

# APPLICATION NOTE

Document NO. AN-UHF-133  
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(Taking charge of Silicon RF by  
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## **SUBJECT:**

RD01MUS2B single-stage amplifier RF performance at  $f = 400$  to  $520\text{MHz}$  ( $V_{dd} = 2.8\text{V}, 3.6\text{V}$ ).

## **SUMMARY:**

This application note shows the RF wide band characteristics data

Sample history :

RD01MUS2B: Lot number "151"

Evaluate conditions :

RD01MUS2B @ $f = 400$  to  $520\text{MHz}$  :  $V_{ds} = 2.8\text{V}, 3.6\text{V}$ ,  $I_{dq} = 40\text{mA}$  ( $V_{gs}$  adjust)

Results :

Page 2. shows the equivalent circuit

Page 3-4. shows the typical RF characteristics (Frequency characteristics) data. ( $V_{dd} = 2.8\text{V}$ )

Page 5-6. shows the typical RF characteristics (Frequency characteristics) data. ( $V_{dd} = 3.6\text{V}$ )

Page 7-11. shows the typical RF characteristics (Pout vs. Pin characteristics) data. ( $V_{dd} = 2.8\text{V}$ )

Page 12-16. shows the typical RF characteristics (Pout vs. Pin characteristics) data. ( $V_{dd} = 3.6\text{V}$ )

Page 17-18. shows the typical RF characteristics (Pout vs.  $V_{gg}$  characteristics) data. ( $V_{dd} = 2.8\text{V}$ )

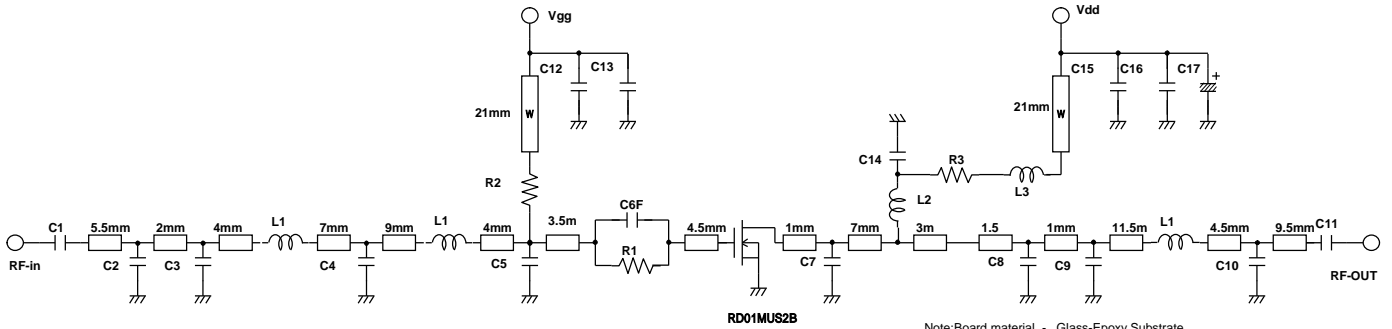
Page 19-20. shows the typical RF characteristics (Pout vs.  $V_{gg}$  characteristics) data. ( $V_{dd} = 3.6\text{V}$ )

Page 21-23. shows the typical RF characteristics (Pout vs.  $V_{dd}$  characteristics) data.

**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V.3.6V).**

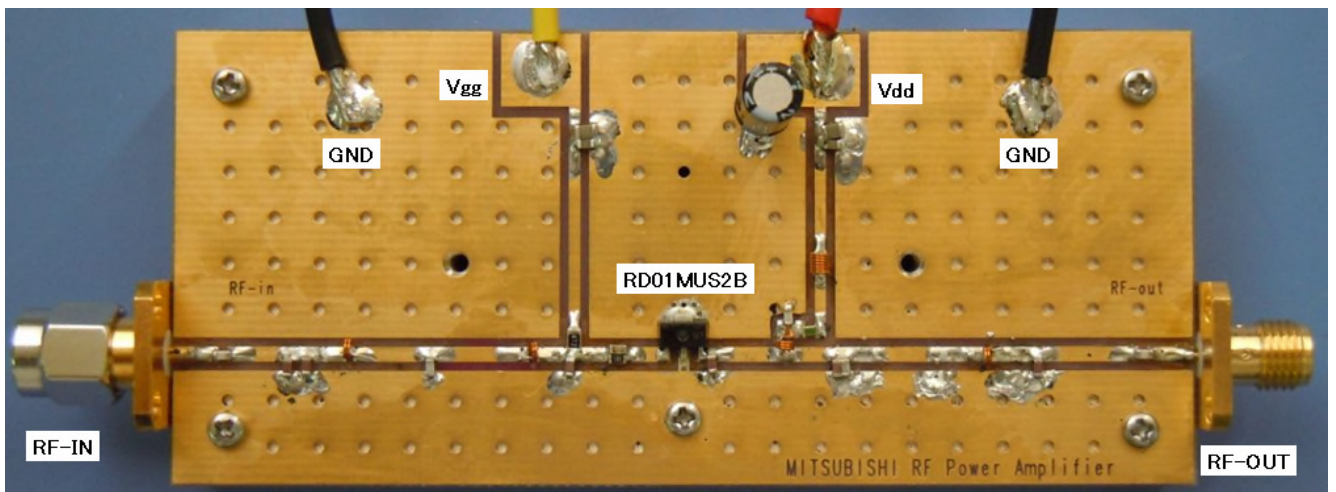
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**RD01MUS2B single-stage amplifier equivalent circuit (@f=400 to 520MHz)**



Note: Board material - Glass-Epoxy Substrate  
Micro strip Line width = 1.3mm/50 OHM, er:4.8, t=0.8mm  
W: Line width = 1.0mm

Parts Type	Symbol	Value	Type name	Vender
Capasitor	C1	100pF	GRM1882C1H101JA01D	Murata Manufacturing Co.,Ltd.
	C2	6pF	GRM1882C1H6R0JA01D	Murata Manufacturing Co.,Ltd.
	C3	6pF	GRM1882C1H6R0JA01D	Murata Manufacturing Co.,Ltd.
	C4	33pF	GRM1882C1H330JA01D	Murata Manufacturing Co.,Ltd.
	C5	3pF	GRM1882C1H3R0JA01D	Murata Manufacturing Co.,Ltd.
	C6	47pF	GRM1882C1H470JA01D	Murata Manufacturing Co.,Ltd.
	C7	5pF	GRM1882C1H5R0JA01D	Murata Manufacturing Co.,Ltd.
	C8	8pF	GRM1882C1H8R0JA01D	Murata Manufacturing Co.,Ltd.
	C9	24pF	GRM1882C1H240JA01D	Murata Manufacturing Co.,Ltd.
	C10	9pF	GRM1882C1H9R0JA01D	Murata Manufacturing Co.,Ltd.
	C11	100pF	GRM1882C1H101JA01D	Murata Manufacturing Co.,Ltd.
	C12	1000pF	GRM1882C1H102JA01D	Murata Manufacturing Co.,Ltd.
	C13	22000pF	GRM216R11H223KA01E	Murata Manufacturing Co.,Ltd.
	C14	130pF	GRM1882C1H131JA01D	Murata Manufacturing Co.,Ltd.
	C15	1000pF	GRM1882C1H102JA01D	Murata Manufacturing Co.,Ltd.
	C16	22000pF	GRM216R11H223KA01E	Murata Manufacturing Co.,Ltd.
	C17	22uF	UVZ1H220MDD	NICHICON COPORATION
Resistance	R1	68Ω	RPC10-680J	TAIYOSHA ELECTRIC CO.,Ltd.
	R2	4.7KΩ	RPC05-472J	TAIYOSHA ELECTRIC CO.,Ltd.
	R3	0Ω	RPC10-0R0J	TAIYOSHA ELECTRIC CO.,Ltd.
Inductance	L1	8nH Enameled wire 2Turns, Diameter:0.23mm,φ1.66mm(the out side diameter)	2302S	yc corporation
	L2	8nH Enameled wire 3Turns, Diameter:0.23mm,φ1.66mm(the out side diameter)	2303A	yc corporation
	L3	8nH Enameled wire 7Turns, Diameter:0.23mm,φ1.66mm(the out side diameter)	2307C	yc corporation

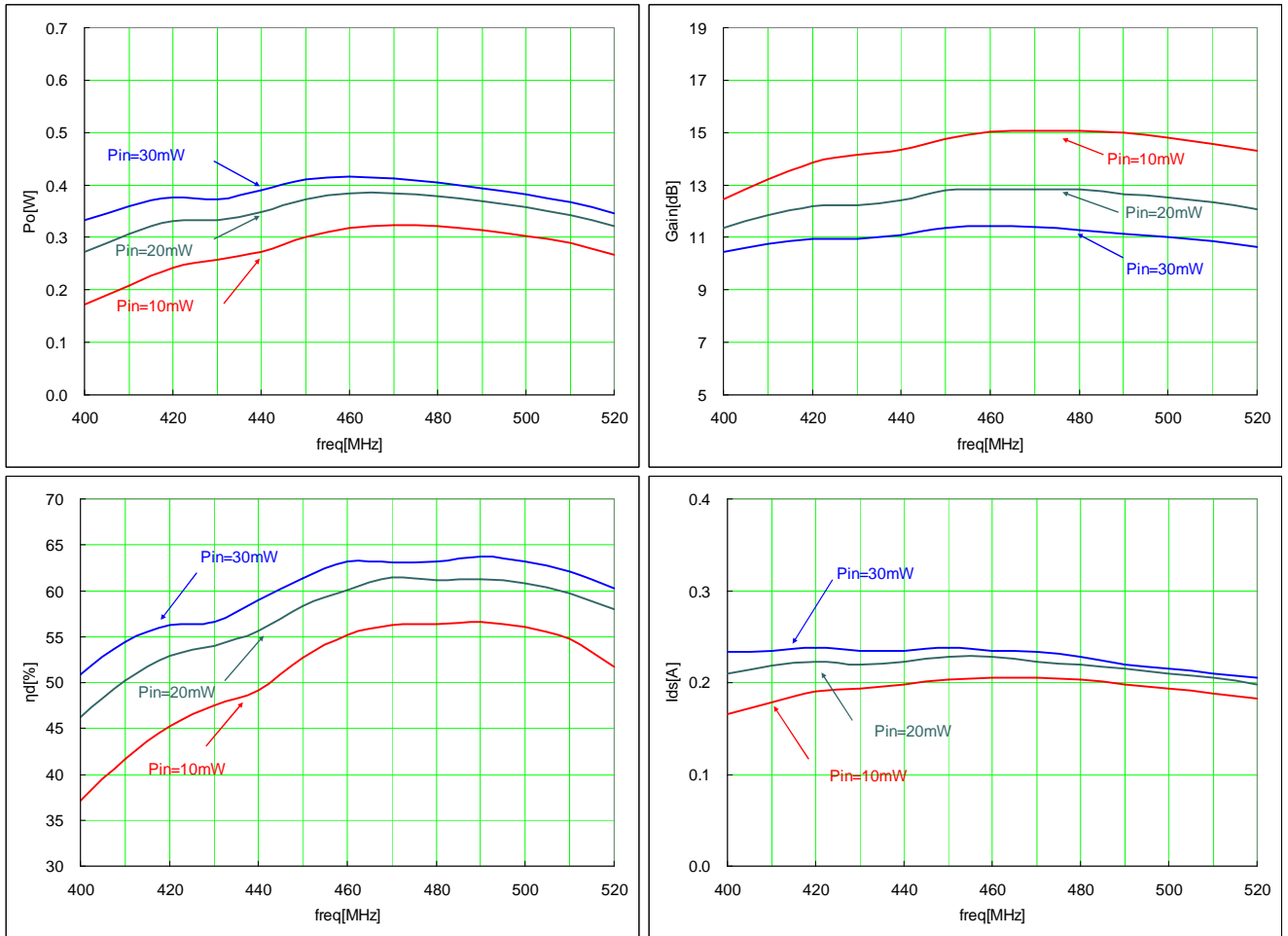


# RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).

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## RD01MUS2B single-stage amplifier Frequency characteristics.(Vdd=2.8V)

@ Vdd=2.8V, Idq=40mA (Vgs adjust), Pin=30mW, Pin=20mW, Pin=10mW



**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**RD01MUS2B single-stage amplifier Frequency characteristics Data.(Vdd=2.8V)**

**Vdd=2.8V,Idq=40mA(Vgg=1.35V)**

@ **Pin=30mW** (14.8dBm)

f [MHz]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
400	25.22	0.3	10.5	0.23	50.9	46.3	-34.2	-56.2	-2.1
410	25.55	0.4	10.8	0.24	54.5	49.9	-36.7	-56.2	-2.5
420	25.75	0.4	11.0	0.24	56.3	51.8	-38.3	-56.7	-3.0
430	25.72	0.4	10.9	0.24	56.6	52.0	-40.7	-57.0	-3.8
440	25.90	0.4	11.1	0.24	59.0	54.4	-42.2	-52.8	-4.7
450	26.12	0.4	11.4	0.24	61.3	56.8	-43.0	-56.5	-5.3
460	26.20	0.4	11.4	0.24	63.2	58.7	-45.2	-57.7	-5.9
470	26.15	0.4	11.4	0.23	63.1	58.5	-46.0	-55.3	-6.0
480	26.07	0.4	11.3	0.23	63.2	58.5	-47.2	-54.0	-5.8
490	25.95	0.4	11.1	0.22	63.7	58.8	-49.5	-57.2	-5.5
500	25.81	0.4	11.0	0.22	63.2	58.2	-50.7	-56.5	-5.3
510	25.64	0.4	10.9	0.21	62.1	57.1	-53.5	-56.3	-5.1
520	25.40	0.3	10.6	0.21	60.2	55.0	-55.2	-55.2	-4.9

@ **Pin=20mW** (13dBm),Vdd=2.8V,Idq=40mA(Vgg=1.35V)

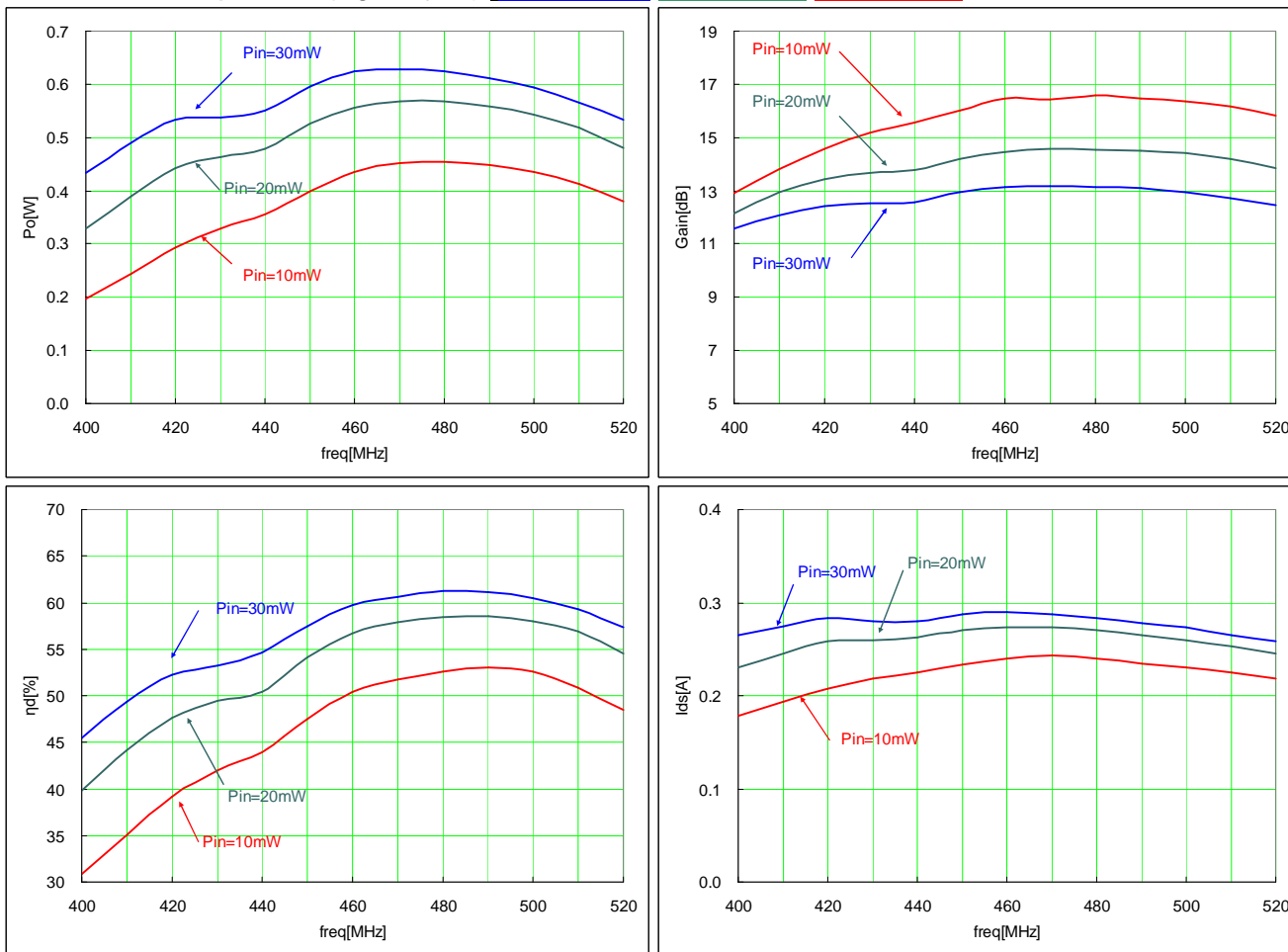
f [MHz]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
400	24.35	0.3	11.4	0.21	46.2	42.8	-33.5	-56.0	-2.3
410	24.87	0.3	11.8	0.22	50.2	46.9	-36.3	-56.7	-2.7
420	25.20	0.3	12.2	0.22	52.9	49.7	-38.8	-56.3	-3.2
430	25.23	0.3	12.2	0.22	54.0	50.8	-40.7	-49.7	-3.8
440	25.42	0.3	12.4	0.22	55.7	52.5	-42.2	-52.7	-4.8
450	25.72	0.4	12.8	0.23	58.3	55.2	-43.2	-56.7	-5.5
460	25.85	0.4	12.8	0.23	60.0	56.9	-44.8	-57.5	-6.0
470	25.85	0.4	12.8	0.22	61.4	58.2	-46.8	-55.5	-6.1
480	25.77	0.4	12.8	0.22	61.2	58.0	-47.8	-54.7	-5.9
490	25.68	0.4	12.6	0.22	61.3	57.9	-48.7	-55.3	-5.6
500	25.54	0.4	12.5	0.21	60.8	57.4	-50.5	-56.3	-5.4
510	25.36	0.3	12.3	0.21	59.7	56.2	-50.8	-55.5	-5.3
520	25.08	0.3	12.1	0.20	58.0	54.4	-54.8	-56.0	-5.1

@ **Pin=10mW** (10dBm),Vdd=2.8V,Idq=40mA(Vgg=1.35V)

f [MHz]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
400	22.35	0.2	12.5	0.17	37.1	35.0	-31.5	-53.5	-2.1
410	23.19	0.2	13.2	0.18	41.7	39.7	-35.2	-50.2	-2.6
420	23.83	0.2	13.8	0.19	45.3	43.4	-38.5	-56.0	-3.0
430	24.11	0.3	14.1	0.19	47.6	45.7	-40.5	-52.3	-3.9
440	24.36	0.3	14.4	0.20	49.1	47.3	-42.5	-55.0	-4.8
450	24.77	0.3	14.8	0.20	52.7	50.9	-42.8	-56.5	-5.4
460	25.02	0.3	15.0	0.21	55.2	53.4	-44.5	-56.5	-5.7
470	25.10	0.3	15.1	0.21	56.3	54.5	-46.8	-56.7	-5.8
480	25.06	0.3	15.1	0.20	56.3	54.6	-47.3	-56.5	-5.5
490	24.98	0.3	15.0	0.20	56.6	54.8	-49.7	-56.2	-5.2
500	24.82	0.3	14.8	0.19	56.0	54.2	-50.7	-56.5	-4.8
510	24.61	0.3	14.6	0.19	54.7	52.8	-53.0	-54.8	-4.7
520	24.25	0.3	14.3	0.18	51.8	49.9	-54.3	-55.5	-4.4

RD01MUS2B single-stage amplifier Frequency characteristics.(Vdd=3.6V)

@ Vdd=3.6V, Idq=40mA (Vgs adjust), **Pin=30mW**, **Pin=20mW**, **Pin=10mW**



**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**RD01MUS2B single-stage amplifier Frequency characteristics Data.(Vdd=3.6V)**

**Vdd=3.6V,I<sub>dq</sub>=40mA(V<sub>gg</sub>=1.34V)**

@ **Pin=30mW** (14.8dBm)

f [MHz]	P <sub>o</sub> [dBm]	P <sub>o</sub> [W]	G <sub>p</sub> [dB]	I <sub>dd</sub> [A]	η <sub>d</sub> [%]	P.A.E. [%]	2f <sub>o</sub> [dBc]	3f <sub>o</sub> [dBc]	R.L. [-dB]
400	26.37	0.4	11.6	0.27	45.5	42.3	-33.3	-55.3	-2.3
410	26.89	0.5	12.1	0.28	49.4	46.4	-35.7	-57.8	-2.7
420	27.27	0.5	12.4	0.28	52.3	49.3	-38.3	-58.7	-3.2
430	27.30	0.5	12.5	0.28	53.3	50.3	-40.5	-47.0	-3.9
440	27.41	0.6	12.6	0.28	54.7	51.7	-41.7	-58.0	-4.8
450	27.75	0.6	12.9	0.29	57.5	54.5	-43.8	-58.3	-5.6
460	27.95	0.6	13.1	0.29	59.7	56.8	-44.3	-58.2	-6.1
470	27.98	0.6	13.2	0.29	60.6	57.7	-46.5	-57.3	-6.2
480	27.95	0.6	13.1	0.28	61.2	58.2	-47.5	-55.8	-5.9
490	27.87	0.6	13.1	0.28	61.1	58.1	-49.5	-59.0	-5.6
500	27.74	0.6	12.9	0.27	60.5	57.4	-50.3	-57.0	-5.2
510	27.53	0.6	12.7	0.27	59.3	56.1	-52.3	-56.7	-5.2
520	27.26	0.5	12.5	0.26	57.3	54.1	-54.5	-57.5	-5.1

@ **Pin=20mW** (13dBm),Vdd=2.8V,I<sub>dq</sub>=40mA(V<sub>gg</sub>=1.35V)

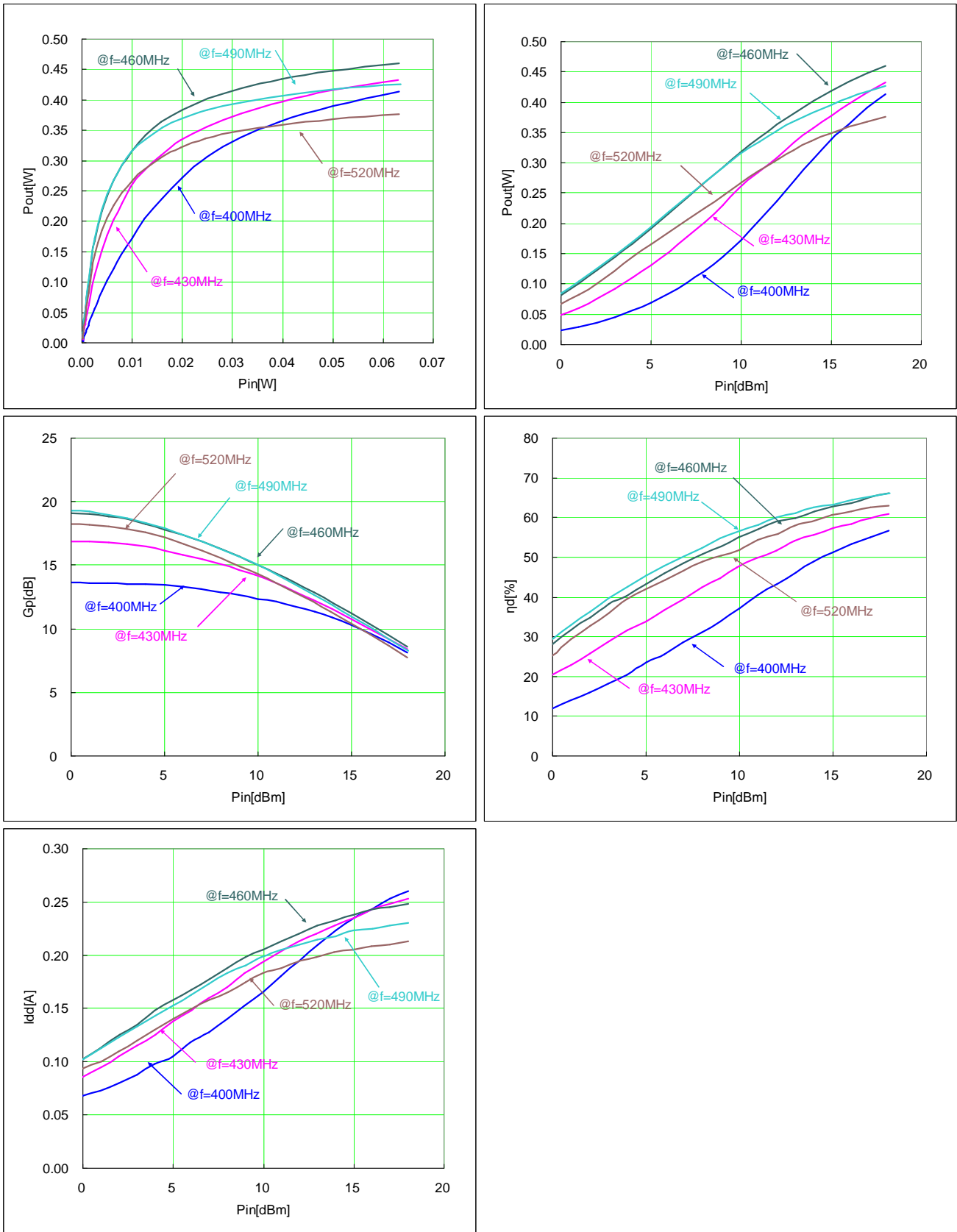
f [MHz]	P <sub>o</sub> [dBm]	P <sub>o</sub> [W]	G <sub>p</sub> [dB]	I <sub>dd</sub> [A]	η <sub>d</sub> [%]	P.A.E. [%]	2f <sub>o</sub> [dBc]	3f <sub>o</sub> [dBc]	R.L. [-dB]
400	25.18	0.3	12.1	0.23	39.8	37.4	-31.8	-55.7	-2.2
410	25.91	0.4	12.9	0.25	44.2	42.0	-35.0	-56.0	-2.6
420	26.46	0.4	13.5	0.26	47.6	45.5	-38.0	-57.8	-3.1
430	26.66	0.5	13.7	0.26	49.5	47.4	-40.5	-50.2	-3.8
440	26.79	0.5	13.8	0.26	50.5	48.4	-41.7	-56.7	-4.6
450	27.21	0.5	14.2	0.27	54.1	52.0	-42.8	-58.5	-5.4
460	27.46	0.6	14.5	0.27	56.7	54.6	-44.2	-58.7	-5.9
470	27.55	0.6	14.6	0.27	57.8	55.8	-45.3	-59.3	-5.9
480	27.55	0.6	14.5	0.27	58.5	56.4	-46.7	-56.8	-5.7
490	27.47	0.6	14.5	0.27	58.5	56.5	-48.3	-49.5	-5.4
500	27.34	0.5	14.4	0.26	58.0	55.9	-51.2	-58.2	-5.1
510	27.15	0.5	14.2	0.25	56.9	54.7	-52.0	-53.7	-5.0
520	26.82	0.5	13.8	0.25	54.5	52.3	-55.3	-55.5	-4.9

@ **Pin=10mW** (10dBm),Vdd=2.8V,I<sub>dq</sub>=40mA(V<sub>gg</sub>=1.35V)

f [MHz]	P <sub>o</sub> [dBm]	P <sub>o</sub> [W]	G <sub>p</sub> [dB]	I <sub>dd</sub> [A]	η <sub>d</sub> [%]	P.A.E. [%]	2f <sub>o</sub> [dBc]	3f <sub>o</sub> [dBc]	R.L. [-dB]
400	22.96	0.2	12.9	0.18	30.8	29.3	-28.7	-53.2	-2.2
410	23.87	0.2	13.8	0.19	35.1	33.6	-32.3	-54.7	-2.6
420	24.67	0.3	14.6	0.21	39.2	37.8	-36.2	-56.3	-3.2
430	25.18	0.3	15.2	0.22	42.0	40.7	-39.2	-55.8	-3.8
440	25.51	0.4	15.6	0.23	43.9	42.7	-40.7	-56.0	-4.5
450	26.01	0.4	16.0	0.23	47.5	46.3	-41.8	-57.2	-5.2
460	26.39	0.4	16.5	0.24	50.4	49.3	-43.8	-57.7	-5.5
470	26.56	0.5	16.4	0.24	51.8	50.6	-45.5	-57.7	-5.7
480	26.58	0.5	16.6	0.24	52.6	51.5	-46.5	-57.3	-5.3
490	26.52	0.4	16.5	0.24	53.0	51.8	-49.7	-57.7	-5.0
500	26.39	0.4	16.4	0.23	52.6	51.3	-51.5	-55.2	-4.8
510	26.15	0.4	16.2	0.23	50.8	49.6	-52.7	-55.8	-4.6
520	25.80	0.4	15.8	0.22	48.4	47.2	-53.5	-56.0	-4.5

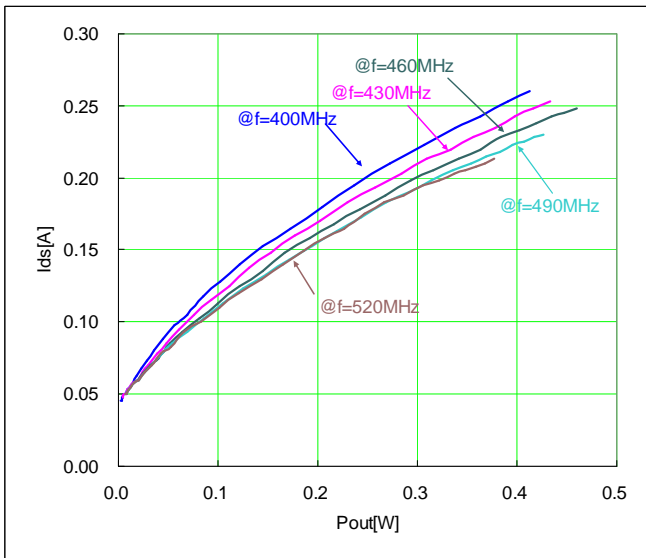
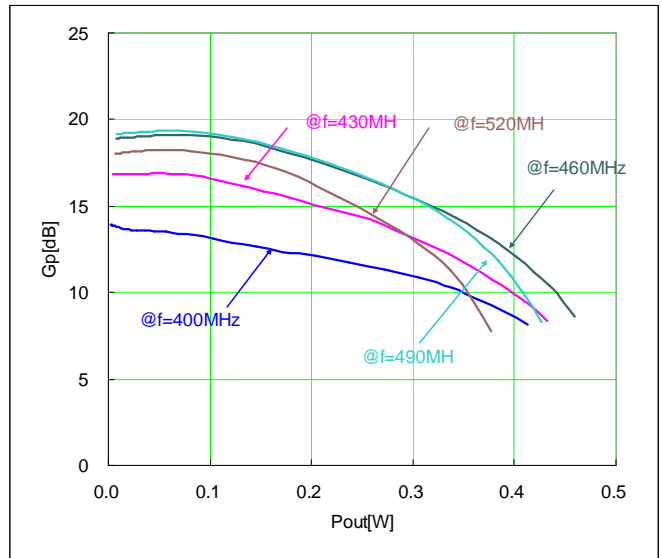
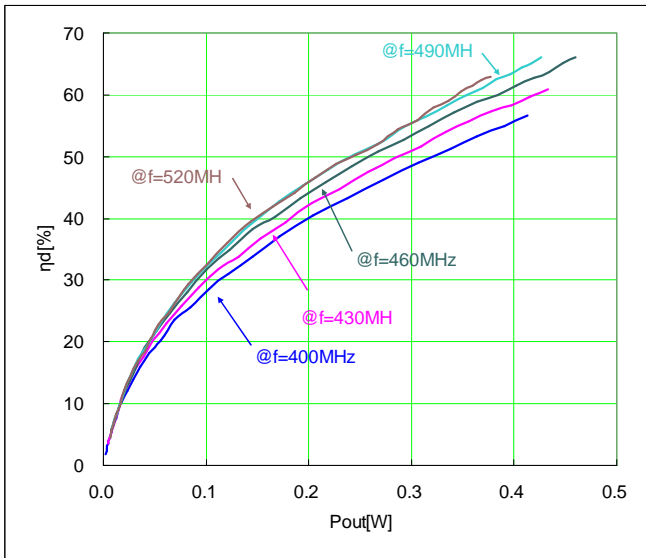
**RD01MUS2B single-stage amplifier Pout vs. Pin characteristics.(Vdd=2.8V)**

@ Vdd=2.8V, Idq=40mA(Vgg=1.35V), f=400MHz, f=430MHz, f=460MHz, f=490MHz, f=520MHz



**RD01MUS2B single-stage amplifier Pout vs. Pin characteristics.(Vdd=2.8V)**

@ Vdd=2.8V, Idq=40mA(Vgg=1.35V), f=400MHz, f=430MHz, f=460MHz, f=490MHz, f=520MHz





**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**RD01MUS2B single-stage amplifier Pout vs. Pin characteristics data**

@ **f=400MHz**, Vdd=2.8V, Idq=40mA(Vgg=1.35V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
2.81	-10.03	0.00	3.89	0.00	13.92	0.05	1.9	1.9	-1.1
2.81	-9.00	0.00	4.90	0.00	13.90	0.05	2.4	2.3	-1.5
2.81	-8.01	0.00	5.87	0.00	13.88	0.05	2.9	2.7	-1.6
2.81	-7.00	0.00	6.85	0.00	13.86	0.05	3.6	3.4	-1.9
2.81	-6.00	0.00	7.83	0.01	13.84	0.05	4.3	4.1	-1.9
2.81	-4.97	0.00	8.83	0.01	13.80	0.05	5.4	5.2	-1.9
2.81	-4.02	0.00	9.75	0.01	13.77	0.05	6.3	6.1	-1.8
2.81	-2.99	0.00	10.74	0.01	13.73	0.06	7.7	7.4	-1.8
2.81	-2.02	0.00	11.67	0.01	13.69	0.06	9.0	8.6	-1.9
2.81	-1.02	0.00	12.64	0.02	13.66	0.06	10.4	9.9	-1.9
2.81	-0.01	0.00	13.61	0.02	13.62	0.07	12.0	11.5	-1.9
2.81	0.99	0.00	14.58	0.03	13.59	0.07	14.0	13.4	-2.0
2.81	1.98	0.00	15.54	0.04	13.56	0.08	16.0	15.3	-2.0
2.81	2.99	0.00	16.53	0.04	13.54	0.09	18.2	17.4	-2.1
2.81	3.97	0.00	17.48	0.06	13.50	0.10	20.3	19.4	-2.1
2.81	4.98	0.00	18.41	0.07	13.43	0.11	23.5	22.4	-2.2
2.81	5.97	0.00	19.28	0.08	13.30	0.12	25.6	24.4	-2.2
2.81	6.98	0.00	20.11	0.10	13.13	0.13	28.5	27.1	-2.2
2.81	7.97	0.01	20.86	0.12	12.89	0.14	31.0	29.4	-2.2
2.81	8.97	0.01	21.62	0.15	12.65	0.15	33.8	32.0	-2.2
2.81	9.99	0.01	22.35	0.17	12.36	0.17	37.1	35.0	-2.3
2.81	10.97	0.01	23.10	0.20	12.13	0.18	40.4	38.0	-2.2
2.81	12.01	0.02	23.75	0.24	11.74	0.20	43.3	40.4	-2.2
2.81	13.01	0.02	24.35	0.27	11.34	0.21	46.2	42.8	-2.3
2.81	13.98	0.02	24.86	0.31	10.89	0.22	49.0	45.0	-2.2
2.81	15.00	0.03	25.30	0.34	10.29	0.24	51.3	46.5	-2.3
2.81	15.96	0.04	25.61	0.36	9.64	0.24	53.4	47.6	-2.3
2.81	17.00	0.05	25.92	0.39	8.92	0.25	55.0	48.0	-2.3
2.81	18.01	0.06	26.16	0.41	8.15	0.26	56.6	47.9	-2.3

@ **f=430MHz**, Vdd=2.8V, Idq=40mA(Vgg=1.35V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
2.81	-10.03	0.00	6.82	0.00	16.85	0.05	3.6	3.5	-2.9
2.81	-9.02	0.00	7.83	0.01	16.85	0.05	4.3	4.2	-3.8
2.81	-8.01	0.00	8.83	0.01	16.84	0.05	5.4	5.3	-2.3
2.81	-7.03	0.00	9.81	0.01	16.84	0.05	6.4	6.3	-2.4
2.81	-6.04	0.00	10.79	0.01	16.83	0.06	7.8	7.6	-2.8
2.81	-4.99	0.00	11.84	0.02	16.83	0.06	9.4	9.2	-3.0
2.81	-3.99	0.00	12.84	0.02	16.83	0.06	11.4	11.2	-3.0
2.81	-3.02	0.00	13.82	0.02	16.84	0.07	13.2	12.9	-3.0
2.81	-2.03	0.00	14.82	0.03	16.85	0.07	15.4	15.1	-3.1
2.81	-1.00	0.00	15.87	0.04	16.87	0.08	17.7	17.3	-3.1
2.81	-0.03	0.00	16.85	0.05	16.88	0.09	20.3	19.9	-3.3
2.81	1.00	0.00	17.87	0.06	16.87	0.10	22.9	22.5	-3.4
2.81	2.01	0.00	18.82	0.08	16.82	0.11	25.9	25.3	-3.5
2.81	3.00	0.00	19.68	0.09	16.68	0.12	28.8	28.2	-3.6
2.81	4.00	0.00	20.47	0.11	16.46	0.13	31.7	31.0	-3.7
2.81	5.01	0.00	21.18	0.13	16.17	0.14	33.9	33.0	-3.8
2.81	6.00	0.00	21.84	0.15	15.84	0.15	36.7	35.8	-3.9
2.81	6.99	0.00	22.48	0.18	15.49	0.16	39.5	38.3	-3.9
2.81	8.00	0.01	23.07	0.20	15.07	0.17	42.5	41.2	-3.9
2.81	8.98	0.01	23.62	0.23	14.64	0.18	44.8	43.2	-3.9
2.81	9.88	0.01	24.11	0.26	14.23	0.19	47.5	45.7	-3.8
2.81	10.91	0.01	24.53	0.28	13.62	0.20	49.8	47.6	-3.8
2.81	11.97	0.02	24.90	0.31	12.92	0.21	51.6	49.0	-3.9
2.81	12.94	0.02	25.24	0.33	12.30	0.22	54.1	50.9	-3.8
2.81	13.97	0.02	25.52	0.36	11.55	0.23	55.7	51.8	-3.9
2.81	15.01	0.03	25.77	0.38	10.76	0.24	57.3	52.5	-4.0
2.81	16.00	0.04	25.99	0.40	9.99	0.24	58.3	52.4	-4.0
2.81	17.00	0.05	26.20	0.42	9.19	0.25	59.8	52.6	-4.0
2.81	17.99	0.06	26.36	0.43	8.37	0.25	61.0	52.1	-4.1

**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

- AN-UHF-133-

@ **f=460MHz**, Vdd=2.8V,Idq=40mA(Vgg=1.35V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
2.81	-10.01	0.00	8.90	0.01	18.91	0.05	5.5	5.5	-2.9
2.81	-9.00	0.00	9.92	0.01	18.92	0.05	6.6	6.5	-4.8
2.81	-8.02	0.00	10.92	0.01	18.93	0.06	8.0	7.9	-5.6
2.81	-7.00	0.00	11.95	0.02	18.95	0.06	9.6	9.5	-3.8
2.81	-6.01	0.00	12.96	0.02	18.97	0.06	11.7	11.6	-4.2
2.81	-4.97	0.00	14.02	0.03	18.99	0.07	13.8	13.7	-4.6
2.81	-3.99	0.00	15.03	0.03	19.02	0.07	16.2	16.0	-4.5
2.81	-3.02	0.00	16.05	0.04	19.06	0.08	19.1	18.9	-4.6
2.81	-1.97	0.00	17.13	0.05	19.10	0.09	21.7	21.4	-4.7
2.81	-1.03	0.00	18.09	0.06	19.12	0.09	24.7	24.4	-4.6
2.81	-0.01	0.00	19.10	0.08	19.11	0.10	28.1	27.7	-4.8
2.81	0.99	0.00	20.02	0.10	19.03	0.11	31.7	31.3	-5.0
2.81	2.01	0.00	20.87	0.12	18.86	0.13	34.8	34.4	-5.0
2.81	3.00	0.00	21.61	0.14	18.62	0.14	38.3	37.7	-5.1
2.81	3.99	0.00	22.23	0.17	18.24	0.15	40.2	39.6	-5.2
2.81	5.01	0.00	22.83	0.19	17.81	0.16	43.2	42.5	-5.4
2.81	5.99	0.00	23.35	0.22	17.36	0.17	45.9	45.0	-5.5
2.81	7.01	0.01	23.84	0.24	16.83	0.18	48.5	47.4	-5.6
2.81	8.01	0.01	24.28	0.27	16.27	0.19	50.8	49.6	-5.7
2.81	9.01	0.01	24.66	0.29	15.66	0.20	52.7	51.3	-5.8
2.81	9.96	0.01	25.00	0.32	15.05	0.21	55.0	53.3	-5.8
2.81	11.01	0.01	25.34	0.34	14.33	0.21	57.2	55.1	-5.9
2.81	11.98	0.02	25.61	0.36	13.63	0.22	58.9	56.4	-5.9
2.81	12.99	0.02	25.84	0.38	12.85	0.23	59.9	56.8	-6.1
2.81	14.01	0.03	26.05	0.40	12.04	0.23	61.5	57.7	-6.1
2.81	15.01	0.03	26.22	0.42	11.21	0.24	62.8	58.0	-6.2
2.81	15.99	0.04	26.38	0.43	10.38	0.24	63.7	57.8	-6.3
2.81	16.99	0.05	26.51	0.45	9.52	0.25	65.1	57.8	-6.4
2.81	18.01	0.06	26.63	0.46	8.62	0.25	66.0	57.0	-6.5

@ **f=490MHz**, Vdd=2.8V,Idq=40mA(Vgg=1.35V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
2.81	-9.99	0.00	9.19	0.01	19.18	0.05	5.9	5.8	-2.2
2.81	-8.97	0.00	10.20	0.01	19.17	0.05	7.0	7.0	-1.7
2.81	-8.00	0.00	11.18	0.01	19.18	0.06	8.5	8.4	-0.5
2.81	-7.01	0.00	12.19	0.02	19.20	0.06	10.2	10.0	-1.5
2.81	-6.01	0.00	13.22	0.02	19.23	0.06	12.5	12.3	-4.4
2.81	-4.97	0.00	14.29	0.03	19.26	0.07	14.7	14.5	-4.3
2.81	-4.00	0.00	15.29	0.03	19.29	0.07	17.2	17.0	-4.3
2.81	-2.97	0.00	16.36	0.04	19.33	0.08	19.7	19.5	-4.3
2.81	-1.99	0.00	17.36	0.05	19.35	0.09	22.8	22.5	-4.4
2.81	-0.98	0.00	18.37	0.07	19.35	0.09	26.3	26.0	-4.3
2.81	0.03	0.00	19.33	0.09	19.30	0.10	29.7	29.3	-4.4
2.81	1.00	0.00	20.19	0.10	19.19	0.11	33.0	32.6	-4.4
2.81	2.01	0.00	20.98	0.13	18.97	0.12	36.3	35.8	-4.4
2.81	3.01	0.00	21.70	0.15	18.69	0.13	39.6	39.1	-4.5
2.81	4.01	0.00	22.33	0.17	18.33	0.14	42.6	42.0	-4.5
2.81	5.00	0.00	22.89	0.19	17.90	0.15	45.3	44.6	-4.6
2.81	5.99	0.00	23.41	0.22	17.42	0.16	47.9	47.0	-4.7
2.81	6.99	0.00	23.87	0.24	16.88	0.17	50.2	49.2	-4.8
2.81	7.99	0.01	24.29	0.27	16.30	0.18	52.3	51.0	-5.0
2.81	8.99	0.01	24.65	0.29	15.67	0.19	54.7	53.3	-5.1
2.81	9.90	0.01	24.97	0.31	15.07	0.20	56.5	54.8	-5.2
2.81	11.01	0.01	25.25	0.34	14.24	0.21	58.3	56.1	-5.4
2.81	12.03	0.02	25.49	0.35	13.46	0.21	60.0	57.3	-5.5
2.81	12.99	0.02	25.67	0.37	12.68	0.22	61.1	57.8	-5.6
2.81	13.97	0.02	25.83	0.38	11.86	0.22	62.6	58.5	-5.7
2.81	14.98	0.03	25.98	0.40	10.99	0.22	63.2	58.2	-5.8
2.81	16.02	0.04	26.10	0.41	10.08	0.23	64.5	58.1	-5.9
2.81	17.01	0.05	26.21	0.42	9.19	0.23	65.3	57.4	-6.0
2.81	18.03	0.06	26.30	0.43	8.27	0.23	66.1	56.2	-6.1

**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

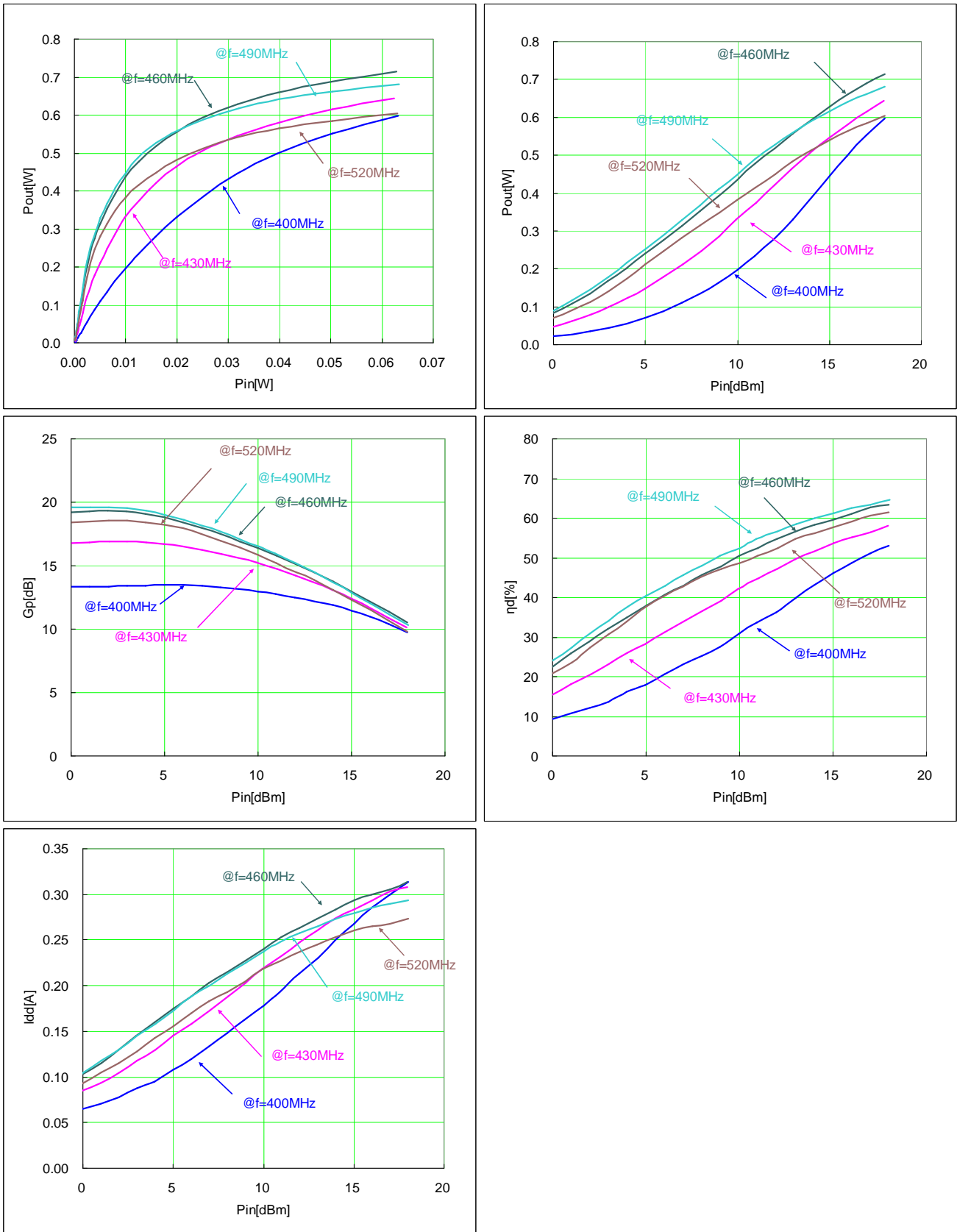
**- AN-UHF-133-**

**@ f=520MHz, Vdd=2.8V, Idq=40mA(Vgg=1.35V)**

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
2.81	-10.00	0.00	8.03	0.01	18.03	0.05	4.5	4.5	-3.3
2.81	-8.99	0.00	9.05	0.01	18.04	0.05	5.7	5.6	-4.3
2.81	-8.00	0.00	10.06	0.01	18.05	0.05	6.8	6.7	-5.0
2.81	-7.01	0.00	11.06	0.01	18.07	0.06	8.3	8.1	-4.6
2.81	-6.00	0.00	12.09	0.02	18.09	0.06	9.9	9.8	-4.0
2.81	-4.98	0.00	13.13	0.02	18.12	0.06	12.2	12.0	-3.9
2.81	-3.99	0.00	14.16	0.03	18.15	0.07	14.3	14.1	-4.2
2.81	-2.97	0.00	15.21	0.03	18.18	0.07	16.9	16.6	-4.0
2.81	-1.97	0.00	16.23	0.04	18.20	0.08	19.2	18.9	-4.0
2.81	-0.97	0.00	17.25	0.05	18.22	0.08	22.8	22.5	-4.0
2.81	-0.03	0.00	18.19	0.07	18.22	0.09	25.2	24.8	-4.1
2.81	1.00	0.00	19.16	0.08	18.17	0.10	29.4	28.9	-4.1
2.81	1.99	0.00	20.04	0.10	18.06	0.11	32.7	32.2	-4.0
2.81	2.98	0.00	20.83	0.12	17.85	0.12	35.9	35.3	-4.1
2.81	3.99	0.00	21.58	0.14	17.60	0.13	39.5	38.8	-4.1
2.81	4.99	0.00	22.17	0.17	17.19	0.14	42.0	41.2	-4.2
2.81	6.01	0.00	22.70	0.19	16.69	0.15	44.2	43.3	-4.3
2.81	7.02	0.01	23.15	0.21	16.13	0.16	46.6	45.4	-4.4
2.81	8.02	0.01	23.55	0.23	15.53	0.17	48.9	47.5	-4.5
2.81	9.01	0.01	23.93	0.25	14.92	0.18	50.3	48.7	-4.6
2.81	9.99	0.01	24.26	0.27	14.27	0.18	51.9	50.0	-4.8
2.81	11.00	0.01	24.57	0.29	13.58	0.19	54.4	52.0	-4.9
2.81	12.04	0.02	24.85	0.31	12.82	0.20	55.8	52.9	-5.1
2.81	12.93	0.02	25.07	0.32	12.14	0.20	57.9	54.3	-5.0
2.81	13.91	0.02	25.27	0.34	11.36	0.20	59.0	54.7	-5.1
2.81	14.97	0.03	25.42	0.35	10.46	0.21	60.6	55.1	-5.3
2.81	15.99	0.04	25.55	0.36	9.56	0.21	61.5	54.7	-5.5
2.81	17.00	0.05	25.66	0.37	8.67	0.21	62.5	54.0	-5.5
2.81	18.00	0.06	25.76	0.38	7.76	0.21	63.0	52.4	-5.6

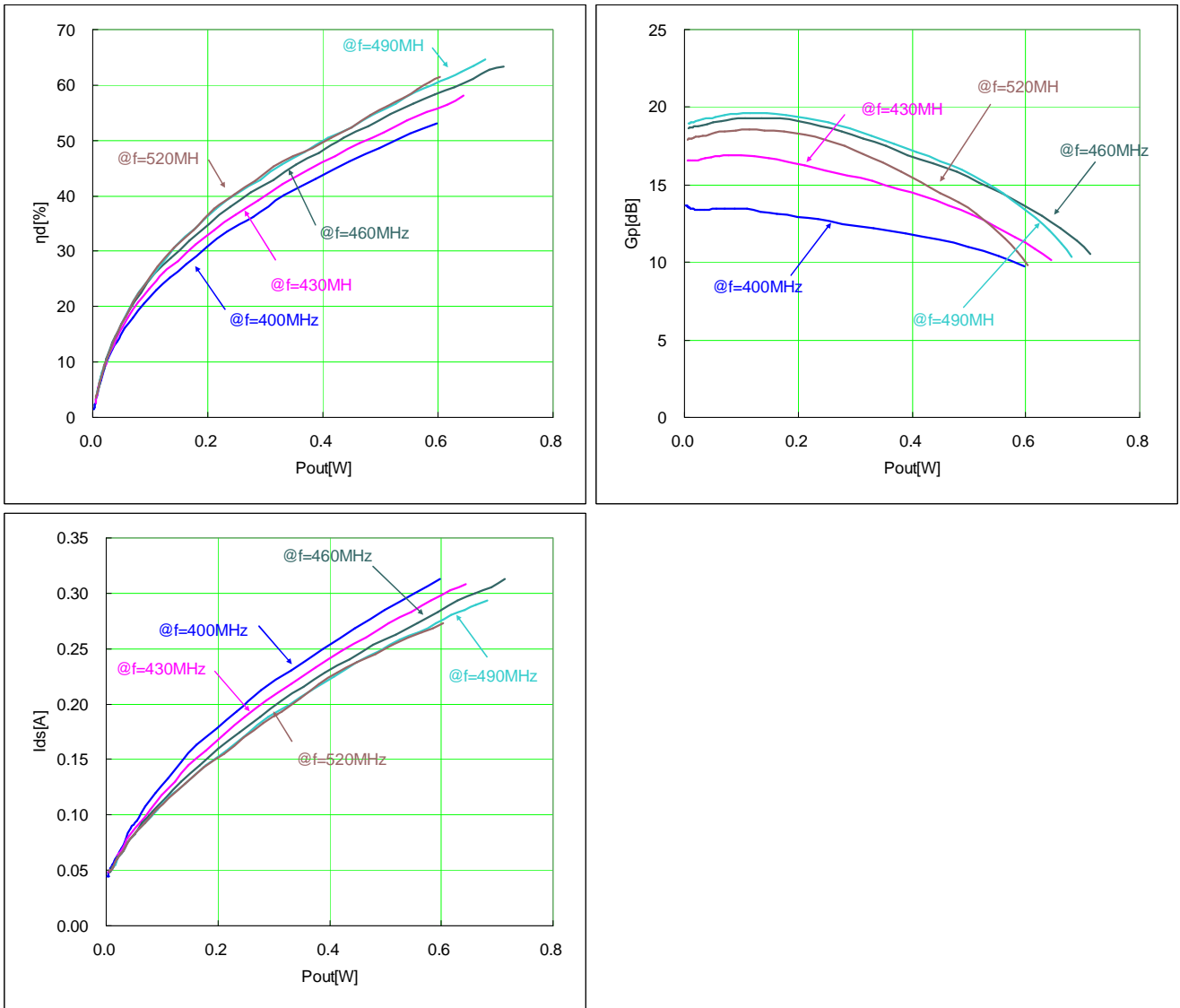
**RD01MUS2B single-stage amplifier Pout vs. Pin characteristics.(Vdd=3.6V)**

@ Vdd=3.6V, Idq=40mA(Vgg=1.34V), f=400MHz, f=430MHz, f=460MHz, f=490MHz, f=520MHz



**RD01MUS2B single-stage amplifier Pout vs. Pin characteristics.(Vdd=3.6V)**

@ Vdd=3.6V, Idq=40mA(Vgg=1.34V), f=400MHz, f=430MHz, f=460MHz, f=490MHz, f=520MHz



**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**RD01MUS2B single-stage amplifier Pout vs. Pin characteristics data(Vdd=3.6V)**

@ **f=400MHz**, Vdd=3.6V, Idq=40mA(Vgg=1.34V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta$ d [%]	P.A.E. [%]	R.L. [-dB]
3.60	-9.98	0.00	3.69	0.00	13.66	0.05	1.4	1.4	-0.6
3.60	-9.01	0.00	4.64	0.00	13.65	0.05	1.8	1.7	-1.0
3.60	-8.00	0.00	5.63	0.00	13.64	0.05	2.3	2.2	-1.6
3.60	-7.01	0.00	6.60	0.00	13.61	0.05	2.6	2.5	-1.9
3.60	-6.01	0.00	7.58	0.01	13.59	0.05	3.3	3.2	-1.7
3.60	-5.03	0.00	8.53	0.01	13.55	0.05	4.0	3.8	-1.9
3.60	-3.99	0.00	9.53	0.01	13.52	0.05	4.7	4.5	-0.2
3.60	-3.00	0.00	10.47	0.01	13.47	0.06	5.6	5.4	-1.9
3.60	-2.01	0.00	11.43	0.01	13.44	0.06	6.6	6.3	-1.9
3.60	-1.03	0.00	12.37	0.02	13.40	0.06	8.0	7.6	-1.9
3.60	-0.02	0.00	13.36	0.02	13.38	0.07	9.2	8.8	-1.9
3.60	0.98	0.00	14.35	0.03	13.36	0.07	10.8	10.3	-1.9
3.60	2.00	0.00	15.36	0.03	13.37	0.08	12.2	11.7	-1.8
3.60	2.98	0.00	16.38	0.04	13.39	0.09	13.7	13.1	-1.9
3.60	3.99	0.00	17.43	0.06	13.43	0.10	16.2	15.4	-2.0
3.60	4.98	0.00	18.45	0.07	13.47	0.11	18.0	17.2	-2.1
3.60	6.00	0.00	19.49	0.09	13.49	0.12	20.6	19.6	-2.1
3.60	7.00	0.01	20.43	0.11	13.43	0.13	23.1	22.0	-2.2
3.60	7.99	0.01	21.28	0.13	13.29	0.15	25.2	24.0	-2.2
3.60	8.97	0.01	22.11	0.16	13.14	0.16	27.7	26.3	-2.2
3.60	10.02	0.01	22.96	0.20	12.94	0.18	30.9	29.3	-2.2
3.60	10.92	0.01	23.69	0.23	12.77	0.19	33.7	31.9	-2.2
3.60	11.97	0.02	24.45	0.28	12.48	0.21	36.3	34.2	-2.2
3.60	13.02	0.02	25.21	0.33	12.18	0.23	40.0	37.6	-2.2
3.60	14.01	0.03	25.88	0.39	11.88	0.25	43.1	40.3	-2.2
3.60	15.02	0.03	26.49	0.45	11.47	0.27	46.2	42.9	-2.2
3.60	15.96	0.04	26.98	0.50	11.01	0.29	48.6	44.8	-2.2
3.60	17.02	0.05	27.42	0.55	10.41	0.30	51.2	46.5	-2.2
3.60	18.00	0.06	27.77	0.60	9.76	0.31	53.0	47.4	-2.3

@ **f=430MHz**, Vdd=3.6V, Idq=40mA(Vgg=1.34V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta$ d [%]	P.A.E. [%]	R.L. [-dB]
3.60	-9.96	0.00	6.62	0.00	16.58	0.05	2.7	2.6	1.9
3.60	-9.01	0.00	7.56	0.01	16.58	0.05	3.3	3.2	-0.2
3.60	-8.00	0.00	8.57	0.01	16.57	0.05	4.0	3.9	0.7
3.60	-7.01	0.00	9.56	0.01	16.57	0.05	5.0	4.9	-1.2
3.60	-6.02	0.00	10.54	0.01	16.57	0.05	5.9	5.8	-1.6
3.60	-5.03	0.00	11.54	0.01	16.57	0.06	7.2	7.0	-1.7
3.60	-3.98	0.00	12.61	0.02	16.59	0.06	8.4	8.2	-1.9
3.60	-3.03	0.00	13.57	0.02	16.60	0.07	9.7	9.5	-1.9
3.60	-2.02	0.00	14.62	0.03	16.64	0.07	11.5	11.2	-3.0
3.60	-1.01	0.00	15.68	0.04	16.69	0.08	13.2	12.9	-3.1
3.60	-0.04	0.00	16.72	0.05	16.76	0.09	15.4	15.0	-3.1
3.60	0.99	0.00	17.83	0.06	16.83	0.09	18.1	17.7	-3.1
3.60	2.03	0.00	18.94	0.08	16.91	0.11	20.7	20.3	-2.9
3.60	3.01	0.00	19.94	0.10	16.94	0.12	23.2	22.8	-3.3
3.60	4.01	0.00	20.88	0.12	16.86	0.13	26.1	25.6	-3.4
3.60	4.98	0.00	21.69	0.15	16.71	0.15	28.2	27.6	-3.0
3.60	5.99	0.00	22.50	0.18	16.51	0.16	31.3	30.6	-3.1
3.60	7.01	0.01	23.24	0.21	16.22	0.17	33.8	33.0	-3.1
3.60	8.02	0.01	23.93	0.25	15.91	0.19	36.5	35.6	-3.3
3.60	9.00	0.01	24.58	0.29	15.57	0.20	39.2	38.1	-3.4
3.60	9.92	0.01	25.19	0.33	15.28	0.22	42.1	40.9	-3.5
3.60	11.02	0.01	25.75	0.38	14.73	0.23	44.8	43.3	-3.6
3.60	12.02	0.02	26.25	0.42	14.23	0.25	47.2	45.4	-3.6
3.60	12.99	0.02	26.67	0.46	13.68	0.26	49.6	47.5	-3.6
3.60	13.95	0.02	27.04	0.51	13.09	0.27	51.5	49.0	-3.6
3.60	15.03	0.03	27.37	0.55	12.35	0.28	53.6	50.5	-3.7
3.60	16.01	0.04	27.64	0.58	11.63	0.29	55.1	51.3	-3.8
3.60	17.02	0.05	27.89	0.62	10.87	0.30	56.4	51.8	-3.8
3.60	17.95	0.06	28.09	0.64	10.14	0.31	58.1	52.5	-3.9

**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

- AN-UHF-133-

@ **f=460MHz**, Vdd=3.6V, Idq=40mA(Vgg=1.34V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
3.60	-10.03	0.00	8.62	0.01	18.65	0.05	4.2	4.2	-4.0
3.60	-9.00	0.00	9.67	0.01	18.67	0.05	5.1	5.1	-5.5
3.60	-8.03	0.00	10.65	0.01	18.68	0.05	6.1	6.0	-4.3
3.60	-7.03	0.00	11.69	0.01	18.71	0.06	7.4	7.3	-4.1
3.60	-6.00	0.00	12.75	0.02	18.75	0.06	8.7	8.6	-4.4
3.60	-4.98	0.00	13.81	0.02	18.79	0.06	10.6	10.5	-4.6
3.60	-4.03	0.00	14.82	0.03	18.85	0.07	12.4	12.2	-4.5
3.60	-2.97	0.00	15.96	0.04	18.93	0.08	14.6	14.4	-4.4
3.60	-1.97	0.00	17.05	0.05	19.02	0.08	16.9	16.7	-4.5
3.60	-0.98	0.00	18.14	0.07	19.12	0.09	19.5	19.2	-4.5
3.60	-0.01	0.00	19.22	0.08	19.23	0.10	22.5	22.3	-4.5
3.60	1.00	0.00	20.31	0.11	19.30	0.12	25.9	25.6	-4.6
3.60	1.98	0.00	21.30	0.13	19.32	0.13	28.8	28.5	-4.6
3.60	2.96	0.00	22.23	0.17	19.27	0.15	32.0	31.6	-4.7
3.60	3.96	0.00	23.03	0.20	19.07	0.16	34.9	34.5	-4.9
3.60	5.00	0.00	23.79	0.24	18.79	0.18	38.0	37.5	-5.1
3.60	6.00	0.00	24.41	0.28	18.40	0.19	40.7	40.1	-5.2
3.60	6.99	0.01	24.96	0.31	17.97	0.20	42.9	42.2	-5.3
3.60	8.00	0.01	25.48	0.35	17.48	0.22	45.6	44.8	-5.4
3.60	9.00	0.01	25.94	0.39	16.93	0.23	47.8	46.8	-5.5
3.60	10.00	0.01	26.40	0.44	16.40	0.24	50.5	49.3	-5.5
3.60	10.98	0.01	26.79	0.48	15.82	0.25	52.5	51.1	-5.6
3.60	12.02	0.02	27.15	0.52	15.13	0.26	54.8	53.1	-5.7
3.60	13.00	0.02	27.46	0.56	14.46	0.27	56.7	54.6	-5.8
3.60	14.00	0.03	27.74	0.59	13.73	0.28	58.3	55.8	-5.9
3.60	15.01	0.03	27.98	0.63	12.97	0.29	59.6	56.6	-6.0
3.60	16.00	0.04	28.20	0.66	12.20	0.30	61.1	57.4	-6.1
3.60	17.01	0.05	28.38	0.69	11.38	0.31	62.7	58.2	-6.2
3.60	17.99	0.06	28.53	0.71	10.55	0.31	63.3	57.7	-6.3

@ **f=490MHz**, Vdd=3.6V, Idq=40mA(Vgg=1.34V)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
3.60	-10.01	0.00	8.96	0.01	18.97	0.05	4.4	4.3	-3.7
3.60	-9.02	0.00	9.97	0.01	18.99	0.05	5.5	5.4	-5.0
3.60	-8.00	0.00	11.03	0.01	19.02	0.05	6.6	6.6	-2.8
3.60	-7.01	0.00	12.05	0.02	19.06	0.06	8.1	8.0	-3.1
3.60	-6.00	0.00	13.10	0.02	19.10	0.06	9.5	9.3	-3.7
3.60	-5.01	0.00	14.14	0.03	19.15	0.07	11.1	11.0	-3.8
3.60	-4.00	0.00	15.23	0.03	19.22	0.07	13.2	13.1	-4.1
3.60	-2.99	0.00	16.32	0.04	19.31	0.08	15.3	15.1	-3.9
3.60	-1.99	0.00	17.40	0.05	19.40	0.09	18.0	17.8	-4.1
3.60	-1.00	0.00	18.49	0.07	19.49	0.09	21.1	20.9	-4.2
3.60	0.02	0.00	19.61	0.09	19.59	0.11	24.2	23.9	-4.3
3.60	1.01	0.00	20.64	0.12	19.63	0.12	27.3	27.0	-4.2
3.60	2.00	0.00	21.61	0.14	19.61	0.13	30.9	30.6	-4.2
3.60	2.99	0.00	22.51	0.18	19.52	0.15	34.1	33.7	-4.2
3.60	4.01	0.00	23.32	0.21	19.31	0.16	37.8	37.3	-4.3
3.60	5.01	0.00	24.02	0.25	19.01	0.17	40.5	40.0	-4.4
3.60	6.01	0.00	24.63	0.29	18.62	0.19	42.9	42.3	-4.5
3.60	7.00	0.01	25.17	0.33	18.18	0.20	45.7	45.0	-4.6
3.60	7.99	0.01	25.65	0.37	17.67	0.21	47.9	47.1	-4.6
3.60	8.98	0.01	26.12	0.41	17.13	0.23	50.5	49.5	-4.8
3.60	10.04	0.01	26.53	0.45	16.49	0.24	52.4	51.3	-5.0
3.60	10.91	0.01	26.89	0.49	15.97	0.25	54.7	53.3	-5.0
3.60	12.02	0.02	27.21	0.53	15.19	0.26	56.7	55.0	-5.2
3.60	13.02	0.02	27.47	0.56	14.45	0.27	58.6	56.5	-5.3
3.60	14.03	0.03	27.71	0.59	13.67	0.27	60.0	57.4	-5.5
3.60	15.05	0.03	27.91	0.62	12.85	0.28	61.3	58.1	-5.6
3.60	16.00	0.04	28.07	0.64	12.07	0.29	62.5	58.6	-5.8
3.60	17.01	0.05	28.21	0.66	11.20	0.29	63.4	58.6	-5.9
3.60	18.02	0.06	28.33	0.68	10.31	0.29	64.6	58.6	-5.9

**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

**- AN-UHF-133-**

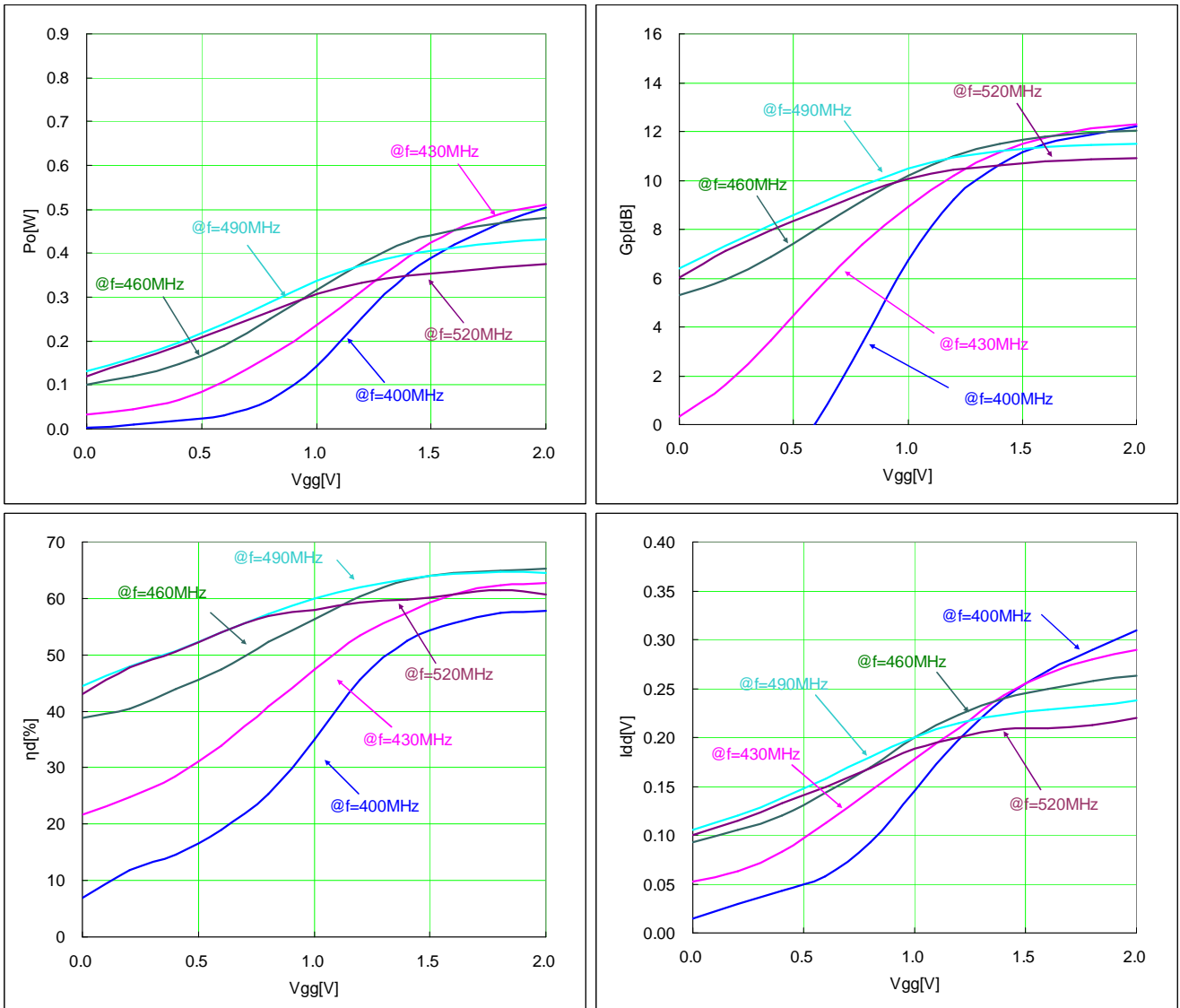
**@ f=520MHz, Vdd=3.6V, Idq=40mA(Vgg=1.34V)**

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	P.A.E. [%]	R.L. [-dB]
3.60	-10.00	0.00	7.93	0.01	17.93	0.05	3.6	3.5	-5.9
3.60	-9.00	0.00	8.94	0.01	17.94	0.05	4.4	4.3	-4.7
3.60	-8.00	0.00	9.97	0.01	17.97	0.05	5.5	5.4	-5.4
3.60	-7.03	0.00	10.96	0.01	17.99	0.05	6.5	6.4	-3.1
3.60	-6.02	0.00	12.01	0.02	18.03	0.06	7.6	7.5	-3.3
3.60	-5.00	0.00	13.07	0.02	18.07	0.06	9.4	9.2	-3.9
3.60	-3.99	0.00	14.14	0.03	18.13	0.07	11.1	10.9	-3.6
3.60	-3.00	0.00	15.20	0.03	18.19	0.07	13.1	12.9	-3.9
3.60	-1.96	0.00	16.31	0.04	18.27	0.08	15.2	15.0	-3.9
3.60	-0.98	0.00	17.37	0.05	18.35	0.09	17.8	17.6	-3.9
3.60	-0.01	0.00	18.43	0.07	18.44	0.09	20.8	20.5	-3.9
3.60	1.01	0.00	19.52	0.09	18.51	0.11	23.7	23.3	-3.9
3.60	1.99	0.00	20.53	0.11	18.54	0.12	27.3	26.9	-3.8
3.60	2.98	0.00	21.51	0.14	18.53	0.13	30.7	30.3	-3.7
3.60	3.97	0.00	22.42	0.17	18.45	0.14	33.9	33.4	-4.0
3.60	4.99	0.00	23.24	0.21	18.25	0.16	37.8	37.2	-3.5
3.60	5.99	0.00	23.92	0.25	17.93	0.17	40.3	39.7	-3.8
3.60	6.98	0.00	24.50	0.28	17.52	0.18	42.8	42.0	-3.9
3.60	7.98	0.01	24.98	0.32	17.00	0.19	45.3	44.4	-4.2
3.60	9.00	0.01	25.42	0.35	16.42	0.21	47.2	46.1	-4.4
3.60	9.98	0.01	25.81	0.38	15.83	0.22	48.6	47.3	-4.6
3.60	10.97	0.01	26.18	0.41	15.20	0.23	50.5	49.0	-4.7
3.60	12.04	0.02	26.52	0.45	14.48	0.24	52.4	50.5	-4.8
3.60	12.97	0.02	26.83	0.48	13.86	0.25	54.6	52.4	-4.7
3.60	14.00	0.03	27.10	0.51	13.10	0.25	56.3	53.5	-5.1
3.60	14.99	0.03	27.33	0.54	12.34	0.26	57.7	54.3	-5.2
3.60	16.01	0.04	27.52	0.56	11.51	0.27	59.2	55.0	-5.3
3.60	17.01	0.05	27.67	0.58	10.66	0.27	60.6	55.4	-5.4
3.60	18.00	0.06	27.81	0.60	9.81	0.27	61.4	55.0	-5.5



**RD01MUS2B single-stage amplifier Pout vs. Vgg characteristics.(Vdd=2.8V)**

@ Vdd=2.8V,Pin=30mW(14.8dB), f=400MHz, f=430MHz, f=460MHz, f=490MHz, f=520MHz



**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**RD01MUS2B single-stage amplifier Pout vs. Vgg characteristics data(Vdd=2.8V)**

@ **f=400MHz**, Vdd=2.8V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.84	0.03	4.62	0.00	-10.22	0.02	6.9	-1.9
0.20	14.77	0.03	9.97	0.01	-4.80	0.03	11.8	-1.6
0.40	14.84	0.03	12.47	0.02	-2.36	0.04	14.6	-1.9
0.60	14.79	0.03	14.90	0.03	0.10	0.06	19.0	-1.9
0.80	14.77	0.03	18.20	0.07	3.43	0.09	25.3	-1.9
1.00	14.80	0.03	21.54	0.14	6.74	0.15	35.1	-2.0
1.20	14.80	0.03	24.04	0.25	9.23	0.20	45.6	-2.1
1.40	14.85	0.03	25.49	0.35	10.64	0.24	52.5	-2.1
1.60	14.74	0.03	26.22	0.42	11.48	0.27	55.6	-2.1
1.80	14.83	0.03	26.70	0.47	11.87	0.29	57.5	-2.3
2.00	14.82	0.03	27.02	0.50	12.20	0.31	57.9	-2.6

@ **f=430MHz**, Vdd=2.8V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.75	0.03	15.09	0.03	0.34	0.05	21.7	-3.1
0.20	14.78	0.03	16.40	0.04	1.62	0.06	24.7	-3.1
0.40	14.75	0.03	18.22	0.07	3.47	0.08	28.5	-3.1
0.60	14.80	0.03	20.31	0.11	5.51	0.11	33.9	-3.2
0.80	14.82	0.03	22.20	0.17	7.38	0.15	40.8	-3.2
1.00	14.80	0.03	23.74	0.24	8.93	0.18	47.3	-3.4
1.20	14.80	0.03	24.97	0.31	10.18	0.21	53.3	-3.5
1.40	14.79	0.03	25.92	0.39	11.14	0.24	57.4	-3.7
1.60	14.79	0.03	26.54	0.45	11.76	0.27	60.7	-3.8
1.80	14.78	0.03	26.90	0.49	12.13	0.28	62.4	-4.0
2.00	14.76	0.03	27.08	0.51	12.31	0.29	62.7	-4.1

@ **f=460MHz**, Vdd=2.8V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.75	0.03	20.06	0.10	5.31	0.09	38.8	-6.0
0.20	14.81	0.03	20.77	0.12	5.96	0.11	40.5	-5.9
0.40	14.86	0.03	21.71	0.15	6.84	0.12	44.0	-5.9
0.60	14.78	0.03	22.79	0.19	8.01	0.14	47.4	-5.8
0.80	14.79	0.03	23.98	0.25	9.18	0.17	52.4	-5.8
1.00	14.82	0.03	25.00	0.32	10.17	0.20	56.3	-5.9
1.20	14.80	0.03	25.77	0.38	10.97	0.22	60.3	-6.0
1.40	14.82	0.03	26.29	0.43	11.48	0.24	63.2	-6.1
1.60	14.77	0.03	26.56	0.45	11.79	0.25	64.5	-6.3
1.80	14.74	0.03	26.72	0.47	11.98	0.26	64.9	-6.5
2.00	14.78	0.03	26.82	0.48	12.04	0.26	65.2	-6.7

@ **f=490MHz**, Vdd=2.8V,Pin=30mW(14.8dB)

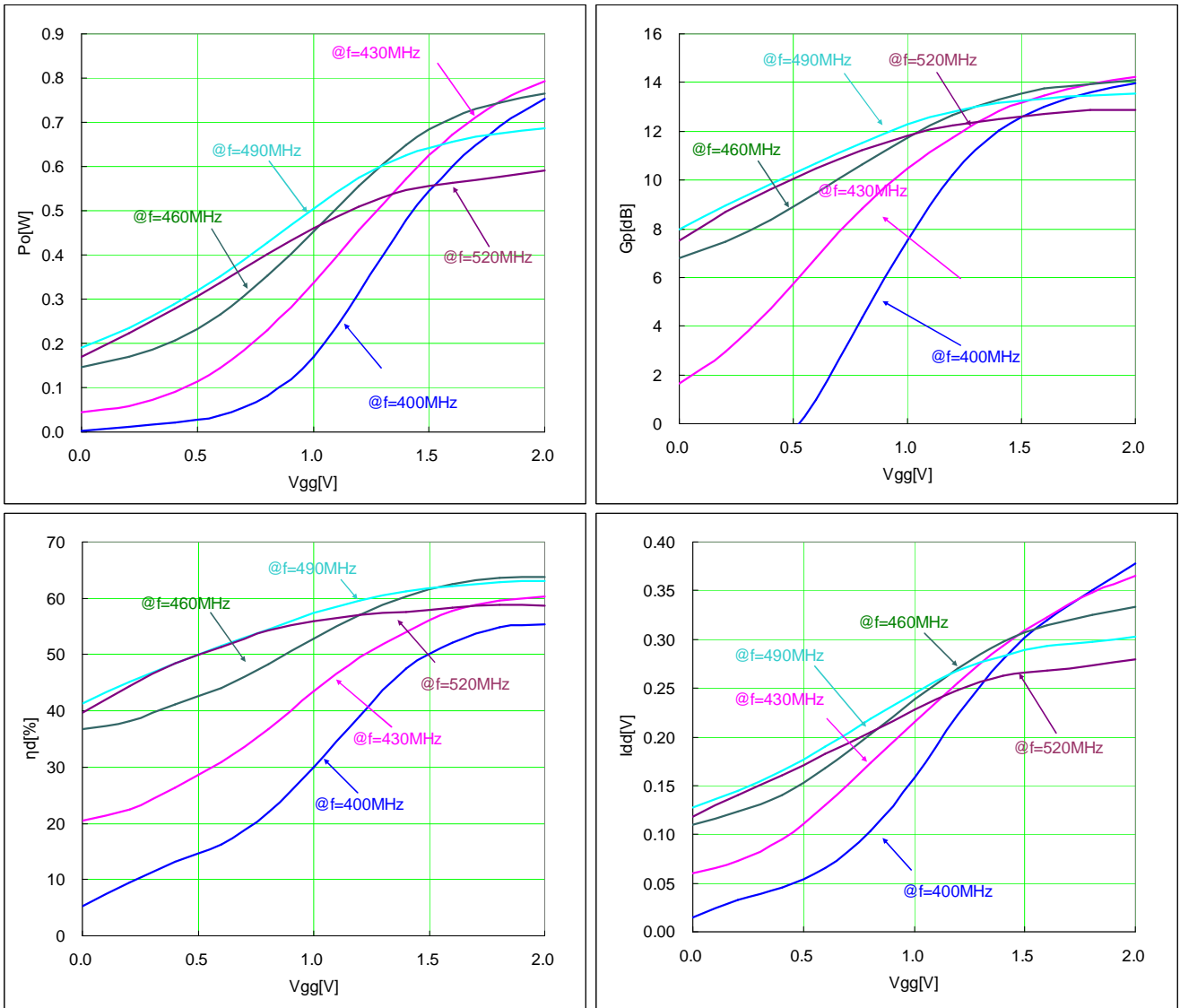
Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.78	0.03	21.18	0.13	6.40	0.11	44.6	-6.2
0.20	14.76	0.03	22.09	0.16	7.33	0.12	48.0	-6.0
0.40	14.79	0.03	22.93	0.20	8.15	0.14	50.7	-6.1
0.60	14.77	0.03	23.79	0.24	9.02	0.16	54.0	-5.9
0.80	14.78	0.03	24.61	0.29	9.83	0.18	57.2	-5.6
1.00	14.80	0.03	25.27	0.34	10.47	0.20	60.0	-5.6
1.20	14.79	0.03	25.73	0.37	10.93	0.22	61.9	-5.5
1.40	14.80	0.03	26.00	0.40	11.20	0.22	63.5	-5.7
1.60	14.79	0.03	26.15	0.41	11.36	0.23	64.4	-5.9
1.80	14.81	0.03	26.27	0.42	11.46	0.23	64.8	-6.0
2.00	14.84	0.03	26.34	0.43	11.50	0.24	64.5	-6.0

@ **f=520MHz**, Vdd=2.8V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.79	0.03	20.81	0.12	6.02	0.10	42.9	-6.5
0.20	14.78	0.03	21.88	0.15	7.10	0.12	47.8	-6.5
0.40	14.82	0.03	22.76	0.19	7.94	0.13	50.6	-6.2
0.60	14.85	0.03	23.56	0.23	8.71	0.15	53.9	-6.0
0.80	14.80	0.03	24.28	0.27	9.48	0.17	56.8	-5.6
1.00	14.80	0.03	24.86	0.31	10.07	0.19	58.0	-5.3
1.20	14.78	0.03	25.22	0.33	10.44	0.20	59.3	-5.2
1.40	14.80	0.03	25.43	0.35	10.62	0.21	59.7	-5.4
1.60	14.75	0.03	25.54	0.36	10.79	0.21	60.7	-5.2
1.80	14.78	0.03	25.65	0.37	10.86	0.21	61.4	-5.3
2.00	14.82	0.03	25.74	0.38	10.92	0.22	60.8	-5.4

**RD01MUS2B single-stage amplifier Pout vs. Vgg characteristics.(Vdd=3.6V)**

@ Vdd=3.6V,Pin=30mW(14.8dB), f=400MHz, f=430MHz, f=460MHz, f=490MHz, f=520MHz



**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**RD01MUS2B single-stage amplifier Pout vs. Vgg characteristics data(Vdd=3.6V)**

@ **f=400MHz**, Vdd=3.6V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.85	0.03	4.61	0.00	-10.24	0.02	5.4	-1.9
0.20	14.79	0.03	10.51	0.01	-4.28	0.03	9.5	-1.9
0.40	14.81	0.03	13.27	0.02	-1.53	0.05	13.1	-1.8
0.60	14.82	0.03	15.78	0.04	0.96	0.07	16.2	-1.8
0.80	14.76	0.03	19.09	0.08	4.33	0.10	21.9	-1.9
1.00	14.80	0.03	22.31	0.17	7.51	0.16	29.9	-2.0
1.20	14.77	0.03	24.98	0.31	10.21	0.22	39.2	-2.1
1.40	14.76	0.03	26.80	0.48	12.04	0.28	47.5	-2.1
1.60	14.79	0.03	27.78	0.60	13.00	0.32	52.1	-2.4
1.80	14.82	0.03	28.40	0.69	13.58	0.35	54.9	-2.4
2.00	14.80	0.03	28.77	0.75	13.97	0.38	55.4	-2.6

@ **f=430MHz**, Vdd=3.6V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.81	0.03	16.46	0.04	1.65	0.06	20.5	-3.4
0.20	14.78	0.03	17.73	0.06	2.94	0.07	22.5	-3.3
0.40	14.81	0.03	19.54	0.09	4.73	0.10	26.3	-3.3
0.60	14.80	0.03	21.60	0.14	6.81	0.13	30.9	-3.3
0.80	14.79	0.03	23.60	0.23	8.82	0.17	36.8	-3.4
1.00	14.78	0.03	25.27	0.34	10.49	0.22	43.4	-3.5
1.20	14.83	0.03	26.58	0.46	11.76	0.26	49.6	-3.6
1.40	14.74	0.03	27.57	0.57	12.82	0.29	54.2	-3.7
1.60	14.80	0.03	28.27	0.67	13.48	0.32	57.8	-4.0
1.80	14.81	0.03	28.74	0.75	13.92	0.35	59.7	-4.2
2.00	14.78	0.03	28.99	0.79	14.21	0.37	60.4	-4.4

@ **f=460MHz**, Vdd=3.6V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.82	0.03	21.63	0.15	6.81	0.11	36.7	-5.7
0.20	14.83	0.03	22.28	0.17	7.45	0.12	38.2	-5.7
0.40	14.81	0.03	23.16	0.21	8.35	0.14	41.1	-5.6
0.60	14.78	0.03	24.25	0.27	9.48	0.17	44.0	-5.6
0.80	14.86	0.03	25.47	0.35	10.62	0.20	48.3	-5.7
1.00	14.84	0.03	26.56	0.45	11.72	0.24	52.9	-5.8
1.20	14.77	0.03	27.44	0.56	12.67	0.27	57.1	-5.8
1.40	14.81	0.03	28.11	0.65	13.31	0.30	60.4	-5.9
1.60	14.76	0.03	28.50	0.71	13.74	0.32	62.5	-6.1
1.80	14.78	0.03	28.71	0.74	13.93	0.33	63.6	-6.4
2.00	14.75	0.03	28.83	0.76	14.08	0.33	63.8	-6.6

@ **f=490MHz**, Vdd=3.6V,Pin=30mW(14.8dB)

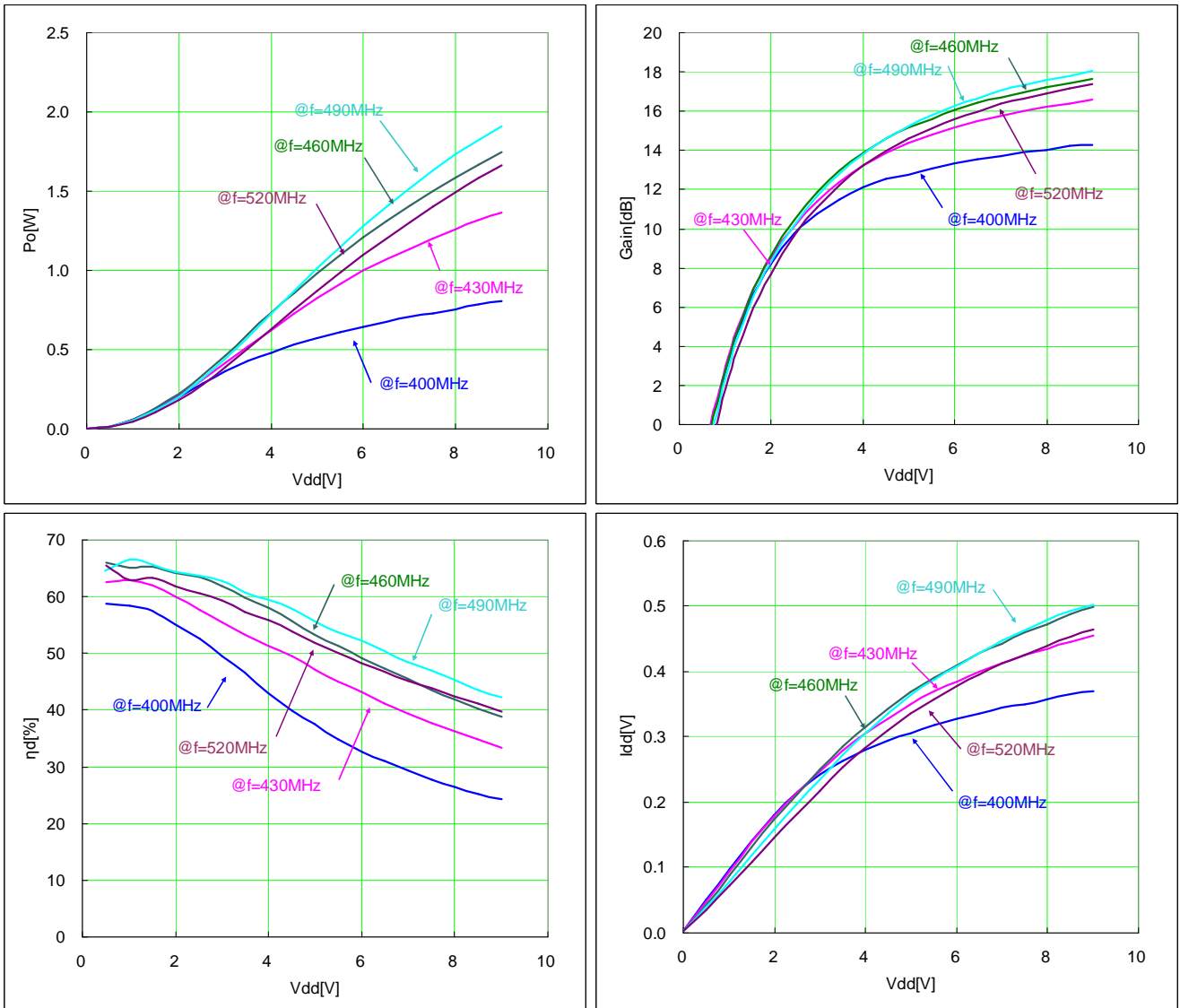
Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.81	0.03	22.80	0.19	7.99	0.13	41.4	-6.3
0.20	14.77	0.03	23.72	0.24	8.95	0.15	45.2	-6.2
0.40	14.75	0.03	24.59	0.29	9.84	0.17	48.5	-5.9
0.60	14.79	0.03	25.47	0.35	10.68	0.19	51.5	-5.8
0.80	14.81	0.03	26.32	0.43	11.51	0.22	54.6	-5.7
1.00	14.75	0.03	27.04	0.51	12.29	0.25	57.3	-5.5
1.20	14.80	0.03	27.59	0.57	12.79	0.27	59.5	-5.6
1.40	14.80	0.03	27.96	0.62	13.16	0.28	61.3	-5.6
1.60	14.81	0.03	28.17	0.66	13.36	0.29	62.2	-5.7
1.80	14.81	0.03	28.29	0.67	13.48	0.30	62.9	-5.8
2.00	14.80	0.03	28.37	0.69	13.57	0.30	63.0	-5.4

@ **f=520MHz**, Vdd=3.6V,Pin=30mW(14.8dB)

Vgg [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.77	0.03	22.27	0.17	7.50	0.12	39.7	-6.9
0.20	14.79	0.03	23.51	0.22	8.71	0.14	44.5	-6.8
0.40	14.83	0.03	24.46	0.28	9.63	0.16	48.5	-6.5
0.60	14.82	0.03	25.29	0.34	10.47	0.18	51.3	-6.1
0.80	14.79	0.03	26.03	0.40	11.24	0.21	54.3	-5.7
1.00	14.80	0.03	26.63	0.46	11.83	0.23	56.0	-5.4
1.20	14.83	0.03	27.07	0.51	12.24	0.25	57.0	-5.3
1.40	14.85	0.03	27.37	0.55	12.51	0.26	57.6	-5.2
1.60	14.80	0.03	27.51	0.56	12.71	0.27	58.4	-5.2
1.80	14.73	0.03	27.62	0.58	12.89	0.27	58.8	-5.2
2.00	14.83	0.03	27.72	0.59	12.90	0.28	58.7	-5.1

**RD01MUS2B single-stage amplifier Pout vs. Vdd characteristics.**

@ Idq=40mA(Vgg=1.35V), Pin=30mW(14.8dB), f=400MHz, f=430MHz, f=460MHz, f=490MHz, f=520MHz



**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**RD01MUS2B single-stage amplifier Pout vs. Vdd characteristics data**

@ **f=400MHz**, I<sub>dq</sub>=40mA(V<sub>gg</sub>=1.35V),Pin=30mW(14.8dB)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	I <sub>dd</sub> [A]	η <sub>d</sub> [%]	R.L. [-dB]
0.00	14.77	0.03	-8.20	0.00	-22.97	0.00	0.0	-1.9
0.50	14.81	0.03	11.65	0.01	-3.16	0.05	58.8	-1.9
1.01	14.82	0.03	17.60	0.06	2.79	0.10	58.4	-2.0
1.50	14.79	0.03	20.82	0.12	6.03	0.14	57.5	-1.9
2.00	14.80	0.03	22.98	0.20	8.17	0.18	55.2	-2.0
2.51	14.77	0.03	24.52	0.28	9.76	0.22	52.5	-2.0
3.00	14.79	0.03	25.57	0.36	10.79	0.24	49.5	-1.9
3.50	14.80	0.03	26.32	0.43	11.51	0.26	46.5	-1.9
4.01	14.73	0.03	26.84	0.48	12.11	0.28	43.1	-1.8
4.50	14.72	0.03	27.25	0.53	12.52	0.30	39.9	-1.8
5.00	14.79	0.03	27.57	0.57	12.78	0.31	37.5	-1.9
5.51	14.78	0.03	27.84	0.61	13.06	0.32	34.8	-1.9
6.00	14.76	0.03	28.08	0.64	13.32	0.33	32.7	-1.8
6.50	14.78	0.03	28.30	0.68	13.52	0.34	31.1	-1.8
7.01	14.82	0.03	28.50	0.71	13.68	0.35	29.3	-1.9
7.50	14.74	0.03	28.63	0.73	13.89	0.35	27.8	-1.8
8.00	14.75	0.03	28.79	0.76	14.04	0.36	26.4	-1.9
8.51	14.74	0.03	28.94	0.78	14.20	0.37	25.2	-1.8
9.00	14.79	0.03	29.07	0.81	14.27	0.37	24.2	-1.9

@ **f=430MHz**, I<sub>dq</sub>=40mA(V<sub>gg</sub>=1.35V),Pin=30mW(14.8dB)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	I <sub>dd</sub> [A]	η <sub>d</sub> [%]	R.L. [-dB]
0.00	14.80	0.03	-5.20	0.00	-20.01	0.00	0.0	-3.6
0.50	14.77	0.03	11.74	0.01	-3.03	0.05	62.6	-3.5
1.01	14.80	0.03	17.79	0.06	2.99	0.10	63.0	-3.5
1.50	14.79	0.03	21.08	0.13	6.29	0.14	61.9	-3.5
2.00	14.77	0.03	23.29	0.21	8.52	0.18	60.0	-3.5
2.51	14.78	0.03	24.93	0.31	10.14	0.22	57.7	-3.5
3.00	14.79	0.03	26.16	0.41	11.37	0.25	55.5	-3.5
3.50	14.77	0.03	27.15	0.52	12.39	0.28	53.4	-3.4
4.01	14.77	0.03	27.97	0.63	13.20	0.31	51.3	-3.4
4.50	14.78	0.03	28.64	0.73	13.85	0.33	49.5	-3.4
5.00	14.80	0.03	29.16	0.82	14.37	0.35	47.2	-3.4
5.51	14.80	0.03	29.62	0.92	14.83	0.37	45.0	-3.4
6.00	14.81	0.03	29.99	1.00	15.18	0.39	43.2	-3.4
6.50	14.78	0.03	30.29	1.07	15.51	0.40	41.1	-3.4
7.01	14.79	0.03	30.56	1.14	15.77	0.41	39.3	-3.4
7.50	14.79	0.03	30.80	1.20	16.01	0.43	37.7	-3.4
7.99	14.80	0.03	31.01	1.26	16.21	0.44	36.3	-3.5
8.51	14.81	0.03	31.20	1.32	16.39	0.45	34.9	-3.5
9.00	14.79	0.03	31.35	1.37	16.56	0.46	33.4	-3.5

@ **f=460MHz**, I<sub>dq</sub>=40mA(V<sub>gg</sub>=1.35V),Pin=30mW(14.8dB)

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	I <sub>dd</sub> [A]	η <sub>d</sub> [%]	R.L. [-dB]
-0.01	14.84	0.03	-4.47	0.00	-19.31	0.00	0.0	-6.3
0.50	14.79	0.03	11.49	0.01	-3.30	0.04	65.9	-6.2
1.01	14.81	0.03	17.60	0.06	2.80	0.09	65.1	-6.2
1.50	14.82	0.03	21.05	0.13	6.23	0.13	65.2	-6.1
2.00	14.85	0.03	23.46	0.22	8.62	0.17	64.2	-6.0
2.51	14.83	0.03	25.30	0.34	10.47	0.21	63.4	-6.0
3.00	14.79	0.03	26.67	0.46	11.88	0.25	61.9	-5.9
3.50	14.77	0.03	27.75	0.60	12.98	0.29	59.8	-5.8
4.01	14.81	0.03	28.65	0.73	13.84	0.32	58.0	-5.7
4.50	14.74	0.03	29.34	0.86	14.60	0.34	55.7	-5.6
5.00	14.76	0.03	29.91	0.98	15.15	0.37	53.3	-5.6
5.51	14.80	0.03	30.41	1.10	15.62	0.39	51.2	-5.6
6.00	14.78	0.03	30.82	1.21	16.04	0.41	49.1	-5.5
6.50	14.78	0.03	31.19	1.31	16.41	0.43	47.3	-5.5
7.01	14.79	0.03	31.50	1.41	16.71	0.44	45.5	-5.5
7.50	14.80	0.03	31.77	1.50	16.97	0.46	43.6	-5.5
7.99	14.77	0.03	32.01	1.59	17.23	0.47	42.0	-5.5
8.50	14.78	0.03	32.23	1.67	17.45	0.49	40.3	-5.5
9.00	14.81	0.03	32.43	1.75	17.62	0.50	38.9	-5.5

**RD01MUS2B single-stage amplifier RF performance at f=400 to 520MHz(Vdd=2.8V,3.6V).**

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**@ f=490MHz, Idq=40mA(Vgg=1.35V),Pin=30mW(14.8dB)**

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
-0.01	14.80	0.03	-4.64	0.00	-19.44	0.00	0.0	-6.5
0.50	14.79	0.03	11.08	0.01	-3.71	0.04	64.6	-6.3
1.01	14.81	0.03	17.18	0.05	2.36	0.08	66.5	-6.2
1.50	14.77	0.03	20.65	0.12	5.88	0.12	65.6	-5.9
2.00	14.78	0.03	23.08	0.20	8.30	0.16	64.5	-5.8
2.51	14.79	0.03	25.00	0.32	10.20	0.20	63.7	-5.6
3.00	14.83	0.03	26.46	0.44	11.63	0.24	62.8	-5.5
3.50	14.80	0.03	27.63	0.58	12.83	0.27	60.8	-5.4
4.01	14.82	0.03	28.62	0.73	13.80	0.31	59.6	-5.3
4.50	14.79	0.03	29.40	0.87	14.62	0.34	57.8	-5.2
5.00	14.82	0.03	30.05	1.01	15.22	0.36	55.7	-5.1
5.51	14.80	0.03	30.60	1.15	15.80	0.39	53.7	-5.0
6.00	14.79	0.03	31.06	1.28	16.27	0.41	52.2	-5.0
6.50	14.81	0.03	31.47	1.40	16.66	0.43	50.4	-4.9
7.01	14.77	0.03	31.82	1.52	17.06	0.45	48.5	-4.8
7.50	14.79	0.03	32.12	1.63	17.33	0.46	46.9	-4.8
8.00	14.81	0.03	32.38	1.73	17.57	0.48	45.3	-4.8
8.51	14.80	0.03	32.62	1.83	17.81	0.49	43.6	-4.8
9.00	14.78	0.03	32.81	1.91	18.03	0.50	42.2	-4.8

**@ f=520MHz, Idq=40mA(Vgg=1.35V),Pin=30mW(14.8dB)**

Vdd [V]	Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	$\eta_d$ [%]	R.L. [-dB]
0.00	14.82	0.03	-5.25	0.00	-20.06	0.00	0.0	-6.3
0.50	14.78	0.03	10.56	0.01	-4.21	0.04	65.5	-6.0
1.01	14.81	0.03	16.64	0.05	1.83	0.07	62.8	-5.8
1.50	14.79	0.03	20.11	0.10	5.33	0.11	63.3	-5.6
2.00	14.85	0.03	22.54	0.18	7.68	0.15	61.9	-5.4
2.51	14.80	0.03	24.44	0.28	9.64	0.18	60.6	-5.2
3.00	14.80	0.03	25.88	0.39	11.09	0.22	59.2	-5.0
3.50	14.80	0.03	27.04	0.51	12.25	0.25	57.2	-4.9
4.01	14.81	0.03	28.01	0.63	13.20	0.28	55.8	-4.8
4.50	14.81	0.03	28.77	0.75	13.96	0.31	53.9	-4.7
5.00	14.82	0.03	29.39	0.87	14.57	0.34	51.9	-4.7
5.51	14.81	0.03	29.95	0.99	15.14	0.36	50.1	-4.6
6.00	14.78	0.03	30.39	1.09	15.61	0.38	48.3	-4.5
6.50	14.82	0.03	30.80	1.20	15.98	0.40	46.8	-4.5
7.01	14.80	0.03	31.16	1.31	16.36	0.41	45.1	-4.5
7.50	14.81	0.03	31.46	1.40	16.65	0.43	43.9	-4.5
8.00	14.83	0.03	31.74	1.49	16.92	0.44	42.5	-4.4
8.51	14.83	0.03	31.99	1.58	17.16	0.45	41.1	-4.4
9.00	14.80	0.03	32.20	1.66	17.40	0.47	39.7	-4.4