

# Military Solution

2021, RF MORECOM COREA

# Contents

## Divider

1. DUAL 1:4 Combiner/Divider 1:4 Divider
2. 1:9 Combiner/Divider
3. 2way Combiner / Divider (1)
4. 2way Combiner / Divider (2)
5. 1:9 Combiner/Divider

## Band Pass Filter

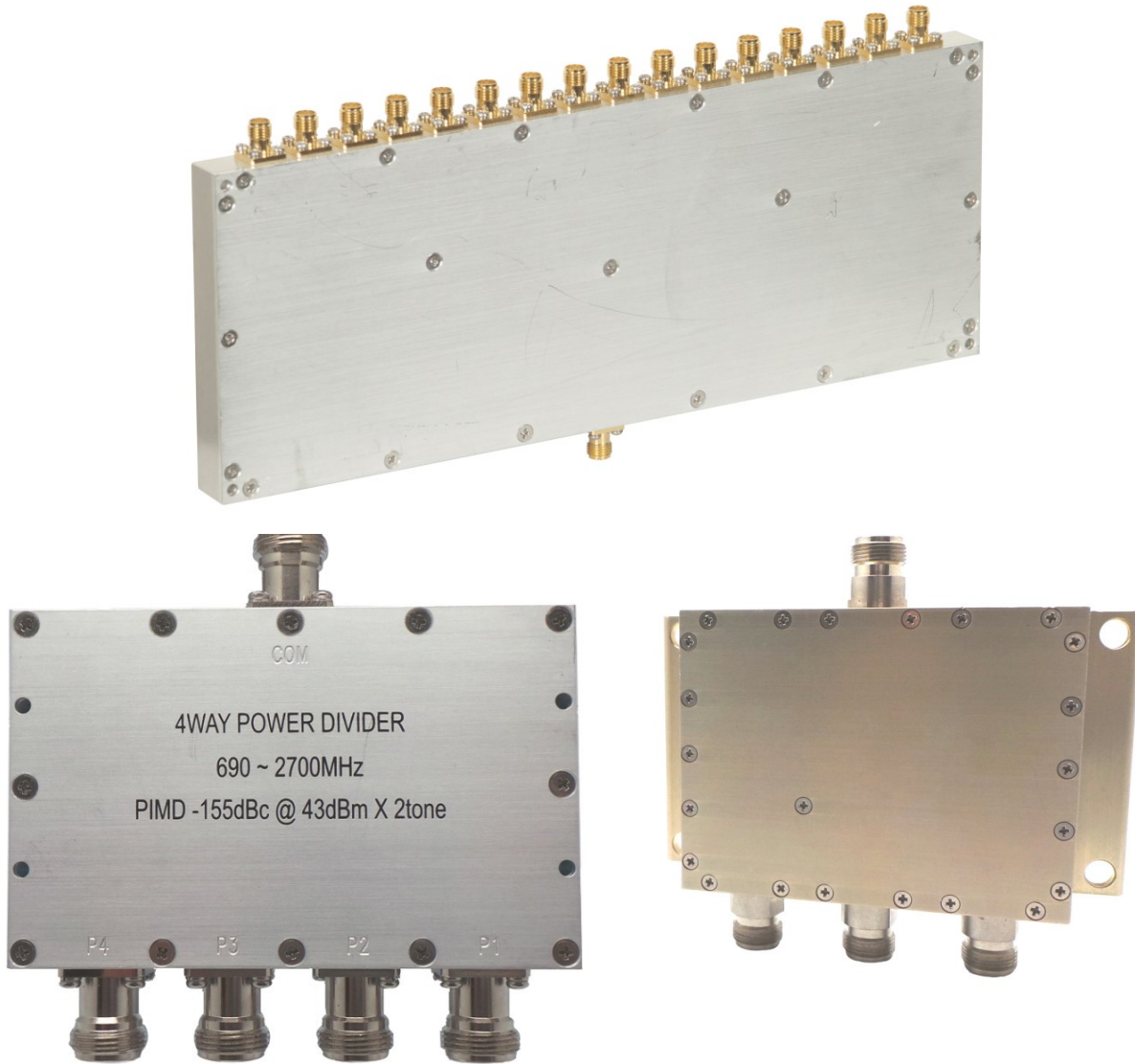
1. KU Band Pass Filter
2. High power airborne Filter
3. BPF for Low Capacity Trunk Radio System
4. Band Reject Filter
5. Diplexer

## Active components

1. Switch Bank Filter Module (1)
2. Switch Bank Filter Module (2)
3. SP4T & 8 Filters Switched Bank
4. Guided Weapon Main Receiver for Seeker
5. Wide Band Continuous Multiplexer
6. Up/Down Converter
7. Power Amplifier (1)
8. Power Amplifier (2)
9. DSP Module

## Cable Assembly

1. Proposal for each Frequency (DC ~50GHz)
2. Electrical data
3. 33GHz Cable Assembly



# Divider

1. DUAL 1:4 Combiner/Divider 1:4 Divider
2. 1:9 Combiner/Divider
3. 2way Combiner / Divider (1)
4. 2way Combiner / Divider (2)
5. 1:9 Combiner/Divider

# 1. DUAL 1:4 Combiner/Divider

## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	3100 to 3500MHz
Insertion Loss	0.8dB max
VSWR	1.4:1 / 1.5:1 max
Isolation	20.0dB min
Amplitude Balance	$\pm 0.3\text{dB}$ max
Phase Balance	$\pm 5^\circ$ max
Input Average Power	200mW
Environmental CONDITIONS	MIL-STD-810F, Methods 501.4 and 502.4

## ✓ Key Features

- Blind mating connection
- MIL-STD-810F



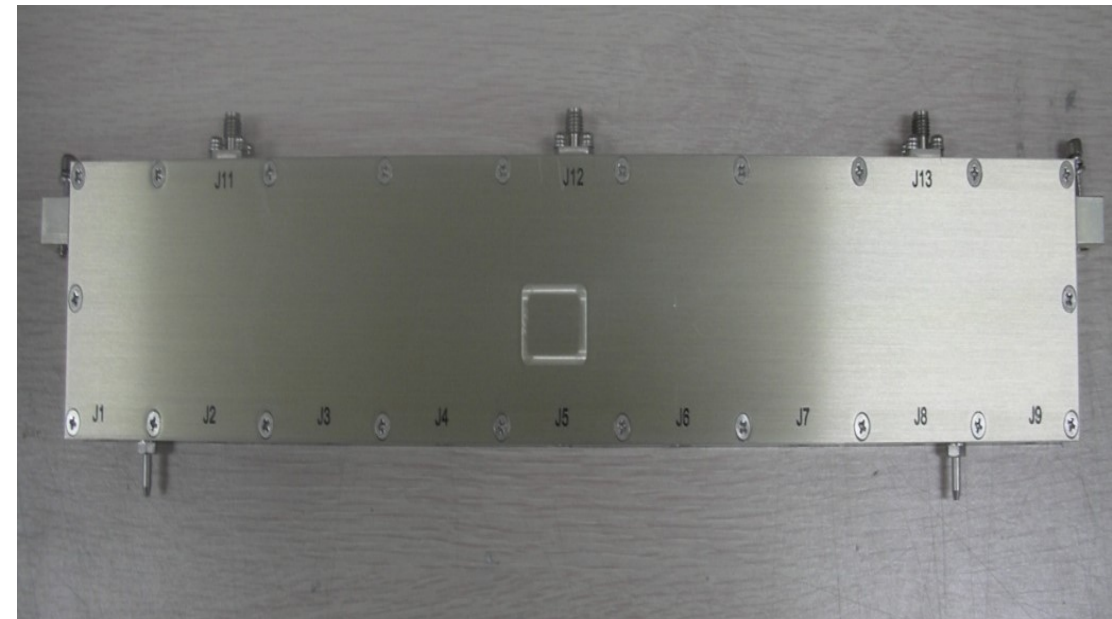
## 2. 1:9 Combiner/Divider

### ✓ Electrical Features

Item	Spec.
Operating Frequency Range	3100 to 3500MHz
Insertion Loss	12.2dB max
VSWR	1.4:1 / 1.5:1 max
Isolation	22.0dB min
Amplitude Balance	±0.5dB max
Phase Balance	±5° max
Input Average Power	1W
Size(mm)	360(w) x 52.2(d) x 14.5(h) mm
Environmental CONDITIONS	MIL-STD-810F, Methods 501.4 and 502.4,

### ✓ Key Features

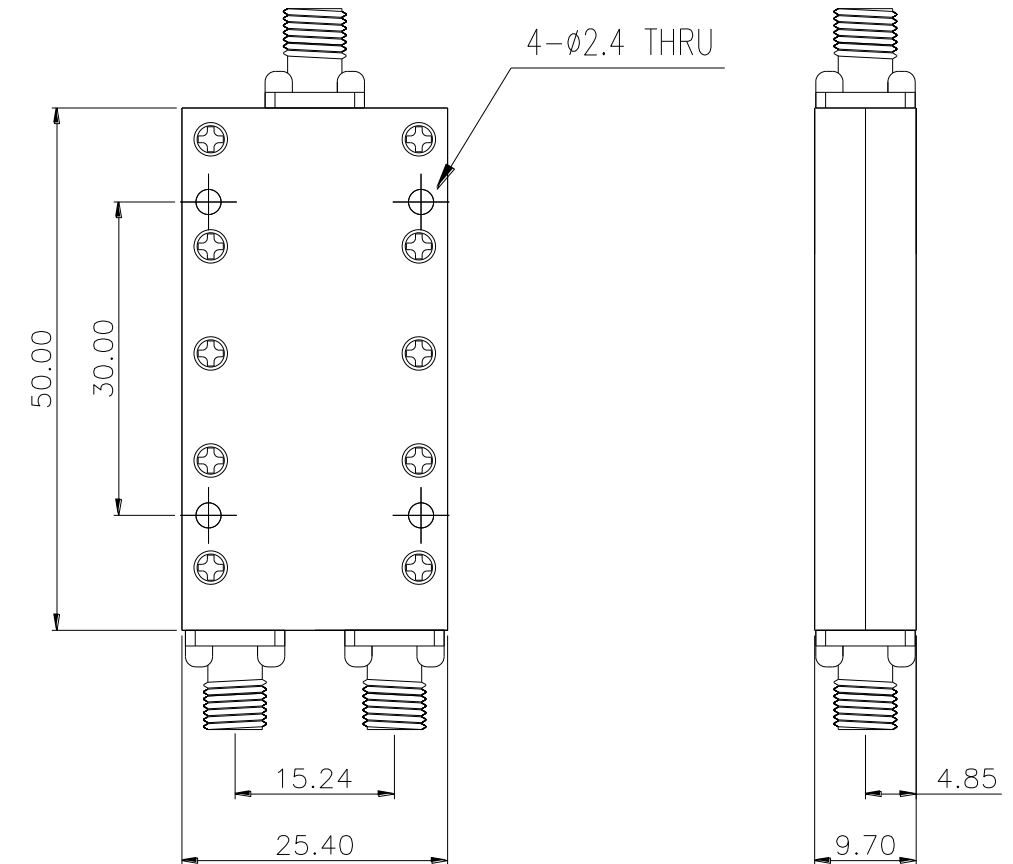
- 3 Combiner in One-body
- MIL-STD-810F



# 3. 2way Combiner / Divider (1)

## ✓ Electrical Features

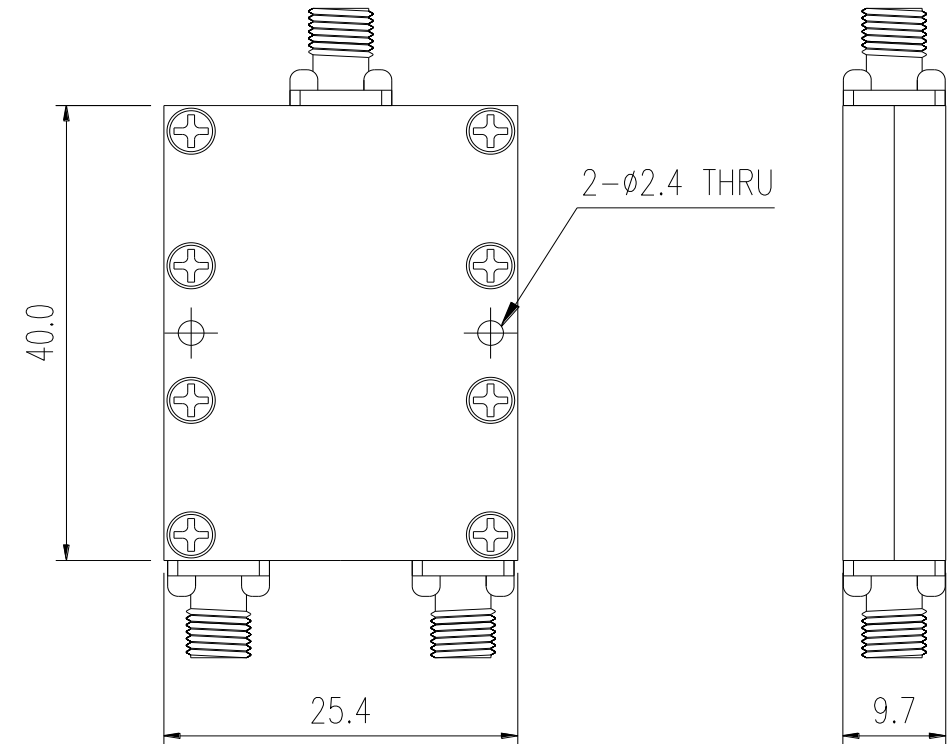
Item	Spec.
Frequency Range	1 ~ 6 GHz
Insertion Loss	0.8 dB max.
Return Loss	17 dB min.
Isolation	18.0dB min
Input Average Power	0.1W
Size(mm)	40.0 x 25.4 x 9.7 mm
Connectors	SMA - Female
Operating temp.	-30°C~+60°C

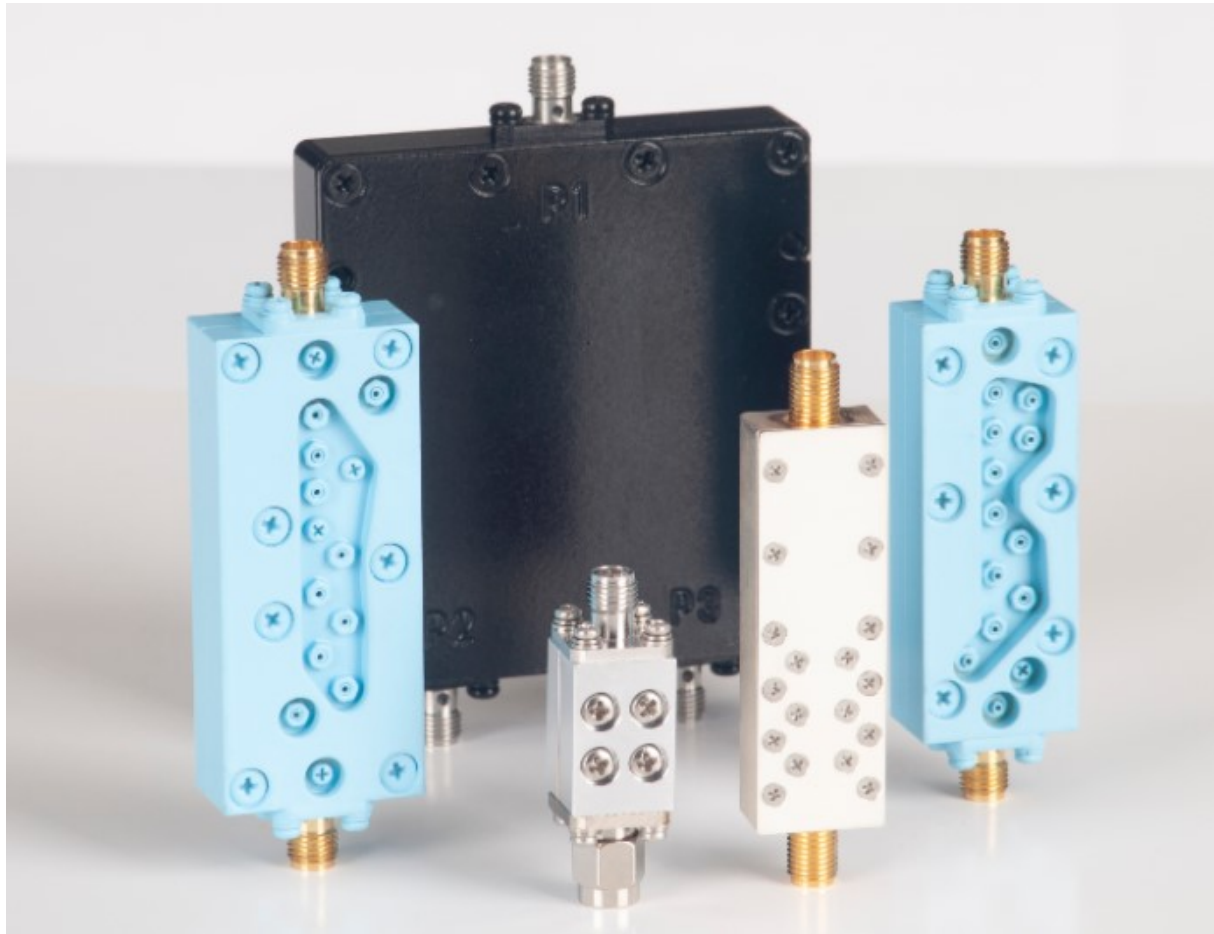


# 4. 2way Divider / Combiner (2)

## ✓ Electrical Features

Item	Spec.
Frequency Range	2 ~ 18 GHz
Insertion Loss	1.2dB max.
Return Loss	14 dB min.
Isolation	16.0dB min
Input Average Power	1W
Size(mm)	40.0 x 25.4 x 9.7 mm
Connetors	SMA - Female
Operating temp.	-20°C~+70°C
Environmental CONDITIONS	MIL-STD-202F





# Band Pass Filter

1. KU Band Pass Filter
2. High power airborne Filter
3. BPF for Low Capacity Trunk Radio System
4. Band Reject Filter



# 1. KU Band Pass Filter

## ✓ Electrical Features

Item	Spec.
Center frequency	14.5GHz
Bandwidth	500MHz
Insertion Loss	1.0 dB Max
VSWR	1.2:1
Rejection	18.0dB min
Pass Band Ripple	±0.5dB max
Input Average Power	10W
Size(mm)	40(w) x 20(d) x 14(h) mm
Operating Temperature	-35°C~+75°C

## ✓ Description

2 stage 6-pole band pass filter(BPF) is designed and implemented by using triple-mode cavity for Receiver seeker module payload system. The BPF has a 500MHz bandwidth at the center frequency of 14.5GHz(Ku-band) and the response of the filter is the Chebyshev function. The cavity filter uses two orthogonal modes and one mode.



## 2. High power airborne Filter

### ✓ Electrical Features

Item	Spec.
Frequency	2300 ~ 2500 MHz
Insertion Loss	1.0 dB max
Return Loss	18 dB min.
Rejection	70 dBc @ DC ~ 2100 MHz 25 dBc @ 2250 , 2550 MHz 70 dBc @ 2700 ~ 8500 MHz
Isolation between filters	70 dB min.
Power Handling	70 W (D/C 80%)
Size(mm)	80 x 34.5 x 25 mm
Connectors	SMA - Female
Weight	100 g
Operating Temperature	-30°C~+80°C

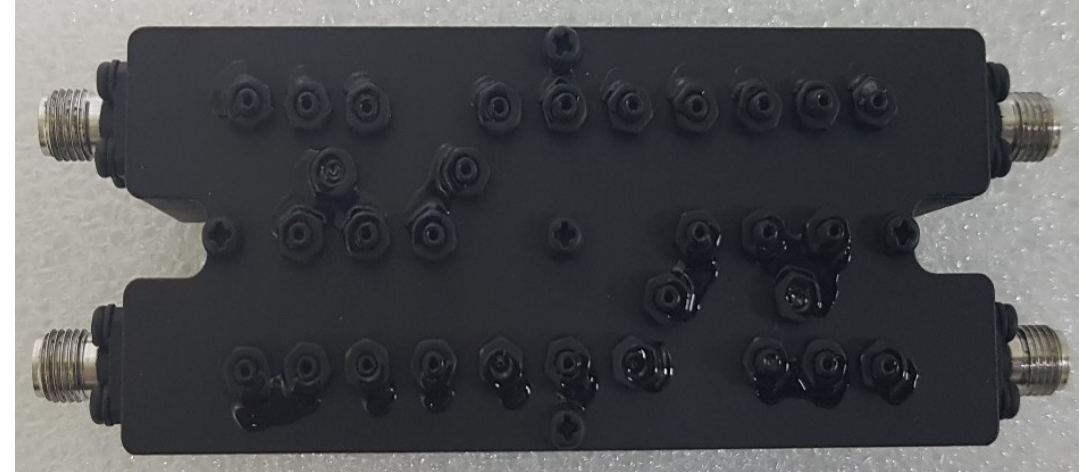
### ✓ Description

High Performance

High Reliability

2 Filters in one-body

Minimum weight design



# 3. BPF for Low Capacity Trunk Radio System

## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	2175.2 ~ 2236.4 MHz
Insertion Loss	1.0 dB Max
VSWR	1.3:1
Rejection	22.0dB min
Pass Band Ripple	±0.5dB max
Rejection	52.7dBc @ 2250 MHz 80dBc @ 2058.8 MHz
Input Average Power	10W
Size(mm)	123(w) x 66(d) x 66(h) mm
Operating Temperature	-32°C~+70°C

## ✓ Description

The LCTRS BPF is very useful for MLR system.

\* TICN: Tactical Information Communication Network and this is Cavity Method.



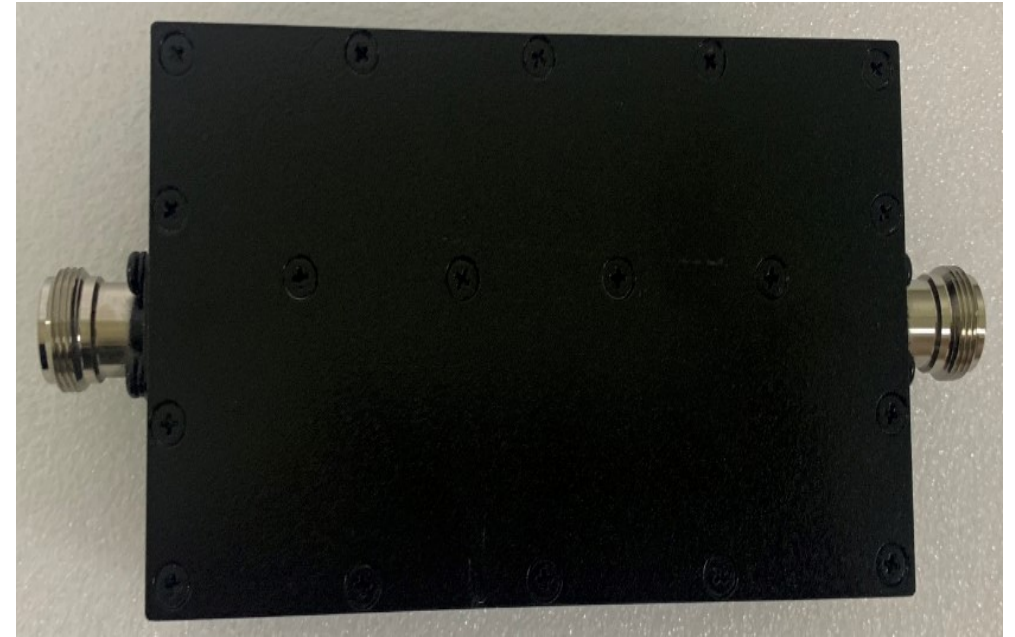
# 4. Band Reject Filter

## ✓ Electrical Features

Item	Spec.
Center frequency	14.5GHz
Bandwidth	500MHz
Insertion Loss	1.0 dB Max
VSWR	1.2:1
Rejection	18.0dB min
Pass Band Ripple	±0.5dB max
Input Average Power	10W
Size(mm)	40(w) x 20(d) x 14(h) mm
Operating Temperature	-35°C~+75°C

## ✓ Description

This filter is high attenuation for Reject band.



# 5. Diplexer

## ✓ Electrical Features

Item	Spec.	
Frequency Range	RX : 253 ~ 268 MHz	TX : 300 ~ 310 MHz
Insertion Loss	1.2 dB max.	
Return Loss	18 dB min.	
Attenuation	22.0dB min	
Pass Band Ripple	50 dB @ 30 ~240 MHz 55 dB @ 300 ~ 310 MHz	50 dB @ 30 ~285 MHz 55 dB @ 253 ~ 268 MHz
Port to Port Isolation	80 dB @ Each band	
Power Handling	50 dBm (testing condition : 60,000 feet)	
Size(mm)	134 x 116 x 71 mm	
Operating Temperature	-32°C~+70°C	

## ✓ Description

This Band Rejection Filter allow high attenuation for reject band with high performance and reliability.



# Active components

1. Switch Bank Filter Module (1)
2. Switch Bank Filter Module (2)
3. SP4T & 8 Filters Switched Bank
4. Guided Weapon Main Receiver for Seeker
5. Wide Band Continuous Multiplexer
6. Up/Down Converter
7. Power Amplifier (1)
8. Power Amplifier (2)
9. DSP Module



# 1. Switch Bank Filter Module (1)

## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	20MHz~3.0GHz / 11Channels
Noise Figure	< 5dB
Gain	$14 \pm 1$ dB
Noise figure	$7 \pm 1$ dB
IIP2	CH 4~11 +55dBm CH 1~3 +65dBm
Switching Time	< 100 $\mu$ sec
Size(mm)	135(w) x70(d) x 13.5(h)mm
Environmental CONDITIONS	MIL-STD-810F, Methods 501.4 and 502.4,

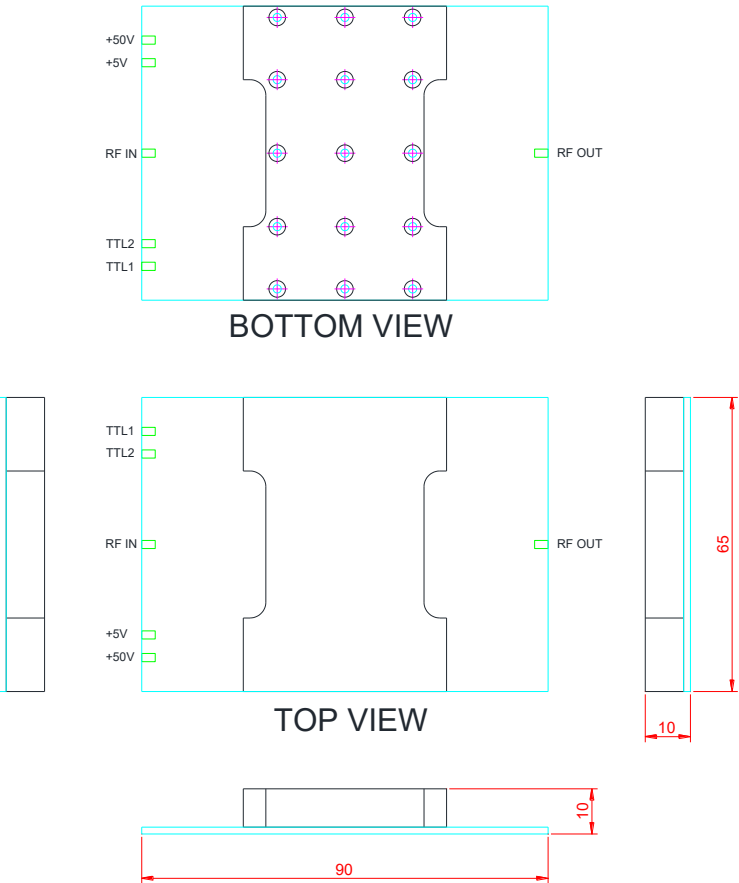




# 2. Switch Bank Filter Module (2)

✓ Electrical Features

Item	Spec.
Operating Frequency Range	30 ~ 406MHz / CH 1~4
Insertion Loss	1.7dB Typ.
Power Handling	40W max. (per channel)
Attenuation	60dBc @ per channel
Switching Time	8uSec
Isolation (between ports)	80dB min.
Return Loss (all ports)	14dB min
Size(mm)	90.0 x 65.0 x 10.0 mm
Operating temp.	-40°C ~ +85°C
Environmental CONDITIONS	MIL-STD-202F





# 3. SP4T & 8 Filters Switched Bank

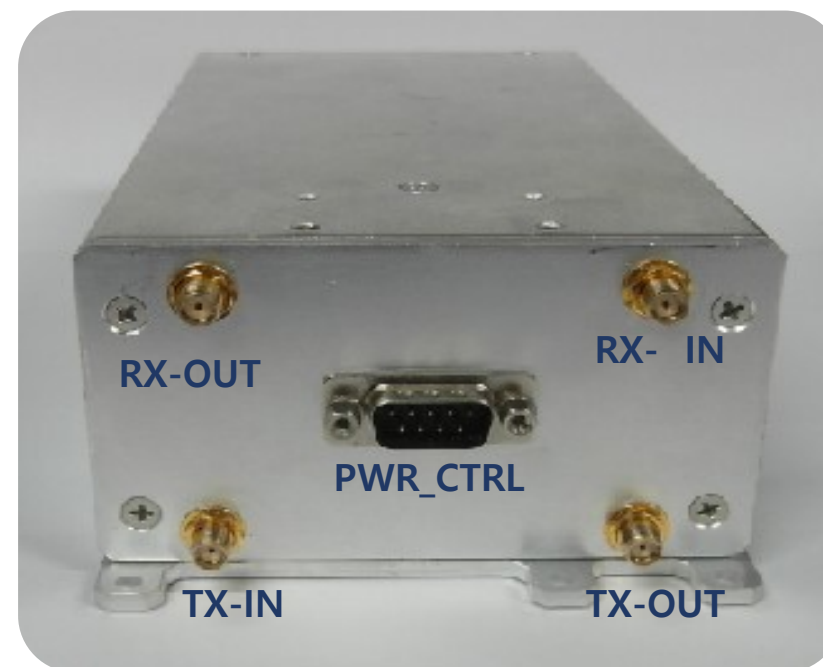
## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	4400 ~ 5000MHz / Band 1~4
Insertion Loss (Tx/Rx)	< 3.1dB
Input Power	16W (C.W) min
Switching Time	2uSec
Isolation (between ports)	80dB min.
Return Loss (all ports)	15dB min
Size(mm)	190(w) x100(d) x 60(h)mm
Environmental CONDITIONS	MIL-STD-810E MIL-STD-461E

## ✓ Description

The filter bank includes independent transmit channel (Tx path) and received channel (Rx path) with 4 filters for each path.

Because the transmit channel and received topologic channel are the same (switches and filters) it is possible to offer them separately (two units 4 filters each) if it cost lower than one unit.



# 4. Guided Weapon Main Receiver for Seeker

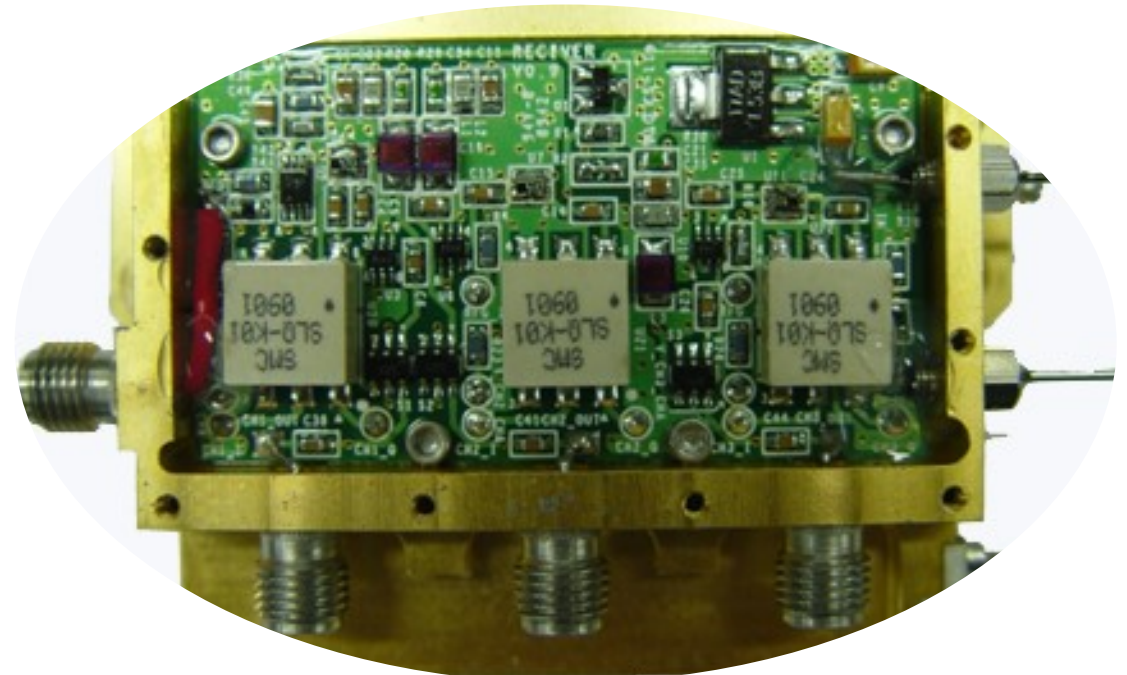
## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	30 ~ 406MHz / CH 1~4
Insertion Loss	1.7dB Typ.
Power Handling	40W max. (per channel)
Attenuation	60dBc @ per channel
Switching Time	8uSec
Isolation (between ports)	80dB min.
Return Loss (all ports)	14dB min
Size(mm)	90.0 x 65.0 x 10.0 mm
Operating temp.	-40°C ~ +85°C
Environmental CONDITIONS	MIL-STD-202F

## ✓ Description

This module has very high speed switching time and switch isolation, low power consumption.

It is for using KU Band for the application(Guided weapon defense missile).



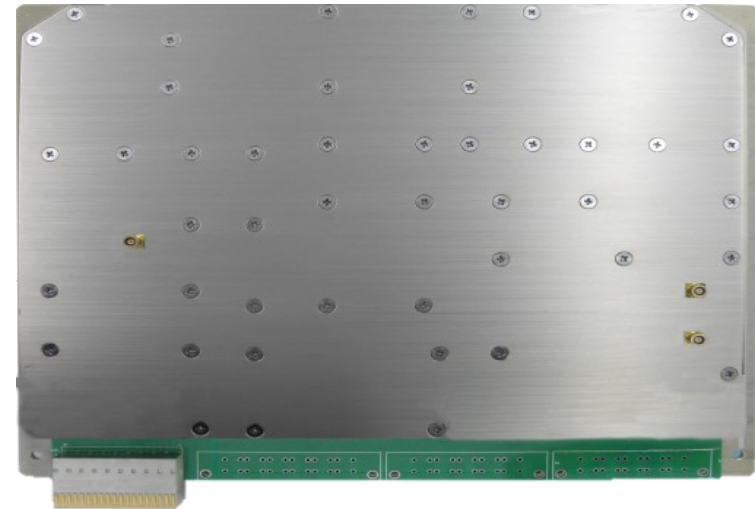
# 5. Wide Band Continuous Multiplexer

## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	20~3,000MHz
Harmonic Rejection	70dBc
3rd Order Intercept Point	40dB
Gain & Flatness	10dB $\pm$ 2dB
Noise Figure	< 5dB
Size(mm)	150(w) x 200(d) x 24(h)mm
Operating Temperature	-30°C~+65°C

## ✓ Description

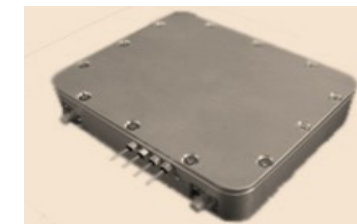
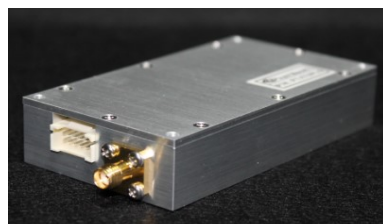
For wideband receiver application such as EW, ISR, this product support 20~3000MHz multi-channel,. The spectrum is divided into N-channel filters before and after amplification stage. This multiplexer has high performance for harmonic rejection, low loss and good wide band gain flatness.



# 6. Up/Down Converter

## ✓ Description

This C/X/Ku-Band Medium power UDCs are designed for use primarily in VSAT applications. Other frequency ranges are also available to customer specification. These series UDC is uniquely designed to be a high quality but cost effective solution for the VSAT market.



## **\*Applications**

- Airplane Internet
- Portable VSAT
- Mobile VSAT

## ✓ Electrical Features

ITEM	Specification		
	C Band	X Band	Ku Band
RF Frequency Range	5.850 ~ 6.650 GHz	7.900 ~ 8.400 GHz	13.75 ~ 14.50 GHz
IF Frequency Range	950 ~ 1450 MHz	950 ~ 1450 MHz	950 ~ 1950 MHz
LO Frequency	4.50 GHz	6.95 GHz	12.80 GHz
P 1dB min	10dBm min	10dBm min	10dBm min
Gain nom.	15 dB min	15 dB min	15 dB min

# 7. Power Amplifier (1)

## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	4 GHz to 6.1 GHz
RF Output	20 watts P3dB
2nd Harmonic	-13 dBc
Output Power Flatness	1 dB
Small Signal Gain	43 dB
VSWR	2.0:1 maximum
Noise Power Density	-100 dBc into a 100 MHz bandwidth
Dimensions	52 x 80 x 20mm
Prime Power	20-32 VDC
Operating Temperature	-40°C~+85°C

## ✓ Description

C-band Solid State Power Amplifier is a high performance solid state power amplifier delivering 20 watts over the frequency band of 4 GHz to 6.1 GHz.



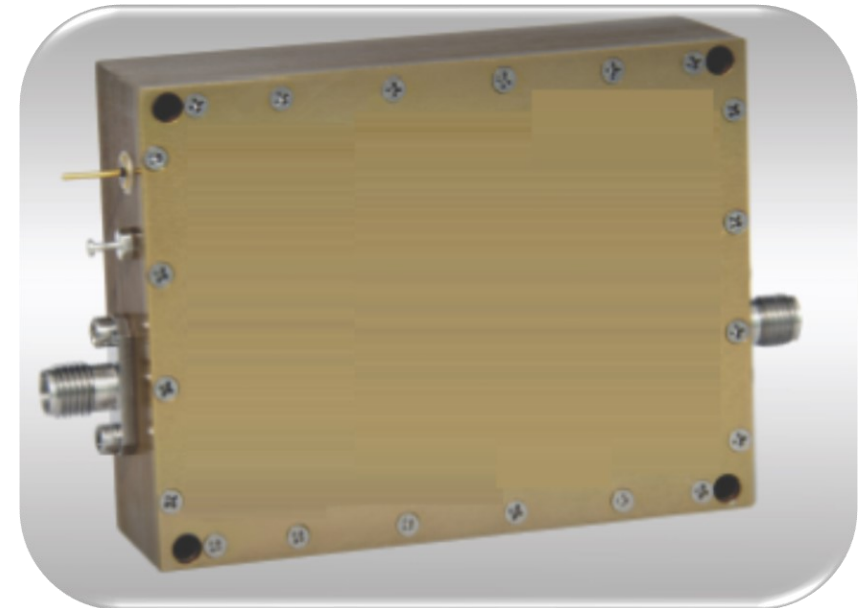
# 8. Power Amplifier (2)

## ✓ Electrical Features

Item	Spec.
Operating Frequency Range	13-16GHz
Peak RF Output	5 W saturated
Pulse Width	1 to 100 usec(typical)
Output Power Flatness	1 dB
Small Signal Gain	35 dB
VSWR	1.5:1 maximum
Noise Figure	10 dB
Dimensions	70 x 54 x 20mm
Prime Power	10 VDC @ 2.5 Amps
Operating Temperature	-30°C~+65°C

## ✓ Description

KU-band is the new generation of power amplifiers. It can support high power out put up to 10 Watts and has high gain 30dB Min(VSWR 2.5:1). The compact rugged design enables these amplifiers to efficiently dissipate the heat with proper heat sink to assure the reliability of the product.



# 9. DSP Module

## ✓ Description

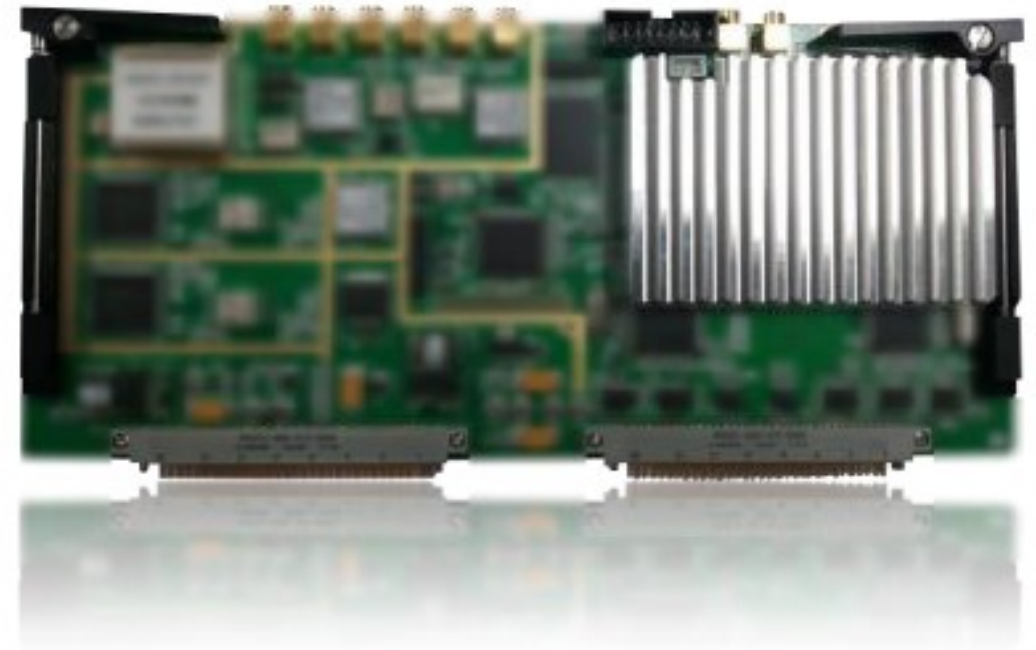
Digital Signal Processing is one method for RF signal handling in digital domain.

It processes converted IF of RF signal by analog to digital or digital to analog chips and enhances system capability by processing very complicate RF domain in simple digital domain.

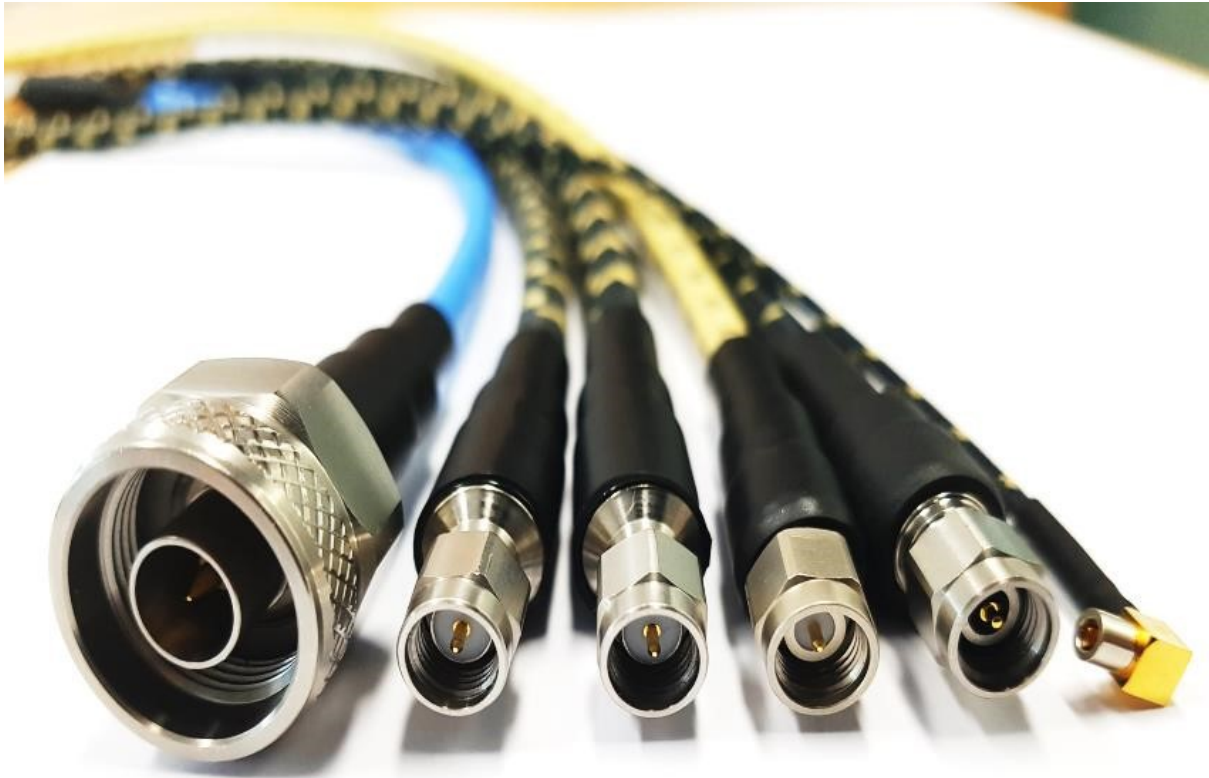
It needs design capability of DSP & FPGA chips and very deep understanding of wireless communication theory for adaptable algorithm design.

## ✓ Key Features

- Application for Anti-Jam GPS
- L1&L2 Processing
- 5 GPS Input
- IF 5MHz, ADC 11 ch

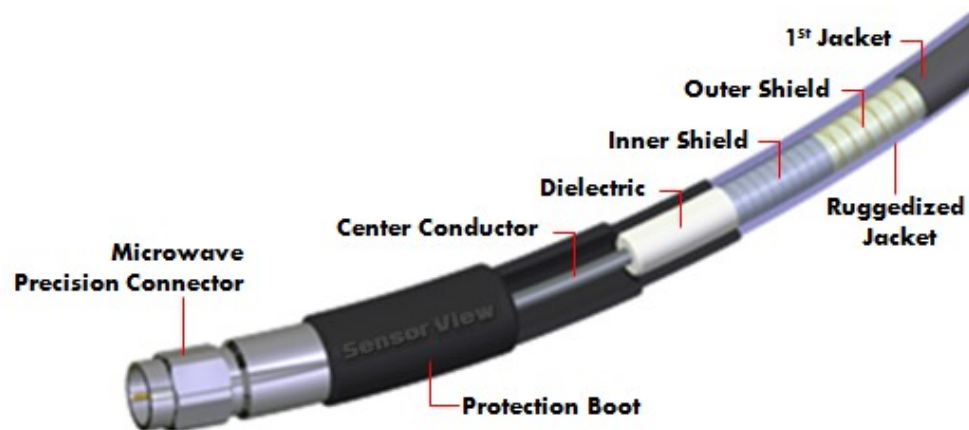






# Cable Assembly




1. Proposal for each Frequency (DC ~50GHz)
2. Electrical data
3. 33GHz Cable Assembly





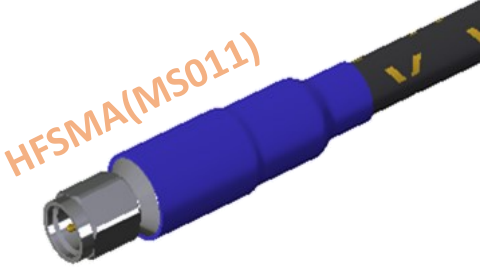

# 1. Proposal for each Frequency (DC ~50GHz)

## ✓ Standard Connector

Frequency	DC ~ 18 GHz	DC ~ 26.5 GHz	DC ~ 26.5 GHz
Image	 A 3D rendering of an N-type connector with a silver-colored threaded body and a black outer jacket. The text "N(MS011)" is written in orange above the connector.	 A 3D rendering of an SMA connector with a silver-colored body and a black outer jacket with yellow diagonal stripes. The text "N(MS011)" is written in red above the connector.	 A 3D rendering of a 3.5mm connector with a silver-colored body and a black outer jacket with yellow diagonal stripes. The text "3P5(MS011)" is written in red above the connector.
Connector Type	N	SMA	3.5mm
VSWR	1.22 : 1	1.25 : 1	1.25 : 1
Insertion Loss[dB]	- 0.10 @ 18GHz	- 0.10 @ 26.5GHz	- 0.10 @ 26.5GHz

# 1. Proposal for each Frequency (DC ~50GHz)

## ✓ Standard Connector

Frequency	DC ~ 33 GHz	DC ~ 40 GHz	DC ~ 50 GHz
Image			
Connector Type	HFSMA®	2.92mm	2.4mm
VSWR	1.25 : 1	1.25 : 1	1.30 : 1
Insertion Loss[dB]	- 0.15 @ 33GHz	- 0.25 @ 40GHz	- 0.30 @ 50GHz

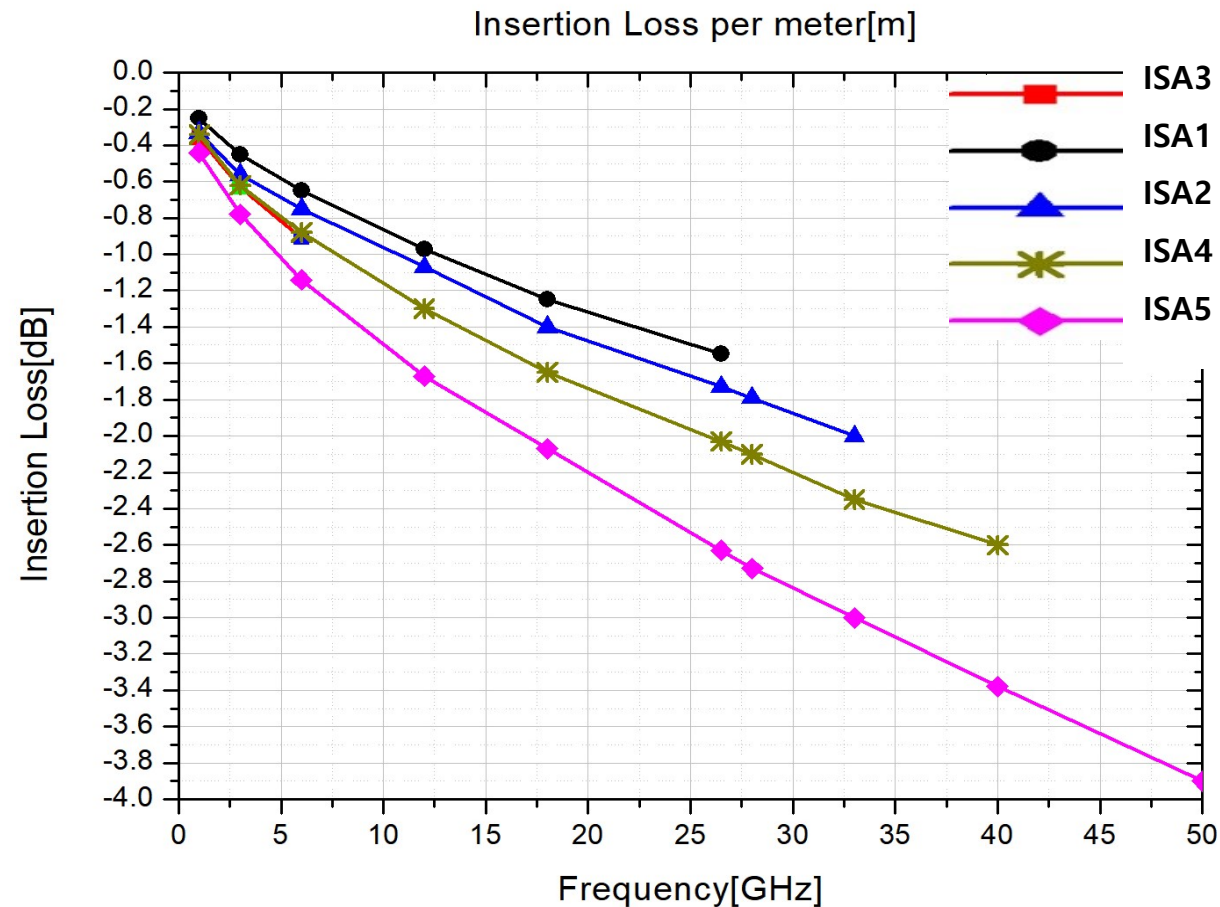
## 2. Electrical data

✓ Table for cable's Insertion Loss value

		Raw cable Insertion Loss [ 25°C, room temp]									
Cable	GHz	1	3	6	12	18	26.5	28	33	40	50
ISA3	[dB / m]	-0.355	-0.629	-0.911							
	[dB / ft]	-0.108	-0.192	-0.278							
ISA1	[dB / m]	-0.250	-0.449	-0.657	-0.973	-1.253	-1.552				
	[dB / ft]	-0.076	-0.137	-0.198	-0.296	-0.381	-0.473				
ISA2	[dB / m]	-0.334	-0.562	-0.753	-1.072	-1.404	-1.732	-1.793	-2.005		
	[dB / ft]	-0.101	-0.171	-0.229	-0.326	-0.427	-0.527	-0.546	-0.610		
ISA4	[dB / m]	-0.344	-0.624	-0.881	-1.300	-1.652	-2.032	-2.104	-2.351	-2.603	
	[dB / ft]	-0.104	-0.189	-0.268	-0.396	-0.503	-0.619	-0.640	-0.716	-0.793	
ISA5	[dB / m]	-0.442	-0.783	-1.141	-1.671	-2.073	-2.632	-2.734	-3.001	-3.382	-3.904
	[dB / ft]	-0.134	-0.237	-0.347	-0.509	-0.631	-0.802	-0.832	-0.915	-1.031	-1.189

## 2. Electrical data

- ✓ Insertion Loss graph for each cable



## 2. Electrical data

### ✓ Relative matching

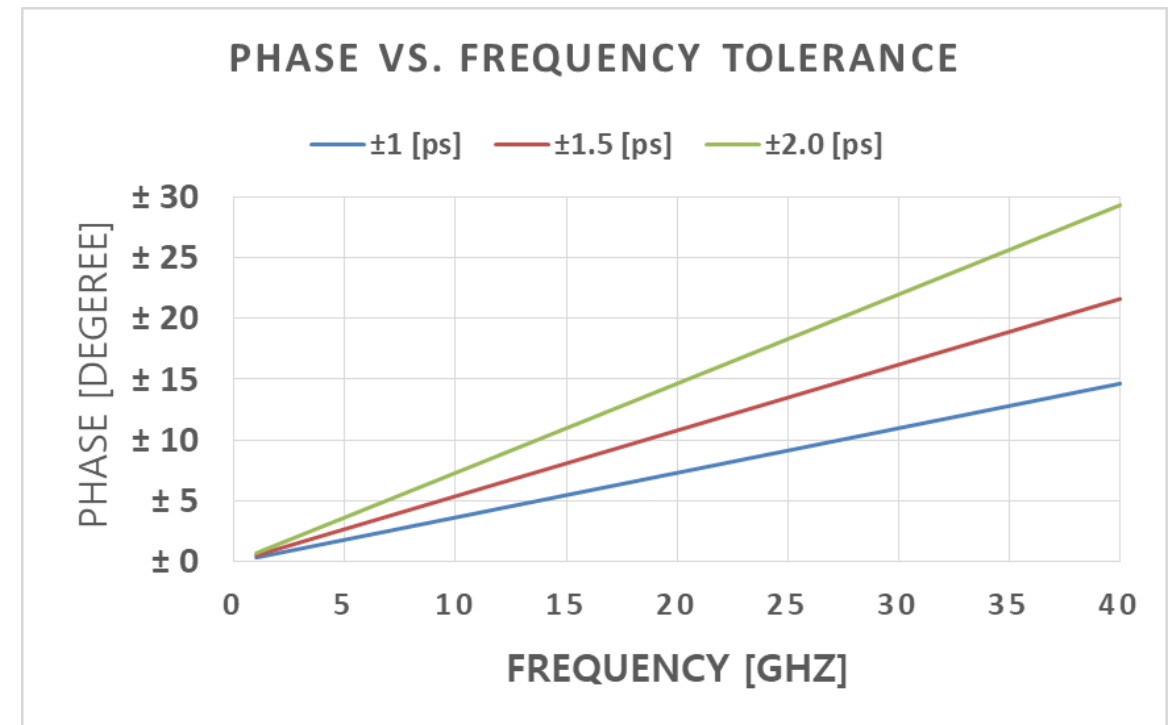
Consists of matching two(one pair) or more assemblies relative to each other. So cable assemblies that are ordered as sets with relative phase tolerance. RFMORECOM's default phase matching tolerance is  $\pm 0.3^\circ/\text{GHz}$ . (e.g. an 18GHz cable can be phase matched to  $\pm 9^\circ$ )

### ✓ Absolute Matching

Consists of matching assemblies to an absolute electrical length (Group delay).

RFMORECOM's precision cutting tools that can achieve very close tolerance in phase matched sets with precision coaxial connectors.

### ✓ Phase vs. time vs. Frequency



# 3. 33GHz Cable Assembly

✓ Electrical Features for cable

Item	Spec.
Cable	ISA2
Capacitance	102 pF/m, 32 pF/FT
Velocity of propagation	77 %
Delay	4.34 nS/m, 1.32 nS/FT
RF leakage	-90 dBc
Insertion loss	-2.0 dB/m, -0.61dB/FT
Minimum bend radius	25mm
Temperature range	-55°C/ +135°C
Weight nominal	62 g/m

✓ Electrical Features for cable

- MIL-STD-202 : Test Method
- MIL-STD-810 : Test Method for Environmental
- MIL-STD-1344 : Test Method for Connectors

