

# Build #3

## DOE6\_1 to DOE6\_5

### T9505A\_1 (12 mm)



Bhagath Talluri  
12-04-2022

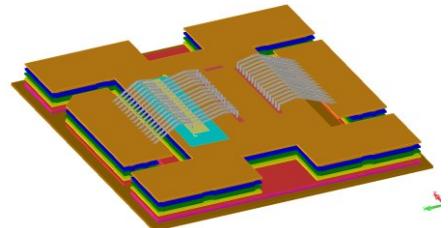
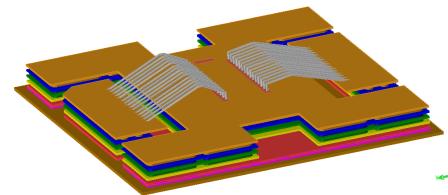
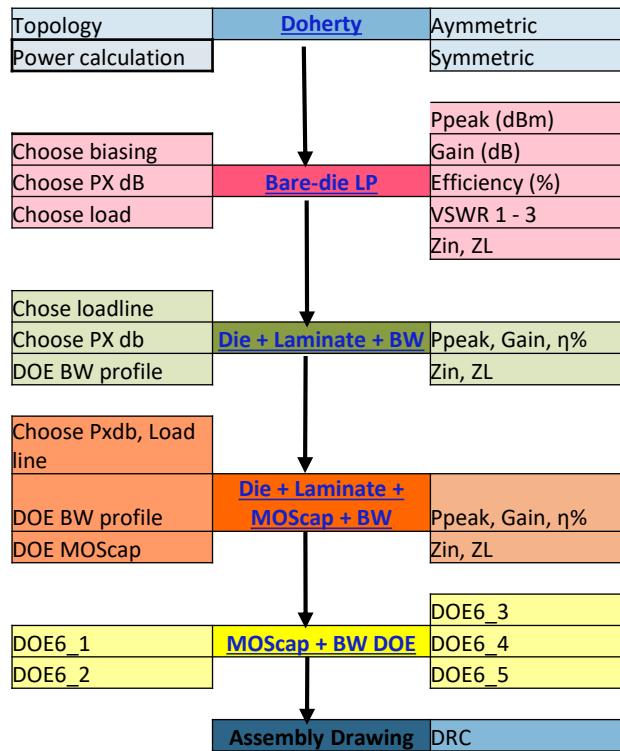


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# Design approach



# Build tracking: starting point

## Minipack build tracking



Assembly/build order	Variant [DOE]	RF GaN device geometry	RF GaN device name	RF GaN device wafer	RF GaN Die X (um)	RF GaN Die Y (um)	Wafer number (GaN)
3	DOE6_1	12 (30*400um)	T9505A_1	1692	816	RU149505.11 wfr#18	R
3	DOE6_2	12 (30*400um)	T9505A_1	1692	816	RU149505.11 wfr#18	R
3	DOE6_3	12 (30*400um)	T9505A_1	1692	816	RU149505.11 wfr#18	R
3	DOE6_4	12 (30*400um)	T9505A_1	1692	816	RU149505.11 wfr#18	R
3	DOE6_5	12 (30*400um)	T9505A_1	1692	816	RU149505.11 wfr#18	R

## RFP\_tech\_product catalog -PL55 (Active GaN die)

Tech	Mask Code	reticle kind	D9 released basetype	Die X (um)	Die Y (um)	die area	aspect ratio	Si Thickness [µm]	Substrate	Substrate Name	suitable for 30V & 50V	cap value [pF]	Oxide [nm]	SiN [nm]	RF Top plate X [um]	RF Top plate Y [um]	RF top plate area [mm²]	BS metal
LD8C	N9501B_V4	shared	-	1770	536	0,95	3,30	85	N_3.5mOhmcm	L001-L004	x	10,22 => 10,30	1300	150	1466	261	0,38	Ag
LD8C	N9501B_V8	shared	-	1770	536	0,95	3,30	85	N_3.5mOhmcm	L001-L004	x	8,09 => 8,19	1300	150	1466	207	0,30	Ag
LD8C	N9501B_V5	shared	-	1770	536	0,95	3,30	85	N_3.5mOhmcm	L001-L004	x	6,5 => 6,58	1950	150	1466	244	0,36	Ag

# MOScap alternative: substrate N044

Dear Colleagues,

Yesterday I had a call with Helmut B. regarding the possible impact of the Moscaps resistivity in the performance of the matched devices. I would like to bring to your attention the following (in case you are not aware),

- We have two main substrates, the POR and N044
- The N044 is better than the POR for the losses
- There are several lots with those substrates
- The table below (provided by Michaela B. to Helmut) shows more details

Please consider this information in future designs so that the best capacitors can be selected.

@Fichtner Niklaus (IFAG PSS RFS D2 RFC TRD) Can you please confirm if the right information is included in the design environment?

Please fw this information to others that might be interested.

Thank you all and best regards,  
Sergio

## N9500B LD8C shared reticle

FE Lot	FE Test	# wafer	Dielectric info	Special info	Basic type	location	Invoice no./Tracking no.	Wafermap/ Picking request	Comment
RU105508.02	yes	#17	900nm SiOx	POR	N9500B	MSE	6600285283 / 730867642	Chip V5 (10.3pF): WMAP_RU105508.37_RU105508	
RU105508.02	yes	#16	900nm SiOx	POR, single dies picked	N9500B	RGB	-	Chip V5 (10.3pF): WMAP_RU105508_RU105508.36_RE	
RU105508.02	yes	#19	900nm SiOx	Special substrate N044	N9500B	RGB	-		
RU105508.03	yes	#13	1700nm SiOx	POR	N9500B	MSE	6600274508 / 369129574	Chip V4 (6pF): WMAP_RU105508.44_RU105508	
RU105508.03	yes	#14	1700nm SiOx	POR	N9500B	VIH->RGB		Chip V5 (5.7pF): WMAP_RU105508.45_RU105508	
RU105508.03	yes	#15	1700nm SiOx	POR	N9500B	AMKOR	6600265155 / 103657990732	Chip V6 (5.6pF): WMAP_RU105508_RU105508.43_RE	
RU105508.03	yes	#20	1700nm SiOx	Special substrate N044, single dies picked	N9500B	RGB	-	Chip V6 (5.6pF): RU105508.09_RU105508.40	
RU105508	yes	#01	1950nm SiOx	POR, single dies picked	N9500B	RGB	-	Chip V5 (5.7pF): RU105508.09_RU105508.41	
RU105508	yes	#02	1950nm SiOx	POR	N9500B	RGB	-		
RU105508	yes	#03	1950nm SiOx	POR	N9500B	RGB	-		

Shared reticle definition/details (tab > Cap decode): "[\\mucsdv534.infineon.com\RFIS\PG\\_W1\90\\_Techinfo\RFP\\_tech\\_product\\_catalog -PL55.xlsx](\\mucsdv534.infineon.com\RFIS\PG_W1\90_Techinfo\RFP_tech_product_catalog -PL55.xlsx)"

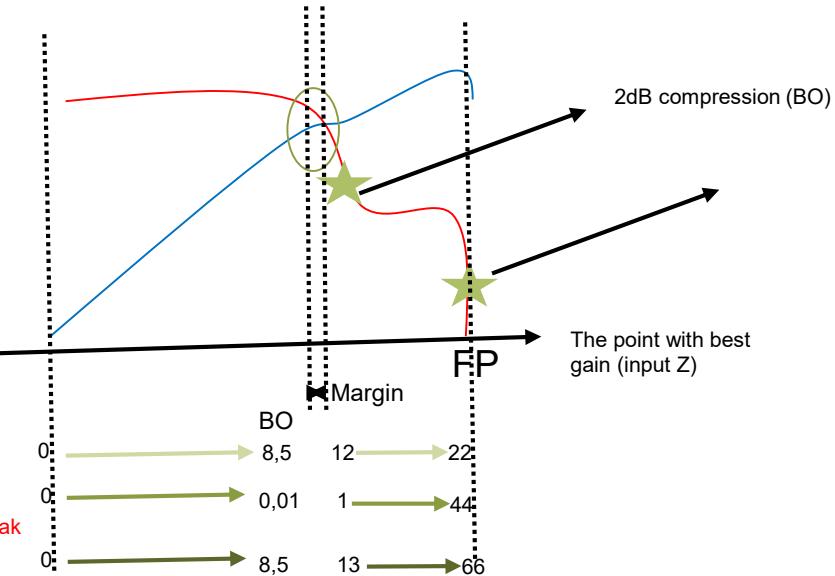
## N9501B LD8C shared reticle

FE Lot	FE Test	# wafer	Dielectric info	Special info	Basic type	location	Invoice no./Tracking no.	Wafermap/ Picking request	Comment
RU105508.04	yes	#10	1300nm SiOx	POR, single dies picked	N9501B	RGB	-	Chip V4 (10.3pF): 30	
RU105508.04	yes	#11	1300nm SiOx	POR	N9501B	RGB	-		
RU105508.04	yes	#12	1300nm SiOx	POR	N9501B	RGB	-		
RU105508.04	yes	#21	1300nm SiOx	Special substrate N044	N9501B	RGB	-		
RU105508.05	yes	#07	1950nm SiOx	POR	N9501B	AMKOR	6600265156 / 103657990743	Chip V5 (6.6pF): RU105508.08_RU105508.42	
RU105508.05	yes	#08	1950nm SiOx	POR	N9501B	VIH->RGB			
RU105508.05	yes	#09	1950nm SiOx	POR	N9501B	MSE	6600274508 / 369129574	Chip V5 (6.6pF): WMAP_RU105508.46_RU105508	
RU105508.05	yes	#22	1950nm SiOx	Special substrate N044, single dies picked	N9501B	RGB	-	Chip V6 (6.3pF): WMAP_RU105508.04_RU105508	08.07.2021 09:14 JEDEC-Daten
RU105508.06	yes	#04	3100nm SiOx	POR, single dies picked	N9501B	RGB	-	Chip V1 (5.6pF): WMAP_RU105508.04_RU105508.34_RE	
RU105508.06	yes	#05	3100nm SiOx	POR	N9501B	RGB	-		
RU105508.06	yes	#06	3100nm SiOx	POR	N9501B	RGB	-		

# Power calculation: Asymmetric Doherty

Specification		P3dB (MHz)	P3dB (W)	PAR				
Project	Frequency-Range (MHz)	3400 - 3800	47,4	54,95				
	Pavg (dBm)		39	8,4				
	Pavg (W)		7,94					
Doherty Topology	Remark	Ratio	Main (W)	Peak (W)				
2-way asymmetric	To maximize efficiency	2	18,32	36,64				
Estimation including loss								
	Required power (W)	Required power (dBm)	Loss (dBm)	Total required power (dBm)				
Main	18,32	42,63	0,8	43,43				
Peak	36,64	45,64	0,8	46,44				
	Total output power (dBm)	PAR	Power @ MXE (dBm)	Margin (dB)	Power @ MXE (dBm)	Power @ MXE (W)	MXP (W)	MXP (dBm)
Main	48,2	8,4	39,8	1,00	40,80	12,02	22,02	43,43
Peak			Peak_start_ideal		Peak_start	0,01	44,05	46,44

Required power from peak



- › Maximize Gain
  - › Main section gain as high as possible while maintaining Power @ MXE
  - › Peak section gain as high as possible while maintaining MXP

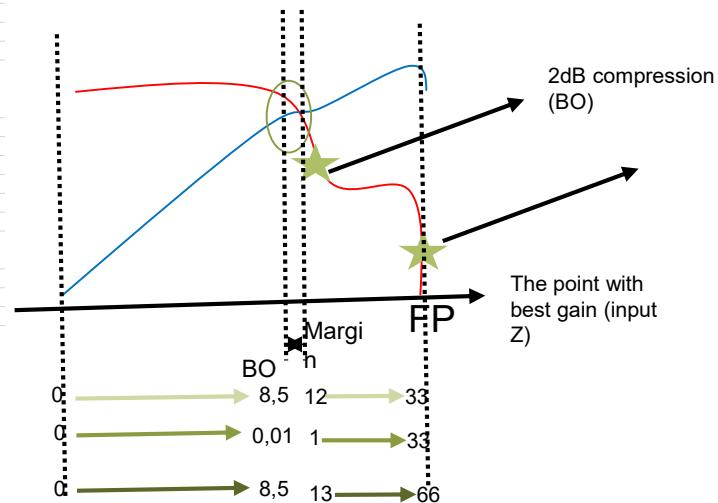


# Power calculation: Hybrid Symmetric Doherty

Doherty Topology	Remark	Ratio	Main (W)	Peak (W)
Symmetric	Maximize BW	1	27,48	27,48

Estimation including loss								
	Required power (W)	Required power (dBm)	Loss (dBm)	Total required power (dBm)	Total required power (W)	Ratio	Total power (W)	Total power (dBm)
Main	27,48	44,39	0,8	45,19	33,03		66,07	48,2
Peak	27,48	44,39	0,8	45,19	33,03			

	Total output power	PAR	Power @ MXE (dBm)	Margin (dB)	Power @ MXE (dBm)	Power @ MXE (W)	MXP (W)	MXP (dBm)
Main	48,2	8,4	39,8	1,00	40,80	12,02	33,03	45,19
Peak			Peak_start_ideal		Peak_start	0,01	33,03	45,19



## Maximize Gain

- >Main section gain as high as possible while maintaining Power @ MXE
- Peak section gain as high as possible while maintaining MXP

# Power scaling (based on simulation)

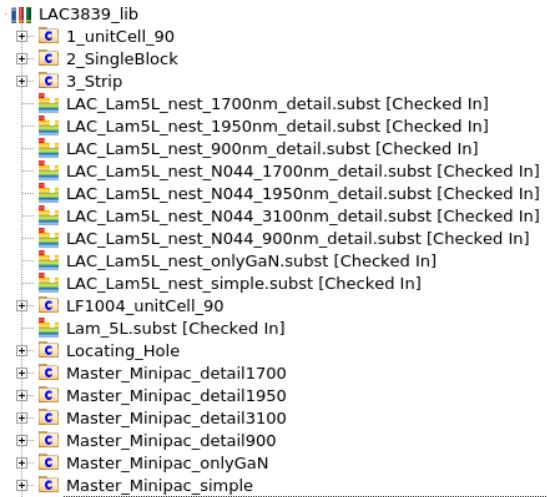
Available dies	Device geometry (mm)	Power scaling (W/mm)	Power deliverd (dBm)	Power deliverd (W)	
P19	5,76 (24x240um)				
P6	5,76 36x160um				
P3	4,8 30x160um	3,88	42,7	18,62	
P14	5,12 16X320um				
P76	10,1 42x240 um				
T9503A_1	12 30X400um	5,48	48,18	65,77	
P39	11,52 36x320um				
P35	10,24 32x320um				
T9507B_2	2,4 6x400um				
P47_RF	1,92 8X240um				
P13	3,84 12X320um				
P10	3,84 16X240um				
P15	6,4 20X320um				
P15	6,4 20X320um				

- › Update for
- › P1.5 dB, P3dB

- › 12 mm die has lot of power
  - › 65 W worst case vs needed 45 W worst case
  - › Can be made operated slightly lower than Class C enabling Main to match for more gain
- › Input matching can be designed for Max gain & reasonable gain still having enough power to deliver.

# Design on laminate DOE6

## › Laminate library:LAC3839\_lib

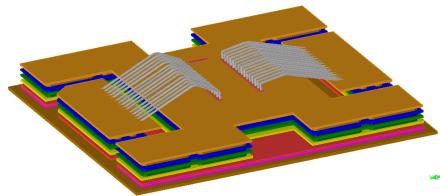


	GaN	MOSCap
Design	Die_GaN_v0_lib	IC_LD8C_lib
Assembly drawing		Central_v0_lib



# DOE6\_1: Laminate, Bond Wire selection

Input – Gate Bondwire						Selection	Simulation case	Output – Drain Bondwire						Selection	
Sl. No.	No. of wires	No. of sets	Length	Height	Pitch			Sl.No.	No. of wires	No. of sets	Length	Height	Pitch		
a	5	3	1070	150	85	Case iii	+	Case i	A	17	1	1070	150	75	B
b	5	3	1070	250	85	Case iv	+	Case ii	B	15	1	1070	150	89	
c	4	3	1070	250	107		+	Case v	C	15	1	1070	250	89	
						a	+	Case vi	D	12	1	1070	250	110	C
							+								

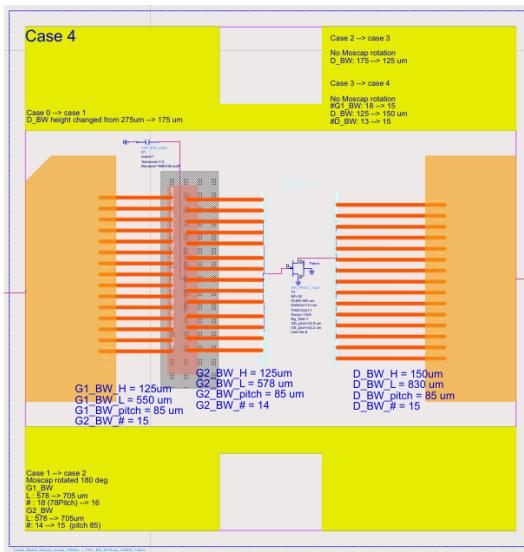


Simulation case	Input + Output	Objective
i	a + A	Check/select no. of wires for output (17 or 15 wires)
ii	a + B	Check/select height for gate BW (150 um or 250 um)
iii	b + B	Select No. of wires for gate BW (12 or 15)
iv	c + B	Select drain BW hieght (150 / 250 um,)
v	a+C	Select No. of drain BW (12 or 15)
vi	a+D	



# DOE6\_simulated cases: MOScap (5) X (5) BW profile (with simple EM model)

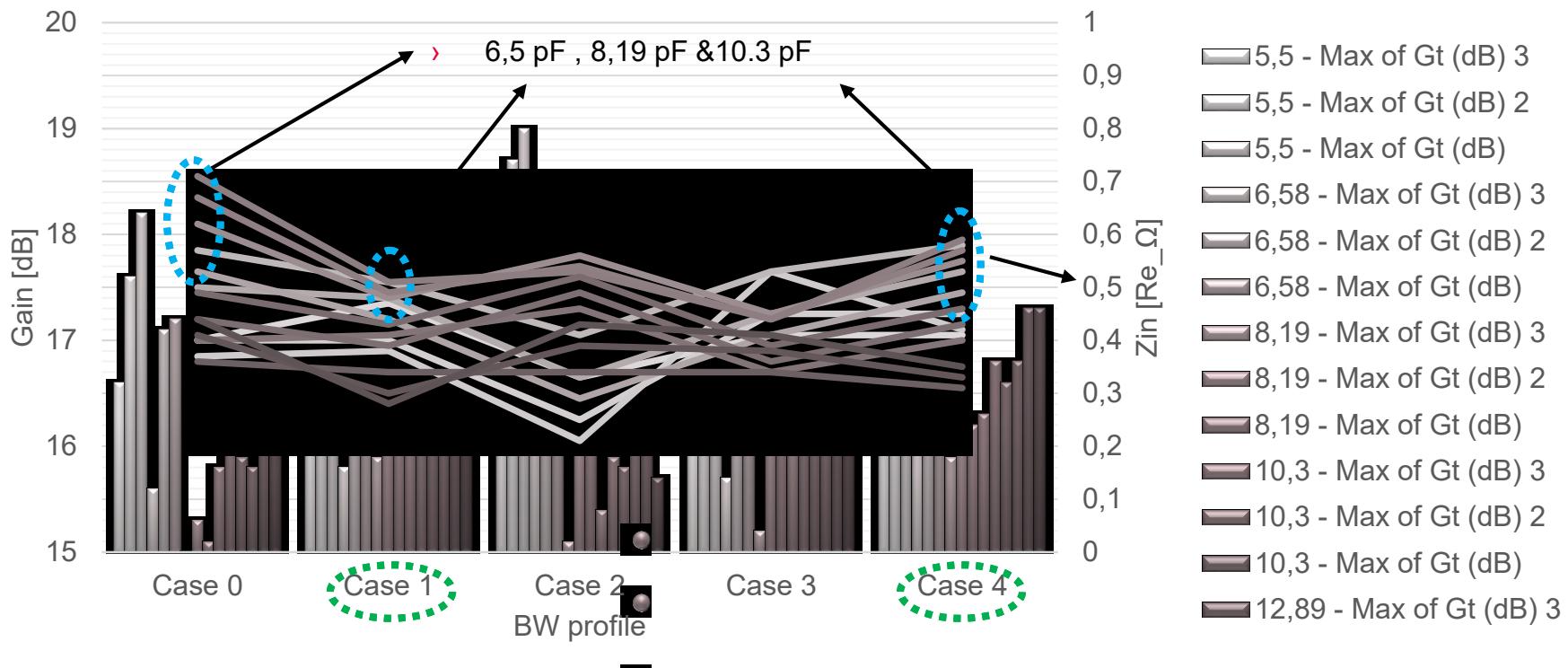
P1.5dB	Moscap		Z_load_1						Z_load_3						
Simulation case_BW_profile	Name	Value (pF)	Zin_Re (Ω)	Zin_imag (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)	Zin_Re (Ω)	Zin_L (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)	
Case 0	N9501B_V8	5,5	0,37	3,60	43,33	72,80	18,20	-8,50	0,40	2,7 - j 0,9	46,80	69,40	16,60	-7,60	
Case 0	N9501B_V5	6,58	0,53	3,60	43,40	74,60	17,20	-13,50	0,57	2,7 - j 0,9	46,74	70,50	15,60	-10,10	
Case 0	N9501B_V8	8,19	0,71	3,40	44,67	70,20	15,10	-19,00	0,62	3,1 - j 0,3	46,81	69,50	15,00	-10,70	
Case 0	N9501B_V4	10,3	0,49	3,45	43,79	63,30	15,90	-12,20	0,40	2,4 - j 0,3	46,68	65,30	15,80	-7,10	
Case 0	N9501B_V1	12,89	0,44	3,40	44,88	63,90	16,00	-10,30	0,36	3,1 - j 0,3	47,04	64,30	15,80	-6,70	
Case 1	N9501B_V8	5,5	0,38	3,50	44,42	73,10	18,20	-7,10	0,47	2,9 - j 0,3	46,70	70,00	16,90	-11,70	
Case 1	N9501B_V5	6,58	0,44	3,50	44,20	71,80	17,60	-8,30	0,51	2,7 - j 0,9	46,93	65,20	15,80	-12,00	
Case 1	N9501B_V8	8,19	0,51	3,50	44,28	68,20	16,40	-10,80	0,48	2,4 - j 0,3	46,90	65,60	15,90	-11,30	
Case 1	N9501B_V4	10,3	0,43	3,40	44,90	64,40	16,50	-9,40	0,41	2,7 + j 0,3	46,84	64,50	16,30	-10,00	
Case 1	N9501B_V1	12,89	0,28	3,40	44,22	60,50	17,20	-5,80	0,34	2,9 + j 0,3	46,93	63,70	16,50	-7,80	
Case 2	N9501B_V8	5,5	0,21	3,80	44,11	70,00	19,00	-4,10	0,33	2,7 - j 0,3	46,80	68,70	17,50	-7,60	
Case 2	N9501B_V5	6,58	0,29	3,80	44,27	71,70	18,40	-5,70	0,41	2,7 - j 0,3	46,70	69,20	16,90	-9,80	
Case 2	N9501B_V8	8,19	0,53	3,60	45,37	73,30	16,50	-13,00	0,56	2,9 - j 0,9	46,93	65,90	15,10	-12,90	
Case 2	N9501B_V4	10,3	0,52	3,70	44,85	68,20	15,80	-12,30	0,46	2,7 - j 0,3	47,05	64,90	15,40	-10,70	
Case 2	N9501B_V1	12,89	0,43	3,80	43,79	68,20	15,70	-9,00	0,34	2,4 + j 0,3	46,70	63,90	16,00	-7,80	
Case 3	N9501B_V8	5,5	0,53	3,50	44,85	76,20	17,50	-17,00	0,41	2,7 - j 0,3	46,99	67,40	16,60	-7,90	
Case 3	N9501B_V5	6,58	0,41	3,50	45,11	71,40	17,90	-11,70	0,53	2,7 - j 0,3	46,89	67,50	15,70	-9,40	
Case 3	N9501B_V8	8,19	0,44	3,40	45,13	67,60	16,90	-12,30	0,45	2,4 - j 0,3	47,08	63,10	15,20	-7,30	
Case 3	N9501B_V4	10,3	0,39	3,50	44,48	63,00	16,50	-10,80	0,34	2,4 + j 0,3	47,04	62,70	16,10	-6,50	
Case 3	N9501B_V1	12,89	0,41	3,50	44,61	63,20	16,70	-11,70	0,34	2,9 + j 0,8	46,87	63,90	16,40	-7,40	
Case 4	N9501B_V8	5,5	0,42	3,70	45,11	73,50	18,20	-10,70	0,41	2,7 - j 0,3	46,86	68,00	17,20	-10,90	
Case 4	N9501B_V5	6,58	0,49	3,70	44,92	72,70	17,60	-13,00	0,58	2,9 - j 0,3	46,79	69,20	16,00	-16,10	
Case 4	N9501B_V8	8,19	0,59	3,70	44,48	70,40	16,20	-16,80	0,55	2,7 + j 0,3	46,79	68,10	15,90	-15,20	
Case 4	N9501B_V4	10,3	0,46	3,60	44,72	64,70	16,60	-12,50	0,40	2,7 + j 0,3	47,03	64,00	16,30	-10,30	
Case 4	N9501B_V1	12,89	0,35	3,60	44,49	62,20	17,30	-8,90	0,31	2,7 + j 0,3	47,00	62,70	16,80	-7,80	



Index	L	W	ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,5
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
8	1446	207	1770	536	1300	8,19



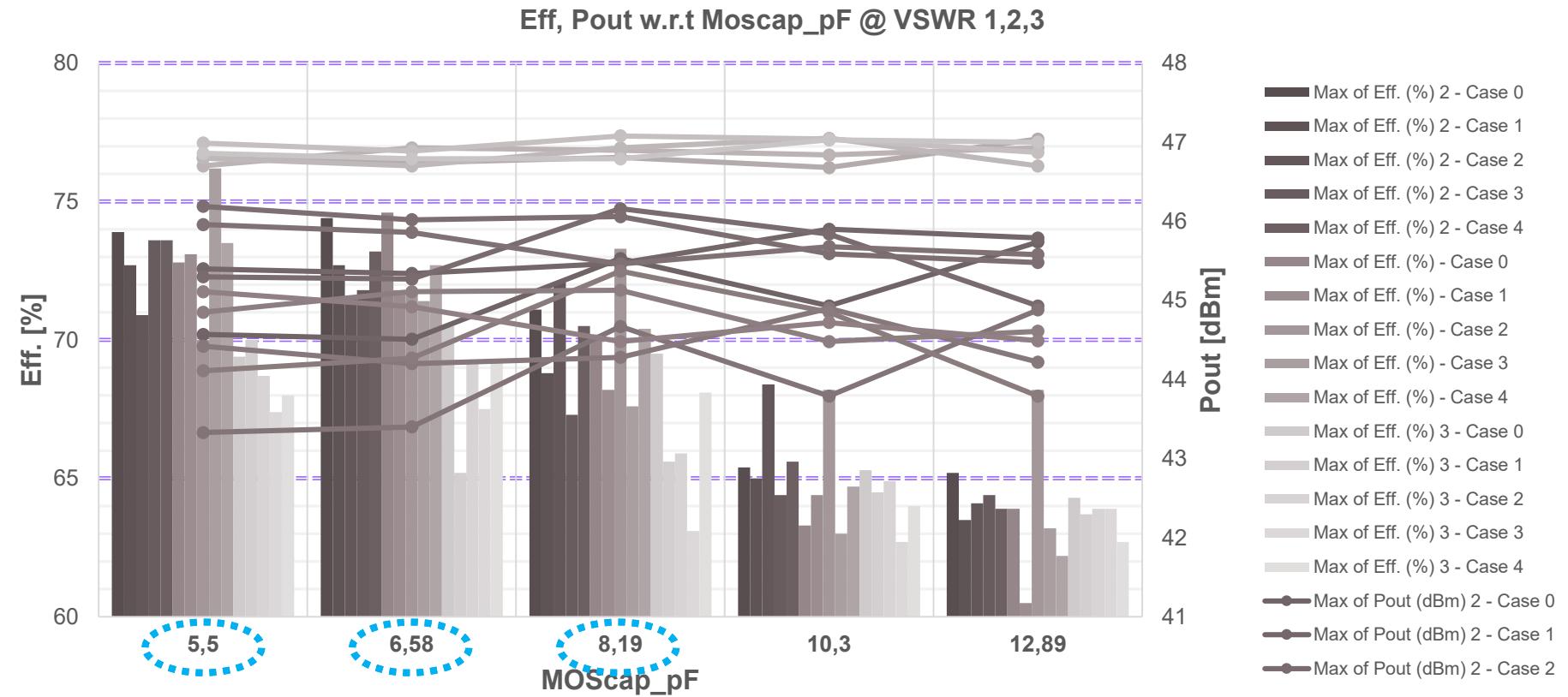
# Zin & Gt @ ZL w.r.t BW config. & MOScap



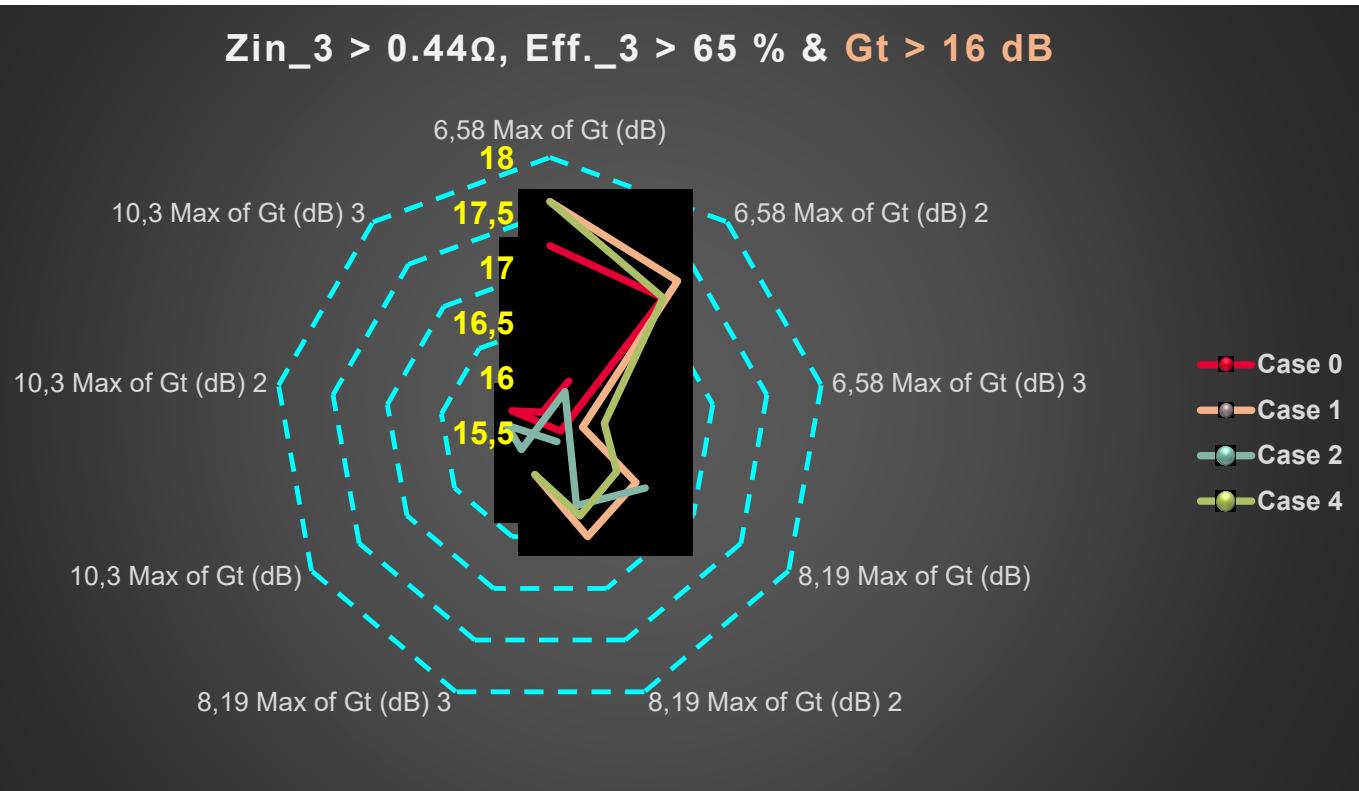
- Gain > 15,5 dB &  $Z_{in} > 0,45 \Omega$
- Flat response over load line

- All cases satisfy min. peak power of 46.8 dBm

# Eff. & Pout @ ZL w.r.t BW config. & MOScap



# MOScap selection



	Moscap (pF)				
	5,5	6,5	8,19	10,3	12,89
Case 0	5,5	6,5	8,19	10,3	12,89
Case 1	5,5	6,5	8,19	10,3	12,89
Case 2	5,5	6,5	8,19	10,3	12,89
Case 3	5,5	6,5	8,19	10,3	12,89
Case 4	5,5	6,5	8,19	10,3	12,89

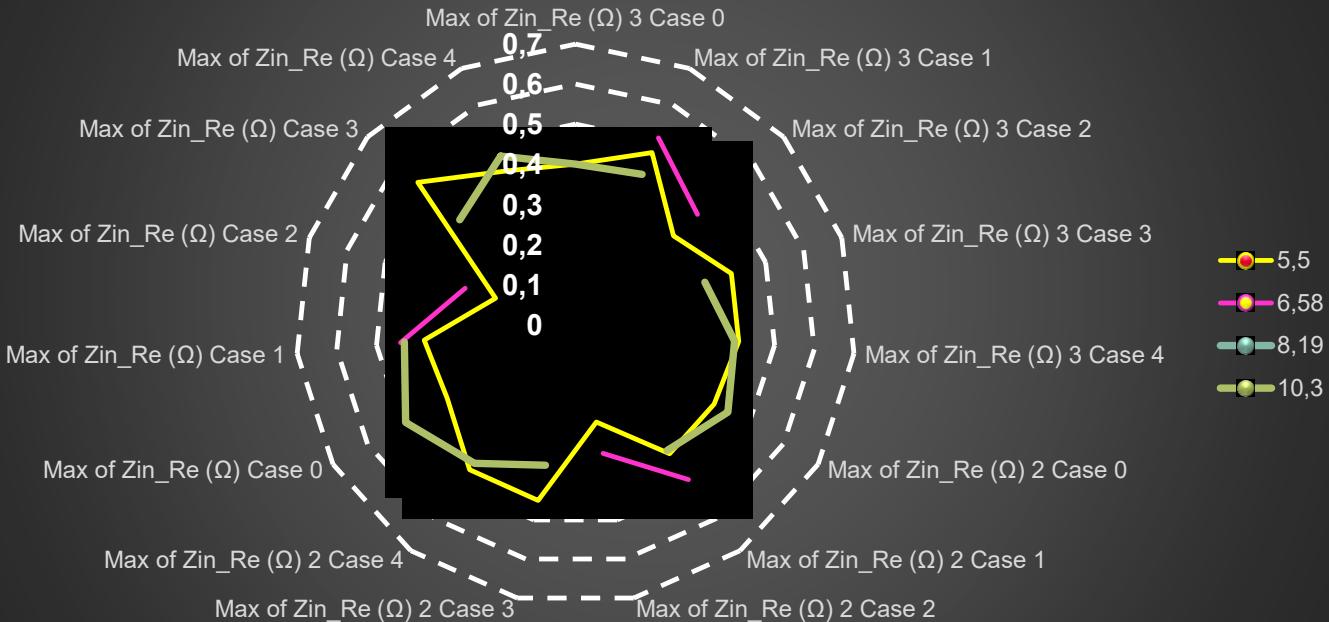
Pass Fail

Selected MOScap

6.5 pF, 8.19pF & 10.3 pF

# BW configuration selection

**Gt > 15.8dB, eff. > 65% & Zin > 0.43Ω**



Moscap (pF)	BW_config.				
5,5	Case0	case1	Case 2	case3	case4
6,58	case 0	case 1	Case 2	case 3	case 4
8,19	case 0	case 1	case 2	Case 3	case 4
10,3	Case 0	Case 1	Case 2	case 3	case 4
12,89	Case 0	case 1	Case 2	Case 3	case 4

PassFail

Selected BW. Config  
Case 1 & case 4

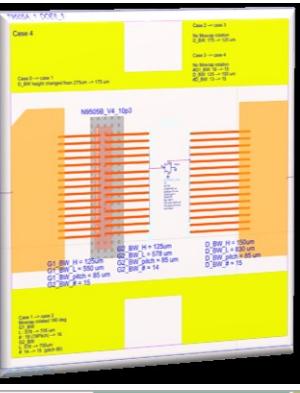
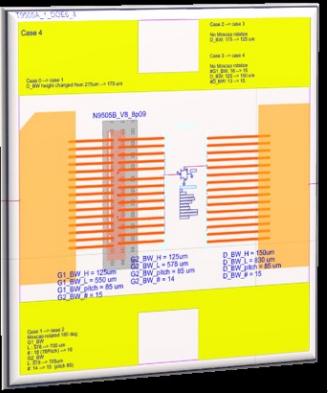
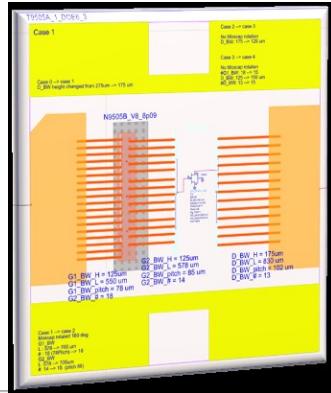
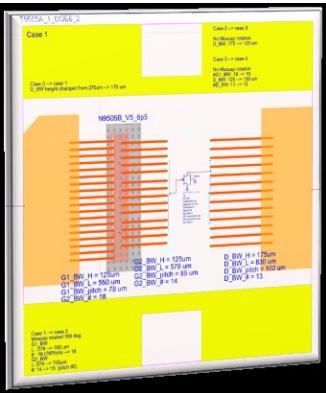
# DOE6 variants: Simple vs detailed EM simulation

Peaking device

Simple_EM	P1.5dB	Moscap		Max. performance @ P1.5dB			Z_load_1						Z_load_3						
		BW_profile	Name	Value (pF)	MXP (dBm)	MXE (%)	MXG (dB)	Zin_Re (Ω)	Zin_imag (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)	Zin_Re (Ω)	Zin_L (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)
DOE_var																			
DOE6_1	Case v	No Moscap		47,4	71	20,6	0,27	2,8	44,54	71	17,2	-4	0,3	3,4 - j 0,8	46,92	68,6	17,2	-4	
DOE6_2	Case 1	N9501B_V5	6,5	46,90	78,00	21,30	0,44	3,50	44,20	71,80	17,60	-8,30	0,51	2,7 - j 0,9	46,93	65,20	15,80	-12,00	
DOE6_3	Case 1	N9501B_V8	8,19	47,30	70,10	19,40	0,51	3,50	44,28	68,20	16,40	-10,80	0,48	2,4 - j 0,3	46,90	65,60	15,90	-11,30	
DOE6_4	Case 4	N9501B_V8	8,19	47,30	70,70	20,30	0,59	3,70	44,48	70,40	16,20	-16,80	0,55	2,7 + j 0,3	46,79	68,10	15,90	-15,20	
DOE6_5	Case 4	N9501B_V4	10,3	47,50	65,70	18,80	0,46	3,60	44,72	64,70	16,60	-12,50	0,40	2,7 + j 0,3	47,03	64,00	16,30	-10,30	

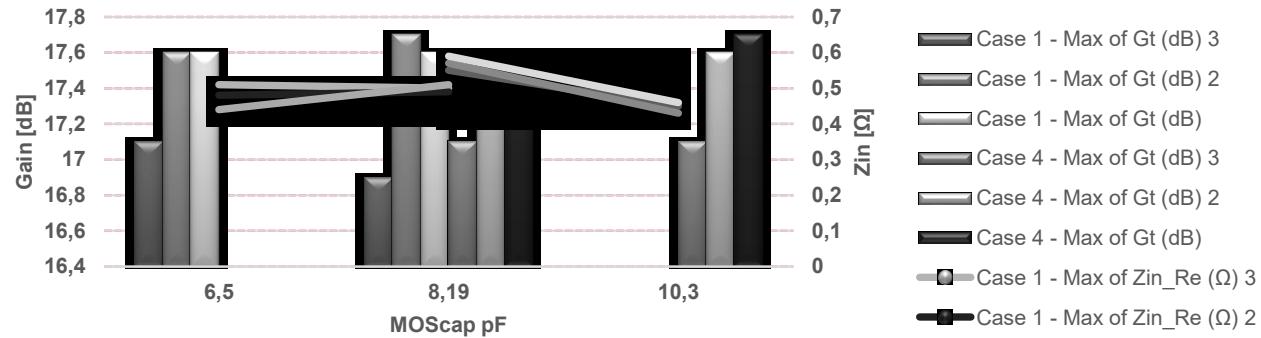
Detailed\_EM

DOE6_1	Case v	No Moscap		47,3	70,4	20,8	0,29	2,8	44,99	70,2	17,5	-4,4	0,32	3,6 - j 0,8	46,78	68,4	16,8	-4
DOE6_2	Case 1	N9501B_V5	6,5	47,20	71,10	22,20	0,43	3,20	44,34	70,40	17,60	-10,40	0,46	3,4 - j 0,3	46,61	68,10	17,10	-9,50
DOE6_3	Case 1	N9501B_V8	8,19	47,20	71,10	22,30	0,43	3,20	44,32	70,30	17,60	-10,60	0,50	3,6 - j 0,3	46,63	68,90	16,90	-10,80
DOE6_4	Case 4	N9501B_V8	8,19	47,20	71,40	21,40	0,39	3,40	44,81	70,10	17,60	-6,80	0,45	3,4 + j 0,3	46,77	67,90	17,10	-8,40
DOE6_5	Case 4	N9501B_V4	10,3	47,20	71,40	21,40	0,39	3,40	44,82	70,10	17,70	-6,80	0,45	3,4 + j 0,3	46,77	68,00	17,10	-8,30



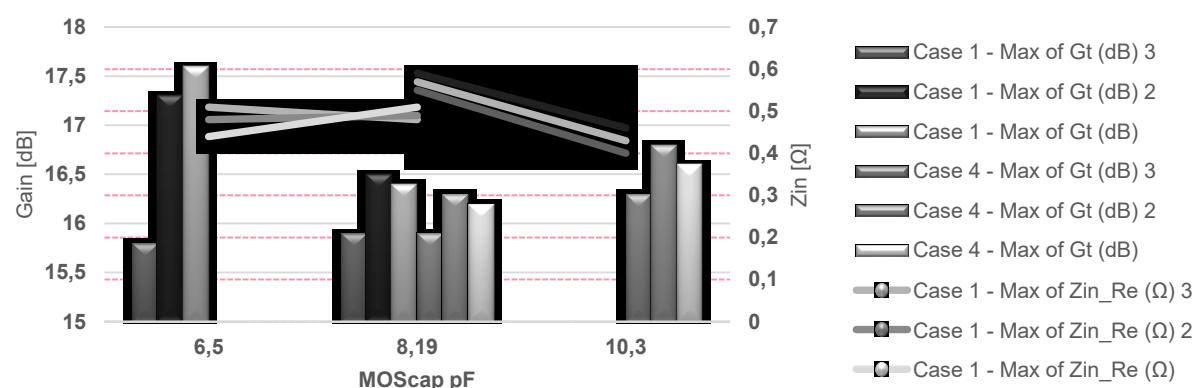
# Selected DOE6: Gt, Zin

Gt, Zin w.r.t MOScap & BW profile (Detailed\_EM)

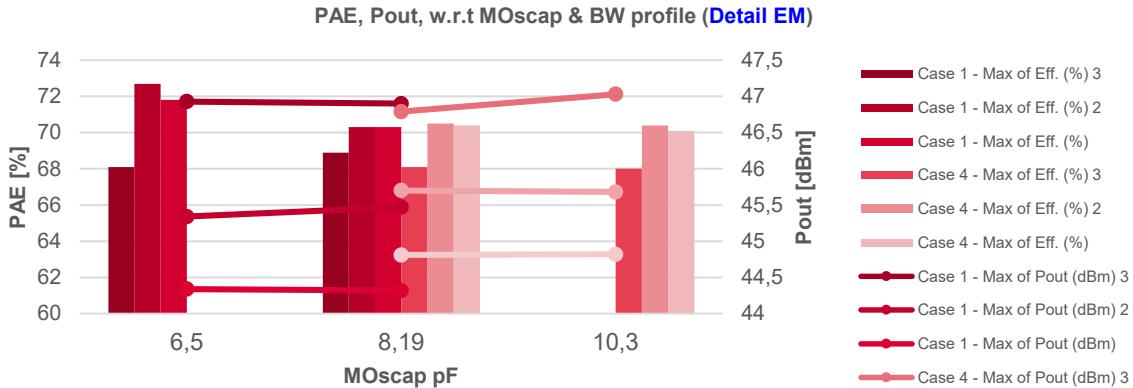


Variant	BW profile	MOScap	
		N9501B_V5	6,5
DOE6_2	Case 1	N9501B_V5	6,5
DOE6_3	Case 1	N9501B_V8	8,19
DOE6_4	Case 4	N9501B_V8	8,19
DOE6_5	Case 4	N9501B_V4	10,3

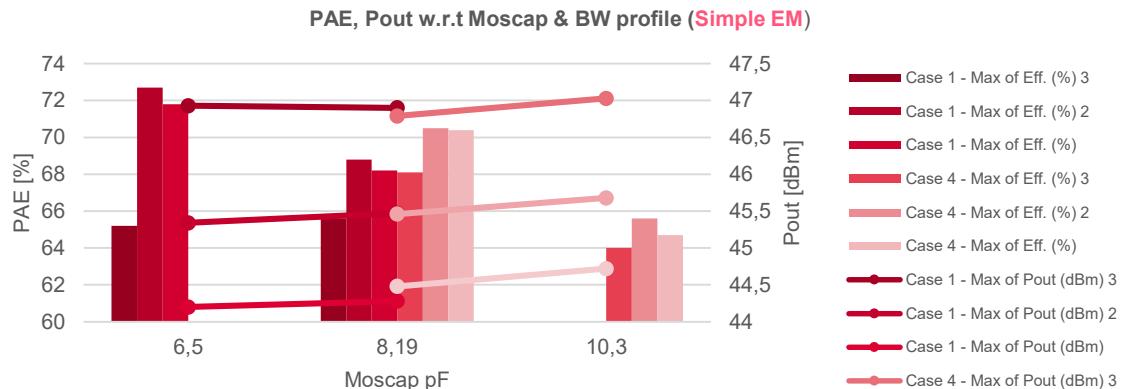
Gt, Zin w.r.t MOScap & BW profile (Simple EM)



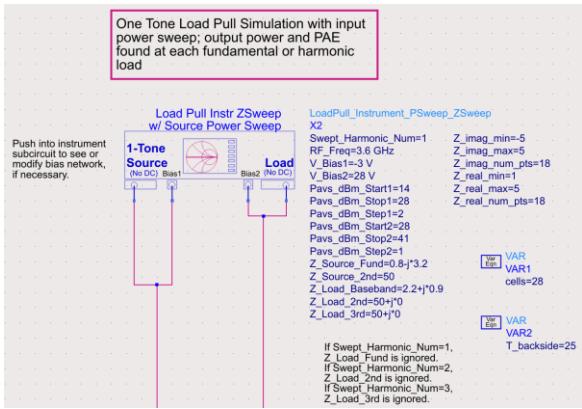
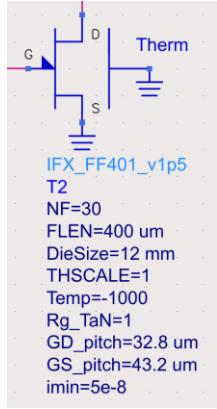
# Selected DOE6: PAE, Pout



Variant	BW profile	MOScap (pF)
DOE6_2	Case 1	N9501B_V5
DOE6_3	Case 1	N9501B_V8
DOE6_4	Case 4	N9501B_V8
DOE6_5	Case 4	N9501B_V4

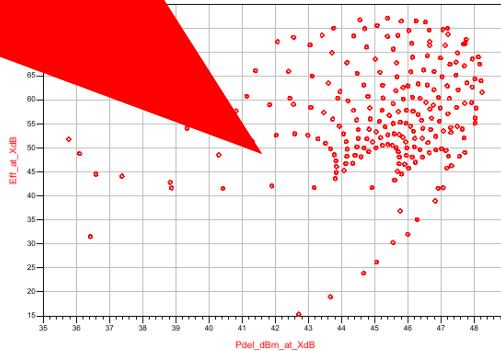
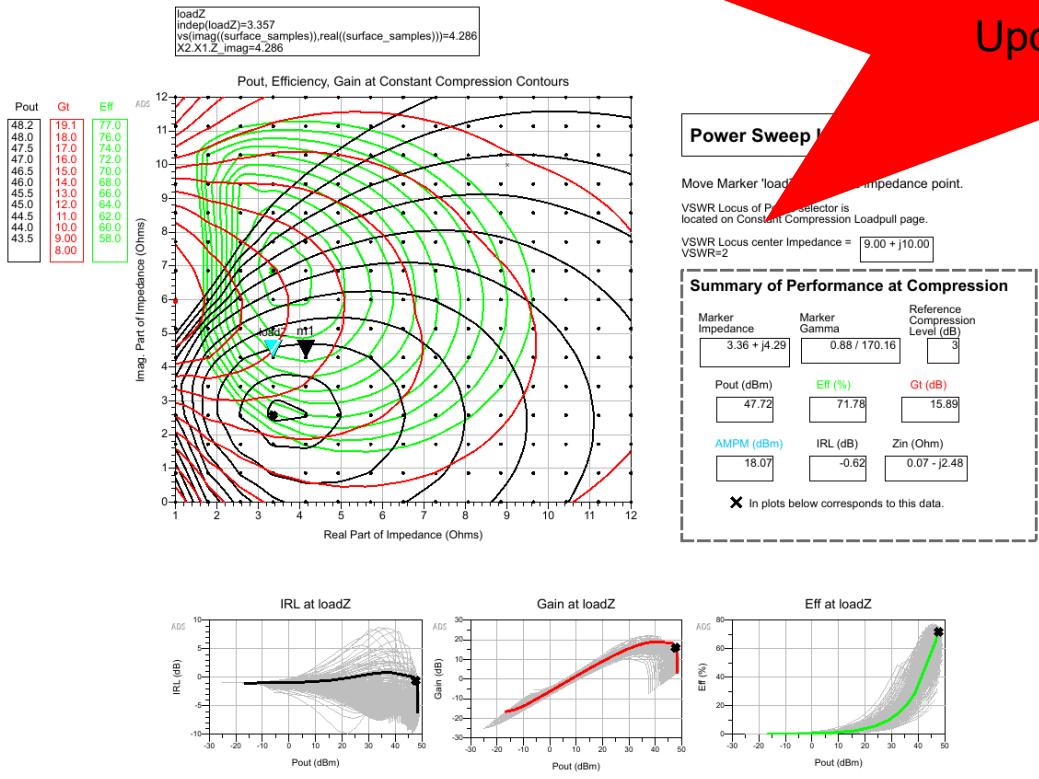


# Bare die GaN Load-pull: T9505A\_1

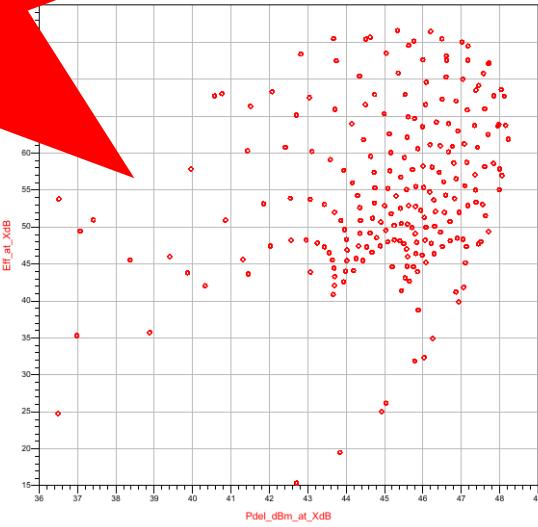
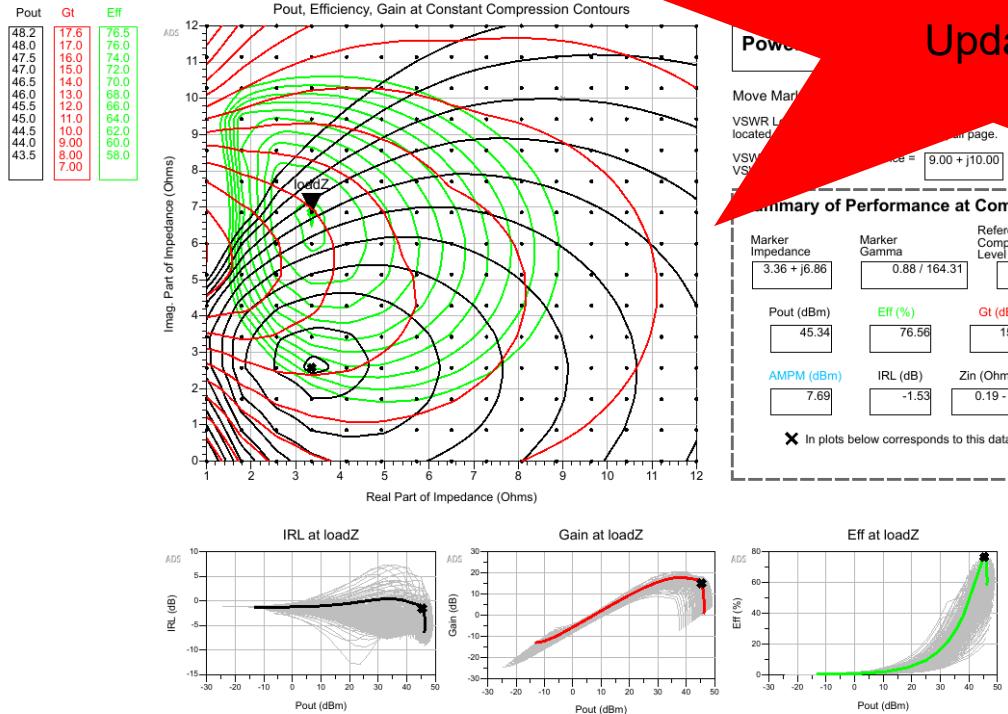


# LP summary 12 mm die @ 3.4 GHz

Update

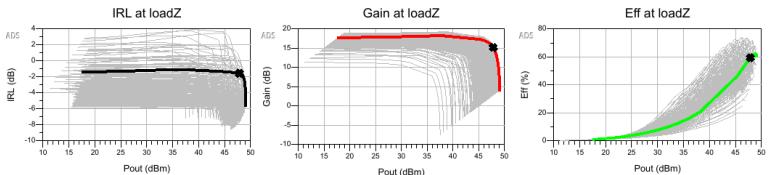
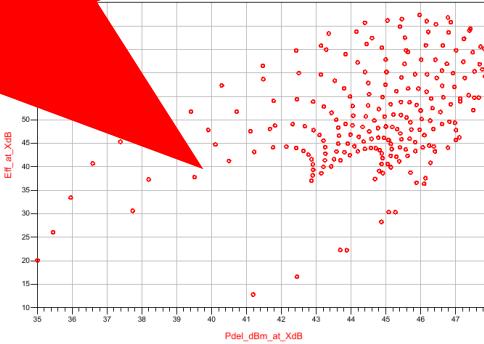
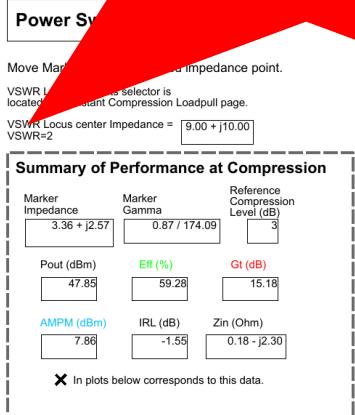
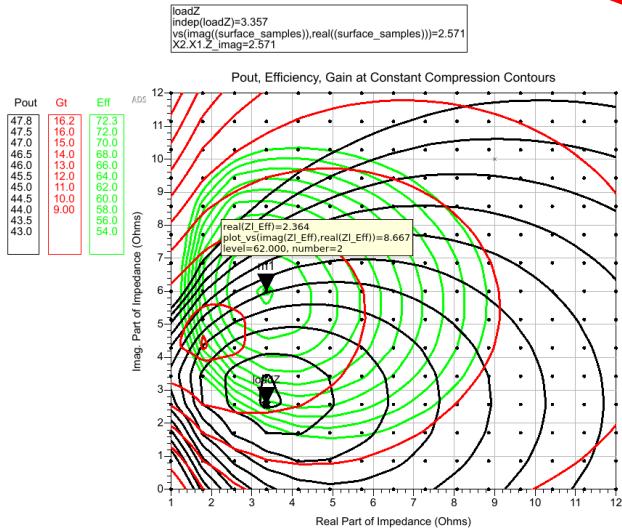


# LP summary 12 mm die @ 3.6 GHz

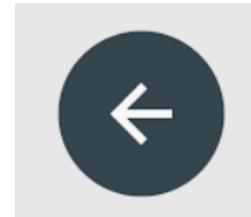
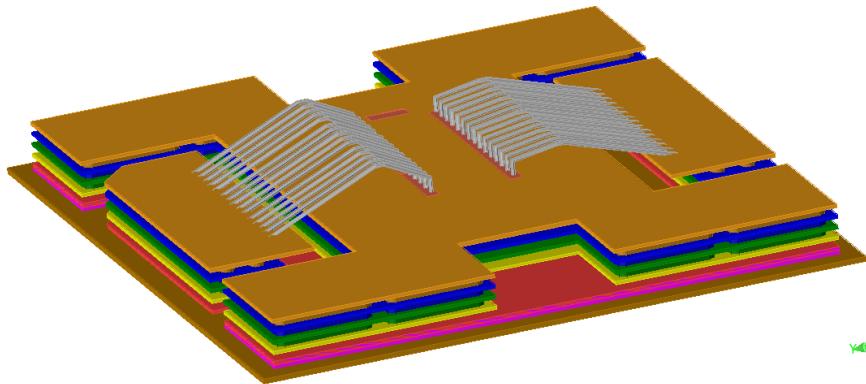


# LP summary 12 mm die @ 3.8 GHz

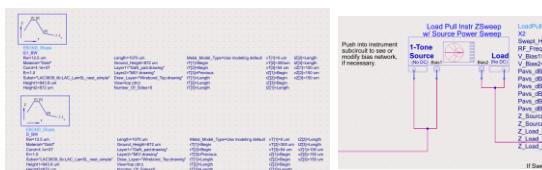
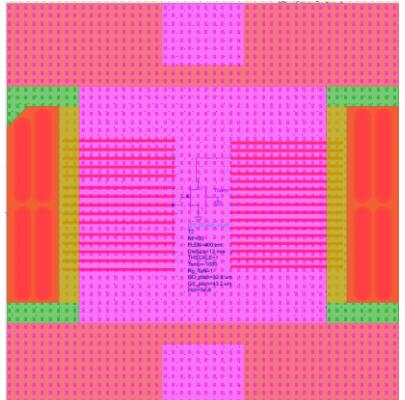
Update



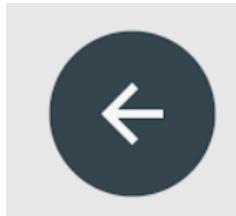
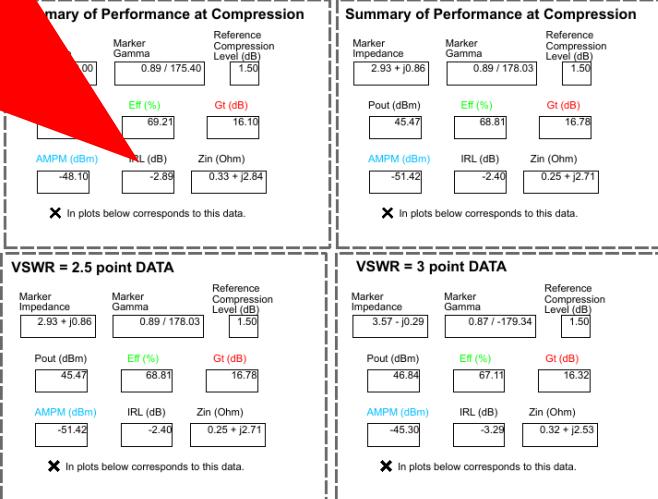
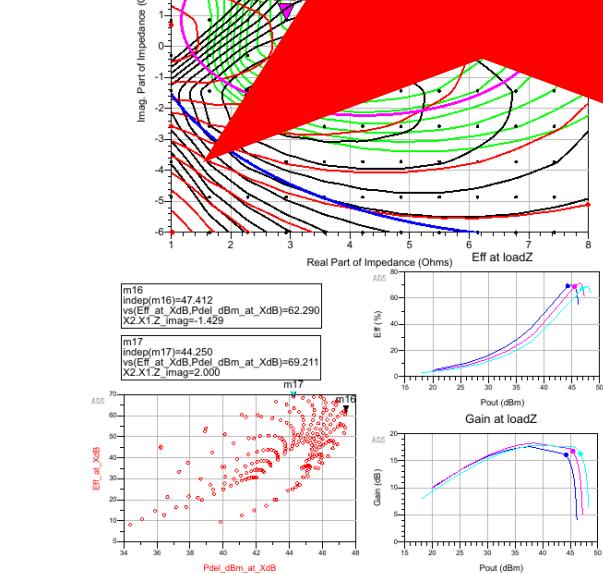
# BW + GaN + LAC3839: Simple EM simulation



# Case i: a+A



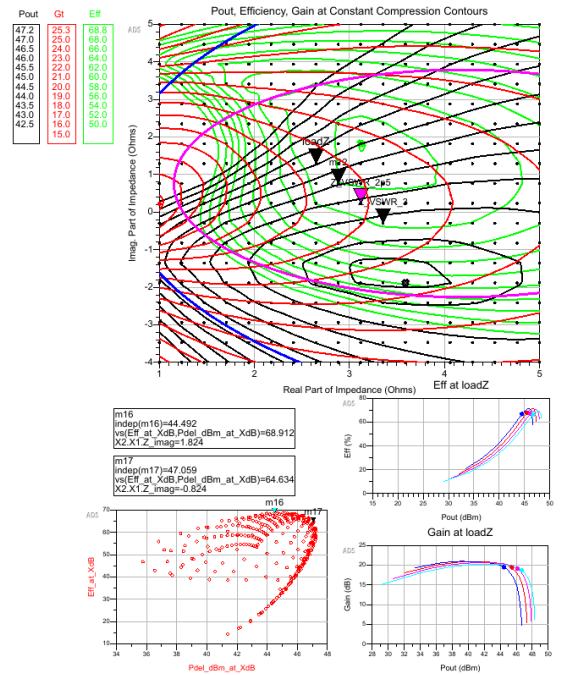
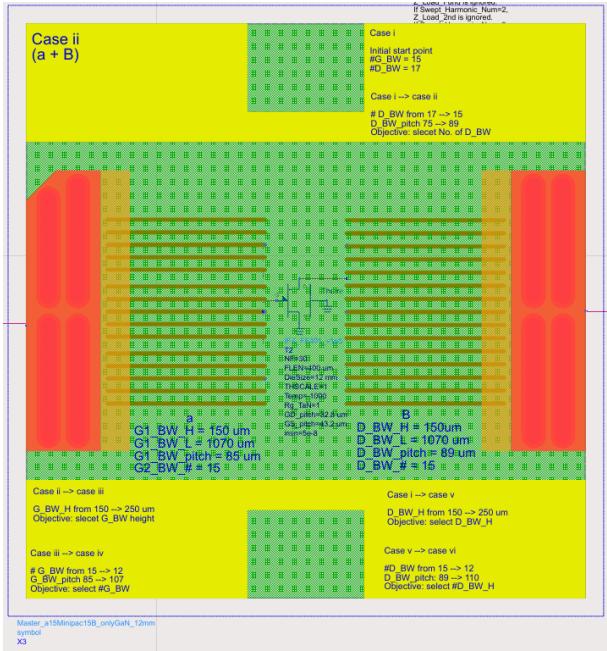
Update



Input - Gate				
Sl. No.	No. of wires	No. of sets	Length	Height
a	5	3	1070	150

Output - Drain				
Sl.No.	No. of wires	No. of sets	Length	Height
A	17	1	1070	150

## Case ii: $a + B$



Move Marker 'loadZ' to desired impedance point.

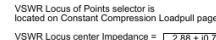
VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center impedance =

Summary of Performance at Compression		
Marker Impedance	Marker Gamma	Reference Compensation Level (dB)
2.65 + j1.29	0.90 / 177.03	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.43	66.75	19.47
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-43.04	-4.23	0.21 + j2.76

✗ In plots below corresponds to this data.

 In plots below corresponds to this data



Summary of Performance at Compression		
Marker Impedance	Marker Gamma	Reference Compensation Level (dB)
2.88 + j0.76	0.89 / 178.24	1.50
Pout (dBm)	Eff (%)	Gl (dB)
45.46	67.98	19.40
AMPP (dBm)	IRL (dB)	Zin (Ohm)
-46.08	-4.88	0.23 + j2.68

 In plots below corresponds to this data

**VSWR = 2.5 point DATA**

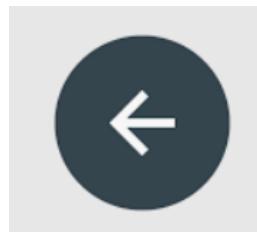
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
3.12 + j0.24	0.88 / 179.46	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.12	67.16	19.12
AMPP (dBm)	IRL (dB)	Zin (Ohm)
-46.44	-5.60	0.25 + j2.60

► In plots below corresponds to this data

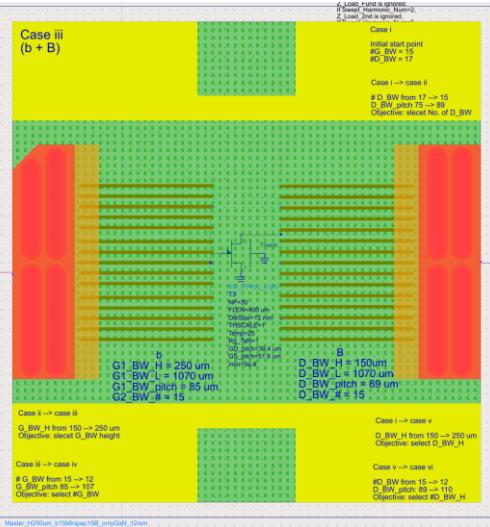
VSWR = 3 point DAT

Marker Impedance	Marker Gamma	Reference Compress Level (dB)
3.35 - j0.29	0.87 / -179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.69	66.37	18.75
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-44.73	-6.42	0.28 + j2.51

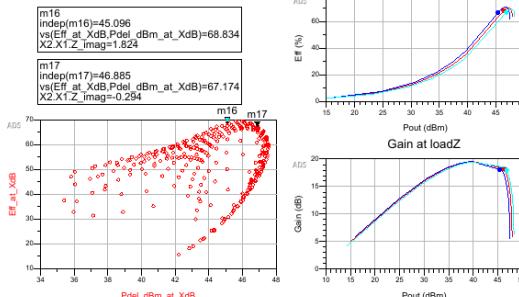
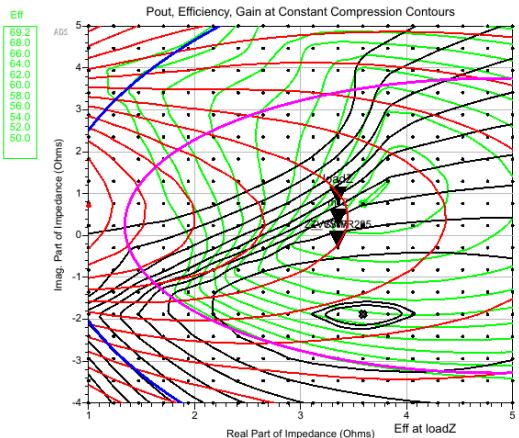
► In plots below corresponds to this doc



# Case iii: b + B



Pout	Gt	Eff
47.5	22.9	69.2
47.0	22.0	68.0
47.0	21.0	66.0
46.5	20.0	64.0
46.0	19.0	62.0
45.5	18.0	60.0
45.0	17.0	58.0
44.5	16.0	56.0
44.0	15.0	54.0
43.5	14.0	52.0
43.0	13.0	50.0
42.0		



## Power Sweep Inspector

Eqn VSWRVal=5 Eqn VSWRVal=1.25

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.59 - j1.68$   
VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.35 + j0.24$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.35 + j0.76$	$0.87 / 178.24$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.38	66.75	18.08
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-59.63	-5.38	$0.32 + j3.45$

X in plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.35 + j0.24$	$0.87 / 179.46$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.37	68.39	18.12
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-59.10	-5.38	$0.31 + j3.40$

X in plots below corresponds to this data.

## VSWR = 2.5 point DATA

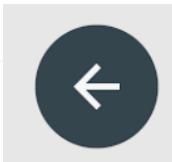
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.35 - j0.29$	$0.87 / -179.32$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.83	66.99	17.98
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-56.30	-5.43	$0.31 + j3.32$

X in plots below corresponds to this data.

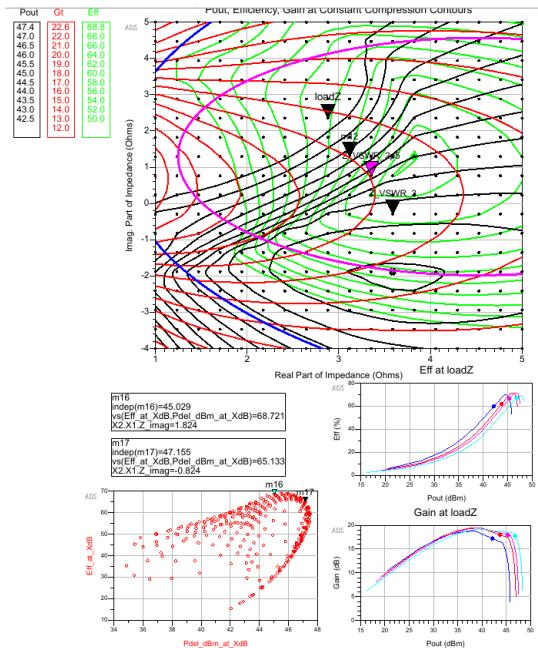
## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.35 - j0.29$	$0.87 / -179.32$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.83	66.99	17.98
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-56.30	-5.43	$0.31 + j3.32$

X in plots below corresponds to this data.



# Case iv: c + B



## Power Sweep Inspector

Eqn VSWRVal=5 Eqn VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.59 - j1.88$

VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.12 + j1.29$

## Summary of Performance at Compression

Marker Impedance:  $2.88 + j2.35$   
Marker Gamma:  $0.89 / 174.59$   
Reference Compression Level (dB): 1.50

Pout (dBm): 42.14  
Eff (%) 59.84  
GI (dB) 17.22

AMPM (dBm): -56.72  
IRL (dB): -4.78  
Zin (Ohm):  $0.35 + j3.70$

X In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance:  $3.12 + j1.29$   
Marker Gamma:  $0.88 / 177.02$   
Reference Compression Level (dB): 1.50

Pout (dBm): 43.79  
Eff (%) 62.02  
GI (dB) 17.98

AMPM (dBm): -59.99  
IRL (dB): -4.51  
Zin (Ohm):  $0.31 + j3.61$

X In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance:  $3.35 + j0.76$   
Marker Gamma:  $0.87 / 178.24$   
Reference Compression Level (dB): 1.50

Pout (dBm): 45.34  
Eff (%) 66.69  
GI (dB) 17.98

AMPM (dBm): -60.21  
IRL (dB): -4.98  
Zin (Ohm):  $0.33 + j3.59$

X In plots below corresponds to this data.

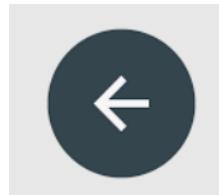
## VSWR = 3 point DATA

Marker Impedance:  $3.59 - j0.29$   
Marker Gamma:  $0.877 / -179.32$   
Reference Compression Level (dB): 1.50

Pout (dBm): 46.80  
Eff (%) 66.95  
GI (dB) 17.73

AMPM (dBm): -56.04  
IRL (dB): -5.86  
Zin (Ohm):  $0.35 + j3.45$

X In plots below corresponds to this data.

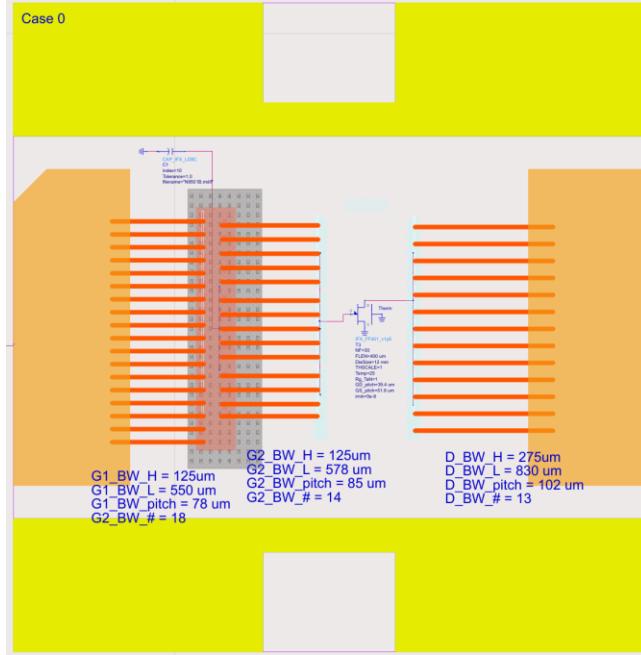
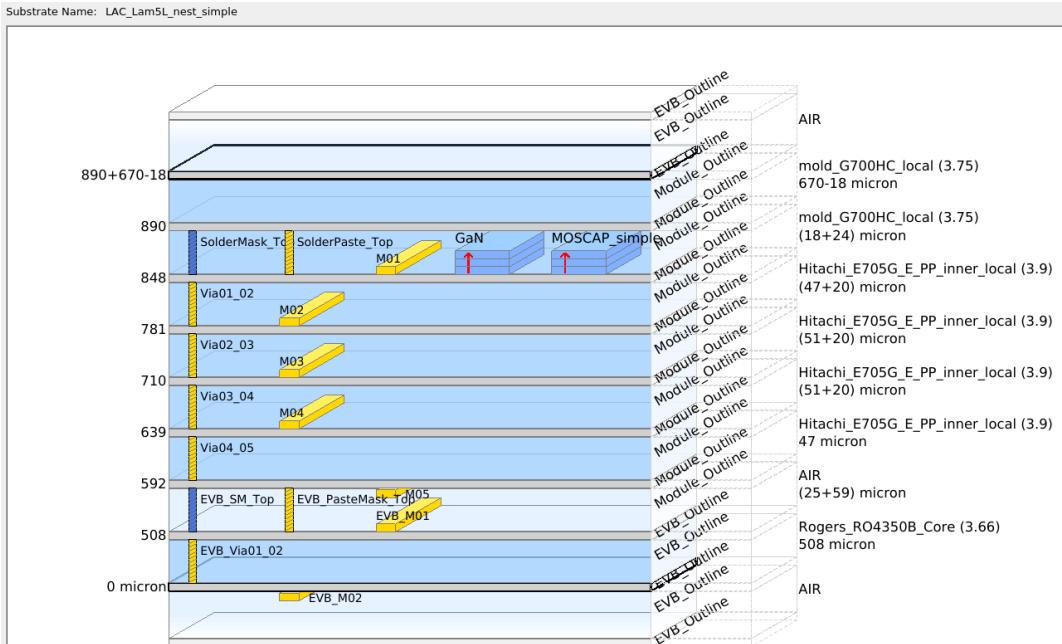






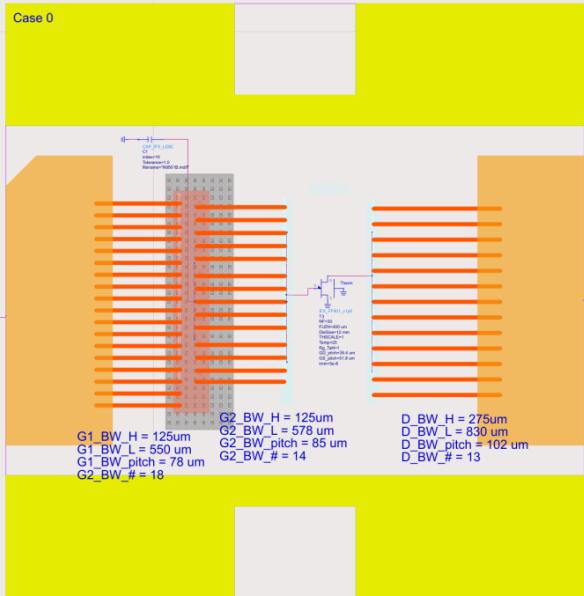
# LP simulations with simple EM model

## Case 0

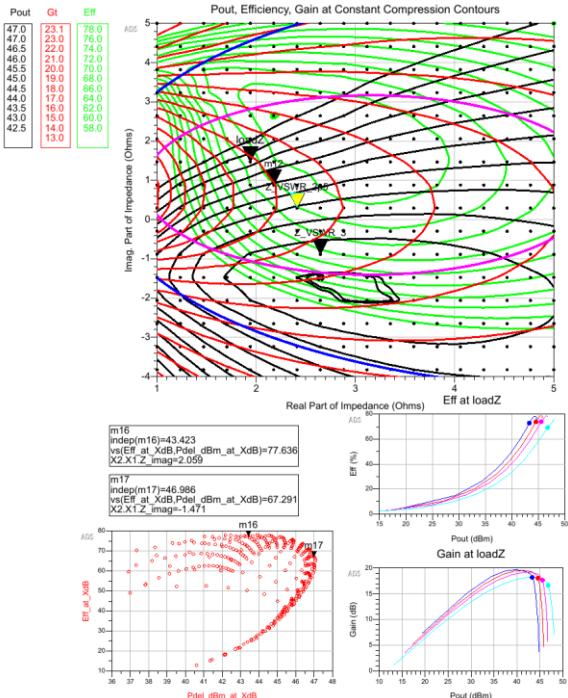


Index	L	W	Ls	Ws	d	Value_pf
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,5
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19

# Case 0 : Moscap 5,5 pF (index 10), P1.5dB,



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8



## Power Sweep Inspector

EgnVSWRVal=5 SgnVSWRVal=2.5

Move Marker loadZ to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.65 + j1.47$

## Summary of Performance at Compression

Marker Impedance:  $1.94 + j1.47$ , Marker Gamma:  $0.93 / 176.63$ , Reference Compression Level (dB): 1.50

Pout (dBm): 43.33, Eff (%): 72.84, Gt (dB): 18.18

AMPM (dBm): -68.90, IRL (dB): -8.52, Zin (Ohm):  $0.37 + j3.60$

X In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance:  $2.18 + j0.88$ , Marker Gamma:  $0.92 / 177.97$ , Reference Compression Level (dB): 1.50

Pout (dBm): 44.57, Eff (%): 73.86, Gt (dB): 18.04

AMPM (dBm): -64.47, IRL (dB): -9.19, Zin (Ohm):  $0.39 + j3.49$

X In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance:  $2.41 + j0.29$ , Marker Gamma:  $0.91 / 179.32$ , Reference Compression Level (dB): 1.50

Pout (dBm): 45.58, Eff (%): 73.92, Gt (dB): 17.64

AMPM (dBm): -58.16, IRL (dB): -9.46, Zin (Ohm):  $0.41 + j3.38$

X In plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance:  $2.65 + j0.88$ , Marker Gamma:  $0.90 / 177.97$ , Reference Compression Level (dB): 1.50

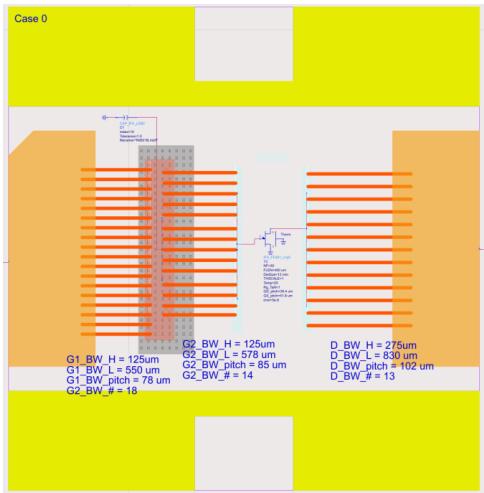
Pout (dBm): 46.80, Eff (%): 69.37, Gt (dB): 16.63

AMPM (dBm): -44.77, IRL (dB): -7.56, Zin (Ohm):  $0.41 + j3.15$

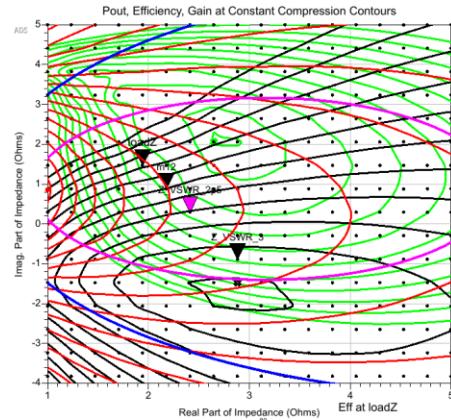
X In plots below corresponds to this data.



# Case 0: Moscap 6,58pF (index 6), P1.5dB



Pout	Gt	Eff
47.0	22.4	75.8
46.5	22.0	76.0
46.0	21.0	76.0
45.5	20.0	74.0
45.0	19.0	73.0
44.5	18.0	70.0
44.0	17.0	68.0
43.5	16.0	66.0
43.0	15.0	64.0
42.5	14.0	62.0
42.0	13.0	60.0



## Power Sweep Inspector

VSWRVal=5 VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.88 + j1.47$

VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.18 + j0.88$

VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j1.47$	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	Gt (dB)
43.42	74.61	17.16
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-68.09	-13.48	$0.53 + j3.58$

X In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.88$	0.92 / 177.97	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.51	74.39	17.04
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-63.59	-13.97	$0.53 + j3.46$

X In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.29$	0.91 / 179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.54	74.59	16.70
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-57.70	-13.14	$0.55 + j3.34$

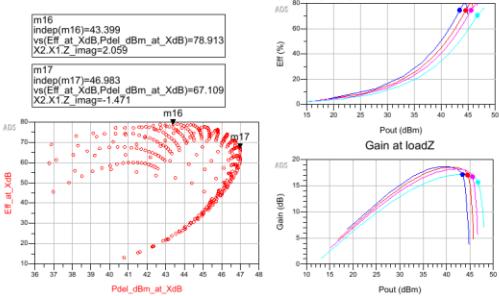
X In plots below corresponds to this data.

## VSWR = 3 point DATA

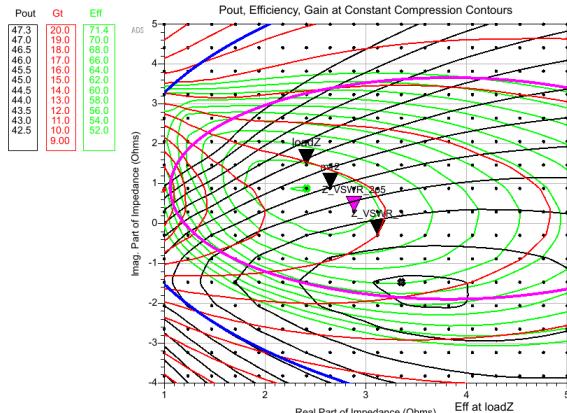
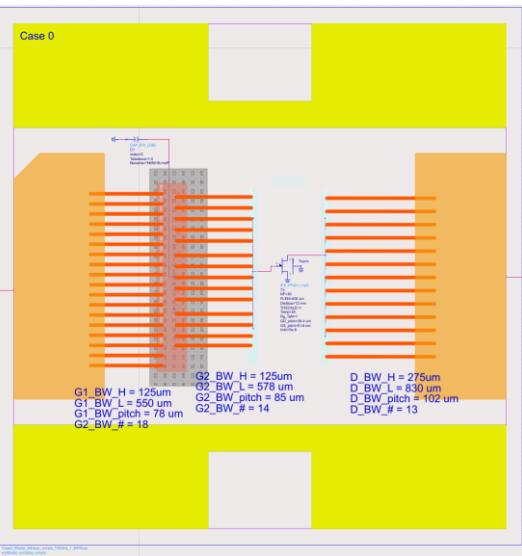
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.88 - j0.88$	0.89 / -177.97	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.74	70.49	15.63
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-44.80	-10.08	$0.57 + j3.12$

X In plots below corresponds to this data.

Index	L	W	Ls	Ws	d	Value pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8



# Case 0: Moscap 8,19pF (index 19), P1.5dB



## Power Sweep Inspector

Eqn vSWRVal=5 Eqn vSWRVal=2.5

Move Marker "loadZ" to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.35 - j1.47$ , VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.65 + j0.88$ , VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j1.47$	$0.91 / 176.62$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.67	70.21	15.07
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-56.59	-19.13	$0.71 + j3.36$

X in plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.88$	$0.90 / 177.97$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.53	71.09	15.28
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-52.56	-15.23	$0.67 + j3.28$

X in plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.88 + j0.29$	$0.89 / 179.32$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.25	70.81	15.25
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-47.26	-12.63	$0.64 + j3.20$

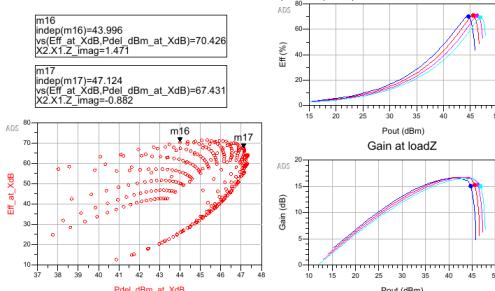
X in plots below corresponds to this data.

## VSWR = 3 point DATA

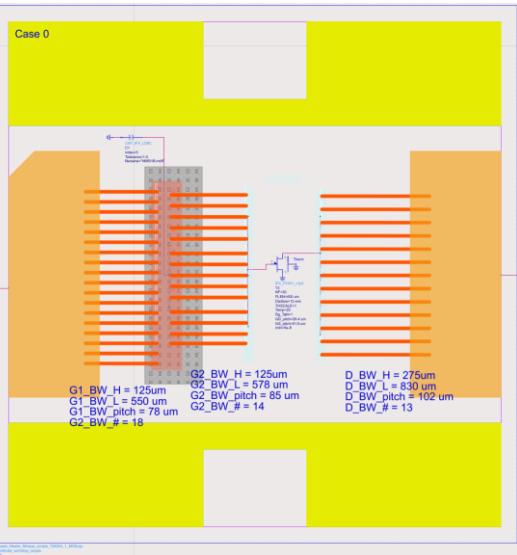
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.12 - j0.29$	$0.88 / -179.32$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.81	69.46	15.00
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-41.39	-10.65	$0.62 + j3.11$

X in plots below corresponds to this data.

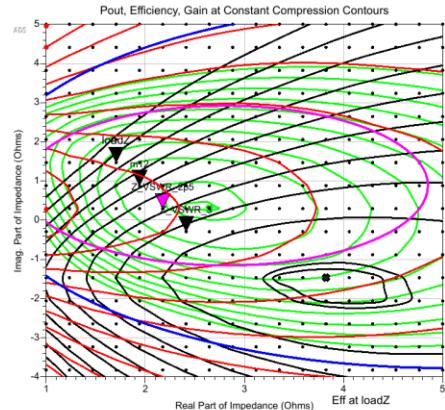
Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8



# Case 0: Moscap 10,3pF (index 5), P1.5dB



Pout	Ct	Eff
47.5	17.8	66.4
47.0	16.0	64.0
46.5	15.0	62.0
46.0	14.0	60.0
45.5	13.0	58.0
45.0	12.0	56.0
44.5	11.0	54.0
44.0	10.0	52.0
43.5	9.00	50.0
43.0	8.00	48.0



## Power Sweep Inspector

Eq1 VSWRVal=5 Eq2 VSWRVal1=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.82 - j1.47$

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.71 + j1.47$	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	Gt (dB)
43.79	63.32	15.86

X in plots below corresponds to this data.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $1.94 + j0.88$

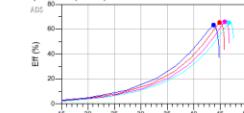
VSWR=5

## Summary of Performance at Compression

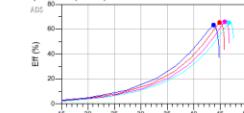
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j0.88$	0.93 / 177.97	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.93	65.36	16.19

X in plots below corresponds to this data.

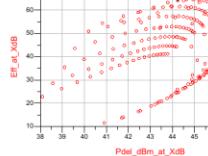
m16  
indep(m16)=44.237  
vs(Eff\_at\_XdB\_Ptot\_dBm\_at\_XdB)=64.113  
 $X2 \cdot X1 \cdot Z_{\text{load}}$ ,  $\text{imag}=1.471$



m17  
indep(m17)=46.967  
vs(Eff\_at\_XdB\_Ptot\_dBm\_at\_XdB)=65.565  
 $X2 \cdot X1 \cdot Z_{\text{load}}$ ,  $\text{imag}=-0.294$



m16  
indep(m16)=44.237  
vs(Eff\_at\_XdB\_Ptot\_dBm\_at\_XdB)=64.113  
 $X2 \cdot X1 \cdot Z_{\text{load}}$ ,  $\text{imag}=1.471$



m17  
indep(m17)=46.967  
vs(Eff\_at\_XdB\_Ptot\_dBm\_at\_XdB)=65.565  
 $X2 \cdot X1 \cdot Z_{\text{load}}$ ,  $\text{imag}=-0.294$



## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.29$	0.92 / 179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.91	65.94	16.15

X in plots below corresponds to this data.

## VSWR = 3 point DATA

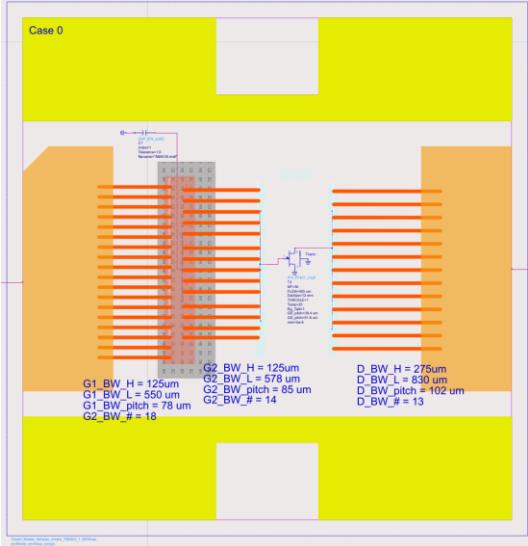
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 - j0.29$	0.91 / -179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.68	65.25	15.83

X in plots below corresponds to this data.

Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8

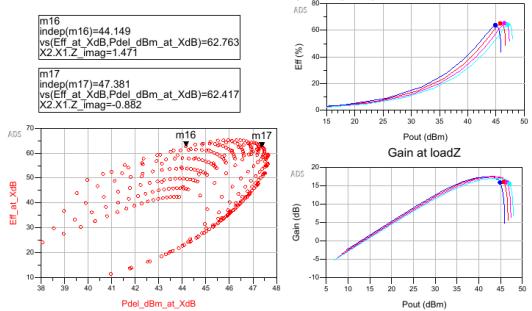
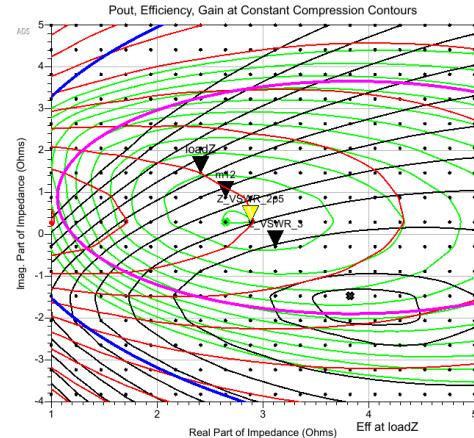


# Case 0: Moscap 12,89pF (index 1), P1.5dB



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

Pout	Gt	Eff
47.6	18.1	65.5
47.5	17.0	62.0
47.0	17.0	60.0
46.5	16.0	58.0
46.0	14.0	56.0
45.5	12.0	52.0
45.0	13.0	54.0
44.5	12.0	52.0
44.0	11.0	50.0
43.5	10.0	48.0
43.0	9.00	46.0
42.5	8.00	44.0



## Power Sweep Inspector

Eqn VSWRVal=5 Eqn VSWRVal=2.5

Move Marker "loadZ" to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.82 - j1.47$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j1.47$	$0.91 / 176.62$	1.50

Pout (dBm)	Eff (%)	Gt (dB)
44.88	63.89	16.00

AMPM (dBm)	IRL (dB)	Zin (Ohm)
-53.61	-10.32	$0.44 + j3.37$

X In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.88 + j0.29$	$0.89 / 179.32$	1.50

Pout (dBm)	Eff (%)	Gt (dB)
46.47	65.30	16.03

AMPM (dBm)	IRL (dB)	Zin (Ohm)
-41.66	-7.54	$0.38 + j3.22$

X In plots below corresponds to this data.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.65 + j0.88$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.88$	$0.90 / 177.97$	1.50

Pout (dBm)	Eff (%)	Gt (dB)
45.74	65.21	16.11

AMPM (dBm)	IRL (dB)	Zin (Ohm)
-48.16	-8.78	$0.41 + j3.29$

## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.12 - j0.29$	$0.88 / 179.32$	1.50

Pout (dBm)	Eff (%)	Gt (dB)
47.04	64.26	15.67

AMPM (dBm)	IRL (dB)	Zin (Ohm)
-35.06	-6.67	$0.36 + j3.14$

X In plots below corresponds to this data.

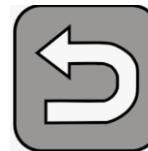
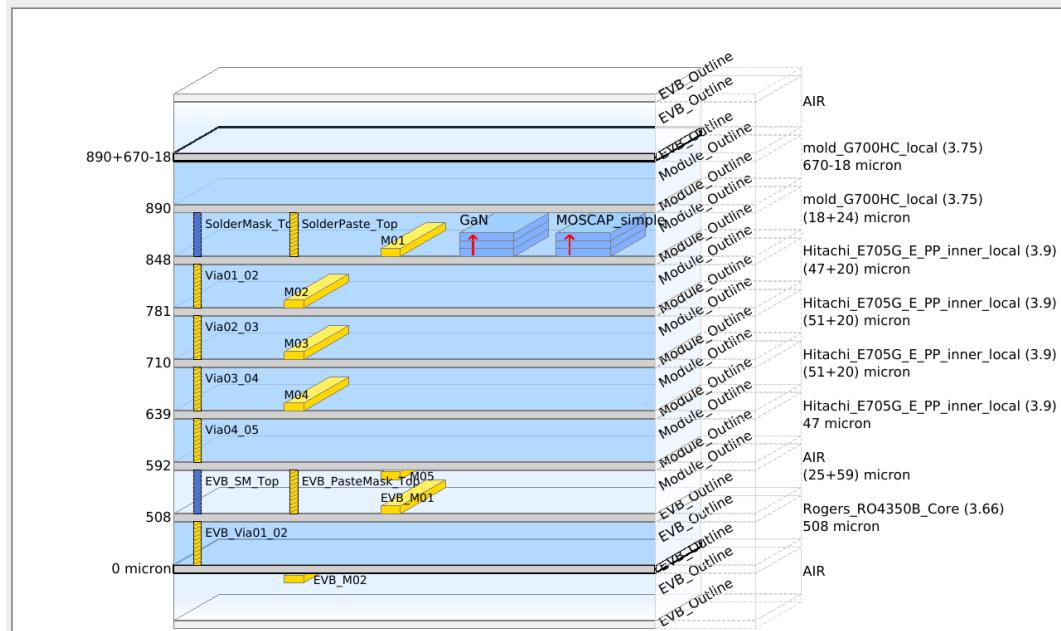


# LP simulations with simple EM model



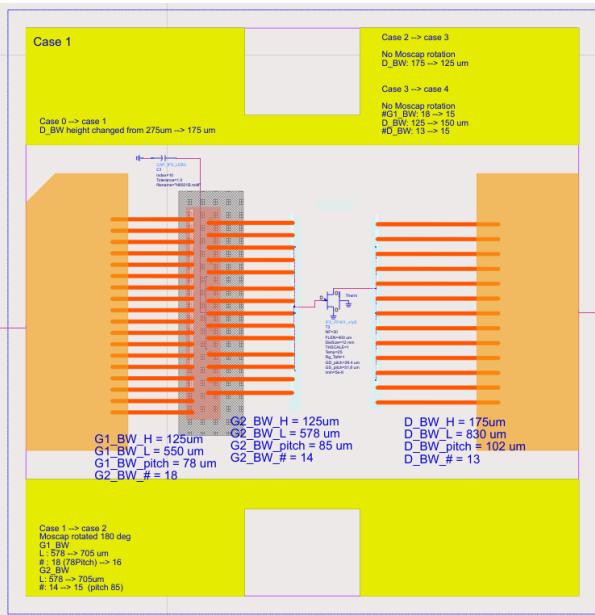
## Case 1

Substrate Name: LAC\_Lam5L\_nest\_simple

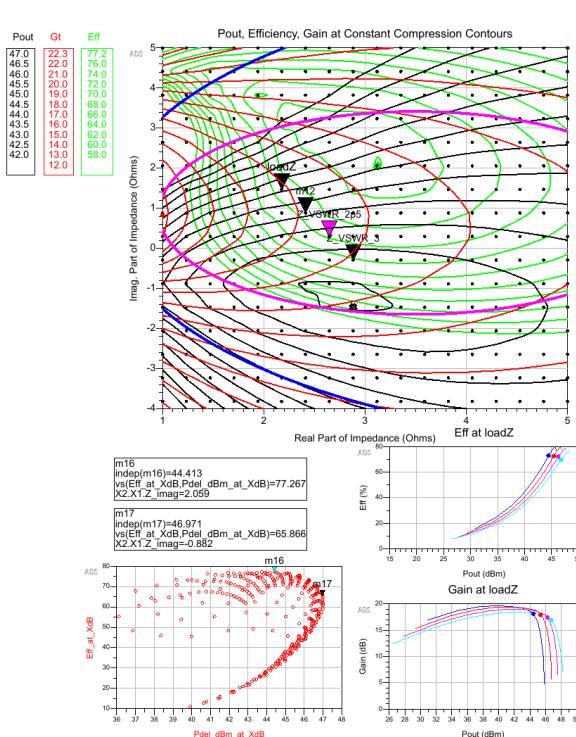


Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,5
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19

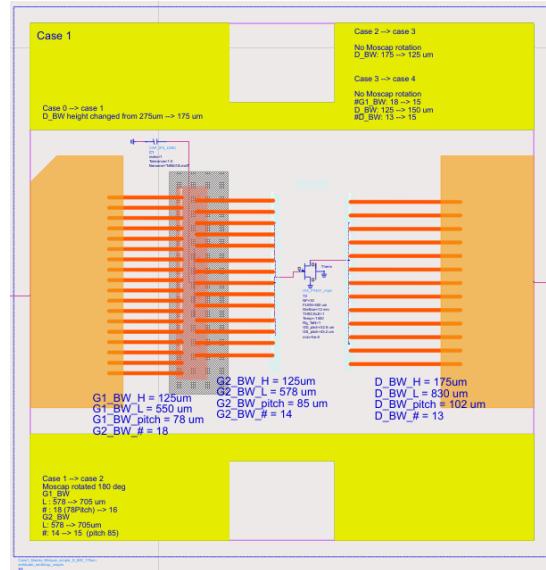
# Case 1 : Moscap 5,5 pF (index 10), P1.5dB,



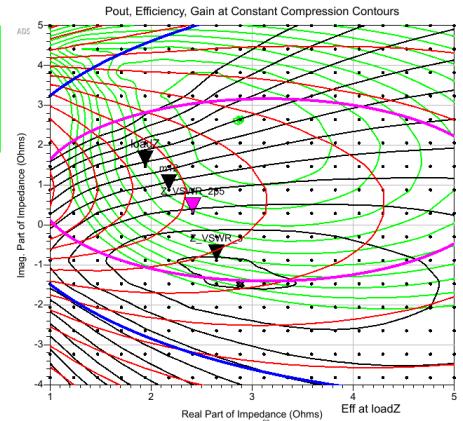
Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8



# Case 1: Moscap 6,58pF (index 6), P1.5dB

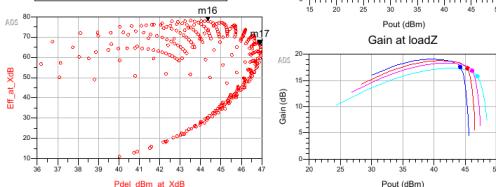


Pout	GT	Eff
46.9	21.3	78.0
46.5	20.0	74.0
46.0	19.0	72.0
45.5	18.0	70.0
45.0	17.0	68.0
44.5	16.0	66.0
44.0	16.0	66.0
43.5	15.0	64.0
43.0	14.0	62.0
42.5	13.0	60.0
42.0	11.0	58.0



m16  
indep(m16)=44.364  
[x]Eff at XdB\_Pdel\_dBm\_at\_XdB]=-77.737  
[x]X2.X1.Z\_imag=2.059

m17  
indep(m17)=46.909  
[x]Eff at XdB\_Pdel\_dBm\_at\_XdB]=66.059  
[x]X2.X1.Z\_imag=-0.682



## Power Sweep Inspector

VSWRval=5    VSWRval=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.88 - j1.47$

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j1.47$	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	GT (dB)
44.19	71.79	17.57
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-46.13	-8.34	$0.44 + j3.53$

**VSWR = 2.5 point DATA**

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.29$	0.91 / 179.32	1.50
Pout (dBm)	Eff (%)	GT (dB)
46.12	71.71	16.84
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-42.18	-12.90	$0.51 + j3.27$

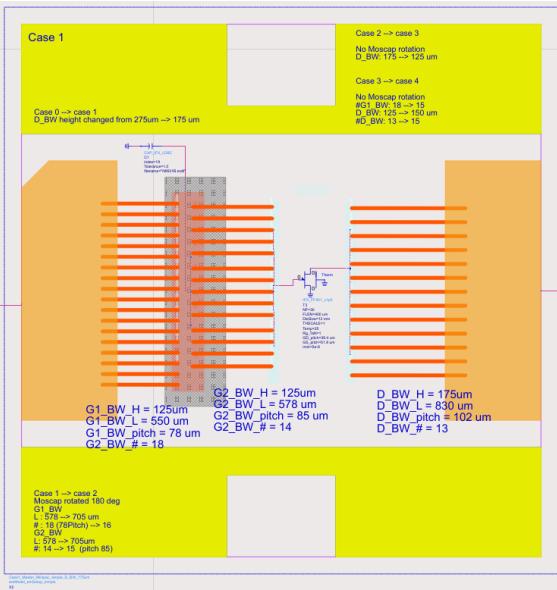
**VSWR = 3 point DATA**

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 - j0.88$	0.90 / -177.97	1.50
Pout (dBm)	Eff (%)	GT (dB)
46.93	65.18	15.81
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-32.65	-11.96	$0.51 + j3.03$

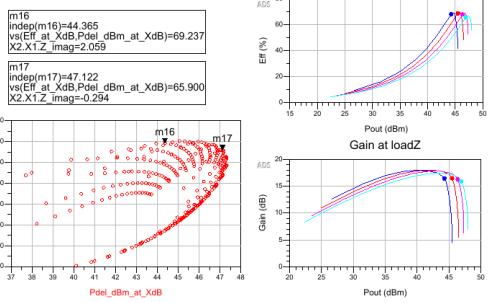
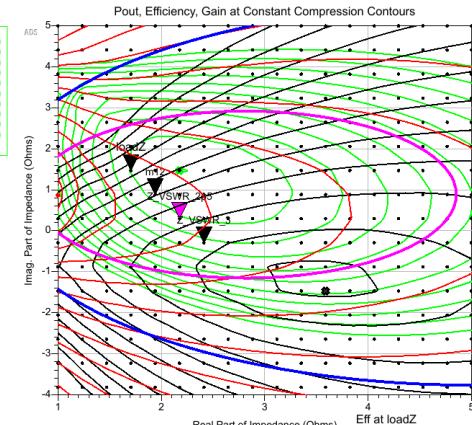


Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8

# Case 1: Moscap 8,19pF (index 19), P1.5dB



Pout	Gt	Eff
47.5	19.4	70.1
47.0	18.0	68.0
46.5	17.0	64.0
46.0	16.0	62.0
45.5	15.0	60.0
45.0	14.0	58.0
44.5	13.0	56.0
44.0	12.0	54.0
43.5	11.0	52.0
43.0	10.0	50.0
42.5	9.00	50.0



## Power Sweep Inspector

Eff VSWRVal=5 Eff VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.59 - j1.47$   
VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $1.94 + j0.88$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.71 + j1.47$	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.28	68.18	16.42
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-52.02	-10.81	$0.51 + j3.45$

× In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j0.88$	0.93 / 177.97	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.47	68.79	16.47
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-48.13	-11.81	$0.49 + j3.32$

× In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.29$	0.92 / 179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.34	67.81	16.28
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-41.63	-12.07	$0.48 + j3.19$

× In plots below corresponds to this data.

## VSWR = 3 point DATA

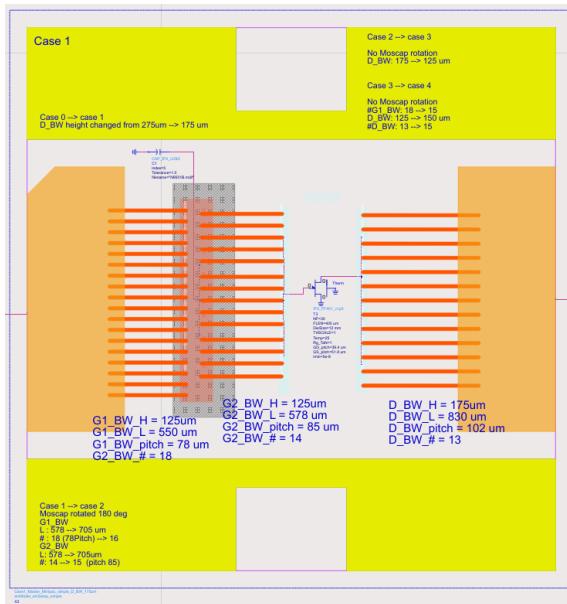
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 - j0.29$	0.91 - j179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.90	65.57	15.88
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-34.28	-11.32	$0.48 + j3.07$

× In plots below corresponds to this data.

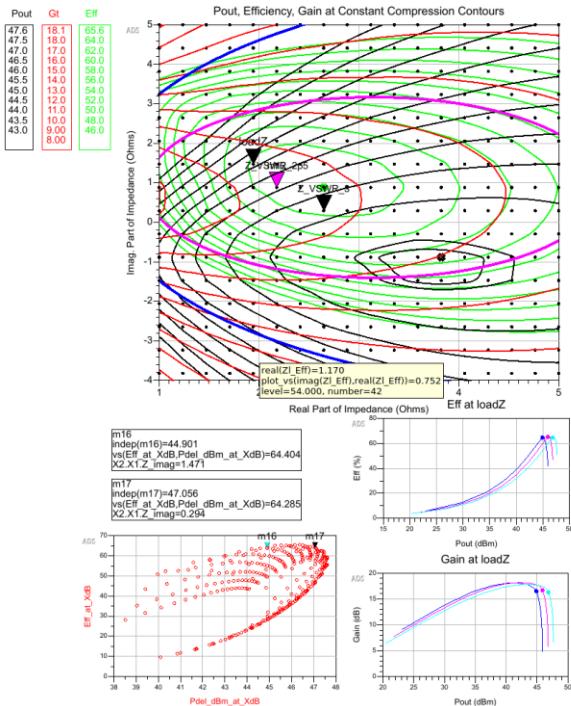


Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

## Case 1: Moscap 10,3pF (index 5), P1.5dB



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8



Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page

VSWR Locus center Impedance =   
VSWR=5

Summary of Performance at Compression		
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
1.94 + j1.47	0.93 / 176.63	1.50

**X** In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance      Marker Gamma

**X** In plots below corresponds to this data.

Marker Impedance      Marker Gamma

Pout (dBm)	Eff (%)
45.90	65.03

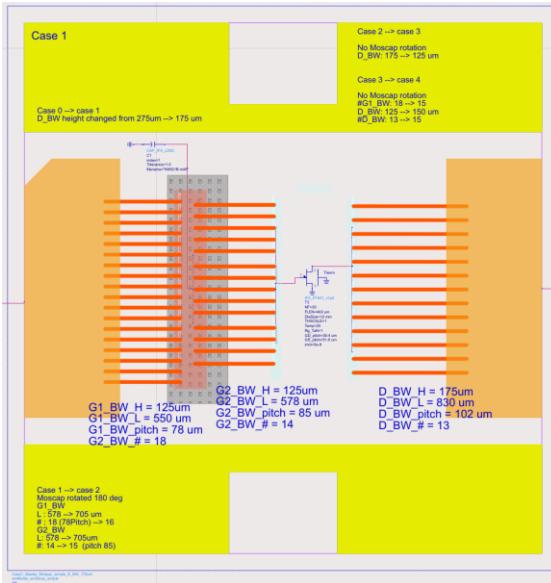
  

AMPM (dBm)	IRL (dB)	Z
-15.00	0.00	Z

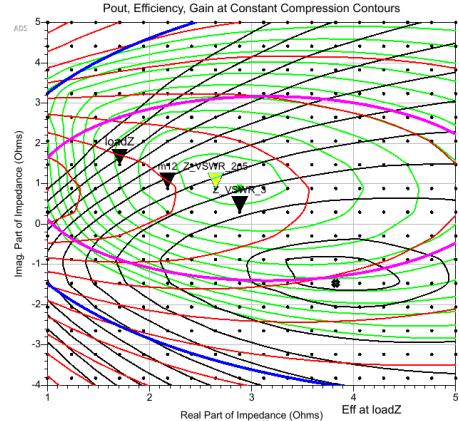
□ □ □



# Case 1: Moscap 12,89pF (index 1), P1.5dB



Pout	Gt	Eff
47.6	18.7	64.7
47.5	18.0	64.0
47.0	16.0	60.0
46.5	14.0	54.0
46.0	12.0	52.0
45.5	10.0	48.0
45.0	9.0	46.0
44.5	8.0	



## Power Sweep Inspector

Ein VSWRVal=5 Ein VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.82 - j1.47$

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.71 + j1.47$	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.22	60.52	17.24
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-64.76	-5.84	$0.28 + j3.43$

✖ In plots below corresponds to this data.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.18 + j0.88$

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.88$	0.92 / 177.97	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.79	63.45	17.08
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-55.36	-6.68	$0.30 + j3.30$

✖ In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.88$	0.90 / 177.97	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.27	64.56	16.68
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-49.16	-8.16	$0.35 + j3.26$

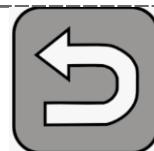
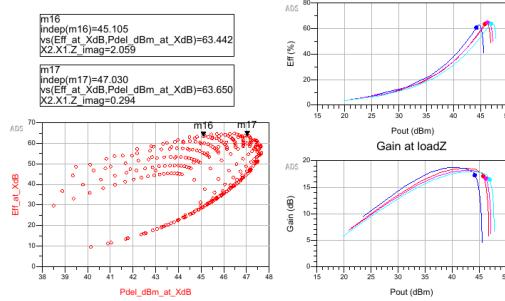
✖ In plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.88 + j0.29$	0.89 / 179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.93	63.70	16.46
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-42.77	-7.79	$0.34 + j3.18$

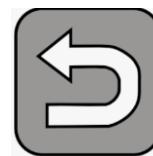
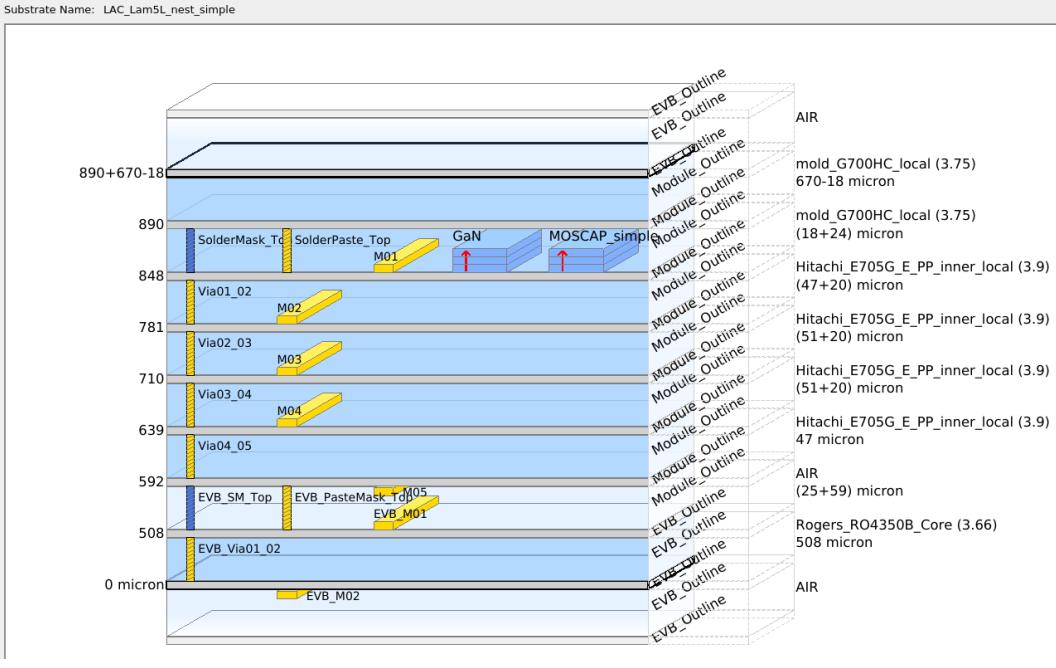
✖ In plots below corresponds to this data.

Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.50
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8



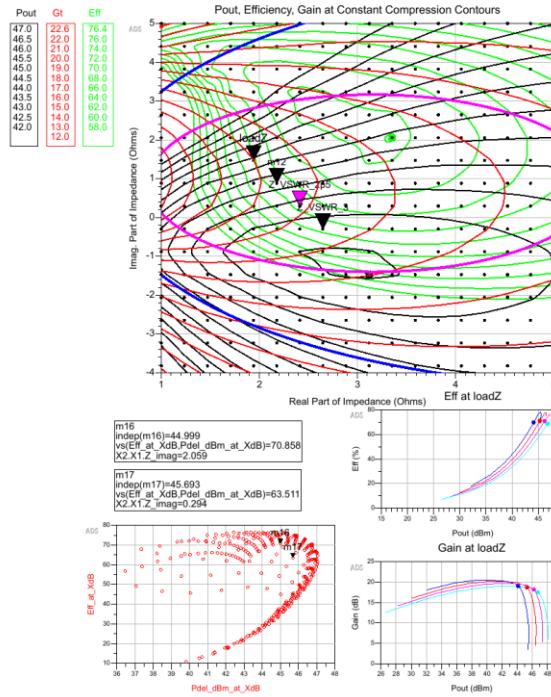
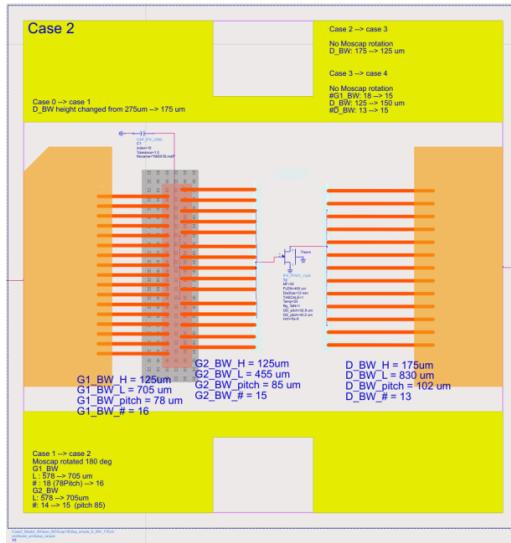
# LP simulations with simple EM model

## Case 2



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,5
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19

## Case 2 : Moscap rotate 180 deg (5,5 pF: index 10)



Move Marker 'loadZ' to desired impedance point.

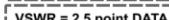
VSWR Locus of Points selector is located on Constant Compression Loadnull page.

VSWR Locus center Impedance =

Summary of Performance at Compression		
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
1.94 + j1.47	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.11	69.75	19.01

VSWR Locus center Impedance =  VSWR=5

## Summary of Performance at Compression



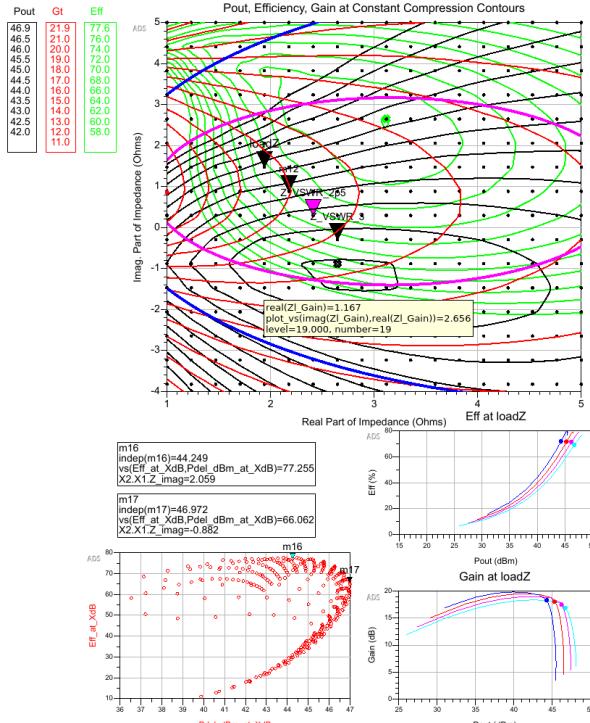
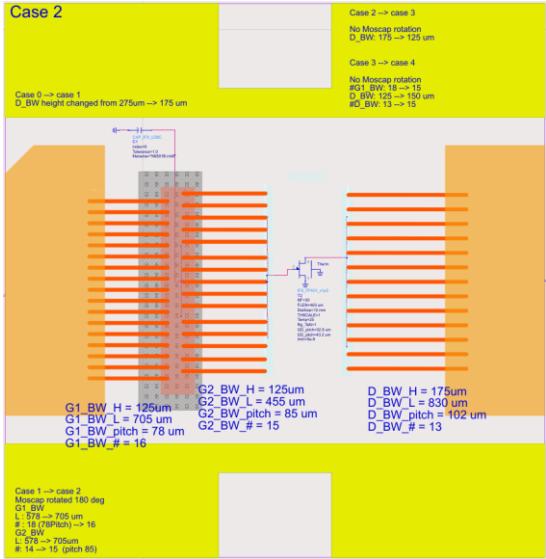
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.29$	0.91 / 179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.21	70.78	18.17
AMPP (dBm)	IRL (dB)	Zin (Ohm)
-43.20	-6.54	0.29 + j3.57

VSWR = 3 point DATA		
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.65 - j0.29	0.90 / -179.32	1.50
Pout (dBm)	Eeff (%)	Gt (dB)
46.75	68.69	17.51
AMPP (dBm)	IRL (dB)	Zin (Ohm)
-36.63	-7.62	0.33 + j3.45



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8

# Case 2 : Moscap rotate 180 deg (6.58 pF: index 6)



## Power Sweep Inspector

Eqn VSWRval=5 Eqn VSWRval=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.65 - j0.88$   
VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.18 + j0.88$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j1.47$	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.27	71.67	18.36
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-45.76	-5.66	$0.29 + j3.81$

✗ In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.88$	0.92 / 177.97	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.27	71.53	18.04
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-45.46	-7.18	$0.33 + j3.69$

✗ In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.29$	0.91 / 179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.18	71.41	17.51
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-42.42	-8.64	$0.37 + j3.57$

✗ In plots below corresponds to this data.

## VSWR = 3 point DATA

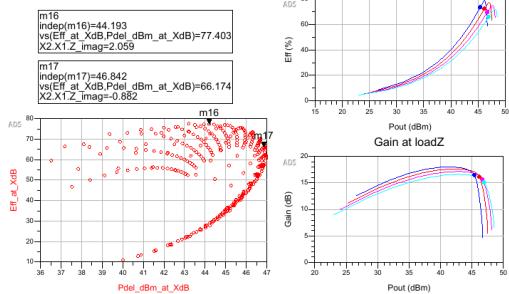
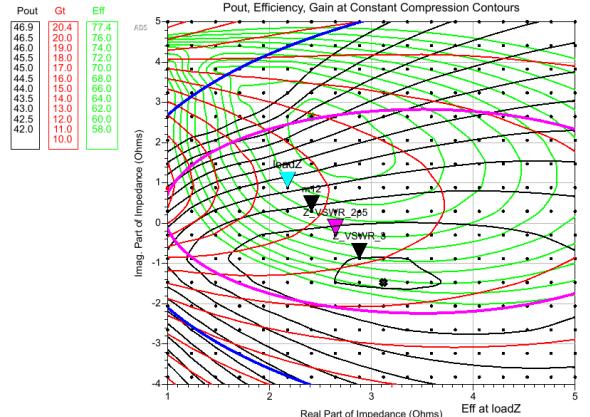
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 - j0.29$	0.90 / -179.32	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.70	69.20	16.89
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-37.85	-9.80	$0.41 + j3.46$

✗ In plots below corresponds to this data.



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

# Case 2 : Moscap rotate 180 deg (8,19 pF: index 19)



## Power Sweep Inspector

$\square$  qn VSWRVal=5  $\square$  qn VSWRVal=1=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.12 - j1.47$   
VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.41 + j0.29$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.88$	$0.92 / 177.97$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.37	73.28	16.52
AMPm (dBm)	IRL (dB)	Zin (Ohm)
-45.53	-12.99	$0.53 + j3.62$

$\times$  In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.29$	$0.91 / 179.32$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.16	72.14	16.15
AMPm (dBm)	IRL (dB)	Zin (Ohm)
-41.44	-14.24	$0.54 + j3.51$

$\times$  In plots below corresponds to this data.

## VSWR = 2.5 point DATA

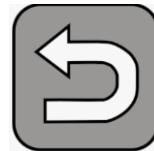
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.29$	$0.90 / -179.32$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.67	69.49	15.67
AMPm (dBm)	IRL (dB)	Zin (Ohm)
-36.68	-14.06	$0.55 + j3.40$

$\times$  In plots below corresponds to this data.

## VSWR = 3 point DATA

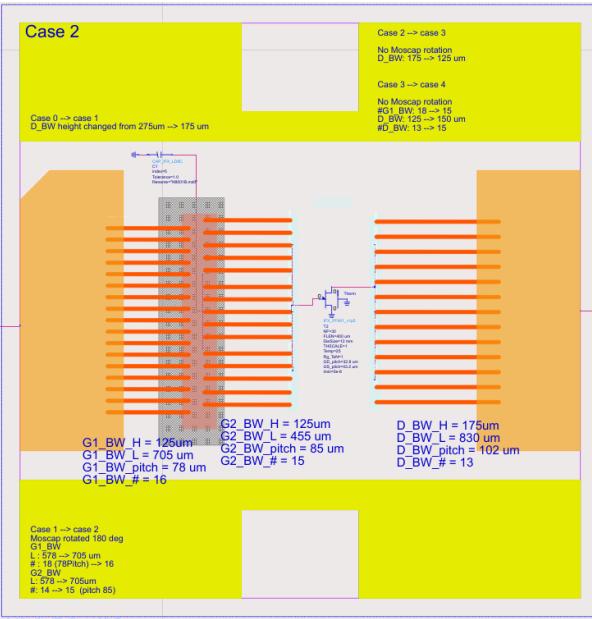
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.88 + j0.88$	$0.89 / 177.97$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.93	65.86	15.13
AMPm (dBm)	IRL (dB)	Zin (Ohm)
-31.62	-12.88	$0.56 + j3.30$

$\times$  In plots below corresponds to this data.

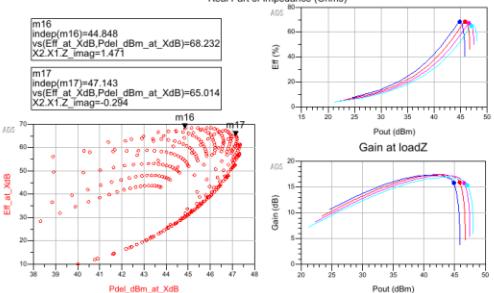
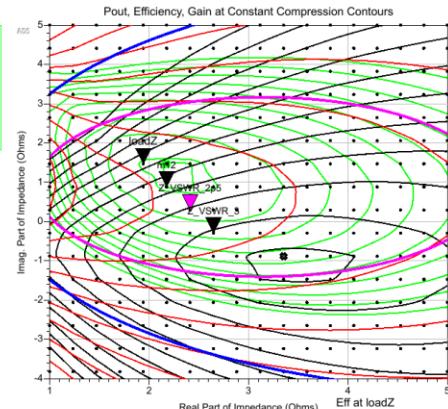


# Case 2 : Moscap rotate 180 deg (10,3 pF: index 5)

D\_BW = 175 um



Pout	Gr	Eff
47.0	18.4	69.3
47.0	18.0	69.0
46.5	17.0	66.0
46.0	16.0	64.0
45.5	15.0	63.0
45.0	14.0	60.0
44.5	13.0	58.0
44.0	12.0	56.0
43.5	11.0	54.0
43.0	9.0	52.0
42.5	8.0	50.0



## Power Sweep Inspector

Eqn VSWRVal=5 Eqn VSWRVal=2.5

Move Marker "loadZ" to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.35 + j0.88$

VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.18 + j0.88$

VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j1.47$	$0.93 / 176.63$	1.50
Pout (dBm)	Eff (%)	Gr (dB)
44.85	68.23	15.80
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-47.56	-12.28	$0.52 + j3.66$

$\times$  in plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.88$	$0.92 / 177.97$	1.50
Pout (dBm)	Eff (%)	Gr (dB)
45.84	68.38	15.88
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-43.02	-12.23	$0.49 + j3.55$

$\times$  in plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.29$	$0.91 / 179.32$	1.50
Pout (dBm)	Eff (%)	Gr (dB)
46.56	67.18	15.74
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-36.72	-11.59	$0.47 + j3.45$

$\times$  in plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.29$	$0.90 / 179.32$	1.50
Pout (dBm)	Eff (%)	Gr (dB)
47.05	64.91	15.36
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-39.16	-10.72	$0.46 + j3.35$

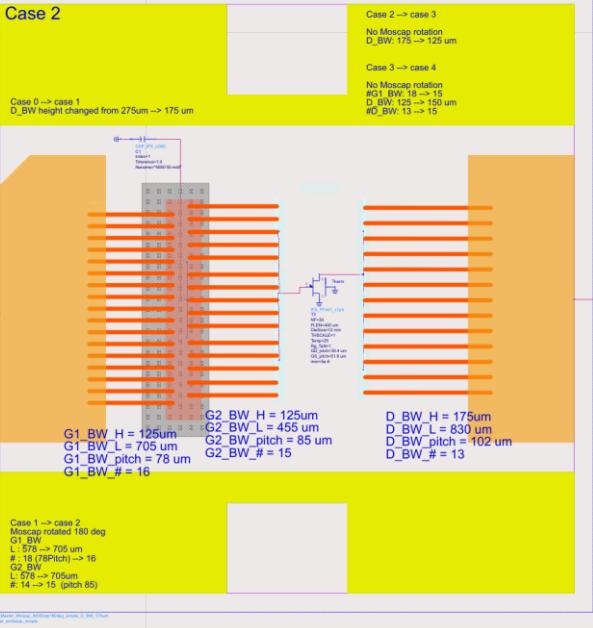
$\times$  in plots below corresponds to this data.



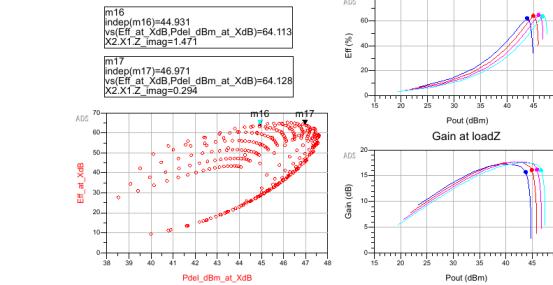
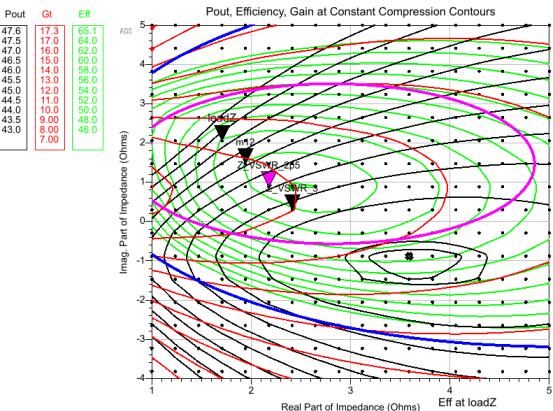
Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8

# Case 2 : Moscap rotate 180 deg (12.89 pF: index 1)

Case 2



Index	L	W	Ws	d	Value_pF
1	1446	328	1678	444	1300
5	1446	261	1678	444	1300
6	1446	244	1678	444	1950
10	1446	207	1678	444	1950
19	1446	207	1770	536	1300
20	1446	328	1770	536	1950
					8.8



## Power Sweep Inspector

Edn VSWRVal=5 Edn VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.59 + j0.88$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.71 + j2.06$	0.93 / 175.28	1.50
Pout (dBm)	Eff (%)	GT (dB)
43.79	62.21	15.70
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-54.92	-9.02	$0.43 + j3.75$

✗ In plots below corresponds to this data.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $1.94 + j1.47$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j1.47$	0.93 / 176.63	1.50
Pout (dBm)	Eff (%)	GT (dB)
44.93	64.11	16.12
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-51.31	-8.65	$0.39 + j3.66$

✗ In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.88$	0.92 / 177.97	1.50
Pout (dBm)	Eff (%)	GT (dB)
45.93	64.73	16.17
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-45.21	-8.27	$0.36 + j3.57$

✗ In plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.29$	0.91 / 179.32	1.50
Pout (dBm)	Eff (%)	GT (dB)
46.70	63.88	16.02
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-37.71	-7.84	$0.34 + j3.48$

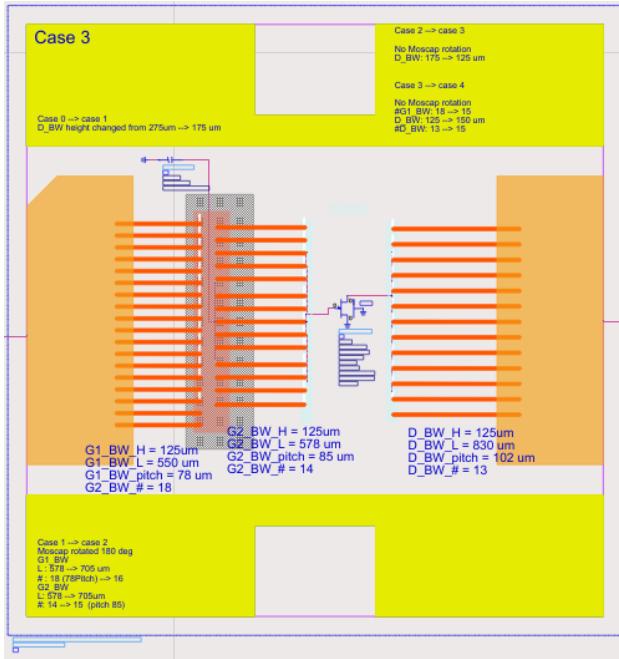
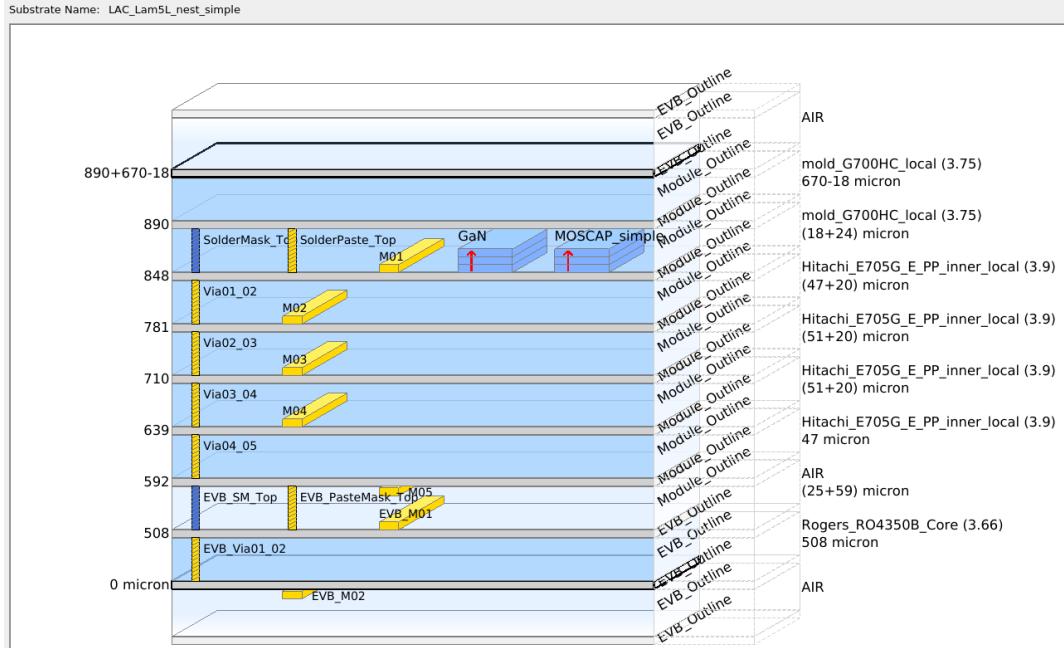
✗ In plots below corresponds to this data.



# LP simulations with simple EM model

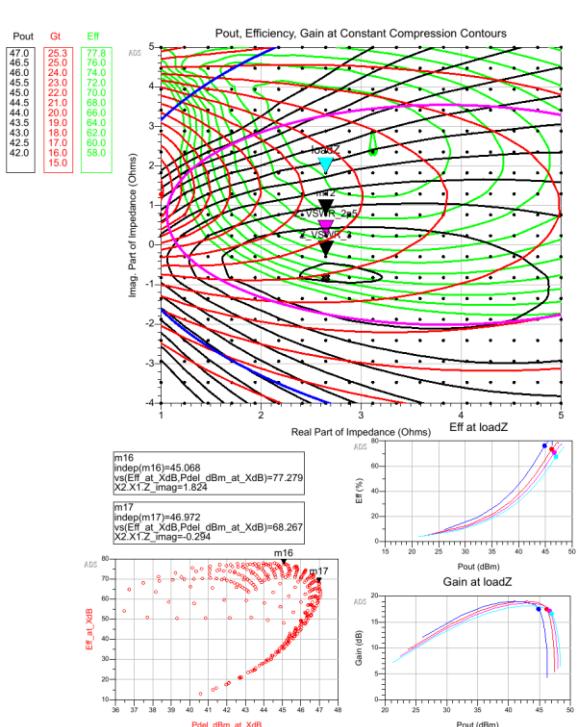
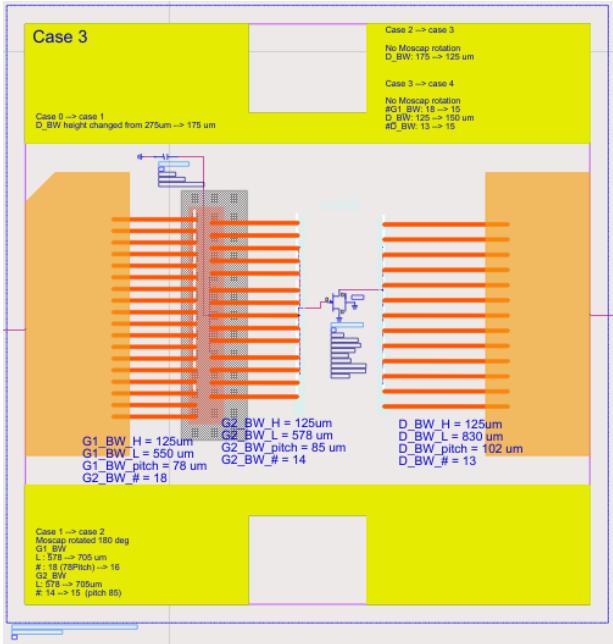
# Case 3

Substrate Name: LAC\_Lam5L\_nest\_simple



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,5
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	819

# Case 3 : Moscap rotate 0 deg (5.5 pF: index 10)



## Power Sweep Inspector

VSWRVal=5 VSWRVal1=2.5

Move Marker "loadZ" to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR center Impedance =  $2.65 + j0.82$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j1.82$	0.90 / 175.81	1.50
Pout (dBm)	Eff (%)	GI (dB)
44.88	76.21	17.48
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-52.72	-16.98	$0.53 + j3.51$

X in plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.24$	0.90 / 179.46	1.50
Pout (dBm)	Eff (%)	GI (dB)
46.66	70.84	17.13
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-44.74	-9.73	$0.42 + j3.25$

X in plots below corresponds to this data.

## VSWR = 3 point DATA

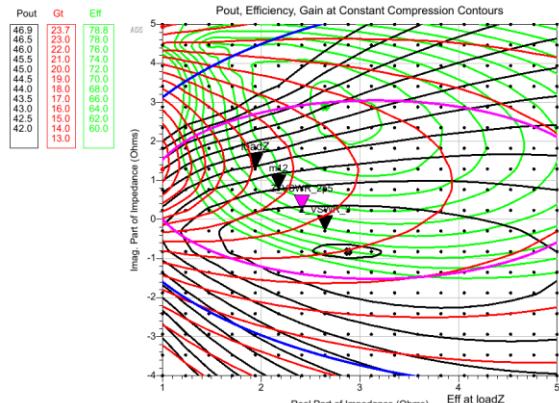
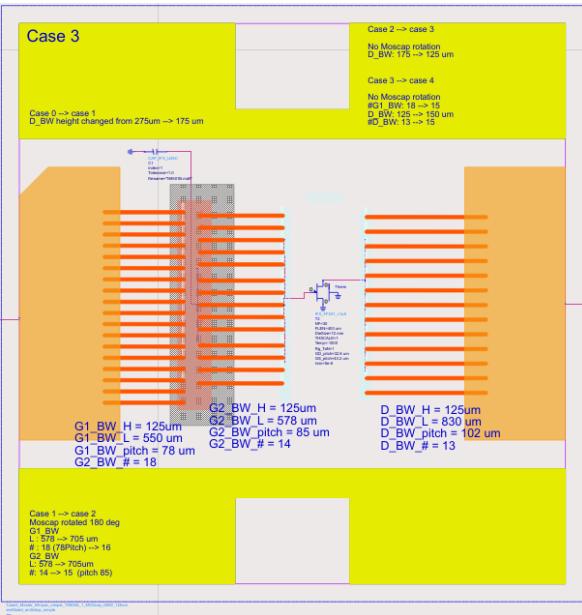
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.29$	0.90 / -179.32	1.50
Pout (dBm)	Eff (%)	GI (dB)
46.99	67.37	16.56
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-39.03	-7.94	$0.41 + j3.13$

X in plots below corresponds to this data.



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

# Case 3 : Moscap rotate 0 deg (6.58 pF: index 6)



## Power Sweep Inspector

EqnVSWRVal=5 EqnVSWRVal=1.25

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.88 + j0.82$

## Summary of Performance at Compression

Marker Impedance

Marker Gamma

Reference Compression Level (dB)

Pout (dBm)

Eff (%)

Gt (dB)

AMPM (dBm)

IRL (dB)

Zin (Ohm)

X in plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance

Marker Gamma

Reference Compression Level (dB)

Pout (dBm)

Eff (%)

Gt (dB)

AMPM (dBm)

IRL (dB)

Zin (Ohm)

X in plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance

Marker Gamma

Reference Compression Level (dB)

Pout (dBm)

Eff (%)

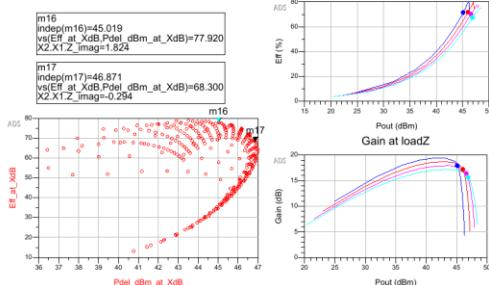
Gt (dB)

AMPM (dBm)

IRL (dB)

Zin (Ohm)

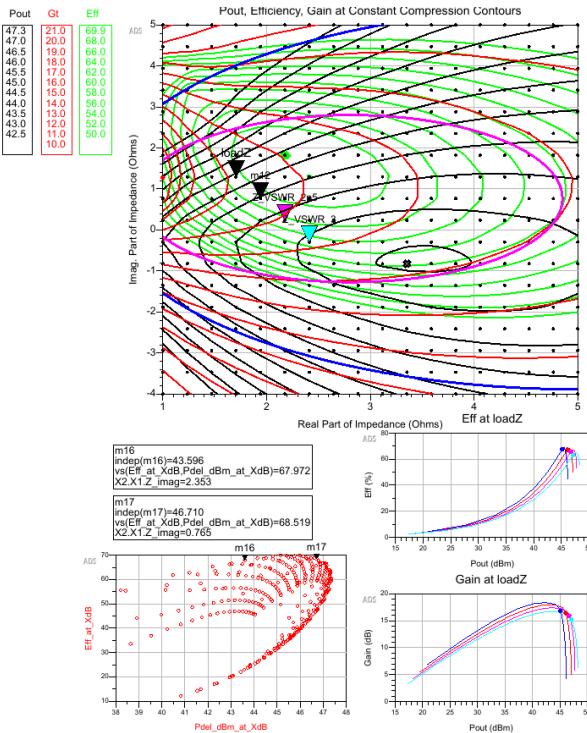
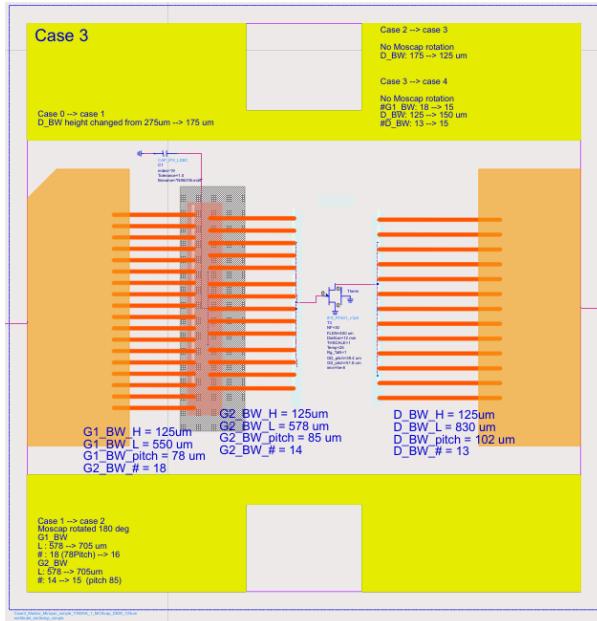
X in plots below corresponds to this data.



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8



Case 3 : Moscap rotate 180 deg (8,19 pF: index 19)



Move Marker 'loadZ' to desired impedance point

VSWR Locus of Points selector is located on Constant Compression Loadpull page

VSWR Locus center Impedance = 3.35 - j0.8  
VSWR=5

Summary of Performance at Compression		
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
1.71 + j1.29	0.93 + j177.03	+1.50
Pout (dBm)	Eff (%)	Gl (dB)
45.13	67.58	16.86
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-57.93	-12.25	0.44 + j3.39

✗ In plots below corresponds to this data

**X** In plots below corresponds to this data

VSWR Locus center Impedance =   
VSWR=5

Summary of Performance at Compression		
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
1.94 + j0.76	0.93 / 178.24	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.06	67.29	16.45
AMPP (dBm)	IRL (dB)	Zin (Ohm)
-48.87	-10.29	0.44 + j3.25

\* In plots below corresponds to this data

**X** In plots below corresponds to this da

VSWR = 2.5 point DATA		
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.18 + [0.24]	0.92 / 179.46	1.50
Pout (dBm)	EIT (%)	GI (dB)
46.69	65.68	15.92
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-39.96	-8.47	0.44 + j3.13

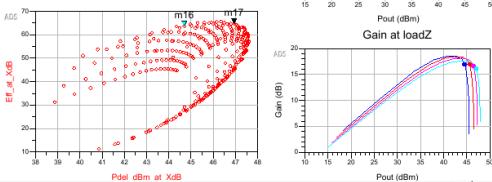
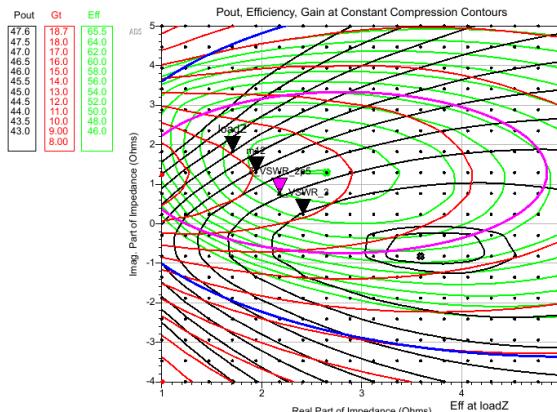
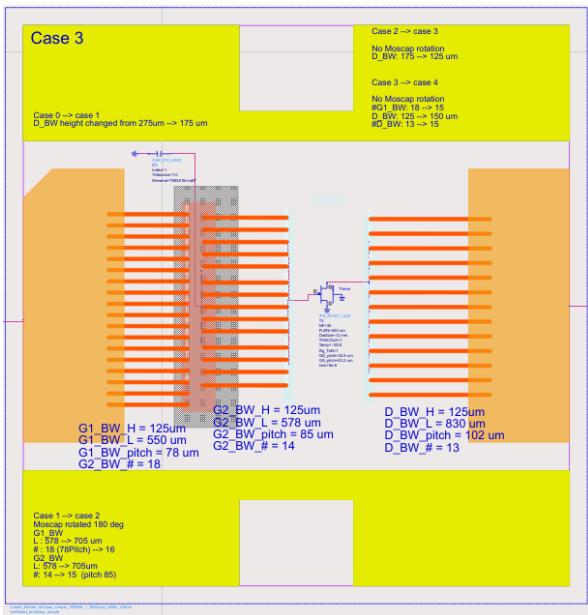
• 100 •

VSWR = 3 point DATA		
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.41 -j0.29	0.91 /-179.32	1.50
Pout (dBm)	Eff (%)	G (dB)
47.08	63.09	15.20
AMPP (dBm)	IRL (dB)	Zin (Ohm)
-32.13	-7.24	0.45 +j3.02

2000-01-02

Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8

# Case 3 : Moscap rotate 0 deg (10,3 pF: index 5)



## Power Sweep Inspector

VSWRVal=5 VSWRVal=2.5

Move Marker "loadZ" to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.59 + j0.82$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.71 + j1.82$	$0.93 / 175.62$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.48	62.99	16.94
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-62.58	-10.83	$0.39 + j3.45$

× In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j0.76$	$0.92 / 178.24$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.42	64.02	16.63
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-44.34	-7.73	$0.35 + j3.23$

× In plots below corresponds to this data.

## VSWR = 3 point DATA

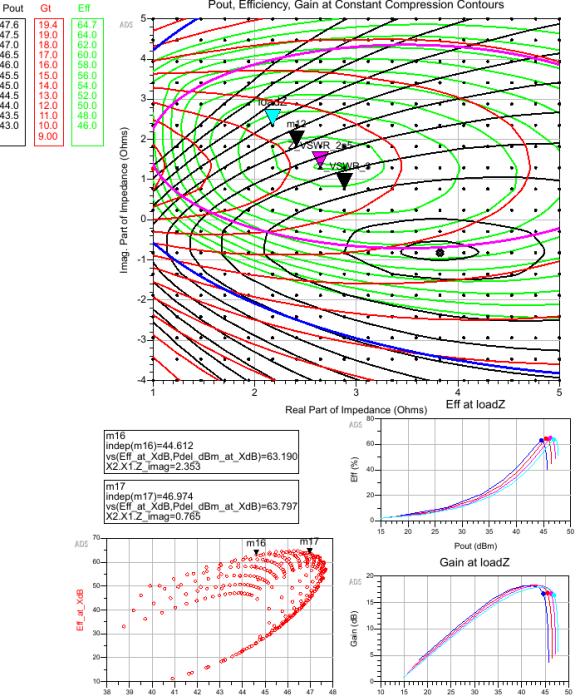
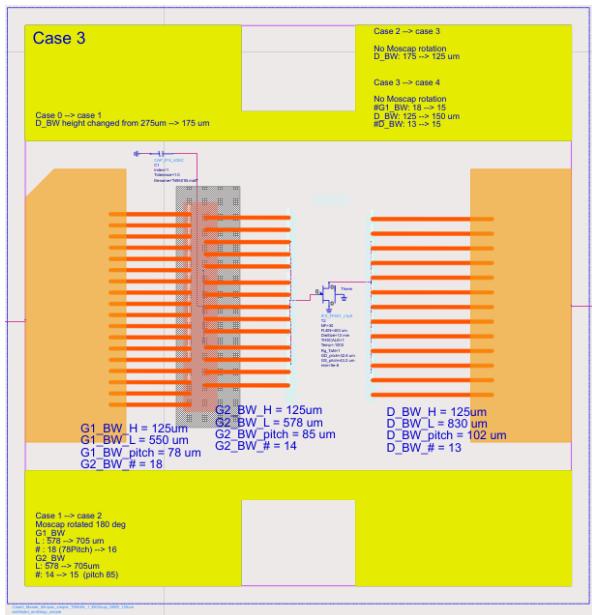
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.24$	$0.91 / 179.46$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
47.04	62.70	16.10
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-34.79	-6.50	$0.34 + j3.12$

× In plots below corresponds to this data.



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

# Case 3 : Moscap rotate 0 deg (12,89 pF: index 1)



## Power Sweep Inspector

Eqn VSWRVal= Eqn VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.82 - j0.82$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.18 + j2.35$	$0.92 / 174.60$	1.50
Pout (dBm)	Eff (%)	Gl (dB)
44.61	63.19	16.66

AMPM (dBm): -61.98, IRL (dB): -11.65, Zin (Ohm):  $0.41 + j3.45$

**X** In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j1.82$	$0.91 / 175.81$	1.50
Pout (dBm)	Eff (%)	Gl (dB)
45.48	64.40	16.84

AMPM (dBm): -56.60, IRL (dB): -9.97, Zin (Ohm):  $0.38 + j3.38$

**X** In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j1.29$	$0.90 / 177.03$	1.50
Pout (dBm)	Eff (%)	Gl (dB)
46.27	64.78	16.70

AMPM (dBm): -50.03, IRL (dB): -8.53, Zin (Ohm):  $0.35 + j3.30$

**X** In plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.88 + j0.76$	$0.89 / 178.24$	1.50
Pout (dBm)	Eff (%)	Gl (dB)
46.87	63.90	16.43

AMPM (dBm): -42.98, IRL (dB): -7.39, Zin (Ohm):  $0.34 + j3.22$

**X** In plots below corresponds to this data.

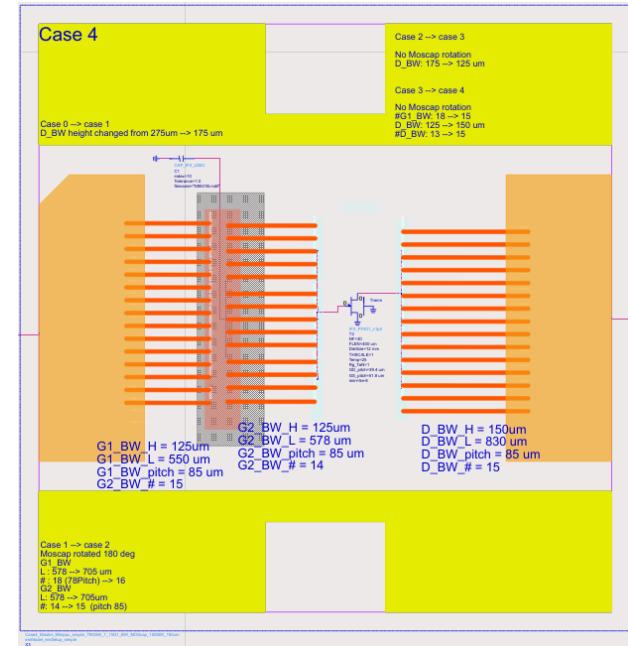
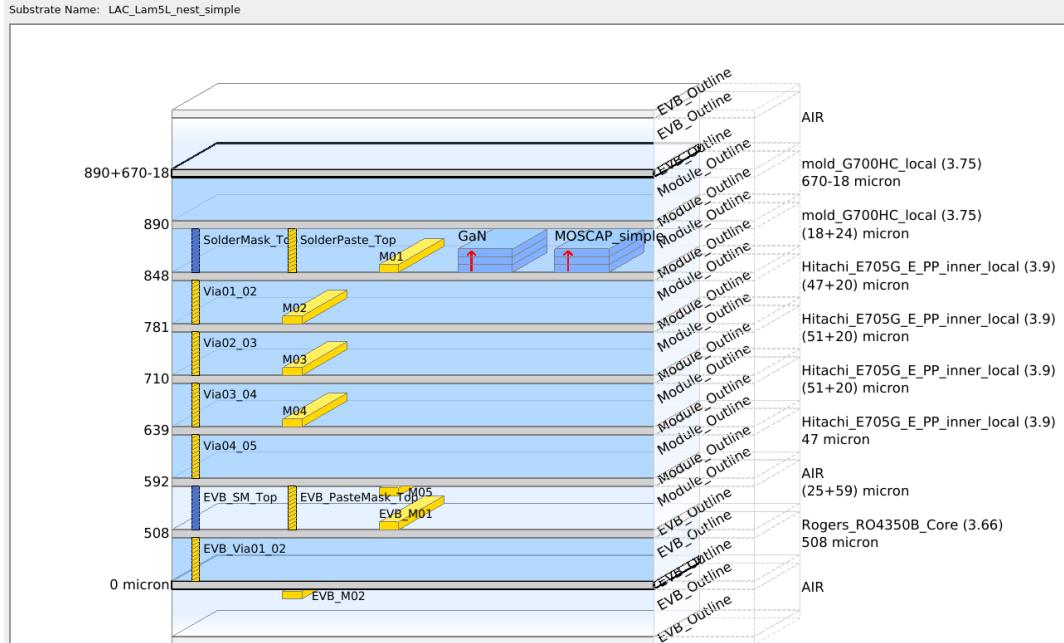
Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8



# LP simulations with simple EM model

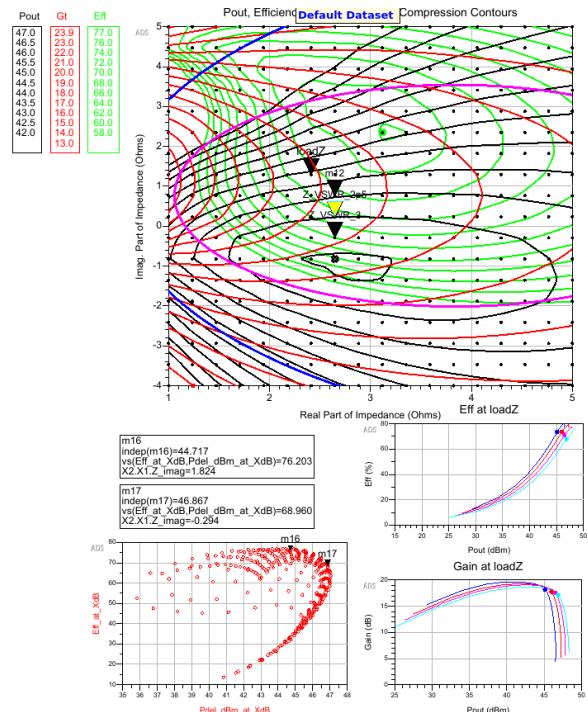
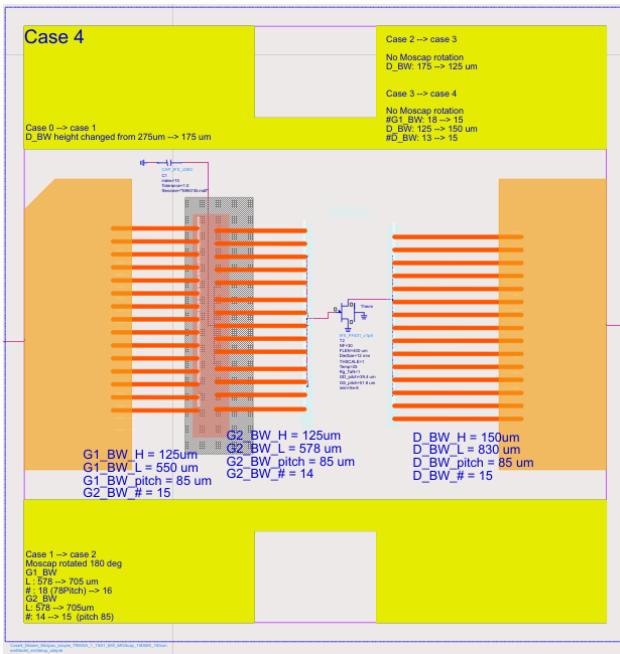


## Case 4



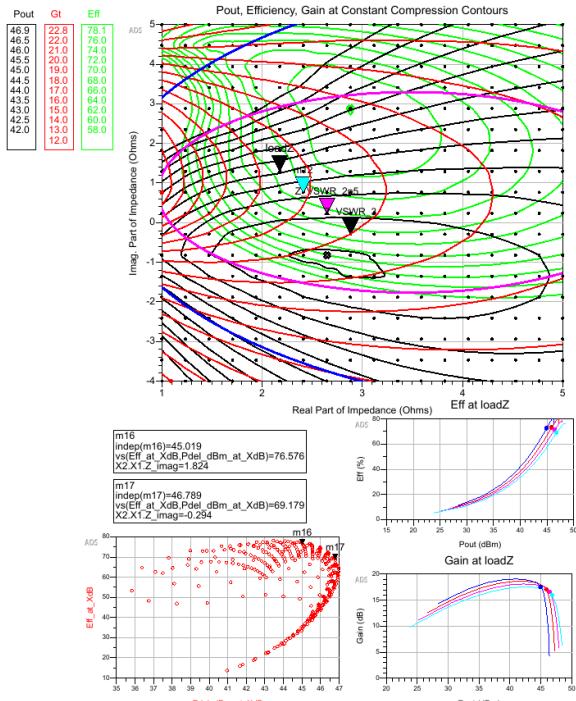
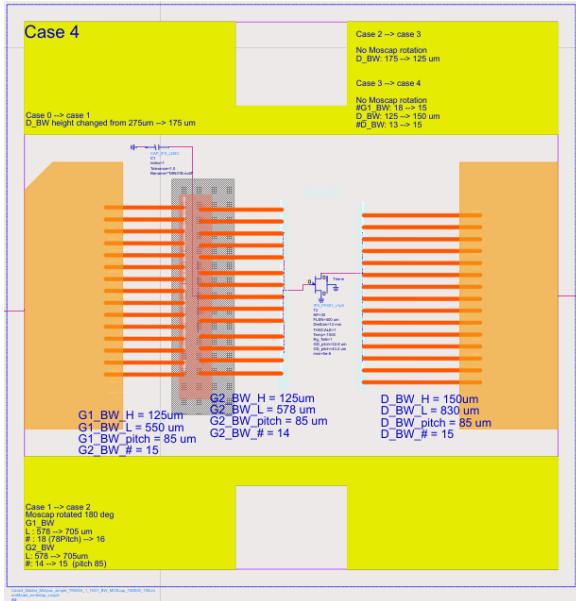
Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,5
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19

# Case 4 : Moscap rotate 0 deg (5.5 pF: index 10)



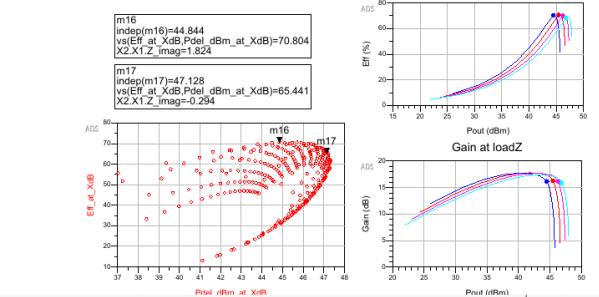
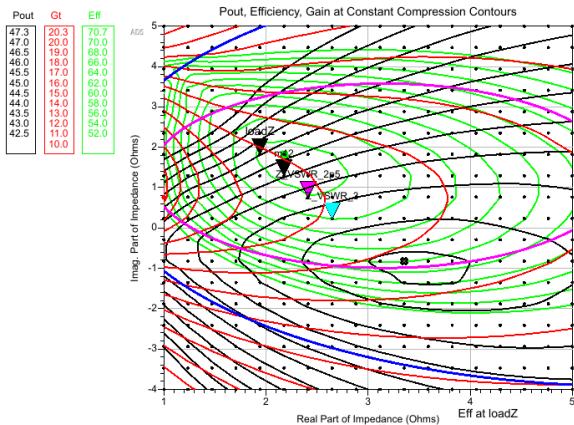
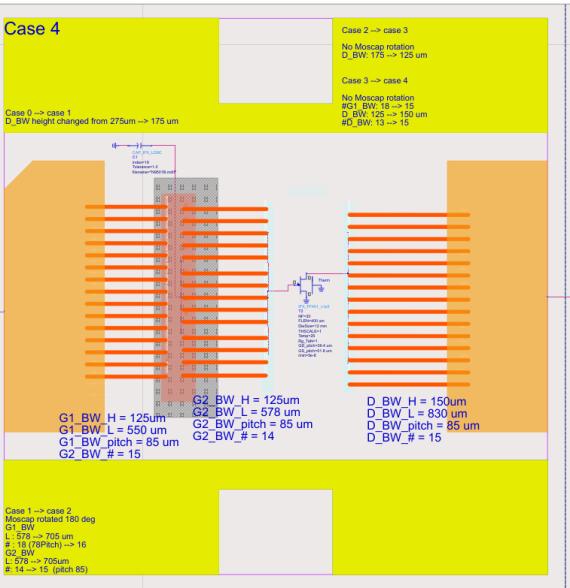
Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

# Case 4 : Moscap rotate 0 deg (6.58 pF: index 6)



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

# Case 4 : Moscap rotate 180 deg (8,19 pF: index 19)



## Power Sweep Inspector

Eff VSWRVal=5 Eff VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Loc center Impedance = 3.35 - j0.82  
VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Loc center Impedance = 2.18 + j1.29  
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
1.94 + j1.82	0.93 / 175.82	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.48	70.37	16.19
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-53.28	-16.77	0.59 + j3.66

✗ In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.18 + j1.29	0.92 / 177.03	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.46	70.53	16.30
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-50.33	-19.17	0.57 + j3.55

✗ In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.41 + j0.76	0.91 / 178.24	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.25	69.98	16.16
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-45.11	-18.19	0.55 + j3.45

✗ In plots below corresponds to this data.

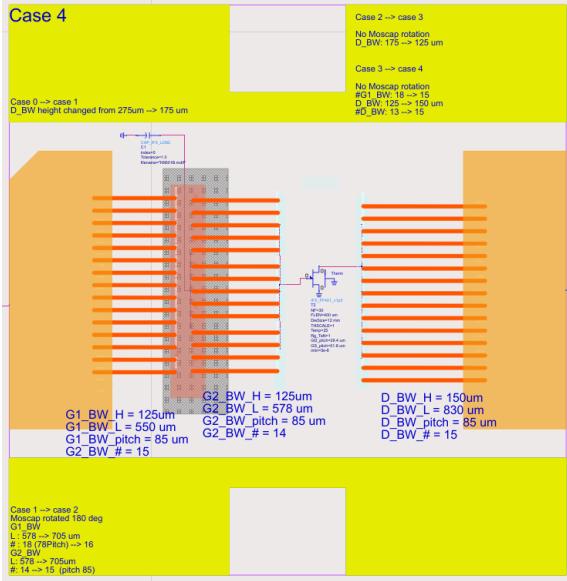
## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.65 + j0.24	0.90 / 179.46	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.79	68.09	15.85
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-39.22	-15.24	0.55 + j3.34

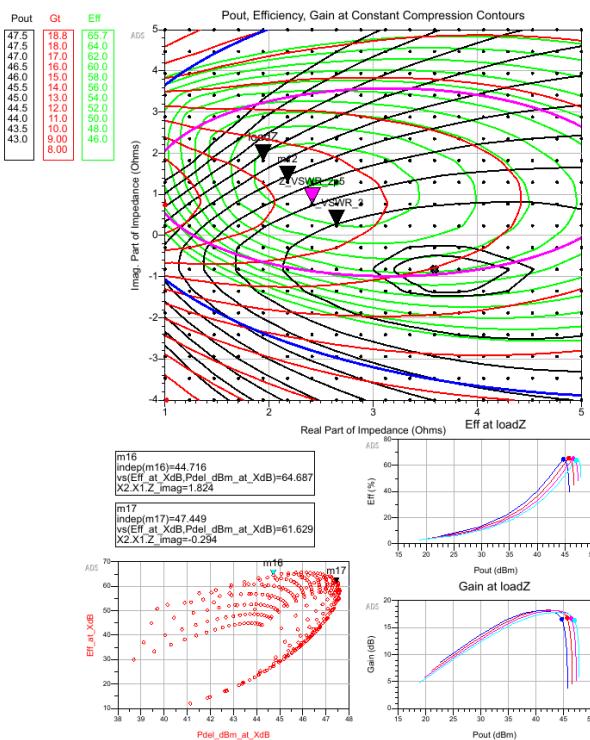
✗ In plots below corresponds to this data.

Index	L	W	ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12.89
5	1446	261	1678	444	1300	10.3
6	1446	244	1678	444	1950	6.58
10	1446	207	1678	444	1950	5.5
19	1446	207	1770	536	1300	8.19
20	1446	328	1770	536	1950	8.8

# Case 4 : Moscap rotate 0 deg (10,3 pF: index 5)



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8



## Power Sweep Inspector

Eqn VSWRval=5 Eqn VSWRval=1.25

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance = VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance = VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
1.94 + j1.82	0.93 / 175.82	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.72	64.69	16.59

AMPM (dBm) IRL (dB) Zin (Ohm)

-57.68 -12.52 0.46 + j3.64

× In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.18 + j1.29	0.92 / 177.03	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.68	65.60	16.77

AMPM (dBm) IRL (dB) Zin (Ohm)

-52.07 -12.23 0.43 + j3.54

× In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.41 + j0.76	0.91 / 178.24	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.47	65.27	16.61

AMPM (dBm) IRL (dB) Zin (Ohm)

-45.08 -11.55 0.41 + j3.44

× In plots below corresponds to this data.

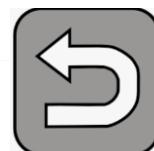
## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.65 + j0.24	0.90 / 179.46	1.50
Pout (dBm)	Eff (%)	Gt (dB)
47.03	63.96	16.32

AMPM (dBm) IRL (dB) Zin (Ohm)

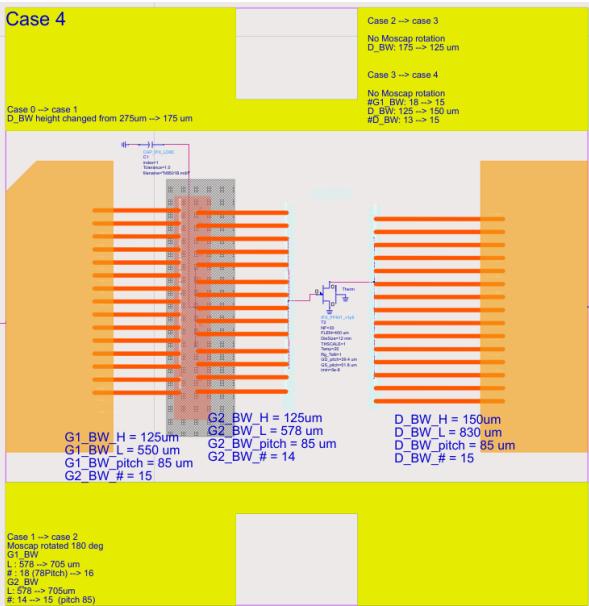
-37.18 -10.25 0.40 + j3.34

× In plots below corresponds to this data.

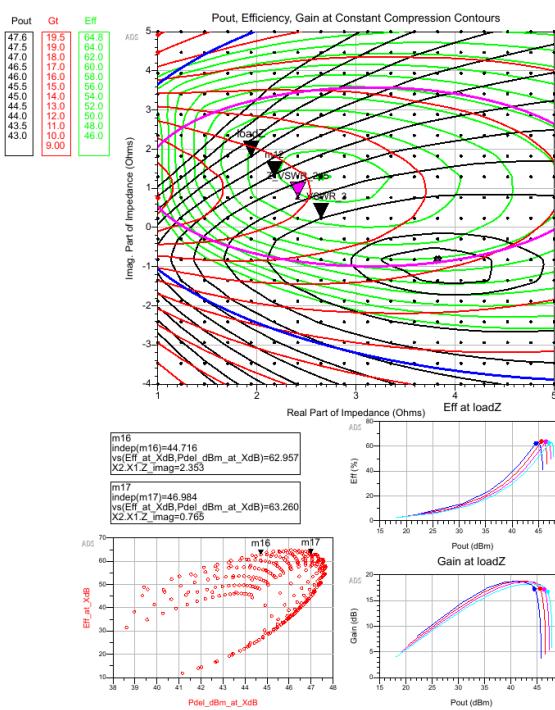


# Case 4 : Moscap rotate 0 deg (12,89 pF: index 1)

## Case 4



Index	L	W	Ls	Ws	d	Value_pF
1	1446	328	1678	444	1300	12,89
5	1446	261	1678	444	1300	10,3
6	1446	244	1678	444	1950	6,58
10	1446	207	1678	444	1950	5,5
19	1446	207	1770	536	1300	8,19
20	1446	328	1770	536	1950	8,8



## Power Sweep Inspector

$\text{Eqn VSWRVal}=5$   $\text{Eqn VSWRVal1}=2.5$

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.82 - j0.82$

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$1.94 + j1.82$	$0.93 / 175.82$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.49	62.24	17.25
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-64.86	-8.88	$0.35 + j3.64$

## VSWR = 2.5 point DATA

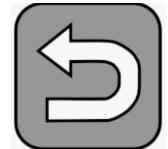
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.41 + j0.76$	$0.91 / 176.24$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.39	63.86	17.18
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-52.02	-8.29	$0.31 + j3.47$

$\times$  In plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j0.24$	$0.90 / 179.46$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
47.00	62.68	16.74
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-44.06	-7.84	$0.31 + j3.38$

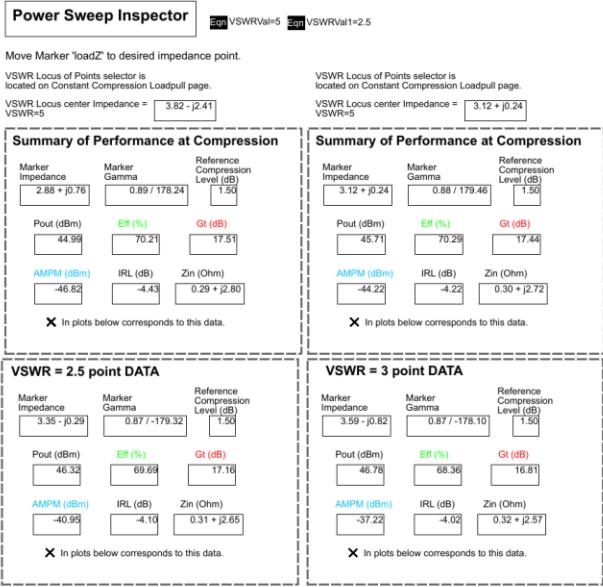
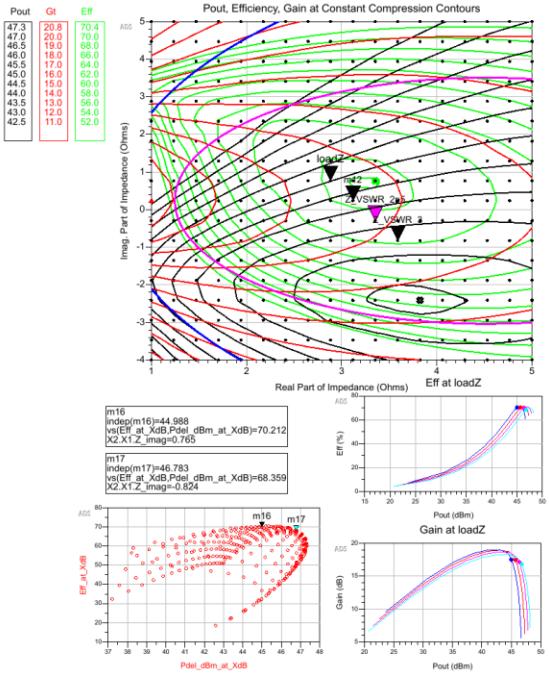
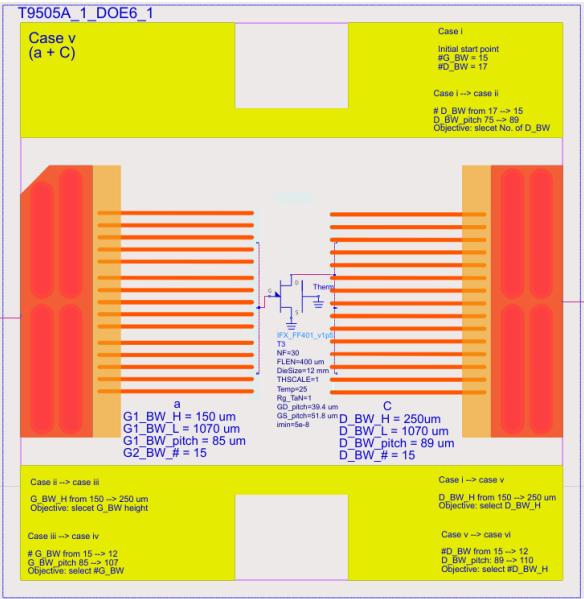
$\times$  In plots below corresponds to this data.



# Detailed EM simulation for Selected DOE variants

# DOE6\_1

## T9405A\_1\_DOE6\_1

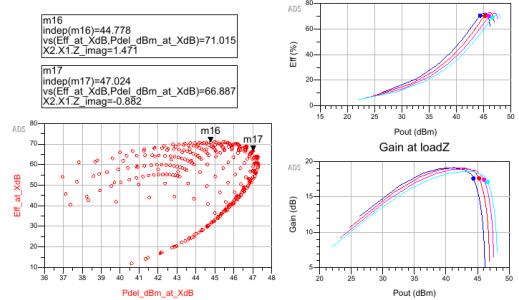
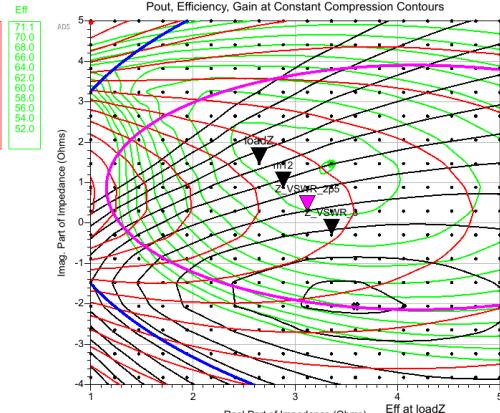
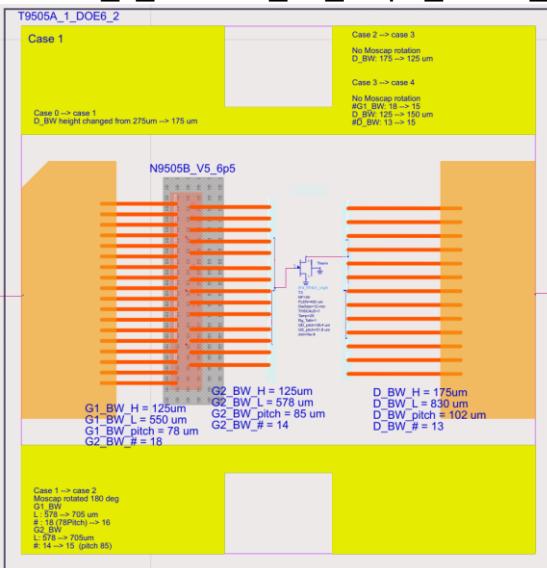


# Case 1: 6,5 pF

Moscap		Z_load					VSWR_3						
Name	Value (pF)	Zin_Re (Ω)	Zin_imag (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)	Zin_Re (Ω)	Zin_L (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)
N9501B_V5	6,58	0,44	3,50	44,20	71,80	17,60	-8,30	0,51	2,7 - j 0,9	46,93	65,20	15,80	-12,00

N9501B_V5	6,58	0,44	3,50	44,20	71,80	17,60	-8,30	0,51	2,7 - j 0,9	46,93	65,20	15,80	-12,00
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T9405A\_1\_N9501B\_V5\_6.5pF\_DOE6\_2



## Power Sweep Inspector

Eq1:VSWRVal=5 Eq2:VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance = 3.59 - j2.06

## Summary of Performance at Compression

Marker Impedance: 2.65 + j1.47

Marker Gamma: 0.90 / 176.62

Reference Compression Level (dB): 1.50

Pout (dBm): 44.34

Eff (%)

Gt (dB): 17.60

AMPM (dBm): -53.05

IRL (dB): -10.40

Zin (Ohm): 0.43 + j3.20

X in plots below corresponds to this data.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance = 2.88 + j0.88

## Summary of Performance at Compression

Marker Impedance: 2.88 + j0.88

Marker Gamma: 0.89 / 177.97

Reference Compression Level (dB): 1.50

Pout (dBm): 45.22

Eff (%)

Gt (dB): 17.64

AMPM (dBm): -52.04

IRL (dB): -10.17

Zin (Ohm): 0.43 + j3.11

X in plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance: 3.12 + j0.29

Marker Gamma: 0.88 / 179.32

Reference Compression Level (dB): 1.50

Pout (dBm): 46.01

Eff (%)

Gt (dB): 17.47

AMPM (dBm): -49.12

IRL (dB): -9.90

Zin (Ohm): 0.44 + j3.03

X in plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance: 3.35 - j0.29

Marker Gamma: 0.87 / -179.32

Reference Compression Level (dB): 1.50

Pout (dBm): 46.61

Eff (%)

Gt (dB): 17.16

AMPM (dBm): -44.87

IRL (dB): -9.50

Zin (Ohm): 0.46 + j2.94

X in plots below corresponds to this data.



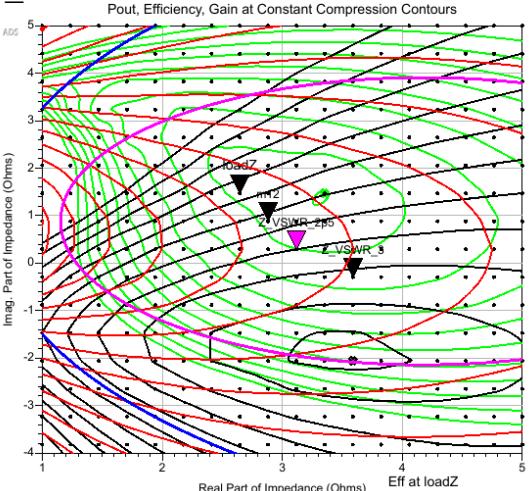
# Case 1: 8.09 pF

T9405A\_1\_N9501B\_V8\_8.09pF\_DOE6\_3



Moscap		Z_load					VSWR_3						
Name	Value (pF)	Zin_Re (Ω)	Zin_imag (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)	Zin_Re (Ω)	Zin_L (Ω)	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)
N9501B_V8	8,19	0,51	3,50	44,28	68,20	16,40	-10,80	0,48	2,4 - j 0,3	46,90	65,60	15,90	-11,30

Pout	Gt	Eff
47.2	22.3	71.1
47.0	22.0	70.0
46.5	21.0	68.0
46.0	20.0	66.0
45.5	19.0	64.0
45.0	18.0	62.0
44.5	17.0	60.0
44.0	16.0	58.0
43.5	15.0	56.0
43.0	14.0	54.0
42.5	13.0	52.0
42.0	12.0	



## Power Sweep Inspector

Eff VSWRVal=5 Ecn VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.59 + j0.06$   
VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.88 + j0.88$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance  $2.65 + j1.47$       Marker Gamma  $0.90 / 176.62$       Reference Compression Level (dB) 1.50

Pout (dBm) 44.32      Eff (%) 70.31      Gt (dB) 17.59

AMPM (dBm) -52.77      IRL (dB) -10.55      Zin (Ohm)  $0.43 + j3.23$

✗ In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance  $2.88 + j0.88$       Marker Gamma  $0.89 / 177.97$       Reference Compression Level (dB) 1.50

Pout (dBm) 45.20      Eff (%) 70.29      Gt (dB) 17.65

AMPM (dBm) -52.02      IRL (dB) -10.46      Zin (Ohm)  $0.43 + j3.14$

✗ In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance  $3.12 + j0.29$       Marker Gamma  $0.88 / 179.32$       Reference Compression Level (dB) 1.50

Pout (dBm) 46.00      Eff (%) 69.99      Gt (dB) 17.48

AMPM (dBm) -49.35      IRL (dB) -10.31      Zin (Ohm)  $0.44 + j3.06$

✗ In plots below corresponds to this data.

## VSWR = 3 point DATA

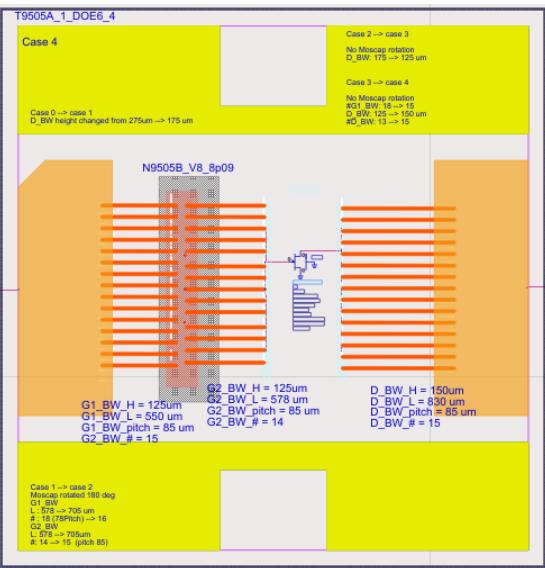
Marker Impedance  $3.59 + j0.29$       Marker Gamma  $0.87 / 179.32$       Reference Compression Level (dB) 1.50

Pout (dBm) 46.63      Eff (%) 68.87      Gt (dB) 16.90

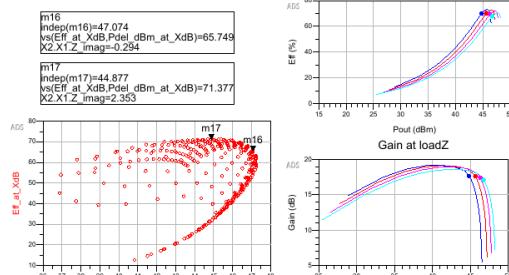
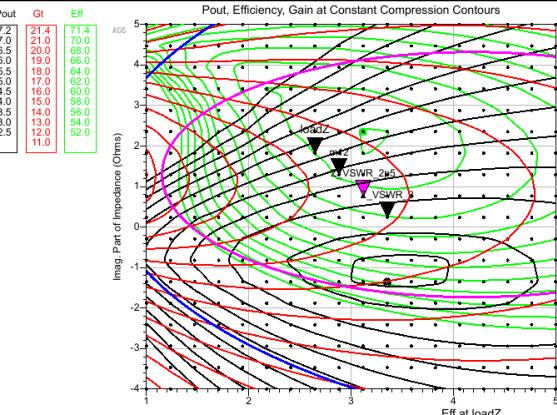
AMPM (dBm) -43.84      IRL (dB) -10.75      Zin (Ohm)  $0.50 + j2.97$

✗ In plots below corresponds to this data.

# Case 4: 8.09 pF T9405A\_1\_N9501B\_V8\_8.09pF\_DOE6\_4



Moscap		Z_load				VSWR_3							
Name	Value (pF)	Zin_Re ( $\Omega$ )	Zin_imag ( $\Omega$ )	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)	Zin_Re ( $\Omega$ )	Zin_L ( $\Omega$ )	Pout (dBm)	Eff. (%)	Gt (dB)	IRL (dB)
<b>N9501B_V8</b>	<b>8,19</b>	0,59	3,70	44,48	70,40	16,20	-16,80	0,55	2,7 + j 0,3	46,79	68,10	15,90	-15,20



## Power Sweep Inspector

Edit VSWRVal=5 Edit VSWRVal1=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance = 3.35 -j1.35  
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
2.65 + j1.82	0.90 / 175.81	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.81	70.06	17.64
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-45.74	-6.82	0.39 + j3.40

✗ In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
3.12 + j0.76	0.88 / 178.24	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.31	69.45	17.42
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-43.24	-7.84	0.42 + j3.24

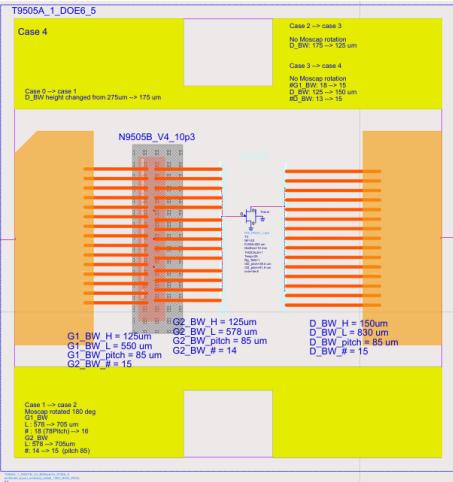
✗ In plots below corresponds to this data.

## VSWR = 3 point DATA

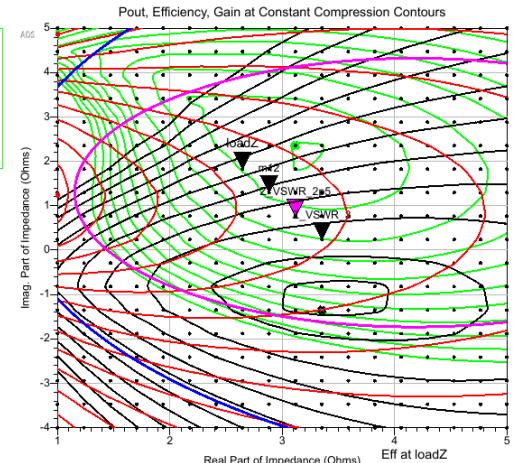
Marker Impedance	Marker Gamma	Reference Compression Level (dB)
3.35 + j0.24	0.87 / 179.46	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.77	67.91	17.11
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-40.00	-8.39	0.45 + j3.15

✗ In plots below corresponds to this data.

# Case 4: 10.3 pF T9405A\_1\_N9501B\_V4\_10,3pF\_DOE6\_5

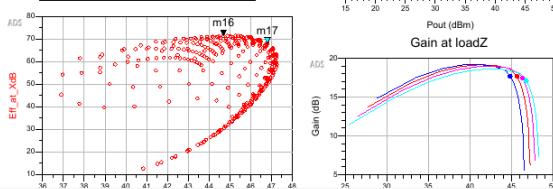


Pout	Gt	Eff
47.2	21.4	71.4
47.5	21.0	68.0
48.0	19.0	66.0
48.5	18.0	64.0
49.0	17.0	62.0
49.5	16.0	60.0
49.8	15.0	58.0
50.0	14.0	56.0
50.2	13.0	54.0
50.5	12.0	52.0
51.0	11.0	50.0



```
m16
indep(m16)=44.692
vs(Eff at XdB,Pdel dBm_at_XdB)=71.461
X2,X1,Z_imag=2.353
```

```
m17
indep(m17)=46.806
vs(Eff at XdB,Pdel dBm_at_XdB)=68.156
X2,X1,Z_imag=0.235
```



## Power Sweep Inspector

EQN VSWRVal=5 EQN VSWRVal=2.5

Move Marker 'loadZ' to desired impedance point.

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $3.35 - j1.35$   
VSWR=5

VSWR Locus of Points selector is located on Constant Compression Loadpull page.

VSWR Locus center Impedance =  $2.88 + j1.29$   
VSWR=5

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.65 + j1.82$	$0.90 / 175.81$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
44.82	70.13	17.66
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-45.81	-6.79	$0.39 + j3.40$

✗ In plots below corresponds to this data.

## Summary of Performance at Compression

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$2.88 + j1.29$	$0.89 / 177.02$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
45.67	70.36	17.64
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-45.39	-7.25	$0.40 + j3.32$

✗ In plots below corresponds to this data.

## VSWR = 2.5 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.12 + j0.76$	$0.88 / 178.24$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.32	69.50	17.43
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-43.21	-7.77	$0.42 + j3.23$

✗ In plots below corresponds to this data.

## VSWR = 3 point DATA

Marker Impedance	Marker Gamma	Reference Compression Level (dB)
$3.35 + j0.24$	$0.87 / 179.46$	1.50
Pout (dBm)	Eff (%)	Gt (dB)
46.77	67.98	17.11
AMPM (dBm)	IRL (dB)	Zin (Ohm)
-39.95	-8.31	$0.45 + j3.14$

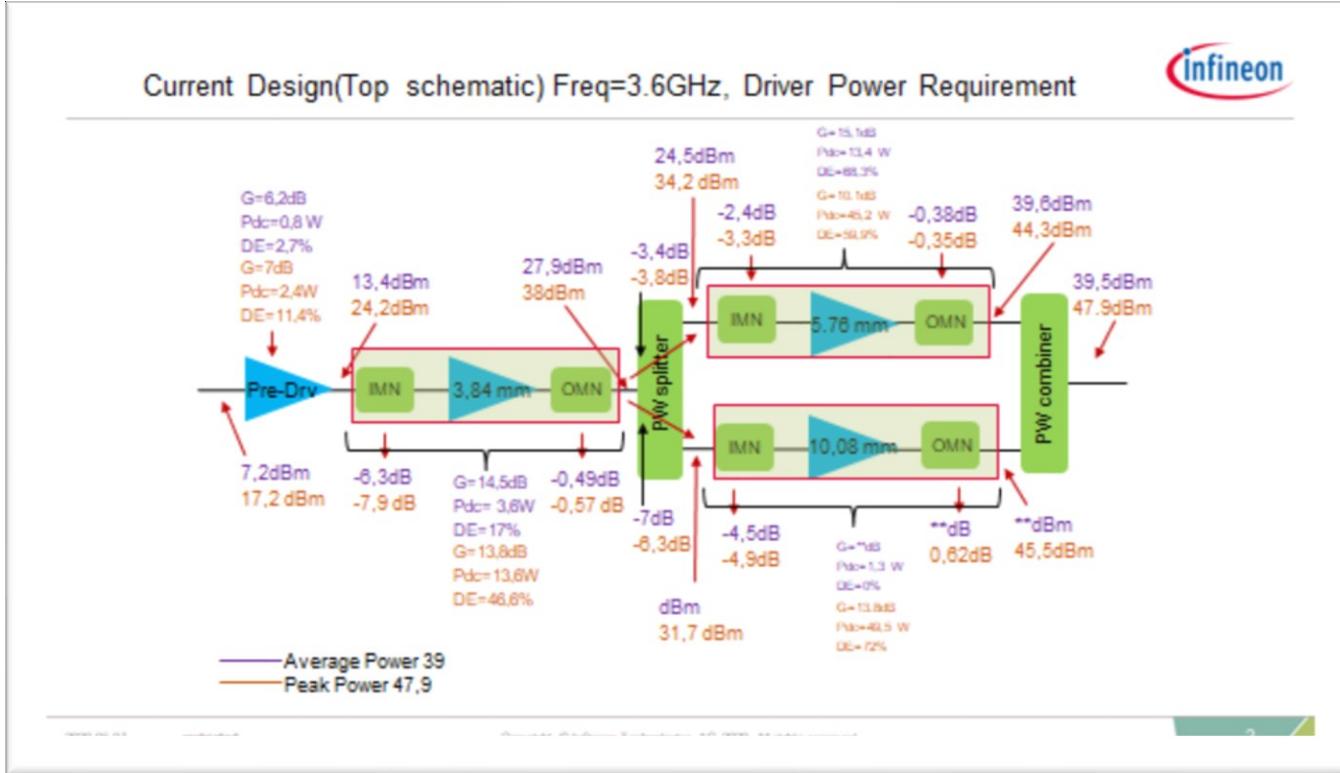
✗ In plots below corresponds to this data.



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## Additional slides

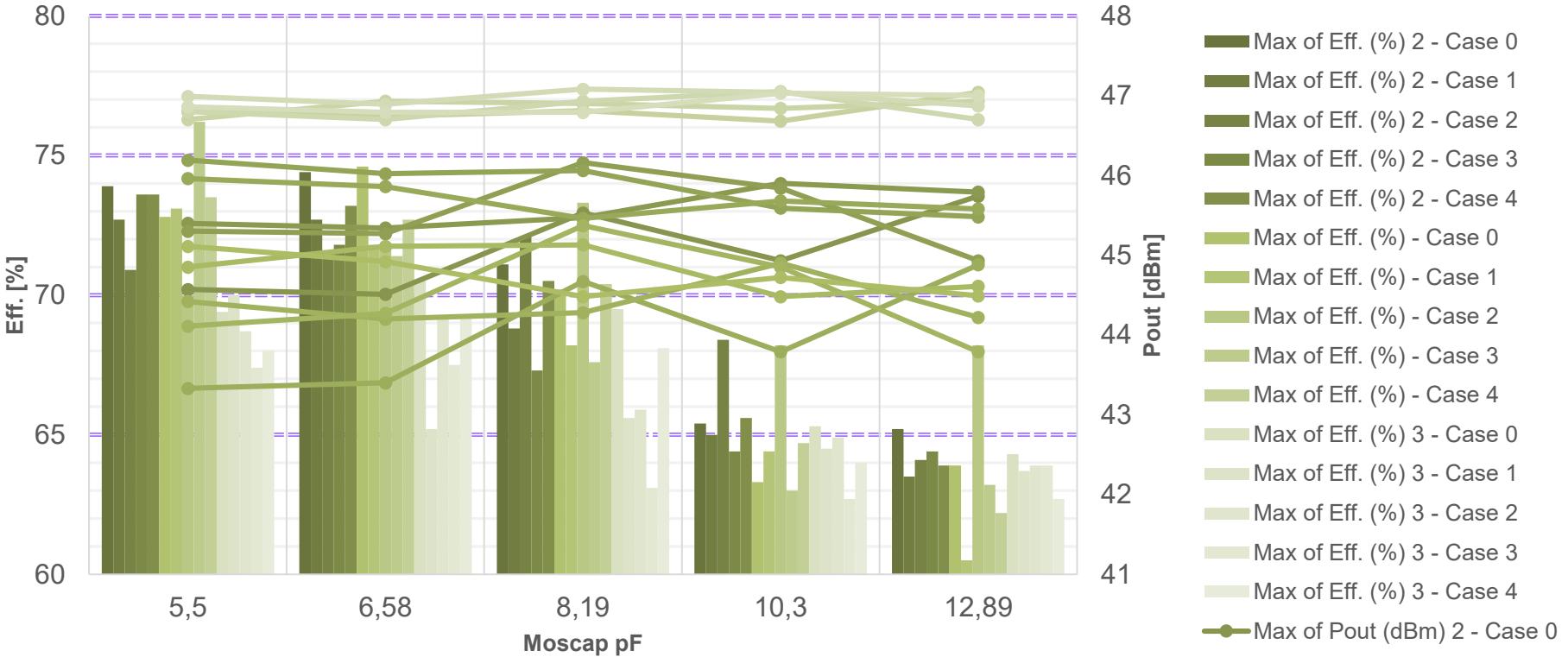
# Power calculation Doherty



From Theepak Shoundrabalan

# Simple EM simulation: BW + LAC3839 + MOScap (DOE all)

Eff, Pout w.r.t Moscap\_pF @ VSWR 1,2,3



# MOScap available in mdif (8<sup>th</sup> April 2022)

BEGIN DSCRDATA

%	INDEX	L	W	Ls	Ws	d
1	1446	328		1678	444	1300
2	1446	304		1678	444	1300
3	1446	281		1678	444	1300
4	1446	261		1678	444	1950
5	1446	261		1678	444	1300
6	1446	244		1678	444	1950
7	1446	244		1678	444	1300
8	1446	233		1678	444	1950
9	1446	221		1678	444	1950
10	1446	207		1678	444	1950
11	1466	281		1770	536	3100
12	1466	261		1770	536	3100
13	1466	244		1770	536	3100
14	1466	233		1770	536	3100
15	1466	221		1770	536	3100
16	1466	207		1770	536	3100
17	1466	328		1770	536	1300
18	1466	261		1770	536	1300
19	1466	207		1770	536	1300
20	1466	328		1770	536	1950

END DSCRDATA

