ENGINEERING TEST REPORT

Product Marketing Name (PMN): Pulsar radar R86 26 GHz
Hardware Version Identification Number (HVIN): R86
FCC ID: LPN-R86

Applicant:

Magnetrol
705 Enterprise St.
Aurora, IL 60504
USA

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.209

UltraTech's File No.: 17MGNT010_F15C209

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: April 24, 2017	
Report Prepared by: Dan Huynh Issued Date: April 24, 2017	Tested by: Hung Trinh Test Dates: April 18, 2017

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by any agency of the US Government.*
- *This test report shall not be reproduced, except in full, without a written approval from UltraTech*

TABLE OF CONTENTS

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Sec. 15.209.
Title:	Code of Federal Regulations (CFR), Title 47 Telecommunication, Part 15, Subpart C - Intentional Radiators
Purpose of Test:	To gain FCC Equipment Certification for FCC Part 15.209.
Test Procedures:	ANSI C63.4 and/or ANSI C63.10
Environmental Classification:	Commercial, industrial or business environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	2017	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 Radio Frequency Devices
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	Magnetrol
Address:	705 Enterprise St Aurora IL 60504 USA
Contact Person:	David Wittenborn Phone #: 630-969-4000 ext 6538 Fax #: 630-969-9489 Email Address: dwittenborn@magnetrol.com

Manufacturer	
Name:	Magnetrol
Address:	705 Enterprise St Aurora IL 60504 USA
Contact Person:	David Wittenborn Phone #: 630-969-4000 ext 6538 Fax #: 630-969-9489 Email Address: dwittenborn@magnetrol.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Magnetrol International Inc.
HVIN:	R86
Model Name or Number:	R86-511A-110
Serial Number:	Test sample
Type of Equipment:	Level Probing Radar
Input Power Supply Type:	24V DC
Primary User Functions of EUT:	Level probing radars operate inside an enclosure containing the substance being measured

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Fixed
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	24 V DC
Field Strength:	n/a
Operating Frequency Range:	25.8 GHz
RF Output Impedance:	50 Ω
Modulation Type:	Pulsed radar
Antenna Connector Type:	Integral

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

The EUT is equipped with the 1.5 inch or 2 inch antenna, the unit with highest gain antenna will be used for compliance testing.

Antenna Description		
Antenna:	# 1	#2
Manufacturer:	Magnetrol	Magnetrol
Type:	Horn	Horn
Model:	R86 1.5" Horn	R86 2" Horn
Frequency Range:	24050MHz to 26500MHz	24050MHz to 26500MHz
Impedance:	50 ohm	50 ohm
Gain:	18.7dBi	20.7dBi

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	24 VDC	1	Terminal block	Non-Shielded

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

None.

2.7. GENERAL TEST SETUP

TLPR Radiated Emissions Test Setup

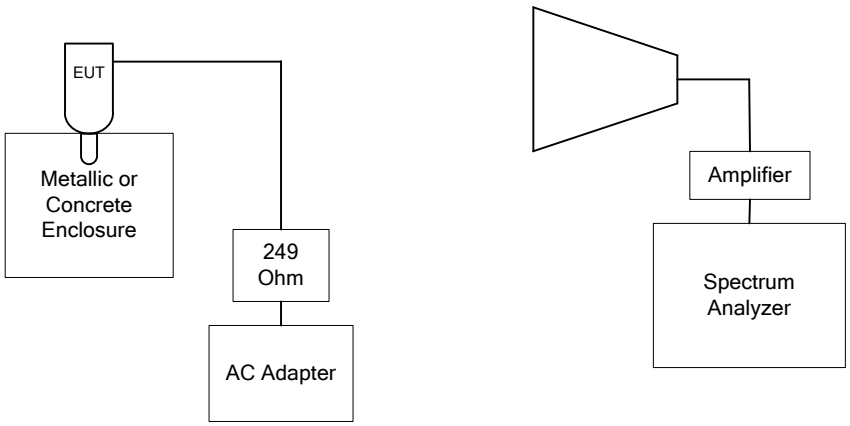

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power input source:	24 VDC

3.2. OPEPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The EUT was configured for continuous transmission for the duration of testing.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signals:	
Frequency Band(s):	25.8 GHz
Test Frequency(ies):	25.8 GHz
Transmitter Wanted Output Test Signals:	
▪ RF Power Output (measured maximum output power):	n/a
▪ Normal Test Modulation:	Pulsed radar
▪ Modulating signal source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2020-03-27.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Regulations	Test Requirements	Compliance (Yes/No)
15.203 & 15.204	The transmitter shall utilize a dedicated or integrated transmit antenna and installation requirement of LPR	Yes*
15.209	Radiated emission limits; general requirements	Yes
1.1307	RF Exposure	N/A**

* The EUT complies with the requirements; it employs integral antenna and is in compliance with the installation requirement.

** Device is categorically excluded from routine environmental evaluation for RF exposure.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. RADIATED EMISSIONS [47 CFR 15.209(a)]

5.1.1. Limits

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

§15.209(a) Radiated emission limits; general requirements

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§15.231 and 15.241.		

5.1.2. Method of Measurements

ANSI C63.4.

5.1.3. Test Data

Remark(s):

- Test results are for inside metallic and concrete tanks enclosure, a metallic tank was used to demonstrate worst case for resonances and any unwanted tank radiation leakage.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.

Frequency (MHz)	Measured Field Strength @ 3 m (dBµV/m)	Detector Used (Peak/QP/Avg)	Antenna Plane (H/V)	§ 15.209 Field Strength Limits (dBµV/m)	Margin (dB)
30 - 100000	*	Peak	V/H	*	*
* No unwanted emission detected that are in excess of 20 dB below the specified limit. Verified at test distance of 30 cm.					

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
EMI Receiver	Rohde & Schwarz	ESU40	100037	20 Hz to 40 GHz	8 May 2017
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	5 Dec 2018
Pre Amplifier	Com-Power	Pam-118A	551052	500 MHz to 18 GHz	14 July 2017
Amplifier	Spacek Labs	SLKKa-30-6	6D26	18–40 GHz	Note 1
Biconilog Antenna	EMCO	3142	9601-1005	26 – 3000 MHz	12 May 2017
Horn Antenna	EMCO	3115	9911-6570	1GHz – 18 GHz	10 Oct 2018
Horn Antenna	ETS-Lindgren	3160-09	00118385	18 – 26.5 GHz	11 Oct 2018
Horn Antenna	ETS-Lindgren	3160-10	00102686	26.5 – 40 GHz	11 Oct 2018
AC Adapter	Triad	WDU24-500	--	--	--
DC Power Supply	Tenma	72-7295	490300270	0-40 VDC	Note 1
Multi-meter	Extech	EX530	12070737	0.01mV - 1kV	14 May 2017
Environmental Chamber	Envirotronics	SSH32C	11994847-S-11059	-60 to 177 ºC	2 Jun 2017
Horn Antenna & Mixer	OML	WR-19	U30625-1	Band U 40-60 GHz	Note 2
Horn Antenna & Mixer	OML	E Band	E30625-1	Band E 60-90 GHz	Note 2
Horn Antenna & Mixer	OML	WR-08	F30625-1	Band F 90-140 GHz	Note 2

Note 1: Internal Verification/Calibration check

Note 2: Dimensions Verified on use

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.79**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.87**	**Under consideration**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	**Under consideration**