

KNWC-FM and K298CY Occupied Bandwidth Measurements

April 29, 2019

FM Broadcast Station Construction Permit for Auxiliary Antenna
KNWC-FM facility ID: 49776
Permit File Number: BXPED-20181113AAY
Call Sign: KNWC-FM

FM Broadcast Translator/Booster Station Construction Permit
Facility Id: 202254
Permit File Number: BMPFT-20181113AAZ
Call Sign: K298CY

In April of 2019 construction was completed for two FCC Construction Permits that involved the installation of a new Shively 2930-2630 Mixed branch combiner feeding a new Shively 6832-2 antenna. The KNWC-FM Auxiliary station installed a new Nautel VS2.5 while the translator (K298CY) installed a new Nautel VS1.

This report for the KNWC-FM combined site for KNWC-FM Auxiliary and Translator for KNWC AM (K298CY) located on Monopole (ASR 12755764) in Sioux Falls, SD is in fulfillment of the special operating conditions set forth in the Construction Permits for both facilities. Both permits had the following Special operating conditions or restrictions:

BEFORE PROGRAM TESTS COMMENCE, sufficient measurements shall be made to establish that the operation authorized in this construction permit is in compliance with the spurious emissions requirements of 47 C.F.R. Sections 73.317(b) through 73.317(d). All measurements must be made with all stations simultaneously utilizing the shared antenna.

47 CFR § 73.317 - FM transmission system requirements.

(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 $43 + 10 \log_{10}(\text{Power, in watts})$ dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

Using the formula in subpart (d) above results in a needed attenuation of 77.3 db for KNWC-FM (96.5 MHz) and 69 db for K298CY (107.5).

On 4/29/2019 measurements were taken with an Anritsu MS2721B Spectrum Analyzer for KNWC-FM Auxiliary and K298CY at the forward output port of the directional coupler of the Shively branched combiner output network. The port had a coupling factor of -50db and required an additional 20 db of attenuation using a Mini-Circuits UNAT-20 20 db pad to prevent front end overload of the analyzer. Front end overload was seen when only adding -15 db to the -50 of the directional coupler.

Measurements were also taken based on the mask defined in 47 CFR § 73.317 of each individual station.

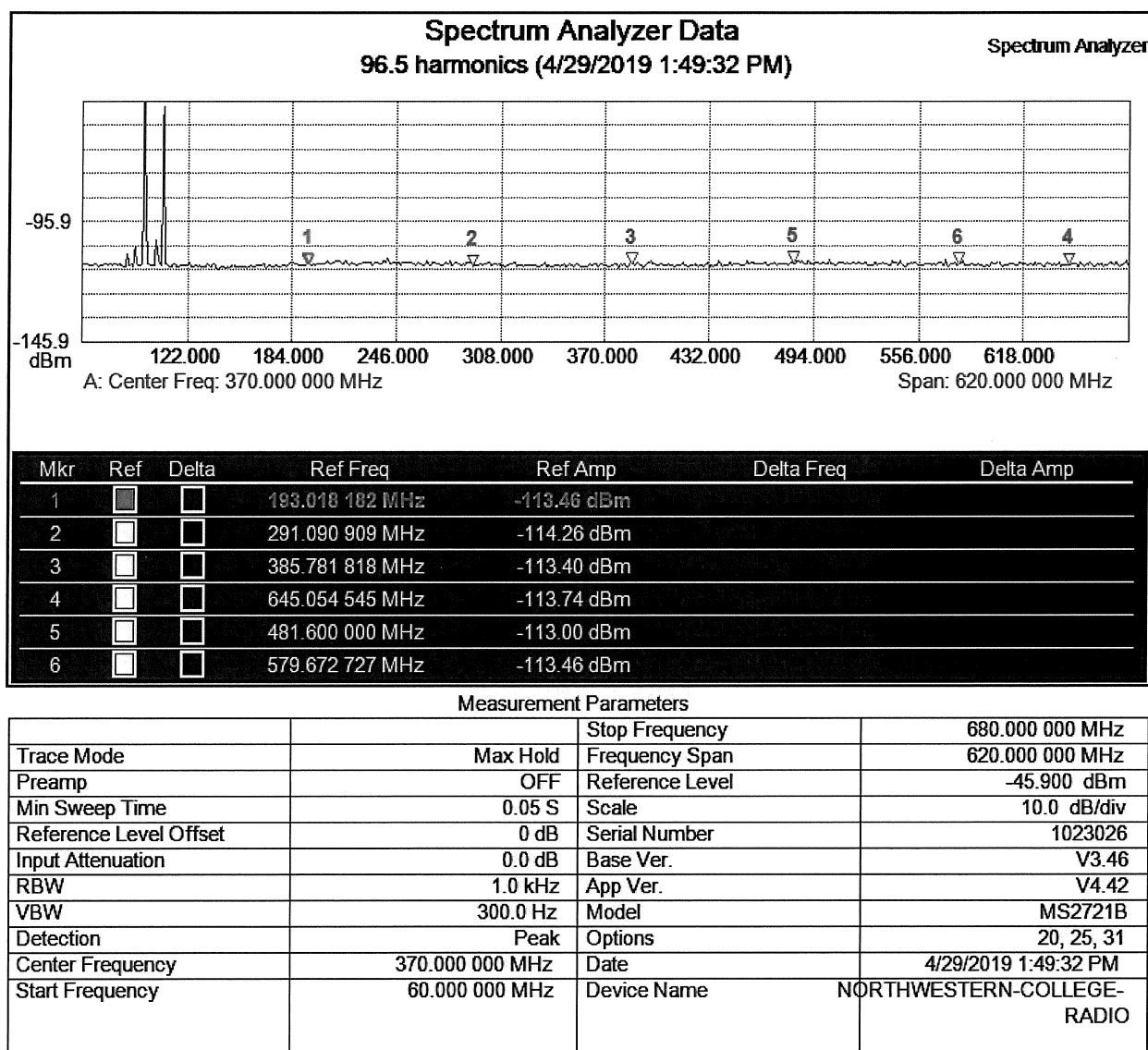
The measurements are documented below and it is believed that they show compliance with 47 CFR § 73.317 - FM transmission system requirements.

All information contained in this report was taken and complied by the undersigned.

A handwritten signature in cursive script, reading "Rod Thannum".

Rod Thannum
Director of Engineering for Northwestern Media

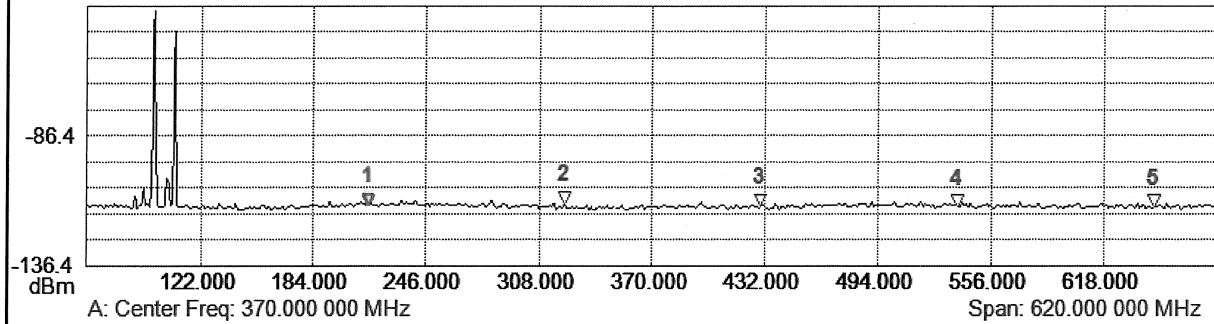
The first set of readings were taken with no type of filter inserted for either fundamental to see if any harmonic products were present. The harmonics of 96.5 and 107.5 were set as markers to see if they appeared in the spectrum. All harmonics for the fundamental of 96.5 and 107.5 were suppressed below the required levels.



Spectrum Analyzer Data

107.50 harmonics (4/29/2019 1:55:57 PM)

Spectrum Analyzer



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	214.436 364 MHz	-113.02 dBm		
2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	321.527 273 MHz	-112.41 dBm		
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	429.745 455 MHz	-113.45 dBm		
4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	537.963 636 MHz	-113.83 dBm		
5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	645.054 545 MHz	-113.74 dBm		
6						

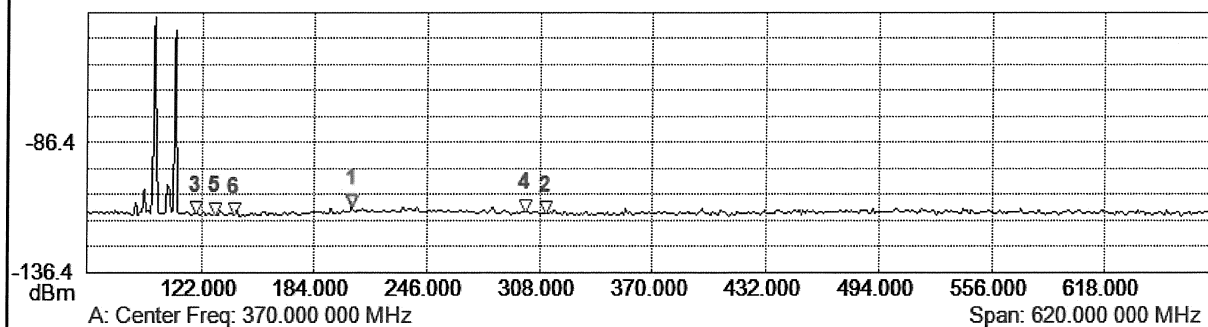
Measurement Parameters

Trace Mode	Max Hold	Stop Frequency	680.000 000 MHz
Preamp	OFF	Frequency Span	620.000 000 MHz
Min Sweep Time	0.05 S	Reference Level	-36.400 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	1023026
RBW	1.0 kHz	Base Ver.	V3.46
VBW	300.0 Hz	App Ver.	V4.42
Detection	Peak	Model	MS2721B
Center Frequency	370.000 000 MHz	Options	20, 25, 31
Start Frequency	60.000 000 MHz	Date	4/29/2019 1:55:57 PM
		Device Name	NORTHWESTERN-COLLEGE-RADIO

Spectrum Analyzer Data

Mix Products (4/29/2019 1:59:13 PM)

Spectrum Analyzer

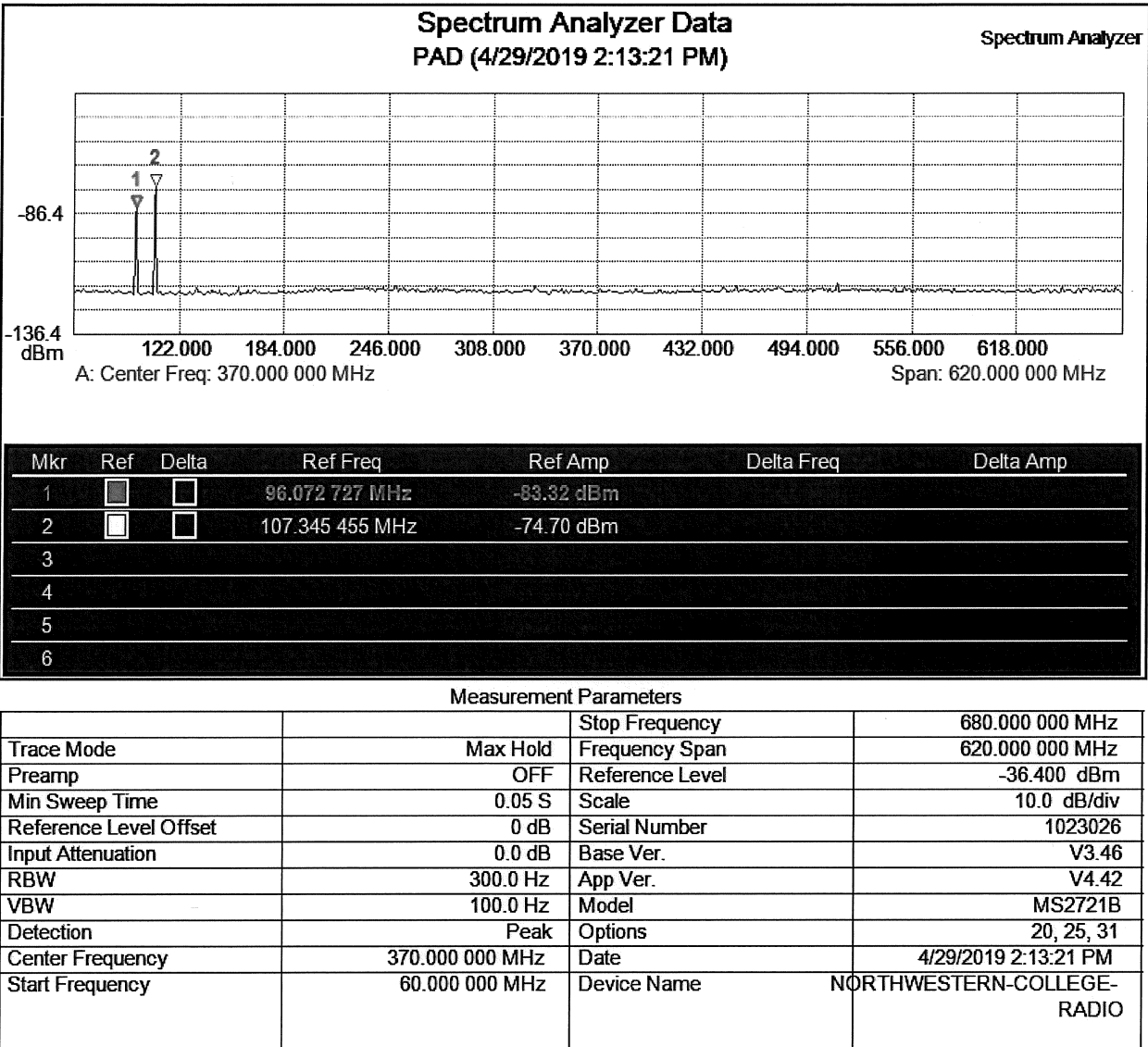


Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	204.290 909 MHz	-110.91 dBm		
2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	311.381 818 MHz	-113.69 dBm		
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	118.618 182 MHz	-113.83 dBm		
4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	300.109 091 MHz	-112.94 dBm		
5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	129.890 909 MHz	-114.08 dBm		
6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	140.036 364 MHz	-114.24 dBm		

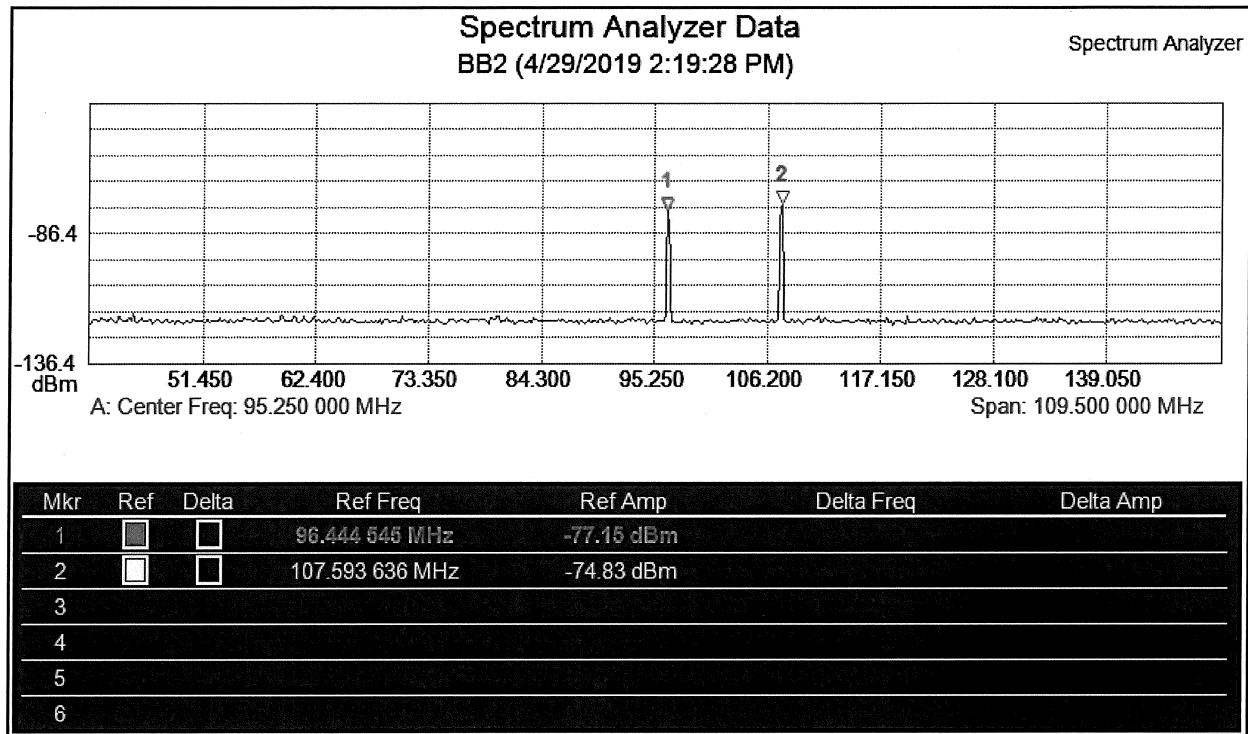
Measurement Parameters

Trace Mode	Max Hold	Stop Frequency	680.000 000 MHz
Preamp	OFF	Frequency Span	620.000 000 MHz
Min Sweep Time	0.05 S	Reference Level	-36.400 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	1023026
RBW	1.0 kHz	Base Ver.	V3.46
VBW	300.0 Hz	App Ver.	V4.42
Detection	Peak	Model	MS2721B
Center Frequency	370.000 000 MHz	Options	20, 25, 31
Start Frequency	60.000 000 MHz	Date	4/29/2019 1:59:13 PM
		Device Name	NORTHWESTERN-COLLEGE-RADIO

A pad was inserted to attenuate the FM broadcast band by using a Mini-circuits High pass filter to lower the fundamentals by 30 db to make sure the analyzer was not being overloaded.



In addition to fundamental harmonics the 2nd, 3rd, 5th, and 7th order harmonics/mix products were also looked at. The spectrum was divided into 40 segments: 40-150, 150-350, 350-550, 550-800 in order to help see if any mix products were present. Markers were placed at the various mix product frequencies to document their levels.

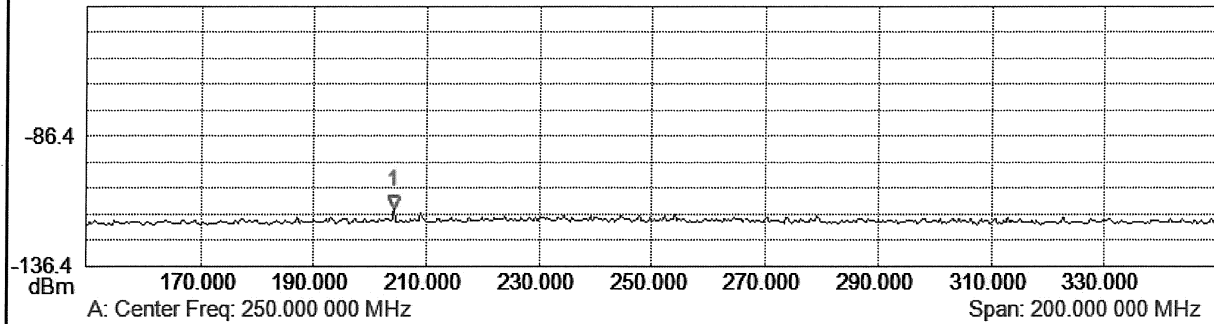


Measurement Parameters			
Trace Mode	Max Hold	Stop Frequency	150.000 000 MHz
Preamplifier	OFF	Frequency Span	109.500 000 MHz
Min Sweep Time	0.05 S	Reference Level	-36.400 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	1023026
RBW	300.0 Hz	Base Ver.	V3.46
VBW	100.0 Hz	App Ver.	V4.42
Detection	Peak	Model	MS2721B
Center Frequency	95.250 000 MHz	Options	20, 25, 31
Start Frequency	40.500 000 MHz	Date	4/29/2019 2:19:28 PM
		Device Name	NORTHWESTERN-COLLEGE-RADIO

Spectrum Analyzer Data

BB150.350 (4/29/2019 2:24:11 PM)

Spectrum Analyzer



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	204.181 818 MHz	-114.05 dBm		
2						
3						
4						
5						
6						

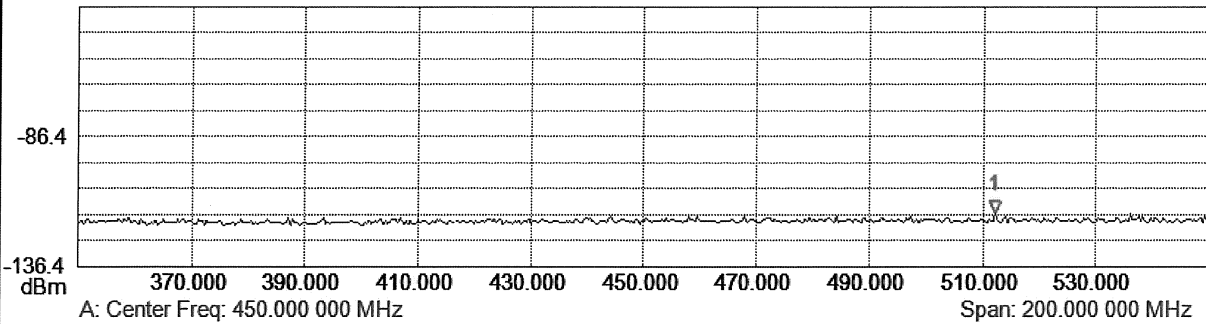
Measurement Parameters

Trace Mode	Max Hold	Stop Frequency	350.000 000 MHz
Preamplifier	OFF	Frequency Span	200.000 000 MHz
Min Sweep Time	0.05 S	Reference Level	-36.400 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	1023026
RBW	300.0 Hz	Base Ver.	V3.46
VBW	100.0 Hz	App Ver.	V4.42
Detection	Peak	Model	MS2721B
Center Frequency	250.000 000 MHz	Options	20, 25, 31
Start Frequency	150.000 000 MHz	Date	4/29/2019 2:24:11 PM
		Device Name	NORTHWESTERN-COLLEGE-RADIO

Spectrum Analyzer Data

BB350.550 (4/29/2019 2:29:14 PM)

Spectrum Analyzer



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	512.181 818 MHz	-115.57 dBm		
2	<input type="checkbox"/>	<input type="checkbox"/>				
3	<input type="checkbox"/>	<input type="checkbox"/>				
4	<input type="checkbox"/>	<input type="checkbox"/>				
5	<input type="checkbox"/>	<input type="checkbox"/>				
6	<input type="checkbox"/>	<input type="checkbox"/>				

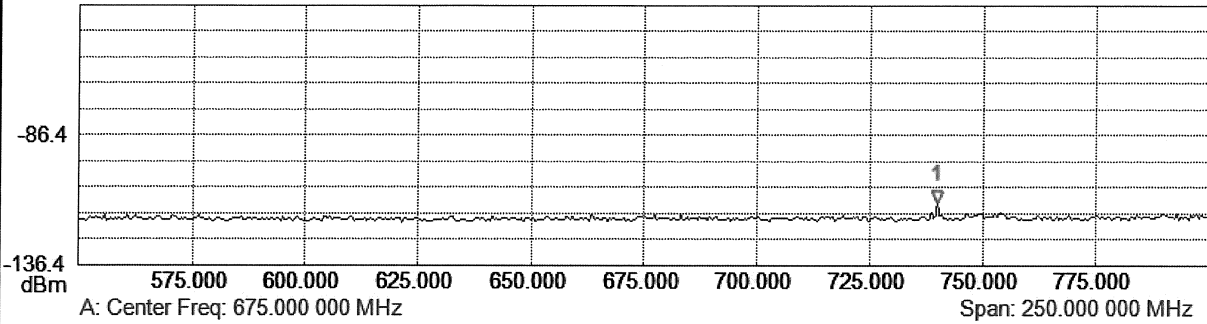
Measurement Parameters

Trace Mode	Max Hold	Stop Frequency	550.000 000 MHz
Preamp	OFF	Frequency Span	200.000 000 MHz
Min Sweep Time	0.05 S	Reference Level	-36.400 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	1023026
RBW	300.0 Hz	Base Ver.	V3.46
VBW	100.0 Hz	App Ver.	V4.42
Detection	Peak	Model	MS2721B
Center Frequency	450.000 000 MHz	Options	20, 25, 31
Start Frequency	350.000 000 MHz	Date	4/29/2019 2:29:14 PM
		Device Name	NORTHWESTERN-COLLEGE-RADIO

Spectrum Analyzer Data

BB550.800 (4/29/2019 2:36:53 PM)

Spectrum Analyzer



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	740.000 000 MHz	-112.00 dBm		
2	<input type="checkbox"/>	<input type="checkbox"/>				
3	<input type="checkbox"/>	<input type="checkbox"/>				
4	<input type="checkbox"/>	<input type="checkbox"/>				
5	<input type="checkbox"/>	<input type="checkbox"/>				
6	<input type="checkbox"/>	<input type="checkbox"/>				

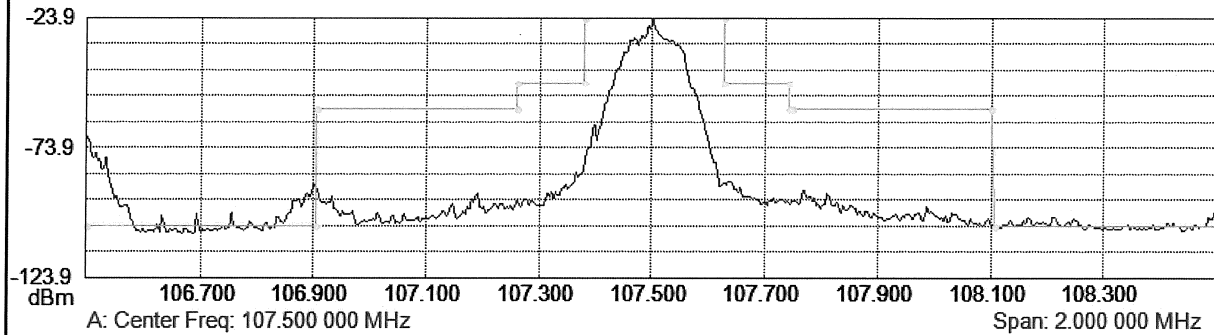
Measurement Parameters

Trace Mode	Max Hold	Stop Frequency	800.000 000 MHz
Preamp	OFF	Frequency Span	250.000 000 MHz
Min Sweep Time	0.05 S	Reference Level	-36.400 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	1023026
RBW	300.0 Hz	Base Ver.	V3.46
VBW	100.0 Hz	App Ver.	V4.42
Detection	Peak	Model	MS2721B
Center Frequency	675.000 000 MHz	Options	20, 25, 31
Start Frequency	550.000 000 MHz	Date	4/29/2019 2:36:53 PM
		Device Name	NORTHWESTERN-COLLEGE-RADIO

Spectrum Analyzer Data

107.5.NRSC (4/18/2019 9:46:59 AM)

Spectrum Analyzer



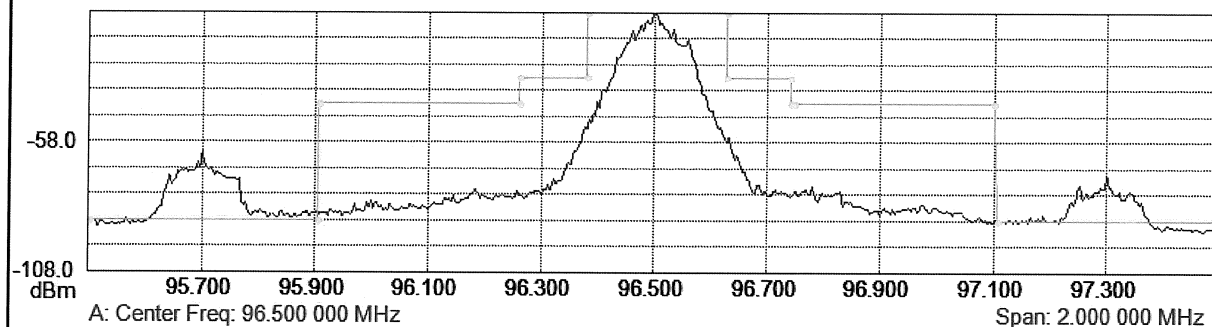
Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1						
2						
3						
4						
5						
6						

Measurement Parameters

Trace Mode	Max Hold	Stop Frequency	108.500 000 MHz
Preamplifier	OFF	Frequency Span	2.000 000 MHz
Min Sweep Time	0.001 S	Reference Level	-23.901 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	0.0 dB	Serial Number	1023026
RBW	1.0 kHz	Base Ver.	V3.46
VBW	300.0 Hz	App Ver.	V4.42
Detection	Peak	Model	MS2721B
Center Frequency	107.500 000 MHz	Options	20, 25, 31
Start Frequency	106.500 000 MHz	Date	4/18/2019 9:46:59 AM
		Device Name	NORTHWESTERN-COLLEGE-RADIO

Spectrum Analyzer Data **96.5.nrs (4/18/2019 10:22:44 AM)**

Spectrum Analyzer



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1						
2						
3						
4						
5						
6						

Measurement Parameters

		Stop Frequency	97.500 000 MHz
Trace Mode	Max Hold	Frequency Span	2.000 000 MHz
Preamp	OFF	Reference Level	-8.001 dBm
Min Sweep Time	0.001 S	Scale	10.0 dB/div
Reference Level Offset	0 dB	Serial Number	1023026
Input Attenuation	15.0 dB	Base Ver.	V3.46
RBW	1.0 kHz	App Ver.	V4.42
VBW	300.0 Hz	Model	MS2721B
Detection	Peak	Options	20, 25, 31
Center Frequency	96.500 000 MHz	Date	4/18/2019 10:22:44 AM
Start Frequency	95.500 000 MHz	Device Name	NORTHWESTERN-COLLEGE-RADIO