Test Report

of an Intentional Radiator for Certification under Part 15 of the FCC rules

DUT:	Control Transmitter
FCC ID	SRN-SHIELD1-1
Section	15.231
Date:	08-December-2004

Manufacturer: Bottle Metrics, Inc.
3001 Bridgeway, #334
Sausalito, CA 94965
(415) 717-4244

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

A. DEVICE UNDER TEST

The product is a transmitter used as an inventory control device that tracks the tilting of a bottle. This device is designed to be attached to the neck of a bottle and indicate the when the bottle is tilted. The product is designed to operate under the provisions of Part 15.231 of the FCC rules in the United States and RSS-210 in Canada.

The device is self contained in a sonically welded, plastic enclosure and is powered by an internal 3 volt lithium coin cell. There is no provision to use an external power source. The frequency of operation is 418.00 MHz. nominal. The modulation mode is on/off keying using a proprietary pulse width scheme. In normal operation, this device is programmed to transmit three packets, spaced over a period of 35ms, upon a “tilt event” and again one packet every four hours to insure system integrity.

The rf circuit is a modified colpitts oscillator using a SAW resonator as the frequency determining element. The radiating element is a track antenna printed on the circuit board. There is no provision to connect an external antenna.

The test samples were provided in prototype plastic enclosures. The FCC ID label will be placed on the plastic cover as shown in the “label area” photograph.

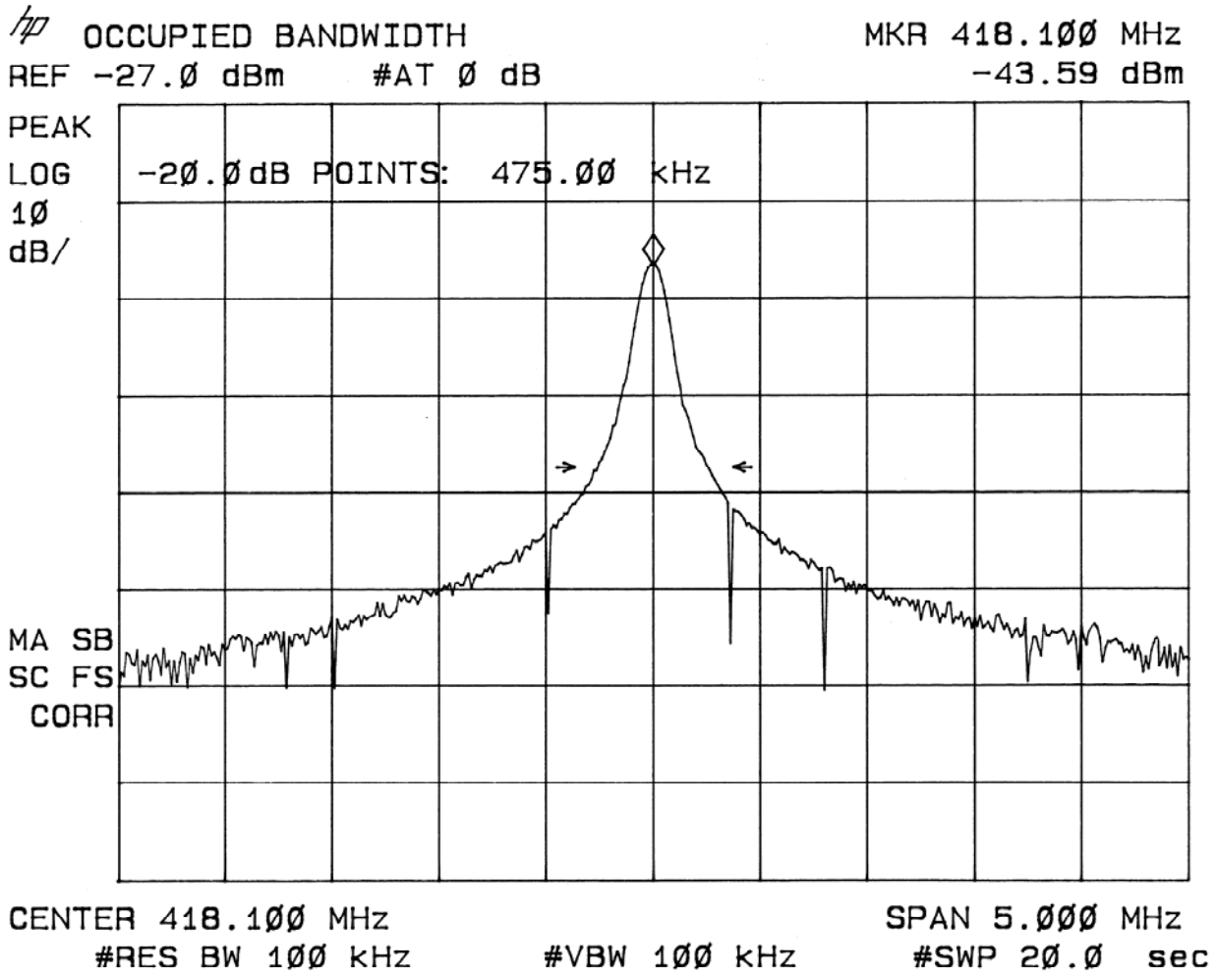
B. MEASUREMENT PROCEDURE: RADIATED EMISSIONS

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 tested in two major planes. Two sets of measurements were taken. The device was placed in the center of the turntable and tested in both positions shown in the test setup photographs.

For the purpose of radiated emissions testing, one of the test samples was specially programmed to transmit typical packets, at an accelerated rate, continuously. The occupied bandwidth plot below (Plot 1) was captured using this signal.

Plot 1


OCCUPIED BANDWIDTH
MKR 418.1ØØ MHz
REF -27.Ø dBm
#AT Ø dB
-43.59 dBm
PEAK
LOG
1Ø
dB/
-2Ø.Ø dB POINTS: 475.ØØ kHz
MA SB
SC FS
CORR
CENTER 418.1ØØ MHz
SPAN 5.ØØØ MHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 2Ø.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 5 GHz. and all emissions were noted. In this case, the only emissions detected were those 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 both of the test positions shown in the setup photos. The peak reading for each frequency was recorded in the fourth column in the tables 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 to measure the 8^{th} and 9^{th} harmonics.

Table 1

RADIATED EMISSIONS DATA

CLIENT: BOTTLE METRICS FCC ID: SRN-SHIELD1-1
ANTENNA: DIPOLES/DRG HORN EUT: CONTROL TRANSMITTER
PART 15.231 DATE: 07-DEC-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	FCC Limit uV/m@3m
418.101	H	22.7	-54.06	5.9	6053	3069	10333
836.202	H	30.2	-78.38	5.9	873	443	1033
1254.303	H	27.6	-83.52	5.9	358	182	1033
1672.404	H	29.3	-89.01	5.9	231	117	500
2090.505	V	31.0	-93.54	5.9	167	85	1033
2508.606	V	32.2	-95.15	5.9	159	81	1033
2926.707	H	33.6	-98.22	5.9	132	67	1033
3344.808	V	34.9	-100.16	5.9	122	62	1033
3762.909	V	36.1	-106.43	5.9	68	35	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 in column five in Table 1 is derived from the manufacture's description of the data scheme and is verified by plots 2 through 5.

The code format for this device is a pulse width scheme that comprises 32 bits of preamble at 50% duty cycle, a de-squelch pulse at 1.16ms and data of evenly distributed "one's and "zero's" at a 33/66 ratio. Measurements of pulse widths have been taken to insure worst case.

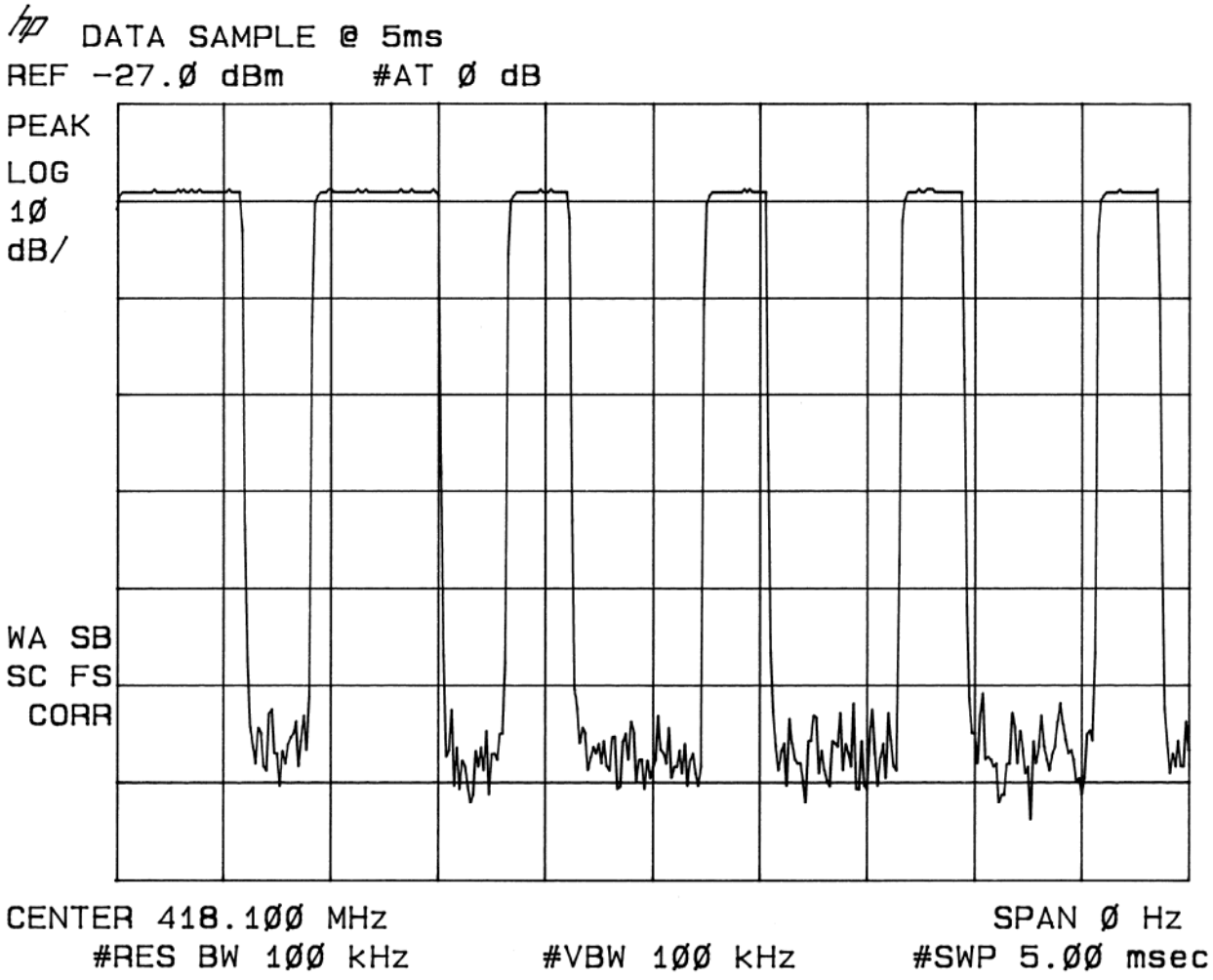
The worst case transmission for this device in any 100ms period is given in the calculation below. The correction factor is given by:

Desquelch		1.16ms
Data and Preamble	98.84ms ÷ 2 =	49.42ms
		50.58ms

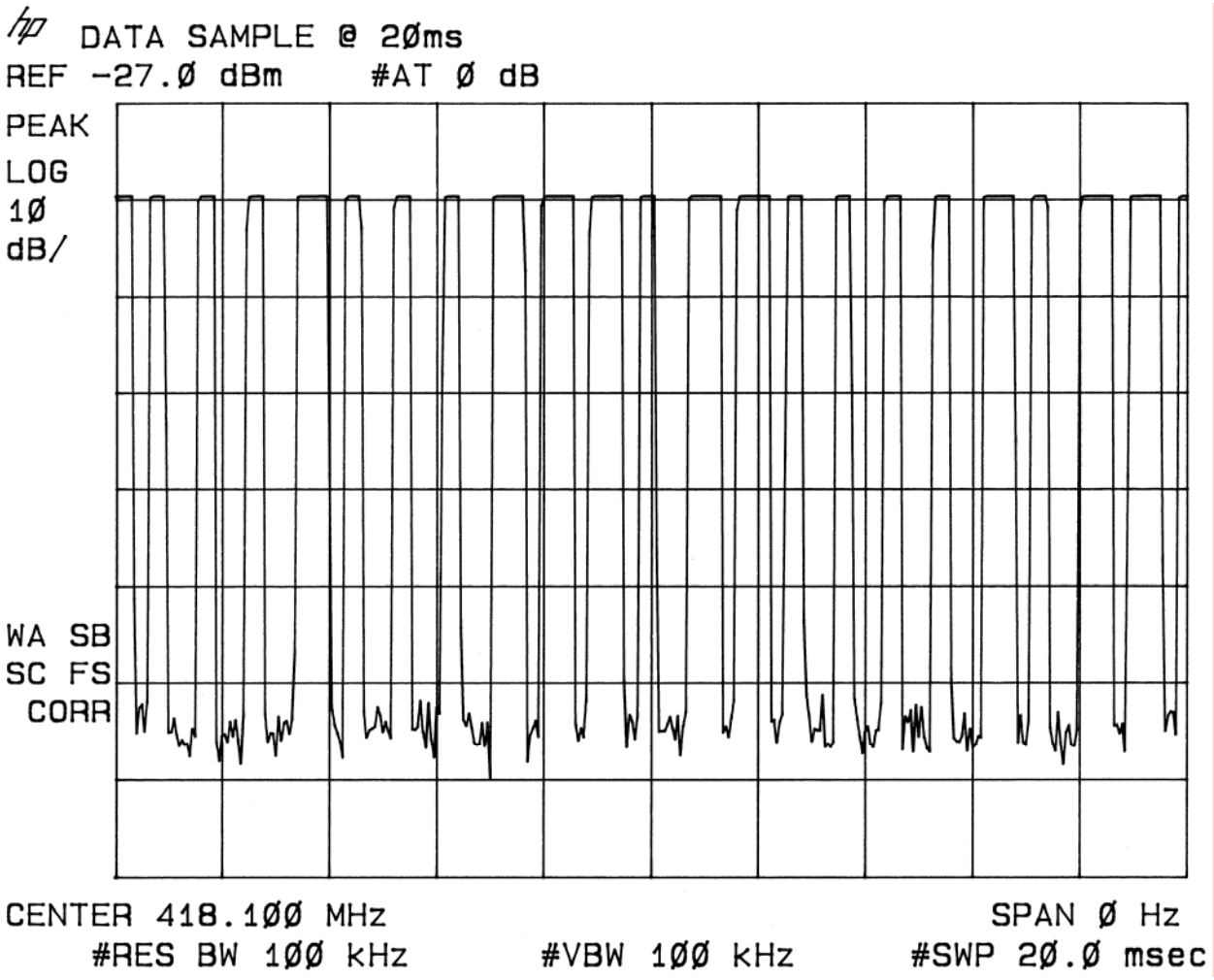
20log(50.58ms./100ms.) = -5.92dB.

As provided in Part 15.35 of the FCC rules, a correction factor of –5.9 dB is used for the calculations on the data sheet above.

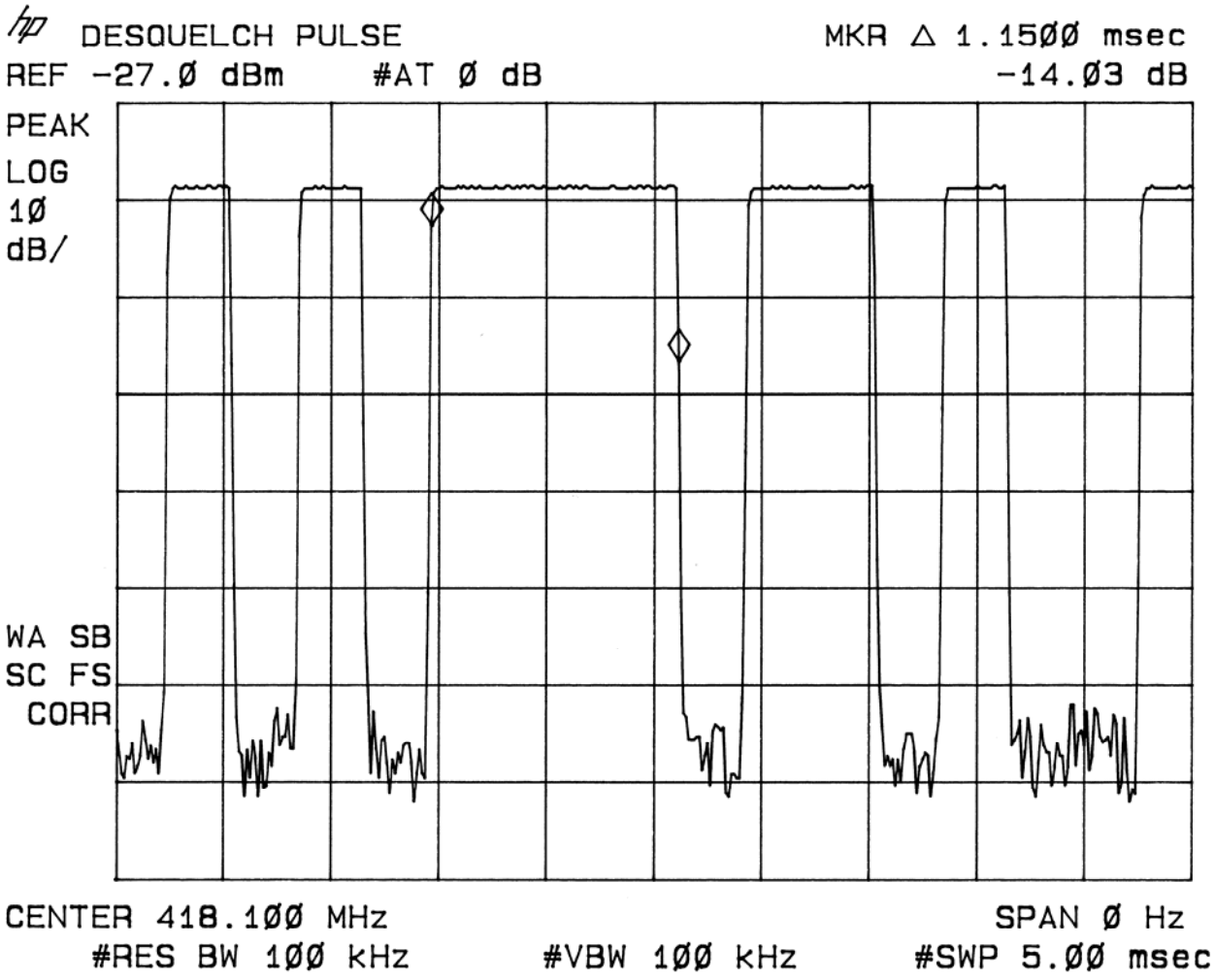
Plot 2


DATA SAMPLE @ 5ms
REF -27.Ø dBm
#AT Ø dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.1ØØ MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.ØØ msec

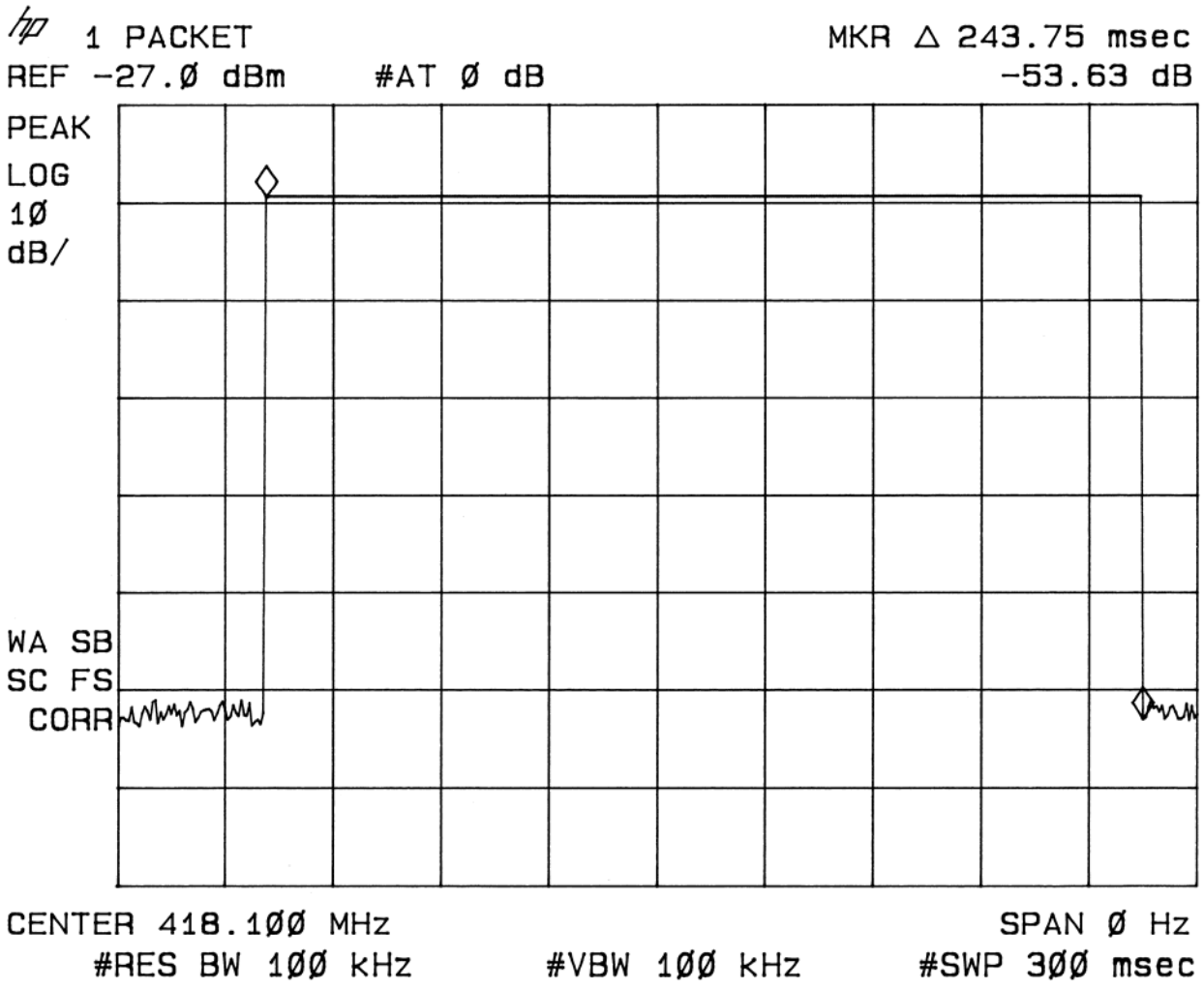
Plot 3


DATA SAMPLE @ 20ms
REF -27.0 dBm
#AT 0 dB
PEAK
LOG
10
dB/
WA SB
SC FS
CORR
CENTER 418.100 MHz
SPAN 0 Hz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 20.0 msec

Plot 4


DESQUELCH PULSE
MKR Δ 1.15ØØ msec
REF −27.Ø dBm
#AT Ø dB
−14.Ø3 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.1ØØ MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.ØØ msec

Plot 5


1 PACKET
MKR Δ 243.75 msec
REF -27.Ø dBm
#AT Ø dB
-53.63 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.1ØØ MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 3ØØ msec