1/SCRS MANUAL

ITS Intertek Testing Services
ETL Testing Laboratories

Lego Systems Inc.

Emissions Testing
Performed
on the

Transmitter

Model: 71646

FCC ID: NPI71646

Applicant: LEGO Systems, Inc.
555 Taylor Road
Enfield, CT 06083

Manufacturer: Tectron Developments Pte.Ltd.
BLD.4008 Ang Mo Kio Avenue 10
#03-12/13 Tech Place
Singapore 569625, Singapore

WO# 98010289
CKL/at
February 16, 1998

Intertek Testing Services Hong Kong Ltd.
2/F., Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong.
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EXHIBIT 1

GENERAL DESCRIPTION

1.0 General Description

1.1 Product Description

The equipment under test (EUT) is a transmitter operating at 27.145 MHz and the transmitting frequency is controlled by a crystal. The transmitter is powered by a 9Vdc battery. The transmitter functions as a controller for a remote controlled toy car. There is two control panels. One control panel is used for control forward and backward motion. The other is used for control left and right motion.

1.2 Test Methodology

The radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in Open Area Test Sites. Preliminary scans were performed in the Open Area Test Sites only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the emission data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been fully placed on file with the FCC.

EXHIBIT 2

SYSTEM TEST CONFIGURATION

2.0 System Test Configuration

2.1 Justification

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a cardboard box, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The worst case bit sequence was applied during test.

The EUT was powered from a new, fully charged 9Vdc battery.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the button is depressed, the unit transmits the typical signal. For simplicity of testing, the unit was wired to transmit continuously.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Equipment Modification

Any modifications installed previous to testing by Logo Systems Inc. will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services.

2.5 Support Equipment List and Description

This product was tested in a standalone configuration.

All the items listed under section 2.0 of this report are

Confirmed by:

C. K. Lam
Assistant Manager
Intertek Testing Services

Lam _____ Signature

16 February, 1998 _____ Date

EXHIBIT 3

EMISSION RESULTS

3.0 Emission Results

Data is included worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

3.1 Field Strength Calculation (cont)

Example

Assume a receiver reading of 62.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 62.0 dBμV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB

AV = -10 dB

FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 dBμV/m

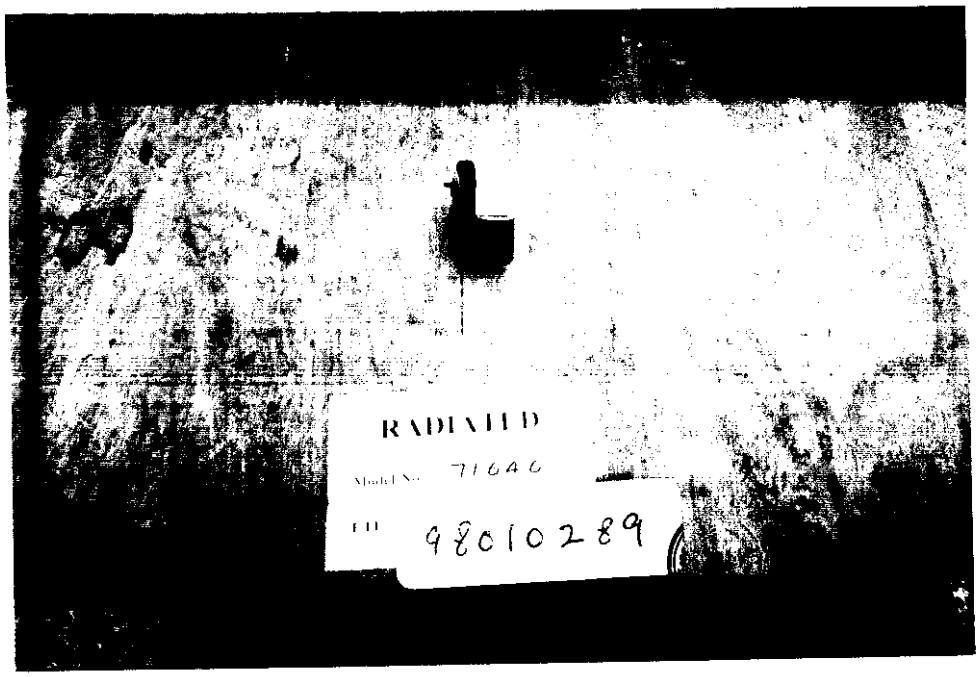
Level in mV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m

3.2 Radiated Emission Configuration Photograph

Worst Case Radiated Emission

Front View

54.296 MHz

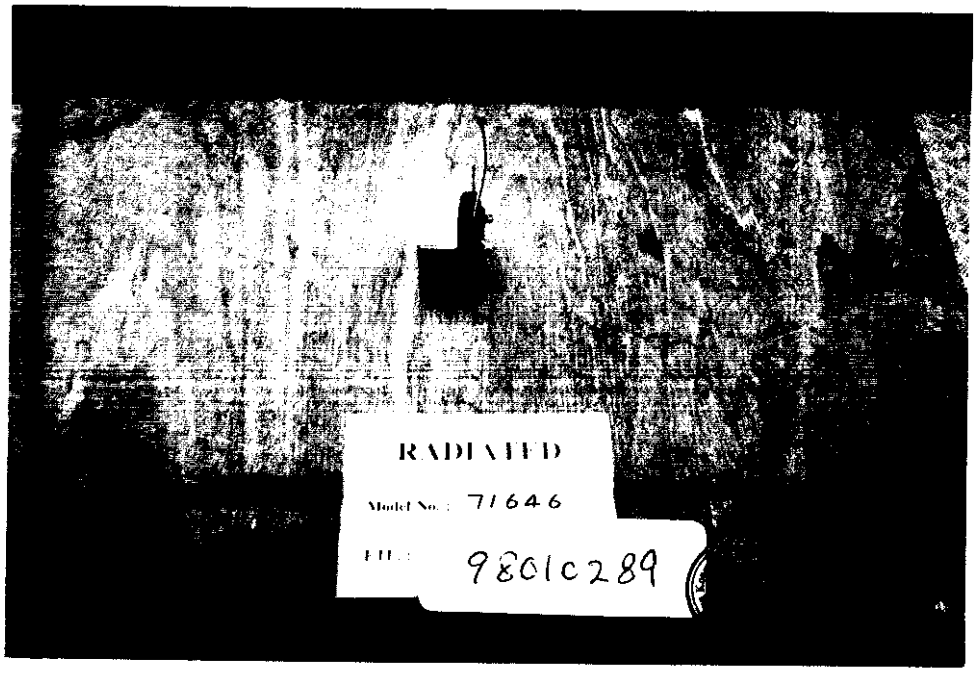


3.2 Radiated Emission Configuration Photograph (cont)

Worst Case Radiated Emission

Rear View

54.296 MHz



3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 3.6 dB

TEST PERSONNEL:

Signature

Ken C. C. Lam, Compliance Engineer
Typed/Printed Name

Feb. 16, 1998
Date

Company: Lego Systems Inc.
Model: 71646

Date of Test: February 3, 1998

Table 1

Radiated Emissions

Polarity	Frequency (MHz)	Reading (dBμV)	Antenna Factor (dB)	Pre-Amp Gain (dB)	Average Factor (-dB)	Net at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
V	27.147	78.9	-1.8	16	5.5	55.6	80.0	-24.4
V	54.296	41.4	11	16	--	36.4	40.0	-3.6
V	81.442	33.2	7	16	--	24.2	40.0	-15.8
H	*108.587	29.2	13	16	--	26.2	43.5	-17.3
H	190.027	29.3	16	16	--	29.3	43.5	-14.2
H	217.174	29.8	17	16	--	30.8	46.0	-15.2
H	*244.318	29.4	20	16	--	33.4	46.0	-12.6
H	*271.464	20.5	22	16	--	26.5	46.0	-19.5

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna and average detector are used for the emission over 1000MHz.

*Emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209 is based on Quasi peak detector data for frequencies below 1000 MHz and average detector data for frequencies over 1000 MHz.

Test Engineer: Ken C. C. Lam

EXHIBIT 4

MISCELLANEOUS INFORMATION

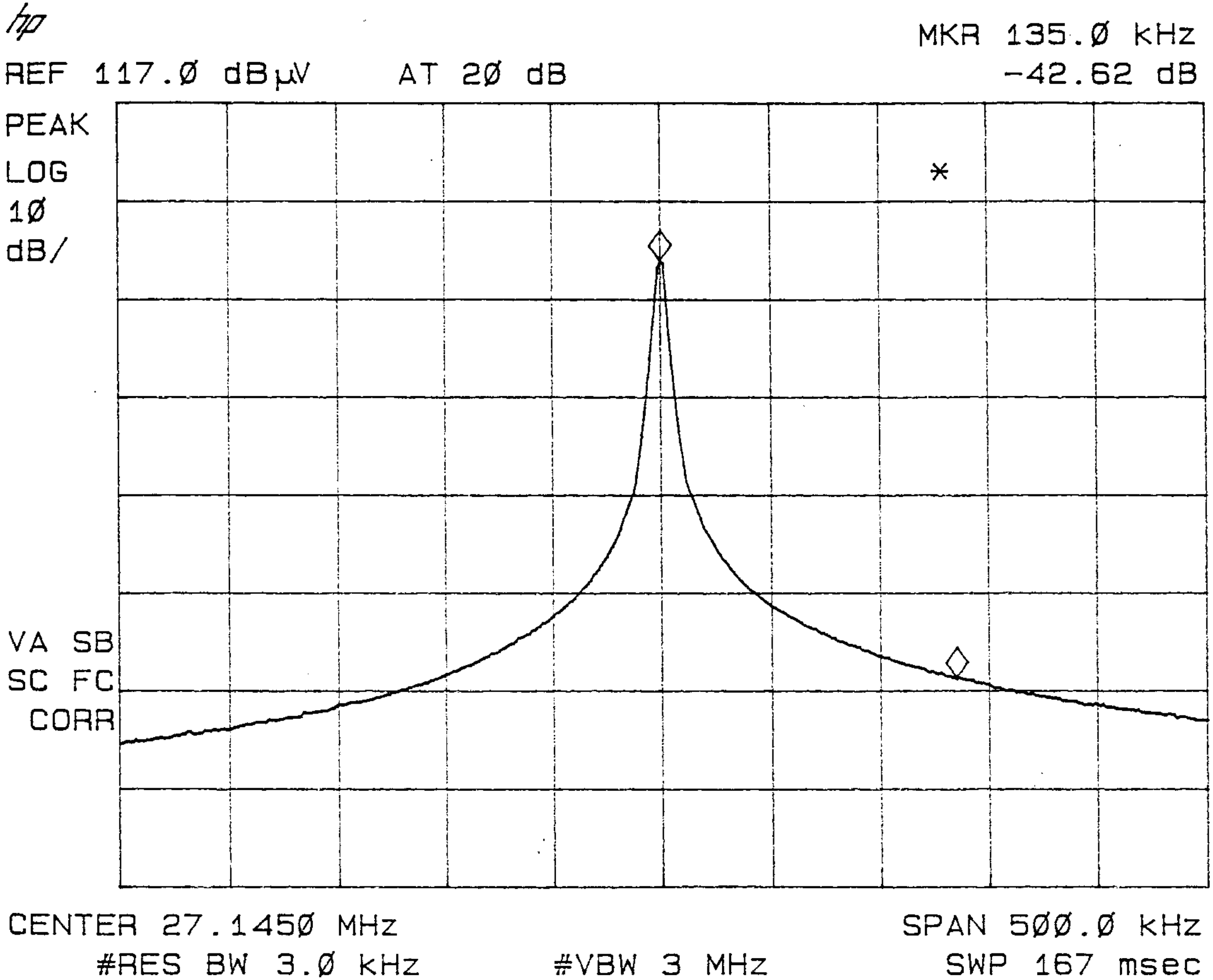
4.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandwidth, the test procedure and calculation of factors such as pulse desensitization and averaging factor.

8.1 Measured Bandwidth

The plot on the following page shows the fundamental emission is confined in the specified band. And it also shows that the emissions are at least 42.6 dB below the carrier level at the band edge (26.96 and 27.28 MHz). It meets the requirement of Section 15.227(b).

Figure 4.1 Bandwidth



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4.2 Discussion of Pulse Desensitization

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF.*

Pulse desensitivity was not applicable for this device. The effective period (T_{eff}) was approximately 0.625ms for a digital "1" bit, as shown in the plots of Exhibit 4.3. With a resolution bandwidth (3 dB) of 100 kHz, the pulse desensitivity factor was 0 dB.

4.3 Calculation of Average Factor

Averaging factor in dB = 20 log (duty cycle)

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

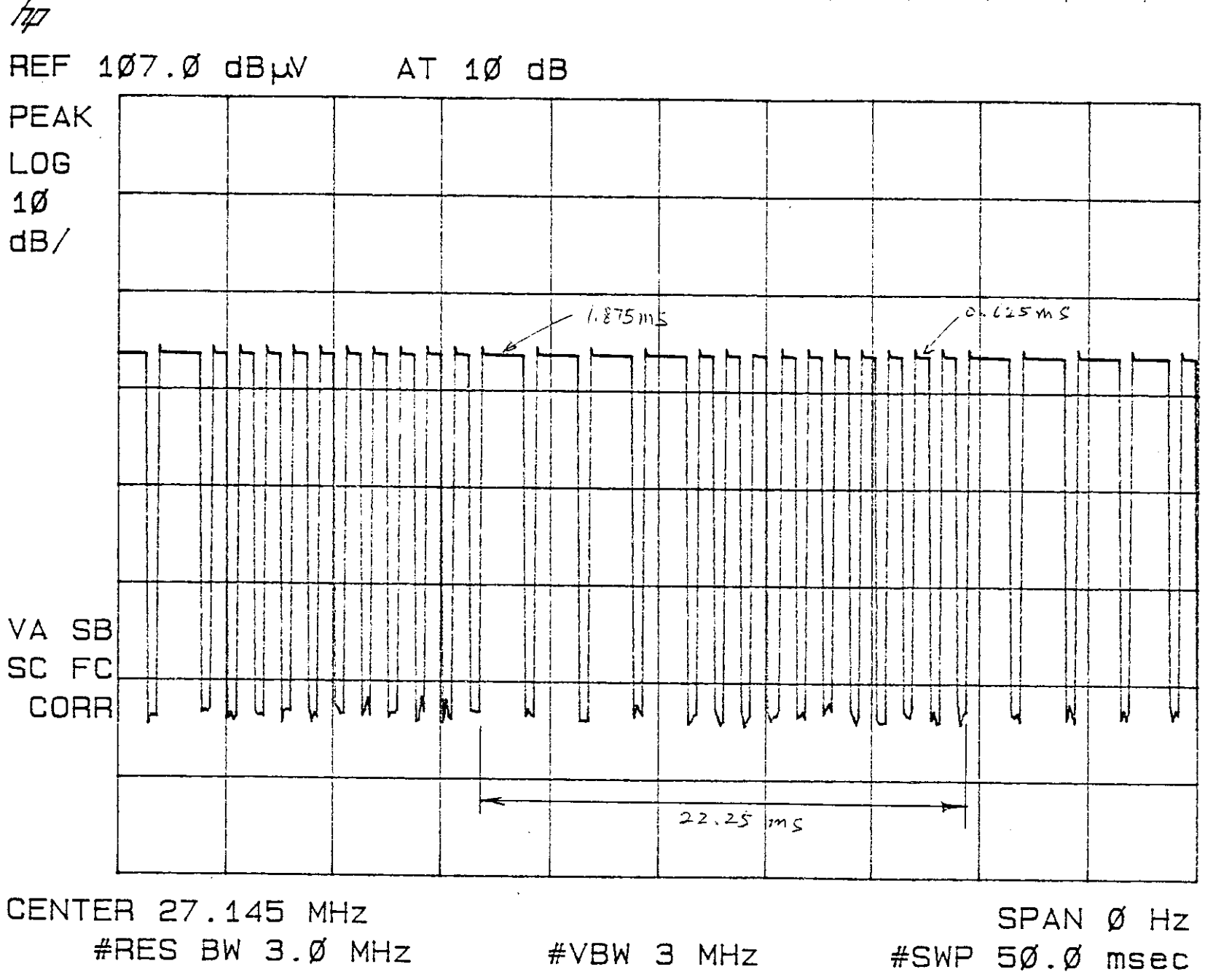
A plot of the worst-case duty cycle as detected in this manner are included in the following pages.

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 22.25ms
Effective period of the cycle = 1.875 x 3 + 0.625 x 10 =11.88ms

DC = 22.25ms / 11.88ms = 0.53 or 53%

Therefore, the averaging factor is found by 20 $\log_{10}$ 0.53 or 53% = -5.5 dB



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FCC ID: UPI7146

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4.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 1992.

The transmitting equipment under test (EUT) is attached to a cardboard box and placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The cardboard box is adjusted through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 450 kHz to 30 MHz.

4.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

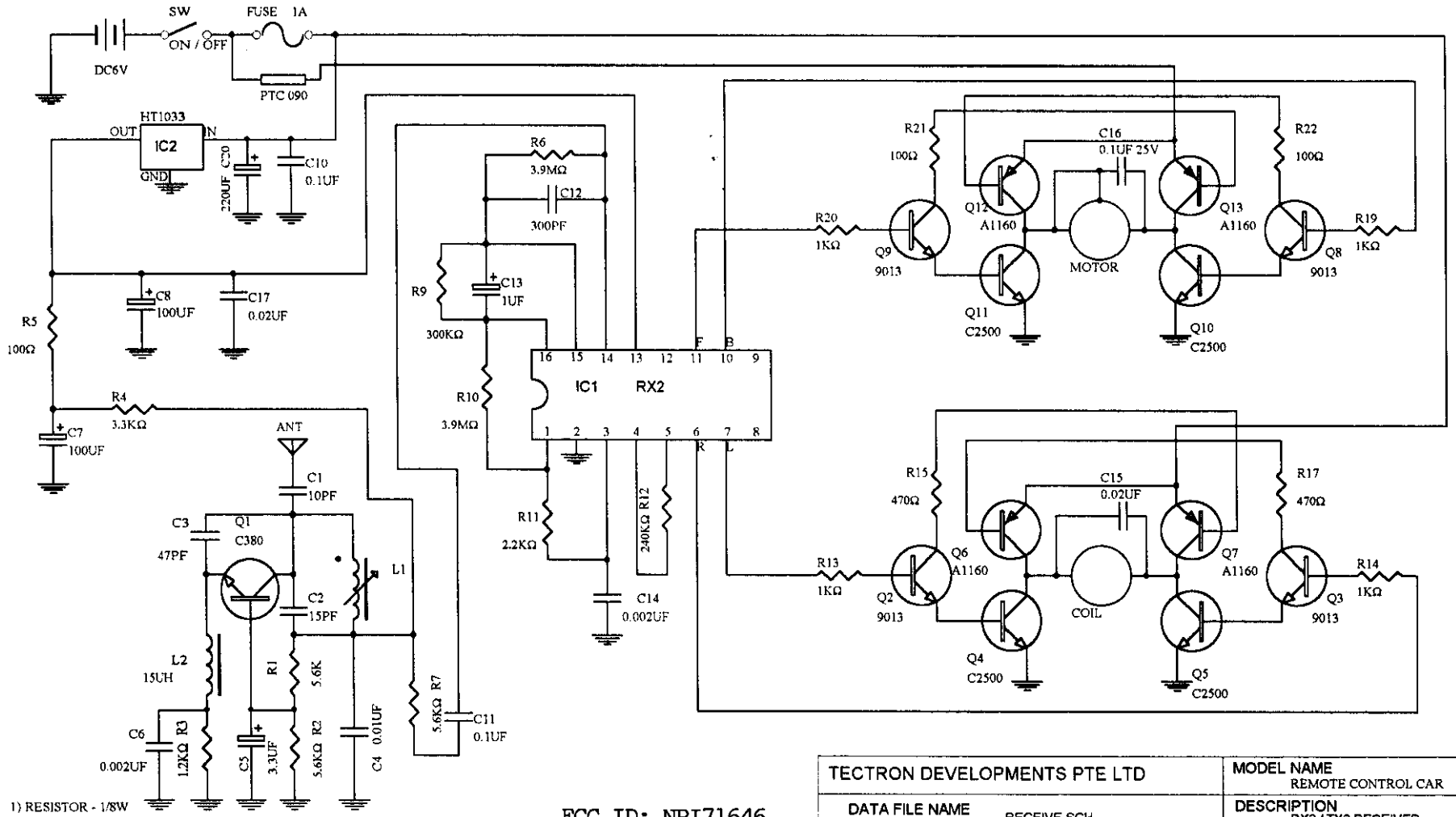
AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.4 - 1992.

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.2). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

REV	ZONE	DESCRIPTION	REV. BY	DATE



NOTE : 1) RESISTOR - 1/8W

2) ELECTROLYTIC & CERAMIC CAP - ABOVE 16V

3) C16 - 25V

FCC ID: NPI71646

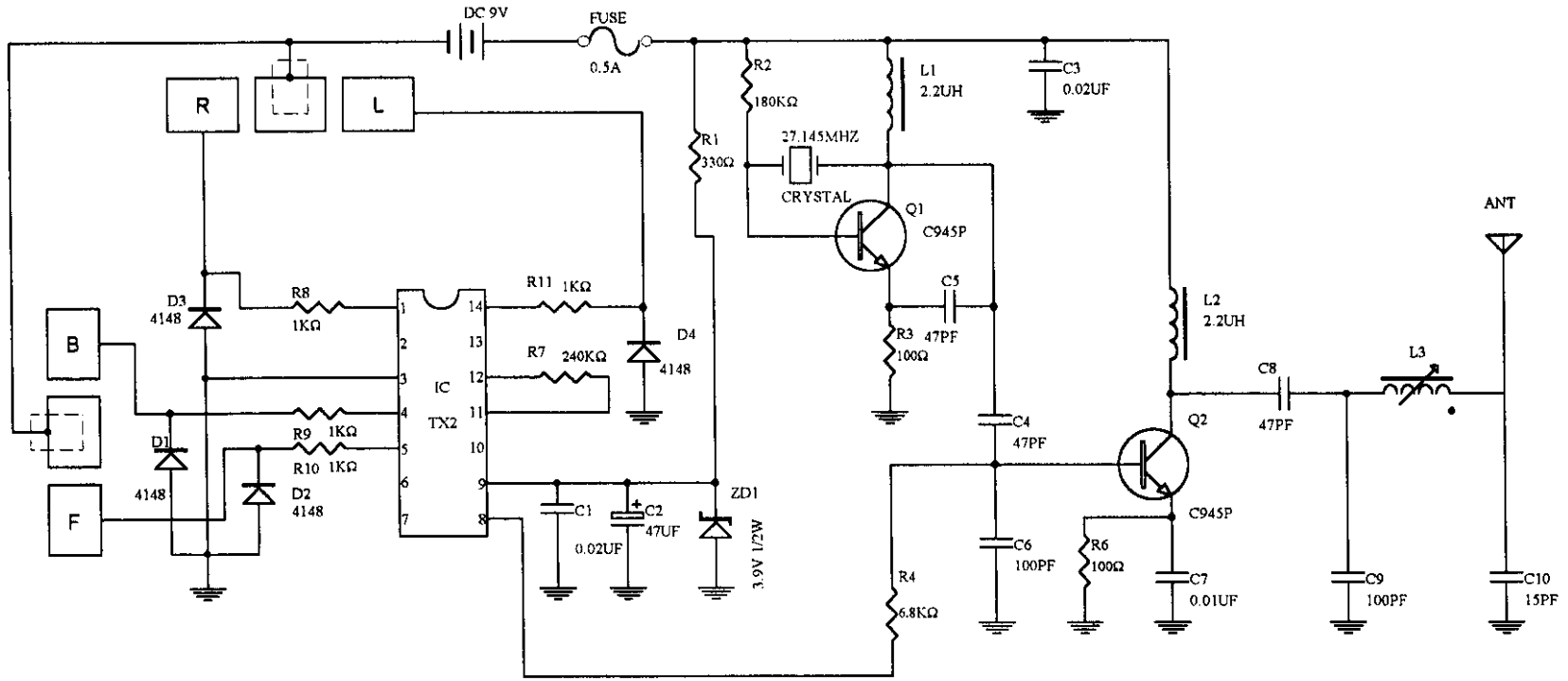
TECTRON DEVELOPMENTS PTE LTD		MODEL NAME REMOTE CONTROL CAR	
DATA FILE NAME RECEIVE.SCH		DESCRIPTION RX2 / TX2 RECEIVER	
SIZE A4	REVISION DATE 11/11/97	MODEL NUMBER 980-13818-00	SHEET 1 OF 1

This drawing is the property of Tectron and must not be passed on to any person not authorised by us to receive it nor be copied or otherwise made use of by such person without our authority	DRAWN BY	DATE	APPROVED BY	DATE
	C.S.TAN	11/11/97		11/11/97

Exhibit D p.7

REV	ZONE	DESCRIPTION	REV. BY	DATE

FCC ID: NPI71646



NOTE : 1) RESISTOR - 1/8W

2) ELECTROLYTIC & CERAMIC CAP - ABOVE 16V

FCC ID: NPI71646

TECTRON DEVELOPMENTS PTE LTD		MODEL NAME: REMOTE CONTROL CAR	
DATA FILE NAME: TRANSMIT.SCH		DESCRIPTION: RX2 / TX2 TRANSMITTER	
SIZE: A4	REVISION DATE: 11/11/97	MODEL NUMBER: 980-13818-00	SHEET 1 OF 1

DRAWN BY	DATE	APPROVED BY	DATE
C.S.TAN	11/11/97		11/11/97

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