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TEST RESULTS REPORT
FOR
STEVENS CAR CARE PRODUCTS, Inc.
35700 VINE STREET
EASTLAKE, OH 44095
U.S.A.

Device Tested: Defiance Model 750HP, includes receiver and transmitters –no serial numbers
Report 1095
November 11, 1998

Summary Report

Radiated Emission tests were performed on the Model 750HP in accordance with ANSI C63.4-1992

The Defiance, Model 750HP was examined for compliance with the appropriate sub-parts of FCC Part 15 and found to satisfy all the requirements for the all tests performed. Various remote command transmitters were tested and all except the originally supplied units passed the requirements for emission of intentional, periodically operated radiators (section 15.231). The battery-operated remote receiver passed the requirements for part 15, sub-part B, for unintentional radiators.

Sheldon Gruber, Executive Vice-president

1. INTRODUCTION

Compliance Labs, Inc. (CLI) has facilities which conform to the requirements of EN 45001: 1989, General criteria for the operation of testing laboratories. This laboratory is certified by the United Kingdom Company TRL EMC, LTD, a competent body, to comply with the EMC/EMI testing procedures established by the European Union. CLI's facilities include a three-meter semi-anechoic chamber, an open area test site (OATS) with both a three and ten-meter capability. The OATS normalized site attenuation satisfies CISPR 16 and ANSI C63.4-1992 requirements and is listed with Industry Canada for emissions testing as File IC 3007 as well as the FCC. The equipment is in compliance with IEC 1000-4-4 for fast transient immunity testing, IEC 1000-4-2 for electrostatic discharge testing and IEC 1000-4-3 for radiated, radio-frequency, electromagnetic immunity testing to 10 V/m E-fields and surge immunity according to IEC 1000-4-5. The receiver used for emission testing is in conformance with CISPR 16. Calibration for all equipment is current. Supporting data will be provided upon request.

2. SPECIFIC TEST RESULTS

Tests were performed on both the receiver control unit and the command module (transmitter).

2.1 Receiver Emission Tests

The receiver performs various functions in the automobile on reception of commands from the remote command module. The unit must conform to the requirements of FCC Part 15, subpart B as an unintentional radiator.

2.2.1 Conducted emission tests

The device is battery operated and therefore these tests were not performed.

2.2.2 Radiated emission tests

Radiated emission from 30 MHz to 1000 MHz was measured at 3 meters using an EMCO 3143 antenna connected to the Dynamic Sciences 2020 CISPR 16 receiver (120 kHz bandwidth, peak detection) in the anechoic chamber as a pre-compliance test. Figure 1 shows the RF emission measured as a pre-compliance test in the anechoic chamber. Note that most of the shape is given by the antenna correction factor operating on DSI 2020 noise. This is evident from the similarities of the two spectra (blue with receiver on, red with it off).

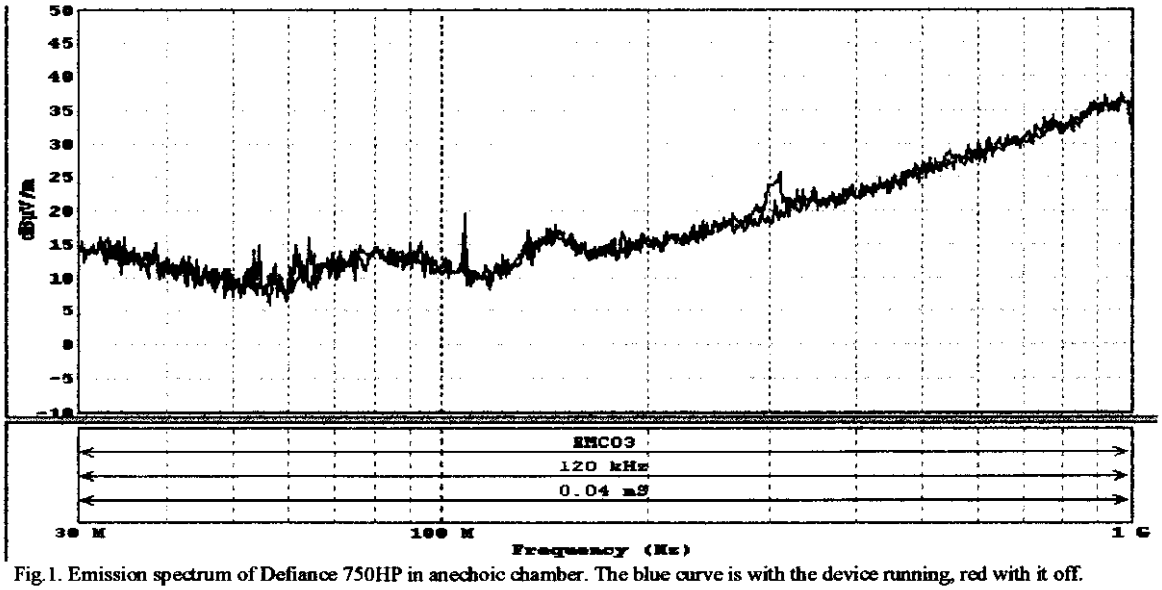

Fig. 1. Emission spectrum of Defiance 750HP in anechoic chamber. The blue curve is with the device running, red with it off.

After noting the lack of any significant regions of emission the EUT was brought to the OATS and RF emission tests were made

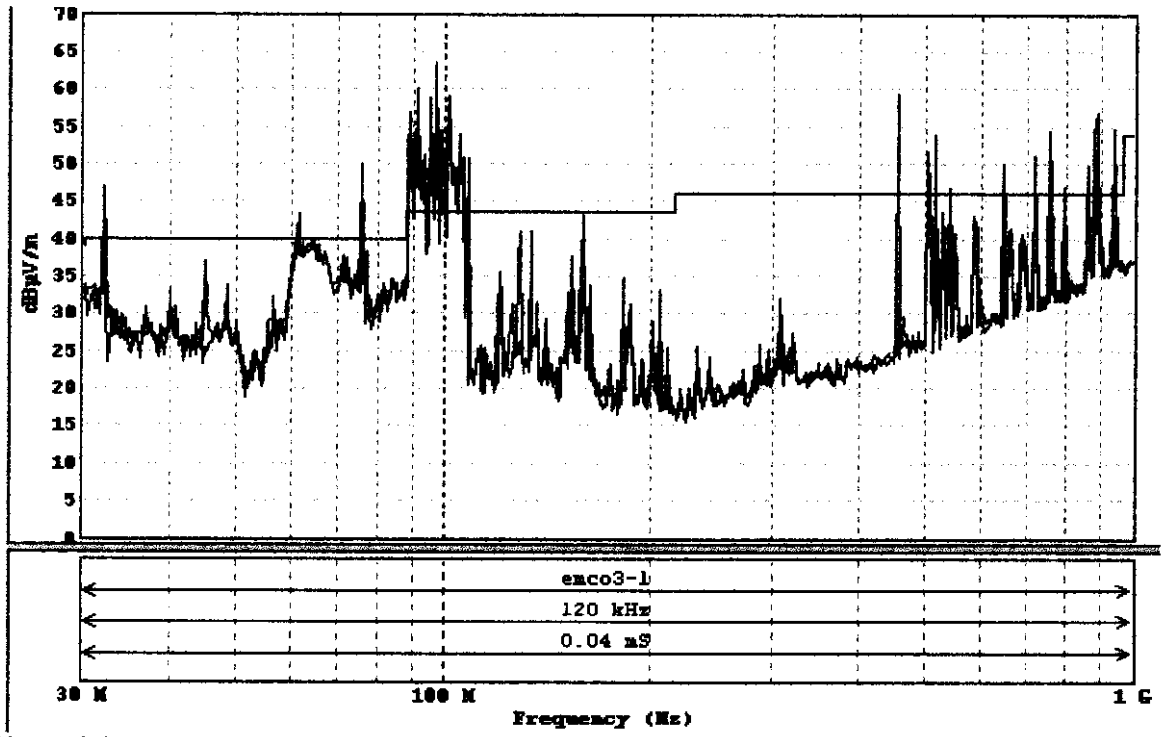

Fig.2. Emission spectra on the 3-m OATS. The antenna is vertically polarized at 1.5-m elevation. The Defiance 750HP receiver is on for the blue curve, off for the red. The FCC limits for an unintentional radiator (not digital) is shown as well.

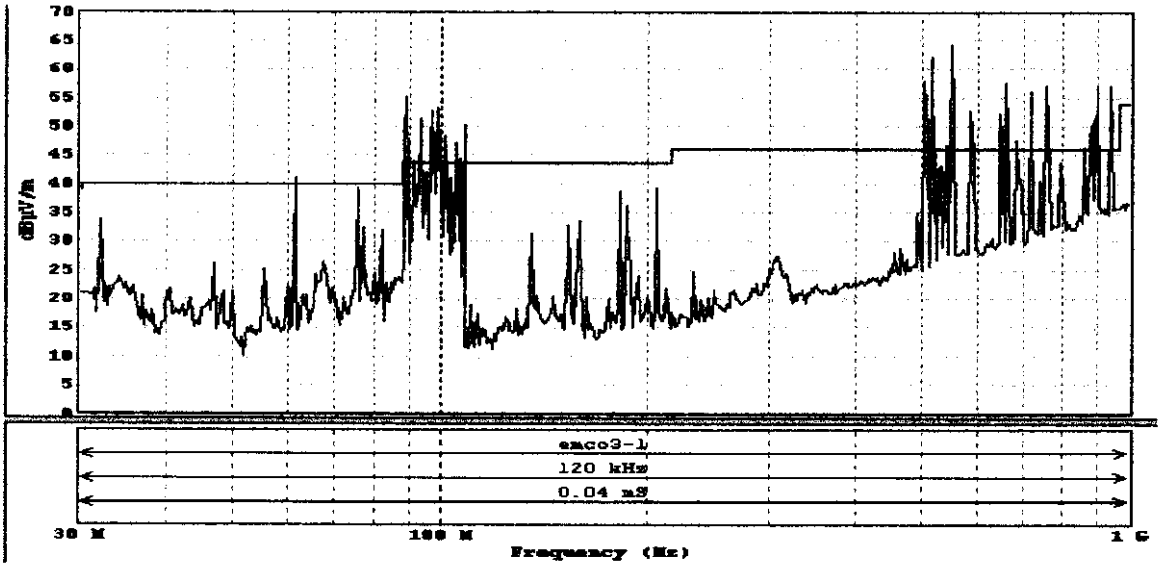

Fig.3. Radiated emission from Defiance receiver measured at 3-m in the OATS. The antenna is horizontally polarized at 1.0-m elevation. The FCC limits for an unintentional, non-digital radiator is shown.

All violations of the limits have been verified to be ambient signals.

2.2 Command Module Emission Tests

Since the command module is a hand-held, battery run unit, no conducted emission tests are required. The module operates near 310 MHz with a code hopping encoder AM modulating the oscillator which feed a built-in loop antenna. Compliance Labs was provided with five different modules: each was tested for emission spectrum and field level at 3-m using an EMCO 3143 antenna up to the fourth harmonic and a ridged waveguide horn, EMCO 3115 for higher harmonics. One sample, provided by Stevens Car Care initially, proved to exceed emission limits at its fundamental. All other units were under the limits for all their harmonics. Data follows.

2.2.1 Emission Spectra.

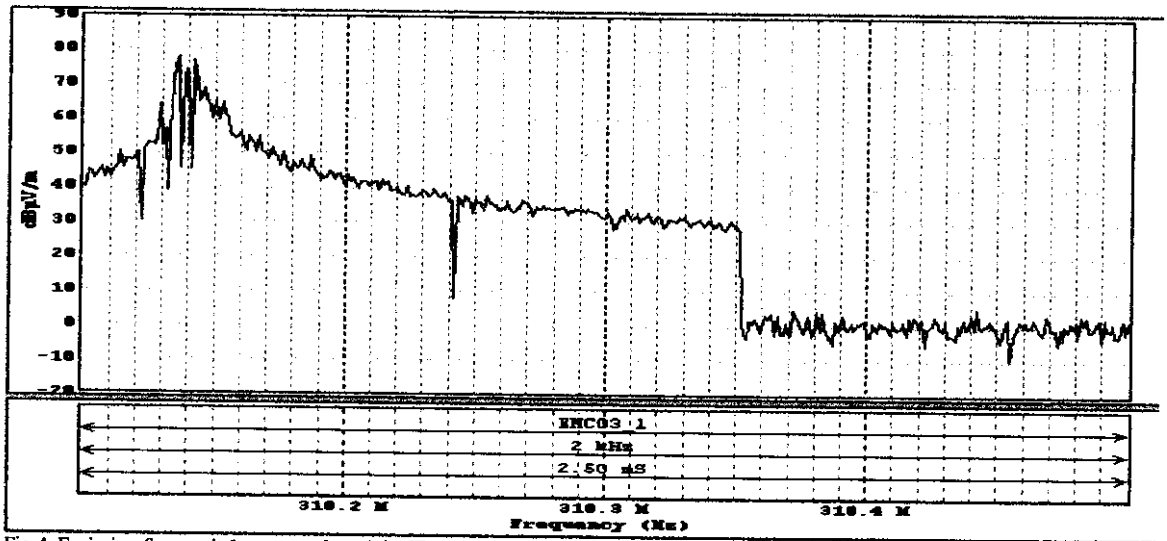

Fig.4. Emission from unit 1 command module. The DSI 2020 receiver uses peak detection for its sweeps. The antenna was horizontally polarized and 1.0-m above the ground plane. The precipitous drop at 310.35 MHz resulted from the module turning off.

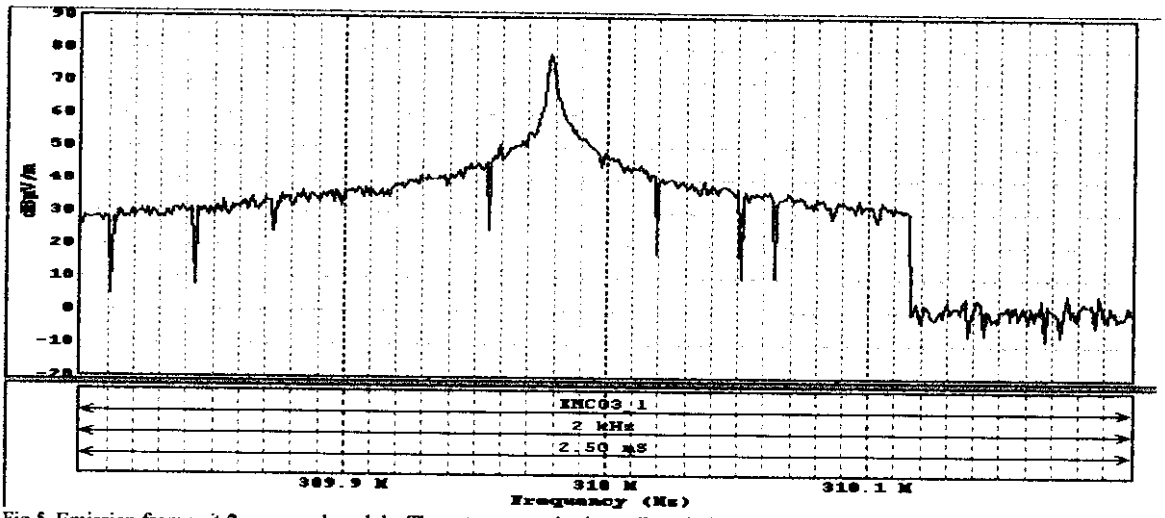

Fig.5. Emission from unit 2 command module. The antenna was horizontally polarized and 1.0-m above the ground plane. The precipitous drop at 310.11MHz resulted from the module turning off.

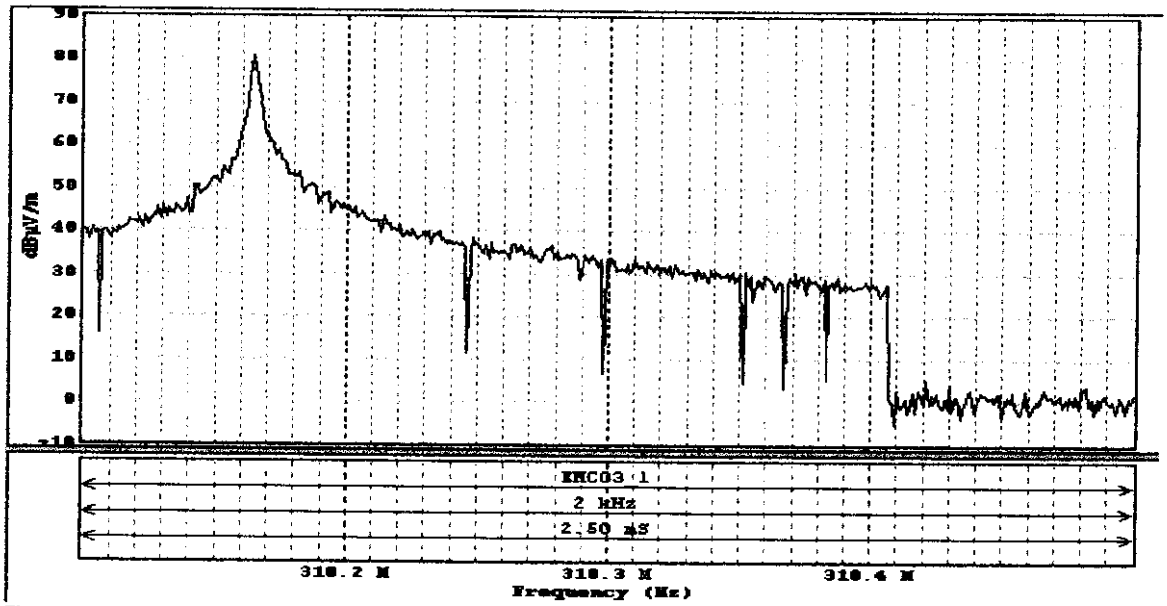

Fig.6. Peak-detected emission from command module 3 at its fundamental frequency.

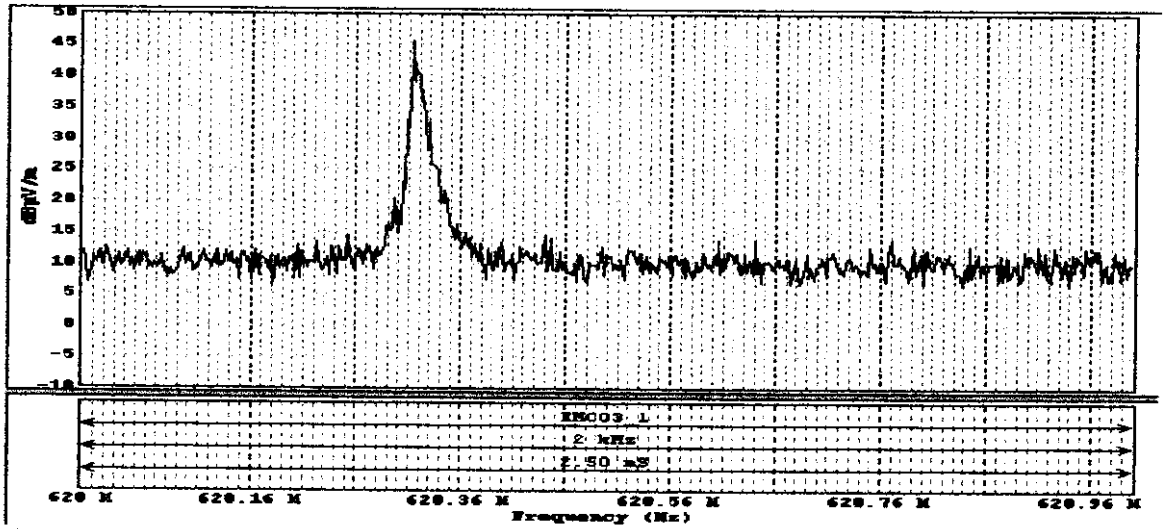

Fig.7. Emission from unit 1 at its second harmonic. The maximum emission was found to be vertically polarized and at 1.0-m height.

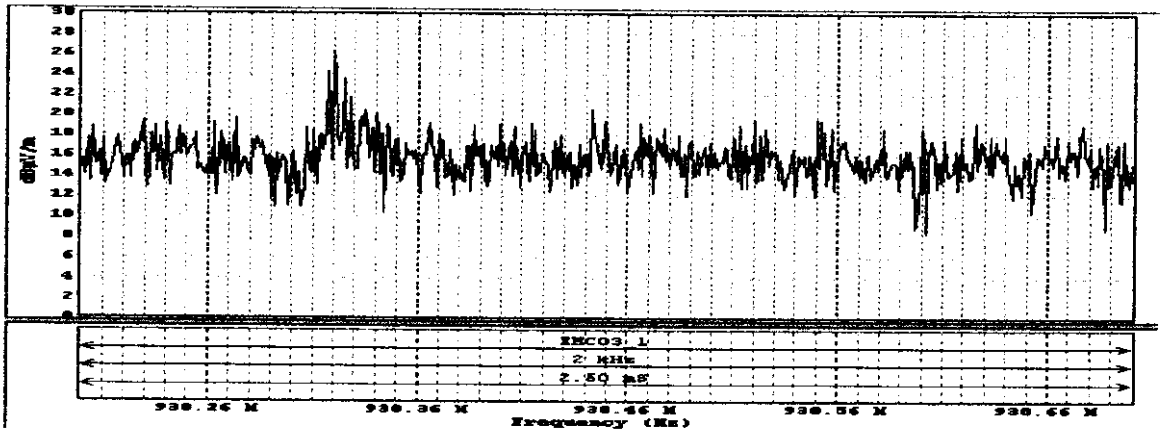

Fig.8. Fourth harmonic emission of unit 1. The maximum was found at 1.0-m height of the vertically polarized antenna.

The preceding figures show the spectral emission of the command modules. They have been obtained with the modules modulated by the code generated by the first button. In each case, the observed emission was maximized by positioning the antenna, changing its polarization, and rotating the command module. It was found that the fundamental emission was horizontally polarized, but the higher harmonics were vertically polarized.

2.2.2. Field Strength Measurements

The duty cycle of a pulse train is obtained from direct measurement of the modulating waveform. The pulse train time including a blanking interval is 81.0 ms and the pulse activity is 30.22 ms. This gives a duty cycle of 0.373. This produces -8.56 dB adjustment to yield a pulse train average field. Table 1 shows the average fundamental emission field measured on the 3-m OATS for three command modules.

Command Module	Frequency-MHz	Peak Field -dB(μV/m)	Average Field-dB(μV/m)
#1	310.1207	82.5	73.9
#2	310.0108	81.3	72.7
#3	310.1643	81.2	72.6

TABLE 1. Fundamental fields of three units. Limit is 75.3 dB(μV/m) at this frequency.

The table below shows the resulting corrected .measurements at the harmonics for unit #1. Note that the antenna factors and cable attenuation are automatically included in the DSI 2020 data.

Frequency (MHz)	Peak Field	Average Field	Limit dB(μV/m)
310.1207	82.5	73.9	75.3
620.32	45	36.4	55
930.34	24	15.4	55

TABLE 2. Harmonic spectra for unit #1 command module. All higher harmonics than 3 are below the receiver noise and the limits.

2.2.3. Bandwidth Measurements

The bandwidth of the emission is estimated from the sweeps shown. The DSI 2020 provides scale expansion. Using this facility, the bandwidth to half power is less than 15 kHz. The FCC states that the bandwidth should not exceed 0.25% of the fundamental frequency. This translates to 775 kHz. The Model 750HP satisfies the FCC part 15 requirements in its entirety.

3.0 Equipment Used in Tests

Cal Cycle	Equipment	Manufacturer	Model	S/N	Cal Due
1 year	CISPR 16 receiver	Dynamic Sciences	DSI 2020	604	08/99
1 year	Antenna	EMCO	3143	1249	08/99
18 mos.	Antenna	EMCO	3115	9809-5580	03/00
1 year	Shield Room	SRI	3m	---	9/99
1 year	OATS	N/A	N/A	N/A	11/98
1 year	Spectrum Analyzer	H-P	HP 8566B	2311A02270	03/99