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Test Report Date:

26 October 2020

Project Number:

1521

EMC Test Report - New Filing

Applicant:



President Electronics USA
1007 Collier Center Way
Naples, FL, 34110
USA

FCC ID:

2AEOCPC206

Product Model Number / HVIN

Andy II FCC

IC Registration Number

20240-PC206

Product Name / PMN

Andy II FCC

In Accordance With:

FCC 47 CFR Part 95 Subpart D, Part 15 Subpart B

Licensed Non-Broadcast Station Transmitter (TNB)

RSS-GEN, RSS-236 Issue 1

Citizen Band (26.960 to 27.410 MHz)

Approved By:

Ben Hewson, President

Celltech Labs Inc.

21-364 Lougheed Rd.

Kelowna, BC, V1X 7R8

Canada



Test Lab Certificate: 2470.01



Industry
Canada

IC Registration 3874A-1



FCC Registration: CA3874

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1.0 DOCUMENT CONTROL

Revision History					
Samples Tested By:		Art Voss, P.Eng.	Date(s) of Evaluation:		9 Oct - 16 Oct, 2020
Report Prepared By:		Art Voss, P.Eng.	Report Reviewed By:		Ben Hewson
Report Revision	Description of Revision	Revised Section	Revised By	Revision Date	
0.1	Initial Draft Release	n/a	Art Voss	20 October 2020	
0.2	Corrected Power Sec. 2.0, Added Radiated Plots	Multi	Art Voss	26 October 2020	
1.0	Initial Release	n/a	Art Voss	26 October 2020	

2.0 CLIENT AND DUT INFORMATION

Client Information	
Applicant Name (FCC)	President Electronics USA
Applicant Address (FCC)	1007 Collier Center Way
	Naples, FL, 34110
	USA
Applicant Name (ISED)	President Electronics USA
Applicant Address (ISED)	1007 Collier Center Way
	Naples, FL, 34110
	USA
DUT Information	
Device Identifier(s):	FCC ID: 2AEOCPC206
	ISED ID: 20240-PC206
Device Type:	Citizen's Band Transceiver
Device Model(s) / HVIN:	Andy II FCC
Device Marketing Name / PMN:	Andy II FCC
Firmware Version ID Number / FVIN:	-
Test Sample Serial No.:	254203900001
Equipment Class (FCC):	Licensed Non-Broadcast Station Transmitter (TNB)
Equipment Class (ISED):	Citizen Band (26.960 to 27.410 MHz)
Transmit Frequency Range:	26.965MHz - 27.405MHz
Number of Channels:	40
Manuf. Max. Rated Output Power:	4W (36dBm)
Manuf. Max. Rated BW/Data Rate:	n/a
Antenna Make and Model:	n/a
Antenna Type and Gain:	0dBi (Typical), 3dBi (Max)
Modulation:	AM
Mode:	Simplex
Emission Designator:	5K5A3E
DUT Power Source:	12-24VDC
DUT Dimensions [LxWxH] (mm)	180x125x45
Deviation(s) from standard/procedure:	None
Modification of DUT:	None

3.0 SCOPE

Scope:

This Certification Report was prepared on behalf of:

President Electronics USA

, (the 'Applicant'), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (the 'Rules'). The scope of this investigation was limited to only the equipment, devices and accessories (the 'Equipment') supplied by the Applicant. The tests and measurements performed on this Equipment were only those set forth in the applicable Rules and/or the Test and Measurement Standards they reference. The Rules applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable Rules were applied to the measurement results obtained during this evaluation and, unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the Equipment tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

Equipment:

The Andy II FCC is a mobile Citizen's Band (CB) transceiver.

Additional Requirement:

As per FCC 47 CFR §2.1091 and Canada Health Safety Code 6 an RF Exposure (MPE) evaluation is required for this Equipment and the results of the RF Exposure (MPE) evaluation appears in a separate report.

Application:


This is an application for a New Certification.

4.0 TEST RESULT SUMMARY

TEST SUMMARY						
Referenced Standard(s):		FCC CFR Title 47 Parts 2, 95D, 15B, ISED RSS-Gen, RSS-236				
Section	Description of Test	Procedure Reference	Applicable Rule Part(s) FCC	Applicable Rule Part(s) ISEDC	Test Date	Result
7.0	Conducted Power (Fundamental)	ANSI/TIA/EIA-382-A	§2.1046	RSS-Gen	14 Oct 2020	Complies
		ANSI C63.4:2014	§2.1033(c)(8) §95.967	RSS-236 5.2		
8.0	Modulation Response	ANSI/TIA/EIA-382-A	§2.1047	RSS-Gen	13-14 Oct 2020	Complies
		ANSI C63.4:2014	§95.975 §95.977			
9.0	Occupied Bandwidth	ANSI/TIA/EIA-382-A	§2.1049	RSS-Gen	14 Oct 2020	Complies
	Emission Mask	ANSI C63.4:2014	§95.973	RSS-236 5.3.2		
10.0	Conducted TX Spurious Emissions	ANSI/TIA/EIA-382-A	§2.1051	RSS-Gen	14 Oct 2020	Complies
		ANSI C63.4:2014	§95.979	RSS-236 5.4.4		
11.0	Radiated TX Spurious Emissions	ANSI/TIA/EIA-382-A	§2.1053	RSS-Gen	9 Oct 2020	Complies
		ANSI C63.4:2014	§95.979	RSS-236 5.4.4		
12.0	Radiated Receiver Emissions	ANSI C63.4:2014	§15 Subpart B §15.109(d)	ICES-003 RSS-Gen	9 Oct 2020	Complies
13.0	Frequency Stability	ANSI/TIA/EIA-382-A ANSI C63.4:2014	§2.1055 §95.965	RSS-Gen	15-16 Oct 2020	Complies

Test Station Day Log					
Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
9 Oct 2020	11.0	88	101.0	OATS	11.0, 12.0
13 Oct 2020	22.1	21	100.4	EMC	8.0
14 Oct 2020	21.9	22	102.5	EMC	7.0, 8.0, 9.0, 10.0
15 Oct 2020	18.6	23	103.6	TC	13.0
16 Oct 2020	19.2	26	101.4	TC	13.0

- EMC** - EMC Test Bench **SAC** - Semi-Anechoic Chamber
OATS - Open Area Test Site **TC** - Temperature Chamber
LISN - LISN Test Area **ESD** - ESD Test Bench
IMM - Immunity Test Area **RI** - Radiated Immunity Chamber

<p>I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.</p>	 <hr/> Art Voss, P.Eng. Technical Manager Celltech Labs Inc. <hr/> 20 October 2020 Date
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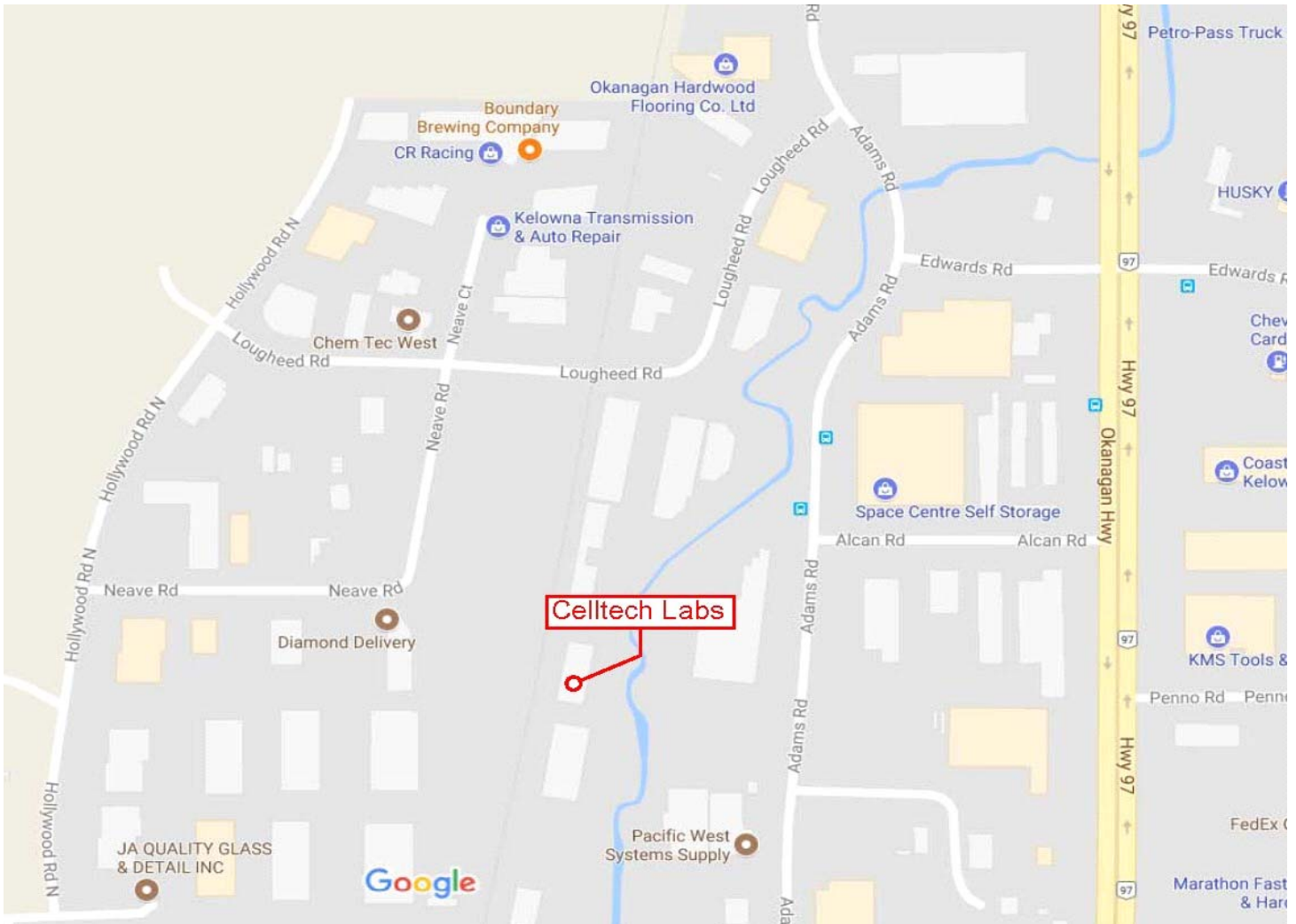
5.0 NORMATIVE REFERENCES

Normative References	
ISO/IEC 17025:2017	General requirements for the competence of testing and calibration laboratories
IEEE/ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/EIA/TIA-382-A-1989	Minimum Standards - Citizens Band Radio Service Amplitude Modulated (AM) Transceivers Operating in the 27MHz Band
CFR	Code of Federal Regulations Title 47: Telecommunication Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
CFR	Code of Federal Regulations Title 47: Telecommunication Part 95: Personal Radio Service Subpart D: Citizens Band Radio Service (CBRS)
CFR Title 47 Part 15	Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Subpart B: Unintentional Radiators
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-Gen Issue 5: General Requirements and Information for the Certification of Radiocommunication Equipment
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-236 Issue 1: General Radio Service Equipment Operating in the Band 26.960 to 27.410 MHz (Citizens Band)

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

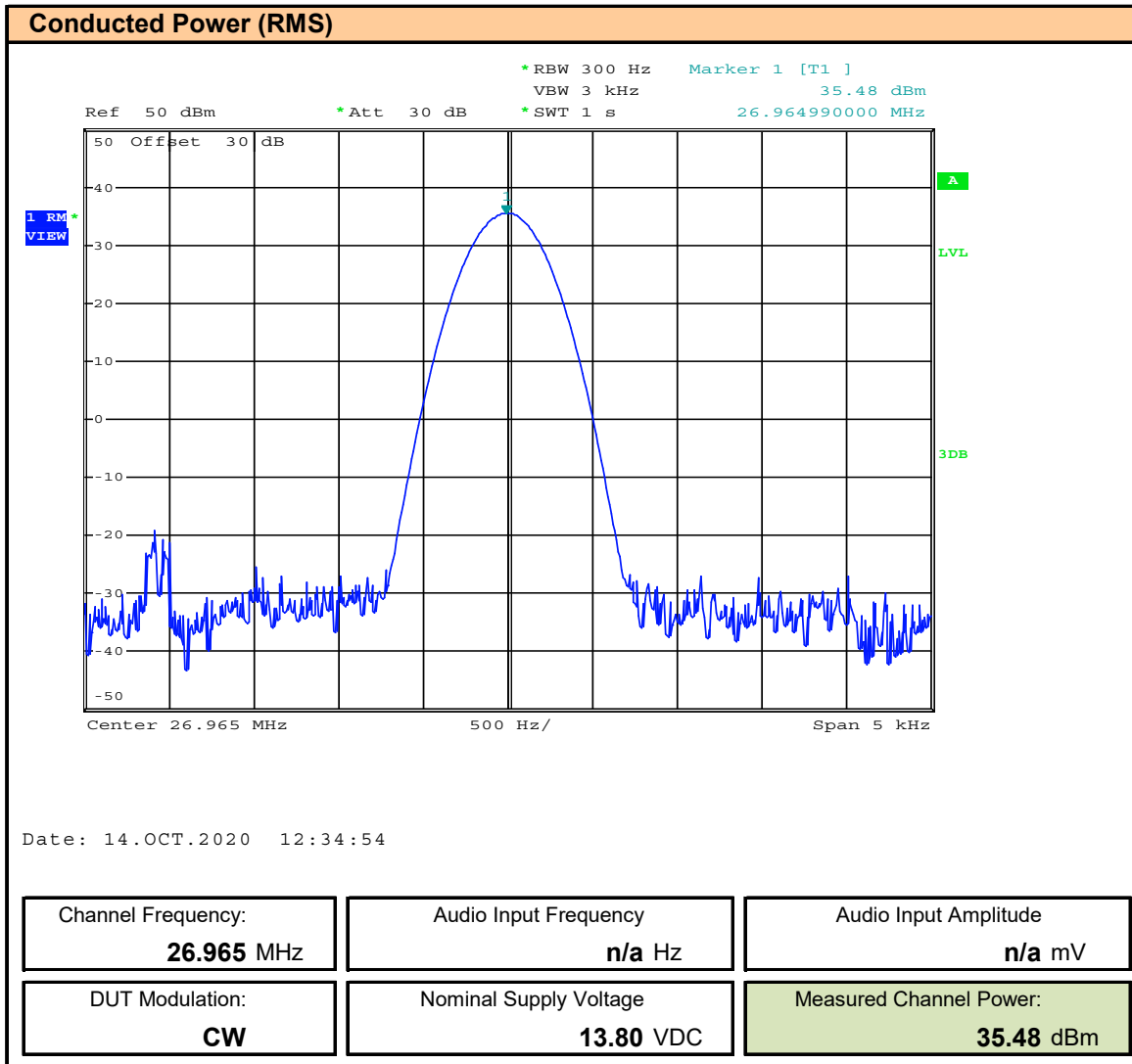
The facilities used to evaluate this device outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site (OATS) conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number CA3874A-1 and Industry Canada under Test Site File Number IC 3874A-1. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



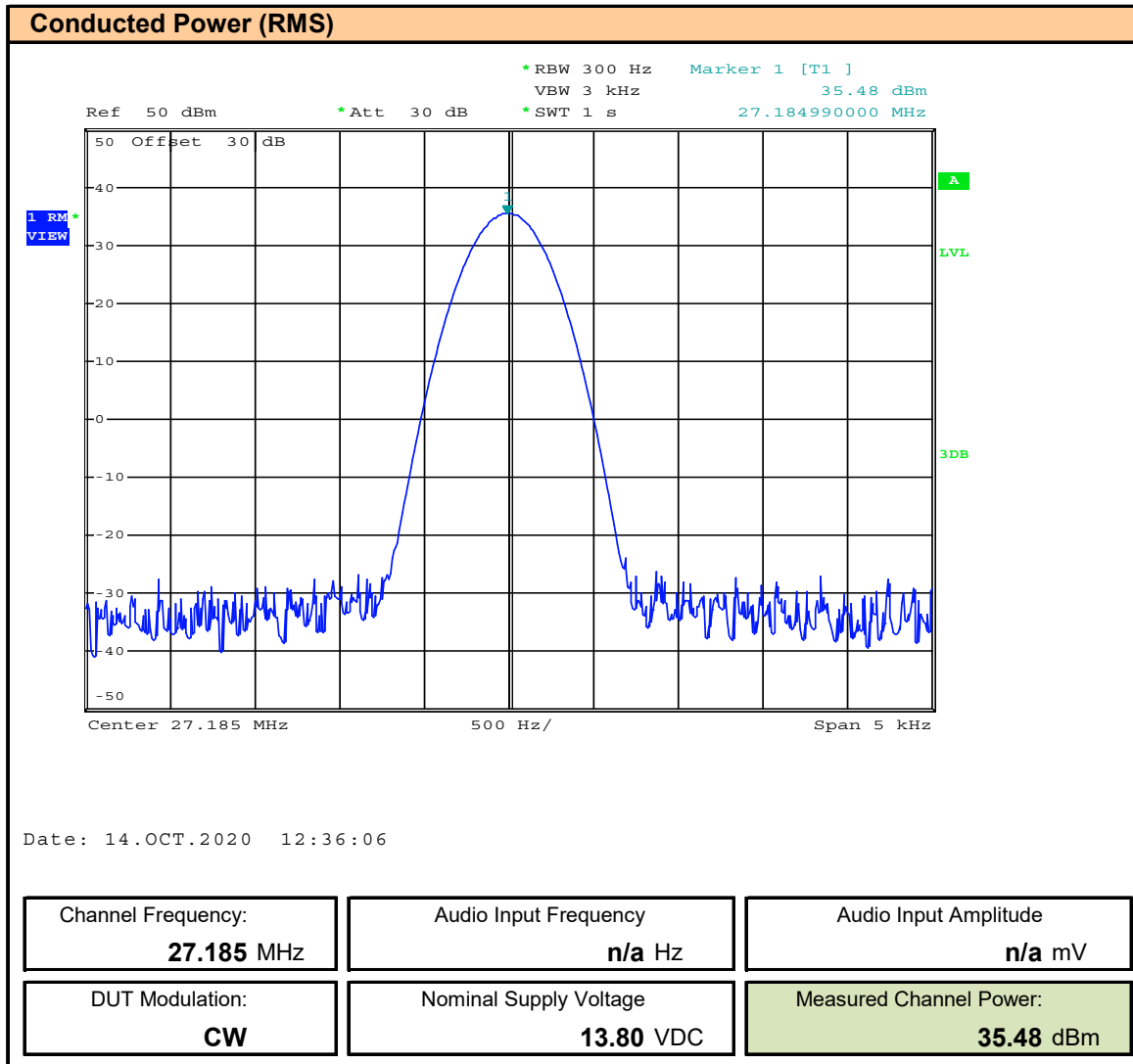
7.0 CONDUCTED POWER

Test Procedure	
Normative Reference	FCC 47 CFR §2.1046, §2.1033(c)(8), §95.967, RSS-236 EIA/TIA-382-A
Limits	
47 CFR §95.967	Each CBRS transmitter type must be designed such that the transmitter power can not exceed the following limits: (1) 4 W Carrier power when transmitting emission type A1D or A3E;
RSS-236 5.2	The transmitter output power shall not exceed 4.0 watts for a DSB mode of operations.
General Procedure	
EIA/TIA-382-A	19. TRANSMITTER CARRIER POWER OUTPUT Transmitter Carrier Power Output for this service is the power (rms) available at the output terminals of the transmitter when the output terminals are connected to a standard output load. This measurement shall be performed without modulation, at standard test. conditions.
Test Setup	Appendix A - Figure A.1
Measurement Procedure	
The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as above using the Automatic 6dB Cursor Bandwidth measurement. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at its maximum Duty Cycle.	

Plot 7.1 – Conducted Output Power – Channel 1



Plot 7.2 – Conducted Output Power – Channel 19



Plot 7.3 – Conducted Output Power – Channel 40

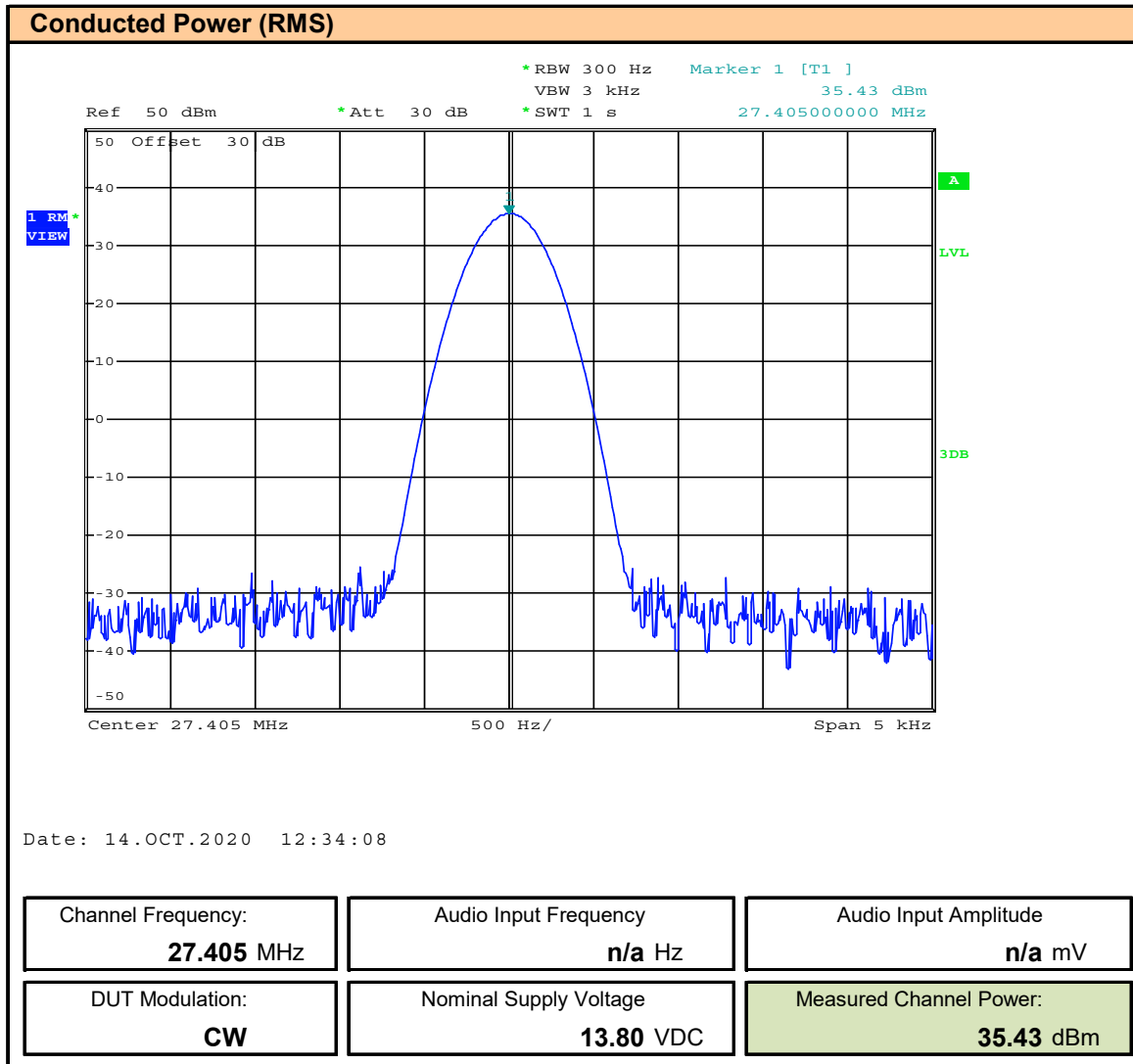


Table 7.1 – Summary of Conducted Power Measurements (RMS)

Conducted Power Measurement Results							
Channel	Frequency (MHz)	Modulation	Nominal Input Voltage (VDC)	Measured Power [E _{Meas}] (dBm)	Measured Power [E _{Meas}] (W)	Limit (W)	Margin (dB)
1	26.965	CW	13.8	35.48	3.53	4.0	0.5
19	27.185			35.48	3.53		0.5
40	27.405			35.43	3.49		0.6
Result:						Complies	

(1) The output power is factory set to maximum
 $Margin = 10 \cdot \log(Limit / E_{meas})$

Table 7.2 – Compliance to §2.1033(c)(8)

FCC CFR 47 §2.1033 (c)(8): Power to Transmitter:	
Measured Receiver Current:	IRx = 0.19A
Measured Total Current:	ITx = 1.50A
Transmitter Current (ITx - IRx):	IXmitter = 1.31A
Power to Transmitter:	(13.8VDC)(1.31) = 18.08W
Result:	Complies

8.0 MODULATION RESPONSE

Test Conditions

Normative Reference	FCC 47 CFR §2.1047, §95.975, RSS-236 5.3.2
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Limits

47 CFR §2.1047	a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted.
47 CFR §95.975	Each CBRS transmitter type must be designed such that the modulation characteristics are in compliance with the rules in this section. (a) When emission type A3E is transmitted with voice modulation, the modulation percentage must be at least 85%, but not more than 100%. (b) When emission type A3E is transmitted by a CBRS transmitter having a transmitter output power of more than 2.5 W, the transmitter must contain a circuit that automatically prevents the modulation percentage from exceeding 100%.
RSS-236	5.3.2) When emission type A3E is transmitted by a CB transmitter having a total power of greater than 2.5 W, the CB transmitter must automatically prevent the modulation from exceeding 100%.

Measurement Procedure

TIA 382 25.2 Transmitter Audio Frequency Response

Operate the transmitter under standard test conditions and monitor the output with a modulation monitor or calibrated test receiver. The audio input signal applied through a suitable impedance matching network, as specified by the manufacturer, shall be adjusted to obtain 50% modulation at the maximum audio frequency response of the transmitter, and this point shall be taken as the 0 dB reference level. Vary the modulating frequency from 100 Hz to 10,000 Hz and record the input levels necessary to maintain a constant 50% modulation.

Graph the audio level in dB relative to the 0 dB reference level as a function of the modulating frequency. Record any audio frequency where it is impossible to perform the measurement.

TIA 382 24.2.2 Transmitter Modulation Limiting

The transmitter is modulated by a sinusoidal audio signal applied to the microphone input jack. First the audio input frequency is adjusted to deliver 50% modulation at the audio frequency that produces the maximum modulation level. Record the modulation input level (mV) and use this level as 0 dB for plotting modulation limiting. Increment the audio signal level to 40 dB above the reference level. Record the modulation level (%). Repeat the measurements using a 400 Hz and a 2500 Hz sinusoidal audio signal. Record the modulation level (%). Perform for both positive and negative modulation.

Test Setup	Appendix A	Figure A.2
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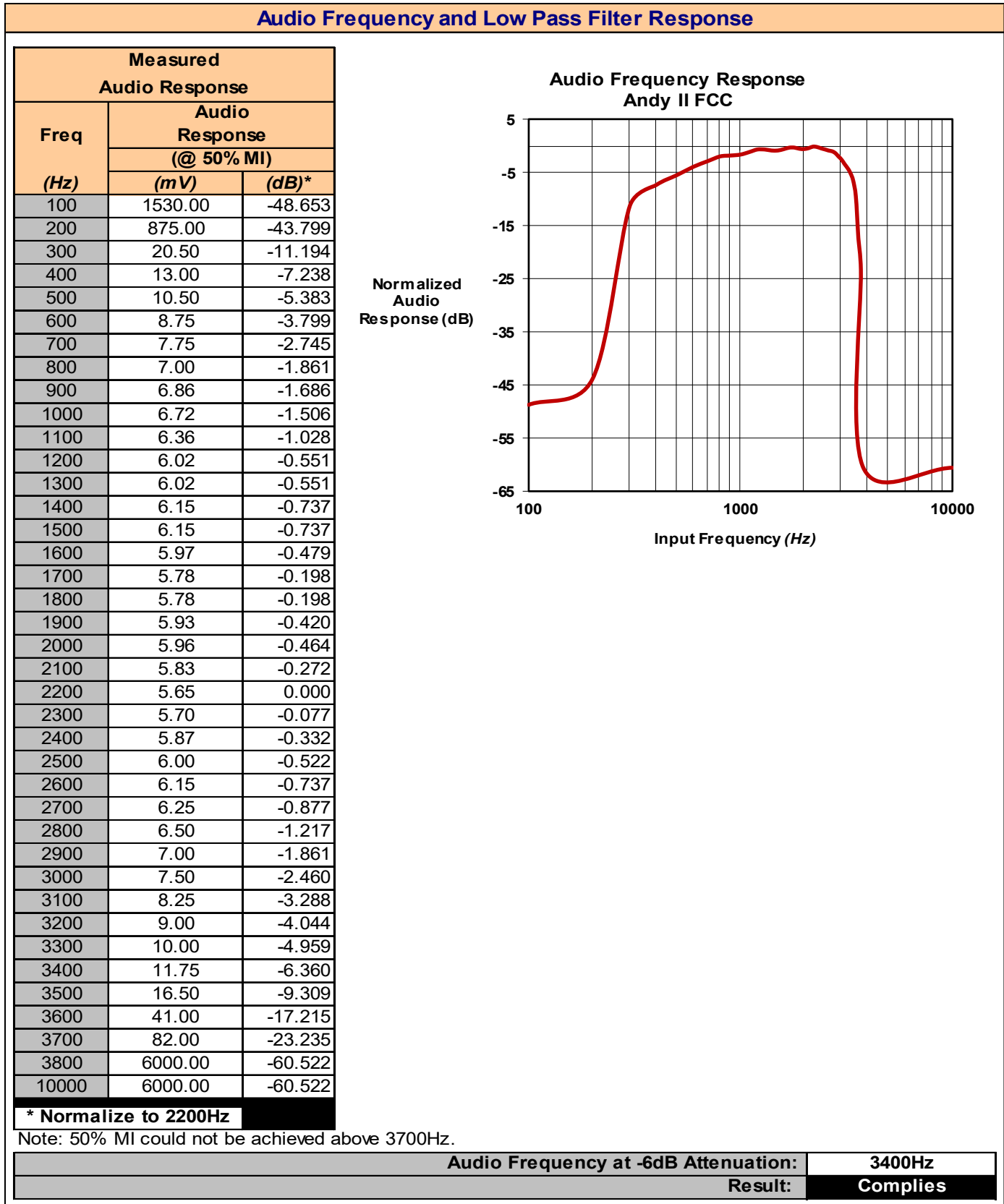
Statement - Compliance to §95.977

§95.977 CBRS tone transmissions.

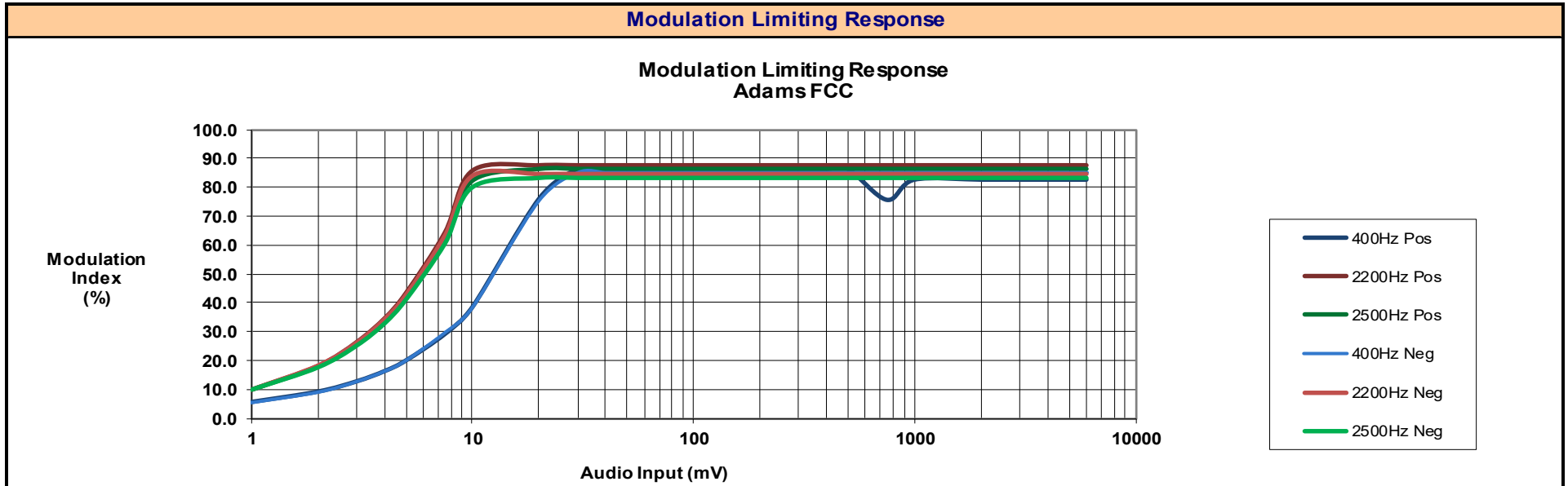
In addition to the tones permitted under §95.377, CBRS transmitter types may be designed to transmit brief tones to indicate the beginning or end of a transmission.

This device is capable of transmitting a brief (less than one second) audio tone, "Roger Beep", when the PTT button is released on the microphone indicating end of transmission. This function is user selectable and complies with the requirements of §95.377. See User's Manual page 11.

Plot 8.1 – Audio Frequency and Low Pass Filter Response



Plot 8.2 – Modulation Limiting Response



Measured Modulation Response [Modulation Index (%)]																										
Freq (Hz)	Audio Input (mV)																									
	1	2	3	4	5	7.5	10	20	30	40	50	75	100	200	300	400	500	750	1000	2000	3000	4000	5000	6000	Deviation	
400	5.6	9.2	12.8	16.3	20.0	29.2	38.6	76.0	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	75.6	82.6	82.6	82.6	82.6	82.6	82.6	Positive	
2200	9.9	18.2	26.5	34.7	43.5	64.5	85.9	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7		87.7
2500	9.6	17.6	25.5	33.4	42.0	62.0	82.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1		86.1
400	5.5	9.1	12.8	16.3	20.0	29.6	38.3	75.2	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	Negative	
2200	9.7	18.1	26.1	34.2	42.7	63.3	84.0	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6		84.6
2500	9.6	17.4	25.0	32.7	41.0	60.5	80.0	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2		83.2
Audio Frequency @ Maximum Deviation:																				2200Hz						
Audio Input @ Maximum Deviation:																				5650mV						
Maximum Measured Modulation Index:																				87.7						
Result:																				Complies						

9.0 OCCUPIED BANDWIDTH AND EMISSION MASKS

Test Conditions

Normative Reference FCC 47 CFR §2.1049, §95.973, RSS-236

Limits

47 CFR §95.973	Each CBRS transmitter type must be designed such that the occupied bandwidth does not exceed the authorized bandwidth for the emission type under test. (a) AM. The authorized bandwidth for emission type A3E is 8 kHz.
RSS-236 5.3.2	The authorized bandwidth for emission type A1D or A3E is 8 kHz.
47 CFR §95.979	Each CBRS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section. (a) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) as specified in the applicable paragraphs listed in the following table: For A3E (1), (3), (5), (6) (1) 25 dB (decibels) in the frequency band 4 kHz to 8 kHz removed from the channel center frequency; (3) 35 dB in the frequency band 8 kHz to 20 kHz removed from the channel center frequency; (5) 53 + 10 log (P) dB in any frequency band removed from the channel center frequency by more than 250% of the authorized bandwidth. (6) 60 dB in any frequency band centered on a harmonic (i.e., an integer multiple of two or more times) of the carrier frequency.
RSS-236 4.4.4	For A1D and A3E: _ At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth. _ At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth. _ At least 53 + 10 log ₁₀ (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%. _ At least 60 dB on any frequency twice or greater than twice the fundamental frequency.

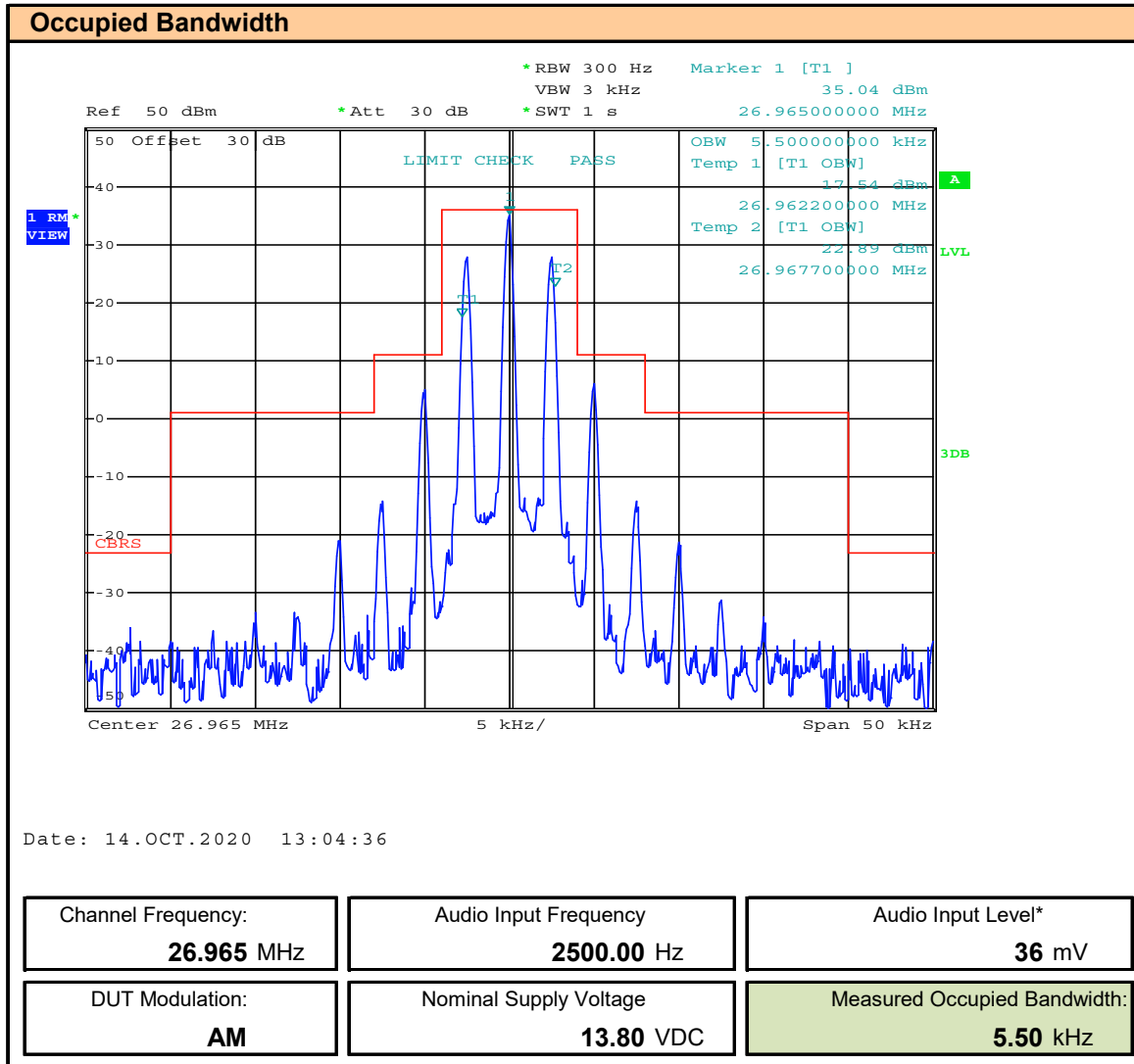
Measurement Procedure

TIA 382 23.2 Transmitter Modulation Occupied Bandwidth

The transmitter is modulated by a sinusoidal audio signal applied to the microphone input jack. First, the frequency is adjusted to deliver 50% modulation at the highest audio response level (minimum applied audio level). Then the audio signal level is increased 16 dB and the audio frequency is readjusted to 2500 Hz. The analyzer is adjusted to display each of the discrete modulation sidebands and their respective harmonic products within +/- 50 kHz of the carrier frequency.

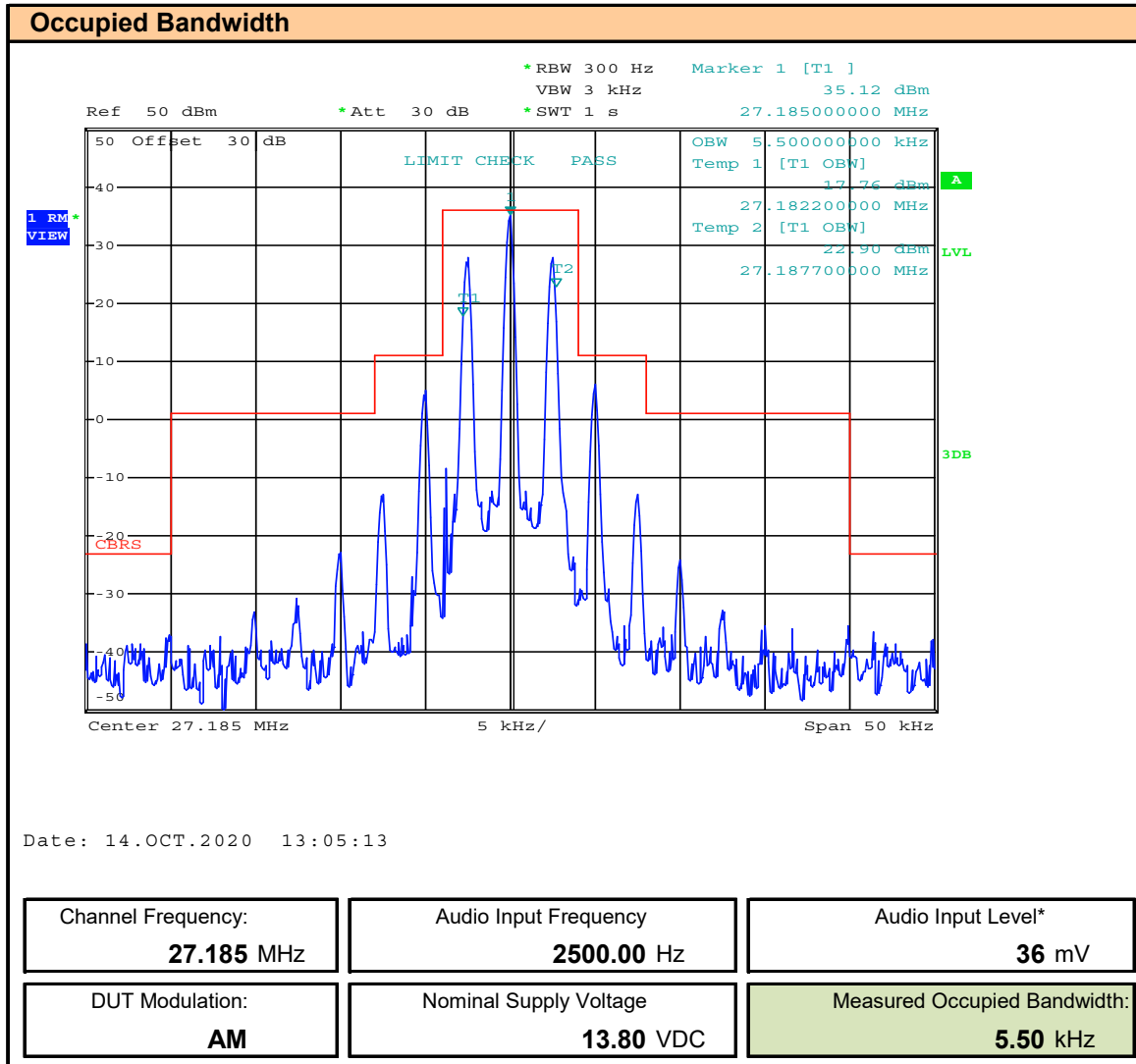
Test Setup Appendix A Figure A.1

Plot 9.1 – Occupied Bandwidth Channel 1



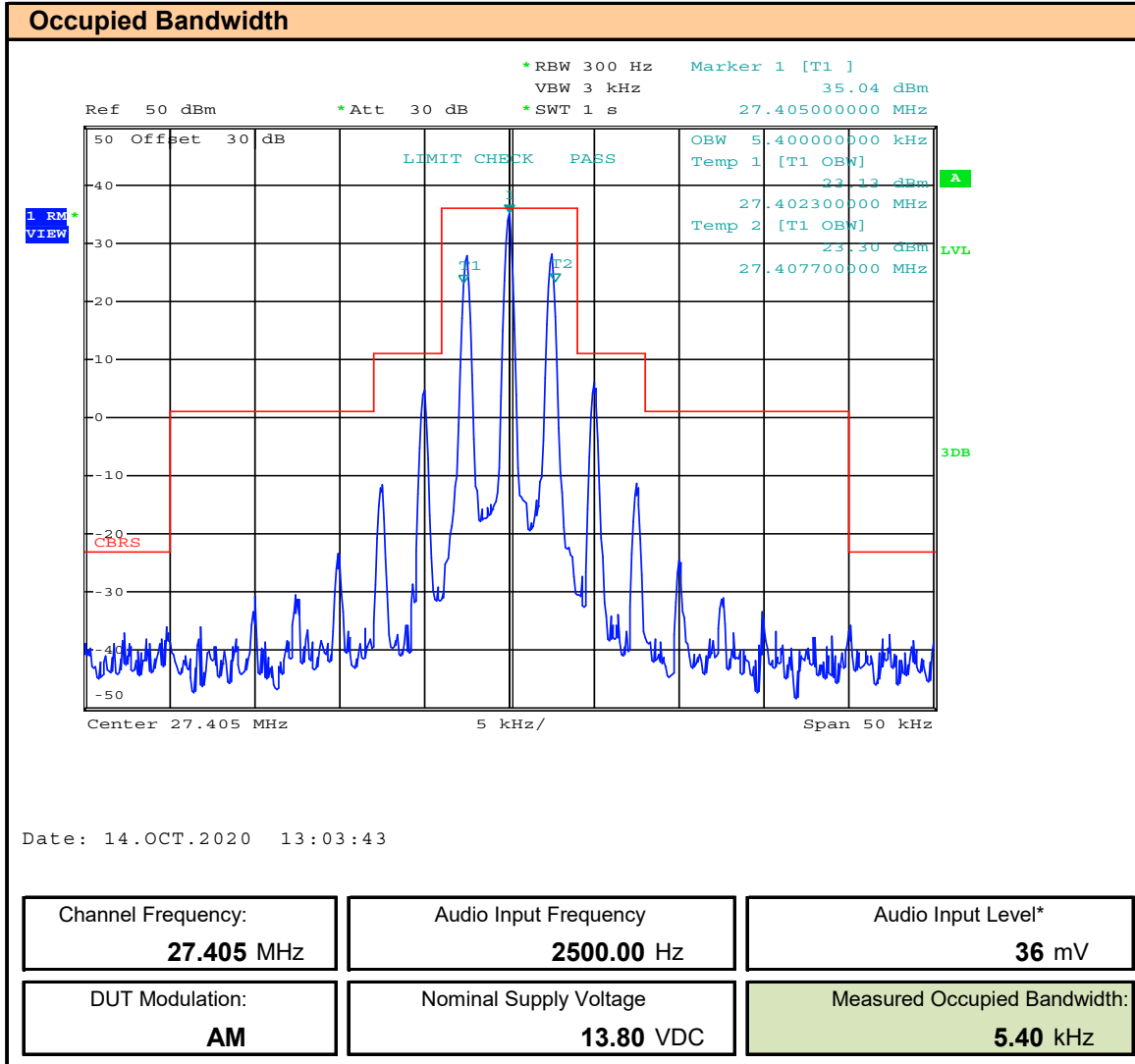
* Audio Input Level > 16dB of Level Required for 50% Modulation Index

Plot 9.2 – Occupied Bandwidth Channel 19



* Audio Input Level > 16dB of Level Required for 50% Modulation Index

Plot 9.3 – Occupied Bandwidth Channel 40



* Audio Input Level > 16dB of Level Required for 50% Modulation Index

Table 9.1 - Summary of Occupied Bandwidth and Emission Mask Results

Occupied Bandwidth Measurement Results							
Channel	Frequency (MHz)	DUT Modulation	Measured Occupied Bandwidth (kHz)	Authorized Bandwidth (kHz)	Margin (kHz)	Emission Mask	Emission Designator
1	26.965	AM	5.5	8.0	2.5	PASS	5K50A3E
19	27.185		5.5		2.5	PASS	5K50A3E
40	27.405		5.4		2.6	PASS	5K40A3E
Margin = Authorized BW - Measured BW					Result:	Complies	
§95.971 CBRS emission types.							
Each CBRS transmitter type must be designed such that its capabilities are in compliance with the emission type rules in this section.							
(a) Permitted emission types. CBRS transmitter types may transmit only AM voice emission type A3E and SSB voice							
This device only transmits AM voice emission type A3E					Result:	Complies	

10 CONDUCTED OUT OF BAND SPURIOUS EMISSIONS

Test Conditions

Normative Reference	FCC 47 CFR §95.979, RSS-236
----------------------------	------------------------------------

Limits

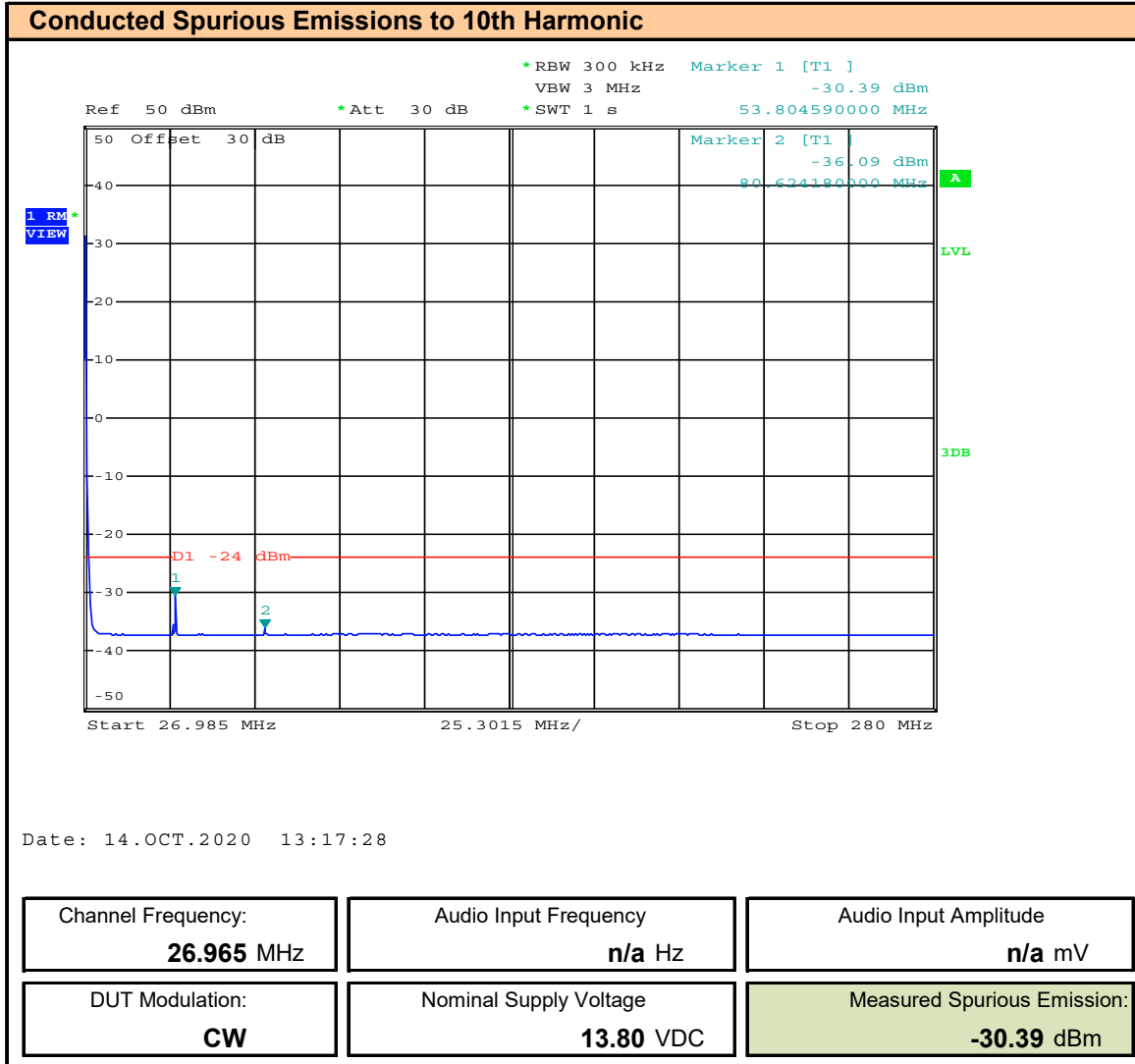
47 CFR §95.979	<p>Each CBRS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section.</p> <p>(a) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) as specified in the applicable paragraphs listed in the following table:</p> <p>For A3E (1), (3), (5), (6)</p> <p>(1) 25 dB (decibels) in the frequency band 4 kHz to 8 kHz removed from the channel center frequency;</p> <p>(3) 35 dB in the frequency band 8 kHz to 20 kHz removed from the channel center frequency;</p> <p>(5) 53 + 10 log (P) dB in any frequency band removed from the channel center frequency by more than 250% of the authorized bandwidth.</p> <p>(6) 60 dB in any frequency band centered on a harmonic (i.e., an integer multiple of two or more times) of the carrier frequency.</p>
RSS-236 4.4.4	<p>For A1D and A3E:</p> <p>_ At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.</p> <p>_ At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.</p> <p>_ At least 53 + 10 log₁₀ (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.</p> <p>_ At least 60 dB on any frequency twice or greater than twice the fundamental frequency.</p>

Measurement Procedure

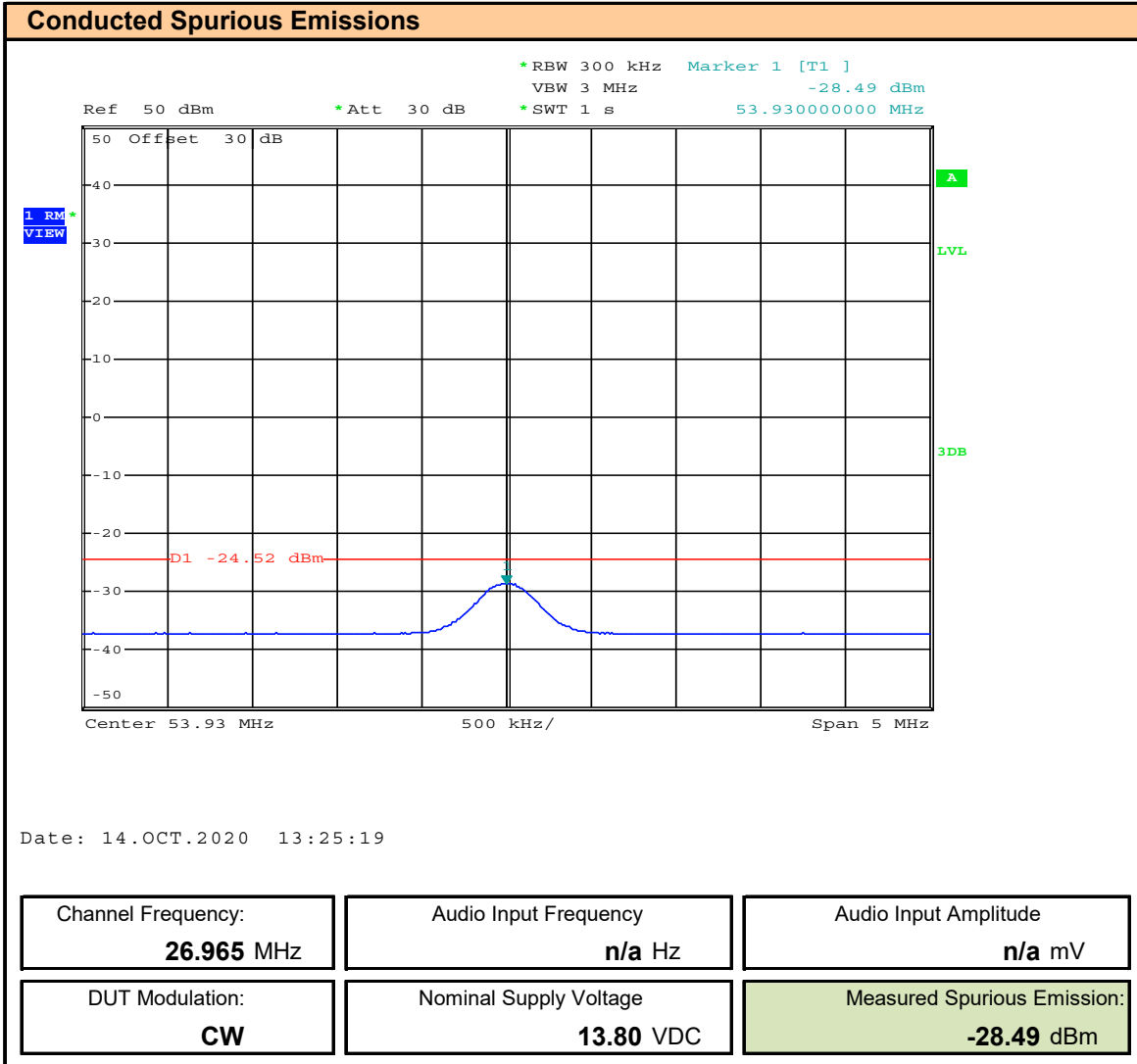
TIA 382 21.2	<p>Transmitter Conducted Spurious and Harmonic Emissions</p> <p>The transmitter RF output shall be connected to the standard nonradiating output load. The output shall be sampled and displayed using spectrum analysis techniques. 2500 Hz modulation shall be applied at a level 16 dB above that required to produce 50% modulation at the frequency of maximum response. The sampled output shall be analyzed from the lowest frequency generated in the equipment to the 10th harmonic of the fundamental signal and the levels of all spurious outputs attenuated not more than 20 dB below the maximum required attenuation shall be recorded.</p>
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Test Setup	Appendix A	A.1
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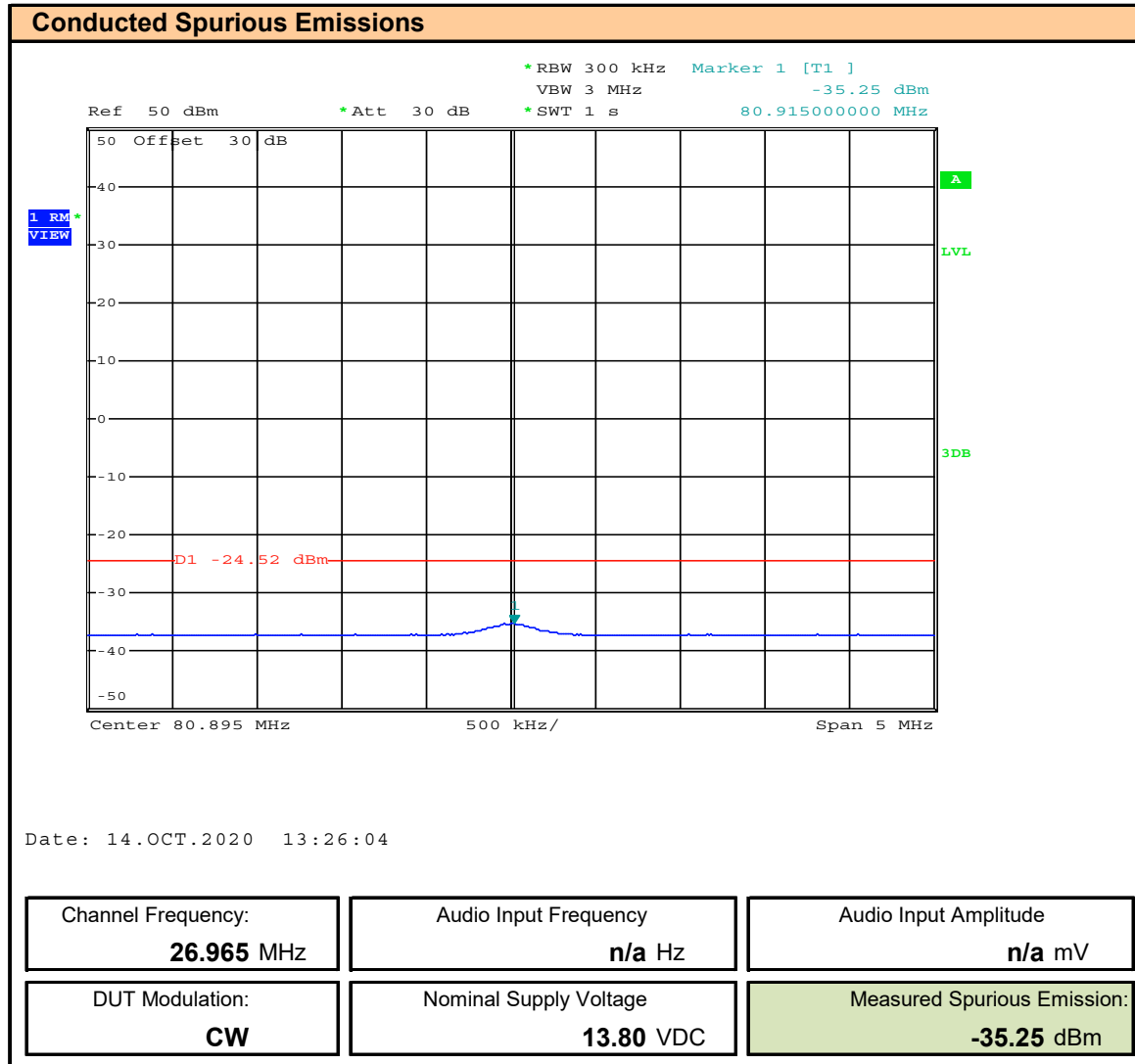
Plot 10.1 – Conducted Out of Band Emissions, 30MHz – 300MHz, Channel 1



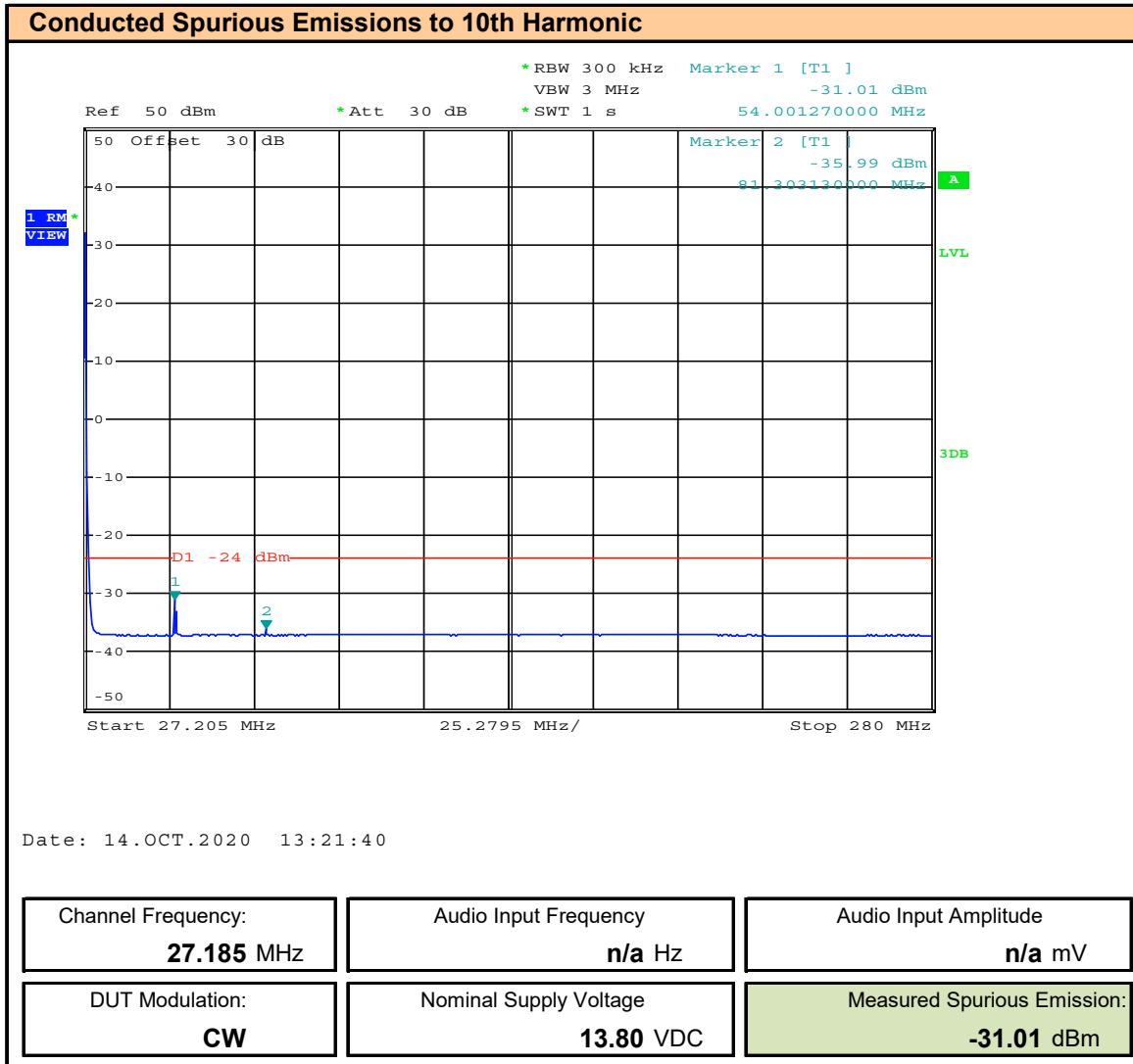
Plot 10.2 – Conducted Out of Band Emissions, Channel 1, 2nd Harmonic



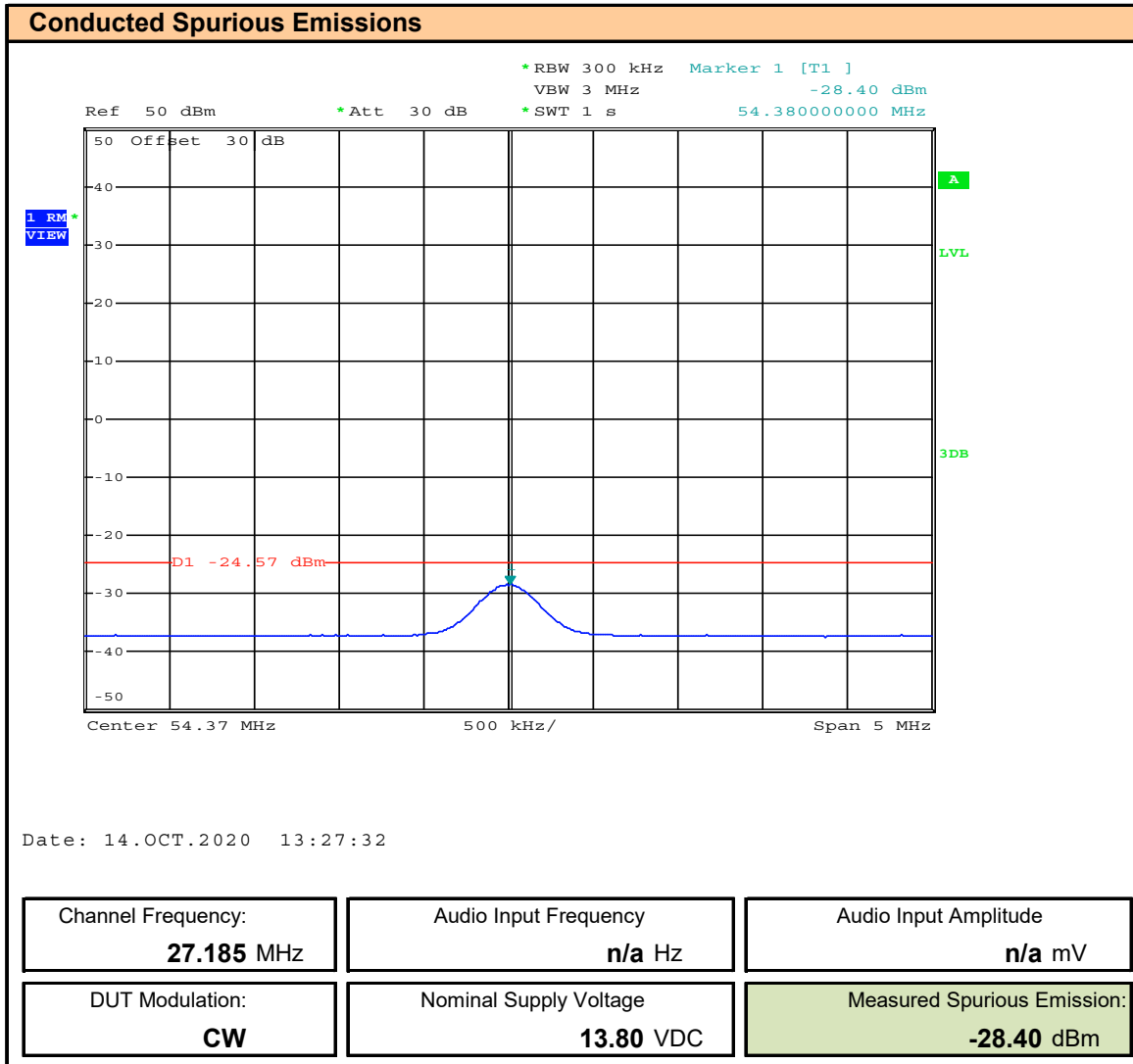
Plot 10.3 – Conducted Out of Band Emissions, Channel 1, 3rd Harmonic



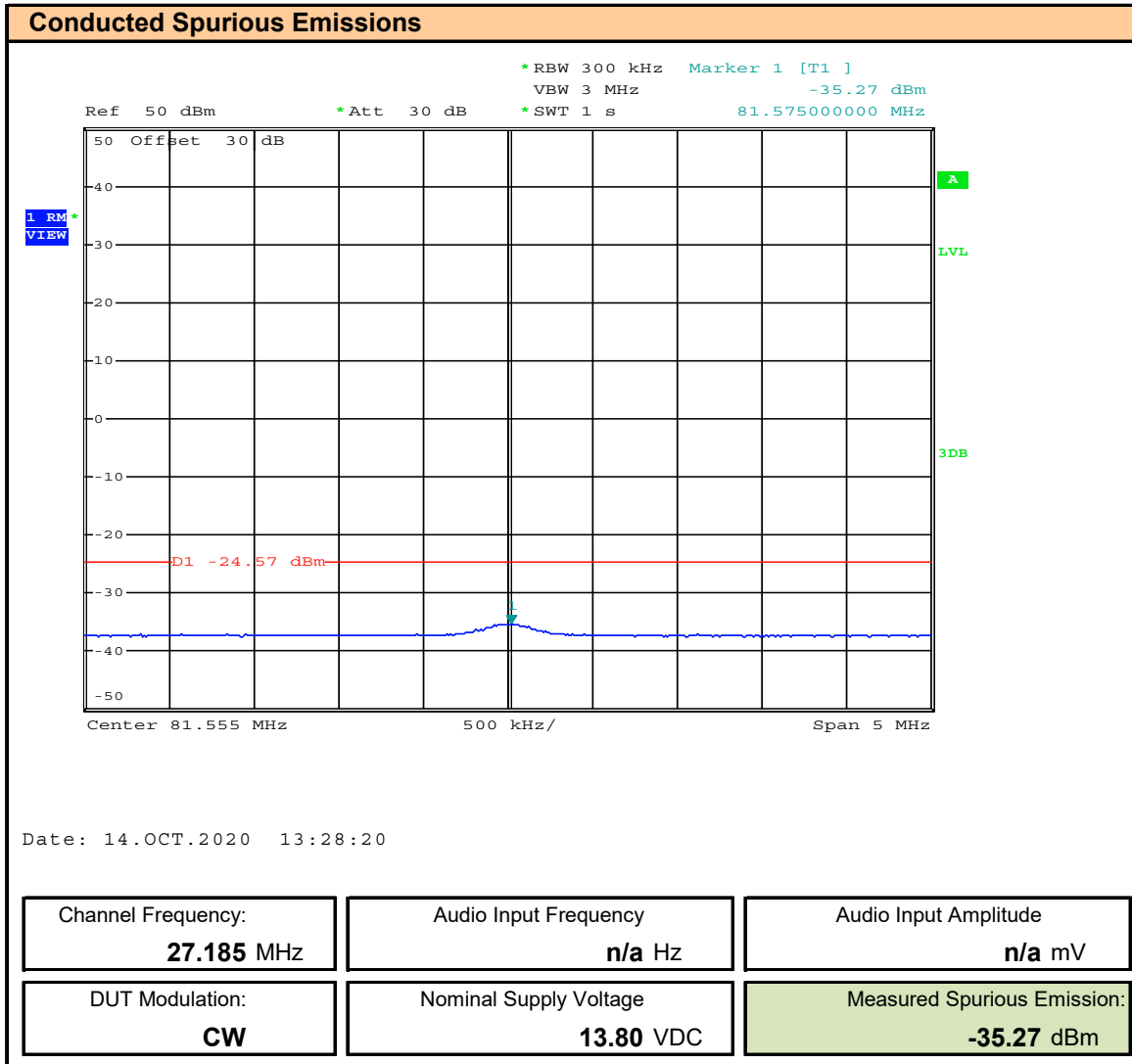
Plot 10.4 – Conducted Out of Band Emissions, 30MHz – 300MHz, Channel 19



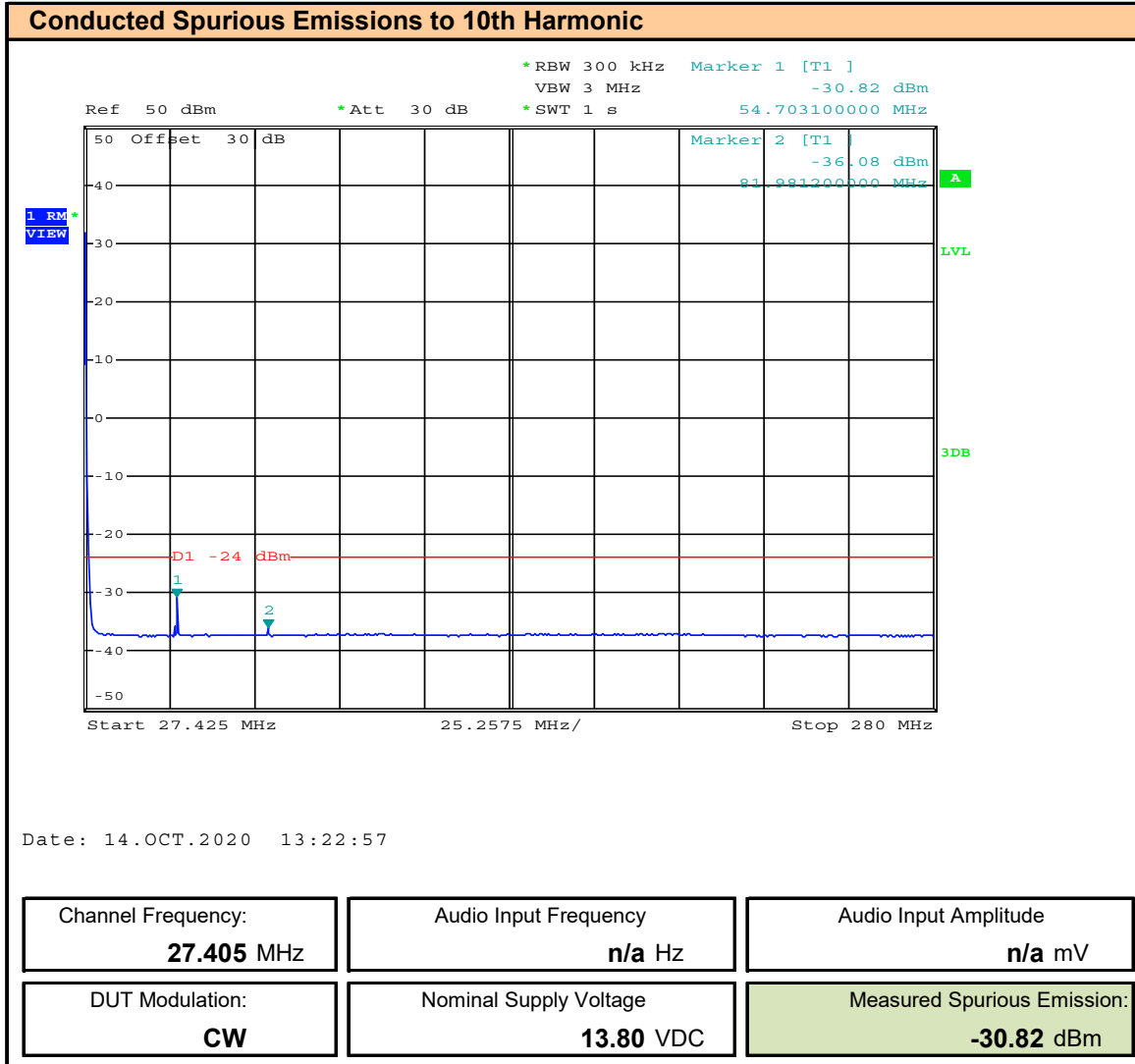
Plot 10.5 – Conducted Out of Band Emissions, Channel 19, 2nd Harmonic



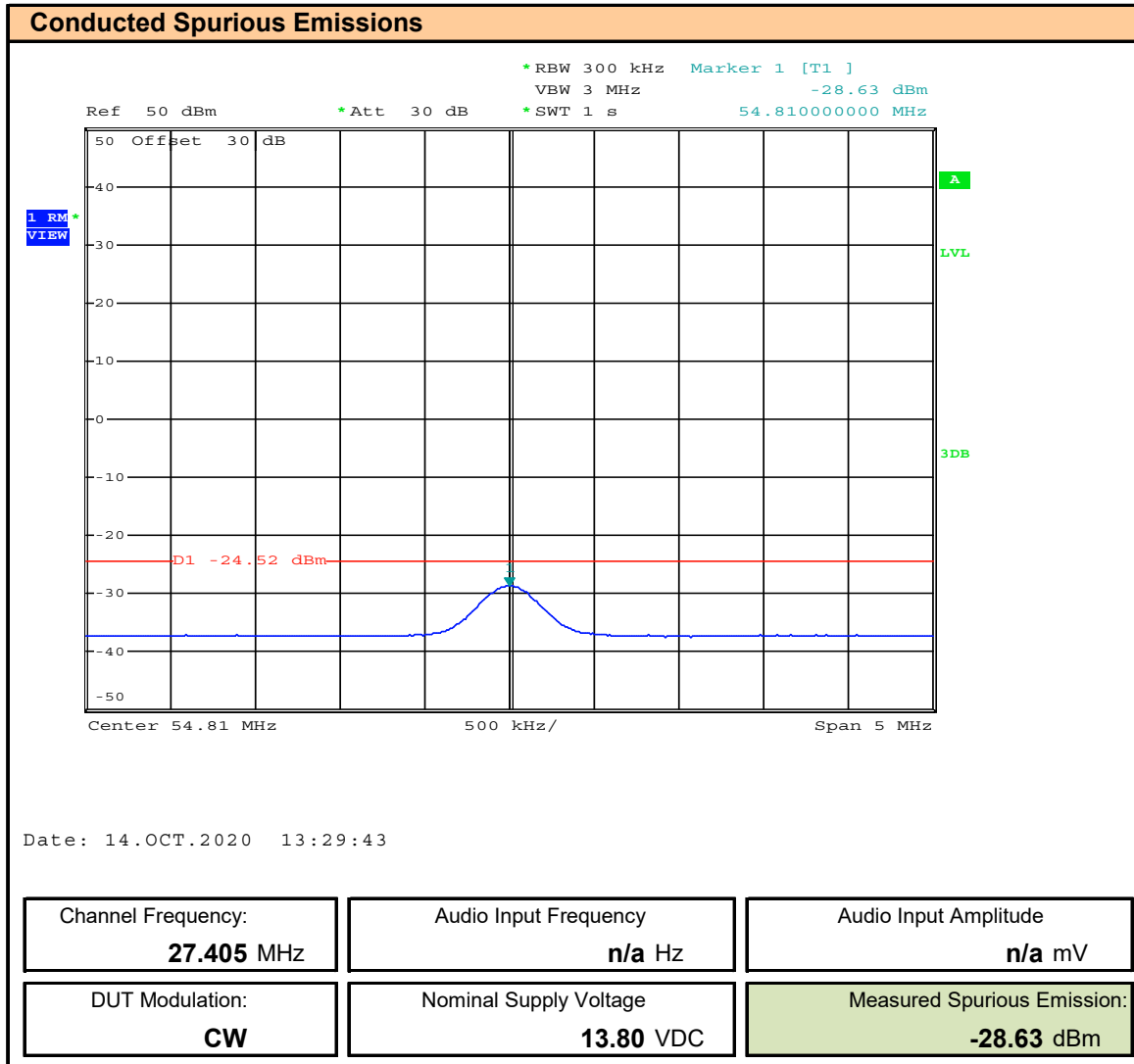
Plot 10.6 – Conducted Out of Band Emissions, Channel 19, 3rd Harmonic



Plot 10.7 – Conducted Out of Band Emissions, 30MHz – 300MHz, Channel 40



Plot 10.8 – Conducted Out of Band Emissions, Channel 40, 2nd Harmonic



Plot 10.9 – Conducted Out of Band Emissions, Channel 40, 3rd Harmonic

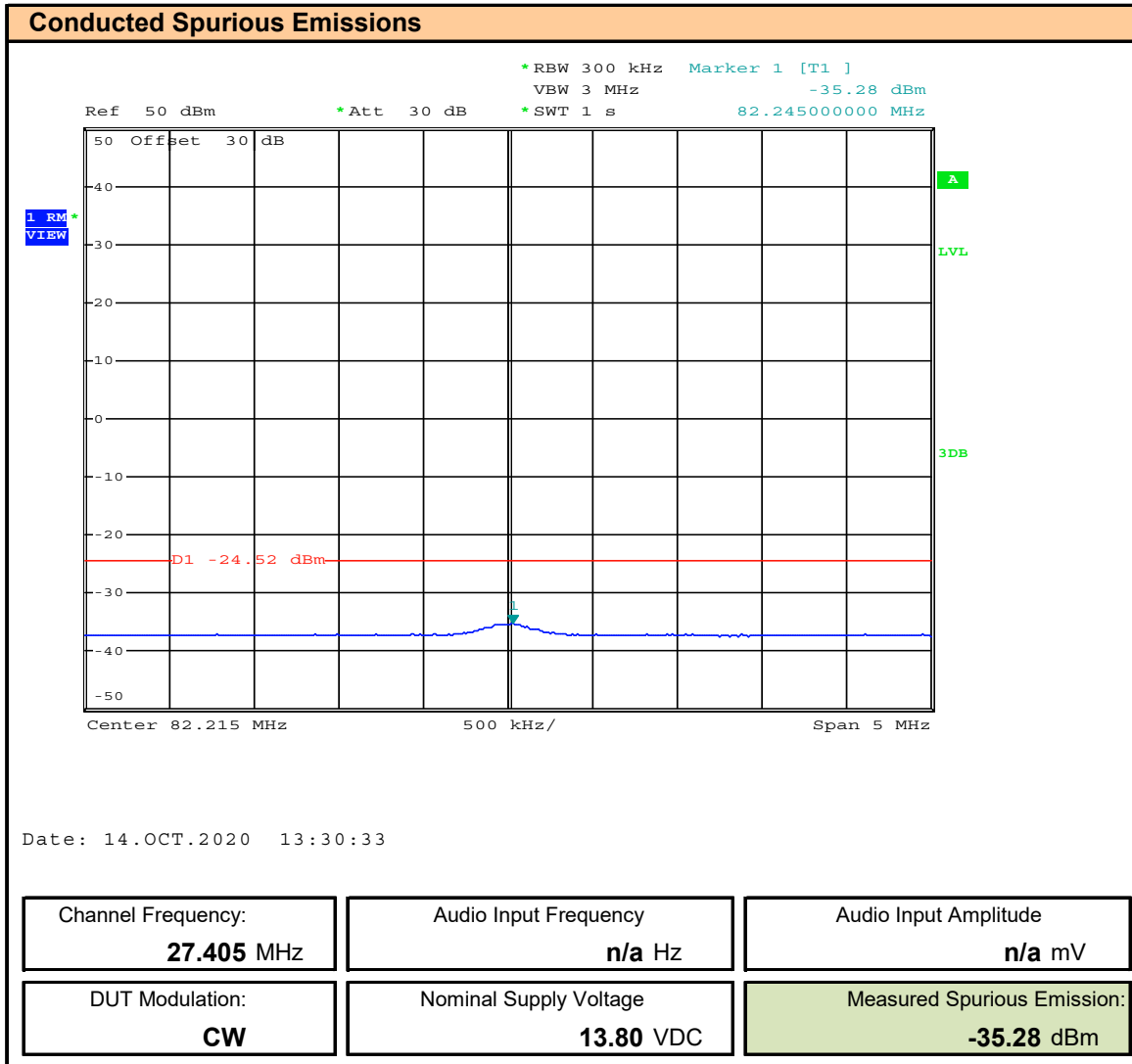


Table 10.1 – Summary of Conducted Out of Band Emissions

Conducted Spurious Emissions							
Channel Frequency (MHz)	Emission Frequency (MHz)	DUT Modulation	Fundamental Power [P] (dBm)	Out of Band Emission [P _E] (dBm)	Attenuation [dB]	Limit (dB)	Margin (dB)
26.965	53.93	CW	35.5	-28.5	64.0	60.0	3.97
	80.89		35.5	-35.3	70.7		10.73
27.185	54.37		35.5	-28.4	63.9		3.88
	81.55		35.5	-35.3	70.8		10.75
27.405	54.83		35.4	-28.6	64.1		4.06
	82.21		35.4	-35.3	70.7		10.71
Attenuation = P - P _E Margin = Limit - Attenuation							
Result:						Complies	
All Spurious Emissions were evaluated to the 10th harmonic (280MHz). No other emissions were observed. Data for fundamental and spurious emissions presented using an RMS detector.							

11.0 RADIATED SPURIOUS TX EMISSIONS

Test Conditions

Normative Reference	FCC 47 CFR §95.979, RSS-236
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Limits

47 CFR §95.979	<p>Each CBRS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section.</p> <p>(a) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) as specified in the applicable paragraphs listed in the following table:</p> <p>For A3E (1), (3), (5), (6)</p> <p>(1) 25 dB (decibels) in the frequency band 4 kHz to 8 kHz removed from the channel center frequency;</p> <p>(3) 35 dB in the frequency band 8 kHz to 20 kHz removed from the channel center frequency;</p> <p>(5) 53 + 10 log (P) dB in any frequency band removed from the channel center frequency by more than 250% of the authorized bandwidth.</p> <p>(6) 60 dB in any frequency band centered on a harmonic (i.e., an integer multiple of two or more times) of the carrier frequency.</p>
RSS-236 4.4.4	<p>For A1D and A3E:</p> <p>_ At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.</p> <p>_ At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.</p> <p>_ At least 53 + 10 log₁₀ (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.</p> <p>_ At least 60 dB on any frequency twice or greater than twice the fundamental frequency.</p>

Measurement Procedure

TIA 382 22.2 Transmitter Radiated Spurious and Harmonic Emissions

The transmitter shall be terminated in a nonradiating dummy load and shall be keyed but not modulated.

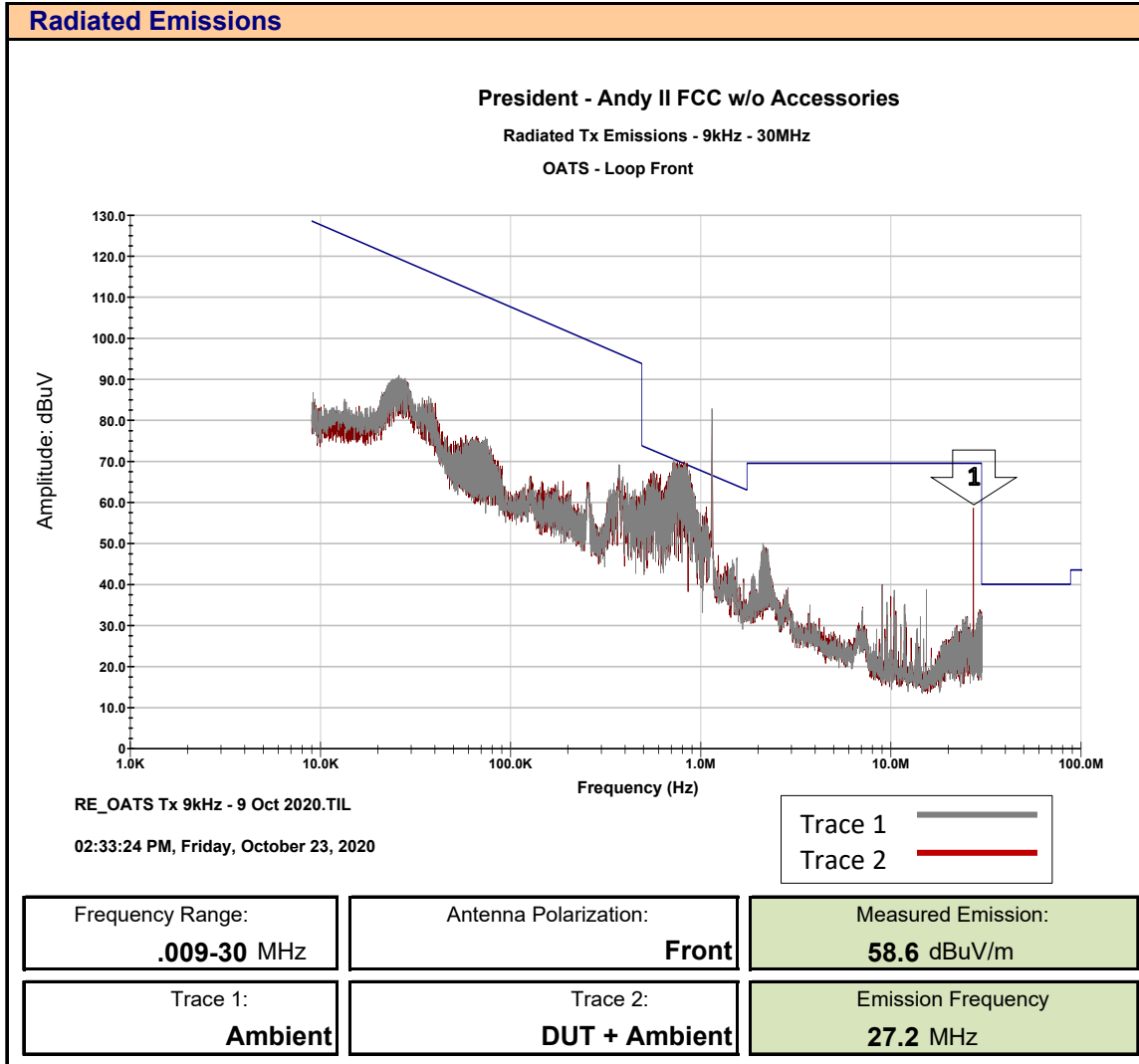
For each spurious frequency, raise and lower the receiver antenna to obtain a maximum reading on the FIM with the antenna at horizontal polarity. Then the turntable should be rotated to further increase this maximum reading. Repeat this procedure of raising and lowering the antenna and rotating the turntable until the highest possible signal has been obtained. The effect of the simulated accessory connections shall be noted, so that the measurement series producing the maximum radiation level can be recorded.

Test Setup

Appendix A

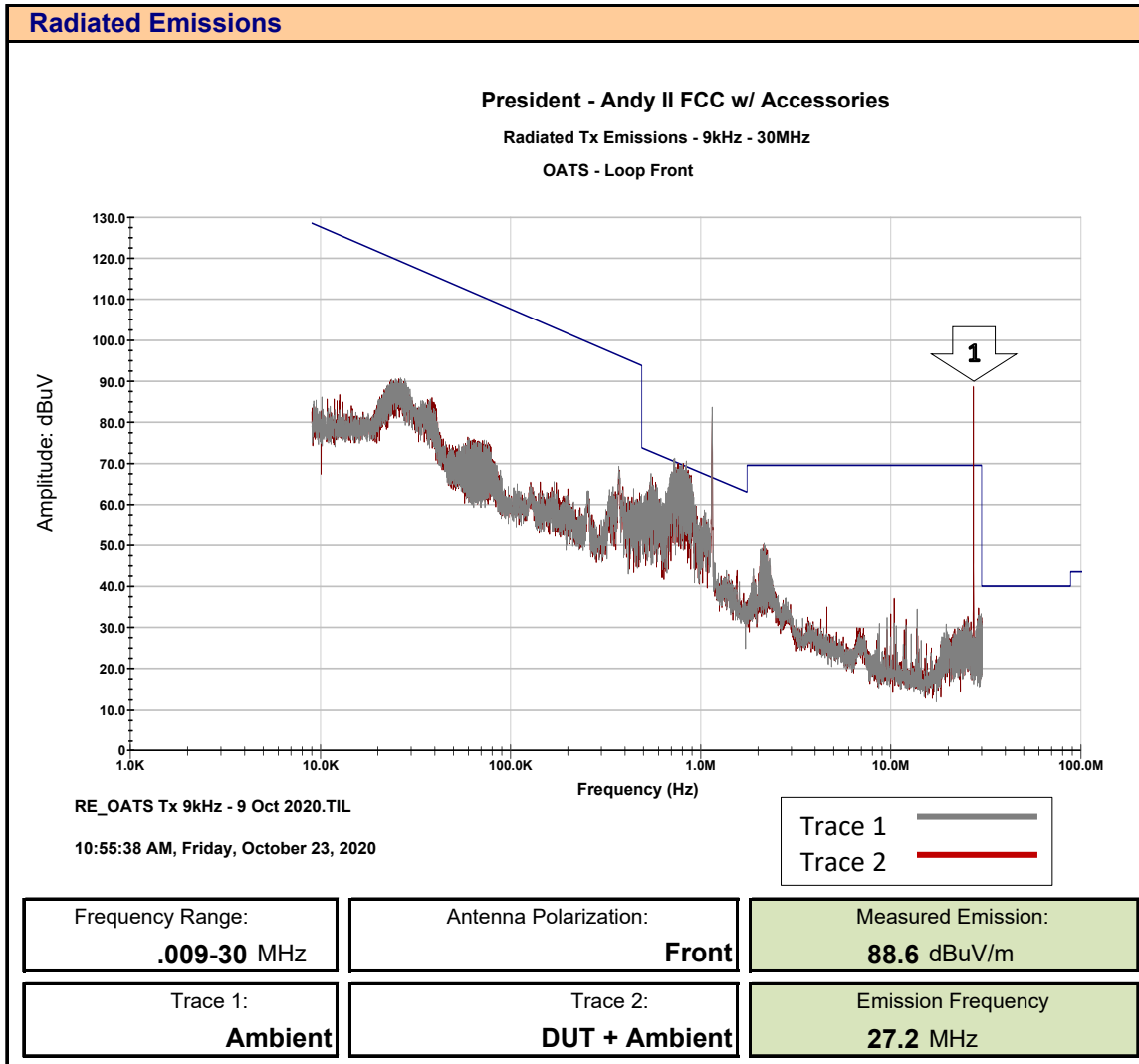
Figure A.3

Plot 11.1 – Radiated Spurious Emissions OATS, 9kHz - 30MHz, Front without Accessories



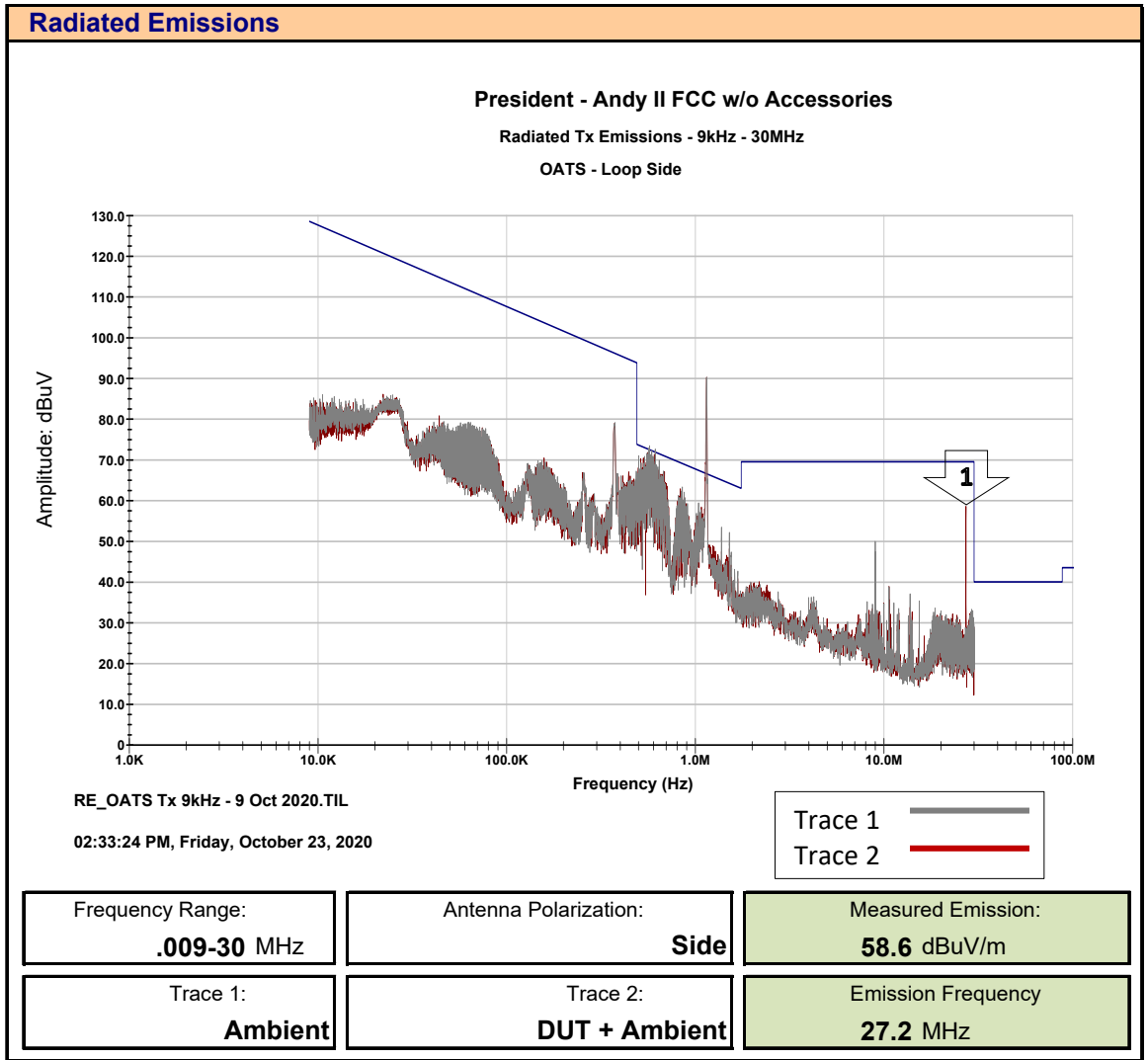
Marker 1 = Fundamental

Plot 11.2 – Radiated Spurious Emissions OATS, 9kHz - 30MHz, Front with Accessories



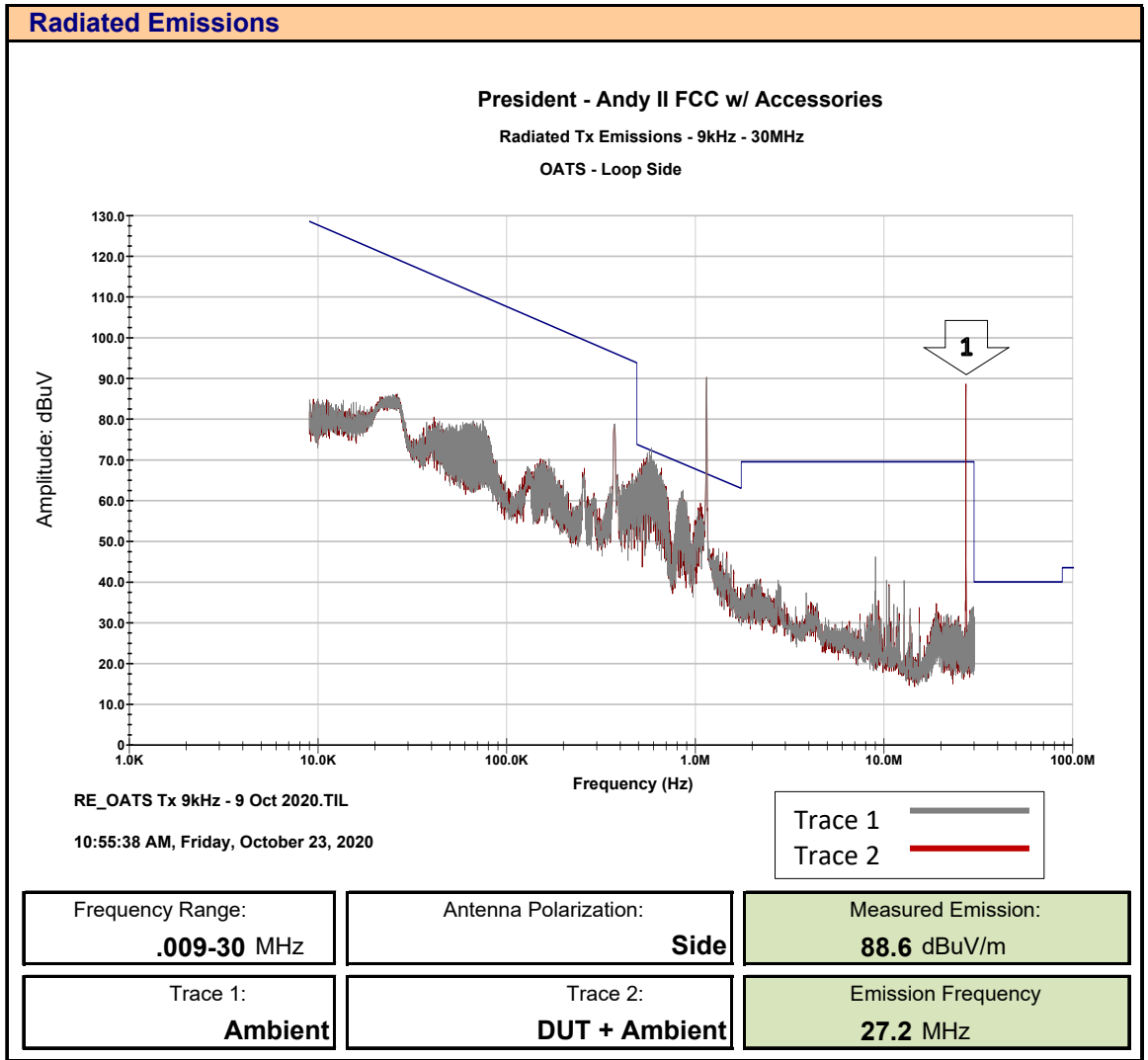
Marker 1 = Fundamental

Plot 11.3 – Radiated Spurious Emissions OATS, 9kHz - 30MHz, Side without Accessories



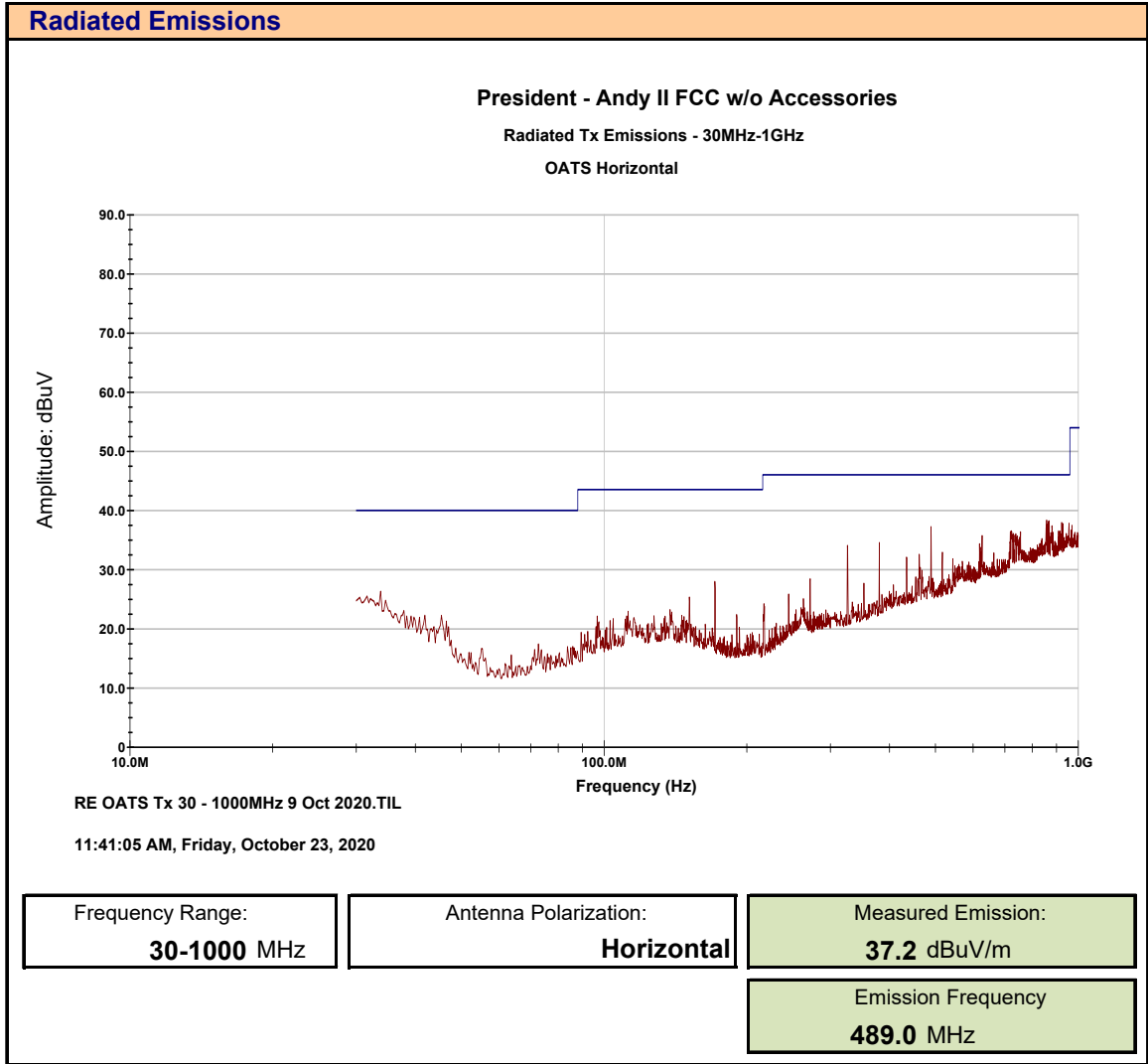
Marker 1 = Fundamental

Plot 11.4 – Radiated Spurious Emissions OATS, 9kHz - 30MHz, Side with Accessories

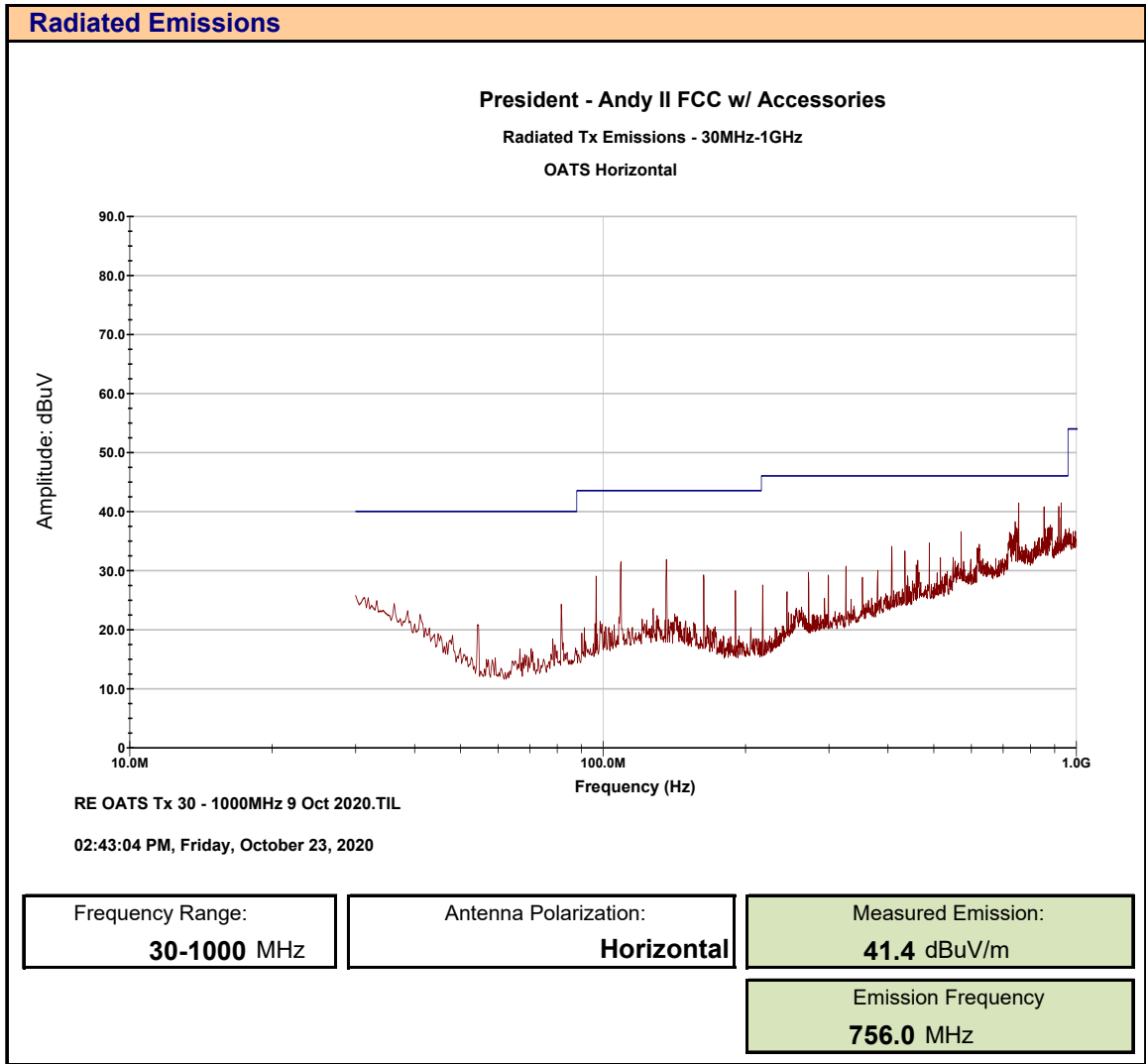


Marker 1 = Fundamental

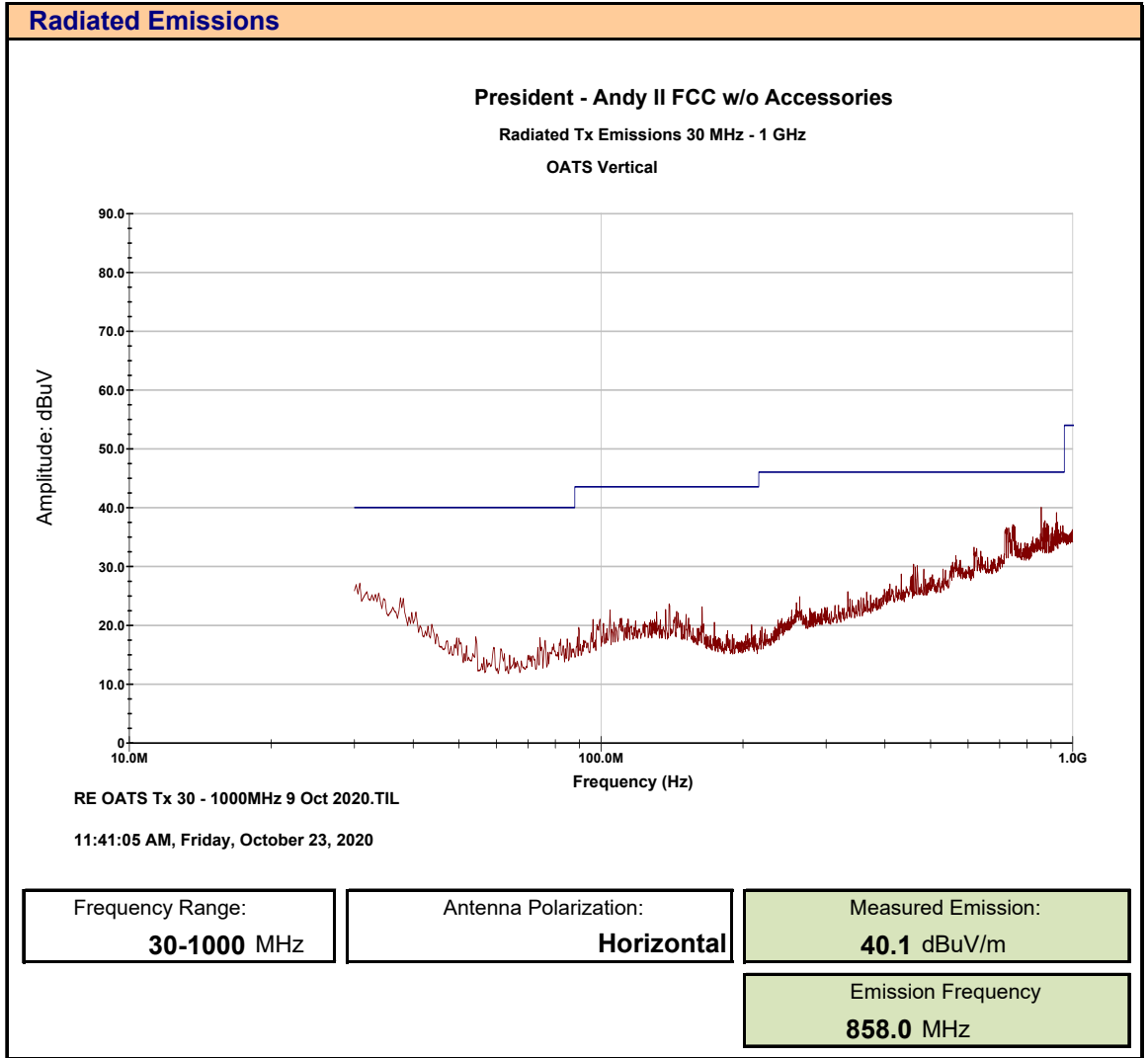
Plot 11.5 – Radiated Spurious Emissions OATS, 30MHz – 1000MHz, Horizontal without Accessories



Plot 11.6 – Radiated Spurious Emissions OATS, 30MHz – 1000MHz, Horizontal with Accessories



Plot 11.7 – Radiated Spurious Emissions OATS, 30MHz – 1000MHz, Vertical without Accessories



Plot 11.8 – Radiated Spurious Emissions OATS, 30MHz – 1000MHz, Vertical with Accessories

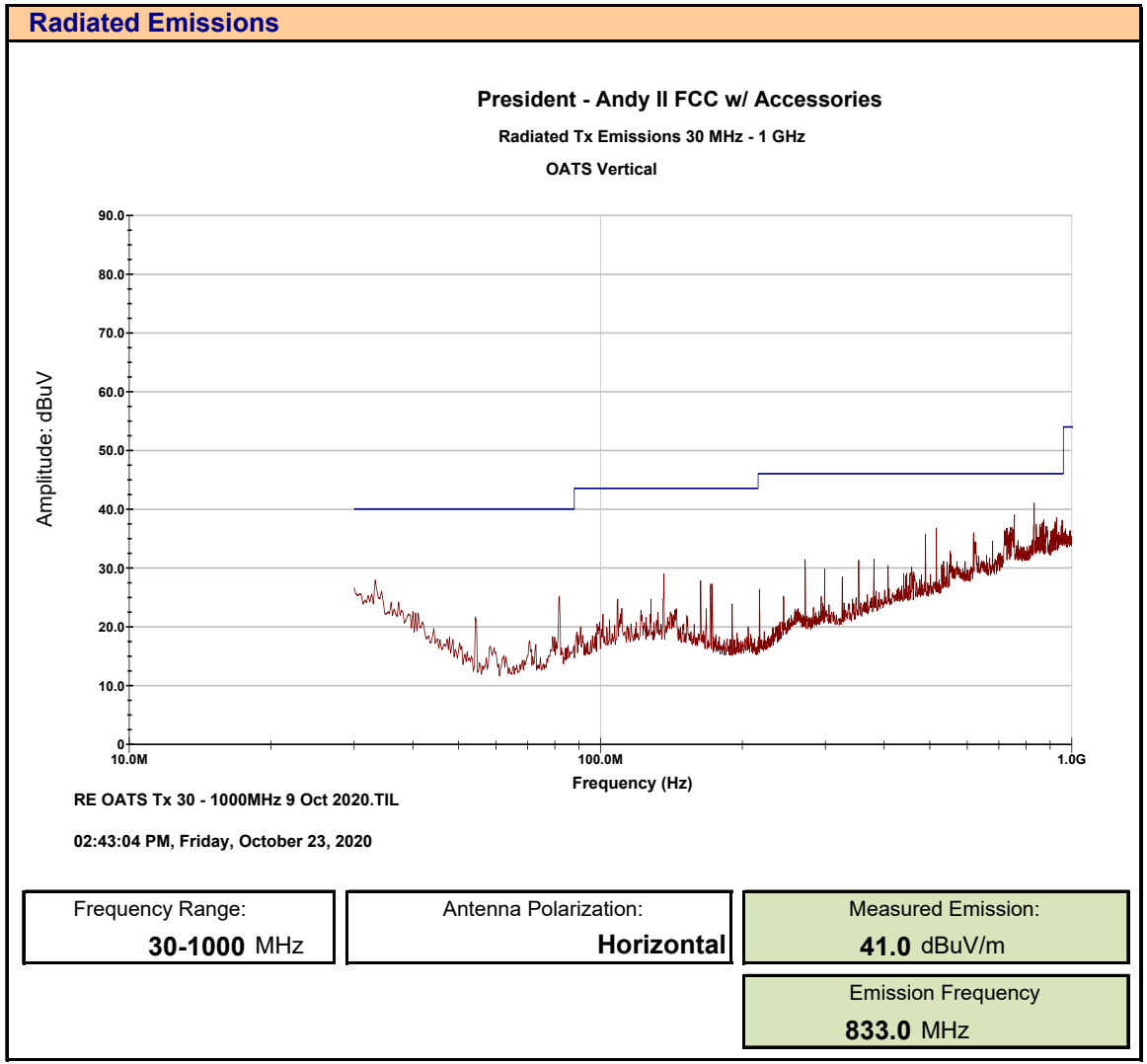


Table 11.1 – Summary of Radiated Spurious Emissions

Radiated Spurious Emissions							
Channel Frequency (MHz)	Emission Frequency (MHz)	Antenna Polarization	DUT Modulation	Fundamental Power [P] (dBm)	Out of Band Emission [P_E] (dBuV/m)	Limit (dBuV/m)	Margin (dB)
27.185	(1)	Front	CW	36.0	n/a	n/a	n/a
27.185	(1)	Side	CW	36.0	n/a	n/a	n/a
27.185	756	Horizontal	CW	36.0	41.4	46.0	4.60
27.185	833	Vertical	CW	36.0	41.0	46.0	5.00
Margin = Limit - Attenuation							
					Result:	Complies	
(1) Peak Detector compared to QP limits. No emissions above ambient were observed other than the fundamental between 9kHz and 30MHz. Data for spurious emissions presented using a peak detector with an RBW greater than QP RBW.							

12.0 RECEIVER RADIATED EMISSIONS - DOC

Test Procedure

Normative Reference	FCC 47 CFR §15.109, ICES-003(6.2) ANSI C63.4:2014
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Limits

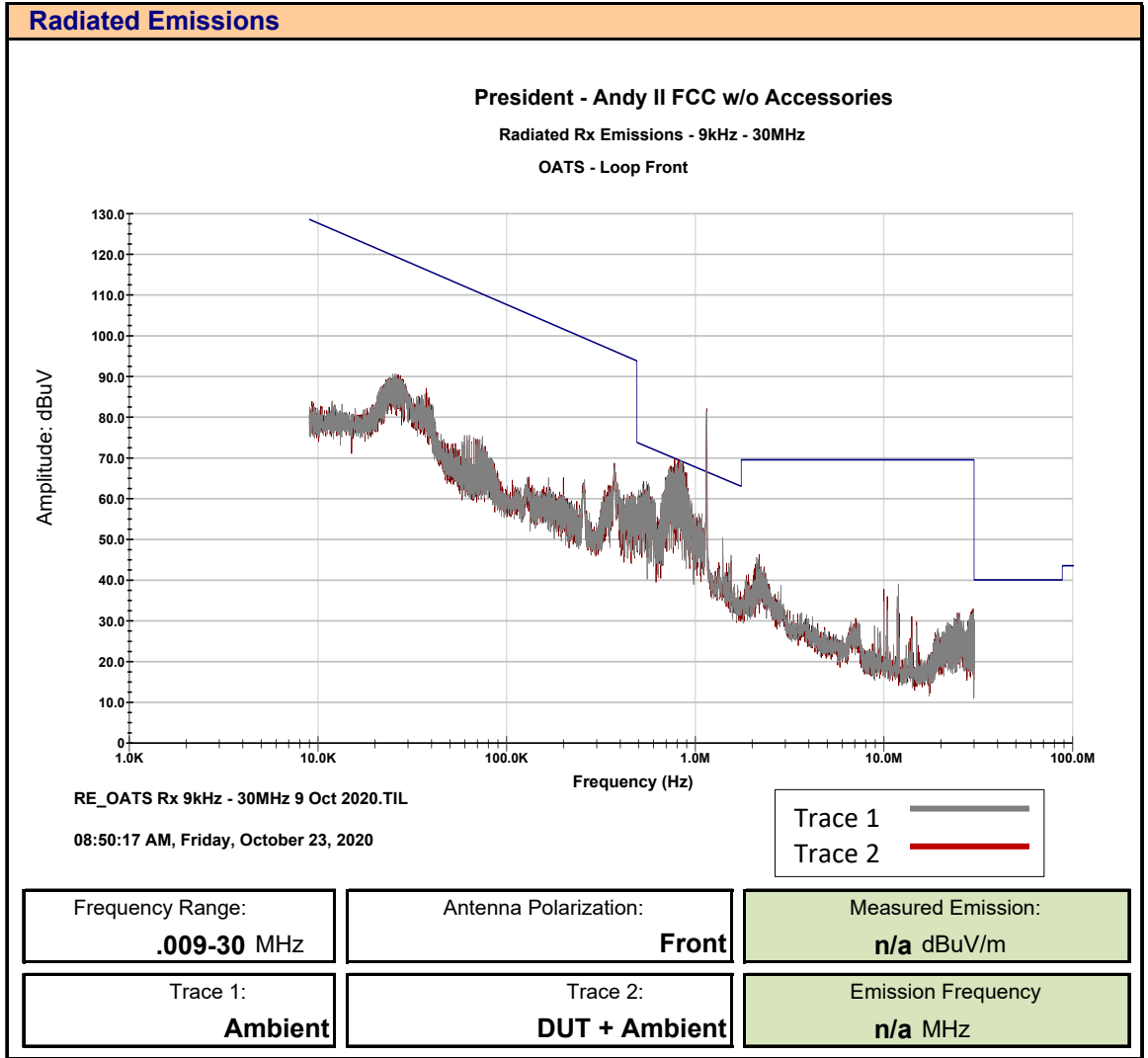
47 CFR §15.109	(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values: 30-88MHz: 40dBuV/m 88-216MHz: 216-960MHz: > 960MHz: 54dBuV/m
ICES-003(6.2.1)	6.2.1 - Radiated Emissions Limits Below 1 GHz Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 5 determined at a distance of 3 metres. 30-88MHz: 40dBuV/m 88-216MHz: 216-960MHz: > 960MHz: 54dBuV/m

Test Setup	Appendix A	Figure A.3
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Measurement Procedure

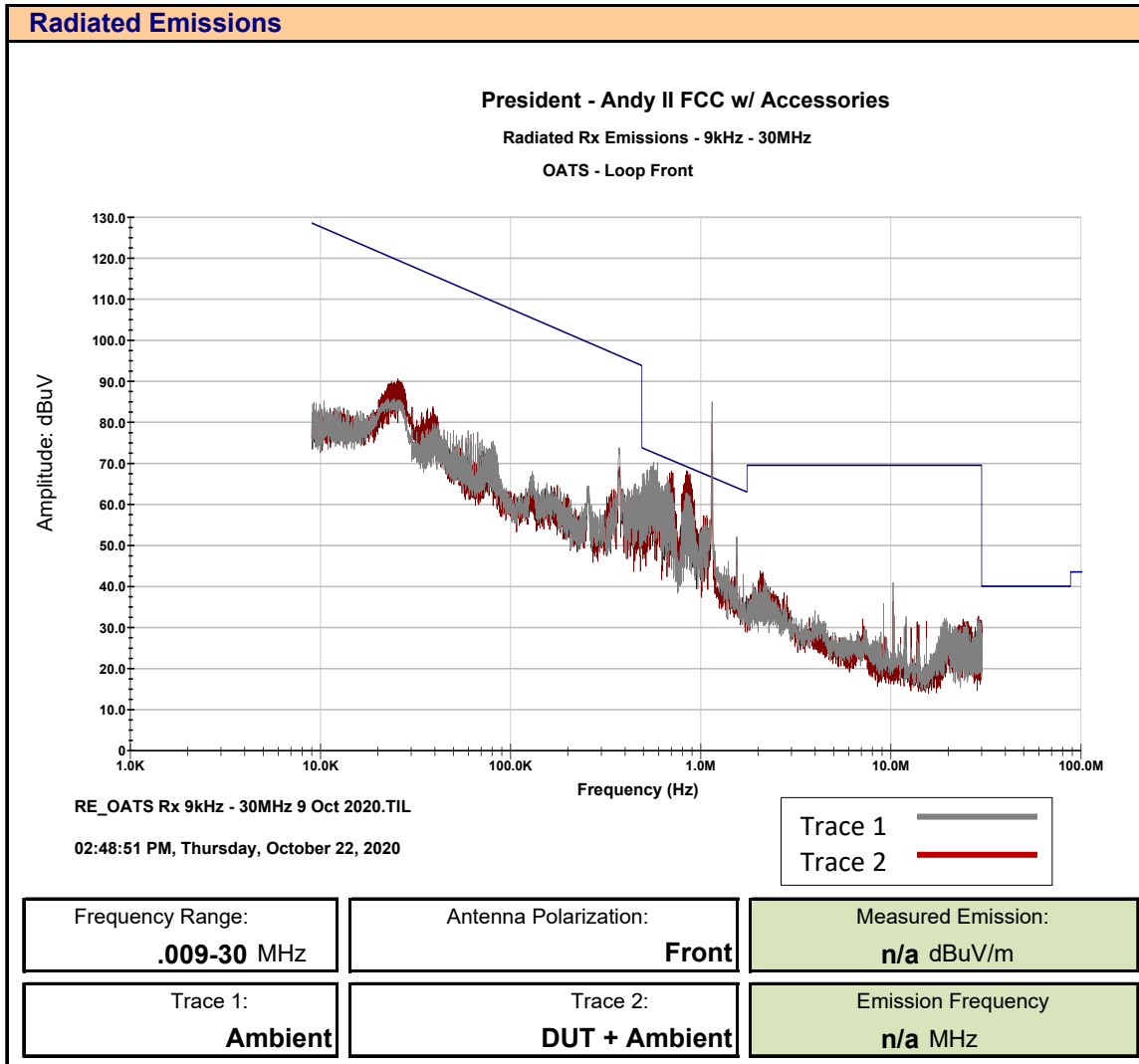
The DUT was set up as per ANSI C63.4:2014. Emissions were scanned between 30MHz and 1000MHz. The turntable was rotated 360 degrees and the antenna was elevated to 4m to optimize the measured emissions.

Plot 12.1 – Receiver Radiated Emissions, 9kHz – 30MHz, Front without Accessories



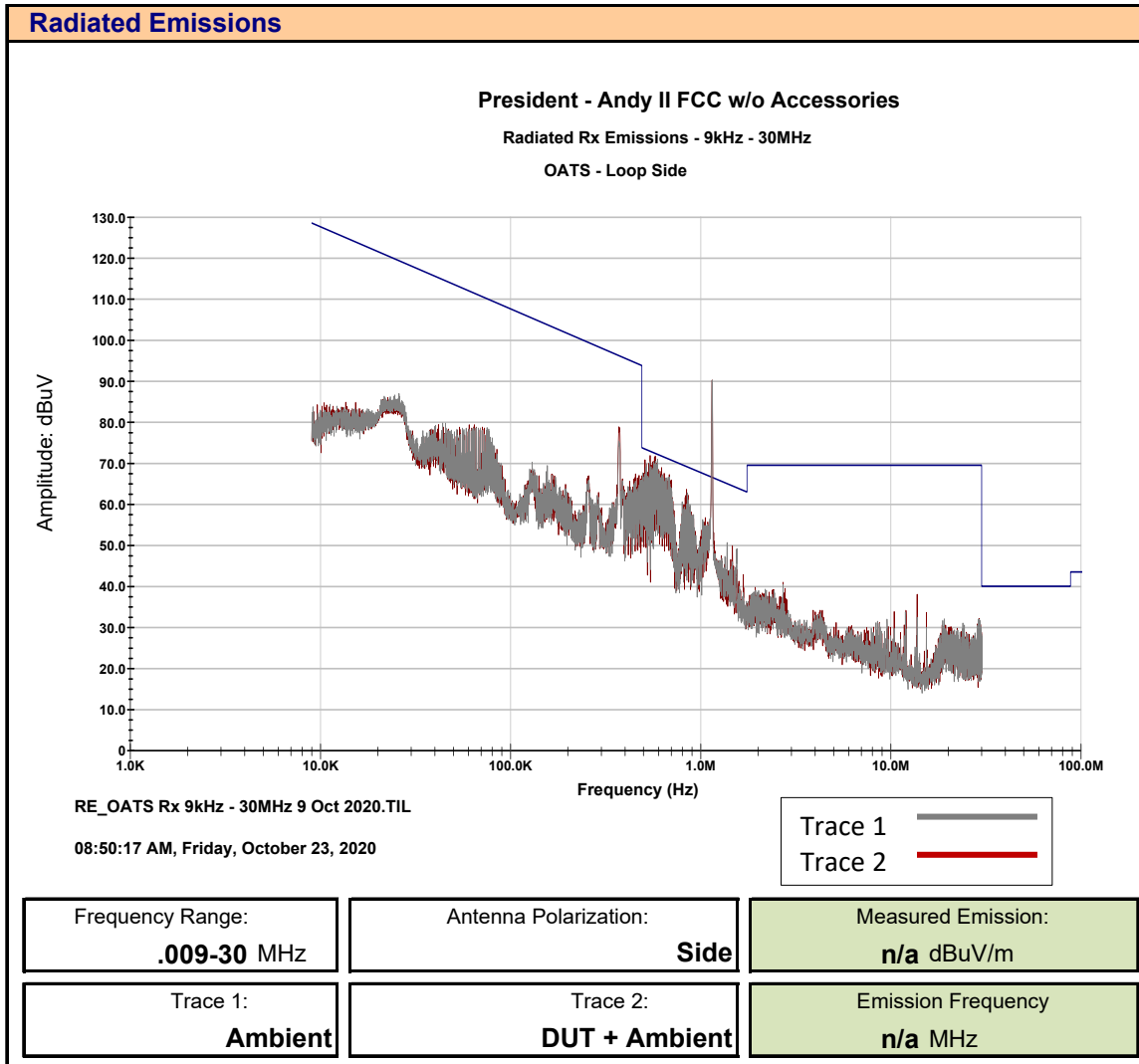
Marker 1 = Fundamental

Plot 12.2 – Receiver Radiated Emissions, 9kHz – 30MHz, Front with Accessories



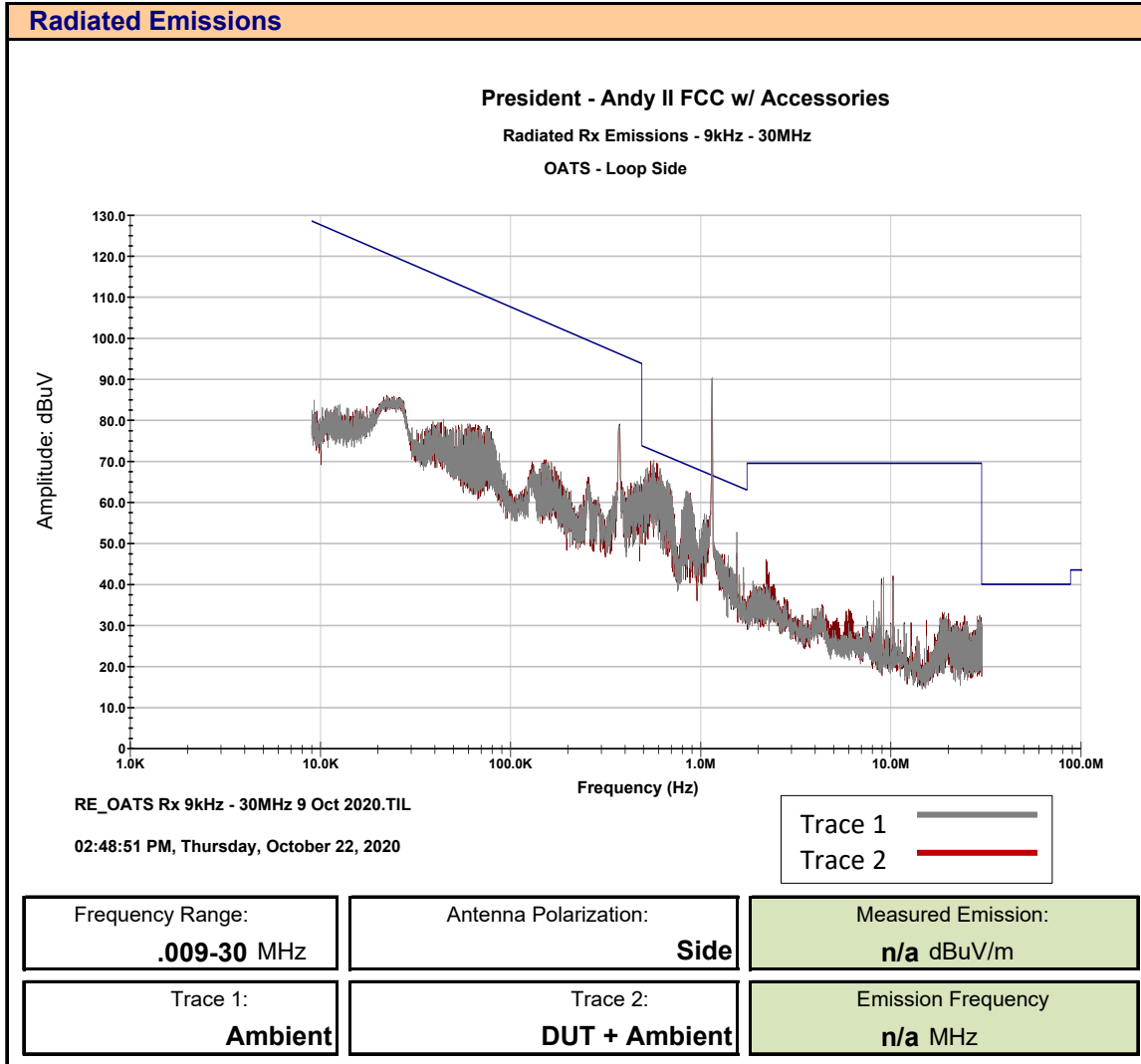
Marker 1 = Fundamental

Plot 12.3 – Receiver Radiated Emissions, 9kHz – 30MHz, Side without Accessories



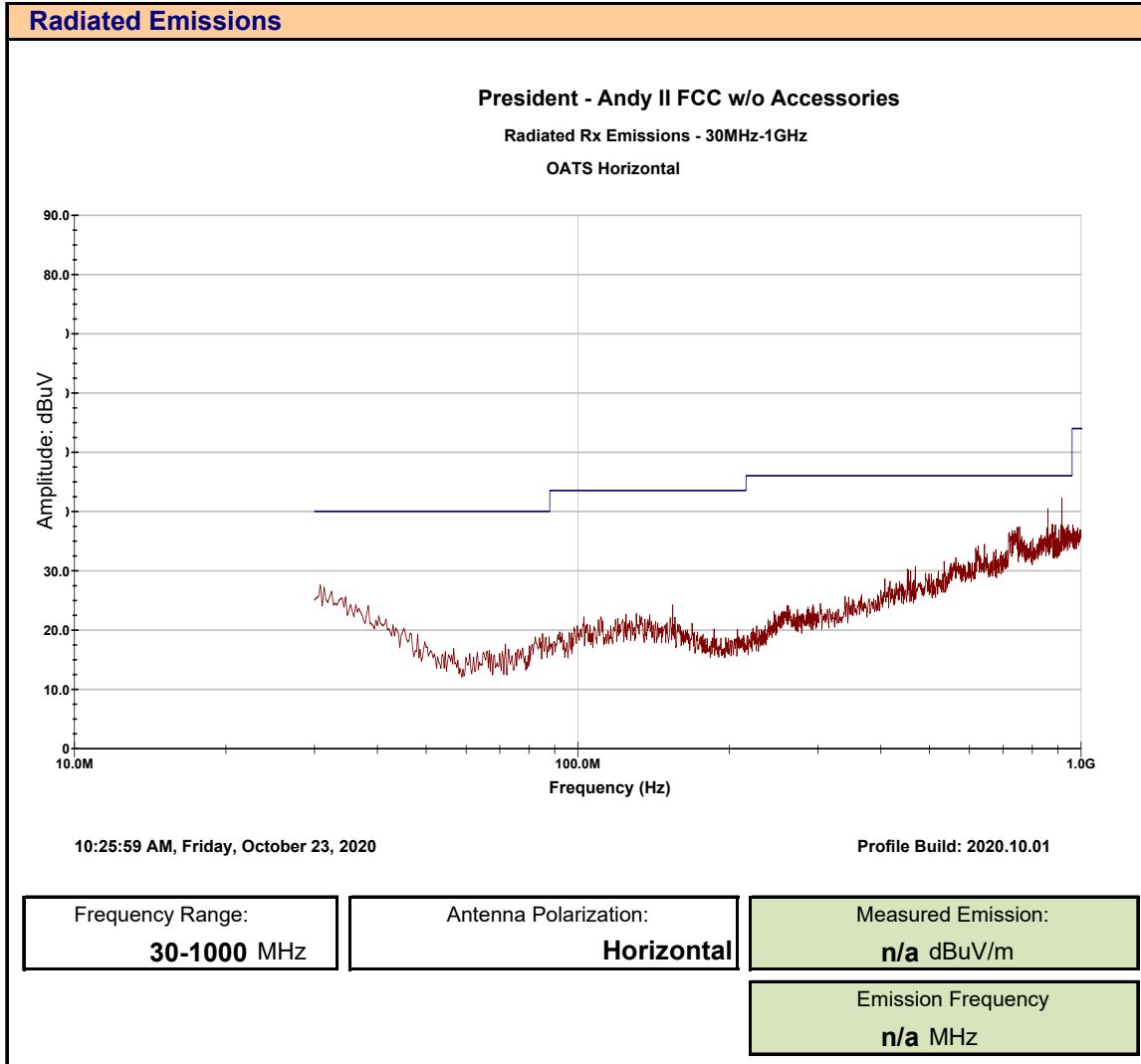
Marker 1 = Fundamental

Plot 12.4 – Receiver Radiated Emissions, 9kHz – 30MHz, Side with Accessories

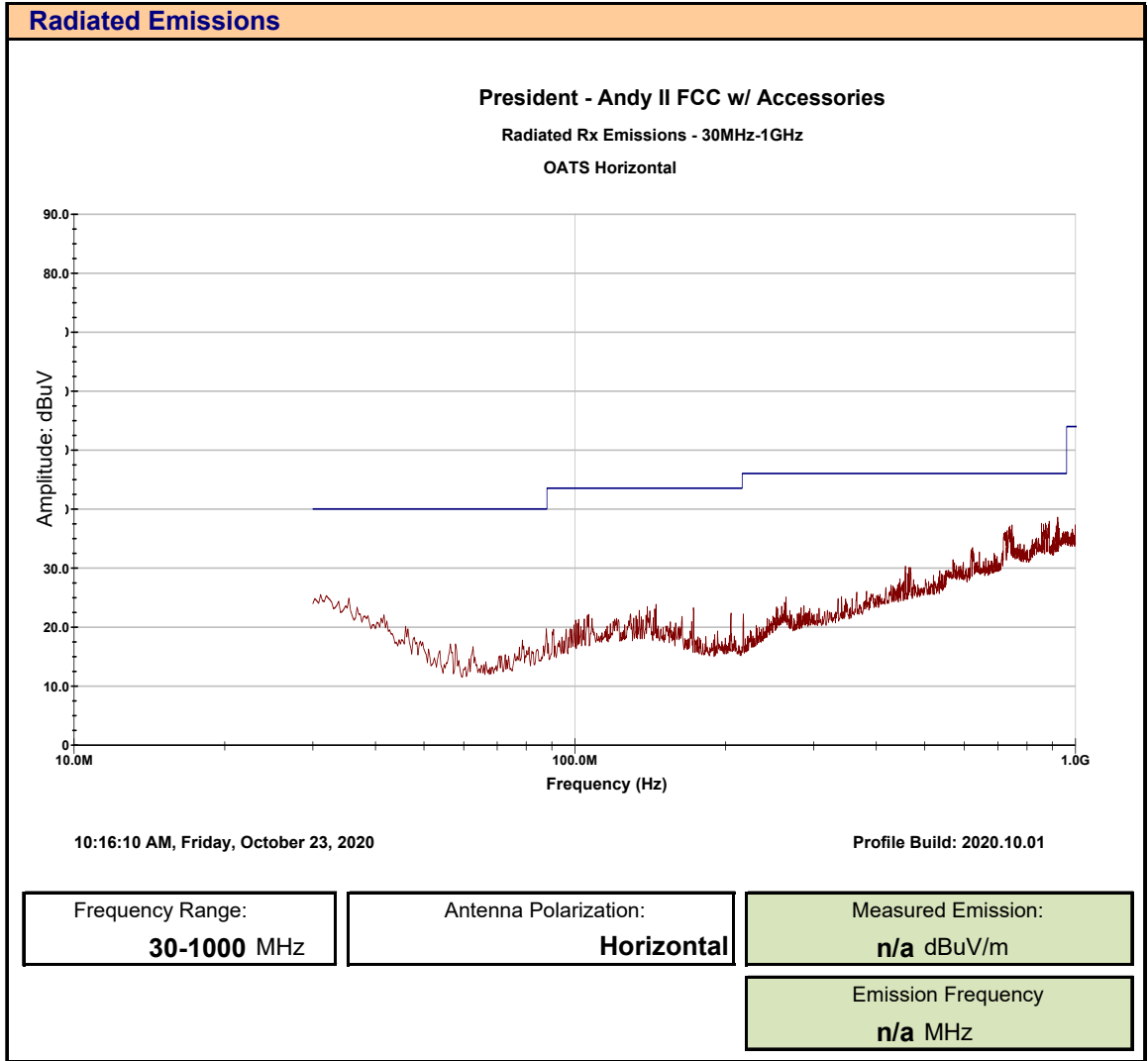


Marker 1 = Fundamental

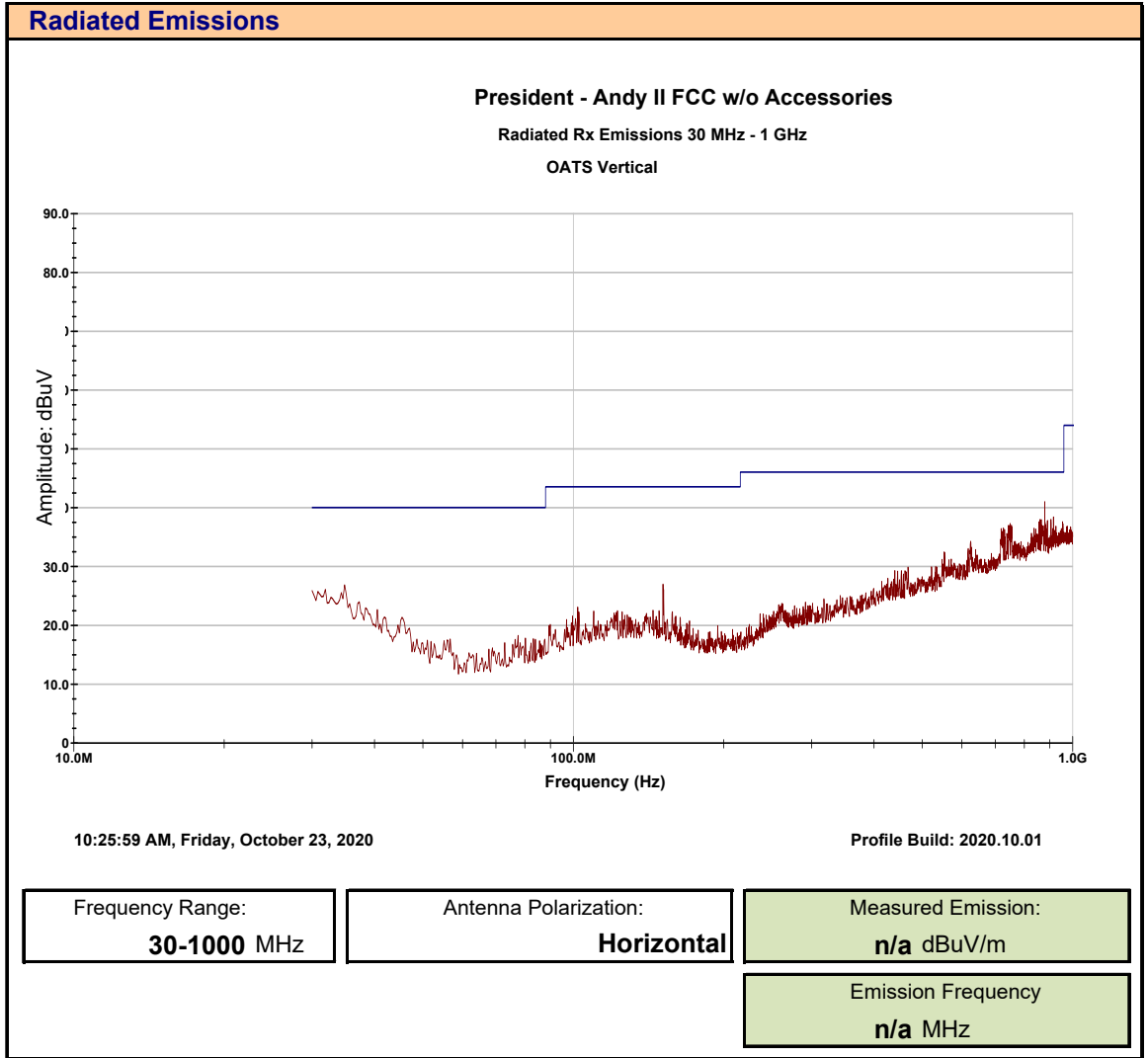
Plot 12.5 – Receiver Radiated Emissions, 30 – 1000MHz, Horizontal without Accessories



Plot 12.6 – Receiver Radiated Emissions, 30 – 1000MHz, Horizontal with Accessories



Plot 12.7 – Receiver Radiated Emissions, 30 – 1000MHz, Vertical without Accessories



Plot 12.8 – Receiver Radiated Emissions, 30 – 1000MHz, Vertical with Accessories

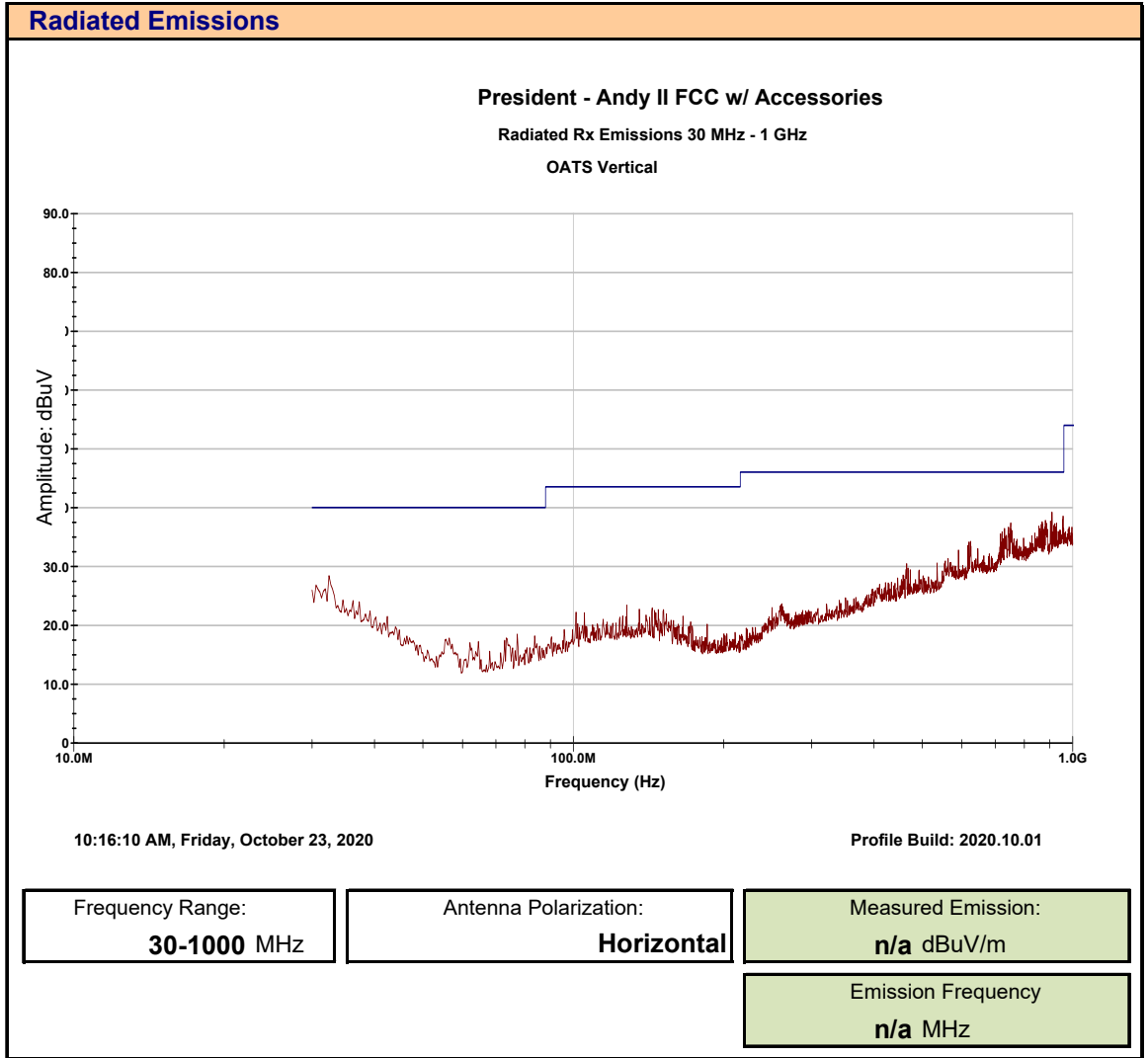


Table 12.1 – Summary of Receiver Radiated Emissions

§15.109, ICES-003 (6.2)					
Emission Frequency	Antenna Polarization	Measured Emission	Corrected Emission	Limit	Margin
(MHz)		[E_{Meas}]	[E_{Corr}]		
		(dBuV)	(W)	(W)	(dB)
30-1000	Horizontal	n/a	n/a	-	-
30-1000	Vertical	n/a	n/a	-	-
				Results:	Complies

No emissions detected above ambient noise.

13.0 FREQUENCY STABILITY

Test Conditions

Normative Reference	FCC 47 CFR §2.1055, §95.965, RSS-Gen
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Limits

47 CFR §95.965	Each CBRS transmitter type must be designed such that the transmit carrier frequency (or in the case of SSB transmissions, the reference frequency) remains within 50 parts-per-million of the channel center frequencies specified in §95.963 under all normal operating conditions.
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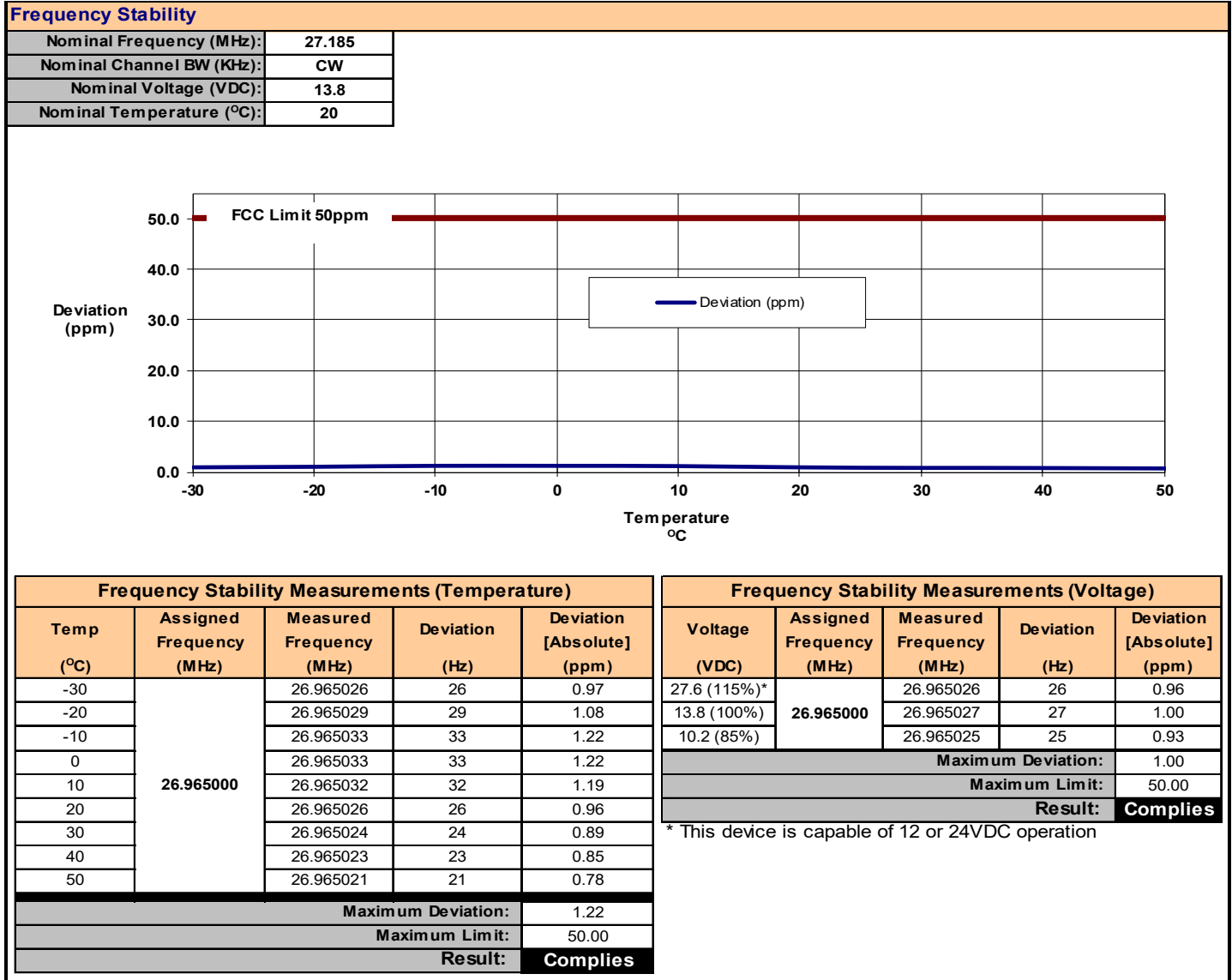
Measurement Procedure

47 CFR §2.1055 Frequency Stability

- (a) The frequency stability shall be measured with variation of ambient temperature as follows:
- (1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
 - (b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.
 - (d) The frequency stability shall be measured with variation of primary supply voltage as follows:
 - (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

Test Setup	Appendix A	Figure A.4
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Table 13.1 – Summary of Frequency Stability Results



APPENDIX A – TEST SETUP DRAWINGS AND EQUIPMENT

Table A.1 – Setup - Conducted Measurements Equipment

Equipment List			
Asset Number	Manufacturer	Model Number	Description
00241	R&S	FSU40	Spectrum Analyzer

Figure A.1 – Test Setup Conducted Measurements

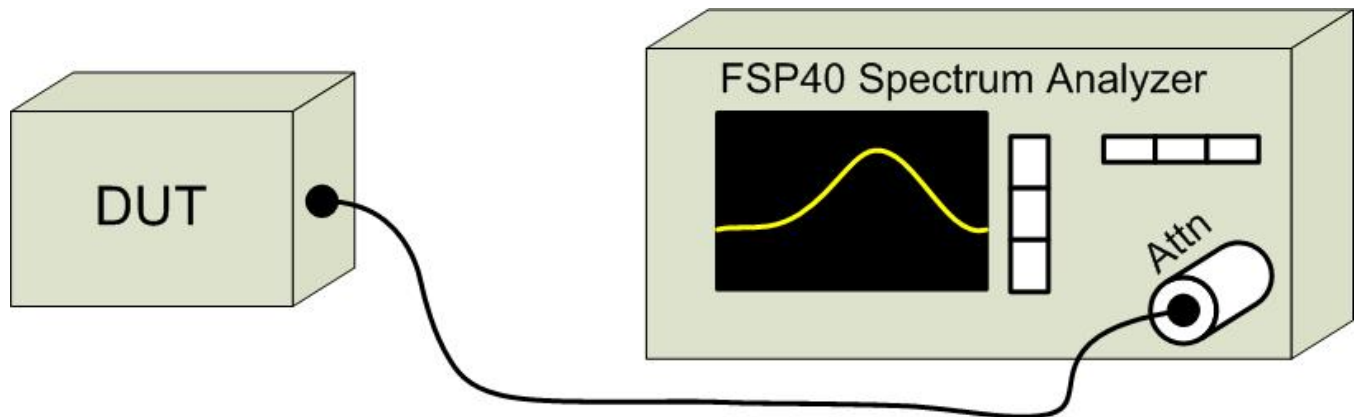


Table A.2 – Setup - Audio Modulation Equipment

Equipment List			
Asset Number	Manufacturer	Model Number	Description
00028	HP	8901A	Modulation Analyzer
00027	HP	8903B	Audio Analyzer/Generator

Figure A.2 – Test Setup Audio Modulation Response Measurements

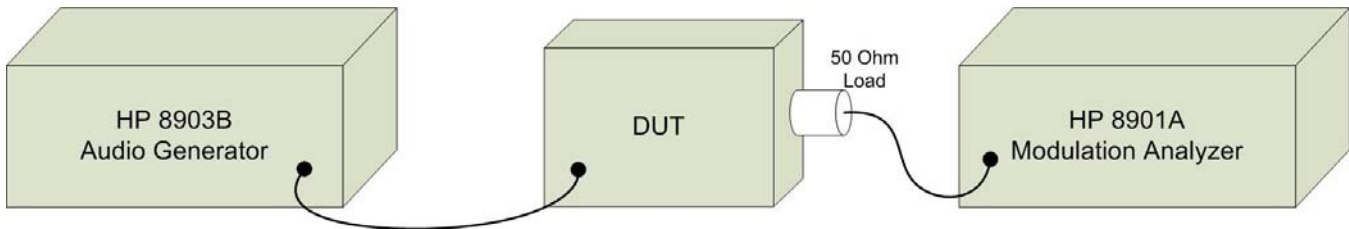


Table A.3 – Setup - Radiated Emissions Equipment

Equipment List			
Asset Number	Manufacturer	Model Number	Description
00051	HP	8566B	Spectrum Analyzer
00049	HP	85650A	Quasi-peak Adapter
00047	HP	85685A	RF Preselector
00072	EMCO	2075	Mini-mast
00073	EMCO	2080	Turn Table
00071	EMCO	2090	Multi-Device Controller
00265	Miteq	JS32-00104000-58-5P	Microwave L/N Amplifier
00241	R&S	FSU40	Spectrum Analyzer
00050	Chase	CBL-6111A	Bilog Antenna
00275	Coaxis	LMR400	25m Cable
00276	Coaxis	LMR400	4m Cable
00278	TILE	34G3	TILE Test Software
00034	ETS	3115	Double Ridged Guide Horn

CNR: Calibration Not Required
 COU: Calibrate On Use

Figure A.3 – Test Setup Radiated Emissions Measurements Below 30MHz

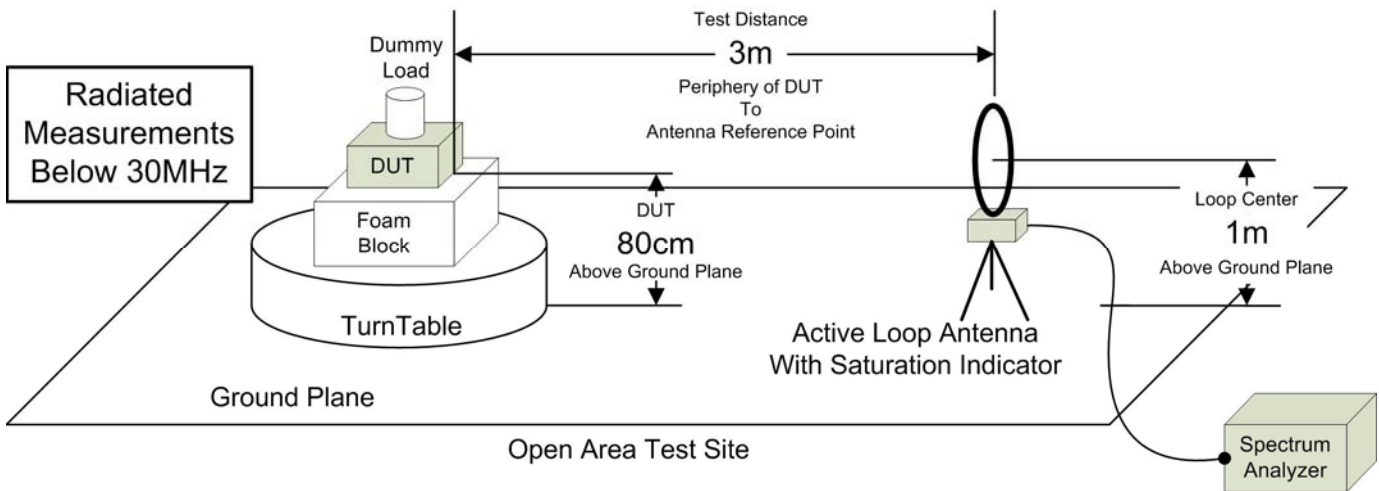


Figure A.4 – Test Setup Radiated Emissions Measurements 30-1000MHz

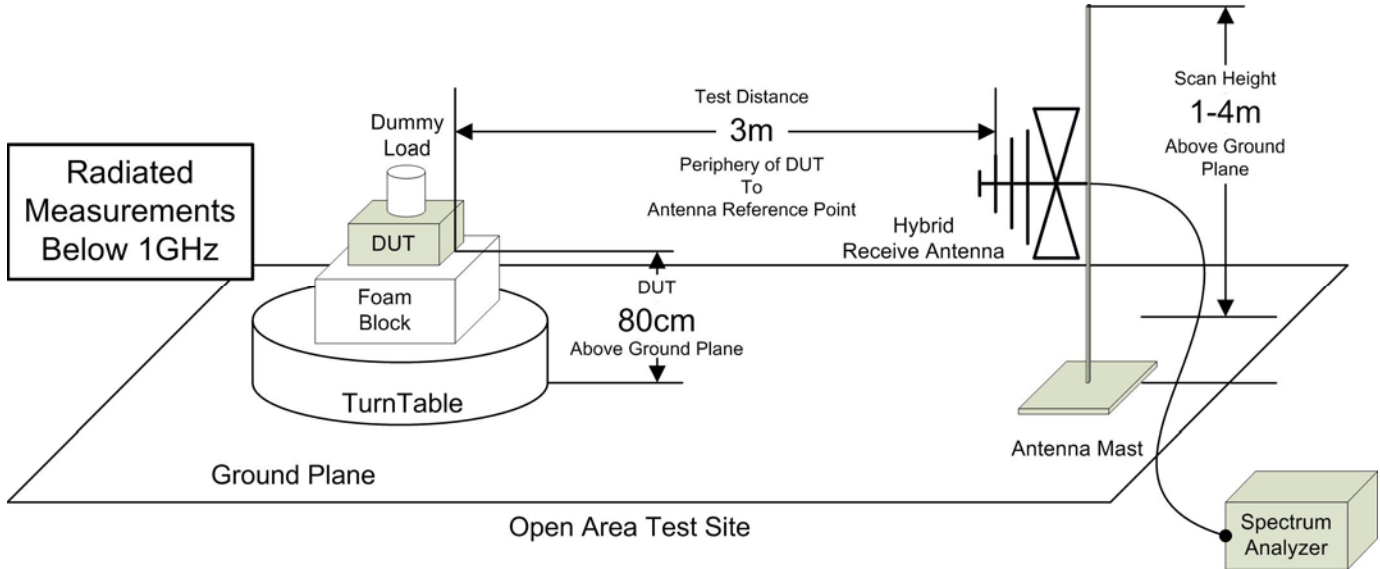


Figure A.5 – Test Setup Radiated Emissions Measurements 30-1000MHz

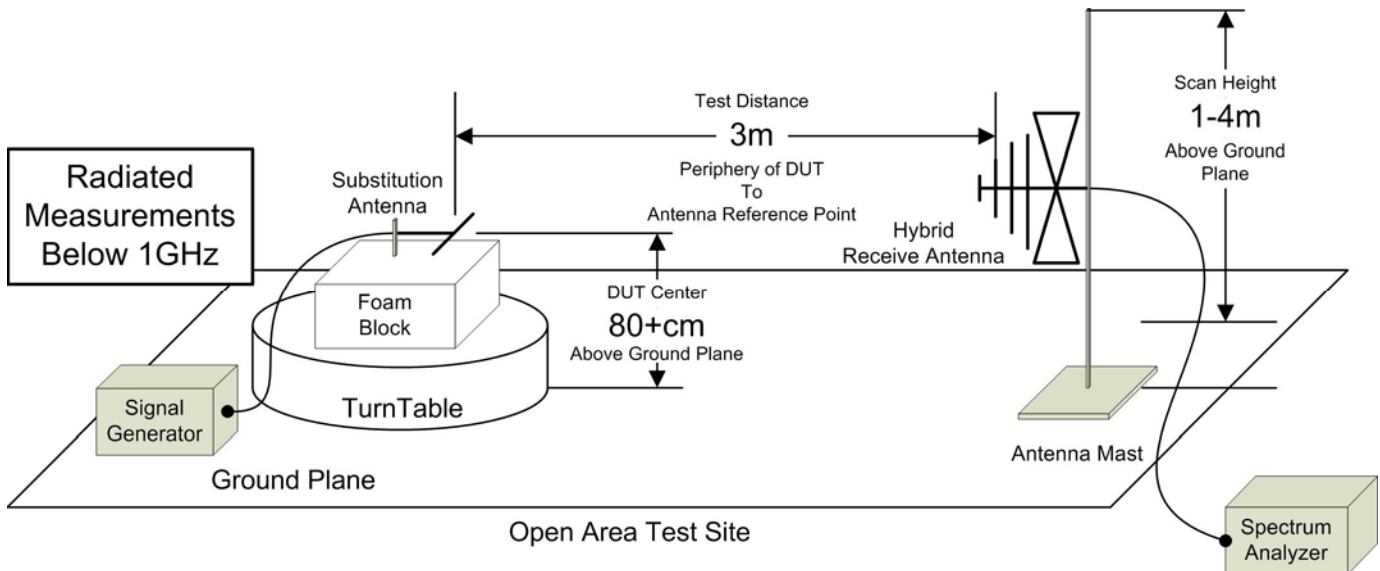
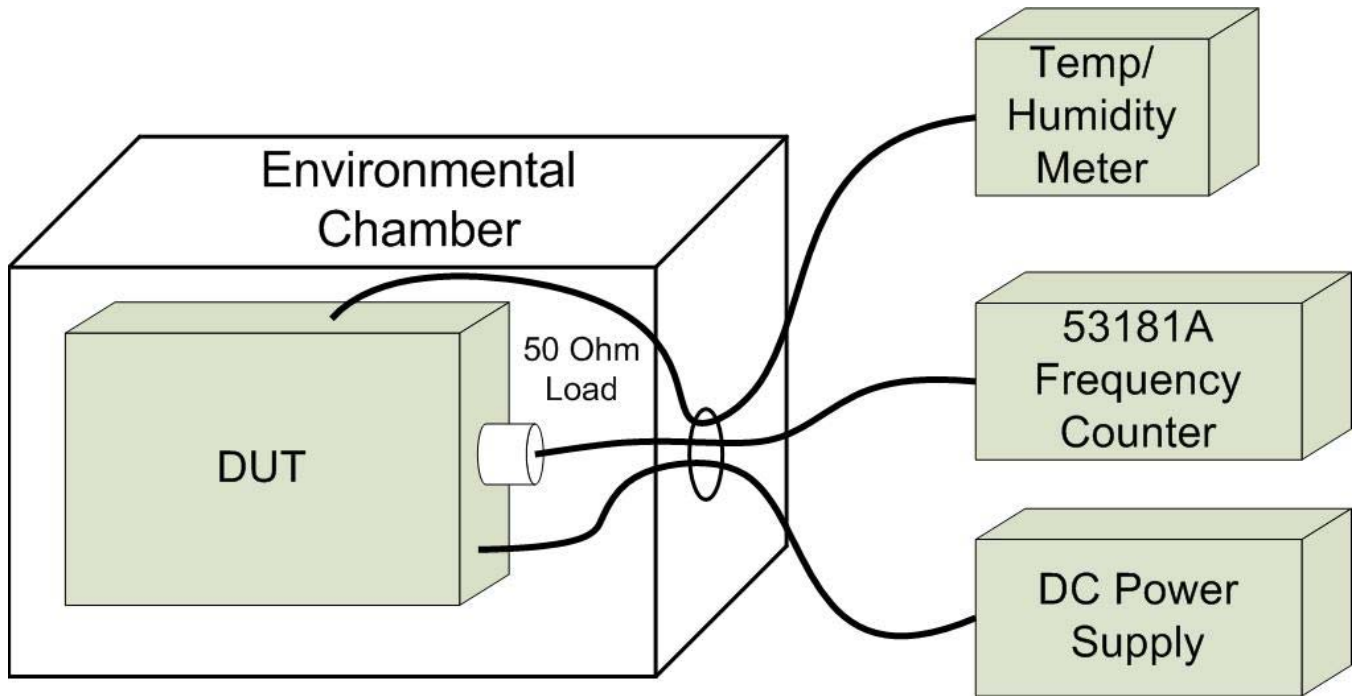


Table A.4 – Setup - Frequency Stability Measurement Equipment

Equipment List			
Asset Number	Manufacturer	Model Number	Description
n/a	ESPEC	ECT-2	Environmental Chamber
00003	HP	53181A	Frequency Counter
n/a	HP	E3611A	Power Supply
00234	VWR	61161-378	Temp/Humidity Meter

Figure A.6 – Test Setup Frequency Stability Measurements



APPENDIX B – EQUIPMENT LIST AND CALIBRATION

Equipment List						Last Calibrated	Calibration Interval	Calibration Due
(*)	Asset Number	Manufacturer	Model Number	Serial Number	Description			
*	00050	Chase	CBL-6111A	1607	Bilog Antenna	3 Jan 2019	Triennial	3 Jan 2022
*	00085	EMCO	6502	9203-2724	Loop Antenna	11 Jun 2019	Triennial	11 Jun 2022
*	00333	HP	85685A	3010A01095	RF Preselector	23 Jun 2020	Triennial	30 Jun 2023
*	00049	HP	85650A	2043A00162	Quasi-peak Adapter	23 Jun 2020	Triennial	23 Jun 2023
*	00051	HP	8566B	2747A05510	Spectrum Analyzer	23 Jun 2020	Triennial	23 Jun 2023
*	00223	HP	8901A	3749A07154	Modulation Analyzer	27 Dec 2017	Triennial	27 Dec 2020
*	00224	HP	8903B	3729A18691	Audio Analyzer	28 Dec 2017	Triennial	28 Dec 2020
*	00241	R&S	FSU40	100500	Spectrum Analyzer	15 May 2018	Triennial	15 May 2021
*	00005	HP	8648D	3847A00611	Signal Generator	23 Jun 2020	Triennial	23 Jun 2023
*	00003	HP	53181A	3736A05175	Frequency Counter	23 Jun 2020	Triennial	23 Jun 2023
*	00250	Circuit Test	DMR-1800	TE182	Digital Multi-Meter - DVM	23 Jun 2020	Triennial	23 Jun 2023
*	00071	EMCO	2090	9912-1484	Multi-Device Controller	n/a	n/a	n/a
*	00072	EMCO	2075	0001-2277	Mini-mast	n/a	n/a	n/a
*	00073	EMCO	2080	0002-1002	Turn Table	n/a	n/a	n/a
*	00081	ESPEC	ECT-2	0510154-B	Environmental Chamber	NCR	n/a	CNR
*	00234	VWR	61161-378	140320430	Temp/Humidity Meter	New	Triennial	New
*	00201	HP	E3611A	KR83015294	DC Power Supply	COU	n/a	COU
*	00064	NARDA	3020A	n/a	Bi-Directional Coupler	COU	n/a	COU
*	00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a	COU
*	00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable	COU	n/a	COU
*	00264	Koaxis	KP10-7.00M-TD	264	7m Armoured Cable	COU	n/a	COU
*	00275	TMS	LMR400	n/a	25m Cable	COU	n/a	COU
*	00276	TMS	LMR400	n/a	4m Cable	COU	n/a	COU
*	00277	TMS	LMR400	n/a	4m Cable	COU	n/a	COU
*	00278	TILE	34G3	n/a	TILE Test Software	NCR	n/a	NCR
Rented Equipment								

* Used during the course of this investigation
 NCR: No Calibration Required
 COU: Calibrate On Use

APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY

CISPR 16-4 Measurement Uncertainty (U_{LAB})	
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence interval using a coverage factor of k=2	
30MHz - 200MHz	
$U_{LAB} = 5.14dB$ $U_{CISPR} = 6.3dB$	
200MHz - 1000MHz	
$U_{LAB} = 5.90dB$ $U_{CISPR} = 6.3dB$	
1GHz - 6GHz	
$U_{LAB} = 4.80dB$ $U_{CISPR} = 5.2dB$	
6GHz - 18GHz	
$U_{LAB} = 5.1dB$ $U_{CISPR} = 5.5dB$	
If the calculated uncertainty U_{lab} is less than U_{CISPR} then:	
1	Compliance is deemed to occur if NO measured disturbance exceeds the disturbance limit
2	Non-Compliance is deemed to occur if ANY measured disturbance EXCEEDS the disturbance limit
If the calculated uncertainty U_{lab} is greater than U_{CISPR} then:	
3	Compliance is deemed to occur if NO measured disturbance, increased by ($U_{lab} - U_{CISPR}$), exceeds the disturbance limit
4	Non-Compliance is deemed to occur if ANY measured disturbance, increased by ($U_{lab} - U_{CISPR}$), EXCEEDS the disturbance limit