

EMISSIONS TEST REPORT

Report Number: 3089938BOX.001b
Project Number: 3089938

Testing performed on the
10.525 GHz Toy Radar Gun

Model: J2358

To

FCC Part 15 Subpart C 15.245

For

Mattel Asia Pacific Sourcing Limited

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719

Test Authorized by:
Mattel Asia Pacific Sourcing Limited
13/F, South Tower, World Finance Center
Harbor City, Tsimshatsui
Kowloon, Hong Kong

Prepared by: 
Nicholas Abbondante

Date: 9/9/06

Reviewed by: 
Michael F. Murphy

Date: 9-7-06

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company: Mattel Asia Pacific Sourcing Limited
13/F, South Tower, World Finance Center
Harbor City, Tsimshatsui
Kowloon, Hong Kong
Contact: Ng Chung Chin
Telephone: 011 852 31855185
Fax: 011 852 27359758
Email: ChungChin.Ng@mattel.com

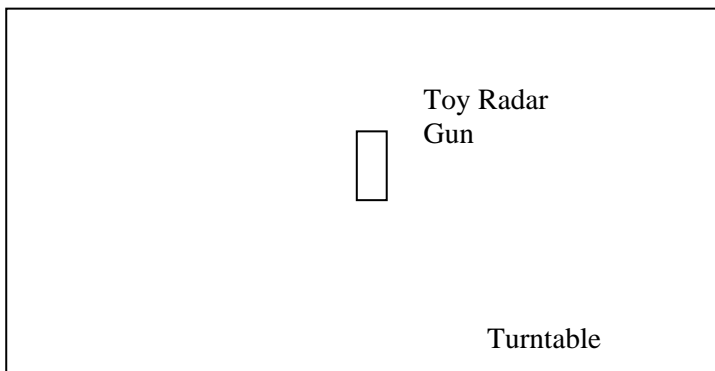
1.2 Equipment Under Test

Equipment Type: 10.525 GHz Toy Radar Gun
Model Number(s): J2358
Serial number(s): 30ms ON, #3
Manufacturer: Dongguan Lung Cheong Toys Co., Ltd.
EUT receive date: 1/3/06
EUT received condition: Prototype in good condition
Test start date: 2/01/2006
Test end date: 3/09/2006

1.3 Test Plan Reference: Tested according to the standards listed and ANSI C63.4:2003.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2. Cables:

Cable	Shielding	Connector	Length (m)	Qty.
None				

1.4.3. Support Equipment:

Name: None
Model No.:
Serial No.:

1.5 Mode(s) of Operation:

The EUT was transmitting a pulse repetitively during testing, and was operated from fresh batteries at 6VDC.

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C 15.245		
SUB-TEST	TEST PARAMETER	COMMENT
Fundamental Field Strength and Radiated Spurious Emissions FCC 15.205, 15.209, 15.245	Fundamental field strength shall not exceed 2500 mV/m (128 dBuV/m) at 3 meters. Harmonic emission field strength shall not exceed 25 mV/m (88.5 dBuV/m) at 3 meters, unless in a restricted band above 17.7 GHz, in which case the harmonic field strength shall not exceed 7.5 mV/m (77.5 dBuV/m). All other emissions must be attenuated at least 50 dB below the level of the fundamental or below 15.209 limits, whichever is the lesser attenuation.	Pass
Radiated Spurious Emissions, 40 – 53 GHz FCC 15.205, 15.209, 15.245	Harmonic emission field strength shall not exceed 25 mV/m (88.5 dBuV/m) at 3 meters, unless in a restricted band above 17.7 GHz, in which case the harmonic field strength shall not exceed 7.5 mV/m (77.5 dBuV/m). All other emissions must be attenuated at least 50 dB below the level of the fundamental or below 15.209 limits, whichever is the lesser attenuation.	Pass
Duty Cycle	Fundamental and harmonic emissions levels can be adjusted by a duty cycle correction factor.	No Requirements

REVISION SUMMARY – The following changes have been made to this Report:

<u>Date</u>	<u>Project No.</u>	<u>Project Handler</u>	<u>Page(s)</u>	<u>Item</u>	Description of Change
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3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V 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, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

$$\text{Level in } \mu\text{V/m} = [10(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where

- NF = Net Reading in dB μ V
- RF = Reading from receiver in dB μ V
- LF = LISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where UF = Net Reading in } \mu\text{V}$$

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 254 \mu\text{V/m}$$

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be:
 ± 3.5 dB at 10m, ± 3.8 dB at 3m

The expanded uncertainty ($k = 2$) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 2.6 dB

The expanded uncertainty ($k = 2$) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 3.2 for ISN and voltage probe measurements

± 3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Test Results: Pass

Test Standard: FCC Part 15 Subpart C 15.245

Test: Fundamental Field Strength and Radiated Spurious Emissions, FCC 15.205, 15.209, 15.245

Performance Criterion: Emissions must be below specified limits.

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	See Tables	Pressure (hPa):	See Tables	Ambient (°C):	See Tables
Pretest Verification Performed	Yes		Equipment under Test:		10.525 GHz Toy Radar gun	

Maximum Test Disturbance Parameters: Fundamental field strength shall not exceed 2500 mV/m (128 dBuV/m) at 3 meters. Harmonic emission field strength shall not exceed 25 mV/m (88.5 dBuV/m) at 3 meters, unless in a restricted band above 17.7 GHz, in which case the harmonic field strength shall not exceed 7.5 mV/m (77.5 dBuV/m). All other emissions must be attenuated at least 50 dB below the level of the fundamental or below 15.209 limits, whichever is the lesser attenuation.

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	08/02/2007
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL028	12/12/2006
3	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/12/2006
4	PREAMPLIFIER 1- 40 GHz	MITEQ	NSP4000-NF	507145	11/21/2006
5	Spectrum Analyzer 20Hz – 40 GHz	Rohde & Schwartz	FSEK-30	100225	07/26/2006
6	ANTENNA	EMCO	3142	9701-1116	11/10/2006
7	HORN ANTENNA	EMCO	3115	9610-4980	09/13/2006
8	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	12/13/2007
9	10 Meter in floor cable for site 2	ITS	RG214B/U	S2 10M FLR	09/02/2006
10	Spectrum Analyzer	Hewlett Packard	8591E	3346A02319	08/09/2006

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	1/12/06 Revision

Test Details:

Notes: The fundamental field strength when measured with a peak detector and averaged with a duty cycle averaging factor was 95.3 dBuV/m. A duty cycle factor was applied to the peak field strength of the harmonics. Where a duty cycle averaging factor is shown, a corresponding line showing the peak value of the emission compared to a limit 20 dB above the average limit is also shown.

Radiated Emissions

Company: Mattel Hong Kong
 Model #: 10.525GHz Toy Radar Gun
 Serial #: 30msON
 Engineers: Kouma Sinn
 Project #: 3089938 Date(s): 02/01/06
 Standard: FCC Part 15 Subpart C 15.245
 Receiver: R&S FSEK-30 (ROS001) Limit Distance (m): 3
 PreAmp: NONE Test Distance (m): 3
 Barometer: BAR2 Temp/Humidity/Pressure: 18C 34% 1000mbar
 Antenna & Cables: HF Bands: N, LF, HF, SHF
 LF Antenna: NONE NONE
 N Antenna: LOG1 11-10-06 V10.ant NONE
 HF Antenna: HORN3 9-13-06 V1m.txt HORN3 9-13-06 H1m.txt
 SHF Antenna: EMC04 V 1m 12-13-2006.txt NONE
 LF Cable(s): NONE NONE
 N Cable(s): S2 10M FLR 9-2-2006.cbl NONE
 HF Cable(s): CBL028 12-12-2006.txt NONE
 SHF Cable(s): NONE NONE
 PreAmp Used? (Y or N): N Voltage/Frequency: Fresh batteries Frequency Range: Fundamental
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Average Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
PK	H	10524.003	63.1	39.7	8.8	0.0	16.3	95.3	128.0	-32.2	1/3MHz
PK	H	10524.003	63.1	39.7	8.8	0.0	0.0	111.6	148.0	-32.2	1/3MHz

Radiated Emissions

Company: Mattel Hong Kong
 Model #: 10.525 GHz Toy Radar Gun
 Serial #: #3
 Engineers: Nicholas Abbondante
 Project #: 3089938 Date(s): 03/08/06
 Standard: FCC Part 15 Subpart C 15.245
 Receiver: HP 8591E (SA0003) Limit Distance (m): 3
 PreAmp: PRE8 11-21-06.amp Test Distance (m): 10
 Barometer: BAR2 Temp/Humidity/Pressure: 19c 24% 1005 mB
 Antenna & Cables: N Bands: N, LF, HF, SHF
 LF Antenna: NONE NONE
 N Antenna: LOG1 11-10-06 V10.ant LOG1 11-10-06 H10.ant
 HF Antenna: NONE NONE
 SHF Antenna: NONE NONE
 LF Cable(s): NONE NONE
 N Cable(s): S2 10M FLR 9-2-2006.cbl NONE
 HF Cable(s): NONE NONE
 SHF Cable(s): NONE NONE
 PreAmp Used? (Y or N): N Voltage/Frequency: Fresh Battery Frequency Range: 30 - 1000 MHz
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

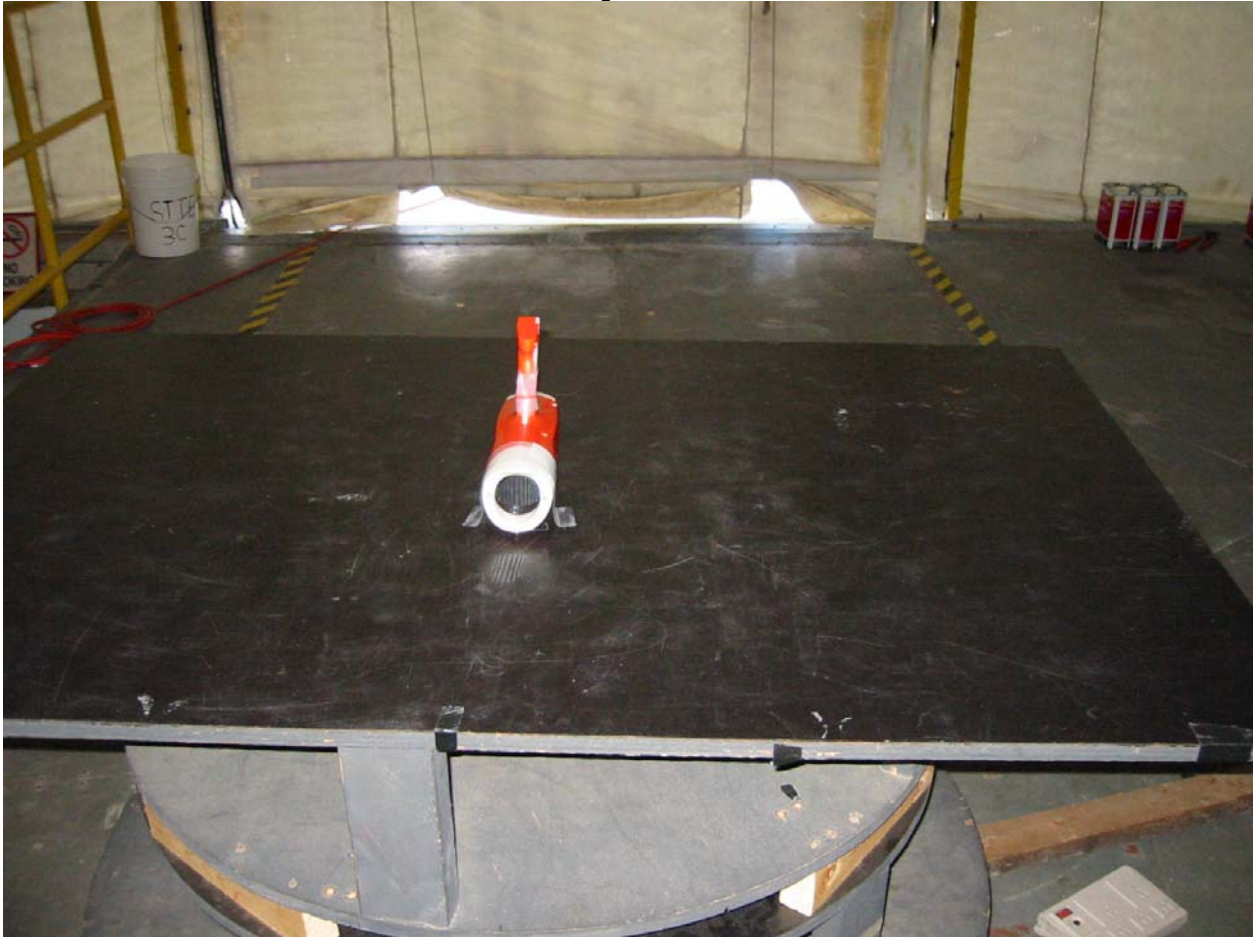
Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
QP	H	170.000	14.9	9.8	2.4	0.0	-10.5	37.6	43.5	-5.9	120/300 kHz
PK	H	200.000	21.8	10.0	2.9	0.0	-10.5	45.2	65.3	-20.1	120/300 kHz
AVG	H	200.000	10.5	10.0	2.9	0.0	-10.5	33.9	45.3	-11.4	120/300 kHz
QP	H	240.000	14.5	11.8	3.0	0.0	-10.5	39.7	46.0	-6.3	120/300 kHz
QP	H	260.000	14.6	12.2	3.0	0.0	-10.5	40.3	46.0	-5.7	120/300 kHz
QP	H	280.000	14.4	12.7	3.0	0.0	-10.5	40.6	46.0	-5.4	120/300 kHz
PK	H	360.000	20.6	15.9	3.3	0.0	-10.5	50.3	65.3	-15.0	120/300 kHz
AVG	H	360.000	9.3	15.9	3.3	0.0	-10.5	39.0	45.3	-6.3	120/300 kHz

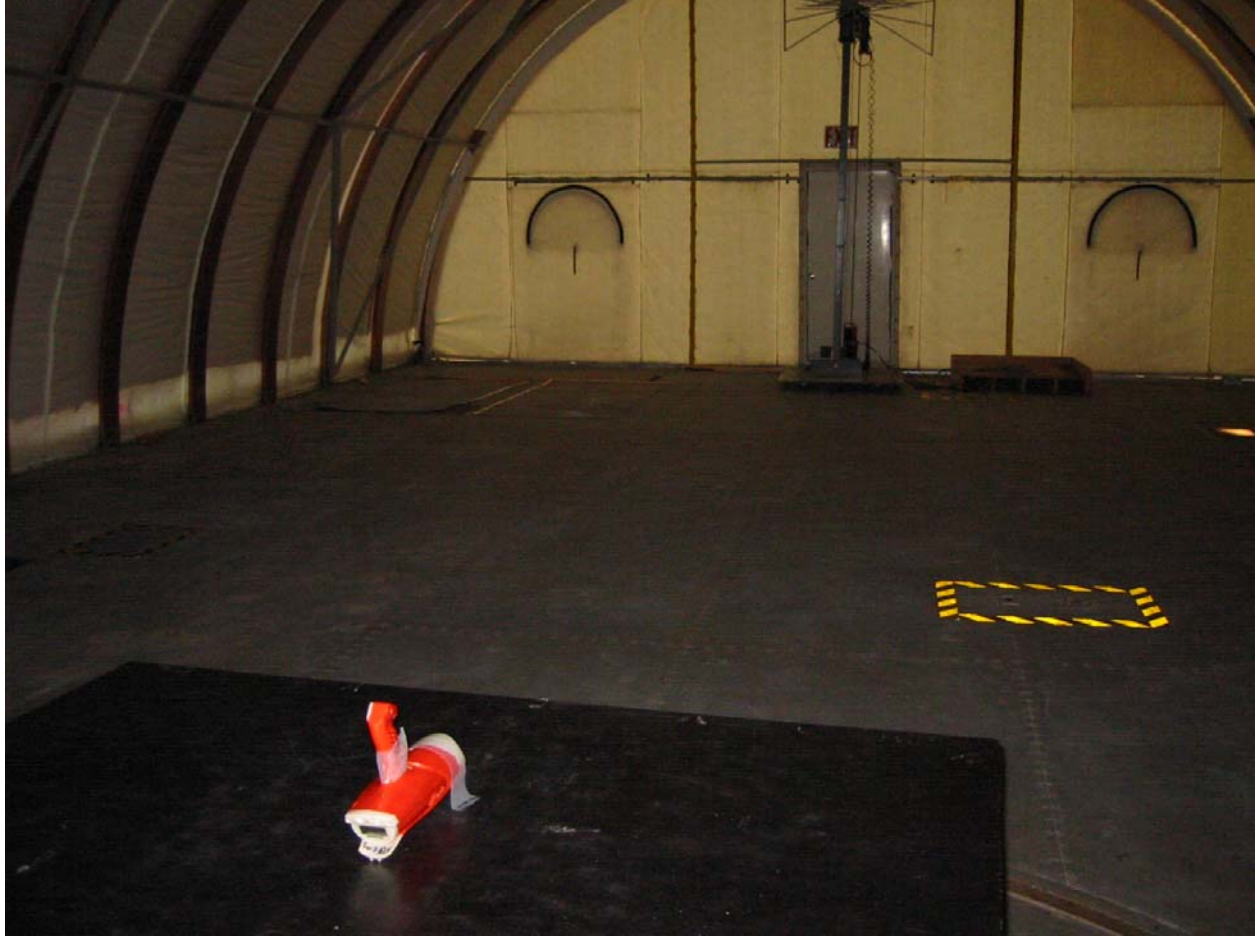
Radiated Emissions

Company: Mattel Hong Kong
 Model #: 10.525GHz Toy Radar Gun
 Serial #: 30msON
 Engineers: Kouma Sinn
 Project #: 3089938
 Standard: FCC Part 15 Subpart C 15.245
 Receiver: R&S FSEK-30 (ROS001)
 PreAmp: PRE8 11-21-06.amp
 Barometer: BAR2
 Temp/Humidity/Pressure: 18C 34% 1000mbar
 PreAmp Used? (Y or N): Y
 Peak: PK Quasi-Peak: QP Average: AVG
 Antenna & Cables: SHF Bands: N, LF, HF, SHF
 LF Antenna: NONE. NONE.
 N Antenna: LOG1 11-10-06 V10.ant NONE.
 HF Antenna: HORN3 9-13-06 V1m.txt HORN3 9-13-06 H1m.txt
 SHF Antenna: EMC04 V 1m 12-13-2006.txt EMC04 H 1m 12-13-2006.txt
 LF Cable(s): NONE. NONE.
 N Cable(s): S2 10M FLR 9-2-2006.cbl NONE.
 HF Cable(s): CBL028 12-12-2006.txt CBL030 12-12-2006.txt
 SHF Cable(s): CBL028 12-12-2006.txt CBL030 12-12-2006.txt
 Location: 2
 Date(s): 02/01/06
 Limit Distance (m): 3
 Test Distance (m): 3
 Voltage/Frequency: Fresh batteries Frequency Range: 1-40GHz
 RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Average Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
pk	H	31572.231	61.2	47.9	22.8	43.0	16.3	72.6	77.5	-4.9	1/3MHz
pk	H	21047.868	45.3	45.9	17.1	23.8	16.3	68.1	77.5	-9.4	1/3MHz
pk	H	31572.231	61.2	47.9	22.8	43.0	0.0	88.9	97.5	-8.6	1/3MHz
pk	H	21047.868	45.3	45.9	17.1	23.8	0.0	84.5	97.5	-13.0	1/3MHz

Setup Photos





Test Results: Pass

Test Standard: FCC CFR47 Part 15 Subpart C 15.245

Test: Radiated Spurious Emissions, 40 – 53 GHz FCC 15.205, 15.209, 15.245

Performance Criterion: Emissions must be below specified limits

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	See Tables	Pressure (hPa):	See Tables	Ambient (°C):	See Tables
Pretest Verification Performed	N/A		Equipment under Test:		10.525 GHz Toy Radar Gun	

Maximum Test Disturbance Parameters: Harmonic emission field strength shall not exceed 25 mV/m (88.5 dBuV/m) at 3 meters, unless in a restricted band above 17.7 GHz, in which case the harmonic field strength shall not exceed 7.5 mV/m (77.5 dBuV/m). All other emissions must be attenuated at least 50 dB below the level of the fundamental or below 15.209 limits, whichever is the lesser attenuation.

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	07/26/2006
2	Mixer / Antenna	Oleson Microwave Lab	M19HWA	U21011-1	Verified
3	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	08/02/2007
4	Super High Frequency Cable	Megaphase	TM40 K1K1 197	CBL028	12/12/2006

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	11/16/05 Revision

Test Results: No Requirements

Test Standard: FCC Part 15 Subpart C 15.245

Test: Duty Cycle

Performance Criterion: Fundamental and harmonic emissions levels can be adjusted by a duty cycle correction factor.

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:	Toy Radar Gun		

Maximum Test Disturbance Parameters: The duty cycle correction factor cannot exceed 20 dB.

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	07/26/2006

Test Details:

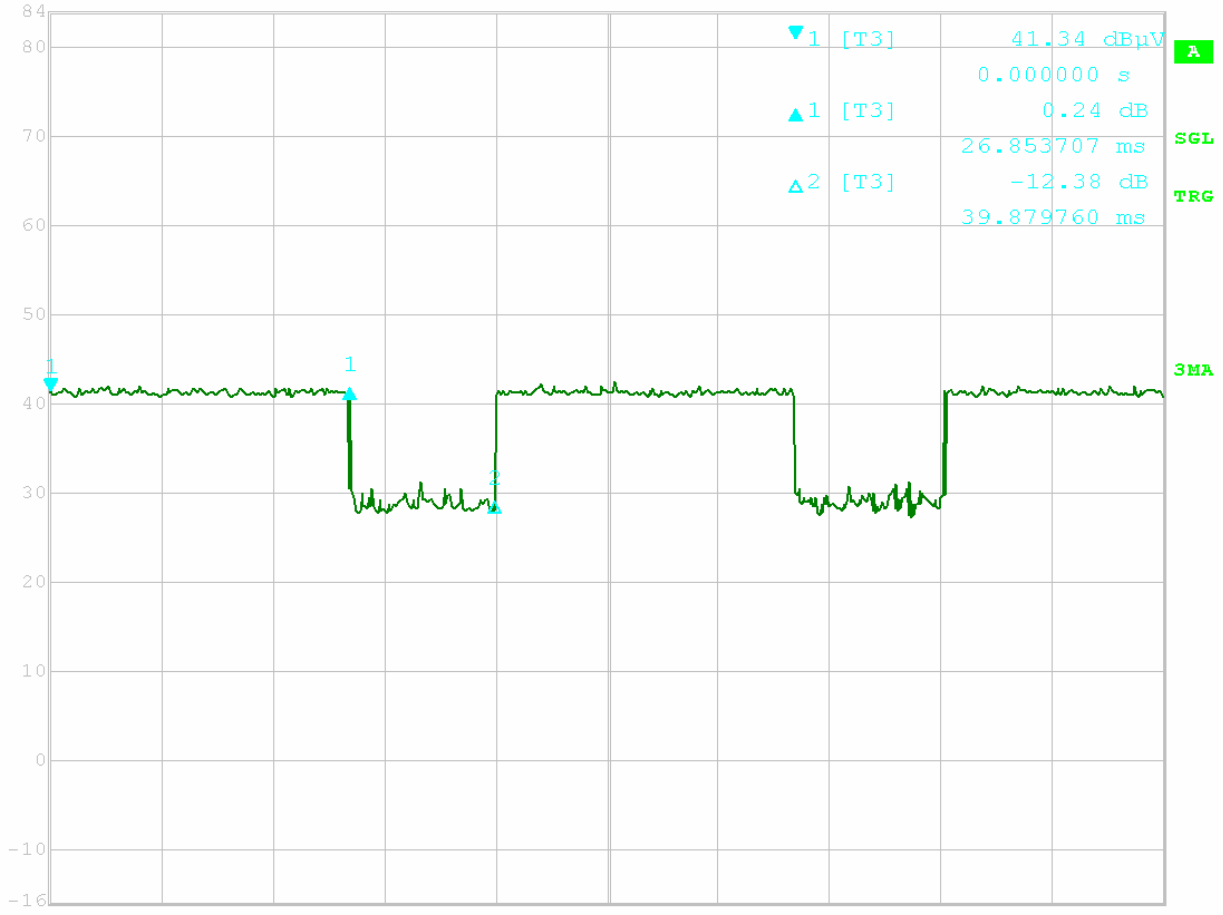
Notes: The spectrum analyzer was triggered at the beginning of a pulse. Pulse length is 26.85 ms, with a pulse interval of 39.88 ms. Therefore, the worst-case on-time in a 100 ms interval is 73.94 ms, or 73.94%. Each pulse is comprised of a train of words, each of 24.05 us, with an interval of 116.4 us. Given the duration of one pulse, 26.85 ms, there are 230 words in one pulse. Given the 24.05 us word length, this results in 5.55 ms of on-time in one 26.85 ms pulse. Based on the pulse interval and pulse length measured previously, in the worst case there are 2.75 pulses in any 100 ms duration. This gives a total worst-case on-time of 15.27 ms in any 100 ms duration. The duty cycle correction factor can be calculated using the formula:

$$\text{dB reduction} = 20 \text{ LOG} (\text{on-time} / 100 \text{ ms})$$

Which yields a correction factor of -16.32 dB.



	Delta 1 [T3]	RBW	1 MHz	RF Att	0 dB
Ref Lvl	0.24 dB	VBW	3 MHz		
84 dBμV	26.853707 ms	SWT	100 ms	Unit	dBμV



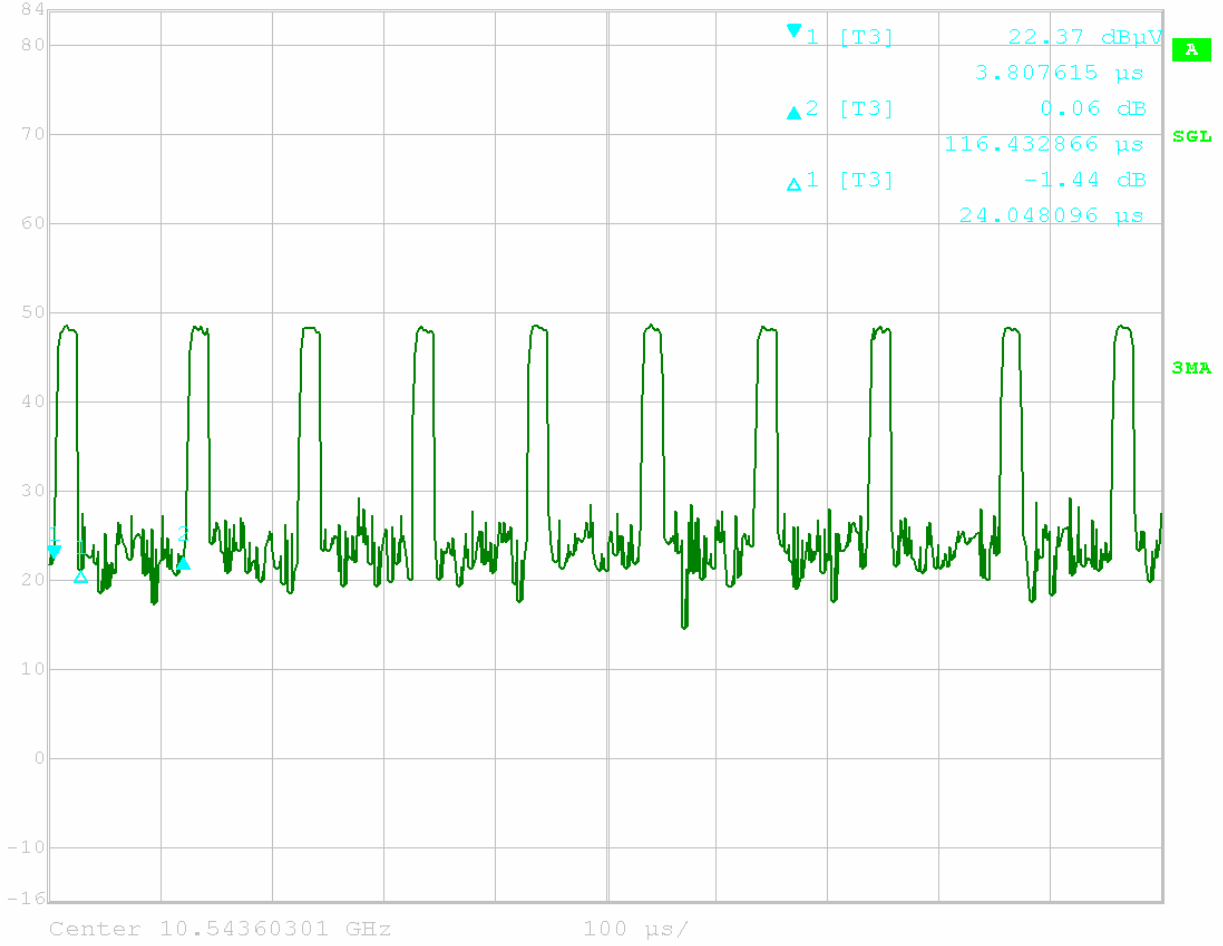
Center 10.54360301 GHz 10 ms/

Date: 13.FEB.2006 17:34:42

Pulse duration and interval



	Delta 2 [T3]	RBW	1 MHz	RF Att	0 dB
Ref Lvl	0.06 dB	VBW	3 MHz		
84 dBμV	116.432866 μs	SWT	1 ms	Unit	dBμV



Date: 13.FEB.2006 17:31:16

Word duration and interval