

BeeWave

Modular RF Prototyping & Education Platform



BeeWave is platform for teaching and prototyping RF systems with a fast and easy Plug & Play approach that is ideal for education and research. Building complex RF circuits on PCB is a tedious task; The user has to carefully route RF tracks, prepare RF layouts and simulations, carefully calculate bias and DC power requirements for different components, design power and control/clock distribution networks... etc. Then wait for PCB fabrication and testing times only to repeat the entire process again with every design iteration. This has made RF design a slow and costly process especially for universities and research centers, startups and small to medium businesses who don't have access to their own RF PCB manufacturing and testing facilities.

BeeWave opens the door to innovation in the RF Field by allowing students, researchers and designers to build complete RF systems simply by connecting readymade modules using standard cables, accelerating the early stages of RF Circuit design and prototyping and minimizing error and uncertainty. BeeWave Modules represent common RF circuit components (Filters, Mixers...etc.) with both active and passive modules to support designing virtually every type of system.

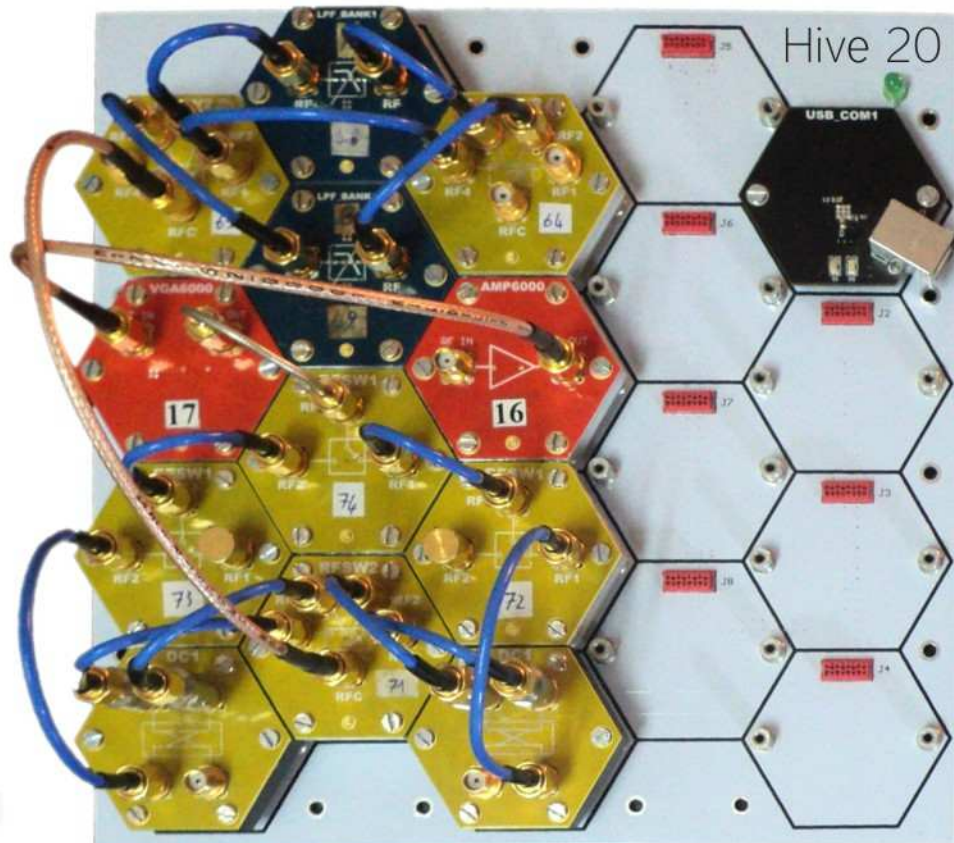
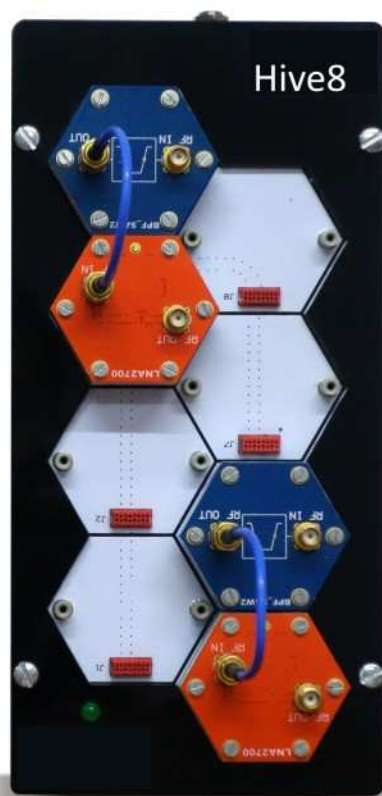
For teachers and educators, BeeWave comes with teaching modules, experiments and lab exercises built around BeeWave to take the student through the different aspects of RF circuit design engineering and RF concepts

Features

- Readymade Plug & Play modules for typical RF functions up to 6 GHz
- Connect modules & build complete RF circuits in a matter of minutes
- Ideal for Hands-on education of RF & Microwave concepts
- The fastest way to prototype, test & validate RF circuit designs
- Build any RF & Microwave circuit without the need for complex RF PCB design and fabrication
- Improve your design over multiple design iterations without the cost or delay of PCB re-fabrication
- Readymade configurations for education and classroom training
- PC controlled modules, compatible with Matlab

BeeHive

A backplane with hexagon shapes. It holds the modules and easily provides power and control data communications



Revolutionary Concept for Education, Research and Prototyping RF Designs

Application Modules

Fixed gain amplifier optimized for applications requiring high performance & wide bandwidth gain blocks.

- Frequency Range: 10 MHz to 6000 MHz
- Gain: 14 dB
- P1dB Output Power: 15 dBm
- Input Return Loss (S11): -20 dB
- Output Return Loss (S22): -9 dB
- Reverse Isolation: 25 dB
- Max. DC Voltage at input or output: 25 V
- Max RF input power: 20 dBm



AMP6000

Variable gain amplifier

- Frequency Range: 10 – 6000 MHz
- Gain Setting: -19.75 to 12 dB
- Gain Resolution: 0.25 dB (Typical)
- P1dB Output Power: 15 dBm
- Input Return Loss (S11): -15 dB
- Output Return Loss (S22): -10 dB
- Reverse Isolation: 23 dB
- Max. DC Voltage at input or output: 25 V
- Max. RF input power: 20 dBm



VGA6000

- Frequency Range: 50 – 1000 MHz
- Gain Setting: -12.25 to 19.5 dB
- Gain Resolution: 0.25 dB (Typical)
- Input Return Loss (S11): -15 dB
- Output Return Loss (S22): -15 dB
- Reverse Isolation: 25 dB
- Max. DC Voltage at input or output: 25 V
- Max. RF input power: 20 dBm



VGA1000

Application Modules

Wideband low noise amplifier

- Frequency Range: 700-2700 MHz
- Saturated Output Power: 18 dBm
- 1 dB Output Compression Point: 15 dBm
- Noise Figure: 2dB
- Small Signal Gain (S21): 16 dB
- Input Return Loss (S11): -18 dB
- Output Return Loss (S22): -17 dB
- DC Voltage (RF in , RF out): 25 Vdc
- Max. RF input power: +20 dBm



LNA2700

Band Pass Filter based on ceramic filters technology.

- Bandwidth: 100 – 1020 MHz
- Center Frequency: 2450 - 5500 MHz
- Return Loss: -22 dB
- Pass Band Insertion Loss: -5 dB
- Stop Band Attenuation: -40 dB
- Max. RF input power: 20 dBm



BPF_CER1

Band Pass Filter based on SAW (Surface Acoustic Wave) technology.

- Bandwidth: 2 – 80 MHz
- Center Frequency: 315 - 2440 MHz
- Return Loss: -20 dB
- Pass Band Insertion Loss: -2 dB
- Stop Band Attenuation: -40 dB
- Max. RF input power: 20 dBm



BPF_SAW1

Application Modules

Band Pass Filter

- Bandwidth: 40–72 MHz
- Center Frequency: 1900 - 2436 MHz
- Return Loss: --17.5 dB
- Pass Band Insertion Loss: -1 dB
- Stop Band Attenuation: -35 dB
- Max. RF input power: 20dBm



BPF_SAW2

Ceramic Low pass filter module.

- Cutoff Frequency: 150–6000 MHz
- Return Loss: -20 dB
- Pass Band Insertion Loss: -3 dB
- Stop Band Attenuation: -50 dB
- Max. RF input power: 20 dBm



LPF_CER1

High performance, Wide band Microwave double balanced passive mixer (can be used for frequency up-conversion or downconversion)

- | | |
|----------------------------------|--|
| • Frequency Range | • LO to IF Leakage: -25 dBm |
| • RF : 2-14 GHz | • RF to IF Isolation: 40 dB |
| • LO : 1-12 GHz | • SSB Noise Figure @ 6 GHz: 8 dB |
| • IF :10–6000 MHz | • IIP3 @ 6 GHz: 24 dBm |
| • Return Loss: | • Max. DC Voltage at input or output: 25 V |
| • RF : -25 TO -9 dB | • RF and IF input power: 20 dBm |
| • LO : -25 TO -5 dB | • LO input power: 10 dBm |
| • IF : -17 TO -5 dB | |
| • Conversion loss : 8 dB @ 6 GHz | |
| • LO to RF Leakage: -25 dBm | |



MX1

Application Modules

Ultra-wideband phaselocked loop (PLL) with integrated voltage control oscillators (VCOs) with good phase noise and spurious performance.

- Frequency Range: 23.5 – 6000 MHz
- Output Power @1GHz
- - Power Setting 0: -8 dBm
- - Power Setting 1: -5 dBm
- - Power Setting 2: -2 dBm
- - Power Setting 3: 1 dBm
- Frequency Resolution
- - 3000 to 6000 MHz : 100kHz
- - 1500 to 3000 MHz: 50kHz
- - 750 to 1500 MHz: 25kHz
- - 375 to 750 MHz: 12.5kHz
- - 187.5 to 375 MHz: 6.25kHz
- Phase Noise @ 1GHz & 10 KHz offset: -104 dBc/Hz
- 2nd Harmonic: -20 dBc
- 3rd Harmonic: -7 dBc
- DC Voltage on RF output or REF in: 50 Vdc



LO6000

10 MHz clock reference source used to provide reference clock inputs to local oscillators.

- Number of Outputs: 4
- Output Frequency: 10 MHz
- Output Power: 11 dBm
- Frequency Stability: 2.5 ppm



REF1

SPDT absorptive RF switch

- Frequency Range: 10 – 6000 MHz
- Insertion Loss: 1.5 dB (Typical)
- RFC Return Loss: -15 dB
- Active Port Return Loss: -15 dB
- Terminated Port Return Loss: -15 dB
- RF Input Power Handling (Active): 36 dBm
- RF Input Power Handling (Terminated): 26 dBm
- Input IP2 @ 2 GHz: 120 dBm
- Input IP3 @ 2 GHz: 65 dBm
- Max. RF input power: 40 dBm
- Max. DC Voltage at input or output: 50 Vdc
- Isolation @ 2GHz: 50dB

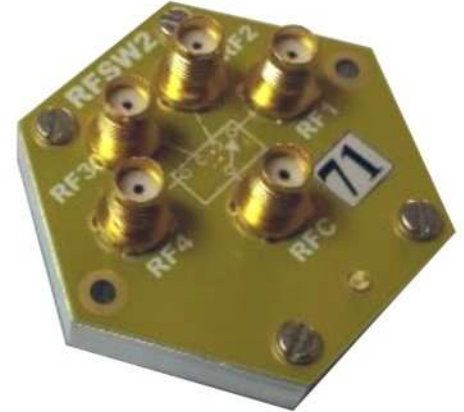


RFSW1

Application Modules

SPDT absorptive RF switch

- Frequency Range: 30 – 5000 MHz
- Insertion Loss: 1.5 dB (Typical)
- RFC Return Loss: -20 dB
- Active Port Return Loss: -15 dB
- Terminated Port Return Loss: -17 dB
- RF Input Power Handling (Active): 33 dBm
- RF Input Power Handling (Terminated): 24 dBm
- Input IP2 @ 2 GHz: 97 dBm
- Input IP3 @ 2 GHz: 58 dBm
- Max. RF input power: 35 dBm
- Max. DC Voltage at input or output: 50 Vdc



RFSW2

Wideband variable attenuator

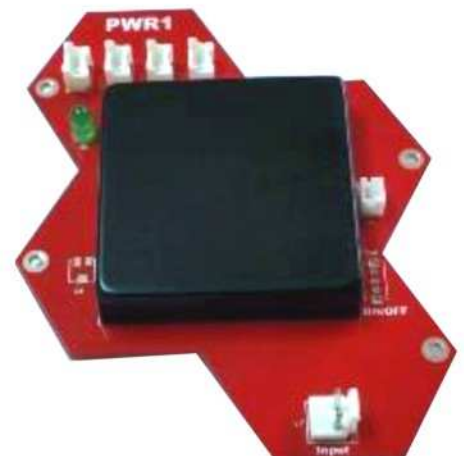
- Frequency Range: 10 – 6000 MHz
- Insertion Loss: 2.5dB (ty)
- Attenuation Setting: -31.75 dB (min)
- Attenuation Resolution: 0.25dB (ty)
- Return Loss: -15dB (ty)
- RF Input Power :23dBm (max)
- Input IP3: 55dBm
- Max DC Voltage at input or output: 25 Volt



VAT6000

Power Supply module providing DC supply to all other Beewave modules through the backplane

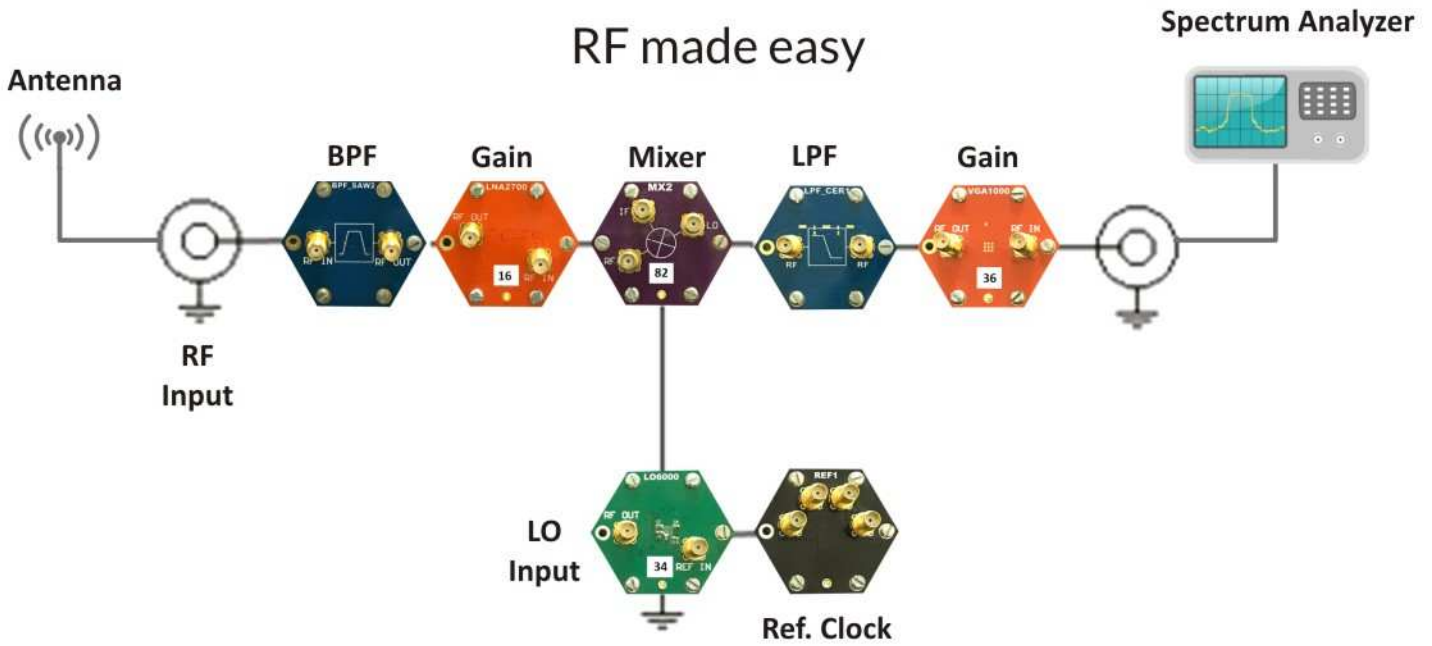
- Input Voltage: 12 Vdc (typical)
- Output Voltage: 3.3 Vdc and 5 Vdc
- Maximum output power: 30 Watt
- Efficiency: up to 89%
- Universal Input Range: 90-305VAC
- Input voltage reverse Protection
- Output Short Circuit and overload Protection
- 4 Additional Outputs (5V and 3.3V)



PWR1

Possible Experiment Setup

Mapping Down-Converter block diagram to relevant BeeWave Modules.



Bee Wave modules used in practical setup of Wireless Modular Design and Test Setup of 2x2 MIMO

