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## FCC PART 90 TEST REPORT

<b>APPLICANT</b>	ROHILL TECHNOLOGIES B.V.
	Edisonstraat 12 7903 AN Hoozevee The Netherlands
<b>FCC ID</b>	2AGJ3R-8070-800MHZ
<b>MODEL NUMBER</b>	R-8070-800
<b>PRODUCT DESCRIPTION</b>	TETRA TRANSCEIVER
<b>DATE SAMPLE RECEIVED</b>	11/6/2015
<b>FINAL TEST DATE</b>	4/23/2016
<b>TESTED BY</b>	Cory Leverett
<b>APPROVED BY</b>	Sid Sanders
<b>TEST RESULTS</b>	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

Report Number	Version Number	Description	Issue Date
2334AUT15TestReport	Rev1	Initial Issue	1/27/2016
2334AUT15TestReport	Rev2	Updated low test frequency Data	

**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  
 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 at:

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

**Authorized Signatory Name:**



Cory Leverett  
Project Manager/Testing Technician

**Date: 4/23/2016**

**Approval Signatory Name:** \_\_\_\_\_



**5/17/2016**

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Applicant: ROHILL TECHNOLOGIES B.V.  
FCC ID: 2AGJ3R-8070-800MHZ  
Report: 2334AUT15TestReport\_Rev1

## GENERAL INFORMATION

### EUT Specification

<b>EUT Description</b>	TETRA TRANSCEIVER
<b>FCC ID</b>	2AGJ3R-8070-800MHZ
<b>Model Number</b>	R-8070-800
<b>Operating Frequency</b>	854-869 MHz
<b>Test Frequencies</b>	854.025, 862, 868.95
<b>Type of Emission</b>	22K0G1W
<b>Modulation</b>	Pi/4 DQPSK 36kbps
<b>EUT Power Source</b>	<input checked="" type="checkbox"/> 110–120Vac/50– 60Hz
	<input type="checkbox"/> DC Power 12V
	<input type="checkbox"/> Battery Operated Exclusively
<b>Test Item</b>	<input type="checkbox"/> Prototype
	<input type="checkbox"/> Pre-Production
	<input checked="" type="checkbox"/> Production
<b>Type of Equipment</b>	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
<b>Test Conditions</b>	The temperature was 24-26°C with a relative humidity of 50 - 65%.
<b>Modification to the EUT</b>	None
<b>Test Exercise</b>	The EUT was operated in a normal mode.
<b>Applicable Standards</b>	FCC CFR 47 Part 90, FCC 12-114
<b>Measurement Procedures</b>	ANSI/TIA 603-E:2016, FCC KDB 971168 v02r02
<b>Test Facility</b>	<b>Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.</b>

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## SUMMARY OT TEST RESULTS

<b>Rule Part No.</b>	<b>Test Item</b>	<b>Result</b>
2.1047(d)	Modulation Characteristics	Pass
90.635 (a), 2.1046	Maximum Conducted Power	Pass
90.209(b)(5), 2.1049	Occupied Bandwidth	Pass
90.221(a)(c), 2.1051	Adjacent Channel Power	Pass
90.221(d), 2.1051	Spurious Emissions At Antenna Terminals	Pass
90.221(d), 2.1053	Field Strength of Spurious Radiation	Pass
90.213(a), 2.1055	Frequency Stability	Pass

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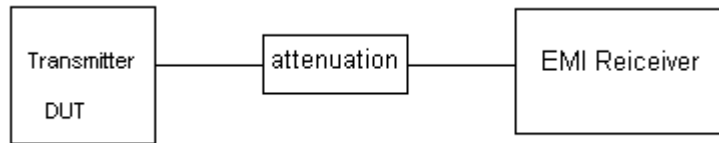
## RF POWER OUTPUT

**Rule Part No.:** Part 2.1046(a), Part 90.635 (a)

**Test Requirements:** Reporting only, geographical area dependent limit

**Method of Measurement:** KDB 971168 v02r02, § 5.1.1 EMI Receiver Peak Power measurement

### Test Setup Diagram:



### Test Data: ERP Conducted Power Output

Tuned Frequency (MHz)	RF POWER (W)	
	HI	LOW
854.025	43.4	-
862.00	43.4	-
868.95	43.4	-

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## MODULATION CHARACTERISTICS

Rule Part No.: 2.1047(d)

**Requirements:** A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed

**Test Data: Customer provided Description**

### Modulation characteristics¶

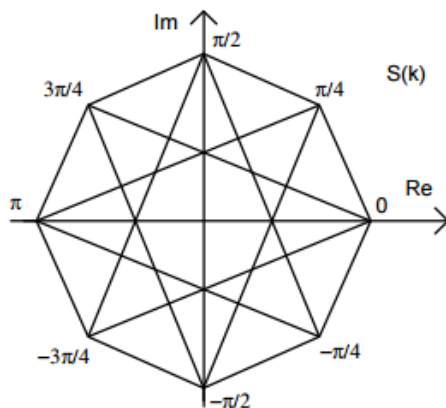
Part-2.1033(c)·Part-2.1033(c)·(4)·FCC-Part-90.209,·IC-RSS-119.5.5·FCC-Part-90.207¶

Type of Emission:  $\pi/4$ DQPSK·TETRA as defined in EN-300-392-2·TETRA is a digital, trunked radio technology that operates with Time-Division Multiple Access (TDMA) in four-slot channels within a twenty-five kilohertz bandwidth.¶

The modulation rate is 36 kbit/s. For  $\pi/4$ DQPSK modulation, the phase transitions are related to the modulation bits as shown in the table below:¶

B(2k-1)	B(2k)	$D\phi(k)$
1	1	$-3\pi/4$
0	1	$+3\pi/4$
0	0	$+\pi/4$
1	0	$-\pi/4$

Constellation diagram:¶



¶

¶

¶

**Audio frequency response**¶

¶

ACELP-digitally-encoded voice.¶

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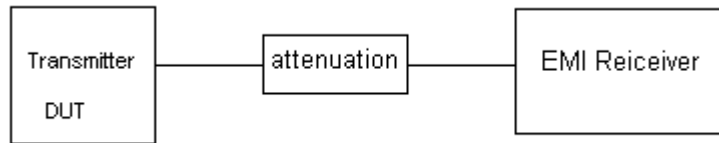
## OCCUPIED BANDWIDTH

**Rule Part No.:** 2.1049, 90.209 (b)(5)

**Requirements:** The Occupied Bandwidth must be  $\leq$  the authorized Bandwidth

**Method of Measurement:** KDB 971168 v02r02, § 4.2 Power BW 99% measurement

**Test Setup Diagram:**



**Test Data:** 99% Occupied Bandwidth Measurement Table

Tuned Frequency (MHz)	99% OBW (KHz)	Authorized BW (KHz)
854.025	20.23	$\leq 22$
862	20.33	
868.95	20.33	

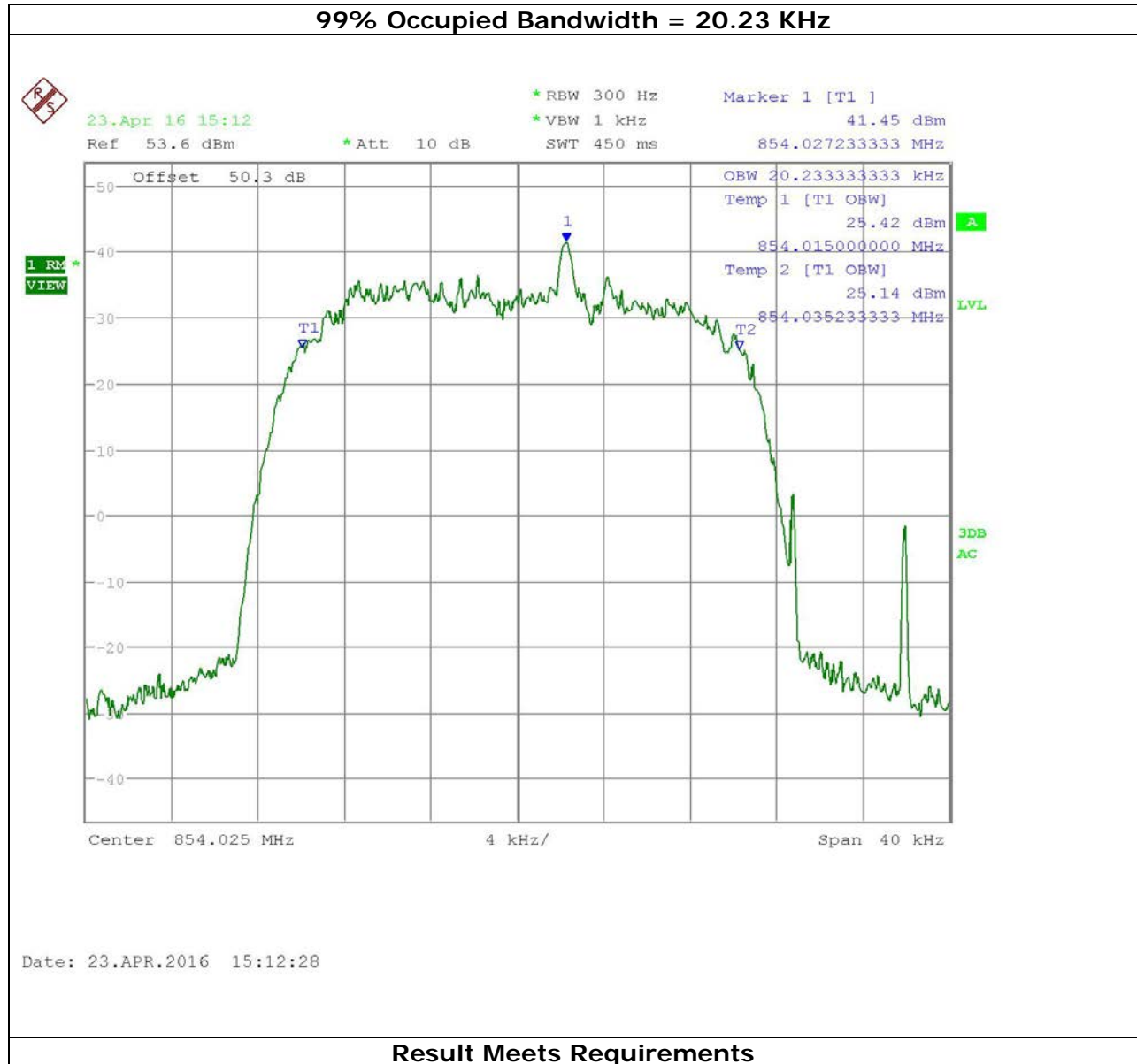
**Results Meet Requirements**

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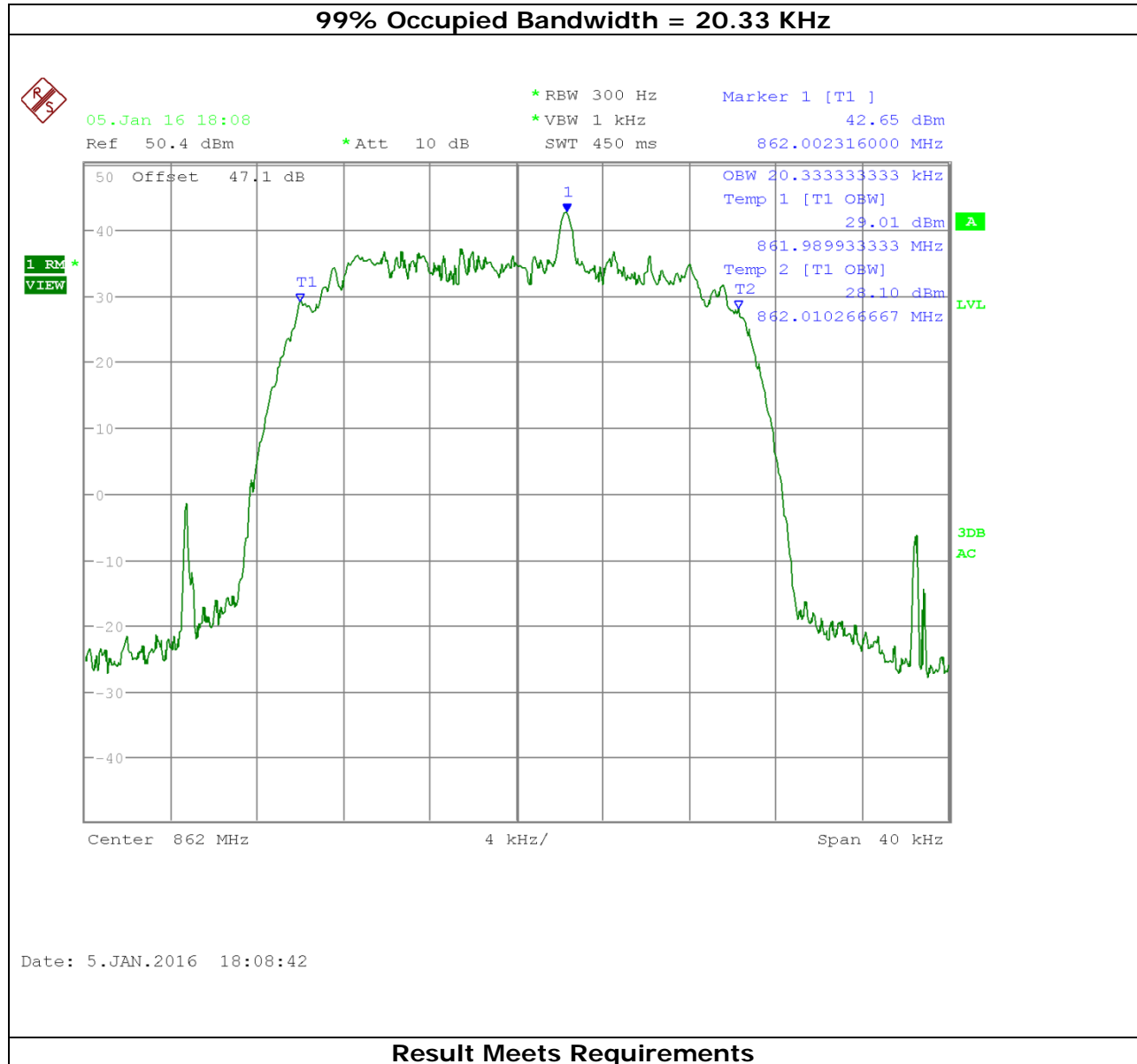
# OCCUPIED BANDWIDTH

Test Data: Low End of Band



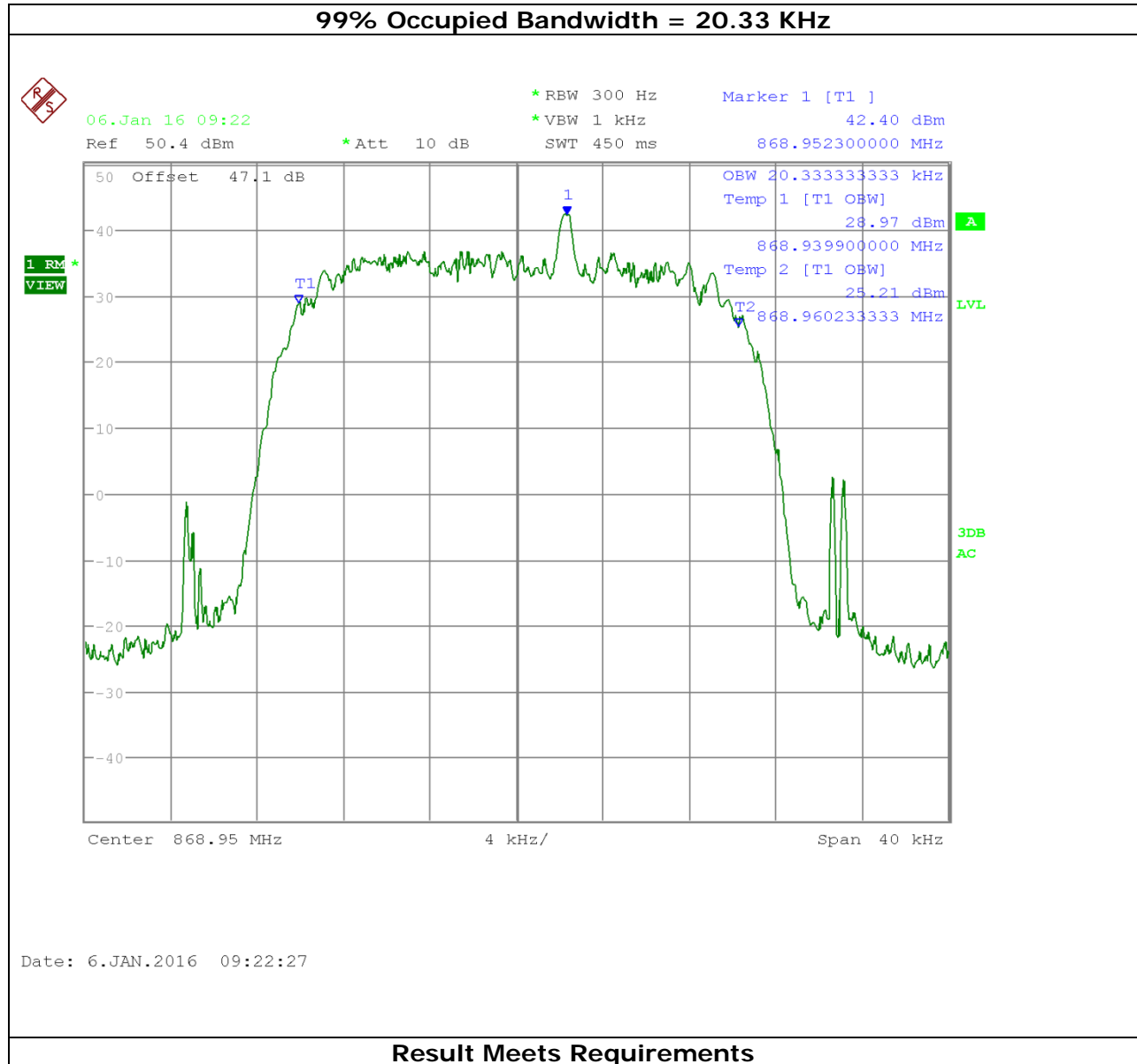
# OCCUPIED BANDWIDTH

Test Data: Middle of Band



# OCCUPIED BANDWIDTH

Test Data: High End of Band



## ADJACENT CHANNEL POWER (ACP)

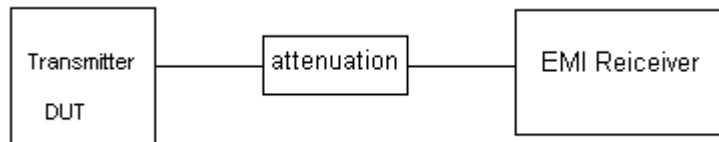
**Rule Parts. No.:** 90.221(a) & (c)

**Requirements:** Operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

Max ACP levels for frequencies in the 854-869 MHz band		
Frequency Offset (KHz)	Max ACP for devices < 15 Watts (dBc)	Max ACP for devices < 15 Watts (dBc)
25	-55	-55
50	-65	-65
75	-65	-70

**Method of Measurement:** The EUT was configured at maximum power and modulation and connected to a EMI receiver through a cable and attenuator. The EMI receiver is capable of automatic ACP testing. The TETRA radio standard test function was configured per the requirements and used for this test.

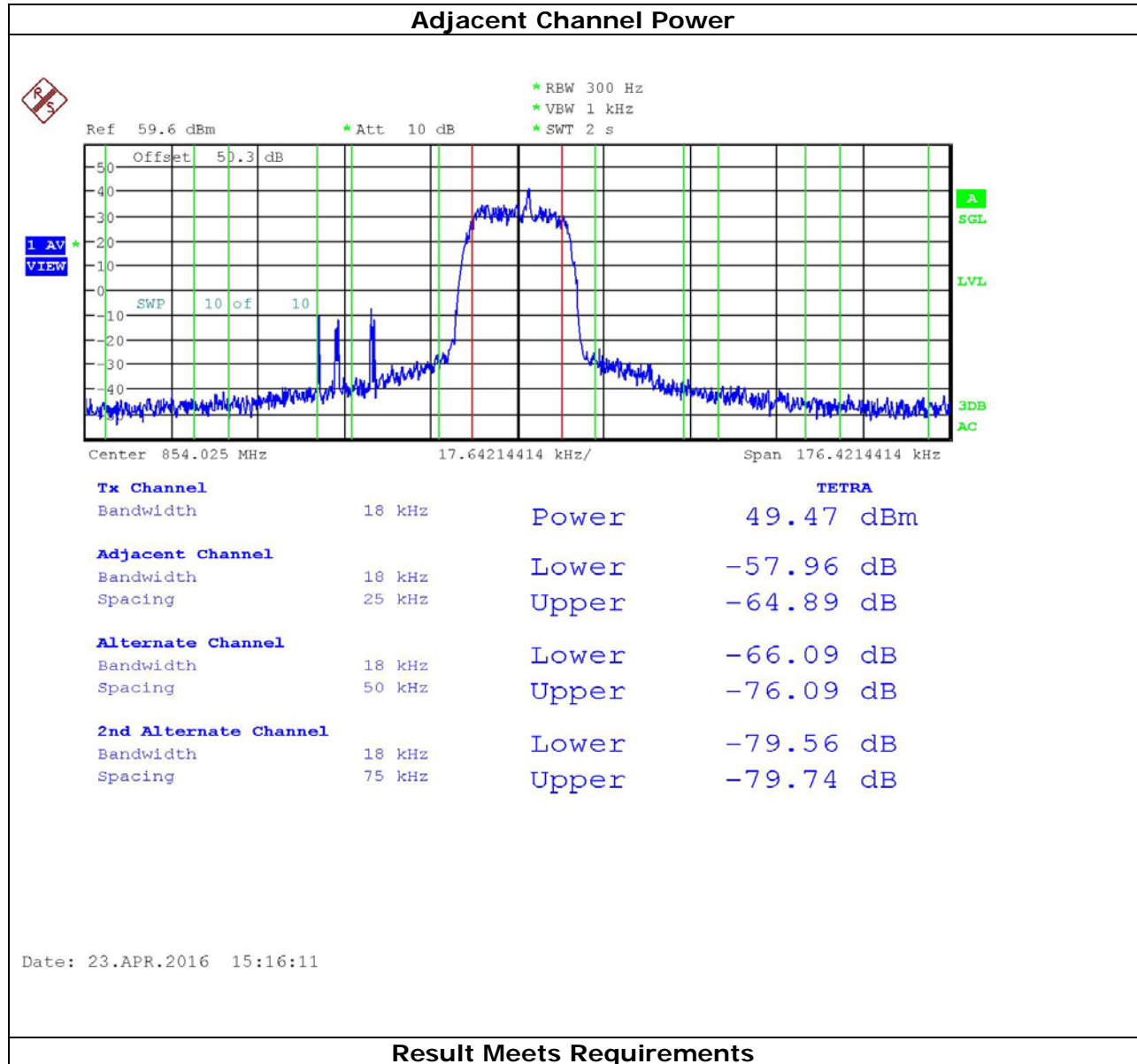
### Test Setup Diagram:



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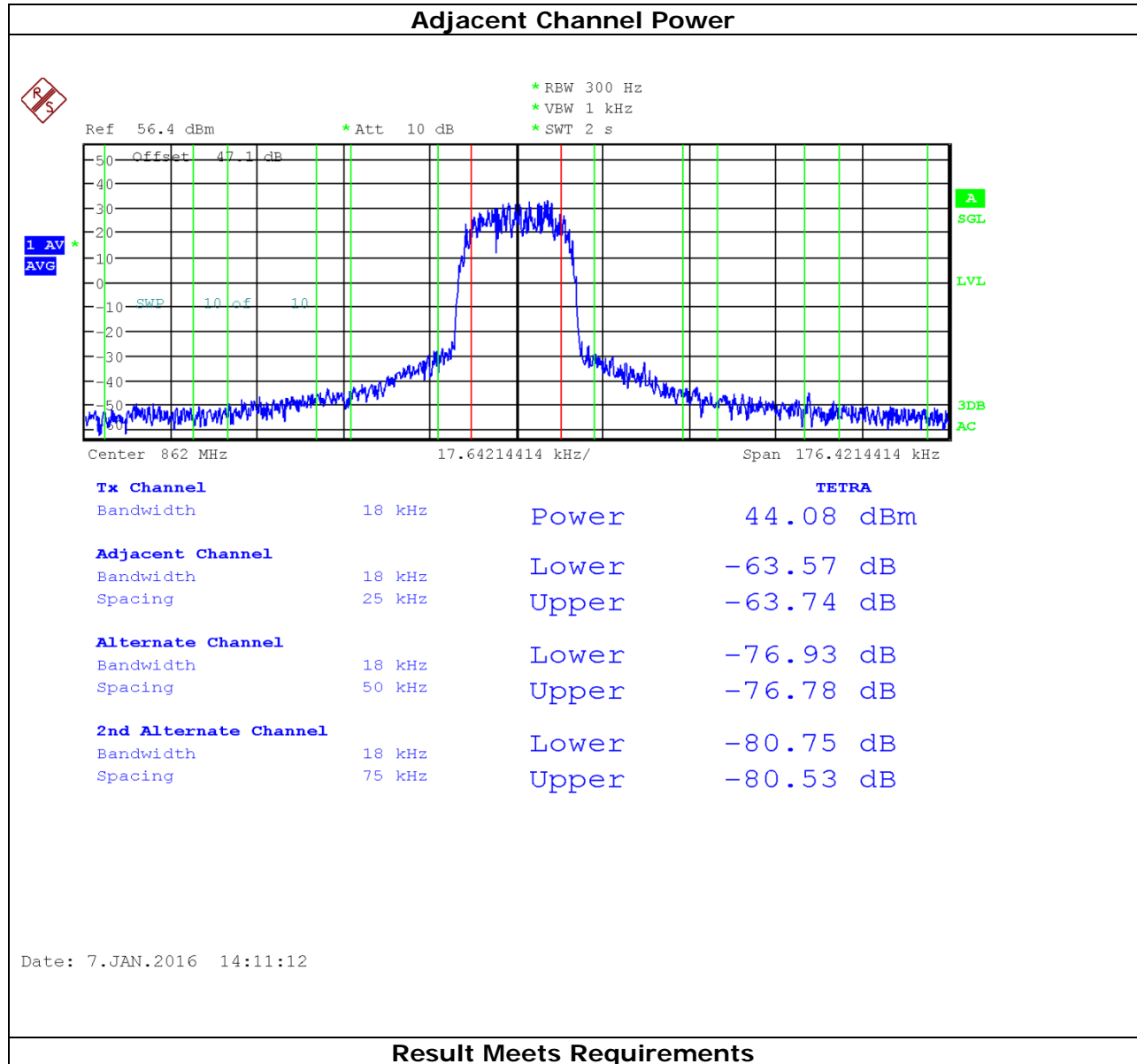
# ADJACENT CHANNEL POWER (ACP)

Test Data: Low End of Band



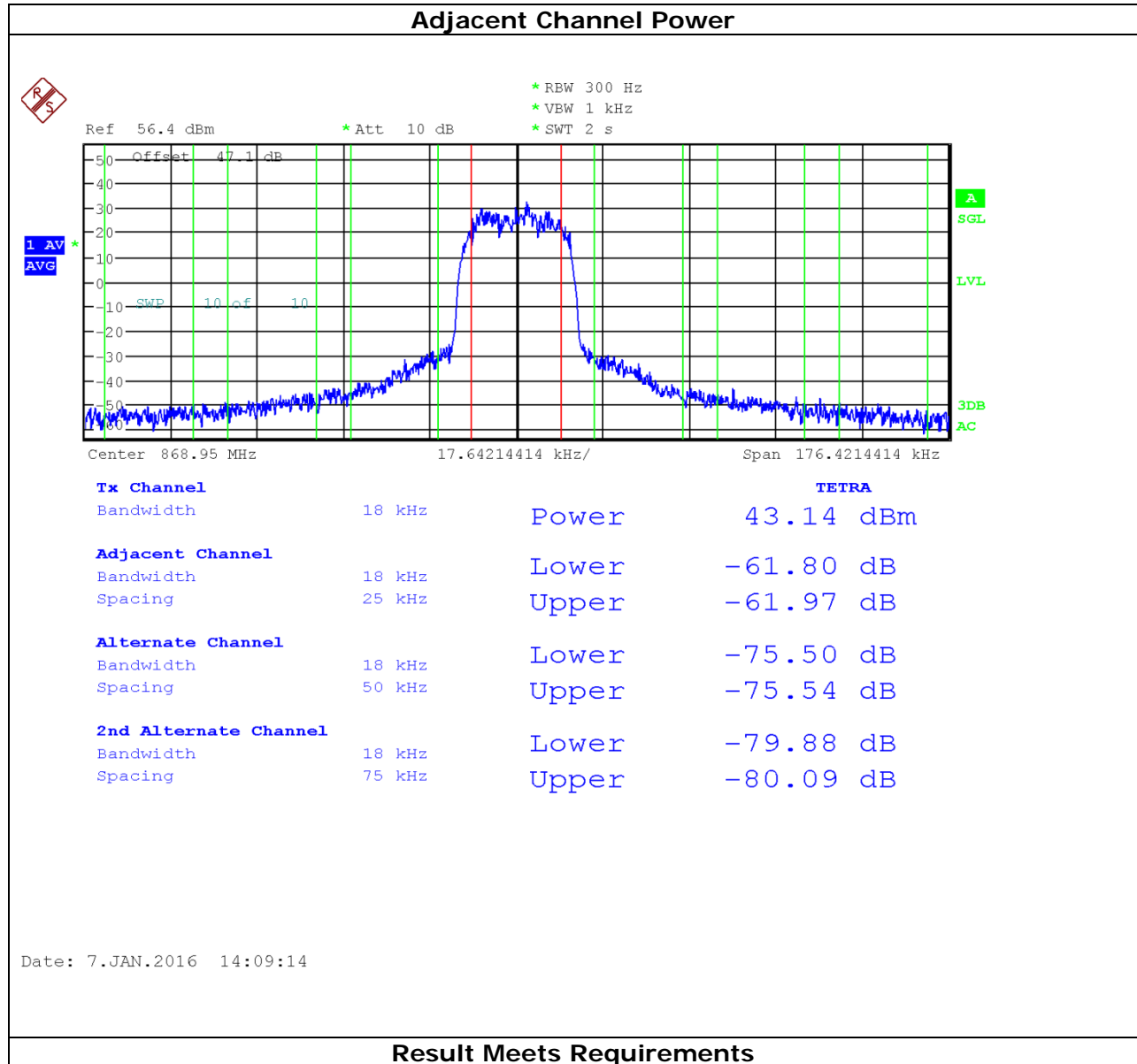
# ADJACENT CHANNEL POWER (ACP)

Test Data: Middle of Band



# ADJACENT CHANNEL POWER (ACP)

Test Data: High End of Band



## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

**Rule Part No.:** Part 2.1051(a), 90.221 (d)

**Requirements:** On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least  $43 + 10 \log$  (Pwatts) dB.

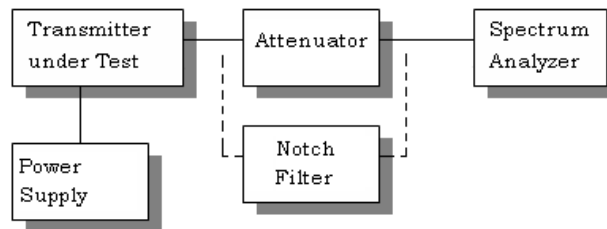
$$43 + 10 \log (39.4) = 58.95 \text{ dBc}$$

$$43 + 10 \log (39.8) = 59.00 \text{ dBc}$$

$$43 + 10 \log (41.1) = 59.14 \text{ dBc}$$

**Method of Measurement:** ANSI/TIA 603 § 2.2.13 Conducted Spurious

**Test Setup Diagram:**



**Test Data: Low End of Band**

	dBm	dBm	Watts
Power Output	46.4	46.4	43.4
	Frequency	dBm	dBc
	854.025	45.95	0
	1708.05	-56.8	103.2
	2562.075	-38.97	85.37
	3416.1	-47.56	93.96
*	4270.125	-59.4	105.8
*	5124.15	-59.19	105.59
*	5978.175	-58.51	104.91
*	6832.2	-58.41	104.81
*	7686.225	-58.32	104.72
*	8540.25	-58.71	105.11

\* Indicates only the noise floor was present

**Results meet requirements**

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## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: Middle of Band

	dBm	dBm	Watts
Power Output	46.4	46.4	43.4
	Frequency	dBm	dBc
	862	46.4	0
	1724	-58.77	105.17
	2586	-49.2	95.6
	3448	-57.01	103.41
*	4310	-58.48	104.88
*	5172	-58.13	104.53
*	6034	-58.48	104.88
*	6896	-58.33	104.73
*	7758	-58.4	104.8
*	8620	-58.47	104.87

\* Indicates only the noise floor was present

Results meet requirements

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## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: High End of Band

	dBm	dBm	Watts
Power Output	46.4	46.4	43.4
	Frequency	dBm	dBc
	868.95	46.4	0
	1737.9	-51.9	98.3
	2606.85	38.9	7.5
	3475.8	-56.76	103.16
*	4344.75	-58.27	104.67
*	5213.7	-58.72	105.12
*	6082.65	-58.97	105.37
*	6951.6	-58.99	105.39
*	7820.55	-58.42	104.82
*	8689.5	-58.73	105.13

\* Indicates only the noise floor was present

√ Results meet requirements

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## FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

**Rule Parts. No.:** Part 2.1053, 90.221 (d)

**Requirements:** On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least  $43 + 10 \log$  (Pwatts) dB.

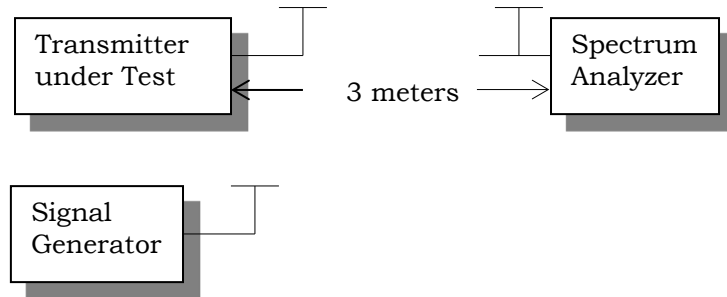
$$43 + 10 \log (39.4) = 58.95 \text{ dBc}$$

$$43 + 10 \log (39.8) = 59.00 \text{ dBc}$$

$$43 + 10 \log (41.1) = 59.14 \text{ dBc}$$

**METHOD OF MEASUREMENT:** The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603 using the substitution method. Measurements were made at the test site of **TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.**

**Test Setup Diagram:**



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Applicant: ROHILL TECHNOLOGIES B.V.  
FCC ID: 2AGJ3R-8070-800MHZ  
Report: 2334AUT15TestReport\_Rev1

## FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

Rule Parts. No.: Part 2.1053

Test Data: High End of Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	IC Requirement dB	Bandwidth - BW - kHz
868.95	Hi	46.4	43.4	59.14	25.00
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin		
1,737.95	V	95.74	36.37		
2,606.93	H	66.17	6.80		
3,475.90	H	92.75	33.38		
4,344.88	V	93.13	33.76		
5,213.85	H	95.11	35.74		
6,082.83	V	90	30.63		
6,951.80	H	91.41	32.04		
7,820.78	V	90.68	31.31		
8,689.75	H	86.41	27.04		

**Note:** 3 places in the band were investigated and the worst case reported

**Results meet requirements**

## FREQUENCY STABILITY

**Rule Parts. No.:** Part 2.1055, Part 90.213 (a)

**Requirements:** Temperature range requirements: -30 to +50° C.

Voltage Variation +, -15%

851-854 MHz  $\pm 1.0$  PPM

854-869 MHz  $\pm 1.5$  PPM

**Method of Measurements:** ANSI/TIA 603 section 2.2.2 Carrier Frequency Stability

**Test Data: High End of Band**

Temperature	Frequency MHz	Cycles	PPM
25°C (reference)	868.975843		
-30°C	868.975966	123	0.142
-20°C	868.975948	105	0.121
-10°C	868.975918	75	0.086
0°C	868.975903	60	0.069
10°C	868.975912	69	0.079
20°C	868.975888	45	0.052
30°C	868.975849	6	0.007
40°C	868.975864	21	0.024
50°C	868.975858	15	0.017
Battery Voltage	Frequency	Cycles	PPM
-15%	868.975846	3	0.003
15%	868.975849	6	0.007

**Results Meet Requirements**

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## EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
24 Volt Power Supply	Astron	VLS-25M	9510040 NO	NA	NA
12 Volt Power Supply	Astron	RS-12A	9312779 NO	NA	NA
Antenna: Biconnical	Eaton	94455-1	1057 YES	11/18/15	11/18/17
DC Power Supply	HP	6264B	2032A04119 NO	NA	NA
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	08/19/14	08/19/16
Digital Multimeter	Fluke	77	35053830	10/21/15	10/21/17
Frequency Counter Large Chamber	HP	5352B	2632A00165 NO	07/01/15	07/01/17
CHAMBER	Panashield	N/A	N/A	02/18/2016	08/18/2018
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	06/13/14	06/13/16
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
Antenna: Active Loop	ETS-Lindgren	6502	00062529 YES	11/18/15	11/18/17
Hygro-Thermometer	Extech	445703	0602	06/30/15	06/30/17
Attenuator N 30dB 150W DC-6G	Narda	769-30	10267	06/26/15	06/26/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/14/16	04/14/18
Sweep/Signal Generator	Anritsu	68369B	985112	10/28/15	10/28/17

### \*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

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