Test 4: Radiated Disturbance Emissions - Occupied Bandwidth, Channel Spacing, Etc.

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 15.231

Test Procedure:

All testing was performed as bench-top measurements using a calibrated spectrum analyzer/receiver. Settings are shown as depicted on the plot presented. A 50 ohm 30 dB attenuator is used between the antenna port and the spectrum analyzer input. Plots indicating power levels are annotated with the attenuator correction to establish the corrected power levels.

Requirements for 902-928 MHz frequency hopping device

Channel Spacing:	Greater of 20 dB Bandwidth or 25 kHz
Duration on channel:	No more than 0.4 seconds
No. of Channels:	50 or more (if bandwidth is less than 250 kHz) 25 or more (if bandwidth is greater than 250 kHz)
Bandedge:	Complies with General Limit at band edges at 902 MHz and 928 MHz.

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	2	Antenna	5 (Channel active as indicated on data)	1 (Receiver Terminated)	1

Test 4 - Results: Radiated Disturbance Emissions - Occupied Bandwidth

Test Results Summary:

The EUT was considered to **Pass** the Requirements.

Comments:

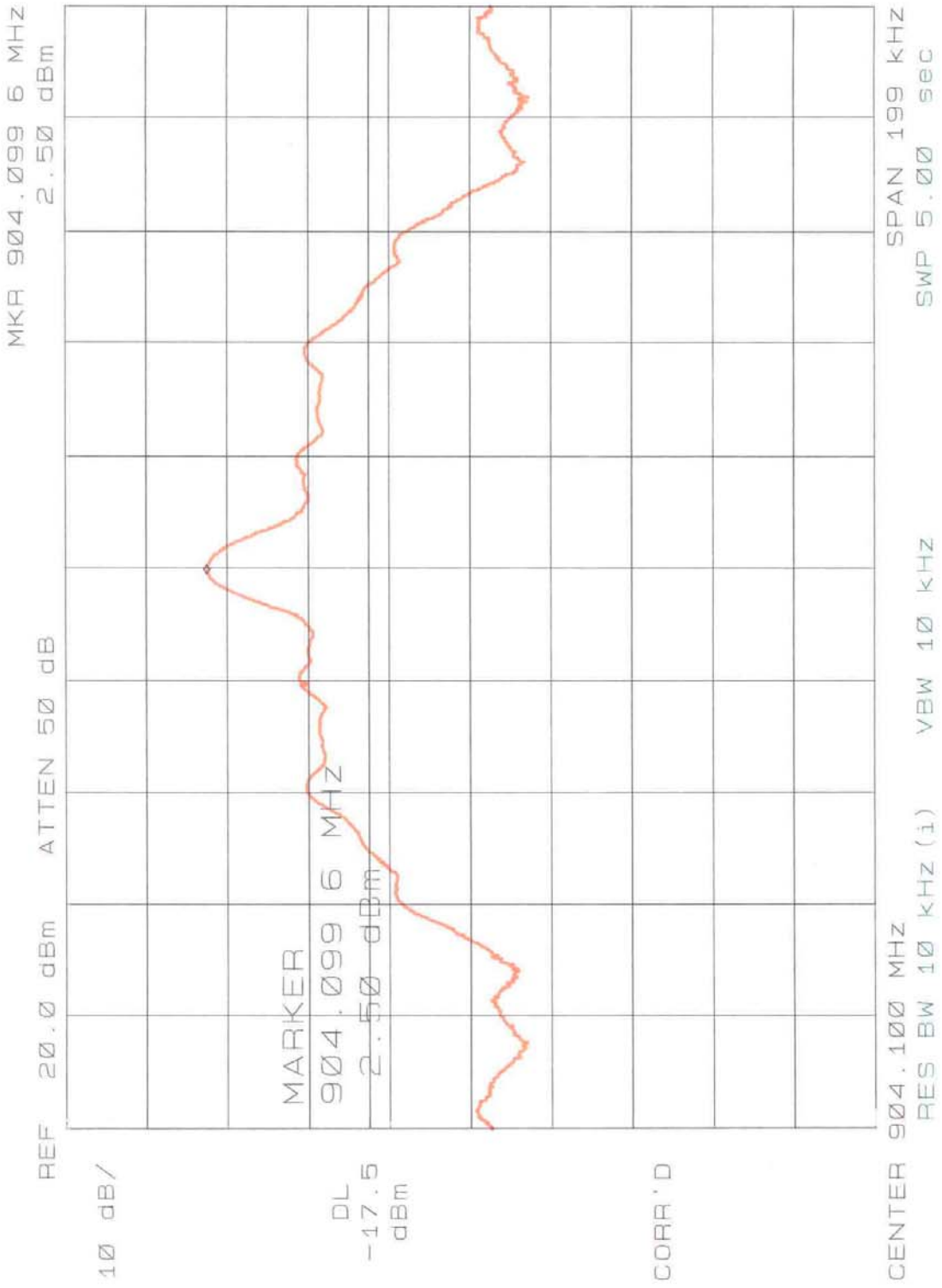
Comment #	Description

Test Equipment Used:

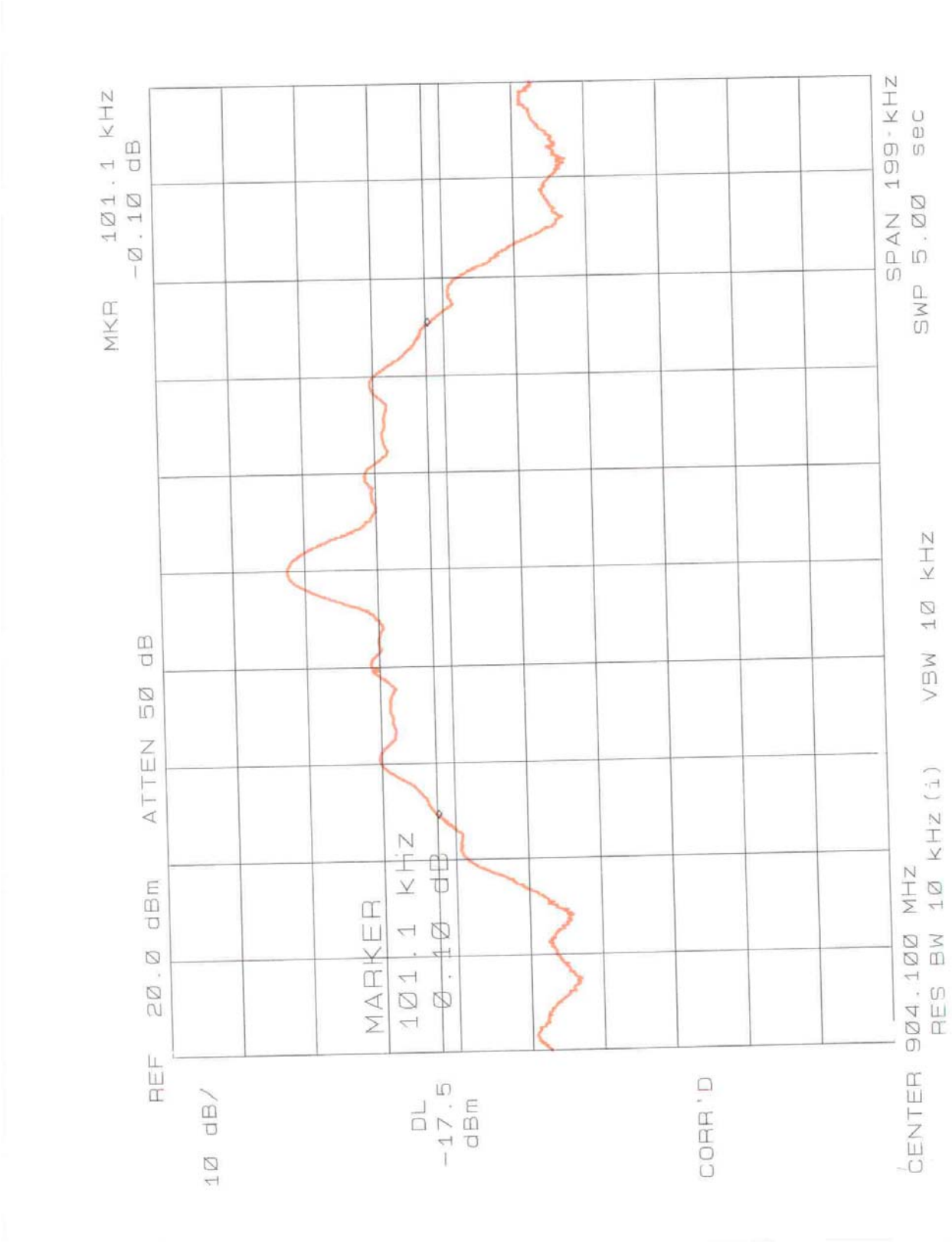
Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
HI0040	Environmental Indicator	Cole-Palmer	99760-00	10/2/02	10/31/03
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	1/31/03	1/31/04
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/5/02	9/30/03

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 4, Item A (Center Frequency, Low Channel) - Peak Plot:



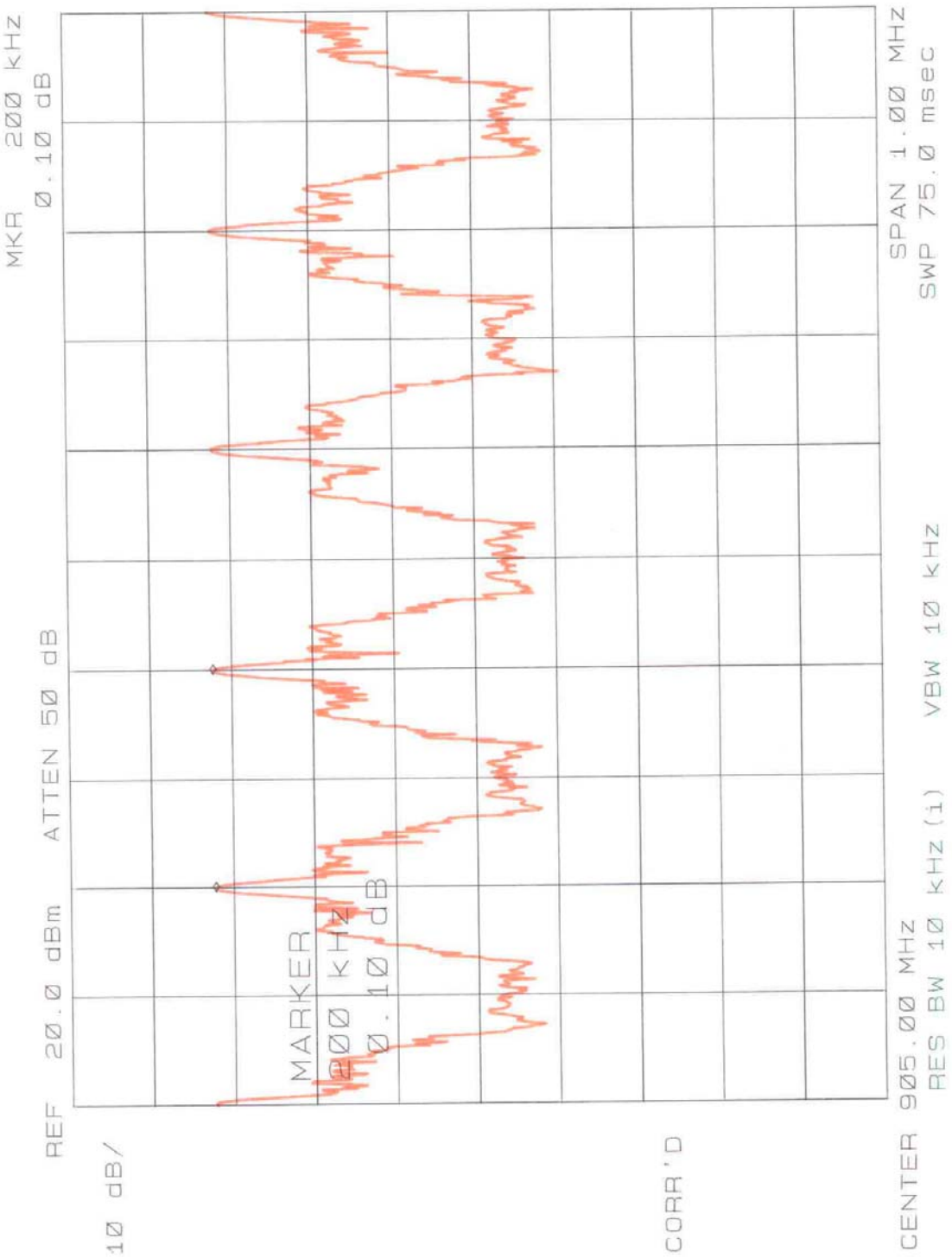
Test 4, Item A (Occupied Bandwidth) - Peak Plot:



Note:
Bandwidth is measured to 101.1 kHz. Limit is 200 kHz maximum per channel spacing requirement.

Test 4, Item A (Channel Spacing) - Peak Plot (Amplitude in dBuV):

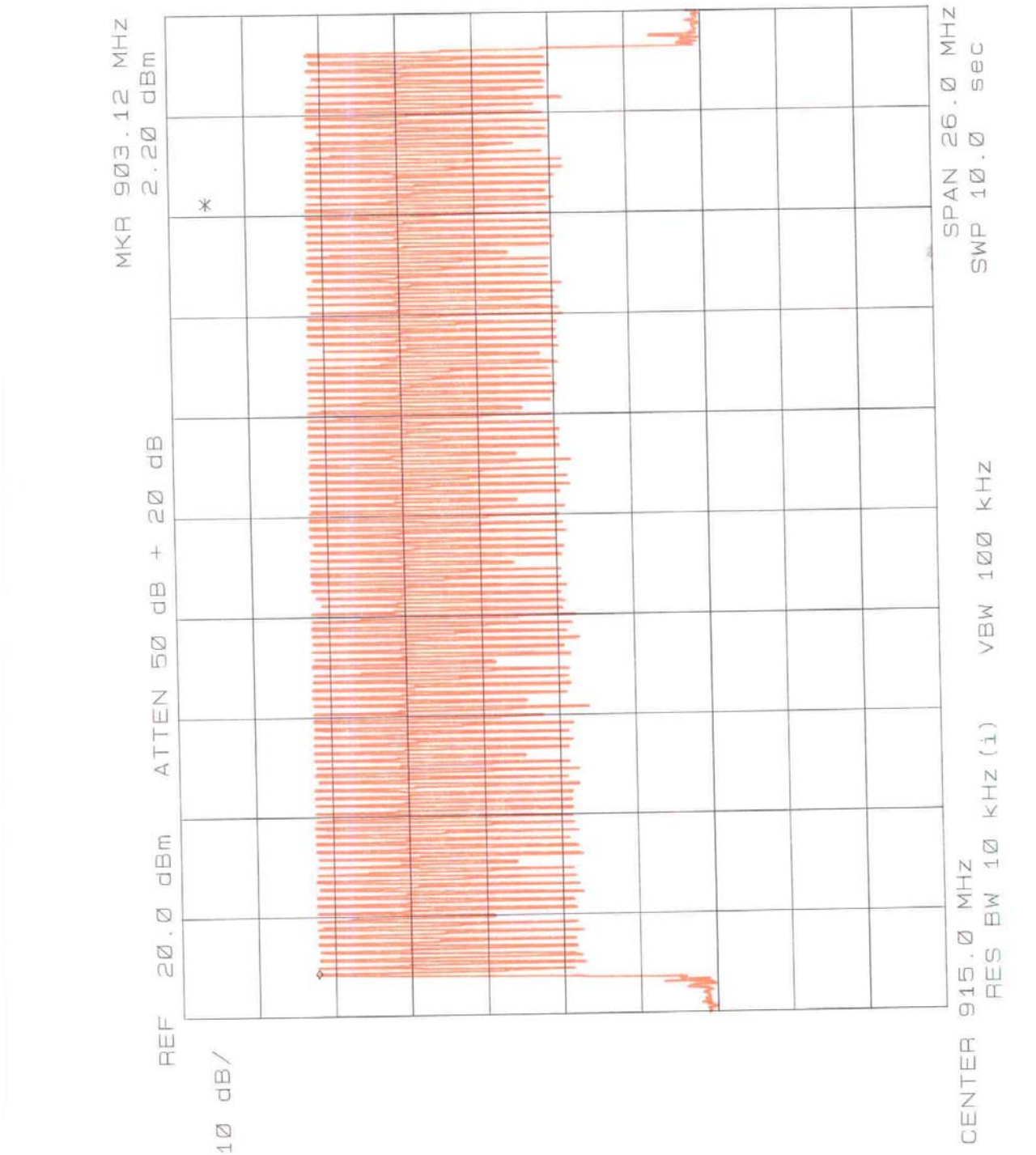
Conducted Measurement – Channel Spacing



Note: Channels are observed to be spaced 200 kHz (center to center).

Test 4, Item A (Lowest channel) - Peak Plot:

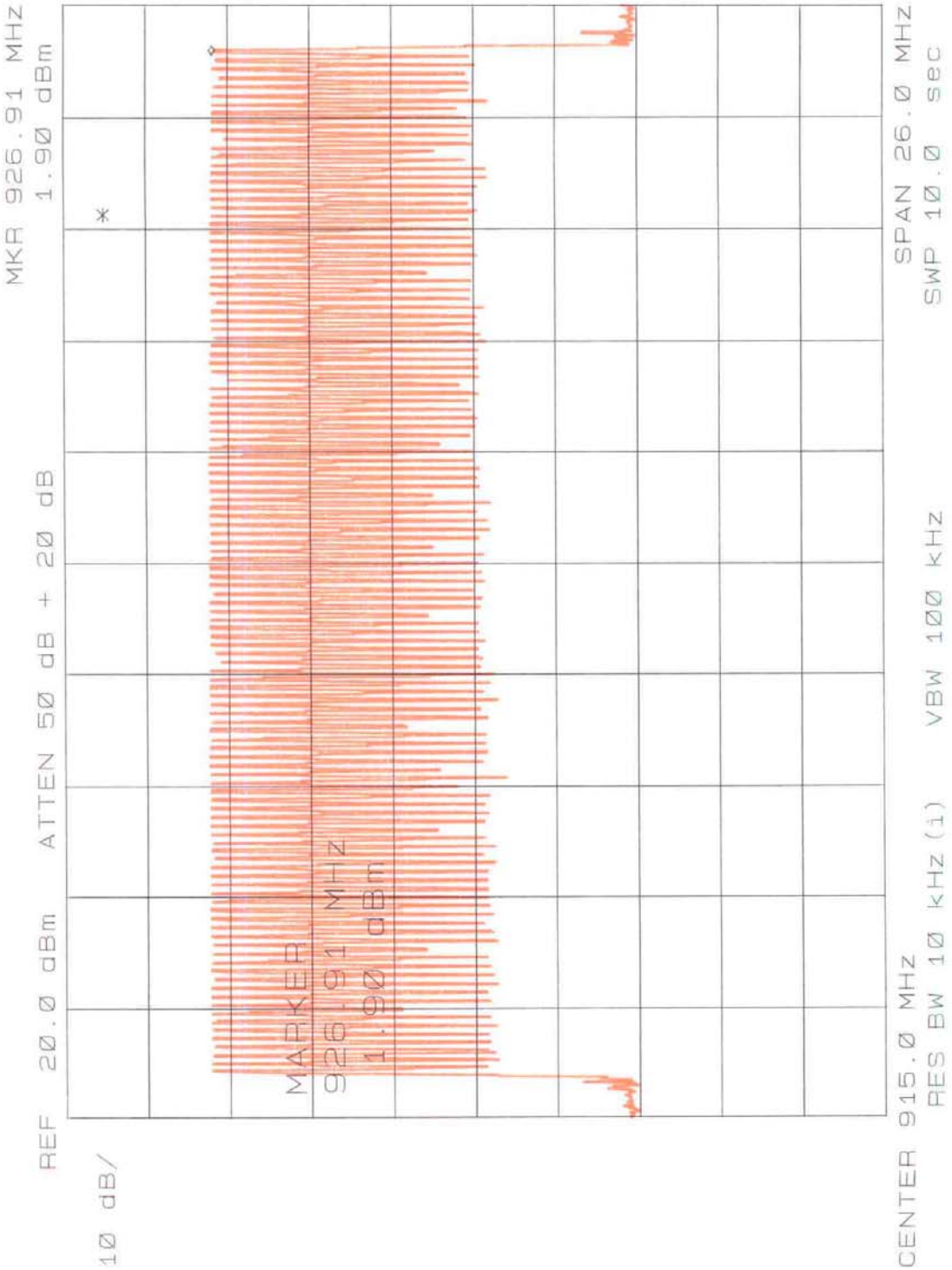
Conducted Measurement - Channels



Plot is used to demonstrate that the required minimum number of hops is met. 120 hopping channels are employed on 200 kHz center frequencies. The lowest channel is observed to be centered at 903.1 MHz.

Test 4, Item A (Highest channel) - Peak Plot:

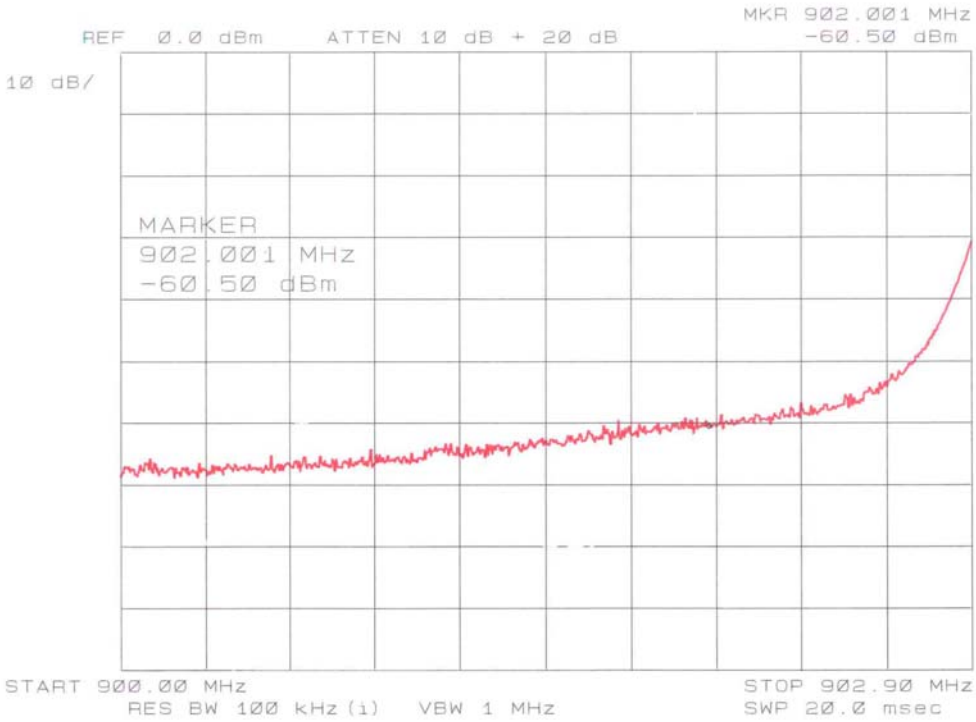
Conducted Measurement - Channels



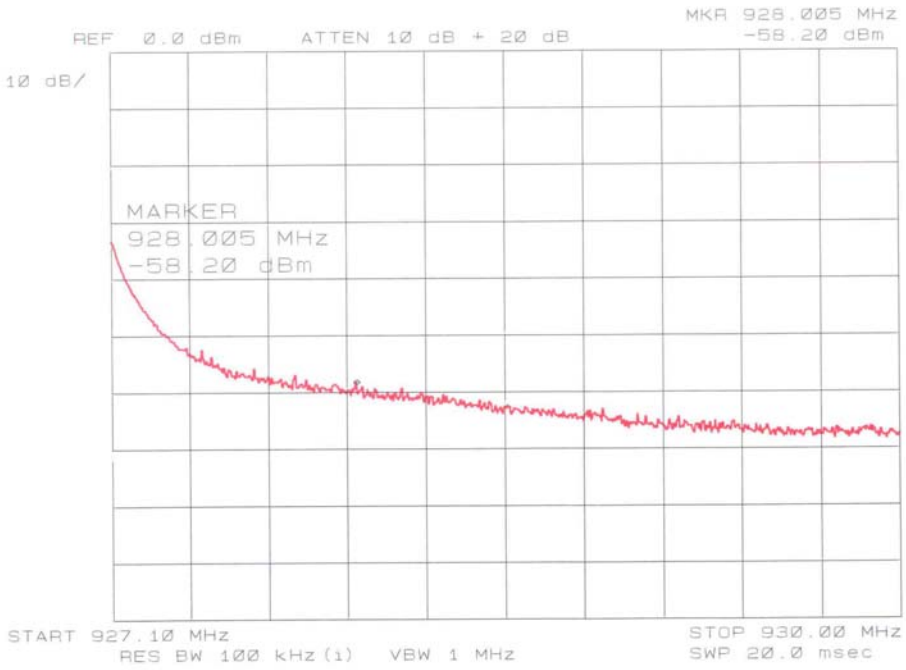
Note: The highest channel is observed to be centered at 926.9 MHz.

Test 4, Item A (Bandedge) - Peak Plot:

Conducted Measurement – Bandedge Left. Marker placed at 902 MHz. Lowest Frequency at 903.1 enabled.

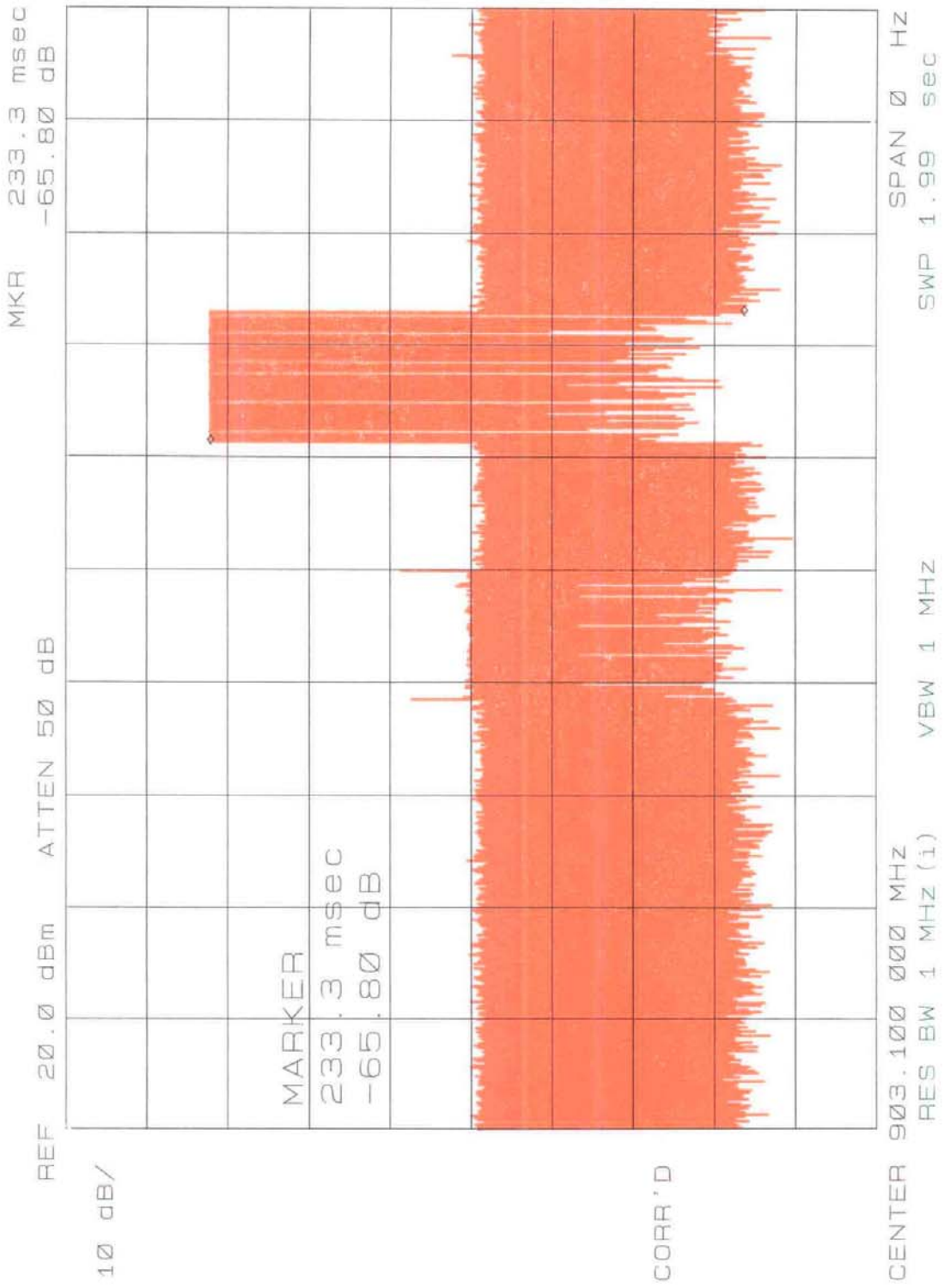


Conducted Measurement - Bandedge Right. Marker placed at 928 MHz. Highest frequency at 926.9 enabled.



Test 4, Item A (duration of a single hop) - Peak Plot:

Radiated Disturbance Emissions – Hop Duration



Note: Duration of each hop is demonstrated to be 233.3 ms. Required hop duration is 400 ms or less.

Test 5: Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

Test Requirement: 47 CFR Part 15, Subpart B

Test Specification: 47 CFR Part 15, Subpart B, Class A

Test Procedure:

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. The EUT was placed inside the anechoic chamber and connected to the proper power supply source. A peak measurement was first made by scanning the entire test frequency range and maximizing the EUT emissions by rotating the EUT and raising the antenna height from 1 to 4 meters above the ground reference plane. Then, a measurement was taken for all peak emissions to verify each were below the Test Limits. In each case, all cables and equipment were adjusted and EUT orientation and antenna height were varied for maximum emissions.

Radiated Disturbance Limits for Class A Equipment
at a measuring distance of 10m.

Frequency Range MHz	Quasi-Peak Limits μV/m	Quasi-Peak Limits dBμV/m
30 to 88	90	39.08
88 to 216	150	43.52
216 to 960	210	46.44
Above 960	300	49.54

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	0	Enclosure	4 (Transmitter set to “RF Off”)	1	1

Test 5 - Results: Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field

Test Results Summary:

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	A	P	6/18/03	1

The EUT was considered to **Pass** the Requirements.

Comments:

Comment #	Description
1	Data above 1 GHz is presented as Test 7.

Test Equipment Used:

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0021	Biconical Antenna, 20 to 300 MHz	Chase	VBA6106A	7/23/02	7/31/03
AT0022	Log Periodic Antenna, 200 to 1000 MHz	Chase	UPA6109	7/22/02	7/31/03
ATA084	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA085	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/19/03	3/31/04
ATA095	6 ft, N male - N male	Micro-Coax	Coaxial Cable	3/19/03	9/30/03
ATA106	19 ft, N - N	Amplifier Research	Low Loss coaxial cable	3/20/03	3/31/04
ATA108	10 m, N male - N male	UL	RG214	3/19/03	3/31/04
ATA110	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/19/03	3/31/04
ATA124	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/20/03	3/31/04
ATA132	45ft. N-Male to N-Male	UL	Coaxial Cable	3/20/03	3/31/04
ATA140	RG214 Ferrite Cable	EMC Eupen	N/A	3/19/03	3/31/04
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/2/02	10/31/03
SAR002	Spectrum Analyzer / Receiver	Hewlett-Packard	8566B	11/21/02	11/30/03

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 5, Item A (Not Transmitting) - Peak Plot (Amplitude in dBuV/m):

Radiated Disturbance Emissions - 30 to 1000 MHz Electric Field