



849 NW STATE ROAD 45  
NEWBERRY, FL 32669 USA  
PH: 888.472.2424 OR  
352.472.5500  
FAX: 352.472.2030  
EMAIL: [INFO@TIMCOENGR.COM](mailto:INFO@TIMCOENGR.COM)  
[HTTP://WWW.TIMCOENGR.COM](http://WWW.TIMCOENGR.COM)

## FCC PART 90 RADAR TEST REPORT

APPLICANT	<b>BARON SERVICES INC.</b>
	<b>4930 Research Dr. Huntsville, Alabama 35805</b>
FCC ID	NX5-GEN3-350CM
MODEL NUMBER	GEN3-350CM
PRODUCT DESCRIPTION	Baron GEN3 350kW C-Band Magnetron
DATE SAMPLE RECEIVED	9/18/2017
FINAL TEST DATE	9/21/2017
TESTED BY	Tim Royer
APPROVED BY	Franklin Rose
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

Report Number	Version Number	Description	Issue Date
1676AUT17TestReport	Rev1	Initial Issue	9/28/2017
	Rev2	Revised Report	3/5/2018

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL  
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

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## GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

## Summary

The device under test does:

- Fulfill the general approval requirements as identified in this test report and was selected by the customer.
- Not fulfill the general approval requirements as identified in this test report

## Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made by:

**Timco Engineering Inc.**  
**849 NW State Road 45**  
**Newberry, FL 32669**



### Tested by:

Name and Title: Tim Royer, Project Manager/Testing Engineer

**Date: 9/27/2017**



### Reviewed and approved by:

Name and Title: Franklin Rose, Project Manager/Testing Technician

**Date: 02/26/2018**

Applicant: BARON SERVICES INC.  
FCC ID: NX5-GEN3-350CM  
Report: 1676AUT17TestReport\_Rev2

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## EUT SPECIFICATION

EUT Description	Baron GEN3 350kW C-Band Magnetron
FCC ID	NX5-GEN3-350CM
Model Number	GEN3-350CM
Operating Frequency	5300, 5550, 5800 MHz
Type of Emission	P0N
Modulation	Pulse Compression FM
EUT Power Source	<input checked="" type="checkbox"/> 110–240Vac/50– 60Hz
	<input type="checkbox"/> DC Power (48 VDC)
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input type="checkbox"/> Pre-Production
	<input checked="" type="checkbox"/> Production
Type of Equipment	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable

## TEST SETUP INFORMATION

Test facility	<b>Timco Engineering, Inc.</b> <b>849 NW State Road 45</b> <b>Newberry, FL 32669 USA</b> <b>Designation #:US1070</b>
Test Condition	The EUT was tested under normal temperature and humidity. The temperature was 20-26°C with a relative humidity of 35 - 55%.
Modifications	None
Test Exercise	The EUT was transmitting a modulated, with the exception of frequency stability testing in which CW signal was used.
Regulatory Standards	FCC CFR 47 Part 2, 90
Measurement Standards	TIA_603-D:2010, CISPR 16-2

## TEST REPORT SUMMARY

Rule Part No.	Test Item	Status Pass/Fail/NA
2.1046, 90.205	RF Power Output	Pass
2.1047, 90.207, 90.209	Modulation Characteristics	Pass
2.1049, 90.210 (b)(1)(2)(3)	Occupied Bandwidth	Pass
2.1051, 90.210 (b)(3)	Antenna Conducted Emissions	Pass
2.1053, 90.210(b)(3)	Field Strength Spurious Emissions	Pass
2.1055, 90.213	Frequency Stability	Pass

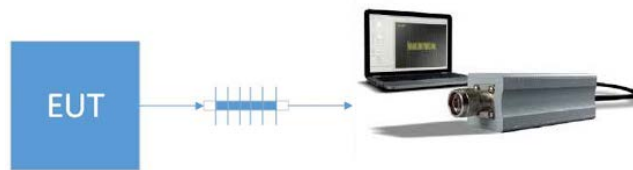
## RF POWER OUTPUT

**Rule Part No.:** 2.1046, 90.205

**Requirements:** Manufacturers specifications

**Procedure:** RF power is measured by connecting a 50-ohm, Peak Power Watt meter to the RF output connector. The EUT was supplied with a nominal voltage, and the transmitter properly adjusted for the target output power.

### Setup Diagram:



**Notes:** The EUT has 1 transmitter; all conducted measurement results are summed and compared to the limit following the procedures listed above

The mean power was calculated based on formula:

$$P_a = P_m * DC$$

$P_a$  is Mean linear power in watts  
 $P_m$  is Peak linear power in watts  
 $DC$  is duty cycle in %

Example:  $404.79 \text{ (W)} * (91.6/833) = 44.51 \text{ (w)}$

### Test Data: Measurement Table

Pulse Type	Tuned Freq (MHz)	$T_d$ (uSec)	Period (uSec)	DC (%)	Peak Power (dBm)	Ant Peak Power (W)	Ant Mean Power (W)
0.4 uS	5550	0.44	800	0.06%	84.25	265766.35	146.17
0.8 uS	5550	0.71	1006	0.07%	84.44	278035.34	197.06
1 uS	5550	1.00	2005	0.05%	84.53	283726.56	140.94
2 uS	5550	1.98	4008	0.05%	84.34	271706.48	134.23

### Part 2.1033 (C) (8) DC Input into the final amplifier

DC INPUT POWER is no greater than:  $P \text{ (W)} = E \text{ (V)} * I \text{ (A)} = 240 \text{ VAC} * 8 \text{ Amps} = 1920 \text{ Watts}$

Applicant: BARON SERVICES INC.  
 FCC ID: NX5-GEN3-350CM  
 Report: 1676AUT17TestReport\_Rev2

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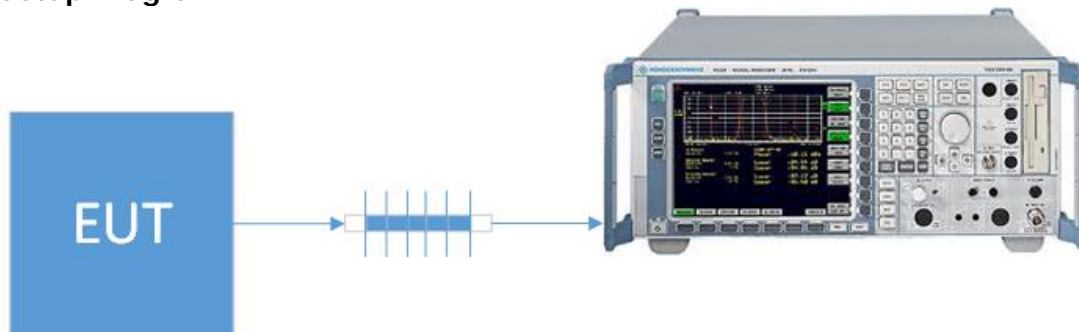
## MODULATION CHARACTERISTICS

**Rule Part No.:** 2.1047, 90.207, 90.209

**Requirements:** Manufacturers specification, authorization reviewed on a case-by case-basis

**Procedure:** As detailed in the procedures listed above

**Setup Diagram:**



**Notes:** The manufacturer specifications declare that the EUT is normally operated with a pulse compression modulation scheme with pulse durations of 0.4, 0.8, 1 and 2  $\mu$ S.

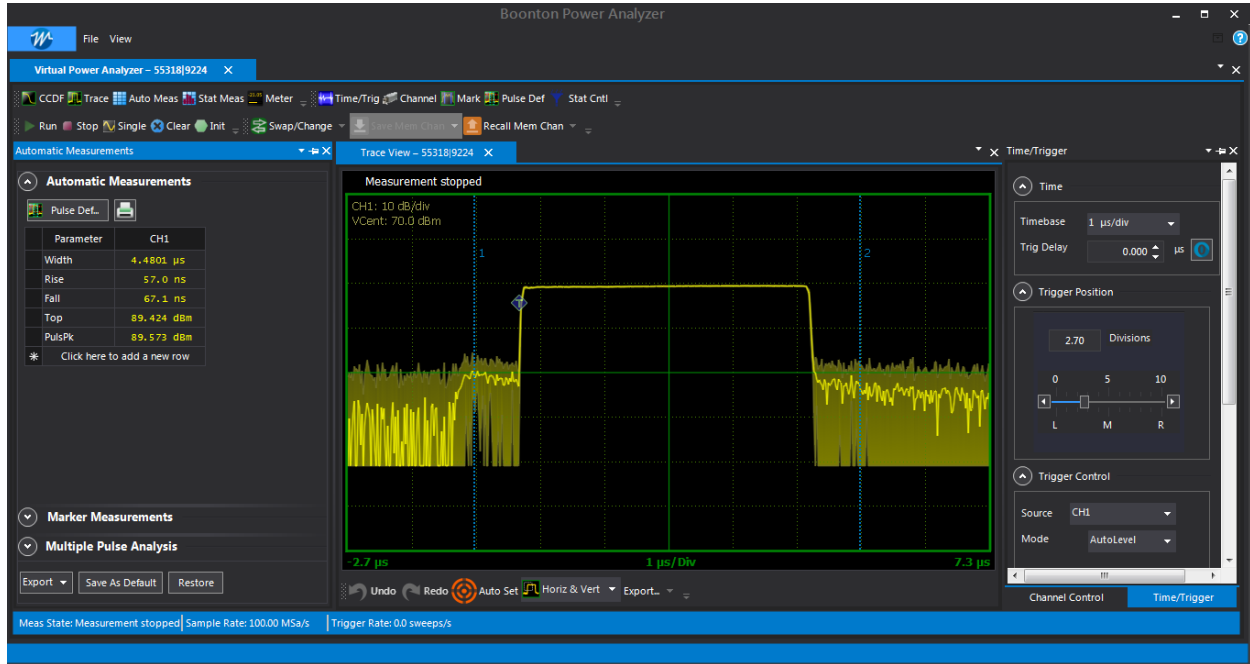
Further detailed specifications are contained in "product specifications" manual.

**Test Data: Measurement Table**

Pulse Type	Pulse widths ( $\mu$ s)	Pulse rep. rate (Hz)	40 dB BW (MHz)
0.4 $\mu$ S	0.44	1250	29.89
0.8 $\mu$ S	0.713	1000	23.48
1 $\mu$ S	0.996	500	19.87
2 $\mu$ S	1.98	250	16.59

# MODULATION CHARACTERISTICS


Test Data: 0.4 uS Pulse width Plot

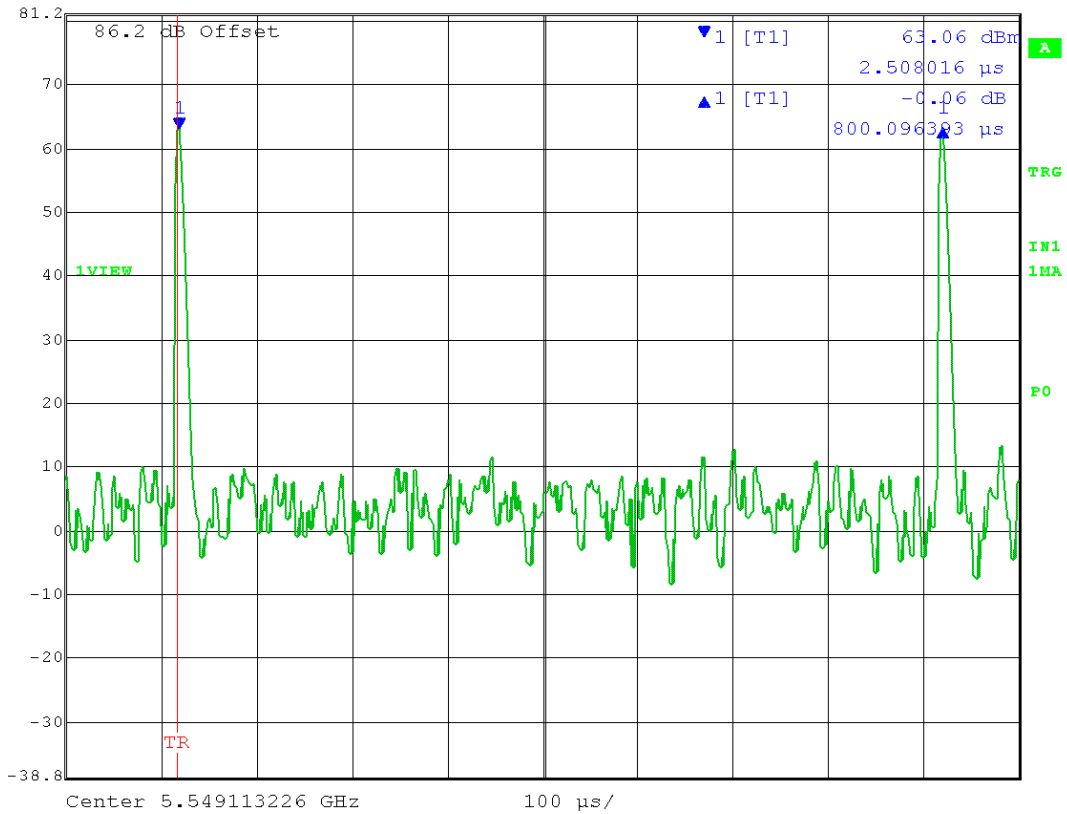




# MODULATION CHARACTERISTICS

## Test Data: 0.4 $\mu$ s Rep Rate Plot

	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
Ref Lvl	-0.06 dB	VBW	1 MHz		
81.2 dBm	800.096393 $\mu$ s	SWT	1 ms	Unit	dBm



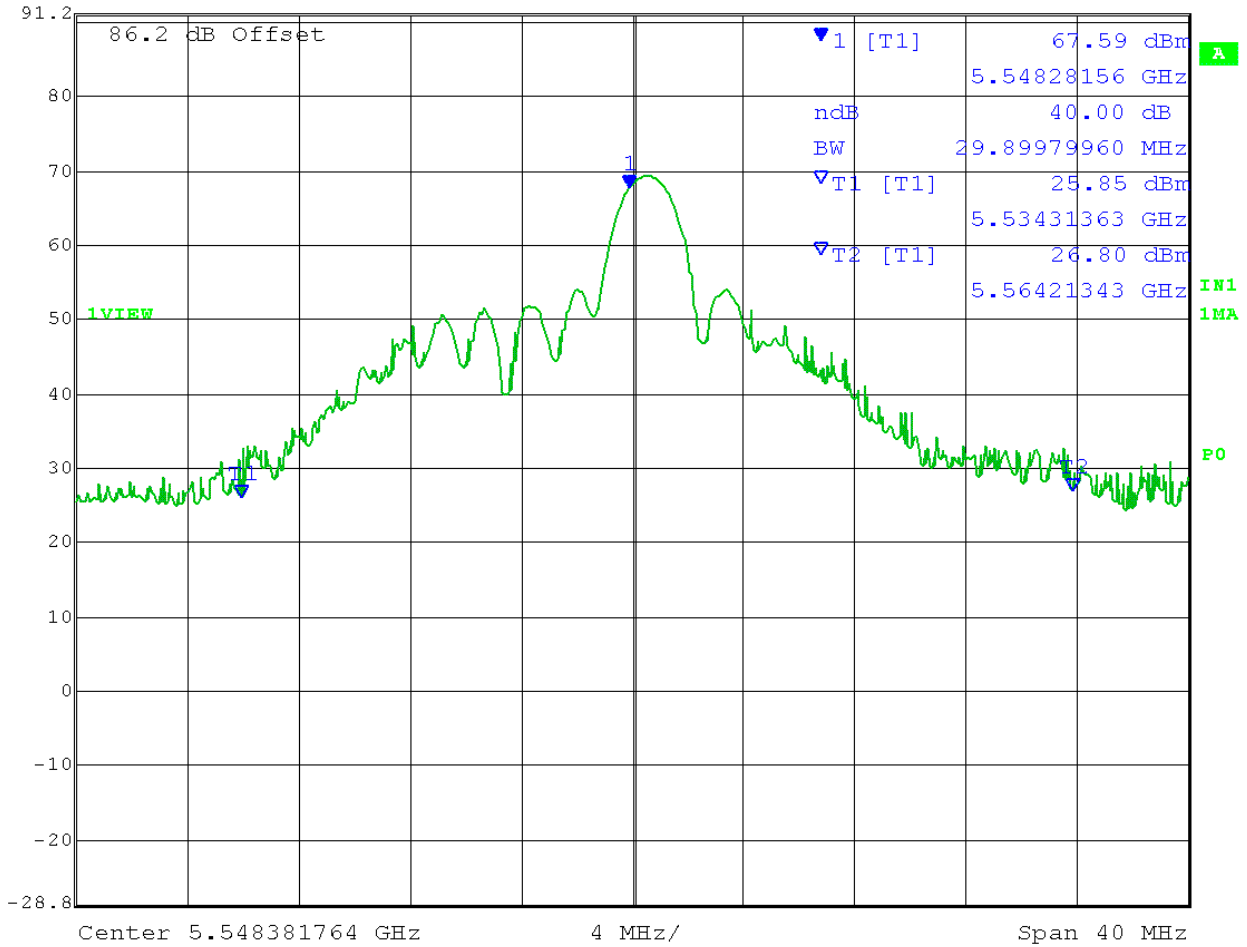
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# MODULATION CHARACTERISTICS

Test Data: 0.4  $\mu$ s 40 dB BW Plot



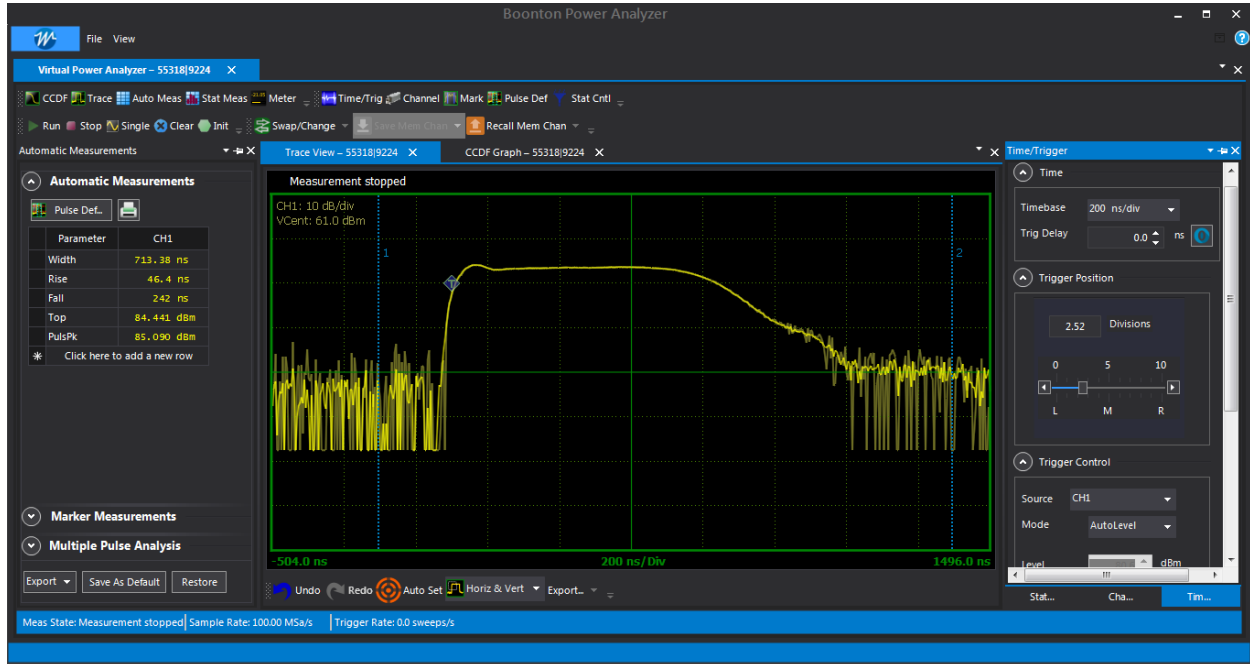
Ref Lvl	Marker 1 [T1 ndB]	RBW	200 kHz	RF Att	20 dB
91.2 dBm	ndB 40.00 dB	VBW	2 MHz		
	BW 29.89979960 MHz	SWT	5 ms	Unit	dBm



Date: 18.SEP.2017 14:18:32

# MODULATION CHARACTERISTICS

Test Data: 0.8 uS Pulse width Plot

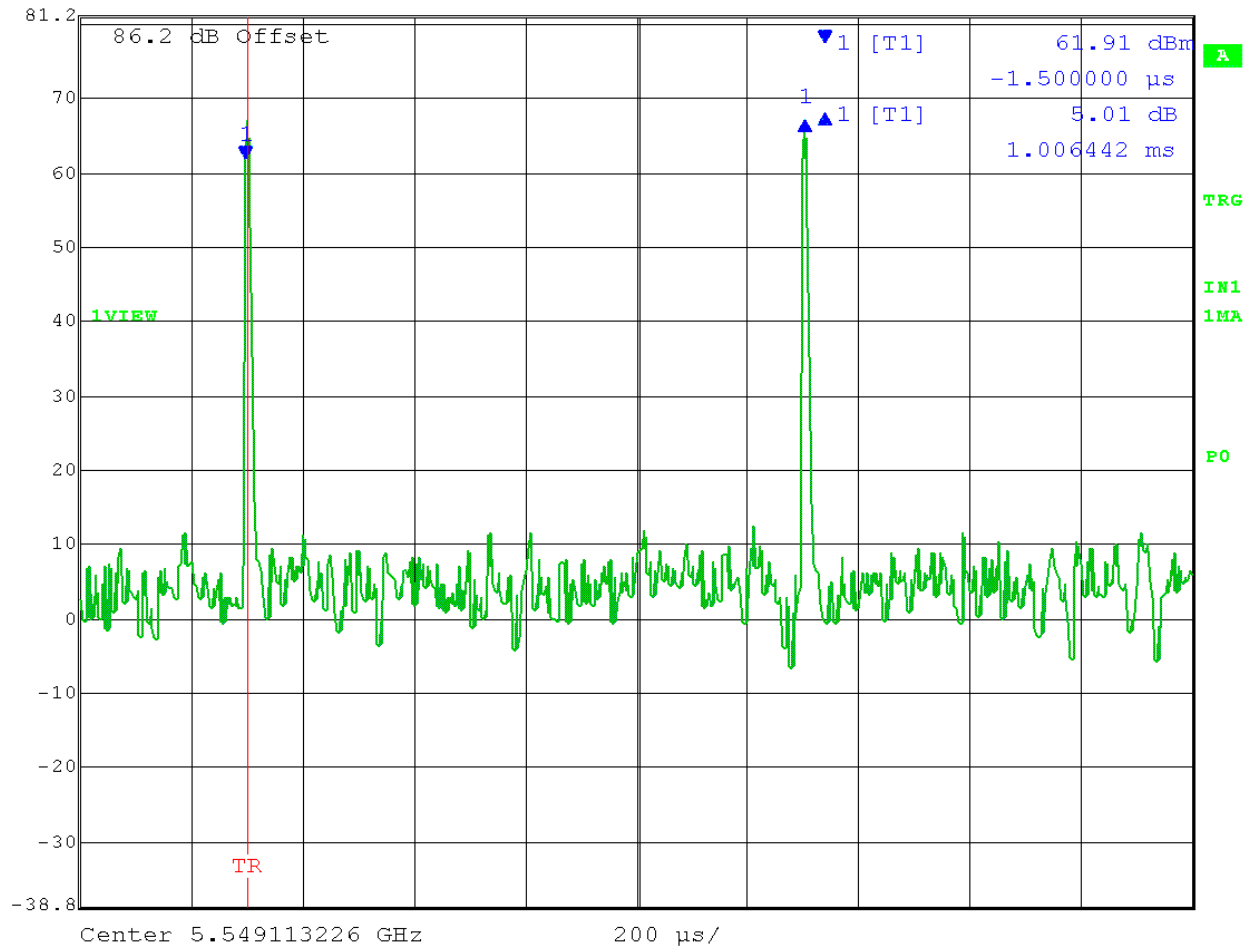


# MODULATION CHARACTERISTICS

Test Data: 0.8  $\mu$ s Rep Rate Plot



	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
Ref Lvl	5.01 dB	VBW	1 MHz		
81.2 dBm	1.006442 ms	SWT	2 ms	Unit	dBm



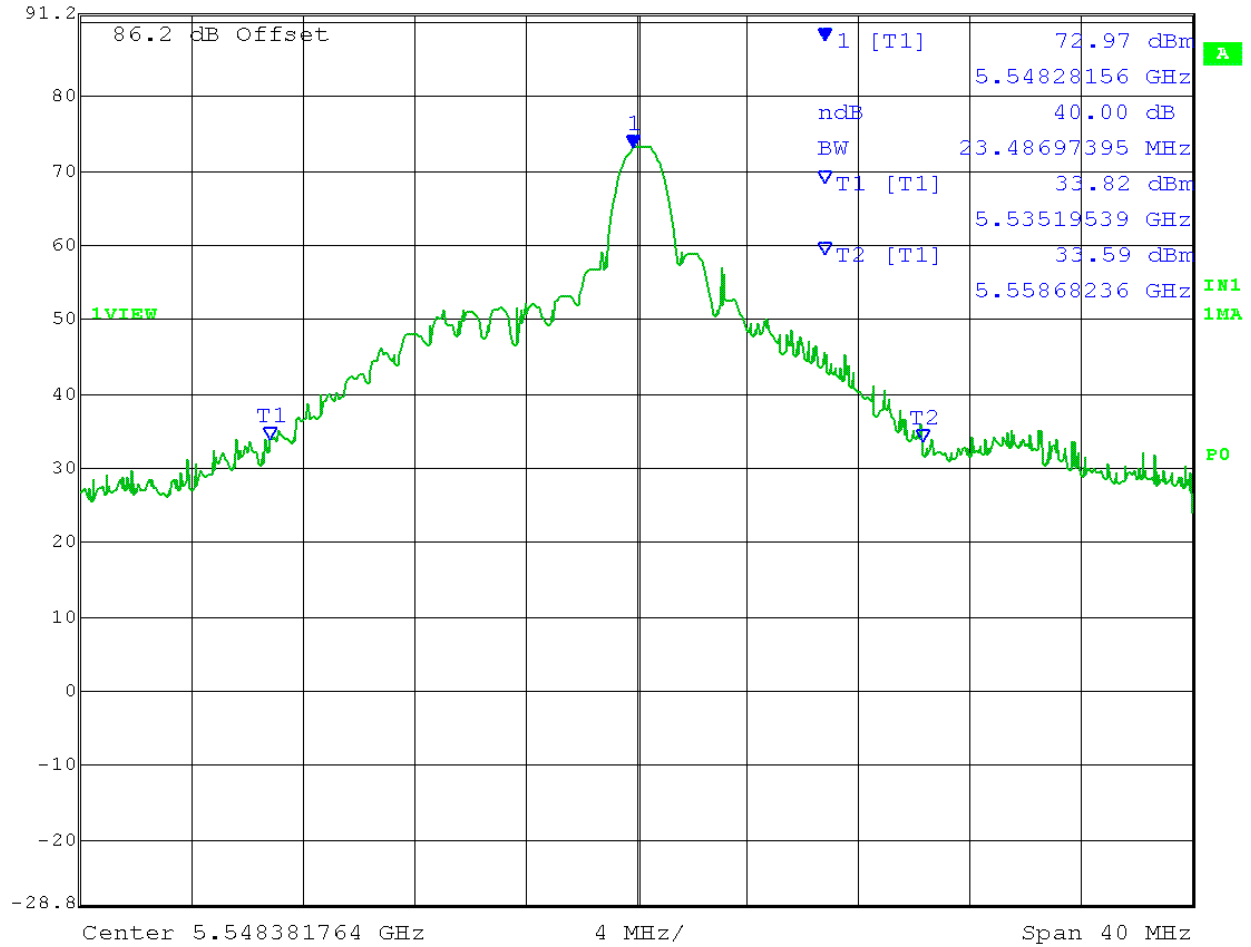
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# MODULATION CHARACTERISTICS

Test Data: 0.8  $\mu$ s 40 dB BW Plot



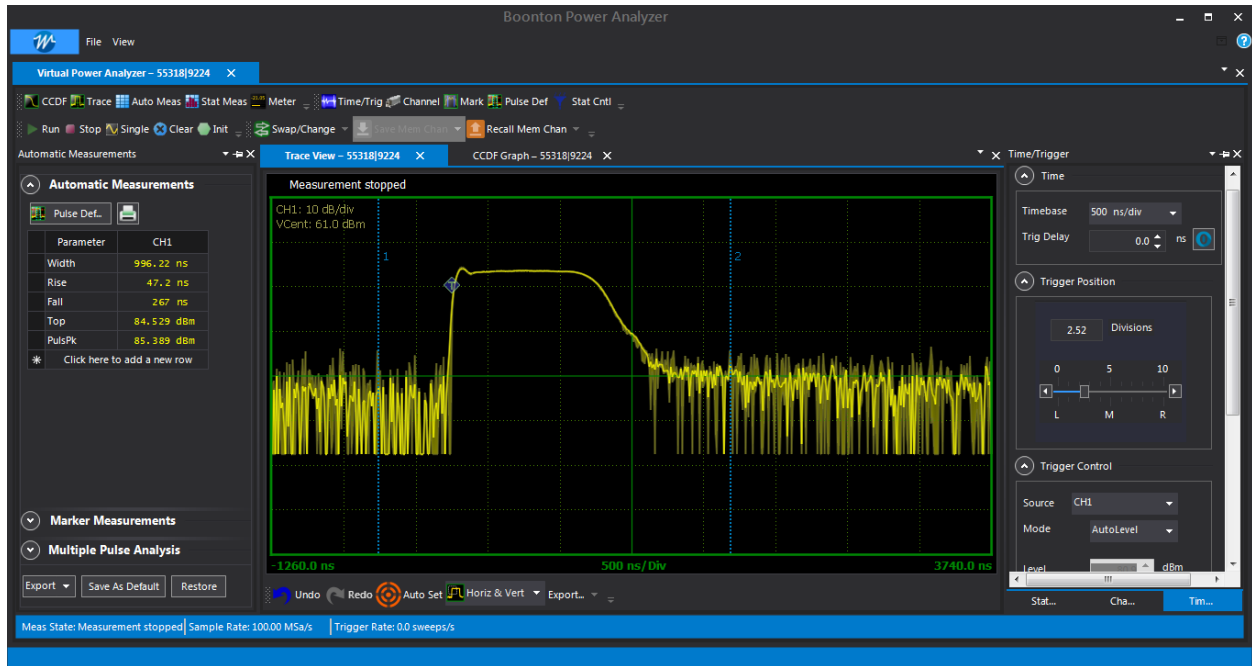
Ref Lvl	Marker 1 [T1 ndB]	RBW	200 kHz	RF Att	20 dB
91.2 dBm	ndB 40.00 dB	VBW	2 MHz		
	BW 23.48697395 MHz	SWT	5 ms	Unit	dBm



Date: 18.SEP.2017 14:16:40

# MODULATION CHARACTERISTICS

Test Data: 1 uS Pulse width Plot

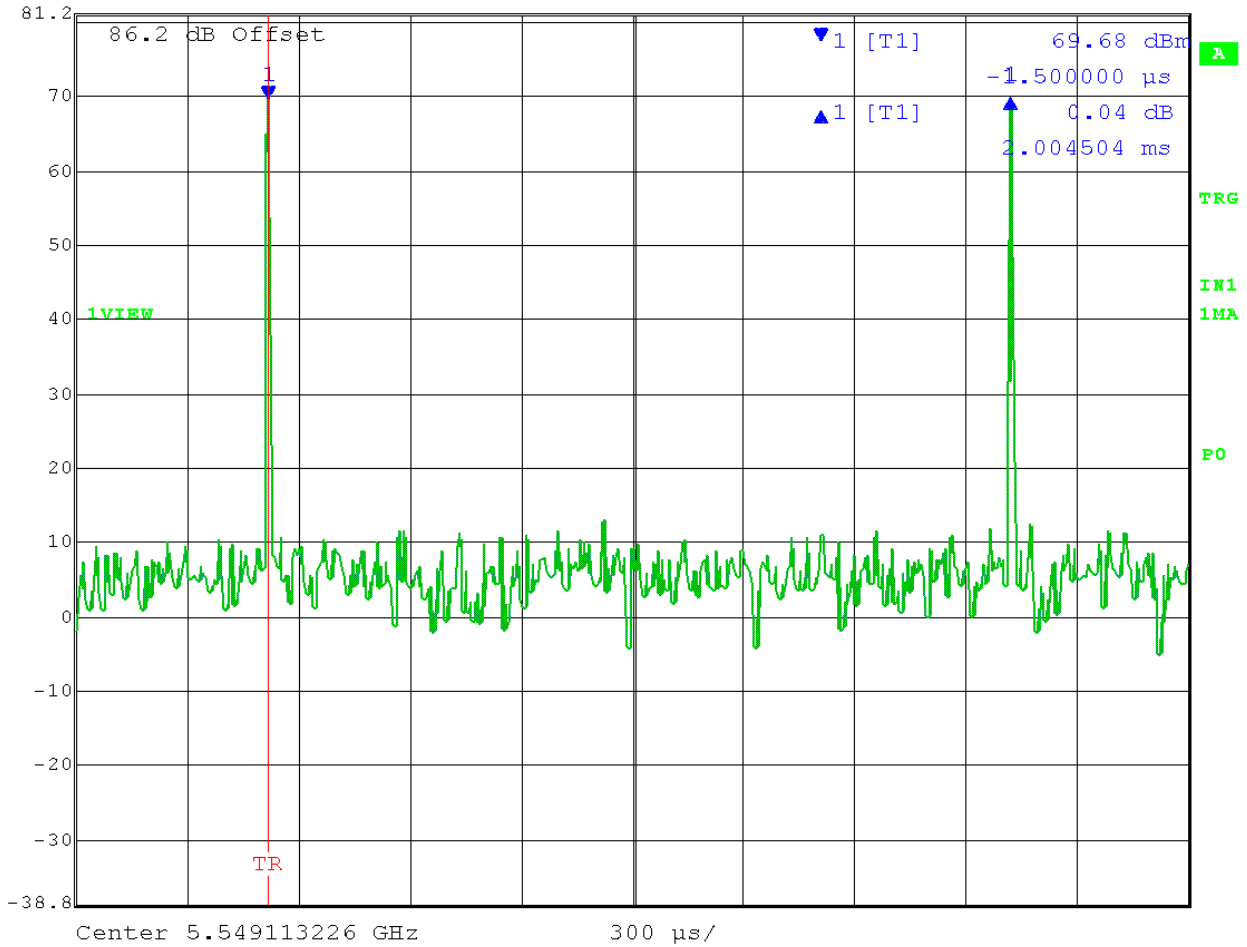


# MODULATION CHARACTERISTICS

Test Data: 1 uS Rep Rate Plot



Ref Lvl	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
81.2 dBm	0.04 dB	VBW	1 MHz		
	2.004504 ms	SWT	3 ms	Unit	dBm



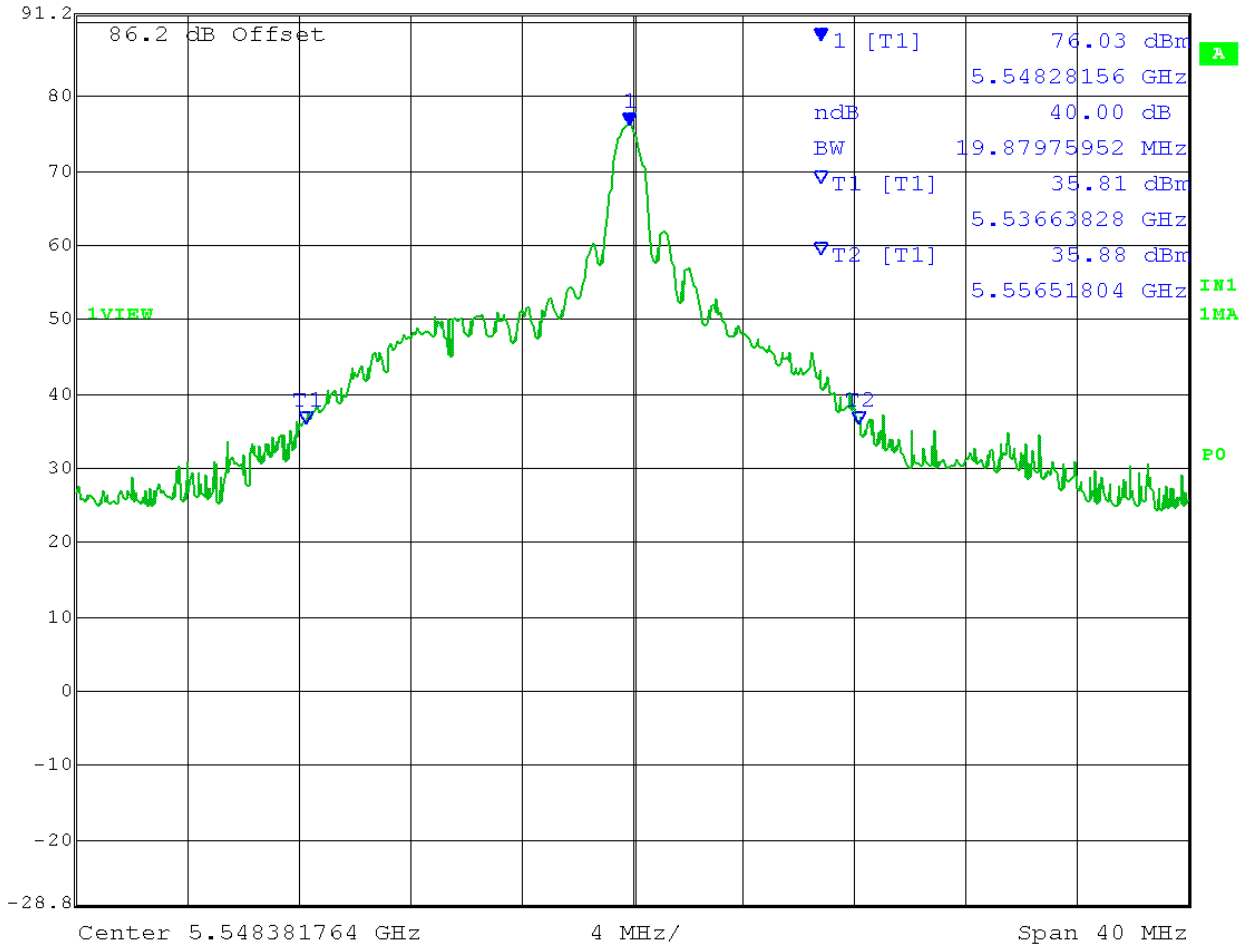
Date: 18.SEP.2017 15:37:31

# MODULATION CHARACTERISTICS

Test Data: 1 uS 40 dBW Plot



Ref Lvl	Marker 1 [T1 ndB]	RBW	200 kHz	RF Att	20 dB
91.2 dBm	ndB 40.00 dB	VBW	2 MHz		
	BW 19.87975952 MHz	SWT	5 ms	Unit	dBm

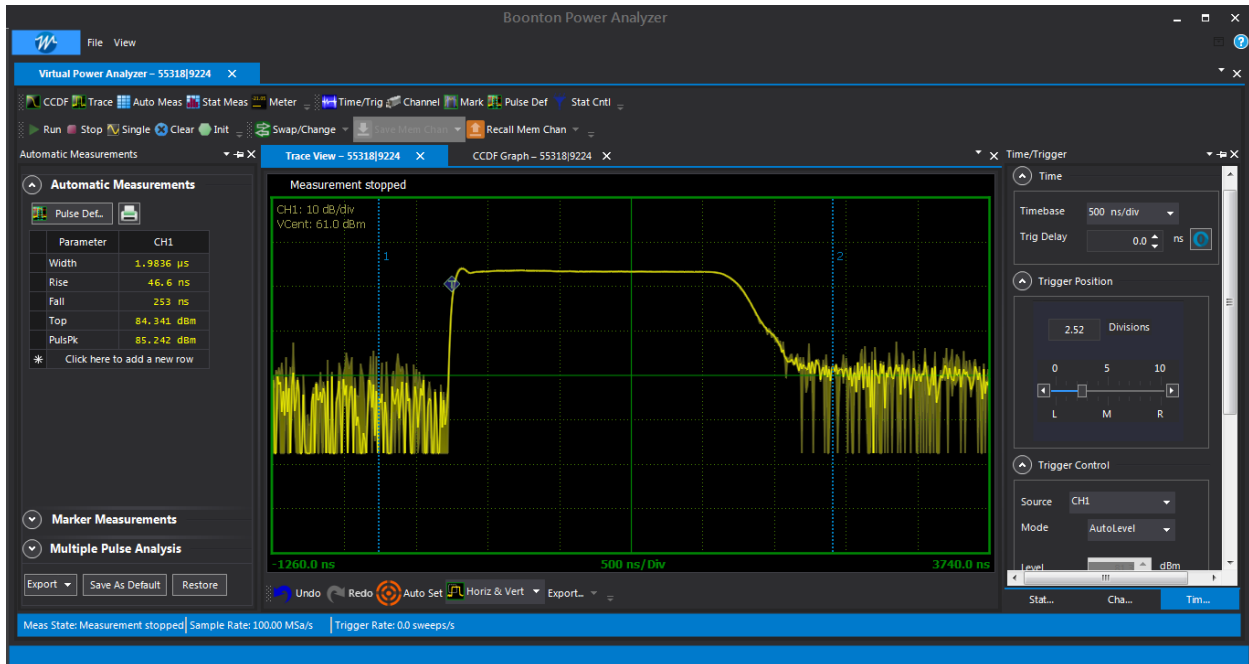


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# MODULATION CHARACTERISTICS

Test Data: 2 uS Pulse width Plot

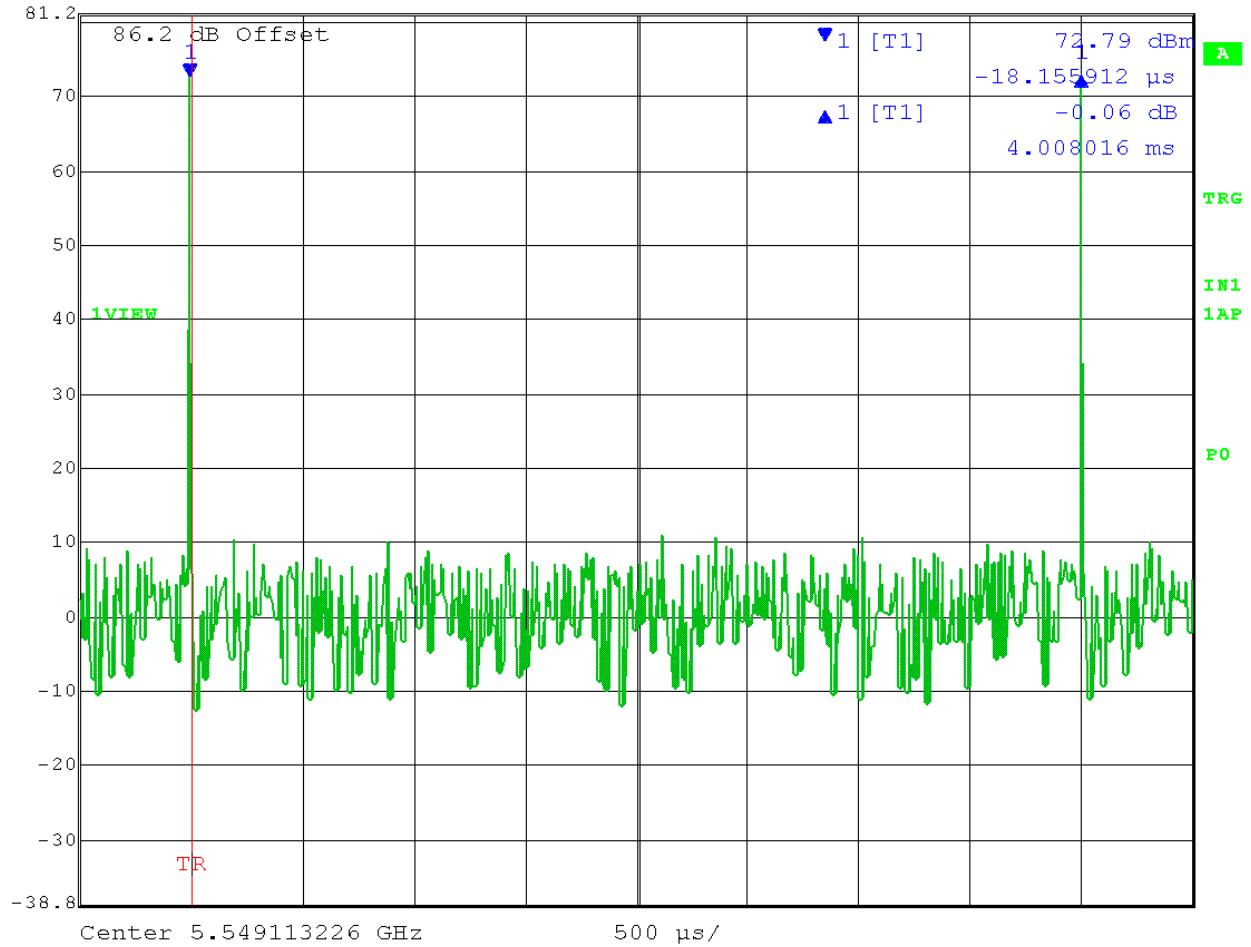


# MODULATION CHARACTERISTICS

Test Data: 2 uS Rep Rate Plot



Ref Lvl	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
81.2 dBm	-0.06 dB	VBW	1 MHz		
	4.008016 ms	SWT	5 ms	Unit	dBm



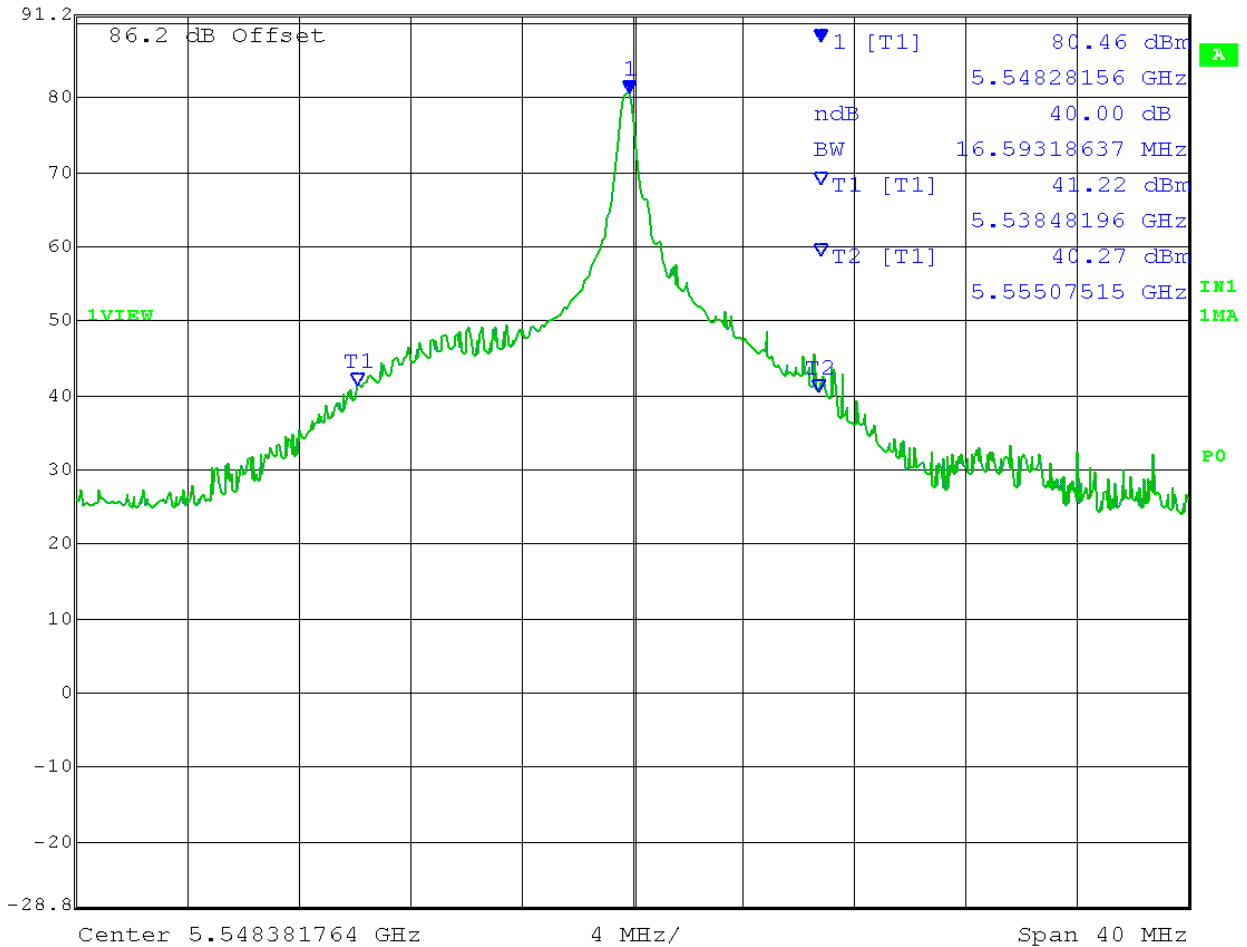
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# MODULATION CHARACTERISTICS

Test Data: 2 uS 40 dB BW Plot



Ref Lvl	91.2 dBm	Marker 1 [T1 ndB]	40.00 dB	RBW	200 kHz	RF Att	20 dB
		BW	16.59318637 MHz	VBW	2 MHz	Unit	dBm
		SWT	5 ms				



Date: 18.SEP.2017 14:08:43

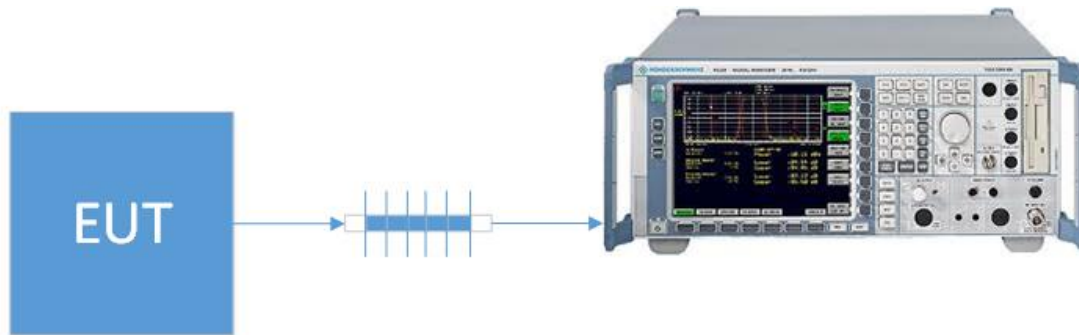
## OCCUPIED BANDWIDTH

**Rule Part No.:** 2.1049

**Requirements:** 99% OBW, Reporting Only

**Procedure:** ANSI/TIA-603

**Setup Diagram:**

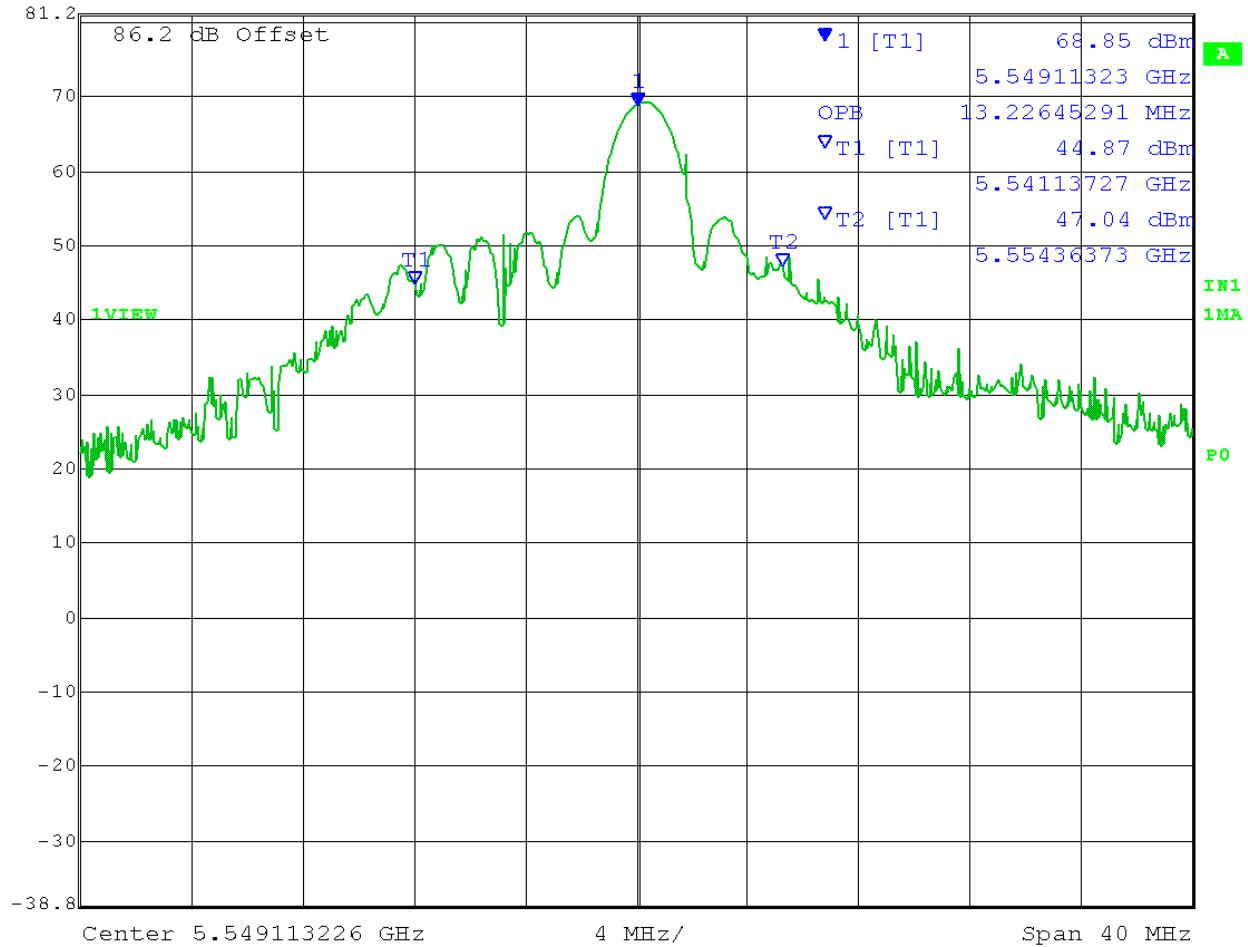


# OCCUPIED BANDWIDTH

Test Data: 0.4 uS 99% OBW Plot



Ref Lvl	81.2 dBm	Marker 1 [T1]	68.85 dBm	RBW	200 kHz	RF Att	10 dB
			5.54911323 GHz	VBW	1 MHz	Unit	dBm
				SWT	5 ms		

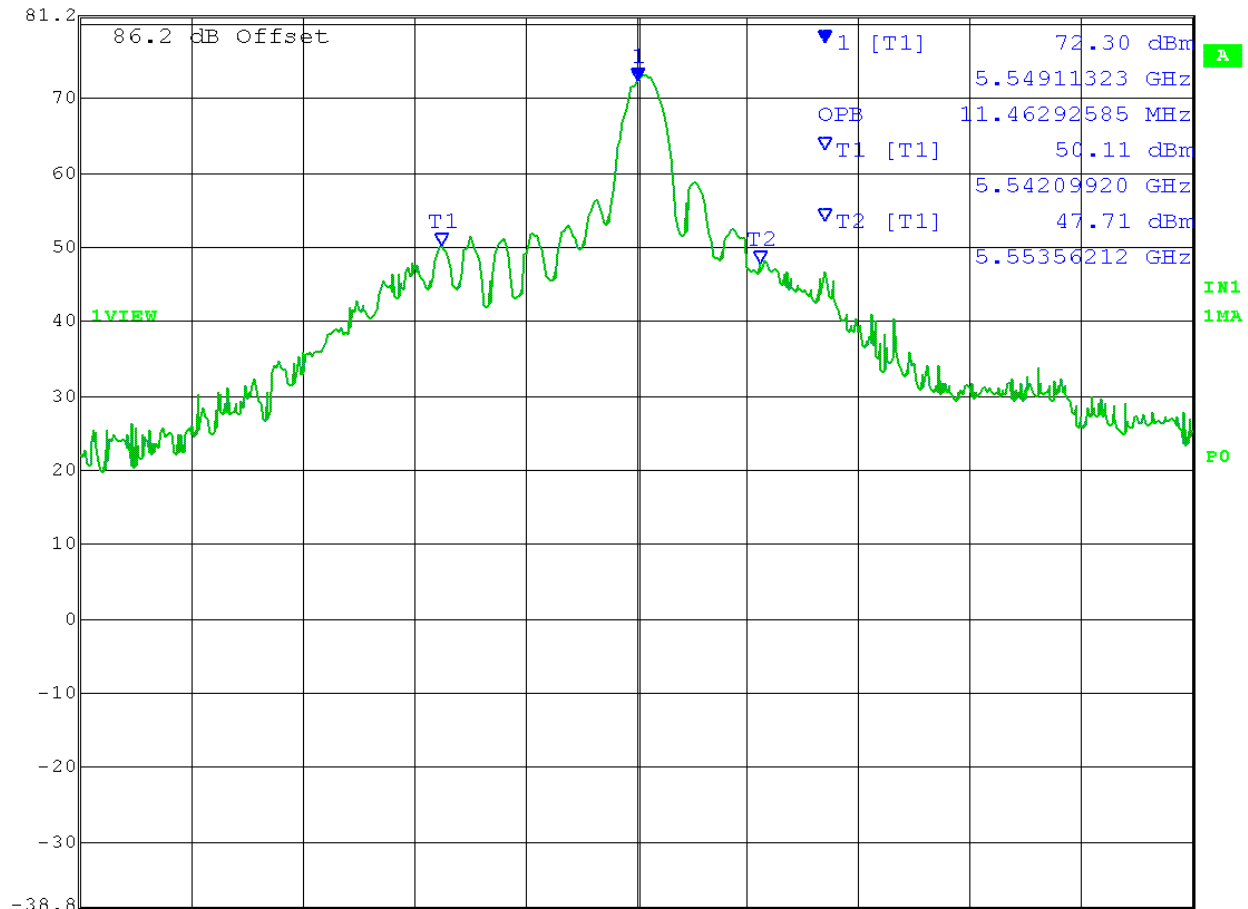


Date: 18.SEP.2017 14:28:00

# OCCUPIED BANDWIDTH

Test Data: 0.8 uS 99% OBW Plot

	Ref Lvl	81.2 dBm	Marker 1 [T1]	72.30 dBm	RBW	200 kHz	RF Att	10 dB
				5.54911323 GHz	VBW	1 MHz	Unit	dBm
					SWT	5 ms		



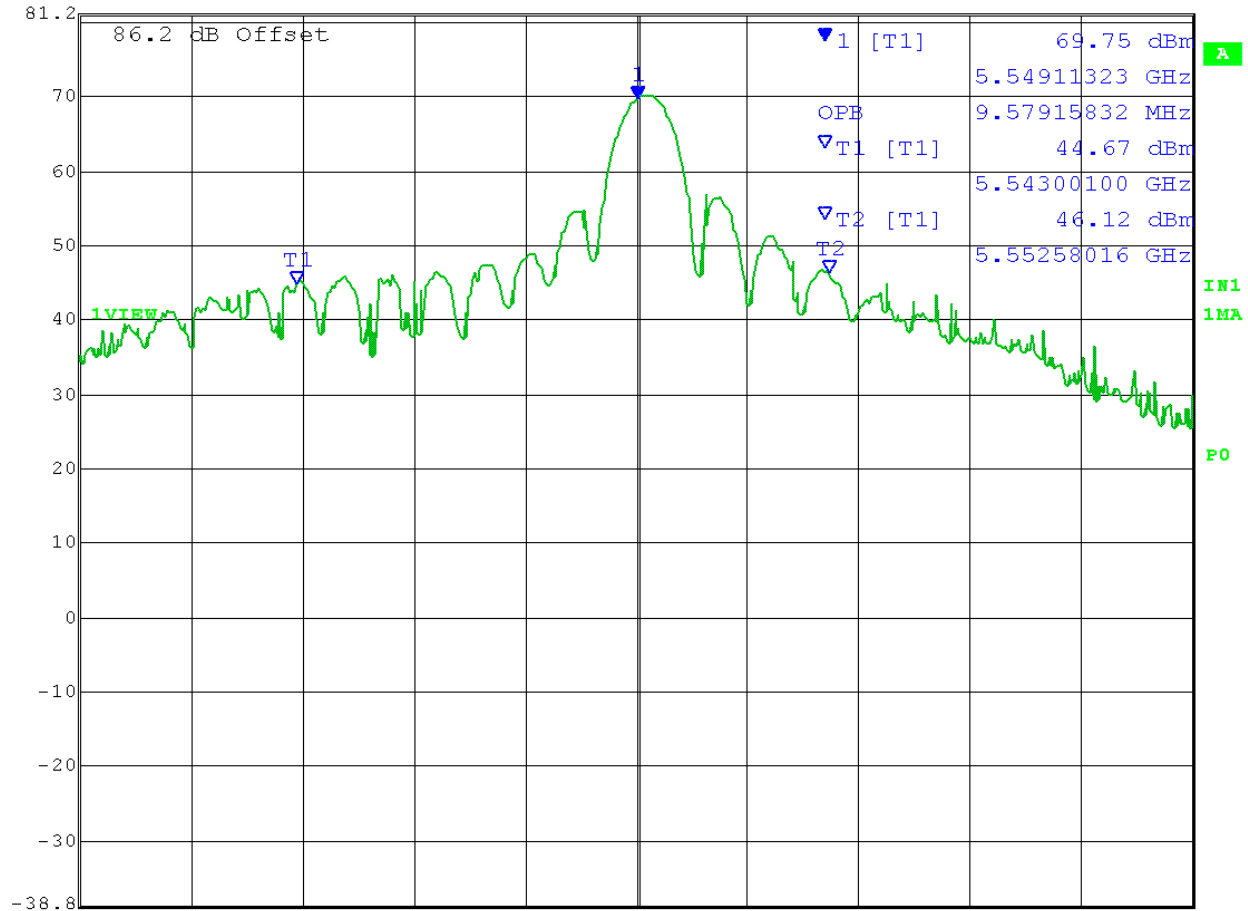
Center 5.549113226 GHz      4 MHz/      Span 40 MHz

Date: 18.SEP.2017 14:30:48

# OCCUPIED BANDWIDTH

Test Data: 1 uS 99% OBW Plot

	Marker 1 [T1]	RBW	100 kHz	RF Att	10 dB
	Ref Lvl	69.75 dBm	VBW	1 MHz	
	81.2 dBm	5.54911323 GHz	SWT	5 ms	Unit dBm



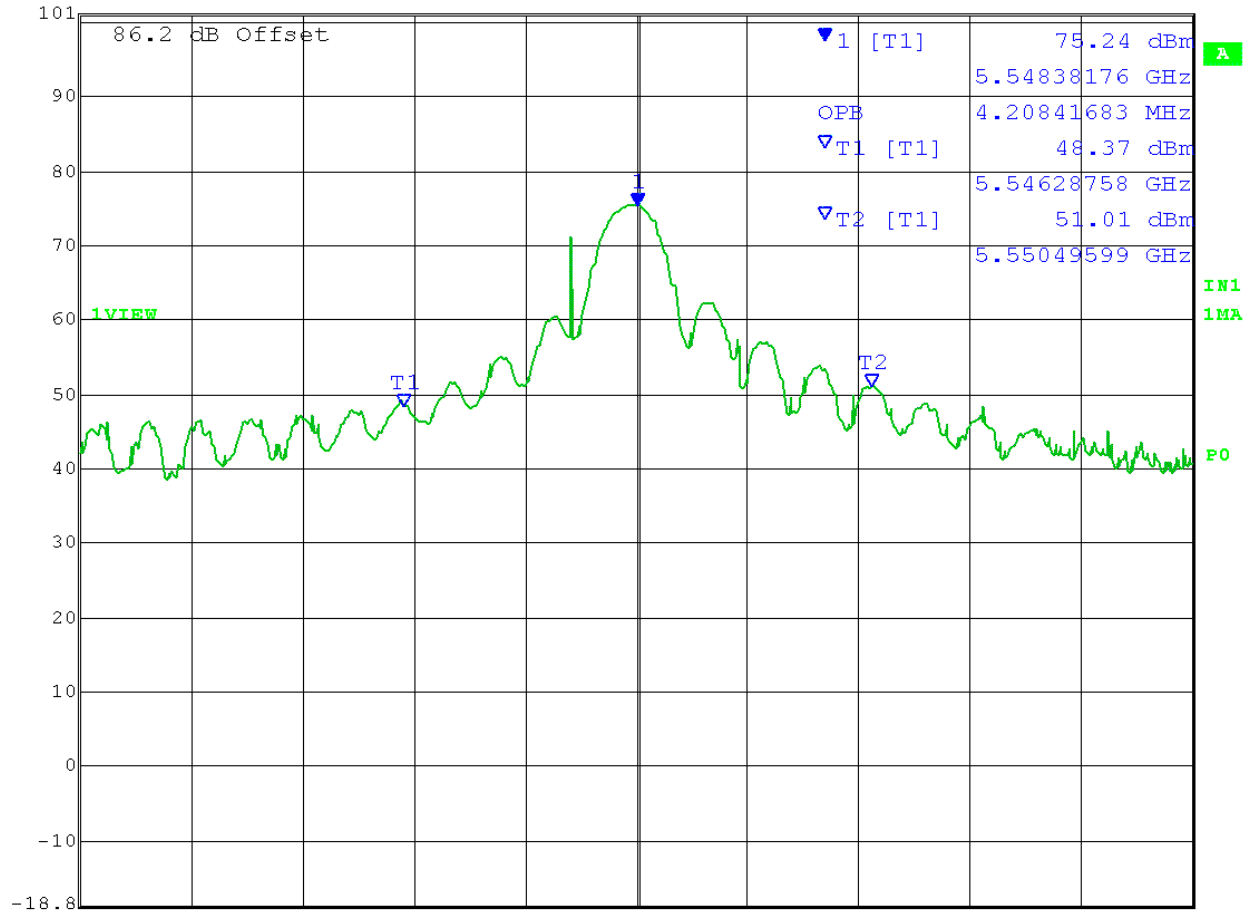
Center 5.549113226 GHz      2 MHz/      Span 20 MHz

Date: 18.SEP.2017 14:34:35

# OCCUPIED BANDWIDTH

Test Data: 2 uS 99% OBW Plot

	Marker 1 [T1]	RBW	100 kHz	RF Att	30 dB
	Ref Lvl	75.24 dBm	VBW	1 MHz	
	101.2 dBm	5.54838176 GHz	SWT	5 ms	Unit dBm



Center 5.548381764 GHz      1 MHz/      Span 10 MHz

Date: 18.SEP.2017 14:02:40



## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

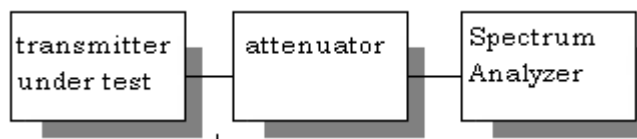
**Rule Part No.:** 2.1051, 90.210 (b) (3)

**Requirements:** 43+10log (P)

**Procedure:** The spectrum was scanned from 9 KHz - 40 GHz. The measurements were made in accordance with standard that is listed above.

The mean power was calculated based on the standard formula for radar systems:  
 $P_a = P_m * T_d * f_r$ . Where  $T_d$  is pulse duration,  $P_m$  is peak power, and  $f_r$  is pulse rep rate.

### Setup Diagram:



**Notes:** Only emissions that are within 20 dB of the limit are reported

## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: Measurement Table

Power Output	dBm		Watts	Limit (dBc)
	84.529		283726.56	97.529

Frequency		dBc	Margin dB
5300.000		0.00	0.00
10600.000	*	120.44	22.91
15900.000		127.60	30.07
21200.000		107.06	9.53
26500.000		117.85	20.32
31800.000	*	113.36	15.83
37100.000	*	113.36	15.83

Power Output	dBm		Watts	Limit (dBc)
	84.829		304018.49	97.829

Frequency		dBc	Margin dB
5550.000		0.00	0.00
11100.000		100.41	2.58
16650.000		104.52	6.69
22200.000		108.81	10.98
27750.000		114.86	17.03
33300.000		108.51	10.68
38850.000		127.06	29.23

Power Output	dBm		Watts	Limit (dBc)
	84.529		283726.56	97.529

Frequency		dBc	Margin dB
5800.000		0.00	0.00
11600.000		108.60	11.07
17400.000		99.94	2.41
23200.000		103.29	5.76
29000.000		126.53	29.00
34800.000	*	131.21	33.68

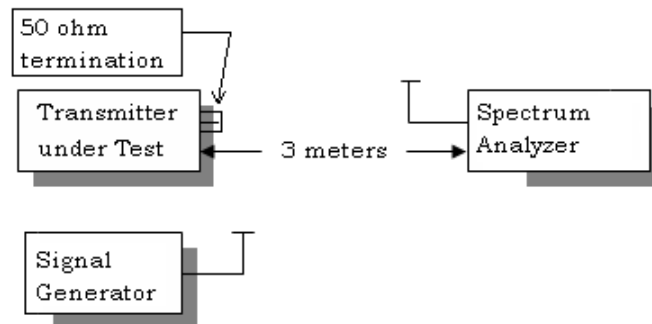
## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Parts. No.:** 2.1053, 90.210(b) (3)

**Requirements:**  $43 + 10 \log (P)$

**Procedure:** The tabulated data shows the results of the substitution measurement of radiated field strength emissions test. The spectrum was scanned from 9 KHz - 40 GHz.

### Setup Diagram:



**Notes:** Only emissions that are within 20 dB of the limit are reported

## FIELD STRENGTH OF SPURIOUS EMISSIONS

### Test Data: Measurement Table

Power Output	dBm	Watts	Limit (dB)
	84.829	304018.49	97.829

Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	erp (dBmW)	Margin dB
5300.0	10600.0	V	-13.0972	0.10
5300.0	15900.0	H	-15.4972	2.50
5300.0	21200.0	H	-16.5672	3.57
5300.0	26500.0	H	-13.1772	0.18
5300.0	31800.0	V	-13.0272	0.03
5300.0	37100.0	V	-13.2972	0.30

5550.0	11100.0	V	-20.4872	7.49
5550.0	11100.0	H	-31.5472	18.55
5550.0	16650.0	V	-23.5522	10.55
5550.0	22200.0	H	-14.2872	1.29
5550.0	27750.0	H	-13.9622	0.96
5550.0	33300.0	H	-14.3772	1.38
5550.0	38850.0	V	-15.2672	2.27

5800.0	27.4	V	-69.2595	56.26
5800.0	192.0	V	-60.3112	47.31
5800.0	579.0	H	-53.9672	40.97
5800.0	11600.0	V	-25.0472	12.05
5800.0	17400.0	V	-15.1072	2.11
5800.0	23200.0	H	-16.0972	3.10
5800.0	29000.0	V	-13.3972	0.40
5800.0	34800.0	H	-13.1972	0.20

## FREQUENCY STABILITY

**Rule Parts. No.:** 2.1055, 90.213

**Requirements:** Manufacturers specification, authorization reviewed on a case-by-case basis.

**Procedure:** The test procedures used are detailed in the standard listed that is listed above.

**Modifications to Standard:** EUT voltage was not varied because it will always be connected to a UPS battery back up system.

### Test Data Measurement Table

Temperature	Frequency MHz	Cycles	PPM
25°C (reference)	5546.416834		
-30°C	5550.937880	4521046	815.129
-20°C	5550.344690	3927856	708.179
-10°C	5549.358720	2941886	530.412
0°C	5548.557110	2140276	385.884
10°C	5547.274550	857716	154.643
20°C	5546.801600	384766	69.372
30°C	5546.000000	-416834	-75.154
40°C	5545.342690	-1074144	-193.664
50°C	5544.487820	-1929014	-347.795

## STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: “Uncertainty in EMC Measurements” and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Audio Frequency Response	±1.86dB	
Modulation limiting	±1.88%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq.	±1.88%	
Within 6kHz and 25kHz of audio Freq.	±2.04%	
Rad Emissions Sub Meth up to 26.5GHz	±2.14dB	
Adjacent channel power	±1.47dB	(1)
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconical 1057	Eaton	94455-1	1057	11/18/15	11/18/17
Antenna: Log- Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244- 02 ; KMKM- 0670-01; KFKF-0197-00	N/A	N/A
Sweep/Signal Generator	Anritsu	68369B	985112	10/28/15	10/28/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/19
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/16/16	08/16/18
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
RF Power Meter	Boonton	4531	11793	01/12/17	01/12/19
Type K J Thermometer	Martel	303	080504494	10/26/15	10/26/17
Attenuator N 30dB 500W DC-2.5G	Bird	8325	1761	05/18/15	09/25/17
Antenna: Double-Ridged Horn 18-40 GHz	EMCO	3116	9011-2145	11/18/15	11/18/17
Non Radiating 50 OHM Load	Sierra Elec	160B-600X	1038	09/13/16	09/13/18
Attenuator K 3dB 2W DC- 40G	Narda	4768-3	1023-2	06/25/15	09/25/17
Attenuator K 6dB 2W DC- 40G	Narda	4768-6	1044-2	06/25/15	09/25/17
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A

**\*EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

**END OF REPORT**

Applicant: BARON SERVICES INC.  
 FCC ID: NX5-GEN3-350CM  
 Report: 1676AUT17TestReport\_Rev2

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