

# Corning – Foxconn ORU Project

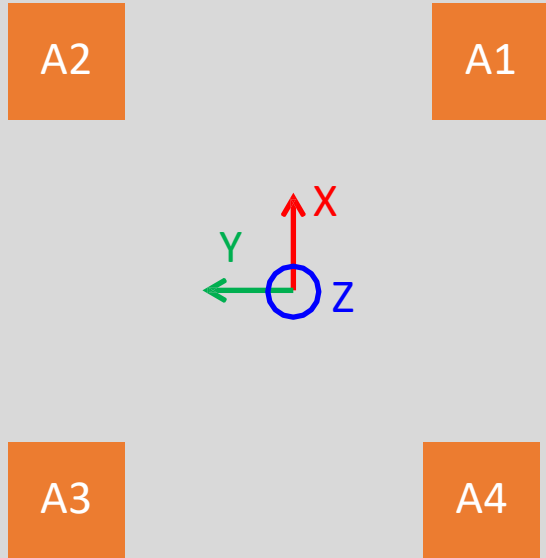
## Antenna PVT Fine Tuned Measurement Report



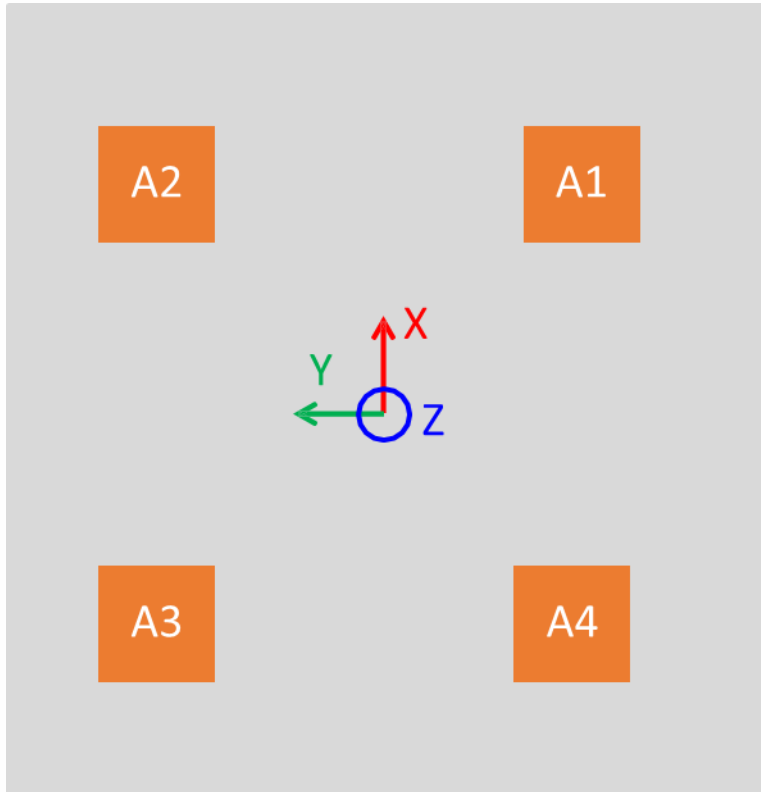
- Hard-tooling sample fine tuning is fully performed with 1 units, performance improvement as below.
- Overall performance within 3700~3975 MHz as below
  - VSWR improve from 1.5:1 to 1.35:1
  - Isolation improve from <-30 dB to < -31 dB
  - Efficiency improve from 79~88 % to 84~89 %
  - Peak gain improve from 3.5~4.5 dBi to 3.7~4.5 dBi
  - Gain ripple at Theta 60° less 4 dB

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# Product and Coordination Definition



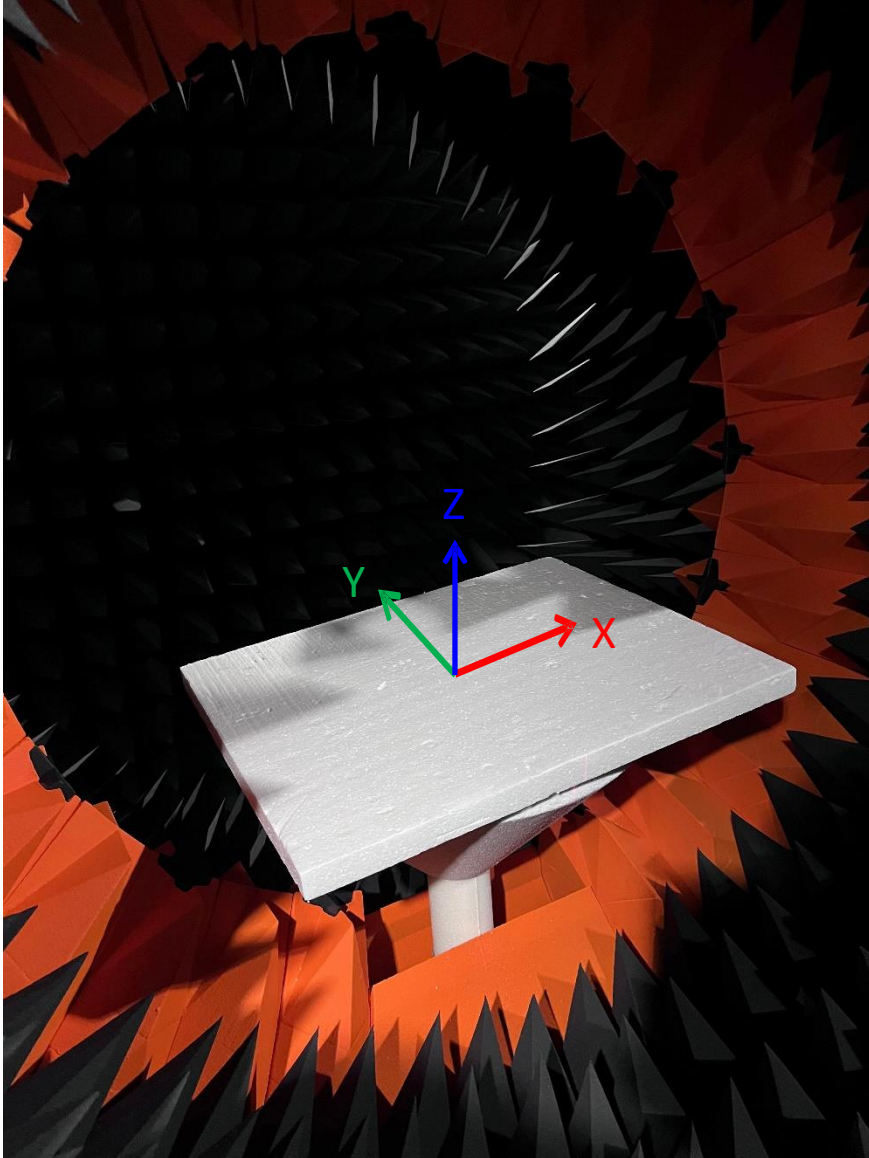
Parameter	Spec	Measurement Results
Working frequency		3300~4200 MHz
Supported band		N48 / N77 / N78
VSWR	< 2:1	< 1.35:1
Isolation	< -30 dB	< -31 dB
Efficiency	> 60 %	> 79 % (W. cable loss)
Peak gain	< 6 dBi	< 4.5 dBi (W. cable loss)
Radiation pattern	Wall/Ceiling	HPBW > 120°x120°
Gain flatness	< 10 dB	< 4 dB



Parameter	A1-A4
Working Frequency (MHz)	3300-4200
Type	PIFA
Polarization	Mix

- Antenna design concept:

- The antenna architecture is been designed for both mounting scenario (wall/ceiling mount). Also the configuration has intently been optimized for the radiation pattern and isolation level requirement.
- The antenna elements adopt metal stamping and will be fixed on the AL plate by screw, each element connect with OD1.37 RF cable 330mm + IPEX MHF 1L connector.



## VNA Testing Information

- VNA model : Keysight E5071C calibrated to 8.5 GHz.
- Frequency sweep : 500~7500 MHz / 1201 points
- Data collection : VSWR / Isolation

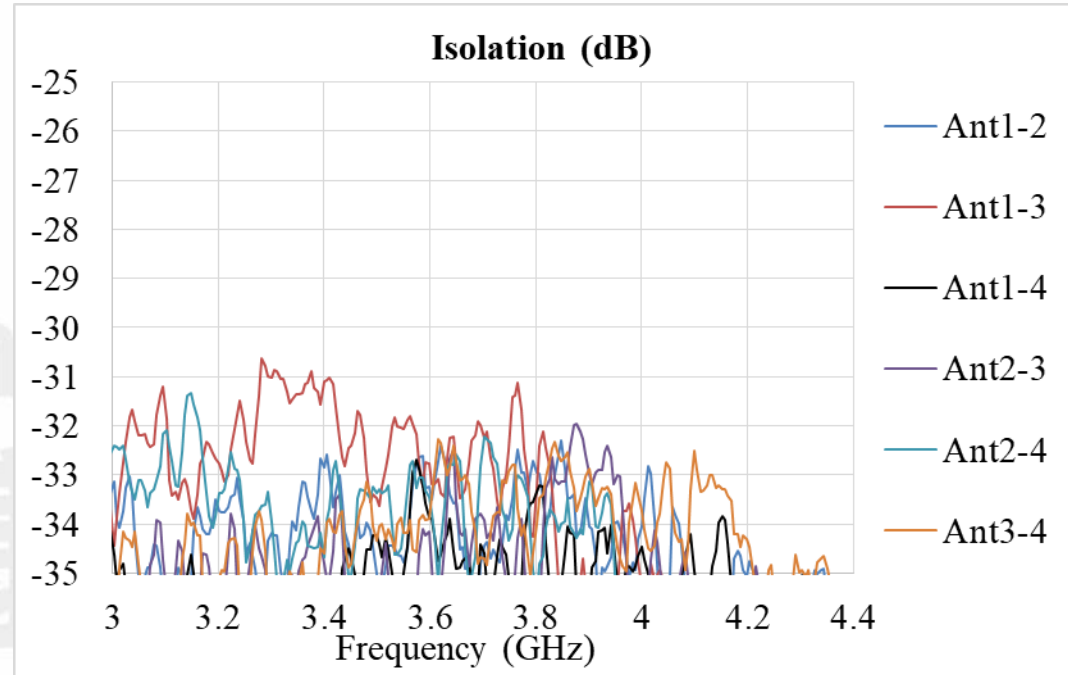
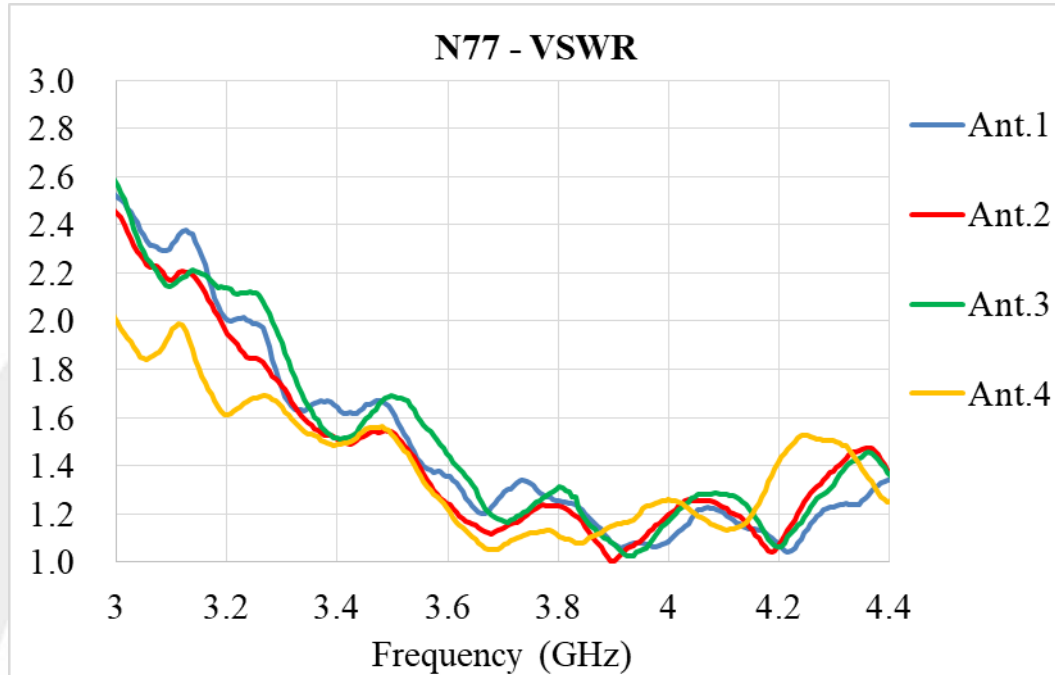
## Over-The-Air Passive Testing Information

- Chamber model : SATIMO Starlab 2021 calibrated to 9 GHz.
- Frequency sweep : 3000~4500 MHz / 25 MHz
- Scanning angle increment : 3D increments are 5 deg  
2D increments are 5 deg
- Data collection : Efficiency / Peak gain / Radiation pattern

## DUT Information

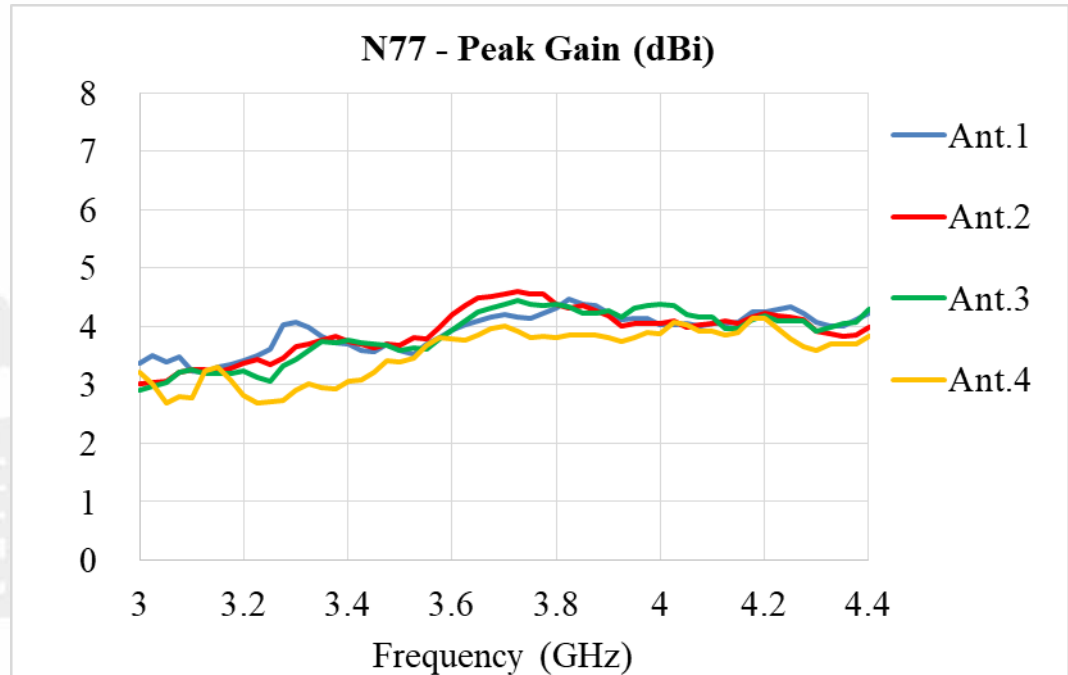
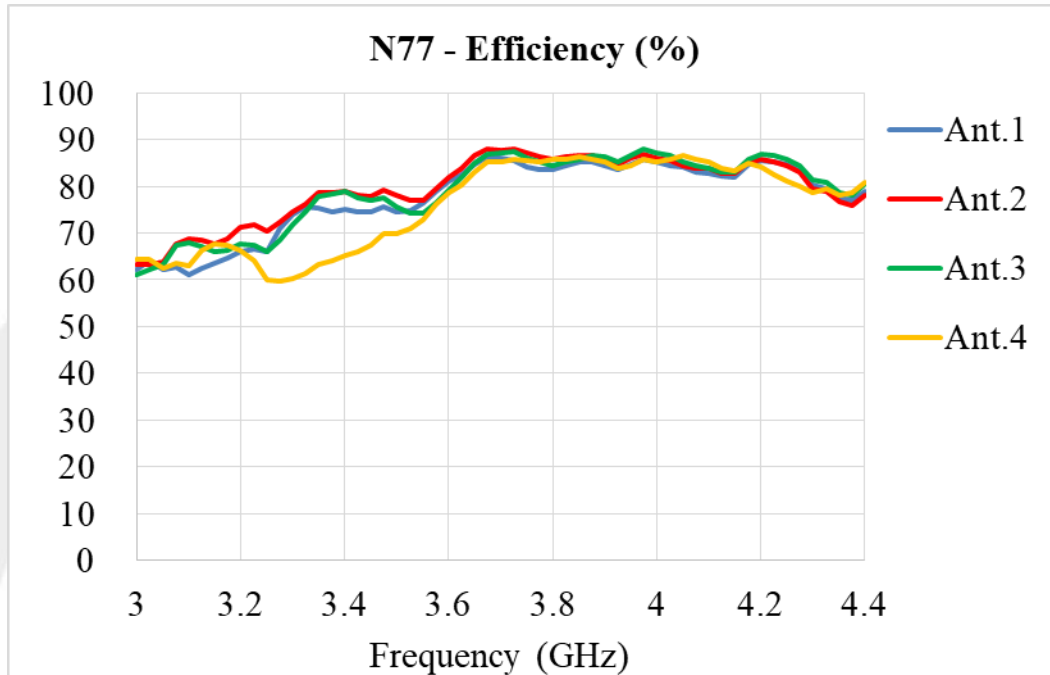
- The DUT included whole product assembly, but didn't include PCBA since it's between bottom chassis and antenna plate. There are 4 holes on the bottom chassis for the passive signal input.

# VSWR and Isolation



- Well impedance matching has fulfilled within 3700~4000 MHz (VSWR < 1.35:1), besides, the VSWR of 3300~4200 MHz is under 1.9:1.
- Cross-pair isolation over antennas is controlled under -31 dB from 3300~4200MHz.

# Peak Gain and Efficiency



- The peak gain and efficiency have included cable loss (330 mm cable loss):
  - Peak gain over 3700-4000 MHz is from 3.7~4.5 dBi.
  - Efficiency over 3700-4000 MHz is from 84~89 %.

# RMS gain



Frequency	A1 3D RMS Gain	A2 3D RMS Gain	A3 3D RMS Gain	A4 3D RMS Gain
3700	0.331973731	0.488033524	0.412293748	0.323058254
3750	0.20578445	0.457136447	0.314096226	0.308973963
3800	0.158437485	0.382785643	-0.346877406	0.3162999
3850	0.270019296	0.439457267	0.405508072	0.377975804
3900	0.254400911	0.4166722	0.453531483	0.347527351
3950	0.291574766	0.453227575	0.496163138	0.358157646

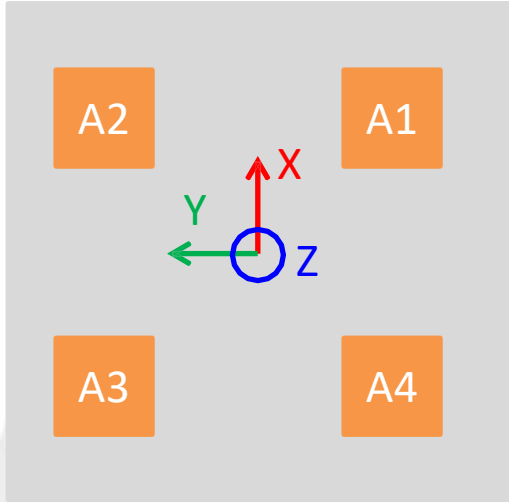
Above value calculated by all 3D angles (Phi -180~+180 and Theta 0~175)

Elevation (Deg)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175
A1_3700_RMS	0.198928	0.370729	0.45238	0.467195	0.462712	0.39146	0.270653	0.231099	0.289372	0.340004	0.315844	0.28475	0.280304	0.262687	0.24042	0.272265	0.323864	0.342896	0.368865	0.416013	0.413047	0.29652	0.109677	-0.0143	-0.01456	0.106037	0.336651	0.623753	0.820382	0.816303	0.658412	0.466935	0.274639	0.103948	0.005443	0.046169
A1_3750_RMS	0.094867	0.267968	0.344115	0.351052	0.381546	0.372995	0.254961	0.155647	0.193088	0.271751	0.271622	0.214783	0.188633	0.206363	0.232457	0.244283	0.239685	0.249609	0.278535	0.312256	0.286718	0.152558	-0.04151	-0.18542	-0.2106	-0.10173	0.131894	0.420244	0.608719	0.585184	0.407264	0.206406	0.035004	-0.09587	-0.14906	-0.07638
A1_3800_RMS	0.063282	0.244982	0.328553	0.336967	0.357153	0.375829	0.262413	0.10295	0.087654	0.197807	0.248439	0.168721	0.105717	0.165918	0.228257	0.203329	0.176825	0.22037	0.26246	0.253437	0.218496	0.105802	-0.06926	-0.20498	-0.21718	-0.09467	0.125272	0.375934	0.519161	0.474798	0.288323	0.086851	-0.072	-0.18524	-0.21389	-0.12249
A1_3850_RMS	0.101906	0.333457	0.433539	0.428644	0.468185	0.559687	0.493268	0.290853	0.243885	0.378372	0.459349	0.367	0.280097	0.346219	0.444521	0.426824	0.35611	0.350698	0.368223	0.343981	0.281085	0.159852	-0.00149	-0.11485	-0.11062	-0.00516	0.194695	0.425409	0.573713	0.533127	0.342744	0.134635	-0.03837	-0.17589	-0.22455	-0.1247
A1_3900_RMS	0.019998	0.263723	0.398455	0.409147	0.458816	0.579477	0.565546	0.352833	0.239376	0.365484	0.483841	0.373977	0.242627	0.330383	0.492851	0.470598	0.34701	0.295077	0.287773	0.252868	0.193441	0.099463	-0.02466	-0.09332	-0.06699	0.042073	0.201082	0.388452	0.519513	0.481159	0.312972	0.127203	-0.03005	-0.17858	-0.25872	-0.19482
A1_3950_RMS	-0.0038	0.243124	0.408189	0.462914	0.512521	0.614579	0.634969	0.458511	0.331346	0.422203	0.522828	0.421931	0.290351	0.385126	0.539259	0.503262	0.378165	0.329808	0.299782	0.231348	0.165857	0.094972	0.005701	-0.03011	0.031345	0.142068	0.267358	0.414984	0.523088	0.488863	0.33499	0.176694	0.030501	-0.12783	-0.23324	-0.19234
A2_3700_RMS	0.737721	0.628781	0.445943	0.308889	0.273467	0.289924	0.312658	0.373807	0.519768	0.661244	0.631077	0.466597	0.325419	0.278716	0.279375	0.313742	0.412528	0.544291	0.61435	0.593531	0.539094	0.481442	0.436215	0.422546	0.45152	0.431243	0.389501	0.435874	0.570813	0.639995	0.564704	0.476016	0.508665	0.614653	0.697877	0.743776
A2_3750_RMS	0.721674	0.636702	0.461728	0.308873	0.243566	0.236228	0.234877	0.279872	0.432435	0.573441	0.543052	0.38213	0.247611	0.200008	0.212349	0.263678	0.392013	0.543339	0.610298	0.562529	0.491096	0.471017	0.464687	0.431436	0.400265	0.384304	0.383681	0.428759	0.529615	0.59587	0.559478	0.502667	0.546288	0.6309	0.671497	0.700637
A2_3800_RMS	0.609195	0.537915	0.349949	0.166554	0.076925	0.073011	0.095658	0.162688	0.319609	0.471556	0.453744	0.279399	0.119995	0.063088	0.074199	0.152971	0.312719	0.501671	0.605034	0.564734	0.45779	0.421155	0.448819	0.436439	0.385819	0.351776	0.359244	0.403261	0.491044	0.549584	0.522889	0.46954	0.51439	0.569868	0.574811	0.583191
A2_3850_RMS	0.704967	0.588939	0.3577	0.163328	0.10108	0.122934	0.132622	0.163119	0.304407	0.473889	0.484938	0.339103	0.189443	0.127952	0.129667	0.198703	0.342746	0.50635	0.598071	0.579276	0.49568	0.485828	0.561521	0.586465	0.496281	0.42247	0.447079	0.521963	0.575599	0.572785	0.55177	0.568149	0.647205	0.671159	0.643544	0.674907
A2_3900_RMS	0.671549	0.535971	0.30556	0.124174	0.080886	0.109459	0.111611	0.114022	0.224014	0.394919	0.431226	0.316726	0.183262	0.125437	0.128305	0.185759	0.293762	0.413983	0.490999	0.502936	0.466929	0.484217	0.595221	0.642392	0.518789	0.396489	0.430245	0.531269	0.553758	0.510526	0.523135	0.620611	0.716822	0.684471	0.619636	0.648827
A2_3950_RMS	0.682226	0.542091	0.31817	0.155273	0.126437	0.17415	0.177088	0.16144	0.251234	0.406226	0.453387	0.359155	0.234824	0.168295	0.160153	0.213136	0.308132	0.391835	0.451085	0.48578	0.491417	0.52438	0.647441	0.724683	0.61403	0.466259	0.484488	0.584905	0.588141	0.531558	0.56069	0.69802	0.78651	0.732225	0.658421	0.681563
A3_3700_RMS	0.600951	0.605662	0.578775	0.528556	0.478118	0.450778	0.469954	0.489891	0.468818	0.483886	0.538159	0.565867	0.535387	0.459794	0.389529	0.384992	0.43206	0.500164	0.559848	0.561705	0.493022	0.369395	0.227298	0.102397	0.043951	0.109671	0.293209	0.455402	0.459163	0.326553	0.199829	0.156314	0.180357	0.256146	0.379034	0.518414
A3_3750_RMS	0.455621	0.491469	0.487988	0.442406	0.402497	0.404019	0.419184	0.40142	0.372086	0.431046	0.503292	0.501236	0.443066	0.420915	0.416214	0.390374	0.359534	0.385612	0.467852	0.500088	0.434706	0.288429	0.121121	-0.01589	-0.08351	-0.03447	0.121022	0.261593	0.260812	0.137829	0.051779	0.032808	0.060559	0.12423	0.235414	0.36709
A3_3800_RMS	-0.56016	-0.33261	-0.23908	-0.36766	-0.37885	-0.1021	0.090609	-0.01316	-0.15132	-0.04518	0.199378	0.280228	0.186123	0.158555	0.198344	0.122119	-0.00278	-0.00222	0.080491	0.094474	-0.01504	-0.2115	-0.46873	-0.76659	-1.03309	-1.11776	-1.00051	-0.91838	-1.02184	-1.22139	-1.3456	-1.33073	-1.1485	-0.86158	-0.64768	-0.63238
A3_3850_RMS	0.351012	0.307084	0.134585	0.175989	0.553034	0.895237	0.851564	0.565074	0.461447	0.631456	0.761324	0.699443	0.640331	0.712241	0.801016	0.779381	0.700688	0.678605	0.712348	0.697375	0.579841	0.4215	0.295814	0.205129	0.127963	0.079596	0.115258	0.17134	0.149916	0.022549	-0.1262	-0.22735	-0.24585	-0.17142	-0.0084	0.208783
A3_3900_RMS	0.428686	0.416074	0.324781	0.365625	0.61289	0.825412	0.765751	0.552702	0.506595	0.663715	0.726951	0.608022	0.564459	0.716039	0.838967	0.748588	0.595452	0.560037	0.618151	0.610076	0.492372	0.361854	0.288674	0.254771	0.221531	0.208488	0.276737	0.36478	0.342421	0.221009	0.130659	0.097314	0.075903	0.073181	0.151224	0.31088
A3_3950_RMS	0.479805	0.496712	0.436478	0.454832	0.645627	0.829503	0.79403	0.620305	0.583114	0.714488	0.752563	0.643788	0.621759	0.793964	0.903769	0.785184	0.601905	0.561845	0.607349	0.576906	0.438331	0.321225	0.279467	0.27553	0.255546	0.248097	0.322321	0.417827	0.398634	0.287387	0.220077	0.20649	0.182045	0.163648	0.221434	0.355603
A4_3700_RMS	0.232762	0.267652	0.217177	0.051825	-0.0952	-0.13825	-0.13045	-0.11472	-0.03733	0.092579	0.141363	0.071256	4.46E-05	0.017418	0.07563	0.123555	0.195059	0.343912	0.53308	0.645574	0.629805	0.576687	0.58158	0.625382	0.666511	0.650679	0.622977	0.621011	0.608991	0.546614	0.485942	0.484878	0.486997	0.423709	0.311065	0.228193
A4_3750_RMS	0.168944	0.164297	0.116378	-0.01953	-0.14125	-0.18127	-0.16415	-0.13374	-0.05795	0.062759	0.107139	0.024012	-0.06867	-0.04888	0.0454	0.11143	0.166482	0.295103	0.485371	0.613032	0.601979	0.555999	0.61818	0.732254	0.753366	0.657217	0.603865	0.653904	0.663417	0.567258	0.486077	0.489228	0.493484	0.436342	0.329128	0.21697
A4_3800_RMS	0.134538	0.102749	0.05751	-0.05469	-0.13803	-0.14358	-0.11804	-0.09402	-0.03738	0.067917	0.099515	0.019942	-0.07793	-0.03802	0.07344	0.14387	0.184361	0.295954	0.476119	0.599602	0.586509	0.567295	0.67244	0.801483	0.772262	0.623472	0.5878	0.670693	0.67809	0.565358	0.493652	0.525338	0.535081	0.458094	0.336126	0.21739
A4_3850_RMS	0.201567	0.185956	0.129157	-0.00333	-0.12401	-0.15848	-0.12635	-0.06321	0.044727	0.185175	0.232855	0.131524	0.005523	0.003489	0.09465	0.157579	0.190517	0.296437	0.479702	0.603552	0.602678	0.616317	0.778119	0.931363	0.85993	0.669789	0.647675	0.779179	0.654096	0.591815	0.637395	0.633627	0.518552	0.374833	0.259316	
A4_3900_RMS	0.177184	0.126058	0.051584	-0.07515	-0.19237	-0.22478	-0.18672	-0.09576	0.031099	0.173505	0.208077	0.099853	-0.02302	-0.02307	0.054873	0.097607	0.115137	0.205587	0.375424	0.487625	0.491303	0.553608	0.764644	0.956461	0.879877	0.663379	0.619708	0.754064	0.786079	0.658816	0.580055	0.639345	0.669317	0.558236	0.385002	0.252524
A4_3950_RMS	0.217072	0.146571	0.070844	-0.04482	-0.15702	-0.20099	-0.16385	-0.08332	0.040994	0.172129	0.198382	0.09291	-0.01351	0.004662	0.088125	0.123145	0.11																			

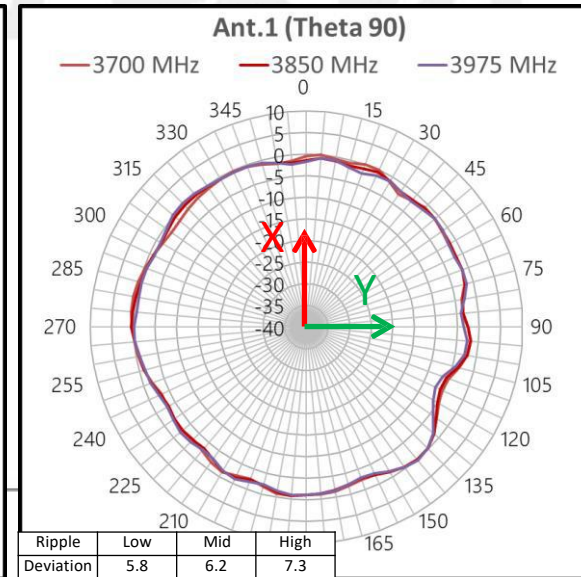
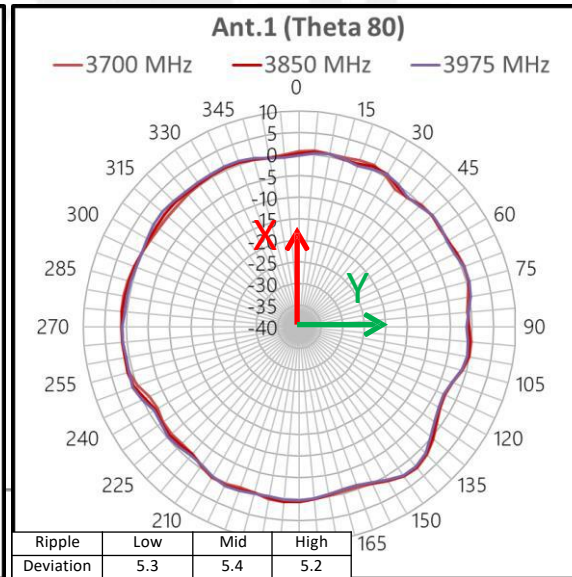
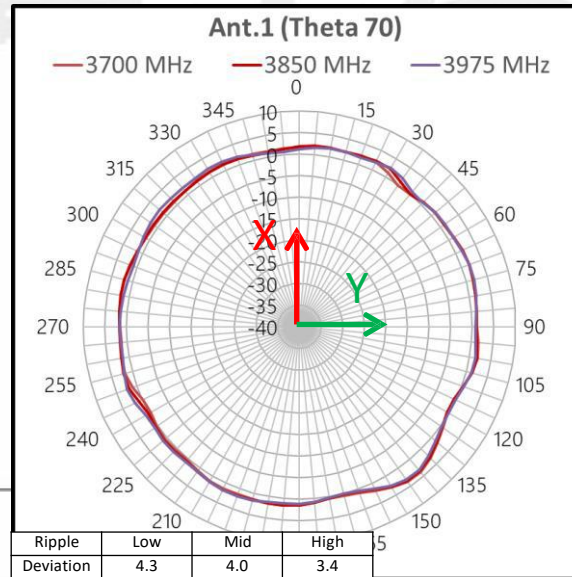
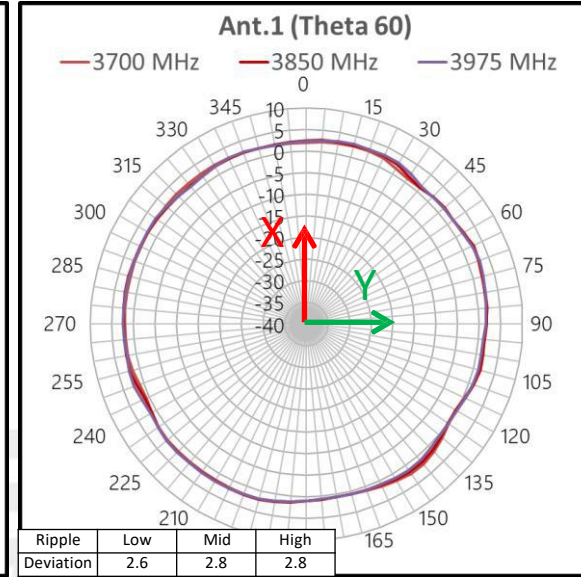
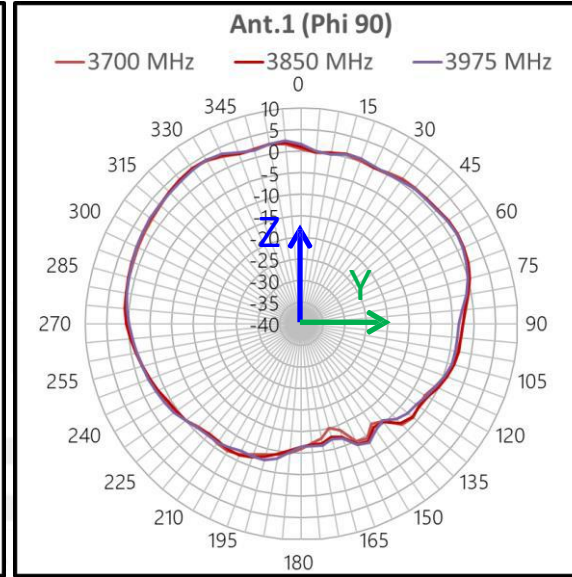
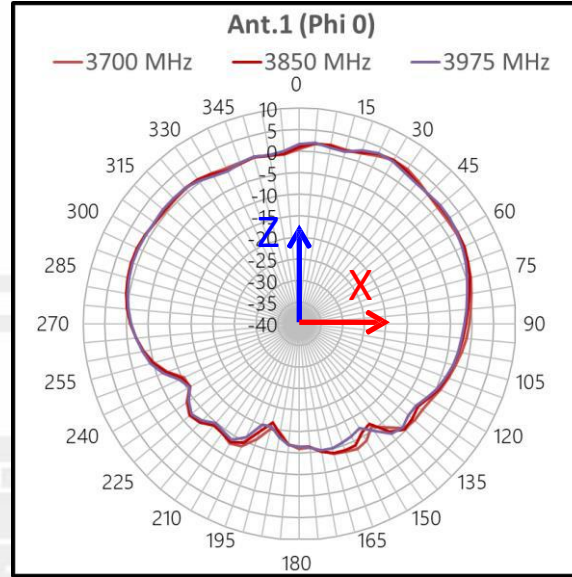
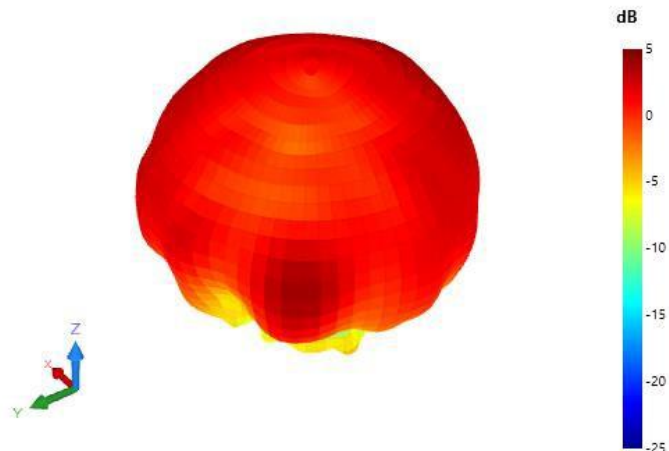


# Radiation Pattern – A1

- Both elevation section (Phi 0° /Phi 90°) demonstrate without any null happen on the +z direction, this pattern can handle both wall/ceiling mount in the same time.
- Azimuth section (Theta 60°) perform omni-directional property, the gain flatness less 3 dB over frequency.

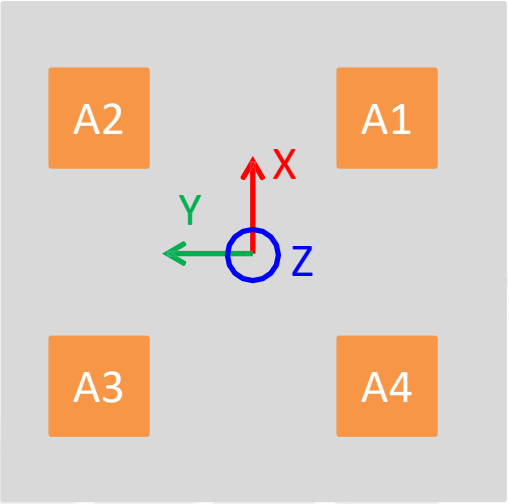


[Gain] Elevation over Azimuth (Gain in dB)

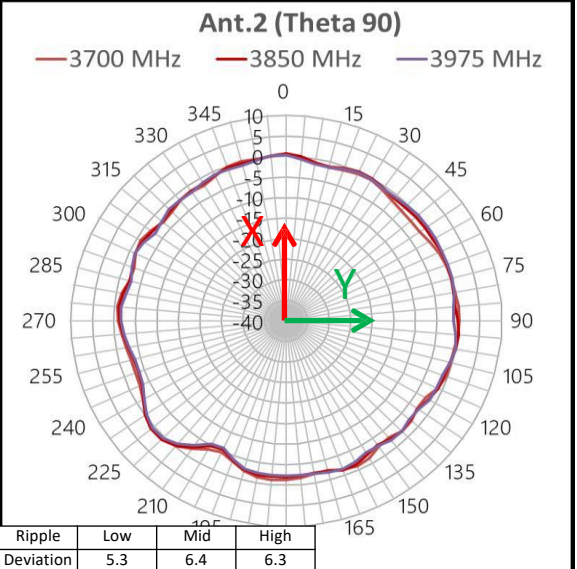
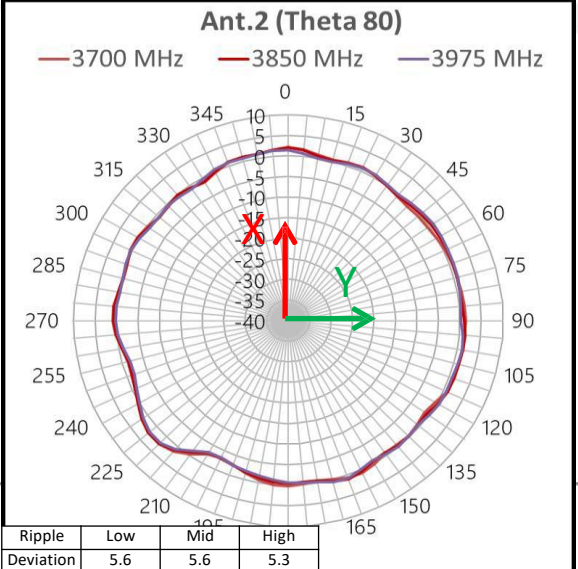
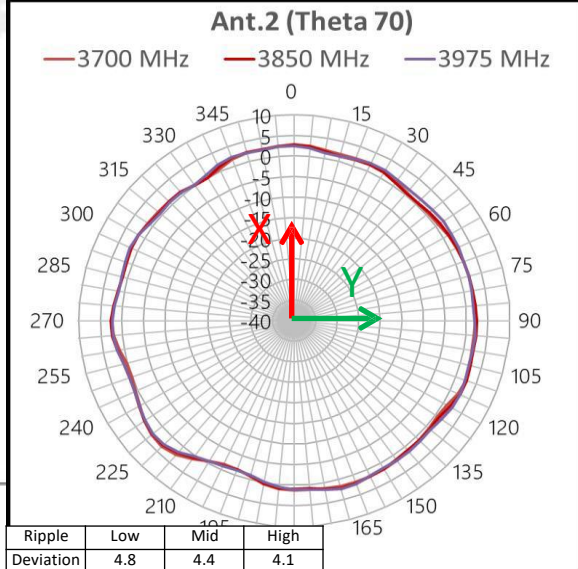
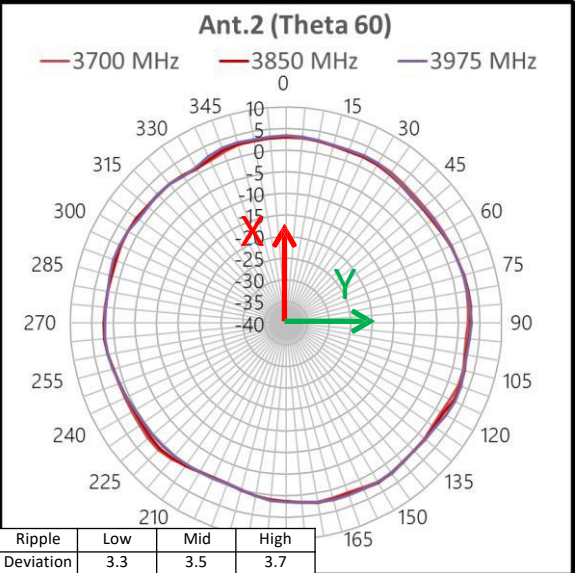
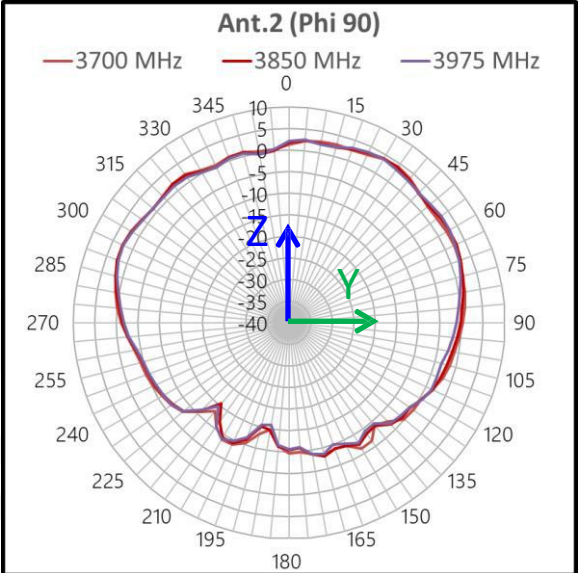
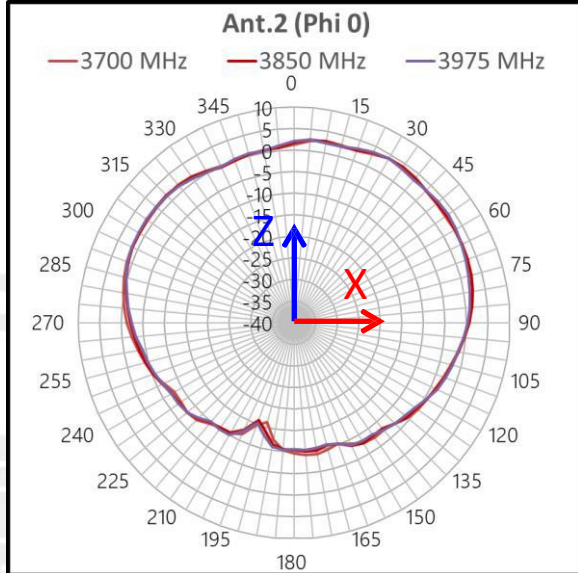
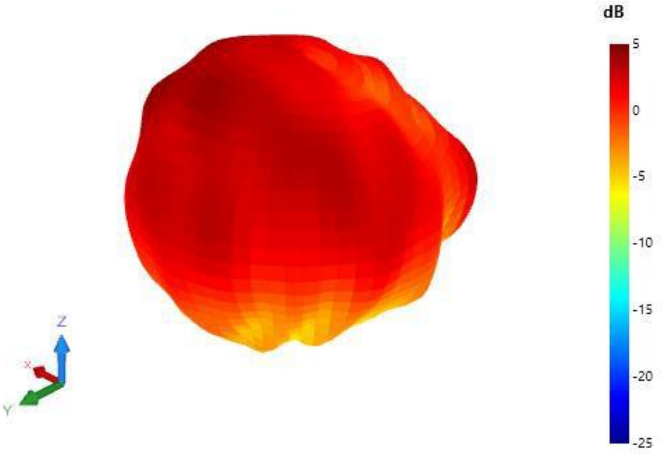


# Radiation Pattern – A2

- Both elevation section (Phi 0° /Phi 90°) demonstrate without any null happen on the +z direction, this pattern can handle both wall/ceiling mount in the same time.
- Azimuth section (Theta 60°) perform omni-directional property, the gain flatness less 4 dB over frequency.

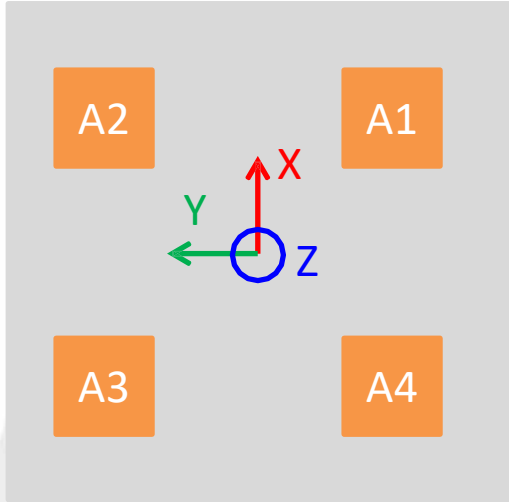


[Gain] Elevation over Azimuth (Gain in dB)

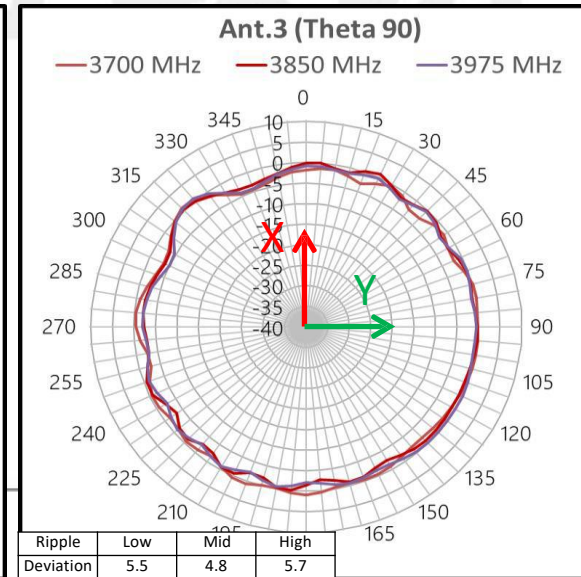
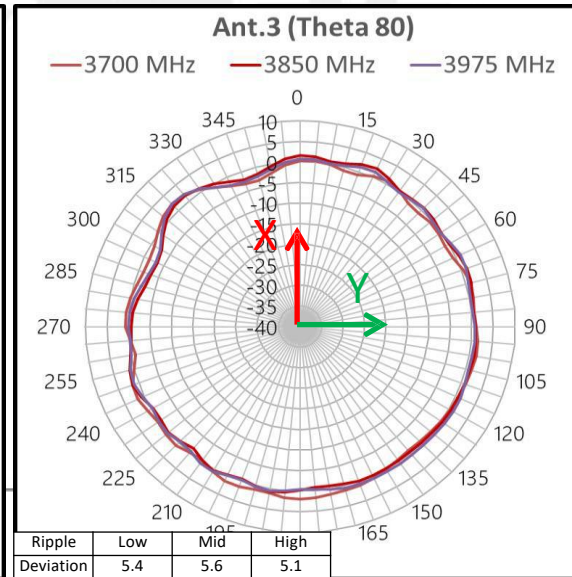
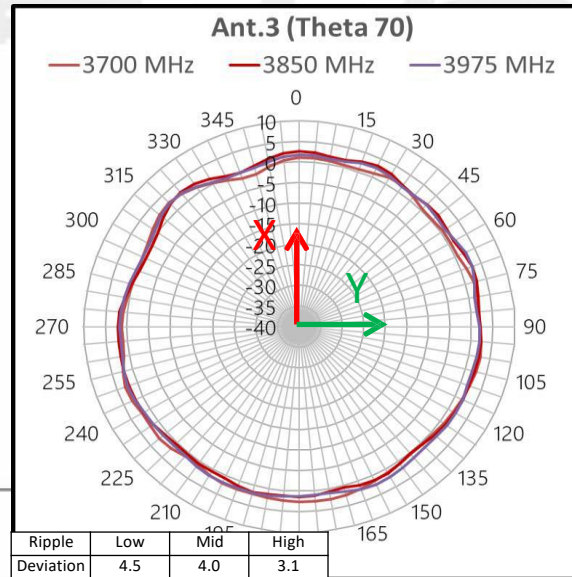
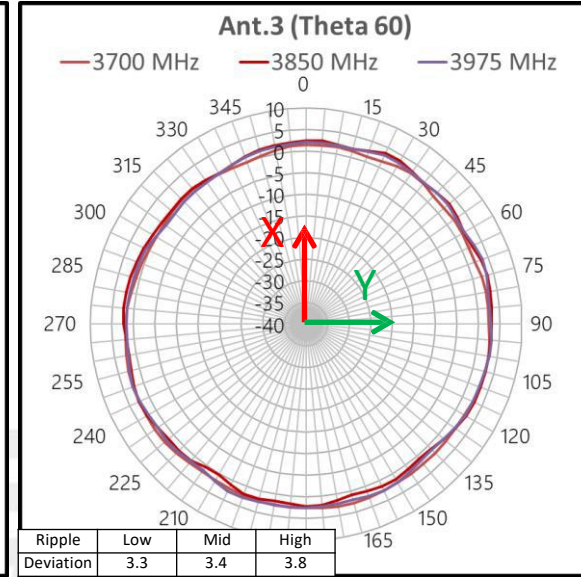
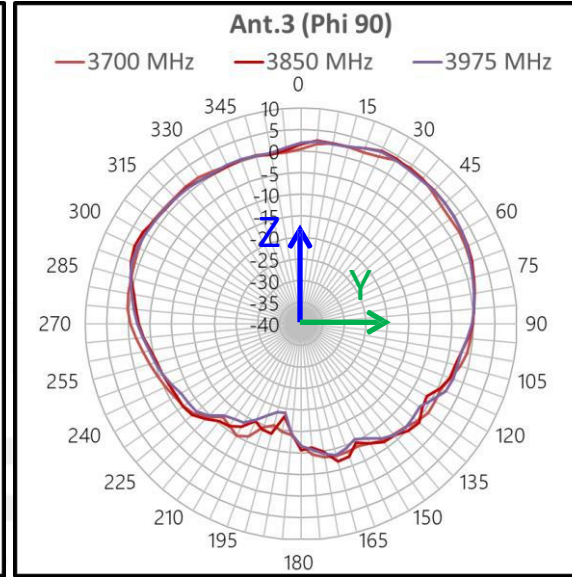
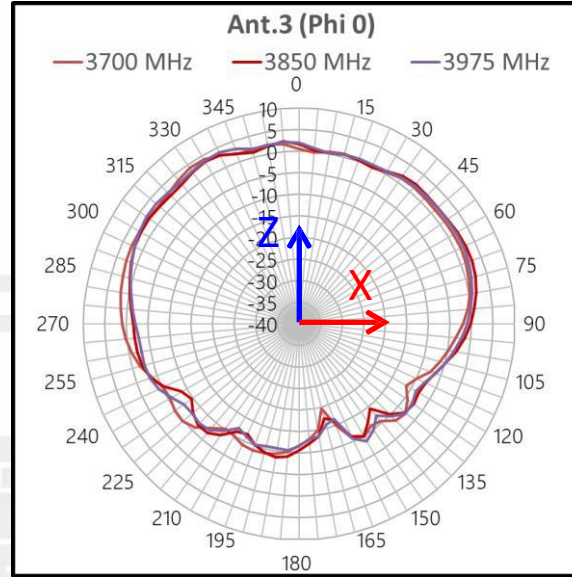
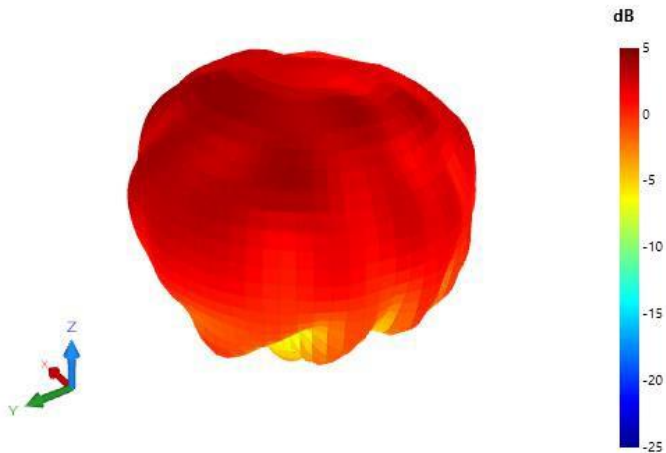


# Radiation Pattern – A3

- Both elevation section (Phi 0° /Phi 90°) demonstrate without any null happen on the +z direction, this pattern can handle both wall/ceiling mount in the same time.
- Azimuth section (Theta 60°) perform omni-directional property, the gain flatness less 4 dB over frequency.

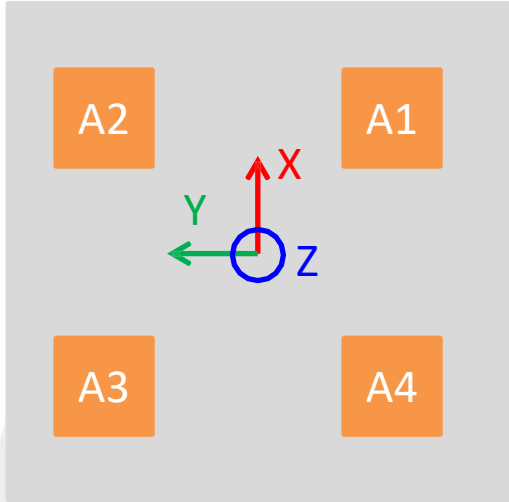


[Gain] Elevation over Azimuth (Gain in dB)



# Radiation Pattern – A4

- Both elevation section (Phi 0° /Phi 90°) demonstrate without any null happen on the +z direction, this pattern can handle both wall/ceiling mount in the same time.
- Azimuth section (Theta 60°) perform omni-directional property, the gain flatness less 4 dB over frequency.



[Gain] Elevation over Azimuth (Gain in dB)

