IMPULSE TECHNOLOGIES INC.

AN INTERNATIONAL COMPANY

SIGNAL

THE RF / MICROWAVE / MILLIMETER-WAVE REVIEW

01

VOL. 01 / 2026

THE HARDWARE BEHIND WHAT'S NEXT

AEROSPACE / DEFENSE / SATCOM / TELECOMMUNICATIONS

INSIDE ISSUE 01

OPENING ESSAY

EVERY LINK IS PHYSICAL.

Digital commands still cross real hardware.

ORIGINAL EDITORIAL ART / SATELLITE, TERRESTRIAL AND GROUND-STATION SIGNAL PATHS

The network can be digital. The commands can be software-defined. The signal still crosses real connectors, transitions, cables, phase paths, waveguide and free space.

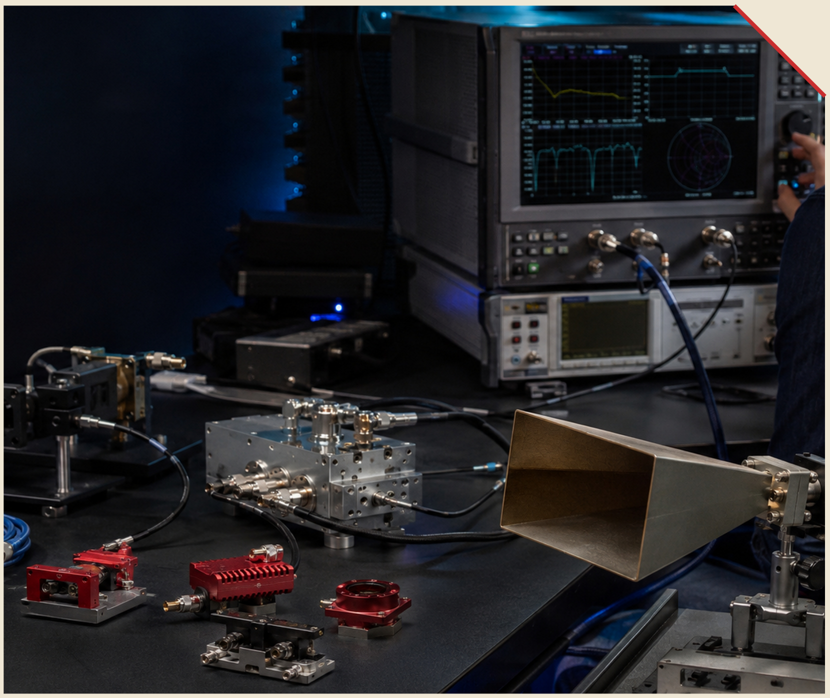
Impulse Technologies manufactures mechanical RF and microwave hardware and connects engineering and procurement teams to a broader network of qualified component sources.

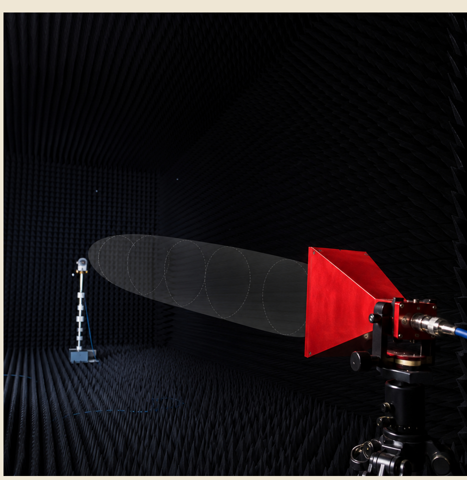
THE COMPLETE PATH

SIGNAL follows that complete path: source, level, phase, transition, radiation, propagation, reception and measurement. Phase shifters remain an Impulse specialty, but they are one part of a wider RF system.

CONTENTS

ARTICLES / PRODUCTS / FIELD NOTES / INDUSTRY





ISSUE 01 / EDITORIAL PROMISE

USEFUL BEFORE COMMERCIAL.

Every feature should help someone design, test, specify or buy more intelligently. Product values are labeled as published data. General RF principles stay separate from model-specific claims.

EDITOR'S NOTE

THE MAGAZINE DIDN'T DIE.

The delivery system changed.

The idea for this issue starts with a memory from inside Impulse: there was a time when companies were introduced through trade magazines, printed catalogs and technical advertisements that stayed on a desk for months.

That behavior did not disappear. It fragmented. Engineers now move between application notes, search results, PDFs, inboxes, video, forums, distributor pages and standards documents. Buyers do the same, but with a different question: who can supply the right part, with defensible data, when the program needs it?

A modern magazine should not imitate social media and it should not become a catalog wearing an editorial costume. It should slow the subject down just enough to connect principles, hardware, measurement and procurement. It should be worth saving even when it is read on a screen.

That is the purpose of SIGNAL. Phase shifters remain an Impulse specialty and receive serious coverage, but the publication follows the complete RF path: level control, transmission, coax-to-waveguide transitions, antennas, test methods, satellite links, telecommunications, aerospace and the decisions that connect engineering with supply.

This first issue is a design and editorial prototype. Published product ranges are drawn from public Impulse pages. Industry developments are grounded in primary sources from 3GPP, ITU, NASA and NIST. Model-specific release still requires controlled technical review.

FROM PRINT TO PLATFORM

1991	2000s	2010s	2026
trade journals	search + PDF	email + social	one story / many formats

SAMIUL HAQ

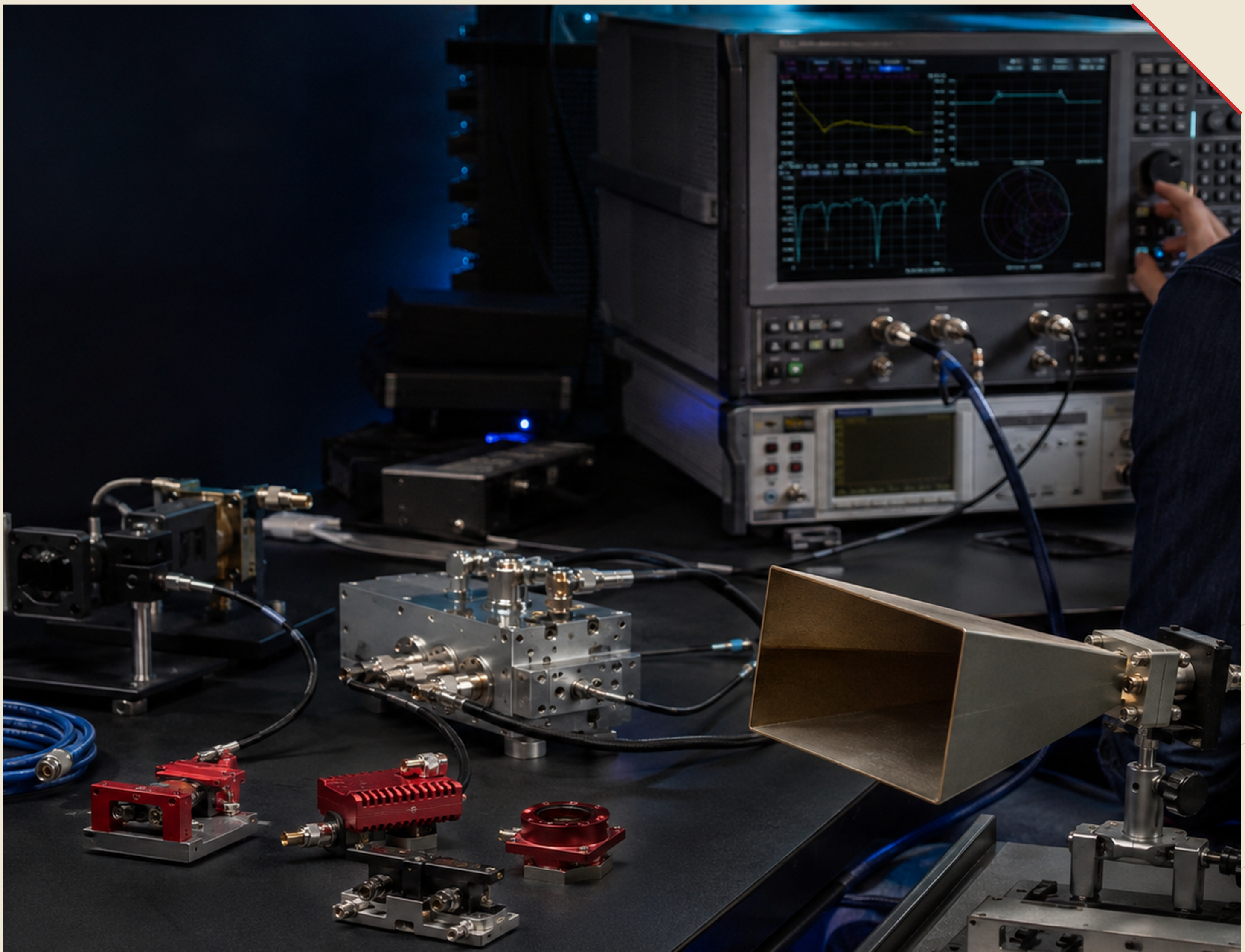
EDITORIAL CONCEPT AND PRODUCTION

01 / 2026

COVER FEATURE

MECHANICAL CONTROL IN A DIGITAL RF WORLD.

Software defines the state. Hardware determines what reaches the device under test.



PHASE / LEVEL / TRANSITION / RADIATION / MEASUREMENT

ORIGINAL EDITORIAL ART

BY SIGNAL EDITORIAL

A system-level feature on the physical hardware between command and result.

THE SYSTEM DOES NOT SEE A COMPONENT.

It sees the accumulated electrical behavior of the entire path.

An RF bench can look deceptively simple: source, cable, device, receiver. In practice, every interface contributes electrical length, mismatch, loss and uncertainty. The mechanical hardware between instruments is not a collection of accessories. It is the signal path.

This is why continuously adjustable phase and attenuation remain useful even when the surrounding system is digitally controlled. They let an engineer introduce a known physical change without rebuilding the chain. A mechanical control can be observed, locked, repeated and correlated with measured S-parameters.

PHASE IS PATH LENGTH

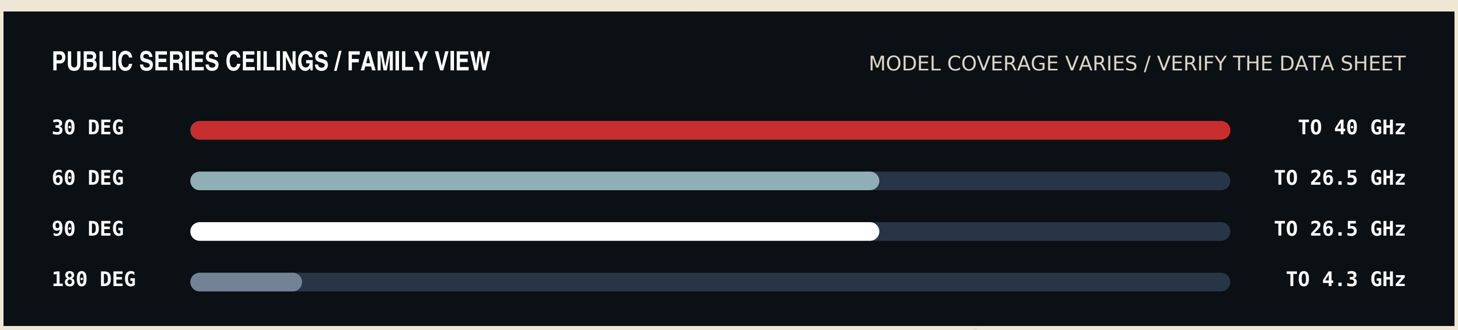
A phase shifter changes the electrical delay experienced by a signal. For a fixed path-length change, phase shift grows with frequency. The same mechanical setting therefore does not represent one universal phase value across an unlimited band. Published frequency coverage, maximum nominal shift, insertion loss, return loss, power, connector and control details belong together.

Impulse publishes four mechanical phase-shifter series: 30 degree models through 40 GHz, 60 and 90 degree series through 26.5 GHz, and 180 degree models through 4.3 GHz. Those are series-level public ranges, not permission to assume that every model covers the ceiling.

LEVEL IS ALSO PART OF THE EXPERIMENT

A continuously variable attenuator makes amplitude a controllable condition. That matters when characterizing receiver sensitivity, establishing compression behavior, balancing channels, setting a repeatable stimulus or protecting downstream equipment. The useful specification is not merely maximum attenuation. It includes frequency range, attenuation range, flatness, insertion loss, VSWR, power handling, impedance, form factor and adjustment method.

Impulse publishes 06, 07 and 08 attenuator families. Public descriptions position 06 as the higher-frequency family, 07 across 2 to 18 GHz with up to 40 dB, and 08 as the lower-frequency family with ranges up to 60 dB. Model selection still requires the approved data sheet.



The useful unit is not the component alone. It is the verified state of the path.

SYSTEM VIEW

FOLLOW THE SIGNAL.

Every interface changes what the receiver reports.

- **01** SOURCE — known stimulus
- **02** LEVEL — attenuation
- **03** PHASE — delay
- **04** TRANSITION — coax to waveguide
- **05** RADIATE — horn / antenna
- **06** RECEIVE — measure

THE REFERENCE PLANE IS AN EDITORIAL DECISION IN METAL

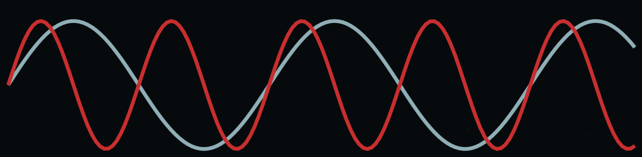
Calibration defines where the measurement begins. Move the cable, add an adapter, change a connector torque or introduce a transition after calibration and the measured system is no longer identical to the calibrated one. Good test writing names the reference plane instead of hiding it.

A mechanical phase shifter belongs where its effect can be isolated. An attenuator belongs where its power and mismatch conditions are understood. A coax-to-waveguide adapter belongs in the uncertainty budget, not outside it. A horn antenna turns the guided field into a free-space problem with alignment, polarization, distance and environment added.

ELECTRICAL LENGTH

$$\text{phase shift} = 360 \text{ degrees} \times \text{frequency} \times \text{delay}$$

For a fixed time delay, phase grows linearly with frequency.



LOWER FREQUENCY   LONGER CYCLE   HIGHER FREQUENCY / MORE PHASE PER DELAY

WHAT MUST TRAVEL WITH THE PART

01 Frequency range and operating band

02 Insertion loss and return-loss / VSWR limits

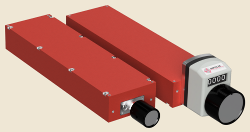
03 Nominal phase or attenuation range

04 Power, connectors, control and mounting

05 Test conditions, calibration state and acceptance method

ENGINEERING NOTE

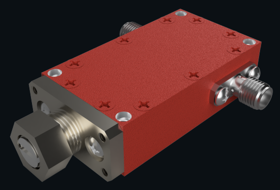
TWO KNOBS.
TWO DIFFERENT QUESTIONS.



PHASE CONTROL

Question: How does relative electrical timing change?

Use: Phase alignment, beamforming tests, calibration and controlled delay.



LEVEL CONTROL

Question: How does signal magnitude change?

Use: Receiver sensitivity, compression testing, level setting and channel balance.

THE MATH IS SIMPLE. THE MEASUREMENT IS NOT.

Phase: phi = 360 f delta-t. A fixed delay corresponds to more degrees as frequency increases. A model's usable phase range therefore belongs to its published frequency coverage and test conditions.

Attenuation: A(dB) = 20 log10(Vin/Vout) for voltage ratios at equal impedance, or 10 log10(Pin/Pout) for power. A 20 dB reduction is a 10:1 voltage ratio and 100:1 power ratio.

Interaction: neither control is perfectly isolated from the rest of the network. Adjustment can change insertion loss, match, phase, repeatability or power stress. The correct question is not whether the knob moves. It is whether the complete state stays inside the application's error budget.

PUBLISHED SERIES RANGE IS A STARTING POINT.

A released model number and controlled data sheet must close the selection.

FIELD REPORT

ORBIT TO GROUND.
ONE SIGNAL PATH.

Higher data rates change the hardware and environmental budget.

UHF / S / X / KA — ORIGINAL EDITORIAL ART / NOT A SYSTEM DIAGRAM

Small-satellite communications commonly use several frequency families. Mature VHF and UHF links coexist with movement toward S, X and Ka where higher data rates are required.

Higher bands make connector geometry, waveguide transitions, pointing, cable movement, propagation and measurement discipline increasingly visible.

FIELD REPORT

HIGHER BANDS. TIGHTER DISCIPLINE.

Bandwidth grows. So does sensitivity to loss, alignment and environment.

NASA's 2026 Small Spacecraft Technology State of the Art notes that small-satellite communications commonly consider UHF, S, X and Ka bands. VHF and UHF remain mature for CubeSat links, while the move toward S, X and Ka has been driven by the need for higher data rates.

That migration changes the physical budget. At higher frequency, shorter wavelengths make connector geometry, flange alignment, surface condition, cable movement, antenna pointing and atmospheric effects more visible. Ka-band systems can support high-rate links, while rain attenuation and propagation conditions become material design concerns.

THE TRANSITION IS PART OF THE LINK

A coax-to-waveguide adapter is where field geometry changes. It cannot be treated as a transparent fitting. Frequency range, waveguide size, flange, connector, return loss, insertion loss, power and mechanical interface determine whether the transition belongs in the system.

Impulse publishes waveguide-to-coax adapter families from WR650 through WR28, spanning 1.12 to 40 GHz on a model-dependent basis. Standard connector families include Type N, SMA and 2.92 mm. The full model data remains the selection authority.

ANTENNA GAIN DOES NOT ERASE ALIGNMENT

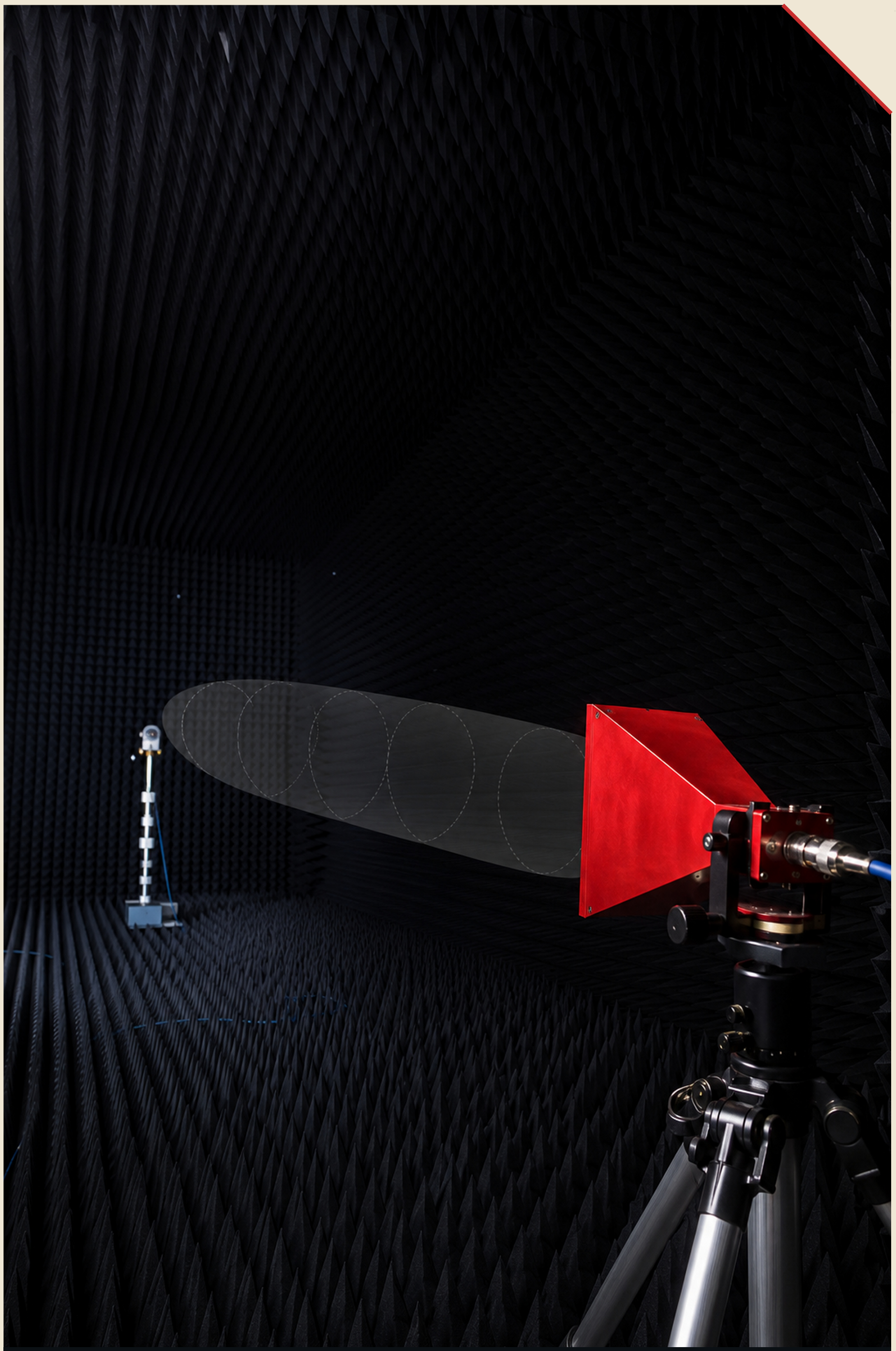
A standard gain horn is useful because its geometry and pattern can form a known part of a test setup. It still requires polarization alignment, separation distance, positioning, cable management and an environment consistent with the measurement objective.

UHF	S / X	KA	RAIN
mature CubeSat links	higher-rate growth	higher data potential	propagation matters

TEST ENVIRONMENT

FROM GUIDED ENERGY TO FREE SPACE.

The measurement becomes geometric at the antenna aperture.



ANECHOIC-CHAMBER CONCEPT ART / EDITORIAL ILLUSTRATION

THE HORN IS NOT THE END OF THE BENCH.

It is the point where a guided field becomes a free-space problem. Alignment, polarization, distance, reflections, mounting and the surrounding environment join the measurement.

A known antenna geometry provides a useful reference only when the complete setup is documented and repeatable.

NEXT PAGE

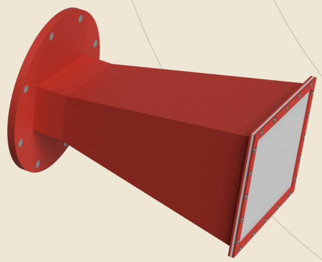
Published horn families, waveguide coverage, gain options and a practical free-space check.

ENGINEERING NOTE

KNOWN GEOMETRY. USEFUL REFERENCE.

Standard gain horns translate guided waveguide modes into a repeatable radiating structure. They are commonly used as reference antennas, illumination antennas, range antennas and general-purpose laboratory radiators.

Impulse publishes linearly polarized, lightweight, corrosion-resistant standard gain horns in nominal 10, 15 and 20 dB gain families. The public range extends from WR650 through WR28. Model-specific frequency coverage spans 1.12 to 40 GHz across the family, with flanges and beamwidths defined by the selected model.



STANDARD GAIN HORN / IMPULSE PUBLIC PRODUCT IMAGE

The horn's nominal gain does not define the full experiment. E-plane and H-plane beamwidth, polarization, mounting, distance, absorber performance, reflections, connector transition and cable behavior all affect the result.

A PRACTICAL FREE-SPACE CHECK

Confirm that the separation supports the intended field-region assumption. Align polarization before interpreting level. Treat the adapter and cable as measured parts of the chain. Record height, angle and reference planes. Repeat after reconnecting hardware to reveal setup sensitivity.

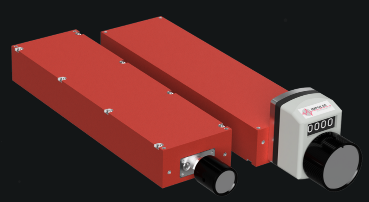
PUBLISHED FAMILY SNAPSHOT

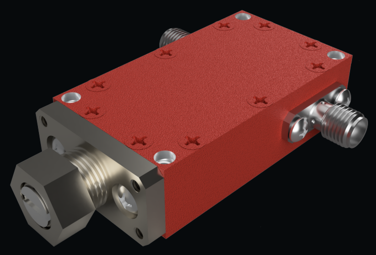
WAVEGUIDE	WR650 to WR28
FREQUENCY	1.12 to 40 GHz, model-dependent
GAIN	10 / 15 / 20 dB nominal families
POLARIZATION	linear
MOUNTING	1/4-20 tripod provision
OPTIONS	adapter-attached and radome options

MANUFACTURED BY IMPULSE

FOUR FAMILIES.
ONE SIGNAL PATH.

Signal control, transition and radiation hardware from Bay Shore, New York.





01 PHASE SHIFTERS

CONTROL PHASE

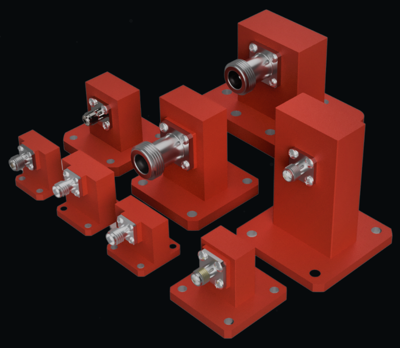
Continuous mechanical phase adjustment.

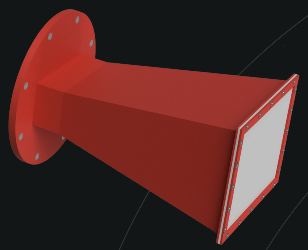
02 VARIABLE ATTENUATORS

CONTROL LEVEL

Continuous RF signal-level adjustment.

CONTROL PHASE → CONTROL LEVEL → CHANGE MODE → RADIATE





03 WG-COAX ADAPTERS

CHANGE MODE

Transition between coaxial and waveguide paths.

04 GAIN HORNS

RADIATE

Known geometry for free-space transmission.

AUTHENTIC IMPULSE PRODUCT PHOTOGRAPHY / NOT TO SCALE

VERIFY MODEL-SPECIFIC DATA BEFORE RELEASE

SELECTION GUIDE

START WITH THE APPLICATION. THEN CLOSE THE MODEL.

A family-level range helps a buyer find the right shelf. It does not replace the controlled model data needed to approve a part. Frequency, power, interfaces, control, mounting and acceptance conditions must close together.

01 PHASE

30 degree: DC to 40 GHz
60 degree: DC to 26.5 GHz
90 degree: DC to 26.5 GHz
180 degree: DC to 4.3 GHz

Confirm requested shift at the operating band, plus loss, match, power, connector and control.

02 LEVEL

06: high-frequency family, up to 30 dB
07: 2 to 18 GHz, up to 40 dB
08: lower-frequency family, up to 60 dB

Select by range, flatness, insertion loss, VSWR, power, form factor and adjustment method.

03 TRANSITION

WR650 through WR28
1.12 to 40 GHz by model
Type N, SMA and 2.92 mm families

Match waveguide size, flange, connector, frequency, power and mechanical envelope.

04 RADIATION

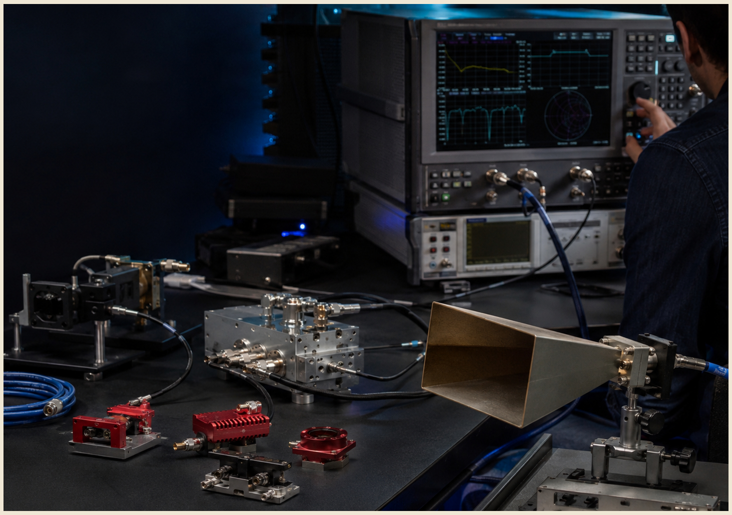
WR650 through WR28
10 / 15 / 20 dB nominal gain families
Linear polarization

Close frequency, gain, beamwidth, flange, mounting, environment and test distance.

BENCH DISCIPLINE

A TRACE IS NOT A COMPLETE RESULT.

A vector network analyzer can display precise-looking curves while the setup remains poorly defined. Calibration, reference planes, cable movement, connector care, fixture repeatability and uncertainty determine whether the trace means what the caption says.



NIST's Microwave Uncertainty Framework treats VNA uncertainty as something that can be modeled and propagated, including with sensitivity and Monte Carlo methods. The practical lesson is broader: a measurement deserves its context.

THE SIX-PART RECORD

CALIBRATION / STATE / SWEEP / POWER / ENVIRONMENT / ACCEPTANCE

01	CALIBRATE	Name method, standards, connectors and reference planes.
02	SET STATE	Record the mechanical setting and interface condition.
03	DEFINE SWEEP	Frequency, points, IF bandwidth and averaging.
04	CONTROL POWER	Source level, losses and device limits.
05	STABILIZE	Cable position, torque, temperature and warm-up.
06	ACCEPT	Compare with the controlled limits and uncertainty.

Repeat after reconnecting. If the result moves, the setup was part of the answer.

BUYER / ENGINEER

THE SPECIFICATION IS A CONVERSATION.

The best RFQ reduces interpretation before price and lead time enter the room.

A model number is useful when it is known and current. When it is not, an application description can be more valuable than an incomplete cross-reference. The buyer's job is not to solve the RF design. It is to transmit the constraints without stripping away their meaning.

Start with function: phase control, level control, transition, radiation, switching, filtering, division, coupling or another system role. Then define the band, interfaces, power and environment. Add the performance limits that decide acceptance. Only then should quantity, schedule, documentation and commercial conditions close the request.

WHAT GOOD LOOKS LIKE

Engineering and procurement often optimize different variables. Engineering protects the system margin. Procurement protects availability, cost, schedule and compliance. A complete RFQ creates one record in which both priorities can be evaluated.

> A requirement that cannot survive the RFQ will not reliably survive the purchase order.

01 **FUNCTION**
What must the hardware do?

02 **FREQUENCY**
Operating band, instantaneous bandwidth and margins

03 **INTERFACES**
Connector, waveguide, flange, gender and mounting

04 **POWER**
CW / peak, duty cycle and expected mismatch

05 **PERFORMANCE**
Loss, match, phase, attenuation, gain and repeatability

06 **ENVIRONMENT**
Temperature, vibration, humidity, altitude or vacuum

07 **DOCUMENTATION**
Data, calibration, traceability and compliance

08 **COMMERCIAL**
Quantity, target date, alternates and lifecycle

PLANT PROFILE

BAY SHORE.
SINCE 1991.

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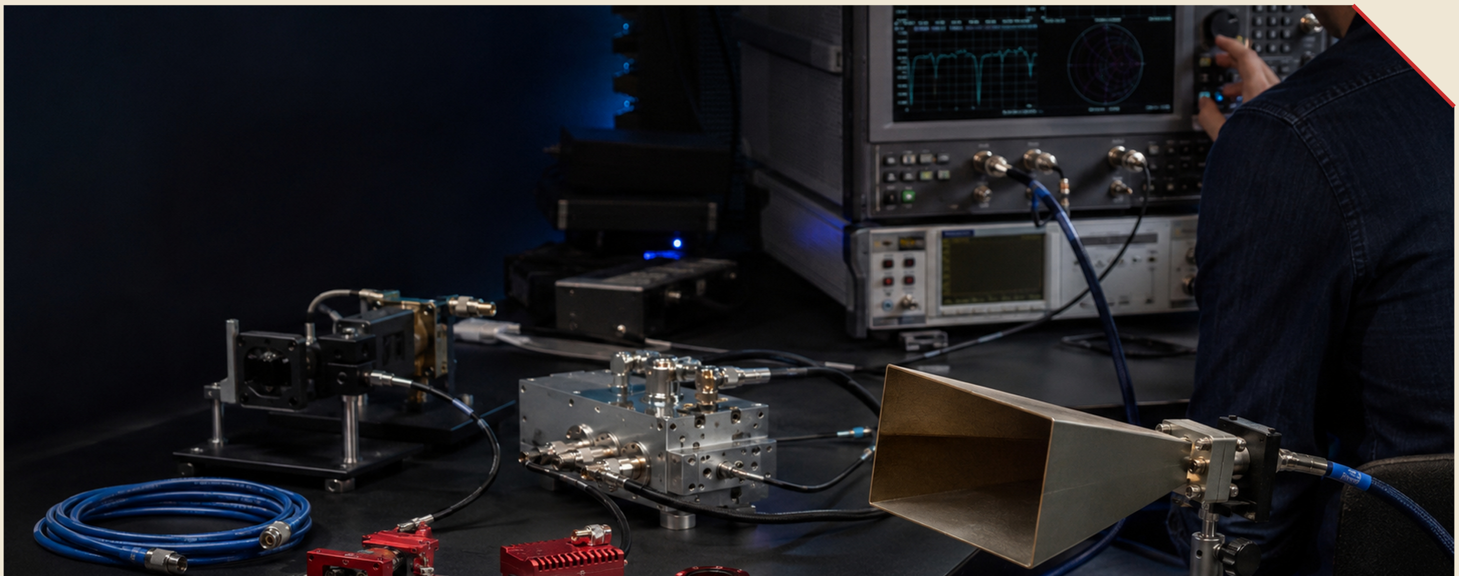

EDITORIAL LAB CONCEPT ART / IMPULSE OPERATES A CONTROLLED BAY SHORE MANUFACTURING AND TEST FACILITY

Impulse Technologies describes its Bay Shore, New York facility as a controlled manufacturing space with anti-static inspection and packaging zones, test equipment and an ISO 9001:2015-certified quality management system.

The company manufactures mechanical phase shifters, continuously variable attenuators, standard gain horn antennas and waveguide-to-coax adapters. It also serves as a sourcing link to a broader network of U.S. and worldwide RF and microwave manufacturers.

That dual position matters. A specialized manufactured item may share a bill of materials with interconnects, passive components, cable assemblies, test equipment and other qualified hardware. One commercial conversation can therefore begin with an Impulse product and expand to the complete requirement.

35 YEARS | CONTROLLED MANUFACTURING | ISO 9001:2015 | GLOBAL SOURCING | BAY SHORE, NY

INDUSTRY RADAR

WHAT CHANGES NEXT.

Three developments moving the RF conversation in 2026.

01
RADAR

5G-ADVANCED

Release 18 established the first 5G-Advanced release. 3GPP's 2026 roadmap keeps 5G-Advanced work active through Release 20, extending deployed 5G capabilities while the industry begins longer-horizon 6G work.

DEPLOYMENT

Standards evolve; deployed hardware must still be measured.

02
RADAR

IMT-2030

In February 2026, an ITU expert group agreed on draft technical performance requirements for IMT-2030 radio interfaces. The draft contains 20 performance requirements, including seven described as new for 6G evaluation.

FRAMEWORK

Requirements guide evaluation; they are not finished products.

03
RADAR

HIGHER-BAND LINKS

NASA's 2026 small-spacecraft communications review describes continued movement from mature VHF/UHF links toward S, X and Ka where higher data rates are needed. Hardware, propagation and measurement discipline move with the band.

APPLICATION

Higher data rate means a new physical and environmental budget.

RF PRIMER

NEW TO RF? START WITH THE PATH.

The vocabulary becomes easier when every term has a physical place.

01 **FREQUENCY**

How many cycles occur each second. RF and microwave systems are usually described by their operating band.

02 **WAVELENGTH**

The physical distance occupied by one cycle in a medium. It becomes shorter as frequency increases.

03 **PHASE**

The relative position within a cycle. A path delay becomes a phase difference at a given frequency.

04 **ATTENUATION**

A controlled or unavoidable reduction in signal magnitude, commonly expressed in decibels.

05 **RETURN LOSS / VSWR**

Two ways of describing mismatch and reflected energy at an interface.

06 **S-PARAMETERS**

A network language for incident and reflected waves. S11 describes input reflection; S21 describes forward transmission.

07 **WAVEGUIDE**

A metal structure that guides electromagnetic fields by supported modes above cutoff.

08 **GAIN**

Directional concentration or amplification, depending on context. Antenna gain is not the same thing as amplifier gain.

PRIMARY SOURCES / ACCESSED JULY 2026

01 Impulse Technologies: About, Phase Shifters, Variable Attenuators, Standard Gain Horn Antennas, WG-Coax Adapters.

02 3GPP: Release 18, Release 19 and Release 20 overview pages.

03 ITU: IMT-2030 Framework; 'IMT-2030: Technical requirements for the 6G future,' March 17, 2026.

04 NASA Small Spacecraft Systems Virtual Institute: State of the Art of Small Spacecraft Technology, Communications, updated May 18, 2026.

05 NIST: Microwave Uncertainty Framework and VNA calibration publications.

06 Product values are public family-level summaries. Model-specific release requires controlled technical approval.

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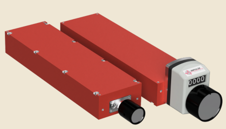
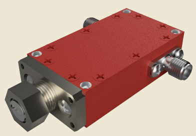
START WITH THE REQUIREMENT.
CLOSE THE SIGNAL PATH.

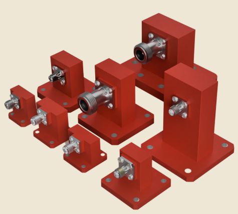
Mechanical RF hardware and sourcing support from Bay Shore, New York.



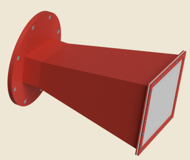
PHASE



LEVEL



TRANSITION



RADIATION

REQUEST A QUOTE

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SINCE 1991 / ISO 9001:2015 QUALITY MANAGEMENT SYSTEM

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