IMPO-RF
Utilized Solutions

IMPO-RF Utilized Solutions LTD established in 2016, located in Israel, Is a representative company.

This presentation provides a quick glance over some of our partners' capabilities.
In most cases some product information is not visible online, custom / tweaked solutions can be offered upon request.

It is better to understand what you are looking for, in order to suggest the most utilized solution for your inquiry.
If interested, to suggest integrated systems or complementary products.

If EUS needs to be avoided, any size limitations / environmental requirements, it is better to know in advance.

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Approved supplier of IAI and Subsidiaries, Elbit Systems, Rafael Systems, Qualcomm, MOD, Ministry of communication.

RF Signal Generators

IZT S1000/IZT S1010

Multi-Channel Signal Generators

- One device – 31 Virtual Signal Generators of highest RF quality
- Two RF outputs for phase-synchronous diversity and MIMO testing
- For I/Q data, Sirius, XM, HD Radio, AM, FM
- Modulators for Digital Radio and TV Standards
- GNSS Constellation Simulator
- Automated testing for development and production
- Versatile real-time impairment simulation
- 50 MSamples/sec real-time streaming

FIGURE 1: IZT S1000 / IZT S1010 SIGNAL GENERATORS

IZT S5000

Real-time RF Environment Simulation System

- Test and validation of COMINT and DF systems
- Operator training
- Simulating time variant, complex and realistic RF signals
- Multiple and accurately synchronized RF test signals

FIGURE 2: IZT S5000

IZT T1000

Compact Broadcast Modulator

- Modulator platform for DAB and DVB-T/DVB-T2
- Seamless switching between any combination of inputs
- User-friendly intuitive web GUI
- Optional integrated GNSS receiver for synchronization

FIGURE 3: IZT T1000

RF Receivers
Signal Collection Systems

IZT
Innovationszentrum
Telekommunikationstechnik

IZT R3000/IZT R3200, IZT R3301/IZT R3302, IZT R3410/IZT R3411

Receivers

- Excellent RF performance
- Frequency range 9 kHz – 3 GHz (6 GHz/18 GHz)
- Real-time bandwidth up to 25 MHz
- Multichannel operation
- Fully remote controllable
- Radio monitoring of broadcast stations
- ITU-R spectrum monitoring measurements
- Jammer location finding
- Spectrum allocation analysis
- Search, intercept and emitter location
- Threat recognition
- Offline processing and technical analysis

FIGURE 4: IZT R3410

IZT R4000, IZT R4010

Digital Wideband Receivers

- Signal collection and recording system
- Superior signal quality
- Continuous interception of up to 120 MHz bandwith
- Real-time signal analyzer
- Spectrum Monitoring

FIGURE 5: IZT R4010

Germany

IZT R5010

Digital Wideband Receivers

- Highest signal quality in the frequency range up to 18 GHz
- Up to 120 MHz instantaneous bandwidth
- Six independent digital downconverters
- Up to 64 narrow-band DDCs
- Real-time spectrum calculation
- Large internal buffer memory

FIGURE 6: IZT R5010

RF Record, Playback & Analysis

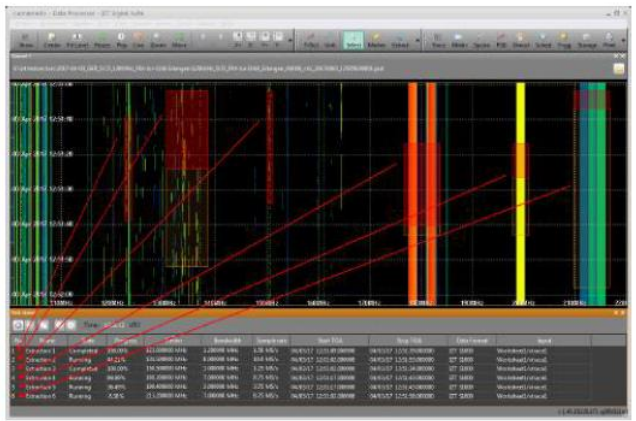
IZT RECPLAY

RF Recording and Playback Systems

- Real RF environment reproduction
- Multi-channel diversity
- Powerful signal extraction
- Real-time impairment simulation
- Repeatable lab tests
- Reduced costs for field-testing
- Automotive applications
- 25 MHz, 60 MHz or 120 MHz real-time bandwidth

FIGURE 10: IZT RECPLAY

IZT SIGNAL SUITE



Software for Signal Analysis

- Automated signal detection
- Analysis and decoding of signals
- Modulation Recognition
- Powerful I/Q post-processing
- Spectrum monitoring and interferer capture

Radio Direction Finders

IZT R3600

Multichannel Receiver System

- Frequency range 9 kHz – 3 GHz / 6 GHz
- Scalable multi-channel receiver system
- Up to 5 channels with 24 MHz instantaneous bandwidth each
- Suitable for direction finding (DF)
- For fixed and mobile systems

FIGURE 7: IZT R3600

IZT R5506/IZT R5509

Radio Direction Finder

- Complete RDF solutions
- Platform for individual software
- Compact IZT R5506 with 20 MHz – 6 GHz
- High-precision IZT R5509 with 100 MHz – 500 MHz

FIGURE 8: IZT R5509 BUILT IN ANTENNA

FIGURE 9: IZT R5506 HARDWARE

Channel Emulators

IZT C3040

FIGURE 12: IZT R3040

Satellite Link Emulator

- Input and output frequency up to 3 GHz
- Instantaneous bandwidth of 100 MHz
- Simulation of uplink, payload and downlink

IZT C5040, IZT C6000

FIGURE 13: IZT C6000

Broadband Satellite Link Emulator

- Bi-directional wideband solutions for up to 600 MHz bandwidth
- Simulation of complete satellite links including pay-load, uplink and downlink effects
- Simulation of complex mesh networks
- Real-time change of parameter
- Flexible and scalable architecture

IZT C7000

FIGURE 14: IZT OTA

Over the Air Research and Testing – OTA

- Signal distribution via IP and optical LAN
- 4G and 5G User Equipment Testing
- MANET Testing
- GNSS Testing
- Wireless cable Testing in non-anechoic and anechoic environments
- Real-Time streaming of channel parameters
- Multi-Frequency Operation
- Up to 80 MHz instantaneous bandwidth
- Extreme low RF to RF latency
- Fully coherent and phase-stable
- Highest signal quality in the frequency range up to 6 GHz
- Scalable number of channels

Digital Broadcasting

IZT DAB/DRM CONTENTSERVER

FIGURE 15: IZT DAB CS

Digital Radio Multiplexer System

- Multiplexing for DAB / DAB+ or DRM
- Real-time audio encoding
- Data service management

IZT DAB ARCHIVE

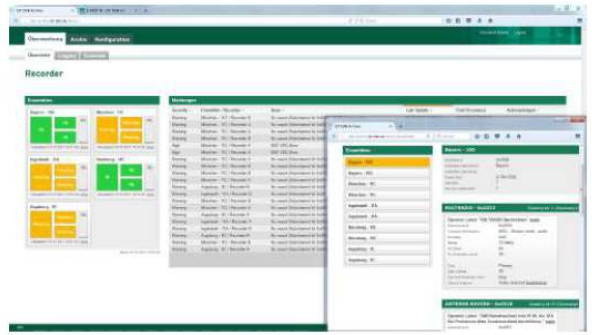


FIGURE 16: IZT DAB ARCHIVE

EDI/ETI Monitoring and Logging System

- Real-time monitoring of DAB ensembles
- Analysis of audio and data content
- Logging of the complete DAB multiplex
- Long-term archiving and indexing of all content
- Search and export functionality

COMINT Simulator

Real-Time RF Environment Simulation System

LOG.IN

- **37 years of experience** (established in 1983), fully privately owned
- **3 Business Units:**
  - COMINT & Electronic Warfare
  - Aerospace Engineering
  - Modelling and Simulations for Aerospace and EW
- **3 sites** and staff qualified in the management of classified information and projects, in accordance with National and NATO regulations
- **ISO9001:2015** Design, development and servicing of integrated IT solutions
- **ISO9001:2015** Design and provision of system **support** services
- **ISO/IEC 27001:2013** (i.e. Information Security)
- **UK MOD Cyber Essential**

COMINT & Electronic Warfare Business Unit

- Digital signal processing using Software Defined Radio;
- Direction Finding (Watson Watt, Correlative, Correlative Vector Interferometry);
- Emitter triangulation (DOA, TDOA, FDOA, hybrid);
- Classification, identification and decoding of radio communications signals;
- Jamming and communications simulation;
- Airports and military areas protection against Electronic Attacks and interference to Communications, Navigation and Surveillance systems;
- Counter-Drone RF sensors.

Aerospace Engineering Business Unit

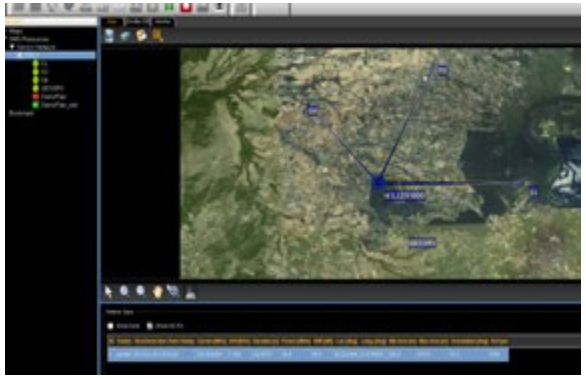
SHIELD – Multi-sensor intercept and DF network for Spectrum Domination

Available configurations:

1)SHIELD-Airport: to protect airports against radio interference, jammers, CNS spoofing and drones.

2)SHIELD-Surveillance: tactical "Intercept, DF and monitoring" of hostile and not-authorised radio communications.

3)SHIELD-Drone: to detect, triangulate and neutralise drones and their remote controllers.



RMS-DF-X Family of "Intercept and DF" sensors for COMINT, SIGINT, spectrum surveillance, spectrum monitoring counter-drone operations

RMS-DF-5-R3600

RMS-DF-5-MK2 – All In One COMINT Sensor

RMS-DF-1-B200

RMS-DF-5-N200

RMS-DF-3-X300

Multiple configurations available to meet any operative and installation requirement.

Italy

Aerospace Engineering Business Unit

- Development of Validation and Verification tools for Avionics Software Qualification;
- Development of Electrical Rigs;
- Development of software for on-board displays;
- Support for EASA/FAA qualification of Level D Full Flight Simulator;
- Design and development of software for Mission Planning and Mission Support stations;
- Development and support of Health and Usage Monitoring Systems (HUMS);
- Turn-Key Support of Flight Simulators.

Support of Full Flight Simulators

- **Typical Service Level Agreement:**
  - Remote via web;
  - Remote via web plus On-Call;
  - On Site Field Support Representative Only;
  - On Site Turn Key 24-7.
- **Optional Support Activities:**
  - "Hot" spare parts management;
  - Obsolescence analysis and management;
  - Reparation of real-parts.
- **Ancillary activities:**
  - Visual Database and 3D models development;
  - Support using IOS during training sessions;
  - Development of Tactical Scenario for CGF;
  - Scheduling of training activities to maximise the efficiency.

- **Human Resources**: the Support Team includes Instructor Pilots, former military Test Pilots, electrical and mechanical engineers, software engineers, former Flight Training Organisation (FTO) managers.
- Main skill and Know-How
  - Image generators support and projectors alignment;
  - Electric and hydraulic motion maintenance;
  - Control loading (electric and hydraulic) maintenance;
  - Avionic bus (e.g. 1553) troubleshooting;
  - Experience with simulators made by Canadian, US, France and Italian manufacturers (exact make can be provided on demand);
  - HLA, DIS and distributed simulation troubleshooting;
  - Tools for simulator QTG;
  - Extended know how of supporting simulator in military bases;
  - Certification of Flight Simulators in accordance to EASA/FAA regulations

Modelling and Simulation Business Unit

- Design, development and testing of software for Full Flight Simulators:
  - Instructor Operator Station (IOS);
  - Computer Generated Forces;
  - Image Generator, Visual Database and 3D models;
  - On-board system;
  - EW Sensors;
  - Communications and Data Link.
- Design, development and testing of software for Virtual Maintenance Trainer;
- COMINT Target and Signal Simulator;
- Drone Test Range;
- EW threat and jamming generators.

SPECIAL PURPOSE ANTENNAS

RFspin

SH48-20

47 GHz – 48.5 GHz
VSWR < 1.3
Gain 20 dBi
Power (CW/Peak)
5 W / 10 W
2 × 2.40mm $_{female}$
Dual polarized
(LHCP/RHCP)

SCSA-27E

2 GHz – 27 GHz
VSWR < 2
Gain -3 – 6 dBi
Power (CW/Peak)
2 W / 4 W
SMA $_{female}$

TEMH20

1 GHz – 22 GHz
VSWR < 2.6
Gain 6 - 22 dBi
Power (CW/Peak)
25 W / 50 W
3.5mm $_{female}$

RBA-1015

10 MHz – 1.5 GHz
VSWR < 2 (freq. > 260 MHz)
Gain -20 – 4 dBi
Power (CW/Peak)
20 W / 40 W
N $_{female}$

DRH818

7.5 GHz – 18 GHz
VSWR < 1.18
WRD750
FPWRD750D24
Gain 19 – 21 dBi
Power (CW/Peak)
1000 W / 2500 W

ADRWC750

7.5 GHz – 18 GHz
VSWR < 1.25
N / SMA $_{female}$
WFPWRD750D24
100 W / 170 W
RD750

H-A40

26 GHz – 40 GHz
VSWR < 1.35
Gain 18 – 21 dBi
HPBW 14° – 19°
Power (CW/Peak)
15 W / 30 W
K $_{female}$

H-A50

33 GHz – 50 GHz
VSWR < 1.35
Gain 18 – 21 dBi
HPBW 14° – 19°
Power (CW/Peak)
10 W / 20 W
2.40mm $_{female}$

H-A60-W

40 GHz – 60 GHz
VSWR < 1.15
Gain 19 – 21 dBi
HPBW 14° – 19°
WR-19, UG-383/U flange

H-A75-W

50 GHz – 75 GHz
VSWR < 1.15
Gain 19 – 21 dBi
HPBW 14° – 19°
WR-15, UG-385/U flange

H-A90-W

60 GHz – 90 GHz
VSWR < 1.15
Gain 19 – 21 dBi
HPBW 14° – 19°
WR-12, UG-387/U flange

90° Hybrid Couplers

Model	HC90–0560	HC90–1720	HC90–4040
Frequency Range	0.5 – 6.0 GHz	1.7 – 20 GHz	4 – 40 GHz
Connector	4x SMA $_{female}$	4x SMA $_{female}$	4x K $_{female}$
VSWR (max)	1.25	1.4	1.6
Amplitude Balance (max)	1 dB	1 dB	1.2 dB
Phase Balance (max)	± 5 deg	± 5 deg	± 10 deg
Isolation (min)	20 dB	17 dB	15 dB
Insertion Loss (max)	1.2 dB	1.3 dB	2.4 dB

Waveguide to Coax Adapters

AWC19F

40 GHz – 60 GHz
VSWR < 1.35
WR19
UG-383/U-Mod
1.85mm $_{female}$

AWC15F

50 GHz – 67 GHz
VSWR < 1.4
WR15
UG-385/U
1.85mm $_{female}$

Coaxial Cables

Pair of Phase Identical Coaxial Cables	CHS-SF141-02-P	CHS-SF141-02-P	CHS-MF86-01-P
Frequency	DC – 11 GHz	DC – 20 GHz	DC – 40 GHz

H-A110-W

75 GHz – 110 GHz
VSWR < 1.18
Gain 19 – 21 dBi
HPBW 14° – 19°
WR-10, UG-387/U flange

H-A90-W25

60 GHz – 90 GHz
VSWR < 1.15
Gain 24 – 26 dBi
HPBW 7° – 12°
WR-12, UG-387/U flange

H-A110-W25

75 GHz – 110 GHz
VSWR < 1.16
Gain 24 – 26 dBi
HPBW 7° – 12°
WR-10, UG-387/U flange

USED BY

NASA
NATO OTAN
NSI MI
TECHNISCHE UNIVERSITÄT ILMENAU
Goddard SPACE FLIGHT CENTER
AIRBUS
Qualcomm
Universität München
Honeywell
NORTHROP GRUMMAN
ROHDE&SCHWARZ
CIT CORK INSTITUTE OF TECHNOLOGY

Czech Republic

MEASUREMENT ANTENNAS

DRH200

180 MHz – 2.2 GHz
VSWR < 1.6
Gain 6 – 14 dBi
Power (CW/Peak)
500 W / 1000 W
N $_{female}$

DRH203

200 MHz – 3 GHz
VSWR < 1.6
Gain 3 – 16 dBi
Power (CW/Peak)
400 W / 750 W
N $_{female}$

DRH370

370 MHz – 6 GHz
VSWR < 1.6
Gain 3 – 16 dBi
Power (CW/Peak)
350 W / 500 W
N $_{female}$

DRH10

740 MHz – 10.5 GHz
VSWR < 1.8
Gain 4 – 17 dBi
Power (CW/Peak)
150 W / 250 W
N $_{female}$

DRH18-EX

800 MHz – 18 GHz
VSWR < 2.4
Gain 4 – 15 dBi
Power (CW/Peak)
100 W / 170 W
SMA $_{female}$

DRH20

1.7 GHz – 20 GHz
VSWR < 1.6
Gain 5 – 16 dBi
Power (CW/Peak)
50 W / 100 W
SMA $_{female}$

DRH40

4 GHz – 40 GHz
VSWR < 1.6
Gain 7 – 19 dBi
Power (CW/Peak)
15 W / 30 W
K $_{female}$

DRH50

4.5 GHz – 50 GHz
VSWR < 1.55
Gain 6 – 20.5 dBi
Power (CW/Peak)
10 W / 20 W
2.40 mm $_{female}$

DRH67

6 GHz – 67 GHz
VSWR < 1.9
Gain 6.5 – 21.5 dBi
Power (CW/Peak)
5 W / 10 W
1.85mm $_{female}$

DRH110

14 GHz – 110 GHz
VSWR < 2.1
Gain 6.5 – 18.5 dBi
Power (CW/Peak)
4 W / 8 W
1.0 mm $_{female}$

Applications – **5G**, Radio Monitoring, Electronics, Government/Defense, Automotive, …

DUAL POLARIZED ANTENNAS

QRH300

300 MHz – 4.5 GHz
VSWR < 2.2
Gain 4 – 15 dBi
Power (CW/Peak)
400 W / 750 W
2 × N $_{female}$

QRH400

400 MHz – 6 GHz
VSWR < 2.3
Gain 4 – 15 dBi
Power (CW/Peak)
300 W / 500 W
2 × N $_{female}$

QRH11

730 MHz – 11 GHz
VSWR < 2.4
Gain 3.5 – 15.5 dBi
Power (CW/Peak)
100 W / 170 W
2 × SMA $_{female}$

QRH18

1 GHz – 18 GHz
VSWR < 2.5
Gain 5 – 16 dBi
Power (CW/Peak)
100 W / 170 W
2 × SMA $_{female}$

QRH20E

1.7 GHz – 20 GHz
VSWR < 2.2
Gain 6 – 15.5 dBi
Power (CW/Peak)
20 W / 40 W
2 × SMA $_{female}$

QRH40

4 GHz – 40 GHz
VSWR < 2.4
Gain 6 – 16 dBi
Power (CW/Peak)
10 W / 20 W
2 × K $_{female}$

QRH50

5 GHz – 50 GHz
VSWR < 2.5
Gain 4 – 14 dBi
Power (CW/Peak)
5 W / 10 W
2 × 2.40mm $_{female}$

DLPP-6

500 MHz – 6 GHz
VSWR < 2.5
Gain 4 – 8 dBi
Power (CW/Peak)
20 W / 40 W
2 × SMA $_{female}$

Applications
WiMAX Testing, UWB, GSM, PCS, Wi-Fi, EMC, Automotive, Radio Monitoring, Electronics, Government/Defense, Medical, ...

Technology Roadmap: Cellular – LTE and 5G NR

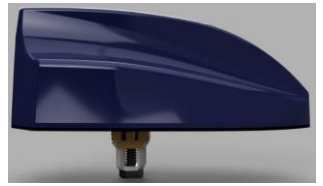
- **Airgain developed antenna technology to support 5G NR both Sub- 6GHz (including all LTE bands) and mm-Wave bands**
- **For Sub-6GHz, various antenna technology covers 600MHz to 6GHz**
  - Embedded antenna solution multi-band antenna design
  - Through-mounted PCB blade-type parts
  - External dipole for indoor or outdoor IP67 applications
  - Custom multi-band high gain antenna array
- **For mm-Wave covers 24GHz to 39GHz**
  - High gain dual polarized passive fixed beam array
  - Active beamforming high gain array
  - Support different beamforming architecture
  - Up/down converter with IF interface
- **Design and evaluation of LTE and 5G NR antennas system**
  - OTA testing support TIS/TRP measurements
  - OTA in test house environment provide real life system data
  - mmWave lab testing support up to 65GHz
- **Antenna solutions support small cells, enterprise access points, fixed wireless access, and CPE (consumer premise equipment) – including fixed & active beamforming antenna arrays**

Universal External OEM antenna with DSRC (V2X)

Airgain

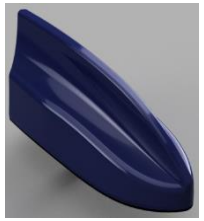
Features & Benefits

- High level of integration
  - Six embedded antenna technologies that operate over multiple bands in one housing. Competitive benchmark typically two or three
- High Performance in LTE bands
  - Leading LTE performance while in coexistence with multiple other embedded antenna technologies
- Small Form factor
  - Lower profile and smaller footprint than competing solutions



6 in-1 compact external OEM antenna

- 2x2 MIMO 4G LTE
- 1x WLAN/Wi-Fi/BT
- GNSS L1/E1/G1 (with high rejection LNA)
- 2x V2X (5.9GHz DSRC antennas)
- Customizable packaging and connection options
- Enclosure: IP67, Impact resistant UV light stabilized ABS
- Industry standard mount & FAKRA SMB connectors



Magnetic Mount C-V2X Antenna

- 2 x ITS 5.9 GHz Elements (MIMO)
- 1 x GNSS Element
- 5m cable length with SMA or FAKRA connectors
- Side exit cables with strong magnetic adhesion

External C-V2X Outdoor Antenna

Broadcast Radio (SDARS)

- **Airgain designs ceramic patch and blade-type antennas for SDARS applications**
- **Airgain also offers blade-type PCB antennas for SDARS, providing some advantages over ceramic patch antennas**
  - Broad bandwidth
  - Less stringent manufacturing tolerances
  - Low mass, low cost
  - Flexible design
  - Larger design space for subsequent antenna tuning
- **Airgain R&D investment in polymer-based chip antennas as an alternative to Ceramic. High DK polymer chip antennas offer various advantages over ceramics:**
  - Lower mass
  - Robust, less susceptible to facture

Ceramic Patch
(traditional)

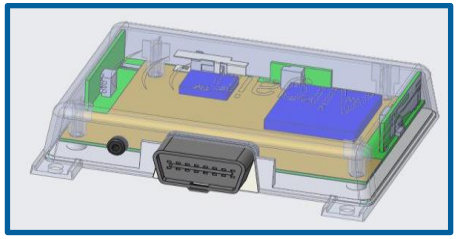
Polymer Patch

Airgain Blade

USA

Reference Antenna System for Telematics (TCU) Units

- **OEM: Dashboard TCU demonstrator**
  - 4-in-1 compact embedded antenna solution
    - 2x2 MIMO 4G LTE
    - 1x Wi-Fi (Dual-band)
    - 1x GNSS L1/E1/G1
  - Customizable packaging and connection options
  - Enclosure: IP67, Impact resistant UV light-stabilized ABS
  - Industry standard mount
  - OBDII and FAKRA SMB connectors
- **WLAN (M2450DLNTFSU-PH)**
  - Frequency range: 2.4-2.49GHz, 4.9GHz-5.9GHz
  - Peak gain < 4dBi @ 2.4GHz and < 5dBi @ 5GHz
  - Plastic insert to mitigate vibrations
- **GNSS L1/E1/G1 Antenna (N1575BGPS-PH)**
  - Blade-type PCB antenna with LCP insert
  - Linear Polarization
  - Frequency range: 1559MHz–1610MHz
  - Efficiency > 70%
  - Peak gain > 2.5dBi
  - VSWR < 2
- **LTE (Main N750BLTEM-PH and Aux N750BLTEA-PH antennas)**
  - Blade-type PCB antennas with LCP insert
  - Frequency range: 700MHz-960MHz & 1.7GHz–2.17GHz & 2.5GHz–2.7GHz



Airgain Antenna System for Telematics Unit

Custom GNSS Single and Stacked Ceramic Antenna

Designs utilize a variety of antenna technologies

- Ceramic patch and stacked ceramic patch antennas
- Blade-type antennas
- Polymer patch antennas

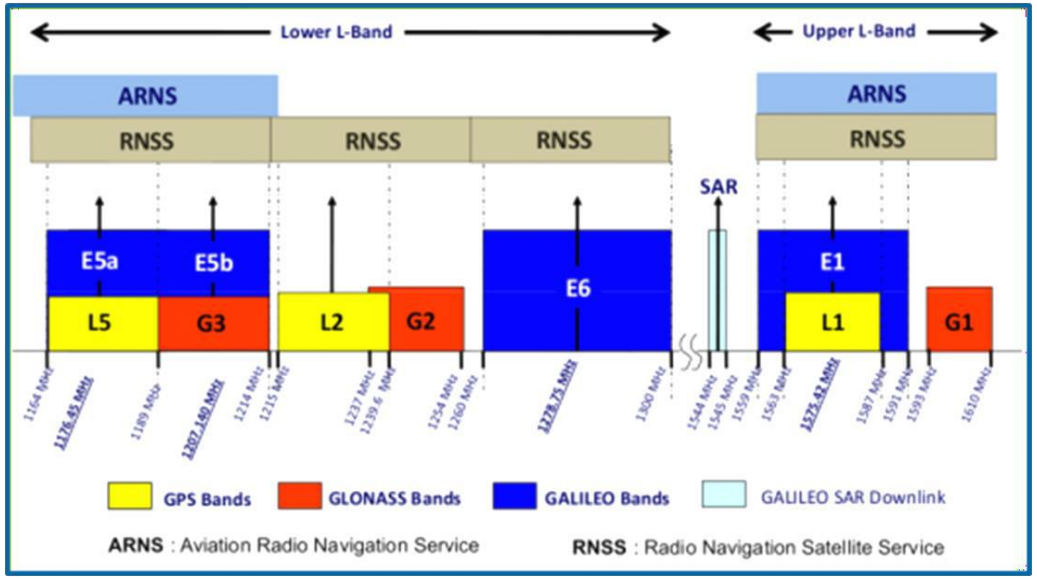
Requirements

- GNSS antennas need to cover wide bandwidth
- RL > 10dB
- Zenith peak gain > 2.5dBi
- VP gain @ low elevation
- Peak gain vs. elevation
- Axial ratio < 3dB

Design Examples

- GNSS L1/E1/G1 (1559MHz-1610MHz; BW=51MHz)
- GNSS L2/G2 (1215MHz-1254MHz; BW=39MHz)
- SDARS (2320MHz-2345MHz; BW=25MHz)
- GNSS L1/E1/G1 + L2/G2
- GNSS L1/E1/G1 + L2/G2 & SDARS

GNSS antennas need to cover wide bandwidth



http://www.navipedia.net/index.php/GNSS_signal

*BeiDou NSS uses the same frequency bands as Galileo. The system will become global in 2020

Active (LNA) GPS Patch Antenna

Overall size is 36x36x15mm³
GNSS patch is 36x36x10mm³
SDARS patch is 18x18x5mm³

Airgain GNSS L1/E1/G1+L2/G2 & SDARS Antenna
(stacked ceramic patches)

Diversified Contract Manufacturing Strategy

- 3 China based manufacturing partners
- 1 Philippines based manufacturing partner
- Over 800+ factory employees
- >10M antennas per week production capacity

Automation and Integration

- High degree of vertical integration
- Fully automated assembly for standard antennas

Quality control according to automotive standards

- ISO 9001, 14001, and IATF 16949:2016 certification
- Outgoing quality yield 99.999%
- Cable tension, mating/un-mating force, Connector insertion
- Open/short high voltage
- Restriction of Hazardous Substances (RoHS)
- Connector cut/cross section
- VSWR, Return loss, with CPK
- Packaging: atmospheric, vibration, shock

Global 5G Broadband LTE Antenna

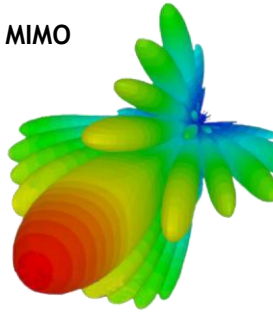
- Fixed Wireless Gateway / Small Cell
- Embedded antenna solution
- Frequency band: 617-960 MHz, 1.4-1.6 GHz, 1.71-2.7 GHz, 3.3-4.2 GHz, 4.3-6 GHz
- Configuration: PCB build and cable-fed multi-band LTE antenna
- Dimension: 162.0 x 33.0 x 1.0 mm
- High efficiency and omni radiation pattern
- In production

Outdoor CBRS/C-Band Omni-directional External Antenna

- Small Cell Base Station and Fixed Wireless Gateway
- Frequency band: 3.3-4.2 GHz (4G: BC42 and 43; 5G: n77 & n78)
- Outdoor dipole antenna with Type N (50 Ohm) female connector
- Dimension: Φ28.0mm×180 mm
- IP67 environmental rating
- 3dBi and 6dBi gain options
- Omni radiation pattern

Custom Sub-6GHz Antenna Solutions

- Fixed high gain panel multi-band antenna array
  - Indoor or Outdoor fixed wireless applications
  - Multi-band modular design concept
  - Linear or dual polarization design support multiple MIMO streams
  - Standalone or integrated design
  - High isolation between ports
  - Various gain and beamwidth antenna array design options
- Outdoor CBRS/C-Band Beamforming active antenna solution
  - Dual polarization design support
  - Low profile solutions
  - Various high gain antenna array design option
- Frequency band: 3.3-4.2GHz (4G: BC42 and 43; 5G: n77 and n78)
- Active digital beamforming capability to support Massive MIMO
  - Analog, hybrid, or digital beamforming solution



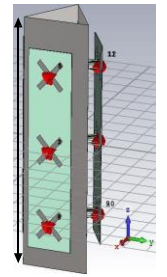
Indoor &Outdoor 5G Sub-6 GHz Omni-directional External Antenna

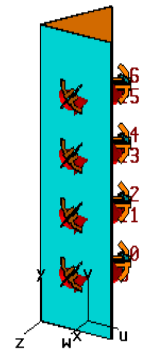
- Fixed Wireless Gateway / Small Cell applications
- Hinged straight and right angled orientations
- Frequency band: 600 MHz – 6000 MHz (full Sub-6 GHz band)
- Configuration: External antenna with SMA (50 Ohm) female connector
- High efficiency and omni antenna radiation pattern

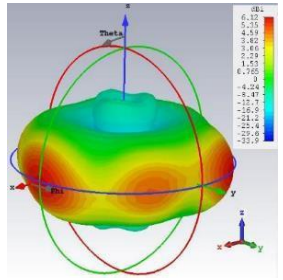
CBRS Tri-Sector/ Pseudo Omni Array Antennas

Dimensions			Pattern Parameters		
Single Sector	Height (mm)	Outer Diameter (mm)	Peak Gain* (dBi)	V Beamwidth (deg.)	H Beamwidth (deg.)
Two-Element	120	80	11	38	74
Three-Element	200 (180)	80	13	24	74
Tri-Sector	Height (mm)	Outer Diameter (mm)	Peak Gain* (dBi)	V Beamwidth (deg.)	Ripple (dB)
Two-Element	120	80	6	38	3
Three-Element	200 (180)	80	8	24	3

- Indoor or Outdoor Small Cell strand mount applications
- Frequency band: 3.3-4.2 GHz (4G: BC42 and 43; 5G: n77 and n78);
- Configuration
  - ±45° dual-polarization array antenna;
  - 6-ports (3 sectors, each with 2 connectors), type N female connector
- Tri-Sector or Pseudo omni mode
- Dimension: 80mm diameter
- Tri-Sector antennas are designed using Two- and Three- element linear arrays with identical elements and separation between elements
- Dual X-polarized antenna covers 3400-3600 MHz
- Antennas fit in a cylinder with OD = 80 mm

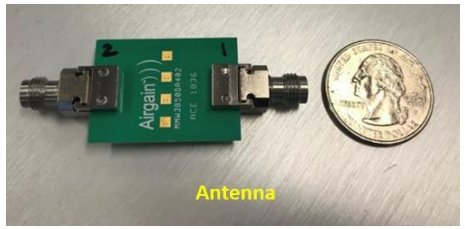




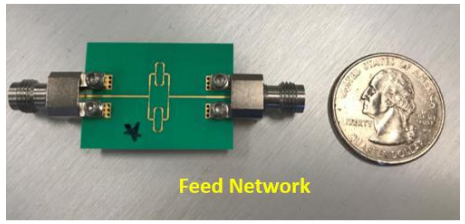


39 GHz 4x1 Dual Polarization Passive Antenna Array

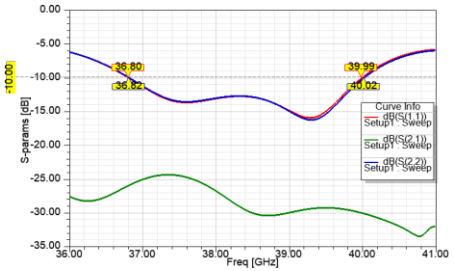
Port 2

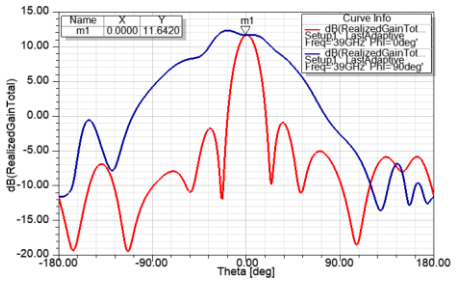


Port 1
45 Degree Port



Far Field Radiation Pattern



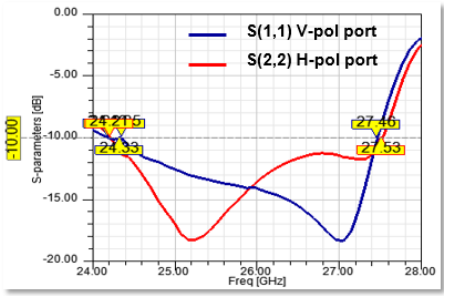


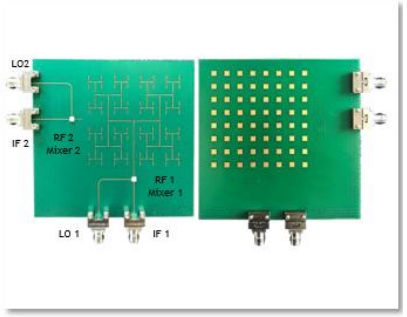
Freq (GHz)	Gain (dBi)		Efficiency	
	-45 deg	45 deg	-45 deg	45 deg
38 GHz	11.6	11.7	91	91
39 GHz	11.6	11.6	90	90
40 GHz	11.6	11.3	88	88

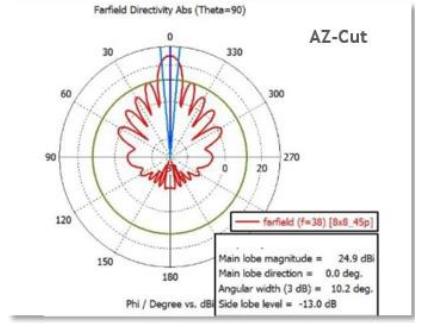
24 GHz - 8x8 Antenna Array

- Dual polarization 8x8 passive array with up/down converter, supporting IF DC to 10 GHz
- External LO from 14 GHz to 18 GHz is required

Antenna	Peak Gain (dBi)	V-BW (deg)	H-BW (deg)	Side Lobe Level (dB)
Single Element	5.0	86	88	N/A
8x8 Array	25.0	10	10	-13





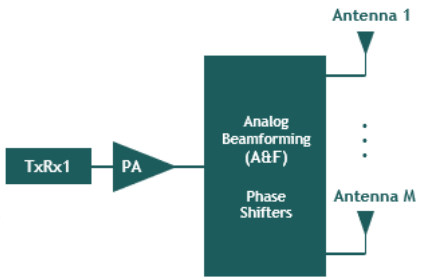


39 GHz Dual-Polarized Beamforming Active 2x4 / 4x4 / 8x8 Array Antenna

- Single polarization 2 × 4 array with 4-branch BFIC chip.
- Analog beamforming with full elevation beam scanning.
- The board consists of RF and SPI interface.
- Antenna array gain is 41dBi along with BFIC gain (Including losses in Wilkinson, feedlines, and connector mismatch).
- Beamwidth: Azimuth = 45°, Elevation = 23°

Beamforming Architecture

Airgain solution supports different beamforming architecture. Selection is based on different use case and product requirements

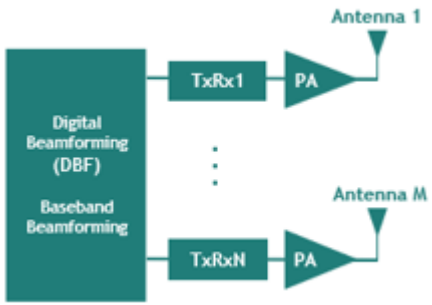


Analog Beamforming (ABF):

- 1 RF Chain with M-antenna elements
- One transceiver and 1 RF directional high gain beam to improve coverage
- Low cost

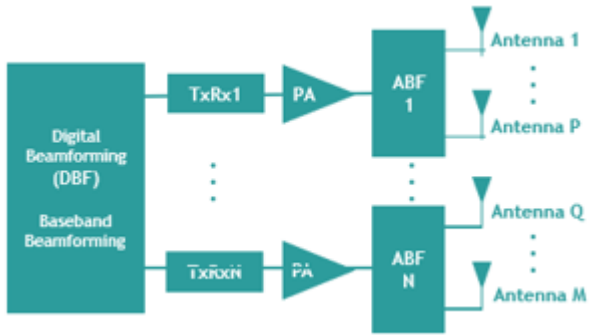
Digital Beamforming (DBF):

- M RF Chain with M-antenna elements
- One transceiver per antenna element to improve capacity and flexibility
- High power consumption and cost, best for low antenna count applications



Hybrid Beamforming (HBF):

- N RF Chain with M-antenna elements (N < M)
- One transceiver per group of antenna elements, good balance between analog and digital beamforming
- Best for high band with high antenna count array

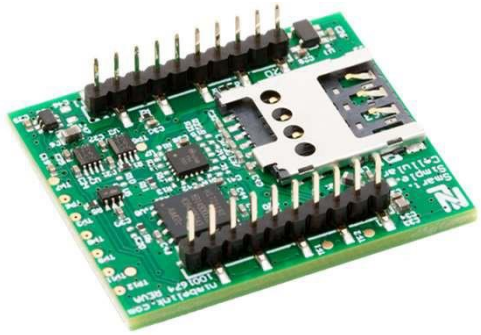


What is a Skywire Modem?

- Simplified, embedded cellular connection between product and internet
- Dramatically Reduces Cost, Risks and Timelines of IoT Product Development
  - Known-Good RF
  - Fully Validated software
  - Standardized interface
  - End Device Certified in US Markets
- Accelerates Your Time to Market
- Enables You to Focus on Your Application and Not Engineering Cellular Radios

Known Good RF

- All RF engineering isolated to the Skywire PCB
  - Transmission Power exceeds Carrier requirements
  - Optimized Receive Sensitivity
  - Maximized Bandwidth
  - Grounding and interface solved
  - Trace lengths as a function of wavelength
- Reduces PCB design complexity vs. engineering with a module
  - Fewer layers
  - Reduces board cost
  - RF Engineering is “Black Magic”
- Proven Design, certified by third party test labs



Fully Validated Software

- Industry norm is a continuous flow of firmware releases from module suppliers, often containing bugs and issues
- NimbeLink manages the release of new module firmware to Skywire customers
  - We run regression tests against expected performance
  - Report issues back to module suppliers and iterate
  - Aggregate firmware updates to a full maintenance release for our customers
  - Notify customers when an update is necessary and provide the maintenance release
  - Manage a full revision control (ECO & PCN) process
- Best software and hardware support system globally for embedded cellular products

NimbeLink®
Smart. Simple. Cellular.

Standardized Interface

- All Skywire modems utilize same 20 pin connector (excluding Skywire Nano)
  - Customer PCB can support multiple Skywire Modems
  - Enables flexibility in modem selection for multiple markets
  - Supports Carrier Changes
  - Supports Geography Changes
  - Reduces complexity in supply chain for baseboard PCB
  - Future Proof - As new cellular technologies are released and new Skywire modems become available, enables easy migration without redesigning the customer PCB
- Simplifies and accelerates early-stage product iterations
- Changes in customer PCB do not require re-certification efforts with carriers nor additional RF testing

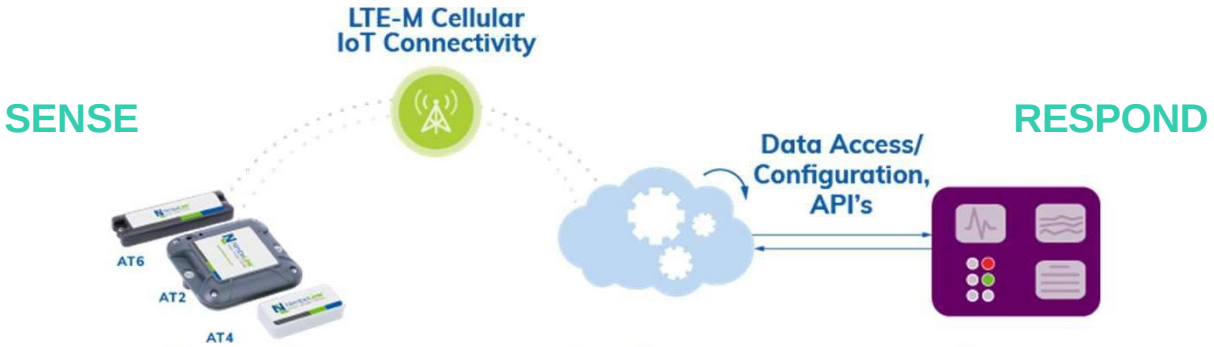
Skywire Modems

- 4G LTE, CAT 4, CAT 3, CAT 1, CAT M1, NB IoT
  - 2G fallback GNSS
- Dual SIM
  - Verizon MFF2 + 3FF slot
- FOTA enabled
- Direct access to the module resources
  - #1 Reason wins over Digi/MultiTech
  - Better power control
  - Faster access speeds

USA

NimbeLink Asset Tracking Solution

An integrated, edge-to-enterprise, application-ready solution: hardware, software, network, and service.



- Location Services
- Condition Monitoring

- Data Enrichment
- System/Configuration Management
- Device Management
- Network Management

- Integration
- Alerts
- Dashboards
- Reports
- System of Record

Robust Battery Life
Rugged Enclosure

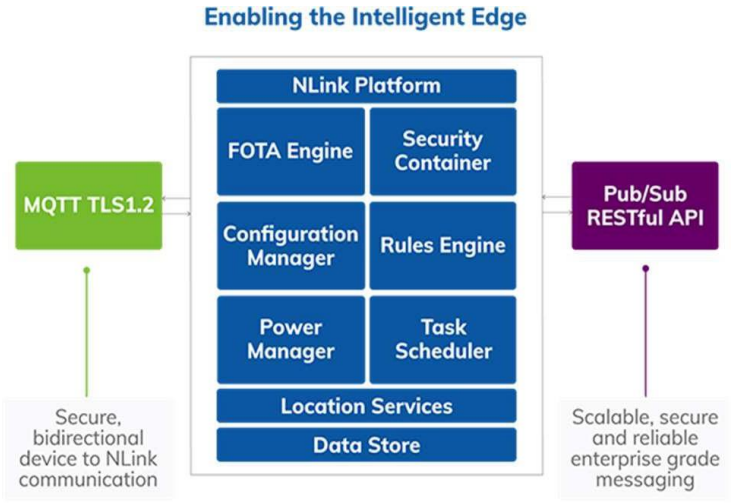
Highly Configurable
Edge-to-Enterprise Security

Asset Tracker Family of Products

	NL-AT2	NL-AT4	NL-AT5	NL-AT6
				
	4" x 4" x 1"	3.1" x 1.5" x 0.56"	3.85" x 3.4" x 1"	4.9" x 1.4" x 0.69"
	8 oz.	1.5 oz.	8 oz.	2.5 oz.
	AA Lithium, Replaceable	Lithium-ion, Rechargeable	AA Lithium, Replaceable	2 AA
	Up to 14 Years	1.5 Years	Up to 14 Years	10+ Years
	LTE-M (CAT M1), NB-IoT, 2G Fallback	LTE-M (CAT M1), NB-IoT, 2G Fallback	LTE-M (CAT M1), NB-IoT, 2G Fallback	LTE-M (CAT M1), NB-IoT, 2G Fallback
	GPS, Wifi, Cellular	Wifi, Cellular	GPS, Wifi, Cellular	GPS, Wifi, Cellular
	Temperature, Humidity, 3 Axis Accelerometer	3 Axis Accelerometer	3 Axis Accelerometer, BLE, Laser Ranging Distance Sensor	3 Axis Accelerometer, Light, Temperature, BLE
	International	International	International	International
	IP67	IP66	IP67	IP67
	-30°C to +60°C / -22°F to 140°F	-20°C to +60°C / -4°F to 140°F	-30°C to +60°C / -22°F to 140°F	-40°C to +85°C / -40°F to 185°F

The NLink Platform

Robust, secure and scalable platform designed for change and longevity.



Why NLink?

Centralized management and edge control, at scale.

Data Management

- FOTA for cellular module
- FOTA for application software
- Edge Intelligence - Configuration management (device personality)
- Unique ID - management of Root CA certs and private keys

Data Normalization

- Payload conversions to JSON subscription
- Raw data analysis

Location Services

- Location lookup services for WiFi SSIDs and Cellular tower data
- Business logic to evaluate location sources and prioritization
- Contracts with 3rd party location lookup services

Future Resistance

- Change - repurpose and redeploy
- Path to support device enhancements over time
- Carrier certification tied to FOTA solution

SLA / Troubleshooting

- NLink as Point of Failure - we adhere to Amazon SLA and provide escalation path
- Response Time - failure could be the device, network, or NLink, all with equal response times
- Problem Definition - hardware failures can't be distinguished from NLink failures until root cause analysis is performed

Security

- Mutually authenticated TLS1.2 secured MQTT communications to device.
- Unique x509 certificate identity per device

Radio monitoring and direction finding

- **Multi-couplers**

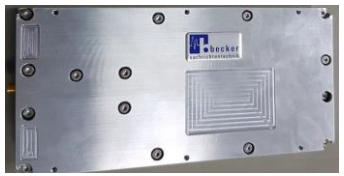
- Short wave: WSDU-1X8SR
- Bandwidth: 0.3 - 30 MHz,
- (Optional HP for interference supression)
- Options: LAN/BITE, DC supply, various HP filters
- V/UHF: WSDU-1X8R
- Bandwidth: 100 kHz - 4000 MHz
- Options: LAN/BITE, DC supply, various HP filters
- SHF-low: WSDU-1X8ER
- Bandwidth: 20 - 8000 MHz
- Options: LAN/BITE, DC supply
- SHF-high: WSDU-1X8UR
- Bandwidth 0.5 – 18 GHz
- Options: LAN/BITE, DC supply

- **Antenna matrices**

- Kurzwelle: RSWM-4X8SR (4 antennas, 8 receiver)
- Bandwidth: 0.3 - 30 MHz,
- (Optional HP for interference supression)
- USB/LAN control, AC supply

- V/UHF: RSWM-4X4R / -4X8R / -8X8R
- Bandwidth: 100 kHz - 4000 MHz
- MMI/USB/LAN control, AC supply

- SHF: RSWM-4X4ER / -4X8R / -8X8R
- Bandwidth: 20 - 8000 MHz
- MMI/USB/LAN control, AC supply



Jamming and mobile communications

Solid state amplifiers for wideband jamming
•Bandwidth 300 -6000 MHz, 10 W

Solid state amplifier for mobile communications
•Bandwidth 20 -2800 MHz, 5 W

Solid state amplifier for air traffic control applications
•Bandwidth 10 –530 MHz, high linearity, 30 W

Radio monitoring

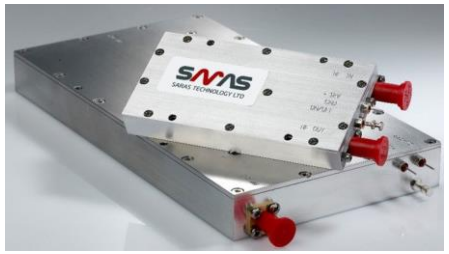
Customer-specific RF matrices (e.g. partially non-blocking)

- GUI (graphical user interface)
- Application: radio monitoring for critical event security

Customer-specific shortwave matrices for large deployments

- Modular concept
- Base module: 16 x 32 non-blocking matrix
- Extendable to (nx16) x (nx32)
- Application: large national radio monitoring stations

Germany



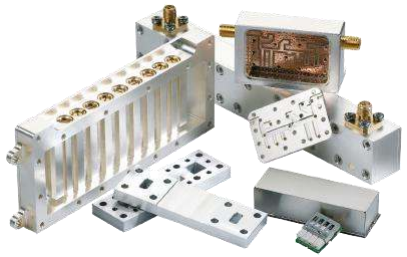
Amplifier Products

True ITAR free

PARAMETER	VALUE	REMARK
Electrical Specification		
Operating Frequency	700 - 2700MHz	
Operating Bandwidth	2000MHz	
Output Power Psat	100W typ	
Small Signal Gain	56dB min	
Gain Flatness	±1dB	
Input Return Loss	-10dB	
Noise Figure	7dB	
Third Order Intercept Point 2-Tone @33dBm/Tone, 100kHz spacing	+48dBm min	
Harmonics @ Pout = 46dBm	15dB min	
Non-Harmonic Spurious Level	60dBc min	
Operating Voltage VDD	35V typ	Range: 34V-36V
Current Consumption	9A max at Psat	3A max at 10W GSM 2.2A max at 5W UMTS/LTE
Quiescent Current	1.3A typ	
Switching Time	2µS	ON/OFF (TDD Option)
Mechanical		
Dimensions	180mm x 95mm x 26mm	
Weight	800g	
RF Input/Output Connector	SMA Female	
DC Interface Connector	D-Sub 7-Pin Male	
Cooling	External Heatsink	Optional
Surface Finish	Iridite	
Environmental Characteristics (Design to Meet)		
Operating Temperature	-40°C to +70°C	Base Plate Temperature
Storage Temperature	-40°C to +75°C	
Relative Humidity	95%	Non-condensing
Altitude	30,000ft	
Limits		
Input RF Drive Level without damage	+15dBm max	
Load VSWR @ Pout = 100W	3:1 @ all loads phase and amplitude continuous	
Thermal Degradation	+85°C	
DC Interface Connector		
Pin A1	VDD	+34-36V DC
Pin A2	GND	Ground
Pin 1	Enable/Disable	Enable: TTL 'Low' Disable: TTL 'High' or Open
Pin 2	N/C	Not Connected
Pin 3	Forward Power Monitor	Analog DC Voltage
Pin 4	TDD Control (Optional)	Active 'High' STD TTL Logic
Pin 5	Temperature Monitor (Optional)	Analog DC Voltage (0.75V@25°C)

Specification subject to change without notice

SARAS TECHNOLOGY LIMITED



RF AND MICROWAVE FILTER PRODUCTS

Product:	**Switched Harmonic Filter Bank**
SARAS Type Code:	SFB026

Product Description:	Switched Harmonic Filter Bank
Number of Channels	Six
Filter Passbands	50MHz - 75MHz 70MHz - 100MHz 95MHz - 150MHz 145MHz - 200MHz 195MHz – 300MHz 295MHz – 500MHz
Frequency Range:	50-500MHz
Insertion Loss:	5dB Typ.
Unit Isolation	60dB min, 65dB typ
Return Loss	12dB min, Target 15dB
Impedance	50Ω
Input Power (max)	+8dBm
Switching Speed (From 50% TTL to 90%/10% RF)	1µS
Video break through	-80dBm max @ 1MHz BW (tbc)
2nd and 3rd Harmonic at output (tested with +8dBm at input)	-55dBc min, -60dBc target
Logic Input	12 control lines based on 74ACT logic
DC Supply	+12V to +15V
Dimensions:	Maximum envelope 150mm x 100mm x 25mm excluding connectors
Connectors:	RF In and Out: SMA Female Control/DC: 15way D-Type Plug Pin-Out: As per attached table

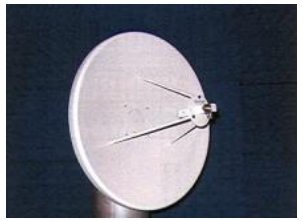
United Kingdom

Monostatic Radar Reflectors
Bistatic Radar Reflectors
Circular Polarized Radar Reflectors

Trihedral Corner Reflectors
TriLens and Buoy Radar Reflectors

Uniform Dielectric Radar Reflectors

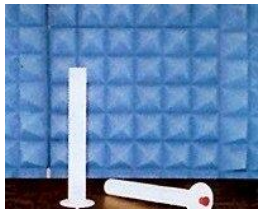
Blade Antenna



Parabolic Reflector Antennas

Spiral Antenna

Feedhorn Antenna



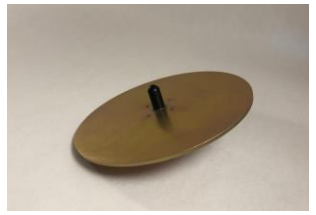
Helix Antenna

Log Periodic Antennas

Dipole Antennas

Lens Corrected Conical Horn Antenna

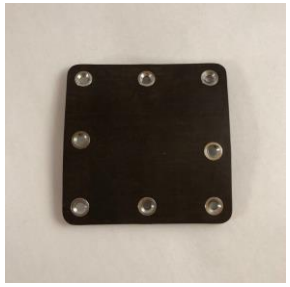
Microwave Hemisphere Lens Antenna



Omni Antenna

GPS Antenna

Microwave Lens Antenna



Radar Altimeter Antenna

GPS Helicone Antenna

GPS Antenna

ROZENDAL
ASSOCIATES INCORPORATED

USA

KA 75 CM ANTENNA SYSTEM

RQT-Ka 75 cm antenna is designed as a low cost, compact and robust Ka-band solution. The system comprises the antenna reflector, feed chain filters, polarizer and related microwave parts. The system is compliant with ITU-R S.465 and EUTELSAT ESOG120 standard.

APPLICATION	KA-BAND REFLEKTOR SYSTEM
TX Frequency	29.5 – 30.0 GHz
RX Frequency	19.7 – 20.2 GHz
Polarity	Circular RHCP up / LHCP down mechanical pol.change
Antenna	Ring focus back fire feed
Flange for connections	WR28, WR42
Main reflector	Diameter 75 cm, depth 15 cm
Return-loss Tx/rx	2o dB
Isolation Tx-Rx	60 dB

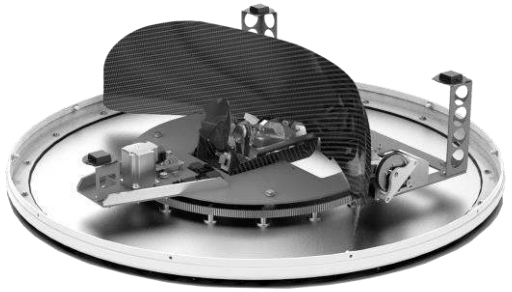
FREQUENCY (GHZ)	GAIN (DBI)	-3 DB (HPBW, DEG)
19.7	42.3	0.6
20.2	42.3	0.6
29.5	45.5	0.4
30.0	45.6	0.4

requtech

PICO75 AND PICO75-AUTO

Manual or autopointing portable satcom antenna terminal is designed as compact and robust carbon fiber for X, Ku and Ka-band operations. The system comprises of Antenna system, Antenna Control Unit (ACU) and casing. The manual system comes with ReQuTech Assisted Pointing Unit (RAP-U) and sensors with WLAN connection to tablet for quick pointing and satellite acquisition. PICO75-auto comes with antenna control unit (ACU) which controls the motorization. Both the manual and automatic system are designed to handle the toughest weather and wind conditions.

X-BAND PICO75	
	ReQuTech feed specifcation
Transceivers	X-band Horn, OMT and filters for optional BUC and LNB
TX Frequency	7.9-8.4 GHz
RX Frequency	7.25-7.75 GHz
EIRP	47.2 dBW (with 25W BUC) / 50.7 dBW (with 55W BUC)
Polarity	Circular RHCP / LHCP, mechanical pol. change
Flange for connections	WR112
Return-loss Tx/Rx	20 dB
Isolation Tx-Rx	70 dB
Tx gain @midband	34.3 dBi
Rx gain @midband	33.6 dBi
Tx AR	1 dB
Rx AR	1 dB
G/T Rx	11.3 dBi/K



COMMUNICATIONON THE MOVE

Designed for hybrid Ku and Ka band operations with mechanical switching and tuning of polarization and frequency bands. Designed for small size, light weight, high gain and good performance applications. Compliant with international standards such as ITU.

PARAMETERS	VALUE
Ku Frequencies	Rx: 10.70 – 12.75 GHz Tx: 13.75 – 14.50 GHz
Ka frequencies	Rx: 19.20 – 20.20 GHz Tx: 29.00 – 30.00 GHz
Polarization	Ku: Linear with skew motor Ka: Circular RHCP&LHCP 4 port
Antenna dimensions	Width: 115 cm Height: 35 cm

SYSTEM OVERVIEW	VALUE
Application	Ku or Ka band SatCom on the Move system Ku or Ka band SatCom on the Paus system
Deployment	Vehicle mounted for SatCom on the Move or on the Paus
Antenna system	Gregorian dual optics
Radome	Aerodynamic shape Electrically optimized for Ku and Ka band operation
Max Platform acceleration	1.3G in horizontal plane. 2G in vertical
BUC and LNB	COTS
Modem	COTS

sweden

IN BUILDING CELLULAR AND WIRELESS TECHNOLOGY

000 PRIMARY/SECONDARY HUB

Frequency Range 136MHz – 2.7GHz
Up to 8 optical or coaxial interfaces to secondary hubs or remote units
Unique software programmable RF combiner architecture enabling flexible service routing
MMF operating distances of at least 550m. SMF operating distances of at least 2km
Web based network management and SNMP interface
RJ-45 Ethernet and Serial management interface
Local monitoring capabilities for hub and remote units via LEDs

REMOTE UNITS
Coaxial and Fibre connected versions
18-20 dBm wideband output power
Remote powering
Ceiling or wall mountable, can be located in roof space
Multi-service capability from 136MHz to 2.7GHz for any service or number of services, irrespective of carrier frequency or protoc

PACIFIC AVE

Singapore

Product Code	PW-IOA-820/2700	PW-IOA-806/6000	PW-O-800/2700	PW-O-700/2700	PW-O-380/2700	PW-P-800/2700	PW-ODA-460D	PW-P2-800/2500	PW-COA-800/2700	PW-IOA-380/6000
Type	Omni Antenna	Omni Antenna	Omni Antenna	Omni Antenna	Omni Antenna	Directional Antenna	Directional Antenna	Bi-Directional Antenna	Omni - Mini Slim/Card	Omni -Super WideBand
Frequency Range	820-890, 890-960 & 1710-2700 MHz	806-960 Mhz, 1.71-2.17, 2.4-2.5, 3.4-3.7, 4.9-6.0 Ghz	800-960, 1710-2700 MHz	698-800 & 801-960, 1710-2700 Mhz	380-960 & 1710-2700 Mhz	800-960, 1710-2700 MHz	800-3000Mhz	806-960, 1710-2500Mhz	800-960, 1710-2700 MHz	380-960, 1710-6000 MHz
3dB HBW	360 deg	360 deg	360 deg	360 deg	360 deg	70 deg	90 deg	65 deg	360 deg	360 deg
3dB VBW	90 deg	To be Adviced	65 deg	< 85 & <45deg	40-90 deg	65 deg	40 deg	25 deg	60-80 deg	60-85 deg
VSWR	<1.5, 1.7 & <1.3	< 2 & <1.6	< 1.5	<1.8 & <1.4	<2.0	< 1.5	<2.0	<1.5	< 1.7	1.7-3.0
Gain	2-3& 4-4.5 dBi	2 – 6 dBi	3-4 dBi	>2 & >5 dBi	1-3 & 4-8 dBi	6-9 dBi	6-9 dBi	5.5 dBi	0 dBi	1-6 dBi
Impedance	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm
Polarization	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical
Max Power	100 Watt	50 Watt	100 Watt	100 Watt	100 Watt	100 Watt	100 Watt	200 Watt	50 Watt	50 Watt
Max weight	400 gram	220 gram	500 gram	300 gram	1,100 gram	900 gram	300 gram	700 gram	35 gram	250 gram
Connector	Nfemale	Nfemale	Nfemale	Nfemale	Nfemale	Nfemale	Nfemale	Nfemale	Nfemale	Nfemale
Dimension	D205xH67mm	D205xH89mm	D165xH100mm	D195x H80mm	D330xH112mm	W173xL220xD44mm	D165xH77mm	405x195x60mm	117x82x1.7mm	D275xH200mm
Picture										
Specification >>	PW-IOA-800/2700	PW-IOA-806/6000	PW-O-800/ 2700	PW-O-700/2700	PW-O-380/ 2700	PW-P-800/2700	PW-ODA.460D-NF	PW-P2-800/2500	PW-COA-800/2700	PW-IOA-380/6000
Factory Test >>	PW-IOA-820/2500+Test	Coming Soon*	PW-O-800/2700+Test	Coming Soon*	Coming Soon*	PW-P-800/2700+Test	PW-ODA-460D+Test	Coming Soon *	Coming Soon*	Coming Soon*

skyfront

THE EASIEST, SAFEST AND LONGEST ENDURANCE HYBRID MULTIROTOR ON THE MARKET

The Perimeter 8 UAV features an impressive 12 lb. / 5.5 kg payload capacity with 1 hour of endurance and a no-payload endurance of over 5 hours. The Perimeter 8 is just as easy to operate as the Perimeter 4, but has full propeller, motor, and ESC redundancy. This redundancy in addition to electronic fuel injection and a 5 minute battery backup reserve flight time ensures the safety of high-value payloads.

5+ HOURS
Flight Endurance
12 LB (5.5 KG) @ 1 HOUR
Payload Capacity
100 KM / 60 MILES*
Video and Control Range
< 5 MINUTES
Setup time

Performance	
Maximum Speed	36 mph (57 km/hr)
Cruise Ground Speed	22 mph (35 km/hr)
Maximum Endurance *	5+ hours without payload 2.5+ hours with 6.5 lb. (3 kg) payload 1+ hour with 11 lb. (5 kg) payload
Maximum Expected Range (at cruise speed)	No Payload – 110 miles (177 km)
Maximum Tested Wind Speeds	25 mph (35 km/hr)
Maximum Payload Capacity	12 lb.+ (5.5 kg) payload with 2.2 lb (1 kg) fuel (1 hour).
Minimum Expected Temperature	15°F (-10°C)
Maximum Expected Temperature	122°F (50°C)

Size	
Tip-to-Tip length	Arms removed: 2 feet x 2.66 feet (0.6 m x 0.81 m) Ready to fly: 6.5 feet x 6.25 feet (2 m x 1.9 m)
Minimum Height	14.5" (0.37 m)
Height	Customizable to fit payload
Maximum Takeoff Weight	42 lb (19 kg)

USA

Quasar

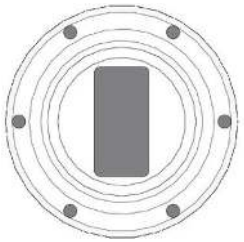
Quasar Microwave Technology Limited

Bends

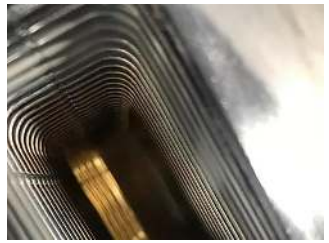
Complex Assemblies

Bends

Couplers



Flanges



Flexible Waveguide

Gaskets & Seals

Rotary Joints

Quick Release

Straights

Tapers

Terminations

Twists

United Kingdom

DiTom MICROWAVE INC.

DiTom Microwave 27.00 – 31.00 GHz Ka band Space Qualified Isolator

Technical Data Sheet DS1017

Configuration

Connector 1	2.92mm Female
Connector 2	2.92mm Female
Frequency Range (GHz)	27.00 – 31.00
Design	Isolator

Electrical Specifications

Frequency Range (GHz)	27.00 – 31.00
Impedance (Ohms)	50
Isolation (dB Min)	20
Insertion Loss (dB Max)	0.60
VSWR (dB Max)	20
Forward Power (Watts)	5
Peak Power (Watts)	30
RF Leakage (dBi)	-70

Connector 1 and Connector 2

Contact Material and Plating	Beryllium Copper, Gold
Connector Material and Plating	Passivated Stainless Steel
Body Material and Plating	Passivated Stainless Steel

Size

Length: inches (mm)	0.50 (12.70)
Width: inches (mm)	0.70 (17.78)
Height: inches (mm)	0.50 (12.70)

Weight

Ounces:	0.70
Grams:	20

Qualification Test Profiles

Please contact us at 559.255.7042 or sales@ditom.com

Acceptance Test Profiles

Please contact us at 559.255.7042 or sales@ditom.com

7592 N. Maroa Ave. - Fresno, CA 93711 - Tel: 559.255.7042

Fax: 559.255.1667 - Web: www.ditom.com - Email: sales@ditom.com

DiTom MICROWAVE INC.

Frequency Range	Model Number	Isolation Min	Insertion Loss Max	VSWR Max	Pricing 1 - 24
0.50 - 1.00	D3C0501	14	1.00	1.50	$2,495
0.50 - 0.70	D3C0507	17	0.60	1.35	$695
0.698 - 1.00	D3C0710S	16	0.60	1.40	$595
0.698 - 1.00	D3C0710N	16	0.60	1.40	$595
0.80 - 2.00	D3C0802S	14	1.00	1.50	$950
0.80 - 2.00	D3C0802N	14	1.00	1.50	$950
0.95 - 1.70	D3C9517S	18	0.50	1.30	$595
0.95 - 1.70	D3C9517N	18	0.50	1.30	$595
0.95 - 2.15	D3C9521S	12	1.00	1.65	$795
0.95 - 2.15	D3C9521N	12	1.00	1.65	$795
1.00 - 2.00	D3C0102S	18	0.50	1.30	$595
1.00 - 2.00	D3C0102N	18	0.50	1.30	$595
1.50 - 3.00	D3C1530	16	0.70	1.40	$795
1.70 - 2.50	D3C1725	17	0.60	1.35	$350
1.70 - 2.70	D3C1727	20	0.50	1.25	$595
2.00 - 8.00	D3C2080	9	1.75	2.10	$795
3.00 - 9.00	D3C3090	14	1.00	1.50	$595
4.00 - 12.00	D3C4012	14	1.00	1.50	$695
5.00 - 15.00	D3C5015	14	1.00	1.50	$495
6.00 - 18.00	DMC6018	14	1.00	1.50	$695
18.00 - 40.00	D3C1840	12	1.70	2.00	$1,300
26.50 - 40.00	D3C2640	14	1.00	1.50	$900
27.00 - 31.00	D3C2731	20	0.60	1.25	$695

FEATURED PRODUCTS

5G Band Isolator Broadband 26.50 - 40.00 GHz

Isolation:	14 dB Min
Insertion Loss:	1.00 dB Max
VSWR:	1.50:1 Max

D3I2640

Q Band Isolator Broadband 37.00 - 43.00 GHz

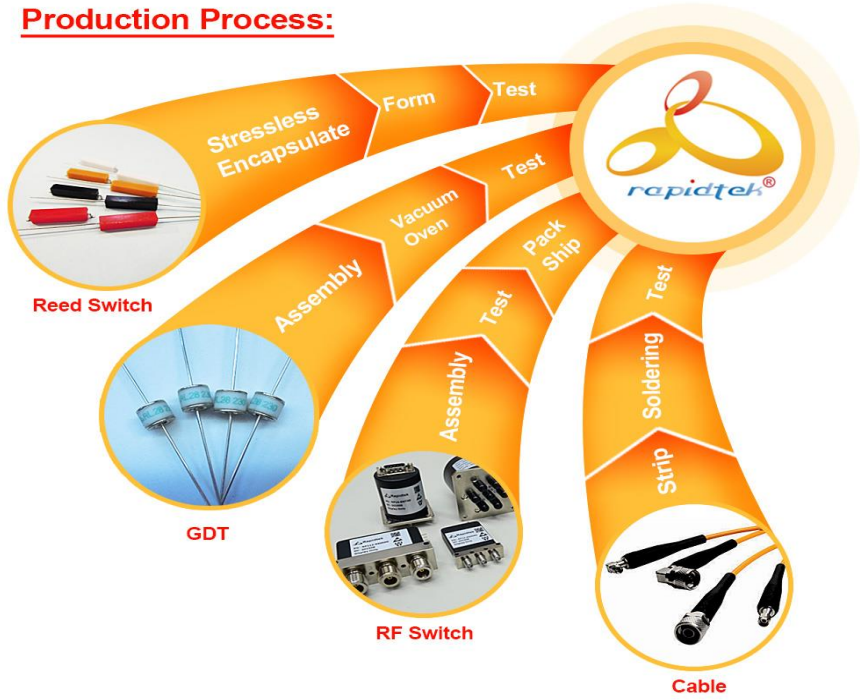
Isolation:	14 dB Min
Insertion Loss:	1.20 dB Max
VSWR:	1.35:1 Max

D3I3743Q

USA

5G rapidtek®

Production Process:



5G NR test

FR1 (DC 410 MHz to 7125 MHz)


RF Shielding Box
DC~18GHz


RF Switch Box
DC~18GHz


RF Cable
DC~18GHz

FR2 (DC 24.25 GHz to 52.6 GHz)


RF Shielding Box
DC~50GHz


RF Switch Box
DC~40GHz


Up-Down Converters
DC 28GHz & 39GHz

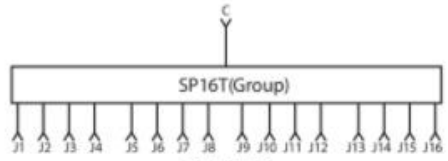
High Power Switch box

RP Switching Box Series allows switching of multiple signals without physically changing the connections.
It provides the life and reliability required for automated test and measurement, signal monitoring and routing applications.

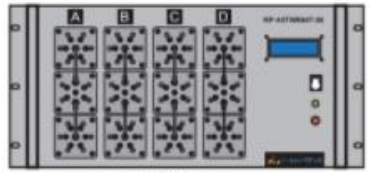
High Performance Switches for RF Applications
- Wide Frequency range, high Isolation, low insertion loss and high repeatability (Please refer to the specifications below for details).
- Guranteed 5 Million cycles operating life (1 million cycles with additional indicator)

Flexible and Econimic Configuration
- Economical price minimizes budgetary contraints
- Flexible configuration to meet various application demands

Optional Control Application
- Remote Control Interface : GPIB / RS232 / USB
- Manual Control Applications : Touch Panel / Button / External Keyboard



SCHEMATIC



EXTERIOR

*Image for reference

FEATURE SPECIFICATIONS	
RF PATH	SP16T x 4 (Unit : SP6T x 3)
CONNECTORS	K(2.92mm) (F)
FREQUENCY RANGE	DC ~ 40 GHz
OPERATING LIFE	5 million cycles (RF contact)
MAX POWER RATING	1 watt (CW) average into 50 Ω loads
OPTIONAL CONTROL I/O	RS232
OPTIONAL MANUAL	N/C
AC INPUT	110V/220V 150W

PERFORMANCE CHARACTERISTICS	TEST CONDITION	SPECIFICATION
INSERTION LOSS	DC ~ 18 GHz	1.4 dB Max
	18 ~ 26.5GHz	1.8 dB Max
	26.5 ~ 32GHz	2.0 dB Max
	32 ~ 40GHz	2.4 dB Max
ISOLATION	DC ~ 18 GHz	60 Min
	18 ~ 26.5GHz	55 Min
	26.5 ~ 32GHz	50 Min
	32 ~ 40GHz	50 Min
VSWR	DC ~ 18 GHz	1.80 Max
	18 ~ 26.5GHz	2.00 Max
	26.5 ~ 32GHz	2.20 Max
	32 ~ 40GHz	2.40 Max

- RF Cable
  Up to 110GHz
- Coaxial Attenuator
  up to 40GHz
- Coaxial Termiantion
  up to 40GHz
- RF Adaptor
- RF Conductive Probe

- EM RF Switch
  Frequency up to 67GHz
- RF Switch BOX
  SolidState
  Mechenical (High power)
- RF Shielding Box-Customized

Taiwan

Power Divider 2.92mm 4Way 25GHz~40GHz

PRODUCT ENQUIRY

Power Divider 2.92mm 2Way 25GHz~40GHz

PRODUCT ENQUIRY

Power Divider N 4Way 0.5GHz~6.0GHz

PRODUCT ENQUIRY

Power Divider N 2Way 0.5GHz~6.0GHz

PRODUCT ENQUIRY

Power Divider, SMA 8Way 0.5 ~6.0GHz

PRODUCT ENQUIRY

Power Divider, SMA 8Way 0.7 ~4.0GHz

Power Divider, SMA 4Way 0.5 ~6.0GHz

Power Divider, SMA 4Way 0.7 ~4.0GHz

Power Divider, SMA 2Way 0.5 ~6.0GHz

Power Divider, SMA 2Way 0.7 ~4.0GHz

FILTER

SRTechnology RF Filter products availability includes:
Multiplexer, Duplexer, Combiner, Band Rejection Filter, Band Pass Filter, Diplexer.

- Low PIMD, High Power Handing.
- 30MHz to 20GHz
- High"Q" and various "Q"
- Low Insertion Loss & Good Attenuation.
- Comb-line, Inter-Digital
- Excellent Temperature Stability
- Custom Design
- The smallest size.

DIVIDER

- VERY BROAD APPLICATION SUCH AS 5G APPLICATION, MILITARY AND MICROWAVE
- VERY SHORT LEAD TIME.

TERMINATION

- 1,2,5,10,30,50,100,200,300,500WATT
- 100% INPUT TEST AND IN-HOUSE INSPECTION APPROVED

ATTENUATOR

- 1,2,5,10,30,50,100,200,300,500,1000WATT, VAR ATT
- MINIMIZED HEATSINK AND VERY RELIABLE POWER CAPACITY

Korea

Standard Pulsed Amplifiers

Model No.	Frequency	Peak Power	Max. duty cycle	Max.pulse width	Low power CW
BT00250-AlphaA	10kHz-3MHz	250W	20%	100ms	Yes
BT00500-AlphaA		500W	20%	100ms	Yes
BT01000-AlphaA BT01000-AlphaA100ms		1kW	20%	10ms 100ms	Yes
BT02000-AlphaA BT02000-AlphaA100ms		2kW	20%	10ms 100ms	Yes
BT00250-AlphaS	100kHz-30MHz	250W	20%	100ms	Yes
BT00500-AlphaS		500W	20%	100ms	Yes
BT01000-AlphaS BT01000-AlphaS100ms		1kW	20%	10ms 100ms	Yes
BT02000-AlphaS BT02000-AlphaS100ms		2kW	20%	10ms 100ms	Yes
BT04000-AlphaS		4kW	20%	100ms	Yes
BT00250-AlphaSA	500kHz-150MHz	250W	20%	100ms	Yes
BT00500-AlphaSA		500W	20%	100ms	Yes
BT01000-AlphaSA BT01000-AlphaSA-100ms		1kW	20%	10ms 100ms	Yes
BT02000-AlphaSA		2kW	20%	100ms	Yes
BT00100-Gamma	5-400MHz	100W	20%	300ms	Yes
BT00250-Gamma		250W	20%	300ms	Yes
BT00500-Gamma		500W	20%	300ms	Yes
BT01000-Gamma		1kW	20%	300ms	Yes
BT01000-GammaS	5-310MHz	1kW	20%	300ms	Yes
BT00100-Delta	100-600MHz	100W	20%	300ms	Yes
BT00250-Delta		250W	20%	300ms	Yes
BT00500-Delta		500W	20%	300ms	Yes
BT01000-Delta		1kW	20%	300ms	Yes

TOMCO TECHNOLOGIES

Standard CW Amplifiers

Model No.	Frequency	Peak Power
BT00100-AlphaS-CW	100kHz-30MHz	100W
BT00250-AlphaS-CW		250W
BT00500-AlphaS-CW		500W
BT01000-AlphaS-CW		1kW
BT00100-AlphaSA-CW	0.5MHz-150MHz	100W
BT00250-AlphaSA-CW		250W
BT00500-AlphaSA-CW		500W

RF Amplifiers for Particle Accelerators

Model no:	Frequency	Peak power	Maximum duty cycle	Maximum pulse width	Notes
VT8C	Fixed freq in the range 10-200MHz	8kW	5%, 10% or 15%*	Approx.1ms Higher pulse width systems available	Power derated to 7kW, 14kW, 20kW, 28kW, 45kW, 90kW at 15% duty Single output and multi-channel sytems available
VT16C		16kW			
VT24C		24kW			
VT32C		32kW			
VT48C		48kW			
VT96C		96kW			

Australia

TWT

The Service Manual provided by Quarterwave on all products is exceptional. Overview, Configuration, Theory of Operation, and Modular sections provide understanding to those unfamiliar with high performance, high voltage supplies. Block Diagrams, Schematics, Circuit Descriptions, and Bills of Material are complete. Colored sections and photographs provide easy orientation and a level of sophistication not found in this industry.

Frequency	Power	Duty Cycle	Click on Model Number to View Data Sheets	**Model View Data Sheets**
Octave	1-2 GHz	1.0 kW	4%	9108/96004-C10D20
	2-4 GHz	1.5 kW	6%	9108/96206-E20G40
	2-4 GHz	4.0 kW	6%	9114/96606 E20F40
	4-8 GHz	2.0 kW	6%	9108/96306-F40H80
	4-8 GHz	4.0 kW	6%	9114/96606-G40H80
	8-12 GHz	1.5 kW	6%	9108/96206-H80J12
	8-12 GHz	4.0 kW	6%	9114/96606-H80J12
	12-18 GHz	2.0 kW	6%	9108/96306-J12J18
Broad	0.8-2.8 GHz	200 Watts	50% - CW	9108/95350-C8E28
	2-8 GHz	200 Watts	50% - CW	9108/95350-E20H80
	8-18 GHz	200 Watts	50% - CW	9108/95350-H80J18
	1-2.5 GHz	1.0 kW	6%	9108/96006-C10E25
	2-8 GHz	1.5 kW	6%	9108/96206-E20H80
	8-18 GHz	4.0 kW	6%	9114/96506-H80J18
	6.5-18 GHz	1.5 kW	6%	9108/96206-H65J18
Narrow	1.2-1.4 GHz	5 kW	2%	9108/96702-D13
	3-4 GHz	10 kW	2.5%	9108/97003-F30F40
	8.0-12.0 GHz	10 kW	8%	Series 2004 2004/97008-H80J12
	9.2-9.9 GHz	40 kW	0.2%	Series 4000/4200 (Special) Call
	9-10 GHz	4 kW	10%	9108/96610-I90I10
	9-10 GHz	8 kW	5%	9108/96905-I90I10
	33-36 GHz	100 Watts	20%	9108/95020-K33K36

Band	Frequency	Power	**Model View Data Sheets**
Octave	1-2.5 GHz	500 watts	9800/95700-C10E25
	2-4 GHz	500 watts	9800/95700-E20F40
	4-8 GHz	500 watts	9800/95700-G40H80
Broad	2.5-7.5 GHz	500 watts	9800/95700-E25H80
	8-18 GHz	500 watts	9800/95700-H80J18
Narrow	27-30 GHz	200 watts	9800/95300-K27K30

and	Frequency	Power	**Model View Data Sheets**
Octave	1 - 2 GHz	200 Watts	9820/95300-C10D20
	2 - 4 GHz	200 Watts	9820/95300-E20F40
	4 - 8 GHz	200 Watts	9820/95300-G40H80
	8 - 12 GHz	200 Watts	9820/95300-H80J12
	12 - 18 GHz	200 Watts	9820/95300-J12J18
Wide	0.8 - 2.8 GHz	200 Watts	9820/95300-C80E28
	2 - 8 GHz	200 Watts	9820/95300-E20H80
	8 - 18 GHz	200 Watts	9820/95300-H80J18
	18-40 GHz	80 Watts	9820/94900-J18K40
Narrow	17.6 - 18.4 GHz	200 Watts	9820/95300-J17J18
	27.5 - 29.5 GHz	120 Watts	9820/95100-K27K30

Performance:
Initially developed for radar systems, the power supplies in Quarterwave amplifiers were designed using patented technology to provide the quietest RF amplification without introducing spurious signals. Unlike flyback and feed forward circuits, these solid state quasi-resonant switch mode supplies operate without high power square waves. This results in less EMI/RFI which is amplified by the TWT, and greater reliability due to reduced stress to the magnetic and semiconductor components

USA

LTC MICROWAVE

- ACTIVE LIMITER
- BIAS TEES
- COAXIAL ISOLATOR AND CIRCULATORS
- HIGH POWER AMPLIFIERS
- LOW NOISE AMPLIFIERS
- MEDIUM POWER AMPLIFIERS
- POWER DIVIDERS AND COMBINERS
- RF MICROWAVE SWITCH (ABSORPTIVE)
- RF MICROWAVE SWITCH (REFLECTIVE)

ELECTRICAL SPECIFICATIONS @ +28V_{DC}, 25°C, 50Ω Module

Parameter	Specifications					Test results (MHz)			
	Symbol	Min	Typ	Max	Units	2400	4200	6000	Note
Operating Frequency	BW	2400		6000	GHz	-	-	-	
Output Power CW @ Pin= 0dBm	P_{SAT}	30	40		Watt	37	35	36	Plot 2
Output Power @ 1dB Gain Compression	P_{1dB}		10		Watt	5	6	8	Plot 1
Power Gain @ P_{SAT}, Pin= 0dBm	G_{SAT}	43	45		dB	45.7	45.5	45.6	Plot 2
Input Power for Rated P_{SAT}	P_{IN}		0		dBm	-6.0	-4.5	-3.0	
Power Gain Flatness, Pin= 0dBm	ΔG		±1.0	±1.5	dB	-	2.3	-	Plot 2
Input Return Loss	S_{11}			-10	dB	-16	-27	-12	Plot 1
3rd IMD 2-Tones @ 34dBm/Tone, 100KHz Spacing	IM3		-32		dBc	-28	-28	-28	
	IP3		+50		dBm	+48	+48	+48	
Harmonics @ Pout=10W	2nd		-20		dBc	-18	-27	-52	
	3rd		-20			-33	-41	-	
Spurious Signals	Spurs		-70	-60	dBc	<-60	<-60	<-60	
Switching Time, 1KHz TTL, Pin=0dBm	T_{ON}			5	μSec	-	1.84	-	
	T_{OFF}			5		-	4.40	-	
Operating Voltage	V_{DC}		28		Volt	-	28	-	
Current Consumption @ Shutdown	I_{DQ}		0.1		Amp	-	0.1	-	
Quiescent Current @ RF off, Enable	I_{DQ}		4.0		Amp	-	2.92	-	
Current Consumption @ Pout=30W	I_{DD}			7.2	Amp	6.78	6.15	5.30	
Current Consumption @ Pin= 0dBm	I_{DD}			9.0	Amp	7.60	6.70	5.90	
	Pout	45			dBm	45.7	45.5	45.6	

- 6-18GHz, 200W SSPA RACKMOUNT LPA06185253RM
- 18-26.5GHz, 10W SSPA RACKMOUNT LPA18263940RM
- 18-26.5GHz, 100W SSPA RACKMOUNT LPA18265050RM
- 26.5-40GHz, 10W SSPA RACKMOUNT LPA26404040RM
- 26.5-40GHz, 100W SSPA RACKMOUNT LPA26404950RM
- 2-18GHz, 100W SSPA RACKMOUNT LPA02184650RM
- 18-40GHz, 10W SSPA RACKMOUNT LPA18404040RM
- 30-40GHz, 1000W SSPA RACKMOUNT LPA30406060RM
- 42-46GHz, 10W SSPA RACKMOUNT LPA42464046RM

Customers

GENERAL ATOMICS

NCSIST

L3HARRIS

HUAWEI

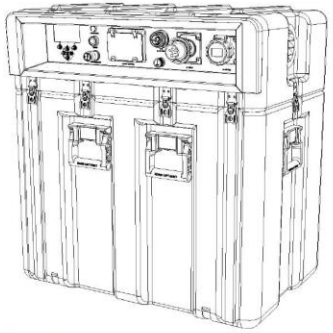
NASA

USA

RENOVA GEN

FAST FOLD Energy Hub

FFENERGYHUB-05 / FFENERGYHUB-10



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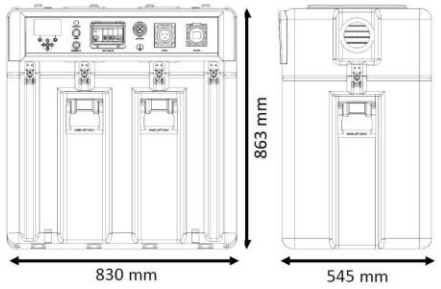
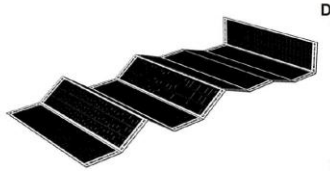


Model Number	FFENERGYHUB-05	FFENERGYHUB-10
Product Weight	96 KG	125 KG
Battery Capacity (Nominal)	5.0 KWH	10.0 KWH
Battery Capacity (Usable)	4.0 KWH	8.0 KWH
Battery Pack Weight	1 X 28.6 KG	2 X 28.6 KG
Battery Certification	UN 38.3	UN 38.3
Maximum AC Output (Continuous)	1.44 KW	2.88 KW
Maximum AC Output (10 minutes)	3.00 KW (PF=1)	3.00 KW (PF=1)
	2.40 KW (PF=0.8)	2.40 KW (PF=0.8)
Maximum AC Output (10 seconds)	6.00 KW	6.00 KW
Maximum AC Input Current	16 A	16 A
AC Voltage Specification	230/240 V 50 HZ	230/240 V 50 HZ
Solar Input Max. Capacity	1.5 KW	3 KW
Maximum PV Open Circuit Voltage	145 V	145 V
Maximum PV Short Circuit Current	70 A	70A
Electrical Safety Equipment	Integrated circuit protection devices, emergency off switch	
Colour Display	Energy consumption, solar generation and battery storage	
Transportation	Shock proof mounting of key components for transportation resilience (FFENERGYHUB-05 transportable as air cargo)	
Start-up Time	Less than 10 seconds	
IP Rating	IP44	
	Fully waterproof (IP67 equivalent) up to 700 mm height	

FAST FOLD Mat

FFMAT-08 / FFMAT-10



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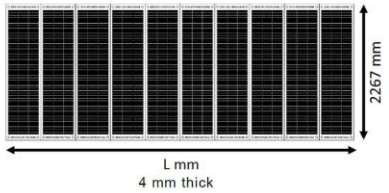

Model Number	FFMAT-08	FFMAT-10
Peak Power	0.8 KW	1.0 KW
Length (L)	5.0 M	5.5 M
Product Weight	28 KG	35 KG
Rated Voltage	71.2 V	89 V
Rated Current	11.2 A	11.2 A
Open Circuit Voltage	93.2 V	116.5 V
Short Circuit Current	12.8 A	12.8 A
Deployment Time	Less than 2 minutes	
Mat Construction	Flexible solar modules bonded to a high strength PVC-coated polyester fabric. Reinforced HF-welded hemmed border with steel eyelets for securing the mat	
Connection	Connected to Fast Fold Energy Hub with quick release secure IP68 cable	
IP Rating	IP67	

	MODEL*		
	RAPID ROLL 4 \ 10	RAPID ROLL 7 \ 60	RAPID ROLL 11 \ 120
ELECTRICAL SPECIFICATION			
PV TECH	CIGS	CIGS	CIGS
NO OF MODULES	12	24	36
MODULE POWER	300 W	300 W	300 W
TOTAL PV POWER	**3.6 kWp**	**7.2 kWp**	**10.8 kWp**
INVERTER SYSTEM			
Electrical specification (split phase also available)	Single Phase 120 V / 60 Hz or 230 V / 50 Hz**	Single Phase 120 V / 60 Hz or 230 V / 50 Hz**	Three Phase 208 V / 60 Hz or 400 V / 50 Hz
Maximum output power (30 second peak/3 sec surge)	8.0 kW (9.1 kW / 11 kW)**	8.0 kW (9.1 kW / 11 kW)**	24 kW (27.3 kW / 33 kW)
Max rated continuous output power	6 kW**	6 kW**	18 kW
BATTERY STORAGE			
Battery Bank Nominal Capacity	**10 kWh**	**60 kWh**	**120 kWh**
Cell Technology	Lithium - NMC	Lithium - NMC	Lithium - NMC
Battery Management System	Automatic, over voltage, under voltage, short circuit protection, temp protection, charge tracking, cell control & active balancing, charge profile control		
Battery bank useable capacity	8 kWh	48 kWh	96 kWh
Battery max Charge rate	6.7 kW	6.7 kW	20.1 kW
Back up time at typical average power	5 hrs	32 hrs	64 hrs

*Model number indicates PV and battery power capacities - e.g. 11 / 120 indicates 11 kWp PV and 120 kWh battery. Battery capacity may be scaled up/down in increments of 10 kWh to a maximum of 120 kWh.

**3-Phase 24kW / 18kW continuous available as an option.

United Kingdom