RF Solutions
4683 Burr Drive | Liverpool NY 13088 | 1-800-724-6452 | Fax 315-457-0428 | 315-457-0245

April 12, 2017

Mr. Paul Brown
GOJO
1 GOJO Plaza, Suite 500
Akron, OH 44311

Dear Mr. Brown

Enclosed is the test report for the GOJO Industries; Limited Approval Wireless Transmitter Module 8-Series (Formally called Firefly), model: 7700-575-910 tested at our facility, located at 4683 Burr Drive in Liverpool, NY. This facility is on file with the Federal Communications Commission (FCC) per 47 CFR 2.948 (Site File Number 306552), and Industry Canada (IC) as Site# 3034A-1.

As narrated in the report, the product configuration meets the requirements of the FCC per CFR 47 Part 15 Class B and Part 15.249 Class C for Intentional Radiators, and of Industry Canada per RSS-210, Issue 9, August 2016.

Thank you for selecting RF Solutions, LLC for your testing needs. We look forward to working with you on future projects. Should you have any questions or concerns regarding this report, contact me at 315-457-0245.

Sincerely,

Larry Andrews
Technical Associate

Table of Contents

Test Information

Laboratory:	***Manufacturer:***
RF Solutions, LLC. 4683 Burr Drive Liverpool, NY 13088-5303	**GOJO Industries** 1 GOJO Plaza, Suite 500 Akron, OH 44311

Report Issue Date: April 12, 2017
Report Number: 6604
Project Number: 6604
Date on Site: April 10, 2017
Date Tested: April 10 to April 12, 2017
Product: 8-Series Limited Module (Formally called Firefly)
Model: 7700-575-910

FCC ID: O76-T6SG0910A **IC Certification#: 10391B-T6SG0910A**

Traceability: *Reference standards of measurement have been calibrated by a competent body using standards traceable to NIST.*

The testing performed by RF Solutions, LLC demonstrates that the product referenced above complies with the electromagnetic compatibility requirements according to the FCC per CFR 47 Part 15 Class B and Part 15.249 Class C, and of Industry Canada per RSS-210, Issue 9, August 2016. The test results in this report apply only to the 8-Series Limited Module with dispenser; Model Number: 7700-575-910.

It is the responsibility of the manufacturer to ensure that the product identification and labeling are in compliance with the applicable requirements. The manufacturer is also responsible for ensuring that additional units are manufactured with identical mechanical and electrical characteristics.

The equipment listed above conforms to the specified requirements of the test standards listed in the Test Regulations section of this report.

Compiled by:
Signature: _____ Date: April 12, 2017
Larry Andrews
Technical Associate

Reviewed by:
Signature: _____ Date: April 12, 2017
Scott Gates
Technical Lab Manager

Authorized by:
Signature: _____ Date: April 12, 2017
Annelle Frierson
Managing Partner

Test Regulations

The tests were performed according to the following standards:

☒ FCC Part 15	☐ Class A	☒ Class B	
☒ FCC Part 15.249	☐ Class A	☐ Class B	☒ Class C
☒ RSS-210, Issue 9, August 2016			
☒ RSS-Gen, Issue 4, November 2014			

☒ **Certification**

Equipment under Test (EUT) Testing Operation Mode

The EUT was operated under the following conditions during testing:

☐ Standby

☒ Normal Operating Mode

☐ Practice Operation

Description / Configuration of the EUT:

Limited Approval Wireless Transmitter 8-Series Module; 7700-575-910 with a Manual POC Dispenser unit was powered with four 1.5 V Batteries during the collection of data included within this report.

Rationale for EUT setup / configuration:

ANSI C63.4-2014, ANSI C63.10-2013

Modifications:

None

Deviations from test method:

None

Emissions Test Results:

Radiated Emissions 30 MHz – 1000 MHz

The requirements are ☒ **MET** ☐ **NOT MET**

FCC Part 15.249 Part C 910 MHz – 9100 MHz

IC RSS-210, Issue 9, August 2016, 910 MHz – 9100 MHz

The requirements are ☒ **MET** ☐ **NOT MET**

General Remarks:

FCC: 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 less than 500 kHz.

The EUT was evaluated in 3 orthogonal orientations and the worst-case data is reflected in the test report.

Radiated Measurements on the EUT were performed from 910 MHz up to the 10^{th} Harmonic and any emission found to be more than 20 dB below the limit have not been reported.

The transmitter module transmits an OOK modulated data packet following a 10 second delay after an event trigger coming from the 8-Series dispenser. The use of the 8-Series dispenser to dispense soap to a customer constitutes an event and once an event occurs a trigger pulse is sent from the 8-Series dispenser to a microcontroller in the transmitter module. The microcontroller in the module uses the 10 second delay period to watch for additional events during that period of time. After the 10 second period has expired the total number of events that occurred during that 10 second period are sent in the transmitted data packet along with the transmitter module serial (ID) number and other information like the battery level. A drawing of the transmit packet is shown on last page of this report.

The transmitter packet starts with a 50% duty cycle Preamble for 38.76mSec followed by an off Space of 3.04mSec. After the Space, the payload is sent twice for redundancy. Each payload time is 63.84mSec in length and consists of an equal number of 1's and 0's. Where each of the 1's has a 25% duty cycle and each of the 0's has a 75% duty cycle. Together the payload has a combined 50% duty cycle. The total packet length is therefore the addition of the 38.76msec Preamble followed by the 3.04mSec Space followed by the two redundant payloads of 63.86mSec each for total packet length of 169.48mSec. The total packet duty cycle consists of 83.22mSec "on" bits and 86.26mSec "off" bits for a total percentage of "on" bits of 0.491%.

Therefore, the duty cycle correction in terms of dB is: 20log (0.491) = -6dB.

Industry Canada:

Devices shall comply with the following requirements:

(a) The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.
The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

(b) Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Summary:

The requirements according to the technical regulations are:

☒ Met.
☐ Not met.

The device under test does:

☒ Fulfill the general approval requirements mentioned on page 3.
☐ Not fulfill the general approval requirements mentioned on page 3.

Emissions Test Conditions:

Radiated Emissions

The Radiated Emissions measurements, in the frequency range of 30 MHz to 1000 MHz, were tested in a horizontal and vertical polarization at the following test location:

☒ RF Solutions Open Area Test Site
☐ RF Solutions lab

At a test distance of:

☐ 1 meter
☒ 3 meters
☐ 10 meters
☐ 30 meters

RF Solutions uses automated data reductions to determine product compliance to Radiated Emissions regulations. The product's signal data is compared to a current ambient scan. The frequencies that are of significant amplitude are sorted and are brought out to be further analyzed and maximized.

Test equipment used:

Manufacturer	Model	Description	Serial No.	Cal Date
Hewlett Packard	E4407B	Spectrum Analyzer	US39440719	6-21-2016
Electro-Metrics	BIA25	Biconical Antenna	001	11-08-2016
Electro-Metrics	LPA25	Log Periodic Antenna	1242	11-08-2016
		Mast, 1 – 4 Meters		N/A
		Co-ax cable, 100 ft. RG 8/U		N/A
		Co-ax cable, 10 ft.		N/A
		Non-conductive wooden turntable		N/A
		10-meter open field test range, grounded with 1/4” x 1/4” hardware cloth		N/A

NOTE: Calibration interval 1 year for the test equipment

FCC Part 15.249 Class C

The Fundamental and Harmonics measurements were tested in a horizontal and vertical polarization. The first fundamental was done at 3 meters and harmonics above 1 GHz were done at 1 meter at the above test location.

☒ RF Solutions Open Area Test Site
☐ RF Solutions lab

At a test distance of:

☒ 1 meter
☐ 3 meters
☐ 10 meters
☐ 30 meters

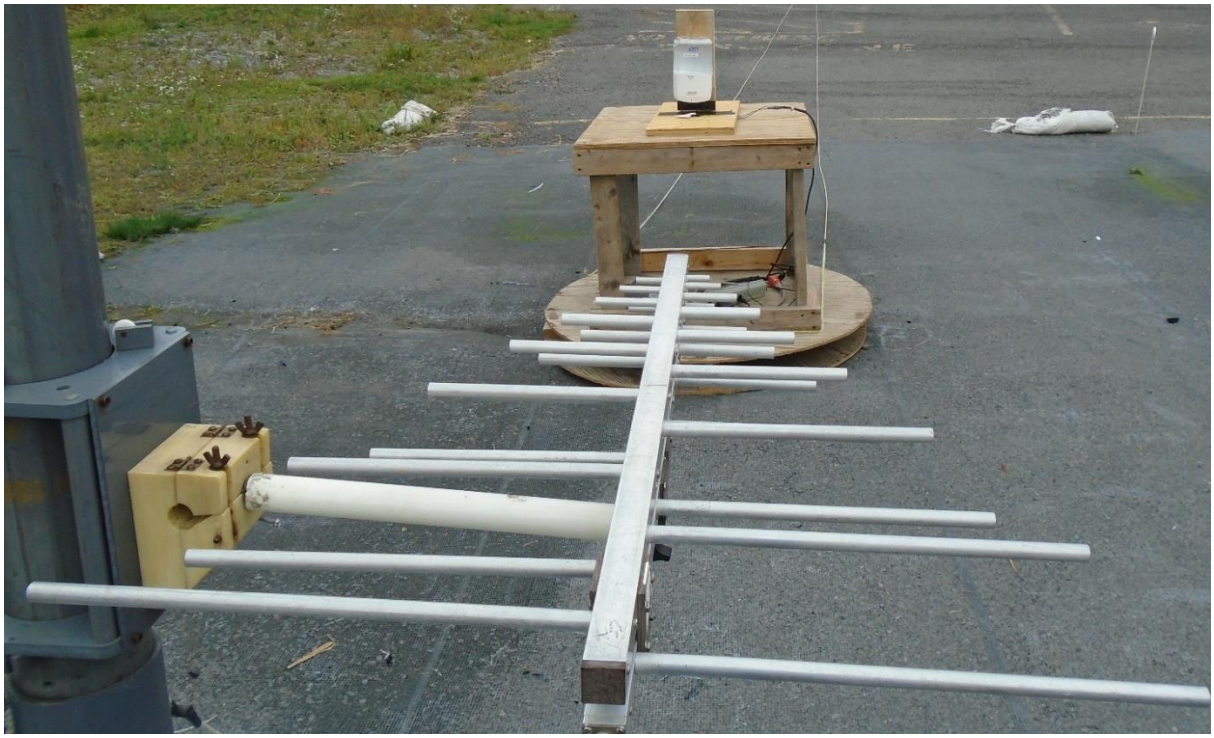
Test equipment used:

Manufacturer	Model	Description	Serial No.	Cal Date
Hewlett Packard	E4407B	Spectrum Analyzer	US39440719	6-21-2016
Electro-Metrics	LPA25	Log Periodic Antenna	1242	11-08-2016
Electro-Metrics	3115	Horn Antenna 1-18 GHz	9602-4672	11-08-2016
		Mast, 1 – 4 Meters		
		Co-ax cable, 100 ft. RG 8/U		
		Co-ax cable, 10 ft.		
		Non-conductive wooden turntable		
		Expanded polystyrene block 2 pieces (1 x 1.5 x .75 meters)		
		10-meter open field test range, grounded with 1/4” x 1/4” hardware cloth		

NOTE: Calibration interval 1 year for the test equipment

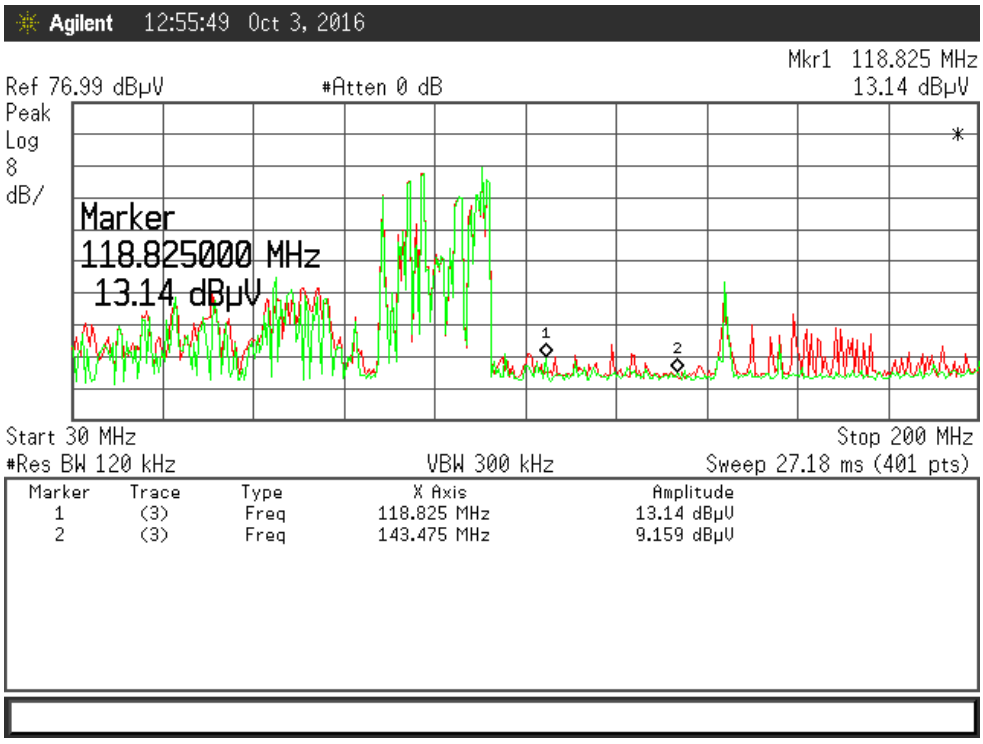
Test Setup Photograph

Two blocks of 1-meter wide by 1.5-meter long compressed polystyrene sit atop rf absorbers which sit atop a turntable, for a combined height of 1.5 meters above the reference ground plane. None of the rf absorbers are over 10 inches high. The area covered by the absorbers is 12 feet wide by 15 feet long (3.6m X 4.6m). A mast sits beyond the absorbers and can adjust the antenna height from 1 to 4 meters. A pole extends from the mast to support the antenna over the absorbers at 10 feet (3 meters) from the center of the turn table. The absorbers extend 1 foot (0.3m) behind the turntable.

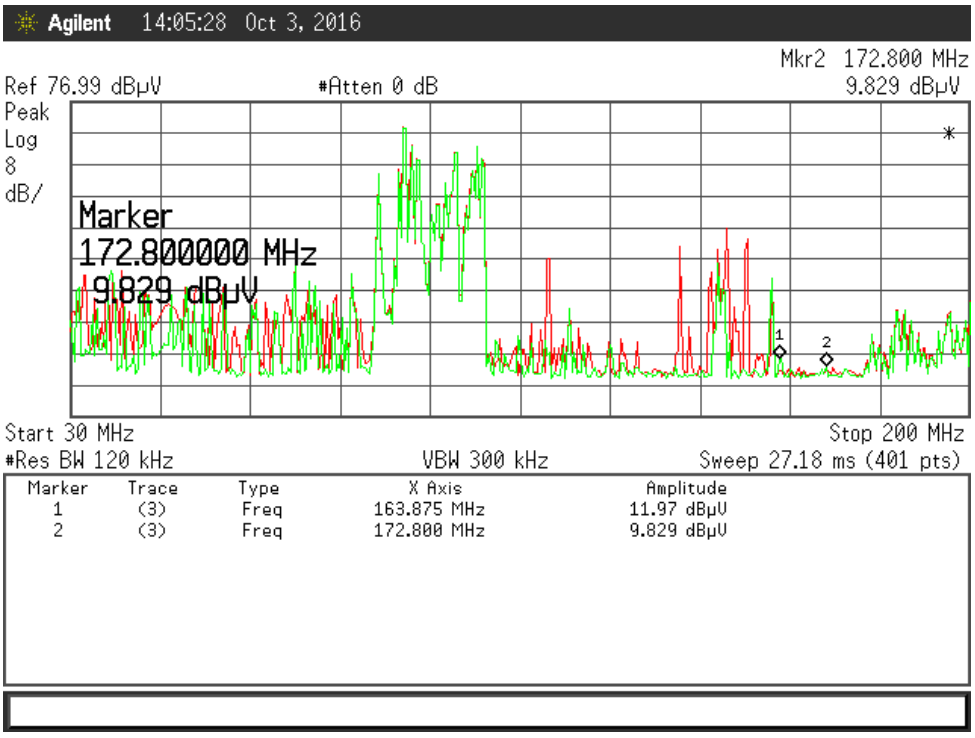


Radiated Emissions Scans

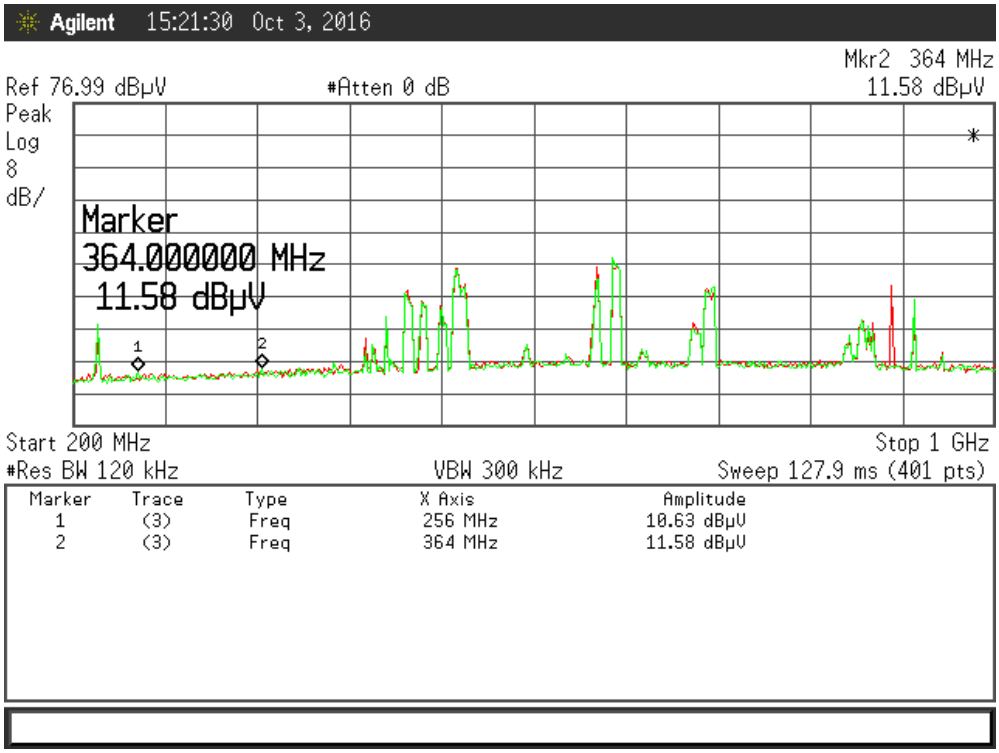
Horizontal 30 MHz to 200 MHz



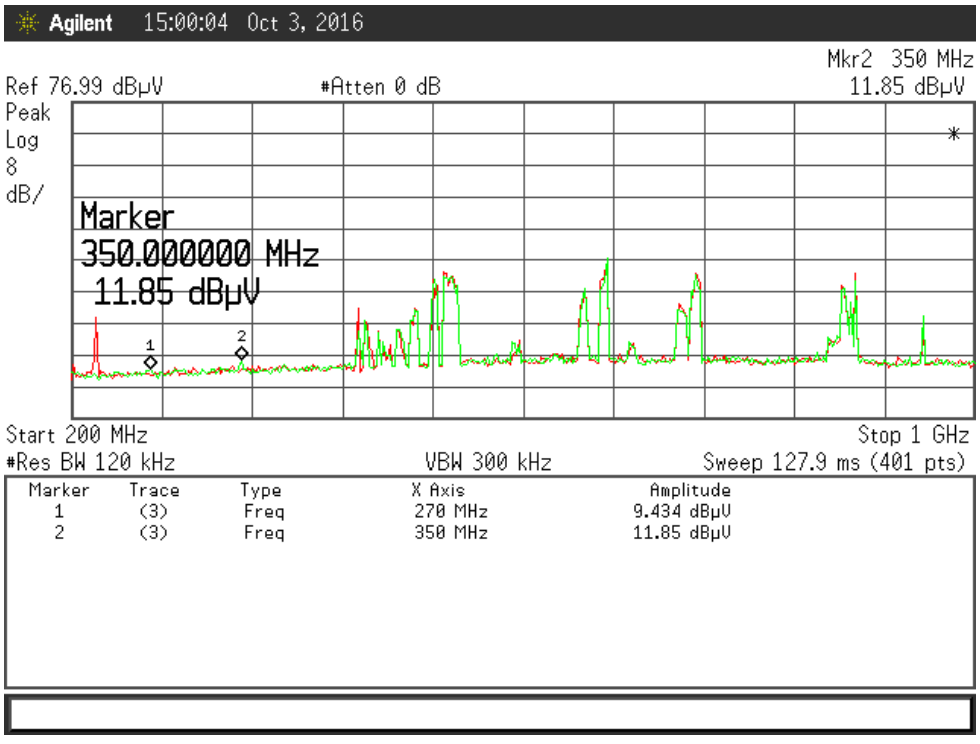
Vertical 30 MHz to 200 MHz



Horizontal 200 MHz to 1000 MHz

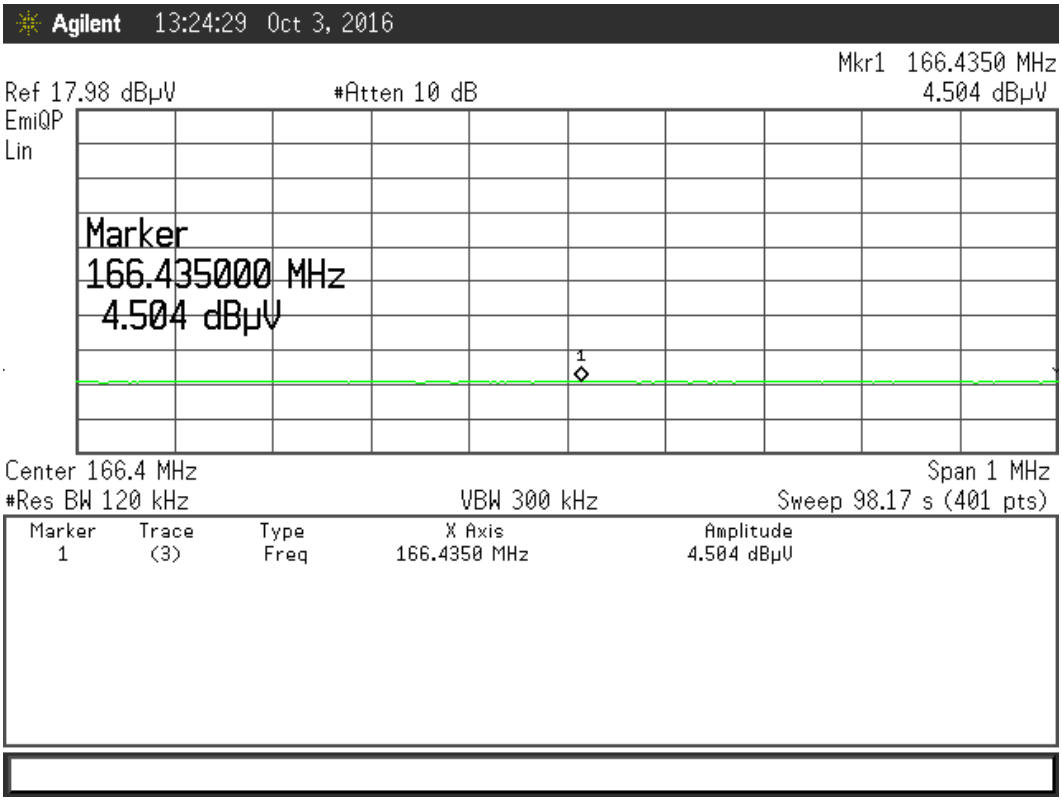


Vertical 200 MHz to 1000 MHz



Radiated Emissions Test Data 30 MHz to 1000 MHz

Polarity (V or H)	Azimuth(Degrees)	Frequency (MHz)	QP(dBµB)	AF(dB)	Net(db)	Test Limit	Margin
V	0	166.43	4.504	23.4	27.9	46	-18.1
V	85	163.95	4.79	22.81	27.6	46	-18.4
V	90	166.62	4.8	23.4	28.2	43.5	-15.3
V	180	170.95	4.53	24.11	28.64	43.5	-14.86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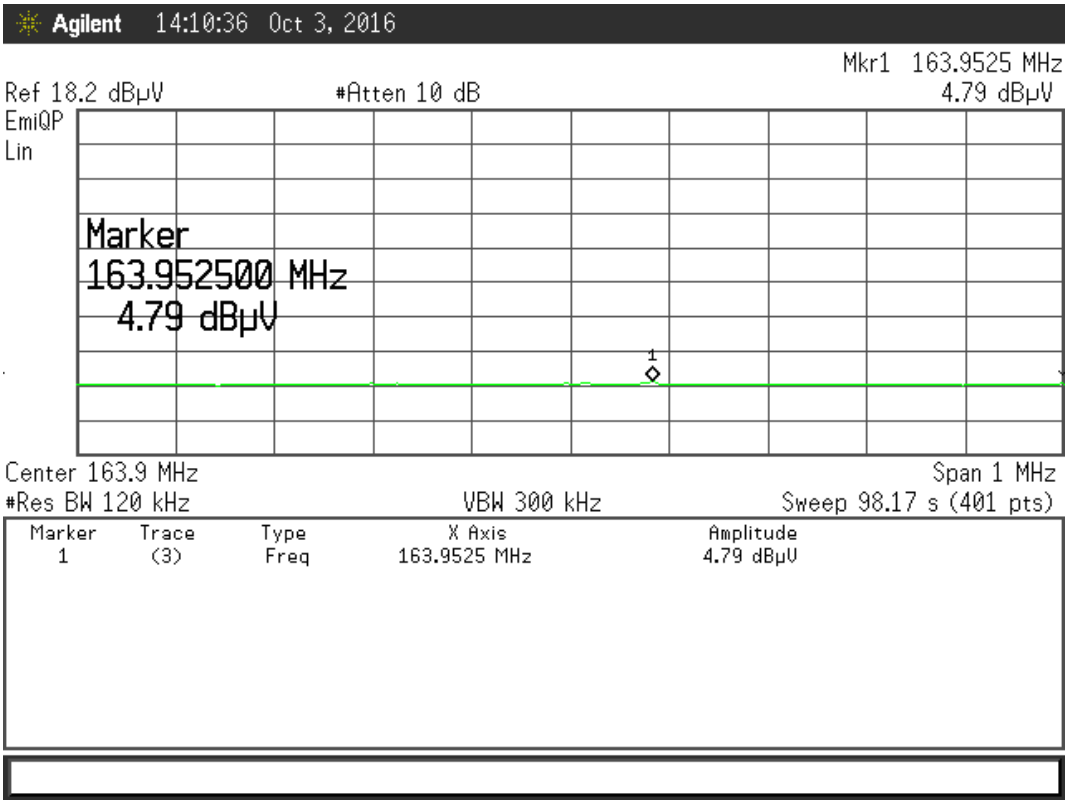
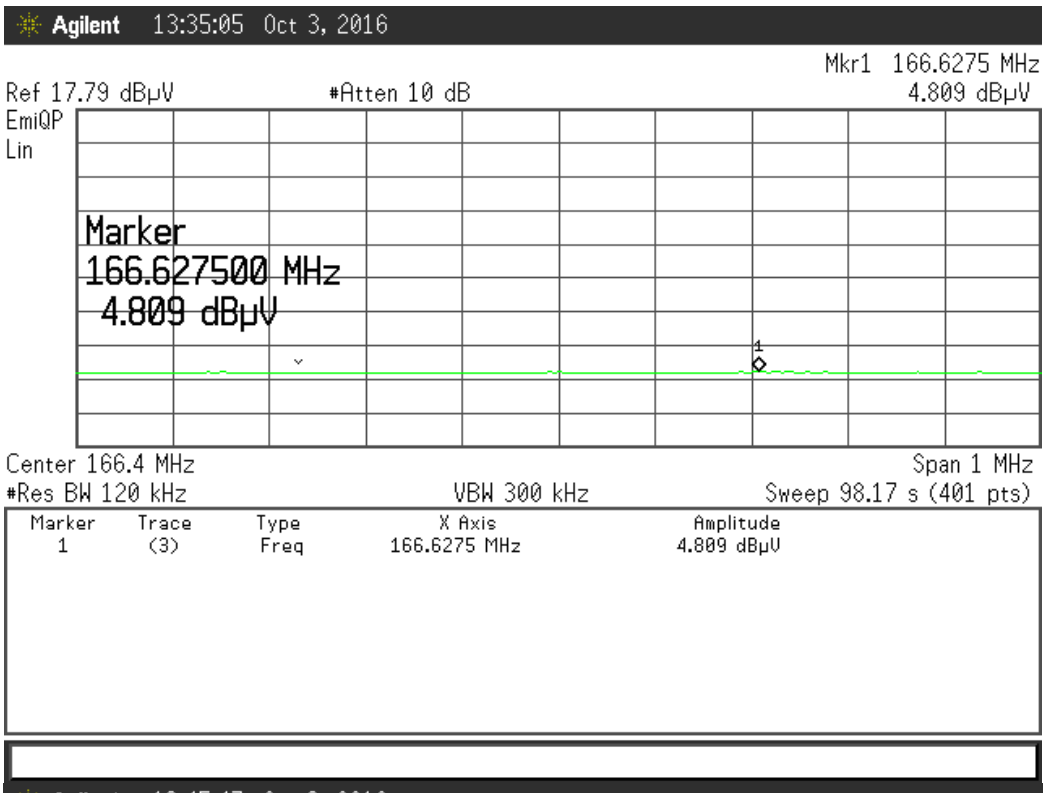
Mkr1 166.4350 MHz
Ref 17.98 dBµV
#Atten 10 dB
4.504 dBµV
EmiQP
Lin
Marker
166.435000 MHz
4.504 dBµV
Center 166.4 MHz
Span 1 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 98.17 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (3) Freq 166.4350 MHz 4.504 dBµV


Agilent 14:10:36 Oct 3, 2016
Mkr1 163.9525 MHz
Ref 18.2 dBµV
#Atten 10 dB
4.79 dBµV
EmiQP
Lin
Marker
163.952500 MHz
4.79 dBµV
Center 163.9 MHz
Span 1 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 98.17 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (3) Freq 163.9525 MHz 4.79 dBµV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Ref 17.79 dBµV
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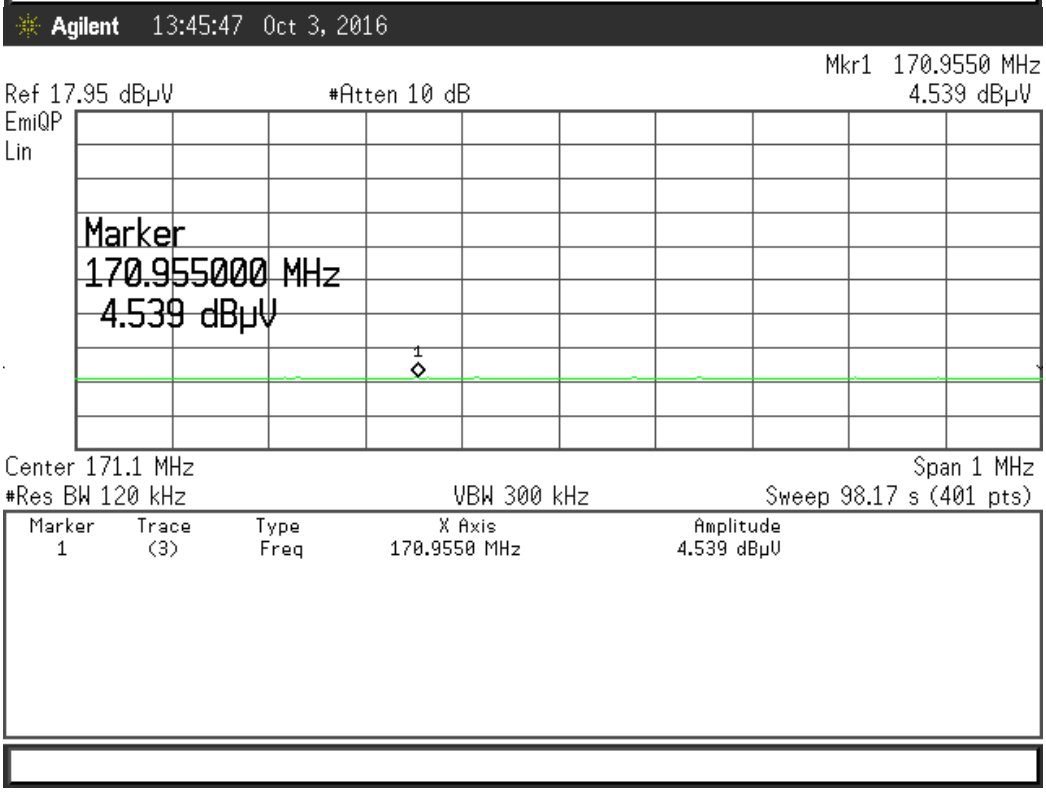
4.809 dBµV
EmiQP
Lin
Marker
166.627500 MHz
4.809 dBµV
Center 166.4 MHz
Span 1 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 98.17 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (3) Freq 166.6275 MHz 4.809 dBµV


Agilent 13:45:47 Oct 3, 2016
Mkr1 170.9550 MHz
Ref 17.95 dBµV
#Atten 10 dB
4.539 dBµV
EmiQP
Lin
Marker
170.955000 MHz
4.539 dBµV
Center 171.1 MHz
Span 1 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 98.17 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (3) Freq 170.9550 MHz 4.539 dBµV

Fundamental and Harmonics Test Data Sheets

Fundamental and Harmonics / Horizontal

FCC Part 15.249 Transmitter Test

Measured Field Strength (dBµV)	Res. Bandwidth (Khz)	DUT Frequency (Mhz)	Measured Frequency (Mhz)	Azimuth degrees	Cable Factor (dB)	Antenna Factor (dB)	Measurement Distance (Meters)	Duty Cycle Correction (dB)	FCC Limit (uV/M) at 3M	Corrected Field Strength to 3M in uV/M Peak	Delta Limit (dB)	Polarity
50.53	120	910	910	315	13.81	22.70	3	-6	50000	11,271.97	-12.94	H
23.38	120	910	1820	315	5.90	27.44	3	-6	500	343.56	-3.26	H
10.21	120	910	2730	315	7.60	30.13	3	-6	500	125.03	-12.04	H
17.73	120	910	3640	315	7.70	32.11	3	-6	500	377.57	-2.44	H
21.86	120	910	4550	315	1.16	32.92	1	-6	500	104.68	-13.58	H
17.12	120	910	5460	315	1.26	34.67	1	-6	500	75.05	-16.47	H
17.62	120	910	6370	315	1.35	35.26	1	-6	500	85.98	-15.29	H
20.60	120	910	7280	315	1.43	36.70	1	-6	500	144.34	-10.79	H
21.28	120	910	8190	315	1.50	37.33	1	-6	500	169.19	-9.41	H
19.52	120	910	9100	315	1.56	38.00	1	-6	500	150.27	-10.44	H

Report# 6604

Unit Under Test: GOJO Firefly 04/12/2017

Fundamental and Harmonics / Vertical

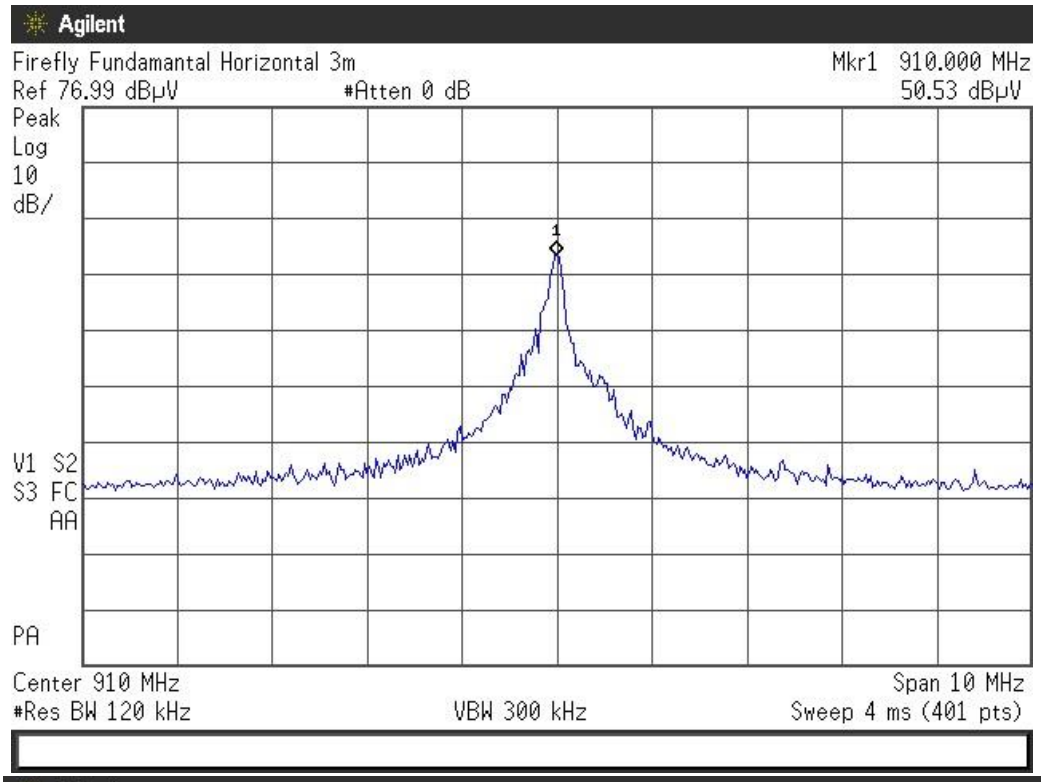
FCC Part 15.249 Transmitter Test

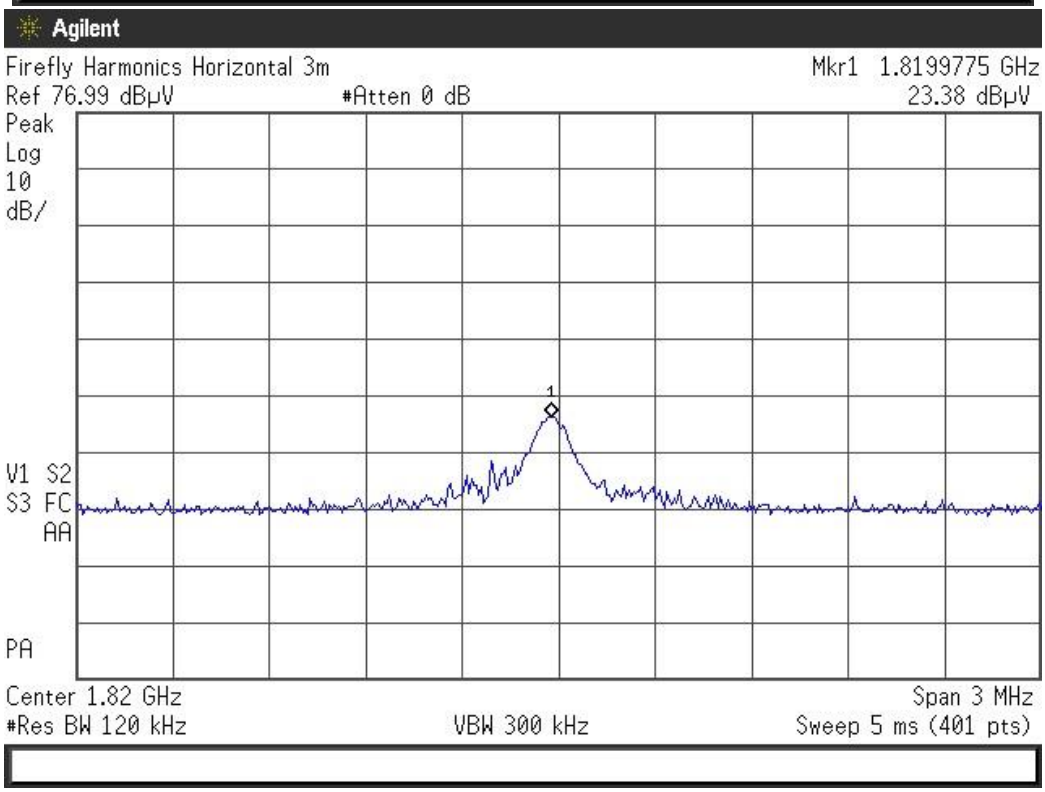
Measured Field Strength (dBµV)	Res. Bandwidth (Khz)	DUT Frequency (Mhz)	Measured Frequency (Mhz)	Azimuth degrees	Cable Factor (dB)	Antenna Factor (dB)	Measurement Distance (Meters)	Duty Cycle Correction (dB)	FCC Limit (uV/M) at 3M	Corrected Field Strength to 3M in uV/M Peak	Delta Limit (dB)	Polarity
52.71	120	910	910	315	13.81	22.70	3	-6	50000	14,487.72	-10.76	V
21.26	120	910	1820	315	5.90	27.44	3	-6	500	269.15	-5.38	V
13.05	120	910	2730	315	7.60	30.13	3	-6	500	173.38	-9.20	V
18.40	120	910	3640	315	7.70	32.11	3	-6	500	407.85	-1.77	V
17.45	120	910	4550	315	1.16	32.92	1	-6	500	63.01	-17.99	V
16.92	120	910	5460	315	1.26	34.67	1	-6	500	73.35	-16.67	V
16.29	120	910	6370	315	1.35	35.26	1	-6	500	73.77	-16.62	V
21.25	120	910	7280	315	1.43	36.70	1	-6	500	155.55	-10.14	V
18.64	120	910	8190	315	1.50	37.33	1	-6	500	124.85	-12.05	V
18.11	120	910	9100	315	1.56	38.00	1	-6	500	127.76	-11.85	V

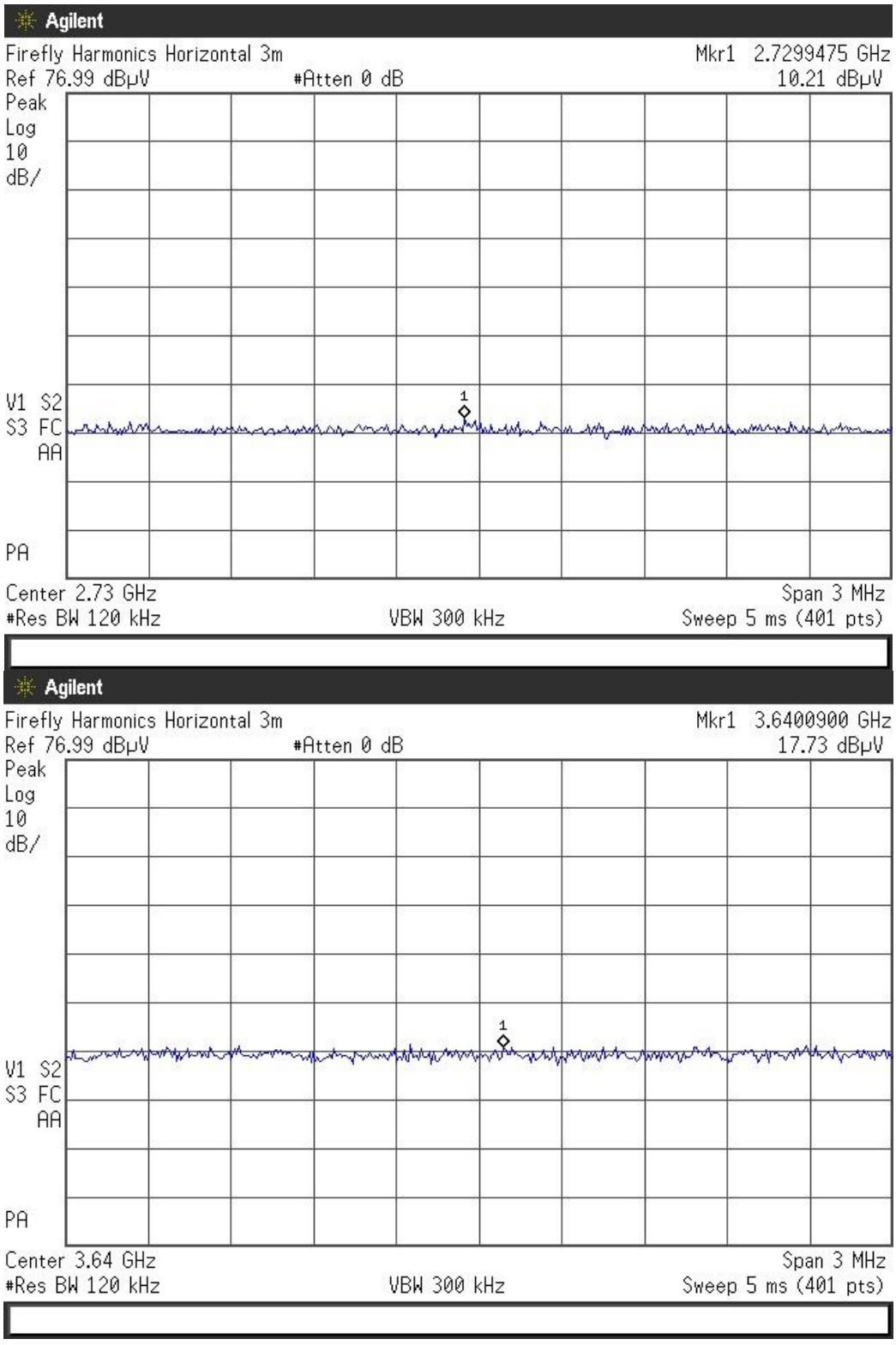
Report# 6604

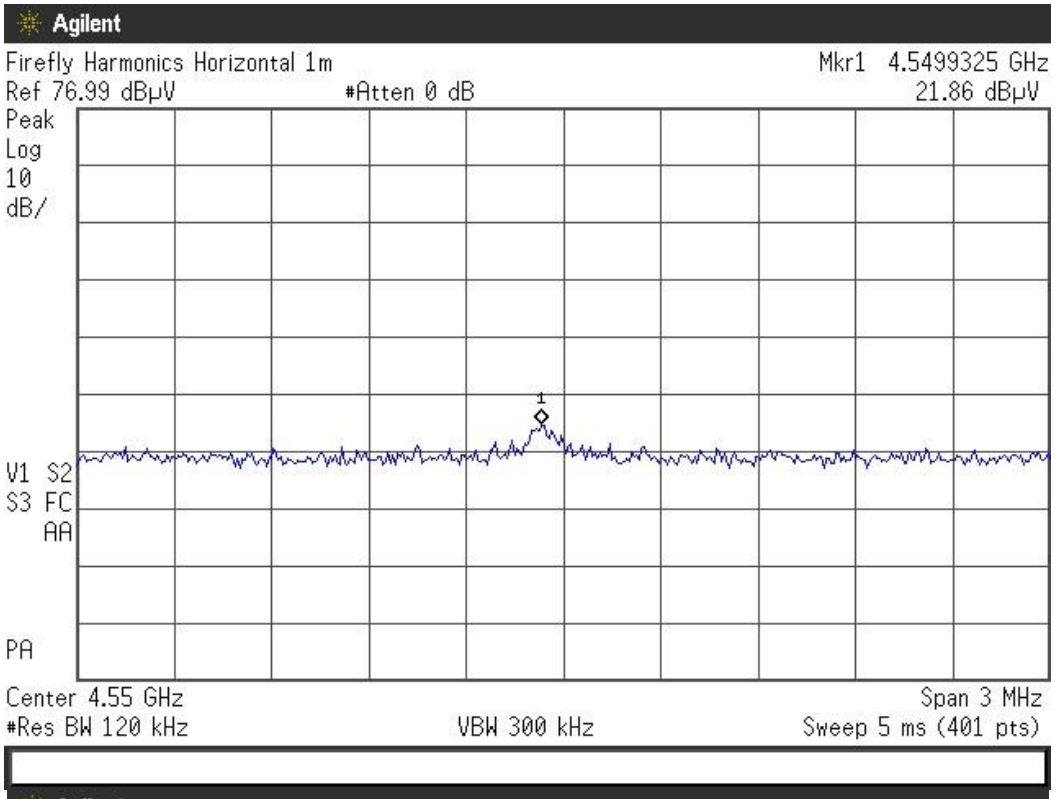
Unit Under Test: GOJO Firefly 04/12/2017

Fundamental and Harmonics Scans Horizontal






Agilent
Firefly Harmonics Horizontal 3m
Mkr1 2.7299475 GHz
Ref 76.99 dBµV
#Atten 0 dB
10.21 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 2.73 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)
Agilent
Firefly Harmonics Horizontal 3m
Mkr1 3.6400900 GHz
Ref 76.99 dBµV
#Atten 0 dB
17.73 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 3.64 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
Firefly Harmonics Horizontal 1m
Mkr1 4.5499325 GHz
Ref 76.99 dBµV
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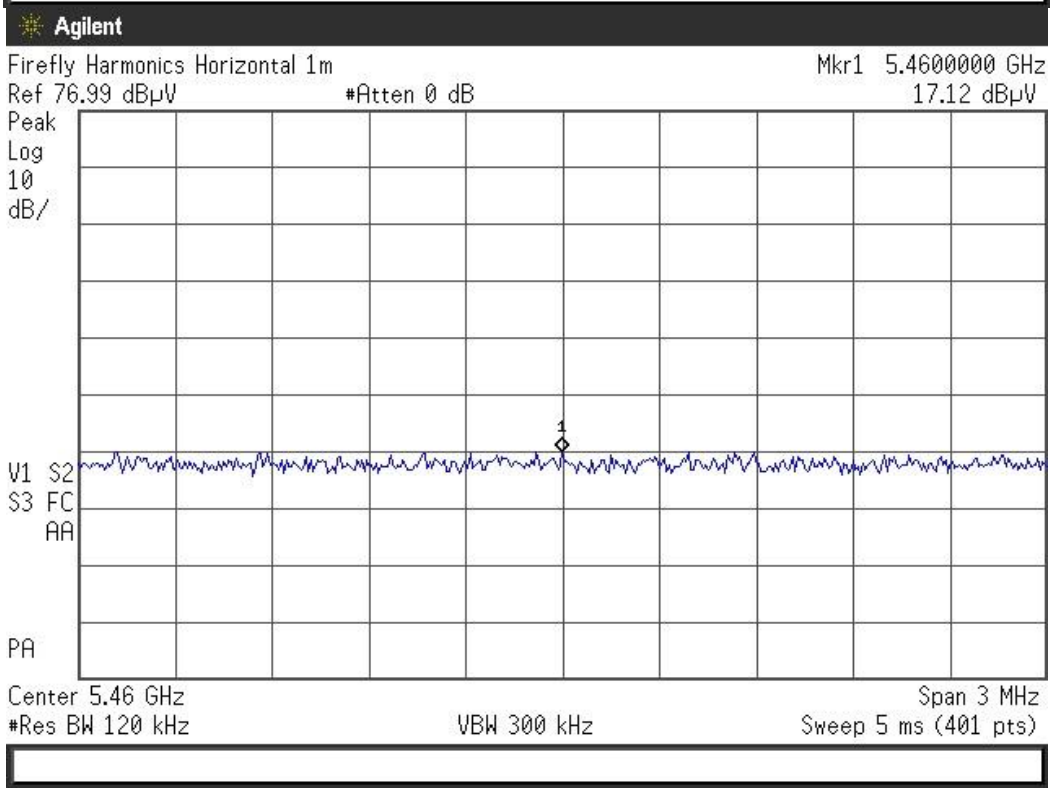
21.86 dBµV
Peak
Log
10
dB/
1
V1 S2
S3 FC
AA
PA
Center 4.55 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
Firefly Harmonics Horizontal 1m
Mkr1 5.4600000 GHz
Ref 76.99 dBµV
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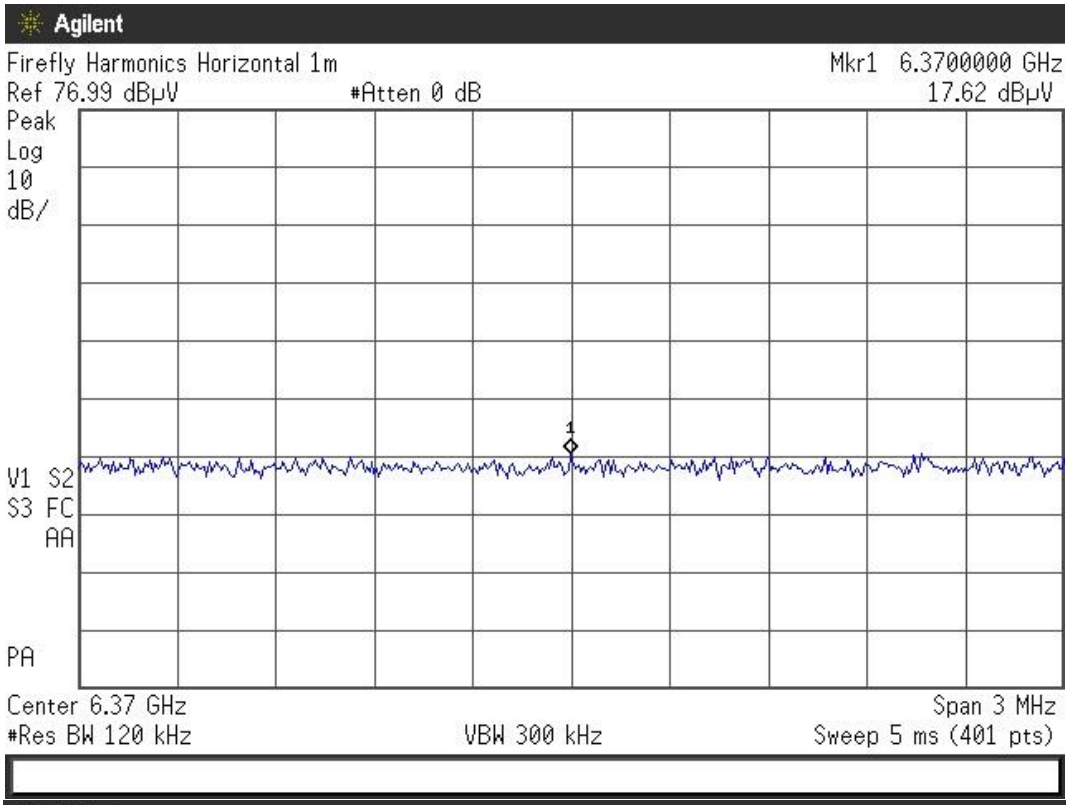
17.12 dBµV
Peak
Log
10
dB/
1
V1 S2
S3 FC
AA
PA
Center 5.46 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)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Firefly Harmonics Horizontal 1m
Mkr1 6.3700000 GHz
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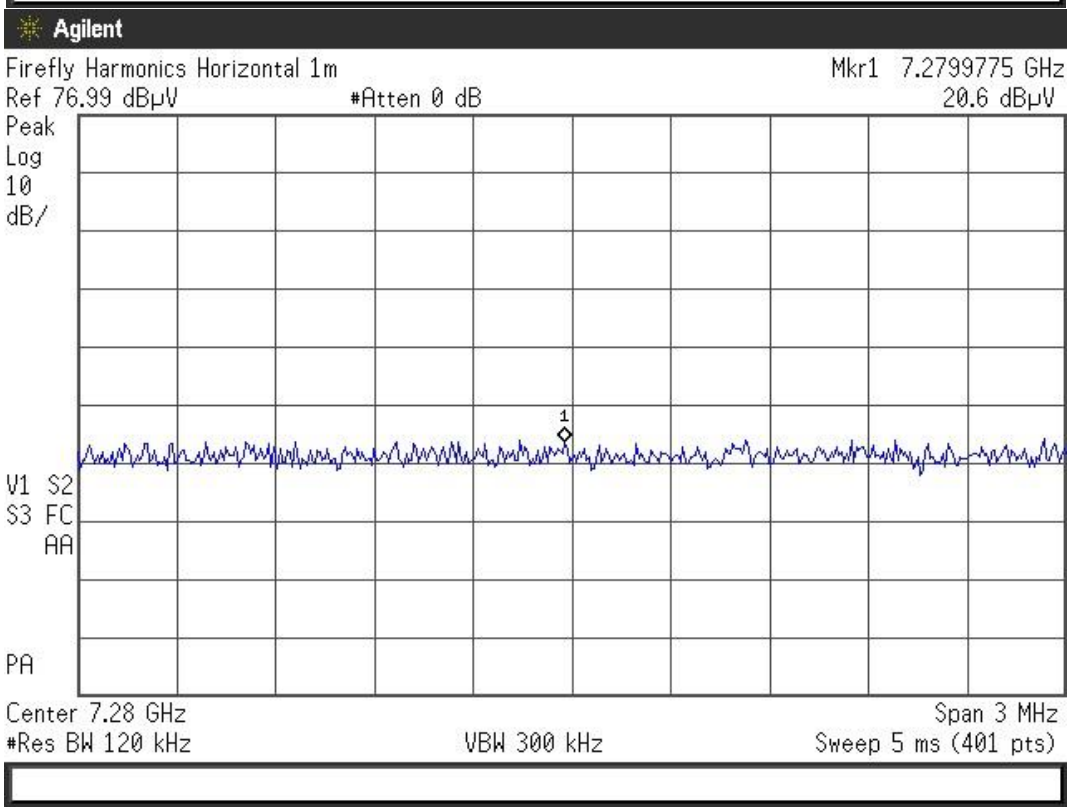
#Atten 0 dB
17.62 dBµV
Peak
Log
10
dB/
1
V1 S2
S3 FC
AA
PA
Center 6.37 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
Firefly Harmonics Horizontal 1m
Mkr1 7.2799775 GHz
Ref 76.99 dBµV
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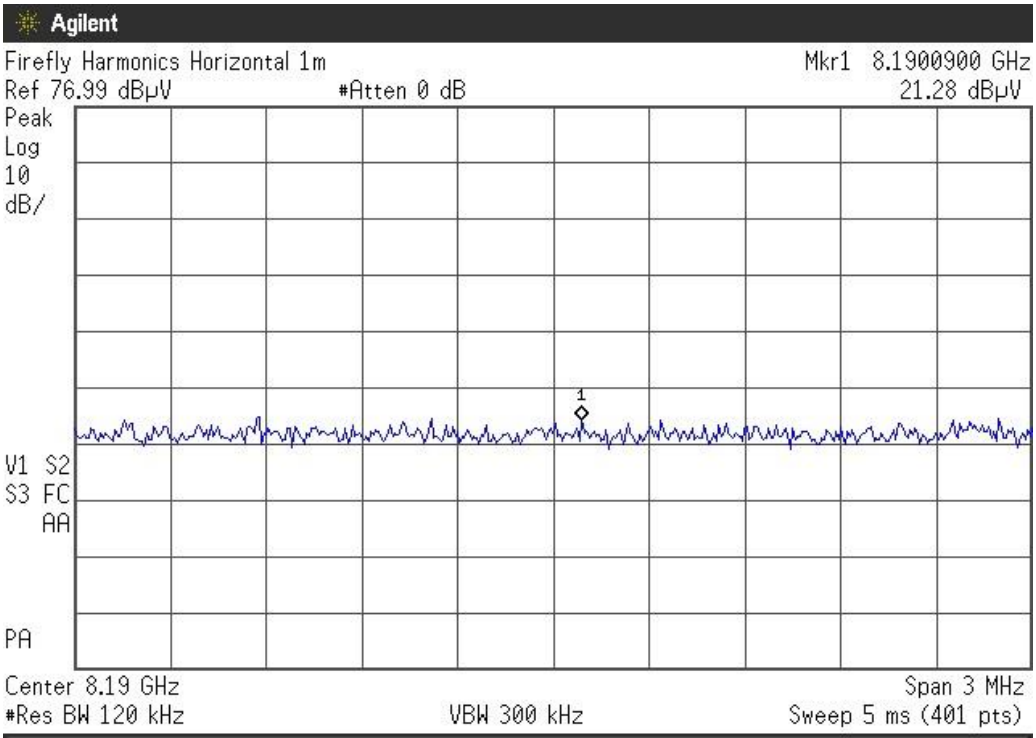
20.6 dBµV
Peak
Log
10
dB/
1
V1 S2
S3 FC
AA
PA
Center 7.28 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
Firefly Harmonics Horizontal 1m
Mkr1 8.1900900 GHz
Ref 76.99 dBµV
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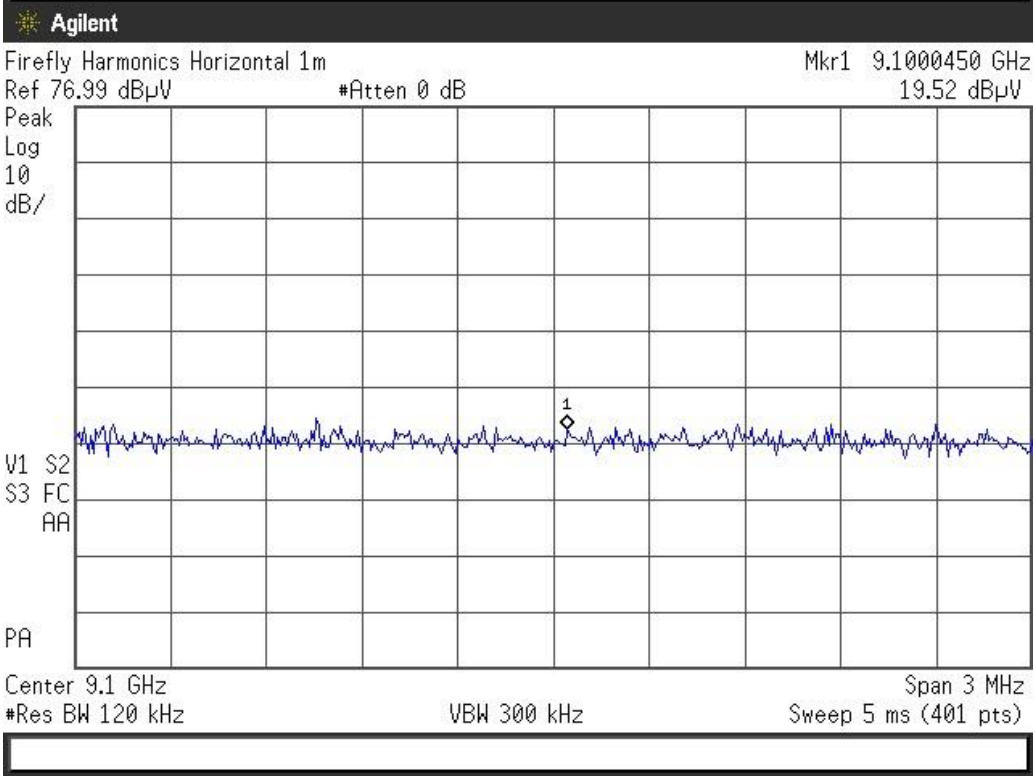
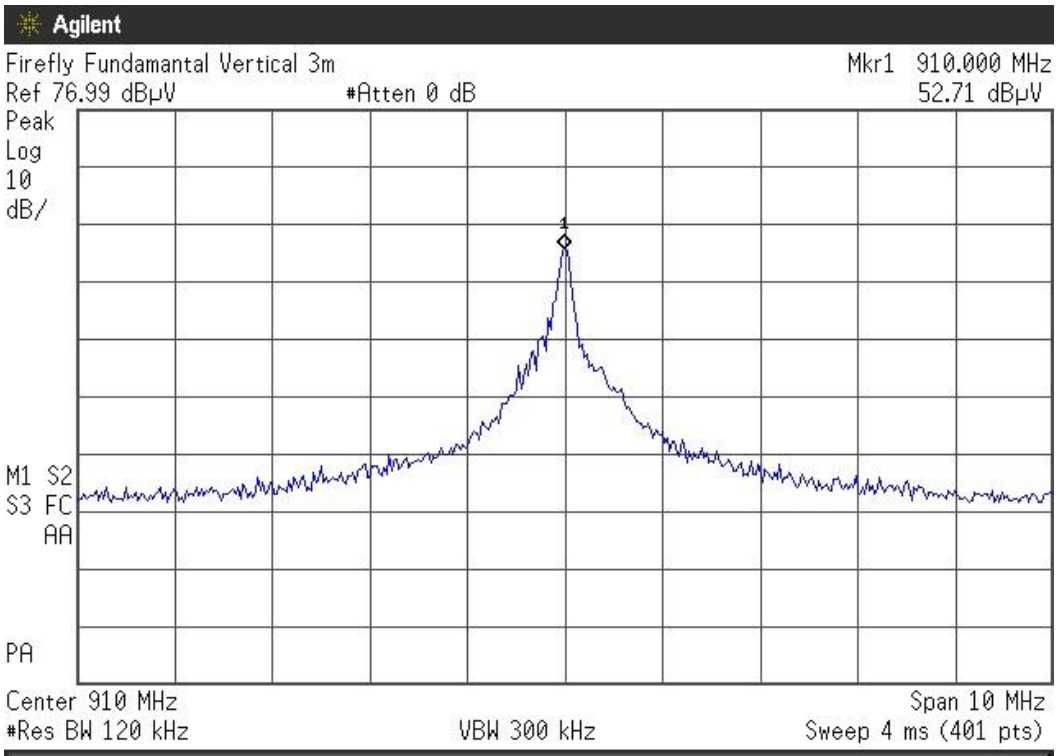
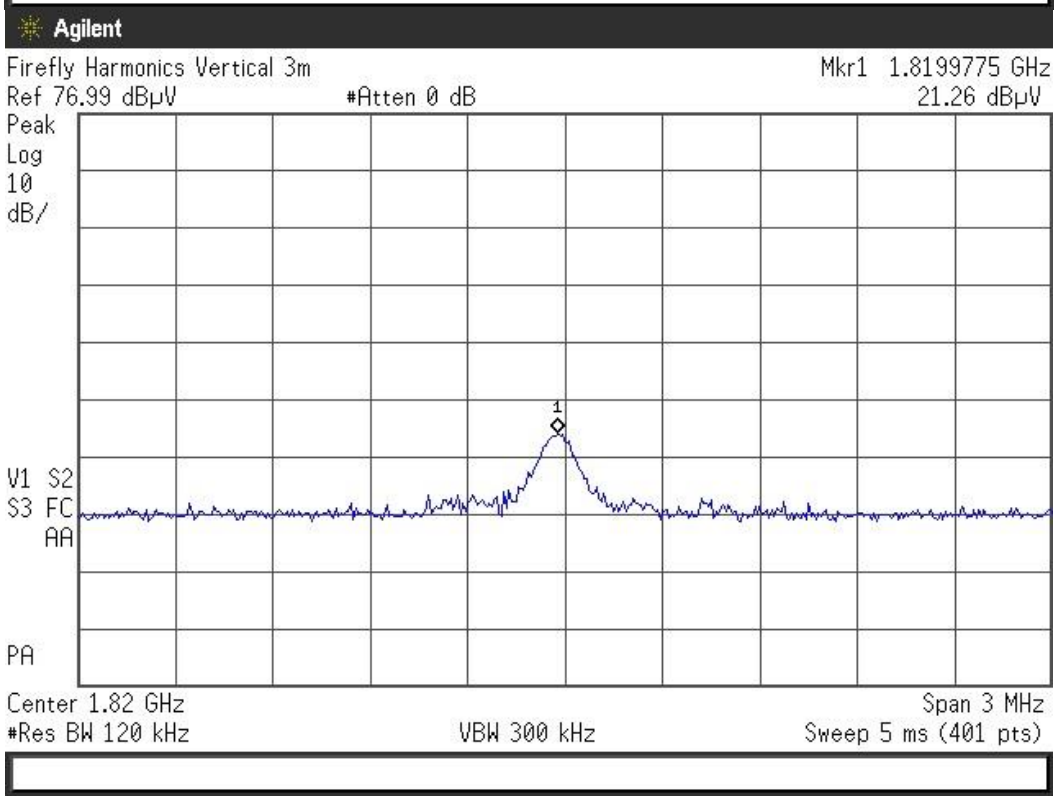
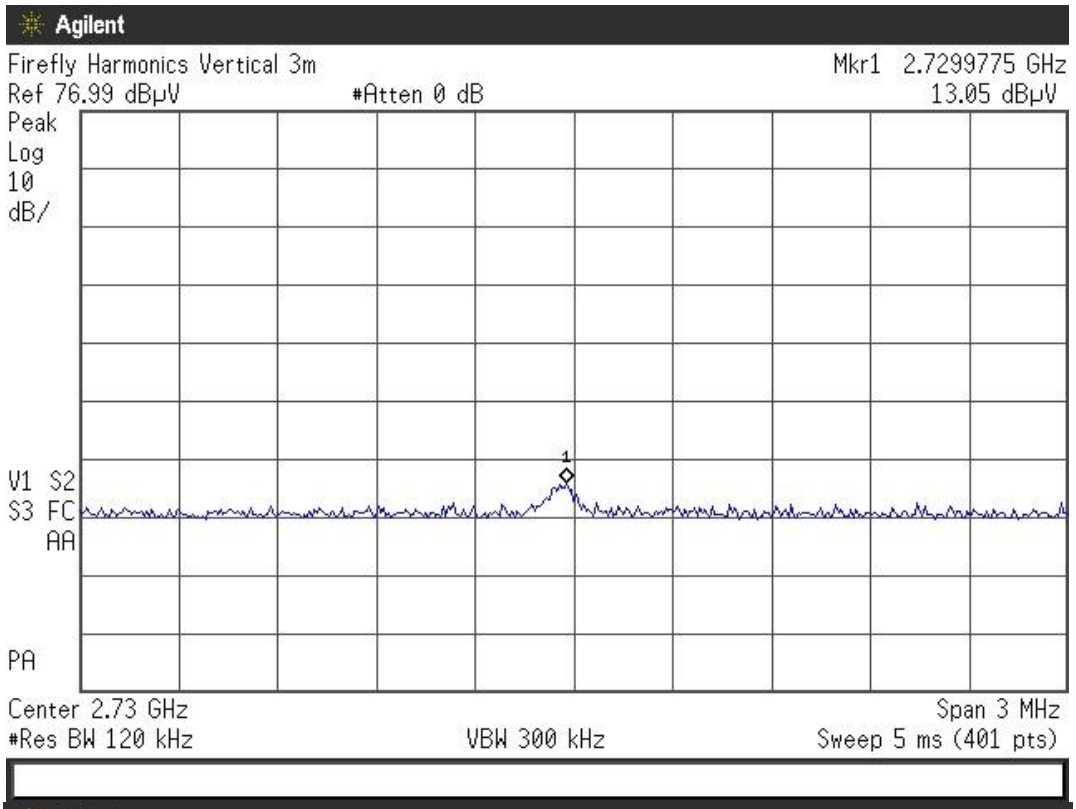
21.28 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 8.19 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)

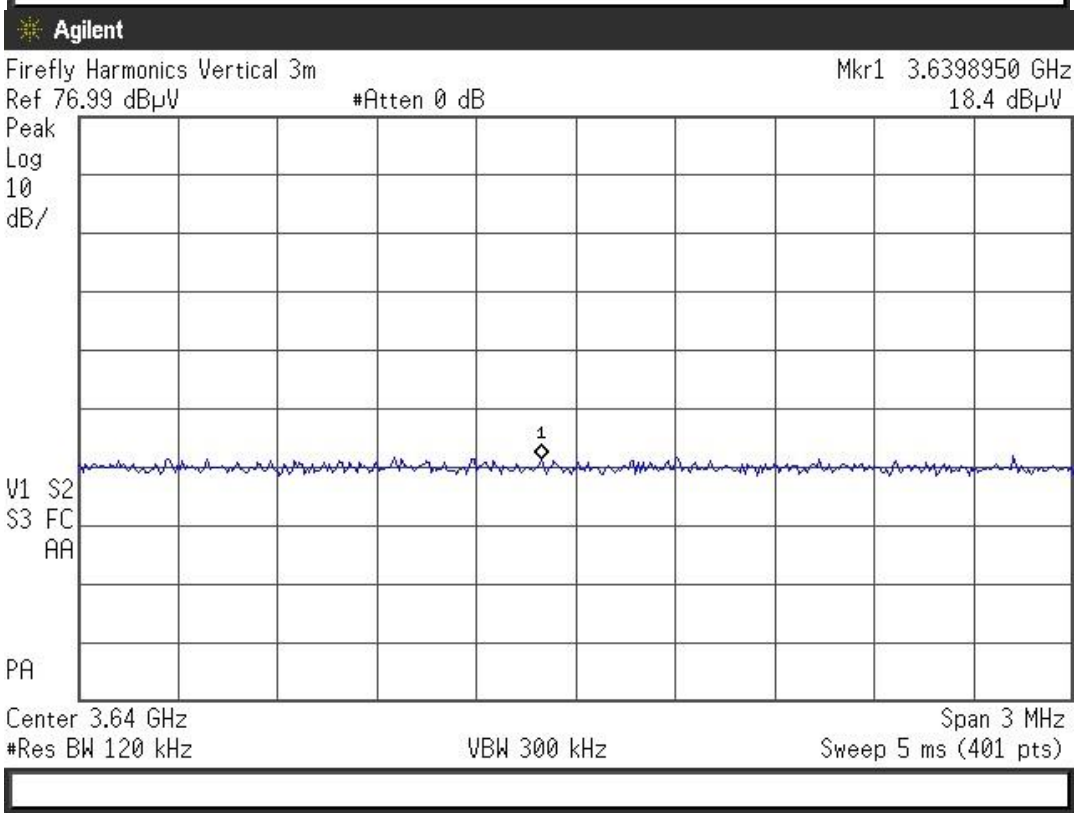

Agilent
Firefly Harmonics Horizontal 1m
Mkr1 9.1000450 GHz
Ref 76.99 dBµV
#Atten 0 dB
19.52 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 9.1 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)

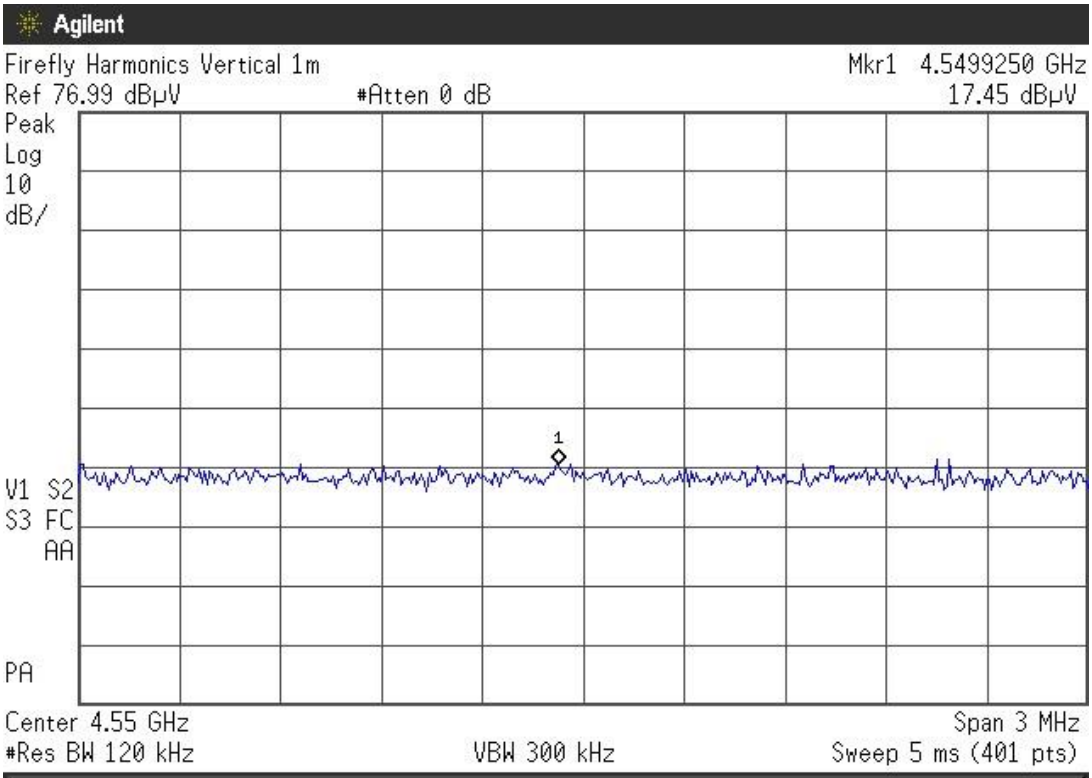
Fundamental and Harmonics Scans Vertical

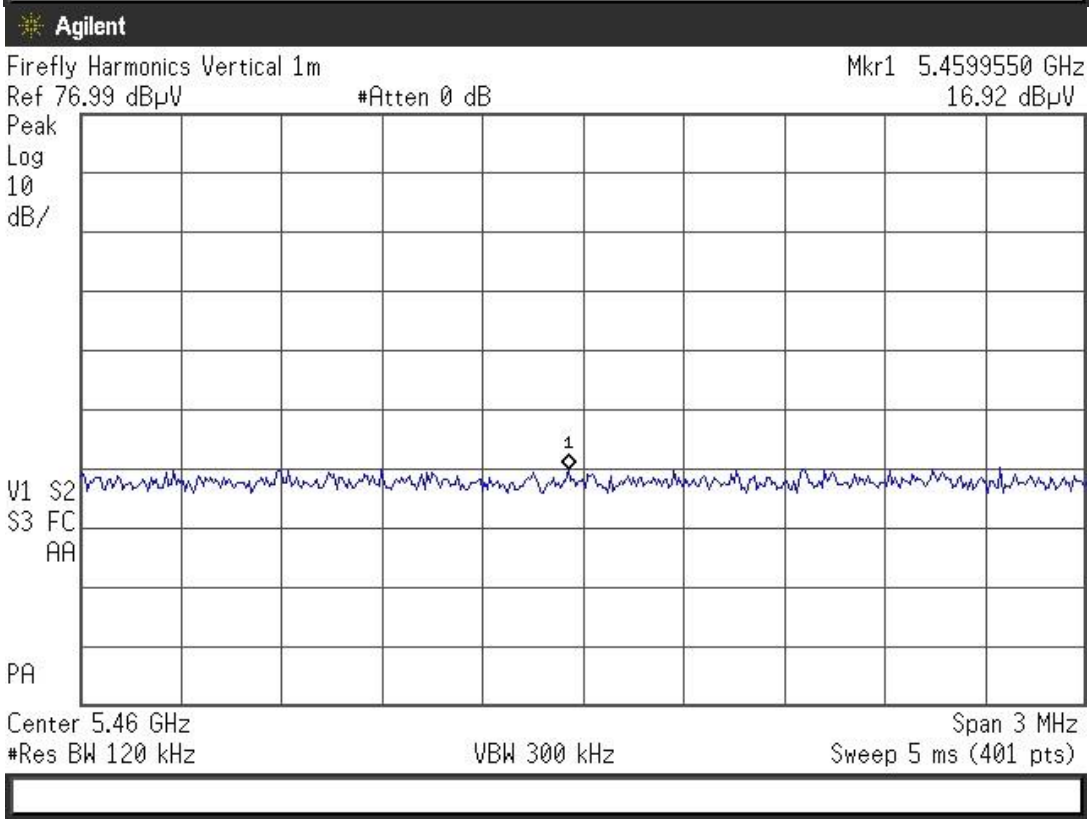


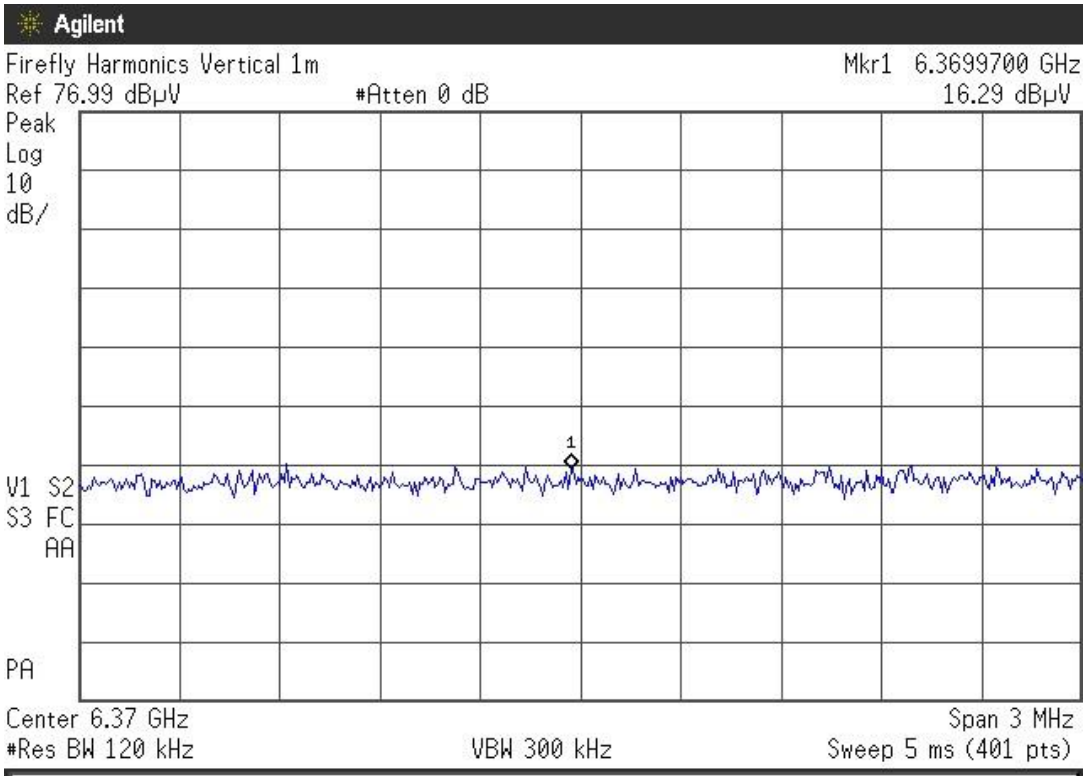


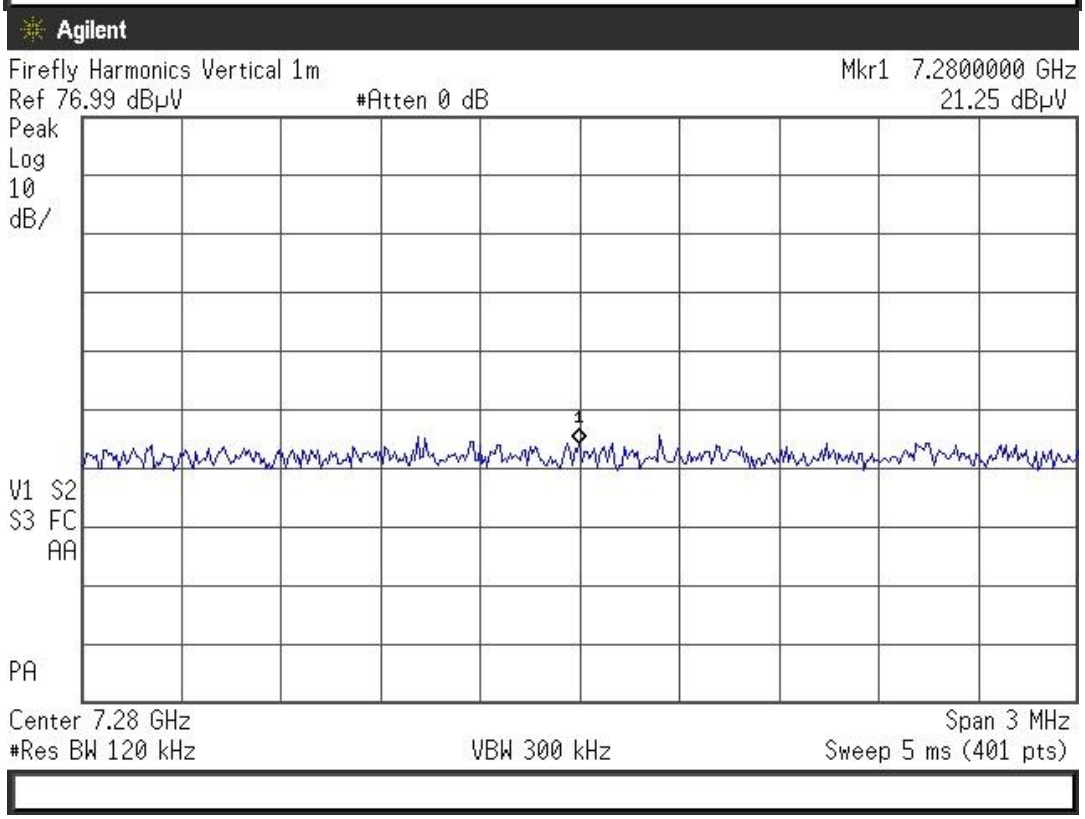

Agilent
Firefly Harmonics Vertical 3m
Ref 76.99 dBµV
#Atten 0 dB
Mkr1 2.7299775 GHz
13.05 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 2.73 GHz
#Res BW 120 kHz
VBW 300 kHz
Span 3 MHz
Sweep 5 ms (401 pts)

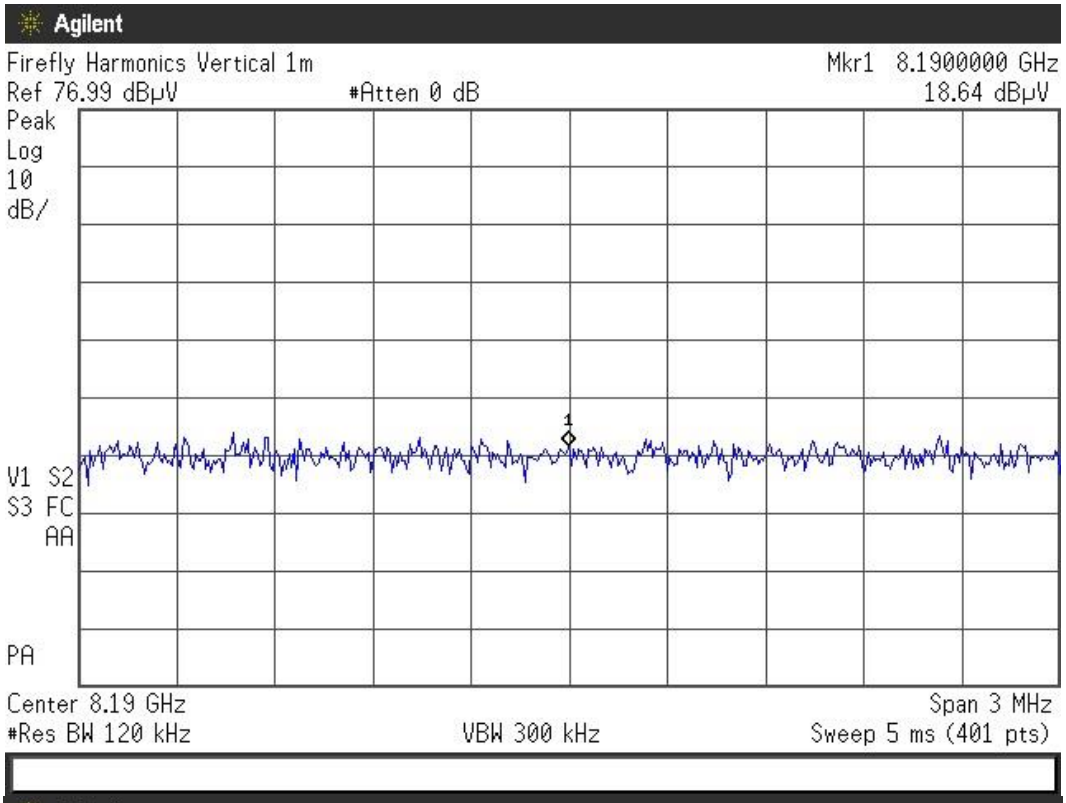

Agilent
Firefly Harmonics Vertical 3m
Ref 76.99 dBµV
#Atten 0 dB
Mkr1 3.6398950 GHz
18.4 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 3.64 GHz
#Res BW 120 kHz
VBW 300 kHz
Span 3 MHz
Sweep 5 ms (401 pts)

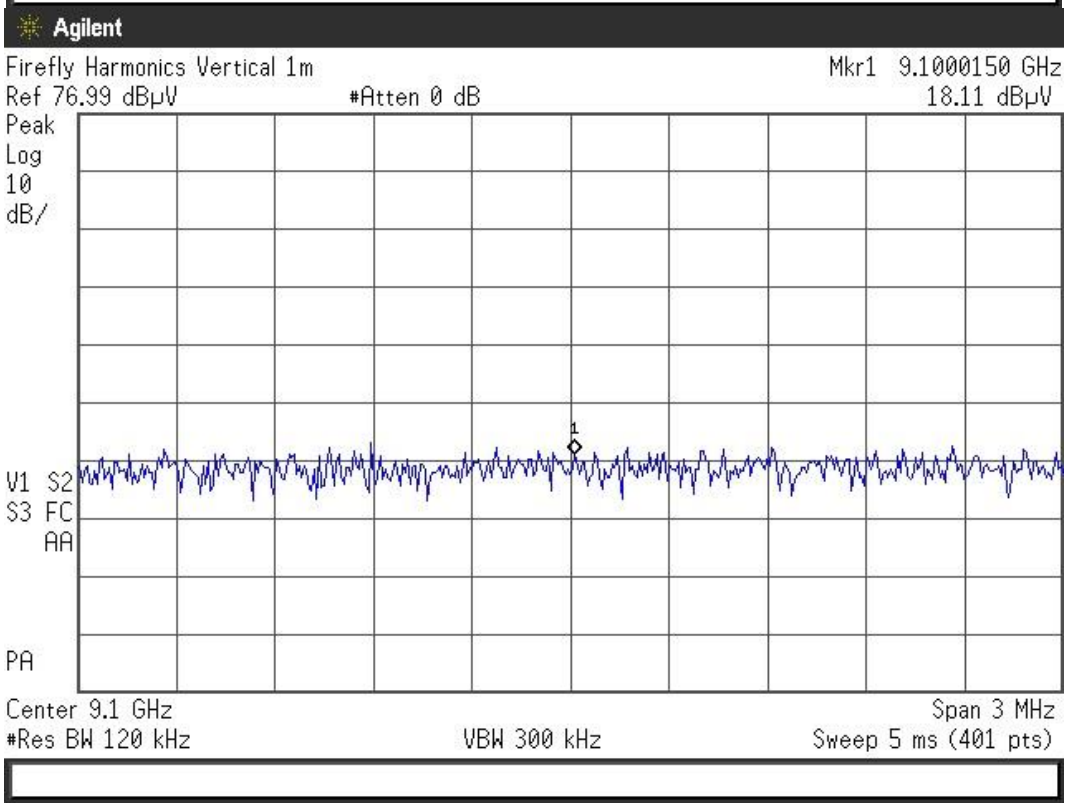

Agilent
Firefly Harmonics Vertical 1m
Mkr1 4.5499250 GHz
Ref 76.99 dBµV
#Atten 0 dB
17.45 dBµV
Peak
Log
10
dB/
1
V1 S2
S3 FC
AA
PA
Center 4.55 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
Firefly Harmonics Vertical 1m
Mkr1 5.4599550 GHz
Ref 76.99 dBµV
#Atten 0 dB
16.92 dBµV
Peak
Log
10
dB/
1
V1 S2
S3 FC
AA
PA
Center 5.46 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)

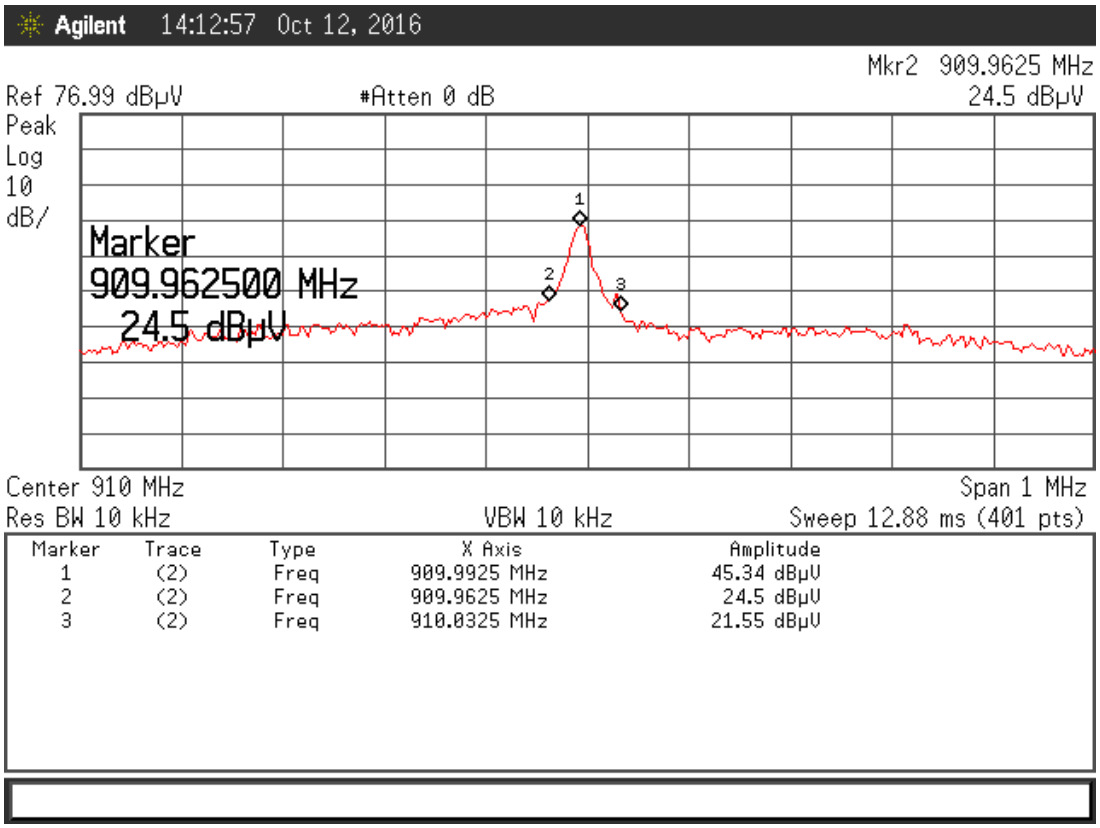

Agilent
Firefly Harmonics Vertical 1m
Mkr1 6.3699700 GHz
Ref 76.99 dBµV
#Atten 0 dB
16.29 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 6.37 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
Firefly Harmonics Vertical 1m
Mkr1 7.2800000 GHz
Ref 76.99 dBµV
#Atten 0 dB
21.25 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 7.28 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
Firefly Harmonics Vertical 1m
Mkr1 8.1900000 GHz
Ref 76.99 dBµV
#Atten 0 dB
18.64 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 8.19 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)

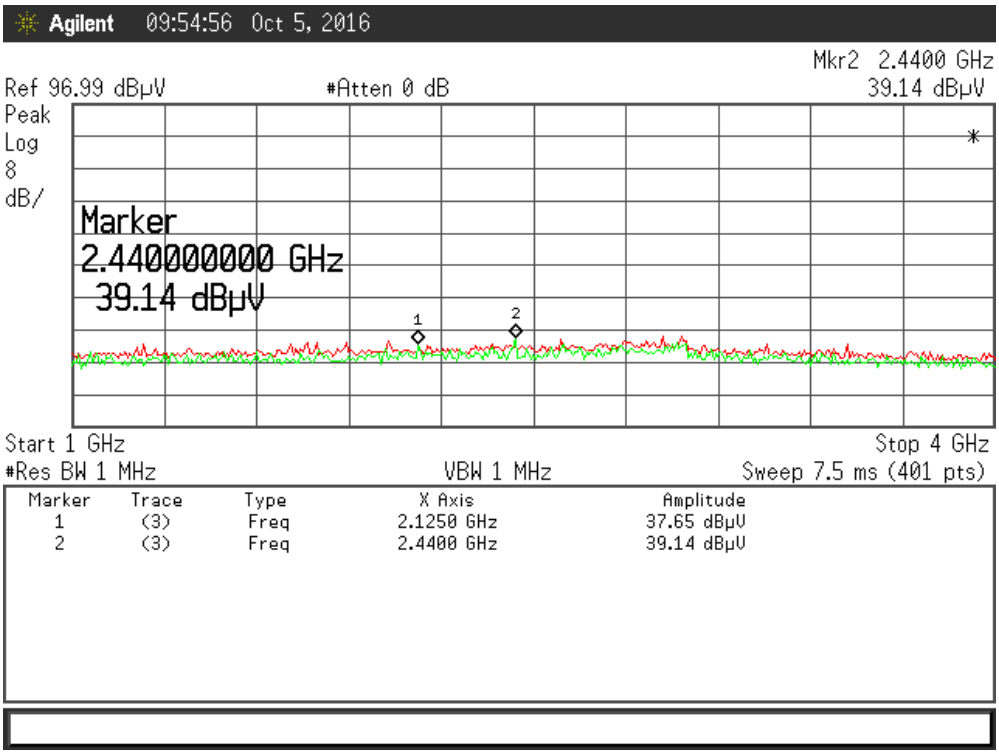

Agilent
Firefly Harmonics Vertical 1m
Mkr1 9.1000150 GHz
Ref 76.99 dBµV
#Atten 0 dB
18.11 dBµV
Peak
Log
10
dB/
V1 S2
S3 FC
AA
PA
Center 9.1 GHz
Span 3 MHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 5 ms (401 pts)

Occupied Bandwidth

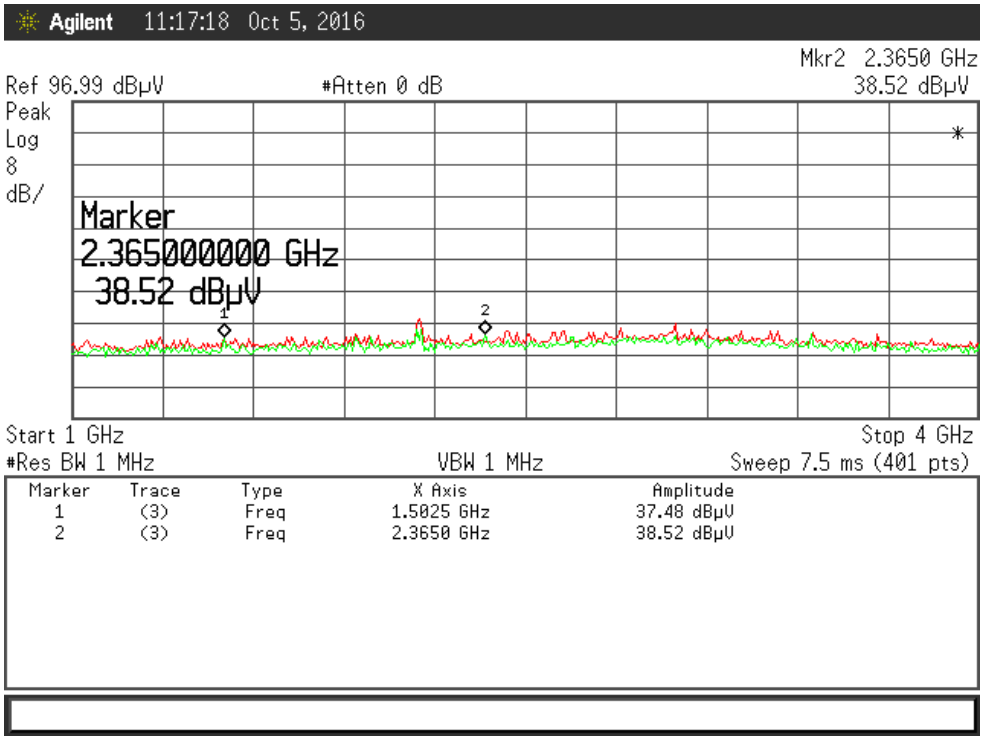


Spurious Data

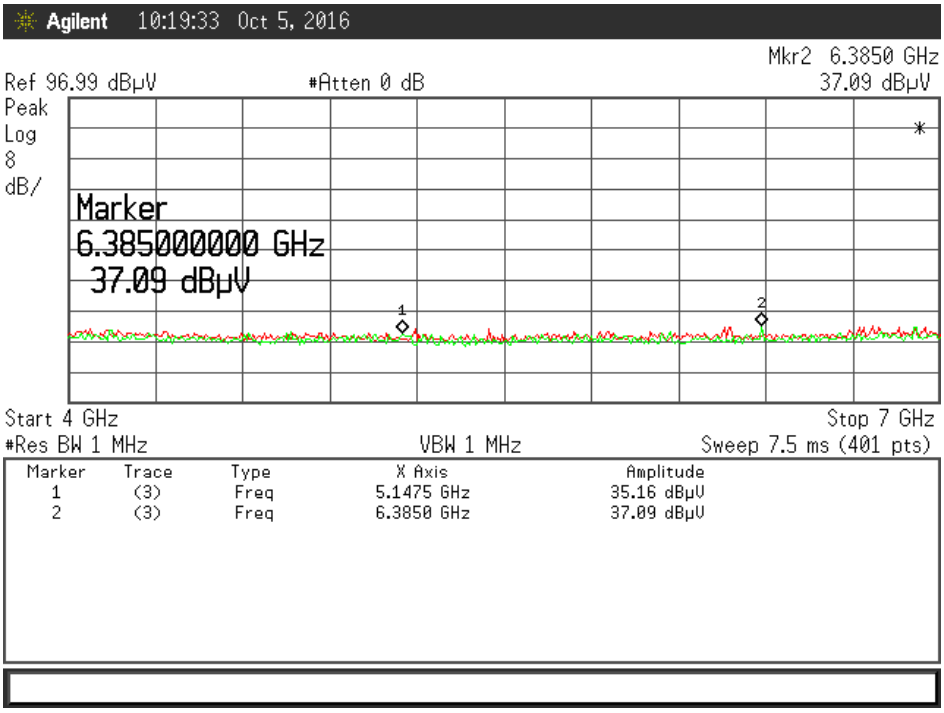
Horizontal 1 to 4 GHz



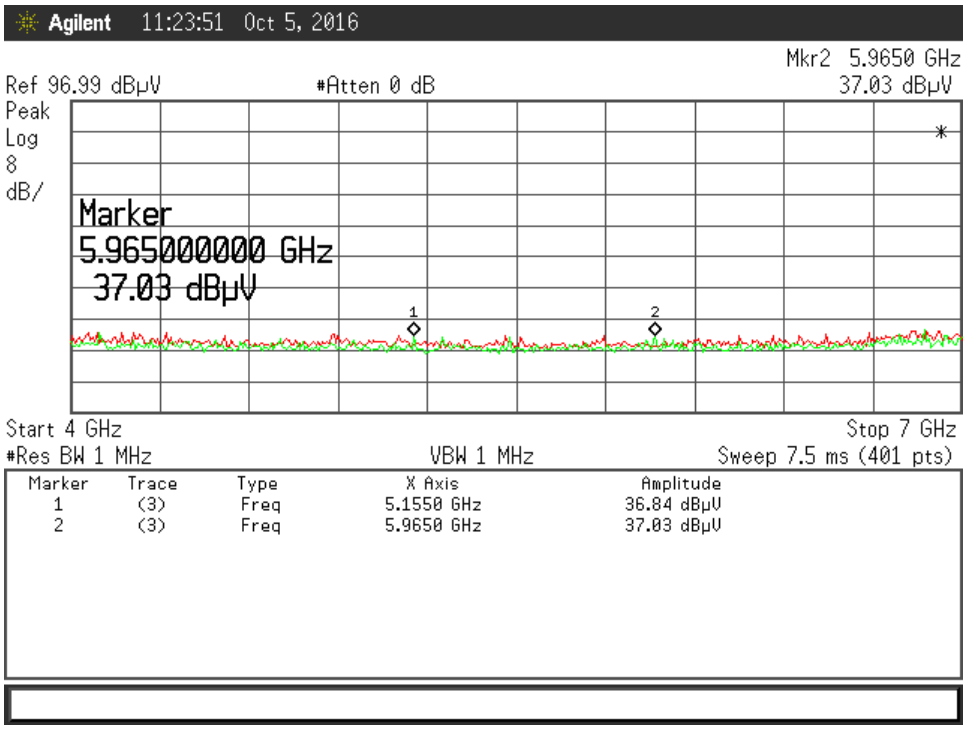
Vertical 1 to 4 GHz



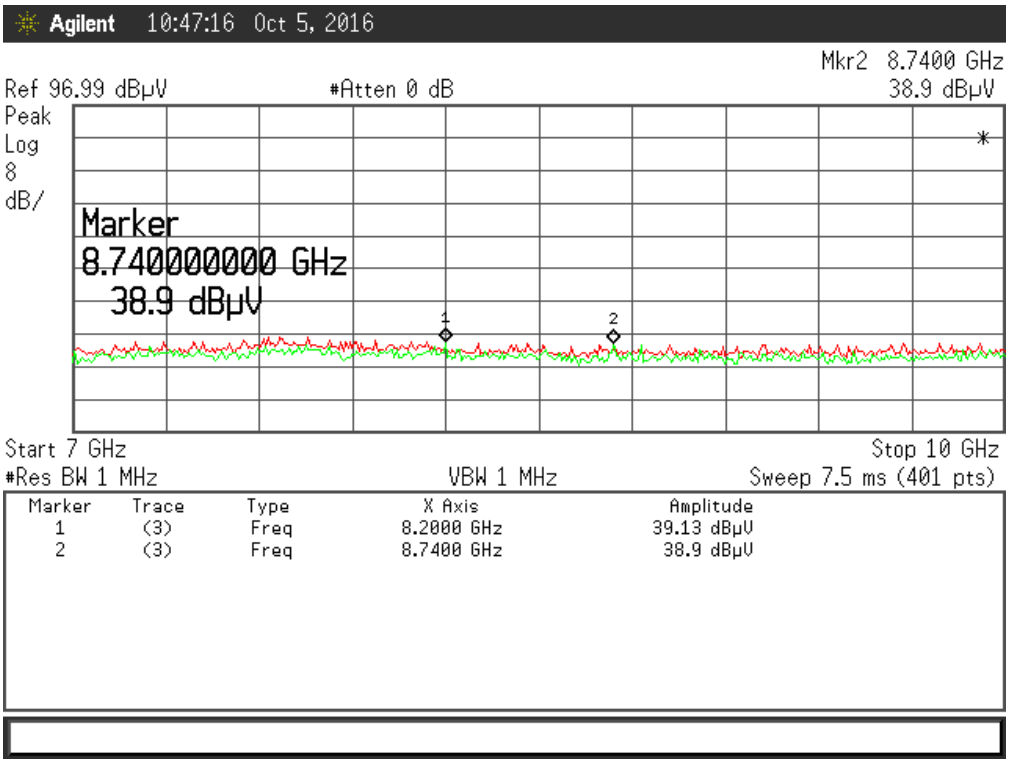
Horizontal 4 to 7 GHz



Vertical 4 to 7 GHz



Horizontal 7 to 10 GHz



Vertical 7 to 10 GHz