EN 301 893 RF Test Report (WLAN)

Report No.:	RE171207E10I-3
Test Model:	BLACK bean
Received Date:	Jan. 17, 2017
Test Date:	Jan. 17 to Apr. 17, 2017
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.

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Release Control Record

Issue No.	Description	Date Issued
RE171207E10I-3	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 Apr. 17, 2017
Standards:	EN 301 893 V2.1.1 (2017-05)

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 : _____ , **Date:** Apr. 15, 2019

Phoenix Huang / Specialist

Approved by : _____ , **Date:** Apr. 15, 2019

May Chen / Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 301 893 V2.1.1		
Clause	Test Parameter	Result
4.2.7	Adaptivity	Pass
4.2.8	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 Apr. 17, 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
RF frequency	±1.132 ppm
RF power conducted	±1.207dB
RF power radiated	±4.925dB
Spurious emissions, conducted	±3dB
Spurious emissions, radiated	±4.925dB
Humidity	±5 %
Temperature	±0.6°C
Time	±5 %

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 301 893 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 and ETSI TR 100 028-2 , in particular in annex D of the ETSI TR 100 028-2.

Maximum measurement uncertainty

Parameter	Uncertainty
RF frequency	±10 ppm
RF power conducted	±1,5 dB
RF power radiated	±6 dB
Spurious emissions, conducted	±3 dB
Spurious emissions, radiated	±6 dB
Humidity	±5 %
Temperature	±2 °C
Time	±10 %

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 Vmin= 207Vac Vmax= 253Vac
Temperature Operating Range	-10℃ ~ 70℃
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
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:

1. This is a supplementary report of Report No: RE171207E10I-A-3. The differences between them are as below information:
   - ◆ Upgraded standard version to EN 301 893 V2.1.1.
2. According to above conditions, only Adaptive and Receiver Blocking of EN 301 893 V2.1.1 test item needs to be performed. And all data was verified to meet the requirements.
3. There are Bluetooth technology and WLAN technology used for the EUT.
4. 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

5. 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.

6. WLAN/BT coexistence mode:
   - ◆ 1x1 WLAN + BT:
     - ➢ 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
     - ➢ 2.4GHz: timely shared coexistence.
7. 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

8. 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

FOR 5180 ~ 5320MHz

8 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	52	5260
40	5200	56	5280
44	5220	60	5300
48	5240	64	5320

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

Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	54	5270
46	5230	62	5310

2 channels are provided for 802.11ac (VHT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210 MHz	58	5290 MHz

FOR 5500 ~ 5700MHz

11 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	124	5620
104	5520	128	5640
108	5540	132	5660
112	5560	136	5680
116	5580	140	5700
120	5600		

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

Channel	Frequency (MHz)	Channel	Frequency (MHz)
102	5510	126	5630
110	5550	134	5670
118	5590		

2 channels are provided for 802.11ac (VHT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
106	5530	122	5610

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
802.11ac (VHT20)	36 to 64	40	OFDM
	100 to 140		
802.11ac (VHT40)	38 to 62	38	OFDM
	102 ot 134		

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)
802.11a	36 to 64	36	OFDM	6
	100 to 140	100	OFDM	6

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 specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standard:

EN 301 893 V2.1.1 (2017-05)

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

4 Test Procedure and Results

4.1 Adaptivity

4.1.1 Product information for Adaptivity (Channel Access Mechanism)

Adaptivity (Channel Access Mechanism)	
☐Frame Based Equipment	☐ The Frame Based Equipment equipment operates as an Initiating Device
	☐ The Frame Based Equipment equipment operates as an Responding Device
	☐ The Frame Based Equipment equipment can operate as an Initiating Device and as a Responding Device
☒Load Based Equipment	☐ The Load Based Equipment equipment operates as a Supervising Device
	☒ The Load Based Equipment equipment operates as a Supervised Device
	☐ The Load Based Equipment equipment can operate as a Supervising and as a Supervised Device

Priority Classes implemented by the Load Based Equipment	
☐Operating as a Supervising Device	☐ Priority Class 4 (Highest priority)
	☐ Priority Class 3
	☐ Priority Class 2 ☐ Note 1 ☐ Note 2
	☐ Priority Class 1 (Lowest priority) ☐ Note 1
☒Operating as a Supervised Device	☐ Priority Class 4 (Highest priority)
	☐ Priority Class 3
	☒ Priority Class 2 ☐ Note 1 ☐ Note 2
	☐ Priority Class 1 (Lowest priority) ☐ Note 1

Energy Detection Threshold Level(TL)	
☐Frame Based Equipment	For $P_H \leq 13$ dBm : TL = -75 dBm/MHz For 13 dBm < P_H < 23 dBm : TL = -85 dBm/MHz + (23 dBm - P_H) For $P_H \geq 23$ dBm : TL = -85 dBm/MHz (assumes a 0 dBi receive antenna and P_H to be specified in dBm e.i.r.p)
☒Load Based Equipment	☒ Option 1: TL = -75 dBm/MHz (assumes a 0 dBi receive antenna)
	☐ Option 2: For $P_H \leq 13$ dBm : TL = -75 dBm/MHz For 13 dBm < P_H < 23 dBm : TL = -85 dBm/MHz + (23 dBm - P_H) For $P_H \geq 23$ dBm : TL = -85 dBm/MHz (assumes a 0 dBi receive antenna and P_H to be specified in dBm e.i.r.p)

4.1.2 Requirements and Limits of Adaptive

Channel Access Mechanism		
Requirement	**Frame Based Equipment**	**Load Based Equipment**
Minimum Clear Channel Assessment (CCA) Time	9 µs	9 µs
Maximum Channel Occupancy (COT) Time	95 % of the Fixed Frame Period (Note 1)	2 ~ 10 ms(see table 1 & 2)
Minimum Idle Period	5% COT, with a min of 100 µs	25µs
Extended CCA check	NA	NA
Short Control Signalling Transmissions	Maximum duty cycle of 5 % within an observation period of 50 ms	
Note 1: The Fixed Frame Periods supported by the equipment shall be declared by the manufacturer and shall be within the range of 1 ms to 10 ms.		

Table 1: Priority Class dependent Channel Access parameters for Supervising Devices

Class #	**p_0**	**CW_{min}**	**CW_{max}**	**maximum Channel Occupancy Time (COT)**
4	1	3	7	2 ms
3	1	7	15	4 ms
2	3	15	63	6 ms (see note 1 and note 2)
1	7	15	1 023	6 ms (see note 1)
NOTE 1: The maximum *Channel Occupancy Time* (COT) of 6 ms may be increased to 8 ms by inserting one or more pauses. The minimum duration of a pause shall be 100 µs. The maximum duration (Channel Occupancy) before including any such pause shall be 6 ms. Pause duration is not included in the channel occupancy time. NOTE 2: The maximum Channel Occupancy Time (COT) of 6 ms may be increased to 10 ms by extending CW to CW × 2 + 1 when selecting the random number q for any backoff(s) that precede the Channel Occupancy that may exceed 6 ms or which follow the Channel Occupancy that exceeded 6 ms. The choice between preceding or following a Channel Occupancy shall remain unchanged during the operation time of the device. NOTE 3: The values for p_0, CW_{min}, CW_{max} are minimum values. Greater values are allowed.				

Table 2: Priority Class dependent Channel Access parameters for Supervised Devices

Class #	**p_0**	**CW_{min}**	**CW_{max}**	**Maximum Channel Occupancy Time (COT)**
4	2	3	7	2 ms
3	2	7	15	4 ms
2	3	15	1 023	6 ms (see note 1)
1	7	15	1 023	6 ms (see note 1)
NOTE 1: The maximum *Channel Occupancy Time* (COT) of 6 ms may be increased to 8 ms by inserting one or more pauses. The minimum duration of a pause shall be 100 µs. The maximum duration (Channel Occupancy) before including any such pause shall be 6 ms. Pause duration is not included in the channel occupancy time. NOTE 2: The values for p_0, CW_{min}, CW_{max} are minimum values. Greater values are allowed.				

Table 3: Classification of Idle Periods dependent Priority Class for Supervising Devices

Class #	Idle Periods Classification
4	$B_n = \begin{cases} [0, 23[\ \mu s, & n = 0 \\ [23 + 9 \times (n-1), 23 + 9 \times n[\ \mu s, & 1 \le n \le 3 \\ [50, \infty[\ \mu s, & n = 4 \end{cases}$
3	$B_n = \begin{cases} [0, 23[\ \mu s, & n = 0 \\ [23 + 9 \times (n-1), 23 + 9 \times n[\ \mu s, & 1 \le n \le 7 \\ [86, \infty[\ \mu s, & n = 8 \end{cases}$
2	$B_n = \begin{cases} [0, 41[\ \mu s, & n = 0 \\ [41 + 9 \times (n-1), 41 + 9 \times n[\ \mu s, & 1 \le n \le 31 \\ [320, \infty[\ \mu s, & n = 32 \end{cases}$ (use of note 2 in table 1) $B_n = \begin{cases} [0, 41[\ \mu s, & n = 0 \\ [41 + 9 \times (n-1), 41 + 9 \times n[\ \mu s, & 1 \le n \le 15 \\ [176, \infty[\ \mu s, & n = 16 \end{cases}$ (not use of note 2 in table 1)
1	$B_n = \begin{cases} [0, 77[\ \mu s, & n = 0 \\ [77 + 9 \times (n-1), 77 + 9 \times n[\ \mu s, & 1 \le n \le 15 \\ [212, \infty[\ \mu s, & n = 16 \end{cases}$

Table 4: Classification of Idle Periods dependent Priority Class for Supervised Devices

Class #	Idle Periods Classification
4	$B_n = \begin{cases} [0, 32[\ \mu s, & n = 0 \\ [32 + 9 \times (n-1), 32 + 9 \times n[\ \mu s, & 1 \le n \le 3 \\ [59, \infty[\ \mu s, & n = 4 \end{cases}$
3	$B_n = \begin{cases} [0, 32[\ \mu s, & n = 0 \\ [32 + 9 \times (n-1), 32 + 9 \times n[\ \mu s, & 1 \le n \le 7 \\ [95, \infty[\ \mu s, & n = 8 \end{cases}$
2	$B_n = \begin{cases} [0, 41[\ \mu s, & n = 0 \\ [41 + 9 \times (n-1), 41 + 9 \times n[\ \mu s, & 1 \le n \le 15 \\ [176, \infty[\ \mu s, & n = 16 \end{cases}$
1	$B_n = \begin{cases} [0, 77[\ \mu s, & n = 0 \\ [77 + 9 \times (n-1), 77 + 9 \times n[\ \mu s, & 1 \le n \le 15 \\ [212, \infty[\ \mu s, & n = 16 \end{cases}$

Table 5: Idle Periods probability dependent Priority Class

Class #	Idle Periods probability
4	$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}05 + n \times 0{,}25, & 1 \leq n \leq 3 \\ 1, & n > 3 \end{cases}$
3	$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}18, & n = 1 \\ 0{,}18 + (n-1) \times 0{,}125, & 2 \leq n \leq 6 \\ 1, & n > 6 \end{cases}$
2	$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}12, & n = 1 \\ 0{,}12 + (n-1) \times 0{,}03125, & 2 \leq n \leq 29 \\ 1, & n > 29 \end{cases}$ (use of note 2 in table 1) $p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}12, & n = 1 \\ 0{,}12 + (n-1) \times 0{,}0625, & 2 \leq n \leq 15 \\ 1, & n > 15 \end{cases}$ (not use of note 2 in table 1) $p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}09 + (n-1) \times 0{,}03125, & 1 \leq n \leq 7 \\ 0{,}59 + (n-1) \times 0{,}03125, & 8 \leq n \leq 14 \\ 1, & n > 14 \end{cases}$ (use of note 1 in table 1 & table 2)
1	$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}12, & n = 1 \\ 0{,}12 + (n-1) \times 0{,}0625, & 2 \leq n \leq 15 \\ 1, & n > 15 \end{cases}$

1. E define the total number of Idle Periods observed. Then E is the sum of events in all bins:
$$E = \sum_{n=0}^{k} H(B_n)$$

2. p(n) define the probability that idle periods of duration less than the upper limit specified for bin B_n occurred, p(n) = p (Idle Period < upper limit of bin B_n)
$$p(n) = \frac{\sum_{i=0}^{n} H(B_i)}{E}$$

4.1.3 Test Procedure

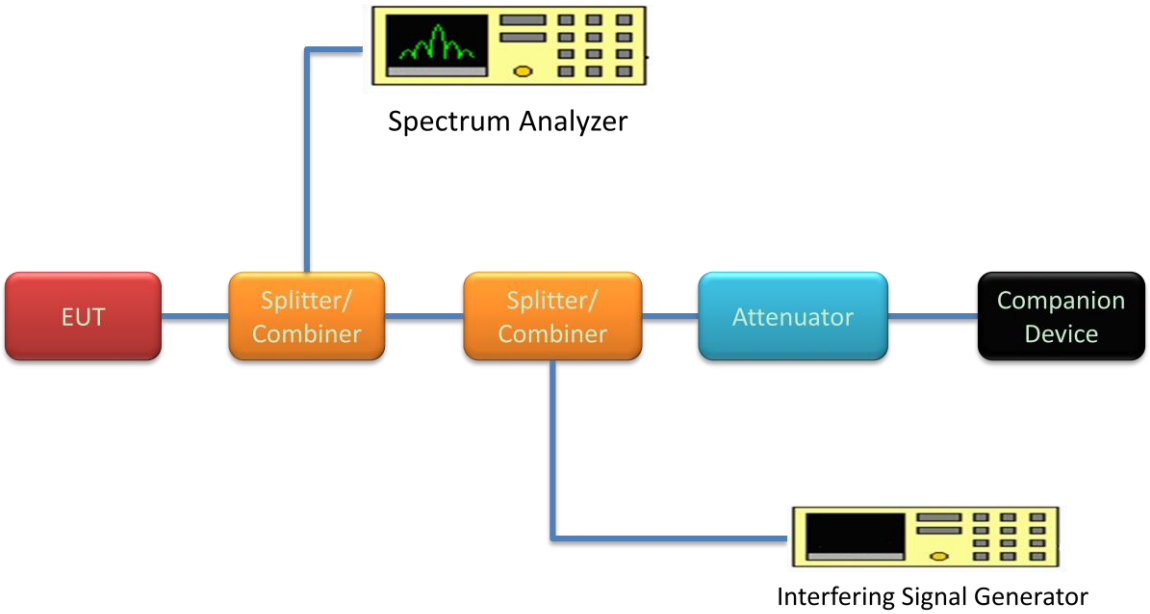
Refer to EN 301 893 V2.1.1 clause 5.4.9

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.1.4 Deviation from Test Standard

No deviation.

4.1.5 Test Setup Configuration



UUT Software and Firmware Version

Product	Model No.	Software/Firmware Version
BLACK-Bean	BLACK bean	4/14/2017 12.0.0.995

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.

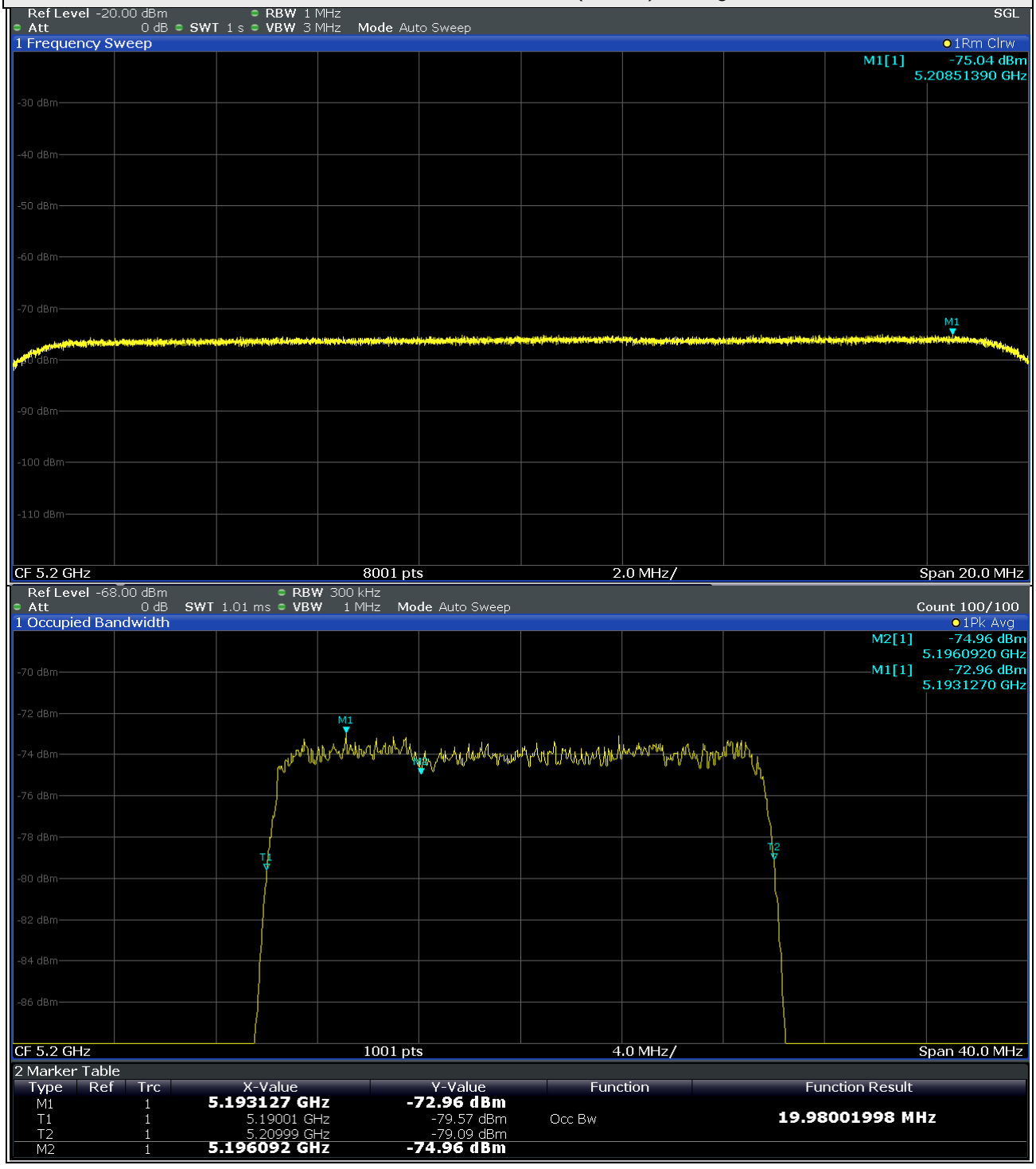
4.1.6 List of Measurements

Clause	Test Parameter	Remarks	Pass/Fail
4.2.7.3.1	Adaptive (Frame Based Equipment)	Not Applicable	NA
4.2.7.3.2	Adaptive (Load Based Equipment)	Applicable	Pass
4.2.7.3.3	Short Control Signalling Transmissions	Applicable	Pass

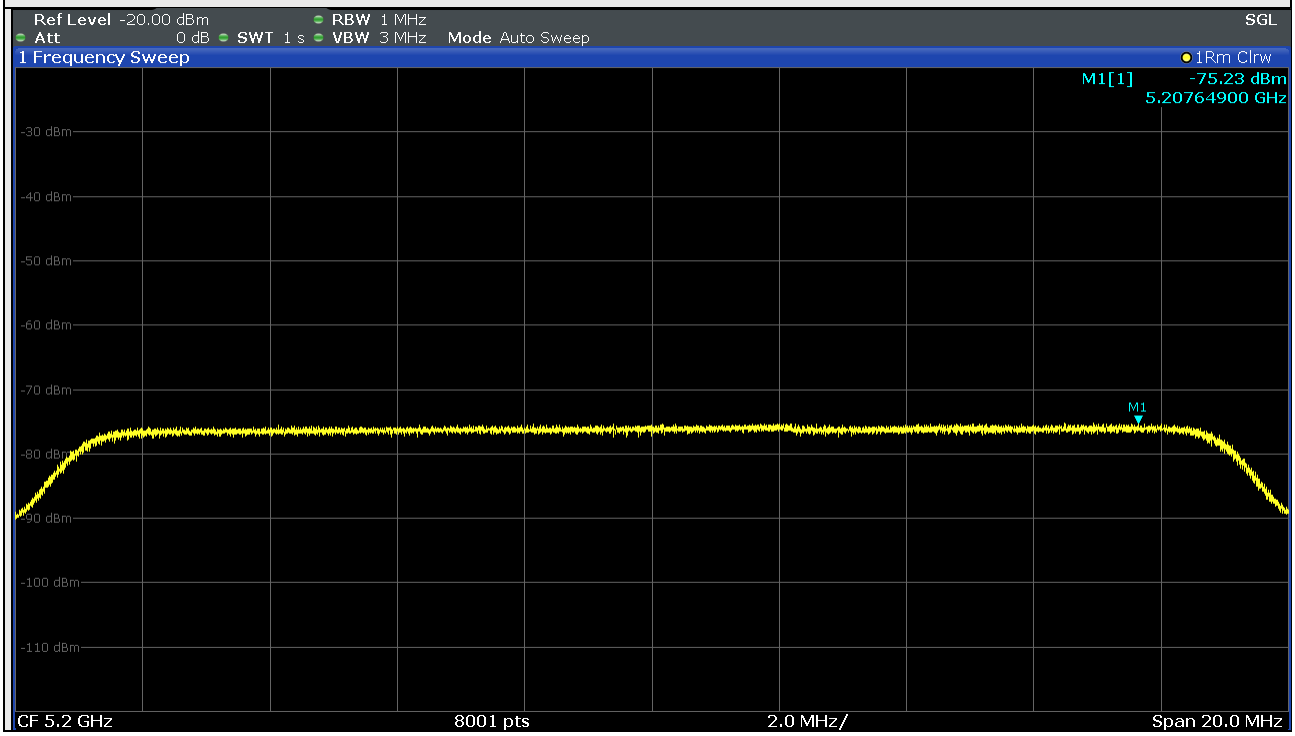
4.1.7 Interference Signals used for Adaptivity tests

Energy Detection Threshold Level(TL)	
Option 1: TL = -75 dBm/MHz (assumes a 0 dBi receive antenna)	
UUT antenna Gain(G) : 0 dBi	
The ED Threshold level (TL) = -75 dBm/MHz + G (0dBi) = -75 dBm/MHz	☒ at the antenna connector ☐ in front of the antenna

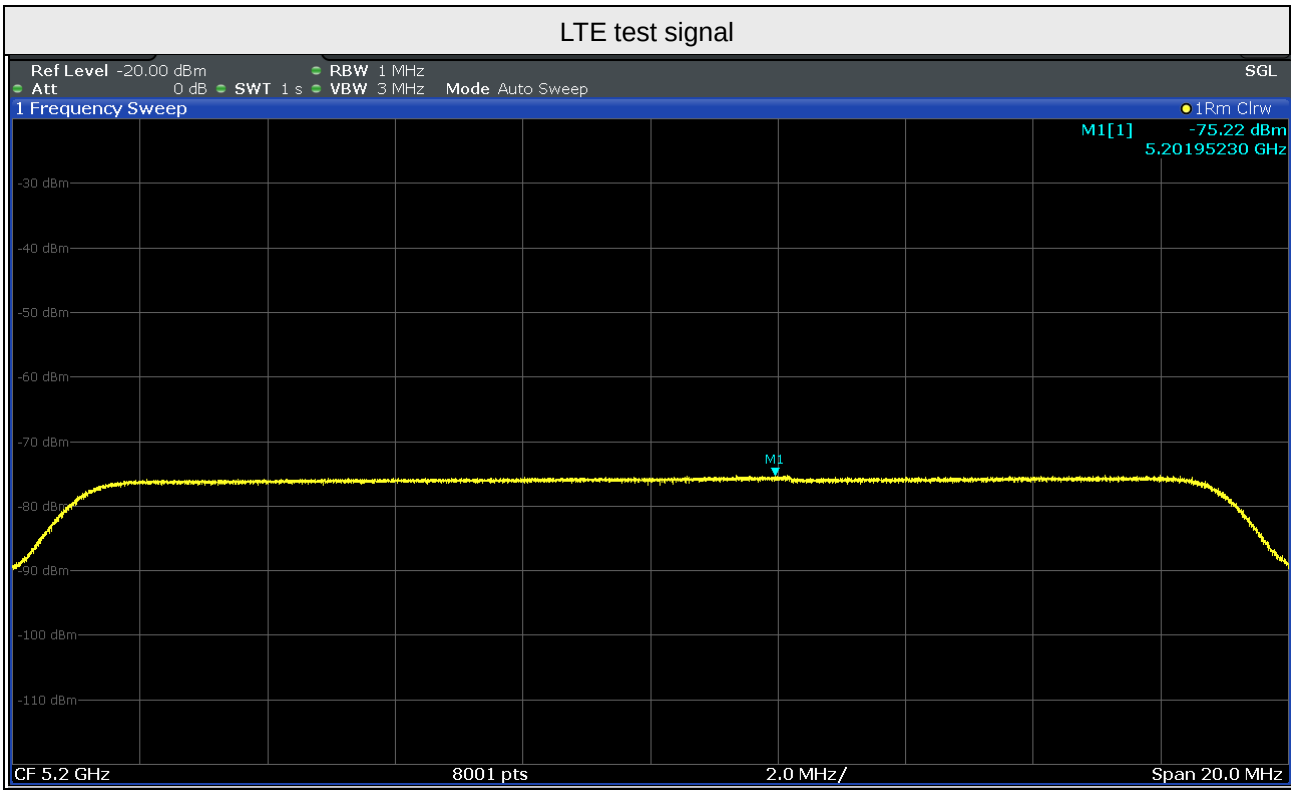
Additive White Gaussian Noise (AWGN) test signal



OFDM test signal



LTE test signal



4.1.8 Test Result

4.1.8.1 Adaptive Test Result

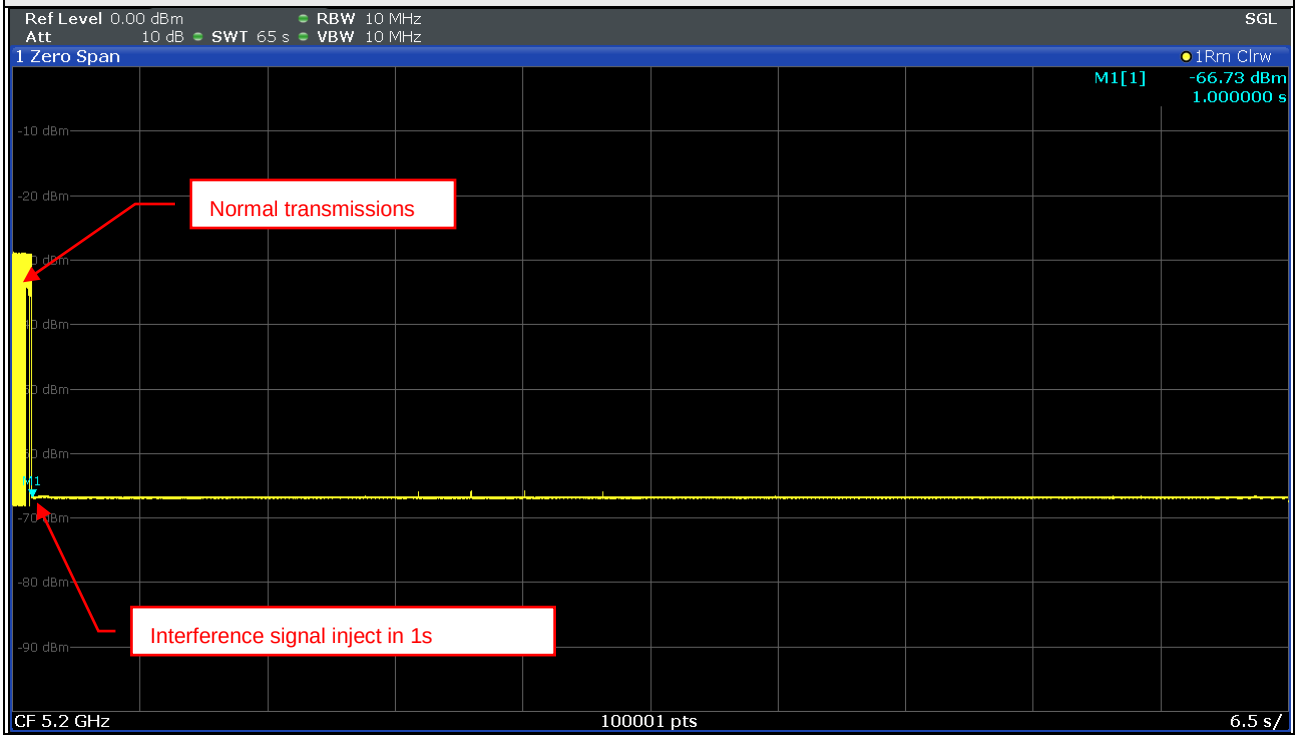
Channel Opreation of EUT Device type

☐Frame Based Equipment	☐ Single Channel Operation
	☐ Multi-Channel Opreation
☒Load Based Equipment	☒ Single Channel Operation
	☐ Option 1 for Multi-Channel Opreation
	☒ Option 2 for Multi-Channel Opreation

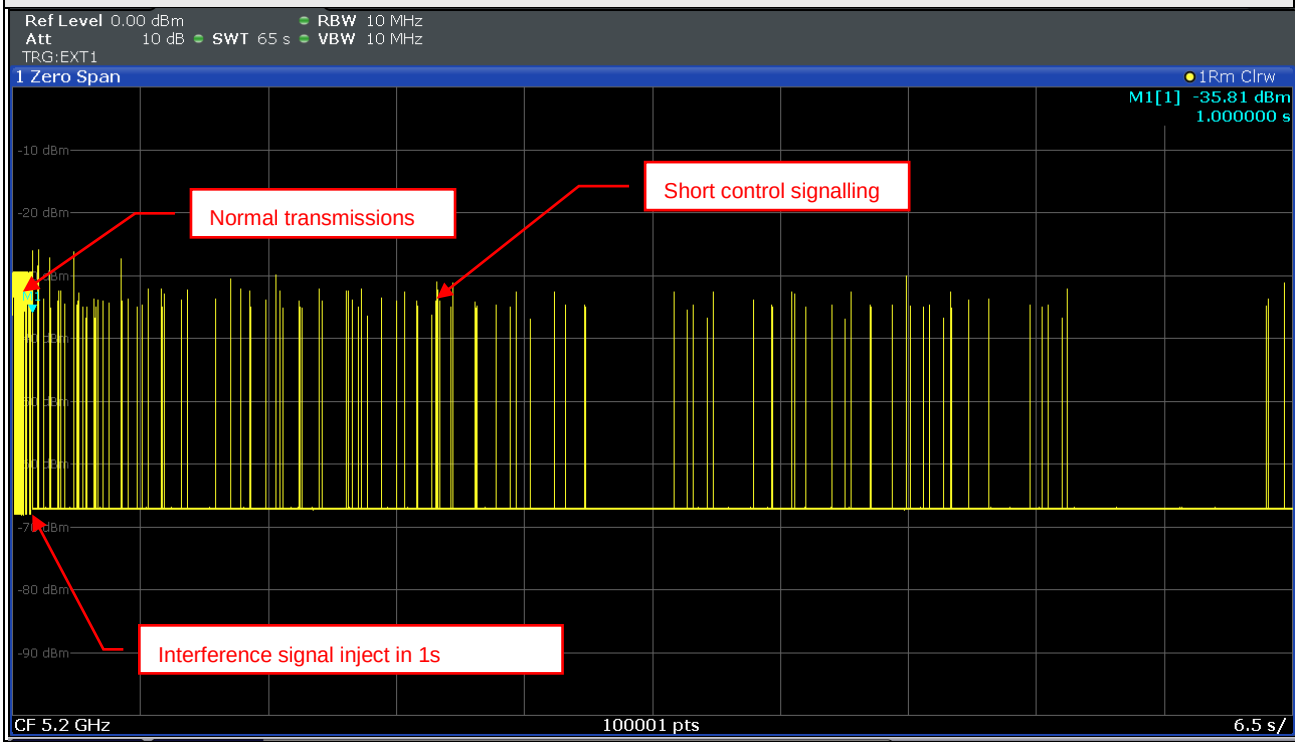
Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (MHz)	Test Result
802.11ac (VHT20)	5200	Pass

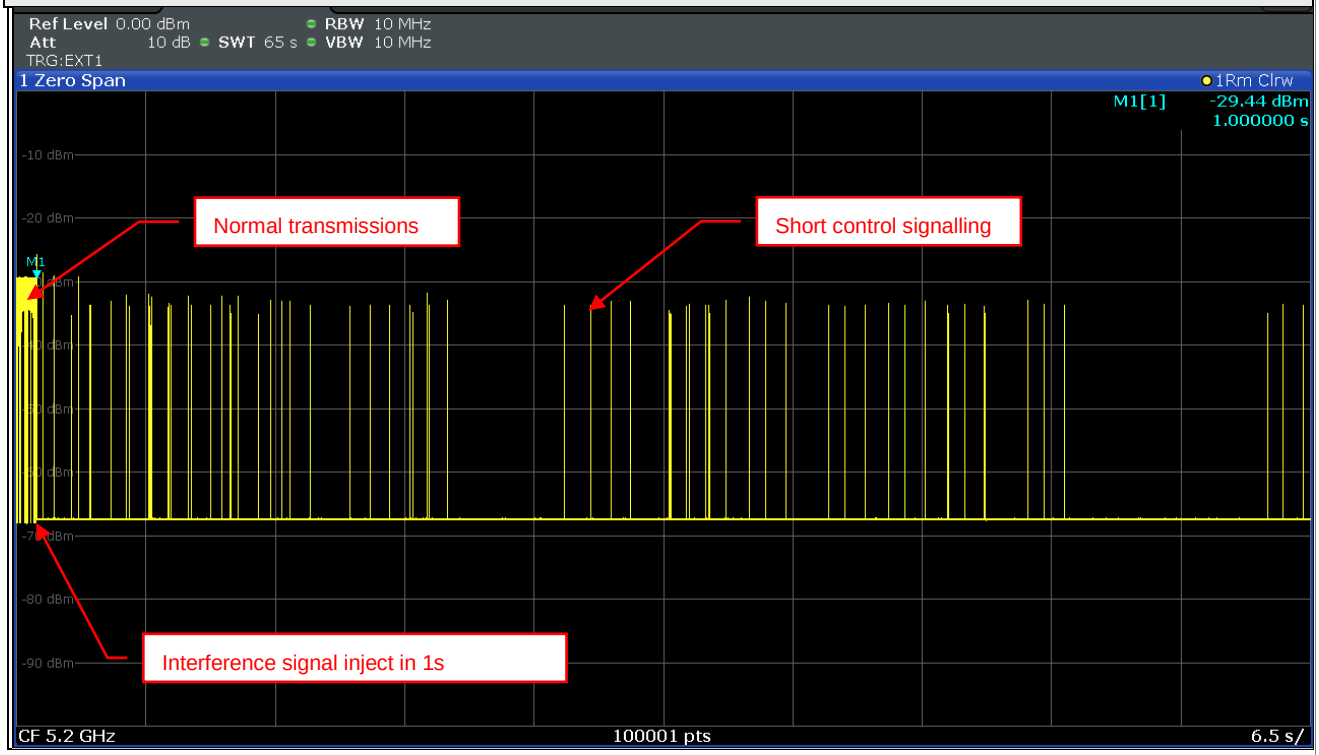
Additive White Gaussian Noise (AWGN) signal test result



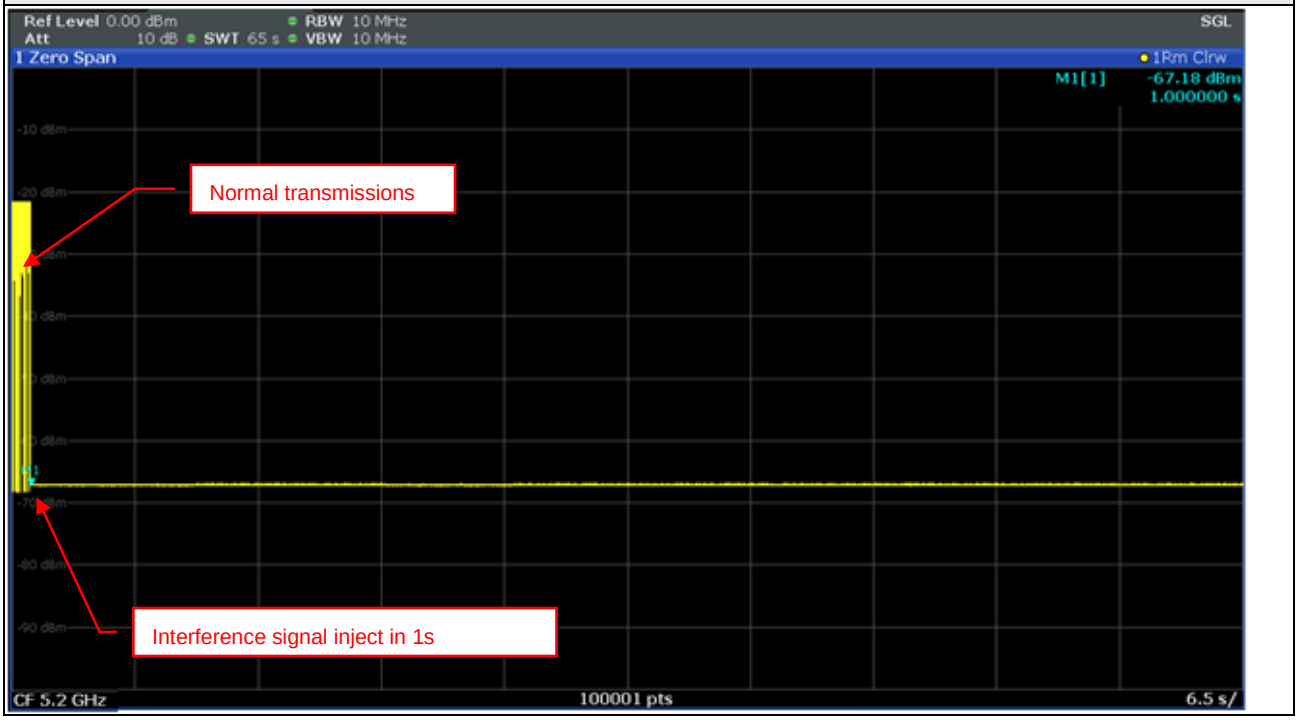
OFDM signal test result



LTE test signal



Operational Mode	Operating Frequency (MHz)	Test Result
802.11ac (VHT40)	5190	Pass

Additive White Gaussian Noise (AWGN) signal test result


4.1.8.2 Test results of Channel Access Mechanism

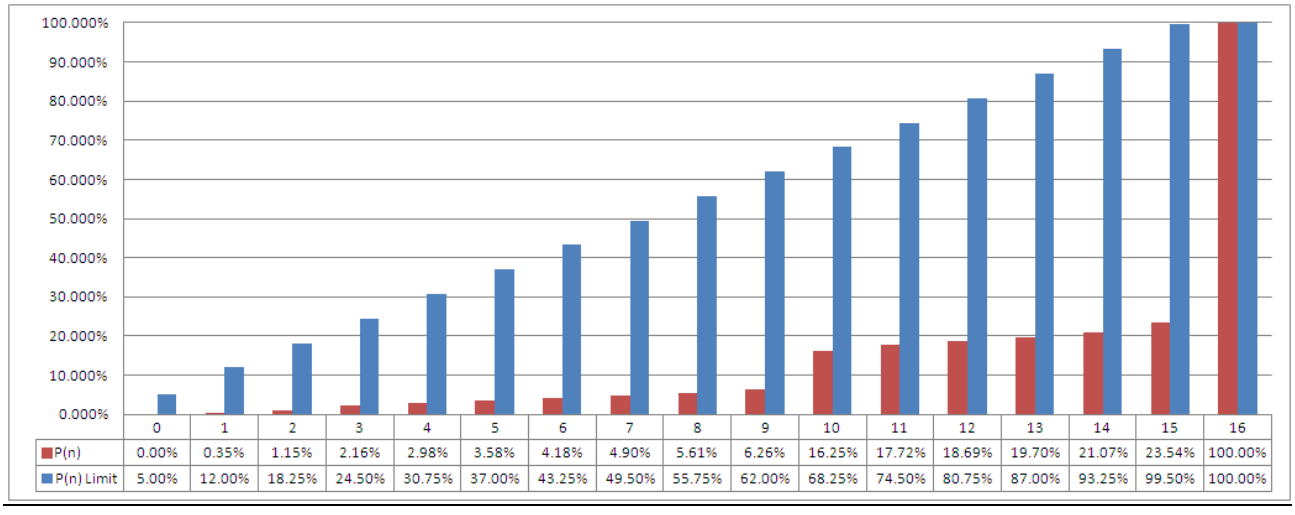
Channel Access Mechanism of EUT type

☐Frame Based Equipment	
☒Load Based Equipment	☒ Option A : verify channel access mechanism
	☐ Option B : declatation by manufacturer

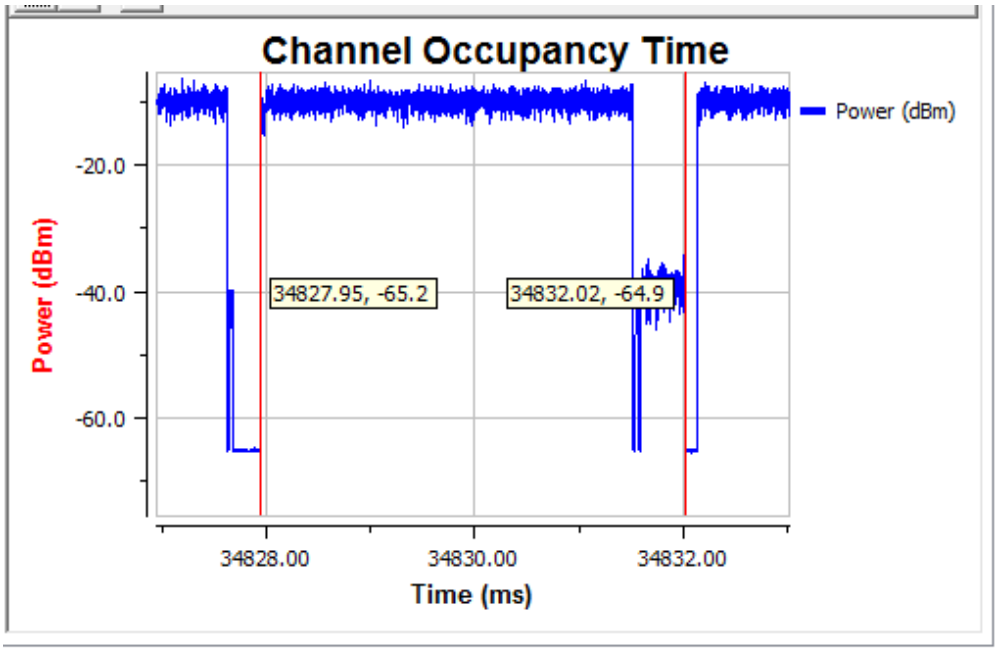
Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (MHz)	Maximum Channel Occupancy Time (ms)	Minimum Idle Period (μs)	Test Result
802.11ac (VHT40)	5190	4.063	27	Pass

Total Idle No	11087		Idle probility	Limit	Result
B[0]	0	P[0]	0.00%	5.00%	Pass
B[1]	39	P[1]	0.35%	12.00%	Pass
B[2]	88	P[2]	1.15%	18.25%	Pass
B[3]	112	P[3]	2.16%	24.50%	Pass
B[4]	91	P[4]	2.98%	30.75%	Pass
B[5]	67	P[5]	3.58%	37.00%	Pass
B[6]	66	P[6]	4.18%	43.25%	Pass
B[7]	80	P[7]	4.90%	49.50%	Pass
B[8]	79	P[8]	5.61%	55.75%	Pass
B[9]	72	P[9]	6.26%	62.00%	Pass
B[10]	1107	P[10]	16.25%	68.25%	Pass
B[11]	163	P[11]	17.72%	74.50%	Pass
B[12]	108	P[12]	18.69%	80.75%	Pass
B[13]	112	P[13]	19.70%	87.00%	Pass
B[14]	152	P[14]	21.07%	93.25%	Pass
B[15]	274	P[15]	23.54%	99.50%	Pass
B[16]	8477	P[16]	100.00%	100.00%	Pass



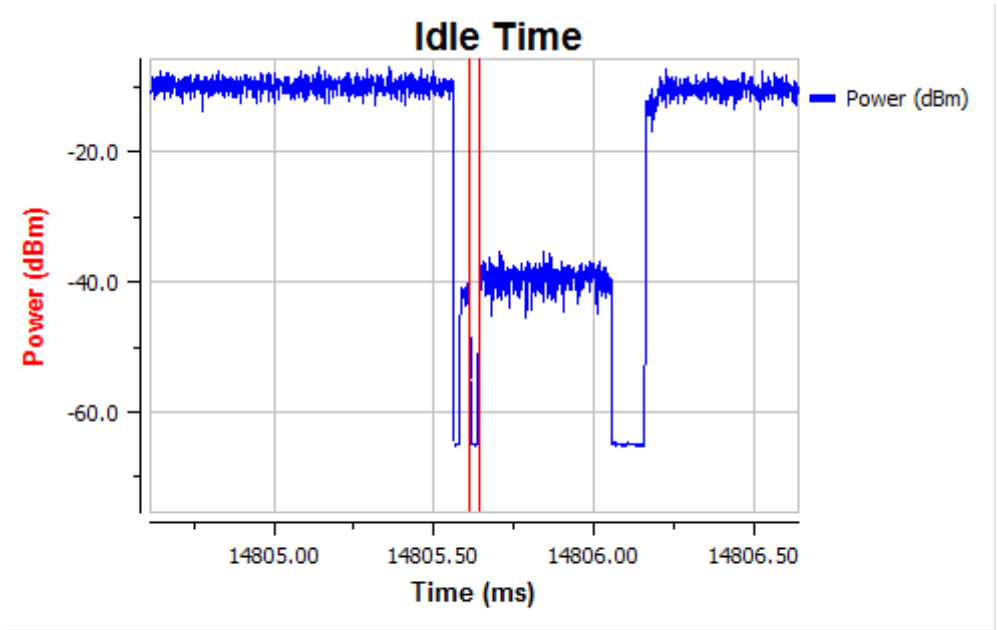
Maximum Channel Occupancy Time



Channel Occupency Information

Maximum COT (ms) : 4.063

Minimum Idle Period



Channel Occupency Information

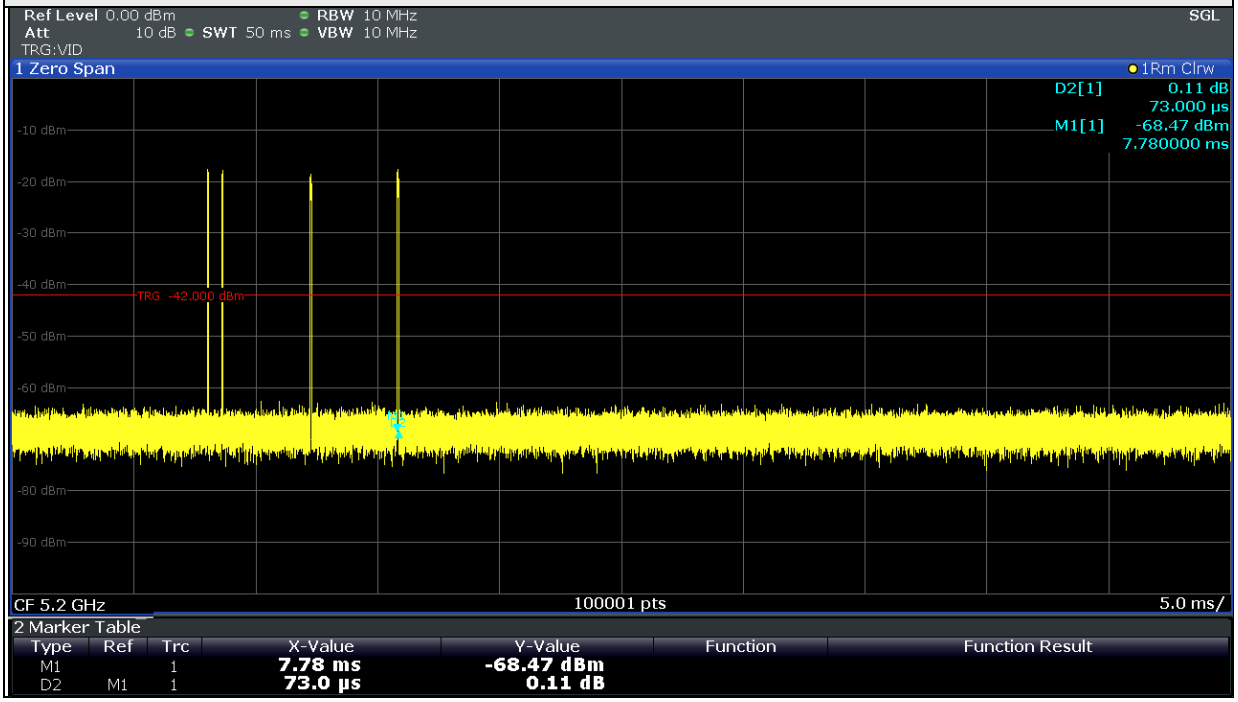
Minimum Idle Time (us) : 27

4.1.8.3 Short Control Signalling Transmissions Result

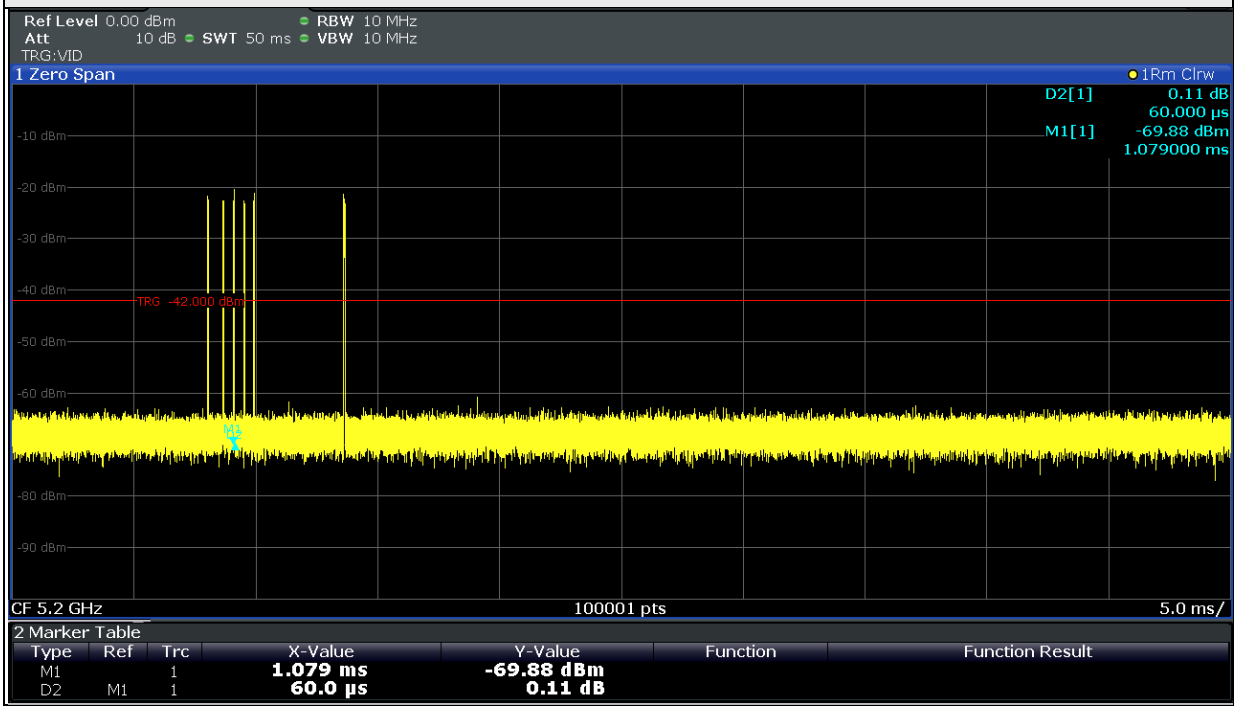
802.11ac (VHT20) mode CH40 5200MHz

Short Control Signalling Transmission Result			
Interference signal	SCST total on time (ms)	SCST Limit (ms)	PASS/FAIL
AWGN signal	0	2.5	PASS
OFDM signal	0.29	2.5	PASS
LTE signal	0.36	2.5	PASS

OFDM signal test result



LTE signal test result



802.11ac (VHT40) mode CH38 5190MHz

Short Control Signalling Transmission Result			
Interference signal	SCST total on time (ms)	SCST Limit (ms)	PASS/FAIL
AWGN signal	0	2.5	PASS

4.2 Receiver Blocking

4.2.1 Limit of Receiver Blocking

This requirement applies to all receiver categories.

Receiver Blocking Criterion	
Minimum performance	☒PER ≦10%
	☐Alternative performance criteria (See note)
Note: The manufacturer was declared performance criteria is x% for the intended use of the equipment.	

Receiver Blocking Parameters				
Wanted signal mean power from companion device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (See note 2)**		**Type of blocking signal**
		Master or Slave with radar detection (see note 3)	**Slave without radar detection (see note 3)**	
P_{min} + 6 dB	5100	-53	-59	Continuous Wave
P_{min} + 6 dB	4900 5000 5975	-47	-53	Continuous Wave

NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.2.8.3 in the absence of any blocking signal.
NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the same levels should be used at the antenna connector irrespective of antenna gain.
NOTE 3: Slave devices with a maximum e.i.r.p. of less than 23 dBm do not have to implement radar detection unless these devices are used in fixed outdoor point to point or fixed outdoor point to multipoint applications

4.2.2 Test Procedure

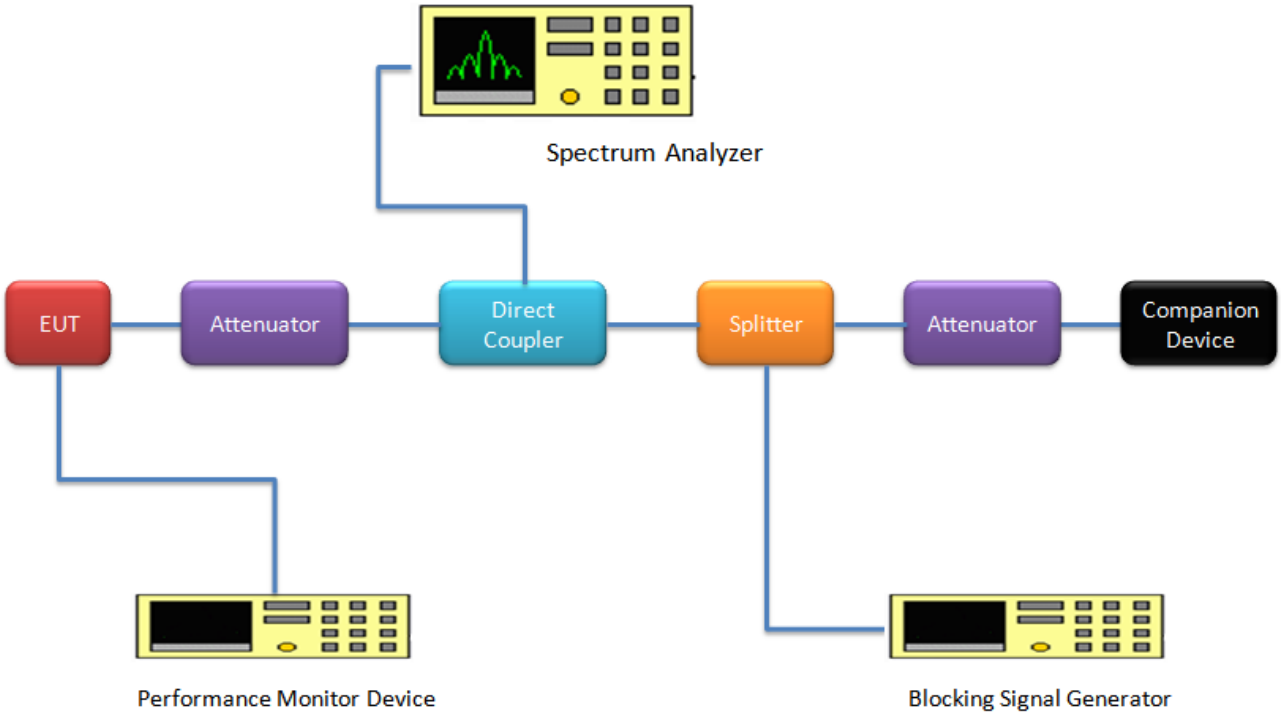
Refer to EN 301 893 V2.1.1 clause 5.4.10

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.2.3 Deviation from Test Standard

No deviation.

4.2.4 Test Setup Configuration



4.2.5 Test Results

Receiver blocking performance when operating at the lower sub-band					
P_{min}: -85dBm					
The actual blocking signal power(Note1)				☒ at the antenna connector ☐ in front of the antenna	
Note1: For the conducted measurements, the same levels should be used at the antenna connector irrespective of antenna gain.					
Operation Mode	**Channel**	**Wanted signal mean power from companion device (dBm)**	**Blocking signal frequency (MHz)**	**The actual blocking signal power (dBm)**	**Pass/Fail**
802.11a	36	-79	5100	-59	Pass
			4900	-53	Pass
			5000	-53	Pass
			5975	-53	Pass

Receiver blocking performance when operating at the higher sub-band					
P_{min}: -87dBm					
The actual blocking signal power(Note1)				☒ at the antenna connector ☐ in front of the antenna	
Note1: For the conducted measurements, the same levels should be used at the antenna connector irrespective of antenna gain.					
Operation Mode	**Channel**	**Wanted signal mean power from companion device (dBm)**	**Blocking signal frequency (MHz)**	**The actual blocking signal power (dBm)**	**Pass/Fail**
802.11a	100	-81	5100	-59	Pass
			4900	-53	Pass
			5000	-53	Pass
			5975	-53	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
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

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.

--- END ---

Appendix A– Original Report No.: RE171207E10I-A-3

EN 301 893 RF Test Report (WLAN)

Report No.:	RE171207E10I-A-3
Test Model:	BLACK-Bean
Received Date:	Oct. 08, 2014
Test Date:	Oct. 16 to Nov. 07, 2014 ; July 23 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.

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RE171207E10I-A-3	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:	Oct. 16 to Nov. 07, 2014 ; July 23 to Aug. 04, 2016
Standards:	EN 301 893 V1.8.1 (2015-03)

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 : , **Date:** Apr. 15, 2019

May Chen / Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 301 893 V1.8.1		
Clause	Test Parameter	Result
	Transmitter Parameters	
4.2	Carrier Frequencies	Pass
4.3	Occupied Channel Bandwidth	Pass
4.4	RF Output Power	Pass
4.4	Transmit Power Control (TPC)	Pass
4.4	Power Density	Pass
4.8	Adaptivity (Channel Access Mechanism)	Pass
4.9	User Access Restrictions	Pass
4.5.1	Transmitter unwanted emissions outside the 5GHz RLAN bands	Pass
4.5.2	Transmitter unwanted emissions within the 5GHz RLAN bands	Pass
4.7	Dynamic Frequency Selection	See Note 1
4.10	Geo-location capability	Not Applicable
	Receiver Parameters	
4.6	Spurious Emissions	Pass

Note: 1. The ” Dynamic Frequency Selection” was recorded in another test report.

..

2.1 Test Instruments

For spurious emissions test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Keysight	N9030A	MY54490679	July 23, 2016	July 22, 2017
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 23 to 26, 2016

For Adaptivity 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: Aug. 04, 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
RF frequency	±1.132x10^{-6}
RF power conducted	±1.207dB
RF power radiated	±4.925dB
Spurious emissions, conducted	±3dB
Spurious emissions, radiated	±4.925dB
Humidity	±5 %
Temperature	±0.6°C
Time	±5 %

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 301 893 standard, the measurement uncertainty figures shall be calculated in accordance with ETSI TR 100 028-1 [2] and ETSI TR 100 028-2 [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
Radio frequency	±1 x 10^{-5}
RF power conducted	±1.5 dB
RF power radiated	±6 dB
Spurious emissions	±6 dB
Humidity	±5 %
Temperature	±1 °C
Time	±10 %

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	QCNFA435
Status of EUT	R&D SAMPLE
Nominal Voltage	3.3Vdc from host equipment
Temperature Operating Range	-10℃ ~ 70℃
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	☐ 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
EIRP Power (Measured Max. Average)	**2.4GHz:** 19.85dBm **5GHz:** 5150 MHz ~ 5250MHz : 22.21dBm 5250 MHz ~ 5350MHz : 21.64dBm 5470 MHz ~ 5725 MHz : 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

FOR 5180 ~ 5320MHz

8 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	52	5260
40	5200	56	5280
44	5220	60	5300
48	5240	64	5320

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

Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	54	5270
46	5230	62	5310

2 channels are provided for 802.11ac (VHT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210 MHz	58	5290 MHz

FOR 5500 ~ 5700MHz

11 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	124	5620
104	5520	128	5640
108	5540	132	5660
112	5560	136	5680
116	5580	140	5700
120	5600		

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

Channel	Frequency (MHz)	Channel	Frequency (MHz)
102	5510	126	5630
110	5550	134	5670
118	5590		

2 channels are provided for 802.11ac (VHT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
106	5530	122	5610

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)**
5GHz (Band 1~2)	5.56
5GHz (Band 3)	5.34

3.4.1.1 Output Powers

802.11a Mode:

Channel	CONDUCTED POWER (dBm)
(CH36) 5180 MHz	15.91
(CH64) 5320 MHz	15.32
(CH100) 5500 MHz	15.64
(CH140) 5700 MHz	15.46

802.11n (HT20) Mode:

Channel	CONDUCTED POWER (dBm)
(CH36) 5180 MHz	15.69
(CH64) 5320 MHz	15.33
(CH100) 5500 MHz	16.04
(CH140) 5700 MHz	16.01

802.11n (HT40) Mode:

Channel	CONDUCTED POWER (dBm)
(CH38) 5190 MHz	14.59
(CH62) 5310 MHz	14.45
(CH102) 5510 MHz	14.38
(CH134) 5670 MHz	15.20

802.11ac (VHT80) Mode:

Channel	CONDUCTED POWER (dBm)
(CH38) 5190 MHz	14.19
(CH62) 5310 MHz	14.32
(CH102) 5510 MHz	14.08
(CH134) 5670 MHz	14.37

3.5 Test Mode Applicability and Tested Channel Detail

EUT configure mode	Applicable to									Description
	FS	OB	ROP	TPC	PD	AD	SE<1G	SE≥1G	SSM	
-	√	√	√	√	√	√	√	√	√	-

Where FS: Frequency Stability
OB: Occupied channel bandwidth measurement
ROP: RF output power
TPC: Transmit Power Control
PD: Power Density
AD: Adaptivity (Channel Access Mechanism)
SE<1G: Spurious Emissions below 1GHz
SE≥1G: Spurious Emissions above 1GHz
SSM: Signal under Spectrum Mask

Carrier Frequencies and Channelization (Frequency Stability):

☒ 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)
802.11a	36 to 64	36	OFDM	6
	100 to 140	140	OFDM	6

Occupied Channel Bandwidth Measurement:

☒ 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)
802.11a	36 to 64	36	OFDM	6
	100 to 140	100	OFDM	6
802.11n (HT20)	36 to 64	36	OFDM	6.5
	100 to 140	100	OFDM	6.5
802.11n (HT40)	38 to 62	38	OFDM	13.5
	102 to 134	134	OFDM	13.5
802.11ac (VHT80)	42 to 58	58	OFDM	29.3
	106 ot 122	122	OFDM	29.3

RF Output Power:

☒ 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)
802.11a	36 to 64	36, 64	OFDM	6
	100 to 140	100, 140	OFDM	6
802.11n (HT20)	36 to 64	36, 64	OFDM	6.5
	100 to 140	100, 140	OFDM	6.5
802.11n (HT40)	38 to 62	38, 62	OFDM	13.5
	102 to 134	102, 134	OFDM	13.5
802.11ac (VHT80)	42 to 58	42, 58	OFDM	29.3
	106 ot 122	106, 122	OFDM	29.3

Transmit Power Control (TPC):

☒ 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)
802.11a	52 to 64	64	OFDM	6
	100 to 140	100, 140	OFDM	6
802.11n (HT20)	52 to 64	64	OFDM	6.5
	100 to 140	100, 140	OFDM	6.5
802.11n (HT40)	54 to 62	62	OFDM	13.5
	102 to 134	102, 134	OFDM	13.5
802.11ac (VHT80)	58	58	OFDM	29.3
	106 ot 122	106, 122	OFDM	29.3

Power Density:

☒ 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)
802.11a	36 to 64	36, 64	OFDM	6
	100 to 140	100, 140	OFDM	6
802.11n (HT20)	36 to 64	36, 64	OFDM	6.5
	100 to 140	100, 140	OFDM	6.5
802.11n (HT40)	38 to 62	38, 62	OFDM	13.5
	102 to 134	102, 134	OFDM	13.5
802.11ac (VHT80)	42 to 58	42, 58	OFDM	29.3
	106 ot 122	106, 122	OFDM	29.3

Adaptivity Test:

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

Mode	Available Channel	Tested Channel	Modulation Technology
802.11ac (VHT80)	42 to 58	42	OFDM
	106 ot 122	106	OFDM

Spurious Emissions 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)	36 to 64	140	OFDM	6.5
	100 to 140			
Receiver	36 to 64	140	-	-
	100 to 140			

Spurious Emissions 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)
802.11a	36 to 64	36	OFDM	6
802.11n (HT20)	100 to 140	100	OFDM	6.5
Receiver	36 to 64	36	-	-
	100 to 140	100		

Transmitter Unwanted Emissions within the 5GHz RLAN Bands (Signal under Spectrum Mask):

☒ 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)
802.11a	36 to 64	36, 64	OFDM	6
	100 to 140	100, 140	OFDM	6
802.11n (HT20)	36 to 64	36, 64	OFDM	6.5
	100 to 140	100, 140	OFDM	6.5
802.11n (HT40)	38 to 62	38, 62	OFDM	13.5
	102 to 134	102, 134	OFDM	13.5
802.11ac (VHT80)	42 to 58	42, 58	OFDM	29.3
	106 to 122	106, 102	OFDM	29.3

Test Condition:

Applicable to	Environmental conditions	Input Power (System)	Tested by
FS	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
OB	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
ROP	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
TPC	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
PD	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin
AD	25deg. C, 60%RH	230Vac, 50Hz	Denny Liu
SE<1G	22deg. C, 65%RH	230Vac, 50Hz	Louis Tseng
SE≥1G	22deg. C, 65%RH	230Vac, 50Hz	Louis Tseng
SSM	25deg. C, 60%RH	230Vac, 50Hz	Chiashiang Lin

3.6 Description of Support Units

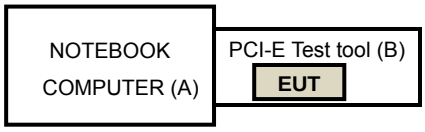
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

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 specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standard:

EN 301 893 V1.8.1 (2015-03)

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

4 Test Procedure and Results

Transmitter Parameters

4.1 Carrier Frequencies and Channelization

4.1.1 Limits of Carrier Frequencies and Channelization

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

4.1.2 Test Procedures

Refer to EN 301 893 V1.8.1 clause 5.3.2.2.

4.1.3 Deviation from Test Standard

No deviation

4.1.4 Test Setup

The EUT was placed into the temperature oven. The power source of the EUT has to be connected with the power supply for voltage change. The frequency has to be recorded for the above threshold.

4.1.5 Test Results

802.11a

Test Condition			Carrier Centre Frequencies f_c (MHz)			
			(CH36) 5180 MHz		(CH140) 5700 MHz	
			Reading	ppm	Reading	ppm
T_{nom}(℃)	25	V_{nom} (V)	5180.0106	2.0463	5700.0138	2.4211
T_{min}(℃)	-10	V_{min} (V)	5180.0017	0.3282	5699.9998	-0.0351
		V_{max} (V)	5180.0025	0.4826	5700.0042	0.7368
T_{max}(℃)	70	V_{min} (V)	5179.9891	-2.1042	5700.0007	0.1228
		V_{max} (V)	5179.987	-2.5097	5699.9862	-2.4211

4.2 Nominal and Occupied Channel Bandwidth Measurement

4.2.1 Limit of Nominal and Occupied Channel Bandwidth Measurement

The Nominal Channel Bandwidth shall be at least 5 MHz at all times.
The Occupied Channel Bandwidth shall be between 80 % and 100 % of the declared Nominal Channel Bandwidth. In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement

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

4.2.2 Test Procedure

Refer to EN 301 893 V1.8.1 clause 5.3.3.2

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.2.3 Deviation from Test Standard

No deviation.

4.2.4 Test Setup

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.
.

4.2.5 Test Results

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Minimum limit (MHz)	Maximun limit (MHz)	Pass / Fail
36	5180	19.28	16	20	Pass
100	5500	18.32	16	20	Pass

802.11n (HT20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Minimum limit (MHz)	Maximun limit (MHz)	Pass / Fail
36	5180	18.24	16	20	Pass
100	5500	20	16	20	Pass

802.11n (HT40)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Minimum limit (MHz)	Maximun limit (MHz)	Pass / Fail
38	5190	37.12	32	40	Pass
134	5670	36.48	32	40	Pass

802.11ac (VHT80)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Minimum limit (MHz)	Maximun limit (MHz)	Pass / Fail
58	5290	76.16	64	80	Pass
122	5610	75.52	64	80	Pass

4.3 RF Output Power and Transmit Power Control (TPC)

4.3.1 Limits of RF output power

Frequency Range (MHz)	Mean e.i.r.p. Limit (dBm)	
	☒ With TPC	☐ Without TPC
5150 to 5350	23	20 / 23 (see note 1)
5470 to 5725	30 (see note 2)	27 (see note 2)

Note 1: The applicable limit is 20 dBm, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 23 dBm.
Note 2: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.
Note 3: In case of multiple (adjacent or non-adjacent) channels within the same sub-band, the total RF output power of all channels in that sub-band shall not exceed the limits defined above table.
In case of multiple, non-adjacent channels operating in separate sub-bands, the total RF output power in each of the sub-bands shall not exceed the limits defined above table.

4.3.2 Limits of RF Output Power at Lowest Power Level

Frequency Range (MHz)	Average EIRP (dBm)
5250 to 5350	17
5470 to 5725	24(see note)

Note: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.

4.3.3 Test Procedure

Refer to EN 301 893 V1.8.1 clause 5.3.4.2

Measurement	
☒ Conducted measurement	☐ Radiated measurement
☒ Option 1: For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment).	
☐ Option 2: For equipment without continuous transmission capability and operating (or with the capability to operate) in only one sub-band.	
☐ Option 3: For equipment without continuous transmission capability and having simultaneous transmissions in both sub-bands.	

4.3.4 Deviation from Test Standard

No deviation.

4.3.5 Test Setup

The test setup has been constructed as the normal and extreme test conditions. The RF power as defined in EN 301 893 clause 4.4.1.1 shall be measured and recorded. Controlling software (QCRT-CONN) has been activated to set the EUT on specific status.

4.3.6 Test Results for RF Output Power at the Highest Power Level

802.11a

Test Condition			Transmitter Power (dBm)	
			(CH36) 5180 MHz	(CH64) 5320 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	21.47	20.88
Tmin(℃)	-10	Vmin(v)	22.19	21.63
		Vmax(v)	22.21	21.64
Tmax(℃)	70	Vmin(v)	20.34	19.80
		Vmax(v)	20.34	19.78

Test Condition			Transmitter Power (dBm)	
			(CH100) 5500 MHz	(CH140) 5700 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	20.98	20.80
Tmin(℃)	-10	Vmin(v)	21.71	21.53
		Vmax(v)	21.69	21.48
Tmax(℃)	70	Vmin(v)	19.94	19.71
		Vmax(v)	19.97	19.74

802.11n (HT20)

Test Condition			Transmitter Power (dBm)	
			(CH36) 5180 MHz	(CH64) 5320 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	21.25	20.89
Tmin(℃)	-10	Vmin(v)	21.96	21.62
		Vmax(v)	21.99	21.57
Tmax(℃)	70	Vmin(v)	20.19	19.77
		Vmax(v)	20.21	19.76

Test Condition			Transmitter Power (dBm)	
			(CH100) 5500 MHz	(CH140) 5700 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	21.38	21.35
Tmin(℃)	-10	Vmin(v)	22.11	22.07
		Vmax(v)	22.15	22.06
Tmax(℃)	70	Vmin(v)	20.29	20.23
		Vmax(v)	20.32	20.28

802.11n (HT40)

Test Condition			Transmitter Power (dBm)	
			(CH38) 5190 MHz	(CH62) 5310 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	20.15	20.01
Tmin(℃)	-10	Vmin(v)	20.88	20.74
		Vmax(v)	20.92	20.78
Tmax(℃)	70	Vmin(v)	19.04	18.95
		Vmax(v)	19.00	18.94

Test Condition			Transmitter Power (dBm)	
			(CH102) 5510 MHz	(CH134) 5670 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	19.72	20.54
Tmin(℃)	-10	Vmin(v)	20.48	21.33
		Vmax(v)	20.48	21.29
Tmax(℃)	70	Vmin(v)	18.68	19.40
		Vmax(v)	18.71	19.41

802.11ac (VHT80)

Test Condition			Transmitter Power (dBm)	
			(CH42) 5210 MHz	(CH58) 5290 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	19.75	19.88
Tmin(℃)	-10	Vmin(v)	20.45	20.60
		Vmax(v)	20.45	20.61
Tmax(℃)	70	Vmin(v)	18.63	18.87
		Vmax(v)	18.61	18.88

Test Condition			Transmitter Power (dBm)	
			(CH106) 5530 MHz	(CH122) 5610 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	19.42	19.71
Tmin(℃)	-10	Vmin(v)	20.16	20.42
		Vmax(v)	20.14	20.45
Tmax(℃)	70	Vmin(v)	18.29	18.62
		Vmax(v)	18.27	18.65

4.3.7 Test Results for RF Output Power at the Lowest Power Level

802.11a

Test Condition			Transmitter Power (dBm)	
			(CH64) 5320 MHz	(CH100) 5500 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	15.88	15.98
Tmin(℃)	-10	Vmin(v)	16.63	16.71
		Vmax(v)	16.64	16.69
Tmax(℃)	70	Vmin(v)	14.80	14.94
		Vmax(v)	14.78	14.97

Test Condition			Transmitter Power (dBm)
			(CH140) 5700 MHz
			Average EIRP
Tnom(℃)	25	Vnom(v)	15.80
Tmin(℃)	-10	Vmin(v)	16.53
		Vmax(v)	16.48
Tmax(℃)	70	Vmin(v)	14.71
		Vmax(v)	14.74

802.11n (HT20)

Test Condition			Transmitter Power (dBm)	
			(CH64) 5320 MHz	(CH100) 5500 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	15.89	15.38
Tmin(℃)	-10	Vmin(v)	16.62	16.11
		Vmax(v)	16.57	16.15
Tmax(℃)	70	Vmin(v)	14.77	14.29
		Vmax(v)	14.76	14.32

Test Condition			Transmitter Power (dBm)
			(CH140) 5700 MHz
			Average EIRP
Tnom(℃)	25	Vnom(v)	15.35
Tmin(℃)	-10	Vmin(v)	16.07
		Vmax(v)	16.06
Tmax(℃)	70	Vmin(v)	14.23
		Vmax(v)	14.28

802.11n (HT40)

Test Condition			Transmitter Power (dBm)	
			(CH62) 5310 MHz	(CH102) 5510 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	16.01	15.72
Tmin(℃)	-10	Vmin(v)	16.74	16.48
		Vmax(v)	16.78	16.48
Tmax(℃)	70	Vmin(v)	14.95	14.68
		Vmax(v)	14.94	14.71

Test Condition			Transmitter Power (dBm)
			(CH134) 5670 MHz
			Average EIRP
Tnom(℃)	25	Vnom(v)	15.54
Tmin(℃)	-10	Vmin(v)	16.33
		Vmax(v)	16.29
Tmax(℃)	70	Vmin(v)	14.40
		Vmax(v)	14.41

802.11ac (VHT80)

Test Condition			Transmitter Power (dBm)	
			(CH58) 5290 MHz	(CH106) 5530 MHz
			Average EIRP	Average EIRP
Tnom(℃)	25	Vnom(v)	15.88	15.42
Tmin(℃)	-10	Vmin(v)	16.60	16.16
		Vmax(v)	16.61	16.14
Tmax(℃)	70	Vmin(v)	14.87	14.29
		Vmax(v)	14.88	14.27

Test Condition			Transmitter Power (dBm)
			(CH122) 5610 MHz
			Average EIRP
Tnom(℃)	25	Vnom(v)	15.71
Tmin(℃)	-10	Vmin(v)	16.42
		Vmax(v)	16.45
Tmax(℃)	70	Vmin(v)	14.62
		Vmax(v)	14.65

4.4 Power Density

4.4.1 Limit of Power Density

Frequency Band (MHz)	Mean e.i.r.p. Density Limit (dBm/MHz)	
	☒ With TPC	☐ Without TPC
5150 to 5350	10	7 / 10 (see note 1)
5470 to 5725	17 (see note 2)	14 (see note 2)

Note 1: The applicable limit is 7 dBm/MHz, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 10 dBm/MHz.
Note 2: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.
Note 3: In case of multiple (adjacent or non-adjacent) channels within the same sub-band, the total RF output power of all channels in that sub-band shall not exceed the limits defined above table.
In case of multiple, non-adjacent channels operating in separate sub-bands, the total RF output power in each of the sub-bands shall not exceed the limits defined above table

4.4.2 Test Procedure

Refer to EN 301 893 V1.8.1 clause 5.3.4.2.1.3

Measurement	
☒ Conducted measurement	☐ Radiated measurement
☒ Option 1: For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment)	
☐ Option 2: For equipment without continuous transmission capability and without the capability to transmit with a constant duty cycle	

4.4.3 Deviation from Test Standard

No deviation.

4.4.4 Test Setup

The transmitter shall be connected to the measuring equipment via a suitable attenuator and the power density value shall be measured and recorded.

4.4.5 Test Results

802.11a

Channel Number	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
36	5180	9.21	10	Pass
64	5320	8.76	10	Pass
100	5500	8.85	10	Pass
140	5700	8.72	10	Pass

802.11n (HT20)

Channel Number	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
36	5180	8.97	10	Pass
64	5320	8.61	10	Pass
100	5500	9.06	10	Pass
140	5700	9.02	10	Pass

802.11n (HT40)

Channel Number	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
38	5190	5.03	10	Pass
62	5310	4.91	10	Pass
102	5510	4.63	10	Pass
134	5670	5.42	10	Pass

802.11ac (VHT80)

Channel Number	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
42	5210	1.35	10	Pass
58	5290	1.49	10	Pass
106	5530	1.04	10	Pass
122	5610	1.33	10	Pass

4.5 Adaptive (Channel Access Mechanism)

This requirement applies to equipment, testing shall be performed using the highest nominal channel Bandwidth. The manufacturer shall state whether the UUT is capable of operating as a Frame Based Equipment or Load Based Equipment. See tables for the applicability of adaptive requirements and limit for each of the operational modes.

4.5.1 Limit of Adaptive

Applicability of adaptive requirements and limit

Requirement	Operational Mode			
	Frame Based Equipment	Load Based Equipment (Base on Spectrum Sharing mechanisms)	Load Based Equipment (Not using any of the mechanisms referenced)	
			Option A	Option B
Minimum Clear Channel Assessment (CCA) Time	20us (see note 1)	(see note 2)	20us (see note 1)	20us (see note 1)
Maximum Channel Occupancy (COT) Time	1 ms to 10 ms	(see note 2)	10ms	(13/32)*q ms (see note 3)
Minimum Idle Period	5% COT	(see note 2)	CCA or extended CCA	CCA to q*CCA (see note 3)
Extended CCA check	NA	(see note 2)	q*18us	N*CCA (see note 4)
Short Control Signalling Transmissions	Maximum duty cycle of 5 % within an observation period of 50 ms (see note 5)			

Note 1: The CCA time used by the equipment shall be declared by the manufacturer.
Note 2: Minimum required of EN301 893 section 4.8.3.2 or LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using 'energy detect', as describedin IEEE 802.11™-2012 [8], clause 9, clause 10, clause 18 and clause 20 or as described in IEEE 802.11ac™-2013 [9], clause 8, clause 9, clause 10 and clause 22
Note 3: q is selected by the manufacturer in the range [4..32]
Note 4: The value of N shall be randomly selected in the range [1..q]
Note 5: Adaptive equipment may or may not have Short Control Signalling Transmissions.

Interference threshold level

Maximum transmit power (P_H) EIRP dBm	Threshold level (TL)
23	(see notes 1 and 2)

Note 1: For transmit power levels of 23 dBm e.i.r.p. or above, the CCA threshold level (TL), at the input to the receiver, shall be a minimum of -73 dBm/MHz assuming a 0 dBi receive antenna.
Note 2: For transmit power levels below 23 dBm e.i.r.p., the CCA threshold level (TL), at the input of the receiver, shall be proportional to the maximum transmit power (PH) according to the formula which assumes a 0 dBi receive antenna and PH to be specified in dBm e.i.r.p.
TL = -73 dBm / MHz + (23 dBm - PH) / (1 MHz)

4.5.2 Test Procedure

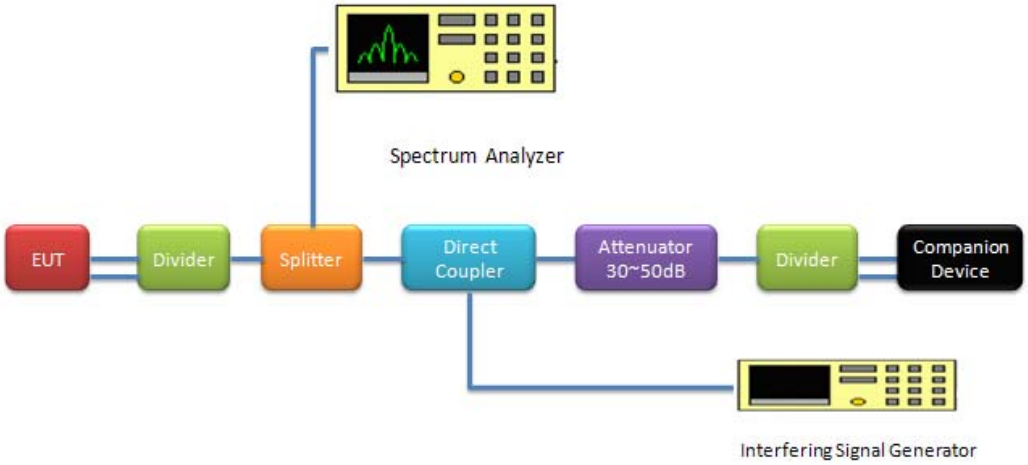
Refer to chapter 5.3.9.2 of EN 301 893 V1.8.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.5.3 Deviation from Test Standard

No deviation.

4.5.4 Test Setup Configuration



UUT Software and Firmware Version

Product	Model No.	Software/Firmware Version
BLACK-Bean	QCNFA435	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.

4.5.5 List of Measurements

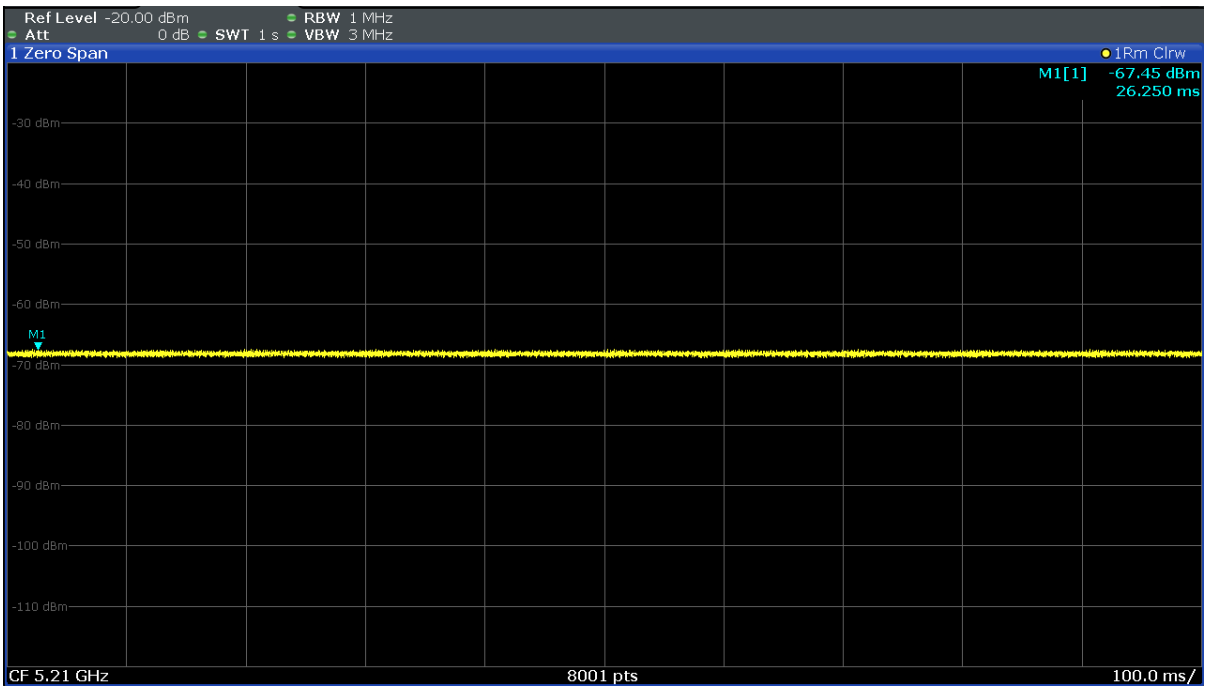
UUT Operational Mode	Applicable	Limit			
		The Maximum Channel Occupancy Time		The Minimum idle Period	
Frame Based Equipment		1ms to 10ms		5% of channel occupancy time	
Load Based Equipment (Base on 'Spectrum Sharing' mechanisms ')		Follow IEEE 802.11 Less than _____ms		Follow IEEE 802.11 More than _____ms	
Load Based Equipment (Not using any of the mechanisms referenced)		Option A	10ms	Option A	CCA or extended CCA
	v	Option B	13 ms	Option B	32us to 640us

Note1: The value of q =32 is declared by the manufacturer.
Note2: The value of CCA =20us is declared by the manufacturer.

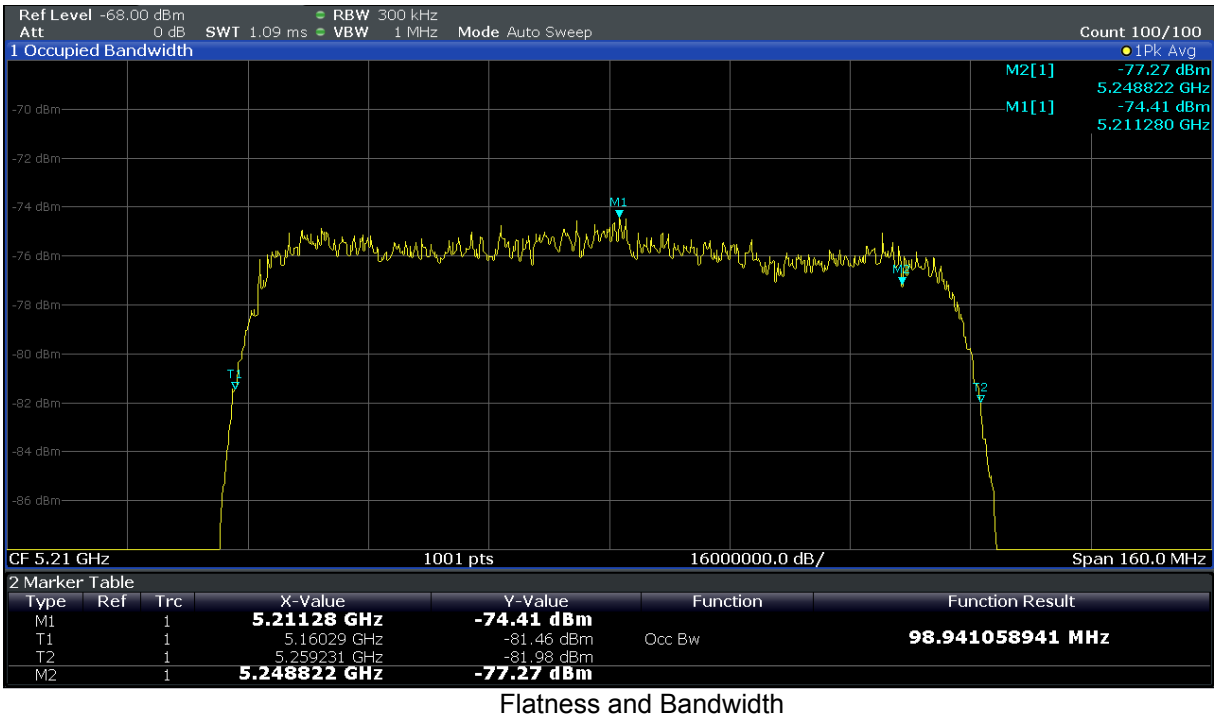
Clause	Test Parameter	Remarks	Pass/Fail
4.8.3.1	Adaptive (Frame Based Equipment)	Not Applicable	NA
4.8.3.2	Adaptive (Load Based Equipment)	Applicable	Pass
4.8.3.3	Short Control Signalling Transmissions	Applicable	Pass

4.5.6 Interference Threshold Level

Detection Threshold Level
The maximum EIRP (Vnom)power is 19.88 dBm and antenna gain is 2.56dBi Detection Threshold level= -73 dBm/MHz + 23 – Pout EIRP (19.88 dBm) + G (2.56 dBi) = -67.32dBm/MHz . The interference signal level to the UUT is lower than -67.32dBm/MHz.



Detection Threshold Level



Flatness and Bandwidth

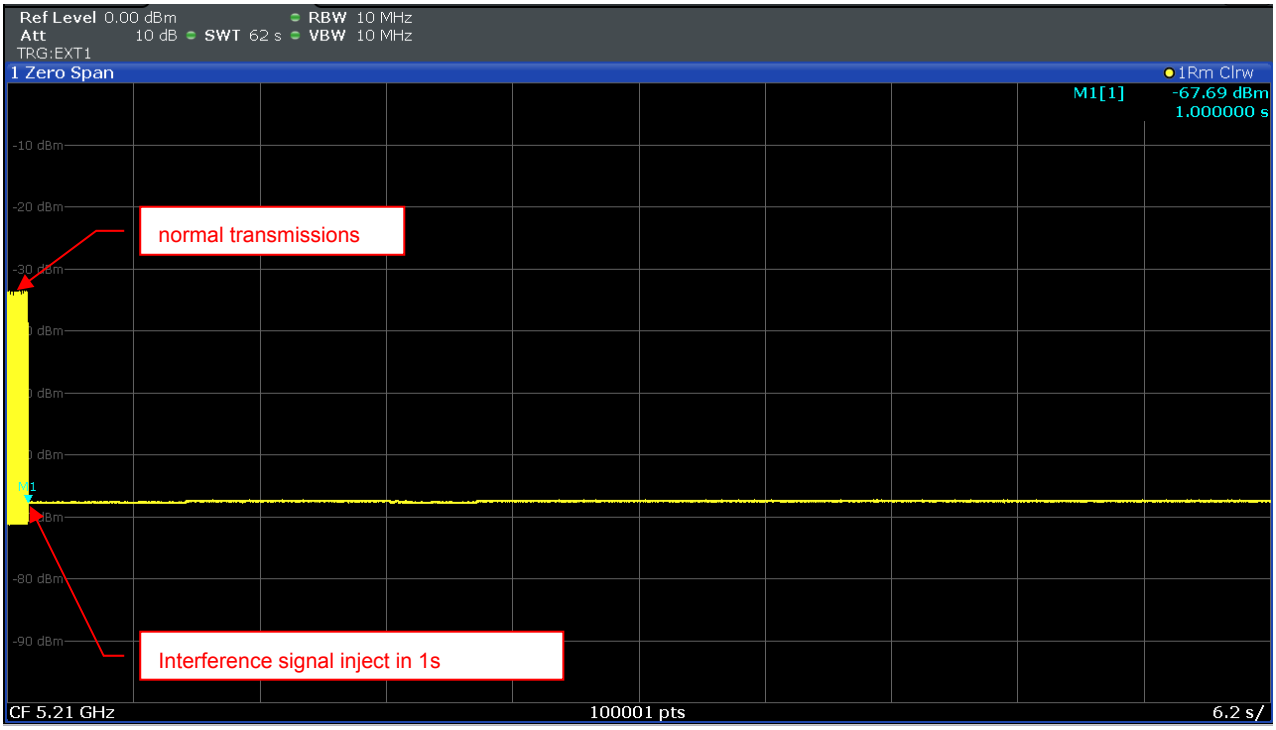
4.5.7 Test Result

4.5.7.1 Adaptive Result

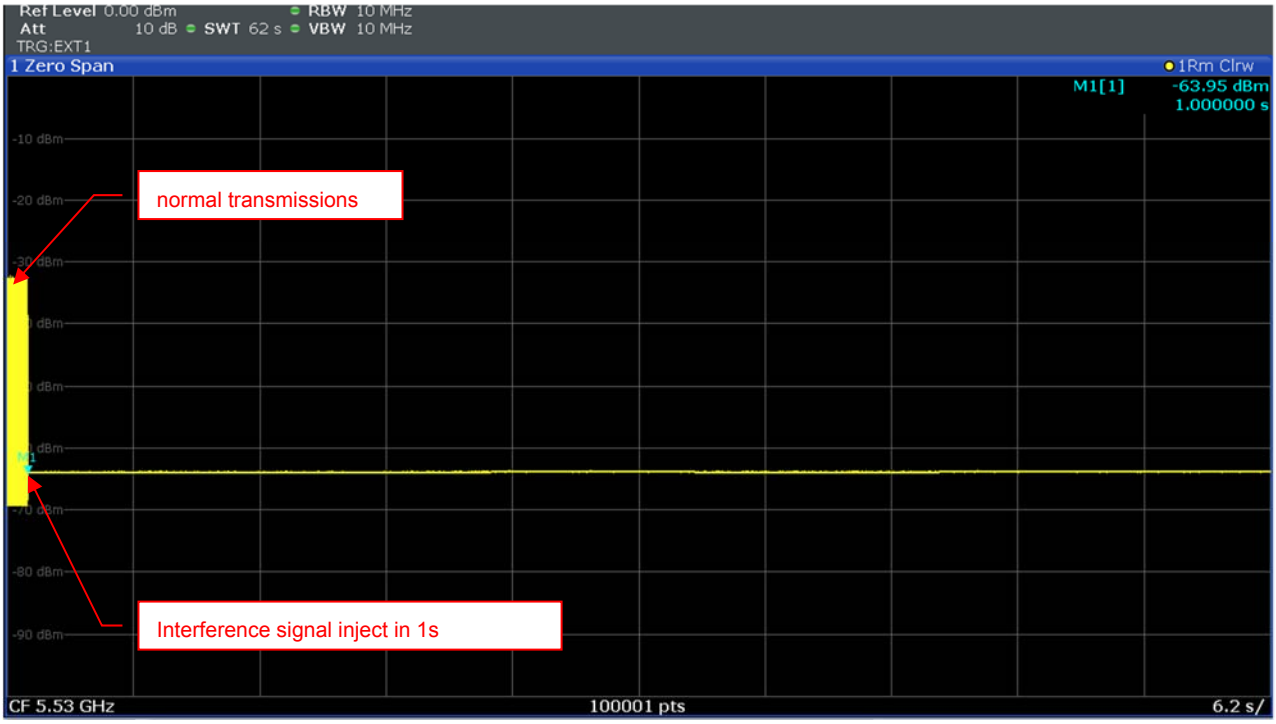
Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (MHz)	Test Result
802.11ac (VHT80)	5210	Pass
	5530	Pass

802.11ac (VHT80) Ch42 5210MHz



802.11ac (VHT80) Ch106 5530MHz

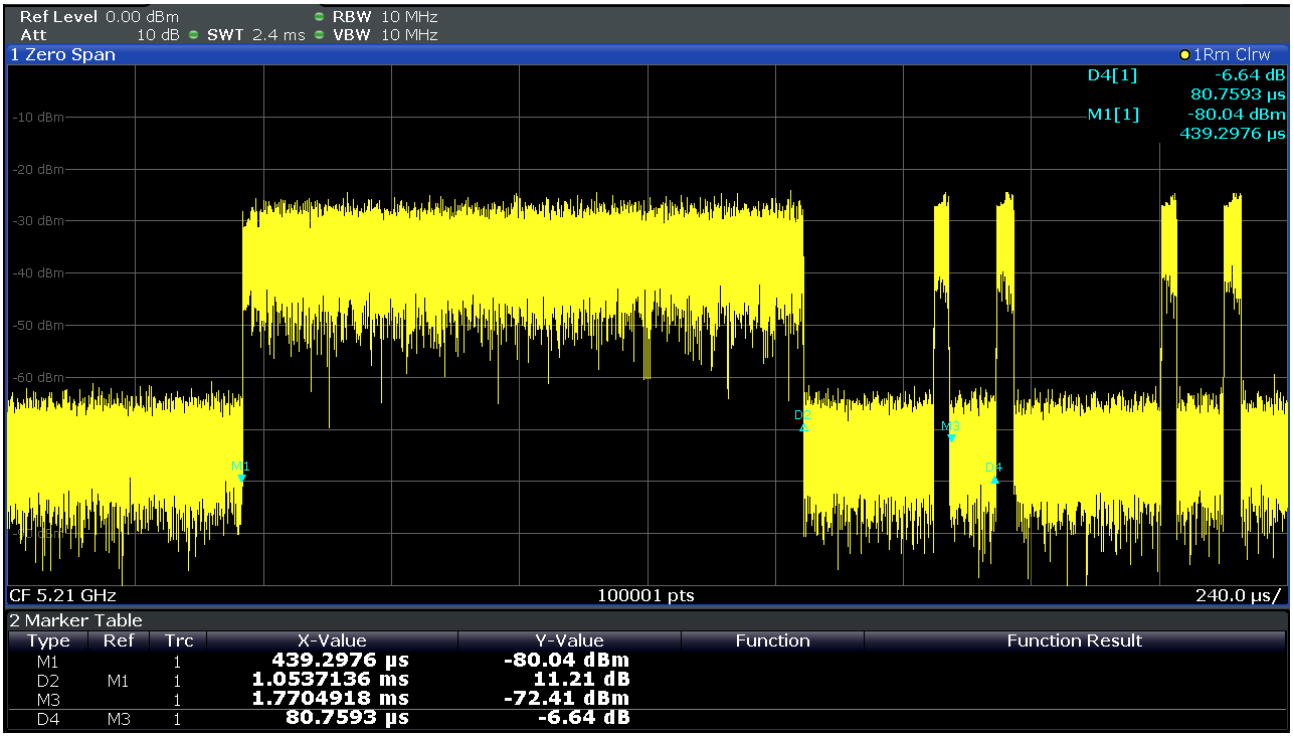


4.5.7.2 The Channel Occupancy Time Result

Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (ms)	Test Result
802.11ac (VHT80)	5210	1.05	0.08	Pass

802.11ac (VHT80) mode



4.5.7.3 Short Control Signalling Transmissions Result

802.11ac (VHT80) Ch42 5210MHz

Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
0 ms	2.5ms	PASS

802.11ac (VHT80) Ch106 5530MHz

Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	PASS/FAIL
0 ms	2.5ms	PASS

4.6 User Access Restrictions

4.6.1 Definition

User Access Restrictions are constraints implemented in the RLAN device to restrict access of the user to any hardware and/or software settings of the equipment, including software replacement(s), which may impact (directly or indirectly) the compliance of the equipment with the requirements in the present document.

NOTE: The user should be understood as the end user, the operator or any person not responsible for the compliance of the equipment against the requirements in the present document.

4.6.2 Requirement

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

Manufacturer provides declaration form to meet this requirement.

4.7 Transmitter Unwanted Emissions outside the 5 GHz RLAN Bands

4.7.1 Limits of Transmitter Unwanted Emission outside the 5 GHz RLAN Bands

Frequency Range (MHz)	Maximum power, ERP (dBm)	Bandwidth (kHz)
30 to 47	-36	100
47 to 74	-54	100
74 to 87.5	-36	100
87.5 to 118	-54	100
118 to 174	-36	100
174 to 230	-54	100
230 to 470	-36	100
470 to 862	-54	100
862 to 1000	-36	100
Frequency Range (GHz)	Maximum power, EIRP (dBm)	Bandwidth (MHz)
1 to 5.15	-30	1
5.35 to 5.47	-30	1
5.725 to 26	-30	1

4.7.2 Test Procedure

Refer to chapter 5.3.5.2 of EN 301 893 V1.8.1.

Measurement	
☒ Conducted measurement	☐ Radiated measurement
For Conducted measurement: 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).	
Conducted measurement (For equipment with multiple transmit chains): ☐ Option 1: The results for each of the transmit chains for the corresponding 1 MHz segments shall be added and compared with the limits. ☒ 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 × $\log_{10}$ (T_{CH}) (number of active transmit chains).	

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 test setup has been constructed as the normal use condition. Controlling software (QCRT-CONN) has been activated to set the EUT on specific status.

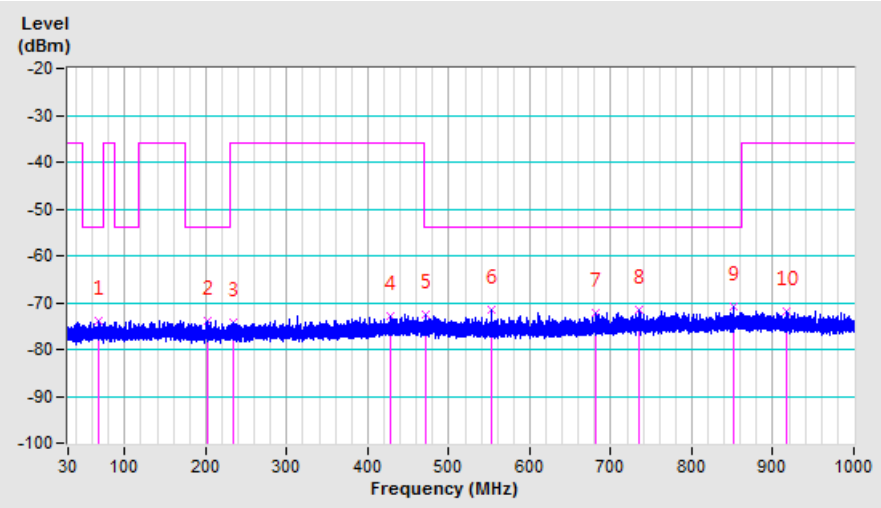
4.7.5 Test Results (Operating – Conducted)

Below 1GHz Worst-Case Data

802.11n (HT20)

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	140

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
68.27	-73.95	-54.00	-19.95
201.71	-73.73	-54.00	-19.73
233.97	-74.40	-36.00	-38.40
427.78	-73.01	-36.00	-37.01
471.25	-72.68	-54.00	-18.68
553.46	-71.61	-54.00	-17.61
681.42	-72.10	-54.00	-18.10
734.03	-71.67	-54.00	-17.67
852.37	-70.86	-54.00	-16.86
916.39	-72.01	-36.00	-36.01

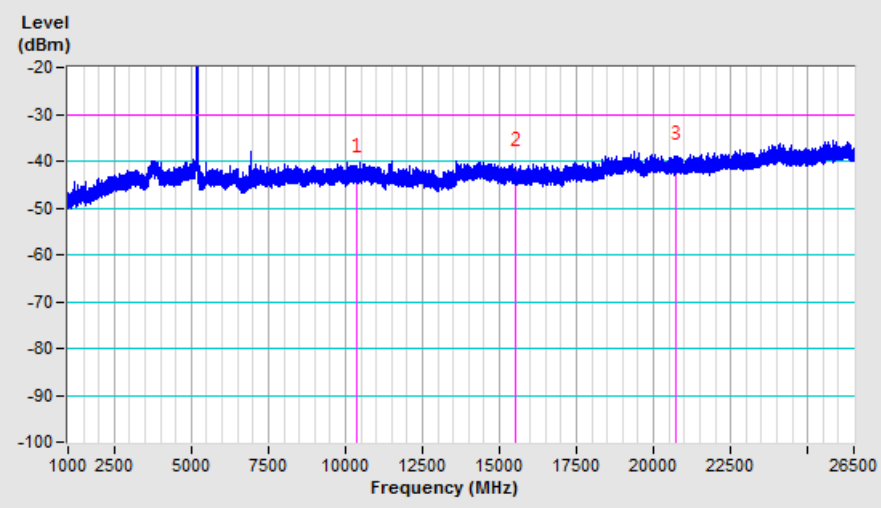


Above 1GHz Worst-Case Data

802.11a

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 26GHz	OPERATING CHANNEL	36

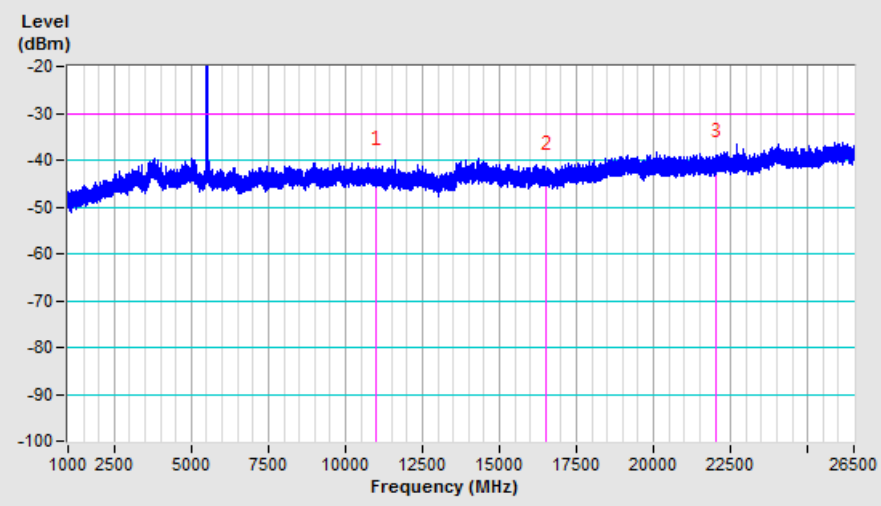
SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
10360.00	-43.60	-30.00	-13.60
15540.00	-42.54	-30.00	-12.54
20720.00	-41.14	-30.00	-11.14



802.11n (HT20)

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 26GHz	OPERATING CHANNEL	100

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
11000.00	-42.45	-30.00	-12.45
16500.00	-43.51	-30.00	-13.51
22000.00	-40.78	-30.00	-10.78



4.7.6 Test Results (Operating – Radiated)

Below 1GHz Worst-Case Data

802.11n (HT20)

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	140

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
47.95	H	-70.77	-54.00	-16.77
47.95	V	-69.25	-54.00	-15.25
67.75	H	-61.66	-54.00	-7.66
67.75	V	-64.80	-54.00	-10.80
135.46	V	-64.25	-36.00	-28.25
144.01	H	-62.24	-36.00	-26.24
150.51	V	-58.87	-36.00	-22.87
180.21	H	-64.73	-54.00	-10.73
222.56	V	-60.32	-54.00	-6.32
462.07	H	-71.20	-36.00	-35.20
497.72	H	-66.74	-54.00	-12.74
508.02	V	-71.83	-54.00	-17.83
532.98	H	-71.26	-54.00	-17.26
615.68	H	-69.18	-54.00	-15.18
615.73	V	-68.77	-54.00	-14.77
640.08	V	-71.13	-54.00	-17.13
696.93	H	-69.58	-54.00	-15.58
708.63	V	-69.91	-54.00	-15.91
749.14	H	-69.35	-54.00	-15.35
758.89	V	-69.12	-54.00	-15.12

Above 1GHz Worst-Case Data

802.11a

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 26GHz	OPERATING CHANNEL	36

SPURIOUS EMISSION LEVEL					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
36	10360.00	H	-46.97	-30.00	-16.97
	10361.00	V	-42.41	-30.00	-12.41
	15540.00	H	-43.11	-30.00	-13.11
	15540.00	V	-41.09	-30.00	-11.09
	20720.00	H	-42.43	-30.00	-12.43
	20720.00	V	-39.18	-30.00	-9.18

802.11n (HT20)

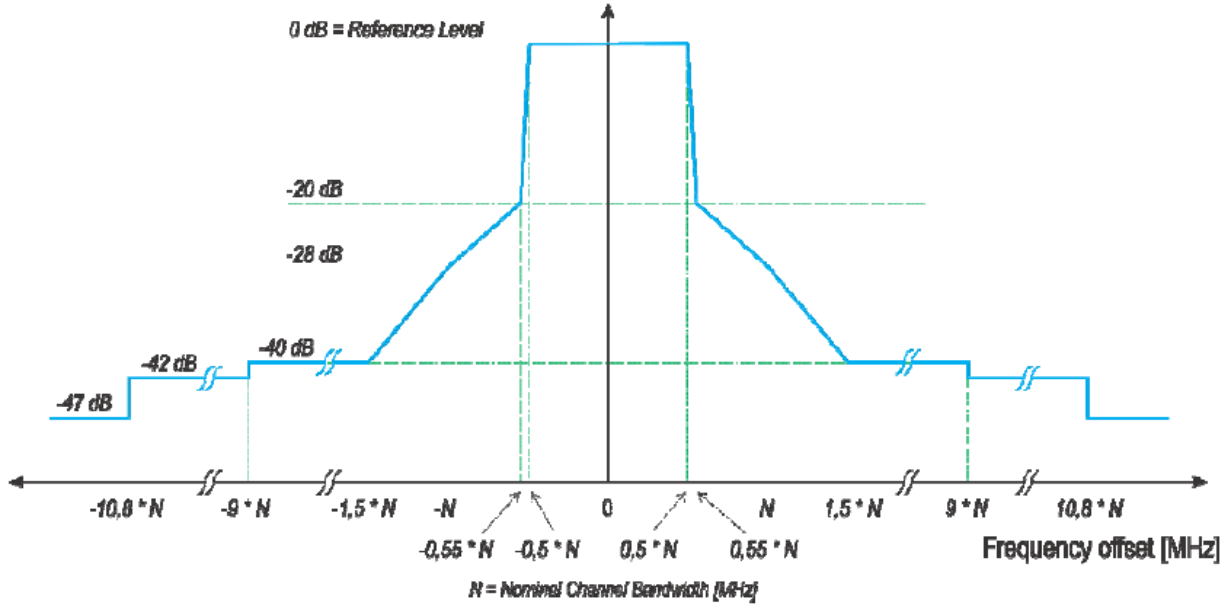
SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 26GHz	OPERATING CHANNEL	100

SPURIOUS EMISSION LEVEL					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
100	11000.00	H	-47.35	-30.00	-17.35
	11007.00	V	-42.08	-30.00	-12.08
	16500.00	H	-43.65	-30.00	-13.65
	16500.00	V	-39.89	-30.00	-9.89
	22000.00	H	-40.72	-30.00	-10.72
	22000.00	V	-35.93	-30.00	-5.93

4.8 Transmitter Unwanted Emissions within the 5 GHz RLAN Bands

4.8.1 Limits of Transmitter Unwanted Emissios within the 5 GHz RLAN Bands

The average level of the transmitted spectrum shall not exceed the limits given in the following figure:



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

The average level of transmitter unwanted emissions within the 5 GHz RLAN bands shall not exceed the limit of the mask provided above figure or the limit for unwanted emissions provided in section 4.7.1 , whichever is the higher.

4.8.2 Test Procedure

Refer to chapter 5.3.6.2 of EN 301 893 V1.8.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement
☒ Option 1: For equipment with continuous transmission capability	
☐ Option 2: For equipment without continuous transmission capability	

4.8.3 Deviation from Test Standard

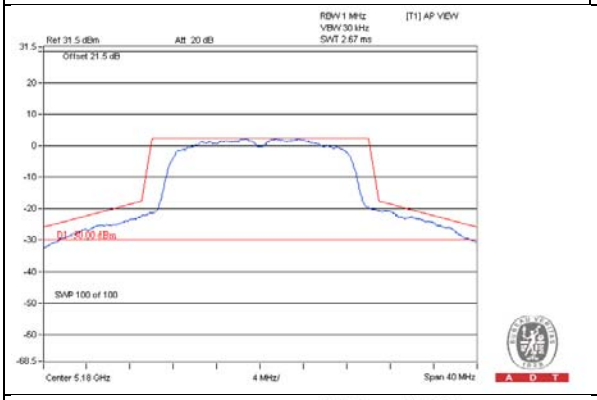
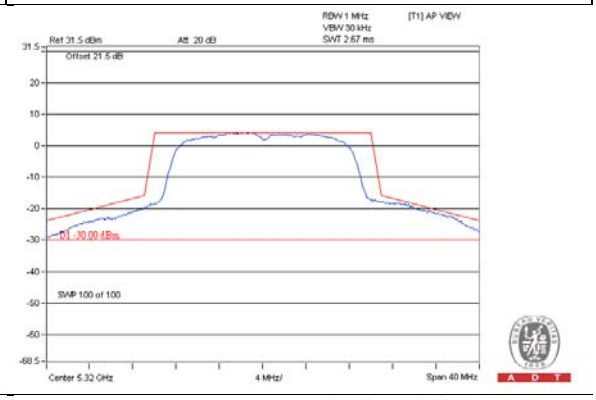
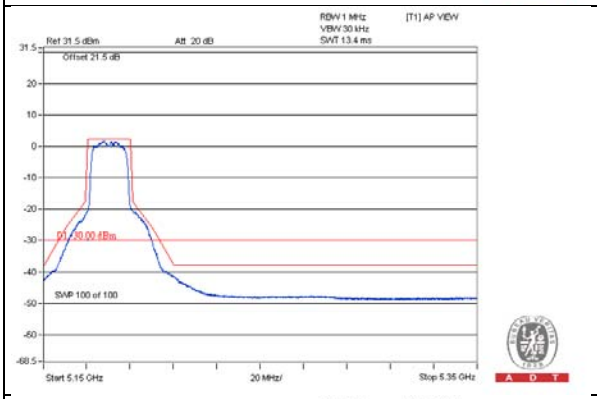
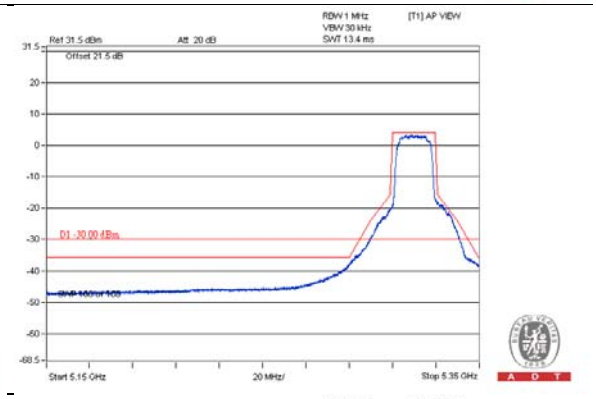
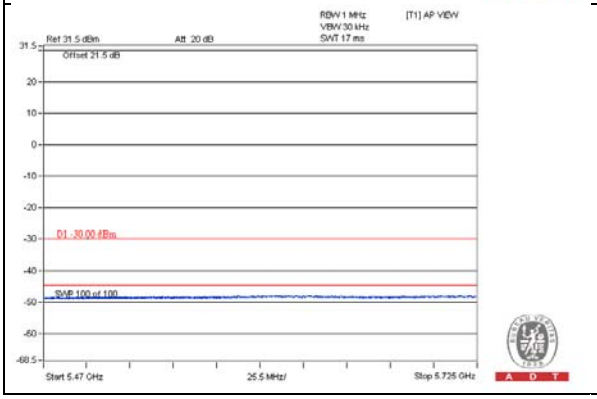
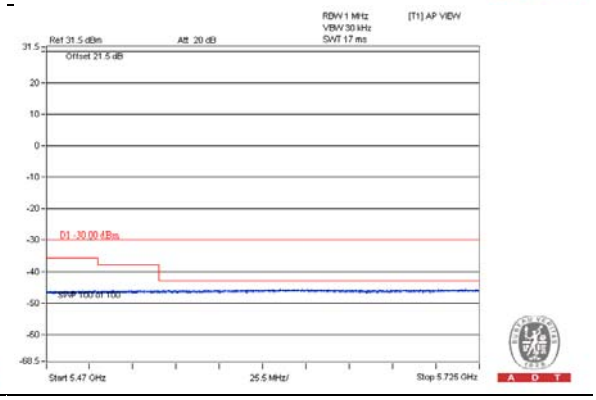
No deviation.

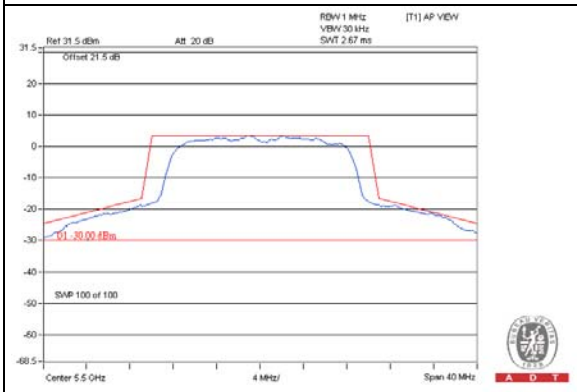
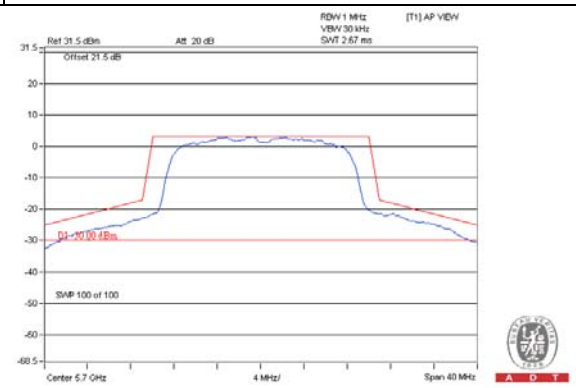
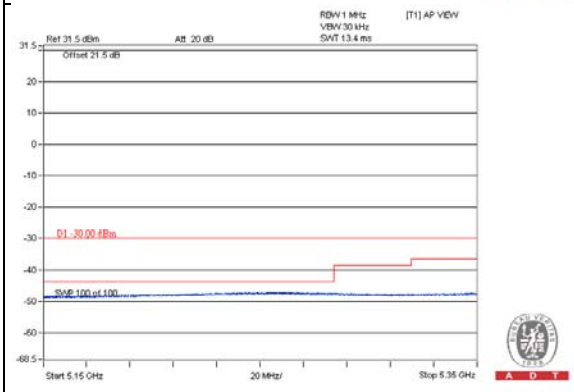
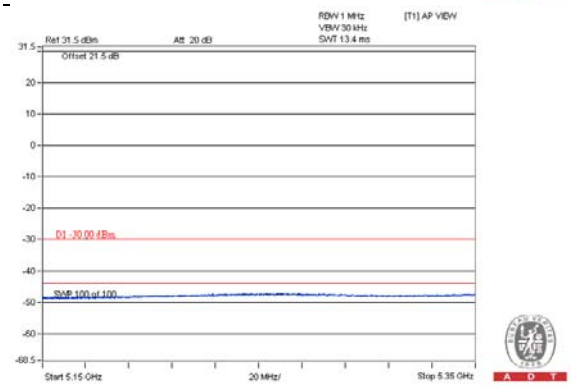
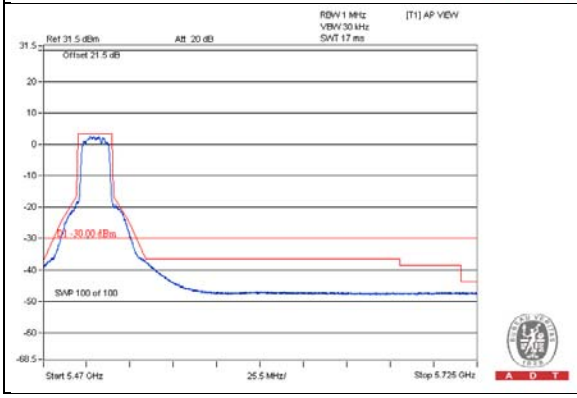
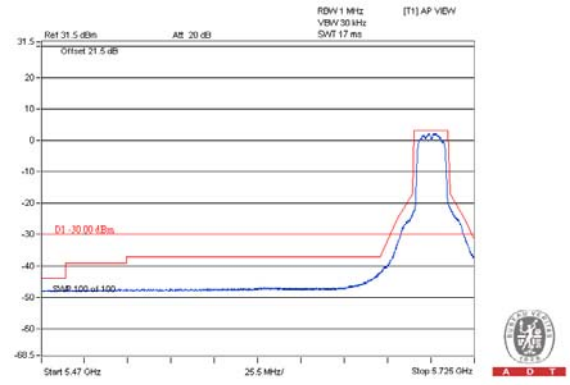
4.8.4 Test Setup

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 for unwanted emissions within the 5 GHz RLAN bands at the highest level

802.11a

CH 36	CH 64
	
	
	

CH 100	CH 140
	
	
	

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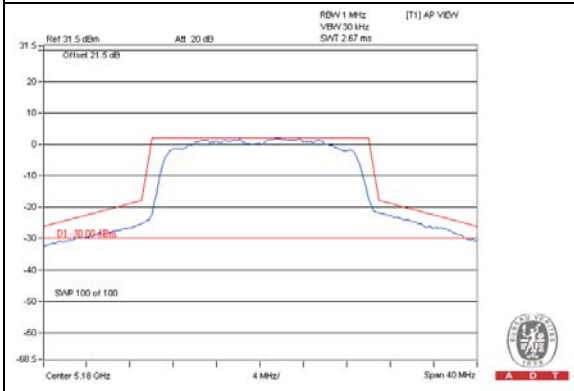
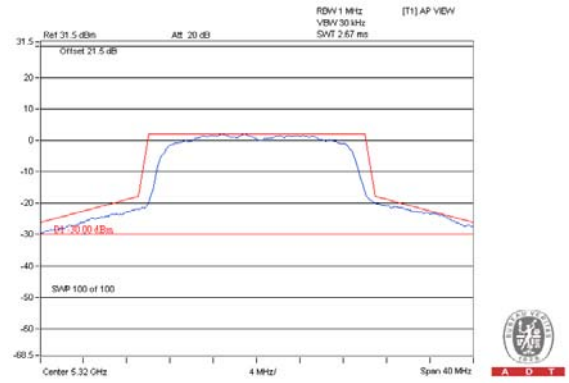
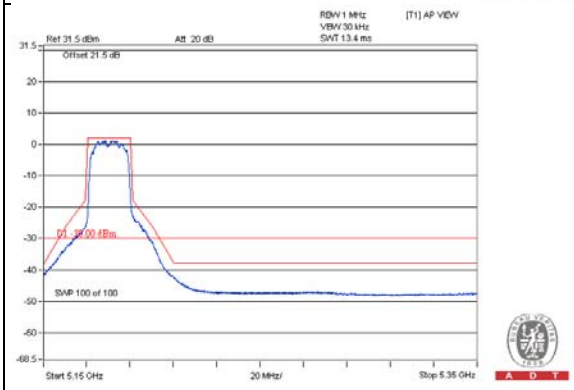
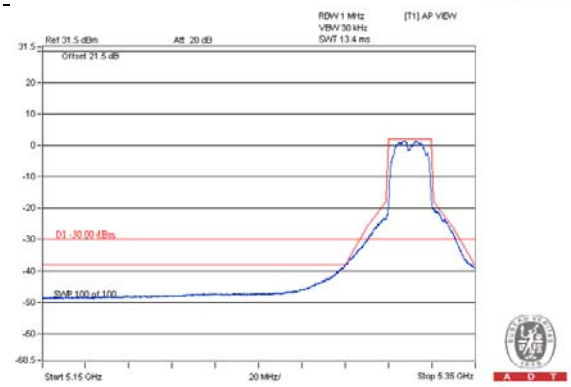
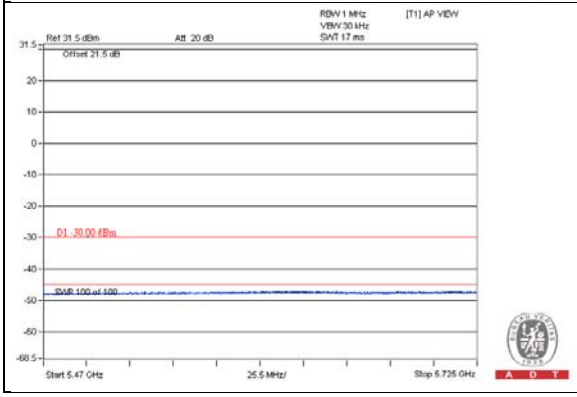
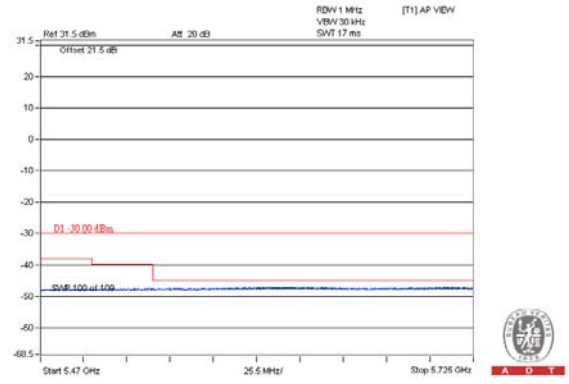
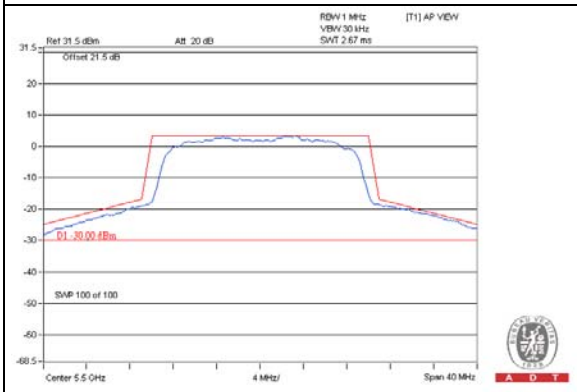
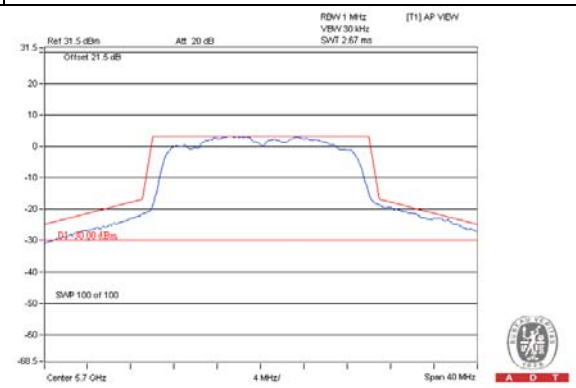
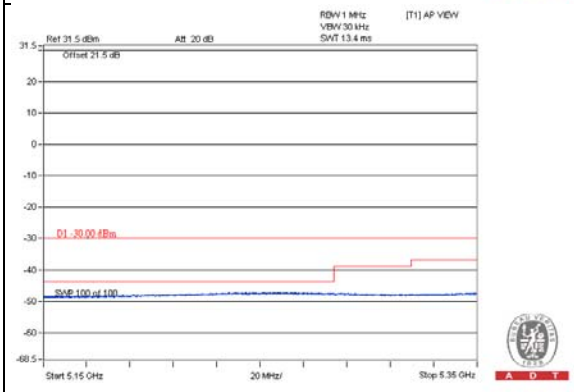
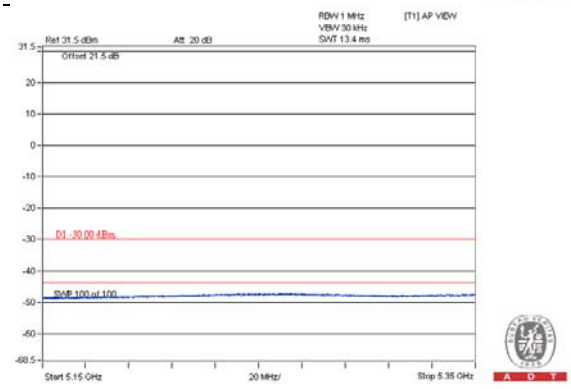
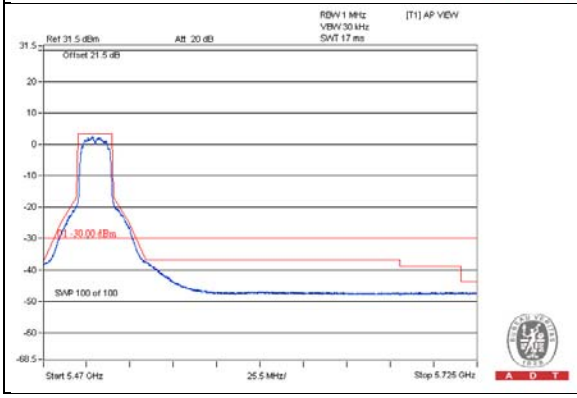
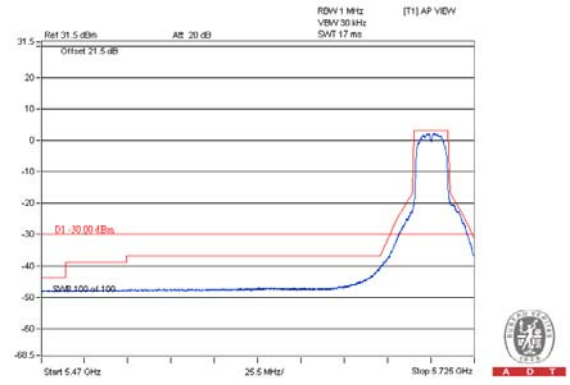
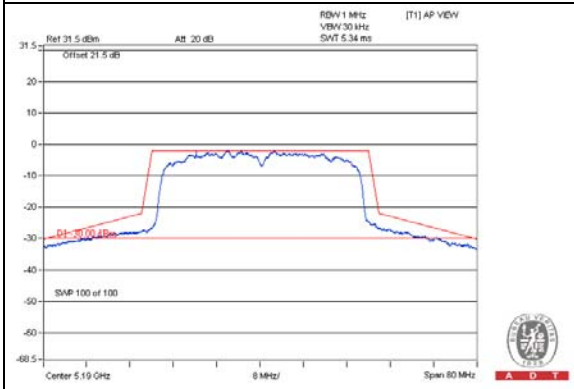
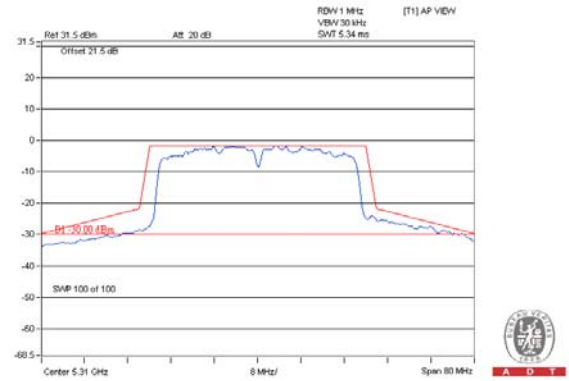
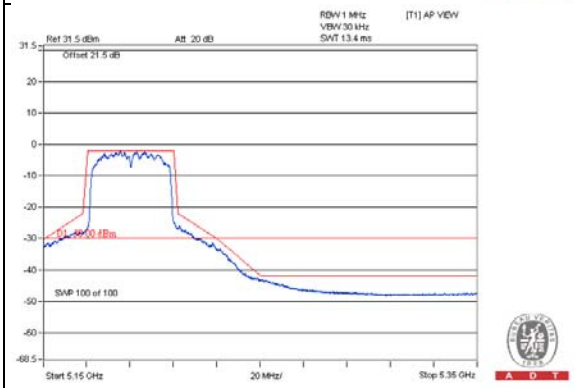
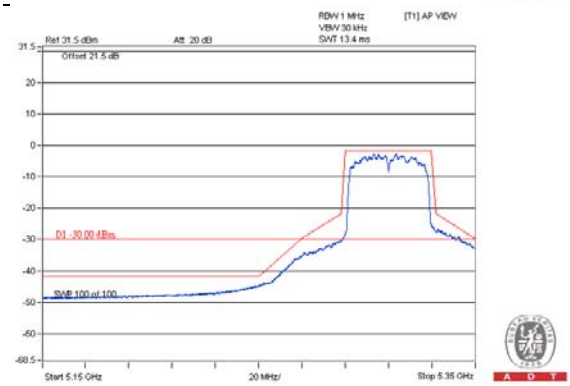
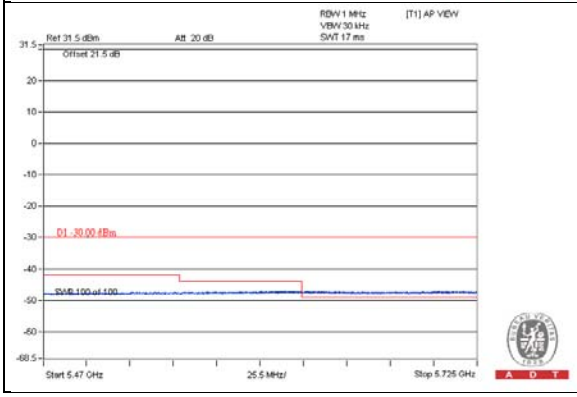
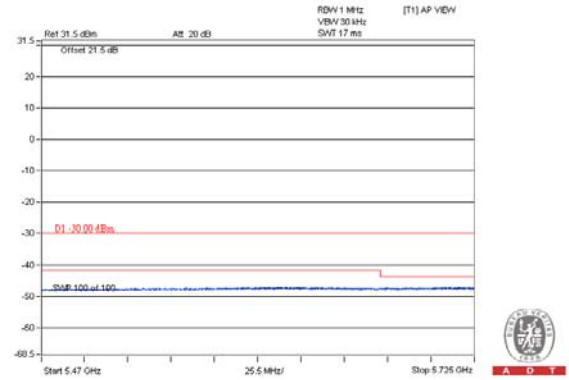
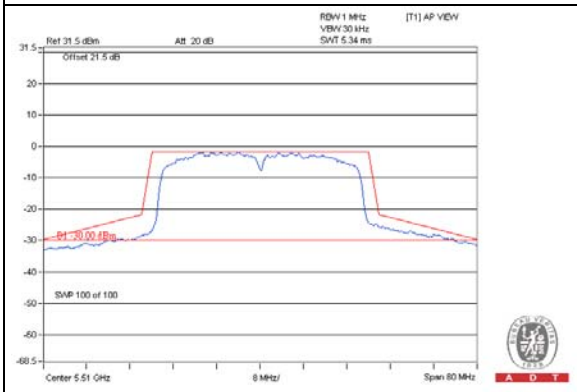
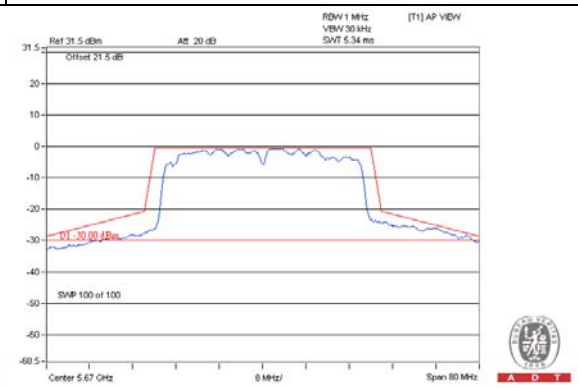
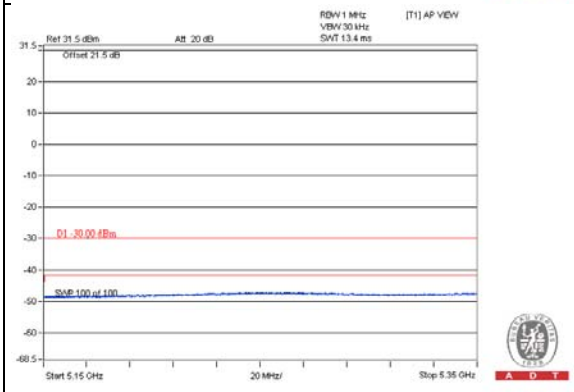
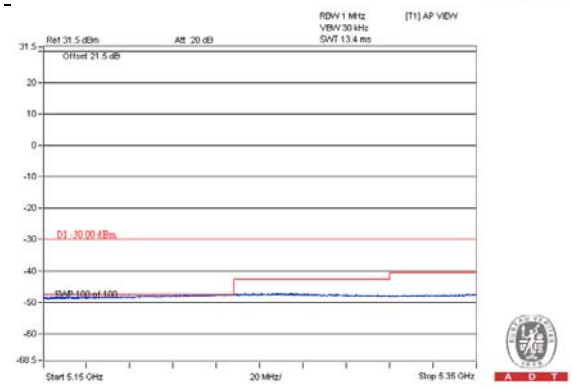
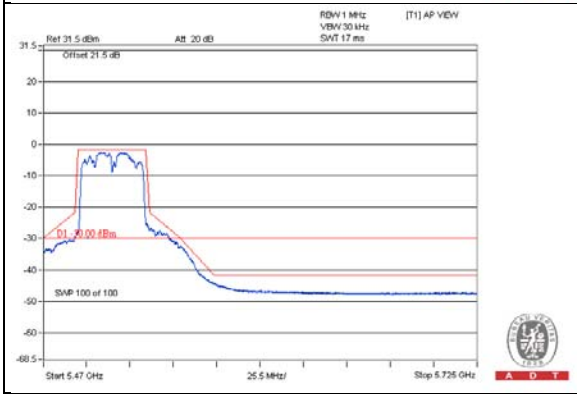
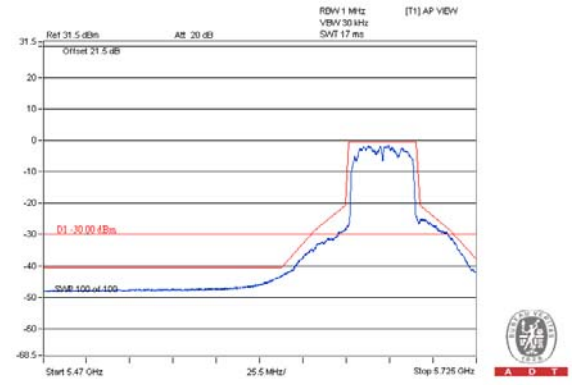
CH 36	CH 64
	
	
	

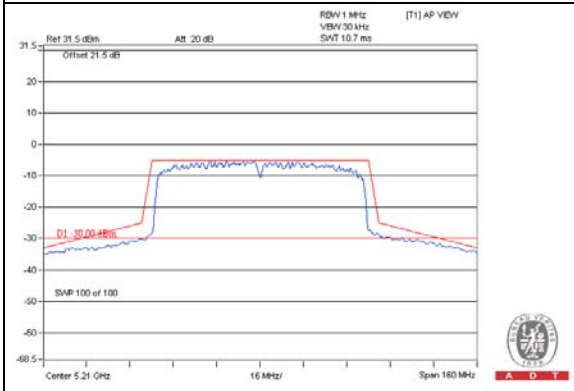
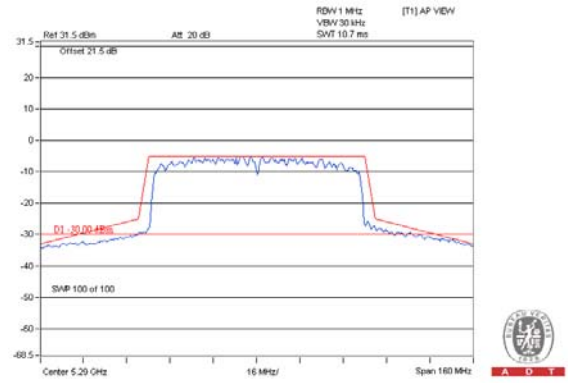
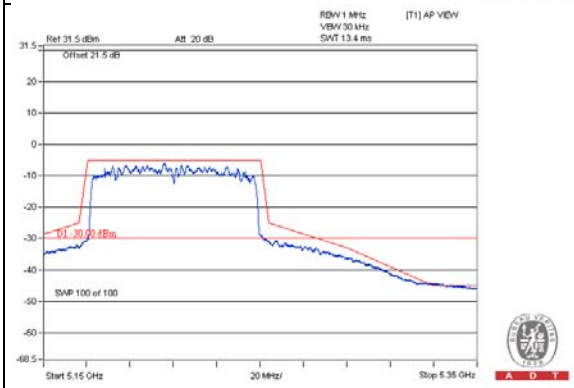
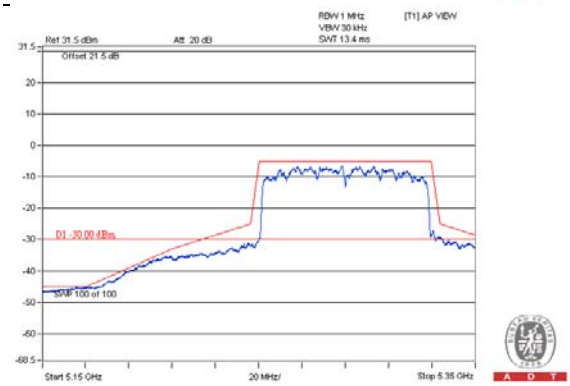
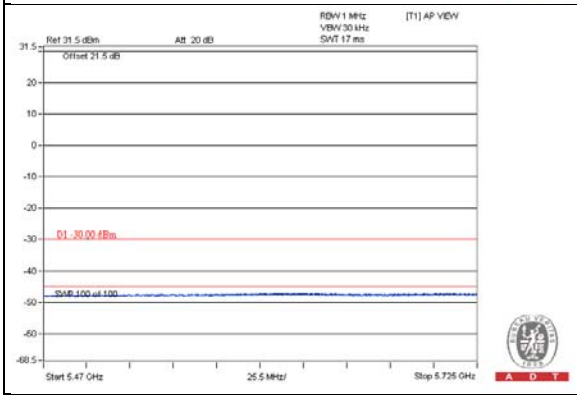
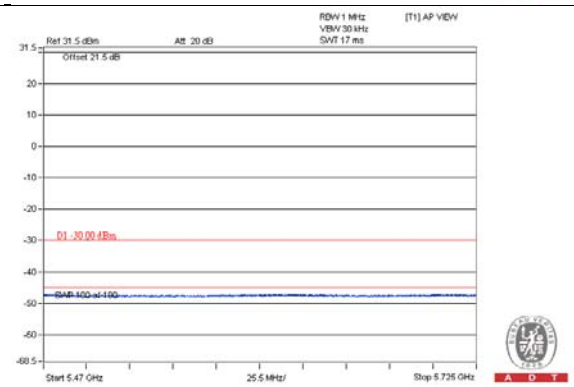
CH 100	CH 140
	
	
	

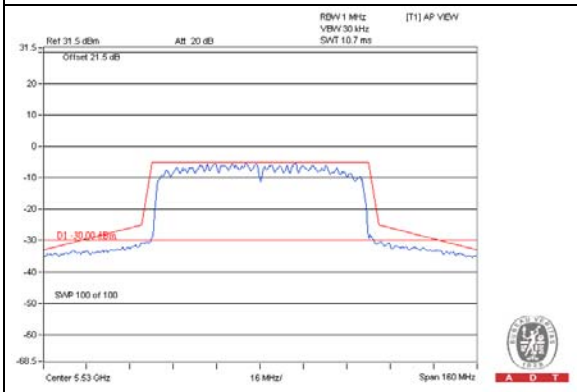
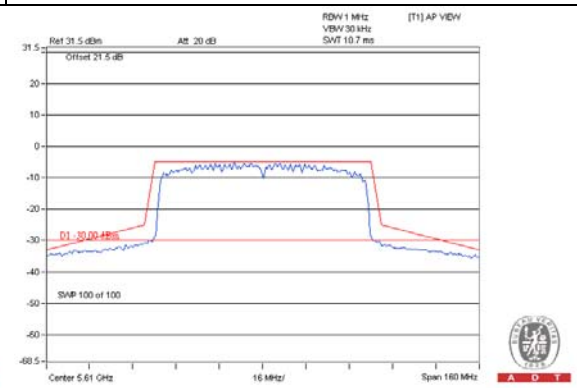
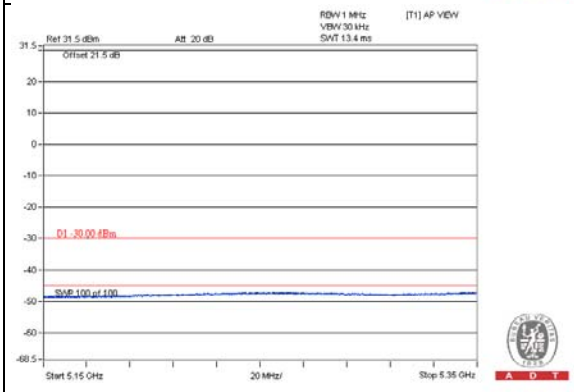
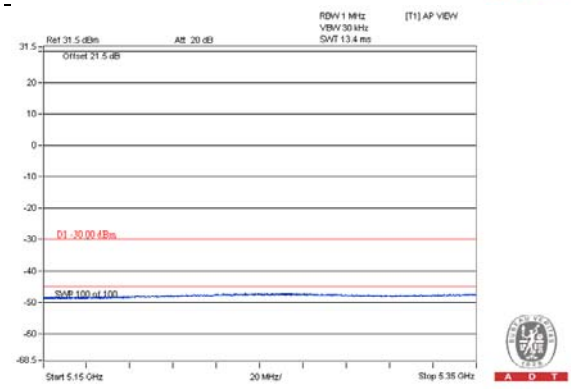
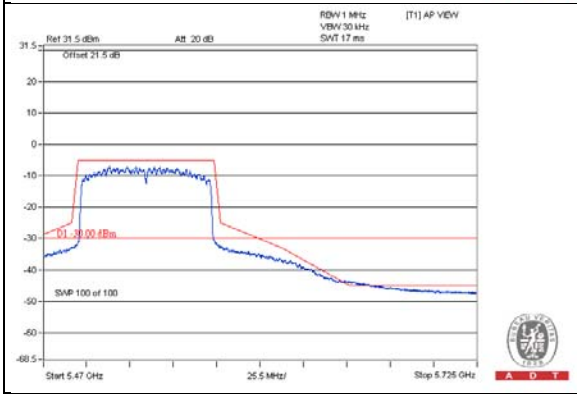
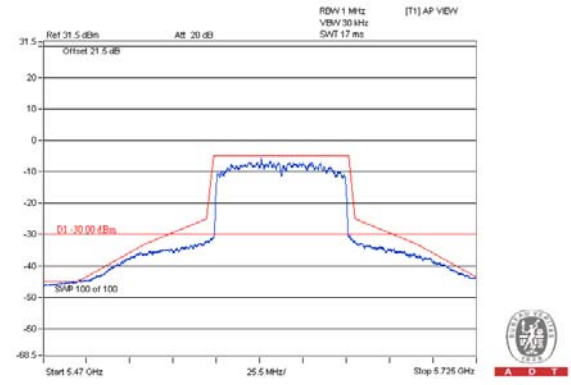
802.11n (HT40)

CH 38	CH 62
	
	
	

CH 102	CH 134
	
	
	

802.11ac (VHT80)

CH 42	CH 58
	
	
	

CH 106	CH 122
	
	
	

Receiver Parameters

4.9 Receiver Spurious Radiation

4.9.1 Limit of Receiver Spurious Radiation

Frequency Range	Maximum Power Limit ERP (≤ 1 GHz) EIRP (>1 GHz)
30 MHz ~ 1 GHz	-57dBm
1 GHz ~ 26 GHz	-47dBm

4.9.2 Test Procedure

Refer to chapter 5.3.7.2 of EN 301 893 V1.8.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement
For Conducted measurement: 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).	
Conducted measurement (For equipment with multiple transmit chains): ☐ Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits. ☒ 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 x log (N) (number of active transmit chains)	

4.9.3 Deviation from Test Standard

No deviation.

4.9.4 Test Setup

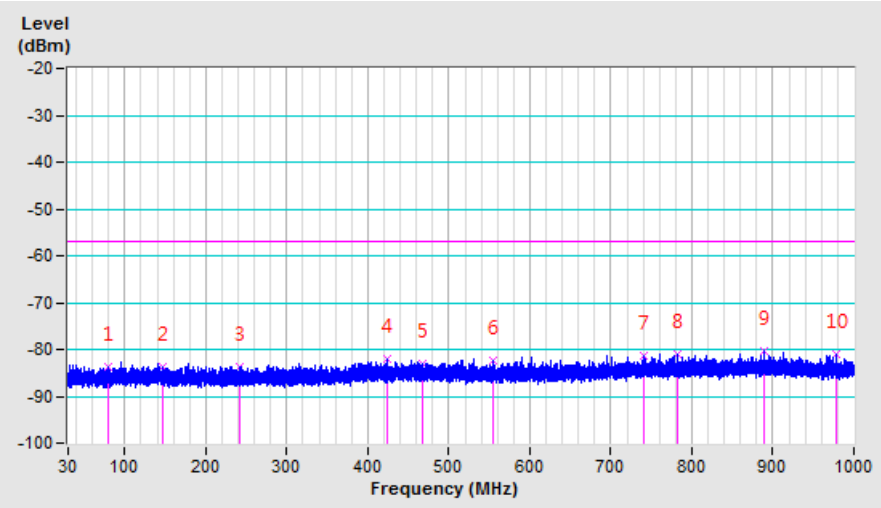
1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. The test setup has been constructed as the normal use condition. Controlling software (QCRT-CONN)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

4.9.5 Test Results (Operating – Conducted)

RX Below 1GHz worst-Case Data:

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	140

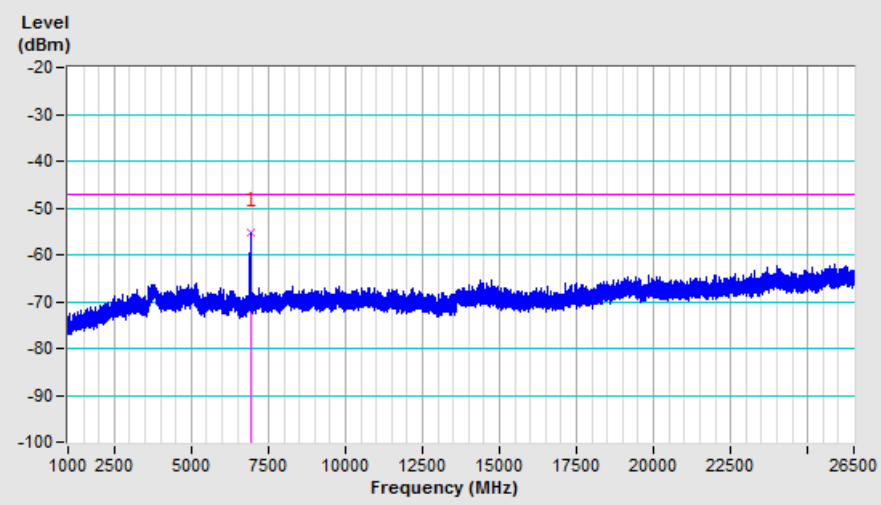
SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
79.22	-83.72	-57.00	-26.72
147.58	-83.56	-57.00	-26.56
241.08	-83.57	-57.00	-26.57
424.81	-82.16	-57.00	-25.16
466.61	-82.92	-57.00	-25.92
554.64	-82.33	-57.00	-25.33
740.72	-81.34	-57.00	-24.34
782.04	-80.91	-57.00	-23.91
889.08	-80.49	-57.00	-23.49
978.51	-81.13	-57.00	-24.13



RX Above 1GHz worst-Case Data:

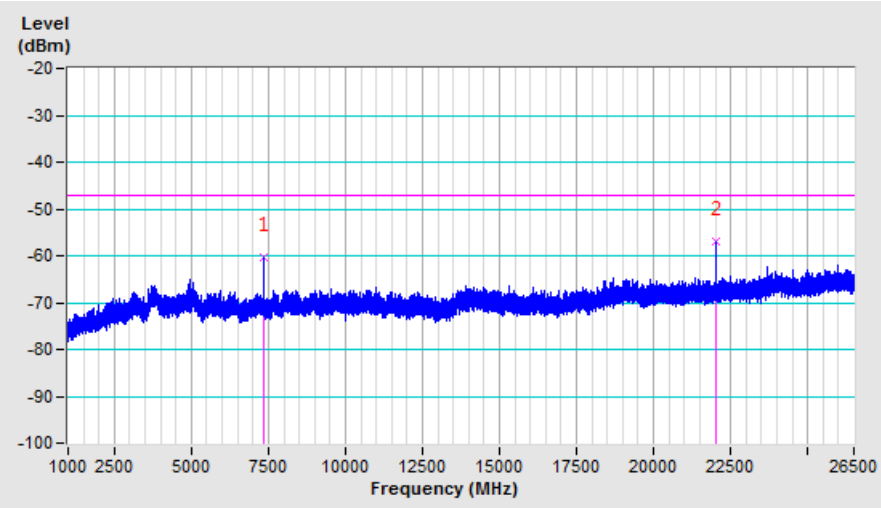
SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 26GHz	OPERATING CHANNEL	36

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	**Level (dBm)**	**Limit (dBm)**	**Margin**
6907.00	-55.36	-47.00	-8.36



SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 26GHz	OPERATING CHANNEL	100

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
7334.00	-60.47	-47.00	-13.47
22001.00	-56.96	-47.00	-9.96



4.9.6 Test Results (Operating – Radiated)

RX Below 1GHz worst-Case Data:

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	140

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
47.95	H	-70.52	-57.00	-13.52
47.95	V	-69.11	-57.00	-12.11
67.75	H	-62.81	-57.00	-5.81
67.75	V	-64.38	-57.00	-7.38
135.46	H	-62.42	-57.00	-5.42
135.46	V	-64.20	-57.00	-7.20
144.01	H	-62.16	-57.00	-5.16
144.01	V	-63.00	-57.00	-6.00
249.16	H	-64.40	-57.00	-7.40
257.26	V	-68.04	-57.00	-11.04
338.72	H	-66.88	-57.00	-9.88
366.42	V	-75.68	-57.00	-18.68
449.27	H	-68.34	-57.00	-11.34
455.97	V	-74.05	-57.00	-17.05
499.67	H	-66.90	-57.00	-9.90
508.02	V	-71.36	-57.00	-14.36
609.68	H	-70.10	-57.00	-13.10
615.73	V	-69.55	-57.00	-12.55
758.94	V	-68.93	-57.00	-11.93
812.84	H	-69.08	-57.00	-12.08

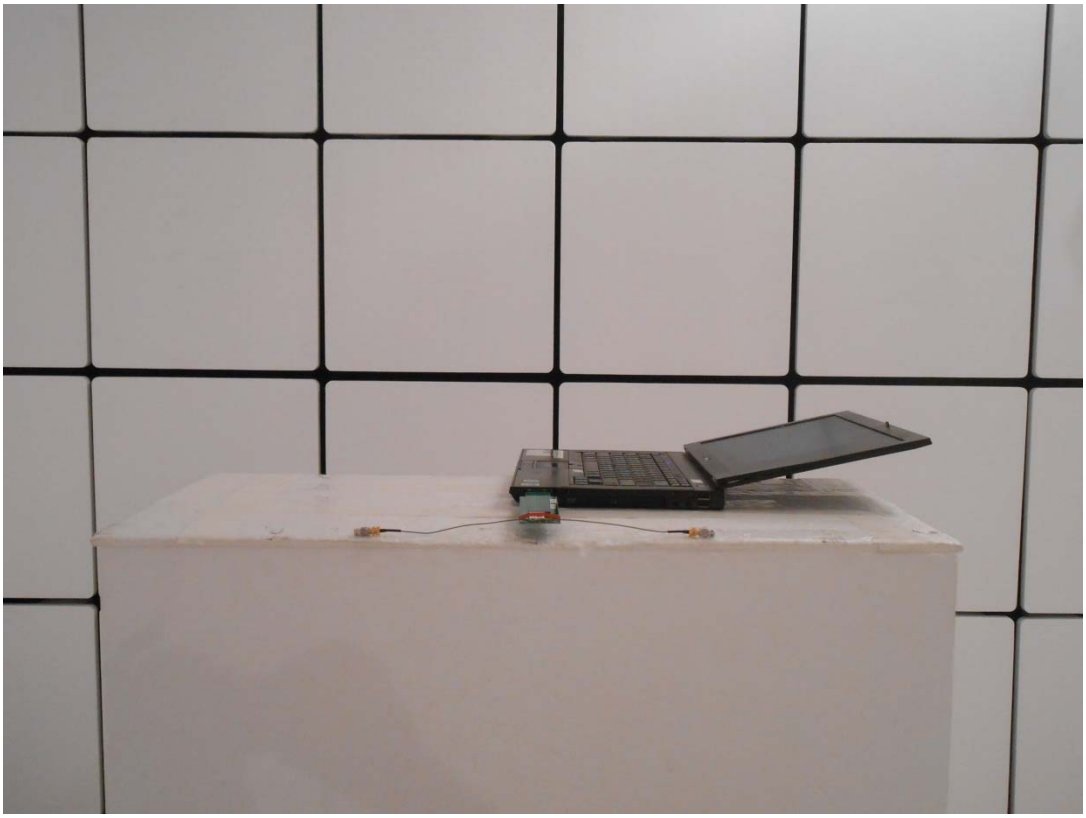
RX Above 1GHz worst-Case Data:

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 26GHz	OPERATING CHANNEL	36, 100

SPURIOUS EMISSION LEVEL					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
36	3453.33	H	-59.28	-47.00	-12.28
	3453.33	V	-61.24	-47.00	-14.24
	6906.55	V	-51.22	-47.00	-4.22
	6906.75	H	-53.63	-47.00	-6.63
100	3666.66	H	-60.87	-47.00	-13.87
	3666.66	V	-60.98	-47.00	-13.98
	7333.30	H	-54.94	-47.00	-7.94
	7333.30	V	-53.62	-47.00	-6.62

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:

Linko EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

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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