

MGA-333840-02 3.3 – 3.8 GHz, 10 W High Efficiency Linear Power Amplifier

Features:

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

Applications:

- 802.16d/e WiMax
- Point-To-Point Radio Applications

Description:

The MGA-333840-02 is a power amplifier with the State-of-the-Art linear power-added-efficiency between 3.3 GHz and 3.8 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 2 W linear burst power with 2.5 % EVM under the 802.16d/e 64-QAM modulation schemes. The high efficiency linear power amplifier also has excellent reliability. Ideal applications include the driver and the output power stage of WiMax infrastructures and access points. It also can be used for PTP (Point-To-Point) radio applications for this band.

Typical RF Performance: $V_{ds} = 28\text{ V}$, $I_{cq} = 80\text{ mA}$, $T_a = 25\text{ °C}$, $Z_0 = 50\text{ }\Omega$

Parameter	Units	Typical Data
Frequency Range	MHz	3300 - 3800
Gain (Typ / Min)	dB	12 / 10
Gain Flatness (Typ / Max)	±dB	1.0 / 1.5
Input Return Loss	dB	8
Output Return Loss	dB	8
Output P _{-3dB}	dBm	40
Pout @ 2.5% EVM	dBm	33
Operating Current Range	mA	100 - 400
Thermal Resistance	°C / W	5

(1) Output IP3 is measured with two tones at output power of 13 dBm / tone separated by 10 MHz.

ESD Caution

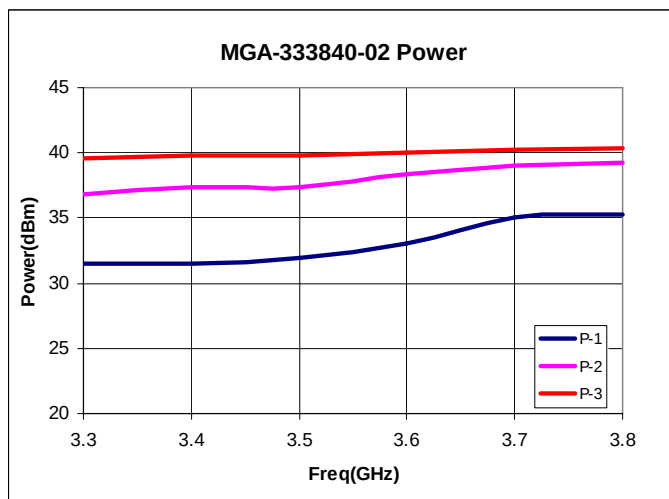
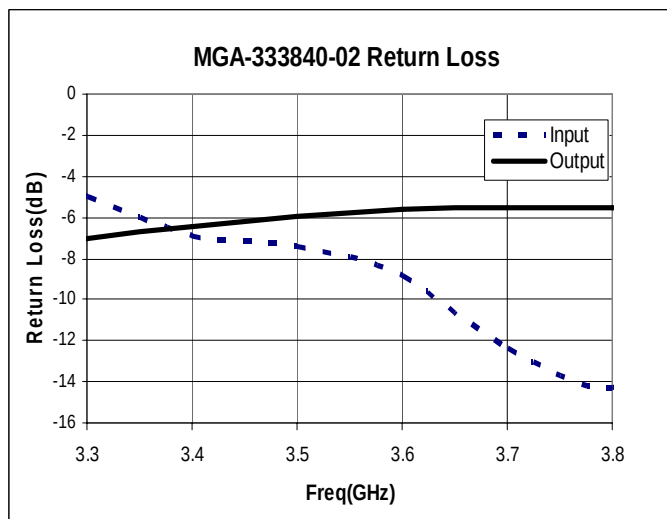
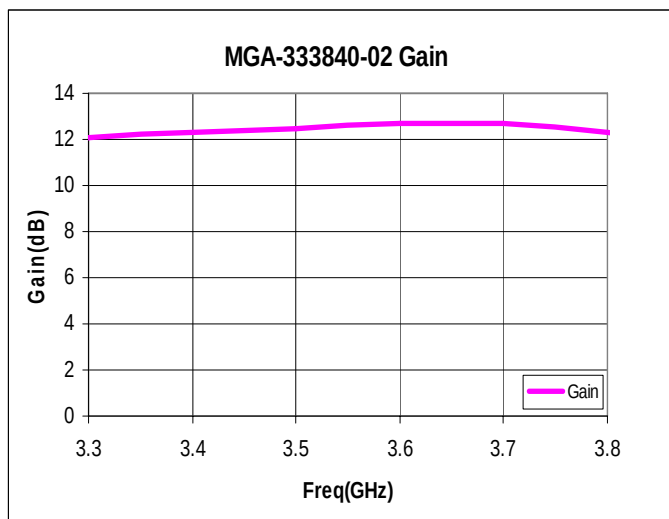


High-performance RF integrated circuits are highly sensitive to electrostatic discharge (ESD) and may contain unprotected inputs and outputs. Handling and assembly should be conducted in an ESD-controlled environment. It is recommended that ESD precautions and protocols are adopted to minimise the risk of electrostatic discharge and protect product integrity.

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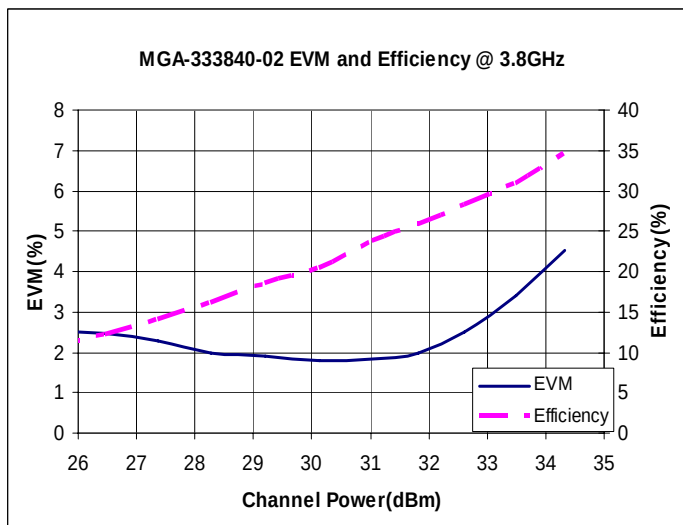
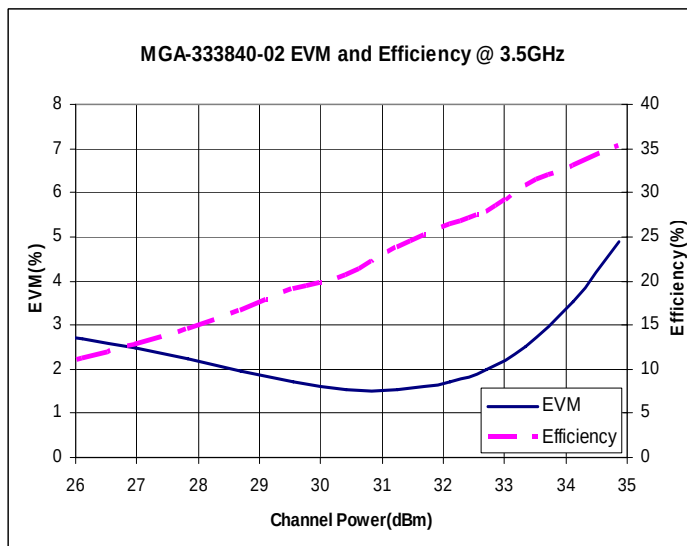
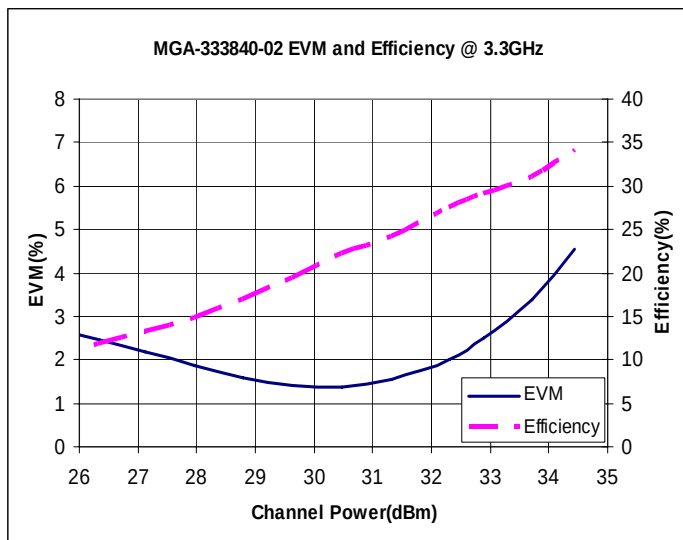
Typical RF Performance: $V_{ds} = 28.0\text{ V}$, $I_{cq} = 80\text{ mA}$, $Z_0 = 50\ \Omega$, $T_a = 25\text{ }^\circ\text{C}$



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



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ACsolute Maximum Ratings: ($T_a = 25\text{ }^{\circ}\text{C}$)

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 -150

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

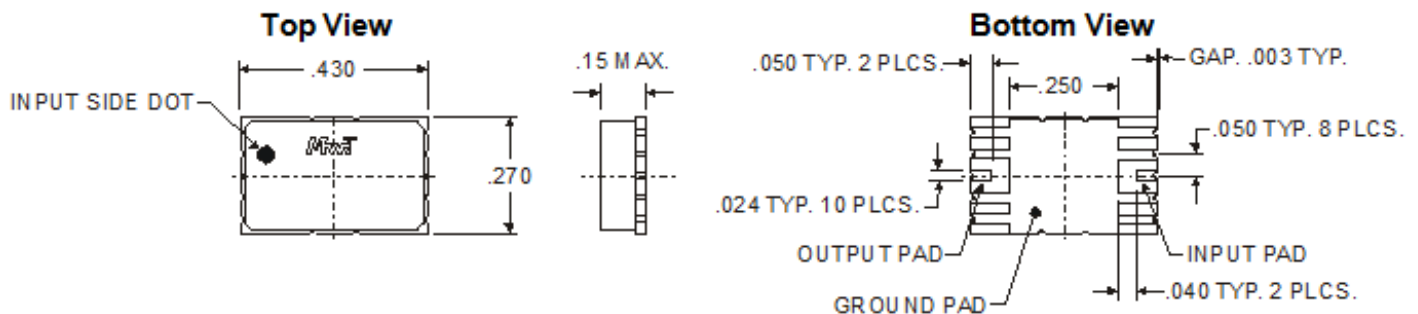
Typical Scattering Parameters: $V_{ds} = 28\text{ V}$, $I_{cq} = 80\text{ mA}$, $Z_0 = 50\text{ }\Omega$, $T_a = 25\text{ }^{\circ}\text{C}$

Freq(GHz)	dB(S11)	Ang(S11)	dB(S21)	Ang(S21)	dB(S12)	Ang(S12)	dB(S22)	Ang(S22)
2.50	-2.12	-125.00	11.20	-102.00	-33.30	-167.00	-7.92	-32.00
2.60	-2.21	-156.00	11.40	-132.00	-33.00	164.00	-7.98	-65.30
2.70	-2.27	173.00	11.50	-162.00	-32.90	136.00	-8.08	-97.50
2.80	-2.36	142.00	11.60	168.00	-33.00	108.00	-8.14	-129.00
2.90	-3.00	112.00	11.60	139.00	-32.90	79.20	-8.15	-160.00
3.00	-3.71	82.40	11.70	110.00	-32.90	50.90	-8.10	169.00
3.10	-4.00	53.50	11.70	80.70	-32.70	22.50	-7.86	139.00
3.20	-4.42	24.70	11.90	51.40	-32.60	-6.25	-7.53	108.00
3.30	-5.03	-4.61	12.10	21.50	-32.40	-34.70	-7.07	78.90
3.40	-6.97	-35.00	12.30	-8.44	-31.90	-65.00	-6.49	50.10
3.50	-7.45	-68.30	12.50	-40.20	-31.50	-96.60	-5.97	21.90
3.60	-8.85	-107.00	12.70	-73.50	-31.30	-130.00	-5.63	-5.10
3.70	-12.40	-160.00	12.70	-107.00	-31.20	-164.00	-5.50	-30.30
3.80	-14.30	120.00	12.30	-142.00	-31.40	160.00	-5.55	-53.70
3.90	-11.30	49.60	11.60	-176.00	-31.90	126.00	-5.68	-74.80
4.00	-8.38	3.82	10.70	151.00	-32.70	93.10	-5.77	-94.50
4.10	-6.55	-32.90	9.67	120.00	-33.50	61.70	-5.79	-113.00
4.20	-5.55	-66.00	8.73	89.90	-34.10	32.90	-5.79	-132.00
4.30	-4.99	-97.60	7.87	61.30	-34.60	3.91	-5.78	-150.00
4.40	-4.71	-130.00	7.07	32.70	-34.90	-24.60	-5.78	-169.00
4.50	-4.64	-164.00	6.38	4.02	-35.20	-53.70	-5.78	172.00

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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 Circuit:

The evaluation board material, shown in Figure A, is Rogers 4003 material, 20 mil thick. The RF trace weight is 2 oz. Through holes with a diameter of 20 mils are spread uniformly over the center paddle for thermal relief and ground. Via holes underneath the paddle are back filled with conductive epoxy. It is recommended that via holes be placed nearby the DC bias connector to maintain ground continuity between the top layer and bottom ground planes. Mounting holes near the unit will help secure the board to the chassis, minimize ground current loops and improve thermal conductivity in the absence of sweat soldering the board to the chassis.

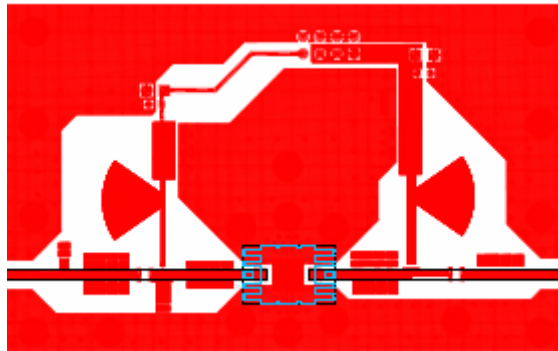


Figure A Evaluation Board

Biasing with quarter-wave stubs at the gate and drain are shown in Figure A. The impedance of the quarter wave structures is cyclical with frequency. A RF short is observed at frequencies that are even multiples of a quarter-wavelength and an open-impedance is observed at frequencies that are odd multiples of a quarter-wavelength. A 56 Ω resistor is added in series to the gate bias. The effective impedance is increased which reduces the risk of oscillations. The 56 Ω resistor is not shown in Figure A. Through holes underneath the package is required to connect the top and bottom grounds and to improve thermal conductivity.

Application Notes:

802.16 256 carriers, 64-QAM @ 3.3 GHz, Pavg = 32.89 dBm @ EVM = 2.5 %

IEEE 802.16-2004 OFDM		
Frequency: 3.3 GHz	Signal Level Setting: 14.7 dBm	Ref. Level / Ext. Att: 24.7 dBm / 17.3 dB
Sweep Mode: Continuous	Trigger Mode: External	Trigger Offset: -10 μ s
Burst Type: OFDM DL Burst	Modulation: ALL	No Of Data Symbols: 1/2425

Result Summary						
No. of Bursts	7					
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	2.51	2.57	2.82	2.70	2.82	%
EVM Data Carriers	2.52	2.58		2.70		%
EVM Pilot Carriers	2.35	2.43		2.59		%
IQ Offset	0.09	0.12	17.78	0.15	17.78	%
Gain Imbalance	0.18	0.13		0.04		%
Quadrature Error	- 0.036	- 0.002		0.021		°
Center Frequency Error	107.25	107.99	$\pm$ 26400	108.66	$\pm$ 26400	Hz
Clock Error	0.08	0.12	$\pm$ 8	0.94	$\pm$ 8	ppm
Burst Power	32.87	32.89		32.90		dBm
Crest Factor	9.02	9.24		9.42		dB
RSSI	35.68	35.72		35.74		dBm
RSSI Standard Deviation		7.25				dB
CINR	15.29	15.33		15.41		dB
CINR Standard Deviation		16.81				dB

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Application Notes:

802.16 256 carriers, 64-QAM @ 3.3GHz, Pavg = 33.24 dBm @ EVM = 2.5 %

IEEE 802.16-2004 OFDM		
Frequency: 3.5 GHz	Signal Level Setting: 16.9 dBm	Ref. Level / Ext. Att: 26.9 dBm / 17.3 dB
Sweep Mode: Continuous	Trigger Mode: External	Trigger Offset: -10 μ s
Burst Type: OFDM DL Burst	Modulation: ALL	No Of Data Symbols: 1/2425

Result Summary						
No. of Bursts	7					
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	2.41	2.49	2.82	2.68	2.82	%
EVM Data Carriers	2.41	2.49		2.68		%
EVM Pilot Carriers	2.29	2.36		2.58		%
IQ Offset	0.03	0.06	17.78	0.08	17.78	%
Gain Imbalance	0.22	0.15		0.05		%
Quadrature Error	- 0.024	0.003		0.027		°
Center Frequency Error	114.46	114.96	± 28000	115.62	± 28000	Hz
Clock Error	0.09	0.19	± 8	0.92	± 8	ppm
Burst Power	33.22	33.24		33.26		dBm
Crest Factor	9.17	9.30		9.41		dB
RSSI	36.04	36.11		36.14		dBm
RSSI Standard Deviation		10.23				dB
CINR	15.50	15.54		15.69		dB
CINR Standard Deviation		21.24				dB

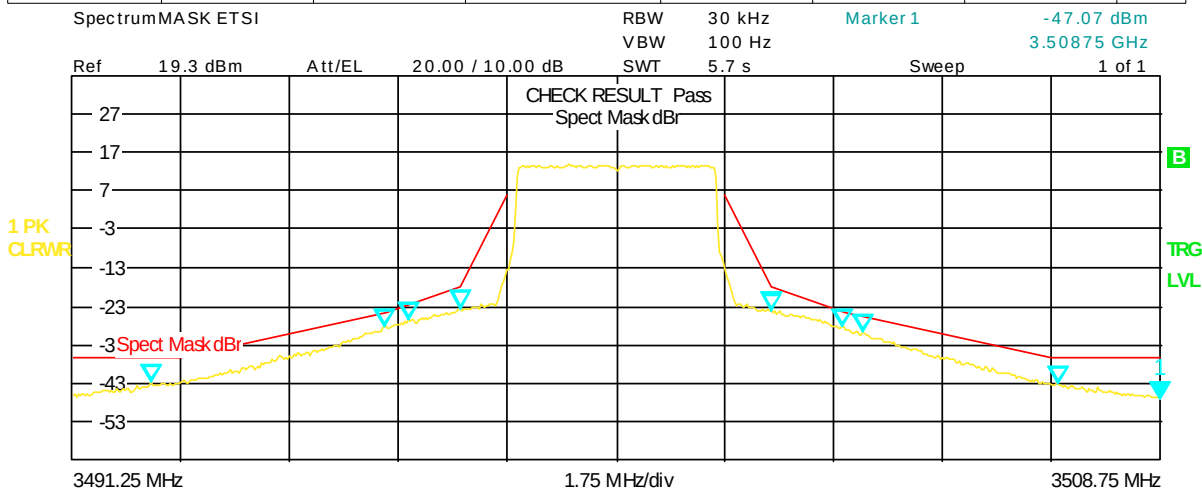
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Application Notes (Cont):

Typical ACPR response for 802.16 - Pavg = 33.24 dBm @ 2.5 % EVM, 3.5 GHz

IEEE 802.16-2004 OFDM							
Frequency: 3.5 GHz			Signal Level Setting: 17.8 dBm		Ref. Level / Ext. Att: 19.3 dBm / 17.3 dB		
Sweep Mode: Continuous			Trigger Mode: External		Trigger Offset: -10 μs		
Burst Type: OFDM DL Burst			Modulation: ALL		No Of Data Symbols: 1/2425		
Spectrum Emission Mask							
Tx Channel:		Bandwidth	3.5 MHz	Power	13.73 dBm		
Start Freq. Rel.	Stop Freq. Rel.	RBW	Freq. at ? to Limit	Pwr Abs	Pwr Rel	? to Limit	
-8.750 MHz	-7.000 MHz	30 kHz	3.492540064 GHz	-42.83 dBm	-56.56 dB	-6.45 dB	
-7.000 MHz	-3.700 MHz	30 kHz	3.496298077 GHz	-28.43 dBm	-42.16 dB	-4.15 dB	
-3.700 MHz	-2.500 MHz	30 kHz	3.496662660 GHz	-26.56 dBm	-40.30 dB	-4.11 dB	
-2.500 MHz	-1.750 MHz	30 kHz	3.497504007 GHz	-23.73 dBm	-37.46 dB	-5.59 dB	
1.750 MHz	2.500 MHz	30 kHz	3.502495993 GHz	-24.17 dBm	-37.90 dB	-6.03 dB	
2.500 MHz	3.700 MHz	30 kHz	3.503617789 GHz	-28.16 dBm	-41.89 dB	-4.30 dB	
3.700 MHz	7.000 MHz	30 kHz	3.503954327 GHz	-29.44 dBm	-43.17 dB	-4.24 dB	
7.000 MHz	8.750 MHz	30 kHz	3.507123398 GHz	-43.24 dBm	-56.97 dB	-6.97 dB	



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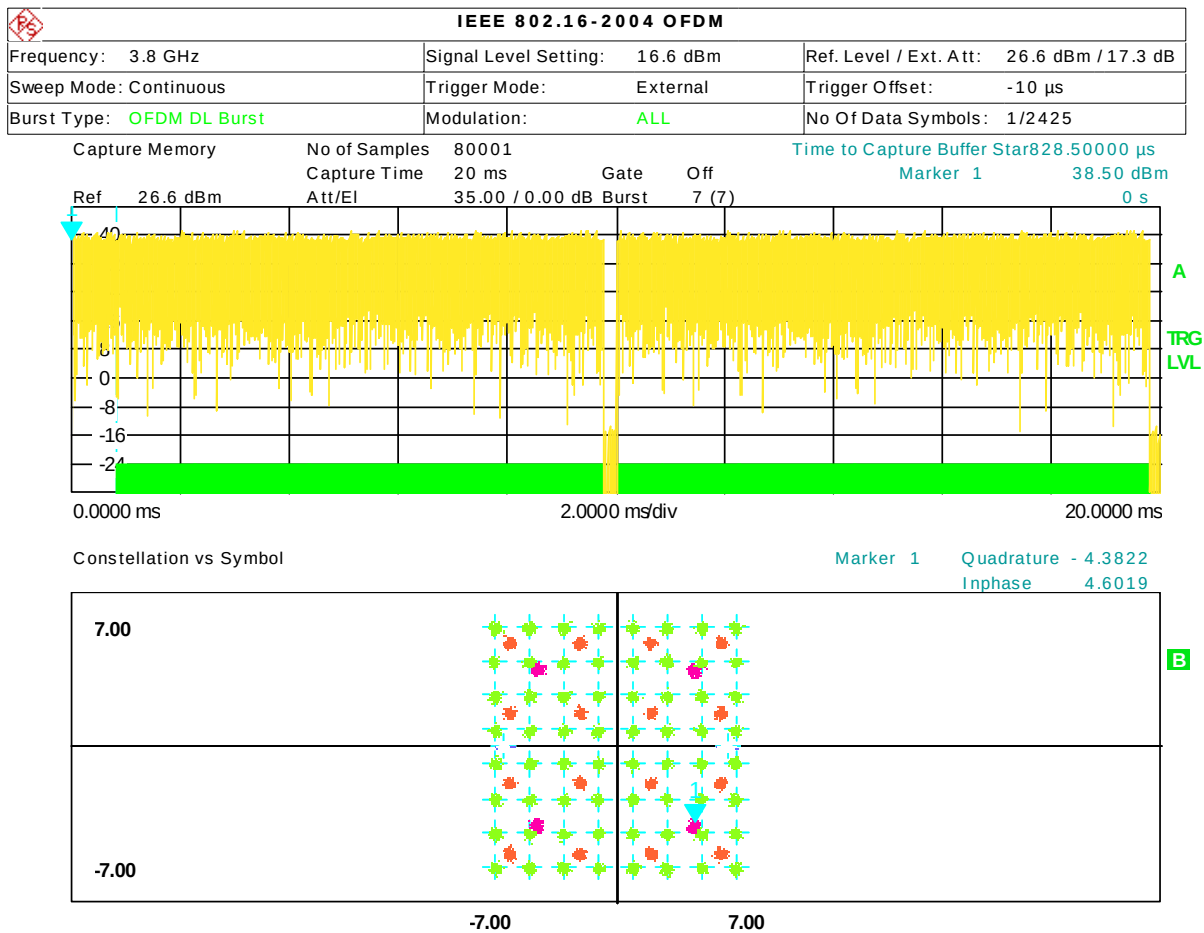
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Application Notes (Cont):

Typical ACPR response for 802.16 - Pavg = 33.24 dBm @ 2.5 % EVM, 3.8 GHz



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RoHS Compliance



CML Micro certifies, to the best of our knowledge, that its products comply with RoHS directive (2011/65/EU), as amended by Directive (EU) 2015/863.

REACH Compliance



CML Micro certifies, to the best of our knowledge, that its products do not contain any of the banned substances specified in the SVHC list at <https://echa.europa.eu/candidate-list-table>. CML Micro are committed to ensuring the safety of products and the compliance with regulations. Publications will be updated in the event that REACH control is compromised.

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