



BRS36ANT00001(WFI GPS)

KZWLSLSVS0001 (LTE)

Antenna Performance Evaluation

- LTE Main/Aux
- WiFi Main/Aux
- GPS

Date of Report: Department: Prepared by:

2023/ 02 / 07

WCB , Auden Techno Corp. Derek Yen

auden^o

Document/Report Information

Project Name	Venus plus
Topics	Antenna Performance Evaluation
Date of Report	2023/ 02 / 07
Report Revision	Rev06
Dept.	WCB, Auden Techno Corp.
Antenna Type	WiFi Main: PIFA Antenna ,WiFi Aux: PIFA Antenna , LTE Aux: PIFA Antenna ,LTE Main: PIFA Antenna
Revised by	Bryant Huang

Date	Report Rev.	Project Stage	Description
2022/07/14	Rev00	EVT	1. All Antennas Performance.
2022/08/01	Rev01	EVT	1. LTE Main, WiFi main, Wifl aux, GPS performance optimization.
2022/08/12	Rev02	EVT	1. LTE Aux and WiFi main performance Evaluation.
2022/10/11	Rev03	DVT1	1. LTE Aux performance with factory sample and finetune.
2022/10/13	Rev04	DVT1	1. Check LTE Main, Wi-Fi, GPS antenna performance in DVT1 device. 2. Fine tune Wi-Fi antenna in DVT1 device.
2022/11/23	Rev05	DVT1	1. LTE main performance debug with spk.
2023/02/07	Rev06	DVT1	1. All Antennas Performance.

- Platform and Fixture Introduction
- Pictures of Antenna pattern
- Antenna Solution and Performance
 - LTE Main
 - LTE Aux
 - WIFI Main/Aux
 - GPS Ant.
- Conclusion

Pictures of Device

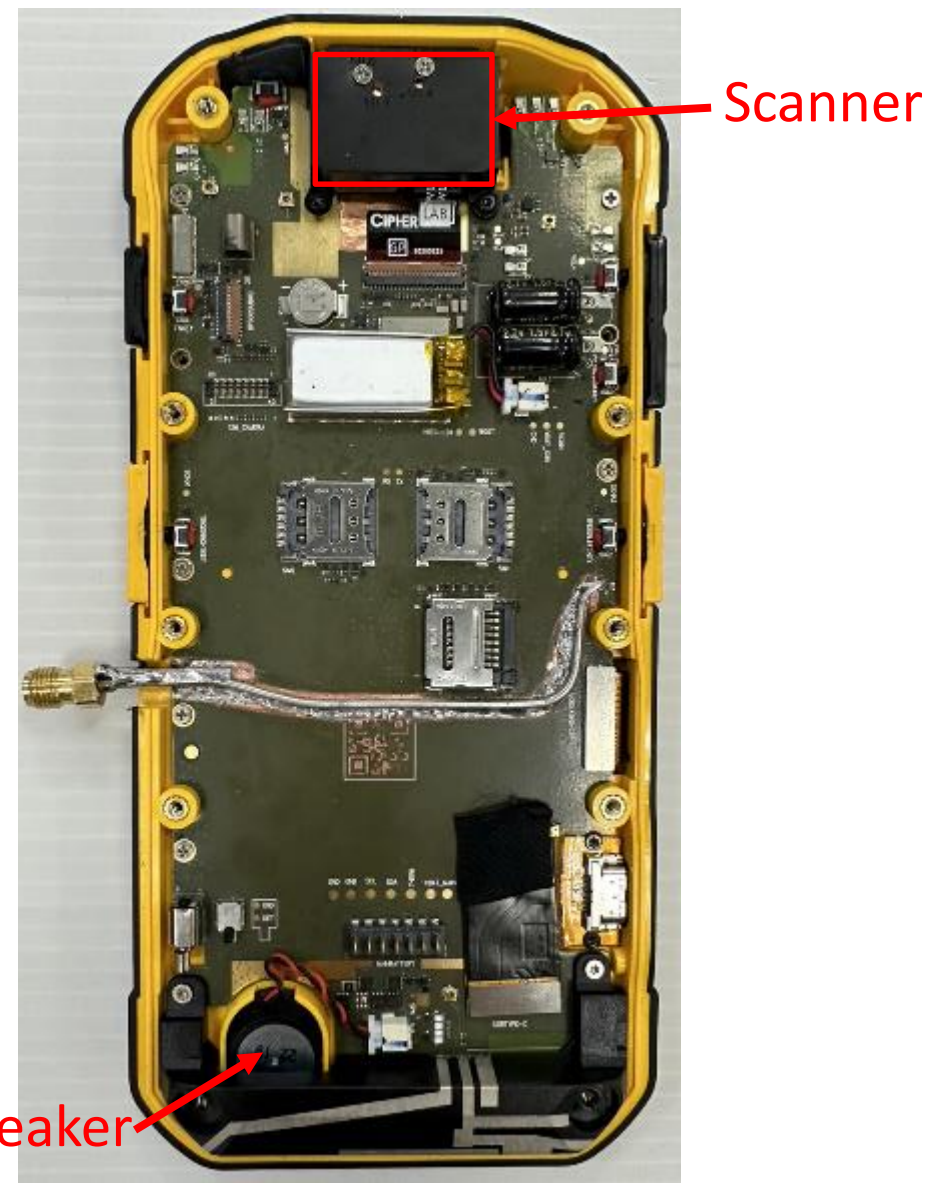
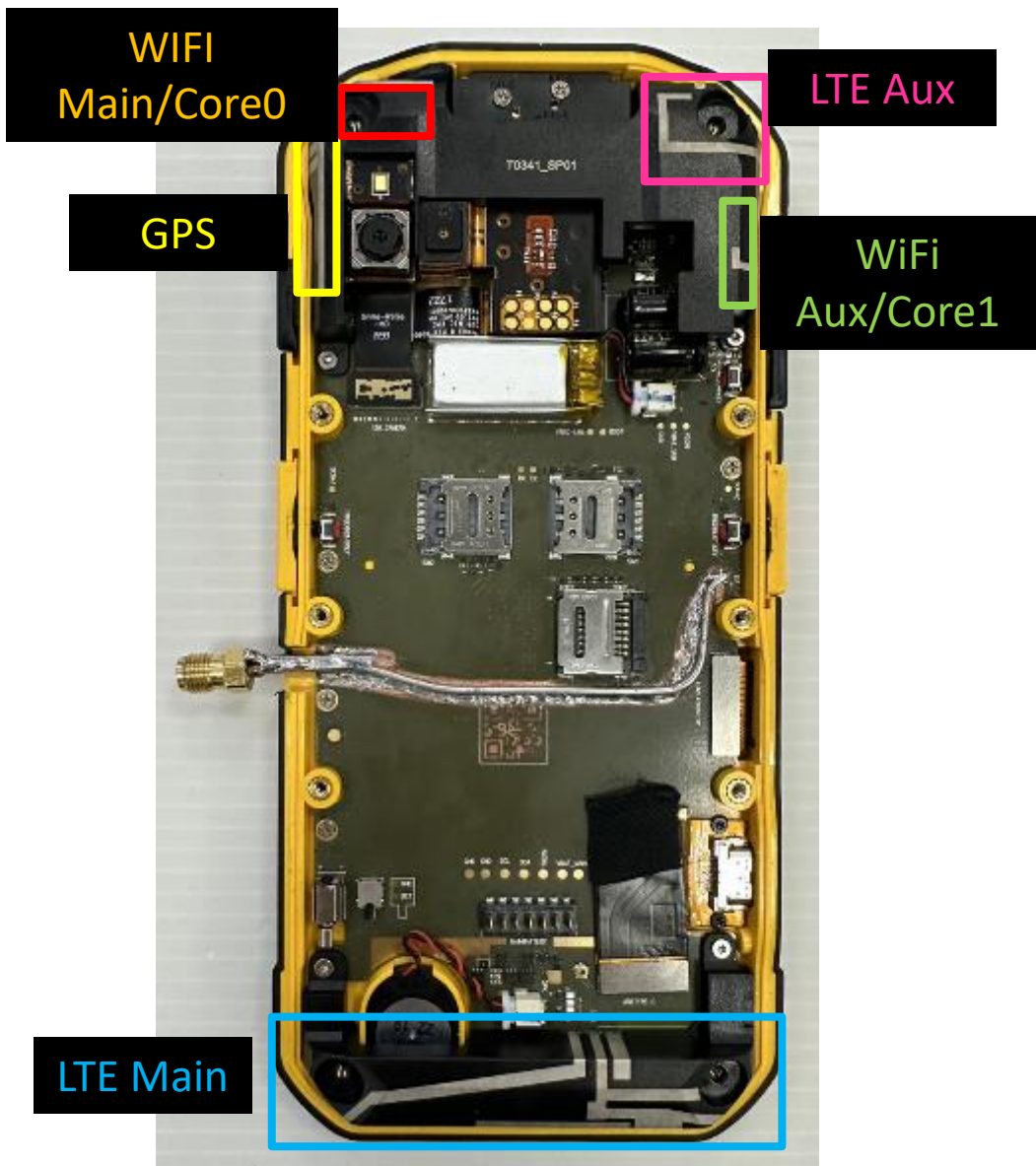


Front view



Back view

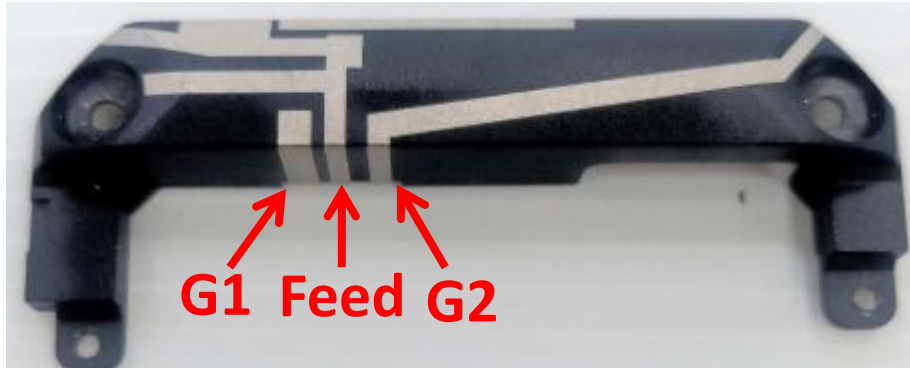
Pictures of Device



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Pictures of Antenna

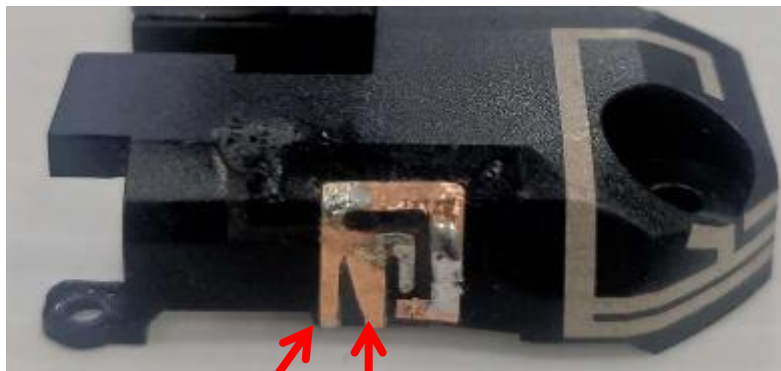
LTE Main antenna



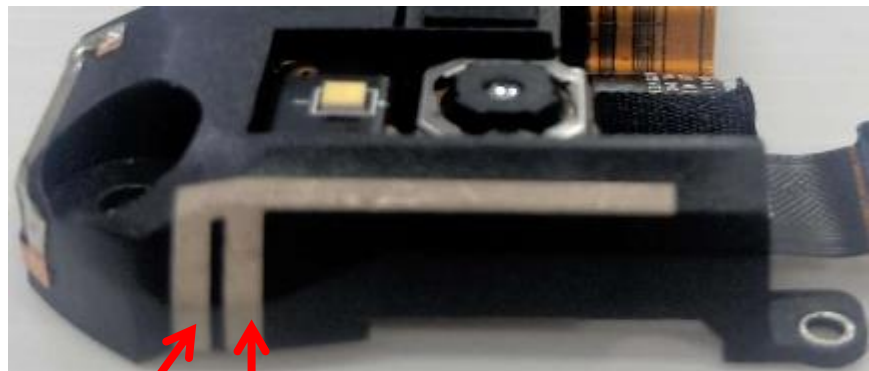
WIFI Main/Core0 antenna



WIFI Aux/Core1 antenna

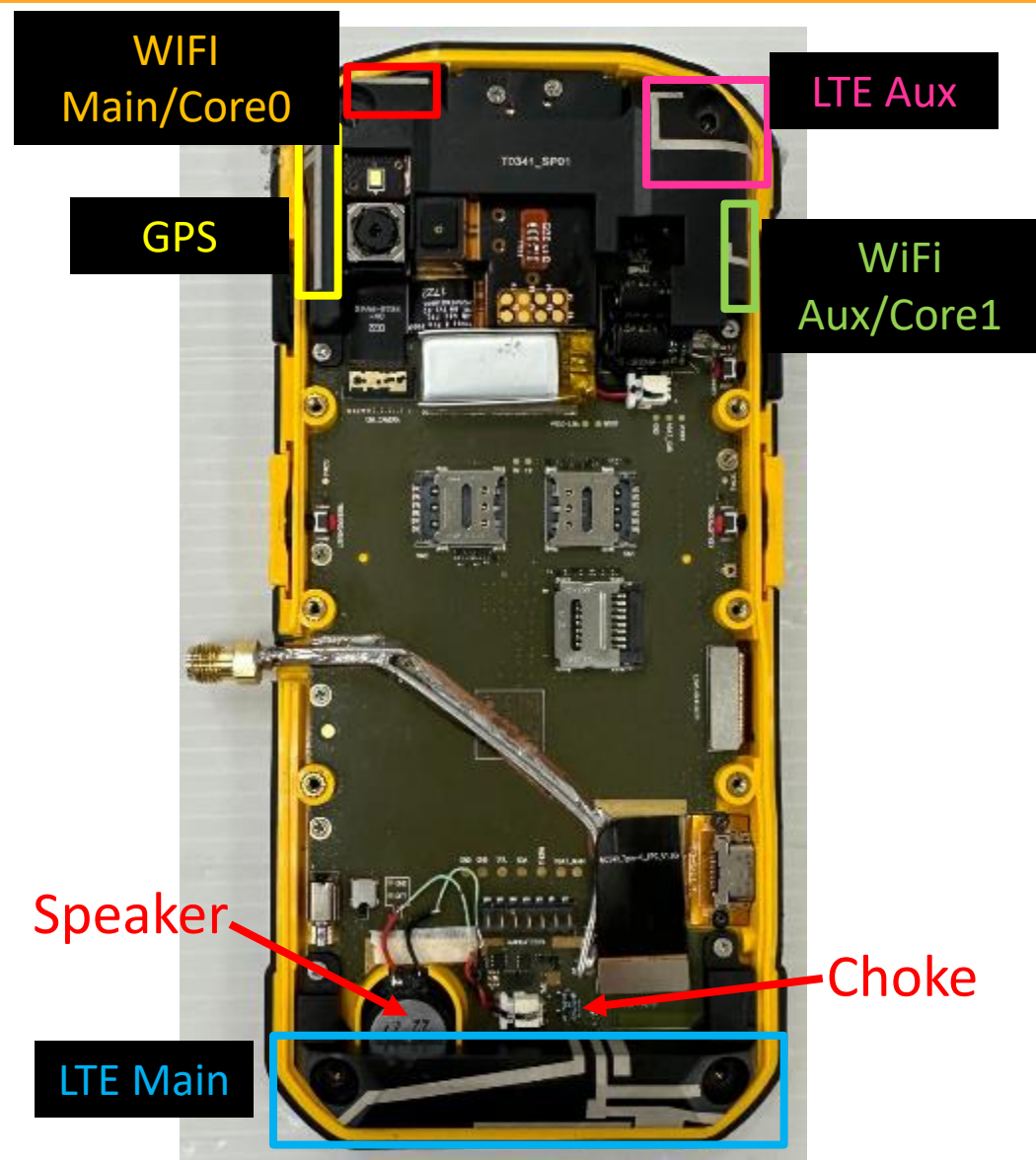


GPS antenna

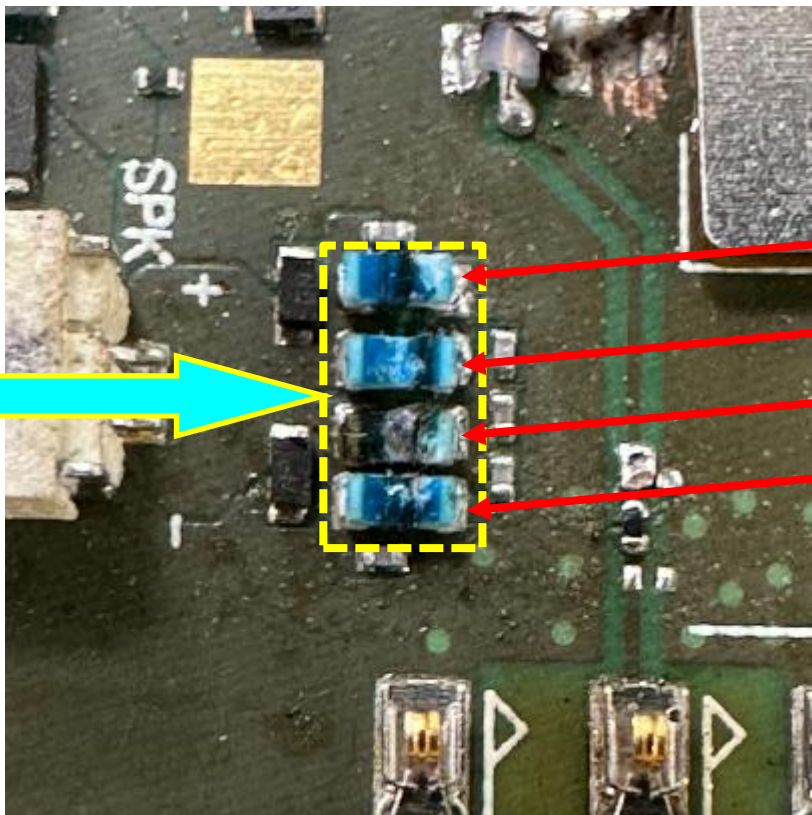
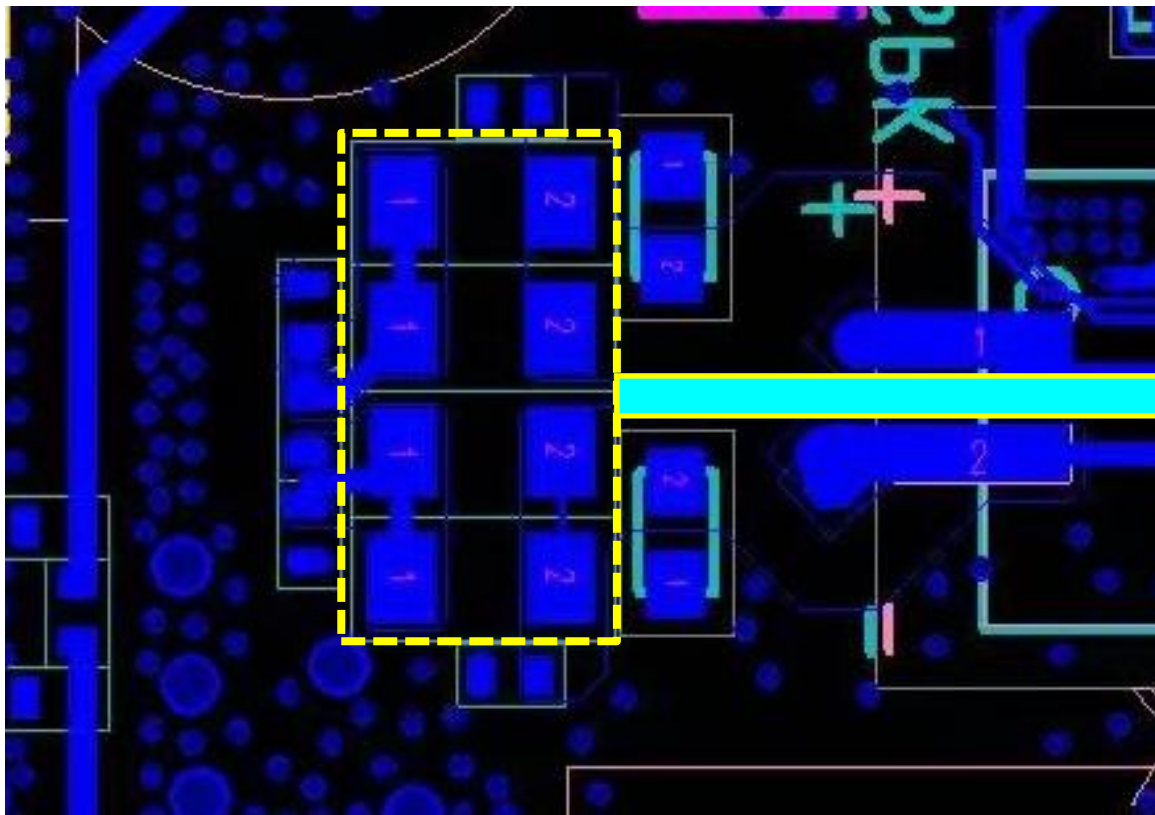


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Pictures of Device



Choke status

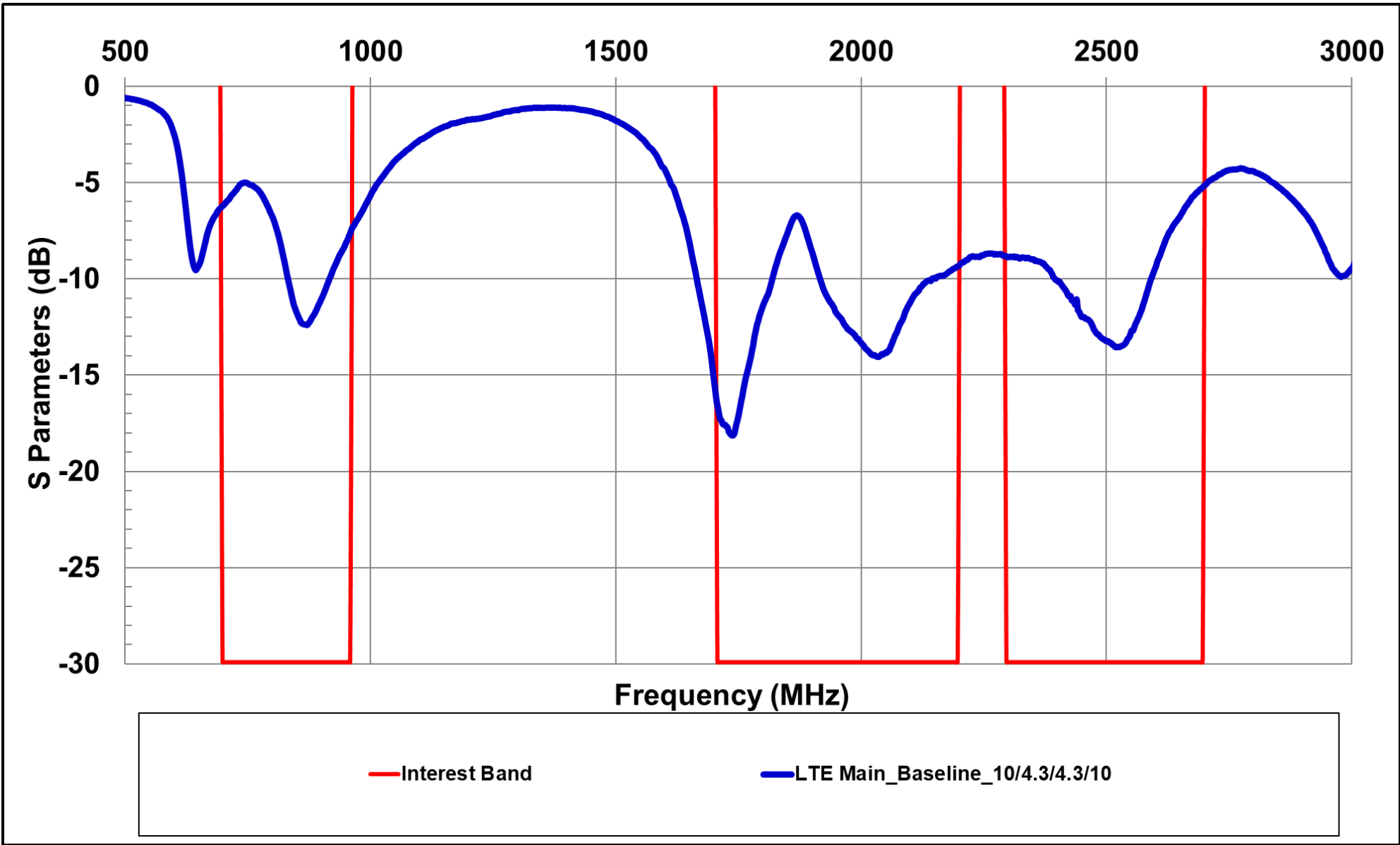


10nH

4.3nH

4.3nH

10nH



Efficiency_LTE Main antenna_Low Band



Conditions		Cond.00		
Date		2022/11/15		
Report Rev.		Rev04		
Antenna		LTE Main		
Project Stage		DVT1 Terminal		
Detail		1. Baseline 2. 10nH/4.3nH/4.3nH/10nH 3. PIFA+coupling type		
Chamber		Auden GTS 2800		
MHz	Spec	MHz	Avg. Gain (dB)	Peck. Gain(dBi)
698	-4.0	698	-3.0	1.4
703	-4.0	703	-3.1	1.4
704	-4.0	704	-3.2	1.4
707	-4.0	707	-3.3	1.4
710	-4.0	710	-3.4	1.3
716	-4.0	716	-3.8	0.9
726	-4.0	726	-3.6	0.7
728	-4.0	728	-3.6	0.6
734	-4.0	734	-3.5	0.5
737	-4.0	737	-3.6	0.5
740	-4.0	740	-3.5	0.5
746	-4.0	746	-3.5	0.5
748	-4.0	748	-3.5	0.5
751	-4.0	751	-3.6	0.3
756	-4.0	756	-3.6	0.1
758	-4.0	758	-3.7	0.1
777	-4.0	777	-3.9	-0.3
781	-4.0	781	-3.9	-0.3
782	-4.0	782	-3.9	-0.3
787	-4.0	787	-4.0	-0.4
791	-4.0	791	-4.0	-0.2

Conditions		Cond.00		
Date		2022/11/15		
Report Rev.		Rev04		
Antenna		LTE Main		
Project Stage		DVT1 Terminal		
Detail		1. Baseline 2. 10nH/4.3nH/4.3nH/10nH 3. PIFA+coupling type		
Chamber		Auden GTS 2800		
MHz	Spec	MHz	Avg. Gain (dB)	Peck. Gain(dBi)
803	-4.0	803	-4.3	-0.1
806	-4.0	806	-4.4	-0.3
821	-4.0	821	-4.5	-0.2
824	-4.0	824	-4.5	-0.1
832	-4.0	832	-4.3	0.0
837	-4.0	837	-4.1	0.5
847	-4.0	847	-3.9	0.5
849	-4.0	849	-3.8	0.5
862	-4.0	862	-3.5	1.0
869	-4.0	869	-3.3	1.1
880	-4.0	880	-3.1	1.4
882	-4.0	882	-3.0	1.4
894	-4.0	894	-2.8	1.4
898	-4.0	898	-2.8	1.4
915	-4.0	915	-2.8	1.5
925	-4.0	925	-3.0	1.3
943	-4.0	943	-3.2	1.2
960	-4.0	960	-3.7	0.8

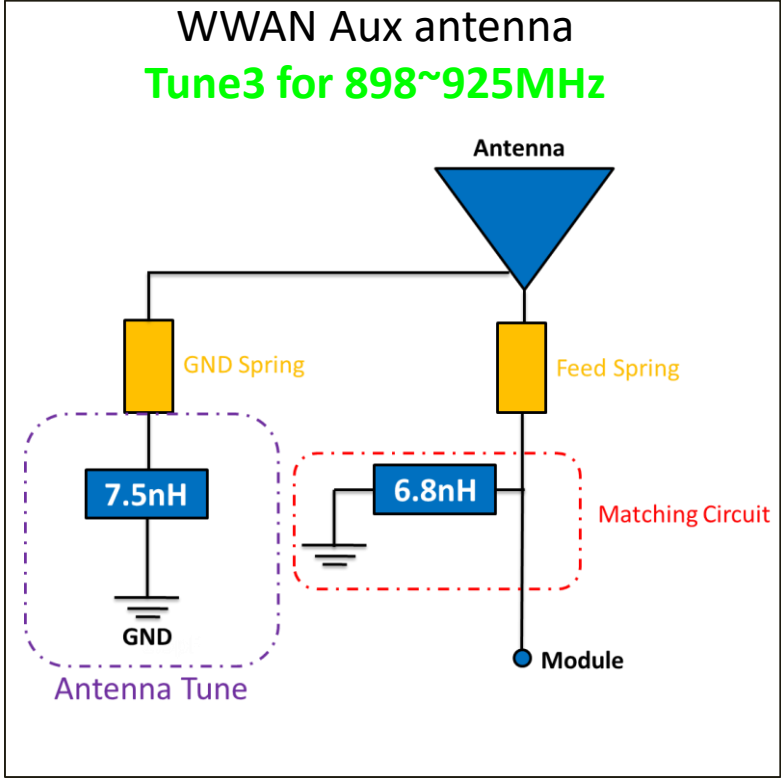
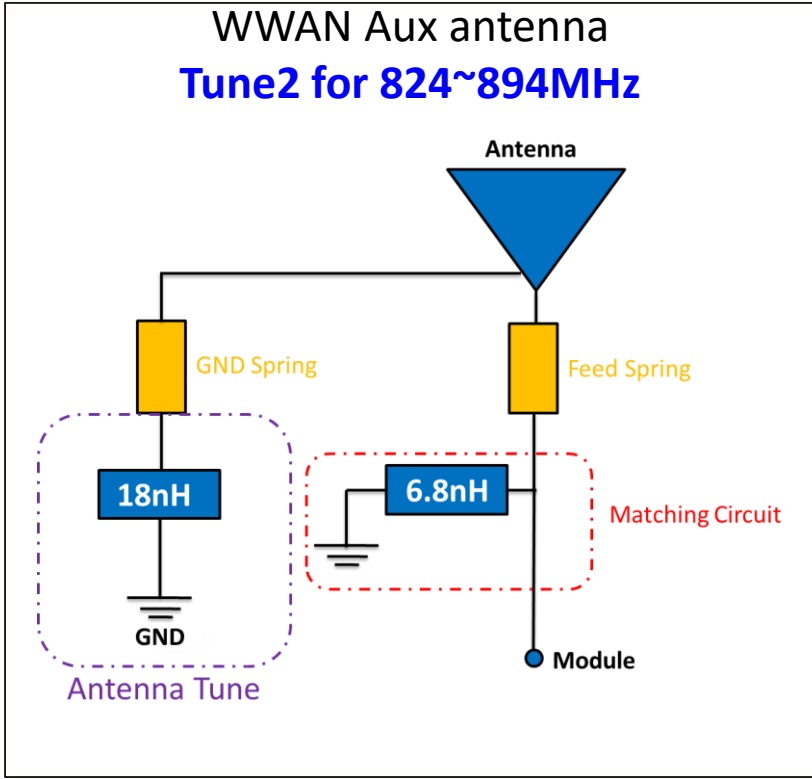
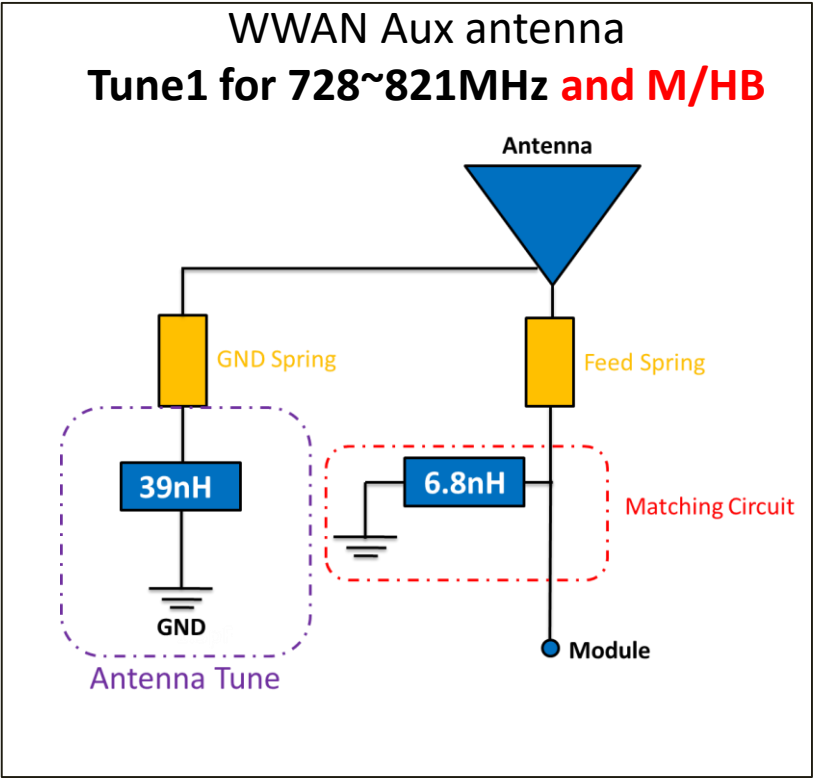
Efficiency_LTE Main Antenna_Middle and High Band

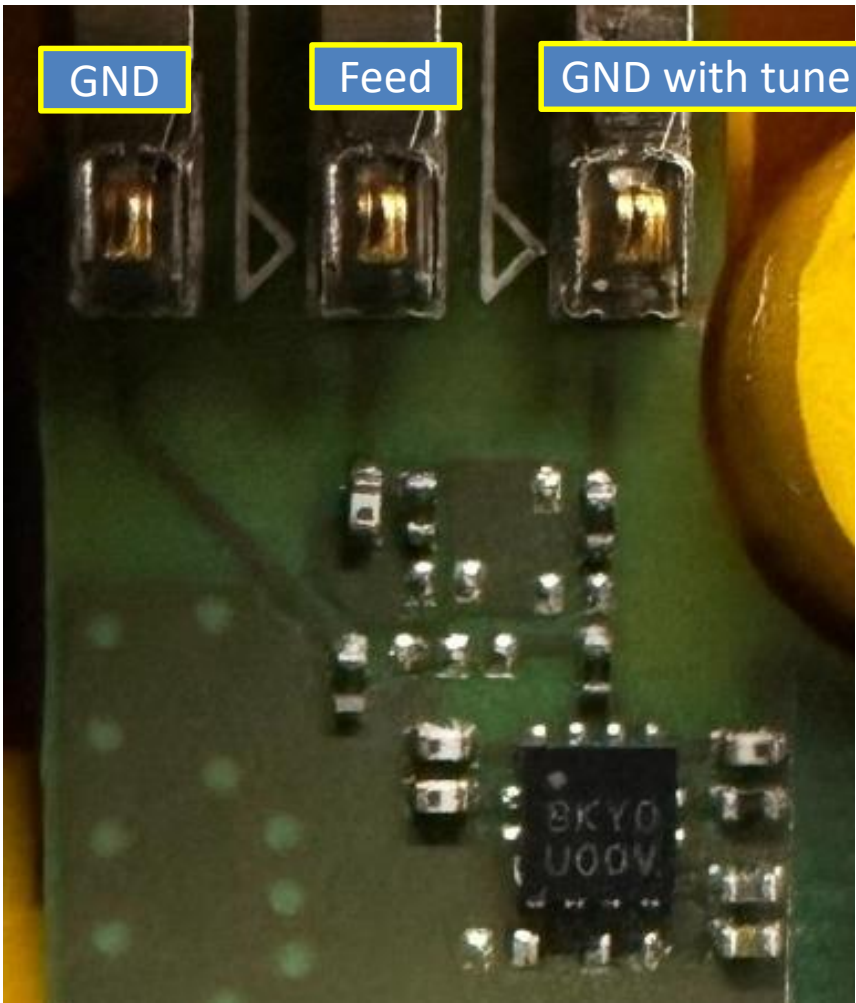
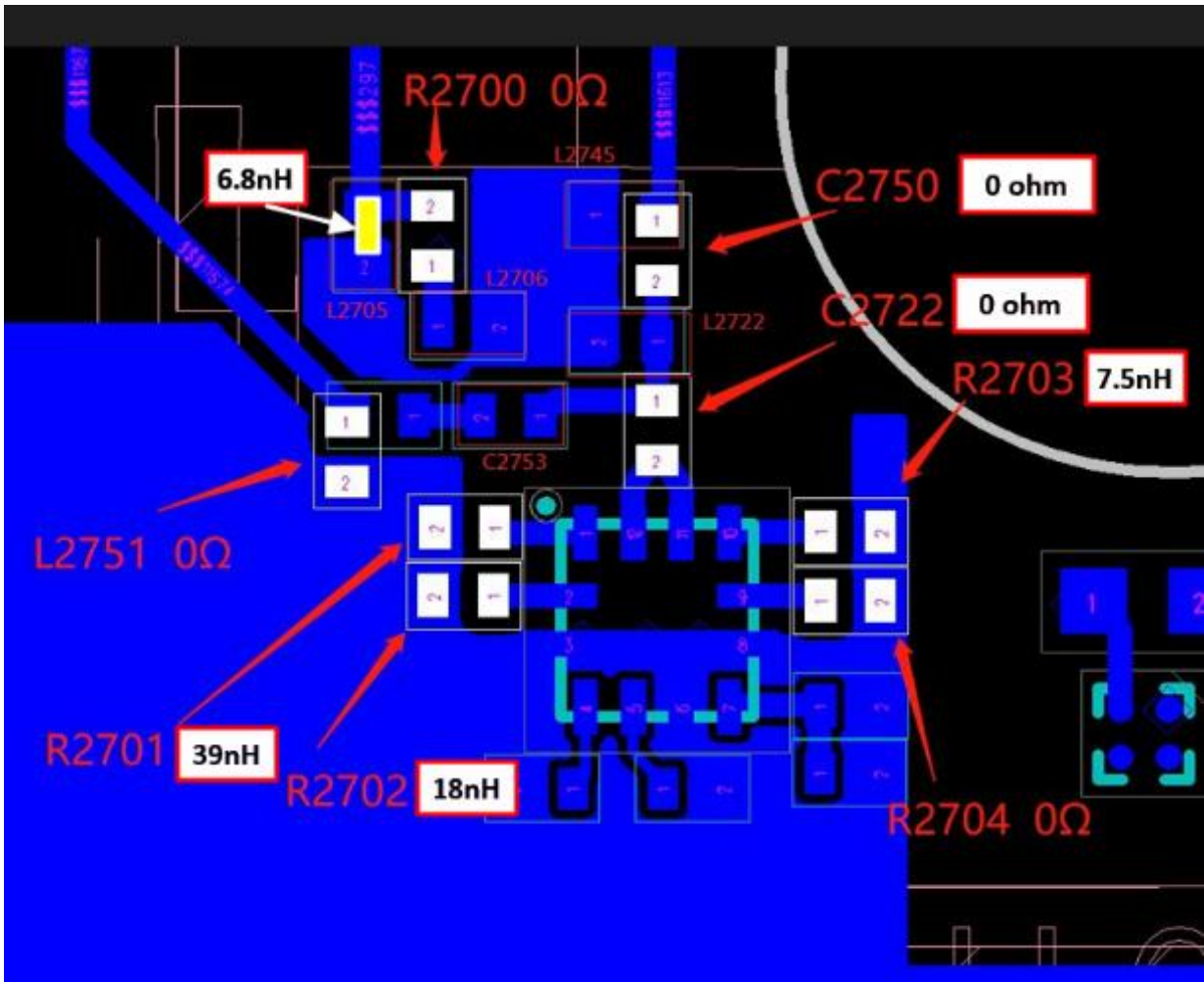


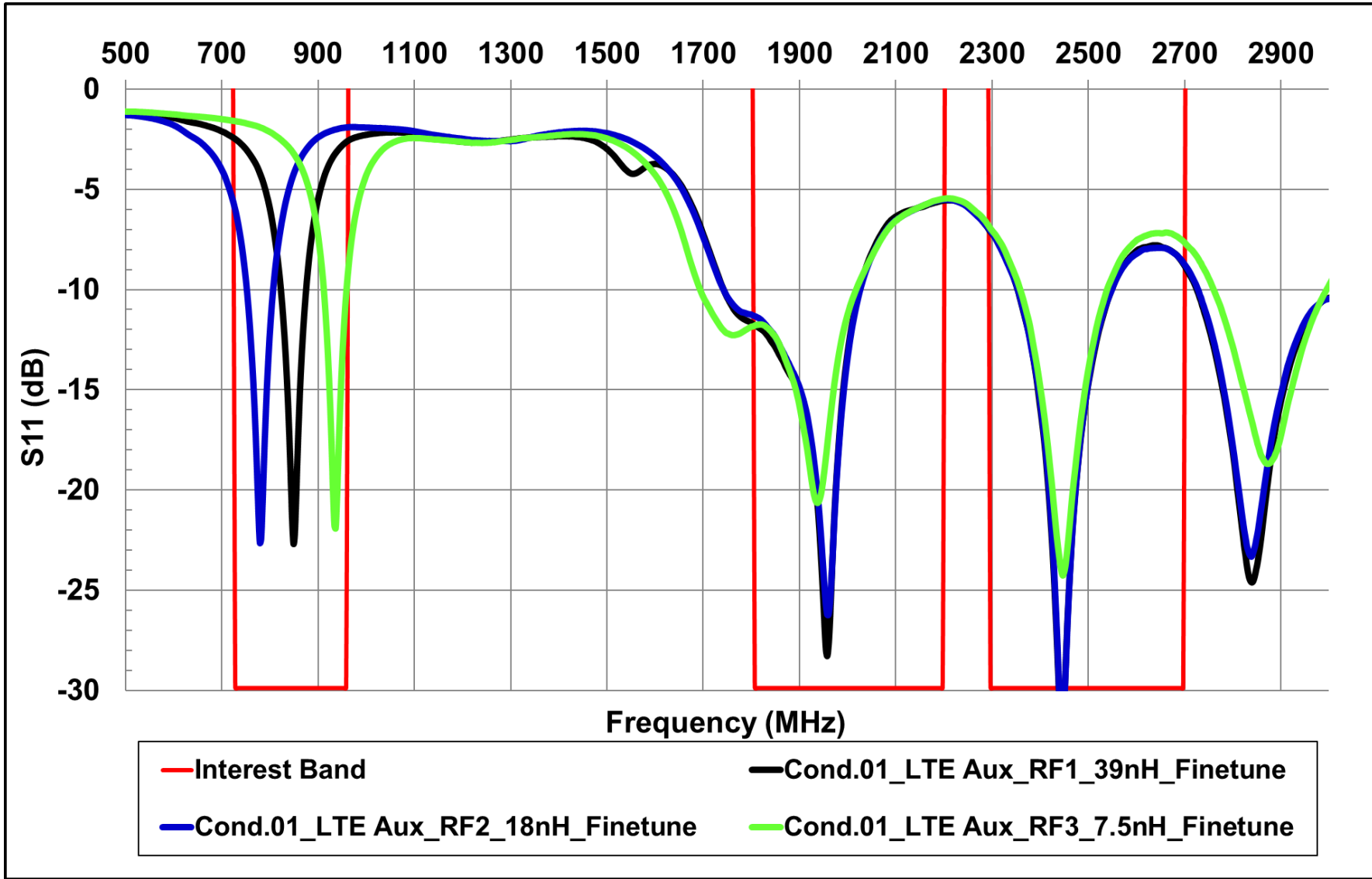
Conditions		Cond.00		
Date		2022/11/15		
Report Rev.		Rev04		
Antenna		LTE Main		
Project Stage		DVT1 Terminal		
Detail		1. Baseline 2. 10nH/4.3nH/4.3nH/10nH 3. PIFA+coupling type		
Chamber		Auden GTS 2800		
MHz	Spec	MHz	Avg. Gain (dB)	Peck. Gain(dBi)
1710	-3.5	1710	-2.7	2.6
1733	-3.5	1733	-2.8	3.1
1745	-3.5	1745	-3.0	2.9
1748	-3.5	1748	-3.0	2.9
1755	-3.5	1755	-3.1	2.7
1780	-3.5	1780	-3.6	2.3
1785	-3.5	1785	-3.7	2.2
1805	-3.5	1805	-4.0	2.1
1843	-3.5	1843	-4.1	1.0
1850	-3.5	1850	-4.0	1.3
1880	-3.5	1880	-3.6	2.2
1910	-3.5	1910	-3.5	2.5
1920	-3.5	1920	-3.6	2.2
1930	-3.5	1930	-3.5	2.3
1950	-3.5	1950	-3.5	1.8
1960	-3.5	1960	-3.4	1.7
1980	-3.5	1980	-3.5	1.4
1990	-3.5	1990	-3.6	1.3
2110	-3.5	2110	-3.3	1.8
2133	-3.5	2133	-2.7	2.2
2140	-3.5	2140	-2.6	2.3

Conditions		Cond.00		
Date		2022/11/15		
Report Rev.		Rev04		
Antenna		LTE Main		
Project Stage		DVT1 Terminal		
Detail		1. Baseline 2. 10nH/4.3nH/4.3nH/10nH 3. PIFA+coupling type		
Chamber		Auden GTS 2800		
MHz	Spec	MHz	Avg. Gain (dB)	Peck. Gain(dBi)
2155	-3.5	2155	-2.4	2.5
2170	-3.5	2170	-2.3	2.3
2200	-3.5	2200	-2.2	2.7
2300	-3.5	2300	-2.6	2.6
2305	-3.5	2305	-2.6	2.6
2310	-3.5	2310	-2.5	2.7
2315	-3.5	2315	-2.5	2.7
2350	-3.5	2350	-2.5	2.5
2355	-3.5	2355	-2.5	2.4
2360	-3.5	2360	-2.6	2.2
2400	-3.5	2400	-2.8	1.5
2402	-3.5	2402	-2.8	1.5
2442	-3.5	2442	-2.6	2.1
2494	-3.5	2494	-2.5	2.5
2500	-3.5	2500	-2.5	2.5
2535	-3.5	2535	-2.6	2.5
2570	-3.5	2570	-2.7	2.6
2620	-3.5	2620	-3.2	2.6
2655	-3.5	2655	-3.8	1.9
2690	-3.5	2690	-4.0	1.5

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LTE Aux_Efficiency_Low Band



➤ LTE Aux antenna use switch to cover low band.

Conditions		Cond.01			Cond.01			Cond.01		
Date		2022/10/7			2022/10/7			2022/10/7		
Report Rev.		Rev03			Rev03			Rev03		
Antenna		LTE Aux			LTE Aux			LTE Aux		
Project Stage		DVT1			DVT1			DVT1		
Detail		1. Feed_p6.8nH. 2. RF1_39nH. 3. Finetune. 4.PIFA+Coupling Type.			1. Feed_p6.8nH. 2. RF2_18nH. 3. Finetune. 4.PIFA+Coupling Type.			1. Feed_p6.8nH. 2. RF3_7.5nH. 3. Finetune. 4.PIFA+Coupling Type.		
Chamber		Auden GTS 2800			Auden GTS 2800			Auden GTS 2800		
MHz	Spec	MHz	Avg. Gain (dB)	Peak. Gain(dBi)	MHz	Avg. Gain(dB)	Peak. Gain(dBi)	MHz	Avg. Gain(dB)	Peak. Gain(dBi)
698	-8.0	698	-10.9	-7.8	698	-15.0	-11.8	698	-19.1	-16.0
703	-8.0	703	-10.2	-7.1	703	-14.5	-11.3	703	-18.6	-15.4
704	-8.0	704	-10.1	-7.1	704	-14.4	-11.2	704	-18.5	-15.4
707	-8.0	707	-9.8	-6.8	707	-14.1	-10.9	707	-18.3	-15.2
710	-8.0	710	-9.6	-6.7	710	-13.9	-10.8	710	-18.1	-15.1
716	-8.0	716	-9.4	-6.6	716	-13.7	-10.7	716	-18.1	-15.2
726	-8.0	726	-8.8	-6.0	726	-13.1	-10.0	726	-17.6	-14.6
728	-8.0	728	-8.7	-5.9	728	-13.1	-10.0	728	-17.6	-14.6
734	-8.0	734	-8.5	-5.6	734	-12.9	-9.8	734	-17.5	-14.4
737	-8.0	737	-8.4	-5.5	737	-12.8	-9.6	737	-17.4	-14.4
740	-8.0	740	-8.3	-5.3	740	-12.6	-9.5	740	-17.4	-14.2
746	-8.0	746	-8.0	-5.0	746	-12.4	-9.2	746	-17.2	-13.9
748	-8.0	748	-7.9	-4.9	748	-12.3	-9.2	748	-17.2	-14.0
751	-8.0	751	-7.8	-4.8	751	-12.2	-9.1	751	-17.1	-14.0
756	-8.0	756	-7.7	-4.7	756	-12.0	-8.9	756	-16.9	-13.8
758	-8.0	758	-7.6	-4.7	758	-11.9	-8.9	758	-16.9	-13.7
777	-8.0	777	-7.2	-4.3	777	-10.7	-7.9	777	-15.9	-13.0
781	-8.0	781	-7.0	-4.1	781	-10.4	-7.5	781	-15.7	-12.6
782	-8.0	782	-7.0	-4.1	782	-10.4	-7.4	782	-15.6	-12.5
787	-8.0	787	-7.1	-4.1	787	-10.1	-7.1	787	-15.4	-12.2
791	-8.0	791	-7.1	-4.1	791	-9.8	-6.9	791	-15.2	-12.1
803	-8.0	803	-7.4	-4.5	803	-9.2	-6.3	803	-14.7	-11.8
806	-8.0	806	-7.5	-4.6	806	-9.1	-6.1	806	-14.6	-11.7
821	-8.0	821	-8.3	-5.5	821	-8.5	-5.6	821	-14.0	-11.1
824	-8.0	824	-8.5	-5.6	824	-8.4	-5.4	824	-13.9	-10.9
832	-8.0	832	-9.0	-6.0	832	-8.1	-5.0	832	-13.5	-10.4
837	-8.0	837	-9.3	-6.3	837	-7.9	-4.9	837	-13.2	-10.2
847	-8.0	847	-9.9	-6.8	847	-7.7	-4.6	847	-12.8	-9.5
849	-8.0	849	-10.1	-6.9	849	-7.7	-4.5	849	-12.7	-9.4
862	-8.0	862	-11.0	-8.0	862	-7.7	-4.6	862	-11.9	-8.7
869	-8.0	869	-11.3	-8.1	869	-7.8	-4.5	869	-11.2	-7.8
880	-8.0	880	-11.8	-8.5	880	-8.0	-4.6	880	-10.1	-6.6
882	-8.0	882	-11.9	-8.6	882	-8.1	-4.6	882	-9.9	-6.4
894	-8.0	894	-12.3	-8.8	894	-8.5	-5.0	894	-8.9	-5.2
898	-8.0	898	-12.6	-9.0	898	-8.7	-5.2	898	-8.6	-4.8
915	-8.0	915	-13.4	-9.8	915	-9.7	-6.1	915	-7.4	-3.6
925	-8.0	925	-14.0	-10.3	925	-10.4	-6.9	925	-7.0	-3.2
943	-8.0	943	-14.8	-11.4	943	-11.6	-8.2	943	-6.7	-3.1
960	-8.0	960	-15.5	-12.2	960	-12.6	-9.2	960	-7.2	-4.0

LTE Aux_Efficiency_Middle & High Band



➤ LTE Aux antenna use switch(RF1) to support MB/HB.

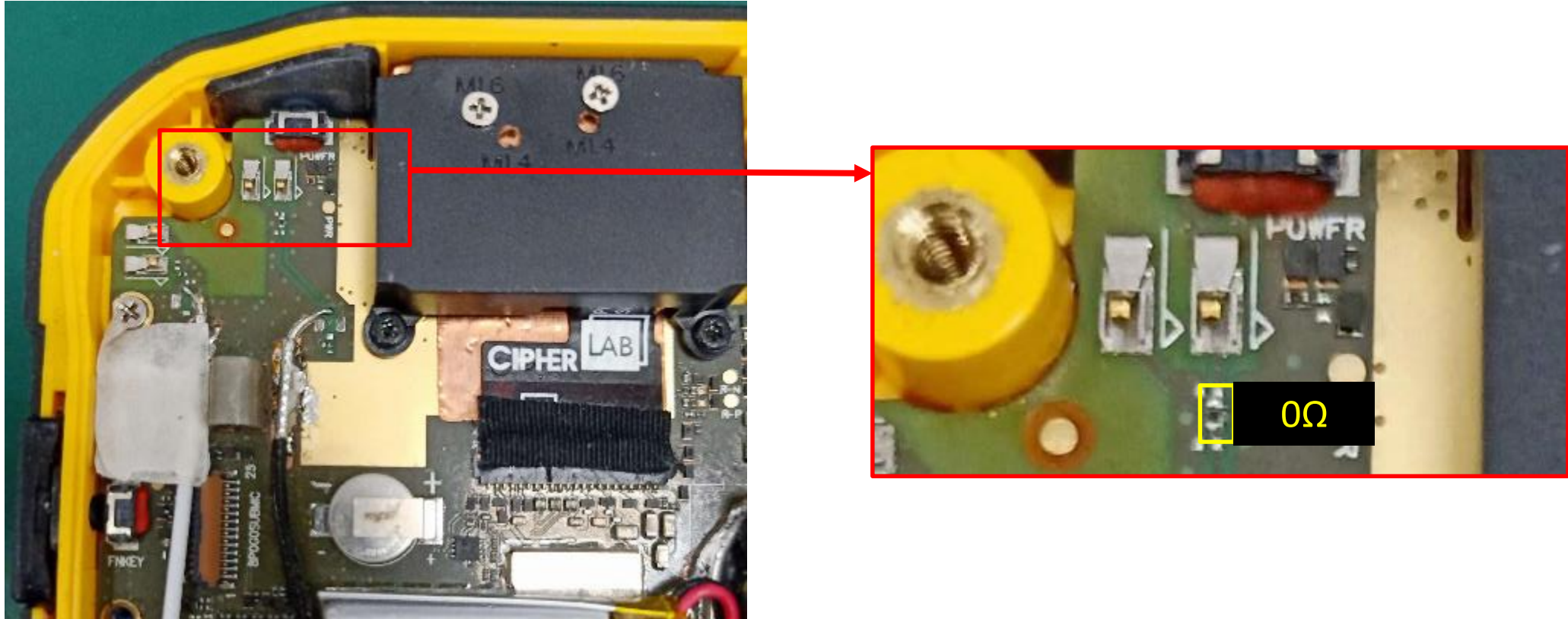
Conditions		Cond.01		
Date		2022/10/7		
Report Rev.		Rev03		
Antenna		LTE Aux		
Project Stage		DVT1		
Detail		1. Feed_p6.8nH. 2. RF1_39nH. 3. Finetune. 4.PIFA+Coupling Type.		
Chamber		Auden GTS 2800		
MHz	Spec	MHz	Gain (dB)	Peak. Gain(dBi)
1710	-7.0	1710	-9.4	-4.9
1733	-7.0	1733	-8.9	-4.3
1745	-7.0	1745	-8.6	-3.8
1748	-7.0	1748	-8.5	-3.8
1755	-7.0	1755	-8.4	-3.6
1780	-7.0	1780	-7.9	-3.0
1785	-7.0	1785	-7.8	-2.9
1805	-7.0	1805	-7.6	-2.8
1843	-7.0	1843	-6.8	-2.4
1850	-7.0	1850	-6.8	-2.5
1880	-7.0	1880	-6.7	-2.4
1910	-7.0	1910	-6.8	-2.0
1920	-7.0	1920	-6.9	-1.7
1930	-7.0	1930	-6.8	-1.3
1950	-7.0	1950	-7.0	-1.2
1960	-7.0	1960	-7.2	-1.6
1980	-7.0	1980	-7.7	-2.4
1990	-7.0	1990	-8.0	-2.8
2110	-7.0	2110	-7.7	-2.6
2133	-7.0	2133	-7.6	-2.7
2140	-7.0	2140	-7.5	-2.8

Conditions		Cond.01		
Date		2022/10/7		
Report Rev.		Rev03		
Antenna		LTE Aux		
Project Stage		DVT1		
Detail		1. Feed_p6.8nH. 2. RF1_39nH. 3. Finetune. 4.PIFA+Coupling Type.		
Chamber		Auden GTS 2800		
MHz	Spec	MHz	Gain (dB)	Peak. Gain(dBi)
2155	-7.0	2155	-7.4	-2.7
2170	-7.0	2170	-7.4	-3.0
2200	-7.0	2200	-7.1	-2.9
2300	-7.0	2300	-5.4	-1.2
2305	-7.0	2305	-5.3	-1.0
2310	-7.0	2310	-5.1	-0.8
2315	-7.0	2315	-5.0	-0.7
2350	-7.0	2350	-4.2	-0.2
2355	-7.0	2355	-4.2	-0.2
2360	-7.0	2360	-4.2	-0.2
2400	-7.0	2400	-3.9	0.2
2402	-7.0	2402	-4.0	0.1
2442	-7.0	2442	-3.7	0.6
2494	-7.0	2494	-3.9	0.6
2500	-7.0	2500	-3.9	0.5
2535	-7.0	2535	-4.2	0.1
2570	-7.0	2570	-4.5	-0.1
2620	-7.0	2620	-5.0	-0.8
2655	-7.0	2655	-5.1	-1.0
2690	-7.0	2690	-5.0	-0.5

- Platform and Fixture Introduction
- Pictures of Antenna pattern
- Antenna Solution and Performance
 - LTE Main
 - LTE Aux
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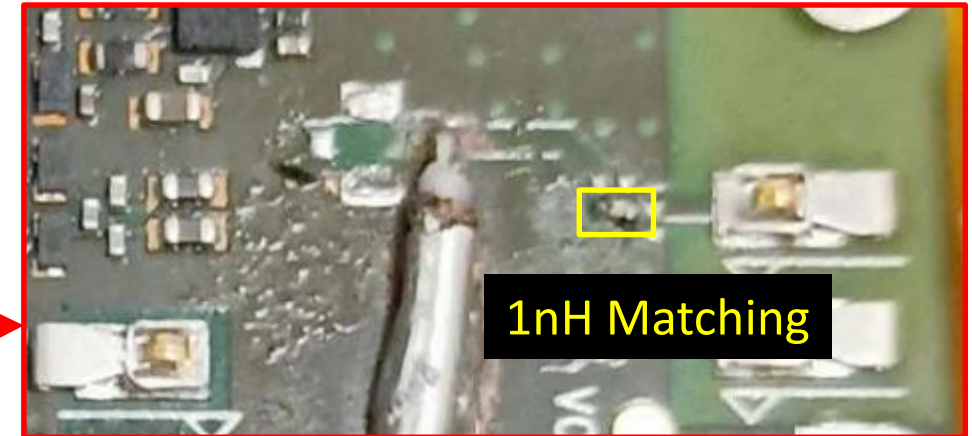
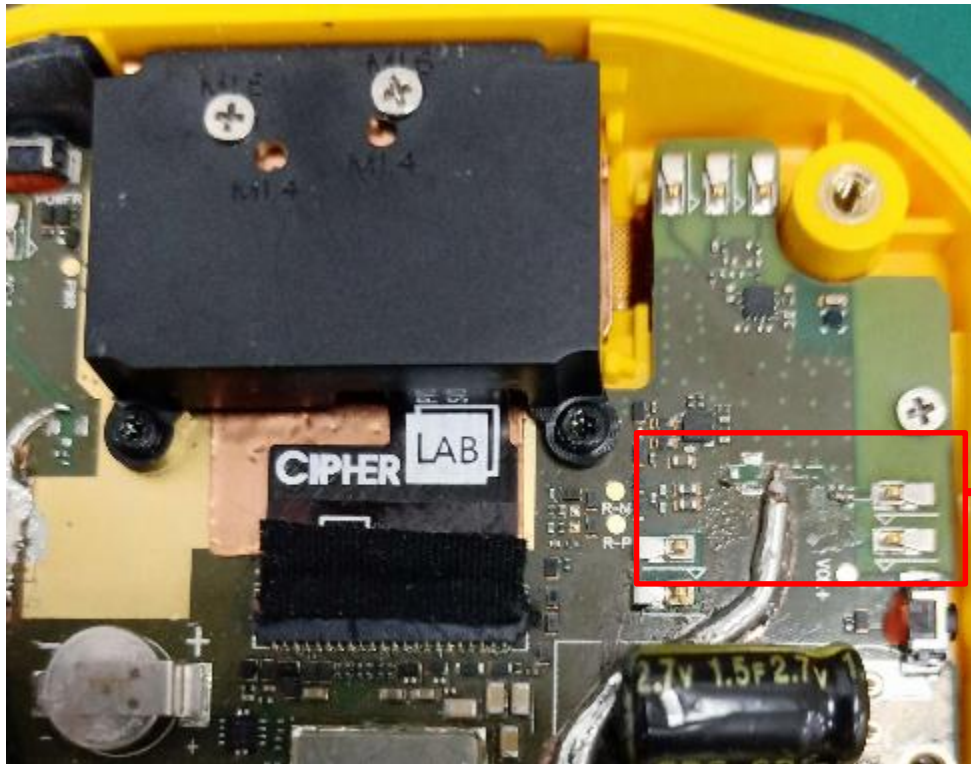
Solution of WIFI Main/Core0 Antenna

因高頻諧振頻偏，原matching替換成0歐姆後特性有改善。

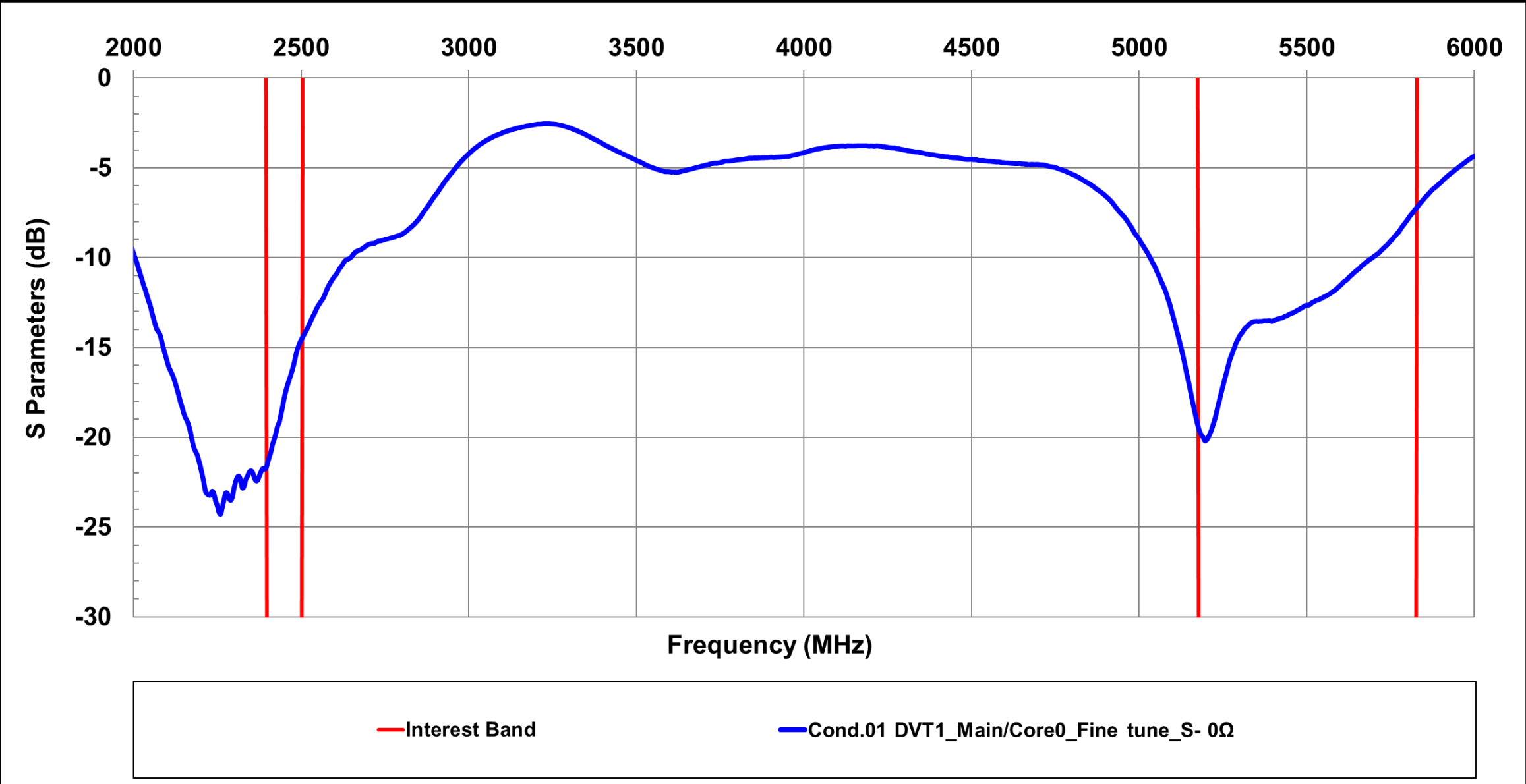


Solution of WIFI Aux/Core1 Antenna

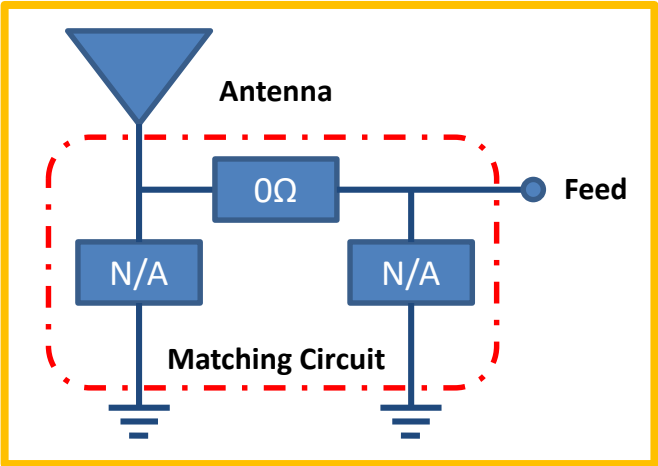
因高頻特性不佳，電路串1nH優化。



S11_WiFi Main/Core0 Antenna

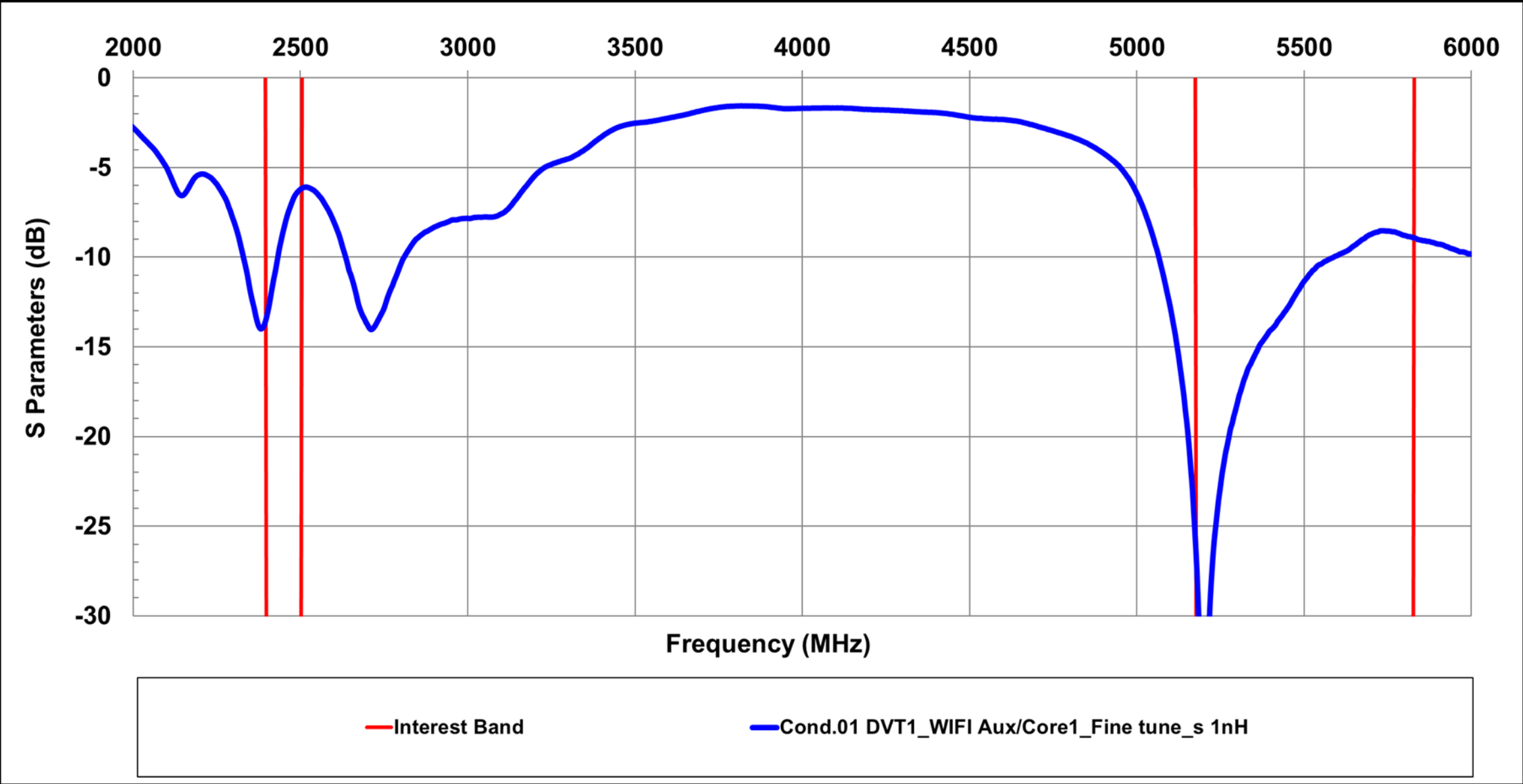


Efficiency_WiFi Main/Core0 Antenna

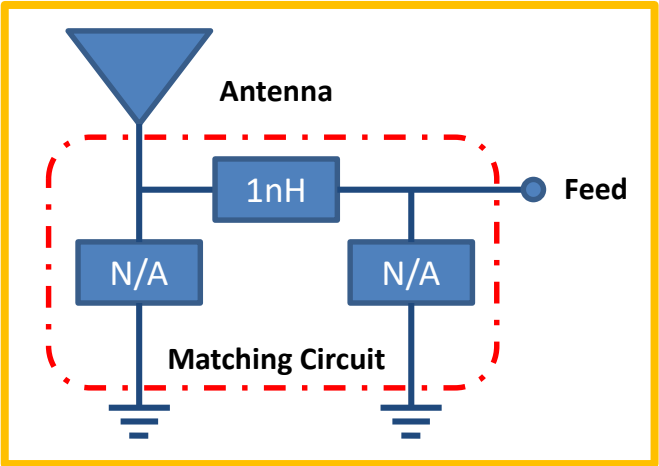


Conditions		Cond.01		
Date		2022/10/13		
Report Rev.		Rev04		
Antenna (Rev.)		WIFI Main/Core0		
Project Stage		DVT1		
Detail		* Fine tune.		
		*S-0歐姆		
Chamber		Auden GTS2800		
MHz	Spec	MHz	Avg. Gain(dB)	Peak. Gain(dBi)
2402	-3.0	2402	-3.5	1.8
2442	-3.0	2442	-4.0	1.7
2484	-3.0	2484	-4.8	0.3
5150	-3.0	5150	-6.1	-0.8
5250	-3.0	5250	-4.6	1.1
5350	-3.0	5350	-4.2	2.1
5470	-3.0	5470	-4.6	1.5
5725	-3.0	5725	-4.9	1.0
5785	-3.0	5785	-5.1	1.3
5875	-3.0	5875	-4.6	1.9

S11_WiFi Aux/Core1 Antenna

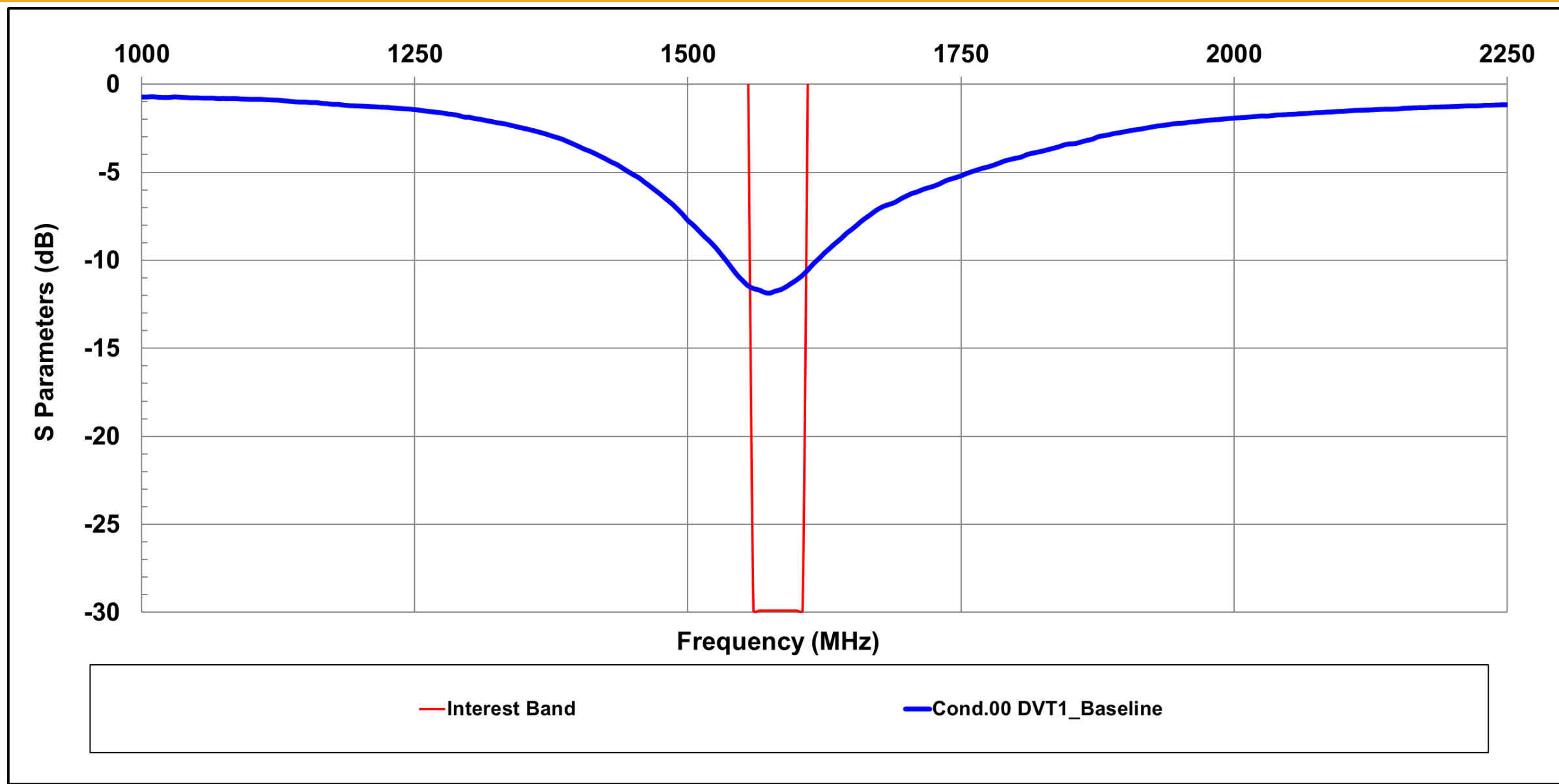


Efficiency_WiFi Aux/Core1 Antenna



Conditions		Cond.01		
Date		2022/10/13		
Report Rev.		Rev04		
Antenna (Rev.)		WIFI Aux/Core1		
Project Stage		DVT1		
Detail		*Fine tune.		
		*S-1nH		
		*PIFA type		
Chamber		Auden GTS2800		
MHz	Spec	MHz	Avg. Gain(dB)	Peak. Gain(dBi)
2402	-3.0	2402	-3.2	0.3
2442	-3.0	2442	-3.2	0.2
2484	-3.0	2484	-3.7	-0.1
5150	-3.0	5150	-6.0	-1.1
5250	-3.0	5250	-5.1	0.2
5350	-3.0	5350	-4.1	1.2
5470	-3.0	5470	-4.0	1.9
5725	-3.0	5725	-4.3	2.9
5785	-3.0	5785	-4.8	2.2
5875	-3.0	5875	-5.1	1.8

- Platform and Fixture Introduction
- Pictures of Antenna pattern
- Antenna Solution and Performance
 - LTE Main
 - LTE Aux
 - WIFI Main/Aux
 - GPS Ant.
- Conclusion



Conditions		Cond.00		
Date		2022/10/13		
Report Rev.		Rev04		
Antenna (Rev.)		GPS		
Project Stage		DVT1		
Detail		*Baseline. *Factory sample. *PIFA type.		
Chamber		Auden GTS 2800		
MHz	Spec	MHz	Avg. Gain(dB)	Peak. Gain(dBi)
Total Eff.				
1560	-3.0	1560	-3.2	1.1
1585	-3.0	1585	-3.4	0.6
1610	-3.0	1610	-3.3	0.2
UHS Eff.				
1560	-6.0	1560	-6.9	
1585	-6.0	1585	-6.9	
1610	-6.0	1610	-6.4	