

# **FCC Radio Test Report**

## FCC ID: 2ALZB-AG1103

Report No.	: BTL-FCCP-6-2102T091A
Equipment	: IEEE 802.11 2X2 MU-MIMO ac/a/b/g/n Wireless LAN +Bluetooth NGFF Module
Model Name	: W8997-1216
Brand Name	: Marvell
Applicant	: SECO S.p.A
Address	: Via Achille Grandi 20, 52100 Arezzo Italy
Radio Function	: Transmit Simultaneously
FCC Rule Part(s) Measurement Procedure(s)	: FCC CFR Title 47, Part 15, Subpart C (15.247) : ANSI C63.10-2013
Date of Receipt Date of Test Issued Date	: 2022/8/9 : 2022/8/9 ~ 2022/12/2 : 2023/1/11

The above equipment has been tested and found in compliance with the requirement of the above standards by BTL Inc.

Tric-Le

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#### Declaration

**BTL** represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

**BTL**'s reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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BTL's laboratory quality assurance procedures are in compliance with the ISO/IEC 17025 requirements, and accredited by the conformity assessment authorities listed in this test report.

**BTL** is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

#### Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.



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### **REVISION HISTORY**

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-6-2102T091A	R00	Original Report.	2022/11/23	Invalid
BTL-FCCP-6-2102T091A	R01	Revised report to address TCB's comments.	2022/12/14	Invalid
BTL-FCCP-6-2102T091A	R02	Revised report to address TCB's comments.	2023/1/11	Valid



#### SUMMARY OF TEST RESULTS 1

Test procedures according to the technical standards.

Standard(s) Section	Description	Test Result	Judgement	Remark
15.205				
15.209	Radiated Emissions	APPENDIX A	Pass	
15.247(d)				

NOTE:

"N/A" denotes test is not applicable in this Test Report.
The report format version is TP.1.1.1.



### 1.1 TEST FACILITY

The test locations stated below are under the TAF Accreditation Number 0659. The test location(s) used to collect the test data in this report are: No. 72, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (FCC DN: TW0659)

 $\Box$  C06  $\boxtimes$  CB21  $\Box$  CB22

### 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $\mathbf{y} \pm \mathbf{U}$ , where expanded uncertainty  $\mathbf{U}$  is based on a standard uncertainty multiplied by a coverage factor of  $\mathbf{k} = 2$ , providing a level of confidence of approximately **95**%. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U<sub>cispr</sub> requirement.

A. Radiated emissions test :

Test Site	Test Site Measurement Frequency Range	
	0.03 GHz ~ 0.2 GHz	4.17
	0.2 GHz ~ 1 GHz	4.72
CP24	1 GHz ~ 6 GHz	5.21
CB21	6 GHz ~ 18 GHz	5.51
	18 GHz ~ 26 GHz	3.69
	26 GHz ~ 40 GHz	4.23

#### NOTE:

Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

### 1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Environment Condition	Test Voltage	Tested by
Radiated emissions	Refer to data	AC 120V	Mark Wang

### 2 GENERAL INFORMATION

### 2.1 DESCRIPTION OF EUT

Equipment	IEEE 802.11 2X2 MU-MIMO ac/a/b/g/n Wireless LAN +Bluetooth NGFF Module
Model Name	W8997-1216
Brand Name	Marvell
Model Difference	N/A
Power Supply Rating	DC 3.3V from host equipment
Host device information	
Equipment	Display Unity 27"
Model Name	Unity27
Brand Name	SECO
Model Difference	Differ in product size.
Power Source	DC voltage supplied from AC/DC Adapter.
Power Rating	DC 12V
Products Covered	N/A
WIFI+BT Module	Marvell / W8997-1216
	BT: 2402 MHz ~ 2480 MHz WLAN: 2412 MHz ~ 2462 MHz
	UNII-1: 5180 MHz ~ 5240 MHz
Operation Frequency	UNII-2A: 5260 MHz ~ 5320 MHz
	UNII-2C: 5500 MHz ~ 5700 MHz
	UNII-3: 5745 MHz ~ 5825 MHz
Test Model	Unity27
Sample Status	Engineering Sample
EUT Modification(s)	N/A

### NOTE:

- (1) The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.
- (2) Channel List:

BT					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478



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23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

WLAN 2.4 GHz							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)		
01	2412	06	2437	11	2462		
02	2417	07	2442				
03	2422	08	2447				
04	2427	09	2452				
05	2432	10	2457				

WLAN 5 GHz								
	UNII-1							
IEEE 8 IEEE 802.1 IEEE 802.11	602.11a 11n (HT20) Iac (VHT20)	IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)				
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)			
36	5180	38	5190	42	5210			
40	5200	46	5230					
44	5220							
48	5240							

	UNII-2A							
IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)				
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)			
52	5260	54	5270	58	5290			
56	5280	62	5310					
60	5300							
64	5320							

UNII-2C							
IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)		
100	5500	102	5510	106	5530		
104	5520	110	5550	122	5610		
108	5540	118	5590				
112	5560	126	5630				
116	5580	134	5670				
120	5600						
124	5620						
128	5640						
132	5660						
136	5680						
140	5700						



UNII-3								
IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)				
Channel	Frequency (MHz)	Channel Frequency (MHz)		Channel	Frequency (MHz)			
149	5745	151	5755	155	5775			
153	5765	159	5795					
157	5785							
161	5805							
165	5825							

(3) Table for Filed Antenna:

Antenna	Manufacture	Part number	Туре	Frequency Range (MHz)	Gain (dBi)
Main dynaflay		C4C	Dinala	2400-2480	1.1
Main dynafiex	dynaliex	010	Dipole	5000-5800	2.5
Aux dypoflax		616	Dinala	2400-2480	1.1
AUX	dynaliex	010	Dipole	5000-5800	2.5

(4) The above Antenna information are derived from the antenna data sheet provided by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

### 2.2 TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode as listed in below table.

Test Mode	Description
1	IEEE 802.11g_2462MHz+ BT(1 Mbps)_2480MHz
2	IEEE 802.11ac (VHT80)_5290MHz+ BT(1 Mbps)_2480MHz

### NOTE:

(1) The highest output powers were set for final test.



### 2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Equipment letters and Cable numbers refer to item numbers described in the tables of clause 2.4.



### 2.4 SUPPORT UNITS

Item	Equipment	Brand	Brand		No.	Series No.	Remarks
А	Adapter	DELTA ELECTRONICS INC.		ADT-060A	12AA	N/A	Supplied by test requester
D	USB	Transcend	d JetFlash7		790	N/A	Supplied by test requester
F	NB	HP		TPN-I119		N/A	Furnished by test lab.
Item	Shielded	Ferrite Core	L	ength		Cable Type	Remarks
3	NO	NO	1.5m		F	Power Cable	Supplied by test requester
4	NO	NO	1.8m			HDMI	Furnished by test lab.
5	NO	NO	1m			cable	Furnished by test lab.



### 3 RADIATED EMISSIONS TEST

### 3.1 LIMIT

In case the emission fall within the restricted band specified on 15.205, then the 15.209 limit in the table below has to be followed.

#### LIMITS OF RADIATED EMISSIONS MEASUREMENT (9 kHz to 1000 MHz)

Field Strength	Measurement Distance
(microvolts/meter)	(meters)
2400/F(KHz)	300
24000/F(KHz)	30
30	30
100	3
150	3
200	3
500	3
	Field Strength (microvolts/meter)       2400/F(KHz)       24000/F(KHz)       30       100       150       200       500

#### LIMITS OF RADIATED EMISSIONS MEASUREMENT (Above 1000 MHz)

	Radiated I (dBu	Measurement Distance	
(IVI⊓ <i>∠)</i>	Peak	Average	(meters)
Above 1000	74	54	3

NOTE:

(1) The limit for radiated test was performed according to FCC Part 15, Subpart C.

- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:

Measurement Value = Reading Level + Correct Factor Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use) Margin Level = Measurement Value - Limit Value Calculation example:

Reading Level		Correct Factor		Measurement Value
19.11	+	2.11	Ш	21.22

Measurement Value		Limit Value		Margin Level
21.22	-	54	Π	-32.78

Spectrum Parameter	Setting	
Attenuation	Auto	
Start Frequency	1000 MHz	
Stop Frequency	10th carrier harmonic	
RBW / VBW	1MHz / 3MHz for Peak,	
(Emission in restricted band)	1MHz / 1/T for Average	

<b>V B VV</b> (112)
1300
2200
2700

2.4G WLAN Mode	VBW(Hz)
IEEE 802.11b	300
IEEE 802.11g	360
IEEE 802.11n (HT20)	300
IEEE 802.11n (HT40)	470

5G RLAN Mode	VBW(Hz)
IEEE 802.11a	360
IEEE 802.11n (HT20)	300
IEEE 802.11n (HT40)	470
IEEE 802.11ac (VHT80)	1000
Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz~110KHz for QP detector
Start ~ Stop Frequency	110KHz~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

### 3.2 TEST PROCEDURE

- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- i. For the actual test configuration, please refer to the related Item EUT TEST PHOTO.

### 3.3 DEVIATION FROM TEST STANDARD

No deviation.



### 3.4 TEST SETUP



### 3.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

### 3.6 TEST RESULT

Please refer to the APPENDIX A.



### 4 LIST OF MEASURING EQUIPMENTS

			Radiated Emission	ons		
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Preamplifier	EMCI	EMC330N	980850	2022/9/19	2023/9/18
2	Preamplifier	EMCI	EMC118A45SE	980819	2022/3/8	2023/3/7
3	Preamplifier	EMCI	EMC184045SE	980882	2022/2/9	2023/2/8
4	Preamplifier	EMCI	EMC001340	980555	2022/4/6	2023/4/5
5	Test Cable	EMCI	EMC104-SM-SM- 1000	220319	2022/3/15	2023/3/14
6	Test Cable	EMCI	EMC104-SM-SM- 3000	220322	2022/3/15	2023/3/14
7	Test Cable	EMCI	EMC104-SM-SM- 7000	220324	2022/3/15	2023/3/14
8	EXA Signal Analyzer	keysight	N9020B	MY57120120	2022/3/7	2023/3/6
9	Loop Ant	Electro-Metrics	EMCI-LPA600	274	2022/6/16	2023/6/15
10	Horn Antenna	RFSPIN	DRH18-E	211202A18EN	2022/5/18	2023/5/17
11	Horn Ant	Schwarzbeck	BBHA 9170D	1136	2022/5/18	2023/5/17
12	Log-bicon Antenna	Schwarzbeck	VULB9168	1369	2022/5/20	2023/5/19
13	6dB Attenuator	EMCI	EMCI-N-6-06	AT-N0625	2022/5/20	2023/5/19
14	Test Cable	EMCI	EMC101G-KM-K M-3000	220329	2022/3/15	2023/3/14
15	Test Cable	EMCI	EMC102-KM-KM- 1000	220327	2022/3/15	2023/3/14
16	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Remark: "N/A" denotes no model name, no serial no. or no calibration specified. All calibration period of equipment list is one year.



### 5 EUT TEST PHOTO

Please refer to document Appendix No.: TP-2102T091A-FCCP-1 (APPENDIX-TEST PHOTOS).

### 6 EUT PHOTOS

Please refer to document Appendix No.: EP-2102T091A-2 (APPENDIX-EUT PHOTOS).

# APPENDIX A RADIATED EMISSIONS



	Test Mo	de	IEEE 80 BT(1 M	2.11g_2 1bps)_2	2462MH 480MH	−lz+ Iz		Test Date	е	202	22/11/9
٦	Fest Frequ	ency	2462	<u>MHz+24</u>	80MH	z	F	Polarizatio	on	Ve	ertical
120.0	lemp			23°C				Hum.			53%
130.0	UDUY/III									1	
120											
110											
100 -											
90											
80 -											
70											
60 —					3						
50					×						
40		1 X			4 ×						
30		2 X									
20											
10.0											
1000.	.000 3550.0	D 6100.00	8650.0	0 112	200.00	13750.0	0 16	300.00 1	8850.00	21400.00	26500.00 MHz
No.	Mk.	Freq.	Readi	ng Co	orrect actor	Meas	ure-	Limit	Ove	r	
		MHz	dBu	V	dB	dBu	//m	dBuV/m	dB	Detecto	r Comment
1		4960.000	40.5	4 <sup>.</sup>	1.18	41.	72	74.00	-32.2	28 peak	
2		4960.000	30.5	8 '	1.18	31.	76	54.00	-22.2	AVG	
3		12310.00	47.3	0	7.02	54.	32	74.00	-19.6	68 peak	
4	*	12310.00	34.2	4	7.02	41.	26	54.00	-12.7	'4 AVG	

Measurement Value = Reading Level + Correct Factor.
Margin Level = Measurement Value - Limit Value.



	Test Mo	de	IEEE 80 BT(1 M	2.11g_2 //bps)_2	462MF 480MF	lz+	Test Da	ate	202	2022/11/9		
٦	Test Frequ	ency	2462	MHz+24	80MHz	Z	Polariza	tion	Hor	izontal		
-	Temp			23°C			Hum		Ę	53%		
130.0	dBuV/m											
120												
110												
100 -												
90 -												
80												
70 -												
60												
50 -					ž							
40		1 X			4							
30		2 X			×							
20												
10.0												
1000	.000 3550.0	0 6100.00	) 8650.0	0 112	200.00	13750.00	16300.00	18850.00	21400.00	26500.00 MHz		
No.	Mk.	Freq.	Readi Leve	ing Co el F	orrect actor	Measure ment	e- Limit	t Ove	er			
		MHz	dBu	V	dB	dBuV/m	n dBuV/	′m dB	Detector	r Comment		
1		4960.000	) 41.7	1	1.18	42.89	74.00	<b>-31</b> .	11 peak			
2		4960.000	) 31.8	6	1.18	33.04	54.00	0 -20.9	AVG			
3		12310.00	) 43.7	2	7.02	50.74	74.00	) -23.2	26 peak			
4	*	12310.00	) 30.4	6	7.02	37.48	54.00	0 -16.5	52 AVG			

Measurement Value = Reading Level + Correct Factor.
Margin Level = Measurement Value - Limit Value.



	Test Mod	le	IEEE 8 (VHT80)_ BT(1 Mbps	802.11ac 5290MHz s)_2480MH	+ Hz	Test Dat	2022	2022/11/9		
Te	est Freque	ency	5290MHz	+2480MH	Z	Polarizati	on	Ver	tical	
	Temp		23	3°C		Hum.		53%		
30.0 c	lBuV/m									
20										
10										
00										
90										
30										
m 📑		ողտ				וח				
· ·			┙╵╹							
							_			
			З Х							
10										
80 -	2 ×									
20										
10.0										
1000.0	00 4900.00	8800.00	12700.00	16600.00	20500.00	24400.00	28300.00 322	200.00	40000.00 MH	
No.	Mk.	Freq.	Reading	Correct	Measure	- Limit	Over			
			Level	Factor	ment					
		MHz	dBuV	dB	dBuV/m	dBuV/m	n dB	Detector	Comment	
1		4960.000	39.18	1.18	40.36	74.00	-33.64	peak		
2		4960.000	29.19	1.18	30.37	54.00	-23.63	AVG		
3	*	10580.00	41.43	5.69	47.12	68.20	-21.08	peak		

(1) Measurement Value = Reading Level + Correct Factor.(2) Margin Level = Measurement Value - Limit Value.



Т	le	IEEE 802.11ac (VHT80)_5290MHz + BT(1 Mbps)_2480MHz						Test Date					2022/11/9			
Tes	t Freque	ency	5290MHz+2480MHz					Polarization						Horizontal		
	Temp			23	3°C			Hum.						53	3%	
130.0 dB	uV/m															-
120																
120																
10																
100																_
90																
80																
70		ոոտ		11					п				П			-
60																1
50			3	· ·	_				-				_		•	-
40	1		0													
30	2															
	Î															
20																1
10.0	1000.00	0000.00	107	0.00	1000	0.00	2050	0.00	244	0.00	2020	0.00	2220	0.00	40000.0	
1000.000	J 4900.00	5800.00	Doo	ding		u.uu	2050		244	Ju.uu	2830		3ZZL	JU.UU	40000.0	UMH
INU.	WIK.	Fieq.	Le	vel	Fa	ctor	alvi 1	nent	,-		L	Ove	1			
		MHz	dB	uV	C	B	dE	BuV/m	) (	dBuV/	m	dB		Detector	Comme	ent
1		4960.000	) 40	.14	1.	18	2	1.32		74.00	)	-32.6	8	peak		
2		4960.000	) 29	.37	1.	18	3	30.55		54.00	)	-23.4	15	AVG		
3	*	10580.00	40	.98	5.	69	4	6.67		68.20	)	-21.5	53	peak		

- (1) Measurement Value = Reading Level + Correct Factor.(2) Margin Level = Measurement Value Limit Value.

### **End of Test Report**