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TIMCO ENGINEERING, Inc.

An IIA Company

FCC Part 95J MURS Test Report

APPLICANT	RITRON, INC.
ADDRESS	505 West Carmel Dr. PO Box 1998 Carmel IN 46032-7564 USA
FCC	AIERIT48-152M
MODEL NUMBER	NT-152M
PRODUCT DESCRIPTION	MURS RADIO
DATE SAMPLE RECEIVED	12/06/2019
FINAL TEST DATE	12/08/2019
TESTED BY	Franklin Rose
APPROVED BY	Tim Royer
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Report Version	Description	Issue Date
3326UT19 MURS 95J TestReport_	Rev1	Initial Issue	12/08/2019
3326UT19 MURS 95J TestReport_	Rev2	Revised Power output and Limits	4/17/2020
3326UT19 MURS 95J TestReport_	Rev3	Revised Masks	4/22/2020

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GENERAL REMARKS

Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.

☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669
Designation #: US1070

Tested by:

Name and Title	Franklin Rose, Project Manager / EMC Testing Technician
Date	12/16/2019

Name and Title	Tim Royer, Project Manager / EMC Testing Engineer
Date	12/16/2019

GENERAL INFORMATION

§95.2703 Definitions, MURS.

MURS. A two-way, short distance voice or data communication service for facilitating personal or business activities of the general public.

EUT Description	MURS RADIO
FCC	AIERIT48-152M
Model Number	NT-152M
Operating Frequencies	MURS channels: 151.82, 151.88, 151.94, 154.57, 154.60 MHz
Type of Emission	11K0F3E (Narrowband FM Voice), 16K0F3E (Wideband FM Voice)
Modulation	FM
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☐ DC Power (12.5 V)
	☒ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☐ Mobile
	☒ Portable
Antenna Connector	Reverse SMA
Test Conditions	The temperature was 26ºC Relative humidity of 50%.
Modification to the EUT	None.
Test Exercise	The EUT was operated according to the User Manual.
Applicable Standards	FCC Part 95 Subpart J, FCC Part 2; ANSI C63.26 2015; Referencing TIA 603-E:2016
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070

RESULTS SUMMARY

Applied Rule Part	Test Description	Result
FCC CFR 47 Part 95.2767	RF Power Output	**PASS**
FCC CFR 47 Part 2.1047 FCC CFR 47 Part 95.2773	Modulation Characteristics	**PASS**
FCC CFR 47 Part 2.1047(a) FCC CFR 47 Part 95.2775	Audio Frequency Response	**PASS**
FCC CFR 47 Part 2.1047(a) FCC CFR 47 Part 95.2775	Low Pass Filter Response	**PASS**
FCC CFR 47 Part 2.1047(b)	Modulation Limiting	**PASS**
FCC CFR 47 Part 2.1049	Occupied Bandwidth	**PASS**
FCC CFR 47 Part 95.2779	Emission Mask	**PASS**
FCC CFR 47 Part 2.1051 FCC CFR 47 Part 95.2779	Spurious Emissions at Antenna Terminals	**PASS**
FCC CFR 47 Part 2.1053(a) FCC CFR 47 Part 95.2779	Field Strength of Spurious Emissions	**PASS**
FCC CFR 47 Part 2.1055 FCC CFR 47 Part 95.2765(b)	Frequency Stability	**PASS**

OPERATING FREQUENCIES

Rule Part: FCC CFR 47 Part 95.2763

§95.2763 MURS channels.

Five VHF channels are allotted for shared use in the MURS. These channels, designated by their center frequencies in megahertz, are as follows: 151.820, 151.880, 151.940, 154.570, and 154.600 MHz. Each MURS transmitter type must be designed to transmit on one or more of these channels.

Frequencies for Testing: ANSI C63.26 5.1.1

Low end of Band: 151.82 MHz

High end of Band: 154.60 MHz

MEASUREMENT PROCEDURE

Rule Part: FCC CFR 47 Part 2.1041

§2.1041 Measurement procedure.

(a) For equipment operating under parts 15 and 18, the measurement procedures are specified in the rules governing the particular device for which certification is requested.

(b) For equipment operating in the authorized radio services, measurements are required as specified in §§2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057. The measurement procedures in ANSI C63.26-2015 (incorporated by reference, see §2.910) are acceptable for performing compliance measurements for equipment types covered by the measurement standard. See also §2.947 for acceptable measurement procedures.

RF POWER OUTPUT

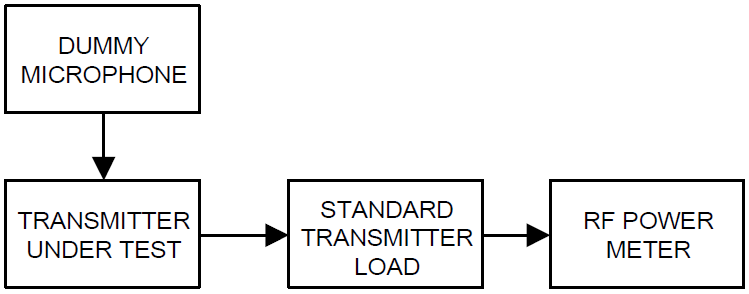
Rule Part: FCC CFR 47 Part 95.2767

§95.2767 MURS transmitting power limit.

Each MURS transmitter type must be designed such that the transmitter power output does not exceed 2 Watts under normal operating conditions.

Test Procedure: ANSI C63.26

Test Setup:

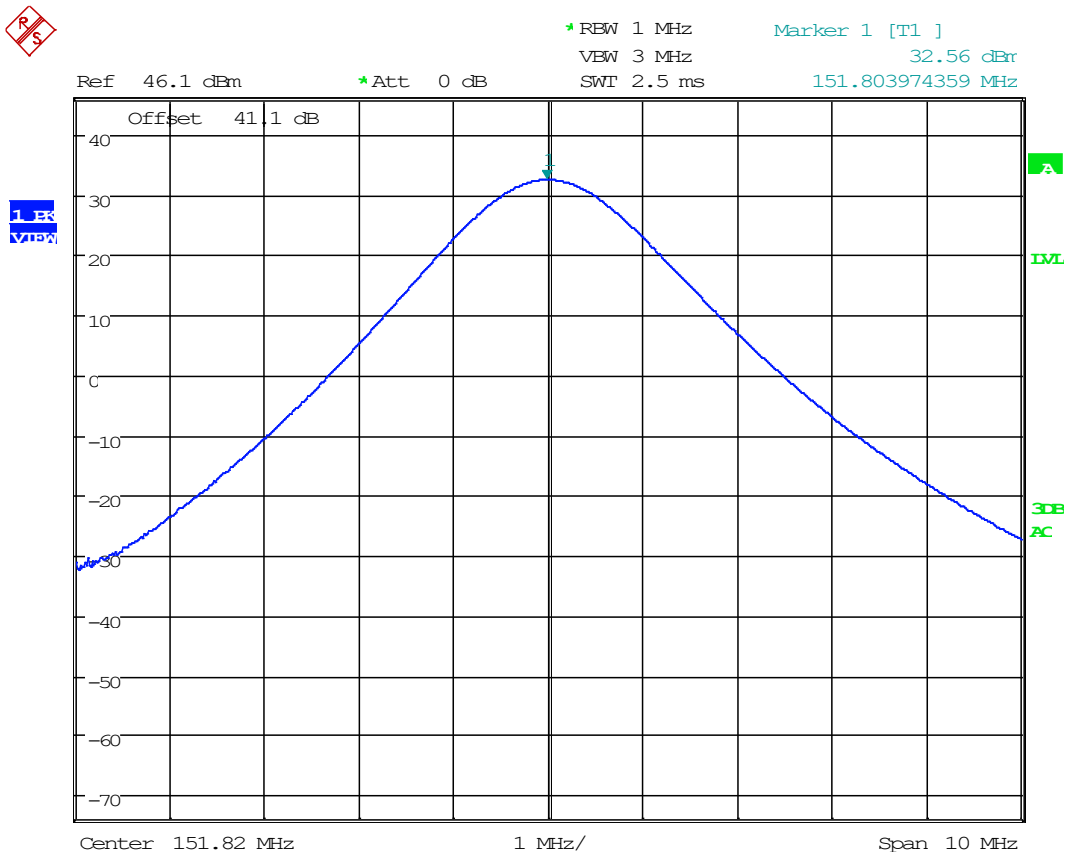


Test Data: **Power Measurement Table**

Frequency (MHz)	Power Output (dBm)	Power Output (W)	Limit (W)	Margin (W)
151.8200	32.56	1.80	2.0	0.20
154.6000	32.68	1.85	2.0	0.15

RF POWER OUTPUT

Test Data: 151.82 MHz Power Output



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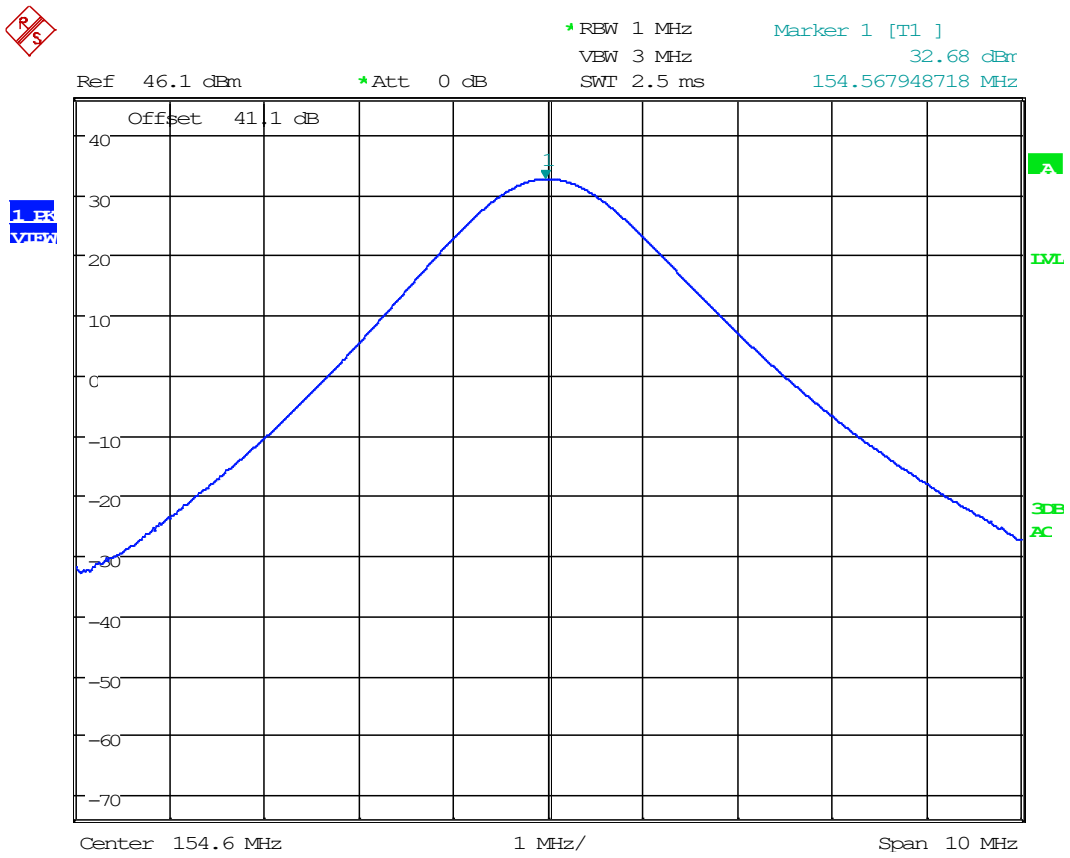
RF POWER OUTPUT

Test Data: 154.60 MHz Power Output



Date: 22.APR.2020 12:23:27

POWER TO THE FINAL AMPLIFIER

Rule Part: FCC CFR 47 Part 2.1033(c)(8)

§2.1033 Application for certification.

(c) Applications for equipment other than that operating under parts 15, 11 and 18 of this chapter shall be accompanied by a technical report containing the following information:

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

Test Data: Power to the Final Amplifier

8.1 VDC (max) * 0.9 A (max) = 7.29 Watts (max)

MODULATION CHARACTERISTICS

Rule Part: FCC CFR 47 Part 2.1047, Part 95.2773

§95.2773 MURS authorized bandwidths.

Each MURS transmitter type must be designed to meet the emission bandwidth limitations in this section.

(a) The occupied bandwidth of emissions transmitted on the center frequencies 151.820 MHz, 151.880 MHz, and 151.940 MHz must not exceed 11.25 kHz.

(b) The occupied bandwidth of emissions transmitted on the center frequencies 154.570 MHz and 154.600 MHz must not exceed 20.0 kHz.

(c) The occupied bandwidth of type A3E emissions must not exceed 8.0 kHz.

11K0F3E (Narrowband FM Voice)

MURS Authorized Bandwidth = **11.25 kHz (151 MHz channels)**

Bn = 2M + 2DK
Bn = (2 * 3) + (2 * 2.5 * 1)
Bn = **11.0**

Where:
M = Max Modulation Frequency (kHz)
D = Deviation (kHz)
K = Constant (Allowable Signal Distortion)

Emission Designator = **11K0F3E**

16K0F3E (Wideband FM Voice)

MURS Authorized Bandwidth = **20.00 kHz (154 MHz channels)**

Bn = 2M + 2DK
Bn = (2 * 3) + (2 * 5 * 1)
Bn = **16.0**

Where:
M = Max Modulation Frequency (kHz)
D = Deviation (kHz)
K = Constant (Allowable Signal Distortion)

Emission Designator = **16K0F3E**

AUDIO FREQUENCY RESPONSE

Rule Part: FCC CFR 47 Part 2.1047(a)

Requirements:

§2.1047 Measurements required: Modulation characteristics.

(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. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

TIA 603-E s. 3.2.6.2

The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level. The exception is from 500 Hz to 300 Hz, where an additional 6 dB per octave rolloff is allowed.

The following exceptions are also permissible:

a) An additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz range.

b) An additional 6 dB per octave rolloff is allowed from 2300 Hz to 2700 Hz, and an additional 12 dB per octave is allowed from 2700 Hz to 3000 Hz, in equipment operating in the 896 MHz to 940 MHz range, and all narrowband (12.5 kHz and 15 kHz channelization) equipment.

Test Procedure: ANSI C63.26 s. 5.3.3

Test Setup:

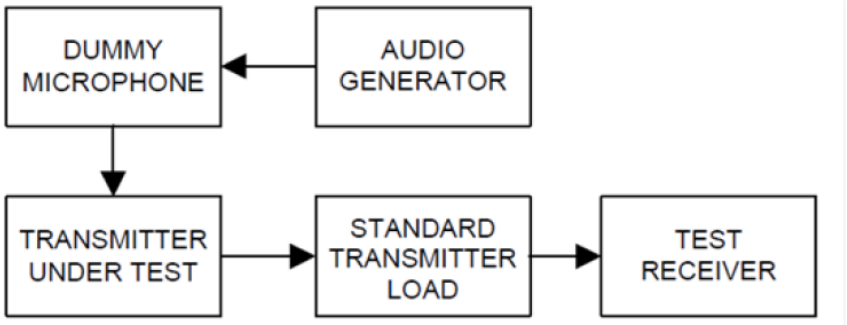
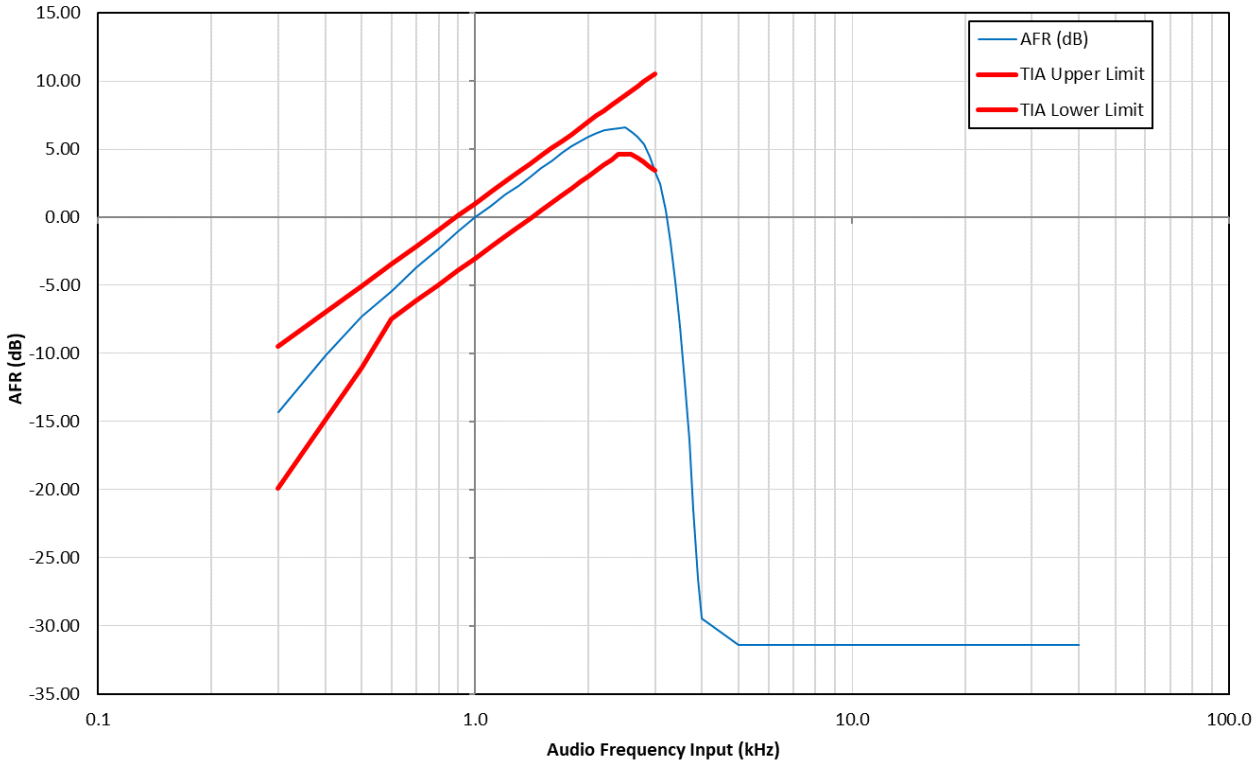


Figure 3—Equipment set-up audio frequency response (constant input)

Audio Frequency Response

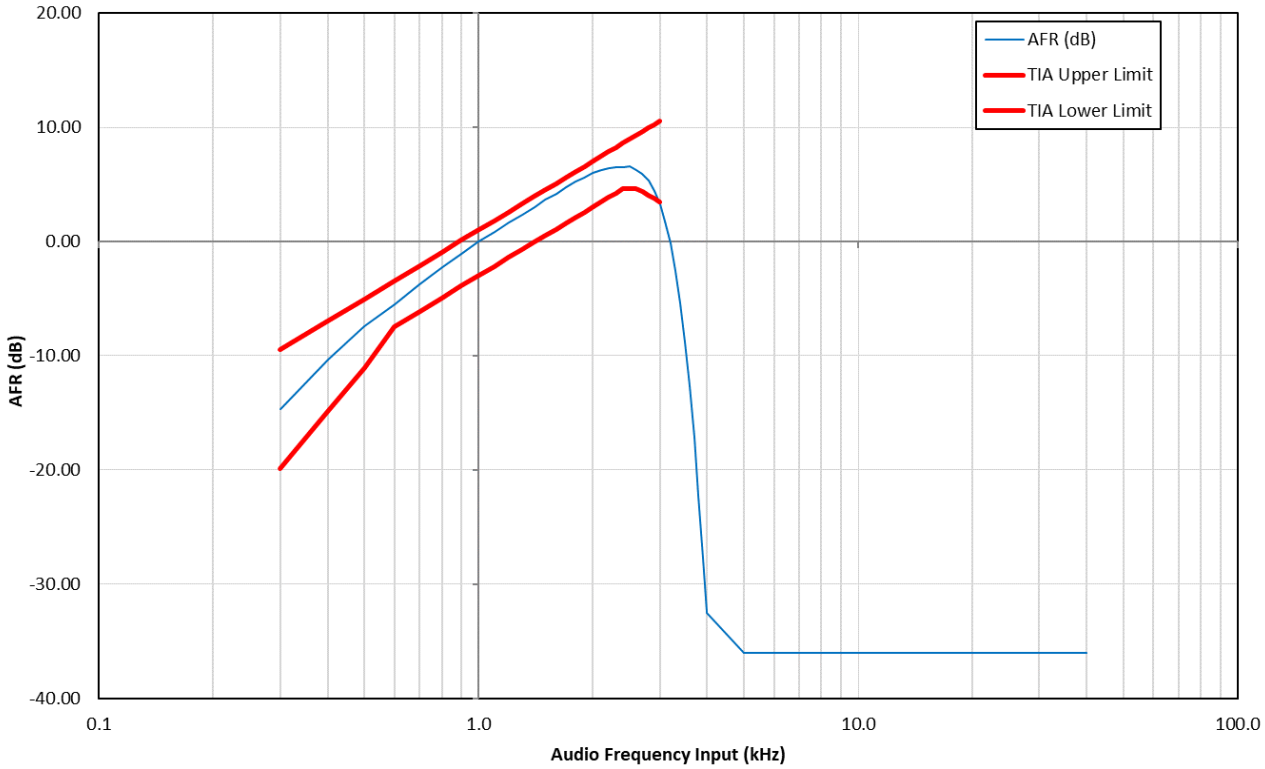
Test Data: Audio Frequency Response Plot, Narrowband, Mic Input



Note: Testing was done to the performance requirements of TIA-603-E. Compliance with this limit is not required by FCC Part 95 J.

Audio Frequency Response

Test Data: Audio Frequency Response Plot, Wideband, Mic Input



Note: Testing was done to the performance requirements of TIA-603-E. Compliance with this limit is not required by FCC Part 95 J.

LOW PASS FILTER RESPONSE

Rule Part: FCC CFR 47 Part 2.1047(a), Part 95.2775

Requirements:

§2.1047 Measurements required: Modulation characteristics.

(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. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

§95.2775 MURS audio filter.

The audio filter referenced in §95.2779 must satisfy the requirements in this section.

(a) The audio filter must be between the modulation limiter and the modulated stage of the transmitter.

(b) At any frequency (f in kHz) between 3 and 15 kHz, the filter must have an attenuation of at least 40 log (f/3) dB more than the attenuation at 1 kHz. Above 15 kHz, it must have an attenuation of at least 28 dB more than the attenuation at 1 kHz.

Test Procedure: ANSI C63.26 s. 5.3.3

Test Setup:

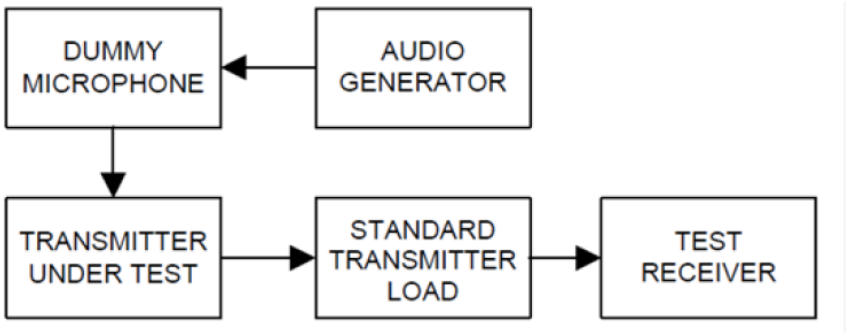
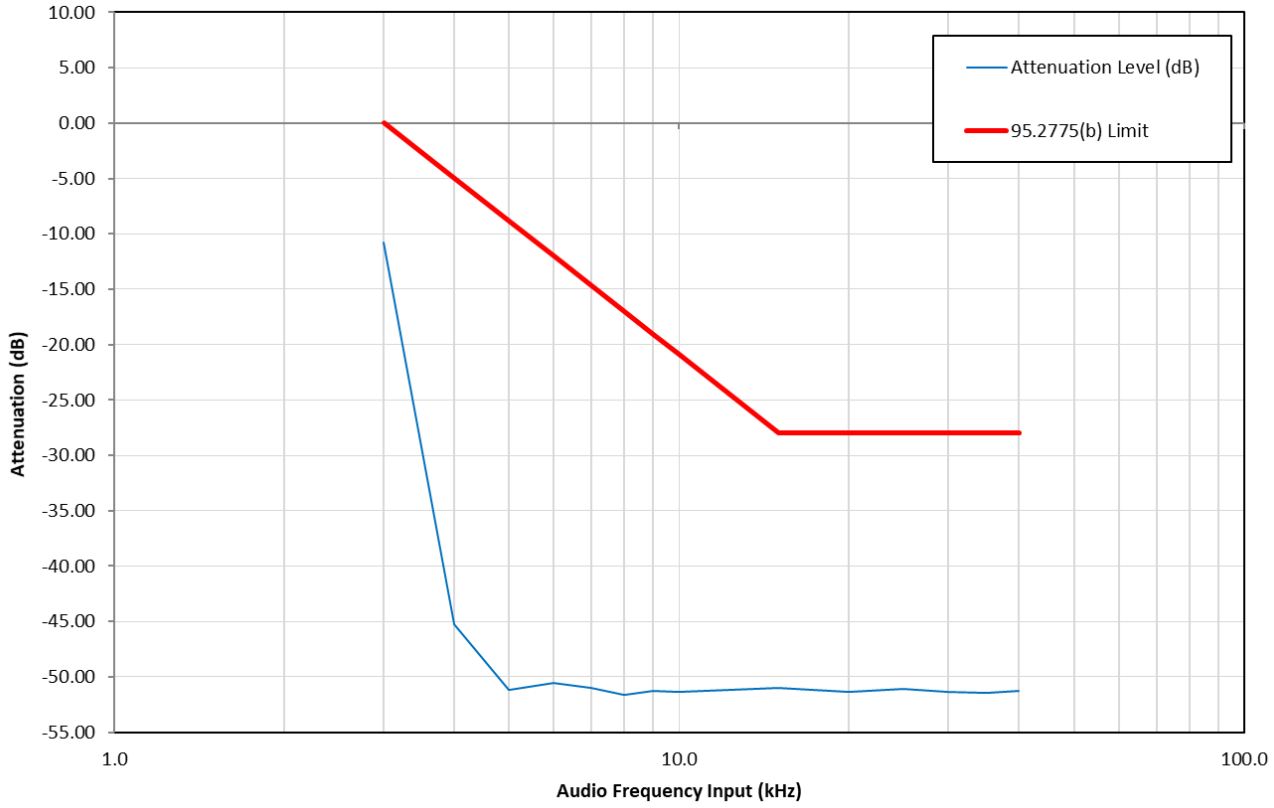


Figure 3—Equipment set-up audio frequency response (constant input)

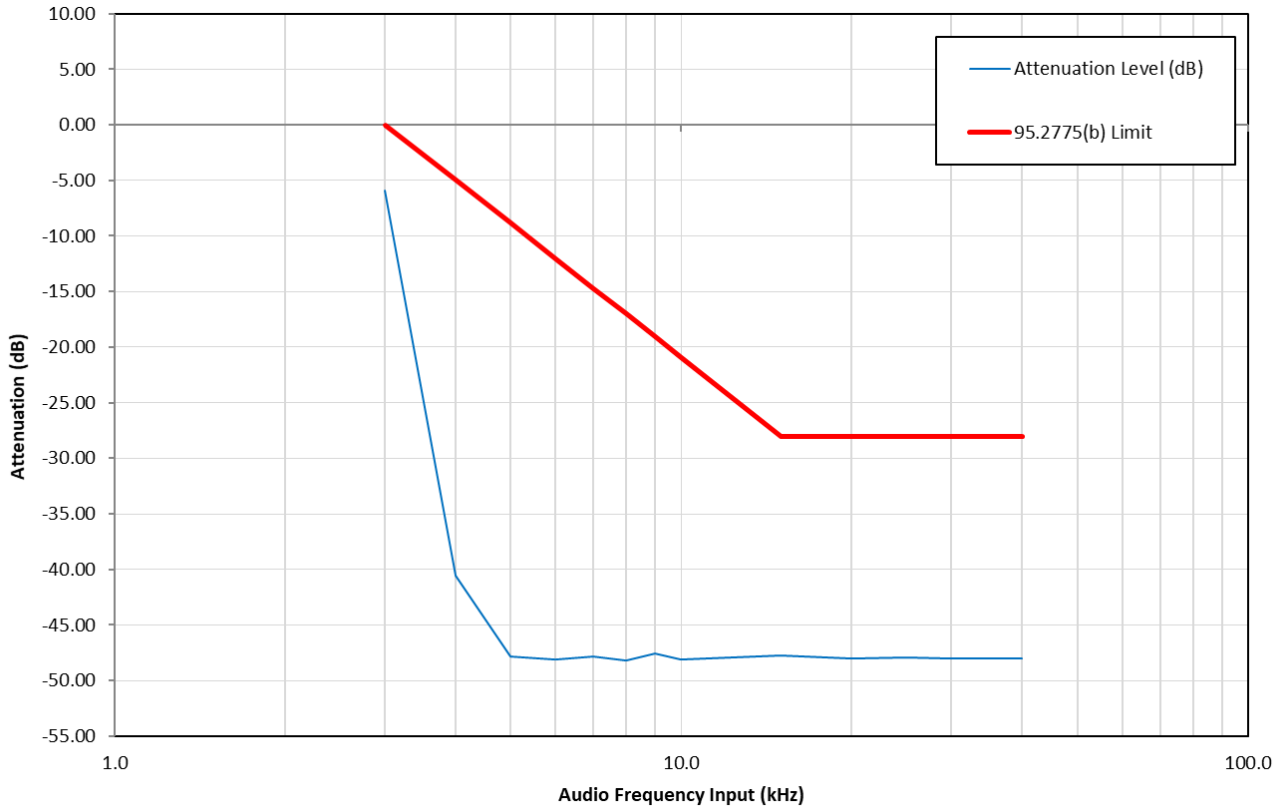
Low Pass Filter Response

Test Data: Low Pass Filter Response Plot, Narrowband



Low Pass Filter Response

Test Data: Low Pass Filter Response Plot, Wideband



MODULATION LIMITING

Rule Part: FCC CFR 47 Part 2.1047, Part 95.2773

§95.2773 MURS authorized bandwidths.

Each MURS transmitter type must be designed to meet the emission bandwidth limitations in this section.

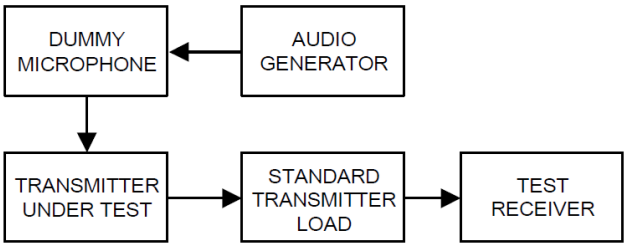
(a) The occupied bandwidth of emissions transmitted on the center frequencies 151.820 MHz, 151.880 MHz, and 151.940 MHz must not exceed 11.25 kHz.

(b) The occupied bandwidth of emissions transmitted on the center frequencies 154.570 MHz and 154.600 MHz must not exceed 20.0 kHz.

(c) The occupied bandwidth of type A3E emissions must not exceed 8.0 kHz.

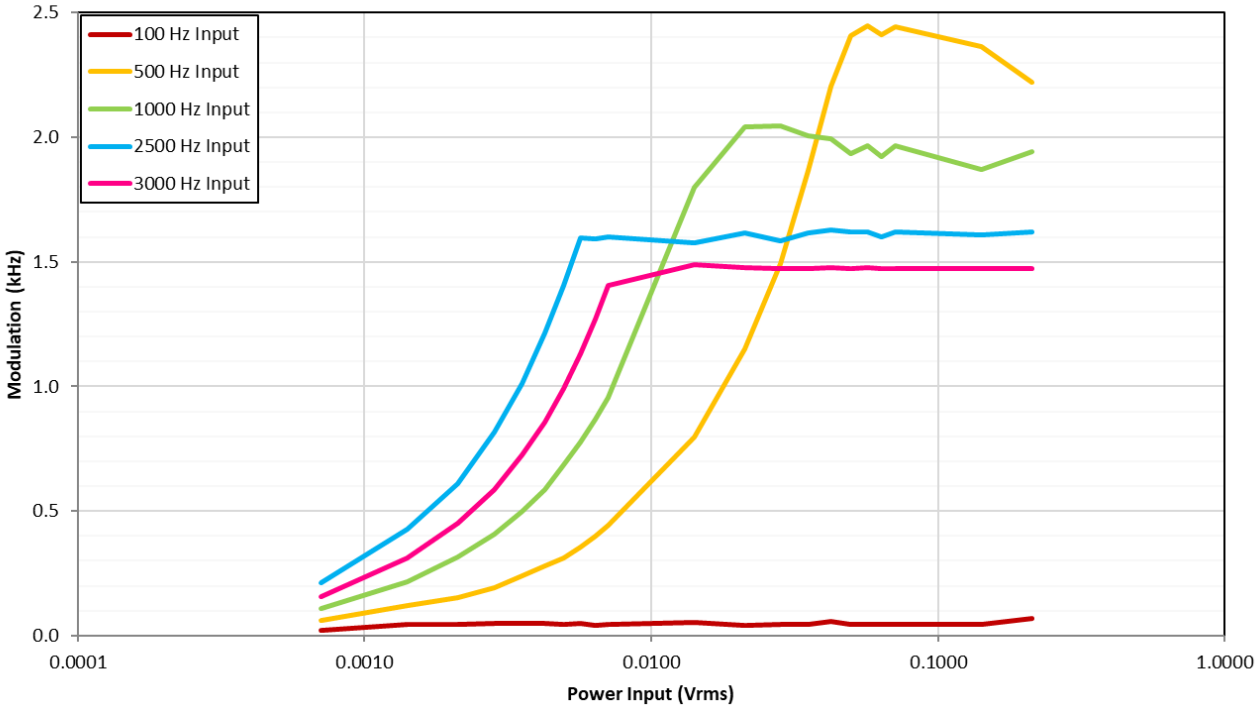
Test Procedure: ANSI C63.26 s. 5.3.2

Test Setup:



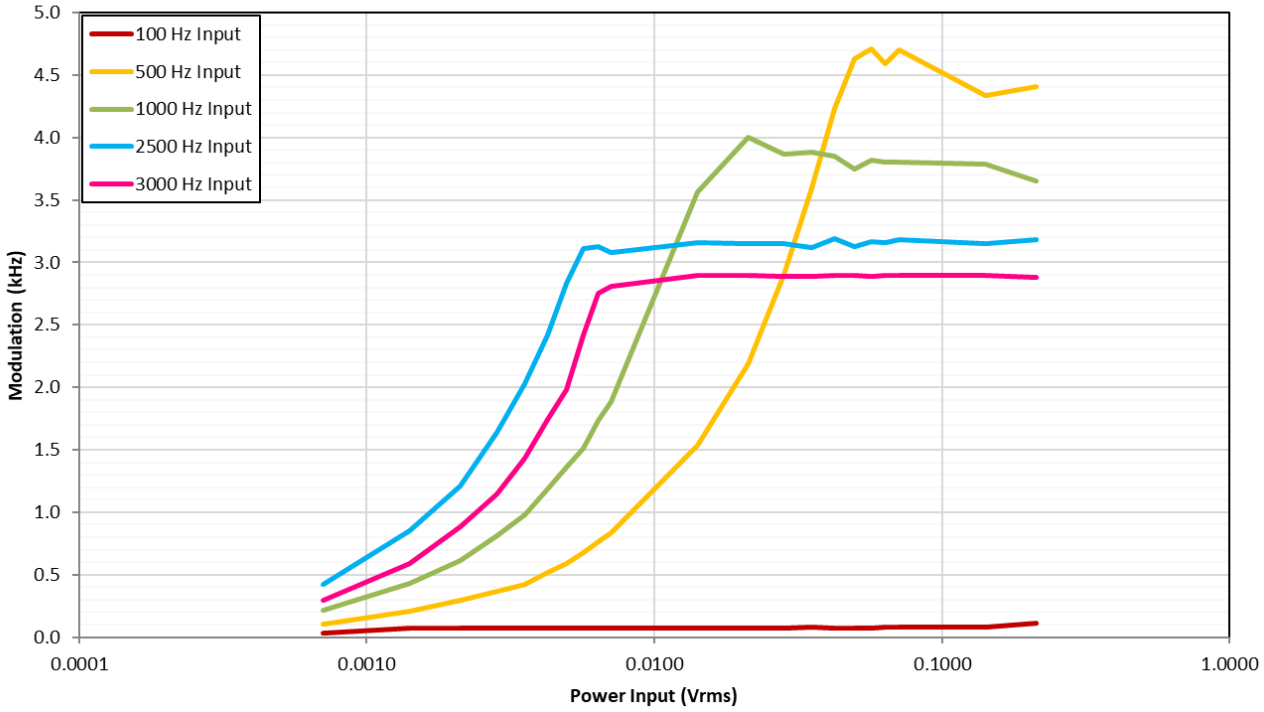
Modulation Limiting

Test Data: Modulation Limiting Plot, Narrowband



Modulation Limiting

Test Data: Modulation Limiting Plot, Wideband



OCCUPIED BANDWIDTH

Rule Part: FCC CFR 47 Part 2.1049(c)(1)

§2.1049 Measurements required: Occupied bandwidth.

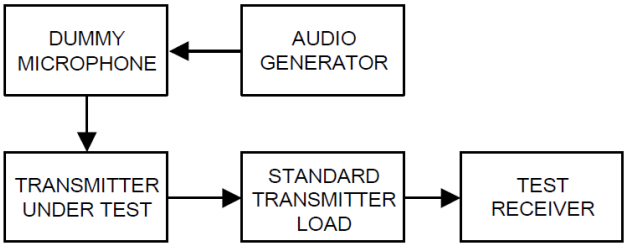
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10 dB greater than that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

Test Procedure: ANSI C63.26 s 5.4.4 (using test setup from TIA 603-E 2.2.11)

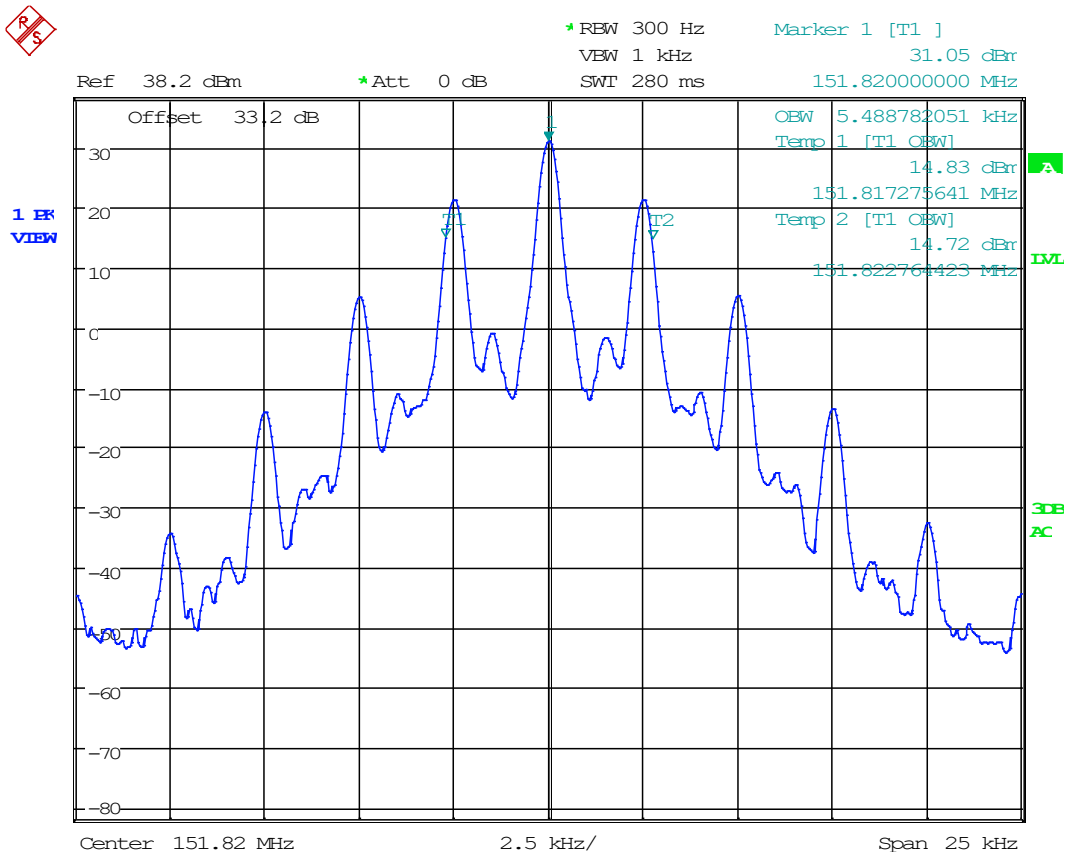
Test Setup:



Note: The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to ANSI C63.26 s 5.4.4, step e.

OCCUPIED BANDWIDTH

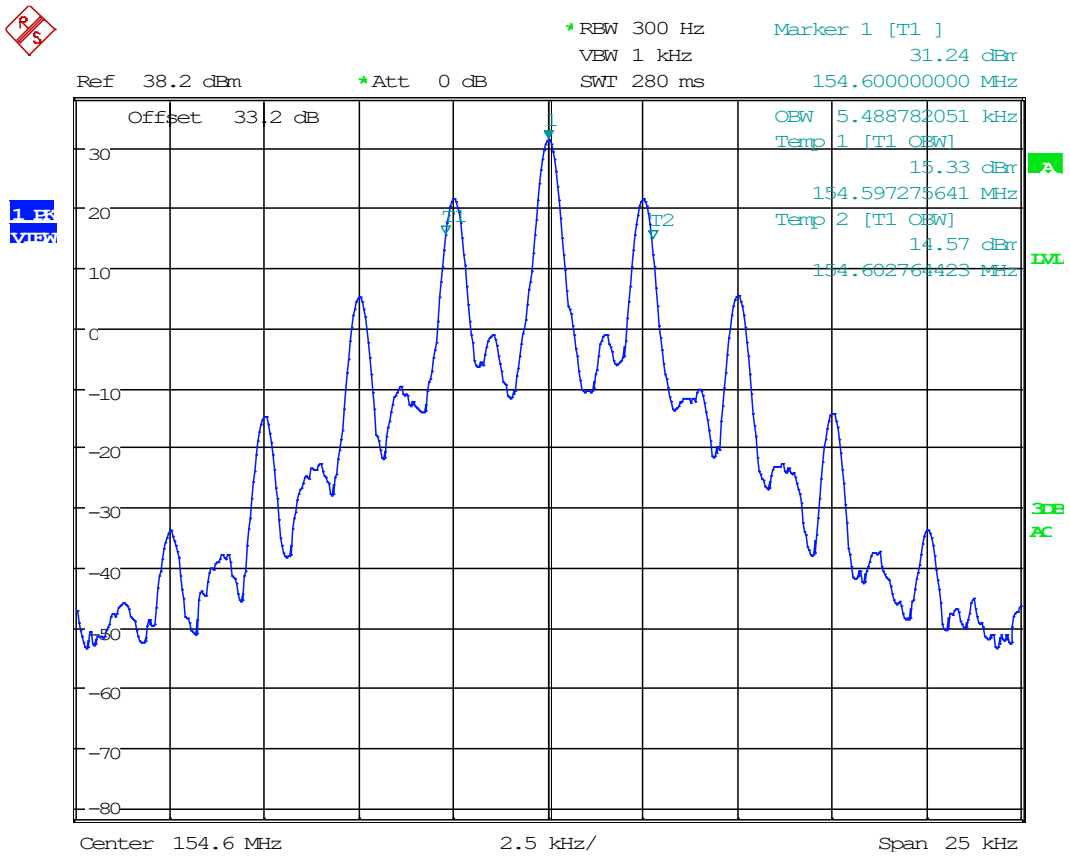
Test Data: 151.82 MHz, Narrowband



Date: 8.DEC.2019 01:59:37

OCCUPIED BANDWIDTH

Test Data: 154.60 MHz, Narrowband



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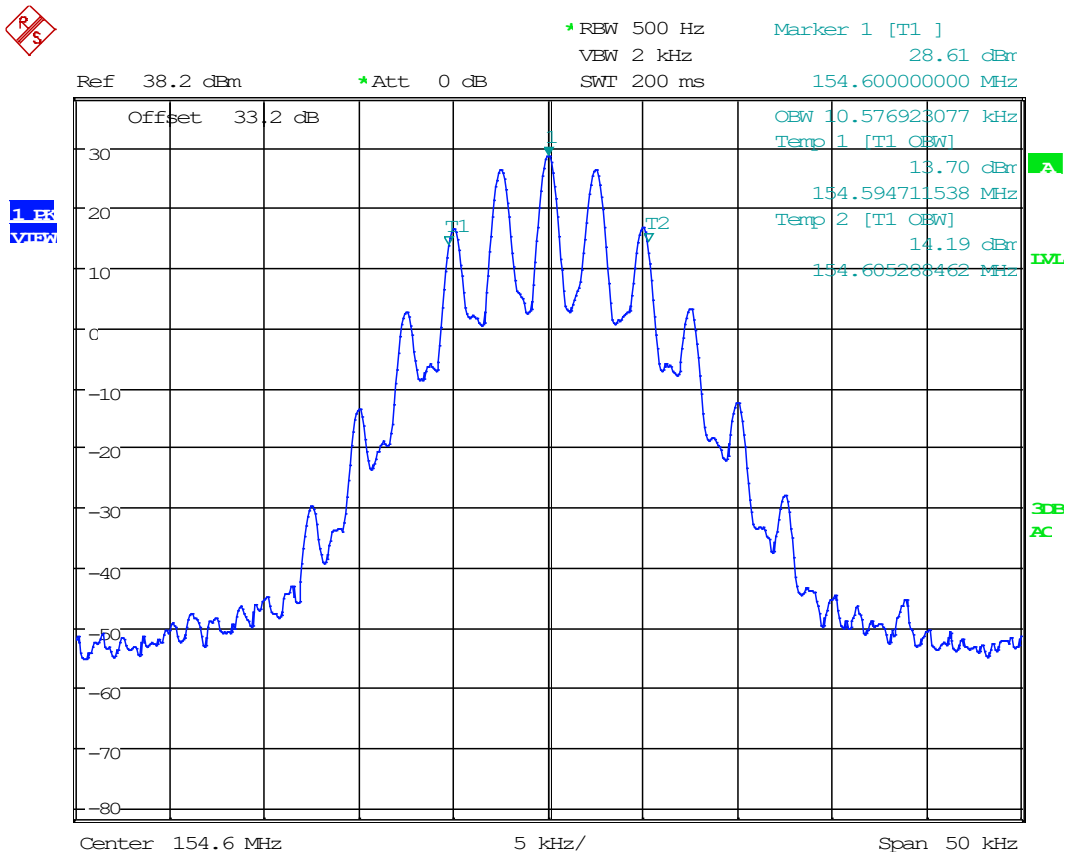
OCCUPIED BANDWIDTH

Test Data: 154.60 MHz, Wideband



Date: 8.DEC.2019 02:05:06

EMISSION MASK

Rule Part: FCC CFR 47 Part 95.2779

§95.2779 MURS unwanted emissions limits.

The requirements in this section apply to each MURS transmitter type both with and without the connection of attachments, such as an external microphone, power cord and/or antenna.

(a) *Emission masks.* Emission masks applicable to transmitting equipment in the MURS are defined by the requirements in the following table. The numbers in the paragraphs column refer to attenuation requirement rule paragraph numbers under paragraph (b) of this section. The words "audio filter" refer to the audio filter described in §95.2775.

Channel center frequencies (MHz)	Paragraphs
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7).
154.570 & 154.600, without audio filter	(5), (6), (7).

(1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of §95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

(2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of §95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

(b) *Attenuation requirements.* The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

(1) $7.27(f_d - 2.88\ kHz)$ dB on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.

(2) 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.

(3) 25 dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.

(4) 35 dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.

(5) $83 \log (f_d \div 5)$ dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) that is more than 5 kHz, but not more than 10 kHz.

(6) $29 \log (f_d^2 \div 11)$ dB or 50 dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 10 kHz, but not more than 50 kHz.

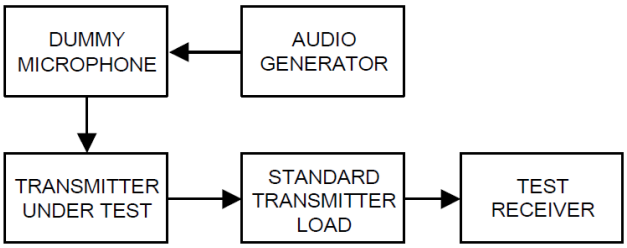
(7) 43 + 10 log(P) dB on any frequency removed from the channel center frequency by more than 50 kHz.

(c) *Measurement bandwidths.* The power of unwanted emissions in the frequency bands specified in paragraphs (b)(1) and (3) through (6) of this section is measured with a reference bandwidth of 300 Hz. The power of unwanted emissions in the frequency ranges specified in paragraphs (b)(2) and (7) of this section is measured with a reference bandwidth of at least 30 kHz.

EMISSION MASK

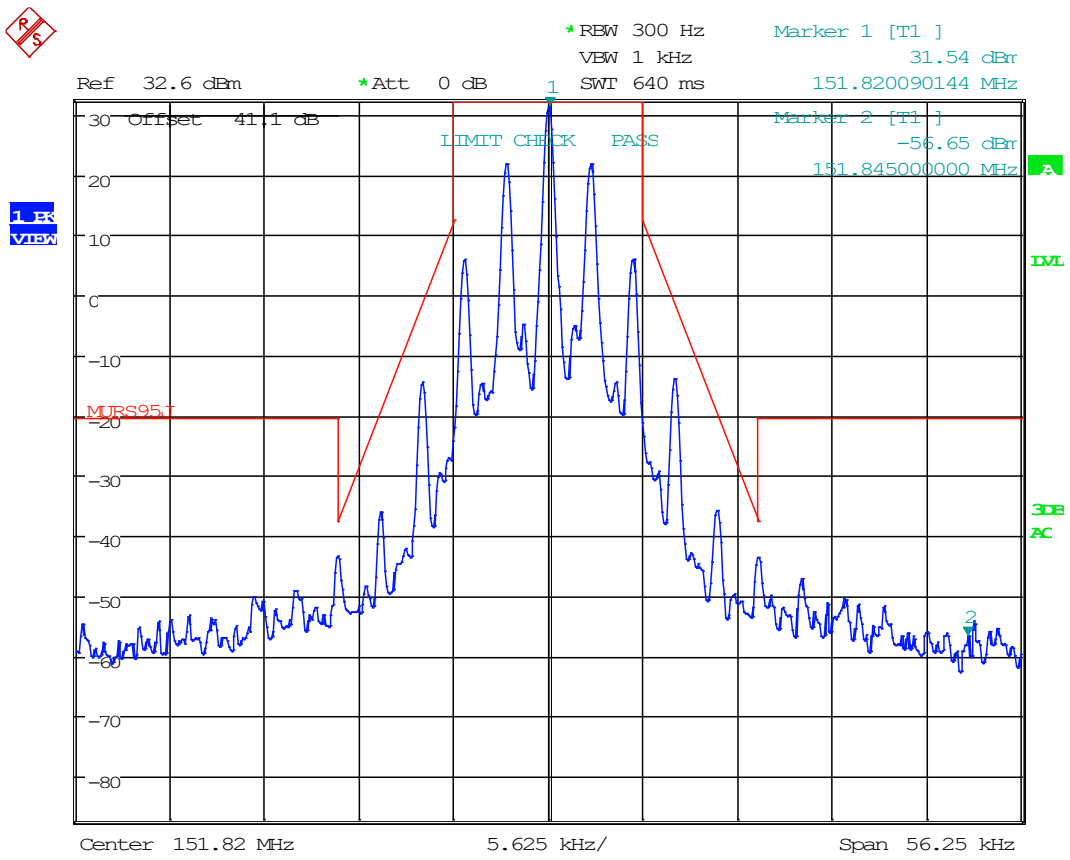
Test Procedure: ANSI C63.26 s 5.4.4 (using test setup from TIA 603-E 2.2.11)

Test Setup:



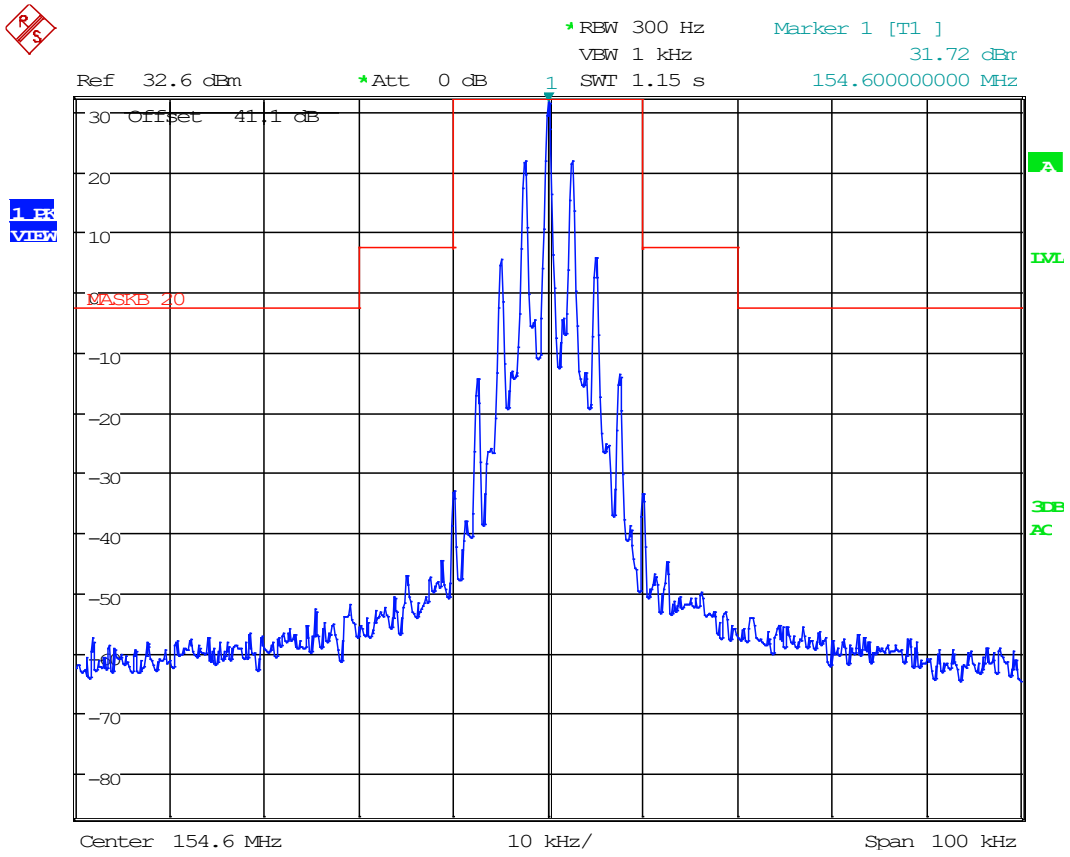
EMISSION MASK

Test Data: 151.82 MHz, Narrowband



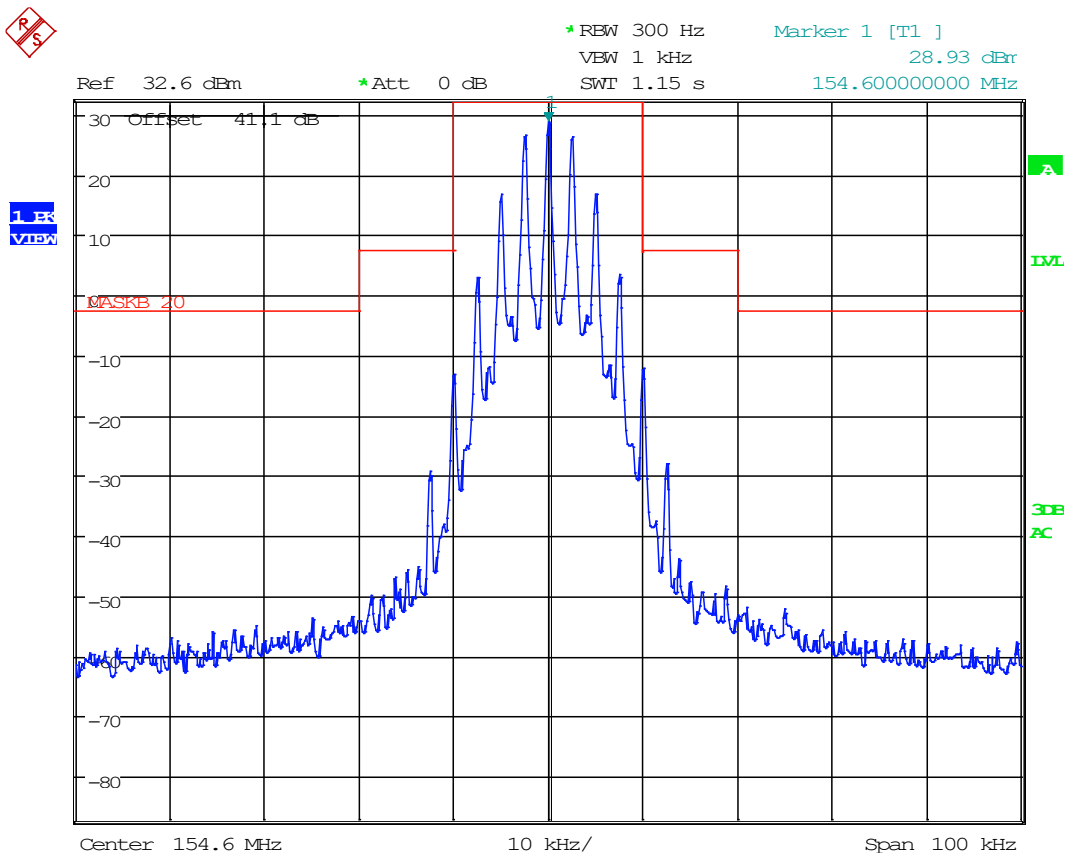
EMISSION MASK

Test Data: 154.60 MHz, Narrowband



EMISSION MASK

Test Data: 154.60 MHz, Wideband



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part: FCC CFR 47 Part 2.1051, Part 95.2779

§95.2779 MURS unwanted emissions limits.

The requirements in this section apply to each MURS transmitter type both with and without the connection of attachments, such as an external microphone, power cord and/or antenna.

(a) *Emission masks.* Emission masks applicable to transmitting equipment in the MURS are defined by the requirements in the following table. The numbers in the paragraphs column refer to attenuation requirement rule paragraph numbers under paragraph (b) of this section. The words "audio filter" refer to the audio filter described in §95.2775.

Channel center frequencies (MHz)	Paragraphs
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7).
154.570 & 154.600, without audio filter	(5), (6), (7).

(1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of §95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

(2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of §95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

(b) *Attenuation requirements.* The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

(1) 7.27(f_d−2.88 kHz) dB on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.

(2) 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.

(3) 25 dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.

(4) 35 dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.

(5) 83 log (f_d ÷ 5) dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) that is more than 5 kHz, but not more than 10 kHz.

(6) 29 log (f_d^2 ÷ 11) dB or 50 dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 10 kHz, but not more than 50 kHz.

(7) 43 + 10 log(P) dB on any frequency removed from the channel center frequency by more than 50 kHz.

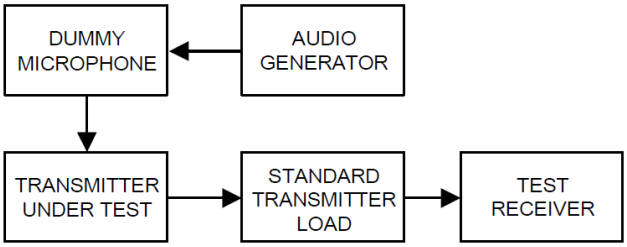
(c) *Measurement bandwidths.* The power of unwanted emissions in the frequency bands specified in paragraphs (b)(1) and (3) through (6) of this section is measured with a reference bandwidth of 300 Hz. The power of unwanted emissions in the frequency ranges specified in paragraphs (b)(2) and (7) of this section is measured with a reference bandwidth of at least 30 kHz.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Procedure: ANSI C63.26 5.7.3, 5.7.4

A notch filter was used to attenuate the fundamental frequency of the EUT.

Test Setup:



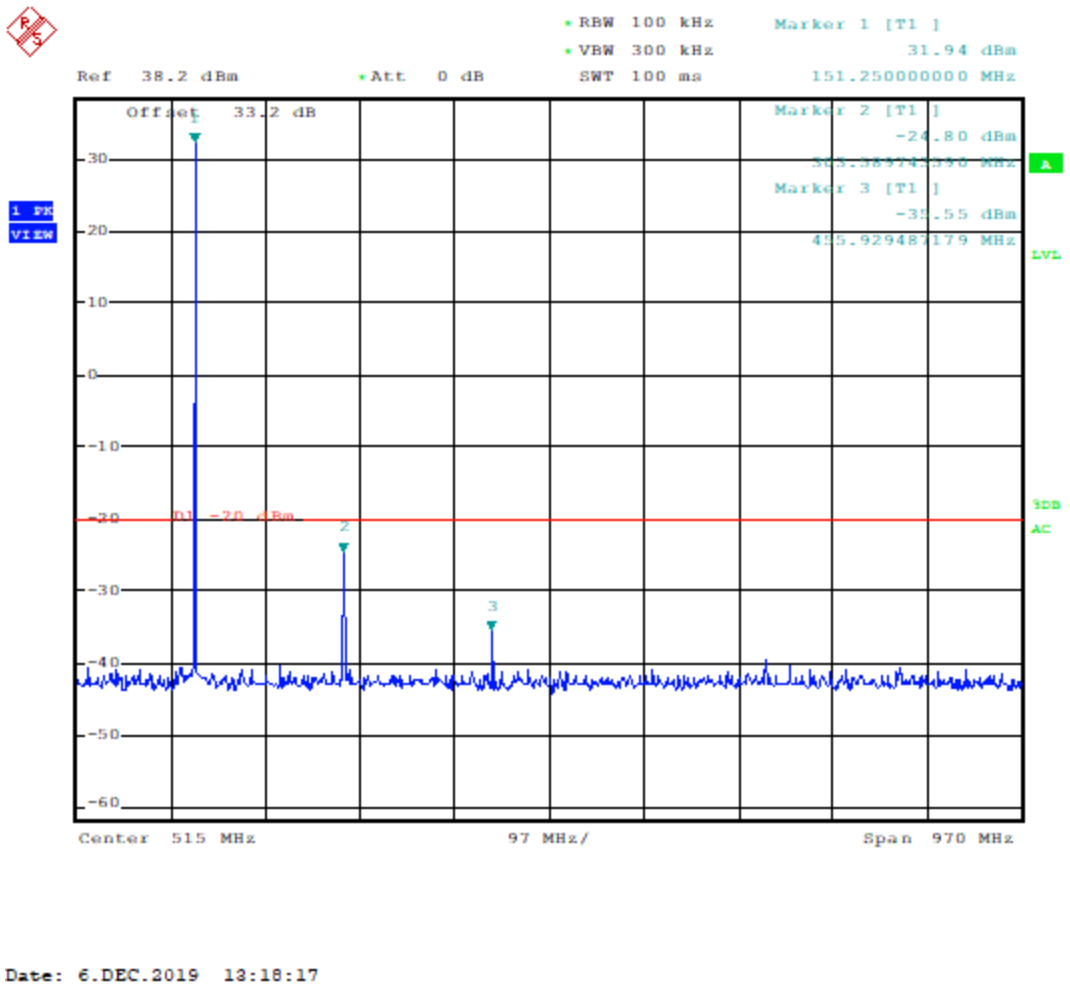
Limit Calculation:

FCC Part 95.2779(a)(7):

Frequency (MHz)	Power Output (dBm)	43 + 10 * log(W) (dBc)	(dBc) to (dBm)
151.82	32.09	52.09	-20.00

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

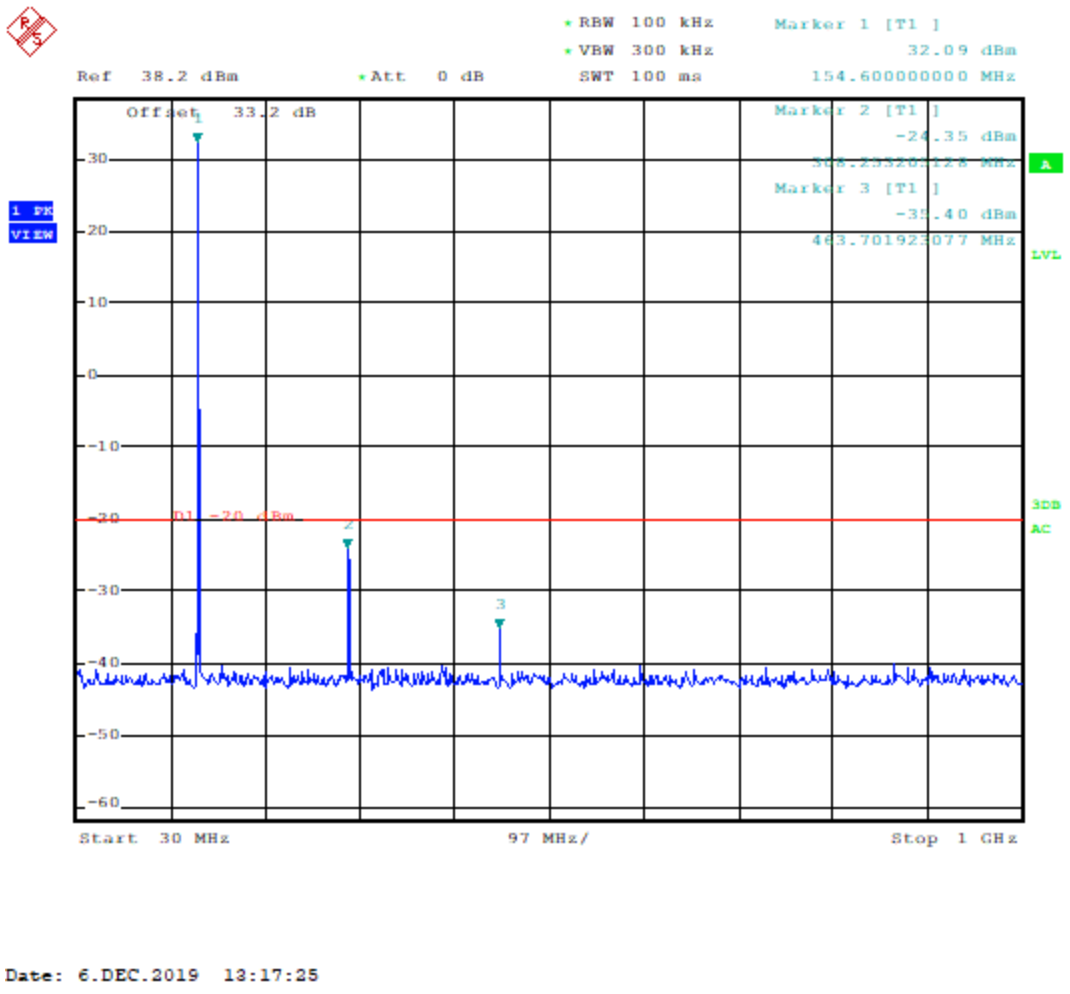
Test Data: 151.82 MHz



Date: 6.DEC.2019 13:18:17

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 154.60 MHz



Date: 6.DEC.2019 13:17:25

RADIATED FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Part: FCC CFR 47 Part 2.1053(a), Part 95.2779

§95.2779 MURS unwanted emissions limits.

The requirements in this section apply to each MURS transmitter type both with and without the connection of attachments, such as an external microphone, power cord and/or antenna.

(a) *Emission masks.* Emission masks applicable to transmitting equipment in the MURS are defined by the requirements in the following table. The numbers in the paragraphs column refer to attenuation requirement rule paragraph numbers under paragraph (b) of this section. The words "audio filter" refer to the audio filter described in §95.2775.

Channel center frequencies (MHz)	Paragraphs
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7).
154.570 & 154.600, without audio filter	(5), (6), (7).

(1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of §95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

(2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of §95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

(b) *Attenuation requirements.* The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

(1) $7.27(f_d - 2.88\ kHz)$ dB on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.

(2) 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.

(3) 25 dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.

(4) 35 dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.

(5) $83 \log (f_d \div 5)$ dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) that is more than 5 kHz, but not more than 10 kHz.

(6) $29 \log (f_d^2 \div 11)$ dB or 50 dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 10 kHz, but not more than 50 kHz.

(7) 43 + 10 log(P) dB on any frequency removed from the channel center frequency by more than 50 kHz.

(c) *Measurement bandwidths.* The power of unwanted emissions in the frequency bands specified in paragraphs (b)(1) and (3) through (6) of this section is measured with a reference bandwidth of 300 Hz. The power of unwanted emissions in the frequency ranges specified in paragraphs (b)(2) and (7) of this section is measured with a reference bandwidth of at least 30 kHz.

RADIATED FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Procedure: ANSI C63.26 s 5.5

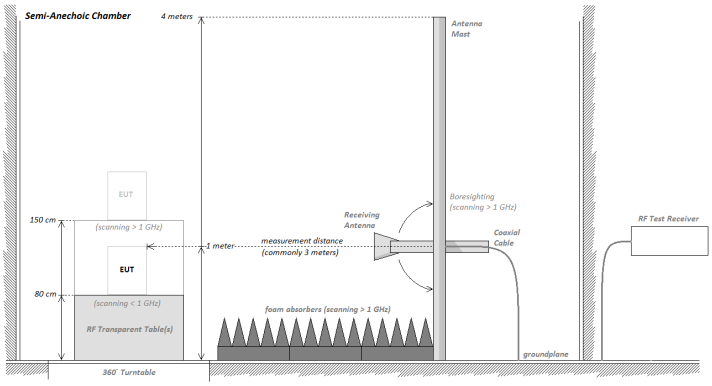
Note: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from the lowest frequency generated internally to at least the tenth harmonic of the fundamental. This test was conducted in accordance with the standard listed above using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669. The measurements below represent the worst case of all the frequencies tested.

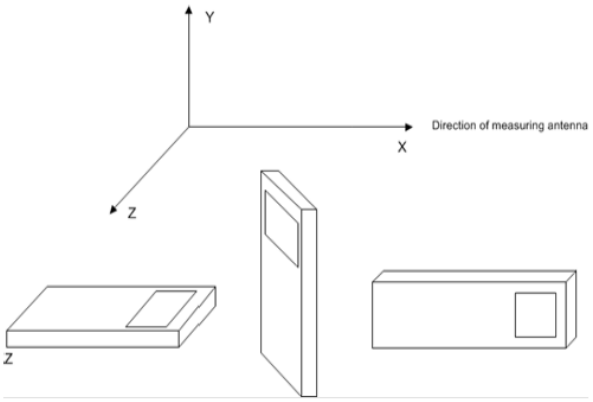
Note: Six (6) or more of the highest emissions of each worst-case operational mode of the EUT are represented below. Emissions 20 dB below the limit were not required to be reported.

Limit Calculation:

Frequency (MHz)	Power Output (dBm)	43 + 10 * log(W) (dBc)	(dBc) to (dBm)
151.82	32.09	52.09	-20.00

Test Site Setup:





Note: The microphone input was chosen for Radiated Emissions testing.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 151.82 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBµV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Limit (dBm)	Margin (dB)
151.82	303.60	30.41	H	2.08	14.12	46.61	3.00	46.61	-50.77	-20.00	30.77
151.82	303.60	23.54	V	2.08	14.12	39.74	3.00	39.74	-57.64	-20.00	37.64
151.82	455.50	15.80	V	2.48	15.69	33.97	3.00	33.97	-63.41	-20.00	43.41
151.82	455.50	16.59	H	2.48	15.69	34.76	3.00	34.76	-62.62	-20.00	42.62
151.82	607.30	10.77	H	2.88	18.55	32.20	3.00	32.20	-65.18	-20.00	45.18
151.82	607.30	18.61	V	2.88	18.55	40.04	3.00	40.04	-57.34	-20.00	37.34
151.82	759.10	19.82	V	3.23	20.92	43.97	3.00	43.97	-53.41	-20.00	33.41
151.82	759.10	19.09	H	3.23	20.92	43.24	3.00	43.24	-54.14	-20.00	34.14
151.82	910.90	19.19	H	3.55	22.60	45.34	3.00	45.34	-52.03	-20.00	32.03
151.82	910.90	16.68	V	3.55	22.60	42.83	3.00	42.83	-54.54	-20.00	34.54
151.82	1062.70	16.93	V	3.79	26.86	47.58	3.00	47.58	-49.80	-20.00	29.80
151.82	1062.70	14.22	H	3.79	26.86	44.87	3.00	44.87	-52.51	-20.00	32.51
151.82	1214.60	16.83	H	3.96	28.16	48.95	3.00	48.95	-48.42	-20.00	28.42
151.82	1214.60	14.21	V	3.96	28.16	46.33	3.00	46.33	-51.04	-20.00	31.04
151.82	1366.40	16.79	V	4.28	28.66	49.73	3.00	49.73	-47.65	-20.00	27.65
151.82	1366.40	18.24	H	4.28	28.66	51.18	3.00	51.18	-46.20	-20.00	26.20
151.82	1518.20	16.57	H	4.52	27.76	48.85	3.00	48.85	-48.53	-20.00	28.53
151.82	1518.20	13.21	V	4.52	27.76	45.49	3.00	45.49	-51.89	-20.00	31.89

Test Data: 154.60 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBµV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Limit (dBm)	Margin (dB)
154.57	309.10	17.07	V	2.08	14.81	33.96	3.00	33.96	-63.42	-20.00	43.42
154.57	309.10	25.63	H	2.08	14.81	42.52	3.00	42.52	-54.86	-20.00	34.86
154.57	463.70	14.85	H	2.50	15.97	33.32	3.00	33.32	-64.05	-20.00	44.05
154.57	463.70	15.14	V	2.50	15.97	33.61	3.00	33.61	-63.76	-20.00	43.76
154.57	618.30	19.04	V	2.90	18.77	40.71	3.00	40.71	-56.67	-20.00	36.67
154.57	618.30	17.70	H	2.90	18.77	39.37	3.00	39.37	-58.01	-20.00	38.01
154.57	772.90	21.50	H	3.28	21.69	46.47	3.00	46.47	-50.91	-20.00	30.91
154.57	772.90	17.09	V	3.28	21.69	42.06	3.00	42.06	-55.32	-20.00	35.32
154.57	927.40	20.46	V	3.58	22.25	46.29	3.00	46.29	-51.09	-20.00	31.09
154.57	927.40	18.47	H	3.58	22.25	44.30	3.00	44.30	-53.08	-20.00	33.08
154.57	1082.00	13.26	V	3.81	27.02	44.09	3.00	44.09	-53.29	-20.00	33.29
154.57	1082.00	17.11	H	3.81	27.02	47.94	3.00	47.94	-49.44	-20.00	29.44
154.57	1236.60	16.49	H	3.99	28.32	48.80	3.00	48.80	-48.58	-20.00	28.58
154.57	1236.60	15.84	V	3.99	28.32	48.15	3.00	48.15	-49.23	-20.00	29.23
154.57	1391.10	15.06	V	4.32	28.52	47.90	3.00	47.90	-49.47	-20.00	29.47
154.57	1391.10	15.39	H	4.32	28.52	48.23	3.00	48.23	-49.14	-20.00	29.14
154.57	1545.70	15.93	H	4.57	27.76	48.26	3.00	48.26	-49.12	-20.00	29.12
154.57	1545.70	18.33	V	4.57	27.76	50.66	3.00	50.66	-46.72	-20.00	26.72

FREQUENCY STABILITY

Rule Part: FCC CFR 47 Part 2.1055, Part 95.2765(b)

§95.2765 MURS frequency accuracy.

Each MURS transmitter type must be designed to meet the applicable frequency tolerance and stability requirements of this section.

(a) MURS transmitters that operate with an emission bandwidth of 6.25 kHz or less must be designed such that the carrier frequencies remain within ±2.0 parts-per-million (ppm) of the channel center frequencies specified in §95.2763 during normal operating conditions.

(b) MURS transmitters that operate with an emission bandwidth greater than 6.25 kHz must be designed such that the carrier frequencies remain within ±5.0 ppm of the channel center frequencies specified in §95.2763 during normal operating conditions.

Test Procedure: ANSI C63.26 s.5.6, referencing TIA 603-E, 2.2.2

Test Setup:

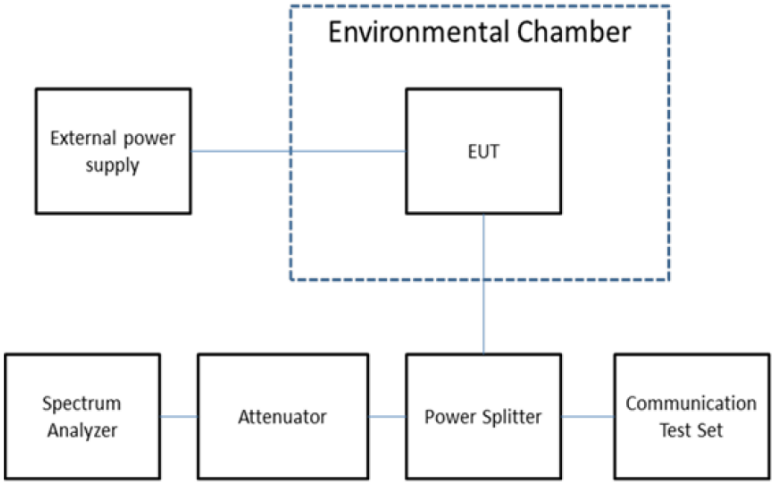
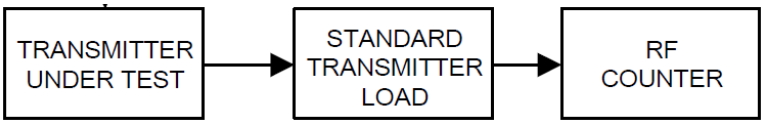


Figure 8—Typical connection of instrumentation and EUT for frequency stability test

Alternative Test Setup:



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Table

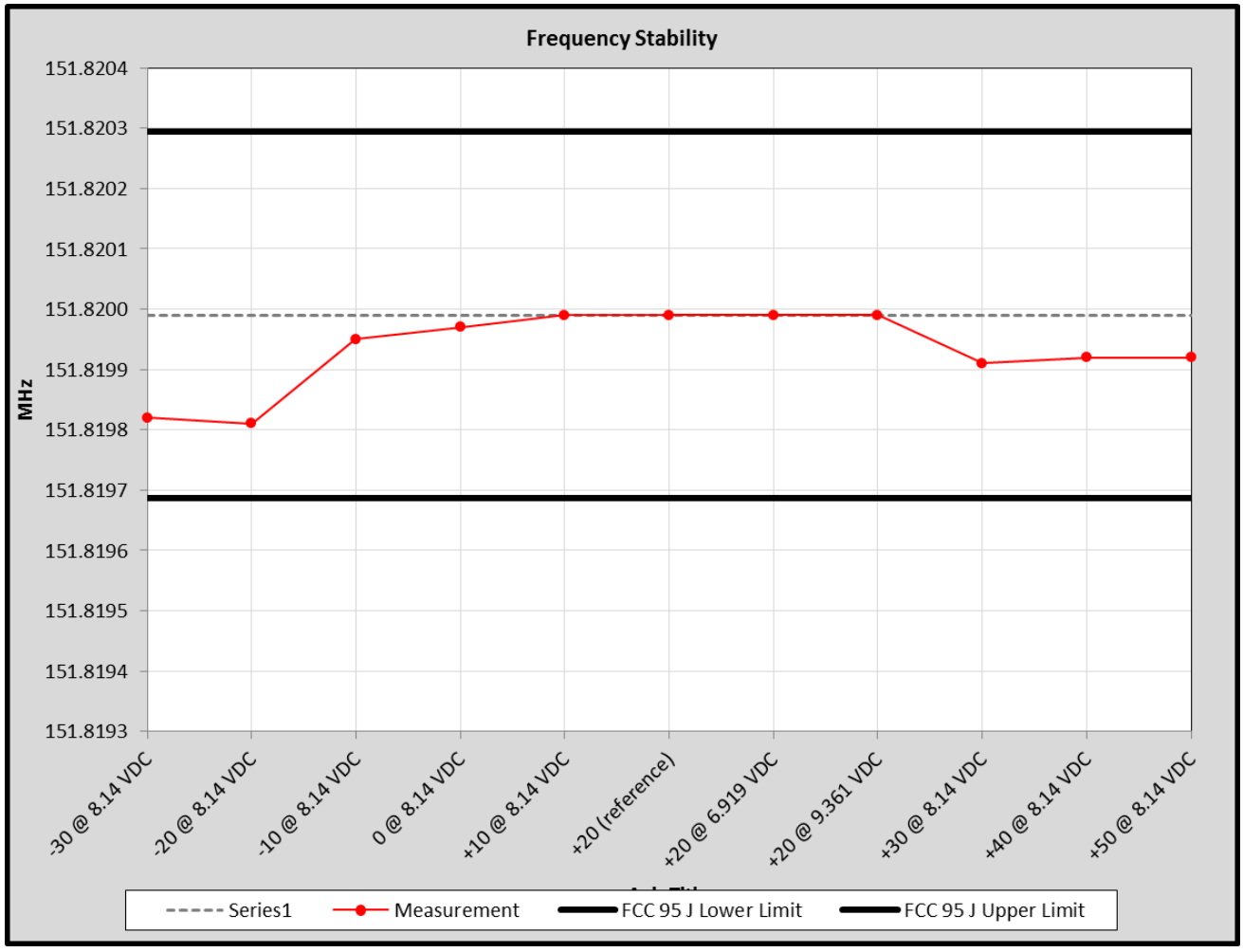
FCC Part 95 J Limit	2.0	ppm
FCC Part 95 J Limit, in Hz	303.640	Hz
FCC 95 J Lower Limit	151.819686	MHz
FCC 95 J Upper Limit	151.820294	MHz
Rated Supply Voltage	8.1	○ AC ◉ DC

Temperature / Voltage Variation

Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (kHz)
-30	8.1	151.81982	0.170
-20	8.1	151.81981	0.180
-10	8.1	151.81995	0.040
0	8.1	151.81997	0.020
+10	8.1	151.81999	0.000
+20 (reference)	8.1	151.81999	0.000
+20	6.9	151.81999	0.000
+20	9.4	151.81999	0.000
+30	8.1	151.81991	0.080
+40	8.1	151.81992	0.070
+50	8.1	151.81992	0.070

FREQUENCY STABILITY

Test Data: Frequency Error Measurement Table



STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or EN TR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
TR 100 028 PARAGRAPH 7.1.1 – FREQUENCY ERROR < 30 MHz	± 0.063 ppm	(1)
TR 100 028 PARAGRAPH 7.1.1 - FREQUENCY ERROR < 200 MHz	± 0.051 ppm	(1)
TR 100 028 PARAGRAPH 7.1.1 - FREQUENCY ERROR < 1 GHz	± 0.051 ppm	(1)
TR 100 028 PARAGRAPH 7.1.1 - FREQUENCY ERROR ≤ 18 GHz	± 0.051 ppm	(1)
TR 100 028 PARAGRAPH 7.1.1 - FREQUENCY ERROR ≤ 40 GHz	± 0.051 ppm	(1)
TR 100 028 PARAGRAPH 7.1.2 - CONDUCTED POWER MEASUREMENT	±0.643 dB	(1)
TR 100 028 PARAGRAPH 7.1.4.1 - CONDUCTED SPURIOUS EMISSIONS 9 kHz – 150 kHz	± 3.14 dB	(1)
TR 100 028 PARAGRAPH 7.1.4.1 - CONDUCTED SPURIOUS EMISSIONS 150 kHz – 30 MHz	± 3.08 dB	(1)
TR 100 028 PARAGRAPH 7.2 – RADIATED EMISSIONS < 200 MHz	± 2.16 dB	(1)
TR 100 028 PARAGRAPH 7.2 – RADIATED EMISSIONS < 1 GHz	± 2.15 dB	(1)
TR 100 028 PARAGRAPH 7.2 – RADIATED EMISSIONS < 18 GHz	± 2.14 dB	(1)
TR 100 028 PARAGRAPH 7.2 – RADIATED EMISSIONS ≤ 40 GHz	± 2.31 dB	(1)
FLUKE Multimeter AC Voltage Uncertainty	± 2.263 %	(1)
FLUKE Multimeter DC Voltage Uncertainty	± 0.453 %	(1)
Temperature (C°)	± 0.81 C°	

Notes: (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

EMC EQUIPMENT LIST

Device	Manufacturer	Model	SN	Calibration Date	Cal Due Date
Function Generator	Standford	DS340	25200	02/21/18	02/21/20
Modulation Analyzer	HP	8901A	3050A05856	04/13/17	04/13/20
Audio Analyzer	HP	8903B	3011A13084	02/20/18	02/20/20
EMI Test Receiver R & S ESIB 40 firmware v 4.34.3 BIOS v3.3	Rohde & Schwarz	ESIB 40	100274	07/22/19	07/22/21
EMI Test Receiver R & S ESU 40 firmware v 4.43 SP 3 BIOS v5.1-24-3	Rohde & Schwarz	ESU 40	100320	08/28/18	08/28/20
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 KMKM-0670-01 KFKF-0197-00	02/27/19	02/27/21
CHAMBER	Panashield	3M	N/A	03/15/19	03/15/21
Antenna: Active Loop	ETS-Lindgren	6502	00062529	12/11/17	12/11/19
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
Ant: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	01/30/17	01/30/19
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	N/A	N/A
Type K J Thermometer	Martel	303	080504494	11/06/17	11/06/20
Oscilloscope	LeCroy	LT364	00414	03/28/19	03/28/21

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT