



Test Report Serial Number:

45461712 R1.0

Test Report Date:

2 March 2022

Project Number:

1576

EMC Test Report - New Filing

Applicant:



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

FCC ID:

2AEOCPC209

Product Model Number / HVIN

RANDY II FCC

IC Registration Number

Product Name / PMN

RANDY II FCC

In Accordance With:

FCC 47 CFR Part 95 Subpart D, Part 15 Subpart B
Licensed Non-Broadcast Station Transmitter (TNB)

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



FCC Registration: CA3874

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Table of Contents

1.0 DOCUMENT CONTROL.....	4
2.0 CLIENT AND DUT INFORMATION.....	5
3.0 SCOPE.....	6
4.0 TEST RESULT SUMMARY.....	7
5.0 NORMATIVE REFERENCES.....	9
6.0 FACILITIES AND ACCREDITATIONS.....	10
7.0 CONDUCTED POWER.....	11
8.0 MODULATION RESPONSE.....	14
9.0 OCCUPIED BANDWIDTH AND EMISSION MASKS.....	20
10 CONDUCTED OUT OF BAND SPURIOUS EMISSIONS.....	22
11.0 RADIATED SPURIOUS TX EMISSIONS.....	24
12.0 RECEIVER RADIATED EMISSIONS - DOC.....	27
13.0 FREQUENCY STABILITY.....	29
APPENDIX A – TEST SETUP DRAWINGS AND EQUIPMENT.....	32
APPENDIX B – EQUIPMENT LIST AND CALIBRATION.....	37
APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY.....	38
END OF REPORT.....	39

Table of Figures

Figure A.1 – Test Setup Conducted Measurements.....	32
Figure A.2 – Test Setup Audio Modulation Response Measurements.....	33
Figure A.3 – Test Setup Radiated Emissions Measurements Below 30MHz.....	34
Figure A.4 – Test Setup Radiated Emissions Measurements 30-1000MHz.....	35
Figure A.5 – Test Setup Radiated Emissions Measurements 30-1000MHz.....	35
Figure A.6 – Test Setup Frequency Stability Measurements.....	36

Table of Plots

Plot 8.1 – Audio Frequency and Low Pass Filter Response - AM.....	16
Plot 8.2 – Audio Frequency and Low Pass Filter Response - FM.....	17
Plot 8.3 – Modulation Limiting Response (AM).....	18
Plot 8.4 – Modulation Limiting Response (FM).....	19

Table of Tables

<i>Table 7.1 – Summary of Conducted Power Measurements (RMS)</i>	12
<i>Table 7.2 – Compliance to §2.1033(c)(8) – AM</i>	13
<i>Table 7.3 – Compliance to §2.1033(c)(8) – FM</i>	13
<i>Statement - Compliance to §95.977</i>	15
<i>Table 9.1 - Summary of Occupied Bandwidth and Emission Mask Results</i>	21
<i>Table 10.1 – Summary of Conducted Out of Band Emissions</i>	23
<i>Table 11.1 – Summary of Radiated Spurious Emissions - AM</i>	25
<i>Table 11.2 – Summary of Radiated Spurious Emissions - FM</i>	26
<i>Table 12.1 – Summary of Receiver Radiated Emissions (AM)</i>	28
<i>Table 12.2 – Summary of Receiver Radiated Emissions (FM)</i>	28
<i>Table 13.1 – Summary of Frequency Stability Results (AM)</i>	30
<i>Table 13.2 – Summary of Frequency Stability Results (FM)</i>	31
<i>Table A.1 – Setup - Conducted Measurements Equipment</i>	32
<i>Table A.2 – Setup - Audio Modulation Equipment</i>	33
<i>Table A.3 – Setup - Radiated Emissions Equipment</i>	34
<i>Table A.4 – Setup - Frequency Stability Measurement Equipment</i>	36

1.0 DOCUMENT CONTROL

Revision History				
Samples Tested By:	Art Voss, P.Eng., Trevor Whillock	Date(s) of Evaluation:	23 - 29 December 2020	
Samples Tested By:	Art Voss, P.Eng., Trevor Whillock	Date(s) of Evaluation:	13 October 2021	
Samples Tested By:	Art Voss, P.Eng.	Date(s) of Evaluation:	7 - 21 February, 2022	
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	Draft	n/a	Art Voss	22 February 2022
1.0	Initial Release	n/a	Art Voss	2 March 2022

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
DUT Information	
Device Identifier(s):	FCC ID: 2AEOCPC209
	IC ID:
Device Type:	Portable Handheld & Mobile AM/FM CBRS Transceiver
Device Model(s) / HVIN:	RANDY II FCC
Device Marketing Name / PMN:	RANDY II FCC
Firmware Version ID Number / FVIN:	-
Host Marketing Name / HMN:	-
Test Sample Serial No.:	T/A Sample #1
Equipment Class (FCC):	Licensed Non-Broadcast Transmitter Held to Face (TNF)
Transmit Frequency Range:	26.965 - 27.405 MHz
Test Channels:	40
Manuf. Max. Rated Output Power:	1W & 4W, (30dBm & 36dBm)
Manuf. Max. Rated BW/Data Rate:	8.0kHz
Antenna Make and Model:	Detachable Flex or External Whip
Antenna Type and Gain:	0dBi Typical, 3dBi Max
Modulation:	AM, FM
Mode:	Simplex
Emission Designator:	See Section 8.0
DUT Power Source:	7.4VDC Rechargeable Li-Ion
DUT Dimensions [HxWxD] (mm)	152 x 66.5 x 37
Deviation(s) from standard/procedure:	None
Modification of DUT:	None

3.0 SCOPE

Preface:

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.

Device:

The RANDY II FCC is Portable Handheld and Mobile 1W/4W, AM or FM CBRS transceiver. With a detachable antenna, it can be configured as a stand-alone portable handheld device or connected to an external vehicular mounted antenna for mobile applications. This *Equipment* can transmit at a user configurable 1W or 4W transmitter power. The RANDY II FCC is identical in all respects to the RANDY FCC (AM only), FCC ID: 2AEOCPC207 with the exception that the FM transceiver section of the RANDY FCC was not enabled for North American operation. The RANDY FCC was evaluated for EMC and SAR in December of 2020 and the results of those evaluations are incorporated into the EMC and SAR reports for this filing. The RANDY II FCC is also identical in all respects to the RANDY III (AM and FM) which is the European variant. The RANDY III was evaluated for SAR in October 2021 and the results of that evaluation appear in the SAR report for this filing.

Certification Requirement:

In accordance with FCC 47 CFR Part 2, Subpart J, this *Equipment* is subject to certification to FCC 47 CFR Part 95, Subpart D. In addition, this *Equipment* is subject to a Suppliers Declaration of Conformity (SDoC) in accordance with FCC 47 CFR §15.101.

RF Exposure Requirement:

As per FCC 47 CFR §2.1091, §2.1093, RF Exposure evaluations (SAR - Portable, MPE - Mobile) are required for this *Equipment*. This *Equipment* is capable of Voice Activated Transmission (VOX), a 75% transmit duty factor applies.

Application:

This is an application for a new FCC certification.

4.0 TEST RESULT SUMMARY

TEST SUMMARY					
Section	Description of Test	Procedure Reference	Applicable Rule Part(s) FCC	Test Date	Result
7.0	Conducted Power (Fundamental)	ANSI/TIA/EIA-382-A ANSI C63.26-2015 ANSI/TIA-603-E	§2.1046 §2.1033(c)(8) §95.967	23 Dec 2020 7 Feb 2022	Complies
8.0	Modulation Response	ANSI/TIA/EIA-382-A ANSI C63.26-2015 ANSI/TIA-603-E	§2.1047 §95.975 §95.977	23 Dec 2020 7 Feb 2022	Complies
9.0	Occupied Bandwidth	ANSI/TIA/EIA-382-A ANSI C63.26-2015 ANSI/TIA-603-E	§2.1049 §95.973	24 Dec 2020 7 Feb 2022	Complies
	Emission Mask	ANSI/TIA/EIA-382-A ANSI C63.26-2015 ANSI/TIA-603-E	§2.1049 §95.979	24 Dec 2020 7 Feb 2022	Complies
10.0	Conducted TX Spurious Emissions	ANSI/TIA/EIA-382-A ANSI C63.26-2015 ANSI/TIA-603-E	§2.1051 §95.979	24 Dec 2020 7 Feb 2022	Complies
11.0	Radiated TX Spurious Emissions	ANSI/TIA/EIA-382-A ANSI C63.26-2015 ANSI C63.4:2014 ANSI C63.26-2015	§2.1053 §95.979	24 Dec 2020 21 Feb 2022	Complies
12.0	Radiated Receiver Emissions	ANSI/TIA/EIA-382-A ANSI C63.4:2014 ANSI C63.26-2015 ANSI/TIA-603-E	§15 Subpart B §15.109(d)	23 Dec 2020 21 Feb 2022	Complies
13.0	Frequency Stability	ANSI/TIA/EIA-382-A ANSI C63.26-2015 ANSI/TIA-603-E	§2.1055 §95.965	29 Dec 2020 15 Feb 2022	Complies

Test Station Day Log

Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
23 Dec 2020	22.0	17	103.9	EMC	7, 8
23 Dec 2020	-6.0	93	103.9	OATS	11, 12
24 Dec 2020	21.0	17	103.1	EMC	9, 10
29 Dec 2020	19.0	21	102.8	TC	13
7 Feb 2022	22.0	17	102.3	EMC	7,8,9,10,
21 Feb 2022	-4.0	59	102.1	OATS	11, 12
29 Dec 2020	15.2	26	101.3	TC	13

EMC - EMC Test Bench

OATS - Open Area Test Site

LISN - LISN Test Area

IMM - Immunity Test Area

SAC - Semi-Anechoic Chamber

TC - Temperature Chamber

ESD - ESD Test Bench

RI - Radiated Immunity Chamber

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.



Art Voss, P.Eng.
Technical Manager
Celltech Labs Inc.

22 February 2022

Date



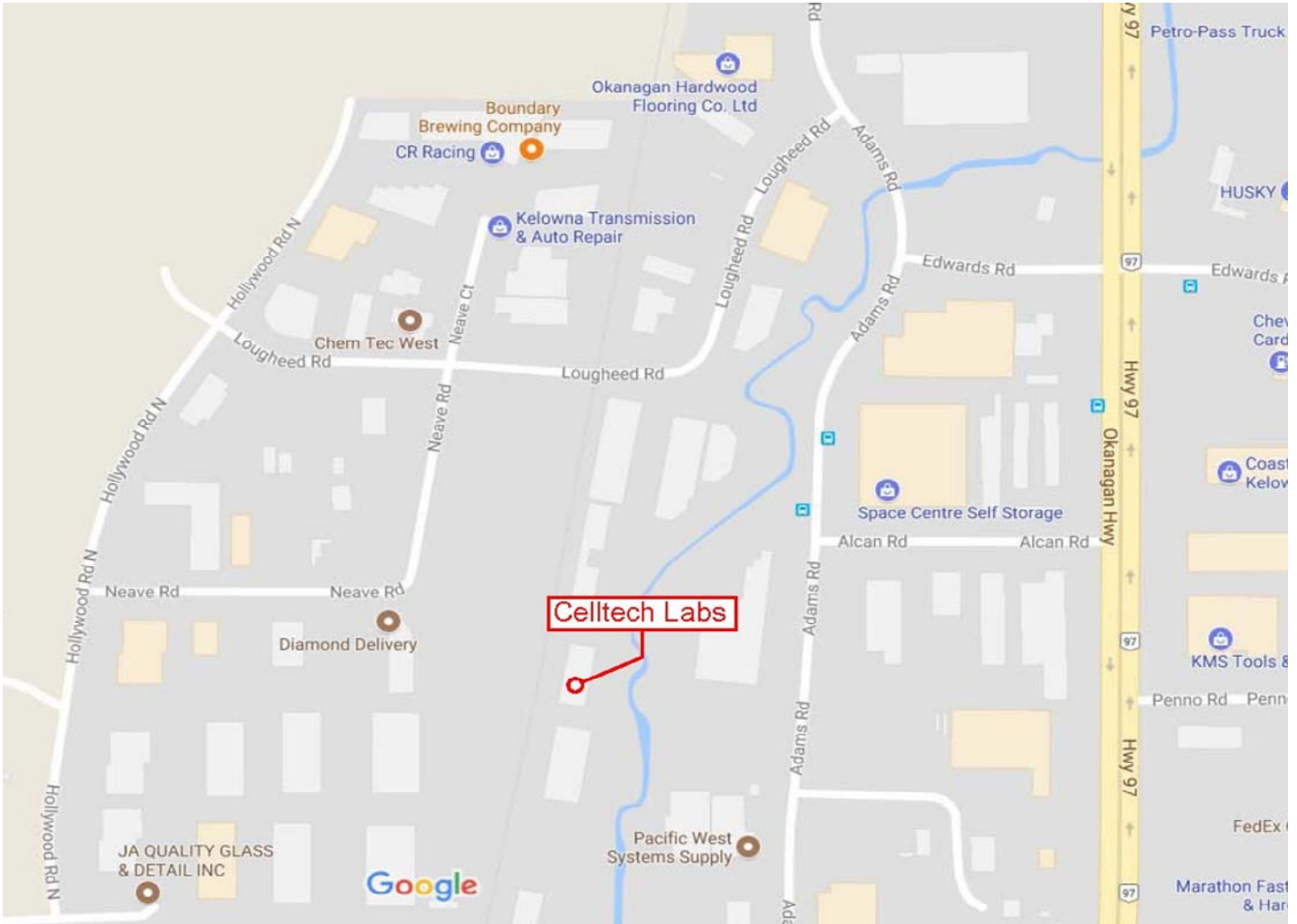
5.0 NORMATIVE REFERENCES

Normative References	
ISO/IEC 17025:2017	General requirements for the competence of testing and calibration laboratories
ANSI C63.4-2014	American National Standard of Procedures for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electric and Electronic Equipment in the Range of 9kHz to 40GHz
ANSI C63.26-2015	American National Standard of Procedures for Compliance Testing of Transmitters Used in Licensed Radio Services
ANSI/TIA-382-A	Minimum Standards - Citizens Band Radio Service Amplitude Modulated (AM) Transceivers Operating in the 27 MHz Band (Revision of EIA-382)
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (Revision of TIA-603-D)
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 15: Radio Frequency Devices Subpart B: Unintentional Radiators
CFR	Code of Federal Regulations Title 47: Telecommunication Part 95: Personal Radio Service Subpart D: Citizens Band Radio Service (CBRS)

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

The facilities used to evaluate this device outlined in this report are located at 21-364 Loughheed 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 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 EIA/TIA-382-A, EIA/TIA-603-E
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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;
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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.
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Test Setup	Appendix A - Figure A.1
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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.

See Appendix D for Measurement Plots

Table 7.1 – Summary of Conducted Power Measurements (RMS)

Conducted Power Measurement Results:								
Channel Number	Frequency (MHz)	Power Setting	Modulation	Measured Power [P _{Meas}] (dBm)	Measured Power [P _{Meas}] (W)	Limit [P _{Lim}] (dBm)	Limit [P _{Lim}] (W)	Margin (dB)
1	26.97	1W	AM	29.850	0.97	36	4.0	6.2
19	27.19			29.990	1.00			6.0
40	27.41			30.080	1.02			5.9
1	26.97		FM	29.530	0.90			6.5
19	27.19			29.710	0.94			6.3
40	27.41			29.940	0.99			6.1
1	26.97	4W	AM	35.300	3.39			0.7
19	27.19			35.460	3.52			0.5
40	27.41			35.540	3.58			0.5
1	26.97		FM	35.700	3.72			0.3
19	27.19			35.860	3.85			0.1
40	27.41			36.000	3.98			0.0
Result:								Complies

Conducted Margin = $P_{\text{Limit}} - P_{\text{Meas}}$

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

FCC CFR 47 §2.1033(c)(8): Power to Transmitter (AM - 1W):	
Measured Receiver Current:	IRx = 0.12A
Measured Total Current:	ITx = 0.37A
Transmitter Current (ITx - IRx):	IXmitter = 0.25A
Power to Transmitter:	(13.8DC)(0.25) = 3.45W
Result:	Complies

FCC CFR 47 §2.1033(c)(8): Power to Transmitter (AM - 4W):	
Measured Receiver Current:	IRx = 0.12A
Measured Total Current:	ITx = 0.76A
Transmitter Current (ITx - IRx):	IXmitter = 0.64A
Power to Transmitter:	(13.8DC)(0.64) = 8.8W
Result:	Complies

Table 7.3 – Compliance to §2.1033(c)(8) – FM

FCC CFR 47 §2.1033(c)(8): Power to Transmitter (FM - 1W):	
Measured Receiver Current:	IRx = 0.12A
Measured Total Current:	ITx = 0.39A
Transmitter Current (ITx - IRx):	IXmitter = 0.27A
Power to Transmitter:	(13.8VDC)(0.27) = 3.72W
Result:	Complies

FCC CFR 47 §2.1033(c)(8): Power to Transmitter (FM - 4W):	
Measured Receiver Current:	IRx = 0.12A
Measured Total Current:	ITx = 0.79A
Transmitter Current (ITx - IRx):	IXmitter = 0.67A
Power to Transmitter:	(13.8DC)(0.57) = 9.2W
Result:	Complies

8.0 MODULATION RESPONSE

Test Conditions

Normative Reference FCC 47 CFR §2.1047, §95.975

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%.

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

Test Conditions

Normative Reference	FCC 47 CFR §2.1047, §95.975
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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%. (c) When emission type F3E is transmitted the peak frequency deviation shall not exceed ± 2 kHz.

Measurement Procedure

TIA-603-E	2.2.6 Audio Frequency Response 2.2.6.2.1 Constant deviation test method (300 Hz to 3000 Hz) a) Connect the equipment as illustrated. b) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 50 Hz to $\geq 15,000$ Hz. Turn the de-emphasis function off. c) Set the DMM to measure rms voltage. d) Adjust the transmitter per the manufacturer's procedure for full rated system deviation. e) Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation. f) Set the test receiver to measure rms deviation and record the deviation reading. g) Record the DMM reading as V_{REF} . h) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz. i) Vary the audio frequency generator output level until the deviation reading that was recorded in step f) is obtained. j) Record the DMM reading as V_{FREQ} . k) Calculate the audio frequency response at the present frequency as: audio frequency response = $20\text{Log}(V_{FREQ}/V_{REF})$
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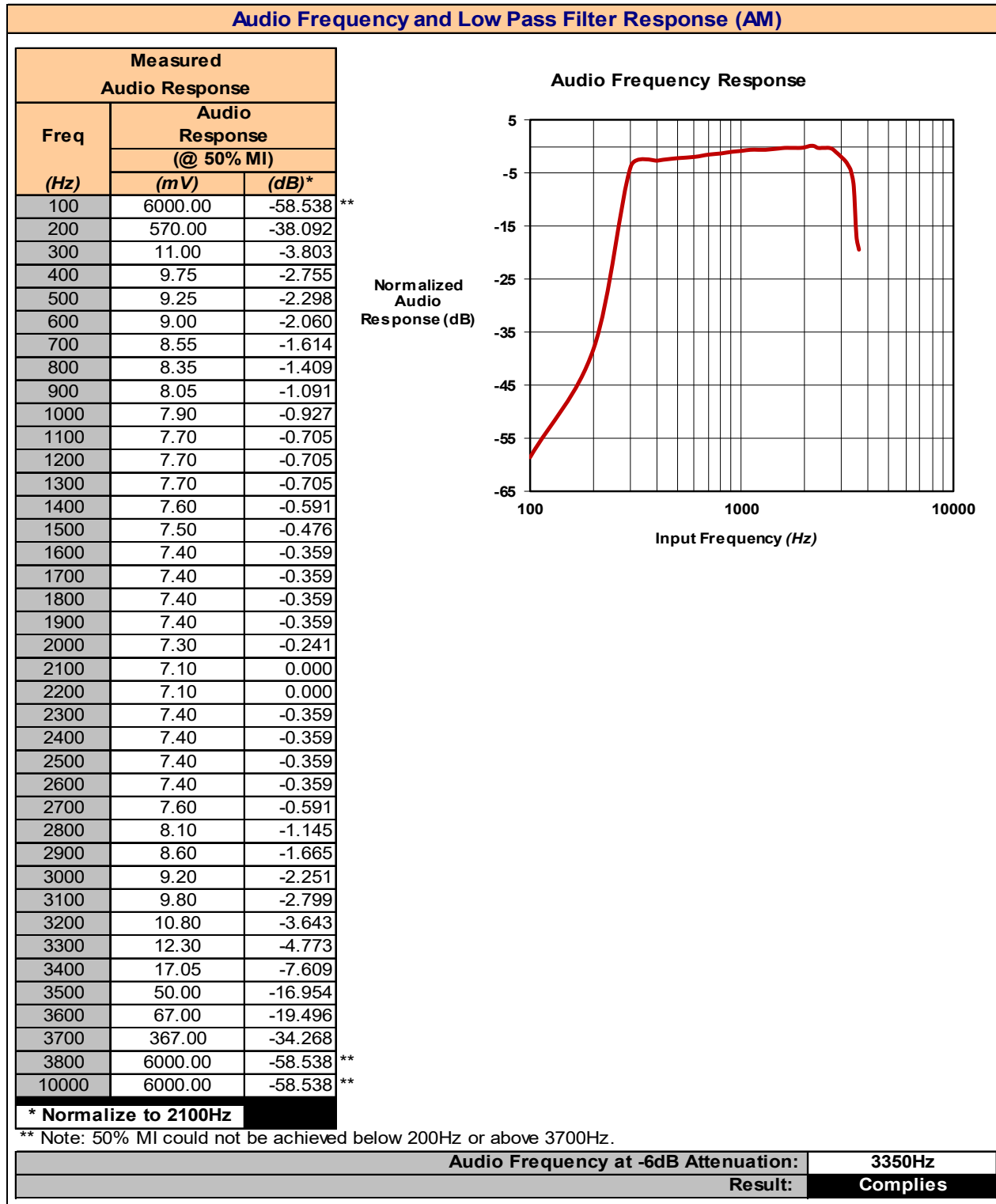
Statement - Compliance to §95.977

§95.977 CBRS tone transmissions.

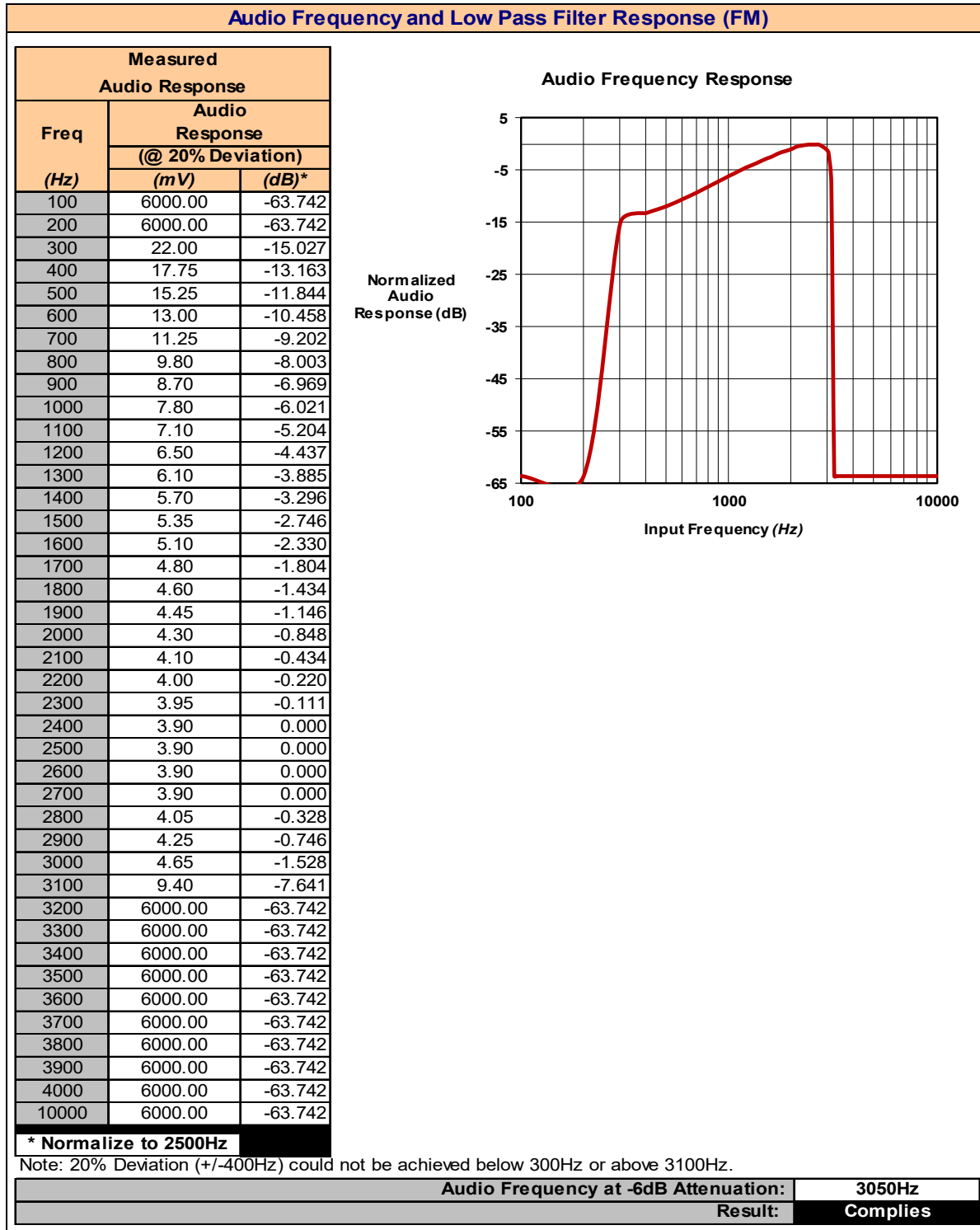
In addition to the tones permitted under §95.377, CBRS transmitter types may be designed to transmit brief tones to indicate the beginning or end of a transmission.

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.

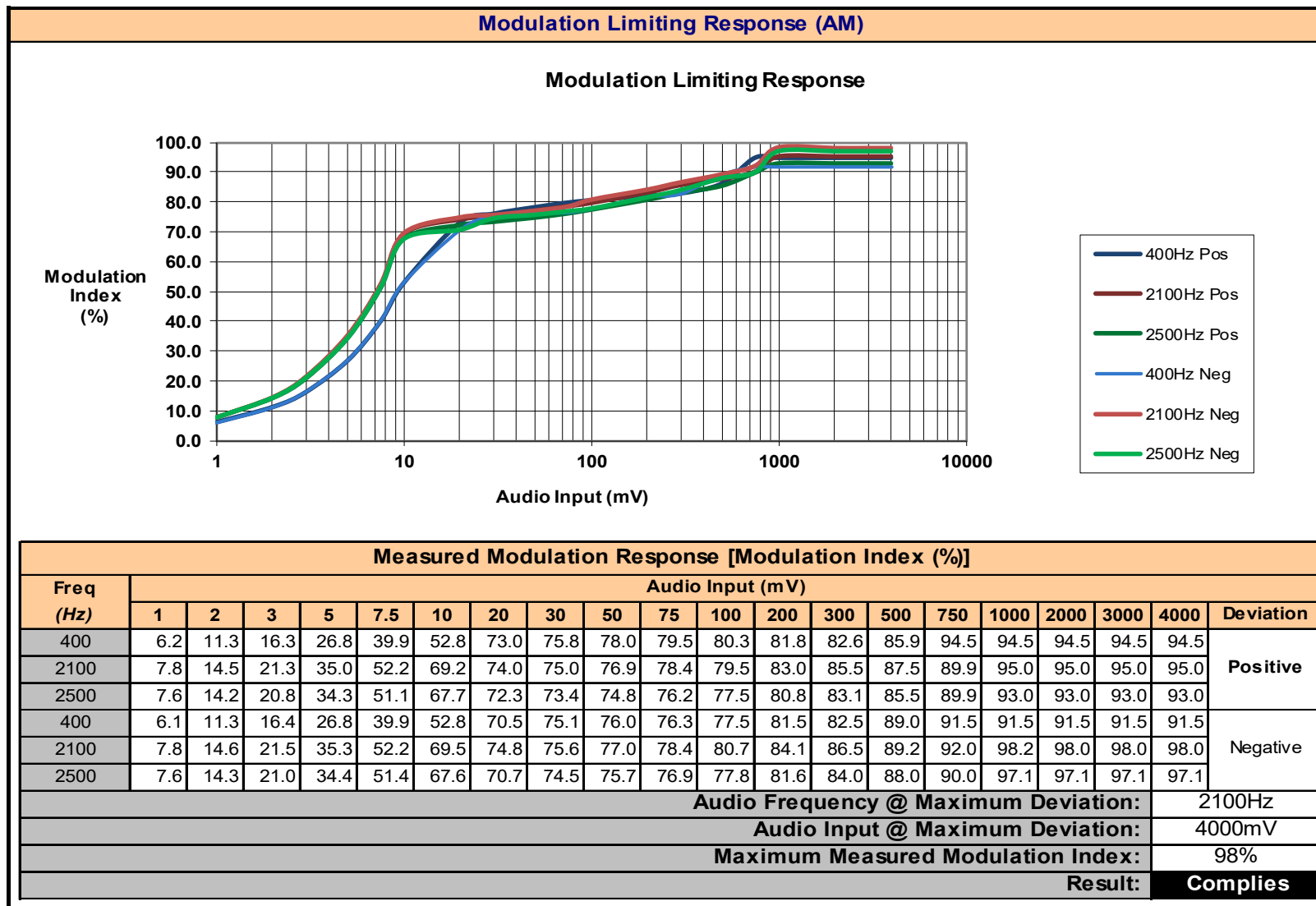
Plot 8.1 – Audio Frequency and Low Pass Filter Response - AM



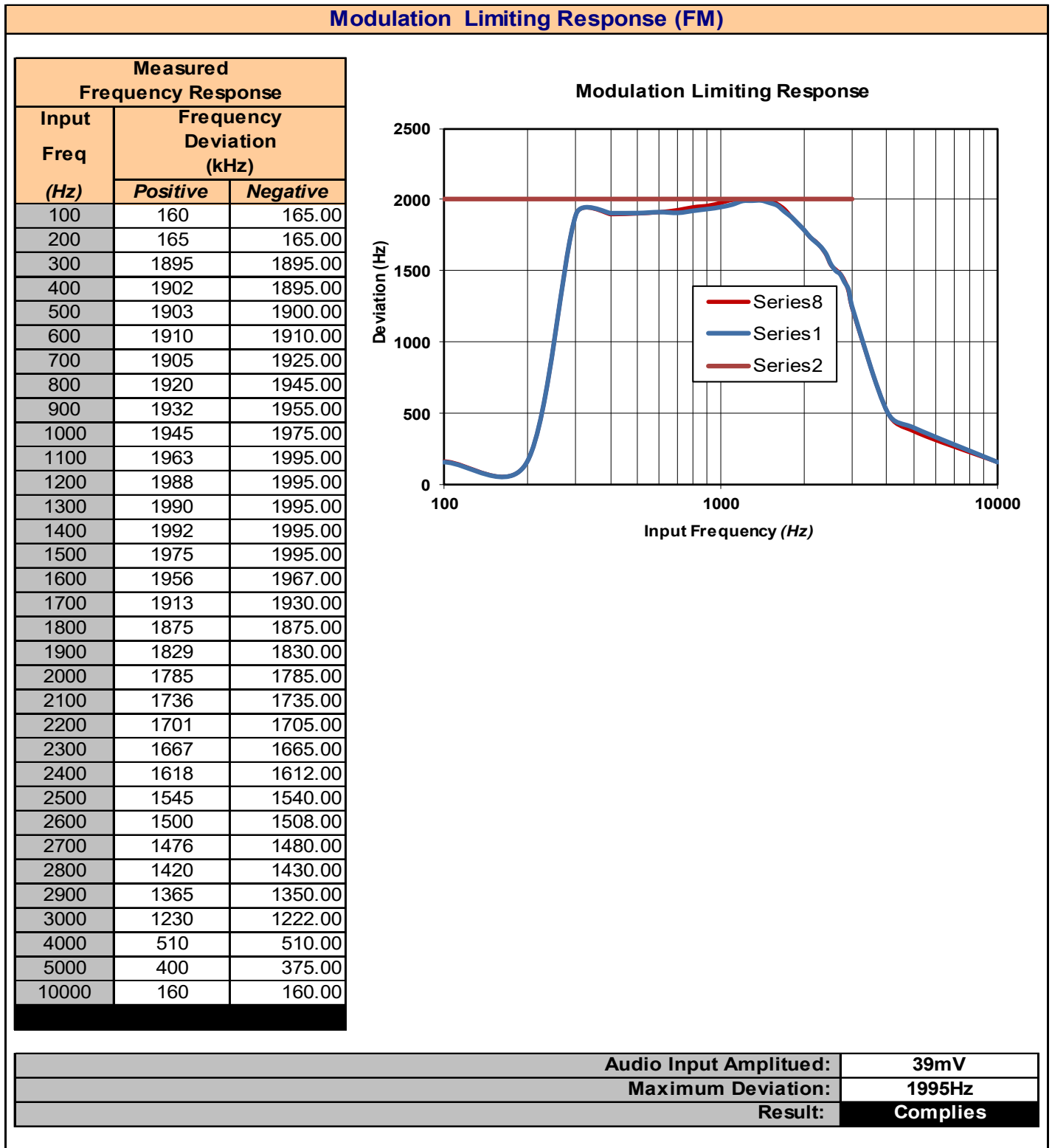
Plot 8.2 – Audio Frequency and Low Pass Filter Response - FM



Plot 8.3 – Modulation Limiting Response (AM)



Plot 8.4 – Modulation Limiting Response (FM)



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

See Appendix D for Measurement Plots

Table 9.1 - Summary of Occupied Bandwidth and Emission Mask Results

Occupied Bandwidth Results:						
Channel Number	Channel Frequency (MHz)	Power Setting	Modulation	Measured Occupied Bandwidth (kHz)	Emission Designator	Emissions Mask Results
1	26.965	1W	AM	5.40	5K40A3E	PASS
19	27.185			5.40	5K40A3E	PASS
40	27.405			5.40	5K40A3E	PASS
1	26.965		FM	5.45	5K45F3E	PASS
19	27.185			5.45	5K45F3E	PASS
40	27.405			5.43	5K43F3E	PASS
1	26.965	4W	AM	5.40	5K40A3E	PASS
19	27.185			5.40	5K40A3E	PASS
40	27.405			5.40	5K40A3E	PASS
1	26.965		FM	5.45	5K45F3E	PASS
19	27.185			5.43	5K43F3E	PASS
40	27.405			5.45	5K45F3E	PASS
Result:						Complies

10 CONDUCTED OUT OF BAND SPURIOUS EMISSIONS

Test Conditions

Normative Reference FCC 47 CFR §95.979

Limits

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.
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Measurement Procedure

TIA 382 21.2

Transmitter Conducted Spurious and Harmonic Emissions

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.

Test Setup

Appendix A

A.1

See Appendix D for Measurement Plots

Table 10.1 – Summary of Conducted Out of Band Emissions

Conducted Spurious Emissions Measurement Results:									
Channel Number	Frequency (MHz)	Power Setting	Modulation	Fundamental Power [P _{Fund}] (dBm)	Emission Frequency (MHz)	Measured Emission [P _{Meas}] (dBm)	Attenuation [Att] (dBm)	Limit (dB)	Margin (dB)
1	26.965	1W	AM	29.85	ND	ND	-	60.0	-
19	27.185			29.90	ND	ND	-		-
40	27.405			30.08	ND	ND	-		-
1	26.965		FM	29.53	53.85	-38.34	67.87		7.9
19	27.185			29.71	54.41	-38.28	67.99		8.0
40	27.405			29.94	54.81	-38.80	68.74		8.7
1	26.965	4W	AM	35.30	53.90	-27.24	62.54		2.5
19	27.185			35.46	54.31	-27.50	62.96		3.0
40	27.405			35.54	54.80	-28.03	63.57		3.6
1	26.965		FM	35.70	53.91	-33.06	68.76		8.8
19	27.185			35.86	54.37	-32.86	68.72		8.7
40	27.405			36.00	54.80	-32.65	68.65		8.7
Result:								Complies	

Attenuation [Att] = Fundamental Power [P_{Fund}] - Measured Emission [P_{meas}]

Margin = [Att] - Limit

ND = None Detected

No other emissions were detected

11.0 RADIATED SPURIOUS TX EMISSIONS

Test Conditions

Normative Reference FCC 47 CFR §95.979

Limits

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.
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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

See Appendix D for Measurement Plots

Table 11.1 – Summary of Radiated Spurious Emissions - AM

Summary of Radiated Tx Emissions (AM)											
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency	Measured Emission [E _{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L _C] (dB)	Amplifier Gain [G _A] (dB)	Corrected Emission [E _{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)	
9kHz - 30MHz	27.2	Front *	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
9kHz - 30MHz	27.2	Side *	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
9kHz - 30MHz	27.2	Front **	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
9kHz - 30MHz	27.2	Side **	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
30-1000MHz	27.2	Horizontal *	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
30-1000MHz	27.2	Vertical *	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
30-1000MHz	27.2	Horizontal **	82.38MHz	29.5	12.60	0.50	0.00 (3)	29.5 (2)	40.0	10.5	
30-1000MHz	27.2	Horizontal **	794.2MHz	39.20	28.30	0.75	0.00 (3)	39.2 (2)	46.0	6.8	
30-1000MHz	27.2	Vertical **	55.11MHz	29.00	11.30	0.50	0.00 (3)	29.0 (2)	40.0	11.0	
30-1000MHz	27.2	Vertical **	82.38MHz	29.50	12.60	0.50	0.00 (3)	29.5 (2)	40.0	10.5	
30-1000MHz	27.2	Vertical **	848.1MHz	41.50	29.50	0.75	0.00 (3)	41.5 (2)	46.0	4.5	
Results:									Complies		

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

See Appendix D for Measurement Plots

Table 11.2 – Summary of Radiated Spurious Emissions - FM

Summary of Radiated Tx Emissions (FM)											
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency	Measured Emission [E _{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L _c] (dB)	Amplifier Gain [G _A] (dB)	Corrected Emission [E _{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)	
9kHz - 30MHz	27.405	Front *	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
9kHz - 30MHz	27.405	Side *	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
9kHz - 30MHz	27.405	Front **	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
9kHz - 30MHz	27.405	Side **	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a	
30-1000MHz	27.405	Horizontal *	89.40 MHz	14.1	11.70	0.77	0.00 (3)	26.6 (2)	40.0	n/a	
30-1000MHz	27.405	Horizontal *	271.92 MHz	10.8	17.90	1.35	0.00 (3)	30.1 (2)	46.0	n/a	
30-1000MHz	27.405	Horizontal *	745.20 MHz	9.5	28.70	2.60	0.00 (3)	40.8 (2)	46.0	10.5	
30-1000MHz	27.405	Horizontal *	794.20 MHz	8.3	28.30	2.60	0.00 (3)	39.2 (2)	46.0	6.8	
30-1000MHz	27.405	Vertical *	856.50 MHz	10.4	29.50	2.78	0.00 (3)	42.7 (2)	46.0	11.0	
30-1000MHz	27.405	Horizontal **	89.40 MHz	9.8	13.40	0.77	0.00 (3)	24.0 (2)	43.5	10.5	
30-1000MHz	27.405	Horizontal **	103.44 MHz	14.5	15.40	0.99	0.00 (3)	30.9 (2)	43.5	4.5	
30-1000MHz	27.405	Horizontal **	136.11 MHz	7.1	16.60	0.99	0.00 (3)	24.6 (2)	43.5	n/a	
30-1000MHz	27.405	Horizontal **	155.55 MHz	34.6	15.80	0.99	0.00 (3)	51.4 (2)	43.5	n/a	
30-1000MHz	27.405	Horizontal **	155.82 MHz	34.3	15.80	0.99	0.00 (3)	51.0 (2)	43.5	10.5	
30-1000MHz	27.405	Horizontal **	156.09 MHz	11.1	15.70	0.99	0.00 (3)	27.8 (2)	43.5	6.8	
30-1000MHz	27.405	Horizontal **	244.65 MHz	11.3	16.80	1.35	0.00 (3)	29.4 (2)	46.0	11.0	
30-1000MHz	27.405	Horizontal **	244.92 MHz	9.5	16.80	1.35	0.00 (3)	27.7 (2)	46.0	10.5	
30-1000MHz	27.405	Horizontal **	352.50 MHz	9.1	19.50	1.64	0.00 (3)	30.3 (2)	46.0	4.5	
30-1000MHz	27.405	Horizontal **	353.20 MHz	9.5	19.50	1.64	0.00 (3)	30.7 (2)	46.0	n/a	
30-1000MHz	27.405	Horizontal **	407.10 MHz	13.0	21.50	1.91	0.00 (3)	36.4 (2)	46.0	n/a	
30-1000MHz	27.405	Horizontal **	407.80 MHz	13.5	21.50	1.91	0.00 (3)	36.9 (2)	46.0	10.5	
30-1000MHz	27.405	Horizontal **	878.90 MHz	8.1	29.30	2.78	0.00 (3)	40.1 (2)	46.0	6.8	
30-1000MHz	27.405	Horizontal **	886.60 MHz	7.4	29.10	2.78	0.00 (3)	39.2 (2)	46.0	11.0	
30-1000MHz	27.405	Vertical **	128.01 MHz	8.8	16.70	0.99	0.00 (3)	26.5 (2)	43.5	10.5	
30-1000MHz	27.405	Vertical **	139.62 MHz	8.6	16.50	0.99	0.00 (3)	26.1 (2)	43.5	4.5	
30-1000MHz	27.405	Vertical **	139.89 MHz	6.7	16.50	0.99	0.00 (3)	24.2 (2)	43.5	n/a	
30-1000MHz	27.405	Vertical **	407.10 MHz	5.4	21.50	1.91	0.00 (3)	28.8 (2)	46.0	n/a	
30-1000MHz	27.405	Vertical **	407.80 MHz	9.4	21.50	1.91	0.00 (3)	32.8 (2)	46.0	10.5	
30-1000MHz	27.405	Vertical **	867.70 MHz	7.9	29.40	2.78	0.00 (3)	40.1 (2)	46.0	6.8	
30-1000MHz	27.405	Vertical **	884.50 MHz	8.2	29.20	2.78	0.00 (3)	40.1 (2)	46.0	11.0	
30-1000MHz	27.405	Vertical **	885.20 MHz	3.6	29.10	2.78	0.00 (3)	35.5 (2)	46.0	10.5	
30-1000MHz	27.405	Vertical **	926.50 MHz	3.9	30.00	2.92	0.00 (3)	36.8 (2)	46.0	4.5	
Results:									Complies		

- (1) No Emissions Detected (ND) above ambient or within 20dB of the limit
(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
(3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

12.0 RECEIVER RADIATED EMISSIONS - DOC

Test Procedure

Normative Reference	FCC 47 CFR §15.109 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: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m
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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.

See Appendix D for Measurement Plots

Table 12.1 – Summary of Receiver Radiated Emissions (AM)

Summary of Radiated Tx Emissions (AM)										
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency	Measured Emission [E _{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L _C] (dB)	Amplifier Gain [G _A] (dB)	Corrected Emission [E _{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)
9kHz - 30MHz	27.405	Front	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
9kHz - 30MHz	27.405	Side	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
30-1000MHz	27.405	Horizontal	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
30-1000MHz	27.405	Vertical	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
Results:									Complies	

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

See Appendix D for Measurement Plots

Table 12.2 – Summary of Receiver Radiated Emissions (FM)

Summary of Radiated Tx Emissions FM)										
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency	Measured Emission [E _{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L _C] (dB)	Amplifier Gain [G _A] (dB)	Corrected Emission [E _{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)
9kHz - 30MHz	27.405	Front	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
9kHz - 30MHz	27.405	Side	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
30-1000MHz	27.405	Horizontal	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
30-1000MHz	27.405	Vertical	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	n/a
Results:									Complies	

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

13.0 FREQUENCY STABILITY

Test Conditions

Normative Reference	FCC 47 CFR §2.1055, §95.965, RSS-Gen, ANSI C63.10
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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

Table 13.1 – Summary of Frequency Stability Results (AM)

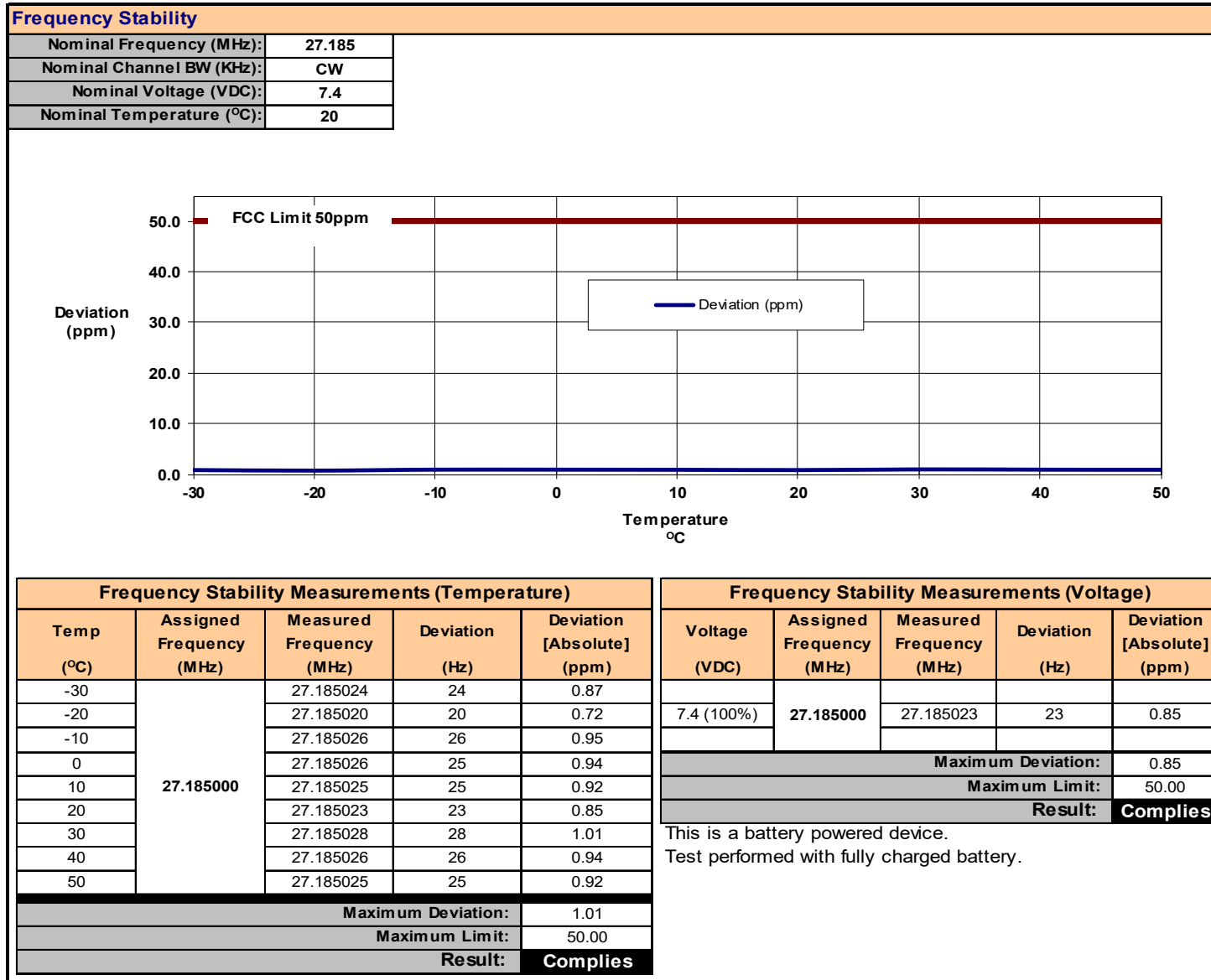
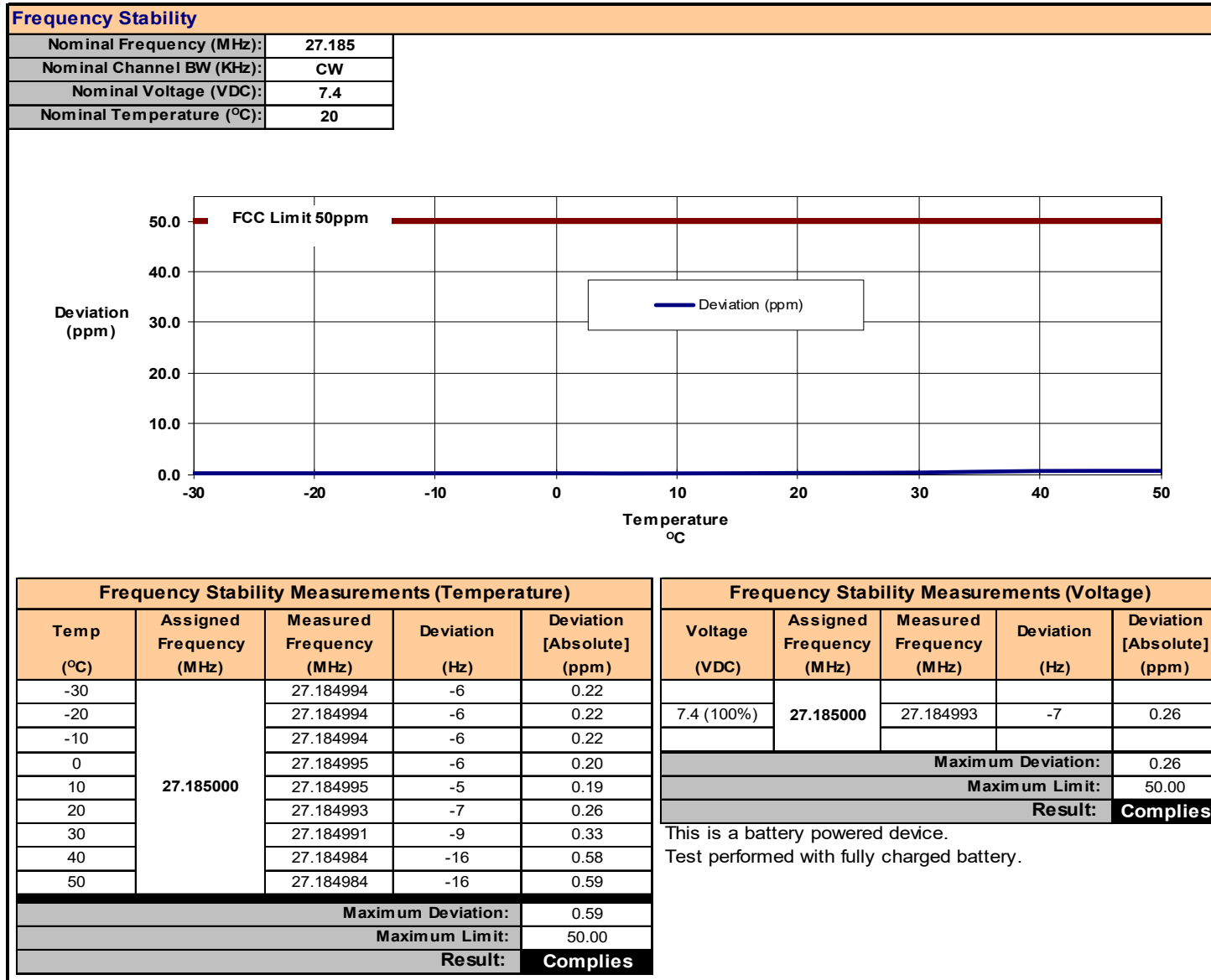


Table 13.2 – Summary of Frequency Stability Results (FM)



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

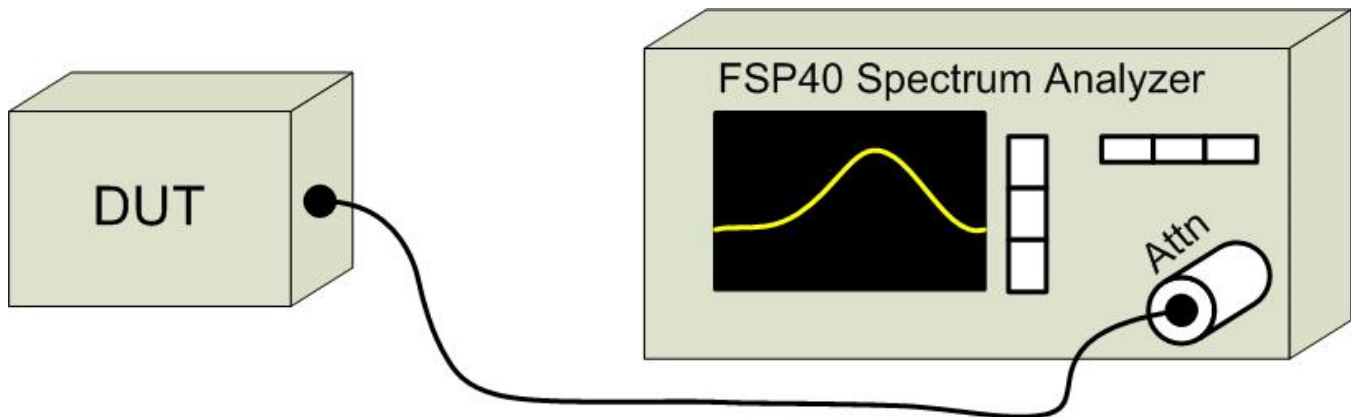


Table A.2 – Setup - Audio Modulation Equipment

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

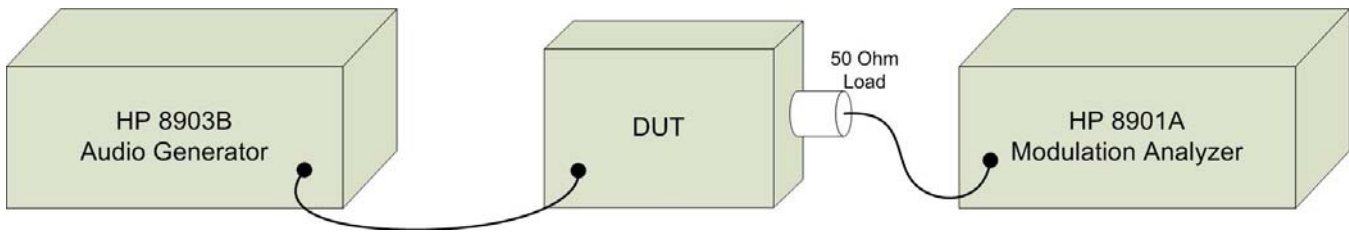


Table A.3 – Setup - Radiated Emissions Equipment

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

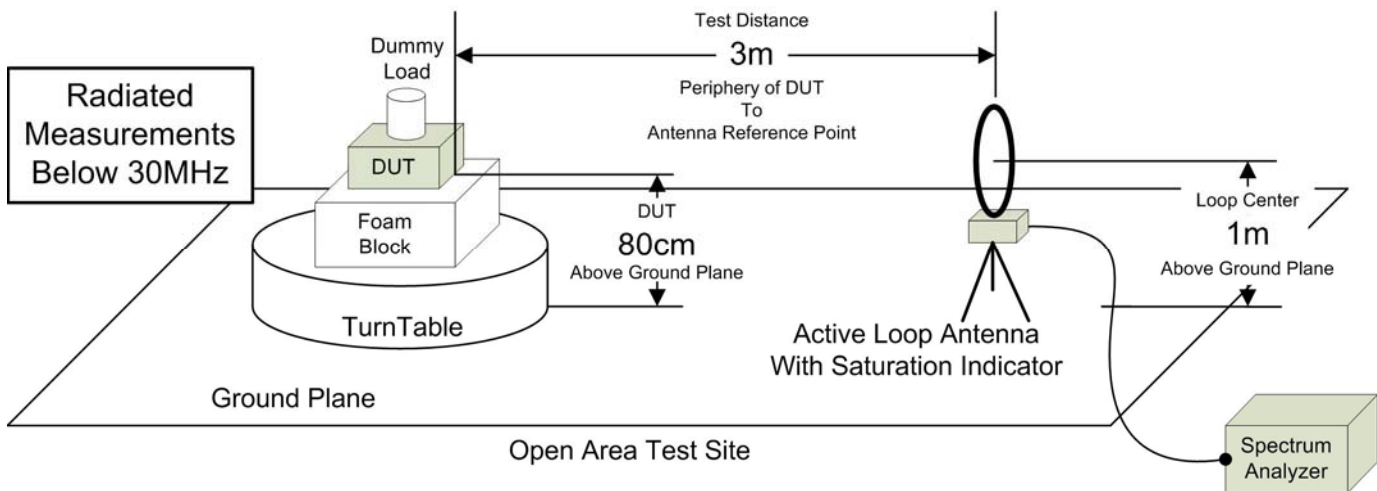


Figure A.4 – Test Setup Radiated Emissions Measurements 30-1000MHz

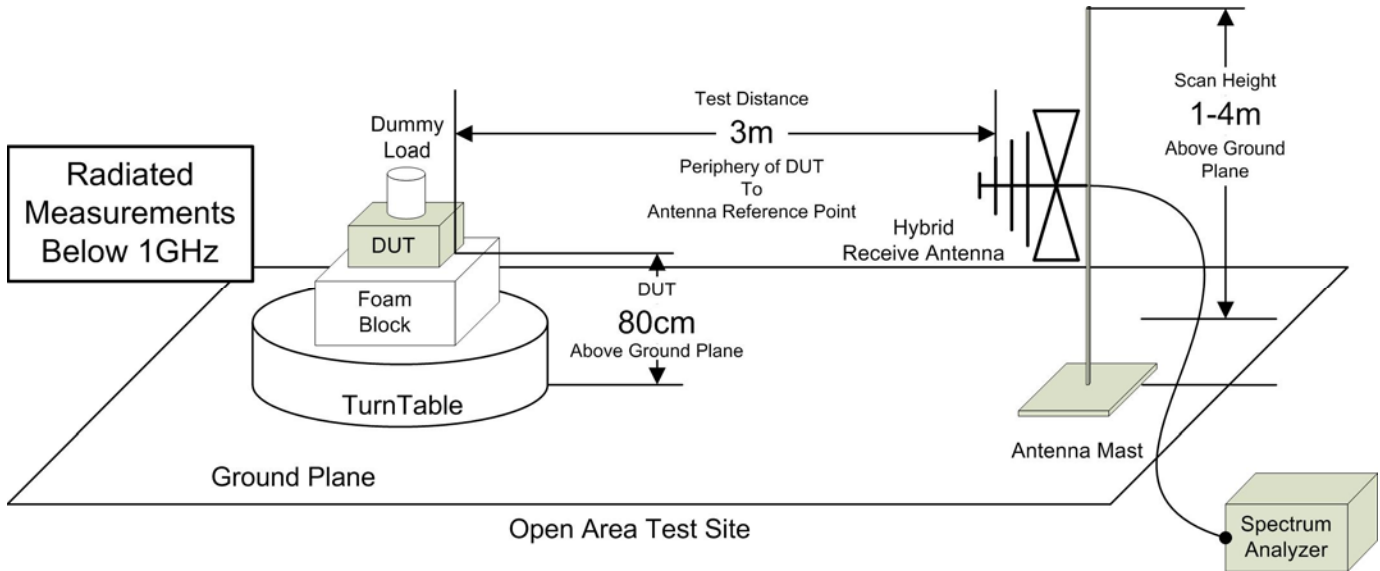


Figure A.5 – Test Setup Radiated Emissions Measurements 30-1000MHz

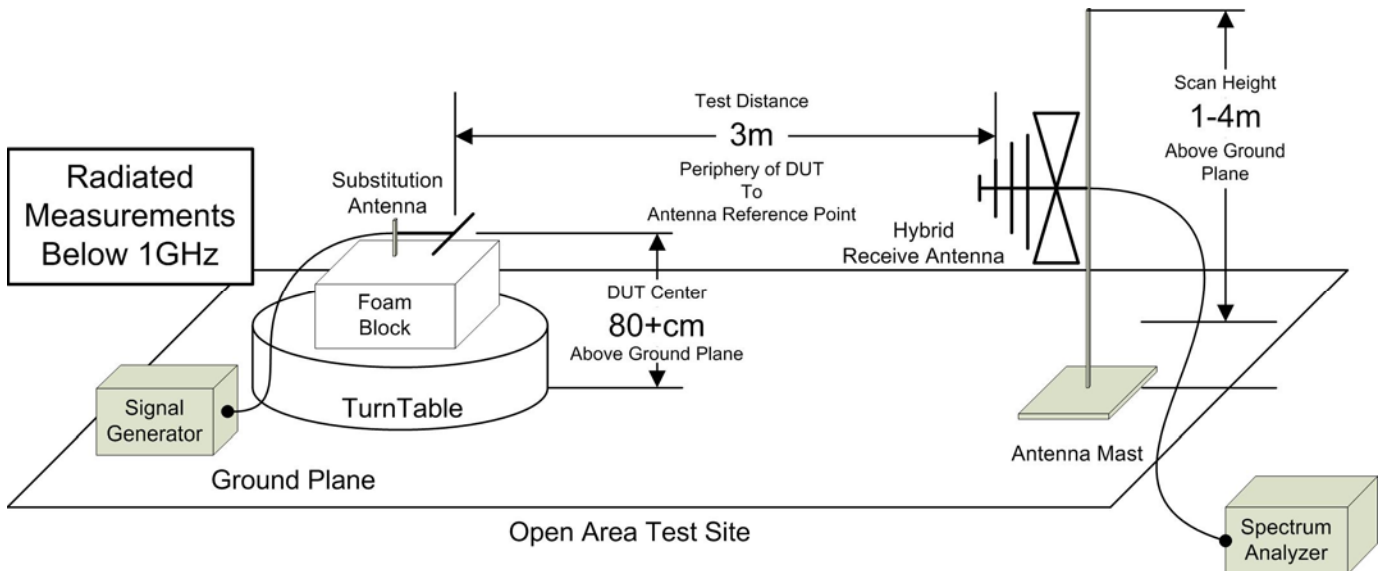
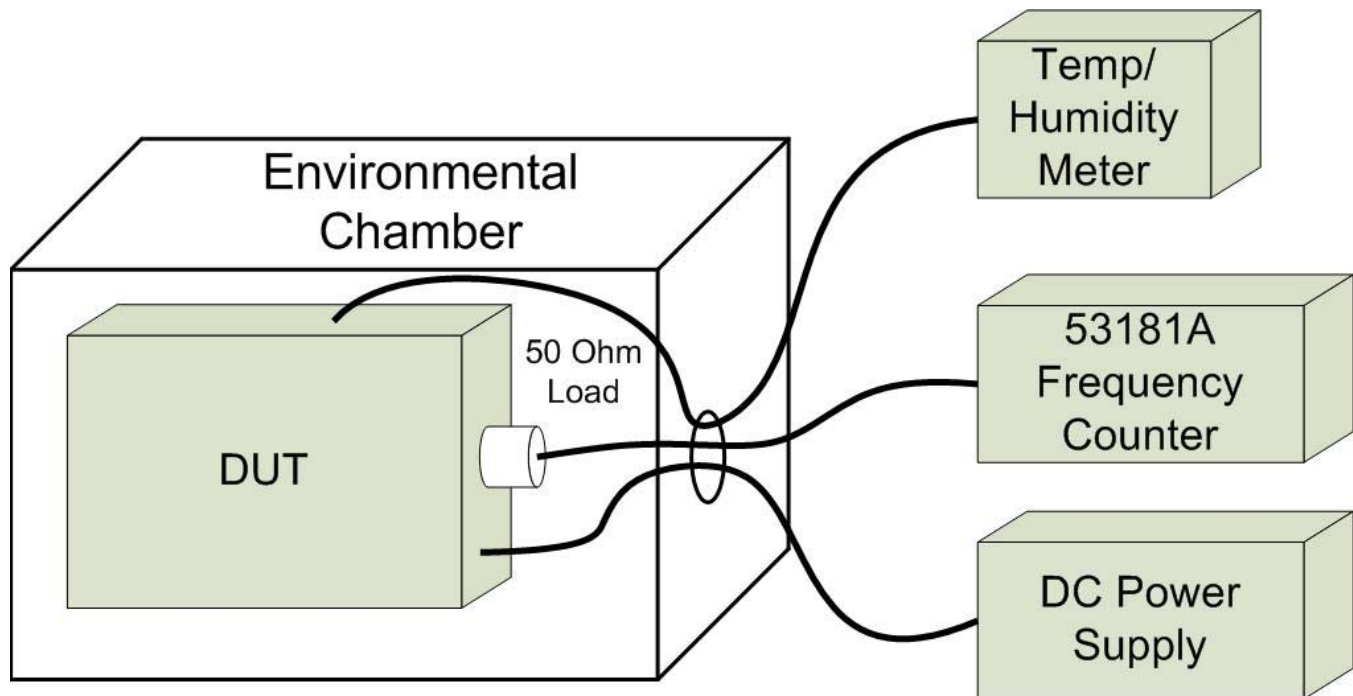


Table A.4 – Setup - Frequency Stability Measurement Equipment

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							
Asset Number	Manufacturer	Model Number	Serial Number	Description	Last Calibrated	Calibration Interval	Calibration Due
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	10 Dec 2020	Triennial	10 Dec 2023
00224	HP	8903B	3729A18691	Audio Analyzer	11 Dec 2020	Triennial	11 Dec 2023
00241	R&S	FSU40	100500	Spectrum Analyzer	10 Aug 2021	Triennial	10 Aug 2024
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
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a	COU
00275	TMS	LMR400	n/a	25m Cable	COU	n/a	COU
00278	TILE	34G3	n/a	TILE Test Software	NCR	n/a	NCR

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 $k=2$

Radiated Emissions 30MHz - 200MHz

$$U_{LAB} = 5.14\text{dB} \quad U_{CISPR} = 6.3\text{dB}$$

Radiated Emissions 200MHz - 1000MHz

$$U_{LAB} = 5.90\text{dB} \quad U_{CISPR} = 6.3\text{dB}$$

Radiated Emissions 1GHz - 6GHz

$$U_{LAB} = 4.80\text{dB} \quad U_{CISPR} = 5.2\text{dB}$$

Radiated Emissions 6GHz - 18GHz

$$U_{LAB} = 5.1\text{dB} \quad U_{CISPR} = 5.5\text{dB}$$

Power Line Conducted Emissions 9kHz to 150kHz

$$U_{LAB} = 2.96\text{dB} \quad U_{CISPR} = 3.8\text{dB}$$

Power Line Conducted Emissions 150kHz to 30MHz

$$U_{LAB} = 3.12\text{dB} \quad U_{CISPR} = 3.4\text{dB}$$

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 |

Other Measurement Uncertainties (U_{LAB})

RF Conducted Emissions 9kHz - 40GHz

$$U_{LAB} = 1.0\text{dB} \quad U_{CISPR} = \text{n/a}$$

Frequency/Bandwidth 9kHz - 40GHz

$$U_{LAB} = 0.1\text{ppm} \quad U_{CISPR} = \text{n/a}$$

Temperature

$$U_{LAB} = 1^{\circ}\text{C} \quad U_{CISPR} = \text{n/a}$$

END OF REPORT