

EN 300 328 RF Test Report (WLAN)

Report No.: RE171207E10I

Test Model: BLACK bean

Received Date: Jan. 17, 2017

Test Date: Jan. 17 to Mar. 16, 2017

Issued Date: Apr. 15, 2019

Applicant: UAB 8devices

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Release Control Record

Issue No.	Description	Date Issued
RE171207E10I	Original release.	Apr. 15, 2019

1 Certificate of Conformity

Product: BLACK-Bean
Brand: 8devices
Test Model: BLACK bean
Sample Status: R&D SAMPLE
Applicant: UAB 8devices
Test Date: Jan. 17 to Mar. 16, 2017
Standards: EN 300 328 V2.1.1 (2016-11)

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Phoenix Huang, **Date:** Apr. 15, 2019
Phoenix Huang / Specialist

Approved by : Max Chen, **Date:** Apr. 15, 2019
Max Chen / Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 300 328 V2.1.1		
Clause	Test Parameter	Results
4.3.2.6	Adaptivity (Adaptive Equipment using modulation other than FHSS)	Pass
4.3.2.11	Receiver Blocking	Pass

2.1 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSW8	101497	Aug. 11, 2016	Aug. 10, 2017
ESG Vector signal generator Agilent	E4438C	MY47271330 506 602 UNJ	Sep. 26, 2016	Sep. 25, 2017
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010004	NA	NA
ESG Vector signal generator Agilent	E4438C	MY45094468/0 05 506 602 UK6 UNJ	Nov. 25, 2016	Nov. 24, 2017
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010001	NA	NA
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53052647	July 25, 2016	July 24, 2017
Direct Coupler EMCI	CS20-18-436/16	1139	NA	NA
Power Splitter/combiner Mini-Circuits	ZN4PD-642W-S +	408501327_0 3	Oct. 11, 2016	Oct. 10, 2017
Power Splitter/combiner Mini-Circuits	ZN4PD-642W-S +	408501327_0 4	Oct. 11, 2016	Oct. 10, 2017

- NOTE:**
1. The test was performed in Adaptivity room.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Jan. 17 to Mar. 16, 2017

2.2 Measurement Uncertainty

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

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

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 1.132 \times 10^{-4} \%$
RF output power, conducted	$\pm 1.207 \text{ dB}$
Power Spectral Density, conducted	$\pm 1.207 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 4.925 \text{ dB}$
Temperature	$\pm 0.6^\circ \text{C}$
Supply voltages	$\pm 0.04\%$
Time	$\pm 5 \%$

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 300 328 standard, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor) $k = 1,96$ or $k = 2$ (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028-1, in particular in annex D of the ETSI TR 100 028-2.

Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 1,5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 6 \text{ dB}$
Temperature	$\pm 3^\circ \text{C}$
Supply voltages	$\pm 3 \%$
Time	$\pm 5 \%$

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (WLAN)

Product	BLACK-Bean
Brand	8devices
Test Model	BLACK bean
Status of EUT	R&D SAMPLE
Nominal Voltage	3.3Vdc from host equipment
Voltage Operation Range	Vnom= 230Vac
Temperature Operating Range	-10°C ~ 70°C
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n : up to 150Mbps 802.11ac: up to 433.3Mbps
Operating Frequency	2.4GHz: 2412 ~ 2472MHz 5GHz: 5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5700MHz
Number of Channel	2.4GHz 802.11b/g, 802.11n (HT20), VHT20: 13 802.11n (HT40), VHT40: 9 5GHz 802.11a, 802.11n (HT20) , 802.11ac (VHT20): 19 802.11n (HT40) , 802.11ac (VHT40): 9 802.11ac (VHT80): 4
Adaptive/Non-Adaptive	<input type="checkbox"/> non-adaptive Equipment <input checked="" type="checkbox"/> adaptive Equipment without the possibility to switch to a non-adaptive mode <input type="checkbox"/> adaptive Equipment which can also operate in a non-adaptive mode
EIRP Power (Measured Max. Average)	2.4GHz: 19.85dBm 5GHz: 22.21dBm
Antenna Type	See item 3.2
Antenna Connector	See item 3.2
Accessory Device	NA
Data Cable Supplied	NA

Note:

- This is a supplementary report of Report No: RE171207E10I-A. The differences between them are as below information:
 - ◆ Upgraded standard version to EN 300 328 V2.1.1
- Per the client requirement & above conditions, only Adaptivity and Receiver Blocking test item need to be performed. And all data was verified to meet the requirements.
- There are Bluetooth technology and WLAN technology used for the EUT.
- The EUT incorporates a 1T1R function.

2.4GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1TX	1RX
802.11g	6 ~ 54Mbps	1TX	1RX
802.11n (HT20)	MCS 0~7	1TX	1RX
802.11n (HT40)	MCS 0~7	1TX	1RX
VHT20	MCS 0~8, Nss=1	1TX	1RX
VHT40	MCS 0~9, Nss=1	1TX	1RX
5GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	1TX	1RX
802.11n (HT20)	MCS 0~7	1TX	1RX
802.11n (HT40)	MCS 0~7	1TX	1RX
802.11ac (VHT20)	MCS 0~8, Nss=1	1TX	1RX
802.11ac (VHT40)	MCS 0~9, Nss=1	1TX	1RX
802.11ac (VHT80)	MCS 0~9, Nss=1	1TX	1RX

- The EUT was pre-tested under the following modes:

Test Mode	Data rate
Mode A	400ns GI
Mode B	800ns GI

From the above modes, the worst case was found in **Mode B**. Therefore only the test data of the mode was recorded in this report.

- WLAN/BT coexistence mode:

- ◆ 1x1 WLAN + BT:
 - 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
 - 2.4GHz: timely shared coexistence.

- Spurious Emission (conducted & radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11a) + Bluetooth (GFSK)	36 to 140	36	OFDM
	0 to 78	78	FHSS

- The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Antenna

The antenna gain was declared by client; please refer to the following table:

Ant. No.	Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)	5GHz Gain with cable loss (dBi)	2.4GHz Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
1	Main	WNC	81-EBJ15.005	PIFA	3.00	Band 1&2: 2.56	1.15	Band 1&2: 1.70	IPEX	300
						Band 3: 4.76		Band 3: 1.74		
						Band 4: 4.76		Band 4: 1.79		
	Aux	WNC	81-EBJ15.005	PIFA	3.62	Band 1&2: 3.08	1.15	Band 1&2: 1.70	IPEX	300
						Band 3: 3.31		Band 3: 1.74		
						Band 4: 2.42		Band 4: 1.79		
2	Main	WNC	81.ED415.001	PIFA	0.22	Band 1&2: 5.56	0.96	Band 1&2: 1.29	IPEX	300
						Band 3: 5.03		Band 3: 1.36		
						Band 4: 3.14		Band 4: 1.38		
	Aux	WNC	81.ED415.001	PIFA	1.48	Band 1&2: 5.17	0.96	Band 1&2: 1.29	IPEX	300
						Band 3: 5.34		Band 3: 1.36		
						Band 4: 2.93		Band 4: 1.38		

Note: 1. Above antenna gains of antenna are Total (H+V).

3.3 Description of Test Modes

13 channels are provided for 802.11b, 802.11g, 802.11n (HT20), VHT20:

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

9 channels are provided for 802.11n (HT40), VHT40:

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

3.3.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to		Description
	AD	RB	
-	√	√	-

Where **AD**: Adaptivity (Channel Access Mechanism) **RB**: Receiver Blocking

Adaptivity Test:

Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY
802.11b	1 to 13	1, 13	DSSS
802.11g	1 to 13	1, 13	OFDM
802.11n (HT20)	1 to 13	1, 13	OFDM
802.11n (HT40)	3 to 11	3, 11	OFDM

Receiver Blocking test:

Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
802.11b	1 to 13	1, 13	DSSS	1

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
AD	25deg. C, 60%RH	230Vac, 50Hz	Denny Liu
RB	23deg. C, 62%RH	230Vac, 50Hz	Allen Chuang

3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

EN 300 328 V2.1.1 (2016-11)

All test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

4.1 Adaptivity (adaptive equipment using modulations other than FHSS)

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

4.1.1 Limit of Adaptive

Applicability of adaptive requirements and limit for wide band modulation techniques Interference threshold level

Requirement	Operational Mode			
	Non-LBT based Detect and Avoid	Frame Based Equipment	Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)	Load Based Equipment (Not using any of the mechanisms referenced)
Minimum Clear Channel Assessment (CCA) Time	NA	18 us (see note 1)	(see note 2)	18 us (see note 1)
Maximum Channel Occupancy (COT) Time	40 ms	1 ms to 10 ms	(see note 2)	13ms
Minimum Idle Period	5us	5% of COT	(see note 2)	18us (see note 3)
Extended CCA check	NA	NA	(see note 2)	18us~160us
Short Control Signalling Transmissions	Maximum duty cycle of 10 % within an observation period of 50 ms (see note 4)			
NOTE 1: The CCA time used by the equipment shall be declared by the supplier.				
NOTE 2: 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 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				
NOTE 3: 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.				
NOTE 4: Adaptive equipment may or may not have Short Control Signalling Transmissions				

Threshold Level for Non-LBT based Detect and Avoid	
Maximum transmit power (P _H) EIRP dBm	Threshold level (TL) (see notes 1 and 2)
20	-70 dBm / MHz
NOTE 1: For a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G)	
NOTE 2: For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to: TL = -70 dBm/MHz + 10 x log ₁₀ (100 mW / P _{out}) ; (P _{out} in mW e.i.r.p.)	

Unwanted signal parameters for Non-LBT based Detect and Avoid

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30	2 395 or 2 488,5 (see note 1)	-35 (see note 2)

NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz.

NOTE 2: 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.

4.1.2 Test Procedure

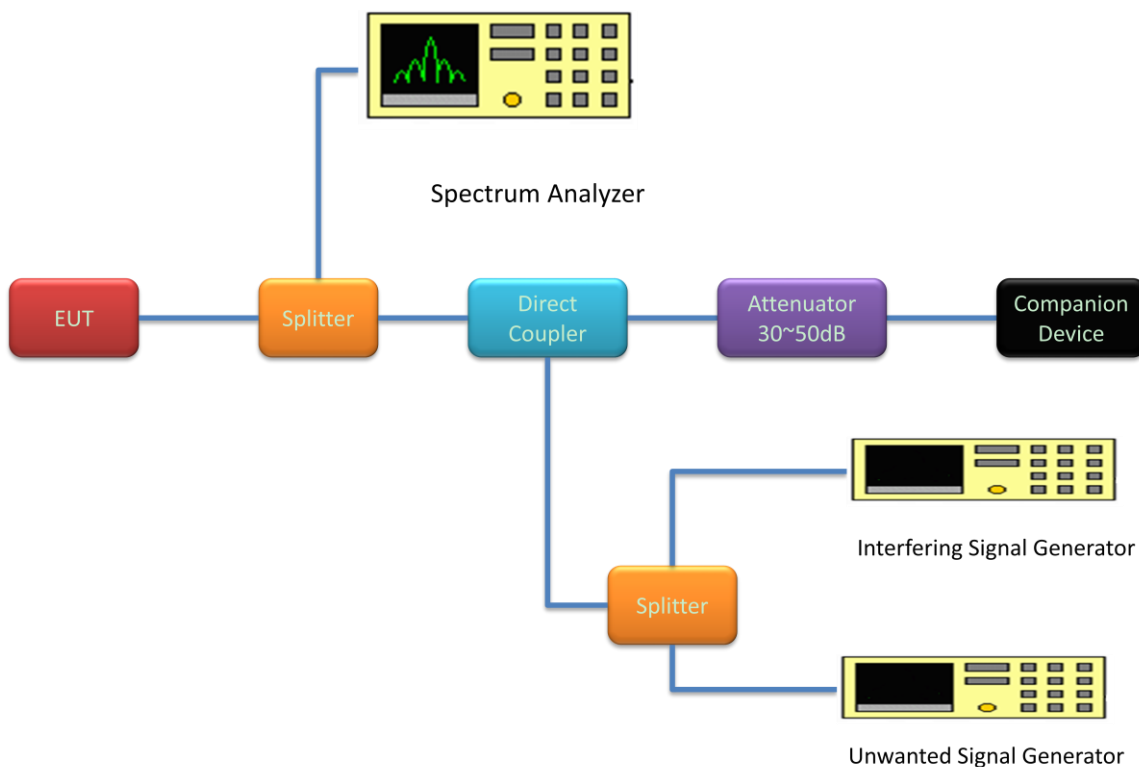
Refer to chapter 5.4.6 of EN 300 328 V2.1.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 Test Setup Configuration



UUT Software and Firmware Version

Product	Model No.	Software/Firmware Version
BLACK-Bean	BLACK bean	2016/12/27 11.0.0.729

Companion Device information

Product	Brand	Model No.	Software/Firmware Version
Wireless AC Module	ALPHA	WMC-AC01	1.0.0 Mon 04 Feb 2013

Note: This module WMC-AC01 was installed in the DIR-868L AP.

4.1.5 List of Measurements

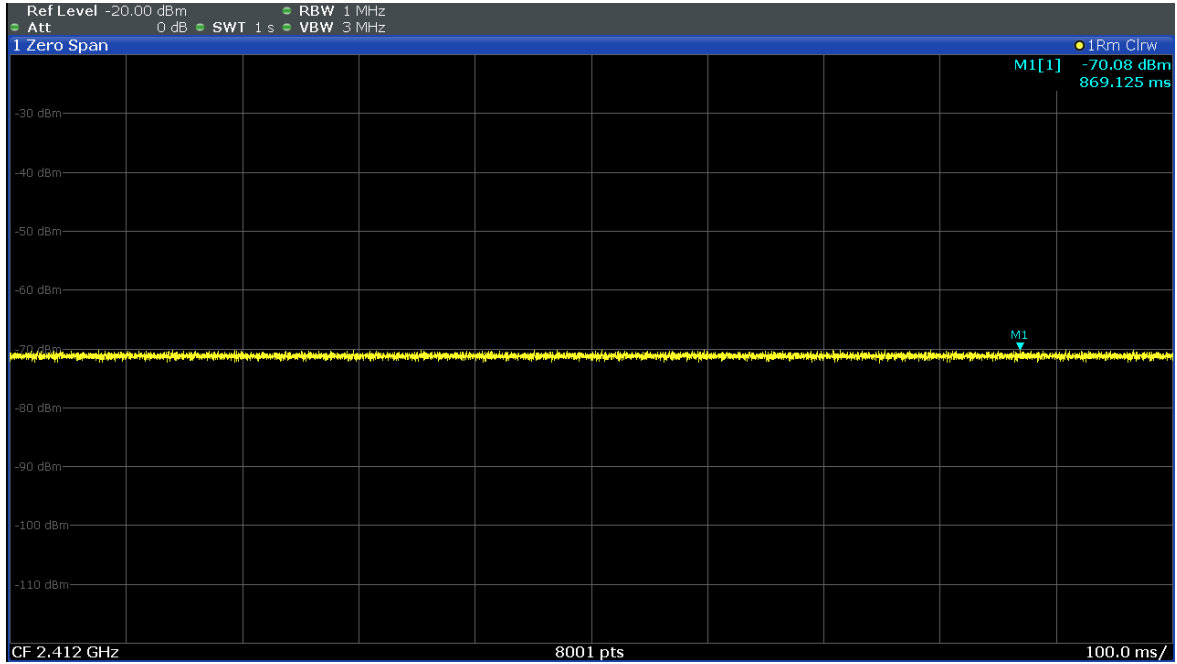
UUT Operational Mode	Applicable	Limit	
		The Maximum Channel Occupancy Time	The Minimum idle Period
Frame Based Equipment		meet in 1ms ~ 10ms	>5% x channel occupancy time
Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)		Follow IEEE 802.11 Less than ____ms	Follow IEEE 802.11 More than ____ms
Load Based Equipment (Not using any of the mechanisms referenced)	v	13ms	18us

Clause	Test Parameter	Remarks	Pass/Fail
4.3.2.6.3.2.2	Adaptive (Frame Based Equipment)	Not Applicable	NA
4.3.2.6.3.2.3	Adaptive (Load Based Equipment)	Applicable	Pass
4.3.2.6.4	Short Control Signalling Transmissions	Applicable	Pass
4.3.2.6.3.2.3.6	Unwanted signal test	Applicable	Pass

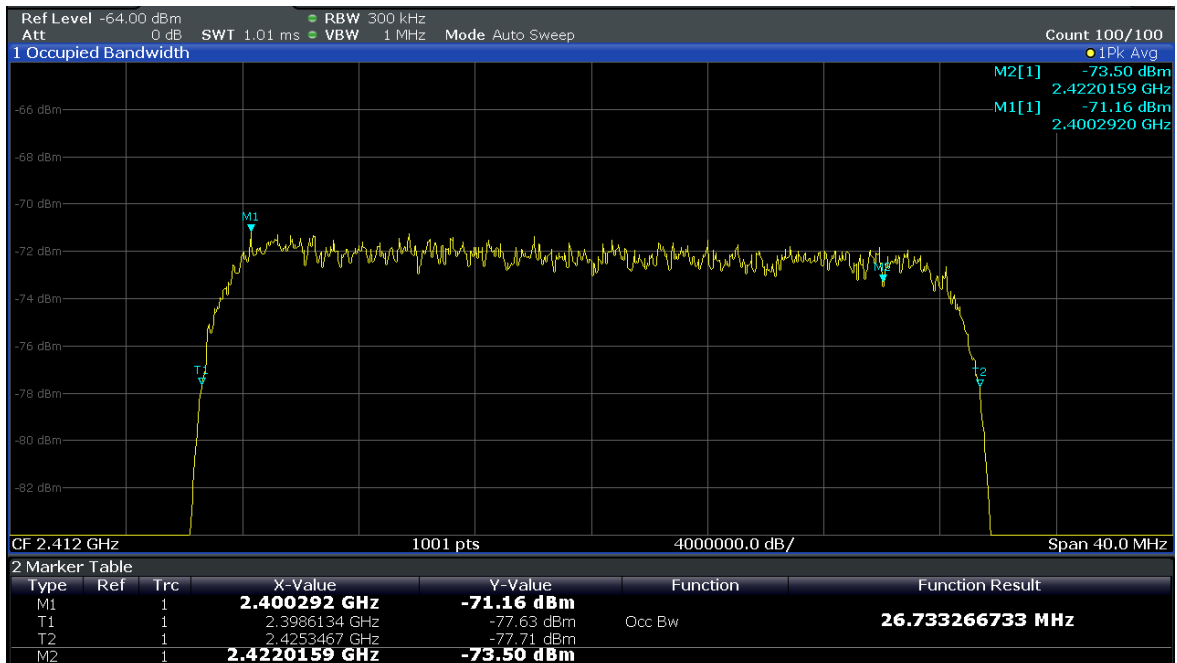
4.1.6 Interference Threshold Level

Detection Threshold Level

The maximum EIRP power is 20 dBm(100mW) and antenna gain is 0 dBi.
 Detection Threshold level= $-70 \text{ dBm/MHz} + 10 \times \log (100 \text{ mW} / P_{\text{out}} (100 \text{ mW})) + G (0\text{dBi}) = -70 \text{ dBm/MHz}$.
 The interference signal level to the UUT is lower than -70 dBm/MHz.



Detection Threshold Level



Flatness and Bandwidth

4.1.7 Test Result

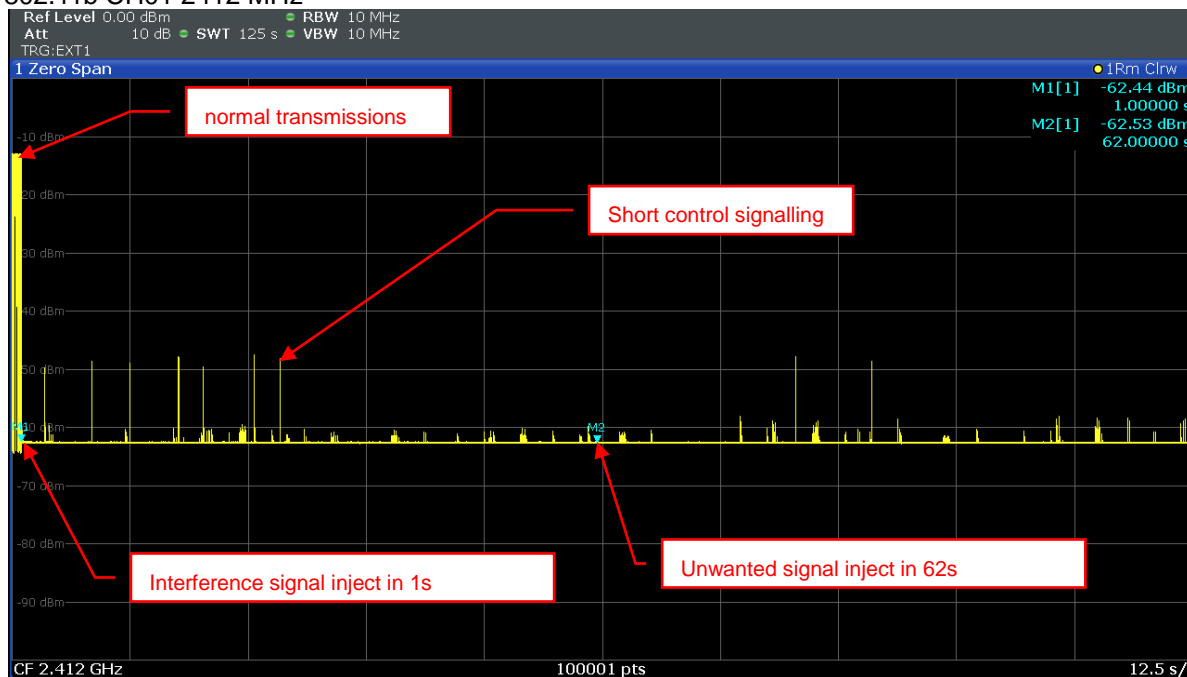
- Not applicable to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode
- Not applicable to equipment with RF output power is less than 10 dBm e.i.r.p.
- Refer to below test result

4.1.7.1 Adaptive Result

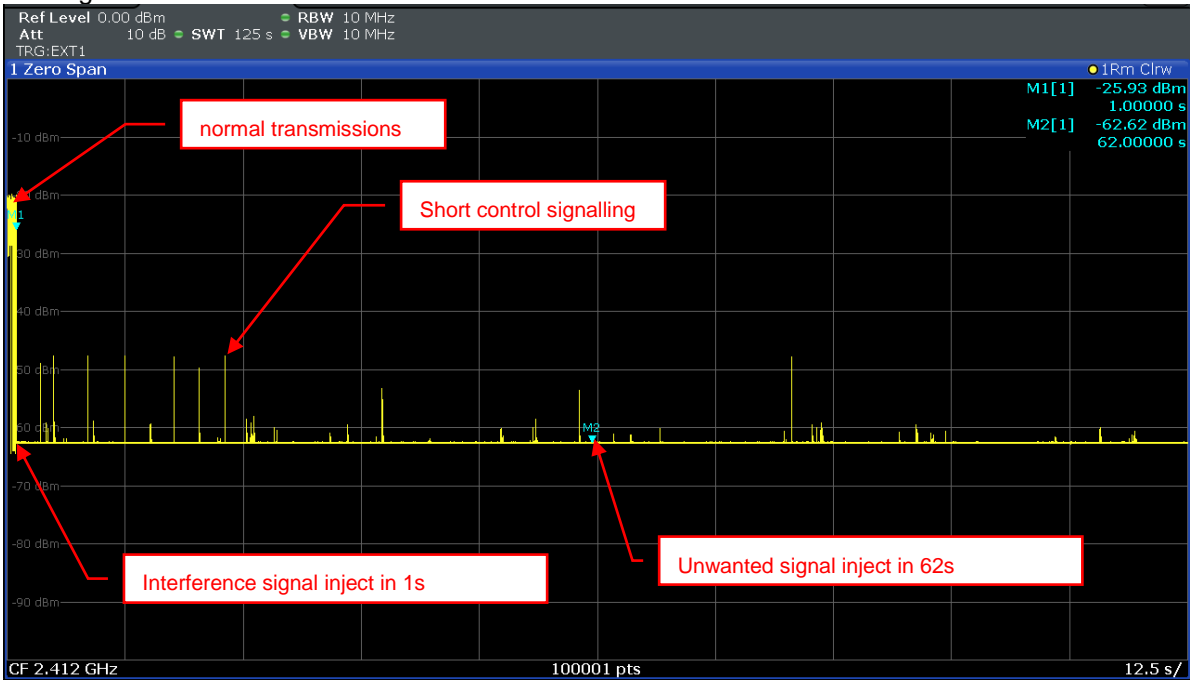
Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (Low Channel, MHz)	Operating Frequency (High Channel, MHz)	Test Result
802.11b	2412	2472	Pass
802.11g	2412	2472	Pass
802.11n (HT20)	2412	2472	Pass
802.11n (HT40)	2422	2462	Pass

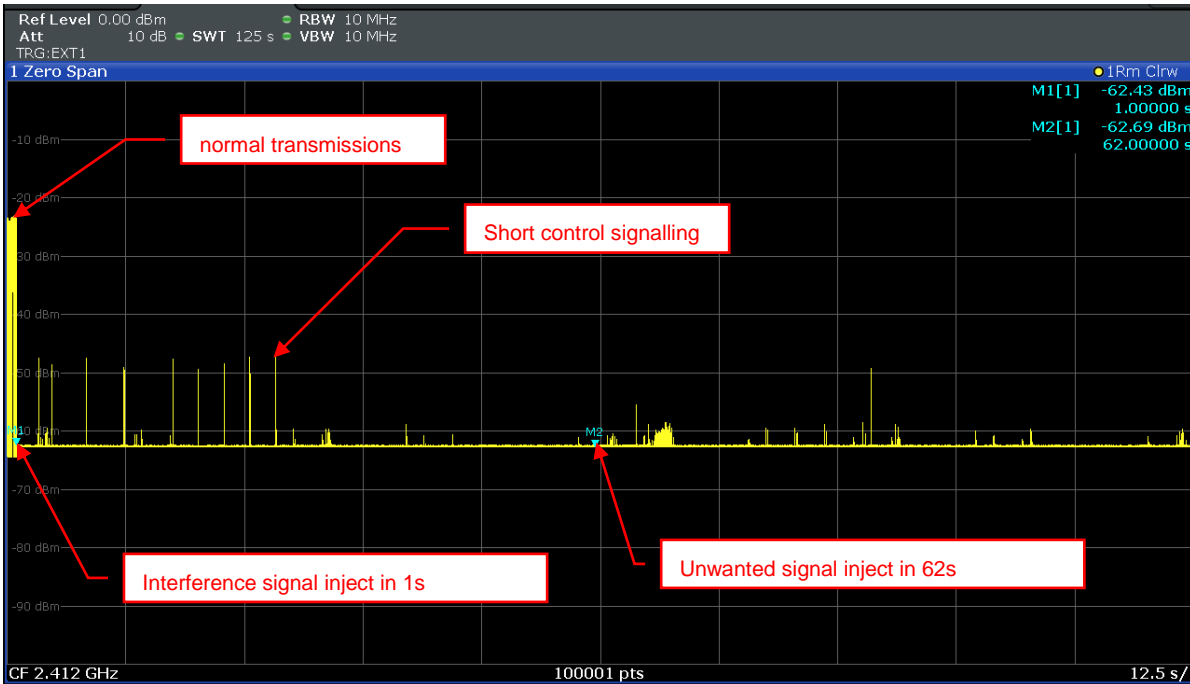
802.11b CH01 2412 MHz



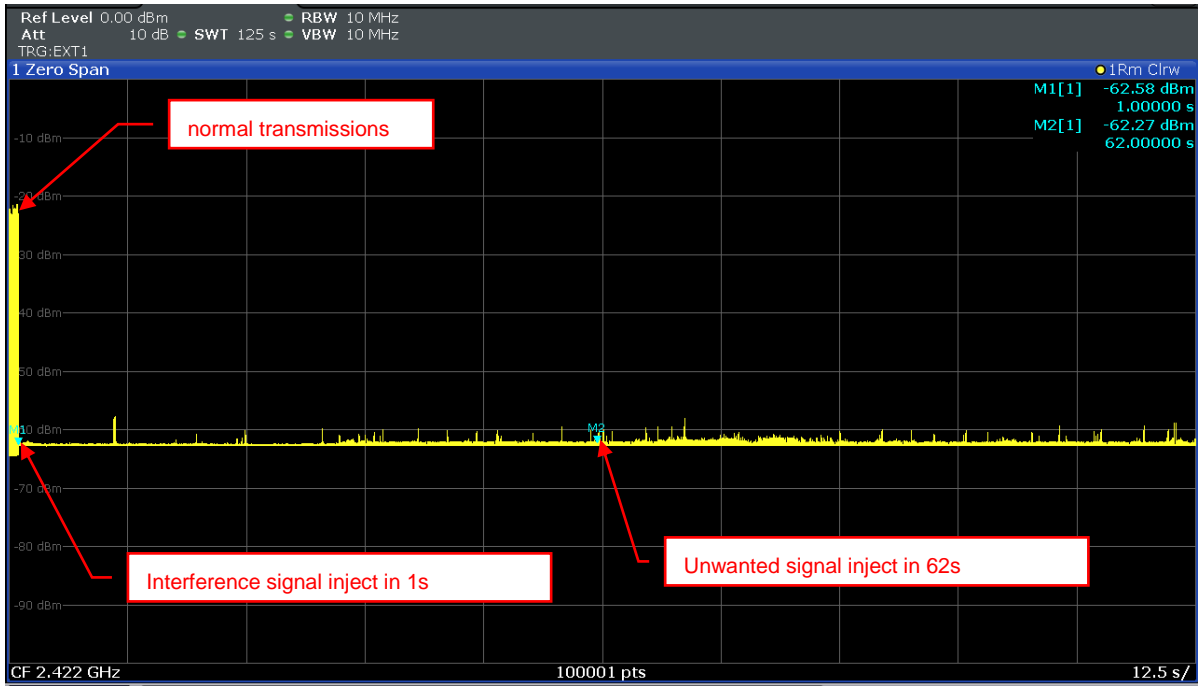
802.11g CH01 2412 MHz



802.11n HT20 CH01 2412 MHz



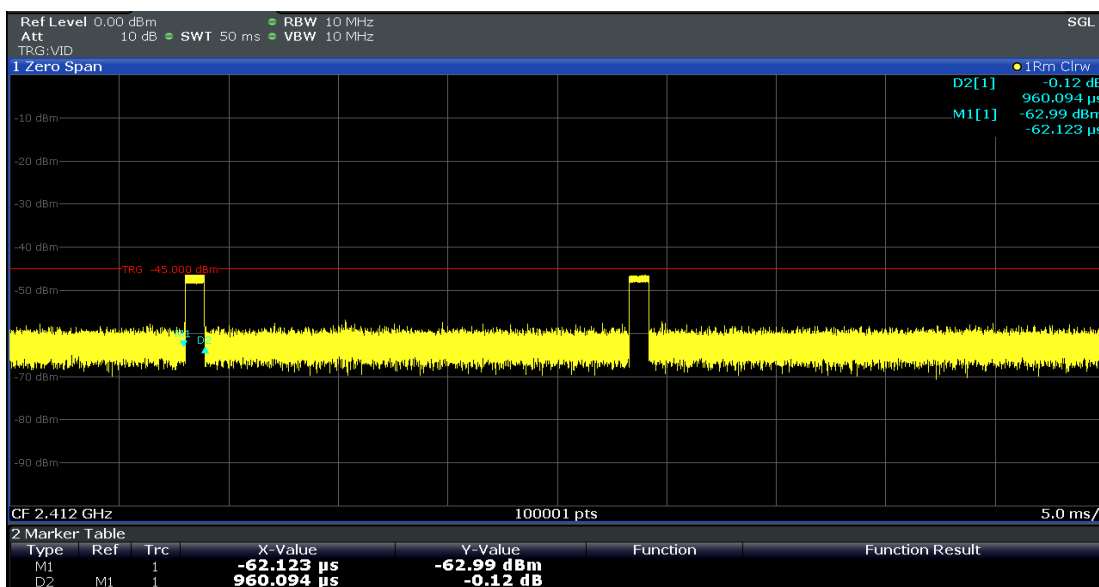
802.11n HT40 CH03 2422 MHz



4.1.7.2 Short Control Signalling Transmissions Result

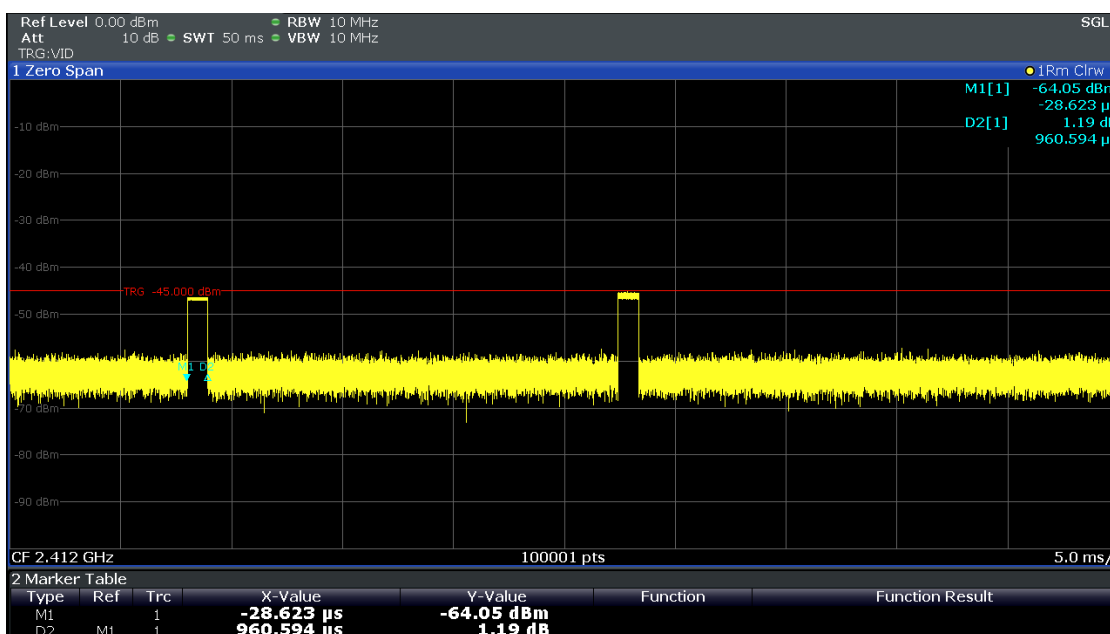
802.11b CH01 2412 MHz

Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
1.92 ms	5ms	PASS



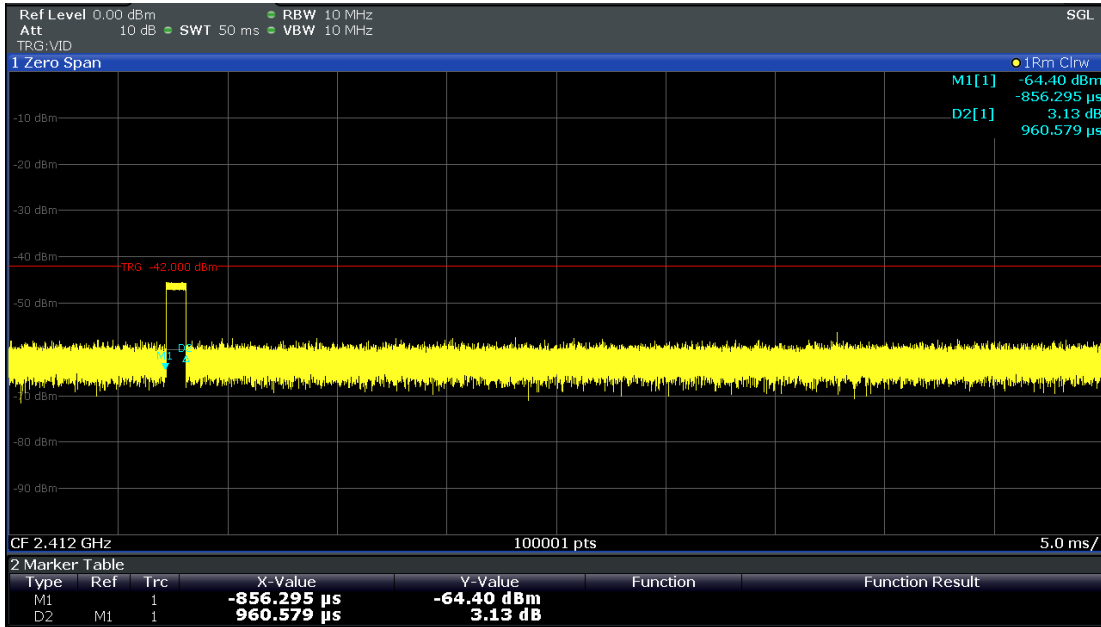
802.11g CH01 2412 MHz

Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
1.92 ms	5ms	PASS



802.11n (HT20) CH01 2412 MHz

Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
0.96 ms	5ms	PASS



802.11n (HT40) CH03 2422 MHz

Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
0 ms	5ms	PASS

4.1.7.3 Unwanted Signal interference Test Results

802.11b

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Unwanted Signal Frequency (MHz)	Unwanted Signal Power (dBm)	Pass/Fail
1	2412	-50	2488.5	-31.38	Pass
13	2472	-50	2395	-31.38	Pass

802.11g

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Unwanted Signal Frequency (MHz)	Unwanted Signal Power (dBm)	Pass/Fail
1	2412	-50	2488.5	-31.38	Pass
13	2472	-50	2395	-31.38	Pass

802.11n (HT20)

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Unwanted Signal Frequency (MHz)	Unwanted Signal Power (dBm)	Pass/Fail
1	2412	-50	2488.5	-31.38	Pass
13	2472	-50	2395	-31.38	Pass

802.11n (HT40)

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Unwanted Signal Frequency (MHz)	Unwanted Signal Power (dBm)	Pass/Fail
3	2422	-50	2488.5	-31.38	Pass
11	2462	-50	2395	-31.38	Pass

4.2 Receiver Blocking

4.2.1 Limit of Receiver Blocking

This requirement applies to all receiver categories.

Receiver Category		
<input checked="" type="checkbox"/> Category 1	<input type="checkbox"/> Category 2	<input type="checkbox"/> Category 3
Minimum performance criterion	<input checked="" type="checkbox"/> PER \leq 10%	
	<input type="checkbox"/> Alternative performance criteria (See note)	
Note: The manufacturer was declared performance criteria is x% for the intended use of the equipment.		

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.			

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.			

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.

4.2.2 Test Procedure

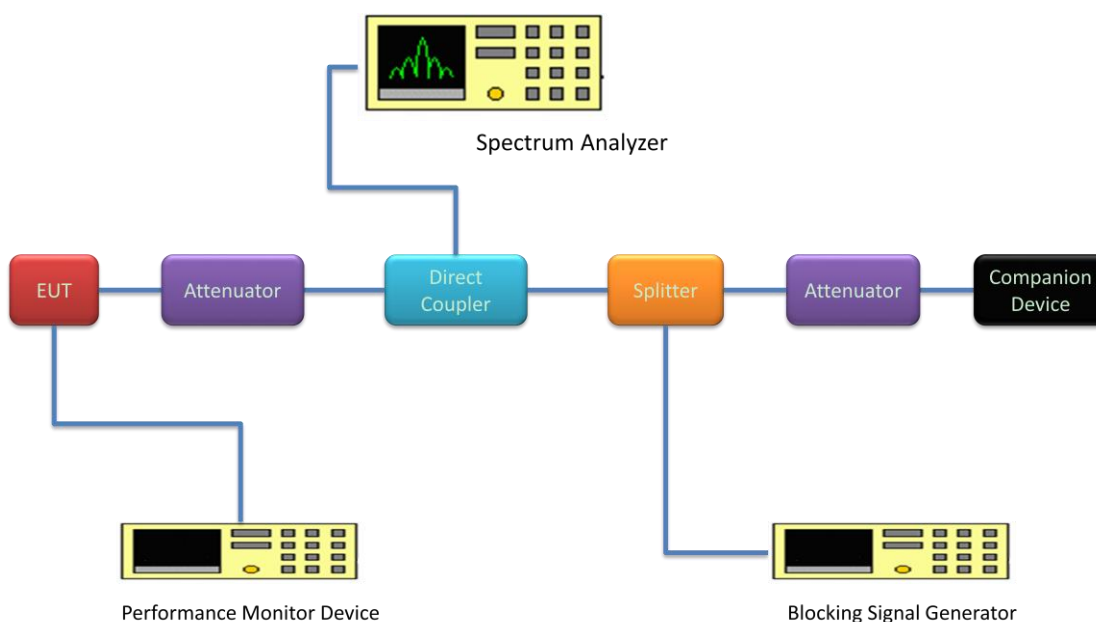
Refer to chapter 5.4.11 of EN 300 328 V2.1.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.2.3 Deviation from Test Standard

No deviation.

4.2.4 Test Setup Configuration



4.2.5 Test Results

Receiver Category 1 Equipment

Receiver blocking performance when operating at the lowest operating channel					
P _{min} : -93dBm			antenna gain(G) : 3.62 dBi		
The actual blocking signal power(Note1)			<input checked="" type="checkbox"/> at the antenna connector		
			<input type="checkbox"/> in front of the antenna		
Note1: For the conducted measurements , the level shall be corrected as follows: the actual blocking signal power = blocking signal power + G					
Operation Mode	Channel	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	The actual blocking signal power (dBm)	Pass/Fail
802.11b	1	-87	2380	-49.38	Pass
			2503.5	-49.38	Pass
			2300	-43.38	Pass
			2330	-43.38	Pass
			2360	-43.38	Pass
			2523.5	-43.38	Pass
			2553.5	-43.38	Pass
			2583.5	-43.38	Pass
			2613.5	-43.38	Pass
			2643.5	-43.38	Pass
			2673.5	-43.38	Pass

Receiver blocking performance when operating at the highest operating channel					
P _{min} : -95dBm			antenna gain(G) : 3.62 dBi		
The actual blocking signal power(Note1)			<input checked="" type="checkbox"/> at the antenna connector		
			<input type="checkbox"/> in front of the antenna		
Note1: For the conducted measurements , the level shall be corrected as follows: the actual blocking signal power = blocking signal power + G					
Operation Mode	Channel	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	The actual blocking signal power (dBm)	Pass/Fail
802.11b	13	-89	2380	-49.38	Pass
			2503.5	-49.38	Pass
			2300	-43.38	Pass
			2330	-43.38	Pass
			2360	-43.38	Pass
			2523.5	-43.38	Pass
			2553.5	-43.38	Pass
			2583.5	-43.38	Pass
			2613.5	-43.38	Pass
			2643.5	-43.38	Pass
			2673.5	-43.38	Pass

Appendix - Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

--- END ---

Appendix A – Original Report No.: RE171207E10I-A

EN 300 328 RF Test Report (WLAN)

Report No.: RE171207E10I-A

Test Model: BLACK-Bean

Received Date: Oct. 08, 2014

Test Date: Oct. 16 to Nov. 07, 2014 ; July 22 to Aug. 04, 2016

Issued Date: Apr. 15, 2019

Applicant: UAB 8devices

Address: Antakalnio 17, LT-10312, Vilnius, Lithuania

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.

Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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Release Control Record

Issue No.	Description	Date Issued
RE171207E10I-A	Original release.	Apr. 15, 2019

1 Certificate of Conformity

Product: BLACK-Bean
Brand: 8devices
Test Model: BLACK-Bean
Sample Status: ENGINEERING SAMPLE
Applicant: UAB 8devices
Test Date: Oct. 16 to Nov. 07, 2014 ; July 22 to Aug. 04, 2016
Standards: EN 300 328 V1.9.1 (2015-02)

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Phoenix Huang, **Date:** Apr. 15, 2019
Phoenix Huang / Specialist

Approved by : May Chen, **Date:** Apr. 15, 2019
May Chen / Manager

P

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 300 328 V1.9.1		
Clause	Test Parameter	Results
	Transmitter Parameters	
4.3.2.2	RF Output Power	Pass
4.3.2.3	Power Spectral Density (Modulations other than FHSS equipment)	Pass
4.3.2.4	Duty cycle, Tx-sequence, Tx-gap (Non-adaptive equipment)	Not Applicable
4.3.2.5	Medium Utilisation (Non-Adaptive Equipment)	Not Applicable
4.3.2.6	Adaptivity (Adaptive Equipment)	Pass
4.3.2.7	Occupied Channel Bandwidth	Pass
4.3.2.8	Transmitter Unwanted Emissions in the OOB Domain	Pass
4.3.2.9	Transmitter Unwanted Emissions in the Spurious Domain	Pass
4.3.2.12	Geo-location capability	Not Applicable
	Receiver Parameters	
4.3.2.10	Receiver Spurious Emissions	Pass
4.3.2.11	Receiver Blocking (Only for Adaptive equipment)	Pass

2.1 Test Instruments

For spurious emissions test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Keysight	N9030A	MY54490679	July 26, 2015	July 25, 2016
Pre_Amplifier Agilent	8447D	2944A10626	Feb. 21, 2016	Feb. 20, 2017
Pre_Amplifier HP	8449B	3008A01281	Jan. 16, 2016	Jan. 15, 2017
Pre_Amplifier EMCi	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
TRILOG Antenna SCHWARZBECK	VULB9168	9168-162	Jan. 20, 2016	Jan. 19, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D1	D124	Jan. 20, 2016	Jan. 19, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Jan. 19, 2016	Jan. 18, 2017
Software	ADT_Radiated_V7.6.15.9.4	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208411	NA	NA
Power meter Anritsu	ML2495A	0824006	May 26, 2016	May 25, 2017
Power sensor Anritsu	MA2411B	0738172	May 26, 2016	May 25, 2017
ESG Vector signal generator Agilent	E4438C	Y45094468/00 5 506 602 UK6 UNJ	Dec. 01, 2015	Nov. 30, 2016

- NOTE:**
1. The test was performed in RF Fully Chamber No. 1.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: July 22 to 23, 2016

For Adaptivity and Receiver Blocking test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSW8	101497	Aug. 07, 2015	Aug. 06, 2016
ESG Vector signal generator Agilent	E4438C	MY45094468/0 05 506 602 UK6 UNJ	Dec. 01, 2015	Nov. 30, 2016
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010001	NA	NA
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53051263	Aug. 10, 2015	Aug. 09, 2016

- NOTE:**
1. The test was performed in Adaptivity room.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: July 25 to Aug. 04, 2016

For Transmitter Unwanted Emissions in the OOB Domain test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 27, 2016	Jan. 26, 2017
Spectrum Analyzer Keysight	N9030A	MY54490570	July 06, 2016	July 05, 2017
AC Power Source Exttech Electronics	6502	1140503	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 03, 2015	Dec. 02, 2016
DC Power Supply GOOD WILL INSTRUMENT CO., LTD.	GPC - 3030D	7700087	NA	NA
ESG Vector signal generator Agilent	E4438C	Y45094468/00 5 506 602 UK6 UNJ	Dec. 01, 2015	Nov. 30, 2016
Power meter Anritsu	ML2495A	0824006	May 26, 2016	May 25, 2017
Power sensor Anritsu	MA2411B	0738172	May 26, 2016	May 25, 2017
Software	ADT_RF Test Software V6.6.5.3	NA	NA	NA
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2015	Nov. 09, 2016
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53051263	Aug. 10, 2015	Aug. 09, 2016
MIMO Powermeasurement Test set (4X4) Agilent	U2021XA	U2021XA_01	Aug. 08, 2015	Aug. 07, 2016
Switch Box Agilent	PS-X10-100	PS-X10-100_0 1	NA	NA
Test Receiver Agilent	N9038A	MY54450088	July 20, 2016	July 19, 2017

- NOTE:**
1. The test was performed in Oven room 1.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: July 25, 2016

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP 40	100060	May 08, 2014	May 07, 2015
AC Power Source EXTECH Electronics	6502	1140503	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 09, 2013	Dec. 08, 2014
DC Power Supply GOOD WILL INSTRUMENT CO., LTD.	GPC - 3030D	7700087	NA	NA
ESG Vector signal generator Agilent	E4438C	MY47271330 506 602 UNJ	Apr. 28, 2014	Apr. 27, 2015
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010004	NA	NA
ESG Vector signal generator Agilent	E4438C	MY45094468/0 05 506 602 UK6 UNJ	Dec. 06, 2013	Dec. 05, 2014
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010001	NA	NA
Power meter Anritsu	ML2495A	0824006	May 22, 2014	May 21, 2015
Power sensor Anritsu	MA2411B	0738172	May 22, 2014	May 21, 2015
Software	Total Power Measurement Tools V7.1	NA	NA	NA
Software	ADT_RF Test Software V6.6.5.3	NA	NA	NA

- NOTE:**
1. The test was performed in Oven room A.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Oct. 16 to Nov. 07, 2014

2.2 Measurement Uncertainty

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

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

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 1.132 \times 10^{-4} \%$
RF output power, conducted	$\pm 1.207 \text{ dB}$
Power Spectral Density, conducted	$\pm 1.207 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 4.925 \text{ dB}$
Temperature	$\pm 0.6 \text{ }^\circ\text{C}$
Supply voltages	$\pm 0.04 \%$
Time	$\pm 5 \%$

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 300 328 standard, the measurement uncertainty figures shall be calculated in accordance with ETSI TR 100 028-1 [1], ETSI TS 103 051 [2] and ETSI TS 103 052 [3] and shall correspond to an expansion factor (coverage factor) $k = 1,96$ or $k = 2$ (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 1,5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 6 \text{ dB}$
Temperature	$\pm 1 \text{ }^\circ\text{C}$
Supply voltages	$\pm 3 \%$
Time	$\pm 5 \%$

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (WLAN)

Product	BLACK-Bean
Brand	8devices
Test Model	BLACK-Bean
Status of EUT	ENGINEERING SAMPLE
Nominal Voltage	3.3Vdc from host equipment
Temperature Operating Range	-10°C ~ 70°C
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n : up to 150Mbps 802.11ac: up to 433.3Mbps
Operating Frequency	2.4GHz: 2412 ~ 2472MHz 5GHz: 5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5700MHz
Number of Channel	2.4GHz 802.11b/g, 802.11n (HT20), VHT20: 13 802.11n (HT40), VHT40: 9 5GHz 802.11a, 802.11n (HT20) , 802.11ac (VHT20): 19 802.11n (HT40) , 802.11ac (VHT40): 9 802.11ac (VHT80): 4
Adaptive/Non-Adaptive	<input type="checkbox"/> non-adaptive Equipment <input checked="" type="checkbox"/> adaptive Equipment without the possibility to switch to a non-adaptive mode <input type="checkbox"/> adaptive Equipment which can also operate in a non-adaptive mode
EIRP Power (Measured Max. Average)	2.4GHz: 19.85dBm 5GHz: 5150 ~ 5250MHz: 22.21dBm 5250 ~ 5350MHz: 21.64dBm 5470 ~ 5725MHz: 22.15dBm
Antenna Type	See item 3.2
Antenna Connector	See item 3.2
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are Bluetooth technology and WLAN technology used for the EUT.
2. The EUT incorporates a 1T1R function.

2.4GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1TX	1RX
802.11g	6 ~ 54Mbps	1TX	1RX
802.11n (HT20)	MCS 0~7	1TX	1RX
802.11n (HT40)	MCS 0~7	1TX	1RX
VHT20	MCS 0~8, Nss=1	1TX	1RX
VHT40	MCS 0~9, Nss=1	1TX	1RX
5GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	1TX	1RX
802.11n (HT20)	MCS 0~7	1TX	1RX
802.11n (HT40)	MCS 0~7	1TX	1RX
802.11ac (VHT20)	MCS 0~8, Nss=1	1TX	1RX
802.11ac (VHT40)	MCS 0~9, Nss=1	1TX	1RX
802.11ac (VHT80)	MCS 0~9, Nss=1	1TX	1RX

Note: The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz) and 802.11ac mode for 20MHz (40MHz), therefore investigated worst case to representative mode in test report.

3. The EUT was pre-tested under the following modes:

Test Mode	Data rate
Mode A	400ns GI
Mode B	800ns GI

From the above modes, the worst case was found in **Mode B**. Therefore only the test data of the mode was recorded in this report.

4. WLAN/BT coexistence mode:

◆ 1x1 WLAN + BT:

- 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
- 2.4GHz: timely shared coexistence.

5. Spurious Emission (conducted & radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11a) + Bluetooth (GFSK)	36 to 140	36	OFDM
	0 to 78	78	FHSS

6. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Antenna

The antenna gain was declared by client; please refer to the following table:

Ant. No.	Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)	5GHz Gain with cable loss (dBi)	2.4GHz Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
1	Main	WNC	81-EBJ15.005	PIFA	3.00	Band 1&2: 2.56	1.15	Band 1&2: 1.70	IPEX	300
						Band 3: 4.76		Band 3: 1.74		
						Band 4: 4.76		Band 4: 1.79		
	Aux	WNC	81-EBJ15.005	PIFA	3.62	Band 1&2: 3.08	1.15	Band 1&2: 1.70	IPEX	300
						Band 3: 3.31		Band 3: 1.74		
						Band 4: 2.42		Band 4: 1.79		
2	Main	WNC	81.ED415.001	PIFA	0.22	Band 1&2: 5.56	0.96	Band 1&2: 1.29	IPEX	300
						Band 3: 5.03		Band 3: 1.36		
						Band 4: 3.14		Band 4: 1.38		
	Aux	WNC	81.ED415.001	PIFA	1.48	Band 1&2: 5.17	0.96	Band 1&2: 1.29	IPEX	300
						Band 3: 5.34		Band 3: 1.36		
						Band 4: 2.93		Band 4: 1.38		

Note: 1. Above antenna gains of antenna are Total (H+V).

3.3 Description of Test Modes

13 channels are provided for 802.11b, 802.11g, 802.11n (HT20), VHT20:

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

9 channels are provided for 802.11n (HT40), VHT40:

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

3.4 Output Power with Variable Antennas under Normal Environmental Conditions

3.4.1 Output Powers with the Highest Gain of Antenna

HIGHEST GAIN OF ANTENNA LIST	
OPERATION BAND	GAIN VALUE (dBi)
2.4GHz	3.62

3.4.1.1 Output Powers

802.11b Mode:

Channel	CONDUCTED POWER (dBm)
(CH1) 2412 MHz	13.75
(CH7) 2442 MHz	14.08
(CH13) 2472 MHz	14.24

802.11g Mode:

Channel	CONDUCTED POWER (dBm)
(CH1) 2412 MHz	15.81
(CH7) 2442 MHz	16.02
(CH13) 2472 MHz	15.34

802.11n (HT20) Mode:

Channel	CONDUCTED POWER (dBm)
(CH1) 2412 MHz	15.58
(CH7) 2442 MHz	15.80
(CH13) 2472 MHz	16.04

802.11n (HT40) Mode:

Channel	CONDUCTED POWER (dBm)
(CH3) 2422 MHz	15.63
(CH7) 2442 MHz	15.82
(CH11) 2462 MHz	15.97

3.5 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to										Description
	ROP	PSD	DC/TS/TG	MU	AD	OCB	EOB	SE< 1G	SE≥ 1G	RB	
-	√	√	-	-	√	√	√	√	√	√	-

Where **ROP**: RF Output Power **PSD**: Power Spectral Density
DC/TS/TG: Duty Cycle/ Tx-Sequence / Tx-gap **MU**: Medium Utilization
AD: Adaptivity (Channel Access Mechanism) **OCB**: Occupied Channel Bandwidth
EOB: Transmitter unwanted emissions in the out-of-band domain **SE<1G**: Unwanted Emissions in the Spurious Domain below 1 GHz
SE≥1G: Unwanted Emissions in the Spurious Domain above 1 GHz **RB**: Receiver Blocking

RF Output Power Test:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
802.11b	1 to 13	1, 7, 13	DSSS	1
802.11g	1 to 13	1, 7, 13	OFDM	6
802.11n (HT20)	1 to 13	1, 7, 13	OFDM	6.5
802.11n (HT40)	3 to 11	3, 7, 11	OFDM	13.5

Power Spectral Density Test:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
802.11b	1 to 13	1, 7, 13	DSSS	1
802.11g	1 to 13	1, 7, 13	OFDM	6
802.11n (HT20)	1 to 13	1, 7, 13	OFDM	6.5
802.11n (HT40)	3 to 11	3, 7, 11	OFDM	13.5

Adaptivity Test:

-
- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology
802.11b	1 to 13	1, 13	DSSS
802.11g	1 to 13	1, 13	OFDM
802.11n (HT20)	1 to 13	1, 13	OFDM
802.11n (HT40)	3 to 11	3, 11	OFDM

Occupied Channel Bandwidth Test:

-
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
-
-
- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
802.11b	1 to 13	1, 13	DSSS	1
802.11g	1 to 13	1, 13	OFDM	6
802.11n (HT20)	1 to 13	1, 13	OFDM	6.5
802.11n (HT40)	3 to 11	3, 11	OFDM	13.5

Transmitter Unwanted Emissions in the Out-of-band Domain Test:

-
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
-
-
- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
802.11b	1 to 13	1, 13	DSSS	1
802.11g	1 to 13	1, 13	OFDM	6
802.11n (HT20)	1 to 13	1, 13	OFDM	6.5
802.11n (HT40)	3 to 11	3, 11	OFDM	13.5

Unwanted Emissions in the Spurious Domain Test (Below 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
802.11n (HT20)	1 to 13	13	OFDM	6.5
Receiver	1 to 13	13	-	-

Unwanted Emissions in the Spurious Domain Test (above 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
802.11b	1 to 13	1, 13	DSSS	1
Receiver	1 to 13	1, 13	-	-

Receiver Blocking test:

- Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology
802.11b	1 to 13	1, 13	DSSS
802.11g	1 to 13	1, 13	OFDM
802.11n (HT20)	1 to 13	1, 13	OFDM
802.11n (HT40)	3 to 11	3, 11	OFDM

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
ROP	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
PSD	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
AD	25deg. C, 60%RH	230Vac, 50Hz	Denny Liu
OCB	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
EOB	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
SE<1G	22deg. C, 65%RH	230Vac, 50Hz	Louis Tseng
SE≥1G	22deg. C, 65%RH	230Vac, 50Hz	Louis Tseng
RB	25deg. C, 60%RH	230Vac, 50Hz	Dolly Chung

3.6 Description of Support Units

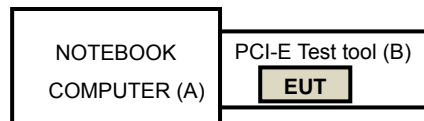
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	DELL	E5430	GM1SKV1	FCC DoC	Provided by Lab
B	PCI-E Test tool	Qualcomm Atheros	NA	NA	NA	Supplied by Client

NOTE:

1. All power cords of the above support units are non-shielded (1.8 m).

3.6.1 Configuration of System under Test



3.7 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

EN 300 328 V1.9.1 (2015-02)

All test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

Transmitter Parameters

4.1 RF Output Power

4.1.1 Limits of RF Output Power

Condition	Frequency Band	Limit (e.i.r.p)
Under all test conditions	2400 ~ 2483.5 MHz	AV: 20dBm

4.1.2 Test Procedures

Refer to chapter 5.3.2.2 of EN 300 328 V1.9.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 Test Setup

The measurements for RF output power was performed at both normal environmental conditions and at the extremes of the operating temperature. Controlling software (QCRT-CONN) has been activated to set the EUT on specific channel and power level.

4.1.5 Test Results

TEST CONDITION			EIRP POWER (dBm)		
			(CH1) 2412 MHz	(CH7) 2442 MHz	(CH13) 2472 MHz
802.11b					
Tnom(°C)	25	Vnom(v)	17.37	17.70	17.86
Tmin(°C)	-10	Vnom(v)	17.60	17.94	18.06
Tmax(°C)	70	Vnom(v)	17.16	17.45	17.61
802.11g					
Tnom(°C)	25	Vnom(v)	19.43	19.64	18.96
Tmin(°C)	-10	Vnom(v)	19.64	19.85	19.19
Tmax(°C)	70	Vnom(v)	19.22	19.42	18.76
802.11n (HT20)					
Tnom(°C)	25	Vnom(v)	19.20	19.42	19.66
Tmin(°C)	-10	Vnom(v)	19.40	19.64	19.85
Tmax(°C)	70	Vnom(v)	18.99	19.20	19.45
TEST CONDITION			EIRP POWER (dBm)		
			(CH3) 2422 MHz	(CH7) 2442 MHz	(CH11) 2462 MHz
802.11n (HT40)					
Tnom(°C)	25	Vnom(v)	19.25	19.44	19.59
Tmin(°C)	-10	Vnom(v)	19.45	19.65	19.80
Tmax(°C)	70	Vnom(v)	19.06	19.25	19.40

4.2 Power Spectral Density

4.2.1 Limit of Power Spectral Density

Condition	Frequency Band	Limit (e.i.r.p.)
Under normal conditions	2400 ~ 2483.5 MHz	10dBm / 1MHz

4.2.2 Test Procedures

Refer to chapter 5.3.3.2 of EN 300 328 V1.9.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.2.3 Deviation of Test Standard

No deviation.

4.2.4 Test Setup

The test setup has been constructed as the normal test condition. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The power spectral density as defined in EN 300 328 clause 4.3.2.3 shall be measured and recorded. Controlling software (QCRT-CONN) has been activated to set the EUT on specific status.

4.2.5 Test Results

802.11b

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
1	2412	9.43	10	Pass
7	2442	9.91	10	Pass
13	2472	9.95	10	Pass

802.11g

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
1	2412	8.55	10	Pass
7	2442	8.69	10	Pass
13	2472	8.13	10	Pass

802.11n (HT20)

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
1	2412	8.20	10	Pass
7	2442	8.40	10	Pass
13	2472	8.64	10	Pass

802.11n (HT40)

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
3	2422	5.51	10	Pass
7	2442	5.65	10	Pass
11	2462	5.82	10	Pass

4.4 Occupied Channel Bandwidth

4.4.1 Limit of Occupied Channel Bandwidth

Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz.
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and e.i.r.p >10dBm.	Less than 20MHz
	For non-adaptive Frequency Hopping system and e.i.r.p >10dBm.	Less than 5MHz

4.4.2 Test Procedure

Refer to chapter 5.3.8.2 of EN 300 328 V1.9.1.

Measurement	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.4.3 Deviation from Test Standard

No deviation.

4.4.4 Test Setup

These measurements only were performed at normal test conditions. The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software (QCRT-CONN) has been activated to set the EUT on specific status.

4.4.5 Test Results

802.11b

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F _L (MHz)	F _H (MHz)		
1	2412	13.12	2405.44	2418.56	F _L > 2400 MHz and F _H < 2483.5 MHz	Pass
13	2472	13.12	2465.44	2478.56		Pass

802.11g

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F _L (MHz)	F _H (MHz)		
1	2412	16.32	2403.84	2420.16	F _L > 2400 MHz and F _H < 2483.5 MHz	Pass
13	2472	16.32	2463.84	2480.16		Pass

802.11n (HT20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F _L (MHz)	F _H (MHz)		
1	2412	17.44	2403.28	2420.72	F _L > 2400 MHz and F _H < 2483.5 MHz	Pass
13	2472	17.44	2463.28	2480.72		Pass

802.11n (HT40)

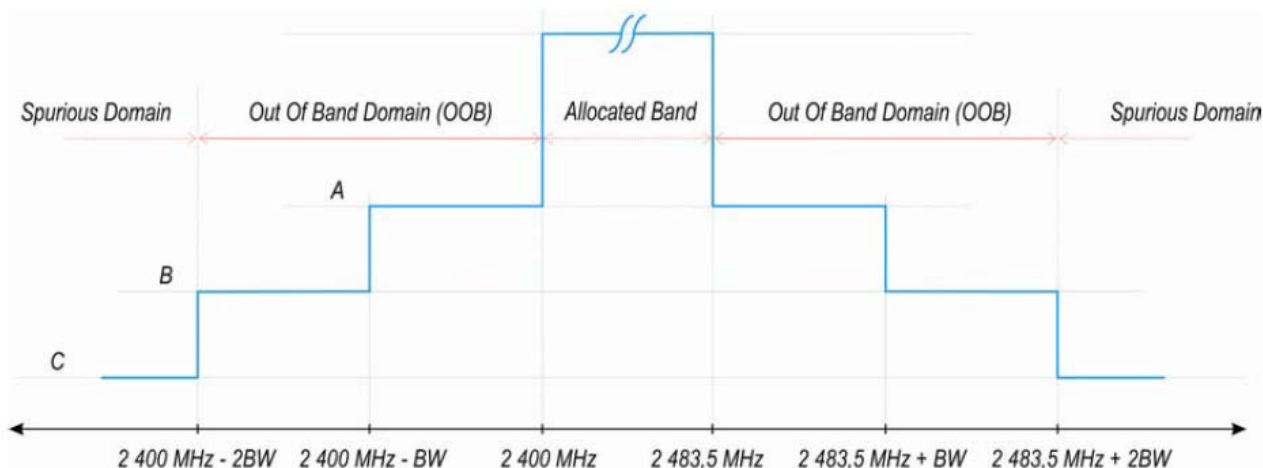
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F _L (MHz)	F _H (MHz)		
3	2422	36	2404.08	2440.08	F _L > 2400 MHz and F _H < 2483.5 MHz	Pass
11	2462	36.16	2443.92	2480.08		Pass

Note: F_L is the lowest frequency of the 99% occupied bandwidth of power envelope.
 F_H is the highest frequency of the 99% occupied bandwidth of power envelope.

4.5 Transmitter Unwanted Emissions in the Out-of-band Domain

4.5.1 Limits of Transmitter Unwanted Emissions in the Out-of-band Domain

Condition	Limit
Under normal conditions	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 below figure.



A: -10 dBm/MHz e.i.r.p.
 B: -20 dBm/MHz e.i.r.p.
 C: Spurious Domain limits

BW = Occupied Channel Bandwidth in MHz or 1 MHz whichever is greater

4.5.2 Test Procedure

Refer to chapter 5.3.9.2 of EN 300 328 V1.9.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.5.3 Deviation from Test Standard

No deviation

4.5.4 Test Setup

The measurements were performed at normal environmental conditions. The measurement was performed at the lowest and the highest channel on which the equipment can operate. The equipment was configured to operate under its worst case situation with respect to output power. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The frequency has to be recorded for the right and left end above threshold of highest and lowest channel respectively.

4.5.5 Test Results

802.11b

Channel Frequency		2412 MHz				2472 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2386.88 ~ 2400		2373.76 ~ 2386.88		2483.5 ~ 2496.62		2496.62 ~ 2509.74	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T _{nom} 25°C	V _{nom} (V)	2398.50	-37.85	2385.38	-40.00	2484.00	-37.17	2502.12	-39.66
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

802.11g

Channel Frequency		2412 MHz				2472 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2383.68 ~ 2400		2367.36 ~ 2383.68		2483.5 ~ 2499.82		2499.82 ~ 2516.14	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T _{nom} 25°C	V _{nom} (V)	2399.50	-24.36	2383.18	-38.90	2484.00	-21.31	2500.32	-38.98
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

802.11n (HT20)

Channel Frequency		2412 MHz				2472 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2382.56 ~ 2400		2365.12 ~ 2382.56		2483.5 ~ 2500.94		2500.94 ~ 2518.38	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T _{nom} 25°C	V _{nom} (V)	2399.50	-22.67	2381.06	-38.99	2484.00	-20.05	2501.44	-39.02
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

802.11n (HT40)

Channel Frequency		2422 MHz				2462 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2364 ~ 2400		2328 ~ 2364		2483.5 ~ 2519.66		2519.66 ~ 2555.82	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T _{nom} 25°C	V _{nom} (V)	2399.50	-22.27	2362.50	-39.45	2484.00	-21.93	2520.16	-39.85
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

4.6 Adaptive (Channel Access Mechanism)

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

4.6.1 Limit of Adaptive

Applicability of adaptive requirements and limit for wide band modulation techniques

Requirement	Operational Mode			
	Non-LBT based Detect and Avoid	LBT based Detect and Avoid		
		Frame Based Equipment	Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)	Load Based Equipment (Not using any of the mechanisms referenced)
Minimum Clear Channel Assessment (CCA) Time	NA	18 us (see note 1)	(see note 2)	18 us (see note 1)
Maximum Channel Occupancy (COT) Time	40 ms	1 ms to 10 ms	(see note 2)	13ms
Minimum Idle Period	5us	5% of COT	(see note 2)	18us (see note 3)
Extended CCA check	NA	NA	(see note 2)	18us~160us
Short Control Signalling Transmissions	Maximum duty cycle of 10 % within an observation period of 50 ms (see note 4)			

NOTE 1: The CCA time used by the equipment shall be declared by the supplier.
 NOTE 2: 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 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
 NOTE 3: 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.
 NOTE 4: Adaptive equipment may or may not have Short Control Signalling Transmissions

Interference threshold level

Maximum transmit power (P _H) EIRP dBm	Threshold level (TL) (see notes 1 and 2)
20	-70 dBm / MHz

NOTE 1: TL = -70 dBm/MHz + 20 - P_H (assuming a 0dBi receive antenna and P_H specified in dBm e.i.r.p.).
 NOTE 2: transmitter the CCA threshold level (TL) shall be equal or lower than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna).

4.6.2 Test Procedure

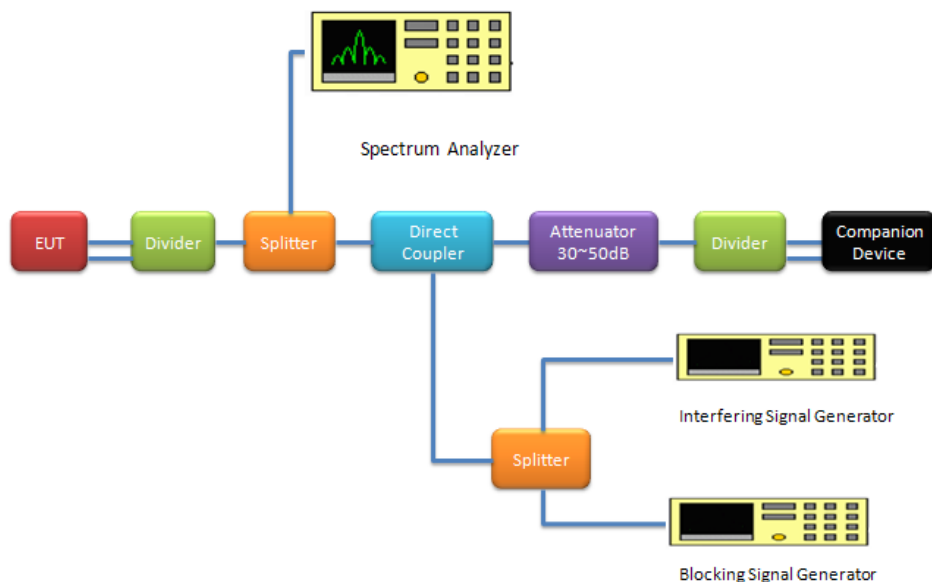
Refer to chapter 5.3.7.2 of ETSI EN 300 328 V1.9.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.6.3 Deviation from Test Standard

No deviation.

4.6.4 Test Setup Configuration



UUT Software and Firmware Version

Product	Model No.	Software/Firmware Version
BLACK-Bean	BLACK-Bean	2016/6/22 11.0.0.688
		2016/9/19 11.0.0.700

Companion Device information

Product	Brand	Model No.	Software/Firmware Version
Wireless AC Module	ALPHA	WMC-AC01	1.0.0 Mon 04 Feb 2013

Note: This module WMC-AC01 was installed in the DIR-868L AP.

4.6.5 List of Measurements

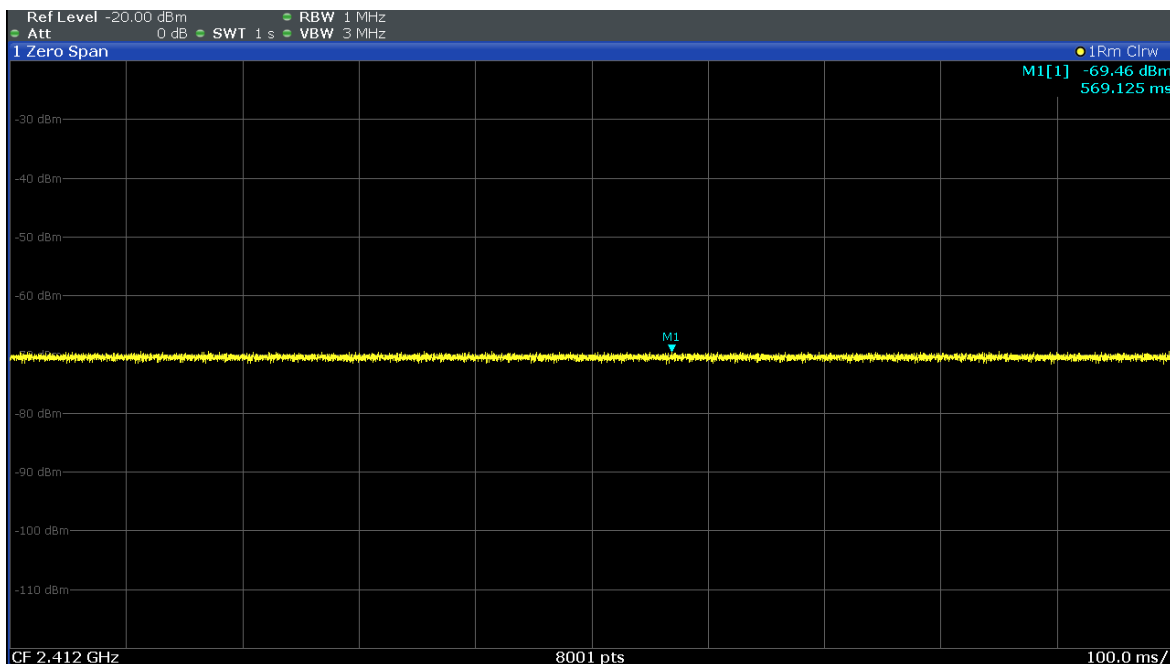
UUT Operational Mode	Applicable	Limit	
		The Maximum Channel Occupancy Time	The Minimum idle Period
Frame Based Equipment		meet in 1ms ~ 10ms	>5% x channel occupancy time
Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)		Follow IEEE 802.11 Less than ____ms	Follow IEEE 802.11 More than ____ms
Load Based Equipment (Not using any of the mechanisms referenced)	v	13ms	18us

Clause	Test Parameter	Remarks	Pass/Fail
4.3.2.6.3.2.2	Adaptive (Frame Based Equipment)	Not Applicable	NA
4.3.2.6.3.2.3	Adaptive (Load Based Equipment)	Applicable	Pass
4.3.2.6.4	Short Control Signalling Transmissions	Applicable	Pass

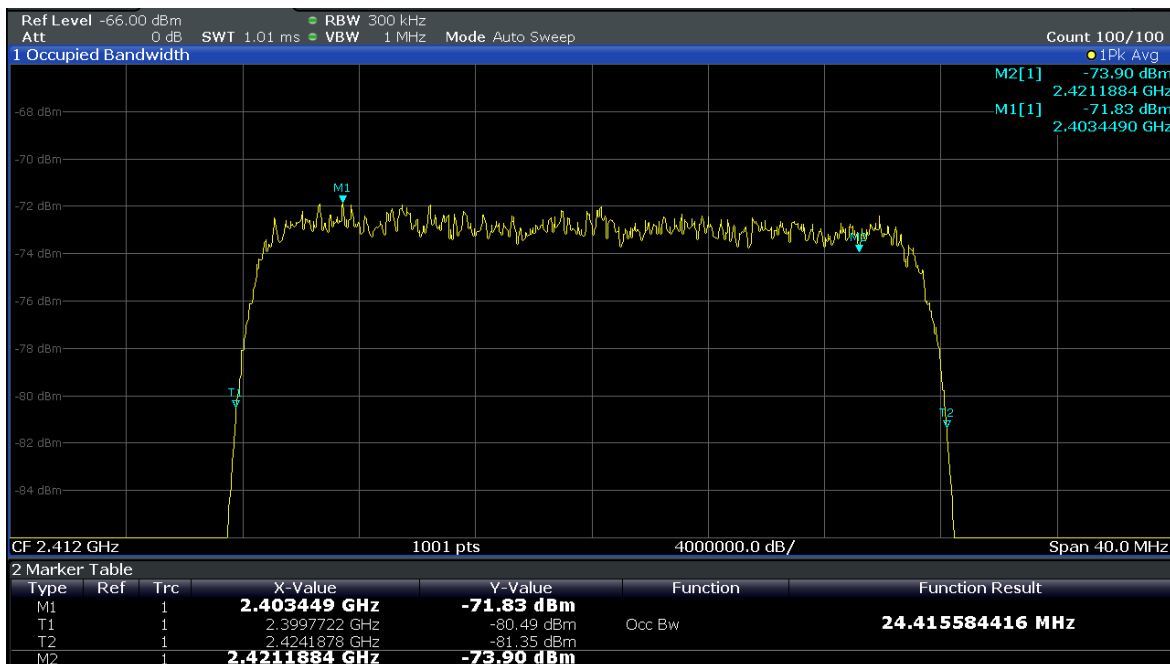
4.6.6 Interference Threshold Level

Detection Threshold Level

The maximum EIRP (Vnom) power is 19.66 dBm and antenna gain is 0.22 dBi.
 Detection Threshold level= $-70\text{dBm/MHz} + 20 - \text{Pout EIRP}(19.66\text{dBm}) + G (0.22 \text{ dBi}) = -69.44 \text{ dBm/MHz}$.
 The interference signal level to the UUT is lower than -69.44 dBm/MHz .



Detection Threshold Level



Flatness and Bandwidth

4.6.7 Test Result

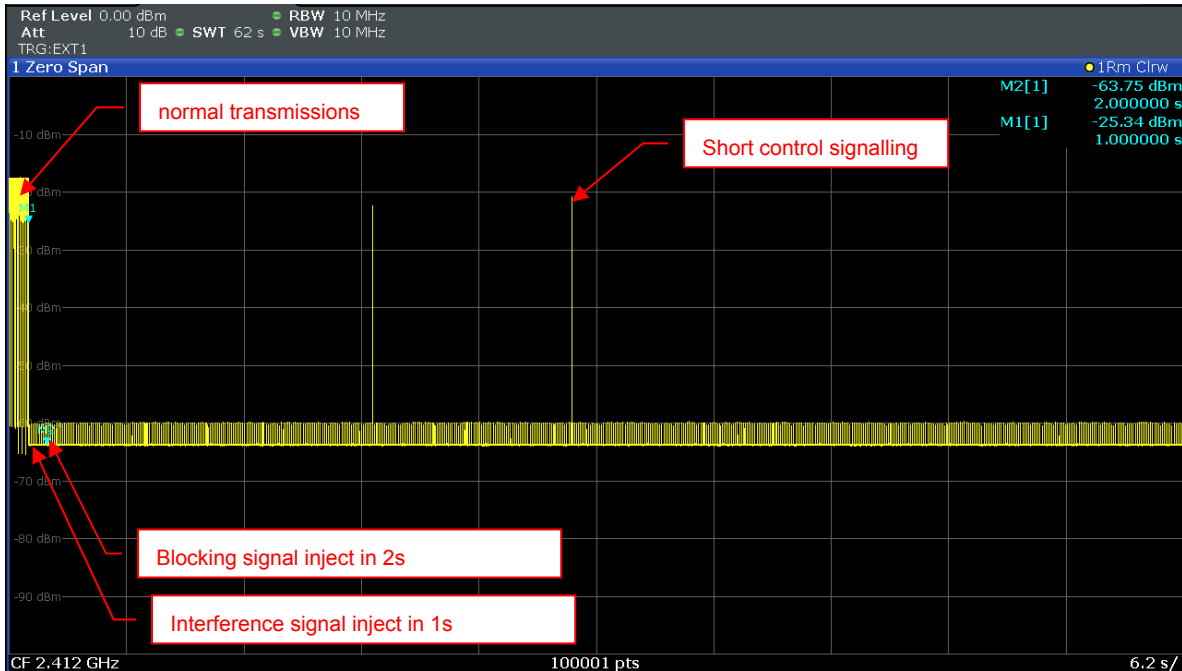
- | | |
|-------------------------------------|---|
| <input type="checkbox"/> | Not applicable to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode |
| <input type="checkbox"/> | Not applicable to equipment with RF output power is less than 10 dBm e.i.r.p. |
| <input checked="" type="checkbox"/> | Refer to below test result |

4.6.7.1 Adaptive Result

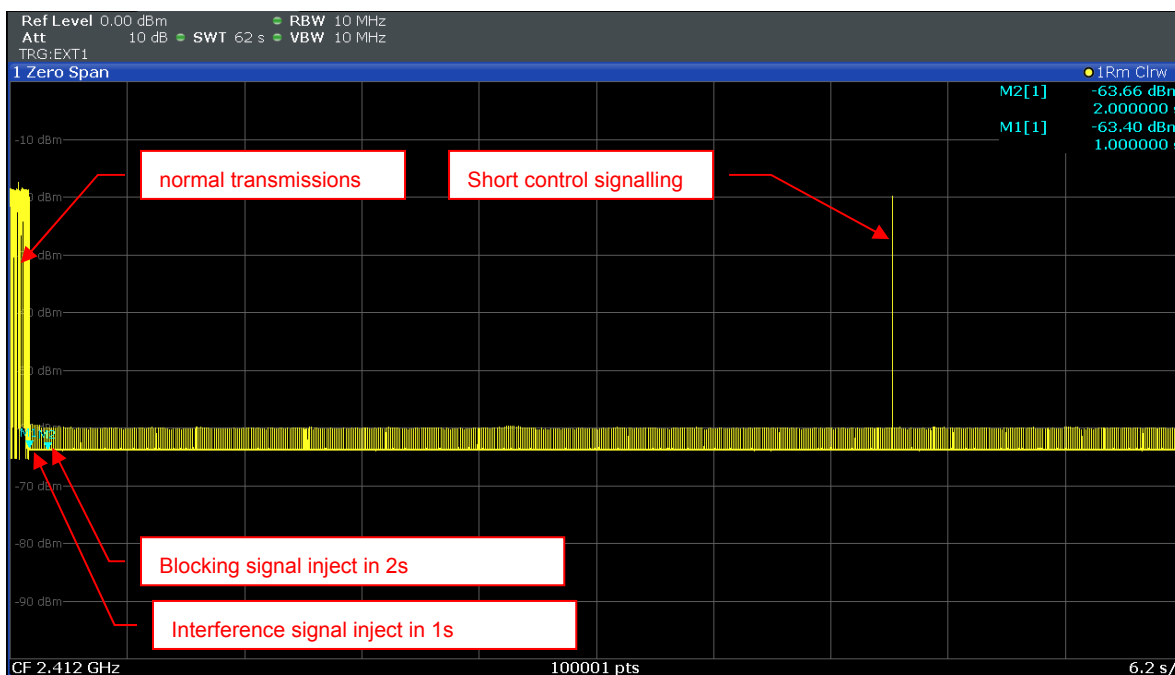
Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (Low Channel, MHz)	Operating Frequency (High Channel, MHz)	Test Result
802.11b	2412	2472	Pass
802.11g	2412	2472	Pass
802.11n (HT20)	2412	2472	Pass
802.11n (HT40)	2422	2462	Pass

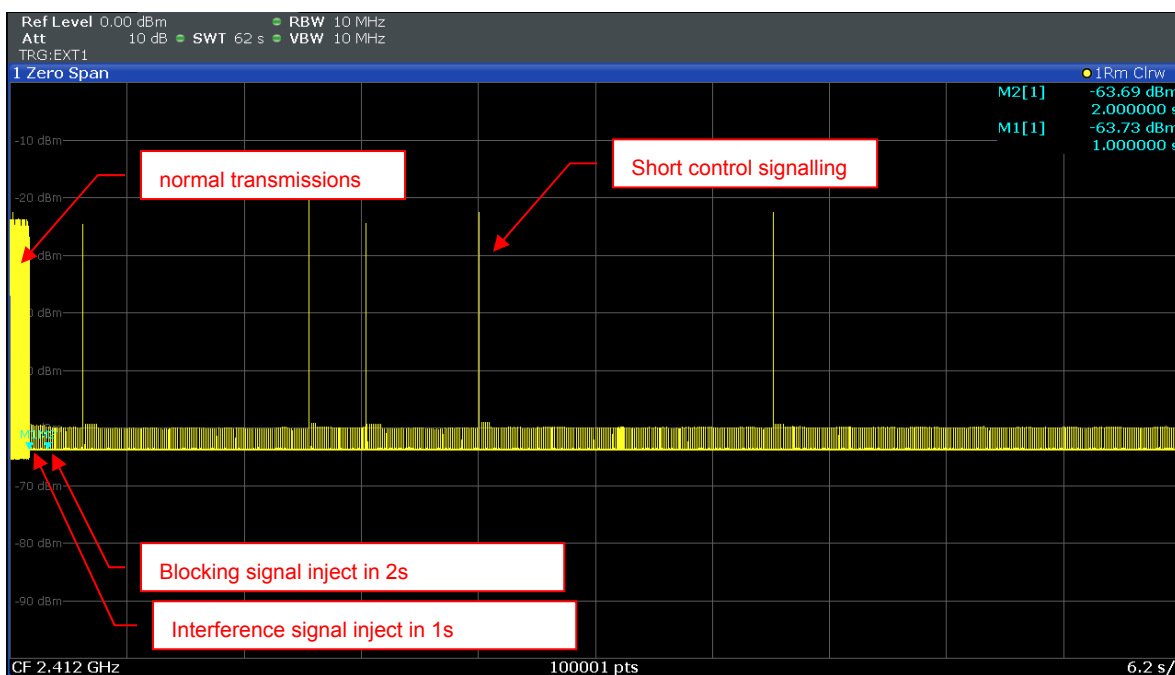
802.11b CH01 2412 MHz



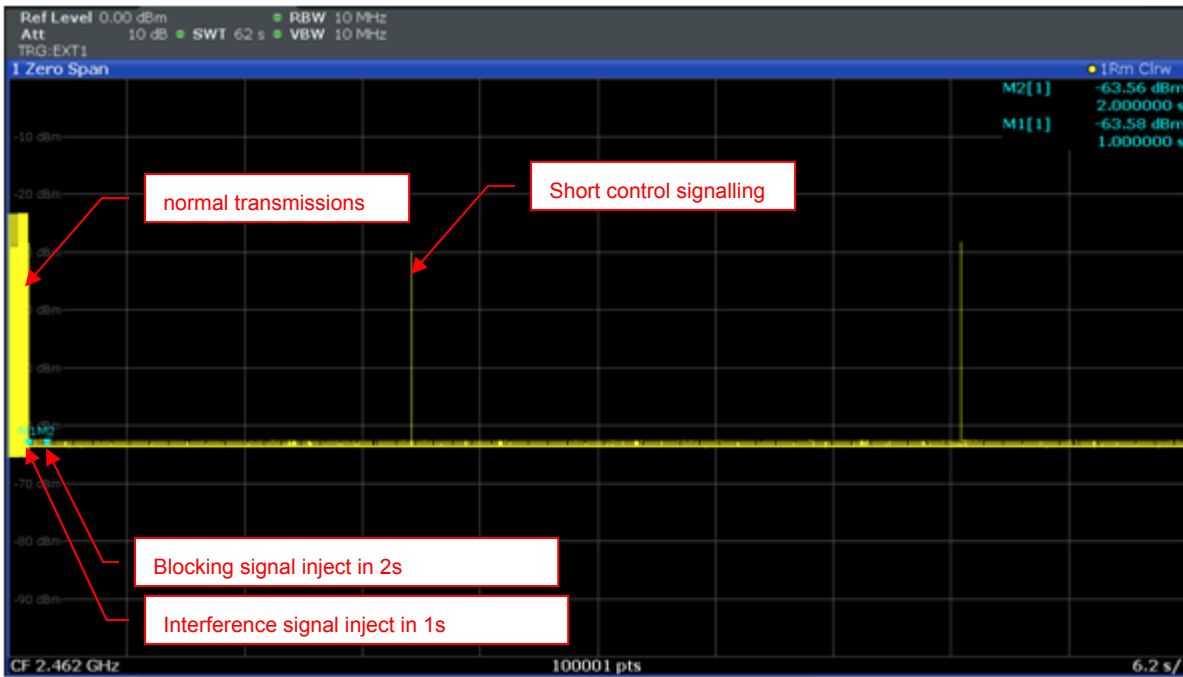
802.11g CH01 2412 MHz



802.11n (HT20) CH01 2412 MHz



802.11n (HT40) CH03 2422 MHz

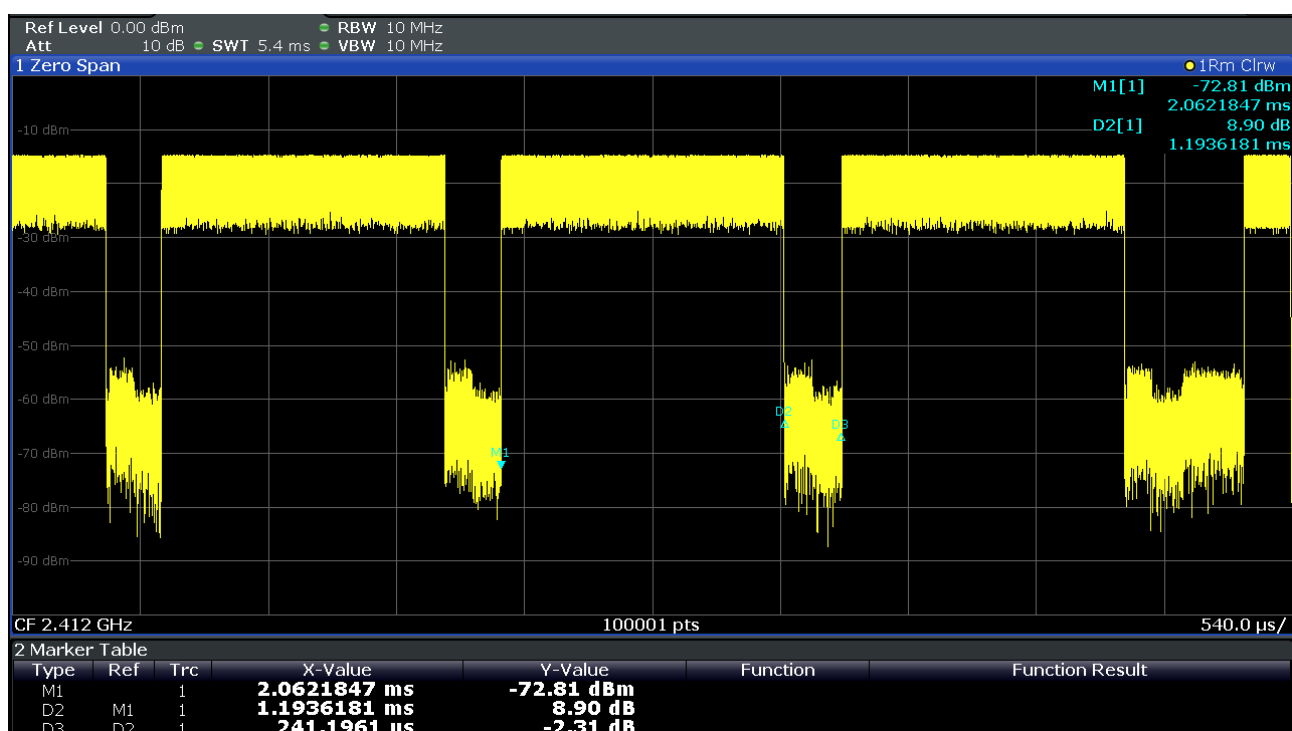


4.6.7.2 The Channel Occupancy Time Result

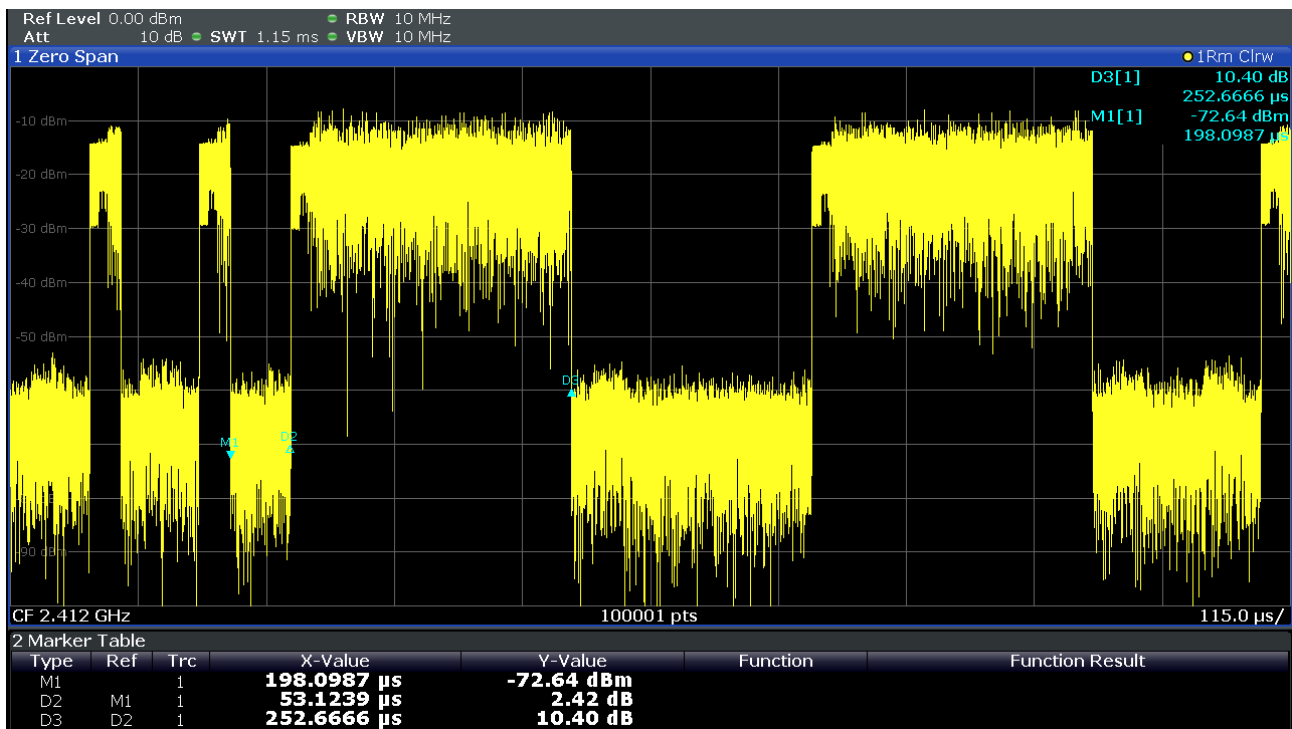
Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency Low Channel (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (ms)	Test Result
802.11b	2412	1.19	0.24	Pass
802.11g	2412	0.25	0.05	Pass
802.11n (HT20)	2412	3.41	0.08	Pass
802.11n (HT40)	2422	1.12	0.07	Pass

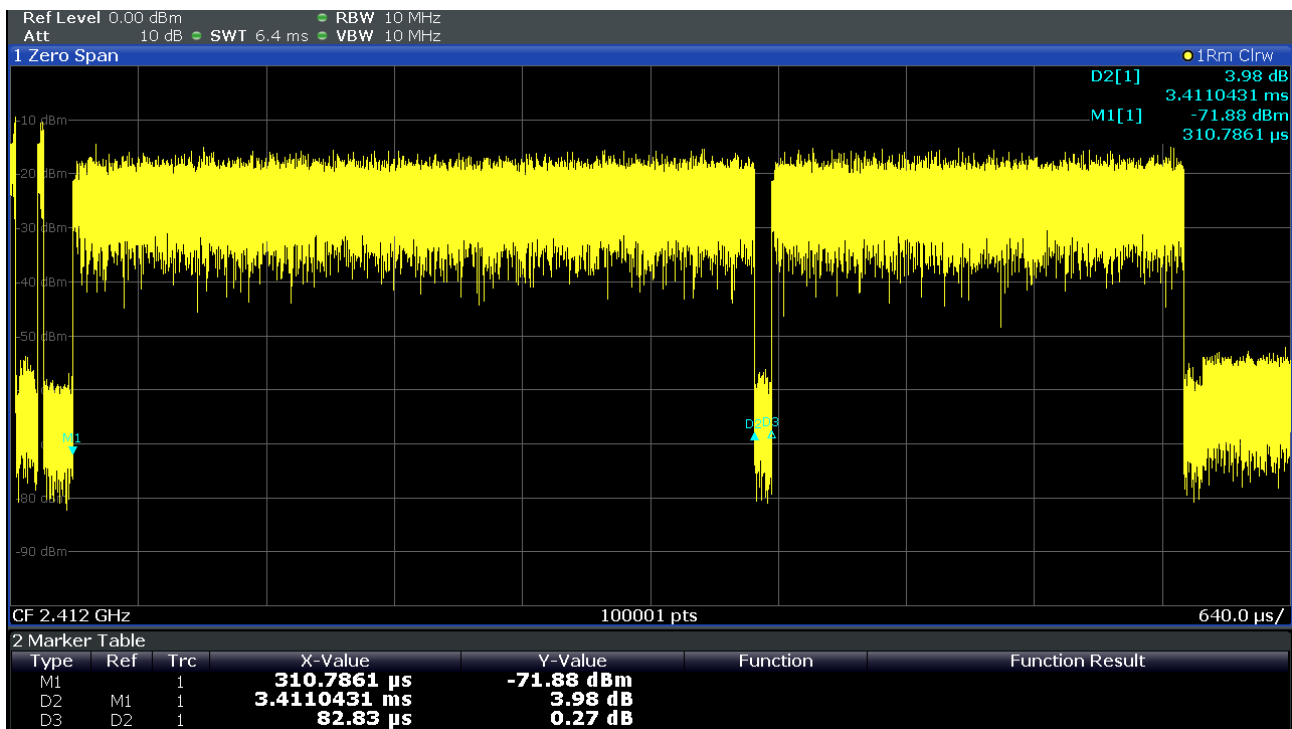
802.11b mode



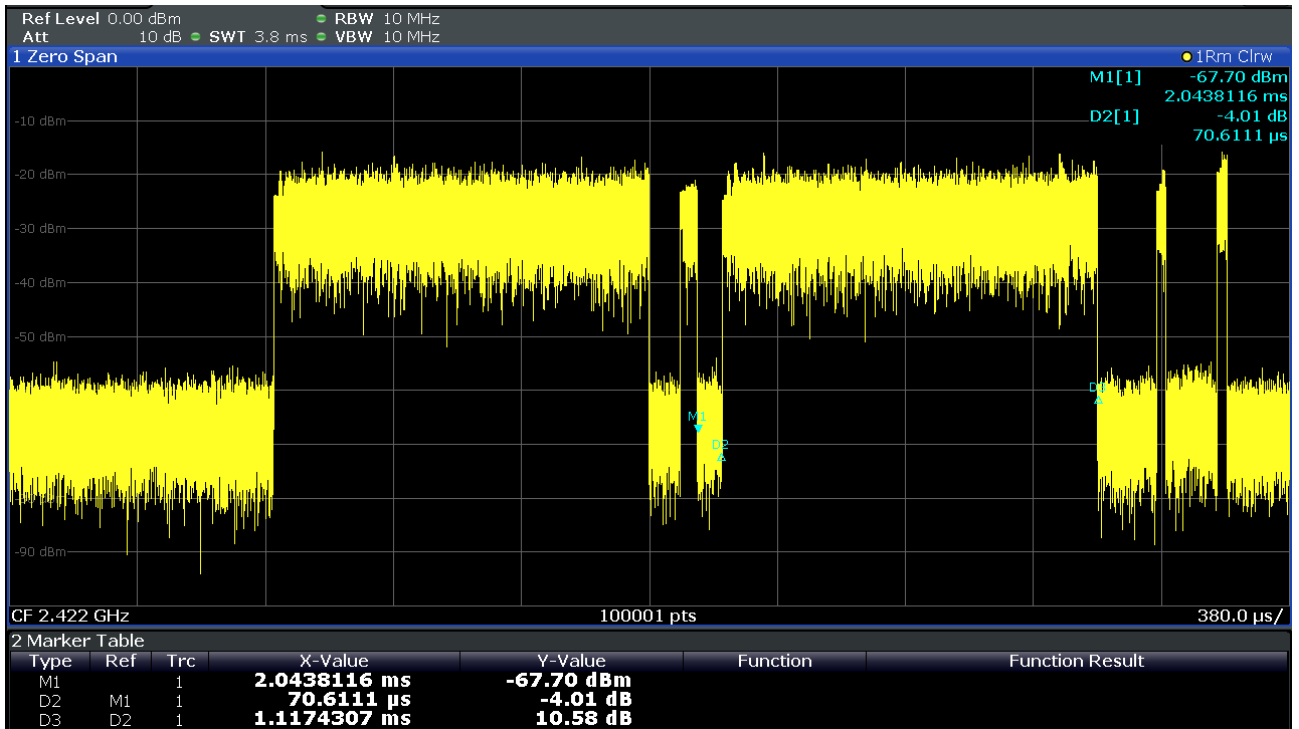
802.11g mode



802.11n (HT20) mode



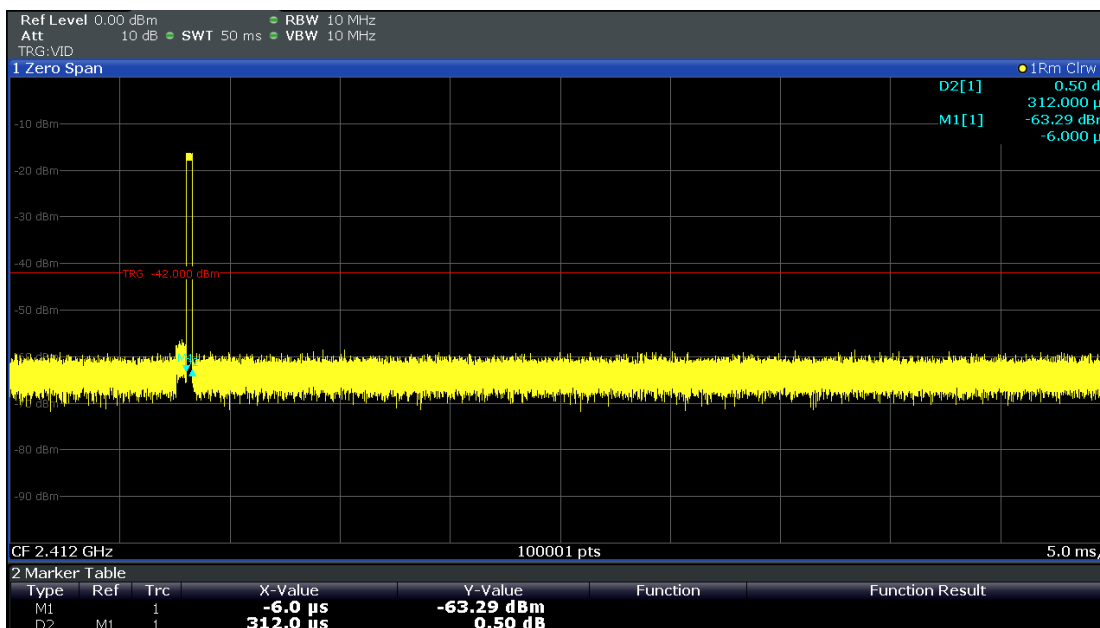
802.11n (HT40) mode



4.6.7.3 Short Control Signalling Transmissions Result

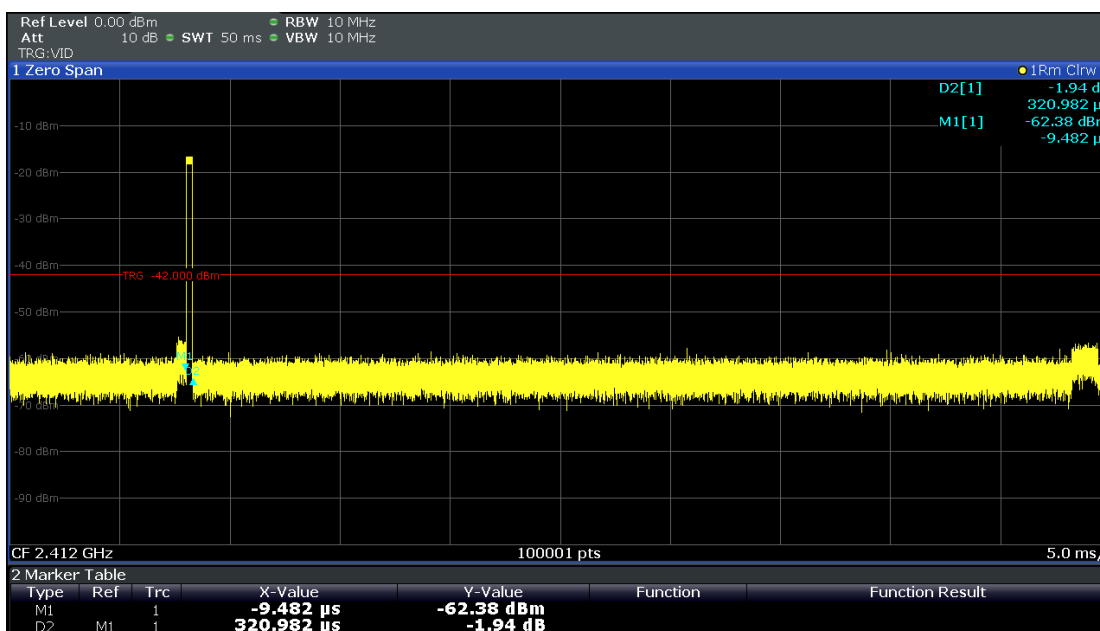
802.11b CH01 2412 MHz

Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
0.31 ms	5ms	PASS



802.11g CH01 2412 MHz

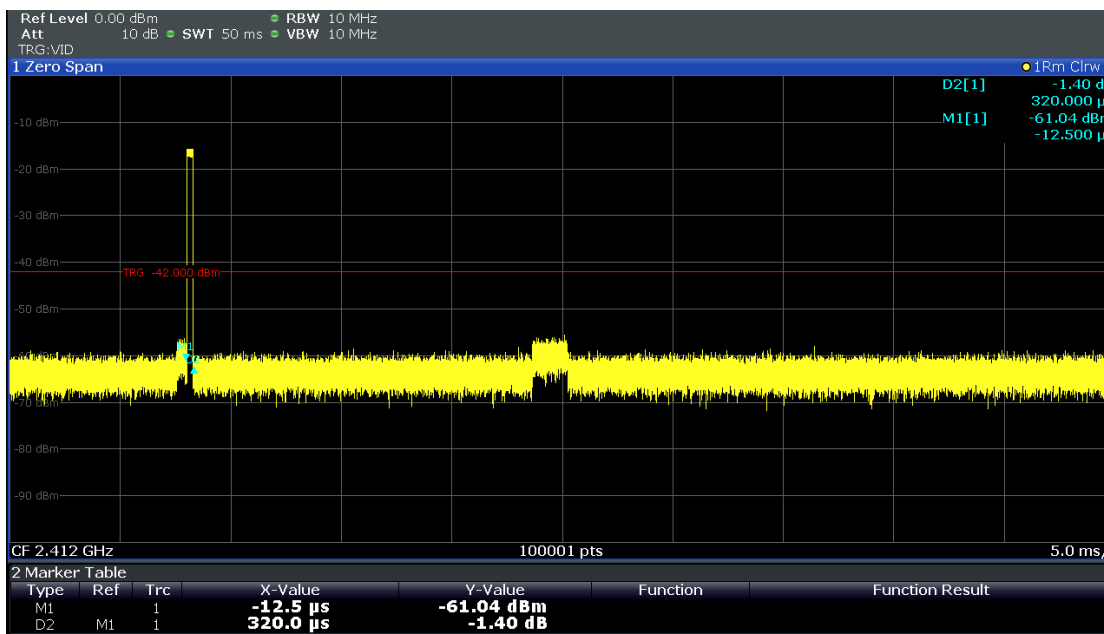
Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
0.32 ms	5ms	PASS



802.11n (HT20) CH01 2412 MHz

Short Control Signalling Transmission Result

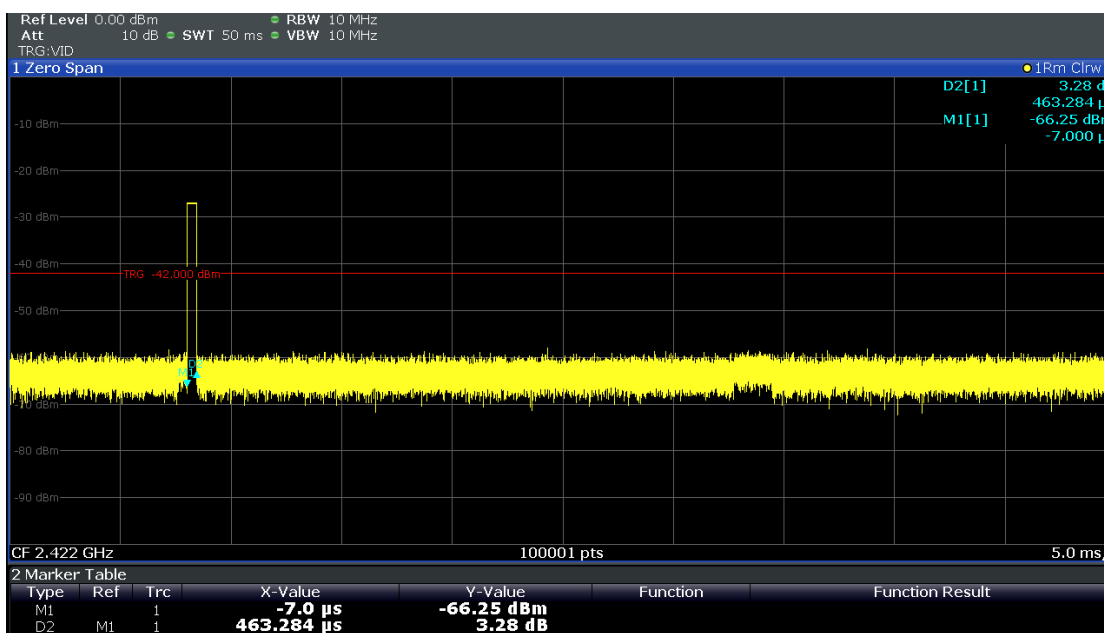
SCST total on time	SCST Limit	PASS/FAIL
0.32 ms	5ms	PASS



802.11n (HT40) CH03 2422 MHz

Short Control Signalling Transmission Result

SCST total on time	SCST Limit	PASS/FAIL
0.46 ms	5ms	PASS



4.7 Transmitter Spurious Emissions

4.7.1 Limits of Transmitter Spurious Emissions

Frequency Range	Maximum Power Limit	Bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87,5 MHz	-36dBm	100kHz
87,5 MHz to 118 MHz	-54dBm	100kHz
118 MHz to 174 MHz	-36dBm	100kHz
174 MHz to 230 MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 862 MHz	-54dBm	100kHz
862 MHz to 1 GHz	-36dBm	100kHz
1GHz ~ 12.75GHz	-30dBm	1MHz

4.7.2 Test Procedure

Refer to chapter 5.3.10.2 of EN 300 328 V1.9.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement
<p><u>For Conducted measurement:</u></p> <p>The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).</p>	
<p><u>Conducted measurement (For equipment with multiple transmit chains):</u></p> <p><input type="checkbox"/> Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits.</p> <p><input checked="" type="checkbox"/> Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by $10 \times \log(N)$ (number of active transmit chains)</p>	

4.7.3 Deviation from Test Standard

No deviation.

4.7.4 Test Setup

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The equipment was configured to operate under its worst case situation with respect to output power.
3. The test setup has been constructed as the normal use condition. Controlling software (QCRT-CONN) has been activated to set the EUT on specific status.

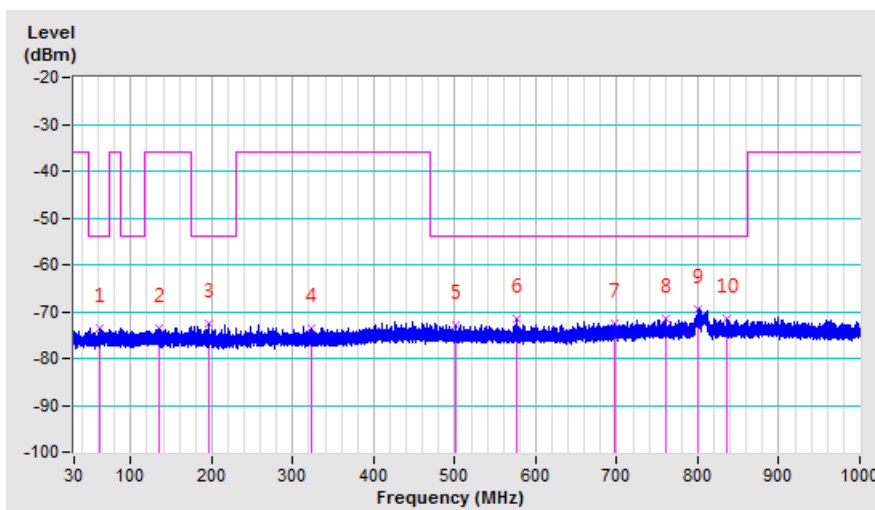
4.7.5 Test Results (Operating - Conducted)

Below 1GHz Worst-case Data

802.11n (HT20)

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	13
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SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
61.60	-73.41	-54.00	-19.41
134.71	-73.60	-36.00	-37.60
196.51	-72.70	-54.00	-18.70
323.02	-73.59	-36.00	-37.59
501.22	-72.87	-54.00	-18.87
576.93	-71.48	-54.00	-17.48
697.13	-72.59	-54.00	-18.59
760.04	-71.58	-54.00	-17.58
799.94	-69.51	-54.00	-15.51
836.19	-71.68	-54.00	-17.68

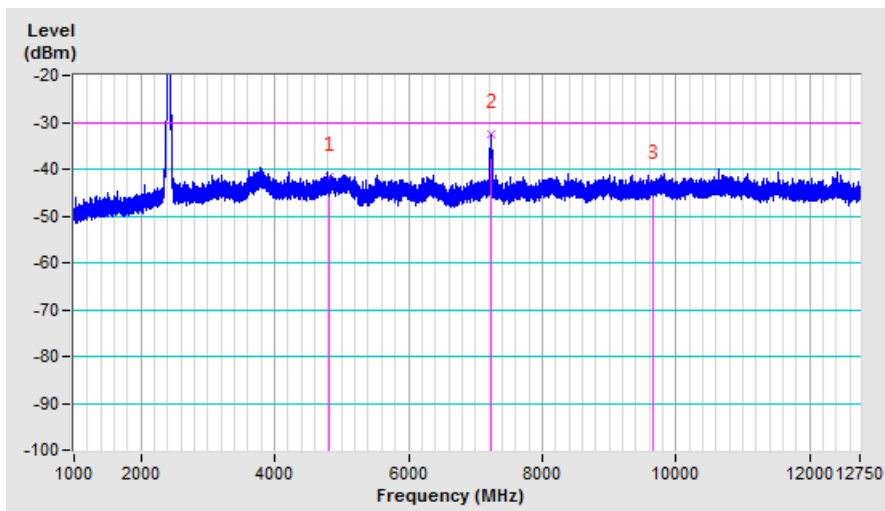


Above 1GHz Worst-case Data

802.11b

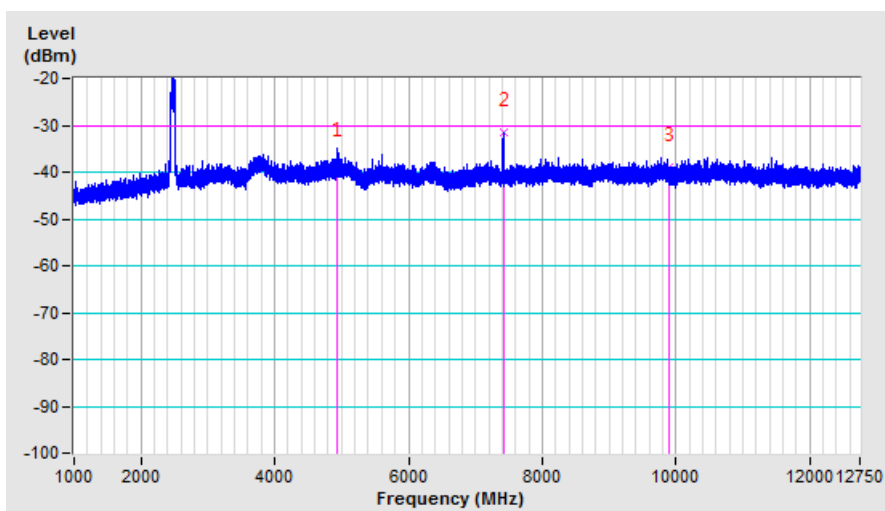
SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	1
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SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
4824.00	-41.74	-30.00	-11.74
7236.91	-32.42	-30.00	-2.42
9648.00	-43.30	-30.00	-13.30



SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	13
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SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
4944.00	-37.96	-30.00	-7.96
7416.80	-31.63	-30.00	-1.63
9888.00	-38.85	-30.00	-8.85



4.7.6 Test Results (Operating - Radiated)

Below 1GHz Worst-case Data

802.11n (HT20)

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	1
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SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
47.95	V	-68.51	-54.00	-14.51
55.10	H	-64.36	-54.00	-10.36
67.70	H	-61.94	-54.00	-7.94
67.75	V	-65.33	-54.00	-11.33
136.66	H	-60.05	-36.00	-24.05
144.01	V	-62.71	-36.00	-26.71
249.11	H	-63.89	-36.00	-27.89
249.71	V	-67.45	-36.00	-31.45
464.67	H	-69.98	-36.00	-33.98
480.07	V	-72.33	-54.00	-18.33
497.77	H	-66.71	-54.00	-12.71
508.02	V	-73.03	-54.00	-19.03
571.58	V	-72.28	-54.00	-18.28
615.68	V	-71.07	-54.00	-17.07
615.73	H	-70.28	-54.00	-16.28
660.58	V	-70.66	-54.00	-16.66
696.88	H	-69.83	-54.00	-15.83
713.04	V	-61.25	-54.00	-7.25
749.19	H	-70.92	-54.00	-16.92
840.09	H	-68.05	-54.00	-14.05

Above 1GHz Worst-case Data

802.11b

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	1, 13
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SPURIOUS EMISSION LEVEL					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	4824.00	H	-55.36	-30.00	-25.36
	4824.00	V	-52.29	-30.00	-22.29
	7234.43	H	-41.31	-30.00	-11.31
	7236.86	V	-41.63	-30.00	-11.63
	9648.00	H	-45.33	-30.00	-15.33
	9648.00	V	-45.00	-30.00	-15.00
13	4944.00	H	-53.16	-30.00	-23.16
	4944.00	V	-54.06	-30.00	-24.06
	7407.98	H	-42.06	-30.00	-12.06
	7419.68	V	-42.90	-30.00	-12.90
	9887.89	V	-41.14	-30.00	-11.14
	9888.00	H	-45.78	-30.00	-15.78

Receiver Parameters

4.8 Receiver Spurious Radiation

4.8.1 Limit of Receiver Spurious Radiation

Frequency Range	Maximum Power Limit
30 MHz ~ 1 GHz	-57dBm
1 GHz ~ 12.75 GHz	-47dBm

4.8.2 Test Procedure

Refer to chapter 5.3.11.2 of EN 300 328 V1.9.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement
<p><u>For Conducted measurement:</u></p> <p>The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).</p>	
<p><u>Conducted measurement (For equipment with multiple transmit chains):</u></p> <p><input type="checkbox"/> Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits.</p> <p><input checked="" type="checkbox"/> Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by $10 \times \log(N)$ (number of active transmit chains)</p>	

4.8.3 Deviation from Test Standard

No deviation.

4.8.4 Test Setup

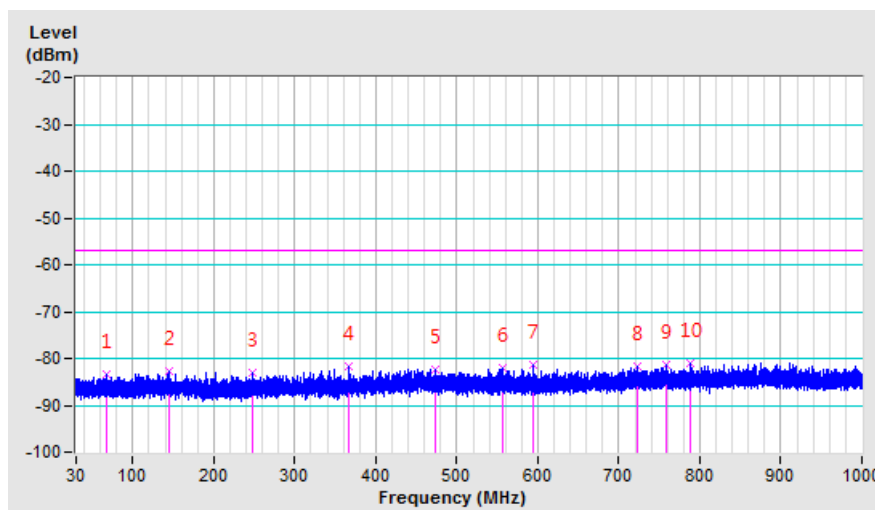
1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. The test setup has been constructed as the normal use condition. Controlling software (QCRT-CONN) has been activated to set the EUT on specific status.

4.8.5 Test Results (Operating - Conducted)

RX Below 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	13
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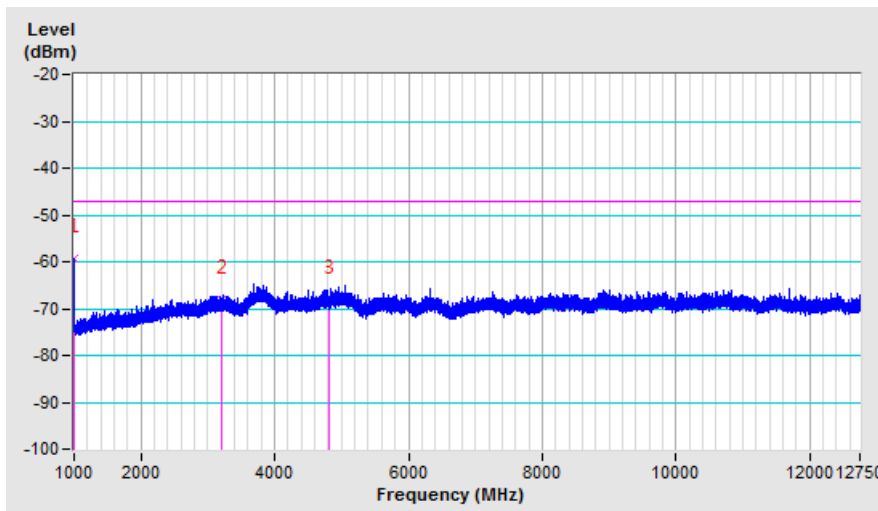
SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
68.55	-83.32	-57.00	-26.32
145.06	-82.70	-57.00	-25.70
247.66	-83.06	-57.00	-26.06
366.47	-81.67	-57.00	-24.67
472.57	-82.23	-57.00	-25.23
556.93	-81.90	-57.00	-24.90
594.83	-81.30	-57.00	-24.30
723.49	-81.59	-57.00	-24.59
758.49	-81.45	-57.00	-24.45
788.29	-80.97	-57.00	-23.97



RX Above 1GHz Worst-case Data

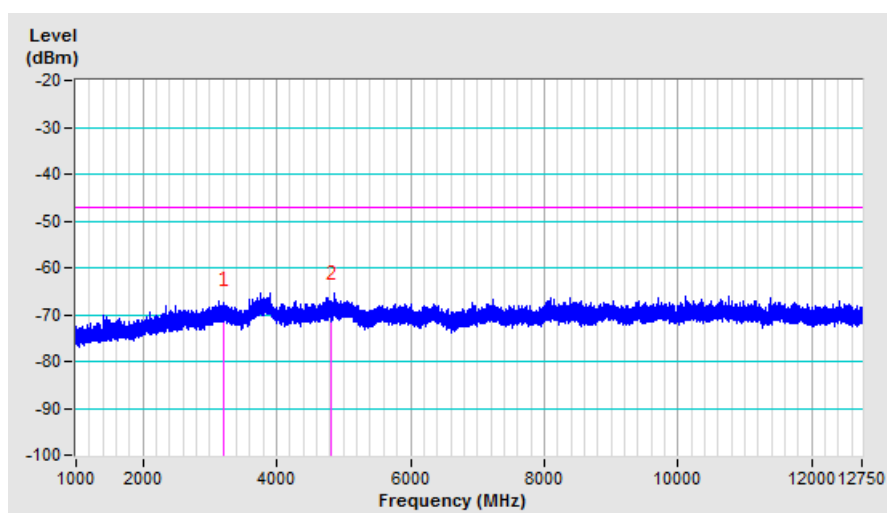
SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	1
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SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
1000.00	-59.32	-47.00	-12.32
3216.00	-68.06	-47.00	-21.06
4824.00	-68.29	-47.00	-21.29



SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	13
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SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
3216.00	-69.64	-47.00	-22.64
4824.00	-68.19	-47.00	-21.19



4.8.8 Test Results (Operating - Radiated)

RX Below 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	13
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SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
48.00	V	-69.05	-57.00	-12.05
67.75	H	-63.20	-57.00	-6.20
67.75	V	-65.73	-57.00	-8.73
116.25	V	-66.97	-57.00	-9.97
135.46	H	-60.32	-57.00	-3.32
135.51	V	-63.34	-57.00	-6.34
144.01	H	-61.59	-57.00	-4.59
144.01	V	-62.96	-57.00	-5.96
181.36	H	-64.77	-57.00	-7.77
235.26	V	-62.54	-57.00	-5.54
324.22	H	-68.39	-57.00	-11.39
374.62	H	-68.50	-57.00	-11.50
431.97	H	-69.45	-57.00	-12.45
462.07	V	-68.52	-57.00	-11.52
466.12	H	-70.93	-57.00	-13.93
497.77	H	-67.88	-57.00	-10.88
508.02	V	-72.71	-57.00	-15.71
746.84	H	-69.40	-57.00	-12.40
758.89	V	-70.19	-57.00	-13.19
899.49	V	-70.01	-57.00	-13.01

RX Above 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	1, 13
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SPURIOUS EMISSION LEVEL					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	3216.00	H	-60.53	-47.00	-13.53
	3216.00	V	-59.24	-47.00	-12.24
	4824.00	H	-57.33	-47.00	-10.33
	4824.00	V	-56.31	-47.00	-9.31
13	3296.00	H	-59.20	-47.00	-12.20
	3296.00	V	-59.41	-47.00	-12.41
	4944.00	H	-56.12	-47.00	-9.12
	4944.00	V	-57.63	-47.00	-10.63

4.9 Receiver Blocking

4.9.1 Limit of Receiver Blocking

Adaptive equipment using wide band modulations other than FHSS, shall comply with the requirements defined in non-LBT based DAA or LBT based DAA in the presence of a blocking signal with characteristics as provided in below table.

Equipment Type (LBT / Non- LBT)	Wanted signal Mean Power from Companion Device	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Type of Interfering Signal
LBT	sufficient to maintain the link (see note 2)	2 395 or 2 488.5 (see note 1)	-35	CW
Non-LBT				

NOTE 1: The highest blocking frequency shall be used for testing the lowest operating hopping frequency, while the lowest blocking frequency shall be used for testing the highest hopping frequency.

NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz.

4.9.2 Test Procedure

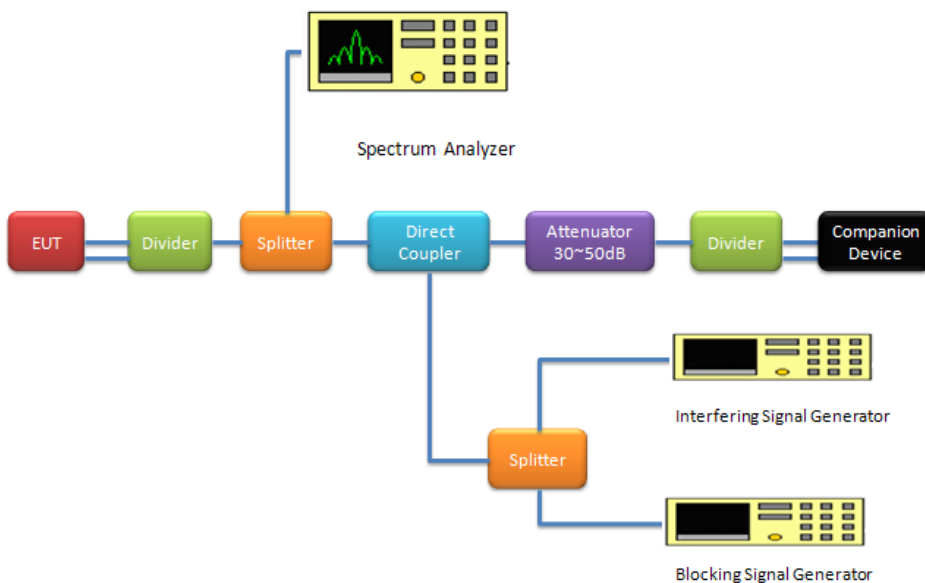
Refer to chapter 5.3.7.2.1. of EN 300 328 V1.9.1.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

4.9.3 Deviation from Test Standard

No deviation.

4.9.4 Test Setup Configuration



4.9.5 Test Results

- Not applicable to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode
- Not applicable due to the RF Output power is less than 10 dBm e.i.r.p.
- Refer to below test result

802.11b

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
1	2412	-50	2488.5	-35	Pass
13	2472	-50	2395	-35	Pass

802.11g

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
1	2412	-50	2488.5	-35	Pass
13	2472	-50	2395	-35	Pass

802.11n (HT20)

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
1	2412	-50	2488.5	-35	Pass
13	2472	-50	2395	-35	Pass

802.11n (HT40)

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
3	2422	-50	2488.5	-35	Pass
11	2462	-50	2395	-35	Pass

5 Photographs of the Test Configuration

TX / RX SPURIOUS EMISSION TEST



Appendix - Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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