EMPOWER RF SYSTEMS, INC.

ACCEPTANCE TEST DATA

Date	Job Number	SKU No.	Frequency	Output Power
May 24, 2022	17126-1-1	2237-001	1000-2000	40kW-Peak

Power Amplifier Final Test

ELECTRICAL SPECIFICATIONS @ 208V_{AC} 3-Phase, 25°C ambient, 50Ω System

Parameter	Specifications						Frequency (MHz)					
	Symbol	Min	Typ	Max	Unit	Notes	1000	1250	1500	1750	2000	P/F
Operating Frequency - BW	BW	1000		2000	MHz		√	√	√	√	√	
Power Gain @ P_{OUT}=40kWpk 500µS pulse width; 10% duty cycle (Measured at the middle of the pulse)	G	76			dB	Record	81.32	81.12	79.32	80.82	76.02	P
Sample Port @ 40kWpk 500µS pulse width; 10% duty cycle (Measured at the middle of the pulse)	P_{sample}		10		dBm	Record	10.9	12.5	14.5	16.5	15.7	P
Min. P_{in} for P_{OUT} = 40kWpk (500µS PW, DC = 10%, MGC and Gated Input)	Pin	-10	0	5	dBm	Record	-5.3	-5.1	-3.3	-4.8	0	P
Min. P_{in} for P_{OUT} = 40kWpk (50µS PW, DC = 10%, MGC and Gated Input)							-4.7	-5.1	-3.1	-4.9	0	P
Droop @ 40kWpk, 500µS PW, DC = 10% (MGC and Gated Input)	P_{Droop}			1.2	dB	Plot 5 & 9	0.68	0.9	0.8	0.8	0.8	P
Droop @ 40kWpk, 50µS PW, DC =10% (MGC and Gated Input)				0.5			0.3	0.4	0.4	0.4	0.4	P
Pulse Characteristics, P_{OUT} = 40kW (500µS PW, DC = 10%, MGC and Gated Input)	T_{RISE}			30	nSec	Plots 6 & 7	8	10	10	11	12	P
	T_{FALL}			30			11	15	15	16	16	P
Pulse Characteristics, P_{OUT} = 40kW (50µS PW, DC = 10%, MGC and Gated Input)	T_{RISE}			30		Plot 10 & 11	13	10	11	12	13	P
	T_{FALL}			30			16	10	15	12	9	P
Input Return Loss	S11			-10	dB	Plot 1	-	-	-	-	-	P
Small Gain Flatness	ΔG			±3	dB	Plot 1	-	-	-	-	-	P
Gain @ Shutdown Condition, P_{IN} = 0dBm (†)	G_{SD}			35	dB	Plot 3	-	-	-	-	-	P
Gain Adjustment Range (500µS PW, DC = 10%, MGC and Gated Input)	VVA	20			dB	Plot 2	-	-	-	-	-	P
Spurious Signals	Spur			-60	dBc	Record	<-70	<-70	<-70	<-70	<-70	P
Noise Power Output (NPO)	Enabled			-10	dBm/MHz	Record	-14.83					P
	Disabled			-100	dBm/MHz	Record	-102					P ϫ
Harmonics @ nominal Pout: (500µS PW, DC = 10%, MGC and Gated Input)	2nd			20	dBc	Record	-23.6	-38.9	-44.2	-42.83	-57.59	P
	3rd			25	dBc	Record	-57	-38.8	-63.3	63.7	-64.8	P

† Gain @ Cold Stand-By Condition ≤ 35dB *(P_{IN} = 0dBm)*

ϫ Spectrum Analyzer noise floor -107dBm/MHz

ELECTRICAL SPECIFICATIONS (cont.) @ $208V_{AC}$ 3-Phase, 25°C ambient, 50Ω System

Parameter	Specifications						Frequency (MHz)					
	Symbol	Min	Typ	Max	Unit	Notes	1000	1250	1500	1750	2000	P/F
Operating Voltage	V_{dc}	180	208	260	V	Record	201	201	201	201	200	P
Power Consumption @ P_{OUT} = 40kW (500µS PW, DC=10%, MGC and Gated Input)	P_D			16	kVA	Record	11.858	12.762	13.214	11.266	11.418	P
Power Consumption @ POUT = 40kW (50µS PW, DC=10%, MGC and Gated Input)				16			12.518	13.109	13.735	11.510	12.041	P
Power Consumption @ Shutdown	P_{SD}			4.5	kVA	Record	2.422					P
Quiescent Power Consumption	P_{DQ}			8	kVA	Record	3.897					P
Cooling Distribution Unit Power Consumption	P_D			6	kVA	Record	4.390					P
NTE Test, P_{IN} = +0dBm, LCD Display = 76dBm	P_{OOD}			77.5	dBm	Record P_{OUT}	77.4	77.0	76.2	76.7	77.3	P
						Record P_{in}	-0.80	-3.80	-3.60	-3.60	4.80	P
Input Overdrive - Shutdown	P_{IOD}			10	dBm	Verify	√	√	√	√	√	P
VSWR - Backoff	VSWR		3:01		-	Verify	√	√	√	√	√	P
Excess Duty Cycle Protection -- 500µS pulse width, 10% duty cycle				12	%	Verify	√	√	√	√	√	P
Thermal Overload - Shutdown *(stage3 -booster)*	T_{OD}			95	°C	Verify	√	√	√	√	√	P

INTERFACE

System Controller	Control Unit SW	Booster SW/FW	NTE	MGC Default Set Point		Max Pulse width / Duty		Interlock	Summary Fault	Shutdown	RS232 Console	GPIO
	Build / Bundle ID	Build / Bundle ID	dBm	0% Min	100% Max	PW	DC	Verify	Verify	Verify	Verify	Verify
Verify / Record	344/3368	344/3242	76.92	√	-	520	11%	√	√	√	√	√

Performance Plots

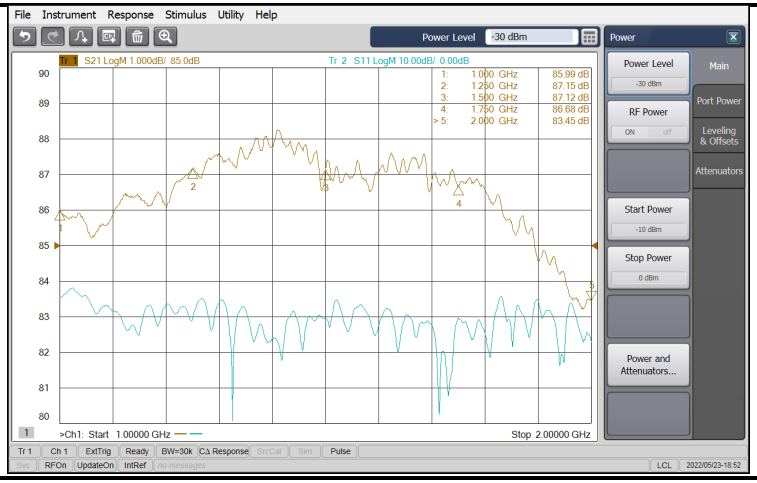
Plot 1 - Small Signal Gain and Input Return Loss (Peak)

Top Curve: Small Signal Gain @ P_{IN} = -30dBm

Reference:85dB, 1dB/div.

Bottom Curve: Input Return Loss

Reference: 0dB, 10dB/div.



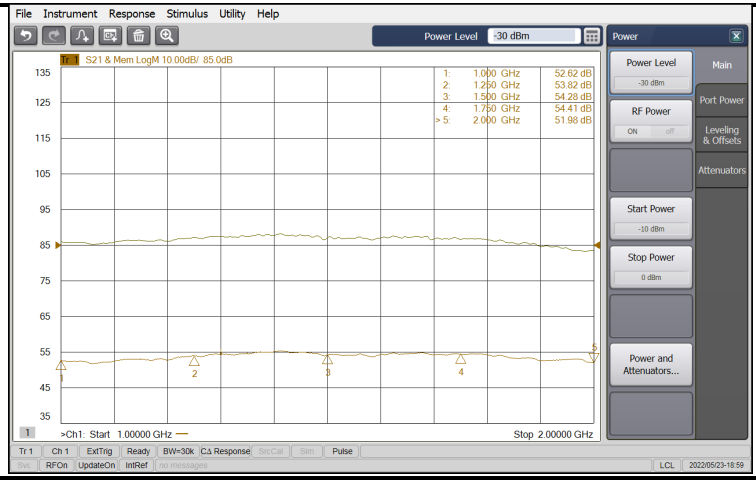
Plot 2 -Gain adjustment range

Top Curve (Trace Memory): Maximum Gain (MGC Mode and P_{IN} = -30dBm)

Reference :85dB, 10dB/div.

Bottom Curve (Active Trace): Minimum Gain (MGC Mode and P_{IN} = -30dBm)

Reference: 85dB, 10dB/div.



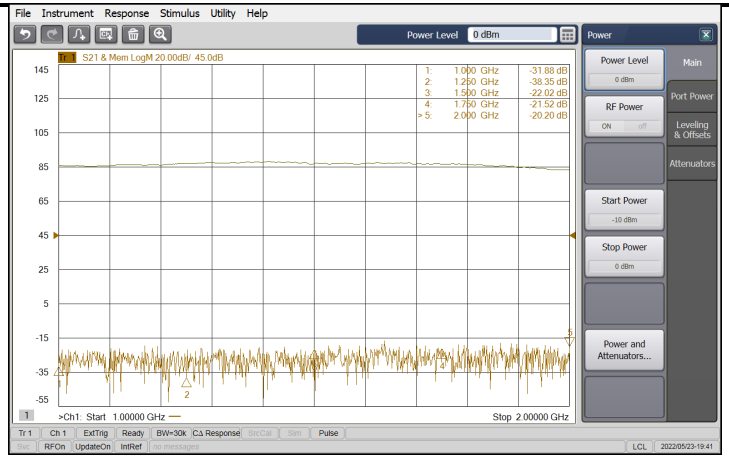
Plot 3 - Gain at shutdown condition

Top Curve (Trace Memory): Maximum Gain (MGC Mode and P_{IN} = -30dBm)

Reference:45dB, 20dB/div.

Bottom Curve: (Active Trace): Gain at Shutdown (MGC Mode and P_{IN} = 0dBm)

Reference: 45dB, 20dB/div.



Plot 4 - (N/A)

Top Curve (Trace Memory):

Reference :80dB, 10dB/div.

Bottom Curve (Active Trace):

Reference: 80dB, 10dB/div.

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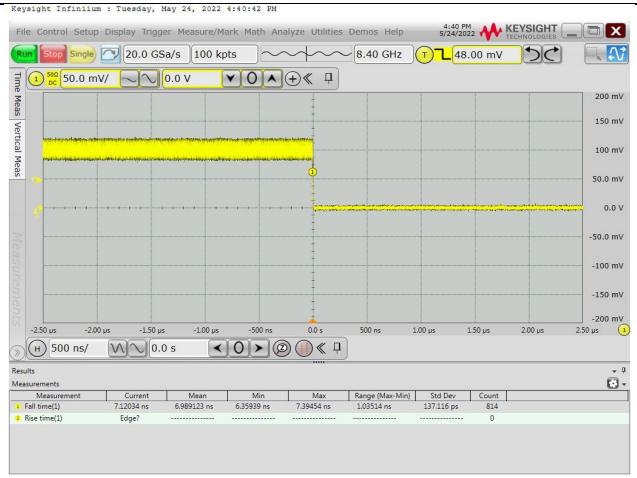
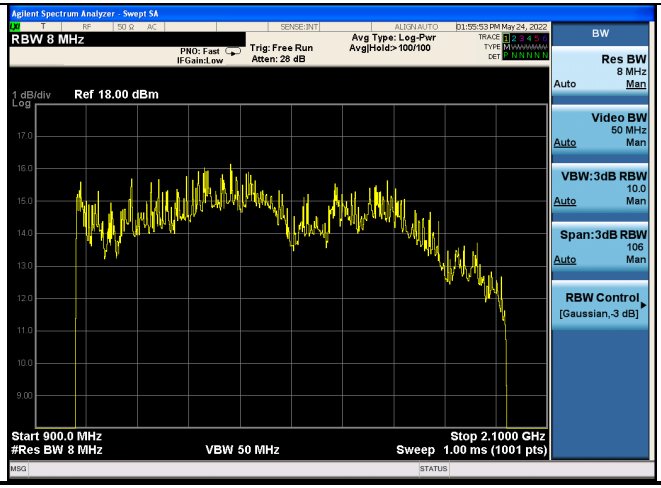
Performance Plots

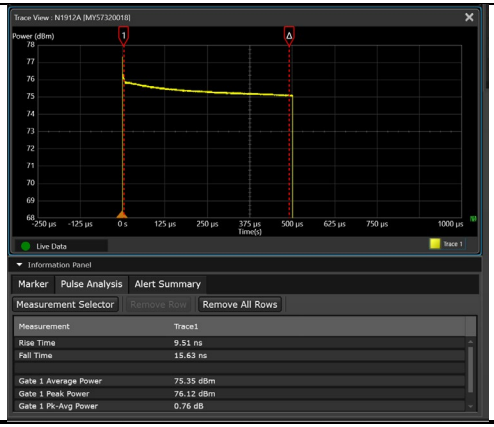
Plot 5 - Pulse Performance - 500µs PW and DC=10%	Plot 6 - Pulse Performance - Typical Rise time- 500µs PW and DC=10%
Pulse at 76Bm Peak Average	Pulse at 76dBm Peak Average
	

Plot 7 - Pulse Performance - Typical Fall time- 500µs PW and DC=10%	Plot 8 - Simulated LFM Pulse Performance - BW = 1000-2000MHz 500µs PW and DC=10%
Pulse at 76dBm Peak Average	Pulse at 76dBm Peak Average
	

Performance Plots

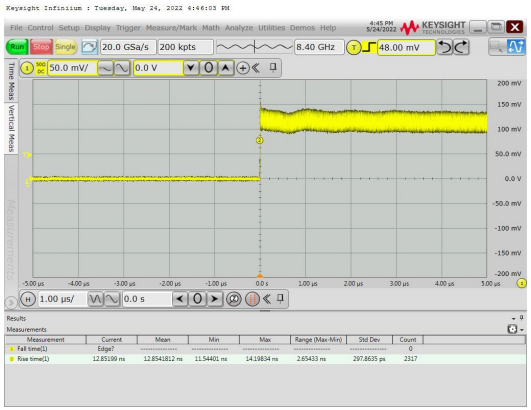
Plot 9 - Pulse Performance - 50µs PW and DC=10%

Pulse at 76dBm Peak Average



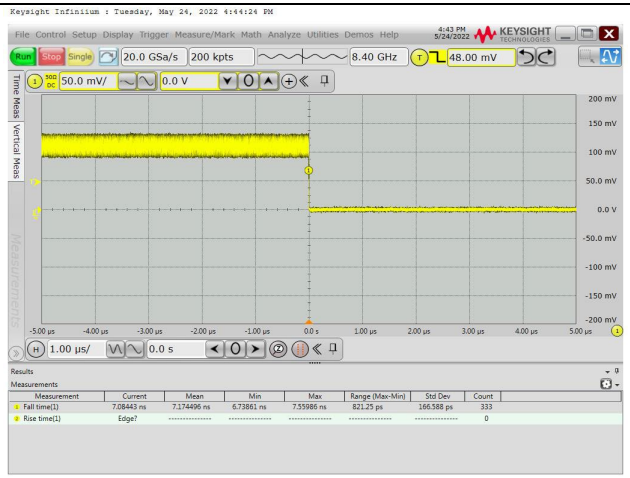
Plot 10 - Pulse Performance - Typical Rise time-50µs PW and DC=10%

Pulse at 76dBm Peak Average



Plot 11 - Pulse Performance - Typical Fall time- 50µs PW and DC=10%

Pulse at 76dBm Peak Average



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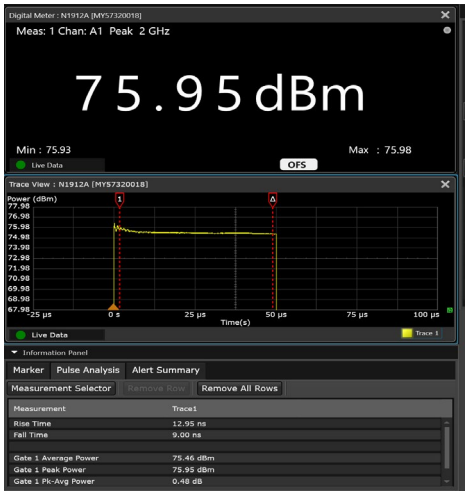
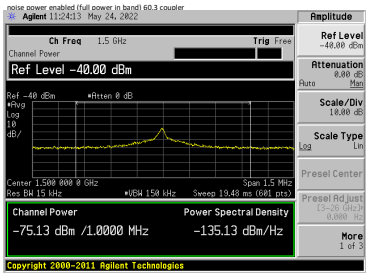
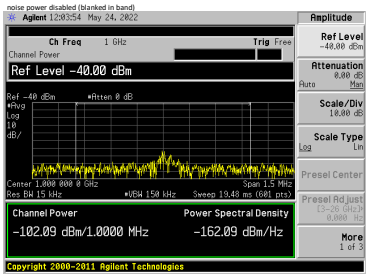


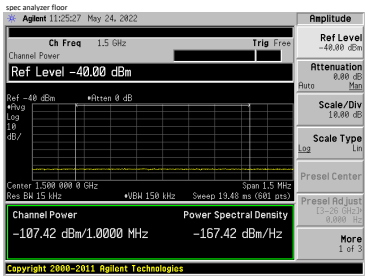
noise power enabled (full power in band) 60.3 coupler



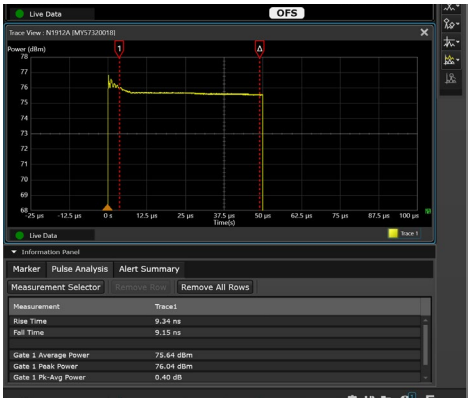
noise power disabled (blanked in band)



spec analyzer floor




Live Data
OFS
Trace View : N1912A [MY57320018]
Power (dBm)
Live Data
Trace 1
Information Panel
Marker
Pulse Analysis
Alert Summary
Measurement Selector
Remove Row
Remove All Rows
Measurement
Trace1
Rise Time
10.74 ns
Fall Time
15.08 ns
Gate 1 Average Power
75.39 dBm
Gate 1 Peak Power
76.26 dBm
Gate 1 Pk-Avg Power
0.87 dB


Live Data
OFS
Trace View : N1912A [MY57320018]
Power (dBm)
Live Data
Trace 1
Information Panel
Marker
Pulse Analysis
Alert Summary
Measurement Selector
Remove Row
Remove All Rows
Measurement
Trace1
Rise Time
9.34 ns
Fall Time
9.15 ns
Gate 1 Average Power
75.64 dBm
Gate 1 Peak Power
76.04 dBm
Gate 1 Pk-Avg Power
0.40 dB


Digital Meter : N1912A [MY57320018]
Meas: 1 Chan: A1 Peak 1 GHz
76.09dBm
Min : 37.16
Max : 76.18
Live Data
OFS
Trace View : N1912A [MY57320018]
Power (dBm)
Live Data
Trace 1
Information Panel
Marker
Pulse Analysis
Alert Summary
Measurement Selector
Remove Row
Remove All Rows
Measurement
Trace1
Rise Time
8.13 ns
Fall Time
11.17 ns
Gate 1 Average Power
75.41 dBm
Gate 1 Peak Power
76.09 dBm
Gate 1 Pk-Avg Power
0.68 dB


Digital Meter : N1912A [MY57320018]
Meas: 1 Chan: A1 Peak 1 GHz
76.16dBm
Min : 72.72
Max : 76.17
Live Data
OFS
Trace View : N1912A [MY57320018]
Power (dBm)
Live Data
Trace 1
Information Panel
Marker
Pulse Analysis
Alert Summary
Measurement Selector
Remove Row
Remove All Rows
Measurement
Trace1
Rise Time
13.49 ns
Fall Time
16.65 ns
Gate 1 Average Power
75.83 dBm
Gate 1 Peak Power
76.16 dBm
Gate 1 Pk-Avg Power
0.33 dB