

Exhibit B: Test Report
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines

Project Number: 04309-10

Prepared for:
Liquid Combustion Technology
315 Hawkins Road
Travelers Rest , SC 29690

By

Professional Testing (EMI), Inc.
1601 FM 1460, Suite B
Round Rock, Texas 78664

February 2004

CERTIFICATION
Electromagnetic Interference Test Report
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines
(Intentional Radiator Portion)

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THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF PROFESSIONAL TESTING (EMI), INC.



Certificate of Compliance

Applicant: Liquid Combustion Technology
Applicant's Address: 315 Hawkins Road
Travelers Rest, SC 29690
Model Number: HQ-TJ-901
FCC ID: RRGLCT901
Project Number: 04309-10
Test Dates: February 4, 2004

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data and this report. I believe them to be true and accurate.

The **Liquid Combustion Technology, Remote Control Transmitter for Small Non-Road Engines** was tested to and found to be in compliance with FCC Part 15 Subpart C for an Intentional Radiator.

The highest emissions generated by the above equipment are listed below:

	<u>Frequency (MHz)</u>	<u>Level (dBμV/m)</u>	<u>Limit (dBμV/m)</u>	<u>Margin (dB)</u>
Fundamental	315	70.5	75.6	-5.1
Spurious	945	55.5	61.9	-6.4
Occupied Bandwidth	KHz		KHz	KHz
	26		787	761

Jeffrey A. Lenk
President

This report has been reviewed and accepted by Liquid Combustion Technology. The undersigned is responsible for ensuring that **Liquid Combustion Technology, Remote Control Transmitter for Small Non-Road Engines** will continue to comply with the FCC rules.

1.0 EUT Description

The Equipment under Test (EUT) is the **Liquid Combustion Technology, Remote Control Transmitter for Small Non-Road Engines**. The **Remote Control Transmitter for Small Non-Road Engines** is a battery powered remote control transmitter that can be used to activate engines like a Gasoline Generator. It transmits to a receiver that activates a starter. The EUT has a permanently installed telescopic antenna. The EUT operates at 315 MHz and is designed for compliance with 47 CFR 15.231 of the FCC rules. Specific test requirements for this device include the following:

47 CFR 15.209 & 15.231	Fundamental Transmit Power
47 CFR 15.231 & 15.205	Spurious Radiated Power
47 CFR 15.231	Occupied Bandwidth
47 CFR 15.203	Antenna Requirement

The system tested consisted of the following:

<u>Manufacturer & Model</u>	<u>Model #</u>	<u>FCC ID #</u>	<u>Description</u>
Liquid Combustion Technology, Remote Control Transmitter for Small Non-Road Engines	HQ-TJ-901	RRGLCT901	Remote Control Transmitter

System Peripherals:

None

Class II Power Transformer

1.1 EUT Operation

The **Liquid Combustion Technology, Remote Control Transmitter for Small Non-Road Engines** was put in a mode to transmit continuously to facilitate the testing process. This is an atypical mode.

2.0 Electromagnetic Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing.

2.1 Radiated Emissions Measurements

Radiated emission measurements were made of the Fundamental and Spurious Emission levels for the **Liquid Combustion Technology, Remote Control Transmitter for Small Non-Road Engines**. Measurements of the occupied bandwidth were also made for the Transmitter.

Measurements of the maximum emission levels for the fundamental and the spurious/harmonic emissions of the **Liquid Combustion Technology Remote Control Transmitter for Small Non-Road Engines** were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental for the device were performed to determine the worst case polarization of the devices.

2.2.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. For spurious/harmonic measurements above 1 GHz, the measurement antenna was placed 1 meter from the EUT. The radiated emissions were maximized by rotating the EUT.

A Spectrum Analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. A drawing showing the test setup is given as Figure 1.

2.2.2 Test Criteria

The table below shows FCC Part 15.231 radiated limits for an intentional radiator operating at 315 MHz band. FCC Part 15.231 allows the use of its spurious limit which is higher than the 15.209 limit normally associated with the restricted bands outlined in 15.205. The spurious measurements of the harmonic were performed to the 8th harmonic of the fundamental. The reference distance for each limit is also shown in this table.

<u>Signal Type</u>	<u>Test Distance (Meters)</u>	<u>Field Strength</u>	
		<u>(μV/m)</u>	<u>(dBμV/m)</u>
Fundamental 315 MHz	3	6042	75.6
Harmonics (through 3rd)	3	6042	55.6

Note: Radiated emissions above 1000 MHz were measured at 1 meter and the limit was increased by 9.5 dB.

2.2.3 Test Results

The radiated test data for the fundamental is included in Appendix A. Measurements were made using Peak detection. Duty cycle measurements indicated a .79% duty cycle, resulting in a 2dB reduction for averaging. The EUT passed the required criteria utilizing Peak detection, with no averaging correction factor applied. The radiated emission test data for the harmonics is included in Appendix A. The emissions were maximized at each frequency and the highest emissions identified were measured using peak detection. The radiated emissions generated by the **Liquid Combustion Technology Remote Control Transmitter for Small Non-Road Engines** are below the FCC Part 15.231 maximum emission criteria.

3.0 Occupied Bandwidth Measurements

Measurements of the occupied bandwidth for the fundamental signals of the FCC Part 15.231 were made at the Professional Testing's Round Rock, Texas site. All measurements were made in a controlled indoor environment in a configuration which did not present measurement distortion or ambient interference.

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor. The table was rotated to an angle which presented the highest signal level. The occupied bandwidth was measured on the device. The occupied bandwidth was based on a 20 dB criteria (20 dB down either side of the emission from the peak emission).

3.2 Test Criteria

According to FCC Part 15.231, the bandwidth of the emission shall not be wider than 0.25 % of the center frequency for the devices operating above 70 MHz and below 900 MHz. The limit is .787 MHz for the transmitter working at 315 MHz.

Measurement of the occupied bandwidth was performed to verify that the emission bandwidth from the EUT did not exceed .787 MHz. The typical occupied bandwidth for the module is 26 kHz.

3.3 Test Results

The occupied bandwidth test data is included in Appendix B. The occupied bandwidth for the fundamental frequency 315 MHz is 25.3 KHz. The figure is typical for the **Remote Control Transmitter for Small Non-Road Engines**. This occupied bandwidth complies with the FCC Part 15.231 requirement.

4.0 Antenna Requirement

An analysis of the **Liquid Combustion Technology Remote Control Transmitter for Small Non-Road Engines** was performed to determine compliance with Section 15.203 of the Rules. This section requires specific handling and control of antennas used for devices subject to regulations under the Intentional Radiator portions of Part 15.

4.1 Evaluation Procedure

The structure and application of the **Liquid Combustion Technology Remote Control Transmitter for Small Non-Road Engines** were analyzed with respect to the rules.

The EUT has an permanently installed telescopic antenna. The antenna is not accessible to the user. No auxiliary antenna port is present.

4.2 Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

- (a) Antenna be permanently attached to the unit.
- (b) Antenna must use a unique type of connector to attach to the EUT.
- (c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

4.3 Evaluation Results

The **Remote Control Transmitter for Small Non-Road Engines** meets the criteria of this rule by virtue of having an internal antenna not accessible to the user. The EUT is therefore compliant with §15.203.

5.0 Modifications to Equipment

The following modification was made on the **Remote Control Transmitter for Small Non-Road Engines** during the performance of the test program in order to meet the FCC criteria.

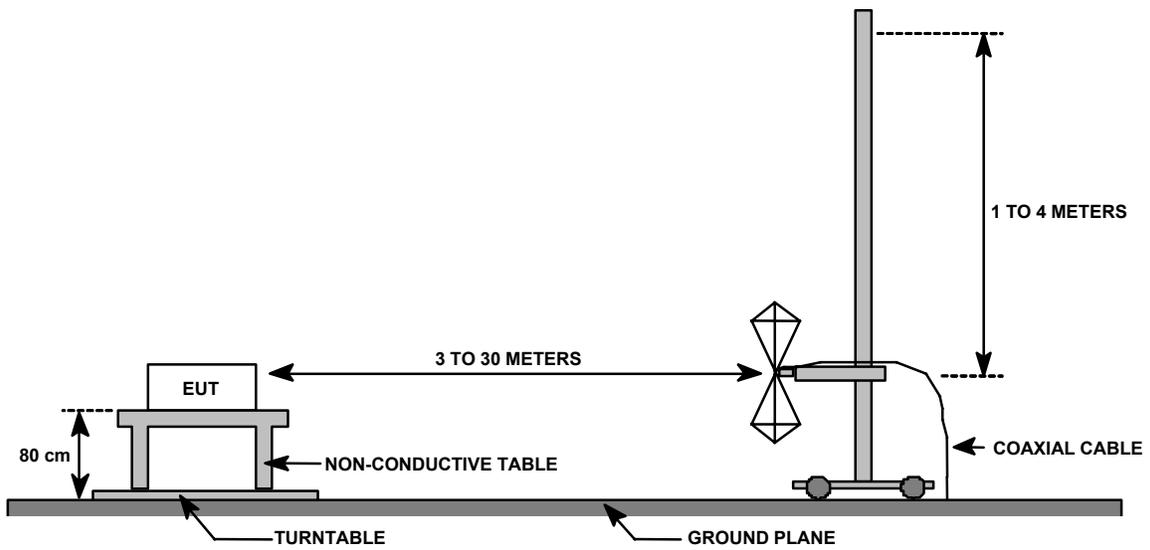
R1 was changed to 2 MegOhms to pass radiated emissions below 1 GHz.

6.0 List of Test Equipment

A list of the test equipment utilized to perform the testing is given below. The date of calibration is given for each.

<u>Device</u>	<u>Description</u>	<u>Calibration Due</u>
<u>Electromagnetic Emissions Test Equipment</u>		
EMCO 3146	Log Periodic Antenna	December 2004
EMCO 3115	Ridge Guide Antenna	June 2004
HP 85650	Quasi-Peak Adapter	November 2004
HP 8447F	Preamplifier	November 2004
HP 8566B	Spectrum Analyzer	November 2004
MITEQ	18GHz 20dB Preamplifier	January 2005
EMCO 3108	Biconical Antenna	September 2004
HP 8447F	Preamplifier	November 2004
Site Cables 30 – 1000 MHz		January 2005
Armored 10 meter		June 2004
Microwave Cable		

FIGURE 1: Radiated Emissions Test Setup



Fundamental Radiated Data Sheet
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines

DATE: January 29, 2004
PROJECT: 04309-10

MEASUREMENT DISTANCE (m): 3
DETECTOR FUNCTION: Peak

Antenna Polarization: Horizontal

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	EUT Orient.
315	70	1	75.8	26.8	14.6	5.7	69.3	75.6	-6.3	flat
315	246	1	63.2	26.8	14.6	5.7	56.7	75.6	-18.9	side
315	266	1	77	26.8	14.6	5.7	70.5	75.6	-5.1	edge

Antenna Polarization: Vertical

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	EUT Orient.
315	0	2	67.4	26.8	14.6	5.7	60.9	75.6	-14.7	edge
315	0	1	65.5	26.8	14.6	5.7	59.0	75.6	-16.6	flat
315	150	1	63.3	26.8	14.6	5.7	56.8	75.6	-18.8	side

Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss

Comment: This data represents the worst case resulting from testing the product in the three orthogonal axes.

TEST ENGINEER: Jason Haley

**Radiated Data Sheet
Spurious
Remote Control Transmitter for Small Non-Road Engines**

DATE: January 29, 2004
PROJECT: 04309-10

MEASUREMENT DISTANCE (m): 3
DETECTOR FUNCTION: Peak

Antenna Horizontal

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	EUT Orient
630	245	1	48.9	26.8	18.7	9.1	49.9	61.9	-12.1	flat
630	215	1.8	42.1	26.8	18.7	9.1	43.1	61.9	-18.9	side
630	274	1.7	52.6	26.8	18.7	9.1	53.6	61.9	-8.4	edge
945	67	1.2	39.4	26.2	27.8	10.8	51.8	61.9	-10.1	flat
945	196	1.5	33	26.2	27.8	10.8	45.4	61.9	-16.5	side
945	270	1.7	34.6	26.2	27.8	10.8	47.0	61.9	-14.9	edge

Antenna Vertical

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	EUT Orient
630	335	1.2	46.8	26.8	18.7	9.1	47.8	61.9	-14.2	Edge
630	227	1	44	26.8	18.7	9.1	45.0	61.9	-17.0	Flat
630	177	1	54.5	26.8	18.7	9.1	55.5	61.9	-6.5	Side
945	336	2	37.6	26.2	27.8	10.8	50.0	61.9	-11.9	Edge
945	191	1.1	43.1	26.2	27.8	10.8	55.5	61.9	-6.4	Flat
945	0	1.3	37.2	26.2	27.8	10.8	49.6	61.9	-12.3	Side

$$\text{Corrected Level} = \text{Recorded Level} - \text{Amplifier Gain} + \text{Antenna Factor} + \text{Cable Loss}$$

Comment: This data represents the worst case resulting from testing the product in the three orthogonal axes.

TEST ENGINEER: Jason Haley

**Microwave Radiated Data Sheet
Harmonics
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines**

DATE: February 4, 2004
PROJECT: 04309-10

MEASUREMENT DISTANCE (m): 1
DETECTOR FUNCTION: Peak

Antenna Horizontal

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Corrected Level (dBuV/M)	Limit (dBuV/M)	Margin (dB)	EUT Orient.
1260	210	1	37.5	23.3	25.7	2.0	41.9	72.4	-30.5	edge
1260	100	1	40	23.3	25.7	2.0	44.4	72.4	-28.0	side
1260	110	1	44.7	23.3	25.7	2.0	49.1	72.4	-23.3	flat
1575	270	1	25.9	23.1	25.5	2.2	30.5	63.5	-33.0	side
1575	200	1	28.4	23.1	25.5	2.2	33.0	63.5	-30.5	flat
1890	210	1	24.4	22.8	27.0	2.4	31.0	72.4	-41.4	edge
1890	75	1	22.8	22.8	27.0	2.4	29.4	72.4	-43.0	side
1890	90	1	23.8	22.8	27.0	2.4	30.4	72.4	-42.0	flat

Antenna Vertical

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Corrected Level (dBuV/M)	Limit (dBuV/M)	Margin (dB)	EUT Orient.
1260	170	1	39.9	23.3	25.7	2.0	44.3	72.4	-28.1	flat
1260	180	1	41.4	23.3	25.7	2.0	45.8	72.4	-26.6	side
1260	90	1	41.5	23.3	25.7	2.0	45.9	72.4	-26.5	edge
1575	270	1	22.6	23.1	25.5	2.2	27.2	63.5	-36.3	flat
1575	0	1	27	23.1	25.5	2.2	31.6	63.5	-31.9	side
1575	200	1	28	23.1	25.5	2.2	32.6	63.5	-30.9	edge
1890	0	1	25.8	22.8	27.0	2.4	32.4	72.4	-40.0	flat
1890	270	1	25.5	22.8	27.0	2.4	32.1	72.4	-40.3	side
1890	220	1	26.9	22.8	27.0	2.4	33.5	72.4	-38.9	edge
2520	190	1	25.8	22.5	26.7	2.9	32.9	72.4	-39.5	flat
2520	0	1	26	22.5	26.7	2.9	33.1	72.4	-39.3	side
2520	140	1	27.2	22.5	26.7	2.9	34.3	72.4	-38.1	edge

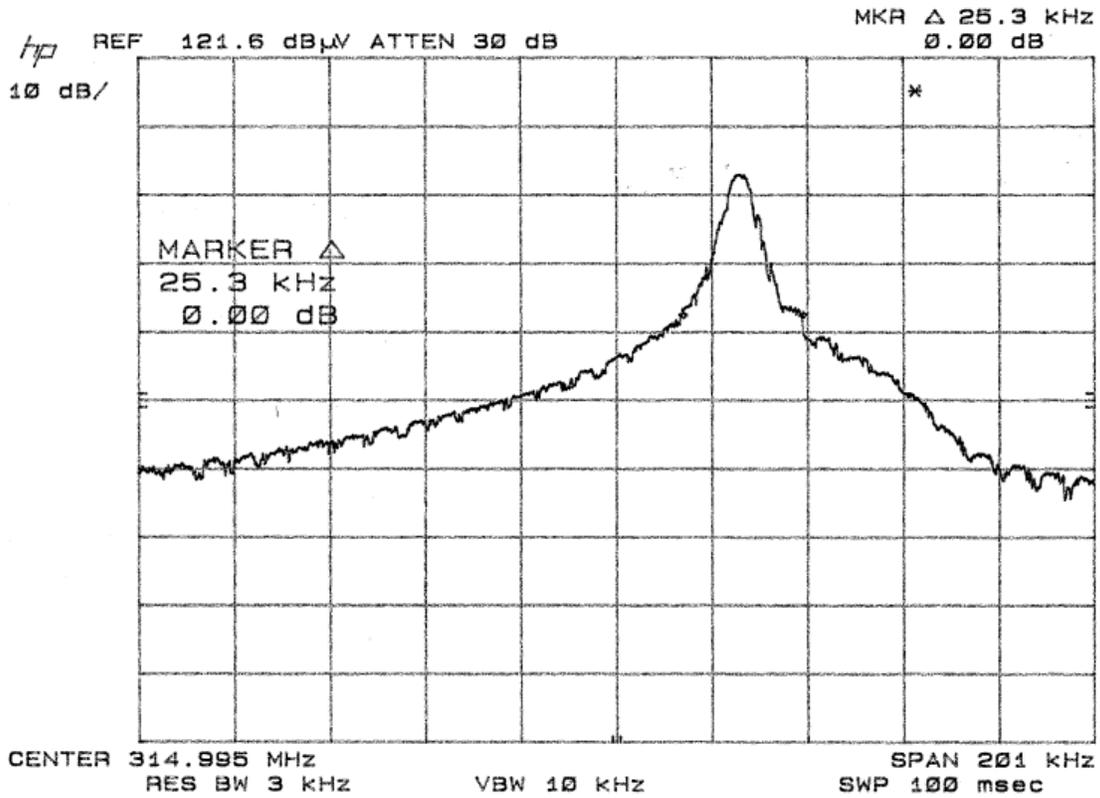
Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss

TEST ENGINEER: Mike Royer

Appendix B Occupied Bandwidth Data Sheets

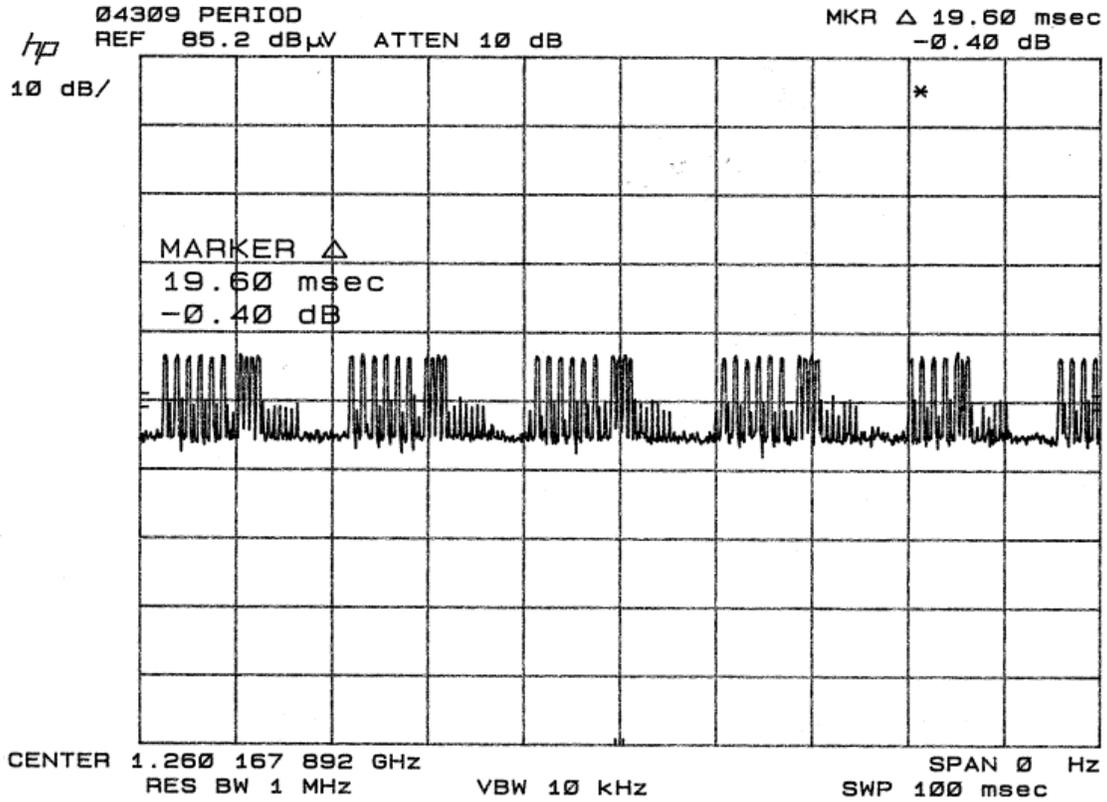
Occupied Bandwidth Datasheet
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines

315 MHz Transmitter



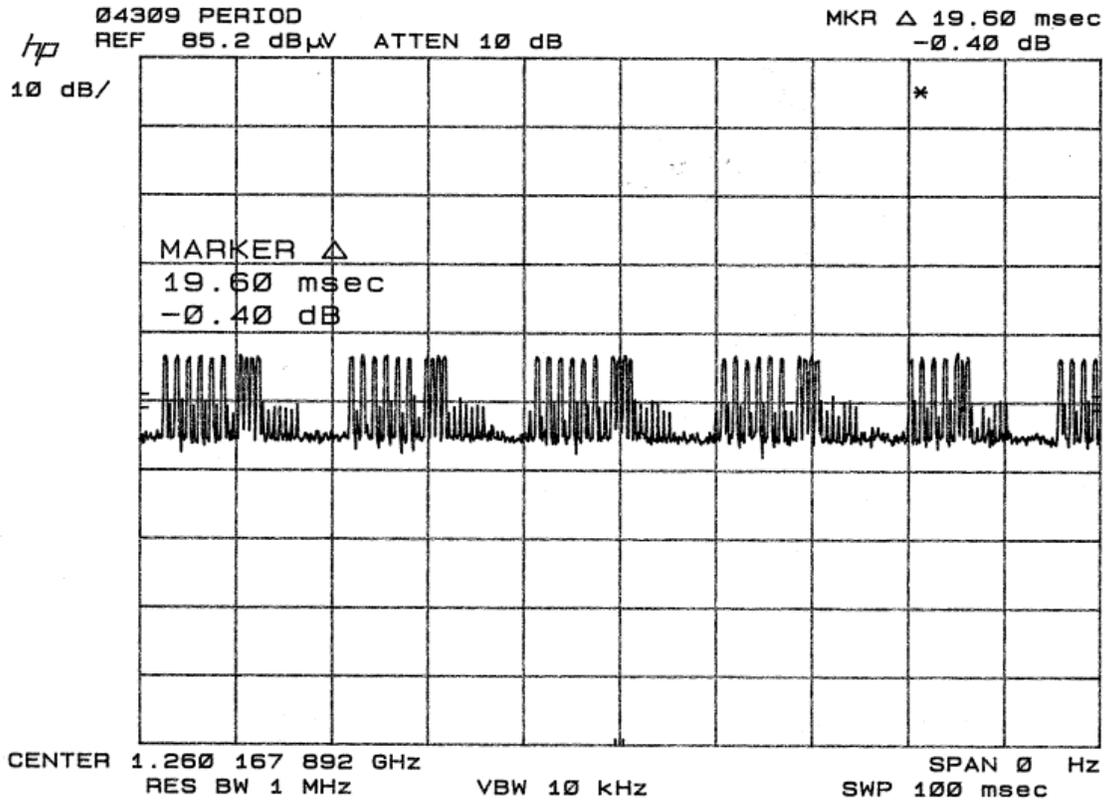
Occupied Bandwidth Datasheet
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines

315 MHz Transmitter



Occupied Bandwidth Datasheet
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines

315 MHz Transmitter



Occupied Bandwidth Datasheet
Liquid Combustion Technology
Remote Control Transmitter for Small Non-Road Engines

315 MHz Transmitter

