TF10402 Tunable Notch Filter

Features

High Stop-Band Rejection

Absorptive Design

Can be Cascaded for Multiple Notches

On-device Temperature Measurement

Compact Form-factor

Control and Power over USB 2.0

Applications

Jamming Mitigation

Communications Receivers

ESM Receiver Protection

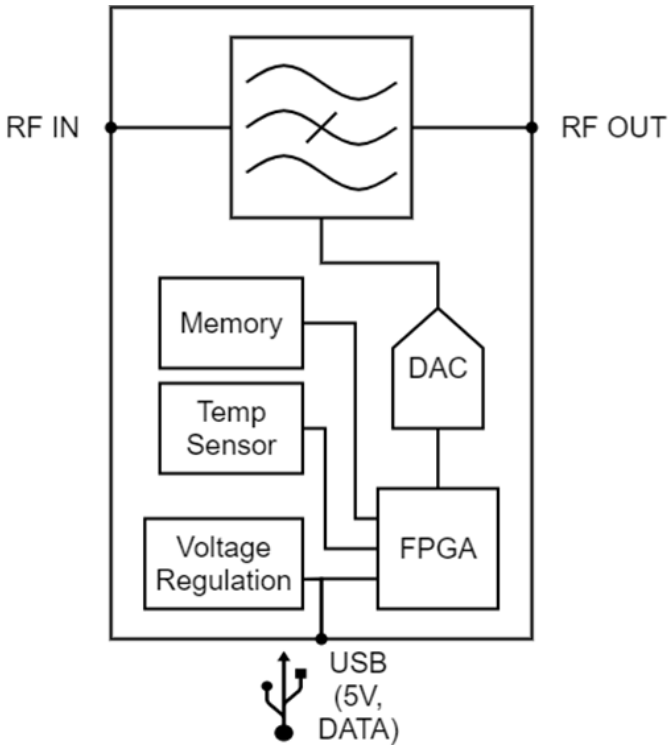
TR Modules

Electronic Warfare

General Description

TF10402 is a unit for a high-rejection, tunable, absorptive notch filter that is designed and packaged to make evaluation and testing straightforward. The unit can be controlled through the provided graphical user interface or python API.

Functional Block Diagram



Electrical Specifications

Parameter	Symbol	Specification	Conditions
Tuning Range	Fc	700 to 1170 MHz	Band 1
		1170 to 2000 MHz	Band 2
Tuning Resolution		1 MHz typical	Calibration Interval
Rejection		36.8dB min, 66.7dB max	Band 1
-3dB Bandwidth		100.62 MHz min, 120.7 MHz max	
-20dB Bandwidth		13 MHz min, 24 MHz max	
Rejection		32.8dB min, 78.5dB max	Band 2
-3dB Bandwidth		192 MHz min, 208.26 MHz max	
-20dB Bandwidth		27 MHz min, 44 MHz max	
Passband Frequency		620 to 2450 MHz	All bands (See Note 1)
Insertion Loss	IL	0.8dB maximum	All bands (See Note 2)
Return Loss		16dB minimum	Band 1 (See Note 3)
		11.9dB minimum	Band 2
Group Delay		10ns maximum	20 MHz spacing from notch center frequency
Tuning Speed		20µs maximum	All bands, Full Scale (See Note 4)
IIP3		34.32dBm typical	Passband 2-Tone Test (See Note 5)
Passband RF Power		+30dBm maximum	
Notch RF Power		-15dBm maximum	
Supply Voltage		5V	USB
Minimum Signal to Notch Spacing		Half Maximum 3dB Bandwidth	

Temperature

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Operating Temperature	OTR	-40		+60	°C	
Storage Temperature	STR	-55		+60	°C	

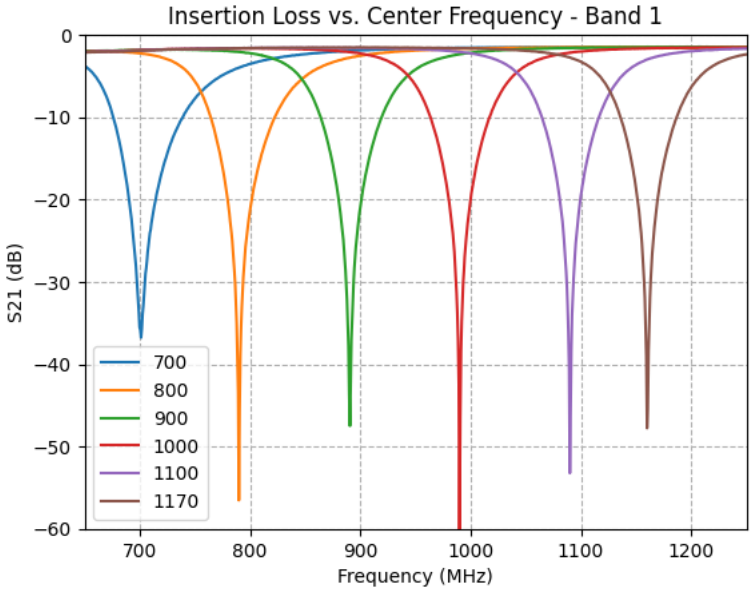
Hardware Interface

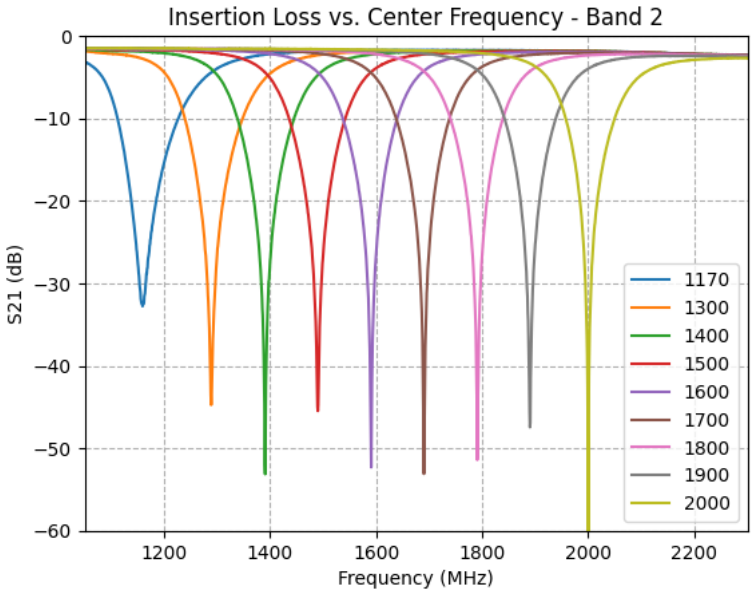
Name	Type	Hardware	Manufacturer	Manufacturer PN#
RF1	RF Input/Output	SMA Female	Amphenol RF	132146
RF2	RF Input/Output	SMA Female	Amphenol RF	132146
Power/Control	USB	USB Mini-B	Amphenol ICC	MUSB15104

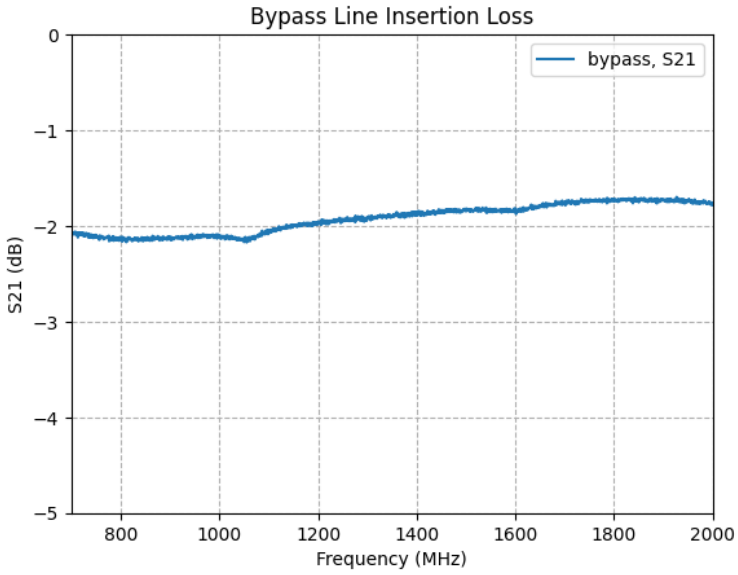
Notes

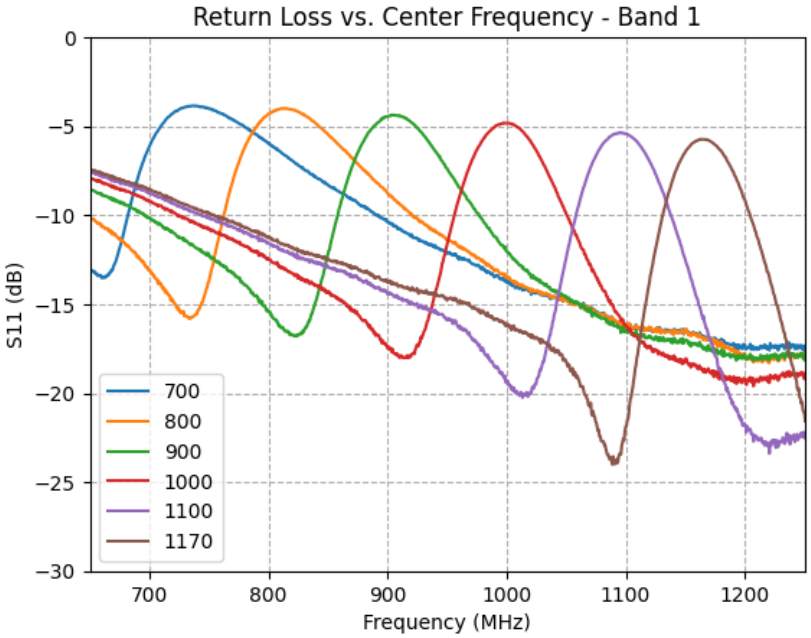
Note 1	Passband is defined as the frequency range between the 3 dB insertion loss points outside of the notch filter tuning range.
Note 2	Filter insertion loss is defined as the maximum insertion loss within the passband of the notch filter tuning range.
Note 3	Maximum return loss in the passband frequency range outside of the notch.
Note 4	Tuning speed is approximated for this demo unit. Actual tuning speed of the filter will depend on voltage driver and control interface latency.
Note 5	IIP3 is determined using the fundamental tone in the passband and the highest 3rd order product produced. Tone spacing of 0.5 MHz was used.

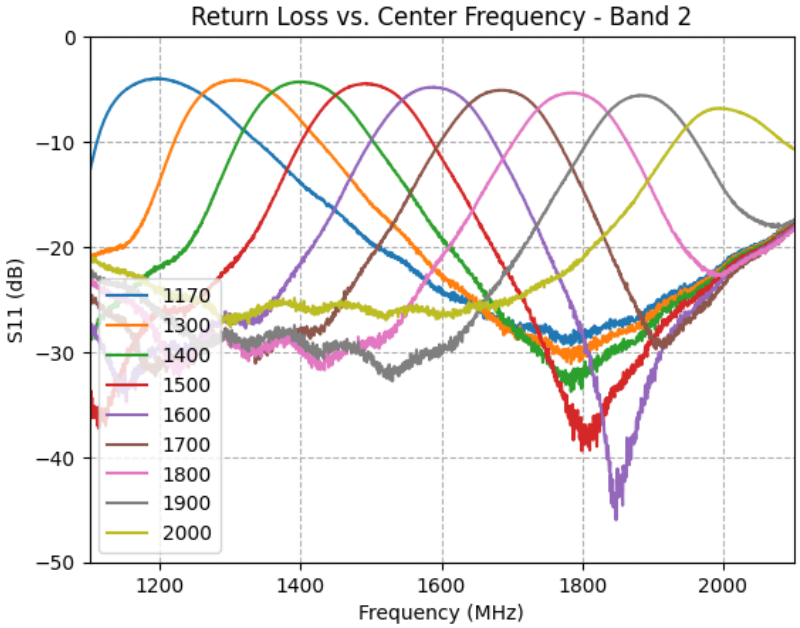
Simulation plots

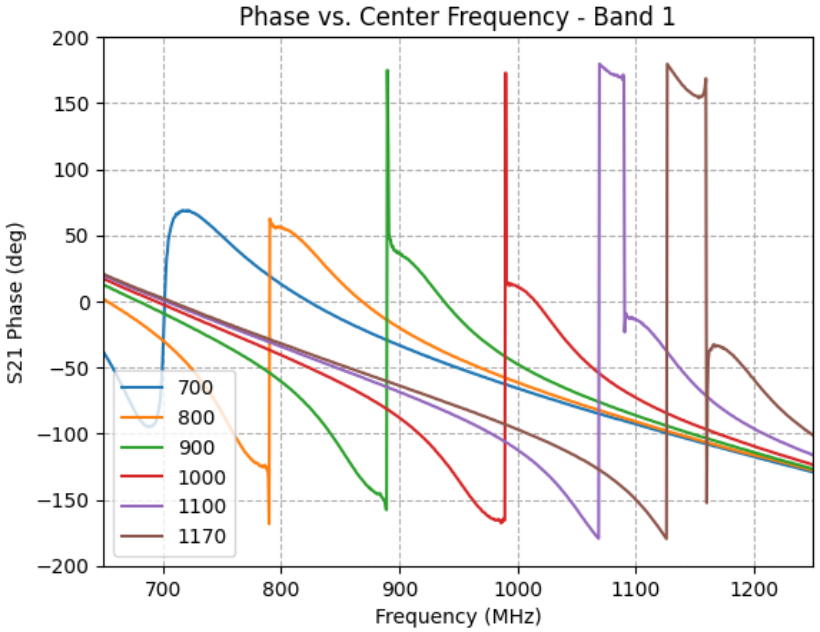


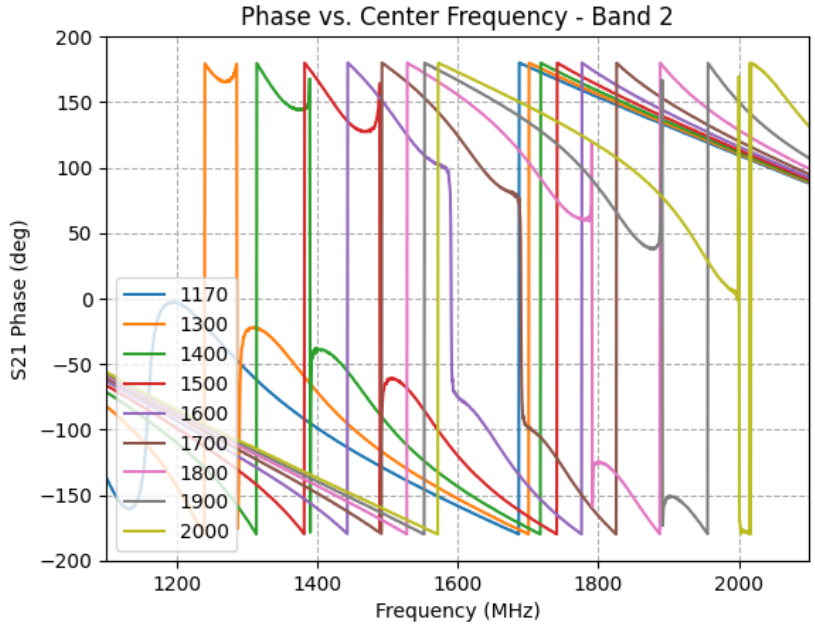

Insertion Loss vs. Center Frequency - Band 2
S21 (dB)
Frequency (MHz)
0
−10
−20
−30
−40
−50
−60
1200
1400
1600
1800
2000
2200
1170
1300
1400
1500
1600
1700
1800
1900
2000

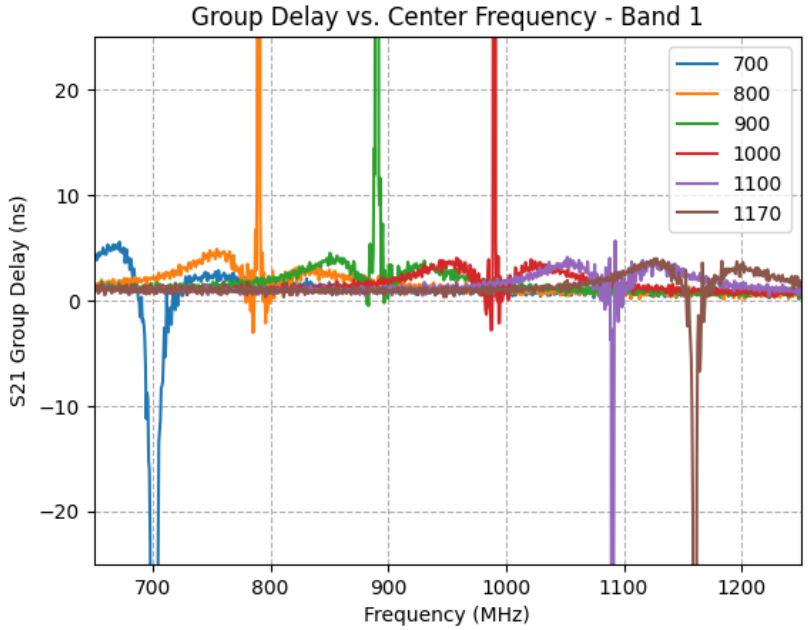

Bypass Line Insertion Loss
S21 (dB)
Frequency (MHz)
bypass, S21
0
−1
−2
−3
−4
−5
800
1000
1200
1400
1600
1800
2000

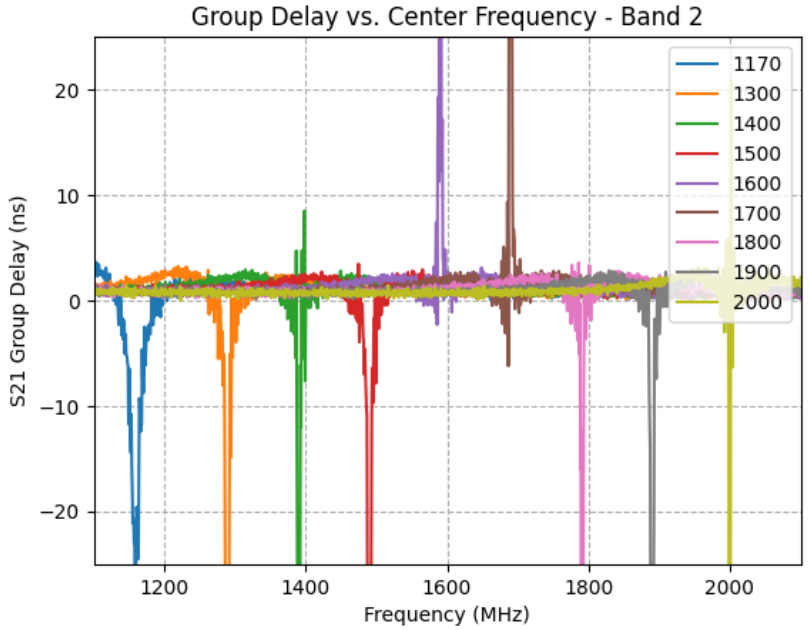

Return Loss vs. Center Frequency - Band 1
S11 (dB)
Frequency (MHz)
0
−5
−10
−15
−20
−25
−30
700
800
900
1000
1100
1200
700
800
900
1000
1100
1170


Return Loss vs. Center Frequency - Band 2
S11 (dB)
Frequency (MHz)
0
−10
−20
−30
−40
−50
1200
1400
1600
1800
2000
1170
1300
1400
1500
1600
1700
1800
1900
2000


Phase vs. Center Frequency - Band 1
S21 Phase (deg)
Frequency (MHz)
700
800
900
1000
1100
1170

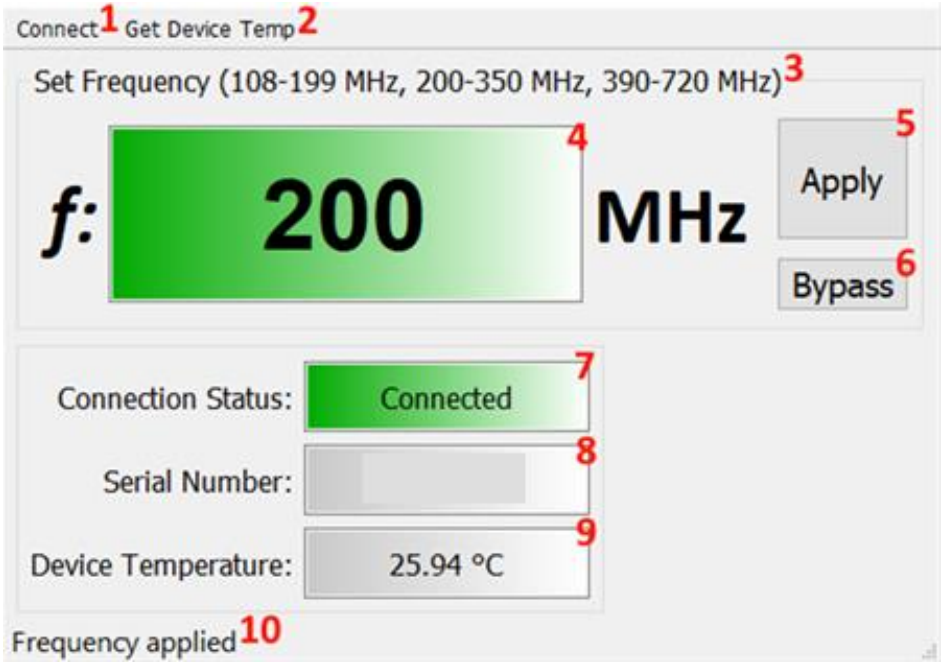

Phase vs. Center Frequency - Band 2
S21 Phase (deg)
Frequency (MHz)
1170
1300
1400
1500
1600
1700
1800
1900
2000


Group Delay vs. Center Frequency - Band 1
S21 Group Delay (ns)
Frequency (MHz)
700
800
900
1000
1100
1170


Group Delay vs. Center Frequency - Band 2
S21 Group Delay (ns)
Frequency (MHz)
1170
1300
1400
1500
1600
1700
1800
1900
2000

Filter Control Software

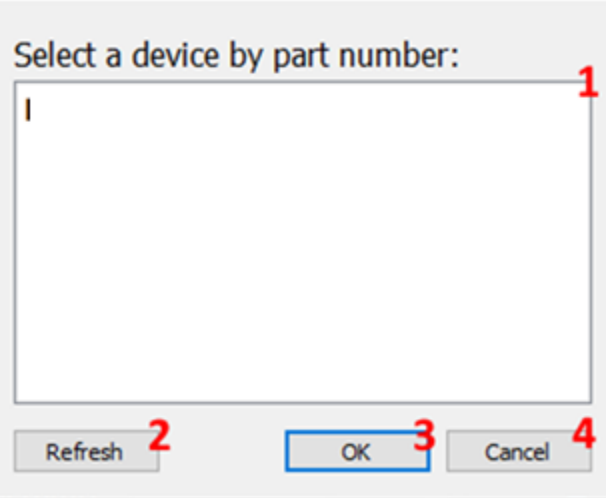
The Tunable Filter unit is provided with control software for ease of testing. To run, connect the filter and the provided USB thumb drive to the same Windows machine. Launch *TunableFilter.exe*. The user interface is detailed below:



Index	Name	Function
1	Connect Button	Opens the connection browser
2	Get Temperature Button	Reads device temperature and updates respective field
3	Frequency Tuning Range(s)	Tuning range of notch. [1]
4	Frequency Input Field	Field to type desired frequency setpoint
5	Apply Frequency Button	Applies frequency typed in Frequency Input Field. [2]
6	Bypass State Enable	Applies Bypass (all-pass) state, if applicable. [3]
7	Connection Status	Shows status of connection to Tunable Notch Filter
8	Connected Device PN	Shows Part Number of connected Tunable Notch Filter
9	Connected Device Temperature	Shows last read Device Temperature. [4]
10	Status Bar	Temporarily shows relevant messages and errors

Notes

Note 1	Some devices have multiple ranges of valid tune states. Values between listed ranges are invalid (e.g., 375 MHz in the example). Bounds of listed ranges are inclusive.
Note 2	Pressing ENTER also applies the value in the Frequency Input Field.
Note 3	Not all devices have a bypass state. The button is unavailable in this case.
Note 4	Device temperature is read on initial connect but will only update when Get Device Temp is pressed.

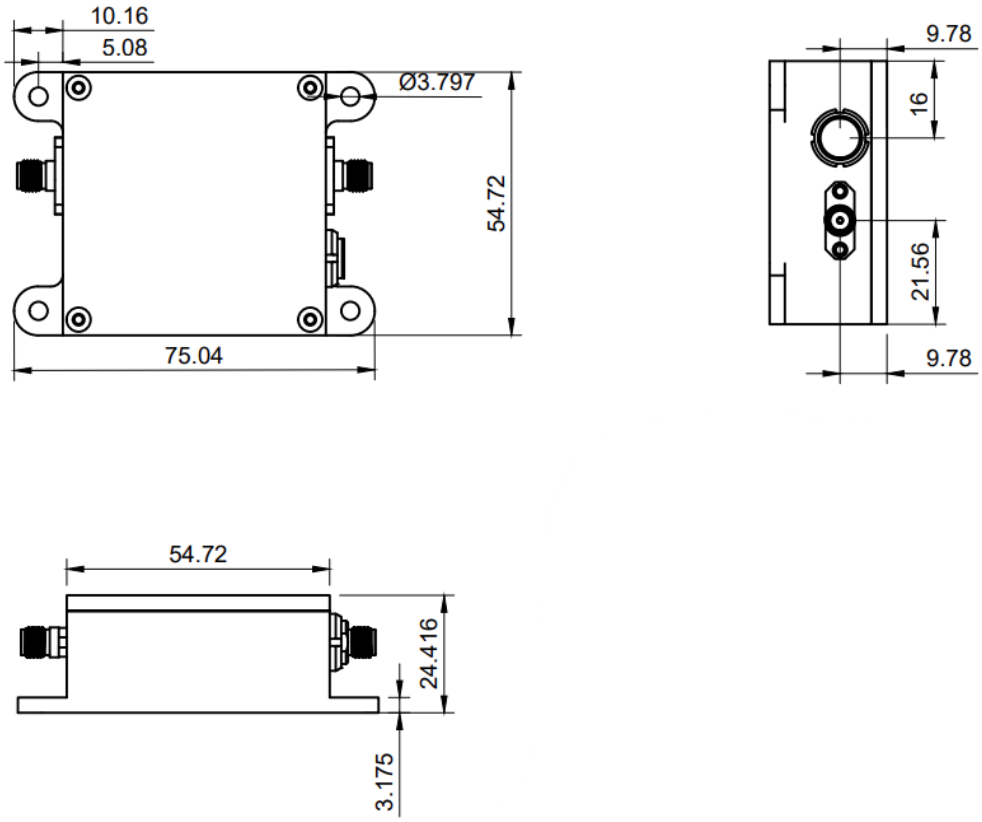


Index	Name	Function
1	Discovered Device List	Shows a list of all discovered Tunable Filters.
2	Refresh List Button	Re-searches for available Tunable Filters and updates list.
3	OK Button	Connects to selected part number. [1]
4	Cancel Button	Cancels connection attempt and closes browser. [2]

Notes

Note 1	Desired Part number must be highlighted in the list when pressed. Double-clicking desired serial number also initiates connection.
Note 2	Equivalent to closing window with X button.

Outline Drawing



All units in mm

Revision History

Date	Rev	Author	Details of Revision
07-22-25	A	AR	Added outline drawing
04-16-25	0	AR	Initial Version