Test Report

of an Intentional Radiator for Certification under Part 15.231 of the FCC rules

DUT:	Garage Door Transmitter
FCC ID	RUC-SE-G5J10
Test Date:	14-April-2004

Manufacturer: Shoreline Electronics, Inc.
2102-F Walsh Avenue
Santa Clara, CA 95050
(408) 987-7733

Prepared by: Control Design & Testing, Inc.
6010 Red Fox Drive
Spotsylvania, VA 22553
(540) 582-2826

A. DEVICE UNDER TEST

The device is a keyfob style transmitter with an integral white light LED used to operate a grage door opening system. The transmitter is manufactured by Shoreline Electronics for Genie Company. This product is designed to operate under the provisions of Part 15.231 of the FCC rules.

The frequency of operation is 390.00 MHz., nominal. The modulation mode is on/off keying using the Microchip “keylok” rolling code format. The test sample was supplied in the final production plastic enclosure.

The device is powered by an internal 1.5 volt alkaline battery. The transmitter circuit is a modified colpitts oscillator using a SAW resonator as the frequency determining element. The antenna is a pc track loop that is etched on the printed circuit board. There is no provision to connect an external antenna.

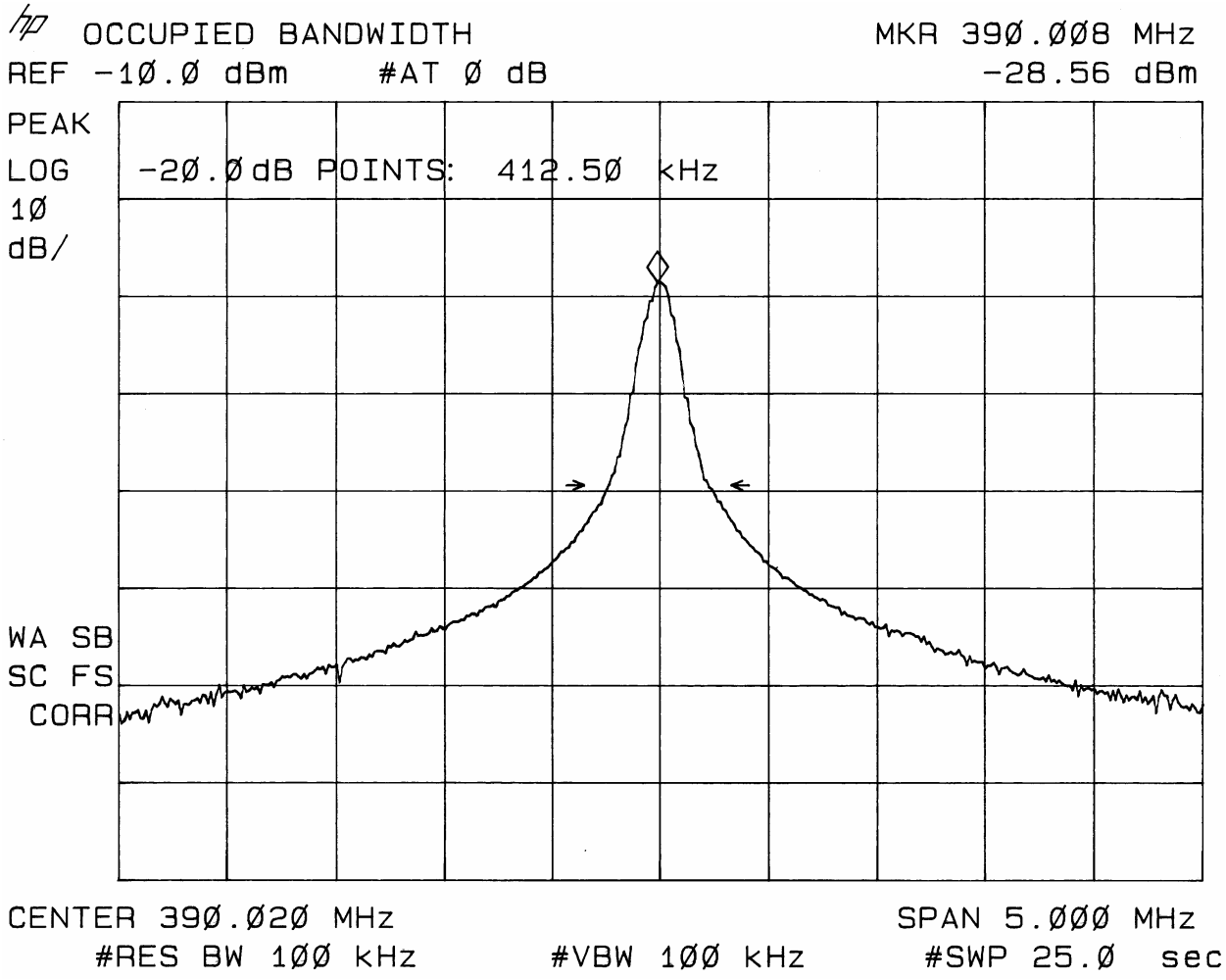
B. MEASUREMENT PROCEDURE: RADIATED EMISSIONS

Radiated emissions testing of this device was conducted at the Carl T. Jones test facility located in Springfield, Virginia. FCC Site #90490

The field strength measurements were conducted according to the procedures set forth in ANSI C63.4 (1992). The device under test was placed on a rotating turntable 0.8 meters high, centered at 3 meters distant from the measurement antenna. The device was placed in the center of the turntable and tested in three positions as shown in the test setup photographs

In normal operation, this device is programmed to transmit when the “open” button is pressed and stops transmitting whe the button is released. For the purpose of radiated emissions testing, the test sample was specially programmed to continuously transmit its code sequence without pressing the button. The occupied bandwidth plot below (Plot 1) was captured using this signal.

Plot 1


OCCUPIED BANDWIDTH
MKR 39Ø.ØØ8 MHz
REF -1Ø.Ø dBm
#AT Ø dB
-28.56 dBm
PEAK
LOG
1Ø
dB/
-2Ø.Ø dB POINTS: 412.5Ø kHz
WA SB
SC FS
CORR
CENTER 39Ø.Ø2Ø MHz
SPAN 5.ØØØ MHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 25.Ø sec

The field strength measurements were taken using an HP8596E spectrum analyzer, an EMCO 3121C dipole set, an EMCO 3115 double ridge guide horn and an Avantek UJ210 preamp. The device was scanned from 30 MHz. to 4 GHz. and all emissions were noted. In this case, the only emissions detected were the primary frequency of operation and frequencies harmonically related to the fundamental transmit frequency.

At each detected emission frequency, the device was measured by rotating the turntable and adjusting the antenna height over a range of 1 to 4 meters to obtain the maximum output level. This procedure was performed with both horizontal and vertical antenna polarizations for each of the three positions shown in the test setup photos. The peak reading for each frequency was recorded in the fourth column in Table 1 below.

Measurements taken for weak emissions were performed by reducing the distance from the measurement antenna to 1 meter and factoring –9.54dB into the calculation. This method was used for the 6^{th} and 7^{th} harmonics.

Table 1

RADIATED EMISSIONS DATA

CLIENT: SHORELINE ELECTRONICS FCC ID: RUC-SE-G5J10

ANTENNA: DIPOLES/DRG HORN EUT: GARAGE DOOR TRANSMITTER

PART 15.231 DATE: 14-APRIL-04

Frequency In MHz.	Ant. Polar. H/V	Ant. Factor dB	Peak reading dBm	Duty Cycle -dB	Peak Power uV/m@3m	Corrected Power uV/m@3m	15.231(a) Limit uV/m@3m
390.019	V	21.9	-56.11	10.5	4360	1302	9166
780.038	V	28.4	-83.91	10.5	375	112	916
1170.057	V	27.2	-84.58	10.5	303	90	500
1560.076	H	28.6	-90.84	10.5	173	52	500
1950.095	V	30.9	-103.77	10.5	51	15	916
2340.114	H	32.3	-110.05	10.5	29	9	500
2730.133	H	33.5	-117.32	10.5	14	4	500

C. DUTY CYCLE AND INTERVAL CALCULATIONS

The occupied bandwidth and duty cycle measurements were made using an HP8594E spectrum analyzer and plotted with an HP7475A pen plotter. The computation for the duty cycle correction factor for column five in Table 1 is derived from the manufacture's description of the data scheme and is verified by plots 2 through 7.

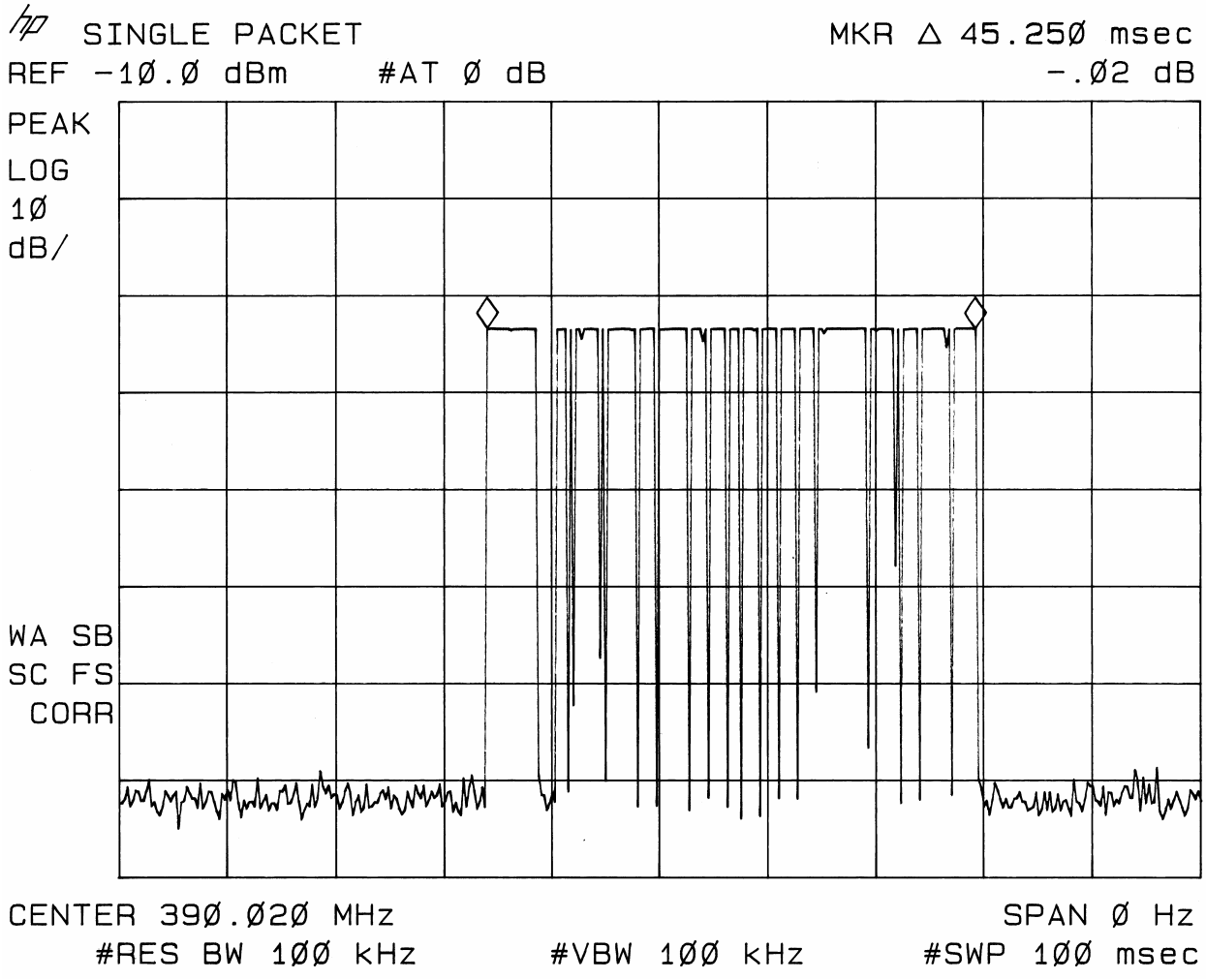
The data format for this device is a proprietary rolling code pulse modulation scheme. The packets are transmitted at 107ms. intervals so there is only one packet in any 100ms. period. Each packet is 45.55ms. long consisting of a 4.55ms. preamble followed by a 2.00ms. space and a 39ms. address. The preamble has 12 evenly spaced pluses of 200µs. each for a total on time of 2.4ms. The address is a 64 bit binary code with a worst case duty cycle of 70% for a total on time of 27.3ms. The net packet duty cycle is calculated below.

Preamble	12 X 200µs. =	2.4ms.
Address	39ms. X 0.7 =	27.3ms.
Total on time		29.7ms.

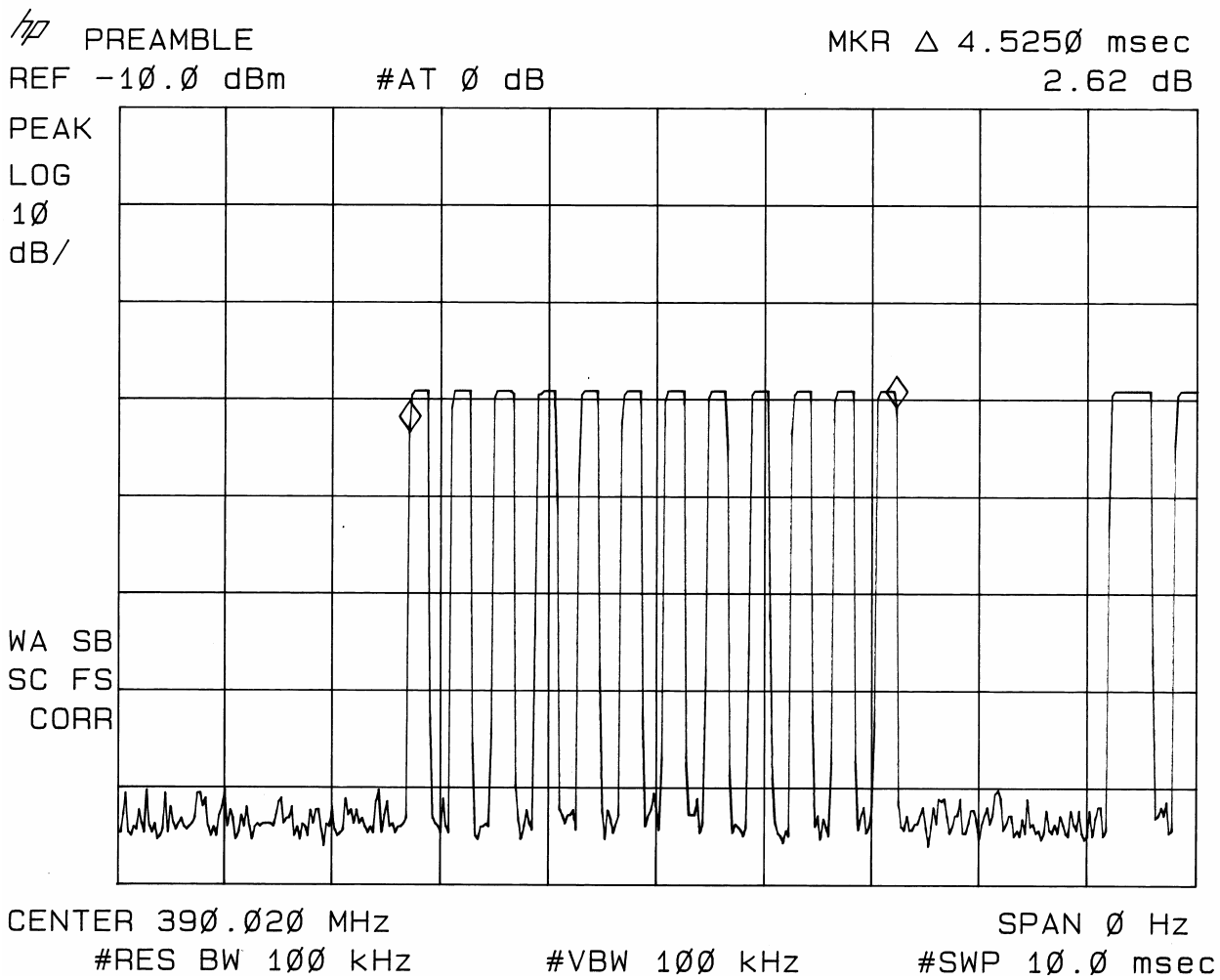
20log(29.7ms. total on time)/100ms.) = -10.54 dB.

As provided in Part 15.35 of the FCC rules, a correction factor of –10.5 dB is used for the calculations on the data sheet. The duty cycle corrected levels appear in the 7th column in the table above.

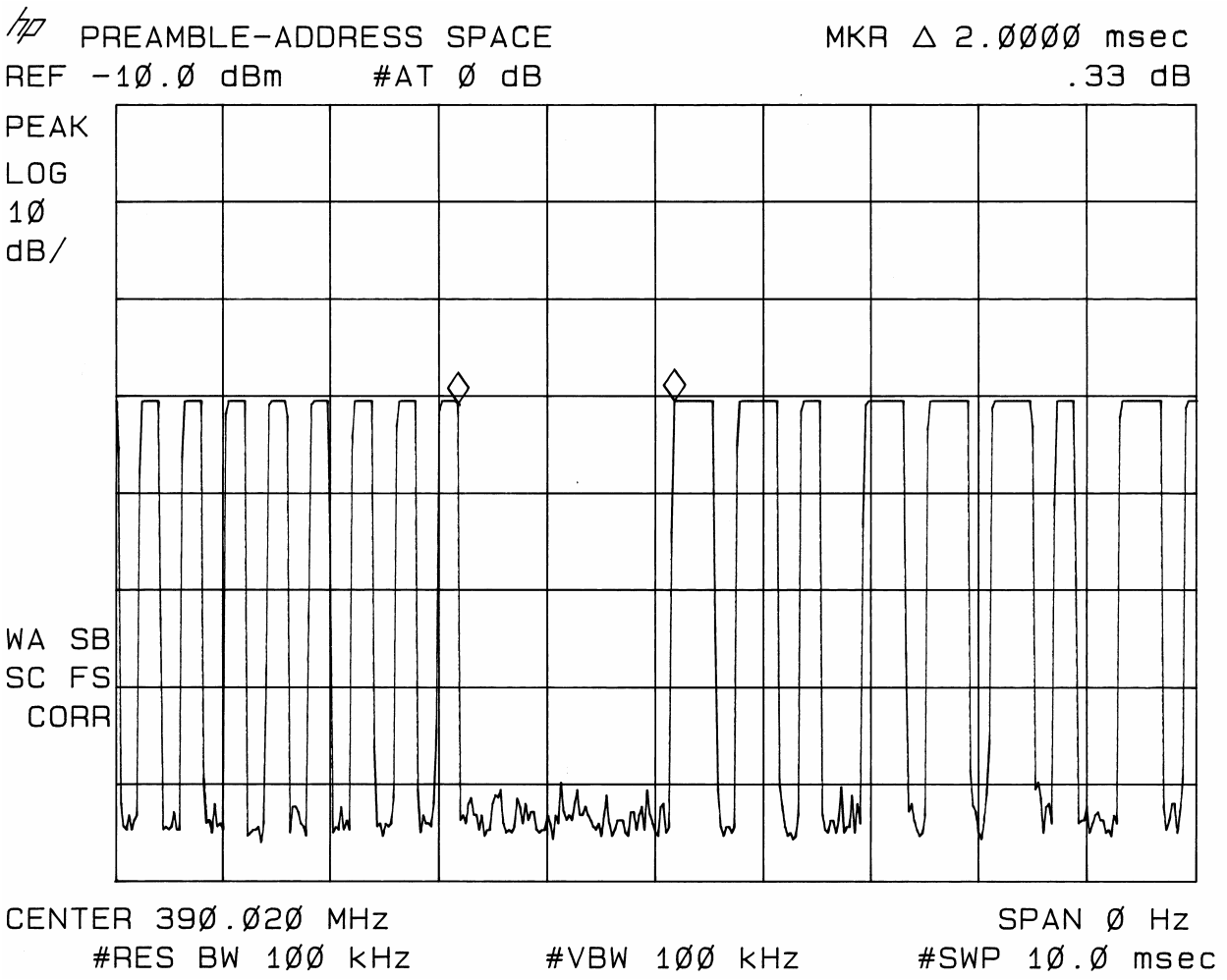
Plot 2


SINGLE PACKET
MKR Δ 45.25Ø msec
REF −1Ø.Ø dBm
#AT Ø dB
−.Ø2 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 39Ø.Ø2Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 1ØØ msec

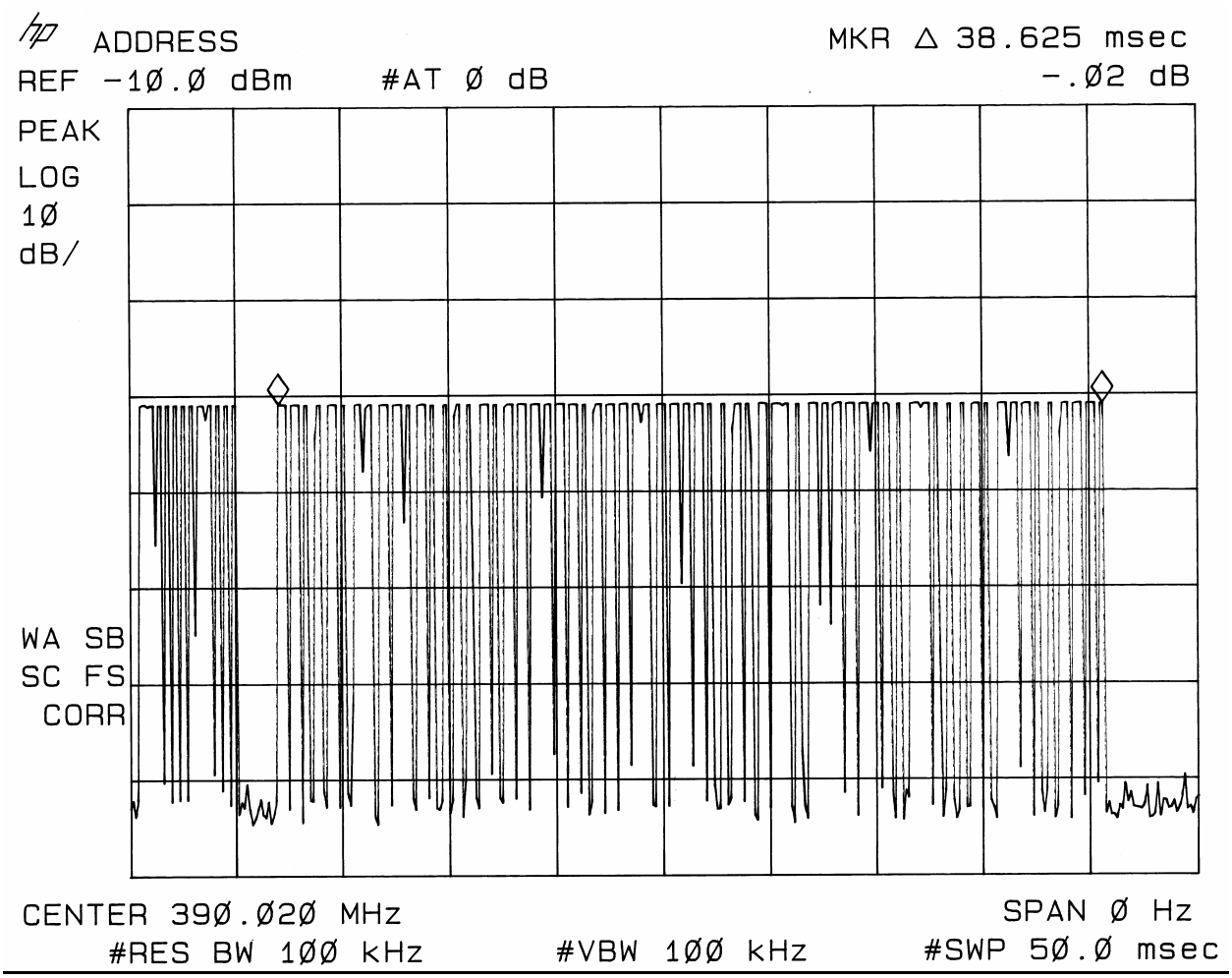
Plot 3


PREAMBLE
MKR Δ 4.525Ø msec
REF −1Ø.Ø dBm
#AT Ø dB
2.62 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 39Ø.Ø2Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 1Ø.Ø msec

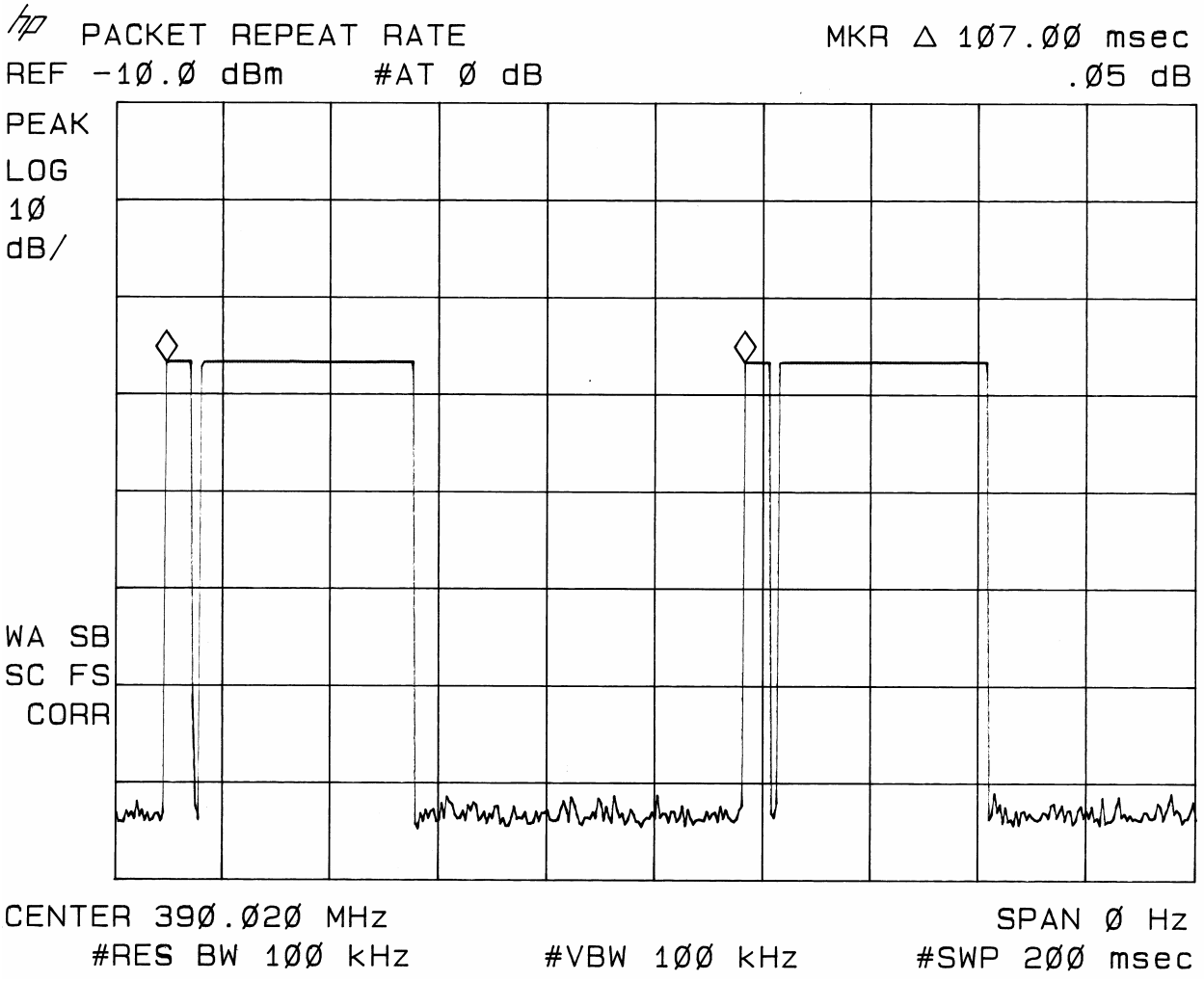
Plot 4


PREAMBLE-ADDRESS SPACE
MKR Δ 2.ØØØØ msec
REF -1Ø.Ø dBm
#AT Ø dB
.33 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 39Ø.Ø2Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 1Ø.Ø msec

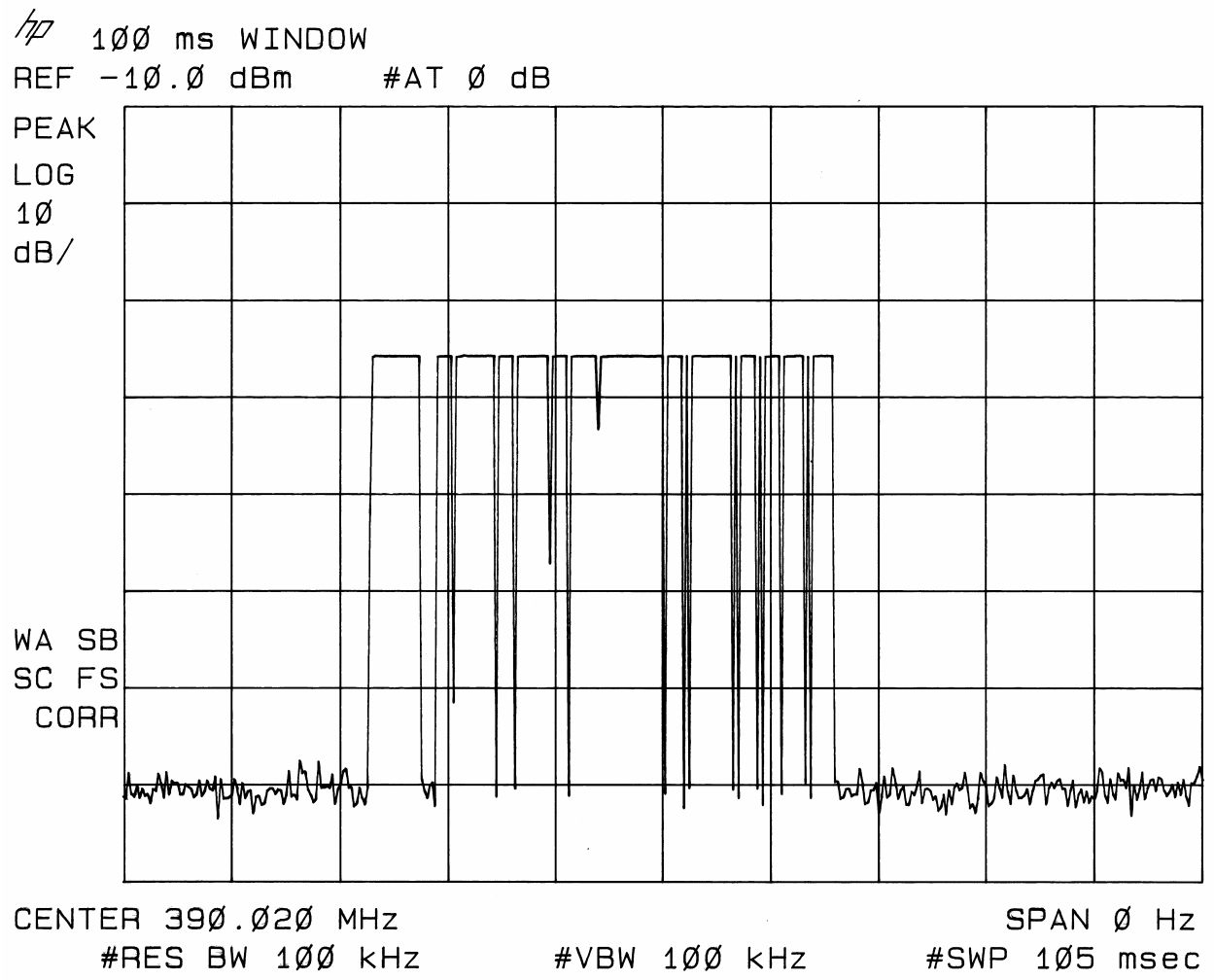
Plot 5


ADDRESS
MKR Δ 38.625 msec
REF −1Ø.Ø dBm
#AT Ø dB
−.Ø2 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 39Ø.Ø2Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5Ø.Ø msec

Plot 6


PACKET REPEAT RATE
MKR Δ 1Ø7.ØØ msec
REF -1Ø.Ø dBm
#AT Ø dB
.Ø5 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 39Ø.Ø2Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 2ØØ msec

Plot 7


1ØØ ms WINDOW
REF -1Ø.Ø dBm
#AT Ø dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 39Ø.Ø2Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 1Ø5 msec