

MGA-445940-02 4.4 – 5.9 GHz 10W High Efficiency Linear Power Amplifier

Features:

- 14 dB Gain
- 40 dBm P_{-3dB}
- 34 dBm Linear Pout @ 2.5% EVM (802.11 64QAM)
- 25% Efficiency at 33 dBm Linear Output Power
- Fully Matched Input and Output for Easy Cascade
- + 28V Bias Voltage
- Surface Mount Package with RoHS Compliance
- MTTF > 100 years @ 85°C ambient temperature

Applications:

- Wireless Mech Networks
- 802.11a WLAN
- Point-To-Point Radio Applications

Description:

The MGA-445940-02 is a power amplifier with the State-of-the-Art linear power-added-efficiency between 4.4 GHz and 5.9 GHz frequency band. Based on advanced robust GaN device technology, the power-added-efficiency of this power amplifier is as high as 25% when it outputs 2W linear burst power with 2.5% EVM under the 802.16d/e 64QAM modulation schemes. The high efficiency linear power amplifier also has excellent reliability. Ideal applications include the driver and the output power stage of WLAN infrastructures and access points. It also can be used for PTP (Point-To-Point) radio applications for this band.

Typical RF Performance: $V_{ds}=28V$, $I_{cq}=80mA$, $T_a=25^\circ C$, $Z_0=50\ ohm$

Parameter	Units	Min	Typical
Frequency Range	MHz		4400-5900
Gain (Typ / Min)	dB		14 / 13
Gain Flatness (Typ / Max)	+/- dB		0.6 / 1.0
Input Return Loss	dB	6	
Output Return Loss	dB	3	
Output P3dB	dBm		40
Pout @ 2.5% EVM	dBm		34
Operating Current Range	mA		100-1200
Thermal Resistance	°C /W		5

Absolute Maximum Ratings: ($T_a=25^\circ C$)*

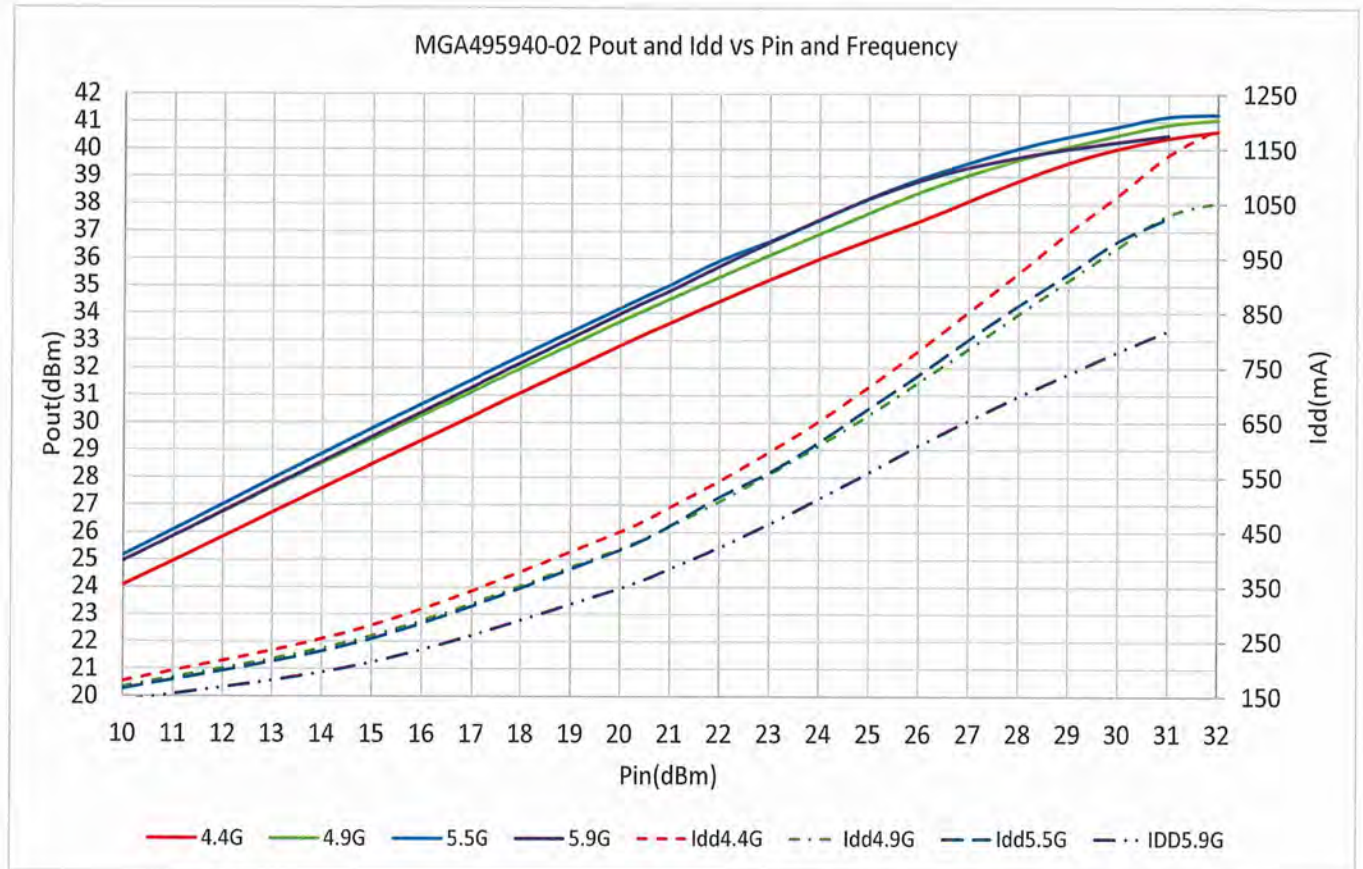
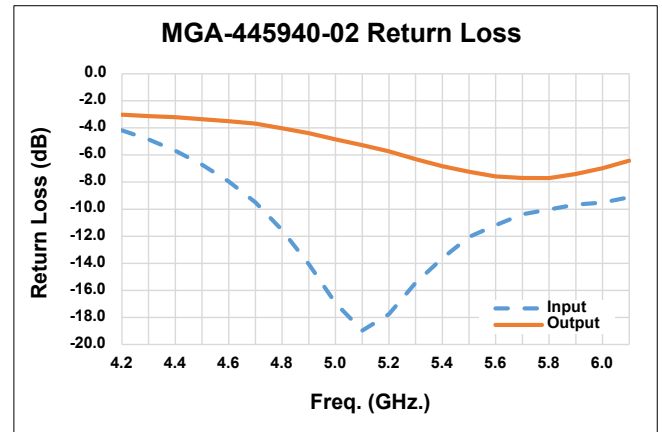
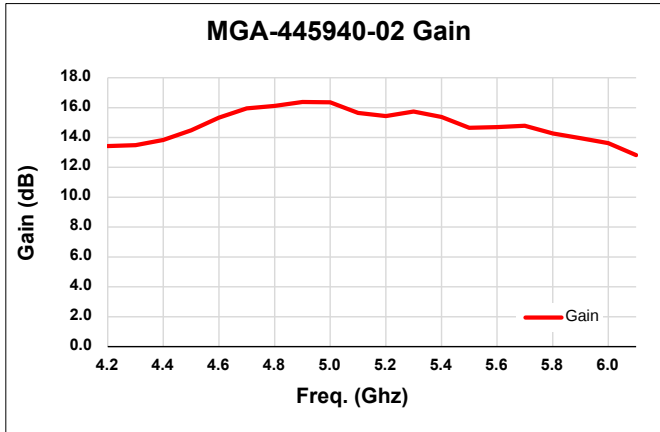
SYMBOL	PARAMETERS	UNITS	ABSOLUTE MAXIMUM
V _{ds}	Drain-Source Voltage	V	50
I _d	Drain Current	mA	1000
I _g	Gate Current	mA	100
P _{diss}	DC Power Dissipation	W	50
P _{in max}	RF Input Power	dBm	+33
T _{ch}	Channel Temperature	°C	175
T _{stg}	Storage Temperature	°C	-55 to 150

*Operation of this device above any one of these parameters may cause permanent damage.

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4.4 – 5.9 GHz 10W High Efficiency
Linear Power Amplifier

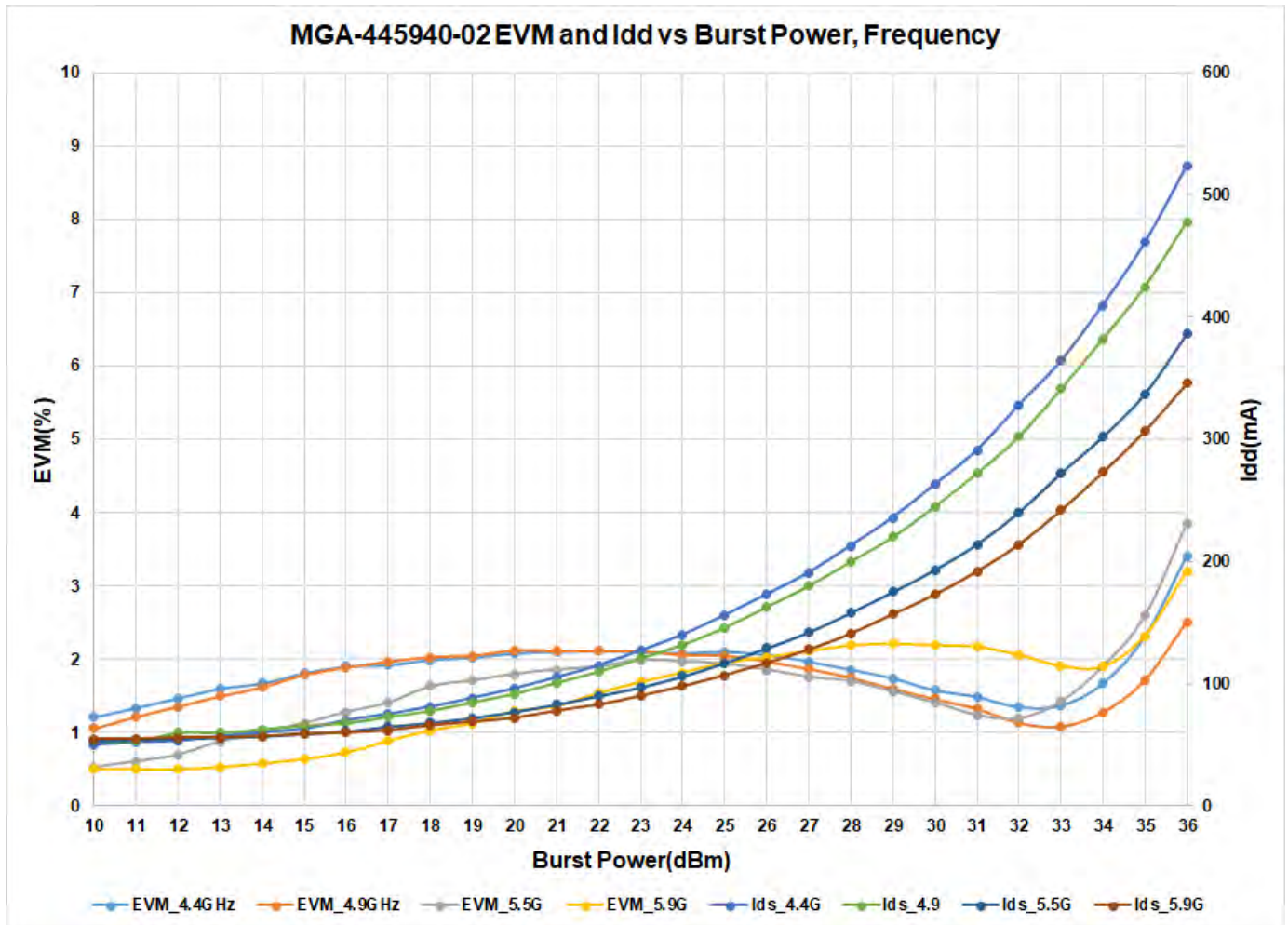
Typical RF Performance: $V_{ds}=28.0V$, $I_{cq}=80mA$, $Z_0=50\ \Omega$, $T_a=25\ ^\circ C$



MGA-445940-02

4.4 – 5.9 GHz 10W High Efficiency
Linear Power Amplifier

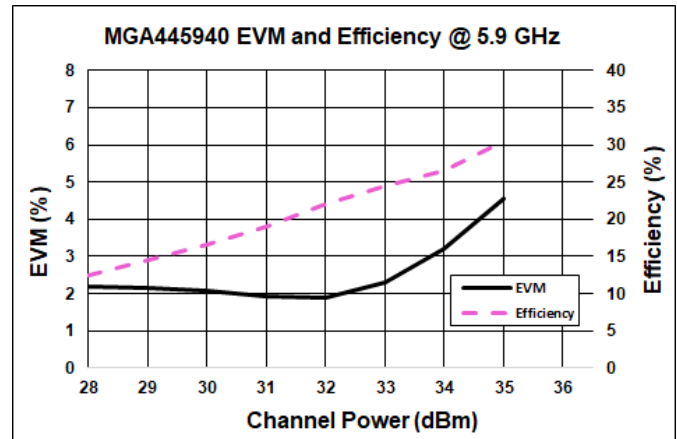
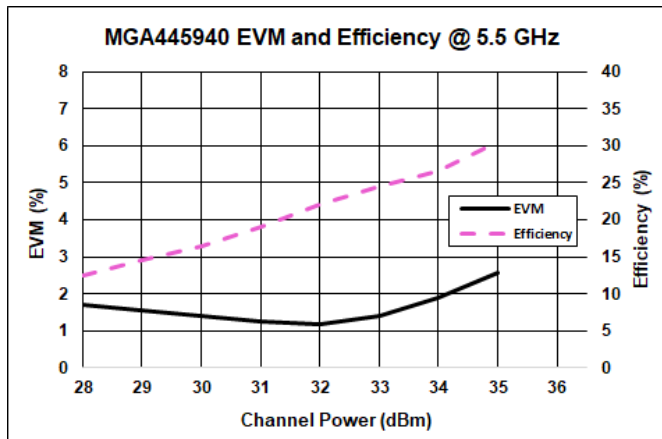
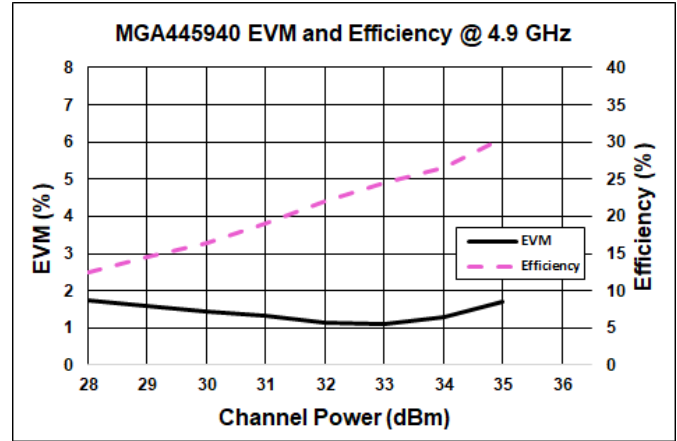
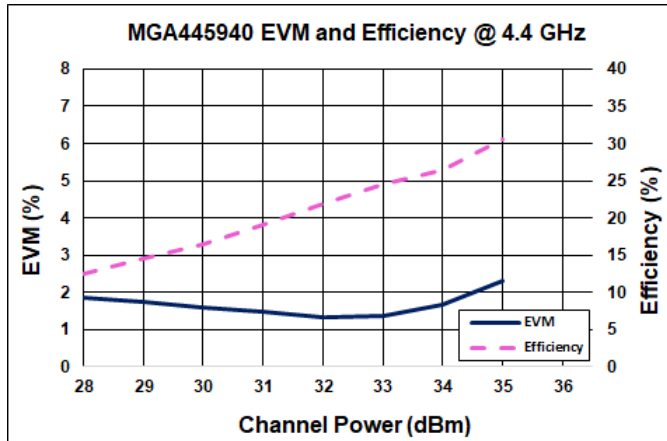
Typical RF Performance(Cont'l): $V_{ds}=28.0V$, $I_{dq}=46mA$, $Z_0=50\ ohm$, $T_a=25\ ^\circ C$



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Typical RF Performance(Cont'l): $V_{ds}=28.0V$, $I_{dq}=80mA$, $Z_0=50\ ohm$, $T_a=25\ ^\circ C$



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4.4 – 5.9 GHz 10W High Efficiency
Linear Power Amplifier

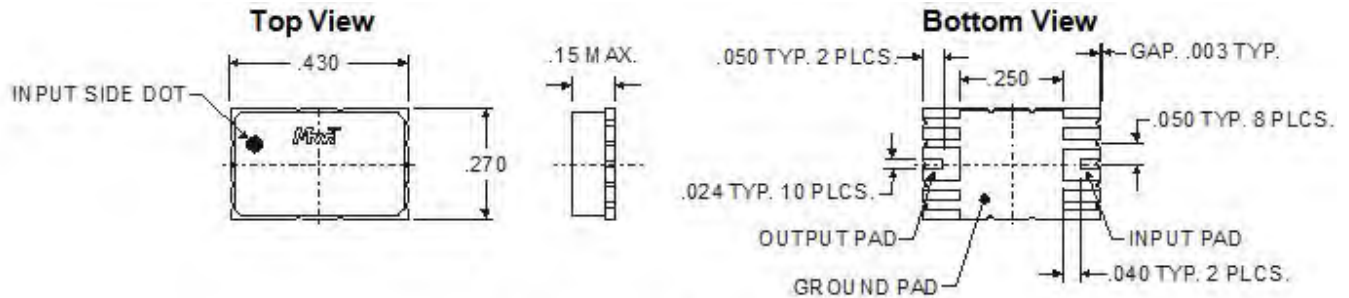
Typical Scattering Parameters: $V_{ds}=28V$, $I_{cq}=80mA$, $Z_0=50\ \Omega$, $T_a=25\ ^\circ C$

Freq (GHz)	dB(S11)	Ang(S11)	dB(S21)	Ang(S21)	dB(S12)	Ang(S12)	dB(S22)	Ang(S22)
3.0	-1.40	107.7	9.70	-24.2	-36.82	-84.6	-3.02	149.9
3.1	-1.43	104.0	9.45	-31.6	-36.75	-84.2	-2.99	146.5
3.2	-1.55	99.8	10.04	-34.2	-37.57	-88.8	-2.96	143.4
3.3	-1.59	95.4	9.97	-34.0	-37.18	-86.1	-2.92	140.0
3.4	-1.71	91.0	9.64	-38.5	-37.18	-90.2	-2.92	136.7
3.5	-1.85	85.9	10.18	-45.5	-36.27	-87.9	-2.91	133.1
3.6	-2.04	80.7	11.12	-50.2	-36.47	-87.3	-2.90	129.3
3.7	-2.24	75.1	11.94	-53.5	-35.91	-89.4	-2.91	125.5
3.8	-2.49	69.3	12.26	-56.4	-34.67	-97.1	-2.92	121.5
3.9	-2.82	63.0	12.08	-63.6	-32.84	-97.0	-2.93	117.2
4.0	-3.18	56.4	12.41	-74.4	-33.08	-103.9	-2.94	113.0
4.1	-3.59	49.4	13.13	-81.4	-31.18	-114.5	-2.97	108.4
4.2	-4.18	41.6	13.42	-86.5	-31.10	-122.3	-3.02	103.3
4.3	-4.85	32.9	13.49	-94.0	-30.28	-134.3	-3.12	98.1
4.4	-5.68	24.1	13.83	-103.1	-30.10	-144.0	-3.21	92.4
4.5	-6.71	13.8	14.49	-111.6	-30.12	-153.3	-3.35	86.2
4.6	-7.96	2.5	15.33	-119.4	-30.22	-162.3	-3.50	79.6
4.7	-9.50	-10.7	15.95	-128.3	-29.87	-168.1	-3.69	72.4
4.8	-11.54	-25.8	16.12	-140.4	-30.30	-173.8	-4.03	64.6
4.9	-14.07	-46.0	16.38	-153.6	-29.78	178.5	-4.39	56.3
5.0	-16.94	-73.0	16.36	-164.7	-29.39	172.8	-4.84	47.7
5.1	-18.97	-116.4	15.65	-176.5	-28.97	163.6	-5.28	38.4
5.2	-17.76	-159.7	15.43	169.5	-28.28	153.9	-5.73	28.6
5.3	-15.45	169.9	15.73	160.5	-28.17	145.1	-6.30	17.5
5.4	-13.63	148.1	15.38	155.0	-28.12	131.1	-6.83	5.0
5.5	-12.06	129.5	14.65	143.8	-27.83	124.6	-7.24	-8.3
5.6	-11.18	113.0	14.70	130.0	-28.76	113.2	-7.58	-22.1
5.7	-10.38	96.2	14.78	118.7	-28.35	104.0	-7.69	-36.8
5.8	-10.03	79.6	14.27	107.6	-29.12	99.2	-7.71	-51.7
5.9	-9.67	60.7	13.95	94.8	-28.90	88.3	-7.40	-66.9
6.0	-9.51	40.8	13.63	85.9	-28.53	84.1	-6.97	-81.1
6.1	-9.12	19.1	12.82	76.7	-28.38	75.2	-6.42	-94.4
6.2	-8.72	-4.0	12.43	60.7	-28.16	65.2	-5.80	-107.2
6.3	-7.99	-28.1	12.88	43.7	-28.44	48.7	-5.20	-119.3
6.4	-7.18	-51.0	12.68	29.5	-28.52	36.0	-4.67	-130.2
6.5	-6.10	-71.2	11.16	14.0	-30.40	25.9	-4.14	-139.7
6.6	-5.19	-89.6	9.25	-1.9	-31.76	11.3	-3.70	-148.7
6.7	-4.25	-106.4	6.72	-15.1	-32.64	8.9	-3.35	-157.1
6.8	-3.58	-121.0	4.30	-29.2	-34.21	7.5	-3.04	-164.8
6.9	-2.94	-134.2	3.36	-33.6	-35.34	2.6	-2.79	-171.7
7.0	-2.49	-145.6	1.77	-24.0	-35.68	5.7	-2.58	-177.8

MGA-445940-02

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Linear Power Amplifier

Mechanical Information: *This Package is RoHS compliant*



All dimensions are in inches

Pin Designation (Top View)			
Pin 1 (DOT Top Left)	GND	Pin 10	GND
Pin 2	GND	Pin 9	GND
Pin 3	RF In/Vg	Pin 8	RF Out/Vdd
Pin 4	GND	Pin 7	GND
Pin 5	GND	Pin 6	GND

Application Notes

The evaluation board, shown in Figure 3, is fabricated with Rogers's 4003 material, 20 mil thick, 2 oz copper weight. The MGA445940-02 shown in the center of board is a 10 watt amplifier with high gain and high linearity. For best thermal performance, the PCB requires via holes with a diameter of 20 mils placed uniformly over the center pad for thermal relief and RF ground as shown in Figure 4. The via holes underneath the package are filled with conductive epoxy as shown in Figure 4. The choice of capacitor bypassing near the amplifier should have a short circuit resonance at the frequency of operation. A small capacitor 3.9 pf 0603 from AVX has a series resonance at 5.5 GHz and will make a good choice for the first bypass capacitor.

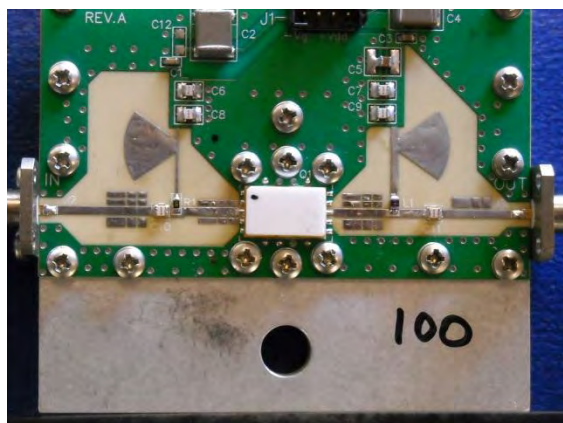


Figure 3 Evaluation board

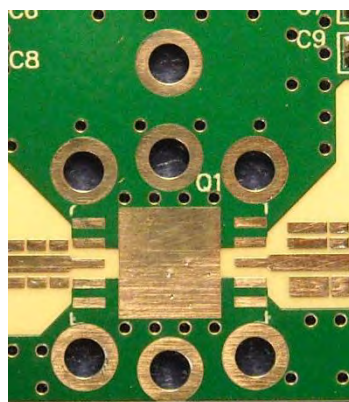


Figure 4 Hole Pattern

Followed up with larger value capacitors 100pf, 1000pf and 2.2 uF. can be used to maintain voltage stability under peak current conditions. The DC ground via holes should be laid out to minimized inductive returns associated with ground loops. Use of stitch ground vias holes can help control the return current and also maintain ground continuity between the top and bottom ground layers. Biasing with quarter-wave stubs at the gate and drain are shown in Figure 3. A 56 ohm resistor is added in series to the gate bias and a 2.2 nH choke is added in series to the drain bias. The effective impedance is increased which reduces the risk of low frequency oscillations.

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 4.4GHz

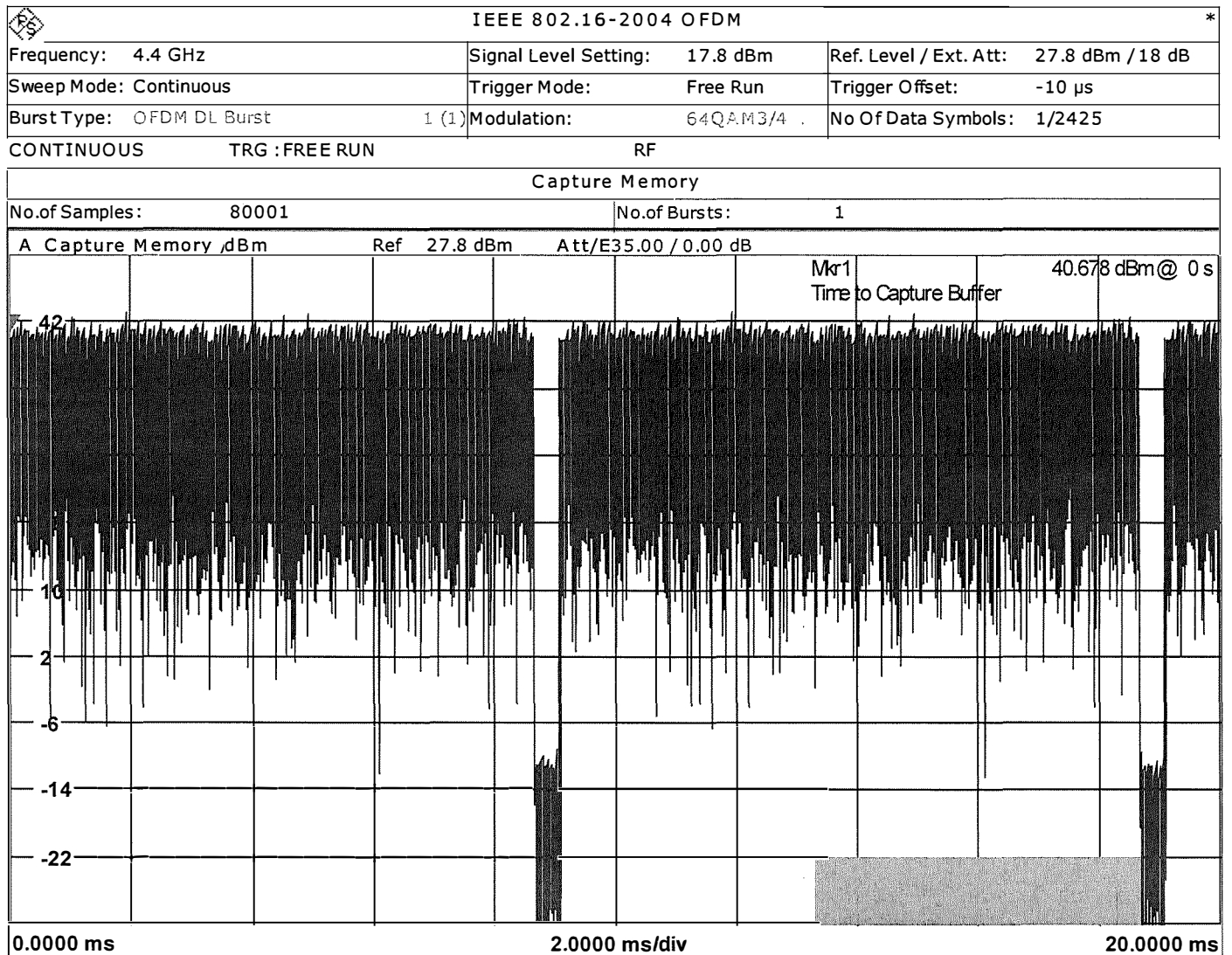
		IEEE 802.16-2004 OFDM				*
Frequency: 4.4 GHz		Signal Level Setting: 17.8 dBm		Ref. Level / Ext. Att: 27.8 dBm / 18 dB		
Sweep Mode: Continuous		Trigger Mode: Free Run		Trigger Offset: -10 µs		
Burst Type: OFDM DL Burst		1 (1)	Modulation: 64QAM3/4		No Of Data Symbols: 1/2425	
CONTINUOUS		TRG : FREE RUN		RF		
Result Summary						
No. of Bursts		1				
	Min	Mean	Limit	Max	Limit Unit	
EVM All Carriers	2.50	2.50	2.82	2.50	2.82 %	
EVM Data Carriers	2.51	2.51		2.51	%	
EVM Pilot Carriers	2.44	2.44		2.44	%	
IQ Offset	0.26	0.26	17.78	0.26	17.78 %	
Gain Imbalance	0.06	0.06		0.06	%	
Quadrature Error	0.015	0.015		0.015	°	
Center Frequency Error	32.23	32.23	± 35200	32.23	± 35200 Hz	
Clock Error	- 0.02	- 0.02	± 8	- 0.02	± 8 ppm	
Burst Power	33.85	33.85		33.85	dBm	
Crest Factor	9.56	9.56		9.56	dB	
RSSI	36.91	36.91		36.91	dBm	
RSSI Standard Deviation		- 2.12			dB	
CINR	15.56	15.56		15.56	dB	
CINR Standard Deviation		- 1.83			dB	

Measurement Aborted

Date: 12.APR.2023 16:40:13

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 4.4GHz



Measurement Aborted

Date: 12.APR.2023 16:42:50

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 4.9GHz

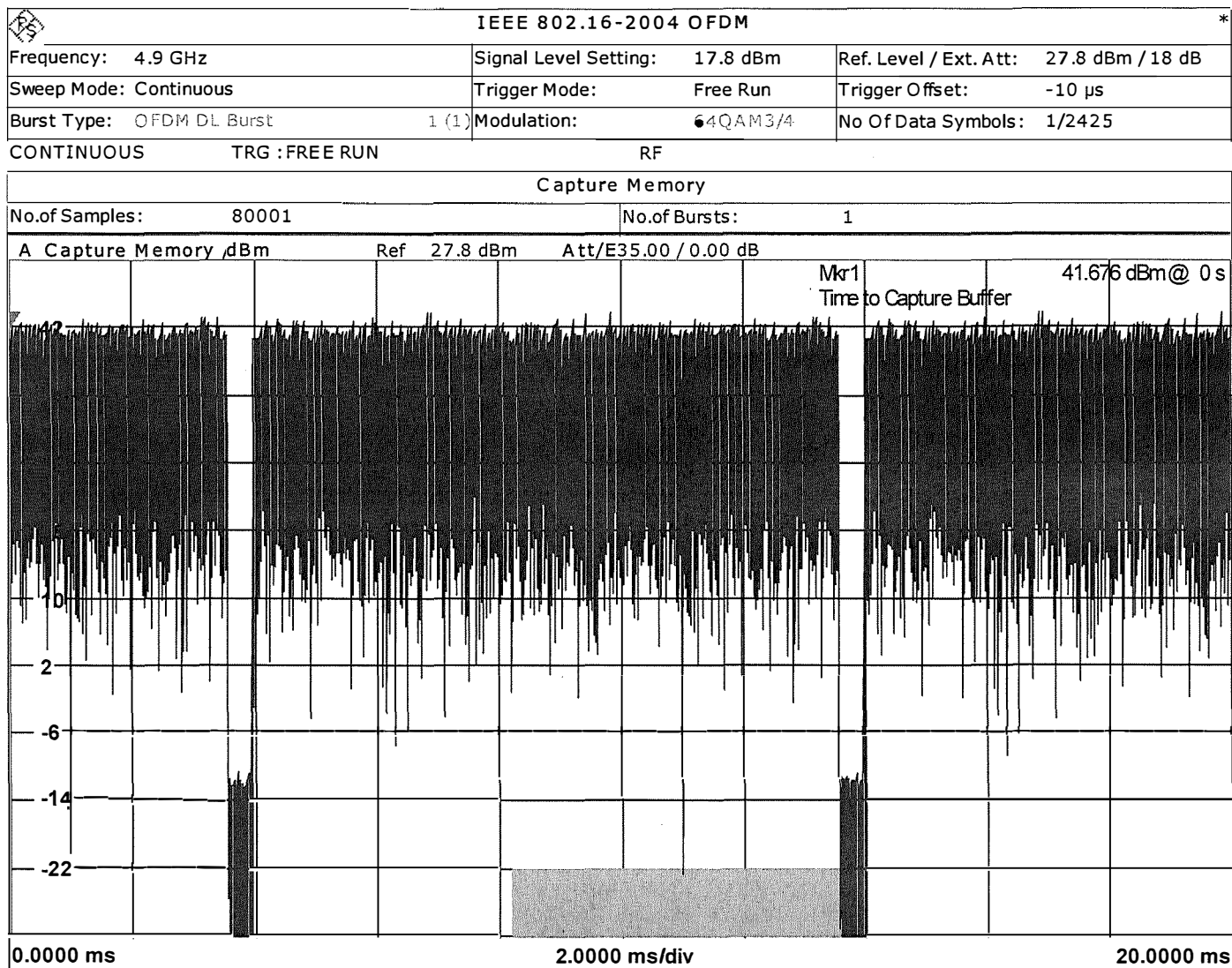
IEEE 802.16-2004 OFDM		*	
Frequency: 4.9 GHz	Signal Level Setting: 17.8 dBm	Ref. Level / Ext. Att: 27.8 dBm / 18 dB	
Sweep Mode: Continuous	Trigger Mode: Free Run	Trigger Offset: -10 μs	
Burst Type: OFDM DL Burst 1 (1)	Modulation: 64QAM3/4	No Of Data Symbols: 1/2425	
CONTINUOUS	TRG : FREE RUN	RF	
Result Summary			
No. of Bursts	1		
	Min	Mean Limit	Max Limit Unit
EVM All Carriers	2.49	2.49 2.82	2.49 2.82 %
EVM Data Carriers	2.49	2.49	2.49 %
EVM Pilot Carriers	2.42	2.42	2.42 %
IQ Offset	0.19	0.19 17.78	0.19 17.78 %
Gain Imbalance	0.10	0.10	0.10 %
Quadrature Error	0.013	0.013	0.013 °
Center Frequency Error	35.30	35.30 ±39200	35.30 ±39200 Hz
Clock Error	- 0.02	- 0.02 ±8	- 0.02 ±8 ppm
Burst Power	34.62	34.62	34.62 dBm
Crest Factor	9.55	9.55	9.55 dB
RSSI	37.64	37.64	37.64 dBm
RSSI Standard Deviation		- 1.09	dB
CINR	15.68	15.68	15.68 dB
CINR Standard Deviation		- 1.53	dB

Measurement Aborted

Date: 12.APR.2023 16:46:03

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 4.9GHz



Measurement Aborted

Date: 12.APR.2023 16:46:52

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 5.4GHz

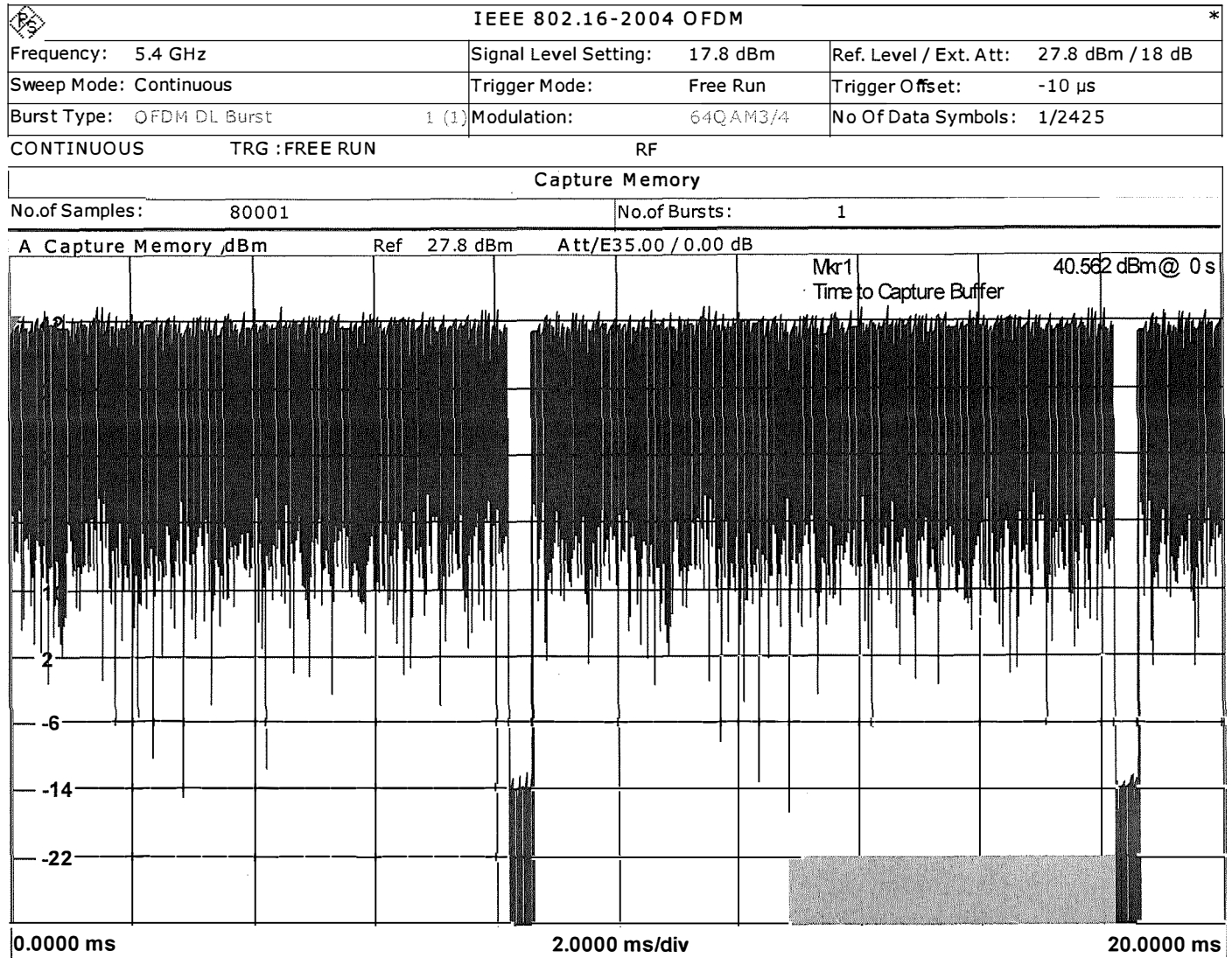
IEEE 802.16-2004 OFDM							*
Frequency: 5.4 GHz		Signal Level Setting: 17.8 dBm		Ref. Level / Ext. Att: 27.8 dBm / 18 dB			
Sweep Mode: Continuous		Trigger Mode: Free Run		Trigger Offset: -10 μs			
Burst Type: ● FDM DL Burst		1 (1)	Modulation: 64QAM3/4		No Of Data Symbols: 1/2425		
CONTINUOUS		TRG : FREE RUN		RF			
Result Summary							
No. of Bursts		1					
	Min	Mean	Limit	Max	Limit	Unit	
EVM All Carriers	2.50	2.50	2.82	2.50	2.82	%	
EVM Data Carriers	2.51	2.51		2.51		%	
EVM Pilot Carriers	2.36	2.36		2.36		%	
IQ Offset	0.11	0.11	17.78	0.11	17.78	%	
Gain Imbalance	0.12	0.12		0.12		%	
Quadrature Error	0.007	0.007		0.007		°	
Center Frequency Error	38.20	38.20	± 43200	38.20	± 43200	Hz	
Clock Error	- 0.06	- 0.06	± 8	- 0.06	± 8	ppm	
Burst Power	34.83	34.83		34.83		dBm	
Crest Factor	9.49	9.49		9.49		dB	
RSSI	37.86	37.86		37.86		dBm	
RSSI Standard Deviation		- 0.97				dB	
CINR	15.76	15.76		15.76		dB	
CINR Standard Deviation		0.65				dB	

Measurement Aborted

Date: 12.APR.2023 16:48:20

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 5.4GHz



Measurement Aborted

Date: 12.APR.2023 16:48:47

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 5.9GHz

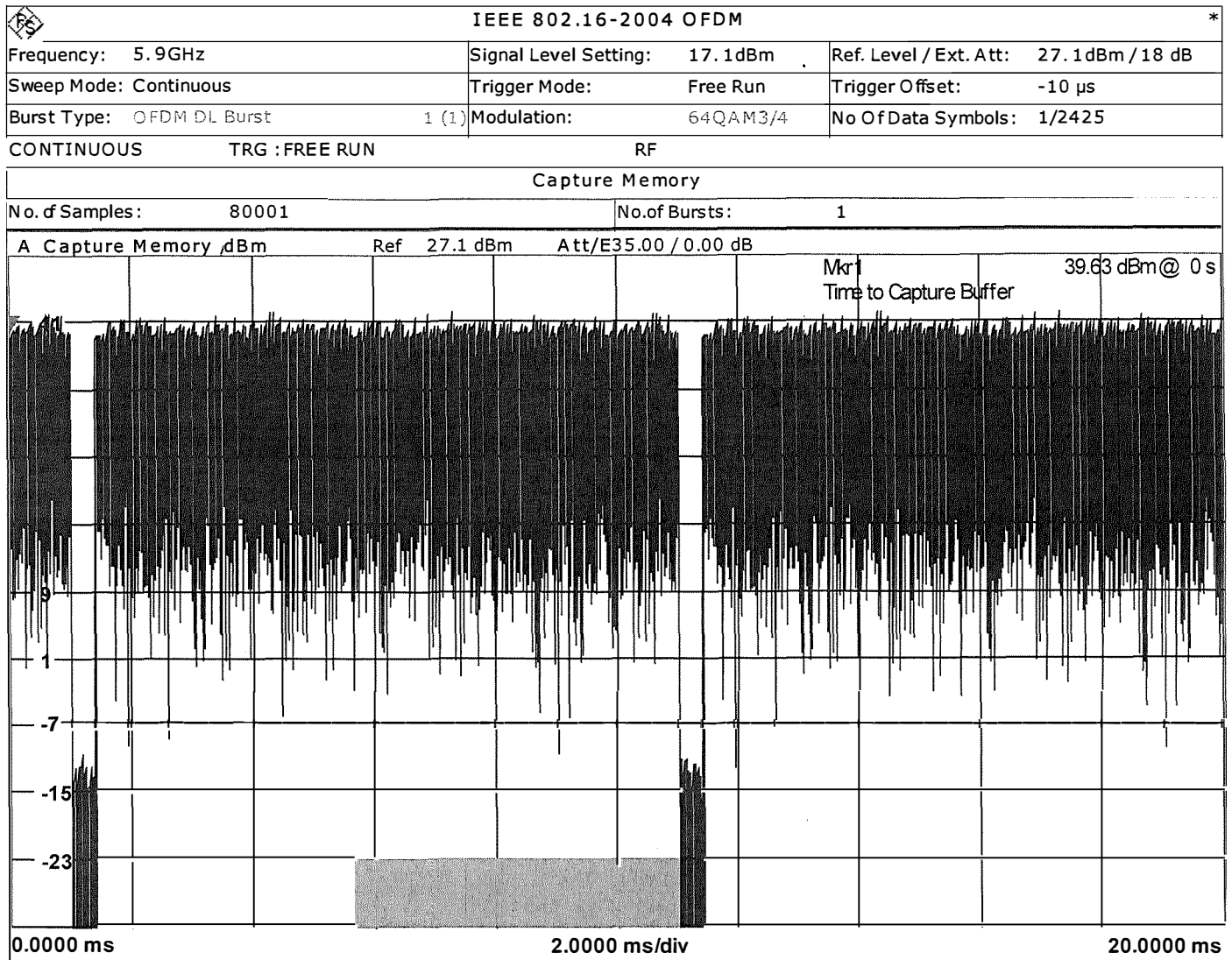
IEEE 802.16-2004 OFDM							*
Frequency: 5.9 GHz		Signal Level Setting: 17.1 dBm		Ref. Level / Ext. Att: 27.1 dBm / 18 dB			
Sweep Mode: Continuous		Trigger Mode: Free Run		Trigger Offset: -10 μs			
Burst Type: OFDM DL Burst		1 (1)	Modulation: 64QAM3/4		No Of Data Symbols: 1/2425		
CONTINUOUS		TRG : FREE RUN		RF			
Result Summary							
No. of Bursts		1					
	Min	Mean	Limit	Max	Limit	Unit	
EVM All Carriers	2.51	2.51	2.82	2.51	2.82	%	
EVM Data Carriers	2.51	2.51		2.51		%	
EVM Pilot Carriers	2.36	2.36		2.36		%	
IQ Offset	0.16	0.16	17.78	0.16	17.78	%	
Gain Imbalance	0.16	0.16		0.16		%	
Quadrature Error	- 0.005	- 0.005		- 0.005		°	
Center Frequency Error	41.47	41.47	± 47200	41.47	± 47200	Hz	
Clock Error	- 0.03	- 0.03	± 8	- 0.03	± 8	ppm	
Burst Power	33.30	33.30		33.30		dBm	
Crest Factor	9.42	9.42		9.42		dB	
RSSI	36.35	36.35		36.35		dBm	
RSSI Standard Deviation		- 3.28				dB	
CINR	15.83	15.83		15.83		dB	
CINR Standard Deviation		- 2.11				dB	

Measurement Aborted

Date: 12.APR.2023 16:50:58

Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 5.9GHz



Measurement Aborted

Date: 12.APR.2023 16:51:21

MGA-445940-02

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Linear Power Amplifier

Contact Information

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