Report Number : FR293008A

Bluetooth

Test Engineer:	Jacob Zhang	Temperature:	20~26	°C
Test Date:	2022/10/9~2022/10/22	Relative Humidity:	40~51	%

TEST RESULTS DATA
20dB and 99% Occupied Bandwidth and Hopping Channel Separation

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (KHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.947	0.897	994.200	0.6310	Pass
DH	1Mbps	1	39	2441	0.949	0.903	1002.900	0.6329	Pass
DH	1Mbps	1	78	2480	0.947	0.903	1159.200	0.6310	Pass
2DH	2Mbps	1	0	2402	1.250	1.164	1002.900	0.8336	Pass
2DH	2Mbps	1	39	2441	1.250	1.164	998.600	0.8336	Pass
2DH	2Mbps	1	78	2480	1.246	1.164	998.600	0.8307	Pass
3DH	3Mbps	1	0	2402	1.220	1.149	998.600	0.8133	Pass
3DH	3Mbps	1	39	2441	1.233	1.149	998.600	0.8220	Pass
3DH	3Mbps	1	78	2480	1.237	1.149	998.600	0.8249	Pass

TEST RESULTS DATA
Dwell Time

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec) (MHz)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	79	106.67	2.91	0.31	0.4	Pass
AFH	20	53.33	2.91	0.16	0.4	Pass

TEST RESULTS DATA
Peak Power Table

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH1	0	1	10.65	20.97	Pass
	39	1	**10.73**	20.97	Pass
	78	1	9.46	20.97	Pass

2DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
2DH1	0	1	10.76	20.97	Pass
	39	1	**10.85**	20.97	Pass
	78	1	9.53	20.97	Pass

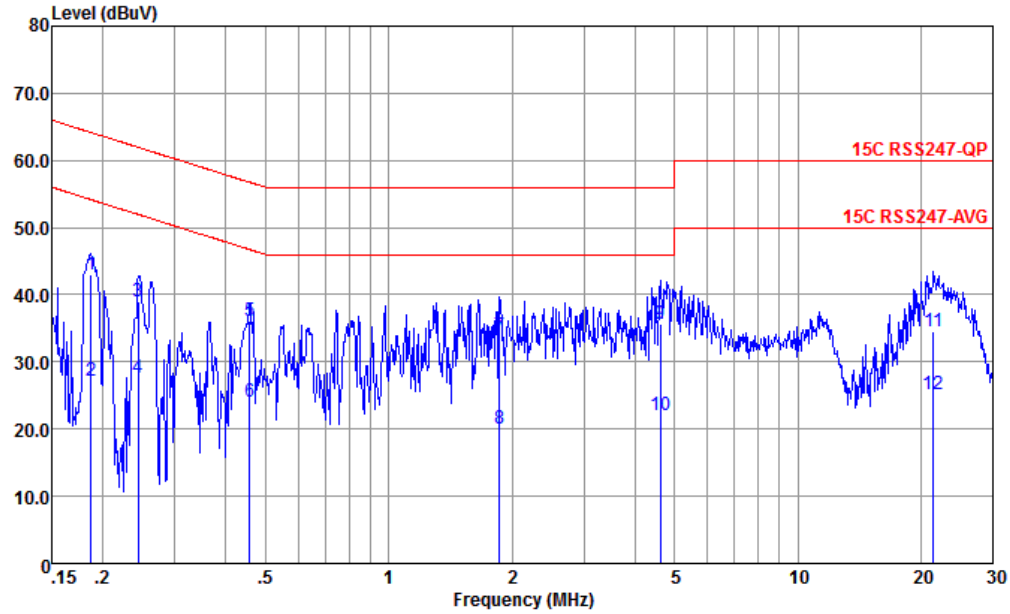
3DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
3DH1	0	1	11.14	20.97	Pass
	39	1	**11.20**	20.97	Pass
	78	1	9.83	20.97	Pass

TEST RESULTS DATA
Number of Hopping Frequency

Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	79	> 15	Pass

Appendix B. AC Conducted Emission Test Results

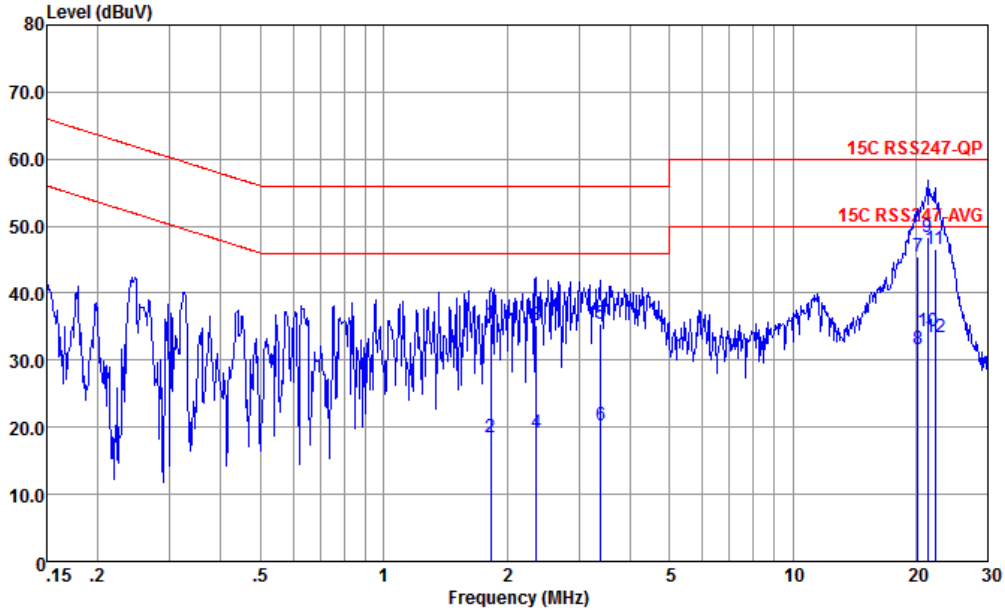
Test Engineer :	Amos Zhang	**Temperature :**	24.2~25.6℃
		Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : 15C RSS247-QP LISN-060105-LINE LINE

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.187	43.05	-21.10	64.15	32.60	0.03	10.42	QP
2		0.187	27.25	-26.90	54.15	16.80	0.03	10.42	Average
3		0.244	38.93	-23.02	61.95	28.50	0.04	10.39	QP
4		0.244	27.73	-24.22	51.95	17.30	0.04	10.39	Average
5		0.456	36.03	-20.73	56.76	25.79	-0.01	10.25	QP
6		0.456	24.03	-22.73	46.76	13.79	-0.01	10.25	Average
7		1.868	33.85	-22.15	56.00	23.91	-0.12	10.06	QP
8		1.868	20.15	-25.85	46.00	10.21	-0.12	10.06	Average
9	*	4.622	35.73	-20.27	56.00	25.80	-0.13	10.06	QP
10		4.622	22.13	-23.87	46.00	12.20	-0.13	10.06	Average
11		21.486	34.56	-25.44	60.00	23.50	-0.33	11.39	QP
12		21.486	25.26	-24.74	50.00	14.20	-0.33	11.39	Average

Test Engineer :	Amos Zhang	Temperature :	24.2~25.6℃
		Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : 15C RSS247-QP LISN-060105-NEUTRAL NEUTRAL

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		1.829	35.45	-20.55	56.00	25.50	-0.12	10.07	QP
2		1.829	18.55	-27.45	46.00	8.60	-0.12	10.07	Average
3		2.358	35.14	-20.86	56.00	25.20	-0.12	10.06	QP
4		2.358	19.14	-26.86	46.00	9.20	-0.12	10.06	Average
5		3.399	35.43	-20.57	56.00	25.49	-0.12	10.06	QP
6		3.399	20.23	-25.77	46.00	10.29	-0.12	10.06	Average
7		20.270	45.55	-14.45	60.00	34.50	-0.29	11.34	QP
8		20.270	31.65	-18.35	50.00	20.60	-0.29	11.34	Average
9	*	21.373	48.28	-11.72	60.00	37.20	-0.30	11.38	QP
10		21.373	34.38	-15.62	50.00	23.30	-0.30	11.38	Average
11		22.298	46.61	-13.39	60.00	35.50	-0.31	11.42	QP
12		22.298	33.41	-16.59	50.00	22.30	-0.31	11.42	Average

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)

Appendix C. Radiated Spurious Emission

Note: All modes had been tested and only the worst channel test data is shown in the report

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 78 2480MHz	*	2480	103.02	-	-	96.5	32.43	6.73	32.64	263	34	P	H
		2480	78.26	-	-	-	-	-	-	-	-	A	H
		2486.5	53.66	-20.34	74	47.14	32.43	6.73	32.64	263	34	P	H
		2486.5	28.90	-25.10	54	-	-	-	-	-	-	A	H
	*	2480	102.76	-	-	96.24	32.43	6.73	32.64	122	193	P	V
		2480	78.00	-	-	-	-	-	-	-	-	A	V
		2483.8	53.77	-20.23	74	47.25	32.43	6.73	32.64	122	193	P	V
		2483.8	29.01	-24.99	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 78 2480MHz		4965	40.73	-33.27	74	58.73	34.1	9.61	61.71	300	0	P	H
		7440	42.6	-31.4	74	57.19	35.7	11.78	62.07	300	0	P	H
		4965	41.35	-32.65	74	59.35	34.1	9.61	61.71	100	0	P	V
		7440	42.95	-31.05	74	57.54	35.7	11.78	62.07	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	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)
2.4GHz BT LF		33.88	28.38	-11.62	40	37.49	23.43	0.76	33.3	-	-	P	H
		71.71	26.98	-13.02	40	46.48	12.49	1.21	33.2	-	-	P	H
		118.27	25.16	-18.34	43.5	40.96	15.7	1.59	33.09	-	-	P	H
		175.5	26.63	-16.87	43.5	42.36	15.19	1.93	32.85	-	-	P	H
		253.1	25.24	-20.76	46	38.03	17.32	2.34	32.45	-	-	P	H
		402.48	26.63	-19.37	46	33.49	21.98	2.94	31.78	-	-	P	H
		30	33.52	-6.48	40	40.24	25.9	0.68	33.3	-	-	P	V
		48.43	33.9	-6.1	40	51.03	15.17	1	33.3	-	-	P	V
		127	26.22	-17.28	43.5	41.99	15.62	1.65	33.04	-	-	P	V
		188.11	21.29	-22.21	43.5	37.04	15.07	2	32.82	-	-	P	V
		288.02	27	-19	46	37.99	18.86	2.49	32.34	-	-	P	V
		684.75	28.61	-17.39	46	28.03	26.64	3.85	29.91	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

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

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	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)
BT CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

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

3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

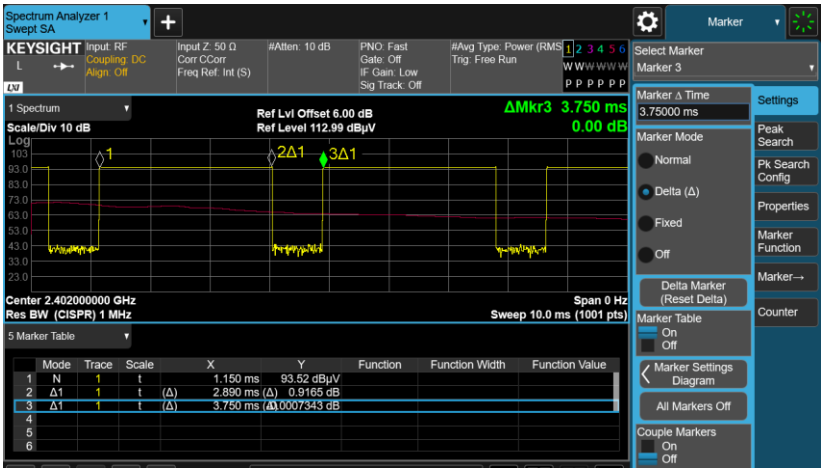
= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

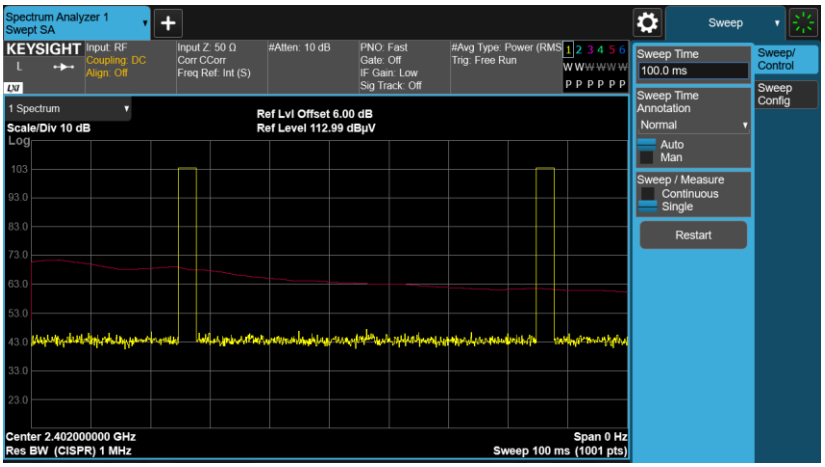
Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Duty Cycle Plots

3DH5 on time (One Pulse) Plot on Channel 39



3DH5 on time (Count Pulses) Plot on Channel 39



Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.89 / 100 = 5.78 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.76 dB
3. 3DH5 has the highest duty cycle worst case and is reported.