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FCC PART 90 RADAR TEST REPORT

APPLICANT	BARON SERVICES INC.
	4930 Research Dr. Huntsville, Alabama 35805
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.

TABLE OF CONTENTS

GENERAL REMARKS	2
EUT SPECIFICATION	3
TEST SETUP INFORMATION	3
TEST REPORT SUMMARY	4
RF POWER OUTPUT	5
Test Data: Measurement Table	5
MODULATION CHARACTERISTICS	6
Test Data: Measurement Table	6
Test Data: 0.4 uS Pulse width Plot	7
Test Data: 0.4 uS Rep Rate Plot	8
Test Data: 0.4 uS 40 dB BW Plot	9
Test Data: 0.8 uS Pulse width Plot	10
Test Data: 0.8 uS Rep Rate Plot	11
Test Data: 0.8 uS 40 dB BW Plot	12
Test Data: 1 uS Pulse width Plot	13
Test Data: 1 uS Rep Rate Plot	14
Test Data: 1 uS 40 dB BW Plot	15
Test Data: 2 uS Pulse width Plot	16
Test Data: 2 uS Rep Rate Plot	17
Test Data: 2 uS 40 dB BW Plot	18
OCCUPIED BANDWIDTH	19
Test Data: 0.4 uS 99% OBW Plot	20
Test Data: 0.8 uS 99% OBW Plot	21
Test Data: 1 uS 99% OBW Plot	22
Test Data: 2 uS 99% OBW Plot	23
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)	24
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)	25
Test Data: Measurement Table	25
FIELD STRENGTH OF SPURIOUS EMISSIONS	26
FIELD STRENGTH OF SPURIOUS EMISSIONS	27
Test Data: Measurement Table	27
FREQUENCY STABILITY	28
Test Data: Measurement Table	28
STATE OF THE MEASUREMENT UNCERTAINTY	29
EQUIPMENT LIST	30

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

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	PON
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	Timco Engineering, Inc. 849 NW State Road 45 Newberry, FL 32669 USA Designation #:US1070
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

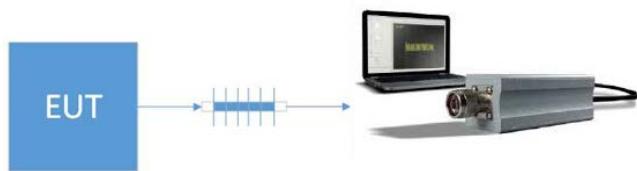
RF POWER OUTPUT

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:

$$Pa = Pm * DC$$

Pa is Mean linear power in watts

Pm 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: $P \text{ (W)} = E \text{ (V)} * I \text{ (A)} = 240 \text{ VAC} * 8 \text{ Amps} = 1920 \text{ Watts}$

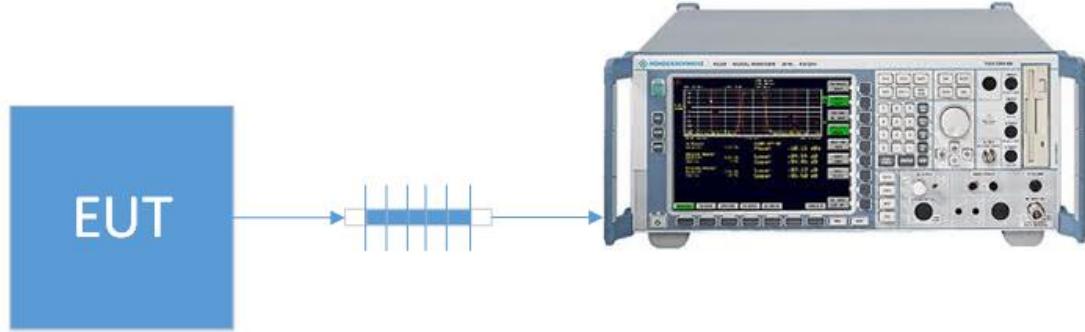
MODULATION CHARACTERISTICS

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 US.

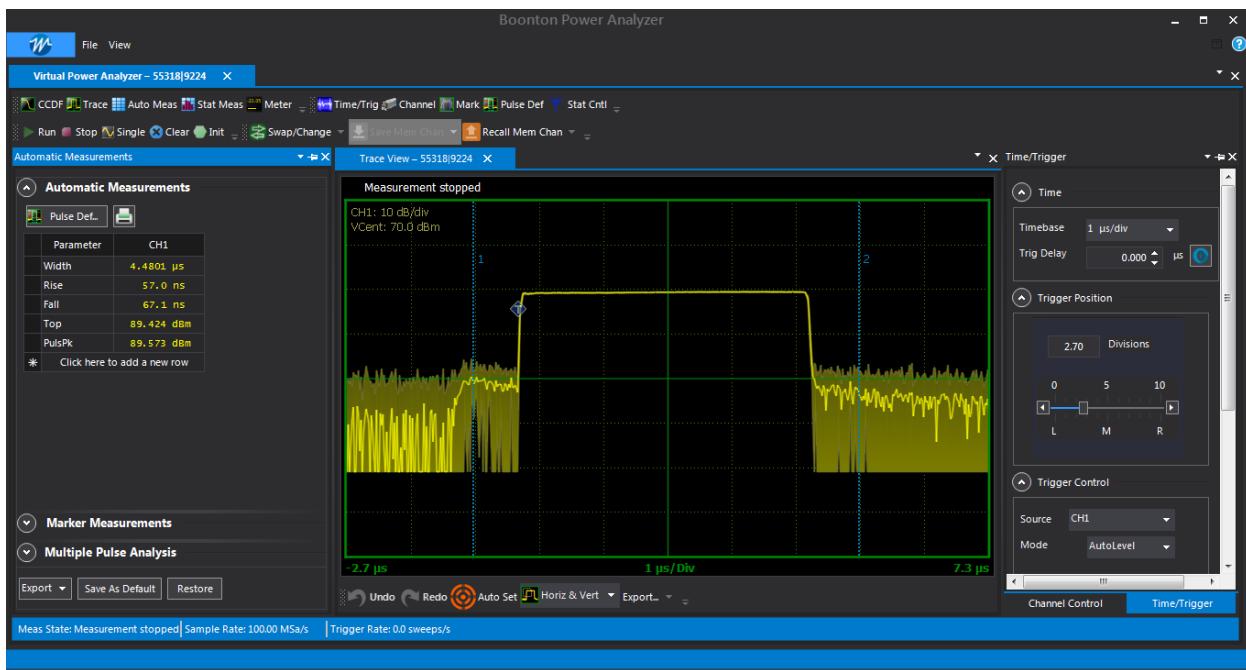
Further detailed specifications are contained in "product specifications" manual.

Test Data: Measurement Table

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

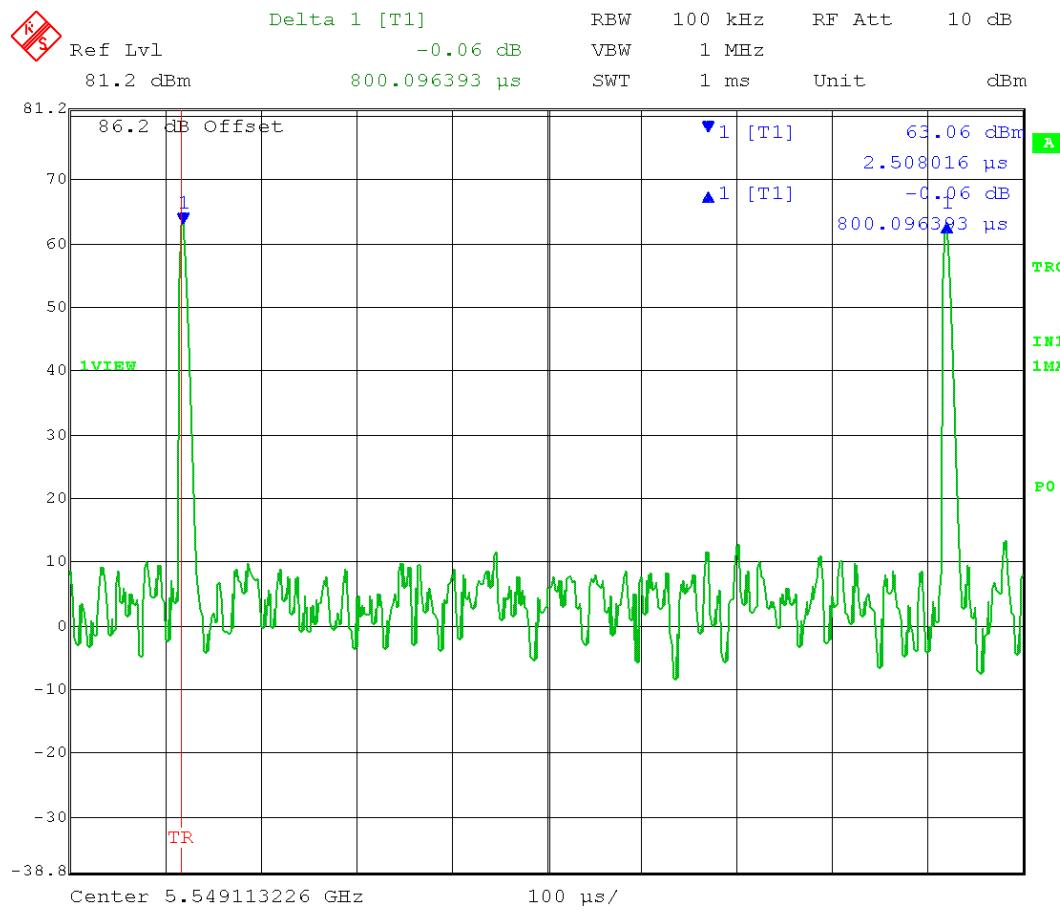
MODULATION CHARACTERISTICS

Test Data: 0.4 uS Pulse width Plot



MODULATION CHARACTERISTICS

Test Data: 0.4 uS Rep Rate Plot



Date: 18.SEP.2017 15:40:00

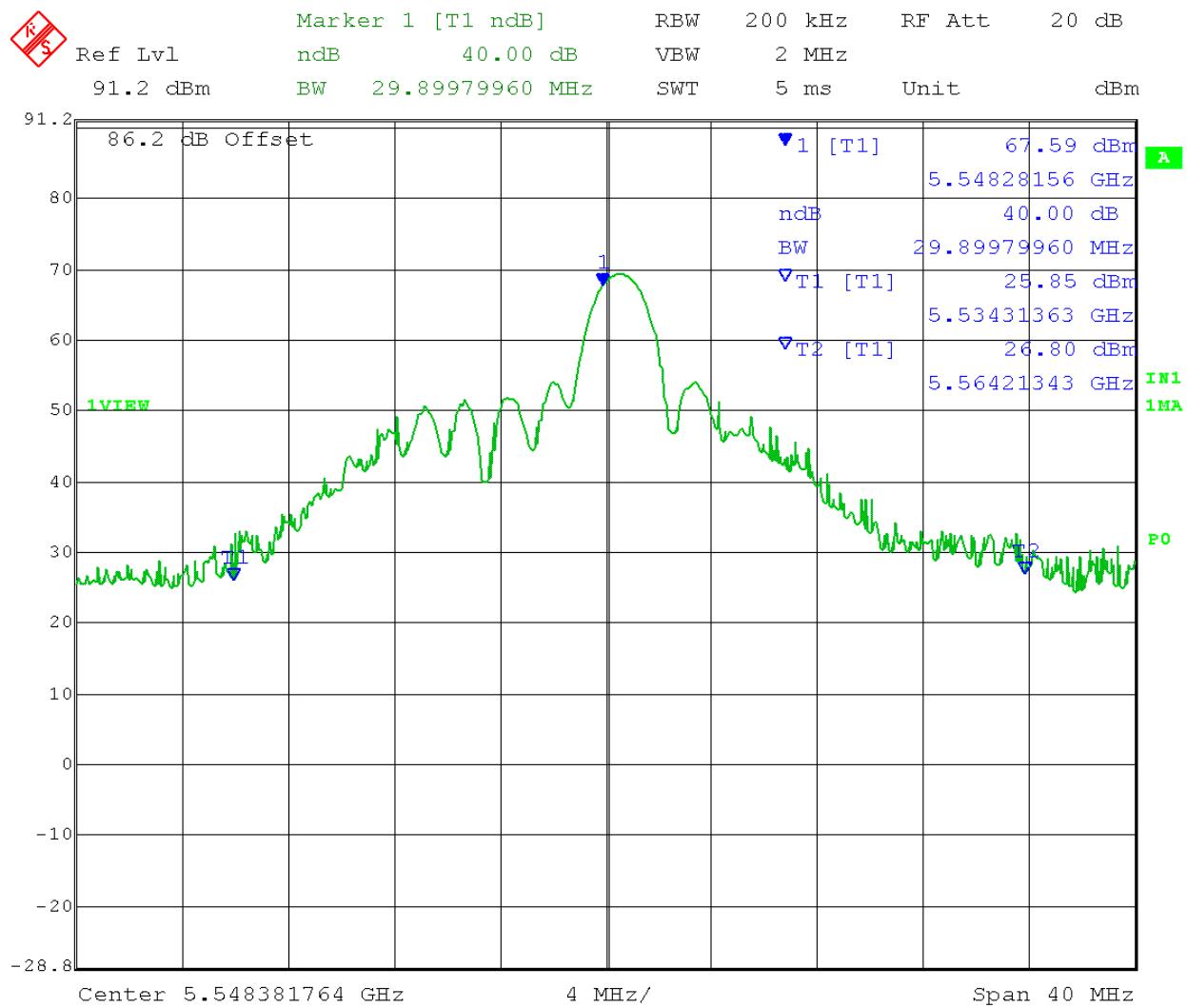
Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 8 of 30

MODULATION CHARACTERISTICS

Test Data: 0.4 μ s 40 dB BW Plot



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

Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 9 of 30

MODULATION CHARACTERISTICS

Test Data: 0.8 uS Pulse width Plot



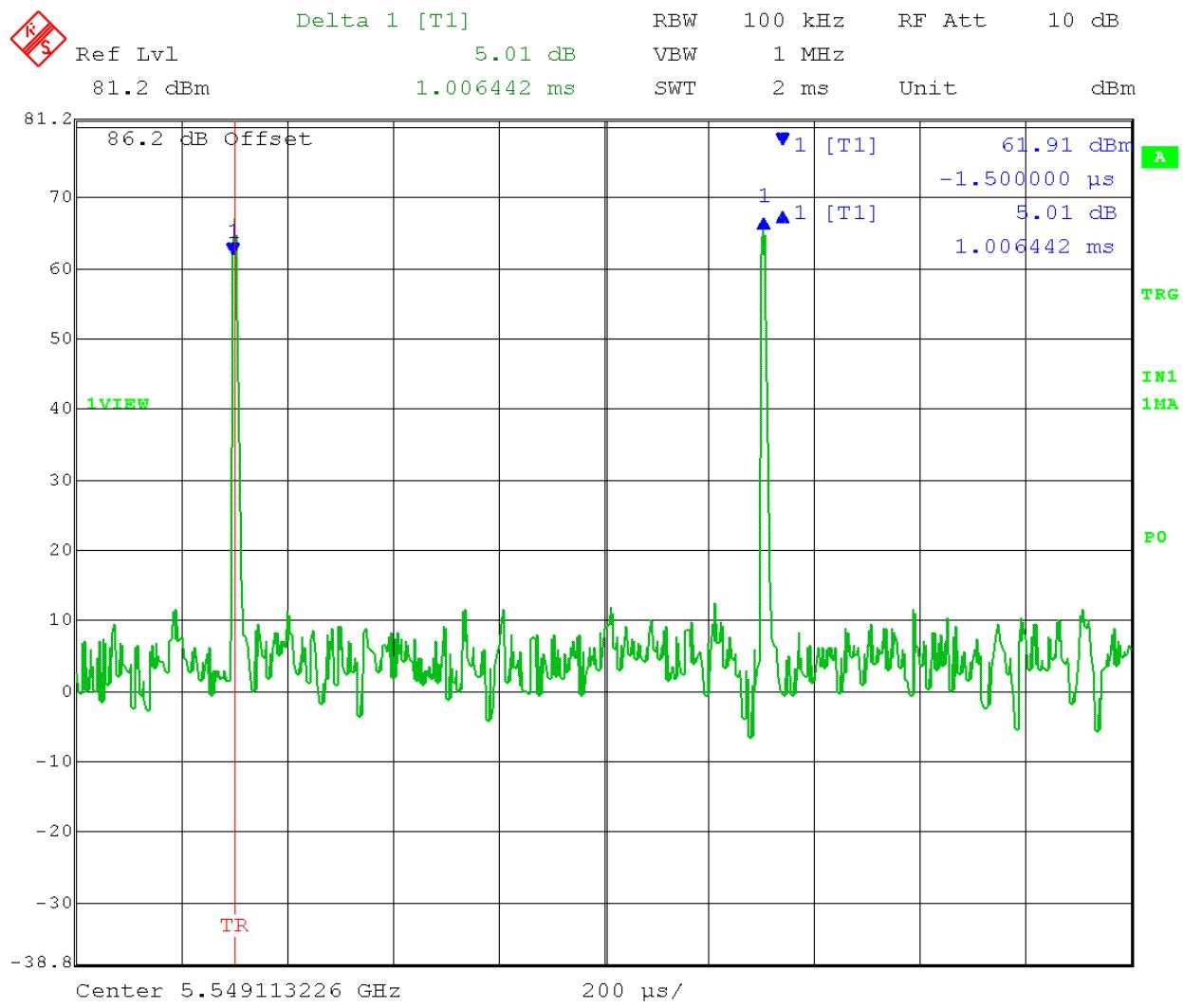
Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 10 of 30

MODULATION CHARACTERISTICS

Test Data: 0.8 uS Rep Rate Plot



Date: 18.SEP.2017 15:39:03

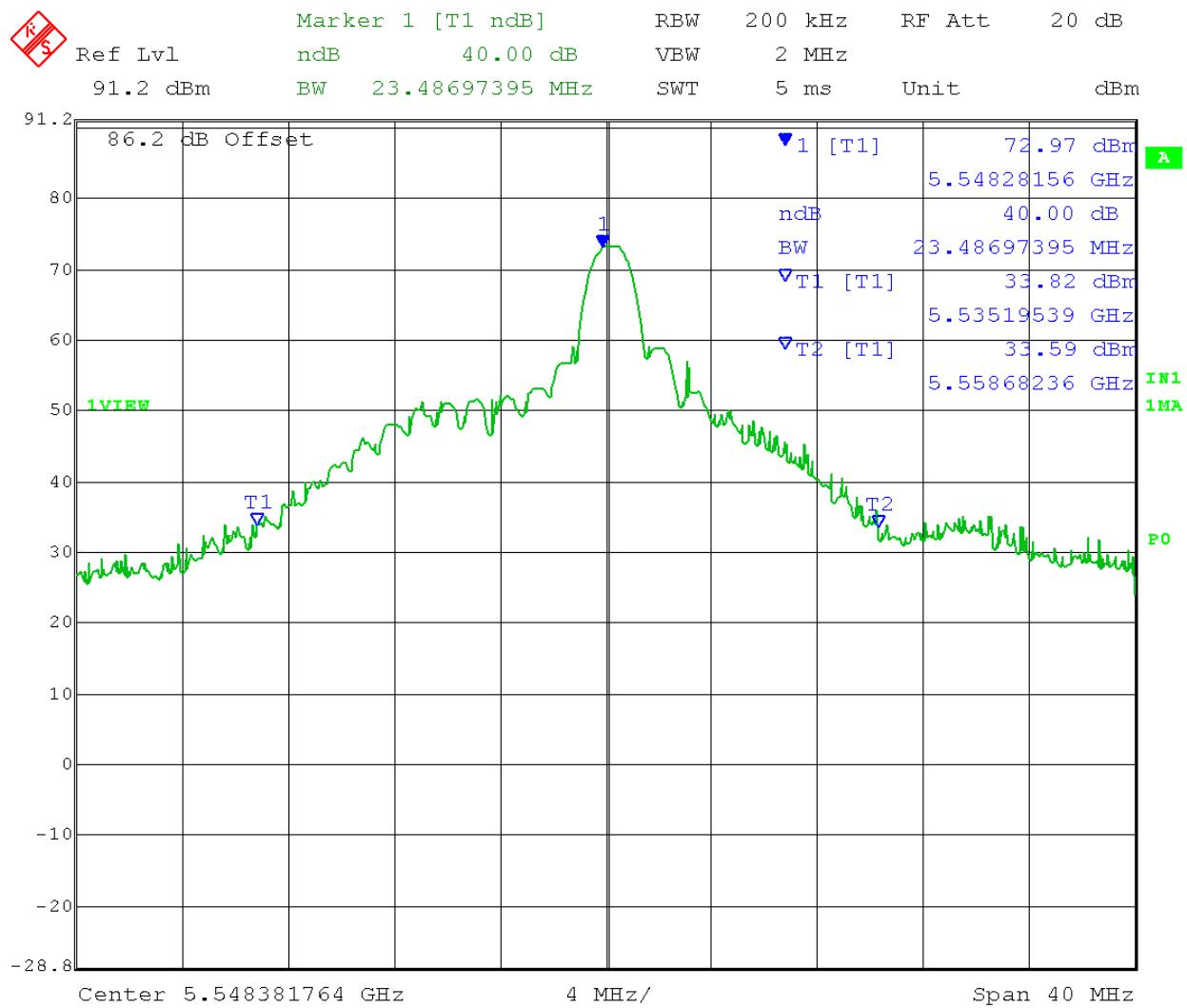
Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 11 of 30

MODULATION CHARACTERISTICS

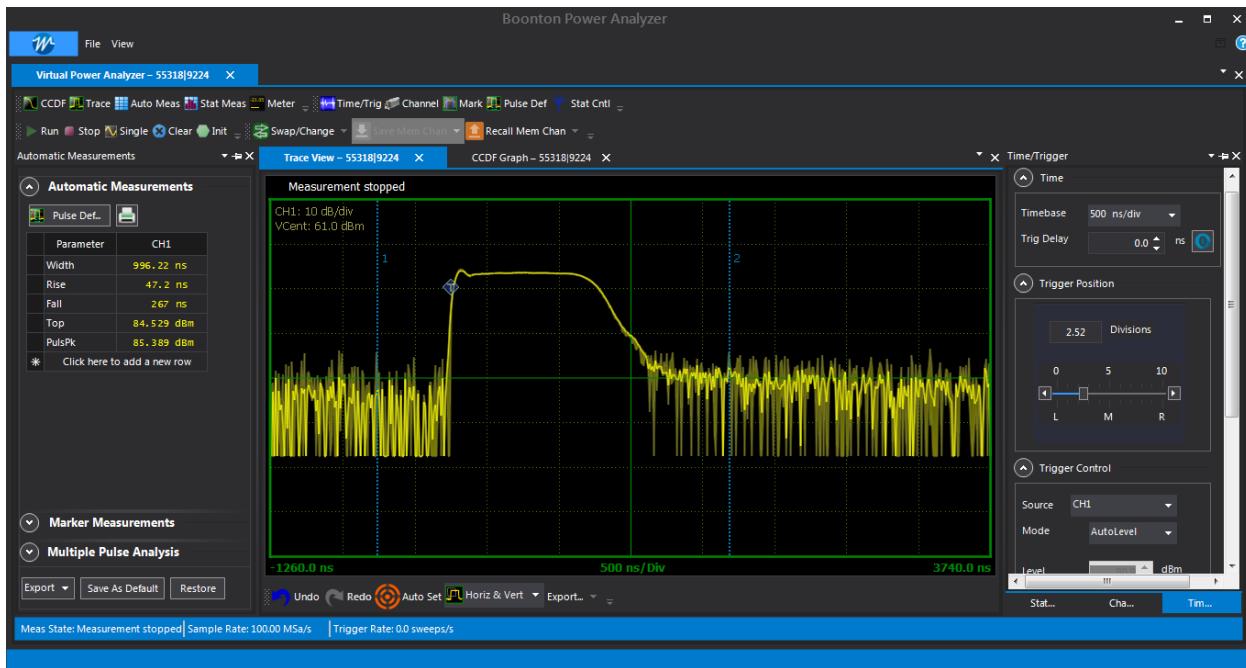
Test Data: 0.8 uS 40 dB BW Plot



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

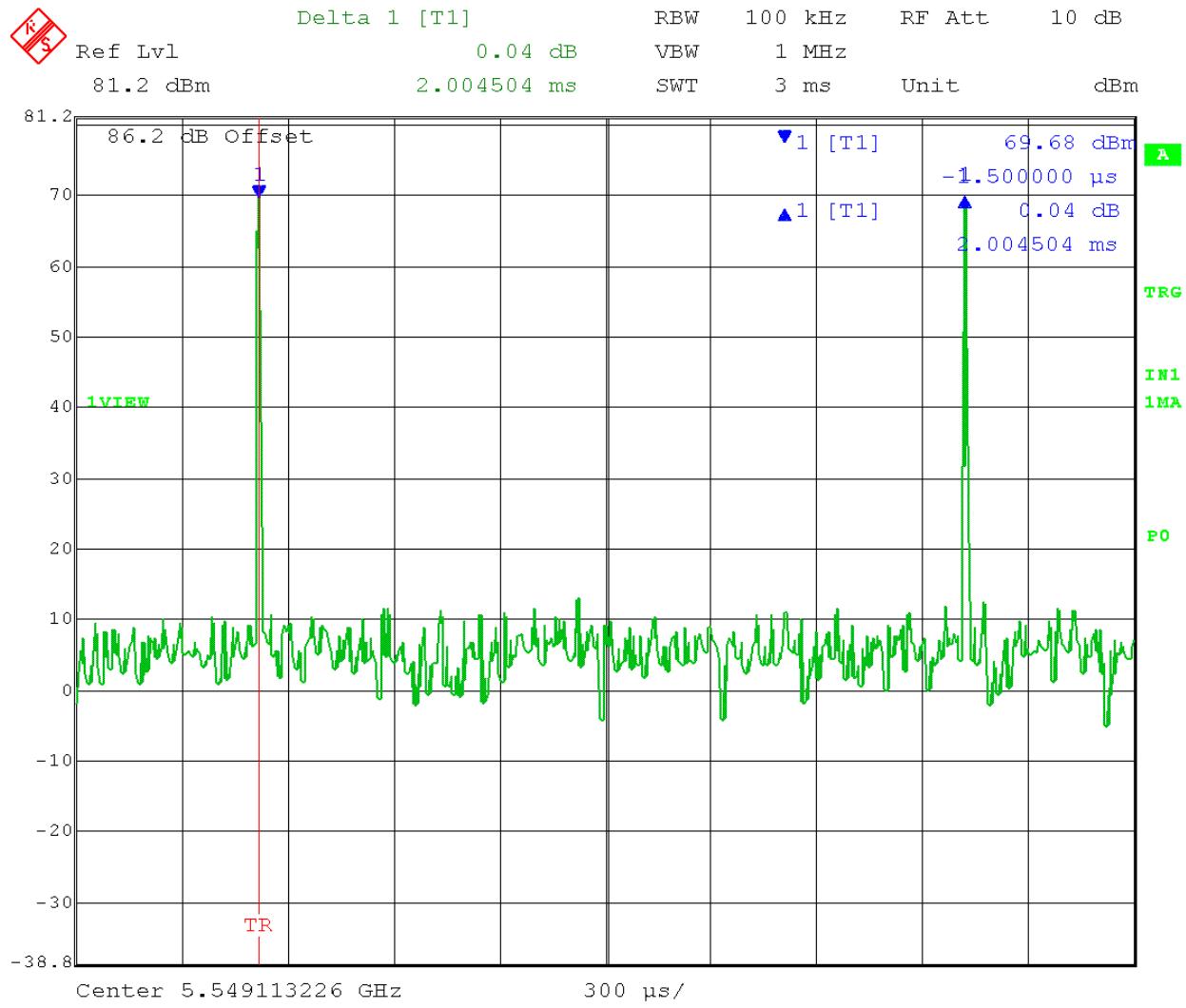
MODULATION CHARACTERISTICS

Test Data: 1 uS Pulse width Plot



MODULATION CHARACTERISTICS

Test Data: 1 uS Rep Rate Plot



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

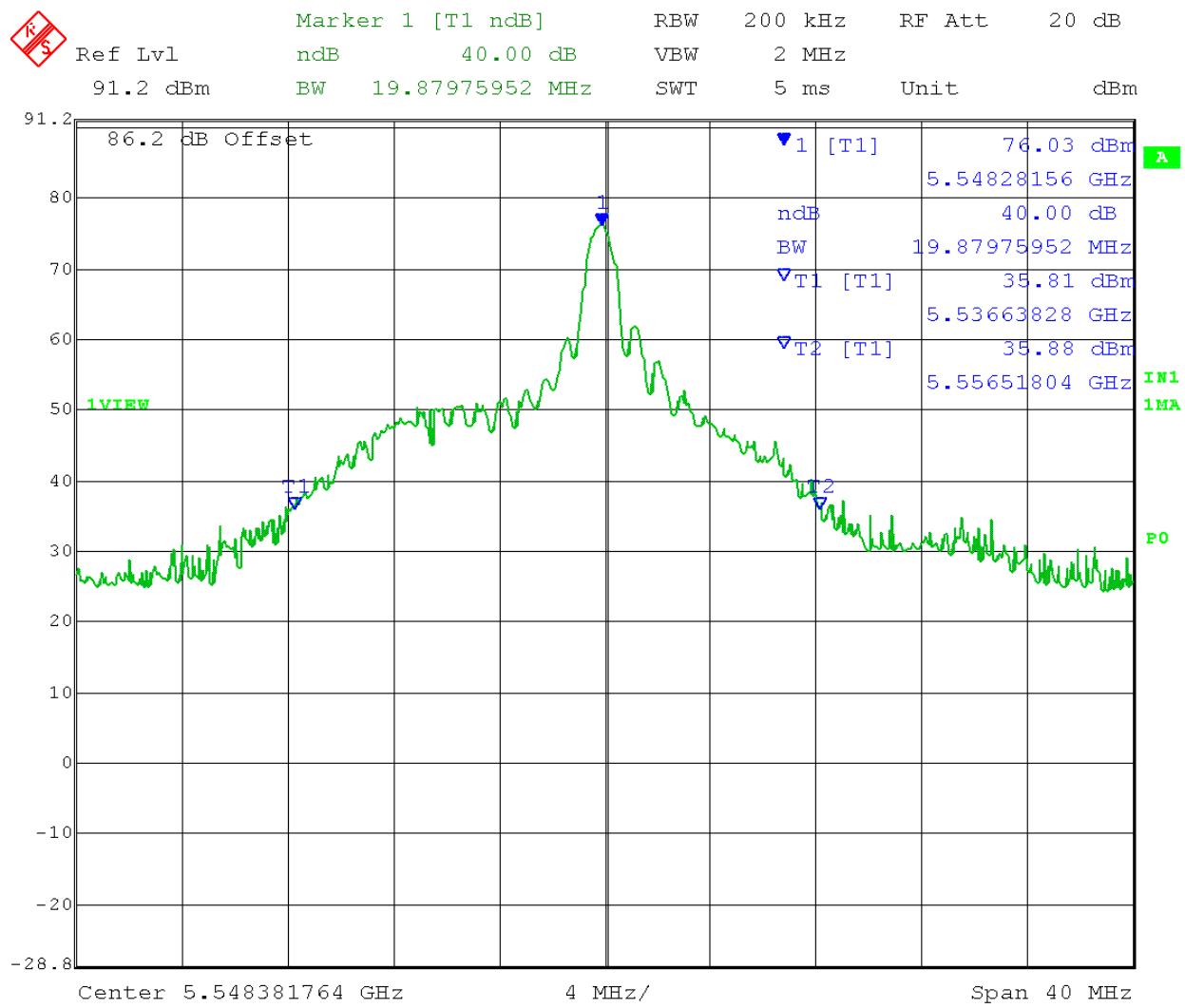
Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 14 of 30

MODULATION CHARACTERISTICS

Test Data: 1 uS 40 dB BW Plot



Date: 18.SEP.2017 14:10:49

MODULATION CHARACTERISTICS

Test Data: 2 uS Pulse width Plot



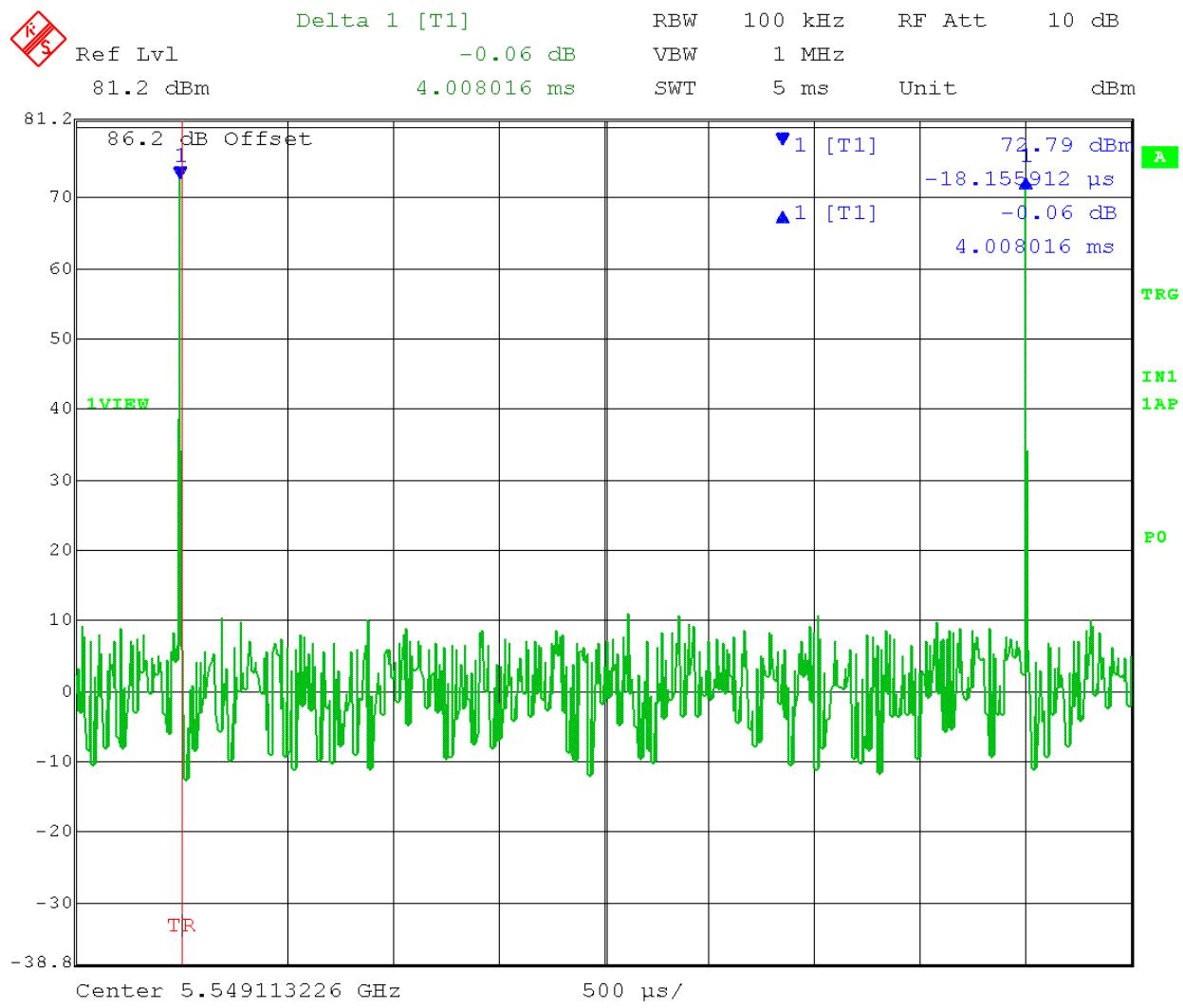
Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 16 of 30

MODULATION CHARACTERISTICS

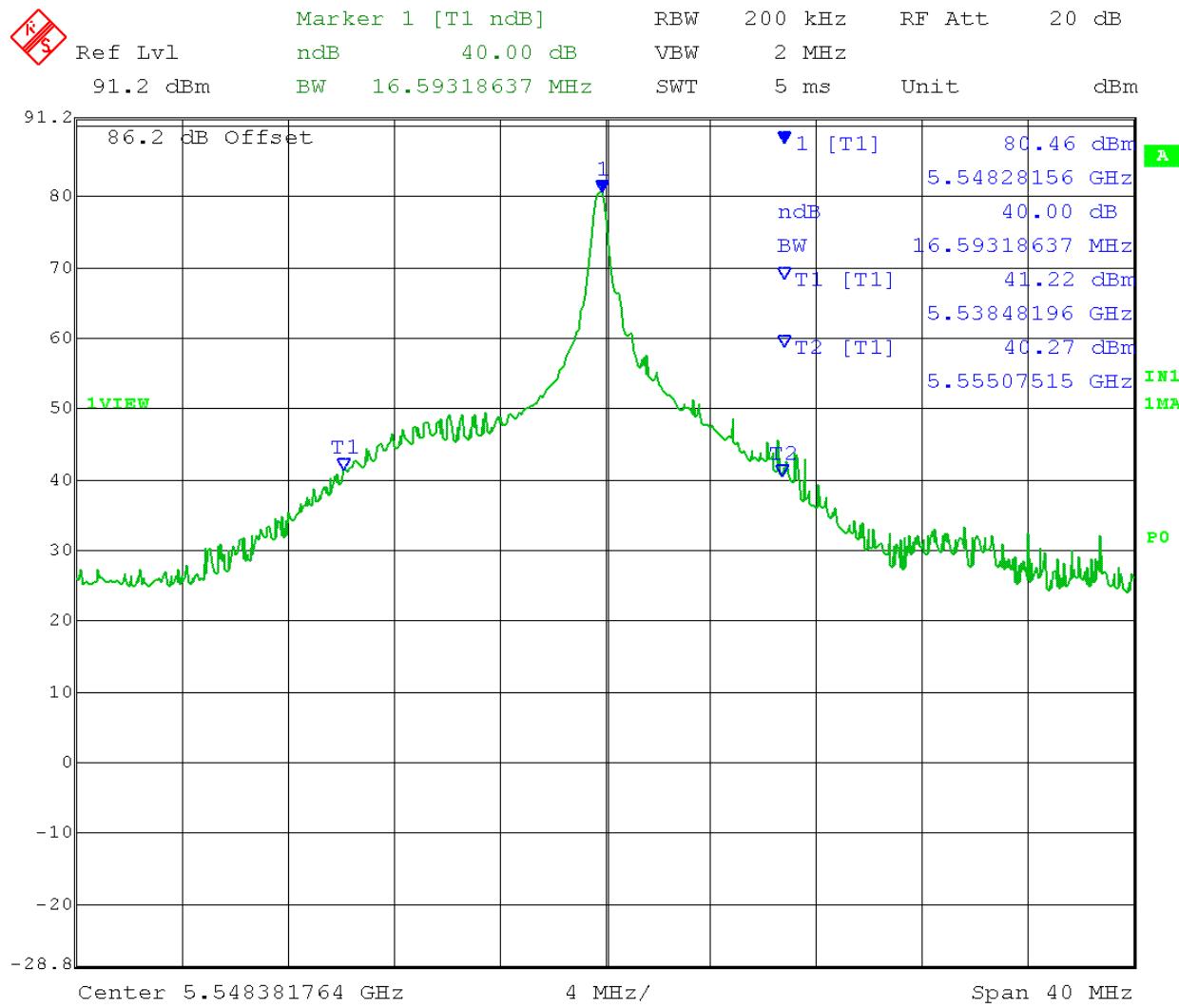
Test Data: 2 uS Rep Rate Plot



Date: 18.SEP.2017 15:34:34

MODULATION CHARACTERISTICS

Test Data: 2 uS 40 dB BW Plot



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

Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 18 of 30

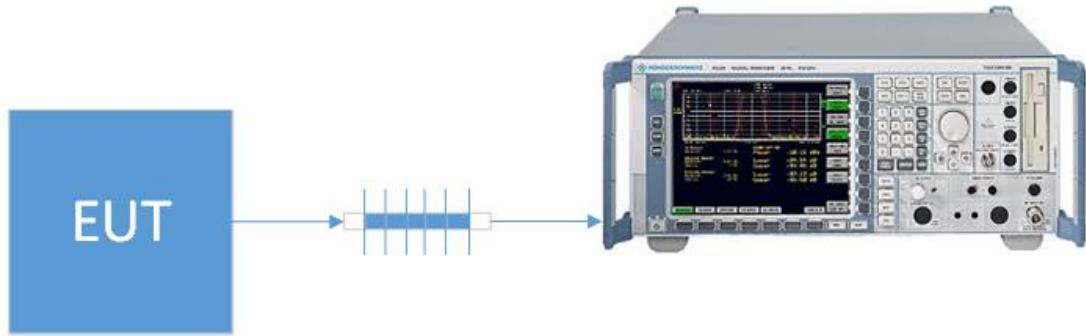
OCCUPIED BANDWIDTH

Rule Part No.: 2.1049

Requirements: 99% OBW, Reporting Only

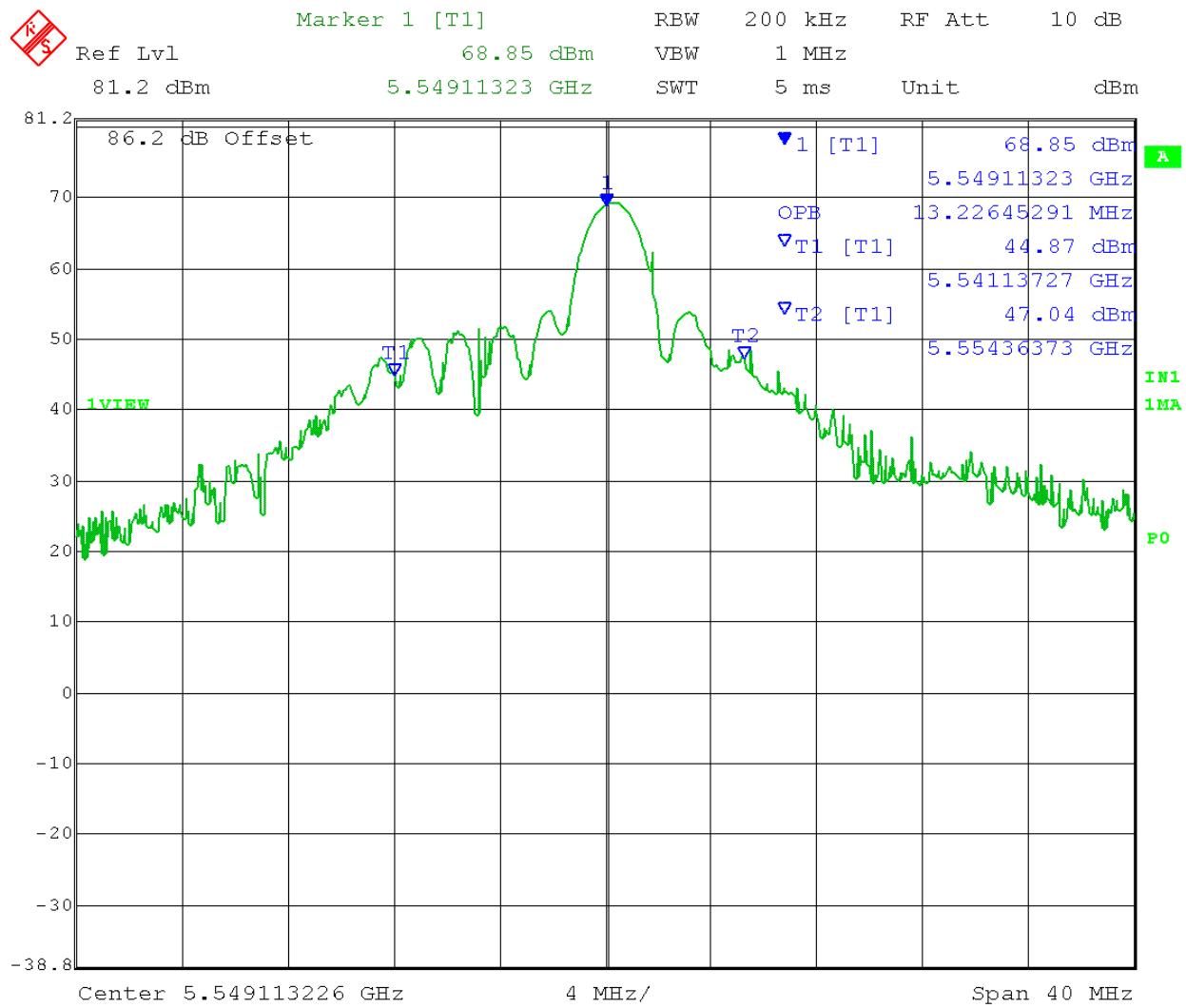
Procedure: ANSI/TIA-603

Setup Diagram:



OCCUPIED BANDWIDTH

Test Data: 0.4 uS 99% OBW Plot



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

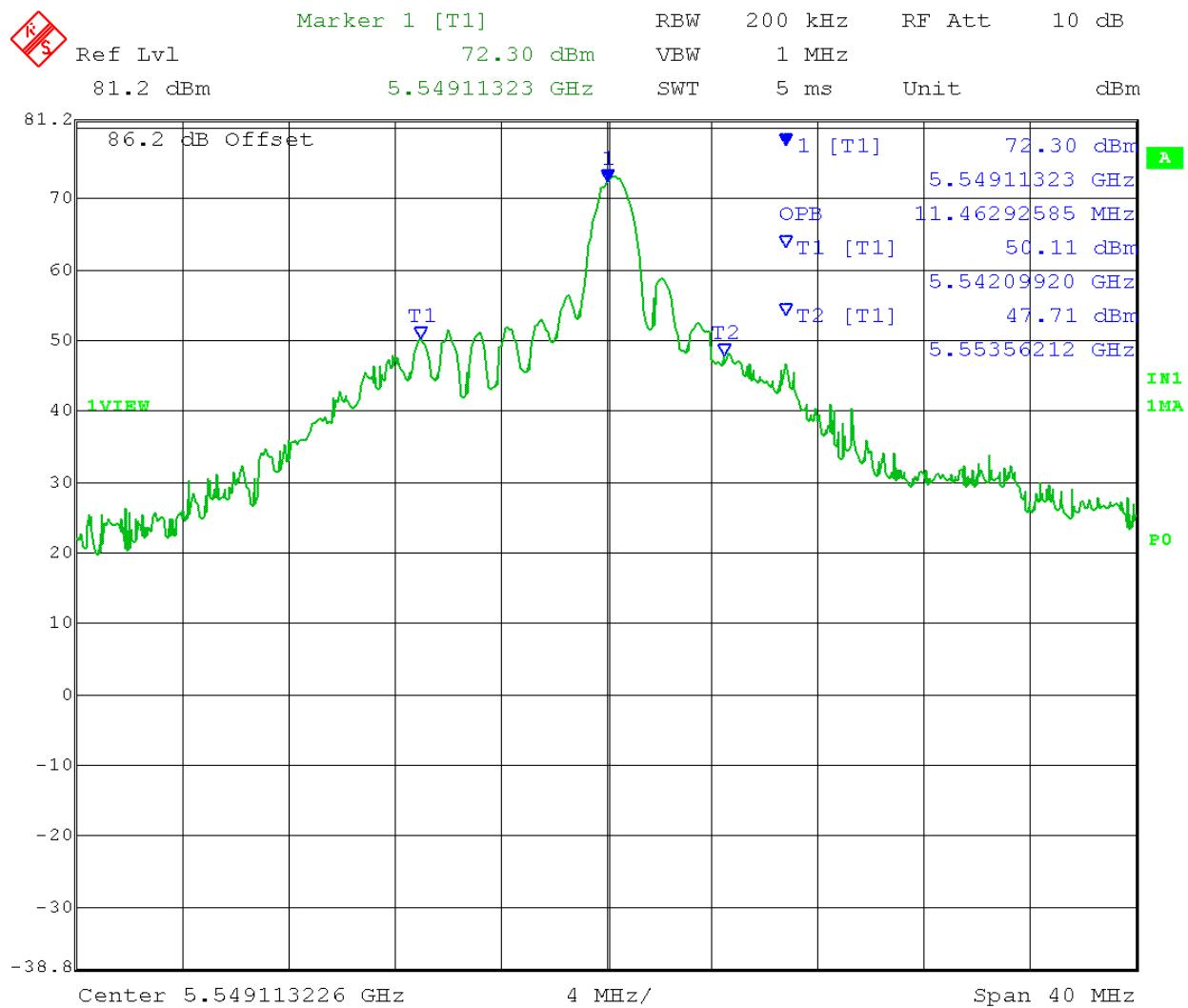
Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 20 of 30

OCCUPIED BANDWIDTH

Test Data: 0.8 uS 99% OBW Plot



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

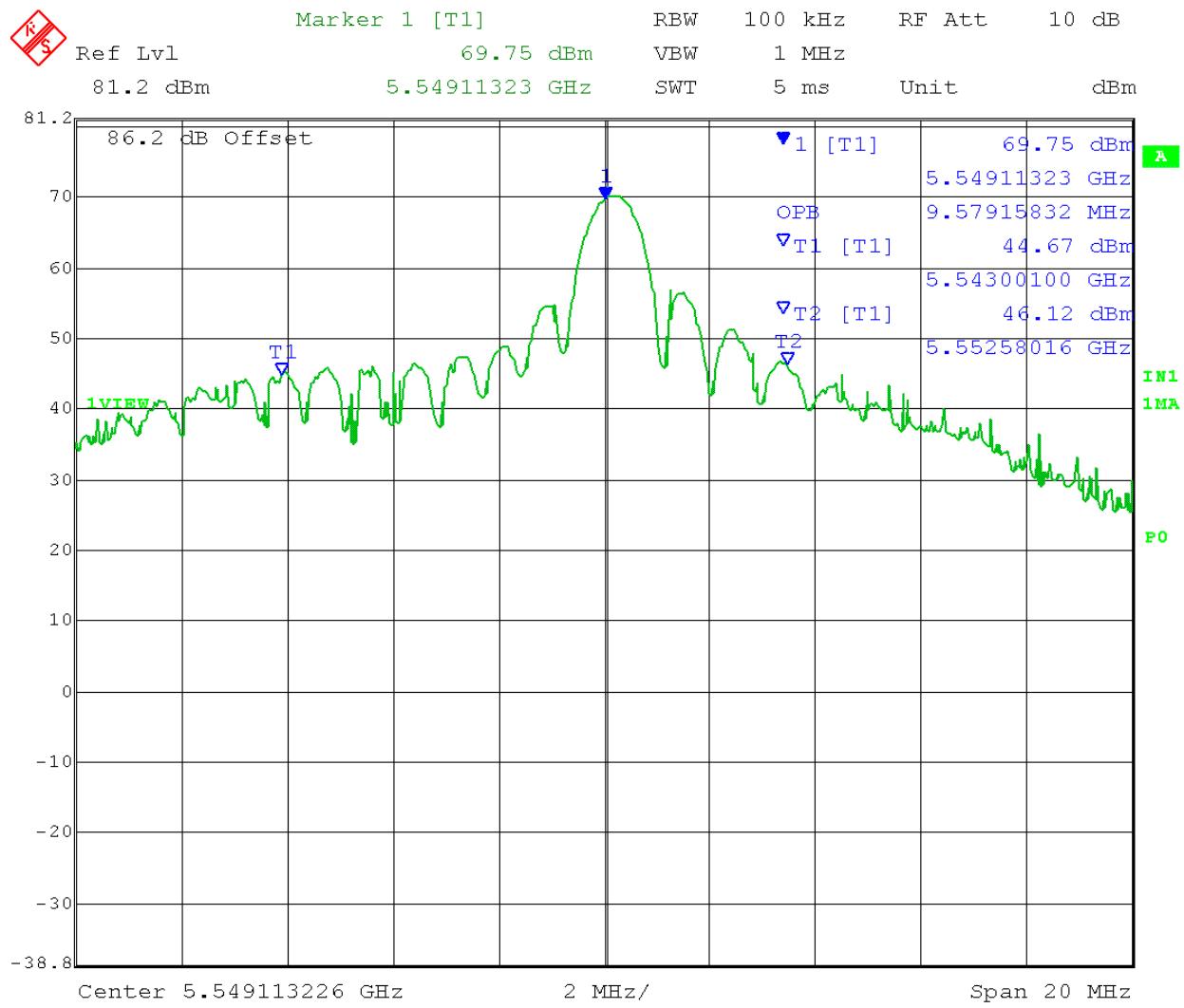
Applicant: BARON SERVICES INC.
FCC ID: NX5-GEN3-350CM
Report: 1676AUT17TestReport Rev2

Table Of Contents

Page 21 of 30

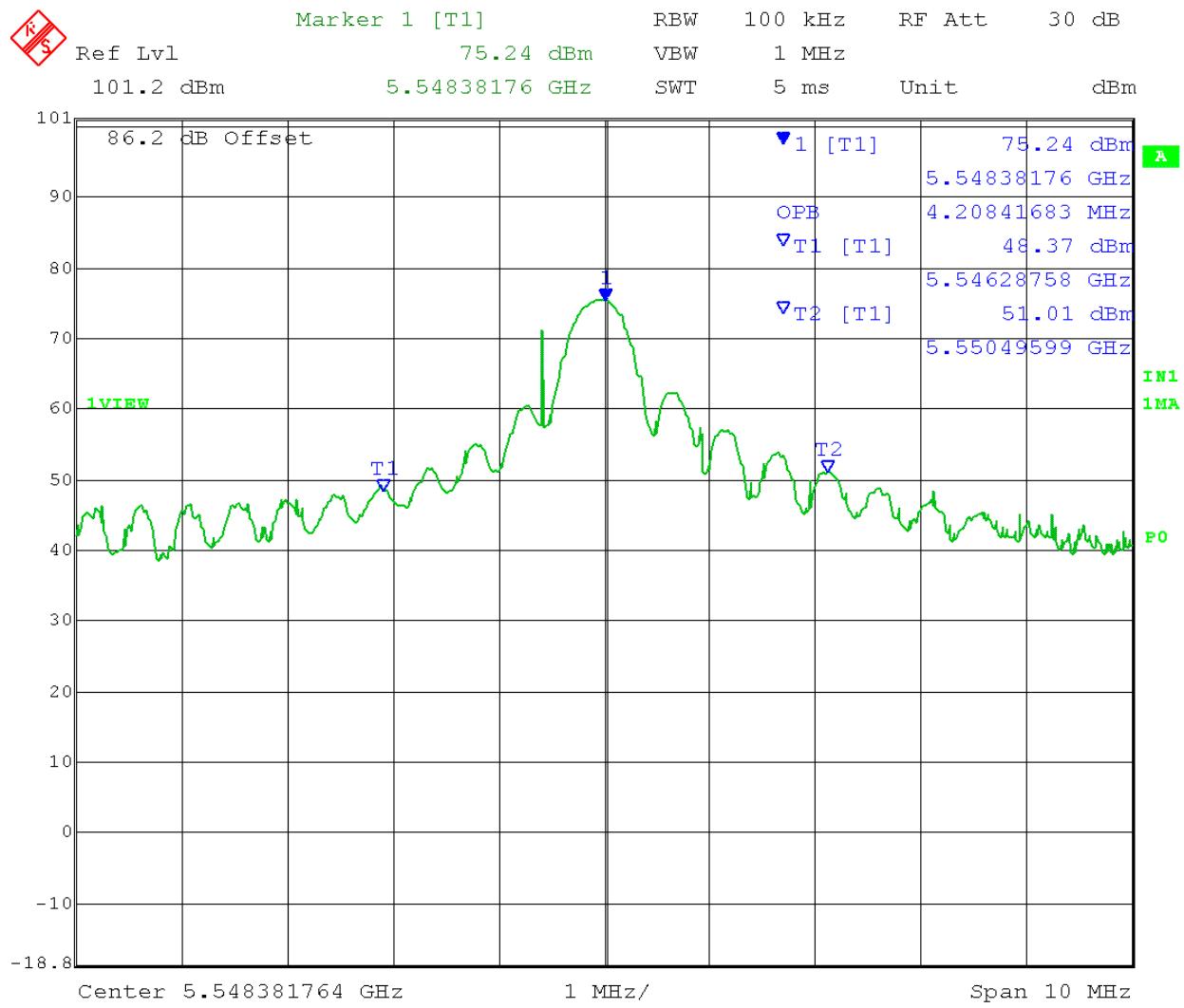
OCCUPIED BANDWIDTH

Test Data: 1 uS 99% OBW Plot



OCCUPIED BANDWIDTH

Test Data: 2 uS 99% OBW Plot



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

Applicant: BARON SERVICES INC.
 FCC ID: NX5-GEN3-350CM
 Report: 1676AUT17TestReport_Rev2

[Table Of Contents](#)

Page 23 of 30

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

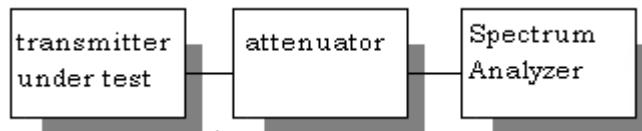
Rule Part No.: 2.1051, 90.210 (b) (3)

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

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

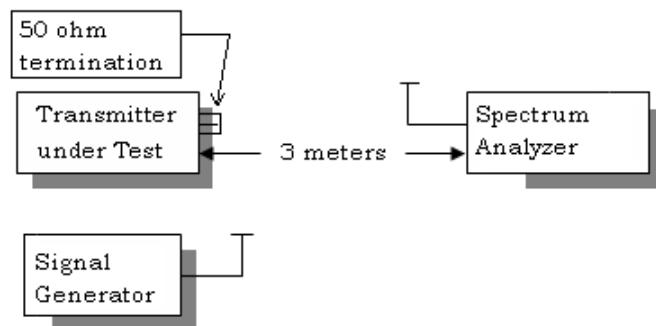
FIELD STRENGTH OF SPURIOUS EMISSIONS

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. Within 6kHz and 25kHz of audio Freq.	±1.88% ±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)	KMKG-0244-02 ; KMKG-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