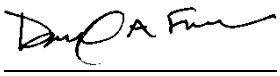
FCC Part 15.225 & Industry Canada RSS-210
Certification Application Report

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. 360 Herndon Parkway Suite 1400 Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com Tel: 703-689-0368 Fax: 703-689-2056 www.rheintech.com	Vocollect, Inc. 703 Rodi Road Pittsburgh, PA 15235 Contact: Joe Lesik Tel: 412-349-2580 Fax: 412-829-1063

FCC/IC ID	MQO-TAP900-01/ 2570A-TAP90001	**Test Report Date**	July 17, 2013
Platform	N/A	**RTL Work Order #**	2013095
Model #'s	TAP910-01, TAP920-01, TAP930-01	**RTL Quote #**	QRTL13-095A
American National Standard Institute	ANSI C63.4-2003: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
FCC Classification	DXX – Part 15 Low Power Communication Device Transmitter		
FCC Rule Part(s)/Guidance	FCC Rules Part 15.225: Operation within the band 13.110-14.010 MHz (10-01-12)		
Industry Canada	RSS-210 Issue 8: Low Power License-Exempt Communications Devices RSS-Gen: Issue 3: 2010 General Requirements and Information for the Certification of Radio Apparatus		
Digital Interface Information	Digital Interface was found to be compliant		

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
13.56	N/A	N/A	2M55A1D

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, RSS-210, and ANSI C63.4.

Signature: 

Date: July 17, 2013

Typed/Printed Name: Desmond A. Fraser

Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

This is an original certification application request for the Vocollect, Inc. A700 Series Terminal, Model #'s TAP910-01, TAP920-01, TAP930-01.

Applicable Standards:

- FCC Part 15.225: Operation within the band 13.110-14.010 MHz
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices

1.2 Description of EUT

Equipment Under Test	A700 Series Terminal
Model/Model #	TAP910-01, TAP920-01, TAP930-01
Power Supply	Hi-Cap Beretta Battery 3.7VDC 20Wh
Modulation Type	ASK
Frequency Range	13.56 MHz
Antenna Connector Type	Magnet Loop
Antenna Type	Internal

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4-2003).

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Vocollect, Inc. A700 Series Terminal, Model #'s: TAP910-01, TAP920-01, TAP930-01, FCC ID: MQO-TAP900-01, IC: 2570A-TAP90001. IC will require a family certification.

The three models are electrically identical from an intentional radiator standpoint. The differences in the three models are the end caps, and only impact digital unintentional emissions. RF exposure (SAR) has been addressed for all three models individually.

1.5 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

2 Test Information

2.1 Description of Test Modes

Table 2-1: Channels Tested

Frequency (MHz)
13.56

2.2 Exercising the EUT

The EUT was supplied with test firmware programmed with modulation types and rates. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.225)

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.225(a),(d)	Field Strength of Fundamental and Harmonics	Pass
RSS-Gen	99% Bandwidth	Pass

2.4 Test System Details

The test samples were received on June 17, 2013. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
A700 Series Terminal	Vocollect, Inc.	TAP920-01	6213184013	MQO-TAP900-01	N/A	20914
A700 Series Terminal	Vocollect, Inc.	TAP910-01	6313184015	MQO-TAP900-01	N/A	20919

2.5 Configuration of Tested System

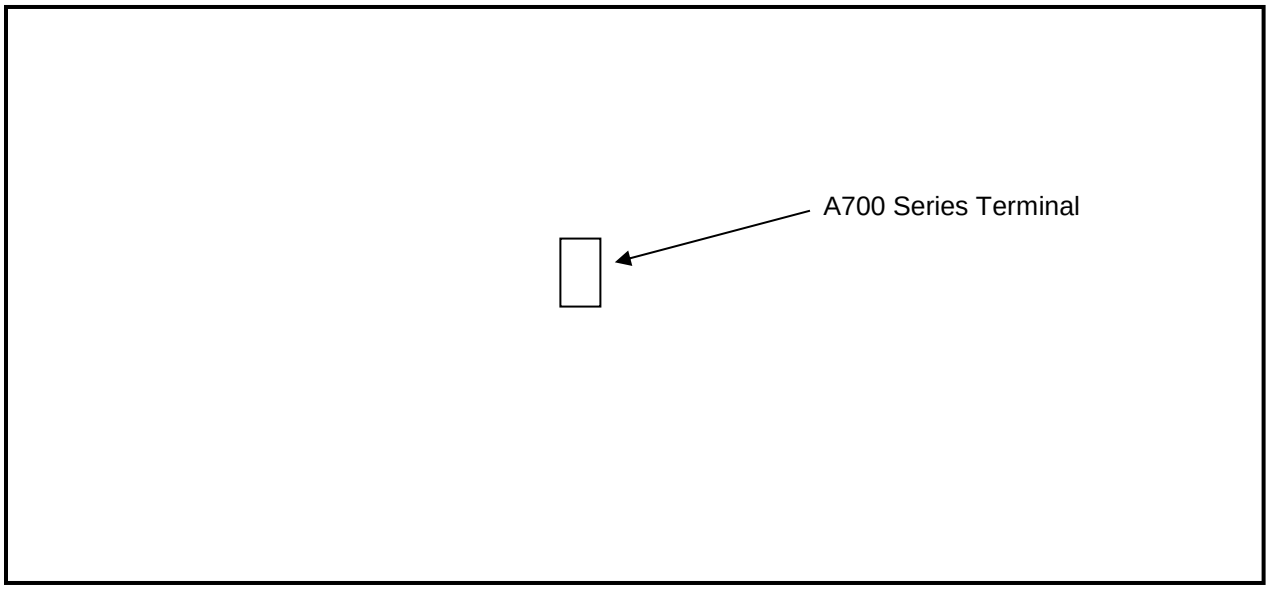


Figure 2-1: Configuration of System Under Test

3 Radiated Emissions – FCC 15.209, 15.225(a) & (d); IC RSS-210 A2.6; RSS-Gen

3.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector however, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 99% under any circumstances of modulation.

15.225(a) states "The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters."

20log(15,848)=84 dBuV/m at 30 m and 40*log(30/3)=40, 84+40=124 dBuV/m at 3 m.

3.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10^{th} harmonic of the highest fundamental transmitter frequency (135.6 MHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 3-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	10/1/13
900905	Rhein Tech Laboratories	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	8/20/13
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	3/15/14
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	2/2/14
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz – 6.5 GHz)	3325A00159	9/20/13
900914	Hewlett Packard	8546OA	RF Filter Section, (100 kHz - 6.5 GHz)	3330A00107	9/20/13

3.3 Radiated Emissions Test Data

Table 3-2: Radiated Emissions Test Data (Fundamental)

Emission Frequency (MHz)	Average Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
13.560*	58.4	20	78.4	124	-45.6

** testing performed at 1m, interpolated to 3m.*

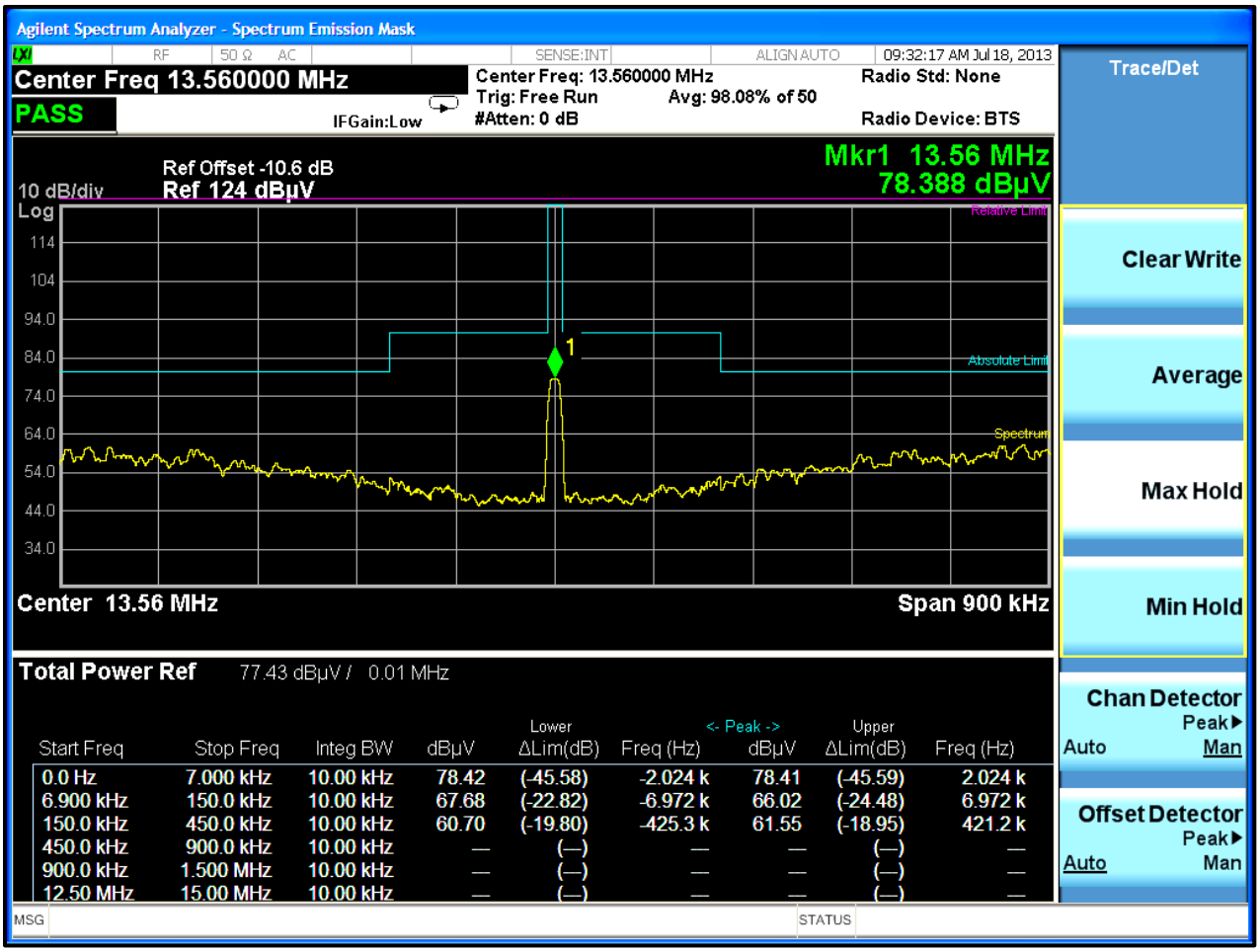
Part 15.225 (a), (b), and (c) state:

> The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
>
> Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
>
> Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The 30 meter limits were interpolated to 3 meter by adding 40 log (30m/3m) to 20 log (E), where E is the limit in microvolts/meter at 30 meters.

The corrected measured fundamental level in Table 3-2 was used as a reference for the fundamental in the following plot in dBuV/m at 3 meter as a means to show compliance with Part 15.225 (b) and (c).

Plot 3-1: Part 15.225 (b)(c) Mask



3.4 Radiated Emissions Harmonics/Spurious Test Data

Table 3-3: Radiated Emissions Harmonics/Spurious

Emission Frequency (MHz)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)
27.120*	-8.4	21.5	13.1	69.5	-56.4
40.690	32.7	-20.1	12.6	40.0	-27.4
54.250	34.1	-24.3	9.8	40.0	-30.2
67.813	34.5	-25.5	9.0	40.0	-31.0
81.369	31.7	-24.5	7.2	40.0	-32.8
94.934	32.7	-22.0	10.4	43.5	-32.8
108.489	31.5	-20.5	11.0	43.5	-32.5
122.049	31.1	-19.8	11.3	43.5	-32.2
135.610	31.6	-20.7	10.9	43.5	-32.6

** testing performed at 1m, interpolated to 3m.*

3.5 Radiated Emissions Digital Test Data

Table 3-4: Digital Radiated Emissions Test Data

Temperature: 87°F Humidity: 87%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
30.307	Qp	H	0	1	30.4	-24.0	6.4	40.0	-33.6	Pass
32.941	Qp	H	0	1	30.1	-25.3	4.8	40.0	-35.2	Pass
35.574	Qp	V	0	1	35.0	-26.6	8.4	40.0	-31.6	Pass
55.330	Qp	H	0	1	40.2	-33.6	6.6	40.0	-33.4	Pass
81.670	Qp	H	0	1	34.8	-33.4	1.4	40.0	-38.6	Pass
141.600	Qp	H	0	1	34.5	-30.1	4.4	43.5	-39.1	Pass
144.000	Qp	V	0	1	40.4	-30.2	10.2	43.5	-33.3	Pass
499.200	Qp	V	0	1	37.6	-21.5	16.1	46.0	-29.9	Pass

Test Personnel:

Daniel W. Baltzell		July 11-18, 2013
Test Engineer	Signature	Date of Test

4 AC Conducted Emissions - FCC 15.207; IC RSS-Gen 7.2.4: Conducted Limits

4.1 Site and Test Description

The power line conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable).

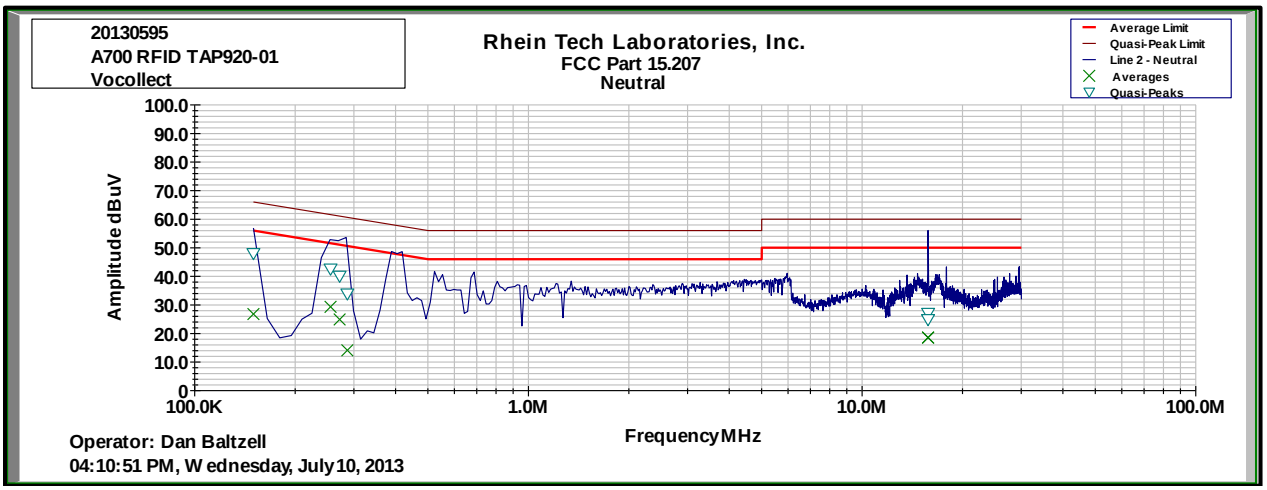
The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded.

4.2 Test Limits

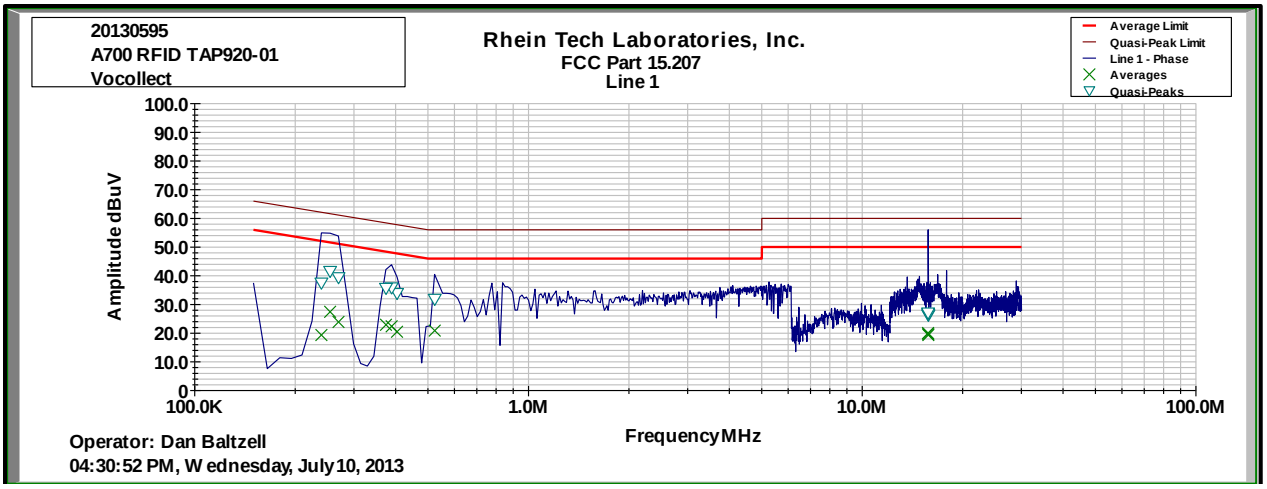
Line-Conducted Emissions		
Limit (dBµV)		
Frequency (MHz)	**Quasi-Peak**	**Average**
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

4.3 Conducted Emissions Test Data

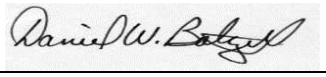
Plot 4-1: Conducted Emissions Receive - Neutral Side



Plot 4-2: Conducted Emissions Receive - Hot Side



Test Personnel:

Daniel W. Baltzell		July 10, 2013
Test Engineer	Signature	Date of Test

5 99% Bandwidth – IC RSS-Gen 4.6.1

5.1 99% Bandwidth Test Procedure

The 99% bandwidths per RSS-Gen 4.6.1 were measured using a 50-ohm spectrum analyzer. The modulated carrier was adjusted on the analyzer so that it was displayed entirely on the spectrum analyzer. The sweep time was auto and allowed through several sweeps with the max hold function used in peak detector mode.

Table 5-1: 99% Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14

5.2 99% Bandwidth Test Data

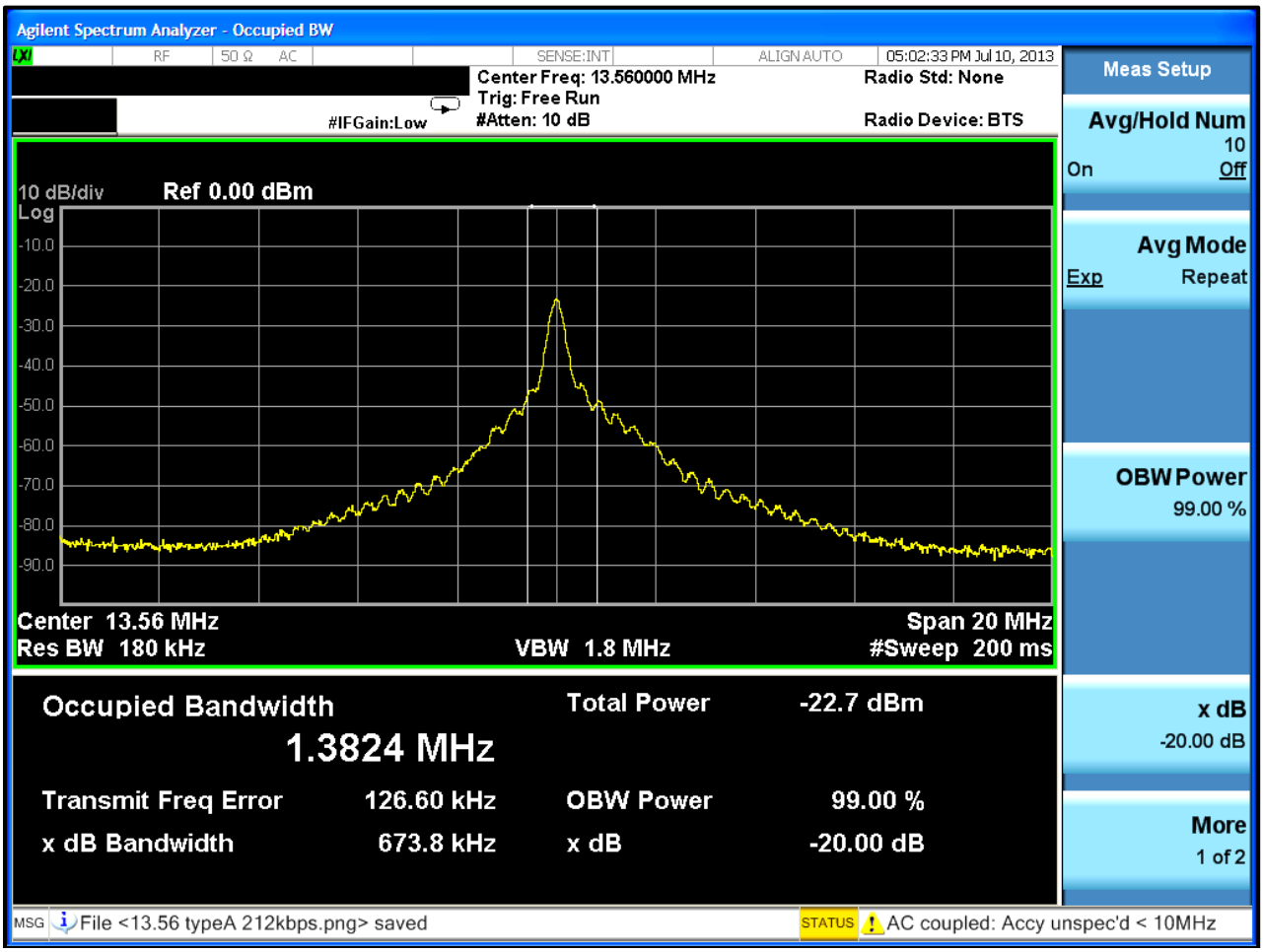
Table 5-2: 99% Bandwidth Test Data

99% bandwidths

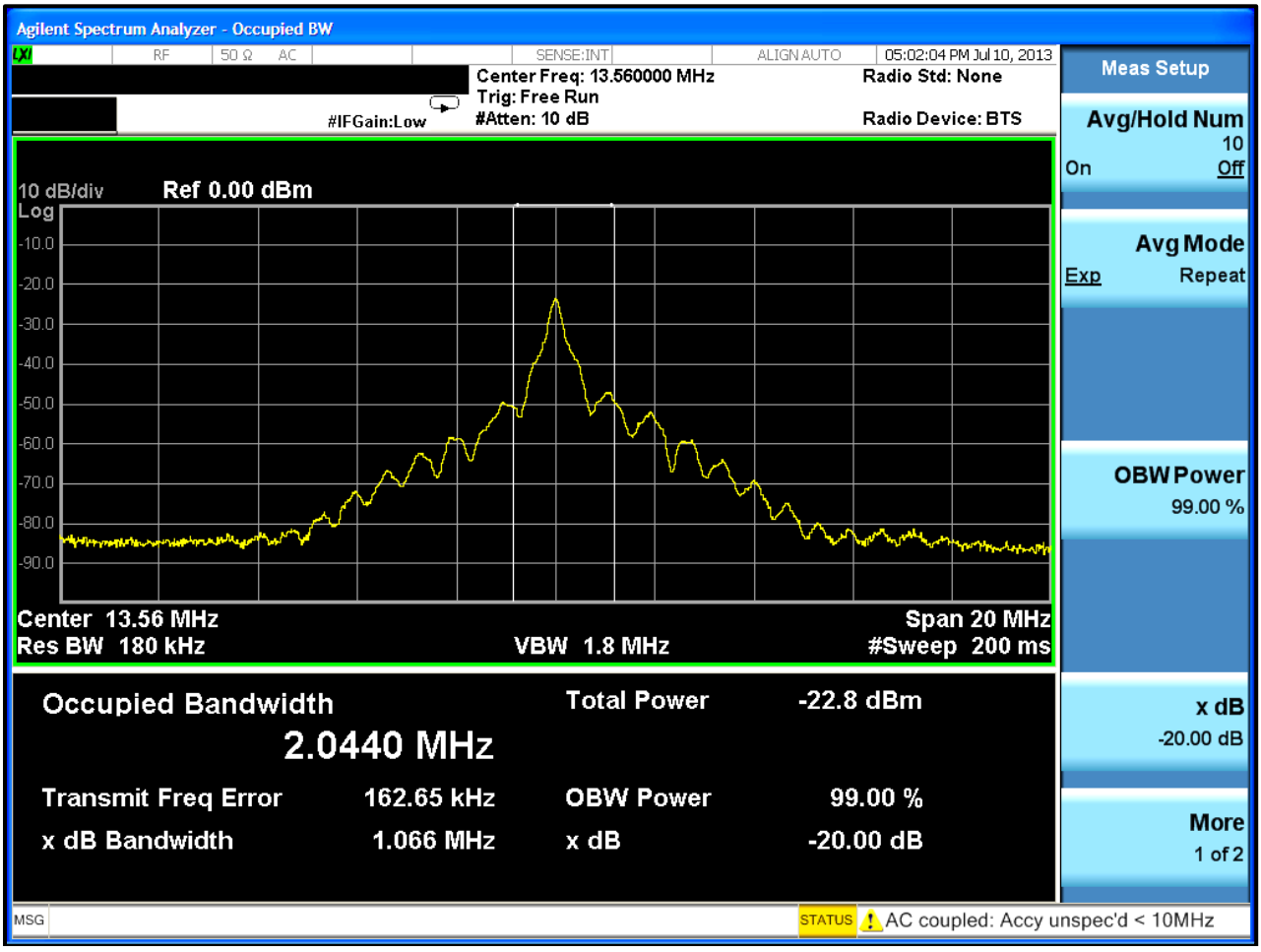
Mode	99% Bandwidth (kHz)
Type A ISO14443A – 106 kbps	1382
Type A ISO14443A – 212 kbps	2044
Type A ISO14443A – 424 kbps	2550
Type B ISO14443B – 106 kbps	387
Type B ISO14443B – 212 kbps	391
Type B ISO14443B – 424 kbps	399
Type F FeliCa – 212 kbps	405
Type F FeliCa – 424 kbps	425

5.3 99% Bandwidth Plots

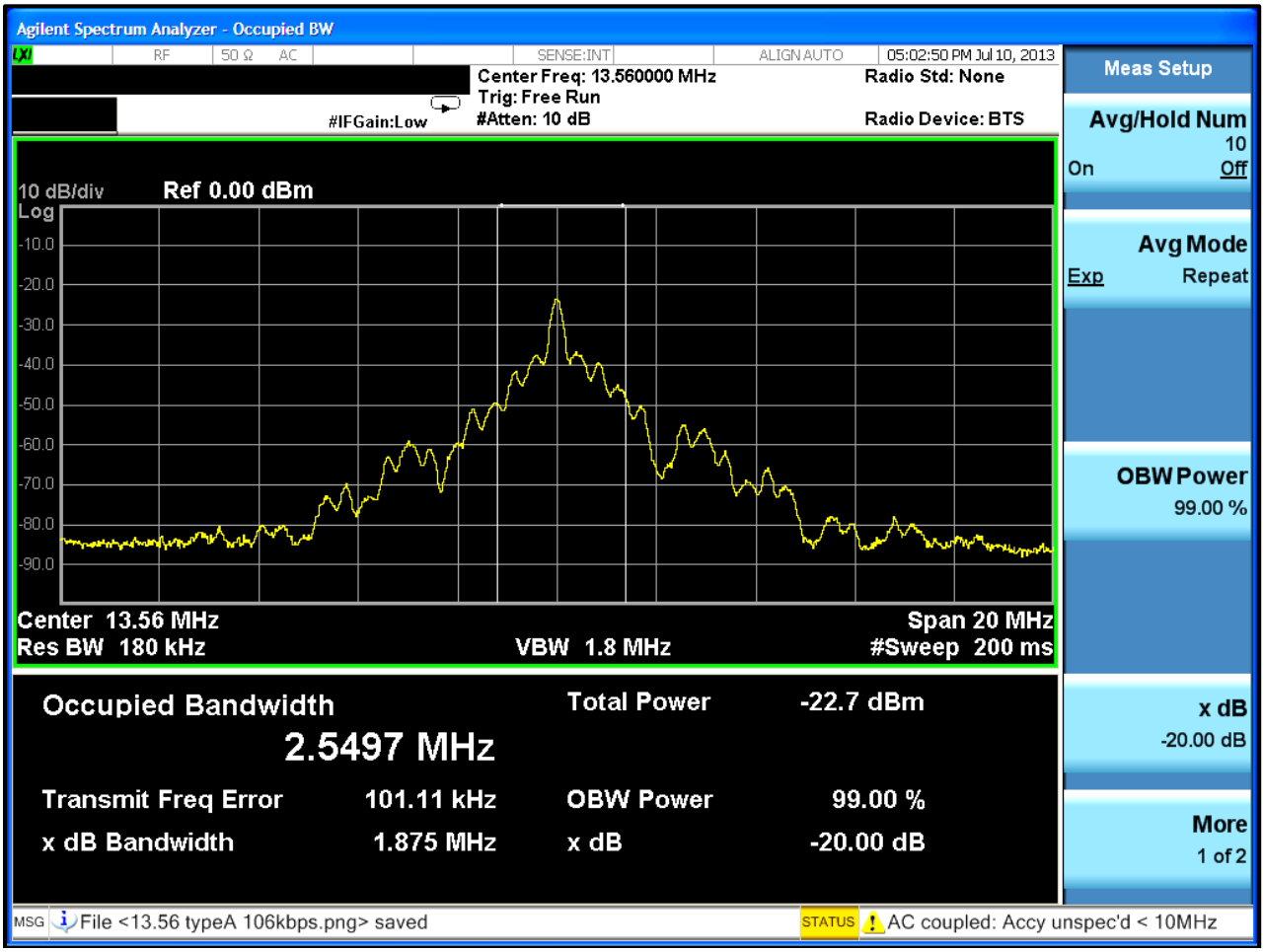
Plot 5-1: 99% Bandwidth - Type A – 106 kbps



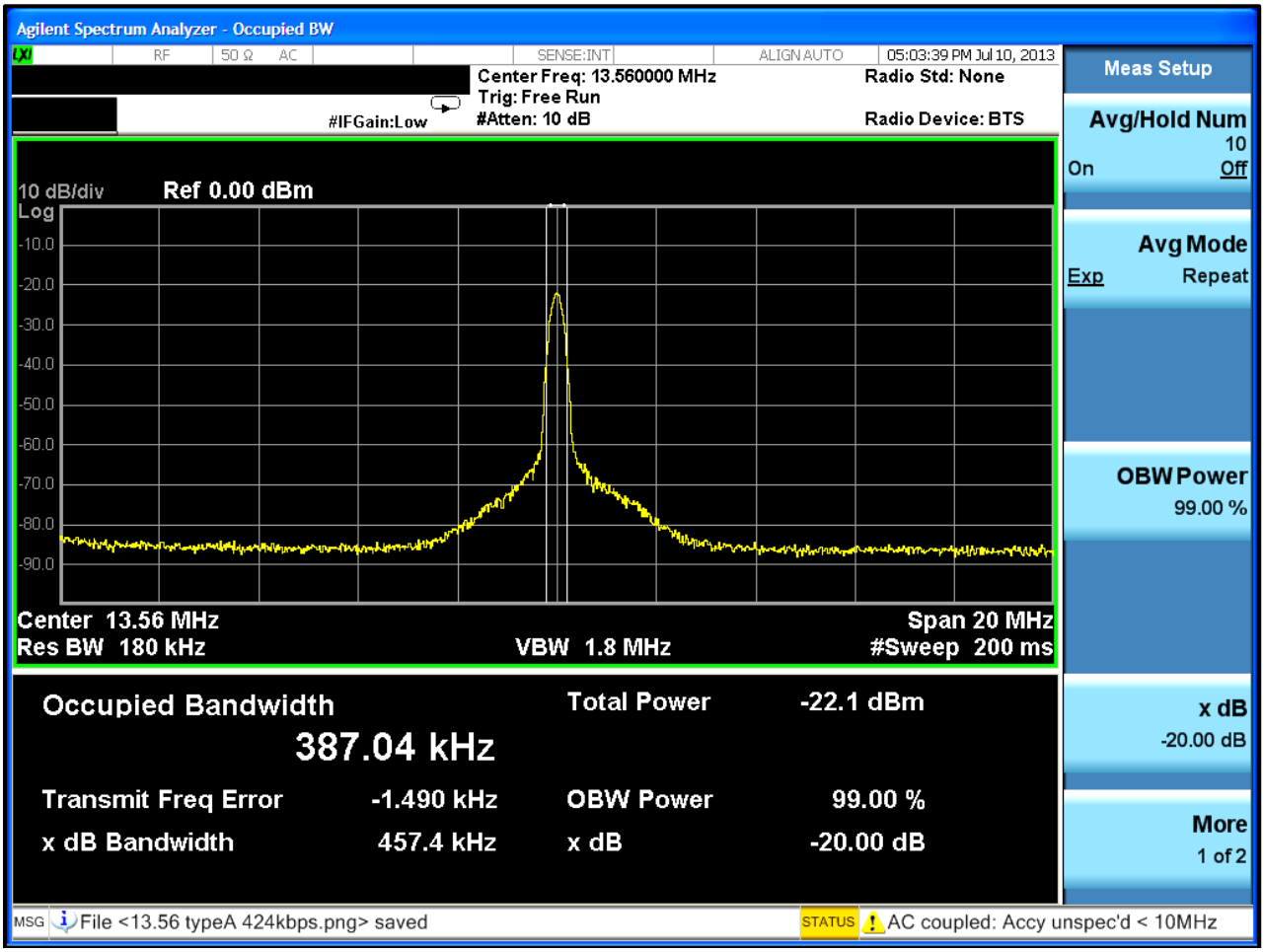
Plot 5-2: 99% Bandwidth - Type A - 212 kbps



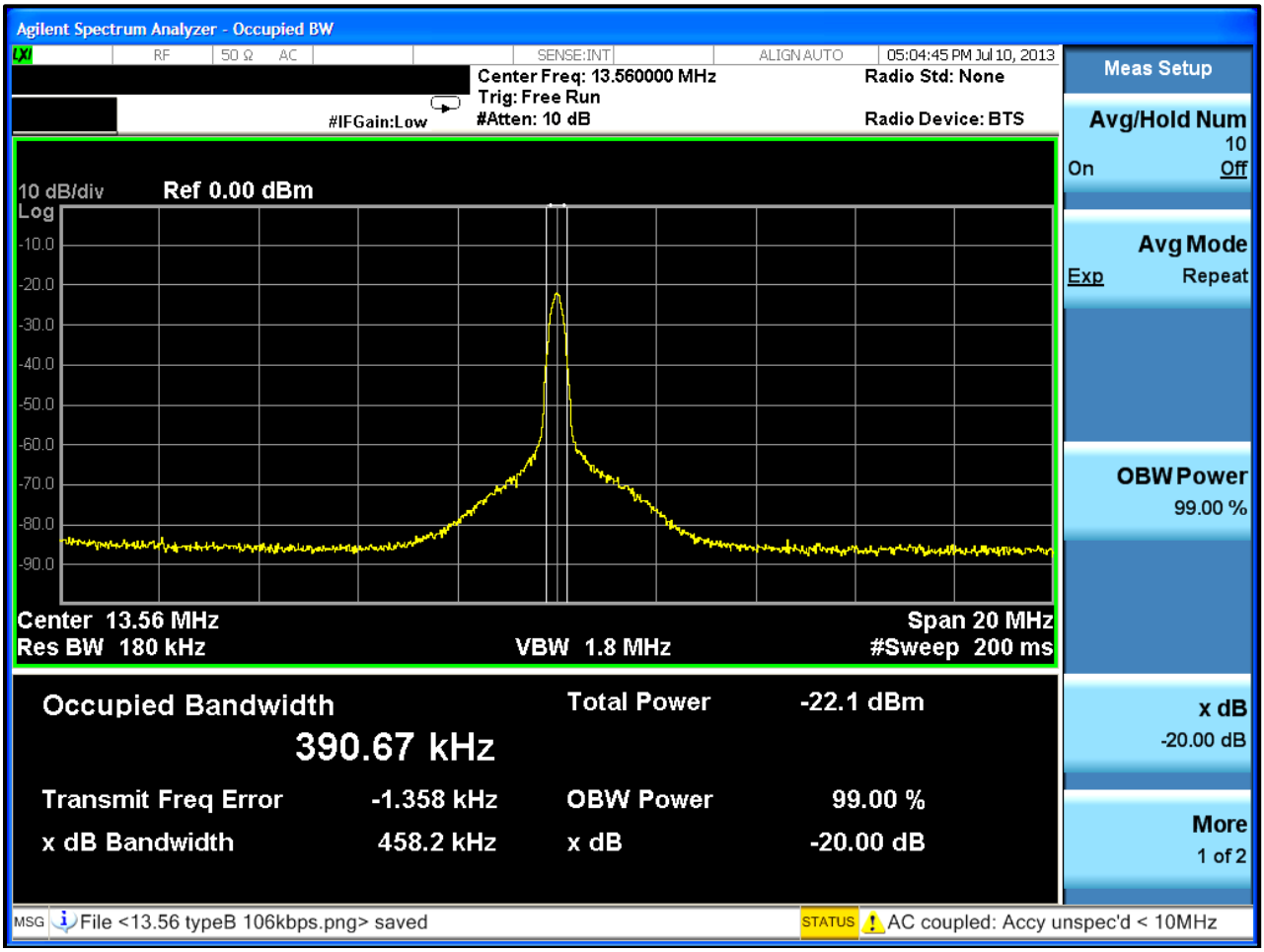
Plot 5-3: 99% Bandwidth – Type A - 424 kbps



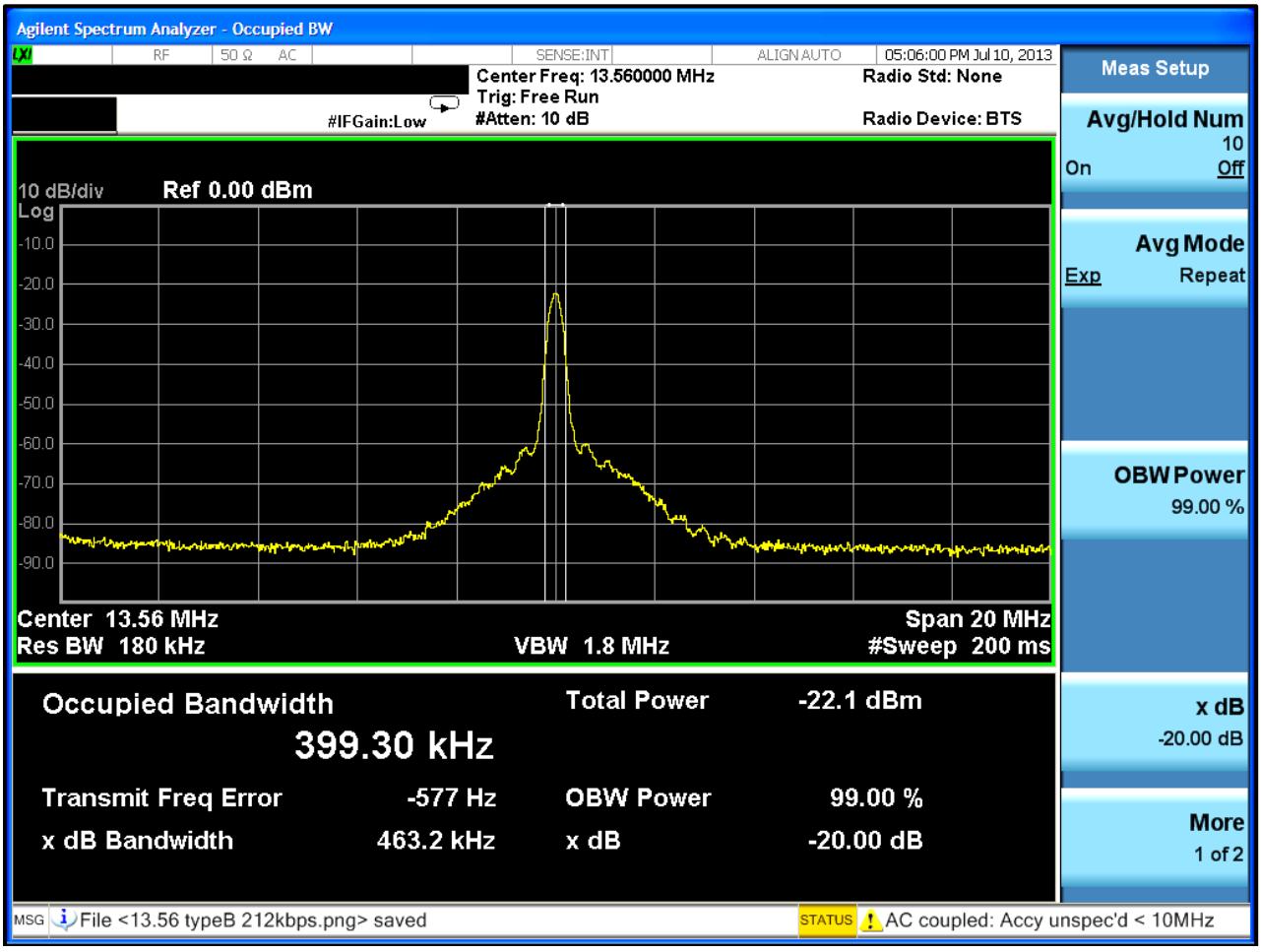
Plot 5-4: 99% Bandwidth - Type B – 106 kbps



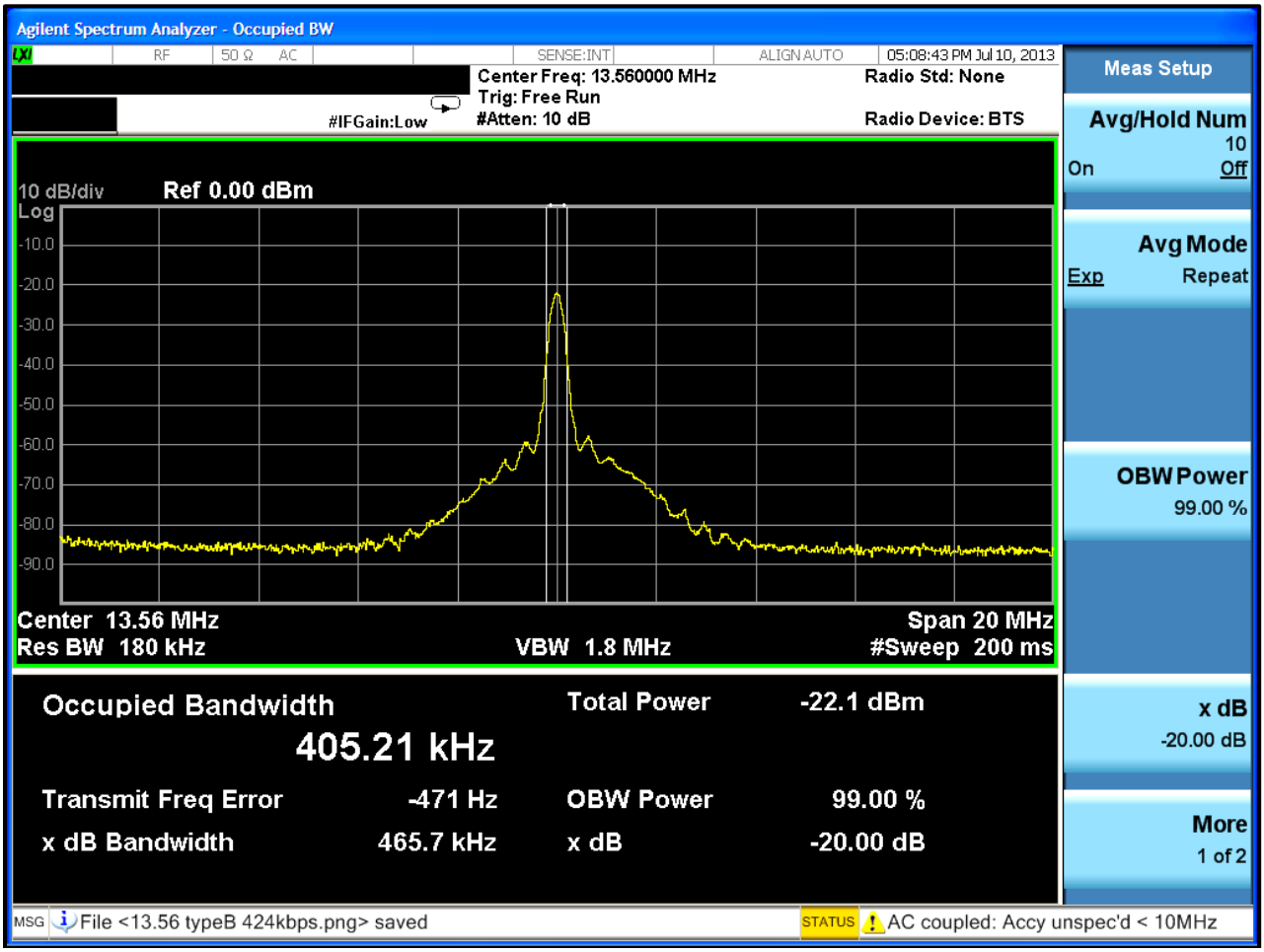
Plot 5-5: 99% Bandwidth - Type B – 212 kbps



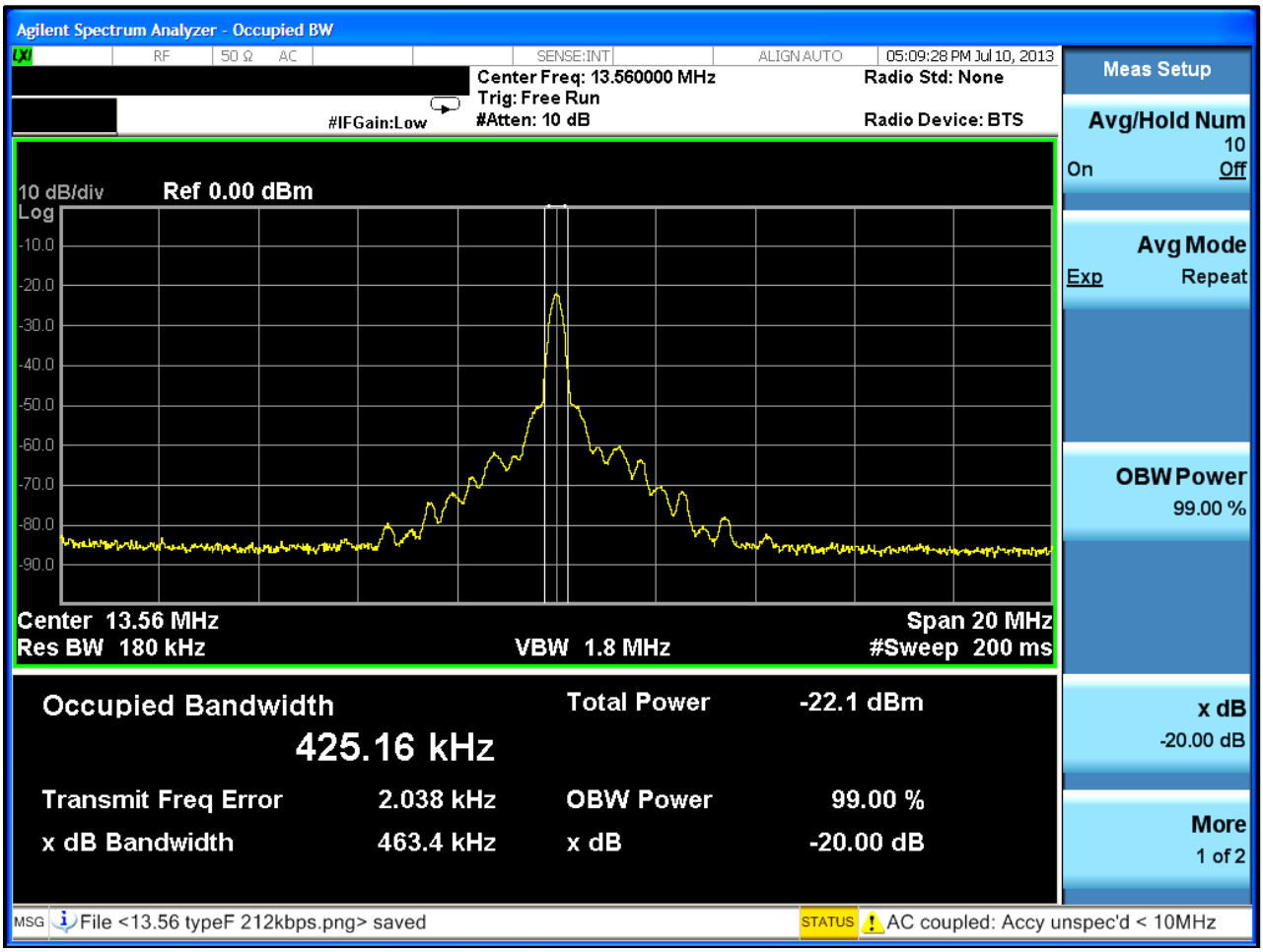
Plot 5-6: 99% Bandwidth - Type B - 424 kbps



Plot 5-7: 99% Bandwidth - Type F - 212 kbps



Plot 5-8: 99% Bandwidth – Type F – 424 kbps



Test Personnel:

Daniel W. Baltzell		July 10, 2013
Test Engineer	Signature	Date of Test

6 Frequency Stability – FCC 2.1055, 15.225(e): Frequency Stability; IC RSS-119 5.3 Transmitter Frequency Stability

6.1 Test Procedure

ANSI/TIA/EIA-603-2004, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

15.255(e): The frequency tolerance of the carrier signal shall be maintained within ± .01% of the operating frequency over a temperature variation of -20°C to +50°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°C. For battery-operated equipment, the equipment tests shall be performed using a new battery.

The EUT was evaluated over the temperature range -20°C to +50°C.

The temperature was initially set to -20°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½-hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage.

The worst-case deviation was found to be -0.0015 % of operating frequency.

Table 6-1: Frequency Stability Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	1/13/14
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	4/16/14
901350	Meterman	33XR	Multimeter	040402802	3/20/15
N/A	Hewlett Packard	6024A	DC Power Supply	1912A00331	N/A

6.2 Test Data

Table 6-2: Temperature Frequency Stability

Temperature (°C)	Measured Frequency (Hz)	Percent of Operating Frequency
-20	13.559799	-0.0015
-10	13.559824	-0.0013
0	13.559866	-0.0010
10	13.559876	-0.0009
20	13.559872	-0.0009
30	13.559858	-0.0010
40	13.559824	-0.0013
50	13.559814	-0.0014

Table 6-3: Voltage Frequency Stability at 20°C

Voltage (DC)	Measured Frequency (Hz)	Percent of Operating Frequency
2.55	13.559845	-0.0011
3.00	13.559845	-0.0011
3.45	13.559845	-0.0011

Results: The EUT is compliant.

Test Personnel:

Daniel Baltzell		July 11, 2013
Test Engineer	Signature	Date of Tests

7 Conclusion

The data in this measurement report shows that the EUT as tested, Vocollect, Inc. A700 Series Terminal Model #'s TAP910-01, TAP920-01, TAP930-01, FCC ID: MQO-TAP900-01, IC: 2570A-TAP90001, comply with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and IC RSS-210 and RSS-Gen.