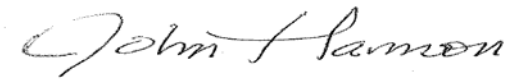
FAX300, FAX500, FAX1K FCC Verification Measurements

This document is compiled to provide the data and records supporting a Verification of Compliance with FCC rules set forth in 47CFR Parts 2 and 73. Verification as described in 2.902 applies to all subsequent identical units marketed.

Use of the Verification method requires that the records identified in 2.955 are kept, and that they shall be retained for two years after the manufacture of the equipment has ceased. This document, along with certain other documents referenced herein, are the records for the verification of the equipment tested and described.

These tests are representative of FAX300, FAX500, FAX1K transmitters.

PERSONS PRIMARILY RESPONSIBLE FOR TESTING	
Name	John Harmon
Signature	
Title	Engineering Specialist
Address for contact purposes	Harris Corporation 5300 Kings Island Drive Suite 101 Mason, OH 45040
Telephone	513-459-3804
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Name(s) of others who performed testing if applicable	Dave Danielsons, Jacob Foote

Official of Responsible Party	
Name	Terry Cockerill
Title	Project Engineer
Address for contact purposes	Harris Corporation 3200 Wismann Lane Quincy, Il. 62305
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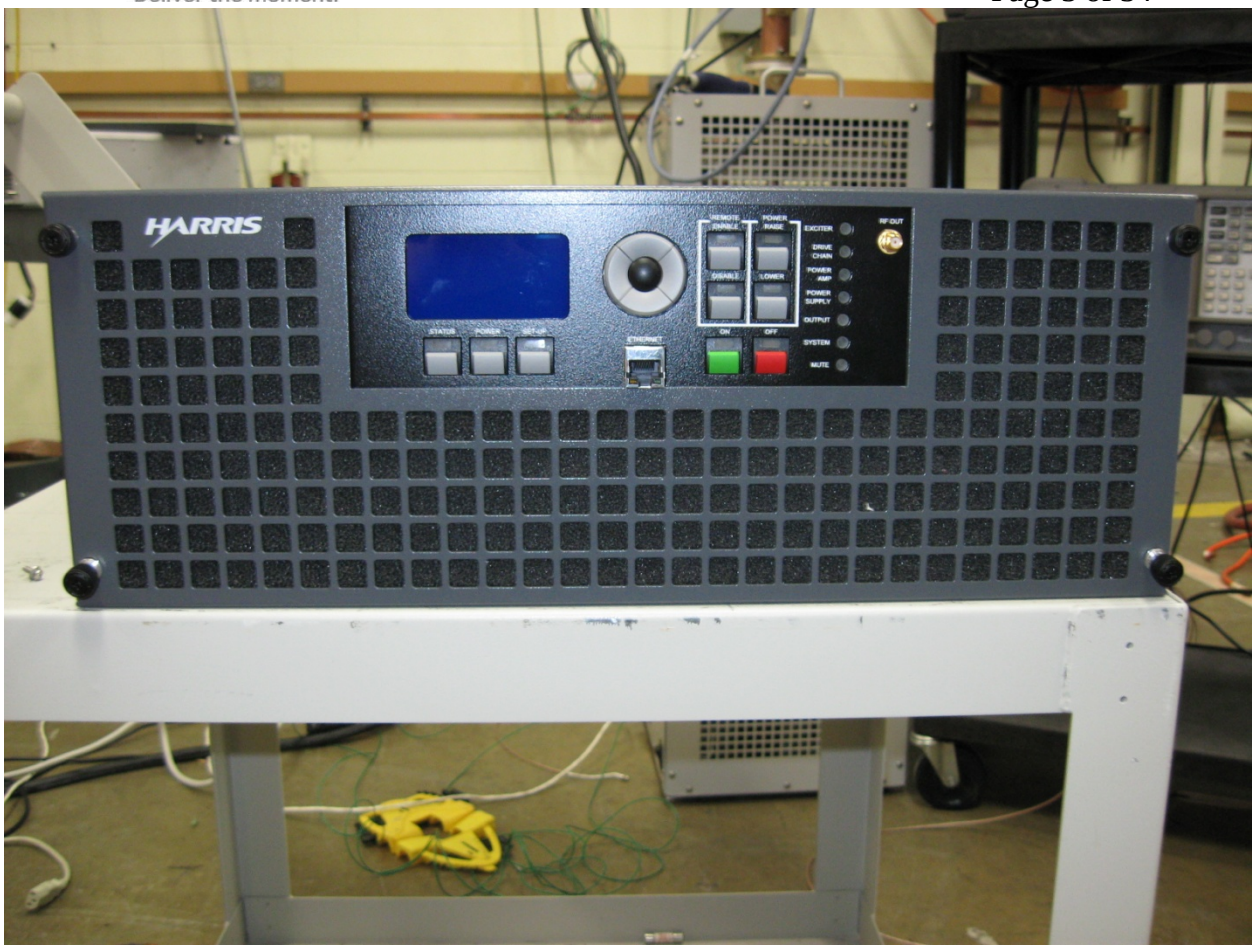
Signature	

1. Description of the EUT

Harris® Flexiva™ is the next generation in solid state transmission for FM analog and HD Radio™ broadcasting.

The Flexiva operates on any single channel in the 88-108 MHz FM band. Power output capability ranges are: 1000W in the FM only mode, and 1590W in the FM+HD mode at -10dB injection. The emission designator is: 400KD9W

Trade Name	Flexiva
Model Tested	FAX300, FAX500, FAX1K
Name and address of manufacturer or responsible party	Harris Corporation 3200 Wismann Lane Quincy, Il. 62305
FCC Identifier	V-FAXMP
Serial Number	Proto
Frequency Tested	98.1MHz, 96MHz
Type (AM, FM, TV, etc)	FM, FM+HD
RF Frequency Range	88 MHz to 108 MHz
RF Power Rating	100-1000W FM Analog 530W FM+HD @-10dB injection level
Date(s) on which testing was performed	September 2012 – April 2013
Address of test location	5300 Kings Island Drive Suite 101 Mason, OH 45040



EUT Front View

2. FCC Rules Reference/Checklist

√		47CFR2	47CFR73	Other	Comment
	Measurement Procedure	2.947			Outlines acceptable standards and procedures.
	Measurements Required	2.1041	NA	NA	Lists the required measurements according to paragraph number. These are what follows.
√	RF Power output.	2.1046	NA	ANSI/TIA-603-C-2004 2.2.1	Record PA parameters over the range of output power.
√	Modulation Characteristics.	2.1047	73.317	NA	Curves must be supplied showing the frequency response.
√	Occupied Bandwidth.	2.1049	73.317	ANSI/TIA-603-C-2004 2.2.13	FM multiplex mode, 15 kHz left only, 9% pilot RBW= 10kHz VBW = 30 kHz Average Detector
√	Occupied Bandwidth.	2.1049	73.317	NRSC5B	FM+HD mode RBW= 1 kHz VBW = 1 kHz Average Detector At least 30 sec and 100 sweeps
√	Spurious Emissions at antenna terminals.	2.1051	73.317	ANSI/TIA-603-C-2004 2.2.13	RBW 10kHz < 1GHz RBW 1MHz > 1GHz VBW = 3 x RBW Average Detector
√	Field Strength of spurious radiation.	2.1053	73.317	ANSI/TIA-603-C-2004 2.2.12	RBW = 10kHz < 1GHz RBW = 1MHz > 1GHz VBW = 300kHz < 1GHz VBW = 3MHz > 1GHz
√	Substitution Method	2.1053	73.317	ANSI/TIA-603-C-2004 2.2.12	Dipole Substitution
√	Frequency Stability.	2.1055	73.1545	ANSI/TIA-603-C-2004 2.2.2	+/- 2000 Hz limit. Use data taken in an environmental chamber
√	Frequency spectrum to be investigated.	2.1057	NA		Lowest generated frequency above 9 kHz to the 10th harmonic
√	Radiated Emissions Setup Photos				
√	Spurious and OBW Setup Photos				
√	Test Setup Diagrams				

The information that follows is a combination of FCC references and results.

3. RF power output.

3.1.1. Rule 47CFR2.1046

2.1046 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 Sec. 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.

(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.

2.1033(c)(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.

3.1.2. Criteria

The parameters noted should be typical of normal operation over the range of output power that we will type verify.

3.1.3. Test Setup

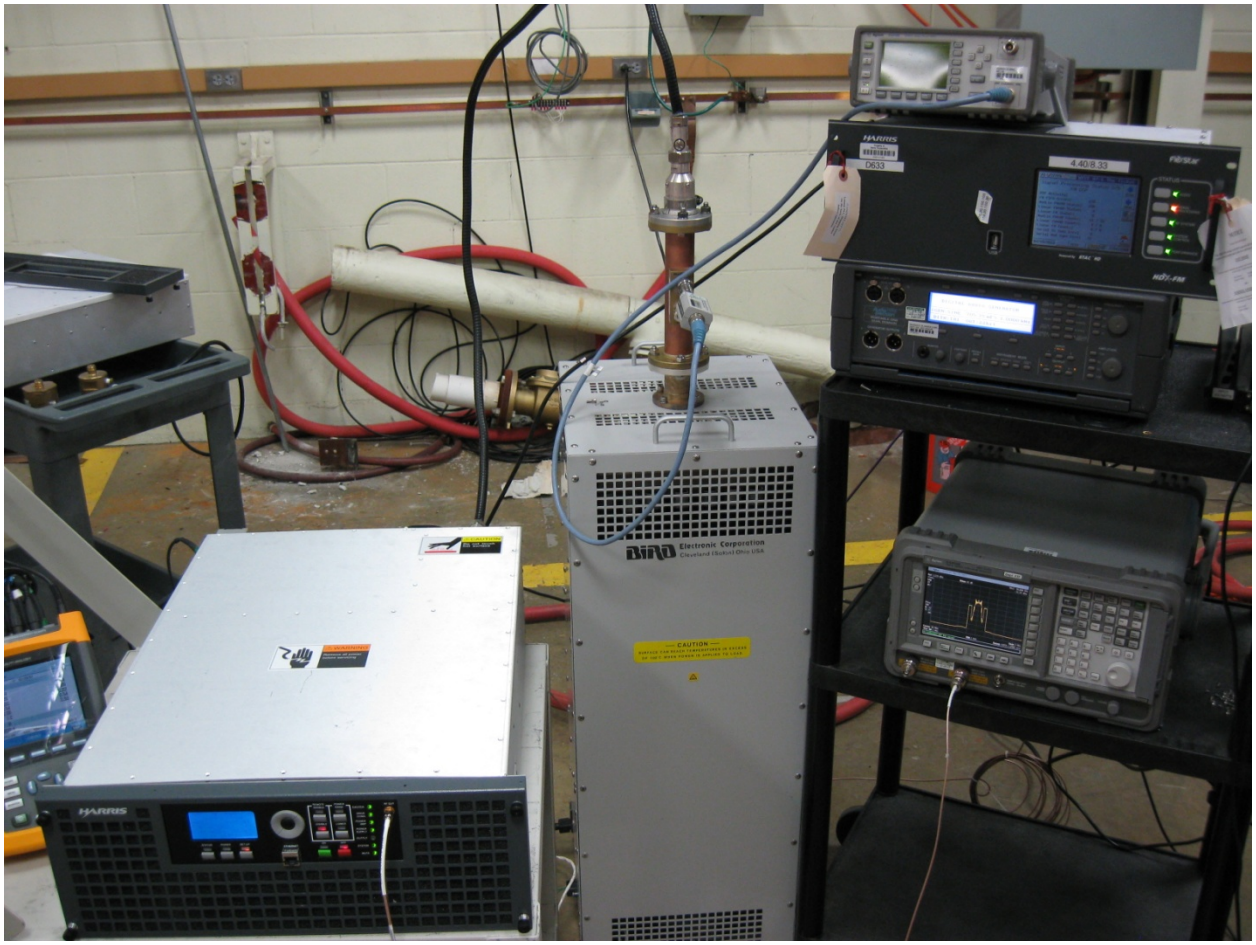


Figure 1, Load, Coupler, and Power sensor for conducted emissions and audio tests.

3.2. Test Equipment Used

Equipment	Model	Serial Number	Cal Due
Fax 3K		KD1-1446-001	
Power Meter	Agilent E4416A	11988	6/29/2013
Directional Coupler	Conneticut Microwave	700R	NA
Audio Precision	Portable One Dual Domain	11872	1/21/2014
Spectrum Analyser	Agilent E4402B	177870	12/28/2013
Dummy Load	Bird 5KW Air Cooled		NA
Flexstar Exciter	HDx-FM		NA
Power Analyser	Fluke 434	20172	5/9/2013

3.2.1. Measurement Procedure

RF output power was measured using the Agilent E4419B Power meter, 8481H Power sensor, and directional coupler documented above. Bird Attenuator HAR-003-A 50 Ohm air cooled load was used.

3.2.2. Test Results:

Data was taken at the nominal power output, and multiple points including values which were less than 50% of the rated transmitter power. Data was taken in both FM only, and FM+HD modes.

Mode	Pout(W)	AC Power Input(W)	PAV	PA A	RF/AC Efficiency	RF/DC Efficiency
FM	1100	1620	47.7	31.1	67.90%	74.15%
FM	1000	1530	47.8	29.1	65.36%	71.89%
FM	900	1410	47.8	27.1	63.83%	69.48%
FM	800	1300	47.8	25	61.54%	66.95%
FM	700	1200	47.8	22.9	58.33%	63.95%
FM	600	1100	47.8	20.9	54.55%	60.06%
FM	500	990	47.8	18.8	50.51%	55.64%
FM	400	880	47.8	16.7	45.45%	50.11%
FM	300	770	47.9	14.4	38.96%	43.49%
FM	200	620	47.9	11.5	32.26%	36.31%
FM	100	460	47.9	8.1	21.74%	25.77%
FM+HD	530	1123	47.8	23.4	47.18%	47.38%
FM+HD	397.5	933	47.8	19.4	42.59%	42.87%
FM+HD	265	763	47.8	15.9	34.72%	34.87%
FM+HD	132.5	570	47.8	11.9	23.25%	23.35%

Modulation characteristics.

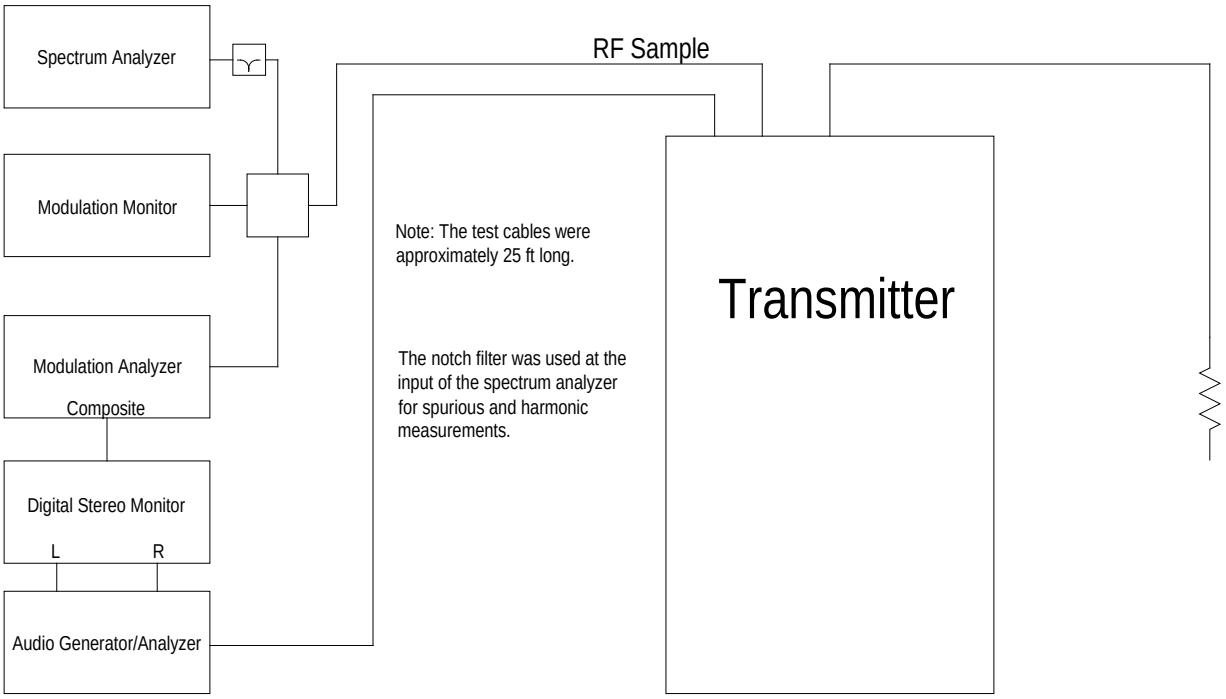
3.2.3. Rule 47CFR2.1047

2.1047 (a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. 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.

3.2.4. Criteria

The L/R response plots should show a steep roll-off that protects the 19 kHz pilot from modulation.

3.2.5. Test Setup



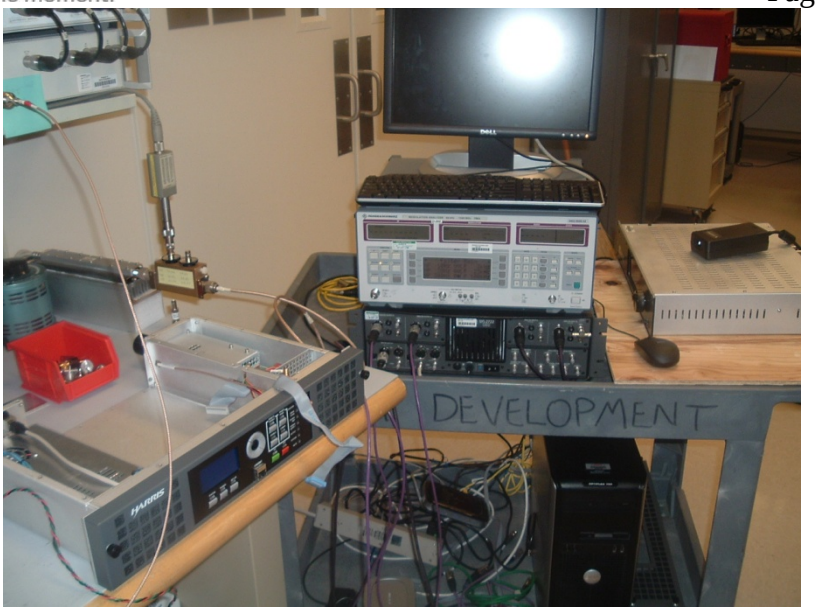


Figure 2, Modulation Performance Test Setup

3.3. Test Equipment Used

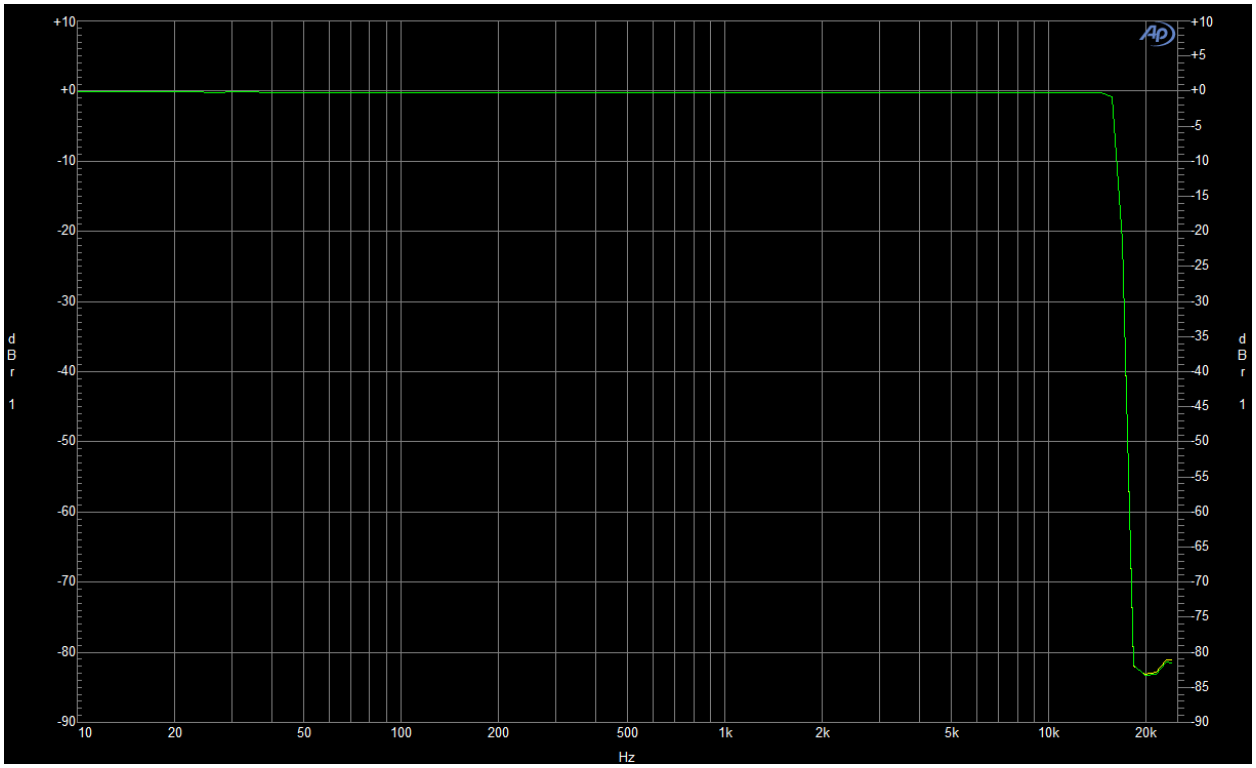
Equipment	Model	Asset	Cal Due Date
Audio Precision Generator/Analyzer	SYS-2722	11857	8/31/13
Rhode & Schwarz Modulation Analyzer	FMA	07587	2/28/15
Belar FM Digital Stereo Monitor	FMSA-1	12304	N/A
Belar FM/HD Monitor	FMHD-1	SN:450103	N/A
Rigol Spectrum Analyzer	DSA815	20924	8/15/13

3.3.1. Measurement Procedure

The transmitter was modulated with a 20 Hz to 20 kHz sweep for the Flexiva 3000W exciter. A plot of the demodulated signal was captured and is presented below.

3.3.2. Test Results:

Left and right frequency response plot with 17 kHz. low-pass filter installed.



Occupied bandwidth.

3.3.3. Rule 47CFR2.1049

2.1049 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:
. . .

(5) FM broadcast transmitter for stereophonic operation—when modulated by a 15 kHz input signal to the main channel, a 15 kHz input signal to the stereophonic subchannel, and the pilot subcarrier simultaneously. The input signals to the main channel and stereophonic subchannel each shall produce 38 percent modulation of the carrier. The pilot subcarrier should produce 9 percent modulation of the carrier.

(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.

3.3.4. Criteria, FM Only

73.317 (b) Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz inclusive must be attenuated at least 25 dB below the level of the unmodulated carrier. Compliance with this requirement will be deemed to show the occupied bandwidth to be 240 kHz or less.

(c) Any emission appearing on a frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz must be attenuated at least 35 dB below the level of the unmodulated carrier.

(d) Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least 43 + 10 Log10 (Power, in watts) dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

3.3.5. Test Setup

See the previous test for the equipment used.

3.3.6. Measurement Procedure

The reference level on the spectrum analyzer was set with an unmodulated carrier. The transmitter was then modulated with a 15 kHz signal, and the plot captured.

For an FM-only signal, the RBW is set to 3 kHz, and the VBW to 30 kHz.

3.3.7. Test Results

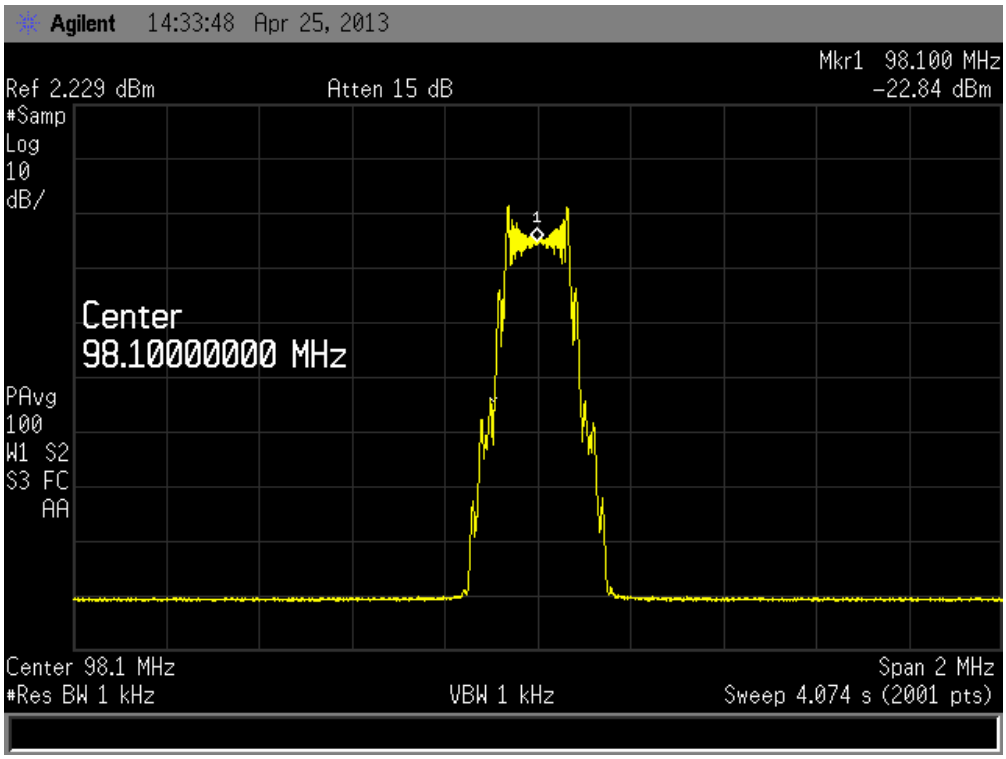


Figure 3, Occupied Bandwidth 15 kHz Left-Only

3.4. Criteria, FM + HD (from NRSC5B)

Frequency Offset Relative to Carrier	Level, dBc/kHz
100-200 kHz offset	-40
200-250 kHz offset	[-61.4 - (|frequency in kHz|-200 kHz) · 0.260]
250-540 kHz offset	-74.4
540-600 kHz offset	[-74.4 - (|frequency in kHz|-540 kHz) · 0.093]
>600 kHz offset	-80

* The requirements for noise and spurious emission limits defined in this subsection reflect acceptable performance criteria. In certain circumstances, additional measures (filtering, active emissions suppression, etc.) may be needed to reduce the spectral emissions below the limits given in this subsection in order to reduce mutual interference between broadcast stations.

4.4.2 Spectral Emissions Limits for All Digital Transmissions

For All Digital transmissions, measurements of the All Digital signal shall be made by averaging the power spectral density of the signal in a 1 kHz bandwidth over a minimum time span of 30-seconds and a minimum of 100 sweeps. Compliance shall be determined by measuring the digital waveform at the input of the broadcast antenna. 0 dBc is defined as the nominal power spectral density in a 1 kHz bandwidth of the digital Primary Main sidebands. Under normal operation, the following requirements shall be met at all times.

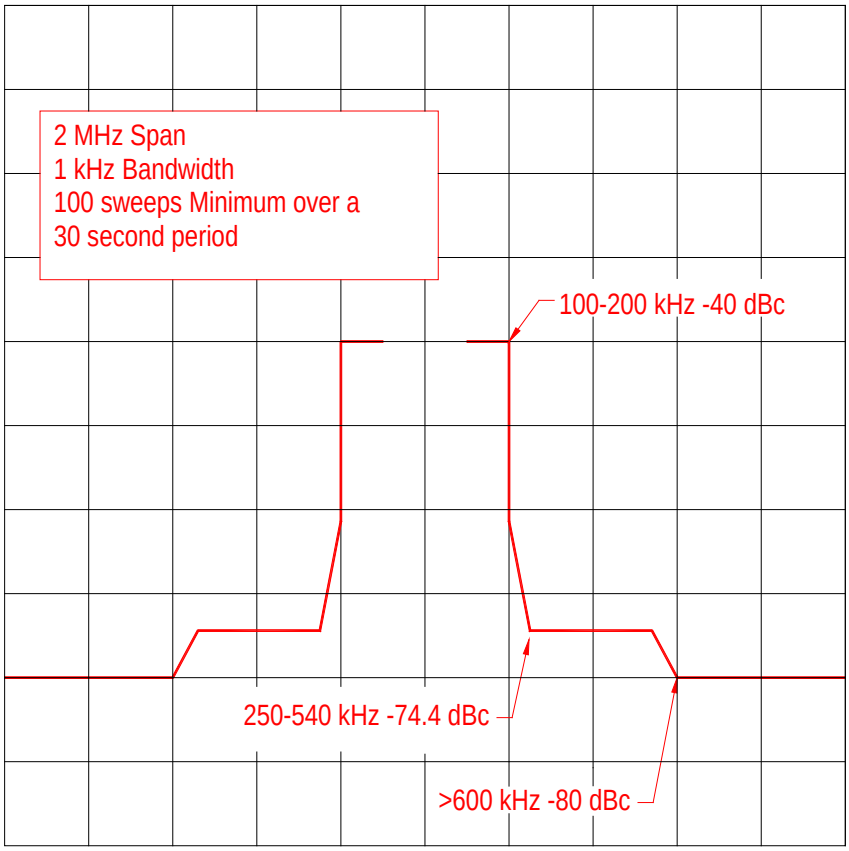


Figure 4, NRSC5B Spectrum Mask

3.4.1. Test Setup

The test setup and equipment used was the same as shown in the previous section of this report.

3.4.2. Measurement Procedure

The unmodulated carrier is set to the reference level on the spectrum analyzer. The HD carriers and RTAC (Real Time Adaptive Correction) were then turned back on. Lastly the transmitter was modulated with a 1 kHz sinewave, and the plot taken after a minimum of 30 seconds.

3.4.3. Test Results, FM + HD:

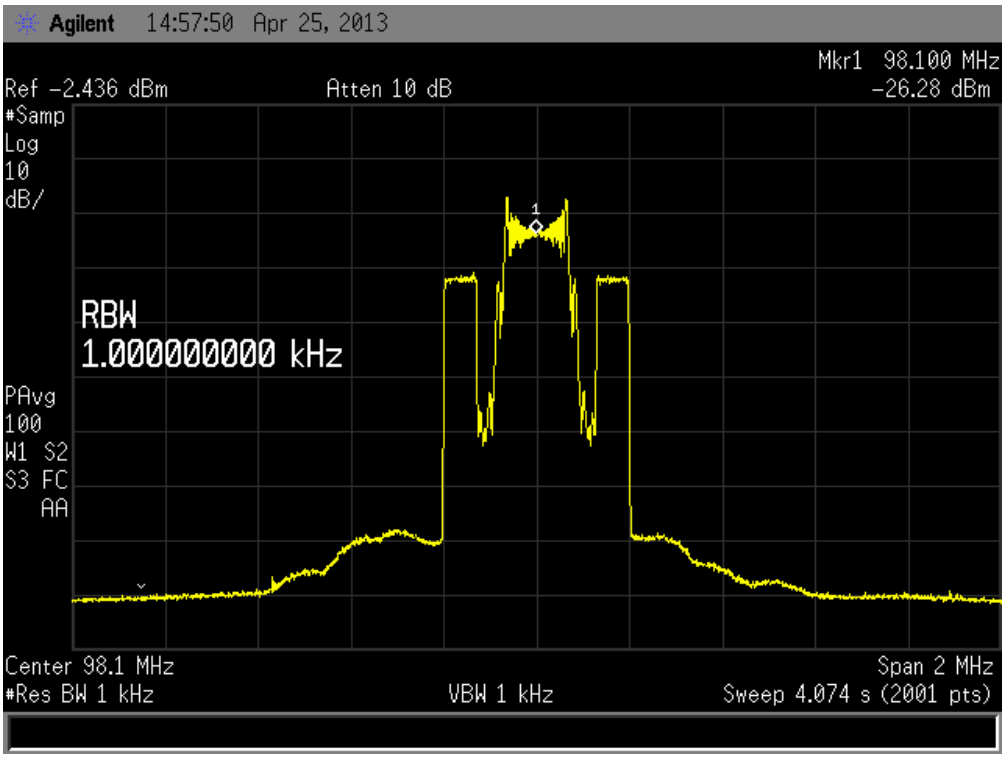


Figure 5, Occupied Bandwidth FM+HD

4. Spurious emissions at antenna terminals.

4.1.1. Rule 47CFR2.1051

2.1051 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 Sec. 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

4.1.2. Criteria

73.317 (d) Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least 43 + 10 Log10 (Power, in watts) dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

At 5000 watts and above, the applicable limit is -80 dBc. The limit is otherwise calculated using 43 +10 log power.

4.1.3. Test Setup

The test setup was as diagramed in an earlier section in this report.

4.1.4. Measurement Procedure

The un-modulated carrier is set to the reference level. A notch filter was inserted at the input of the spectrum analyzer in order to augment the dynamic range of the analyzer. The coupling factor, cable, pad, and notch filter are accounted for in the corrections column. RF power output was adjusted from 1 W to 1000W and the follow spurious readings were noted.

4.1.5. Test Results:

Frequency	Delta from Fundamental	Correction	Corrected Value	Spec
98.1	0	0	0	NA
196.2	92.11	6.04	98.15	73.41393
294.3	82.5	9.58	92.08	73.41393
392.4	91.95	12	98.91	73.41393
490.5	86.91	13.89	103.86	73.41393
588.6	89.97	15.6	107.94	73.41393
686.7	92.34	16.9	110.14	73.41393
784.8	93.24	18.04	111.28	73.41393
882.9	89.3	19.14	108.44	73.41393
981	92.78	20.04	112.82	73.41393

Field strength of spurious radiation (Cabinet Radiation)

4.1.6. Rule 47CFR2.1053

2.1053 (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 side band, independent side band, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 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 half wave dipole antennas.

4.1.7. Reference 47CFR73.317

73.317 (d) Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least 43 + 10 Log10 (Power, in watts) dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

4.1.8. Criteria

The mask description of 73.317, which determines the spurious level, also applies to cabinet radiation. Thus the radiated emissions need to be below the “43 + 10 log (Power)” rule, with these emissions being referenced to a half-wave dipole antenna.

4.1.9. Test Setup

The FAX1K was set up in an indoor space at the Mason, Ohio building. The antenna was placed at a distance of 10 meters from the antenna mount to the nearest surface of the transmitter, and adjusted in height to maximize each emission. Measurements were made on all four sides, by rotating the transmitter, and leaving the antenna and receiver stationary. Emission measurements were made at the carrier frequency as well; though the carrier frequency is excluded from the limits, it is a useful data point for validation of the other radiated emission measurements. The direct measurements for the highest emissions were later validated with the substitution method described in ANSI/TIA-603C: 2004.

4.1.10. Test Equipment Used

Equipment	Description	Asset #	Cal Due Date
Agilent HP 4419A	Power Meter	11135	9/30/2013
Agilent 8482H	Power Sensor	11169	9/30/2013
WQRK SSG-3	Signal Genertor	330	2/28/2013
Cable "Brown 1"	RF Coax	N/A	N/A
Cable "Brown 2"	RF Coax	N/A	N/A
E4443A	Spectrum Analyzer	11777	12/31/2013
Harris FAX150	Pilot Unit	N/A	N/A
Electro-Metrics EM6917-2	Antenna	8843	9/1/2013
Bird 8328	Load	7440	N/A
Rankweil coupler	Directional Coupler	SN 00013/G1	N/A

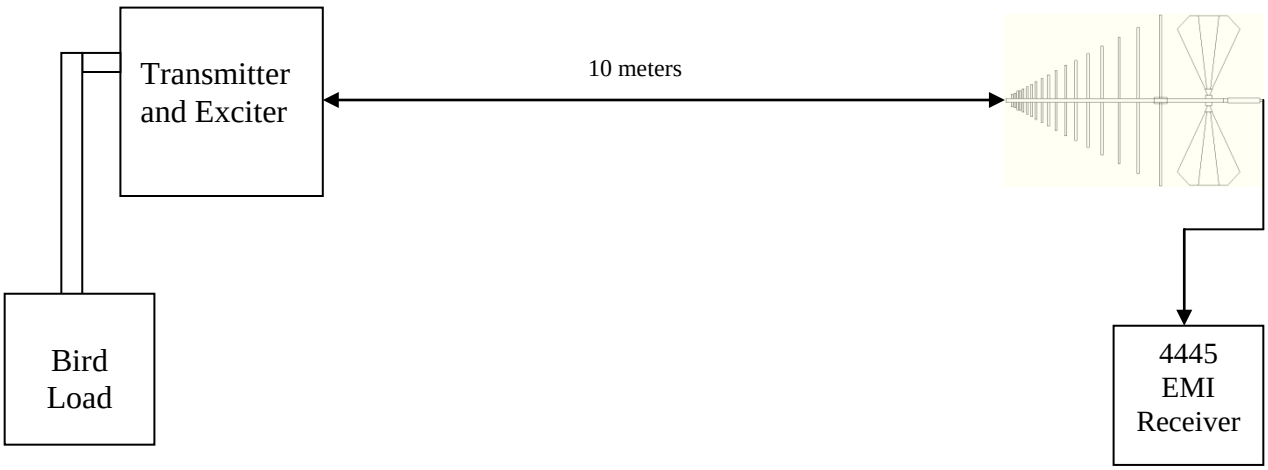


Figure 6, Radiated Emissions Layout

Figure 7, Transmitter under test/Test Setup

4.1.11. Measurement Procedure

The measurement bandwidth was set per ANSI/TIA-603C: 2004:

Range	RBW	VBW
30 MHz to 1 GHz	10 kHz	300 kHz
> 1 GHz	1 MHz	3 MHz

At each frequency, the antenna was adjusted over a 1 to 2 meter height to maximize the received signal level. Measurements were made on all four sides, using both vertical and horizontal antenna polarizations.

Cabinet radiation was measured in the FM-Only mode at 3300 watts.

4.1.12. Test Results

FM Only Vertical 98MHz F_c

Cabinet Radiation FCC

CP_W	=	1160	Watts
R	=	10	meters
$FL_{dBuV/m}$	=	147.56	dBuV/m

FCC		
Standard:	-73.6	$Spur_{dBc}$-RA

Tabulated Measurements and results - Worst case Vertical and Horizontal. Antenna factors (AF), and Cable losses (Cable dB) were installed in the analyzer so zero was used in these columns below.

Front						Left				
Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA		Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA
98	58.83	0.0	0	-88.73		98	54.19	0.0	0	-93.37
196	34.16	0.0	0	-113.40		196	34.3	0.0	0	-113.26
294	47.79	0.0	0	-99.77		294	42.01	0.0	0	-105.55
392	29.89	0.0	0	-117.67		392	31.64	0.0	0	-115.92
490	58.91	0.0	0	-88.65		490	49.49	0.0	0	-98.07
588	51.11	0.0	0	-96.45		588	46.92	0.0	0	-100.64
686	51.05	0.0	0	-96.51		686	48.07	0.0	0	-99.49
784	53.43	0.0	0	-94.13		784	44.64	0.0	0	-102.92
882	48.59	0.0	0	-98.97		882	45.5	0.0	0	-102.06
980	45.82	0.0	0	-101.74		980	40.61	0.0	0	-106.95
Rear						Right				
Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA		Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA
98	59.07	0.0	0	-88.49		98	55.47	0.0	0	-92.09
196	32.87	0.0	0	-114.69		196	38.48	0.0	0	-109.08
294	42.13	0.0	0	-105.43		294	46.64	0.0	0	-100.92
392	32.53	0.0	0	-115.03		392	31.96	0.0	0	-115.60
490	57.14	0.0	0	-90.42		490	52.75	0.0	0	-94.81
588	51.21	0.0	0	-96.35		588	48.47	0.0	0	-99.09
686	51.73	0.0	0	-95.83		686	47.26	0.0	0	-100.30
784	55.51	0.0	0	-92.05		784	45.31	0.0	0	-102.25
882	51.49	0.0	0	-96.07		882	48.43	0.0	0	-99.13
980	48.23	0.0	0	-99.33		980	41.67	0.0	0	-105.89

FM Only Horizontal 98MHz F_c

Cabinet Radiation FCC

CP_W	=	1160	Watts	FCC
R	=	10	meters	Standard: -73.6 $Spur_{dBc}$-RA
$FL_{dBuV/m}$	=	147.56	dBuV/m	

Tabulated Measurements and results - Worst case Vertical and Horizontal. Antenna factors (AF), and Cable losses (Cable dB) were installed in the analyzer so zero was used in these columns below.

Front						Left				
Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA		Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA
98	58.83	0.0	0	-88.73		98	54.19	0.0	0	-93.37
196	34.16	0.0	0	-113.40		196	34.3	0.0	0	-113.26
294	47.79	0.0	0	-99.77		294	42.01	0.0	0	-105.55
392	29.89	0.0	0	-117.67		392	31.64	0.0	0	-115.92
490	58.91	0.0	0	-88.65		490	49.49	0.0	0	-98.07
588	51.11	0.0	0	-96.45		588	46.92	0.0	0	-100.64
686	51.05	0.0	0	-96.51		686	48.07	0.0	0	-99.49
784	53.43	0.0	0	-94.13		784	44.64	0.0	0	-102.92
882	48.59	0.0	0	-98.97		882	45.5	0.0	0	-102.06
980	45.82	0.0	0	-101.74		980	40.61	0.0	0	-106.95
Rear						Right				
Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA		Frequency (MHz)	$Meas_{dBuV}$	AF dB	Cable dB	$Spur_{dBc}$-RA
98	59.07	0.0	0	-88.49		98	55.47	0.0	0	-92.09
196	32.87	0.0	0	-114.69		196	38.48	0.0	0	-109.08
294	42.13	0.0	0	-105.43		294	46.64	0.0	0	-100.92
392	32.53	0.0	0	-115.03		392	31.96	0.0	0	-115.60
490	57.14	0.0	0	-90.42		490	52.75	0.0	0	-94.81
588	51.21	0.0	0	-96.35		588	48.47	0.0	0	-99.09
686	51.73	0.0	0	-95.83		686	47.26	0.0	0	-100.30
784	55.51	0.0	0	-92.05		784	45.31	0.0	0	-102.25
882	51.49	0.0	0	-96.07		882	48.43	0.0	0	-99.13
980	48.23	0.0	0	-99.33		980	41.67	0.0	0	-105.89

4.2. Substitution Method

The substitution method as described in ANSI/TIA-603C: 2004 was used to validate the direct measurements at the highest emission frequencies found. A second broadband antenna was used in place of the transmitter. A signal generator (WQRK SSG-3) was used as the signal source.

The substitution results were in fairly close agreement with the direct readings, as indicated in comparing the “Sub dBc” readings with the “Direct dBc”.

Freq. (MHz.)	Pg (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Pd (dBm)	TX Watts	Sub dBc	Direct	Limit	Antenna orientation	Direct result minus substitution result
98	-45	0.49	1.9	-43.59	3200	-108.6	-101.9		Horizontal	6.7415
196	-39	0.69	6	-33.69	3200	-98.74	-107.72	-80	Horizontal	-8.979
294	-29	0.85	7.3	-23.95	3200	-89	-96.94	-80	Horizontal	-7.939
392	-45	1.01	5.9	-39.85	3200	-104.9	-104.54	-80	Horizontal	0.3615
490	-53.8	1.15	6.3	-48.37	3200	-113.4	-103.99	-80	Horizontal	9.4315
588	-45.8	1.27	6.7	-39.29	3200	-104.3	-114.12	-80	Horizontal	-9.779
686	-59.8	1.39	7.9	-54.71	3200	-119.8	-121.01	-80	Horizontal	-1.249
784	-51.8	1.51	6.6	-46.72	3200	-111.8	-117.66	-80	Horizontal	-5.889
882	-59.8	1.62	6.7	-56.05	3200	-121.1	-121	-80	Horizontal	0.1015
980	-40	1.75	5.5	-40	3200	-105.1	-117.57	-80	Horizontal	-12.52

5. Frequency stability.

5.1.1. Reference 47CFR2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

. . . .

(3) From 0 deg. to +50 deg. centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 deg. centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

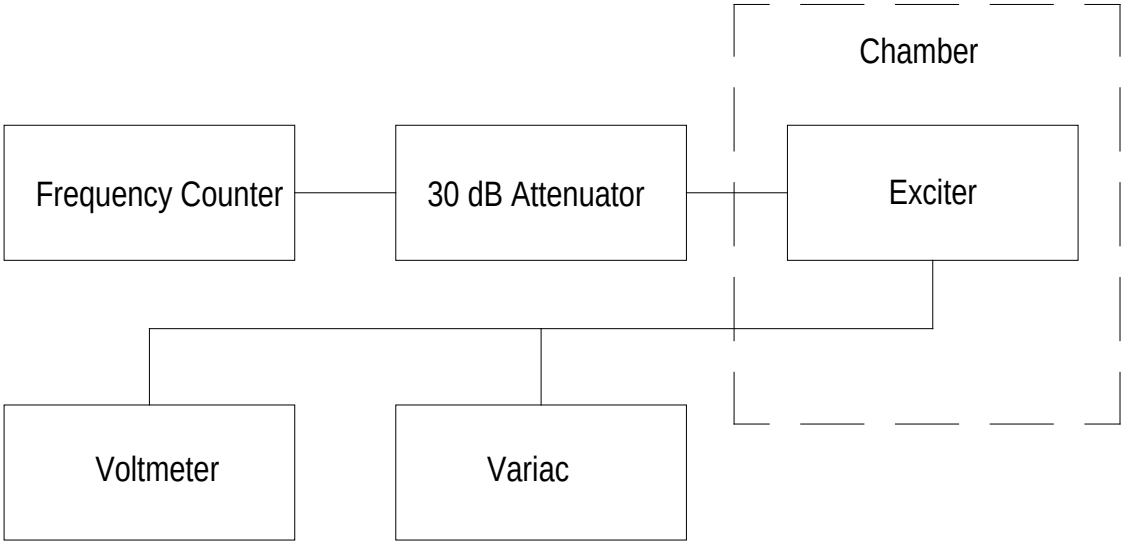
(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

5.1.2. Criteria

73.1545 (b) *FM stations.* (1) The departure of the carrier or center frequency of an FM station with an authorized transmitter output power more than 10 watts may not exceed ±2000 Hz from the assigned frequency.

5.1.3. Test Setup

The transmitter frequency is set by the frequency source in the exciter. To demonstrate compliance, the exciter is placed in a temperature controlled chamber, and powered by an AC variable transformer. It is operated at a range of temperatures, from 0°C to 50°C.



Harris Response

The transmitter frequency is set by an internal frequency reference. To demonstrate compliance, the transmitter was placed in a temperature controlled chamber, powered by an AC variable transformer. Measurements were taken over the temperature a range of 0°C to 50°C. At each operating temperature the equipment was allowed to stabilize, then operated with the AC variac set to nominal, -15% and +15%, recording the operating frequency at each setting.

The following tables list the frequency measurements made and demonstrate the equipment remains within ±2,000 Hz.

Test results:

Temperature ˚C	Hz at 102V (85%)	Hz at 120V (100%)	Hz at 138V (115%)
0	98,000,016	98,000,017	98,000,018
10	98,000,017	98,000,015	98,000,017
20	98,000,010	98,000,012	98,000,013
25	98,000,008	98,000,010	98,000,014
30	98,000,009	98,000,007	98,000,010
40	98,000,004	98,000,005	98,000,007
50	98,000,003	98,000,002	98,000,005

Equipment	Mfr / Model	Harris #	Calibration Due Date
Temperature Chamber	Tenney T6C-1	11167	NA
Frequency Counter	Agilent 53132A	11876	9/15/13
Variac	Staco 3PN1010	NA	NA
40 dB Attenuator	Bird HAR-003	NA	NA

6. Frequency spectrum to be investigated.

6.1.1. Reference(s) 47CFR2.1057

(a) In all of the measurements set forth in 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

6.1.2. Criteria

None.

6.1.3. Measurement Procedure

Conducted spurious measurements are made from 9 kHz to the 10th harmonic. Radiated measurements were made from 30 MHz to the 10th harmonic.

6.1.4. Test Results

No signals other than harmonics were found.

7. Specifications for Indicating Instruments

7.1.1. Reference 47CFR73.1215

§ 73.1215 Specifications for indicating instruments.

The following requirements and specifications shall apply to indicating instruments used by broadcast stations:

(a) Linear scale instruments:

(1) Length of scale shall not be less than 2.3 inches (5.8 cm).

(2) Accuracy shall be at least 2 percent of the full scale reading.

(3) The maximum rating of the meter shall be such that it does not read off scale during modulation or normal operation.

(4) Scale shall have at least 40 divisions.

(5) Full scale reading shall not be greater than five times the minimum normal indication.

7.1.2. Results

Not applicable. No analog metering used on the FAX1K.

(b) Instruments having square-lawscales:

(1) Meet the requirements of paragraphs(a) (1), (2), and (3) of this section for linear scale instruments.

(2) Full scale reading shall not be greater than three times the minimum normal indication.

(3) No scale division above one-third full scale reading shall be greater than one-thirtieth of the full scale reading. (Example: An ammeter meeting requirement (1) having full scale reading of 6 amperes is acceptable for reading currents from 2 to 6 amperes, provided no scale division between 2 and 6 amperes is greater than one-thirtieth of 6 amperes, 0.2 ampere.)

7.2. Results

Not applicable.

(c) Instruments having logarithmic scales:

(1) Meet the requirements of paragraphs (a) (1), (2), and (3) of this section for linear scale instruments.

(2) Full scale reading shall not be greater than five times the minimum normal indication.

(3) No scale division above one-fifth full scale reading (in watts) shall be greater than one-thirtieth of the full scale reading. Example: A wattmeter meeting requirement (3) having full scale reading of 1,500 watts is acceptable for reading power from 300 to 1,500 watts, provided no scale division between 300 and 1,500 watts is greater than one-thirtieth of 1,500 watts or 50 watts.)

7.3. Results

Not applicable.

(d) Instruments having expanded scales:

(1) Shall meet the requirements of paragraphs (a) (1), (2), and (3) of this section for linear scale instruments.

(2) Full scale reading shall not be greater than five times the minimum normal indication.
(3) No scale division above one-fifth full scale reading shall be greater than one-fiftieth of the full scale reading. (Example: An ammeter meeting the requirement (1) is acceptable for indicating current from 1 to 5 amperes, provided no division between 1 and 5 amperes is greater than one-fiftieth of 5 amperes, 0.1 ampere.)

7.4. Results

The FAX1K complies with this requirement.

(e) Digital meters, printers, or other numerical readout devices may be used in addition to or in lieu of indicating instruments meeting the specifications of paragraphs (a), (b), (c), and (d) of this section. The readout of the device must include at least three digits and must indicate the value of the parameter being read to an accuracy of 2%. The multiplier, if any, to be applied to the reading of each parameter must be indicated at the operating position.

7.5. Results

The exciters meet this requirement. It is otherwise not applicable.

(f) No instrument which has been broken or appears to be damaged or defective, or the accuracy of which is questionable shall be used, until it has been checked, and if necessary repaired and recalibrated by the manufacturer or qualified instrument repair service.

Repaired instruments shall not be used unless a certificate of calibration has been provided showing that the instrument conforms to the manufacturer's specifications for accuracy.

8. Description of Modifications Performed to Achieve Compliance

None.

9. Detailed Photos of EUT

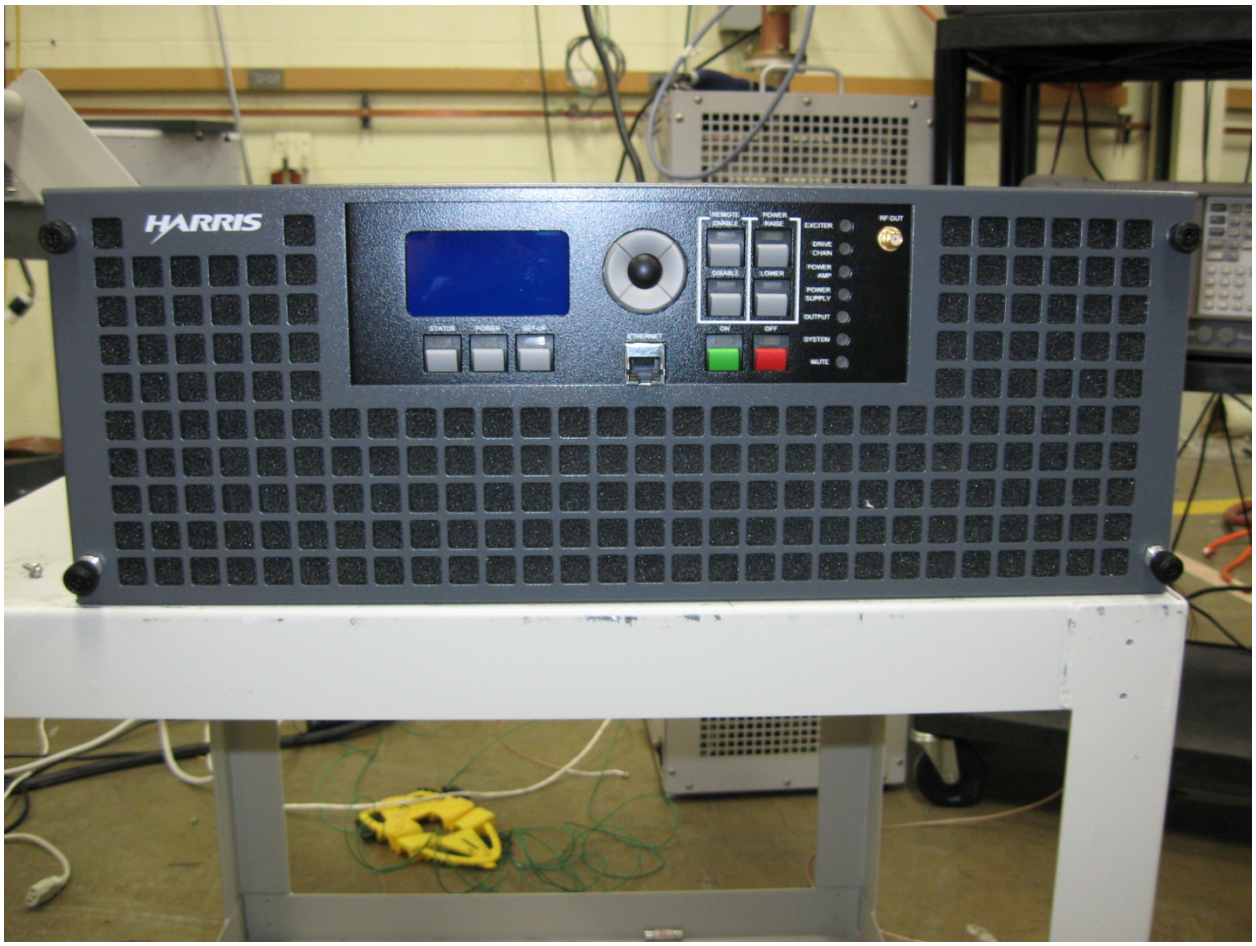


Figure 8, Front

Figure 9, Rear

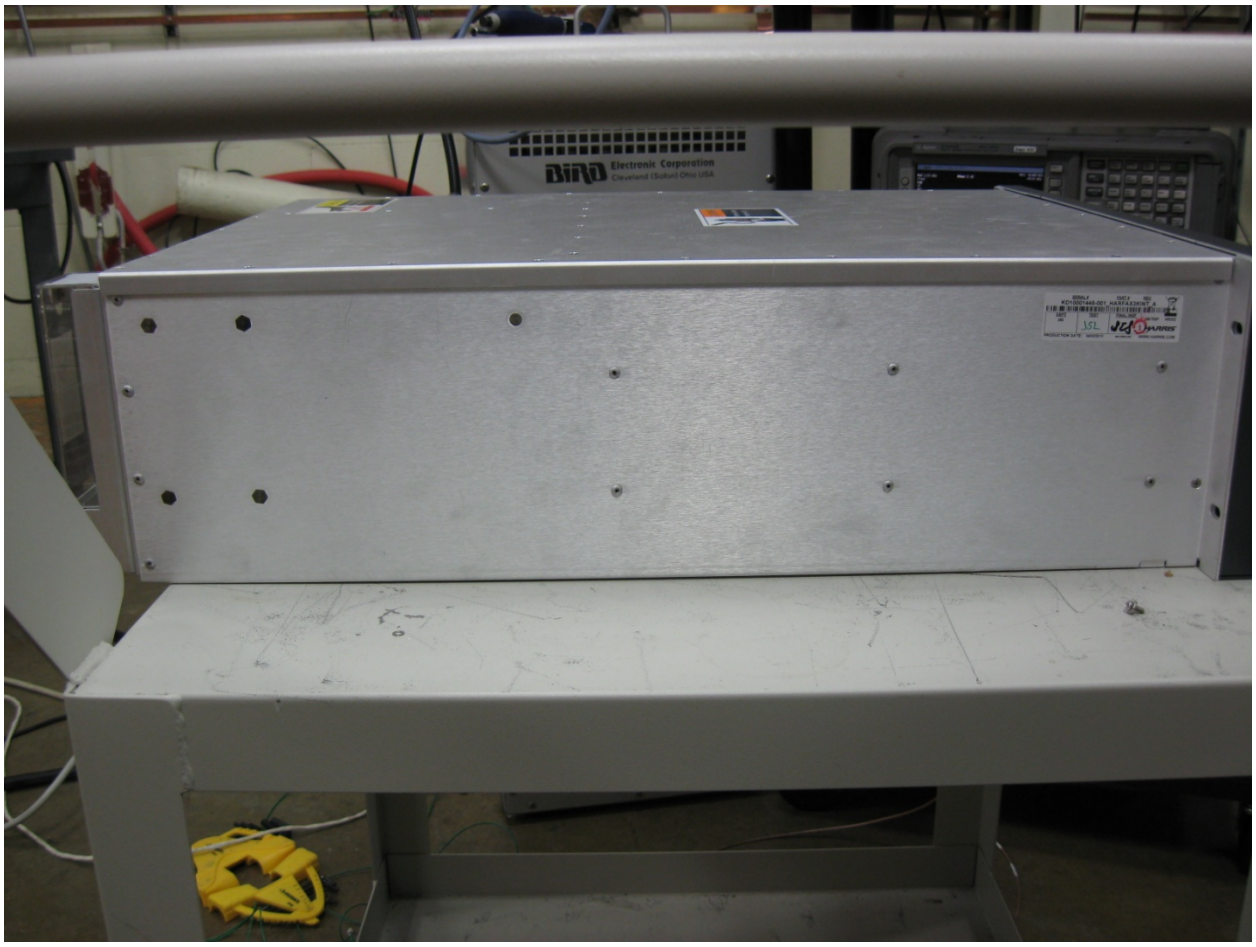


Figure 10, Left

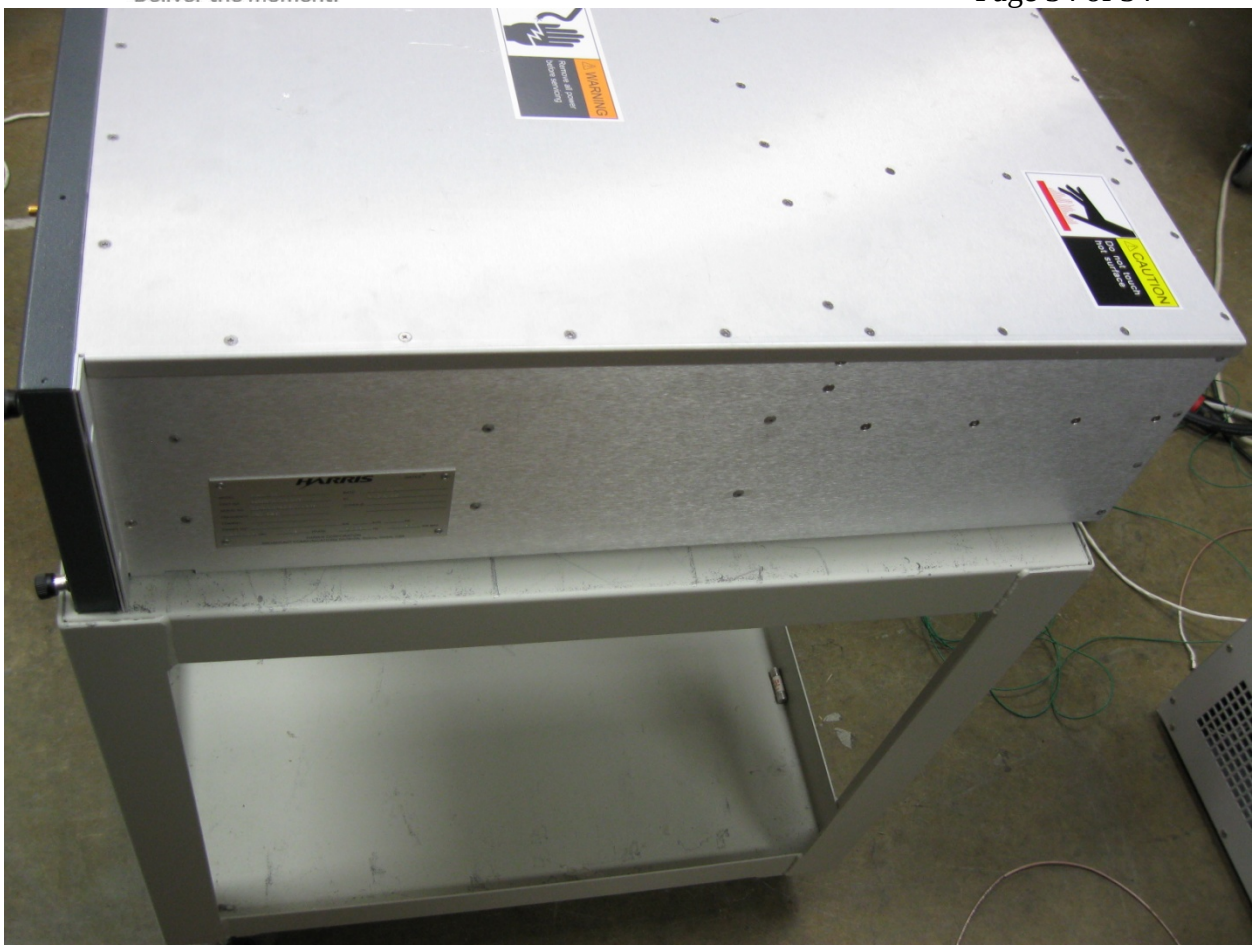


Figure11, Right