

Company & Product Range



COM-TECH is an Italian leading company designing and developing high-end RF passive components. COM-TECH has become a reference worldwide, having supplied products and services to Customers in more than 50 Countries.
COM-TECH key distinctive factors are: Innovation, Reliability, Performance, Flexibility

The Broadcast business area covers the UHF, VHF B.III, VHF B.I, FM frequency ranges for the following applications:

- Digital (DVB-T, ATSC, ISDB-T) and Analog Broadcast TV
- Digital (DAB, T-DMB) and Analog (FM) Broadcast Radio

The Industrial, Scientific and Medical business area covers the 50 - 2.500 MHz frequency range for the following applications:

- Particle Accelerators (Synchrotrons, LINACs...)
- IoT (Internet of Things)
- Microwave Communications (Wireless camera links, microwave distribution...)
- Transport Networks (Service communications, tunnel signal distribution...)
- ATC (Radio communication for Air Traffic Control)
- PMR (Professional Mobile Radio)
- Weather and Hydrological Monitoring

COM-TECH production range comprehends four main product families:

- **FILTERS:** Output Bandpass Filters for Broadcast TV and Radio Transmitters
- **COMBINERS:** Channel Combiners for Broadcast TV and Radio Stations
- **COMPONENTS:** RF Components for Broadcast TV and Radio Transmitters and Stations. (Hybrid Couplers, Multicouplers, Patch Panels, Directional Couplers, Loads...)
- **ISM:** RF Passive components for the Industrial, Scientific and Medical business areas (Hybrid Couplers, Multicouplers, High Power Couplers, Directional Couplers...)

Service & Quality



10
Year
Warranty

Service & Warranty

COM-TECH grants the fastest delivery terms in the market, thanks to a stock-oriented production process. COM-TECH offers a complete Service, including site survey, installation, commissioning, maintenance, on-site retuning, and tuning trainings.

COM-TECH passive components are guaranteed for 10 years.
Active components are guaranteed for 2 years.

See *Warranty Conditions on COM-TECH website for details.*

RoHS
Compliant
2011/65/EC
2015/863/EC

BeO
Free

RoHS II Compliancy, BeO Free

COM-TECH supports the European Union's efforts to remove harmful chemicals from consumer electronics.

COM-TECH products are compliant with Directive 2011/65/EC and Directive 2015/863/EC of the European Parliament and the Council of the European Union regarding the restriction of the use of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB), and polybrominated biphenyl ether (PBD) flame retardants, bis(2-ethylhexyl) phthalate (DEHP), butyl benzyl phthalate (BBP), dibutyl phthalate (DBP), and diisobutyl phthalate (DIBP).

COM-TECH is taking an extra effort by making all its products Beryllium Oxide free, in accordance with the directive 2003/36/EC, which has classified Beryllium Oxide as "Carcinogenic", and has thereof restricted its use and imposed safety rules in processing it.



Quality, Environment, Health and Safety

COM-TECH has established and maintains the following certified and documented Systems:

- UNI EN ISO 9001:2015 - Quality Management
- UNI EN ISO 14001:2015 - Environmental Management
- BS OHSAS 18001:2007 - Occupational Health and Safety

to ensure that:

- Products and Services offered comply with the requirements specified and defined in the contract with the customer, and maintain expectations
- Production processes are defined and managed in order to prevent pollution as far as possible
- Production processes are defined and managed in order to guarantee a safe workplace for the employees, customers, suppliers, and visitors.

History & Innovation

COM-TECH products have set new benchmarks in the broadcast industry, introducing brand new techniques and world first innovations:

Microteco Snc founded by ing. Daniele Valenti	1990	TV Manifold Combiner World first Broadcast TV Combiner with Manifold technique (MPX3L)
Microteco changes name and company type into COM-TECH Srl (Private Limited Company)	1992	
	1998	DAB Filter COM-TECH first DAB Filter (CL6NVDAB)
First company in Italy to purchase CST Microwave Studio ISO 9001 Certification	2000	
First exhibition at IBC (Amsterdam)	2001	Elliptical Response World first Broadcast TV Bandpass Filter with Elliptical Response technique (TC4E120L) Interdigital Hairpin Design COM-TECH ultra-compact <i>Interdigital Hairpin</i> Design VHF B.I Bandpass Filter
New Premises (Via Industria 7, Morbegno)	2003	DualCross World first Broadcast TV Bandpass Filter with Double Cross-Coupling technique (TC6E120C)
	2004	XLine World first Broadcast TV Bandpass Filter with Extracted-Pole technique (CL6X30C)
	2005	MultiStep International patent application for world first Ultra-Flat response UHF TV Hybrid Coupler (TH100C) 200mm Cavity Filter World first TV Bandpass Filter with 200 mm cavity size (TC4E200C)
	2006	BeO-Free Dry Load World first Broadcast TV BeO-Free Dry Load (DL3000C) Multicouplers COM-TECH first introduction of Multicouplers and Splitters DF Series World first Balanced Combiner with <i>Multistep</i> Hybrid Couplers
	2007	Liquid Cooling COM-TECH first introduction of Liquid Cooling on Bandpass Filters
	2009	Accuprobe World first Directional Coupler with fully Equalized Probes (DC4A23)
COM-TECH do Brasil established	2011	
COM-TECH Srl changes name and company type into COM-TECH Italia SpA (Public Limited Company) ISO 14001 Certification	2012	Forced Air Cooling World first integrated Air Cooling System on a Broadcast TV Filter
	2013	TF Series COM-TECH novel and unique ultra-compact UHF Bandpass Filters NH Series COM-TECH innovative and proprietary UHF <i>MultiStep</i> Hybrid Couplers
New Premises (Via Artigianato 9, Morbegno)	2014	FM Manifold Combiner World first FM Combiner with Manifold technique (ME3P120F)
	2015	TS Series COM-TECH innovative and ultra-compact VHF B.III Filter
BS OHSAS 18001 Certification	2016	MH Series COM-TECH innovative Progressive Multicoupler
	2018	Accuprobe III COM-TECH New Generation Directional Coupler with Equalized Single and Dual Probes

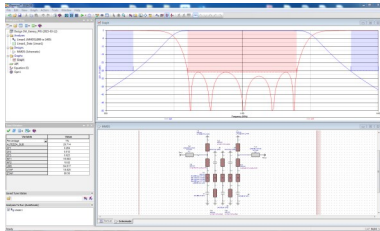
Design & Workflow

COM-TECH products are designed with state-of-the-art techniques, engineered with the most innovative development tools, and realized with cutting-edge manufacturing technology, in order to deliver the most advanced performances with the highest level of reliability:

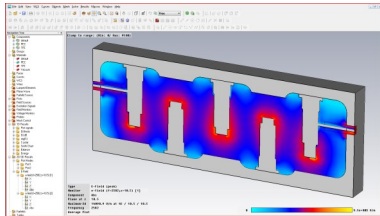
- Highest voltage safety margins for maximum reliability
- Lowest insertion loss for optimum efficiency
- Highest power handling over the physical dimension, for maximum compactness
- Rugged construction for maximum mechanical stability, durability, and immunity to transportation shocks

Since the beginning COM-TECH has made extensive use of Computer Aided Engineering (CAE), and has been amongst the first to adopt 3D EM and Fluid Dynamic simulation, coupled with the most advanced Optimization tools.

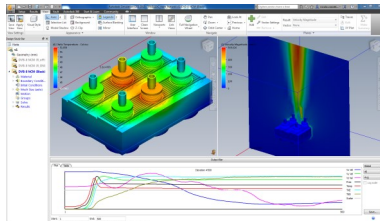
COM-TECH's development workflow:



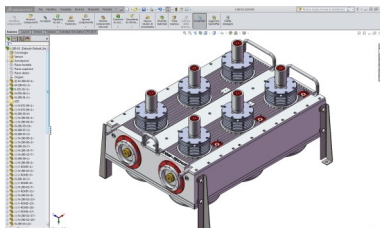
1. Exact Circuit Synthesis, Analysis and Optimization



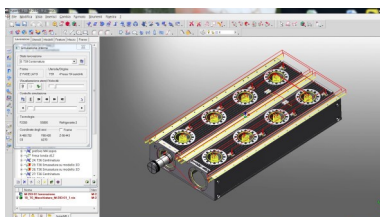
2. Distributed Synthesis, 3D EM Modeling and Analysis, and Multi-Objective Optimization



3. 3D Fluid Dynamic Modelling



5. 3D CAD



6. CAD-CAM Machining



Features & Techniques



Full Band Tunability

COM-TECH Filters and Combiners are designed to be easily and completely tunable:

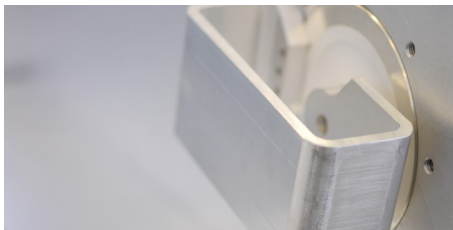
- Fully tunable all over their operating band
- Tunable in accordance to all worldwide standards, channel widths and regulation masks
- Customizable Tunings in accordance with Customer specifications
- Designed to be easily tuned (Tuning Instructions available on request)
- Engineered to be tuned with a standardized set of tools (Tuning Toolbox available on request)



Temperature Stabilization

COM-TECH Filters and Combiners feature a state-of-the-art Temperature Stabilization, achieved through:

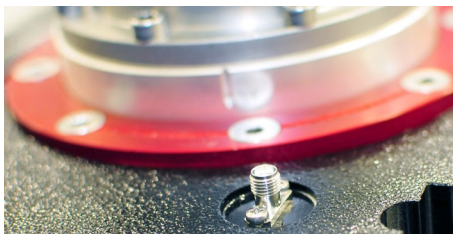
- Innovative interactive CAE design (3D EM and Fluid Dynamic simulation)
- Accurate choice of materials
- Environmental and laboratory tests



DC Short

COM-TECH Filters and Combiners have a built-in lightning protection:

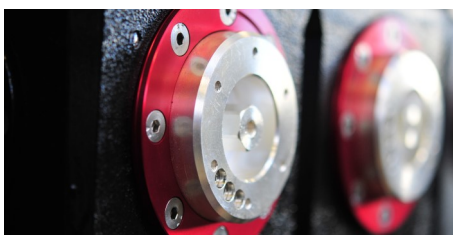
- Solid DC Short Circuit towards ground on the input/output couplings
- No Open Circuits, in order to avoid dangerous charge accumulations
- Full protection towards the antenna side



Output Monitor Probe

COM-TECH Filters feature a capacitive, non-directive Output Monitor Probe, providing a reference signal on the output port:

- SMA or SMB female connector available
- Available on both sides (according to the position of the output port)



Interchangeable Connector System

COM-TECH products feature an interchangeable and modular connector system, based on unified mounting panels.

Each panel accept different connectors, allowing a wide choice of connections to be mounted on the same product:

- Panel sizes: 25 mm, 32 mm, 64 mm, 100 mm, 130 mm, and 150 mm
- Wide choice of connectors available on each product
- Easy connector change

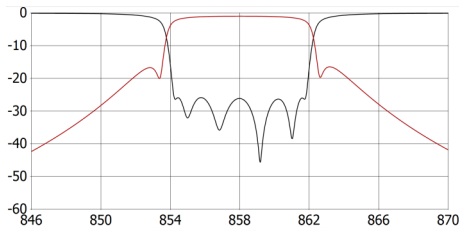


Modular Frame System

COM-TECH Modular Frame System, available on medium and high power Combiners (SM, SF, DM, DF Series), allows a complete Combiner modularity:

- Easy and convenient possibility of extension, integration, module switch, and maintenance
- Modules separable to be easily shipped, and later assembled and installed on site
- Integrable with Directional Couplers (with Monitor Panel), Patch Panels, System Monitor

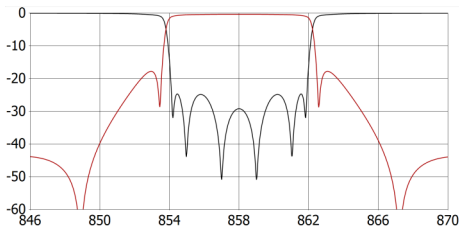
Features & Techniques



XLine: Extracted-Pole Elliptical Response

COM-TECH innovative and proprietary Extracted-Pole design technique, available on 6 and 7-pole low-power Filters (CL Series) and Combiners (SB, DB Series):

- Two Transmission Zeros
- Compact, in-line form factor
- Balanced Combiners: Adjacent Channel Combination



DualCross: Double Cross Coupling

COM-TECH innovative and proprietary Double Cross-Coupling design technique, available on 6 and 8-pole medium and high power Filters (FC, TF, TS, TC, BF Series) and Combiners (SM, SF, DM, DF Series):

- Four Transmission Zeros
- Enhanced Selectivity
- Optimum Insertion Loss and Efficiency
- Balanced Combiners: Adjacent Channel Combination



SIR; Interdigital Hairpin; EVA-Mode

COM-TECH innovative and proprietary designs, leading to very compact yet full-band VHF and FM Filters:

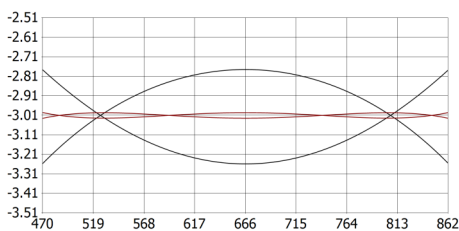
- **SIR:** Novel resonator design, for compact VHF B.III Filters (TS Series)
- **Interdigital Hairpin:** Unique resonator design, for ultra-compact low-power VHF B.I Filters (HR Series)
- **EVA-Mode:** Highest Quality Factor in the smallest space, available on VHF B.I and FM Filters and Combiners (HE, CE, ME Series)



Unified Connector Spacing

COM-TECH Unified Connector Spacing, available on most Hybrid Couplers (HC, HF, NH Series) and Multicouplers (MC, MH Series) provides input connectors exactly spaced by a multiple of Rack Units:

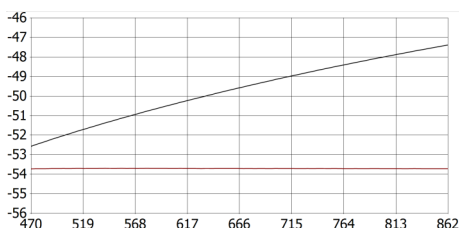
- 2U, 3U, 3.5U, 4U, 5U, 6U, and 9U (400 mm) spacings available
- Direct plug-in into Power Amplifiers (Quick Plug Connectors available)
- Wider and optimized choice of Input and Output Hybrid Couplers on Balanced Combiners



MultiStep: Ultra-Flat Frequency Response

COM-TECH exclusive and proprietary design technique, available on high power UHF Hybrid Couplers, (NH Series) and Balanced Combiners (DF Series):

- Ultra-Flat frequency response (10 times flatter compared to traditional design Hybrid Couplers)
- Enhanced Return Loss and Isolation
- Antenna Systems: Accurate power balance
- Balanced Combiners: Agile connection of several modules with unparalleled performances



Accuprobe III: Equalized Response Probes

COM-TECH exclusive and proprietary equalization technique, available on Directional Couplers (DC Series):

- Accurate coupling level equalization (typical flatness: ± 0.05 dB)
- Single Probe with Integrated Load and Dual Probe for simultaneous FWD and RFL measurement
- Interchangeable probes: Single or Double, SMA or N Female, Band Type (UHF, VHF B. III, B.I-II, FM...)
- Transmitters: enhanced wideband agility; channel changes do not affect the measured level
- Combiners: measured output level constant for every channel; frequency correction table not required

Interchangeable Connector System



25 mm Panel

Native panel for N connections, extends up to 7-16 connections

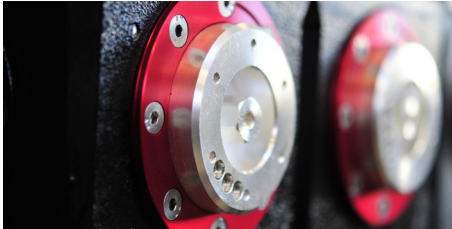
Code	Connection
C, C3	N Female, Angular Female
D	N Male
E	7-16 Female
F	7-16 Male



32 mm Panel

Native panel for 7-16 and 7/8" connections, extends up to 1+5/8" connections and down to N

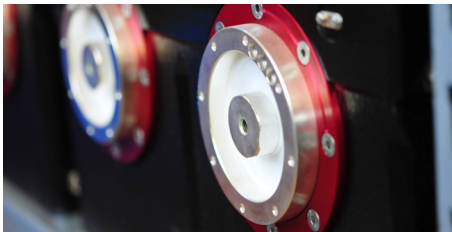
Code	Connection
C; D	N Female; N Male
E; F	7-16 Female; 7-16 Male
G, G1, G2	7/8", WX-20D Socket
H, H1	7/8" Flange
I, I0, I1, I2	7/8", WX-20D Plug, 7/8" Quick Plug
J, J1, J2	1+5/8", WX-39D Socket
K, K1	1+5/8" Flange



64 mm Panel

Native panel for 1+5/8" connections, extends up to 3+1/8" connections and down to all smaller connections

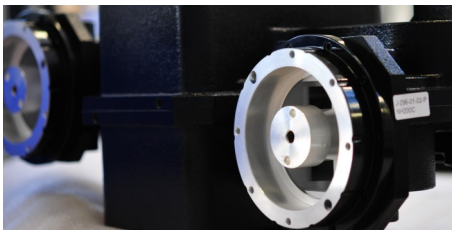
Code	Connection
J, J1, J2	1+5/8", WX-39D Socket
K, K1	1+5/8" Flange
L, L1, L2	1+5/8", WX-39D Plug
M, M1, M2	3+1/8", NAX-77D Socket
N, N1	3+1/8" Flange



100 mm Panel

Native panel for 3+1/8" connections, extends up to 4+1/2" connections and down to all smaller connections

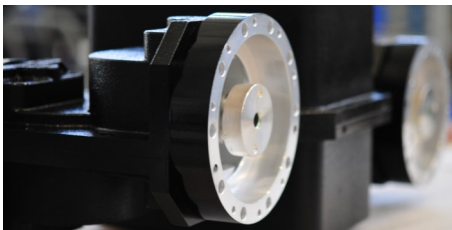
Code	Connection
M, M1, M2, M4	3+1/8", NAX-77D, WX-77D, Socket
N, N1	3+1/8" Flange
O, O1, O2, O4	3+1/8", NAX-77D, WX-77D, Plug
P	4+1/2" Socket
Q	4+1/2" Flange



130 mm Panel

Native panel for 4+1/2" connections, extends up to RL-120 connections and down to all smaller connections

Code	Connection
P, P2	4+1/2", WX-103D Socket
Q	4+1/2" Flange
R	4+1/2" Plug
S	RL-120 Socket
X	RL-120 Flange



150 mm Panel

Native panel for RL-120 and 6+1/8" connections, extends down to all smaller connections

Code	Connection
S	RL-120 Socket
X	RL-120 Flange
T	RL-120 Plug
U	6+1/8" Socket
V	6+1/8" Flange
W	6+1/8" Plug

Options



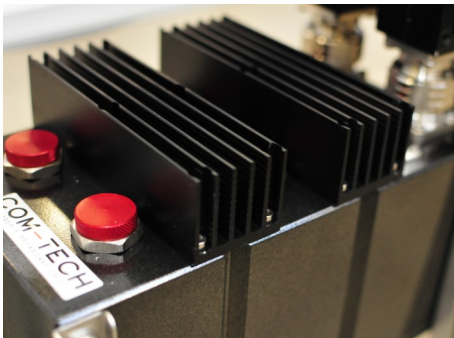
19" Rack Shelves

COM-TECH products have been engineered to be easily and conveniently fit into 19" Rack Shelves. COM-TECH can provide standard and customized solutions to integrate Filters, Combiners, Directional Couplers, Lowpass Filters, and other components and accessories into 19" Rack Shelves:

- Specifically designed for COM-TECH Filters and Combiners
- Compatible with standard 19" Racks
- Customizable front panel

Notes:

- Components inserted in 19" Rack Shelves, with limited or no ventilation, might suffer from an increased over-temperature; power ratings should be consequently reduced
- In any applicable case, the body temperature must be kept below the maximum value (65°C, 149°F)



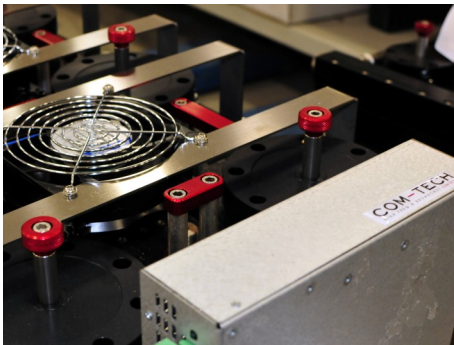
Heat Sinks

Heat Sinks expressly designed to efficiently reduce the over-temperature on Filters and Combiners, and to consequently increase their maximum operating power:

- Specifically designed for COM-TECH Filters and Combiners
- Add-on option, can be conveniently added subsequently

Notes:

- Power ratings with the Heat Sinks Option are calculated with fins in vertical position and with no obstructions to the natural air flow
- Power ratings can be further increased with the aid of extra ventilation (E.g. through the internal transmitter ventilation)
- In any applicable case, the body temperature must be kept below the maximum value (65°C, 149°F)



Forced Air Cooling

The innovative Forced Air Cooling system allows to dramatically reduce the over-temperature on Filters and Combiners, and to consequently increase their maximum operating power.

Thanks to the downsizing possibility, the Forced Air Cooling allows significant cost and space savings:

- Complete and standalone system, not requiring any external parts
- Variable speed fans controlled by microprocessor, allowing fans to operate at the minimum flow
- Premium quality DC 24 V brushless fans, engineered to be quickly and easily replaced
- Multi-standard (110-230V, 50-60 Hz) switching power supply
- Contact Alarm for over-temperature, missing power or any kind of electrical failure
- Add-on option, can be conveniently added subsequently

Notes:

- In any applicable case, the body temperature must be kept below the maximum value (65°C, 149°F)



Liquid Cooling

The innovative Liquid Cooling system allows to dramatically reduce the over-temperature on Filters and Combiners, and to consequently increase their maximum operating power.

Thanks to the downsizing possibility, the Liquid Cooling allows significant cost and space savings:

- Conveniently integrates with the transmitter liquid cooling system
- Compatible with most NTP connecting threads
- Chemically compatible with available coolant liquids
- Thermo-sensor included (70°C - 158°F N.C. SPST)
- Add-on option, can be conveniently added subsequently

Notes:

- In any applicable case, the body temperature must be kept below the maximum value (65°C, 149°F)

Power Ratings & Environmental Conditions



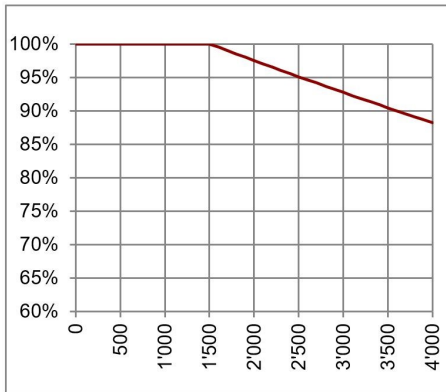
Power Ratings

Power ratings reported in the datasheets refer to the following standard operating conditions:

- Altitude: below 1.500 m (4.900 ft.). (See Altitude Thermal Derating)
- Free air, no enclosures (e.g. Racks), no obstructions to natural air convection
- Heat Sinks: Fins in vertical position, and no obstructions to air flow
- Liquid Cooling: Glycol 30%, Liquid temp. 45 °C (113 °F), Liquid flow 6 l/min (1.6 gal/min)
- Standard Environmental Conditions (see Environmental Conditions)
- Body temperature below the maximum operating value (See Product Datasheet)
- Combiners: Non Adjacent Channels

Note:

- *Specific calculations need to be carried out to determine the effective power rating in case one or more of the previous conditions are not met*



Altitude Thermal Derating

Power ratings for COM-TECH Components refer to a maximum altitude of 1.500 m (4.900 ft.). When installed at higher altitudes, power ratings must be reduced according to the following table:

Altitude	Relative Power
0 - 1.500 m (4.900 ft.)	100%
2.000 m (6.500 ft.)	97.5%
2.500 m (8.200 ft.)	95.1%
3.000 m (9.800 ft.)	92.8%
3.500 m (11.400 ft.)	90.5%
4.000 m (13.000 ft.)	88.2%
4.500 m (14.700 ft.)	86.0%
5.000 m (16.400 ft.)	83.9%

Notes:

- *The above derating is related to the decreased thermal dissipation of rarified air. Filters and Combiners may undergo an additional power reduction due to voltage safety factors. This reduction depends on the design and the cooling technique (typically Forced Air Cooling and Liquid Cooling)*



Environmental Conditions

COM-TECH components withstand to the following Operational, Transport, and Storage conditions:

Operational Conditions:

- ETSI EN 300 019-1-3 V.2.4.1 (2014-04), Class 3.1, Normal Conditions
- Maximum Operating Temperature: see Product Datasheet

Transport Conditions:

- ETSI EN 300 019-1-2 V.2.2.1 (2014-04), Class 2.2

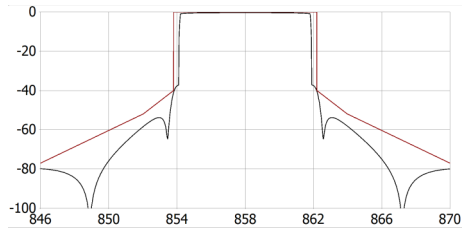
Storage Conditions:

- ETSI EN 300 019-1-1 V.2.2.1 (2014-04), Class 1.1

Notes:

- *COM-TECH products are designed for indoor use, and are not waterproof. Maximum attention should be carried out to prevent contact with water, especially during transportation and installation*

Filter Mask Requirements

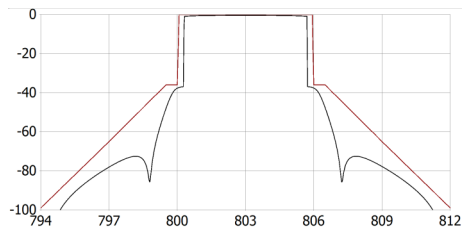


DVB-T / T2

Breakpoints (Center Freq.)	Reference Spectrum	Non Critical Mask		Critical Mask	
		TXMask Requirement	Filter Requirement	Mask Requirement	Filter Requirement
± 4.2 MHz	- 36 dB	- 40 dB	- 4 dB	- 50 dB	- 14 dB
± 6 MHz	- 36 dB	- 52 dB	- 16 dB	- 62 dB	- 26 dB
± 12 MHz	- 36 dB	- 77 dB	- 41 dB	- 87 dB	- 51 dB

Notes:

- The system analysis has been carried out with reference to an out-of-band noise of -36 dBc
- Adjacent Channels combination can be implemented independently of the required Mask (e.g.: Critical or Non-Critical): there is no strictly need of 8-Pole Filters to combine adjacent channels

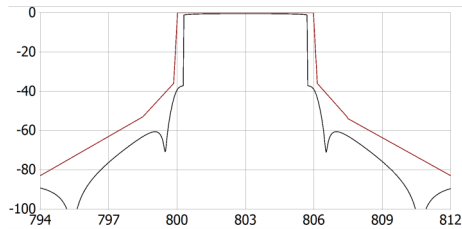


ATSC 1.0 / 3.0

Breakpoints (Center Freq.)	Reference Spectrum	LPTV Simple Mask		FCC Mask	
		TXMask Requirement	Filter Requirement	Mask Requirement	Filter Requirement
± 3.5 MHz	- 36 dB	- 35 dB	0 dB	- 36 dB	0 dB
± 6 MHz	- 36 dB	- 42 dB	- 6 dB	- 65 dB	- 29 dB
± 9 MHz	- 36 dB	- 60 dB	- 24 dB	- 99 dB	- 63 dB

Notes:

- The system analysis has been carried out with reference to an out-of-band noise of -36 dBc
- Adjacent Channel combination can be implemented independently of the required Mask (e.g.: Critical or Non-Critical): there is no strictly need of 8-Pole Filters to combine adjacent channels

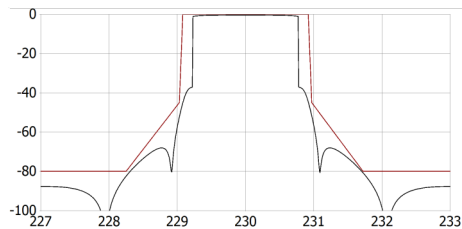


ISDB-T

B.points (C. Freq.)	Ref. Spectrum	Non Critical Mask		Sub Critical Mask		Critical Mask	
		TXMask Requir.	Filter Requir.	Mask Requir.	Filter Requir.	Mask Requir.	Filter Requir.
± 3.15 MHz	- 36 dB	- 36 dB	0 dB	- 43 dB	- 7 dB	- 50 dB	- 14 dB
± 4.5 MHz	- 36 dB	- 53 dB	- 17 dB	- 60 dB	- 24 dB	- 67 dB	- 31 dB
± 9 MHz	- 36 dB	- 83 dB	- 47 dB	- 90 dB	- 54 dB	- 97 dB	- 61 dB

Notes:

- The system analysis has been carried out with reference to an out-of-band noise of -36 dBc
- Adjacent Channel combination can be implemented independently of the required Mask (e.g.: Critical or Non-Critical): there is no strictly need of 8-Pole Filters to combine adjacent channels



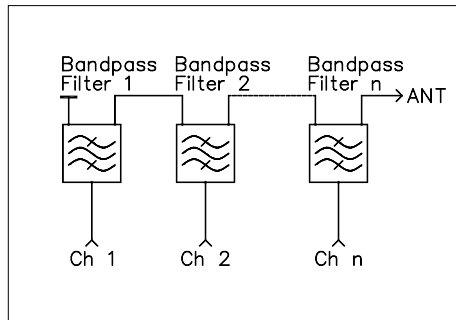
DAB / DAB+

B.points (C. Freq.)	Ref. Spectrum	Case 1 (Critical Mask)		Case 2 (Non Crit. Mask)		Case 3		Case 4 (Block 12D)	
		TXMask Requir.	Filter Requir.	Mask Requir.	Filter Requir.	Mask Requir.	Filter Requir.	Mask Requir.	Filter Requir.
± 0.97 MHz	- 35 dB	- 45 dB	- 10 dB	- 30 dB	0 dB	- 45 dB	- 10 dB	- 52 dB	- 17 dB
± 1.75 MHz	- 35 dB	- 80 dB	- 45 dB	- 50 dB	- 15 dB	- 80 dB	- 45 dB	- 83 dB	- 48 dB
± 2.2 MHz	- 35 dB	- 80 dB	- 45 dB	- 61 dB	- 26 dB	- 100 dB	- 65 dB	- 100 dB	- 65 dB
± 3 MHz	- 35 dB	- 80 dB	- 45 dB	- 80 dB	- 45 dB	- 100 dB	- 65 dB	- 100 dB	- 65 dB

Notes:

- The system analysis has been carried out with reference to an out-of-band noise of -35 dBc
- Values refer to Power levels ≤ 1 kW. For Power levels > 1 kW, Filter Requirements must be increased according to the increased dB ratio (E.g. 2 kW: increase Filter Requirements by 3 dB)
- Adjacent Block combination can be implemented independently of the required Mask (e.g.: Critical or Non-Critical): there is no strictly need of 8-Pole Filters to combine adjacent blocks

Combination Techniques



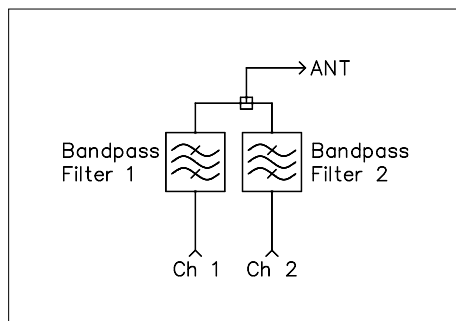
Manifold

Cascade of several filters on a common output transmission line ("Manifold"); one end of the line is shorted, while the opposite is the output (Antenna). The solution to the filter interaction problem is assigned to the respective position of the filters on this line; the complexity is greatly reduced compared to the Starpoint, and it is possible to implement multiplexers with up to 10 or even more channels with a great efficiency.

COM-TECH was the first to introduce the Manifold technique to Broadcast TV and FM applications, and further extended the versatility of this architecture exploiting the Adjacent Channel combination.

The Manifold combination technique is available on UHF and VHF B.III (MX Series) and FM (ME Series) Combiners:

- Adjacent Channel combination
- Large number of channels combinable
- Cost effective solution for low and medium power applications



Starpoint

Multiple connection of various filters with a common junction.

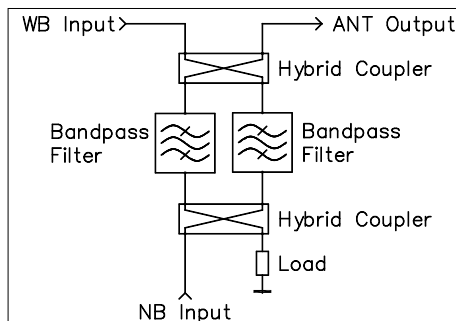
The connecting lines are resonant in order to provide the open circuit condition at the junction node.

The implementation is always possible for 2 channels, and becomes very critical or even not achievable with more than 2 channels.

COM-TECH offers a complete range of Starpoint Combiners (2-Channel as standard, more on request).

The Starpoint combination technique is available on UHF, VHF B.III, DAB, FM (SB, SM, SF Series) Combiners:

- Adjacent Channel combination not possible
- Limited number of channels combinable
- Cost effective solution for 2-channel combination, or in conjunction with Balanced Combiners



Balanced (Constant Impedance)

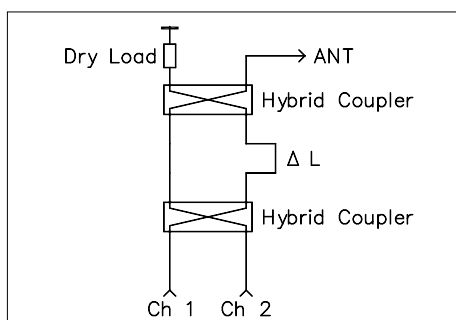
Balanced structure of two identical bandpass filters and two hybrid couplers, creating a Directional Filter, having one Narrowband (filtered) input and a Wideband (non-filtered) complementary input.

Balanced Combiners are the definitive solution in broadcast combining systems, providing the best performances and versatility.

COM-TECH offers a complete range of Balanced Combiners, allowing Adjacent Channel combination (in conjunction with *DualCross* or *XLine* Filters), and Multi-Channel combination (up to 10 channels).

The Balanced combination technique is available on UHF, VHF B.III, DAB, FM (DB, DM, DF Series) Combiners:

- Maximum versatility and performances
- Adjacent Channel combination
- Large number of channels combinable



Stretch Line (Westford Multiplexer)

Simple construction made of two hybrid couplers and a phasing line.

The result is a phase-shift filter with a periodic frequency response, having one input complementary to the other.

This combiner has major limitations, since the frequency responses fall at discrete intervals which are difficult to match with the desired channels; in addition its selectivity is very limited and thus does not make it possible to combine neighboring channels.

COM-TECH can provide Stretchline Combiners (2-Channel) upon request.

- Limited versatility and compromised performances
- Adjacent Channel combination not possible
- Limited number of channels combinable

Multi-Channel Combiners

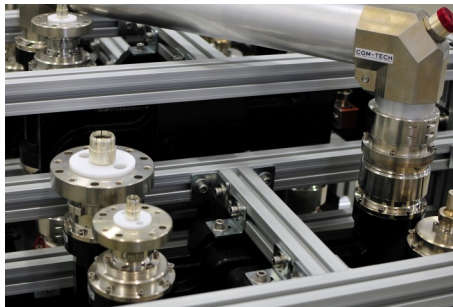


Multi-Channel Combination

The Wideband port of a Balanced Combiner allows to cascade several Balanced modules (also with Filters of different cavity sizes or different number of poles). The result is a Multi-Channel Combiner composed of "n" balanced modules, having "n" Narrowband inputs and one Wideband input.

The remaining Wideband input can be further used to extend the combiner combination capability:

Wideband Use	Extended combination
Not used (Terminated with Load)	0 channels added; Future expansion possible
<i>Provides Constant Impedance for all channels</i>	
Single Filter	1 extra channel combined
Starpoint Combiner	2 extra channels combined
Manifold Combiner	Several extra channels combined



Multi-Channel Power Management

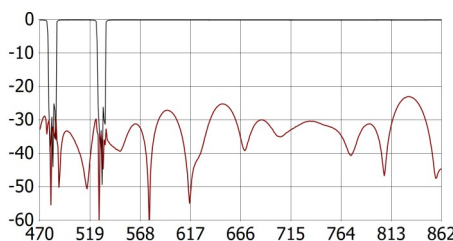
Peak Voltage Peaks

COM-TECH Balanced Combiners have been dimensioned to widely sustain the increased voltage peaks caused by the vector composition of several signals (up to 10 channels).

Wideband Input Power

COM-TECH Balanced Combiners have been dimensioned to withstand the overall output power even in Wideband mode (the Wideband input power has double impact on hybrid couplers), thus making the calculation of the total power extremely easy:

$$\text{Maximum Output Power} = \text{Sum of NB Input Powers} + \text{Sum of WB Input Powers}$$

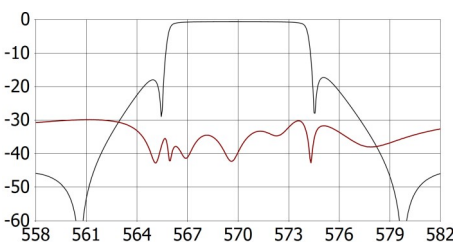


Wideband Return Loss Optimization

The Wideband port Return Loss can be optimized either for the best value on specific channel(s) (at the expense of reducing the performances outside the given frequencies), or to reach the best tradeoff value on the whole operating band.

Combiners with *MultiStep* technique, available on UHF high power Balanced Combiners (DF Series), have unparalleled Return Loss performances, allowing an almost optimal Return Loss value on all the operating band.

Wideband Tuning	Features
Channel Optimized	Best values on the specified channel(s) (reduced performances outside)
Whole-band Optimized	Best tradeoff on all operating band



Multi-Channel Performances

Tuning data reported on the Datasheets refer to one single Balanced module.

Multi-Channel combination requires specific calculations for the overall Insertion Loss and Return Loss:

Insertion Loss

The overall insertion loss is the sum of the Insertion Loss of the single module, increased by the sum of the Wideband Insertion Losses of the following modules:

$$I.L. (Overall) = I.L. (Single Module) + n \times I.L. (Wideband)$$

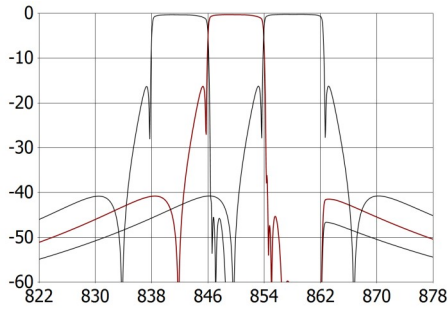
Return Loss

The combination of several Balanced modules involves a derating of the overall Return Loss, influenced by the number of combined channels, channel order and assortment, and adjacency.

For basic reference, and in case Channel-Optimized Wideband tuning, the following table is provided:

No. of Modules	Overall Return Loss (VSWR)
1	26 dB (1.11)
2-5	25 dB (1.14)
6-8	24 dB (1.16)
9-10	23 dB (1.18)

Adjacent Channel Combiners



Adjacent Channel Combination

COM-TECH has exploited the Adjacent Channel combination, thanks to innovative and proprietary techniques and innovations:

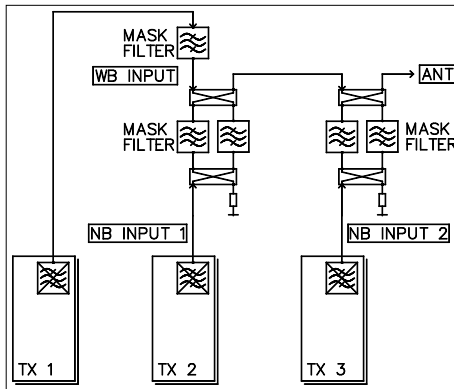
- *DualCross* and *XLine* design techniques
- Ultra-Flat Response *MultiStep* Hybrid Couplers
- Improved Manifold combination technique

Adjacent Channel combination is possible on most Balanced and Manifold COM-TECH Combiners:

- 6 and 7-Pole low power Balanced Combiners (DB Series)
- 6 and 8-Pole medium and high power Balanced Combiners (DM, DF Series)
- 5-Pole Manifold Combiners (MX Series)

Notes:

- *Adjacent Channel combination involves an increased dissipation for the Filters reflecting the adjacent channel; for these modules, Narrowband power ratings must be consequently reduced*
- *Adjacent Channels combination can be implemented independently of the required Mask (e.g.: Critical or Non-Critical): there is no strictly need of 8-Pole Filters to combine adjacent channels*

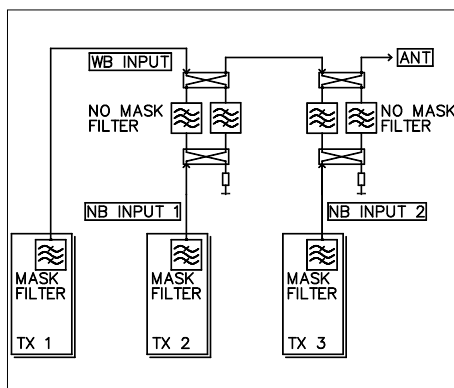


Mask Combiner

This configuration refer to a Combiner which makes use of Bandpass Mask Filters (6, 7, and 8-Pole) , and consequently Filters in the Transmitters are either not present or removed.

This approach has several advantages:

- Highest system efficiency
- Transmitters are completely frequency-agile (no built-in Filters)
- Adjacent Channel combination
- Constant impedance provides best Transmitter working conditions (Balanced Combiners)



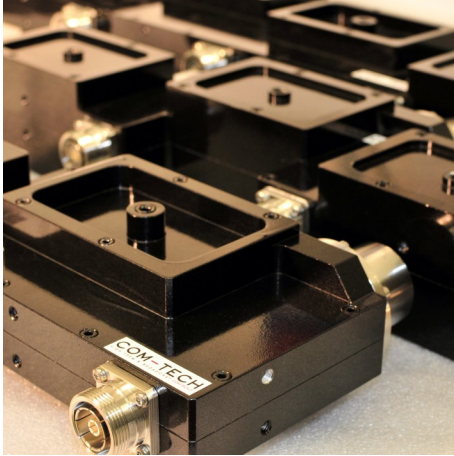
No-Mask Combiner

This configuration refer to a Combiner which makes use of Bandpass No-Mask Filters (3 and 4-Pole) while Mask Filters are built-in the Transmitters.

Though not allowing Adjacent Channel combination, this approach can be adopted with existing Transmitters already having their own built-in filters:

- Suitable to adapt to existing site configurations
- Adjacent Channel combination not possible

Multicoupler System



Power Amplifier Combination

COM-TECH proprietary and complete solutions, offering practical and efficient components to drive and combine several Power Amplifiers, providing the maximum possible overall efficiency of the Transmitter.

Techniques

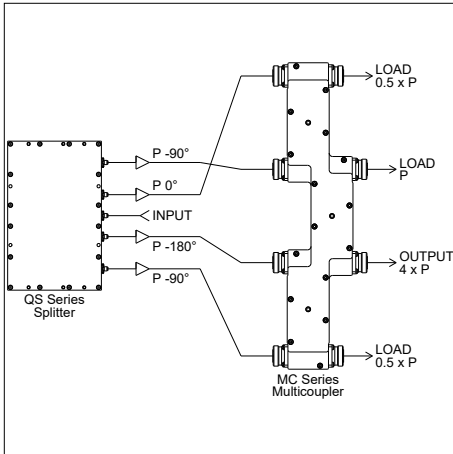
Two different systems, with different techniques, are available:

- Quadrature Multicoupler System (MC Series Multicouplers and QS Series Splitters)
- Progressive Multicoupler System (MH Series Multicouplers and SP Series Splitters)

Components

Both systems include two main components:

- Multicoupler: sums the power of the Amplifiers, and can be conveniently plugged-in at the back of the Power Amplifiers themselves, thanks to the Unified Connector Spacing, which enables connectors to be spaced a multiple of Rack Units (2U, 3U, 3.5U)
In case of 2-way combination a simple Hybrid Coupler is used.
- Splitter: divides the power into the correct number of outputs, driving the Power Amplifiers with accurately balanced amplitudes and correct phases in order to be subsequently be re-combined by the Multicoupler with the highest possible efficiency



Quadrature Multicoupler System

This cost-effective system makes use of Quadrature Couplers and Splitters:

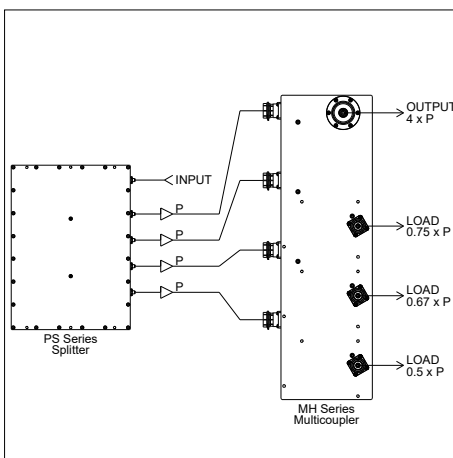
- 3, 4 and 5-way combinations available (2-way with a Hybrid Coupler)
- 3U and 3.5U Unified Connector Spacing
- Direct plug-in into Power Amplifiers (Quick Plug Connectors available)
- Cost effective solution
- Low and medium power
- Ideal for Air-Cooled transmitters

MC Series Quadrature Multicouplers

- High Efficiency (Typical 99%, corresponding to 0.04 dB overall Insertion Loss)
- High Port Isolation (> 30 dB), allowing partial operation and hot replacement of amplifiers
- Phase Compensated Design (3-way and 5-way)

QS Series Quadrature Splitters

- Outputs with proper phase and balanced amplitude levels, providing optimum amplifier performance
- 2, 4, and 8-way Splitters available; odd-numbered Splitters obtained by the even-numbered Splitters terminating the unused outputs



Progressive Multicoupler System

This innovative system makes use of Progressive Couplers and Splitters:

- 3, 4, 5, 6, 8, 10-way combinations available
- 2U and 3U Unified Connector Spacing
- Direct plug-in into Power Amplifiers (Quick Plug Connectors available)
- Integrated Liquid Cooled load (Option)
- High power
- Ideal for Liquid-Cooled transmitters

MH Series Progressive Multicouplers

- High Efficiency (Typical 99%, corresponding to 0.04 dB overall Insertion Loss)
- High Port Isolation (> 30 dB), allowing partial operation and hot replacement of amplifiers

PS Series Progressive Splitters

- Outputs with proper phase and equalized amplitude levels, providing optimum amplifier performance
- 3, 4 and 5-way Splitters available

FastLine Rigid Line System



Connections Power Ratings

Power ratings for COM-TECH Connectors and Rigid Lines:

Type	UHF (700 MHz)		VHF B.III (230 MHz)		VHF B.I (88 MHz)		FM (108 MHz)	
N	500 W		900 W		1.4 kW		1.3 kW	
7-16	2.0 kW		3.5 kW		5.6 kW		5.1 kW	
	Rigid Line	Components and R.L. Painted	Rigid Line	Components and R.L. Painted	Rigid Line	Components and R.L. Painted	Rigid Line	Components and R.L. Painted
7/8"	2.2 kW	2.7 kW	3.8 kW	4.7 kW	6.1 kW	7.6 kW	5.5 kW	6.9 kW
1+5/8"	5.6 kW	7.0 kW	9.8 kW	12.0 kW	16.0 kW	20.0 kW	14.0 kW	18.0 kW
3+1/8"	20.0 kW	25.0 kW	35.0 kW	44.0 kW	57.0 kW	71.0 kW	52.0 kW	65.0 kW
4+1/16"	28.0 kW	35.0 kW	49.0 kW	61.0 kW	79.0 kW	99.0 kW	71.0 kW	89.0 kW
4+1/2"	30.0 kW	37.0 kW	52.0 kW	65.0 kW	84.0 kW	105.0 kW	76.0 kW	95.0 kW
RL-120	38.0 kW	48.0 kW	66.0 kW	83.0 kW	107.0 kW	134.0 kW	97.0 kW	121.0 kW
6+1/8"	59.0 kW	74.0 kW	104.0 kW	130.0 kW	168.0 kW	210.0 kW	151.0 kW	189.0 kW

Notes:

- Maximum Operating Temperature (Outer Conductor): 70°C (158°F); Recommended: < 65°C (149°F)
- Power referred to 1.500 m (4.900 ft.). See Altitude Thermal Derating
- "R.L. Painted": Painting applied after Rigid Line installation: water-based, matte black, 80°C (176°F) resistant



Range of Components

FastLine, COM-TECH proprietary Rigid Line system for indoor applications, comprehends a complete range of connections and components from 7/8" to 6+1/8", compatible with EIA and JEITA standards:

- Rigid Lines: 2m or 4m line lengths
- Elbows: with quick Plug or Flanged connections
- Junctions: quick direct connections between Rigid Lines
- Flanges: with extra threads for direct connection without using nuts
- Inner Connections: to connect Flanges
- Inner Supports: to support the inner conductor of the rigid line

Different Cutbacks (offset between the outer and inner conductor) are available:

- Flush (Zero) Cutback, for convenient and simple installations
- Recessed (Offset) Cutbacks, for compatibility with NAX/WX and legacy standards

Two different types of connections are available:

- COM-TECH Socket-Plug system for more compact, more efficient, faster and cheaper connections
- Traditional Flanged connections for compatibility with all EIA systems



Choice of Materials

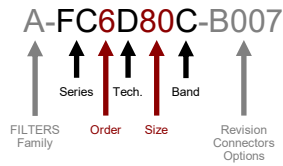
FastLine has been developed with an innovative choice of materials:

- Inner conductor: Highly Conductive ETP Copper for low losses (as the Insertion Losses depends mainly on the inner conductor)
- Outer conductor: Highly Conductive Hardened Aluminium, for better mechanical properties (flexibility, and lightness) and cost reduction
- Optimal temperature compensation between Outer and Inner conductors: the highest temperature of the inner conductor is compensated by the lower coefficient of expansion of Copper
- Full galvanic compatibility between metals, as Copper is matched to Copper (or compatible metal, as silver plated copper alloy), whereas Aluminium is connected to Aluminium

Notes:

- Copper Rigid Line Outer available on request

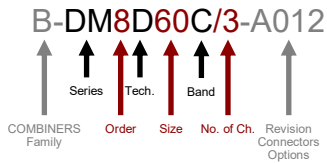
Coding Guide



FILTERS

Filters product codes are named with reference to Series, Order, Technique, Size, and Band:

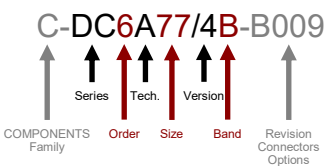
Series	CL, FC...:	Combine, Folded Combine...
Order	4, 6, 8...:	No. of Poles
Technique	E:	Cross Coupling
	X:	<i>XLine</i>
	D:	<i>DualCross</i>
	P:	All-Pole
	N:	2-Notch
Size	60, 80...:	Cavity Size in mm
Band	C:	UHF
	B:	VHF B.III
	A:	VHF B.I
	R:	DAB (VHF B.III)
	F:	FM



COMBINERS

Combiners product codes are named with reference to Series, Order, Technique, Size, Band and Number of Channels:

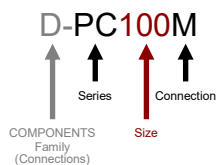
Series	MX, DM...:	Manifold, Compact Modular...
Order	4, 6, 8...:	No. of Poles
Technique	E:	Cross Coupling
	X:	<i>XLine</i>
	D:	<i>DualCross</i>
	P:	All-Pole
Size	60, 80...:	Cavity Size in mm
Band	C:	UHF
	B:	VHF B.III
	A:	VHF B.I
	R:	DAB (VHF B.III)
	F:	FM
No. of Channels	2, 3, 4...:	Number of Filtered Channels



COMPONENTS

Components product codes are named with reference to Series, Order, Technique, Size, Version, Band and Connection:

Series	DC, PC...:	Directional Couplers, Panel Connectors...
Order	3, 4, 6...:	No. of Slots (Directional Couplers)...
	3, 4, 5...:	No. of Inputs (Multicouplers)
	3, 4, 6...:	No. of Ports (Patch Panels)
Technique	Q:	Quadrature (MC Series)
	P:	Progressive (MH Series)
	A:	<i>Accuprobe</i> (DC Series)
Size	60, 80...:	Hybrid Couplers, Multicouplers...
	39, 77...:	Directional Couplers, Rigid Lines...
	64, 100...:	Panel Connectors, Adapters...
Version	3, 4, 5...:	No. of Probes (DC Series)
	1, 2, 4...:	Balancing (AP Series), ...
Band	C:	UHF
	B:	VHF B.III
	A:	VHF B.I
	R:	DAB (VHF B.III)
	F:	FM
Connection	C, D:	N Female, Male
	E, F:	7-16 Female, Male
	G, H, I:	7/8" (WX-20D) Socket, Flange, Plug
	J, K, L:	1+5/8" (WX-39D) Socket, Flange, Plug
	M, N, O:	3+1/8" (WX/NAX-77D) Socket, Fl., Plug
	P, Q, R:	4+1/2" Socket, Flange, Plug
	S, X, T:	RL-120 (WX/NAX-120D) Socket, Fl., Plug
	U, V, W:	6+1/8" (WX-152) Socket, Flange, Plug



FILTERS

UHF Bandpass Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
CL Series			
CL5P20C	5-Pole / 20 mm	80 W	-
CL6X30C	6-Pole <i>XLine</i> / 30 mm	150 W	-
CL7X30C	7-Pole <i>XLine</i> / 30 mm	150 W	-
CL6X50C	6-Pole <i>XLine</i> / 50 mm	300 W	-
CL7X50C	7-Pole <i>XLine</i> / 50 mm	270 W	-
FC Series			
FC6D60C	6-Pole <i>DualCross</i> / 60 mm	410 W	-
FC8D60C	8-Pole <i>DualCross</i> / 60 mm	350 W	-
FC6D80C	6-Pole <i>DualCross</i> / 80 mm	790 W	-
FC8D80C	8-Pole <i>DualCross</i> / 80 mm	670 W	-
FC6D110C	6-Pole <i>DualCross</i> / 110 mm	1.80 kW	-
FC8D110C	8-Pole <i>DualCross</i> / 110 mm	1.50 kW	-
TF Series			
TF6D120C	6-Pole <i>DualCross</i> / 120 mm	2.10 kW	5.05 kW
TF8D120C	8-Pole <i>DualCross</i> / 120 mm	2.05 kW	4.60 kW
TF6D170C	6-Pole <i>DualCross</i> / 170 mm	4.40 kW	10.20 kW
TF8D170C	8-Pole <i>DualCross</i> / 170 mm	4.10 kW	9.10 kW
TF6D220C	6-Pole <i>DualCross</i> / 220 mm	8.75 kW	20.25 kW
TF8D220C	8-Pole <i>DualCross</i> / 220 mm	8.35 kW	18.50 kW
TC Series (To Be Discontinued)			
TC6D140C	6-Pole <i>DualCross</i> / 140 mm	4.60 kW	12.10 kW
TC8D140C	8-Pole <i>DualCross</i> / 140 mm	4.45 kW	11.55 kW
TC6D200C	6-Pole <i>DualCross</i> / 200 mm	9.45 kW	20.10 kW
TC8D200C	8-Pole <i>DualCross</i> / 200 mm	8.05 kW	17.10 kW
Analog TV			
CL3N30C	3-Pole / 30 mm	380 W S.P.	-
CL3N50C	3-Pole / 50 mm	780 W S.P.	-
FC4E80C	4-Pole / 80 mm	1.85 kW S.P.	-
FC4E110C	4-Pole / 110 mm	4.10 kW S.P.	-
TC4E140C	4-Pole / 140 mm	7.80 kW S.P.	20.90 kW S.P.
TC4E200C	4-Pole / 200 mm	17.20 kW S.P.	33.80 kW S.P.

UHF Balanced Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
BF Series			
BF6D220C	6-Pole <i>DualCross</i> / 220 mm	17.45 kW	40.55 kW
BF8D220C	8-Pole <i>DualCross</i> / 220 mm	16.65 kW	37.05 kW

UHF Lowpass Filters

Code	Low Pass Frequency	Max RMS Input Power
LC Series		
LC39RC	DC to 806 MHz	2.50 kW
LC39C	DC to 862 MHz	2.50 kW
LP Series		
LP39RC	DC to 806 MHz	3.50 kW
LP39C	DC to 862 MHz	6.50 kW
LP77RC	DC to 806 MHz	8.50 kW
LP77C	DC to 862 MHz	11.00 kW

VHF B.III Bandpass Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
CL Series			
CL6X30B	6-Pole <i>XLine</i> / 30 mm	130 W	-
CL6X60B	6-Pole <i>XLine</i> / 60 mm	840 W	-
TS Series			
TS6D80B	6-Pole <i>DualCross</i> / 80 mm	1.50 kW	-
TS8D80B	8-Pole <i>DualCross</i> / 80 mm	1.30 kW	-
TC Series			
TC6D100B	6-Pole <i>DualCross</i> / 100 mm	2.55 kW	6.30 kW
TC8D100B	8-Pole <i>DualCross</i> / 100 mm	2.30 kW	5.60 kW
TC6D140B	6-Pole <i>DualCross</i> / 140 mm	5.35 kW	10.75 kW
TC8D140B	8-Pole <i>DualCross</i> / 140 mm	4.80 kW	9.55 kW
TC6D200B	6-Pole <i>DualCross</i> / 200 mm	11.0 kW	22.00 kW
TC8D200B	8-Pole <i>DualCross</i> / 200 mm	10.25 kW	20.50 kW
Analog TV			
CL3N30B	3-Pole / 30 mm	290 W S.P.	-
CL3N60B	3-Pole / 60 mm	2.25 kW S.P.	-
TC4E100B	4-Pole / 100 mm	4.95 kW S.P.	11.35 kW S.P.
TC4E140B	4-Pole / 140 mm	13.10 kW S.P.	26.2 kW S.P.
TC4E200B	4-Pole / 200 mm	22.05 kW S.P.	48.10 kW S.P.

FILTERS

VHF B. III Balanced Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
BF Series			
BF6D200B	6-Pole <i>DualCross</i> / 200 mm	22.00 kW	44.00 kW
BF8D220B	8-Pole <i>DualCross</i> / 200 mm	22.50 kW	40.95 kW

VHF B.III Lowpass Filters

Code	Low Pass Frequency	Max RMS Input Power
LC Series		
LC39B	DC to 240 MHz	3.50 kW
LP Series		
LP39B	DC to 240 MHz	3.50 kW
LP77B	DC to 240 MHz	11.00 kW

VHF B.I Bandpass Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
HR Series			
HR6P60A	6-Pole / 60 mm	380 W	-
HR6P110A	6-Pole / 110 mm	1.35 kW	-
HE Series			
HE6P300A	6-Pole / 300 mm	18.90 kW	25.00 kW

DAB Bandpass Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
CL Series			
CL7P60R	7-Pole / 60 mm	270 W	-
TS Series			
TS6D80R	6-Pole <i>DualCross</i> / 80 mm	490 W	-
TC Series			
TC6D100R	6-Pole <i>DualCross</i> / 100 mm	0.83 kW	2.10 kW
TC8D100R	8-Pole <i>DualCross</i> / 100 mm	0.76 kW	1.90 kW
TC6D140R	6-Pole <i>DualCross</i> / 140 mm	1.75 kW	3.45 kW
TC8D140R	8-Pole <i>DualCross</i> / 140 mm	1.60 kW	3.20 kW
TC6D200R	6-Pole <i>DualCross</i> / 200 mm	3.65 kW	7.30 kW
TC8D200R	8-Pole <i>DualCross</i> / 200 mm	3.35 kW	6.70 kW

DAB Balanced Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
BF Series			
BF6D200R	6-Pole <i>DualCross</i> / 200 mm	7.30 kW	14.60 kW
BF8D220R	8-Pole <i>DualCross</i> / 200 mm	6.70 kW	13.35 kW

FM Bandpass Filters

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
CL Series			
CL2P80F	2-Pole / 80 mm	670 W	-
CL3P80F	3-Pole / 80 mm	670 W	-
CL2P120F	2-Pole / 120 mm	1.35 kW	-
CL3P120F	3-Pole / 120 mm	1.35 kW	-
CL2P220F	2-Pole / 220 mm	2.65 kW	-
CL3P220F	3-Pole / 220 mm	2.65 kW	-

COMBINERS

UHF Manifold Combiners

Code	Order / Cavity	Max RMS Output Power	Max RMS Input Power
MX Series			
MX4P20C	4-Pole / 20 mm	500 W	100 W
MX5P20C	5-Pole / 20 mm	500 W	80 W

UHF Starpoint Combiners

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
SB Series			
SB6X30C	6-Pole <i>XLine</i> / 30 mm	150 W	-
SB7X30C	7-Pole <i>XLine</i> / 30 mm	150 W	-
SB6X50C	6-Pole <i>XLine</i> / 50 mm	300 W	-
SB7X50C	7-Pole <i>XLine</i> / 50 mm	270 W	-
SM Series			
SM6D60C	6-Pole <i>DualCross</i> / 60 mm	410 W	-
SM8D60C	8-Pole <i>DualCross</i> / 60 mm	350 W	-
SM6D80C	6-Pole <i>DualCross</i> / 80 mm	790 W	-
SM8D80C	8-Pole <i>DualCross</i> / 80 mm	670 W	-
SM6D110C	6-Pole <i>DualCross</i> / 110 mm	1.80 kW	-
SM8D110C	8-Pole <i>DualCross</i> / 110 mm	1.50 kW	-
SF Series			
SF6D120C	6-Pole <i>DualCross</i> / 120 mm	2.10 kW	5.05 kW
SF8D120C	8-Pole <i>DualCross</i> / 120 mm	2.05 kW	4.60 kW
SF6D170RC	6-Pole <i>DualCross</i> / 170 mm	4.40 kW	-
SF8D170RC	8-Pole <i>DualCross</i> / 170 mm	4.10 kW	-
SF6D170C	6-Pole <i>DualCross</i> / 170 mm	4.40 kW	10.20 kW
SF8D170C	8-Pole <i>DualCross</i> / 170 mm	4.10 kW	9.15 kW
SF6D220RC	6-Pole <i>DualCross</i> / 220 mm	8.75 kW	-
SF8D220RC	8-Pole <i>DualCross</i> / 220 mm	8.35 kW	-
SF6D220C	6-Pole <i>DualCross</i> / 220 mm	8.75 kW	20.25 kW
SF8D220C	8-Pole <i>DualCross</i> / 220 mm	8.35 kW	18.50 kW
Analog TV / No Mask			
SB4P30C	4-Pole / 30 mm	190 W	-
SB4P50C	4-Pole / 50 mm	390 W	-
SM4E80C	4-Pole / 80 mm	1.30 kW	-
SM4E110C	4-Pole / 110 mm	2.85 kW	-

COMBINERS

UHF Balanced Combiners

Code	Order / Cavity	Max RMS Output Power	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
DB Series				
DB4A30KC	4-Pole / 30 mm	1.0 kW	160 W	-
DB4A30C	4-Pole / 30 mm	2.5 kW	300 W	-
DB6X30C	6-Pole <i>XLine</i> / 30 mm	2.5 kW	300 W	-
DB7X30C	7-Pole <i>XLine</i> / 30 mm	2.5 kW	300 W	-
DB6X50C	6-Pole <i>XLine</i> / 50 mm	2.5 kW	600 W	-
DB7X50C	7-Pole <i>XLine</i> / 50 mm	2.5 kW	550 W	-
DM Series				
DM6D60RC	6-Pole <i>DualCross</i> / 60 mm	2.5 kW	830 W	-
DM8D60RC	8-Pole <i>DualCross</i> / 60 mm	2.5 kW	710 W	-
DM6D60C	6-Pole <i>DualCross</i> / 60 mm	7.0 kW	830 W	-
DM8D80C	8-Pole <i>DualCross</i> / 80 mm	7.0 kW	710 W	-
DM6D80RC	6-Pole <i>DualCross</i> / 80 mm	2.5 kW	1.60 kW	-
DM8D80RC	8-Pole <i>DualCross</i> / 80 mm	2.5 kW	1.35 kW	-
DM6D80C	6-Pole <i>DualCross</i> / 80 mm	7.0 kW	1.60 kW	-
DM8D80C	8-Pole <i>DualCross</i> / 80 mm	7.0 kW	1.35 kW	-
DM6D110C	6-Pole <i>DualCross</i> / 110 mm	7.0 kW	3.60 kW	-
DM8D110C	8-Pole <i>DualCross</i> / 110 mm	7.0 kW	3.05 kW	-
DF Series				
DF6D120C	6-Pole <i>DualCross</i> / 120 mm	21.0 kW	4.25 kW	10.10 kW
DF8D120C	8-Pole <i>DualCross</i> / 120 mm	21.0 kW	4.05 kW	9.15 kW
DF6D170RC	6-Pole <i>DualCross</i> / 170 mm	21.0 kW	8.75 kW	-
DF8D170RC	8-Pole <i>DualCross</i> / 170 mm	21.0 kW	8.20 kW	-
DF6D170C	6-Pole <i>DualCross</i> / 170 mm	35.0 kW	8.75 kW	20.35 kW
DF8D170C	8-Pole <i>DualCross</i> / 170 mm	35.0 kW	8.20 kW	18.25 kW
DF6D220RC	6-Pole <i>DualCross</i> / 220 mm	35.0 kW	17.45 kW	-
DF8D220RC	8-Pole <i>DualCross</i> / 220 mm	35.0 kW	16.65 kW	-
DF6D220C	6-Pole <i>DualCross</i> / 220 mm	70.0 kW	17.45 kW	40.55 kW
DF8D220C	8-Pole <i>DualCross</i> / 220 mm	70.0 kW	16.65 kW	37.05 kW
DF Series (To Be Discontinued)				
DF6D140C	6-Pole <i>DualCross</i> / 140 mm	22.0 kW	6.45 kW	16.95 kW
DF8D140C	8-Pole <i>DualCross</i> / 140 mm	22.0 kW	6.25 kW	16.15 kW
DF6D200C	6-Pole <i>DualCross</i> / 200 mm	48.0 kW	13.20 kW	28.15 kW
DF8D200C	8-Pole <i>DualCross</i> / 200 mm	48.0 kW	11.25 kW	23.95 kW
Analog TV / No-Mask				
DB4P30C	4-Pole / 30 mm	2.7 kW	370 W	-
DB4P50C	4-Pole / 50 mm	2.7 kW	780 W	-
DM4E80C	4-Pole / 80 mm	7.0 kW	2.60 kW	-
DM4E110C	4-Pole / 110 mm	7.0 kW	5.70 kW	-
DF4E140C	4-Pole / 140 mm	22.0 kW	10.90 kW	29.25 kW
DF4E200C	4-Pole / 200 mm	48.0 kW	24.05 kW	48.15 kW

COMBINERS

VHF B.III Manifold Combiners

Code	Order / Cavity	Max RMS Output Power	Max RMS Input Power
MX Series			
MX5P30B	5-Pole / 30 mm	130 W	130 W

VHF B.III Starpoint Combiners

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
SB Series			
SB6X30B	6-Pole <i>XLine</i> / 30 mm	130 W	-
SM Series			
SM6X60B	6-Pole <i>XLine</i> / 60 mm	840 W	-
SM6D80B	6-Pole <i>DualCross</i> / 80 mm	1.50 kW	-
SM8D80B	8-Pole <i>DualCross</i> / 80 mm	1.30 kW	-
SF Series			
SF6D100RB	6-Pole <i>DualCross</i> / 100 mm	2.55 kW	-
SF8D100RB	8-Pole <i>DualCross</i> / 100 mm	2.30 kW	-
SF6D100B	6-Pole <i>DualCross</i> / 100 mm	2.55 kW	6.30 kW
SF8D100B	8-Pole <i>DualCross</i> / 100 mm	2.30 kW	5.60 kW
SF6D140RB	6-Pole <i>DualCross</i> / 140 mm	5.35 kW	-
SF8D140RB	8-Pole <i>DualCross</i> / 140 mm	4.80 kW	-
SF6D140B	6-Pole <i>DualCross</i> / 140 mm	5.35 kW	10.75 kW
SF8D140B	8-Pole <i>DualCross</i> / 140 mm	4.80 kW	9.55 kW
SF6D200B	6-Pole <i>DualCross</i> / 200 mm	11.00 kW	22.05 kW
SF8D200B	8-Pole <i>DualCross</i> / 200 mm	10.25 kW	20.50 kW
Analog TV / No Mask			
SB3N30B	3-Pole / 30 mm	240 W	-
SB3N60B	3-Pole / 60 mm	1.80 kW	-
SF4E100B	4-Pole / 100 mm	5.00 kW	9.10 kW
SF4E140B	4-Pole / 140 mm	10.50 kW	20.95 kW
SF4E200B	4-Pole / 200 mm	22.10 kW	45.15 kW

VHF B.III Balanced Combiners

Code	Order / Cavity	Max RMS Output Power	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
DB Series				
DB6X30B	6-Pole <i>XLine</i> / 30 mm	4.60 kW	270 W	-
DM Series				
DM6X60B	6-Pole <i>XLine</i> / 30 mm	4.60 kW	1.70 kW	-
DM6D80B	6-Pole <i>DualCross</i> / 80 mm	4.60 kW	3.00 kW	-
DM8D80B	8-Pole <i>DualCross</i> / 80 mm	4.60 kW	2.65 kW	-
DF Series				
DF6D100B	6-Pole <i>DualCross</i> / 100 mm	12.0 kW	5.10 kW	12.60 kW
DF8D100B	8-Pole <i>DualCross</i> / 100 mm	12.0 kW	4.55 kW	11.25 kW
DF6D140B	6-Pole <i>DualCross</i> / 140 mm	33.0 kW	10.75 kW	21.45 kW
DF8D140B	8-Pole <i>DualCross</i> / 140 mm	33.0 kW	9.60 kW	18.15 kW
DF6D200RB	6-Pole <i>DualCross</i> / 200 mm	33.0 kW	22.0 kW	-
DF8D200RB	8-Pole <i>DualCross</i> / 200 mm	33.0 kW	20.50 kW	-
DF6D200B	6-Pole <i>DualCross</i> / 200 mm	65.0 kW	22.00 kW	44.00 kW
DF8D200B	8-Pole <i>DualCross</i> / 200 mm	65.0 kW	20.50 kW	40.95 kW
Analog TV / No Mask				
DB3N30B	3-Pole / 30 mm	4.60 kW	470 W	-
DB3N60B	3-Pole / 60 mm	4.60 kW	3.60 kW	-
DF4E100B	4-Pole / 100 mm	12.0 kW	7.95 kW	18.20 kW
DF4E140B	4-Pole / 140 mm	33.0 kW	20.95 kW	41.90 kW
DF4E200B	4-Pole / 200 mm	57.0 kW	44.15 kW	76.90 kW

VHF B.I Starpoint Combiners

Code	Order / Cavity	Max RMS Input Power
SM Series		
SM6P60A	6-Pole / 60 mm	380 W
SM6P110A	6-Pole / 110 mm	1.35 kW

COMBINERS

DAB Starpoint Combiners

Code	Order / Cavity	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
SM Series			
SM7P60R	7-Pole / 60 mm	270 W	–
SM6D80R	6-Pole <i>DualCross</i> / 80 mm	490 W	–
SF Series			
SF6D100R	6-Pole <i>DualCross</i> / 100 mm	0.83 kW	2.10 kW
SF8D100R	8-Pole <i>DualCross</i> / 100 mm	0.76 kW	1.90 kW
SF6D140R	6-Pole <i>DualCross</i> / 140 mm	1.75 kW	3.45 kW
SF8D140R	8-Pole <i>DualCross</i> / 140 mm	1.60 kW	2.85 kW
SF6D200R	6-Pole <i>DualCross</i> / 200 mm	3.65 kW	7.30 kW
SF8D200R	8-Pole <i>DualCross</i> / 200 mm	3.35 kW	5.65 kW

DAB Balanced Combiners

Code	Order / Cavity	Max RMS Output Power	Max RMS Input Power (Default or with Heat Sinks)	Max RMS Input Power (w/ Liq. or F. Air Cooling)
DM Series				
DM7P60R	7-Pole / 60 mm	4.60 kW	540 W	-
DM6D80R	8-Pole <i>DualCross</i> / 80 mm	4.60 kW	0.98 kW	-
DF Series				
DF6D100RR	6-Pole <i>DualCross</i> / 100 mm	4.60 kW	1.65 kW	-
DF8D100RR	8-Pole <i>DualCross</i> / 100 mm	4.60 kW	1.50 kW	-
DF6D100R	6-Pole <i>DualCross</i> / 100 mm	12.0 kW	1.65 kW	4.15 kW
DF8D100R	8-Pole <i>DualCross</i> / 100 mm	12.0 kW	1.50 kW	3.80 kW
DF6D140RR	6-Pole <i>DualCross</i> / 140 mm	4.60 kW	3.45 kW	-
DF8D140RR	8-Pole <i>DualCross</i> / 140 mm	4.60 kW	3.20 kW	-
DF6D140R	6-Pole <i>DualCross</i> / 140 mm	12.0 kW	3.45 kW	6.95 kW
DF8D140R	8-Pole <i>DualCross</i> / 140 mm	12.0 kW	3.20 kW	6.35 kW
DF6D200RR	6-Pole <i>DualCross</i> / 200 mm	12.0 kW	7.30 kW	-
DF8D200RR	8-Pole <i>DualCross</i> / 200 mm	12.0 kW	6.70 kW	-
DF6D200R	6-Pole <i>DualCross</i> / 200 mm	33.0 kW	7.30 kW	14.60 kW
DF8D200R	8-Pole <i>DualCross</i> / 200 mm	33.0 kW	6.70 kW	13.35 kW

FM Manifold Combiners

Code	Order / Cavity	Max RMS Output Power	Max Ch. RMS Input Power (Default or with Heat Sinks)
MX Series			
MX2P80KF	2-Pole / 80 mm	2.00 kW	470 W
MX2P80F	2-Pole / 80 mm	2.00 kW	670 W
MX3P80KF	3-Pole / 80 mm	2.00 kW	470 W
MX3P80F	3-Pole / 80 mm	2.00 kW	670 W
MX2P120KF	2-Pole / 120 mm	2.00 kW	940 W
MX2P120F	2-Pole / 120 mm	2.00 kW	1.35 kW
MX2P120SF	2-Pole / 120 mm	2.00 kW	1.35 kW
MX3P120KF	3-Pole / 120 mm	2.00 kW	940 W
MX3P120F	3-Pole / 120 mm	2.00 kW	1.35 kW
MX3P120SF	3-Pole / 120 mm	2.00 kW	1.35 kW
MX2P220KF	2-Pole / 220 mm	5.70 kW	1.5 kW
MX2P220F	3-Pole / 220 mm	5.70 kW	2.65 kW
MX3P220KF	3-Pole / 220 mm	5.70 kW	1.85 kW
MX3P220F	3-Pole / 220 mm	5.70 kW	2.65 kW

FM Balanced Combiners

Code	Order / Cavity	Max RMS Output Power	Max RMS Input Power (Default or with Heat Sinks)
DB Series			
DM2P80F	2-Pole / 80 mm	5.90 kW	1.35 kW
DM3P80F	3-Pole / 80 mm	5.90 kW	1.35 kW
DM2P120F	2-Pole / 120 mm	5.90 kW	2.70 kW
DM3P120F	3-Pole / 120 mm	5.90 kW	2.70 kW
DM2P220RF	2-Pole / 220 mm	5.90 kW	5.25 kW
DM3P220RF	3-Pole / 220 mm	5.90 kW	5.25 kW

COMPONENTS

UHF Hybrid Couplers

Code	Unified Connector Spacing	Max RMS Output Power
HC Series		
HC40C	3U	4.300 kW
HC40ZC	3.5U	4.30 kW
HC60C	3.5U	11.00 kW
HC100C	6U	25.00 kW
NH Series		
NH100C	9U	34.00 kW
NH140C	9U	48.00 kW
NH200C	9U	74.00 kW

UHF Multicouplers

Code	Unified Connector Spacing	No. of Inputs	Max RMS Input / Output Power
MC Series			
MC3Q40C	3U	3	1.43 kW / 4.30 kW
MC4Q40C	3U	4	1.08 kW / 4.30 kW
MC3Q60C	3.5U	3	3.67 kW / 11.00 kW
MC4Q60C	3.5U	4	2.75 kW / 11.00 kW
MC5Q60C	3.5U	5	2.20 kW / 11.00 kW
MC3Q60EC	5U	3	3.67 kW / 11.00 kW
MC4Q60EC	5U	4	2.75 kW / 11.00 kW
MH Series			
MH3P60C	3U	3	2.00 kW / 6.00 kW
MH4P60C	3U	4	2.00 kW / 8.00 kW
MH5P60C	3U	5	2.00 kW / 10.00 kW
MH6P60C	3U	6	2.00 kW / 12.00 kW
MH8P60C	3U	8	2.00 kW / 16.00 kW
MH10P60C	3U	10	2.00 kW / 20.00 kW
MH3P60RC	2U	3	2.00 kW / 6.00 kW
MH4P60RC	2U	4	2.00 kW / 8.00 kW
MH5P60RC	2U	5	2.00 kW / 10.00 kW
MH6P60RC	3U	6	2.00 kW / 12.00 kW
MH8P60RC	3U	8	2.00 kW / 16.00 kW
MH10P60RC	3U	10	2.00 kW / 20.00 kW

UHF Splitters

Code	No. of Ways
QS Series	
QS2C	2
QS4C	4
QS8C	8
PS Series	
PS3C	3
PS5C	5

COMPONENTS

VHF B.III Hybrid Couplers

Code	Unified Connector Spacing	Max RMS Output Power
HF Series		
HF40B	3U	7.40 kW
HF60B	3.5U	19.00 kW
HC Series		
HC100B	-	53.00 kW
HC150B	-	83.00 kW

VHF B.III Multicouplers

Code	Unified Connector Spacing	No. of Inputs	Max RMS Input / Output Power
MC Series			
MC3Q40B	3U	3	2.47 kW / 7.40 kW
MC4Q40B	3U	4	1.85 kW / 7.40 kW
MC3Q60B	3.5U	3	6.33 kW / 19.00 kW
MC4Q60B	3.5U	4	4.75 kW / 19.00 kW
MC5Q60B	3.5U	5	3.80 kW / 19.00 kW

VHF B.III Splitters

Code	No. of Ways
QS Series	
QS2B	2
QS4B	4
QS8B	8

VHF B.I Splitters

Code	No. of Ways
QS Series	
QS2A	2
QS4A	4
QS8A	8

FM Hybrid Couplers

Code	Unified Connector Spacing	Max RMS Output Power
HF Series		
HF40F	4U	9.40 kW

COMPONENTS

Patch Panels

Code	No. of Ports	Max RMS Input Power UHF	Max RMS Input Power VHF B.III	Max RMS Input Power VHF BI-II	Max RMS Input Power FM
AP Series					
AP6I39C/B	6	7.00 kW	12.00 kW	-	18.00 kW
AP8I39C/B	8	7.00 kW	12.00 kW	-	18.00 kW
AP6I77C/B	6	25.00 kW	44.00 kW	-	65.00 kW
AP8I77C/B	8	25.00 kW	44.0 kW	-	65.00 kW
AP6I120C/B	6	48.0 kW	83.0 kW	-	121.00 kW
AP8I120C/B	8	48.0 kW	83.0 kW	-	121.00 kW
TP Series					
TP3F39C	3	7.0 kW	12.00 kW	19.00 kW	18.00 kW
TP4F39C	4	7.0 kW	12.00 kW	19.00 kW	18.00 kW
TP3F77C	3	25.0 kW	44.00 kW	67.00 kW	65.00 kW
TP4F77C	4	25.0 kW	44.00 kW	67.00 kW	65.00 kW
TP3F120C	3	48.0 kW	83.00 kW	126.00 kW	121.00 kW
TP4F120C	4	48.0 kW	83.00 kW	126.00 kW	121.00 kW
BP Series					
BP4F77C	4	25.00 kW	44.00 kW	71.00 kW	65.00 kW
BP4F120C	4	48.00 kW	83.00 kW	126.00 kW	121.00 kW

Directional Couplers

Code	No. of Slots	Max RMS Input Power UHF	Max RMS Input Power VHF B.III	Max RMS Input Power VHF BI-II	Max RMS Input Power FM
DC Series					
DC2A23	Up to 3	2.70 kW	4.70 kW	7.20 kW	6.90 kW
DC4A23	Up to 6	2.70 kW	4.70 kW	7.20 kW	6.90 kW
DC3A39	Up to 3	7.00 kW	12.00 kW	19.00 kW	18.00 kW
DC6A39	Up to 6	7.00 kW	12.00 kW	19.00 kW	18.00 kW
DC3A77	Up to 3	25.00 kW	44.00 kW	67.00 kW	65.00 kW
DC6A77	Up to 6	25.00 kW	44.00 kW	67.00 kW	65.00 kW
DC3A103	Up to 3	37.00 kW	65.00 kW	99.00 kW	95.00 kW
DC6A103	Up to 6	37.00 kW	65.00 kW	99.00 kW	95.00 kW
DC3A120	Up to 3	48.00 kW	83.00 kW	126.00 kW	121.00 kW
DC6A120	Up to 6	48.00 kW	83.00 kW	126.00 kW	121.00 kW

Matching Lines

Code	Max RMS Input Power
ML Series	
ML39C	7.00 kW
ML77C	25.00 kW
ML120C	48.00 kW

Dry Loads

Code	Application	Max RMS Input Power
DH Series		
DH25C	Integrated Heat Sink	40 W
DL Series		
DL40C	For Integration	400 W
DL 40HC	With Heat Sink	250 W
DL80C	For Integration	800 W
DL80HC	With Heat Sink	600 W
DT Series		
DT300HC	With Heat Sink	1.40 kW
DT300FC	With Forced Air	2.40 kW
DT300C	For Integration	3.00 kW
DT300SC	For Integration	3.75 kW
DT300LC	For Integration, Liq. Cooling	3.25 kW

Power Loads

Code	Technology	Max RMS Input Power
DP Series		
DP2C	Oil	2.50 kW
DP4C	Oil	4.00 kW
DP5C	Oil	5.00 kW
DP10	Oil	10.00 kW
DP15C	Water	15.00 kW
DP25C	Water	25.00 kW
DP50C	Water	50.00 kW

CONNECTIONS

Rigid Lines Connections

Code	Size	Max RMS Power UHF	Max RMS Power VHF B.III	Max RMS Input Power VHF BI-II	Max RMS Power VHF B.I, FM
RL Series					
RL-23	7/8" (WX-20D)	2.70 kW	4.70 kW	7.20 kW	6.90 kW
RL-39	1+5/8" (WX-39D)	7.00 kW	12.00 kW	19.00 kW	18.00 kW
RL-77	3+1/8" (WX-77D)/NAX-77D	25.00 kW	44.00 kW	67.00 kW	65.00 kW
RL-103	4+1/2"	37.00 kW	65.00 kW	99.00 kW	95.00 kW
RL-120	RL-120 (WX-120D)/NAX-120D	48.00 kW	83.00 kW	126.00 kW	121.00 kW
RL-152	6+1/8" (WX-152D)	74.00 kW	130.00 kW	197.00 kW	189.00 kW

Panel Connectors

Code	Size	Available Connections
PC Series		
PC25	25 mm	N, 7-16
PC32	32 mm	N, 7-16, 7/8", 1+5/8"
PC64	64 mm	1+5/8", 3+1/8"
PC100	100 mm	3+1/8", 4+1/2"
PC130	130 mm	4+1/2", RL-120
PC150	150 mm	RL-120, 6+1/8"

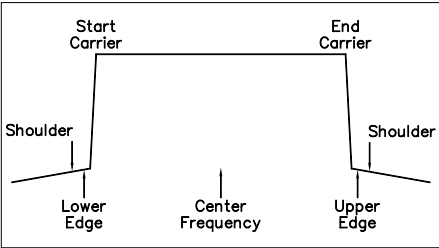
Adapters

Code	Size	Available Connections
AC Series		
AC32	32 mm	N, 7-16, 7/8"
AC64	64 mm	7/8", 1+5/8", 3+1/8"
AC100	100 mm	1+5/8", 3+1/8"
AC130	130 mm	3+1/8", 4+1/2"
AC150	150 mm	4+1/2", RL-120, 6+1/8"
SCSeries		
SC32	32 mm	N, 7-16, 7/8"
SC64	64 mm	N, 7-16, 7/8", 1+5/8"
SC100	100 mm	N, 7-16, 7/8", 1+5/8", 3+1/8"
SC130	130 mm	N, 7-16, 7/8", 1+5/8", 3+1/8", 4+1/2"
SC150	150 mm	N, 7-16, 7/8", 1+5/8", 3+1/8", 4+1/2", RL-120, 6+1/8"

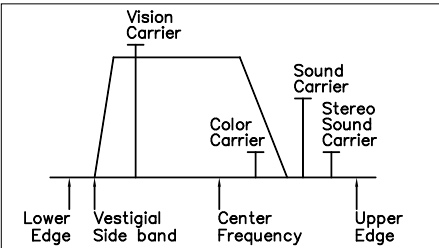
Accessories

Code	Description
MAC	Measurement Adapter Case
RLC	Rigid Line Cutter
RTT	Retuning Toolkit

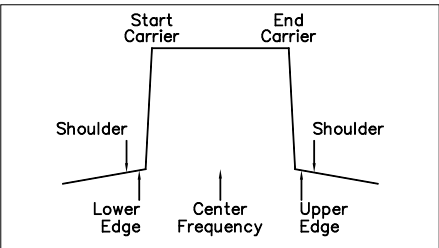
Channel Structure



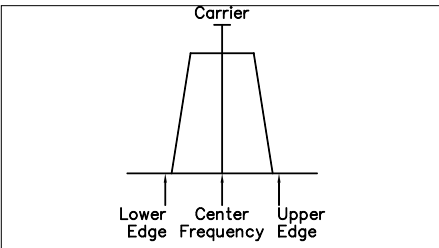
DTV					
Standard	Channel Width	Start - Stop	Shoulders	1 st Mask Breakpoint	2 nd Mask Breakpoint
DVB-T/T2 8 MHz	8 MHz	± 3.8/3.9 MHz	± 4.2 MHz	± 6 MHz	± 12 MHz
DVB-T/T2 7 MHz	7 MHz	± 3.325/3.4 MHz	± 3.675 MHz	± 5.25 MHz	± 10.5 MHz
DVB-T/T2 6 MHz	6 MHz	± 2.85/2.9 MHz	± 3.15 MHz	± 4.5 MHz	± 9 MHz
ATSC/ATSC 3.0	6 MHz	± 2.7/2.93 MHz	± 3.5 MHz	± 6 MHz	± 9 MHz
ISDB	6 MHz	± 2.79 MHz	± 3.15 MHz	± 4.5 MHz	± 9 MHz



ATV					
Standard	Channel Width	Sound Carrier	Center Frequency	Vestigial Sideband	Stereo Sound Carrier
G	8 MHz	V.C.+5.5 MHz	V.C.+2.75 MHz	V.C.-0.75 MHz	V.C.+5.74 MHz
D, K, K1 L	8 MHz	V.C.+6.5 MHz	V.C.+3.25 MHz	V.C.-0.75 MHz	
I	8 MHz	V.C.+6.0 MHz	V.C.+3.00 MHz	V.C.-1.25 MHz	
B	7 MHz	V.C.+5.5 MHz	V.C.+2.75 MHz	V.C.-0.75 MHz	
M, N	6 MHz	V.C.+4.5 MHz	V.C.+2.25 MHz	V.C.-0.75 MHz	



DAB / T-DMB					
Channel Width	Start / Stop	Shoulders	1 st Mask Breakpoint	2 nd Mask Breakpoint	3 rd Mask Breakpoint
1.712 MHz	± 0.77 MHz	± 0.97 MHz	± 1.75 MHz	± 2.2 MHz	± 3 MHz



FM		
Channel Width	Modulation Limit	Carrier
200 KHz	± 90 KHz	Center Frequency

8 MHz (UHF)

DVB 8 MHz / G, K, L, I

Ch. Europe	Ch. China	Center Freq. (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
21	13	474	471.25	470	478
22	14	482	479.25	478	486
23	15	490	487.25	486	494
24	16	498	495.25	494	502
25	17	506	503.25	502	510
26	18	514	511.25	510	518
27	19	522	519.25	518	526
28	20	530	527.25	526	534
29	21	538	535.25	534	542
30	22	546	543.25	542	550
31	23	554	551.25	550	558
32	24	562	559.25	558	566
33	-	570	567.25	566	574
34	-	578	575.25	574	582
35	-	586	583.25	582	590
36	-	594	591.25	590	598
37	-	602	599.25	598	606
38	25	610	607.25	606	614
39	26	618	615.25	614	622
40	27	626	623.25	622	630
41	28	634	631.25	630	638
42	29	642	639.25	638	646
43	30	650	647.25	646	654
44	31	658	655.25	654	662
45	32	666	663.25	662	670
46	33	674	671.25	670	678
47	34	682	679.25	678	686
48	35	690	687.25	686	694
49	36	698	695.25	694	702
50	37	706	703.25	702	710
51	38	714	711.25	710	718
52	39	722	719.25	718	726
53	40	730	727.25	726	734
54	41	738	735.25	734	742
55	42	746	743.25	742	750
56	43	754	751.25	750	758
57	44	762	759.25	758	766
58	45	770	767.25	766	774
59	46	778	775.25	774	782
60	47	786	783.25	782	790
61	48	794	791.25	790	798
62	49	802	799.25	798	806
63	50	810	807.25	806	814
64	51	818	815.25	814	822
65	52	826	823.25	822	830
66	53	834	831.25	830	838
67	54	842	839.25	838	846
68	55	850	847.25	846	854
69	56	858	855.25	854	862

8 MHz (VHF)

DVB 8 MHz / I, K1, D OIRT

Ch. Ireland	Ch. South Africa	Ch. French Overseas K1	Ch. OIRT	Center Freq. (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
Band I							
I A	-	-	-	48.5	45.75	44.5	52.5
I B	-	-	-	56.5	53.75	52.5	60.5
I C	-	-	-	64.5	61.75	60.5	68.5
-	-	-	R I	52.5	49.75	48.5	56.5
-	-	-	R II	62	59.25	58	66
-	-	-	R III	80	77.25	76	84
Band II							
-	-	-	R IV	88	85.25	84	92
-	-	-	R V	96	93.25	92	100
Band III							
I D	4	4	R VI	178	175.25	174	182
I E	5	5	R VII	186	183.25	182	190
I F	6	6	R VIII	194	191.25	190	198
I G	7	7	R IX	202	199.25	198	206
I H	8	8	R X	210	207.25	206	214
I J	9	9	R XI	218	215.25	214	222
-	10	-	R XII	226	223.25	222	230
-	11	-	-	234	231.25	230	238
-	(12)	-	-	242	-	238	246
-	13	-	-	250	247.25	246	254

DVB 8 MHz / D

Ch. China	Center Frequency (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
Band I				
1	52.5	49.75	48.5	56.5
2	60.5	57.75	56.5	64.5
3	68.5	65.75	64.5	72.5
4	80	77.25	76	84
5	88	85.25	84	92
Band III				
6	171	168.25	167	175
7	179	176.25	175	183
8	187	184.25	183	191
9	195	192.25	191	199
10	203	200.25	199	207
11	211	208.25	207	215
12	219	216.25	215	223

DVB 8 MHz / L

Ch. France	Center Frequency (DTV)	Vision Carrier (ATV)	Lower Edge	Channel End
Band I				
A	44	47.75	41	49
B	52	55.75	49	57
C	60	63.75	57	65
C1	56.75	60.5	53.75	61.75
Band III				
1	178.75	176	174.75	182.75
2	186.75	184	182.75	190.75
3	194.75	192	190.75	198.75
4	202.75	200	198.75	206.75
5	210.75	208	206.75	214.75
6	218.75	216	214.75	222.75

7 MHz (UHF / VHF)

DVB 7 MHz / B (UHF)

Ch. Australia	Center Freq. (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
28	529.5	527.25	526	533
29	536.5	534.25	533	540
30	543.5	541.25	540	547
31	550.5	548.25	547	554
32	557.5	555.25	554	561
33	564.5	562.25	561	568
34	571.5	569.25	568	575
35	578.5	576.25	575	582
36	585.5	583.25	582	589
37	592.5	590.25	589	596
38	599.5	597.25	596	603
39	606.5	604.25	603	610
40	613.5	611.25	610	617
41	620.5	618.25	617	624
42	627.5	625.25	624	631
43	634.5	632.25	631	638
44	641.5	639.25	638	645
45	648.5	646.25	645	652
46	655.5	653.25	652	659
47	662.5	660.25	659	666
48	669.5	667.25	666	673
49	676.5	674.25	673	680
50	683.5	681.25	680	687
51	690.5	688.25	687	694
52	697.5	695.25	694	701
53	704.5	702.25	701	708
54	711.5	709.25	708	715
55	718.5	716.25	715	722
56	725.5	723.25	722	729
57	732.5	730.25	729	736
58	739.5	737.25	736	743
59	746.5	744.25	743	750
60	753.5	751.25	750	757
61	760.5	758.25	757	764
62	767.5	765.25	764	771
63	774.5	772.25	771	778
64	781.5	779.25	778	785
65	788.5	786.25	785	792
66	795.5	793.25	792	799
67	802.5	800.25	799	806
68	809.5	807.25	806	813
69	816.5	814.25	813	820

DVB 7 MHz / B (VHF)

Ch. Europe	Ch. Australia	Ch. New Zealand	Center Frequency (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
Band I						
E 2	-	-	50.5	48.25	47	54
E 3	-	-	57.5	55.25	54	61
E 4	-	-	64.5	62.25	61	68
-	0	-	48.5	46.25	45	52
-	1	-	59.5	57.25	56	63
-	2	-	66.5	64.25	63	70
-	-	1	47.5	45.25	44	51
-	-	2	57.5	55.25	54	61
-	-	3	64.5	62.25	61	68
Band II						
-	3	-	88.5	86.25	85	92
-	4	-	97.5	95.25	94	101
-	5	-	104.5	102.25	101	108
-	5A	-	140.5	138.25	137	144
Band III						
E 5	6	4	177.5	175.25	174	181
E 6	7	5	184.5	182.25	181	188
E 7	8	6	191.5	189.25	188	195
E 8	9	7	198.5	196.25	195	202
E 9	9A	8	205.5	203.25	202	209
E 10	10	9	212.5	210.25	209	216
E 11	11	10	219.5	217.25	216	223
E 12	12	-	226.5	224.25	223	230

6 MHz (UHF)

ATSC, ISDB, DVB 6 MHz / M, N

Ch. USA	Ch. Japan	Center Freq. (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
14	13	473	471.25	470	476
15	14	479	477.25	476	482
16	15	485	483.25	482	488
17	16	491	489.25	488	494
18	17	497	495.25	494	500
19	18	503	501.25	500	506
20	19	509	507.25	506	512
21	20	515	513.25	512	518
22	21	521	519.25	518	524
23	22	527	525.25	524	530
24	23	533	531.25	530	536
25	24	539	537.25	536	542
26	25	545	543.25	542	548
27	26	551	549.25	548	554
28	27	557	555.25	554	560
29	28	563	561.25	560	566
30	29	569	567.25	566	572
31	30	575	573.25	572	578
32	31	581	579.25	578	584
33	32	587	585.25	584	590
34	33	593	591.25	590	596
35	34	599	597.25	596	602
36	35	605	603.25	602	608
37	36	611	609.25	608	614
38	37	617	615.25	614	620
39	38	623	621.25	620	626
40	39	629	627.25	626	632
41	40	635	633.25	632	638
42	41	641	639.25	638	644
43	42	647	645.25	644	650
44	43	653	651.25	650	656
45	44	659	657.25	656	662
46	45	665	663.25	662	668
47	46	671	669.25	668	674
48	47	677	675.25	674	680
49	48	683	681.25	680	686
50	49	689	687.25	686	692
51	50	695	693.25	692	698
52	51	701	699.25	698	704
53	52	707	705.25	704	710
54	53	713	711.25	710	716
55	54	719	717.25	716	722
56	55	725	723.25	722	728
57	56	731	729.25	728	734
58	57	737	735.25	734	740
59	58	743	741.25	740	746
60	59	749	747.25	746	752
61	60	755	753.25	752	758
62	61	761	759.25	758	764
63	62	767	765.25	764	770
64	-	773	771.25	770	776
65	-	779	777.25	776	782
66	-	785	783.25	782	788
67	-	791	789.25	788	794
68	-	797	795.25	794	800
69	-	803	801.25	800	806

6 MHz (VHF)

ATSC, DVB 6 MHz / M, N

Ch. USA	Center Freq. (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
Band I				
A 02	57	55.25	54	60
A 03	63	61.25	60	66
A 04	69	67.25	66	72
A 05	79	77.25	76	82
A 06	85	83.25	82	88
Band III				
A 07	177	175.25	174	180
A 08	183	181.25	180	186
A 09	189	187.25	186	192
A 10	195	193.25	192	198
A 11	201	199.25	198	204
A 12	207	205.25	204	210
A 13	213	211.25	210	216

ISDB, DVB 6 MHz / N

Ch. Japan	Center Freq. (DTV)	Vision Carrier (ATV)	Lower Edge	Upper Edge
Band II				
J 1	93	91.25	90	96
J 2	99	97.25	96	102
J 3	105	103.25	102	108
Band III				
J 4	173	171.25	170	176
J 5	179	177.25	176	182
J 6	185	183.25	182	188
J 7	191	189.25	188	194
J 8	195	193.25	192	198
J 9	201	199.25	198	204
J 10	207	205.25	204	210
J 11	213	211.25	210	216
J 12	219	217.25	216	222

DAB, T-DMB (VHF)

DAB, T-DMB

Block	Center Freq.	Lower Edge	Upper Edge
5A	174.928	174.072	175.784
5B	176.640	175.784	177.496
5C	178.352	177.496	179.208
5D	180.064	179.208	180.920
6A	181.936	181.080	182.792
6B	183.648	182.792	184.504
6C	185.360	184.504	186.216
6D	187.072	186.216	187.928
7A	188.928	188.072	189.784
7B	190.640	189.784	191.496
7C	192.352	191.496	193.208
7D	194.064	193.208	194.920
8A	195.936	195.080	196.792
8B	197.648	196.792	198.504
8C	199.360	198.504	200.216
8D	201.072	200.216	201.928
9A	202.928	202.072	203.784
9B	204.640	203.784	205.496
9C	206.352	205.496	207.208
9D	208.064	207.208	208.920
10A	209.936	209.080	210.792
10B	211.648	210.792	212.504
10C	213.360	212.504	214.216
10D	215.072	214.216	215.928
11A	216.928	216.072	217.784
11B	218.640	217.784	219.496
11C	220.352	219.496	221.208
11D	222.064	221.208	222.920
12A	223.936	223.080	224.792
12B	225.648	224.792	226.504
12C	227.360	226.504	228.216
12D	229.072	228.216	229.928
13A	230.784	229.928	231.640
13B	232.496	231.640	233.352
13C	234.208	233.352	235.064
13D	235.776	234.920	236.632
13E	237.488	236.632	238.344
13F	239.200	238.344	240.056



COM-TECH

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