

RAK Outdoor Cavity Band-Pass Filter Datasheet

Overview

Description

The **RAK Outdoor Cavity Band-Pass Filter** is an RF accessory designed to improve LoRaWAN gateway performance in high-interference environments. It passes only the target LoRa frequency band while attenuating out-of-band signals, including LTE, 5G, radar, and industrial noise, by more than 75 dB at the antenna input.

Based on a high-Q resonant cavity design, the filter provides precise band isolation with low insertion loss (2.0 to 3.2 dB, model dependent), preserving LoRa link budget while suppressing interference that would otherwise degrade gateway receiver sensitivity and packet delivery rates.

Features

- **High out-of-band rejection:** >75 dB attenuation to suppress LTE, 5G, radar, and other signals, protecting gateway receiver sensitivity and reducing packet loss in noisy RF environments.
- **Low insertion loss:** 2.0–3.2 dB (model dependent), helping preserve LoRa signal strength and overall link budget performance.
- **Easy integration:** Standard N-Female connectors enable direct integration with compatible LoRaWAN gateways without additional adapters.
- **Rugged enclosure design:** IP67-rated aluminum alloy enclosure suitable for indoor and outdoor gateway deployments.
- **Wide regional support:** Available for EU868, US915, IN865, RU864, AU915, KR920, AS923-1/2/3/4, and CN470 frequency plans.

Typical Applications

- Urban rooftop deployments where dense **LTE/5G** infrastructure creates high ambient RF noise.
- Industrial environments located near machinery, radar systems, or **high-power RF** emitters.
- **Smart city infrastructure** where gateways serve large sensor networks and uptime is critical.
- High-density IoT networks where **maximizing gateway sensitivity** directly impacts coverage range and reliability.

Specifications

Interfaces

The band-pass filter provides the following interfaces:

Name	Description
N-Female Connector (Port 1)	Connects the filter to the LoRa gateway via RF coaxial cable.
N-Female Connector (Port 2)	Connects the filter to the external LoRa antenna.
Ground Pad	Provides connection to earth ground for ESD and surge protection. Strongly recommended.

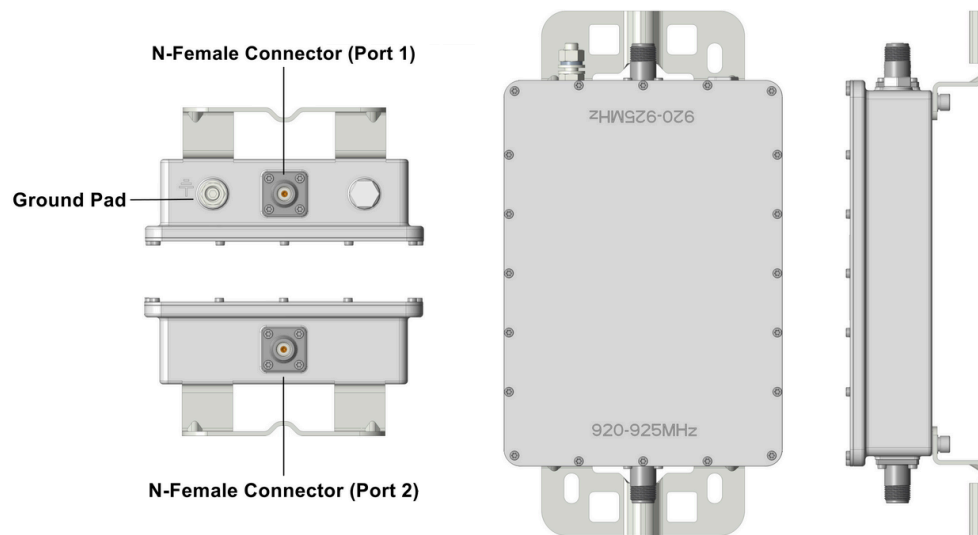


Figure 1: Band-pass filter interfaces

Filter Variants and Specifications

NOTE

Select the appropriate cavity band-pass filter based on your LoRaWAN regional frequency band. Each variant provides optimized out-of-band rejection and low insertion loss for specific regional deployments

Variant	Band (MHz)	Insertion Loss (dB)	Rejection (dB)	Dimensions (mm)	Weight (kg)	LoRaWAN Region
BPF01 	470–510	< 2.5	> 75	280 × 170 × 75	3.6	CN470
BPF03 	863–870	< 2.5	> 75	228 × 164.6 × 51.5	1.5	EU868, RU864
BPF04 	865–867	< 3.2	> 80	250 × 170 × 55	3	IN865
BPF05 	902–928	< 2.0	> 75	270 × 170 × 55	3	US915
BPF06 	915–921	< 2.5	> 75	250 × 170 × 55	3	AS923-3, AS923-4
BPF07 	915–928	< 2.6	> 75	250 × 170 × 55	3	AU915, AS923-1
BPF08 	920–925	< 2.85	> 80	228 × 164.6 × 51.5	1.5	AS923-2, KR920 (Hong Kong, Macao, Taiwan, Singapore, Thailand, etc.)

Detailed specifications for each filter variant are provided in the following sections, including its **LoRaWAN region**, **electrical** and **mechanical** parameters, and a **typical frequency response curve**.

BPF01 (470–510 MHz)

- **LoRaWAN Region:** CN470

BPF01 Electrical Specifications

Parameter	Specification
Pass Band (MHz)	470~510
Insertion Loss (dB)	< 2.5 (470~510 MHz)
Stop Band Attenuation (dB)	> 75 (0~465 MHz) > 75 (515~2000 MHz)
VSWR	< 1.25
Input Power (W)	< 100
Intermodulation Products (dBm)	< -150 (3rd order, with 2 x 37 dBm)
Operating Temperature (° C)	-40 to +65
IP Rating	IP67
Deployment Environment	Outdoor
Connector	N-Female

BPF01 Mechanical Specifications

Parameter	Specification
Filter Dimensions (H x W x D) (mm)	280 x 170 x 75 (without connector, without mounting brackets)
Packing Dimensions (mm)	450 x 325 x 190 (double unit)
Filter Weight (kg)	3.6

BPF01 Typical Frequency Response

Figure 2 shows a typical 470-510 MHz frequency response curve. Actual results may vary with component and environmental factors.

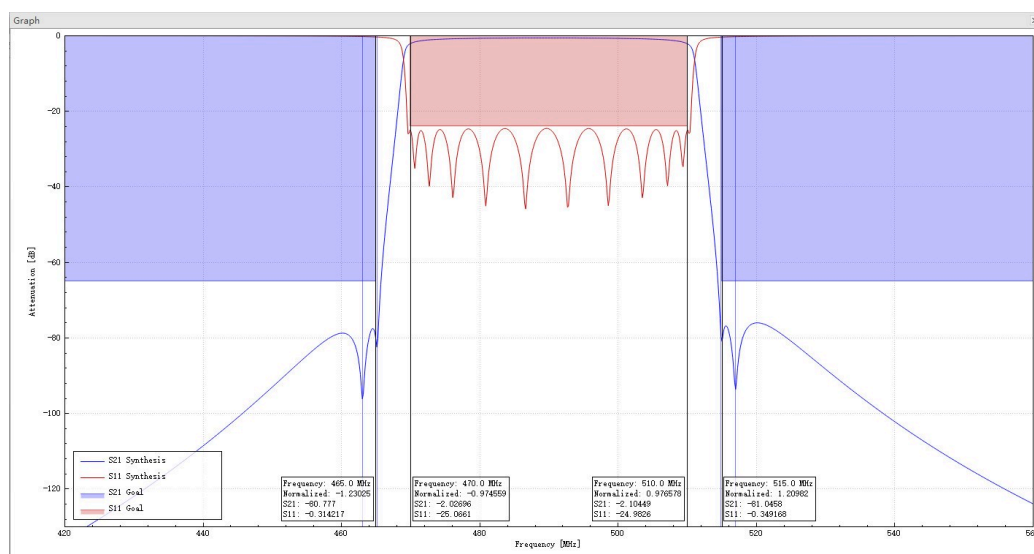


Figure 2: 470-510 MHz Frequency Response

BPF03 (863~870 MHz)

- **LoRaWAN Region:** EU868, RU864

BPF03 Electrical Specifications

Parameter	Specification
Pass Band (MHz)	863~870
Insertion Loss (dB)	< 2.5 (863~870 MHz)
Stop Band Attenuation (dB)	> 70 (0~860 MHz) 70 (873~4000 MHz)
VSWR	< 1.25
Input Power (W)	< 100
Intermodulation Products (dBm)	< -150 (3rd order, with 2 x 37 dBm)
Operating Temperature (° C)	-40 to +65
IP Rating	IP67
Deployment Environment	Outdoor
Connector	N-Female

BPF03 Mechanical Specifications

Parameter	Specification
Filter Dimensions (H x W x D) (mm)	228 x 164.6 x 51.5 (without connector, without mounting brackets)
Packing Dimensions (mm)	450 x 325 x 190 (double unit)
Filter Weight (kg)	1.5

BPF03 Typical Frequency Response

Figure 3 shows a typical 863-870 MHz frequency response curve. Actual results may vary with component and environmental factors.

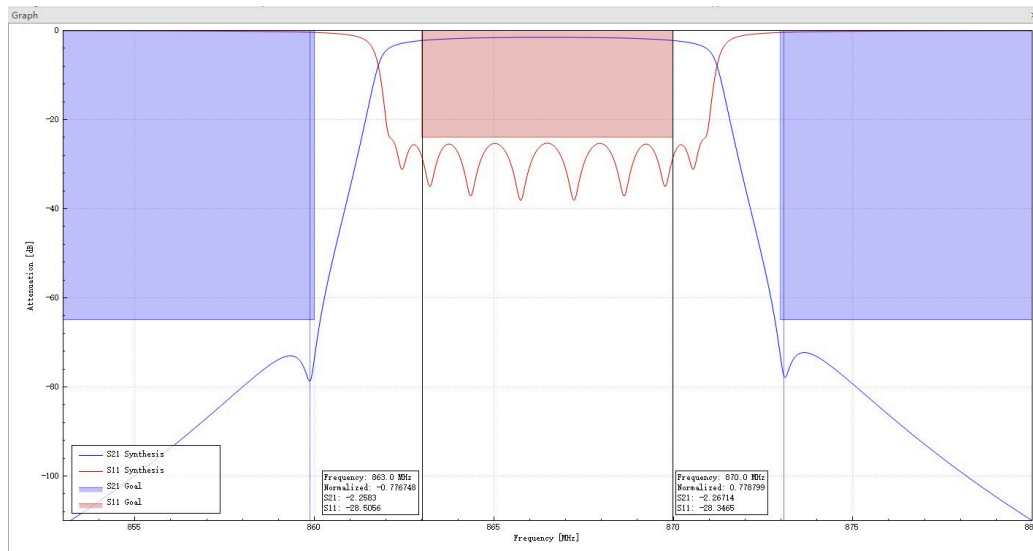


Figure 3: 863-870 MHz Frequency Response

BPF04 (865~867 MHz)

- LoRaWAN Region: IN865

BPF04 Electrical Specifications

Parameter	Specification
Pass Band (MHz)	865~867
Insertion Loss (dB)	< 3.2 (865~867 MHz)
Stop Band Attenuation (dB)	> 80 (0~863 MHz) 80 (870~4000 MHz)
VSWR	< 1.25
Input Power (W)	< 100
Intermodulation Products (dBm)	< -150 (3rd order, with 2 x 37 dBm)
Operating Temperature (° C)	-40 to +65
IP Rating	IP67
Deployment Environment	Outdoor
Connector	N-Female

BPF04 Mechanical Specifications

Parameter	Specification
Filter Dimensions (H x W x D) (mm)	250 x 170 x 55 (without connector, without mounting brackets)
Packing Dimensions (mm)	450 x 325 x 190 (double unit)
Filter Weight (kg)	3

BPF04 Typical Frequency Response

Figure 4 shows a typical 865-867 MHz frequency response curve. Actual results may vary with component and environmental factors.

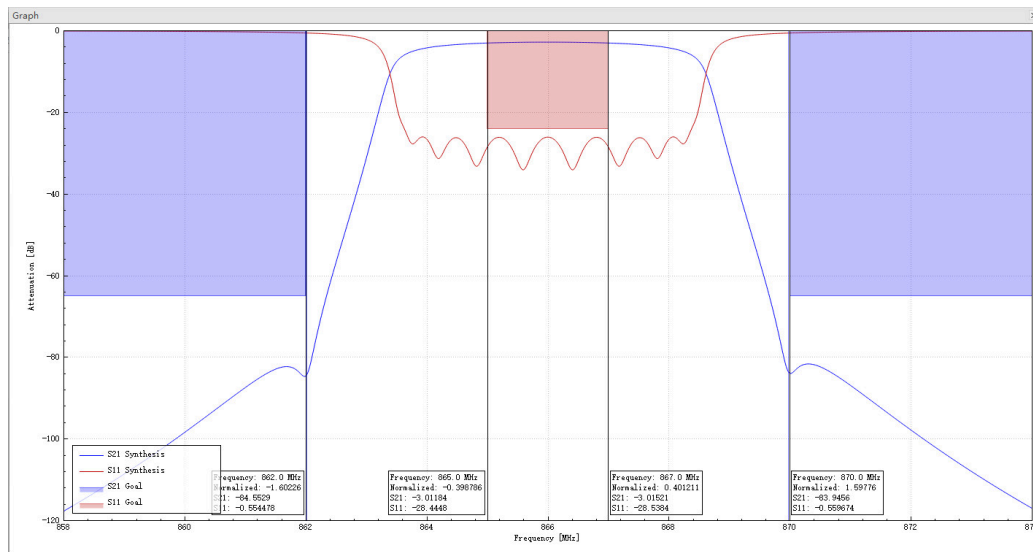


Figure 4: 865-867 MHz Frequency Response

BPF05 (902~928 MHz)

- LoRaWAN Region: US915

BPF05 Electrical Specifications

Parameter	Specification
Pass Band (MHz)	902~928
Insertion Loss (dB)	< 2.0 (902~928 MHz)
Stop Band Attenuation (dB)	> 75 (0~889 MHz) 75 (931~4000 MHz)
VSWR	< 1.25
Input Power (W)	< 100
Intermodulation Products (dBm)	< -150 (3rd order, with 2 x 37 dBm)
Operating Temperature (° C)	-40 to +65
IP Rating	IP67
Deployment Environment	Outdoor
Connector	N-Female

BPF05 Mechanical Specifications

Parameter	Specification
Filter Dimensions (H x W x D) (mm)	270 x 170 x 55 (without connector, without mounting brackets)

Parameter	Specification
Packing Dimensions (mm)	450 x 325 x 190 (double unit)
Filter Weight (kg)	3

BPF05 Typical Frequency Response

Figure 5 shows a typical 902-928 MHz frequency response curve. Actual results may vary with component and environmental factors.

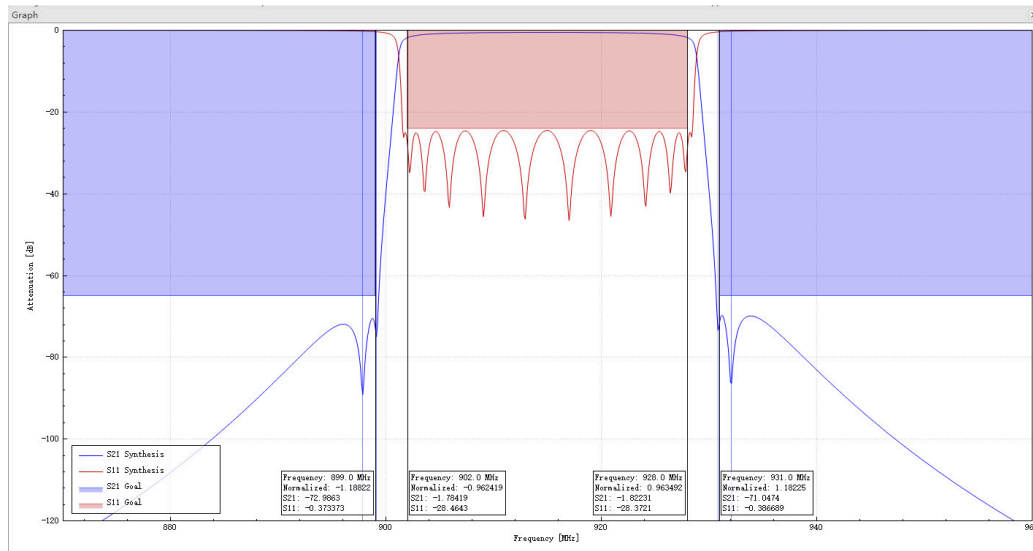


Figure 5: 902-928 MHz Frequency Response

BPF06 (915~921 MHz)

- LoRaWAN Region: AS923-3, AS923-4

BPF06 Electrical Specifications

Parameter	Specification
Pass Band (MHz)	915~921
Insertion Loss (dB)	< 2.5 (915~921 MHz)
Stop Band Attenuation (dB)	> 75 (0~912 MHz) 75 (924~4000 MHz)
VSWR	< 1.25
Input Power (W)	< 100
Intermodulation Products (dBm)	< -150 (3rd order, with 2 x 37 dBm)
Operating Temperature (° C)	-40 to +65
IP Rating	IP67
Deployment Environment	Outdoor
Connector	N-Female

BPF06 Mechanical Specifications

Parameter	Specification
Filter Dimensions (H x W x D) (mm)	250 x 170 x 55 (without connector, without mounting brackets)
Packing Dimensions (mm)	450 x 325 x 190 (double unit)
Filter Weight (kg)	3

BPF06 Typical Frequency Response

Figure 6 shows a typical 915-921 MHz frequency response curve. Actual results may vary with component and environmental factors.

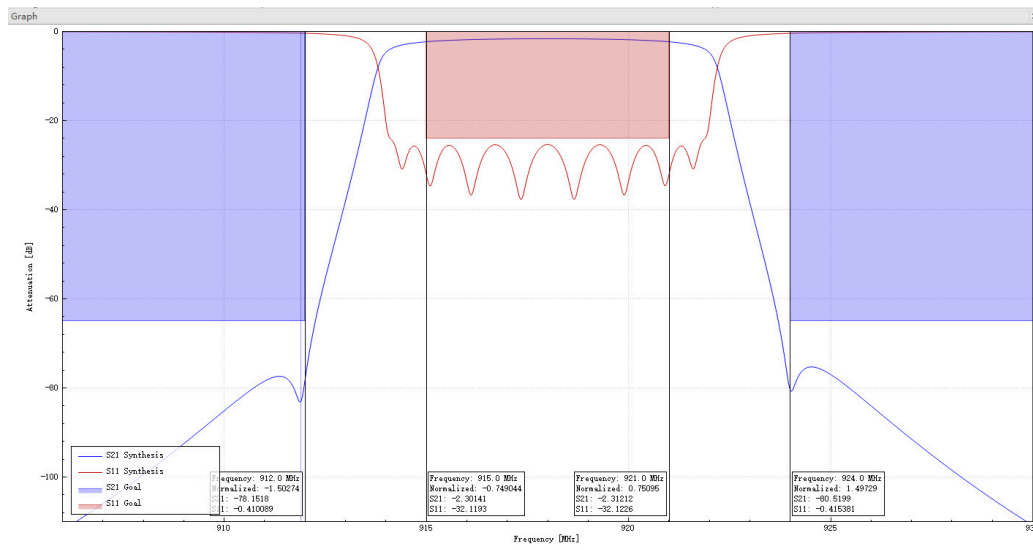


Figure 6: 915-921 MHz Frequency Response

BPF07 (915-928 MHz)

- LoRaWAN Region: AU915, AS923-1

BPF07 Electrical Specifications

Parameter	Specification
Pass Band (MHz)	915~928
Insertion Loss (dB)	< 2.6 (915~928 MHz)
Stop Band Attenuation (dB)	> 75 (0~912 MHz) > 75 (931~4000 MHz)
VSWR	< 1.25
Input Power (W)	< 100
Intermodulation Products (dBm)	< -150 (3rd order, with 2 x 37 dBm)
Operating Temperature (° C)	-40 to +65
IP Rating	IP67

Parameter	Specification
Deployment Environment	Outdoor
Connector	N-Female

BPF07 Mechanical Specifications

Parameter	Specification
Filter Dimensions (H x W x D) (mm)	250 x 170 x 55 (without connector, without mounting brackets)
Packing Dimensions (mm)	450 x 325 x 190 (double unit)
Filter Weight (kg)	3

BPF07 Typical Frequency Response

Figure 7 shows a typical 915-928 MHz frequency response curve. Actual results may vary with component and environmental factors.

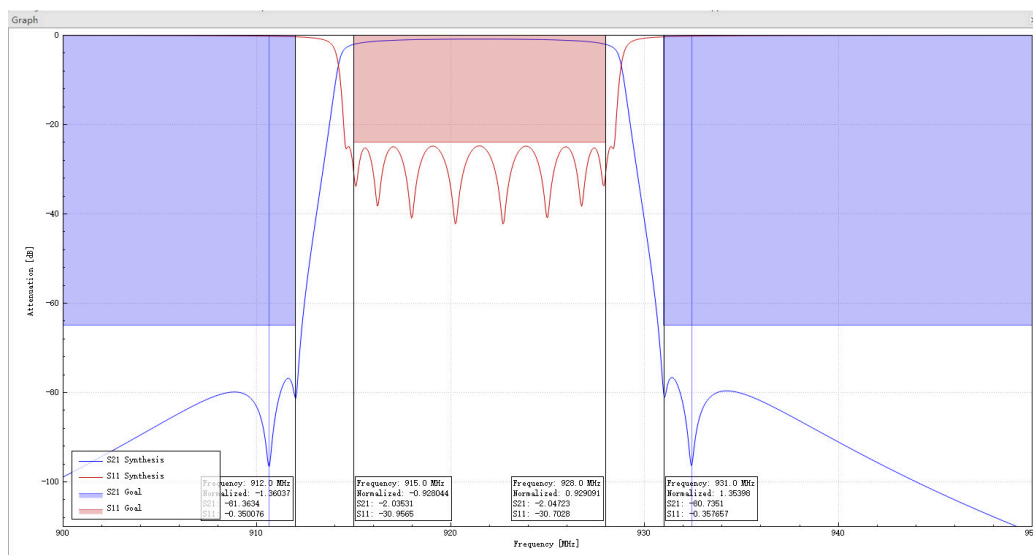


Figure 7: 915-928 MHz Frequency Response

BPF08 (920~925 MHz)

- **LoRaWAN Region:** AS923-2, KR920 (Hong Kong, Macao, Taiwan, Singapore, Thailand, etc.)

BPF08 Electrical Specifications

Parameter	Specification
Pass Band (MHz)	920~925
Insertion Loss (dB)	< 2.85 (920~925 MHz)
Stop Band Attenuation (dB)	> 80 (0~917 MHz) 80 (928~4000 MHz)
VSWR	< 1.25
Input Power (W)	< 100

Parameter	Specification
Intermodulation Products (dBm)	< -150 (3rd order, with 2 x 37 dBm)
Operating Temperature (° C)	-40 to +65
IP Rating	IP67
Deployment Environment	Outdoor
Connector	N-Female

BPF08 Mechanical Specifications

Parameter	Specification
Filter Dimensions (H x W x D) (mm)	228 x 164.6 x 51.5 (without connector, without mounting brackets)
Packing Dimensions (mm)	450 x 325 x 190 (double unit)
Filter Weight (kg)	1.5

BPF08 Typical Frequency Response

Figure 8 shows a typical 920-925 MHz frequency response curve. Actual results may vary with component and environmental factors.

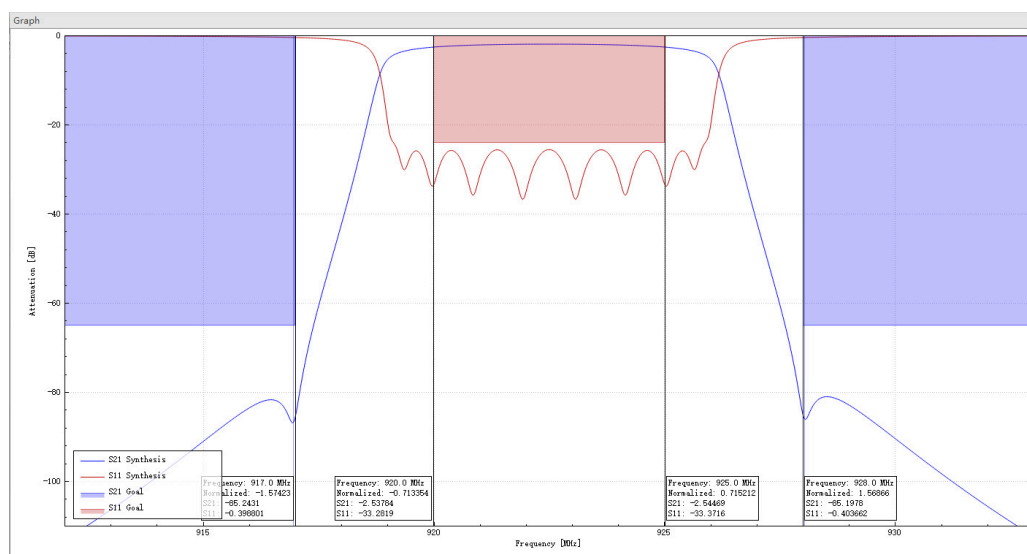


Figure 8: 920-925 MHz Frequency Response