Audio Specialties Group
Products Division

MAS-524
4x1 Transmitter Combiner
Technical Specifications

MAS$_t$
SYSTEM
MANAGED
ANTENNA
SYSTEM
TECHNOLOGY

Rev-0

Audio Specialties Group and any of its vendors, dealers or representatives forbid the use of this product in any way that is contrary to FCC Regulations.

Utilizing this product in a manner which is contrary to FCC Regulations is expressly forbidden.

Maintaining power levels to within FCC regulations is the sole responsibility of the user or operator.

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SECTION 1

Introduction/Features

1.1 Introduction

The MAS-524 4x1 Transmitter Combiner is a 1-HP (horizontal pitch) module that is compatible with the ASG MAS-Rack Series 500 system. It is a passive device used to combine up to four transmit signals into a single connector output. Its usable frequency range is 450-800MHz. Inter-modulation products and artifacts are typically 50dBm[1] below the primary carrier level. Each input can sustain a continuous, single-tone input of approx 5-watts. (+38dBm)

1.2 Features

The design of the combiner is based on a Wilkinson , non-lumped topology with ceramic surface mount resistors and trim-capacitors. The capacitors allow the combiner to be ideally matched for the frequency placed on any input. Unlike lumped, non adjustable topologies, the products and artifacts generated by combining are absolutely minimized for the four specific frequencies being combined. The internal PCB uses gold-plated SMA type RF connectors. These are extended to the rear-panel with RG-316 size 50ohm cable with Teflon outer jacket and silver plated center-conductor.

[1] Typical, after optimization

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Operation

2.1 Precautions

2.1.1 Explanations

 Identifies important performance information

 Identifies safety information

Note Identifies important operator actions

2.1.2 Environmental

 Do not expose the MAS-524 to rain or direct sunlight.

 Maintain proper ventilation for temperature specification.

2.1.3 Electrical

 The Ceramic impedance matching resistors on the MAS-524 combining PCB can get very HOT. Use caution when RF power is applied to any input to avoid burns.

 Emission specifications will only be met if operated within the guidelines of this manual. Operating the MAS-524 other than as specified can generate unwanted radio frequency radiation that could adversely affect the proper operation of other electrical equipment.

 Do not remove output transmission cabling or radiating device from the transmission cable while RF power is active. High power RF energy can cause burns and electrical shock. Damage can occur in the power amplifier stage if the output becomes unloaded.

2.2 Power Dissipation.

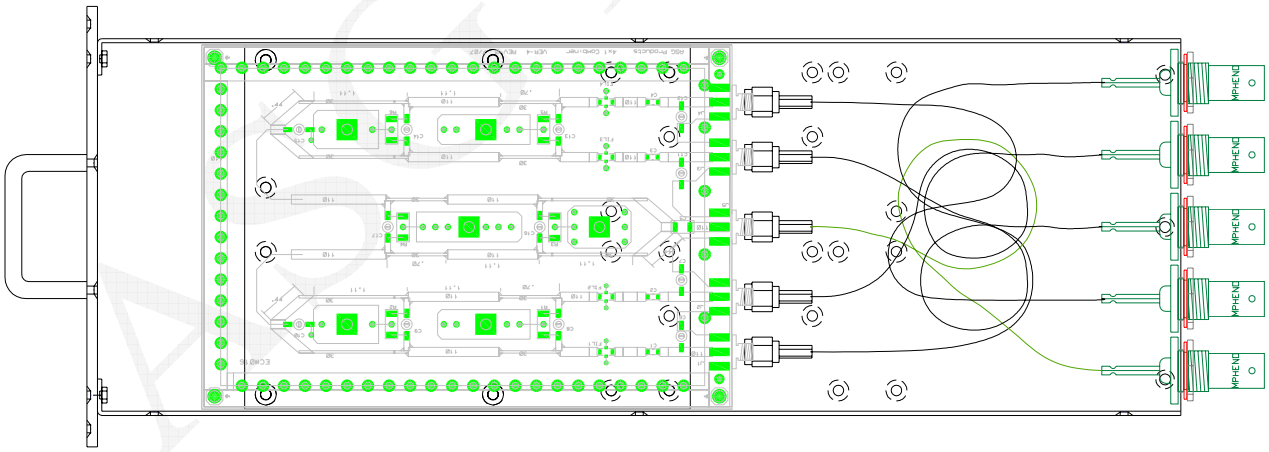
The 4x1 combiner PCB is screwed to a ¼' thick aluminum plate which in turn is screwed to the chassis of the MAS-524. The screws which connect the circuit board to the aluminum plate act as thermal conduits from the top-side copper ground-plane regions to the plate. It is very important that these screws remain in place. Do not attempt to disassemble the combiner PCB from the aluminum plate. It is normal for the MAS-524 to have an operational temperature of 90 deg F. on the exterior of the chassis. The internal PCB components are inside a RF shielded area. The cover of the shield is removable to gain access to the adjustment capacitors. This shield must be replaced for normal use.

In normal installation, the MAS-524 orients vertically in the MAS-500 frame. The chassis features vertical air-flow vents for heat dissipation. These vents, located on the top and bottom of the module must be kept un-obstructed for optimum performance.

Note If the system is used out doors or in an otherwise un-air conditioned environment, proper ventilation and air flow is critical. Do not obstruct the bottom-to-top air flow.

2.3 Connections

A single RF connection is provided for each input. The combined output is available as a full power output and optionally can have a front panel TEST output which allows the output signal to be monitored without interrupting the transmission line feed.



MAS-524 Transmitter Combiner

2.4 Adjustments

Chose the frequency of the four signals to be used for desired operation. Measure and record the amplitude of each of these signals. (A worksheet is provided at the back of this manual for recording this information.). Connect the output of the MAS-525 to a RF spectrum analyzer.

. Verify that the signal level does not exceed the analyzer's maximum input specification.

Note The MAS-524 can only be optimized for known frequencies. If frequencies change, the optimization is negated and the unit must be re-tuned.[2]

Note A ceramic or other type of non-metallic adjustment tool must be used.

Note Common practice is to place the lowest frequency signal on input #1 and the highest on input #4. This allows the spectrum analyzer to display the carriers left to right on the screen as inputs 1-4 in order of ascending frequency. This is *not* required for proper operation.

1 Connect the lowest frequency signal to input #1. Terminate inputs 2, 3, 4
Adjust C6 for maximum amplitude. Input match trimmer. .

2 Connect the next highest frequency test signal to input #2. Terminate inputs 1,3,4
Adjust C7 for maximum amplitude. Input match trimmer.

3 Connect the next highest frequency test signal to input #3 Terminate inputs 1,2,4
Adjust C11 for maximum amplitude. Input match trimmer.

4 Connect the highest frequency test signal to input #4 Terminate inputs 1,2,3
Adjust C12 for maximum amplitude. Input match trimmer.

All the inputs are now optimized for each frequency.

[2] Performance is optimized for specific frequencies: Maximum +-50KHz displacement from optimized center.

5 Remove all terminators and connect each signal to its determined input.

There should be four intentional carriers displayed on the analyzer along with many un-intentional “products” approximately 30-40dBm below the intentional carrier amplitude.

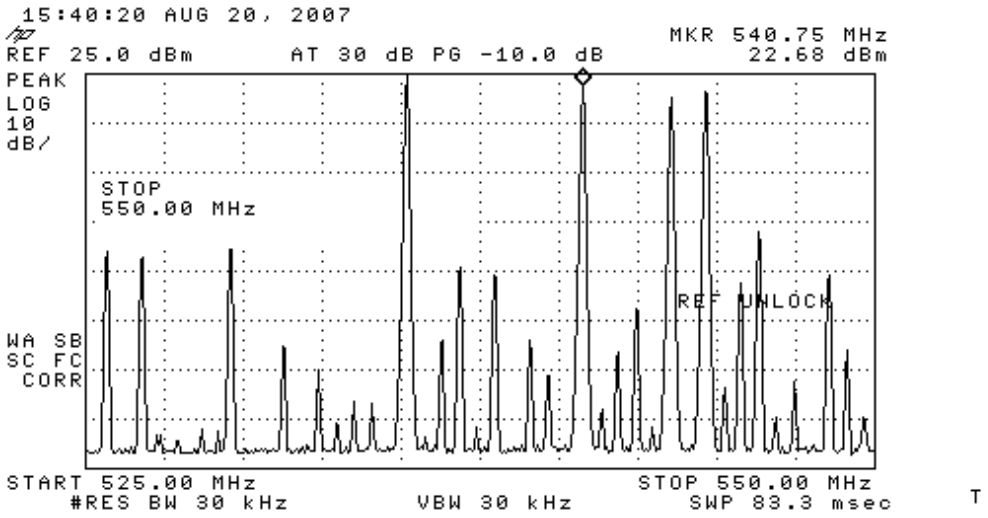


Figure shows output before optimization

6 Adjust C18, for minimum products. Final Output Match

7 Adjust C16, for minimum products. Stage-1 Output

8 Adjust C17, for minimum products. Stage-2 Output

9 Adjust C10, for minimum products. Final for Inputs 1&2

10 Adjust C15, for minimum products. Final for Inputs 3&4

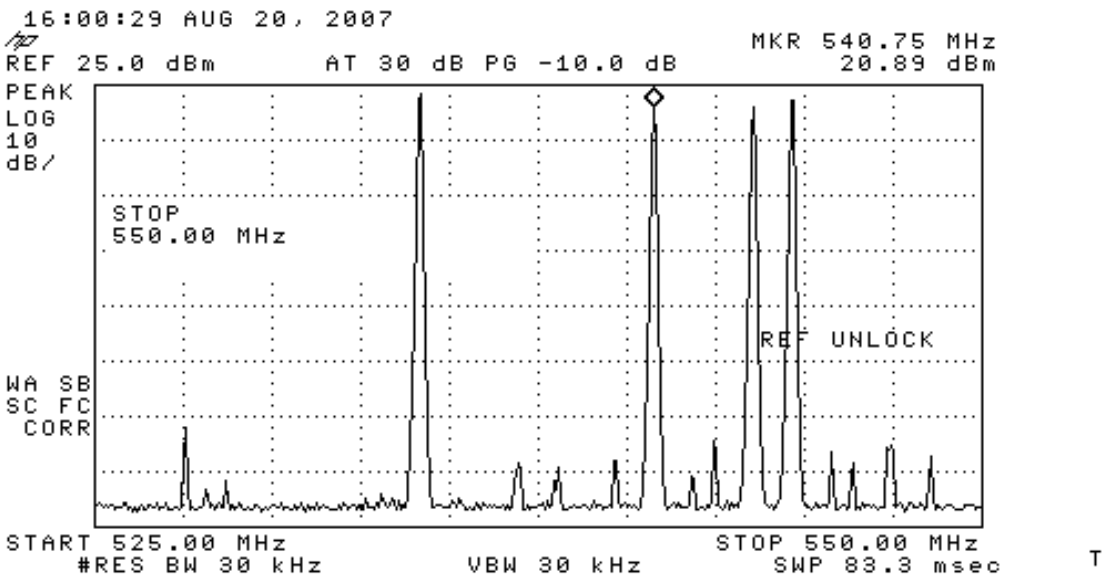
11 Adjust C9, for minimum products. Stage-2 for Inputs 1&2

12 Adjust C14, for minimum products. Stage-2 for Inputs 3&4

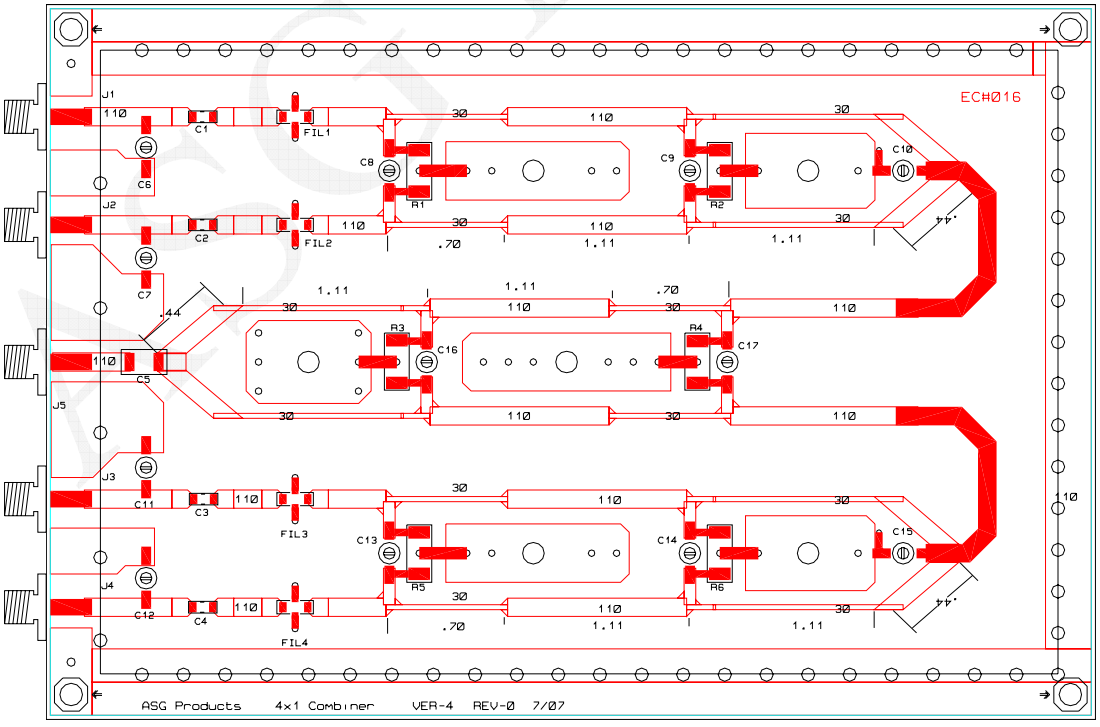
13 Adjust C8, for minimum products. Stage-1 for Inputs 1&2

14 Adjust C13, for minimum products. Stage-1 for Inputs 3&4

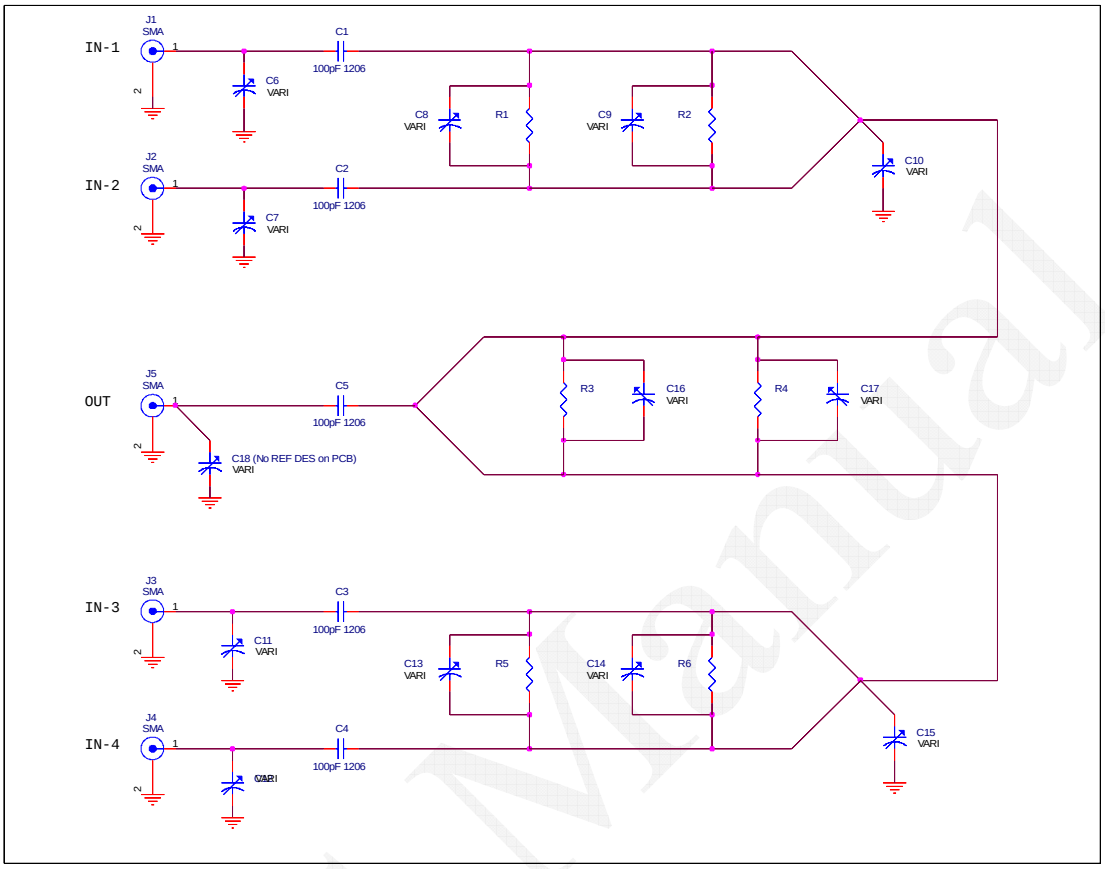
These capacitors interact with each other. As each capacitor is adjusted, several re-adjustments will be required beginning at step #6 of these procedures for full optimization.



Spectrum analyzer display showing the four carriers after optimization.



Interior of the combiner PCB showing locations of the adjustment capacitors.

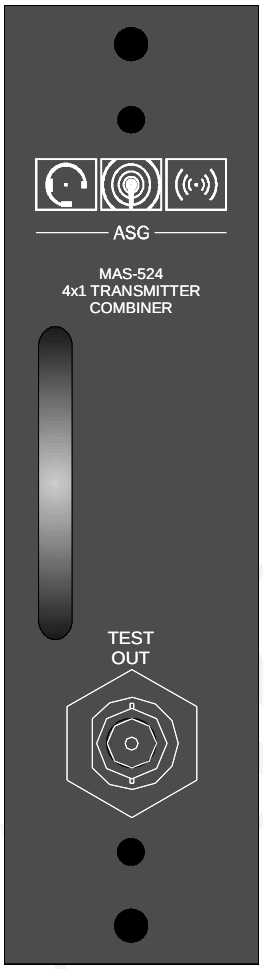


Equivalent Schematic

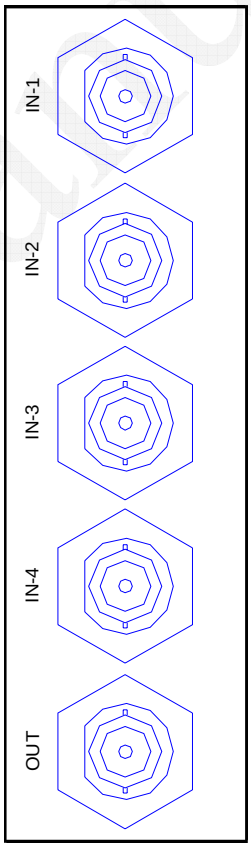
Section 3

Panel Layout

3.1 Front Panel Layout



3.2 Rear Panel Layout



Section 4

Specifications

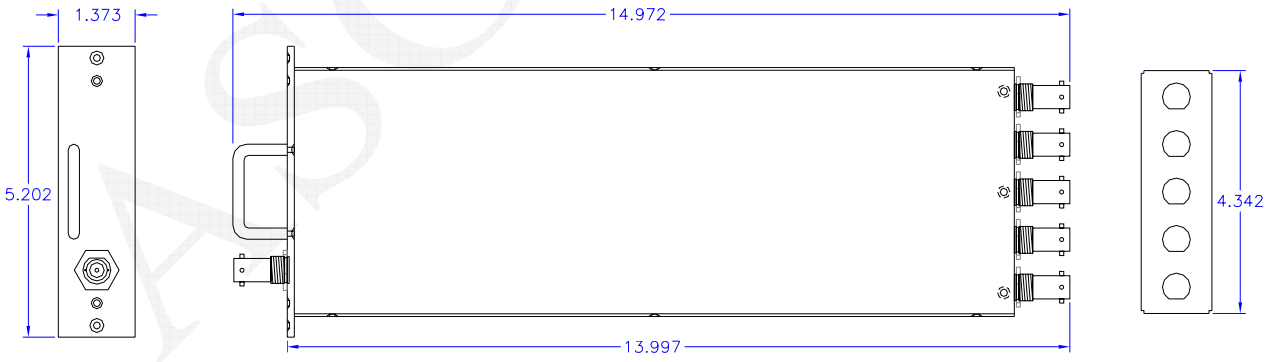
4.1 Electrical Specifications

RF Bandwidth:	450-800MHz
Maximum RF Input level:	+33 per input, single carrier
Output Level:	-8dBm below input amplitude for any single input.

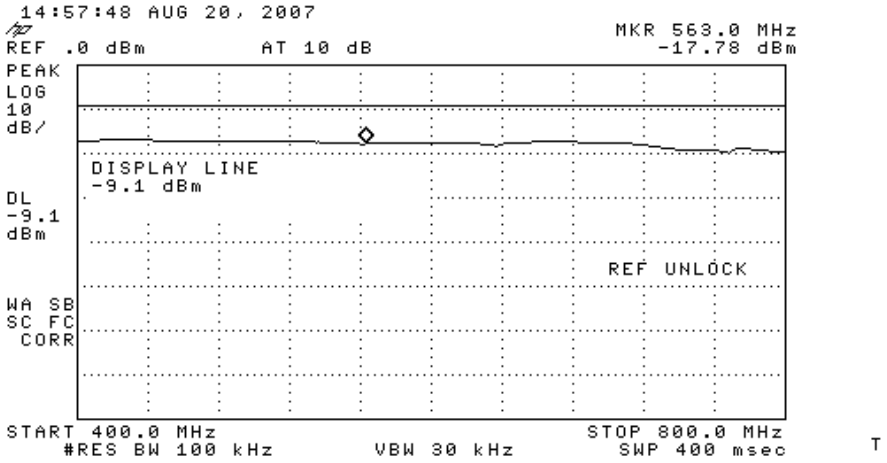
4.2 Operational Conditions

Temperature 20 Degrees Celsius to 40 Degrees Celsius

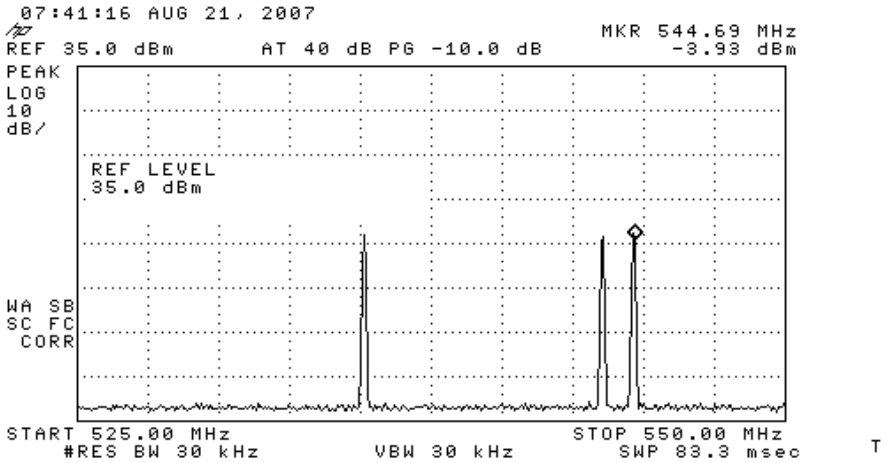
4.3 Mechanical Parameters



Specifications subject to change without notice.

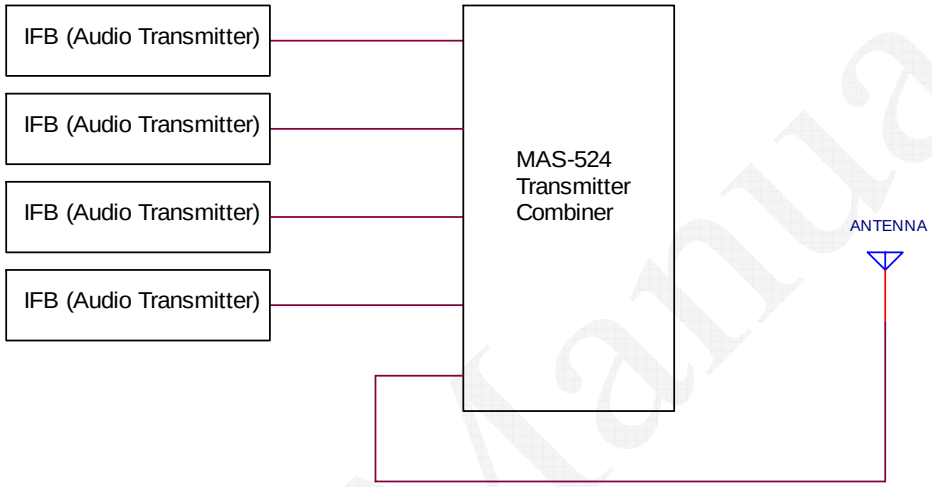


Frequency Response. (Input #1 to Output)

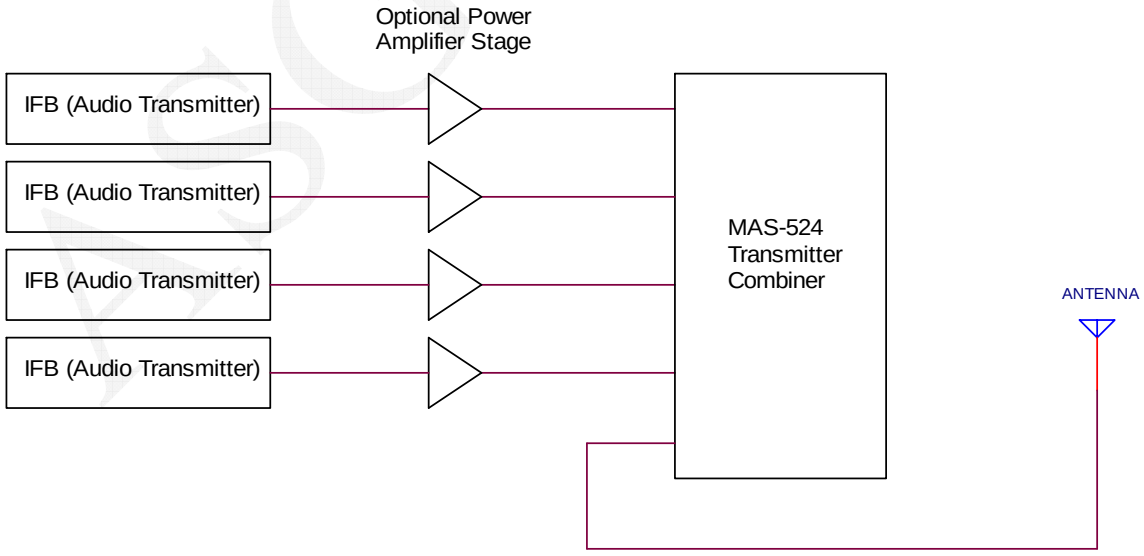


Adjacent channel leakage. (Input #1,3,4 Driven with +30dBm; Input #2 Analyzed)

Typical Applications



This application features no additional amplification. Used when the coverage area is a small stage or similar which does not require full, legal limit RF energy.



This application uses additional amplification. Ideal for large areas or for splitting the output to multiple transmit antennas for coverage in complex facilities with multiple stages. Proper amplification can yield full legal limit energy on each carrier on multiple antennas.

MAS-524 Signal Source Information

For Input #1

Frequency_____MHz

Input Power_____dBm Measured at Output_____dBm

For Input #2

Frequency_____ MHz

Input Power _____ dBm Measured at Output_____dBm

For Input #3

Frequency_____ MHz

Input Power _____ dBm Measured at Output_____dBm

For Input #4

Frequency_____ MHz

Input Power _____ dBm Measured at Output_____dBm