RETLIF TESTING LABORATORIES | Put Us To The Test℠
3131 Detwiler Road
Harleysville, PA 19438 USA
Tel: (215) 256-4133 • Fax: (215) 256-4130 • www.retlif.com

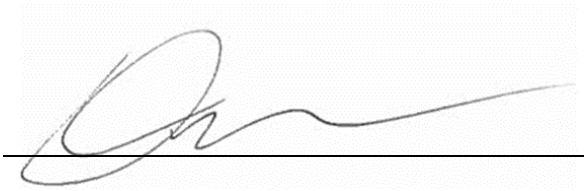
FCC Part 15.225, Subpart C Test Report
on

Electromagnetic Swinghandle with Integrated RFID Reader Module
and CANBus Module
Model: H3-EM

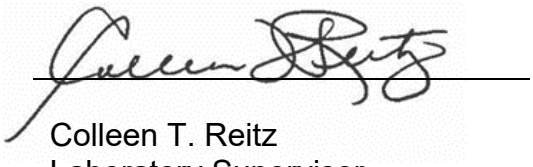
Customer Name:	Southco, Inc.
Customer P.O.:	7500016855
Date of Report Rev.:	January 11, 2018
Test Report No.:	R-2612P-3, Rev. A
Test Start Date:	January 12, 2017
Test Finish Date:	January 10, 2018
Test Technician:	M. Nowak
Test Engineer:	D. Rybicki
Laboratory Supervisor:	C. Reitz
Results Prepared By:	P. Harris
FCC ID:	YKRH3EM99521

Certification and Signatures

We certify that these Test Results are true results obtained from the tests of the equipment stated, and relates only to the equipment tested. We further certify that the measurements shown in this Test Results package were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.



David M. Rybicki
EMC Test Engineer
NVLAP Approved Signatory



Colleen T. Reitz
Laboratory Supervisor
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 may not be used by the client to claim product endorsement by NVLAP, NIST or any agency of the U.S. Government.

Revision History

Revisions to this document are listed below; the latest revised document supersedes all previous issues of this document.

Revision	Date	Pages Affected
-	January 8, 2018	Original Release
A	January 11, 2018	Global Changes: • Report R-2612P-3 changed to R-2612P-3, Rev. A • Completion date changed to January 10, 2018 5: • Updated Test Methods Performed table to include Field Strength of Emissions • Updated Test Sample/Test Program to state: 15.205 Restricted Bands - No emissions were observed from the EUT which exceeded the limits specified in FCC Part 15.205(a). 7: • Added Part 15.225(a) requirements and results 13-19: • Updated Test Data 20-23: • Added Test Data for 15.225(a)

Test Program Summary

Report Number:	R-2612P-3, Rev. A		
Customer:	Southco, Inc.		
Address:	210 N. Brinton Lake Road		
	Concordville, PA 19331		
Test Sample:	Electromagnetic Swinghandle with Integrated RFID Reader Module and CANBus Module Consisting Of:		
System Components:	Electromagnetic Swinghandle with Integrated RFID Reader Module	CANBus Module	Door Switch Kit
Part Numbers:	H3-EM-99-521	EA-99-223	EA-99-240
Model Numbers:	H3-EM	N/A	N/A
Manufactured By:	Southco Mfg. Ltd.	Vexos EMS	Vexos EMS
Type:	Low Power Transceiver		
Power Requirements:	5 VDC Provided by CANBus Module		
Frequency of Operation:	13.56 MHz		
Equipment Class:	DXX		
Equipment Use:	Fixed Mount, < 20 cm		

Test Specification:
FCC Rules and Regulations Part 15, Subpart C, Paragraph 15.225

Test Procedure:
ANSI C63.10:2013

Test Site:
ANSI C63.4:2014

Test Facility:
Retlif Testing Laboratories
3131 Detwiler Road
Harleysville, PA 19438

FCC Accreditation Designation Number: US5342

Purpose:
The purpose of this test program was to demonstrate compliance of the Electromagnetic Swinghandle with Integrated RFID Reader Module to the requirements of FCC Part 15.225.

Test Methods:
The following table detailed the test method performed on the EUT and the corresponding test results:

Testing Date	Test Method	Test Results
January 12, 2017	15.209, Radiated Emissions (9 kHz to 1 GHz)	Complied
January 5, 9, 2018	15.225(e), Frequency Stability	Complied
January 10, 2018	15.225(a), Field Strength of Emission (Band-Edge Measurement)	Complied

Test Sample Operation:
The EUT is an Electromagnetic Swinghandle with Integrated RFID Reader Module and CANBus Module. The EUT is installed in rack panels which are used in datacenters, industrial enclosures, and secure storage.

Test Sample/Test Program:
- 15.203 Antenna Requirements -The device uses a permanently attached internal antenna. The antenna was totally enclosed inside the case.
- 15.205 Restricted Bands - No emissions were observed from the EUT which exceeded the limits specified in FCC Part 15.205(a). This includes the band of 13.36 MHz to 13.41 MHz, the restricted band closest to the transmit band.
- 15.209 Radiated Emissions-Fundamental Frequency 13.56 MHz, Harmonic/Spurious Emissions 9 kHz to 1000 MHz.
- No harmonic or spurious emissions were observed within 10 dB of the specified limit at test distances of 3 meters.
- Radiated Emissions from the EUT were measured in all three axis. The attached Radiated Emissions test data shows the maximized fundamental emission of each orientation.

Determination of Field Strength Limits:
The field strength limits shown below are derived from FCC Part 15.209.

Fundamental Frequency: 13.56 MHz

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
0.009 to 0.490	2400 / F(kHz)	300
0.490 to 1.705	24000 / F(kHz)	30
1.705 to 30	30	30
30 to 88	100	3
88 to 216	150	3
216 to 960	200	3
960 to 1000	500	3

Distance Factor:
Testing was performed at a 3 meter distance and the field strength reading extrapolated to 300 meters for comparison to the 300 meter limit. The field strength reading was extrapolated using the extrapolation (distance) factor of 40 dB/decade as specified in FCC Part 15.31(f)(2) for frequencies below 30 MHz.

Distance Factor from 300 meters to 3 meters (2 decades) = -80dB

Test Methods/Requirements:

15.209 Radiated Emissions
The test sample was placed on an 80 cm high wooden test stand which was located 3 meters from the test antenna on an FCC listed open area test site. Emissions from the EUT were maximized by rotating the test sample and adjusting the test sample orientation and antenna polarization.

15.225(a) Operation within the band 13.110-14.010 MHz
The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15.848 microvolts/meter at 30 meters.

Test Results:
The maximized peak field strength at 13.56 MHz was 4.02 uV/M (12.10 dBµV/M) and met the limit specified in FCC Part 15.209 and FCC Part 15.225(a). All harmonic/spurious emissions observed at 3 meter test distances met the limit specified in FCC Part 15.209. The maximized corrected peak field strength was calculated as follows:

$R_C = M_R + C_F - D_F$

Where:
R_C = Corrected Reading in dBµV/M
M_R = Uncorrected Meter Reading in dBµV
C_F = Correction Factor in dB (Antenna Factor + Cable Loss)
D_F = Distance Factor in dB

M_R = 43.40 dBµV
C_F = 8.70 dB
D_F = 40 dB

R_C = 43.40dBuV + 8.7dB – 40dB = 12.10 dBµV/M

15.225(e) Frequency Stability

Requirements:
The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Test Results:
The carrier signal of 13.56 MHz met the specified requirements of 15.225(e) over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Equipment List
Radiated Emissions, 1-12-2017

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
127A	ETS / EMCO	ANTENNA, BICONICAL	20 - 200 MHz	3104	3/24/2016	9/30/2017
8016	ETS / EMCO	ANTENNA, LOG PERIODIC	200 MHz - 1 GHz	3146	7/18/2016	1/31/2018
8079	ROHDE & SCHWARZ	RECEIVER, EMI	9 kHz - 30 MHz	ESH3	6/15/2016	6/30/2017
8080	ROHDE & SCHWARZ	RECEIVER, EMI	20 - 1300 MHz	354-3000.56ESVP	8/26/2016	8/31/2017
8300	RETLIF	OPEN AREA TEST SITE, ATTENUATION	3/10 Meter OATS	RPA	8/7/2014	8/31/2017
8300C	UNKNOWN	CABLE, COAXIAL	3/10 METER	3 METER CABLE	10/25/2016	10/31/2017
8322	ETS / EMCO	ANTENNA, LOOP	10 KHz - 30 MHz	6512	4/19/2016	4/30/2018
8411	SONOMA INSTRUMENT	PRE-AMPLIFIER	9 KHz - 1 GHz	310N	9/19/2016	9/30/2017
8644	AGILENT / HP	ANALYZER, SPECTRUM	100 Hz - 22 GHz	85662A	7/21/2016	7/31/2017
8644A	AGILENT / HP	ANALYZER, SPECTRUM	100 Hz - 22.5 GHz	8566B	7/21/2016	7/31/2017

Note: Testing was performed January 12, 2017, therefore all equipment listed above was within calibration at the time of test.

Equipment List
Radiated Emissions, Band Edge, 1-10-2018

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
8260	MASTECH	POWER SUPPLY, DC		HY3003	Calibrate Before Use	
8300	RETLIF	OPEN AREA TEST SITE, ATTENUATION	3/10 Meter OATS	RPA	3/29/2016	3/31/2018
8300C	UNKNOWN	CABLE, COAXIAL	3/10 METER	3 METER CABLE	10/30/2017	10/31/2018
8322	ETS / EMCO	ANTENNA, LOOP	10 KHz - 30 MHz	6512	4/19/2016	4/30/2018
8411	SONOMA	PRE-AMPLIFIER INSTRUMENT	9 KHz - 1 GHz	310N	9/19/2017	9/30/2018
R718	AGILENT / HP	ANALYZER, SPECTRUM	100 Hz - 26.5 GHz	E7405A;A	10/5/2017	10/31/2018

Equipment List
Frequency Stability

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1625	FLUKE	MULTIMETER, DIGITAL	True RMS Multimeter	115	10/12/2017	10/31/2018
7043	OMEGA	DATA LOGGER, THERMOCOUPLE	-200 - 1372 deg. C	RDXL6SD	6/13/2017	6/30/2018
8137	EMPIRE DEVICES	ANTENNA, LOOP	150 KHz - 30 MHz	LP-105	No Calibration Required	
8260	MASTECH	POWER SUPPLY, DC		HY3003	Calibrate Before Use	
8320	ASSOCIATED	CHAMBER, TEMPERATURE ENVIRONMENTAL	- 50 - 150 deg. C	ZFD-531	11/10/2017	11/30/2018
R718	AGILENT / HP	ANALYZER, SPECTRUM	100 Hz - 26.5 GHz	E7405A;A	10/5/2017	10/31/2018

FCC Part 15, Subpart B, Class B, Radiated Emissions, 9 kHz to 1 GHz
Paragraph 15.209(a)
Test Data

Test Method:	**FCC Part 15, Subpart B, Class B, Radiated Emissions, 9 kHz to 1 GHz, Paragraph 15.209(a)**		
Customer:	Southco Inc	**Job No.:**	R-2612P-3
Test Sample:	Electromagnetic Swing handle with Integrated RFID Reader Module and CANBUS		
Model:	H3-EM		
Operating Mode:	Continuously Locking and Unlocking		
Technician:	D.Fiore / M. Nowak	**Date:**	01/12/2017

Notes: Test Distance: 3 Meters Converted via 1/D Temp: 10.1 °C RH: 51%
Detector: Quasi-Peak & Average Below 1 GHz, Peak above 1 GHz

Frequency	Antenna Position	EUT Orientation	Meter Readings	Correction Factor	Distance Correction	Corrected Reading	Converted Reading	Limit
MHz	(V/H) / Meters	Degrees	dBuV	dB	dB	dBuV/m	uV/m	uV/m
0.009								
0.124	Parallel	202.0	58.70	11.79	-80.00	-9.51	0.334	19.35
0.124	Perpendicular	255.1	50.80	11.79	-80.00	-17.41	0.135	19.35
*0.248	Parallel	178.0	32.10	11.71	-80.00	-36.19	0.155	9.68
*0.248	Perpendicular	183.1	37.20	11.71	-80.00	-31.09	0.028	9.68
0.372	Parallel	2.12	32.00	11.39	-80.00	-36.61	0.014	6.45
0.372	Perpendicular	152.6	32.30	11.39	-80.00	-36.31	0.015	6.45
*0.496	Parallel	119.0	26.40	11.73	-40.00	-1.87	0.806	48.39
*0.496	Perpendicular	181.1	27.70	11.73	-40.00	-0.57	0.936	48.39
*0.620	Parallel	0.15	32.10	11.67	-40.00	3.77	1.54	38.71
*0.620	Perpendicular	262.0	30.00	11.67	-40.00	1.67	1.21	38.71
*0.744	Parallel	163.0	33.60	11.69	-40.00	5.29	1.84	32.25
*0.744	Perpendicular	189.0	44.40	11.69	-40.00	16.09	6.37	32.25
*0.868	Parallel	96.8	28.80	11.72	-40.00	0.52	1.06	27.65
*0.868	Perpendicular	229.0	29.80	11.72	-40.00	1.52	1.19	27.65
*0.992	Parallel	330.7	29.50	11.73	-40.00	1.23	1.15	24.19
*0.992	Perpendicular	229.3	33.00	11.73	-40.00	4.73	1.72	24.19
*1.116	Parallel	185.2	26.10	11.76	-40.00	-2.14	0.781	21.50
*1.116	Perpendicular	191.1	27.60	11.76	-40.00	-0.64	0.929	21.50
*1.240	Parallel	179.1	31.10	11.75	-40.00	2.85	1.39	19.35
*1.240	Perpendicular	180.0	30.20	11.75	-40.00	1.95	1.25	19.35
13.56	Parallel	180.0	58.90	1.98	-40.00	20.88	11.07	30.00
13.56	Perpendicular	180.0	62.76	1.98	-40.00	24.74	17.26	30.00
*27.12	Parallel	180.0	1.10	5.88	-40.00	-33.02	0.022	30.00
*27.12	Perpendicular	360.0	2.40	5.88	-40.00	-31.72	0.026	30.00
30.00								100
40.68	H/1.00	180.0	2.30	13.33	0	15.63	6.05	100
40.68	V/1.00	181.1	9.10	13.33	0	22.43	13.23	100

*54.24	V/1.00	180.0	8.50	12.40	0	20.90	11.09	100
*54.24	H/1.00	180.0	10.7	12.40	0	23.10	14.29	
*67.80	V/1.00	180.0	11.80	9.65	0	21.45	11.82	
*67.80	H/1.00	180.0	9.40	9.65	0	19.05	8.96	
*81.36	V/1.00	180.0	9.5	8.46	0	17.96	7.91	
*81.36	H/1.00	180.0	9.0	8.46	0	17.46	7.46	
88.00								100
88.00								150
*94.92	V/1.00	180.0	9.80	11.78	0	21.58	11.99	
*94.92	H/1.00	180.0	9.50	11.78	0	21.28	11.59	
108.48	V/1.00	201.5	9.60	13.69	0	23.29	14.60	
108.48	H/2.00	180.0	6.40	13.69	0	20.09	10.10	
122.04	V/1.00	263.3	11.90	13.95	0	25.85	19.61	
122.04	H/1.00	194.1	5.69	13.95	0	19.64	9.59	
135.63	V/1.00	319.6	24.40	13.85	0	38.25	81.75	
135.63	H/3.63	189.6	23.35	13.85	0	37.20	72.44	
143.98	V/1.00	204.2	17.80	14.80	0	32.60	42.66	
143.98	H/3.15	178.4	16.80	14.80	0	31.60	38.02	
149.18	V/1.04	170.7	18.40	15.87	0	34.27	51.70	
149.18	H/2.86	178.7	21.63	15.87	0	37.50	74.99	
203.37	V/1.00	189.6	18.20	13.70	0	31.90	39.36	
203.37	H/1.15	174.5	14.40	13.70	0	28.10	25.41	
216.0								150
216.0								200
271.22	V/1.00	235.0	14.40	16.14	0	30.54	33.65	
271.22	H/1.10	188.1	18.30	16.14	0	34.44	52.72	
298.34	V/1.00	82.2	14.9	17.62	0	32.52	42.27	
298.34	H/1.00	190.6	15.10	17.62	0	32.72	43.25	
366.10	V/1.00	74.7	18.80	18.55	0	37.35	73.71	
366.10	H/1.00	189.6	24.60	18.55	0	43.15	143.71	
447.51	V/1.00	153.3	16.60	20.67	0	37.27	73.03	
447.51	H/1.00	188.9	19.60	20.67	0	40.27	103.16	
474.62	V/1.00	203.9	14.50	21.91	0	36.41	66.14	
474.62	H/1.00	213.7	18.1	21.91	0	40.01	100.11	
960.00								200
960.00								500
1000.0								500
	The frequency range was scanned from 9kHz to 1 GHz.							
	The emissions observed from the EUT do not exceed the specified limits.							
	Emissions not recorded were more than 20dB under the specified limit.							
	*This represents the minimum sensitivity of measurement system.							

FCC Part 15, Subpart C, Frequency Stability
Paragraph 15.225(e)
Test Data

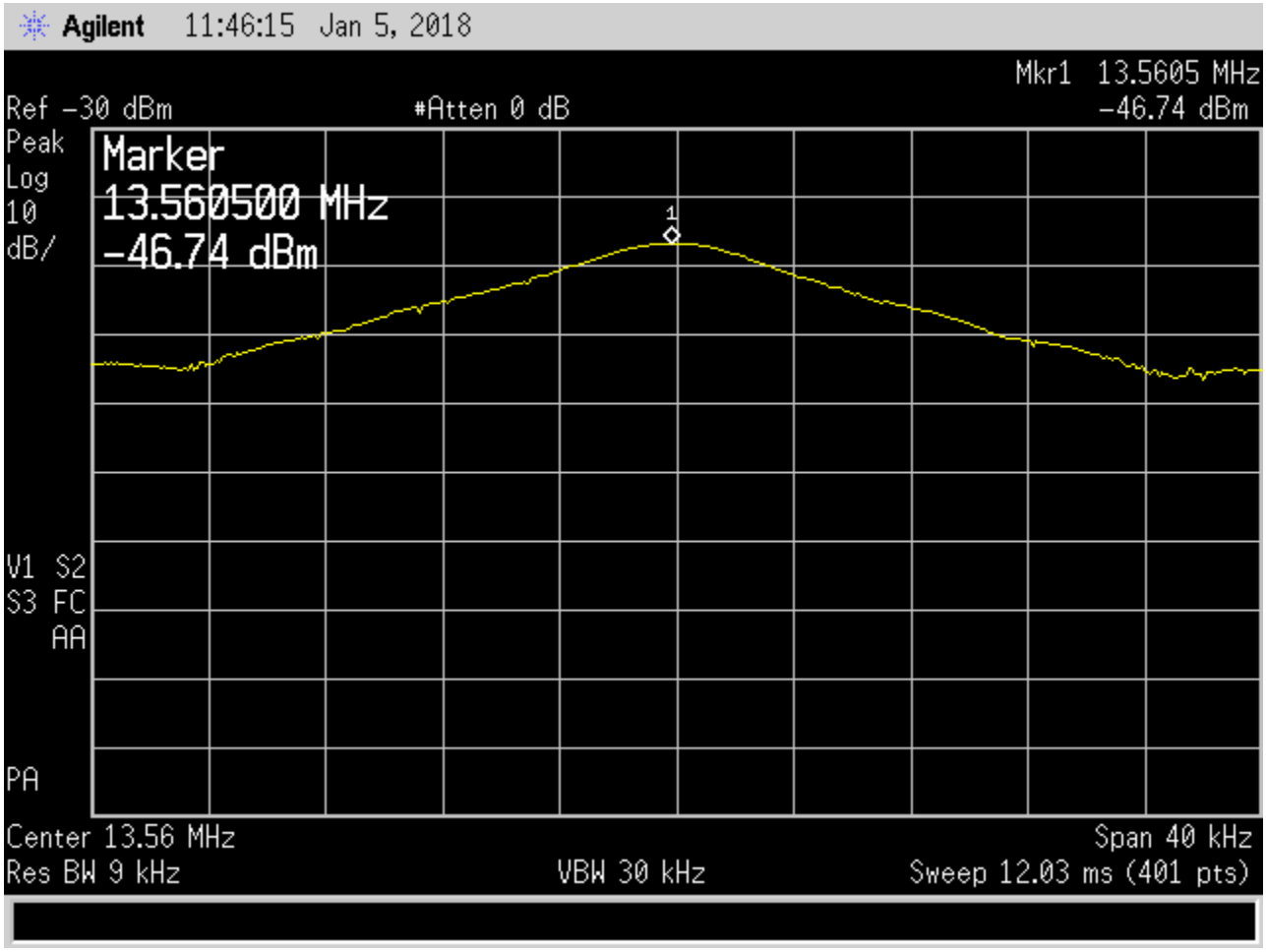
Test Method:	**FCC Part 15, Subpart B, Frequency Stability, Paragraph 15.225(e)**		
Customer:	Southco Inc	**Job No.:**	R-2612P-3
Test Sample:	Electromagnetic Swing handle with Integrated RFID Reader Module and CANBUS		
Model:	H3-EM		
Operating Mode:	Continuously Outputting 13.56MHz		
Technician:	M. Nowak	**Date:**	01/05/2018
Notes:			

Temperature (℃)	Input Voltage (VDC)	Frequency Measured (MHz)	Lower Frequency Limit (MHz)	Upper Frequency Limit (MHz)	Result
20	5	13.5605	13.5591	13.5619	Pass
20	4.25	13.5605	13.5591	13.5619	Pass
20	5.75	13.5607	13.5591	13.5619	Pass
- 20	5	13.5607	13.5591	13.5619	Pass
50	5	13.5603	13.5591	13.5619	Pass

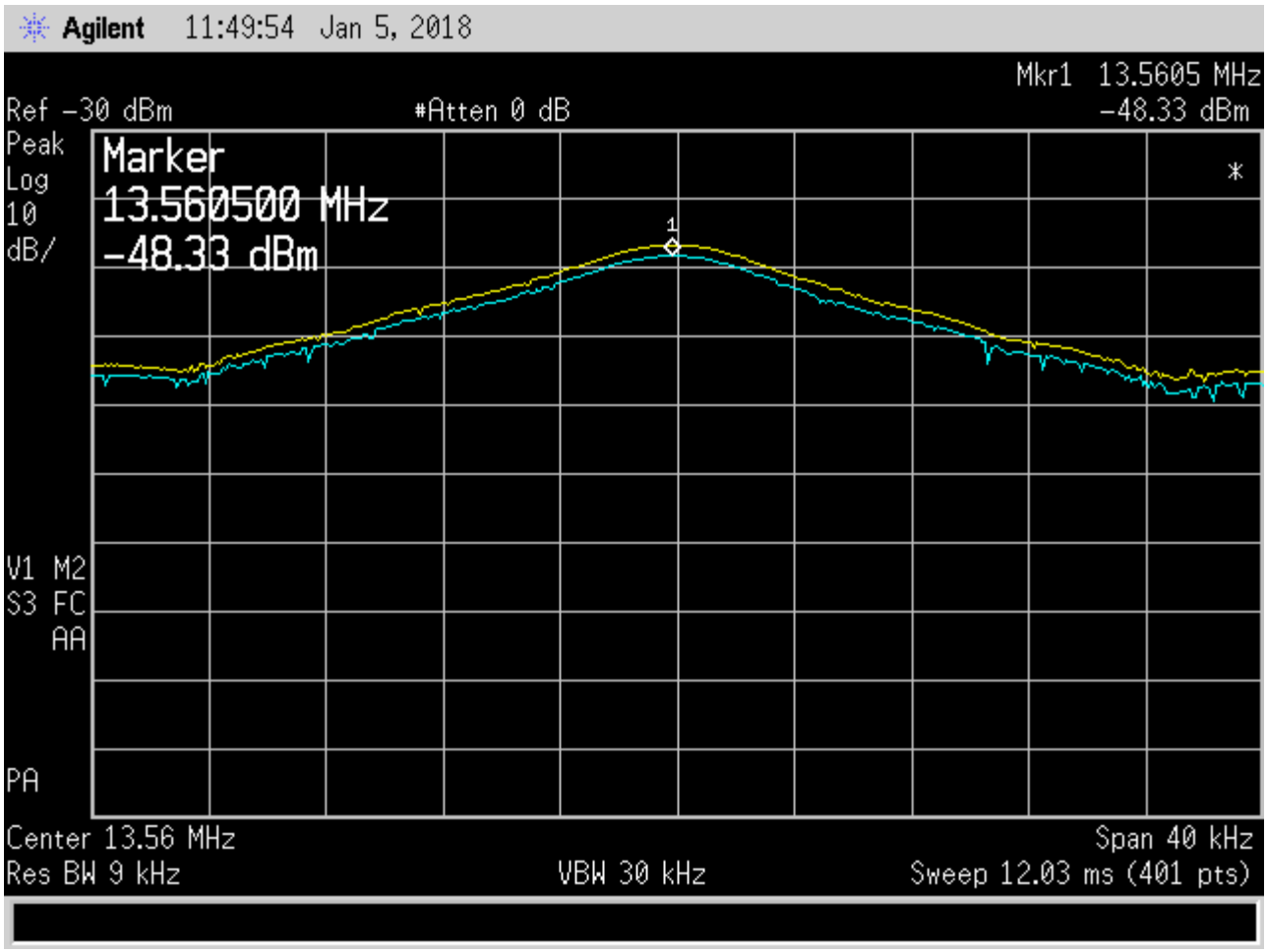
Plots for data above provided below.

Test Method:	FCC Part 15, Subpart B, Frequency Stability, Paragraph 15.225(e)		
Customer:	Southco Inc	Job No.:	R-2612P-3
Test Sample:	Electromagnetic Swing handle with Integrated RFID Reader Module and CANBUS		
Model:	H3-EM		
Operating Mode:	Continuously Outputting 13.56MHz		
Technician:	M. Nowak	Date:	01/09/2015

Temperature (℃)	Time After Power Applied (Minutes)	Frequency Measured (MHz)	Lower Frequency Limit (MHz)	Upper Frequency Limit (MHz)	Result
50	0	13.5604	13.5591	13.5619	Pass
	2	13.5605	13.5591	13.5619	Pass
	5	13.5604	13.5591	13.5619	Pass
	10	13.5604	13.5591	13.5619	Pass
40	0	13.5605	13.5591	13.5619	Pass
	2	13.5605	13.5591	13.5619	Pass
	5	13.5603	13.5591	13.5619	Pass
	10	13.5605	13.5591	13.5619	Pass
30	0	13.5605	13.5591	13.5619	Pass
	2	13.5605	13.5591	13.5619	Pass
	5	13.5605	13.5591	13.5619	Pass
	10	13.5604	13.5591	13.5619	Pass
20	0	13.5606	13.5591	13.5619	Pass
	2	13.5604	13.5591	13.5619	Pass
	5	13.5607	13.5591	13.5619	Pass
	10	13.5605	13.5591	13.5619	Pass
10	0	13.5607	13.5591	13.5619	Pass
	2	13.5607	13.5591	13.5619	Pass
	5	13.5605	13.5591	13.5619	Pass
	10	13.5607	13.5591	13.5619	Pass
0	0	13.5606	13.5591	13.5619	Pass
	2	13.5606	13.5591	13.5619	Pass
	5	13.5607	13.5591	13.5619	Pass
	10	13.5606	13.5591	13.5619	Pass
-10	0	13.5606	13.5591	13.5619	Pass
	2	13.5606	13.5591	13.5619	Pass
	5	13.5607	13.5591	13.5619	Pass
	10	13.5606	13.5591	13.5619	Pass
- 20	0	13.5606	13.5591	13.5619	Pass
	2	13.5603	13.5591	13.5619	Pass
	5	13.5606	13.5591	13.5619	Pass
	10	13.5607	13.5591	13.5619	Pass

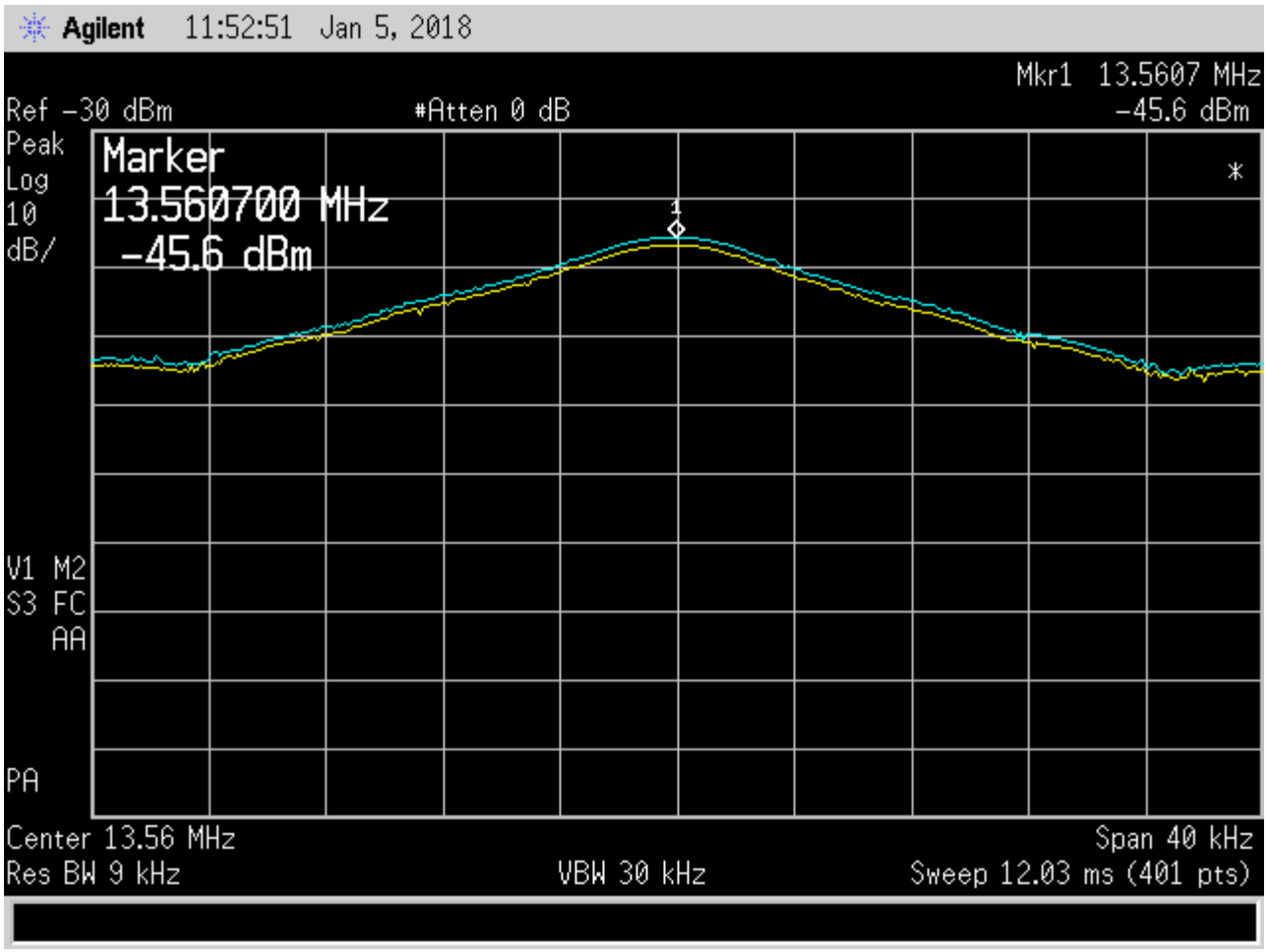


20ºC, 5.00 VDC Supply Voltage
Baseline



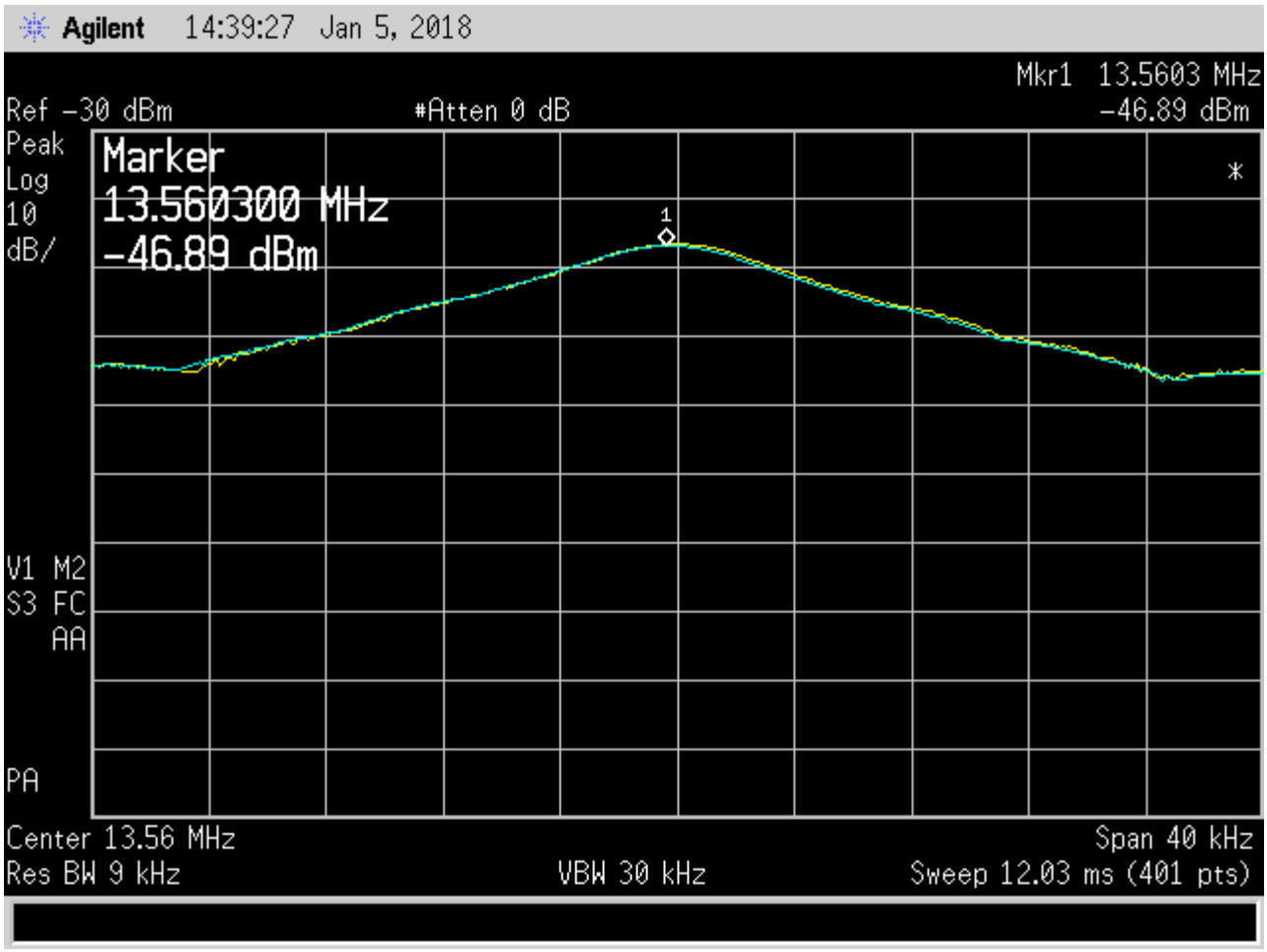
20ºC, 4.25 VDC Supply Voltage
Yellow Trace – Baseline
Blue Trace - Measurement

Note: The asterisk in the plot is due to a change in marker placement after viewing the yellow trace as baseline measurement. No settings were changed from when the baseline was taken.



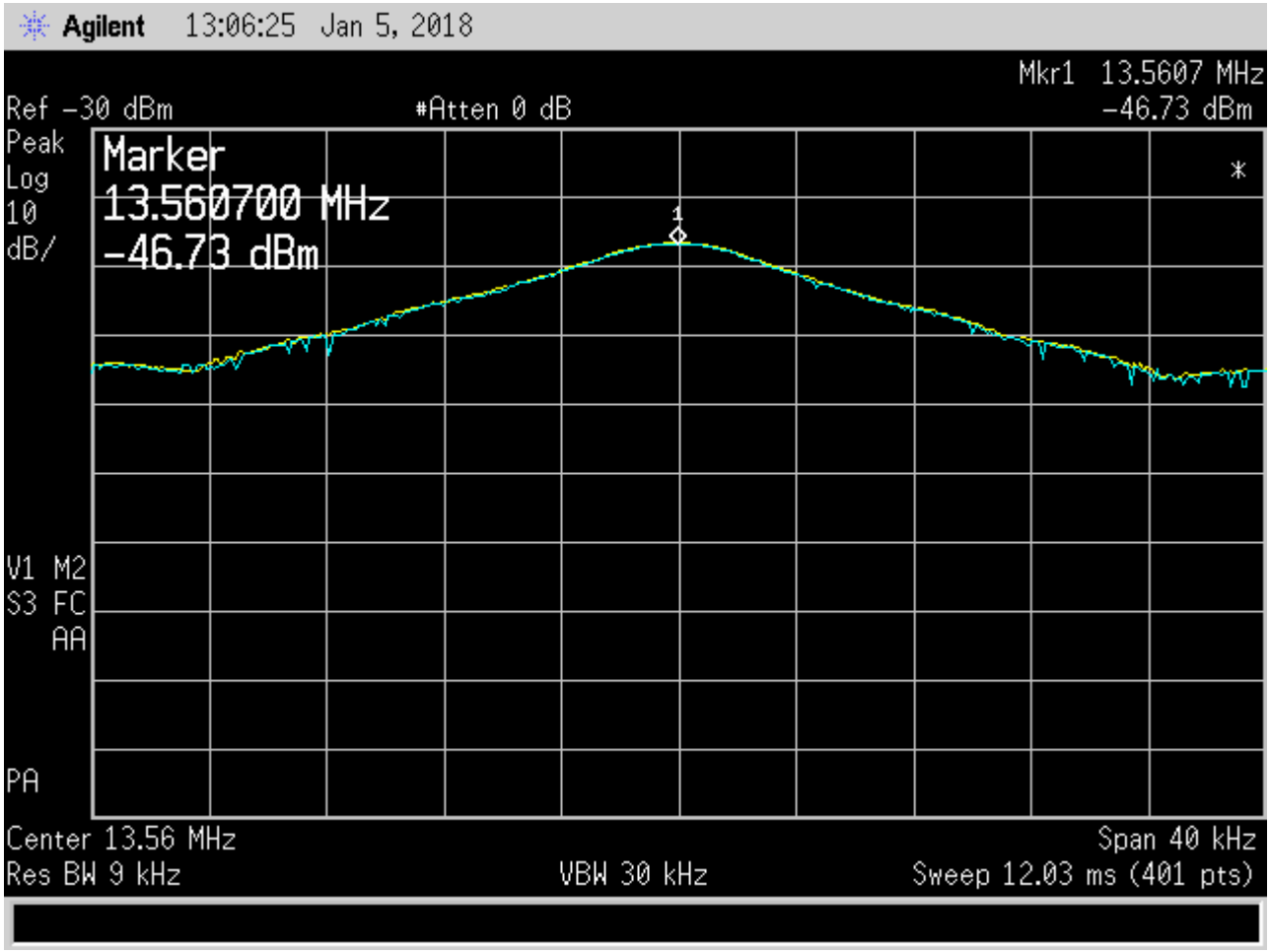
20ºC, 5.75 VDC Supply Voltage
Yellow Trace – Baseline
Blue Trace - Measurement

Note: The asterisk in the plot is due to a change in marker placement after viewing the yellow trace as baseline measurement. No settings were changed from when the baseline was taken.



50ºC, 5.00 VDC Supply Voltage
Yellow Trace – Baseline
Blue Trace - Measurement

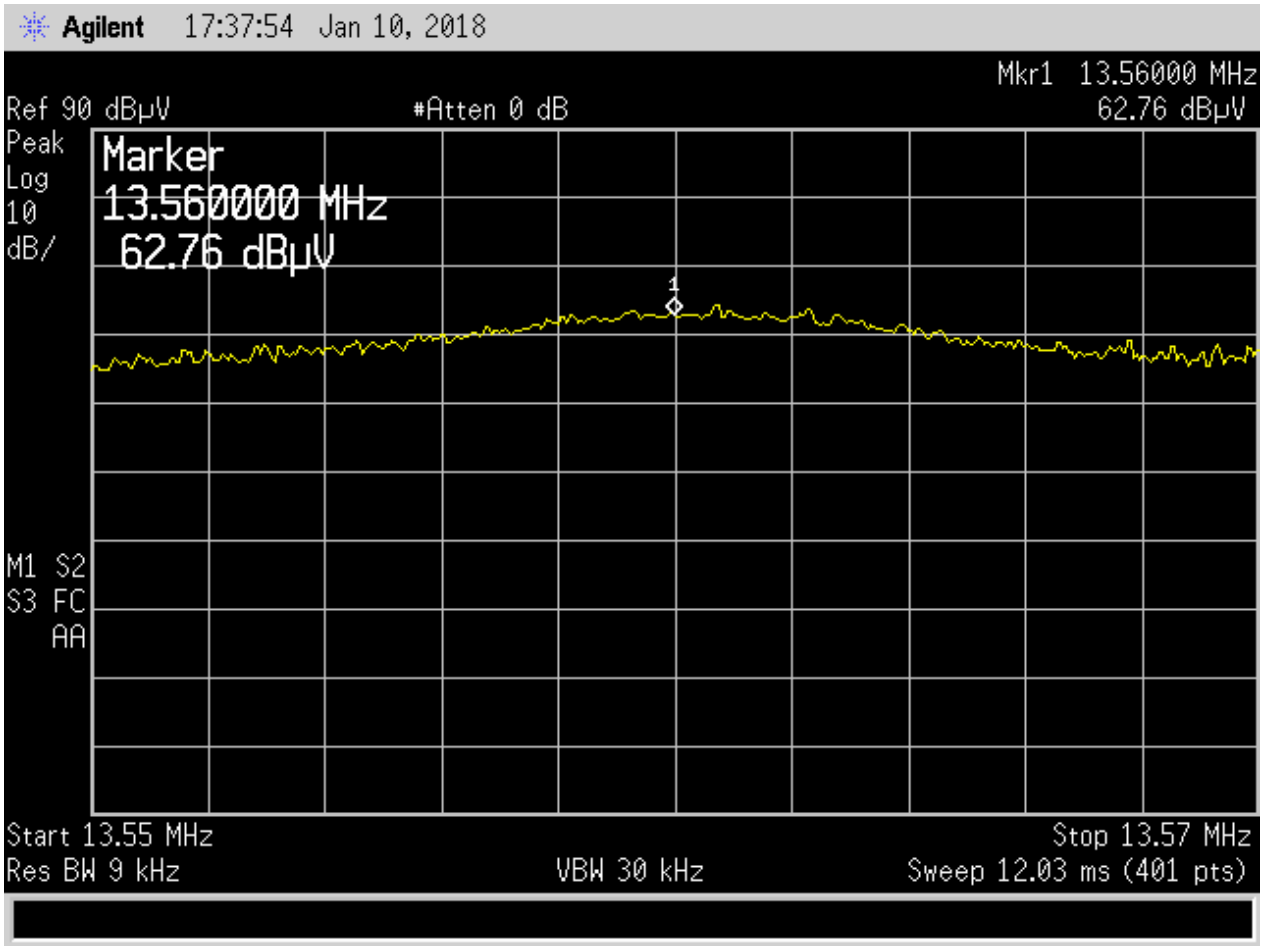
Note: The asterisk in the plot is due to a change in marker placement after viewing the yellow trace as baseline measurement. No settings were changed from when the baseline was taken.



-20ºC, 5.00 VDC Supply Voltage
Yellow Trace – Baseline
Blue Trace - Measurement

Note: The asterisk in the plot is due to a change in marker placement after viewing the yellow trace as baseline measurement. No settings were changed from when the baseline was taken.

FCC 15.225(a) Band Edge Measurements
Test Data



Transmit Frequency

Final Reading (dBuV/m) =
Meter Reading – Preamplifier Factor + Cable Loss + Antenna Factor – Distance Correction

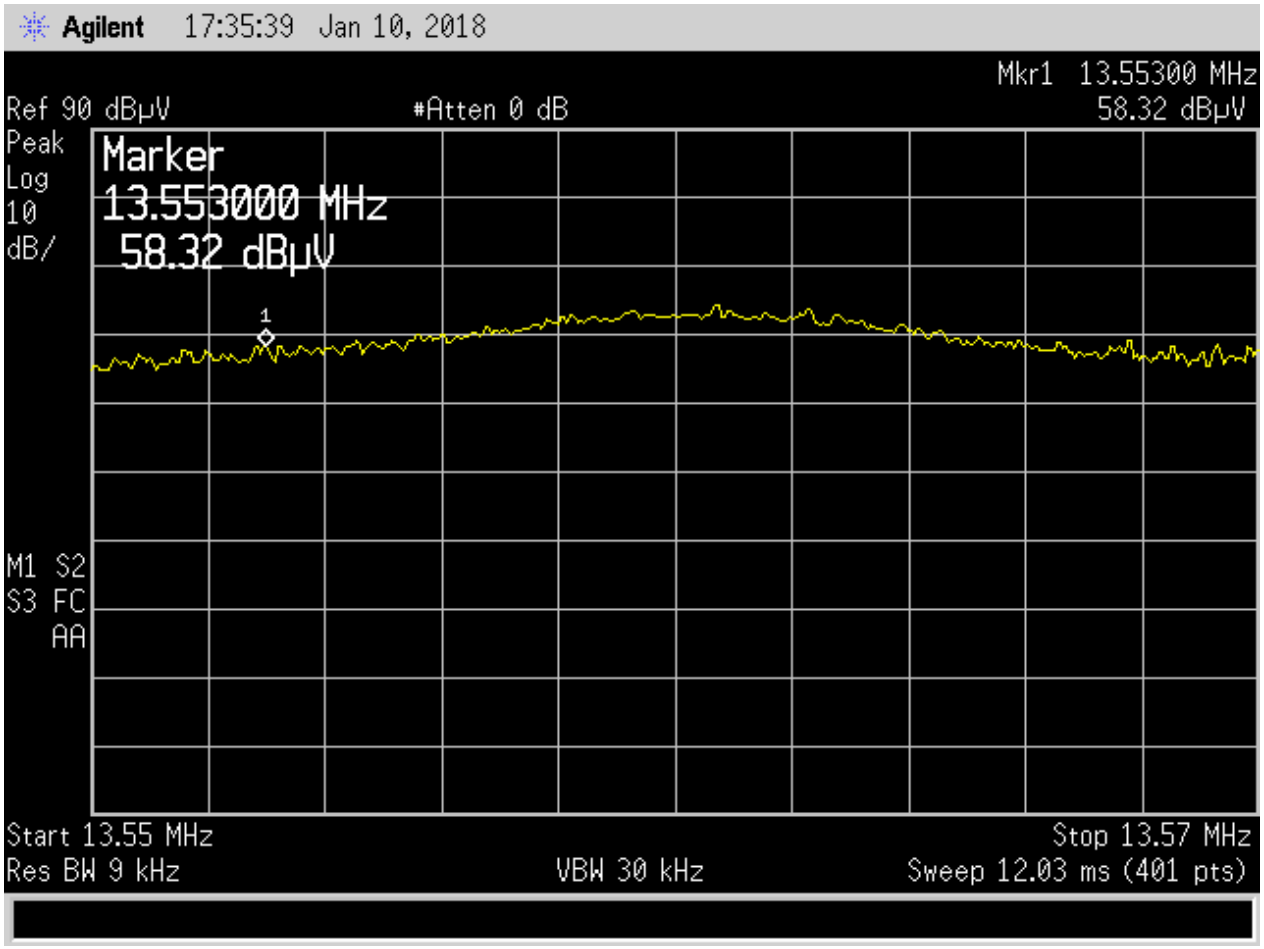
Final Reading (dBuV/m) =
62.76 – 33.78 + 0.76 + 35.00 – 40.00

Final Reading (dBuV/m) =
24.74 dBuV

Final Reading (uV/m) =
$10^{((dBuV/m)/20)}$

Final Reading (uV/m) =
$10^{(24.74/20)}$

Final Reading (uV/m) =
17.26 uV/m



Lower Band Edge Frequency

Final Reading (dBuV/m) =
Meter Reading – Preamplifier Factor + Cable Loss + Antenna Factor – Distance Correction

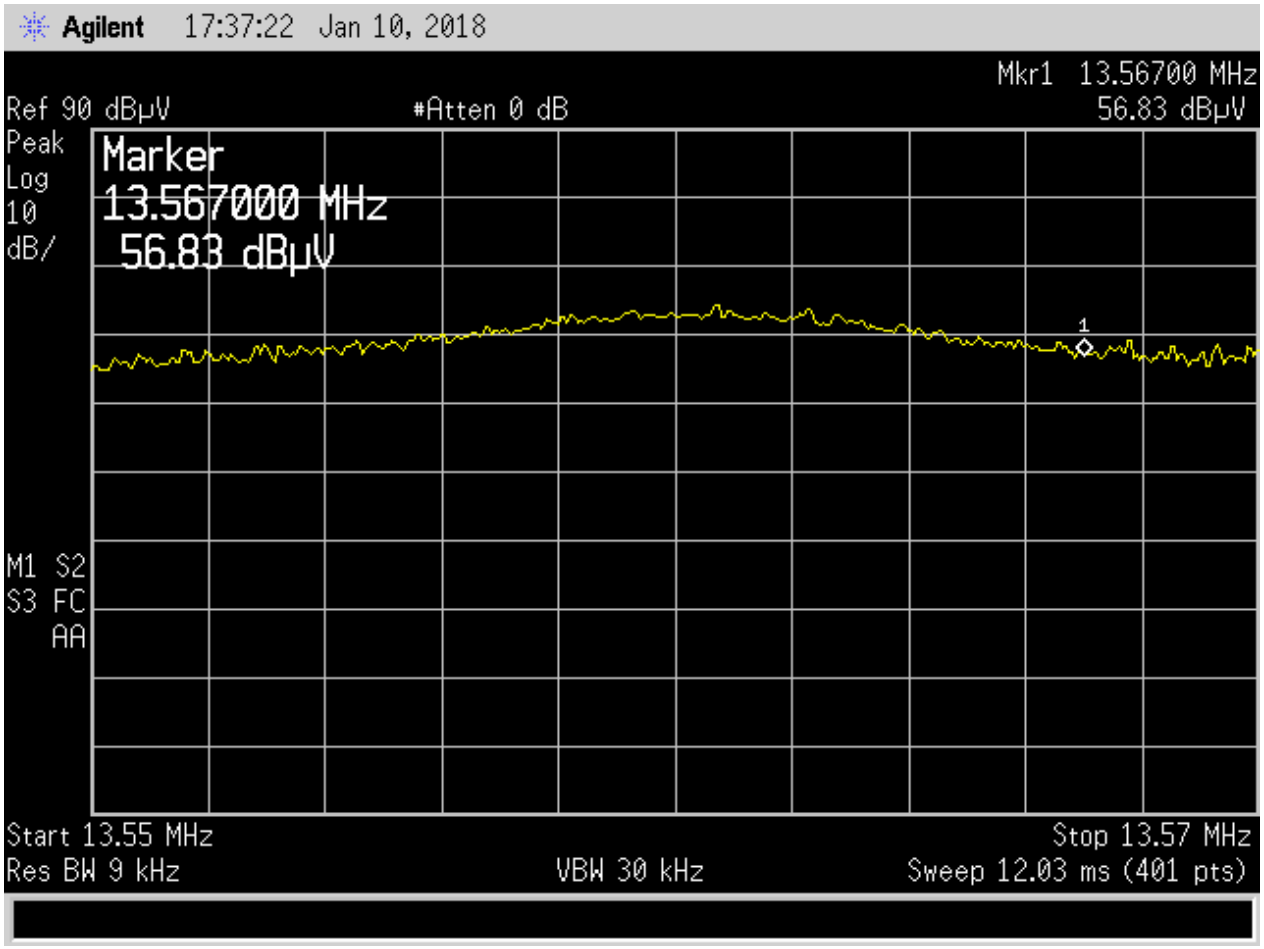
Final Reading (dBuV/m) =
58.32 – 33.78 + 0.76 + 35.00 – 40.00

Final Reading (dBuV/m) =
20.30 dBuV

Final Reading (uV/m) =
$10^{((dBuV/m)/20)}$

Final Reading (uV/m) =
$10^{(20.30/20)}$

Final Reading (uV/m) =
10.35 uV/m



Upper Band Edge Frequency

Final Reading (dBuV/m) =
Meter Reading – Preamplifier Factor + Cable Loss + Antenna Factor – Distance Correction

Final Reading (dBuV/m) =
56.83 – 33.78 + 0.76 + 35.00 – 40.00

Final Reading (dBuV/m) =
18.81 dBuV

Final Reading (uV/m) =
$10^{((dBuV/m)/20)}$

Final Reading (uV/m) =
$10^{(18.810/20)}$

Final Reading (uV/m) =
8.72 uV/m