

**ENGINEERING REPORT
FM OCCUPIED SPECTRUM ANALYSIS**

CFR 47 §73.317 Compliance

WGHN-FM – Grand Haven, MI

**Facility ID # 72105
92.1 MHz**

July 2023

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MUNN-REESE

Broadcast Engineering Consultants
Coldwater, MI 49036

FM Occupied Spectrum Analysis

Station Data

Call sign: WGHN-FM

Frequency: 92.1 MHz

City of License: Grand Haven, MI

Channel: 221A

Service: FM

Facility ID: 72105

Effective Radiated Power: 6 kW

Antenna Mode: Omni-Directional

Measurement Date: 7/21/2023

Discussion:

The measurement data obtained for this report indicates the operation of WGHN-FM to be **IN COMPLIANCE** with the provisions of CFR 47 §73.317 of the FCC rules regarding FM Broadcast Stations. Occupied Spectrum measurements taken during the regular broadcast day by Richard Grzebik, staff engineer in the regular employ of Munn-Reese. The stored spectrum data gathered by the analyzer has been processed and displayed in this report as Figure A, Figure B, and Figure C for WGHN-FM, and also for co-located WMPA(FM) 93.1 MHz, Ferrysburg, MI, Facility ID 189472. The spectrum analyzer and calibrated FM antenna were located in an unobstructed clearing within 0.25 km of the transmitting antenna to generate Figures A, B,& C. In addition, spurious emission and harmonic measurements were made at the combined output of the cavity filters of WGHN-FM and WMPA(FM) using an existing Coaxial Dynamics Line Section and Coaxial Dynamics BNC Element with an inline pad to feed the Anritsu Spectrum Analyzer. These measurements are included in FM Harmonic Measurements Table A, within the report. A frequency measurement has also been performed.

Equipment Employed

Anritsu MS2720T, Spectrum Master, calibrated on November 2, 2022. Technical specifications of the Anritsu MS2720T are available on the Internet at www.anritsu.com. FM notch filters were used to notch out the fundamental frequencies of 92.1 and 93.1 FM to eliminate potential mixer overload

within the Anritzu Spectrum Analyzer to measure the harmonic mix products. A calibrated FM antenna was used for Figure A, B, & C measurements.

EXHIBITS

Measured Carrier Frequency – 92,100,021.913 Hz.

Figure A - Plot of Occupied Spectrum using a Span of 50 kHz/division

Figure B - Plot of Occupied Spectrum using a span of 200 kHz/division

Figure C - Plot of Measured Occupied Bandwidth, 99% Carrier Method.

The Figure A measurement and mask is the top part of the Figure B measurement mask expanded.

The Figure B measurement and mask is primarily for spurious emissions out to 1 MHz removed from the carrier. The resolution of the analyzer comes into play here. Many stations running high average modulation hit the top inside edges of the Figure B mask. Almost all stations running IBOC hit or exceed the top edges of the Figure B mask.

Figure C is the Spectrum Analyzer performing an Occupied Bandwidth measurement using the standard 99% of carrier energy method. The measurement is peak averaged over a “period of time” and represents the peak average modulation of the station with typical program material.

The conversion of Peak Average Occupied Bandwidth to percentage of peak modulation based on 75 kHz deviation equal to 100% modulation is as follows:

$$(\text{Measured Occupied Bandwidth in kHz}) \div 2 \div (75 \text{ kHz}) \times 100 = \% \text{ of Modulation}$$

From Figure C, WGHN-FM has a Measured Occupied Bandwidth of 147.005 kHz.

The Conversion to modulation level indicates 98.00% Peak FM Modulation.

Harmonic measurements up to the fourth harmonic and mix product measurements between 92.1 FM and co-located 93.1 FM were measured using the Anritsu 2720T. The Anritsu 2720T was setup and calibrated in accordance with the manufacturer's instructions, and the readings taken on the fundamental carrier frequency and up to the fourth harmonic.

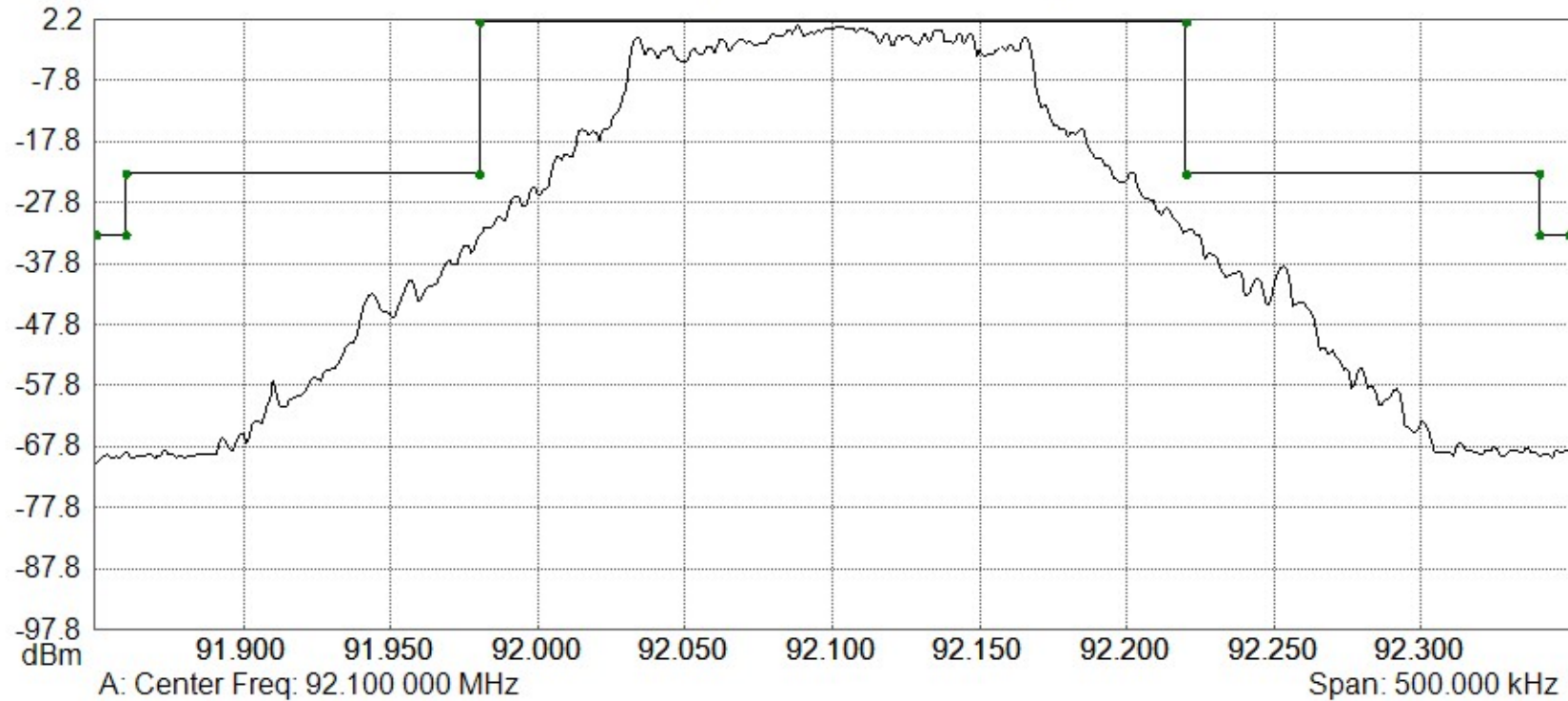
FM Harmonic Measurements – Table A						
Main Carrier Frequency:		92.1 MHz		93.1 MHz		
ERP in Watts:		6,000 Watts		6000 Watts		
Required Attenuation of harmonics:		-80.0 dB		-80.0 dB		
Main Carrier Level:		-26.28 dBm		-20.34 dBm		
	Frequency MHz.	Level	Attenuation	Flag		
92.1 2nd Harmonic:	184.2	-114.89 dBm	-88.61 dB	Passed		
92.1 3rd Harmonic:	276.3	-122.82 dBm	-96.54 dB	Passed		
92.1 4th Harmonic:	368.4	-110.87 dBm	-84.59 dB	Passed		
93.1 2nd Harmonic:	186.2	-118.61 dBm	-98.27 dB	Passed		
93.1 3rd Harmonic:	279.3	-117.86 dBm	-97.52 dB	Passed		
93.1 4th Harmonic:	372.4	-128.05 dBm	-107.71 dB	Passed		
2 x 92.1 – 93.1	91.1	-114.62 dBm	-88.34 dB	Passed		
2 x 93.1 – 92.1	94.1	-113.36 dBm	-93.02 dB	Passed		
92.1 + 93.1	185.2	-117.45 dBm	-91.17 dB	Passed		
2 x 92.1 + 93.1	277.3	-125.51 dBm	-105.17 dB	Passed		
2 x 93.1 + 92.1	278.3	-127.85 dBm	-101.57 dB	Passed		
2 x 92.1 + 2 x 93.1	370.4	-128.54 dBm	-102.26 dB	Passed		

This report has been prepared by properly trained electronics specialists under the direction of the undersigned whose qualifications are a matter of record before the Federal Communications Commission. I declare under penalty of laws of perjury that the contents of this report are true and accurate to the best of my knowledge and belief.

By 
Richard P. Grzebiak, Engineer

Spectrum Analyzer Data
WGHN-FIG-A (7/21/2023 7:10:40 PM)

Spectrum Analyzer



Trace A data:

Trace Mode = Max Hold

Preamplifier = OFF

Min Sweep Time = 0.001 S

Reference Level Offset = 0 dB

Input Attenuation = 30.0 dB

RBW = 3.0 kHz

VBW = 1.0 kHz

Detection = Peak

Center Frequency = 92.100 000 MHz

Start Frequency = 91.850 000 MHz

Stop Frequency = 92.350 000 MHz

Frequency Span = 500.000 000 kHz

Reference Level = 2.242 dBm

Scale = 10.0 dB/div

Serial Number = 2143017

Base Ver. = V6.04

App Ver. = V7.27

Model = MS2720T

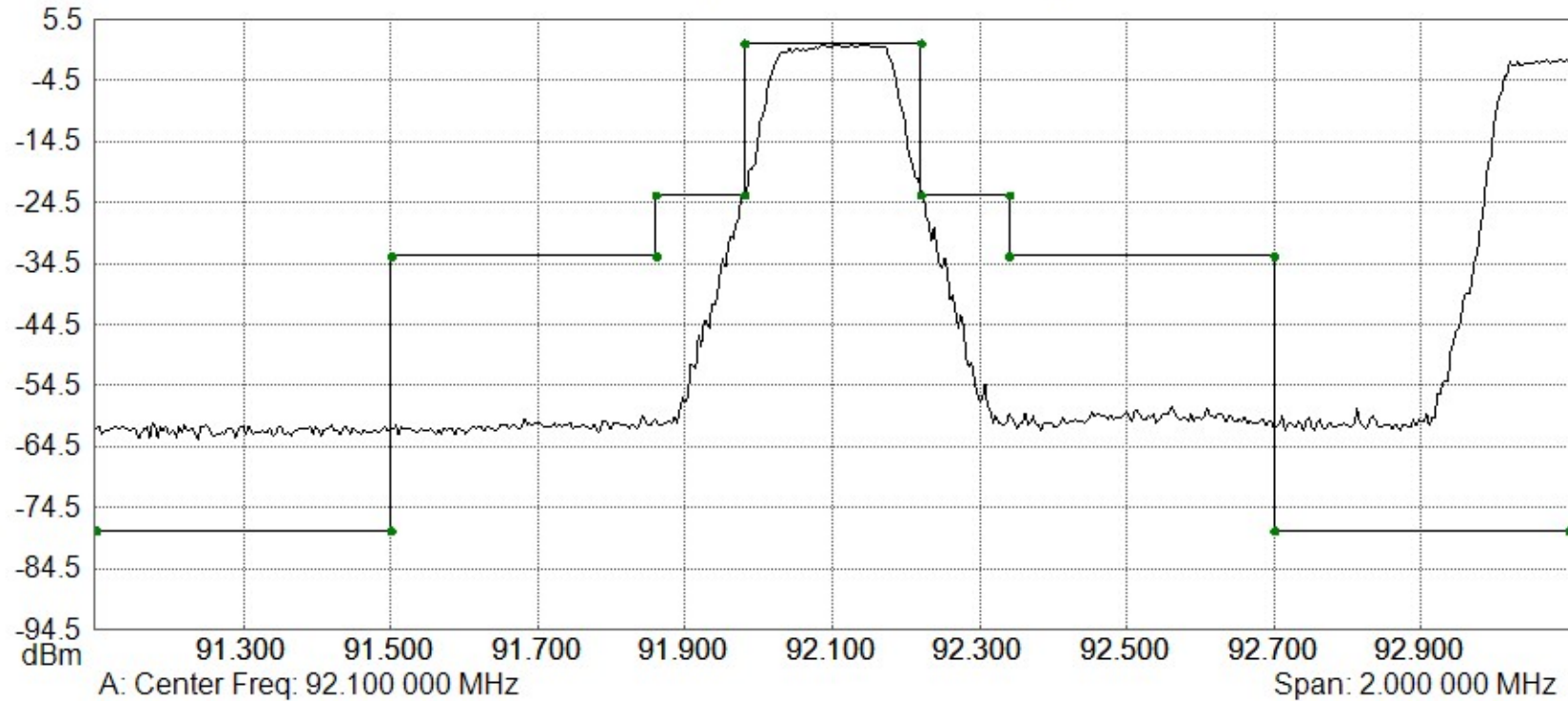
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Device Name =

Spectrum Analyzer Data WGHN-FIG-B (7/21/2023 6:54:52 PM)

Spectrum Analyzer



Trace A data:

Trace Mode = Max Hold

Preamplifier = OFF

Min Sweep Time = 0.001 S

Reference Level Offset = 0 dB

Input Attenuation = 35.0 dB

RBW = 30.0 kHz

VBW = 10.0 kHz

Detection = Peak

Center Frequency = 92.100 000 MHz

Start Frequency = 91.100 000 MHz

Stop Frequency = 93.100 000 MHz

Frequency Span = 2.000 000 MHz

Reference Level = 5.542 dBm

Scale = 10.0 dB/div

Serial Number = 2143017

Base Ver. = V6.04

App Ver. = V7.27

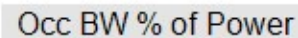
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Options = 743

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Device Name =

Spectrum Analyzer



Occ BW: 147.005 kHz

Trace A data:

Detection = Peak

Base Ver. = V6.04

Center Frequency = 92.100 000 MHz

App Ver. = V7.27

Start Frequency = 91.850 000 MHz

Model = MS2720T

Stop Frequency = 92.350 000 MHz

Options = 743

Frequency Span = 500.000 000 kHz

Date = 7/21/2023 7:13:24 PM

Reference Level = 2.242 dBm

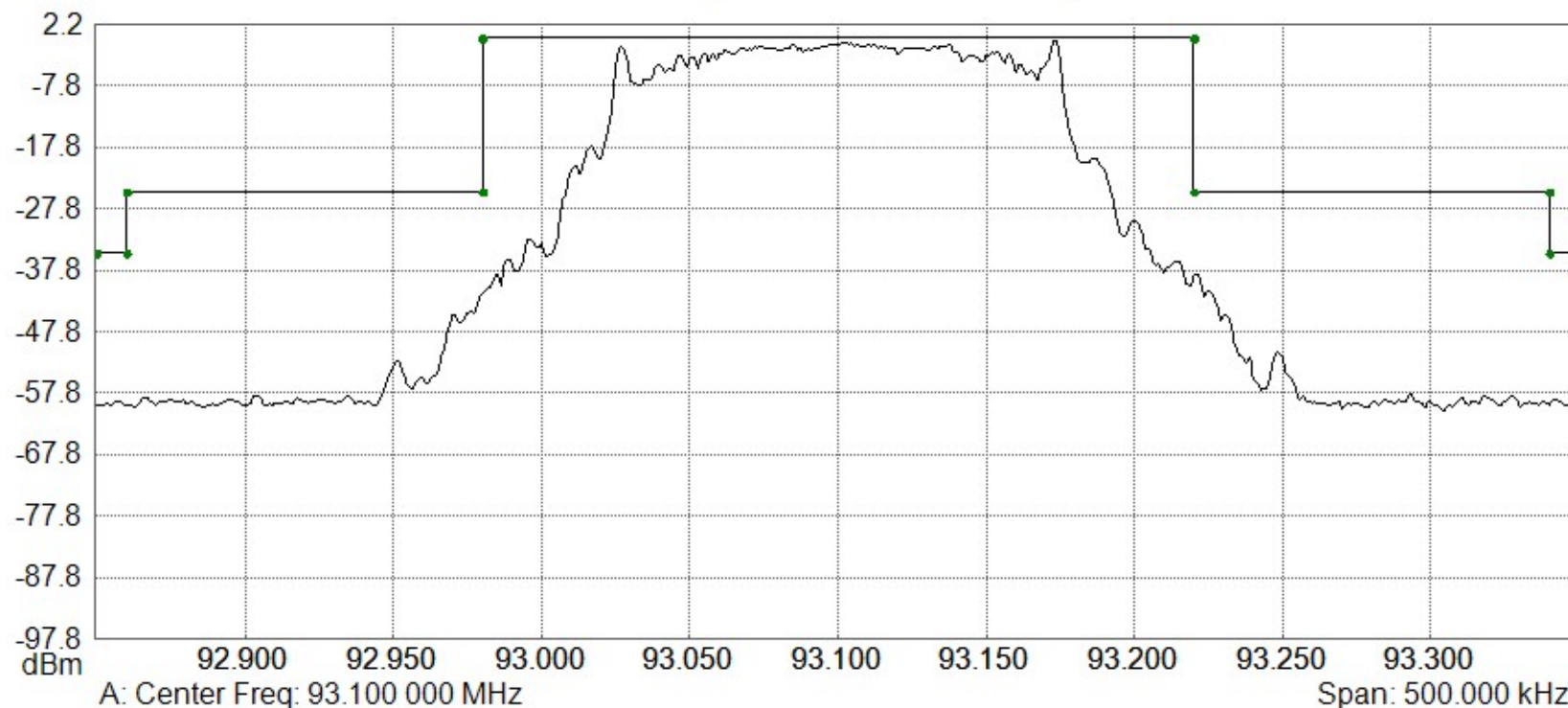
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Scale = 10.0 dB/div

Serial Number = 2143017

Spectrum Analyzer Data WMPA-FIG-A (7/21/2023 7:24:50 PM)

Spectrum Analyzer



Trace A data:

Trace Mode = Max Hold

Preamplifier = OFF

Min Sweep Time = 0.001 S

Reference Level Offset = 0 dB

Input Attenuation = 50.0 dB

RBW = 3.0 kHz

VBW = 1.0 kHz

Detection = Peak

Center Frequency = 93.100 000 MHz

Start Frequency = 92.850 000 MHz

Stop Frequency = 93.350 000 MHz

Frequency Span = 500.000 000 kHz

Reference Level = 2.242 dBm

Scale = 10.0 dB/div

Serial Number = 2143017

Base Ver. = V6.04

App Ver. = V7.27

Model = MS2720T

Options = 743

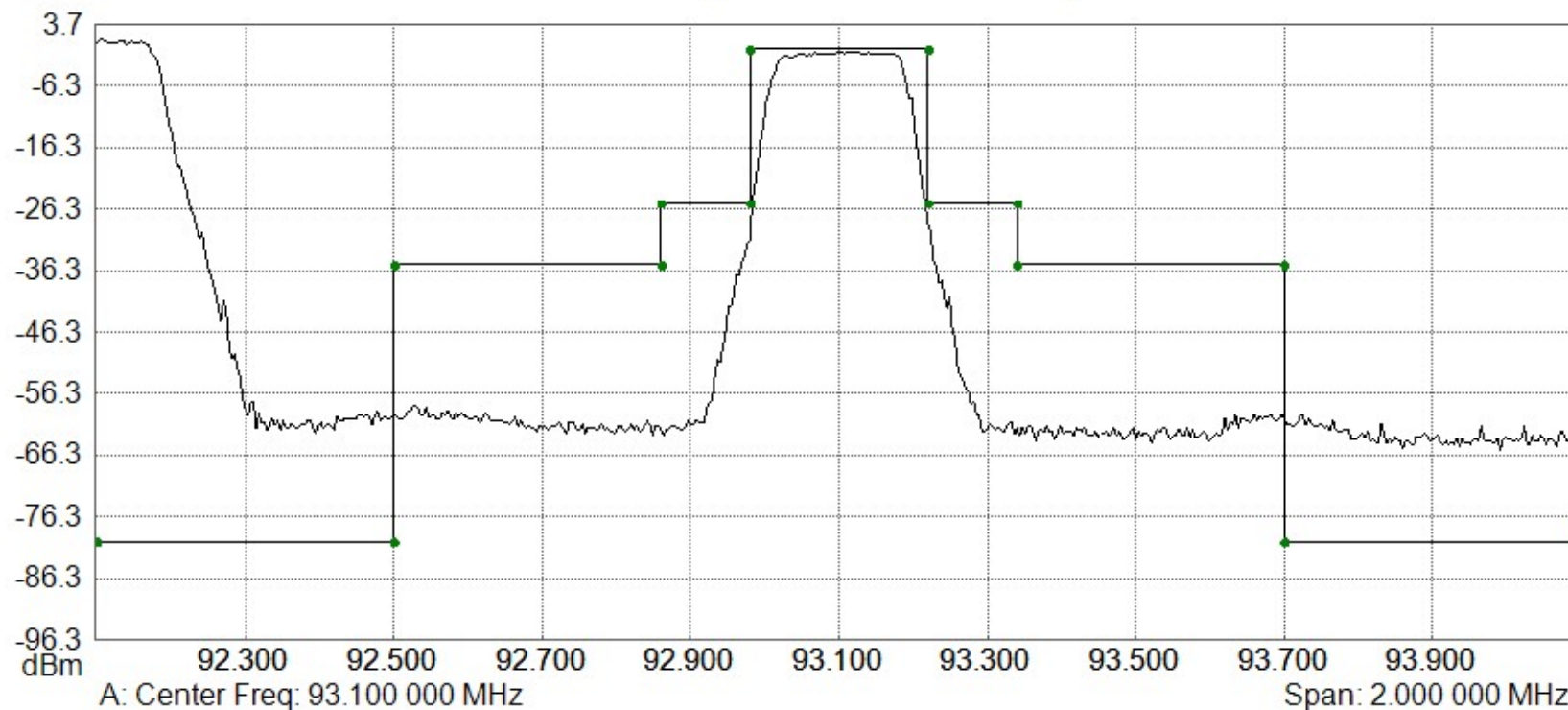
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Device Name =

Spectrum Analyzer Data

WMPA-FIG-B (7/21/2023 6:58:07 PM)

Spectrum Analyzer



Trace A data:
Trace Mode = Max Hold
Preamplifier = OFF
Min Sweep Time = 0.001 S
Reference Level Offset = 0 dB
Input Attenuation = 30.0 dB
RBW = 30.0 kHz
VBW = 10.0 kHz

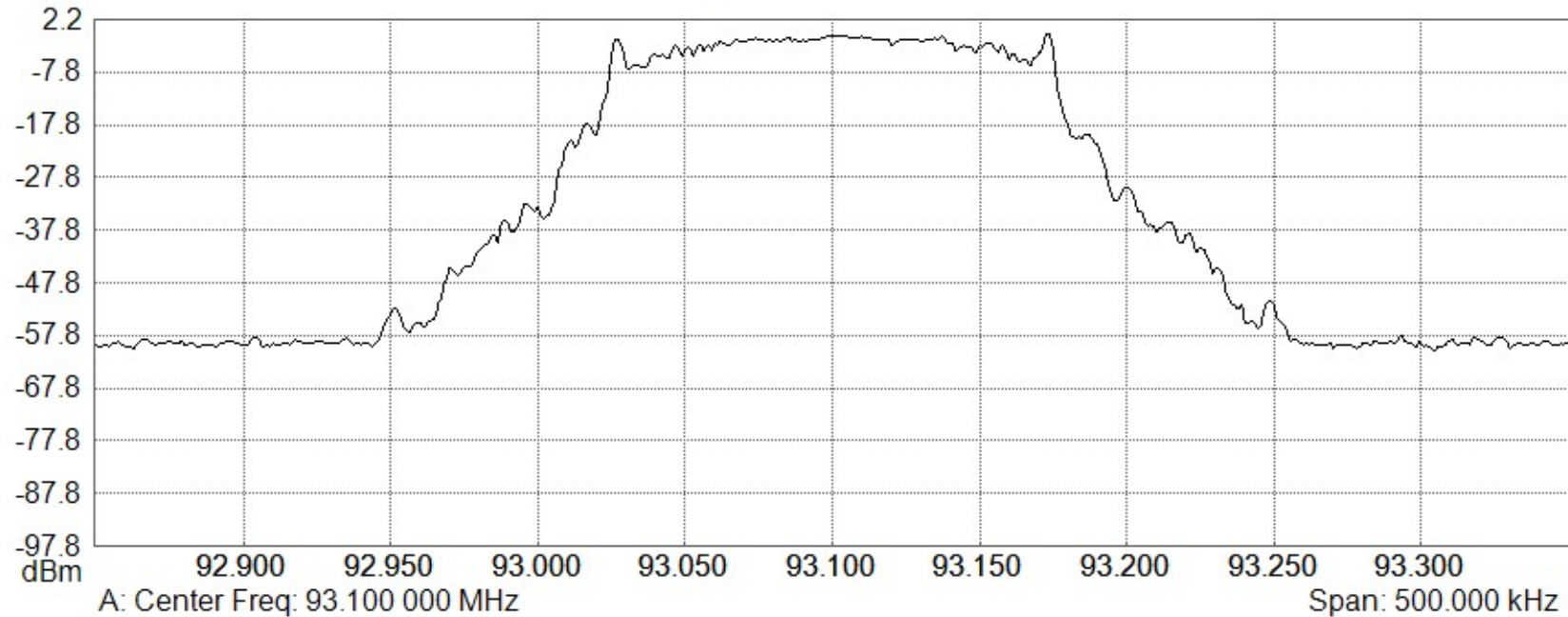
Detection = Peak
Center Frequency = 93.100 000 MHz
Start Frequency = 92.100 000 MHz
Stop Frequency = 94.100 000 MHz
Frequency Span = 2.000 000 MHz
Reference Level = 3.742 dBm
Scale = 10.0 dB/div
Serial Number = 2143017

Base Ver. = V6.04
App Ver. = V7.27
Model = MS2720T
Options = 743
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Device Name =

Spectrum Analyzer Data

WMPA-FIG-C (7/21/2023 7:26:01 PM)

Spectrum Analyzer



Occ BW % of Power

Percent: 99.00 %

Occ BW: 151.543 kHz

Measured XdB: 5.67 dB

Trace A data:

Trace Mode = Max Hold

Preamplifier = OFF

Min Sweep Time = 0.001 S

Reference Level Offset = 0 dB

Input Attenuation = 50.0 dB

RBW = 3.0 kHz

VBW = 1.0 kHz

Detection = Peak

Center Frequency = 93.100 000 MHz

Start Frequency = 92.850 000 MHz

Stop Frequency = 93.350 000 MHz

Frequency Span = 500.000 000 kHz

Reference Level = 2.242 dBm

Scale = 10.0 dB/div

Serial Number = 2143017

Base Ver. = V6.04

App Ver. = V7.27

Model = MS2720T

Options = 743

Date = 7/21/2023 7:26:01 PM

Device Name =