Cert. No. 1152.01
Electrical (EMC)

DATE: 02 October 2005

I.T.L. (PRODUCT TESTING) LTD.

AS/NZS EMC Test Report

for

Galcon Galil Control

Equipment under test:

Wireless Unit

Gator G3Rx

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
Y. Mordukhovitch, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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1. General Information

1.1 Administrative Information

Manufacturer:	Galcon Galil Control
Manufacturer's Address:	Kibbutz Kfar Blum Upper Galilee D.N. 12150 Israel Tel: +972-4-690-0222 Fax: +972-4-690-2727
Manufacturer's Representative:	Shay Shtekelmacher Eyal Lubenfeld
Equipment Under Test (E.U.T):	Wireless Unit
Equipment Model No.:	Gator G3Rx
Equipment Serial No.:	000425L
Date of Receipt of E.U.T:	08.06.05
Start of Test:	08.06.05
End of Test:	08.06.05
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2

1.2 Abbreviations and Symbols

The following abbreviations and symbols are applicable to this test report:

AC	alternating current
ARA	Antenna Research Associates
Aux	auxiliary
Avg	average
CDN	coupling-decoupling network
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dbµV	decibel referred to one microvolt
dbµV/m	decibel referred to one microvolt per meter
DC	direct current
EMC	electromagnetic compatibility
E.U.T.	equipment under test
GHz	gigahertz
HP	Hewlett Packard
Hz	Hertz
kHz	kilohertz
kV	kilovolt
LED	light emitting diode
LISN	line impedance stabilization network
m	meter
mHn	millihenry
MHz	megahertz
msec	millisecond
N/A	not applicable
QP	quasi-peak
PC	personal computer
RF	radio frequency
RE	radiated emission
sec	second
V	volt

1.3 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

2. Applicable Documents

2.1	**AS/NZS CISPR 22: 2004**	*Information technology equipment —Radio disturbance characteristics —Limits and methods of measurement*
2.2	**CISPR 16-1: 1999**	*Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1. Radio Disturbance and Immunity Measuring Apparatus*
2.3	**CISPR 16-2: 1999**	*Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 2. Methods of measurement of disturbances and immunity*
2.4	**ANSI C63.4-2003**	*American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.*

3. Test Site Description

3.1 Location

The Electromagnetic Compatibility Test Facility of I.T.L. (PRODUCT TESTING) LTD. is located at Kfar Bin Nun, Israel 99780

Telephone: + 972-8-9797799, Fax: + 972-8-9797702

3.2 Shielded Room

A Modular Shielded Room, Type S81, manufactured by Rayproof, consisting of a Main Room and a Control Room.

The dimensions of the Main Room are: length: 7.4 m, width: 4.35 m, height: 3.75 m.

The dimensions of the Control Room are: length: 3.12 m, width: 2.5 m, height: 2.5 m.

The shielding performance is:

magnetic field: 60 dB at 10 kHz rising linearly to 100 dB at 100 kHz,
electric field: better than 110 dB between 50 MHz and 1 GHz,
plane wave: 110 dB between 50 MHz and 1 GHz.

All the power lines entering both shielded rooms are filtered.

3.3 Open Test Site

Consists of 3 meter and 10 meter ranges, using a 7x14 meter solid metal ground plane, a remote controlled turntable and an antenna mast. The turntable and the tested equipment that is placed on it are environment protected. All the power, control and signal lines are routed under the ground plane.

3.4 Antenna Mast

Type AAM-4/A, manufactured by Antenna Research Associates (ARA). The antenna position and polarization are remotely controlled via Fiber Optical Link using ARA Dual Controller Type ACU-2/5, and pressurized air.

The antenna position is adjustable between 1-4 meters.

3.5 Turntable

Type ART-1001/4, manufactured by ARA. The position of the turntable is remotely controlled via a Fibre Optic Link, using ARA Dual Controller Type ACU-2/5. The turntable is mounted in a pit and its surface is flush with the Open Site Ground Plane.

3.6 EMI Receiver

Type HP8542E, including HP85420E R.F. filter manufactured by Hewlett-Packard, being in full compliance with CISPR 16 requirements.

3.7 Test Equipment

See details in Section 6.

4. Summary of Test Results

Test	Results
Radiated Emissions AS/NZS CISPR 22: 2004, Class B	The E.U.T met the performance requirements of the specification. The margin between the emission level and the specification limit was 8.5 dB in the worst case at the frequency of 74.28 MHz, horizontalpolarization.

5. Equipment Under Test (E.U.T.) Description

This product is a receiver that was tested at the operating frequency of 445 MHz. Please contact the manufacturer for additional details.

6. List of Test Equipment

6.1 Emission Tests

The equipment indicated below by an "X" was used for testing Conducted Emission and (**CE**) and Radiated Emission (**RE**).

Test equipment calibration is in accordance with ITL Q.A. Procedure PM 110 "Calibration Control Procedure", which complies with ISO 9002 and ISO/IEC Guide 17025

Instrument	Manufacturer	Model	Serial No.	Used in Test	
				CE	RE
Dipole Antenna Set	CDI	A100	597		
Signal Generator	Marconi	2022D	119196015		
LISN	Fischer	FCC-LISN-2A	127		
LISN	Fischer	FCC-LISN-2A	128		
Spectrum Analyzer	HP	8591E	3414U01226		
RF Amplifier	HP	8447F	3113A04961		
Close Field Probe	HP	HP11941A	2807A03046		
Close Field Probe	HP	HP11940A	2650A04587		
Receiver	HP	85420E/85422E	3427A00103/34		X
Antenna - Biconical	ARA	BCD-235/B	1041		X
Antenna - Log Periodic	ARA	LPD-2010/A	1037		
Antenna - Log Periodic	ARA	LPD-2010/A	1038		X
Antenna Mast	ARA	AAM-4A			X
Turntable	ARA	ART-1001/4			X
Mast & Table Controller	ARA	ACU-2/5	1001		X
Standard Impedance Network	Xitron	2520	7002		
Power Analysis System	Xitron	2503A	2005		
AC Power Source	Behlman	ACP			
CDN Network	FCC	FCC-801-T4	64		
CDN Network	FCC	FCC-801-T2	60		
Current probe	FCC	F42			

7. E.U.T. Performance Verification

7.1 Mode of Operation

The E.U.T. was operated in normal operation mode with an internal 3.6VDC lithium battery.
The E.U.T. was operated with the outputs in the “OFF” position and open circuits wires.

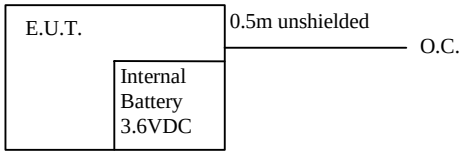

Figure 1. Test Set-up

8. Radiated Emission

8.1 Test Specification

30-1000 MHz, AS/NZS CISPR 22: 2004, CLASS B

8.2 Test Procedure

The E.U.T operation mode and test set-up are as described in section 7.1.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph *Figure 4. Radiated Emission Test*.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.

Using a frequency span less than 10 MHz.

Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The emissions were measured at a distance of 3 meters.

8.3 Test Results

The E.U.T met the requirements of the AS/NZS CISPR 22: 2004, Class B specification requirements.
The margin between the emission level and the specification limit was 8.5 dB in the worst case at the frequency of 74.28 MHz, horizontal polarization.

The signals in the band 300 MHz – 1000 MHz were below the spectrum analyzer noise level which is at least 6dB below the specification limit.

The details of the highest emissions are given in *Figure 2* to *Figure 3*.

Radiated Emission

E.U.T Description Wireless Unit
Type Gator G3Rx
Serial Number: 000425L

Specification: AS/NZS CISPR 22: 2002, Class B

Antenna Polarization: Horizontal
Antenna: 3 meters distance
Frequency range: 30 MHz to 300 MHz
Detectors: Quasi-peak

Frequency (MHz)	Quasi-peak Amp (dBµV/m)	Antenna Factor (dB)	Cable Factor (dB)	Specification (dBµV/m)	Margin (dB)
74.23	32.0	8.7	1.3	40.5	-8.5
148.46	23.3	12.5	2.0	40.5	-17.2
296.91	24.9	19.7	3.1	47.5	-22.6

Figure 2. Radiated Emission. Antenna Polarization: HORIZONTAL. Detectors: Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description Wireless Unit
Type Gator G3Rx
Serial Number: 000425L

Specification: AS/NZS CISPR 22: 2002, Class B

Antenna Polarization: Vertical
Antenna: 3 meters distance
Frequency range: 30 MHz to 300 MHz
Detectors: Quasi-peak

Frequency (MHz)	Quasi-peak Amp (dBµV/m)	Antenna Factor (dB)	Cable Factor (dB)	Specification (dBµV/m)	Margin (dB)
74.23	29.4	8.7	1.3	40.5	-11.1
148.46	25.8	12.5	2.0	40.5	-14.7
296.91	24.3	19.7	3.1	47.5	-23.2

Figure 3. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

9. Set Up Photographs

Figure 4. Radiated Emission Test

10. Signatures of the E.U.T.'s Test Engineers

Test	Test Engineer Name	Signature	Date
Radiated Emissions	Y. Mordukhovitch		20.10.05

11. APPENDIX A - CORRECTION FACTORS

11.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
90.0	1.6
100.0	1.7
150.0	2.0
200.0	2.3
250.0	2.7
300.0	3.1
350.0	3.4
400.0	3.7
450.0	4.0
500.0	4.3
600.0	4.7
700.0	5.3
800.0	5.9
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 27 meters.

3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

11.2 Correction factors for CABLE

from EMI receiver to test antenna

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.2
20.0	0.2
30.0	0.2
40.0	0.2
50.0	0.3
60.0	0.4
70.0	0.4
80.0	0.4
90.0	0.5
100.0	0.5
150.0	0.6
200.0	0.6
250.0	0.7
300.0	0.8
350.0	0.9
400.0	1.0
450.0	1.1
500.0	1.2
600.0	1.3
700.0	1.4
800.0	1.4
900.0	1.5
1000.0	1.5

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	1.6
1400.0	1.8
1600.0	2.1
1800.0	2.2
2000.0	2.3
2300.0	2.8
2600.0	2.7
2900.0	3.1

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 5.5 meters.

11.3 Correction factors for CABLE

from EMI receiver to test antenna at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.8
30.0	0.9
40.0	1.2
50.0	1.4
60.0	1.6
70.0	1.8
80.0	1.9
90.0	2.0
100.0	2.1
150.0	2.6
200.0	3.2
250.0	3.8
300.0	4.2
350.0	4.6
400.0	5.1
450.0	5.3
500.0	5.6
600.0	6.3
700.0	7.0
800.0	7.6
900.0	8.0
1000.0	8.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	9.8
1400.0	10.0
1600.0	11.3
1800.0	12.2
2000.0	13.1
2300.0	14.5
2600.0	15.9
2900.0	16.4

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 34 meters.

3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

11.4 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

11.5 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

11.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. *Antenna serial number is 1041.*
2. *The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".*

11.7 Correction factors for BICONICAL ANTENNA

Type 3109,
1.0 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	11.1
30.0	12.0
40.0	12.0
50.0	11.4
60.0	10.3
70.0	10.7
80.0	8.3
90.0	9.0
100.0	10.0
110.0	11.6
120.0	13.6
130.0	14.2
140.0	13.5
150.0	12.7
160.0	12.7
170.0	13.6
180.0	15.3
190.0	14.6
200.0	14.7
210.0	15.3
220.0	15.8
230.0	17.0
240.0	18.0
250.0	18.1
260.0	18.0
270.0	17.5
280.0	18.2
290.0	19.7
300.0	21.8

NOTES:

1. Antenna serial number is 3244.

2. The above list is located in file 44BIC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"

11.8 Correction factors for BICONICAL ANTENNA

Type 3109,
3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	18.4
30.0	14.0
40.0	12.3
50.0	10.6
60.0	8.3
70.0	8.7
80.0	7.2
90.0	8.6
100.0	10.1
110.0	11.2
120.0	11.8
130.0	12.3
140.0	12.7
150.0	12.5
160.0	12.4
170.0	12.1
180.0	12.2
190.0	12.8
200.0	13.7
210.0	14.5
220.0	15.4
230.0	15.9
240.0	16.3
250.0	16.7
260.0	17.1
270.0	17.2
280.0	17.5
290.0	18.1
300.0	18.9

NOTES:

1. Antenna serial number is 3244.

2. The above list is located in file 44BIC3M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"

12. APPENDIX B - MEASUREMENT UNCERTAINTY

12.1 Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.