RADIO TEST REPORT

For

Shenzhen Cudy Technology Co., Ltd.

Cellular WiFi Router

Test Model: LT500

Additional Model No.: P5, LT12, LT700, LT18, LT500D, LT450, LT350

Prepared for	:	Shenzhen Cudy Technology Co., Ltd.
Address	:	Room A606, Gaoxinqi Industrial Park, Liuxianyi Road, Baoan District, Shenzhen, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Tel	:	(+86)755-82591330
Fax	:	(+86)755-82591332
Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	July 07, 2022
Number of tested samples	:	2
Serial number	:	Prototype
Date of Test	:	July 07, 2022 ~ July 20, 2022
Date of Report	:	July 21, 2022

CE

RADIO TEST REPORT
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

Report Reference No.	:	**LCSA062122013ED**
Date of Issue.....	:	July 21, 2022
Testing Laboratory Name.....	:	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure ...	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	:	**Shenzhen Cudy Technology Co., Ltd.**
Address.....	:	Room A606, Gaoxinqi Industrial Park, Liuxianyi Road, Baoan District, Shenzhen, China
Test Specification		
Standard	:	ETSI EN 301 893 V2.1.1 (2017-05)
Test Report Form No.	:	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

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Test Item Description.....	:	**Cellular WiFi Router**
Trade Mark.....	:	Cudy
Test Model	:	LT500
Ratings.....	:	Input: 12V⎓1A For Adapter Input: 100-240V~, 50/60Hz, 0.5A For Adapter Output: 12.0V⎓1.0A, 12.0W
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Vera Deng/ Administrator	Cary Luo/ Technique principal	Gavin Liang/ Manager

RADIO -- TEST REPORT

Test Report No. : LCSA062122013ED	July 21, 2022 Date of issue

Test Model.....	: LT500
EUT.....	: Cellular WiFi Router
Applicant.....	**: Shenzhen Cudy Technology Co., Ltd.**
Address.....	: Room A606, Gaoxinqi Industrial Park, Liuxianyi Road, Baoan District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Shenzhen Cudy Technology Co., Ltd.**
Address.....	: Room A606, Gaoxinqi Industrial Park, Liuxianyi Road, Baoan District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Factory.....	**: Shenzhen Cudy Technology Co., Ltd.**
Address.....	: Room A606, Gaoxinqi Industrial Park, Liuxianyi Road, Baoan District, Shenzhen, China
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

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.

Revision History

Report Version	Issue Date	Revision Content	Revised By
000	July 21, 2022	Initial Issue	--

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1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

EUT	:	Cellular WiFi Router
Test Model	:	LT500
Additional Model No.	:	P5, LT12, LT700, LT18, LT500D, LT450, LT350
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	:	Input: 12V⎓1A For Adapter Input: 100-240V~, 50/60Hz, 0.5A For Adapter Output: 12.0V⎓1.0A, 12.0W
Hardware Version	:	V2
Software Version	:	1.14.9
WIFI(2.4G Band)	:	
Frequency Range	:	2412MHz ~ 2472MHz
Channel Spacing	:	5MHz
Channel Number	:	13 Channel for 20MHz bandwidth(2412~2472MHz) 9 channels for 40MHz bandwidth(2422~2462MHz)
Modulation Type	:	802.11b: DSSS; 802.11g/n: OFDM
Antenna Description	:	ANT0: External Antenna, 2.0dBi(Max.) ANT1: External Antenna, 2.0dBi(Max.)
WIFI(5.2G Band)	:	
Frequency Range	:	5180MHz ~ 5240MHz
Channel Number	:	4 channels for 20MHz bandwidth(5180-5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Modulation Type	:	802.11a/n/ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	ANT0: External Antenna, 2.0dBi(Max.) ANT1: External Antenna, 2.0dBi(Max.)
LTE	:	
Support Band	:	☒E-UTRA Band 1 ☒E-UTRA Band 3 ☒E-UTRA Band 5 ☒E-UTRA Band 7 ☒E-UTRA Band 8 ☒E-UTRA Band 20 ☒E-UTRA Band 38 ☒E-UTRA Band 40 ☒E-UTRA Band 41

LTE Release Version	:	R9
FDD Band	:	Uplink: E-UTRA Band 1: 1920MHz~1980MHz E-UTRA Band 3: 1710MHz~1785MHz E-UTRA Band 5: 824MHz~849MHz E-UTRA Band 7: 2500MHz~2570MHz E-UTRA Band 8: 880MHz~915MHz E-UTRA Band 20: 832MHz~862MHz Downlink: E-UTRA Band 1: 2110MHz~2170MHz E-UTRA Band 3: 1805MHz~1880MHz E-UTRA Band 5: 869MHz~894MHz E-UTRA Band 7: 2620MHz~2690MHz E-UTRA Band 8: 925MHz~960MHz E-UTRA Band 20: 791MHz~821MHz
TDD Band	:	E-UTRA Band 38: 2570MHz~2620MHz E-UTRA Band 40: 2300MHz~2400MHz E-UTRA Band 41: 2496MHz~2690MHz
Type Of Modulation	:	QPSK/16QAM
Antenna Description	:	External Antenna 1.0dBi (max.) For E-UTRA Band 1 1.0dBi (max.) For E-UTRA Band 3 1.0dBi (max.) For E-UTRA Band 5 1.0dBi (max.) For E-UTRA Band 7 1.0dBi (max.) For E-UTRA Band 8 1.0dBi (max.) For E-UTRA Band 20 1.0dBi (max.) For E-UTRA Band 38 1.0dBi (max.) For E-UTRA Band 40 1.0dBi (max.) For E-UTRA Band 41
Power Class	:	Class 3

Product Information

a) The Nominal Channel Bandwidth(s):

Nominal Channel Bandwidth 1: 20MHz
Nominal Channel Bandwidth 2: 40MHz
Nominal Channel Bandwidth 3: 80MHz
The associated centre frequencies:
For Nominal Channel Bandwidth 1:
for the band 5 150 - 5 350 MHz: 5180MHz; 5200 MHz; 5220 MHz; 5240 MHz;
for the band 5 470 - 5 725 MHz: ..... MHz; ..... MHz; ..... MHz; ..... MHz;
For Nominal Channel Bandwidth 2:
for the band 5 150 - 5 350 MHz: 5190MHz; 5230 MHz; ..... MHz; ..... MHz;
for the band 5 470 - 5 725 MHz: ..... MHz; ..... MHz; ..... MHz; ..... MHz;
For Nominal Channel Bandwidth 3:
for the band 5 150 - 5 350 MHz: 5210MHz; ..... MHz; ..... MHz; ..... MHz;
for the band 5 470 - 5 725 MHz: ..... MHz; ..... MHz; ..... MHz; ..... MHz;

b) For equipment that support simultaneous transmissions in one or more channels:

The (maximum) number of channels used for these simultaneous transmissions: .....
These channels are adjacent channels: ☐Yes ☒No
In case of non-adjacent channels, whether or not these channels are in different sub-bands:
☐Yes ☐No
NOTE 1: In case of simultaneous transmissions, further information defining the channels used for these simultaneous transmissions may be required.

c) The different transmit operating modes (see clause 5.1.4.2) (tick all that apply):

☒**Operating mode 1:** Single Antenna Equipment
☒a) Equipment with only 1 antenna
☐b) Equipment with diversity antennas but only 1 antenna active at any moment in time
☐c) Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11a legacy mode in smart antenna systems)
☐**Operating mode 2:** Smart Antenna Systems - Multiple Antennas without beamforming
☐a) Single spatial stream/Standard throughput (e.g. IEEE 802.11a legacy mode)
☐b) High Throughput (>1 spatial stream) using Nominal Channel Bandwidth 1
☐c) High Throughput (>1 spatial stream) using Nominal Channel Bandwidth 2
☐**Operating mode 3:** Smart Antenna Systems - Multiple Antennas with beamforming
☐a) Single spatial stream/Standard throughput (e.g. IEEE 802.11a legacy mode)
☐b) High Throughput (>1 spatial stream) using Nominal Channel Bandwidth 1
☐c) High Throughput (>1 spatial stream) using Nominal Channel Bandwidth 2

d) In case of Smart Antenna Systems or multiple antenna systems

• The number of Receive chains:

• The number of Transmit chains:

• Equal power distribution among the transmit chains: ☐Yes ☐No

• In case of beamforming, the maximum (additional) beamforming gain: ..... dB

NOTE 2: Beamforming gain does not include the basic gain of a single antenna (assembly).

e) TPC feature available:

☐Yes

☒No

f) For equipment with TPC range:

The lowest and highest power level (or lowest and highest e.i.r.p. level in case of integrated antenna equipment), intended antenna assemblies and corresponding operating frequency range for the TPC range (or for each of the TPC ranges if more than one is implemented).

TPC range 1: Applicable Frequency Range:

☐5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz (Indoor)

Simultaneous transmissions in both sub-bands: ☐Yes ☒No

☐5 470 MHz to 5 725 MHz only (Outdoor only)

Indicate whether the power levels specified are Transmitter Output Power levels or e.i.r.p. levels in case of integrated antenna equipment.

Power levels are specified for: ☐Tx out ☐e.i.r.p

If more than one transmit chain is present (e.g. in the case of smart antenna systems), the power levels below represent the power settings per active transmit chain (and per sub-band in case of simultaneous transmissions).

Table F.1: Power levels for TPC range 1

	Sub-band (MHz)	Operating Mode 1 (dBm)	Operating Mode 2 (dBm)	Operating Mode 3 (dBm)
Lowest setting (P_{low})	5 150 to 5 350			
	5 470 to 5 725			
Highest setting (P_{high})	5 150 to 5 350			
	5 470 to 5 725			

Beamforming possible: ☐Yes ☐No

Intended Antenna Assemblies:

Table F.2: Intended Antenna Assemblies for TPC range 1

Antenna Assembly name	Antenna Gain (dBi)	Operating Mode	Sub-band (MHz)	Beamforming gain (dB)	e.i.r.p. for P_{low} (dBm)	e.i.r.p.for P_{high} (dBm)
Antenna 1		Mode1	5150 to 5350			
			5470 to 5725			
		Mode2	5150 to 5350			
			5470 to 5725			
		Mode3	5150 to 5350			
			5470 to 5725			
Antenna 2		Mode1	5150 to 5350			
			5470 to 5725			
		Mode2	5150 to 5350			
			5470 to 5725			
		Mode3	5150 to 5350			
			5470 to 5725			
Antenna 3		Mode1	5150 to 5350			
			5470 to 5725			
		Mode2	5150 to 5350			
			5470 to 5725			
		Mode3	5150 to 5350			
			5470 to 5725			

DFS Threshold level: ..... dBm ☐at the antenna connector

☐in front of the antenna

TPC range 2: Applicable Frequency Range:

☐5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz (Indoor)

Simultaneous transmissions in both sub-bands: ☐Yes ☐No

☐5 470 MHz to 5 725 MHz only (Outdoor only)

Indicate whether the power levels specified are Transmitter Output Power levels or e.i.r.p. levels in case of integrated antenna equipment.

Power levels are specified for: ☐Tx out ☐e.i.r.p

If more than one transmit chain is present (e.g. in the case of smart antenna systems), the power levels below represent the power settings per active transmit chain (and per sub-band in case of simultaneous transmissions).

Table F.3: Power levels for TPC range 2

	Sub-band (MHz)	Operating Mode 1 (dBm)	Operating Mode 2 (dBm)	Operating Mode 3 (dBm)
Lowest setting (P_{low})	5 150 to 5 350			
	5 470 to 5 725			
Highest setting (P_{high})	5 150 to 5 350			
	5 470 to 5 725			

Beamforming possible: ☐Yes ☐No

Intended Antenna Assemblies:

Table F.4: Intended Antenna Assemblies for TPC range 2

Antenna Assembly name	Antenna Gain (dBi)	Operating Mode	Sub-band (MHz)	Beamforming gain (dB)	e.i.r.p. for P_{low} (dBm)	e.i.r.p. for P_{high} (dBm)
Antenna 1		Mode1	5150 to 5350			
			5470 to 5725			
		Mode2	5150 to 5350			
			5470 to 5725			
		Mode3	5150 to 5350			
			5470 to 5725			
Antenna 2		Mode1	5150 to 5350			
			5470 to 5725			
		Mode2	5150 to 5350			
			5470 to 5725			
		Mode3	5150 to 5350			
			5470 to 5725			
Antenna 3		Mode1	5150 to 5350			
			5470 to 5725			
		Mode2	5150 to 5350			
			5470 to 5725			
		Mode3	5150 to 5350			
			5470 to 5725			

DFS Threshold level: ..... dBm ☐at the antenna connector

☐in front of the antenna

g) For equipment without a TPC range:

Power Setting 1: Applicable Frequency Range:

☒5 150 MHz to 5 350 MHz (Indoor)

Simultaneous transmissions in both sub-bands: ☐Yes ☒No

☐5 470 MHz to 5 725 MHz only (Outdoor only)

Indicate whether the power levels specified are Transmitter Output Power levels or e.i.r.p. levels in case of integrated antenna equipment.
Power levels are specified for: ☐Tx out ☒e.i.r.p.

If more than one transmit chain is present (e.g. in the case of smart antenna systems), the power levels below represent the power settings per active transmit chain (and per sub-band in case of simultaneous transmissions).

Table F.5: Maximum Transmitter Output Power for Power Setting 1

Sub-band (MHz)	Operating Mode 1 (dBm)	Operating Mode 2 (dBm)	Operating Mode 3 (dBm)
5150 to 5350			
5470to 5725			

Beamforming possible: ☐Yes ☒No

Intended Antenna Assemblies

Table F.6: Intended Antenna Assemblies for Power Setting 1

Antenna Assembly name	Antenna Gain (dBi)	Operating Mode	Sub-band (MHz)	e.i.r.p. for P_{low} (dBm)	e.i.r.p. for P_{high} (dBm)
Antenna 1		Mode1	5150 to 5350		
			5470 to 5725		
		Mode2	5150 to 5350		
			5470 to 5725		
		Mode3	5150 to 5350		
			5470 to 5725		
Antenna 2		Mode1	5150 to 5350		
			5470 to 5725		
		Mode2	5150 to 5350		
			5470 to 5725		
		Mode3	5150 to 5350		
			5470 to 5725		
Antenna 3		Mode1	5150 to 5350		
			5470 to 5725		
		Mode2	5150 to 5350		
			5470 to 5725		
		Mode3	5150 to 5350		
			5470 to 5725		

DFS Threshold level: ..... dBm ☐at the antenna connector
☐in front of the antenna

Power Setting 2: Applicable Frequency Range:
☐5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz (Indoor)
Simultaneous transmissions in both sub-bands: ☐Yes ☐No
☐5 470 MHz to 5 725 MHz only (Outdoor only)
Indicate whether the power levels specified are Transmitter Output Power levels or e.i.r.p. levels in case of integrated antenna equipment
Power levels are specified for: ☐Tx out ☐e.i.r.p.

If more than one transmit chain is present (e.g. in the case of smart antenna systems), the power levels below represent the power settings per active transmit chain (and per sub-band in case of simultaneous transmissions).

Table F.7: Maximum Transmitter Output Power for Power Setting 2

Sub-band (MHz)	Operating Mode 1 (dBm)	Operating Mode 2 (dBm)	Operating Mode 3 (dBm)
5150 to 5350			
5470to 5725			

Beamforming possible: ☐Yes ☐No

Intended Antenna Assemblies

Table F.8: Intended Antenna Assemblies for Power Setting 2

Antenna Assembly name	Antenna Gain (dBi)	Operating Mode	Sub-band (MHz)	e.i.r.p. for P_{low} (dBm)	e.i.r.p. for P_{high} (dBm)
Antenna 1		Mode1	5150 to 5350		
			5470 to 5725		
		Mode2	5150 to 5350		
			5470 to 5725		
		Mode3	5150 to 5350		
			5470 to 5725		
Antenna 2		Mode1	5150 to 5350		
			5470 to 5725		
		Mode2	5150 to 5350		
			5470 to 5725		
		Mode3	5150 to 5350		
			5470 to 5725		
Antenna 3		Mode1	5150 to 5350		
			5470 to 5725		
		Mode2	5150 to 5350		
			5470 to 5725		
		Mode3	5150 to 5350		
			5470 to 5725		

DFS Threshold level: ..... dBm ☐at the antenna connector

☐in front of the antenna

h) The DFS related operating mode(s) of the equipment

☐Master

☐Slave with radar detection

☐Slave without radar detection

NOTE 7: If the equipment has more than 1 operating mode, tick all that apply.

i) User access restrictions (please check box below to confirm)

☐the equipment is constructed to comply with the requirements contained in clause 4.10 in ETSI EN 301 893 V2.1.1.

j) For equipment with Off-Channel CAC functionality

The equipment has an "Off-Channel CAC" function: ☐Yes ☐No

If yes, specify the "Off-Channel CAC Time"

• For channels outside the 5 600 MHz to 5 650 MHz range: ..... hours

• If applicable, for channels (partially) within the 5 600 MHz to 5 650 MHz range: ..... hours

k) The equipment can operate in ad-hoc mode

☐no ad-hoc operation

☒ad-hoc operation in the frequency range 5 150 MHz to 5 250 MHz without DFS

☐ad-hoc operation with DFS

If more than 1 is applicable, tick all that apply.

l) Operating Frequency Range(s):

Range 1: ☐ 5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz

Range 2: ☐5 470 MHz to 5 725 MHz

Range 3: ☒5 150 MHz to 5 250 MHz (ad-hoc without DFS)

Range 4: ☐other, please specify: ……..

If the equipment has more than one Operating Frequency Range, tick all that apply.

m) The extreme operating temperature and supply voltage range that apply to the equipment:

☒-20 °C to +45 °C (Outdoor & Indoor usage)

☐0 °C to +35 °C (Indoor usage only)

☐Other: .....

The supply voltages of the stand-alone radio equipment or the supply voltages of the combined (host) equipment or test jig in case of plug-in devices:

Details provided are for the: ☒stand-alone equipment

☐combined (or host) equipment

☐test jig

Supply Voltage: ☒ AC mains State AC voltage: Minimum: … Nominal: ... Maximum: ...
☒DC State DC voltage Minimum: …
In case of DC, indicate the type of power source:
☐Internal Power Supply
☒External Power Supply or AC/DC adapter
☐Battery ☐Nickel Cadmium
☐Alkaline
☐Nickel-Metal Hydride
☐Lithium-Ion
☐Lead acid (Vehicle regulated)
☐Other .....

n) The test sequence/test software used (see also ETSI EN 301 893 V2.1.1 (2017-05)):
.....
.....

o) Type of Equipment
☒Stand-alone
☐Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐Plug-in radio device (Equipment intended for a variety of host systems)
☐Other .....

p) Adaptivity (Channel Access Mechanism) ☒Yes ☐No
☐Frame Based Equipment
☐Load Based Equipment – Option A
☒Load Based Equipment – Option B
Specify which protocol has been implemented: ☒IEEE 802.11™ ☐Other: .....

q) Clear Channel Assessment
In case of Load Based Equipment implementing Option B (see clause 4.8.3.2) the value q: 4

1.2. Objective

This Type approval report is prepared on behalf of **Shenzhen Cudy Technology Co., Ltd.** in accordance with 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

The objective is to determine compliance with ETSI EN 301 893 V2.1.1 (2017-05).

1.3. Related Submittal(s)/Grant(s)

No Related Submittals.

1.4. Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 893 V2.1.1 (2017-05).

1.5. Description of Test Facility

NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.

1.6. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
DEE VAN ENTERPRISE CO., LTD	Adapter	DSA-12PF11-12 FEU 120100	--	CE
Lenovo	Notebook	TP00094A	--	CE

Note: The notebook is supplied by lab and only use tested.

1.7. External I/O

I/O Port Description	Quantity	Cable
Power Port	1	N/A
LAN Port	4	N/A

1.8. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Occupied Channel Bandwidth	5 %
RF output power, conducted	1,5 dB
Power Spectral Density, conducted	3 dB
Unwanted Emissions, conducted	3 dB
All emissions, radiated	6 dB
Temperature	1 °C
Humidity	5 %
DC and low frequency voltages	3 %
Time	5 %
Duty Cycle	5 %

1.9. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	23.1
Humidity (%RH)	25-75	53.3
Barometric pressure (mbar)	860-1060	950-1000

1.10. Description of Test Modes

LCS has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit by 802.11a
Mode 2: Transmit by 802.11n(20MHz)
Mode 3: Transmit by 802.11ac(20MHz)
Mode 4: Transmit by 802.11n(40MHz)
Mode 5: Transmit by 802.11ac(40MHz)
Mode 6: Transmit by 802.11ac(80MHz)
Mode 7: Receive by 802.11a
Mode 8: Receive by 802.11n(20MHz)
Mode 9: Receive by 802.11ac(20MHz)
Mode 10: Receive by 802.11n(40MHz)
Mode 11: Receive by 802.11ac(40MHz)
Mode 12: Receive by 802.11ac(80MHz)

Note:

(1) For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

(2) Regard to the frequency band operation for systems using Wide Band modulation: the lowest, middle, highest frequency channel for conducted test, and the lowest, highest frequency channel for radiation spurious test.

(3) The extreme test condition for voltage and temperature were declared by the manufacturer.

2. SYSTEM TEST CONFIGURATION

2.1. Justification

The system was configured for testing in engineering mode.

2.2. EUT Exercise Software

N/A.

2.3. Special Accessories

N/A.

2.4. Block Diagram/Schematics

Please refer to the related document.

2.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

2.6. Configuration of Test Setup

Please refer to the test setup photo.

3. SUMMARY OF TEST RESULT

☒ No deviations from the test standards

☐ Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Centre Frequencies	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Nominal Channel Bandwidth and Occupied Channel Bandwidth	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
RF Output Power	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Transmit Power Control (TPC)	ETSI EN 301 893 V2.1.1 (2017-05)	N/A	N/A
Power Density	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Transmitter unwanted emissions outside the 5 GHz RLAN bands	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Transmitter unwanted emissions within the 5 GHz RLAN bands	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Receiver spurious emissions	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Dynamic Frequency Selection (DFS)	ETSI EN 301 893 V2.1.1 (2017-05)	N/A	N/A
Adaptivity (Channel Access Mechanism)	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Receiver Blocking	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
User Access Restrictions	ETSI EN 301 893 V2.1.1 (2017-05)	Yes	No
Geo-location capability	ETSI EN 301 893 V2.1.1 (2017-05)	N/A	N/A

Note:
1. The EUT can operate in an adaptive mode, and can't operate in a non-adaptive mode which is stated by the supplier.
2. The EUT is equipment which using wide band modulations other than FHSS. It is an adaptive equipment which can't operate in non-adaptive mode.
3. N/A: the test item not required for channels whose nominal bandwidth falls completely within the band 5150 MHz to 5250 MHz.

4. TEST RESULTS

4.1. Centre Frequencies

4.1.1 Limit

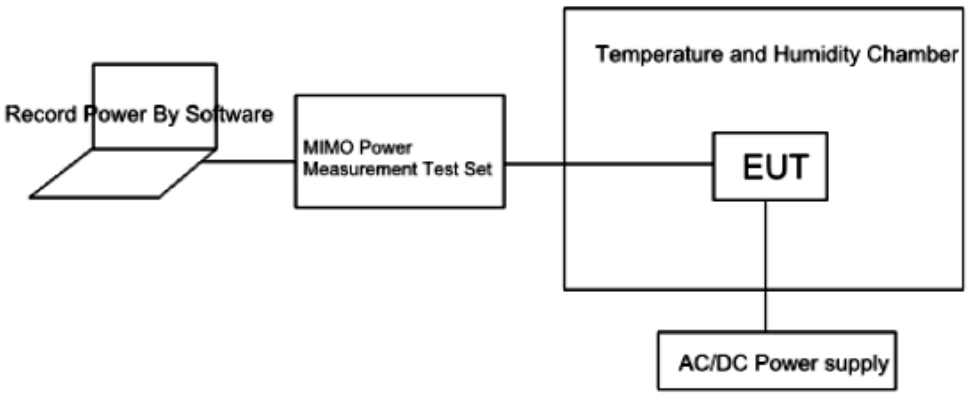
The centre frequency is the centre of the channel declared by the manufacturer as part of the declared channel plan(s).

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

In case of conducted measurements on smart antenna systems (devices with multiple transmit chains) the measurements shall be performed on only one of the active transmit chains.

4.1.2 Test Setup

These measurements shall be performed under both normal and extreme test conditions.
For Conducted Measurement



4.1.3 Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.2

Conducted measurement:

1) Equipment operating without modulation

• This test method requires that the UUT can be operated in an unmodulated test mode.

• 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.

• The result shall be recorded.

2) Equipment operating with modulation

• This method is an alternative to the above method in case the UUT cannot be operated in an un-modulated mode.

• The UUT shall be connected to spectrum analyser.

• Max Hold shall be selected and the centre frequency adjusted to that of the UUT.

• 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.

• 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.

• The centre frequency is calculated as $(f_H + f_L) / 2$.

4.1.4 Test Result

Please refer to the Appendix F.1 for 5.2G WIFI RF Test Data.

4.2. Nominal Channel Bandwidth and Occupied Channel Bandwidth

4.2.1 Limit

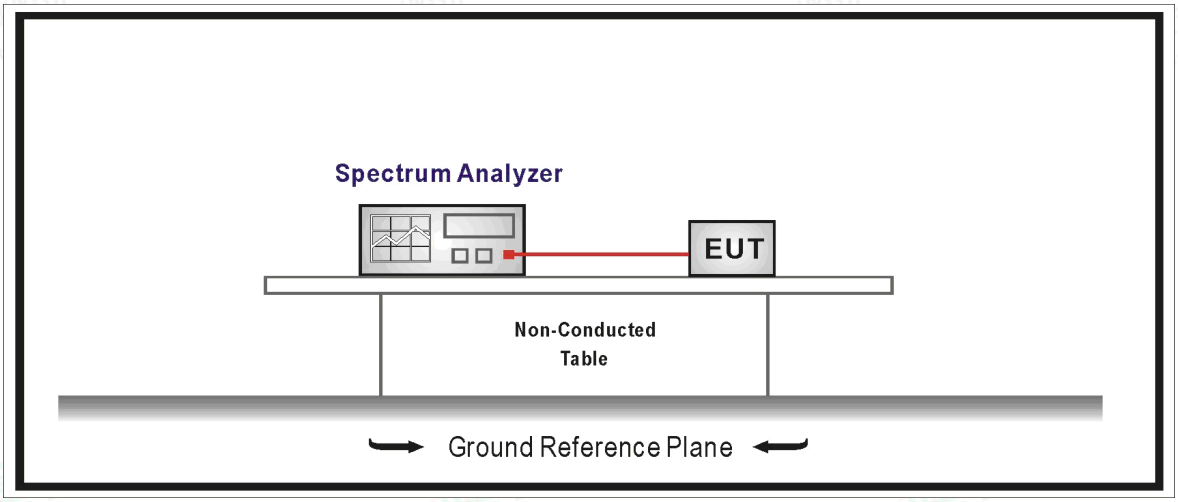
The Nominal Channel Bandwidth is the widest band of frequencies, inclusive of guard bands, assigned to a single channel.
The Nominal Channel Bandwidth shall be at least 5 MHz at all times.

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.

4.2.2 Test Setup

The conformance requirements shall be verified only under normal operating conditions.



4.2.3 Test Procedure

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

Conducted measurement:

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.

4.2.4 Test Result

Please refer to the Appendix F.2 for 5.2G WIFI RF Test Data.

4.3. RF Output Power, Transmit Power Control (TPC) and Power Density

4.3.1 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.				

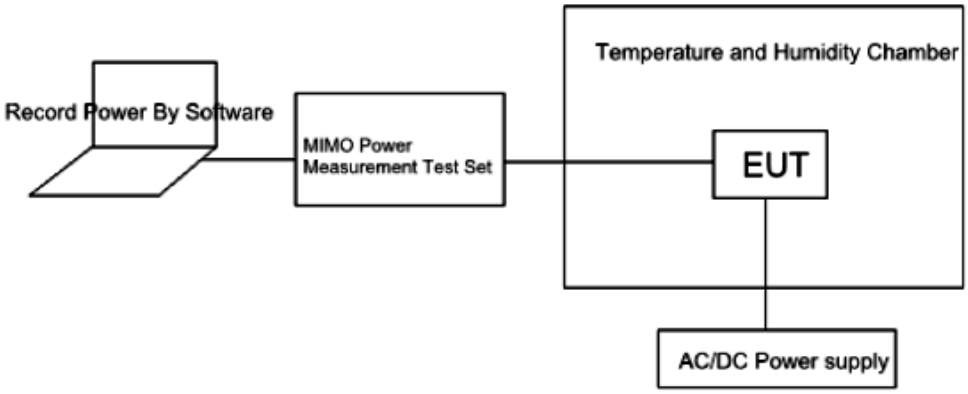
For devices using TPC, the RF output power during a transmission burst when configured to operate at the lowest stated power level of the TPC range shall not exceed the levels given in table 2. For devices without TPC, the limits in table 2 do not apply.

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.	

4.3.2 Test Setup

For Conducted Measurement



4.3.3 Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.4

Conducted measurement:

1) 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 P_H (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.

$$P_H = A + G + Y + 10 \times \log (1 / x) \text{ (dBm)}.$$

2) 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.

$$PD = D + G + Y + 10 \times \log (1 / x) \text{ (dBm / MHz)}$$

4.3.4 Test Result

Please refer to the Appendix F.3&F.4 for 5.2G WIFI RF Test Data.

4.4. Transmitter Unwanted Emissions Outside the 5 GHz RLAN Bands

4.4.1 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).

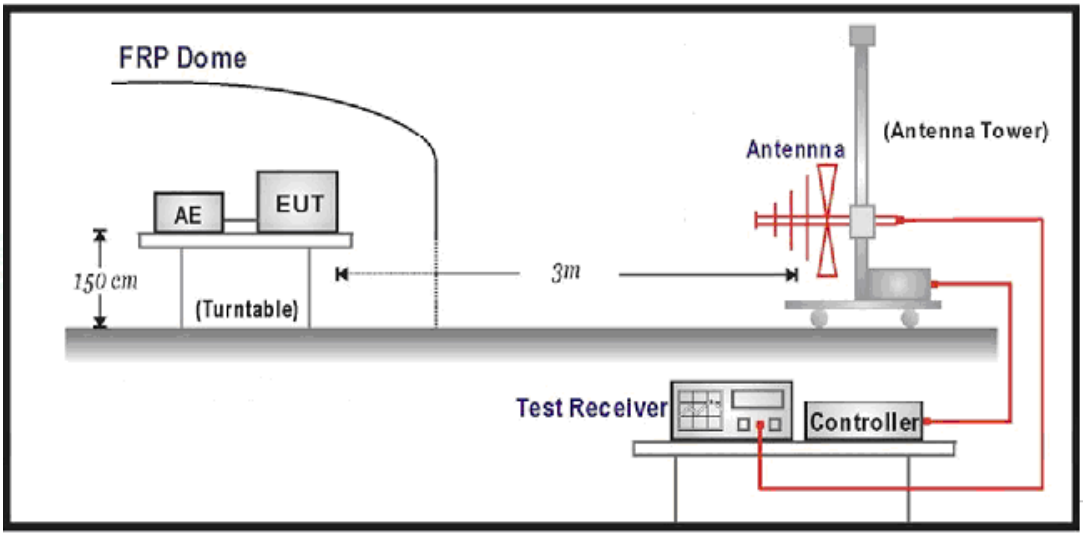
The level of transmitter unwanted emissions outside the 5 GHz RLAN bands shall not exceed the limits given in table 3.

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

4.4.2 Test Setup

For Radiated Measurement



4.4.3 Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.5

The conformance requirements shall be verified only under normal operating conditions.

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in table 3.

Step 2:

The unwanted emissions over the range 30 MHz to 1000 MHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 100 kHz

• Video bandwidth: 300 kHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 9700

NOTE: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

• Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT.

• Allow the trace to stabilize. Any emissions identified that have a margin of less than 6 dB with respect to the limits given in table 3 shall be individually measured and compared to the limits given in table 3.

Step 3:

The unwanted emissions over the range 1 GHz to 26 GHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 1 MHz

• Video bandwidth: 3 MHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 25000

NOTE: For spectrum analysers not supporting this number of sweep points, the frequency band may be segmented.

• Sweep time: For non-continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 1 MHz frequency step, the measurement time is greater than two transmissions of the UUT.

• Allow the trace to stabilize. Any emissions identified that have a margin of less than 6 dB with respect to the limits given in table 3 shall be individually measured and compared to the limits given in table 3.

Note: For continuous transmit signals, a simple measurement using the RMS detector of the spectrum analyser is permitted. The measured values shall be recorded and compared with the limits in table 3.

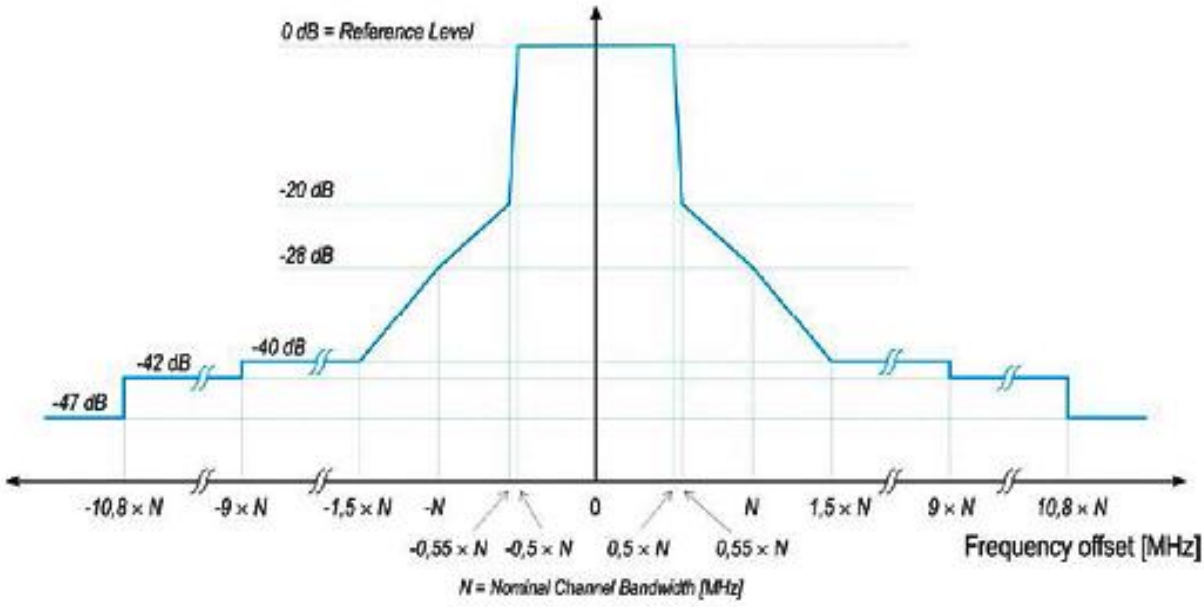
4.4.4 Test Result

Please refer to the Appendix F.5 for 5.2G WIFI RF Test Data.

4.5. Transmitter Unwanted Emissions Within the 5 GHz RLAN Bands

4.5.1 Limit

Transmitter unwanted emissions within the 5 GHz RLAN bands are radio frequency emissions within 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).



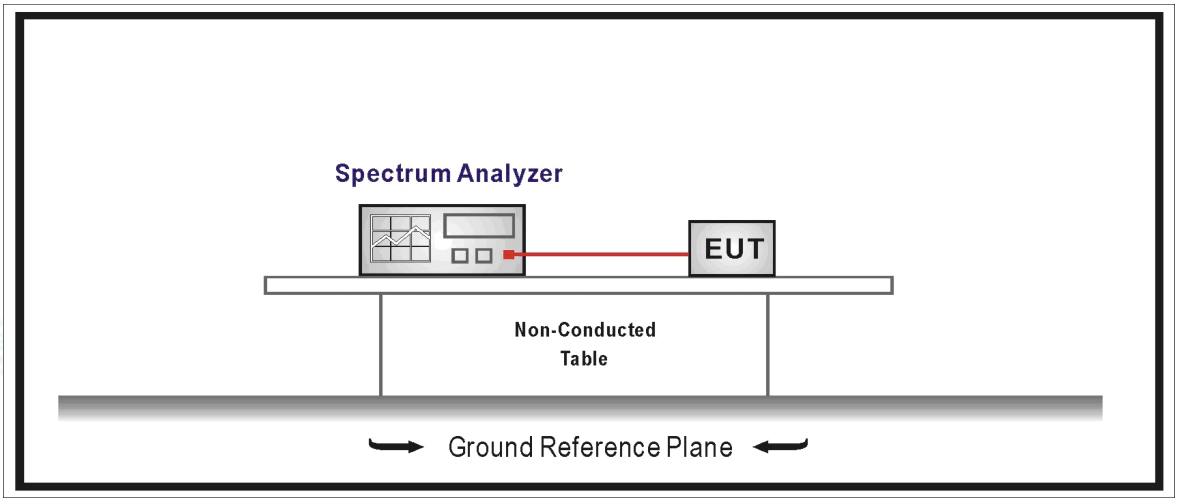
NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

Figure 1: Transmit spectral power mask

The average level of transmitter unwanted emissions within the 5 GHz RLAN bands shall not exceed the limit of the mask provided in figure 1 or the limit for unwanted emissions provided in table 3, whichever is the higher.
The mask is only applicable within the band of operation.
In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement.

4.5.2 Test Setup

For Conducted Measurement



4.5.3 Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.6

The conformance requirements shall be verified only under normal operating conditions.

The UUT shall be configured for continuous transmit mode (duty cycle equal to 100 %).

Step 1: Determination of the reference average power level.

• Spectrum analyser settings:

- Resolution bandwidth: 1 MHz
- Video bandwidth: 30 KHz
- Detector Mode: Peak
- Trace Mode: Video Average
- Sweep Time: Coupled
- Centre Frequency: Centre frequency of the channel being tested
- Span: 2 × Nominal Channel Bandwidth
- Use the marker to find the highest average power level of the power envelope of the UUT. This level shall be used as the reference level for the relative measurements.

Step 2: Determination of the relative average power levels.

• Adjust the frequency range of the spectrum analyser to allow the measurement to be performed within the sub-bands 5150 MHz to 5350 MHz and 5470 MHz to 5725 MHz. No other parameter of the spectrum analyser should be changed.

• Compare the relative power envelope of the UUT with the limits

4.5.4 Test Result

Please refer to the Appendix F.6 for 5.2G WIFI RF Test Data.

4.6. Receiver Spurious Emissions

4.6.1 Limit

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.

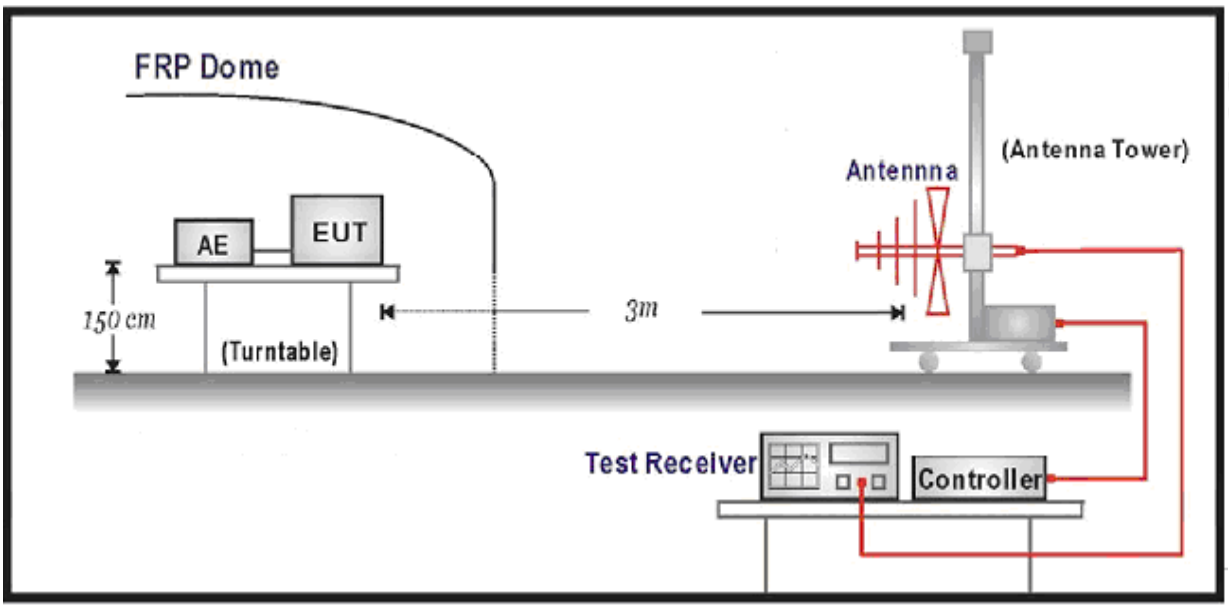
The spurious emissions of the receiver shall not exceed the limits given in table 4.

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

4.6.2 Test Setup

For Radiated Measurement



4.6.3 Test Procedure

Refer to ETSI EN 301 893 V2.1.1 (2017-05) Clause 5.4.7

The conformance requirements shall be verified only under normal operating conditions.

The test procedure below shall be used to identify potential receiver spurious emissions of the UUT.

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in table 4.

Step 2:

The emissions shall be measured over the range 30 MHz to 1000 MHz.

Spectrum analyser settings:

• Resolution bandwidth: 100 kHz

• Video bandwidth: 300 kHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 9700

NOTE: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

• Sweep time: Auto

• Wait for the trace to stabilize. Any emissions identified that have a margin of less than 6 dB with respect to the limits given in table 4 shall be individually measured and compared to the limits given in table 4.

Step 3:

The emissions shall now be measured over the range 1 GHz to 26 GHz.

Spectrum analyser settings:

• Resolution bandwidth: 1 MHz

• Video bandwidth: 3 MHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 25000

NOTE: For spectrum analysers not supporting this number of sweep points, the frequency band may be segmented.

• Sweep time: Auto

• Wait for the trace to stabilize. Any emissions identified that have a margin of less than 6 dB with respect to the limits given in table 4 shall be individually measured and compared to the limits given in table 4.

4.6.4 Test Result

Please refer to the Appendix F.7 for 5.2G WIFI RF Test Data.

4.7. Adaptivity (Channel Access Mechanism)

4.7.1 Limit

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 (P_H) according to the formula which assumes a 0 dBi receive antenna and P_H to be specified in dBm e.i.r.p.

For $P_H \leq 13$ dBm: TL = -75 dBm/MHz

For 13 dBm < P_H < 23 dBm: TL = -85 dBm/MHz + (23 dBm - P_H)

For $P_H \geq 23$ dBm: TL = -85 dBm/MHz

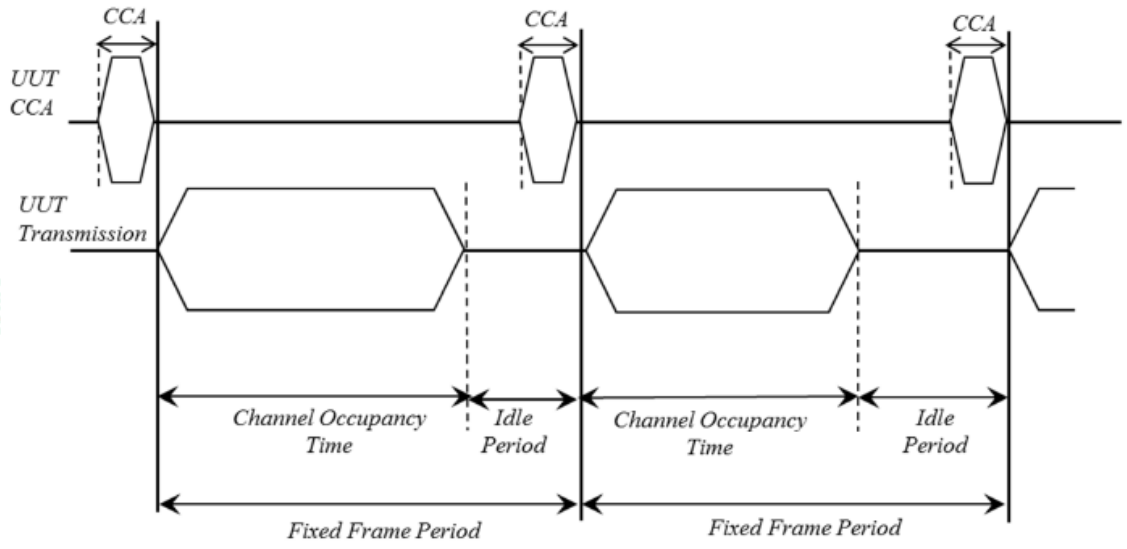


Figure 2: Example of timing for Frame Based Equipment

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 CW_{min}.

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 CW_{min} 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 CW_{max} the Channel Access Engine may set CW equal to CW_{max}. 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 (P_H).

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 (P_H).

Assuming a 0 dBi receive antenna the ED Threshold Level (TL) shall be:

For P_H

≤ 13 dBm: TL = -75 dBm/MHz

For 13 dBm < P_H < 23 dBm: TL = -85 dBm/MHz + (23 dBm - P_H) (3)

For P_H ≥ 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.

4.7.2 Test Setup

Conducted measurements

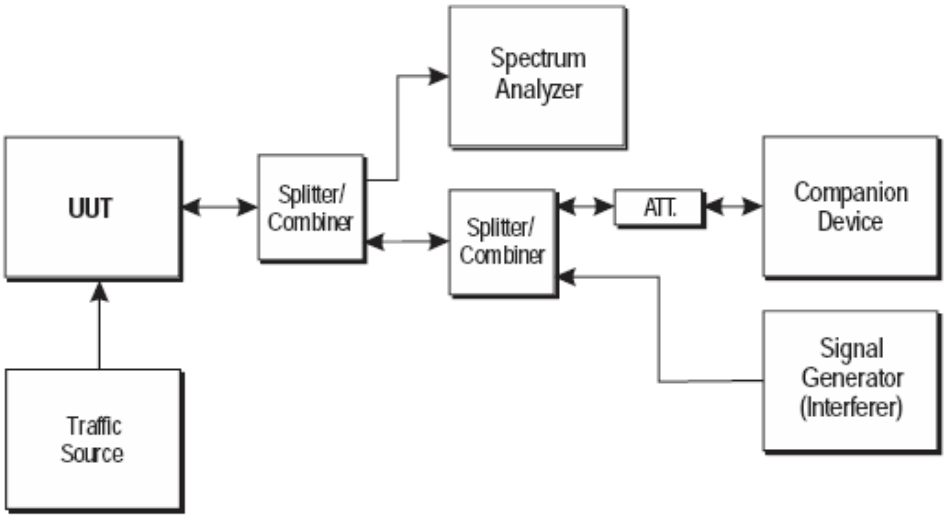


Figure 14: Example Test Set-up for verifying the adaptivity of an equipment

4.7.3 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.

• The analyser shall be set as follows:
RBW: ≥ Occupied Channel Bandwidth (if the analyser does not support this setting, the highest available setting shall be used. We set RBW=8MHz)
VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used. We set VBW=50MHz)
Detector mode: RMS
Centre Frequency: Equal to the centre frequency of the operating channel
Span: 0 Hz
Sweep time: > 2 × Channel Occupancy Time
Trace Mode: Clear/Write
Trigger Mode: Video or RF/IF Power

Step 2:

• Configure the traffic source so that it fills the UUT's buffers to a level causing the UUT to always have transmissions queued (buffer-ready-for-transmission condition) towards the companion device. Where this is not possible, the UUT shall be configured to occupy the Channel Occupancy Time of the Fixed Frame Period to the highest extent possible.

• To avoid adverse effects on the measurement results, a unidirectional traffic source should be used. An example of such a unidirectional traffic source not triggering reverse traffic on higher layer protocols is UDP.

• Verified that the UUT complies with the maximum Channel Occupancy Time and the (minimum) Idle Period for Load Based Equipment.

• Adding the interference signal and verified of reaction to the interference signal.

• Record the data.

4.7.4 Test Result

Please refer to the Appendix F.8 for 5.2G WIFI RF Test Data.

4.8. Receiver Blocking

4.8.1 Limit

The minimum performance criterion shall be a PER of less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment.

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 7.

Table 7: 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.				

4.8.2 Test Setup

Conducted measurements

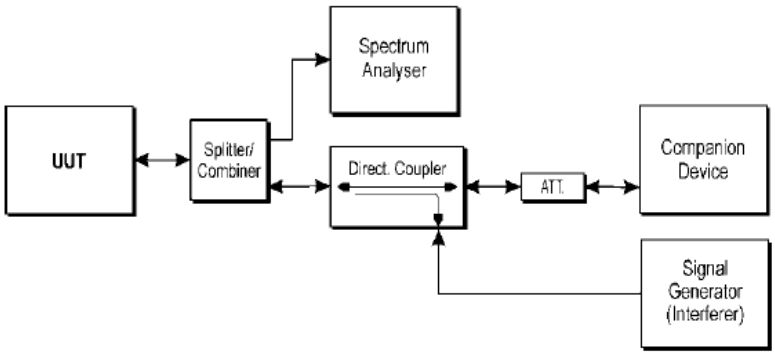


Figure 13: Example Test Set-up for verifying the adaptivity of an equipment

4.8.3 Test Procedure

Step 1:

- The UUT shall be set to the first operating frequency to be tested (see clause 5.3.2).

Step 2:

- The blocking signal generator is set to the first frequency as defined in table 7.

Step 3:

- With the blocking signal generator switched off a communication link is set up between the UUT and the associated companion device using the test setup shown in figure 14. The attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.2.8.3 is still met. The resulting level for the wanted signal at the input of the UUT is P min .
- This signal level (P min) is increased by 6 dB resulting in a new level (Pmin + 6 dB) of the wanted signal at the UUT receiver input.

Step 4:

- The level of the blocking signal at the UUT input is set to the level provided in table 7. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.2.8.3 are met.
- If the performance criteria as specified in clause 4.2.8.3 are met, the level of the blocking signal at the UUT may be further increased (e.g. in steps of 1 dB) until the level whereby the performance criteria as specified in clause 4.2.8.3 are no longer met. The highest level at which the performance criteria are met is recorded in the test report.

Step 5:

- Repeat step 4 for each remaining combination of frequency and level as specified in table 7.

Step 6:

- Repeat step 2 to step 5 with the UUT operating at the other operating frequencies at which the blocking test has to be performed. See clause 5.3.2.

4.8.4 Test Result

Please refer to the Appendix F.9 for 5.2G WIFI RF Test Data.

5. LIST OF MEASURING EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	X-series USB Peak and Average Power Sensor Agilent	Agilent	U2021XA	MY54080022	2021-10-22	2022-10-21
2	4 CH. Simultaneous Sampling 14 Bits 2MS/s	Agilent	U2531A	MY54080016	2021-10-22	2022-10-21
3	Test Software	Ascentest	AT890-SW	20160630	N/A	N/A
4	RF Control Unit	Ascentest	AT890-RFB	N/A	2021-11-16	2022-11-15
5	MXA Signal Analyzer	Agilent	N9020A	MY49061051	2022-06-16	2023-06-15
6	DC Power Supply	Agilent	E3642A	N/A	2021-11-25	2022-11-24
7	MXG Vector Signal Generator	Agilent	N5182A	MY47071151	2022-06-16	2023-06-15
8	ESG Vector Signal Generator	Agilent	E4438C	MY49072627	2022-06-16	2023-06-15
9	PSG Analog Signal Generator	Agilent	E8257D	MY4520521	2022-06-16	2023-06-15
10	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2021-10-07	2022-10-06
11	EMI Test Software	Farad	EZ	/	N/A	N/A
12	3m Full Anechoic Chamber	MRDIANZI	FAC-3M	MR009	2021-09-25	2022-09-24
13	Positioning Controller	MF	MF7082	MF78020803	2022-06-16	2023-06-15
14	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2021-07-25	2024-07-24
15	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-07-25	2024-07-24
16	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-07-01	2024-06-30
17	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2020-09-20	2023-09-19
18	Broadband Preamplifier	SCHWARZBECK	BBV9745	9719-025	2022-06-16	2023-06-15
19	EMI Test Receiver	R&S	ESR 7	101181	2022-06-16	2023-06-15
20	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2021-11-16	2022-11-15
21	Broadband Preamplifier	/	BP-01M18G	P190501	2022-06-16	2023-06-15
22	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2022-06-16	2023-06-15
23	6dB Attenuator	/	100W/6dB	1172040	2022-06-16	2023-06-15
24	3dB Attenuator	/	2N-3dB	/	2021-11-16	2022-11-15

6. PHOTOGRAPHS OF TEST SETUP

Please refer to separated files Appendix D for Photographs of Test Setup_RF.

7. PHOTOGRAPHS OF THE EUT

Please refer to separated files Appendix C for Photographs of The EUT.

----------THE END OF REPORT----------