	-1.13
	+45		5209.983419	-3.18
DC 10.8	-20		5210.001490	0.29
	+45		5209.967383	-6.26
Limit			±20 ppm	
Result			PASS	

4.2. Nominal Channel Bandwidth and Occupied Channel Bandwidth

LIMIT

The Nominal Channel Bandwidth is the widest band of frequencies, inclusive of guard bands, assigned to a single channel.
The Nominal Channel Bandwidth shall be at least 5 MHz at all times.

The Occupied Channel Bandwidth is the bandwidth containing 99 % of the power of the signal.
The Occupied Channel Bandwidth shall be between 80 % and 100 % of the declared Nominal Channel Bandwidth. In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement.

During an established communication, the device is allowed to operate temporarily with an Occupied Channel Bandwidth below 80 % of its Nominal Channel Bandwidth with a minimum of 4 MHz.

Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.3

Step 1:
Connect the UUT to the spectrum analyser and use the following settings:
• Centre Frequency: The centre frequency of the channel under test
• Resolution Bandwidth: 100 kHz
• Video Bandwidth: 300 kHz
• Frequency Span: 2 × Nominal Bandwidth (e.g. 40 MHz for a 20 MHz channel)
• Sweep time: > 1 s; for larger Nominal Bandwidths, the sweep time may be increased until a value where the sweep time has no impact on the RMS value of the signal
• Detector Mode: RMS
• Trace Mode: Max Hold

Step 2:
Wait for the trace to stabilize.

Step 3:
• Make sure that the power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals left and right from the power envelope being taken into account by this measurement.
• Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

The measurement described in step 1 to step 3 above shall be repeated in case of simultaneous transmissions in non-adjacent channels.

TEST RESULTS

Mode	Channel	Frequency (MHz)	99% Occupied Channel Bandwidth (MHz)	Result
802.11 a	CH36	5180	16.434	Pass
802.11 n 20	CH36	5180	17.622	Pass
802.11 n 40	CH38	5190	36.150	Pass
802.11 ac20	CH36	5180	17.623	Pass
802.11 ac40	CH38	5190	36.149	Pass
802.11 ac80	CH42	5210	74.942	Pass

802.11 a

CH36

802.11 n20

CH36

802.11 n40

CH38

802.11 ac20

CH36

802.11 ac40

CH38

802.11 ac80

CH42

4.3. RF output power, Transmit Power Control (TPC) and power density

LIMIT

The RF Output Power is the mean equivalent isotropically radiated power (e.i.r.p.) during a transmission burst.
Transmit Power Control (TPC) is a mechanism to be used by the RLAN device to ensure a mitigation factor of at least 3 dB on the aggregate power from a large number of devices. This requires the RLAN device to have a TPC range from which the lowest value is at least 6 dB below the values for mean e.i.r.p. given in table 1 for devices with TPC.
TPC is not required for channels whose nominal bandwidth falls completely within the band 5150 MHz to 5250 MHz.
The Power Density is the mean equivalent isotropically radiated power (e.i.r.p.) density during a transmission burst.

For devices with TPC, the RF output power and the power density when configured to operate at the highest stated power level of the TPC range shall not exceed the levels given in table 1.
Devices are allowed to operate without TPC. See table 1 for the applicable limits in this case.

Table 1: Mean e.i.r.p. limits for RF output power and power density at the highest power level

Frequency range [MHz]	Mean e.i.r.p. limit [dBm]		Mean e.i.r.p. density limit [dBm/MHz]	
	with TPC	without TPC	with TPC	without TPC
5 150 to 5 350	23	20/23 (see note 1)	10	7/10 (see note 2)
5 470 to 5 725	30 (see note 3)	27 (see note 3)	17 (see note 3)	14 (see note 3)
NOTE 1: The applicable limit is 20 dBm, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 23 dBm.				
NOTE 2: The applicable limit is 7 dBm/MHz, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 10 dBm/MHz.				
NOTE 3: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.				

For devices using TPC, the RF output power during a transmission burst when configured to operate at the lowest stated power level of the TPC range shall not exceed the levels given in table 2.
For devices without TPC, the limits in table 2 do not apply.

Table 2: Mean e.i.r.p. limits for RF output power at the lowest power level of the TPC range

Frequency range	Mean e.i.r.p. [dBm]
5 250 MHz to 5 350 MHz	17
5 470 MHz to 5 725 MHz	24 (see note)
NOTE: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.	

4.3.1. RF output power at the highest power - PH

Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.4
Conducted measurement:
Measurement For RF Output Power
The measurement shall be performed under both normal and extreme test conditions.
Step 1:
• The equipment is configured into a continuous transmit mode (x = 1), proceed immediately with step 2.
Step 2:
• The RF output power shall be determined using a wideband RF power meter with a thermocouple detector or an equivalent thereof and with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be noted as A (in dBm).
• In case of conducted measurements on smart antenna systems operating in a mode with multiple transmit chains active simultaneously, the output power of each transmit chain shall be measured separately to calculate the total power (value A in dBm) for the UUT.
Step 3:
• The RF output power at the highest power level PH (e.i.r.p.) shall be calculated from the above measured power output A (in dBm), the observed duty cycle x, the stated antenna gain G in dBi and if applicable the beamforming gain Y in dB, according to the formula below. This value shall be recorded in the test report. If more than one antenna assembly is intended for this power setting or TPC range, the gain of the antenna assembly with the highest gain shall be used.
PH = A + G + Y + 10 × log (1 / x) (dBm).

Test Results

802.11a							
Test conditions		Channel/ Frequency	Measured power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)						
+25℃	DC 12.0	36/5180	7.28	2.00	9.28	23	PASS
-20℃	DC 13.2		7.16	2.00	9.16		
	DC 10.8		7.02	2.00	9.02		
+45℃	DC 13.2		7.05	2.00	9.05		
	DC 10.8		7.64	2.00	9.64		

802.11n HT 20							
Test conditions		Channel/ Frequency	Measured power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)						
+25℃	DC 12.0	36/5180	6.76	2.00	8.76	23	PASS
-20℃	DC 13.2		6.33	2.00	8.33		
	DC 10.8		6.52	2.00	8.52		
+45℃	DC 13.2		6.75	2.00	8.75		
	DC 10.8		6.14	2.00	8.14		

802.11n HT40							
Test conditions		Channel/ Frequency	Measured power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)						
+25℃	DC 12.0	38/5190	4.43	2.00	6.43	23	PASS
-20℃	DC 13.2		4.06	2.00	6.06		
	DC 10.8		4.24	2.00	6.24		
+45℃	DC 13.2		4.97	2.00	6.97		
	DC 10.8		4.41	2.00	6.41		

802.11ac20							
Test conditions		Channel/ Frequency	Measured power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)						
+25℃	DC 12.0	36/5180	6.08	2.00	8.08	23	PASS
-20℃	DC 13.2		6.12	2.00	8.12		
	DC 10.8		6.54	2.00	8.54		
+45℃	DC 13.2		6.46	2.00	8.46		
	DC 10.8		6.06	2.00	8.06		

802.11ac40							
Test conditions		Channel/ Frequency	Measured power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)						
+25℃	DC 12.0	38/5190	5.91	2.00	7.91	23	PASS
-20℃	DC 13.2		5.43	2.00	7.43		
	DC 10.8		5.91	2.00	7.91		
+45℃	DC 13.2		5.43	2.00	7.43		
	DC 10.8		5.02	2.00	7.02		

802.11ac80							
Test conditions		Channel/ Frequency	Measured power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)						
+25℃	DC 12.0	42/5210	1.79	2.00	3.79	23	PASS
-20℃	DC 13.2		1.09	2.00	3.09		
	DC 10.8		1.38	2.00	3.38		
+45℃	DC 13.2		1.92	2.00	3.92		
	DC 10.8		1.57	2.00	3.57		

4.3.2. RF output power at the lowest power level of the TPC range - PL

Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.4
Step 1 and step 2:
• See step 1 and step 2 in clause 5.4.4.2.1.1.2.
The duty cycle measurement done in step 1 of clause 5.4.4.2.1.1.2 may not need to be repeated.
Step 3:
• The RF output power at the lowest power level PL (e.i.r.p.) shall be calculated from the above measured power
output A (in dBm), the observed duty cycle x, the stated antenna gain G in dBi and if applicable the beamforming gain Y in dB, according to the formula below. This value shall be recorded in the test report. If more than one antenna assembly is intended for this power setting or TPC range, the gain of the antenna assembly with the highest gain shall be used:
PL = A + G + Y + 10 × log (1 / x) (dBm). (10)
• This value PL shall be compared to the applicable limit contained in table 3 of clause 4.2.3.2.3.

Test Results

This test item is not applicable for the EUT without TPC featur.

4.4. Power density

Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.4
Measurement For Power Density
The measurement shall only be performed at normal test conditions.
Step 1:
• Connect the UUT to the spectrum analyser and use the following settings:
• Centre Frequency: The centre frequency of the channel under test
• RBW: 1MHz
• VBW: 3MHz
• Frequency Span: 2 × Nominal Bandwidth (e.g. 40 MHz for a 20 MHz channel)
• Detector Mode: Peak
• Trace Mode: Max Hold
Step 2:
• When the trace is complete, find the peak value of the power envelope and record the frequency.

Step 3:
• Make the following changes to the settings of the spectrum analyser:
• Centre Frequency: Equal to the frequency recorded in step 2
• Frequency Span: 3MHz
• RBW: 1MHz
• VBW: 3MHz
• Sweep Time: 1 minute
• Detector Mode: RMS
• Trace Mode: Max Hold
Step 4:
• When the trace is complete, the trace shall be captured using the "Hold" or "View" option on the spectrum analyser.
• Find the peak value of the trace and place the analyser marker on this peak. This level is recorded as the highest mean power (power density) D in a 1 MHz band.
• Alternatively, where a spectrum analyser is equipped with a function to measure spectral power density, this function may be used to display the power density D in dBm / MHz.
• In case of conducted measurements on smart antenna systems operating in a mode with multiple transmit chains active simultaneously, the power density of each transmit chain shall be measured separately to calculate the total power density (value D in dBm / MHz) for the UUT.
Step 5:
• The maximum spectral power density e.i.r.p. is calculated from the above measured power density D, the observed duty cycle x, the applicable antenna assembly gain G in dBi and if applicable the beamforming gain Y in dB, according to the formula below. This value shall be recorded in the test report. If more than one antenna assembly is intended for this power setting, the gain of the antenna assembly with the highest gain shall be used.
PD = D + G + Y + 10 × log (1 / x) (dBm / MHz)

Test Results

Mode	Channel/ Frequency（MHz）	Measured value (dBm/MHz)	Antenna Gain (dBi)	PSD (dBm/MHz)	Limit (dBm/MHz)	Result
802.11a	36/5180	-2.98	2.0	-0.98	10	Pass
802.11n20	36/5180	-4.53	2.0	-2.53	10	Pass
802.11n40	38/5190	-9.59	2.0	-7.59	10	Pass
802.11ac20	36/5180	-4.62	2.0	-2.62	10	Pass
802.11ac40	38/5190	-8.90	2.0	-6.9	10	Pass
802.11ac80	42/5210	-13.93	2.0	-11.93	10	Pass

4.5. Transmitter unwanted emissions

4.5.1. Transmitter unwanted emissions outside the 5 GHz RLAN bands

Limit

Transmitter unwanted emissions outside the 5 GHz RLAN bands are radio frequency emissions outside the 5 GHz RLAN bands(total frequency range that consists of the 5150 MHz to 5350 MHz and the 5470 MHz to 5725 MHz sub-bands).

The level of transmitter unwanted emissions outside the 5 GHz RLAN bands shall not exceed the limits given in table 3.

Table 3: Transmitter unwanted emission limits outside the 5 GHz RLAN bands

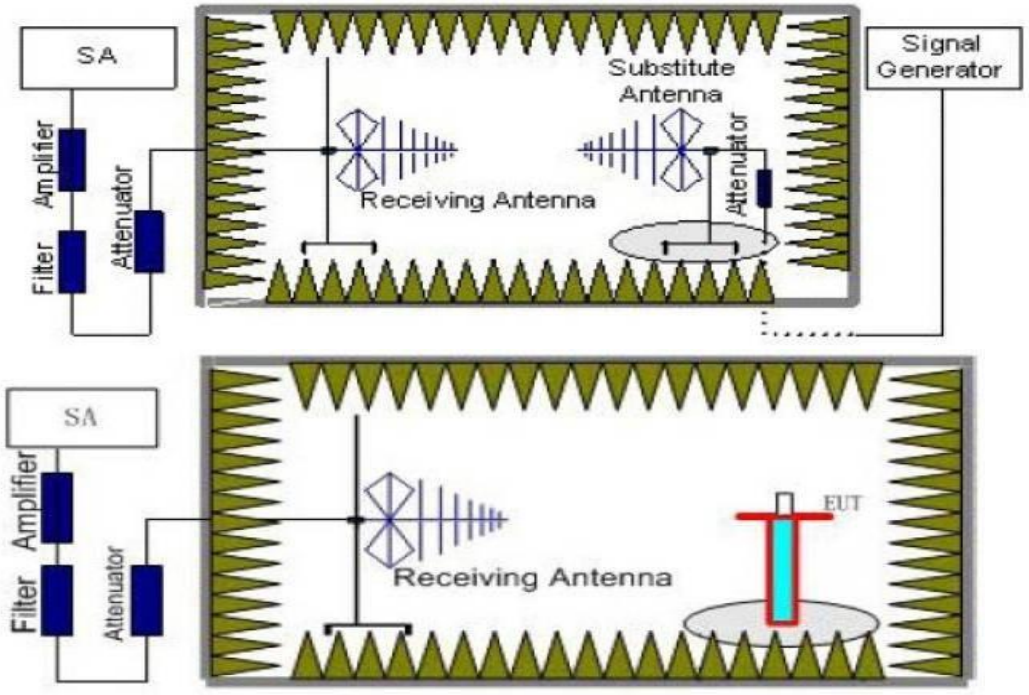
Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 5,15 GHz	-30 dBm	1 MHz
5,35 GHz to 5,47 GHz	-30 dBm	1 MHz
5,725 GHz to 26 GHz	-30 dBm	1 MHz

Test Procedure

1. The measurement procedure follows ETSI EN 301 893 (V2.1.1) Sub-clause 5.4.5.2.2
2. The measurement shall only be performed at normal test conditions.
   One channel out of the declared channels for each sub-band shall be tested.

Test Configuration

Effective Radiated Power measurement (30 MHz to 26 GHz)



TEST RESULTS

Radioation Spurious Emissions:

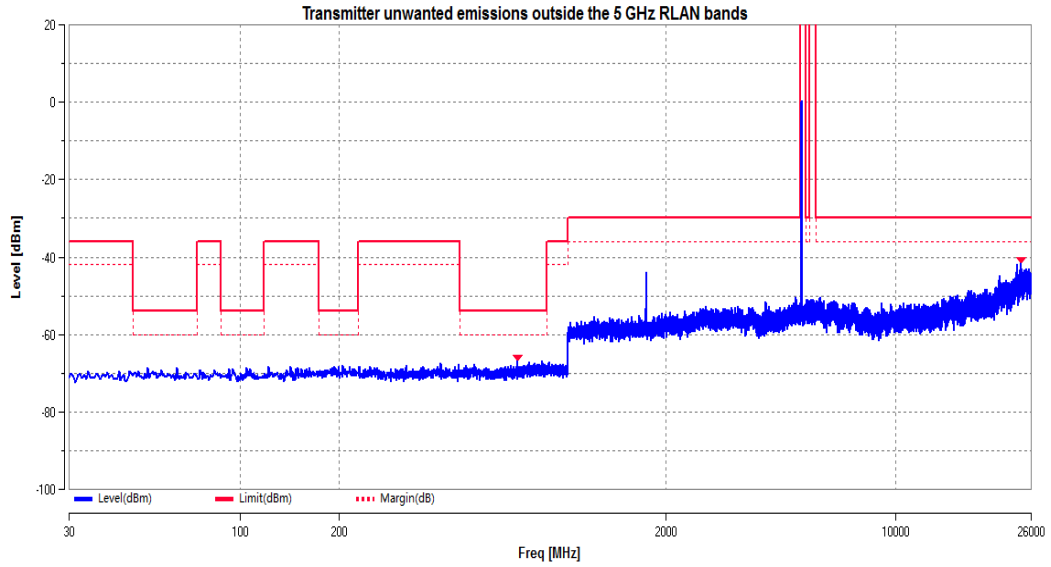
The Worst Test Result For 802.11n(20MHz) (The Worst Case)					
Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 36 (5180MHz)					
54.68	H	-84.32	-54.00	-30.32	PK
62.78	V	-74.77	-54.00	-20.77	PK
806.59	H	-78.07	-54.00	-24.07	PK
920.44	V	-75.71	-36.00	-39.71	PK
3174.11	H	-50.82	-30.00	-20.82	PK
3194.54	V	-61.82	-30.00	-31.82	PK
10360.08	H	-54.78	-30.00	-24.78	PK
10360.09	V	-51.38	-30.00	-21.38	PK

NOTE: All the modes have been tested and recorded worst mode in the report.

Conducted Spurious Emissions:

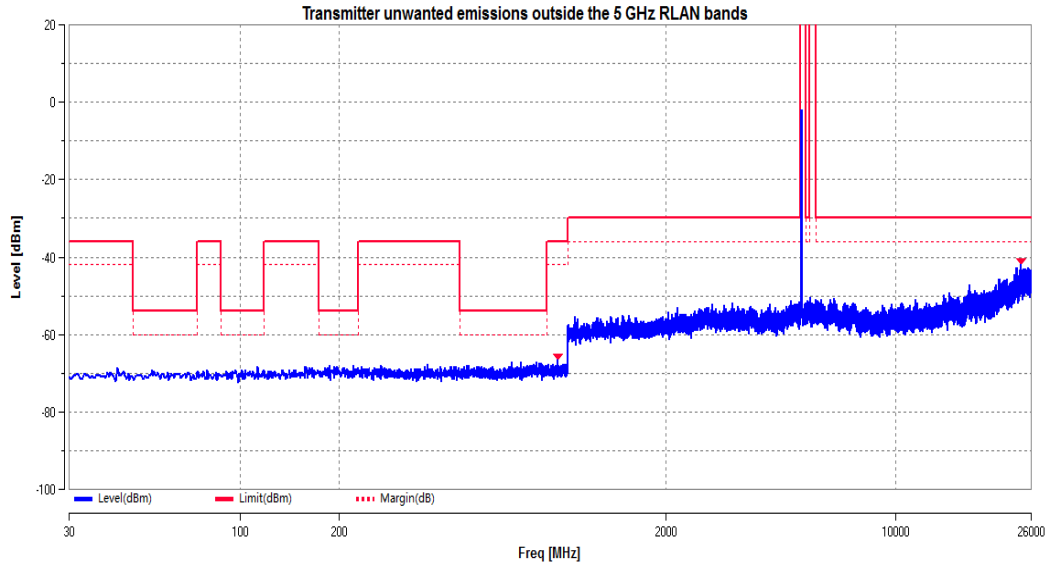
802.11 a

CH36



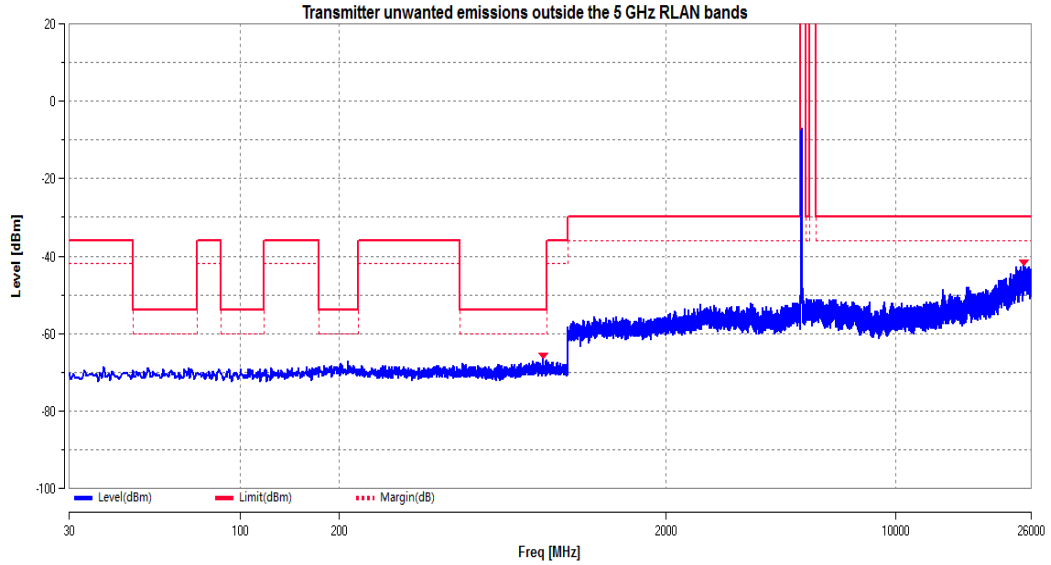
802.11 n20

CH36



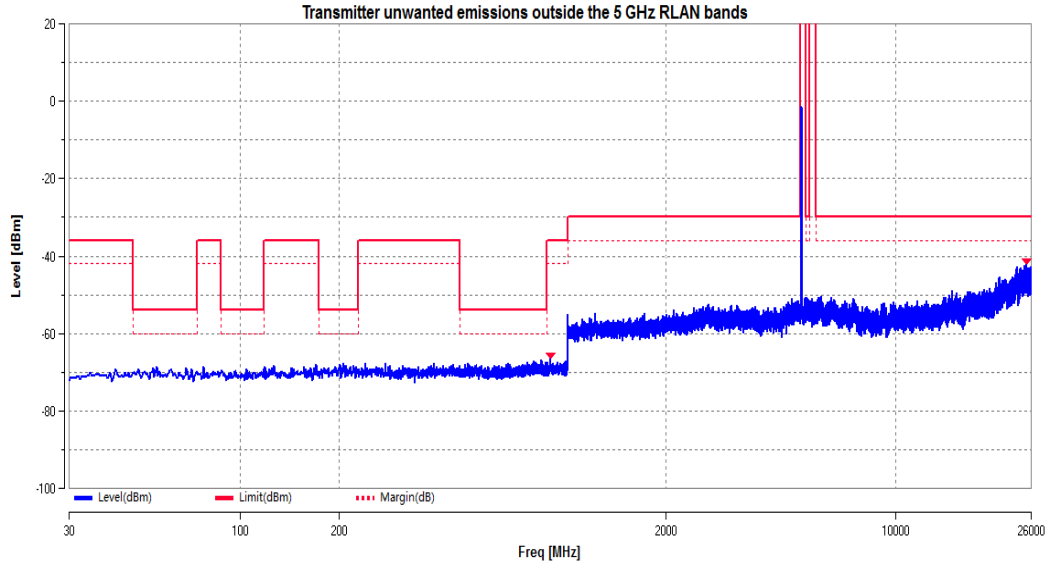
802.11 n40

CH38



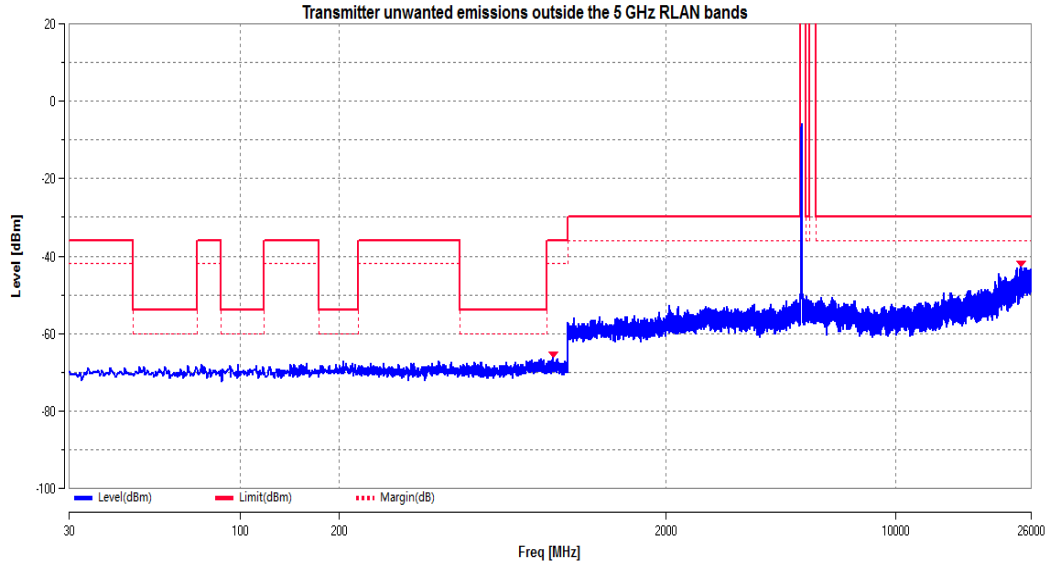
802.11 ac20

CH36



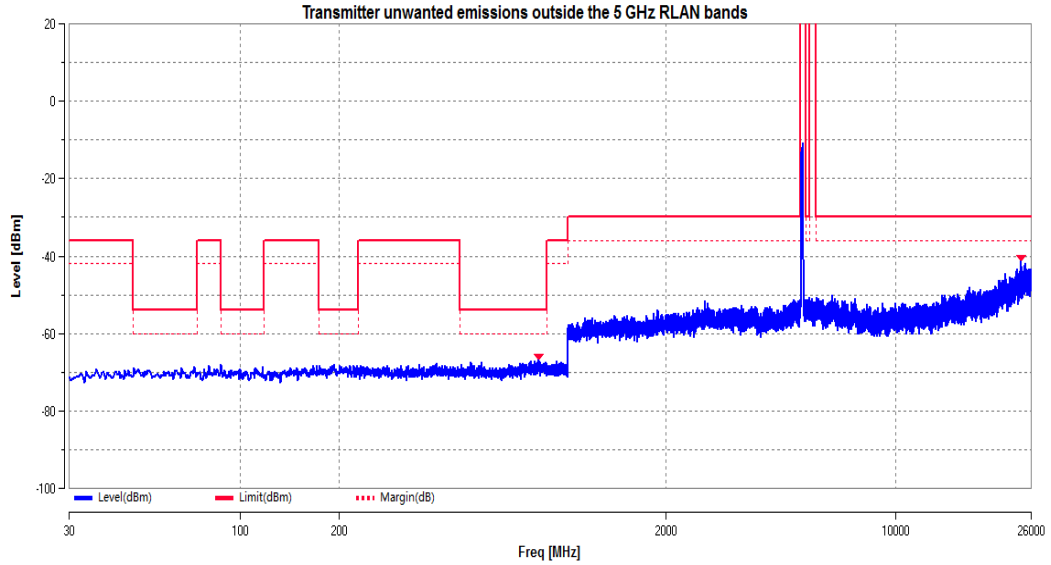
802.11 ac40

CH38



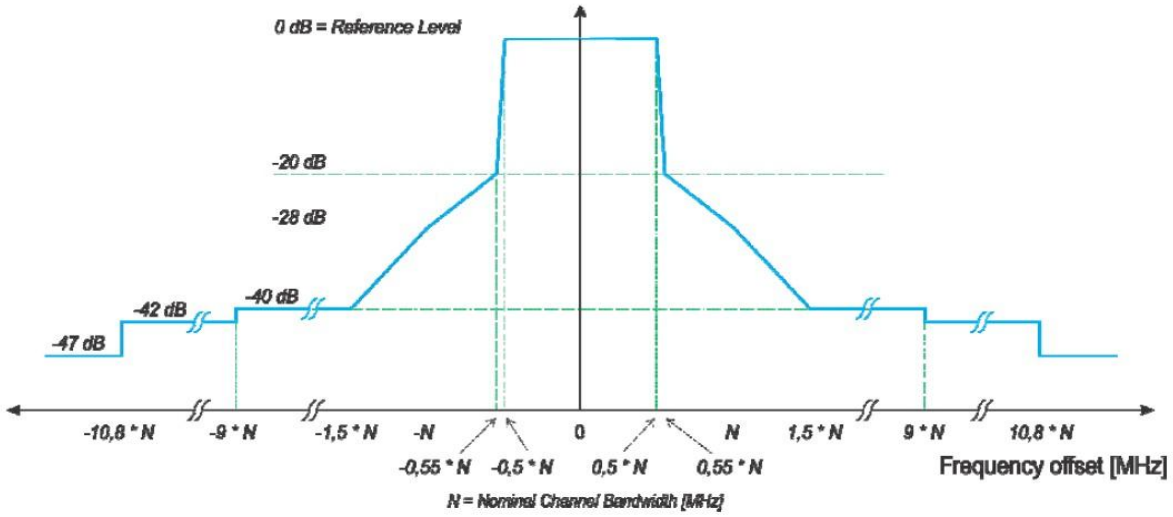
802.11 ac80

CH42



4.5.2. Transmitter unwanted emissions within the 5 GHz RLAN bands

LIMIT



NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

Figure 1: Transmit spectral power mask

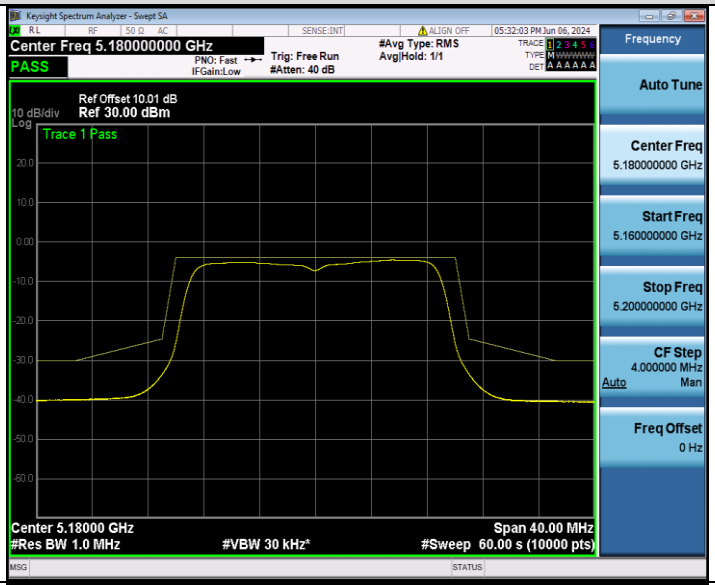
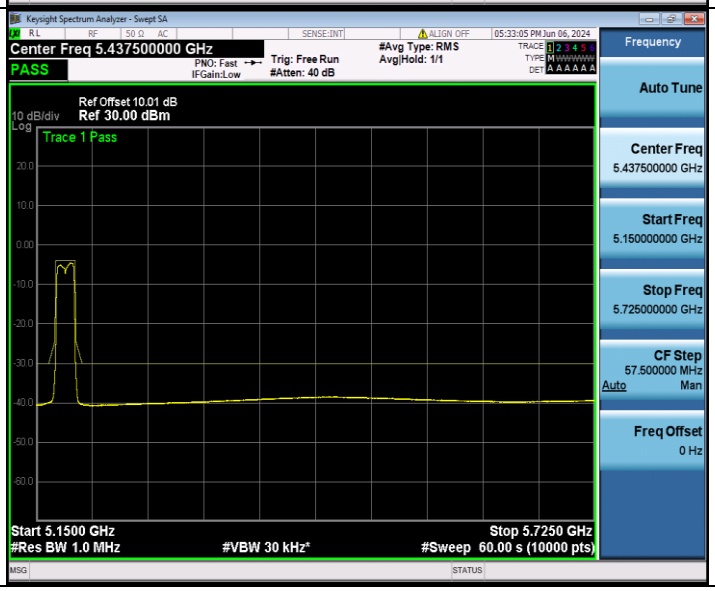
Test Procedure

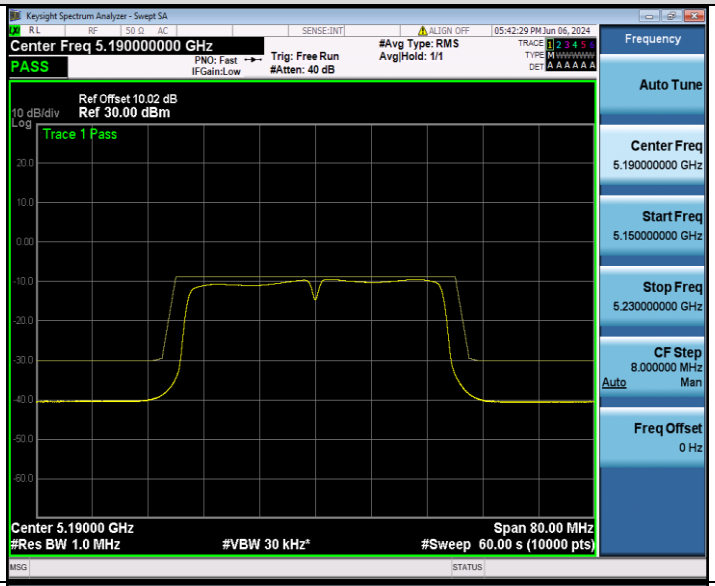
1. The measurement procedure follows ETSI EN 301 893 (V2.1.1) Sub-clause .4.6.2.1.
2. The measurement shall only be performed at normal test conditions.

Test Result

The test plots as follow:

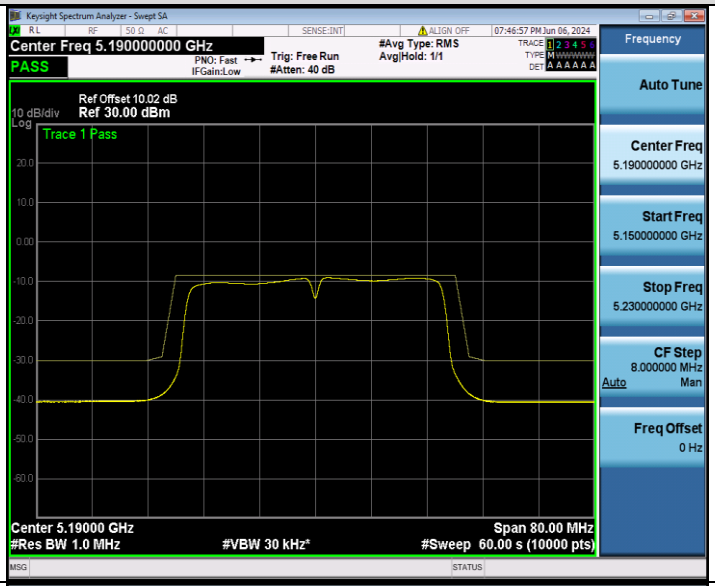
802.11a
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.180000000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 05:22:48 PM Jun 06, 2024 Frequency Auto Tune Ref Offset 10.01 dB 10 dB/div Ref 30.00 dBm Log Trace 1 Pass Center Freq 5.180000000 GHz Start Freq 5.160000000 GHz Stop Freq 5.200000000 GHz CF Step 4.000000 MHz Auto Man Freq Offset 0 Hz Center 5.18000 GHz #Res BW 1.0 MHz #VBW 30 kHz* Span 40.00 MHz #Sweep 60.00 s (10000 pts) MSG STATUS
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.437500000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 05:23:51 PM Jun 06, 2024 Frequency Auto Tune Ref Offset 10.01 dB 10 dB/div Ref 30.00 dBm Log Trace 1 Pass Center Freq 5.437500000 GHz Start Freq 5.150000000 GHz Stop Freq 5.725000000 GHz CF Step 57.500000 MHz Auto Man Freq Offset 0 Hz Start 5.1500 GHz #Res BW 1.0 MHz #VBW 30 kHz* Stop 5.7250 GHz #Sweep 60.00 s (10000 pts) MSG STATUS

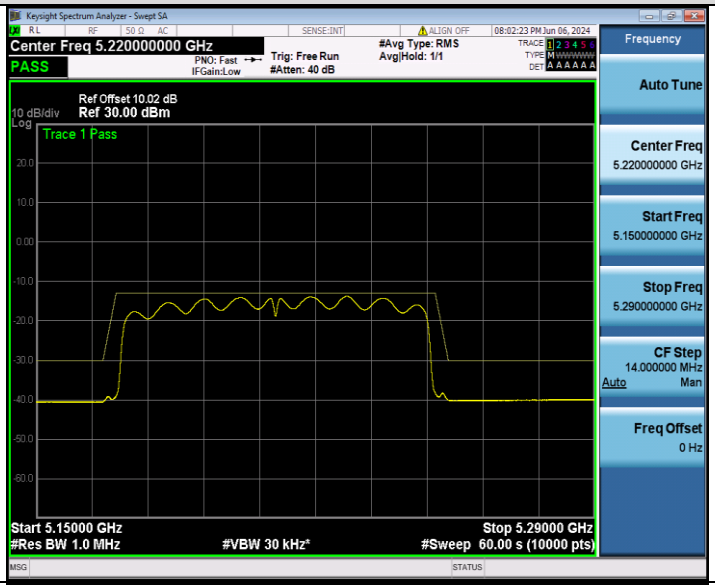
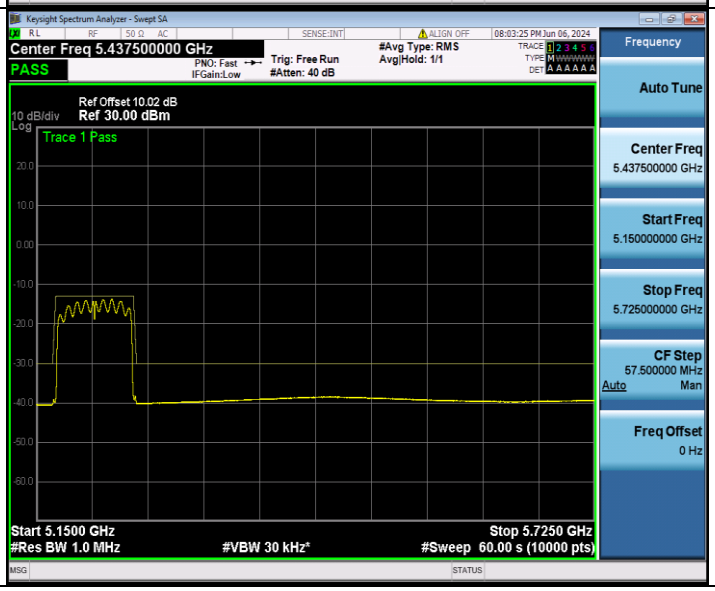
802.11n20
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.180000000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 05:32:03 PM Jun 06, 2024 Ref Offset 10.01 dB 10 dB/div Ref 30.00 dBm Log Trace 1 Pass Center 5.18000 GHz #Res BW 1.0 MHz #VBW 30 kHz* Span 40.00 MHz #Sweep 60.00 s (10000 pts) Frequency Auto Tune Center Freq 5.180000000 GHz Start Freq 5.160000000 GHz Stop Freq 5.200000000 GHz CF Step 4.000000 MHz Auto Man Freq Offset 0 Hz
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.437500000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 05:33:05 PM Jun 06, 2024 Ref Offset 10.01 dB 10 dB/div Ref 30.00 dBm Log Trace 1 Pass Start 5.1500 GHz #Res BW 1.0 MHz #VBW 30 kHz* Stop 5.7250 GHz #Sweep 60.00 s (10000 pts) Frequency Auto Tune Center Freq 5.437500000 GHz Start Freq 5.150000000 GHz Stop Freq 5.725000000 GHz CF Step 57.500000 MHz Auto Man Freq Offset 0 Hz

802.11n40
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.190000000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 05:42:29 PM Jun 06, 2024 Frequency Auto Tune Ref Offset 10.02 dB 10 dB/div Log Ref 30.00 dBm Trace 1 Pass Center Freq 5.190000000 GHz Start Freq 5.150000000 GHz Stop Freq 5.230000000 GHz CF Step 8.000000 MHz Auto Man Freq Offset 0 Hz Center 5.19000 GHz #Res BW 1.0 MHz #VBW 30 kHz* Span 80.00 MHz #Sweep 60.00 s (10000 pts) MSG STATUS
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.437500000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 05:43:31 PM Jun 06, 2024 Frequency Auto Tune Ref Offset 10.02 dB 10 dB/div Log Ref 30.00 dBm Trace 1 Pass Center Freq 5.437500000 GHz Start Freq 5.150000000 GHz Stop Freq 5.725000000 GHz CF Step 57.500000 MHz Auto Man Freq Offset 0 Hz Start 5.1500 GHz #Res BW 1.0 MHz #VBW 30 kHz* Stop 5.7250 GHz #Sweep 60.00 s (10000 pts) MSG STATUS

802.11ac20

Keysight Spectrum Analyzer - Swept SA
Center Freq 5.180000000 GHz
PASS
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 1/1
06:01:10 PM Jun 06, 2024
Frequency
Auto Tune
Ref Offset 10.01 dB
10 dB/div
Ref 30.00 dBm
Log
Trace 1 Pass
Center Freq
5.180000000 GHz
Start Freq
5.160000000 GHz
Stop Freq
5.200000000 GHz
CF Step
4.000000 MHz
Auto
Man
Freq Offset
0 Hz
Center 5.18000 GHz
#Res BW 1.0 MHz
#VBW 30 kHz*
Span 40.00 MHz
#Sweep 60.00 s (10000 pts)
MSG
STATUS
Keysight Spectrum Analyzer - Swept SA
Center Freq 5.437500000 GHz
PASS
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 1/1
06:02:11 PM Jun 06, 2024
Frequency
Auto Tune
Ref Offset 10.01 dB
10 dB/div
Ref 30.00 dBm
Log
Trace 1 Pass
Center Freq
5.437500000 GHz
Start Freq
5.150000000 GHz
Stop Freq
5.725000000 GHz
CF Step
57.500000 MHz
Auto
Man
Freq Offset
0 Hz
Start 5.1500 GHz
#Res BW 1.0 MHz
#VBW 30 kHz*
Stop 5.7250 GHz
#Sweep 60.00 s (10000 pts)
MSG
STATUS

802.11ac40
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.190000000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 07:46:57 PM Jun 06, 2024 Ref Offset 10.02 dB 10 dB/div Log Ref 30.00 dBm Trace 1 Pass Center 5.19000 GHz #Res BW 1.0 MHz #VBW 30 kHz* Span 80.00 MHz #Sweep 60.00 s (10000 pts) Frequency Auto Tune Center Freq 5.190000000 GHz Start Freq 5.150000000 GHz Stop Freq 5.230000000 GHz CF Step 8.000000 MHz Auto Man Freq Offset 0 Hz MSG STATUS
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.437500000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 07:47:59 PM Jun 06, 2024 Ref Offset 10.02 dB 10 dB/div Log Ref 30.00 dBm Trace 1 Pass Start 5.1500 GHz #Res BW 1.0 MHz #VBW 30 kHz* Stop 5.7250 GHz #Sweep 60.00 s (10000 pts) Frequency Auto Tune Center Freq 5.437500000 GHz Start Freq 5.150000000 GHz Stop Freq 5.725000000 GHz CF Step 57.500000 MHz Auto Man Freq Offset 0 Hz MSG STATUS

802.11ac80
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.220000000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 08:02:23 PM Jun 06, 2024 Ref Offset 10.02 dB 10 dB/div Log Ref 30.00 dBm Trace 1 Pass Start 5.15000 GHz #Res BW 1.0 MHz #VBW 30 kHz* Stop 5.29000 GHz #Sweep 60.00 s (10000 pts) Frequency Auto Tune Center Freq 5.220000000 GHz Start Freq 5.150000000 GHz Stop Freq 5.290000000 GHz CF Step 14.000000 MHz Auto Man Freq Offset 0 Hz
 Keysight Spectrum Analyzer - Swept SA Center Freq 5.437500000 GHz PASS PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB #Avg Type: RMS Avg|Hold: 1/1 08:03:25 PM Jun 06, 2024 Ref Offset 10.02 dB 10 dB/div Log Ref 30.00 dBm Trace 1 Pass Start 5.1500 GHz #Res BW 1.0 MHz #VBW 30 kHz* Stop 5.7250 GHz #Sweep 60.00 s (10000 pts) Frequency Auto Tune Center Freq 5.437500000 GHz Start Freq 5.150000000 GHz Stop Freq 5.725000000 GHz CF Step 57.500000 MHz Auto Man Freq Offset 0 Hz

4.6. Receiver spurious emissions

The spurious emissions of the receiver shall not exceed the limits given in table 4.

Table 4: Spurious radiated emission limits

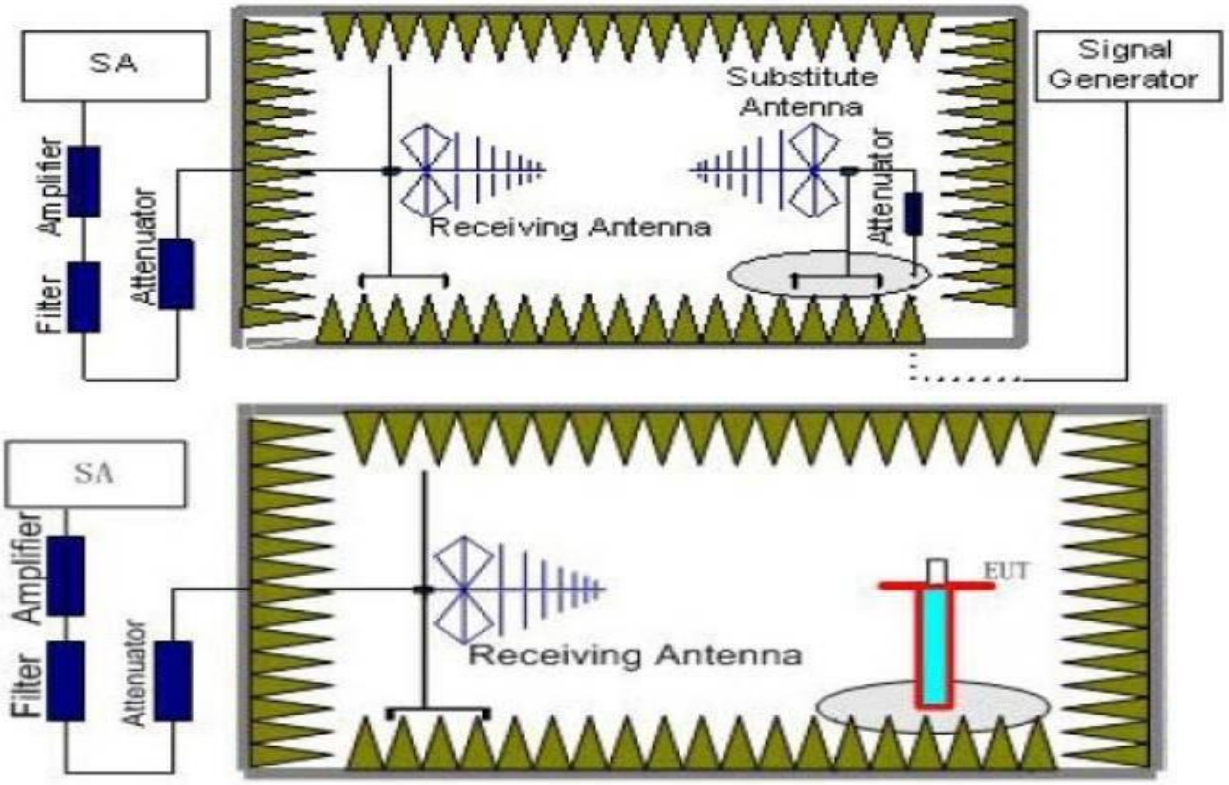
Frequency range	Maximum power	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 26 GHz	-47 dBm	1 MHz

Test Procedure

1. The measurement procedure follows ETSI EN 301 893 (V2.1.1) Sub-clause 5.4.7.2.2
2. The measurement shall only be performed at normal test conditions.
3. One channel out of the declared channels for each sub-band shall be tested.

Test Configuration

Effective Radiated Power measurement (30 MHz to 26 GHz)



TEST RESULTS

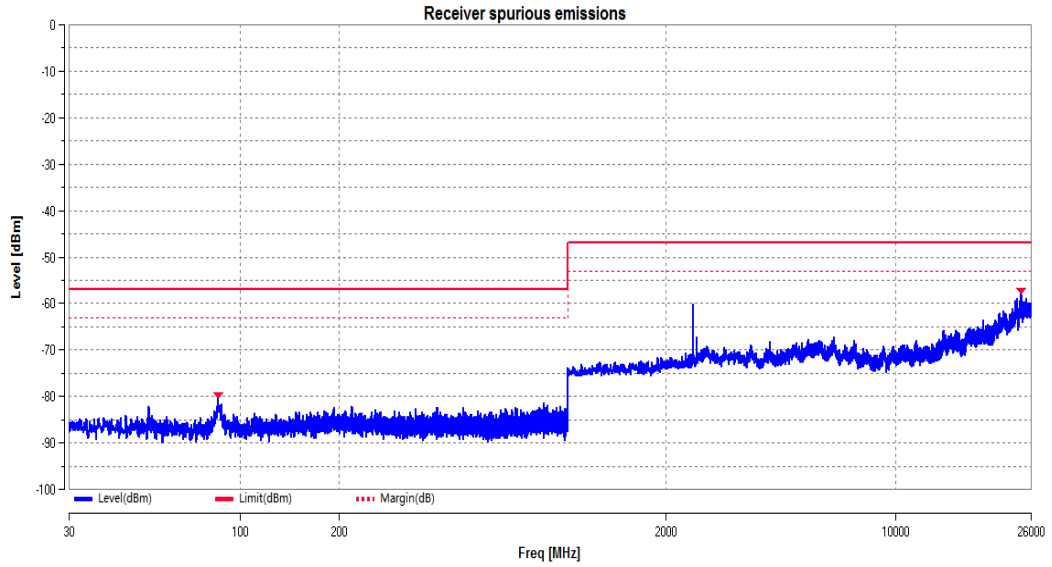
The Worst Test Result For 802.11n(20MHz) (The Worst Case)					
Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 36 (5180MHz)					
55.87	H	-83.69	-57.00	-26.69	PK
62.72	V	-76.15	-57.00	-19.15	PK
805.33	H	-75.96	-57.00	-18.96	PK
921.52	V	-76.24	-57.00	-19.24	PK
1242.36	H	-64.73	-47.00	-17.73	PK
1312.31	V	-65.39	-47.00	-18.39	PK
6270.09	H	-59.90	-47.00	-12.90	PK
6367.02	V	-61.61	-47.00	-14.61	PK

NOTE: All the modes have been tested and recorded worst mode in the report.

Conducted Spurious Emissions:

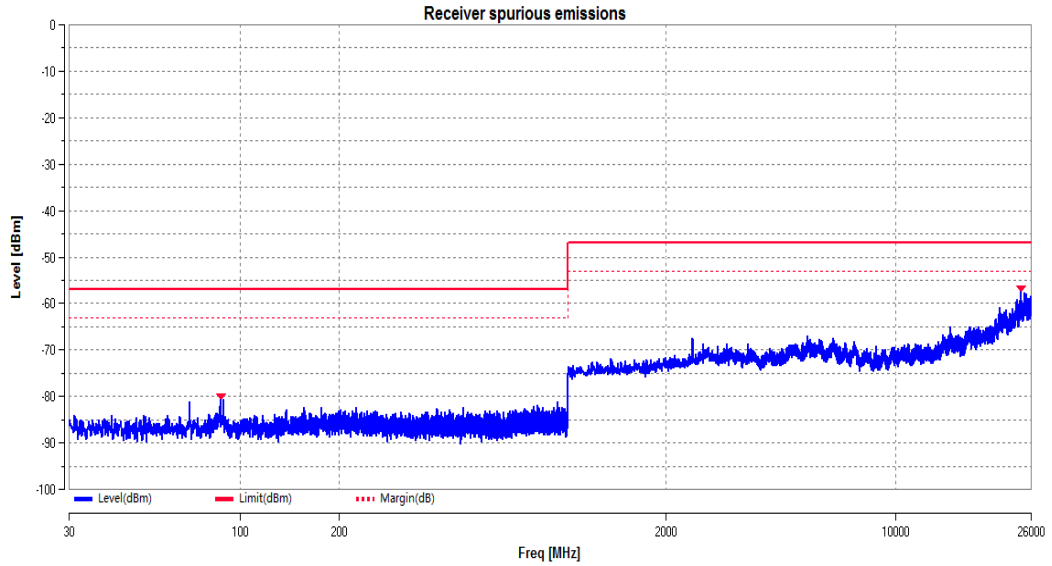
802.11 a

CH36



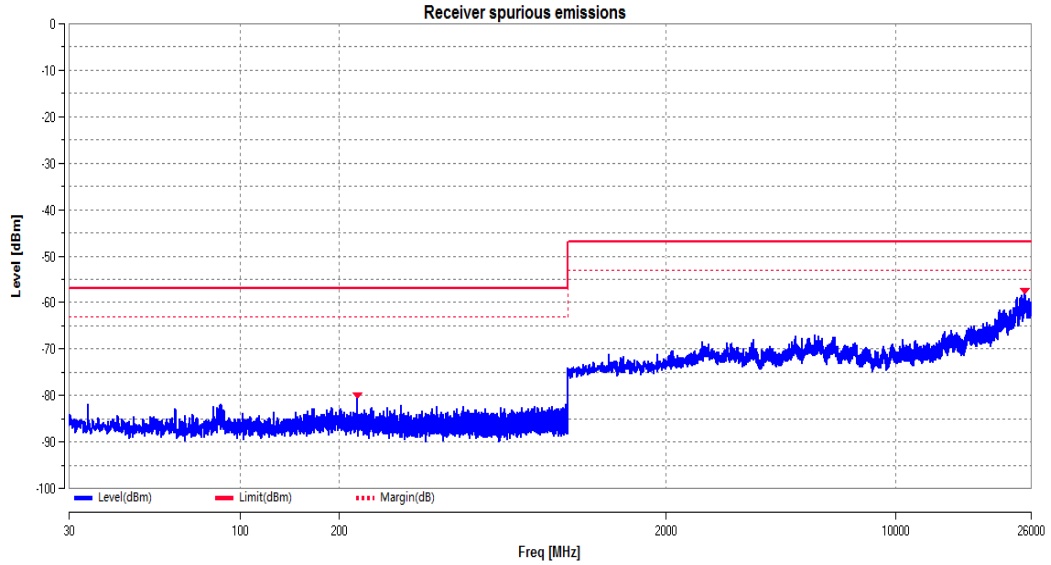
802.11 n20

CH36



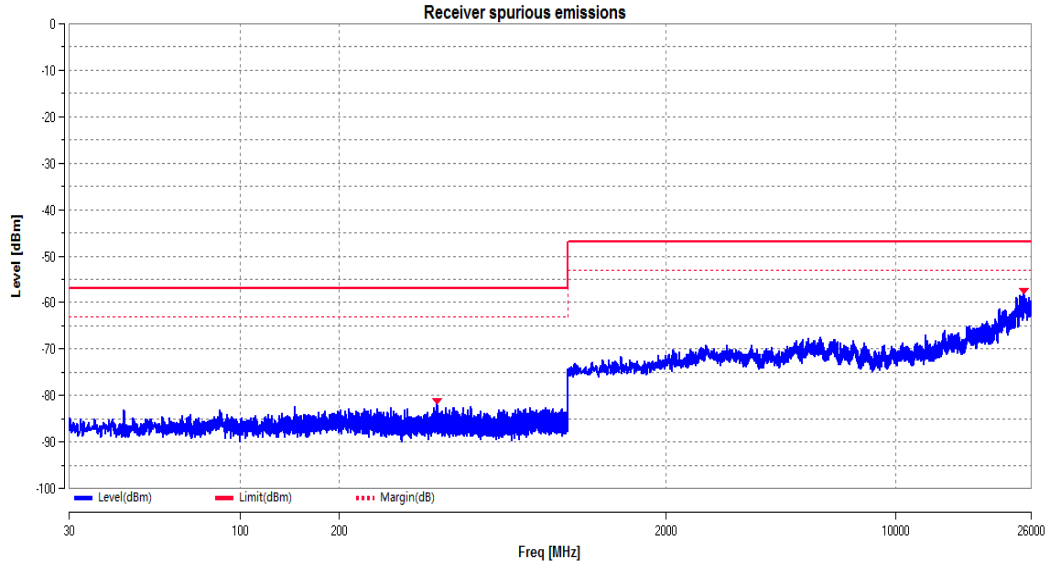
802.11 n40

CH38



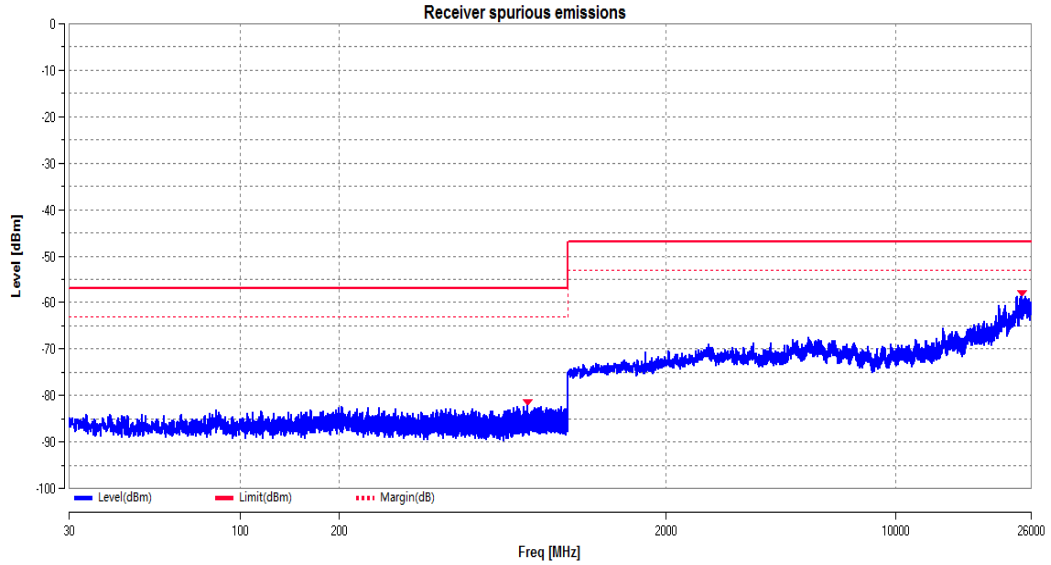
802.11 ac20

CH36



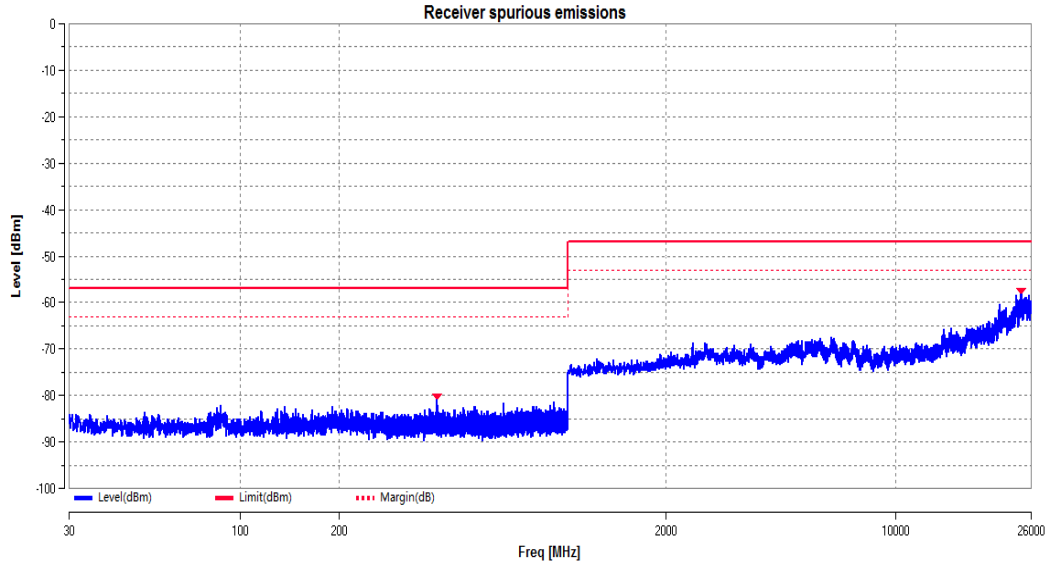
802.11 ac40

CH38



802.11 ac80

CH42



NOTE: All the modes have been tested and recorded worst mode in the report.

4.7. Dynamic Frequency Selection (DFS)

DFS parameters

Table D.1: DFS requirement values

Parameter	Value
Channel Availability Check Time	60 s (see note 1)
Minimum Off-Channel CAC Time	6 minutes (see note 2)
Maximum Off-Channel CAC Time	4 hours (see note 2)
Channel Move Time	10 s
Channel Closing Transmission Time	1 s
Non-Occupancy Period	30 minutes
NOTE 1: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the *Channel Availability Check Time* shall be 10 minutes. NOTE 2: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the *Off-Channel CAC Time* shall be within the range 1 to 24 hours.	

Table D.2: Interference threshold values

e.i.r.p. Spectral Density dBm/MHz	Value (see notes 1 and 2)
10	-62 dBm
NOTE 1: This is the level at the input of the receiver of an RLAN device with a maximum e.i.r.p. density of 10 dBm/MHz and assuming a 0 dBi receive antenna. For devices employing different e.i.r.p. spectral density and/or a different receive antenna gain G (dBi) the DFS threshold level at the receiver input follows the following relationship: DFS Detection Threshold (dBm) = -62 + 10 - e.i.r.p. Spectral Density (dBm/MHz) + G (dBi), however the DFS threshold level shall not be lower than -64 dBm assuming a 0 dBi receive antenna gain. NOTE 2: Slave devices with a maximum e.i.r.p. of less than 23 dBm do not have to implement radar detection.	

Table D.3: Parameters of the reference DFS test signal

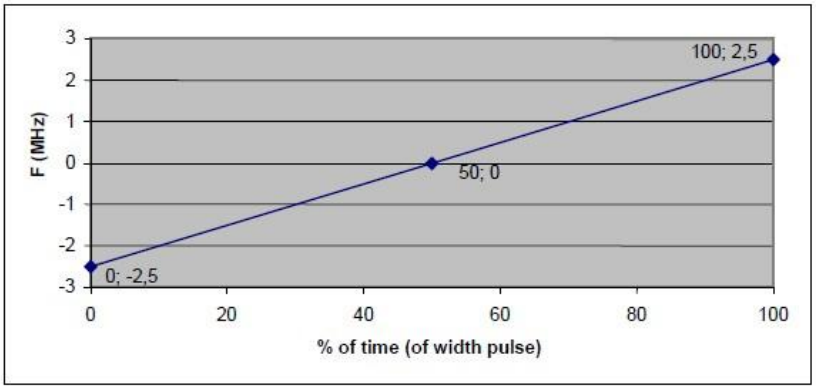
Pulse width W [µs]	Pulse repetition frequency PRF [PPS]	Pulses per burst [PPB]
1	700	18

Table D.4: Parameters of radar test signals

Radar test signal # (see notes 1 to 3)	Pulse width W [µs]		Pulse repetition frequency PRF (PPS)		Number of different PRFs	Pulses per burst for each PRF (PPB) (see note 5)
	Min	Max	Min	Max		
1	0,5	5	200	1 000	1	10 (see note 6)
2	0,5	15	200	1 600	1	15 (see note 6)
3	0,5	15	2 300	4 000	1	25
4	20	30	2 000	4 000	1	20
5	0,5	2	300	400	2/3	10 (see note 6)
6	0,5	2	400	1 200	2/3	15 (see note 6)

NOTE 1: Radar test signals 1 to 4 are constant PRF based signals. See figure D.1. These radar test signals are intended to simulate also radars using a packet based Staggered PRF. See figure D.2.

NOTE 2: Radar test signal 4 is a modulated radar test signal. The modulation to be used is a chirp modulation with a ±2,5 MHz frequency deviation which is described below.



NOTE 3: Radar test signals 5 and 6 are single pulse based Staggered PRF radar test signals using 2 or 3 different PRF values. For radar test signal 5, the difference between the PRF values chosen shall be between 20 PPS and 50 PPS. For radar test signal 6, the difference between the PRF values chosen shall be between 80 PPS and 400 PPS. See figure D.3.

NOTE 4: Apart for the Off-Channel CAC testing, the radar test signals above shall only contain a single burst of pulses. See figures D.1, D.3 and D.4.
For the Off-Channel CAC testing, repetitive bursts shall be used for the total duration of the test. See figures D.2 and D.5. See also clauses 4.7.2.2, 5.3.8.2.1.3.1 and 5.3.8.2.1.3.2.

NOTE 5: The total number of pulses in a burst is equal to the number of pulses for a single PRF multiplied by the number of different PRFs used.

NOTE 6: For the CAC and Off-Channel CAC requirements, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5 600 MHz to 5 650 MHz shall be 18.

Table D.5: Detection probability

Parameter	Detection Probability (P_d)	
	Channels whose nominal bandwidth falls partly or completely within the 5 600 MHz to 5 650 MHz band	Other channels
CAC, Off-Channel CAC	99,99 %	60 %
In-Service Monitoring	60 %	60 %

NOTE: P_d gives the probability of detection per simulated radar burst and represents a minimum level of detection performance under defined conditions. Therefore P_d does not represent the overall detection probability for any particular radar under real life conditions.

Test set-ups

Set-up A

Set-up A is a set-up whereby the UUT is an RLAN device operating in master mode. Radar test signals are injected into the UUT. This set-up also contains an RLAN device operating in slave mode which is associated with the UUT.

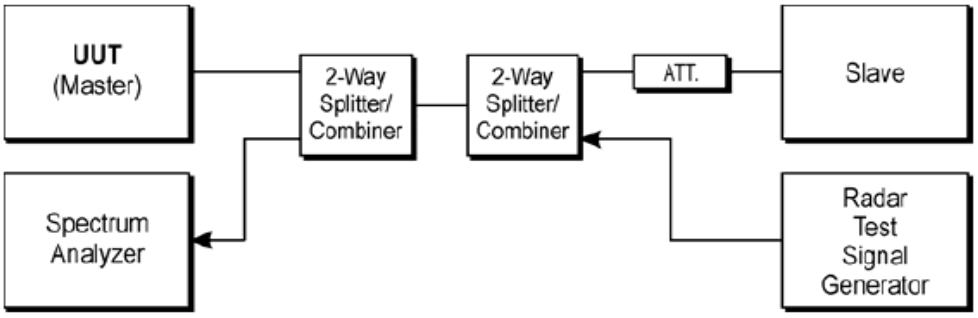


Figure 4: Set-up A

Set-up B

Set-up B is a set-up whereby the UUT is an RLAN device operating in slave mode, with or without Radar Interference Detection function. This set-up also contains an RLAN device operating in master mode. The radar test signals are injected into the master device. The UUT (slave device) is associated with the master device。

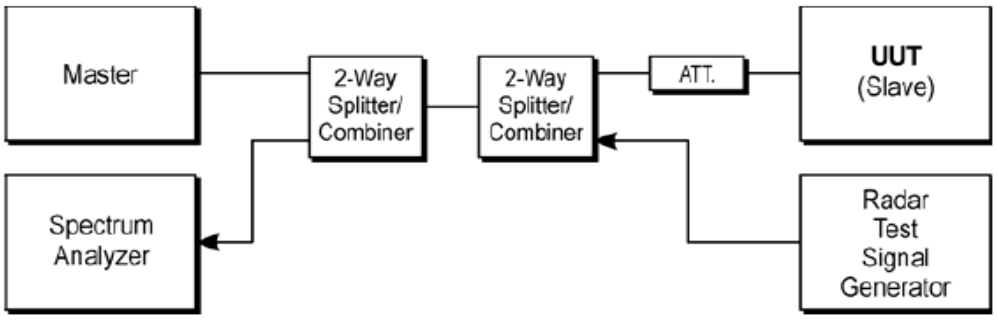


Figure 5: Set-up B

Set-up C

The UUT is an RLAN device operating in slave mode with Radar Interference Detection function. Radar test signals are injected into the slave device. This set-up also contains an RLAN device operating in master mode. The UUT (slave device) is associated with the master device.

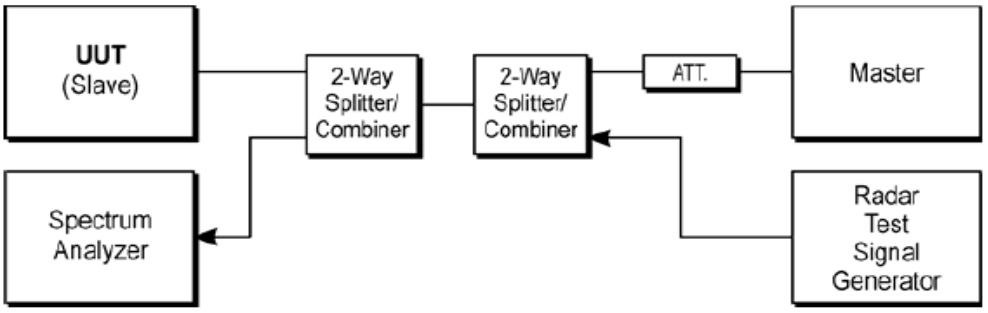


Figure 6: Set-up C

DFS technical requirements specifications

Follow table lists the DFS related technical requirements and their applicability for every operational mode. If the RLAN device is capable of operating in more than one operational mode then every operating mode shall be assessed separately.

Applicability of DFS requirements

Requirement	DFS Operational mode		
	Master	**Slave without radar detection** (see table D.2, note 2)	**Slave with radar detection** (see table D.2, note 2)
Channel Availability Check	√	Not required	√(see note 2)
Off-Channel CAC (see note 1)	√	Not required	√(see note 2)
In-Service Monitoring	√	Not required	√
Channel Shutdown	√	√	√
Non-Occupancy Period	√	Not required	√
Uniform Spreading	√	Not required	Not required
NOTE 1: Where implemented by the manufacturer. NOTE 2: A slave with radar detection is not required to perform a CAC or Off-Channel CAC at initial use of the channel but only after the slave has detected a radar signal on the Operating Channel by In-Service Monitoring.			

TEST RESULTS

Testing is not required for nominal channel bandwidths that fall completely within the frequency range 5 150 MHz to 5 250 MHz. So this test item is not applicable for the EUT.

4.8. Adaptivity

Requirements and limits

Adaptivity (Channel Access Mechanism) is an automatic mechanism by which a device limits its transmissions and gains access to an Operating Channel.

The present document defines two types of adaptive equipment:
• Frame Based Equipment;
• Load Based Equipment.

Adaptivity is not intended to be used as an alternative to DFS to detect radar transmissions, but to detect transmissions from other RLAN devices operating in the band. DFS requirements are covered by clause 4.2.6.

Frame Based Equipment:

Frame Based Equipment shall comply with the following requirements:
1) The Fixed Frame Periods supported by the equipment shall be declared by the manufacturer. See clause 5.4.1, item q). This shall be within the range of 1 ms to 10 ms. Transmissions can start only at the beginning of a Fixed Frame Period. See figure 2 below. An equipment may change its Fixed Frame Period but it shall not do more than once every 200 ms.
2) Immediately before starting transmissions on an Operating Channel at the start of a Fixed Frame Period, the Initiating Device shall perform a Clear Channel Assessment (CCA) check during a single Observation Slot. The Operating Channel shall be considered occupied if the energy level in the channel exceeds the ED Threshold Level (TL) given in point 6) below. If the Initiating Device finds the Operating Channel(s) to be clear, it may transmit immediately. See figure 2.
If the Initiating Device finds an Operating Channel occupied, then there shall be no transmissions on that channel during the next Fixed Frame Period. The Frame Based Equipment is allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.2.7.3.3.
For equipment having simultaneous transmissions on multiple (adjacent or non-adjacent) Operating Channels, the equipment is allowed to continue transmissions on other Operating Channels providing the CCA check did not detect any signals on those channels.
The total time during which Frame Based Equipment can have transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time (COT).
The equipment can have multiple transmissions within a Channel Occupancy Time without performing an additional CCA on this Operating Channel providing the gap between such transmissions does not exceed 16 µs.
If the gap exceeds 16 µs, the equipment may continue transmissions provided that an additional CCA detects no RLAN transmissions with a level above the threshold defined in point 6). The additional CCA shall be performed within the gap and within the observation slot immediately before transmission. All gaps are counted as part of the Channel Occupancy Time.
3) An Initiating Device is allowed to grant an authorization to one or more associated Responding Devices to transmit on the current Operating Channel within the current Channel Occupancy Time. A Responding Device that receives such a grant shall follow the procedure described in clause 4.2.7.3.1.5.
4) The Channel Occupancy Time shall not be greater than 95 % of the Fixed Frame Period defined in point 1) and shall be followed by an Idle Period until the start of the next Fixed Frame Period such that the Idle Period is at least 5 % of the Channel Occupancy Time, with a minimum of 100 µs.
5) The equipment, upon correct reception of a packet which was intended for this equipment, can skip CCA and immediately proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames). A consecutive sequence of such transmissions by the equipment, without it performing a new CCA, shall not exceed the Maximum Channel Occupancy Time as defined in point 4) above.
For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.
6) The ED Threshold Level (TL), at the input of the receiver, shall be proportional to the maximum transmit power (PH) according to the formula which assumes a 0 dBi receive antenna and PH to be specified in dBm e.i.r.p.
For PH ≤ 13 dBm: TL = -75 dBm/MHz
For 13 dBm < PH < 23 dBm: TL = -85 dBm/MHz + (23 dBm - PH)
For PH ≥ 23 dBm: TL = -85 dBm/MHz

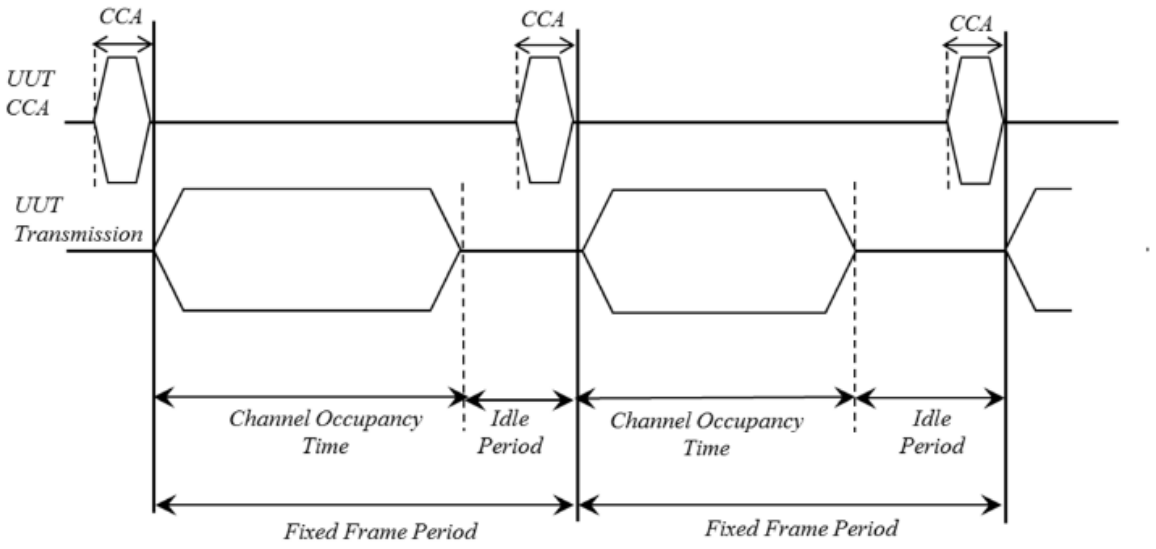


Figure 2: Example of timing for Frame Based Equipment

Load Based Equipment:

Before a transmission or a burst of transmissions on an Operating Channel, the Initiating Device shall operate at least one Channel Access Engine that executes the procedure described in step 1) to step 8) below. This Channel Access Engine makes use of the parameters defined in table 7 or table 8 in clause 4.2.7.3.2.4.

A single Observation Slot as defined in clause 3.1 and as referenced by the procedure in the present clause shall have a duration of not less than 9 µs.

An Initiating Device shall operate at least one and no more than four different Channel Access Engines each with a different Priority Class as defined in clause 4.2.7.3.2.4:

1) The Channel Access Engine shall set CW to CWmin.

2) The Channel Access Engine shall select a random number q from a uniform distribution over the range 0 to CW. Note 2 in table 7 defines an alternative range for q when the previous or next Channel Occupancy Time is greater than the maximum Channel Occupancy Time specified in table 7.

3) The Channel Access Engine shall initiate a Prioritization Period as described in step 3) a) to step 3) c):

a) The Channel Access Engine shall set p according to the Priority Class associated with this Channel Access Engine. See clause 4.2.7.3.2.4.

b) The Channel Access Engine shall wait for a period of 16 µs.

c) The Channel Access Engine shall perform a Clear Channel Assessment (CCA) on the Operating Channel during a single Observation Slot:

i) The Operating Channel shall be considered occupied if other transmissions within this channel are detected with a level above the ED threshold defined in clause 4.2.7.3.2.5. In this case, the Channel Access Engine shall initiate a new Prioritization Period starting with step 3) a) after the energy within the channel has dropped below the ED threshold defined in clause 4.2.7.3.2.5.

ii) In case no energy within the Operating Channel is detected with a level above the ED threshold defined in clause 4.2.7.3.2.5, p may be decremented by not more than 1. If p is equal to 0, the Channel Access Engine shall proceed with step 4), otherwise the Channel Access Engine shall proceed with step 3) c).

4) The Channel Access Engine shall perform a Backoff Procedure as described in step 4) a) to step 4) d):

a) This step verifies if the Channel Access Engine satisfies the Post Backoff condition. If $q < 0$ and the Channel Access Engine is ready for a transmission, the Channel Access Engine shall set CW equal to CWmin and shall select a random number q from a uniform distribution over the range 0 to CW before proceeding with step 4) b). Note 2 in table 7 defines an alternative range for q when the previous or next Channel Occupancy Time is greater than the maximum Channel Occupancy Time specified in table 7.

b) If $q < 1$ the Channel Access Engine shall proceed with step 4) d). Otherwise, the Channel Access Engine may decrement the value q by not more than 1 and the Channel Access Engine shall proceed with step 4) c).

c) The Channel Access Engine shall perform a Clear Channel Assessment (CCA) on the Operating Channel during a single Observation Slot:

i) The Operating Channel shall be considered occupied if energy was detected with a level above the ED threshold defined in clause 4.2.7.3.2.5. In this case, the Channel Access Engine shall continue with step 3).

ii) If no energy was detected with a level above the ED threshold defined in clause 4.2.7.3.2.5, the Channel Access Engine shall continue with step 4) b).

d) If the Channel Access Engine is ready for a transmission the Channel Access Engine shall continue with step 5). Otherwise, the Channel Access Engine shall decrement the value q by 1 and the Channel Access Engine shall proceed with step 4) c). It should be understood that q can become negative and keep decrementing as long as the Channel Access Engine is not ready for a transmission.

If only one Channel Access Engine of the Initiating Device is in this stage (see note 1) the Channel Access Engine shall proceed with step 6). If the Initiating Device has a multitude of Channel Access Engines in this stage (see note 2), the Channel Access Engine with highest Priority Class in this multitude shall proceed with step 6) and all other Channel Access Engines in the current stage shall proceed with step 8).
NOTE 1: This is equivalent to the equipment having no internal collision.
NOTE 2: This is equivalent to the equipment having one or more internal collisions.
The Channel Access Engine may start transmissions belonging to the corresponding or higher Priority Classes, on one or more Operating Channels. If the initiating device transmits in more than one Operating Channels, it shall comply with the requirements contained in clause 4.2.7.3.2.3:
a) The Channel Access Engine can have multiple transmissions without performing an additional CCA on this Operating Channel providing the gap in between such transmissions does not exceed 16 μs. Otherwise, if this gap exceeds 16 μs and does not exceed 25 μs, the Initiating Device may continue transmissions provided that no energy was detected with a level above the ED threshold defined in clause 4.2.7.3.2.5 for a duration of one Observation Slot.
b) The Channel Access Engine may grant an authorization to transmit on the current Operating Channel to one or more Responding Devices. If the Initiating Device issues such a transmission grant to a Responding Device, the Responding Device shall operate according to the procedure described in clause 4.2.7.3.2.7.
c) The Initiating Device may have simultaneous transmissions of Priority Classes lower than the Priority Class of the Channel Access Engine, provided that the corresponding transmission duration (Channel Occupancy Time) is not extended beyond the time that is needed for the transmission(s) corresponding to the Priority Class of the Channel Access Engine.
7) When the Channel Occupancy has completed, and it has been confirmed that at least one transmission that started at the beginning of the Channel Occupancy was successful, the Initiating Device proceeds with step 1) otherwise the Initiating Device proceeds with step 8).
8) The Initiating Device may retransmit. If the Initiating Device does not retransmit the Channel Access Engine shall discard all data packets associated with the unsuccessful Channel Occupancy and the Channel Access Engine shall proceed with step 1). Otherwise, the Channel Access Engine shall adjust CW to ((CW + 1) × m) - 1 with m ≥ 2. If the adjusted value of CW is greater than CWmax the Channel Access Engine may set CW equal to CWmax. The Channel Access Engine shall proceed with step 2).
According to clause 4.2.7.3.2.4 where four different Priority Classes are defined, an Initiating Device shall operate only one Channel Access Engine for each Priority Class implemented.
CW may take values that are greater than the values of CW in step 1) to step 8).

Equipment shall consider a channel to be occupied as long as other RLAN transmissions are detected at a level greater than the ED Threshold Level (TL). The ED Threshold Level (TL) is integrated over the total Nominal Channel Bandwidth of all Operating Channels used by the equipment.
The ED Threshold level (TL) depends on the type of equipment:
Option 1: For equipment that for its operation in the 5 GHz bands is conforming to IEEE 802.11™-2016 [9], clause 17, clause 19 or clause 21, or any combination of these clauses, the ED Threshold Level (TL) is independent of the equipment's maximum transmit power (PH). Assuming a 0 dBi receive antenna the ED Threshold Level (TL) shall be:
TL = -75 dBm/MHz
Option 2: For equipment conforming to one or more of the clauses listed in Option 1, and to at least one other operating mode, and for equipment conforming to none of the clauses listed in Option 1, the ED Threshold Level (TL) shall be proportional to the equipment's maximum transmit power (PH).
Assuming a 0 dBi receive antenna the ED Threshold Level (TL) shall be:
For PH
≤ 13 dBm: TL = -75 dBm/MHz
For 13 dBm < PH < 23 dBm: TL = -85 dBm/MHz + (23 dBm - PH) (3)
For PH ≥ 23 dBm: TL = -85 dBm/MHz
Equipment shall consider a channel to be occupied as long as other RLAN transmissions are detected at a level greater than the TL.

Short Control Signalling Transmissions (FBE and LBE)
Frame Based Equipment and Load Based Equipment are allowed to have Short Control Signalling Transmissions on the Operating Channel providing these transmissions comply with the requirements in clause 4.2.7.3.3. It is not required for adaptive equipment to implement Short Control Signalling Transmissions.

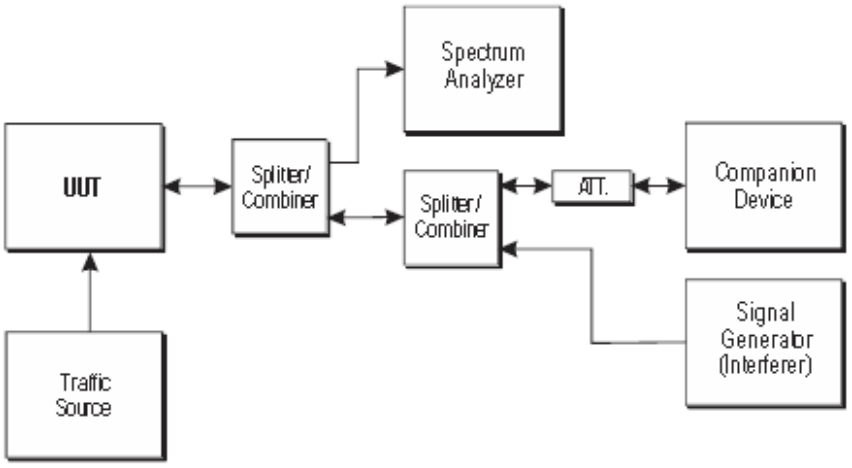
Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.9
These measurements shall only be performed at normal test conditions.
The different steps below define the procedure to verify the efficiency of the adaptivity mechanism of the equipment.

Step 1:

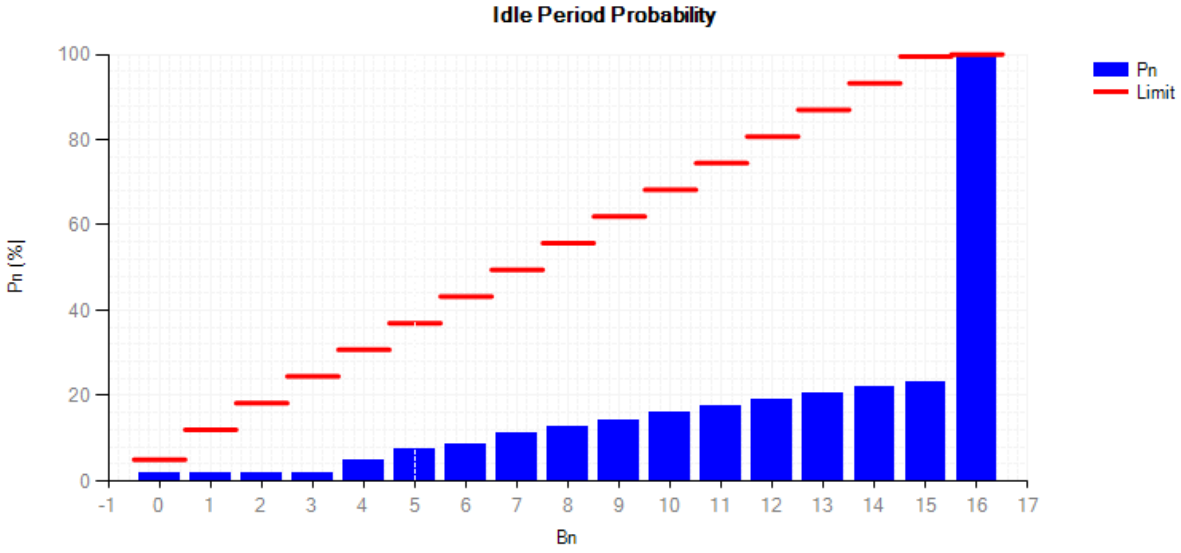
• The UUT shall connect to a companion device during the test. The signal generator, the spectrum analyser, the UUT, the traffic source and the companion device are connected using a set-up equivalent to the example given by figure 14 although the interference source is switched off at this point in time. The spectrum analyser is used to monitor the transmissions of the UUT in response to the interference signal. The traffic source might be part of the UUT itself.
• The received signal level (wanted signal from the companion device) at the UUT shall be sufficient to maintain a reliable link for the duration of the test. A typical value for the received signal level which can be used in most cases is -50 dBm/MHz.

Test Configuration



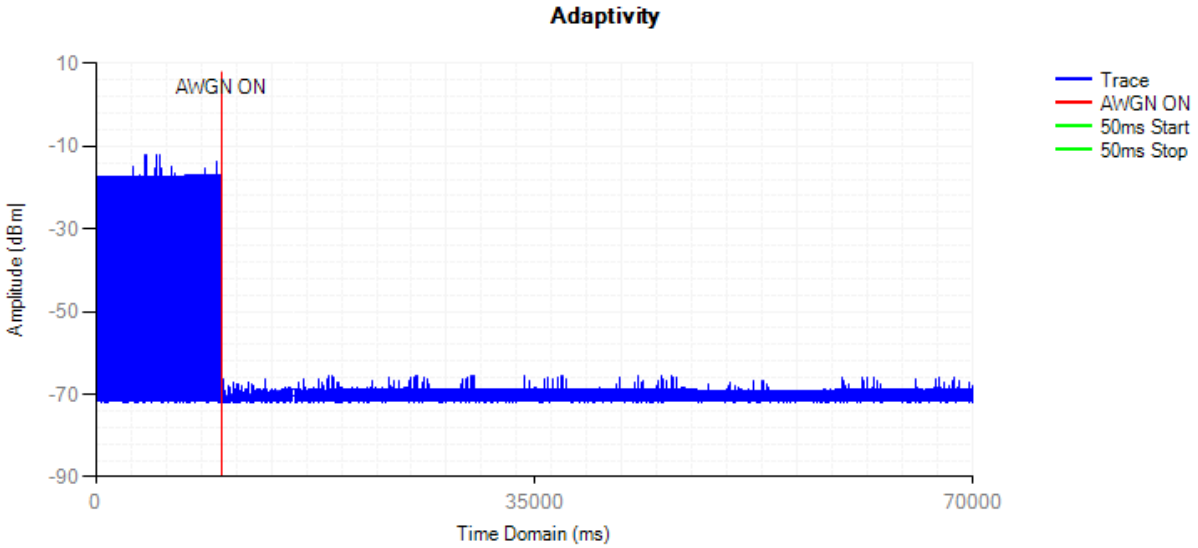
TEST RESULTS

According to Table 11 in clause 5.3.2 of ETSI EN 301 893 V2.1.1(2017-05), for adaptivity, testing shall be performed using the highest nominal channel bandwidth. So this test item is only performed on 802.11ac(80MHz; Channel 42: 5210MHz)



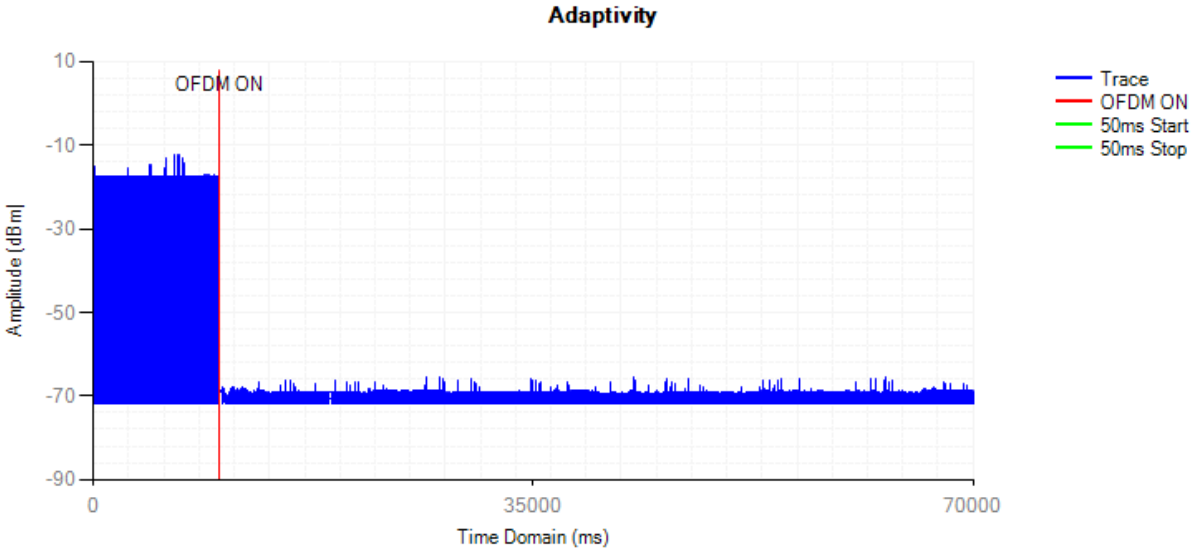
Test Mode	802.11ac(80MHz; Channel 42: 5210MHz)
AWGN Interference Level (dBm)	-63.95
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Suggest q Level	4
Max. COT (ms)	5.36
Pulse width (ms)	0
Duty Cycle (%)	0

Test plot For 802.11ac(80MHz; Channel 42: 5210MHz):



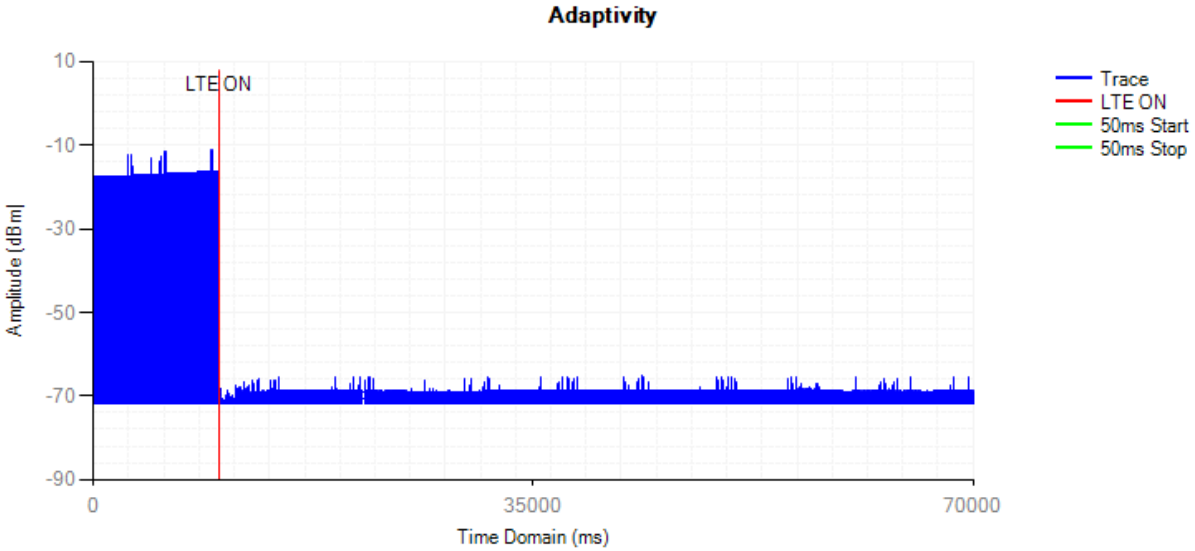
Test Mode	802.11ac(80MHz; Channel 42: 5210MHz)
OFDM Interference Level (dBm)	-66.25
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Suggest q Level	4
Max. COT (ms)	5.26
Pulse width (ms)	0
Duty Cycle (%)	0

Test plot For 802.11ac(80MHz; Channel 42: 5210MHz):



Test Mode (MAIN Port)	802.11ac(80MHz; Channel 42: 5210MHz)
LTE Interference Level (dBm)	-65.93
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Suggest q Level	4
Max. COT (ms)	5.81
Pulse width (ms)	0
Duty Cycle (%)	0

Test plot For 802.11ac(80MHz; Channel 42: 5210MHz):



4.9. Receiver Blocking

Limits

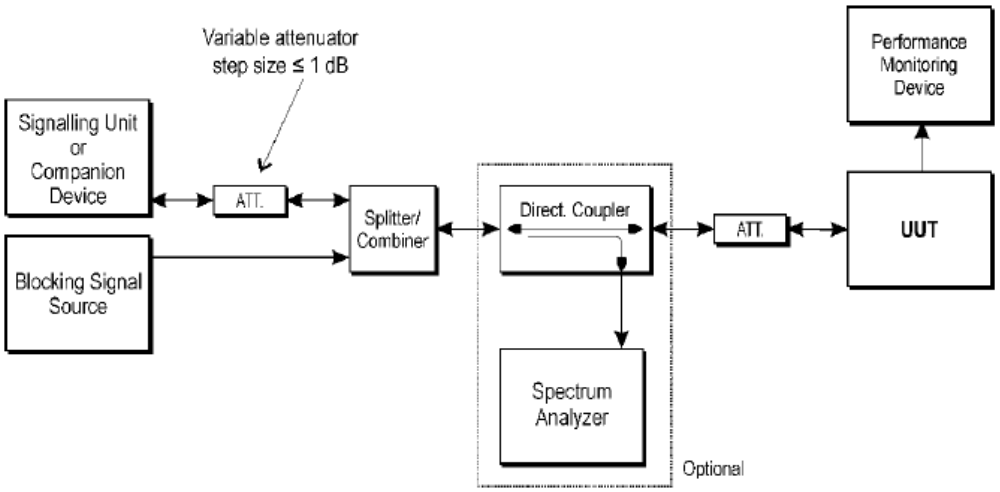
ETSI EN 301 893 Sub-4.2.8.4

While maintaining the minimum performance criteria as defined in clause 4.2.8.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined in table 9.

Table 9: Receiver Blocking parameters

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)		Type of blocking signal
		Master or Slave with radar detection (see table D.2, note 2)	Slave without radar detection (see table D.2, note 2)	
Pmin + 6 dB	5 100	-53	-59	Continuous Wave
Pmin + 6 dB	4 900 5 000 5 975	-47	-53	Continuous Wave
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined clause 4.2.8.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the same levels should be used at the antenna connector irrespective of antenna gain.				

TEST CONFIGURATION:



TEST PROCEDURE

Please refer to ETSI EN 301 893 Sub-clause 5.4.10.2.1 for the measurement method.

TEST RESULTS

The Worst Test Result For 802.11a/CH36 (The Worst Case)						
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)		Limit(PER)	test value(PER)	Result
		Test Value	Limit			
-88(Pmin) + 6dB	5100	-58	-59	10%	3%	PASS
	4900	-51	-53	10%	6%	PASS
	5000	-51	-53	10%	5%	PASS
	5975	-52	-53	10%	3%	PASS

The Worst Test Result For 802.11n 20/CH36 (The Worst Case)						
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)		Limit(PER)	test value(PER)	Result
		Test Value	Limit			
-85(Pmin) + 6dB	5100	-58	-59	10%	4%	PASS
	4900	-51	-53	10%	5%	PASS
	5000	-52	-53	10%	6%	PASS
	5975	-52	-53	10%	4%	PASS

The Worst Test Result For 802.11 n 40/CH38 (The Worst Case)						
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)		Limit(PER)	test value(PER)	Result
		Test Value	Limit			
-87(Pmin) + 6dB	5100	-58	-59	10%	3%	PASS
	4900	-51	-53	10%	5%	PASS
	5000	-52	-53	10%	2%	PASS
	5975	-51	-53	10%	4%	PASS

The Worst Test Result For 802.11 ac 80/CH42 (The Worst Case)						
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)		Limit(PER)	test value(PER)	Result
		Test Value	Limit			
-88(Pmin) + 6dB	5100	-58	-59	10%	5%	PASS
	4900	-50	-53	10%	4%	PASS
	5000	-51	-53	10%	5%	PASS
	5975	-51	-53	10%	1%	PASS

4.10. User Access Restrictions

Requirement

The equipment shall be so constructed that settings (hardware and/or software) related to DFS shall not be accessible to the user if changing those settings result in the equipment no longer being compliant with the DFS requirements in EN301893 (clause 4.7) The above requirement includes the prevention of indirect access to any setting that impacts DFS.

Result

The EUT do not use the DFS Band and The customers will not obtain the information to set hardware and/ software related to DFS, if the product is on sales.So The EUT meets this requirement.

4.11. Geo-location capability

Requirement

Geo-location capability is a feature of the RLAN device to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates. The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical location may also be available in equipment already installed and operating at the same geographical location.

The geographical location determined by the equipment as defined in the above shall not be accessible to the user.

Result

This requirement only applies to equipment with geo-location capability,and the EUT do not support this fuction.So this requirement is not applicable for the EUT.

5. TEST SETUP PHOTOS OF THE EUT

Reference to the test report No. **GTS20240426022-1-14.**

6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No. **GTS20240426022-1-14.**

.....End of Report.....