

Test Report



(Declaration of Conformity)

for

Electromagnetic Interference

of

E.U.T.: ROBOT 2000

Trade Name: STL

Model Number: SI583

Prepared for

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Prepared by

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NVLAP LAB. Code: 200458-0

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3. This test data is traceable to National or International Standards.

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Certification of Compliance

Applicant : STL Electronics Limited
Manufacturer : STL Electronics Limited
EUT Description : ROBOT 2000
Model No. : SI583
Serial No. : N/A
Tested Power Supply : 15Vdc
Date of Final Test : Dec. 22, 2000
Measurement Procedures and Standards Used :

- ☒ CFR 47, Part 15
☒ ANSI C63.4: 1992

The device described above was tested by Interocean EMC Technology Corporation to determine the maximum emission levels emanated from the device and severity levels of the device endure and its performance criterion. The measurement results are contained in this test report and Interocean EMC Technology Corp assumes full responsibility for the accuracy and completeness of these measurements. This report shows the EUT is technically compliant with the Part 15 subpart C and ANSI C63.4 official requirements. This report applies to the above sample only and shall not be reproduced in part without written approval of Interocean EMC Technology Corporation.

Report Issued: 2000.12.30

Test Engineer:

Jacky Yeh 12/30/2000
Jacky Yeh

Checked:

Tomy Hu
Tomy Hu

Approved:

Kent J.K. Hsu
Kent J.K. Hsu

1 General Information

1.1 Description of Equipment Under Test

- Equipment Under Test** : ROBOT 2000
- Model Number** : SI583
- Serial Number** : N/A
- Type of Sample Tested** : ☒ Proto-type, ☐ Pre-production, ☐ Mass Production
- Applicant** : STL Electronics Limited
16D, CDW Building, 388 Castle Peak Road, Tsuen Wan, Hong Kong
- Manufacturer** : STL Electronics Limited
Block 15, Huang Gong Industrial Area, Huang Gong, Fu Tian, Shenzhen, P.R.C.
- Power Supply** : AC/DC Adapter
M/N: MEC-B5678
Input: 120Vac, 100mA, 60Hz
Output: 15Vdc, 700mA
Cable: Non-Shielded, Un-detachable, 1.8m
- Data Cable** : N/A
- Date of Receipt of Sample** : Nov. 07, 2000
- Date of Test** : Nov. 10 ~ Dec. 22, 2000
- Description of E.U.T.** : The EUT is ROBOT. The ROBOT device can be controlled with a wireless remote system. The power system is used rechargeable battery. This wireless system is multi-functional. It provides not only with control signal but also voice, audio and video signal. There are two frequencies for communication:
- 1) 2.4 GHz for audio and video data transmission.
There are two channel from ROBOT sent to signal:
 - a) 2.411 GHz
 - b) 2.453 GHz
 - 2) 900 MHz for voice transmission.

There are 3 channel from ROBOT & Remote Controller:

| | ROBOT |
|-----------|--------|
| Channel 1 | 903.00 |
| Channel 2 | 903.75 |
| Channel 3 | 904.50 |

1.2 Tested Supporting System Detail



Do not Support system.




1.3 Test Facility

Site Description : ☒ OATS 1 ☐ OATS 2

Name of Firm : Interocean EMC Technology Corp.

Site Location : No.5-2, Lin 1, Tin-Fu Tsun, Lin-Kou Hsiang,
Taipei County, Taiwan, R.O.C.

Site Filing :  Federal Communication Commissions – USA
Registration No.: 96399
 Voluntary Control Council for Interference by Information Technology
Equipment (VCCI) – Japan
Registration No. (Conducted Room): C-1094
Registration No. (OATS 1): R-1040
Registration No. (OATS 2): R-1041

Site Accreditation :  Bureau of Standards and Metrology and Inspection (BSMI) – Taiwan, R.O.C.
Accreditation No.:
SL2-IN-E-0026 for CNS13438 / CISPR22
SL2-A1-E-0026 for CNS13783-1 / CISPR14
 National Voluntary Laboratory Accreditation Program (NVLAP) - USA
Lab Code: 200458-0
 NEMKO
ELA 181

1.3.1 Test Methodology

Both conducted and Radiated Emission Measurement was performed according to the procedures in ANSI C63.4-1992 and Part 15 subpart C. Radiated Emission Measurement was performed at 3 meters distance from antenna to EUT.

1.3.2 Measurement Uncertainty

The uncertainty is calculated in accordance with NAMAS document NIS 81.

Conducted Uncertainty $U_c = \pm 2.96\text{dB}$.

Radiated Uncertainty $U_c = \pm 3.67\text{dB}$.

2 Power Line Conducted Emission Measurement

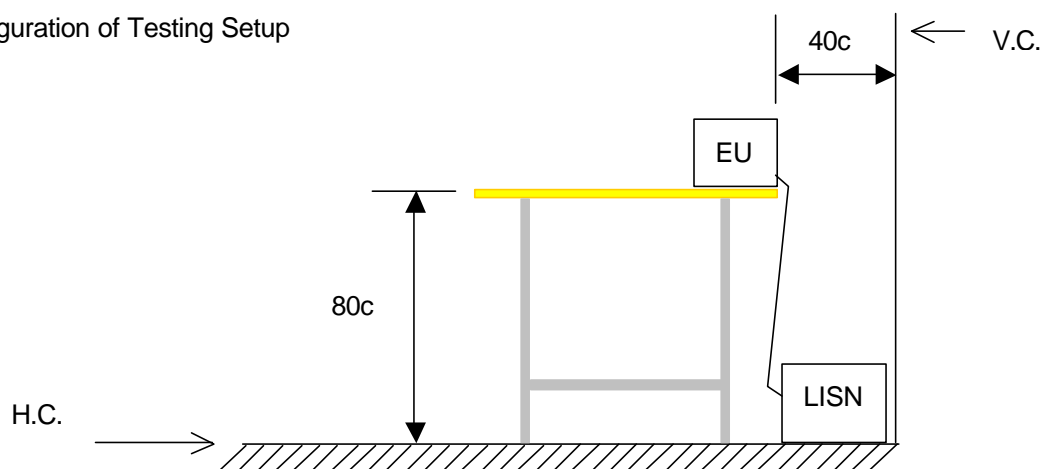
2.1 Instrument

| Instrument | Manufacturer | Model | Serial No. | Last Calibration |
|-------------------|-----------------|----------|------------|------------------|
| EMI Test Receiver | Rohde & Schwarz | ESCS 30 | 830245/027 | 2000/07/26 |
| L.I.S.N. | Schwarzbeck | NNLK8121 | 8121417 | 2000/09/08 |
| L.I.S.N. | Rohde & Schwarz | ESH3-Z5 | 829996/016 | 2000/06/16 |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 830836/026 | 2000/07/29 |
| RF Cable | IETC | CBL04 | N/A | 2000/10/11 |

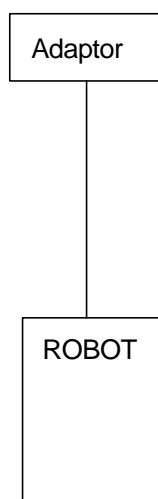
Note: All instrument upon which need to calibrated are with calibration period of 1 year.

2.2 Block Diagram of Test Configuration

Configuration of Testing Setup



Configuration of EUT Setup



2.3 Conducted Limit

☒ FCC Part 15

| Frequency (MHz) | <input checked="" type="checkbox"/> Class B | |
|-----------------|---|------|
| | uV | dBuV |
| 0.45 ~ 1.705 | 250 | 48 |
| 1.705 ~ 30 | 250 | 48 |

2.4 Instrument configuration

2.4.1 The EMI test receiver frequency range set from 450 KHz to 30 MHz.

2.4.2 The EMI test receiver bandwidth set at 9kHz.

2.4.3 The EMI test receiver detector set as Quasi-Peak (Q.P.).

2.5 Measured Mode

2.5.1 The test mode for preliminary test as following:

Mode 1: ROBOT

2.5.2 Selected the worst case mode when after preliminary test for final test, the mode as following:

Mode 1: ROBOT

2.6 Configuration of Measurement

2.6.1 The EUT was place on a non-conductive table whose total height equaled 80cm and vertical conducting plane located 40cm to the rear of the EUT.

2.6.2 The EUT was connected to the main power through Line Impedance Stabilization Networks (LISN). This setup provided a 50ohm/50?H coupling impedance for the measuring equipment. The auxiliary equipment was also connected to the main power through a LISN that provided a 50ohm/50?H coupling impedance with 50ohm termination. (Refer to the block diagram of the test setup and photographs.)

2.6.3 The conducted disturbance was measured between the phase lead and the reference ground, and between the neutral lead and reference ground. The initial testing identified the frequency that has the highest disturbance relative to the limit while operating the EUT in typical modes of operation and cable positions in a test setup representative of typical system configuration.

2.6.4 The identification of the frequency of highest disturbance with respect to the limit was found by investigating disturbances at a number of significant frequencies. The probable frequency of maximum disturbance had been found and that the associated cable and EUT configuration and mode of operation had been identified.

2.7 Configuration of EUT

2.7.1 Setup the EUT and simulators as shown section 2.2.

2.7.2 Turn on the power of all equipment.

2.7.3 Measured the Line phase and record value.

2.7.4 Changed into Neutral phase and record value.

2.8 Test Result

PASS

The final tests data as shown on following page.

Power Line Conducted Test Data

| | | | |
|----------------|-----------------|------------|--------|
| Date of Tested | : Dec. 11, 2000 | Power Line | : Line |
| Temperature | : 19 | Humidity | : 71% |
| Tested Mode | : ROBOT | | |

| Frequenc (MHz) | Factor (dB) | Meter Reading (dBuV) | | Emission Level (dBuV) | | Limits (dBuV/m) | | Margin (dB) | |
|-------------------|----------------|----------------------|---------|-----------------------|---------|-----------------|---------|-------------|---------|
| | | Quasi-Peak | Average | Quasi-Peak | Average | Quasi-Peak | Average | Quasi-Peak | Average |
| 0.462 | 0.70 | 38.60 | -- | 39.30 | -- | 48.00 | -- | -8.70 | -- |
| 0.485 | 0.67 | 38.40 | -- | 39.07 | -- | 48.00 | -- | -8.93 | -- |
| 0.520 | 0.67 | 37.40 | -- | 38.07 | -- | 48.00 | -- | -9.93 | -- |
| 0.559 | 0.70 | 36.40 | -- | 37.10 | -- | 48.00 | -- | -10.90 | -- |
| 0.587 | 0.70 | 34.70 | -- | 35.40 | -- | 48.00 | -- | -12.60 | -- |
| 0.630 | 0.70 | 32.20 | -- | 32.90 | -- | 48.00 | -- | -15.10 | -- |
| 25.231 | 1.90 | 32.40 | -- | 34.30 | -- | 48.00 | -- | -13.70 | -- |
| | | | | | | | | | |
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| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Remark :

1. All readings are Quasi-Peak values.
2. Factor = Insertion Loss + Cable Loss
3. “*” Means emission level un-detectable.
4. “--” Means do not need detect.

| | | | |
|----------------|-----------------|------------|-----------|
| Date of Tested | : Dec. 11, 2000 | Power Line | : Neutral |
| Temperature | : 19 | Humidity | : 71% |
| Tested Mode | : ROBOT | | |

[illegible]

1. All readings are Quasi-Peak values.
2. Factor = Insertion Loss + Cable Loss
3. “*” Means emission level un-detectable.
4. “--” Means do not need detect.

3 Radiated Emission Measurement

3.1 Instrument

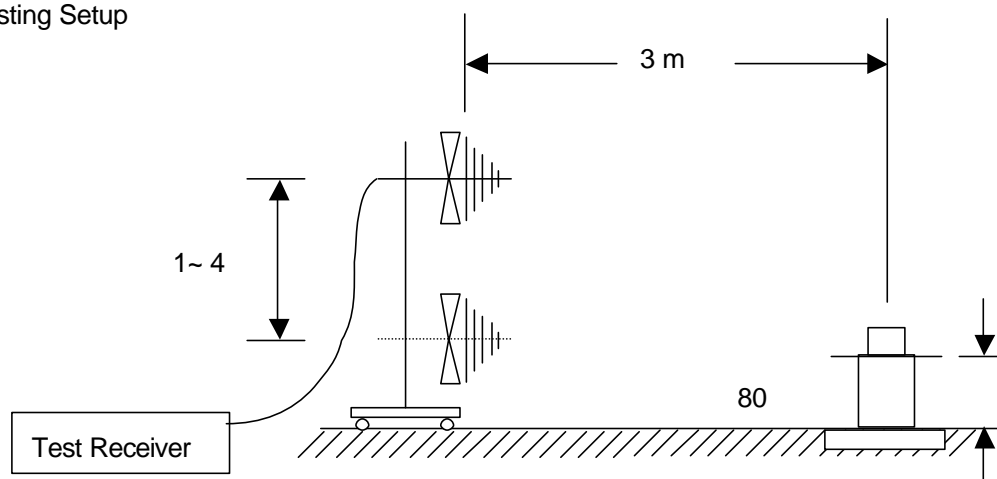
OATS 1

| Instrument | Manufacturer | Model | Serial No. | Last Calibration |
|-------------------|----------------------|-------------------|------------|------------------|
| EMI Test Receiver | Rohde & Schwarz | ESI 07 | 830154/002 | 2000/07/28 |
| Bi-Log Antenna | Schaffner | CBL6112B | 2610 | 2000/06/28 |
| Pre-Amplifier | Schaffner | CPA9231A | 3351 | 2000/11/13 |
| RF Cable | IETC | CBL01 | N/A | 2000/10/11 |
| Horn Antenna | Com-Power | AH-118 | 10081 | 2000/05/15 |
| Pre-Amplifier | Agilent Technologies | 8449B | 3008A01434 | 2000/06/19 |
| RF Cable | Insulated Wire | NPS-2251-7880-NPR | CBL06 | 2000/10/19 |

Note: All instrument upon which need to calibrated are with calibration period of 1 year.

3.2 Block Diagram of Test Configuration

Configuration of Testing Setup



3.3 Radiated Limit

☒ FCC Part 15 (30~1000 MHz)

| Frequency (MHz) | <input type="checkbox"/> Class A (10m) | | <input checked="" type="checkbox"/> Class B (3m) | |
|--------------------|--|---------------------|--|---------------------|
| | Field Strength (uV/m) | Quasi-Peak (dBuV/m) | Field Strength (uV/m) | Quasi-Peak (dBuV/m) |
| 30 ~ 88 | 90 | 39.08 | 100 | 40.00 |
| 88 ~ 216 | 150 | 43.52 | 150 | 43.52 |
| 216 ~ 960 | 210 | 46.44 | 200 | 46.02 |
| 960 above | 300 | 49.54 | 500 | 53.98 |

☒ FCC Part 15 (Section 15.249)

| Frequency (MHz) | Fundamental | | Harmonics | |
|-----------------|-------------|--------|-----------|--------|
| | mv/m | dBuV/m | uV/m | dBuV/m |
| 902~928 | 50 | 93.98 | 500 | 53.98 |
| 2400~2483.5 | 50 | 93.98 | 500 | 53.98 |

3.4 Instrument configuration

3.4.1 The EMI test receiver frequency range set from 30 MHz to 1000 MHz.

3.4.2 The EMI test receiver bandwidth set at 120 kHz.

3.4.3 The EMI test receiver detector set as Quasi-Peak (Q.P.).

3.4.4 The Spectrum frequency range set to fundamental and harmonics.

3.5 Measured Mode

3.5.1 The test mode for preliminary test as following:

Mode 1: ROBOT

3.5.2 Selected the worst case mode when after preliminary test for final test, the mode as following:

Mode 1: ROBOT

3.6 Configuration of Measurement

3.6.1 The EUT was place on a non-conductive table whose total height equaled 80cm. The turntable can rotate 360 degree to determine the position of the maximum emission level.

3.6.2 The EUT was set 10 meters away from the receiving antenna that was mounted on a non-conductive mast. The antenna can move up and down between 1 to 4 meters to find out the maximum emission level.

3.6.3 The initial testing identified the frequency that has the highest disturbance relative to the limit while operating the EUT in typical modes of operation and cable positions in a test setup representative of typical system configuration.

3.6.4 The identification of the frequency of highest emission with respect to the limit was found by investigating emissions at a number of significant frequencies. The probable frequency of maximum emission had been found and that the associated cable and EUT configuration and mode of operation had been identified.

3.7 Configuration of EUT

- 3.7.1 Setup the EUT and simulators as shown section 3.2.
- 3.7.2 Turn on the power of all equipment.
- 3.7.3 Measured the horizontal polarization and record the value.
- 3.7.4 Changed into vertical polarization and record the value.

3.8 Test Result

PASS.

The final tests data as shown on following page.

Radiated Emission Measurement Data

| | | | |
|----------------|-----------------|--------------|--------------|
| Date of Tested | : Dec. 18, 2000 | Polarization | : Horizontal |
| Temperature | : 22 | Humidity | : 68% |
| Tested Mode | : ROBOT | | |

| Frequency (MHz) | Factor (dB) | Meter Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV/m) | Margin (dB) |
|--------------------|----------------|-------------------------|--------------------------|--------------------|----------------|
| 270.075 | -12.34 | 50.18 | 37.84 | 46.00 | -8.16 |
| 333.125 | -8.59 | 44.77 | 36.18 | 46.00 | -9.82 |
| 342.825 | -7.81 | 46.68 | 38.87 | 46.00 | -7.13 |
| 352.525 | -8.56 | 47.75 | 39.19 | 46.00 | -6.81 |
| 548.950 | -7.48 | 48.04 | 40.56 | 46.00 | -5.44 |
| 563.500 | -7.67 | 44.35 | 36.68 | 46.00 | -9.32 |
| 585.325 | -7.12 | 43.54 | 36.42 | 46.00 | -9.58 |
| 602.300 | -4.89 | 42.87 | 37.98 | 46.00 | -8.02 |
| 810.850 | -5.84 | 41.22 | 35.38 | 46.00 | -10.62 |
| 903.000 * | -7.13 | 92.83 | 85.70 | 93.98 | -8.28 |
| 1806.104 * | -16.33 | 36.78 | 20.45 | 53.98 | -33.53 |
| 2452.966 * | -23.81 | 100.63 | 76.82 | 93.98 | -17.16 |
| 4905.972 * | -15.24 | 50.71 | 35.47 | 53.98 | -18.51 |
| | | | | | |
| | | | | | |

Remark :

1. All readings are Quasi-Peak values.
2. “*” Means Average values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier

Radiated Emission Measurement Data

| | | | |
|----------------|-----------------|--------------|------------|
| Date of Tested | : Dec. 18, 2000 | Polarization | : Vertical |
| Temperature | : 22 | Humidity | : 68% |
| Tested Mode | : ROBOT | | |

| Frequency (MHz) | Factor (dB) | Meter Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV/m) | Margin (dB) |
|--------------------|----------------|-------------------------|--------------------------|--------------------|----------------|
| 129.425 | -13.42 | 45.75 | 32.33 | 43.50 | -11.17 |
| 401.025 | -11.43 | 47.84 | 36.41 | 46.00 | -9.59 |
| 442.250 | -6.90 | 45.72 | 38.82 | 46.00 | -7.18 |
| 464.075 | -2.85 | 42.34 | 39.49 | 46.00 | -6.51 |
| 490.750 | -4.68 | 41.15 | 36.47 | 46.00 | -9.53 |
| 820.550 | -3.76 | 42.40 | 38.64 | 46.00 | -7.36 |
| 842.375 | -4.32 | 42.25 | 37.93 | 46.00 | -8.07 |
| 854.500 | -3.65 | 44.48 | 40.83 | 46.00 | -5.17 |
| 883.600 | -4.80 | 41.50 | 36.70 | 46.00 | -9.30 |
| 903.000 * | -5.66 | 94.43 | 88.77 | 93.98 | -5.21 |
| 1805.985 * | -16.33 | 43.11 | 26.78 | 53.98 | -27.20 |
| 2453.000 * | -23.81 | 100.03 | 76.22 | 93.98 | -17.76 |
| 4905.254 * | -15.24 | 51.43 | 36.19 | 53.98 | -17.79 |
| | | | | | |
| | | | | | |

Remark :

1. All readings are Quasi-Peak values.
2. “*” Means Average values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier

4 Frequency Measurements

4.1 Instrument

| Instrument | Manufacturer | Model | Serial No. | Last Calibration |
|---------------------|----------------------|-------------------|------------|------------------|
| EMI Test Receiver | Rohde & Schwarz | ESI 07 | 830154/002 | 2000/07/28 |
| Bi-Log Antenna | Schaffner | CBL6112B | 2610 | 2000/06/28 |
| Pre-Amplifier | Schaffner | CPA9231A | 3351 | 2000/11/13 |
| RF Cable | IETC | CBL03 | CBL03 | 2000/11/10 |
| Horn Antenna | Com-Power | AH-118 | 10081 | 2000/05/15 |
| Pre-Amplifier | Agilent Technologies | 8449B | 3008A01434 | 2000/06/19 |
| RF Cable | Insulated Wire | NPS-2251-3940-NPS | CBL08 | 2000/10/19 |
| RF Cable | Insulated Wire | NPS-2251-1180-NPR | CBL09 | 2000/10/19 |
| Temperature Chamber | KATO | SSE47BLA | N/A | 2000/08/23 |

Note: All instrument upon which need to calibrated are with calibration period of 1 year.

4.2 Measurement Operating Frequency

- 4.2.1 Test Condition: Temperature: 21 .
- 4.2.2 Supplied the EUT with fully charged battery.
- 4.2.3 Turn the EUT on and measure the EUT operating frequency at the start-up, and two, five, and ten minutes after startup.
- 4.2.4 Result as ROBOT:

| Timing | 900 MHz Channel | 2.4 GHz Channel |
|----------|-----------------|-----------------|
| Start-Up | 903.75039 | 2.45351 |
| 2 min. | 903.75038 | 2.45348 |
| 5 min. | 903.75027 | 2.45347 |
| 10 min. | 903.75017 | 2.45347 |

4.3 Measurement Frequency Stability vs. Temperature

- 4.3.1 Set the environmental temperature test chamber to temperature of 20 .
- 4.3.2 Supplied the EUT with fully charged battery.
- 4.3.3 Turn the environmental temperature test chamber on and wait the temperature of the chamber to stabilize.
- 4.3.4 While maintaining a constant temperature inside the environmental chamber, turn the EUT on and measure the EUT operating frequency at the start-up, and two, five, and ten minutes after startup.
- 4.3.5 Result as ROBOT:

| Timing | 900 MHz Channel | 2.4 GHz Channel |
|----------|-----------------|-----------------|
| Start-Up | 903.74989 | 2.45349 |
| 2 min. | 903.74987 | 2.45348 |
| 5 min. | 903.74980 | 2.45346 |
| 10 min. | 903.74977 | 2.45339 |

5 Occupied Bandwidth Measurements

5.1 Instrument

| Instrument | Manufacturer | Model | Serial No. | Last Calibration |
|-------------------|----------------------|-------------------|------------|------------------|
| EMI Test Receiver | Rohde & Schwarz | ESI 07 | 830154/002 | 2000/07/28 |
| Bi-Log Antenna | Schaffner | CBL6112B | 2610 | 2000/06/28 |
| Pre-Amplifier | Schaffner | CPA9231A | 3351 | 2000/11/13 |
| RF Cable | IETC | CBL03 | CBL03 | 2000/11/10 |
| Horn Antenna | Com-Power | AH-118 | 10081 | 2000/05/15 |
| Pre-Amplifier | Agilent Technologies | 8449B | 3008A01434 | 2000/06/19 |
| RF Cable | Insulated Wire | NPS-2251-3940-NPS | CBL08 | 2000/10/19 |
| RF Cable | Insulated Wire | NPS-2251-1180-NPR | CBL09 | 2000/10/19 |

Note: All instrument upon which need to calibrated are with calibration period of 1 year.

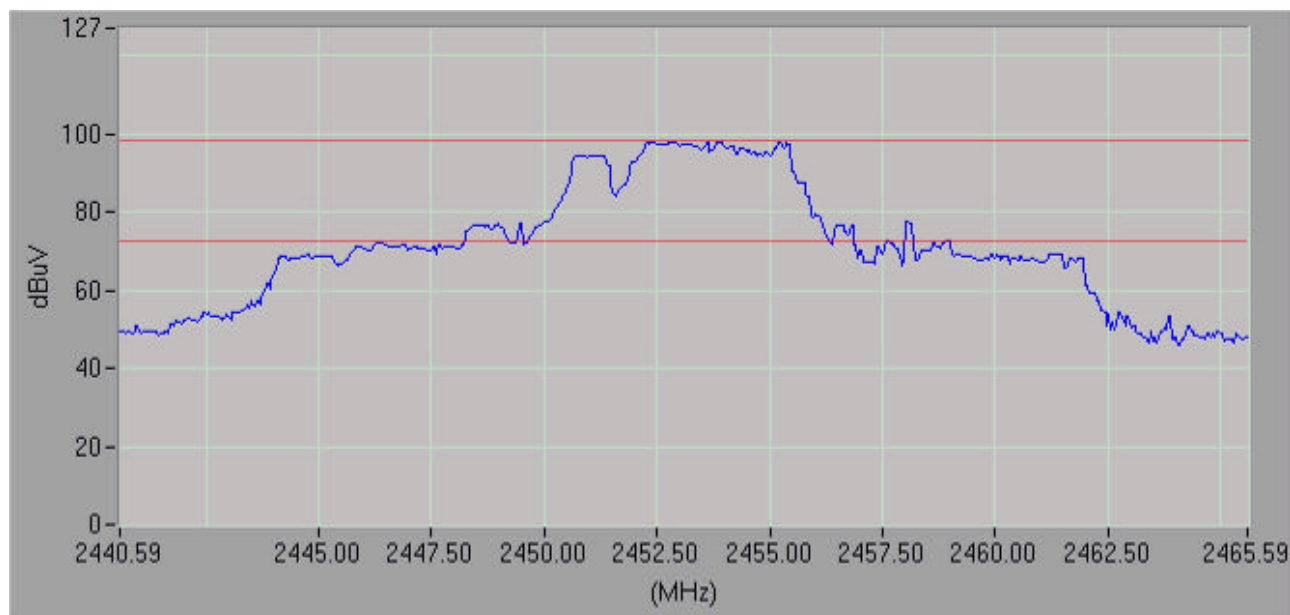
5.2 Instrument configuration

5.2.1 The EMI test receiver bandwidth set at 120 kHz.

5.3 Result

5.3.1 ROBOT 2.4 GHz Channel

Frequency: 2.453 GHz



5.3.2 ROBOT 900 MHz Channel

Frequency: 903.75 MHz

