

# FCC - TEST REPORT

Report Number	:	68.950.20.0281	.01	Date of Iss	sue:	June 17, 2020	
Model	:	AMW842					
Product Type	:	Wireless Mouse	9				
Applicant	:	Targus Internati	onal LLC				
Address	:	1211 North Mille	er Street A	naheim, CA	9280	6 USA	
Manufacturer	:	Targus Internati	onal LLC				
Address	:	1211 North Mille	er Street A	naheim, CA	9280	6 USA	
Factory	:	SHENZHEN WEI	JIAN PLAS	TIC PRODU	ст сс	., LTD.	
Address	:	Floor 2, Building Street, Baoan D	g H, Wanda vistrict, She	a Industrial enzhen, Chi	<u>Park,</u> ina	Zhoushi Road, S	Shiyan
Test Result	:	n Positive	O Negati	ve			
Total pages including Appendices	:	38					

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# 1 Table of Contents

1	Та	able of Contents
2	D	etails about the Test Laboratory
3	D	escription of the Equipment Under Test
4	Sı	ummary of Test Standards
5	Sı	ummary of Test Results
6	G	eneral Remarks
7	Те	est Setups
8	S	stems test configuration
9	Te	echnical Requirement
ç	<b>)</b> .1	Conducted peak output power
9	9.2	20 dB bandwidth and 99% Occupied Bandwidth13
9	9.3	Carrier Frequency Separation
ç	ə.4	Number of hopping frequencies
9	9.5	Dwell Time
9	9.6	Spurious RF conducted emissions
9	9.7	Band edge testing
9	9.8	Spurious radiated emissions for transmitter
10	Те	est Equipment List
11		System Measurement Uncertainty



# 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
	Shenzhen City, 518052, P. R. China

FCC Registration 514049 No.:

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



# 3 Description of the Equipment Under Test

Product:	Wireless Mouse
Model no.:	AMW842
FCC ID:	OXM000112
Brand Name:	MTG
Options and accessories:	NIL
Rating:	1.5VDC, 100mA(supplied by 1x1.5V " AA" non-rechargeable Battery)
RF Transmission	2408-2474MHz
No. of Operated Channel:	34
Modulation:	FSK
Antenna Type:	PCB
Antenna Gain:	-0.61dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Wireless Mouse operated at 2.4GHz



# 4 Summary of Test Standards

	Test Standards
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES
10-1-2019 Edition	Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 v05r02 and Public Notice DA 00-705 - Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and ANSI C63.10-2013.



# 5 Summary of Test Results

	Technical Requirements						
FCC Part 15 Sub	part C						
<b>Test Condition</b>		Pages	Test Site	Test Result			
§15.207 Conducted emission AC power port		N/A		Not Applicable			
§15.247(b)(1)	Conducted peak output power	13	Site 1	Pass			
§15.247(a)(2)	6dB bandwidth			N/A			
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	15	Site 1	Pass			
§15.247(a)(1)	Carrier frequency separation	20	Site 1	Pass			
§15.247(a)(1)(iii)	Number of hopping frequencies	22	Site 1	Pass			
§15.247(a)(1)(iii)	Dwell Time	24	Site 1	Pass			
§15.247(e)	Power spectral density*			N/A			
§15.247(d)	Spurious RF conducted emissions	27	Site 1	Pass			
§15.247(d)	Band edge	33	Site 1	Pass			
§15.247(d) & §15.209	Spurious radiated emissions for transmitter and receiver	38	Site 1	Pass			
§15.203	Antenna requirement	See	note 2	Pass			

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a permanently PCB antenna, which gain is -0.61dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

Remark: The EUT power supplied by 1x1.5V "AA" non-rechargeable Battery.

# 6 General Remarks

#### Remarks

This submittal(s) (test report) is intended for FCC ID: OXM000112 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

May 13, 2020

## SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

O - Not Performed

The Equipment Under Test

n - Fulfills the general approval requirements.

O - Does not fulfill the general approval requirements.

Sample Received Date:

Testing Start Date: May 14, 2020

Testing End Date: May 27, 2020

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

Reviewed by:

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# 7 Test Setups





7.2 Radiated test setups

Below 1GHz



Above 1GHz



# 7.3 Conducted RF test setups



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# 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
PC	Dell		
Notebook	Lenovo	X220	

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power



# 9 Technical Requirement

# 9.1 Conducted peak output power

#### **Test Method**

- 1. Use the following spectrum analyzer settings:
  - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Add a correction factor to the display.
- 3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

#### 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



#### Conducted peak output power

FSK modula	tion Test Result	
Frequency	Output Power	Result
MHz	dBm	
Low channel 2408MHz	-12.69	Pass
Middle channel 2440MHz	-12.58	Pass
High channel 2474MHz	-12.66	Pass



Report Number: 68.950.20.0281.01



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# 9.2 20 dB bandwidth and 99% Occupied Bandwidth

# **Test Method**

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.

#### Limit

Limit [kHz]

N/A

### 20 dB bandwidth and 99% Occupied Bandwidth



#### FSK Modulation test result

#### 20 dB Bandwidth

Spectru	m	)									
Ref Lev Att Count 10	el 30.0 0/100	0 dBm 40 dB	Offset 1 SWT	00 dB e ι8.9 μs e	RBW VBW	100 kHz 300 kHz	Mode /	Auto FFT			
01Pk View	Ċ										
20 dBm-							M M	1[1] 2[1]		2.406	33.57 dBn 64700 GH 13.53 dBr
10 dBm-										2.408	51900 GH
0 dBm											
-10 dBm—	+							N	2		
-20 dBm—		$\sim$		/ -		-7	<u> </u>		~		
-30 dBm-	01 -3	33,532	dBm-							1	
-40 dBm—	-										$\sim$
-50 dBm—	+					-+					
-60 dBm—	-								_		
CF 2.408	GHz					1001 p	ots			Spa	n 3.0 MHz
Marker											
Type R	ef   Tr	c	X-value		Y-v	alue	Func	tion	Fu	nction Result	
M1		1	2.4066	47 GHz	-3:	3.57 dBm					
M2 D3	M1	1	2.4085	19 GHZ L7 MHZ	-1.	-0.01 dB					
								Mea	eurine		6

Date: 27.MAY.2020 10:21:45

Spectru	ım									
Ref Lev	zel 3	30.00 dB	m Offset	1.00 dB 🖷	RBW 100	(Hz				
Att		40 d	B SWT	18.9 µs 🖷	• VBW 300 F	Hz Mod	le Auto FFT			
Count 10	00/10	00								
1Pk Viev	N									
							M1[1]		-:	33.25 dB
20 dBm-									2.438	53900 GI
20 0011							M2[1]		-1	13.22 dB
10 dBm—									2.440	i1300 Gł
10 00111										
) dBm—	_						_			
-10 dBm-	+						M	2		
				-	_					
-20 dBm-	-			X				~	+ +	
	-	$\sim$					Y	-		
30 dBm-	-0	1 .22 00	n dam						0	
										$\sim$
-40 dBm-										
50 d9m-										
-JU UBIII-										
-60 d8m-										
00 0011										
CF 2.44	GHz				100	01 pts			Spar	1 3.0 MH
1arker										
Tyne   I	Ref	Tre	X-valu	e l	Y-value	EI EI	unction	Eun	ction Result	
M1		1	2.4385	539 GHz	-33.25	dBm				
M2		1	2.4405	513 GHz	-13.22	dBm				
D3	M1	1	2.6	37 MHz	-0.09	) dB				

Date: 27.MAY.2020 10:23:02

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Date: 27.MAY.2020 10:24:06

#### 99% Bandwidth



Date: 27.MAY.2020 10:21:56

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Page 15 of 38





Date: 27.MAY.2020 10:23:13



Date: 27.MAY.2020 10:24:16

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Page 16 of 38



## **Test Method**

- Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. By using the Max-Hold function record the separation of two adjacent channels.
- 3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
- 4. Repeat above procedures until all frequencies measured were complete.

# Limit

Limit	
kHz	
$\geq$ 25KHz or 2/3 of the 20 dB bandwidth which is greater	

# FSK Modulation Limit

Frequency	2/3 of 20 dB Bandwidth
MHz	kHz
2408	1678
2440	1758
2474	1658





#### **Carrier Frequency Separation**

Test result: The measurement was performed with the typical configuration (normal hopping status), here FSK modulation mode was used to show compliance.

#### FSK Modulation test result

440		kHz	Carrier Frequency Separation kHz						
440		1991					Pass		
Spectrum Ref Level 30.00	dBm Offset 1.00	db 🖷 RBW 100 kHz							
Att 44     Count 100/100     IDk View	J dB SWI 18.9	µs 🖶 <b>VBW</b> 300 kHz	Mode A	Auto FFT					
20 dBm			M: D2	1[1] 2[1]		2.440	13.14 dBm 50870 GHz 0.12 dB		
10 dBm							99100 0012		
0 dBm									
1110 dBm									
-30 dBm		$\sim$							
-40 dBm									
-50 dBm									
-60 dBm									
Start 2.4405 GHz		691 p	ts			Stop 2.	4425 GHz		

Date: 27.MAY.2020 10:18:03



# 9.4 Number of hopping frequencies

## **Test Method**

- Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
- 3. Record all the signals from each channel until each one has been recorded.
- 4. Repeat above procedures until all frequencies measured were complete.

# Limit

Limit <u>number</u> ≥ 15



#### Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here FSK modulation mode was used to show compliance.

Number of hopping frequenc	ies Result
34	Pass
Spectrum Ref Level 30.00 dbm Offset 1.00 db @ RBW 100 kHz	<b>₩</b>
Att 40 dB SWI 1 ms VBW 300 kHz Mode	a Auto Sweep
20 dBm	
10 dBm	
0 dBm	
-10 dBm	
	<u> </u>
-30 dBm	
-40 dem-	
-60 dBm	
Start 2.4 GHz 691 pts	Stop 2.4835 GHz

Date: 27.MAY.2020 10:18:20



# 9.5 Dwell Time

# **Test Method**

- 1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. Equipment mode: Spectrum analyzer
- 2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
- 3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
- 4. Measure the Dwell Time by spectrum analyzer Marker function.
- 5. Repeat above procedures until all frequencies measured were complete.

# Limit

According to §15.247(a)(1)(iii) The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

# **Dwell Time**

#### **Dwell time**

The maximum dwell time shall be 0,4 s.

The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows: The duration for dwell time calculation: 0.4 [s] \* hopping number = 0.4 [s] \* 34 [ch] = 13.6 [s\*ch];

The burst width, which is directly measured, refers to the duration on one channel hop.

Test Result

Modulation	Mode	Reading (ms)	Total Hops	Test Result (ms)	Limit (ms)	Result
FSK	Нор	15.62	25	390.5	< 400	Pass



Date: 17.JUN.2020 18:02:57



#### Report Number: 68.950.20.0281.01



Date: 17.JUN.2020 18:02:04

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# 9.6 Spurious RF conducted emissions

# **Test Method**

- Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
- 3. The level displayed must comply with the limit specified in this Section. Submit these plots.
- 4. Repeat above procedures until all frequencies measured were complete.

# Limit

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

### Spurious RF conducted emissions

#### 2408MHz



Date: 27.MAY.2020 10:22:24

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2440:

Ref Level	21.00 dBm	Offset :	1.00 dB 👄	RBW 100 kH	iz				( • )
Att 1Pk View	30 dB	SWT	18.9 µs 😑	<b>VBW</b> 300 kH	z Mode	Auto FFT			
					M	1[1]		2.440	13.22 dBm 52970 GHz
10 dBm									
0 dBm									
-10 dBm	~							MI	
-20 dBm-						~			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
-30 dBm-			-				~		
-40 dBm									
-50 dBm									
-60 dBm									
70 d8m									
-/ 0 ubiii									
CF 2.44 GH	lz			691	pts			Spa	1.5 MHz
						Measur	ing	4,4	1
ate: 27.MAY.:	2020 10:23:1	9							
Spectrum		041	1 00 40 0	PPUL 100 H	-				
Ref Level Att	11.00 dBm 20 dB	Offset SWT 3	1.00 dB 👄 30.1 ms 👄	VBW 300 kH	IZ IZ Mode	Auto Sweep	)		
Count 10/1 1Pk Max	.0								
					м	1[1]		607	52.88 dBm .9880 MHz
0 dBm									
-10 dBm									
-20 dBm									
-30 dBm	D1 -33.220	dBm							
-40 dBm									
-50 dBm									
-60 dBm-					м				
	<u>н</u>	ي ال				l lution			and the second second second
-duc-uservat)	lager an an gaalan Baada ay ay ay ay ah	langgantigan. Manungsan	layyeennaaree Angelangen State	el la properta en la sur A la properta en la sur	Learn Saine Lands	indenteroradija Andreasen indenterora	-	e New Arrest and a street	endel en de anti-
-80 dBm									
Start 30.0	MHz			3000	1 pts			Sto	p 1.0 GHz
	)[]					Measur	ing 💷		
ate: 27.MAY.	2020 10:23:2	25							
Spectrum	ı								
Ref Level	20.00 dBm 30 dB	Offset : SWT	1.00 dB 👄 255 ms 👄	RBW 100 kH VBW 300 kH	iz Iz Mode	auto Sween			
Count 9/10	l								
					М	1[1]			48.04 dBm
10 dBm							1		51100 GHz
0 dBm									
10 d0									
-10 UBM									
-20 dB <mark>m</mark>									
-30 dBm	01 00 005	dBm							
-40 dBm	01 -33.220	ubiii							
	M1								
-50 dBm		and the second	a de se constitue	a and the state of the	الدويع المساريين	and the state of the	وار والمقار الصور بعد و	a market al	ار بو تقرر والملاون
	n Balant Park and Marking Providence	all shares and shares and shares	and a state of the set	and the state of the	And the state of the states.	and the second	an an an Anglan ang pa	Contract of the local data	an si si si dan si
60. dB			1	1	1	1	1	1	
-70 dBm									
-70 dBm									

EMC\_SZ\_FR\_21.00 FCC Release 2014-03-20 Page 26 of 38

2474:



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# 9.7 Band edge testing

# **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  $RBW = 100 \text{ kHz}, VBW \ge RBW$ , 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. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

# Limit:

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen7.2.2, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).



# Band edge testing

#### Test Result: Hopping on mode:

Ref Level 20.00 dBm         Offset 1.00 dB         PBW 100 kHz         Mode Auto FFT           Count 300/300         SWT 246.5 µs         YBW 300 kHz         Mode Auto FFT           Count 300/300         ID dBm	Spectrum						
9.1Pk View         -14-0-d           10 dBm         -14-0-d           10 dBm         -14-0-d           0 dBm         -14-0-d           -10 dBm         -14-0-d           -20 dBm         -14-0-d           -30 dBm         -14-0-d           -20 dBm         -14-0-d           -30 dBm         -14-0-d           -30 dBm         -14-0-d           -20 dBm         -14-0-d           -30 dBm <t< th=""><th>Ref Level Att Count 300/3</th><th>20.00 dBr 30 d</th><th>m <b>Offset</b> 1.00 d В <b>SWT</b> 246.5 µ</th><th>B 🖶 RBW 100 kH s 🖶 VBW 300 kH</th><th>z z <b>Mode</b> Auto I</th><th>FT</th><th></th></t<>	Ref Level Att Count 300/3	20.00 dBr 30 d	m <b>Offset</b> 1.00 d В <b>SWT</b> 246.5 µ	B 🖶 RBW 100 kH s 🖶 VBW 300 kH	z z <b>Mode</b> Auto I	FT	
10 dBm	∋1Pk View						
10 dBm					M1[1]		-14.04 dBn
AB dam     M2[1]     -49.07 d       0 dam     2.400000 d       -10 dam     2.400000 d       -20 dam     -       -20 dam     -       -30 dam     -       -30 dam     -       -40 dam     -       -40 dam     -       -40 dam     -       -50 dam     -       -60 dam     -       -70 dam     -       -71 1     -       -72 1     -       -72 1     -       -70 dam     -       -70 d	10 d8m						2.408520 GH
0 dBm 22.400000 c -10 dBm 22.400000 c -10 dBm 22.400000 c -10 dBm 22.400000 c -10 dBm 22.40000 c -10 dBm 22.4000 c -	10 dbiii				M2[1]		-49.07 dBn
0.00000000000000000000000000000000000	0 dBm						2.400000 GH
-10 d8m -20	o ubili						
20 dBm	-10 dBm						MI
-20 dBm 01 -34.040 dBm 01 -30 dBm 01 -							T I
-30 dBm 01 -34.040 dBm 01 -35.0	-20 dBm						
30 dBm         01         -34.040 dBm         M4           40 dBm         40 dBm         40 dBm         40 dBm           50 dBm         50 dBm         40 dBm         40 dBm           50 dBm         50 dBm         50 dBm         50 dBm           50 dBm         50 dBm         50 dBm         50 dBm           70 dBm         1         2.40852 GHz         -14.04 dBm         Function Result           M1         1         2.40852 GHz         -14.04 dBm         50 dBm           M3         1         2.39 GHz         -58.21 dBm         59.21 dBm							1 Ni
01 -34.040 dBm 40 dBm 50 dBm 50 dBm 50 dBm 50 dBm 50 dBm 50 dBm 51 dB	-30 dBm						
40 dbm         M4           -50 dbm         -50 dbm           -50 dbm         -50 dbm           -50 dbm         -50 dbm           -70 dbm         -50 dbm           -70 dbm         -50 dbm           Start 2.3 GHz         691 pts           Start 2.3 GHz         691 pts           Start 2.3 GHz         -50 pts           Marker	D	1 -34.040	) dBm				
-50 dBm -70	-40 dBm						
Stot 2.3 GHz         691 pts         Stop 2.412 GH           Start 2.3 GHz         691 pts         Stop 2.412 GH           Marker         Type         Ref         Trc         X-value         Function Result           M1         1         2.40852 GHz         -14.04 dBm         Function Result           M3         1         2.39 GHz         -50.71 dBm         Function Result						M4	M2 1
Start 2.3 GHz         Stop 2.412 GH           Additional and the stop of the sto	-50 dBm						
Start 2.3 GHz         691 pts         Stort 2.4 Cliff           Start 2.3 GHz         691 pts         Stort 2.4 Cliff           Start 2.3 GHz         691 pts         Stort 2.4 Cliff           Marker         Trope         Ref         Trc         X-value           M1         1         2.4 GHz         -14.04 dBm         Hereitian           M3         1         2.39 GHz         -58.21 dBm         Stort 2.412 GHz		1.1.1				1.00	անությունը։
To dBm         691 pts         Stop 2.412 Git           Andreer         Function         Function         Function Result           M1         1         2.40852 GHz         -14.04 dBm         Function         Function Result           M2         1         2.4 GHz         -55.21 dBm         -55.21 dBm         55.21 dBm	-signer when	ut Mpha	margewallow House	mounder	Josh Alexandration and a	man the little and	Merual multin a
Start 2.3 GHz         691 pts         Stop 2.412 Gl           farker         Troc         X-value         Y-value         Function         Function Result           M1         1         2.40852 GHz         -14.04 dBm         Function         Function Result           M2         1         2.4 GHz         -59.21 dBm         Function         Function Result			•				
Start 2.3 GHz         691 pts         Stop 2.412 GI           Warker         Type         Ref         Trc         X-value         Function         Function Result           M1         1         2.40852 GHz         -14.04 dBm         Function Result         Marker           M2         1         2.4 GHz         -69.07 dBm         Function Result         Function Result           M3         1         2.39 GHz         -58.21 dBm         Function Result         Function Result	-/U dBm						
Start 2.3 GHz         691 pts         Stop 2.412 GI           Warker         Trype         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.40852 GHz         -14.04 dBm         Function         Function         Function         Function           M1         1         2.40852 GHz         -49.07 dBm         Function         <							
Marker         Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.40852 GHz         -14.04 dBm                 Function Result <td>Start 2.3 GH</td> <td>łz</td> <td></td> <td>691 p</td> <td>ots</td> <td></td> <td>Stop 2.412 GHz</td>	Start 2.3 GH	łz		691 p	ots		Stop 2.412 GHz
Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.40852 GHz         -14.04 dBm	Marker						
M1         1         2.40852 GHz         -14.04 dBm           M2         1         2.4 GHz         -45.07 dBm           M3         1         2.39 GHz         -58.21 dBm	Type Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M2         1         2.4 GHz         -49.07 dBm           M3         1         2.39 GHz         -58.21 dBm	M1	1	2.40852 GHz	-14.04 dBn	1		
M3 1 2.39 GHz -58.21 dBm	M2	1	2.4 GHz	-49.07 dBr	n		
	M3	1	2.39 GHz	-58.21 dBn	n		
M4 1 2.386516 GHz -50.66 dBm	M4	1	2.386516 GHz	-50.66 dBn	n		
		10				-	

Date: 27.MAY.2020 10:17:32

Ref Level         20.00         Offset         1.00 dB         PRW         100 kHz           Att         30 dB         SWT         1.1 ms         VBW         300 kHz         Mode         Auto Sweep           Count 300/300         SWT         1.1 ms         VBW         300 kHz         Mode         Auto Sweep           0 dBm         MI[1]         -13.80 dB         -13.80 dB         -47.47240 GH         -49.472490 GH           10 dBm         M2[1]         -58.10 dB         -50.0 dB         -50.0 dB         -50.0 dB           30 dBh         01         -33.800 dBm         -60.0 dB         -60.0 dB         -60.0 dB           -50 dBm         M2         M2         -60.0 dB         -60.0 dB         -60.0 dB           -70 dBm         M2         61.0 cb / cb	Spectrum										
0 IPk View       MI[1]       -13.80 dby         10 dbm	Ref Level Att Count 300/3	20.00 d 30	Bm Offset 1 dB SWT	.00 dB ( 1.1 ms (	<ul> <li>RBW 100 kH;</li> <li>VBW 300 kH;</li> </ul>	z Mode	Auto S	weep			
10 dBm     Image: second	∋1Pk View										
10 dBm						IM	11[1]				13.80 dBn
0 dbm	10 dBm									2.4	72490 GH
2.483500 GH           10 dBm           10 dBm           30 dBm           30 dBm           30 dBm           40 dBm           30 dBm           40 dBm           50 dBm           40 dBm           50 dBm           50 dBm           60 dBm           70 dBm           51 dBm           60 dBm           11 Lot						N	12[1]			120	58.10 dBr
11 dam	) dBm		_		-		1	1		2.4	183500 GH
17:0dm     1 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>											
30 dm         01 -33.900 dbm         01 -33.900	-10 dBm										
30 dBm         01 -33.800 dBm         01 -33.800 dBm         01 -33.800 dBm           40 dBm         01 -33.800 dBm         01 -33.800 dBm         01 -33.800 dBm           50 dBm         90 dBm         91 -33.800 dBm         91 -33.800 dBm           50 dBm         91 -33.800 dBm         91 -33.800 dBm         94 - 40 - 40 - 40 - 40 - 40 - 40 - 40 -	Jul Jul										
30 dam         01 -33.800 dBm         0	-20 apm						1				
01 dan 40 dan 50 dan terrer 50 dan terrer 70 dan terrer 10 - 33.800 dan 50 dan terrer 50											
40 d8m 40	30 UBM	01 -33.8	00 dBm								
Store         M3         M3         M4         M4 <thm< td=""><td>40 dBm</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></thm<>	40 dBm										
Stort 2.47 GHz         M3         M4		1.1									
Annual Statt         Annual Statt<	-50 dBm	A 1		N	12					4.4	
66 dbm         Function         Function         Function         Function         Function         Function         Result           70 dbm         I         2.47 GHz         691 pts         Stop 2.55 GHz         Stop 2.55 GHz           tarker         Tro         X-value         Y-value         Function         Function Result           M1         1         2.47249 GHz         -13.80 dbm         Function Result         M2           M2         1         2.4835 GHz         -58.10 dbm         Function         Function Result           M3         1         2.5 GHz         -56.25 dbm         H         For 2.54 dbm         For 2.54 dbm	19 M	1.1.1.			Ϋ́ι, γι, γι, Ι	6 . L. A. A.				<b>V</b>	
To dBm         Start 2.47 GHz         691 pts         Start 2.55 GHz           arker           Type Ref Trc         X-value         Y-value         Function         Function Result           M1         1         2.47249 GHz         13.80 dBm         Function         Function Result           M2         1         2.4485 GHz         -13.80 dBm         Function         Function Result           M3         1         2.5 GHz         -57.25 dBm         Function         Function Result	60 dBm	- WILMIND	المحمد محمد المعلية	بحماية فاستخاطه	geogle - energy	متهامينا التصابية	amen	بحمليكط	ليامايتم الماحتيار	المحمد والمعرفة والمحمد والم	فالباليانية
V 0 bit         Y/ 0 bit         Stop 2.55 GHz           Start 2.47 GHz         691 pts         Stop 2.55 GHz           tarker         Type         Ref         Trc         X-value         Function           M1         1         2.47249 GHz         -13.80 dBm         Function Result           M2         1         2.4335 GHz         -58.10 dBm         M3           M3         1         2.5 GHz         -57.25 dBm         H	70.40										
Start 2.47 GHz         691 pts         Stop 2.55 GHz           tarker         Function         Function Result           M1         1         2.47249 GHz         -13.80 dBm         Function Result           M2         1         2.4835 GHz         -58.10 dBm         Function         Function Result           M3         1         2.5 GHz         -57.25 dBm         M         I         2.53458 GHz         -56.25 dBm	-70 dBm										
Start 2.47 GHz         691 pts         Stop 2.55 GHz           Type [Ref]         Trc         X-volue         Function           M1         1         2.47249 GHz         -13.80 dBm         Function Result           M1         1         2.47249 GHz         -13.80 dBm         Function Result           M3         1         2.4835 GHz         -58.10 dBm         Function Result           M3         1         2.5 GHz         -57.25 dBm         Function Result           M4         1         2.53458 GHz         -56.25 dBm         Function Result											
Marker           Type         Ref         Trc         X-volue         Function         Function Result           M1         1         2.47249 GHz         -13.80 dBm             M2         1         2.4835 GHz         -58.10 dBm             M3         1         2.5 GHz         -57.25 dBm             M4         1         2.53458 GHz         -56.25 dBm	Start 2.47 (	SHZ			691	pts				Stop	0 2.55 GHz
Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.47249 GHz         -13.80 dHm	1arker										
M1         1         2.47249 GHz         -13.80 dBm           M2         1         2.4835 GHz         -58.10 dBm           M3         1         2.5 GHz         -57.25 dBm           M4         1         2.53458 GHz         -56.25 dBm	Type Ref	Trc	X-value		Y-value	Fund	tion		Fund	tion Result	
M2         1         2.4835 kHz         -b8.10 dBm           M3         1         2.5 GHz         -57.25 dBm           M4         1         2.53458 GHz         -56.25 dBm	M1	1	2.4724	9 GHz	-13.80 dBi	n					
M3         1         2.5 GHZ         -57.25 GHM           M4         1         2.53458 GHz         -56.25 dBm	M2	1	2.483	IS GHZ	-58.10 dBi	n		-			
Mit 1 2.55456 GHZ -50.25 UBM	M4	1	2 5245	5 GHZ	-57.25 dBi	n		-			
	14146	1 1	2.5345		-50.25 UBI		_				

Date: 27.MAY.2020 10:20:43



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# Band edge testing

# Hopping off mode:

Specti	um							
Ref Le	evel :	20.00 30	dBm Offset 1.00 dB 0 dB SWT 246.5 µs	<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>	Mode Auto F	FT		
10k Vi	300/3	00						
10 dBm-					M1[1]	-9.53 dBm 2.408520 GHz		
0 dBm—					M2[1]	-56.68 dBm 2.400000 GHz		
-10 dBm	_					M1		
-20 dBm	_					<u>"</u>		
-30 dBm	-0	1 -29.	530 dBm					
-40 dBm	+					M4		
-50 dBm	+					MA N3 4 M2		
-60 dBm	Junt	Jeron	manner	the super provides	Hobersonal	mun har		
-70 dBm	+							
Start 2.3 GHz         691 pts         Stop 2.412 GHz								
Marker								
Type	Ref	Trc	X-value	Y-value	Function	Function Result		
M1		1	2.40852 GHz	-9.53 dBm				
M2		1	2.4 GHz	-56.68 dBm				
M3		1	2.39 GHz	-59.29 dBm				
M4		1	2.395606 GHz	-40.40 dBm				

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Spectrui	n										[9
Ref Leve	20.00	dBm Offset	1.00 dB	RBW 100	<hz< th=""><th></th><th></th><th></th><th></th><th></th><th></th></hz<>						
Att	31	DdB SWT	1.1 ms	VBW 300	<hz< th=""><th>Mode /</th><th>Auto Sv</th><th>veep</th><th></th><th></th><th></th></hz<>	Mode /	Auto Sv	veep			
Count 300	)/300										
1Pk View			_								
						M	1[1]				-9.24 dB
10 dBm			_							2.	.474570 G
						M	2[1]				-58.71 dB
) dBm	-	_	-		-			7		2.	.483500 GI
M1											
10 dBm-					-						
M											
20 dBm—					+						
	01 00	0.40 d0-									
зи авт—	01 -29.	240 UBII									
an and											
EO dom	15	M4									
JU UBIII-	#1 L.N	21.IId.	- Lale	43							
60 dBm—	466	Mymillion	marchell	Juddam and		ann	Winsmill			Landerson	بملغله بعدام
70 dBm—			_		_						
Start 2.47	GHz			69	1 pts					Sto	p 2.55 GH
larker											
Type   R	ef   Trc	X-valu	ie	Y-value	1	Func	tion		Fun	ction Resu	lt
M1	1	2.47	457 GHz	-9.24	dBm						
M2	1	2.4	835 GHz	-58.71	dBm						
M3	1		2.5 GHz	-58.86	dBm						
M4	1	2.487	507 GHz	-50.81	dBm						

Date: 22.MAY.2020 15:32:08

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#### **Test Method**

- 1. The EUT is placed on a turntable, which is 0.8m above ground plane.
- 2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- Use the following spectrum analyzer settings: Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 4. Follow the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(duty cycle/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

# Limit

According to part 15.247(d), 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 section 15.205, 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:** Below 1G:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
67.466250	31.75	40.00	8.25	200.0	Н	94.0	15
94.444375	25.15	43.50	18.35	200.0	н	338.0	15
134.941875	29.69	43.50	13.81	200.0	Н	260.0	13
148.521875	28.56	43.50	14.94	200.0	н	244.0	12
240.005000	31.15	46.00	14.85	200.0	н	0.0	17
296.931875	34.07	46.00	11.93	100.0	Н	5.0	19



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.427500	28.81	40.00	11.19	100.0	V	134.0	17
67.466250	31.04	40.00	8.96	200.0	V	243.0	15
80.985625	29.09	40.00	10.91	200.0	V	0.0	11
94.444375	27.04	43.50	16.46	100.0	V	181.0	15
134.941875	30.84	43.50	12.66	100.0	V	181.0	13
202.478125	27.10	43.50	16.40	100.0	V	142.0	16
310.451250	31.55	46.00	14.45	200.0	V	190.0	19

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Page 32 of 38

# Above 1GHz: 2408MHz Test Result



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2841.500000	46.33	74.00	27.67	150.0	Н	227.0	-2.9
4815.500000	52.55	74.00	21.45	150.0	Н	98.0	2.5
5992.000000	48.97	74.00	25.03	150.0	Н	306.0	4.8
7222.500000	49.64	74.00	24.36	150.0	Н	241.0	6.2
12866.500000	48.68	74.00	25.32	150.0	н	258.0	10.1
16786.500000	50.45	74.00	23.55	150.0	Н	206.0	16.9



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2830.000000	46.49	74.00	27.51	150.0	V	35.0	-3.0
4817.500000	49.56	74.00	24.44	150.0	V	120.0	2.5
6664.000000	50.51	74.00	23.49	150.0	V	19.0	6.7
12658.500000	47.64	74.00	26.36	150.0	V	207.0	9.8
15289.000000	50.09	74.00	23.91	150.0	v	47.0	12.7
17223.500000	52.14	74.00	21.86	150.0	V	83.0	17.3

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# 2440MHz Test Result



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2787.000000	46.77	74.00	27.23	150.0	Н	288.0	-3.2
4881.500000	51.75	74.00	22.25	150.0	н	126.0	2.6
6801.000000	50.70	74.00	23.30	150.0	Н	185.0	6.7
7318.500000	48.44	74.00	25.56	150.0	Н	164.0	6.5
12262.500000	47.66	74.00	26.34	150.0	н	97.0	9.6
16933.500000	50.20	74.00	23.80	150.0	Н	217.0	16.5



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2853.000000	47.18	74.00	26.82	150.0	V	350.0	-2.9
5017.000000	48.68	74.00	25.32	150.0	V	83.0	2.9
6679.000000	50.05	74.00	23.95	150.0	v	228.0	6.5
12380.000000	47.95	74.00	26.05	150.0	V	278.0	10.2
15027.000000	48.69	74.00	25.31	150.0	v	278.0	11.9
17752.000000	51.16	74.00	22.84	150.0	v	3.0	17.7

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# 2474MHz Test Result



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2848.500000	47.89	74.00	26.11	150.0	Н	54.0	-3.0
4949.500000	52.66	74.00	21.34	150.0	Н	108.0	1.6
6820.500000	51.02	74.00	22.98	150.0	Н	180.0	6.8
7423.500000	49.14	74.00	24.86	150.0	Н	278.0	6.0
15350.000000	50.22	74.00	23.78	150.0	н	21.0	12.9
17756.000000	51.64	74.00	22.36	150.0	Н	243.0	17.6



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2861.000000	46.84	74.00	27.16	150.0	v	179.0	-2.9
4524.500000	49.03	74.00	24.97	150.0	v	276.0	3.0
6014.000000	50.76	74.00	23.24	150.0	V	340.0	5.0
6688.500000	51.69	74.00	22.31	150.0	v	72.0	6.6
14605.000000	48.96	74.00	25.04	150.0	V	183.0	11.1
16956.500000	50.36	74.00	23.64	150.0	۷	4.0	16.6



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) Level=Reading Level + Correction Factor
   Correction Factor=Antenna Factor + Cable Loss Pre-amplifier
   (The Reading Level is recorded by software which is not shown in the sheet)
- (3) The test was applied up to 25GHz, only 30-18GHz test data were put into report, because the reading of 18GHz -25GHz emissions are attenuated more than 20db below the permissible limits or the field strength.

# **10 Test Equipment List**

#### List of Test Instruments

Ra	diated Emission Test						
	Description	Manufacturer	Model no.	Serial no.	cal. due date		
	EMI Test Receiver	Rohde & Schwarz	ESR 26	101031	2020-6-28		
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	708	2020-6-28		
	Horn Antenna	Rohde & Schwarz	HF907	102295	2020-7-5		
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2020-6-28		
	Signal Generator	Rohde & Schwarz	SMY01	100432	2020-3-20		
	Attenuator	Agilent	8491A	MY39264334	2020-6-28		
	3m Semi-anechoic chamber	TDK	9X6X6		2020-7-7		
	Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A		

#### TS8997 Test System

Description	Manufacturer	Model no.	Serial no.	cal. due date
Vector Signal Generator	Rohde & Schwarz	FSV40	262825	2020-6-28
10dB Attenuator	R&S	DNF	DNF-002	2020-6-28





# **11 System Measurement Uncertainty**

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

System Measurement Uncerta	inty
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using High Voltage Probe TK9420(VT9420))	3.21 dB
Uncertainty for Radiated Spurious Emission 25MHz- 3000MHz	Horizontal: 4.80dB; Vertical: 4.87dB;
Uncertainty for Radiated Spurious Emission 3000MHz- 18000MHz	Horizontal: 4.59dB; Vertical: 4.58dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10-7 or 1%