



DAMM® MultiTech Outdoor Base Station BS422

Operation/Design

The DAMM BS422 is a multi-carrier, multi-technology outdoor base station. The base station is a supplement to DAMM's current portfolio of TETRA base stations, by being much more than just a TETRA base station.

It can operate up to four logical carriers, each in any technology mode:

- TETRA
- DMR Tier III
- Analog
- TEDS (TETRA Enhanced Data Service)

For example, with the BS422 one single base station can contain one TETRA, one DMR, one TEDS and one Analog logical carrier or any other mix, enabling seamless communication across these technologies.

As a single-carrier setup, it is possible to connect up to eight BS422 base stations at one site (node), each running TETRA with full 25W output power, offering up to 31 simultaneous traffic channels and one master control channel. As a dual logical-carrier setup, this will be 16 TETRA carriers with 10W output power and 63 traffic channels and one master control channel.

Common Network Management/Dispatcher

The BS422 can be integrated into any existing DAMM TetraFlex® multi-site IP network. Intuitive and user-friendly tools like the DAMM TetraFlex Network Management (NM) and the DAMM TetraFlex Dispatcher support the easiness of setting up a DAMM base station across all technologies.

With the IP connectivity, the network enables multimode connections, remote diagnostics, test and software updates, as well as Windows Remote Desktop connections, file transfer, SNMP and the OM interfaces.

Only one NM and Dispatcher are required for managing and communicating across all technologies.

Flexible installation, even in harsh environments

The BS422 base station is designed to be mounted in the top of a mast close to the antennas. This eliminates the traditional TX and RX signal degradations due to feeder loss and reduces the cost considerably.

It is also ideal as a mobile base station mounted in a truck or on a ship. It is designed for harsh climatic environmental conditions and is fully IP65 sealed.

Best-in-class RF handling

The BS422 is provided with full dual RX diversity, offering outstanding sensitivity, and has a built-in duplex filter with an output power to the antenna connector of max 25W in TETRA and 50W in DMR and Analog mode. With the elimination of the normal feeder loss, it has a radio performance superior to most other available solutions.

Very high power efficiency enables relative high power RF output in a very compact design, which in general enables low operational costs.

Wide frequency ranges from the 80MHz to the 800MHz band, independent of operation mode, allows for agile spectrum adaptation.

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The BS422 is available in seven versions of frequency bands from mid-band to the 800MHz band. Each version offers up to a 150kHz wideband spectrum for up to four logical carriers.

VHF		
Band	Mid-band	VHF
TR RX/TX	68–87.5MHz	146–174MHz
Duplex spacing	2.5MHz	4.6MHz
Physical carrier bandwidth	75kHz	150kHz
Carrier #	1–2	1–4
Duplex filter bandwidth	0.5MHz	1MHz
Other freq. on request		

UHF					
Band	UHF	UHF	UHF	UHF	800MHz
TR RX/TX	350–370MHz	380–400MHz	410–430MHz	450–470MHz	805–870MHz
Duplex spacing	10MHz	10MHz	10MHz	10MHz	45MHz
Physical carrier bandwidth	150kHz	150kHz	150kHz	150kHz	150kHz
Carrier #	1–4	1–4	1–4	1–4	1–4
Duplex filter bandwidth	3.5MHz	3.5MHz	3.5MHz	3.5MHz	10MHz
Other freq. on request					

Redundancy

A fully integrated base station controller (node) eliminates the need for separate hardware and enables very flexible installation options. With a second BS422, a full hot stand-by redundancy, without any single point of failure, on both controller level and carrier level, is achieved.

Powerful hardware

A powerful hardware platform with Windows 10 IoT makes it possible to run network management, gateways and voice & data logging directly on the base station, without the need of additional computers.

An optional 64GB SSD drive can be factory installed, for running applications like the DAMM TetraFlex Voice and Data Log System directly on the BS422.

Repeater/simulcast mode

The ability to operate the BS422 in simulcast (repeater) mode for TETRA, DMR or Analog gives an integrated solution for installations where frequency scarcity is an issue. Hereby the BS422 is offering advantages compared to standard repeater systems in the market. Advantages like full output power, full feature operation set (when isolated from master node), full network management, redundancy, alarm handling and log system integration.

Up to 10 base stations can be connected to one BS422 as a master unit. Where a powerful server is used as a master, with synchronization via IEEE 1588, up to 50 simulcast slaves can be connected.

Multiple simulcast and non-simulcast sub-networks can be combined to a single large network as well.

System/capacity

The TetraFlex system setup and the maximum possible number of subscribers will follow the TETRA and DMR standards. The BS422 setup is dongle controlled, where the settings in the dongle define the size of each technology as well as the number of subscribers, profiles and organisations.

The limitations in the dongle can be changed over time and so an upgrade of a network can be done when a real need has become visible. The update is done remotely and without handling of large files over the network.

Connectivity: Power/Ethernet/synchronization

The BS422 can be powered via -48VDC or as an option via Power-over-Ethernet (PoE) and the controller constantly monitors for any kind of overload of the BS422. Power consumption depends on a number of factors including output power, the number of carriers and ambient temperatures.

When multiple carriers are used, a unique possibility for power savings becomes possible. If a one carrier setup is used it becomes equal to former units using just one carrier. However, with two carriers (either using the same or a different technology) up to 30% power intake is saved. With three carriers up to 45% power intake is saved and finally with four carriers a power reduction of up to 55% is achieved. This can be an important parameter when operating 24/7 and can be seen as best-in-class for these product types.

The BS422 is developed to be used together with an SB422 Service Box with options simplifying the installation of power, network, and keeping it cost efficient. See separate SB422 Product Sheet. Power supplies and network switches may be sourced via any third-party brands as well.

Each BS422 offers a WAN and a LAN connection. The LAN connection is used for communication between the nodes based on a multi-cast IP, whereas the WAN connection is used to integrate applications and third-party products like PABX systems or dispatchers.

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Synchronization between the BS422 base stations is possible in multiple ways:

- Via GNSS – Global Navigation Satellite System receiver (e.g. GPS, Galileo)
- Via IEEE1588 synchronization over LAN.

Licenses

Each BS422 contains a dongle controlling all the services of the base station. With this feature, any upgrade like number of subscribers,

additional operation modes or additional logical carriers, can be easily updated remotely by executing a file obtainable from DAMM. This gives the customer a possibility to upgrade a network whenever needed.

Another benefit is that the fully featured software is available in the BS422, eliminating the need for software updates involving large files across the network.

Specifications

Parameter	Value
Frequency bands	
RX=68-87.5MHz, TX=68-87.5MHz, BW=0.5MHz	Mid-band
RX=146-174MHz, TX=146-174MHz, BW=1MHz	VHF
RX=300-310MHz, TX=336-346MHz, BW=3.5MHz (On request)	UHF
RX=350-360MHz, TX=360-370MHz, BW=3.5MHz	UHF
RX=380-390MHz, TX=390-400MHz, BW=3.5MHz	UHF
RX=410-420MHz, TX=420-430MHz, BW=3.5MHz	UHF
RX=450-460MHz, TX=460-470MHz, BW=3.5MHz	UHF
RX=805-825MHz, TX=850-870MHz, BW=10MHz	800MHz band
(Other frequencies on request)	

Base station bandwidth options	Value
Carrier bandwidth	150kHz ¹
Max. no. of logical carriers per base station ¹	4 ¹

Operation modes (carrier modes)	Channel bandwidth
TETRA	25kHz (20kHz FCC)
TETRA simulcast (repeater-mode)	25kHz (20kHz FCC)
DMR Tier III	12.5kHz
DMR Tier III simulcast	12.5kHz
Analog	12.5, 20, 25kHz
TEDS	25, 50, 100, 150kHz

Common RX/TX	Value
Synthesizer frequency step	6.25kHz
Frequency accuracy	Locked to synch. source
Timing accuracy	+/-14us ref. synch. source
Duplexer	Built in

Transmitter	Value
Output power TETRA mode	0.2W to 25W ²
Output power DMR mode	0.2W to 50W ²
Output power Analogue mode	0.2W to 50W ²
Output power TEDS mode	0.2W to 10W ²

¹ Exceptions are 68–87.5MHz with 75kHz bandwidth and two carriers only

² Output at antenna connector, one carrier only; for multi-carrier setup please see examples in separate table.

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Receiver	Value
TETRA RX sensitivity with diversity. Static	-124dBm typ.
TETRA RX sensitivity without diversity. Static	-121dBm typ.
TETRA RX sensitivity with diversity. Dynamic TU50 at 4% BER	-118dBm typ.
TETRA RX sensitivity without diversity. Dynamic TU50 at 4% BER	-112dBm typ.
DMR RX sensitivity with diversity. Static	-124dBm typ.
DMR RX sensitivity without diversity. Static	-121dBm typ.
Analog RX sensitivity with diversity. Static	-124dBm typ.
Analog RX sensitivity without diversity. Static	-121dBm typ.
TEDS 25kHz, RX sensitivity, Static QAM 4U, at 3.66% BER	Lower than -116dBm
TEDS 50kHz, RX sensitivity, Static QAM 4U, at 3.66% BER	Lower than -113dBm
TEDS 100kHz, RX sensitivity, Static QAM 4U, at 3.66% BER	Lower than -110dBm
TEDS 150kHz, RX sensitivity, Static QAM 4U, at 3.66% BER	Lower than -108dBm

Parameter	Value
Diversity	Dual as standard
Noise figure	3.5dB typ.
Third-order IM input intercept point	+13dBm typ.
RSSI dynamic range	Noise floor to -20dBm
Diversity pre-gain using remote RX B antenna	Up to 6dB

Operating system	
CPU	Intel Atom 4-Core 1.9GHz
Storage included (C:\ drive)	32GB, 64GB SSD (optional)
Operating system	Microsoft Windows 10 IoT
Ethernet LAN/WAN (voice over IP)	10/100Mbit/s
Storage, optional (D:\ drive)	64GB SSD

Synchronization source	
	Galileo, GPS, GLONASS
	IEEE1588

Antenna configuration	
Minimum antenna setup, no diversity	One combined TX/RX
Minimum antenna setup, dual diversity	One TX/RX A, one RX B
Minimum antenna setup with two BS422s, dual diversity	Two antennas
GPS antenna	Passive or active (+5VDC)

Connectors	
RX connectors RX A and RX B	N female
TX connector	N female
GPS antenna connector	N female
Combined power, WAN/LAN and sync connector	Sub D-25 male
License dongle	1 x USB 2.0
Keyboard/mouse	1 x USB 3.0
Local monitor	Mini Display Port

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Parameter	Value
Power Supply	
Power source	-48 VDC SELV
Max. fuse before PS	10A T
Power-over-Ethernet ³ , optional, on request	8-wire PoE (4 WAN + 4 LAN)
Power consumption, idle mode	20W typ.
Power consumption, active mode (diff. modes, see separate table)	50–200W typ. (see tables next page)
Power limitation above	+85°C

Physical	
Dimensions excl. mounting bracket (HxWxD)	340 x 250 x 205mm
Weight	12kg
Wind area	0.08m ²
Storage temperature range (ambient air temperature)	-40°C to +85°C
Operating temperature range (ambient air temperature)	-25°C to +55°C
Maximum enclosure temperature (PA protective limitation)	+85°C
Encapsulation	IP65

Data rate per timeslot	
TETRA, pure IP load	12kbit/s
TETRA, IP load inside tunnel	20kbit/s
DMR ⁴ , pure IP load	10kbit/s
DMR, IP load inside tunnel	18kbit/s
Analog, pure IP load	71kbit/s
Analog, IP load inside tunnel	74kbit/s
Backbone control communication per node	0.4kbit/s

Power output and power consumption table

Power ⁵ input @ VHF 160MHz	BS422 TETRA		BS422 DMR		BS422 Analog				BS422 TEDS				
	Output [W]	Input [W]	Output [W]	Input [W]	Output [W]	Bandwidth			Output [W]	Bandwidth			
						12.5kHz	20kHz	25kHz		25kHz	50kHz	100kHz	150kHz
						Input [W]			Input [W]				
Idle	-	20	-	20	-	20	20	20	-	20	20	20	20
1 carrier	25	150	50	200	50	200	200	200	10	115	115	115	115
1 carrier	10	95	25	135	25	135	135	135	-	-	-	-	-
2 carriers	10+10	145	15+15	160	15+15	160	160	160	2x3.7	115	110	-	-
3 carriers	3x4.4	125	3x9	165	3x9	160	160	160	3x1.6	100	100	-	-
4 carriers	4x2.5	115	4x7	165	4x7	165	165	165	4x0.9	100	-	-	-

³ PoE max. power is 90W, where output power will be limited accordingly

⁴ Beware that single-tech systems cannot transcode DMR, therefore in mixed mode multivocoding off is recommended, and DMR will then be transported as Analog G.711

⁵ All numbers are typical values. PA – efficiency drops with multi-carrier setup => power intake can be limited due to heat dissipation

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Power ⁵ input @ VHF 160MHz	BS422 TETRA		BS422 DMR		BS422 Analog				BS422 TEDS				
	Output [W]	Input [W]	Output [W]	Input [W]	Output [W]	Bandwidth			Output [W]	Bandwidth			
						12.5kHz	20kHz	25kHz		25kHz	50kHz	100kHz	150kHz
						Input [W]				Input [W]			
Idle	-	21	-	21	-	21	21	21	-	21	21	21	21
1 carrier	25	150	50	200	50	200	200	200	10	115	115	115	115
1 carrier	10	95	25	135	25	135	135	135	-	-	-	-	-
2 carriers	10+10	120	15+15	160	15+15	160	160	160	2x3.7	110	110	110	110
3 carriers	3x4.4	100	3x9	170	3x9	155	155	155	3x1.6	100	100	100	-
4 carriers	4x2.5	90	4x7	170	4x7	170	170	170	4x0.9	95	95	-	-

Ordering

Item number	BS422 hardware
10520101	BS422 Outdoor 68-87.5/68-87.5MHz
10520111	BS422 Outdoor 146-174/146-174MHz
10520131	BS422 Outdoor 380-390/390-400MHz
10520132	BS422 Outdoor 350-360/360-370MHz
10520133	BS422 Outdoor 300-310/336-346MHz (on request)
10520141	BS422 Outdoor 410-420/420-430MHz
10520142	BS422 Outdoor 450-460/460-470MHz
10520181	BS422 Outdoor 805-825/850-870MHz

Ordering options and accessories

Item number	Description
10528001	System Connector for BS422 LAN/WAN, 48VDC
10528002	System Connector for BS422 LAN/PPS, 48VDC, LAN/IEEE 1588
105314	GA422 GNSS GPS Antenna (without cable)
105313	GS422 GNSS GPS Splitter 2-way (Indoor, IP20, without cable)
68202103	SSD 64GB iSLC M.2 2242; optional, on request
acc205081	Mounting plate for BS/SB421 30-102mm (included in BS422)
	Below numbers are without mounting plate.
acc205190	Clamp kit 30-51mm
acc205191	Clamp kit 50-102mm
acc205192	Mounting kit 100-153mm (for larger diameter masts)
acc205193	Mounting kit 150-200mm (for larger diameter masts)

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Item number	BS422 licenses
TF-DL-N0	RF Node license
TF-DL-N5-CAR-TETRA	Carrier license, TETRA
TF-DL-N5-CAR-TETRA-SIM	Carrier license, TETRA simulcast
TF-DL-N6-CAR-DMRT3	Carrier license, DMR Tier 3
TF-DL-N6-CAR-DMRT3-SIM	Carrier license, DMR Tier 3 simulcast
TF-DL-N7-CAR-ANALOG	Multi-carrier license, Analog
TF-DL-N7-CAR-ANALOG-SIM	Multi-carrier license, Analog simulcast
TF-DL-N5-CAR-TEDS-25	Carrier license TEDS 25kHz
TF-DL-N5-CAR-TEDS-50	Carrier license TEDS 50kHz
TF-DL-N5-CAR-TEDS-100	Carrier license TEDS 100kHz
TF-DL-N5-CAR-TEDS-150	Carrier license TEDS 150kHz
X-Small	100 Subscribers, 5 Profiles, 1 Organisation
Small	200 Subscribers, unlim. Profiles, 1 Organisation
Medium	500 Subscribers, unlim. Profiles, 1 Organisation
Large	500 Subscribers, unlim. Profiles, unlim. Organisations
X-Large	1,000 Subscribers, unlim. Profiles, unlim. Organisations
Unlim	Unlim. Subscribers, unlim. Profiles, unlim. Organisations

Item number	SB422 Service Box, 230VAC input, connection options
10535001 ⁶	SB422 Service Box, 48VDC 200W PSU, Controller, LAN/WAN switch, IEEE 1588

Item number	Additional licenses
TF-DL-N12-PDGW	Packet Data GW
TF-DL-N13-AGW-1	Application GW, incl. 1 port
TF-DL-N14-TERM GW	Terminal GW license
TF-DL-N11-VGW-1	Voice GW, incl. 1 voice stream
TF-DL-N5-AIE-C3	AIE Class 3, per node
TF-DL-N5-TEA2	TEA 2, per node
TF-DL-N4-DSA	Dynamic Subscriber Assignment



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