

**Advanced
Compliance Laboratory**

*6 Randolph Way
Hillsborough, NJ 08844
Tel: (908) 927 9288
Fax: (908) 927 0728*

FCC CFR47 PART 15 SUBPART C CERTIFICATION

TEST REPORT

For

Frequency Hopping Module

Model Number: RTS1

FCC ID: OF7RTS1

Report Number: 0048-051114-01

Prepared for
**The TORO Company
5825 Jasmine Street
Riverside, CA 92504
USA**

Prepared by
**Advanced Compliance Laboratory, Inc.
6 Randolph Way
Hillsborough, NJ 08844
Tel: (908) 927 9288
Fax: (908) 927 0728**

**Revision No: A
Date: 11/18/2005**

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION.....	3
2. EUT DESCRIPTION	4
3. TEST METHODOLOGY.....	5
4. FACILITIES AND ACCREDITATION.....	5
5. CALIBRATION AND UNCERTAINTY.....	6
5.1. MEASURING INSTRUMENT CALIBRATION.....	6
5.2. MEASUREMENT UNCERTAINTY.....	6
5.3. TEST AND MEASUREMENT EQUIPMENT.....	7
6. SETUP OF EQUIPMENT UNDER TEST.....	8
7. APPLICABLE LIMITS AND TEST RESULTS.....	9
7.1. 20 dB BANDWIDTH.....	9
7.2. HOPPING FREQUENCY SEPARATION	13
7.3. NUMBER OF HOPPING CHANNELS.....	15
7.4. AVERAGE TIME OF OCCUPANCY.....	17
7.5. PEAK OUTPUT POWER.....	20
7.6. MAXIMUM PERMISSIBLE EXPOSURE.....	24
7.7. AVERAGE POWER.....	27
7.8. PEAK POWER SPECTRAL DENSITY.....	28
7.9. CONDUCTED SPURIOUS EMISSIONS	32
7.10. RADIATED EMISSIONS.....	46
7.10.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS.....	46
7.10.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ	49
7.10.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz.....	59
7.10.4. WORST-CASE RADIATED EMISSIONS FOR HOSTED MODULE.....	60
8. SETUP PHOTOS.....	61
9. APENDEX	68

1. TEST RESULT CERTIFICATION

COMPANY NAME: THE TORO COMPANY
5825 Jasmine Street
Riverside, CA 92504 U.S.A.

EUT DESCRIPTION: FREQUENCY HOPPING MODULE

MODEL: RTS1

DATE TESTED: November 14, 2005 to November 18, 2005

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Advanced Compliance Laboratory, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Advanced Compliance Laboratory, Inc. (ACL) and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by ACL, Advanced Compliance Laboratory, Inc. will constitute fraud and shall nullify the document.

Approved & Released For ACL By:

Tested By:



Wei Li
Manager
Advanced Compliance Laboratory, Inc.



Edward Lee
EMC Engineer

2. EUT DESCRIPTION

The EUT is a Frequency Hopping Module operating in the 902-928 MHz band.

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
902 - 928	9.55	9

The radio utilizes an Integral antenna with a maximum gain of 0 dBi.

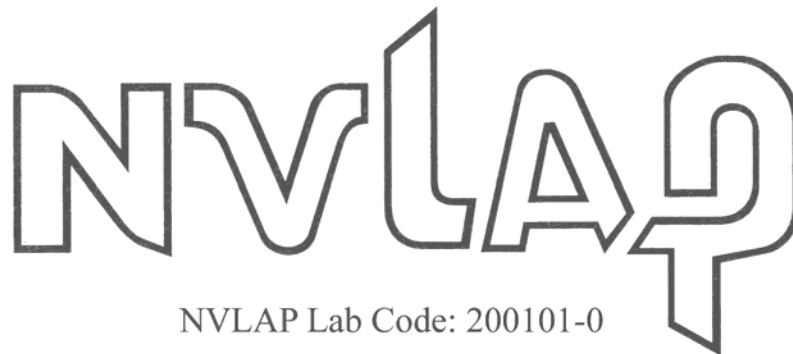
3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at Somerset, New Jersey, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

ACL is accredited by NVLAP, Laboratory Code 200101-0. The full accreditation can be viewed at <http://www.ac-lab.com>



No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. MEASUREMENT UNCERTAINTY

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	± 2.36	± 2.99	± 1.83

5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Manufacture	Model	Serial No.	Description	Last Cal dd/mm/yy	Cal Due dd/mm/yy
Hewlett-Packard	HP8546A	3448A00290	EMI Receiver	12/01/05	12/01/06
Agilent	E4440A	US40420700	PSA Spectrum Analyzer	11/07/05	11/07/06
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	12/02/05	12/02/06
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	09/02/05	09/02/06
EMCO	6502	2665	10KHz-30MHz Active Loop Antenna	27/02/05	27/02/06
EMCO	3115	4945	Double Ridge Guide Horn Antenna	18/08/05	18/08/06
Fischer Custom	LISN-2	900-4-0008	Line Impedance Stabilization Networks	15/09/05	15/09/06
Fischer Custom	LISN-2	900-4-0009	Line Impedance Stabilization Networks	23/08/05	23/08/06

All Test Equipment Used are Calibrated Traceable to NIST Standards.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

n/a

TEST SETUP

The system was configured for testing in a typical fashion (as a customer would normally use it). And its antenna was permanently attached to the EUT with max length, 3 in.

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 20 dB BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

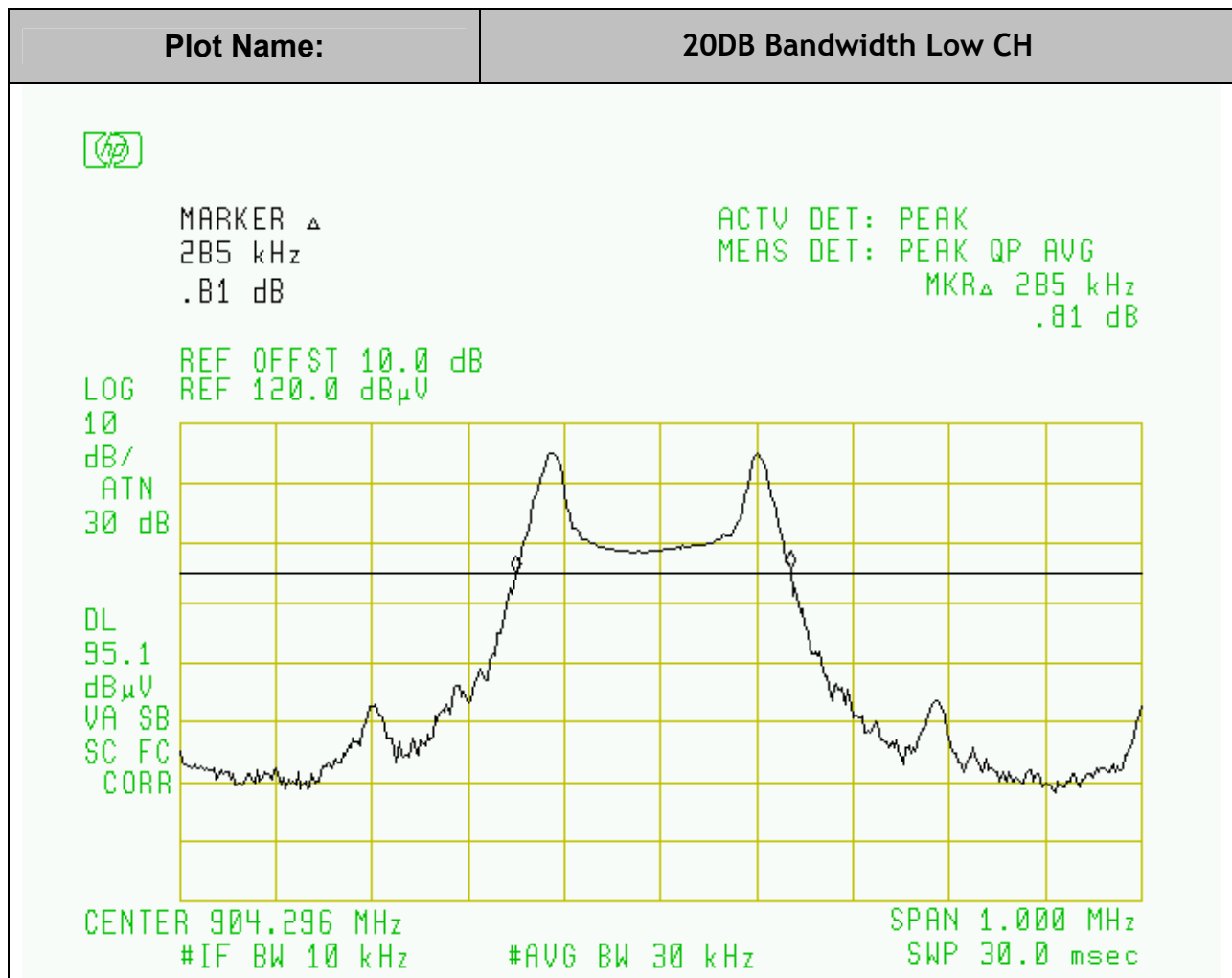
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

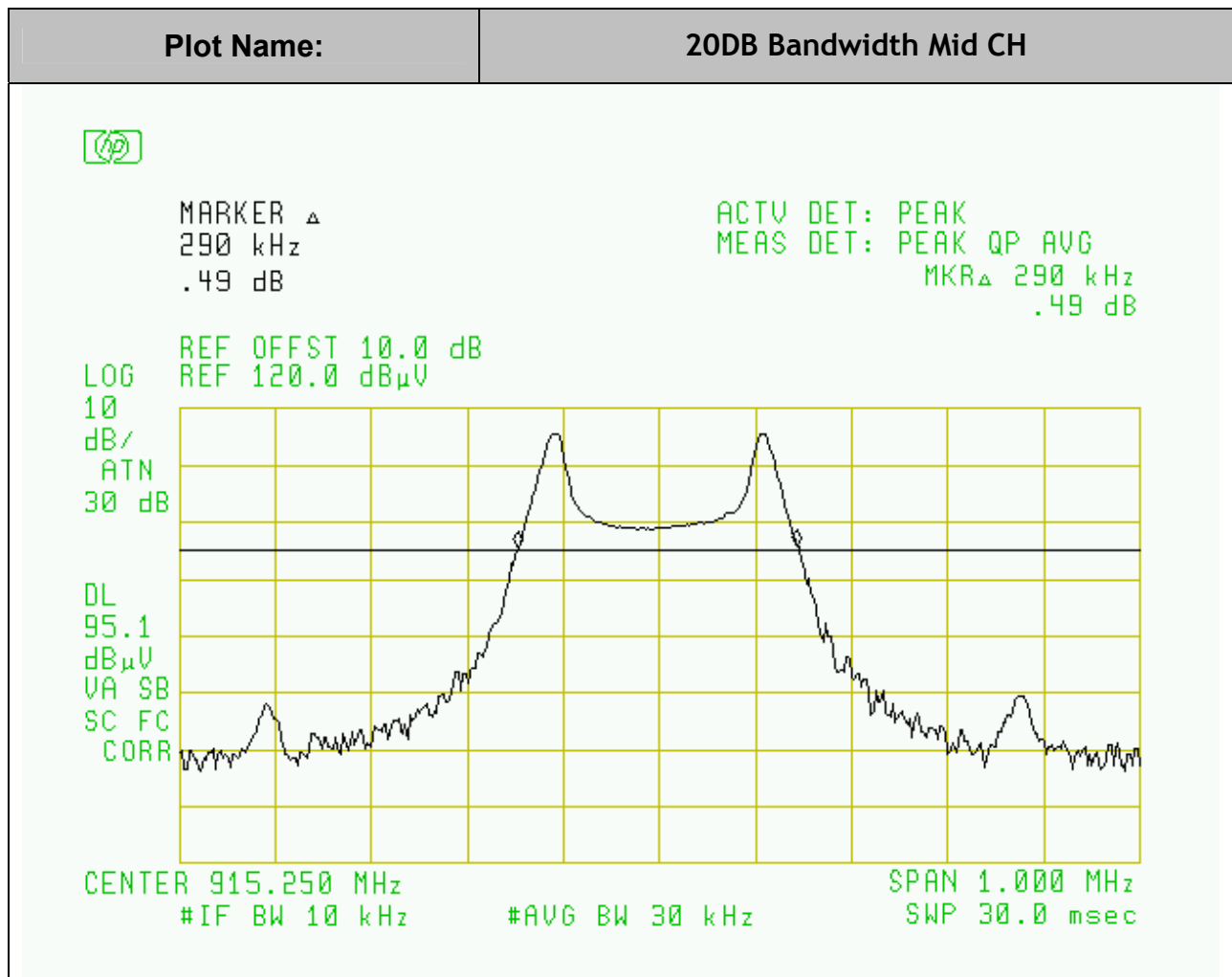
RESULTS

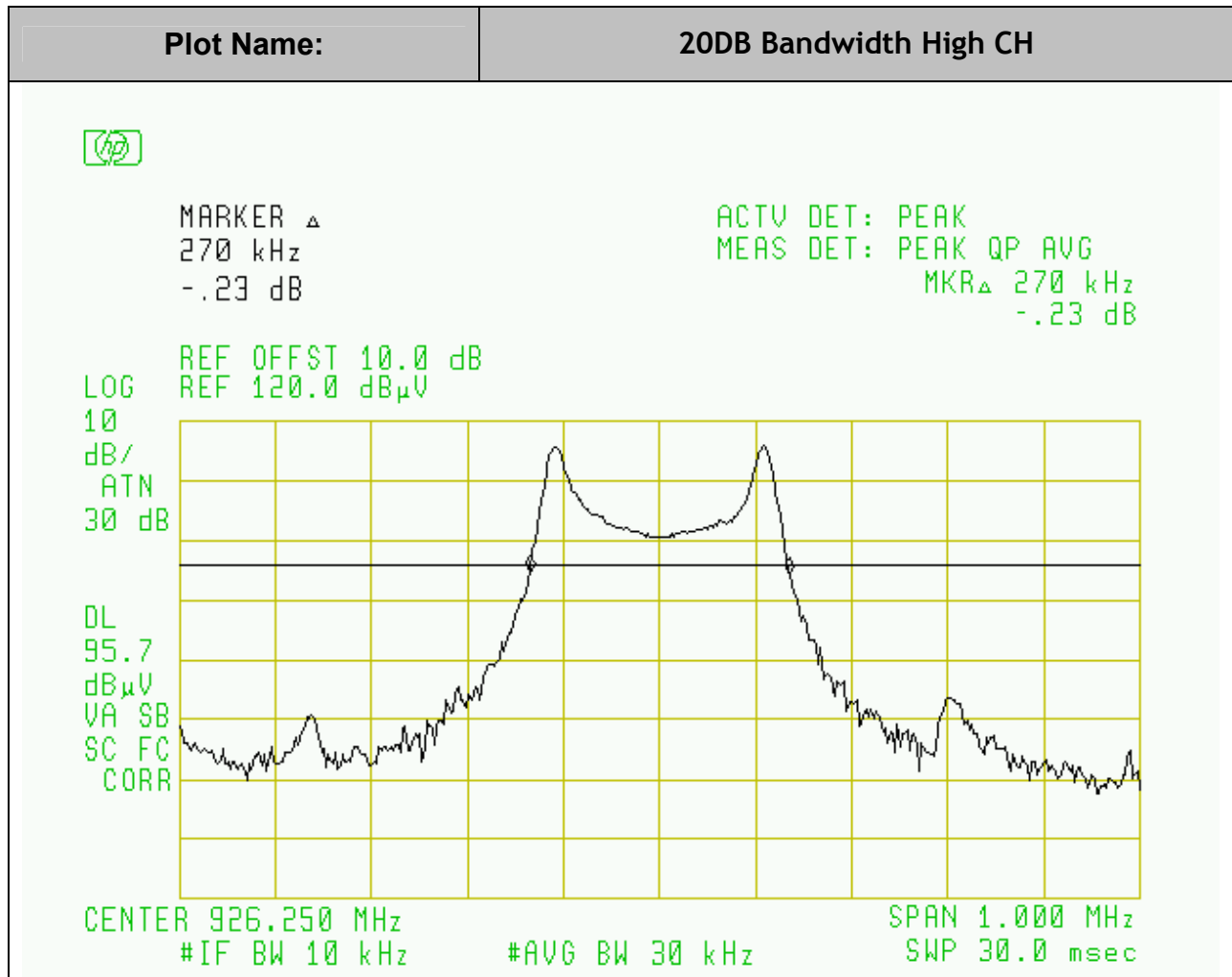
No non-compliance noted:

Channel	Frequency (MHz)	20 dB Bandwidth (KHz)
Low	904.296	285
Middle	915.250	290
High	926.250	270

20 dB BANDWIDTH







7.2. HOPPING FREQUENCY SEPARATION

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

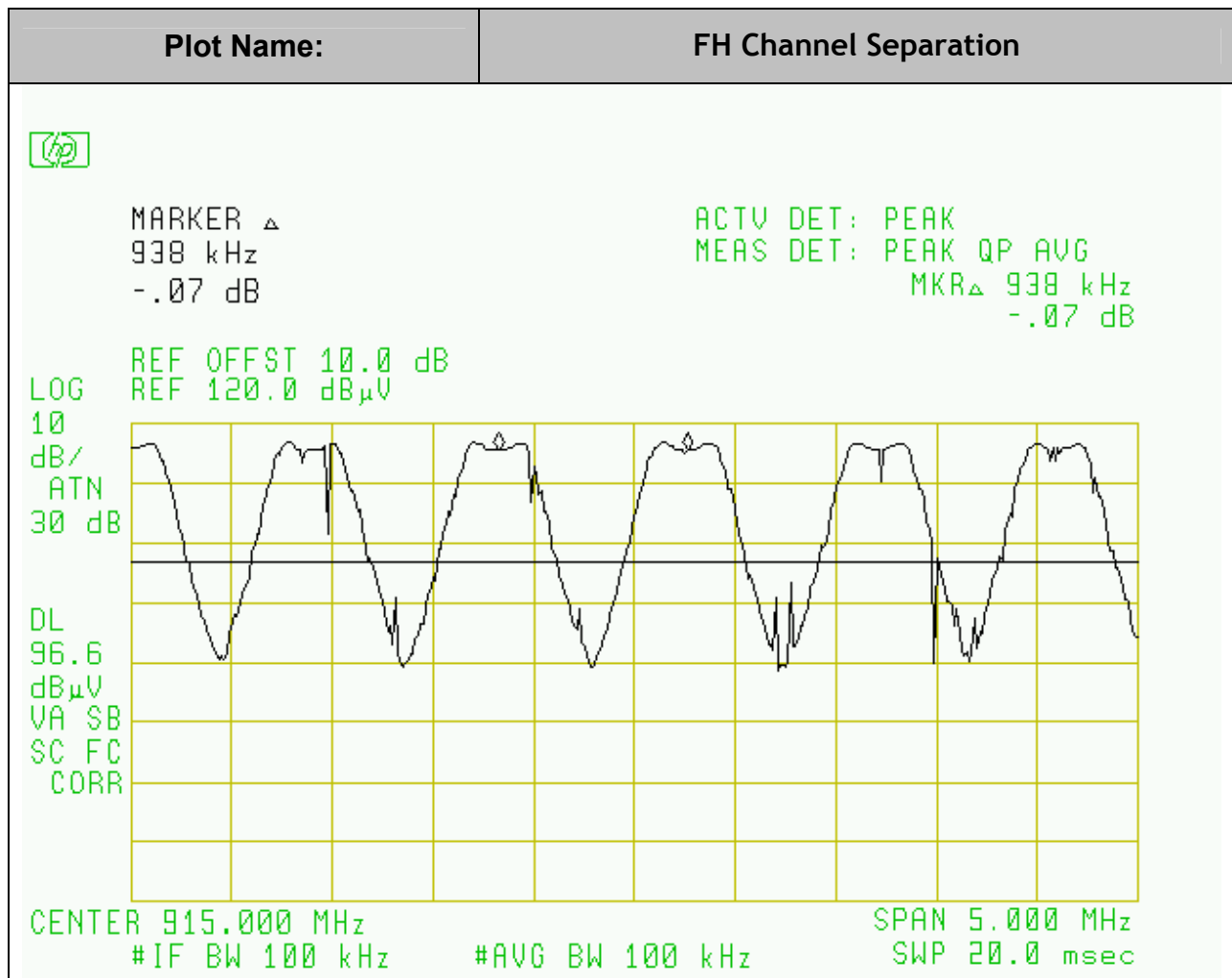
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

No non-compliance noted.

Channel Separation (KHz)	20 dB Bandwidth (KHz)
938	290

HOPPING FREQUENCY SEPARATION



7.3. NUMBER OF HOPPING CHANNELS

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

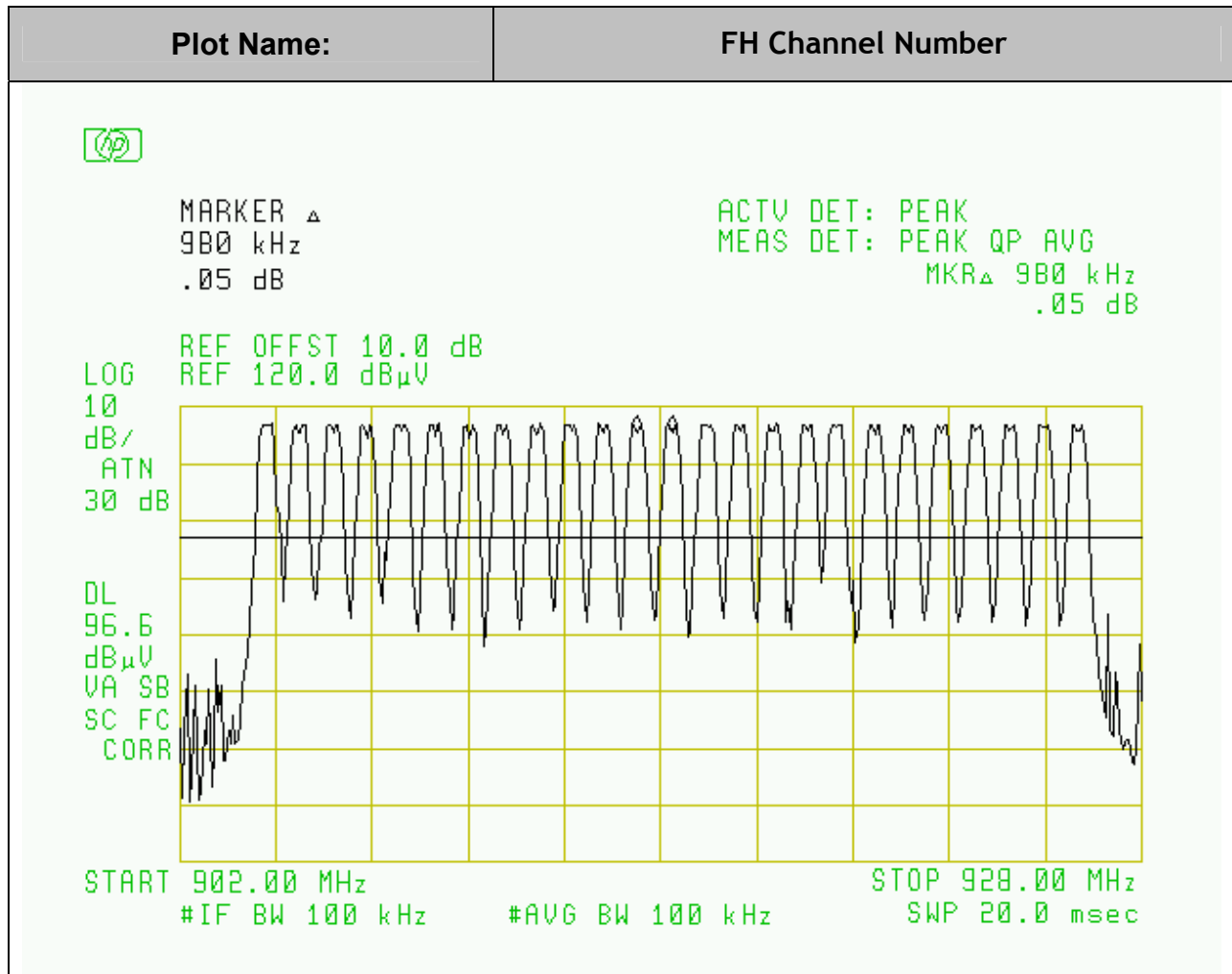
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Channels Observed
25

No non-compliance noted:

NUMBER OF HOPPING CHANNELS



7.4. TIME OF OCCUPANCY

LIMIT

§15.247 (a) (1) (i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

§15.247 (f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. In this case, we selected the mid channel. RBW(IF)=1MHz, VBW=1MHz. The width of a single pulse was measured and the number of the pulses was measured in the period of 10 seconds.

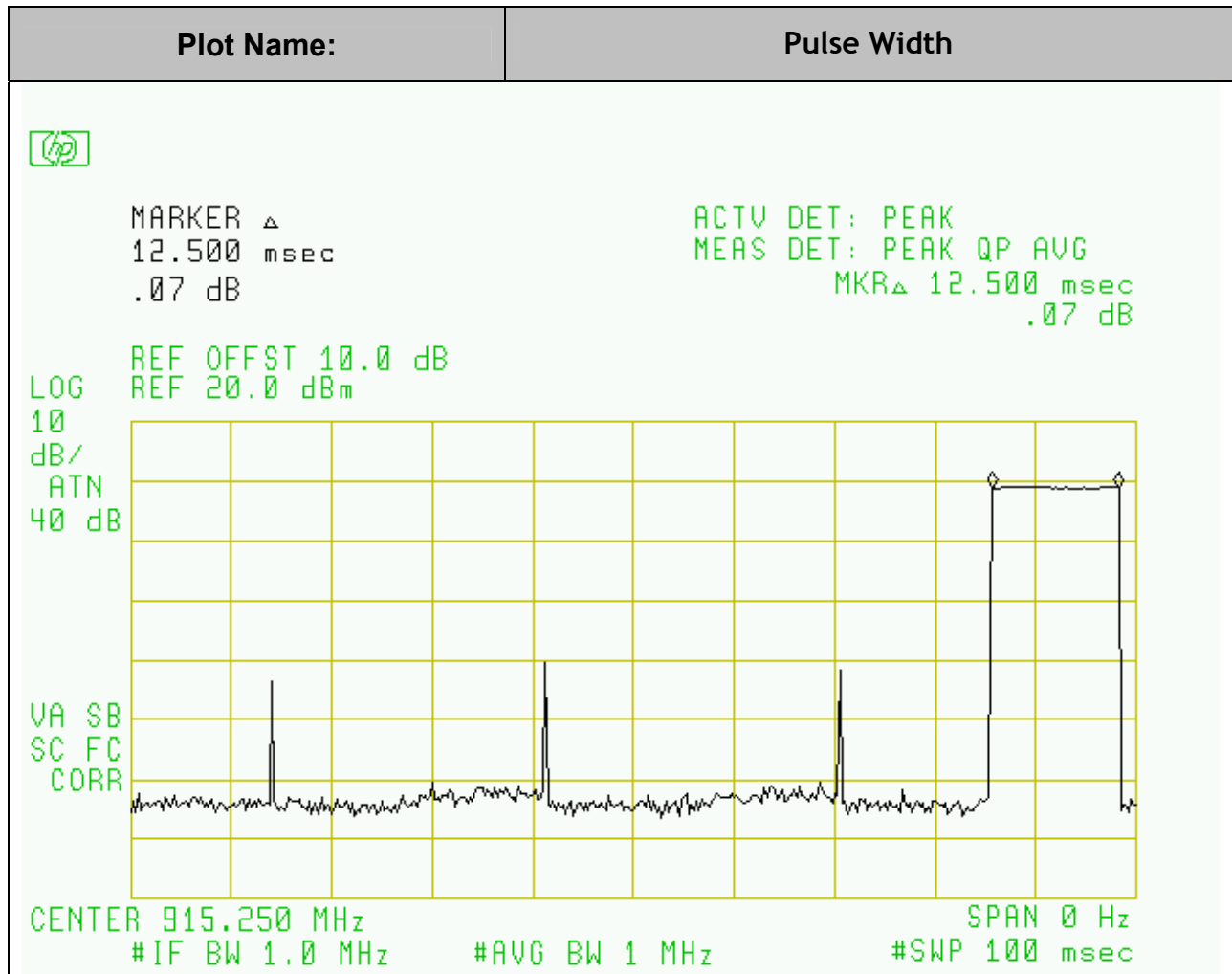
RESULTS

No non-compliance noted:

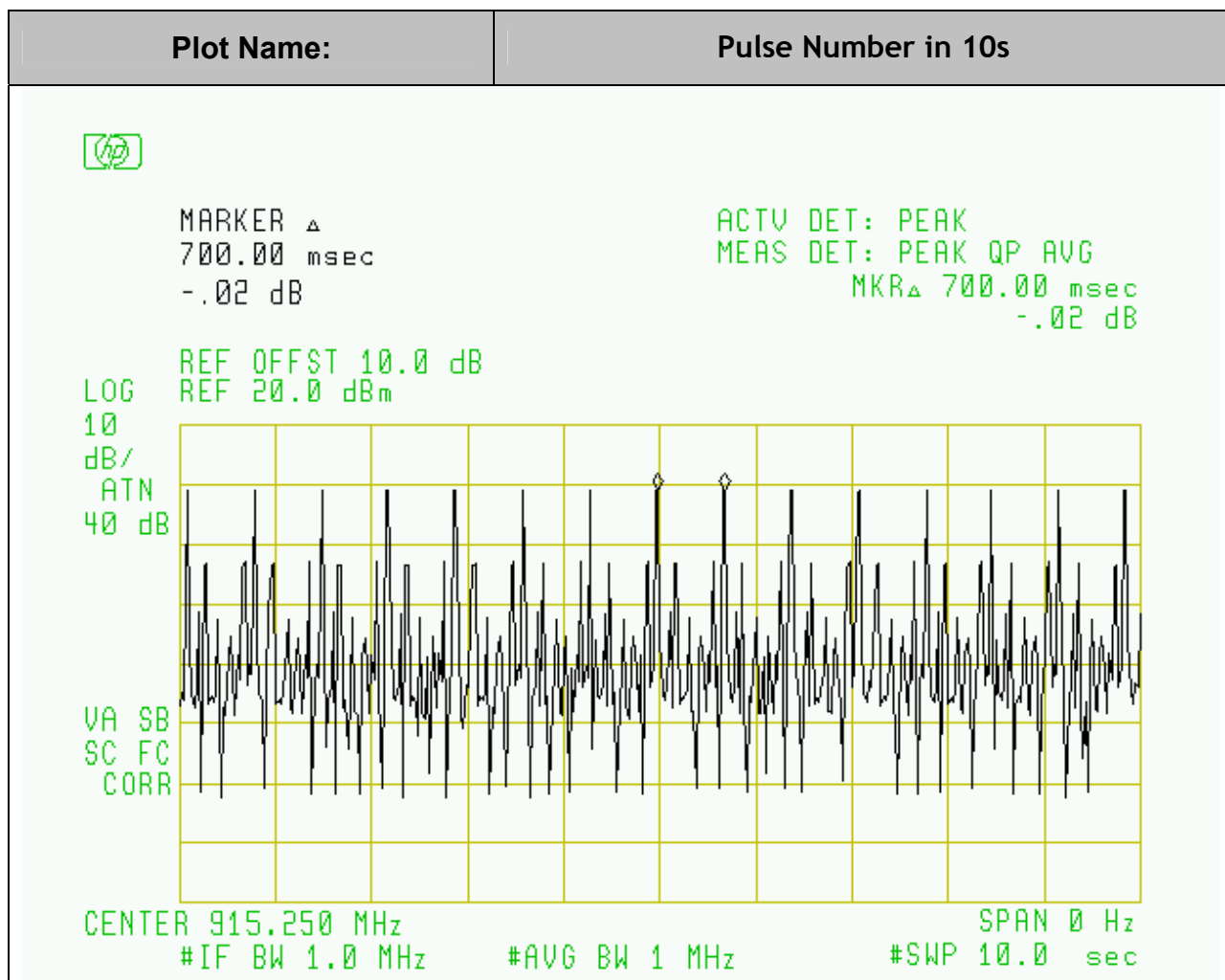
of Occurrence/Pulses in 10 sec
15

Pulse Width (ms)	# of Occurrence/Pulses in 10 sec	Time of Occupancy (sec)	Limit (sec)	Margin (sec)
12.5	15	0.188	0.400	0.212

PULSE WIDTH



NUMBER OF PULSES IN 10 SECOND OBSERVATION PERIOD



7.5. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(4) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 0dBi, which is lower than 6dBi. Therefore, the min. limit in (b)(2) is 0.25Watt, which is 250mW, 24dBm.

TEST PROCEDURE

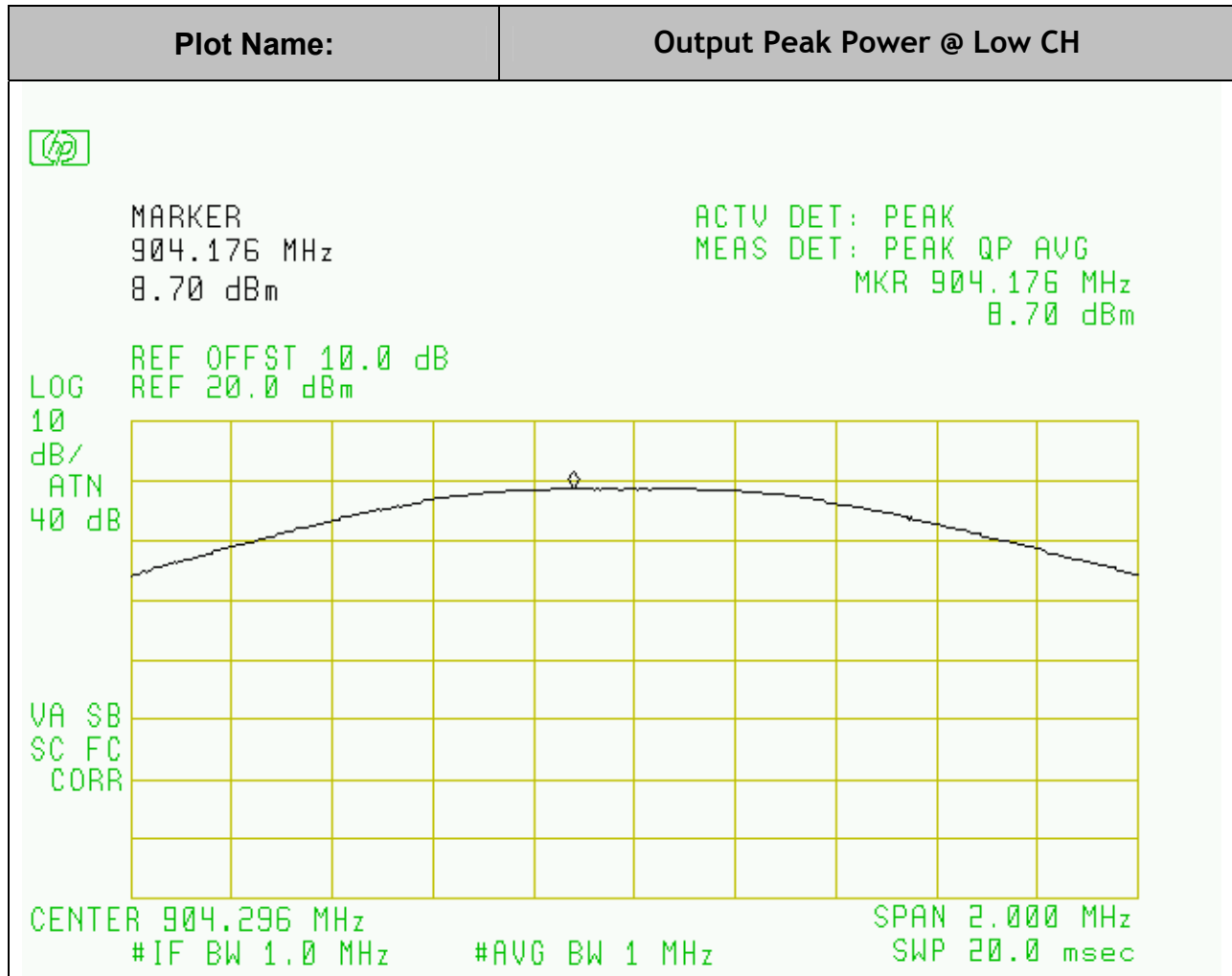
The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

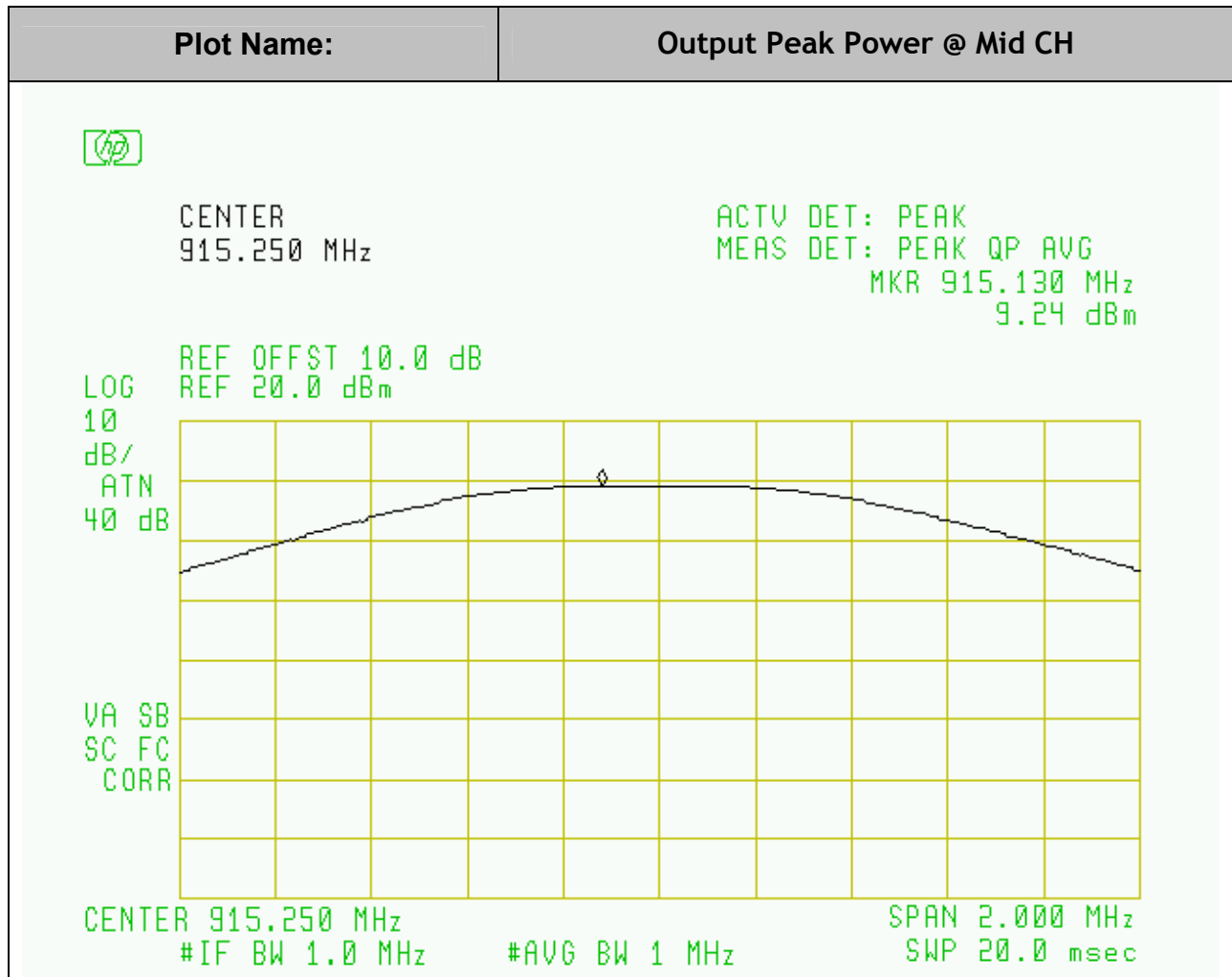
RESULTS

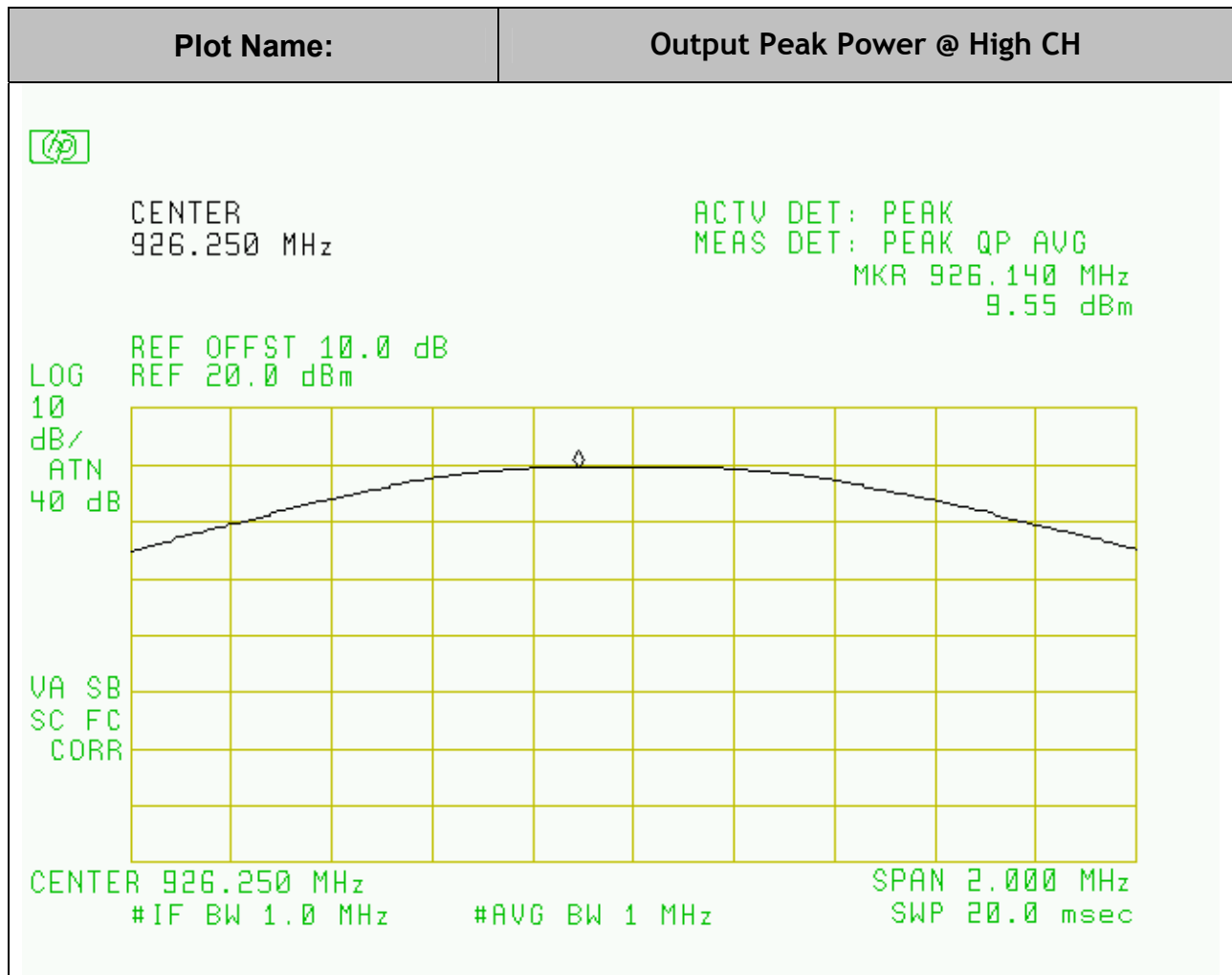
No non-compliance noted:

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dBm)
Low	904.296	8.70	24	-15.3
Middle	915.250	9.24	24	-14.76
High	926.250	9.55	24	-14.45

OUTPUT PEAK POWER







7.6. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

Equation (1)

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

Equation (1) and the measured peak power is used to calculate the MPE distance.

LIMITS

From §1.1310 Table 1 (B), $S = 0.6 \text{ mW/cm}^2$

RESULTS

No non-compliance noted:

From equation (1)

$$d = 0.282 \times \frac{10^{\frac{P+G}{20}}}{\sqrt{S}}$$

Where, $P=9.55 \text{ dBm}$, $G=0 \text{ dBi}$, and $S=0.6 \text{ mW/cm}^2$

Plug all three items into equation 1, and yields,

Power Density Limit (mW/cm²)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
0.6	9.55	0	1.02

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

7.7. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	Average Power (dBm/mW)
Low	904.296	8.38/6.88
Middle	915.250	8.93/7.80
High	926.250	9.21/8.32

7.8. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

§15.247 (f) The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

TEST PROCEDURE

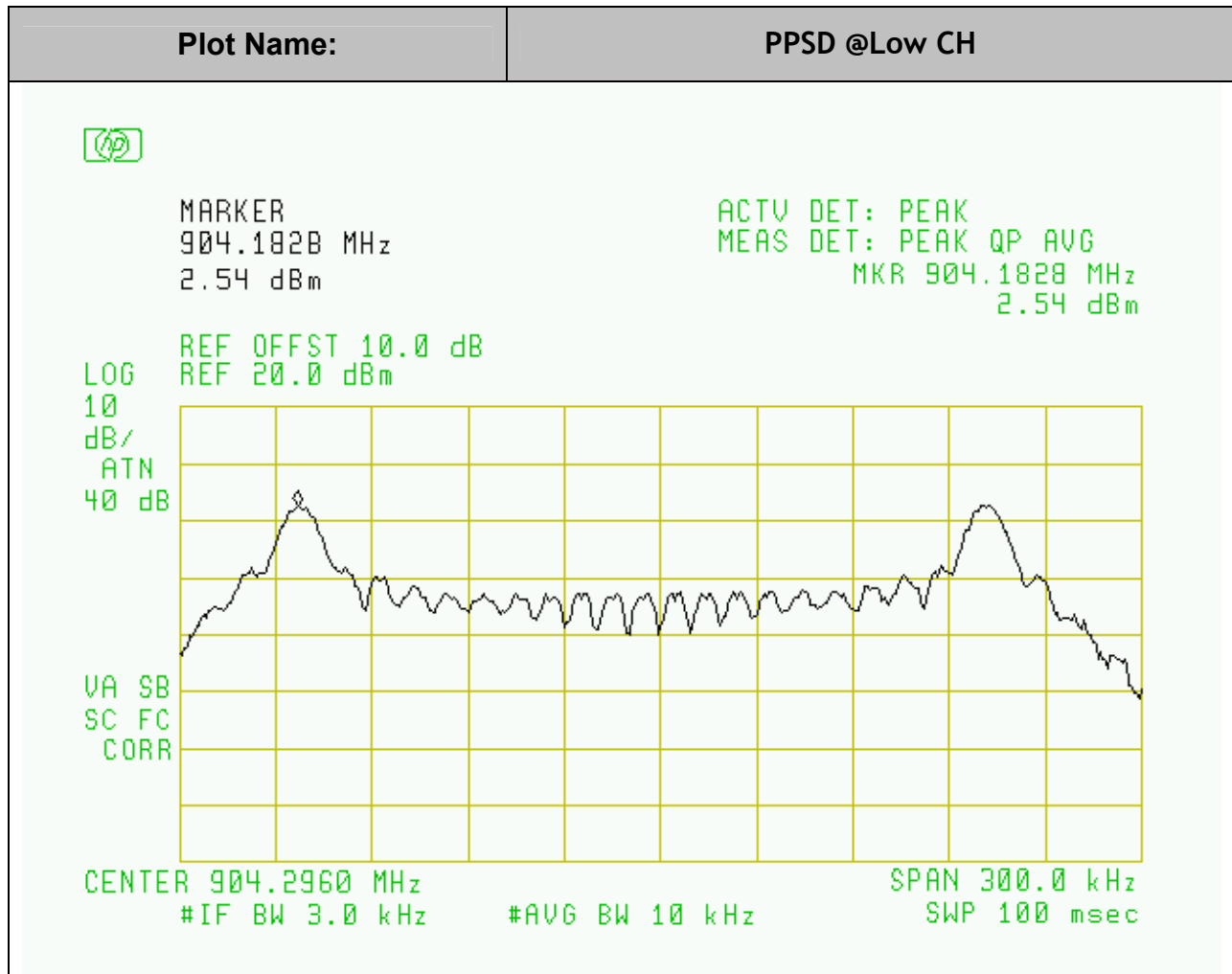
The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

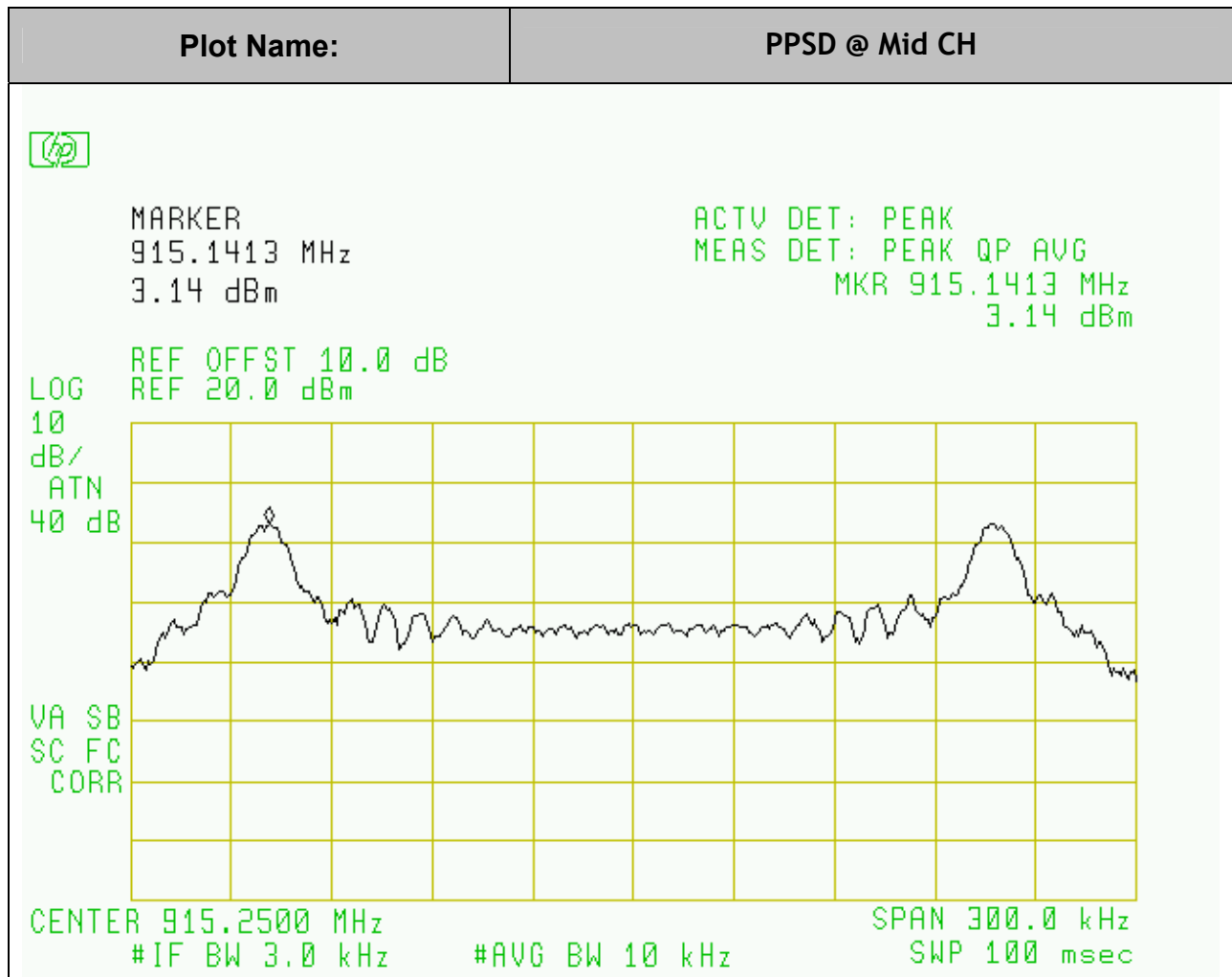
RESULTS

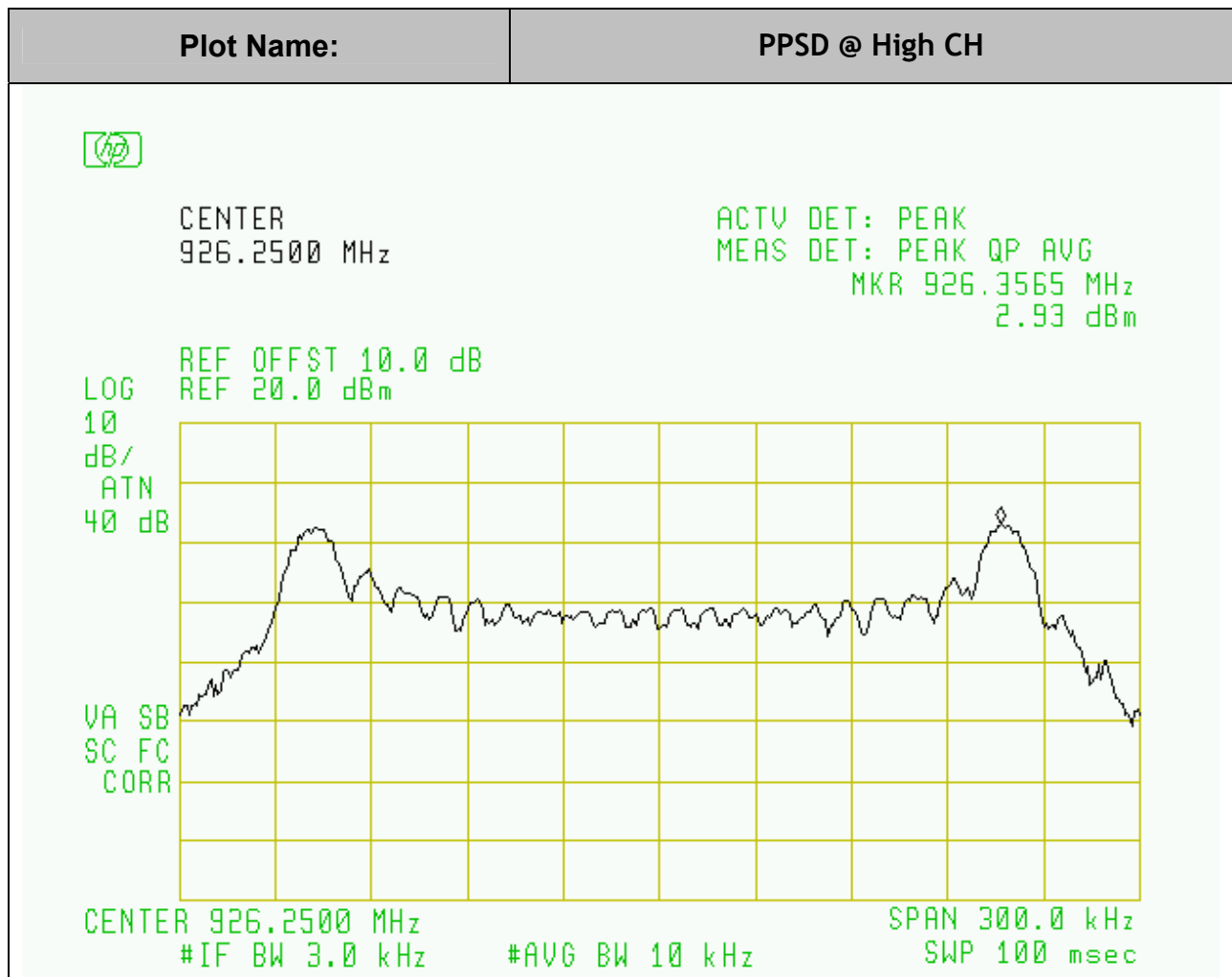
No non-compliance noted:

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	904.296	2.54	8	-5.46
Middle	915.250	3.14	8	-4.86
High	926.250	2.93	8	-5.07

PEAK POWER SPECTRAL DENSITY







7.9. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see) §15.205(c)).

TEST PROCEDURE

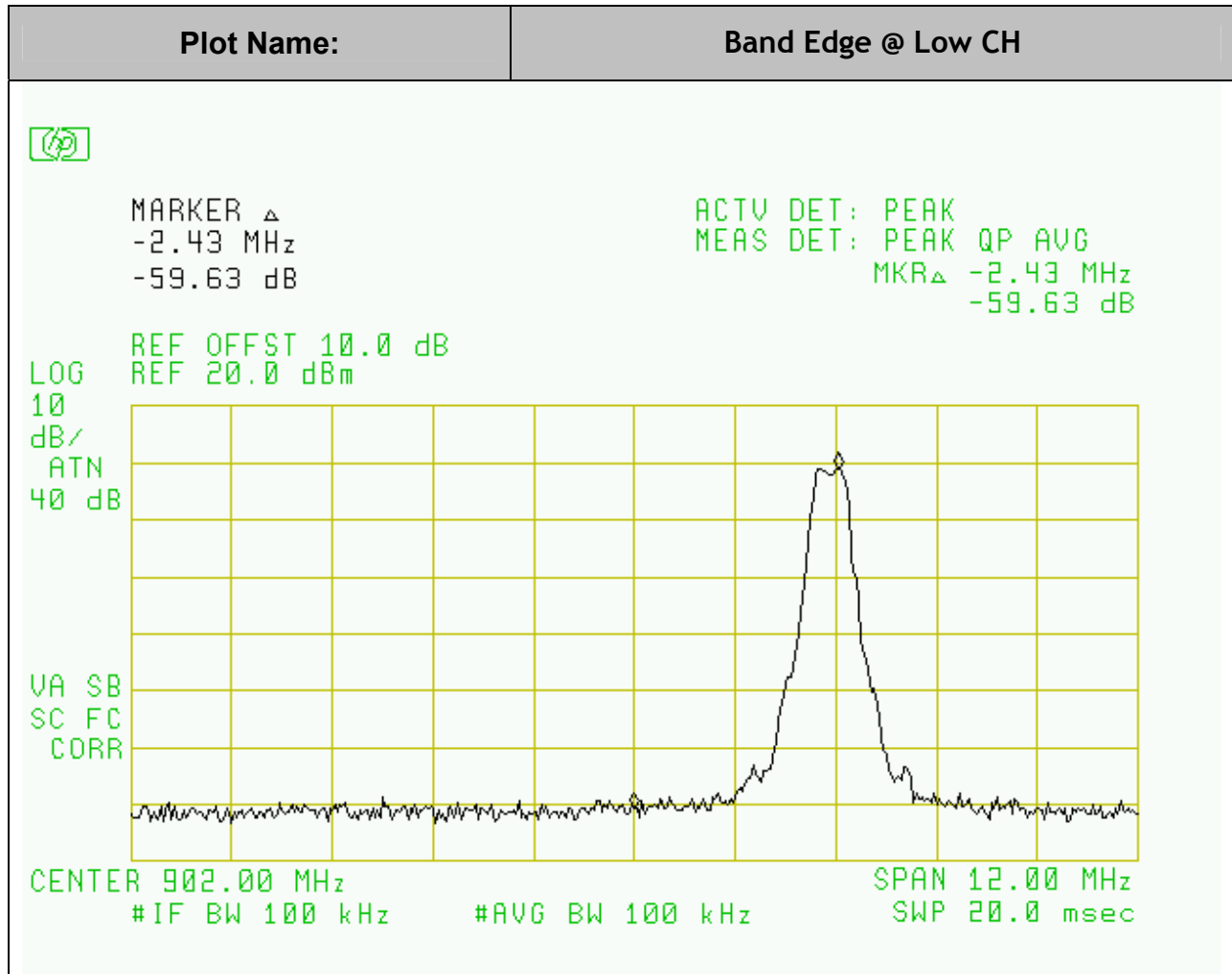
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

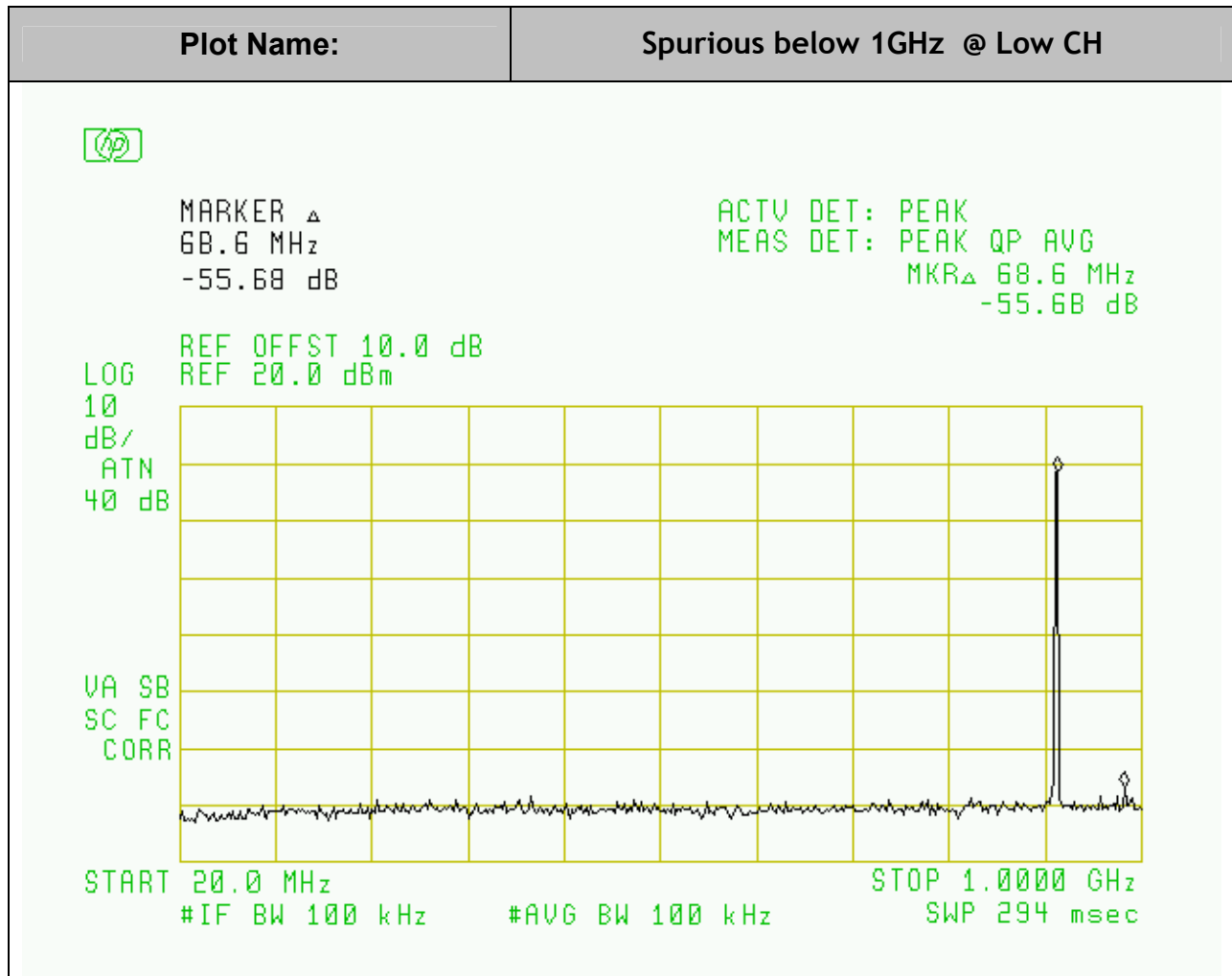
The spectrum from 30 MHz to 6.5 GHz and 6.5GHz-10GHz are investigated with the transmitter set to the lowest, middle, and highest channels.

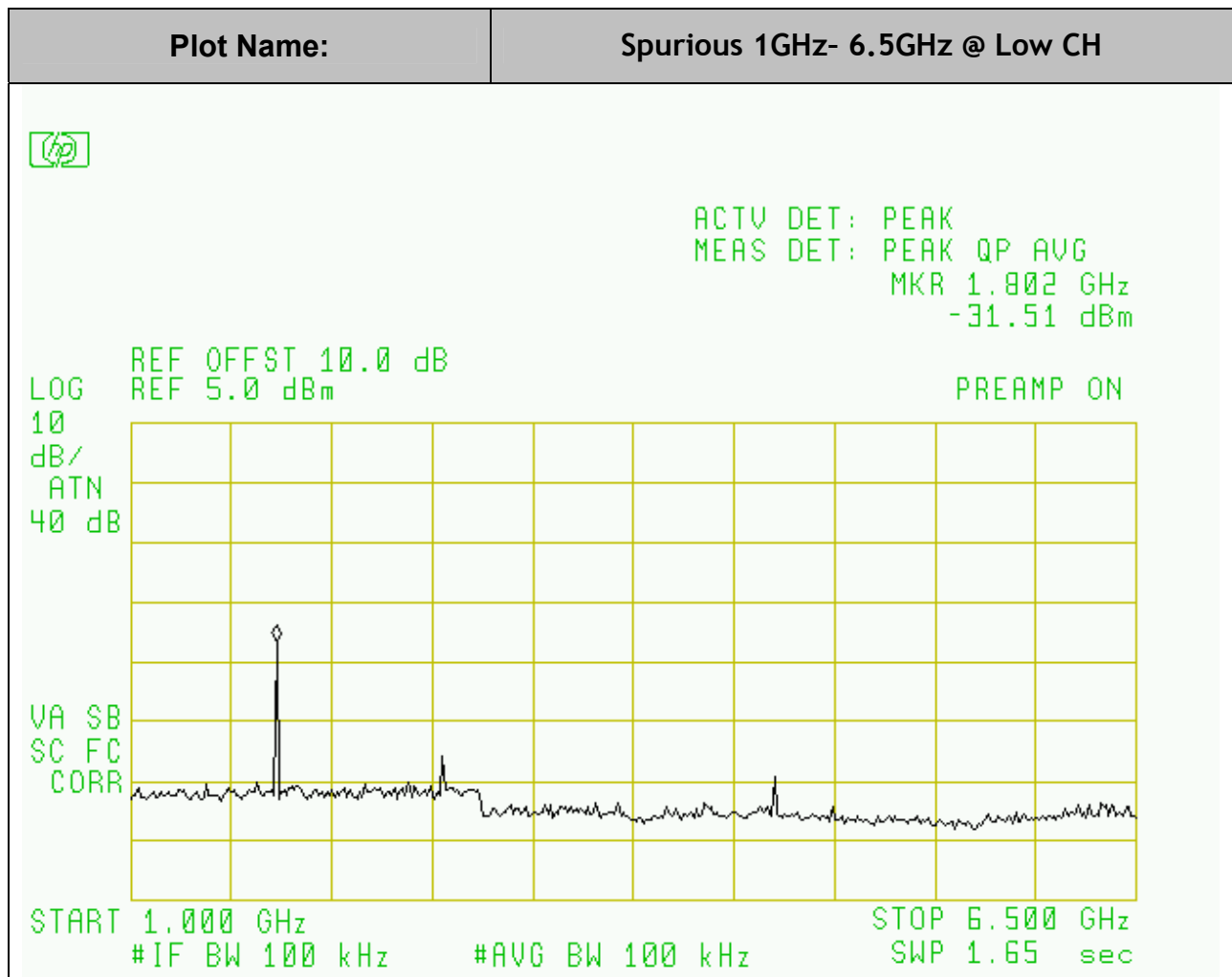
RESULTS

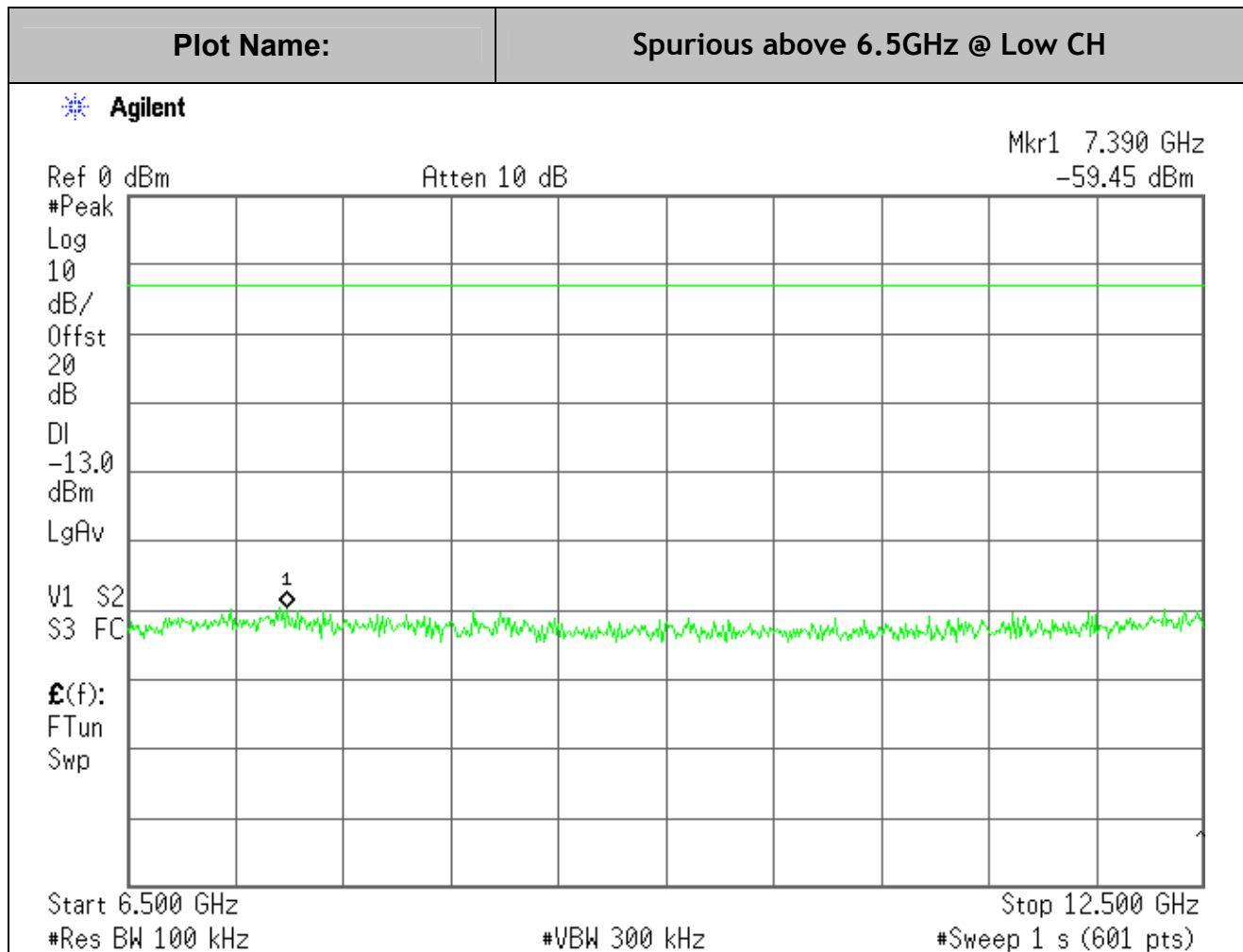
No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL

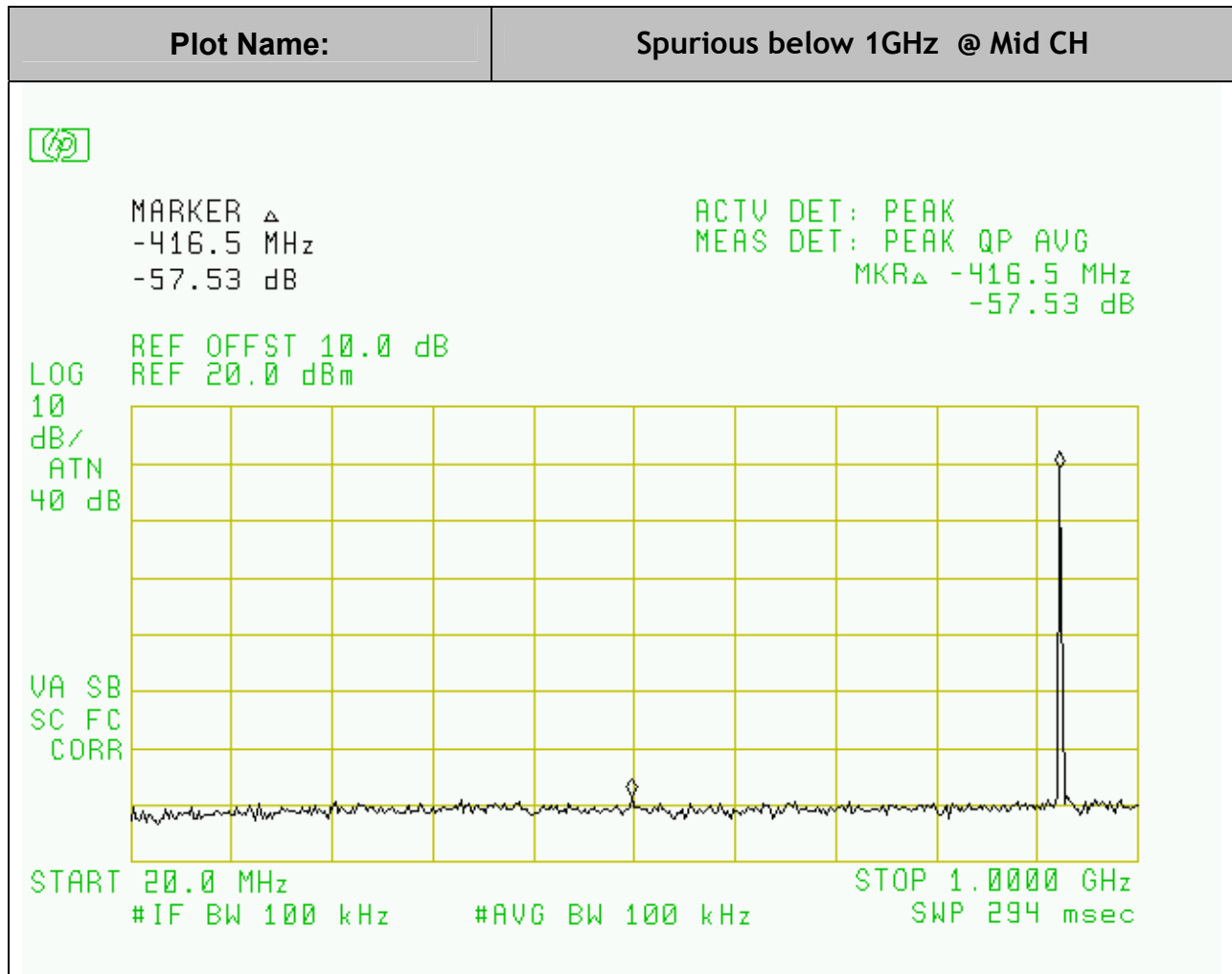


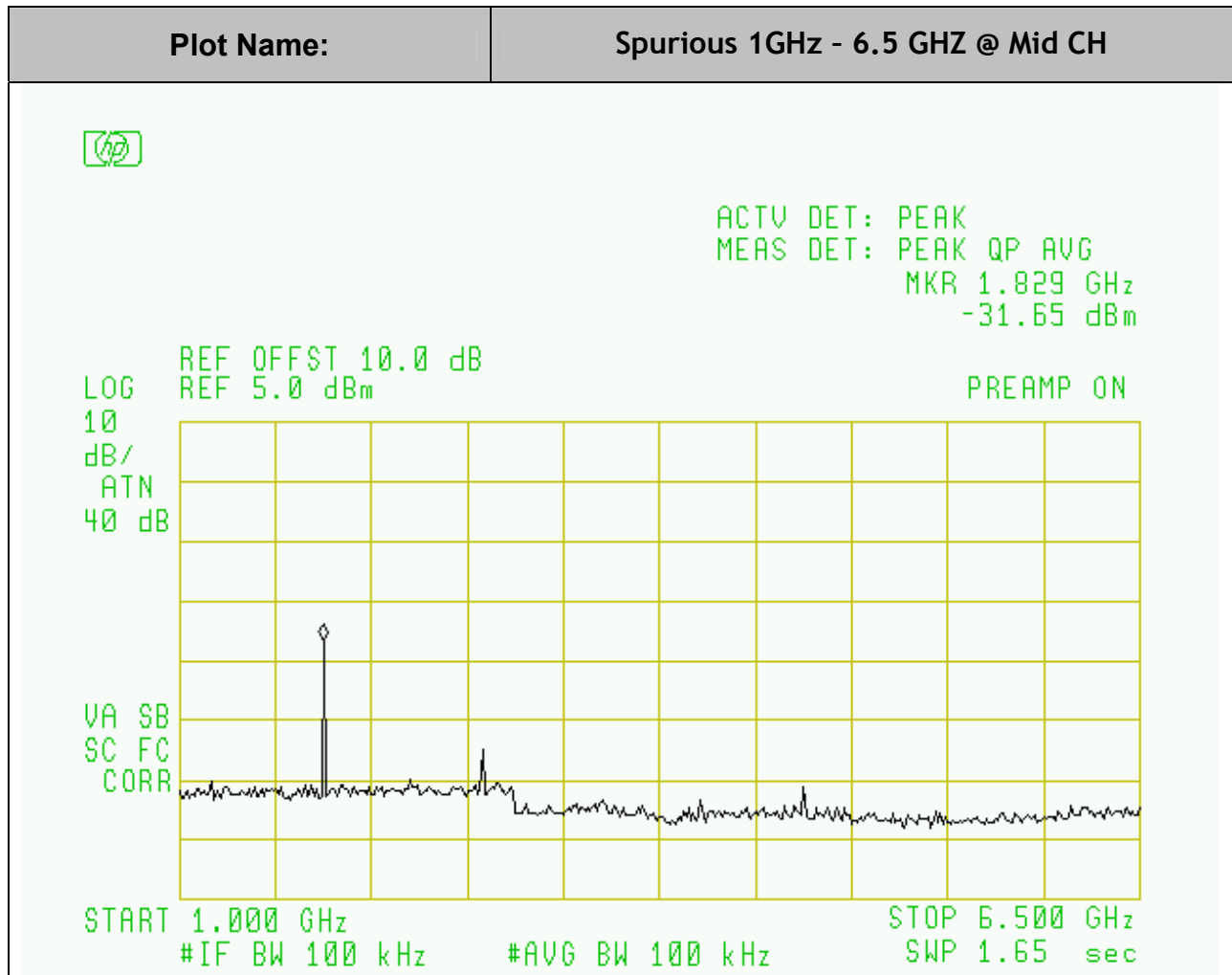


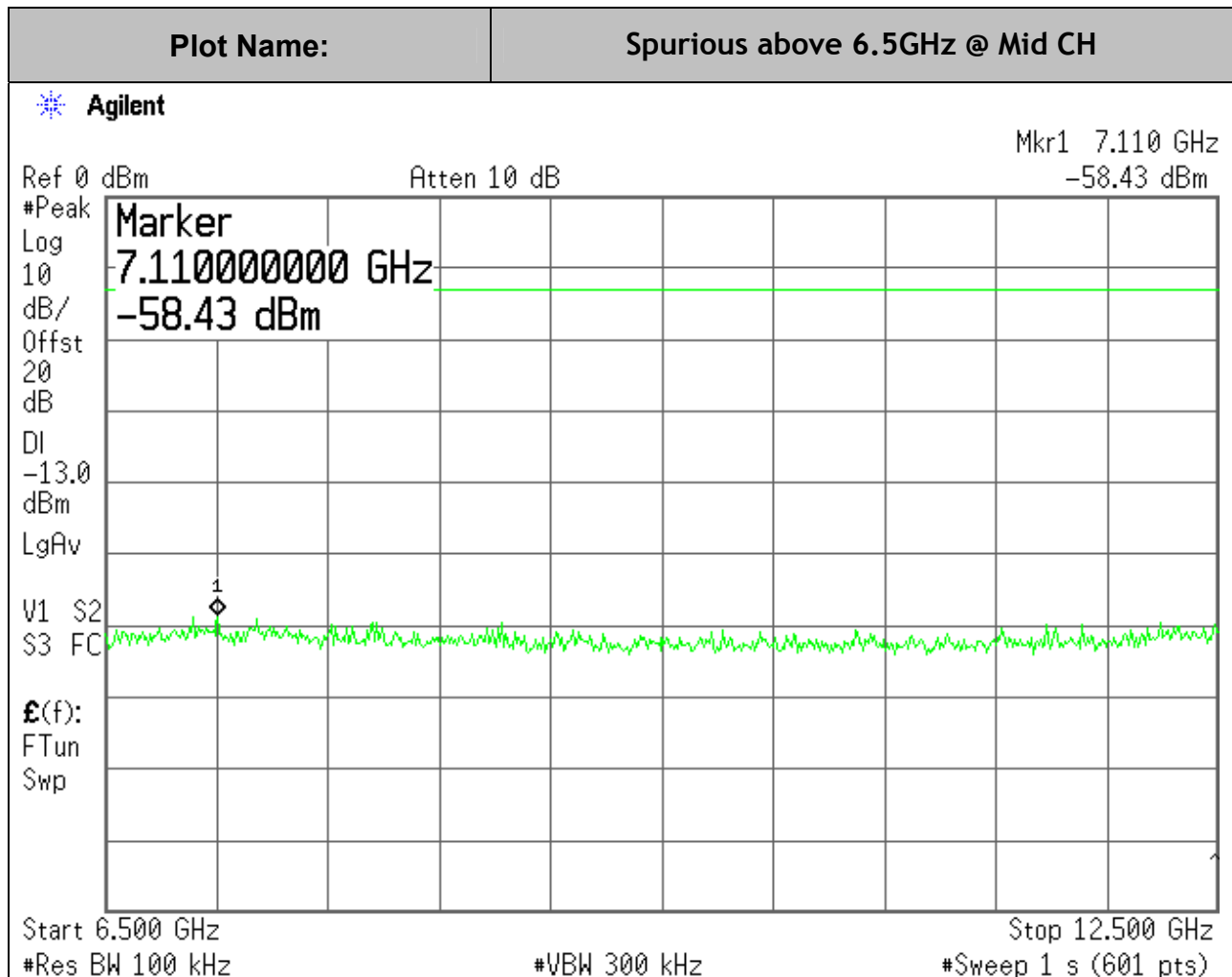




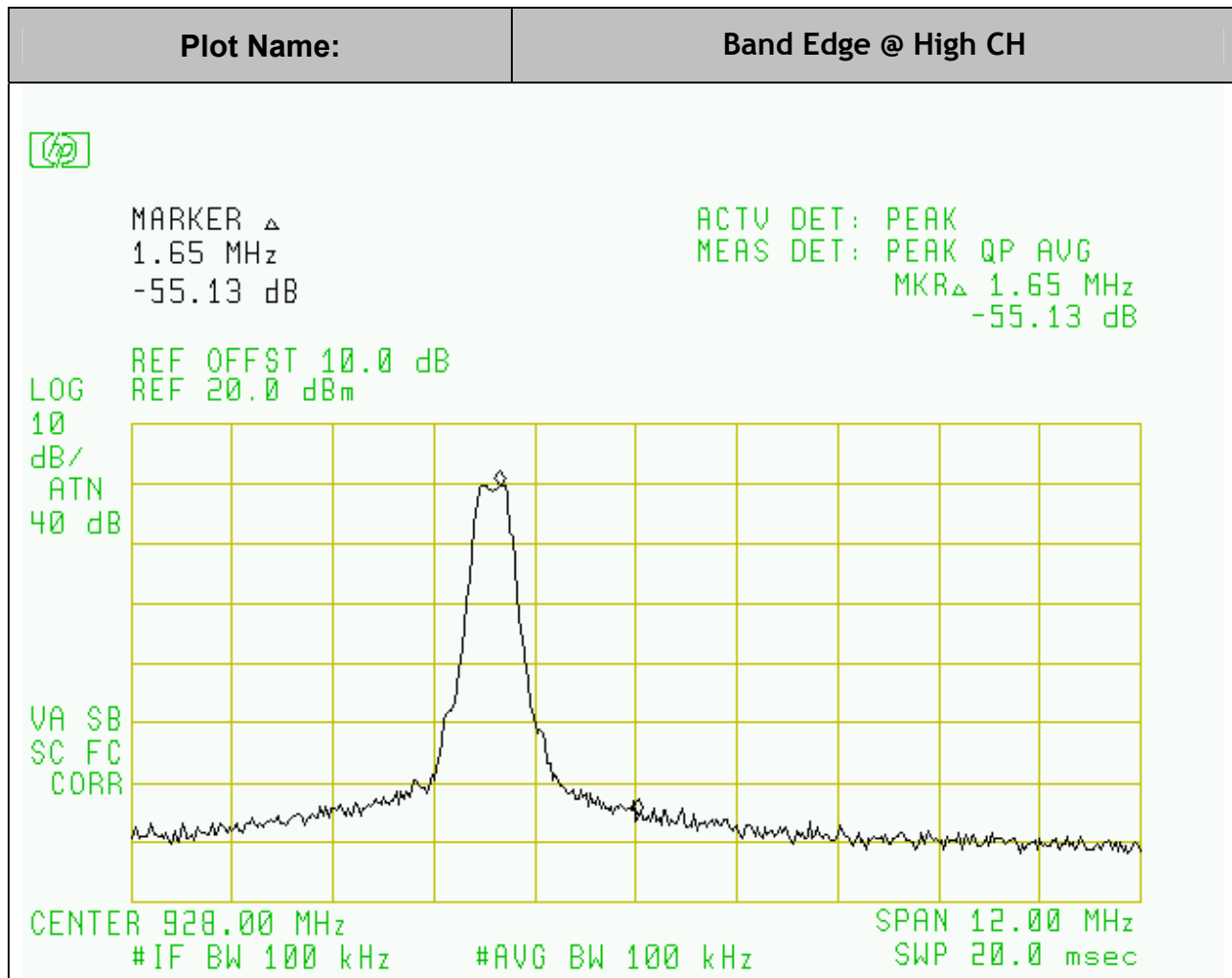
SPURIOUS EMISSIONS, MID CHANNEL

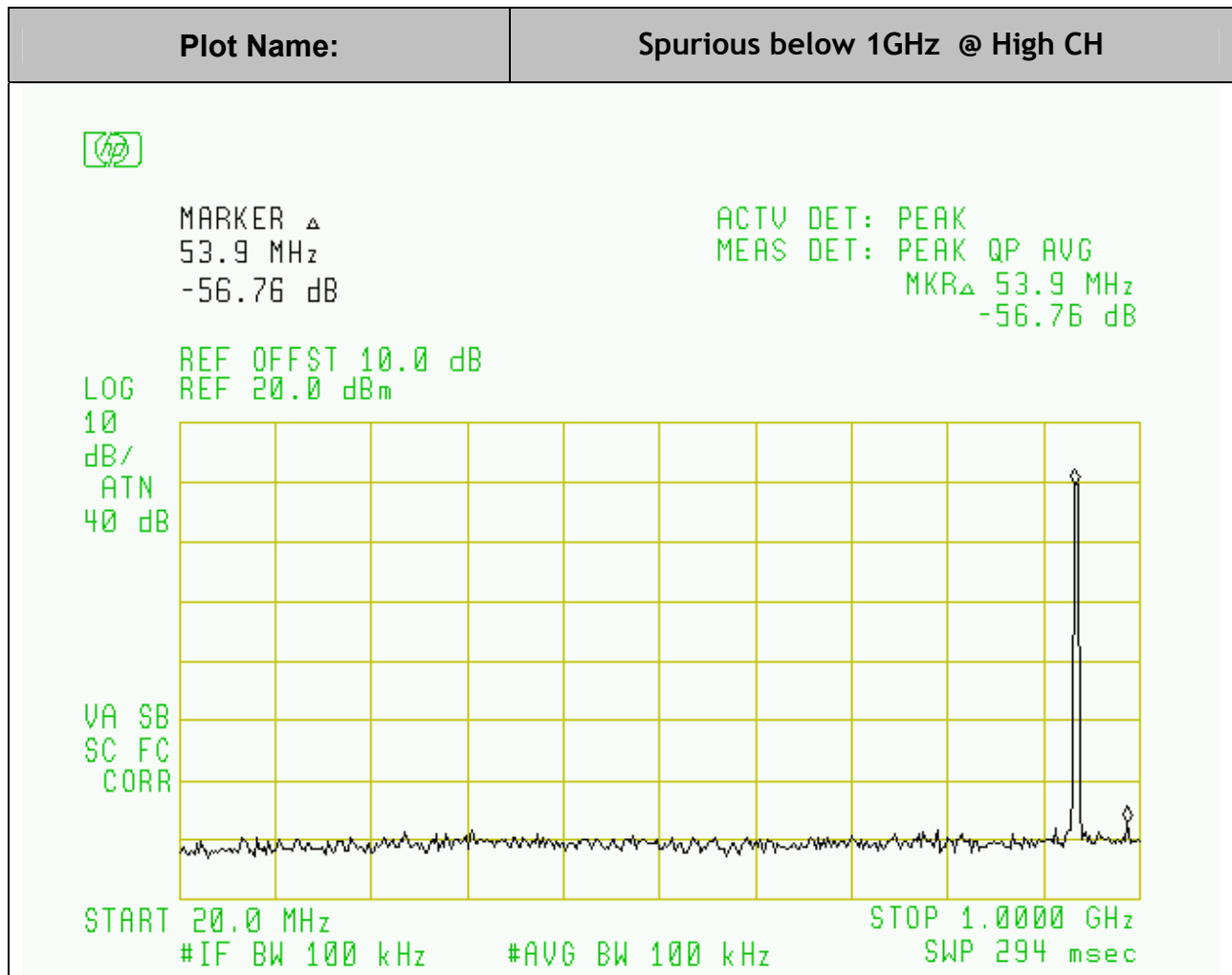


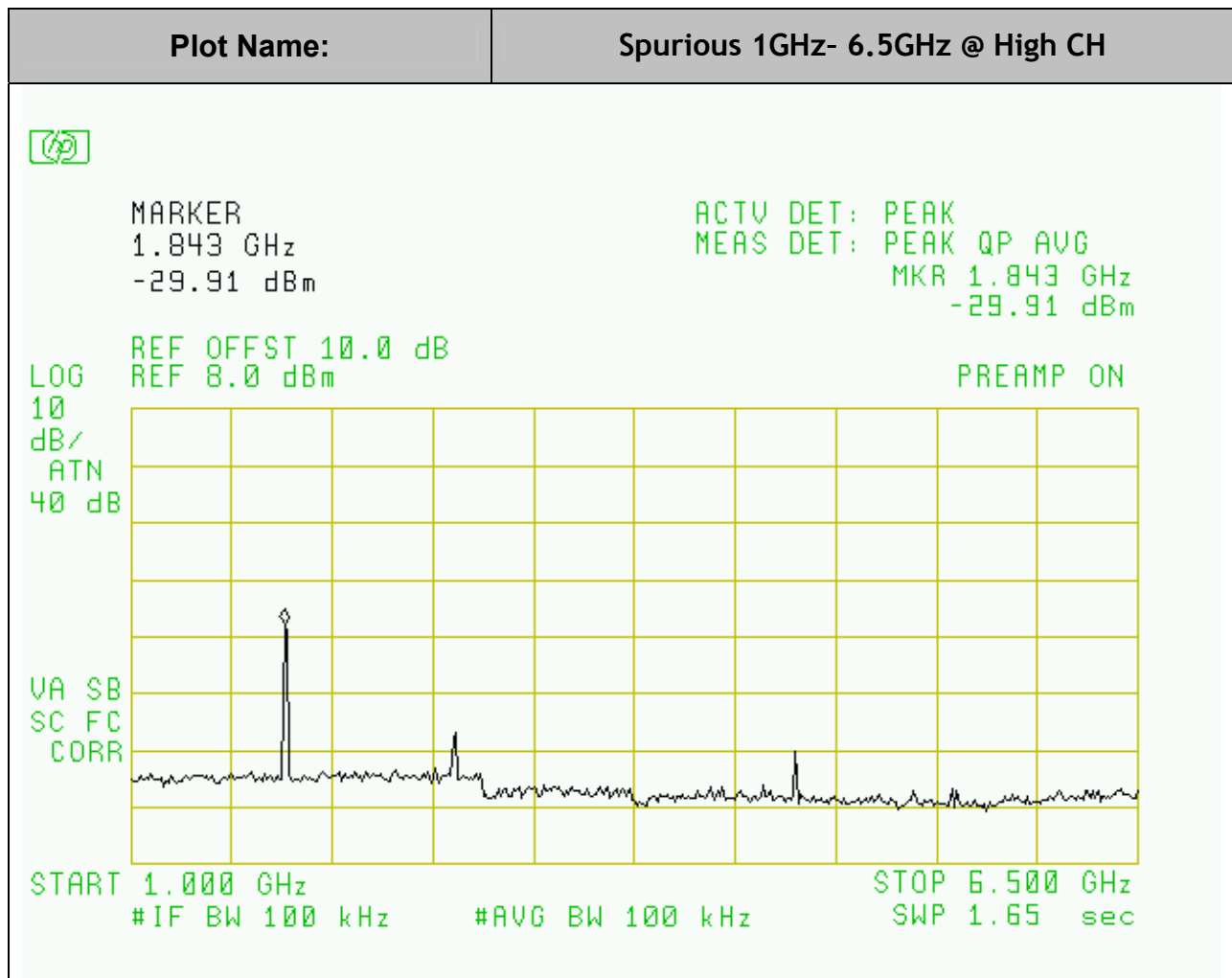


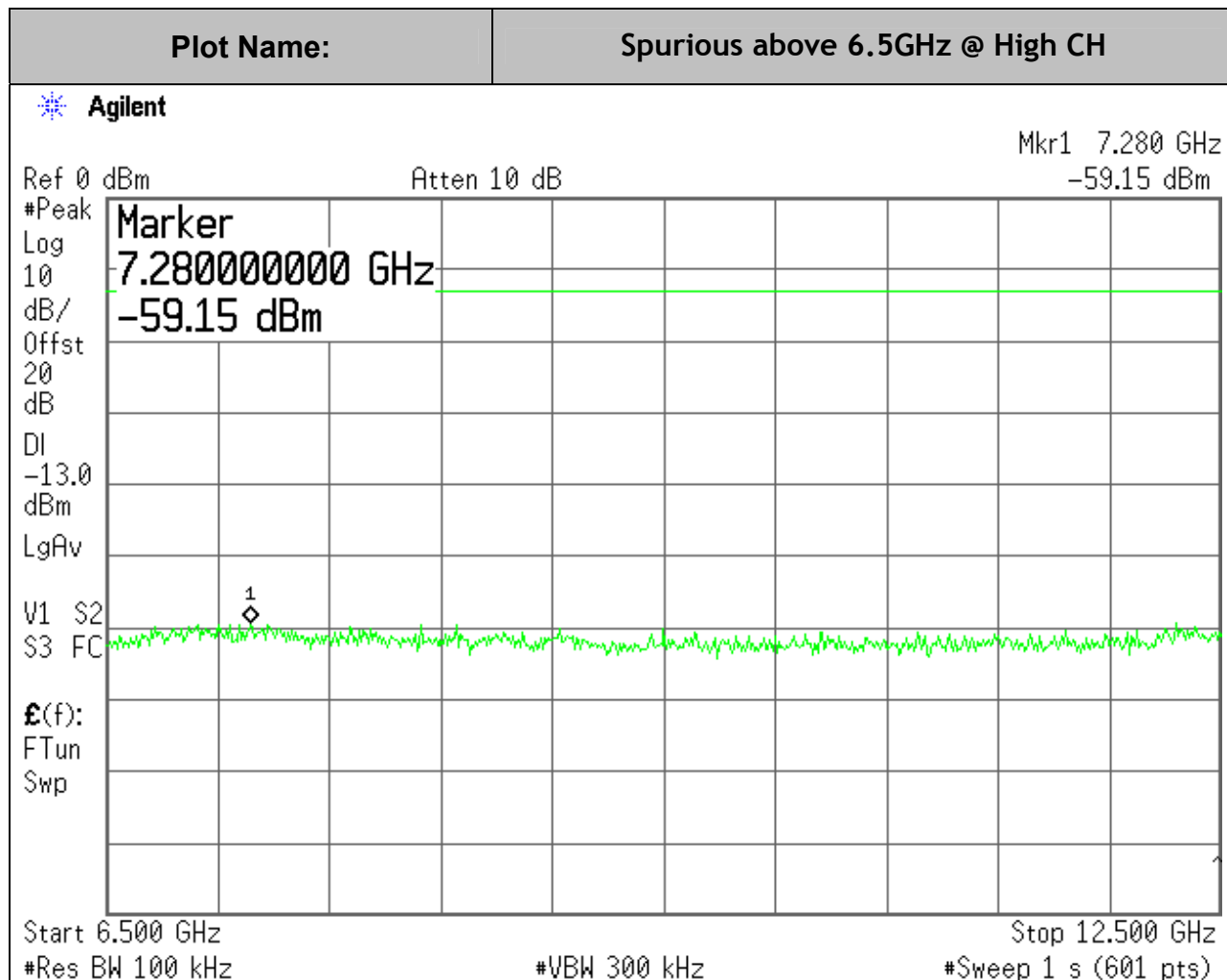


SPURIOUS EMISSIONS, HIGH CHANNEL

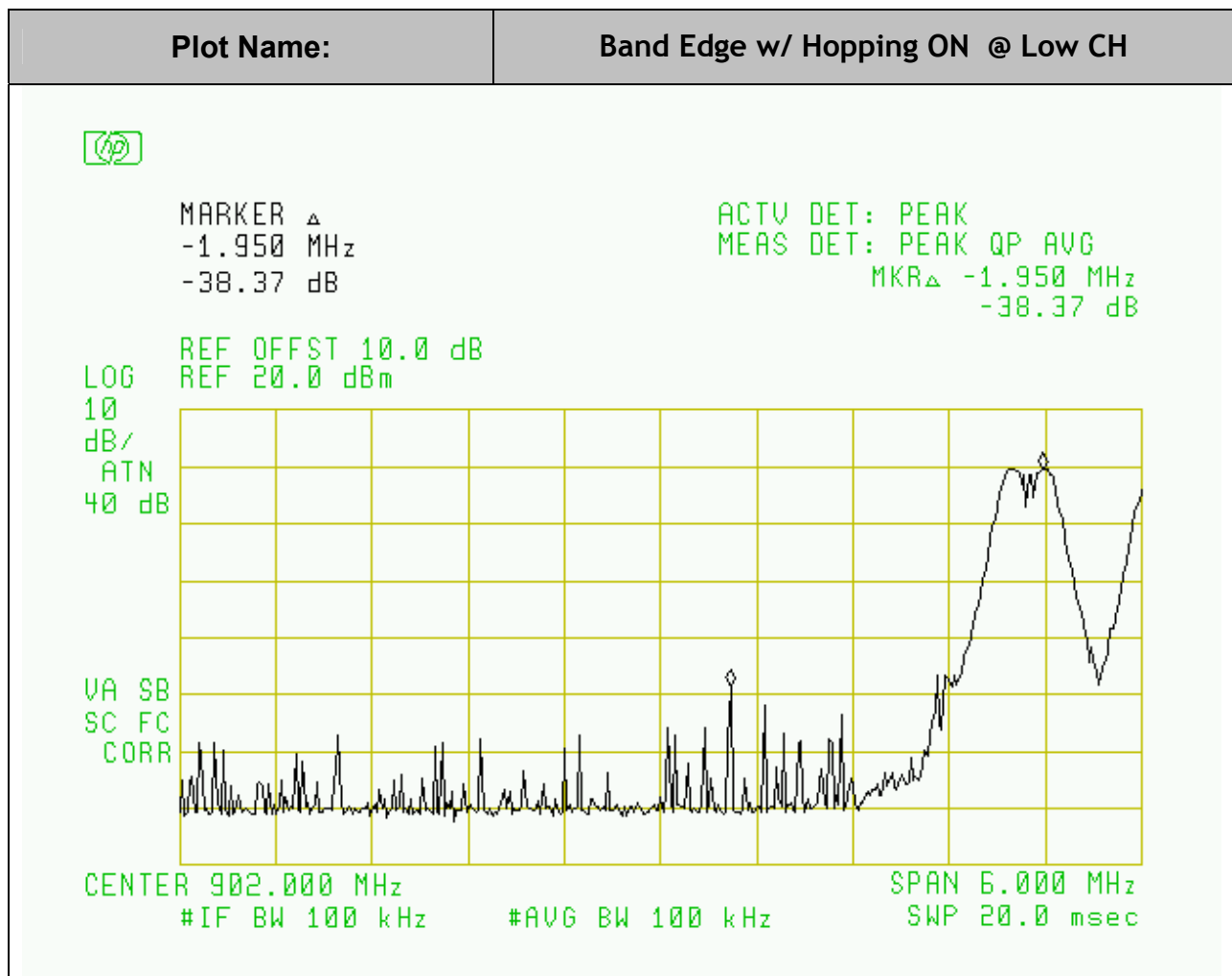


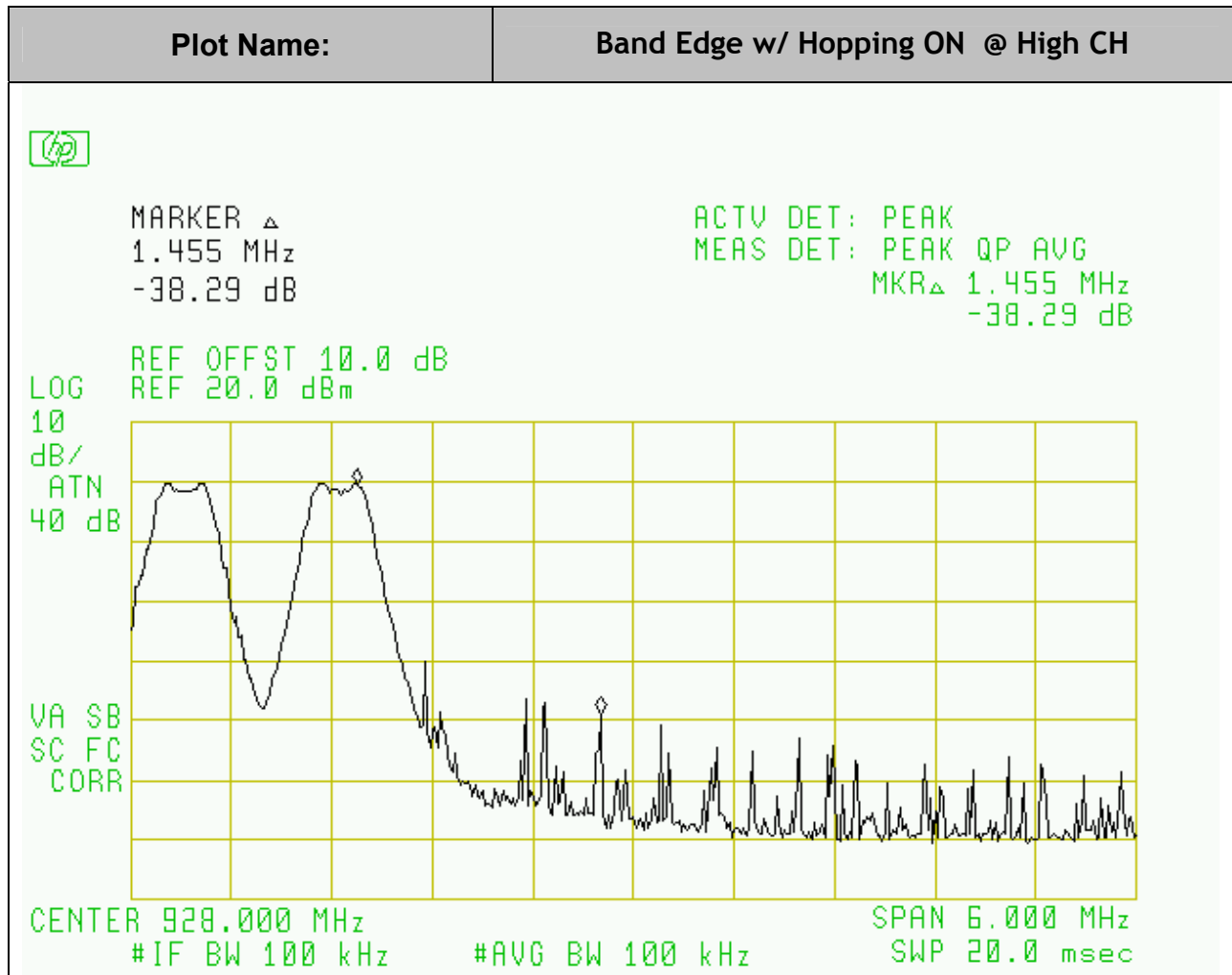






SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





7.10. RADIATED EMISSIONS

7.10.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

RESULTS

No non-compliance noted:

7.10.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

DUTY CYCLE CORRECTION FACTOR

*IN ACCORDANCE WITH FCC PUBLIC NOTICE DA-00-705, THE “DUTY CYCLE CORRECTION FACTOR” FOR SPURIOUS RADIATED EMISSIONS IS; $20 \log * (\max. 40 \text{ ms} / 100 \text{ ms}) = -8 \text{ dB}$, WHICH WAS USED TO CORRECT THE AVERAGE SPURIOUS READING.

BY SETTING THE VBW TO 10HZ, REPEAT ALL THE RADIATED EMISSION TESTS ABOVE, AND THE READINGS ARE RECORDED IN THE FOLLOWING TABLE, THEN APPLY THE DUTY CYCLE CORRECTION FACTOR TO DEMONSTRATE COMPLIANCE WITH THE 15.209 LIMIT.

HARMONICS AND SPURIOUS EMISSIONS

A. Transmitting Mode

Freq. (MHz)	Position (H,V-X,Y,Z)	Dist. (m)	D Corr (dB)	Peak (dBuV/m)	Avg. (dBuV/m)	Corr. Avg. (dBuV/m)	PK Lim (dBuV/m)	Avg.L im (dBuV/m)	PK Mar (dBuV/m)	Avg.Mar. (dBuV/m)
High Channel Harmonics										
2779	H,Z	1	-10.5	65.5	57.0	49.0	74	54	-8.5	-5.0
2779	V,Z	1	-10.5	62.6	53.7	45.7	74	54	-11.4	-8.3
3705	V,Z	1	-10.5	43.1	40.8	32.8	74	54	-30.9	-21.2
4631	V,Z	1	-10.5	36.6	34.7	26.7	74	54	-37.4	-27.3
Mid Channel Harmonics										
2745	H,Z	1	-10.5	64.5	56.1	48.1	74	54	-9.5	-5.9
2745	V,Z	1	-10.5	63.0	54.0	46.0	74	54	-11	-8.0
3660	H,Z	1	-10.5	40.4	38.9	30.9	74	54	-33.6	-23.1
Low Channel Harmonics										
2713	H,Z	1	-10.5	64.0	56.0	48.0	74	54	-9.7	-6.0
2713	V,Z	1	-10.5	63.0	54.0	46.0	74	54	-10.1	-8.0
No other harmonics or spurious emissions were detected in the rest band above system floor, noise above -20dB to the limit.										
Average field strength includes duty circle correction factor of -8dB.										

B. Receiving Mode (No Enclosure)

Freq. (MHz)	Position (H,V-X,Y,Z)	Dist. (m)	D Corr (dB)	Peak (dBuV/m)	Quasi-Peak (dBuV/m)	Avg. (dBuV/m)	FCC-15 3m Lim (dBuV/m)	Mar. (dBuV/m)
55.2	V,Z	1	-10.5	28.2			40.0	-11.8
85.5	V,Z	1	-10.5	29.5			40.0	-10.5
117.1	V,Z	1	-10.5	26.5			43.5	-17
236.5	V,Z	1	-10.5	31			46.5	-15.5
256.5	V,Z	1	-10.5	33.6			46.5	-12.9
288.5	V,Z	1	-10.5	32.8			46.5	-13.7
295.5	V,Z	1	-10.5	36.4			46.5	-10.1
320.0	V,Z	1	-10.5	33			46.5	-13.5
336.5	V,Z	1	-10.5	32.4			46.5	-14.1
355.0	V,Z	1	-10.5	32.8			46.5	-13.7
418.0	V,Z	1	-10.5	31.9			46.5	-14.6
738.5	V,Z	1	-10.5	33.7			46.5	-12.8
No other harmonics or spurious emissions were detected in the rest band above system floor, noise above -20dB to the limit.								
Worst case: operation frequency=926MHz								

7.10.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

<p>No significant emissions were detected in this band above system floor, noise above -20dB to the limit.</p>
--

7.10.4. WORST-CASE ROR HARMONICS AND SPURIOUS EMISSIONS when CA-100 Module hosted in Typical Enclosure

I. Hosted in Hand Held Remote

A. Transmitting Mode

Freq. (MHz)	Positi on (H,V- X,Y,Z)	Dist. (m)	D Corr (dB)	Peak (dBuV/m)	Avg. (dBuV/m)	Corr. Avg. (dBuV/m)	PK Lim (dBu V/m)	Avg.L im (dBuV /m)	PK Mar (dBuV/m)	Avg.Mar. (dBuV/m)
High Channel Harmonics										
2779	H,Z	1	-10.5	65.5	55.8	47.8	74	54	-8.5	-6.2
2779	V,Z	1	-10.5	67.0	57.0	49.0	74	54	-7.0	-5
3705	V,Z	1	-10.5	45.5	43.6	35.6	74	54	-28.5	-18.4
4631	V,Z	1	-10.5	37.2	36.0	28.0	74	54	-36.8	-26
Mid Channel Harmonics										
2745	H,Z	1	-10.5	64.9	55.0	47	74	54	-9.1	-7
2745	V,Z	1	-10.5	63.2	54.0	46	74	54	-10.8	-8
3660	H,Z	1	-10.5	41.0	39.2	31.2	74	54	-33	-22.8
Low Channel Harmonics										
2713	H,Z	1	-10.5	63.3	53.8	45.8	74	54	-10.7	-8.2
2713	V,Z	1	-10.5	60.0	52.2	44.2	74	54	-14	-9.8
No other harmonics or spurious emissions were detected in the rest band above system floor, noise above -20dB to the limit.										
Corrected Average field strength includes duty circle correction factor of -8dB.										

In addition, the band edge requirements are also re-verified and the testing results are the same as those shown on page 33 & 40. Therefore, this device with operation band of 902MHz –928MHz, still comply with the band edge requirements per FCC Part 15.247 902-928MHz FHSS.

B. Receiving Mode

Freq. (MHz)	Positio n (H,V- X,Y,Z)	Dist. (m)	D Corr (dB)	Peak (dBuV/m)	Quasi- Peak (dBuV/m)	Avg. (dBuV/m)	FCC-15 3m Lim (dBuV/m)	Mar. (dBuV/m)
66.4	V,Z	3	0	32.5			40.0	-7.5
105.2	V,Z	3	0	33.6			43.5	-9.9
245.8	V,Z	3	0	34.0			46.5	-12.5
296.0	V,Z	3	0	36.8			46.5	-9.7
338.0	V,Z	3	0	41.4			46.5	-5.1
468.9	V,Z	3	0	36.5			46.5	-10
592.6	V,Z	3	0	36.9			46.5	-9.6
718.7	V,Z	3	0	38.0			46.5	-8.5
No other harmonics or spurious emissions were detected in the rest band above system floor, noise above -20dB to the limit.								
Worst case: operation frequency=926MHz								

II. Hosted in VCU Station

A. Transmitting Mode

Freq. (MHz)	Position (H,V-X,Y,Z)	Dist. (m)	D Corr (dB)	Peak (dBuV/m)	Avg. (dBuV/m)	Corr. Avg. (dBuV/m)	PK Lim (dBuV/m)	Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	Avg. Mar. (dBuV/m)
High Channel Harmonics										
2779	H,Z	1	-10.5	64.9	56.0	48.0	74	54	-9.1	-6
2779	V,Z	1	-10.5	63.2	54.6	46.6	74	54	-10.8	-7.4
3705	V,Z	1	-10.5	45.5	43.6	35.6	74	54	-28.5	-18.4
4631	V,Z	1	-10.5	37.2	36.0	28.0	74	54	-36.8	-26
Mid Channel Harmonics										
2745	H,Z	1	-10.5	63.3	54.0	46.0	74	54	-10.7	-8
2745	V,Z	1	-10.5	60.0	51.8	43.8	74	54	-14	-10.2
3660	H,Z	1	-10.5	41.0	39.2	31.2	74	54	-33	-22.8
Low Channel Harmonics										
2713	H,Z	1	-10.5	62.1	53.0	45.0	74	54	-11.9	-9
2713	V,Z	1	-10.5	61.8	52.5	44.5	74	54	-12.2	-9.5
No other harmonics or spurious emissions were detected in the rest band above system floor, noise above -20dB to the limit.										
Corrected Average field strength includes duty circle correction factor of -8dB.										

In addition, the band edge requirements are also re-verified and the testing results are the same as those shown on page 33 & 40. Therefore, this device with operation band of 902MHz –928MHz, still comply with the band edge requirements per FCC Part 15.247 902-928MHz FHSS.

B. Receiving Mode

Freq. (MHz)	Position (H,V-X,Y,Z)	Dist. (m)	D Corr (dB)	Peak (dBuV/m)	Quasi-Peak (dBuV/m)	Avg. (dBuV/m)	FCC-15 3m Lim (dBuV/m)	Mar. (dBuV/m)
55.2	V,Z	3	0	34.8			40.0	-5.2
112.5	V,Z	3	0	32.6			43.5	-10.9
237.0	V,Z	3	0	34.0			46.5	-12.5
338.0	V,Z	3	0	39.9			46.5	-6.6
418.0	V,Z	3	0	37.2			46.5	-9.3
553.8	V,Z	3	0	38.0			46.5	-8.5
937.8	V,Z	3	0	36.7			46.5	-9.8
No other harmonics or spurious emissions were detected in the rest band above system floor, noise above -20dB to the limit.								
Worst case: operation frequency=926MHz								

C. Conducted Emission Test

The EUT was setup and located so that the distance between the boundary of the EUT and the closest surface to the LISN was 0.8m or more.

EUT test configuration was according to CISPR22 and Section 7 of ANSI C63.4/2003.

Conducted disturbance was measured between the phase lead and the ground, and between the neutral lead and the ground. The frequency 0.150 - 30 MHz was investigated.

The EMI receiver was set to PEAK detector setting, and swept continuously over the frequency range to be investigated. The resolution bandwidth was set to 9KHz minimum. The EMI receiver input cable was connected to LINE 1 RF measurement connection on the LISN. A 50ohm terminator was connected to the unused RF port on the LISN. For each mode of EUT operation, emissions readings were maximized by manipulating cable and wire positions. The configuration for each EUT power cord which produced emissions closest to the limit was recorded. The same procedure was repeated for LINE 2 of each EUT power cord.

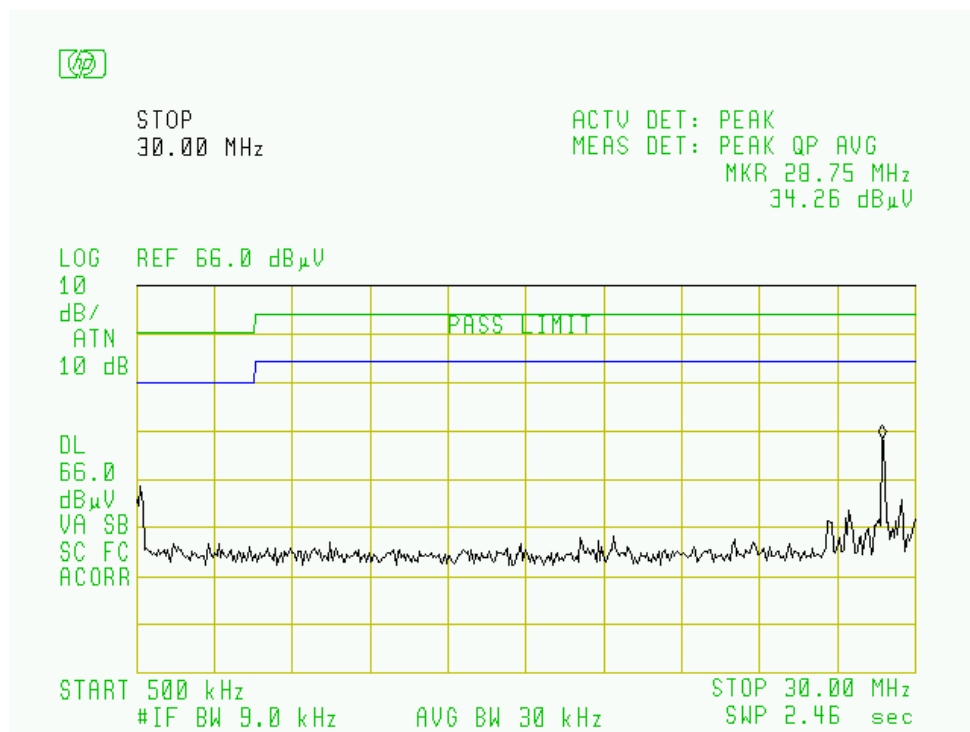
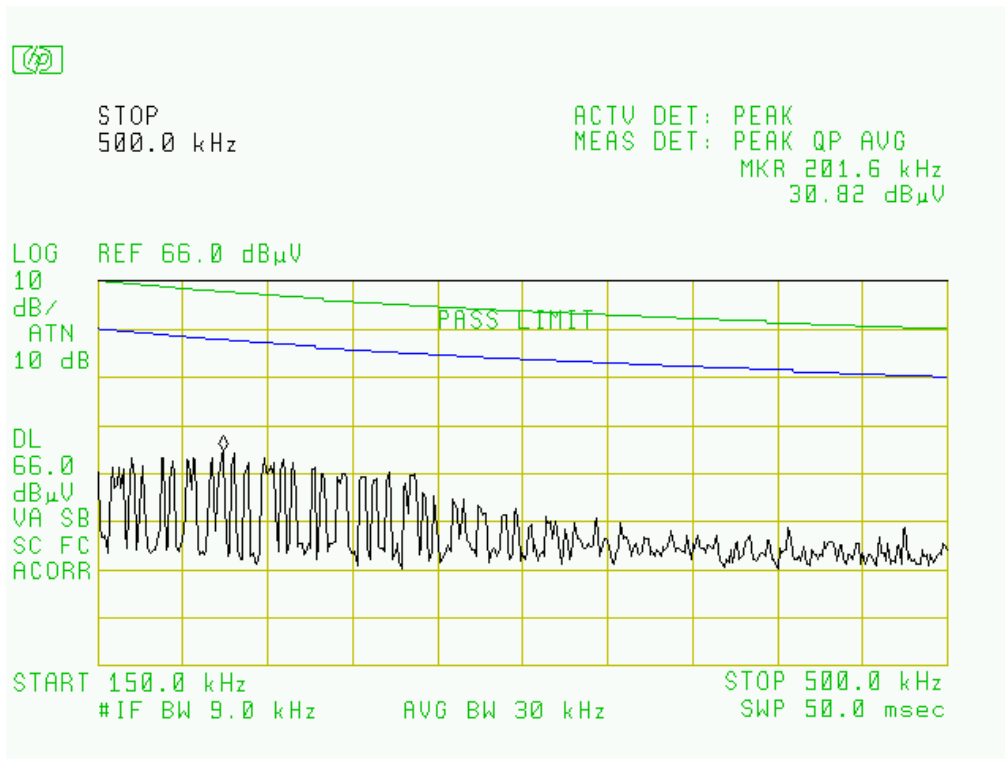
Instrument Settings

Frequency Range	Peak	Quasi-Peak	Average
0.15 – 30 MHz	9 kHz	9 kHz	30 kHz

Limit: FCC Part 15 / CISPR22 Class B

Result: No non-compliance noted

Line Conducted Emission



Neutral Conducted Emission

