DAMM® Indoor System BS418 with 16 carriers

Description
DAMM Indoor System BS418-16 is a 16-carrier TETRA indoor system consisting of two BS418 racks (see fig. 3 and 4) and is complementary to DAMM BS421 and BS418 TETRA systems and the DAMM MultiTech Outdoor Base Station BS422. The BS418-16 may be used in networks where high traffic capacity is required (up to 63 traffic channels).

It is designed for fully IP based connectivity and allows for remote supervision and diagnostics, test, control, setting and software update, file transfer and SNMP. Its embedded Operate & Maintenance (OM) system is reached by means of Windows remote desktop.

The BS418-16 supports fully GPS synchronized discontinuous transmission. This allows a dramatic decrease in power consumption, as only the active TR412(s) needs to be powered, until traffic load requires more carriers to be on air.

BS418-16 fully supports voice + data services in full and half duplex modes, compliant with the TETRA air interface standard ETSI EN 300 392.

Access to all field replaceable units (FRU) is from the front, protected by a lockable door, and all external connectors are located on top of the rack.

The BS418-16 consists of the base station controller, the transceiver modules, the combiner system and the filter system. In the receiving path, a separate Tower Mounted Amplifier/Duplexer (TMD412) is an integrated functional part of BS418-16.

The TMD412 is intended for mast/tower mounting. Substantially the unit is a receiver amplifier, but can be coupled as an amplifier with a built-in duplex filter. Using the TMD412 in Duplex mode it is necessary to take the numbers of carriers and frequencies used into consideration in order to eliminate potential interference.

The TMD412 amplification of the received signals fully eliminates the feeder cable loss by up to 8dBm, which gives superior radio coverage performance and link balance.

The BS418 rack contains (see figures 1 and 2):

Base Station Controller, BSC412
The operating system in the BSC412 executes DAMM's TetraFlex® system software and may also execute TETRA system software from DAMM OEM Partners.

By installing a second redundant BCS412 in the BS418 rack, reliability will be improved.

BSC412 is equipped with an internal GPS receiver giving accurate time, date and frequency synchronization of all installed TR412s and allowing the base station to run full time synchronous with other base stations in a network. This is necessary for optimum cell-reselection and seamless handover from mobiles. Missing GPS signals will cause the internal high stability oscillator to take over synchronization.

The GPS sync input signal from a single GPS antenna may also allow for external synchronization in tunnel solutions and in other operational areas where GPS signals cannot be received directly.

KEY FEATURES

- Modular concept
- Highly redundant
- Fully scalable
- Suitable for high-capacity cells

It is provided with an enhanced processor with the ability to handle a complete TETRA site. It contains enhanced Ethernet LAN and WAN connections intended for Voice over IP switching.

Dongle management of software licenses can be provided via a USB port.

The Power Supply, PS419 is a universal unit used in all versions of the DAMM Indoor Systems BS418.

The PS419 Cassette consists of a Power Supply Controller and up to three PS419 power supply units, to secure N+1 redundancy with load sharing and allow for both standard and high-power transceivers.

Together with the **PS418** Power Supply it is a dual output unit delivering both +14V and +26V output voltage, where the +14V output feeds all units in the indoor system and the +26V output feeds the power amplifier in the TR412.

The PS419 Power Supply is designed to run on both AC mains and DC battery input. In addition, it is able to charge a -48V back-up battery.

When running with AC input the PS419 Power Supply accepts 100V to 240VAC, 50/60 Hz, covering all commonly used AC mains standards.

Transceiver, TR412
The TR412 Transceiver is a complete TETRA carrier unit.

The TX section contains a linear, low noise transmitter linearized with a Cartesian loop. It can deliver a peak output power of 60W, giving a nominal output power of 25W TETRA.

Modulation and power control is performed in software of the DSP (Digital Signal Processor). The output amplifier is protected with a VSWR protection circuit and a temperature protection scheme. The forward and reflected power can be measured with built-in RMS power meters. An RFTL output is available for Base Station test.

The RX is a double super-heterodyne high dynamic range receiver provided with dual diversity with separate RX paths all the way to the DSP. The final selectivity, diversity combination, demodulation etc. is made in DSP software.

The 16-bit micro-controller handles the general control functions of the transceiver, boot of DSP, O&M communications etc. It also handles the packet mode communication on the HDLC bus to the BSC412.

All internal frequencies are generated with PLLs locked to the information coming from the BSC.

TX Combiner, TC411
The TC411 is a four-way TX cavity combiner module used to combine the individual TX outputs to a single cable.

The TC411 consists of four motor-tuned ¼ or ¾ λ TEM resonators. The inputs are provided with dual circulators with high-power loads, which are able to dissipate the reflected power when the TX antenna is missing, or the cavity is tuned to a frequency not matching the transmitter.

An RF detector is provided on the high-power load used for manual adjustment and alarm generation.

The TC411 is equipped with the TCC411 TC Combiner Controller with built-in micro-controller, which controls the motors.

At power-up, the micro-controller initializes the tuning position against a mechanical end stop. The TCC411 is connected to the O&M UART bus and can be reached with O&M commands from the BSC412.

TX Filter, TF411
The TF411 is a high-power TX filter, which reduces the radiation in the RX band, and is connected to the TX antenna socket located on top of the rack.

Tower Mounted Amplifier/Duplexer, TMD412
The TMD412 contains two low-loss highly selective RX filters and two low-noise high dynamic range amplifiers which amplify the RXA and RXB signals.

The TMD412 also contains a duplex filter, which can be used to combine the TX and one of the RX antennas to a single antenna. The duplex part of the TMD412 is optimized for low loss and extremely low inter-modulation distortion. When using the duplex filter option, care shall be taken not to use TX frequencies generating 5th order inter-modulations products in the RX frequencies.

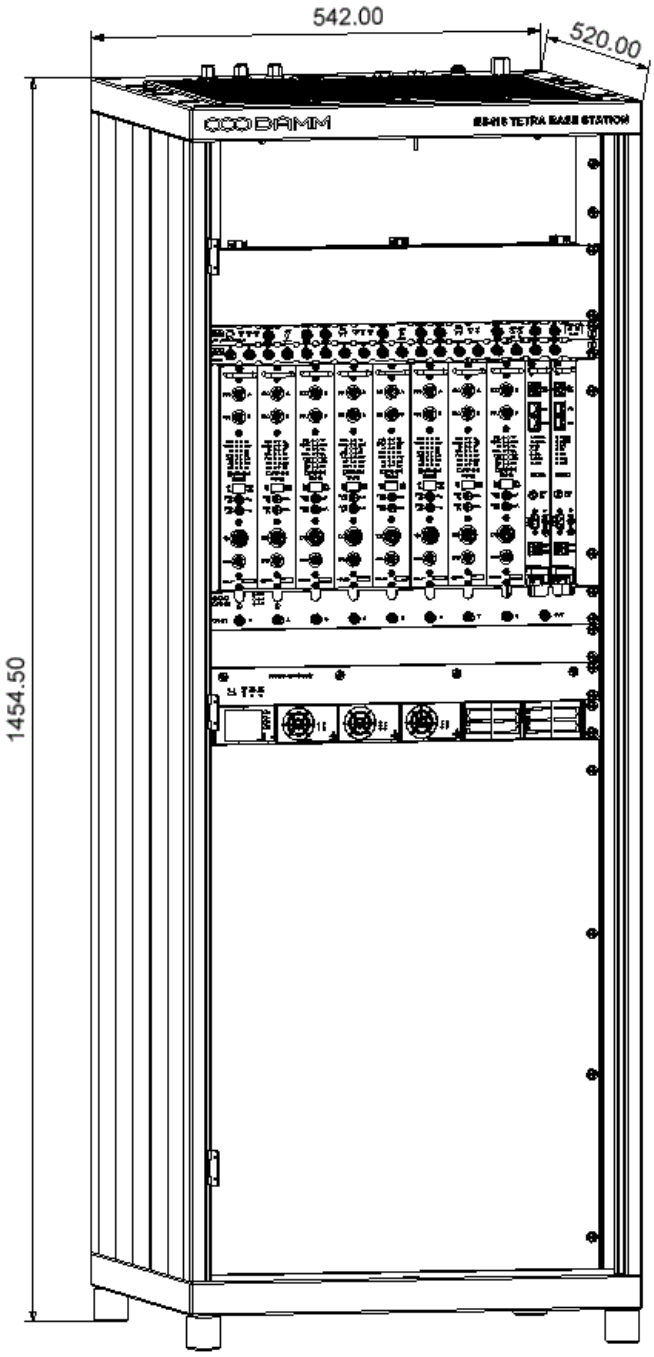
Antenna Interface, AI411
The AI411 Antenna Interface unit is used in all base stations and contains all the necessary circuits to support a complete radio cell including support of the Tower Mounted Amplifier/Duplexer TMD412 with all functions.

The two independent RX multi-coupler amplifiers are built with low-noise high dynamic range transistors. They have DC insertion in the feeders for the TMA/TMD and alarm circuits to monitor the TMA/TMDs and the internal amplifiers' current consumption. Included in the input are variable input attenuators to adjust for actual cable loss.

An RF power detector is used to supervise the forward and reflected power at the TX antenna connector. The detectors are temperature-compensated, and the output levels can be fine adjusted.

Receiver Multi-coupler Divider, RMD411
The RMD411 divides the RXA and RXB signals and feeds them to the receiver part of the TR412.

Figure 1: DAMM BS418 30U rack:



3HE CON412 CONNECTION BOX
TF411 TX FILTER

2HE (SPARE) DEPTH 300mm

½HE AI411 ANTENNA INTERFACE
½HE RMD411 RECEIVER MULTICOUPLER DIVIDER

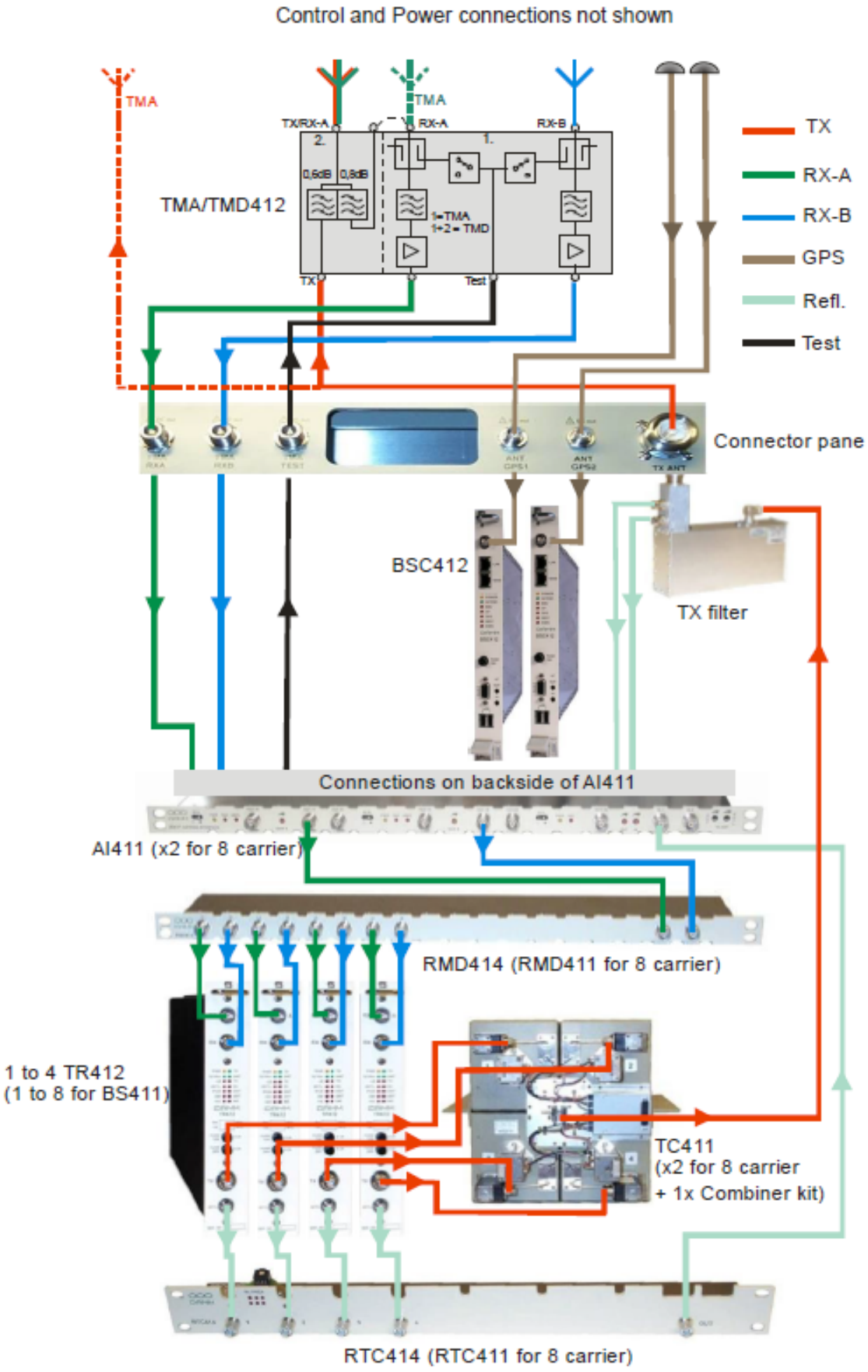
6HE CAS411 TR CASSETTE
8 x TR412 TRANCEIVER
2 x BSC412 BASE STATION CONTROLLER

1HE RTC411 TEST LOOP COMBINER
1HE AIR FLOW
1HE PS418 POWER SUPPLY
1HE PS419 POWER SUPPLY

14HE 2 x TC411 4-WAY TX COMBINER

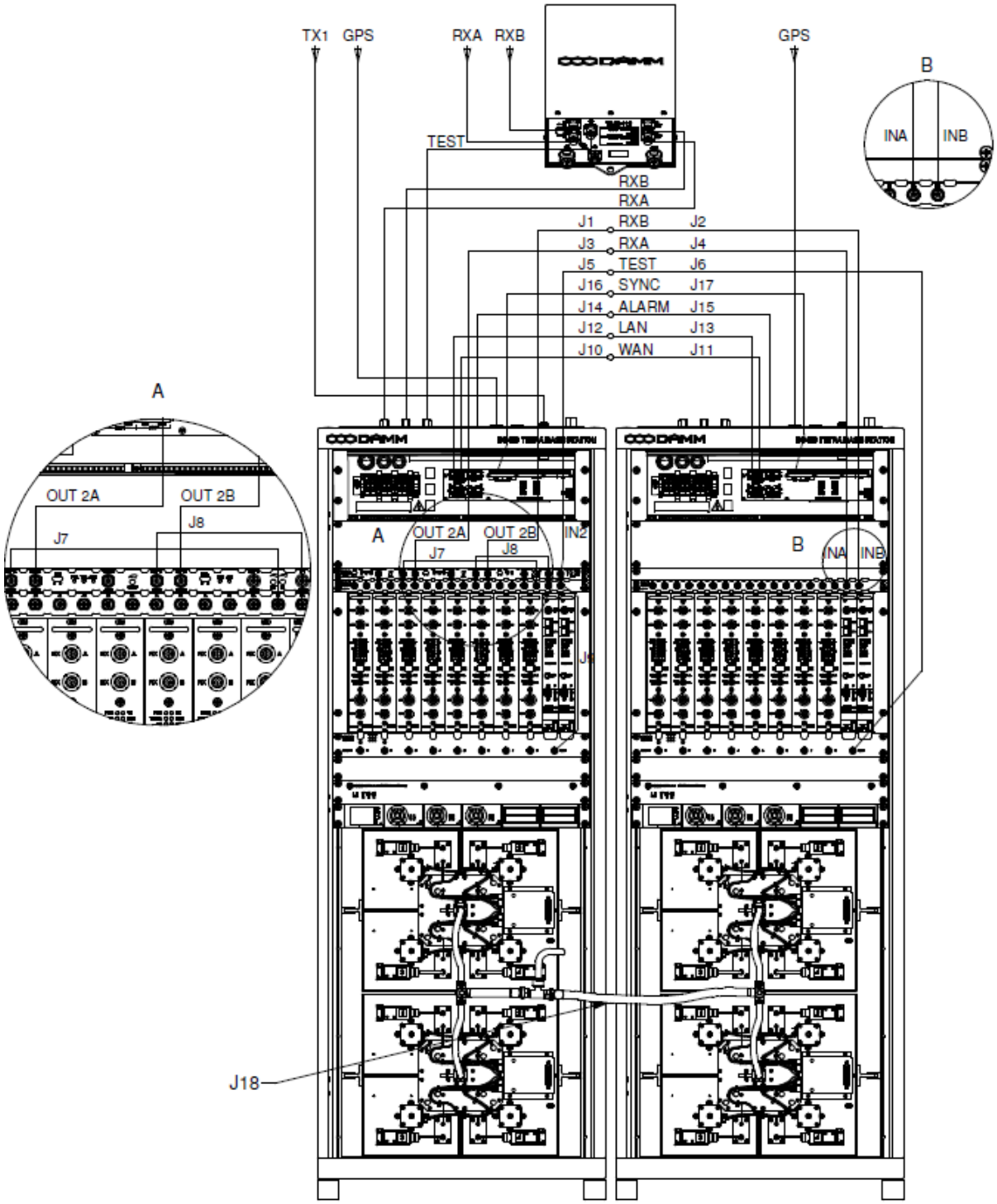
CAB418 CABINET

Figure 2: DAMM BS418 TX/RX Signal Paths



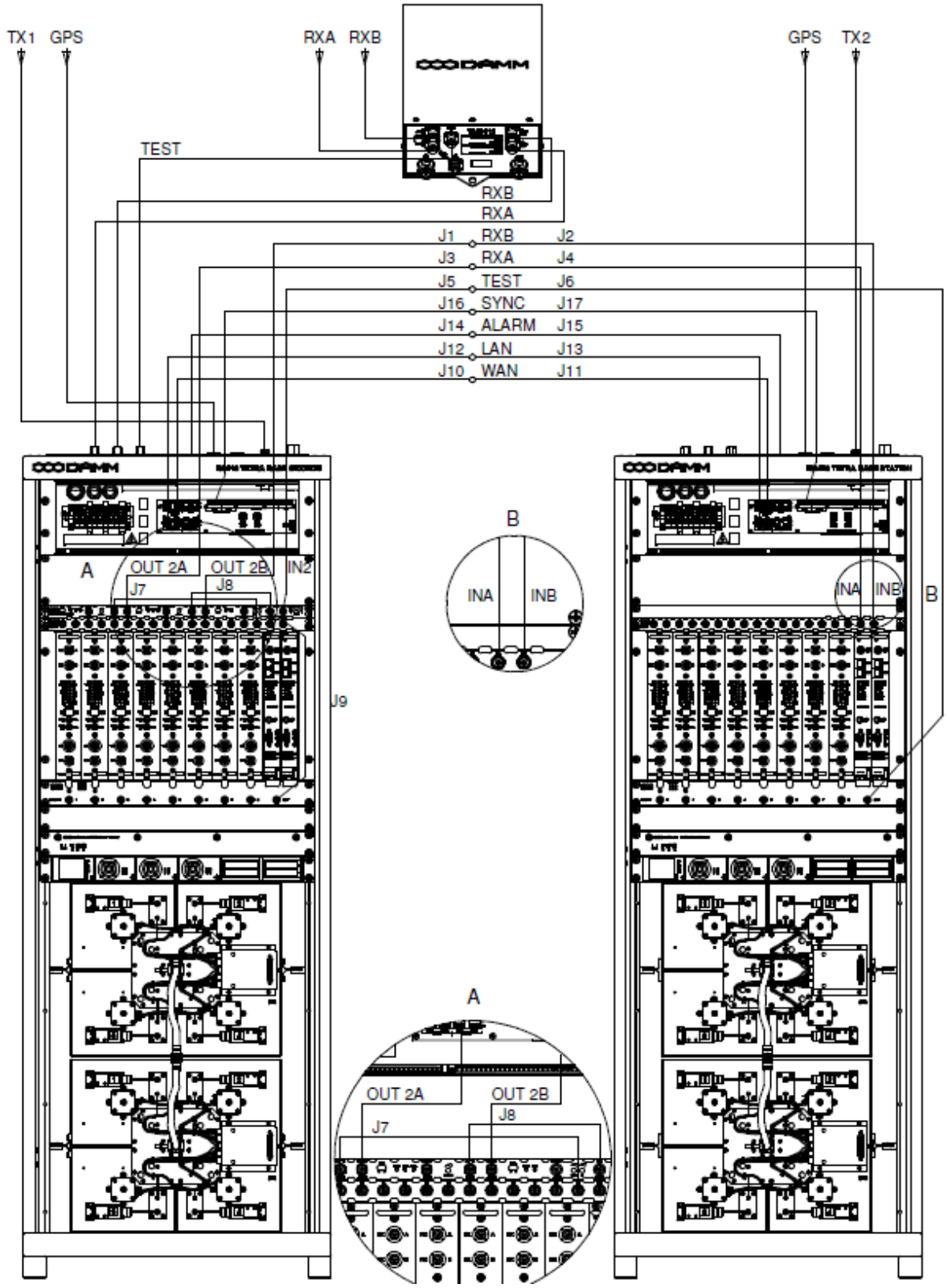
External connections for rack 1 and 2

Figure 3: Solution 1
This solution requires only one Tx antenna but the frequency spacing must be >175kHz* for all cavity combiners in both racks. The distance between the two racks cannot exceed the length of the junction cable. This means that rack 1 and 2 must be placed beside each other. See “BS418 Rack extension from 9 to 16 carriers (kit for two racks)” in the table on the last page.



* = >175kHz in the 300 and 400MHz band. >250kHz in the 800MHz band

Figure 4: Solution 2
This solution requires two Tx antennas and the frequency spacing must be >175kHz* per cavity combiner in each rack.



* = >175kHz in the 300 and 400MHz band. >250kHz in the 800MHz band

Specifications

Parameter	Value
Frequency bands	
RX=300-310MHz, TX=336-346MHz, BW=10MHz	
RX=350-360MHz, TX=360-370MHz, BW=5MHz	
RX=380-390MHz, TX=390-400MHz, BW=5MHz	EU Public safety
RX=410-420MHz, TX=420-430MHz, BW=5MHz	
RX=450-460MHz, TX=460-470MHz, BW=5MHz	
RX=805-825MHz, TX=850-870MHz, BW=14MHz	US-FCC
Other frequencies on request	

Common TX/RX	Value
Synthesizer frequency step	12.5kHz and 6.25kHz
Frequency accuracy	Locked to GPS
Timing accuracy	+/-14us ref. GPS timing

Duplexer-Amplifier	Value
RX feeder loss compensation max.	8dB nom.
TX path insertion loss (10MHz duplex spacing)	0.6dB typ.

Transmitter	Value
Output power before combiner	1W to 25W
Output power after cavity combiner and TX filter	0.5W to 10W
TX linearization scheme	Cartesian Loop
Forward and reflected power meter	0.1W to 99.9W

Receiver[1]	Value
Static sensitivity	-118dBm
Dynamic sensitivity with diversity (TU50 at 4% BER)	-118dBm
Dynamic sensitivity without diversity (TU50 at 4% BER)	-112dBm
Diversity	Dual as standard
Noise figure	3.5dB typ.
Third-order IM input intercept point	+13dBm typ.
Intermediate frequencies	45MHz and 144kHz
RSSI dynamic range	Noise floor to -43dBm

Base Station Controller (BSC)	Value
BSC version	BSC412 Ver. 03
Operating system:	
Host processor	Intel Atom D510 1.66GHz
RAM	2GB
Operating system	Windows 10 IoT
Synchronisation of date/time	From GPS or External sync.
Non synchronized operation	Built-in oscillator
Co-processor	HDLC buses to TR412 and PS411
CF Disk Multiple partition	32GB
Ethernet including voice over IP	10/100Mbit
Synchronization	1 sec pulse in/out

[1] Note: The TMD412 Tower Mounted Amplifier/Duplexer is a functional and integral part of the BS41x range. The two RX amplifiers in the TMA/TMD are included in the RX sensitivity values.

Antenna configuration	Value
Using TMD412 coupled as duplexer, no diversity	One combined TX/RX
Using TMD412 coupled as duplexer, dual diversity	One TX/RX A, One RX B
Using TMD412 coupled as amplifier, dual diversity	One TX, One RX A, One RX B
GPS antenna	Passive or Active (+5VDC)

Combiner	Value
4-way cavity combiner, motor tuned	Two combiners installed as standard
Channel spacing per cavity combiner	>175kHz in 300 and 400MHz band
	>250kHz in 800MHz band

Internal connectors between Base Station rack and TMD412	Value
RXA – RXB and Test	N Female

External Connectors	Value
Directly on BS rack or TMD412:	
TX	7/16
2 x GPS antenna connector one for each BSC412	BNC on top of Rack
Earth Base Station	Rear right top of the rack
Earth TMD412	Mounting Plate
Via Connection Box	
AC Mains connector 100 to 240VAC (Phase, 0, GND)	Screw-type for 6sq. mm. max
External DC supply or battery connector -48VDC (-48, 0, GND)	Screw-type for 10sq. mm. max
-48V out for external router/modem etc. (-48, 0, GND)	Screw terminal 3 x 2.5sq. mm
External battery temperature sensor	RJ12
BSC1 and BSC2 Ethernet LAN/WAN connections	RJ45 (x8)
Number of RJ45 patch-field positions	3
External alarm connector (8xIn/GND and 2xOut/+14V)	LSA for 0.4-0.6mm solid wire
External 1 sec. Sync (BSC1 and BSC2)	LSA for 0.4-0.6mm solid wire

Power Supply	Value
Power source	-48V DC or 100-185/185-240 VAC, 45-66Hz or -48VDC
Power consumption basic rack without carriers	100W
Power consumption per active carrier at 10W output	100W
Power consumption per “standby carrier”	14W
Power consumption with 8 active carriers at 8 x10W output	910W
Output for external battery, adjustable	-43.5 to 57.6VDC – max. 14A (per PS419)
Output for other units, fixed (alternative to charging battery)	-48VDC - 12A

Physical	Value
BS418 Rack 30U (optional 36U)	
Dimensions (HxWxD), excl. connectors	1455x542x520 mm
Weight, fully equipped	117kg
Storage temperature range	-40°C to +85°C
Operating temperature range	-20°C to +55°C
Encapsulation	IP20
TMD412	
Dimensions (HxWxD), excl. connectors	337x245x130mm
Weight (incl. Mounting accessories)	8.9kg
Wind area	0.1sq.m
Storage temperature range	-55°C to +70°C
Operating temperature range	-25°C to +55°C
Encapsulation	IP65

Options	Item number
BS418 Rack extension from 9 to 16 carriers (kit for two racks)	
9-16 Ext.kit for ext. Rack, 390-400MHz	104671
9-16 Ext.kit for ext. Rack, 420-430MHz	104672
9-16 Ext.kit for ext. Rack, 460-470MHz	104673
9-16 Ext.kit for ext. Rack, 360-370MHz	104675
9-16 Ext.kit for ext. Rack, 336-346MHz	104676
9-16 Ext.kit for ext. Rack, 850-870MHz	104678