Test Report

of an intentional radiator under Part 15 of the FCC rules prepared for:
RGB Wireless Applications, Inc.

DigiGuard Transmitter FCC ID: S5J-TX01

DUT:	Security Transmitter
Model:	TX01
Test Date:	April 12, 2005
Manufacturer:	RGB Wireless Applications, Inc. 8103 Lee Jackson Circle Spotsylvania, VA 22553 (540) 786-0621
Conducted by:	Control Design & Testing, Inc. 6010 Red Fox Drive Spotsylvania, VA 22553 (540) 582-2826
Facility:	Carl T Jones Corporation 7901 Yarnwood Court Springfield, VA 22153 FCC Site #90490, IC Site #3101

CD&T FCC ID: S5J-TX01

A. DEVICE UNDER TEST

The product is a security transmitter intended for the self storage industry to monitor the state of the roll-up doors that are typical of self storage facilities. This product is designed to operate under the provisions of Part 15.231 of the FCC rules.

The transmit frequency is 418.00 MHz., nominal. The modulation mode is on/off keyed using Manchester Phase encoding at 4800 baud. Power for the device is provided by an internal “AA” size 3.6 volt lithium battery. The circuit is contained in a plastic housing and is weather sealed by a custom molded silicone gasket compressed between the case body and the case lid.

The radio section is a two stage discrete circuit that employs a SAW resonator as the frequency determining element. The frequency tolerance is ± 200 KHz. The device employs a low power micro-controller, clocked at 32.368 KHz. to monitor input sensing and generate the transmission data. The rf circuitry and the modulation input are both regulated a 2.5 volts to insure level output power over the life of the battery. The antenna is a beryllium-copper loaded ¼ wave wire, custom manufactured for this product and is soldered directly to the printed circuit board. There is no provision to connect an external antenna.

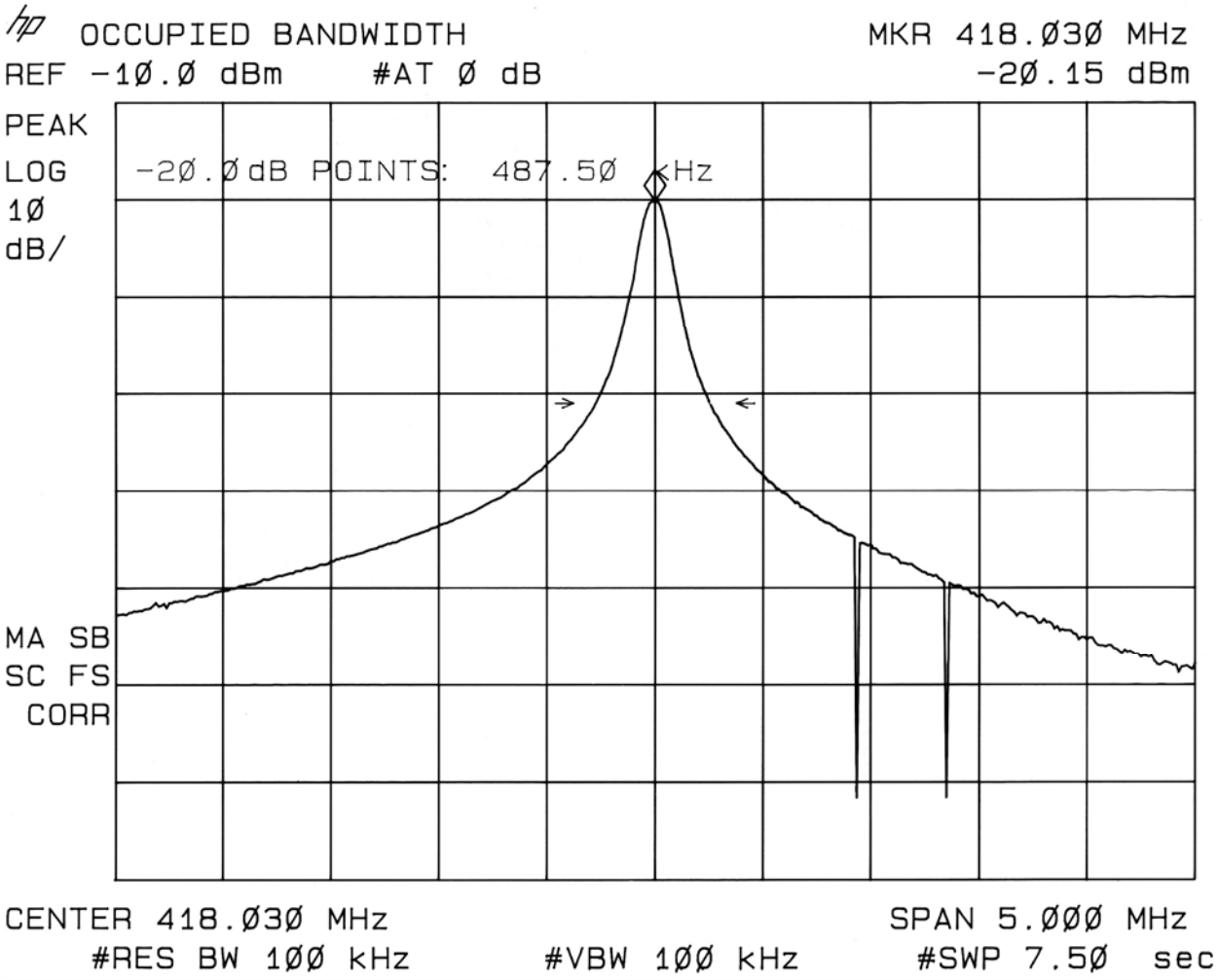
B. MEASUREMENT PROCEDURE: RADIATED EMISSIONS

Testing of this device was conducted at the Carl T. Jones test facility located in Springfield, Virginia. FCC Site #90490, IC #3101.

Transmitter 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 three meters distant from the measurement antenna. The device was placed in the center of the turntable and tested in the positions shown in the test setup photographs. Testing was conducted with a fresh battery and monitored periodically to insure that the battery voltage (under load) was maintained at 90% of nominal or greater. However, the rf output of this device is regulated and will remain constant down to 2.65 volts at the battery.

For the purpose of radiated emissions testing, the sample was programmed to issue a constant pulse stream of alternating “1’s” and “ 0’s” at 4800 baud. The occupied bandwidth (Plot 1) was captured using a repeating stream of typical data packets, also at 4800 baud. The occupied bandwidth limit for this frequency is 1.045 MHz.

Plot 1



The field strength measurements were taken using an HP8596E spectrum analyzer, an EMCO 3121C dipole set, an EMCO 3115 double ridge guide horn. 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 of the transmit frequency.

There is a 32.768 KHz. clock crystal associated with the micro-controller but no emissions related to the micro-controller or its clock could be identified in the screen room or on the OATS setup.

At each detected emission frequency, the DUT 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 in all three positions shown in the setup photographs. The peak reading for each frequency was recorded in the fourth column in Table 1 below. The duty cycle corrected level is recorded in the seventh column.

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 9th harmonic.

Table 1

RADIATED EMISSIONS DATA

CLIENT: RGB WIRELESS FCC ID: S5J-TX01
ANTENNA: DIPOLES/DRG HORN EUT: SECURITY 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
418.030	V	22.7	-33.19	20.0	66911	6691	10333
836.060	V	30.2	-74.38	20.0	1384	138	1033
1254.090	H	27.6	-80.64	20.0	499	50	1033
1672.120	H	29.3	-85.27	20.0	356	36	500
2090.150	V	31.0	-91.41	20.0	214	21	1033
2508.180	V	32.2	-94.11	20.0	180	18	1033
2926.210	H	33.6	-96.09	20.0	168	17	1033
3344.240	V	34.9	-97.18	20.0	172	17	1033
3762.270	V	36.1	-101.83	20.0	116	12	500

C. DUTY CYCLE AND INTERVAL CALCULATIONS

The occupied bandwidth and duty cycle measurements were made using an HP-8594E spectrum analyzer and plotted with an HP-7475A 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 below.

The device transmits five packets every 28 minutes for system integrity and battery status but otherwise, it only transmits upon activation of the reed sensors or the tamper switch.

The data format is a modified Manchester phase pulse modulation scheme. Each data packet consists of a start pulse of 968µs followed by a dead space of 1.76ms and then 32 pulses (32 * 208µs = 6.656ms) in Manchester Phase at 4800. This yields a total on time of 7.624ms per packet. Upon activation, 10 packets are transmitted at an interval greater than 100ms according to the formula: packet repeat interval time = (102.4ms + (serial number X random number in µs, between 1 and 2048))

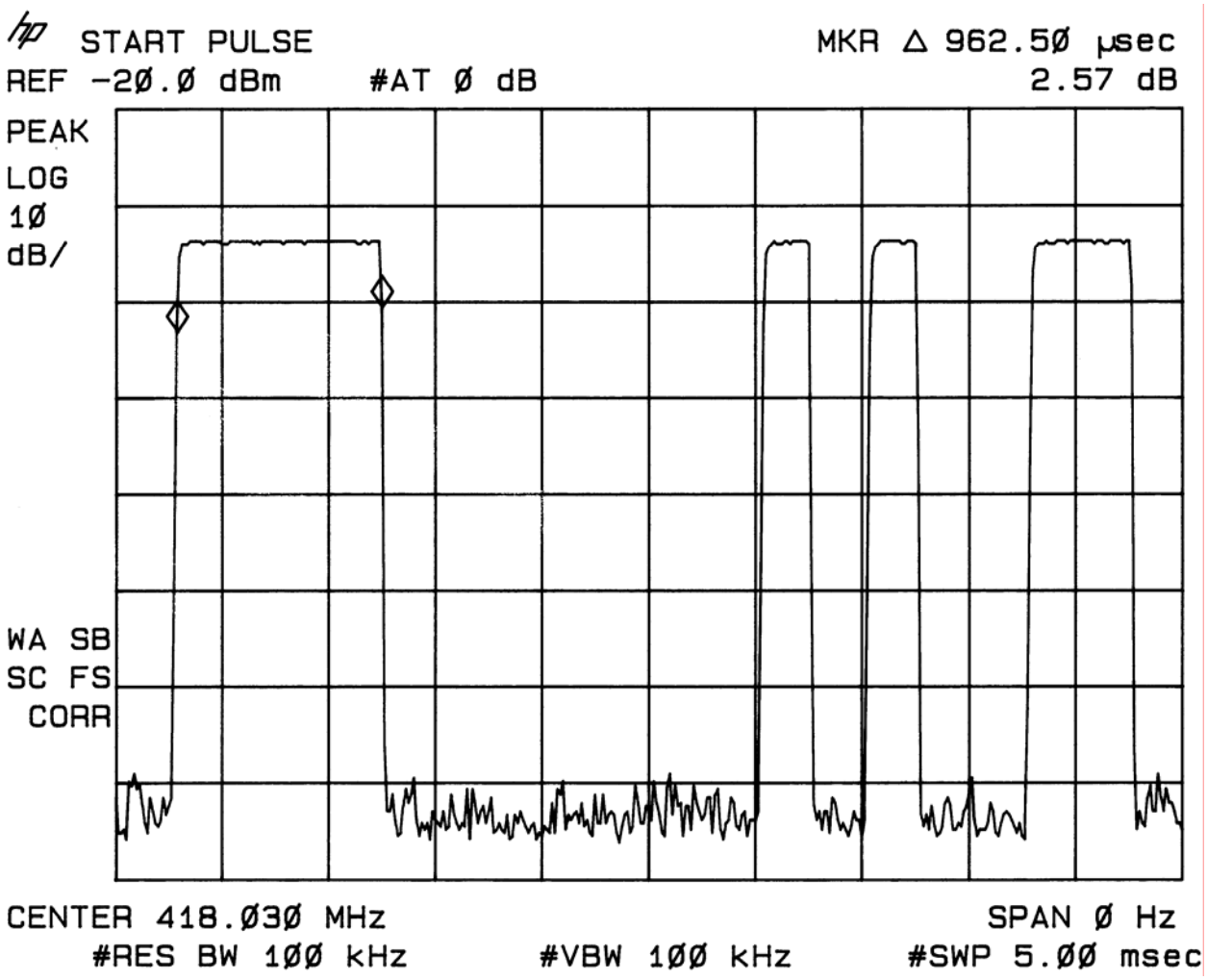
The repeat interval is always greater than 100ms and there can never be more than one packet in any 100ms. period.

Start pulse	(1 X 0.968) =	0.968 ms
Data pulses	(32 X 208µs) =	6.656 ms
On time per 100ms.		7.624 ms

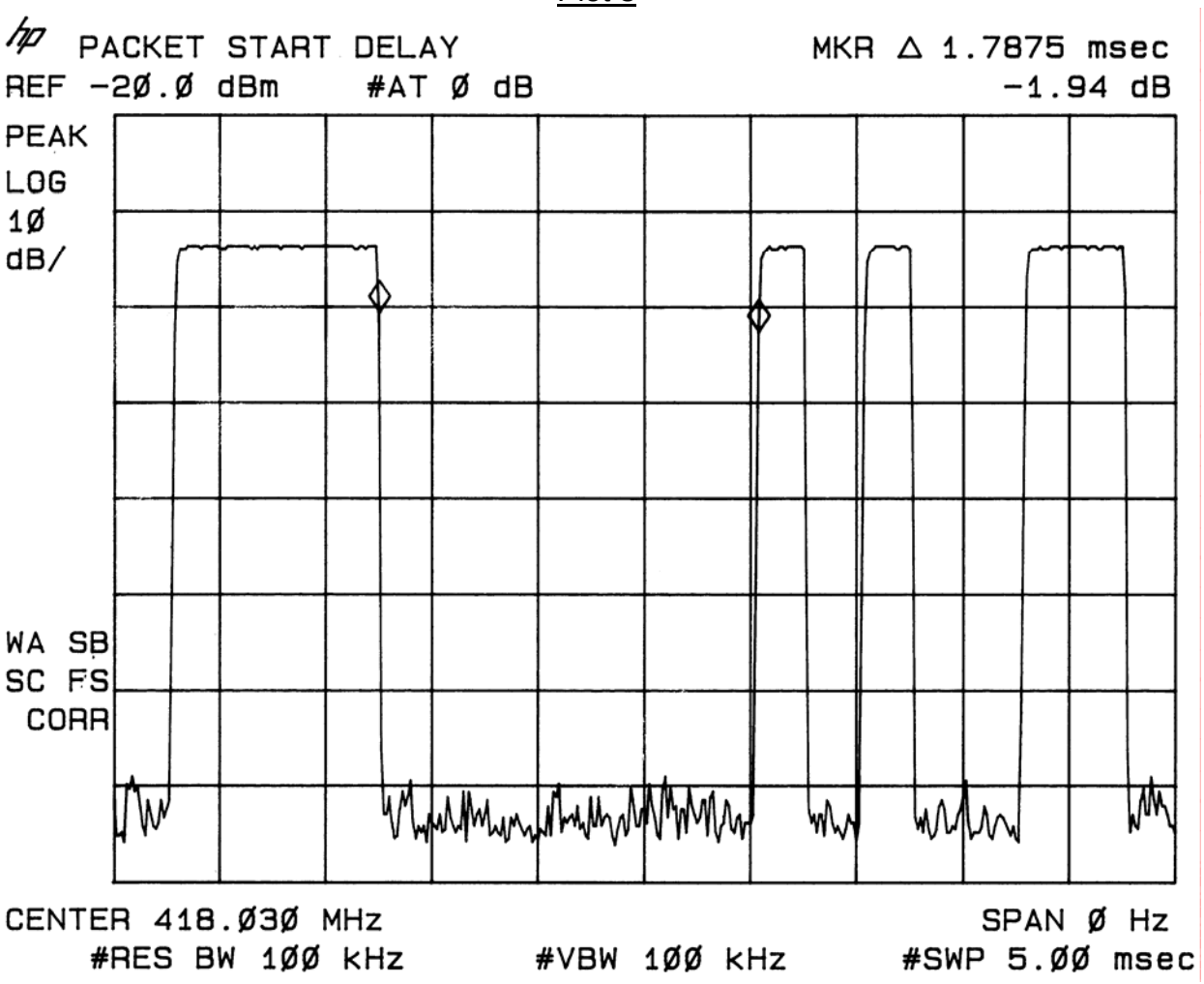
20log (7.624ms total on time)/100ms) = -22.356 dB.

As provided in Part 15.35 of the FCC rules, a correction factor of –20.0 dB is used for the calculations on the data sheet. The duty cycle corrected levels appear in the 7th column in Table 1 above.

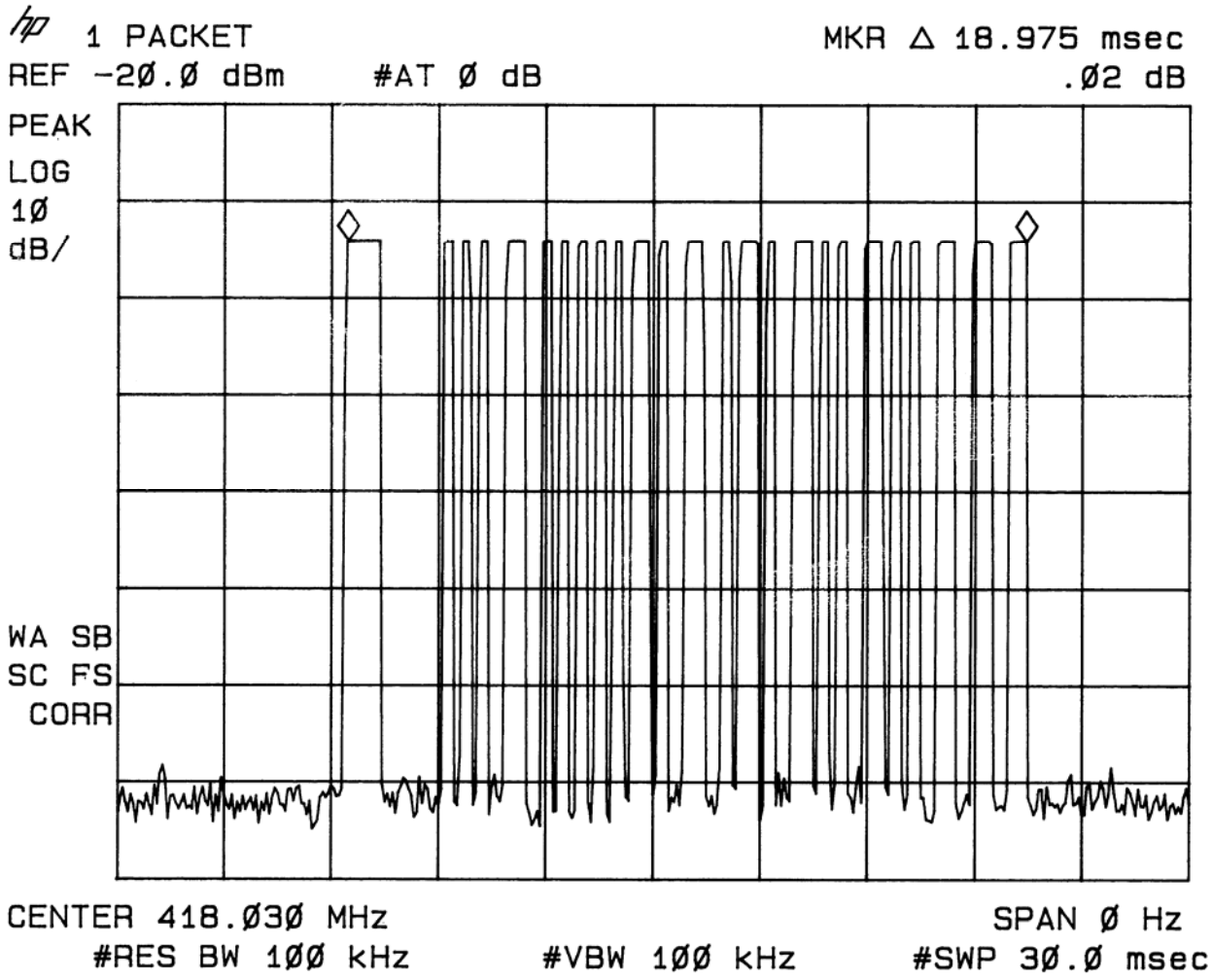
Plot 2


START PULSE
MKR Δ 962.5Ø µsec
REF −2Ø.Ø dBm
#AT Ø dB
2.57 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.Ø3Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.ØØ msec

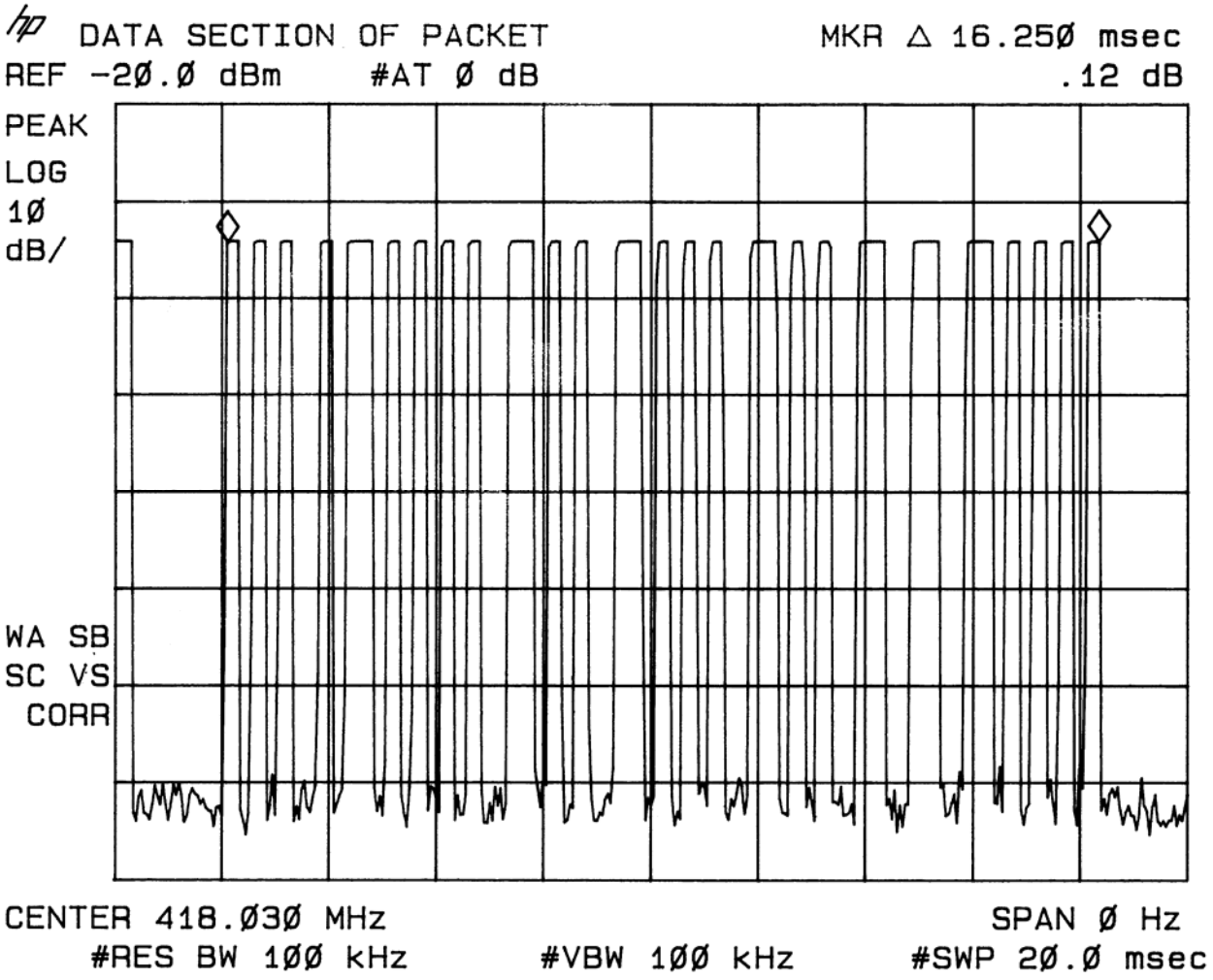
Plot 3


PACKET START DELAY
MKR Δ 1.7875 msec
REF −2Ø.Ø dBm
#AT Ø dB
−1.94 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.Ø3Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.ØØ msec

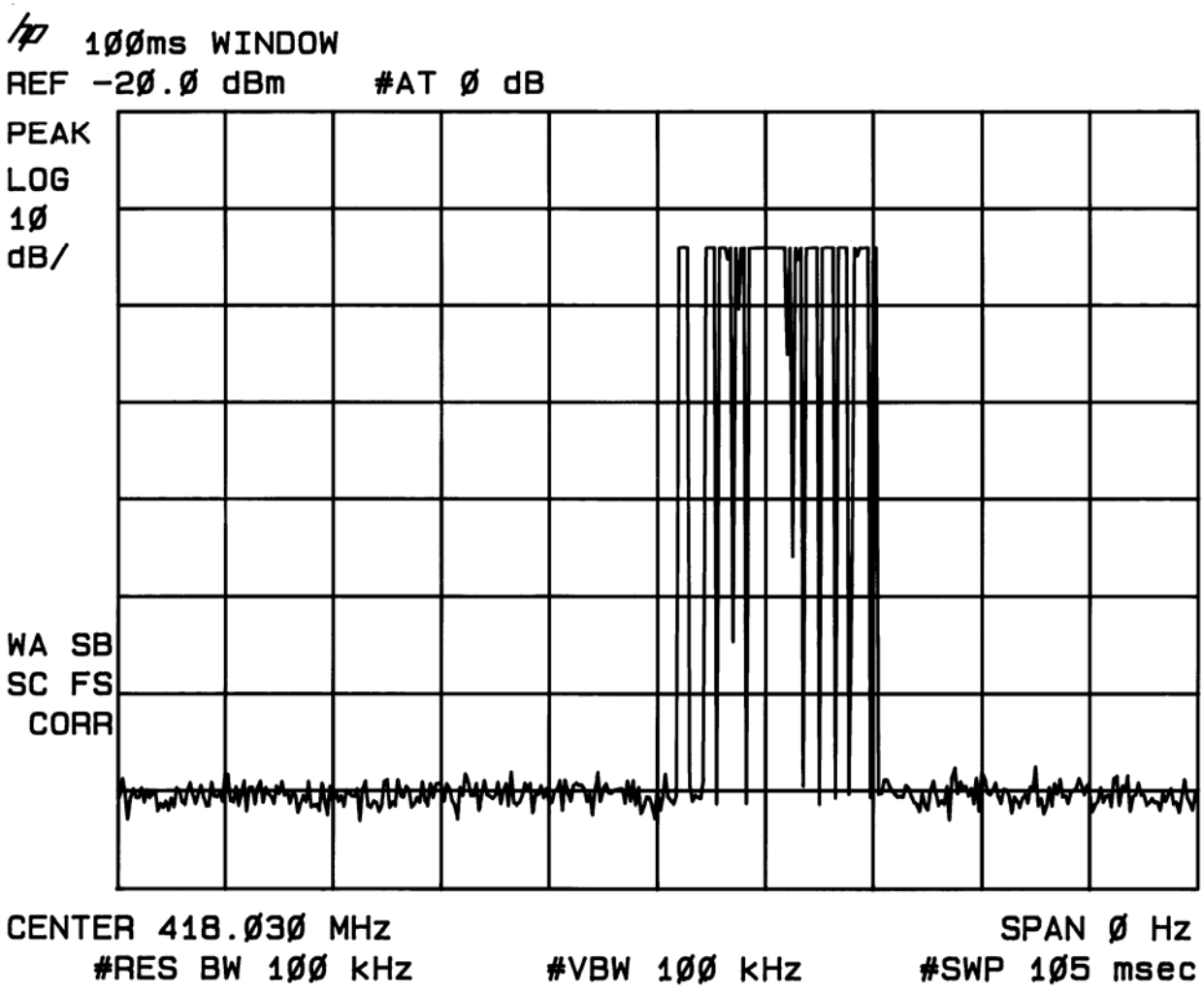
Plot 4


1 PACKET
MKR Δ 18.975 msec
REF −2Ø.Ø dBm
#AT Ø dB
.Ø2 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.Ø3Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 3Ø.Ø msec

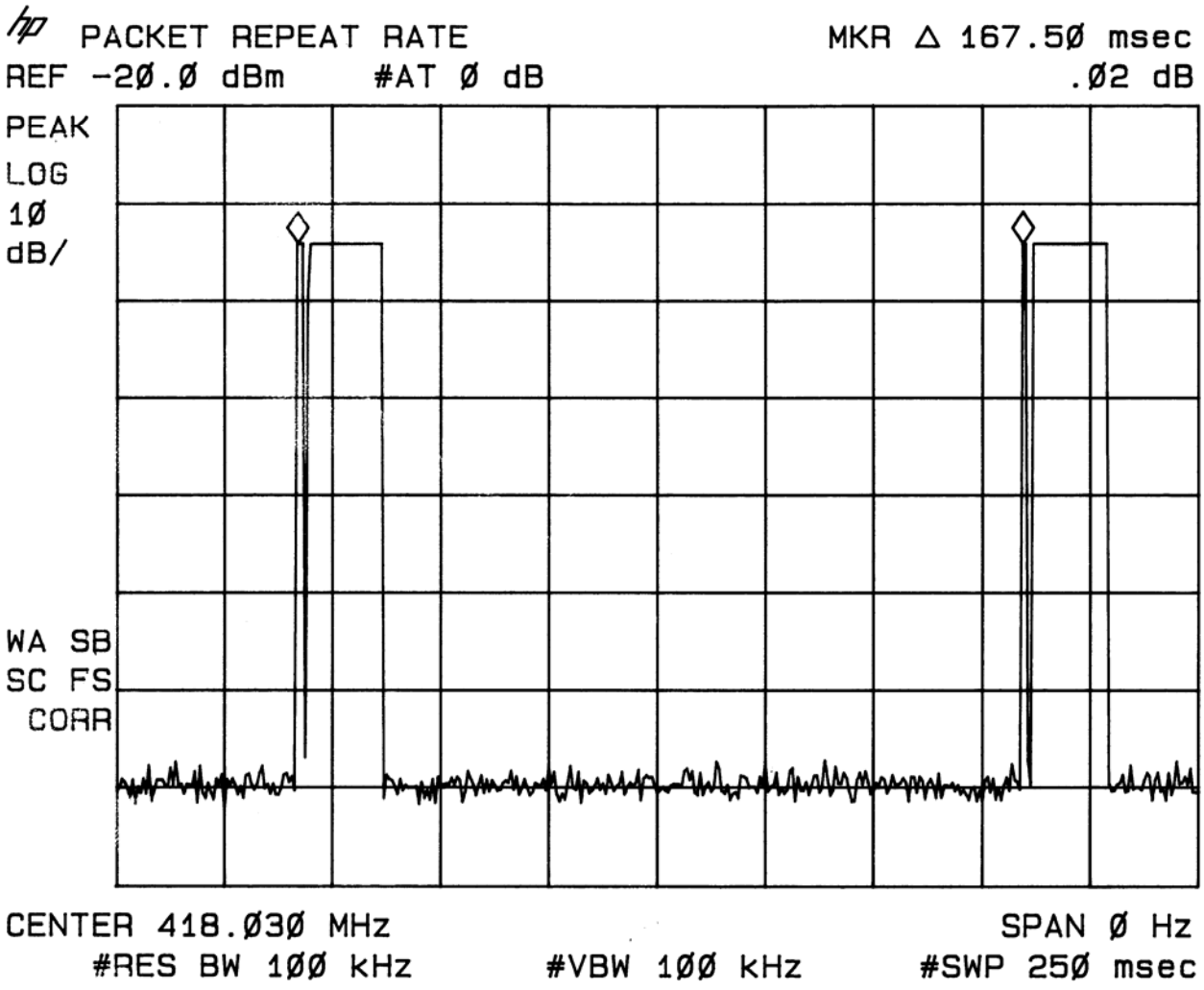
Plot 5


DATA SECTION OF PACKET
MKR Δ 16.25Ø msec
REF −2Ø.Ø dBm
#AT Ø dB
.12 dB
PEAK
LOG
1Ø
dB/
WA SB
SC VS
CORR
CENTER 418.Ø3Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 2Ø.Ø msec

Plot 6


1ØØms WINDOW
REF -2Ø.Ø dBm
#AT Ø dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.Ø3Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 1Ø5 msec

Plot 7


PACKET REPEAT RATE
MKR Δ 167.5Ø msec
REF −2Ø.Ø dBm
#AT Ø dB
.Ø2 dB
PEAK
LOG
1Ø
dB/
WA SB
SC FS
CORR
CENTER 418.Ø3Ø MHz
SPAN Ø Hz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 25Ø msec