

**COMPLIANCE WORLDWIDE INC.
TEST REPORT 180-20**

**In Accordance with the Requirements of
FCC PART 15.247, SUBPART C
Innovation, Science and Economic Development Canada
RSS-247, Issue 2**

**Low Power License-Exempt Radio Communication Devices
Intentional Radiators**

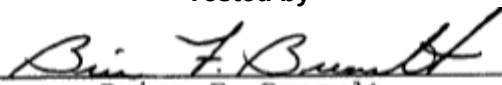
**Issued to
BLP Technologies
3 Essex Square
Essex, CT 06426**

**for the
Wireless Ceiling Sensor
and the
Wireless Wide View Sensor
915 MHz Transmitter**

**FCC ID: 2AVRY-SWX0002
IC: 26012-SWX0002
HVIN: 830-45E-10000**

Report Issued on April 17, 2020

Tested by


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Reviewed by


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1. Scope

This test report certifies that the BLP Technologies Ceiling Sensor, SWX-201-B, 915 MHz Transmitter and Wide View Sensor, SWX-401-B, 915 MHz Transmitter, HVIN: 830-45E-10000 as tested, meet the FCC Part 15, Subpart C and ISED Canada RSS-247, Issue 2 requirements. The scope of this test report is limited to the test samples provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated, and a retest may be required.

The two devices included in this test report contain modules that are mechanically and electrically identical in all respects. The only difference between the two devices are the plastic enclosures. For the sake of this test report, the SWX-201-B was used for all conducted mode measurements. For radiated mode measurements, both units were tested individually to account for the battery position relative to the module.

2. Product Details

2.1. Manufacturer:	BLP Technologies
2.2. Model Number:	803-45E-10000
2.3. Serial Number:	None (Production firmware will contain serial numbers)
2.4. Description:	Wireless ceiling mount sensor
2.5. Power Source:	DC 3.6 Volt, CR123 Lithium Battery
2.6. Hardware Revisions:	175-00045 Rev E (SWX-201-B & SWX-201-B)
2.7. Software Revision:	Firmware revision 510-45E-1.0.0
2.8. Modulation Type:	FSK
2.9. Operating Frequency:	915 MHz Nominal, 903 MHz, 915 MHz and 927 MHz tested
2.10. EMC Modifications:	None

3. Product Configuration

3.1. Operational Characteristics & Software

Note: The supplied test samples contained firmware configured specifically for EMC testing and not normal operation.

The device under test contains a single tach switch that is used to enable/disable continuous transmission on a selected channel. Each time the button is pressed, the blue led will illuminate providing feedback of a switch being activated/closed. Once released, the blue led will turn off. Here is the menu list of available commands:

- Stop any wireless transmission: push and release the tach switch once. Upon successful entry of the command, the white led will burst flash (rapidly turn on and off) once for about 1 second.
- Continuously transmit the max output power on channel 1, 903MHz (lowest channel): push and release the tach switch two times (the time in between switch press/releases should be less than 2 seconds). Upon successful entry of the command, the blue led will burst flash (rapidly turn on and off) twice. There will be a 1 second delay in between blue burst flashes.

3. Product Configuration (continued)

3.1. Operational Characteristics & Software (continued)

- Continuously transmit the max output power on channel 11, 915MHz (middle channel): push and release the tach switch three times (the time in between switch press/releases should be less than 2 seconds). Upon successful entry of the command, the blue led will burst flash (rapidly turn on and off) twice. There will be a 1 second delay in between blue burst flashes.
- Continuously transmit the max output power on channel 21, 927MHz (upper channel): push and release the tach switch four times (the time in between switch press/releases should be less than 2 seconds). Upon successful entry of the command, the blue led will burst flash (rapidly turn on and off) twice. There will be a 1 second delay in between blue burst flashes.

3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number ¹	Input Voltage	Freq (Hz)	Description/Function
BLP Technologies	Ceiling Mount Sensor	None	3.6	DC	
BLP Technologies	Wide View Sensor	None	3.6	DC	

¹Regular production firmware will contain a serial number for: (1) manufacturing traceability and (2) a means for wirelessly pairing/linking devices.

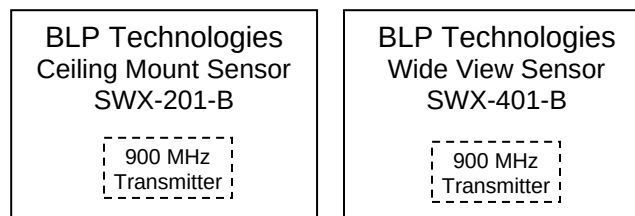
3.3. EUT Cables/Transducers

Cable Type	Length	Shield	From	To
None				

3.4. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
None				

3.5. Block Diagrams



4. Measurements Parameters

4.1 Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz ¹	Rohde & Schwarz	ESR7	101156	9/10/2020	2 Years
EMI Test Receiver, 10 Hz - 7GHz ¹	Rohde & Schwarz	ESR7	101770	10/3/2020	2 Years
Spectrum Analyzer, 2 Hz to 26.5 GHz ²	Rohde & Schwarz	FSW26	102057	9/13/2020	2 Years
Spectrum Analyzer, 9 kHz to 40 GHz ³	Rohde & Schwarz	FSV40	100899	9/10/2020	2 Years
EMI Receiver 9 kHz - 1 GHz	Hewlett Packard	8546A	3650A00360	9/11/2020	2 Years
Loop Antenna 9 kHz - 30 MHz	EMCO	6512	9309-1139	1/28/2022	3 Years
Biconilog Antenna, 30 MHz to 2 GHz	Sunol Sciences Corp	JB1	A050913	6/5/2022	2 Years
Horn Antenna, 960 MHz to 18 GHz	Electro-Metrics	EM-6961	6337	10/3/2020	2 Years
Horn Antenna, 18 GHz to 40 GHz	Com-Power	AH-840	03075	1/7/2021	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	9/11/2020	2 Years
1.8 GHz - 9.3 GHz Passband Filter	Mini-Circuits	VHP-16	0341	3/23/2021	1 Year
Digital Barometer	Extech Instruments	SD700	Q590483	9/6/2020	1 Year
Temperature Chamber	Associated Environmental	SD-308	10782	CNR	

¹ ESR7 Firmware revision: V3.46 SP1, Date installed: 12/22/2018

² FSW26 Firmware revision: V4.30 SP1, Date installed: 02/22/2019

³ FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016

Previous V3.36 SP2, installed 12/5/2018.

Previous V3.36 SP2, installed 10/26/2018.

Previous V2.30 SP1, installed 10/22/2014.

4.2. Measurement Software

Manufacturer	Software Description	Title or Model #	Rev.	Report Sections
Compliance Worldwide	Test Report Generation Software	Test Report Generator	1.0	Not required for this product

4.3. Measurement & Equipment Setup

Test Dates:	April 6 th to April 17 th 2020
Test Engineers:	Brian Breault
Normal Site Temperature (15 - 35°C):	21.7
Relative Humidity (20 - 75%RH):	32%
Frequency Range:	1 MHz to 10 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	9 kHz – 150 kHz to 30 MHz 120 kHz – 30 MHz to 1 GHz 1 MHz – Above 1 GHz
EMI Receiver Avg Bandwidth:	30 kHz – 150 kHz to 30 MHz 300 kHz – 30 MHz to 1 GHz 3 MHz – Above 1 GHz
Detector Function:	Peak, QP - 150 kHz to 1 GHz Peak, Avg - Above 1 GHz Unless otherwise specified.

4. Measurements Parameters (continued)

4.4. Measurement Procedures

Test measurements were made in accordance FCC Part 15.247: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5850 MHz, and 24.0 - 24.25 GHz.

The measurement procedures in this report are in accordance with ANSI C63.10-2013: *American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*. FCC OET Publication Number KDB 558074 D01 v05r02, *Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS), Frequency Hopping Spread Spectrum Systems, and Hybrid System Devices Operating Under §15.247*, dated April 2, 2019, was also referenced for the test procedures used to generate the data in this report. All references to these publications refer to this versions and dates detailed in this paragraph.

4.5. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency	$\pm 1 \times 10^{-8}$
Radiated Emission of Transmitter	± 4.55 dB
Radiated Emission of Receiver	± 4.55 dB
Temperature	$\pm 0.91^{\circ}$ C
Humidity	$\pm 5\%$

5. Choice of Equipment for Test Suits

5.1 Choice of Model

This test report is based on the test samples supplied by the manufacturer and are reported by the manufacturer to be equivalent to the production units.

5.2 Presentation

This test sample was tested complete with all required ancillary equipment. Refer to Section 3 of this report for product equipment configuration.

5.3 Choice of Operating Frequencies

The BLP Technologies Ceiling Sensor, model SWX-201-B, as tested, operates on 21 channels in the 902 MHz to 928 MHz band.

In accordance with ANSI C63.10-2013, section 5.6, and FCC Part 15.31 (m), the choice of operating frequencies selected for the testing detailed in this report are outlined in the following table:

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	903.0	8	911.4	15	919.8
2	904.2	9	912.6	16	921.0
3	905.4	10	913.8	17	922.2
4	906.6	11	915.0	18	923.4
5	907.8	12	916.2	19	924.6
6	909.0	13	917.4	20	925.8
7	910.2	14	918.6	21	927.0

6. Measurement Summary

Test Requirement	FCC Rule Requirement	ISED Rule Requirement	Test Report Section	Result
Antenna Requirement	15.203	---	7.1	Compliant
Minimum DTS Bandwidth	15.247 (a) (2)	RSS-247 5.2 a)	7.2	Compliant
Maximum Peak Conducted Output Power	15.247 (b) (1)	RSS-247 5.4 d)	7.3	Compliant
Operation with directional antenna gains greater than 6 dBi	15.247 (b) (4)	---	7.4	Compliant
Spurious Radiated Emissions	15.247 (d)	RSS-GEN 6.13	7.5	Compliant
Spurious Radiated Emissions (> GHz) - Harmonic Measurements	15.247 (d)	RSS-GEN 6.13		Compliant
Band Edge Measurements	15.247 (d)	RSS-GEN 6.13	7.6	Compliant
Emissions in Non-restricted Frequency Bands	15.247(e)	RSS-GEN 6.13	7.7	Compliant
Peak Power Spectral Density	15.247(e)	RSS-247 5.2 b)	7.8	Compliant
AC Power Line Conducted Emissions	15.207	RSS-GEN 7.2	N/A	Battery Operated
Duty Cycle	15.247	N/A	7.9	Compliant
99% (Occupied) Bandwidth	---	RSS-GEN 6.7	7.10	Compliant
Public Exposure to Radio Frequency Energy Levels	1.1307 (b) (1)	RSS-GEN, Issue 5, Section 3.4, RSS 102	7.11	Compliant

7. Measurement Data

7.1. Antenna Requirement (15.203)

Requirement: 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.

Results: The BLP Technologies SWX-201-B and SWX-401-B utilize a Johanson Technology 0915AT43A0026 chip antenna that is not user replaceable.

7. Measurement Data

7.2. Minimum DTS Bandwidth (15.247 (a) (2), ISSED_RSS-247 5.2 a))

Requirement: 15.247 (a) (2)

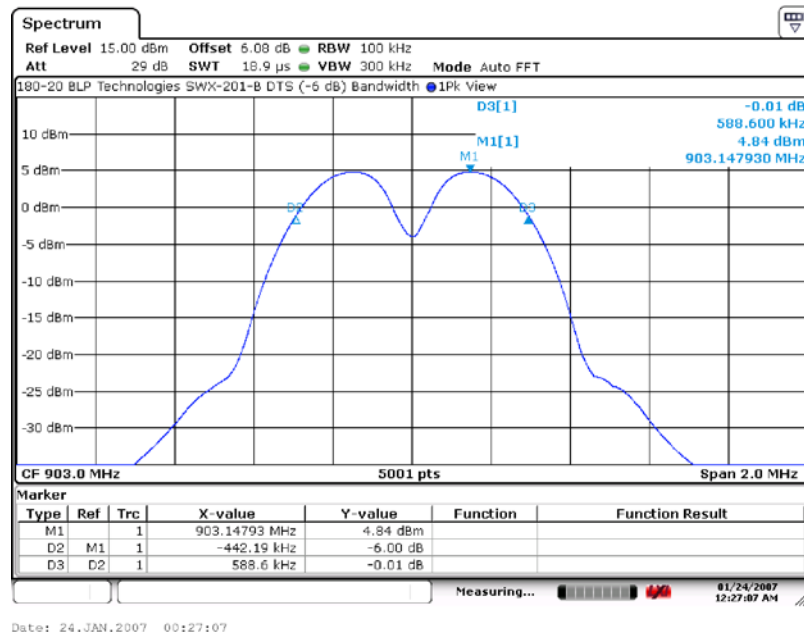
Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 8.1 Option 1, DTS (6 dB) Channel Bandwidth.

Results: The device under test meets the minimum 500 kHz DTS (6 dB) bandwidth requirement.

Channel	Frequency (MHz)	-6 dB Bandwidth (kHz)	Minimum -6 dB Bandwidth (kHz)	Result
1	903	588.60	>500	Compliant
11	915	586.68	>500	Compliant
21	927	585.88	>500	Compliant

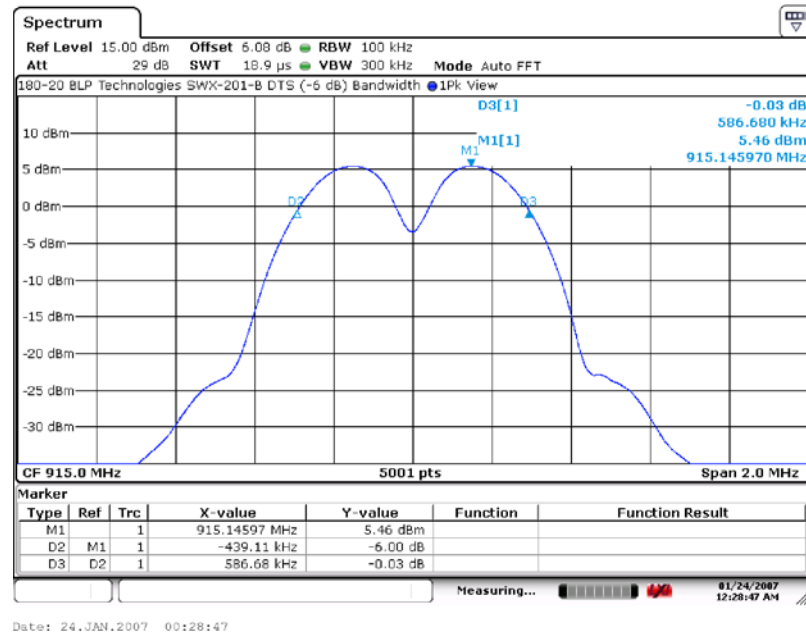
7.2.1. Low Channel – 1, 903 MHz



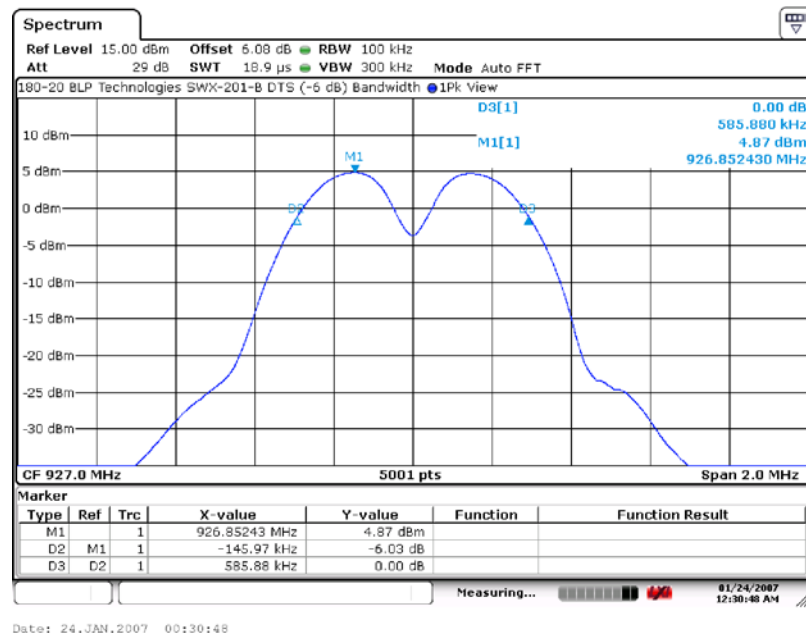
7. Measurement Data

7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

7.2.2. Middle Channel – 11, 915 MHz



7.2.3. High Channel – 21, 927 MHz



7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power (FCC 15.247 (b)(3), ISED RSS-247 5.4 d)

Requirement: (15.247 (b) (3))

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt (+30 dBm).

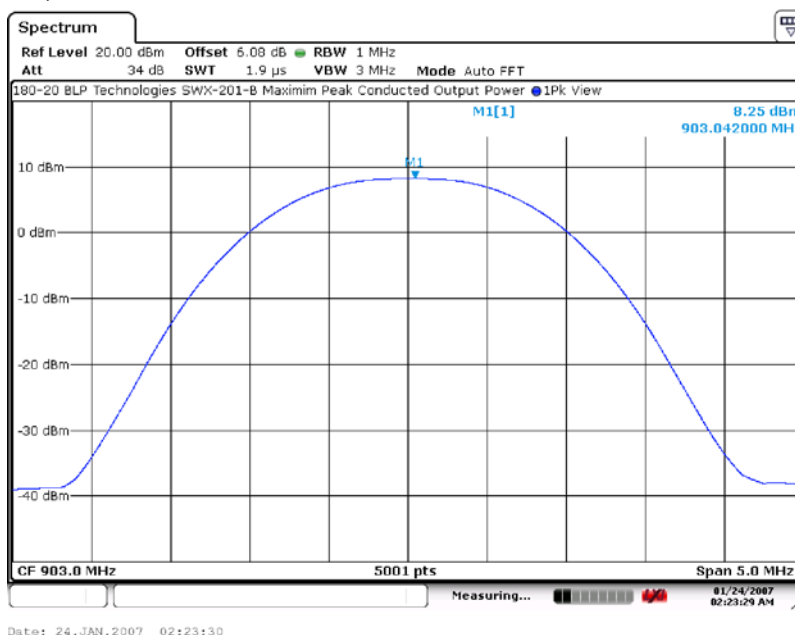
Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number KDB 558074, Section 9.1.1.

Test Note: A spectrum analyzer resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz were used to meet the requirements of FCC OET publication number 558074, Section 9.1.1 and the measured product DTS bandwidth.

Results: The device under test meets the required maximum peak conducted output power level of 1 Watt (30 dBm).

Channel	Frequency	Maximum Peak Conducted Output Power	Peak Limit	Margin	Result
	(MHz)	(dBm)	(dBm)	(dB)	
1	903	8.25	30	-21.75	Compliant
11	915	9.05	30	-20.95	Compliant
21	927	8.37	30	-21.63	Compliant

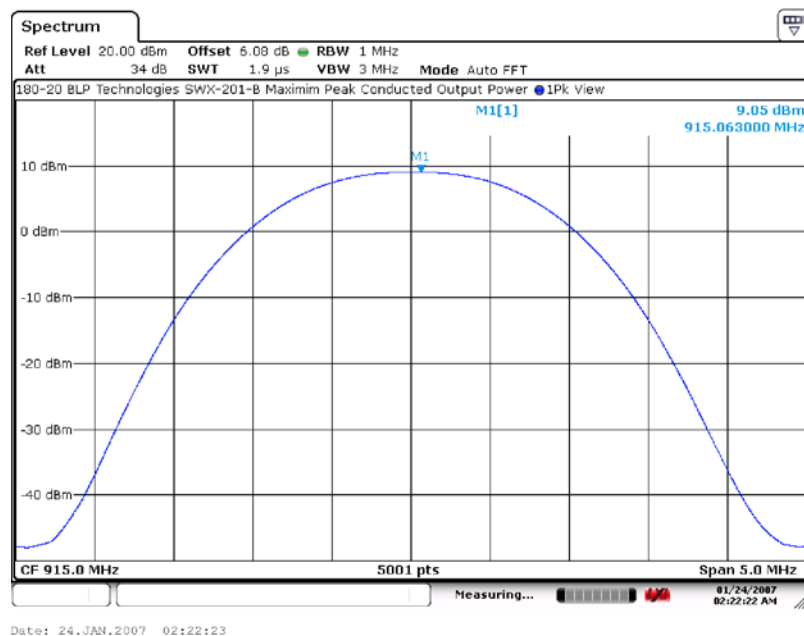
7.3.1. Low Channel – 1, 903 MHz



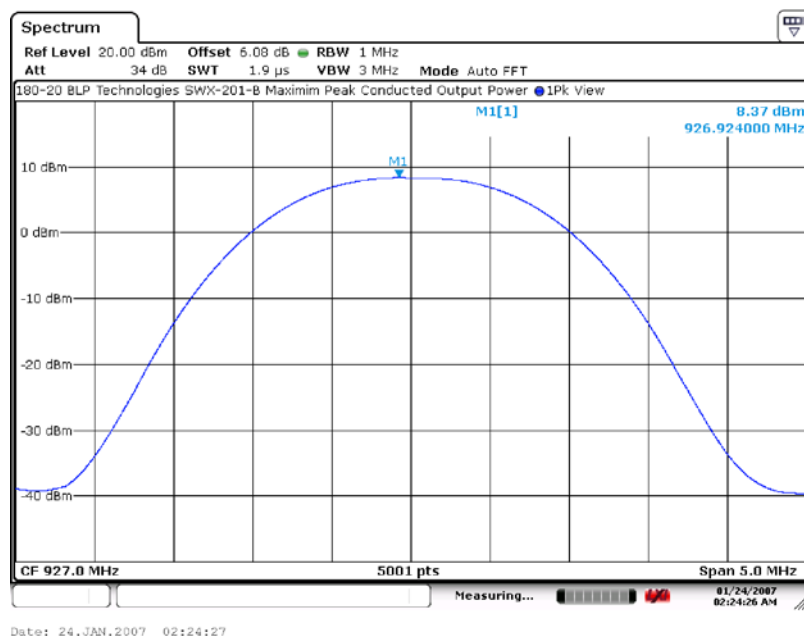
7. Measurement Data

7.3. Maximum Peak Conducted Output Power (continued)

7.3.2. Middle Channel – 11, 915 MHz



7.3.3. High Channel – 21, 927 MHz



7. Measurement Data

7.4. Operation with directional antenna gains greater than 6 dBi (15.247 (b)(4))

Requirement: 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 paragraphs (b)(1), (b)(2), and (b)(3) of FCC Part 15.247, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Procedure: Not applicable for the device under test.

DUT Status: Both devices under test utilize a Johanson Technology 0915AT43A0026 chip antenna with a peak gain of -1 dBi and therefore is exempt from this requirement.

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (1 MHz to 10 GHz) (FCC 15.209, ISED RSS-GEN 6.13)

7.5.1 Transmitter Spurious Radiated Emissions

Requirement: (15.209) The Emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency Range (MHz)	Distance (Meters)	Limit (dBμV/m) ¹
0.009 to 0.490	3	128.5 to 93.8
0.490 to 1.705	3	73.8 to 63.0
1.705 to 30	3	69.5
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
>960	3	54.0

¹Measurements in the 9 to 90 kHz, 110 to 490 kHz and above 1000 MHz ranges employ an average detector. Otherwise a quasi-peak detector is used.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 12.0: Emissions in restricted frequency bands and FCC 47CFR Part 15.209: Radiated Emission Limits; General Requirements.

The test methods used to generate the data in this test report is in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

Test Notes: Measurements were made from the lowest oscillator frequency as stated by the manufacturer (1 MHz) to the 10th harmonic of the highest transmitter frequency (9270 MHz).

Reference FCC Part 15.33(a) and FCC Part 15.33(a)(1).

The manufacturer lists the frequencies generated by this device as follows:

Serial peripheral interface	1.0 MHz
μController main processing clock	4.0 MHz
Phase lock loop reference	12.8 MHz
Highest transmitter frequency	927.0 MHz

The spurious radiated emissions scans used for the following tables can be found in Appendix A. Note that the unmarked emissions in these scans are harmonic emissions and are detailed in section 7.5.2.

Results: Compliant. The emissions from the two devices detailed in this report DUT did not exceed the field strength levels specified in the above table. Reference the tables on the following page.

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (1 MHz to 10 GHz) (FCC 15.209, ISED RSS-GEN 6.13)

7.5.1 Transmitter Spurious Radiated Emissions

7.5.1.1. SWX-201-B

Frequency Range	Worst-Case Measured Frequency	Field Strength	FCC Part 15.209 Limit	Margin	Reference	Receive Antenna Polarity
	(MHz)	(dBμV/m)	(dBμV/m)	(dB)	Appendix A	(H/V)
1 MHz - 30 MHz	1.00675	51.85	67.56	-15.71	A1.1.3.2.	Perpendicular
30 MHz - 1000 MHz	824.01000	28.24	46.00	-17.76	A1.2.3.1.	H
1000 MHz - 9270 MHz	6982.90000	46.45	54.00	-7.55	A1.3.1.1.	H

7.5.1.2. SWX-401-B

Frequency Range	Worst-Case Measured Frequency	Field Strength	FCC Part 15.209 Limit	Margin	Reference	Receive Antenna Polarity
	(MHz)	(dBμV/m)	(dBμV/m)	(dB)	Appendix A	(H/V)
1 MHz - 30 MHz	1.00675	51.96	67.56	-15.60	A2.1.2.2.	Perpendicular
30 MHz - 1000 MHz	852.09000	27.85	46.00	-18.15	A2.2.2.1.	H
1000 MHz - 9270 MHz	7884.10000	46.52	54.00	-7.48	A2.3.2.1.	H

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (30 kHz to 40 GHz) (FCC 15.209, ISED RSS-GEN 6.13)

7.5.2. Transmitter Spurious Radiated Emissions (Harmonic Meas.) Test Results

Worst case measurements of Harmonics that fall into the restricted bands.

7.5.2.1. SWX-201-B

Freq. (MHz)	Field Strength (dBµV/m) ¹		Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
2709.00	50.00	37.78	74.00	54.00	-24.00	-16.22	H	Compliant
2745.00	47.97	34.60	74.00	54.00	-26.03	-19.40	V	Compliant
2781.00	47.80	33.71	74.00	54.00	-26.20	-20.29	V	Compliant
3612.00	49.18	35.75	74.00	54.00	-24.82	-18.25	H	Compliant
3660.00	48.25	35.16	74.00	54.00	-25.75	-18.84	V	Compliant
3708.00	47.89	33.52	74.00	54.00	-26.11	-20.48	V	Compliant
4515.00	50.44	36.93	74.00	54.00	-23.56	-17.07	V	Compliant
4575.00	50.31	36.43	74.00	54.00	-23.69	-17.57	H	Compliant
4635.00	49.86	35.79	74.00	54.00	-24.14	-18.21	H	Compliant
5418.00	53.55	41.45	74.00	54.00	-20.45	-12.55	H	Compliant
7320.00	52.73	38.67	74.00	54.00	-21.27	-15.33	V	Compliant
7416.00	53.45	38.54	74.00	54.00	-20.55	-15.46	V	Compliant
8127.00	54.30	40.14	74.00	54.00	-19.70	-13.86	V	Compliant
8235.00	54.18	39.97	74.00	54.00	-19.82	-14.03	V	Compliant
8343.00	53.55	39.79	74.00	54.00	-20.45	-14.21	H	Compliant
9030.00	55.00	40.83	74.00	54.00	-19.00	-13.17	V	Compliant
9150.00	54.52	40.04	74.00	54.00	-19.48	-13.96	V	Compliant

¹ All correction factors are stored in the spectrum analyzer and applied to these column entries.

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (30 kHz to 40 GHz) (FCC 15.209, ISED RSS-GEN 6.13)

7.5.2. Transmitter Spurious Radiated Emissions (Harmonic Meas.) Test Results

Worst case measurements of Harmonics that fall into the restricted bands.

7.5.2.2 SWX-401-B

Freq. (MHz)	Field Strength (dBµV/m) ¹		Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
2709.00	49.55	37.08	74.00	54.00	-24.45	-16.92	H	Compliant
2745.00	47.91	34.94	74.00	54.00	-26.09	-19.06	H	Compliant
2781.00	48.07	33.97	74.00	54.00	-25.93	-20.03	H	Compliant
3612.00	47.96	34.28	74.00	54.00	-26.04	-19.72	V	Compliant
3660.00	48.53	34.98	74.00	54.00	-25.47	-19.02	V	Compliant
3708.00	47.92	33.53	74.00	54.00	-26.08	-20.47	V	Compliant
4515.00	50.74	36.52	74.00	54.00	-23.26	-17.48	H	Compliant
4575.00	50.71	36.58	74.00	54.00	-23.29	-17.42	H	Compliant
4635.00	49.85	35.94	74.00	54.00	-24.15	-18.06	V	Compliant
5418.00	55.31	44.29	74.00	54.00	-18.69	-9.71	V	Compliant
7320.00	52.80	38.49	74.00	54.00	-21.20	-15.51	V	Compliant
7416.00	53.18	38.75	74.00	54.00	-20.82	-15.25	V	Compliant
8127.00	53.57	39.54	74.00	54.00	-20.43	-14.46	H	Compliant
8235.00	54.24	39.97	74.00	54.00	-19.76	-14.03	V	Compliant
8343.00	53.54	40.14	74.00	54.00	-20.46	-13.86	H	Compliant
9030.00	54.38	40.52	74.00	54.00	-19.62	-13.48	V	Compliant
9150.00	55.66	41.21	74.00	54.00	-18.34	-12.79	V	Compliant

¹ All correction factors are stored in the spectrum analyzer and applied to these column entries.

7. Measurement Data (continued)

7.6. Band Edge Measurements (FCC 15.209, ISSED RSS-GEN 6.13)

Requirement: 15.247(d) 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 this section, 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)).

Procedure: For the lower and upper band edges, the measurements were performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 11: Emissions in non-restricted frequency bands.

Test Note: Measurements performed were conducted mode measurements.

Results: The DUT met the 20 dB requirement at the lower band edge and the Part 15.209 requirements at the upper band edge.

7.6.1. Lower Band Edge

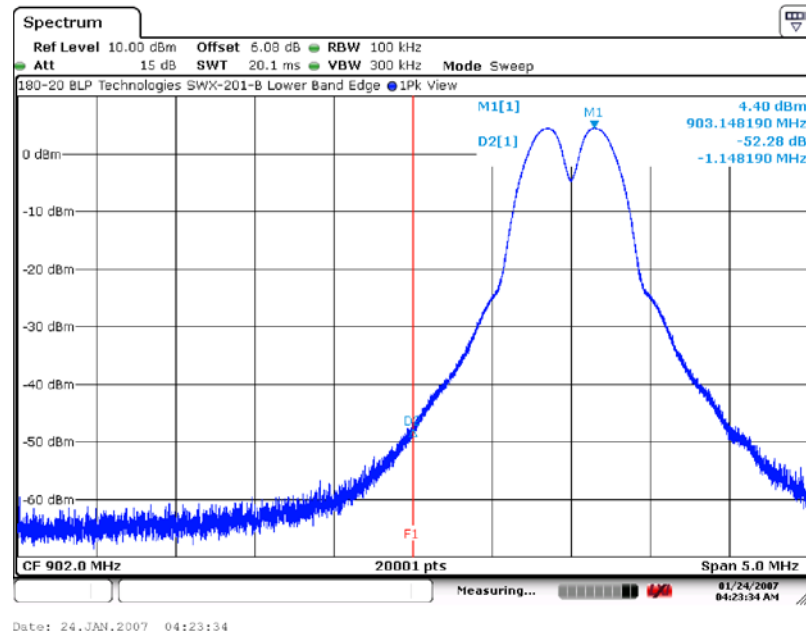
Band Edge Frequencies	Lower & Upper Transmitter Frequency	Maximum PSD (100 kHz)	Band Edge Delta to Max PSD (100 kHz)	Minimum Required Delta	Result
(MHz)	(MHz)	(dB/m)	(dB)	(dB)	
902	903	4.40	-52.28	-20	Compliant
928	927	4.78	-52.37	-20	Compliant

Note: Reference the plots on the following page.

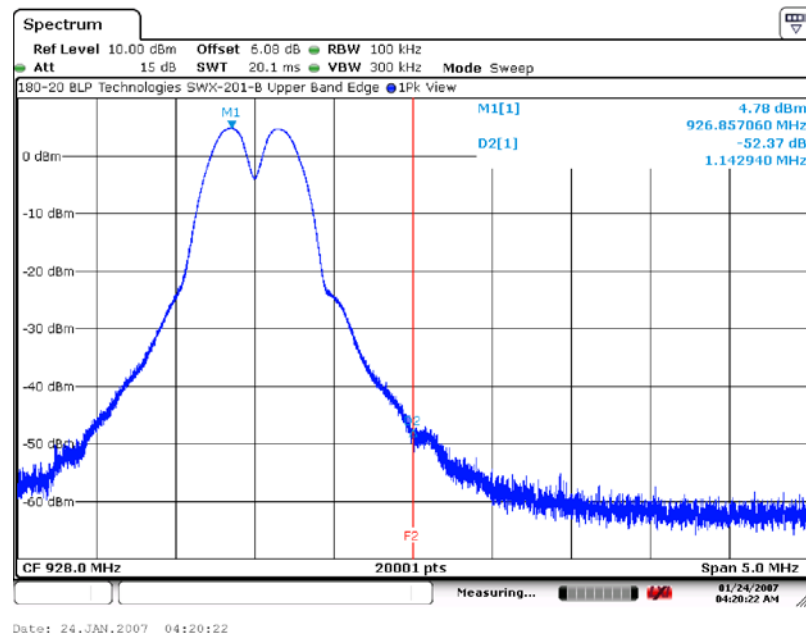
7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

Lower Band Edge



Upper Band Edge



7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands

Requirement: 15.247(d) 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.

Test Notes: Peak in-band measurements were taken at the time the DTS (-6 dB) bandwidth measurements were made. These values were used as the reference levels for the following measurements. Refer to section 7.2 of this report for these values.

Reference Appendix B for the measurement data used for this test section.

Results: The DUT met the 20 dB requirement emission level delta requirement in the non restricted frequency bands.

Worst Case Emission in Non-restricted Frequency Bands

Maximum PSD (100 kHz) In-Band ¹ (dBμV/m)	Worst Case Out-of-Band Frequency (MHz)	Maximum PSD (100 kHz) Out-of-Band (dBm)	Delta to Maximum PSD (dB)	Minimum Required Delta	Result	Reference Appendix B
5.46	928.23	-45.35	-45.35	-14.54	Compliant	B3.2

¹Taken from Section 7.2 - DTS Bandwidth

7. Measurement Data (continued)

7.8. Peak Power Spectral Density (FCC 15.247(e), ISED RSS-247, 5.2 b))

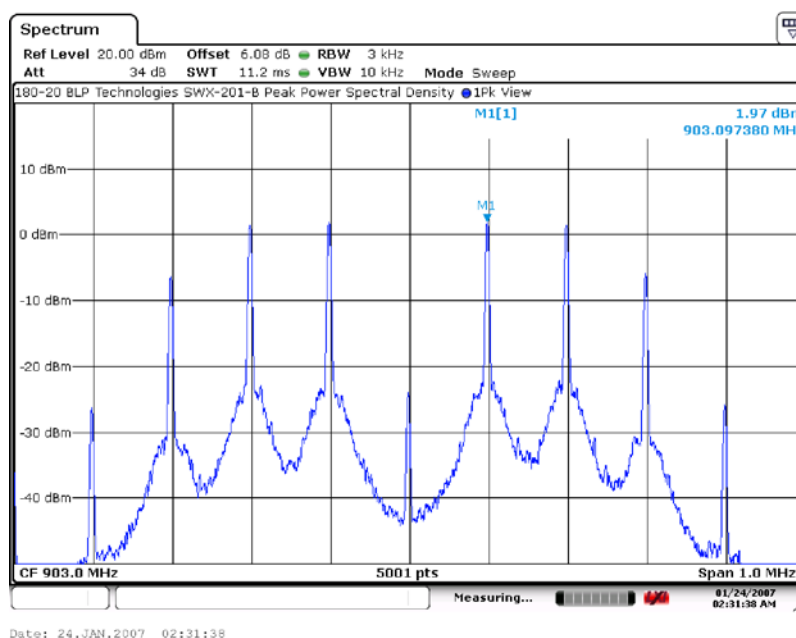
Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm (103.2 dB μ V/m) in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of FCC Part 15.247. The same method of determining the conducted output power shall be used to determine the power spectral density.

Procedure: FCC OET publication number 558074, Section 10.2: Method PKPSD (peak PSD). FCC OET 662911 was referenced to determine the procedure for measuring in-band power spectral density of transmitters with multiple outputs in the same band.

Results: The DUT met the required power spectral density limit at the tested frequencies.

Channel	Frequency	Maximum PSD Frequency	Maximum Power Spectral Density	Limit	Margin	Result
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)	
1	MHz	903.0974	1.97	8	-6.03	Compliant
11	MHz	915.0972	2.63	8	-5.37	Compliant
21	MHz	926.8974	2.03	8	-5.97	Compliant

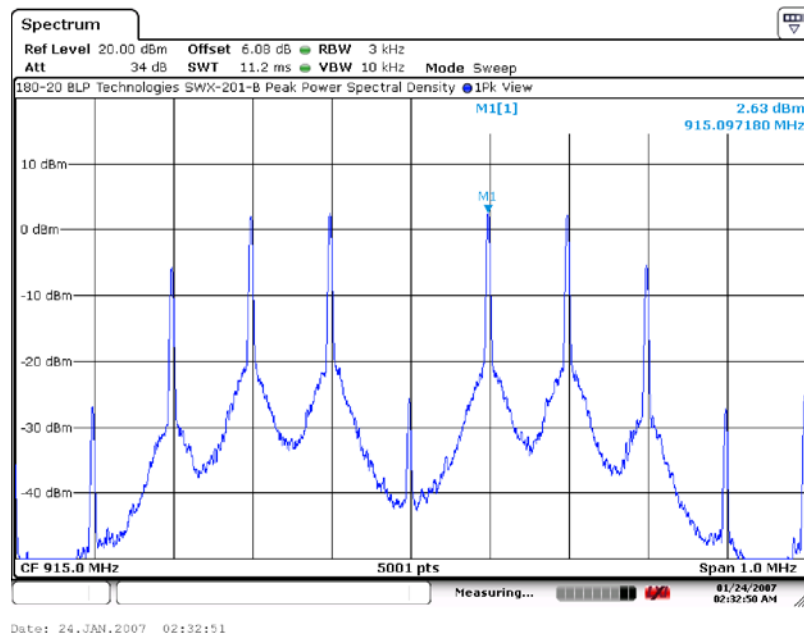
7.8.1. Low Channel – 1, 903 MHz



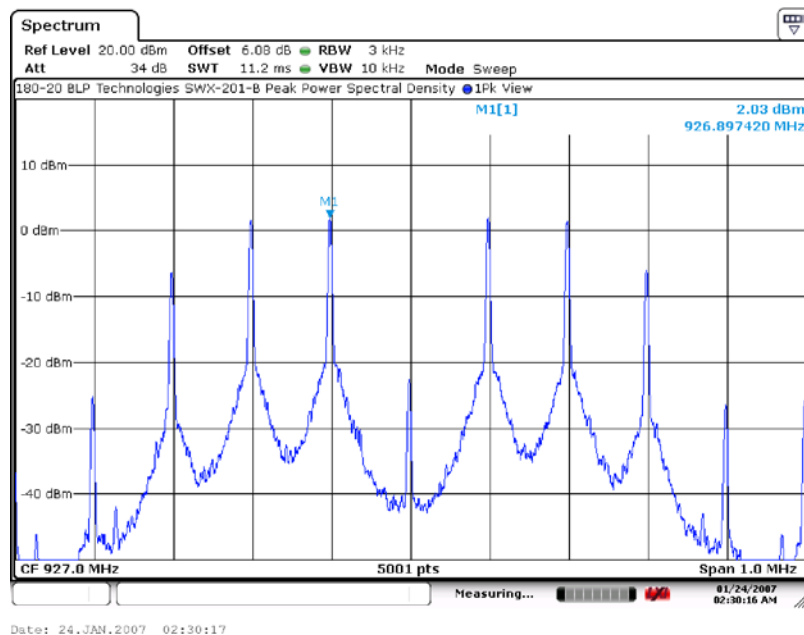
7. Measurement Data

7.8. Peak Power Spectral Density (15.247(e)), ISED RSS-247, 5.2 b)) (continued)

7.8.2. Middle Channel – 11, 915 MHz



7.8.3. High Channel – 21, 927 MHz



7. Measurement Data (continued)

7.9. Duty Cycle

Requirement: (FCC OET publication number 558074)

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

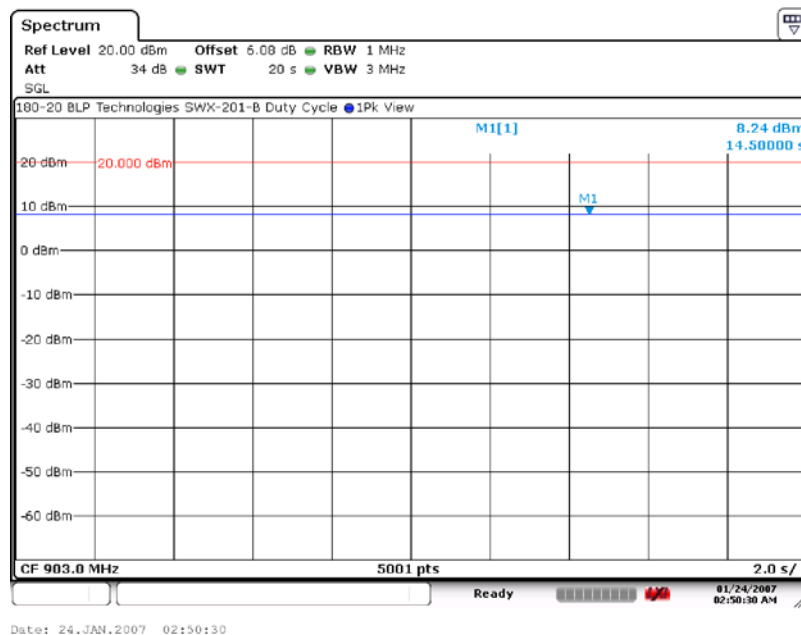
Procedure: Duty cycle measurements were made according to the procedure detailed ANSI C63.10-2013, Section 11.6(b)

Results: Duty cycle measurements are listed in the following table.

All power and power spectral density measurements for this report are peak mode measurements. Ample peak hold time was provided to ensure maximum peak measurements.

Channel	Frequency	Time High	Time per Period	Duty Cycle	
	(MHz)	(S)	(S)	(Numeric)	(%)
1	903	20	20	1.0	100.00
11	915	20	20	1.0	100.00
21	927	20	20	1.0	100.00

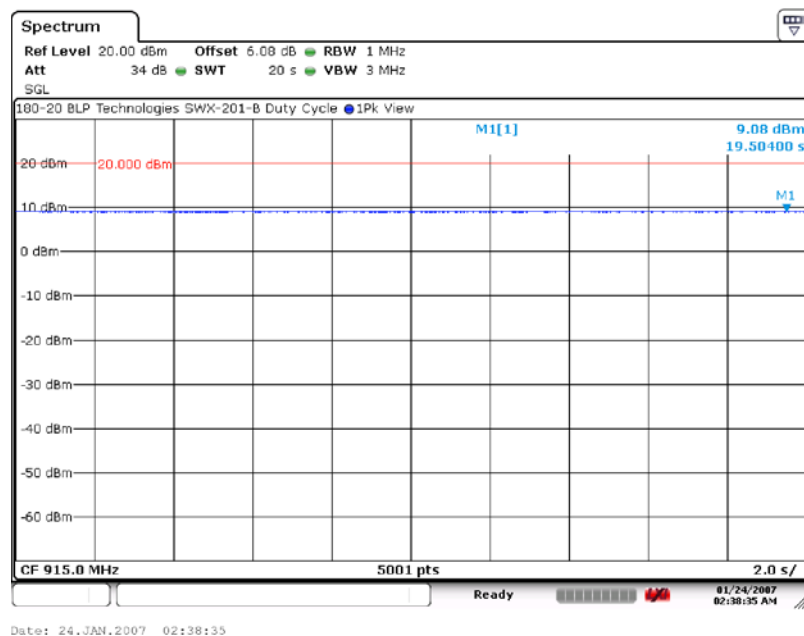
7.9.1. Low Channel – 1, 903 MHz



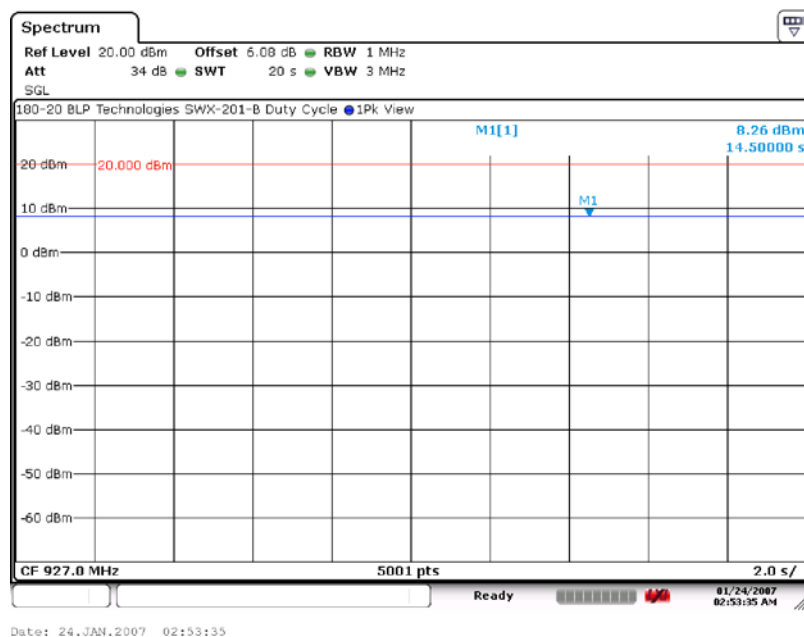
7. Measurement Data (continued)

7.9. Duty Cycle (continued)

7.9.2. Middle Channel – 11, 915 MHz



7.9.3. High Channel – 21, 927 MHz



7. Measurement Data (continued)

7.10. 99% (Occupied) Bandwidth (RSS-GEN 6.7)

Requirement: The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

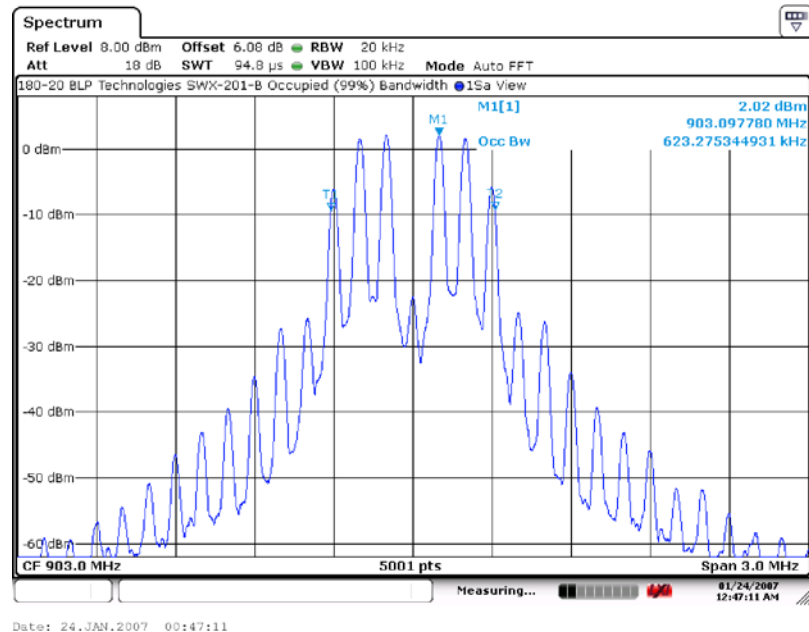
The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.

The sample detector of the spectrum analyzer shall be used to make the measurement.

7.10.1. Measurement Results

Channel	Channel Frequency (MHz)	99% Power Bandwidth (kHz)
1	903	623.2753
11	915	623.2753
21	927	624.4751

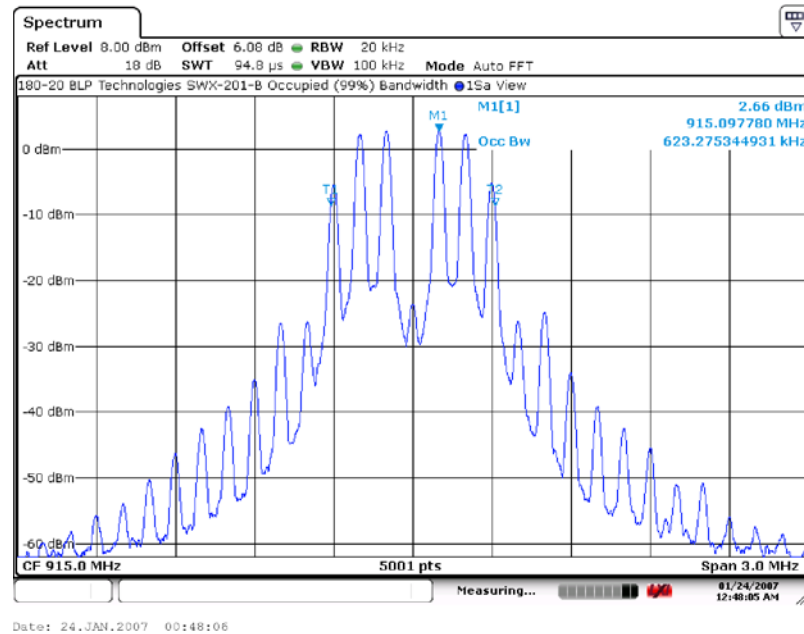
7.10.1.1. 99% Power Bandwidth – Channel 1 (903 MHz)



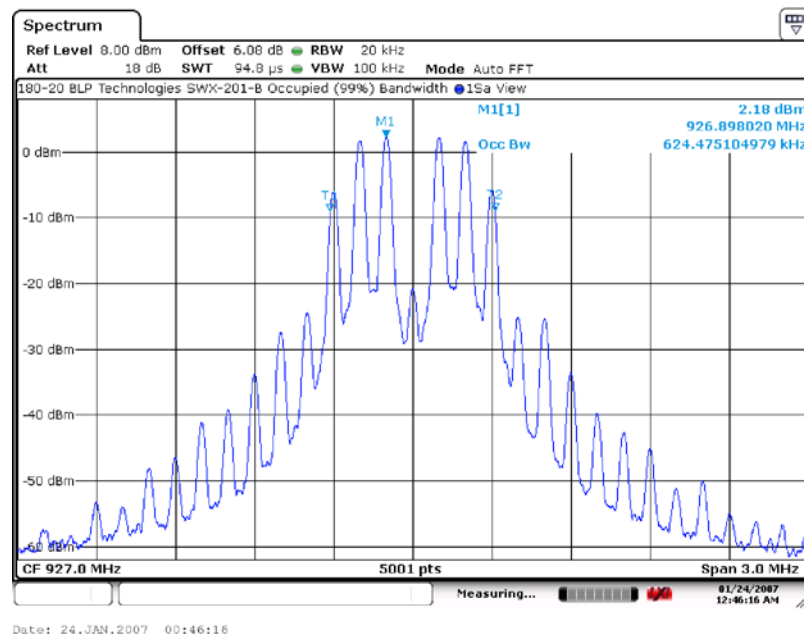
7. Measurement Data (continued)

7.10. 99% (Occupied) Bandwidth (RSS-GEN 6.7)

7.10.1.2. 99% Power Bandwidth – Channel 11 (915 MHz)



7.10.1.3. 99% Power Bandwidth – Channel 21 (927 MHz)



7. Measurement Data (continued)

7.11. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN, ISSUE 5, section 3.4, RSS 102)

7.11.1. FCC 15.247 (i) Requirements

Requirement: Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Frequency (MHz)	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm ²)	Result
				(mW/cm ²)	(W/m ²)		
				(4)		(5)	
903	20	8.25	-1.0	0.001056161	0.01056161	0.6020000	Compliant
915	20	9.05	-1.0	0.001269785	0.01269785	0.6100000	Compliant
927	20	8.37	-1.0	0.001085751	0.01085751	0.6180000	Compliant

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

- PD = Power Density (mW/cm²)
- OP = DUT Output Power (dBm)
- AG = DUT Antenna Gain (dBi)
- d = MPE Distance (cm)

1. Reference CFR 2.1091: For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.
2. Table 6.2 of this test report. Converted from field strength measurements.
3. Johanson Technology 0915AT43A0026 chip antenna specifications.
4. Power density is calculated from field strength measurement and antenna gain.
5. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure. Limit = f/1500, where f is in MHz.

Results: Passed - The device under test meets the exclusion requirement detailed for a device with a separation distance of 20 cm.

7. Measurement Data (continued)

7.11. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN, ISSUE 5, section 3.4, RSS 102)

7.11.2. RSS-102 Issue 5 Requirements

Requirement: Requirement: RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz.

Results: Compliant

Frequency	Separation Distance	Maximum Power ¹		RSS-102 Exemption Limit ²	Result
(MHz)	(cm)	(mW)	(W/m ²)	(W/m ²)	
903	≥ 20	6.68	0.01056	1.37	Compliant
915	≥ 20	8.04	0.01270	1.38	Compliant
927	≥ 20	6.87	0.01086	1.40	Compliant

¹ Reference Section 6.2 of this report.

² Reference RSS-102, § 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation for distances greater than 20 cm.

The following formula was used to determine the exemption limit (W):

$$1.31 \times 10^{-2} f^{0.6834} \quad (f = \text{frequency (MHz)})$$

8. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1**) and VCCI (Member number 3168) under registration number A-0274.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 32, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

The radiated emissions test site for measurements above 1GHz is a 3 Meter open area test site (OATS) with a 3.6 by 3.6 meter anechoic absorber floor patch to achieve a quasi-free space measurement environment per ANSI C63.4/C63.10 and CISPR 16-1-4 standards.

The sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

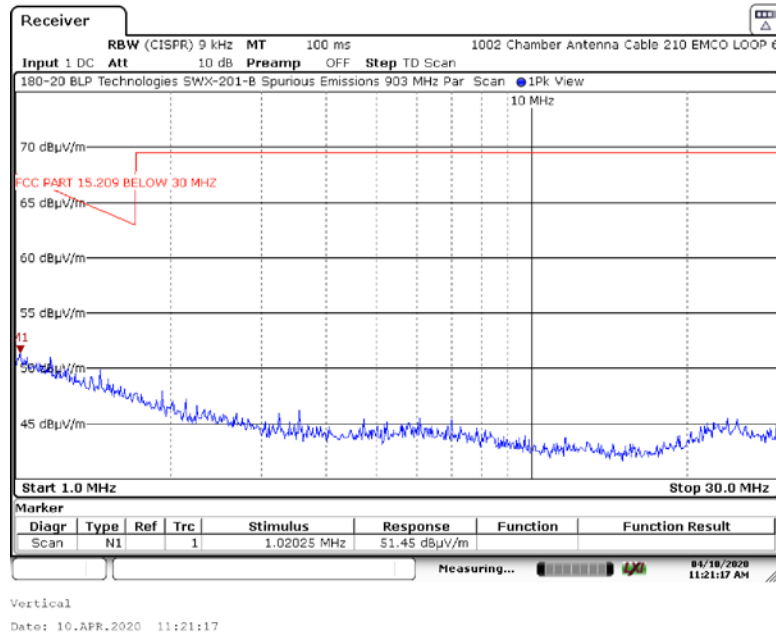
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

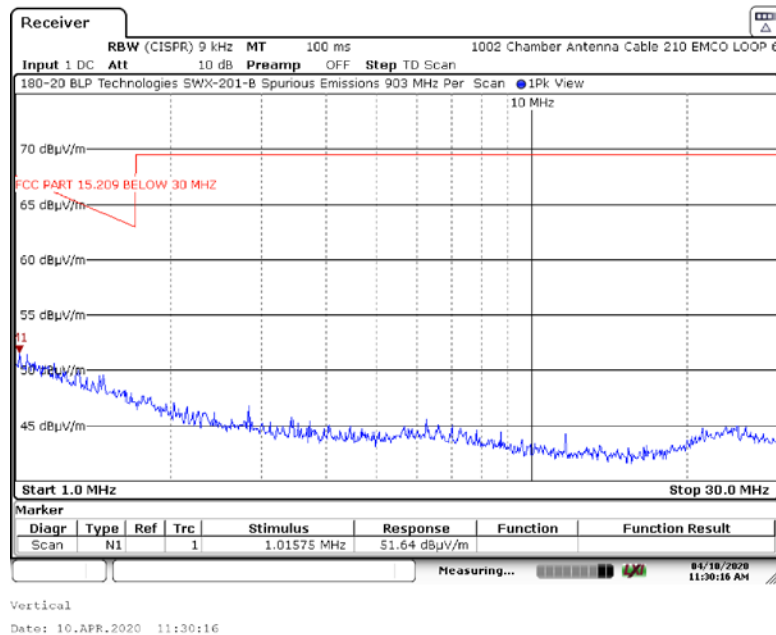
A1.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A1.1.1 Channel 1, 903 MHz

A1.1.1.1. Measurement Results: Parallel Receive Antenna



A1.1.1.2. Measurement Results: Perpendicular Receive Antenna



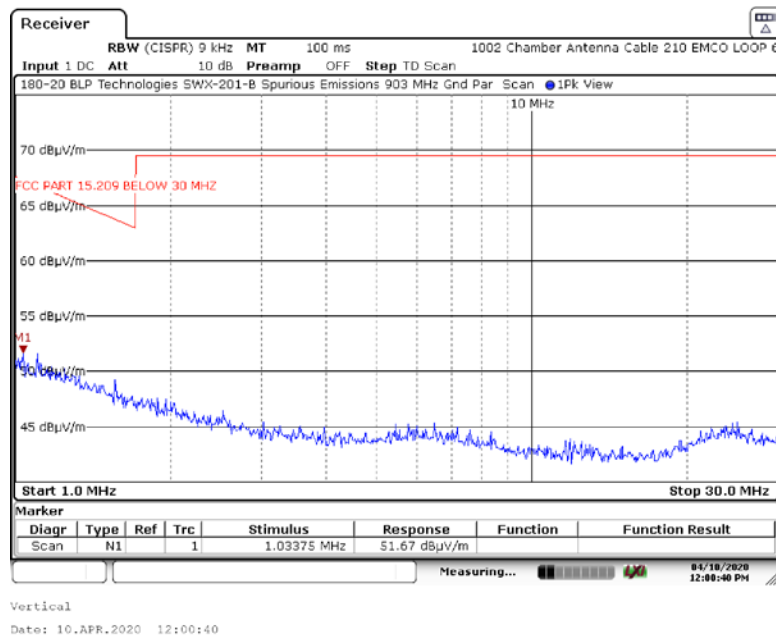
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

A1.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

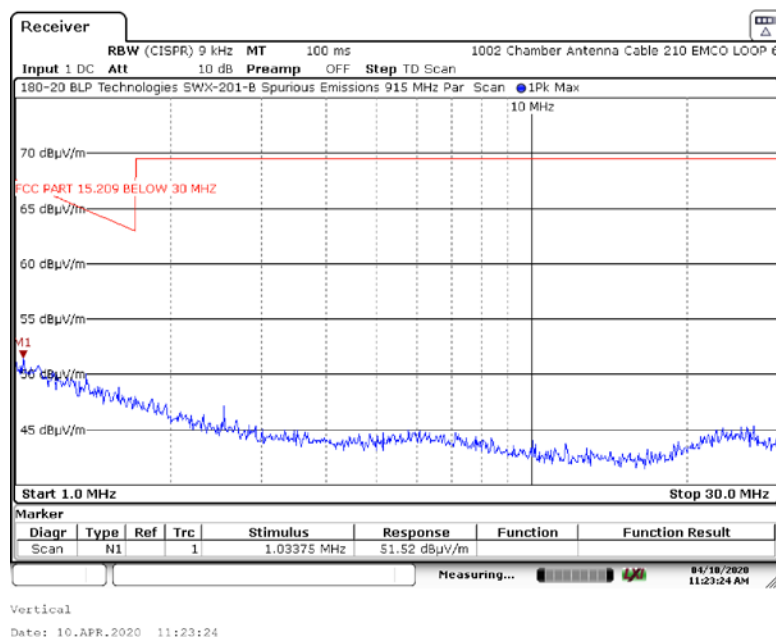
A1.1.1 Channel 1, 903 MHz

A1.1.1.3. Measurement Results: Ground Parallel Receive Antenna



A1.1.2. Channel 11, 915 MHz

A1.1.2.1. Measurement Results: Parallel Receive Antenna



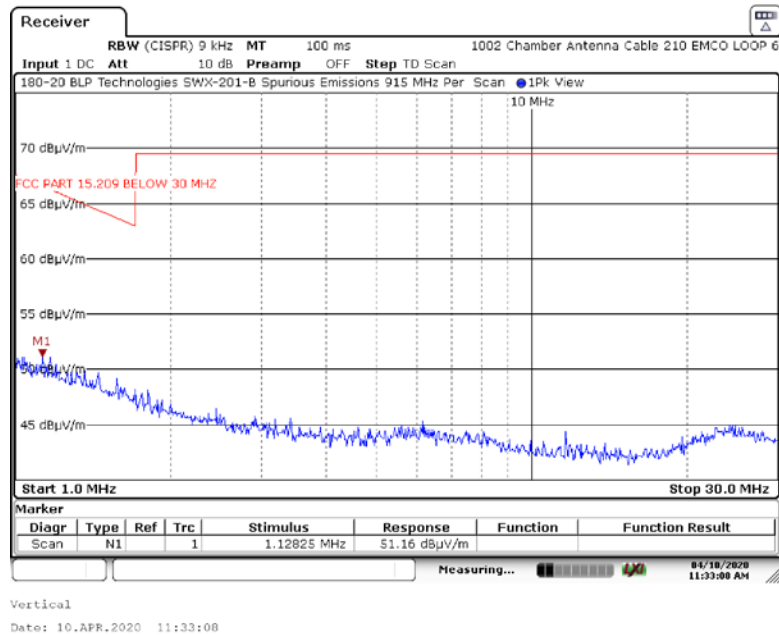
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

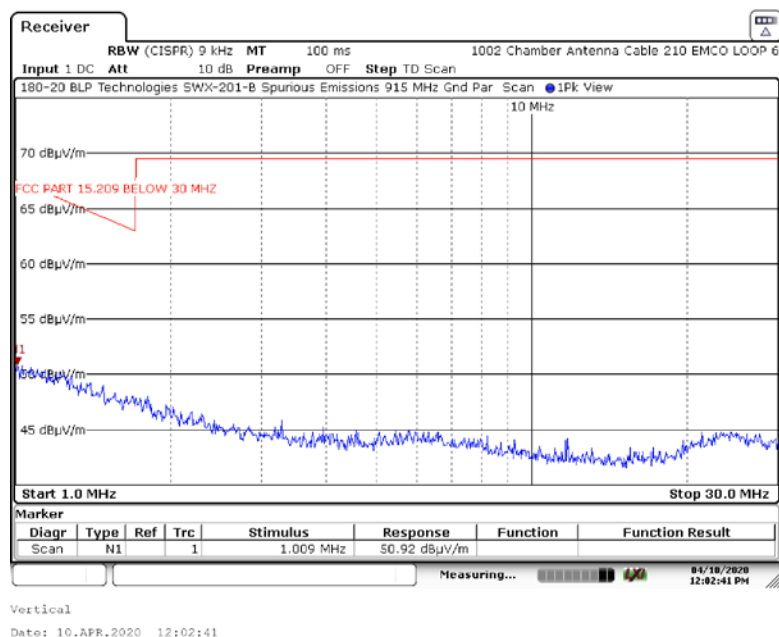
A1.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A1.1.2 Channel 11, 915 MHz

A1.1.2.2. Measurement Results: Perpendicular Receive Antenna



A1.1.2.3. Measurement Results: Ground-Parallel Receive Antenna



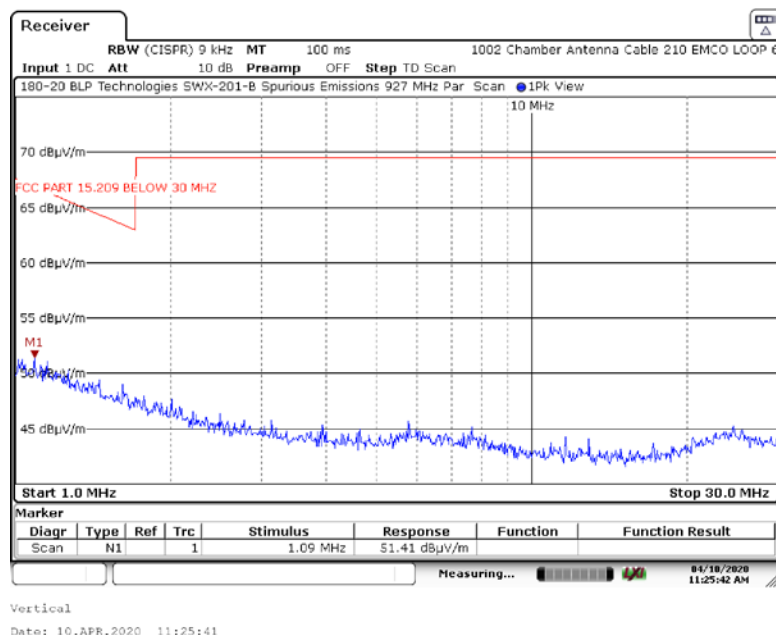
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

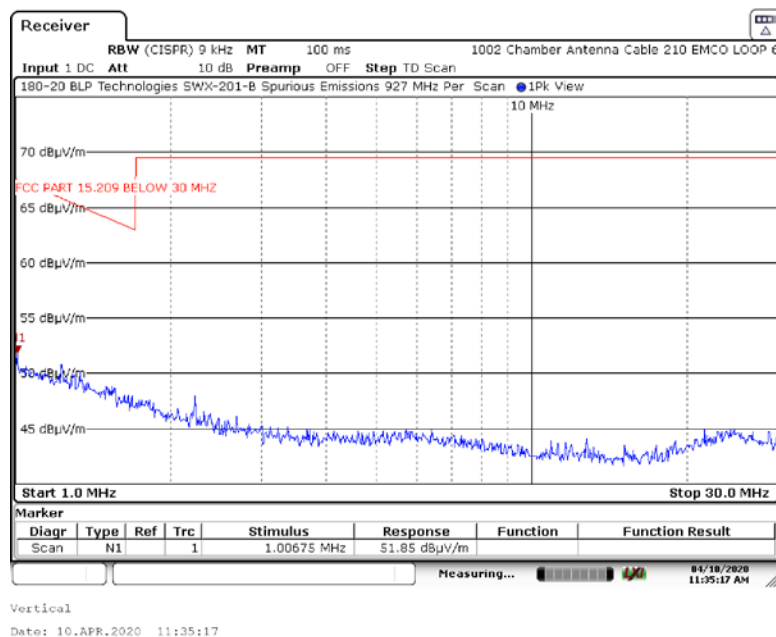
A1.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A1.1.3 Channel 21, 927 MHz

A1.1.3.1. Measurement Results: Parallel Receive Antenna



A1.1.3.2. Measurement Results: Perpendicular Receive Antenna



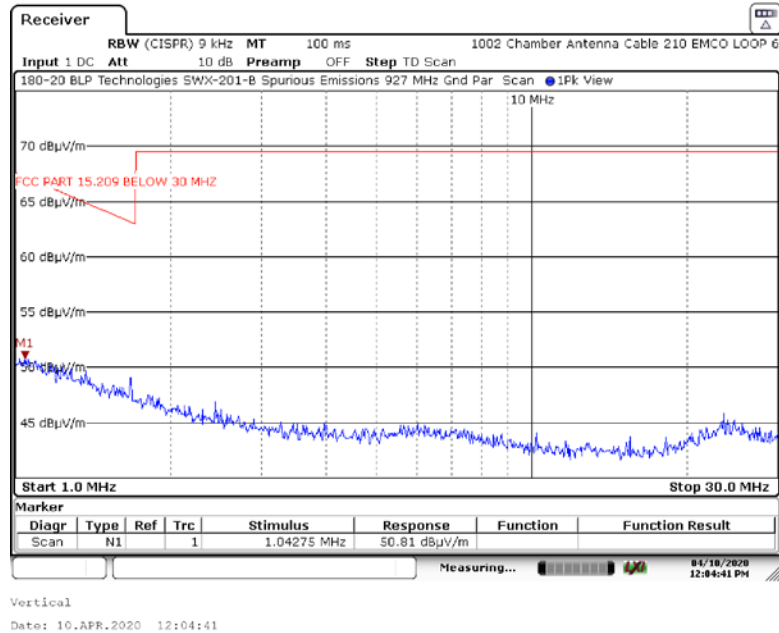
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

A1.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A1.1.3 Channel 21, 927 MHz

A1.1.3.3. Measurement Results: Ground Parallel Receive Antenna



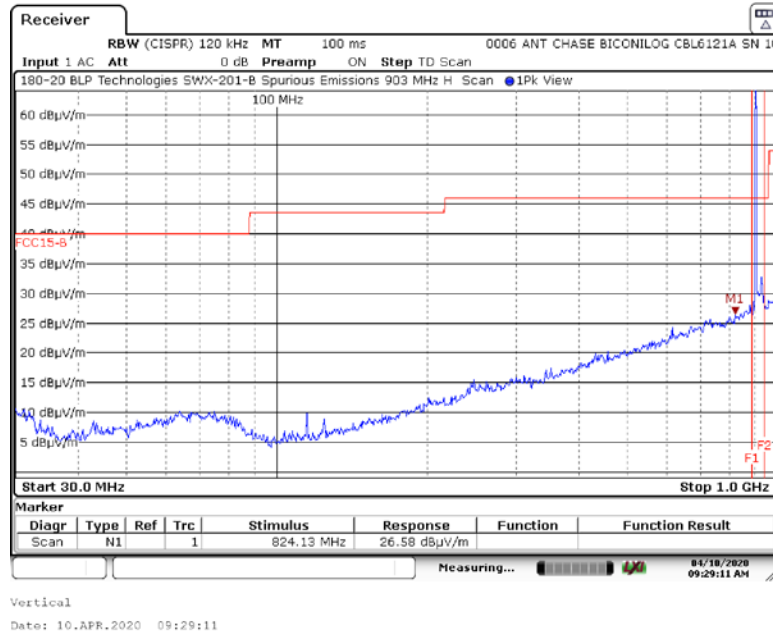
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

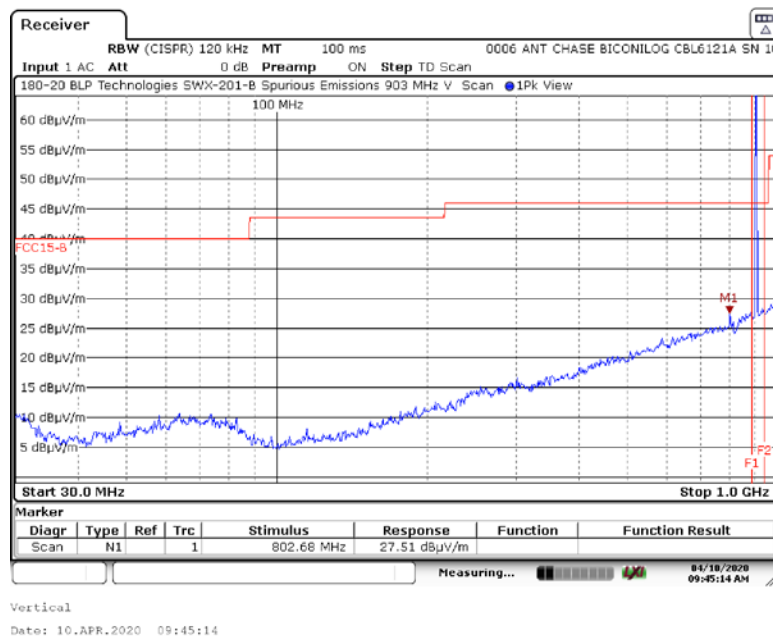
A1.2. Spurious Radiated Emissions (30 MHz – 1000 MHz) Test Results

A1.2.1 Channel 1, 903 MHz

A1.2.1.1. Measurement Results: Horizontal Receive Antenna



A1.2.1.2. Measurement Results: Vertical Receive Antenna



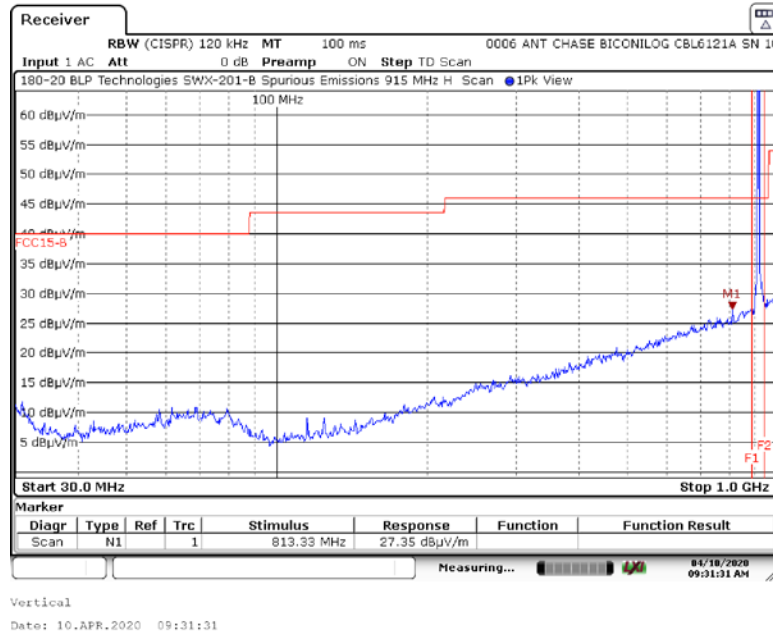
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

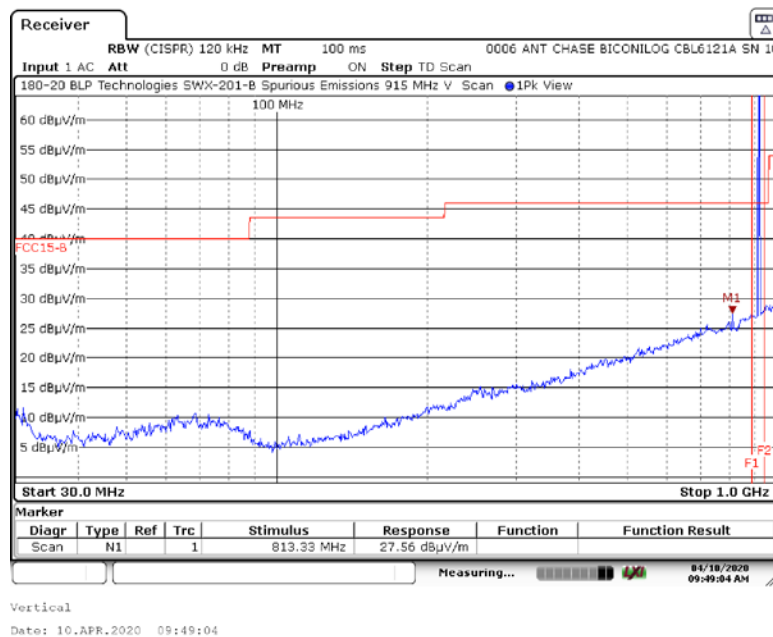
A1.2. Spurious Radiated Emissions (30 MHz – 1000 MHz) Test Results

A1.2.2 Channel 11, 915 MHz

A1.2.2.1. Measurement Results: Horizontal Receive Antenna



A1.2.2.2. Measurement Results: Vertical Receive Antenna



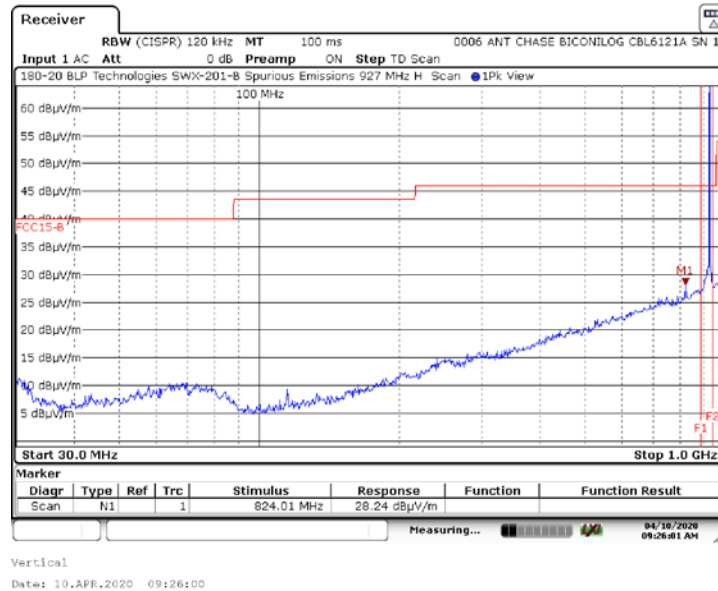
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

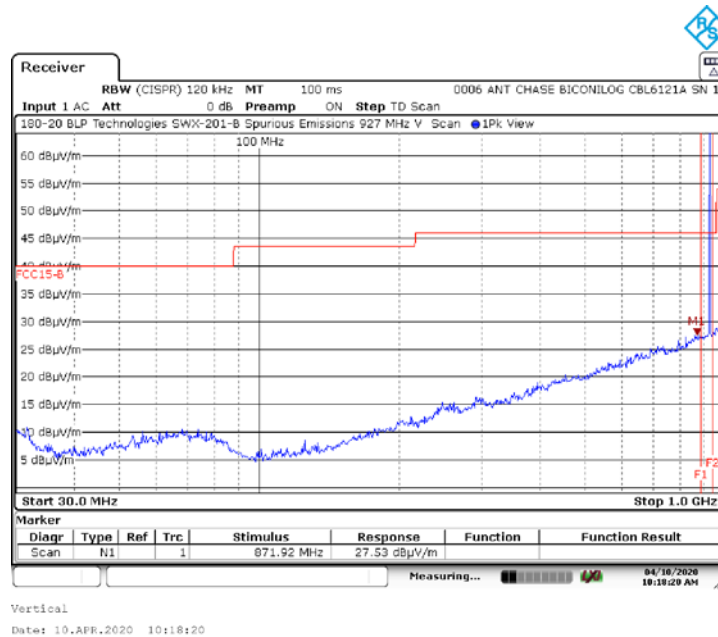
A1.2. Spurious Radiated Emissions (30 MHz – 1000 MHz) Test Results

A1.2.3 Channel 21, 927 MHz

A1.2.3.1. Measurement Results: Horizontal Receive Antenna



A1.2.3.2. Measurement Results: Vertical Receive Antenna



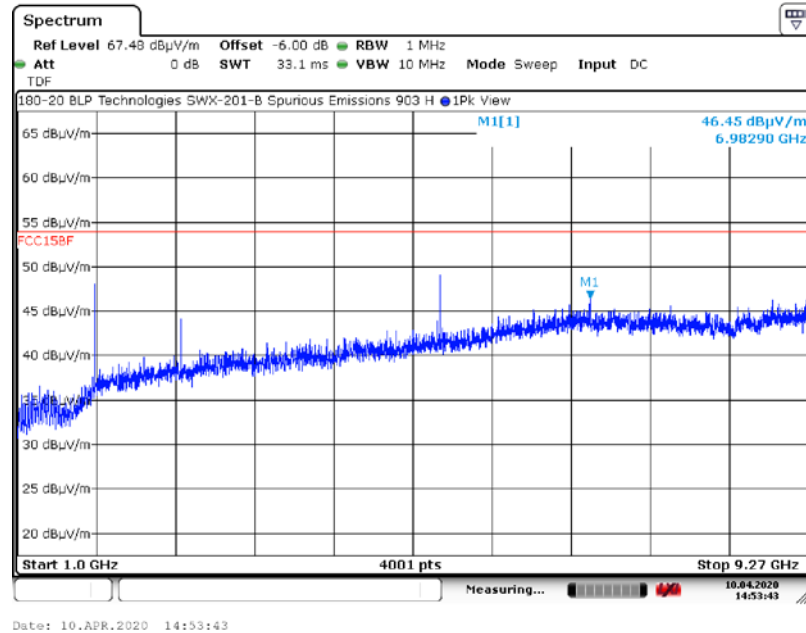
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

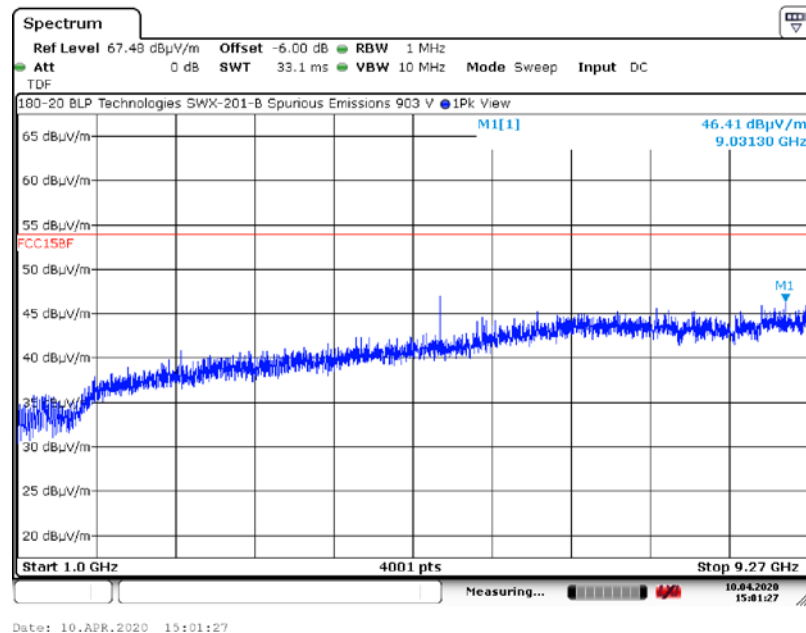
A1.3. Spurious Radiated Emissions (1000 MHz – 9270 MHz) Test Results

A1.3.1 Channel 1, 903 MHz

A1.3.1.1. Measurement Results: Horizontal Receive Antenna



A1.3.1.2. Measurement Results: Horizontal Receive Antenna



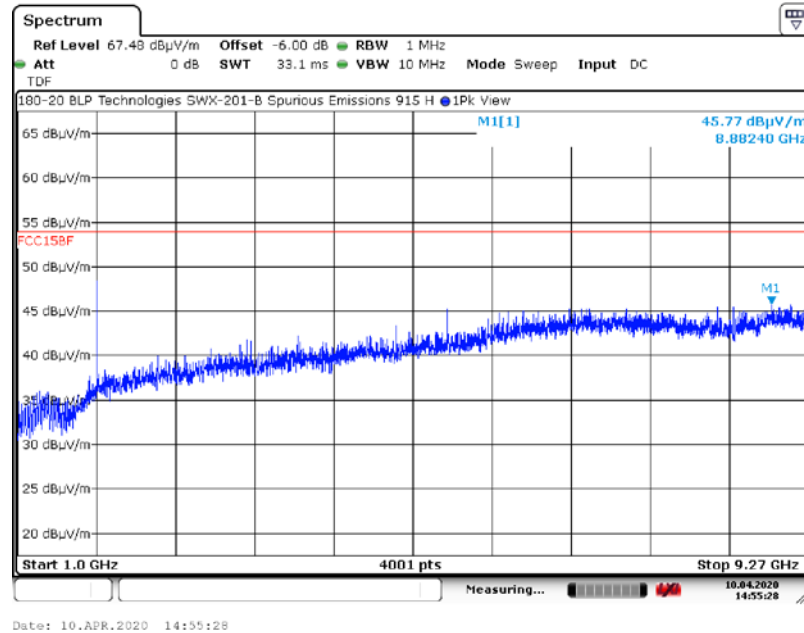
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

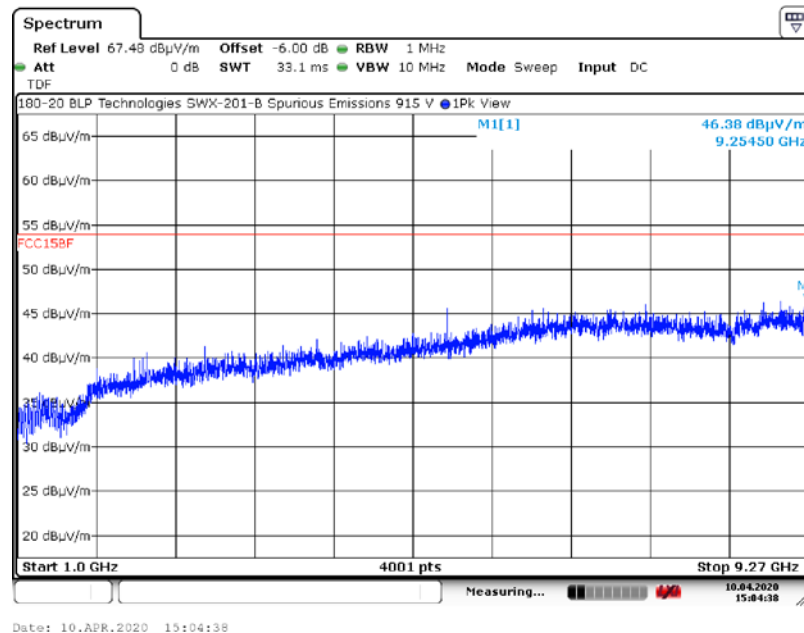
A1.3. Spurious Radiated Emissions (1000 MHz – 9270 MHz) Test Results

A1.3.2 Channel 11, 915 MHz

A1.3.2.1. Measurement Results: Horizontal Receive Antenna



A1.3.2.2. Measurement Results: Horizontal Receive Antenna



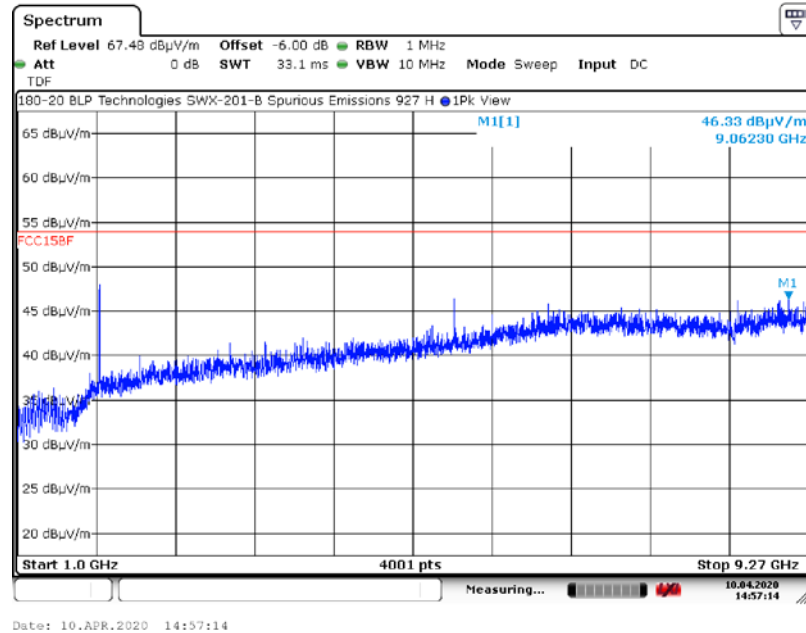
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A1. Device Tested – SWX-201-B

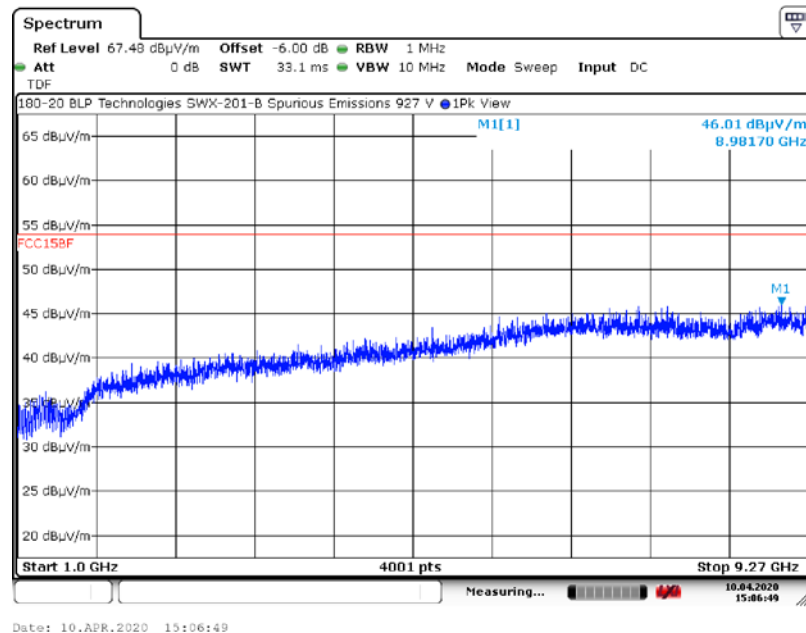
A1.3. Spurious Radiated Emissions (1000 MHz – 9270 MHz) Test Results

A1.3.3 Channel 21, 927 MHz

A1.3.3.1. Measurement Results: Horizontal Receive Antenna



A1.3.3.2. Measurement Results: Horizontal Receive Antenna



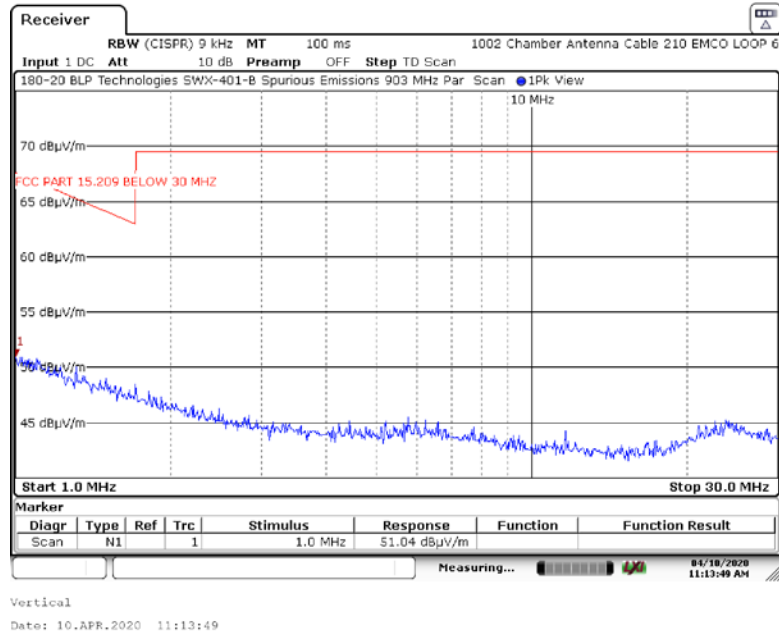
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

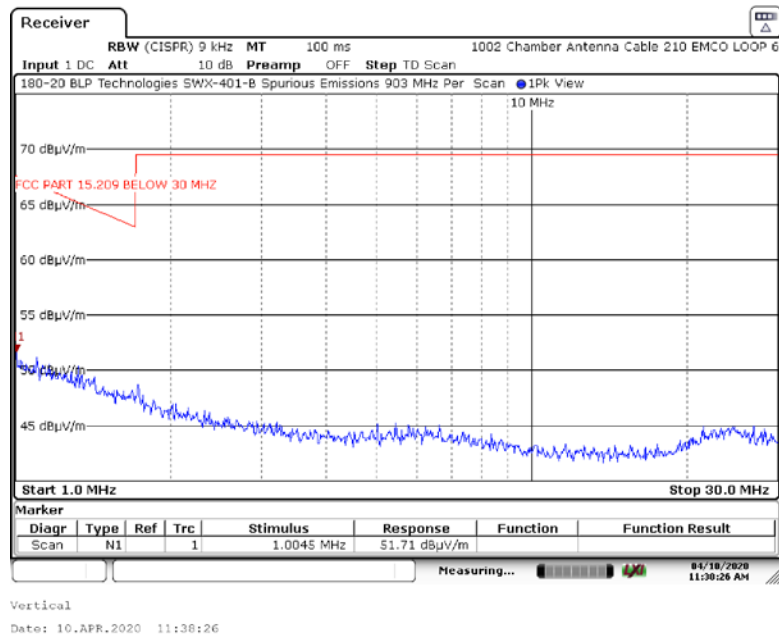
A2.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A2.1.1 Channel 1, 903 MHz

A2.1.1.1. Measurement Results: Parallel Receive Antenna



A2.1.1.2. Measurement Results: Perpendicular Receive Antenna



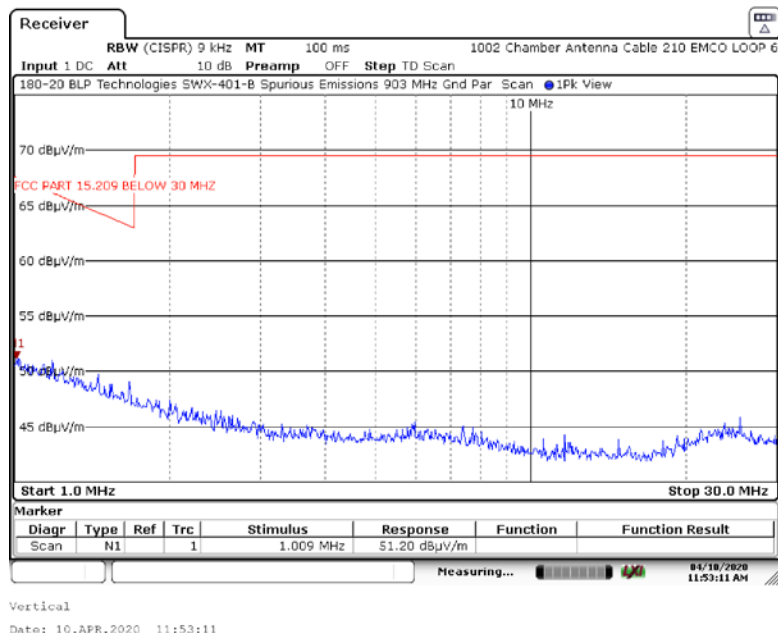
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

A2.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

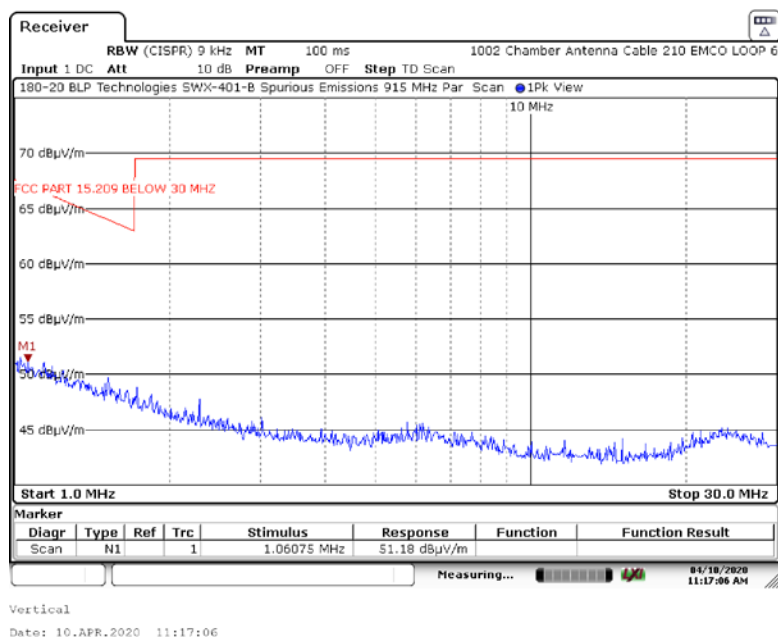
A2.1.1 Channel 1, 903 MHz

A2.1.1.3. Measurement Results: Ground Parallel Receive Antenna



A2.1.2. Channel 11, 915 MHz

A2.1.2.1. Measurement Results: Parallel Receive Antenna



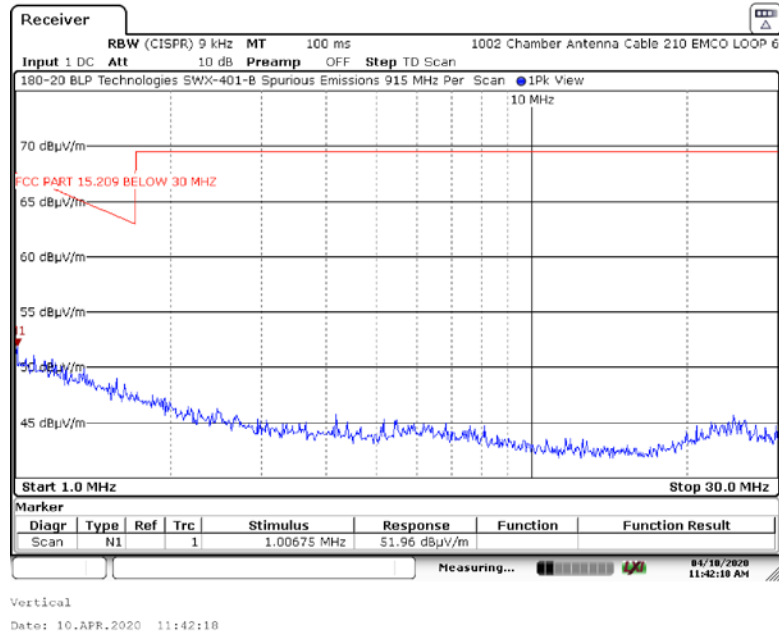
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

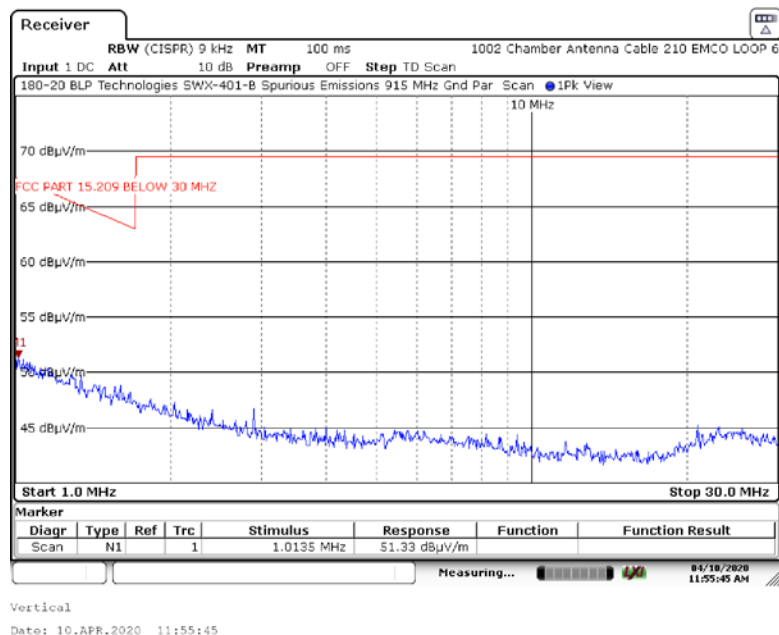
A2.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A2.1.2 Channel 11, 915 MHz

A2.1.2.2. Measurement Results: Perpendicular Receive Antenna



A2.1.2.3. Measurement Results: Ground-Parallel Receive Antenna



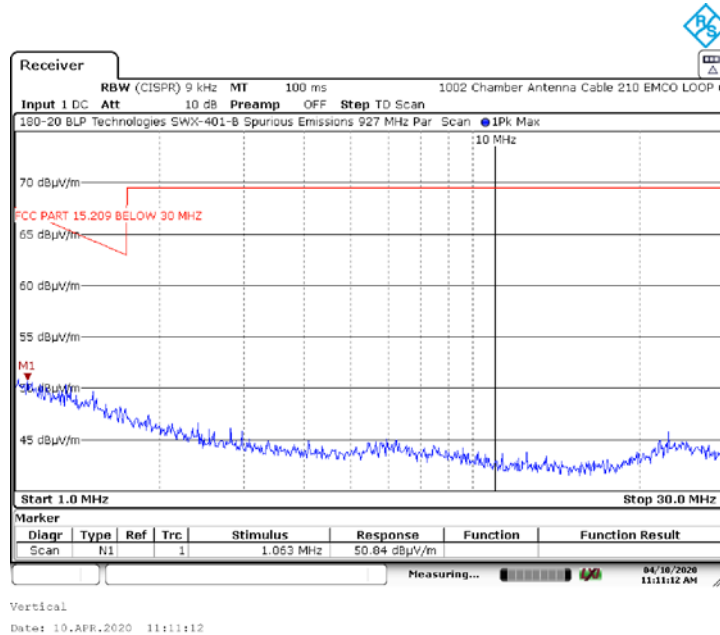
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

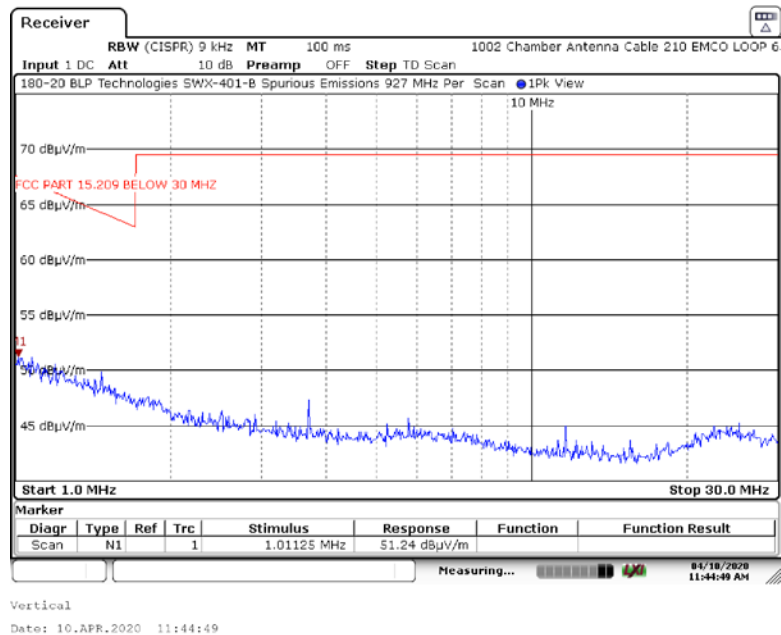
A2.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A2.1.3 Channel 21, 927 MHz

A2.1.3.1. Measurement Results: Parallel Receive Antenna



A2.1.3.2. Measurement Results: Perpendicular Receive Antenna



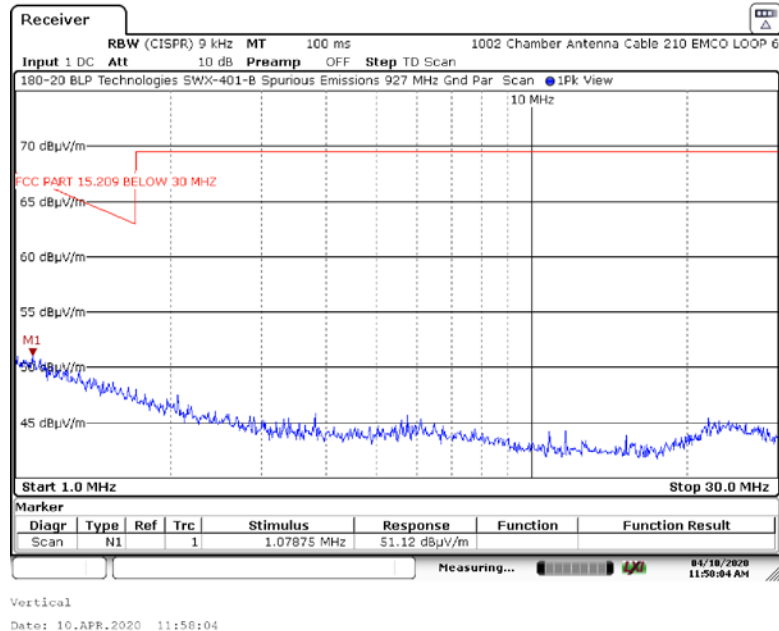
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

A2.1. Spurious Radiated Emissions (1 MHz – 30 MHz) Test Results

A2.1.3 Channel 21, 927 MHz

A2.1.3.3. Measurement Results: Ground Parallel Receive Antenna



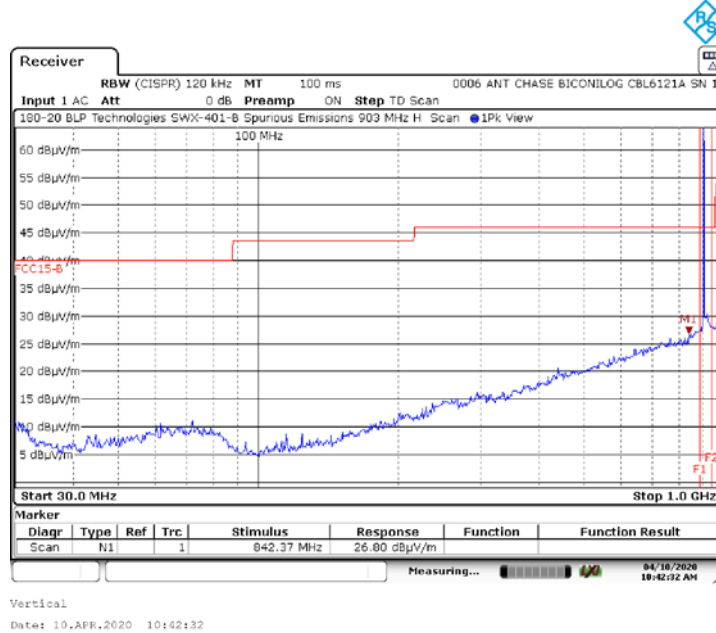
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

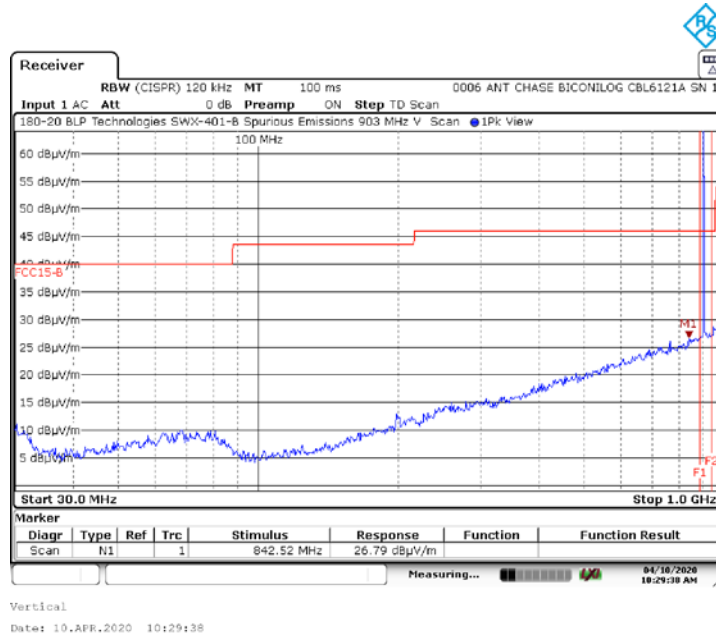
A2.2. Spurious Radiated Emissions (30 MHz – 1000 MHz) Test Results

A2.2.1 Channel 1, 903 MHz

A2.2.1.1. Measurement Results: Horizontal Receive Antenna



A2.2.1.2. Measurement Results: Vertical Receive Antenna



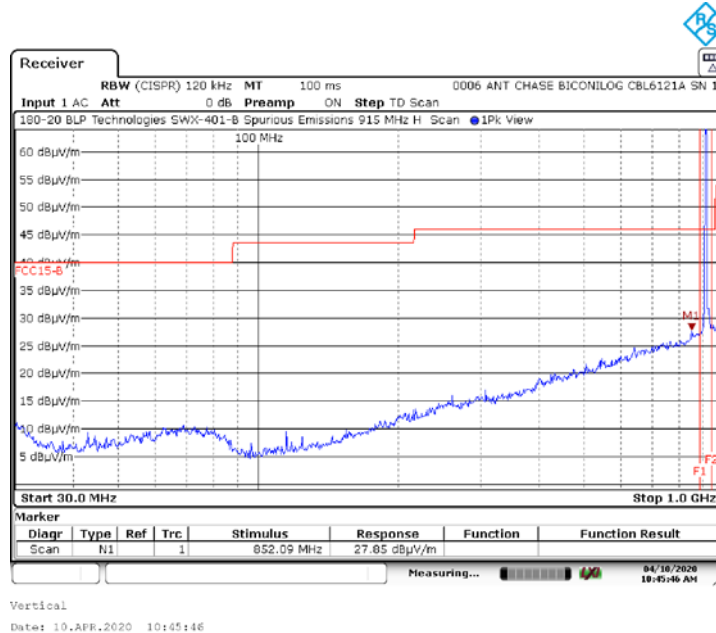
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

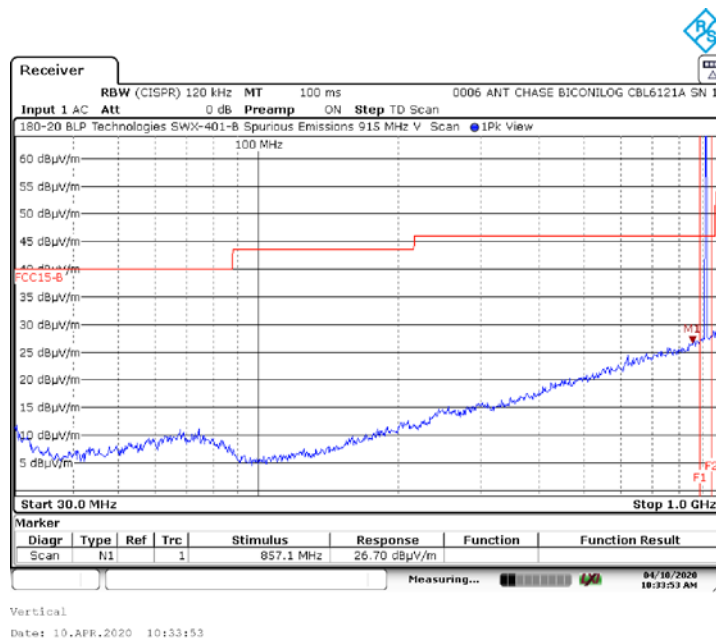
A2.2. Spurious Radiated Emissions (30 MHz – 1000 MHz) Test Results

A2.2.2 Channel 11, 915 MHz

A2.2.2.1. Measurement Results: Horizontal Receive Antenna



A2.2.2.2. Measurement Results: Vertical Receive Antenna



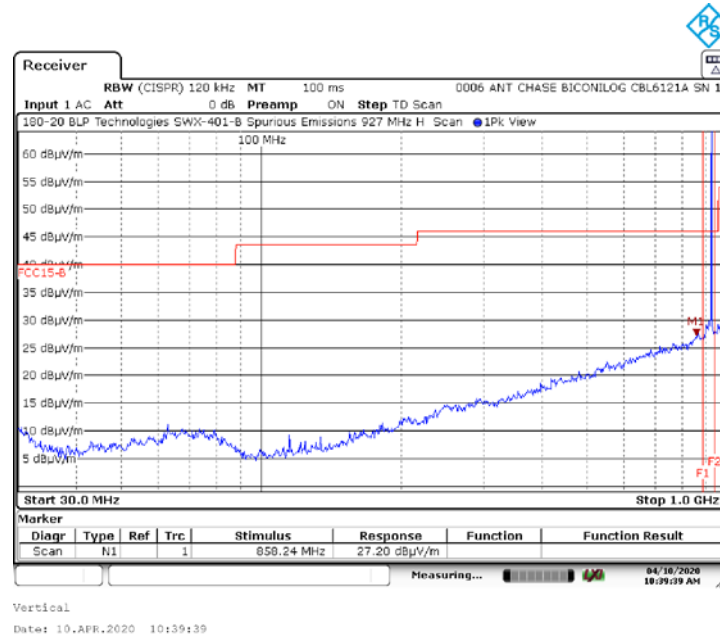
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

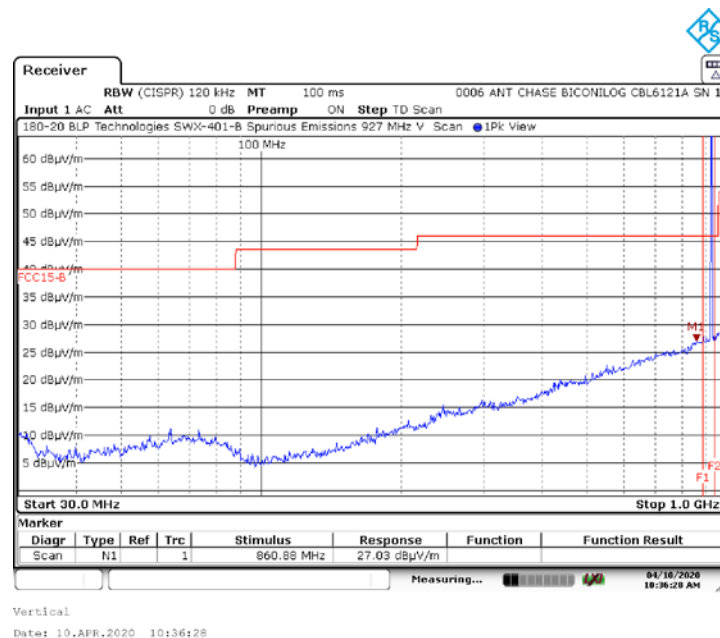
A2.2. Spurious Radiated Emissions (30 MHz – 1000 MHz) Test Results

A2.2.3 Channel 21, 927 MHz

A2.2.3.1. Measurement Results: Horizontal Receive Antenna



A2.2.3.2. Measurement Results: Vertical Receive Antenna



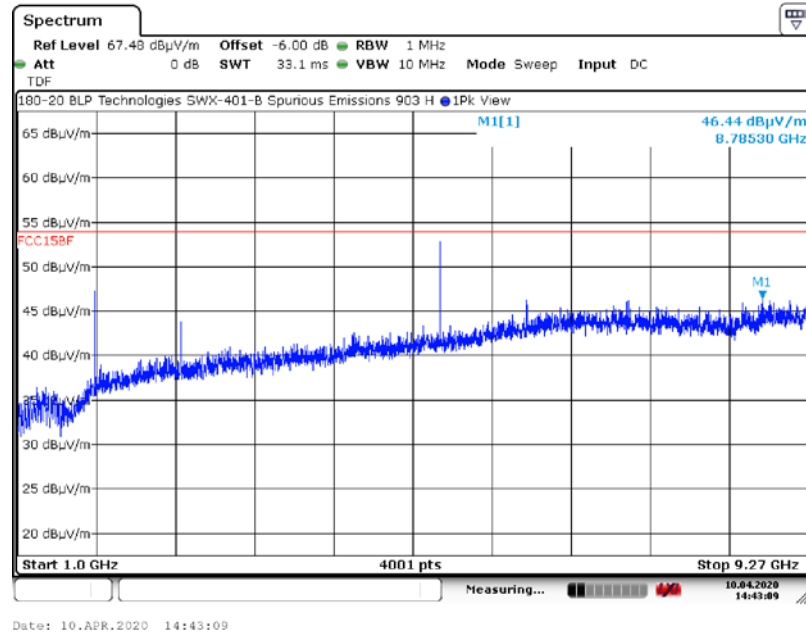
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

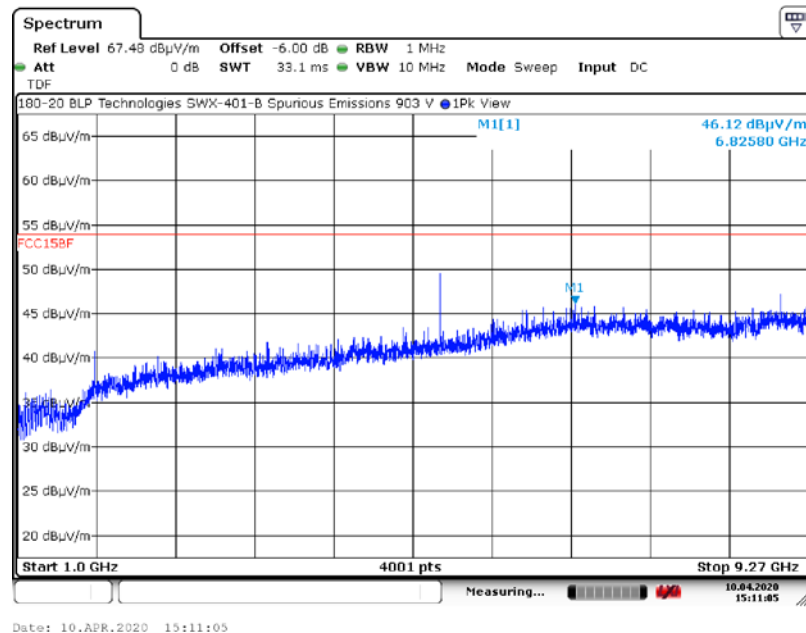
A2.3. Spurious Radiated Emissions (1000 MHz – 9270 MHz) Test Results

A2.3.1 Channel 1, 903 MHz

A2.3.1.1. Measurement Results: Horizontal Receive Antenna



A2.3.1.2. Measurement Results: Horizontal Receive Antenna



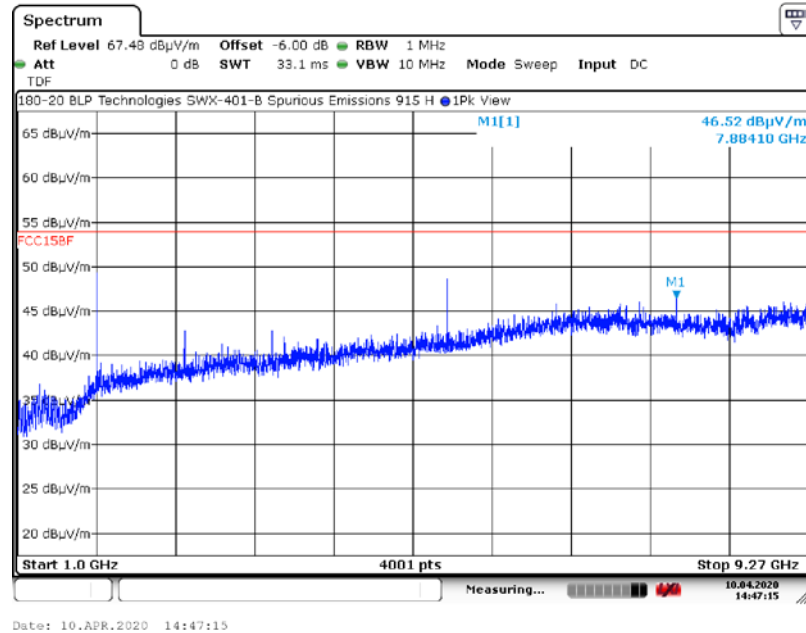
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

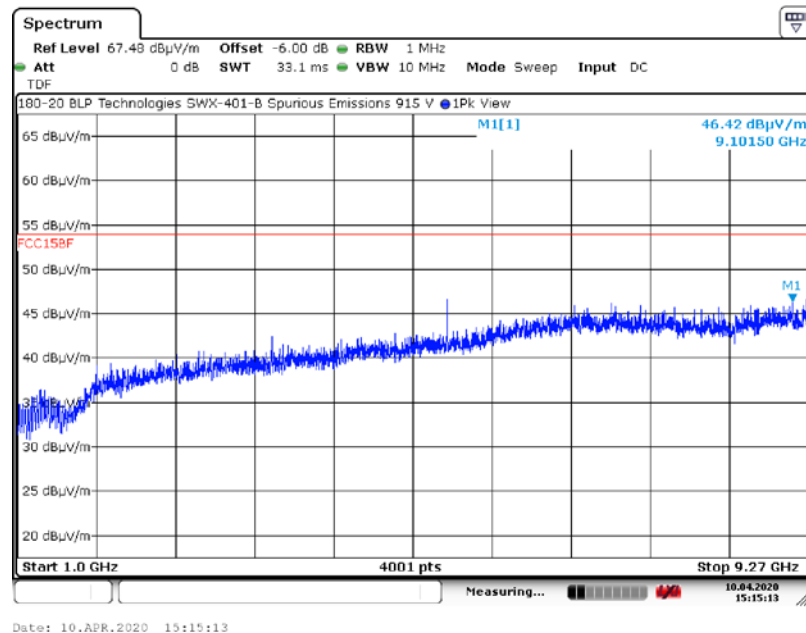
A2.3. Spurious Radiated Emissions (1000 MHz – 9270 MHz) Test Results

A2.3.2 Channel 11, 915 MHz

A2.3.2.1. Measurement Results: Horizontal Receive Antenna



A2.3.2.2. Measurement Results: Horizontal Receive Antenna



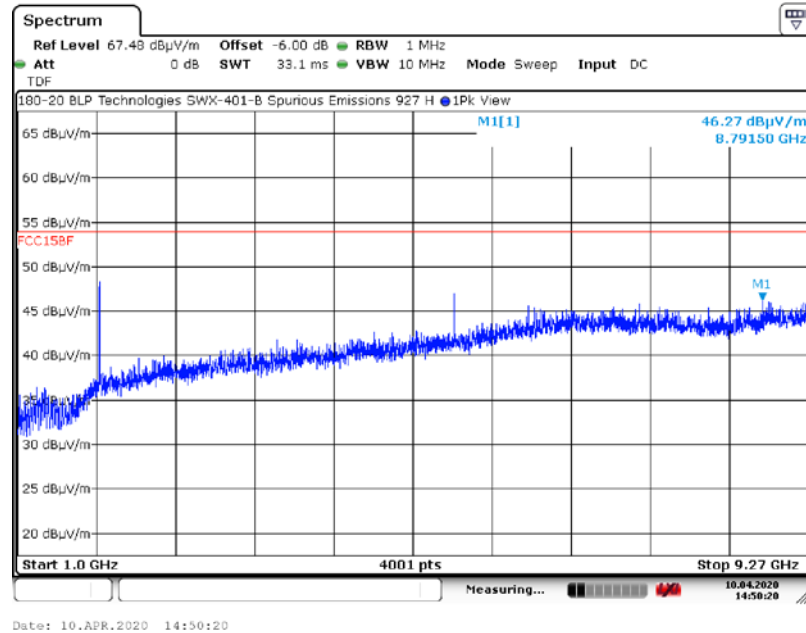
Appendix A - Transmitter Spurious Radiated Emissions (1 MHz to 9.270 GHz)

A2. Device Tested – SWX-401-B

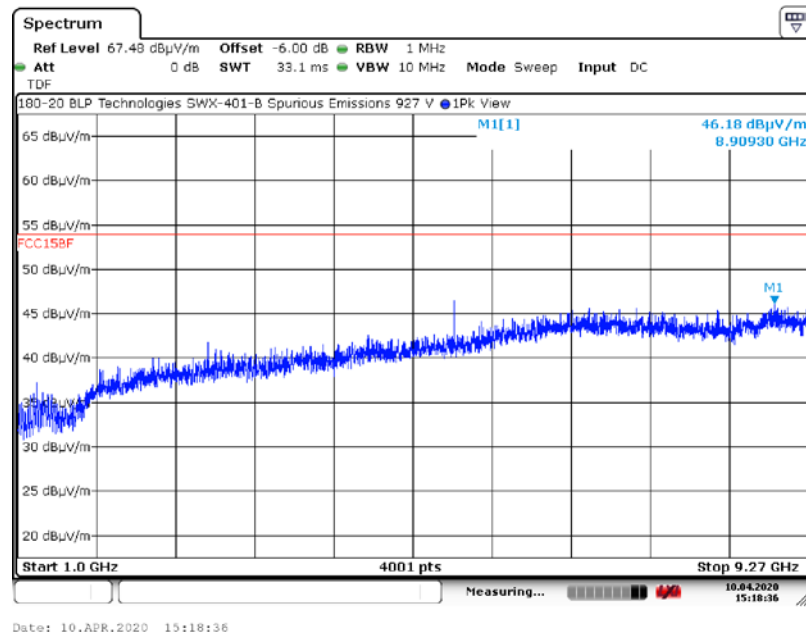
A2.3. Spurious Radiated Emissions (1000 MHz – 9270 MHz) Test Results

A2.3.3 Channel 21, 927 MHz

A2.3.3.1. Measurement Results: Horizontal Receive Antenna



A2.3.3.2. Measurement Results: Horizontal Receive Antenna

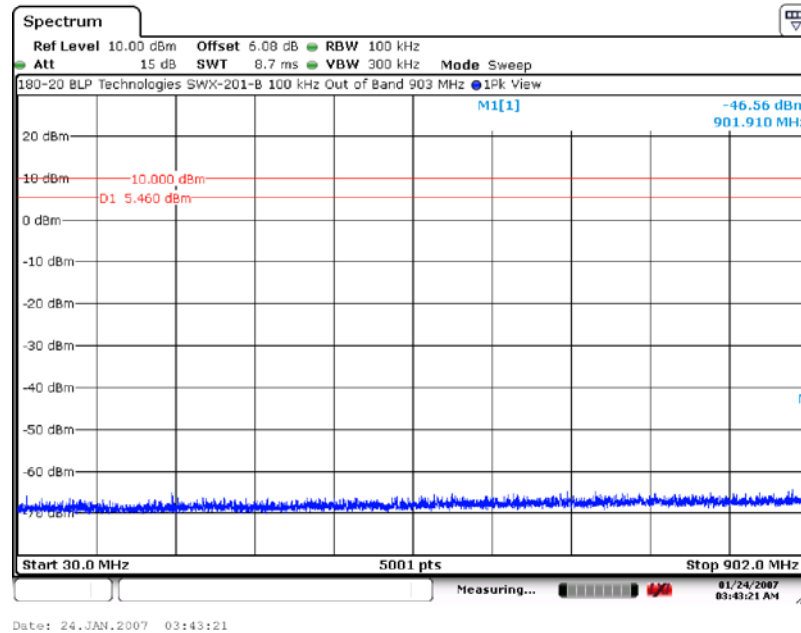


Appendix B - Emissions in Non-restricted Frequency Bands (1 MHz to 9.270 GHz)

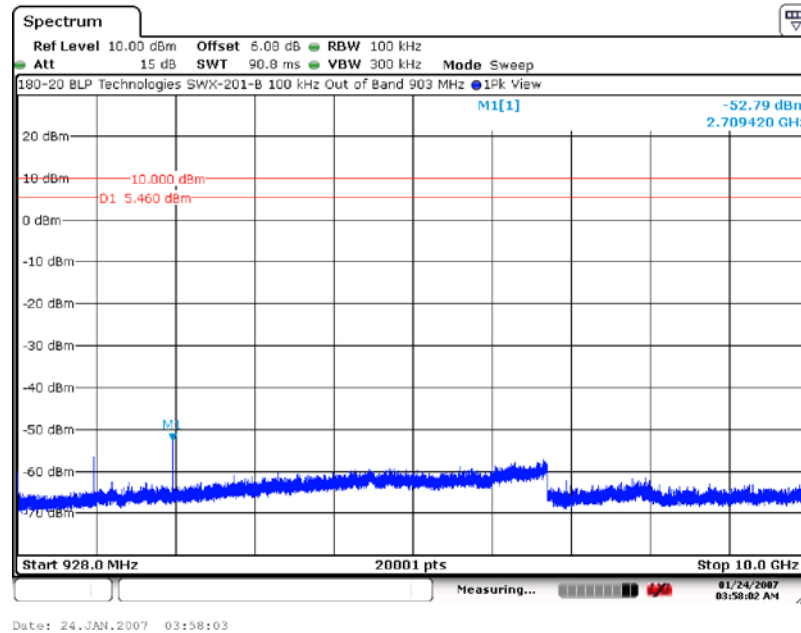
Device Tested – SWX-201-B / SWX-401-B (Conducted mode Measurements)

B1. Channel 1, 903 MHz

B1.1. Frequency Range 1 (30 MHz – 902 MHz) Test Results



B1.2. Frequency Range 2 (928 MHz – 10 GHz) Test Results

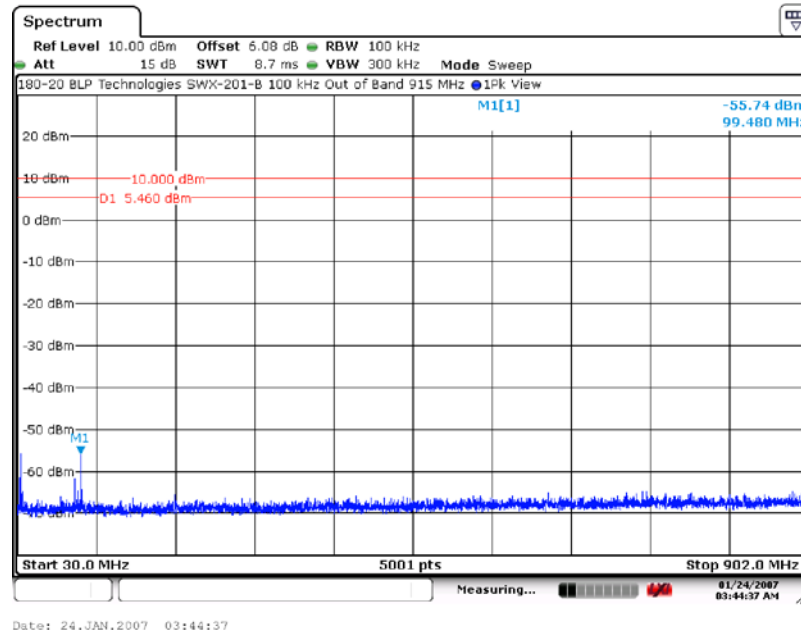


Appendix B - Emissions in Non-restricted Frequency Bands (1 MHz to 9.270 GHz)

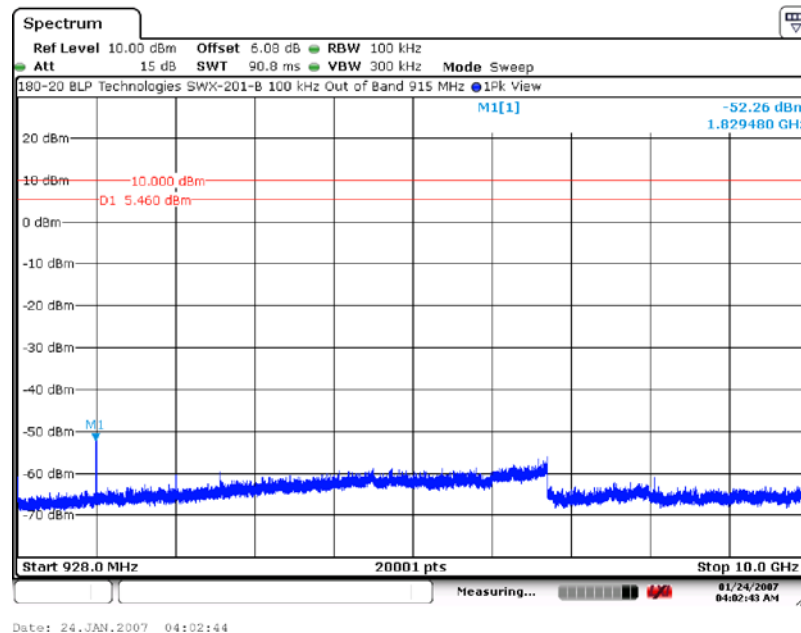
Device Tested – SWX-201-B / SWX-401-B (Conducted mode Measurements)

B2. Channel 11, 915 MHz

B2.1. Frequency Range 1 (30 MHz – 902 MHz) Test Results



B2.2. Frequency Range 2 (928 MHz – 10 GHz) Test Results

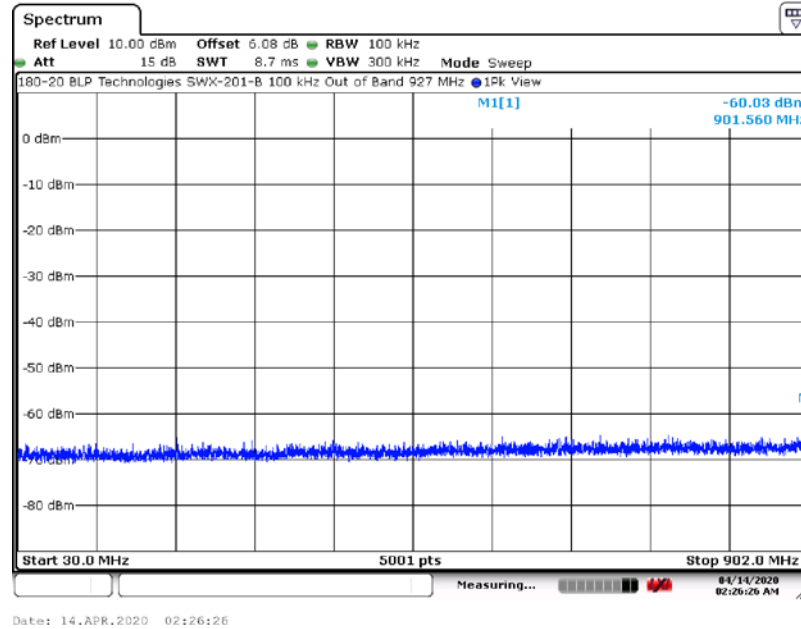


Appendix B - Emissions in Non-restricted Frequency Bands (1 MHz to 9.270 GHz)

Device Tested – SWX-201-B / SWX-401-B (Conducted mode Measurements)

B3. Channel 21, 927 MHz

B3.1. Frequency Range 1 (30 MHz – 902 MHz) Test Results



B3.2. Frequency Range 2 (928 MHz – 10 GHz) Test Results

