

Technical Information

Applicant		Manufacturer	
Name:	The Sapling Company, Inc.	Name:	The Sapling Company, Inc.
Address:	1633 Republic Road	Address:	1633 Republic Road
City, State, Zip:	Huntington Valley, PA 19006	City, State, Zip:	Huntington Valley, PA 19006
Date of Report:	May 30, 2012		

Test Specification:

FCC Rules and Regulations Part 15, Subpart C, Para. 15.247

Test Procedure: ANSI C63.4:2003

FCC Public Notice DA 00-705, Dated: March 30, 2000

Test Sample Description

TEST SAMPLE: 914 to 928 MHz Transceiver Module

BRANDNAME: Sapling

MODEL: LPM-900-1

FCC ID: R73LPA1

TYPE: Frequency Hopping Spread Spectrum Transceiver Module

POWER REQUIREMENTS: 120 VAC, 60 Hz

FREQUENCY OF OPERATION: 914 to 928 MHz

Tests Performed

FCC Part 15, Subpart C	Test Method
15.247(a)(1)	Channel Separation
15.247(a)(1)	20 dB Bandwidth
15.247(a)(1) (i)	Number of Channels and Occupancy Time
15.247(b)(1) and (4)	Peak Conducted Output Power
15.247(d)	Field Strength of Spurious Emissions, 32.7 kHz to 10 GHz
15.207(b)	Conducted Emissions, Power Leads, 150 kHz to 30 MHz

Certification and Signatures

We certify that this report is a true representation of the results obtained from the tests of the equipment stated. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.



Dean Landers
EMC Test Engineer



Richard J. Reitz
Corporate Laboratory Manager
iNARTE Certified Engineer: ALT-0036-E
NVLAP Approved Signatory

Non-Warranty Provision

The testing services have been performed, findings obtained and reports prepared in accordance with generally accepted laboratory principles and practices. This warranty is in lieu of all others, either expressed or implied.

Non-Endorsement

This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement or certification of the product or material tested. This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

General Test Requirements

1. The measurement procedures of ANSI C63.4:2003 were utilized as specified in FCC Part 15, Subpart C, Section 15.31(a)(3).
2. All radiated emissions measurements were performed on an Open Area Test Site (OATS), listed with the FCC, in accordance with FCC Section 15.31(d).
3. The level of the RF power output was measured with the AC input varied from 85 to 115% of rated. The worst case results were reported in accordance with FCC Section 15.31(e).
4. All radiated emissions measurements were performed at the specified 3 meter test distance as required by FCC Section 15.31(f).
5. The EUT was rotated throughout 360 degrees for all radiated emissions measurements as specified in FCC Section 15.31(f)(5).
6. All readily accessible EUT controls were adjusted in such a manner as to maximize the level of emissions in accordance with FCC Section 15.31(g).
7. Appropriate accessories were attached to all EUT ports during the performance of radiated emissions measurements as required by FCC Section 15.31(i).
8. AC line conducted emissions were measured utilizing a 50 Ohm / 50 MicroHenry LISN as specified in FCC Section 15.31(l).
9. The EUT operated over the frequency range of 914 to 928 MHz. A total range of 14 MHz. Testing was performed with the device operating at 3 frequencies, 1 at the top, 1 in the middle and 1 at the bottom of the range of operation in accordance with FCC Section 15.31(m).
10. The frequency spectrum was investigated from the lowest frequency generated in the device up to the 10th harmonic of the highest fundamental frequency in accordance with FCC Section 15.33(a)(1).
11. Measurements below 1000 MHz were taken utilizing a Quasi-Peak Detector. Measurements above 1 GHz were taken utilizing an Average Detector in accordance with FCC Section 15.35(a). The peak value of emissions above 1 GHz were verified to meet the 20 dB requirement of FCC Section 15.35(b).

Requirements and Test Results

Requirement:

FCC Section 15.203

Antenna Requirements

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

- **Results:**
This module, when integrated into the final product, is distributed and professionally installed through a dealer network, therefore the module is deemed compliant with FCC Section 15.203.

Requirement:

FCC Section 15.207(a) - Conducted Limits

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits shown in Table 1, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of the paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Table 1 - Conducted Emission Limits

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50
*Decreases due to logarithm of the frequency		

- **Results:**
The conducted emissions observed did not exceed the limits specified in Table 1.

Requirements and Test Results (con't)

FCC Section 15.209(a)

Radiated Emission Limits, General Requirements

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the values specified in Table 2.

Table 2 - Radiated Emission Limits

Frequency of Emission (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 to 0.490	2400/F(kHz)	300
0.490 to 1.705	24000/F(kHz)	30
1.705 to 30.0	30	30
30 to 88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960	500	3

- Results:
The field strength of spurious radiated emissions did not exceed the limits specified in Table 2.

Requirement:

FCC Section 15.247 (a)(1)

Channel Separation and 20 dB Bandwidth

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

- Results:
The carrier frequencies were separated by 255 kHz which complies with the requirements specified above.

Requirements and Test Results (con't)

FCC Section 15.247 (a)(1)(i)

Number of Channels and Occupancy Time

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.

- Results
 - The Bandwidth was 127.5 kHz (less than 250 kHz)
 - 51 hopping frequencies were utilized
 - The occupancy time is 312 msec / 20 sec

FCC Section 15.247 (b)(1)

Peak Conducted Output Power

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(4) The conducted output power limit specified in Paragraph (b) of Section 15.247 is based on the use of antenna with directional gains that do not exceed 6 dBi. Except as shown in Paragraph (c) of Section 15.247, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in Paragraph (b)(1), (b)(2) and (b)(3) of Section 15.247, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

- Results

The frequency hopping system utilizes a PCB trace antenna with a directional gain of less than 6 dBi. The maximum peak conducted output power was measured to be 10.2 milliwatts.

Requirements and Test Results (con't)

FCC Section 15.247 (d)

Field Strength of Spurious Emissions

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Paragraph (b)(3) of Section 15.247, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

- **Results**

The antenna conducted spurious emissions comply with the requirement that the radio frequency power be at least 20 dB below the highest in band level.

In addition, Harmonic and Spurious Emissions which were found to be within the restricted bands of operation, as defined in section 15.205 (a) were found to be in compliance with the general limits specified in section 15.209 (a).

Requirements and Test Results (con't)

FCC Section 15.247 (i)

RF Exposure Limits

Spread Spectrum Transmitters operating under 15.247 are categorically excluded from routine environmental evaluation for demonstrating RF exposure compliance with respect to MPE or SAR limits however per 15.247(i) must be operated in a manner that ensures the public is not exposed to RF energy levels in excess of the commission's guidelines. The user/installation manual contains the proper cautionary statements and specifies that the device be installed and operated so that a minimum separation distance of 3 cm will be maintained. Based on the transmitter power and maximum antenna gain (see calculation below) the 3 cm separation distance exceeds the calculated distance for acceptable MPE power density levels to meet both the Occupational/Controlled Exposure and the General Population/Uncontrolled Exposure requirements of FCC Part 1.1310. The calculation below uses the more stringent General Population MPE Limits.

$$S = \frac{PG}{4\pi D^2}$$

D = Minimum Separation Distance in cm

S = Max allowed Power Density in mW/cmsq

Per 1.1310 For the Frequency of 928 MHz $S = 928 / 1500 = 0.618$ mW/cmsq

Power = Max Power Input to Antenna = 10.2 mW

Gain = Max Power Gain of Antenna = 5.14 dBi = 3.26 numeric

$$0.618 \text{ mW/cmsq} = \frac{10.2 \times 3.26}{4\pi (3.14) D^2} = \frac{33.25}{12.56 D^2}$$

$$D^2 = \frac{33.25}{12.56 \times 0.618}$$

$$D = \sqrt{4.28} = 2.1 \text{ cm}$$

Equipment List

FCC Section 15.247(a)(1) - Channel Separation

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1009	NARDA	30.0DB ATTENUATOR	DC - 18 GHz	776C-30	8/23/2011	8/23/2012
8329	STACO	AC POWER SOURCE	0 - 140 VAC 9 Amp	E1010VAW	Calibrate Before Use	
R603	AGILENT / HP	SPECTRUM ANALYZER	100 kHz - 26.5 GHz	E7405A;B	6/7/2011	6/7/2012

FCC Section 15.247(a)(1) - 20 dB Bandwidth

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1009	NARDA	30.0DB ATTENUATOR	DC - 18 GHz	776C-30	8/23/2011	8/23/2012
8329	STACO	AC POWER SOURCE	0 - 140 VAC 9 Amp	E1010VAW	Calibrate Before Use	
R603	AGILENT / HP	SPECTRUM ANALYZER	100 kHz - 26.5 GHz	E7405A;B	6/7/2011	6/7/2012

FCC Section 15.247 (a)(1) (i) - Number of Channels and Occupancy Time

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1009	NARDA	30.0DB ATTENUATOR	DC - 18 GHz	776C-30	8/23/2011	8/23/2012
8329	STACO	AC POWER SOURCE	0 - 140 VAC 9 Amp	E1010VAW	Calibrate Before Use	
R603	AGILENT / HP	SPECTRUM ANALYZER	100 kHz - 26.5 GHz	E7405A;B	6/7/2011	6/7/2012

FCC Section 15.247 (a)(1) - Peak Conducted Output Power

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1009	NARDA	30.0DB ATTENUATOR	DC - 18 GHz	776C-30	8/23/2011	8/23/2012
8329	STACO	AC POWER SOURCE	0 - 140 VAC 9 Amp	E1010VAW	Calibrate Before Use	
R603	AGILENT / HP	SPECTRUM ANALYZER	100 kHz - 26.5 GHz	E7405A;B	6/7/2011	6/7/2012

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
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FCC Section 15.247 (d) - Field Strength of Spurious Emissions

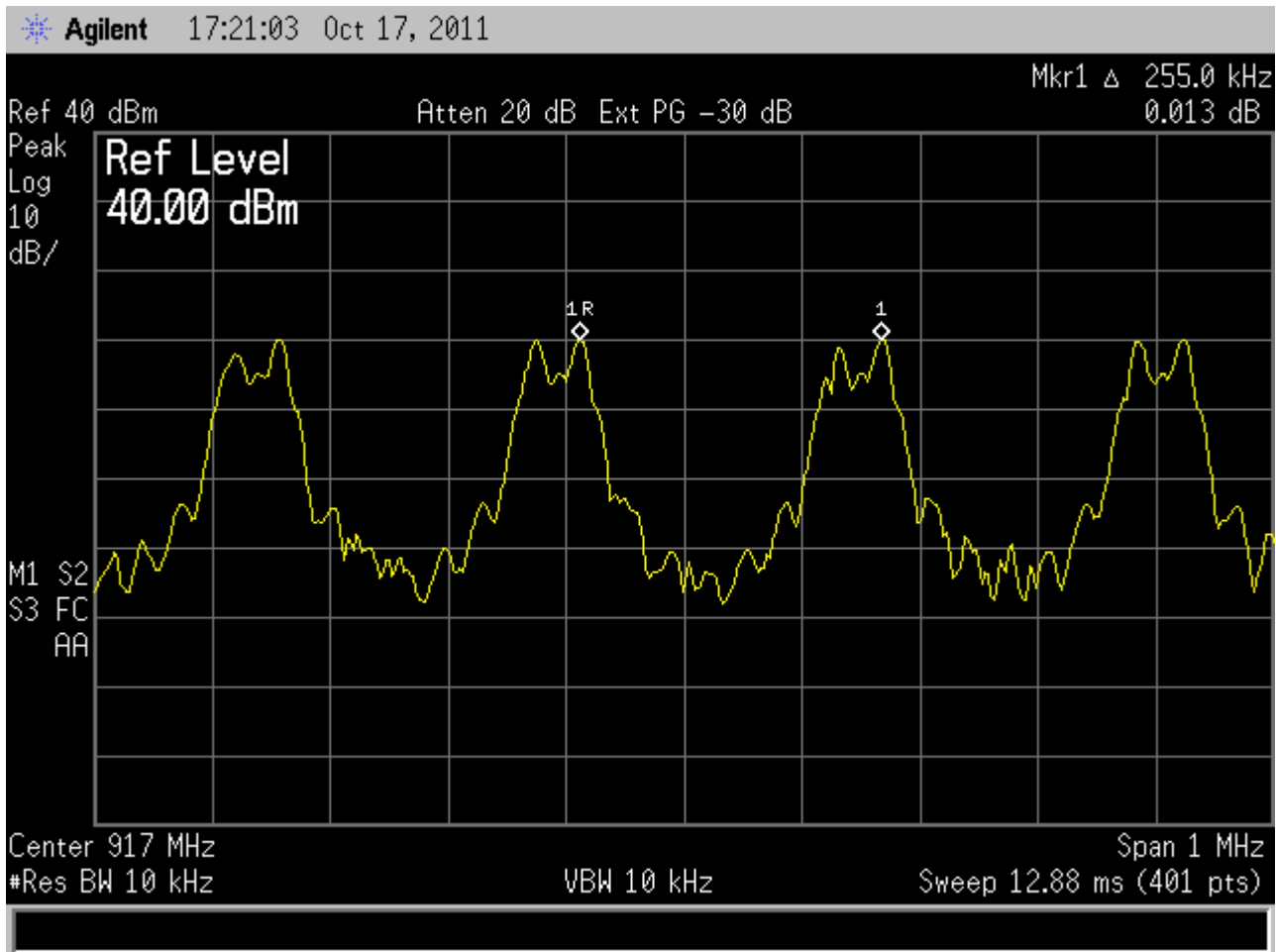
EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1009	NARDA	30.0DB ATTENUATOR	DC - 18 GHz	776C-30	8/23/2011	8/23/2012
713	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 26.5 GHz	ESIB26	6/8/2011	6/8/2012
012	EMCO	ACTIVE LOOP		6502	7/25/2011	7/25/12
8017	EMCO	DOUBLE RIDGED GUIDE	1-18 GHz	3115	8/24/2011	8/24/2012
8071	AGILENT / HP	SPECTRUM ANALYZER	100Hz-2.5 GHz/2-22GH	8566B	6/10/2011	6/10/2012
8072	AGILENT / HP	SPECTRUM ANALYZER DISPLAY		85662A	6/10/2011	6/10/2012
8080	ROHDE & SCHWARZ	EMI TEST RECEIVER	20-1300 MHz	ESVP	7/18/2011	7/18/2012
8300C	UNKNOWN	3/10 METER CABLE	3/10 METER	3 METER CABLE	8/23/2011	8/23/2012
8317	AGILENT / HP	PRE-AMPLIFIER	1-26.5 GHz, 30 dB	8449B	6/10/2011	6/10/2012
8411	SONOMA INSTRUMENT	PRE-AMPLIFIER	9 kHz - 1 GHz	310N	8/11/2011	8/11/2012
8433	ETS LINDGREN	BICONILOG	20-6000 MHz	3142D	8/31/2011	8/31/2012
R603	AGILENT / HP	SPECTRUM ANALYZER	100 kHz - 26.5 GHz	E7405A;B	6/7/2011	6/7/2012

Equipment List (con't)

FCC Section 15.107 (a) and 15.207(a) - Conducted Emissions, Power Leads, 150 kHz to 30 MHz

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
713	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 26.5 GHz	ESIB26	6/8/2011	6/8/2012
8194	SOLAR ELECTRONICS	LINE IMPEDANCE STABILIZATION NETWORK	10 kHz - 30 MHz	8028-50-TS-24-B	2/15/2011	2/15/2012
8195	SOLAR ELECTRONICS	LINE IMPEDANCE STABILIZATION NETWORK	10 kHz - 30 MHz	8028-50-TS-24-B	2/15/2011	2/15/2012
8276	ELGAR	TRANSFORMER		2.5-13	Inspect Before Use	
8457	GENERAL TECHNICS	Control Computer				
8493	NARDA	MED PWR ATTEN	DC-4.0 GHZ, 20W	766-10	6/14/2011	6/14/2012

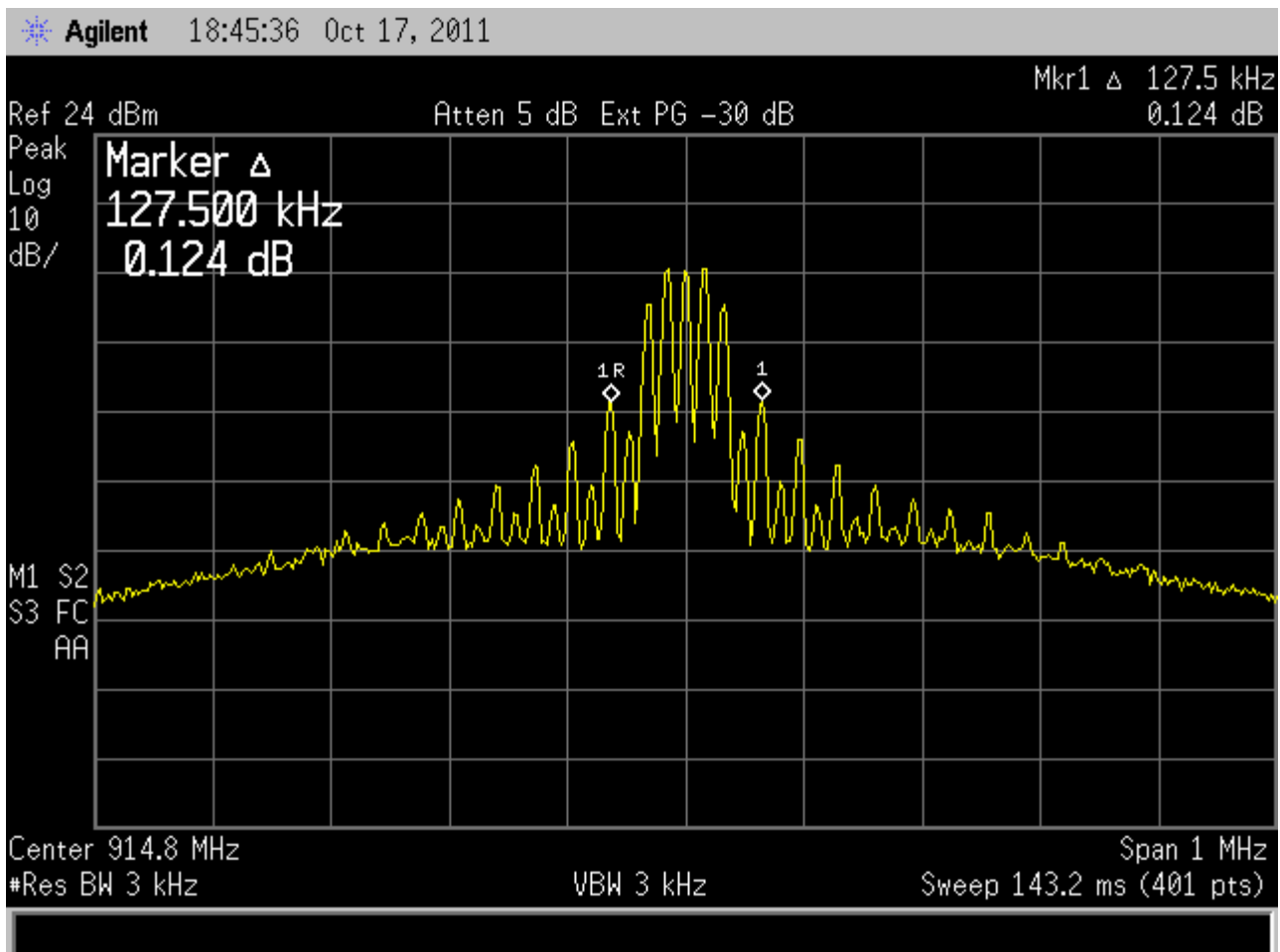
FCC Part 15, Subpart C, 15.247 (a)(1)
Channel Separation, Bandwidth and Occupancy Time
Test Data



FCC Part 15, Subpart C, 15.247(a) (1) Channel Separation

Note:

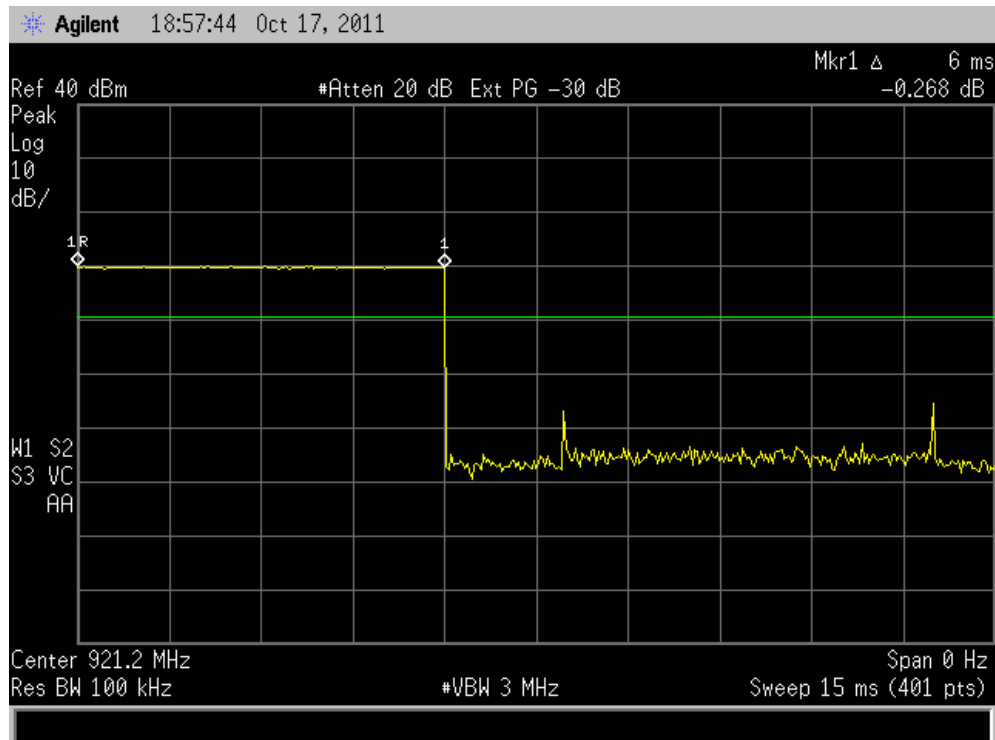
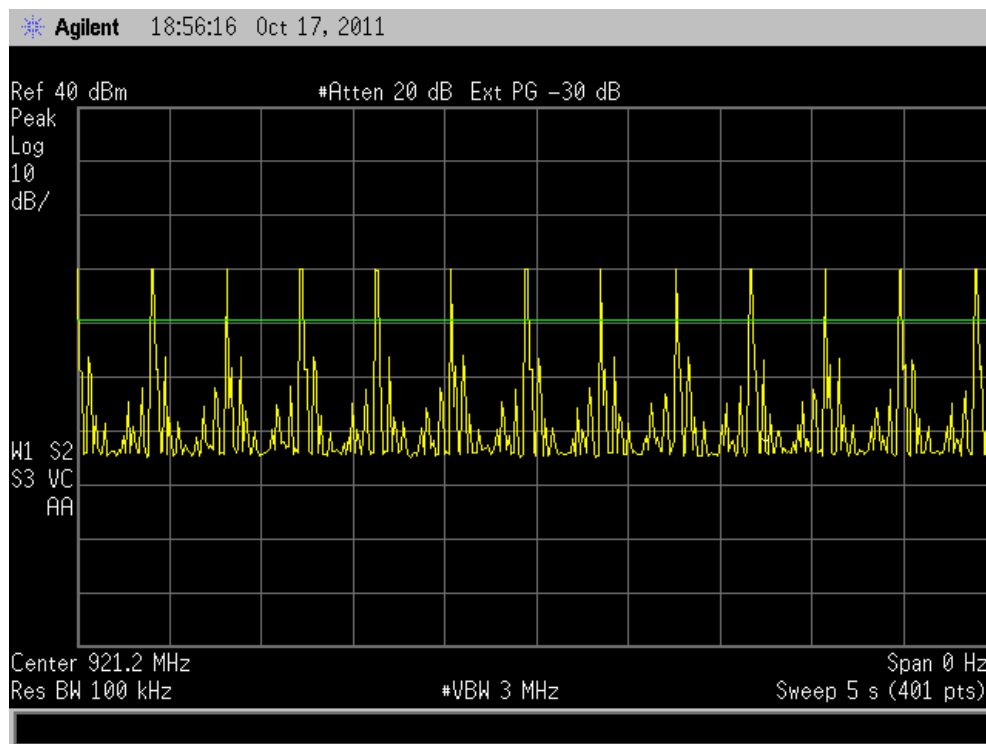
Customer	The Sapling Company, Inc.	
Test Sample	Transceiver	
Model Number	LPM-900-1	
Date: 10/21/11	Tech: D.Fiore	Sheet 1 of 3



FCC Part 15, Subpart C, 15.247(a) (1) 20dB Bandwidth

Note:

Customer	The Sapling Company, Inc.	
Test Sample	Transceiver	
Model Number	LPM-900-1	
Date: 10/21/11	Tech: D.Fiore	Sheet 2 of 3



FCC Part 15, Subpart C, 15.247(a) (1) Occupancy Time

Note: (6 ms on time/pulse) X (52 pulses / 20 second period)= 312 msec

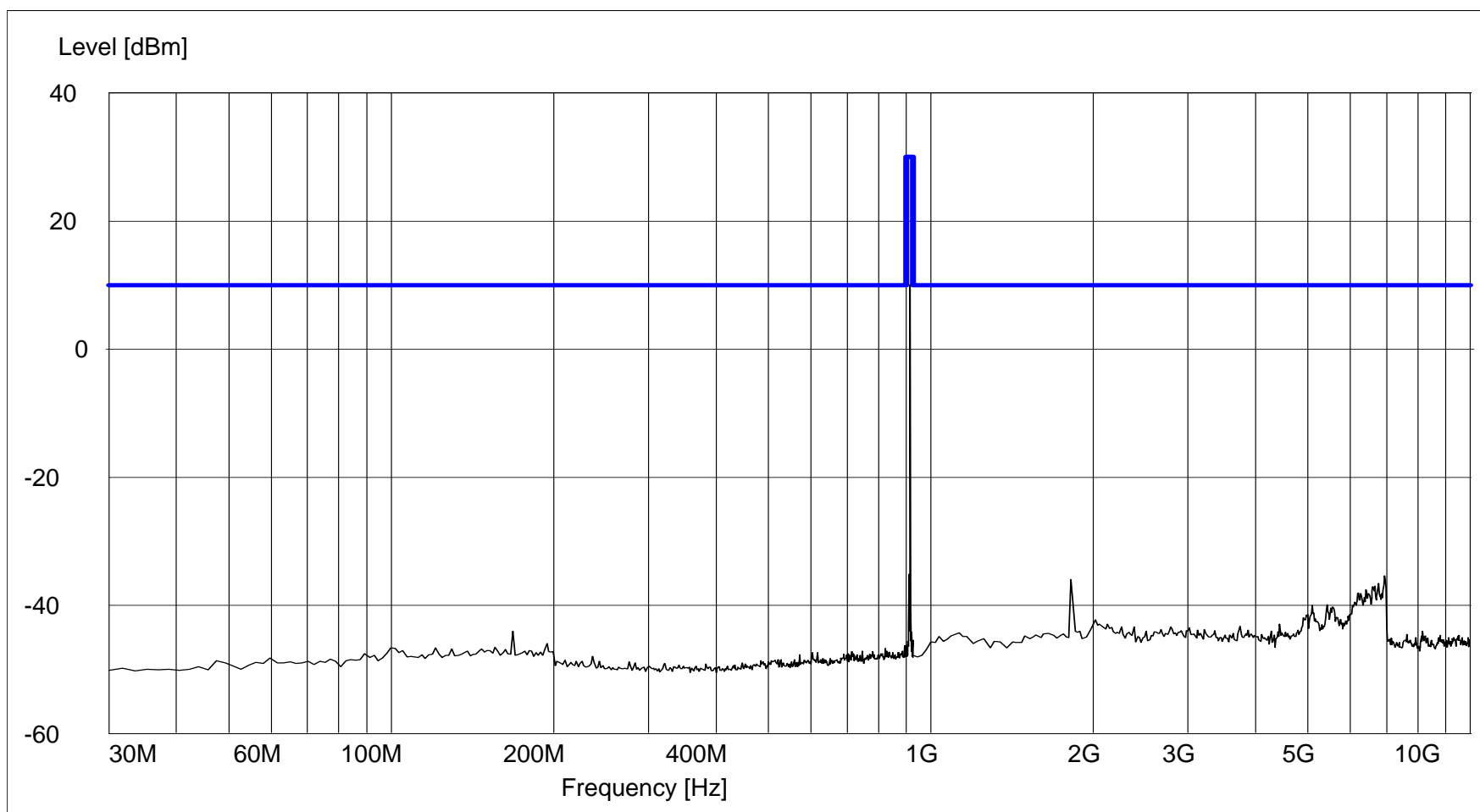
Customer	The Sapling Company, Inc.	
Test Sample	Transceiver	
Model Number	LPM-900-1	
Date: 10/21/11	Tech: D.Fiore	Sheet 3 of 3

**FCC Part 15, Subpart C Conducted Emissions, Power Output
Paragraph 15.247(b) RF Power Output
Test Data**

**FCC Part 15, Subpart C, Section 15.247(d), Spurious Emissions, Antenna Conducted
Test Data**

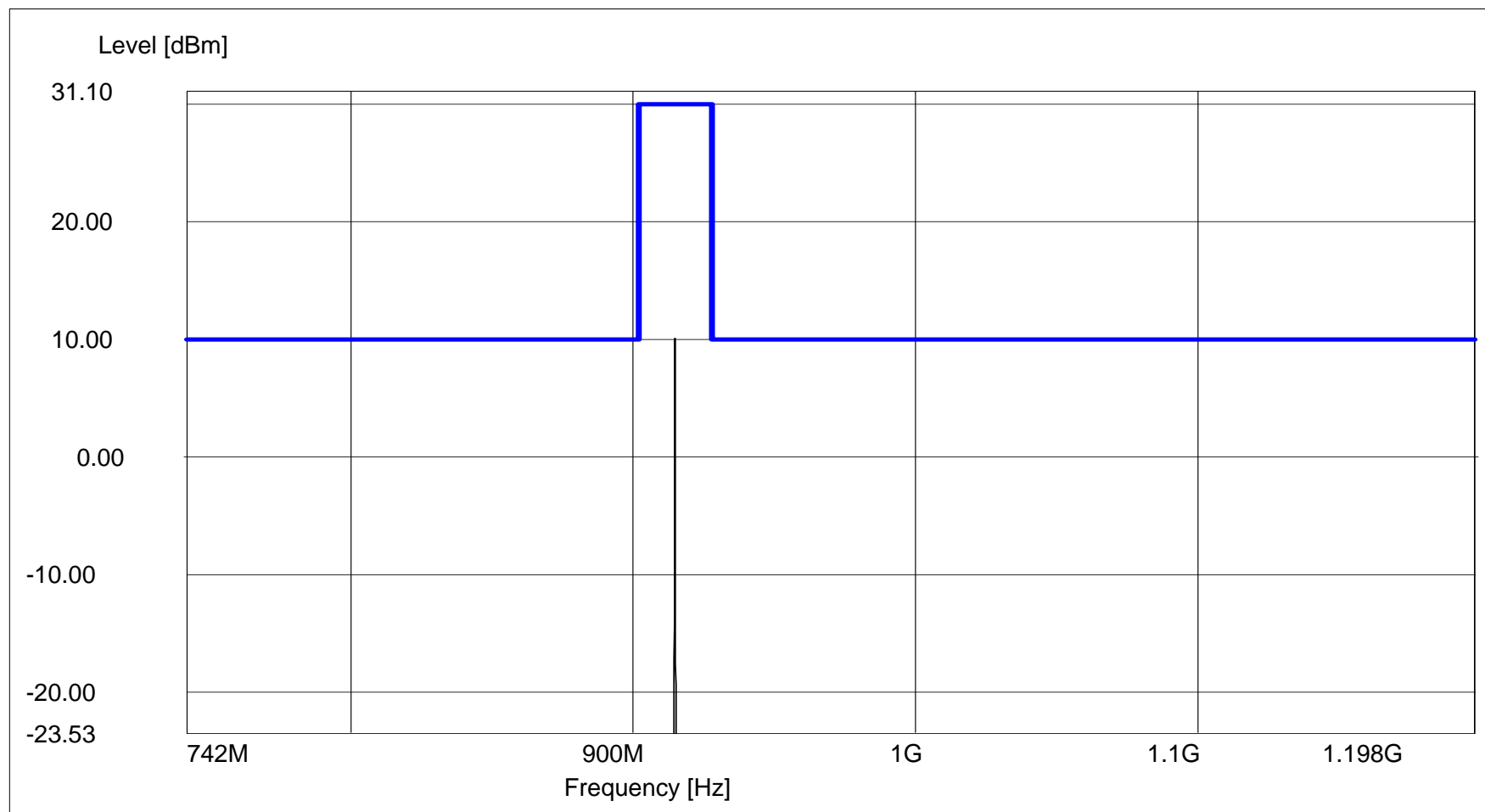
Antenna Conducted Emissions

Customer: Sapling Inc.
Test Sample: Transceiver
Part Number: LPA1
Test Specification: FCC 15.247 (d)
Mode of Operation: Continuous CW Transmission at Discrete Hopping Frequencies
Technician/Date: D.Fiore / 10-14-11
Lead Tested: Antenna Port
Note: Low Channel 1



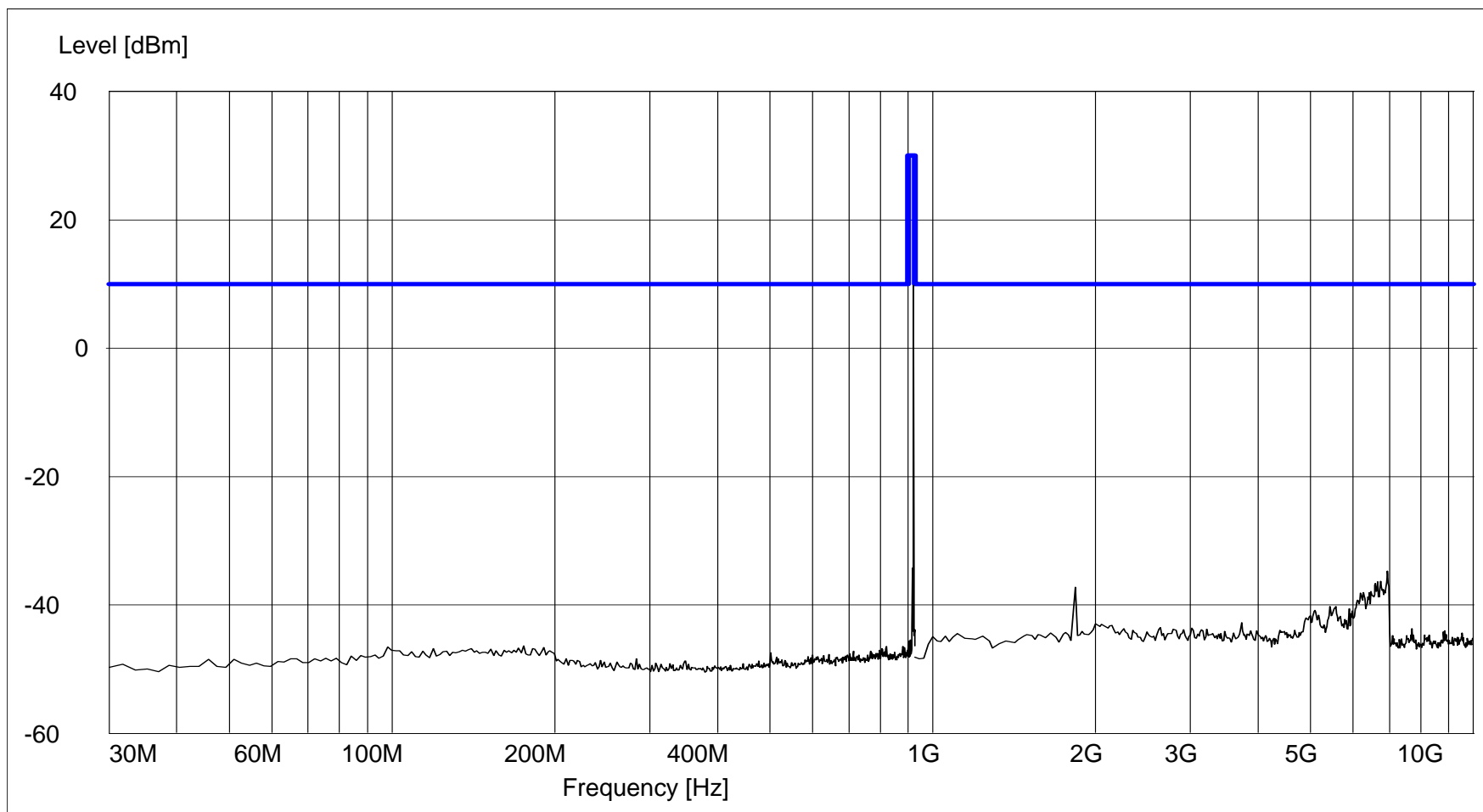
Antenna Conducted Emissions

Customer: Sapling Inc.
Test Sample: Transceiver
Part Number: LPA1
Test Specification: FCC 15.247 (d)
Mode of Operation: Continuous CW Transmission at Discrete Hopping Frequencies
Technician/Date: D.Fiore / 10-14-11
Lead Tested: Antenna Port
Note: Low Channel 1



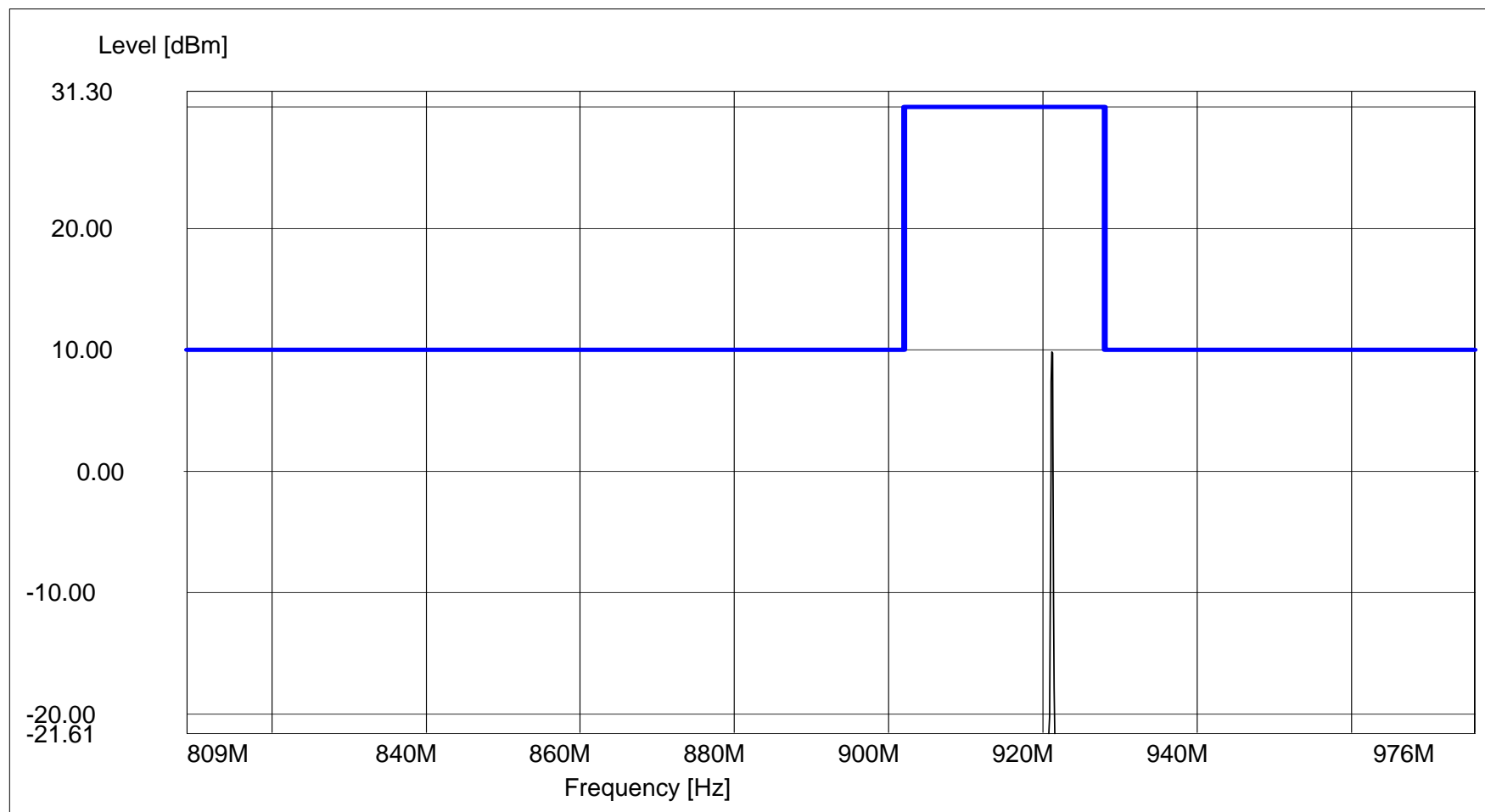
Antenna Conducted Emissions

Customer: Sapling Inc.
Test Sample: Transceiver
Part Number: LPA1
Test Specification: FCC 15.247 (d)
Mode of Operation: Continuous CW Transmission at Discrete Hopping Frequencies
Technician/Date: D.Fiore / 10-14-11
Lead Tested: Antenna Port
Note: Mid Channel 2



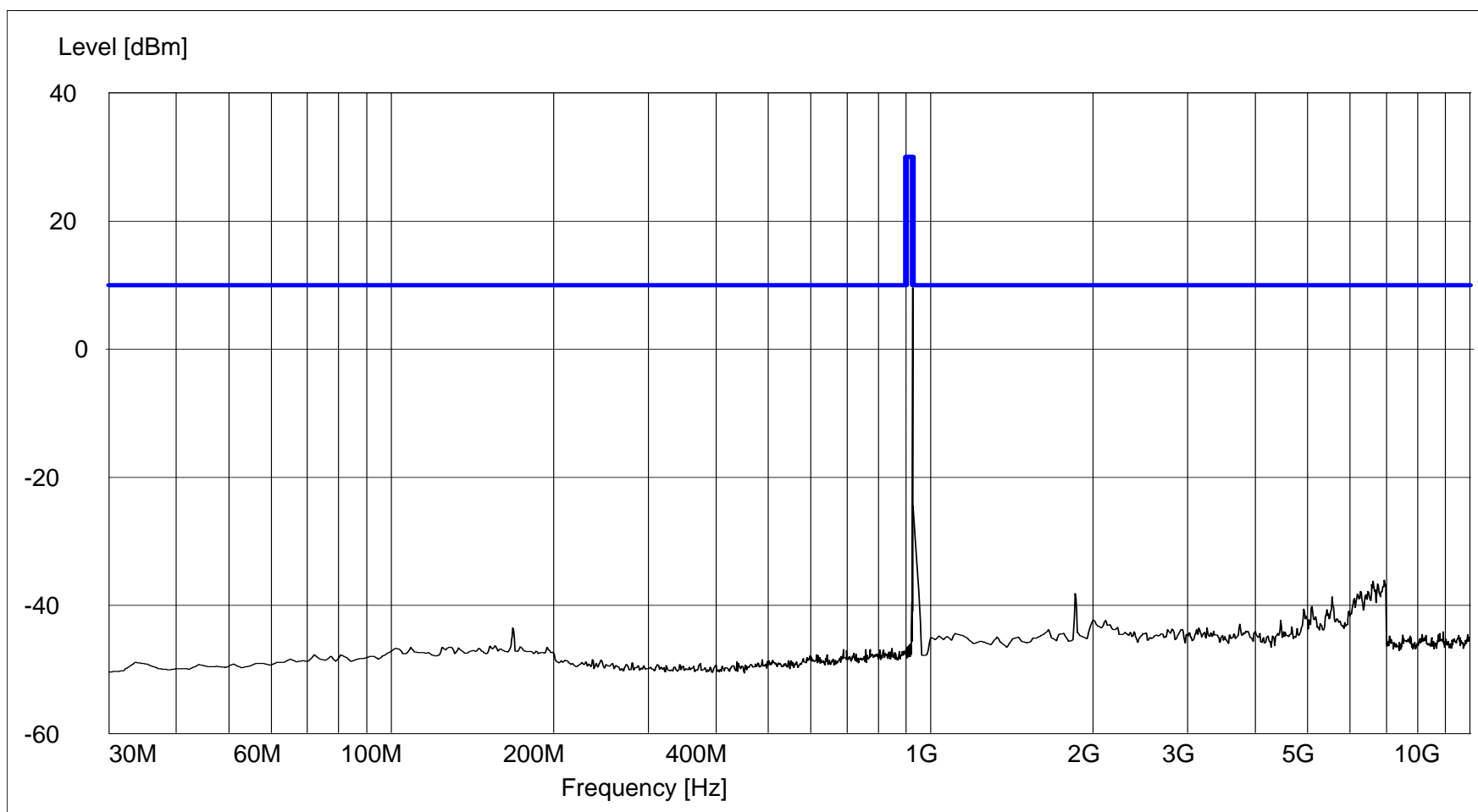
Antenna Conducted Emissions

Customer: Sapling Inc.
Test Sample: Transceiver
Part Number: LPA1
Test Specification: FCC 15.247 (d)
Mode of Operation: Continuous CW Transmission at Discrete Hopping Frequencies
Technician/Date: D.Fiore / 10-14-11
Lead Tested: Antenna Port
Note: Mid Channel 2



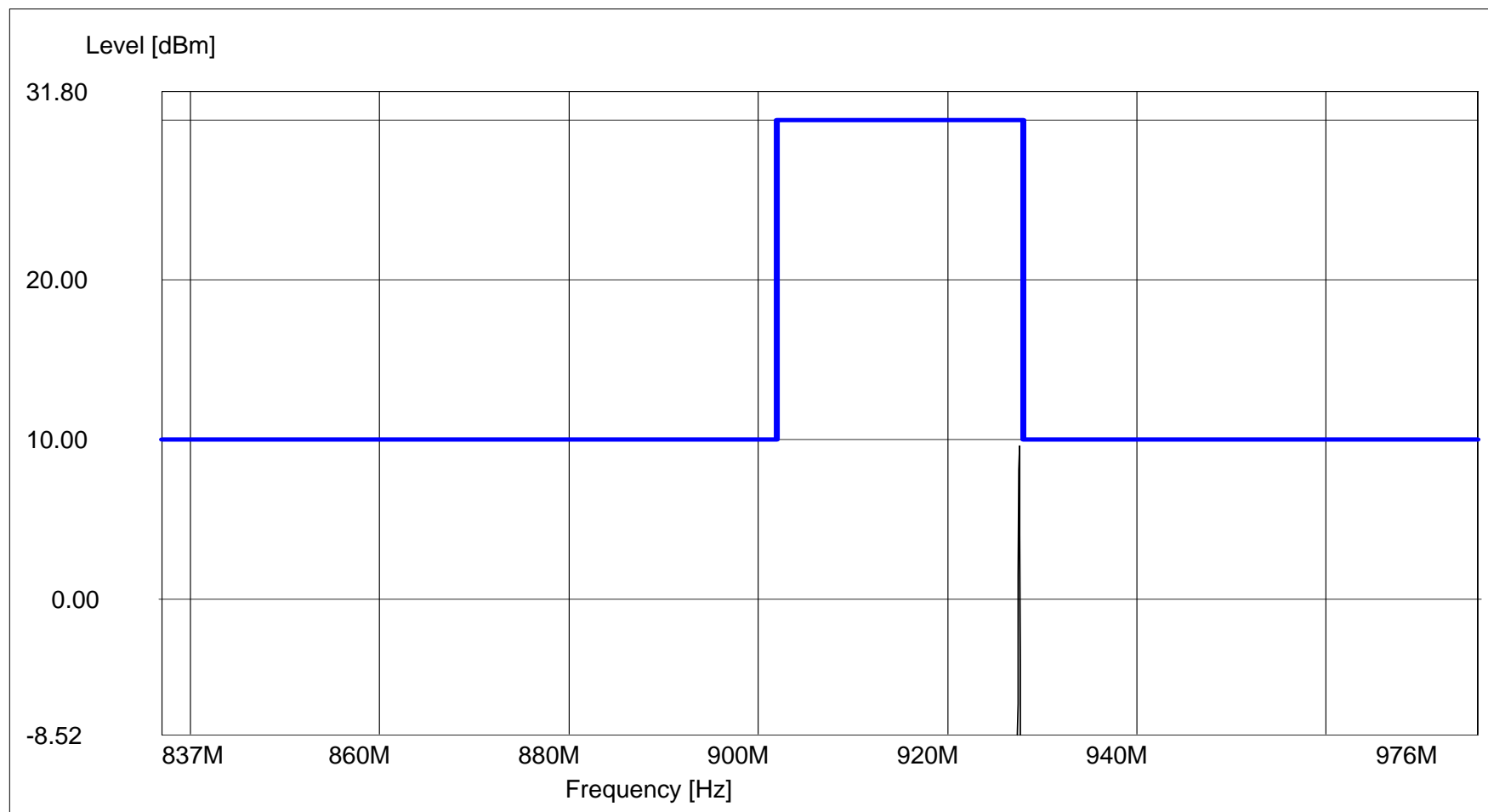
Antenna Conducted Emissions

Customer: Sapling Inc.
Test Sample: Transceiver
Part Number: LPA1
Test Specification: FCC 15.247 (d)
Mode of Operation: Continuous CW Transmission at Discrete Hopping Frequencies
Technician/Date: D.Fiore / 10-14-11
Lead Tested: Antenna Port
Note: High Channel 3



Antenna Conducted Emissions

Customer: Sapling Inc.
Test Sample: Transceiver
Part Number: LPA1
Test Specification: FCC 15.247 (d)
Mode of Operation: Continuous CW Transmission at Discrete Hopping Frequencies
Technician/Date: D.Fiore / 10-14-11
Lead Tested: Antenna Port
Note: High Channel 3

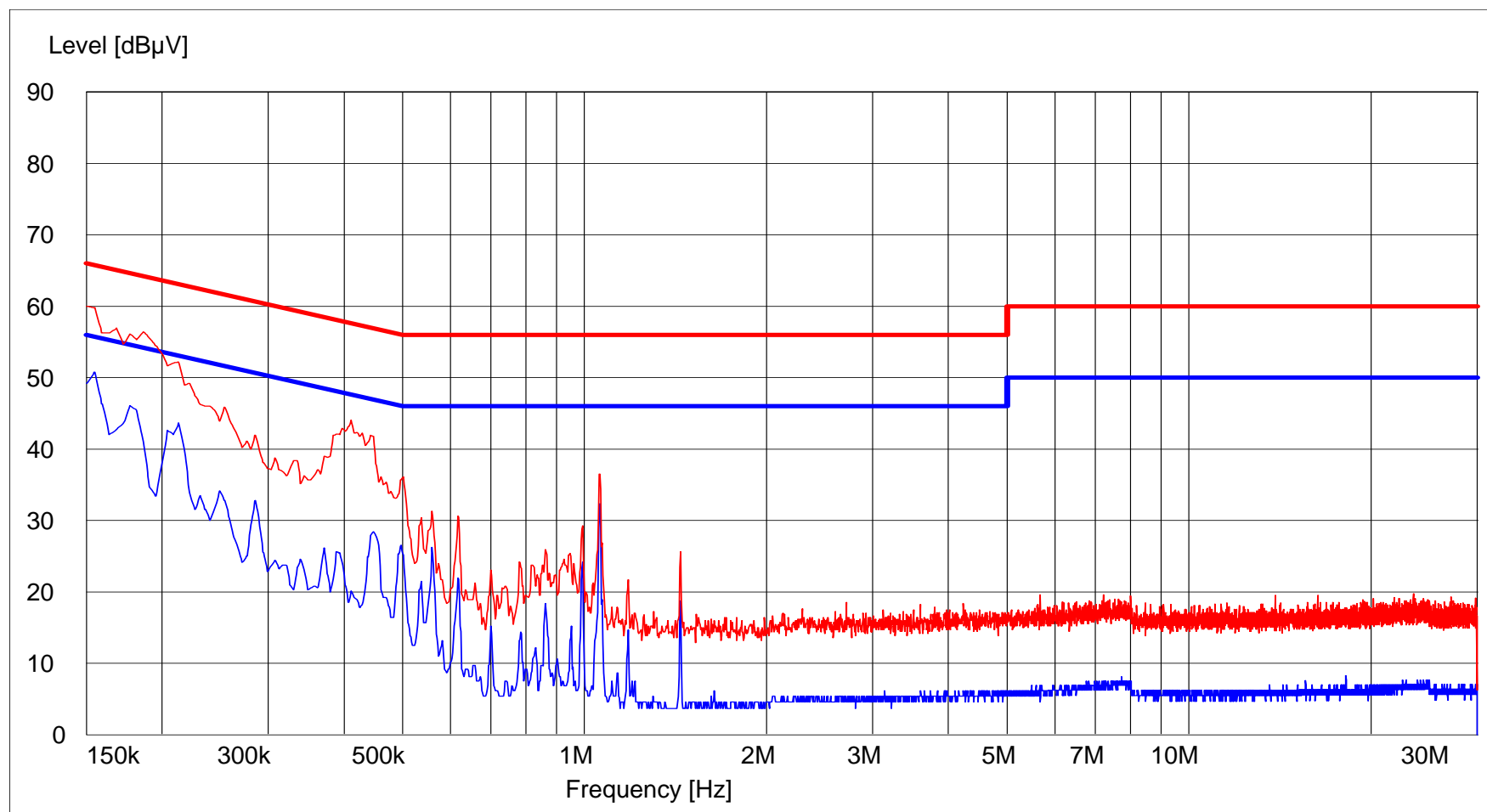


**Paragraph 15.247(d), Field Strength of Spurious Emissions
32.7 kHz to 10 GHz
Test Data**

**FCC Part 15, Subpart C, Section 15.207(a), Conducted Emissions, Power Leads
150 kHz to 30 MHz
Test Data**

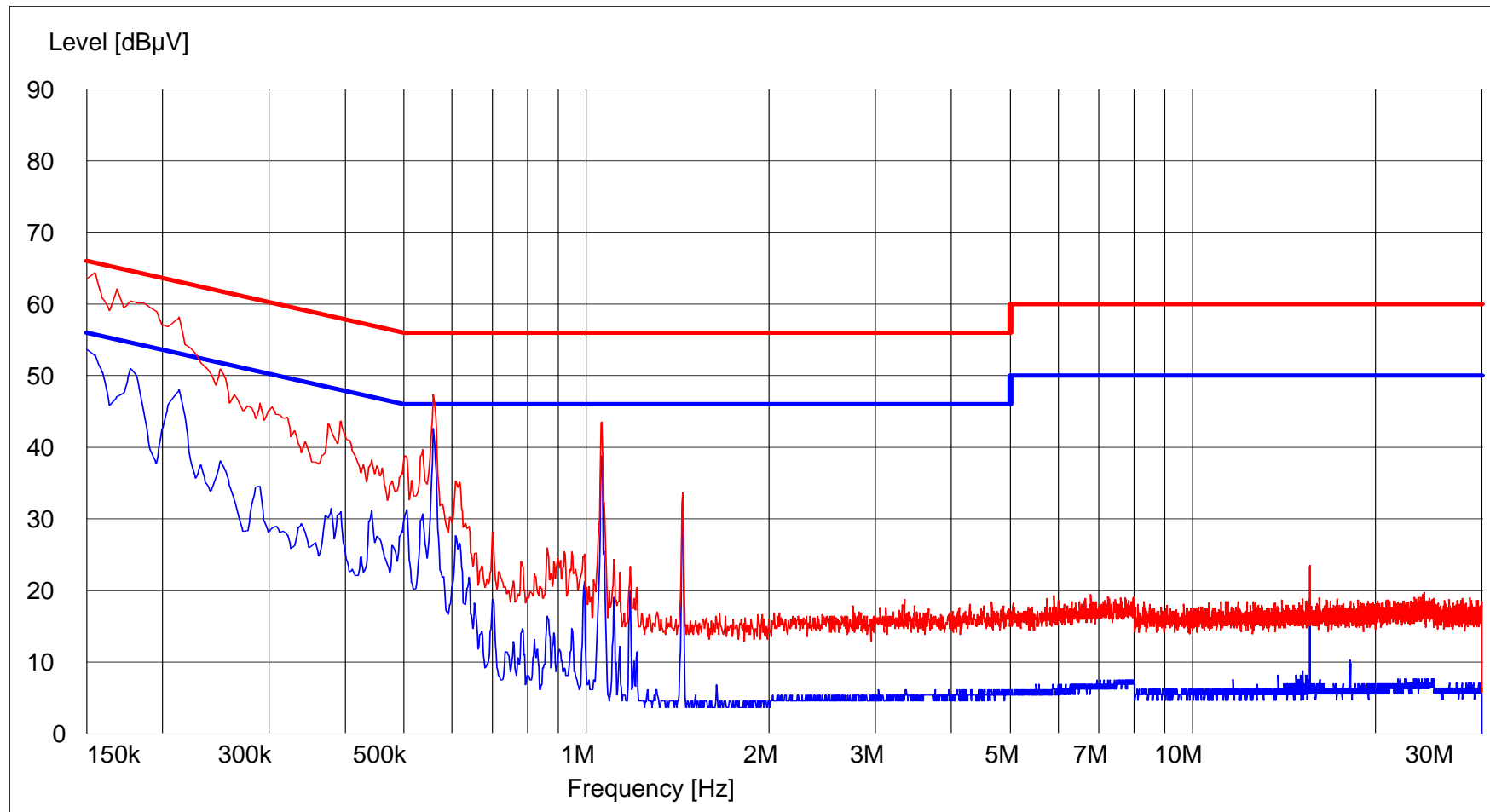
Retlif Testing Laboratories, R-1735P

Customer: The Sapling Company, Inc.
Test Sample: Transceiver
Model Number: LPM-900-1
Test Specification: FCC 15.207(a)
Mode of Operation: Continuous Modulated Transmissions under Normal Conditions
Technician/Date: D.Fiore / 10-4-11
Lead Tested: 120VAC, 60 Hz Hot
Notes:



Retlif Testing Laboratories, R-1735P

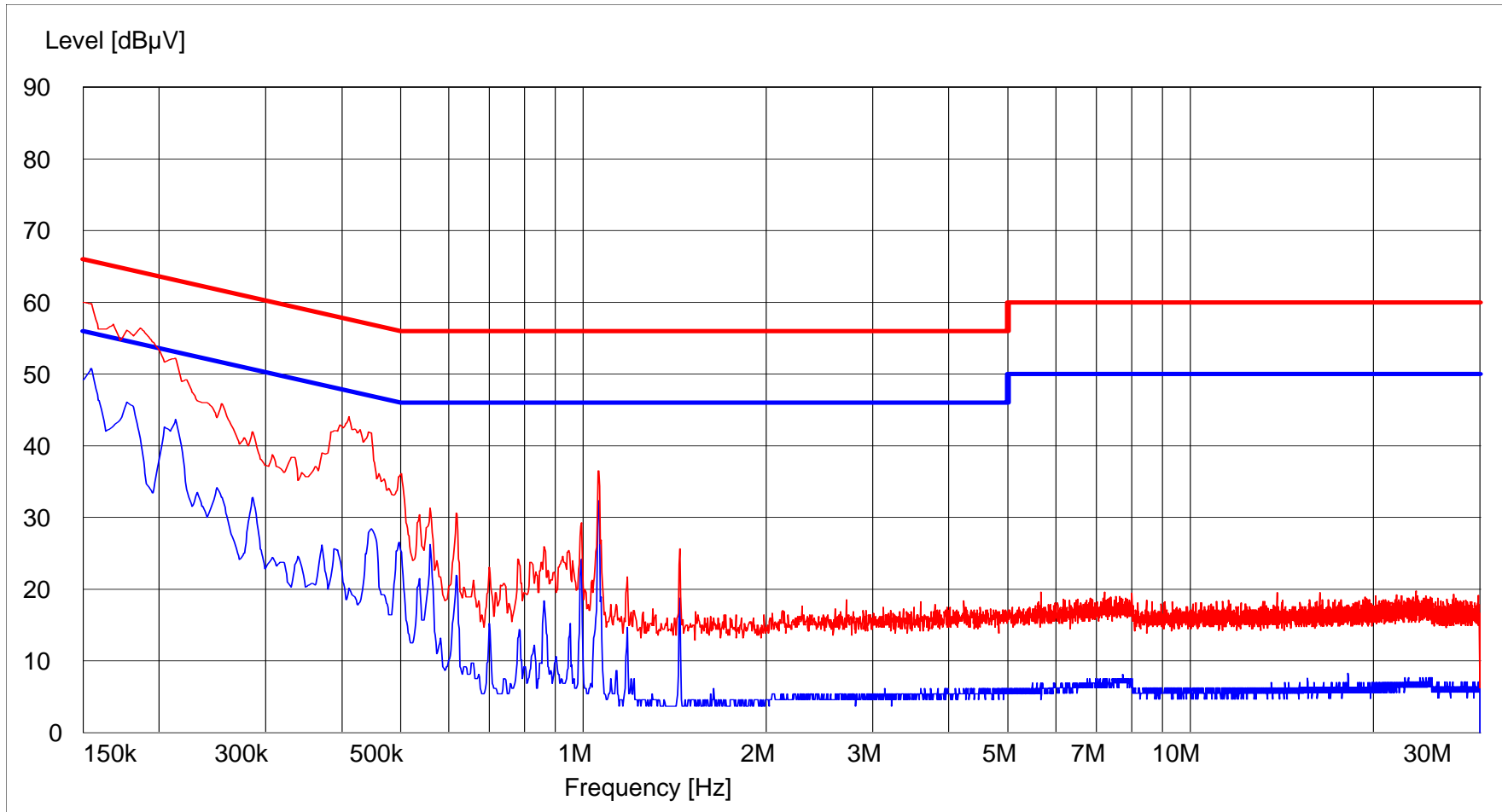
Customer: The Sapling Company, Inc.
Test Sample: Transceiver
Model Number: LPM-900-1
Test Specification: FCC 15.207(a)
Mode of Operation: Continuous Modulated Transmissions under Normal Conditions
Technician/Date: D.Fiore / 10-4-11
Lead Tested: 120VAC, 60 Hz Neutral
Notes:



**FCC Part 15, Subpart C, Section 15.107(a), Conducted Emissions, Power Leads
150 kHz to 30 MHz
Test Data**

Retlif Testing Laboratories, R-1735P

Customer: The Sapling Company, Inc.
Test Sample: Transceiver
Model Number: LPM-900-1
Test Specification: FCC 15.107(a)
Mode of Operation: Continuous Modulated Transmissions under Normal Conditions
Technician/Date: D.Fiore / 10-4-11
Lead Tested: 120VAC, 60 Hz Hot
Notes:



Retlif Testing Laboratories, R-1735P

Customer: The Sapling Company, Inc.
Test Sample: Transceiver
Model Number: LPM-900-1
Test Specification: FCC 15.107(a)
Mode of Operation: Continuous Modulated Transmissions under Normal Conditions
Technician/Date: D.Fiore / 10-4-11
Lead Tested: 120VAC, 60 Hz Neutral
Notes:

