



LSRESEARCH, LLC

Wireless Product Development

W66 N220 Commerce Court • Cedarburg, WI 53012 USA • Phone: 262.375.4400 • Fax: 262.375.4248 • www.lsr.com

ENGINEERING TEST REPORT # TR 314378 A

LSR Job #: C-2204

Compliance Testing of:

A500 Talkman

Test Date(s):

April 28, 29, 30 and May 5, 6, 8, 9, 15 2015

August 7, 2015

Prepared For:

Vocollect, Inc.

703 Rodi Road

Pittsburgh, PA 15235

This Test Report is issued under the Authority of: Adam Alger, EMC Engineer

Signature:

Date: 8-7-15

Test Report Reviewed by:

Tom Smith, VP EMC Test Services

Signature:

Date: 7-1-15

Report by:

Adam Alger, EMC Engineer

Signature:

Date: 6-30-15

This Test Report may not be reproduced, except in full, without written approval of LS Research, LLC.

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

Table of Contents

i.	Title Page	1
ii.	Table of Contents	2
iii.	LS Research, LLC in Review	3
1.0	Summary of Test Report.....	4
2.0	Test Facilities	4
3.0	Client Information.....	5
3.1	Equipment Under Test (EUT) Information.....	5
3.2	Product Description	5
3.3	Modifications Incorporated In the EUT for Compliance Purposes	5
3.4	Deviations & Exclusions from Test Specifications	5
3.5	Additional Information	5
4.0	Conditions of Test.....	6
5.0	Test Equipment	6
6.0	Conformance Summary	6
	Appendix A – Test Equipment	7
	Appendix B – Test Data.....	8
	B.1 – RF Conducted Emissions	8
	B.2 – Transmitter Radiated Emissions in Restricted Bands	25
	B.3 – Radiated Emissions in Receive Mode	35
	B.4 – AC Mains Conducted Emissions	40
	Appendix C - Uncertainty Summary	42
	Appendix D - References.....	43

LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:



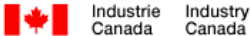
A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01



Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756



Canada

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A
On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088



U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.
Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

1.0 Summary of Test Report

In April-August 2015 the EUT, A500, was tested and MEETS the following requirements:

FCC Requirement	IC Requirement	Test Requirements	Measurement Procedure	Compliance (Yes/No)
15.247 (a)(2)	RSS-247 Section 5.2 (1)	6 dB Bandwidth of a Digital Modulation System	ANSI C63.10-2013 Section 11.8	Yes
15.247(b) & 1.1310	RSS-247 Section 5.4 (4)	Maximum Output Power	ANSI C63.10-2013 Section 11.9	Yes
15.247 (e)	RSS-247 Section 5.2 (2)	Power Spectral Density of a Digital Modulation System	ANSI C63.10-2013 Section 11.10	Yes
15.247(d)	RSS-247 Section 5.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	ANSI C63.10-2013 Section 11.11	Yes
15.247(c), 15.209 & 15.205	RSS-GEN Section 8.9, 8.10	Transmitter Radiated Emissions in Restricted Bands	ANSI C63.10-2013 Section 11.12 (6.3,6.5,6.6)	Yes
2.1055 (d)	RSS-GEN Section 6.11	Frequency Stability	ANSI C63.10-2013 Section 6.8	Yes
15.207 15.107	RSS-GEN Section 8.8	Power Line Conducted Emissions Measurements	ANSI C63.10-2013 Section 6.2	Yes
15.109	RSS-GEN Section 7	Receive Mode (Digital Device) Radiated Emissions	ANSI C63.4-2014 Section 8	Yes

2.0 Test Facilities

All testing was performed at:

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

3.0 Client Information

Manufacturer Name:	Vocollect, Inc.
Address:	703 Rodi Road Pittsburg, PA 15235
Contact Person:	Brian Sutton

3.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	A500 Talkman
Model Number:	TAP802-01
Serial Number:	Eng. Sample
FCC ID:	MQO-TAP802-01
IC:	2570A-TAP80201

3.2 Product Description

802.11 b/g/n device using HT20 channels 1-11

3.3 Modifications Incorporated In the EUT for Compliance Purposes

None noted at time of test

3.4 Deviations & Exclusions from Test Specifications

None noted at time of test

3.5 Additional Information

Low Channel 1(2412 MHz), Middle Channel 6 (2437 MHz), High Channel 11 (2462 MHz).
EUT programmed for continuous transmit or receive on selectable channel and data rate
(modulation) using hyper terminal program connection via programming port on EUT.

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

4.0 Conditions of Test

Environmental:

Temperature: 20-25° C
Relative Humidity: 30-60%
Atmospheric Pressure: 86-106 kPa

Mains Voltage: 120 VAC 60Hz

Battery Voltage: 3.7 V

5.0 Test Equipment

All test equipment is calibrated by a calibration laboratory accredited by A2LA to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below.

Frequency Range	Resolution Bandwidth
9 kHz – 150 kHz	200 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

6.0 Conformance Summary

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, 15.109, 15.207, 15.107 as well as Industry Canada RSS-247 Issue 1, RSS-GEN Issue 4.

If some emissions are seen to be within 3 dB of their respective limits:

As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

Appendix A – Test Equipment



Date : 28-Apr-2015 Type Test : Radiated and RF Conducted Job # : C-2204
 Prepared By: Adam Alger Customer : Vocollect Quote #: 314378

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	10/19/2014	10/19/2015	Active Calibration
2	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	1/9/2015	1/9/2016	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	1/19/2015	1/19/2016	Active Calibration
4	AA 960150	Biconical Antenna	ETS	3110B	0003-3346	1/22/2015	1/22/2016	Active Calibration
5	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	WLA622-4 / 3160-09	123001	8/20/2014	8/20/2015	Active Calibration
6	AA 960137	Standard Gain Horn Ant.	EMCO	3160-10	69259	8/20/2014	8/20/2015	Active Calibration
7	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	6/20/2014	6/20/2015	Active Calibration
8	EE 960159	0.8 - 21GHz LNA	Mini-Circuits	ZVA-213X-S+	740411007	6/20/2014	6/20/2015	Active Calibration
9	AA 960161	Highpass Filter	K&L Microwave	11SH10-8000	2	2/6/2015	2/6/2016	Active Calibration



Date : 7-Aug-2015 Type Test : AC Emissions Job # : C-2204
 Prepared By: Adam Alger Customer : Vocollect Quote #: 314378

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960162	LISN - 15A	COM-POWER	LI-215A	191969	7/24/2015	7/24/2016	Active Calibration
2	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	1/9/2015	1/9/2016	Active Calibration

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

Appendix B – Test Data
B.1 – RF Conducted Emissions

Manufacturer	Vocollect, Inc.
Test Location	LS Research, LLC
Rule Part	FCC 15.247 IC RSS-247
General Measurement Procedure	ANSI C63.10 Section 6.7
General Description of Measurement	A direct measurement of the transmitted signal was performed at the antenna port of the EUT via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source.

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

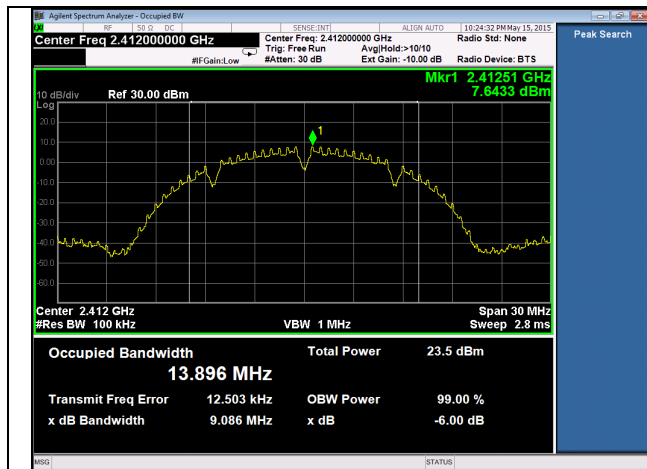
B.1.1 – RF Conducted – Fundamental Bandwidth

Manufacturer	Vocollect, Inc.
Date	5-15-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247 (a)(2) IC RSS-247 Section 5.2(1)
Specific Measurement Procedure	ANSI C63.10-2013 Section 11.8
Additional Description of Measurement	Peak detector used
Additional Notes	Continuous transmit modulated used for this test.

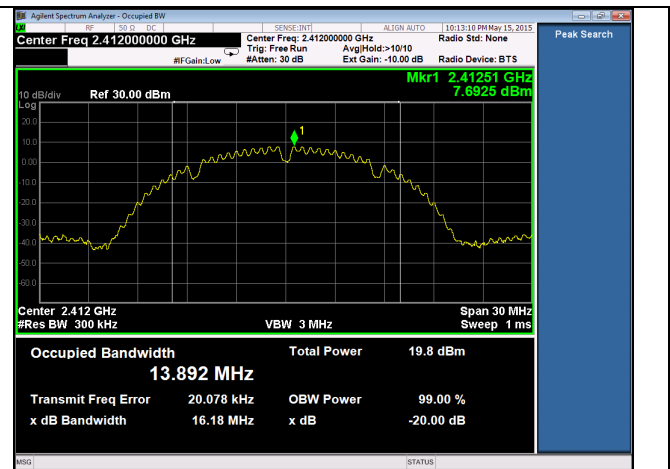
Table

Mode (802.11)	Mode (Mbps)	Frequency (MHz)	6 dB DTS BW (MHz)	99 % BW (MHz)	20 dB OBW (MHz)
b	1	2412	9.09	13.89	16.16
		2437	9.09	13.89	16.17
		2462	9.10	13.90	16.18
g	6	2412	15.53	16.84	19.80
		2437	15.53	16.84	19.55
		2462	15.17	16.86	19.53
n	6.5	2412	15.67	17.99	20.80
		2437	15.32	18.06	21.09
		2462	15.67	17.97	20.60

Plots 802.11b – 1 Mbps Low Channel – 2412 MHz

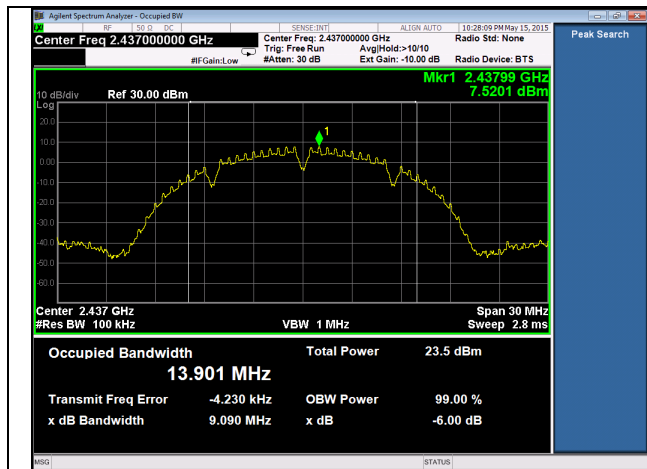


6 dB DTS BW

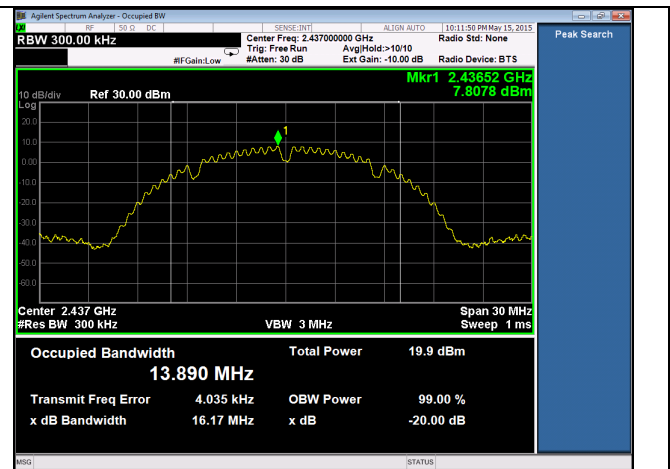


20 dB OBW + 99% BW

Mid Channel – 2437 MHz

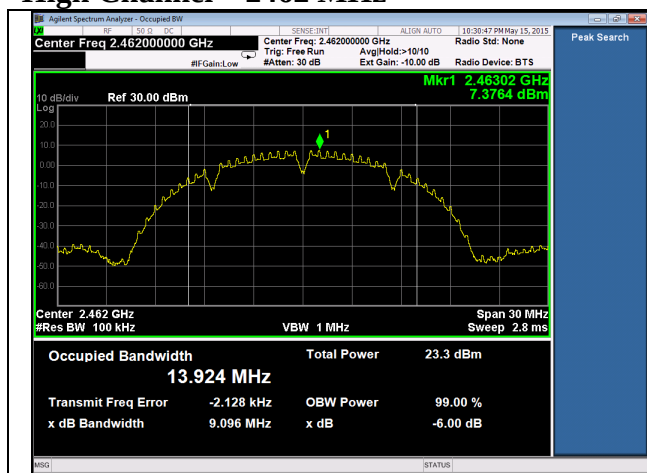


6 dB DTS BW

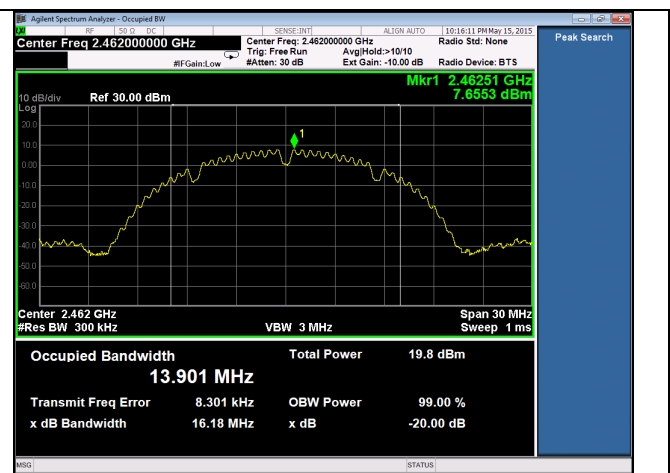


20 dB OBW + 99% BW

High Channel – 2462 MHz



6 dB DTS BW



20 dB OBW + 99% BW

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

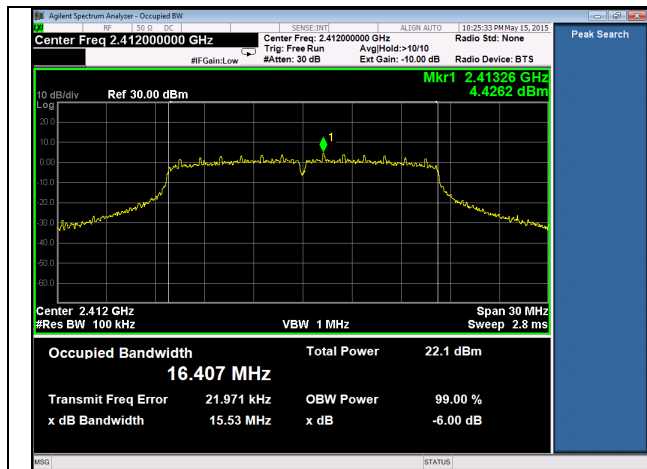
Name: A500 Talkman

Model: TAP802-01

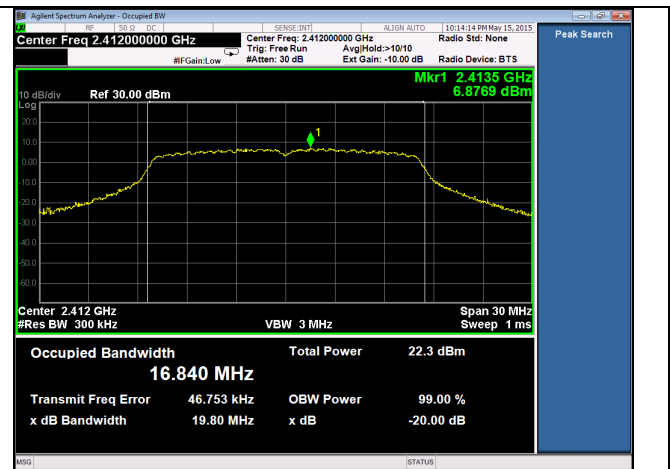
Serial: Eng. Sample

802.11b – 6 Mbps

Low Channel – 2412 MHz

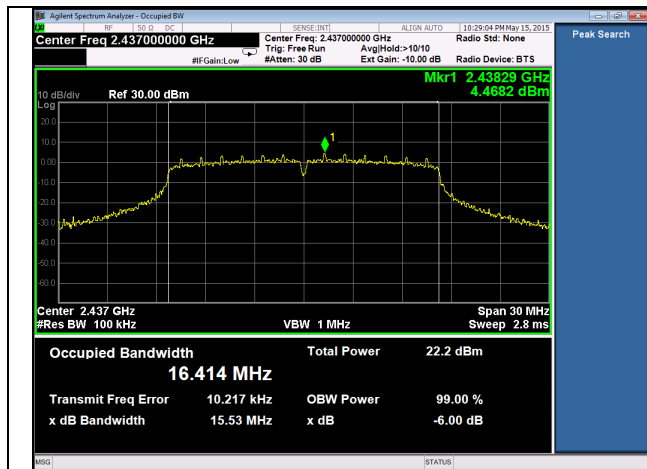


6 dB DTS BW

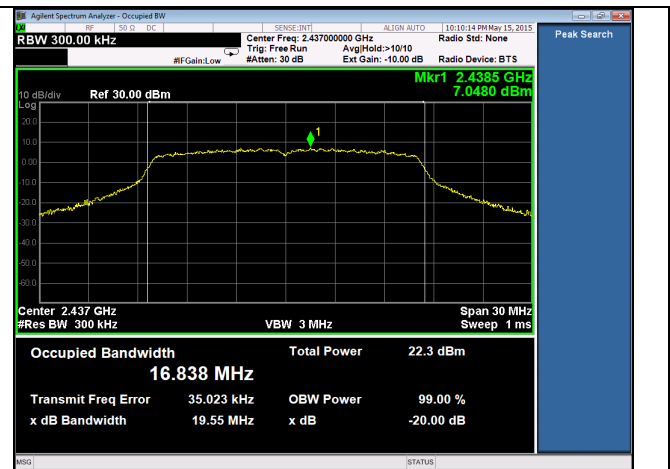


20 dB OBW + 99% BW

Mid Channel – 2437 MHz

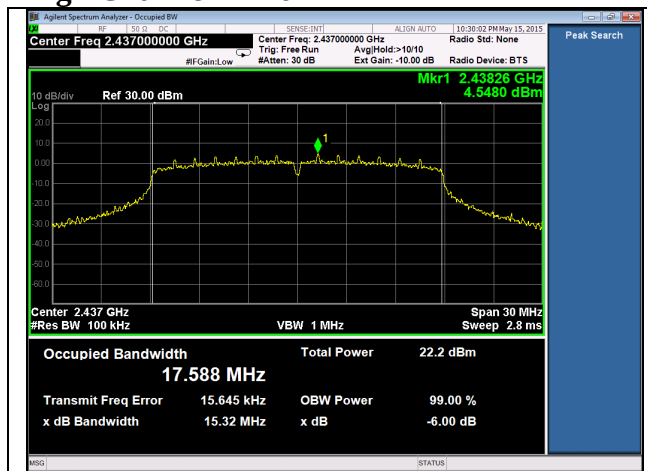


6 dB DTS BW

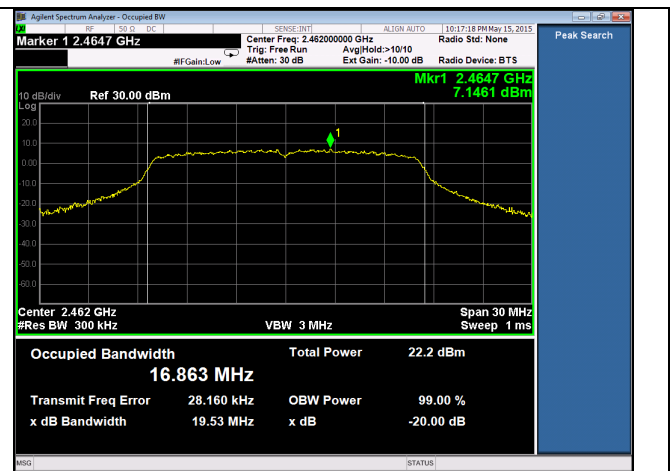


20 dB OBW + 99% BW

High Channel – 2462 MHz



6 dB DTS BW



20 dB OBW + 99% BW

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

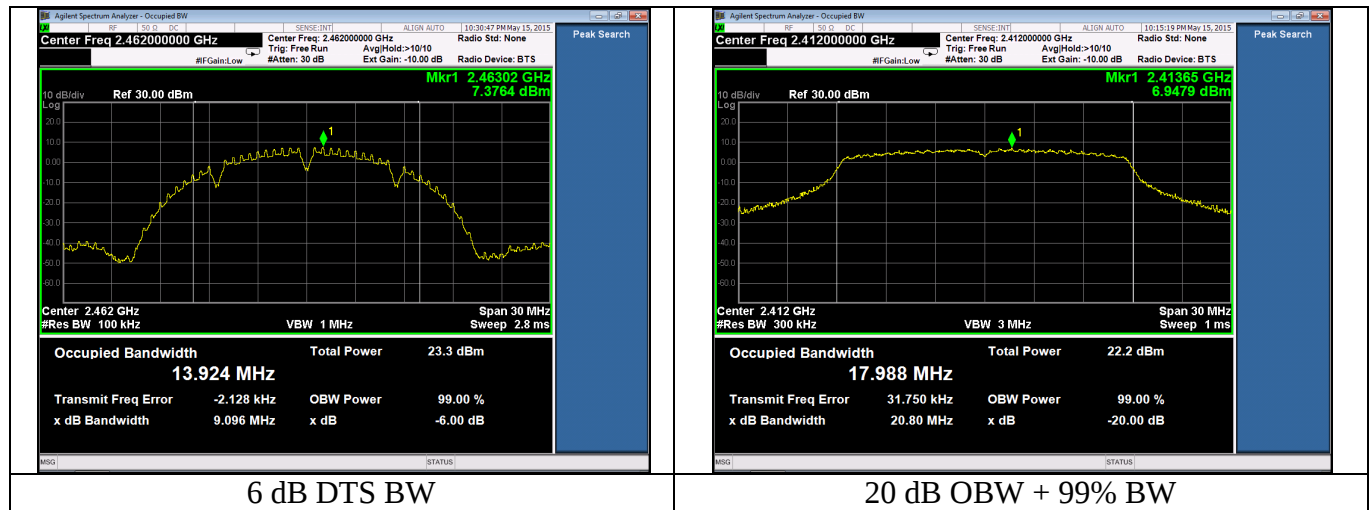
Name: A500 Talkman

Model: TAP802-01

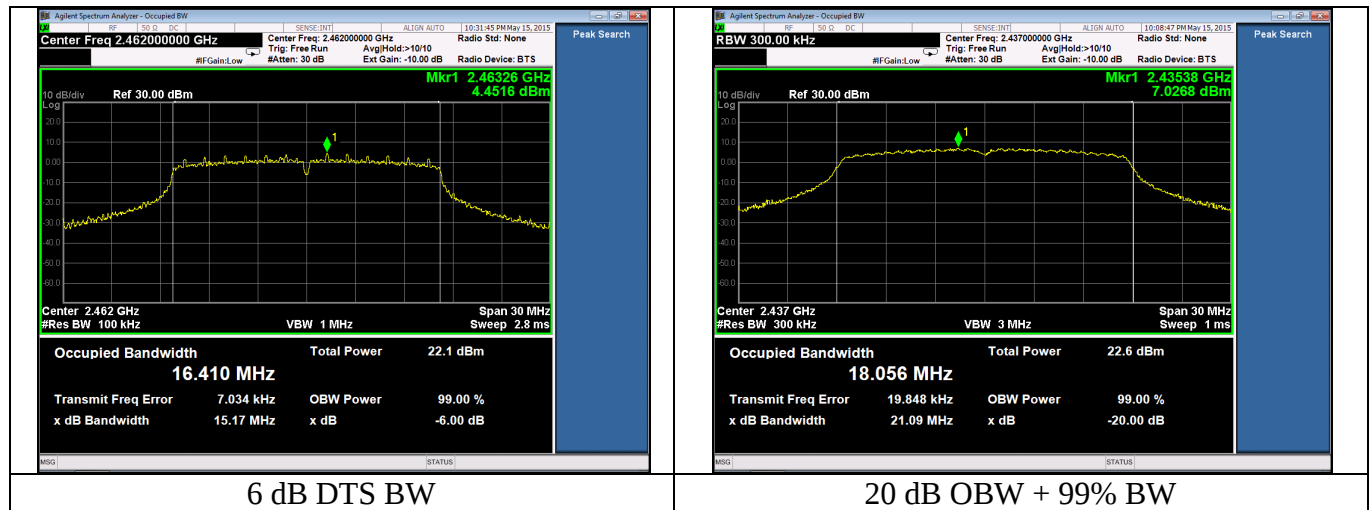
Serial: Eng. Sample

802.11n – 6.5 Mbps

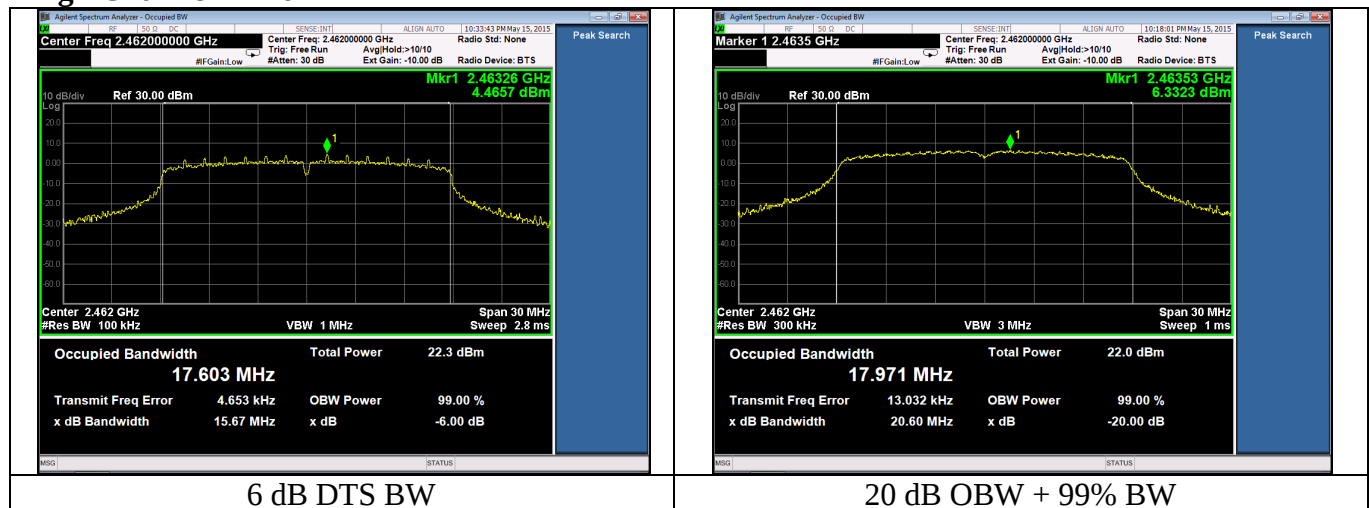
Low Channel – 2412 MHz



Mid Channel – 2437 MHz



High Channel – 2462 MHz



Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.1.2 – RF Conducted – Fundamental Power and Spectral Density

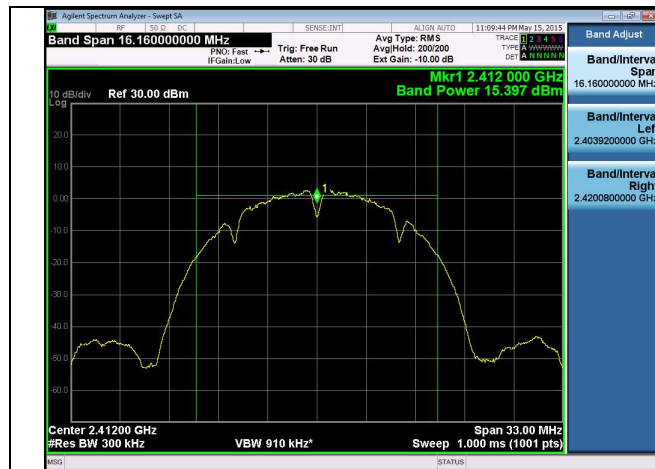
Manufacturer	Vocollect, Inc.
Date	5-15-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247 (b) & (e) IC RSS-247 Section 5.4 (4) & 5.2 (2)
Specific Measurement Procedure	ANSI C63.10-2013 Section 11.9 and 11.10
Additional Description of Measurement	100 kHz resolution bandwidth used for Power Spectral Density measurement
Additional Notes	Continuous transmit modulated used for this test. Sample Calculation: Margin (dB) = Limit – Measured level

Table

Mode (802.11)	Mode (Mbps)	Frequency (MHz)	6 dB DTS BW (MHz)	99 % BW (MHz)	20 dB OBW (MHz)	Meas Power (dBm)	Duty (dB)	Max Avg. Power (dBm)	Max Avg. Power Limit (dBm)	Max Avg. Power Margin (dB)	Meas PSD 100 kHz (dBm)	Duty (dB)	Max Avg. PSD 100 kHz (dBm)	Max Avg. PSD Limit (dBm / 3 kHz)	Max Avg. PSD Margin (dB)
b	1	2412	9.09	13.89	16.16	15.397	0.435	15.832	30	14.17	-1.988	0.015	-1.973	8	9.97
		2437	9.09	13.89	16.17	15.535	0.435	15.970		14.03	-1.857	0.015	-1.842		9.84
		2462	9.10	13.90	16.18	15.454	0.435	15.889		14.11	-1.182	0.015	-1.167		9.17
g	6	2412	15.53	16.84	19.80	14.434	0.269	14.703		15.30	-4.985	0.116	-4.869		12.87
		2437	15.53	16.84	19.55	14.477	0.269	14.746		15.25	-4.978	0.116	-4.862		12.86
		2462	15.17	16.86	19.53	14.566	0.269	14.835		15.17	-5.082	0.116	-4.966		12.97
n	6.5	2412	15.67	17.99	20.80	14.277	0.289	14.566		15.43	-5.695	0.128	-5.567		13.57
		2437	15.32	18.06	21.09	14.376	0.289	14.665		15.34	-5.162	0.128	-5.034		13.03
		2462	15.67	17.97	20.60	14.379	0.289	14.668		15.33	-5.312	0.128	-5.184		13.18

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

Plots - 802.11b – 1 Mbps
Low Channel – 2412 MHz

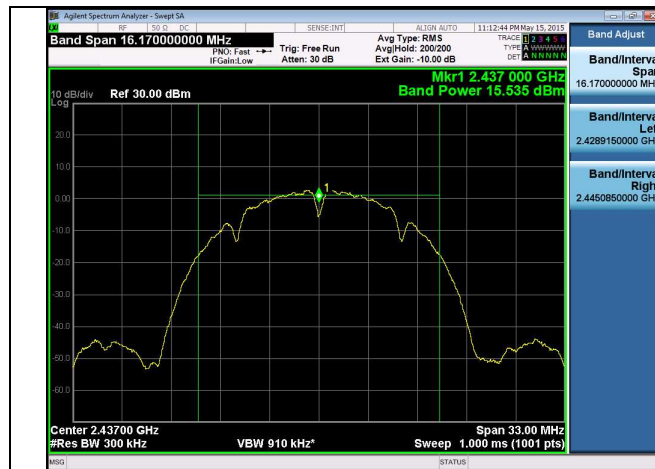


Output Power



Power Spectral Density

Mid Channel – 2437 MHz

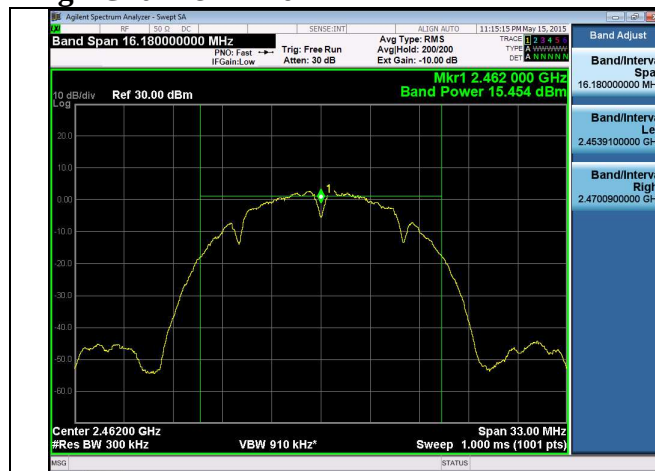


Output Power

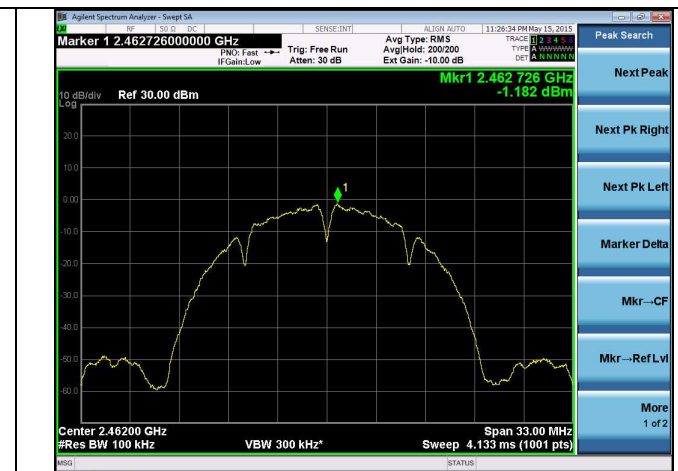


Power Spectral Density

High Channel – 2462 MHz



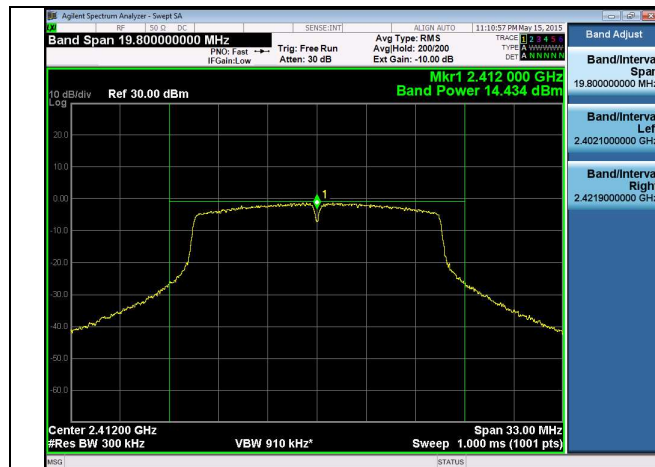
Output Power



Power Spectral Density

802.11g – 6 Mbps

Low Channel – 2412 MHz

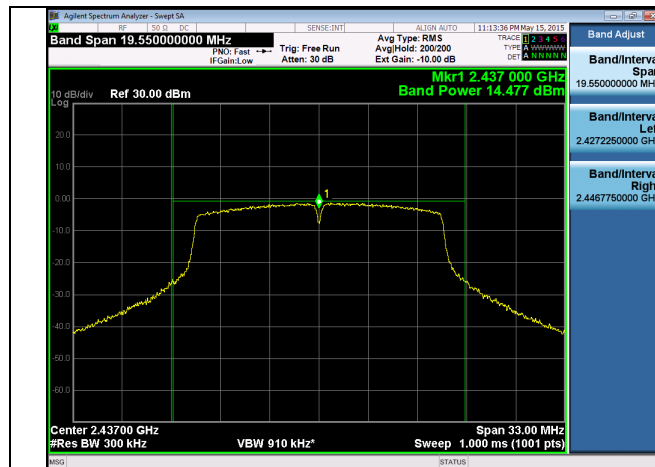


Output Power

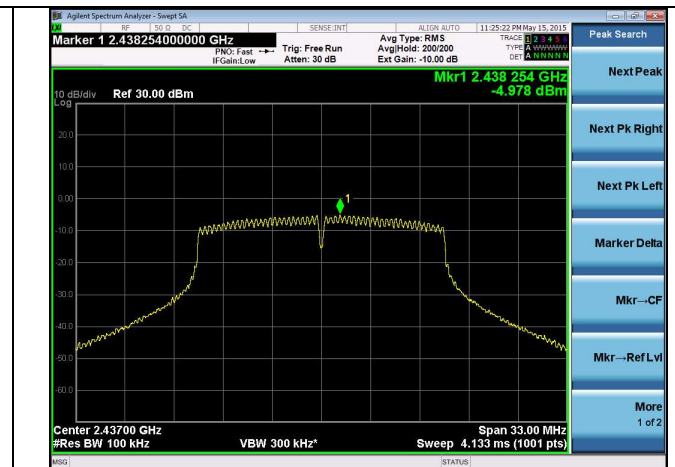


Power Spectral Density

Mid Channel – 2437 MHz

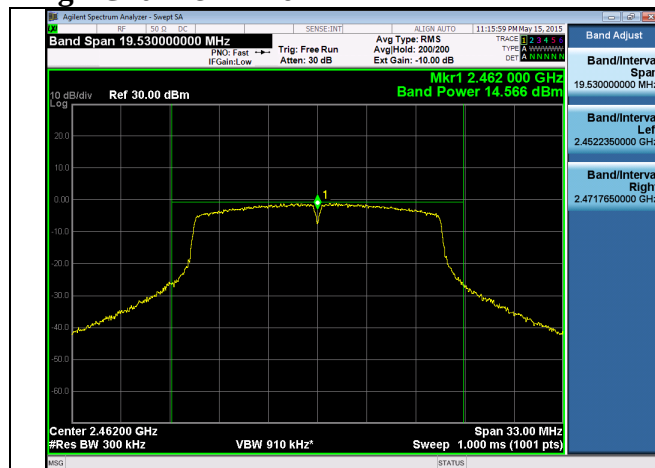


Output Power

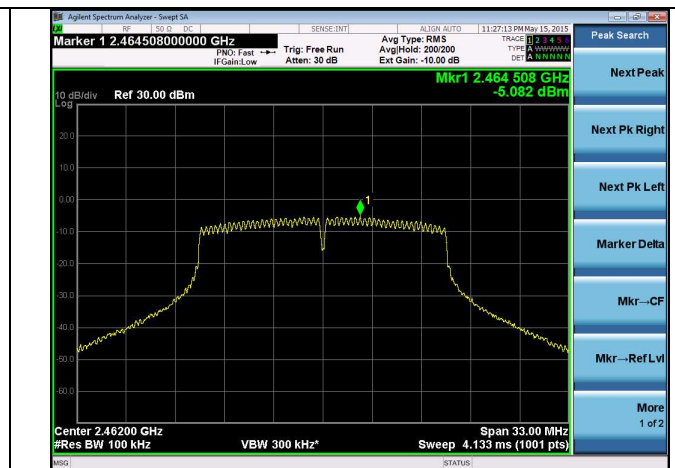


Power Spectral Density

High Channel – 2462 MHz



Output Power



Power Spectral Density

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

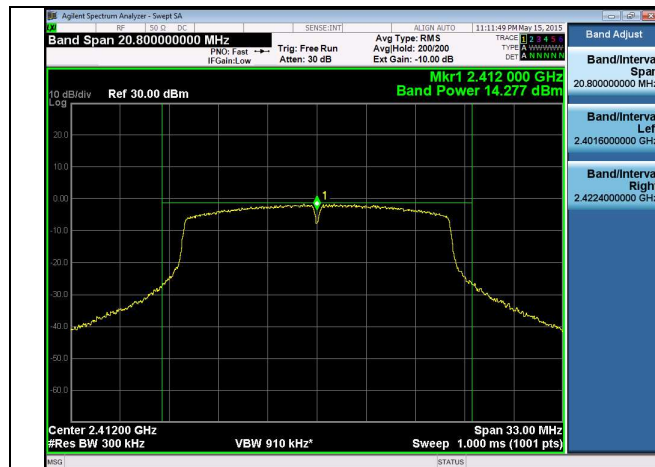
Name: A500 Talkman

Model: TAP802-01

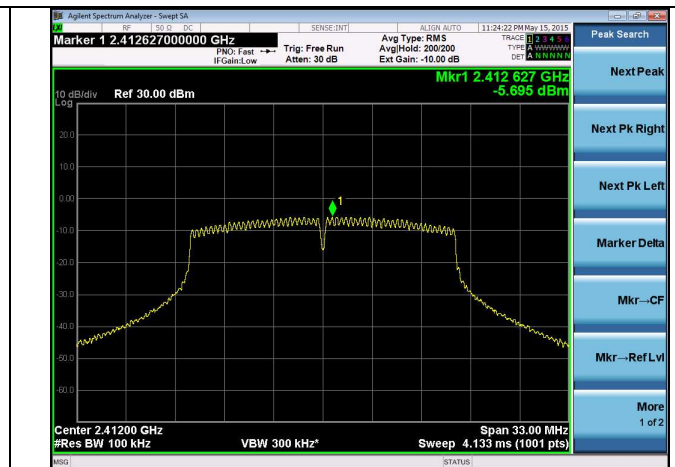
Serial: Eng. Sample

802.11n – 6.5 Mbps

Low Channel – 2412 MHz

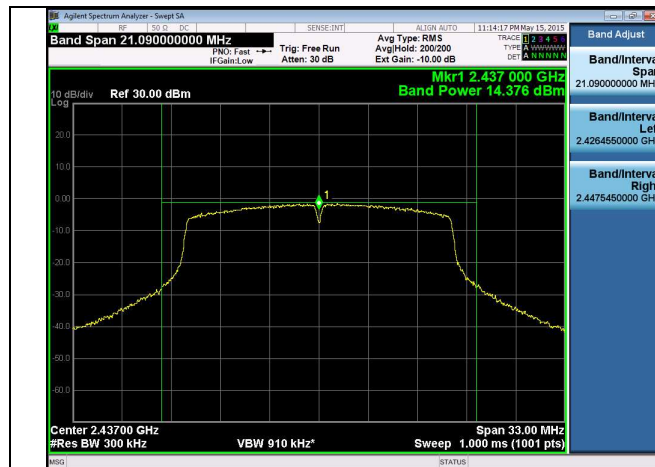


Output Power



Power Spectral Density

Mid Channel – 2437 MHz



Output Power

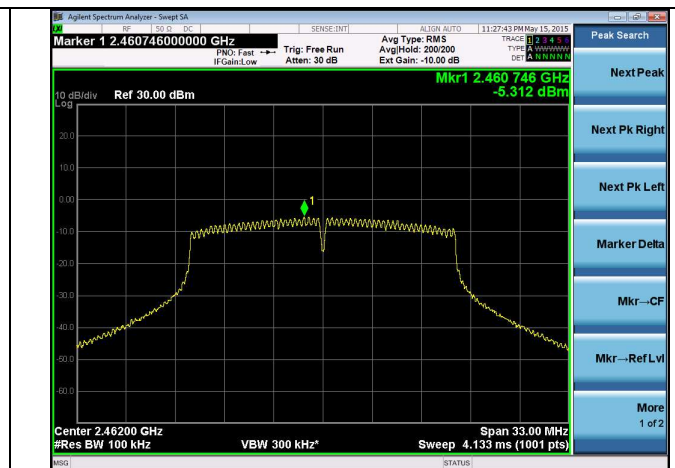


Power Spectral Density

High Channel – 2462 MHz



Output Power



Power Spectral Density

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

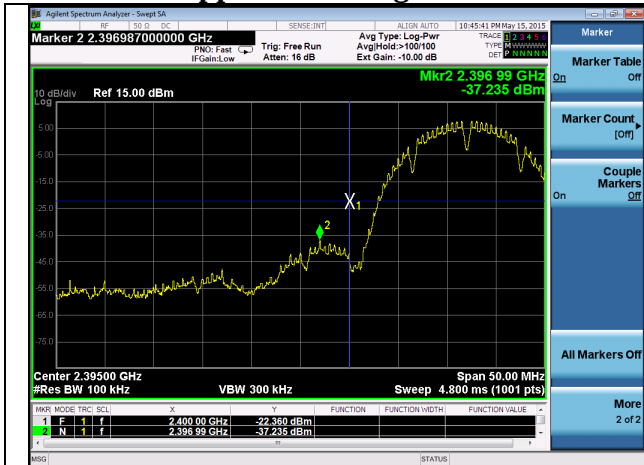
B.1.3 – RF Conducted – Transmitter Spurious Emissions

Manufacturer	Vocollect, Inc.
Date	5-15-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247 (d) IC RSS-247 Section 5.5
Specific Measurement Procedure	ANSI C63.10-2013 Section 11.11
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	1. Power measurements made with average method therefore emissions attenuated 30 dB relative in band PSD level. 2. For reference level measurement see DTS BW plots. 3. Spurious non-band-edge worst case 1 Mbps.

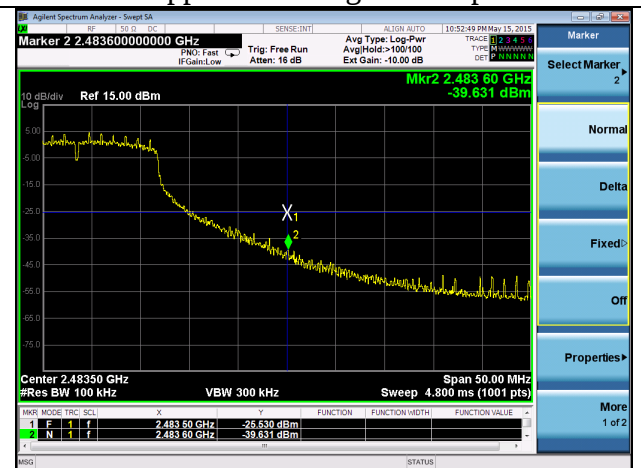
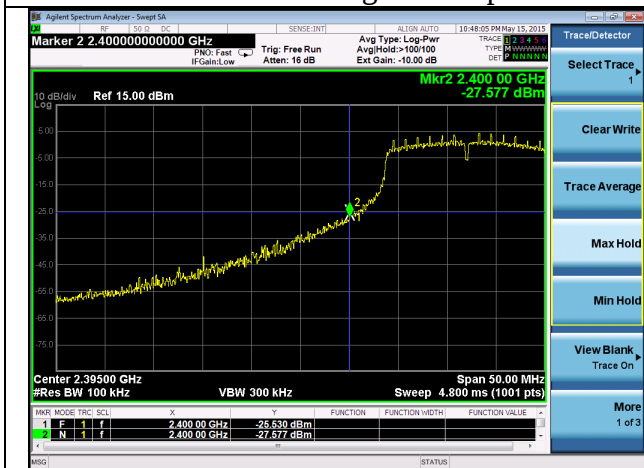
Table

Mode (802.11)	Mode (Mbps)	Channel	100 kHz Reference (dBm)	-30 dBc Limit (dBm)	Frequency (GHz)	Out-of-Band Level (dBm)	Margin (dB)
b	1	1	7.64	-22.36	2.39699	-37.235	14.9
		11	7.38	-22.62	2.48800	-46.847	24.2
g	6	1	4.43	-25.57	2.40000	-27.577	2.0
		11	4.45	-25.55	2.48360	-39.631	14.1
n	6.5	1	4.46	-25.54	2.40000	-28.158	2.6
		11	4.47	-25.53	2.48415	-38.417	12.9

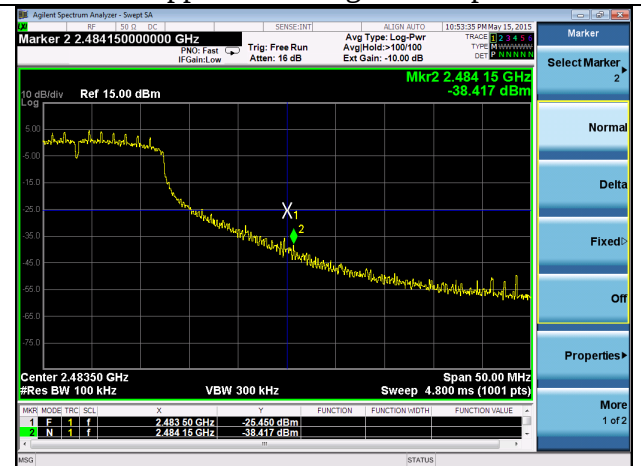
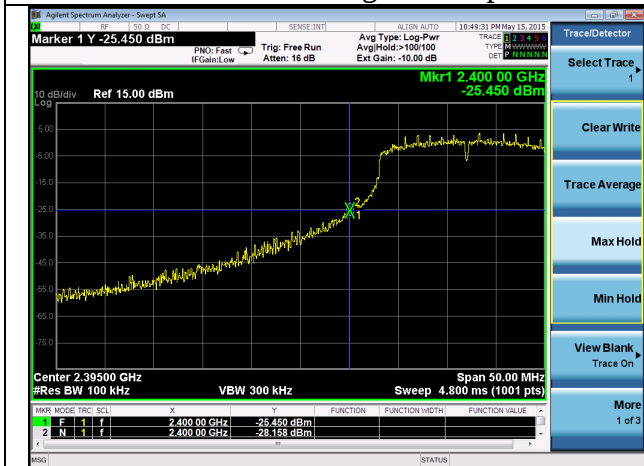
Lower and Upper Band-Edge



Lower Band-Edge - 1 Mbps



Lower Band-Edge - 6 Mbps



Lower Band-Edge - 6.5 Mbps

Upper Band-Edge - 6.5 Mbps

Prepared For: Vocollect, Inc.

Report: TR 314378 A

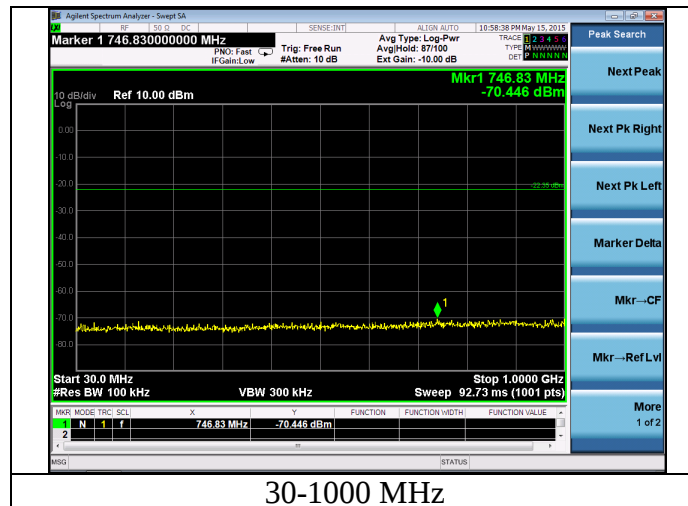
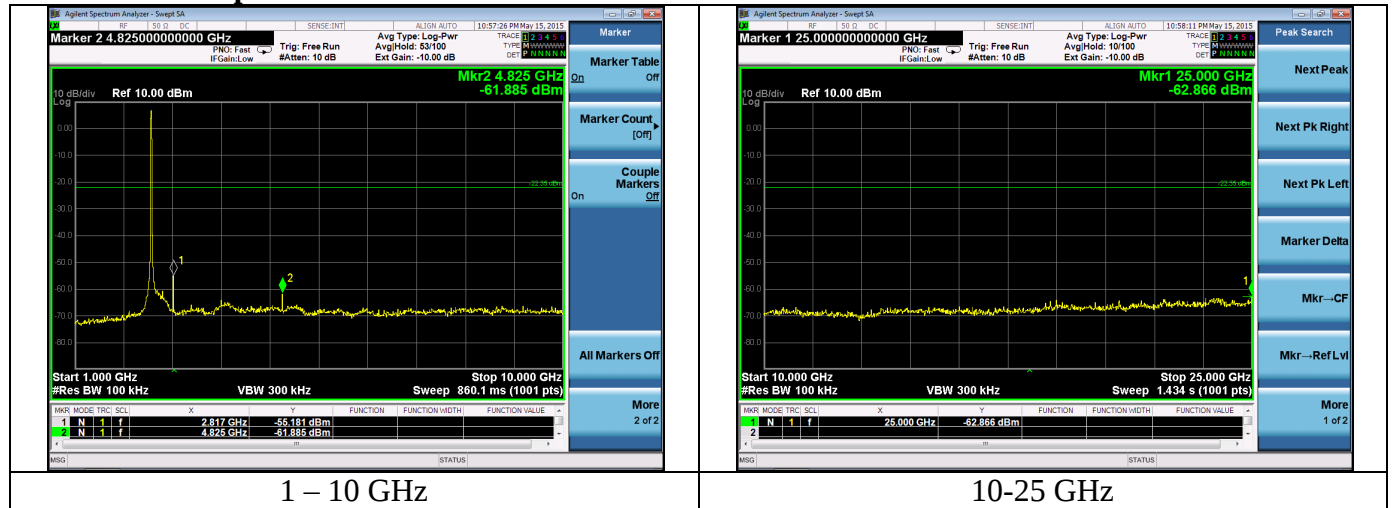
LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

802.11b – 1 Mbps - Low Channel – 2412 MHz



30-1000 MHz

Prepared For: Vocollect, Inc.

Report: TR 314378 A

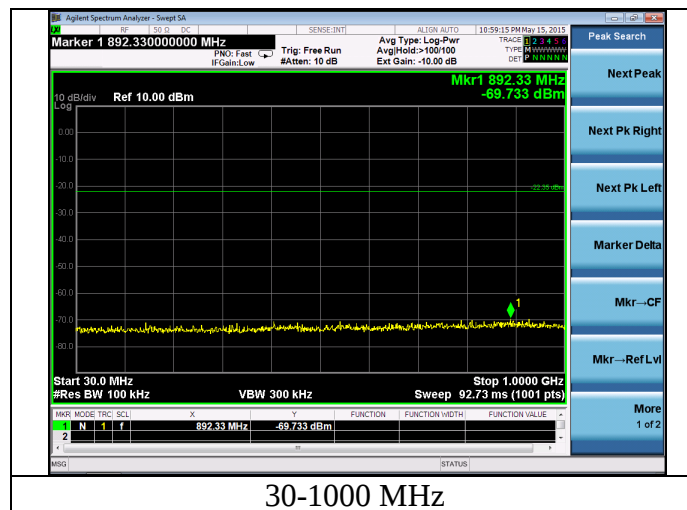
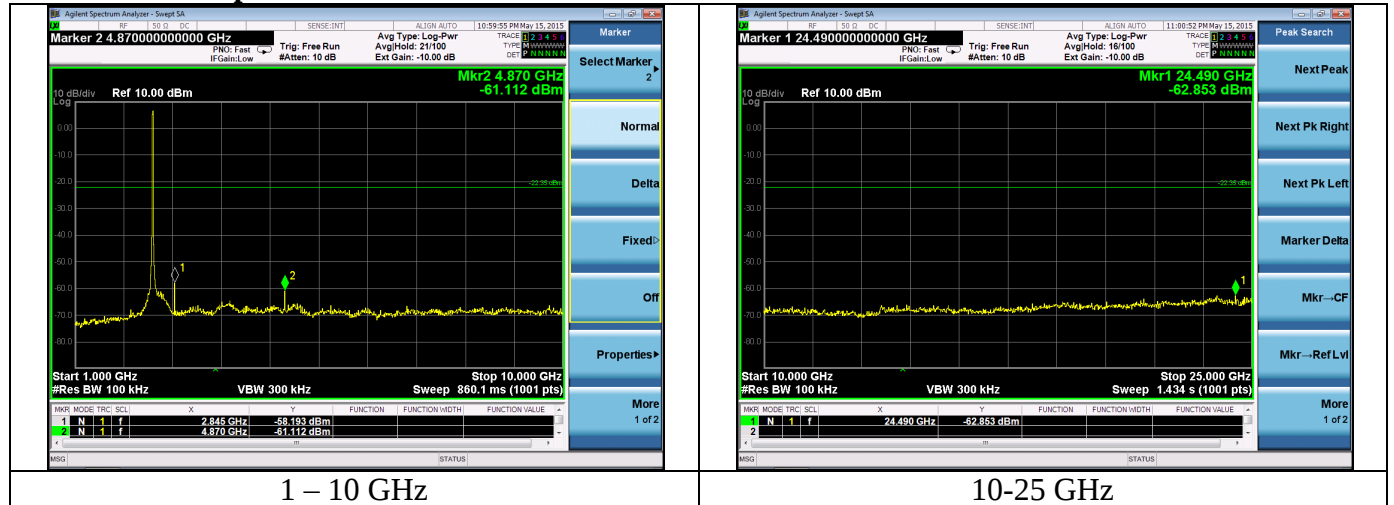
LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

802.11b – 1 Mbps - Mid Channel – 2437 MHz



Prepared For: Vocollect, Inc.

Report: TR 314378 A

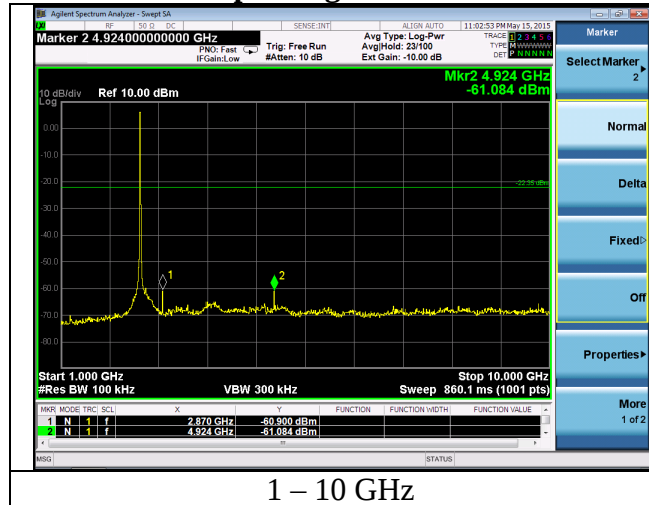
LSR: C-2204

Name: A500 Talkman

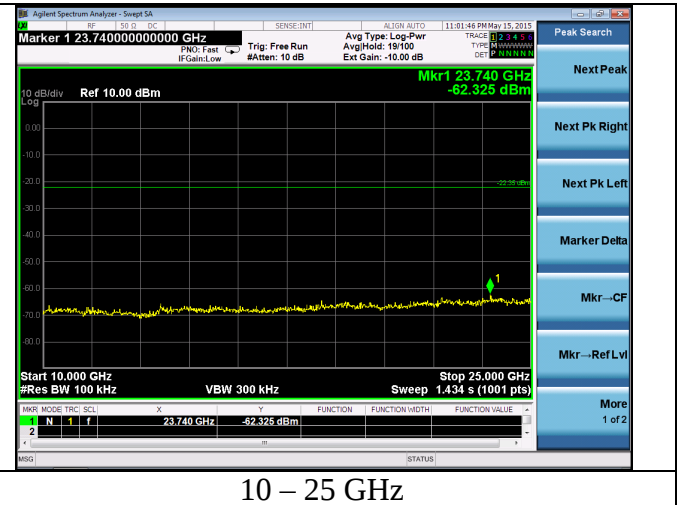
Model: TAP802-01

Serial: Eng. Sample

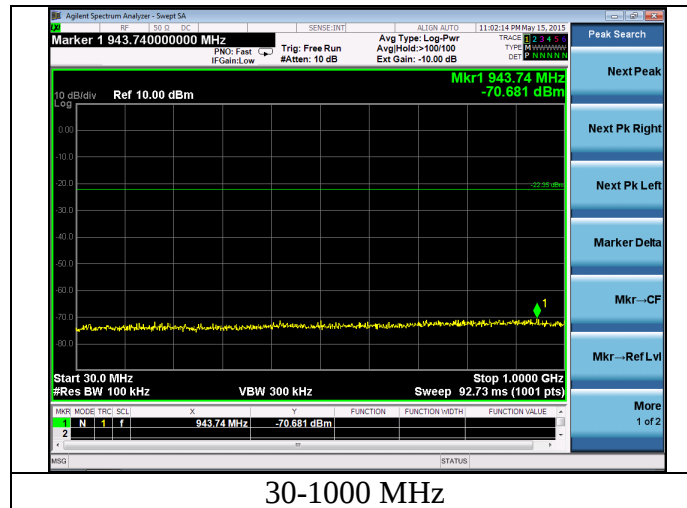
802.11b – 1 Mbps - High Channel – 2462 MHz



1 – 10 GHz



10 – 25 GHz



30-1000 MHz

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.1.4 – RF Conducted – Frequency Stability

Manufacturer	Vocollect, Inc.
Date	5-15-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 2.1055 RSS-GEN Section 6.11
Specific Measurement Procedure	ANSI C63.10-2013 Section 6.8
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	The power and frequency stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the RF output power and frequency at the appropriate frequency markers. Power was supplied by an external bench-type DC power supply and was varied from the nominal. The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle. Below is data showing stability of the fundamental frequency. Continuous transmit un-modulated used for this test. EUT does not operate below 3.15-4.26 VDC, 3.7 VDC nominal

	3.15		3.70		4.26		FREQ DRIFT (Hz)
	POWER (dBm)	FREQUENCY (Hz)	POWER (dBm)	FREQUENCY (Hz)	POWER (dBm)	FREQUENCY (Hz)	
LOW CHANNEL	3.5	2411997132	3.6	2411997122	3.5	2411997133	11
MID CHANNEL	4.1	2436997104	4.1	2436997104	4.1	2436997100	4
HIGH CHANNEL	4.5	2461997067	4.5	2461997073	4.5	2461997074	7

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

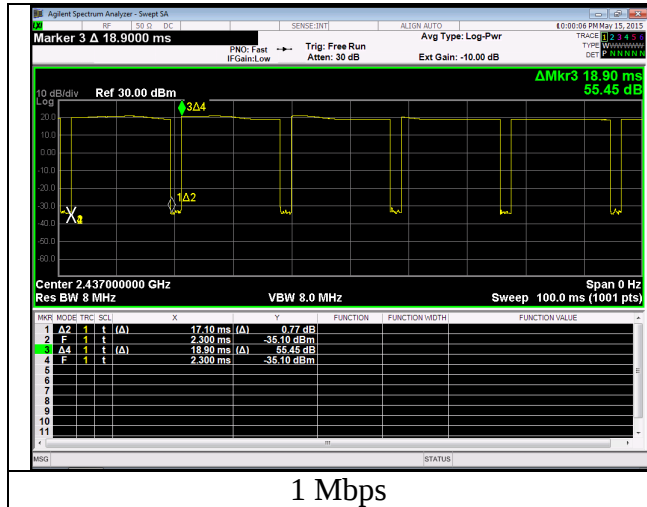
B.1.5 – RF Conducted – Duty Cycle

Manufacturer	Vocollect, Inc.
Date	5-15-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	N/A
Specific Measurement Procedure	ANSI C63.10-2013 Section 11.6
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	Duty cycle used for average power and average PSD procedures

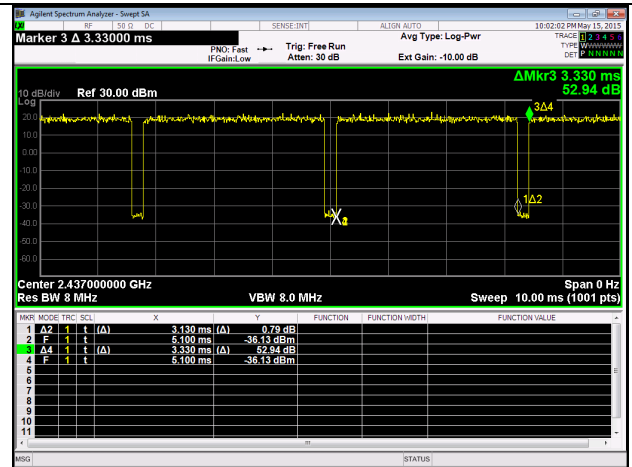
Table

Mode (802.11)	Mode (Mbps)	On-time (ms)	Total Time (ms)	Duty	*Duty Cycle correction (dB)
b	1	17.100	18.900	0.90	0.43
g	6	3.130	3.330	0.94	0.27
n	MCS0	2.910	3.110	0.94	0.29

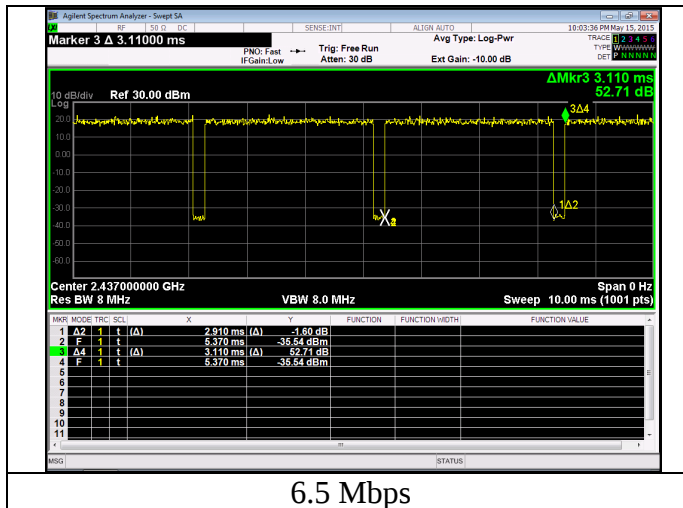
Plots



1 Mbps



6 Mbps



6.5 Mbps

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.2 – Transmitter Radiated Emissions in Restricted Bands

Rule Part(s)	FCC: 15.247 / 15.205 / 15.209 IC: RSS-GEN Section 8.9,8.10			
Measurement Procedure	ANSI C63.10 – 2013 Section 11.12 (6.3,6.5,6.6)			
Test Location	LS Research, LLC – FCC/IC Listed 3 meter Chamber			
Test Distance	See data section			
EUT Placement	Above 1 GHz: 150 cm height non-conductive table above reference ground plane covered with absorbers Below 1 GHz: 80 cm height non-conductive table above reference ground plane			
Frequency Range of Measurement	Biconical: 30-300 MHz	Log Periodic Dipole Array: 300-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz	Standard Gain Horn: 18-26GHz
Measurement Detectors	30-1000MHz RBW: 120 kHz VBW: At least 300 kHz		1 - 40 GHz: RBW : 1MHz VBW: At least 3 MHz Peak VBW: 30 Hz Average	
Description of Measurement	1) The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at the test distance from the EUT 3) Maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height.			
Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)			

Limits:

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Average (>1 GHz)

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

B.2.1 – Radiated Band-Edge Restricted Bands

Manufacturer	Vocollect, Inc.
Date	4-28-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247/ 15.205 / 15.209 IC RSS-247 / RSS-GEN
Measurement Procedure	ANSI C63.10-2013 Section 11.12
Test Distance	3 meter
EUT Placement	150 cm height non-conductive table centered on turn-table , absorbers covering ground plane
Detectors	Final Measurements: Peak / Max Hold, RBW 1 MHz, Average VBW 30Hz, Peak VBW 3 MHz
Additional Notes	1) EUT maximized in orientation, azimuth, and antenna height with maximum results reported.

Example Calculation:

Limit (dBμV/m) – Reading (dBμV/m) = Margin (dB)

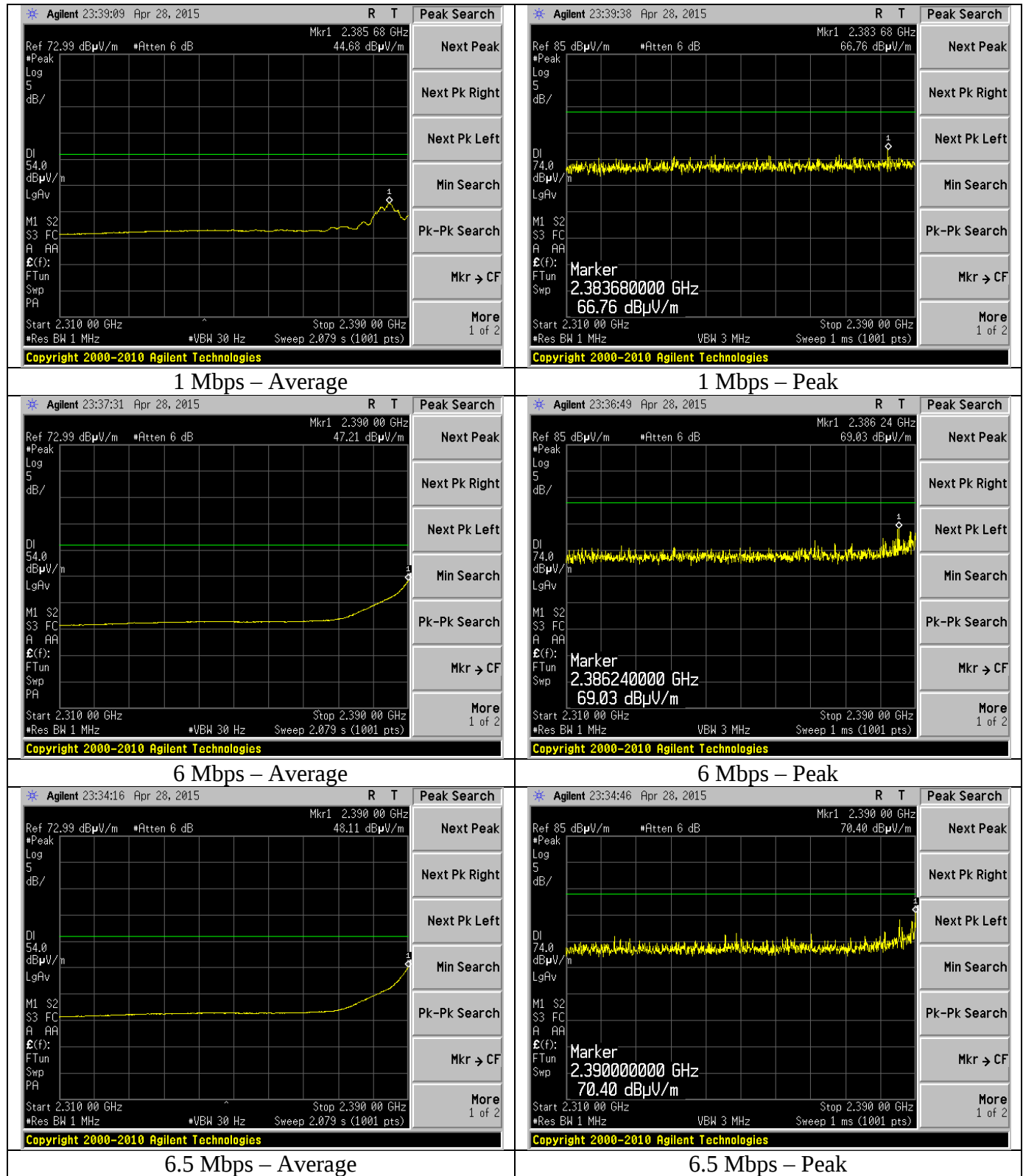
Table Average

Mode (802.11)	Mode (Mbps)	Channel	Frequency (GHz)	Avg Meas (dBμV/m)	Avg Limit (dBμV/m)	Margin (dB)
b	1	1	2.38568	44.68	54	9.3
		11	2.48829	44.87		9.1
g	6	1	2.39000	47.21		6.8
		11	2.48350	48.74		5.3
n	6.5	1	2.39000	48.11		5.9
		11	2.48352	50.32		3.7

Peak

Mode (802.11)	Mode (Mbps)	Channel	Frequency (GHz)	Peak Meas (dBμV/m)	Peak Limit (dBμV/m)	Margin (dB)
b	1	1	2.38368	66.76	74	7.2
		11	2.48827	67.50		6.5
g	6	1	2.38624	69.03		5.0
		11	2.48355	70.61		3.4
n	6.5	1	2.39000	70.40		3.6
		11	2.48350	70.17		3.8

Plots - Low Channel



Prepared For: Vocollect, Inc.

Report: TR 314378 A

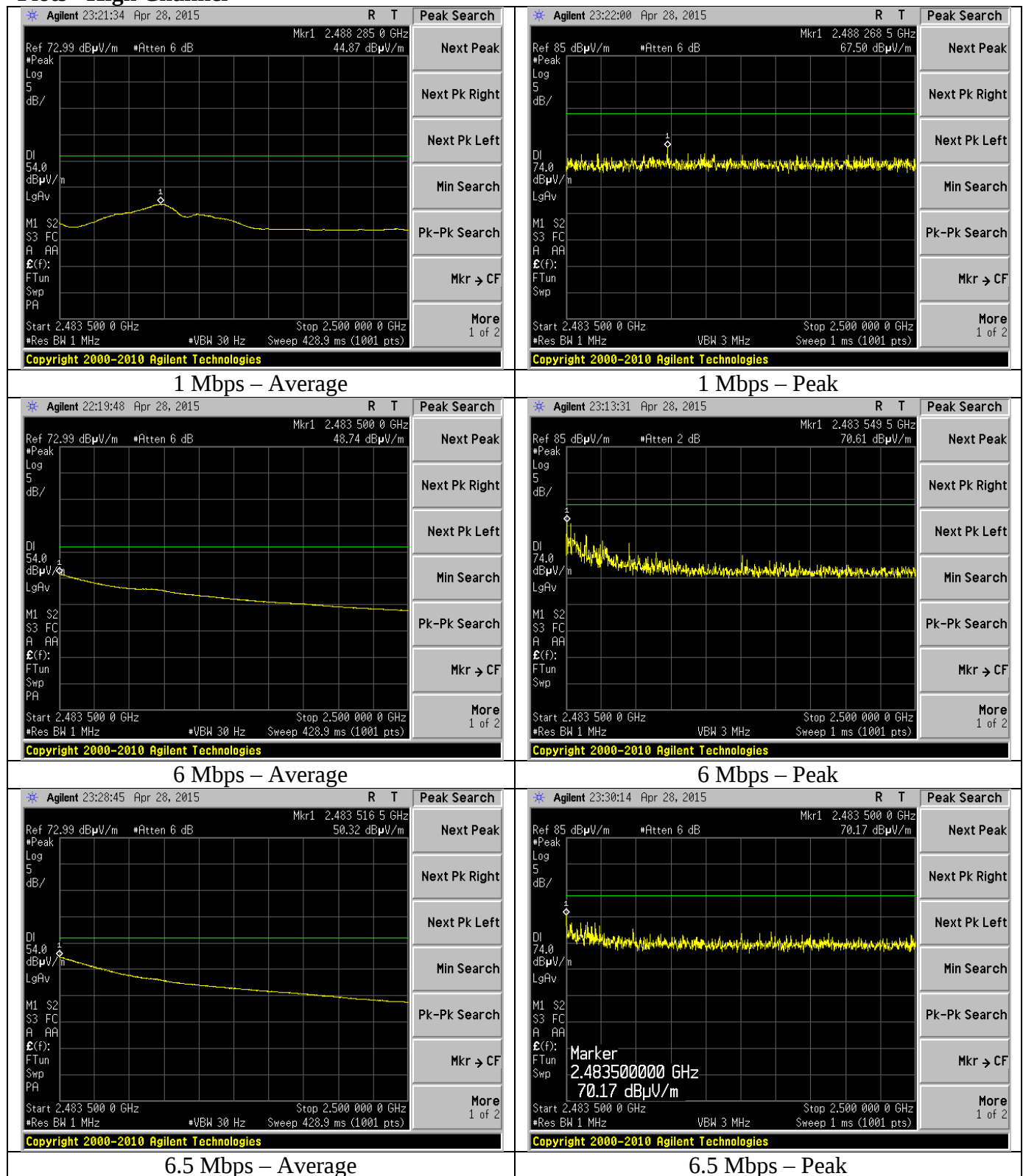
LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

Plots - High Channel



Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.2.2 – Radiated Harmonics in Restricted Bands

Manufacturer	Vocollect, Inc.
Date	4-29, 4-30
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247/ 15.205 / 15.209 IC RSS-247 / RSS-GEN
Measurement Procedure	ANSI C63.10-2013 Section 11.12
Test Distance	3 meter
EUT Placement	150 cm height non-conductive table centered on turn-table , absorbers covering ground plane
Detectors	Final Measurements: Peak / Max Hold, RBW 1 MHz, Average VBW 30Hz, Peak VBW 3 MHz
Additional Notes	1) EUT maximized in orientation, azimuth, and antenna height with maximum results reported. 2) Worst case mode (1 Mbps) measured.

Example Calculation:

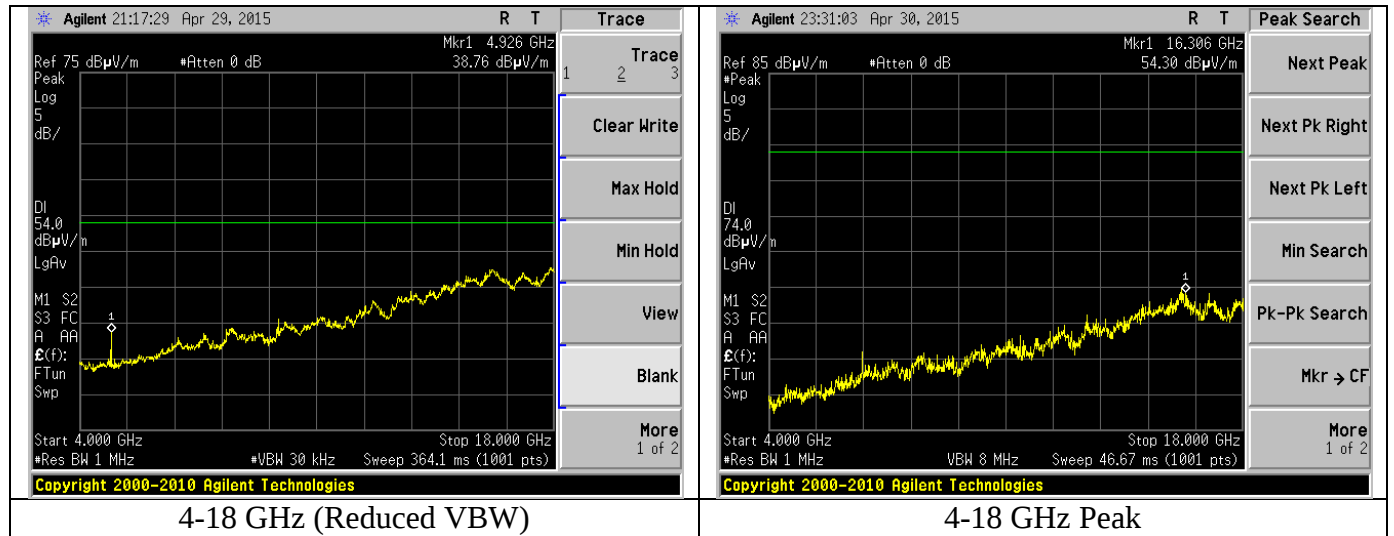
Limit (dBμV/m) – Reading (dBμV/m) = Margin (dB)

Table

EUT Channel	Frequency (MHz)	EUT orientation	Antenna Polarity	Azimuth (degree)	Height (cm)	Average Reading (dBμV/m)	Peak Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Limit (dBμV/m)	Peak Margin (dB)
11	4924	Horizontal	Vertical	174	118	38.20	46.53	54	15.8	74	27.5
1	4824	Flat	Horizontal	6	109	39.90	46.44		14.1		27.6
6	4874	Flat	Horizontal	12	108	38.57	46.28		15.4		27.7

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

Plots



Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.2.3 – Radiated Spurious Emissions Transmit Mode (1-26 GHz)

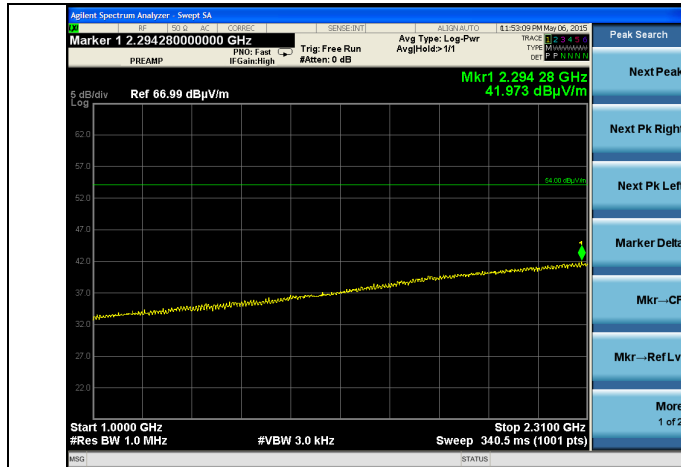
Manufacturer	Vocollect, Inc.
Date	5-5, 5-6 2015
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247/ 15.205 / 15.209 IC RSS-247 / RSS-GEN
Measurement Procedure	ANSI C63.10-2013 Section 11.12
Test Distance	3 meter 1-18 GHz 1 meter 18-26 GHz
EUT Placement	150 cm height non-conductive table centered on turn-table , absorbers covering ground plane
Detectors	Peak; RBW 1 MHz
Additional Notes	1) EUT maximized in orientation, azimuth, and antenna height with maximum results reported. 2) No Emissions found above system noise floor 3) Frequency ranges 2310-2390 MHz, 2483.5-2500 MHz, and 4-18 GHz seem in previous sections.

Example Calculation:

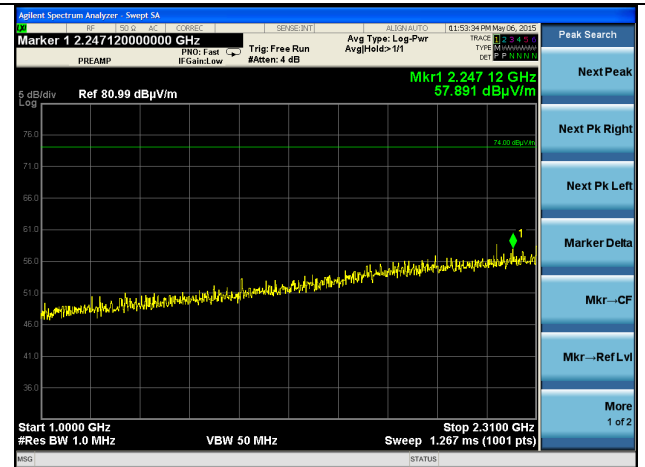
Limit (dBμV/m) – Reading (dBμV/m) = Margin

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

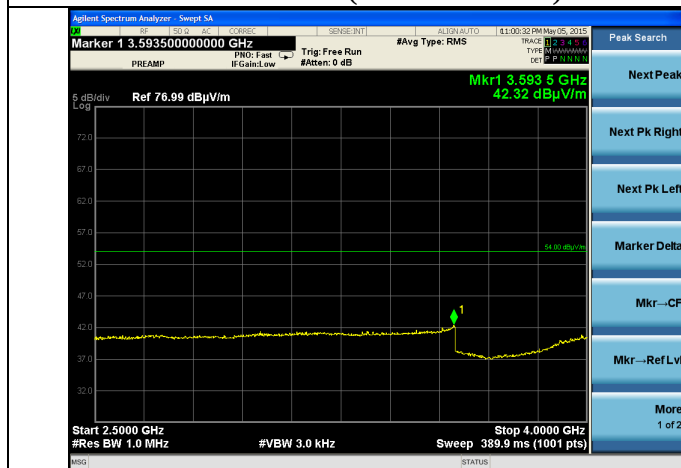
Plots



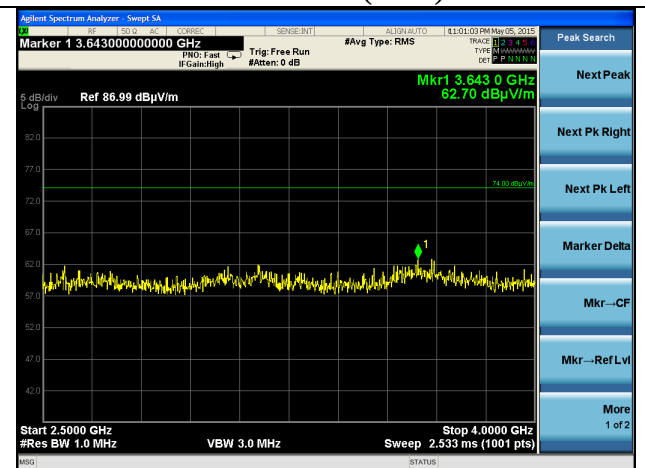
1-2.31 GHz (Reduced VBW)



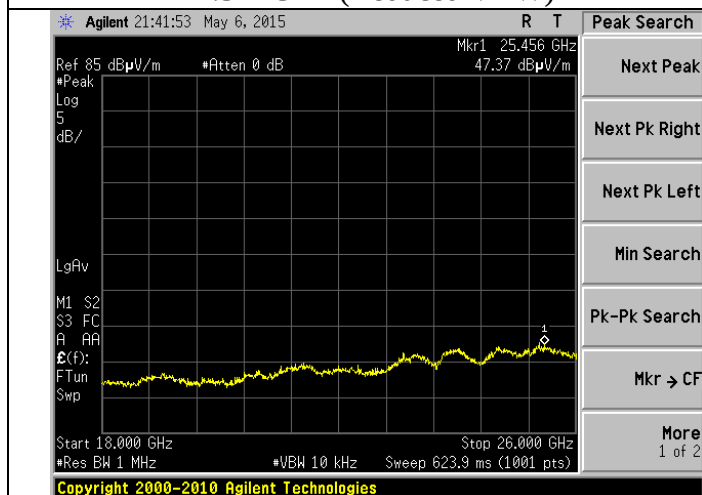
1-2.31 GHz (Peak)



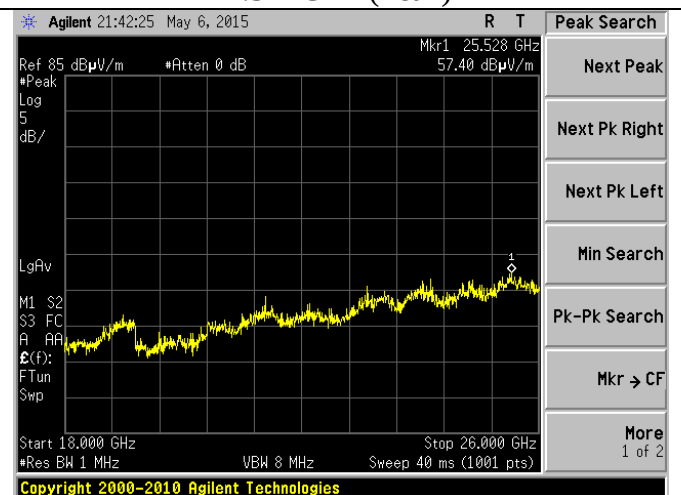
2.5-4 GHz (Reduced VBW)



2.5-4 GHz (Peak)



18-26 GHz (Reduced VBW)



18-26 GHz (Peak)

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.2.4 – Radiated Spurious Emissions Transmit Mode (30-1000 MHz)

Manufacturer	Vocollect, Inc.
Date	5-8, 5-9 2015
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247/ 15.205 / 15.209 IC RSS-247 / RSS-GEN
Measurement Procedure	ANSI C63.10-2013 Section 11.2
Test Distance	3 meter 30-1000 MHz
EUT Placement	80 cm height non-conductive table centered on turn-table (no absorbers on ground plane)
Detectors	Peak; RBW 120 kHz
Additional Notes	1) Tested in continuous transmit modulated mode with EUT in three orientations at maximum power. 2) Emissions not effected by channel or modulation.

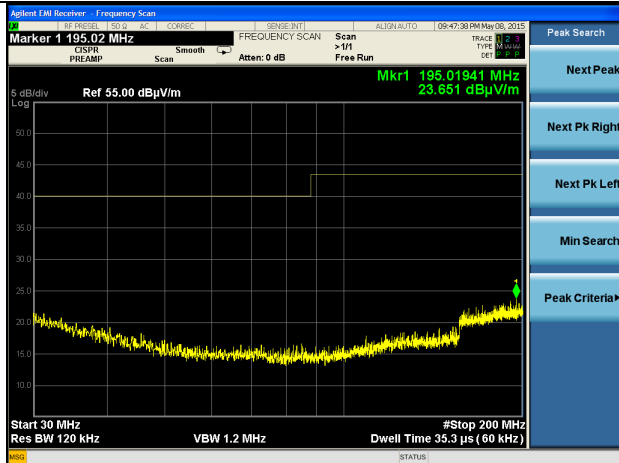
Example Calculation:

Limit (dBμV/m) – Reading (dBμV/m) = Margin

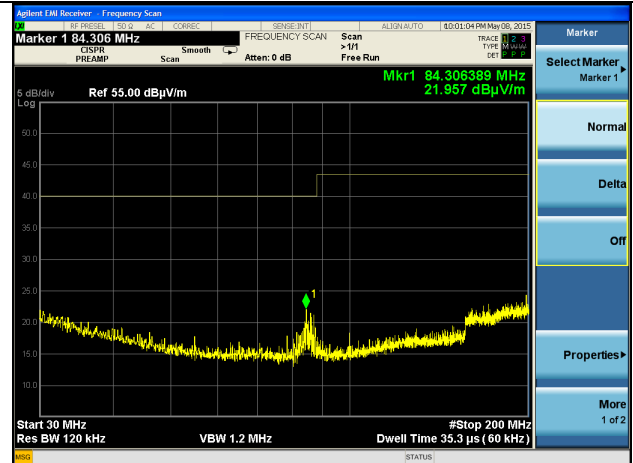
Table

Frequency (MHz)	Antenna Polarity	Azimuth (degree)	Height (cm)	Peak Reading (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Margin (dB)	Comment
85.86	Horizontal	187	202	22.27	40.0	17.7	Not related to transmitter
195.02	Vertical	0	100	23.65	43.5	19.8	Noise Floor
974.79	Horizontal	0	100	33.96	46.0	12.0	Noise Floor
864.33	Vertical	0	100	34.37	54.0	19.6	Noise Floor

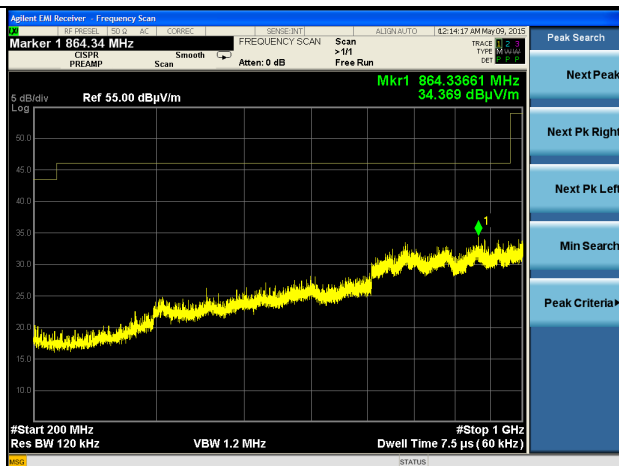
Plots



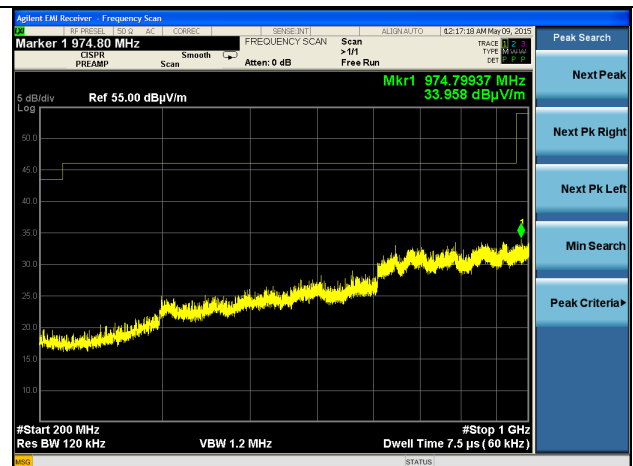
30-200 MHz Vertical



30-200 MHz Horizontal



200-1000 MHz Vertical



200-1000 MHz Horizontal

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.3 – Radiated Emissions in Receive Mode

Rule Part(s)	FCC: 15.109 IC: RSS-GEN Section 7			
Measurement Procedure	ANSI C63.4-2014 Section 8			
Test Location	LS Research, LLC – FCC/IC Listed 3 meter Chamber			
Test Distance	See data section			
EUT Placement	Above 1 GHz: 80 cm height non-conductive table above reference ground plane covered with absorbers Below 1 GHz: 80 cm height non-conductive table above reference ground plane			
Frequency Range of Measurement	Biconical: 30-300 MHz	Log Periodic Dipole Array: 300-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz	Standard Gain Horn: 18-26GHz
Measurement Detectors	30-1000MHz RBW: 120 kHz VBW: At least 300 kHz		1 - 40 GHz: RBW : 1MHz VBW: At least 3 MHz Peak VBW: 30 Hz Average	
Description of Measurement	1) The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at the test distance from the EUT 3) Maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height.			
Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)			

Limits:

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Average (>1 GHz)

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

B.3.1 – Radiated Spurious Emissions Receive Mode (30-1000 MHz)

Manufacturer	Vocollect, Inc.
Date	5-8, 5-9 2015
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.109 IC RSS-GEN
Measurement Procedure	ANSI C63.4-2013 Section 8
Test Distance	3 meter 30-1000 MHz
EUT Placement	80 cm height non-conductive table centered on turn-table (no absorbers on ground plane)
Detectors	Peak; RBW 120 kHz
Additional Notes	1) Tested in continuous receive mode with EUT in three orientations 2) Emissions not effected by channel

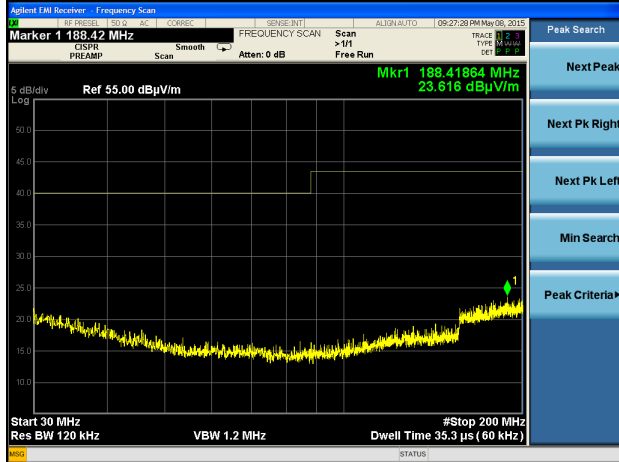
Example Calculation:

Limit (dBμV/m) – Reading (dBμV/m) = Margin

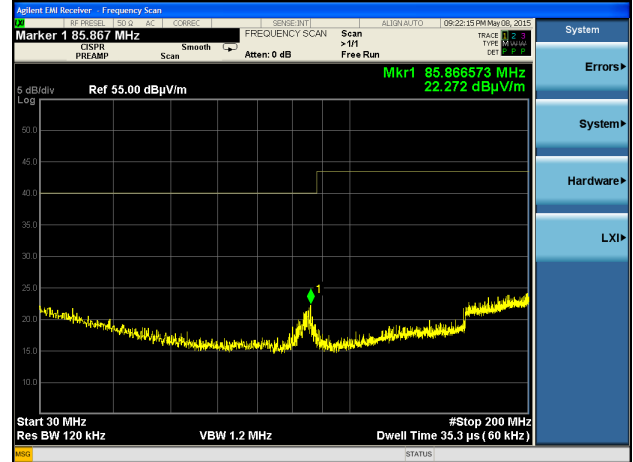
Table

Frequency (MHz)	Antenna Polarity	Azimuth (degree)	Height (cm)	Peak Reading (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Margin (dB)	Comment
85.86	Horizontal	187	202	22.27	40.0	17.7	Not related to transmitter
188.42	Vertical	0	100	23.61	43.5	19.9	Noise Floor
863.19	Horizontal	0	100	34.05	46.0	11.9	Noise Floor
863.43	Vertical	0	100	34.24	46.0	11.8	Noise Floor

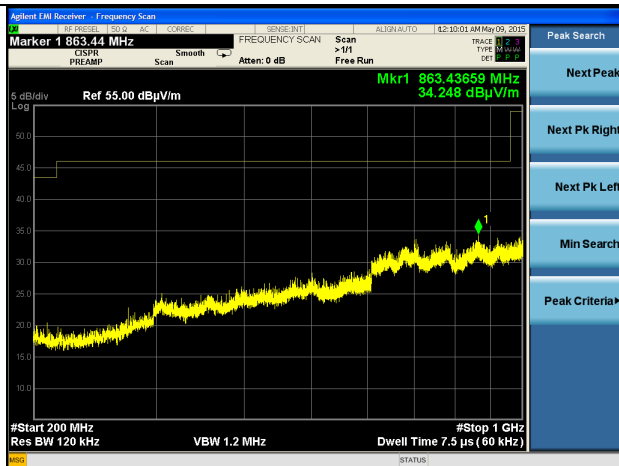
Plots



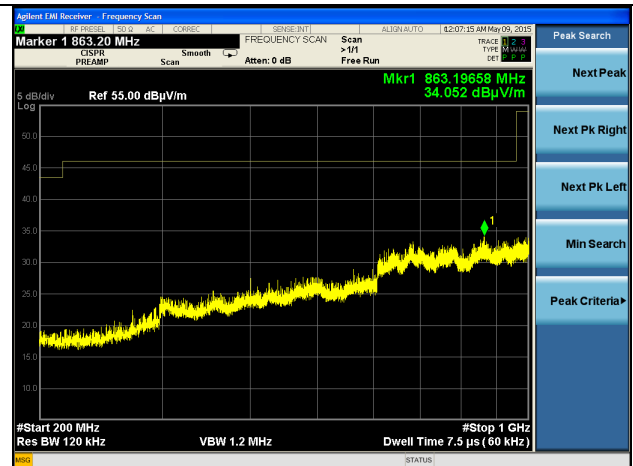
30-200 MHz Vertical



30-200 MHz Horizontal



200-1000 MHz Vertical



200-1000 MHz Horizontal

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.3.2 – Radiated Spurious Emissions Receive Mode (1-26 GHz)

Manufacturer	Vocollect, Inc.
Date	4-30, 5-6 2015
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.109 IC RSS-GEN
Measurement Procedure	ANSI C63.4-2013 Section 8
Test Distance	3 meter 1-18 GHz 1 meter 18-26 GHz
EUT Placement	80 cm height non-conductive table centered on turn-table (absorbers on ground plane)
Detectors	Peak; RBW 120 kHz
Additional Notes	1) Tested in continuous receive mode with EUT in three orientations 2) Emissions not effected by channel

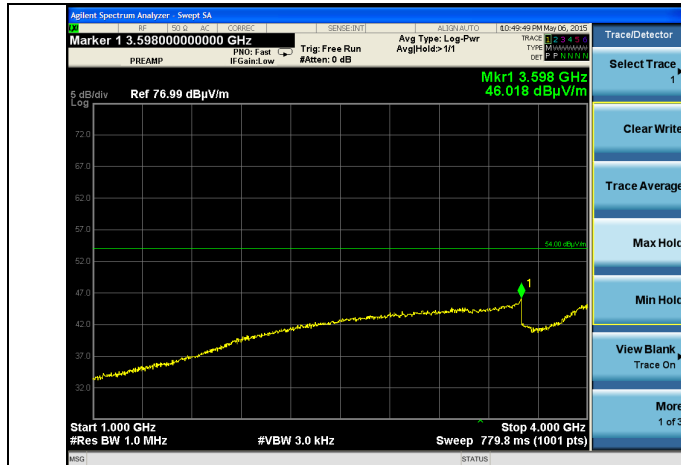
Example Calculation:

Limit (dBμV/m) – Reading (dBμV/m) = Margin

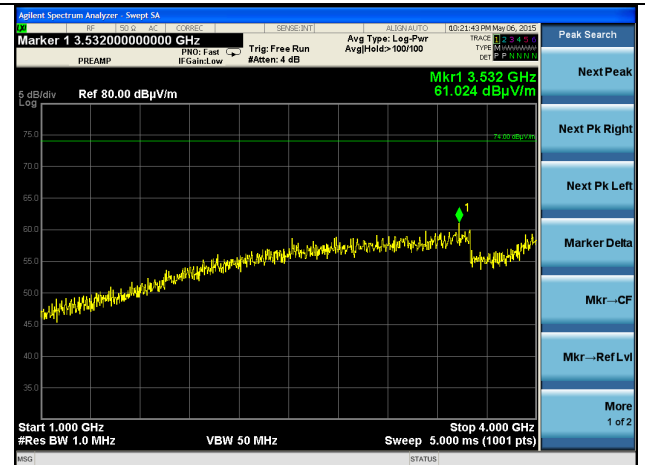
EUT Channel	Frequency (MHz)	EUT orientation	Antenna Polarity	Azimuth (degree)	Height (cm)	Average Reading (dBμV/m)	Peak Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Limit (dBμV/m)	Peak Margin (dB)
6	9748	Vertical	Vertical	89	106	40.65	48.86	54	13.4	74	25.1
1	9648	Vertical	Vertical	81	168	38.73	47.26		15.3		26.7
11	9848	Vertical	Vertical	81	168	39.03	48.39		15.0		25.6

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

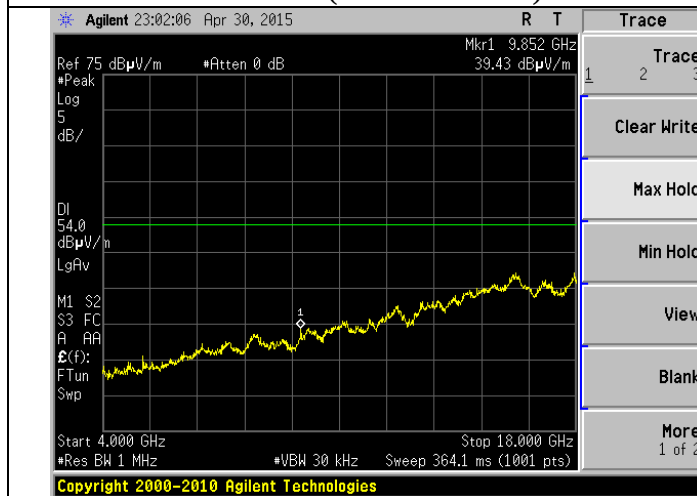
Plots



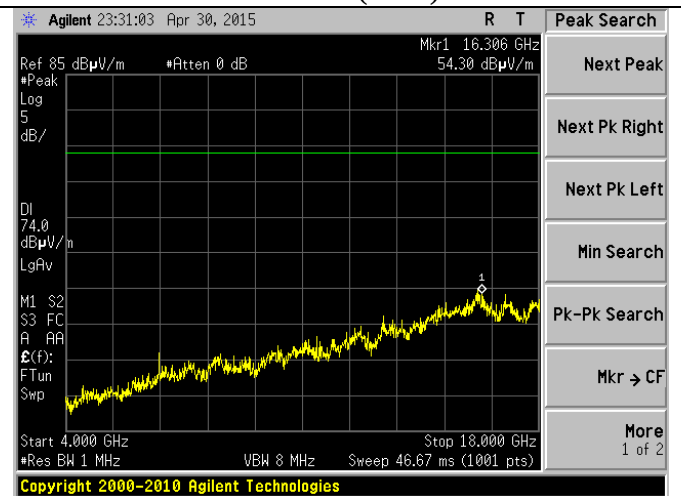
1-4 GHz (Reduced VBW)



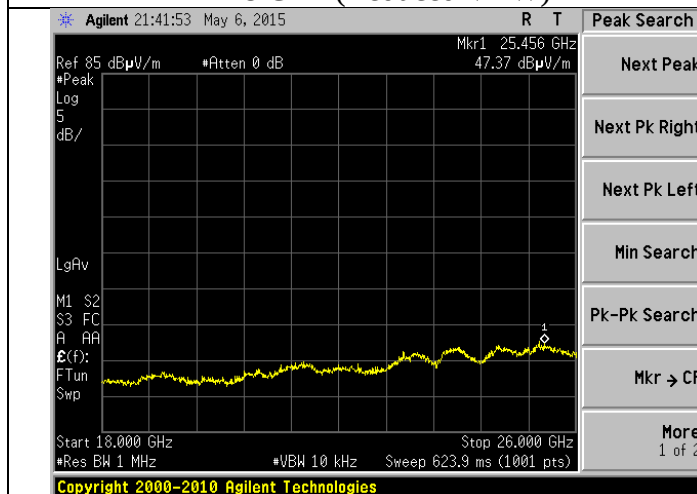
1-4 GHz (Peak)



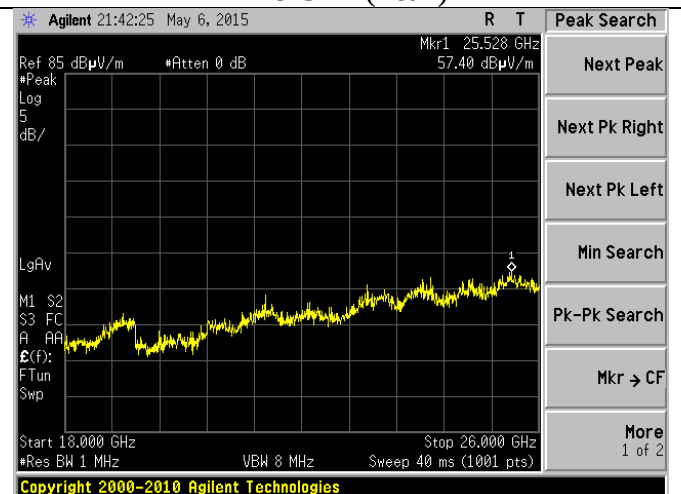
4-18 GHz (Reduced VBW)



4-18 GHz (Peak)



18-26 GHz (Reduced VBW)



18-26 GHz (Peak)

Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

B.4 – AC Mains Conducted Emissions

Rule Part(s)	FCC: 15.207 / 15.107 IC: RSS-247 / RSS-GEN
Measurement Procedure	ANSI C63.4 - 2014 ANSI C63.10 – 2013
Test Location	LS Research, LLC – Conducted Emissions Area
Test Voltage	120 VAC 60 Hz
EUT Placement	80 cm height non-conductive table above reference ground plane
Frequency Range of Measurement	150 kHz – 30 MHz
Measurement Detectors	Peak, Quasi-Peak, Average RBW: 9 kHz VBW: At least 27 kHz
Description of Measurement	1) The LISN, cable, limiter, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal at appropriate distance from ground planes and plugged into LISN. The LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral). 3) Maximum emissions are determined with peak detector and measurements at select points are made with quasi-peak and average detectors. Results are recorded and compared to limit.
Example Calculations	Reported Measurement data = Raw receiver measurement + LISN Factor + Cable factor (dB) + Additional factor (when applicable)

Limits of Conducted Emissions at the AC Mains Ports:

Frequency Range (MHz)	Class B Limits (dBμV)	
	Quasi-Peak	Average
0.150 -0.50 *	66-56	56-46
0.5 – 5.0	56	46
5.0 – 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

Prepared For: Vocollect, Inc.	Name: A500 Talkman
Report: TR 314378 A	Model: TAP802-01
LSR: C-2204	Serial: Eng. Sample

B.4.1 – AC Mains Conducted Emissions

Manufacturer	Vocollect
Date	8-7-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.207 / 15.107 / RSS-GEN
Measurement Procedure	ANSI C63.4 - 2014 ANSI C63.10 - 2013 Section 6.2
Test Voltage	120 VAC 60 Hz
EUT Placement	80 cm height non-conductive table, 40 cm from vertical ground plane
Detectors	Peak; RBW 9 kHz Quasi-Peak and Average
Additional Notes	1) Tested in continuous transmit and receive with no significant difference between operating channels.

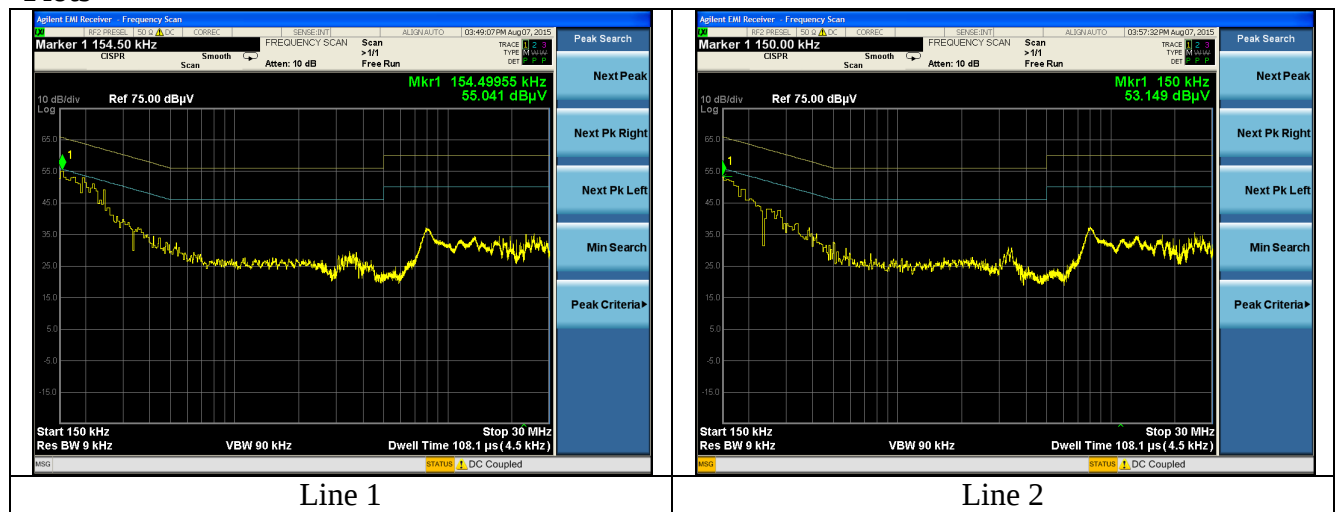
Example Calculation:

Margin (dB) = Limit (dBμV) – Reading (dBμV)

Table

Frequency (MHz)	Line	Peak Reading (dBμV)	Quasi-Peak Reading (dBμV)	Average Reading (dBμV)	Q-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	Average Limit (dBμV)	Average Margin (dB)
0.154	1	55.6	48.2	34.6	65.8	17.6	55.8	21.2
0.195	1	53.3	44.1	31.7	63.8	19.7	53.8	22.1
0.218	1	50.5	42.5	30.6	62.9	20.4	52.9	22.3
0.150	2	54.5	47.6	29.2	66.0	18.4	56.0	26.8
0.190	2	50.1	42.5	24.3	64.0	21.5	54.0	29.7
0.276	2	42.2	35.5	22.7	60.9	25.4	50.9	28.2

Plots



Prepared For: Vocollect, Inc.

Report: TR 314378 A

LSR: C-2204

Name: A500 Talkman

Model: TAP802-01

Serial: Eng. Sample

Appendix C - Uncertainty Summary

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k=2$.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.82 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.88 dB
Radiated Emissions	3-Meter Chamber, Horn Antenna	4.85 dB
Absolute Conducted Emissions	Agilent PSA/ESA Series	1.38 dB
AC Line Conducted Emissions	Shielded Room/EMCO LISN	3.20 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	2.05 Volts/Meter
Conducted Immunity	3 Volts level	2.33 V
EFT Burst, Surge, VDI	230 VAC	54.4 V
ESD Immunity	Discharge at 15kV	3200 V
Temperature/Humidity	Thermo-hygrometer	0.64°/ 2.88 %RH

Appendix D - References

Publication	Year	Title
FCC CFR Parts 0-15	2015	Code of Federal Regulations – Telecommunications
RSS-247 Issue 1	2015	Digital Transmissions Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-GEN Issue 4	2014	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing Unlicensed Wireless Devices

END OF REPORT

Date	Version	Comments	Person
6-30-15	V0	Initial Draft Release	Adam A
7-1-15	V1	Final Release	Adam A
8-7-15	V1a	Added AC Emissions	Adam A

Prepared For: Vocollect, Inc.

Name: A500 Talkman

Report: TR 314378 A

Model: TAP802-01

LSR: C-2204

Serial: Eng. Sample