

# **FCC- TEST REPORT**

Report Number :	68.910.18.0030.01	D	Date of Issue:	10 September 2018				
Model	: X500, X500i, X500w, X500r, X500Pro, D5, D51, D52, D5s, D5Pro, Robvacuum8, X-503, X500, X520, X530, X550, X560							
Product Type	: Robotic Vacuum	Cleaner						
Applicant	: Shenzhen Hua X	Kin Informati	ion Technology	Co., Ltd.				
Address	: Section A 10/F, I	Block 1, No.	.7 Industrial Parl	k, Yulu Community,				
	Yutang, Guangm	ning New Di	strict, 518132 S	henZhen,				
	PEOPLE'S REP	UBLIC OF C	CHINA					
Production Facility	: Shenzhen Hua X	(in Informati	ion Technology	Co., Ltd.				
Address	: Section A 10/F, I	Block 1, No.	.7 Industrial Parl	k, Yulu Community,				
	Yutang, Guangm	ning New Di	strict, 518132 S	henZhen,				
	PEOPLE'S REP	UBLIC OF C	CHINA					
Test Result :	Positive	□ Negative	•					
Total pages including Appendices :	49							

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# 2 Details about the Test Laboratory

## **Details about the Test Laboratory**

Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12&13, Zhiheng Wisdomland Business Park,
	Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052,
	P. R. China

FCC Registration 514049 Number:

Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299



# **3** Description of the Equipment under Test

## **Description of the Equipment Under Test**

Product:	Robotic Vacuum Cleaner
Model no.:	X500
FCC ID:	2AMYQ-20180700500
Options and accessories:	NIL
Rated Input:	19VDC, 0.6A (supplied by an external adapter)
RF Transmission	2412-2462MHz
Frequency: No. of Operated Channel:	11
Modulation:	DSSS for 802.11b OFDM for 802.11g/n
Duty Cycle:	100%
Antenna Type:	Integral Antenna
Antenna Gain:	2dBi
Description of the EUT:	Tested with external approved adaptor GSCU0600S019V12E: Input: 100-240V AC, 50/60Hz, 0.5A Max, Output: 19V DC, 0.6A; Or tested with external approved adaptor YJS015D-1900600U: Input: 120V AC, 60Hz, 0.5A, Output: 19V DC, 0.6A



## 4 Summary of Test Standards

Test Standards				
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES			
10-1-2017 Edition	Subpart C - Intentional Radiators			

All the test methods were according to KDB558074 D01 v04 DTS Measurement Guidance and ANSI C63.10 (2013).

## 5 Summary of Test Results

Technical Requirements							
FCC Part 15 Subpart C							
Test Condition		Pages	Test Result	Test Site			
§15.207	Conducted emission AC power port	10	Pass	Site 1			
§15.247(b)(1)	Conducted peak output power	14	Pass	Site 1			
§15.247(e)	Power spectral density*	21	Pass	Site 1			
§15.247(a)(2)	6dB bandwidth	15	Pass	Site 1			
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	15	Pass	Site 1			
§15.247(a)(1)	Carrier frequency separation		N/A				
§15.247(a)(1)(iii)	Number of hopping frequencies		N/A				
§15.247(a)(1)(iii)	Dwell Time		N/A				
§15.247(d)	Spurious RF conducted emissions	27	Pass	Site 1			
§15.247(d)	Band edge	37	Pass	Site 1			
§15.247(d) & §15.209 & 15.205	Spurious radiated emissions for transmitter	41	Pass	Site 1			
§15.203	Antenna requirement	See note 1	Pass				

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses a permanently integral antenna, which gain is 2dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.



## 6 General Remarks

### Remarks

This submittal(s) (test report) is intended for FCC ID: 2AMYQ--20180700500, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C rules.

All modes have same technical construction including circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction except color of appearance. So, the full tests were applied on X500, the others were deemed to fulfil the EMC requirement without the further test.

The EUT has multiple work modes, the worst test results are listed in the report.

### SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed
- □ Not Performed

The Equipment under Test

- - Fulfills the general approval requirements.
- □ **Does not** fulfill the general approval requirements.

Sample Received Date:July 01, 2018Testing Start Date:July 01, 2018Testing End Date:August 06, 2018

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Prepared by:

Tested by:

Laurent Yuan EMC Project Manager

Dari. dn

Dawi Xu EMC Project Engineer

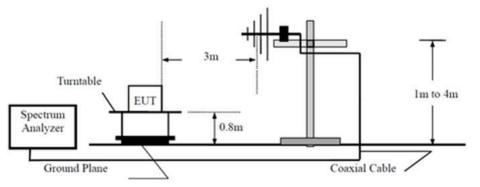
Tree them

Tree Zhan EMC Test Engineer

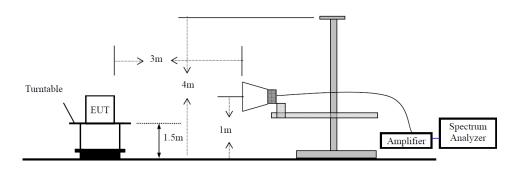
## 7 Test Setups

## 7.1 Radiated test setups

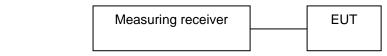
### Below 1GHz



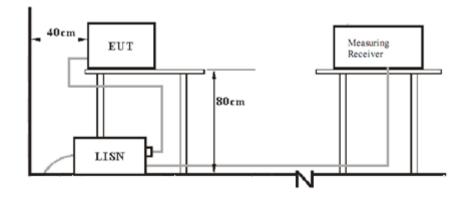
## Above 1GHz



## 7.2 Conducted RF test setups



## 7.3 AC Power Line Conducted Emission test setups



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## 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)	

Test software: RF test tool

The system was configured to channel 1, 6 and 11 for the test.

# 9 Technical Requirement

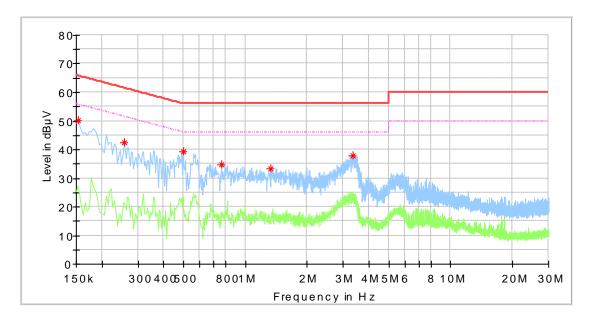
## 9.1 Conducted Emission

### Conducted Emission Test 150kHz – 30MHz

M/N:	X500(with adapter: GSCU0600S019V12E)
Op Cond.:	Charging
Test Spec.:	Power Line, Live

Comment: AC 120V/60Hz

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.154000	50.00		65.78	15.78	L1	10.2
0.258000	42.63		61.50	18.86	L1	10.2
0.498000	39.40		56.03	16.63	L1	10.2
0.766000	34.73		56.00	21.27	L1	10.2
1.330000	33.18		56.00	22.82	L1	10.2
3.358000	38.00		56.00	18.00	L1	10.3

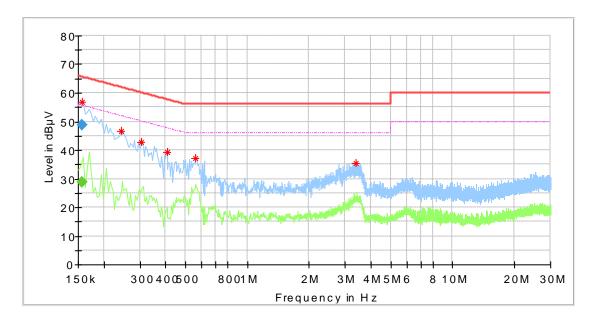


### Conducted Emission Test 150kHz – 30MHz

M/N: X500(with adapter: GSCU0600S019V12E) Op Cond.: Charging Test Spec.: Power Line, Neutral

Comment: AC 120V/60Hz

 Temperature (°C):
 22.5
 Relative Humidity (%):
 46.7
 Atmospheric Pressure(mbar) :
 1012



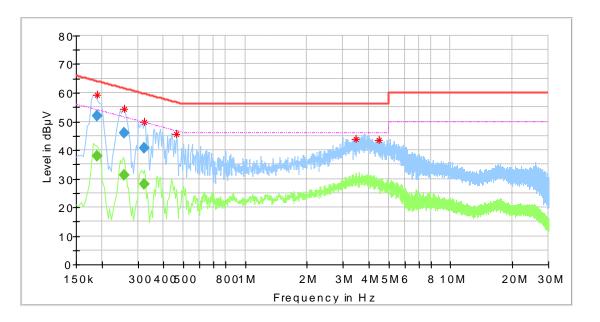
Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.157500		28.93	55.59	26.66	Ν	10.3
0.157500	48.70		65.59	16.89	Ν	10.3



### Conducted Emission Test 150kHz – 30MHz

M/N:X500(with adapter: YJS015D-1900600U)Op Cond.:ChargingTest Spec.:Power Line, LiveComment:AC 120V/60Hz

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.189500		37.80	54.06	16.26	L1	10.2
0.189500	51.91		64.06	12.15	L1	10.2
0.257500		31.27	51.51	20.24	L1	10.2
0.257500	46.02		61.51	15.49	L1	10.2
0.321500		28.13	49.67	21.54	L1	10.2
0.321500	40.68		59.67	18.99	L1	10.2



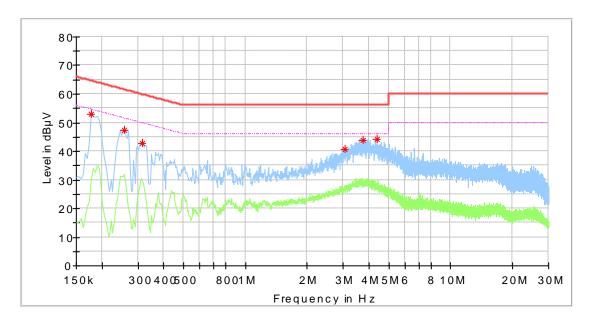
### Conducted Emission Test 150kHz – 30MHz

M/N: X500(with adapter: YJS015D-1900600U) Op Cond.: Charging

Test Spec.: Power Line, Neutral

Comment: AC 120V/60Hz

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.178000	53.10		64.58	11.48	Ν	10.3
0.258000	47.31		61.50	14.19	Ν	10.3
0.314000	42.95		59.86	16.91	Ν	10.3
3.046000	40.66		56.00	15.34	Ν	10.5
3.730000	43.88		56.00	12.12	Ν	10.5
4.374000	44.37		56.00	11.63	Ν	10.5



## 9.2 Conducted peak output power

### **Test Method**

- 1. Connect the power meter to the EUT
  - a) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
  - b) At all times the EUT is transmitting at its maximum power control level.
  - c) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- 2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- 3. Adjust the measurement in dBm by adding 10log (1/x), where x is the duty cycle to the measurement result.

### Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

Frequency Range	Limit	Limit
MHz	W	dBm
2400-2483.5	≤1	≤30

Test result as below table

802.11b

Frequency MHz	Output Power dBm	Result
Top channel 2412MHz	13.7	Pass
Middle channel 2437MHz	13.7	Pass
Bottom channel 2462MHz	12.9	Pass

802.11g

Conducted Peak			
Output Power	Result		
dBm			
16.1	Pass		
16.4	Pass		
14.8	Pass		
	Output Power dBm 16.1 16.4		

## 802.11nHT20

Conducted Peak			
Output Power	Result		
dBm			
16.0	Pass		
16.2	Pass		
14.6	Pass		
	Output Power dBm 16.0 16.2		



## 9.3 6dB and 99% bandwidth

### **Test Method**

- 1. Use the following spectrum analyzer settings:
- RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
  Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that
- the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be  $\geq$  6 dB.
- 3. Allow the trace to stabilize, record the X dB Bandwidth value.

### Limit

	Limit [kHz]
-	≥500
Test result	
802.11b	

002.110			
Frequency MHz	6dB bandwidth KHz	99 bandwidth KHz	Result
Bottom channel 2412MHz	8120	11948	Pass
Middle channel 2437MHz	9120	11948	Pass
Top channel 2462MHz	9080	11788	Pass
802.11g			
Frequency	6dB bandwidth	99 bandwidth	Decult
MHz	KHz	KHz	Result
Bottom channel 2412MHz	15920	16863	Pass
Middle channel 2437MHz	15920	16943	Pass
Top channel 2462MHz	16120	16703	Pass
802.11n HT20			
Frequency	6dB bandwidth	99 bandwidth	Desult
MHz	KHz	KHz	Result
Bottom channel 2412MHz	15800	17702	Pass

15800

15800

Middle channel 2437MHz

Top channel 2462MHz

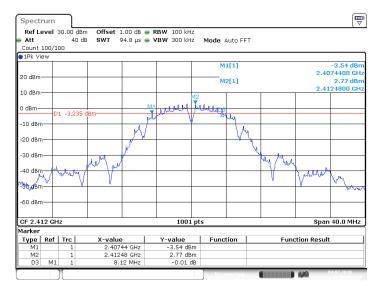
17782

17582

Pass

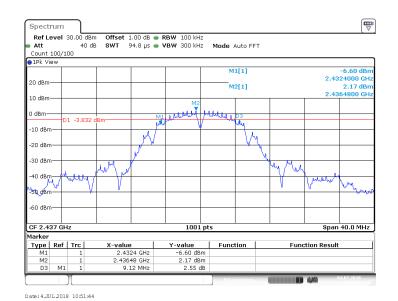
Pass

### 802.11b



Date:4.JUL.2018 10:50:12





2437MHz

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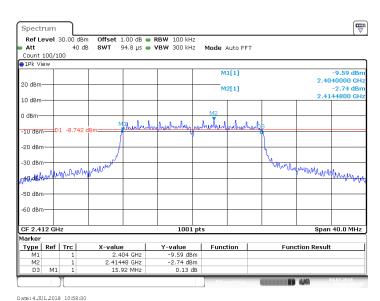




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802.11g

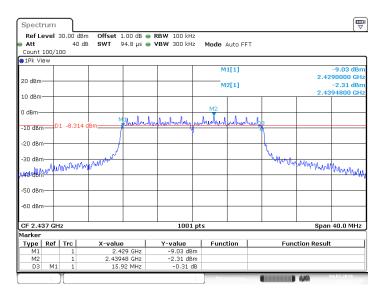


2412MHz

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	evel	30.00 dB		IB <b>⇔ RBW</b> 100 kH					
Att Count	100/1	40 ( 00	∃B <b>SWT</b> 94.8µ	ıs <b>⊜ VBW</b> 300 kH	iz Mode	Auto FFT			
∋1Pk Vi	ew								
					N	11[1]			-10.62 dBi
20 dBm	_				<u> </u>	10141		2.4	538000 GH
					N N	12[1]		2.4	-4.18 dBi 644800 GH
10 dBm						1		2.7	044000 GI
0 dBm-					MO				
					I T				
10 dBm		1 -10.18	3 dBm	haber beerherberg	MUMBIN	manun	<u>, pa</u>		
					Y		1		
-20 dBr	-								-
-30 dBm			/				1		
							Marino A		
-40 dBa		مى مەلىرى	grower -				· V* V	mush	A
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-50 dBr	-								
-60 dBm									
-60 aBn									
CF 2.4		-		100	l pts			0	n 40.0 MHz
darker	JZ GH	2		100.	r prs			spa	11 40.0 MHz
Type	Ref	Trc	X-value	Y-value	Fund	tion	Fur	ction Resu	lt
M1	Nat	1	2.4538 GH				1 41	10010 N K630	
M2		1	2.46448 GH						
D3	M1	1	16.12 MH	iz -0.30	dB				

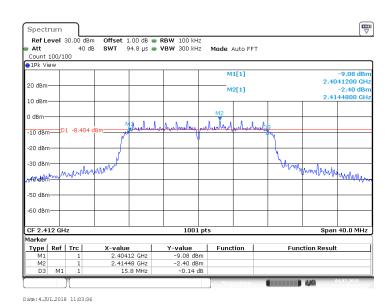
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2462MHz

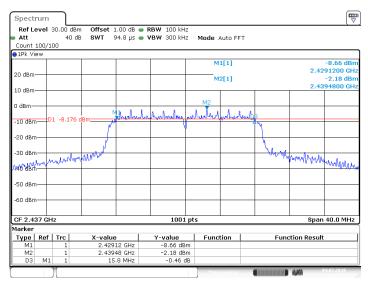
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### 802.11nHT20







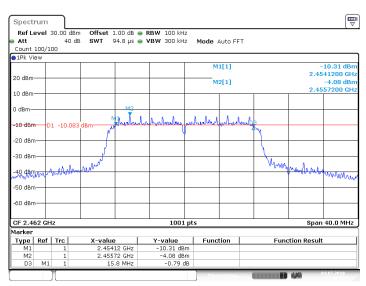
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2437MHz

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Date:4.JUL.2018 11:06:57

<sup>2462</sup>MHz



## 9.4 Power spectral density

### Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

- Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
- 2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
- 3. Repeat above procedures until other frequencies measured were completed.

### Limit

Limit [dBm]

≤8

### Test result

802.11b

	Power spectral			
Frequency	density	Result		
MHz	dBm			
Top channel 2412MHz	-11.80	Pass		
Middle channel 2437MHz	-12.30	Pass		
Bottom channel 2462MHz	-13.18	Pass		

802.11g

Power spectral			
Frequency	density	Result	
MHz	dBm		
Top channel 2412MHz	-17.94	Pass	
Middle channel 2437MHz	-17.61	Pass	
Bottom channel 2462MHz	-18.97	Pass	

### 802.11nHT20

Frequency MHz	Power spectral density dBm	Result
Top channel 2412MHz	-17.94	Pass
Middle channel 2437MHz	-17.61	Pass
Bottom channel 2462MHz	-19.48	Pass

802.11b







2437MHz

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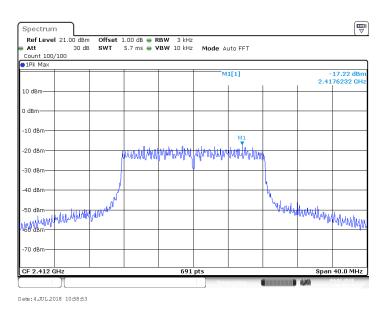
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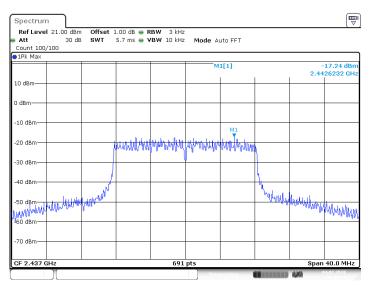


2412MHz

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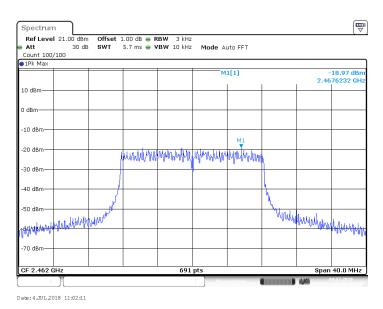
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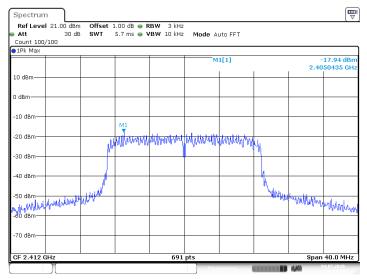


2462MHz

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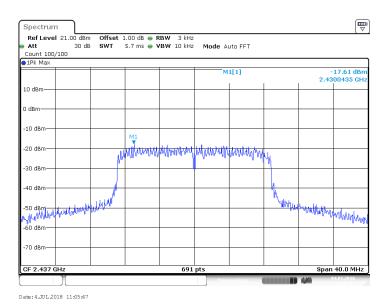
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#### 802.11nHT20



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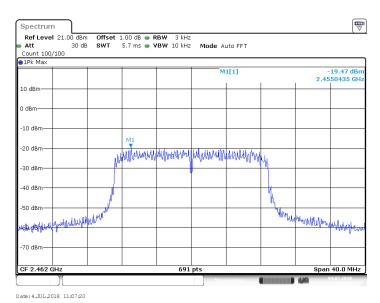


2437MHz

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2462MHz

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## 9.5 Spurious RF conducted emissions

### **Test Method**

- 1. Establish a reference level by using the following procedure:
  - a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
  - b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
- 2. Use the maximum PSD level to establish the reference level.
  - a. Set the center frequency and span to encompass frequency range to be measured.
  - b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
- 3. Repeat above procedures until other frequencies measured were completed.

## Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

### **Spurious RF conducted emissions**

### 802.11b

0 dBm					M	L[1]		_	66.95 dB
0 dBm									1.8570 MI
-10 dBm									
-20 dBm—	D1 -17.880	dBm							
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm—									M1
-70 dBm		r faileat naite	trinis to back	and allocations	or of the difference of	an de chende	an a	na classicitate de	a turbuch
استغاظتهما والمراهين	<ul> <li>A second s</li></ul>								
-80 dBm									
Start 30.0	) MHz			3000	1 pts			Sto	p 1.0 GH
	Υ				Mela	suring		4/4	14.07.2018
ate:4.JUL2	2018 10:51:00								
Spectrur									ſ

●1Pk Max				М	1[1]			31.21 dBm
10.10					I.		9.6	47900 GH:
10 dBm								
0 dBm								
-10 dBm								
-20 dBm D1 -	17.880 dBm							
-30 d8m		M1						
-40 dEm								
-50 dEm			The com	و منتخص ال	Males, Juniss	na allanda ana ana	li dandaktar i ar	de bad and
-60 d5	alayaha ya kuta na pada na Manazara na mata na ana ana	al and the second	t in the second state		and the stand of t	proven Anna con		an frankriger af der
-70 dBm								
Start 1.0 GHz			3000	1 pts			Stop	26.5 GHz
) (				Mas	eurin a		1.00	4.07.2018

2412MHz

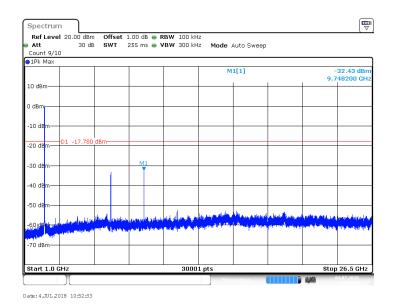
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1Pk Max							
				Mi	[1]		-65.10 dBr 1.3650 MH
) dBm			 				+
10 dBm—			 				
20 dBm—	D1 -17.780	) dBm				 	
30 dBm—			 			 	
40 dBm—			 				
50 dBm—						 	-
60 dBm—							M1
70 40				a fall as a fall a sub-			

Date:4.JUL.2018 10:52:21



2437MHz

EMC\_SZ\_FR\_21.00 FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299

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# Spurious RF conducted emissions

Att 20 c Count 10/10	iB SWT 30.1 m	5 👄 <b>VBW</b> 300 kHz	Mode Auto Sweep		
1Pk Max			M1[1]	94	-62.40 dB 41.4950 MI
) dBm					-
-10 dBm					
20 dBm D1 -19.11	0 dBm				
30 dBm					_
40 dBm					
50 dBm					
60 dBm					M1
70 dBm	and the particular of the second	the street of the street or the	nelek yang di pang di p	-	day a har
			Herein Hallen auf an		
Start 30.0 MHz		30001 g	ats	s	top 1.0 GH

Ref Level 20.0 Att Count 9/10	30 dB SWT	1.00 dB 👄 R 255 ms 👄 V			Auto Sweep			
1Pk Max								
				N	11[1]			-34.17 dB 847650 GF
10 dBm					1	+	-	+
) dBm								
-10 dBm								
10 dbm								
20 dBm D1 -:	19.110 dBm							
-30 dBm		M1						
40 dBm								
io abiii								
-50 dBm								
1.44	A	a han makelahad	وريعانا والمعارين	and a state of the	different of the lot	بالمطوا والحمو	Markhan	all most stu
60 de tradition	Accessing the particular of the second	the state of the state of the		departies and and	The second second	nienduw.	page of the party	dis-babapant
-70 dBm								
/ C dbm								
Start 1.0 GHz				1 pts				26.5 GH

2462MHz

EMC\_SZ\_FR\_21.00 FCC Release 2014-03-20

802.11g

Ref Level 1 Att	20 dB			<b>RBW</b> 100 kł <b>VBW</b> 300 kł		Auto Sweep			
Count 10/10 1Pk Max									
					м	1[1]			-63.33 dE 41.3330 M
0 dBm									41.5550 M
-10 dBm									
-20 dBm-01	-22,580	dBm							
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									M1
-70 dBm		and the particular	a manager and	Re. addinger, black		a na sa	Adama (	-	Aphradam
-80 dBm	handhadilaan	orgenstandeter	and the second secon	a Busidinti Ananapa	enderstanden stadsförar	an a	al printer de la composi	nillingen helseler	land (Second Hills Body)
Start 30.0 MH	12			2000	1 pts				top 1.0 GH

Spectrum RefLevel 20.00 dBm Att 30 dB 
 Offset
 1.00 dB ● RBW
 100 kHz

 SWT
 255 ms ● VBW
 300 kHz
 Mode
 Auto Sweep
 Count 9/10 -44.21 dB M1[1] 10 dBm 0 dBm -10 dE -20 dE -30 d 40 d -50 d -70 dBm Stop 26.5 GHz 30001 pt Start 1.0 GI 1 1/4 Date: 4.JUL 2018 10:59:30

2412MHz

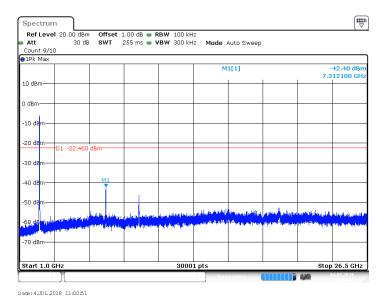
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## **Spurious RF conducted emissions**

	1				M	1[1]			-66.33 dB
					I III	1(1)			1.3650 MF
0 dBm									
-10 dBm									
-20 dBm—	D1 -22.460	dBm							
-30 dBm									
40 dBm									
-50 dBm									
-60 dBm—									M1
-70 dBm	a like de liter, a klasset also	an the first the solution	un and the second second second	uppet lend pilotes	algorithmitroper str		n an	-	
-60 dBm			-						. Tu

Date:4.JUL.2018 11:00:40

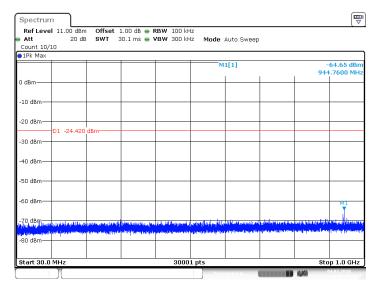


2437MHz

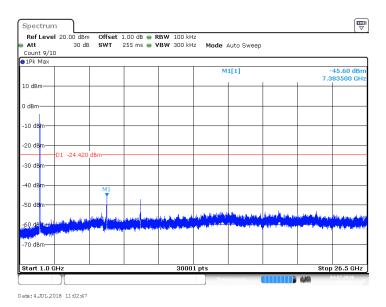
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Date:4.JUL.2018 11:02:36



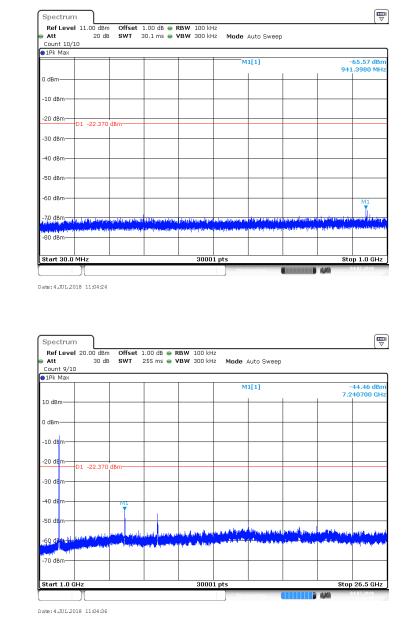
2462MHz

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## **Spurious RF conducted emissions**

### 802.11nHT20

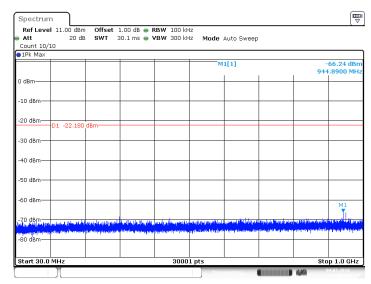


2412MHz

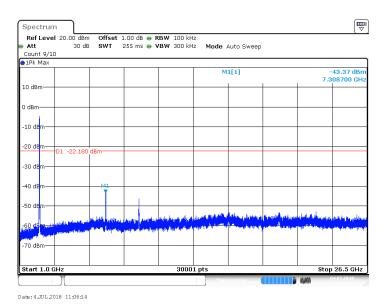
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Date:4.JUL.2018 11:06:02



2437MHz

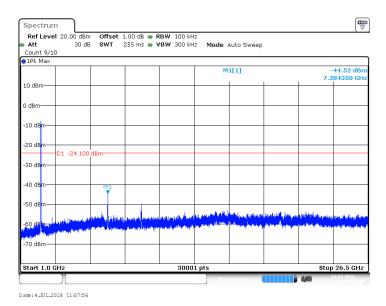
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## **Spurious RF conducted emissions**

Count 10/	10								
1 PK Mdx					м	1[1]			-66.06 dB
0 dBm									
-10 dBm—									
-20 dBm—	-D1 -24.100	dBm							
-30 dBm									
-40 dBm—									
-50 dBm—									
-60 dBm—									M1
-70 dBm	a provide optications		a stilling the set of set	an title to be farmed	A contactor and all the	-	-	(ar storighted	Ť
	<sup>b</sup> elowershown (joba	La serie de la sec	In the second second	and the bullet of the state		Farth off roght on	a dama data ana an		a gata literatur

Date:4.JUL.2018 11:07:44



2462MHz

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# 9.6 Band edge

# **Test Method**

1 Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW  $\geq$  RBW, Sweep = auto, Detector function = peak, Trace = max hold.

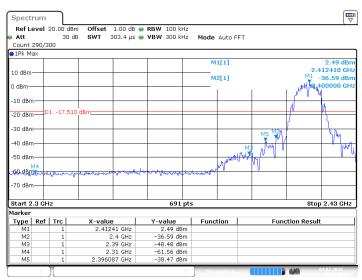
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

# Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

# Test result

802.11b



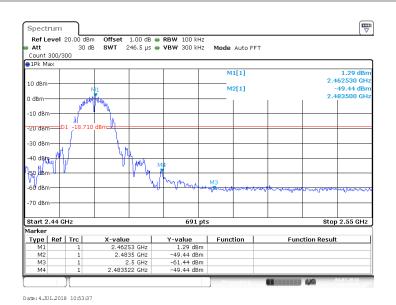
Date:4.JUL.2018 10:50:45

2412MHz

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#### Report Number: 68.910.18.0030.01

# **Band edge**





# 802.11g

Ref L	evel	20.00 d	Bm Offset	1.00 dB (	RBW 100 kH;	2				
Att		30	dB SWT	303.4 µs (	VBW 300 kH:	. Mode	Auto Fl	FT		
Count	289/3	00								
∍1Pk M	ах									
						M	1[1]			-2.64 dB
10 dBm										114480 GI
						M	2[1]			-34.19 dB
0 dBm–	-								· · · · · · · · · · · · · · · · · · ·	100000 GI
-10 dBn									hermond	- M
-to ubii										
-20 dBn		1 00 0	40 dBm	-					1	
		1 -22.0	40 UBIII					M542	1	
-30 dBn	n							TL	/	heren
-40 dBn	-							M3 HAVE		•0
10 401	·							A MARINE		
-50 dBn	∩——						WWW MC		-	
co do d	M4			1.1.		white				
yor nol	ternet	www.	www.	and all we was		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				
-70 dBn	n——				_					
Start 2	.3 GH	Iz			691 p	ts			Sto	2.43 GH
1arker										
Туре	Ref	Trc	X-valu	e	Y-value	Func	tion	Fun	ction Resul	t
M1		1	2.41	448 GHz	-2.64 dBm					
M2		1		2.4 GHz	-34.19 dBm					
M3		1		.39 GHz	-44.36 dBm					
M4 M5		1		.31 GHz	-62.51 dBm					
		1	2.397	971 GHz	-33.76 dBm					

Date:4.JUL.2018 10:59:03

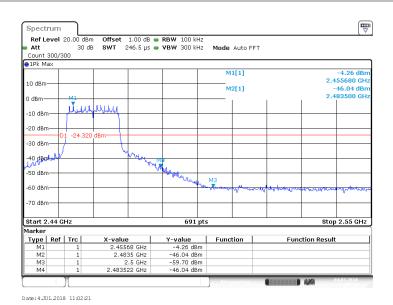
2412MHz

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#### Report Number: 68.910.18.0030.01

# **Band edge**





# 802.11nHT20

Ref L Att	evel :	20.00 dE 30 (			RBW 100 kHz VBW 300 kHz					
Count	291/3		JB 8WI 303.	+ µs 🔲	VBW 300 KH2	Mode	Auto FFT			
1Pk M										-
						M	1[1]			-2.35 dB
10 dBm									2.4	14480 GI
20 00						M	2[1]			33.23 dB
0 dBm–										00000 GI
-10 dBn									uluhuhu	Щ
-10 aBn								(		
-20 dBn	n	1 -22.35	in diam							_
		1 -22.35	o asm					M82		
-30 dBn	n							T		pre la
-40 dBn							M	wwww		
TO GDI	·						obus	M82 J		
-50 dBn	n						North and a			
co do-	M4					mander	1			
og døl	and	man	and the second second second		Canal Contraction of the					
-70 dBn	n									
Start 2	.3 GH	z			691 p	ts			Stop	2.43 GH
1arker					•				•	
Type	Ref	Trc	X-value	1	Y-value	Func	tion	Fund	tion Result	
M1		1	2.41448 0		-2.35 dBm					
M2		1	2.4 G		-33.23 dBm					
M3		1	2.39 G		-43.79 dBm					
M4		1	2.31 0		-61.44 dBm -33.21 dBm					

Date:4.JUL.2018 11:04:09

2412MHz

EMC\_SZ\_FR\_21.00 FCC Release 2014-03-20

# Band edge

	20.00 dBr							
Att Count 300/	30 d	B SWT 246.5 µs	VBW 300 kH	z Mode	Auto F	FT		
1Pk Max								
				M	1[1]			-4.21 dBr
10 dBm								54440 GH
				M	2[1]			47.08 dBr
0 dBm		M1				1	2.4	33500 GH
	11.14	Juru						
-10 dBm	Jones							
-20 dBm-		T						
	01 -24.210	D dBm						
-30 dBm	1							
-30 abiii	J	N						
-40 dBm		Malau	Ward ward					
		100	V. I					
-50 dBm			dhew works					
			- O Willy	M3				
-60 dBm					-Oryan	mandanananan	monor	Mr. Changel
-70 dBm-								
-/o ubiii								
Start 2.44			691 p					2.55 GHz
Aarker	GHZ		Part	JUS			stup	2.33 GHZ
Type Re	f Trc	X-value	Y-value	Fund	tion	Eup	tion Result	
M1	1	2,46444 GHz	-4.21 dBn		cion	Full	Ston Result	
M2	1	2.4835 GHz	-47.08 dBn					
M3	1	2.5 GHz	-60.04 dBn					
M4	1	2.483841 GHz	-45.84 dBn					

Date:4.JUL.2018 11:07:30





# 9.7 Spurious radiated emissions for transmitter

### **Test Method**

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz,  $VBW \ge RBW$  for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz, VBW  $\ge$  RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

#### Note:

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.



# Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK



#### Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

#### Transmitting spurious emission test result as below:

# 802.11b

2412MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
360.01	38.83	Horizontal	46.0	QP	Pass	-24.7
320.13	32.79	Vertical	46.0	QP	Pass	-26.3

#### 2412MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2384 00*	43.29	Horizontal	74.00	PK	Pass	-6.1
17784.27*	51.23	Vertical	74.00	PK	Pass	23.1
	<b>MHz</b> 2384 00*	Frequency         Level           MHz         dBuV/m           2384 00*         43.29	FrequencyLevelPolarizationMHzdBuV/m2384 00*43.29Horizontal	FrequencyLevelPolarizationLimitMHzdBuV/mdBµV/m2384 00*43.29Horizontal74.00	FrequencyLevelPolarizationLimitDetectorMHzdBuV/mdBuV/m2384 00*43.29Horizontal74.00PK	FrequencyLevelPolarizationLimitDetectorResultMHzdBuV/mdBuV/m2384 00*43.29Horizontal74.00PKPass

#### Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

(2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain

(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

#### 2437MHz (30MHz - 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
		Horizontal		QP	Pass
		Vertical		QP	Pass

#### 2437MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2437.62	42.83	Horizontal	74.00	PK	Pass	-5.9
4873.69*	41.98	Vertical	74.00	PK	Pass	2.6

#### Remark:

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
- (4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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#### 2462MHz (30MHz - 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	
MHz	dBuV/m		dBµV/m			
		Horizontal		QP	Pass	
		Vertical		QP	Pass	

#### 2462MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2460.5	45.75	Horizontal	74.00	PK	Pass	-5.7
9847.96	44.14	Vertical	74.00	PK	Pass	9.3

#### Remark:

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
- (4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

# 802.11g

2412MHz (30MHz – 1GHz)

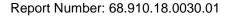
Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
		Horizontal		QP	Pass
		Vertical		QP	Pass

#### 2412MHz (Above 1GHz)

Frequency	Emission	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2377.87*	42.92	Horizontal	74.00	PK	Pass	-6.1
7730.93*	50.71	Vertical	74.00	PK	Pass	22.9

#### Remark:

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
- (4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss





#### 2437MHz (30MHz – 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result	
		Horizontal		QP	Pass	
		Vertical		QP	Pass	

#### 2437MHz (Above 1GHz)

Frequency	Emission	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2438.93	36.12	Horizontal	74.00	PK	Pass	-5.8
17758.59*	51.01	Vertical	74.00	PK	Pass	23.0

#### Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

(2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain

(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

#### 2462MHz (30MHz - 1GHz)

Frequency	Emission Level	Polarization Limit		Detector	Result
MHz	dBuV/m		dBµV/m		
		Horizontal		QP	Pass
		Vertical		QP	Pass

#### 2462MHz (Above 1GHz)

`	Frequency	Emission	Polarization	Limit	Detector	Result	Corr. (dB)
	MHz	dBuV/m		dBµV/m			
	2640.00	37.14	Horizontal	74.00	PK	Pass	-4.7
	17600.15	50.52	Vertical	74.00	PK	Pass	22.4

#### Remark:

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain

(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

#### 802.11nHT20 2412MHz (30MHz – 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result	
		Horizontal		QP	Pass	
		Vertical		QP	Pass	

#### 2412MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2381.30*	39.19	Horizontal	74.00	PK	Pass	-6.1
17739.84	50.54	Vertical	74.00	PK	Pass	23.0

#### Remark:

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
- (4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

#### 2437MHz (30MHz - 1GHz)

Frequency	Emission Level	Polarization Limit		Detector	Result
MHz	dBuV/m		dBµV/m		
		Horizontal		QP	Pass
		Vertical		QP	Pass

#### 2437MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2443.25	37.37	Horizontal	74.00	PK	Pass	-5.8
17897.81*	50.67	Vertical	74.00	PK	Pass	23.0

#### Remark:

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
- (4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss



#### 2462MHz (30MHz - 1GHz)

Frequency	Emissior Level dBuV/m	Polarizatio		Limit D BµV/m	etector	Result
		Horizontal Vertical			QP QP	Pass Pass
(Above 1GHz)	Emission	Polarization	Limit	Detecto	r Resu	Corr.

Level	Polarization	Limit	Detector	Result	(dB)
dBuV/m		dBµV/m			
45.42	Horizontal	74.00	PK	Pass	-14.1
46.86	Vertical	74.00	PK	Pass	22.9
	<b>dBuV/m</b> 45.42	<b>dBuV/m</b> 45.42 Horizontal	LeveldBμV/mdBuV/mdBμV/m45.42Horizontal74.00	LeveldBμV/mdBuV/m45.42Horizontal74.00PK	LeveldBμV/mdBuV/m45.42Horizontal74.00PKPass

Remark:

2462MHz

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
- (4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

# **10 Test Equipment List**

# **List of Test Instruments**

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2019-7-6
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2019-7-6
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2019-7-6
Horn Antenna	Rohde & Schwarz	HF907	102294	2019-7-6
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2019-7-6
3m Semi-anechoic chamber	TDK	9X6X6		2020-7-7
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2019-7-6
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2019-7-6
Horn Antenna	Rohde & Schwarz	HF907	102294	2019-7-6
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2019-7-6
LISN	Rohde & Schwarz	ENV4200	100249	2019-7-6
LISN	Rohde & Schwarz	ENV216	100326	2019-7-6
ISN	Rohde & Schwarz	ENY81	100177	2019-7-6
ISN	Rohde & Schwarz	ENY81-CA6	101664	2019-7-6
High Voltage Probe	Rohde & Schwarz	TK9420(VT94 20)	9420-58	2019-7-6
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2019-7-6

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- Power spectral density\*
- Spurious RF conducted emissions
- Band edge





# For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty				
Test Items	Extended Uncertainty			
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.98dB; Vertical: 5.06dB;			
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.95dB; Vertical: 4.94dB;			
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 5.14dB; Vertical: 5.12dB;			
Uncertainty for Conducted RF test	Power level test involved: 2.06dB Frequency test involved: 1.16×10 <sup>-7</sup>			

