NVLAP®
Testing
NVLAP Lab Code 200087-0

Test Report for FCC Part 74 Application for Certification Band 470-608 MHz

Model: TLU9

FCC ID: HFLTLU9T

FOR

Rohde & Schwarz Inc.
2255 N. Ontario St., Suite 150
Burbank, CA 91504

Test Report Number: 180415
FCC Designation: US5305
IC Test Site Registration: 3041A-1

Authorized Signatory: Scot D Rogers
Scot D. Rogers

NVLAP
Testing
NVLAP Lab Code 200087-0

ROGERS LABS, INC.

4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

Engineering Test Report for

Application for Grant of Certification

FOR

FCC Part 74

Rohde & Schwarz Inc.

2255 N. Ontario St., Suite 150
Burbank, CA 91504

Model: TLU9
Frequency Range 470 - 608 MHz

FCC ID: HFLTLU9T

Test Date: April 15, 2018

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053
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Revisions

Revision 1 Issued April 25, 2019

Foreword

The following information is submitted for consideration in obtaining Equipment Grant of Certification for Broadcast Licensed equipment for use in Bands IV and V, 470-608 MHz.

Transmitter equipment operating under 47CFR Paragraphs 2 and 74.

Summary

☒ The device fulfills the general approval requirements of the referenced standards identified in this test report and requested by the customer.

☐ The device does not fulfill the general approval requirements of the referenced standards identified in this test report.

Name of Applicant: Rohde & Schwarz FRN: 0018674531
2255 N. Ontario St., Suite 150
Burbank, CA 91504

Model: TLU9 PMN: TLU9

FCC ID: HFLTLU9T
Frequency Range: Band IV, V 470-608 MHz
Maximum Power: 180-watt Average Power

Attestations

This equipment has been tested in accordance with the standards identified in this report and determined in compliance with the referenced requirements and regulations. To the best of my knowledge all testing was performed using the measurement procedures identified in this report. All instrumentation and accessories used during compliance testing are calibrated and remain in a calibrated state in accordance with ISO 17025 requirements.
Further, I attest that all necessary measurements were completed at

Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053

Scot D Rogers
Scot D. Rogers

Date: April 25, 2019

Opinion / Interpretation of Results

Test Number	Measurement	FCC Rule	Pass/Fail
#1	Power Measurement	47CFR 2.1046	Pass
#2	Occupied Bandwidth, Conducted Emissions Mask and Spurious Emissions	47CFR 2.1049, 2.1051, 74.794	Pass
#3	Radiated Spurious Emissions	47CFR 2.1051, 2.1053	Pass
#4	Frequency Stability	47CFR 74.795	Pass

Equipment Tested

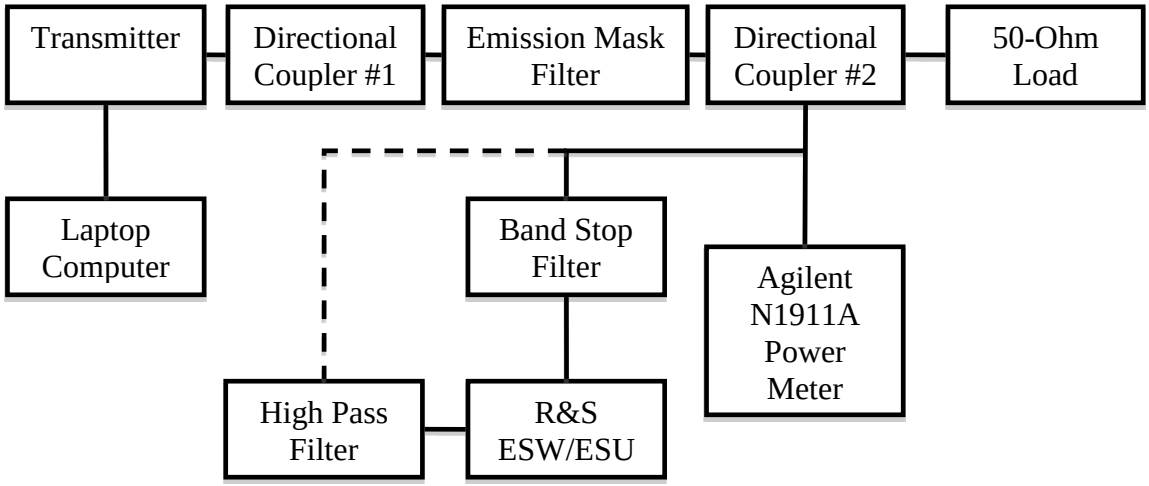
Equipment	Model	FCC I.D.
EUT#1	TLU9	HFLTLU9T
Laptop Computer	Dell PP02X	N/A

Test results in this report relate only to the items tested.

Equipment Function and Configuration

The EUT is a TLU9 Digital low power Broadcast Transmitter. The design provides operational capabilities in the 470-608 MHz band. The EUT offers broadband wireless connectivity to transmit commercial programming. The design is a fully self-contained transmitter system. The system utilizes external Harmonic and Band specific filters which are specified and provided at time of purchase. Filters were provided for test system and used during testing of this device. The EUT provides Ethernet connectivity for control and interface. The design requires power provided through connection to the utility AC mains facility of the building. For testing purposes, the EUT was connected to a laptop computer through an Ethernet network interface to provide transmitter interface and control. This configuration provided operational control of the EUT and communications over the network interface between the EUT and supporting computer. The design provides no other interfacing options than those presented in this report. For testing purposes, the TLU9 test sample was configured to transmit in the available mode while receiving power from the AC mains of the building. A single production test sample was provided for evaluation and testing purposes. As requested by the manufacturer and required by regulations, the equipment was tested for emissions compliance using the available configurations with the worst-case data presented. Test results in this report relate only to the products described in this report.

Equipment Configuration



Directional Coupler #2 was 48.08 dB at the channel of operation 605 MHz.

Applicant Company information

Applicants Company	Rohde & Schwarz
Applicants Address	2255 N. Ontario St., Suite 150 Burbank, CA 91504
FCC Identifier	HFLTLU9T
Manufacturer Company	Rohde & Schwarz
Manufacturer Address	2255 N. Ontario St., Suite 150 Burbank, CA 91504

Equipment information

Brand Name	Rohde & Schwarz
Model Number	TLU9
Test Rule Part(s)	FCC CFR 2, 74
Test Frequency Range	470-608MHz
Project Number	180415
Submission Type	Certification

Product Details

Items	Description
Product Type	Licensed Broadcast Transmitter
Radio Type	Transmitter
Power Type	Utility
Frequency Range	470-608 MHz
Modulation	Digital
Emissions Designation	6M00D7W
Channel Bandwidth	6 MHZ
Maximum Conducted Output Power	180 WATTS

Application for Certification

(1) The full name and mailing address of the manufacturer of the device and the applicant for certification.

Rohde & Schwarz. 2255 N. Ontario St., Suite 150 Burbank, CA 91504

(2) FCC identifier. FCC ID: HFLTLU9T

(3) A copy of the installation and operating instructions to be furnished the user. A draft copy of the instructions may be submitted if the actual document is not available. The actual document shall be furnished to the FCC when it becomes available.

Refer to exhibit for Instruction Manual.

(4) Type or types of emission. 6M00D7W

(5) Frequency range. 470-608 MHz using 6 MHz channels

(6) Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power.

180 W nominal to 50 watts minimum. The output power is variable by digital control commands issued via connected computer or from front panel.

(7) Maximum power rating as defined in the applicable part(s) of the rules.

Service for transmitter use is defined by ERP and not transmitter output rating.

(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.

The EUT does not allow direct current sample measurement. The manufacturer provided efficiency factors of 23 % at nominal power and 17% at low power. This translates to a DC power of 783 watts for nominal power and 294 watts at low power operation.'

(9) Tune-up procedure over the power range, or at specific operating power levels.

Refer to Exhibit for Transmitter Alignment Procedure.

(10) A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power.

Refer to Exhibit for Circuit information and theory of operation.

(11) A photograph or drawing of the equipment identification plate or label showing the information to be placed thereon.

Refer to Exhibit for Photograph or Drawing.

(12) Photographs (8″ × 10″) of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, if any, and labels for controls and meters and sufficient views of the internal construction to define component placement and chassis assembly. Insofar as these requirements are met by photographs or drawings contained in instruction manuals supplied with the certification request, additional photographs are necessary only to complete the required showing.

Refer to Exhibit for Drawings of Components Layout and Chassis Drawings.

(13) For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase and amplitude) of any filters provided, and a description of the modulating wave train, shall be submitted for the maximum rated conditions under which the equipment will be operated.

Not applicable

(14) The data required by §§2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in §2.1041.

Data is contained in this application

(15) The application for certification of an external radio frequency power amplifier under part 97 of this chapter need not be accompanied by the data required by paragraph (b)(14) of this section. In lieu thereof, measurements shall be submitted to show compliance with the technical specifications in subpart C of part 97 of this chapter and such information as required by §2.1060 of this part.

Does not apply to this device or application.

(16) An application for certification of an AM broadcast stereophonic exciter-generator intended for interfacing with existing certified, or formerly type accepted or notified transmitters must include measurements made on a complete stereophonic transmitter. The instruction book must include complete specifications and circuit requirements for interconnecting with existing transmitters. The instruction book must also provide a full description of the equipment and measurement procedures to monitor modulation and to verify that the combination of stereo exciter-generator and transmitter meet the emission limitations of §73.44.

Does not apply to this device or application.

(17) Applications for certification required by §25.129 of this chapter shall include any additional equipment test data required by that section.

Does not apply to this device or application.

(18) An application for certification of a software defined radio must include the information required by §2.944.

Does not apply to this device or application.

(19) Applications for certification of equipment operating under part 27 of this chapter, that a manufacturer is seeking to certify for operation in the:

(i) 1755-1780 MHz, 2155-2180 MHz, or both bands shall include a statement indicating compliance with the pairing of 1710-1780 and 2110-2180 MHz specified in §§27.5(h) and 27.75 of this chapter.

(ii) 1695-1710 MHz, 1755-1780 MHz, or both bands shall include a statement indicating compliance with §27.77 of this chapter.

(iii) 600 MHz band shall include a statement indicating compliance with §27.75 of this chapter.

Does not apply to this device or application.

(20) Before equipment operating under part 90 of this chapter and capable of operating on the 700 MHz interoperability channels (See §90.531(b)(1) of this chapter) may be marketed or sold, the manufacturer thereof shall have a Compliance Assessment Program Supplier's Declaration of Conformity and Summary Test Report or, alternatively, a document detailing how the manufacturer determined that its equipment complies with §90.548 of this chapter and that the equipment is interoperable across vendors. Submission of a 700 MHz narrowband radio for certification will constitute a representation by the manufacturer that the radio will be shown, by testing, to be interoperable across vendors before it is marketed or sold.

Does not apply to this device or application.

(21) Contain at least one drawing or photograph showing the test set-up for each of the required types of tests applicable to the device for which certification is requested. These drawings or photographs must show enough detail to confirm other information contained in the test report. Any photographs used must be focused originals without glare or dark spots and must clearly show the test configuration used.

Data is contained in this application or application exhibits.

Applicable Standards & Test Procedures

The following information is submitted in accordance with CFR dated April 25, 2019, Part 2, Subpart J, and Part 74, Subpart G. Test procedures used are the established IEEE 2008-1631 Recommended Practice On 8-VSB Digital Television Transmission Compliance Measurement Radiated Emission Test Procedure, ANSI C63.26-2015, and KDB 971148.

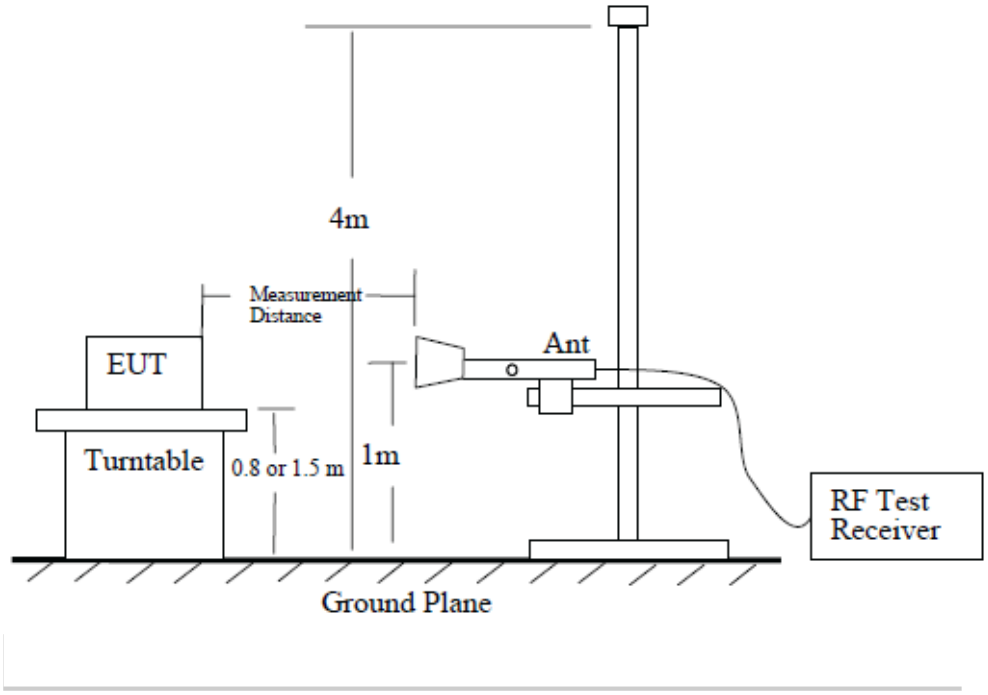
Radiated Emission Test Procedure

Radiated emission testing was performed as required on a CISPR 16-1-4 compliant OATS and as specified in ANSI C63.26-2015 and applicable KDB documents. The EUT was placed on a rotating 0.9 x 1.2-meter platform, elevated as required above the ground plane at a distance of 3 meters from the FSM antenna. The table permitted orientation of the EUT in each of three orthogonal axis positions if necessary. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. The frequency spectrum from 9 kHz to 6,100 MHz was searched for during preliminary investigation. Refer to Diagram 1 showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during radiated emissions testing.

A Rohde and Schwarz ESU40 was used as the measuring instrument for radiated emissions testing.

Antenna Port Conducted Emissions Test Procedure

The test configuration was placed on a 1 x 1.5-meter bench. Testing for the antenna port conducted emissions was performed as defined in ANSI C63.26-2015. The test sample antenna port was connected to appropriate splitters, directional coupler, filters, and attenuation and spectrum analyzer (or Power Meter) during measurements.



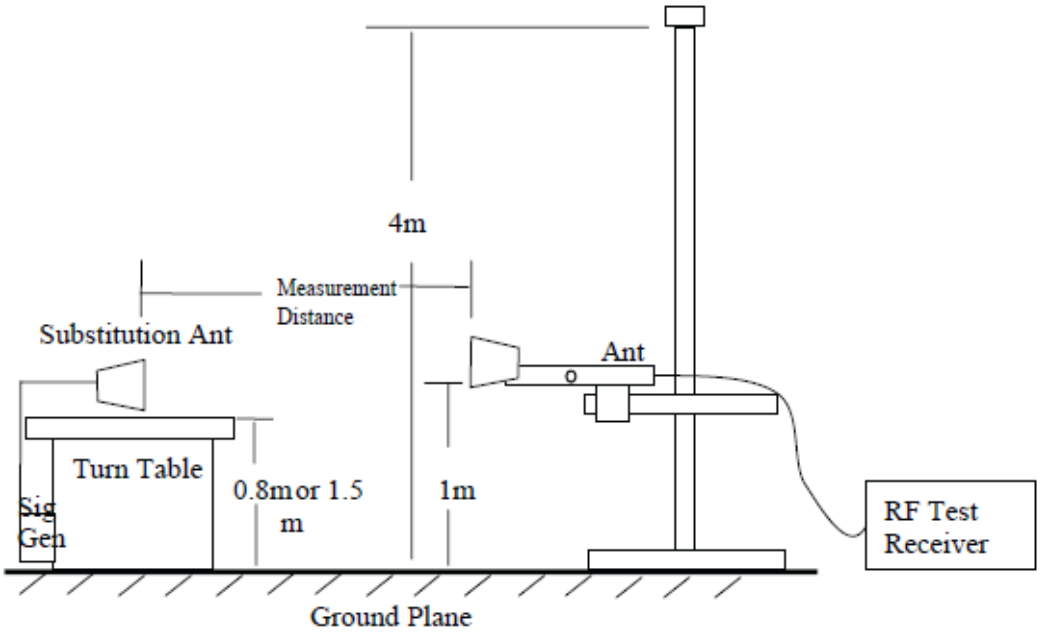


Diagram 1 Test arrangement for Radiated emissions

List of Test Equipment

Equipment	Manufacturer	Model (SN)	Band	Cal Date(m/d/y)	Due
☒ LISN	FCC	FCC-LISN-50-2-10(1PA) (160611)	.15-30MHz	5/15/17	5/15/18
☒ LISN	Compliance Design	FCC-LISN-2.Mod.cd,(126)	.15-30MHz	10/24/17	10/24/18
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(303073)	9kHz-40 GHz	10/24/17	10/24/18
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303069)	9kHz-40 GHz	10/24/17	10/24/18
☒ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	10/24/17	10/24/18
☒ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	10/24/17	10/24/18
☐ Antenna	ARA	BCD-235-B (169)	20-350MHz	10/24/17	10/24/18
☐ Antenna	EMCO	3147 (40582)	200-1000MHz	10/24/17	10/24/18
☒ Antenna	ETS-Lindgren	3117 (200389)	1-18 GHz	5/15/17	5/15/18
☐ Antenna	Com Power	AH-118 (10110)	1-18 GHz	10/24/17	10/24/19
☐ Antenna	Com Power	AH-840 (101046)	18-40 GHz	5/15/17	5/15/19
☒ Antenna	Com Power	AL-130 (121055)	.001-30 MHz	10/24/17	10/24/18
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	10/24/17	10/24/18
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	5/15/17	5/15/18
☒ Analyzer	Rohde & Schwarz	ESW44 (101534)	20Hz-44GHz	12/22/17	12/22/18
☐ Analyzer	Rohde & Schwarz	FS-Z60, 90, 140, and 220	40GHz-220GHz	12/22/17	12/22/19
☒ Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	10/24/17	10/24/18
☒ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	10/24/17	10/24/18
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	10/24/17	10/24/18
☐ Amplifier	Com-Power	PAM-840A (461328)	18-40 GHz	10/24/17	10/24/18
☒ Power Meter	Agilent	N1911A with N1921A	0.05-40 GHz	5/15/17	5/15/18
☒ Generator	Rohde & Schwarz	SMB100A6 (100150)	20Hz-6 GHz	5/15/17	5/15/18
☐ Generator	Rohde & Schwarz	SMBV100A6 (260771)	20Hz-6 GHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	BRC50722 (009).9G notch	30-1800 MHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	HPM50114 (017)1.5G HPF	30-18000 MHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	HPM50117 (063) 3G HPF	30-18000 MHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	HPM50105 (059) 6G HPF	30-18000 MHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	BRM50702 (172) 2G notch	30-1800 MHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	BRC50703 (G102) 5G notch	30-1800 MHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	BRC50705 (024) 5G notch	30-1800 MHz	5/15/17	5/15/18
☐ RF Filter	Micro-Tronics	BRC17663 (001) 9G notch	30-1800 MHz	5/15/17	5/15/18
☐ Attenuator	Fairview	SA6NFNF100W-14 (1625)	30-1800 MHz	5/15/17	5/15/18
☐ Attenuator	Mini-Circuits	VAT-3W2+ (1735)	30-6000 MHz	5/15/17	5/15/18
☐ Attenuator	Mini-Circuits	VAT-3W2+ (1436)	30-6000 MHz	5/15/17	5/15/18
☐ Attenuator	Mini-Circuits	VAT-3W2+ (14362)	30-6000 MHz	5/15/17	5/15/18
☐ Attenuator	Mini-Circuits	VAT-3W2+ (1445)	30-6000 MHz	5/15/17	5/15/18
☐ Attenuator	Mini-Circuits	VAT-3W2+ (14452)	30-6000 MHz	5/15/17	5/15/18
☐ Attenuator	Mini-Circuits	VAT-6W2+ (1438)	30-6000 MHz	5/15/17	5/15/18
☐ Attenuator	JFW Industries	50FH-010-10 (1)	30-18000 MHz	5/15/17	5/15/18
☒ Weather station	Davis	6312 (A70927D44N)		10/24/17	10/24/18

Test Site Locations

Radiated EMI	The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 West 259th Terrace, Louisburg, KS
Site Registration	Refer to Annex for Site Registration Letters
NVLAP Accreditation	Lab code 200087-0

Units of Measurements

Conducted EMI	Data is in dBµV; dB referenced to one microvolt
Radiated EMI	Data is in dBµV/m; dB/m referenced to one microvolt per meter

Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured
A.F. = Receive antenna factor, Gain = amplification gains and/or cable losses
RFS (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)

Environmental Conditions

Ambient Temperature	21.9° C
Relative Humidity	29%
Atmospheric Pressure	1009.1 mb

TEST #1 Power Output

FCC Reference: 47CFR 2.1046, 74.794

Test Method: 971168 D01 v03r01, Section 5 and Notes Below

Results: Meets requirements

Notes:

1. The Antenna port was connected to filter network, splitter, and terminated in 50-Ohm load attenuation. Emissions were monitored at the splitter using a coaxial cable to connect measurement equipment to the RF output port of the test setup.
2. Power is measured using trace averaging over 100 sweeps during a period of continuous transmission.
3. The EUT was transmitting at maximum power with duty cycle equal to 100 % during testing.
4. A pseudo-random data pattern was selected for testing on the basis this provided worst-case emissions.
5. No reduction in power was required to demonstrate compliance with regulations.

§2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as follows. In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(1) Single sideband transmitters in the A3A or A3J emission modes—by two tones at frequencies of 400 Hz and 1800 Hz (for 3.0 kHz authorized bandwidth), or 500 Hz and 2100 Hz (3.5 kHz authorized bandwidth), or 500 Hz and 2400 Hz (for 4.0 kHz authorized bandwidth), applied simultaneously, the input levels of the tones so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(2) Single sideband transmitters in the A3H emission mode—by one tone at a frequency of 1500 Hz (for 3.0 kHz authorized bandwidth), or 1700 Hz (for 3.5 kHz authorized bandwidth), or 1900 Hz (for 4.0 kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency signal component equal in magnitude to the magnitude of the carrier in this mode.

(3) As an alternative to paragraphs (b) (1) and (2) of this section other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However, any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the −25 dB step of the emission bandwidth limitation curve, the seventh and ninth order intermodulation product must fall within the 35 dB step of the referenced curve and the eleventh and all higher order products must fall beyond the −35 dB step of the referenced curve.

(4) Independent sideband transmitters having two channels by 1700 Hz tones applied simultaneously in both channels, the input levels of the tones so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(5) Independent sideband transmitters having more than two channels by an appropriate signal or signals applied to all channels simultaneously. The input signal or signals shall simulate the input signals specified by the manufacturer for normal operation.

(6) Single-channel controlled-carrier transmitters in the A3 emission mode—by a 2500 Hz tone.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§74.794 Digital emissions.

(a)(1) An applicant for a digital LPTV or TV translator station construction permit shall specify that the station will be constructed to confine out-of-channel emissions within one of the following emission masks: Simple, stringent or full service.

(2) The power level of emissions on frequencies outside the authorized channel of operation must be attenuated no less than following amounts below the average transmitted power within the authorized 6 MHz channel. In the mask specifications listed in §74.794(a)(2) and (a)(3), A is the attenuation in dB and Δf is the frequency difference in MHz from the edge of the channel.

(i) *Simple mask.* At the channel edges, emissions must be attenuated no less than 46 dB. More than 6 MHz from the channel edges, emissions must be attenuated no less than 71 dB. At any frequency between 0 and 6 MHz from the channel edges, emissions must be attenuated no less than the value determined by the following formula:

$A\ (dB) = 46 + (\Delta f^2 / 1.44)$

(ii) *Stringent mask.* In the first 500 kHz from the channel edges, emissions must be attenuated no less than 47 dB. More than 3 MHz from the channel edges, emissions must be attenuated no less than 76 dB. At any frequency between 0.5 and 3 MHz from the channel edges, emissions must be attenuated no less than the value determined by the following formula:

$A(dB) = 47 + 11.5\ (\Delta f - 0.5)$

(iii) *Full service mask:* (A) The power level of emissions on frequencies outside the authorized channel of operation must be attenuated no less than the following amounts below the average transmitted power within the authorized channel. In the first 500 kHz from the channel edge the emissions must be attenuated no less than 47 dB. More than 6 MHz from the channel edge, emissions must be attenuated no less than 110 dB. At any frequency between 0.5 and 6 MHz from the channel edge, emissions must be attenuated no less than the value determined by the following formula:

Attenuation in dB = −11.5([Delta]f + 3.6);

Where:

[Delta] f = frequency difference in MHz from the edge of the channel.

(B) This attenuation is based on a measurement bandwidth of 500 kHz. Other measurement bandwidths may be used as long as appropriate correction factors are applied. Measurements need not be made any closer to the band edge than one half of the resolution bandwidth of the measuring instrument. Emissions include sidebands, spurious emissions and radio frequency harmonics. Attenuation is to be measured at the output terminals of the transmitter (including any filters that may be employed). In the event of interference caused to any service, greater attenuation may be required.

(3) The attenuation values for the simple and stringent emission masks are based on a measurement bandwidth of 500 kHz. Other measurement bandwidths may be used and converted to the reference 500 kHz value by the following formula:

$A(dB) = A_{alternate} + 10 \log (BW_{alternate} / 500)$

where A(dB) is the measured or calculated attenuation value for the reference 500 kHz bandwidth, and $A_{alternate}$ is the measured or calculated attenuation for a bandwidth $BW_{alternate}$. Emissions include sidebands,

spurious emissions and radio harmonics. Attenuation is to be measured at the output terminals of the transmitter (including any filters that may be employed). In the event of interference caused to any service by out-of-channel emissions, greater attenuation may be required.

(b) In addition to meeting the emission attenuation requirements of the simple or stringent mask (including attenuation of radio frequency harmonics), digital low power TV and TV translator stations authorized to operate on TV channels 22-24, (518-536 MHz), 32-36 (578-608 MHz), 38 (614-620 MHz), and 65-69 (776-806 MHz) must provide specific “out of band” protection to Radio Navigation Satellite Services in the bands: L5 (1164-1215 MHz); L2 (1215-1240 MHz) and L1 (1559-1610 MHz).

(1) An FCC-certificated transmitter specifically certified for use on one or more of the above channels must include filtering with an attenuation of not less than 85 dB in the GPS bands, which will have the effect of reducing harmonics in the GPS bands from what is produced by the digital transmitter, and this attenuation must be demonstrated as part of the certification application to the Commission.

(2) For an installation on one of the above channels with a digital transmitter not specifically FCC-certificated for the channel, a low pass filter or equivalent device rated by its manufacturer to have an attenuation of at least 85 dB in the GPS bands, which will have the effect of reducing harmonics in the GPS bands from what is produced by the digital transmitter, and must be installed in a manner that will prevent the harmonic emission content from reaching the antenna. A description of the low pass filter or equivalent device with the manufacturer's rating or a report of measurements by a qualified individual shall be retained with the station license. Field measurements of the second or third harmonic output of a transmitter so equipped are not required.

Methods of Measurement Conducted Output Power

KDB 971168 D01 Power Meas License Digital Systems v03, Power Measurements

5.1 Peak power measurements

5.1.1 General

Sections 2.1046 (a) and (c) call for conducted power measurements at the RF output terminal(s) of a device.[4] Some radio service rule parts specify RF output power limits in terms of, for example, total peak output power or total peak ERP or EIRP. The total peak power is often implied when the limits specify peak power or peak ERP or EIRP, without additional specification of a reference bandwidth. Also, when the output power limits are specified in terms of total average power or total average ERP or EIRP, it is acceptable to demonstrate compliance using total peak power measurements under the assumption that the measured peak power will always be greater than or equal to the measured average power. The peak output power, which can subsequently be used to determine the peak ERP or EIRP, can be measured with a spectrum/signal analyzer, an EMI receiver, or a peak-reading power meter. Guidance is provided below for measurements performed with these instruments.

5.1.2 Peak power measurements with a spectrum/signal analyzer or EMI receiver

Subclause 5.2.3.3 of ANSI C63.26-2015 is applicable.

5.1.3 Peak power measurements with a peak-reading power meter

Subclause 5.2.3.2 of ANSI C63.26-2015 is applicable.

5.2 Average power measurements

5.2.1 General

Some radio service rule parts specify the RF output power limits in terms of total average power or total average ERP or EIRP. Total average power is often implied when the limit is stated as average, but no reference bandwidth is specified. When average power measurements are permitted, there may also be a limit imposed on the peak-to-average power ratio (PAPR) of the signal.

When average limits are specified, the averaging is to be performed only over durations of active transmissions at maximum output power level (i.e., averaging over the symbol transitions particular to the

applied modulation scheme). For licensed digital transmitters, average measurements do not include averaging over periods when the transmitter is quiescent or when operating at reduced power levels. Thus, for burst transmissions, the EUT must either be configured to transmit continuously at full power while the compliance measurement is performed, or the measurement instrumentation must be configured to acquire data only over durations when the EUT is actively transmitting at full power. A spectrum/signal analyzer, an EMI receiver or an average-reading power meter can be used to perform this measurement as long as the above condition can be realized.
Additionally, when using a spectrum/signal analyzer to perform an average power measurement, the number of measurement points in each sweep must be set greater than or equal to twice the span divided by the RBW (# measurement points ≥ 2 x span / RBW). This will ensure a bin-to-bin spacing that is less than or equal to the RBW / 2, so that narrowband signals are not lost between frequency bins.

Table 1 Maximum Conducted Output Power Data measured on Power Meter

Frequency MHz	Conducted Antenna Port Average Output Power (Watts)
602-608	180

Plots were produced for graphical presentation of operation and demonstration of compliance. The EUT operates on single channel defined by installation. Plots were produced using traces for the channel observed addressing the requirement.

The associated spectrum analyzer settings and relevant factors for the power measurement spectrum plot are :

Directional Coupler and cable loss to the spectrum analyzer 48.80 dB
Level Offset 50.0 dB
Attenuation 22 dB
Frequency center 605 MHz
Frequency Span 15.1 MHz
RBW 10 kHz
VBW 100 kHz

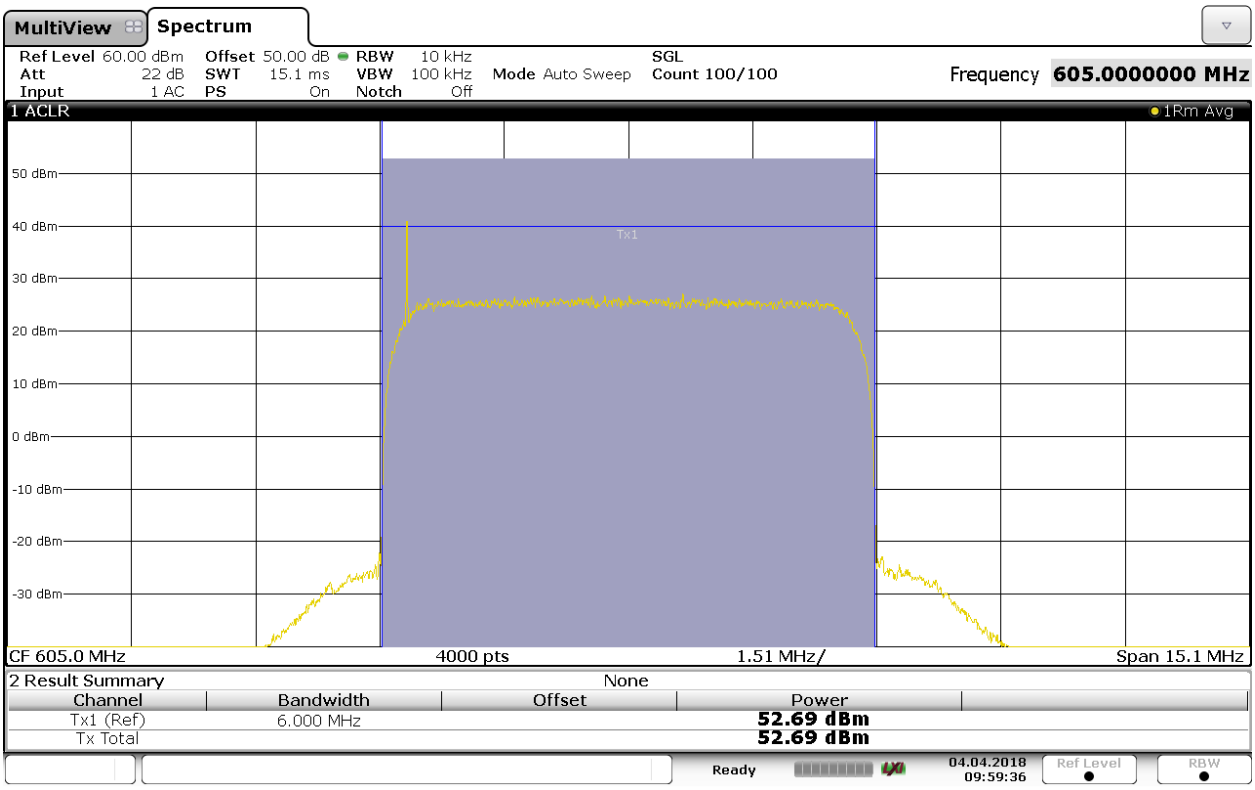


Figure 1 Plot of Antenna Port Power Output

Test #2 Occupied Bandwidth, Undesirable Conducted Radiation And Emission Mask Compliance

FCC Reference: 47CFR 2.1049, 2.1051, 74.794

Test Method: The IEEE 2008-1631 Recommended Practice On 8-VSB Digital Television Transmission Compliance Measurement, KDB 971168 D01, Section 4.1 and Notes Below

Results: Meets requirements

Notes:

1. The Antenna port was connected to filter network, splitter, and terminated in 50-Ohm load attenuation. Emissions were monitored at the splitter using a coaxial cable to connect measurement equipment to the RF output port of the test setup.
2. Power is measured using trace averaging over 100 sweeps during a period of continuous transmission.
3. The EUT was transmitting at maximum power with duty cycle equal to 100 % during testing.
4. A pseudo-random data sequence was selected for testing on the basis this provided wort-case emissions.
5. No reduction in power was required to demonstrate compliance with regulations.

§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:
(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

§2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§74.794 Digital emissions.

(a)(1) An applicant for a digital LPTV or TV translator station construction permit shall specify that the station will be constructed to confine out-of-channel emissions within one of the following emission masks: Simple, stringent or full service.

(2) The power level of emissions on frequencies outside the authorized channel of operation must be attenuated no less than following amounts below the average transmitted power within the authorized 6 MHz channel. In the mask specifications listed in §74.794(a)(2) and (a)(3), A is the attenuation in dB and Δf is the frequency difference in MHz from the edge of the channel.

(i) *Simple mask.* At the channel edges, emissions must be attenuated no less than 46 dB. More than 6 MHz from the channel edges, emissions must be attenuated no less than 71 dB. At any frequency between 0 and 6 MHz from the channel edges, emissions must be attenuated no less than the value determined by the following formula:

$A\ (dB) = 46 + (\Delta f^2 / 1.44)$

(ii) *Stringent mask.* In the first 500 kHz from the channel edges, emissions must be attenuated no less than 47 dB. More than 3 MHz from the channel edges, emissions must be attenuated no less than 76 dB. At any frequency between 0.5 and 3 MHz from the channel edges, emissions must be attenuated no less than the value determined by the following formula:

$A(dB) = 47 + 11.5\ (\Delta f - 0.5)$

(iii) *Full service mask:* (A) The power level of emissions on frequencies outside the authorized channel of operation must be attenuated no less than the following amounts below the average transmitted power within the authorized channel. In the first 500 kHz from the channel edge the emissions must be attenuated no less than 47 dB. More than 6 MHz from the channel edge, emissions must be attenuated no less than 110 dB. At any frequency between 0.5 and 6 MHz from the channel edge, emissions must be attenuated no less than the value determined by the following formula:

Attenuation in dB = −11.5([Delta]f + 3.6);

Where:

[Delta] f = frequency difference in MHz from the edge of the channel.

(B) This attenuation is based on a measurement bandwidth of 500 kHz. Other measurement bandwidths may be used as long as appropriate correction factors are applied. Measurements need not be made any closer to the band edge than one half of the resolution bandwidth of the measuring instrument. Emissions include sidebands, spurious emissions and radio frequency harmonics. Attenuation

is to be measured at the output terminals of the transmitter (including any filters that may be employed). In the event of interference caused to any service, greater attenuation may be required.

(3) The attenuation values for the simple and stringent emission masks are based on a measurement bandwidth of 500 kHz. Other measurement bandwidths may be used and converted to the reference 500 kHz value by the following formula:

$A(dB) = A_{alternate} + 10 \log (BW_{alternate} / 500)$

where A(dB) is the measured or calculated attenuation value for the reference 500 kHz bandwidth, and $A_{alternate}$ is the measured or calculated attenuation for a bandwidth $BW_{alternate}$. Emissions include sidebands, spurious emissions and radio harmonics. Attenuation is to be measured at the output terminals of the transmitter (including any filters that may be employed). In the event of interference caused to any service by out-of-channel emissions, greater attenuation may be required.

(b) In addition to meeting the emission attenuation requirements of the simple or stringent mask (including attenuation of radio frequency harmonics), digital low power TV and TV translator stations authorized to operate on TV channels 22-24, (518-536 MHz), 32-36 (578-608 MHz), 38 (614-620 MHz), and 65-69 (776-806 MHz) must provide specific “out of band” protection to Radio Navigation Satellite Services in the bands: L5 (1164-1215 MHz); L2 (1215-1240 MHz) and L1 (1559-1610 MHz).

(1) An FCC-certificated transmitter specifically certified for use on one or more of the above channels must include filtering with an attenuation of not less than 85 dB in the GPS bands, which will have the effect of reducing harmonics in the GPS bands from what is produced by the digital transmitter, and this attenuation must be demonstrated as part of the certification application to the Commission.

Note: CFR Part 74 Subpart G contains no reference or requirements for occupied bandwidth but instead requires emissions to be limited to the stipulated emission mask. For that reason, no typical 99% OBW measurement has been made. For this report, CFR 47 Part 74 Subpart G has been used to define the limits of emissions and the occupied bandwidth requirement definition has been interpreted as 47 dB below the total power within the 6 MHz channel allocation.

Test Methodology: Occupied Bandwidth, Undesirable Conducted Radiation And Emission Mask Compliance

Test Method: The IEEE 2008-1631 Recommended Practice On 8-VSB Digital Television Transmission Compliance Measurement.

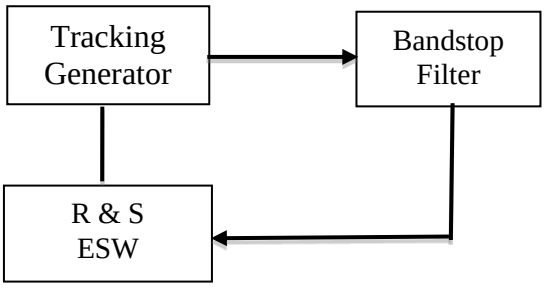
Test Methodology Notes—180 Watts
To determine conducted radiation emission mask compliance, the test equipment configuration shown on Figure 1 was used. For adjacent channel and harmonic energy measurements, spectrum analyzer was used in conjunction with the bandstop filter.

The transmitter was tested for compliance with the stringent emission mask as specified in FCC rule 74.794 (a) (2) (ii). The IEEE 2008-1631 Recommended Practice On 8-VSB Digital Television Transmission Compliance Measurement was used as the test measurement methodology. The first part of the emission mask compliance tests measured the adjacent channel emission and the second part of the tests measured the harmonic and spurious energy.

The transmitter was energized at 180 watts on Channel 36 (center frequency of 605 MHz) as measured at the output of Directional coupler #2 using the Agilent N1911A power meter. Using this RF sample signal, a reference was established (using the channel power measurement mode) on the spectrum analyzer screen. The bandstop filter insertion loss (including input and output cables loss) versus frequency response was previously determined using the spectrum analyzer and tracking generator combination. The plot of the bandstop filter is shown below for reference. The insertion loss at the center of each of the twelve 500 kHz segments either side of the main channel was tabulated. The bandstop filter response is shown as Figure 2. The BSF filter tabulated attenuation versus frequency has been indicated in the next section within the table of measured emission values.

The 6 MHz DTV channel power was first measured for the channel 36 signal. Then the twelve 500 kHz segments on both sides of the channel 36 signal were measured. For the channel power reference and the first four 500 kHz segments on each side of channel 36, the bandstop filter was bypassed. To measure the remaining eight 500 kHz segments on each side of channel 36, the bandstop filter was inserted and the sensitivity of the spectrum analyzer was increased by removing RF attenuation. Without the bandstop filter, the noise floor of the spectrum analyzer with a 10 kHz RBW was -97.8 dBm (for measurement of four 500 kHz segments closest to the channel) and using the bandstop filter, the attenuation was reduced to achieve a noise floor of -103.5 dBm (for measurement of the eight other 500 kHz segments in the adjacent channels). Each 500 kHz segment was measured, and the results corrected and recorded for the bandstop filter loss and cables and, where needed, it was also corrected for the proximity to the noise floor in the emission mask table shown after the bandstop filter plot.

Test Equipment Characterization—Bandstop Filter



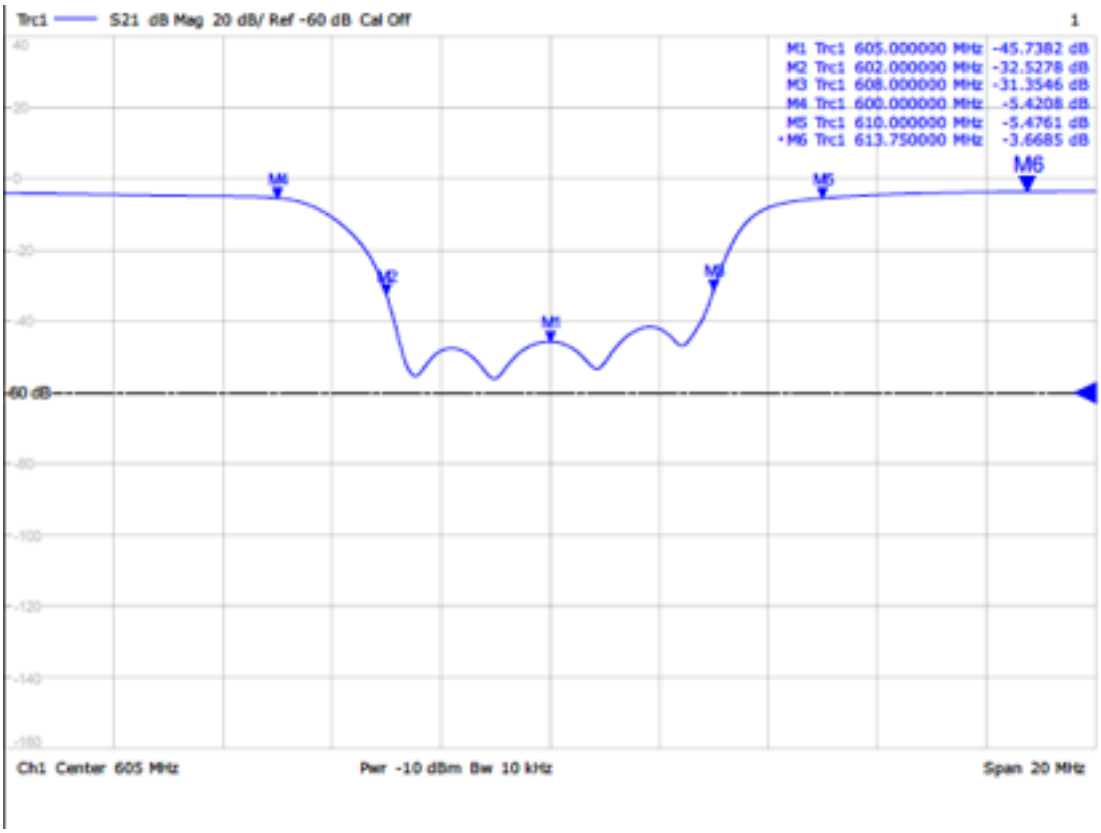


Figure 2 – Bandstop Filter Plot

Emission Mask Compliance—

Test Methodology Notes—50 Watts
The same test method for operation at 180 Watts was used to determine conducted radiation emission mask compliance at Low Power (50 W). The test equipment configuration shown on Figure 1 was used. The first part of the emission mask compliance tests measured the adjacent channel emission and the second part of the tests measured the harmonic and spurious energy.

The noise floor of the spectrum analyzer in the adjacent channels was determined. The minimum sample level required in order to determine whether the emission mask was met was calculated and recorded in the table. The actual RF sample level, -3 dBm, was above the required minimum RF sample so margin was available with the test configuration used.

The twelve 500 kHz segments on both sides of the channel 36 signal were measured and recorded in the table shown on the next page.

ATSC TRANSMITTER TEST REPORT 180 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-115.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-98.0
Noise floor proximity upper threshold [dBm]	-88.0
Noise floor proximity lower threshold [dBm]	-95.0

Min. Sample Level [dBm]	-21.8
Actual Sample Level [dBm]	3.0

ATSC TRANSMISSION MASK COMPLIANCE TEST Stringent Mask

Channel Power [dBm]	2.7
Channel Number	36
Center Frequency [MHz]	605

Delta Frequency [MHz]	Frequency [MHz]	Measured Amplitude [dBm]	Corrected for Noise Floor [dBm]	Bandstop Filter (dB)	Corrected Amplitude [dBm]	Amplitude below Channel Power [dB]	FCC Limit [dB]	Pass/ Fail
3.25	608.25	-56.6	-56.6		-56.6	59.3	47.0	**Pass**
3.75	608.75	-59.2	-59.2		-59.2	61.9	49.9	**Pass**
4.25	609.25	-63.6	-63.6		-63.6	66.3	55.6	**Pass**
4.75	609.75	-66.9	-66.9		-66.9	69.6	61.4	**Pass**
5.25	610.25	-90.1	-90.9	3.7	-87.2	89.9	67.1	**Pass**
5.75	610.75	-96.4	-98.0	3.1	-95.0	97.7	71.9	**Pass**
6.25	611.25	-100.5	-98.0	2.6	-95.4	98.1	76.0	**Pass**
6.75	611.75	-102.0	-98.0	2.2	-95.8	98.5	76.0	**Pass**
7.25	612.25	-102.0	-98.0	1.9	-96.2	98.9	76.0	**Pass**
7.75	612.75	-102.0	-98.0	1.6	-96.4	99.1	76.0	**Pass**
8.25	613.25	-102.0	-98.0	1.5	-96.5	99.2	76.0	**Pass**
8.75	613.75	-102.0	-98.0	1.3	-96.7	99.4	76.0	**Pass**
-3.25	601.75	-59.3	-59.3		-59.3	62.0	47.0	**Pass**
-3.75	601.25	-63.8	-63.8		-63.8	66.5	49.9	**Pass**
-4.25	600.75	-70.4	-70.4		-70.4	73.1	55.6	**Pass**
-4.75	600.25	-73.7	-73.7		-73.7	76.4	61.4	**Pass**
-5.25	599.75	-91.0	-92.0	3.7	-88.3	91.0	67.1	**Pass**
-5.75	599.25	-96.2	-98.0	3.2	-94.8	97.5	71.9	**Pass**
-6.25	598.75	-100.0	-98.0	2.9	-95.1	97.8	76.0	**Pass**
-6.75	598.25	-102.0	-98.0	2.8	-95.2	97.9	76.0	**Pass**
-7.25	597.75	-102.0	-98.0	2.7	-95.3	98.0	76.0	**Pass**
-7.75	597.25	-102.0	-98.0	2.6	-95.4	98.1	76.0	**Pass**
-8.25	596.75	-102.0	-98.0	2.5	-95.5	98.2	76.0	**Pass**
-8.75	596.25	-102.0	-98.0	2.4	-95.6	98.3	76.0	**Pass**

ATSC TRANSMITTER TEST REPORT 50 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-115.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-98.0
Noise floor proximity upper threshold [dBm]	-88.0
Noise floor proximity lower threshold [dBm]	-95.0

Min. Sample Level [dBm]	-21.8
Actual Sample Level [dBm]	-3.0

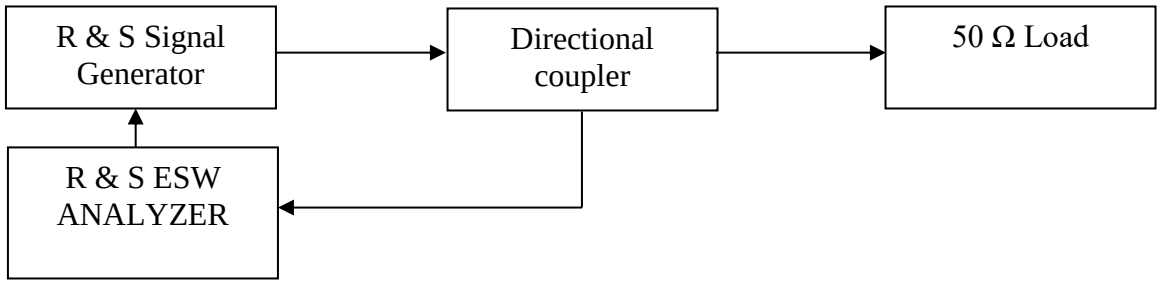
ATSC TRANSMISSION MASK COMPLIANCE TEST Stringent Mask

Channel Power [dBm]	-7.1
Channel Number	36
Center Frequency [MHz]	605

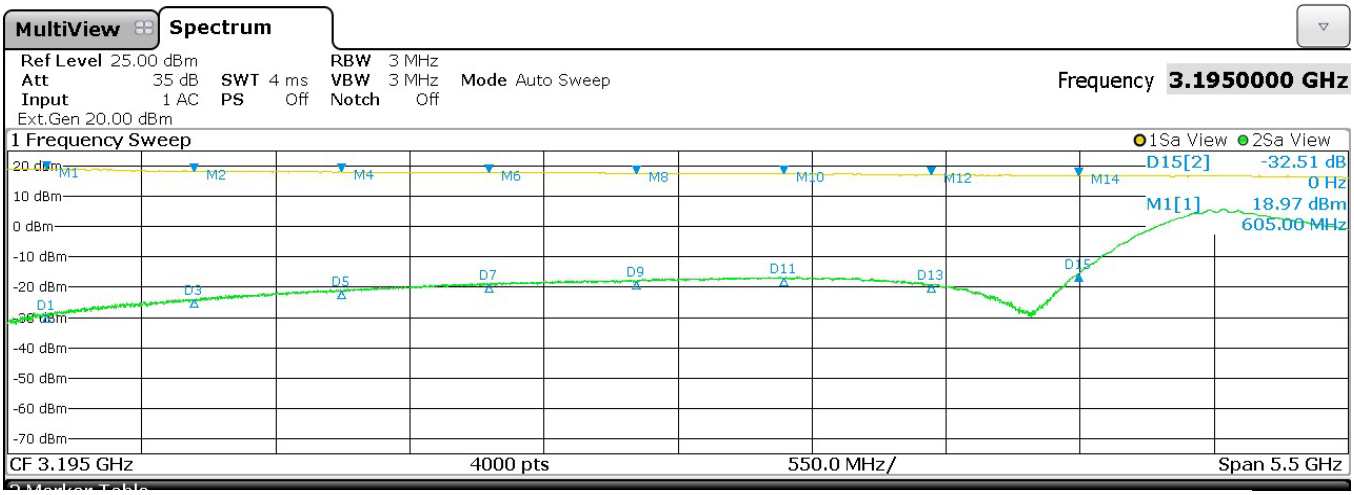
Delta Frequency [MHz]	Frequency [MHz]	Measured Amplitude [dBm]	Corrected for Noise Floor [dBm]	Bandstop Filter (dB)	Corrected Amplitude [dBm]	Amplitude below Channel Power [dB]	FCC Limit [dB]	Pass/Fail
3.25	608.25	-70.5	-70.5		-70.5	63.4	47.0	**Pass**
3.75	608.75	-74.0	-74.0		-74.0	66.9	49.9	**Pass**
4.25	609.25	-79.4	-79.4		-79.4	72.3	55.6	**Pass**
4.75	609.75	-83.8	-83.8		-83.8	76.7	61.4	**Pass**
5.25	610.25	-98.9	-98.0	3.7	-94.3	87.2	67.1	**Pass**
5.75	610.75	-101.0	-98.0	3.1	-95.0	87.9	71.9	**Pass**
6.25	611.25	-102.0	-98.0	2.6	-95.4	88.3	76.0	**Pass**
6.75	611.75	-102.0	-98.0	2.2	-95.8	88.7	76.0	**Pass**
7.25	612.25	-102.0	-98.0	1.9	-96.2	89.1	76.0	**Pass**
7.75	612.75	-102.0	-98.0	1.6	-96.4	89.3	76.0	**Pass**
8.25	613.25	-102.0	-98.0	1.5	-96.5	89.4	76.0	**Pass**
8.75	613.75	-102.0	-98.0	1.3	-96.7	89.6	76.0	**Pass**
-3.25	601.75	-70.7	-70.7		-70.7	63.6	47.0	**Pass**
-3.75	601.25	-76.5	-76.5		-76.5	69.4	49.9	**Pass**
-4.25	600.75	-83.2	-83.2		-83.2	76.1	55.6	**Pass**
-4.75	600.25	-87.0	-87.0		-87.0	79.9	61.4	**Pass**
-5.25	599.75	-82.0	-99.8	3.7	-96.1	89.0	67.1	**Pass**
-5.75	599.25	-88.3	-101.0	3.2	-97.8	90.7	71.9	**Pass**
-6.25	598.75	-94.6	-102.0	2.9	-99.1	92.0	76.0	**Pass**
-6.75	598.25	-99.1	-102.0	2.8	-99.2	92.1	76.0	**Pass**
-7.25	597.75	-101.0	-102.0	2.7	-99.3	92.2	76.0	**Pass**
-7.75	597.25	-101.0	-102.0	2.6	-99.4	92.3	76.0	**Pass**
-8.25	596.75	-101.0	-102.0	2.5	-99.5	92.4	76.0	**Pass**
-8.75	596.25	-101.0	-102.0	2.4	-99.6	92.5	76.0	**Pass**

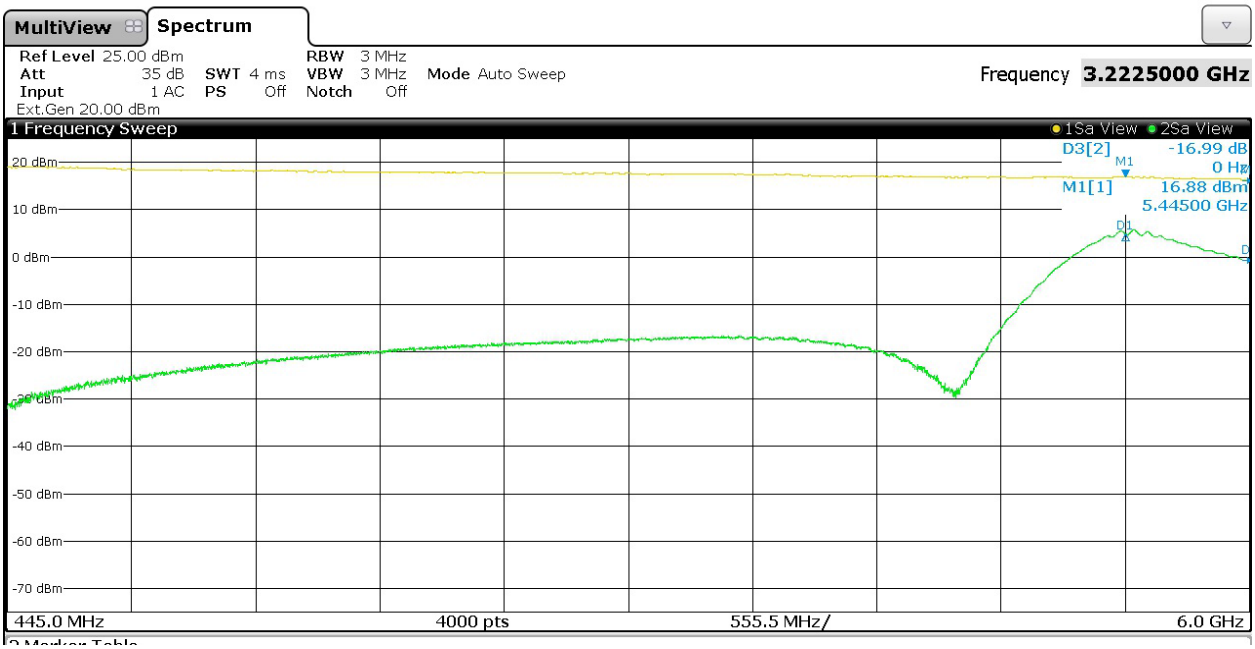
Emission Mask Compliance--Harmonic and Spurious Radiation at Max Power of 180 W

Test Methodology Notes—Harmonic and spurious conducted energy
The next set of tests provided measurements of conducted harmonic and spurious energy from the transmitter. The frequency spectrum up to the 10th harmonic was investigated for harmonic and spurious energy. The test setup of Figure 1 was used with the RF sample feeding the high pass filter and then the ESW analyzer. First, the net coupling at each transmitter harmonic was determined. A highpass filter was used to keep the total fundamental channel energy applied to the ESW analyzer low enough to prevent harmonic energy from being created in the spectrum analyzer itself. The directional coupler, highpass filter, and cables to and from the unit under test were characterized at each harmonic of the transmitter frequency using the ESW analyzer. The test setup to measure the coupler and highpass filter is shown below and the results from this characterization are shown below and the tabulated values are included in the Marker Tables.



COUPLING VALUE VERUS FREQUENCY PLOT
(Includes High Pass filter and cable loss)
(Markers tabulated on following pages)





**TABULATED COUPLING VALUE VERSUS FREQUENCY
(INCLUDES HIGH PASS FILTER)**

1.1.2 Marker Table

Type	Ref	Trace	X-Value	Y-Value	Function	Func Result
M1		1	605 MHz	19 dBm		
D1	M1	2	0 Hz	-48.1 dB		
M2		1	1.21 GHz	18.3 dBm		
D3	M2	2	0 Hz	-42.4 dB		
M4		1	1.815 GHz	18.1 dBm		
D5	M4	2	0 Hz	-39.2 dB		
M6		1	2.42 GHz	17.8 dBm		
D7	M6	2	0 Hz	-36.9 dB		
M8		1	3.025 GHz	17.6 dBm		
D9	M8	2	0 Hz	-35.6 dB		
M10		1	3.63 GHz	17.5 dBm		
D11	M10	2	0 Hz	-34.4 dB		
M12		1	4.235 GHz	17 dBm		
D13	M12	2	0 Hz	-36.1 dB		
M14		1	4.84 GHz	16.9 dBm		
D15	M14	2	0 Hz	-32.5 dB		

2.1.2 Marker Table

Type	Ref	Trace	X-Value	Y-Value	Function	Func Result
M1		1	5.445 GHz	16.9 dBm		
D1	M1	2	0 Hz	-12 dB		
M2		1	6 GHz	16.2 dBm		
D3	M2	2	0 Hz	-17 dB		

Results of the Spurious and Harmonic Tests—Operation at 180 W

The only energy measurable was the ESW analyzer at its noise floor. In this case, no harmonic power above the spectrum analyzer noise floor was observed. Channel power measurements using a 500 kHz channel power bandwidth were taken at harmonics up to the 10th and the largest signal level in any 500 kHz segment of the energy was recorded in the table following on the next page. The measured values were converted back to an equivalent power at the transmitter output using the directional coupler factor and compared with the total power of 56 dBm for the channel 36 spectrum. See Figure 3 for spectrum plot measurement before converting the measured results to power in a 500 kHz bandwidth, adding the directional coupler factors, and comparing the amounts to the total power. The following table provides the Test Results after all factors are included. All test results are below the minimum value of 76 dBc per the FCC Rule 74.794 (a) (2) (ii).

HARMONIC AND SPURIOUS RADIATION AT 180 W

ATSC TRANSMISSION MASK COMPLIANCE TEST
HARMONICS

Channel Power [dBm]	52.6
Channel Number	36
Center Frequency [MHz]	605

Harmonic	Frequency [MHz]	Measured Amplitude [dBm]	HPF & Cable Loss [dB]	Coupling Value [dB]	Corrected Amplitude [dBm]	Amplitude below Channel Power[dB]	FCC Limit [dB]	Pass/ Fail
2nd	1210.00	-104.0	1.6	42.4	-60.0	112.6	76.0	**Pass**
3rd	1815.00	-102.0	2.3	39.2	-60.5	113.1	76.0	**Pass**
4th	2420.00	-100.0	1.7	36.9	-61.4	114.0	76.0	**Pass**
5th	3025.00	-102.0	2.2	35.6	-64.2	116.8	76.0	**Pass**
6th	3630.00	-102.0	1.9	34.4	-65.7	118.3	76.0	**Pass**
7th	4235.00	-99.6	3.1	36.1	-60.4	113.0	76.0	**Pass**
8th	4840.00	-98.3	4.0	32.5	-61.8	114.4	76.0	**Pass**
9th	5445.00	-100.0	3.2	17.0	-79.8	132.4	76.0	**Pass**
10th	6050.00	-99.5	2.7	12.0	-84.8	137.4	76.0	**Pass**

Figure 3 - Spectrum at 2nd & 3rd harmonics

TEST #3 Radiated Spurious Emissions

FCC Reference: 47CFR 2.1053, 74.794

Test Method: KDB 971168 D01, Section 7 and Notes Below

Results: Meets requirements

Notes:

1. Test sample was used during radiated spurious emissions testing on the OATS.
2. Power is measured using trace averaging over 100 sweeps during a period of continuous transmission.
3. The EUT was transmitting at maximum power with duty cycle equal to 100 % during testing.
4. A pseudo-random data sequence was selected for testing on the basis this provided wort-case emissions.
5. No reduction in power was required to demonstrate compliance with regulations.

§2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

Test Arrangement Radiated Spurious Emissions

Reference Diagram 1

Table 8 Radiated Spurious Emissions

Frequency (MHz)	Horizontal ERP (dBm)	Vertical ERP (dBm)	Limit (dBm)	Horizontal Level below (dBc)	Vertical Level below (dBc)
177.4	-75.9	-79.3	-15.0	-128.4	-131.8
456.6	-79.7	-79.6	-15.0	-132.2	-132.1
602.3	-76.9	-77.0	-15.0	-129.4	-129.5
607.7	-75.6	-76.8	-15.0	-128.1	-129.3
713.9	-75.1	-75.3	-15.0	-127.6	-127.8
1210.0	-71.9	-71.6	-15.0	-124.4	-124.1
1815.0	-69.2	-71.1	-15.0	-128.4	-131.8

Other emissions present had amplitudes at least 20 dB below the limit. Emission amplitudes are recorded above for frequency range of 0.009-6100 MHz.

TEST #4 Frequency Stability

FCC Reference: 47CFR 2.1055, 74.794, 74.795 (b) (4)

Test Method: KDB 971168 D01, Section 7 and Notes Below

Results: Meets requirements

Notes:

1. Measurement equipment was connected to the test sample.
2. The EUT in this case was without the power amplifier running as the power amplifier has no impact on the frequency of the transmission. The EUT was transmitting with a duty cycle of 100% during testing.
3. A pseudo-random data sequence was used for testing on the basis this provided worst-case emissions.

§74.795 Digital low power TV and TV translator transmission system facilities.

(a)(1) An applicant for a digital LPTV or TV translator station construction permit shall specify that the station will be constructed to confine out-of-channel emissions within one of the following emission masks: Simple, stringent or full service.

(2) The power level of emissions on frequencies outside the authorized channel of operation must be attenuated no less than following amounts below the average transmitted power within the authorized 6 MHz channel. In the mask specifications listed in §74.794(a)(2) and (a)(3), A is the attenuation in dB and Δf is the frequency difference in MHz from the edge of the channel.

§ 74.795 Digital low power TV and TV translator transmission system facilities.
(a) A digital low power TV or TV translator station shall operate with a transmitter that is either certificated for licensing based on the following provisions or has been modified for digital operation pursuant to § 74.796.

(b) The following requirements must be met before digital low power TV and TV translator transmitter will be certificated by the FCC:

Methods of Measurement Frequency Stability

KDB 971168 D01 Power Meas License Digital Systems v03, Frequency Stability

FREQUENCY STABILITY

The frequency stability of the transmitter shall be measured while varying the ambient temperatures and supply voltages over the ranges specified in Section 2.1055. The specific frequency stability limits are provided in the relevant rules section(s).

The measurement procedure is outlined below.

Step 1 The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.

Step 2 With the transmitter inoperative (power switched "OFF"), the temperature of the test chamber shall be adjusted to 0°C. After a temperature stabilization period of 50 minutes at 0°C, the transmitter shall be switched "ON" with standard test voltage applied.

Step 3 The carrier shall be keyed "ON", and the transmitter shall be operated at full radio frequency power output at 100% duty cycle for a duration of at least 20 minutes. The digital emission contains a pilot frequency locked to the EUT reference oscillator. The radio frequency pilot carrier frequency shall be monitored, and measurements shall be recorded.

Step 4 Frequency measurements shall be repeated after stabilizing the transmitter at the environmental temperatures specified for at least 20 minutes, over the temperature range from 0 to 45°C (as identified in the relevant rule section) in no more than 10-degree increments.

Table 9 Frequency Stability vs. Temperature data

Nominal Temperature °C	Measured Frequency (Hz)	Difference (Hz)
0	602,309,482.0	Reference (Start of Test)
10	602,309,479.2	-2.8
20	602,309,478.0	-4.0
25	602,309,475.6	-6.4
30	602,309,473.2	-8.8
40	602,309,472.5	-9.5
45	602,309,471.0	-11.0

Table 10 Frequency Stability vs. Input Power Supply Voltage data

Line Voltage (V_{ac})	Frequency (MHz)	Difference (Hz)
103 V_{ac} (85%)	602,309,408.5	0.0
121 V_{ac} (Nominal)	602,309,408.5	0.0
139 V_{ac} (115%)	602,309,408.5	0.0

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to demonstrate compliance with the 47CFR Parts 2 or 74 emissions requirements. There were no deviations or modifications to the specifications.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Additional Test Equipment List
- Annex C Rogers Qualifications
- Annex D Rogers Labs Certificate of Accreditation

Annex A Measurement Uncertainty Calculations

The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4. Result of measurement uncertainty calculations are recorded below. Component and process variability of production devices similar to those tested may result in additional deviations. The manufacturer has the sole responsibility of continued compliance.

Measurement	Expanded Measurement Uncertainty $U_{(lab)}$
3 Meter Horizontal 0.009-1000 MHz Measurements	4.16
3 Meter Vertical 0.009-1000 MHz Measurements	4.33
3 Meter Measurements 1-18 GHz	5.14
3 Meter Measurements 18-40 GHz	5.16
10 Meter Horizontal Measurements 0.009-1000 MHz	4.15
10 Meter Vertical Measurements 0.009-1000 MHz	4.32
AC Line Conducted	1.75
Antenna Port Conducted power	1.17
Frequency Stability	1.00E-11
Temperature	1.6˚C
Humidity	3%

Annex B Additional Test Equipment List

List of Test Equipment	Calibration Date (m/d/y)	Due
Antenna: Schwarzbeck Model: BBA 9106/VHBB 9124 (9124-627)	5/15/17	5/15/18
Antenna: Schwarzbeck Model: VULP 9118 A (VULP 9118 A-534)	5/15/17	5/15/18
Antenna: EMCO 6509	10/24/17	10/24/18
Antenna: EMCO 3143 (9607-1277) 20-1200 MHz	5/15/17	5/15/18
Antenna: EMCO Dipole Set 3121C	2/23/18	2/23/19
Antenna: C.D. B-101	2/23/18	2/23/19
Antenna: Solar 9229-1 & 9230-1	2/23/18	2/23/19
Cable: Belden 8268 (L3)	10/24/17	10/24/18
Cable: Time Microwave: 4M-750HF290-750	10/24/17	10/24/18
Frequency Counter: Leader LDC-825 (8060153	5/15/17	5/15/18
Oscilloscope Scope: Tektronix 2230	2/23/18	2/23/19
Wattmeter: Bird 43 with Load Bird 8085	2/23/18	2/23/19
R.F. Generator: SMB100A6 s/n 100623	5/15/17	5/15/18
R.F. Generator: SBMBV100A s/n: 260771	5/15/17	5/15/18
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/23/18	2/23/19
R.F. Power Amp 65W Model: 470-A-1010	2/23/18	2/23/19
R.F. Power Amp 50W M185- 10-501	2/23/18	2/23/19
R.F. Power Amp A.R. Model: 10W 1010M7	2/23/18	2/23/19
R.F. Power Amp EIN Model: A301	2/23/18	2/23/19
LISN: Compliance Eng. Model 240/20	5/15/17	5/15/18
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	5/15/17	5/15/18
Audio Oscillator: H.P. 201CD	2/23/18	2/23/19
ESD Test Set 2010i	2/23/18	2/23/19
Oscilloscope Scope: Tektronix MDO 4104	2/23/18	2/23/19
EMC Transient Generator HVT TR 3000	2/23/18	2/23/19
AC Power Source (Ametech, California Instruments)	2/23/18	2/23/19
Fast Transient Burst Generator Model: EFT/B-101	2/23/18	2/23/19
Field Intensity Meter: EFM-018	2/23/18	2/23/19
KEYTEK Ecat Surge Generator	2/23/18	2/23/19
ESD Simulator: MZ-15	2/23/18	2/23/19
Shielded Room not required		

Annex C Rogers Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 30 years' experience in the field of electronics. Work experience includes six years working in the automated controls industry and remaining years working with the design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer: A/C Controls Mfg. Co., Inc. 6 Years

Electrical Engineer: Rogers Consulting Labs, Inc. 5 Years

Electrical Engineer: Rogers Labs, Inc. Current

Educational Background:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University

2) Bachelor of Science Degree in Business Administration Kansas State University

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Annex D Rogers Labs Certificate of Accreditation

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200087-0

Rogers Labs, Inc.
Louisburg, KS

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2018-02-21 through 2019-03-31
Effective Dates

For the National Voluntary Laboratory Accreditation Program