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TEST RESULTS REPORT
FOR
DVC INDUSTRIES, INC.
4080 BENNETT ROAD, SUITE A
TOLEDO, OHIO 43612
U.S.A.

Devices Tested: ASCULTATION Trainer, S/N: Prototype
Consisting of 418 MHz remote control, stethoscope and mannequin with internal responding sensors
Report 1160
Report date: April 3, 2000
Test date: March 22, 2000

Summary Report

The following tests were performed on these devices

- Electrostatic Discharge in accordance with EN 61000-4-2
- Immunity to radiated electromagnetic fields in accordance with EN 61000-4-3
- Immunity to radiated pulse modulated electromagnetic fields in accordance with ENV50204.
- Radiated Emission in accordance with EN55011, Class B
- Spectral characteristics of the remote transmitter with regard to the requirements of E^TSI 400 683 and the FCC Part 15 for intentional radiators.

The devices satisfy the requirements of the above EU standards as well as the remote passing the FCC part 15 requirements for an intermittently used intentional radiator.

Sheldon Gruber, Vice-President

1. INTRODUCTION

Compliance Labs, Inc.
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, and 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

2.0 Device Description

These devices serve as a trainer for medical technicians and are battery operated. The remote transmitter, operating at 418 MHz, serves as a control for the responsive sensors within the mannequin. The instructor can set the characteristic waveforms which the students then are requested to interpret by listening with their stethoscopes.

2.1 Immunity Tests

The following tests were performed in the Compliance Labs facility where the temperature typically ranges from 19 to 30 degrees Celsius and a relative humidity from 20 to 60 percent. These measurements are made using an electronic hygrometer.
The tests described herein were performed at 22° C and RH between 29 and 30%.

2.1.1 Electrostatic Discharge Immunity

These EUT's were tested to ±4 kV contact and ±8 kV non-contact as required by EN 61000-4-2. The device enclosure is non-conductive. Neither of the EUT's were effected during or after the discharges were applied- a category A response. The temperature was 23° C and RH 40%.

2.1.2 Immunity to Radiated Radio Frequency Fields.

Both EUT's. (remote controller, stethoscope and mannequin) were placed on a non-conducting table 0.8-m from the ground plane in the uniform field region, 3-meters from the EMCO 3143 antenna. The test used a sweep from 80 MHz to 1000 MHz at the level of 3 volts/meter, modulated at 1 kHz, as measured by a Chase Model EMC 20 electric field meter. The frequency was increased in steps of 1 Percent of the previous frequency in accordance with the generic immunity standard, EN50082-2: 1998. Dwell time at any one frequency was approximately 1/2 second, deemed long enough for the EUT's to respond. Four orientations of the EUT's were tested with frequency sweeps in both horizontal and vertical polarization. The EUT's passed this test with performance criterion A as required.

The devices were tested at 897 MHz for immunity to radiated pulse modulated electromagnetic fields in accordance with ENV50204 and passed without a problem.

EN60101-2 suggests testing beyond the level required for EN50082-1. The tests performed at 10 V/m went from 800 MHz to 1 GHz. The EUT's continued to function normally.

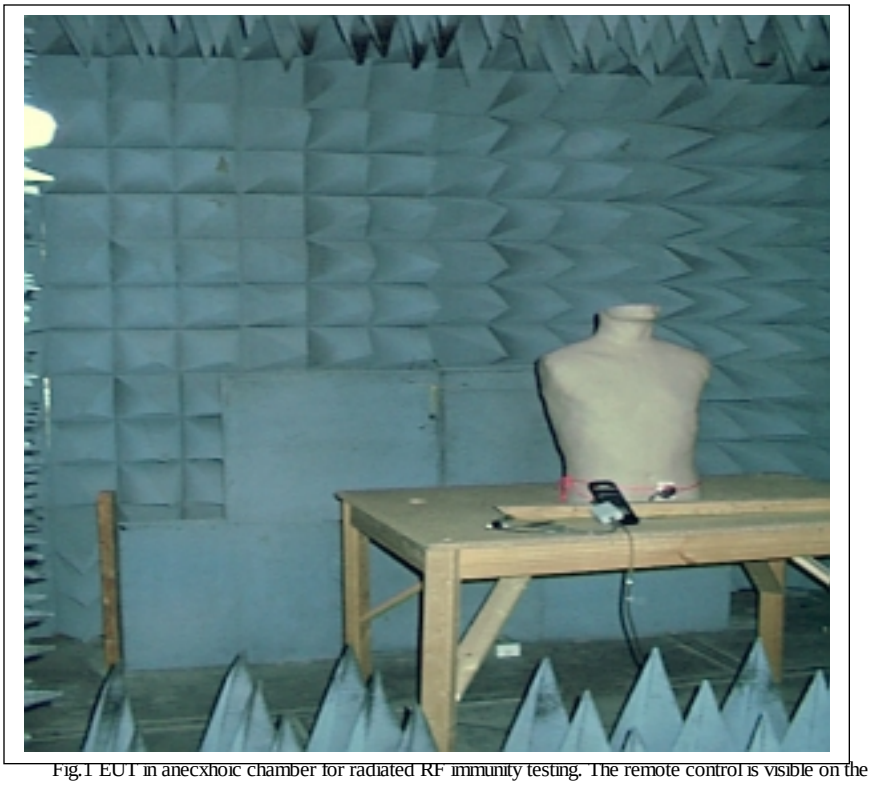

Fig.1 EUT in anecxhoic chamber for radiated RF immunity testing. The remote control is visible on the table next to the receiver.

3.1 Emission Tests

Fig.2 EUT on 10-m OATS for radiated RF emission testing.

The devices were tested for emission on the 10-m OATS. The following figures give an indication of the level of emitted noise. All sweeps are performed using peak detection.

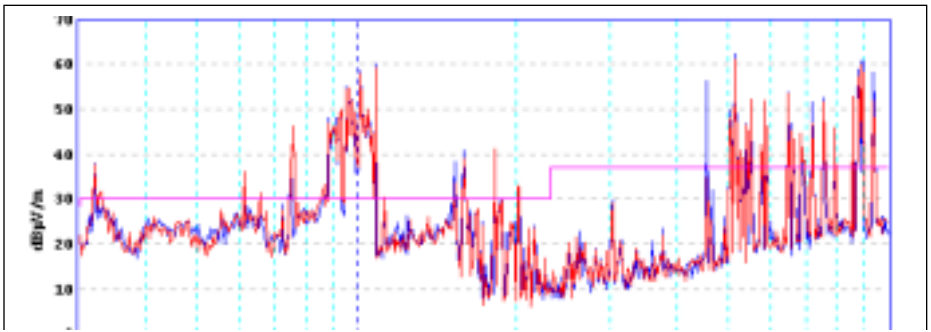

Fig.3. EUT emission on 10-m OATS taken with the broadband antenna vertically polarized and 1.0-m above groundplane. The sweep uses peak detection. Blue is with the EUT on. The ISM class B quai-peak limit is shown.

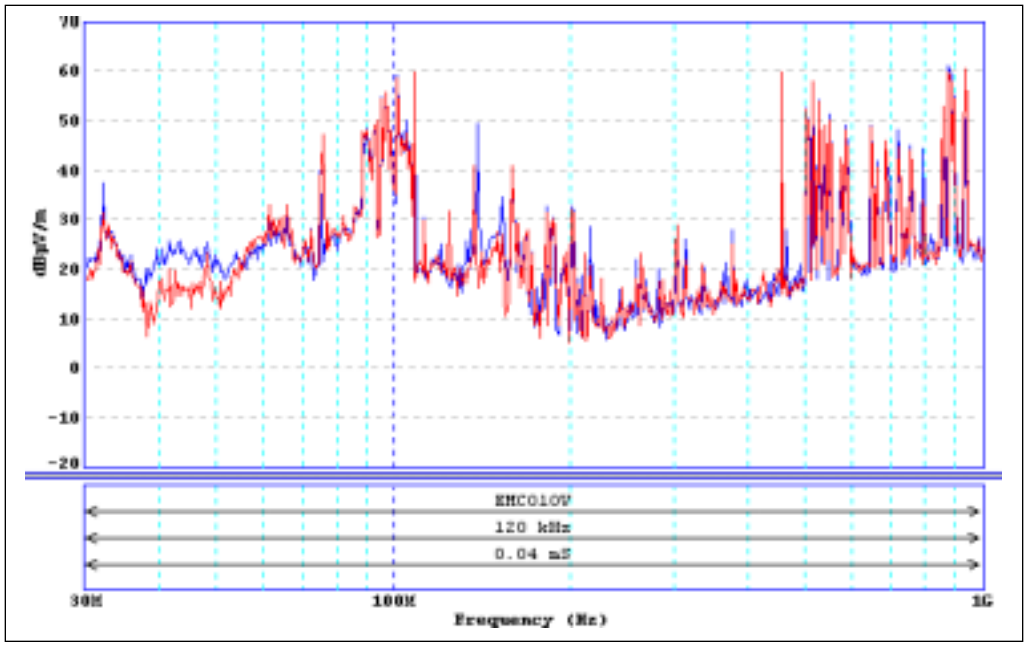

Fig.4. EUT emission on 10-m OATS taken with the broadband antenna vertically polarized and 1.5-m above groundplane. The sweep uses peak detection. Blue is with the EUT on. The ISM class B quai-peak limit is shown.

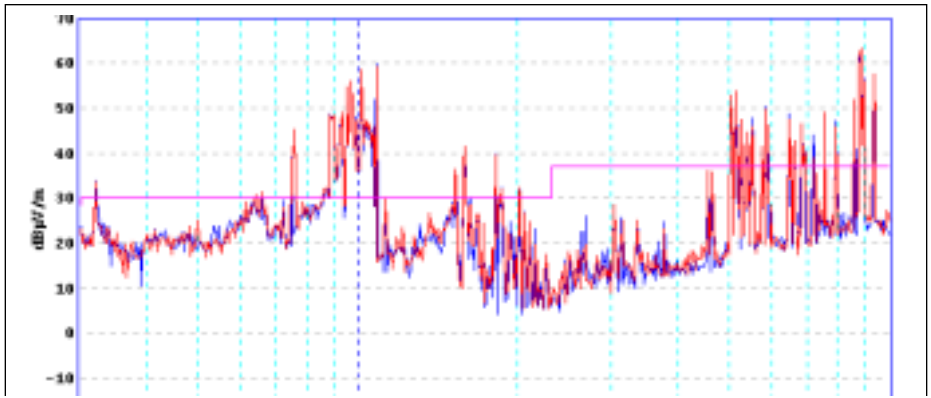

Fig.5. EUT emission on 10-m OATS taken with the broadband antenna vertically polarized and 2-m above groundplane. The sweep uses peak detection. Blue is with the EUT on. The ISM class B quai-peak limit is shown.

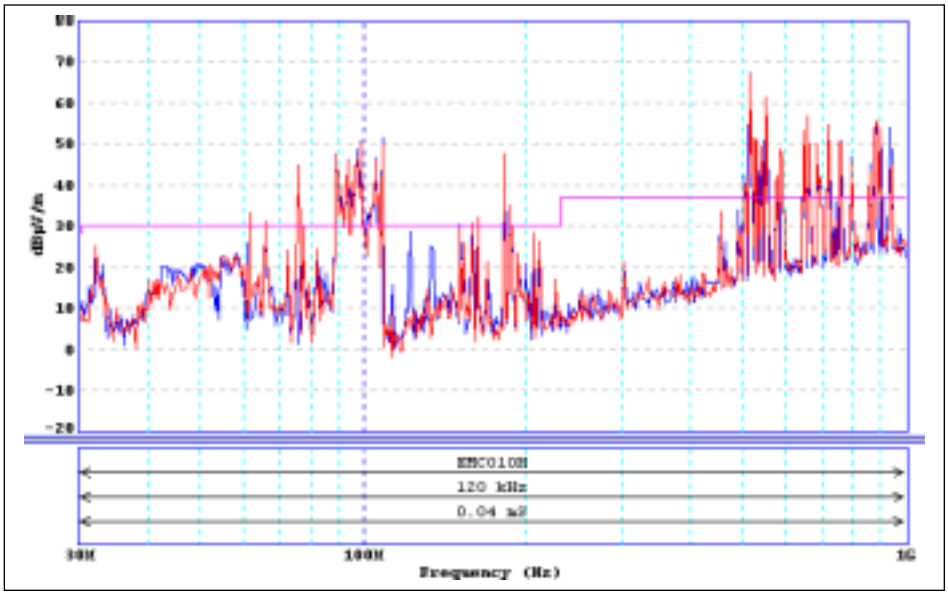

Fig. 6. The emission from the EUT's with a horizontally polarized broadband antenna 10-m from it. The antenna is 1.0-m up. Red is the ambient. The class B limit line is shown.

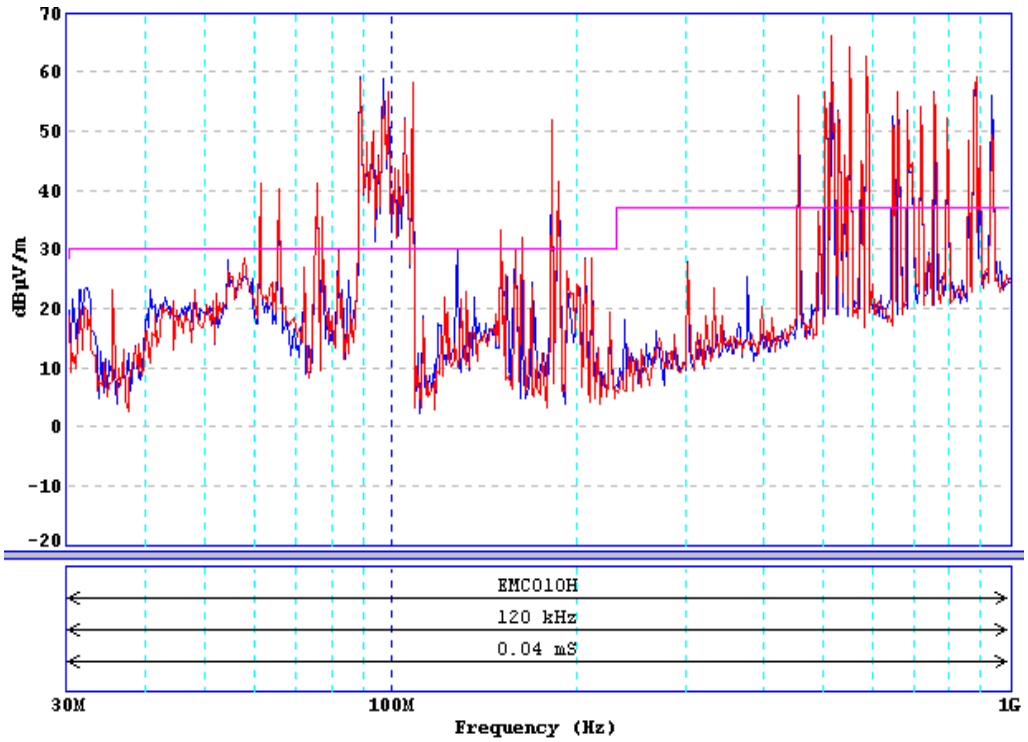

Fig. 7. The emission from the EUT's with a horizontally polarized broadband antenna 10-m from it. The antenna is 2.0-m up. Red is the ambient. The class B limit line is shown.

Fig. 8. The emission from the EUT's with a horizontally polarized broadband antenna 10-m from it. The antenna is 3.0-m up. Red is the ambient. The class B limit line is shown.

All possible violations of the limits were found to be the result of fluctuating ambients. The EUT's passed the requirements for radiated emission while the remote was inactive. In the next section the spectra of the remote will be considered.

4.0 Remote Transmitter Emission Tests

The short-range remote transmitter must satisfy the requirements of the FCC part 15 for intermittently operated intentional radiators. It also must satisfy the requirements of the EU as given in ETS 300 683 and ETS 300 220-1.

4.1 Emission Spectra.

The remote was operated intermittently and during its short 4ms pulse-train a sweep of the spectrum using peak detection was obtained. The receiving antenna was oriented for both horizontal and vertical polarization and raised to different heights above the ground plane. The remote was placed in four different orientations for each combination of height and polarization so that a maximum received signal would be observed. The following spectra summarize the results for these trials. Note that the vertical scale should read dB(μV/m) and not dB(μV) as the antenna factor has been utilized for the antenna 3-m from the device. In CFR 47 Part 15.231 the maximum emission from a device which transmits at 418 MHz during an interval of 5 ms or less may be no higher than 80.28 dB(μV/m) measured 3-m from the device. The data shown below clearly corroborates that this remote passes this requirement.

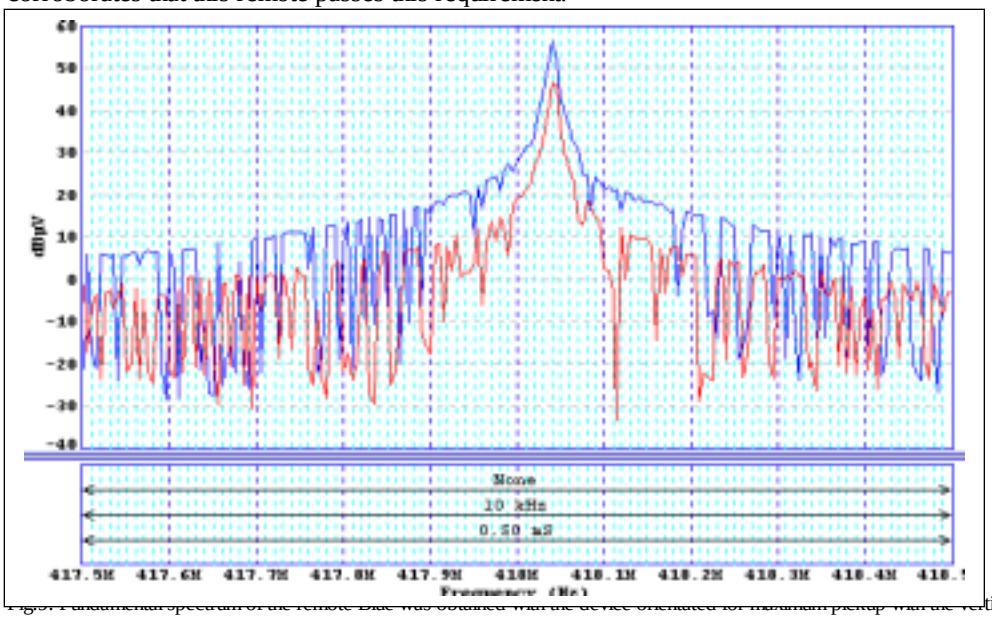

Fig. Fundamental spectrum of the remote Blue was obtained with the device oriented for maximum pickup with the vertically polarized antenna at 1-m altitude.

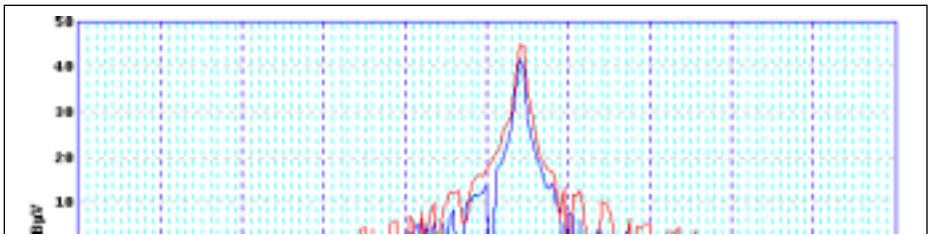

Fig.10. Fundamental spectrum of the remote Blue was obtained with the device orientated for maximum pickup with the vertically polarized antenna at 1.5-m altitude. Note that the previous figure shows the maximum for this polarization.

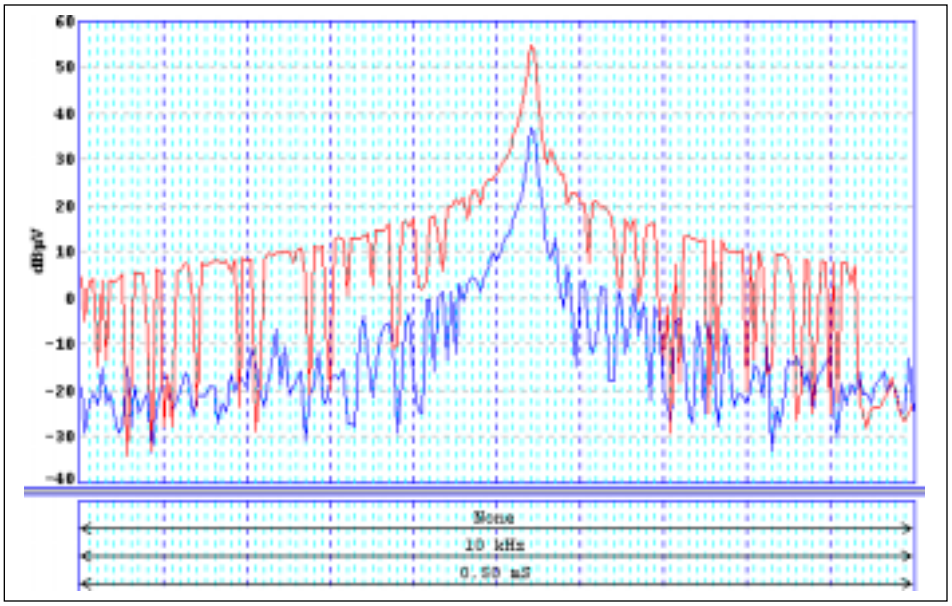

Fig.11. Fundamental spectrum of the remote Blue was obtained with the device orientated for maximum pickup with the horizontally polarized antenna at 1.0-m altitude. Note that the peak in fig. 9 is somewhat higher.

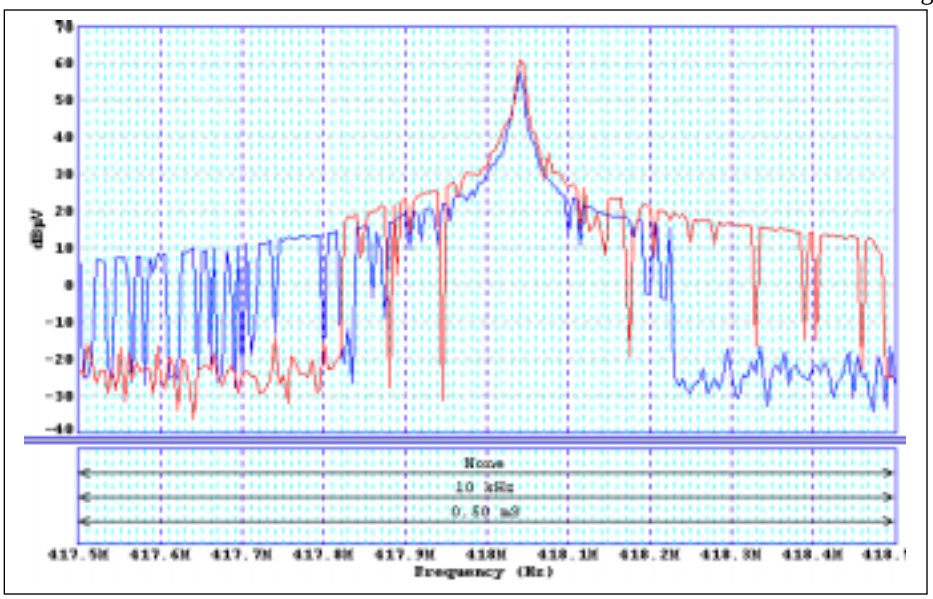

Fig.12. Fundamental spectrum of the remote Blue was obtained with the device orientated for maximum pickup with the horizontally polarized antenna at 1.5-m altitude. Note that the peak in this figure is somewhat higher than the rest.

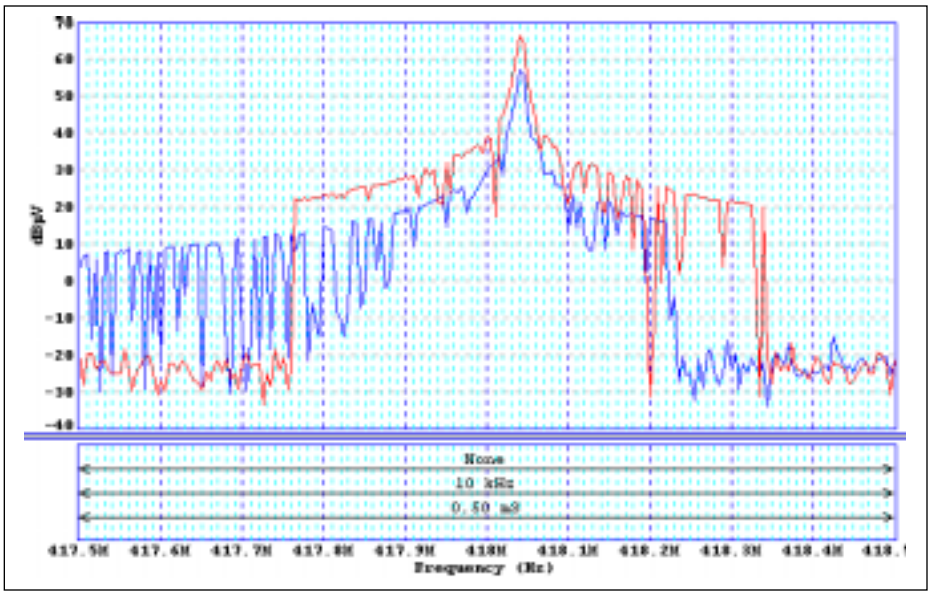

Fig.13. Fundamental spectrum of the remote Blue was obtained with the device orientated for maximum pickup with the horizontally polarized antenna at 2.0-m altitude. Note that the peak in this figure is somewhat higher than the previous.

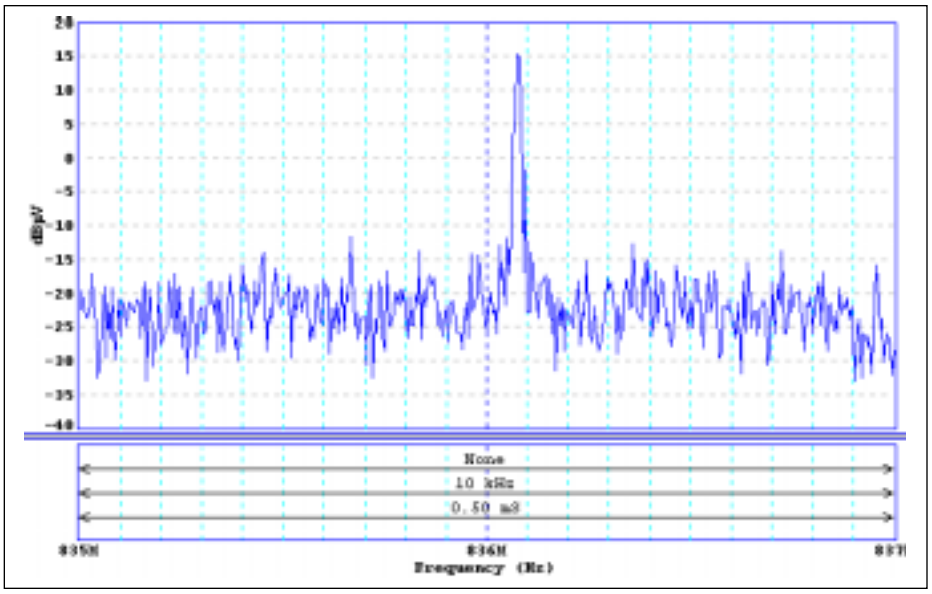

Fig.14. The second harmonic spectrum for the orientation of the remote and the antenna yielding maximum.

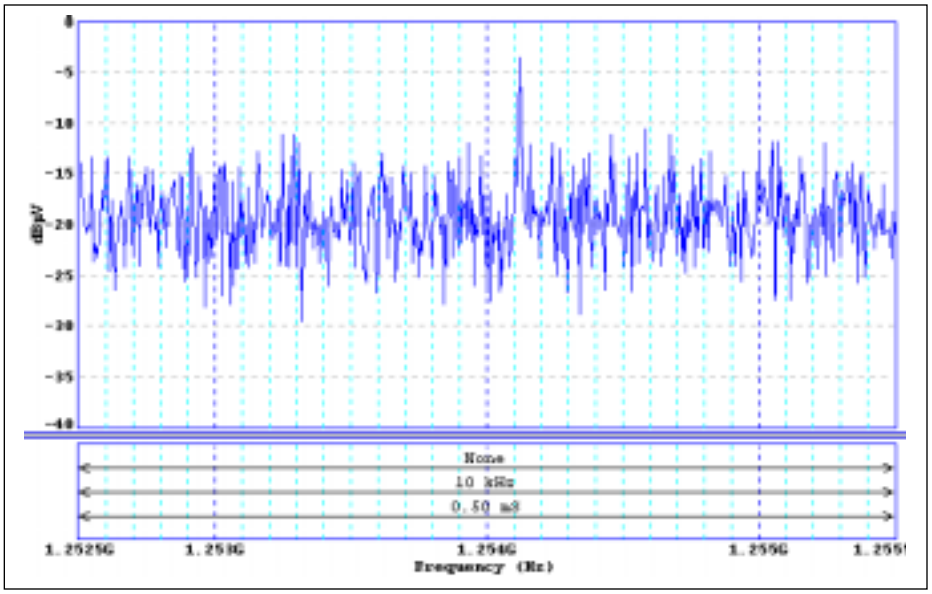

Fig.15. The third harmonic spectrum for the orientation of the remote and the antenna yielding maximum.

The bandwidth of the modulated emission is approximately 20 kHz. Furthermore the harmonics of the EUT satisfies the spectral requirements. Higher harmonics than the third are unmeasurable. This EUT satisfies the FCC requirements for an intentional periodic-radiator.

ETS 800 220-1 specifies the EU requirements for this device. The EUT should have a total power output of 5 mW or less. Using the antenna factor for the EMCO 3143 the maximum field obtained is

70 dB(μV/m). Equivalently the field is 3.16 mV/m. Since the EUT antenna length of 7.1 cm is much smaller than the 71 cm wavelength at this frequency, the antenna radiation is a total power of 1.5 μW. This readily satisfies the maximum power requirements of ETS 300 220-1(1997).