ITS Intertek Testing Services
ETL SEMKO

Emissions Testing
Performed
on the
Malden Mills
Cordless Remote Control
Model: 5700Q

To

FCC Part 15 Subpart C, Section 15.231

Date of Test: June 21, 2001

Job Number: J20051700A

Report Number: J20051700_Subpart C
KPS/Rbt

Contact: Mr. Dave Connery

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I – Introduction and Summary

TO: Mr. Dave Connery
FROM: Kouma Sinn
DATE: June 27, 2001
JOB #: J20051700

RE: Emissions Testing Performed on the Cordless Remote Control, Model: 5700Q

On June 21, 2001 we tested the Cordless Remote Control, Model: 5700Q to determine if it was in compliance with the FCC Part 15, Subpart C, Section 15.231 emission requirements. We found that the unit met the FCC Part 15, Subpart C, Section 15.231 emission requirements when tested as received.

A prototype version of the sample was received on Thursday, June 21, 2001 in good condition.

The following Table summarizes the results of testing.

Test	Frequency (MHz)	Measurement	Requirement	Pass/Fail	Section of FCC Rules	Section of Test Report
Fundamental Field Strength	418.000	77.0 dBµV/m	80.3 dBµV/m	Pass	§15.231	9
Restricted Band & Spurious Emissions	836.000 1253.928	54.7 dBµV/m 54.7 dBµV/m	60.3 dBµV/m 60.3 dBµV/m	Pass Pass	§15.205 & §15.209	8
Line-conducted	Line-conducted emission testing was not performed on the unit as it is battery powered.					
Bandwidth	418.000	97.5 kHz	1045 kHz	Pass	§15.231	23
Duty Cycle	41.8%			N/A	§15.231	18
Antenna Conducted Emissions	Measurements were not performed as the device does not have the ability to connect to an external antenna.				Not Applicable	None

In summary, this report confirms that the Cordless Remote Control, Model: 5700Q is compliant with the FCC Part 15, Subpart C, Section15.231 emission requirements when production units conform to the initial sample. Please address all questions and comments concerning this report to Michael Murphy, EMC Staff Engineer.

II – Technical Requirements

15.1 Scope

The product is a cordless remote controlled electric blanket. The remote is powered by a replaceable CR-2032 Li Ion cell and transmits at 418 MHz. The base unit receives RF signals and takes a portion of 30VDC at 4A and delivers it to the blanket. The base unit has a step-down transformer for converting wall power to 30VDC. The device is an intentional radiator intended to operate in accordance with 15.231 "Operation within the bands above 70 MHz.".

15.15 General Technical Requirements

There are no controls accessible to the user that would cause the device to operate in violation of the FCC rules.

15.27 Special Accessories

No special accessories are necessary to meet the compliance requirements.

15.31 Measurement Standards

The measurement procedures as specified by ANSI C63.4:1992 were used to test this device. See Section IV of the test report for a detailed description of the test site and the measurement equipment.
A new battery for the transmitter was used during testing. The device was mounted to cardboard box, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

15.33 Frequency range of measurement

The device was scanned for spurious and harmonic emissions from 30 MHz to the 10^{th} harmonic of the fundamental emission.

15.35 Measurement detector functions and bandwidth

The following table illustrates the detector functions and bandwidth used to test the device.

Frequency Range	Measurement Detector	Measurement Bandwidth
450 kHz to 30 MHz	Quasi-Peak	9 kHz
30 MHz to 1000 MHz	Quasi-Peak	120 kHz
1000 MHz to 10th harmonic	Average	1 MHz

The quasi-peak detector meets the requirements of CISPR 16.
An averaging factor was used because the device operates with a 41.8% duty cycle.

15.36 Transition Provisions

Transition provisions were not applied to the device. The receiver is not being certified with the device. The device does not operate in the band 902-905 MHz.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

> NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
>
> -- Reorient or relocate the receiving antenna.
>
> -- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

15.107 Conducted limits.

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line shall not exceed the following. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

Frequency of Emission Conducted Limit – Class B

Frequency (MHz)	Limit (μV)	Limit (dBμV)
0.45 to 30	250	48

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency of Emission Conducted Limit – Class A

Frequency (MHz)	Limit (μV)	Limit (dBμV)
0.45 to 1.705	1000	60
1.705 to 30	3000	69.5

The following option may be employed if the conducted emissions exceed the limits in paragraph (a) or (b) of this Section, as appropriate, when measured using instrumentation employing a quasi-peak detector function: if the level of the emission measured using the quasi-peak instrumentation is 6 dB, or more, higher than the level of the same emission measured with instrumentation having an average detector and a 9 kHz minimum bandwidth, that emission is considered broadband and the level obtained with the quasi-peak detector may be reduced by 13 dB for comparison to the limits. When employing this option, the following conditions shall be observed:

(1) The measuring instrumentation with the average detector shall employ a linear IF amplifier.
(2) Care must be taken not to exceed the dynamic range of the measuring instrument when measuring an emission with a low duty cycle.
(3) The test report required for verification or for an application for a grant of equipment authorization shall contain all details supporting the use of this option.

Summary of Test Results

Test	Frequency (MHz)	Measurement (dBµV)	Measurement (µV)	Limit (µV)	Pass/Fail
Line-Conducted Emission	Line-conducted emission testing was not performed on the unit as it is battery powered.				

15.109 Radiated emission limits.

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission Radiated Limit – Class B

Frequency (MHz)	Limit (µV/m)	Limit (dBµV/m)
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of Emission Radiated Limit – Class A

Frequency (MHz)	Limit (µV/m)	Limit (dBµV/m)
30 to 88	90	39.1
88 to 216	150	43.5
216 to 960	210	46.4
Above 960	300	49.5

In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement

standards apply.

Summary of Test Results

Test	Frequency (MHz)	Measurement (dBmV)	Measurement (mV)	Limit (mV)	Pass/Fail
Radiated	836.000	54.7	543.3	1035.1	Pass
Emission	1253.928	54.7	543.3	1035.1	Pass

15.201 Certification

The device is required to be certified in accordance with Part 2 of the FCC rules, Subpart J.

15.203 Antenna Requirements

The antenna connects to the device is integral to the device. Additionally, it is specified in the user's manual that users are not permitted to modify the device in any way.

15.204 External Radio Amplifier

The device is not an amplifier.

15.205 Restricted bands of operation

All unwanted emissions from the transmitter that fall in 15.205 restricted bands were compared to the general limits in 15.209.

Below 1000 MHz a quasi-peak detector was employed to measure emissions.
Above 1000 MHz an average detector was employed to measure emissions. Peak measurements were also performed above 1000 MHz to insure that they were not greater than 20 dB of the average.

15.207 Conducted limits

No line-conducted emission testing was performed on the transmitter as it is powered by battery.

15.209 Radiated emission limits; general requirements

All unwanted emissions from the transmitter were compared to the general requirements, 15.209.

Test Method Justifications

For maximizing emissions, the system 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.

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C63.4 (1992). The device was mounted to cardboard box, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

The device was powered from a new, fully charged battery.

For simplicity of testing, the unit was wired to transmit continuously.

15.223 Operation within the band above 70 MHz

The field strength limit for the device was based on the operating frequency of 418 MHz:

Frequency (MHz)	Emission Limit (mV/m)	Emission Limit (dBmV/m)	Test Distance (meters)
418.000	10334.76	80.29	3

The emission requirement for harmonic emission is identical to the general requirement of 15.209. Spurious emission measurements were compared to the general requirement of 15.209.

The fundamental emission was measured with a peak detector. For above 1000 MHz, measurements were made with both a peak and average detector to insure that peak measurements did not exceed the average by more than 20 dB.

III - Attestation

LABORATORY MEASUREMENTS

Pursuant To
Part 15, Subpart C
For
Intentional Radiators

Company Name:	Malden Mills.
Address:	46 Stafford Street, P.O.Box 809 Lawrence, MA 01842
Model No.:	5700Q
Serial No.:	FCC-1
Date of Test(s):	June 21, 2001
Test Site Location:	INTERTEK TESTING SERVICES NA INC. 70 Codman Hill Road Boxborough, MA 01719
Site:	1C

We attest to the accuracy of this report:

Kouma Sinn	Michael S. Ogunleye
Signature	Signature
Kouma Sinn	Michael Ogunleye
Testing Performed By:	Reviewer
Senior Project Engineer	Senior Project Engineer
Title	Title

IV - Site Description and Measurement Equipment

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, General Requirements.

A. **Test Set-Up**: The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 (1992).

1. The test site is a Plastic/Fiberglass structure with a groundplane. The site has attenuation characteristics which meet the requirements of ANSI C63.4 (1992). Information on the site has been filed with the FCC as required by Rule 2.948. The address of the site is 70 Codman Hill Road, Boxborough, MA 01719.

2. Power to the site is nominal line voltage of 117 V_{AC} and 230 V_{AC}, 60 Hz.

3. The equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the groundplane. During the radiated emissions test, the turntable is rotated 360 degrees and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the search for maximum signal levels. The height of the antenna is varied from one meter to four meters. Body-worn, hand-held and small portable devices are mounted on a non-conductive box and emissions are investigated on three orthogonal axis.

4. Detector function for radiated emissions is in peak or quasi-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 according to the following formula:

   Averaging Factor in dB = 20 LOG (duty cycle)

   The time period over which the duty cycle is measured is 100 msec. The worst-case (highest percentage on) duty cycle is used and described specifically in the data section. 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 465 Oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

5. Antennas used below 1000 MHz were EMCO Model 3142 Biconolog. For measurements above 1 GHz, an EMCO Model: 3115 Horn Antenna is used. The Antennas used are listed in the Test Equipment Summary in Section 6.

6. The field strength measuring equipment used included:

The following equipment was used to make measurements for emissions testing:

Description	Manufacturer	Model	Serial #	Cal Due
LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	941712	05/02/2002
RECEIVER	HEWLETT PACKARD	8546A	3330A00158	12/28/2001
BICONOLOG	EMCO	3142	9701-1116	07/18/2001
High Freq. Amplifier	MITEQ	NSP4000-NF	507145	09/26/2001
Horn Antenna	EMCO	3115	960-4980	11/01/2001
Cable, SMA-SMA <18GHz	Sucoflex (Huber + Suhner)	104PE	CBLSHF103	08/21/2001
Cable, SMA-SMA <18GHz	Sucoflex (Huber + Suhner)	104PE	CBLSHF203	08/21/2001

7. The frequency range to be 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.

8. 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 battery is used.

9. Conducted measurements were made as described in ANSI C63.4 (1992). An IF bandwidth of 9 kHz is used, and peak or quasi-peak detection is employed.

10. 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 No. 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report. Above 1000 MHz, a bandwidth of 1 MHz is generally used.

11. 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 (where no preamplifier is used), 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.

12. For measurements made in the 9 kHz to 30 MHz range, a distance of 30 meters was used unless a good

signal-to-noise ratio could not be obtained. In that case, a closer distance was used and that distance is so marked in the data table.

V – Summary of Equipment Under Test

1	**Manufacturer**:	Malden Mills 46 Stafford Street, P.O.Box 809 Lawrence, MA 01842 Contact: Dave Connery
2	**Grantee**:	Malden Mills 46 Stafford Street, P.O.Box 809 Lawrence, MA 01842 Contact: Dave Connery
3	**Model No.**:	5700Q
4	**Trade Name**:	None
5	**Serial No.**:	Prototype 1
6	**Date of Test**:	June 21, 2001
7	**Frequencies to which device can be tuned**:	None
8	**Can customer tune device?**	No
9	**Detailed description of operation pursuant to 15.231**:	See 15.231
10	**Applicable emissions limits**:	15.105, 15.109, 15.205, 15.207,15.209 and 15.231

VI - Configuration Information

Equipment Under Test:	Cordless Remote Control
Model:	5700Q
Serial No.:	Prototype 1
FCC Identifier:	None

Support Equipment:

Description: Micrel RF Receiver
Manufacturer: Malden Mills
Part No.: MICRO111BM
Serial No.: Not Labeled

Description: Polartec Heat Blanket
Manufacturer: Malden Mills
Model No.: Queen 5700Q
Serial No.: 97555006

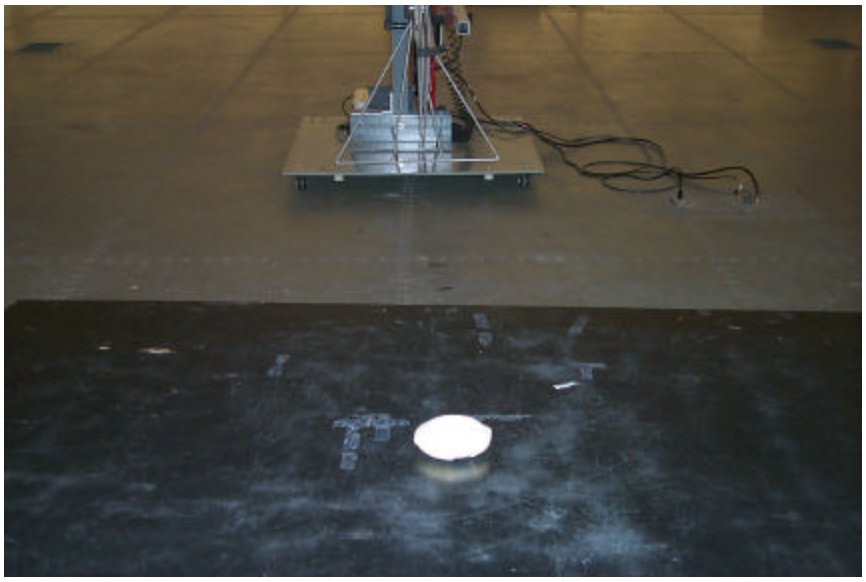
Cables:

QTY	Description	Shield Description	Hood Description	Length (m)

Battery Powered

VII - Configuration Photographs

Worst-Case Radiated Emissions



VIII - Sample Calculation

The following is how net field strength readings were determined:

NF = RF + AF + CF + PF + DF

Where,

NF = Net Reading in dBµV/m
RF = Reading from receiver in dBµV
AF = Antenna Correction Factor in dB(1/m)
CF = Cable Correction Factor in dB
PF = Preamplifier Correction Factor in dB
DF = Distance Factor in dB (using 20 dB/decade), from 3 to 1 meters 10.5 dB was added for measurements performed at 1 meter

To convert from dBµV/m to µV/m or mV/m the following was used:

$UF = 10^{(NF / 20)}$

Where,

UF = Net Reading in µV/m

Example:

For the fundamental field strength measurement at 8.4 (distance = 3 meters) see table [1].

NF = RF + AF + CF + PF + DF = 61.6 + 27.7 + 3.9 + 0.0 + 0.0 = 89.8 dBµV/m

$UF = 10^{(89.8\ dB\mu V / 20)} = 30{,}902\ \mu V/m$

IX - Data Tables

Radiated Emissions / Interference

Table: 1

Company: Malden Mills
Model: 5700Q
Serial Prototype 1
Job No.: J20051700
Date: 06/21/01
Standard: FCC Part 15 Subpart C. Section 231
Class: B Group: None
Notes: From 1 GHz to 4.18 GHz, used cable CBLSF103 and CBLSF203

Tested by: Kouma Sinn
Location: Site 1C
Detector: HP 8546A
Detector: Peak
Antenna: LOG1 7-18-00 H10
PreAmp: None
Cable(s): 1C. 10MPRIME MAR01 0
Distance: 10 and 3 meters

Abbreviations: nb - narrow band, bb - broadband, pk - peak measurement

EUT Position	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-Amp Factor dB	Average Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
Flat	H	418.000	54.1	16.4	3.7	0.0	-7.6	-10.5	77.0	80.3	-3.3
Side	V	836.000	22.6	22.9	6.3	0.0	-7.6	-10.5	54.7	60.3	-5.6
Side	V	1253.928	51.7	27.1	5.6	22.1	-7.6	0.0	54.7	60.3	-5.6
Side	V	2090.000	36.1	29.9	7.6	22.3	-7.6	0.0	43.6	60.3	-16.6
Side	V	2507.900	40.0	30.6	8.3	22.3	-7.6	0.0	49.0	60.3	-11.3
Side	V	2925.790	42.2	32.0	9.2	22.3	-7.6	0.0	53.5	60.3	-6.8

Note: From 30 MHz to 1000 MHz, the measurements were made at 10 meters, and from 1 GHz to 4.18 GHz, measurements were made at 3 meters.

Average Factor Calculation:

Word duty cycle: 39.0 ms/62.2 ms = 0.627
Bit duty cycle: 1.2 ms/1.8 ms = 0.666

Average Factor: 20Log (0.627)(0.666) = -7.576

X - Duty Cycle (Average Factor)

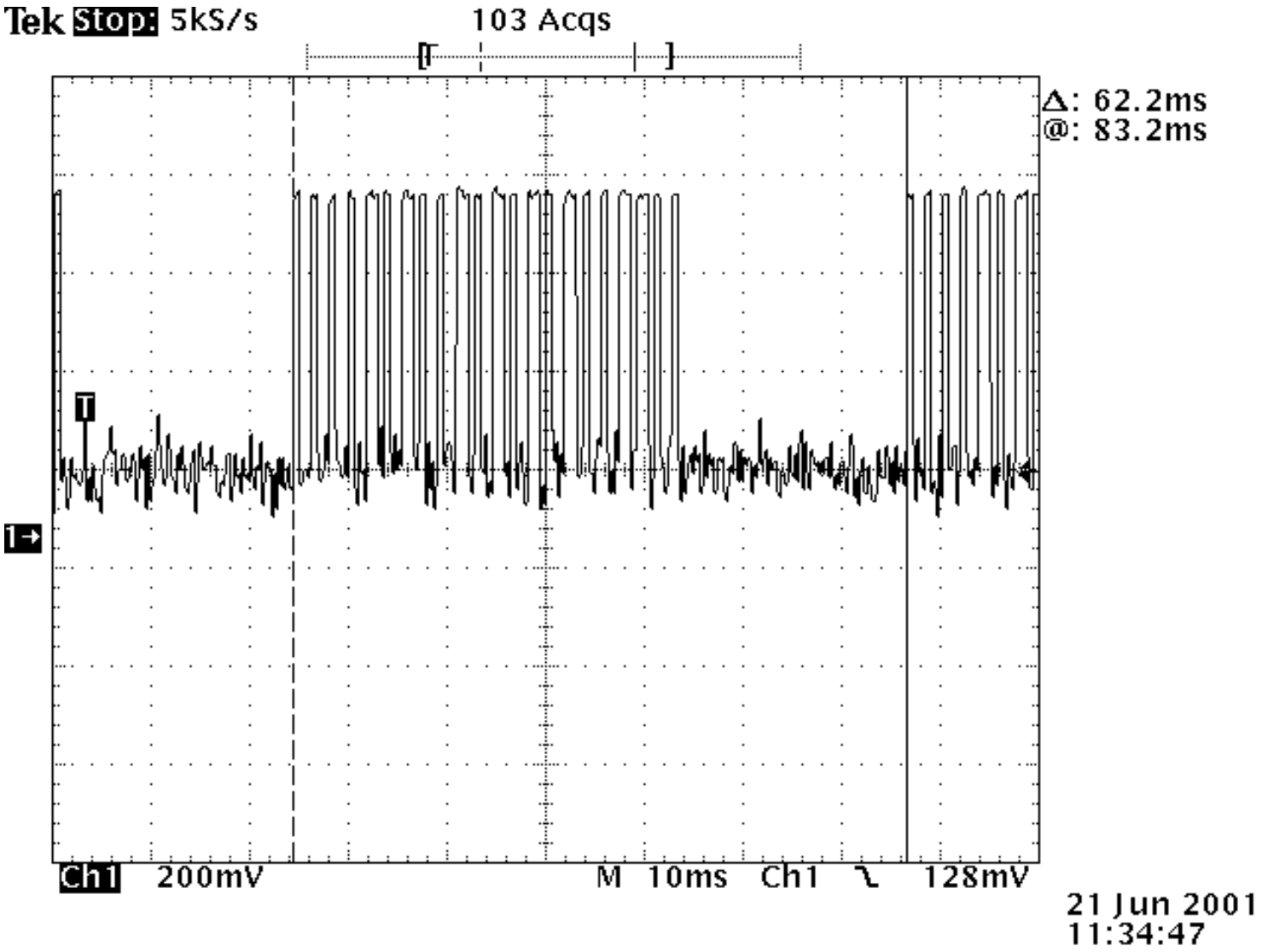
Average factor is subtracted from peak readings to compare emissions readings to average limits. The average factor is calculated from duty cycle measurements from the following plots.

The average factor is 20 Log (ON-TIME/PERIOD) of the emission. If the period is longer than 100 milliseconds then 100 milliseconds is used for the period. Average factor is determined using the worst-case duty cycle.

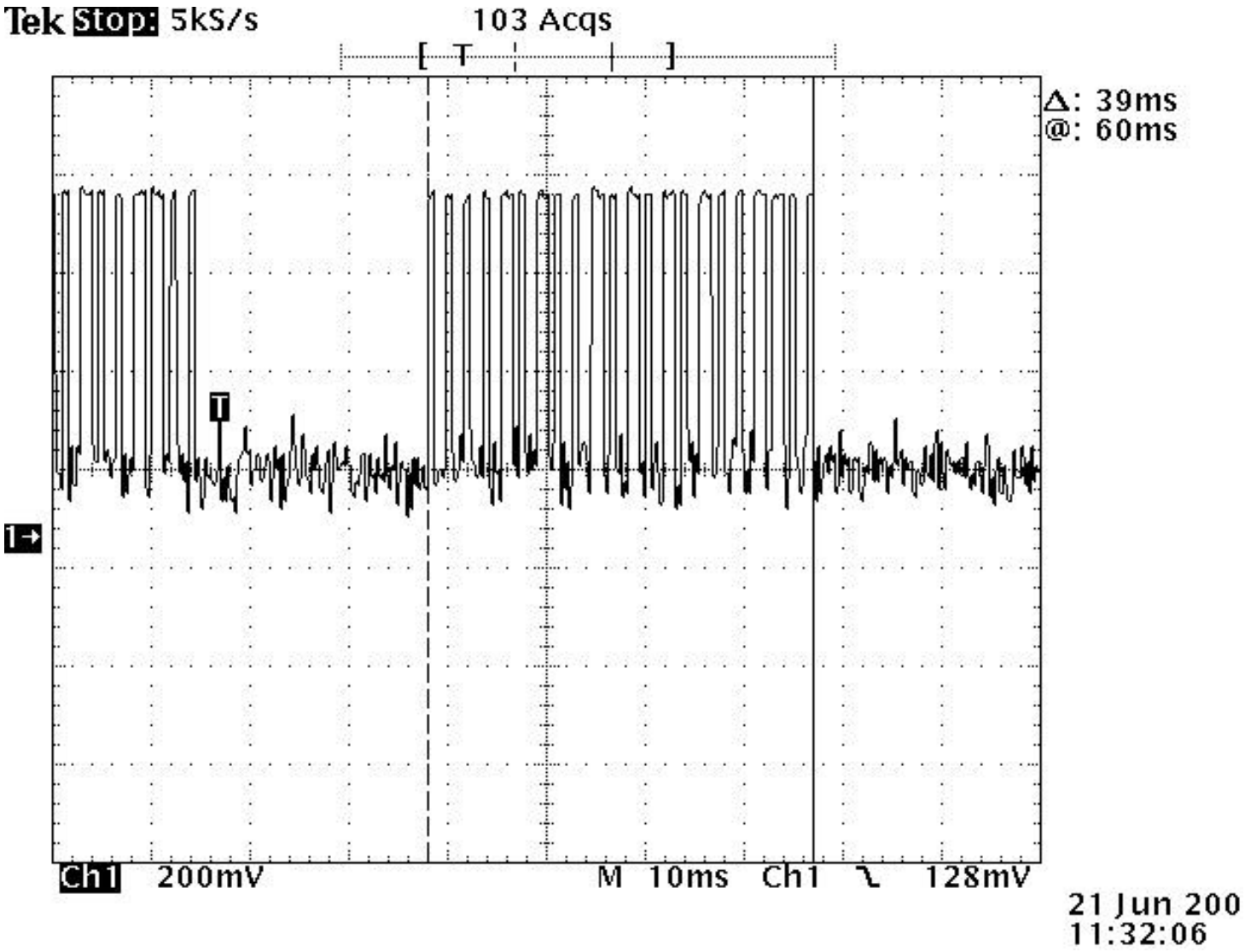
		Plot
A) Period of a "Word"	62.2 ms	1
B) ON-TIME of a "Word"	39.0 ms	2
C) Period of one "Bit"	1.8 ms	3
D) ON-TIME of one "Bit" (worst-case)	1.2 ms	4

E) Percent ON-TIME of a "Word" (A/B)	62.7 %
F) Percent ON-TIME of a "Bit" (C/D)	66.7%
20 LOG (A * B)	-7.6

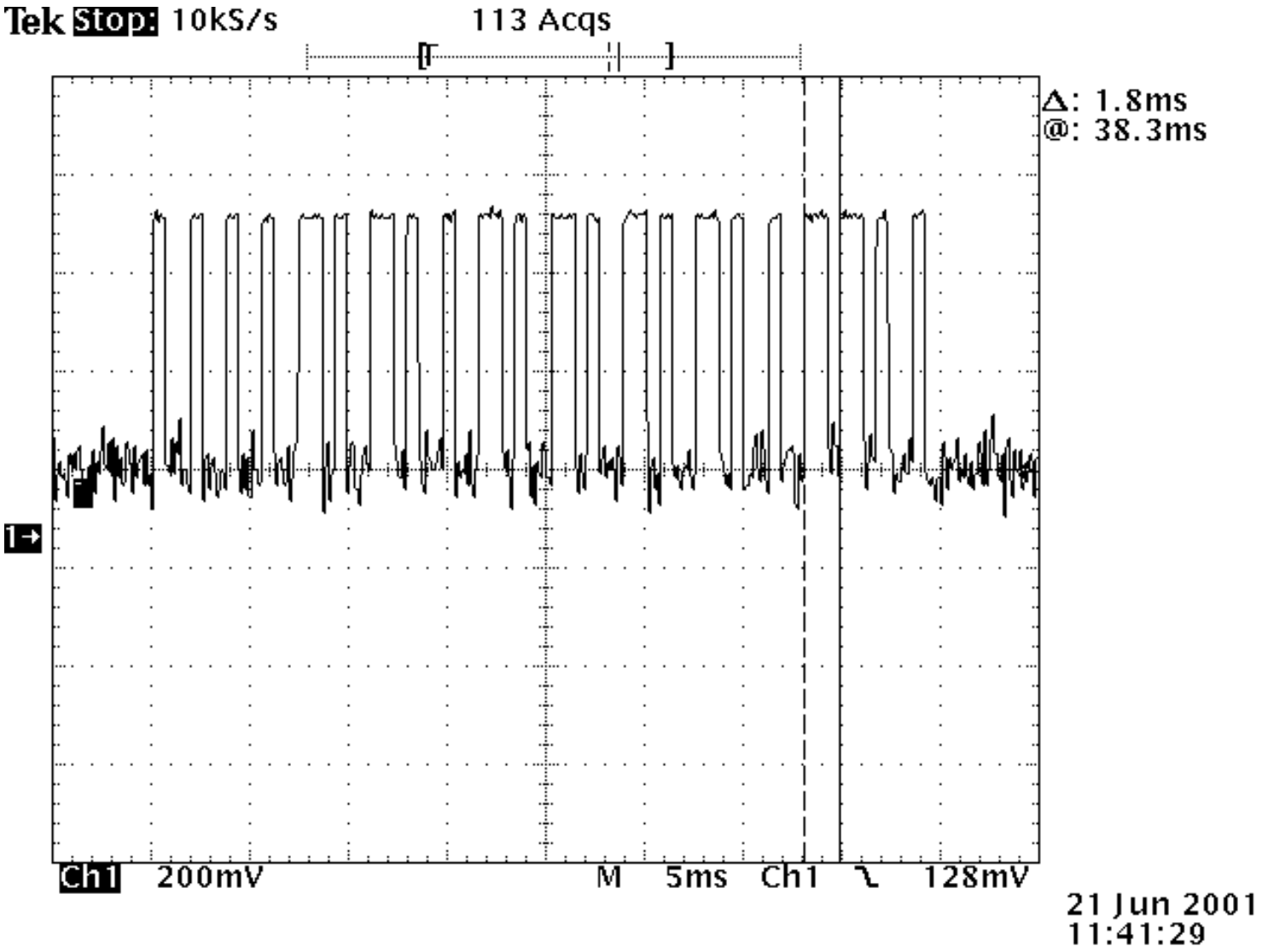
Plot 1



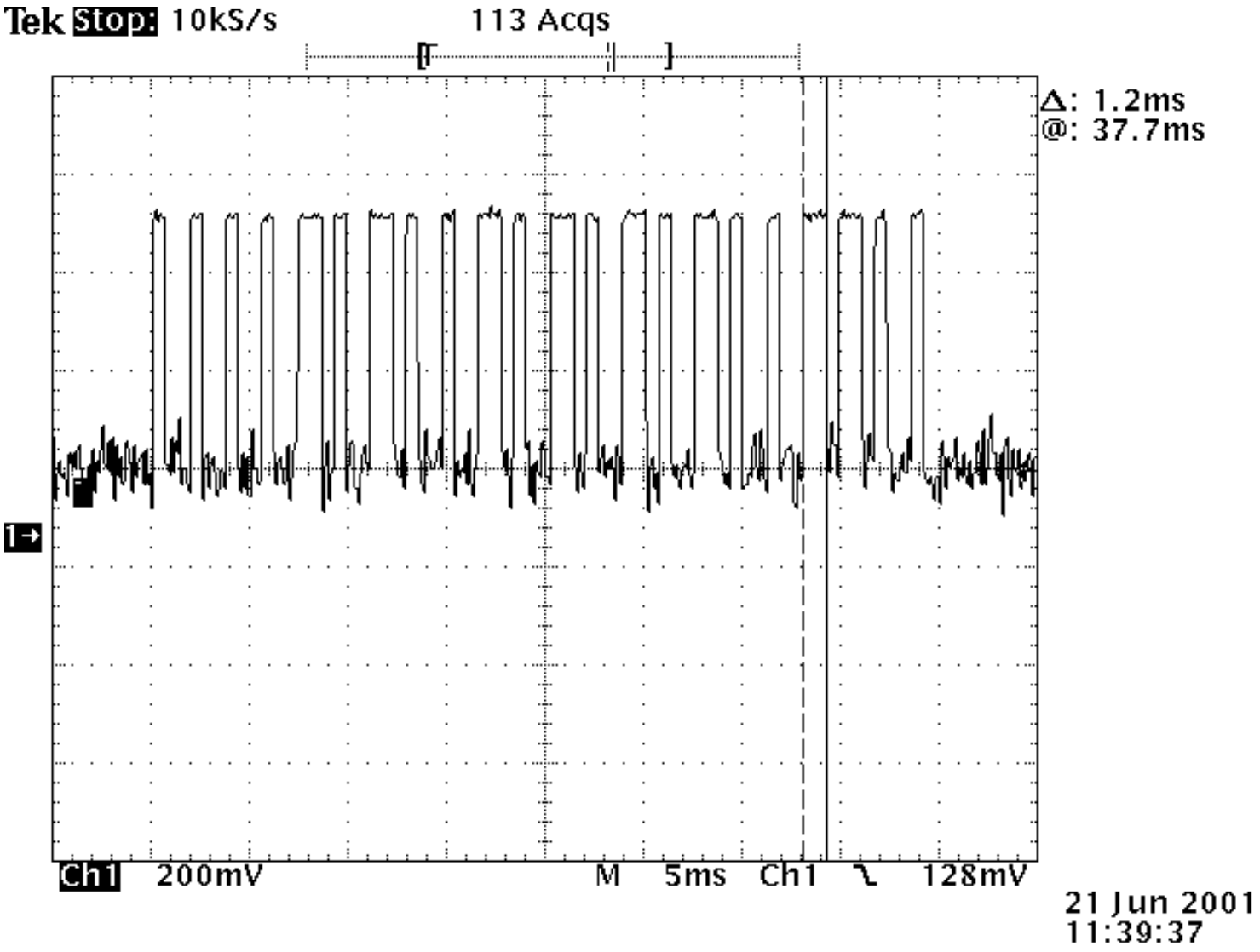
Plot 2



Plot 3



Plot 4



XI - Bandwidth

The following plot(s) show bandwidth measurements made.