REPORT No. : SZ18010062W06

TEST REPORT

MANUFACTURER	**:**	Shenzhen Chainway Information Technology Co.,Ltd.
PRODUCT NAME	**:**	Mobile Data Terminal
MODEL NAME	**:**	C72
BRAND NAME	**:**	CHAINWAY
STANDARD(S)	**:**	ETSI EN 300 328 V2.1.1 (2016-11)
TEST DATE	**:**	2018-01-14 to 2018-01-18
ISSUE DATE	**:**	2018-02-02

Tested by: Tu Ya'nan

Tu Yanan (Test Engineer)

Approved by: Andy Yeh

Andy Yeh (Technical Director)

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Change History		
Issue	**Date**	**Reason for change**
1.0	2018-02-02	First edition

1. Technical Information

Note: Provide by manufacturer.

1.1. Manufacturer and Factory Information

Manufacturer:	Shenzhen Chainway Information Technology Co.,Ltd.
Manufacturer Address:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen
Factory:	Shenzhen Chainway Information Technology Co.,Ltd.
Factory Address:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen

1.2. Equipment Under Test (EUT) Description

Product Name:	Mobile Data Terminal	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	C70SE_MB_V11	
Software Version:	C72E_MT6735_V1.1_EU_GITfcd74c4_20180115	
Equipment type:	WLAN 2.4G	
Modulation Technology:	Other than FHSS	
Modulation Type:	Refer 1.3	
Operating Frequency Range:	2.412GHz - 2.472GHz	
Channel Number:	Refer 1.4	
Maximum e.r.i.p:	14.60dBm	
Adaptive Mode:	Adaptive/non-adaptive equipment:	Adaptive Equipment without the possibility to switch to a non-adaptive mode
	LBT Base DAA:	No
	Non-LBT Base DAA:	Yes
	Frame Based Equipment:	No
	Load Based Equipment:	Yes
	Number of transmit chain:	1
	Number of receive chain:	1
Antenna Gain:	Antenna Type:	PIFA Antenna
	Antenna Gain:	0.49 dBi
Power Supply:	Battery/AC Adaptor	
Operating voltage:	Normal(NV):	3.8V
Operating temperature:	Normal(NT):	25°C
	Lowest(LT):	-20°C
	Highest(HT):	50°C

Note 1: This test report is updated from report (Report No.: SZ17080130W05), based on the similarity between before, the software version was changed and added an external accessory with RFID function. The changes only affect the test results of transmitter unwanted emissions in the spurious domain and receiver spurious emissions.

Note 2: The EUT is operating at 2.4GHz ISM band; it supports 802.11b, 802.11g, 802.11n and they are all tested in this report. For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. Modulation type of EUT

Modulation technology	Modulation Type	Transfer Rate (Mbps)	The Frequency Equal to the Transmission Rate of Modulation Signal
DSSS (802.11b)	DBPSK	1	1MHz
	DQPSK	2	
	CCK	5.5/ 11	1.375MHz
OFDM (802.11g)	BPSK	6 / 9	1MHz
	QPSK	12 / 18	
	16QAM	24 / 36	
	64QAM	48 / 54	
OFDM (802.11n-20MHz)	BPSK	6.5	1MHz
	QPSK	13/19.5	
	16QAM	26/39	
	64QAM	52/58.5/65	
OFDM (802.11n-40MHz)	BPSK	13.5	1MHz
	QPSK	27/40.5	
	16QAM	54/81/108	
	64QAM	121.5/135	

1.4. The channel number and frequency of EUT

Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
HT20	**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**		

Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
HT40	**3**	**2422**	8	2447
	4	2427	9	2452
	5	2432	10	2457
	6	2437	**11**	**2462**
	7	**2442**		

Note 1: The Lowest Channel (1), Middle Channel (7) and Highest Channel (13) was selected test for HT20;

Note 2: The Lowest Channel (3), Middle Channel (7) and Highest Channel (11) was selected test for HT40;

1.5. Setting of test system

Setting	Value	
EUT type:	WLAN 2.4G	
Test Mode:	Mode	Modulation Type
	802.11b	DBPSK
	802.11g	BPSK
	802.11n20	BPSK
	802.11n40	BPSK
EUT frequency configurable:	Yes	
Test channel-Low:	2412MHz(HT20); 2422MHz(HT40)	
Test channel-Middle:	2442MHz(HT20); 2442MHz(HT40)	
Test channel-High:	2472MHz(HT20); 2462MHz(HT40)	
Adaptive:	Yes	
With TPC function:	No	
Number of the antenna:	1	
Number of transmission chains:	1	
Beam forming:	No	
Maximum beam forming gain:	N/A	
Antenna gain:	0.49dBi	

1.6. Test Standards and Results

The EUT has been tested according to ETSI EN 300 328 V2.1.1 (2016-11).

ETSI EN 300 328 V2.1.1 (2016-11)	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Test items and the results are as bellow:

EN Reference		EN 300 328 v2.1.1 (2016-11)	Test	Result
№	Sub clause	Test Items	Engineer	
1	4.3.2.2	RF Output Power	Tu Yanan	**PASS** Note1
2	4.3.2.3	Power Spectral Density	Tu Yanan	**PASS** Note1
3	4.3.2.6	Adaptivity	Tu Yanan	**PASS** Note1
4	4.3.2.7	Occupied Channel Bandwidth	Tu Yanan	**PASS** Note1
5	4.3.2.8	Transmitter unwanted emissions in the OOB domain	Tu Yanan	**PASS** Note1
6	4.3.2.9	Transmitter unwanted emissions in the spurious domain	Tu Yanan Peng Shiqing	**PASS**
7	4.3.2.10	Receiver spurious emissions	Tu Yanan Peng Shiqing	**PASS**
8	4.3.2.11	Receiver Blocking	Tu Yanan	**PASS** Note1
9	4.3.2.12	Geo-location capability	Tu Yanan	**PASS** Note1
Note1: The test results of these test items in this report refer to the test report (Report No.: SZ17080130W06).				

1.7. EUT Setup and Operating Conditions

The EUT is activated and controlled by the System Simulator and software. The EUT is powered by battery.

1.8. Environmental Conditions

Ambient temperature: +15~+35°C
Relative humidity: 20~75%
Atmosphere pressure: 86-106kPa

2. Transmitter Parameters

2.1. EN 300 328 §4.3.2.2 Maximum transmit power

2.1.1. Definition

The RF output power is defined as the mean equivalent isotropic radiated power (e.i.r.p.) of the equipment during a transmission burst.

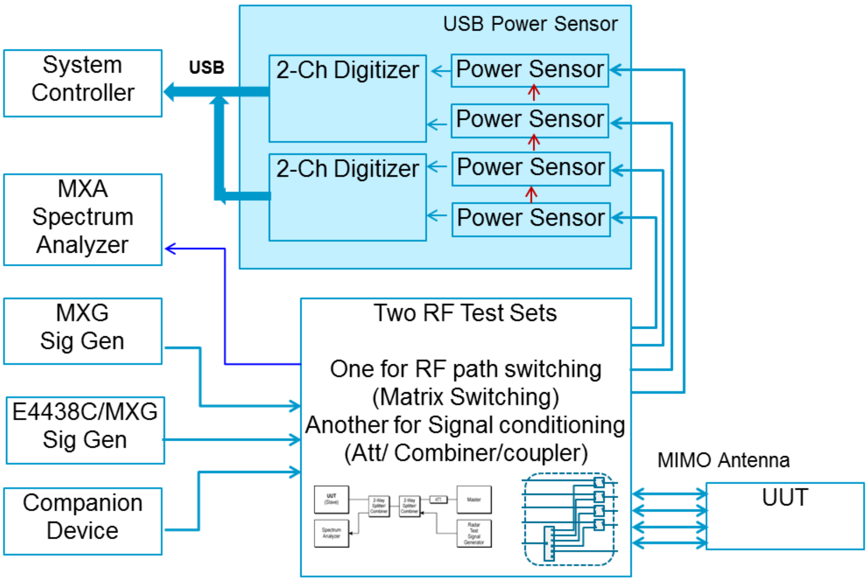
2.1.2. Limits

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.
The maximum RF output power for non-adaptive equipment shall be declared by the manufacturer and shall not exceed 20 dBm. See clause 5.4.1 m). For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the manufacturer.
This limit shall apply for any combination of power level and intended antenna assembly.

2.1.3. Test condition

See clause 5.1 for the environmental test conditions. Apart from the RF output power, these measurements need only to be performed at normal environmental conditions. The measurements for RF output power shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.
In the case of equipment intended for use with an integral antenna and where no antenna connectors are provided, a test fixture as described in clause B.4 may be used to perform relative measurements at the extremes of the operating temperature range.
The equipment shall be operated under its worst case configuration (for example modulation, bandwidth, data rate.power) with regards to the requirement being tested. Measurement of multiple data sets may be required.
For equipment using FHSS modulation, the measurements shall be performed during normal operation (hopping) and the equipment is assumed to have no blacklisted frequencies (operating on all hopping positions).
For equipment 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.

2.1.4. Test procedures



test procedure shall be as follows:

Step 1:

•Use a fast power sensor suitable for 2,4 GHz 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 dynamic range, 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.

•If applicable, 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 (P) shall be calculated using the formula below:

P = A + G + Y

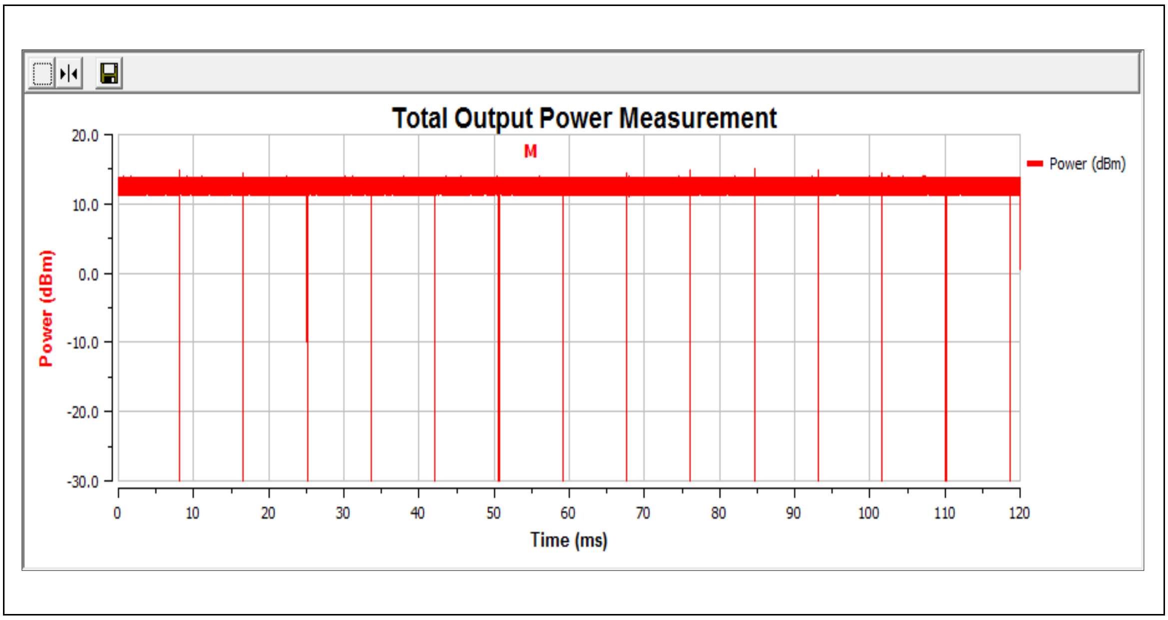
•This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

2.1.5. Result

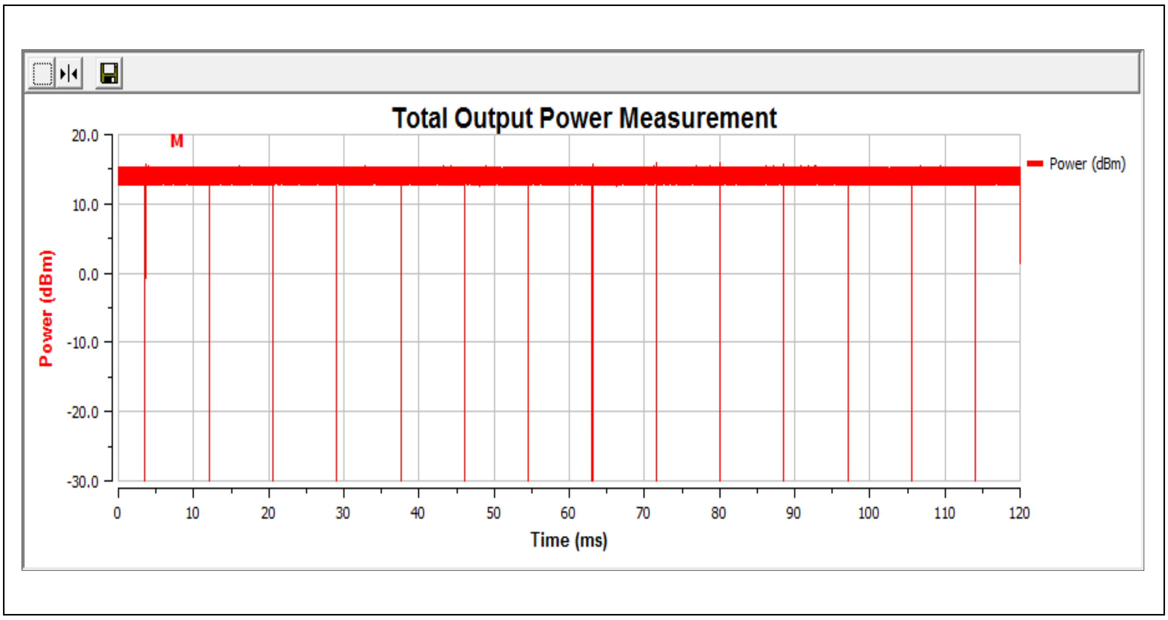
2.1.5.1 802.11b Mode:

Test Conditions	EIRP (dBm)			Result
	Channel 1 2412MHz	Channel 7 2442MHz	Channel 13 2472MHz	
NT	13.12	14.60	13.76	PASS
LT	13.23	14.58	13.79	PASS
HT	13.11	14.52	13.72	PASS

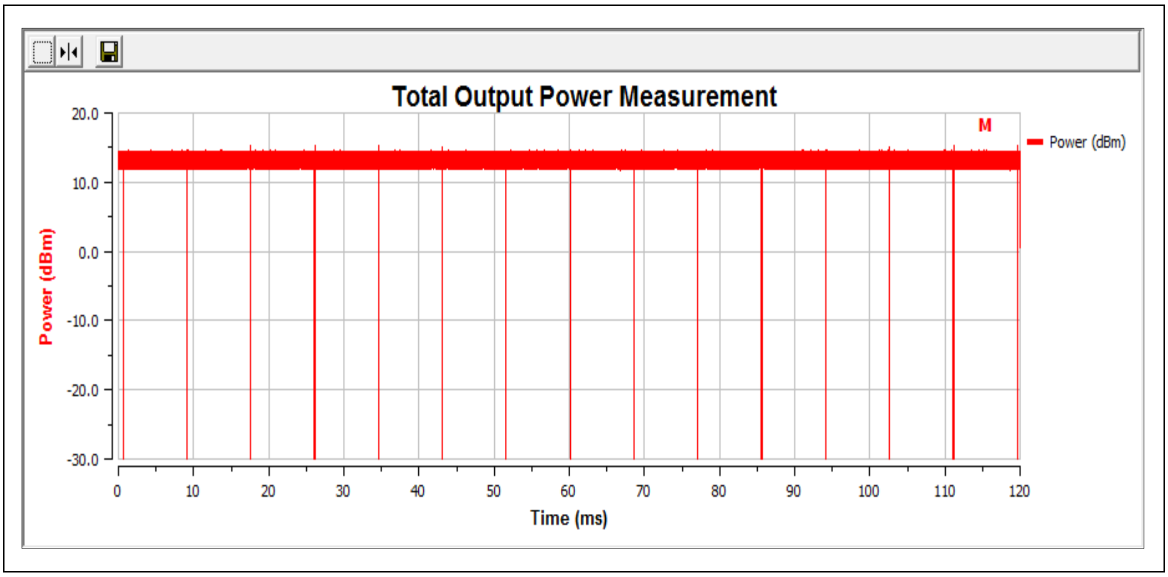
Test Plot



(802.11b Mode: Channel1 2412MHz)



(802.11b Mode: Channel7 2442MHz)

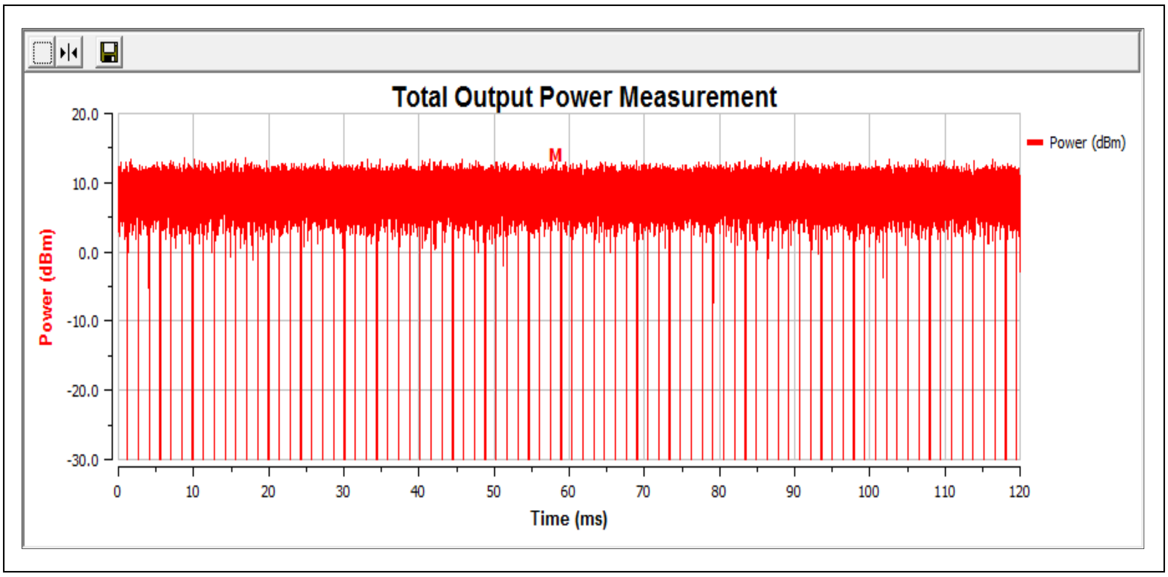


(802.11b Mode: Channel13 2472MHz)

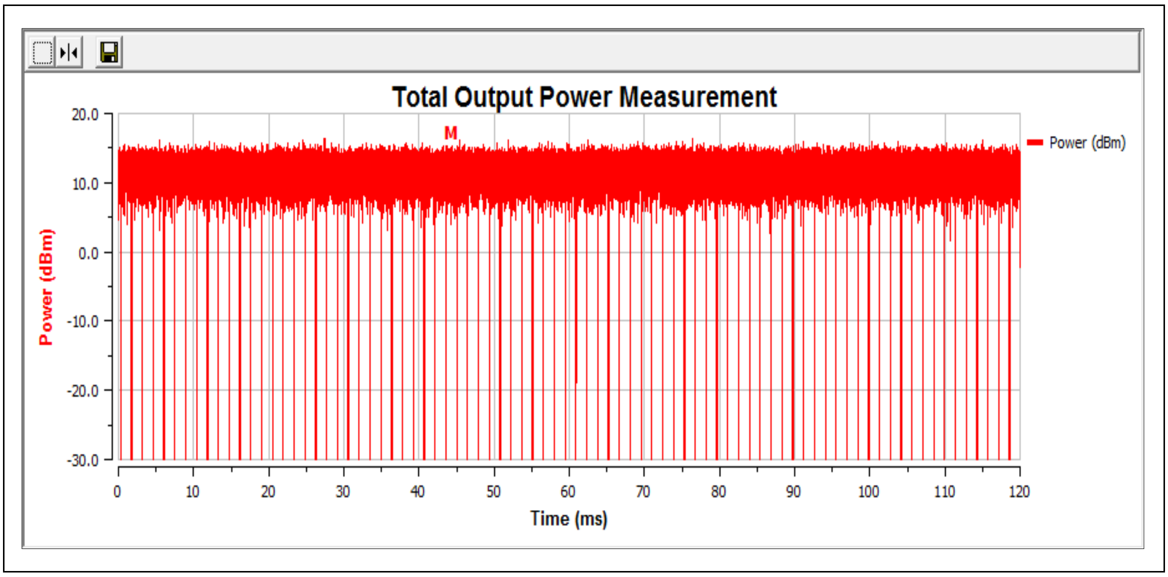
2.1.5.2 802.11g Mode:

Test Conditions	EIRP (dBm)			Result
	Channel 1 2412MHz	Channel 7 2442MHz	Channel 13 2472MHz	
NT	9.50	12.63	9.65	PASS
LT	9.56	12.66	9.71	PASS
HT	9.45	12.58	9.62	PASS

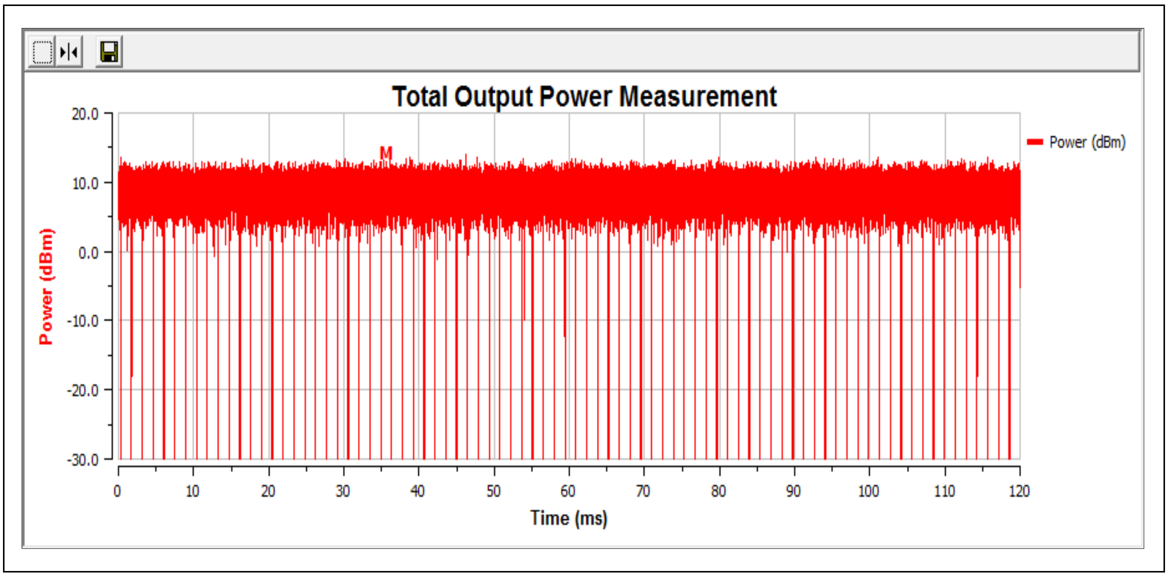
Test Plot



(802.11g Mode: Channel1 2412MHz)



(802.11g Mode: Channel7 2442MHz)

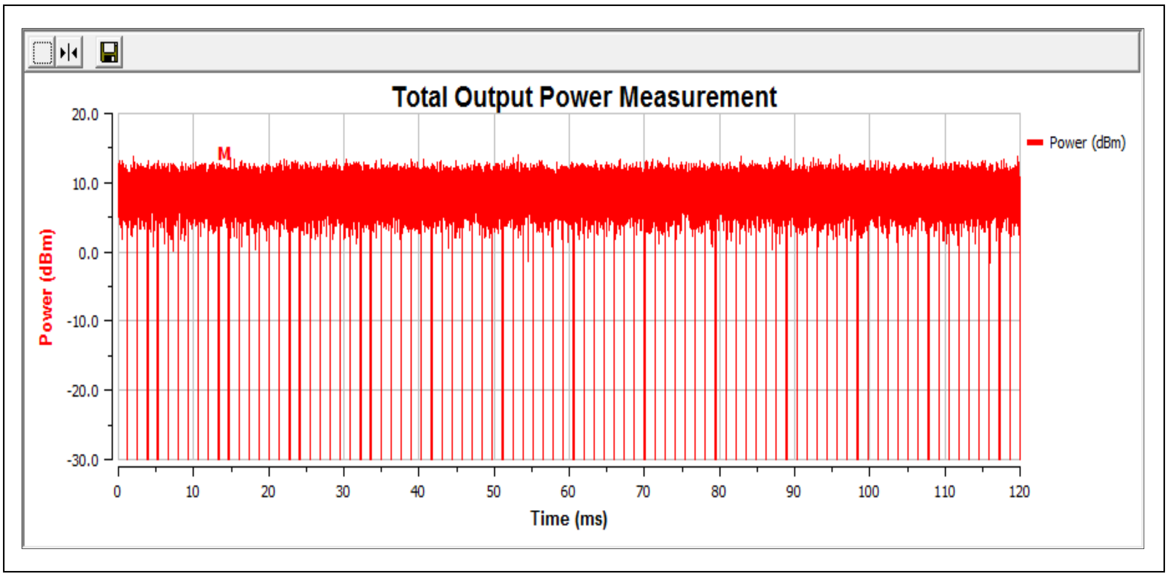


(802.11g Mode: Channel13 2472MHz)

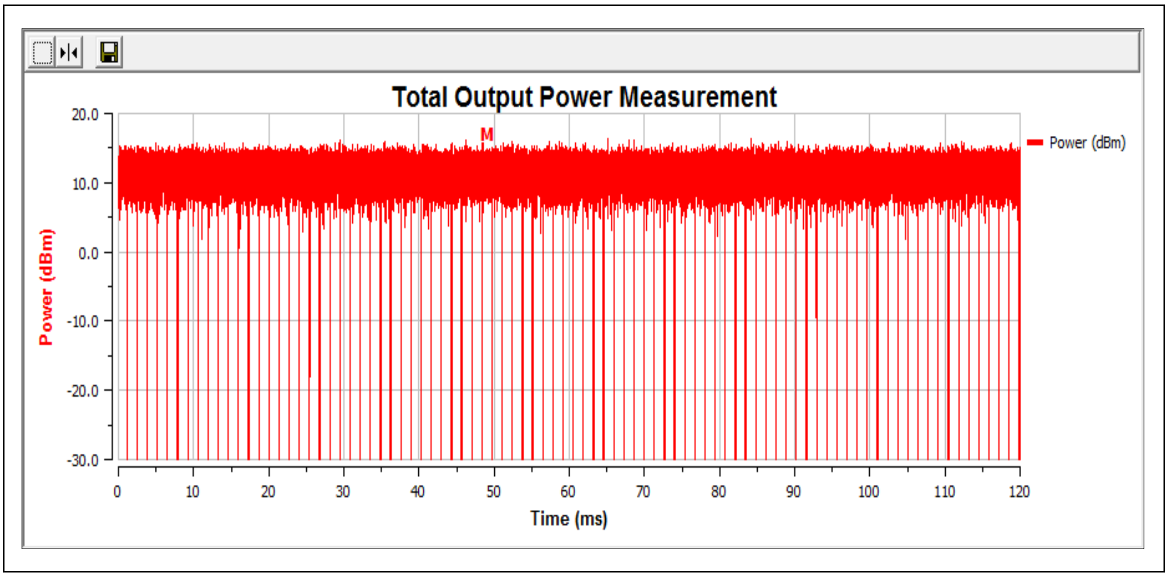
2.1.5.3 802.11n20 Mode:

Test Conditions	EIRP (dBm)			Result
	Channel 1 2412MHz	Channel 7 2442MHz	Channel 13 2472MHz	
NT	9.67	12.50	9.63	**PASS**
LT	9.69	12.55	9.67	**PASS**
HT	9.63	12.42	9.66	**PASS**

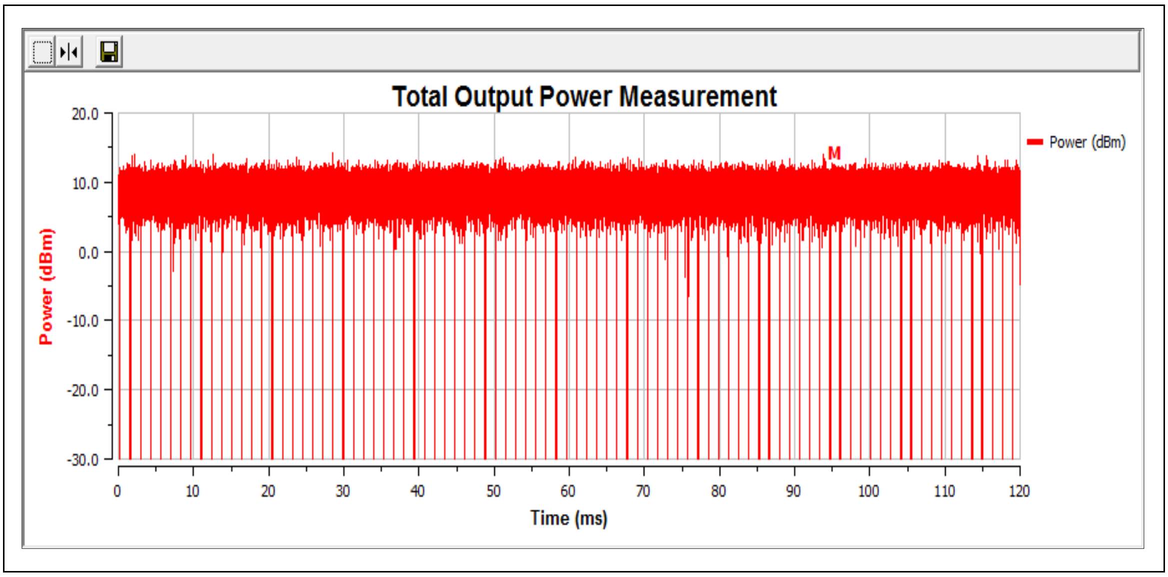
Test Plot



(802.11n20 Mode: Channel1 2412MHz)



(802.11n20 Mode: Channel7 2442MHz)

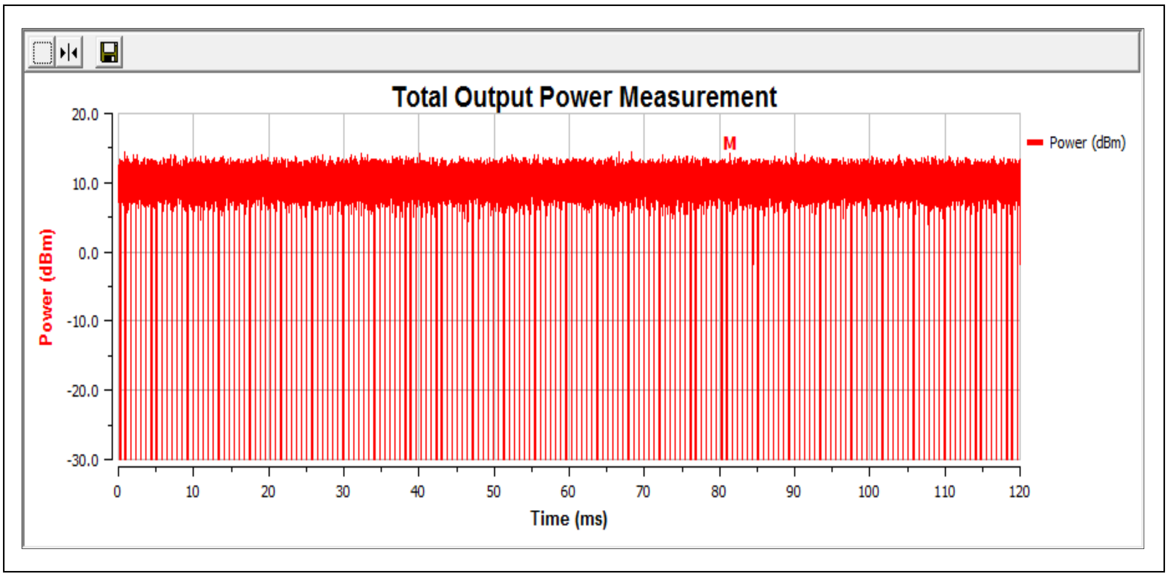


(802.11n20 Mode: Channel13 2472MHz)

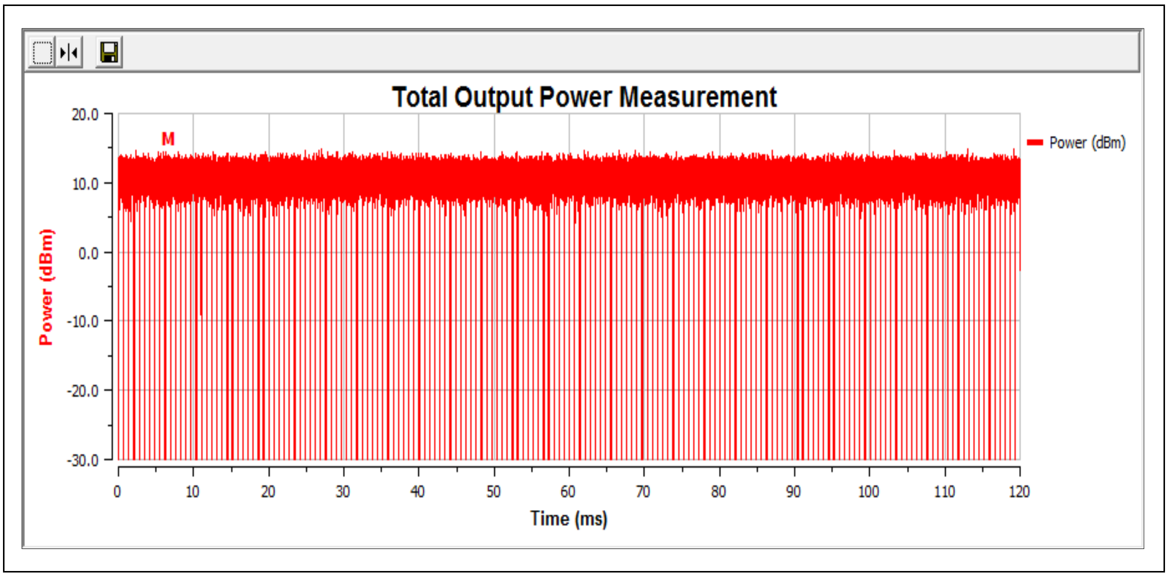
2.1.5.4 802.11n40 Mode:

Test Conditions	EIRP (dBm)			Result
	Channel 3 2422MHz	Channel 7 2442MHz	Channel 11 2462MHz	
NT	11.24	11.78	11.02	**PASS**
LT	11.26	11.79	11.05	**PASS**
HT	11.20	11.74	10.96	**PASS**

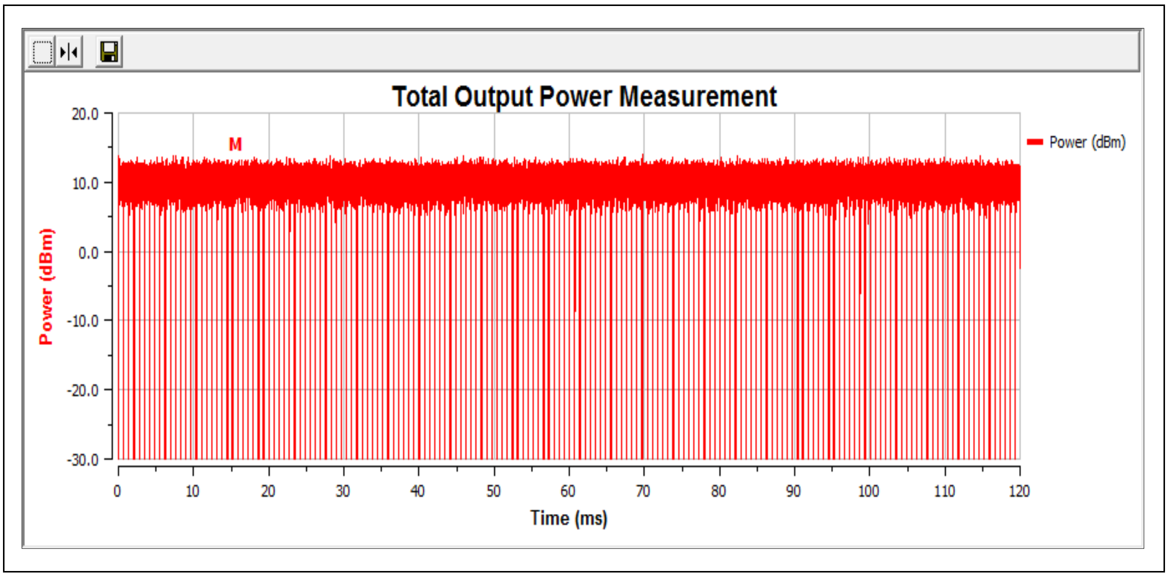
Test Plot



(802.11n40 Mode: Channel3 2422MHz)



(802.11n40 Mode: Channel7 2442MHz)



(802.11n40 Mode: Channel11 2462MHz)

Notes:

(1) Conducted measurement method was used.

(2) The path loss as the factor is calibrated to correct the reading.

2.2. EN 300 328 §4.3.2 .3- Maximum e.i.r.p. spectral density

2.2.1. Definition

The Power Spectral Density (PSD) is the mean equivalent isotropically radiated power (e.i.r.p.) spectral density in a1 MHz bandwidth during a transmission burst.

2.2.2. Limit

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm per MHz.

2.2.3. Test condition

See clause 5.1 for the test conditions. These measurements shall only be performed at normal test conditions.
The measurement shall be repeated for the equipment being configured to operate at the lowest, the middle, and the highest frequency of the stated frequency range. These frequencies shall be recorded.
For the duration of the test, the equipment shall not change its operating frequency.

2.2.4. Test procedures

The transmitter shall be connected to a spectrum analyser and the Power Spectral Density as defined in clause 4.3.2.3 shall be measured and recorded.
The test procedure shall be as follows:
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: 8 351
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 sweeppoints

For continuous transmissions:10 s; the sweep time may be increased further until a value where the sweep time has no impact on the RMS value of the signal

For non-continuous signals, wait for the trace to stabilize.

Save the data (trace data) set to a file.

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 $P_{Samplecorr}(n)$ (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.

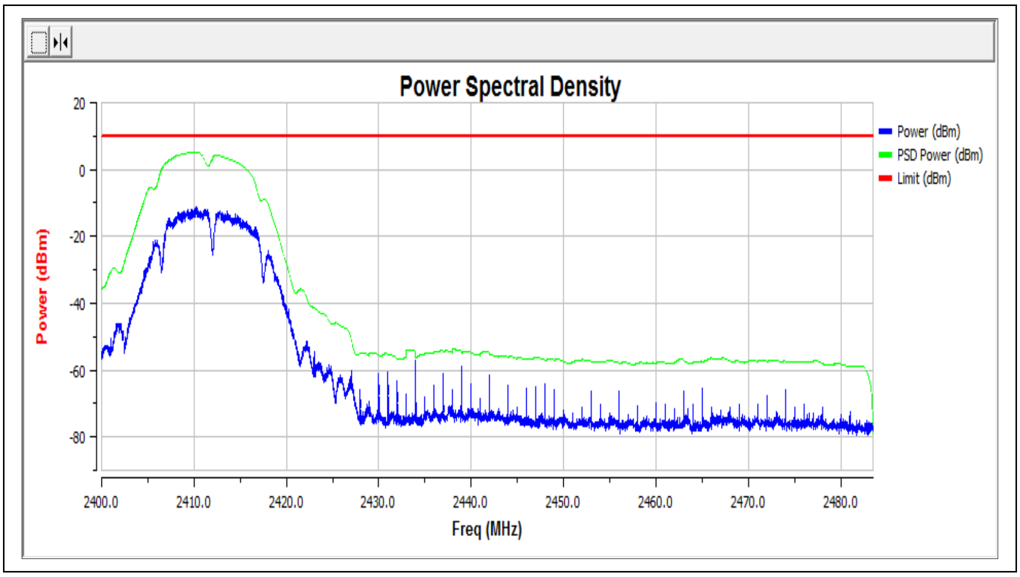
From all the recorded results, the highest value is the maximum Power Spectral Density for the UUT. This value, which shall comply with the limit given in clause 4.3.2.3.3, shall be recorded in the test report.

2.2.5. Result

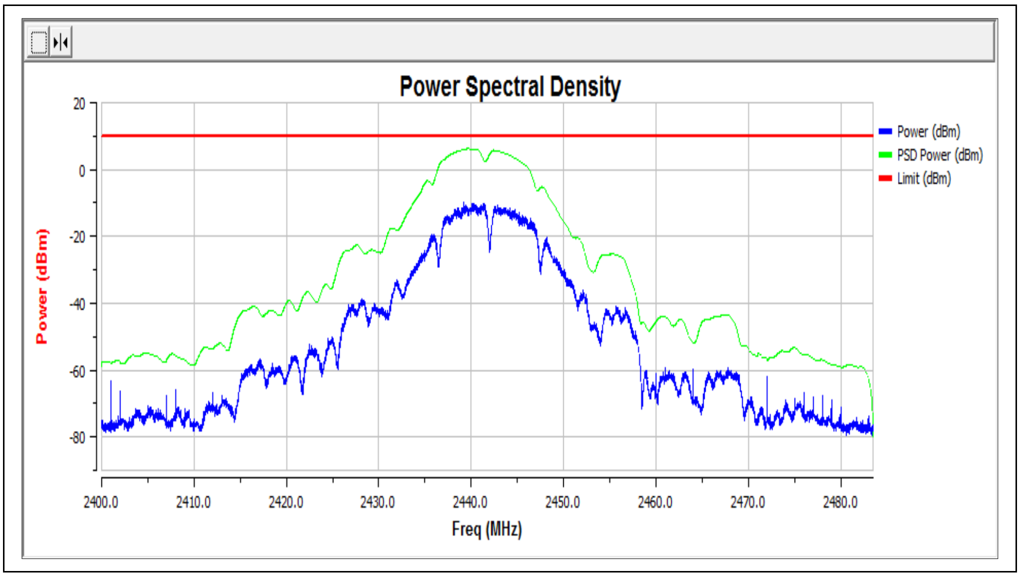
Test Mode	Power Spectral Density (dBm/MHz)			Result
	Channel 1 2412MHz	Channel 7 2442MHz	Channel 13 2472MHz	
802.11b	5.14	6.25	5.66	PASS
802.11g	-0.74	2.54	-0.36	PASS
802.11n20	-1.06	2.35	-0.61	PASS

Test Mode	Power Spectral Density (dBm/MHz)			Result
	Channel 3 2422MHz	Channel 7 2442MHz	Channel 11 2462MHz	
802.11n40	5.14	6.25	5.66	PASS

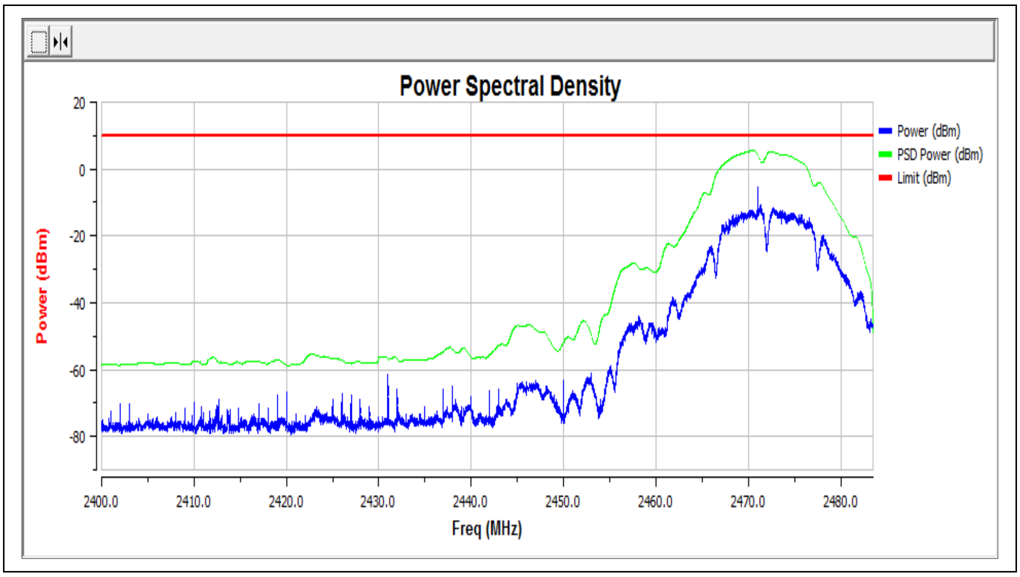
2.2.5.1 802.11b Mode



(802.11b: Channel1 2412MHz)

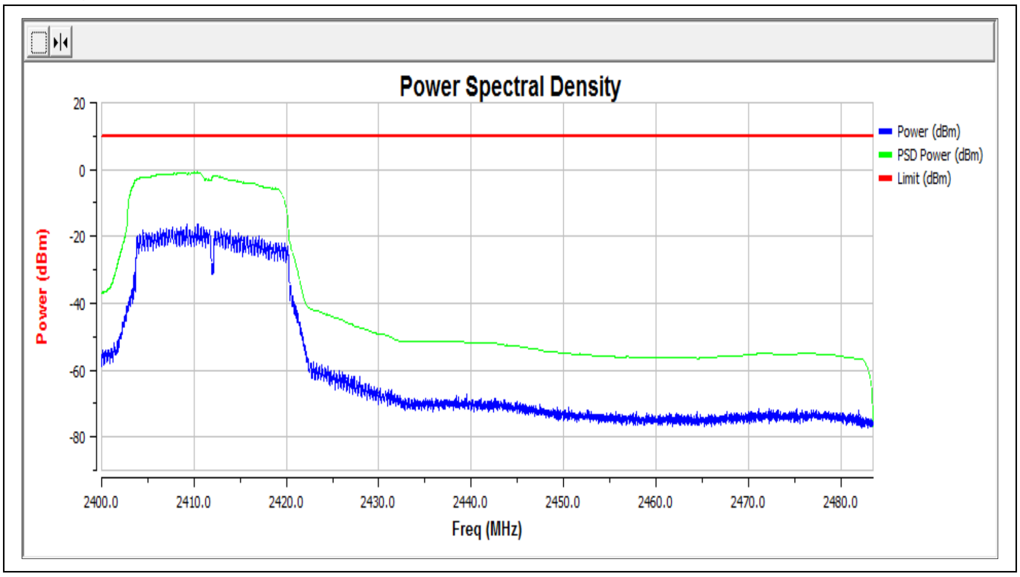


(802.11b: Channel 7 2442MHz)

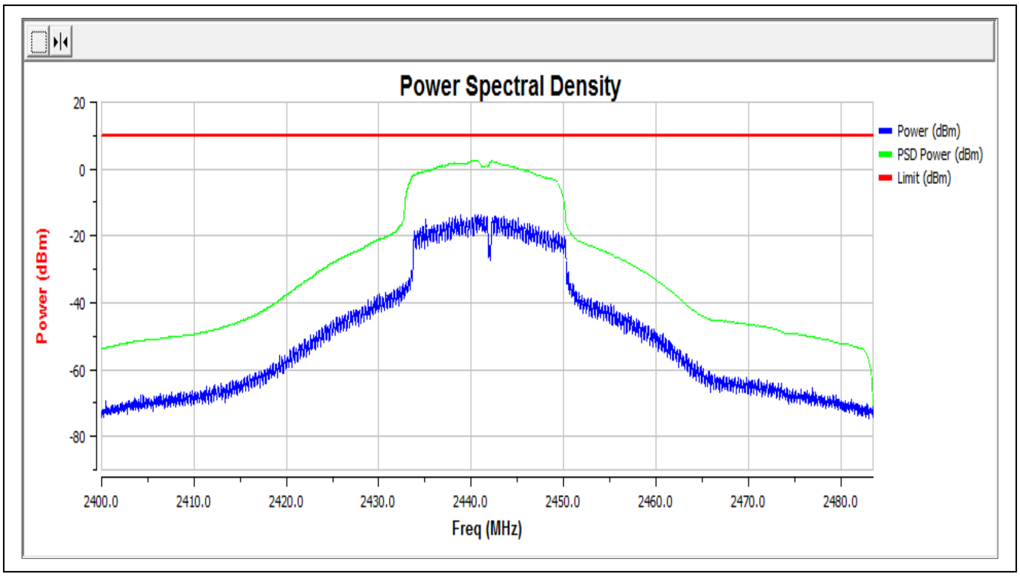


(802.11b: Channel13 2472MHz)

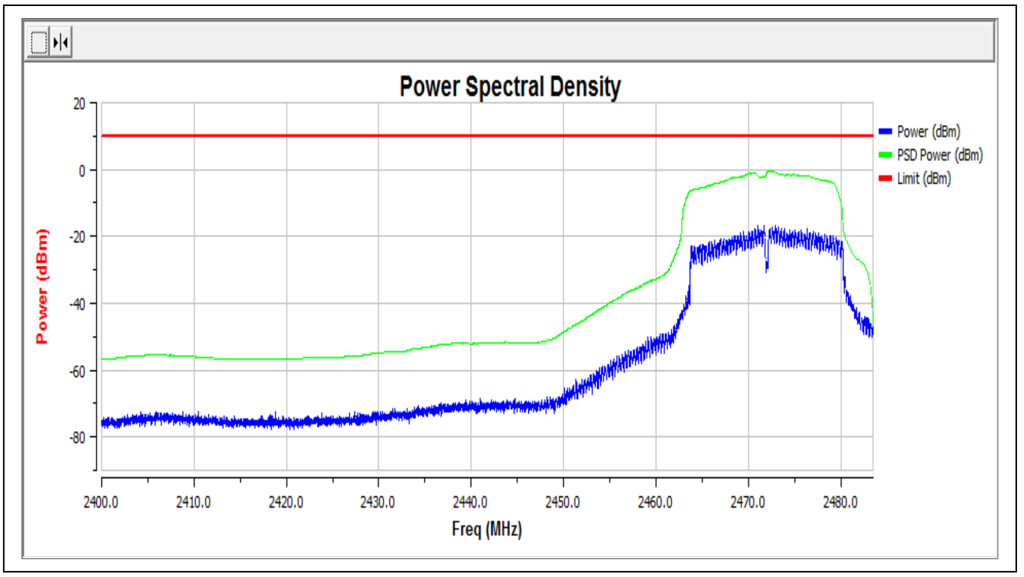
2.2.5.2 802.11g Mode



(802.11g: Channel1 2412MHz)

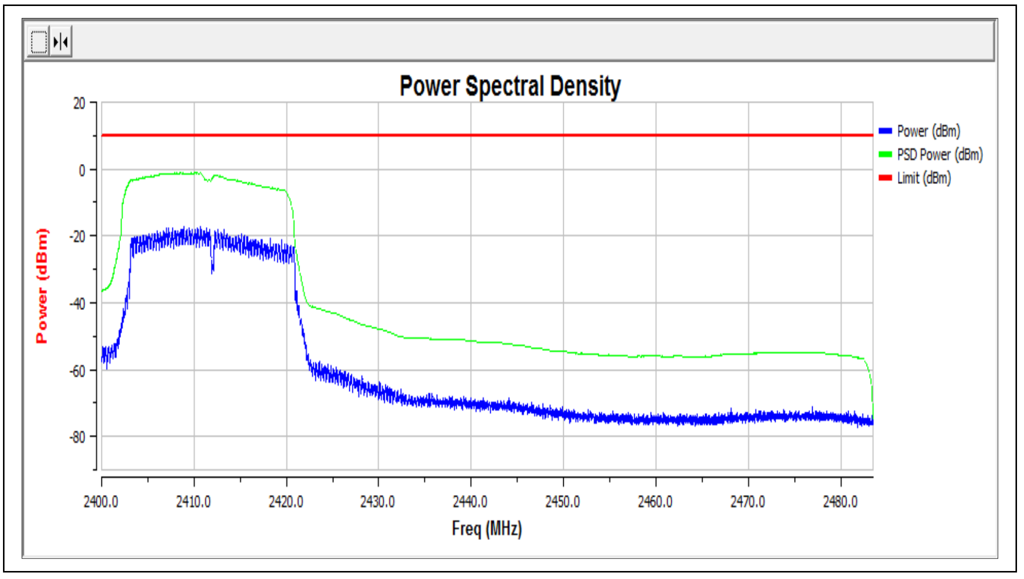


(802.11g: Channel7 2442MHz)

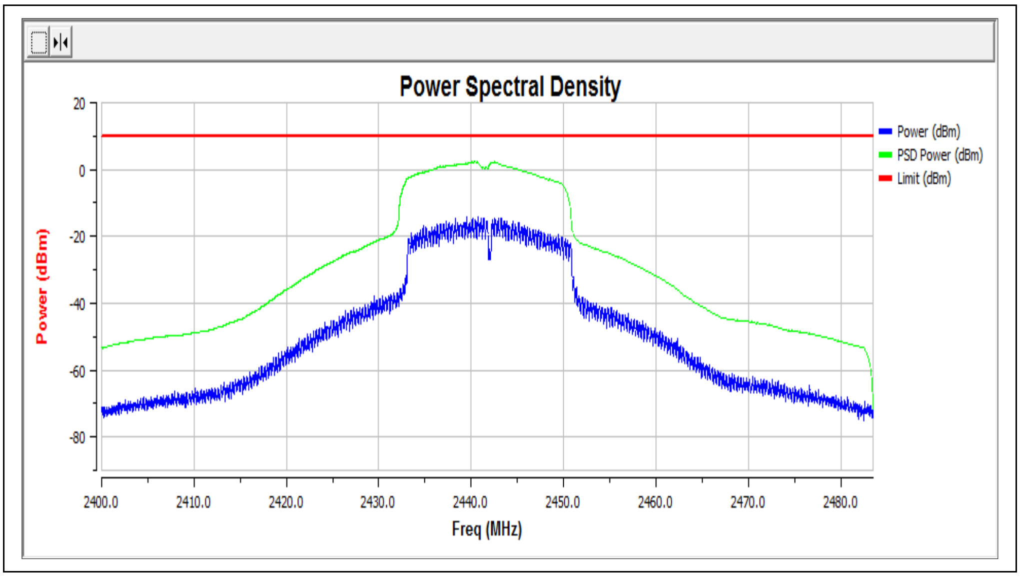


(802.11g: Channel13 2472MHz)

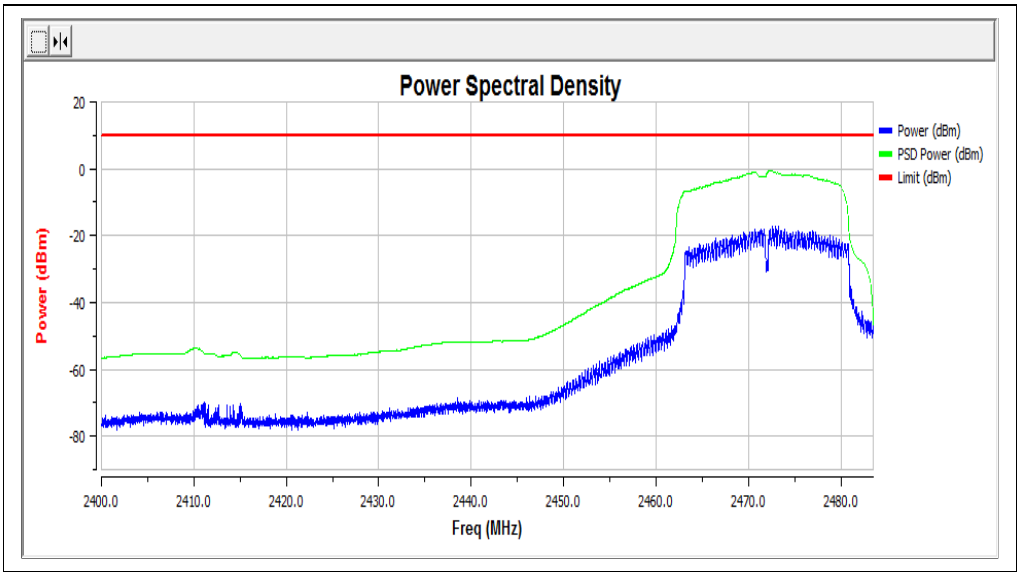
2.2.5.3 802.11n20 Mode



(802.11n20:Channel1 2412MHz)

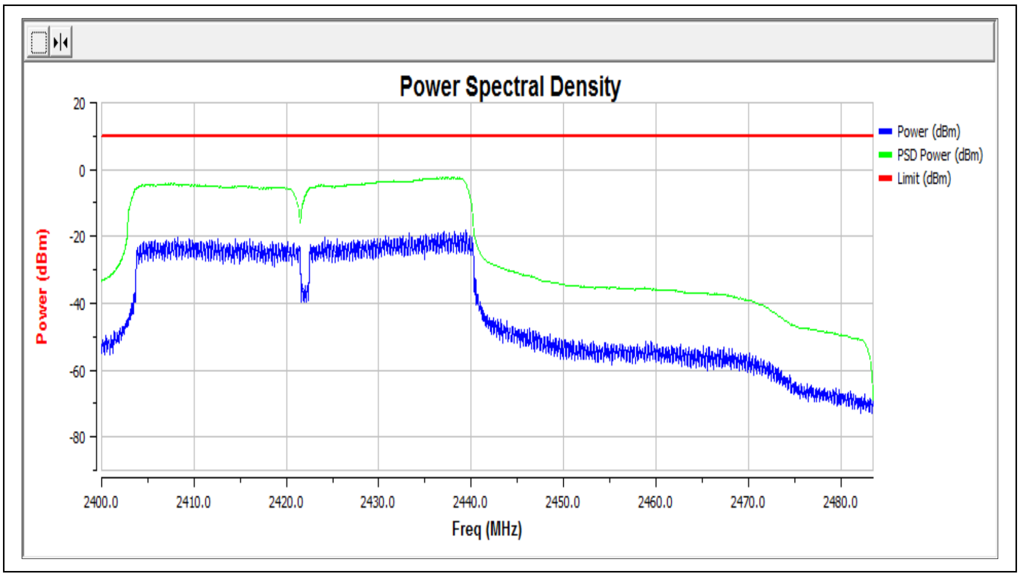


(802.11n20: Channel7 2442MHz)

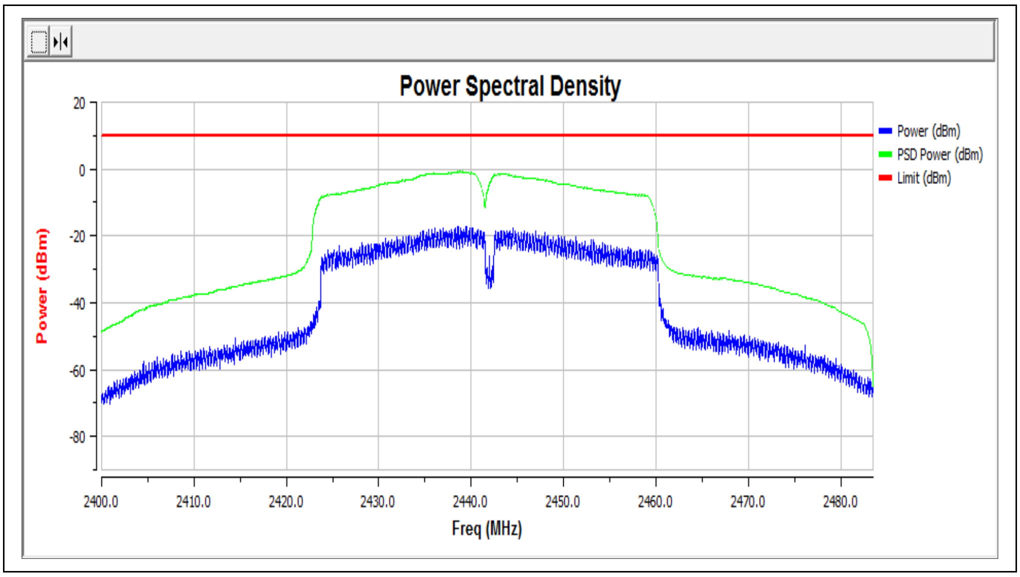


(802.11n20: Channel13 2472MHz)

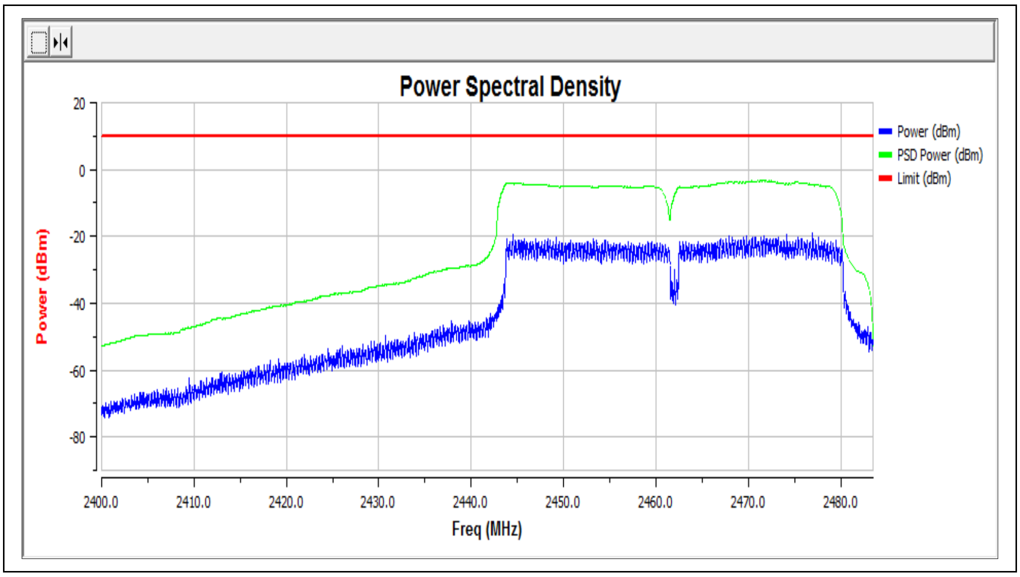
2.2.5.4 802.11n40 Mode



(802.11n40:Channel3 2422MHz)



(802.11n40: Channel7 2442MHz)



(802.11n40: Channel11 2462MHz)

2.3. EN 300 328 §4.3.2.6 Adaptivity (adaptive equipment using modulations other than FHSS)

2.3.1. Definition

LBT based Detect and Avoid is a mechanism by which equipment using wide band modulations other than FHSS, avoids transmissions in a channel in the presence of an interfering signal in that channel. This mechanism shall operate as intended in the presence of an unwanted signal on frequencies other than those of the operating band.

2.3.2. Limit

2.3.2.1 Introduction

The present document defines two types of adaptive equipment using wide band modulations other than FHSS and that uses an LBT based Detect and Avoid mechanism: Frame Based Equipment and Load Based Equipment.

Adaptive equipment which is capable of operating as either Load Based Equipment or as Frame Based Equipment is allowed to switch dynamically between these types of operation.

2.3.2.2 Frame Based Equipment

Frame Based Equipment shall comply with the following requirements:

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. See figure 2 below.

2) If the equipment finds the channel occupied, it shall not transmit on this channel during the next Fixed 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 Fixed Frame Period. See figure 2 below.

4) An equipment, upon correct reception of a packet which was intended for this equipment can

skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). 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 0 dBi (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:

$$TL = -70 \text{ dBm/MHz} + 10 \times \log10 (100 \text{ mW} / Pout) \qquad \text{(Pout in mW e.i.r.p.)}$$

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 table 10.

Table 10: Unwanted Signal parameters

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 value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

2.3.2.3 Load Based Equipment

Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect as described in IEEE 802.11™-2012 [i.3], clause 9, clause 10, clause 16, clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 providing the equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4. Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements:

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.

NOTE: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this 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. 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 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 packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). 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 0 dBi (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:

$$TL = -70\ dBm/MHz + 10 \times \log10\ (100\ mW / Pout) \qquad \text{(Pout in mW e.i.r.p.)}$$

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 table 11.

Table 11: Unwanted Signal parameters

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 value which can be used in most cases is -50 dBm/MHz.
NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.

2.3.2.4 Short Control Signalling Transmissions

Definition

Short Control Signalling Transmissions are transmissions used by adaptive equipment to send control signals (e.g. ACK/NACK signals, etc.) without sensing the operating channel for the presence of other signals.

Adaptive equipment may or may not have Short Control Signalling Transmissions.

Limits

If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than FHSS shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.

NOTE: Duty Cycle is defined in clause 4.3.2.4.2.

Test condition

See clause 5.1 for the environmental test conditions. These measurements shall only be performed at normal test conditions.

When supported by the operating frequency range of the equipment, this test shall be performed on two operating (hopping) frequencies randomly selected from the operating frequencies used by the equipment. The first (lower) frequency shall be randomly selected within the range 2 400 MHz to 2 442 MHz while the second (higher) frequency shall be randomly selected within the range 2 442 MHz to 2 483,5 MHz. The equipment shall be in a normal operating (hopping) mode.

For equipment which can operate in an adaptive and a non-adaptive mode, it shall be verified that prior to the test, the equipment is operating in the adaptive mode.

The equipment shall be configured in a mode that results in the longest Channel Occupancy Time.

2.3.3. Test procedures

2.3.3.1 Test set-up

Figure 5 describes an example of the test set-up.

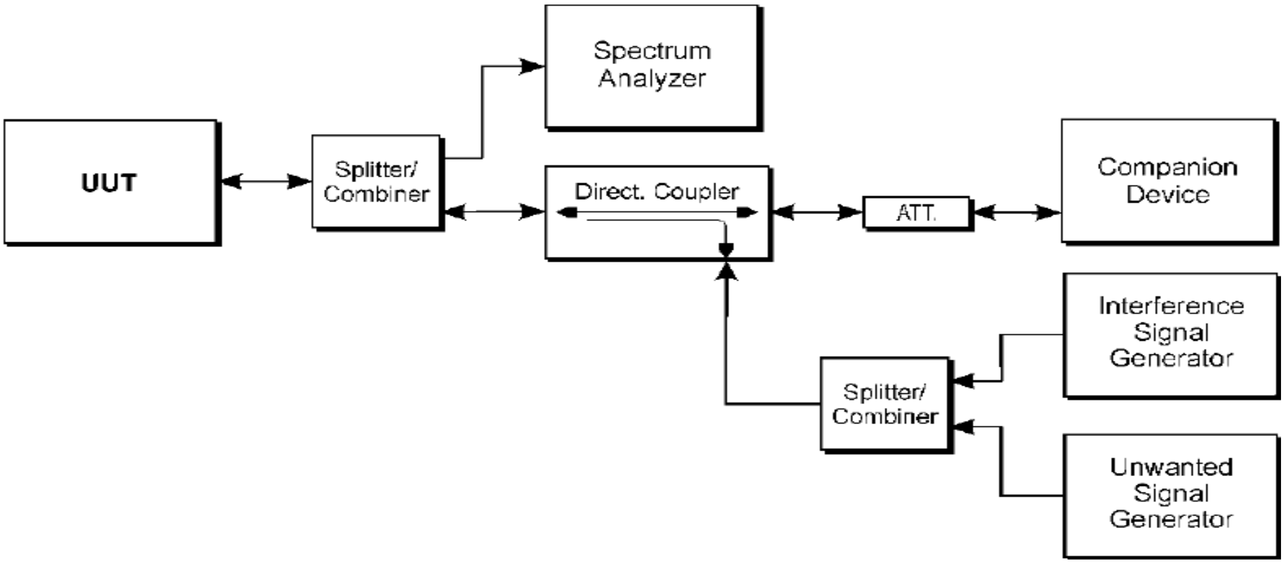


Figure 5: Test set-up for verifying the adaptivity of an equipment

2.3.3.2 LBT based adaptive equipment using modulations other than FHSS

Step 1 to step 7 below define the procedure to verify the efficiency of the LBT based adaptive mechanism of equipment using wide band modulations other than FHSS. This method can be applied on Load Based Equipment and Frame Based Equipment.

Step 1:

• The UUT shall connect to a companion device during the test. The interference signal generator, the unwanted signal generator, the spectrum analyser, the UUT and the companion device are connected using a set-up equivalent to the example given by figure 5 although the interference and unwanted signal generator do not generate any signals at this point in time. The spectrum analyser is used to monitor the transmissions of both the UUT and the companion device and it should be possible to distinguish between either transmission. In addition, the spectrum analyser is used to monitor the transmissions of the UUT in response to the interfering and the unwanted signals.

• Adjust the received signal level (wanted signal from the companion device) at the UUT to the value defined in table 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load Based Equipment.

Testing of Unidirectional equipment does not require a link to be established with a companion device.

• 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)
- VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used)
- Detector Mode: RMS
- Centre Frequency: Equal to the centre frequency of the operating channel
- Span: 0 Hz

- Sweep time: > maximum Channel Occupancy Time
- Trace Mode: Clear Write
- Trigger Mode: Video

Step 2:

• Configure the UUT for normal transmissions with a sufficiently high payload resulting in a minimum
transmitter activity ratio (TxOn / (TxOn + TxOff)) of 0,3. Where this is not possible, the UUT shall be configured to the maximum payload possible.

• For Frame Based Equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.2, step 3. When measuring the Idle Period of the UUT, it shall not include the transmission time of the companion device.

• For Load Based equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.3, step 2 and step 3. When measuring the Idle Period of the UUT, it shall not include the transmission time of the companion device.

For the purpose of testing Load Based Equipment referred to in the first paragraph of clause 4.3.2.6.3.2.3 (IEEE 802.11™ [i.3] or IEEE 802.15.4™ [i.4] equipment), the limits to be applied for the minimum Idle Period and the maximum Channel Occupancy Time are the same as defined for other types of Load Based Equipment (see clause 4.3.2.6.3.2.3, step 2 and step 3). The Idle Period is considered to be equal to the CCA or Extended CCA time defined in clause 4.3.2.6.3.2.3, step 1 and step 2.

Step 3: Adding the interference signal

• An interference signal as defined in clause B.7 is injected on the current operating channel of the UUT. The power spectral density level (at the input of the UUT) of this interference signal shall be equal to the detection threshold defined in clause 4.3.2.6.3.2.2, step 5 (frame based equipment) or clause 4.3.2.6.3.2.3, step 5 (load based equipment).

Step 4: Verification of reaction to the interference signal

• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel with the interfering signal injected. This may require the spectrum analyser sweep to be triggered by the start of the interfering signal.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:

i) The UUT shall stop transmissions on the current operating channel.

The UUT is assumed to stop transmissions within a period equal to the maximum Channel Occupancy Time defined in clause 4.3.2.6.3.2.2 (frame based equipment) or clause 4.3.2.6.3.2.3 (load based equipment).

ii) Apart from Short Control Signalling Transmissions, there shall be no subsequent transmissions while the interfering signal is present.

To verify that the UUT is not resuming normal transmissions as long as the interference signal is

present, the monitoring time may need to be 60 s or more.
iii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering signal is present. These transmissions shall comply with the limits defined in
clause 4.3.2.6.4.2.
The verification of the Short Control Signalling transmissions may require the analyser settings to be
changed (e.g. sweep time).
iv) Alternatively, the equipment may switch to a non-adaptive mode.

Step 5: Adding the unwanted signal

• With the interfering signal present, a 100 % duty cycle CW signal is inserted as the unwanted signal. The frequency and the level are provided in table 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load Based Equipment.
• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel. This may require the spectrum analyser sweep to be triggered by the start of the unwanted signal.
• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:
i) The UUT shall not resume normal transmissions on the current operating channel as long as both the interference and unwanted signals remain present.
To verify that the UUT is not resuming normal transmissions as long as the interference and unwanted signals are present, the monitoring time may need to be 60 s or more.
ii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering and unwanted signals are present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.
The verification of the Short Control Signalling transmissions may require the analyser settings to be
changed (e.g. sweep time).

Step 6: Removing the interference and unwanted signal

• On removal of the interference and unwanted signals the UUT is allowed to start transmissions again on this channel; however, this is not a requirement and, therefore, does not require testing.

Step 7:

• Step 2 to step 6 shall be repeated for each of the frequencies to be tested.

2.3.3.3 Generic test procedure for measuring channel/frequency usage

This is a generic test method to evaluate transmissions on the operating (hopping) frequency being investigated. This test is performed as part of the procedures described in clause 5.4.6.2.1.2 to clause 5.4.6.2.1.4.
The test procedure shall be as follows:

Step 1:

• The analyser shall be set as follows:

- Centre Frequency: Equal to the hopping frequency or centre frequency of the channel being investigated.
- Frequency Span: 0 Hz.
- RBW: ~ 50 % of the Occupied Channel Bandwidth (if the analyser does not support this setting, the highest available setting shall be used).
- VBW: ≥ RBW (if the analyser does not support this setting, the highest available setting shall be used).
- Detector Mode: RMS.
- Sweep time: > the Channel Occupancy Time. It shall be noted that if the Channel Occupancy Time is non-contiguous (for non-LBT based Frequency Hopping Equipment), the sweep time shall be sufficient to cover the period over which the Channel Occupancy Time is spread out.
- Number of sweep points: The time resolution has to be sufficient to meet the maximum measurement uncertainty of 5 % for the period to be measured. In most cases, the Idle Period is the shortest period to be measured and thereby defining the time resolution. If the Channel Occupancy Time is non-contiguous (non-LBT based frequency hopping equipment), there is no Idle Period to be measured and therefore the time resolution can be increased (e.g. to 5 % of the dwell time) to cover the period over which the Channel Occupancy Time is spread out, without resulting in too high a number of sweep points for the analyser.

EXAMPLE 1: For a Channel Occupancy Time of 60 ms, the minimum Idle Period is 3 ms, hence the minimum time resolution should be < 150 μs.

EXAMPLE 2: For a Channel Occupancy Time of 2 ms, the minimum Idle Period is 100 μs, hence the minimum time resolution should be < 5 μs.

EXAMPLE 3: In case of an equipment using the non-contiguous Channel Occupancy Time approach (40 ms) and using 79 hopping frequencies with a dwell time of 3,75 ms, the total period over which the Channel Occupancy Time is spread out is 3,2 s. With a time resolution 0,1875 ms (5 % of the dwell time), the minimum number of sweep points is ~ 17 000.

- Trace mode: Clear / Write
- Trigger: Video

In case of Frequency Hopping Equipment, the data points resulting from transmissions on the hopping frequency being investigated are assumed to have much higher levels compared to data points resulting from transmissions on adjacent hopping frequencies. If a clear determination between these transmissions is not possible, the RBW in step 1 shall be further reduced. In addition, a channel filter may be used.

Step 2:

• Save the trace data to a file for further analysis by a computing device using an appropriate software application or program.

Step 3:

• Identify the data points related to the frequency being investigated by applying a threshold.
• Count the number of consecutive data points identified as resulting from a single transmission on

the frequency being investigated and multiply this number by the time difference between two consecutive data points. Repeat this for all the transmissions within the measurement window.

• For measuring idle or silent periods, count the number of consecutive data points identified as resulting from a single transmitter off period on the frequency being investigated and multiply this number by the time difference between two consecutive data points. Repeat this for all the transmitter off periods within the measurement window

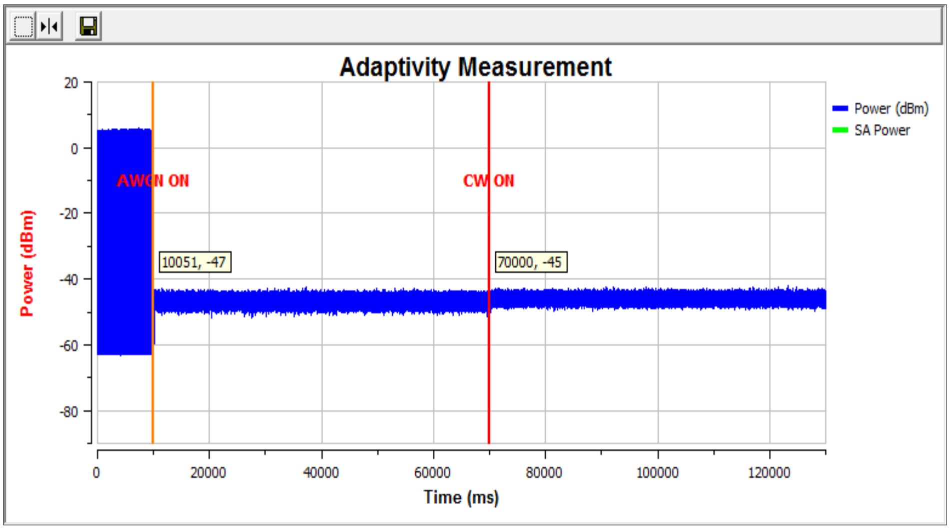
2.3.4. Result

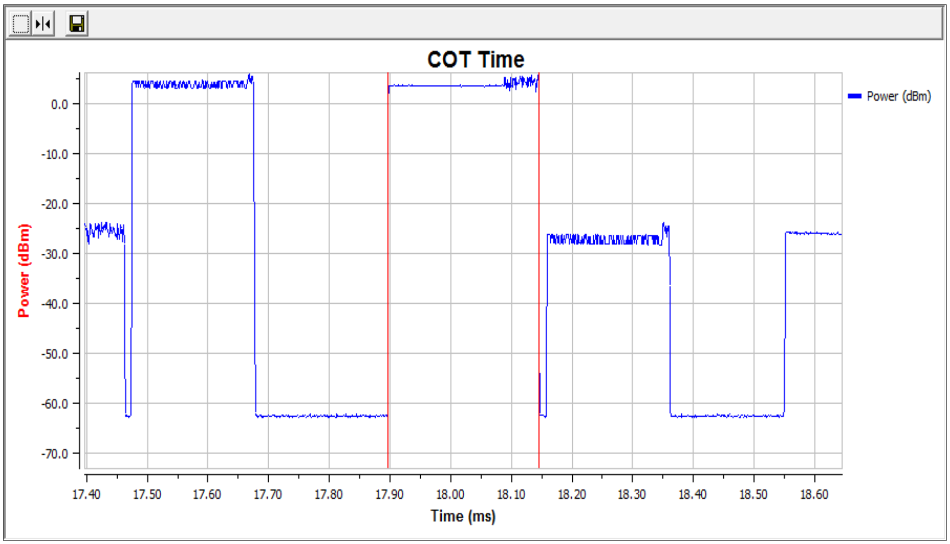
2.3.4.1 802.11b Mode

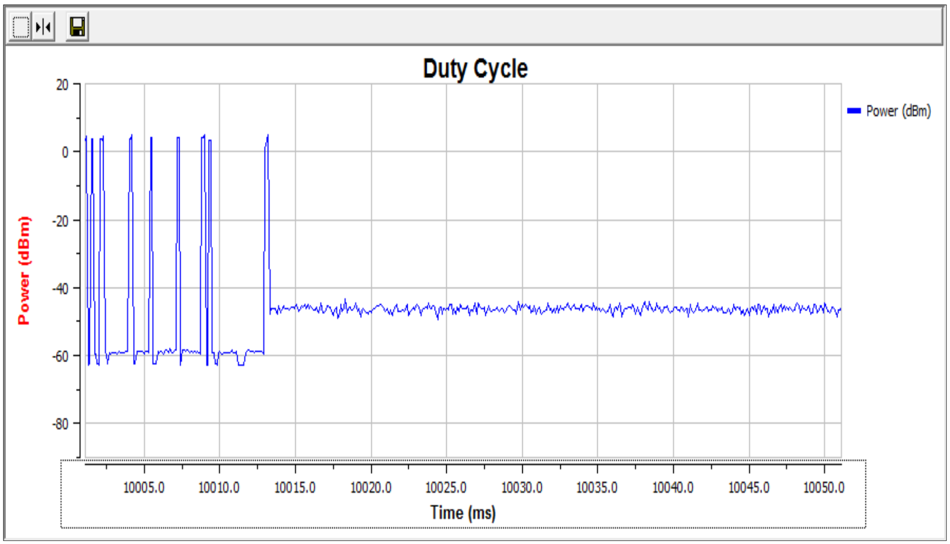
Channel1: 2412MHz

Blocking signal frequency: 2488.5 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-58.33	0.25	4.39	111.00
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:



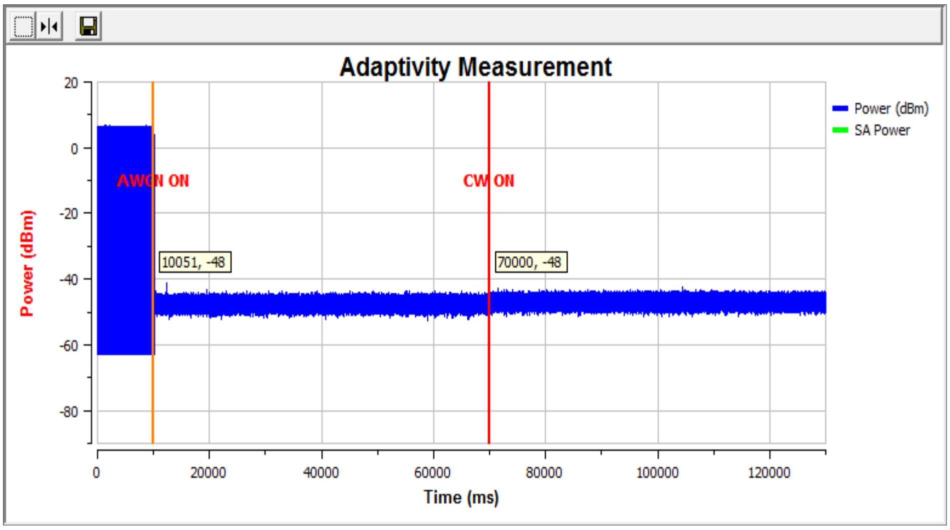

COT Time
Power (dBm)
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Power (dBm)
17.40
17.50
17.60
17.70
17.80
17.90
18.00
18.10
18.20
18.30
18.40
18.50
18.60
Time (ms)

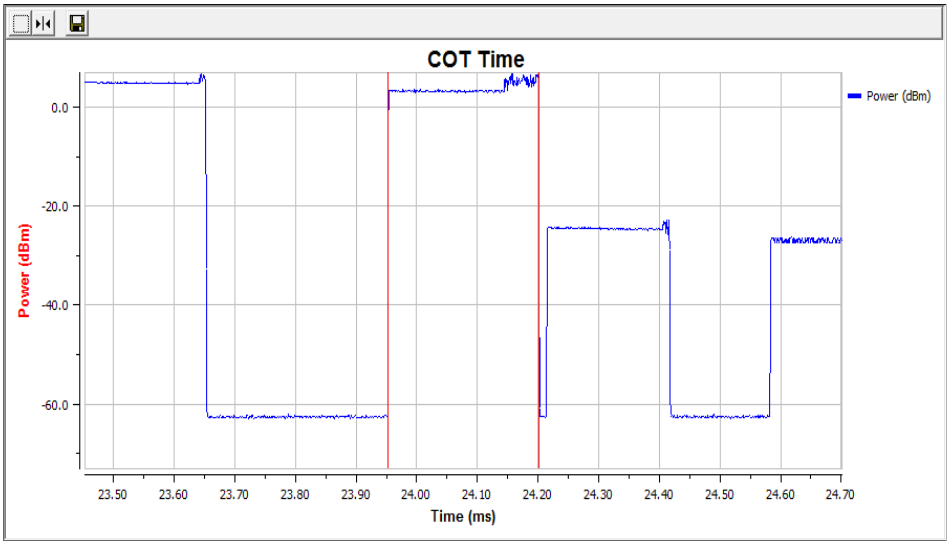

Duty Cycle
Power (dBm)
20
0
-20
-40
-60
-80
Power (dBm)
10005.0
10010.0
10015.0
10020.0
10025.0
10030.0
10035.0
10040.0
10045.0
10050.0
Time (ms)

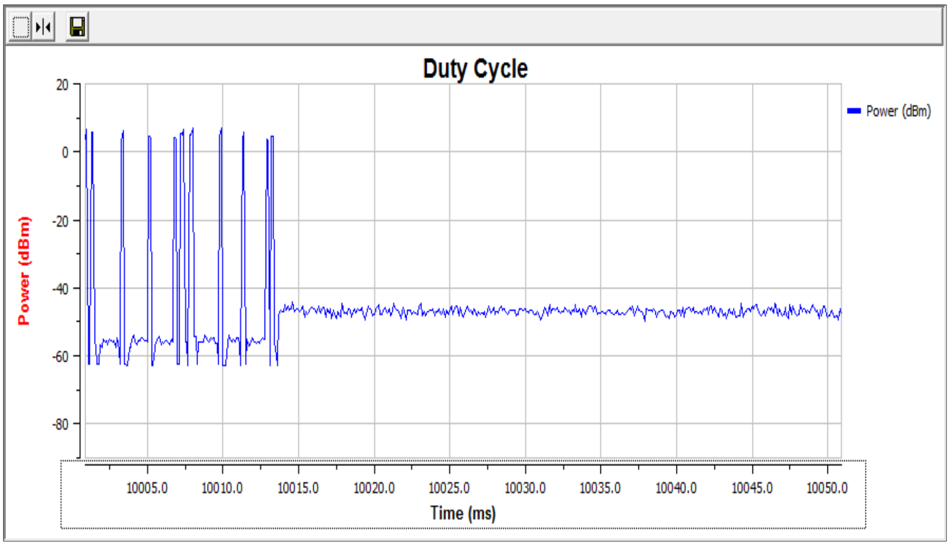
Channel13: 2472MHz

Blocking signal frequency: 2395 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-58.11	0.25	4.79	112.00
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:




COT Time
Power (dBm)
0.0
-20.0
-40.0
-60.0
23.50
23.60
23.70
23.80
23.90
24.00
24.10
24.20
24.30
24.40
24.50
24.60
24.70
Time (ms)
Power (dBm)

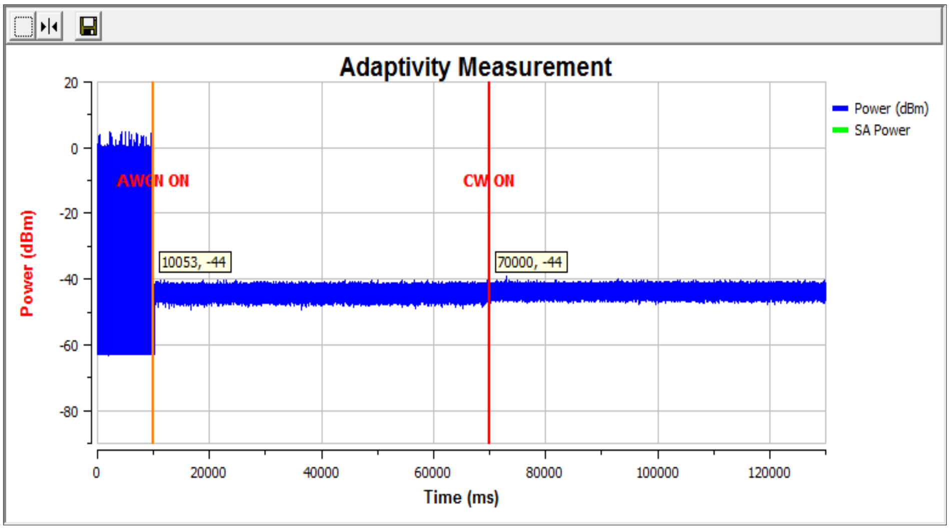

Duty Cycle
Power (dBm)
20
0
-20
-40
-60
-80
10005.0
10010.0
10015.0
10020.0
10025.0
10030.0
10035.0
10040.0
10045.0
10050.0
Time (ms)
Power (dBm)

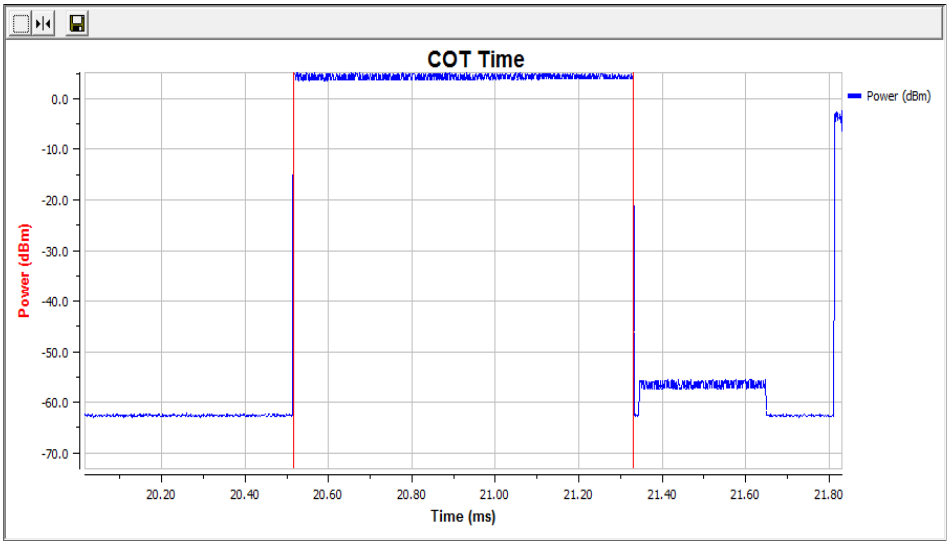
2.3.4.2 802.11g Mode

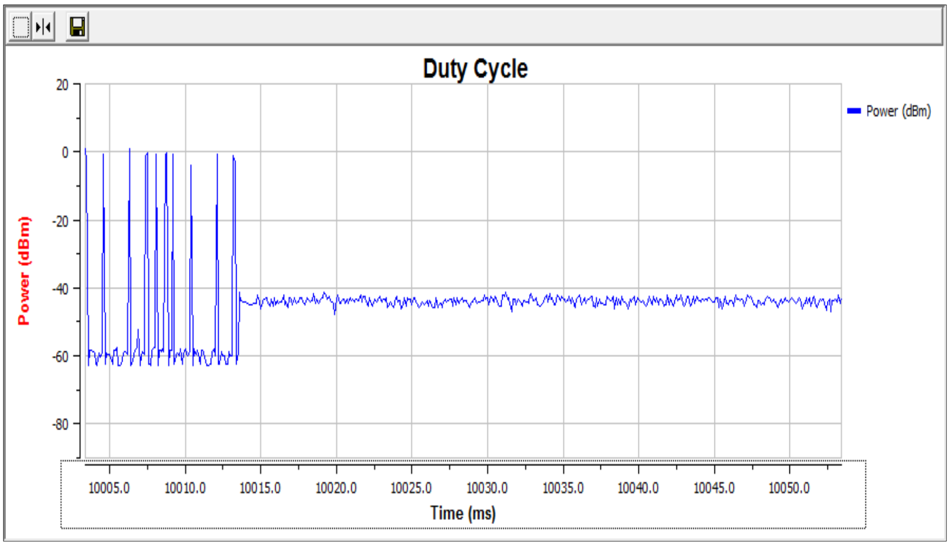
Channel1: 2412MHz

Blocking signal frequency: 2488.5 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-59.71	0.81	2.79	129.00
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:



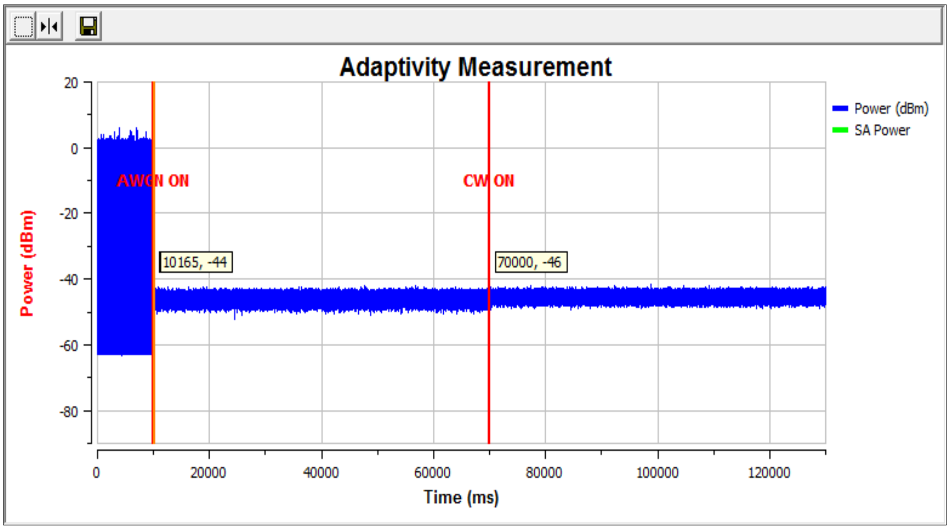

COT Time
Power (dBm)
Power (dBm)
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
20.20
20.40
20.60
20.80
21.00
21.20
21.40
21.60
21.80
Time (ms)

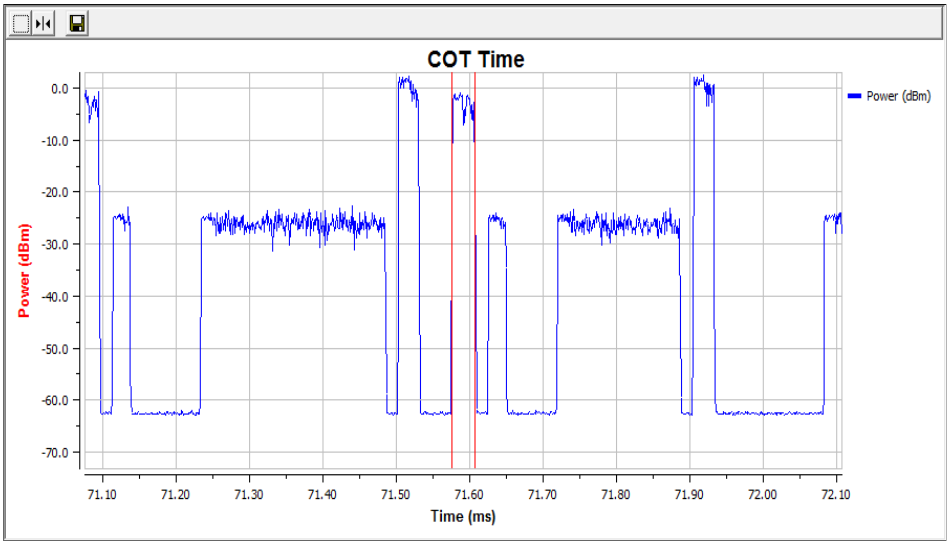

Duty Cycle
Power (dBm)
Power (dBm)
20
0
-20
-40
-60
-80
10005.0
10010.0
10015.0
10020.0
10025.0
10030.0
10035.0
10040.0
10045.0
10050.0
Time (ms)

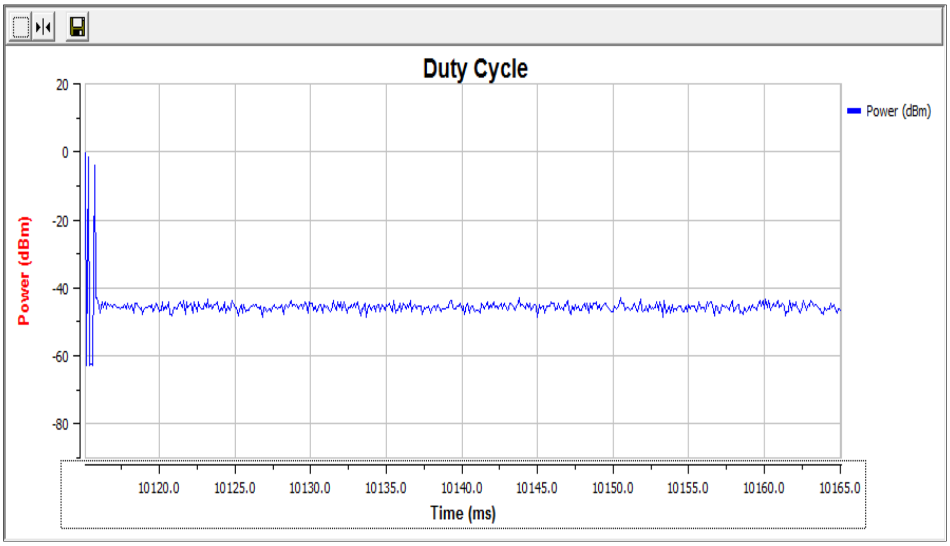
Channel13: 2472MHz

Blocking signal frequency: 2395 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-59.64	0.03	0.60	131.00
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:




COT Time
Power (dBm)
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
71.10
71.20
71.30
71.40
71.50
71.60
71.70
71.80
71.90
72.00
72.10
Time (ms)

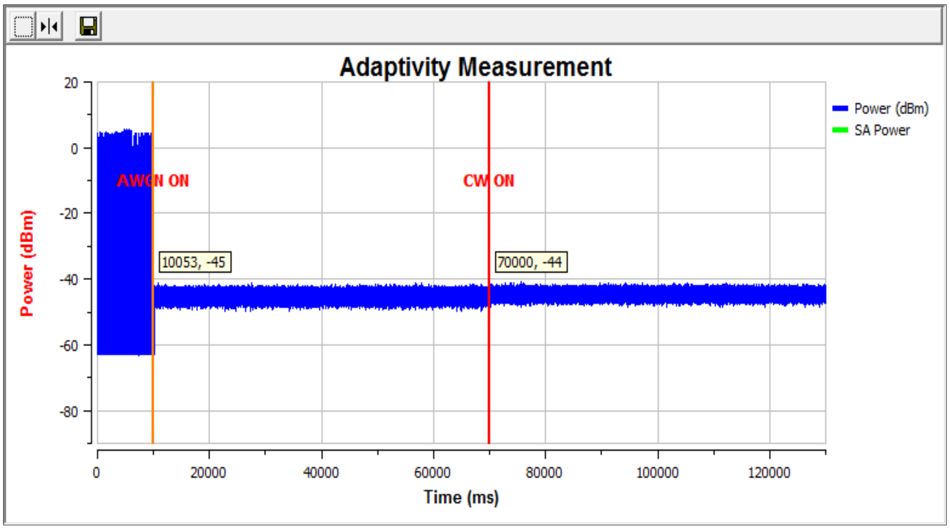

Duty Cycle
Power (dBm)
20
0
-20
-40
-60
-80
10120.0
10125.0
10130.0
10135.0
10140.0
10145.0
10150.0
10155.0
10160.0
10165.0
Time (ms)

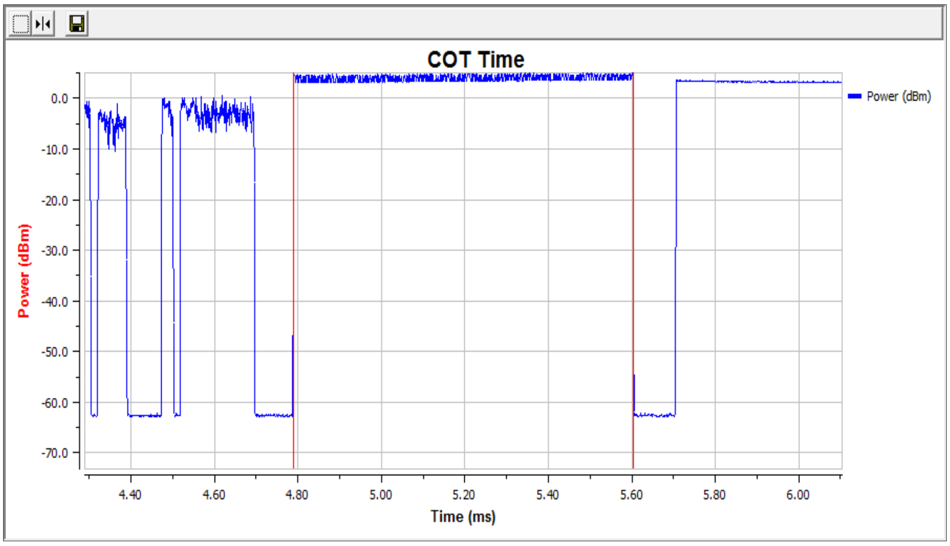
2.3.4.3 802.11n20 Mode

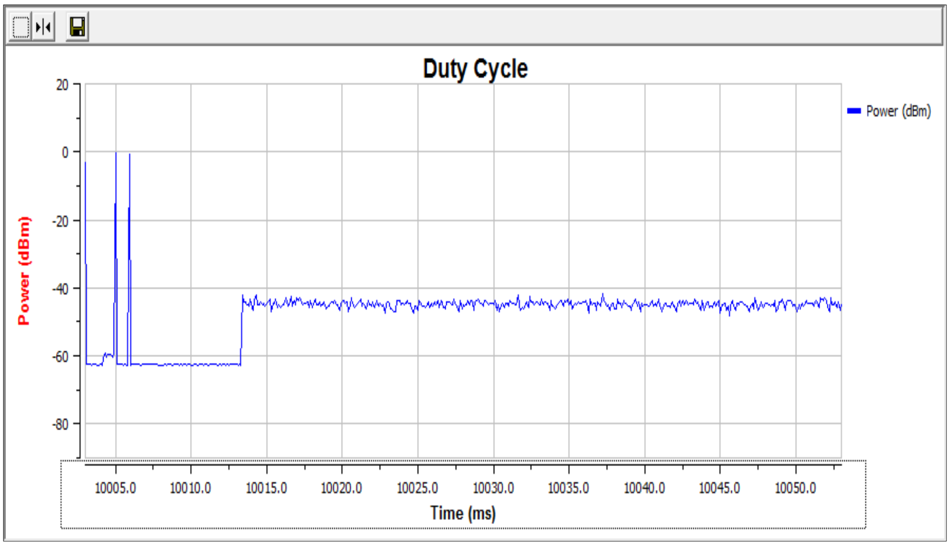
Channel1: 2412MHz

Blocking signal frequency: 2488.5 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-59.65	0.82	0.60	106.00
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:



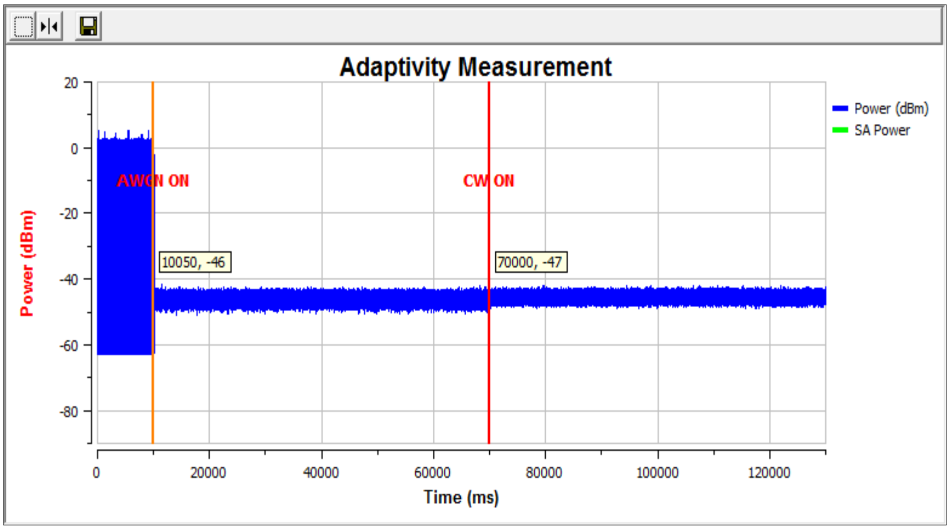

COT Time
Power (dBm)
Time (ms)
Power (dBm)
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
4.40
4.60
4.80
5.00
5.20
5.40
5.60
5.80
6.00

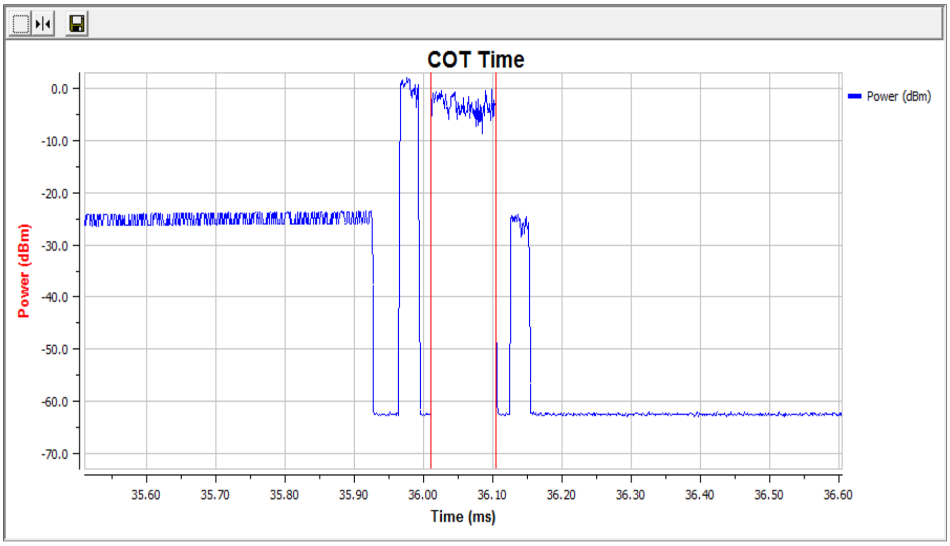

Duty Cycle
Power (dBm)
Time (ms)
Power (dBm)
20
0
-20
-40
-60
-80
10005.0
10010.0
10015.0
10020.0
10025.0
10030.0
10035.0
10040.0
10045.0
10050.0

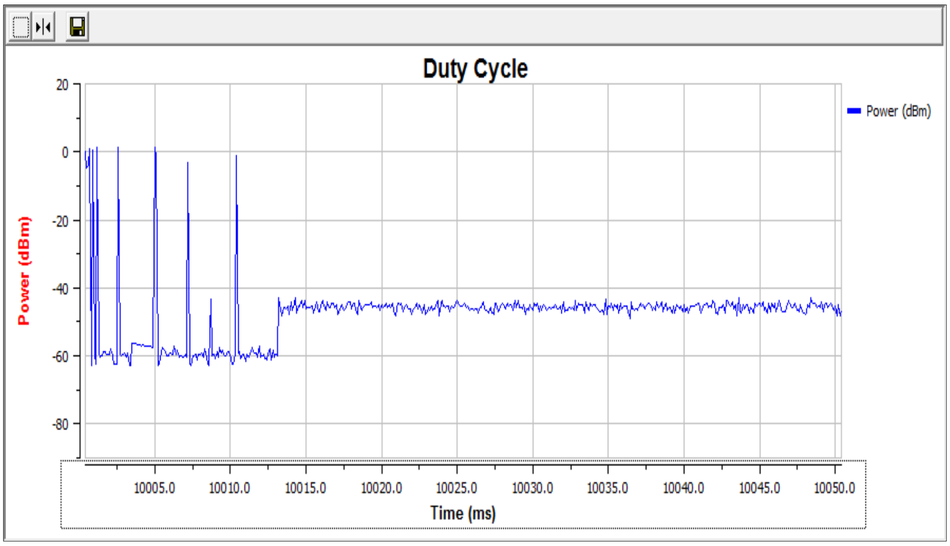
Channel13: 2472MHz

Blocking signal frequency: 2395 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-59.66	0.09	2.20	101.98
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:




COT Time
Power (dBm)
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
35.60
35.70
35.80
35.90
36.00
36.10
36.20
36.30
36.40
36.50
36.60
Time (ms)
Power (dBm)

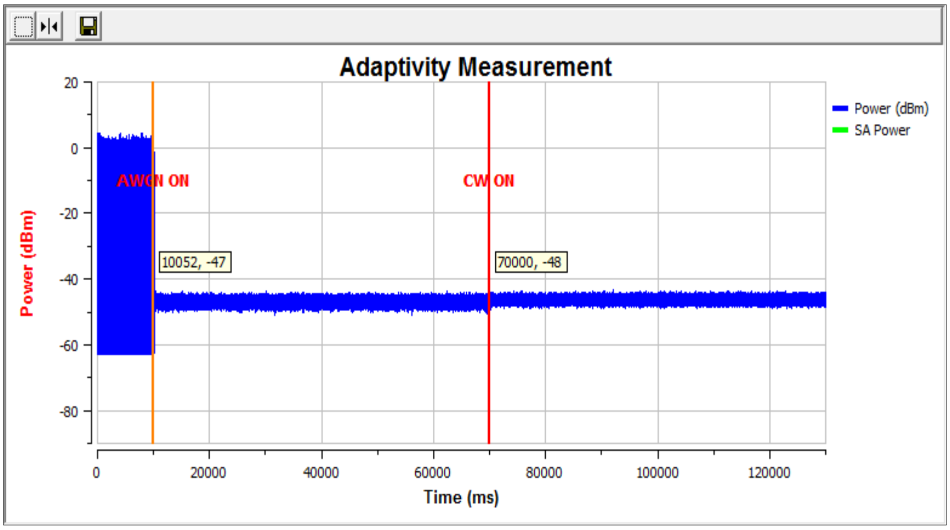

Duty Cycle
Power (dBm)
20
0
-20
-40
-60
-80
10005.0
10010.0
10015.0
10020.0
10025.0
10030.0
10035.0
10040.0
10045.0
10050.0
Time (ms)
Power (dBm)

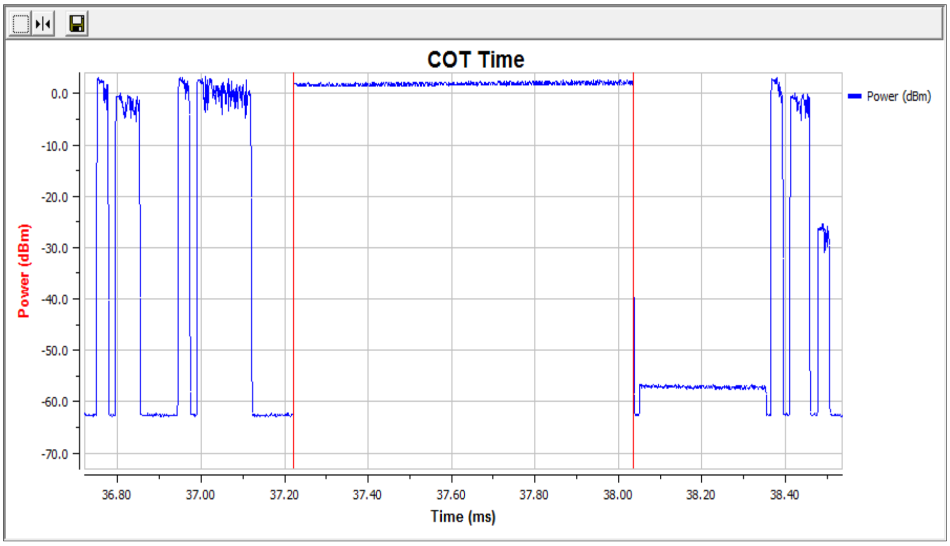
2.3.4.4 802.11n40 Mode

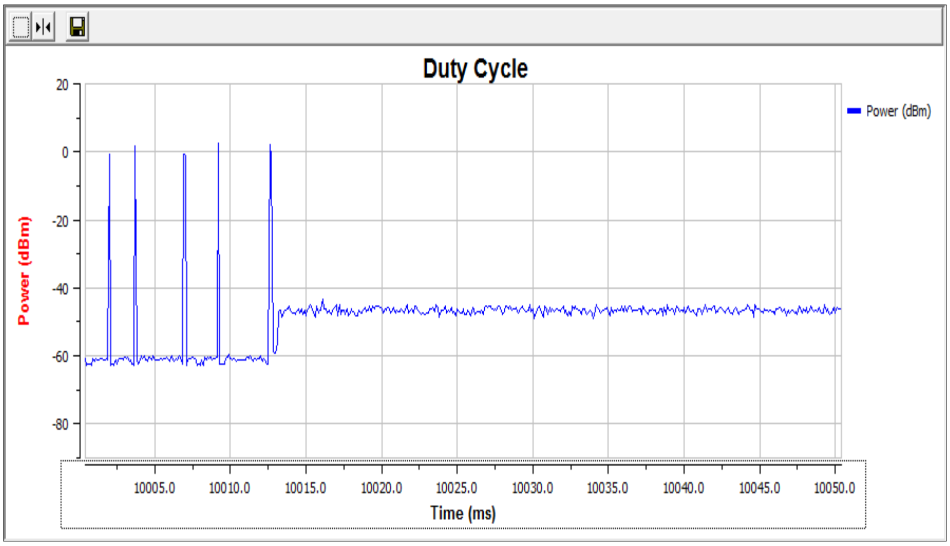
Channel1: 2422MHz

Blocking signal frequency: 2488.5 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-58.99	0.81	1.40	120.00
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:



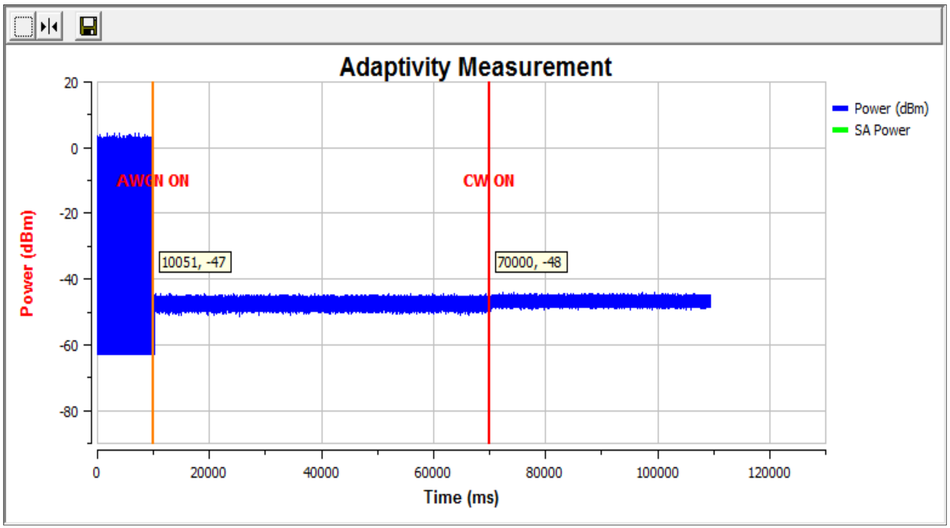

COT Time
Power (dBm)
Time (ms)
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
36.80
37.00
37.20
37.40
37.60
37.80
38.00
38.20
38.40

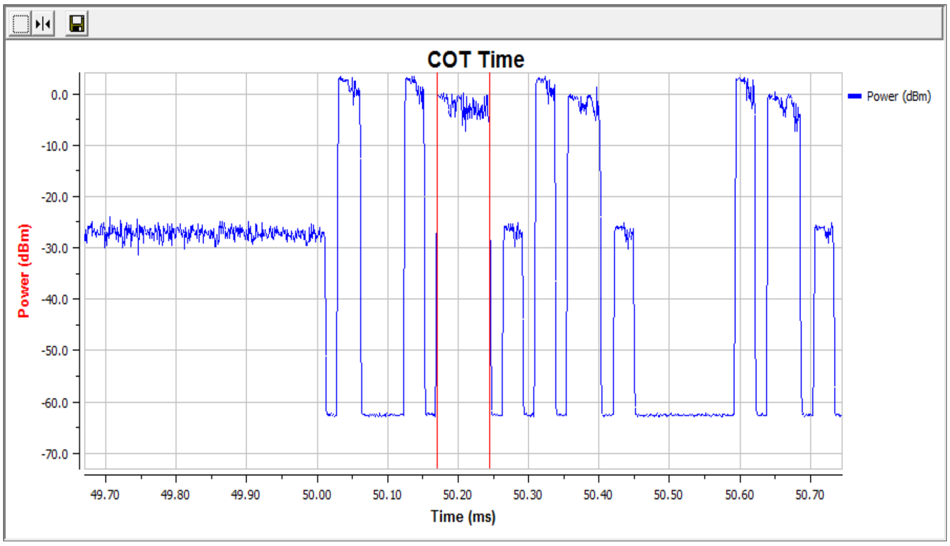

Duty Cycle
Power (dBm)
Time (ms)
20
0
-20
-40
-60
-80
10005.0
10010.0
10015.0
10020.0
10025.0
10030.0
10035.0
10040.0
10045.0
10050.0

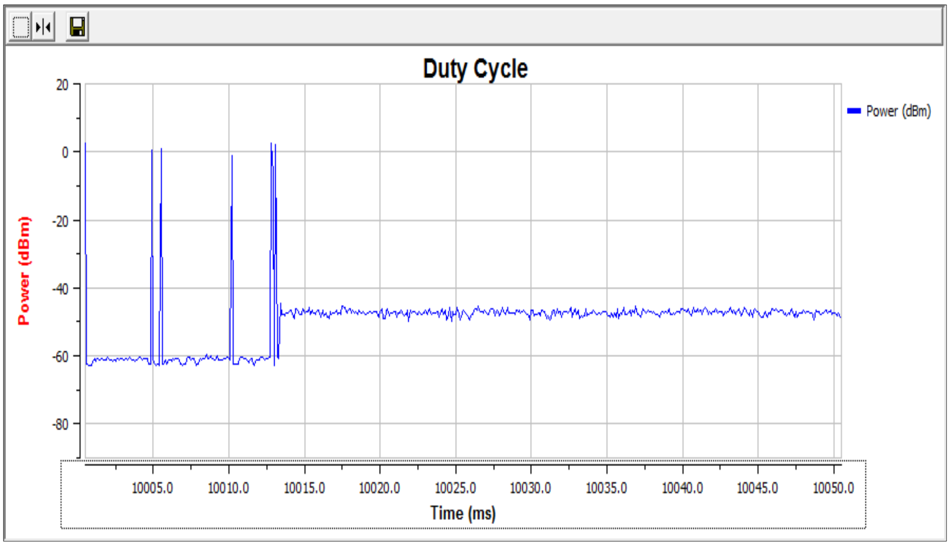
Channel13: 2462MHz

Blocking signal frequency: 2395 MHz Blocking signal power: -35 dBm				
Item	**Interferer signal level dBm/MHz**	**Max COT (ms)**	**SCST TxOn / (TxOn + TxOff) (%)**	**CCA Time (us)**
Test Data	-59.08	0.08	1.40	118.00
Limit	N.A	≤13ms	10%（in 50ms）	18≤T≤160 us
Result	**PASS**			

Test Plot:




COT Time
Power (dBm)
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
49.70
49.80
49.90
50.00
50.10
50.20
50.30
50.40
50.50
50.60
50.70
Time (ms)


Duty Cycle
Power (dBm)
20
0
-20
-40
-60
-80
10005.0
10010.0
10015.0
10020.0
10025.0
10030.0
10035.0
10040.0
10045.0
10050.0
Time (ms)

2.4. EN 300 328 §4.3.2.7 Occupied Channel Bandwidth

2.4.1. Definition

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal.

2.4.2. Limit

The Occupied Channel Bandwidth shall fall completely within the band given in able 1.In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

2.4.3. Test condition

See clause 5.1 for the test conditions. These measurements shall only be performed at normal test conditions.

In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains) measurements need only to be performed on one of the active transmit chains (antenna outputs).

For equipment using FHSS modulation and which have overlapping channels, special software might be required to force the UUT to hop or transmit on a single Hopping Frequency.

The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range.

The frequencies on which the tests were performed shall be recorded.

If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then each channel bandwidth shall be tested separately.

2.4.4. Test procedures

The measurement procedure shall be as follows:

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: 430KHz (HT20); 820KHz (HT40)
- Video BW: 1.3MHz (HT20); 2.4MHz (HT40)
- Frequency Span: 40MHz (HT20); 80MHz (HT40)
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep time: 1 s

Step 2:

Wait for the trace to stabilize.

Find the peak value of the trace and place the analyser marker on this peak.

Step 3:

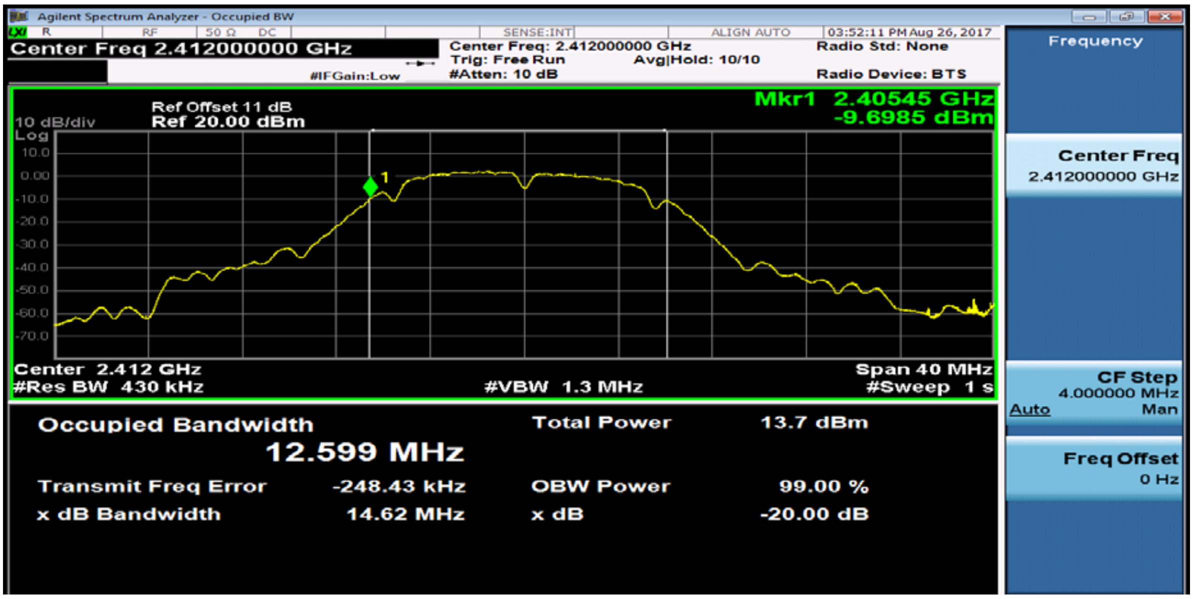
Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

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.

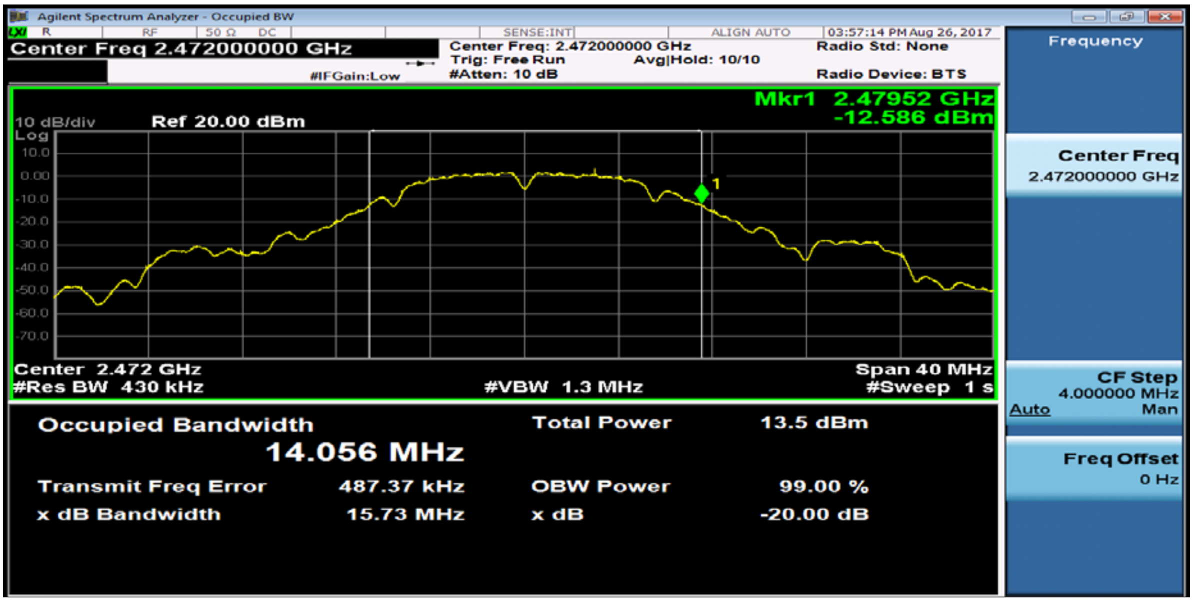
2.4.5. Result

Test Mode	Channel	Frequency (MHz)	Measure Frequency (MHz)	Refer Plot	Limit (MHz)	Result
802.11b	1	2412	2405.45	Plot A1	≥2400	**PASS**
802.11b	13	2472	2479.52	Plot A2	≤2483.5	**PASS**
802.11g	1	2412	2403.69	Plot A3	≥2400	**PASS**
802.11g	13	2472	2480.30	Plot A4	≤2483.5	**PASS**
802.11n20	1	2412	2403.12	Plot A5	≥2400	**PASS**
802.11n20	13	2472	2480.87	Plot A6	≤2483.5	**PASS**
802.11n40	3	2422	2403.88	Plot A7	≥2400	**PASS**
802.11n40	11	2462	2480.13	Plot A8	≤2483.5	**PASS**

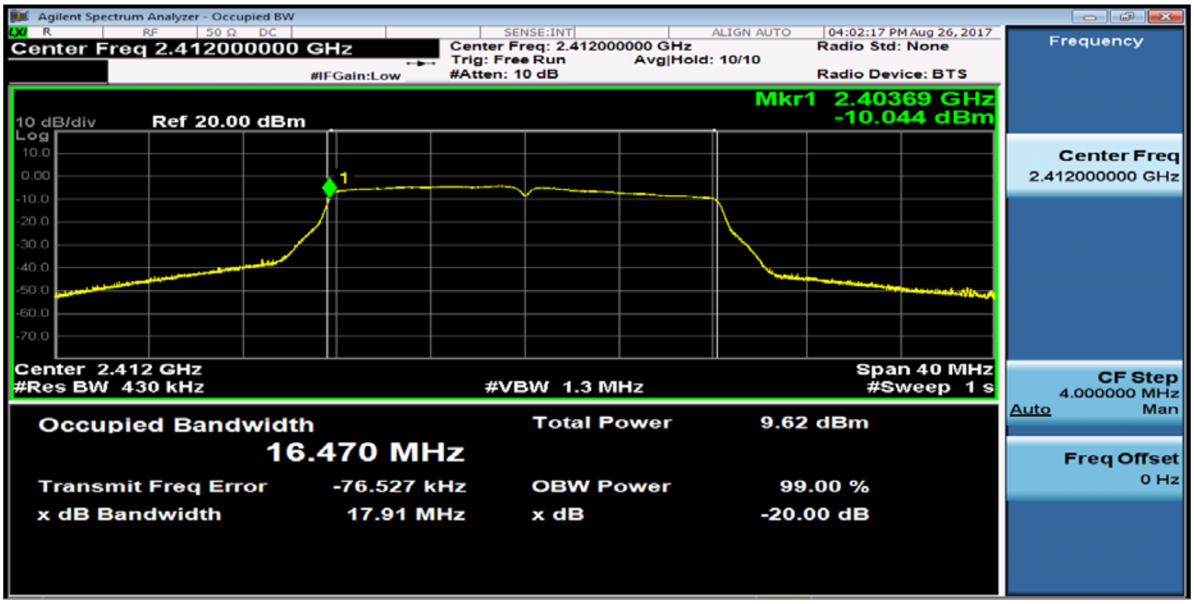
2.4.6. Test Plot



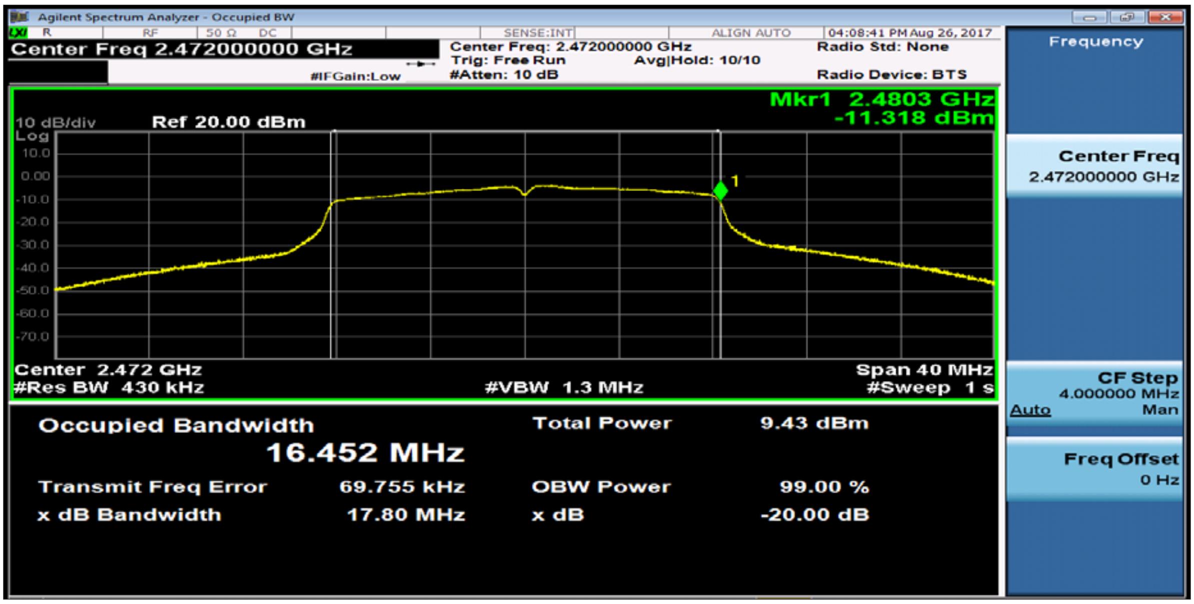
(Plot A1: Occupied Channel Bandwidth_802.11b_2412MHz)



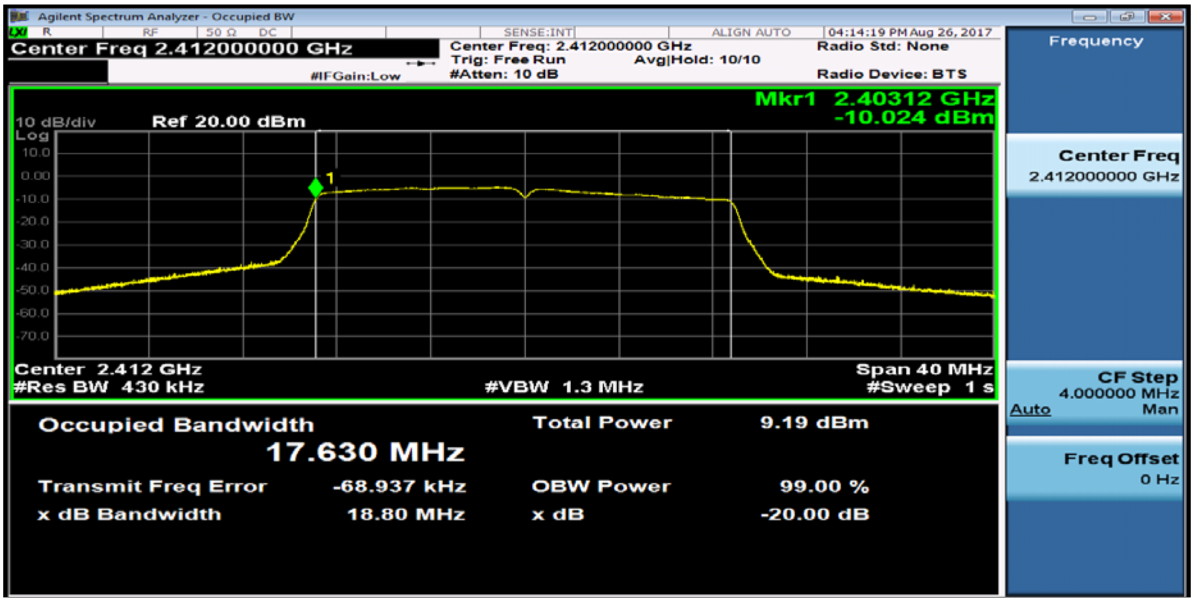
(Plot A2: Occupied Channel Bandwidth_802.11b_2472MHz)



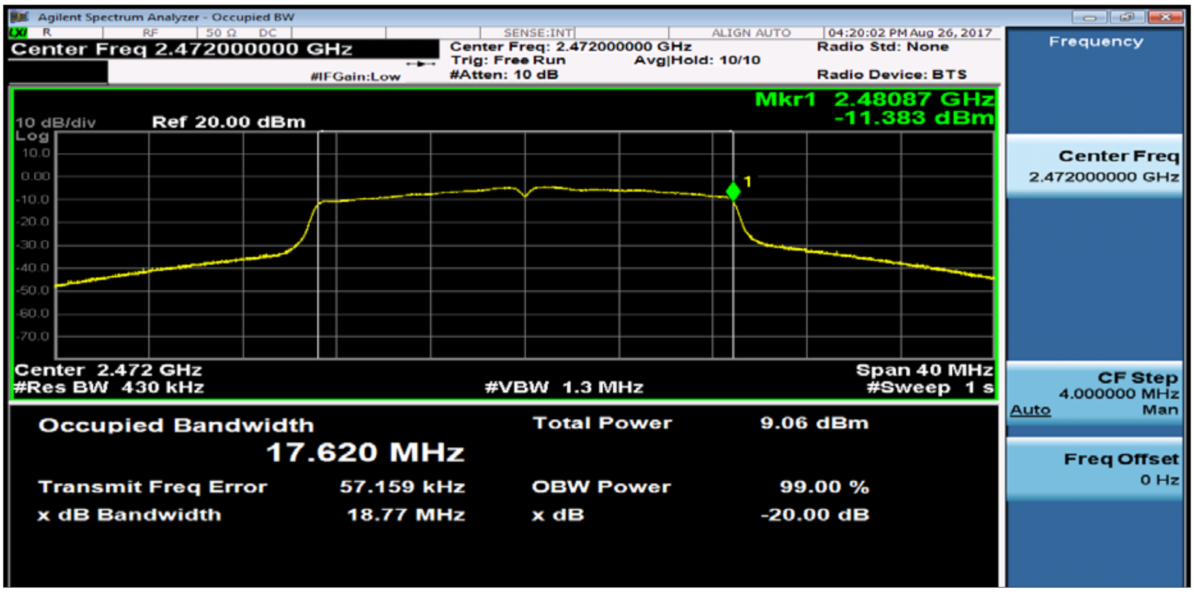
(Plot A3: Occupied Channel Bandwidth_802.11g_2412MHz)



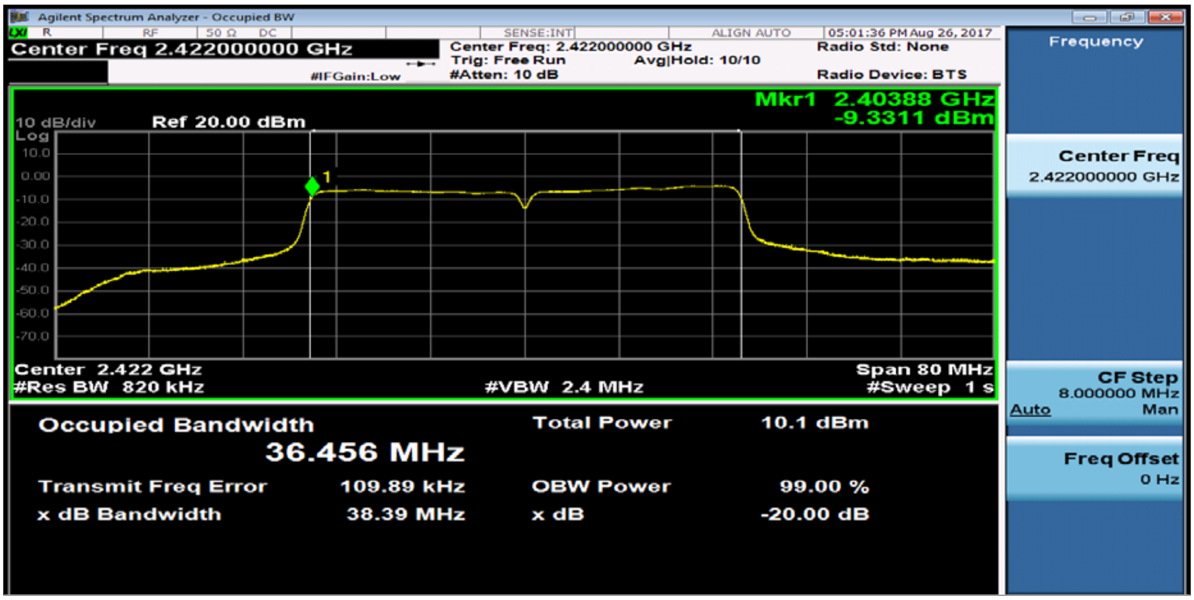
(Plot A4: Occupied Channel Bandwidth_802.11g_2472MHz)



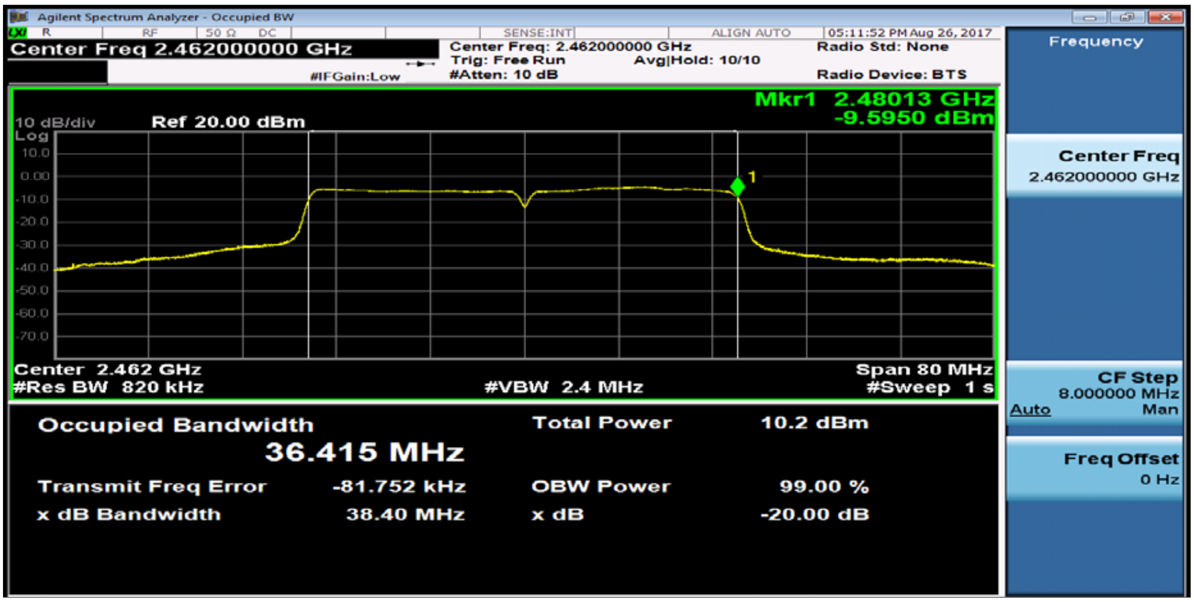
(Plot A5: Occupied Channel Bandwidth_802.11n20_2412MHz)



(Plot A6: Occupied Channel Bandwidth_802.11n20_2472MHz)



(Plot A7: Occupied Channel Bandwidth_802.11n40_2422MHz)



(Plot A8: Occupied Channel Bandwidth_802.11n40_2462MHz)

2.5. EN 300 328 §4.3.2.8 Transmitter unwanted emissions in the out-of-band domain

2.5.1. Definition

Transmitter unwanted emissions in the out-of-band domain are emissions when the equipment is in Transmit mode, on frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

2.5.2. Limit

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 3.
Within the band specified in table 1, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.2.7..

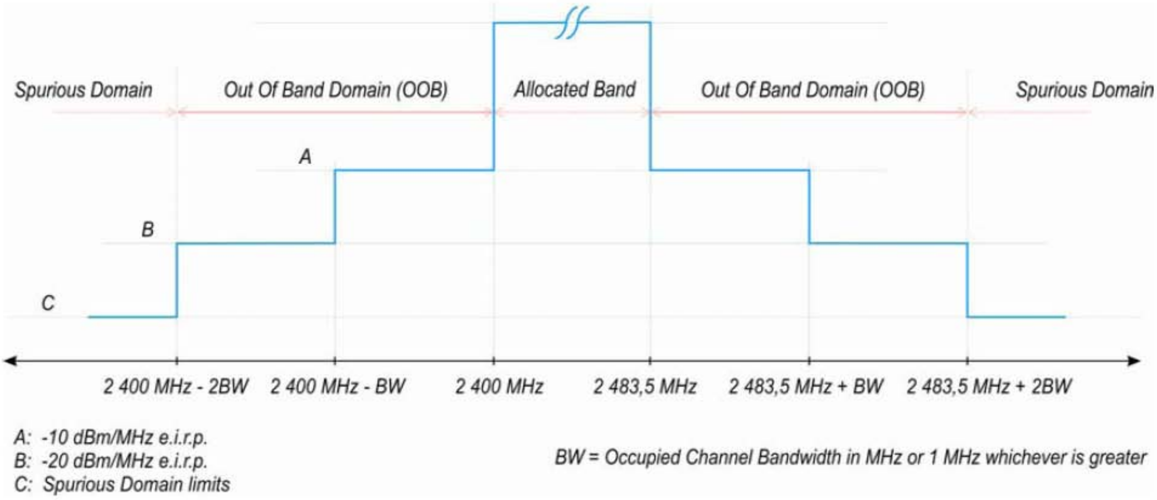


Figure 1: Transmit mask

2.5.3. Test condition

See clause 5.1 for the environmental test conditions.
These measurements shall only be performed at normal test conditions.
For equipment using FHSS modulation, the measurements shall be performed during normal operation (hopping).
For equipment using wide band modulations other than FHSS, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. These operating channels shall be recorded.

The equipment shall be configured to operate under its worst case situation with respect to output power.

If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then each channel bandwidth shall be tested separately..

2.5.4. Test procedures

The applicable mask is defined by the measurement results from the tests performed under clause 5.4.7 (Occupied Channel Bandwidth).

The Out-of-band emissions within the different horizontal segments of the mask provided in figure 1 and figure 3 shall be measured using the procedure in step 1 to step 6 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:

- Centre Frequency: 2 484 MHz
- Span: 0 Hz
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep Mode: Continuous
- Sweep Points: Sweep Time [s] / (1 μs) or 5 000 whichever is greater
- Trigger Mode: Video trigger; in case video triggering is not possible, an external trigger source may

be used

- 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):

• Adjust the trigger level to select the transmissions with the highest power level.

• For frequency hopping 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 + 2BW. 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 - 2BW 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 - 2BW + 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

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chains shall be individually compared with these reduced limits.
NOTE: Ach refers to the number of active transmit chains.
It shall be recorded whether the equipment complies with the mask provided in figure 1 or figure 3.

2.5.5. Result

2.5.5.1 802.11b Mode

Note: Only the worst test data was inserted in following table for every limit band.

Test Conditions		Out-of-band domain (MHz)		Out-of-band domain (MHz)	
		2400-BW to 2400	2400-2BW to 2400-BW	2483.50 to 2483.5+BW	2483.5+BW to 2483.5+2BW
NT	NV	-37.24	-64.79	-24.65	-44.02
Limit (dBm/MHz)		-10	-20	-10	-20
Result		**PASS**	**PASS**	**PASS**	**PASS**

2.5.5.2 802.11g Mode

Note: Only the worst test data was inserted in following table for every limit band.

Test Conditions		Out-of-band domain (MHz)		Out-of-band domain (MHz)	
		2400-BW to 2400	2400-2BW to 2400-BW	2483.50 to 2483.5+BW	2483.5+BW to 2483.5+2BW
NT	NV	-37.14	-66.86	-29.17	-55.51
Limit (dBm/MHz)		-10	-20	-10	-20
Result		**PASS**	**PASS**	**PASS**	**PASS**

2.5.5.3 802.11n20 Mode

Note: Only the worst test data was inserted in following table for every limit band.

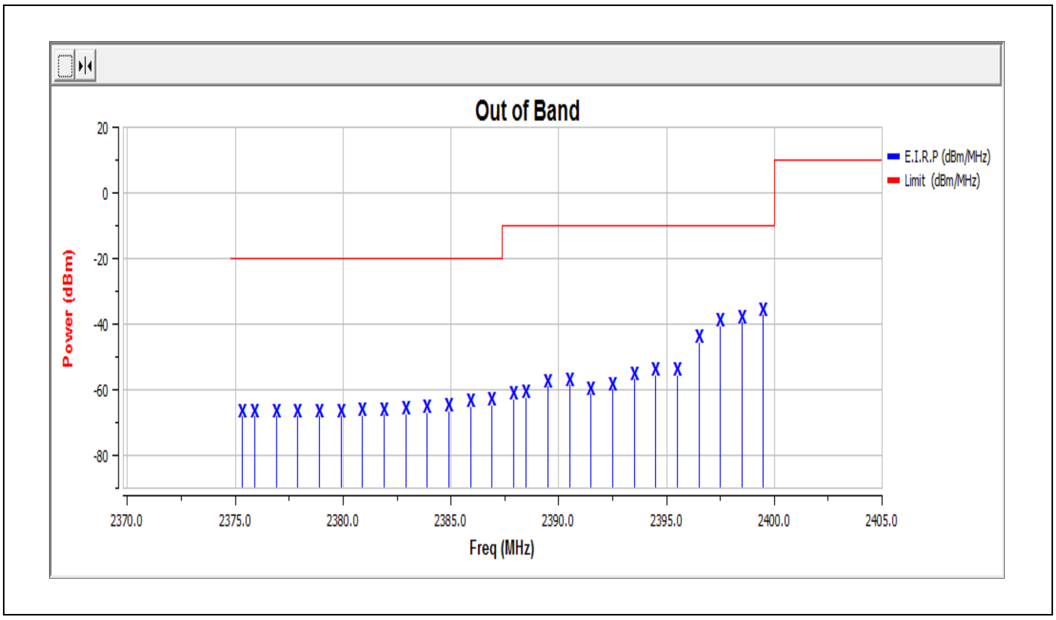
Test Conditions		Out-of-band domain (MHz)		Out-of-band domain (MHz)	
		2400-BW to 2400	2400-2BW to 2400-BW	2483.50 to 2483.5+BW	2483.5+BW to 2483.5+2BW
NT	NV	-37.14	-66.86	-29.17	-55.51
Limit (dBm/MHz)		-10	-20	-10	-20
Result		**PASS**	**PASS**	**PASS**	**PASS**

2.5.5.4 802.11n40 Mode

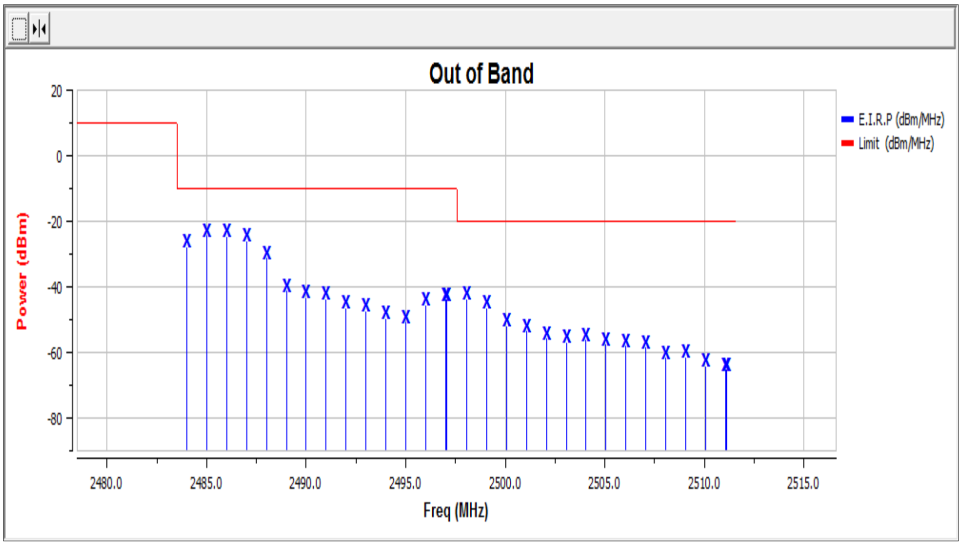
Note: Only the worst test data was inserted in following table for every limit band.

Test Conditions		Out-of-band domain (MHz)		Out-of-band domain (MHz)	
		2400-BW to 2400	2400-2BW to 2400-BW	2483.50 to 2483.5+BW	2483.5+BW to 2483.5+2BW
NT	NV	-33.74	-68.16	-32.36	-67.46
Limit (dBm/MHz)		-10	-20	-10	-20
Result		**PASS**	**PASS**	**PASS**	**PASS**

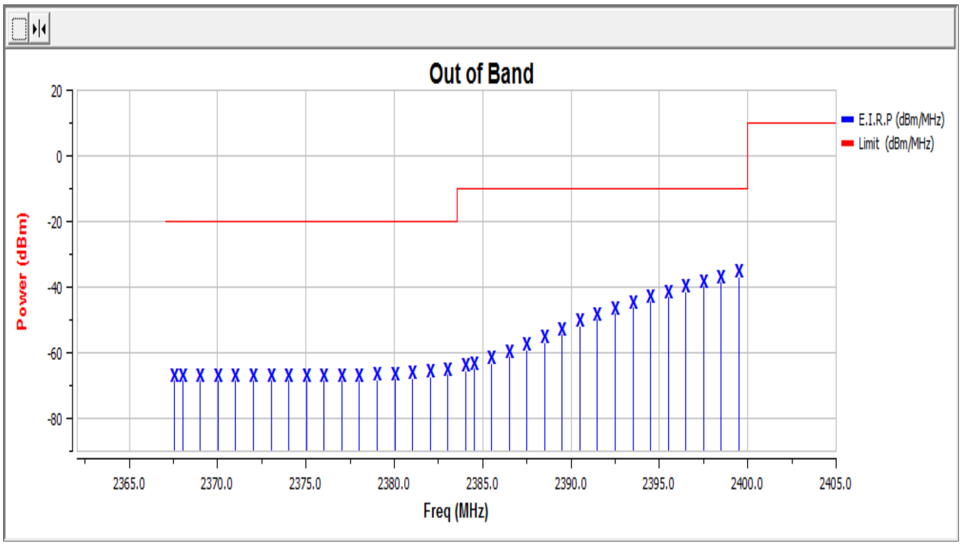
2.5.5.5 Test Plot:



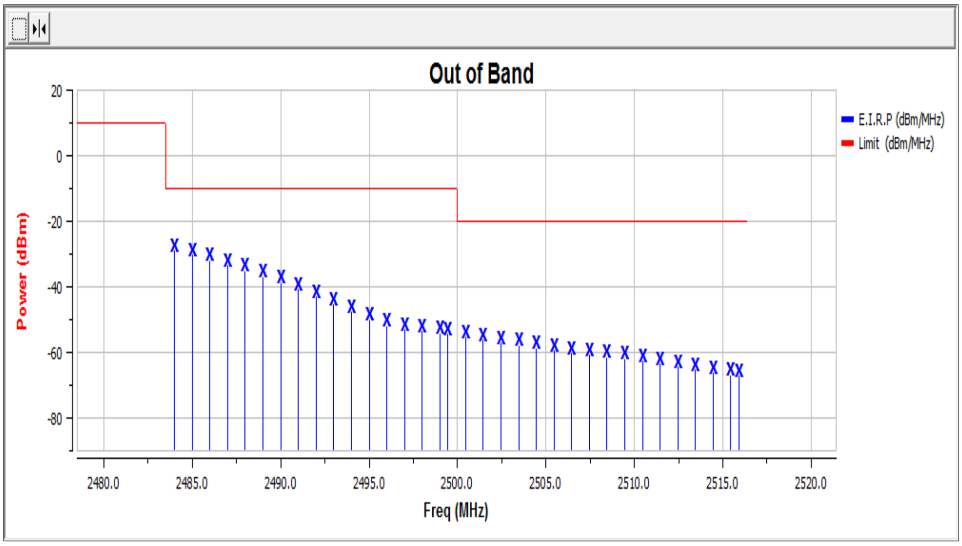
(OOB_802.11b _ 2412MH)



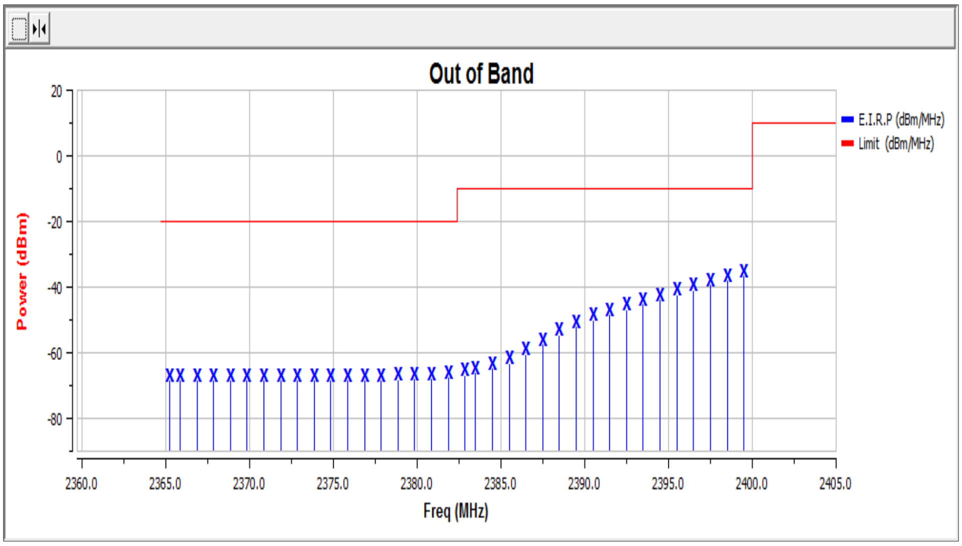
(OOB_802.11b _ 2472MHz)



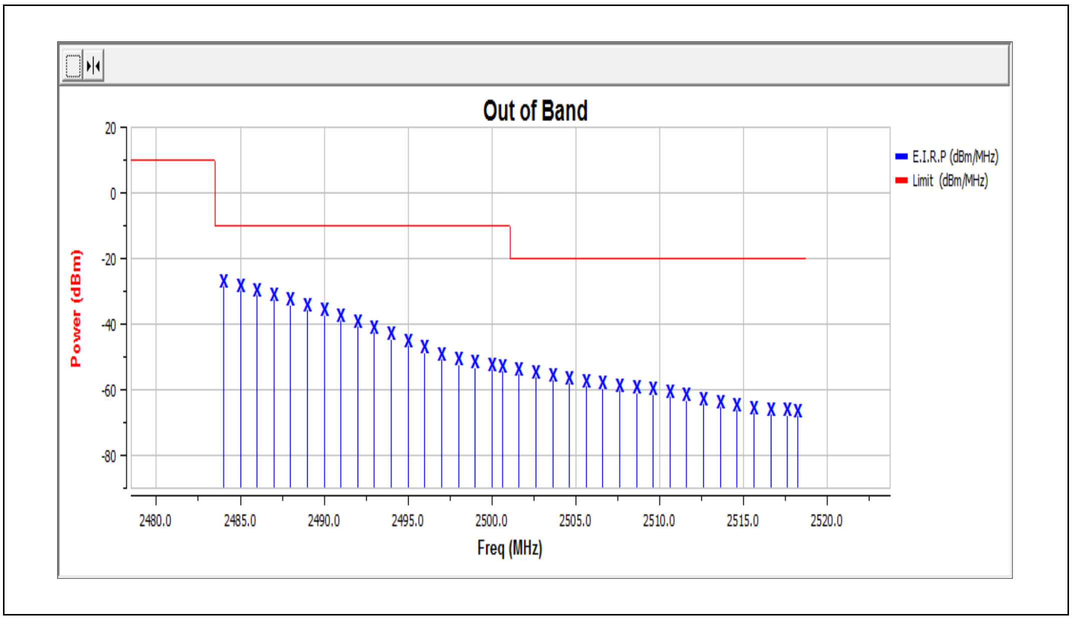
(OOB_802.11g _ 2412MHz)



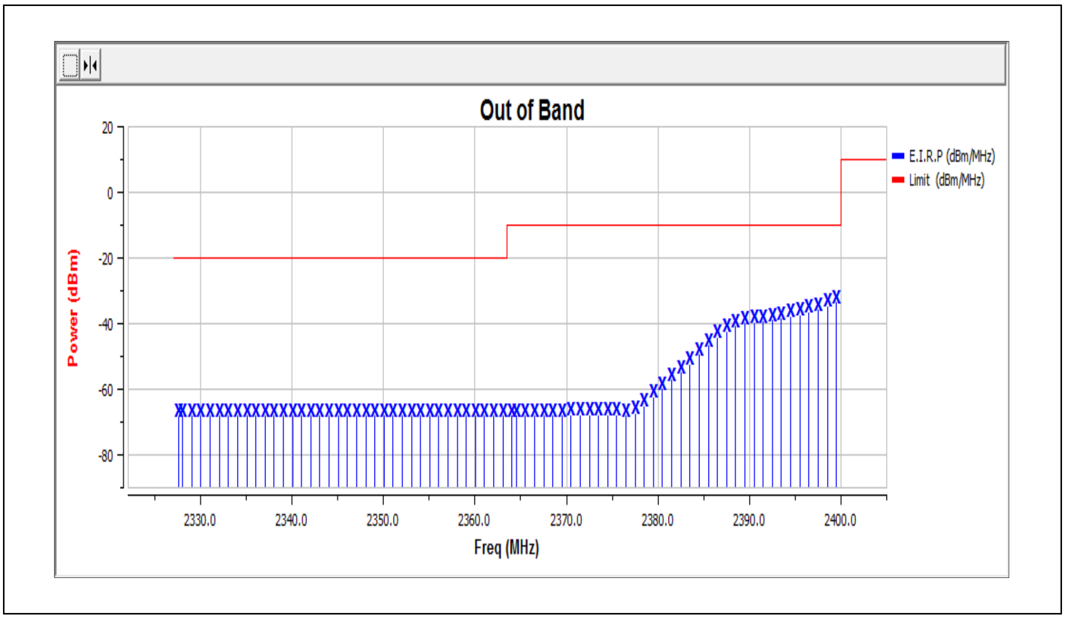
(OOB_802.11g _ 2472MHz)



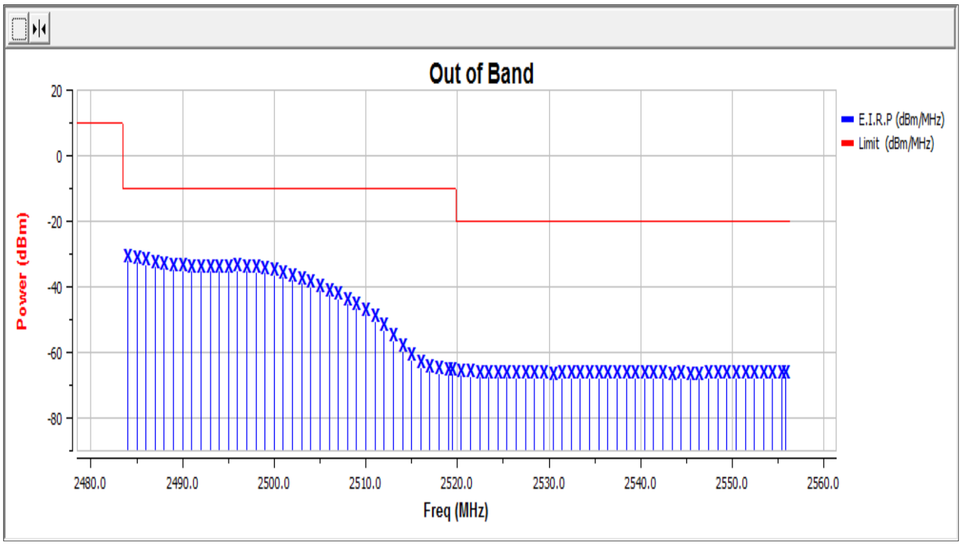
(802.11n20 _ 2412MHz_2400MHz-2BW to 2400MHz)



(OOB_802.11n20 _ 2472MHz)



(OOB_802.11n40 _ 2422MHz)



(OOB_802.11n40 _ 2462MHz)

2.6. EN 300 328 §4.3.2.9Transmitter unwanted emissions in the spurious domain

2.6.1. Definition

Transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the Out-of-band Domain as indicated in figure 3 when the equipment is in Transmit mode.

2.6.2. Limit

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 12.
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..

Table 12: Transmitter limits for spurious emissions

Frequency Range	Maximum Power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100kHz
47 MHz to 74 MHz	-54 dBm	100kHz
74 MHz to 87,5 MHz	-36 dBm	100kHz
87,5 MHz to 118 MHz	-54 dBm	100kHz
118 MHz to 174 MHz	-36 dBm	100kHz
174 MHz to 230 MHz	-54 dBm	100kHz
230 MHz to 470 MHz	-36 dBm	100kHz
470 MHz to 862 MHz	-54 dBm	100kHz
862 MHz to 1 GHz	-36 dBm	100kHz
1 GHz to 12,75 GHz	-30 dBm	1MHz

2.6.3. Test condition

See clause 5.1 for the environmental test conditions. These measurements shall only be performed at normal test conditions.
The level of spurious emissions shall be measured as, either:
a) their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation); or

b) their effective radiated power when radiated by cabinet and antenna in case of integral antenna equipment with no antenna connectors.

For equipment using FHSS modulation, the measurements may be performed when normal hopping is disabled. In this case measurements need to be performed when operating at the lowest and the highest hopping frequency. When this is not possible, the measurement shall be performed during normal operation (hopping).

For equipment using wide band modulations other than FHSS, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. These operating channels shall be recorded.

The equipment shall be configured to operate under its worst case situation with respect to output power. If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then the equipment shall be configured to operate under its worst case situation with respect to spurious emissions..

2.6.4. Test procedures

2.6.4.1 Introduction

The spectrum in the spurious domain (see figure 1 or figure 3) shall be searched for emissions that exceed the limit values given in table 4 or table 12 or that come to within 6 dB below these limits. Each occurrence shall be recorded.

The measurement procedure contains 2 parts..

2.6.4.2 Pre-scan

The procedure in step 1 to step 4 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 Frequency Hopping 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 frequency hopping 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 Frequency Hopping 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 frequency hopping 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.

Frequency Hopping 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 × log10 (Ach).

2.6.4.3 Measurement of the emissions identified during the pre-scan

5.4.9.2.1.3 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: Video (burst signals) or Manual (continuous signals)

• Detector: 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 (Ach).

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..

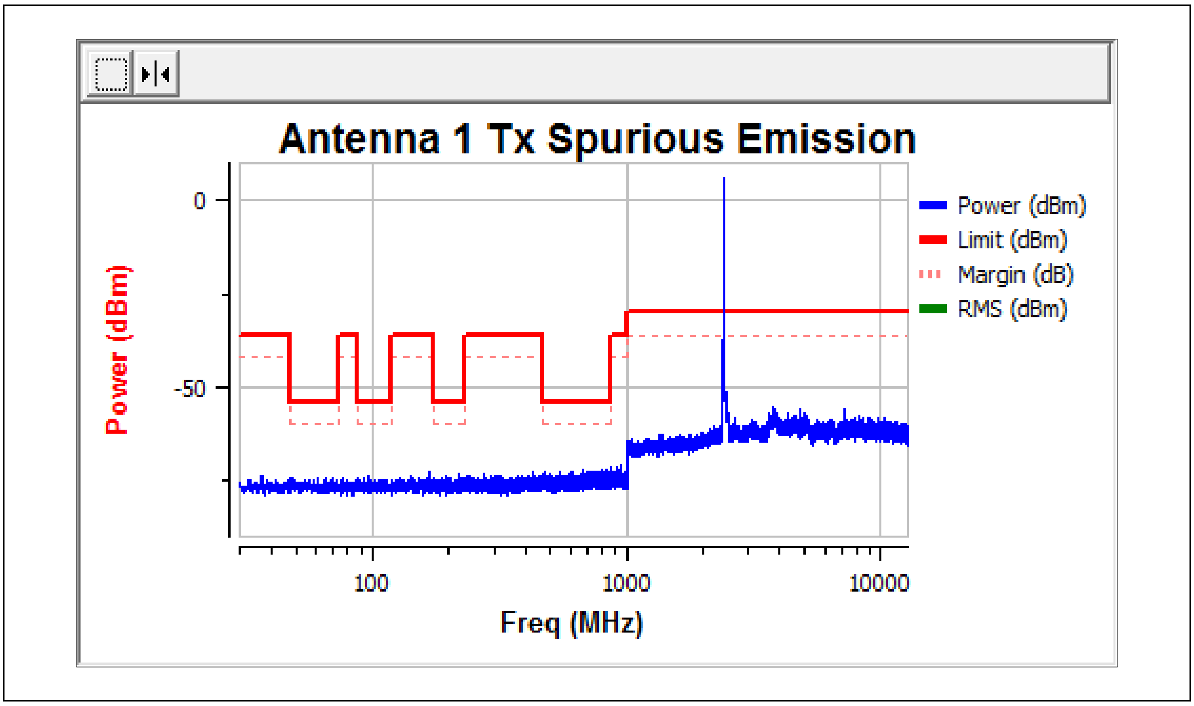
2.6.5. Result

Below is the worst case situation test data:

2.6.5.1 Result for Conducted test

802.11b Mode:

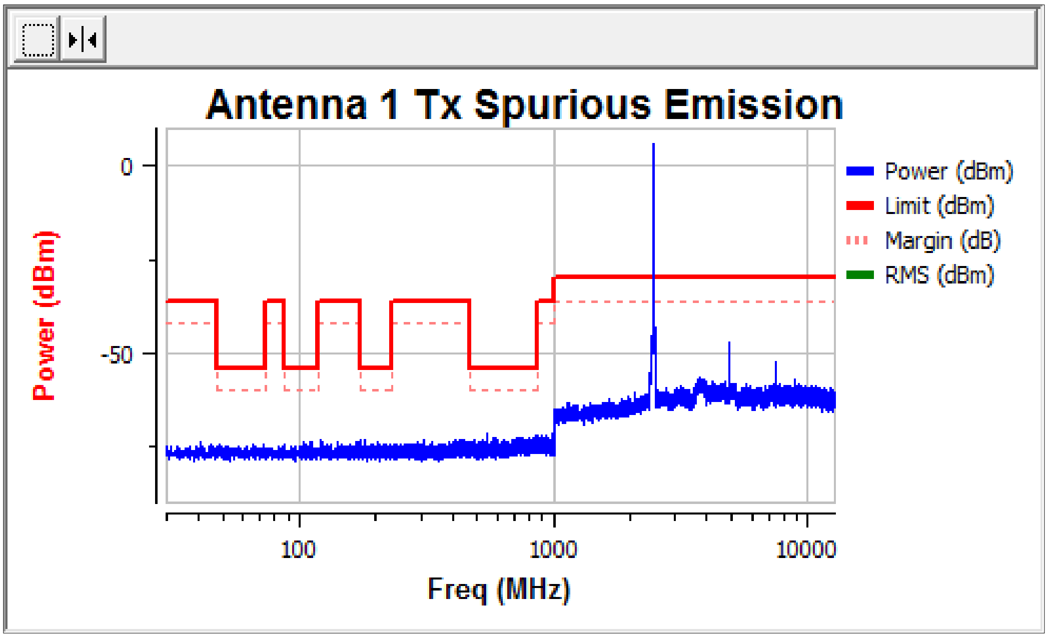
Plot for Channel = 1



(Channel 1, 30MHz to 12.75GHz)

Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
670.350	-71.54	-54.00	-17.54	PASS
745.900	-71.82	-54.00	-17.82	PASS
773.900	-71.99	-54.00	-17.99	PASS
799.250	-71.62	-54.00	-17.62	PASS
833.800	-71.87	-54.00	-17.87	PASS
3772.500	-54.47	-30.00	-24.47	PASS
3866.000	-56.17	-30.00	-26.17	PASS
3906.000	-56.29	-30.00	-26.29	PASS
4824.000	-55.50	-30.00	-25.50	PASS
7236.500	-55.13	-30.00	-25.13	PASS

Plot for Channel = 13

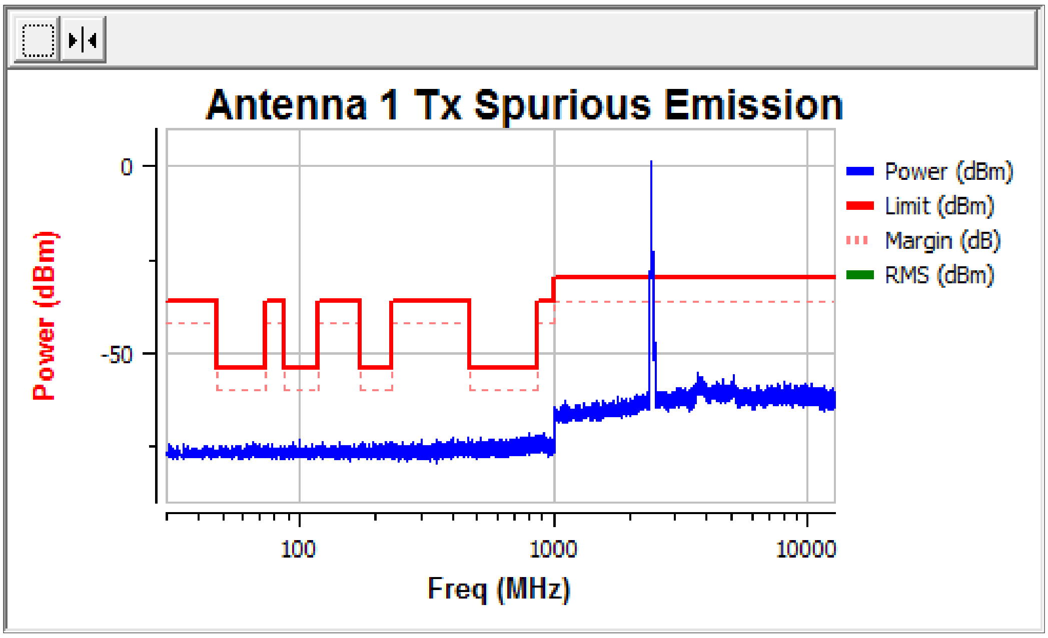


(Channel 13, 30MHz to 12.75GHz)

Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
544.350	-70.64	-54.00	-16.64	PASS
728.900	-72.04	-54.00	-18.04	PASS
757.900	-71.80	-54.00	-17.80	PASS
795.450	-71.80	-54.00	-17.80	PASS
855.350	-71.27	-54.00	-17.27	PASS
3675.500	-56.24	-30.00	-26.24	PASS
3756.500	-56.14	-30.00	-26.14	PASS
3781.000	-55.75	-30.00	-25.75	PASS
4944.000	-46.45	-30.00	-16.45	PASS
7415.000	-52.11	-30.00	-22.11	PASS

802.11n40 Mode:

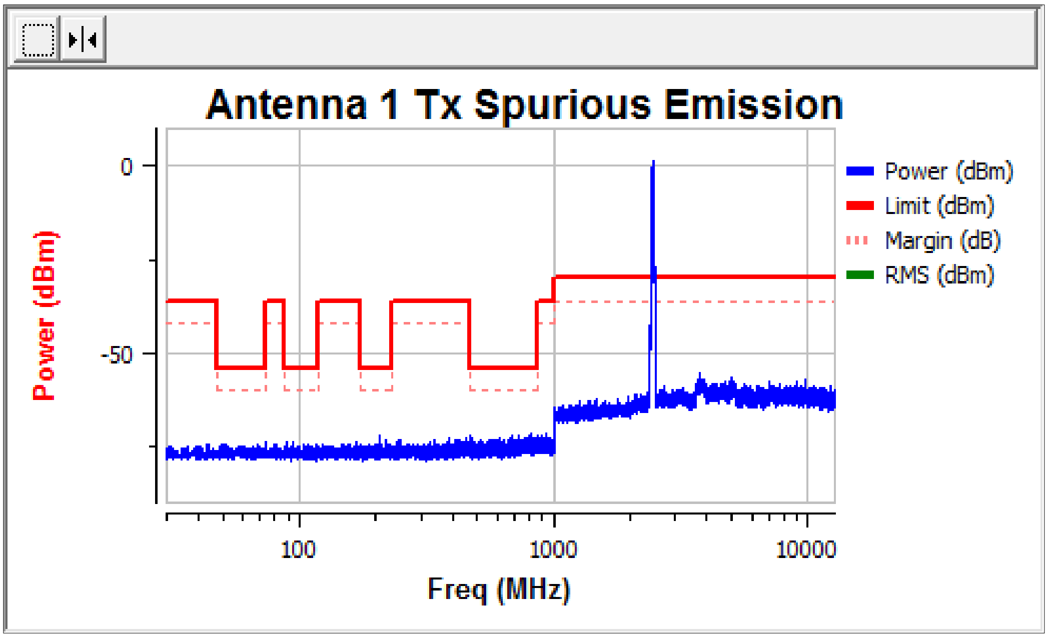
Plot for Channel = 3



(Channel 3, 30MHz to 12.75GHz)

Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
716.600	-71.99	-54.00	-17.99	PASS
764.950	-71.83	-54.00	-17.83	PASS
793.350	-71.20	-54.00	-17.20	PASS
819.000	-72.00	-54.00	-18.00	PASS
846.700	-71.58	-54.00	-17.58	PASS
3677.000	-55.99	-30.00	-25.99	PASS
3709.500	-54.78	-30.00	-24.78	PASS
3744.500	-56.18	-30.00	-26.18	PASS
3824.500	-56.04	-30.00	-26.04	PASS
5055.500	-55.59	-30.00	-25.59	PASS

Plot for Channel = 11



(Channel 11, 30MHz to 12.75GHz)

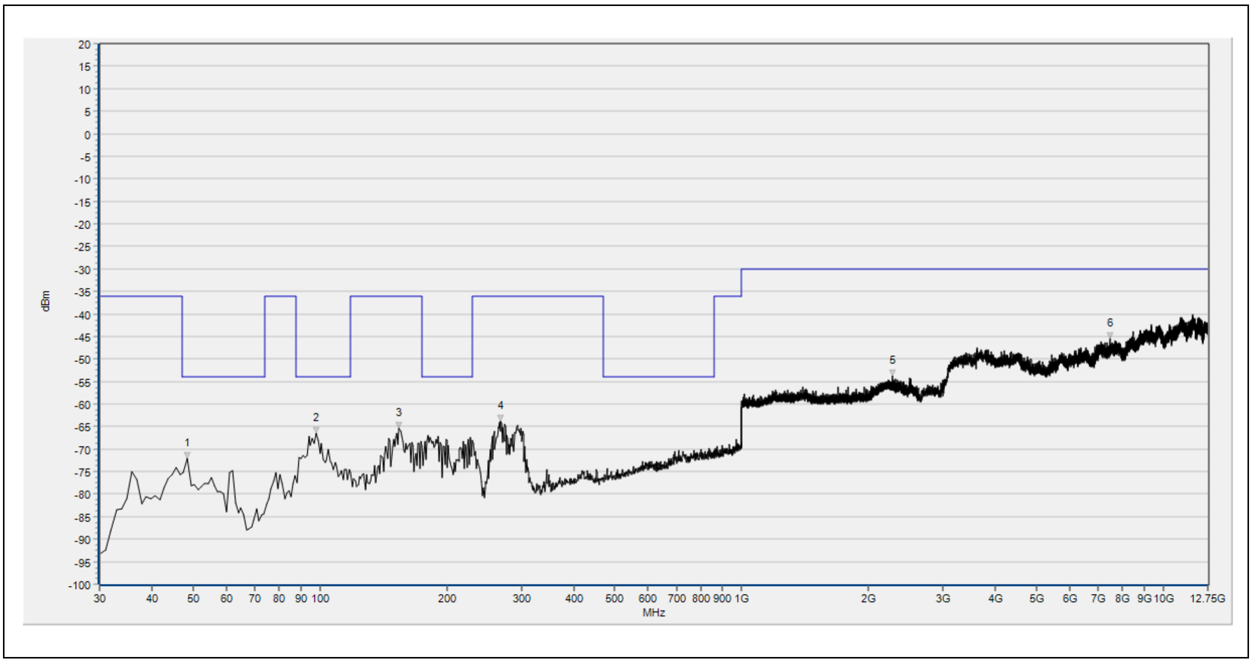
Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
207.000	-71.73	-54.00	-17.73	PASS
472.350	-71.77	-54.00	-17.77	PASS
690.250	-71.52	-54.00	-17.52	PASS
723.350	-71.34	-54.00	-17.34	PASS
809.500	-70.92	-54.00	-16.92	PASS
3734.000	-54.56	-30.00	-24.56	PASS
3834.000	-56.66	-30.00	-26.66	PASS
3893.500	-56.51	-30.00	-26.51	PASS
5028.500	-56.03	-30.00	-26.03	PASS
9707.500	-56.58	-30.00	-26.58	PASS

2.6.5.2 Result for Radiated test

Below is the worst case situation test data:

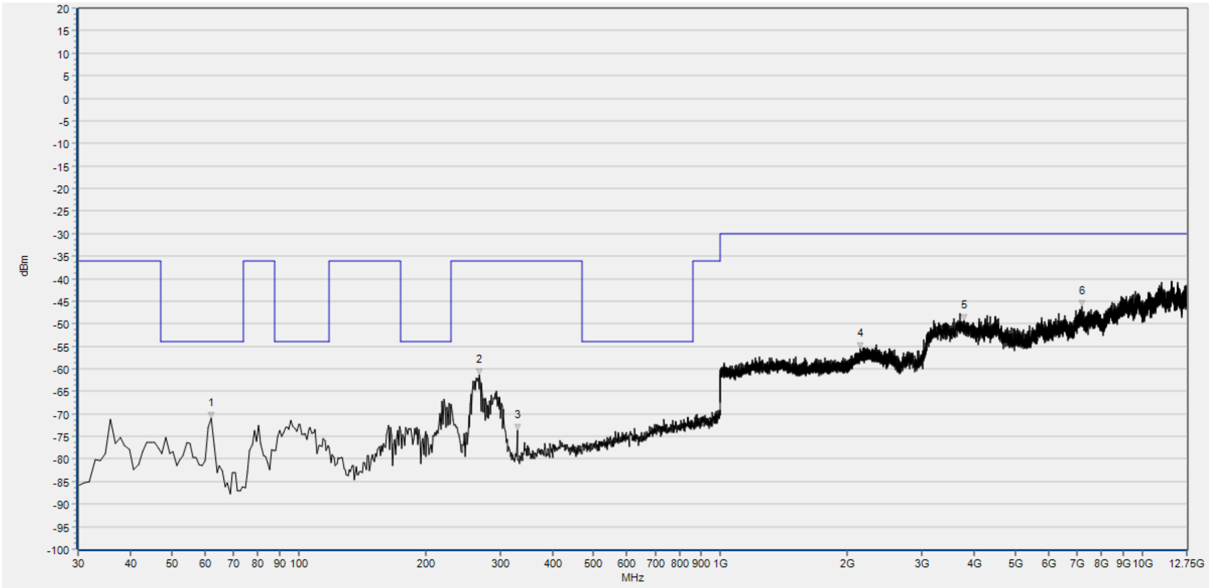
802.11b Mode:

<u>Plot for Channel = 1</u>



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11b, channel 1)

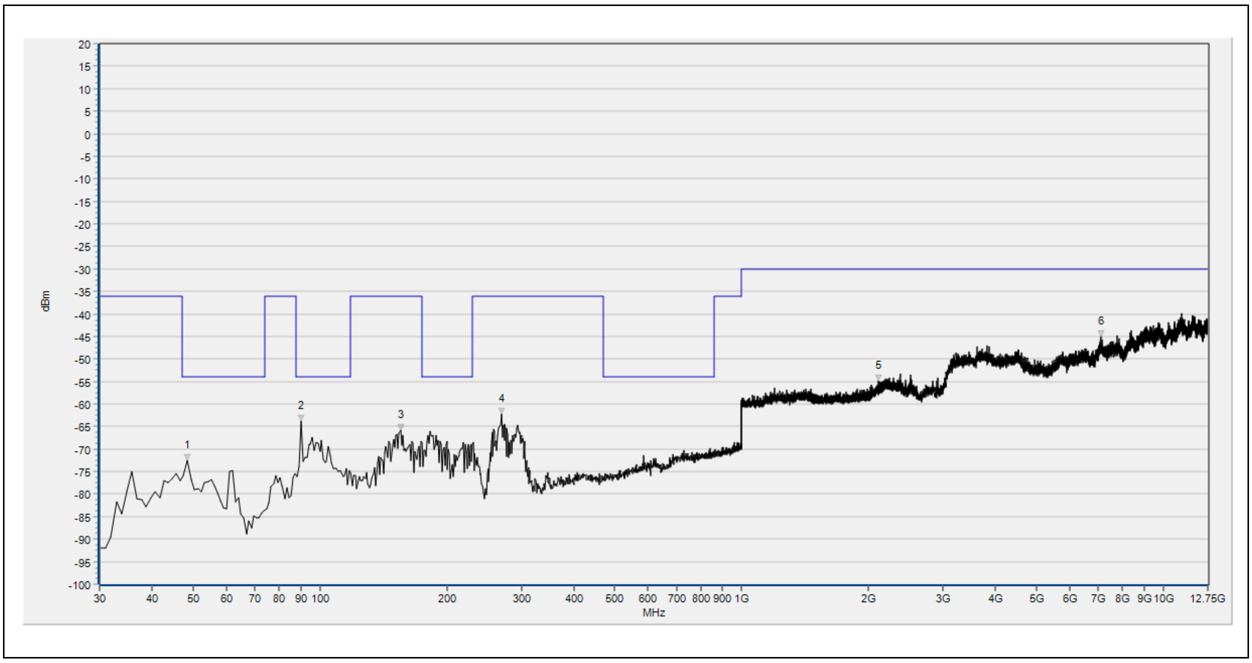
Test frequency range 30MHz to 12.75 GHz	Channel = 1				
	Transmitter with modulation Mode at 2412MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	48.430	-72.14	-54.00	Horizontal	PASS
	97.900	-66.49	-54.00	Horizontal	PASS
	154.160	-65.39	-36.00	Horizontal	PASS
	268.620	-63.86	-36.00	Horizontal	PASS
	2274.667	-53.76	-30.00	Horizontal	PASS
	7457.790	-45.50	-30.00	Horizontal	PASS



(30MHz GHz to12.75GHz, Antenna Vertical @ 802.11b, channel 1)

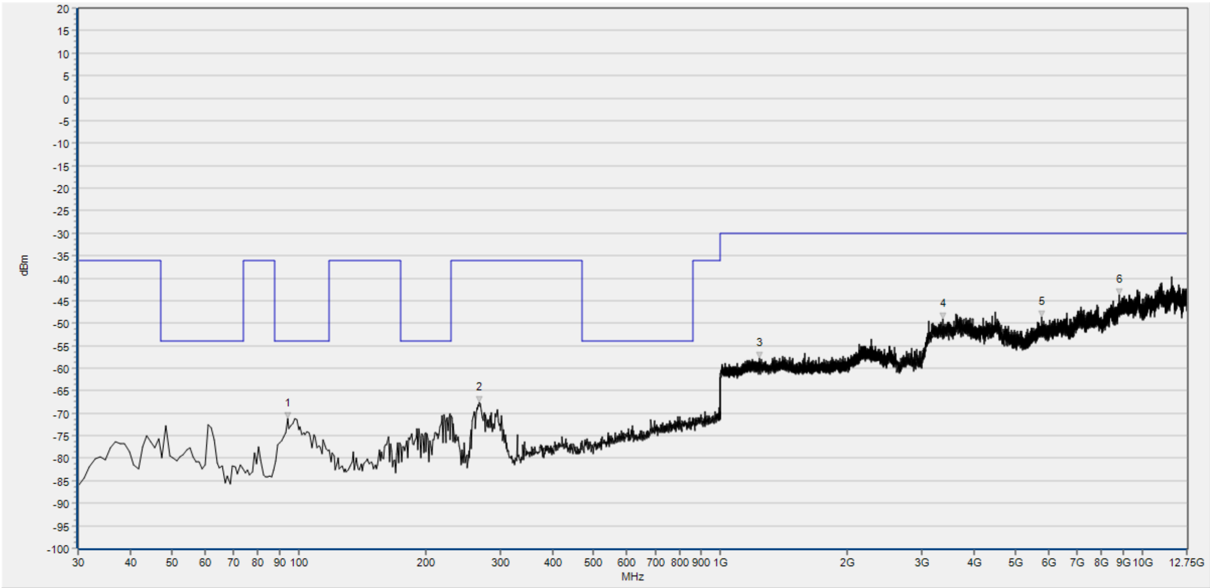
Test frequency range 30MHz to 12.75 GHz	Channel = 1				
	Transmitter with modulation Mode at 2412MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	62.010	-71.01	-54.00	Vertical	PASS
	268.620	-61.26	-36.00	Vertical	PASS
	329.730	-73.61	-36.00	Vertical	PASS
	2145.600	-55.63	-30.00	Vertical	PASS
	3777.400	-49.32	-30.00	Vertical	PASS
	7189.830	-46.22	-30.00	Vertical	PASS

Plot for Channel = 13



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11b, channel 13)

Test frequency range 30MHz to 12.75 GHz	Channel = 13				
	Transmitter with modulation Mode at 2472MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	48.430	-72.54	-54.00	Horizontal	PASS
	90.140	-63.77	-54.00	Horizontal	PASS
	155.130	-65.85	-36.00	Horizontal	PASS
	269.590	-62.31	-36.00	Horizontal	PASS
	2114.667	-54.87	-30.00	Horizontal	PASS
	7096.450	-45.12	-30.00	Horizontal	PASS

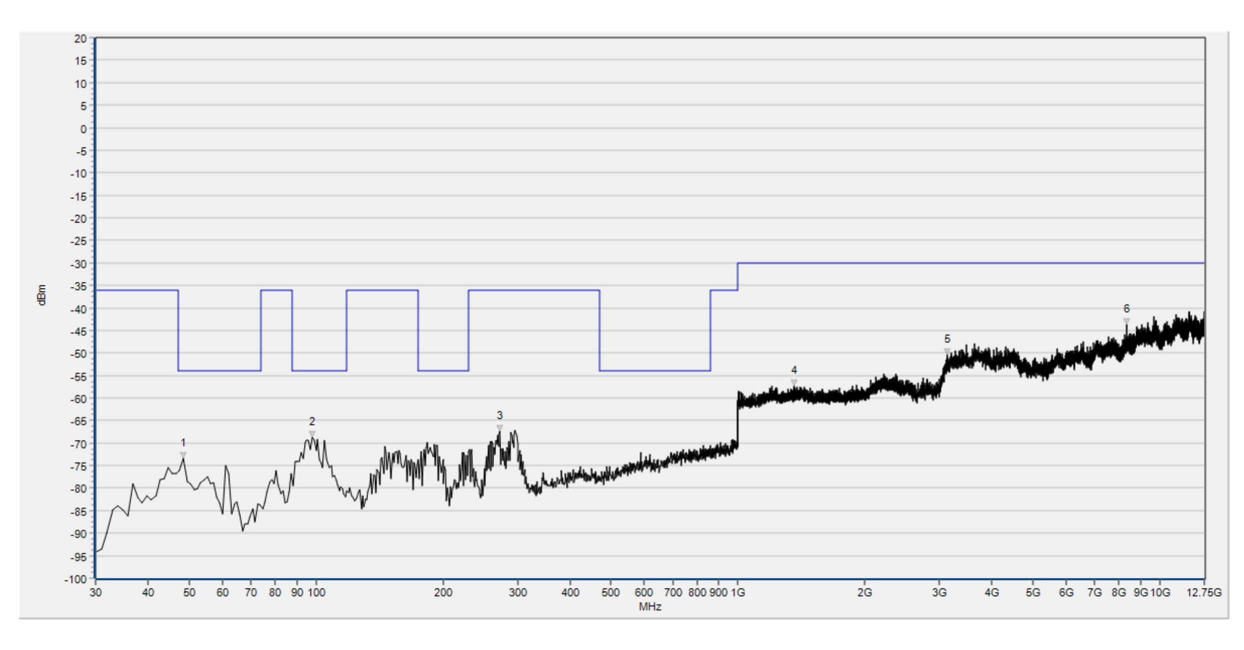


(30MHz to 12.75GHz, Antenna Vertical @ 802.11b, channel 13)

Test frequency range 30MHz to 12.75 GHz	Channel = 13				
	Transmitter with modulation Mode at 2472MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	94.020	-71.13	-54.00	Vertical	PASS
	268.620	-67.53	-36.00	Vertical	PASS
	1238.933	-57.87	-30.00	Vertical	PASS
	3369.370	-49.06	-30.00	Vertical	PASS
	5762.740	-48.69	-30.00	Vertical	PASS
	8805.710	-43.66	-30.00	Vertical	PASS

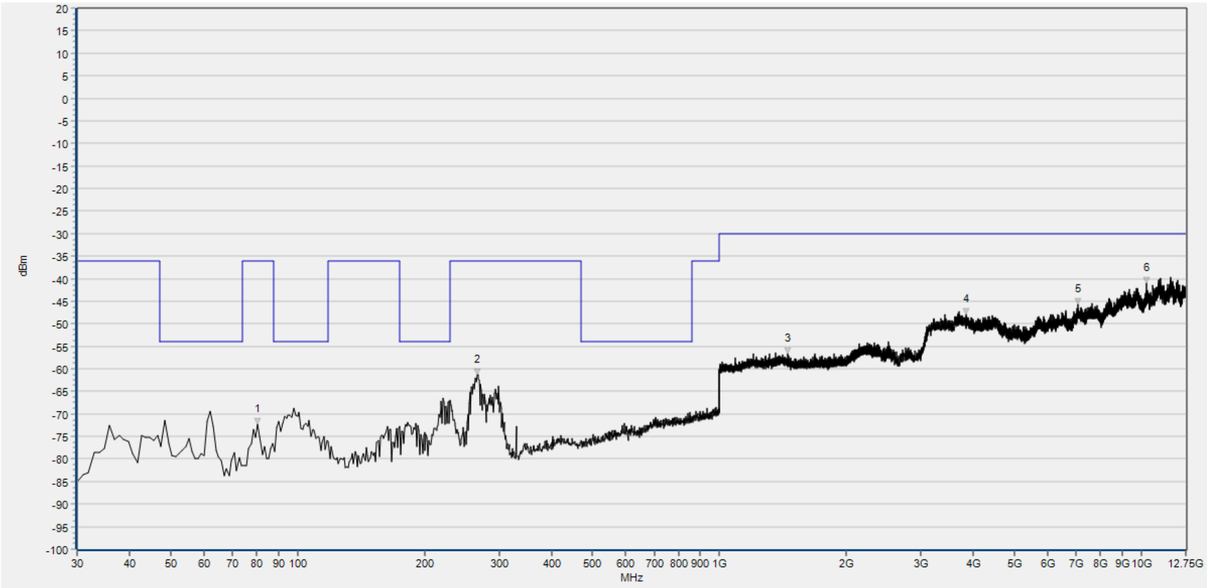
802.11n40 Mode:

Plot for Channel = 3



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11n40, channel 3)

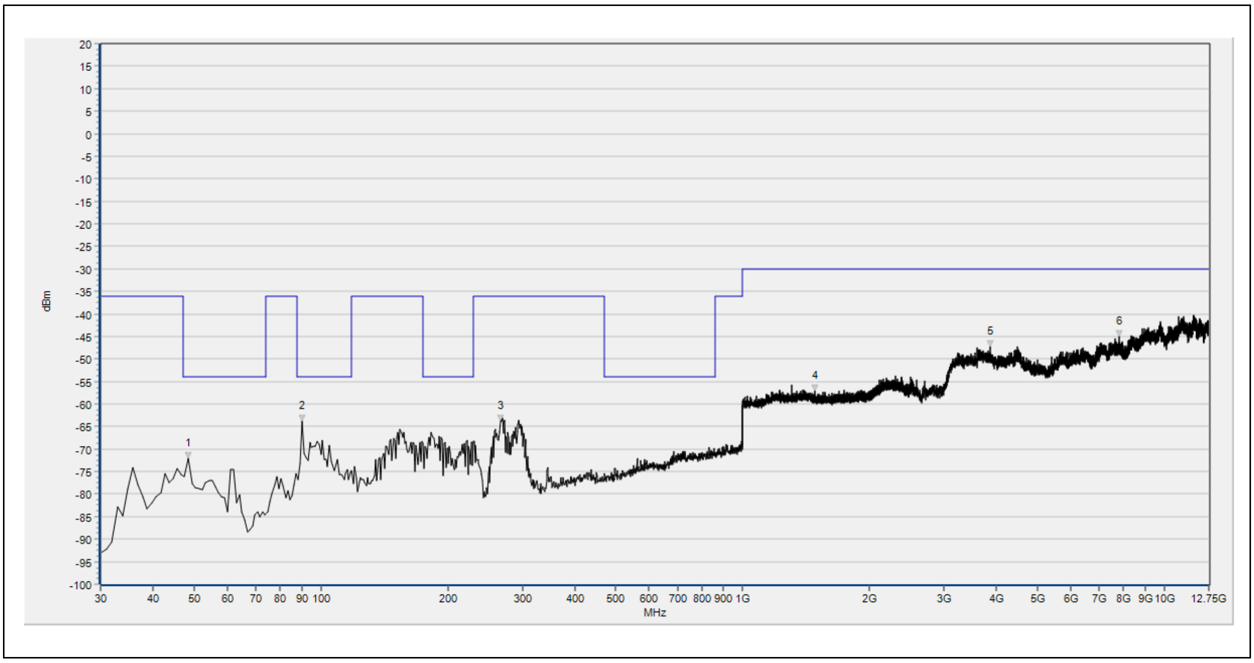
Test frequency range 30MHz to 12.75 GHz	Channel = 3				
	Transmitter with modulation Mode at 2422MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	48.430	-73.41	-54.00	Horizontal	PASS
	97.900	-68.76	-54.00	Horizontal	PASS
	272.500	-67.34	-36.00	Horizontal	PASS
	1358.400	-57.36	-30.00	Horizontal	PASS
	3135.920	-50.45	-30.00	Horizontal	PASS
	8357.080	-43.75	-30.00	Horizontal	PASS



(30MHz GHz to12.75GHz, Antenna Vertical @ 802.11n40, channel 3)

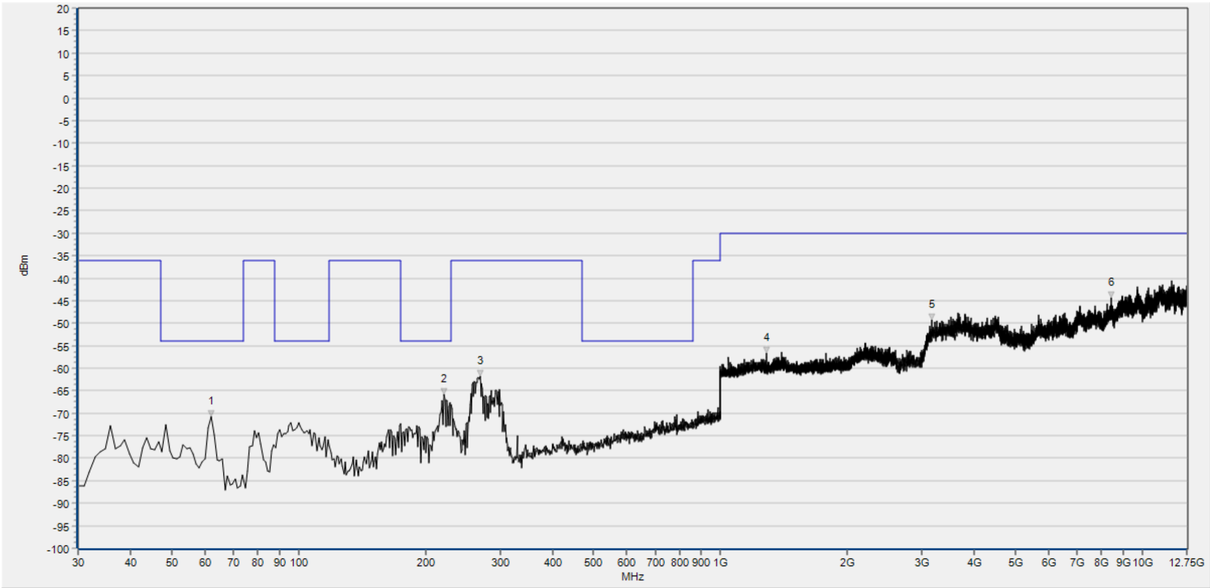
	Channel = 3				
	Transmitter with modulation Mode at 2422MHz				
Test frequency range 30MHz to 12.75 GHz	**Frequency (MHz)**	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	80.440	-72.36	-36.00	Vertical	PASS
	266.680	-61.36	-36.00	Vertical	PASS
	1451.200	-56.59	-30.00	Vertical	PASS
	3852.510	-47.90	-30.00	Vertical	PASS
	7086.300	-45.71	-30.00	Vertical	PASS
	10301.820	-41.01	-30.00	Vertical	PASS

Plot for Channel = 11



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11n40, channel 11)

Test frequency range 30MHz to 12.75 GHz	Channel = 11				
	Transmitter with modulation Mode at 2462MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	48.430	-72.10	-54.00	Horizontal	PASS
	90.140	-63.80	-54.00	Horizontal	PASS
	266.680	-63.85	-36.00	Horizontal	PASS
	1483.200	-57.17	-30.00	Horizontal	PASS
	3856.570	-47.28	-30.00	Horizontal	PASS
	7804.920	-44.98	-30.00	Horizontal	PASS



(30MHz to 12.75GHz, Antenna Vertical @ 802.11n40, channel 11)

Test frequency range 30MHz to 12.75 GHz	Channel = 11				
	Transmitter with modulation Mode at 2462MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	62.010	-70.71	-54.00	Vertical	PASS
	221.090	-65.80	-54.00	Vertical	PASS
	269.590	-61.90	-36.00	Vertical	PASS
	1284.800	-56.65	-30.00	Vertical	PASS
	3166.370	-49.26	-30.00	Vertical	PASS
	8438.280	-44.47	-30.00	Vertical	PASS

3. Receiver Parameters

3.1. EN 300 328 §4.3.2.10 - Receiver Spurious Emissions

3.1.1. Definition

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

3.1.2. Limit

The spurious emissions of the receiver shall not exceed the values given in table 13.
In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or for emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz..

Table 13: Spurious emission limits for receivers

Frequency range	Maximum power	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

3.1.3. Test condition

See clause 5.1 for the environmental test conditions. These measurements shall only be performed at normal test conditions.
The level of spurious emissions shall be measured as, either:
a) their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation); or
b) their effective radiated power when radiated by cabinet and antenna in case of integral antenna equipment with no temporary antenna connectors.
Testing shall be performed when the equipment is in a receive-only mode.
For equipment using wide band modulations other than FHSS, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. These frequencies shall be recorded.
For equipment using FHSS modulation, the measurements may be performed when normal hopping is disabled. In this case measurements need to be performed when operating at the lowest and the highest hopping frequency. These frequencies shall be recorded. When disabling the normal hopping is not possible, the measurement shall be performed during normal operation (hopping).

3.1.4. test procedures

3.1.4.1 Conducted measurement

Introduction

In case of conducted measurements, the radio equipment shall be connected to the measuring equipment via an attenuator.

The spectrum in the spurious domain (see figure 1 or figure 3) shall be searched for emissions that exceed the limit values given in table 5 or table 13 or that come to within 6 dB below these limits. Each occurrence shall be recorded.

The measurement procedure contains 2 parts.

Pre-scan

The procedure in step 1 to step 4 below shall be used to identify potential unwanted 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 5 or table 13.

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
• Sweep time: Auto

Wait for 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 5.4.10.2.1.3 and compared to the limits given in table 5 or table 13.

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: Auto

Wait for 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 5.4.10.2.1.3 and compared to the limits given in table 5 or table 13.

Frequency Hopping 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 5.4.10.2.1.3.

Step 4:

• In case of conducted measurements on smart antenna systems (equipment with multiple receive chains), step 2 and step 3 need to be repeated for each of the active receive chains AchThe limits used to identify emissions during this pre-scan need to be reduced by 10 × log10 Ach.

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: 30 ms
• Sweep points: ⩾ 30 000
• Trigger: Video (for burst signals) or Manual (for continuous signals)
• Detector: 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 the start and stop times of the sweep.

Step 3:

In case of conducted measurements on smart antenna systems (equipment with multiple receive chains), step 2 needs to be repeated for each of the active receive chains Ach.

Sum the measured power (within the observed window) for each of the active receive chains.

Step 4:

The value defined in step 3 shall be compared to the limits defined in table 5 and table 13.

3.1.4.2 Radiated measurement

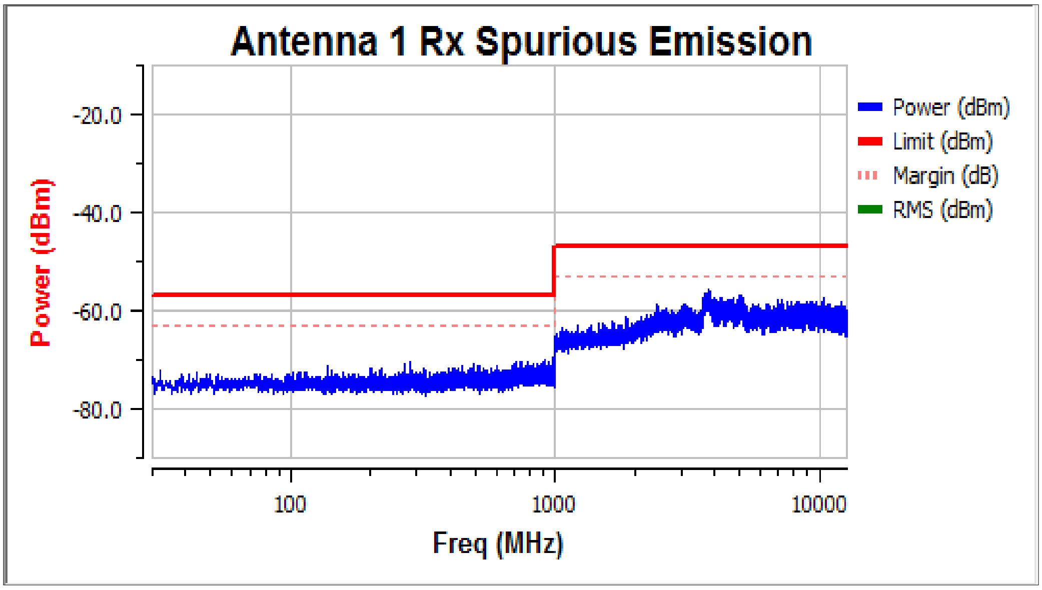
The test site as described in annex B and applicable measurement procedures as described in annex C shall be used. The test procedure is further as described under clause 5.4.10.2.1.

3.1.5. Results

3.1.5.1 Result for Conducted test

802.11b Mode:

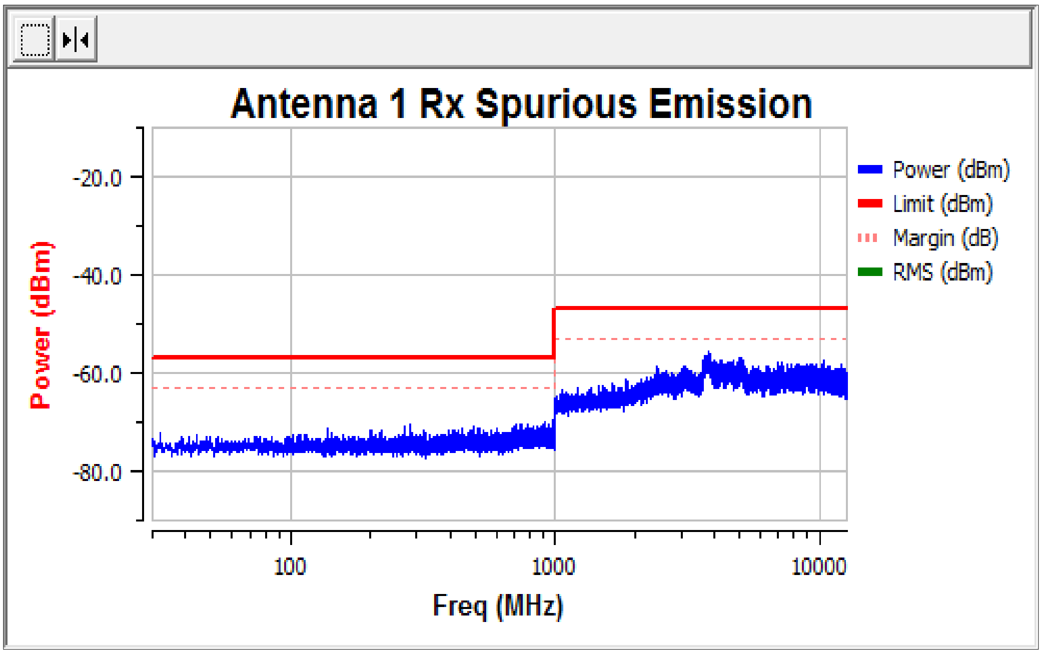
Plot for Channel = 1



(Channel 1, 30MHz to 12.75GHz)

Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
707.000	-71.52	-57.00	-14.52	PASS
813.050	-71.47	-57.00	-14.47	PASS
833.250	-71.00	-57.00	-14.00	PASS
860.550	-70.53	-57.00	-13.53	PASS
919.350	-71.26	-57.00	-14.26	PASS
3712.000	-55.30	-47.00	-8.30	PASS
3732.500	-55.76	-47.00	-8.76	PASS
3794.500	-56.23	-47.00	-9.23	PASS
3832.500	-56.21	-47.00	-9.21	PASS
7236.500	-55.13	-30.00	-25.13	PASS

Plot for Channel = 13

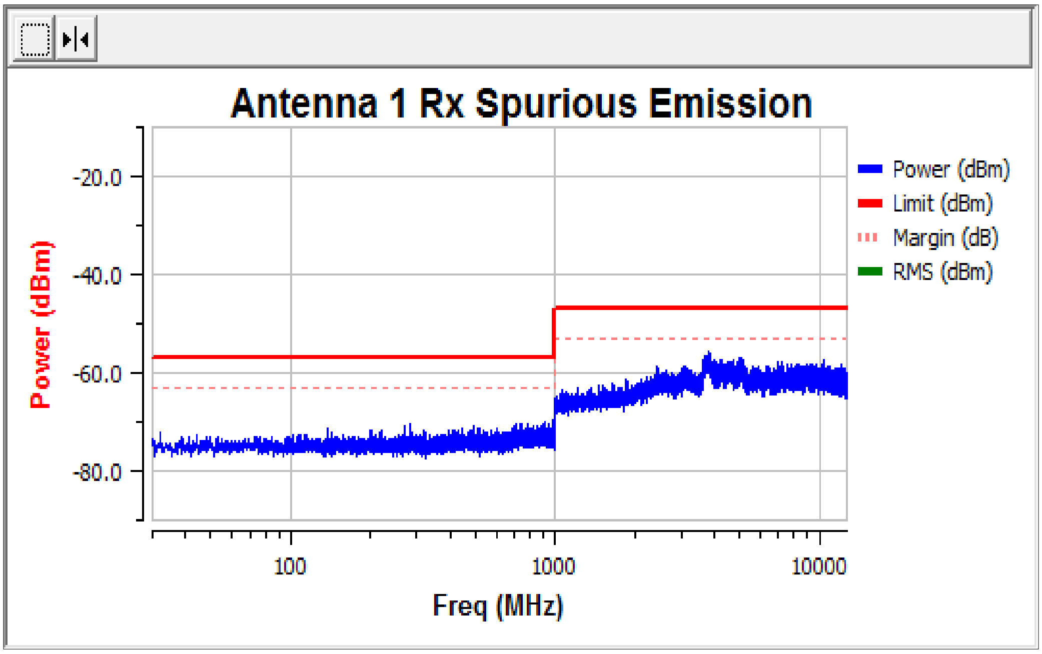


(Channel 13, 30MHz to 12.75GHz)

Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
730.400	-71.65	-57.00	-14.65	PASS
770.600	-71.87	-57.00	-14.87	PASS
826.150	-71.35	-57.00	-14.35	PASS
846.600	-71.91	-57.00	-14.91	PASS
960.400	-71.93	-57.00	-14.93	PASS
3726.500	-55.64	-47.00	-8.64	PASS
3755.500	-55.48	-47.00	-8.48	PASS
3801.500	-55.77	-47.00	-8.77	PASS
3845.500	-55.79	-47.00	-8.79	PASS
4603.000	-55.45	-47.00	-8.45	PASS

802.11n40 Mode:

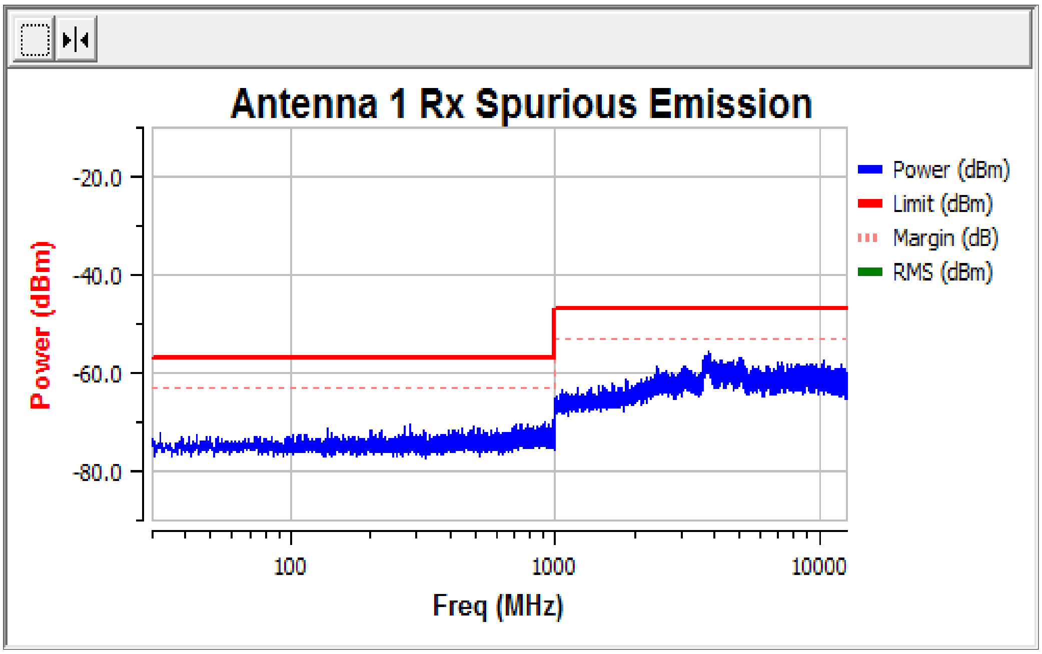
<u>Plot for Channel = 3</u>



(Channel 3, 30MHz to 12.75GHz)

Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
762.500	-69.52	-57.00	-12.52	PASS
800.800	-69.60	-57.00	-12.60	PASS
902.500	-69.10	-57.00	-12.10	PASS
934.600	-69.99	-57.00	-12.99	PASS
989.700	-69.61	-57.00	-12.61	PASS
3717.500	-56.48	-47.00	-9.48	PASS
3747.500	-55.90	-47.00	-8.90	PASS
3777.000	-56.42	-47.00	-9.42	PASS
3804.500	-55.34	-47.00	-8.34	PASS
3834.500	-56.33	-47.00	-9.33	PASS

Plot for Channel = 11



(Channel 11, 30MHz to 12.75GHz)

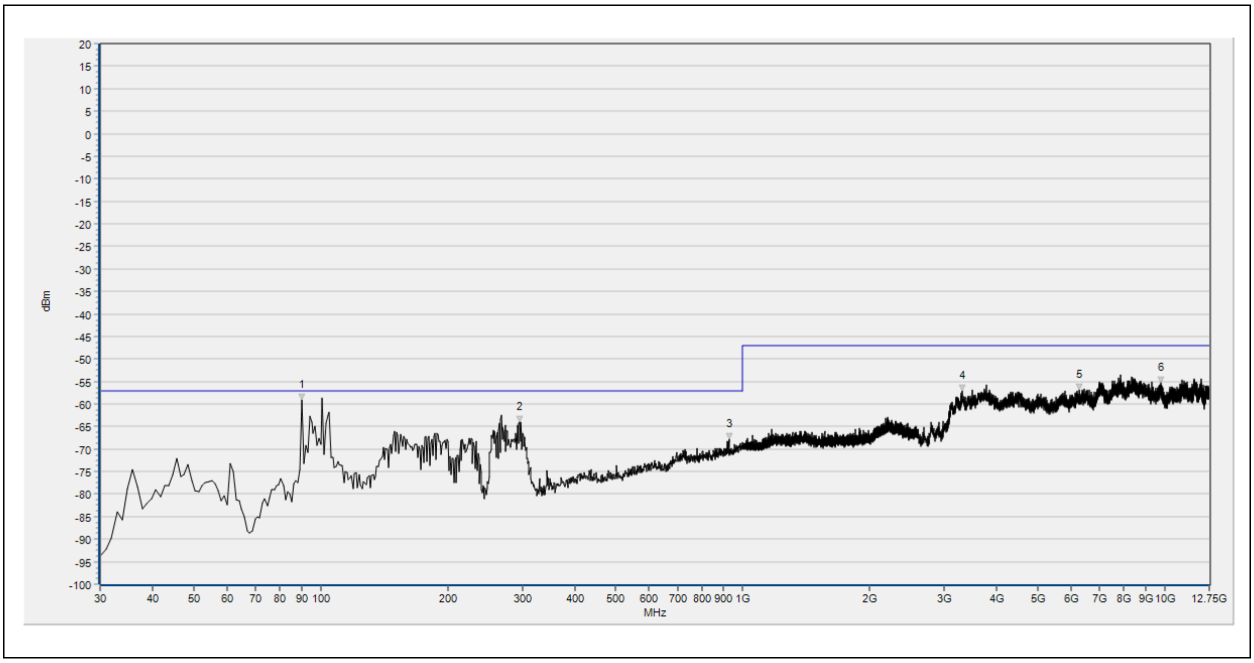
Freq (MHz)	Peak Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
711.450	-69.89	-57.00	-12.89	PASS
748.850	-69.82	-57.00	-12.82	PASS
790.100	-70.03	-57.00	-13.03	PASS
911.300	-69.78	-57.00	-12.78	PASS
976.750	-69.24	-57.00	-12.24	PASS
3717.500	-56.15	-47.00	-9.15	PASS
3761.000	-56.26	-47.00	-9.26	PASS
3817.500	-55.34	-47.00	-8.34	PASS
3845.500	-56.30	-47.00	-9.30	PASS
3889.500	-55.72	-47.00	-8.72	PASS

3.1.5.2 Result for Radiated test

Below is the worst case situation test data:

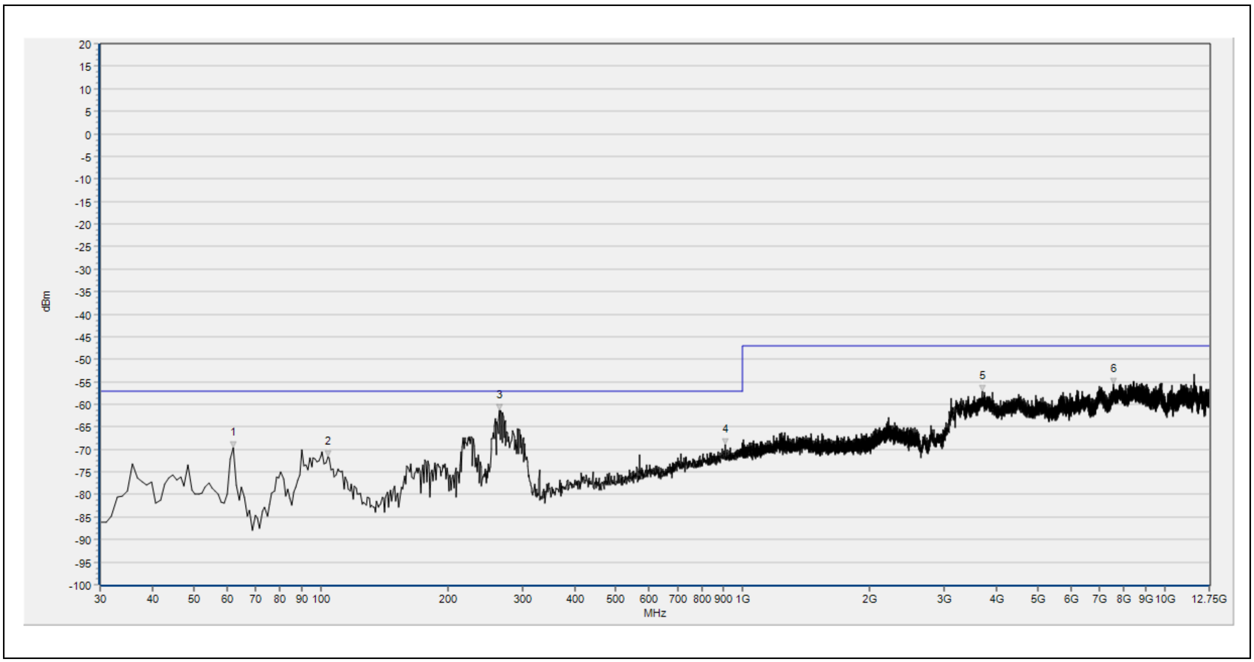
802.11b Mode

Plot for Channel = 1



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11b, channel 1)

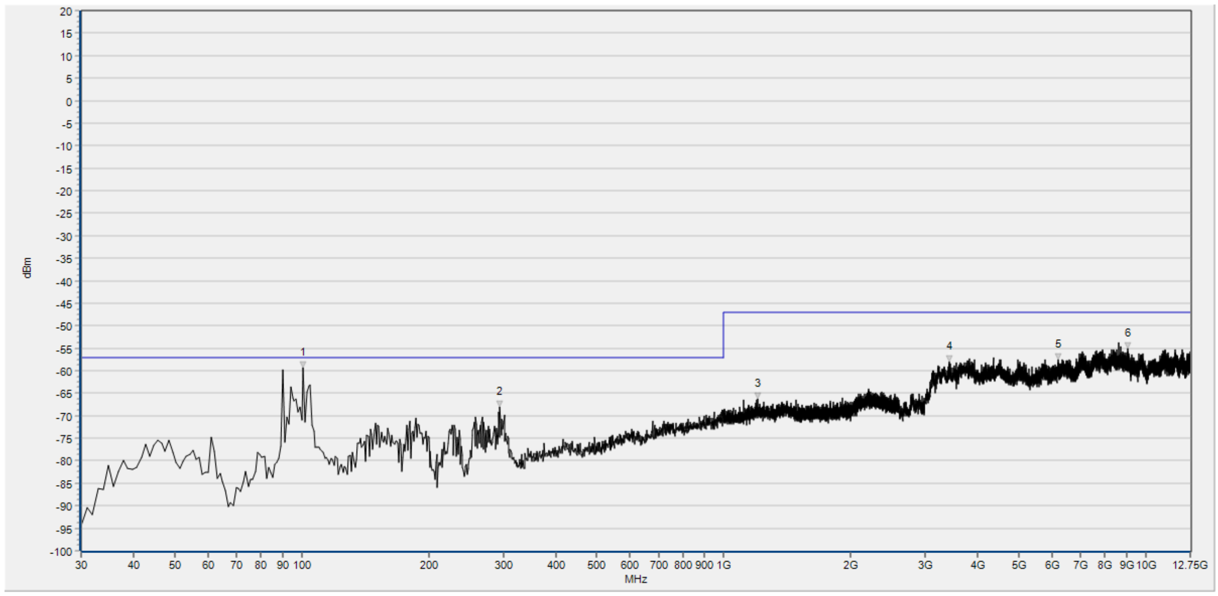
Test frequency range 30MHz to 12.75 GHz	Channel = 1				
	Receiver with modulation Mode at 2412MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	90.200	-59.03	-57.00	Horizontal	PASS
	296.046	-63.98	-57.00	Horizontal	PASS
	927.177	-67.89	-57.00	Horizontal	PASS
	3318.620	-57.10	-47.00	Horizontal	PASS
	6286.480	-56.78	-47.00	Horizontal	PASS
	9774.020	-55.37	-47.00	Horizontal	PASS



(30MHz to 12.75GHz, Antenna Vertical @ 802.11b, channel 1)

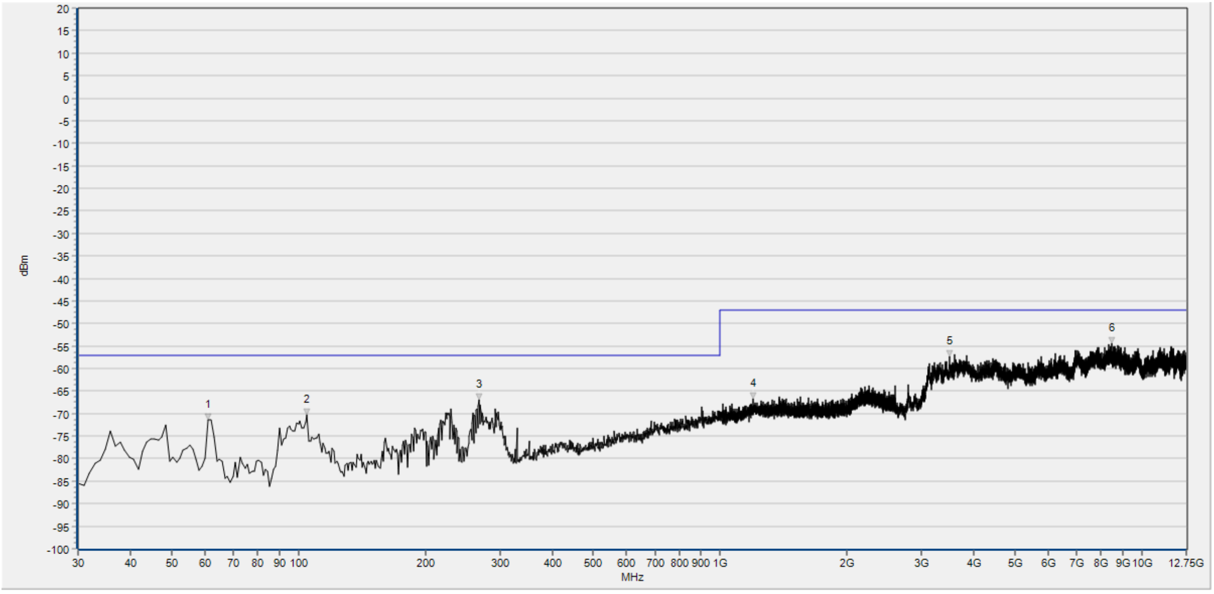
	Channel = 1				
	Receiver with modulation Mode at 2412MHz				
Test frequency range 30MHz to 12.75 GHz	**Frequency (MHz)**	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	62.042	-69.50	-57.00	Vertical	PASS
	103.794	-71.51	-57.00	Vertical	PASS
	264.975	-61.36	-57.00	Vertical	PASS
	907.758	-68.97	-57.00	Vertical	PASS
	3688.080	-57.04	-47.00	Vertical	PASS
	7545.080	-55.57	-47.00	Vertical	PASS

Plot for Channel = 13



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11b, channel 13)

<table>
<tr><td rowspan="8">Test frequency range 30MHz to 12.75 GHz</td><td colspan="5">Channel = 13</td></tr>
<tr><td colspan="5">Receiver with modulation Mode at 2472MHz</td></tr>
<tr><td>Frequency (MHz)</td><td>Peak (dBm)</td><td>Limit(PK)</td><td>Antenna</td><td>Verdict</td></tr>
<tr><td>100.881</td><td>-59.26</td><td>-57.00</td><td>Horizontal</td><td>PASS</td></tr>
<tr><td>295.075</td><td>-67.95</td><td>-57.00</td><td>Horizontal</td><td>PASS</td></tr>
<tr><td>1202.133</td><td>-66.35</td><td>-47.00</td><td>Horizontal</td><td>PASS</td></tr>
<tr><td>3430.270</td><td>-57.93</td><td>-47.00</td><td>Horizontal</td><td>PASS</td></tr>
<tr><td>6191.070</td><td>-57.61</td><td>-47.00</td><td>Horizontal</td><td>PASS</td></tr>
<tr><td></td><td>9067.580</td><td>-54.98</td><td>-47.00</td><td>Horizontal</td><td>PASS</td></tr>
</table>

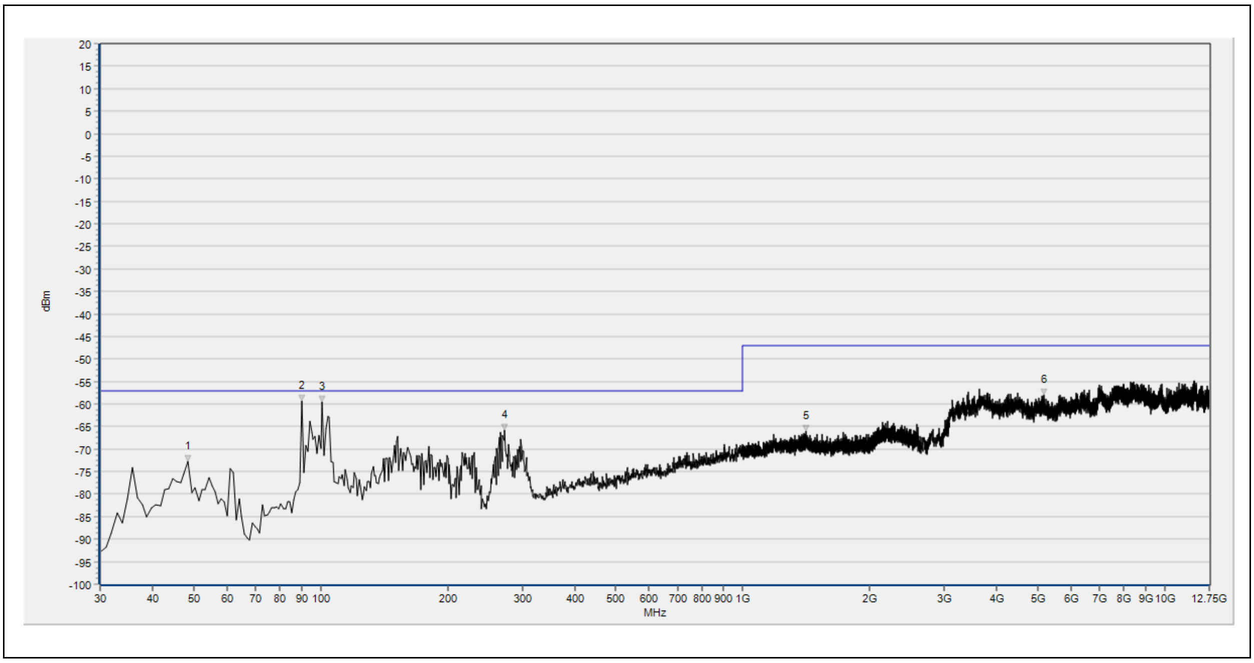


(Plot C.2: 30MHz to 12.75GHz, Antenna Vertical @ 802.11b, channel 13)

Test frequency range 30MHz to 12.75 GHz	Channel = 13				
	Receiver with modulation Mode at 2472MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	61.071	-71.45	-57.00	Vertical	PASS
	104.765	-70.19	-57.00	Vertical	PASS
	267.888	-66.87	-57.00	Vertical	PASS
	1196.800	-66.64	-47.00	Vertical	PASS
	3505.380	-57.26	-47.00	Vertical	PASS
	8464.670	-54.38	-47.00	Vertical	PASS

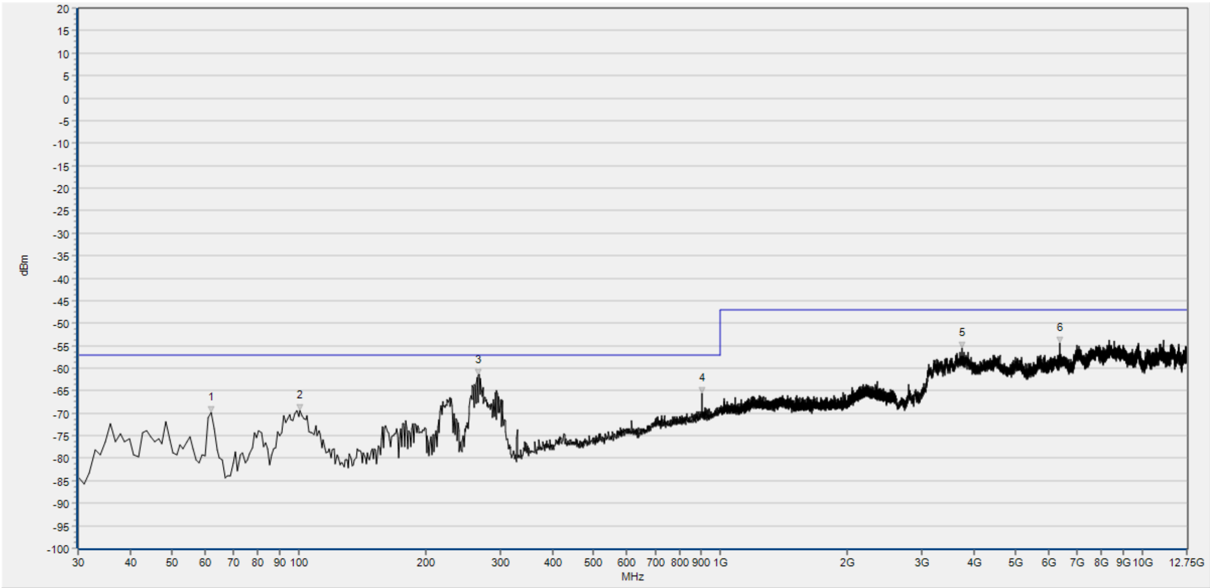
802.11n40 Mode

Plot for Channel = 3



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11n40, channel 3)

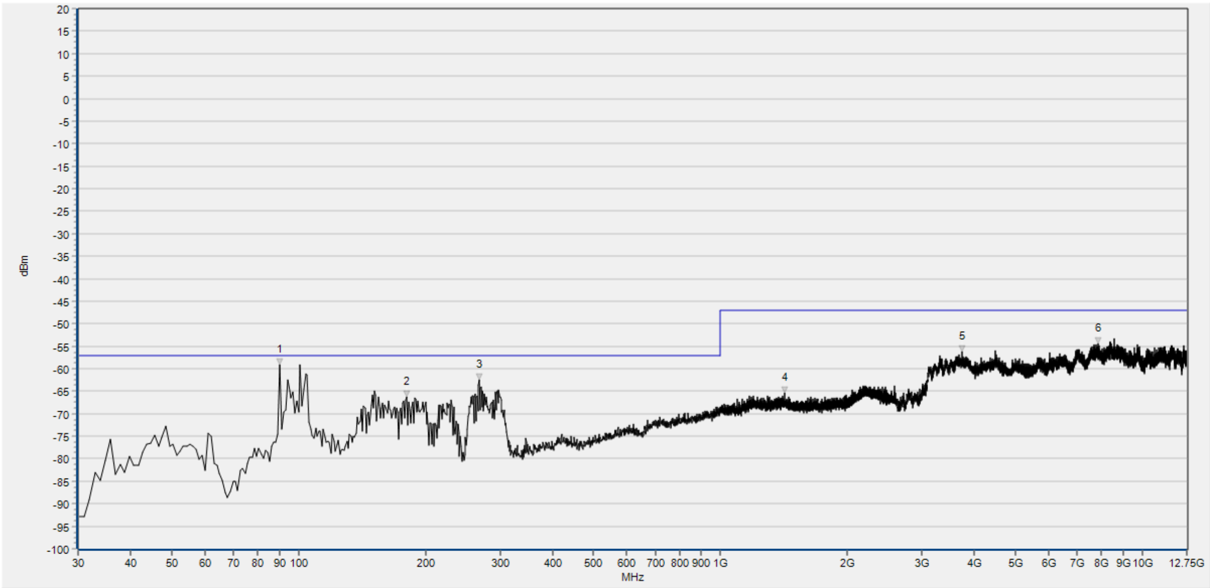
Test frequency range 30MHz to 12.75 GHz	Channel = 3				
	Receiver with modulation Mode at 2422MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	48.448	-72.72	-57.00	Horizontal	PASS
	90.200	-59.38	-57.00	Horizontal	PASS
	100.881	-59.48	-57.00	Horizontal	PASS
	272.743	-65.74	-57.00	Horizontal	PASS
	1409.600	-66.14	-47.00	Horizontal	PASS
	5174.040	-57.98	-47.00	Horizontal	PASS



(30MHz to 12.75GHz, Antenna Vertical @ 802.11n40, channel 3)

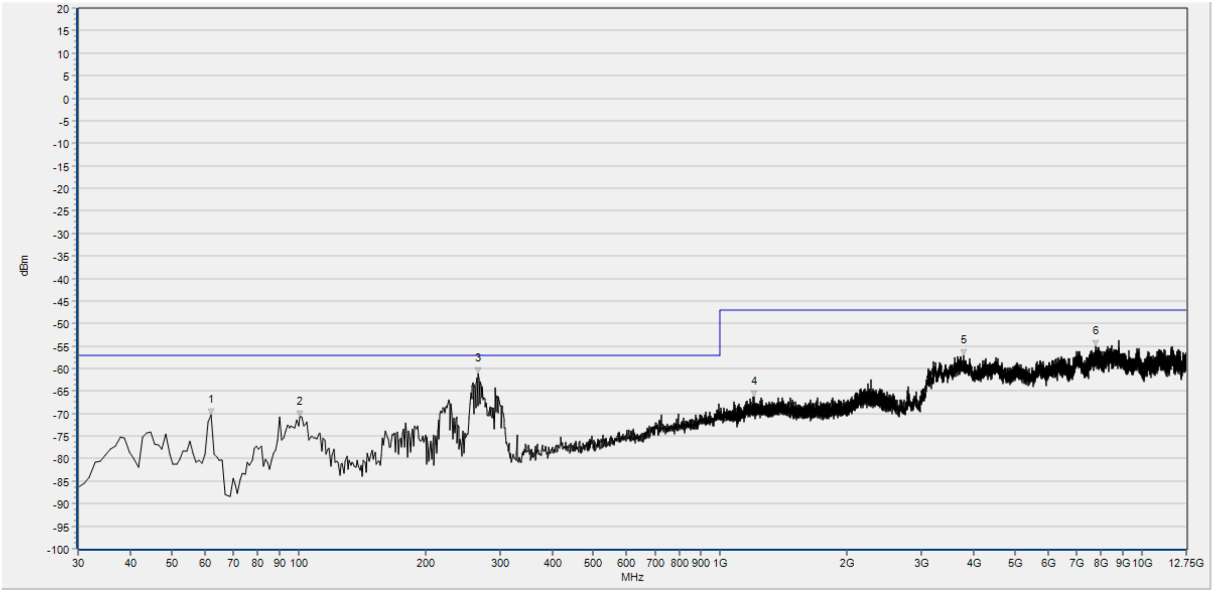
Test frequency range 30MHz to 12.75 GHz	Channel = 3				
	Receiver with modulation Mode at 2422MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	62.042	-69.81	-57.00	Vertical	PASS
	100.881	-69.46	-57.00	Vertical	PASS
	266.917	-61.67	-57.00	Vertical	PASS
	902.903	-65.58	-57.00	Vertical	PASS
	3738.830	-55.58	-47.00	Vertical	PASS
	6359.560	-54.51	-47.00	Vertical	PASS

Plot for Channel = 11



(30MHz to 12.75GHz, Antenna Horizontal @ 802.11n40, channel 11)

Test frequency range 30MHz to 12.75 GHz	Channel = 11				
	Receiver with modulation Mode at 2462MHz				
	Frequency (MHz)	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	90.200	-59.03	-57.00	Horizontal	PASS
	180.501	-66.16	-57.00	Horizontal	PASS
	267.888	-62.37	-57.00	Horizontal	PASS
	1416.533	-65.46	-47.00	Horizontal	PASS
	3740.860	-56.14	-47.00	Horizontal	PASS
	7837.400	-54.33	-47.00	Horizontal	PASS



(30MHz to 12.75GHz, Antenna Vertical @ 802.11n40, channel 11)

	Channel = 11				
	Receiver with modulation Mode at 2462MHz				
Test frequency range 30MHz to 12.75 GHz	**Frequency (MHz)**	**Peak (dBm)**	**Limit(PK)**	**Antenna**	**Verdict**
	62.042	-70.28	-57.00	Vertical	PASS
	100.881	-70.68	-57.00	Vertical	PASS
	266.917	-61.02	-57.00	Vertical	PASS
	1203.733	-66.18	-47.00	Vertical	PASS
	3775.370	-57.08	-47.00	Vertical	PASS
	7772.440	-55.08	-47.00	Vertical	PASS

3.2. EN 300 328 §4.3.2.11 - Receiver Blocking

3.2.1. Definition

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation in the presence of an unwanted signal (blocking signal) at frequencies other than those of the operating band.

3.2.2. Limit

3.2.2.1 General

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 14, table 15 or table 16.

3.2.2.2 Receiver Category 1

Table 14 contains the Receiver Blocking parameters for Receiver Category 1 equipment.

Table 14: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 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 levels have to be corrected by the actual antenna assembly gain.			

3.2.2.3 Receiver Category 2

Table 15 contains the Receiver Blocking parameters for Receiver Category 2 equipment.

Table 15: Receiver Blocking parameters receiver category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 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 levels have to be corrected by the actual antenna assembly gain.			

3.2.2.4 Receiver Category 3

Table 16 contains the Receiver Blocking parameters for Receiver Category 3 equipment.

Table 16: Receiver Blocking parameters receiver category 3 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 12 dB	2 380 2 503,5	-57	CW
P_{min} + 12 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 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 levels have to be corrected by the actual antenna assembly gain.			

3.2.3. Test condition

See clause 5.1 for the environmental test conditions. These measurements shall only be performed at normal test conditions.

For non-frequency hopping equipment, having more than one operating channel, the equipment shall be tested operating at both the lowest and highest operating channels. Equipment which can change their operating channel automatically (adaptive channel allocation), and where this function cannot be disabled, shall be tested as a frequency hopping equipment.

If the equipment can be configured to operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz) and different data rates, then the combination of the smallest channel bandwidth and the lowest data rate for this channel bandwidth which still allows the equipment to operate as intended shall be used. This mode of operation shall be aligned with the performance criteria defined in clause 4.3.1.12.3 or clause 4.3.2.11.3 as declared by the manufacturer (see clause 5.4.1 t)) and shall be described in the test report.

It shall be verified that this performance criteria as declared by the manufacturer is achieved..

3.2.4. Test procedures

For systems using multiple receive chains only one chain (antenna port) need to be tested. All other receiver inputs shall be terminated.

Figure 6 shows the test set-up which can be used for performing the receiver blocking test..

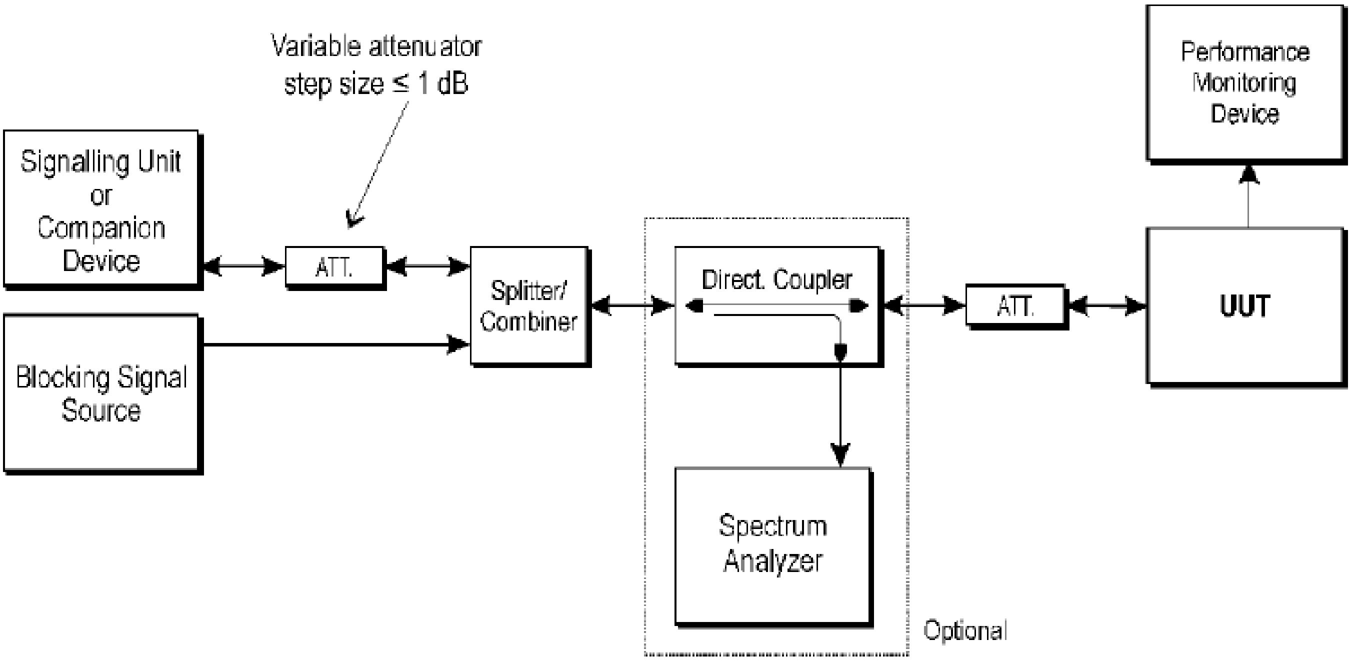


Figure 6: Test Set-up for receiver blocking

The procedure in step 1 to step 6 below shall be used to verify the receiver blocking requirement as described in clause 4.3.1.12 or clause 4.3.2.11.

Table 6, table 7 and table 8 in clause 4.3.1.12.4 contain the applicable blocking frequencies and blocking levels for each of the receiver categories for testing Receiver Blocking on frequency hopping equipment.

Table 14, table 15 and table 16 in clause 4.3.2.11.4 contain the applicable blocking frequencies and blocking levels for each of the receiver categories for testing Receiver Blocking on equipment using wide band modulations other than FHSS.

Step 1:

• For non-frequency hopping equipment, the UUT shall be set to the lowest operating channel.

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. 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 Pmin.

• This signal level (Pmin) is increased by the value provided in the 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. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is met.

Step 5:

• Repeat step 4 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 6:

• For non-frequency hopping equipment, repeat step 2 to step 5 with the UUT operating at the highest operating channel.

3.2.5. Results

Below is the worst case situation test data:

802.11b: 2412MHz:

Receiver Blocking parameters for Receiver Category 1 equipment							
P_{min}=-80dBm							
Wanted signal mean power from companion device (dBm)	**Blocking signal frequency (MHz)**	**Blocking signal power (dBm) (see note 2)**	**Type of blocking signal**	**Send packets**	**Receiver Pack**	**PER (%)**	**Verdict**
P_{min} + 6 dB	2 380	-53	CW	1000	994	0.6	PASS
	2 503,5	-53	CW	1000	996	0.4	PASS
P_{min} + 6 dB	2 300	-47	CW	1000	996	0.4	PASS
	2 330	-47	CW	1000	994	0.6	PASS
	2 360	-47	CW	1000	992	0.8	PASS
P_{min} + 6 dB	2 523,5	-47	CW	1000	993	0.7	PASS
	2 553,5	-47	CW	1000	993	0.7	PASS
	2 583,5	-47	CW	1000	993	0.7	PASS
	2 613,5	-47	CW	1000	995	0.5	PASS
	2 643,5	-47	CW	1000	991	0.9	PASS
	2 673,5	-47	CW	1000	990	1	PASS
NOTE 1: P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 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 levels have to be corrected by the actual antenna assembly gain.							

802.11b: 2472MHz:

Receiver Blocking parameters for Receiver Category 1 equipment							
P_{min}=-83dBm							
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal	Send packets	Receiver Pack	PER (%)	Verdict
P_{min} + 6 dB	2 380	-53	CW	1000	992	0.8	PASS
	2 503,5	-53	CW	1000	992	0.8	PASS
P_{min} + 6 dB	2 300	-47	CW	1000	989	1.1	PASS
	2 330	-47	CW	1000	984	1.6	PASS
	2 360	-47	CW	1000	987	1.3	PASS
P_{min} + 6 dB	2 523,5	-47	CW	1000	978	2.2	PASS
	2 553,5	-47	CW	1000	980	2	PASS
	2 583,5	-47	CW	1000	986	1.4	PASS
	2 613,5	-47	CW	1000	991	0.9	PASS
	2 643,5	-47	CW	1000	983	1.7	PASS
	2 673,5	-47	CW	1000	988	1.2	PASS
NOTE 1: P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 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 levels have to be corrected by the actual antenna assembly gain.							

3.3. EN 300 328 §4.3.2.12 - Geo-location capability

3.3.1. Definition

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.

3.3.2. Requirements

The geographical location determined by the equipment as defined in clause 3.3.1 shall not be accessible to the user.

3.3.3. Results

The geographical location determined by the equipment shall not be accessible to the user.

Annex A Photographs of Test Setup

1. Radiated Measurement Setup

2. Conducted Measurement Setup

Annex B Test Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±5%
RF output power, conducted	±1,5%
Power Spectral Density, conducted	±3dB
Unwanted Emissions, conducted	±3dB
All emissions, radiated	±6dB
Temperature	±3°C
Supply voltages	±3%
Time	±5%

Annex C Information of EUT

C.1 Introduction

Notwithstanding the provisions of the copyright clause related to the text of the present document, ETSI grants that users of the present document may freely reproduce the application form pro forma in this annex so that it can be used for its intended purposes and may further publish the completed application form.

The form contained in this annex may be used by the manufacturer to comply with the requirement contained in clause 5.4.1 to provide the necessary information about the equipment to the test laboratory prior to the testing. It contains product information as well as other information which might be required to define which configurations are to be tested, which tests are to be performed as well the test conditions.

This application form should form an integral part of the test report.

C.2 Information as required by ETSI EN 300 328 V2.1.1, clause 5.4.1

In accordance with ETSI EN 300 328, clause 5.4.1, the following information is provided by the manufacturer..

a) The type of modulation used by the equipment:

☐FHSS

☑Other forms of modulation

b) In case of FHSS modulation:

• In case of non-Adaptive Frequency Hopping equipment:

The number of Hopping Frequencies: …………..

• In case of Adaptive Frequency Hopping Equipment:

The maximum number of Hopping Frequencies: …………..

The minimum number of Hopping Frequencies: …………..

• The (average) Dwell Time: …………..

c) Adaptive / non-adaptive equipment:

☐non-adaptive Equipment

☑adaptive Equipment without the possibility to switch to a non-adaptive mode

☐adaptive Equipment which can also operate in a non-adaptive mode

d) In case of adaptive equipment:

The maximum Channel Occupancy Time implemented by the equipment: <u>0.84</u> ms

☐The equipment has implemented an LBT based DAA mechanism

• In case of equipment using modulation different from FHSS:

☐The equipment is Frame Based equipment

☑The equipment is Load Based equipment

☐The equipment can switch dynamically between Frame Based and Load Based equipment

The CCA time implemented by the equipment: <u>N/A</u> μs

☐The equipment has implemented a non-LBT based DAA mechanism

☐The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): ………. dBm

The maximum (corresponding) Duty Cycle: ………. %

Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle

and corresponding power levels to be declared):...........

f) The worst case operational mode for each of the following tests:

- RF Output Power: _802.11b_
- Power Spectral Density: 802.11b 1Mbps
- Duty cycle, Tx-Sequence, Tx-gap: N/A
- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment): N/A
- Hopping Frequency Separation (only for FHSS equipment) : N/A
- Medium Utilisation: N/A
- Adaptivity & Receiver Blocking: 802.11b
- Occupied Channel Bandwidth: 802.11n40
- Transmitter unwanted emissions in the OOB domain: 802.11b 1Mbps
- Transmitter unwanted emissions in the spurious domain: 802.11b 1Mbps
- Receiver spurious emissions: 802.11b 1Mbps

g) The different transmit operating modes (tick all that apply):

☑ Operating mode 1: Single Antenna Equipment

☑Equipment with only one antenna

☐Equipment with two diversity antennas but only one antenna active at any moment in time

☐Smart Antenna Systems with two or more antennas, but operating in a (legacy) mode where only one antenna is used (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)

☐Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming

☐Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2

NOTE 1: Add more lines if more channel bandwidths are supported.

☐Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming

☐Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2

NOTE 2: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems:

- The number of Receive chains: ....
- The number of Transmit chains: ....

☐symmetrical power distribution

☐asymmetrical power distribution

In case of beam forming, the maximum (additional) beam forming gain: .... dB

NOTE: The additional beam forming gain does not include the basic gain of a single antenna.

i) Operating Frequency Range(s) of the equipment:

• Operating Frequency Range 1: 2400 MHz to 2483.5 MHz

NOTE: Add more lines if more Frequency Ranges are supported.

j) Nominal Channel Bandwidth(s):

• Occupied Channel Bandwidth 1: 20 MHz

• Occupied Channel Bandwidth 2: 40 MHz

NOTE: Add more lines if more channel bandwidths are supported..

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

☑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

l) The normal and the extreme operating conditions that apply to the equipment:

Normal operating conditions (if applicable):

Operating temperature: 25 ° C

Other (please specify if applicable): ……

Extreme operating conditions:

Operating temperature range: Minimum: -20 ° C Maximum 50 ° C

Other (please specify if applicable): …… Minimum: …… Maximum ……

Details provided are for the:

☑ stand-alone equipment

☐combined (or host) equipment

☐test jig

m) The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p. levels:

• Antenna Type:

☑Integral Antenna (information to be provided in case of conducted measurements)

Antenna Gain: 0.49 dBi

If applicable, additional beamforming gain (excluding basic antenna gain): .... dB

☐Temporary RF connector provided

☑No temporary RF connector provided

☐Dedicated Antennas (equipment with antenna connector)

☐Single power level with corresponding antenna(s)

☐Multiple power settings and corresponding antenna(s)

Number of different Power Levels: ....
Power Level 1: .... dBm
Power Level 2: .... dBm
Power Level 3: .... dBm
NOTE 1: Add more lines in case the equipment has more power levels.
NOTE 2: These power levels are conducted power levels (at antenna connector).

• For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable

Power Level 1: .... dBm

Number of antenna assemblies provided for this power level: N/A

Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model name
1			
2			
3			
4			

NOTE3: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 2: .... dBm

Number of antenna assemblies provided for this power level: ....

Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model name
1			
2			
3			
4			

NOTE4: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 3: .... dBm

Number of antenna assemblies provided for this power level: ....

Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model name
1			
2			
3			
4			

NOTE5: Add more rows in case more antenna assemblies are supported for this power level.

n) The nominal voltages of the stand-alone radio equipment or the nominal 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 N/A V

☑DC State DC voltage 3.8 V

In case of DC, indicate the type of power source

☐Internal Power Supply

☐External Power Supply or AC/DC adapter

☑Battery

☐Other: ....

o) Describe the test modes available which can facilitate testing:

Use special software to control the EUT transmit or receiver.

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], IEEE 802.15.4™ [i.4], proprietary, etc.): IEEE 802.11 b/g/n

q) If applicable, the statistical analysis referred to in clause 5.4.1 q)

(to be provided as separate attachment)

r) If applicable, the statistical analysis referred to in clause 5.4.1 r)

(to be provided as separate attachment)

s) Geo-location capability supported by the equipment:

☑Yes

☑The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user

☐No

t) Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 or clause 4.3.2.11.3):...........

E.3: Configuration for testing (see clause 5.3.2.3 of ETSI EN 300 328 V2.1.1)

From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 5.4.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment. Unless otherwise specified in ETSI EN 300 328, this power setting is to be used for testing against the requirements of ETSI EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also ETSI EN 300 328, clause 5.3.2.3.

Highest overall e.i.r.p. value: 14.60 dBm	
Corresponding Antenna assembly gain: 0.49 dBi	Antenna Assembly #: N/A
Corresponding conducted power setting: N/A dBm (also the power level to be used for testing)	Listed as Power Setting #: Max Power Setting

C.4 Additional information provided by the applicant

C.4.1 Modulation

ITU Class(es) of emission: ....

Can the transmitter operate unmodulated? ☐yes ☑no

C.4.2 Duty Cycle

The transmitter is intended for: ☑ Continuous duty

☐Intermittent duty

☐Continuous operation possible for testing purposes

C.4.3 About the UUT

☑The equipment submitted are representative production models

☐If not, the equipment submitted are pre-production models?

☐If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested

☐If not, supply full details...............

C.4.4 Additional items and/or supporting equipment provided

☐Spare batteries (e.g. for portable equipment)

☑Battery charging device

☐External Power Supply or AC/DC adapter

☐Test jig or interface box

☐RF test fixture (for equipment with integrated antennas)

☑Host System Manufacturer: Shenzhen Chainway Information Technology Co.,Ltd.
Model #: N/A.
Model name: C72

☐Combined equipment Manufacturer: ....
Model #: ....
Model name: ....

☑User Manual

☑Technical documentation (Handbook and circuit diagrams)

Annex D Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Test Equipments Utilized

3.1 EN300328 Test system

Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Base Station	Anritsu	MT8852B	6K00006210	2017.05.24	2018.05.23
Temperature Chamber	CHONGQING HANBA EXPERIMENTAL EQUIPMENT CO.,LTD	HUT705P	(N/A.)	2017.05.24	2018.05.23
Power Splitter	Mini-Circuits	ZFRSC-183+	SF808201417	2017.05.24	2018.05.23
DC Power Supply	Good Will Instrument Co.,Ltd.	(N/A)	(N/A)	2017.05.24	2018.05.23
Attenuator 1	Resnet	20dB	(N/A)	2017.05.24	2018.05.23
MXG Vector Signal Generator	Angilent	N5182B	MY53050961	2017.05.24	2018.05.23
EXG Analog Signal Generator	Angilent	N5171B	MY53050558	2017.05.24	2018.05.23
EXA Signal analyzer	Angilent	N9010A	MY53470836	2017.12.02	2018.12.01
USB Power Sensor	Angilent	U2021XA	MY54210011	2017.05.24	2018.05.23

3.2 List of Software Used

Description	Manufacturer	Software Version
Test system	Tonscend	V2.6
Power Panel	Agilent	V3.8

3.3 RSE Test System

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
MXE EMI Receiver	MY54130016	N9038A	Agilent	2017.05.17	2018.05.16
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2017.05.14	2018.05.13
Test Antenna - Horn	01774	BBHA 9120D	Schwarzbeck	2017.09.13	2018.09.12
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

——— END OF REPORT ———