TEST REPORT
ETSI EN 300 328 V2.2.2（2019-07）

Report Reference No. .... :	**GTS20240426022-1-10**
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.18, 2024
Testing 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 300 328 V2.2.2（2019-07）**

Test item description .... :	**All in one Panel PC**
Trade Mark .... :	N/A
Manufacturer .... :	Shenzhen Techtion Smart Electronics Co.,Ltd
Model/Type reference .... :	TS-150ACBJ
List Model .... :	Please refer to page two
Operation Frequency .... :	From 2412MHz to 2472MHz
Ratings .... :	DC 12.0V/4.0A by Adapter
Result .... :	**PASS**

TEST REPORT

Test Report No. :	**GTS20240426022-1-10**	Jun. 18, 2024 Date of issue

Equipment under Test	:	All in one Panel PC
Model /Type	:	TS-150ACBJ
Listed model	:	TS-070AXXX, TS-070PXXX, TS-080AXXX, TS-080PXXX, TS-101AXXX, TS-101PXXX, TS-104AXXX, TS-104PXXX, TS--116AXXX, TS--116PXXX, TS--120AXXX, TS--120PXXX, TS--121AXXX, TS--121PXXX, TS--133AXXX, TS--133PXXX, TS--150AXXX, TS--150PXXX, TS--156AXXX, TS--156PXXX, TS--170AXXX, TS--170PXXX, TS--173AXXX, TS--173PXXX, TS--185AXXX, TS--185PXXX, TS--190AXXX, TS--190PXXX, TS--195AXXX, TS--195PXXX, TS--215AXXX, TS--215PXXX, TS--238AXXX, TS--238PXXX, TS--270AXXX, TS--270PXXX, TS--320AXXX, TS--320PXXX, TS-XXXAXXX , TS-XXXPXXX (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 300 328 V2.2.2 (2019-07)–Wideband transmission systems;Data transmission equipment operating in the 2,4 GHz band;Harmonised Standard for access to radio spectrum

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. 17, 2024

2.2. Product Description

Product Name:	All in one Panel PC
Trade Mark:	N/A
Model/Type reference:	TS-150ACBJ
List Model:	TS-070AXXX, TS-070PXXX, TS-080AXXX, TS-080PXXX, TS-101AXXX, TS-101PXXX, TS-104AXXX, TS-104PXXX, TS--116AXXX, TS--116PXXX, TS--120AXXX, TS--120PXXX, TS--121AXXX, TS--121PXXX, TS--133AXXX, TS--133PXXX, TS--150AXXX, TS--150PXXX, TS--156AXXX, TS--156PXXX, TS--170AXXX, TS--170PXXX, TS--173AXXX, TS--173PXXX, TS--185AXXX, TS--185PXXX, TS--190AXXX, TS--190PXXX, TS--195AXXX, TS--195PXXX, TS--215AXXX, TS--215PXXX, TS--238AXXX, TS--238PXXX, TS--270AXXX, TS--270PXXX, TS--320AXXX, TS--320PXXX, TS-XXXAXXX, TS-XXXPXXX (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
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)
Channel number:	13 Channel for IEEE 802.11b/g/n (HT20)
Channel separation:	5MHz
Antenna Description	External Antenna, 2.0dBi (Max.) for 2.4G Band

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

Description of the test mode

IEEE 802.11b/g/n: Thirteen channels are provided to the EUT.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

Test Frequency List

Modulation Type	Test Frequency					
	Lowest		Middle		Highest	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
802.11b	1	2412	7	2442	13	2472
802.11g	1	2412	7	2442	13	2472
802.11n HT20	1	2412	7	2442	13	2472
802.11n HT40	3	2422	7	2442	11	2462

2.4. Description of the Equipment under Test (EUT)

Reference documents:	802.11™ WLAN	
Special test descriptions:	None	
Configuration descriptions:	TX tests: performed at the lowest, the middle, and the highest channel	
	RX/Standby tests: WLAN test mode enabled, scan enabled, TX Idle	
Test mode:	☒ Special software is used. EUT is transmitting pseudo random data by itself	
802.11™ WLAN standard capabilities:	channel numbers:	☒ 802.11b:13; ☒ 802.11g:13; ☒ 802.11n HT20:13;
	channel separation:	5MHz
	used freq. range:	☒2412-2472MHz; ☒2422-2462MHz
	modulation types:	DSSS,OFDM
	Used Bandwidth:	☒20MHz;

2.5. EUT Classification:

Type of equipment:	☒	stand alone equipment	
	☐	plug in radio equipment	
	☐	combined equipment	
Modulation types:	☒	Wide Band Modulation (None Hopping – e.g. DSSS, OFDM)	
	☐	Frequency Hopping Spread Spectrum (FHSS)	
Adaptive equipment:	☒	Yes, LBT-based	☐ Frame Based Equipment
			☒ Load Based Equipment
	☐	Yes, non-LBT-based	
	☐	Yes (but can be disabled)	
	☐	No	
	☒	q value	32
	☐	COT value	
	☒	CCA value	20µs
Antennas and transmit operating modes:	☒	Operating mode 1 (single antenna)	
		Equipment with 1 antenna, Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used, Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)	
	☐	Operating mode 2 (multiple antennas, no beamforming)	
		Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.	
	☐	Operating mode 3 (multiple antennas, with beamforming)	
		Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming. In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.	

2.6. 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

2.7. 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: DC 10.8V
Relative Humidity: 55 %
Air Pressure: 989 hPa

3.4. Test setting of system：

Setting	Value
Modulation	other
Adaptive	Yes
Number Of Transmission Chains	1
Antenna Gain Port 1	2.0dBi
Antenna Gain Port 2	/
Beamforming Gain	0 dB
Nominal Channel Bandwidth	20 MHz/40 MHz
Maximum EIRP	20 dBm
Attenuation / Pathloss File Port 1	DUT cable 12.75Ghz_10dB
Sourious Tx Receiver reference level below power	20 dB
power measurement for radiated	No
DUT Port Occupied Channel Bandwidth	1
LBT Based	Yes
Dual Mode	No

3.5. Test Description

3.5.1 Main Terms

Verdict Verdict of each test cases.
Test Case Test cases identification number and description in 3GPP test specification and ETSI specification.

3.5.2 Terms used in Condition column

NTC Normal voltage, Normal Temperature
HV High voltage, Normal Temperature
LV Low voltage, Normal Temperature
HT High Temperature, Normal voltage
LT Low Temperature, Normal voltage
HTHV High voltage, High Temperature
LTHV High voltage, Low Temperature
HTLV Low voltage, High Temperature
LTLV Low voltage, Low Temperature
Vib Vibration

3.5.3 Terms used in Verdict column

Pass This test cases has been tested, and EUT is conformant to the applied standards in the given frequency band.
Fail This test cases has been tested, but EUT is not conformant to the applied standards in the given frequency band.
N/A This test case is either not required/not applicable in the specified band or is not applicable according to the specific PICS/PIXIT for the EUT.
Inc Test case result is ambiguous in the given frequency band.
Decl Declaration is received from the client to demonstrate the conformity to the relevant specification in the given frequency band.
BR This test cases is not tested in the given frequency band, but this testcases was tested with pass result for the initial model in the given frequency band.

3.5.4 Sumarry of measurement results

☒ **No deviations from the technical specifications were ascertained**
☐ **There were deviations from the technical specifications ascertained**

Test Specification Clause	Test Case	Test Condition	Mode	Pass	Fail	N/A	NP	Remark
5.4.2	RF output power	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	
		LT		☒	☐	☐	☐	
		HT		☒	☐	☐	☐	
5.4.3	Power Spectral Density	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	
5.4.2	Duty Cycle, Tx-sequence, Tx-gap	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☐	☐	☒	☐	
5.4.2	Medium Utilisation (MU) factor	NTC	802.11b 802.11g 802.11n HT20 802.11n	☐	☐	☒	☐	

			HT40					
5.4.6	Adaptivity (adaptive equipment using modulations other than FHSS)	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	
5.4.7	Occupied Channel Bandwidth	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	
5.4.8	Transmitter unwanted emissions in the out-of-band domain	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	
		LT		☒	☐	☐	☐	
		HT		☒	☐	☐	☐	
5.4.9	Transmitter unwanted emissions in the spurious domain (conducted & radiated)	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	
5.3.10	Receiver spurious emissions (conducted & radiated)	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	
5.4.11	Receiver Blocking	NTC	802.11b 802.11g 802.11n HT20 802.11n HT40	☒	☐	☐	☐	

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

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Mode	**Data Rate**
11b/CCK	1 Mbps
11g/OFDM	6 Mbps
11n HT20/OFDM	6.5 Mbps

3.6. 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)
Frequency range	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Adjacent and alternate channel power Conducted	1.20 dB	(1)
Conducted spurious emission	1.60 dB	(1)
Radiated spurious emission	2.20 dB	(1)
Intermodulation attenuation	1.00dB	(1)
Maximum useable receiver sensitivity	2.80 dB	(1)
Co-channel rejection	2.80 dB	(1)
Adjacent channel selectivity	2.80 dB	(1)
Spurious response rejection	2.80 dB	(1)
Intermodulation response rejection	2.80 dB	(1)
Blcking or desensitization	2.80 dB	(1)

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

3.7. 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/X12750-O/O	KL1420 31	2023/07/13	2024/07/12
11	High-Pass Filter	K&L	41H10-1375/U12750-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+SUHNER	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. ETSI EN 300 328 REQUIREMENTS

4.1.1. RF Output Power

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.2.3

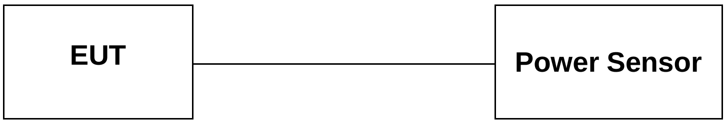
The RF output power for non-FHSS equipment shall be equal to or less than 20 dBm.

NOTE: For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.2.5. This is verified by the conformance test referred to in clause 4.3.2.5.4.

For non-adaptive non-FHSS equipment, where the manufacturer has declared an RF output power of less than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value.

This limit shall apply for any combination of power level and intended antenna assembly.

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.2

Step 1:

- Use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.
- Use the following settings:
  - Sample speed 1 MS/s or faster.
  - The samples shall represent the RMS power of the signal.
  - Measurement duration: For non-adaptive equipment: equal to the observation period defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) is captured.
  - For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.

Step 2:

- For conducted measurements on devices with one transmit chain:
  - Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.
- For conducted measurements on devices with multiple transmit chains:
  - Connect one power sensor to each transmit port for a synchronous measurement on all transmit ports.
  - Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between the samples of all sensors is less than 500 ns.
  - For each individual sampling point (time domain), sum the coincident power samples of all ports and store them. Use these summed samples as the new stored data set.

Step 3:

- Find the start and stop times of each burst in the stored measurement samples.
  The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples in step 2.
  In case of insufficient sensitivity of the power sensor (e.g. in case of radiated measurements), the value of 30 dB may need to be reduced appropriately.

Step 4:

- Between the start and stop times of each individual burst calculate the RMS power over the burst using the formula below. The start and stop points shall be included. Save these Pburst values, as well as the start and stop times for each burst.

$$P_{burst} = \frac{1}{k}\sum_{n=1}^{k} P_{sample}(n)$$

with k being the total number of samples and n the actual sample number.

Step 5:

- The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:

- Add the (stated) antenna assembly gain G in dBi of the individual antenna.
- case of smart antenna systems operating in mode with beamforming (see clause 5.3.2.2.4), add the additional beamforming gain Y in dB.
- If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.
- The RF Output Power (Pout) shall be calculated using the formula below:

$$P_{out} = A + G + Y$$

- This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

Instrument:	Power Meter measuring burst Power(RMS) of a least 10 packets	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Test Mode:802.11b				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2412 MHz		Maximum conducted Burst Power (RMS) [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	12.32	2.00	14.32
T min (-20℃)	DC 12.0	12.75	2.00	14.75
T Max (+45℃)	DC 12.0	12.79	2.00	14.79
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11b at finial test to get the worst-case emission at 1Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode:802.11b				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2442 MHz		Maximum conducted Burst Power (RMS) [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	12.71	2.00	14.71
T min (-20℃)	DC 12.0	12.57	2.00	14.57
T Max (+45℃)	DC 12.0	12.12	2.00	14.12
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11b at finial test to get the worst-case emission at 1Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode:802.11b				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2472 MHz		Maximum conducted Burst Power (RMS) [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	12.99	2.00	14.99
T min (-20℃)	DC 12.0	12.98	2.00	14.98
T Max (+45℃)	DC 12.0	12.90	2.00	14.90
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2 .802.11b at finial test to get the worst-case emission at 1Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode:802.11g				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2412 MHz		Maximum conducted Burst Power [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	10.75	2.00	12.75
T min (-20℃)	DC 12.0	10.19	2.00	12.19
T Max (+45℃)	DC 12.0	10.78	2.00	12.78
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11g at finial test to get the worst-case emission at 6Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode:802.11g				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2442 MHz		Maximum conducted Burst Power [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	10.28	2.00	12.28
T min (-20℃)	DC 12.0	10.47	2.00	12.47
T Max (+45℃)	DC 12.0	10.80	2.00	12.80
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11g at finial test to get the worst-case emission at 6Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode:802.11g				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2472 MHz		Maximum conducted Burst Power [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	10.06	2.00	12.06
T min (-20℃)	DC 12.0	10.98	2.00	12.98
T Max (+45℃)	DC 12.0	10.18	2.00	12.18
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11g at finial test to get the worst-case emission at 6Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode: 802.11n HT20				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2412 MHz		Maximum conducted Burst Power [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	10.01	2.00	12.01
T min (-20℃)	DC 12.0	10.98	2.00	12.98
T Max (+45℃)	DC 12.0	10.94	2.00	12.94
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11n HT20 at finial test to get the worst-case emission at 6.5 Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode: 802.11n HT20				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2442 MHz		Maximum conducted Burst Power [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	10.96	2.00	12.96
T min (-20℃)	DC 12.0	10.76	2.00	12.76
T Max (+45℃)	DC 12.0	10.28	2.00	12.28
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11n HT20 at finial test to get the worst-case emission at 6.5 Mbps.
3. 20 bursts had been captured for power measurement.

Test Mode: 802.11n HT20				
Antenna Gain: 2.0dBi		Test Method: Conducted		
Test Frequency: 2472 MHz		Maximum conducted Burst Power [dBm]		
Test environmental				
Temperature (℃)	Voltage (V)	Measured Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)
T Nor (25℃)	DC 12.0	10.05	2.00	12.05
T min (-20℃)	DC 12.0	10.99	2.00	12.99
T Max (+45℃)	DC 12.0	10.49	2.00	12.49
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.
2. 802.11n HT20 at finial test to get the worst-case emission at 6.5 Mbps.
3. 20 bursts had been captured for power measurement.

4.1.2. Duty Cycle,TX-sequence,TX-gap

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.4.3
Non-FHSS equipment shall comply with the following:
● The Duty Cycle shall be equal to or less than the maximum value declared by the manufacturer.
● The Tx-sequence time shall be equal to or less than 10 ms.
● The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Tx-sequence with a minimum of 3,5 ms.
NOTE: For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.2.5. This is verified by the conformance test referred to in clause 4.3.2.5.4.

TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.3
For systems using wide band modulations other than FHSS, the measurement shall be performed at the lowest, the middle, and the highest channel on which the equipment can operate. These frequencies shall be recorded.
The test procedure, which shall only be performed for non-adaptive systems and only to be performed at normal environmental conditions, shall be as follows:
Step 1:
● Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.
● The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples. In case of insufficient sensitivity of the power sensor (e.g. in case of radiated measurements), the value of 30 dB may need to be reduced appropriately.
Step 2:
● Between the saved start and stop times of each individual burst, calculate the TxOn time. Save these TxOn values.
Step 3:
● Duty Cycle (DC) is the sum of all TxOn times between the end of the first gap (which is the start of the first burst within the observation period) and the start of the last burst (within this observation period) divided by the observation period. The observation period is defined in clause 4.3.1.3.2 or clause 4.3.2.4.2.
Step 4:
● For FHSS equipment using blacklisting, the TxOn time measured for a single (and active) hopping frequency shall be multiplied by the number of blacklisted frequencies. This value shall be added to the sum calculated in step 3 above. If the number of blacklisted frequencies cannot be determined, the minimum number of hopping frequencies (N) as defined in clause 4.3.1.4.3 shall be assumed.
● The calculated value for Duty Cycle (DC) shall be recorded in the test report. This value shall be equal to or less than the maximum value declared by the manufacturer.
Step 5:
● Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.
● Identify any TxOff time that is equal to or greater than the minimum Tx-gap time as defined in clause 4.3.1.3.3 or clause 4.3.2.4.3. These are the potential valid gap times to be further considered in this procedure.
● Starting from the second identified gap, calculate the time from the start of this gap to the end of the preceding gap. This time is the Tx-sequence time for this transmission. Repeat this procedure until the last identified gap within the observation period is reached.
● A combination of consecutive Tx-sequence times and Tx-gap times followed by a Tx-gap time, which is at least as long as the duration of this combination, may be considered as a single Tx-sequence time and in which case it shall comply with the limits defined in clause 4.3.1.3.3 or clause 4.3.2.4.3.
● It shall be noted in the test report whether the UUT complies with the limits for the maximum Tx-sequence time and minimum Tx-gap time as defined in clause 4.3.1.3.3 or clause 4.3.2.4.3.

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

Instrument:	Power Meter measuring average burst Power of a least 10 packets	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Not Applicable

4.1.3. Medium Utilisation (MU) factor

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.5.3
The maximum Medium Utilization factor for non-adaptive non-FHSS equipment shall be 10 %.

TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.4

Step 1:
● Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.

Step 2:
● For each burst calculate the product of (P_{burst}/100 mW) and the TxOn time.
NOTE: Pburst is expressed in mW. TxOn time is expressed in ms.

Step 3:
● Medium Utilization is the sum of all these products divided by the observation period (expressed in ms) which is defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. This value, which shall comply with the limit given in clause 4.3.1.6.3 or clause 4.3.2.5.3, shall be recorded in the test report.
● If, in case of FHSS equipment, operation without blacklisted frequencies is not possible, the power of the bursts on blacklisted hopping frequencies (for the calculation of the Medium Utilization) is assumed to be equal to the average value of the RMS power of the bursts on all active hopping frequencies.

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

Instrument:	Power Meter measuring average burst Power of a least 10 packets	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Not Applicable

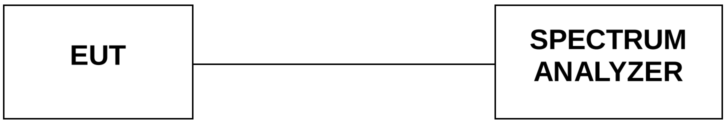
4.1.4. Power Spectral Density

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.3.3

The maximum Power Spectral Density for non-FHSS equipment is 10 dBm per MHz.

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.3.2.1
The transmitter shall be connected to a spectrum analyser and the Power Spectral Density as defined in clause 4.3.2.2 shall be measured and recorded.

Step 1:
Connect the UUT to the spectrum analyser and use the following settings:

- Start Frequency: 2 400 MHz
- Stop Frequency: 2 483,5 MHz
- Resolution BW: 10 kHz
- Video BW: 30 kHz
- Sweep Points: > 8 350

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

- Detector: RMS
- Trace Mode: Max Hold
- Sweep time:

- For non-continuous transmissions: 2 × Channel Occupancy Time × number of sweep points(For non-adaptive equipment use the maximum TX-sequence time in the formula above instead of the Channel Occupancy Time).
- For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore on the RMS value of the signal

Step 2:
For conducted measurements on smart antenna systems using either operating mode 2 or operating mode 3 (see clause 5.3.2.2), repeat the measurement for each of the transmit ports. For each sampling point (frequency domain), add up the coincident power values (in mW) for the different transmit chains and use this as the new data set.

Step 3:
Add up the values for power for all the samples in the file using the formula below.

$$P_{Sum} = \sum_{n=1}^{k} P_{sample}(n)$$

with k being the total number of samples and n the actual sample number

Step 4:
Normalize the individual values for power (in dBm) so that the sum is equal to the RF Output Power (e.i.r.p.) measured in clause 5.4.2 and save the corrected data. The following formulas can be used:

$$C_{Corr} = P_{Sum} - P_{e.i.r.p.}$$

$$P_{Samplecorr}(n) = P_{Sample}(n) - C_{Corr}$$

with n being the actual sample number

Step 5:
Starting from the first sample $PS_{amplecorr}(n)$ (lowest frequency), add up the power (in mW) of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to sample #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.

Step 6:
Shift the start point of the samples added up in step 5 by one sample and repeat the procedure in step 5 (i.e. sample #2 to sample #101).

Step 7:
Repeat step 6 until the end of the data set and record the Power Spectral Density values for each of the 1 MHz segments.
From all the recorded results, the highest value is the maximum Power Spectral Density (PSD) for the UUT. This value, which shall comply with the limit given in clause 4.3.2.3.3, shall be recorded in the test report.

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz	☒2412MHz ☒2442MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	RMS	
Sweep time:	auto	
Video bandwidth:	30KHz	
Resolution bandwidth:	10KHz	
Span:	83.5MHz	
Frequency range	2400-2483.5MHz	
Sweep Points	15000	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Test Mode:802.11b		
Antenna Gain: 2.0dBi		**Test Method: Conducted**
Test Temperature: 25℃		**Test Voltage: DC 12.0**
The Maximum Power Spectral Density		
Test Channel Number	**Test Frequency (MHz)**	**EIRP Density (dBm/MHz)**
1	2412	4.66
7	2442	4.62
13	2472	4.28
Result		**Pass**
Limit		**10dBm/MHz**

Note :1. Measured Power include the cable loss.
2. 802.11b at finial test to get the worst-case emission at 1Mbps.

Test Mode:802.11g		
Antenna Gain: 2.0dBi		**Test Method: Conducted**
Test Temperature: 25℃		**Test Voltage: DC 12.0**
The Maximum Power Spectral Density		
Test Channel Number	**Test Frequency (MHz)**	**EIRP Density (dBm/MHz)**
1	2412	0.10
7	2442	0.08
13	2472	-0.14
Result		**PASS**
Limit		**10dBm/MHz**

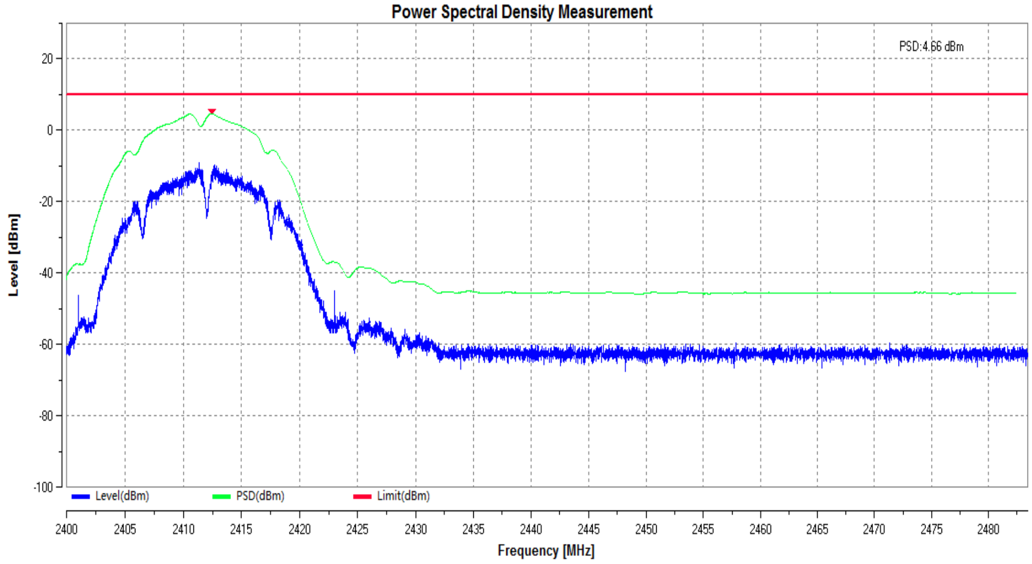
Note :1. Measured Power include the cable loss.
2. 802.11g at finial test to get the worst-case emission at 6Mbps.

Test Mode: 802.11n HT20		
Antenna Gain: 2.0dBi		Test Method: Conducted
Test Temperature: 25℃		Test Voltage: DC 12.0
The Maximum Power Spectral Density		
Test Channel Number	Test Frequency (MHz)	EIRP Density (dBm/MHz)
1	2412	-0.49
7	2442	-0.86
13	2472	-0.79
Result		Pass
Limit		10dBm/MHz

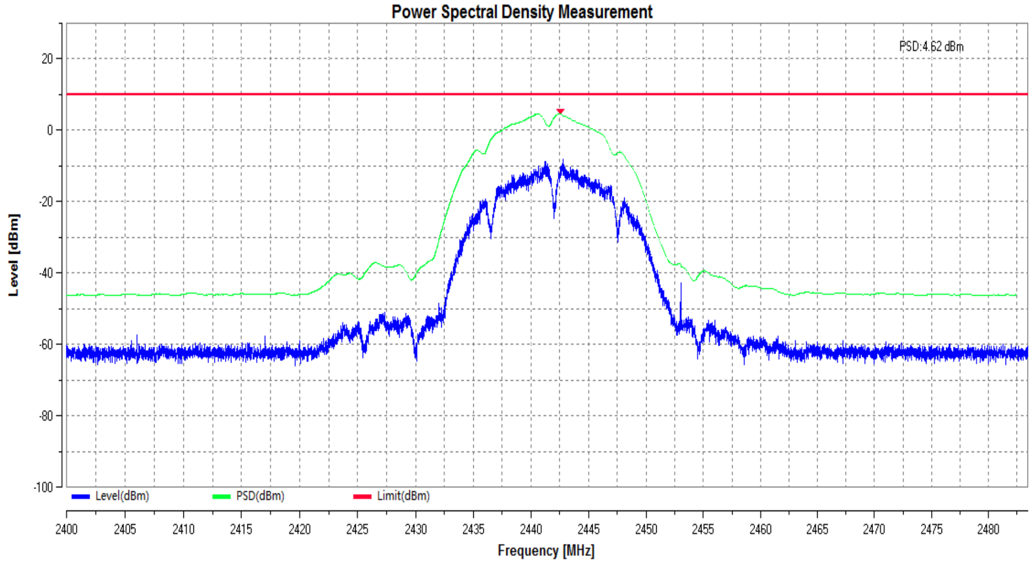
Note :1. Measured Power include the cable loss.
2. 802.11n HT20 at finial test to get the worst-case emission at 6.5 Mbps.

Test plot as follows:

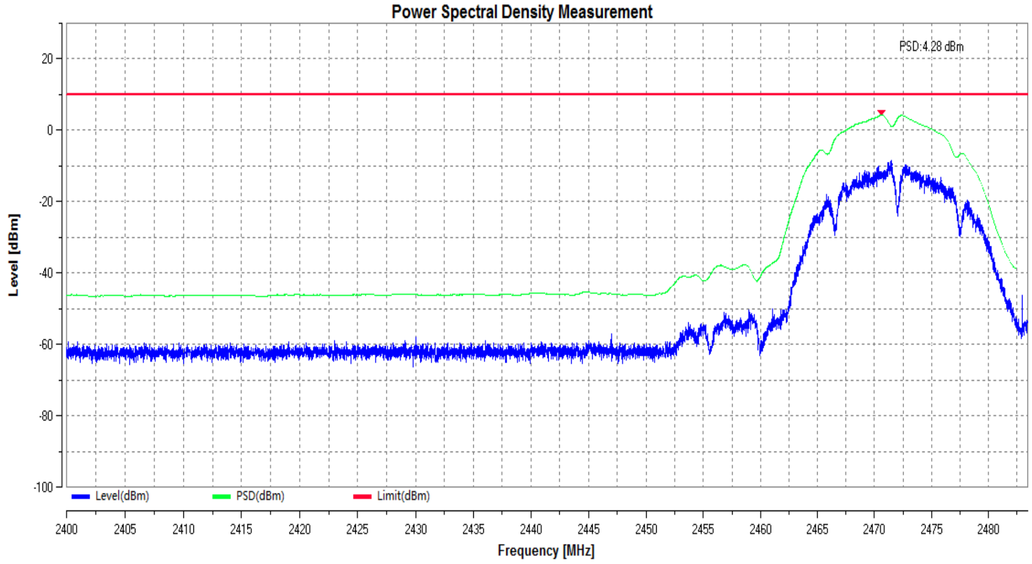
802.11B
CH01



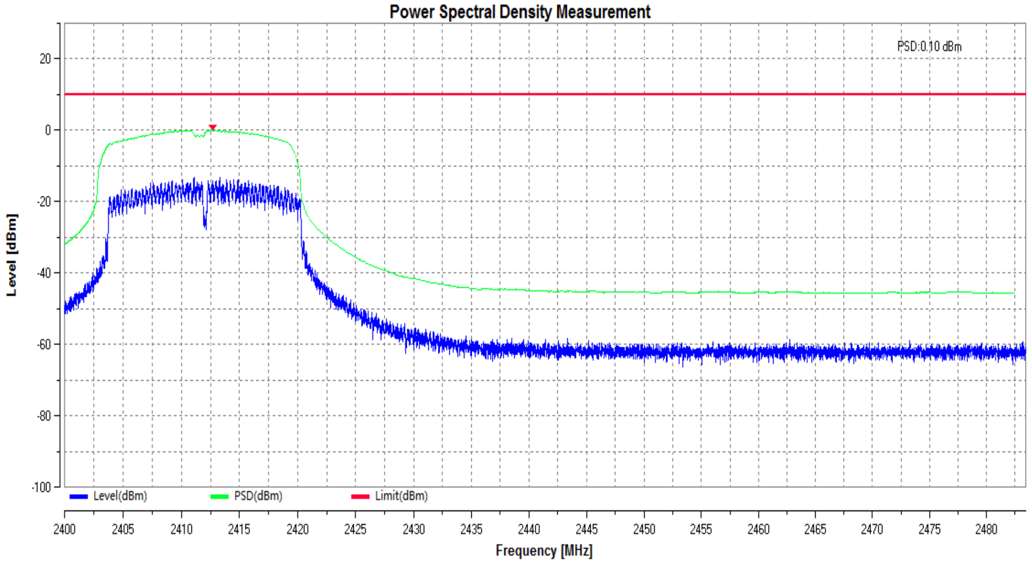
CH07



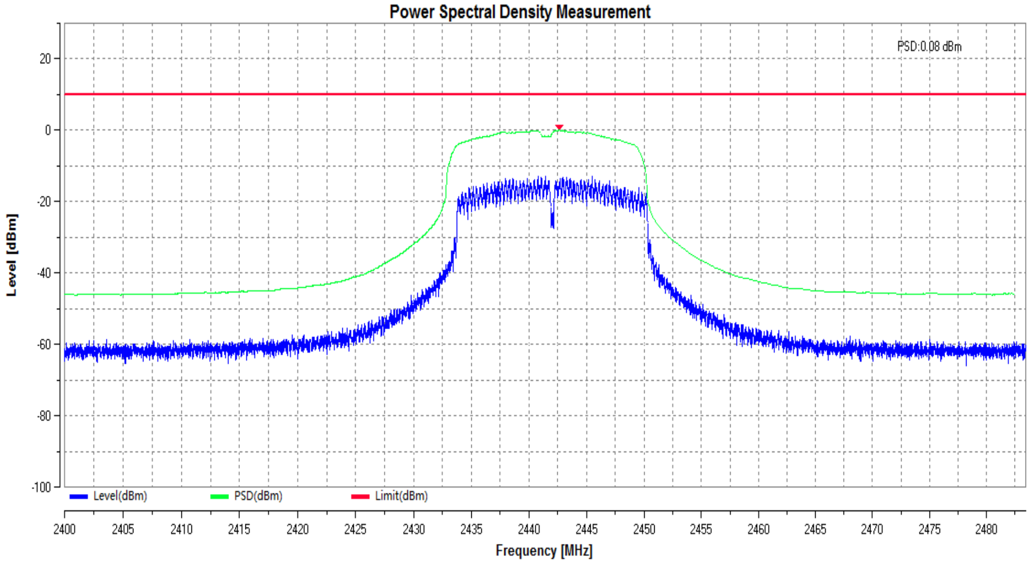
CH13



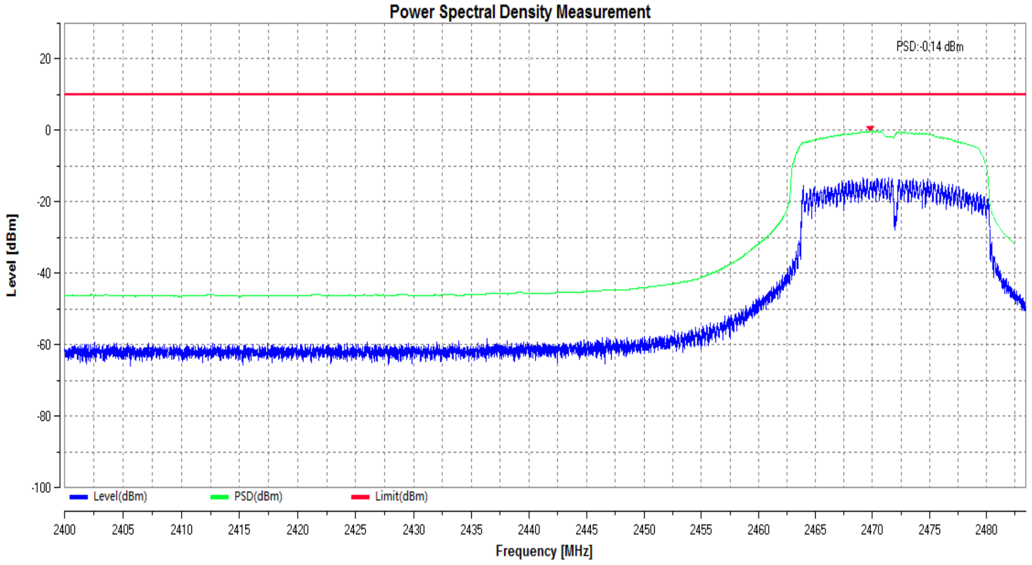
802.11G
CH01



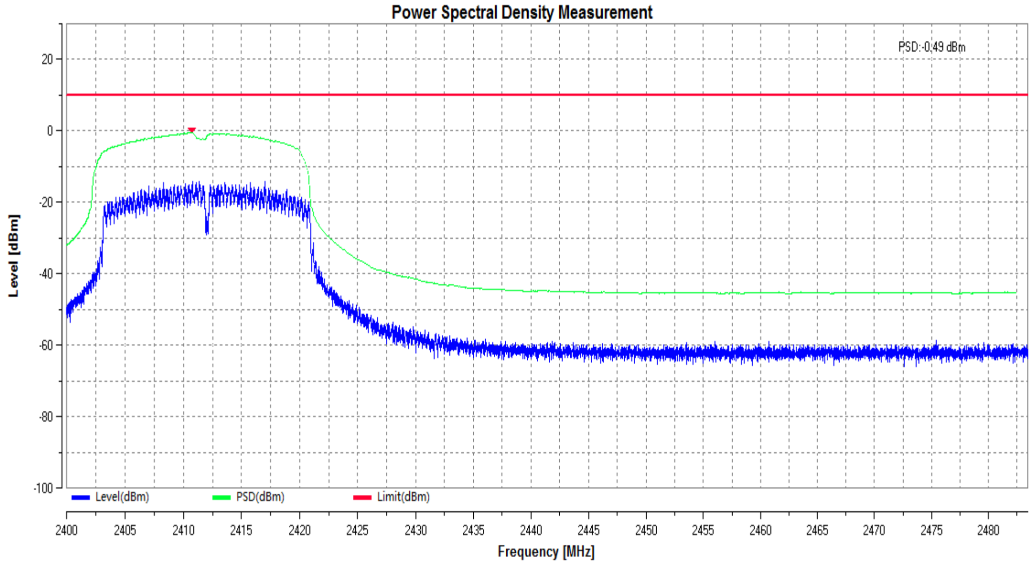
CH07



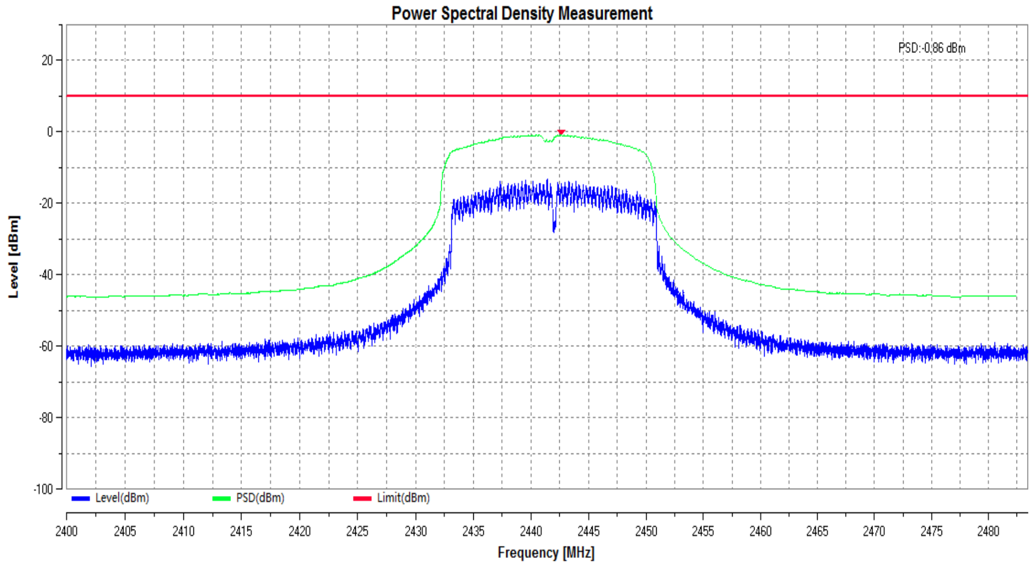
CH13



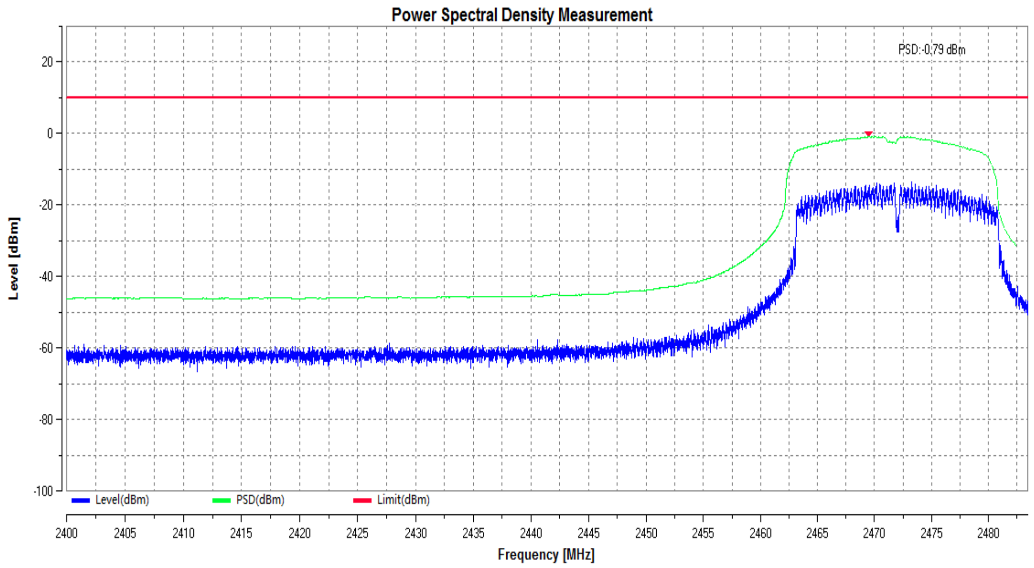
802.11N(20M)
CH01



CH07



CH13



4.1.5. Adaptivity

Requirements & Limits

ETSI EN 300 328 Sub-4.3.2.6

For Adaptive non-FHSS using DAA

1) During normal operation, the equipment shall evaluate the presence of a signal on its current operating channel(s). If it is determined that a signal is present with a level above the detection threshold defined in step 5 that channel shall be marked as 'unavailable'.
2) The channel(s) shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be less than 40 ms. Each such transmission sequence shall be followed by an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs. After this, the procedure as in step 1 needs to be repeated.
4) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 2.00dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to:
$TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$ (P_{out} in mW e.i.r.p.)
5) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in following table

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30 (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 2)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density in front of the UUT antenna.		

For Adaptive non-FHSS using LBT (Frame Based Equipment):

1) Before transmission, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.
2) If the equipment finds the channel occupied, it shall not transmit on this channel during the next Frame Period. The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. See clause 4.3.2.6.1. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be in the range 1 ms to 10 ms followed by an Idle Period of at least 5 % of the Channel Occupancy Time used in the equipment for the current Frame Period.
4) An equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. A consecutive sequence of such transmissions by the equipment without a new CCA shall not exceed the maximum Channel Occupancy Time. 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.
5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 2.00dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:

$TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$ (P_{out} in mW e.i.r.p.)

6) The equipment shall comply with the requirements defined in step 1 to step 4 in the present clause in the presence of an unwanted CW signal as defined in following table

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density in front of the UUT antenna.		

For Adaptive non-FHSS using LBT (Frame Based Equipment):

1) Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.

2) If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 µs and at least 160 µs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.

3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above.

4) The equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 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.

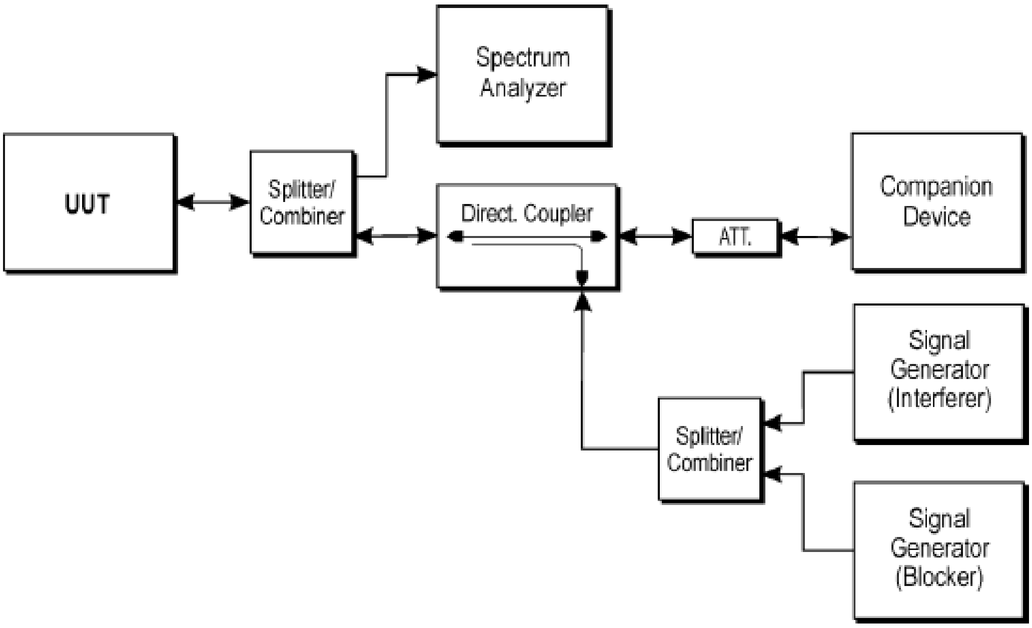
5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 2.00dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:

$TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$ (P_{out} in mW e.i.r.p.)

6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in following table

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna.		

TEST CONFIGURATION:



TEST PROCEDURE

1. Please refer to ETSI EN 300 328 Sub-clause 5.1 for the test conditions.
2. Please refer to ETSI EN 300 328 Sub-clause 5.4.6 for the measurement method.

RBW: ⩾ Occupied Channel Bandwidth (if the analyser does not support this setting, the highest available setting shall be used) (10MHz)
VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used) (10MHz)
Detector Mode: RMS
Centre Frequency: Equal to the centre frequency of the operating channel
Span: 0 Hz
Sweep time: > Channel Occupancy Time of the UUT
Trace Mode: Clear/Write

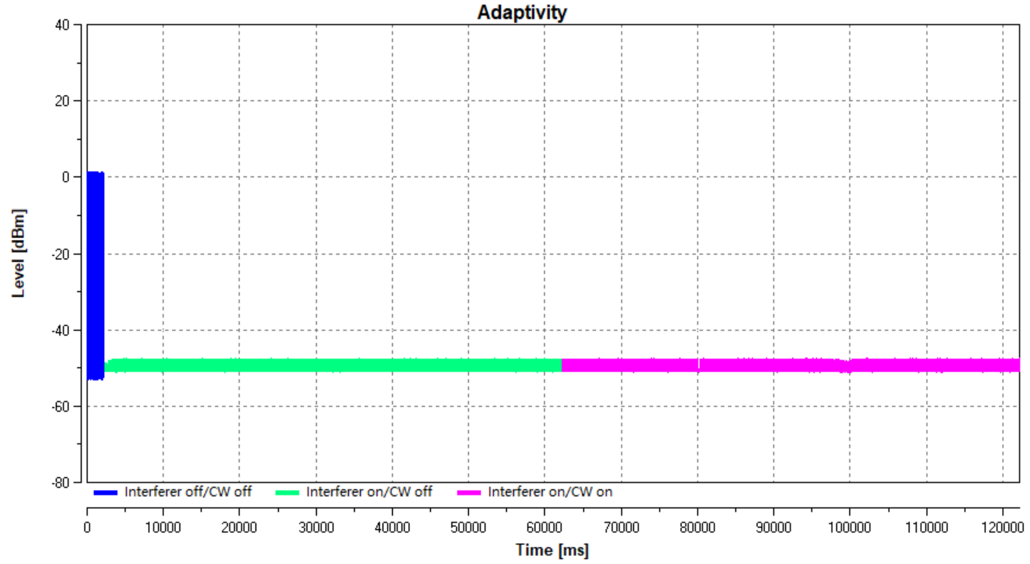
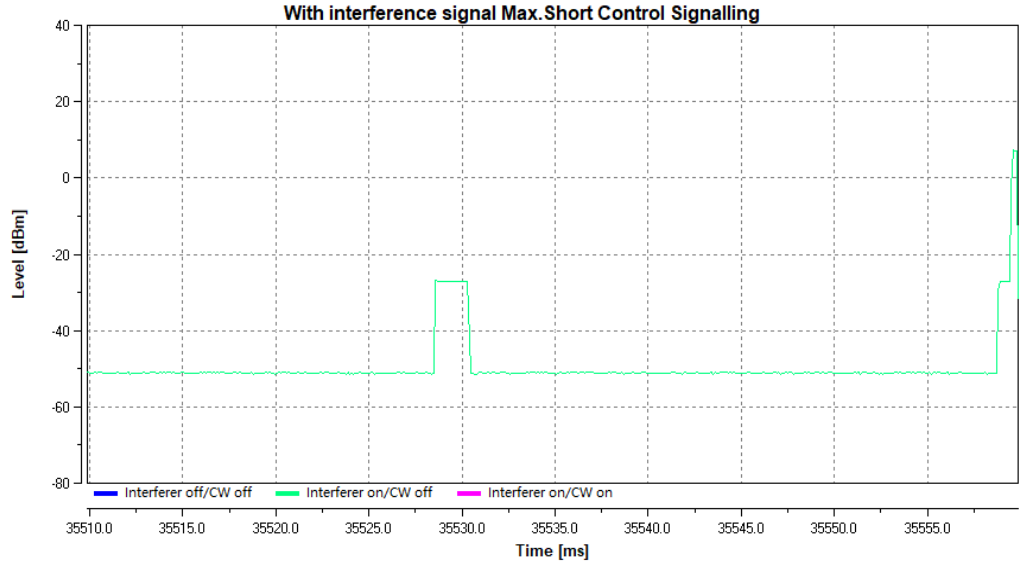
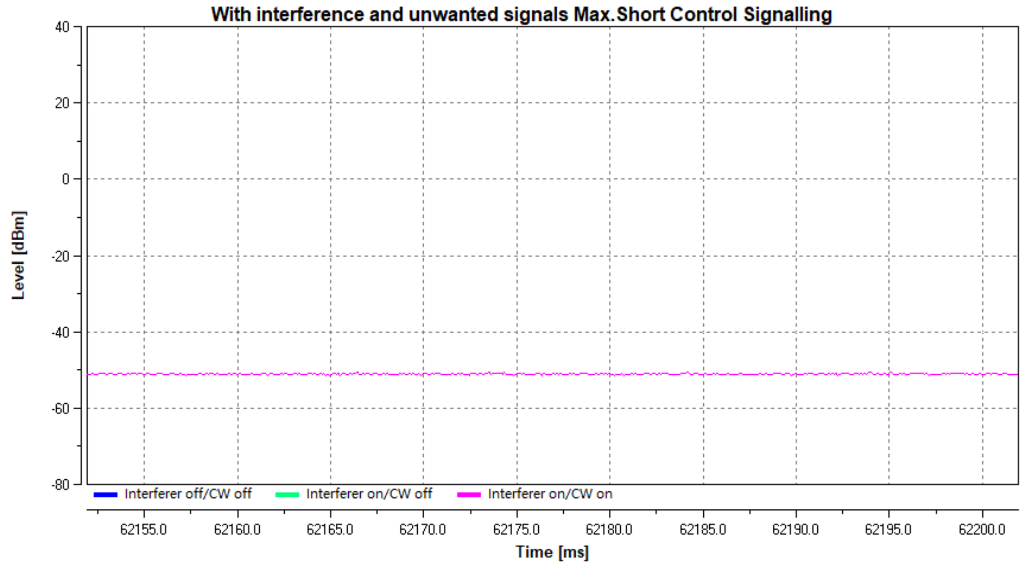
TEST RESULTS

Adaptivity 1：
802.11g:

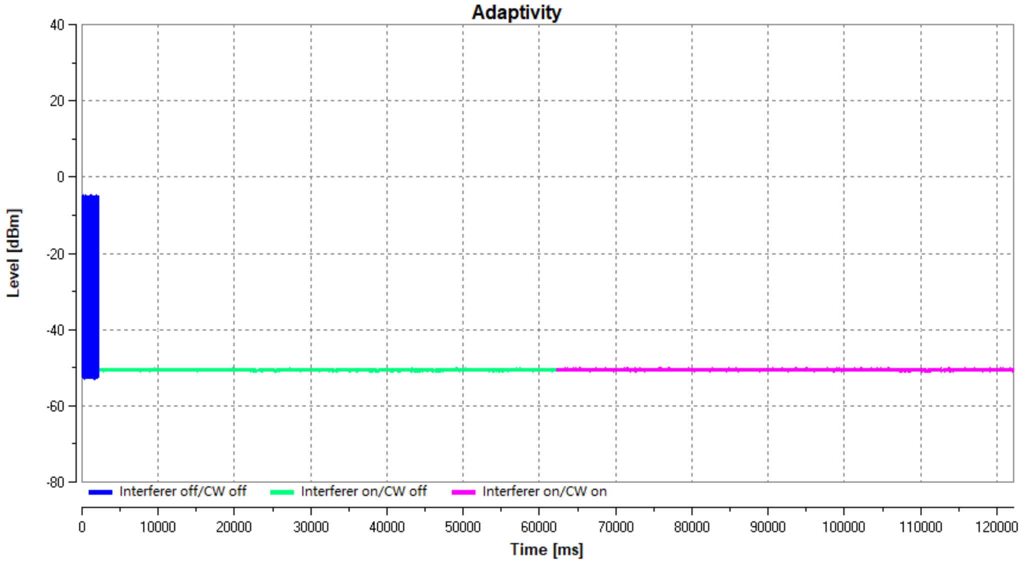
Frequency (MHz)	Test Step	COT(ms)	Limit (ms)	CCA Time (μs)	Limit (μs)	Result
2412.850000	Test Step 1	4.012	<13.000	40.000	>18.000	PASS
2472.850000	Test Step 1	3.654	<13.000	38.000	>18.000	PASS

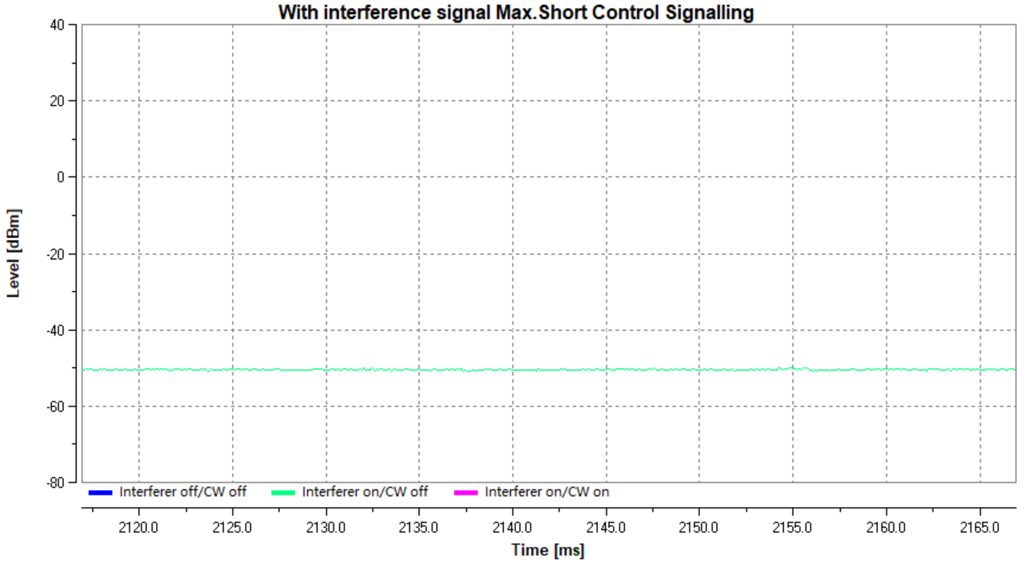
Adaptivity 2：
802.11g:

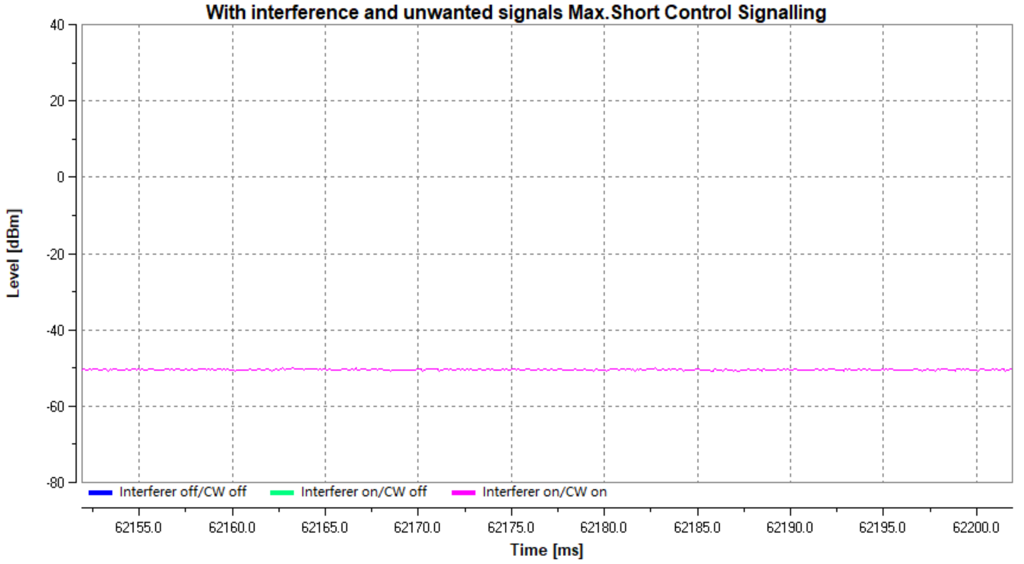
DUT Frequency (MHz)	Test Step	Short Signaling (%)	Limit (%)	Result
2412.850000	Test Step 2	0.8	<10.0	PASS
2412.850000	Test Step 2_2nd	0.0	<10.0	PASS
2412.850000	Test Step 3	0.0	<10.0	PASS
2412.850000	Test Step 3_2nd	0.0	<10.0	PASS
2472.850000	Test Step 2	0.0	<10.0	PASS
2472.850000	Test Step 2_2nd	0.0	<10.0	PASS
2472.850000	Test Step 3	0.0	<10.0	PASS
2472.850000	Test Step 3_2nd	0.0	<10.0	PASS

802.11g
CH01
Adaptivity Level [dBm] Time [ms] Interferer off/CW off Interferer on/CW off Interferer on/CW on
With interference signal Max.Short Control Signalling Level [dBm] Time [ms] Interferer off/CW off Interferer on/CW off Interferer on/CW on
With interference and unwanted signals Max.Short Control Signalling Level [dBm] Time [ms] Interferer off/CW off Interferer on/CW off Interferer on/CW on

802.11g
CH13







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

4.1.6. Occupied Channel Bandwidth

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.7.3
The Occupied Channel Bandwidth shall be within the band given in following table.

	Service frequency bands
Transmit	2 400 MHz to 2 483,5 MHz
Receive	2 400 MHz to 2 483,5 MHz

In addition, for non-adaptive non-FHSS equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth shall be equal to or less than 20 MHz.

TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.7.2.1
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 BW: ~ 1 % of the span without going below 1 %
- Video BW: 3 × RBW
- Frequency Span: 2 × Occupied Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
- Detector Mode: RMS
- Trace Mode: Max Hold

Step 2:
Wait until the trace is completed.
Find the peak value of the trace and place the analyser marker on this peak.
Step 3:
Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.
NOTE: 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.

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	RMS	
Sweep time:	auto	
Video bandwidth:	☒20 MHz(Bandwith):1.5MHz	☒40 MHz(Bandwith):3MHz
Resolution bandwidth:	☒20 MHz(Bandwith):410KHz	☒40 MHz(Bandwith):820KHz
Span:	☒20 MHz(Bandwith):40MHz	☒40 MHz(Bandwith):80MHz
Center:	Transmit channel	
Trace:	Max hold	
Performed:	☒ Conducted	
	☐ Radiated (only if no conducted sample is provided)	

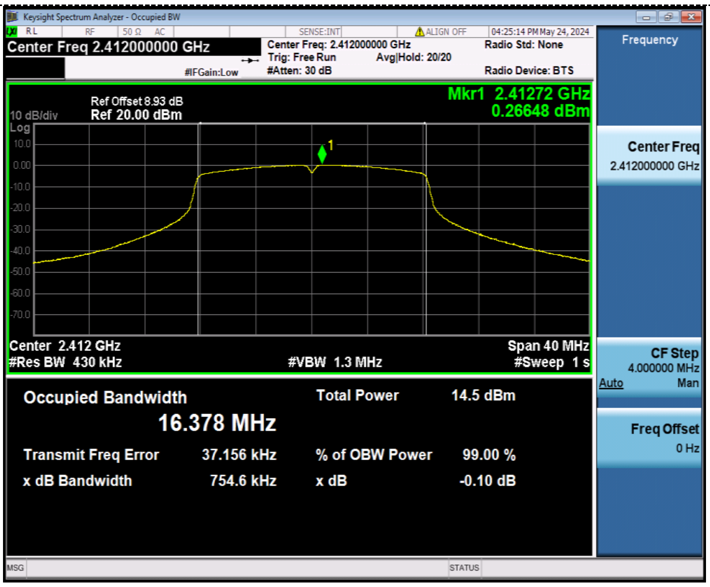
TEST RESULTS

Mode	Channel	Frequency (MHz)	99% Bandwidth (MHz)	FL[MHz]	FH[MHz]	Limits (MHz)	Verdict
802.11b	1	2412	13.946	2405.0897	2419.0357	2400 to 2483.5	PASS
	13	2472	13.938	2464.9735	2478.9115	2400 to 2483.5	PASS
802.11g	1	2412	16.378	2403.8482	2420.2262	2400 to 2483.5	PASS
	13	2472	16.364	2463.8114	2480.1754	2400 to 2483.5	PASS
802.11n (H20)	1	2412	17.525	2403.2764	2420.8014	2400 to 2483.5	PASS
	13	2472	17.514	2463.2346	2480.7486	2400 to 2483.5	PASS

Test plot as follows:

802.11B
CH01

CH13


802.11G
CH01

CH13


802.11N(20M)
CH01

CH13


4.1.7. Transmitter unwanted emissions in the out-of-band domain

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.8.3
The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in following figure

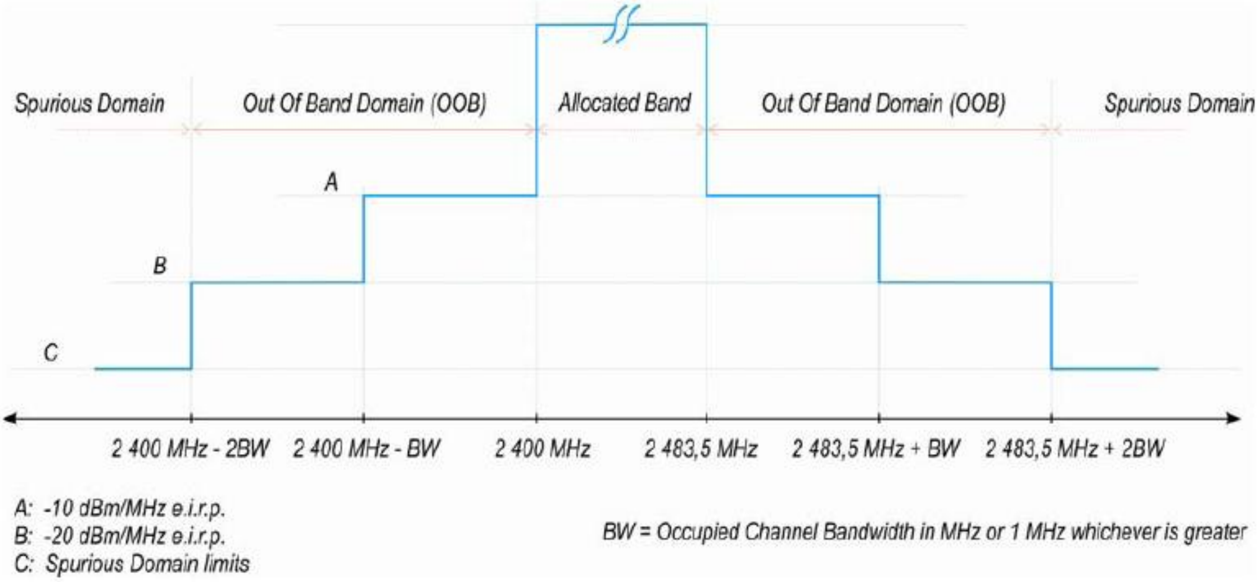


Figure 1: Transmit mask

TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.8.2.1
The Out-of-band emissions within the different horizontal segments of the mask provided in figures 1 and 3 shall be measured using the steps below. This method assumes the spectrum analyser is equipped with the Time Domain Power option.
Step 1:
Connect the UUT to the spectrum analyser and use the following settings:
- Measurement Mode: Time Domain Power
- Centre Frequency: 2 484 MHz
- Span: Zero Span
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep Mode: Single Sweep
- Sweep Points: Sweep time [µs] / (1 µs) with a maximum of 30 000
- Trigger Mode: Video
- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

Step 2: (segment 2 483,5 MHz to 2 483,5 MHz + BW)
● The measurement shall be performed and repeated while the trigger level is increased until no triggering takes place.
● For FHSS equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.
● Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.
● Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.
● Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).
Step 3: (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW)

● Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2 BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 4: (segment 2 400 MHz - BW to 2 400 MHz)

● Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 5: (segment 2 400 MHz - 2BW to 2 400 MHz - BW)

● Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2 BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2 BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 6:

● In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain G in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figure 1 or figure 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.

● In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain G in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.

Comparison with the applicable limits shall be done using any of the options given below:

- Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain Y in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figure 1 or figure 3.
- Option 2: the limits provided by the mask given in figure 1 or figure 3 shall be reduced by 10 × log10(Ach) and the additional beamforming gain Y in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE: Ach refers to the number of active transmit chains.

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

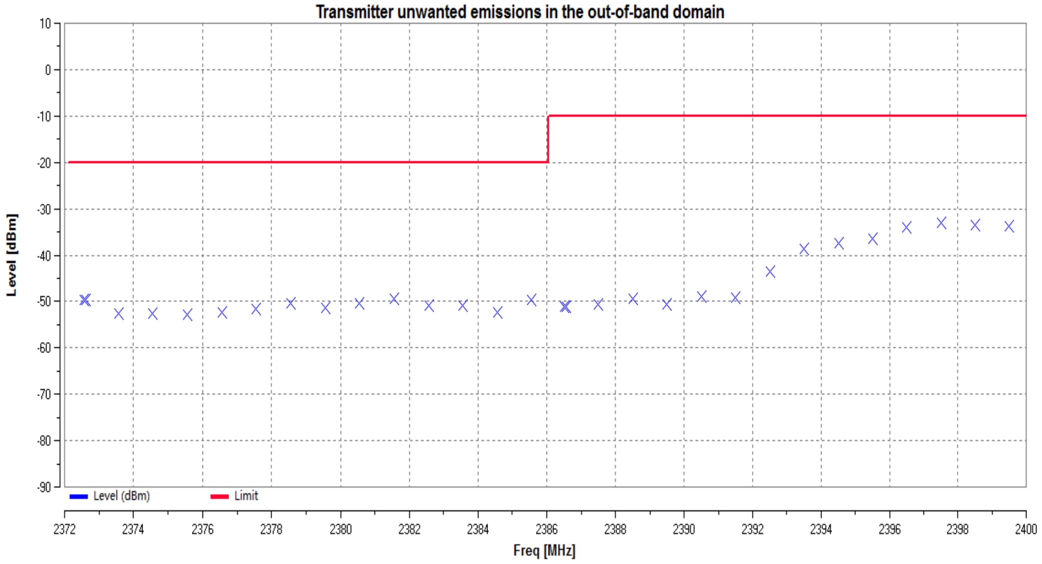
Instrument:	Spectrum Analyzer	
Detector:	RMS	
Sweep time:	depending on packet length	
Video bandwidth:	3MHz	
Resolution bandwidth:	1MHz	
Span:	0Hz	
Trace:	Trigger to burst	
Sweep points:	5000	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

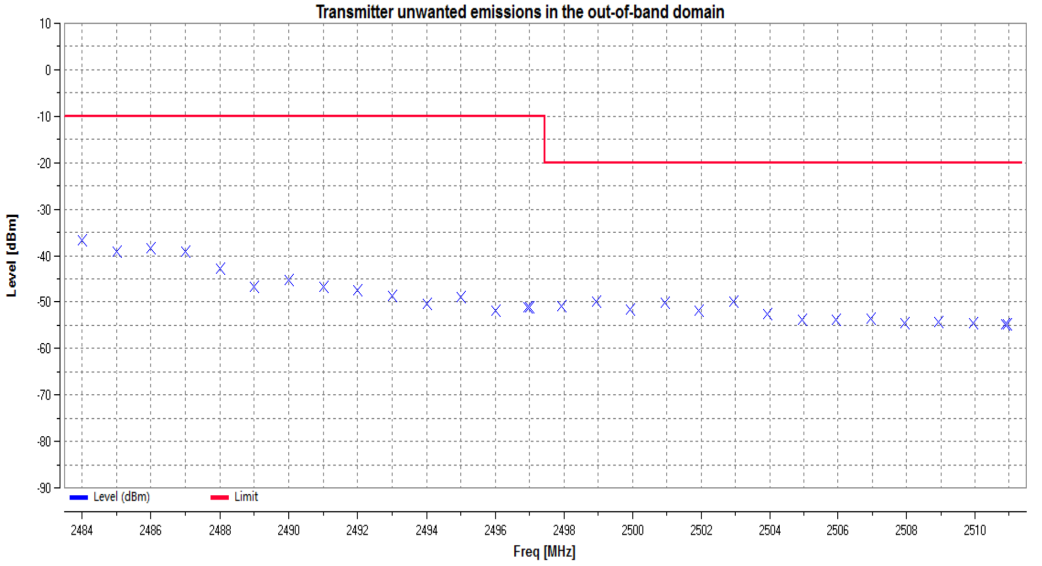
Test plot as follows:

Note:we listed the worst case at normal condition

802.11b

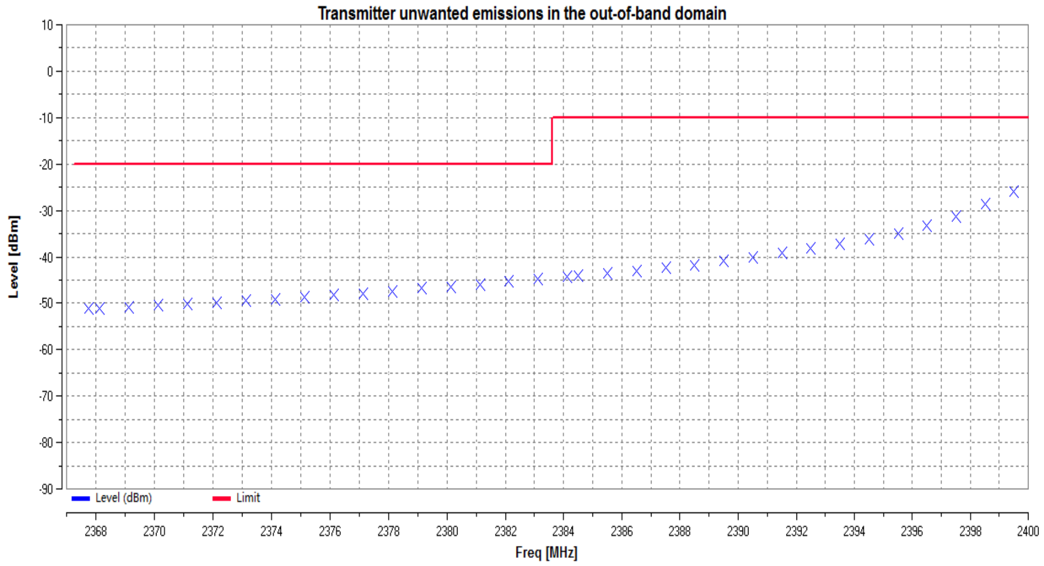


CH01(Left)

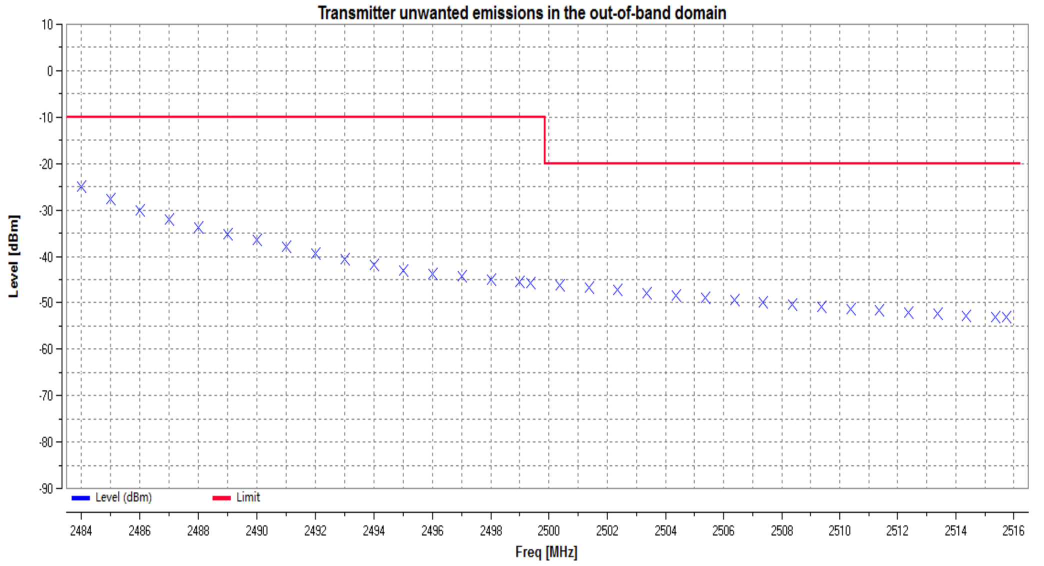


CH13(Right)

802.11g

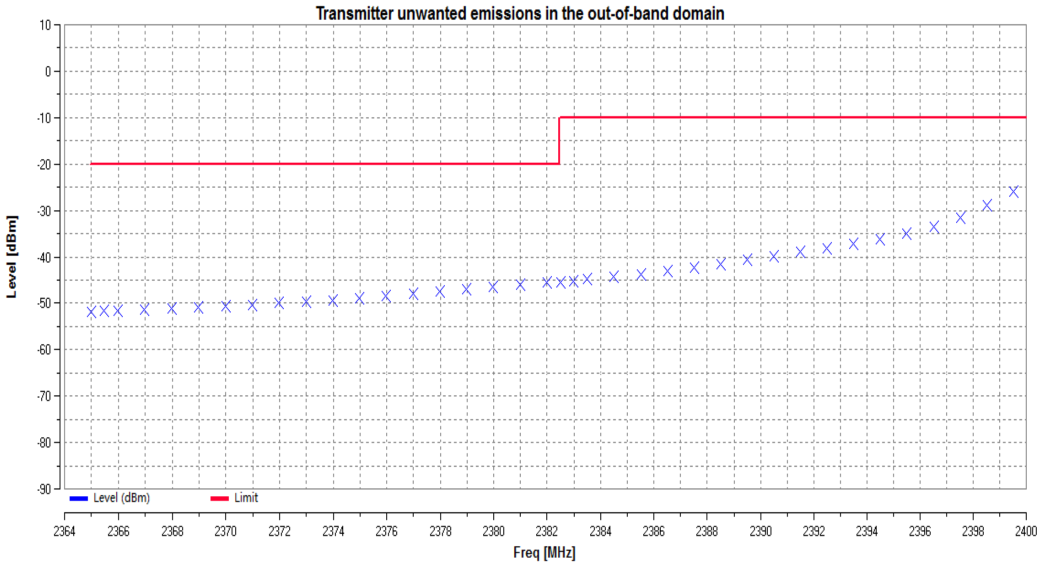


CH01(Left)

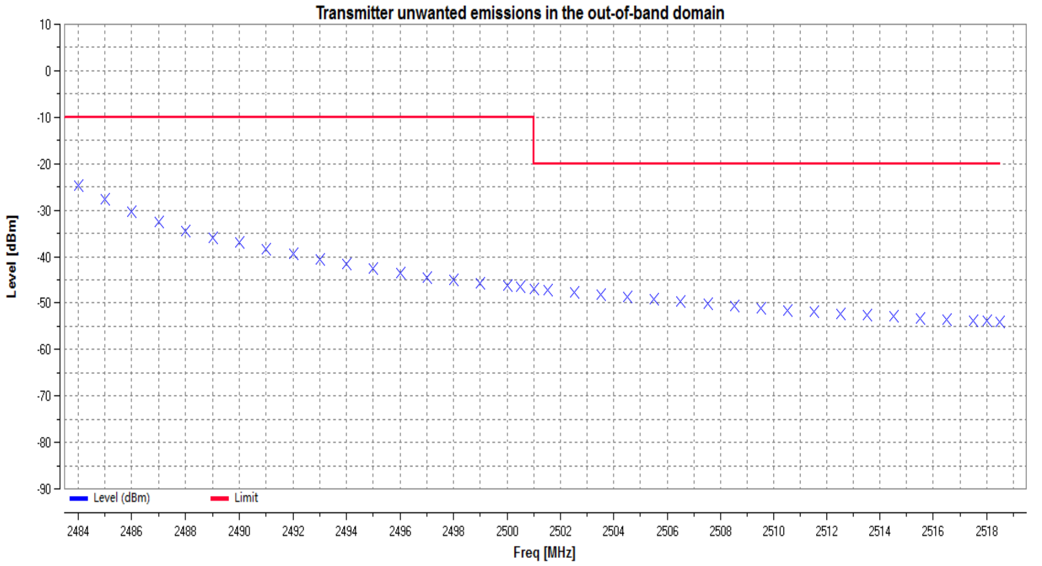


CH13(Right)

802.11n(H20)



CH01(Left)



CH13(Right)

4.1.8. Transmitter unwanted emissions in the spurious domain

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.9.2
The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 4

Table 4: Transmitter limits for spurious emissions

Frequency range	Maximum power, e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)	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 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

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

TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.9.2.1 & 5.4.9.2.2
In case of conducted measurements, the radio equipment shall be connected to the measuring equipment via a suitable attenuator.
The spectrum in the spurious domain (see figures 1 or 3) shall be searched for emissions that exceed the limit values given in tables 1 or 4 or that come to within 6 dB below these limits. Each occurrence shall be recorded.

Pre-scan
The test procedure below shall be used to identify potential unwanted emissions of the UUT.

Step 1:
The sensitivity of the measurement set-up should be such that the noise floor is at least 12 dB below the limits given in table 4 or table 12.

Step 2:
The emissions over the range 30 MHz to 1 000 MHz shall be identified.
Spectrum analyser settings:
● Resolution bandwidth: 100 kHz
● Video bandwidth: 300 kHz
● Filter type: 3 dB (Gaussian)
● Detector mode: Peak
● Trace Mode: Max Hold
● Sweep Points: ≥ 19 400; for spectrum analysers not supporting this high 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 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT, on any channel.
-For FHSS equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies.
-The above sweep time setting may result in long measuring times in case of FHSS equipment. To avoid such long measuring times, an FFT analyser may be used.

Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12.

Step 3
The emissions over the range 1 GHz to 12,75 GHz shall be identified.
Spectrum analyser settings:
● Resolution bandwidth: 1 MHz

● Video bandwidth: 3 MHz
● Filter type: 3 dB (Gaussian)
● Detector mode: Peak
● Trace Mode: Max Hold
● Sweep Points: ≥ 23 500; for spectrum analysers not supporting this high 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, on any channel.
- For FHSS equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies.
- The above sweep time setting may result in long measuring times in case of FHSS equipment. To avoid such long measuring times, an FFT analyser may be used.

Allow the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12.

FHSS equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.4.9.2.1.3.

Step 4:
● In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 and step 3 need to be repeated for each of the active transmit chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced by $10 \times \log_{10} (A_{ch})$..

Measurement of the emissions identified during the pre-scan
The procedure in step 1 to step 4 below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above. This method assumes the spectrum analyser has a Time Domain Power function.

Step 1:
The level of the emissions shall be measured using the following spectrum analyser settings:
● Measurement Mode: Time Domain Power
● Centre Frequency: Frequency of the emission identified during the pre-scan
● Resolution Bandwidth: 100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
● Video Bandwidth: 300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
● Frequency Span: Zero Span
● Sweep Mode: Single Sweep
● Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power
● Sweep Points: Sweep time [µs] / (1 µs) with a maximum of 30 000
● Trigger Mode: Video (burst signals) or Manual (continuous signals)
● Detector Mode: RMS

Step 2:
Set a window where the start and stop indicators match the start and end of the burst with the highest level and record the value of the power measured within this window. If the spurious emission to be measured is a continuous transmission, the measurement window shall be set to match the start and stop times of the sweep.

Step 3:
In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 needs to be repeated for each of the active transmit chains (A_{ch}). Sum the measured power (within the observed window) for each of the active transmit chains.

Step 4:
The value defined in step 3 shall be compared to the limits defined in table 4 or table 12.

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	Peak for prescan / RMS for emission retest	
Sweep time:	Auto	
Video bandwidth:	Below 1 GHz: 300 kHz / above 3MHz	
Resolution bandwidth:	Below 1 GHz: 100 kHz / above 1MHz	
Trace:	Max hold	
Sweep points:	40001	
Performed:	☒	Conducted
	☒	Radiated (only if no conducted sample is provided)

TEST RESULTS

Pass

Note :We tested the all modes,and recorded the worst case at the 802.11n20 Mode.

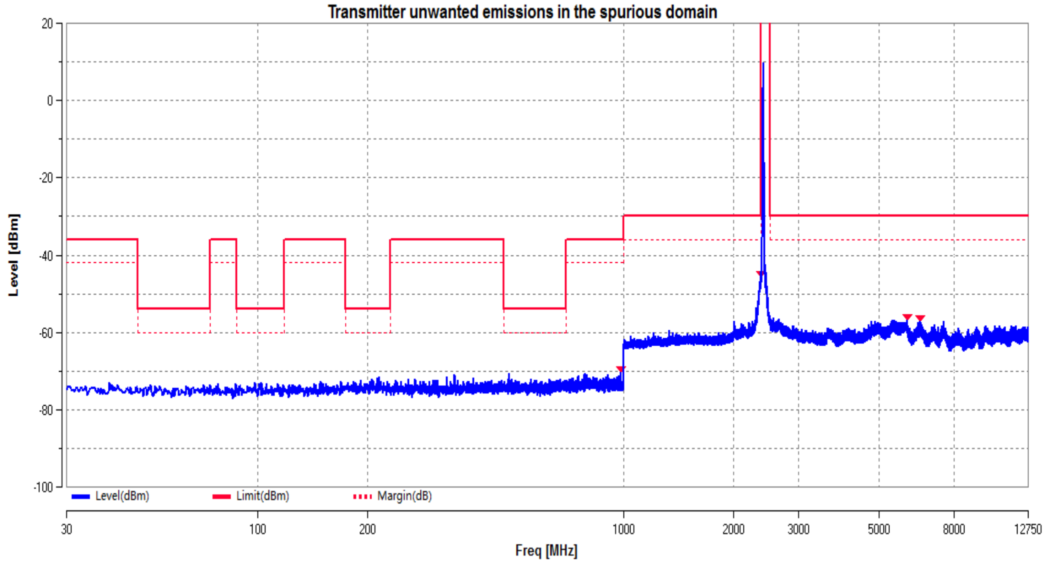
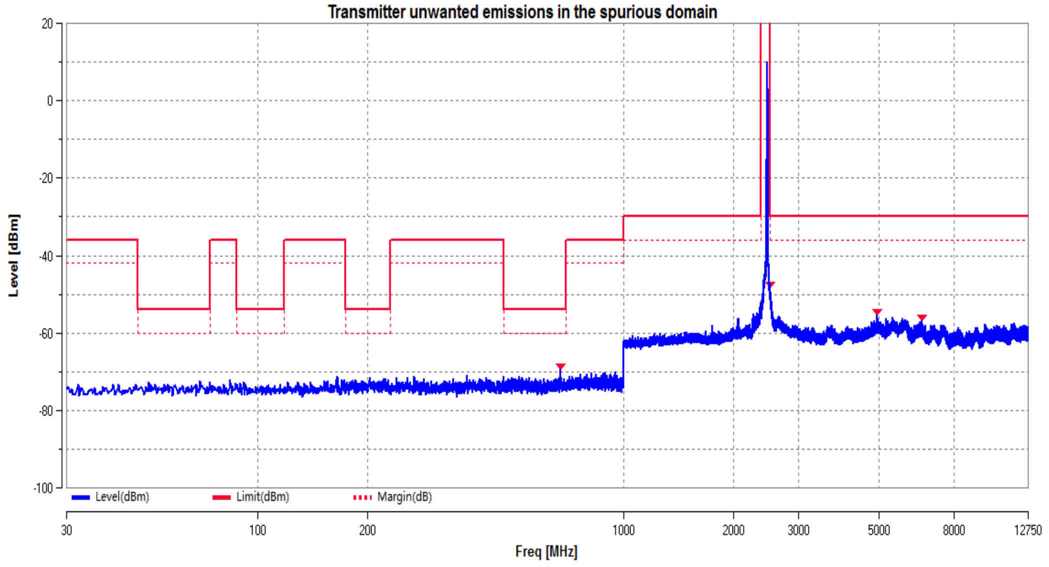
Radioation Spurious Emissions

Measured Modulation	☒802.11b	☒802.11g	☒802.11n HT20

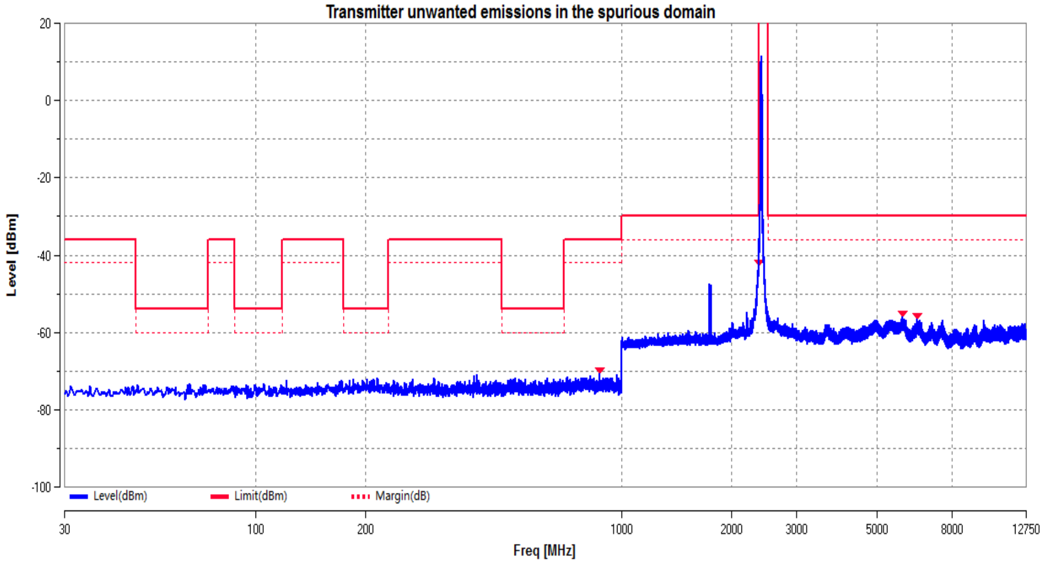
Radioation Spurious Emissions:

The Worst Test Mode 802.11n20					
Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 01 (2412MHz)					
175.55	H	-67.41	-54.00	-13.41	PK
226.32	V	-62.78	-54.00	-8.78	PK
998.35	H	-42.95	-36.00	-6.95	PK
800.89	V	-49.88	-36.00	-13.88	PK
4824.96	H	-43.64	-30.00	-13.64	PK
4823.86	V	-43.69	-30.00	-13.69	PK
7236.87	H	-41.17	-30.00	-11.17	PK
7236.75	V	-45.04	-30.00	-15.04	PK
Channel 13 (2472MHz)					
151.37	H	-48.83	-36.00	-12.83	PK
204.44	V	-69.47	-54.00	-15.47	PK
979.55	H	-52.44	-36.00	-16.44	PK
970.44	V	-46.30	-36.00	-10.30	PK
4945.73	H	-44.19	-30.00	-14.19	PK
4942.90	V	-39.86	-30.00	-9.86	PK
7416.79	H	-40.88	-30.00	-10.88	PK
7415.77	V	-40.36	-30.00	-10.36	PK

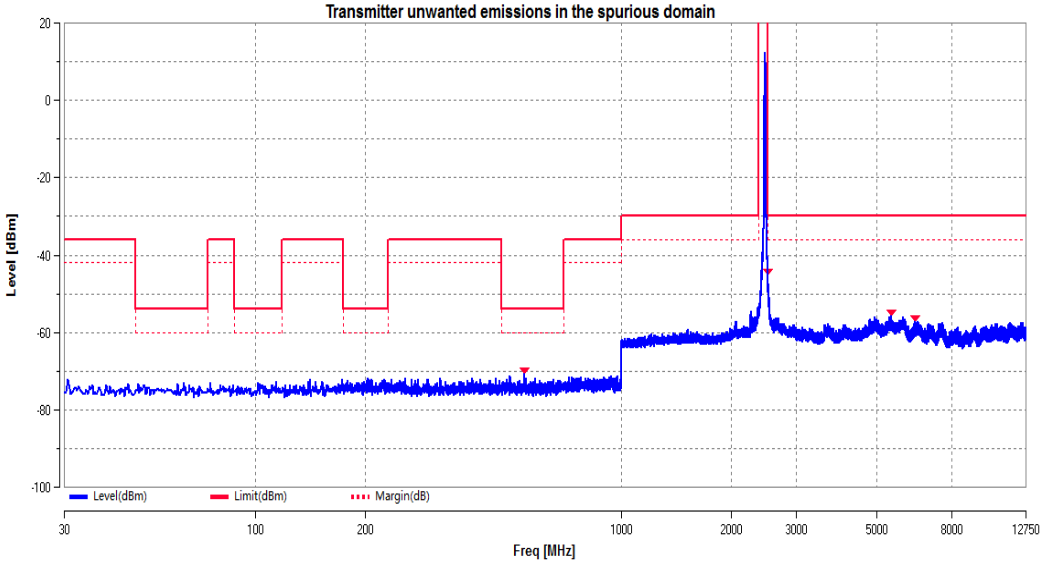
Conducted Spurious Emissions:

802.11B
CH01

CH13


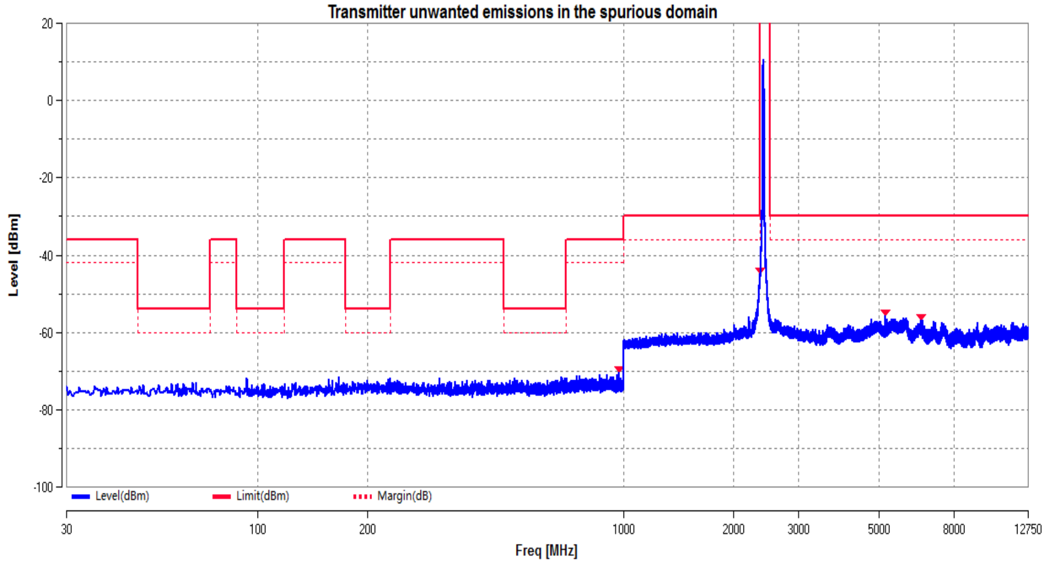
802.11G
CH01



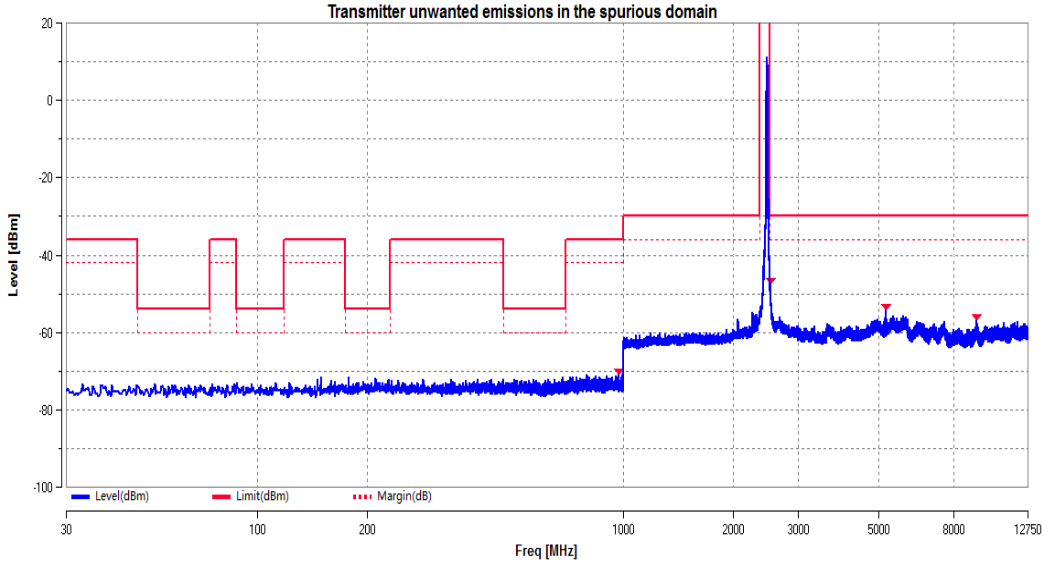
CH13



802.11N(20M)
CH01



CH13



4.1.9. Receiver spurious emissions

LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.10.3

The spurious emissions of the receiver shall not exceed the values given in following table.

Frequency range	Maximum power e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

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

TEST CONFIGURATION

The same as described in section 4.1.8

TEST PROCEDURE

The same as described in section 4.1.8

EUT DESCRIPTION:

Mode:	☒802.11b	☒802.11g	☒802.11n HT20
Test Channel	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz	☒2412MHz ☒2472MHz
Bandwidth	☒20MHz ☐40MHz	☒20MHz ☐40MHz	☒20MHz ☐40MHz
Modulation Type	☒DSSS ☐OFDM	☐DSSS ☒OFDM	☐DSSS ☒OFDM
Channel Separation	☒5MHz	☒5MHz	☒5MHz

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	Peak for prescan / RMS for emission retest	
Sweep time:	Auto	
Video bandwidth:	Below 1 GHz: 300 kHz / above 3MHz	
Resolution bandwidth:	Below 1 GHz: 100 kHz / above 1MHz	
Trace:	Max hold	
Sweep points:	40001	
Performed:	☒	Conducted
	☒	Radiated (only if no conducted sample is provided)

TEST RESULTS

Pass

Note :We tested the all modes,and recorded the worst case at the 802.11n20 Mode.

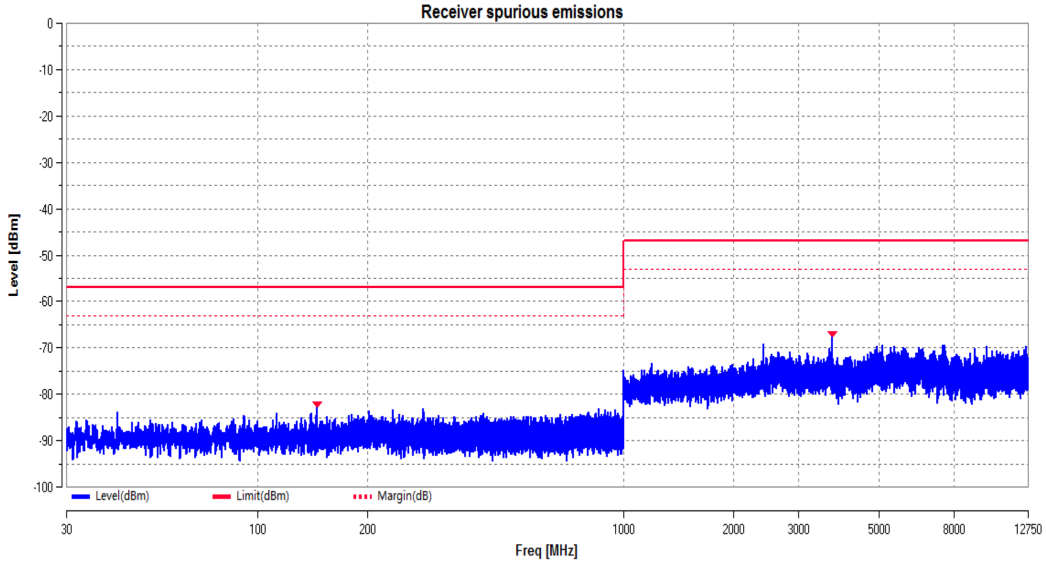
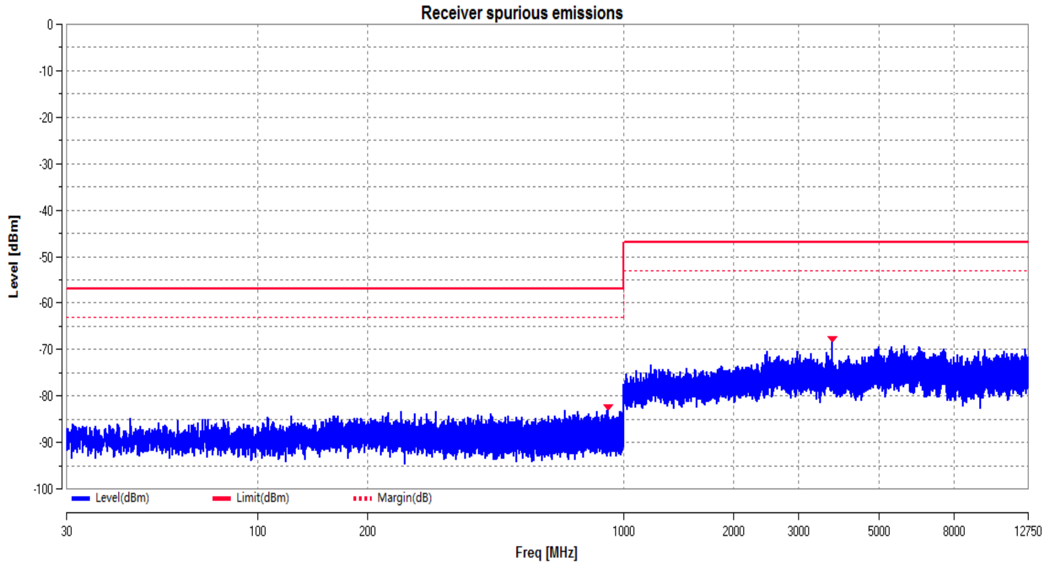
Radioation Spurious Emissions

Measured Modulation	☒802.11b	☒802.11g	☒802.11n HT20

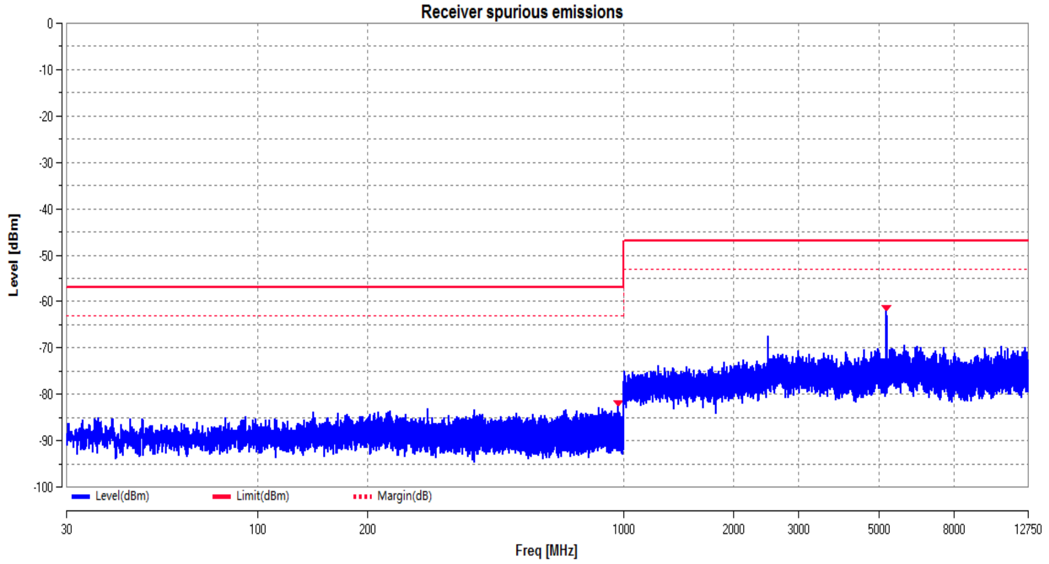
Radioation Spurious Emissions：

The Worst Test Mode 802.11n20					
Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 01 (2412MHz)					
215.66	H	-69.17	-57.00	-12.17	PK
183.28	V	-68.02	-57.00	-11.02	PK
890.84	H	-68.86	-57.00	-11.86	PK
895.70	V	-65.86	-57.00	-8.86	PK
1828.88	H	-58.14	-47.00	-11.14	PK
1303.20	V	-56.95	-47.00	-9.95	PK
2202.98	H	-63.28	-47.00	-16.28	PK
2329.27	V	-59.00	-47.00	-12.00	PK
Channel 13 (2472MHz)					
216.82	H	-67.98	-57.00	-10.98	PK
180.09	V	-68.25	-57.00	-11.25	PK
889.95	H	-69.26	-57.00	-12.26	PK
896.32	V	-69.09	-57.00	-12.09	PK
1830.05	H	-58.08	-47.00	-11.08	PK
1304.11	V	-56.79	-47.00	-9.79	PK
2204.66	H	-59.46	-47.00	-12.46	PK
2330.27	V	-58.49	-47.00	-11.49	PK

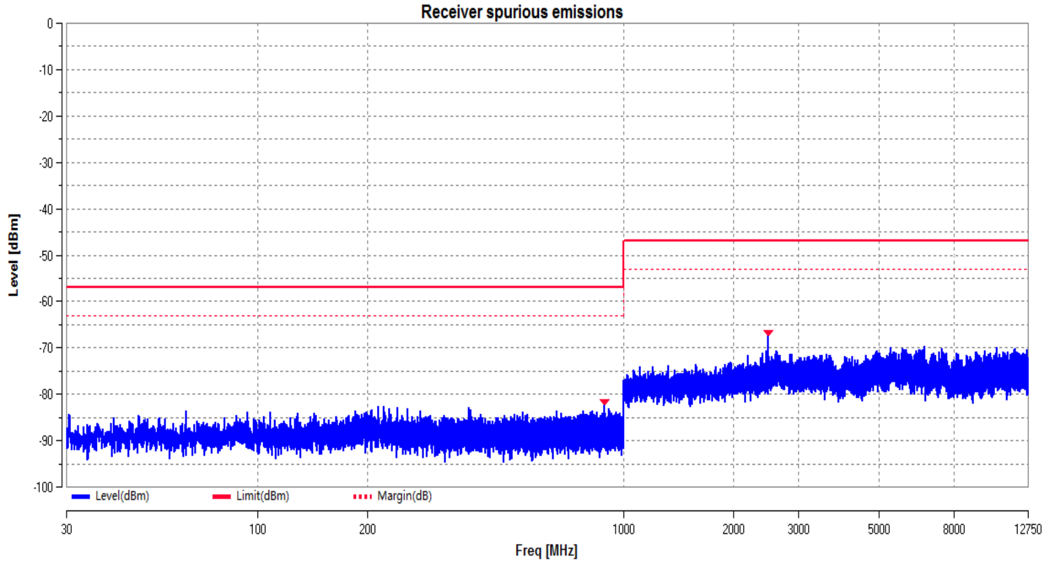
Conducted Spurious Emissions:

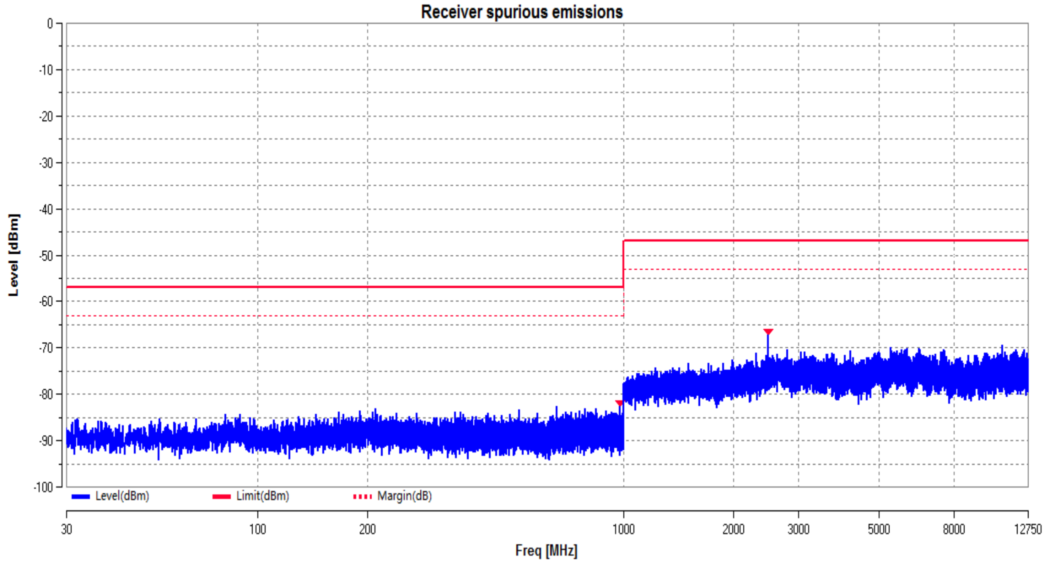
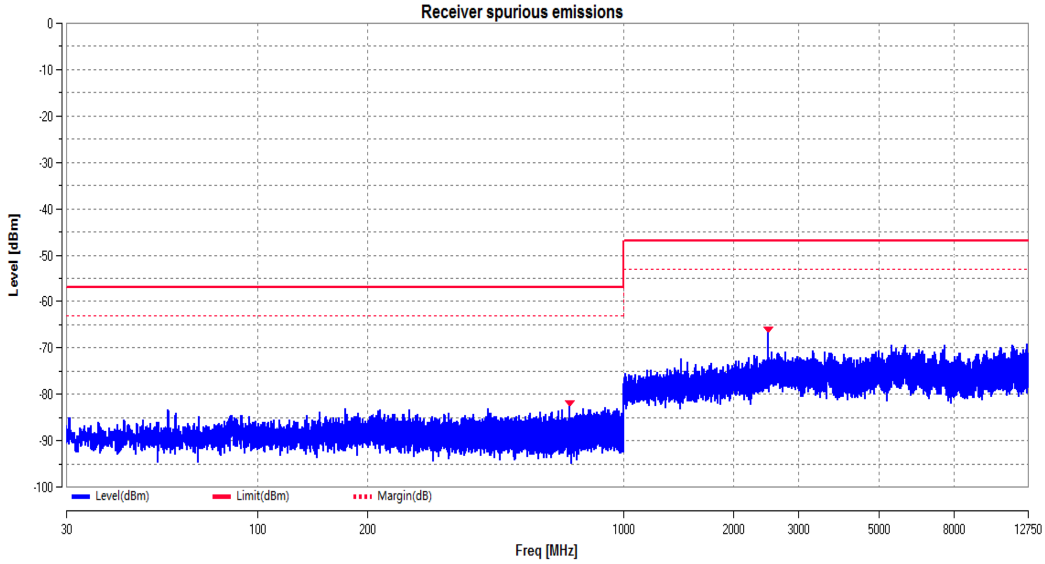
802.11B
CH01

CH13


802.11G
CH01



CH13



802.11N(20M)
CH01

CH13


4.1.10. Receiver Blocking

Limits

ETSI EN 300 328 Sub-4.3.2.11.4

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.4, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in follow

Receiver Category 1

<table>
<tr><th>Wanted signal mean power from companion device (dBm)
(see notes 1 and 4)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm)
(see note 4)</th><th>Type of blocking signal</th></tr>
<tr><td>(-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less
(see note 2)</td><td>2 380
2 504</td><td rowspan="2">-34</td><td rowspan="2">CW</td></tr>
<tr><td>(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less
(see note 3)</td><td>2 300
2 330
2 360
2 524
2 584
2 674</td></tr>
<tr><td colspan="4">NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.</td></tr>
</table>

Receiver Category 2

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log_{10}(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

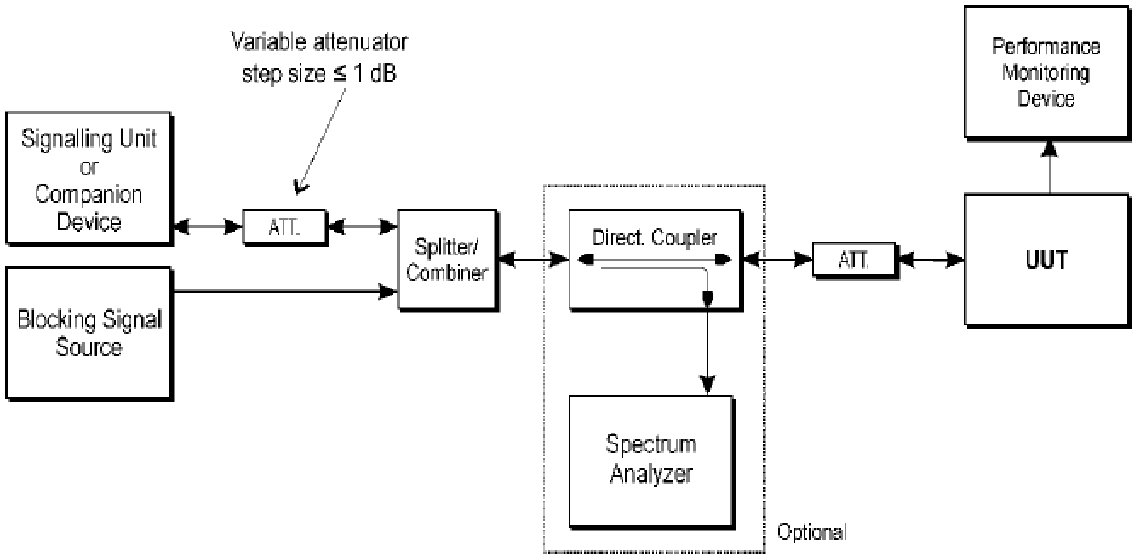
NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

Receiver Category 3

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log_{10}(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

TEST CONFIGURATION:



TEST PROCEDURE

Please refer to ETSI EN 300 328 Sub-clause 5.4.11.2.1 for the measurement method..

Step 1:
● For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).

Step 2:
● The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.

Step 3:
● With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6.
● Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be used to measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain of the companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report.
● When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, 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 4.3.1.12.3 or clause 4.3.2.11.3 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 the value provided in note 2 of the applicable table corresponding to the receiver category and type of equipment.

Step 4
● The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment.
● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6.

Step 5
● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been increased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.

● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.

● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required.
● It shall be recorded in the test report whether the shift of blocking frequencies as described in the present step was used.

Step 6:
● Repeat step 4 and step 5 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.

Step 7:
● For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).

Step 8:

● It shall be assessed and recorded in the test report whether the UUT complies with the Receiver Blocking requirement.

TEST RESULTS

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

mode	Test Channel Frequency (MHz)	2412MHz	OCBW(Hz)		14266000	
		2472MHz			14186000	
802.11b	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Limit(PER)	test value(PER)	Result
2412	-68	2380	-34	10%	3%	PASS
		2504			4%	PASS
	-74	2300			3%	PASS
		2330			3%	PASS
		2360			5%	PASS
		2524			5%	PASS
		2584			5%	PASS
		2674			4%	PASS
2472	-68	2380	-34	10%	4%	PASS
		2504			2%	PASS
	-74	2300			7%	PASS
		2330			3%	PASS
		2360			4%	PASS
		2524			2%	PASS
		2584			3%	PASS
		2674			6%	PASS

mode	Test Channel Frequency (MHz)	2412MHz	OCBW(Hz)		16424000	
		2472MHz			16384000	
802.11g	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Limit(PER)	test value(PER)	Result
2412	-68	2380	-34	10%	3%	PASS
		2504			6%	PASS
	-74	2300			5%	PASS
		2330			3%	PASS
		2360			5%	PASS
		2524			4%	PASS
		2584			4%	PASS
		2674			4%	PASS
2472	-68	2380	-34	10%	6%	PASS
		2504			2%	PASS
	-74	2300			7%	PASS
		2330			6%	PASS
		2360			7%	PASS
		2524			4%	PASS
		2584			6%	PASS
		2674			5%	PASS

mode	Test Channel Frequency (MHz)	2412MHz	OCBW(Hz)		17622000	
		2472MHz			17582000	
802.11n 20	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Limit(PER)	test value(PER)	Result
2412	-68	2380	-34	10%	6%	PASS
		2504			5%	PASS
	-74	2300			4%	PASS
		2330			2%	PASS
		2360			6%	PASS
		2524			7%	PASS
		2584			2%	PASS
		2674			4%	PASS
2472	-68	2380	-34	10%	6%	PASS
		2504			1%	PASS
	-74	2300			4%	PASS
		2330			2%	PASS
		2360			6%	PASS
		2524			3%	PASS
		2584			7%	PASS
		2674			6%	PASS

mode	Test Channel Frequency (MHz)	2422MHz	OCBW(Hz)		36044000	
		2462MHz			35884000	
802.11n 40	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Limit(PER)	test value(PER)	Result
2422	-68	2380	-34	10%	5%	PASS
		2504			3%	PASS
	-74	2300			3%	PASS
		2330			5%	PASS
		2360			5%	PASS
		2524			6%	PASS
		2584			3%	PASS
		2674			4%	PASS
2462	-68	2380	-34	10%	6%	PASS
		2504			1%	PASS
	-74	2300			5%	PASS
		2330			4%	PASS
		2360			3%	PASS
		2524			3%	PASS
		2584			5%	PASS
		2674			7%	PASS

Note1:Wanted signal mean power from companion device is -133 dBm + 10 × log10(OCBW) or -68 dBm whichever is less for Blocking signal frequency (2380,2504MHz)

Note2:Wanted signal mean power from companion device is -139 dBm + 10 × log10(OCBW) or -74 dBm whichever is less Blocking signal frequency (2300,2330,2360,2524,2584,2674MHz)

4.1.11. Geo-location capability

Requirements

ETSI EN 300 328 Sub-clause 4.3.2.12.2 & Sub-clause 4.3.2.12.3
Geo-location capability is a feature of the equipment 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 non-FHSS equipment as defined in clause 4.3.2.12.2 shall not be accessible to the user in a way that would allow the user to alter it.

TEST RESULTS

This item is not applicable for the EUT

5. TEST SETUP PHOTOS OF THE EUT

Reference to the test report No. **GTS20240426022-1-7.**

6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No. **GTS20240426022-1-7.**

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