# Appendix B. Radiated Spurious Emission

Test Engineer :	Bill Chang, Jesse Wang, and Nick Yu	Temperature :	22~23°C
rest Engineer.	Bill Chang, Jesse Wang, and Nick Tu	Relative Humidity :	51~55%

<For Sample 1>

#### 2.4GHz 2400~2483.5MHz

# BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	( dB )	( dB )	( cm )	(deg)	(P/A)	(H/V)
		2375.16	50.96	-23.04	74	51.8	27.19	6.01	34.04	111	116	Р	Н
		2389.11	39.77	-14.23	54	40.57	27.23	6.01	34.04	111	116	Α	Н
	*	2402	83.84	-	-	84.64	27.23	6.01	34.04	111	116	Р	Н
51.5	*	2402	83.01	-	-	83.81	27.23	6.01	34.04	111	116	Α	Н
BLE CH 00													Н
2402MHz		2357.79	50.76	-23.24	74	51.72	27.14	5.95	34.05	103	225	Р	V
2402141712		2385.33	39.78	-14.22	54	40.62	27.19	6.01	34.04	103	225	Α	V
	*	2402	84.72	-	-	85.52	27.23	6.01	34.04	103	225	Р	V
	*	2402	83.92	-	-	84.72	27.23	6.01	34.04	103	225	Α	V
													V
		2333.22	50.94	-23.06	74	52	27.05	5.95	34.06	105	100	Р	Н
		2383.1	39.76	-14.24	54	40.6	27.19	6.01	34.04	105	100	Α	Н
	*	2440	83.91	-	-	84.53	27.37	6.04	34.03	105	100	Р	Н
	*	2440	83.06	-	-	83.68	27.37	6.04	34.03	105	100	Α	Н
5.5		2484.12	50.76	-23.24	74	51.22	27.46	6.09	34.01	105	100	Р	Н
BLE CH 19		2491.72	40.15	-13.85	54	40.57	27.5	6.09	34.01	105	100	Α	Н
2440MHz		2328.63	50.54	-23.46	74	51.6	27.05	5.95	34.06	149	223	Р	V
244011112		2385.42	39.76	-14.24	54	40.6	27.19	6.01	34.04	149	223	Α	V
	*	2440	84.07	-	-	84.69	27.37	6.04	34.03	149	223	Р	V
	*	2440	83.2	1	-	83.82	27.37	6.04	34.03	149	223	Α	V
		2491.8	51.63	-22.37	74	52.04	27.5	6.09	34	149	223	Р	V
		2490.56	40.14	-13.86	54	40.56	27.5	6.09	34.01	149	223	А	V

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	*	2480.327	81.53	-	-	82.01	27.46	6.07	34.01	100	97	Р	Н
	*	2480.076	80.57	-	-	81.05	27.46	6.07	34.01	100	97	Α	Н
		2495.44	50.95	-23.05	74	51.36	27.5	6.09	34	100	97	Р	Н
		2484.92	40.17	-13.83	54	40.63	27.46	6.09	34.01	100	97	Α	Н
													Н
BLE													Н
CH 39 2480MHz	*	2479.742	83.52	-	-	84	27.46	6.07	34.01	375	223	Р	V
240UWITIZ	*	2480.076	82.57	-	-	83.05	27.46	6.07	34.01	375	223	Α	V
		2492.4	50.98	-23.02	74	51.39	27.5	6.09	34	375	223	Р	V
		2483.6	40.2	-13.8	54	40.66	27.46	6.09	34.01	375	223	Α	V
													V
													V
Remark	1. N	o other spurious	s found.										
	2. A	II results are PA	SS against F	Peak and	Average lim	it line.							

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#### 2.4GHz 2400~2483.5MHz

# BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	(dB)	(dB)	( cm )	( deg )	(P/A)	(H/V)
		4804	44.94	-29.06	74	70.08	31.3	8.65	65.09	100	0	Р	Н
													Н
													Н
BLE													H
CH 00		4804	50.1	-23.9	74	75.24	31.3	8.65	65.09	100	0	Р	V
2402MHz													٧
													V
													V
		4880	44.94	-29.06	74	69.86	31.41	8.69	65.02	100	0	Р	Н
		7320	40.66	-33.34	74	59.02	36.32	10.39	65.07	100	0	Р	Н
DI E													Н
BLE CH 19													Н
2440MHz		4880	46.48	-27.52	74	71.4	31.41	8.69	65.02	100	0	Р	V
		7320	41.14	-32.86	74	59.5	36.32	10.39	65.07	100	0	Р	V
													V
													V
		4960	43.07	-30.93	74	67.67	31.54	8.79	64.93	100	0	Р	Н
		7440	40.73	-33.27	74	58.71	36.59	10.52	65.09	100	0	Р	Н
BLE													Н
CH 39													Н
2480MHz		4960	46.09	-27.91	74	70.69	31.54	8.79	64.93	100	0	Р	V
240011112		7440	41.35	-32.65	74	59.33	36.59	10.52	65.09	100	0	Р	V
													V
													V
Remark		o other spurious		Peak and	Average lim	it line.							

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## **Emission below 1GHz**

# 2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
		31.62	16.09	-23.91	40	28.33	18.92	0.67	31.83			Р	Н
		56.73	16.29	-23.71	40	40.02	7.03	1.04	31.8			Р	Н
		112.08	13.83	-29.67	43.5	32.79	11.54	1.28	31.78			Р	Н
		750.8	21.58	-24.42	46	28.7	21.61	3.25	31.98			Р	Н
		839	22.98	-23.02	46	28.9	22.41	3.4	31.73			Р	Н
		945.4	23.48	-22.52	46	26.66	24.21	3.68	31.07	121	25	Р	Н
													Н
													Н
													Н
													Н
2.4GHz													Н
BLE		20.07	05.70	44.00	40	00.00	00	0.07	04.00	404	450		Н
LF		30.27	25.72	-14.28	40	36.88	20	0.67	31.83	101	152	Р	V
		56.46	25.14	-14.86	40	48.56	7.34	1.04	31.8			Р	V
		79.95	15.85	-24.15	40	38.72	7.88	1.04	31.79			Р	V
		638.1	20.42	-25.58	46	29.44	20.06	2.96	32.04			Р	V
		809.6	22.26	-23.74	46	28.55	22.18	3.4	31.87			Р	V
													V
													V
													V
													V
													V
													V
	1												V
Don't	1. No	o other spurious	s found.										
Remark	2. AI	I results are PA	SS against li	mit line.									

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# Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not
	exceed the level of the fundamental frequency per 15.209(c).
!	Test result is <b>over limit</b> line.
P/A	Peak or Average
H/V	Horizontal or Vertical

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#### A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	(dB)	( dB )	( cm )	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	Н
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	Α	Н

1. Level( $dB\mu V/m$ ) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ V/m)

#### For Peak Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 54.51(dB\mu V) 35.86 (dB)$
- $= 55.45 (dB\mu V/m)$
- 2. Over Limit(dB)
- = Level( $dB\mu V/m$ ) Limit Line( $dB\mu V/m$ )
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

#### For Average Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dB $\mu$ V) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 42.6(dB\mu V) 35.86 (dB)$
- $= 43.54 (dB\mu V/m)$
- 2. Over Limit(dB)
- = Level(dB $\mu$ V/m) Limit Line(dB $\mu$ V/m)
- $= 43.54(dB\mu V/m) 54(dB\mu V/m)$
- = -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

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<For Sample 2>

# 2.4GHz 2400~2483.5MHz

# BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	(dB)	( dB )	( cm )	( deg )	(P/A)	(H/V)
		2386.59	50.74	-23.26	74	51.54	27.23	6.01	34.04	166	150	Р	Н
		2388.21	39.85	-14.15	54	40.65	27.23	6.01	34.04	166	150	Α	Н
	*	2401.837	85.08	-	-	85.88	27.23	6.01	34.04	166	150	Р	Н
	*	2402.087	84.25	-	-	85.05	27.23	6.01	34.04	166	150	Α	Н
BLE													Н
CH 00													Н
2402MHz		2339.97	50.7	-23.3	74	51.7	27.1	5.95	34.05	100	122	Р	V
2-02111112		2389.02	39.89	-14.11	54	40.69	27.23	6.01	34.04	100	122	Α	V
	*	2402.338	87.9	-	-	88.7	27.23	6.01	34.04	100	122	Р	V
	*	2402.087	87.12	-	-	87.92	27.23	6.01	34.04	100	122	Α	V
													V
													V
		2385.69	50.65	-23.35	74	51.45	27.23	6.01	34.04	131	149	Р	Н
		2389.74	39.8	-14.2	54	40.6	27.23	6.01	34.04	131	149	Α	Н
	*	2440.331	83.9	-	-	84.52	27.37	6.04	34.03	131	149	Р	Н
	*	2440.08	83.04	-	-	83.66	27.37	6.04	34.03	131	149	Α	Н
DI E		2492.92	51.13	-22.87	74	51.54	27.5	6.09	34	131	149	Р	Н
BLE CH 19		2493.76	40.2	-13.8	54	40.61	27.5	6.09	34	131	149	Α	Н
2440MHz		2388.12	50.24	-23.76	74	51.04	27.23	6.01	34.04	100	112	Р	V
277011112		2385.06	39.81	-14.19	54	40.65	27.19	6.01	34.04	100	112	Α	V
	*	2439.83	85.98	-	-	86.6	27.37	6.04	34.03	100	112	Р	V
	*	2440.08	85.13	1	-	85.75	27.37	6.04	34.03	100	112	Α	V
		2498	50.5	-23.5	74	50.91	27.5	6.09	34	100	112	Р	V
		2492.96	40.2	-13.8	54	40.61	27.5	6.09	34	100	112	Α	V

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		1					ı		1	1			
	*	2479.826	83.29	-	-	83.77	27.46	6.07	34.01	100	147	Р	Н
	*	2480.076	82.36	-	-	82.84	27.46	6.07	34.01	100	147	Α	Н
		2489.4	51.24	-22.76	74	51.66	27.5	6.09	34.01	100	147	Р	Н
		2483.52	40.21	-13.79	54	40.67	27.46	6.09	34.01	100	147	Α	Н
													Н
BLE													Н
CH 39 2480MHz	*	2479.993	85.78	-	-	86.26	27.46	6.07	34.01	113	119	Р	V
240UWITI2	*	2480.076	85.03	-	-	85.51	27.46	6.07	34.01	113	119	Α	V
		2483.68	50.87	-23.13	74	51.33	27.46	6.09	34.01	113	119	Р	V
		2483.56	40.27	-13.73	54	40.73	27.46	6.09	34.01	113	119	Α	V
													V
													V
	1. N	o other spurious	s found										
Remark		•											
	2. A	II results are PA	SS against I	Peak and	Average lim	it line.							

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#### 2.4GHz 2400~2483.5MHz

# BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	(dB)	(dB)	( cm )	( deg )	(P/A)	(H/V)
		4806	47.76	-26.24	74	72.9	31.3	8.65	65.09	100	0	Р	Н
													Н
													Н
BLE													Н
CH 00		4806	47.56	-26.44	74	72.7	31.3	8.65	65.09	100	0	Р	V
2402MHz													V
													V
													V
		4878	47.53	-26.47	74	72.45	31.41	8.69	65.02	100	0	Р	Н
		7320	46.33	-27.67	74	64.69	36.32	10.39	65.07	100	0	Р	Н
													Н
BLE													Н
CH 19		4878	48.84	-25.16	74	73.76	31.41	8.69	65.02	100	0	Р	V
2440MHz		7320	42.83	-31.17	74	61.19	36.32	10.39	65.07	100	0	Р	V
													V
													V
		4962	44.91	-29.09	74	69.47	31.54	8.83	64.93	100	0	Р	Н
		7440	43.42	-30.58	74	61.4	36.59	10.52	65.09	100	0	Р	Н
D. F													Н
BLE													Н
CH 39 2480MHz		4962	47.48	-26.52	74	72.04	31.54	8.83	64.93	100	0	Р	V
240UWITIZ		7440	41.4	-32.6	74	59.38	36.59	10.52	65.09	100	0	Р	V
													V
													V
	1. No	o other spurious	s found										
Remark		I results are PA		Peak and	Average lim	it line							
	, (	3041.0 410 171	- agamot i	Jan and									

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## **Emission below 1GHz**

# 2.4GHz BLE (LF)

(MHz) 57.54 111 270.84 425.3 551.3 864.2	(dBµV/m) 17.29 14 13.78 18.11 20.99 22.34	Limit (dB) -22.71 -29.5 -32.22 -27.89 -25.01 -23.66	Line ( dBμV/m ) 40 43.5 46 46 46	Level (dBμV) 41.02 33.01 30.13 30.6 31.96 27.81	Factor (dB/m) 7.03 11.49 13.48 16.92 18.23 22.7	Loss (dB) 1.04 1.28 1.94 2.41 2.77 3.44	Factor (dB) 31.8 31.78 31.77 31.82 31.97 31.61	Pos (cm) 105	Pos (deg) 265	P P P	(H/V)
57.54 111 270.84 425.3 551.3	17.29 14 13.78 18.11 20.99	-22.71 -29.5 -32.22 -27.89 -25.01	40 43.5 46 46 46	41.02 33.01 30.13 30.6 31.96	7.03 11.49 13.48 16.92 18.23	1.04 1.28 1.94 2.41 2.77	31.8 31.78 31.77 31.82 31.97			P P P	н н н н
111 270.84 425.3 551.3	14 13.78 18.11 20.99	-29.5 -32.22 -27.89 -25.01	43.5 46 46 46	33.01 30.13 30.6 31.96	11.49 13.48 16.92 18.23	1.28 1.94 2.41 2.77	31.78 31.77 31.82 31.97	105	265	P P	H H H
270.84 425.3 551.3	13.78 18.11 20.99	-32.22 -27.89 -25.01	46 46 46	30.13 30.6 31.96	13.48 16.92 18.23	1.94 2.41 2.77	31.77 31.82 31.97			P P	H H
425.3 551.3	18.11 20.99	-27.89 -25.01	46 46	30.6 31.96	16.92 18.23	2.41	31.82 31.97			Р	Н
551.3	20.99	-25.01	46	31.96	18.23	2.77	31.97			Р	Н
864.2	22.34	-23.66	46	27.81	22.7	3.44	31.61			Р	Н
											Н
											Н
											Н
											Н
											Н
											Н
31.62	25.75	-14.25	40	37.99	18.92	0.67	31.83			Р	V
56.46	25.89	-14.11	40	49.31	7.34	1.04	31.8	100	147	Р	V
79.95	15.65	-24.35	40	38.52	7.88	1.04	31.79			Р	V
425.3	18.29	-27.71	46	30.78	16.92	2.41	31.82			Р	V
769	21.55	-24.45	46	28.37	21.79	3.35	31.96			Р	V
967.1	24.02	-29.98	54	26.91	24.23	3.78	30.9			Р	V
											V
											V
											V
											V
											V
											V
	56.46 79.95 425.3 769 967.1	56.46 25.89  79.95 15.65  425.3 18.29  769 21.55  967.1 24.02  No other spurious found.	56.46     25.89     -14.11       79.95     15.65     -24.35       425.3     18.29     -27.71       769     21.55     -24.45       967.1     24.02     -29.98	56.46       25.89       -14.11       40         79.95       15.65       -24.35       40         425.3       18.29       -27.71       46         769       21.55       -24.45       46         967.1       24.02       -29.98       54    No other spurious found.	56.46       25.89       -14.11       40       49.31         79.95       15.65       -24.35       40       38.52         425.3       18.29       -27.71       46       30.78         769       21.55       -24.45       46       28.37         967.1       24.02       -29.98       54       26.91    No other spurious found.	56.46       25.89       -14.11       40       49.31       7.34         79.95       15.65       -24.35       40       38.52       7.88         425.3       18.29       -27.71       46       30.78       16.92         769       21.55       -24.45       46       28.37       21.79         967.1       24.02       -29.98       54       26.91       24.23    No other spurious found.	56.46       25.89       -14.11       40       49.31       7.34       1.04         79.95       15.65       -24.35       40       38.52       7.88       1.04         425.3       18.29       -27.71       46       30.78       16.92       2.41         769       21.55       -24.45       46       28.37       21.79       3.35         967.1       24.02       -29.98       54       26.91       24.23       3.78    No other spurious found.	56.46         25.89         -14.11         40         49.31         7.34         1.04         31.8           79.95         15.65         -24.35         40         38.52         7.88         1.04         31.79           425.3         18.29         -27.71         46         30.78         16.92         2.41         31.82           769         21.55         -24.45         46         28.37         21.79         3.35         31.96           967.1         24.02         -29.98         54         26.91         24.23         3.78         30.9	56.46         25.89         -14.11         40         49.31         7.34         1.04         31.8         100           79.95         15.65         -24.35         40         38.52         7.88         1.04         31.79           425.3         18.29         -27.71         46         30.78         16.92         2.41         31.82           769         21.55         -24.45         46         28.37         21.79         3.35         31.96           967.1         24.02         -29.98         54         26.91         24.23         3.78         30.9   No other spurious found.	56.46         25.89         -14.11         40         49.31         7.34         1.04         31.8         100         147           79.95         15.65         -24.35         40         38.52         7.88         1.04         31.79           425.3         18.29         -27.71         46         30.78         16.92         2.41         31.82           769         21.55         -24.45         46         28.37         21.79         3.35         31.96           967.1         24.02         -29.98         54         26.91         24.23         3.78         30.9   No other spurious found.	56.46         25.89         -14.11         40         49.31         7.34         1.04         31.8         100         147         P           79.95         15.65         -24.35         40         38.52         7.88         1.04         31.79         P           425.3         18.29         -27.71         46         30.78         16.92         2.41         31.82         P           769         21.55         -24.45         46         28.37         21.79         3.35         31.96         P           967.1         24.02         -29.98         54         26.91         24.23         3.78         30.9         P           No other spurious found.

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# Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not
	exceed the level of the fundamental frequency per 15.209(c).
!	Test result is <b>over limit</b> line.
P/A	Peak or Average
H/V	Horizontal or Vertical

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#### A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	(dB)	( dB )	( cm )	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	Н
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	Α	Н

1. Level( $dB\mu V/m$ ) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ V/m)

#### For Peak Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 54.51(dB\mu V) 35.86 (dB)$
- $= 55.45 (dB\mu V/m)$
- 2. Over Limit(dB)
- = Level( $dB\mu V/m$ ) Limit Line( $dB\mu V/m$ )
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

#### For Average Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dB $\mu$ V) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 42.6(dB\mu V) 35.86 (dB)$
- $= 43.54 (dB\mu V/m)$
- 2. Over Limit(dB)
- = Level(dB $\mu$ V/m) Limit Line(dB $\mu$ V/m)
- $= 43.54(dB\mu V/m) 54(dB\mu V/m)$
- = -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

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