CERTIFICATION TEST REPORT

FOR THE

27.145 MHZ TRANSMITTER, FMT-302

FCC PART 15 SUBPART C
COMPLIANCE

DATE OF ISSUE: DECEMBER 20, 1999

PREPARED FOR:

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W.O. No: 71920

Report No: FC00-007

PREPARED BY:

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Date of test: August 5 & December 23, 1999

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Director of Laboratories
CKC Laboratories, Inc.

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ADMINISTRATIVE INFORMATION

DATE OF TEST:	August 5 & December 23, 1999
PURPOSE OF TEST:	To demonstrate the compliance of the 27.145 MHz Transmitter, FMT-302, with the requirements for FCC Part 15 Subpart C devices.
MANUFACTURER:	Elsema Pty Ltd Unit 3, 10 Hume Road Smithfield 2164 Australia
REPRESENTATIVE:	Hermann Roesch
TEST LOCATION:	CKC Laboratories, Inc. 5473A Clouds Rest Mariposa, CA 95338
TEST PERSONNEL:	Skip Doyle & Craig Mullis
TEST METHOD:	ANSI C63.4 1992
FREQUENCY RANGE TESTED:	27-1000 MHz
EQUIPMENT UNDER TEST:	**27.145 MHz Transmitter** Manuf: South Pacific Electronics LTD. Model: FMT302 Serial: 001 FCC ID: OHKFMT-302 (pending)

SUMMARY OF RESULTS

The Elsema Pty Ltd 27.145 MHz Transmitter, FMT-302, was tested in accordance with ANSI C63.4 1992 for compliance with FCC Part 15 Subpart C.

As received, the above equipment was found to be fully compliant with the limits of FCC Part 15 Subpart C. The results in this report apply only to the items tested, as identified herein.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Two channel 27MHz hand held remote control digital transmitter.

Note: The customer user manual refers to multiple channels. Only the one channel reflected in this test report will be sold in the United States. The other channels are for different countries. A different channel is selected by using a different crystal and is done during the manufacturing stage. The consumer cannot change the transmitter to a different channel.

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ±4dB measurement uncertainty.

PERIPHERAL DEVICES

The EUT was not tested with peripheral devices.

REPORT OF MEASUREMENTS

The following tables report the highest worst case levels recorded during the tests performed on the 27.145 MHz Transmitter, FMT-302. All readings taken are peak readings unless otherwise noted by a "Q" or "A". The data sheets from which these tables were compiled are contained in Appendix B.

Table 1: Fundamental Radiated Emission Levels

FREQUENCY MHz	METER READING dBµV	CORRECTION FACTORS Mag dB	dB	Cable dB	Dist dB	CORRECTED READING dBµV/m	SPEC LIMIT dBµV/m	MARGIN DB	NOTES
27.150	64.9	9.4		1.0		75.3	80.0	-4.7	VQ
27.150	65.6	9.4		1.0		76.0	80.0	-4.0	V
27.150	59.9	9.4		1.0		70.3	80.0	-9.7	V
27.150	55.7	9.4		1.0		66.1	80.0	-13.9	V
27.150	61.2	9.4		1.0		71.6	80.0	-8.4	H
27.150	59.7	9.4		1.0		70.1	80.0	-9.9	H

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.227(a)/15.205
Test Distance: 3 Meters

NOTES:
H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT operating on fresh 9V battery. EUT is continuously transmitting a modulated signal at 27.145 MHz. Limits are in accordance with FCC 15.227(a). The EUT was tested in three orthogonal planes of orientation to reflect the worse case of spurious emissions.

Table 2: Six Highest Spurious Emission Levels									
FREQUENCY MHz	METER READING dBµV	CORRECTION FACTORS Ant dB	Amp dB	Cable dB	Dist dB	CORRECTED READING dBµV/m	SPEC LIMIT dBµV/m	MARGIN dB	NOTES
48.046	48.7	10.5	-26.9	1.3		33.6	40.0	-6.4	V
60.064	47.4	9.4	-26.8	1.3		31.3	40.0	-8.7	V
66.071	50.7	8.5	-26.8	1.4		33.8	40.0	-6.2	V
108.061	47.7	12.6	-26.8	1.9		35.4	43.5	-8.1	V
114.030	48.9	13.1	-26.8	1.9		37.1	43.5	-6.4	V
126.078	45.6	14.0	-26.8	2.0		34.8	43.5	-8.7	V

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.227(b)/15.209
Test Distance: 3 Meters

NOTES:
H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: The EUT is located on the 80 cm table at the center of the Barn turntable. The transmitter is operating on 9VDC batteries. The EUT was tested in three orthogonal planes of orientation to reflect the worse case of spurious emissions.

TABLE A

LIST OF TEST EQUIPMENT

The following list of test equipment used is calibrated regularly.

1. Spectrum Analyzer, Hewlett Packard, Model No. HP 8568B, S/N 2007A01066 (RF section), Model No. 85662A, S/N 2005A01550 (Display unit). Calibration date: October 28, 1998. Calibration due date: October 10, 1999.

2. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2043A00272. Calibration date: October 10, 1998. Calibration due date: October 10, 1999.

3. Preamp, Hewlett Packard, Model No. 8447D, S/N 1937A01933. Calibration date: April 28, 1999. Calibration due date: April 28, 2000.

4. Biconical Antenna, Electro-metric Model No. BIA-30, S/N 138. Calibration date: May 20, 1998. Calibration due date: May 20, 2000.

5. Mag Loop Antenna, EMCO, Model No. 6502, S/N 1074. Calibration date: June 16, 1999. Calibration due date: June 16, 2000.

6. Log Periodic Antenna, Electro-metric, Model No. LPA-30, S/N 352. Calibration date: May 20, 1998. Calibration due date: May 20, 2000.

7. Mariposa site A. Calibration date: September 16, 1999. Calibration due date: September 16, 2002.

8. Test software, EMI Test 3.08

EUT SETUP

The equipment under test (EUT) was set up in a manner that represented its normal use. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Table 1 for the fundamental emissions and Table 2 for spurious emissions. Additionally, a complete description of all the ports and I/O cables is included on the information sheets contained in Appendix A.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of table top devices.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect the radiated emissions data for the 27.145 MHz Transmitter, FMT-302. The mag loop antenna was used for measurements below 30 MHz. For radiated measurements between 30 to 300 MHz, the biconical antenna was used. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. All antennas were located at a distance of 3 meters from the edge of the EUT.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dBµV, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz

SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1 and 2 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in the appropriate table. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the 27.145 MHz Transmitter, FMT-302.

Peak

In this mode, the Spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP Quasi-Peak Adapter for the HP Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

Average

When the frequencies are less than 30 MHz, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

TEST METHODS

The radiated emissions data of the 27.145 MHz Transmitter, FMT-302, was taken with the HP Spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". The corrected data was then compared to the FCC Part 15, Subpart C emissions limits to determine compliance.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode. For frequencies below 30 MHz the mag loop antenna was used. The frequency range of 30 MHz - 88 MHz was then scanned with the biconical antenna located about 1.5 meter above the ground plane in the vertical configuration. During this scan, the turntable was rotated and all peaks which were at or near the limit were recorded. The frequency range of 100 - 300 MHz was scanned with the biconical antenna in the same manner, and the peaks recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconical antenna was changed to the horizontal polarity and the above steps were repeated. After changing to the log periodic antenna in the horizontal configuration, the frequency range of 300 - 1000 MHz was scanned. The log periodic antenna was changed to the vertical polarity and the frequency range of 300 - 1000 MHz was again scanned. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan, a thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation and antenna height. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

FCC Part 15.215- Occupied Bandwidth Measurements

In accordance with Part 15.215(c), the fundamental frequency was kept within the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Frequency Range of Transmitter: 27 MHz

In accordance with Part 15.227(a), the field strength of the emissions within the 26.96-27.28 MHz band did not exceed 10,000 microvolts/meter at 3 meters. The emission limit is based on the measurement instrumentation employing an average detector. The provisions in 15.35 for limiting peak emissions apply.

SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in Tables 1 and 2. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula:

Meter reading (dBµV)
+ Antenna Factor (dB)
+ Cable Loss (dB)
- Distance Correction (dB)
- Pre-amplifier Gain (dB)

= Corrected Reading (dBµV/m)

This reading was then compared to the applicable specification limit to determine compliance.

A typical data sheet will display the following in column format:

#	Freq MHz	Rdng dBuV	Cable	Amp	Bicon	Log	Dist	Corr dBuV/m	Spec	Margin	Polar
	Mag										

means reading number
Freq MHz is the frequency in MHz of the obtained reading.
Rdng dBuV is the reading obtained on the spectrum analyzer in dBµV.
Amp is short for the preamplifier factor or gain in dB.
Bicon is the biconical antenna factor in dB.
Log is the log periodic antenna factor in dB.
Mag is the mag loop antenna factor in dB.
Cable is the cable loss in dB of the coaxial cable on the OATS.
Dist is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.
Corr dBµV/m is the corrected reading which is now in dBµV/m (field strength).
Spec is the specification limit (dB) stated in the agency's regulations.
Margin is the closeness to the specified limit in dB; + is over and - is under the limit.
Polar is the Polarity of the antenna with respect to earth.

APPENDIX A

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

INFORMATION ABOUT THE EQUIPMENT UNDER TEST	
Test Software/Firmware:	N/A
CRT was displaying:	N/A
Power Supply Manufacturer:	N/A
Power Supply Part Number:	N/A
AC Line Filter Manufacturer:	N/A
AC Line Filter Part Number:	N/A
The EUT has no power cord.	

I/O PORTS	
Type	#
N/A	

CRYSTAL OSCILLATORS	
Type	Freq. In MHz
Custom made CMOS Chip 30ppm Fundamental Crystal	27.145

PRINTED CIRCUIT BOARDS				
Function	Model & Rev	Clocks, MHz	Layers	Location
Transmitter main board	Elsema B43A	N/A	2	N/A

REQUIRED EUT CHANGES TO COMPLY:
None.

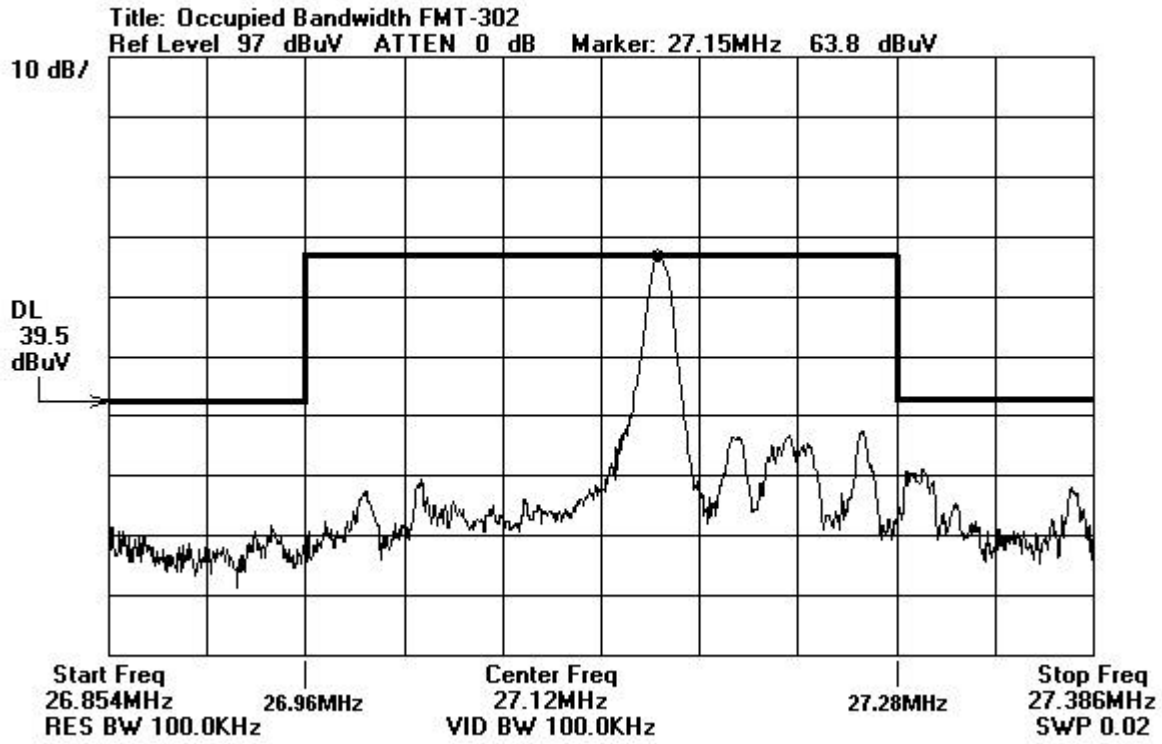
CABLE PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Front View

APPENDIX B

MEASUREMENT DATA SHEETS

Occupied Bandwidth Plot Part 15.215



Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC

Customer: **Elsema**
Specification: **FCC 15.227(a)/15.205**
Work Order #: **71920** Date: 12/23/1999
Test Type: **Fundamental Emissions** Time: 11:11:24
Equipment: **Transmitter** Sequence#: 1
Manufacturer: Elsema Tested by: Craig Mullis
Model: FMT-302
S/N:

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Transmitter	Elsema	FMT-302	

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

COMMENTS: EUT operating on fresh 9V battery. EUT is continuously transmitting a modulated signal at 27.145 MHz. Limits are in accordance with FCC 15.227(a). The EUT was tested in three orthogonal planes of orientation to reflect the worse case of spurious emissions.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Cable dB	Mag DB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1 QP	27.150M	64.9	+1.0	+9.4			+0.0	75.3	80.0 Standing	-4.7	Vert
^	27.150M	65.6	+1.0	+9.4			+0.0	76.0	80.0 Standing	-4.0	Vert
^	27.150M	59.9	+1.0	+9.4			+0.0	70.3	80.0 Flat	-9.7	Vert
^	27.150M	55.7	+1.0	+9.4			+0.0	66.1	80.0 Side	-13.9	Vert
5	27.150M	61.2	+1.0	+9.4			+0.0	71.6	80.0 Standing	-8.4	Horiz
6	27.150M	59.7	+1.0	+9.4			+0.0	70.1	80.0 Flat	-9.9	Horiz
7	27.150M	51.3	+1.0	+9.4			+0.0	61.7	80.0 Side	-18.3	Horiz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC

Customer: **ELSEMA**
Specification: **FCC 15.227(b)/15.209**
Work Order #: **71920** Date: Thu Aug-05-1999
Test Type: **Spurious Emissions** Time: 16:04:40
Equipment: **Transmitter** Sequence#: 2
Manufacturer: ELSEMA Tested By: Skip Doyle
Model: FMT302
S/N: N/A

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Transmitter	Elsema	FMT302	

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

The EUT is located on the 80 cm table at the center of the Barn turntable. The transmitter is operating on 9VDC batteries. The EUT was tested in three orthogonal planes of orientation to reflect the worse case of spurious emissions.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Amp dB	Bicon dB	Log dB	Cable dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	66.071M	50.7	-26.8	+8.5	+0.0	+1.4	+0.0	33.8	40.0	-6.2	Vert
2	114.030M	48.9	-26.8	+13.1	+0.0	+1.9	+0.0	37.1	43.5	-6.4	Vert
3	48.046M	48.7	-26.9	+10.5	+0.0	+1.3	+0.0	33.6	40.0	-6.4	Vert
4	108.061M	47.7	-26.8	+12.6	+0.0	+1.9	+0.0	35.4	43.5	-8.1	Vert
5	60.064M	47.4	-26.8	+9.4	+0.0	+1.3	+0.0	31.3	40.0	-8.7	Vert
6	126.078M	45.6	-26.8	+14.0	+0.0	+2.0	+0.0	34.8	43.5	-8.7	Vert
7	48.046M	46.1	-26.9	+10.5	+0.0	+1.3	+0.0	31.0	40.0	-9.0	Horiz
8	84.076M	48.0	-26.9	+8.0	+0.0	+1.6	+0.0	30.7	40.0	-9.3	Vert
9	78.072M	48.7	-26.9	+7.1	+0.0	+1.6	+0.0	30.5	40.0	-9.5	Vert
10	78.074M	48.1	-26.9	+7.1	+0.0	+1.6	+0.0	29.9	40.0	-10.1	Horiz
11	36.060M	43.9	-27.1	+11.2	+0.0	+1.1	+0.0	29.1	40.0	-10.9	Vert
12	132.078M	42.8	-26.8	+13.8	+0.0	+2.1	+0.0	31.9	43.5	-11.6	Vert
13	72.078M	45.1	-26.8	+7.7	+0.0	+1.4	+0.0	27.4	40.0	-12.6	Vert
14	120.086M	42.1	-26.8	+13.5	+0.0	+2.0	+0.0	30.8	43.5	-12.7	Vert
15	84.046M	44.4	-26.9	+8.0	+0.0	+1.6	+0.0	27.1	40.0	-12.9	Horiz
16	168.084M	39.7	-26.7	+14.6	+0.0	+2.4	+0.0	30.0	43.5	-13.5	Horiz
17	144.076M	40.8	-26.8	+13.1	+0.0	+2.2	+0.0	29.3	43.5	-14.2	Vert
18	138.068M	40.2	-26.8	+13.5	+0.0	+2.1	+0.0	29.0	43.5	-14.5	Vert
19	150.071M	40.5	-26.8	+12.7	+0.0	+2.2	+0.0	28.6	43.5	-14.9	Vert