Rigging – Feeder Systems

RD10012

GSDD004A

11.04.2008
Revision 3.00

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Document Information

Project Name	Diamond Network
Doc. Name	**Rigging – Feeder Systems**
Prepared by	Colin Johnson
Date	11/04/2008
File Name	Rigging – Feeder Systems
Document Owner	Sundar Ali

Updates

Revision	Date	Updated By	Changes
1.10	11/04/2008	Guy Haynes	Updated to MBNL template. Document revised. Rigging Feeder Management System document incorporated into this doc.
1.20	N/A	N/A	Not Issued
1.30	28/09/2012	Colin Johnson	Updated with R3001, R4001 and part EE consolidation. Major re-write.
1.40	21st June 2013	Colin Johnson	Some 2G and 3G reverenced changed to 1800 and 2100. Tech neutral. Cell Planner concession details amended. Jumpers – SFXA-500 and RFS 3/8”added. Prefer to use up to 3m 1/2“ Factory Made jumpers to MHA from larger feeders to MHA. 1/2” jumper to antenna standard. Labelling expanded to cover 800 / 900 / 1800 / 2100 / 2600 for LTE / UMTS / GSM and H3G / EE / Dual Operator. In Line sex change connectors addressed. Some minor typographic corrections.
3.00	13th Dec 2013	Colin Johnson	Published as RD10012

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Distribution

Name	Position	Purpose
RD_GSDD on MBNL SharePoint website	n/a	Build
RD_GSDD on ADC Build	n/a	Build

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1 Introduction

This is a framework document detailing MBNL's overall rigging requirement and philosophy for the design, installation and commissioning of Cellular Antenna Systems on new and consolidated sites.

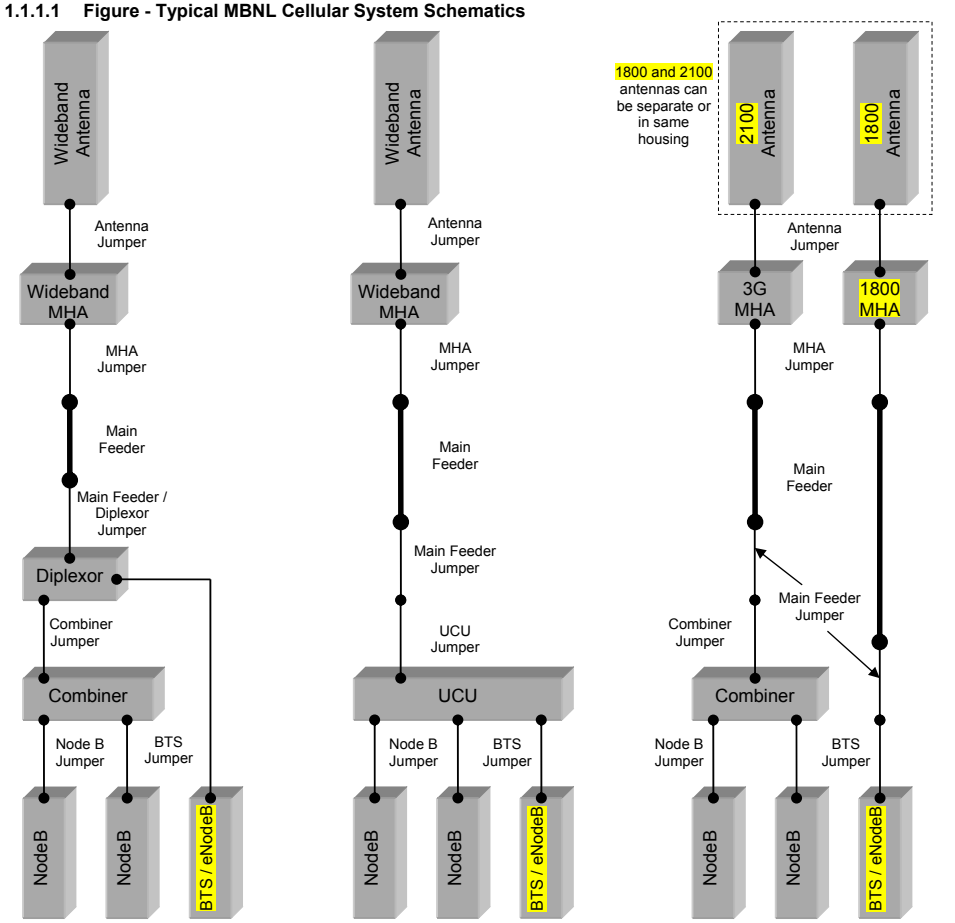
MBNL radio access network includes **Everything Everywhere (EE)** and **Hutchison 3G UK (H3G)** are covered within this document. MBNL's RAN operates at: 800 LTE, 1800 GSM & LTE, 2100 UMTS and 2600 LTE.

Decisions made during the Cellular Antenna System design, and the quality of the final installation, are critical as they will continuously influence the site's performance for its entire operational life.

The generic term **SWC** (Small Works Contractor) is used throughout this document referring to any company, contractor, rigging contractor, or ADC who may be involved within the remit of this document.

Legacy 2G and 3G systems exist separately on some sites (see Appendices). The sketches below show typical Cellular Antenna System schematics where there is some form of consolidation.

1.1.1.1 Figure - Typical MBNL Cellular System Schematics

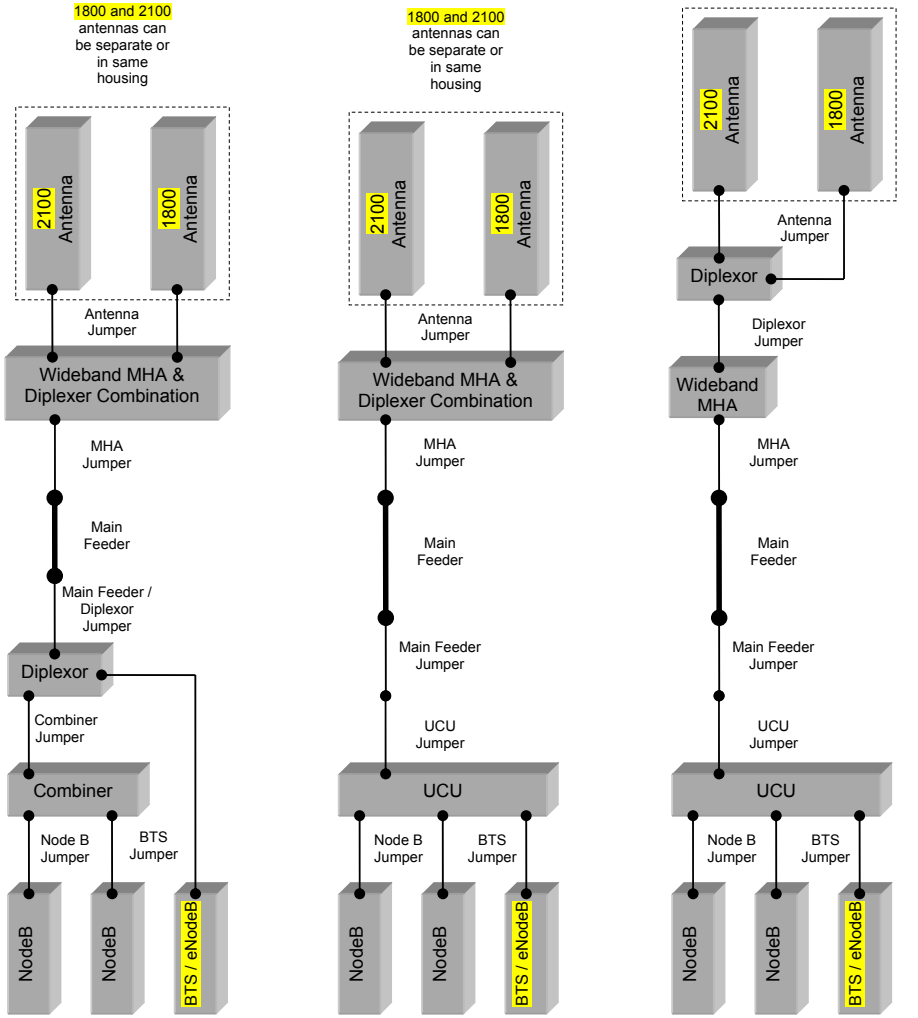


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In the figure below a wideband system has a Wideband MHA & Diplexer Combination unit or separate wideband amp and diplexor. This may be used in situations where:

- Different 2G and 3G bearings / mechanical tilts are needed
- Different 2G and 3G beam widths (and bearing / mechanical tilts) are needed. For example on 3G 6 sector sites where the 2G is not 6 sector.

1.1.1.2 Figure - Typical MBNL Cellular System Schematics (cont'd)



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2 Scope

The Cellular Antenna System includes all feeders, connections, grounding, MHA, combiners, antennas from the antenna to the final radio equipment (BTS / NodeB) connection. This document outlines how to design, install and commission (RD10011_GSDD054) the Cellular Antenna System.

Excluded from this document are internal distributed antenna systems.

Not a commercial document, although may be referenced in contractual documentation.

Target users are Cell Planner, Project Manager, Implementation Teams and SWCs, so the document is a balance between technical detail and practical application.

MBNL documentation covers current Projects and legacy information for the MBNL radio access network. These can be downloaded from:

MBNL Intranet - mbnl.co.uk

ADC Build Extranet - adcbuild.com

Covered in other MBNL documentation

1. Guidance and instruction on the deployment of specific equipment, parasitic solutions and Project specific solutions.
2. Installation of communications equipment / equipment cabinets / cabins is outside the scope of this document.

3 Project Structures / Responsibilities

These will vary depending on Project specific scope, organisation and contractual arrangements. Generic requirements are described in the Appendices.

3.1 Project Radio Requirements

Normally the Cell Planner will issue an RDS designed to achieve the desired Project requirements. The Project Manager will issue this with other information as necessary, providing work instructions to the SWC.

3.2 Free Issue Equipment

Free issue equipment is called-off using the SRF. Once delivered free issue equipment is the responsibility of the SWC until installed on site or returned.

The following items are normally free-issue:

- Cellular antennas and associated antenna fixing bracketry.
- Tower Mounted Amplifiers and associated support bracketry and accessories.
- Remote Electrical Tilt equipment
- UCU / combiners / diplexers

3.3 Commissioning and Handover Packs (SWC)

Commissioning and tolerances are specified in *RD10011_GSDD054 / LEE003 – Commissioning & Testing of Cellular Antenna System.*

Handover Pack Requirements are detailed in: *S1010 Handover Documentation, Audit and Quality, S1016 Handover Documents.*

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4 Design of Cellular Antenna System

The SWC shall design, as detailed below, in accordance with the rigging requirement outlined by the Cell Planner in the RDS and per the scope of the Project.

4.1 Feeder Systems Design Loss

Cell Planners (and thus SWCs) work to a design link budget for the complete feeder system from ports of the BTS / Node B / eNodeB to antenna of:

Max of 3dB at 2100MHz or 1800MHz

7/8" main feeder is the minimum on Macrocells

½" main feeder may be used on: streetworks structures, microcell sites, RRU and DAS sites

The Contractor will check the new site / upgrade to confirm the expected loss for each sector, based on planned solution and what is actually found on site. CAD drawings will detail plans of the Cellular Antenna System, including proposed feeder type, runs, length and losses.

As the majority of works will include the addition of more equipment, thus more loss into the system, and that most sites are already existing, there will be significant input from the Cell Planners to achieve the commercially / operational optimal solution.

The SWC can calculate or use the *RD10011_GSDD054 Form – Rigging I&C Certificate (RICC)* to calculate expected system losses.

4.1.1 Feeder System Concessions from Cell Planner

Feeder design concessions from the Cell Planner will be documented as follows:

1. FIXIT and RDS Comment
    1) ICNIRP non compliance ***GSDD008***
2. RDS Comment
    1) Where main feeders larger than 7/8" are to be installed.
    2) Where legacy feeders are to be upgraded to manage feeder losses.
    3) Confirmation to use the minimal feeder size when near a feeder length limit.
    4) For use of 1/2" main feeder (except on streetwork, microcell, RRU and DAS sites)
    5) Calculated losses greater than 3dB

4.1.1.1 Table - Main Feeder Typical Max Lengths

Size	Supplier Naming	1800MHz (no UCU)	2100MHz (with UCU)
½" *	4-50 / 12-50 *	19 *	13 *
7/8"	5-50 / 78-50	36	25
1 ¼"	6-50 / 114-50	42	27
1 5/8"	7-50 / 158-50	52	33

* - ½" main feeder on streetworks, microcell, RRU and DAS sites only

4.1.2 Feeder System Loss Exceptions

DEDB with 500mm jumpers is installed above the RBS. The DEDB and associated 500mm jumpers are to be EXCLUDED from the Feeder System Loss 3dB allowance.

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4.1.3 Legacy Sites Mixed Main Feeders - Feeder Preparation for 2G Refresh

There was some legacy use of mixed main feeders, typically on 2G site on ALNA or FOREM amp sites where separate TX and RX main feeders were deployed. When swapping out the amps or changing the 2G circuits in preparation of 2G refresh:

- Sector should not be left with mixed feeder sizes (i.e. same size on both polarizations)
- Any new feeders installed shall be dimensioned per RD10012_GSDD004A. (i.e. minimum 7/8" size and circuit loss design limits).
- Where a new feeder needs to be installed this should be sized to match the larger of the mixed feeders.

Where it is necessary to install a new main feeder it is preferred to re-stack the existing 2G feeders (the redundant legacy feeders can be removed), rather than adding new feeder management or unnecessarily sterilising other feeder management space.

4.1.4 Legacy Site Main Feeder Extensions

Where towers heights are being increased, BTS / Node B equipment positions being changed, or antenna positions moved, it is permissible to extend the main feeders, rather than replace them.

Main feeder extensions shall be the same as the main feeder type already used on the site. 7/8” feeder is the norm on tower and rooftop sites.

In some instances, where main feeder extensions are **under 2m**, the SWC may justify the use factory made ½” standard flex jumpers. But these should not be jumper to jumper extensions; the old jumper should be replaced for a single jumper in these instances.

4.2 Feeder System Site Design Principles

Design for the shortest practical route to each antenna.

The site planning drawing should contain the feeder cable route on the plans and the notes should specify the length of each feeder from the equipment to the antenna along with anticipated feeder system losses.

Cable routes shall not impede any pedestrian, work areas such as window cleaning apparatus, areas that require clear access for other site maintenance activities.

Feeder cables present a trip hazard on roof tops; therefore they are to be positioned away from the free edge of a building and the top or bottom of access ladders.

Where feasible cable trays should be sited in accessible areas, and 2m or more away from any unprotected edge.

Where motorised platforms, scaffolds or specialist access equipment is required to reach the cable route, the Designer must apply for a FIXIT. Where special access measures are required to maintain the feeder cables, this should be identified by the SWC in the residual hazards section of the handover documents.

Splicing of feeders on new installation is not permitted. However on existing sites, main feeder can be extended, where jumper losses would be excessive.

4.3 Structural Loading

Structural loading for the addition or increase of the Cellular Antenna System deployed will be required. The weight of and wind load effect (with ice in some instances) shall be considered. This if particular relevance with regards to increased antenna sized, installation of additional / larger feeders and their associated cable management, or in cases where other equipment is being mounted up the structure (e.g. remote radio heads).

Towers may be owned by MBNL or other parties, and any assessments will satisfy the structure owners requirements. Details on MBNL structures, manufacturer’s details and their capacities are detailed in the Structural of ADC build / MBNL intranet.

Normal limiting factor is the operational deflection, in particular with regards to microwave links.

Reference the relevant structure mechanical specification.

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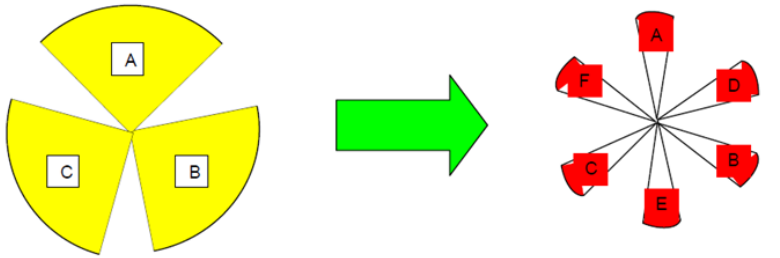
4.4 Sector Identification

The Cell Planner's RDS will identify sectors for 2G and 3G, based on the principles below. There will be some variance at the boundaries on legacy sites and because of certain site physical limitations. However the RDS will ultimately confirm the Cell Planner's antenna bearing and sector identification.

Legacy sector identification conventions are shown in appendices.

4.4.1.1 Table - Sector Bearings

2G Sector*	3G / LTE Sector	Sector Centre Bearing	3 Sector Bearing Range	6 Sector Bearing Range	3G RNC/WBTS LCR ID
C1	**A**	**0**	**301 to 60**	331 to 30	1
C4	D	60	N/A	31 to 90	4
C2	**B**	**120**	**61 to 180**	91 to 150	2
C5	E	180	N/A	151 to 210	5
C3	**C**	**240**	**181 to 300**	211 to 270	3
C6	F	300	N/A	271 to 330	6



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5 RF Cable / Jumper Manufacturers

Only the following manufacturer's products are approved for use on MBNL sites, as detailed in this section:

5.1.1.1 Table - Feeder System Manufacturers

Manufacturer	Main Feeder Products	Factory Made Jumpers
RFS	LCF CELLFLEX (UCF legacy)	CELLFLEX Factory-Fit Premium 1/2" and 3/8"
CommScope **Andrew Heliax Brand Feeders**	Heliax AVA (LDF no longer manufactured in larger sizes) Heliax FXL* (vandal sites only)	Heliax SFXA-500 Premium AL Smooth Wall Jumper May be used in place of 1/2" Cu SuperFlex SureFlex Premium 1/2" only
Rosenberger Leoni	Legacy Feeders only. Not for new deployments.	N/A
Quadrant	N/A	S Type Factor Jumpers 1/2" only
Spinner	N/A	SPINNERFlex Factor Jumpers 1/2" only
Amphenol	N/A	Supplied and installed by NSN to contract specification. 1/2" and 3/8" 3/8"replacement can be made like for like, as found on site.
Internal Cabinet / Bulkhead Jumpers / REGM amp connections (FREDO / POW/ Phoenix / WREA / WREB)	N/A	Types / size length are can be confirmed by the relevant GSDD document will confirm the cabinet / tower supplier. Replacement can be made like for like, as found on site.

Black covered copper feeders is standard. Where necessary low smoke jacket cable variants shall be used.

***Aluminium FXL feeders may be used as a theft deterrent where vandalism has proven to be rife. FXL (aluminium smooth wall option). AL cable signage to be deployed on site, see later section for details.**

Some legacy OuK sites may have grey feeder and clamps, RAL7047, Telegrey 4. Feeder colours should not be mixed, although black jumpers may be used on grey feeder sites. Where replacing damaged grey / white covered feeders the preference is to use black feeders, as long as the lease / planning permits this.

***Any Factory Made Jumper supplied with a man made connector / end ***
*** should be rejected back to the supplier***

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5.2 Connectors

RFS and Andrew provide free certified connector training courses, details in Appendix. Any persons terminating feeders and installing connectors shall have proof of satisfactory completion of **one** of either:

1. RFS connector training or,
2. Andrew Institute connector training

Only the cable / connector pairings specified below may be used. Main feeders will be terminated in DIN 7/16 Male. Always follow manufacturer's component installation instructions for:

1. Cable preparation, with specified manufacturer's cable preparation tool.
2. Connector installation to specified torque levels with specified tools.

DIN7/16 connectors are the standard. N-type connectors are rarely, if ever, used only on DAS or Microcell sites.

Correct connector to cable type and connector torque levels become more critical the more technologies and power that are transmitted up a feeder cable. Incorrect connector installation is the primary source of unwanted interference and PIM on mobile sites.

Existing site / legacy feeder connectors shall not be removed and re-installed. Cable ends should be prepared and a new connector installed.

5.2.1 Right Angle Connectors

Right angle connectors should only be used indoors or where they are protected from vibration and direct exposure to the elements. Should only be used :

1. 3/8" Jumpers – onto UCU and Flexi (under weather covers if outdoors). Factory made jumpers.
2. ½" cable and below where connecting to internal equipment or to UCU (under weather covers if outdoors). Factory made jumpers.
3. 7/8" cables in restricted space legacy cabinets. Should be covered by a FIXIT.

5.2.2 In Line Connectors – Do Not Use / Design Out

Either right angle or in line sex change connectors may ONLY be used where they are specifically detailed as part of an approved / documented MBNL design or cabinet (very rare).

Where significant site antenna line works are being carried out then **legacy errors** should be corrected by either: replacing with correctly sexed jumper, or, if necessary, main feeder re-termination. E.g. Right Angle adaptors on UCU / Flexi terminals, in internal rooms etc, NOT allowed.

5.3 Jumper Cables (Factory Made Jumpers)

Jumper lengths shall be kept to a minimum.

Where possible Factory Made Jumper cables **shall** be used. It is expected that **all outdoor** 1/2" and smaller jumpers shall be factory made, as far as is reasonably practicable.

Where possible 7/8" feeder and 7/8" main feeder jumper will connect direct onto diplexors / MHAs / equipment. 1/2" Factory Made Jumpers are the preferred jumper option and superflex 1/2" Factory Made Jumpers, and 'smaller' should only be used as last resort because of:

- Space limitations
- Project documentation
- Equipment documentation

Antenna connections **shall always be** with a **1/2" Factory Made Antenna Jumper** to facilitate the movement / optimization of the antenna. Unless there is existing UCF 7/8" feeder already on site that is being re-used.

***Any Factory Made Jumper supplied with a man made connector / end ***
*** should be rejected back to the supplier***

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5.3.1.1 Table - Jumper Table

Jumper Type	Use	Examples	Max Lengths
7/8" Main Feeder Jumpers (Made on site)	Where main feeders are larger than 7/8" **and jumper required is greater than 3m**, for connection to MHA or entry into cabin.	Where entering cabin / room or re-using legacy main feeders in a poor position.	**3.0m Min** to MHA / diplexor To optimize design when entering rooms / cabins terminated above the equipment rack.
1/2" Factor Made Jumpers	Node B / BTS Jumper on most outdoor equipment cabinets / indoor equipment racks	**Antenna Jumper*** *Preferred Indoor equipment Node B / BTS jumper RBS2206/2202/2106, S8000, WINA, WINB.	Max Nominally 2.0m Exception: May be longer to facilitate safe location of MHA on some rooftops or in place of site made 7/8" jumpers (See above)
1/2" Jumpers (Made on site)	To connect between combiner / cabinet interconnect of a non standard length	Streetworks with remote 2G equipment.	Per overall Link Budget limits. Keep to minimum lengths.
1/2" Cu Superflex **or** **AL SFXA 500 SmoothWall** **Factory Made Jumpers**	As permitted in Project / Equipment specific documentation where space is limited:	Direct connection to equipment RF Module Ports e.g. Huawei 3900 and Internal Jumpering on some Parasitic conversions Outdoor UCU connection, , FCOA, dEDBs, NB531, UCUs, POW, cabinet jumpers.	Max Nominally 1.5m Per overall Link Budget limits. Keep to minimum lengths.
3/8" Factory Made Jumpers	As permitted in Project / Equipment specific documentation where space is limited:	Internal Jumpering on some Parasitic conversions, FREDO, POW. BTS / Node B Jumper when coming from a UCU onto an NSN Flexi radio Pig tail for MHA or antenna jumper in some shrouded structures.	Per overall Link Budget limits. Keep to minimum lengths.
1/4" Factory Made Jumpers	As permitted in Project / Equipment specific documentation where space is limited:	Internal Jumpering on some restricted space streetworks poles (MHA to Antenna) and some Parasitic Conversions.	Per overall Link Budget limits. Keep to minimum lengths.

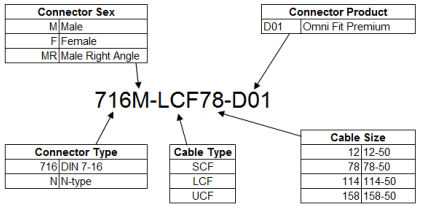
* - Option – existing RFS 7/8" UCF feeder may be used to reconnect direct onto antennas and internal equipment racks in place of ½" jumpers.

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5.4 Approved Feeder System Components

5.4.1 Radio Frequency Systems (RFS)

5.4.1.1 Cable and Connectors

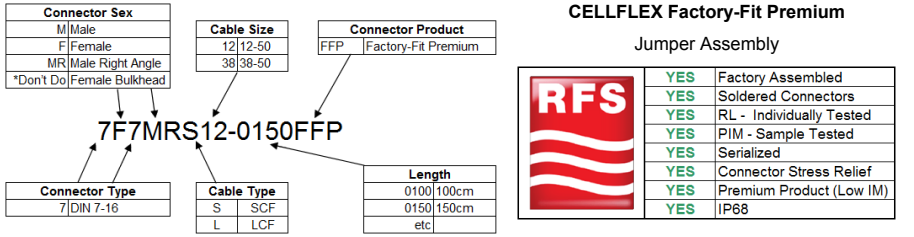


New Deployment Approved Cables (RFS)										
Cable	Size	Metal / Type	Connector		Connector		Connector		Grounding Kit	
			Type	Male Straight	Type	Female Straight	Type	Male Right Angle	Type	Product Code
SCF12-50	1/2"	Cu	D01	716M-SCF12-D01	D01	716F-SCF12-D01	D01	716MR-SCF12-D01		EAR-12-S
LCF12-50	1/2"	Cu	D01	716M-LCF12-D01	D01	716F-LCF12-D01	D01	716MR-LCF12-D01	Speed	GKSPEED20-12P
LCF78-50	7/8"	Cu	D01	716M-LCF78-D01	D01	716F-LCF78-D01	D01	716MR-LCF78-D01	Speed	GKSPEED20-78P
LCF114-50	1 1/4"	Cu	D01	716M-LCF114-D01	D01	716F-LCF114-D01	D01	N/A	Speed	GKSPEED20-114P
LCF158-50	1 5/8"	Cu	D01	716M-LCF158-D01	D01	716F-LCF158-D01	D01	N/A	Speed	GKSPEED20-158P

Legacy Cables (RFS)										
Cable	Size	Metal / Type	Connector		Connector		Connector		Grounding Kit	
			Type	Male Straight	Type	Female Straight	Type	Male Right Angle	Type	Product Code
UCF78-50	7/8"	Cu	D01	716M-LCF78-D01	D01	716F-LCF78-D01	D01	716MR-LCF78-D01	Speed	GKSPEED20-78P
UCF114-50	1 1/4"	Cu	D01	716M-LCF114-D01	D01	716F-LCF114-D01	D01	N/A	Speed	GKSPEED20-114P
UCF158-50	1 5/8"	Cu	D01	716M-LCF158-D01	D01	716F-LCF158-D01	D01	N/A	Speed	GKSPEED20-158P

5.4.1.2 Factory Made Jumpers

Approved RFS factory made jumper; 1/2" and 3/8" CELLFLEX Factory-Fit Premium range (FFP).



CELLFLEX Factory-Fit Premium

Jumper Assembly

YES	Factory Assembled
YES	Soldered Connectors
YES	RL - Individually Tested
YES	PIM - Sample Tested
YES	Serialized
YES	Connector Stress Relief
YES	Premium Product (Low IM)
YES	IP68



CELLFLEX Factory-Fit Jumpers (Premium) Other lengths available					
SCF 38-50 * Limited stock new supply *		SCF 12-50		LCF 12-50	
7MR7MRS38-0100FFP	7M7MS38-0100FFP	7F7MRS12-0100FFP	7M7MS12-0100FFP	7F7MRL12-0100FFP	7M7ML12-0100FFP
7MR7MRS38-0150FFP	7M7MS38-0150FFP	7F7MRS12-0150FFP	7M7MS12-0150FFP	7F7MRL12-0150FFP	7M7ML12-0150FFP
7MR7MRS38-0200FFP	7M7FS38-0100FFP	7M7FS12-0100FFP	7M7MS12-0200FFP	7M7FL12-0100FFP	7M7ML12-0200FFP
7F7MRS38-0100FFP	7M7FS38-0150FFP	7M7FS12-0200FFP	7M7MS12-0250FFP	7M7FL12-0200FFP	7M7ML12-0250FFP
7F7MRS38-0150FFP	No Female Bulkhead	7M7FS12-0300FFP	7M7MS12-0300FFP	7M7FL12-0300FFP	7M7ML12-0300FFP

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5.4.2 Commscope (Andrew)

5.4.2.1 Cable and Connectors

New Deployment Approved Cables (Commscope Andrew)										
Cable	Size	Metal / Type	Connector						Grounding Kit	
			Type	Male Straight	Type	Female Straight	Type	Male Right Angle	Type	Product Code
FSJ4-50	1/2"	Cu / Cor	Captivated	F4PDMV2-C	Captivated	F4PDF-C	Captivated	F4DR-C	Standard	241545
LDF4-50	1/2"	Cu / Cor	Pos Stop	L4TDM-PSA	Pos Stop	L4TDF-PSA	Captivated	L4DR-PS	Compact SureGround	CSG12-06B1A
AVA5-50	7/8"	Cu / Cor	EZ Fit	78EZDM	EZ Fit	78EZDF	Ring Flare	A5PDR-RCN	Compact SureGround	CSG78-06B1A
AVA6-50	1 1/4"	Cu / Cor	EZ Fit	114EZDM	EZ Fit	114EZDF	N/A	N/A	SureGround	SG114-06B2A
AVA7-50	1 5/8"	Cu / Cor	EZ Fit	158EZDM	EZ Fit	158EZDF	N/A	N/A	SureGround	SG158-06B2A

Vandal Site Cables (Commscope Andrew)										
Cable	Size	Metal / Type	Connector		Connector		Connector		Grounding Kit	
			Type	Male Straight	Type	Female Straight	Type	Male Right Angle	Type	Product Code
FXL540*	1/2"	Al / Sm	EZ Fit	540EZDMV2*	EZ Fit	540EZDFV2*	EZ Fit	540EZDMRV2*	Compact SureGround	CSG12-06B1A
FXL780	7/8"	Al / Sm	EZ Fit	78EZDM	EZ Fit	78EZDF	N/A	N/A	Compact SureGround	CSG78-06B1A
FXL1480	1 1/4"	Al / Sm	EZ Fit	114EZDM	EZ Fit	114EZDF	N/A	N/A	SureGround	SG114-06B2A
FXL1873	1 5/8"	Al / Sm	EZ Fit	158EZDM	EZ Fit	158EZDF	N/A	N/A	SureGround	SG158-06B2A

* - FXL EZ fit 1/2" connector is not compatible with the LDF

Legacy Cables (Commscope Andrew)										
Cable	Size	Metal / Type	Connector		Connector		Connector		Grounding Kit	
			Type	Male Straight	Type	Female Straight	Type	Male Right Angle	Type	Product Code
LDF5-50	7/8"	Cu / Cor	Pos Stop	L5TDM-PS	Pos Stop	L5TDF-PS	Standard	L5PDR	Compact SureGround	CSG78-06B1A
VXL5-50	7/8"	Cu / Cor	Pos Stop	78VDM-6PK	Pos Stop	78VDF-6PK	Pos Stop	N/A	Compact SureGround	CSG78-06B1A
LDF6-50	1 1/4"	Cu / Cor	Pos Stop	L6TDM-PS	Pos Stop	L6TDF-PS	N/A	N/A	Compact SureGround	SG114-06B2A
VXL6-50	1 1/4"	Cu / Cor	TBC	TBC	TBC	TBC	N/A	N/A	SureGround	SG114-06B2A
LDF7-50	1 5/8"	Cu / Cor	Pos Stop	AL7DM-PSA	Pos Stop	AL7DF-PSA	N/A	N/A	SureGround	SG158-06B2A
VXL7-50	1 5/8"	Cu / Cor	Pos Stop	AL7DM-PSA	Pos Stop	AL7DF-PSA	N/A	N/A	SureGround	SG158-06B2A

WARNING - Legacy Connector (NOT FOR DEPLOYMENT)
AL5** and AL6** PSA are **ONLY** compatible with AVA5 or AVA6. AL connectors on LDF should be swapped for currently approved connector.
Note: AL7** PSA connectors are compatible with AVA7/LDF7

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5.4.2.2 Factory Made Jumpers (AL SFXA 500 SmoothWall)

Heliax SFXA Premium factory made jumpers are a smooth wall Aluminium equivalent (with slightly better RF performance) to a traditional 1/2" Cu Corrugated Superflex Jumper. These jumpers will hold a formed shape and will not spring back.

Their structure is such that the outer plastic coating is fully bonded to the Al outer and forms part of the structure. This should NOT be removed, for application of earths or other reasons, as it is part of the structure and the Al outer core may crack / crease if removed.

Connector Sex	
DM	DIN Male
DF	DIN Female
DR	DIN Male Right Angle

Quality	
P	Premium Assembly

SFXA-DMDR-2M-P

Length	
1M	1000mm
1M5	1500mm
2M	2000mm
etc	

Cable Type	
SFXA	SFX Aluminium

Heliax SFXA Premium Cable Assemblies

COMMSCOPE® ANDREW® A CommScope Company

YES	Factory Assembled
YES	Soldered Connectors
YES	RL - Individually Tested
YES	PIM - Individually Tested
YES	Serialized
YES	Connector Stress Relief
YES	Premium Product (Low IM)
YES	IP68



Heliax SFXA - Premium Cable Assemblies Other lengths available	
SFXA 500 Alu Smooth wall Super Flex Equivalent to 1/2" Supreflex Corrugated Cu	
SFXA-DMDR-1M-P	SFXA-DMDM-1M-P
SFXA-DMDR-2M-P	SFXA-DMDM-1M5-P
SFXA-DMDR-4M-P	SFXA-DMDM-2M-P
SFXA-DMDR-5M-P	SFXA-DMDM-3M-P

5.4.2.3 Factory Made Jumpers (Cu)

Approved Commscope (Andrew) factory made jumper is their ½" SureFlex Premium range.

Connector Sex	
DM	DIN Male
DF	DIN Female
DR	DIN Male Right Angle

Quality	
P	Premium Assembly

F4A-DFDR-1M5-P

Length	
1M	1000mm
1M5	1500mm
2M	2000mm
etc	

Cable Type	
F4	FSJ 4-50
L4	LDF 4-50

SureFlex Premium

COMMSCOPE® ANDREW® A CommScope Company

YES	Factory Assembled
YES	Soldered Connectors
YES	RL - Individually Tested
YES	PIM - Individually Tested
YES	Serialized
YES	Connector Stress Relief
YES	Premium Product (Low IM)
YES	IP68



Sureflex Premium Cable Assemblies - P - Premium Assemblies Other lengths available			
FSJ 4-50		LDF 4-50	
F4A-DFDR-1M-P	F4A-DMDM-1M-P	L4A-DFDR-1M-P	L4A-DMDM-1M-P
F4A-DFDR-1M5-P	F4A-DMDM-1M5-P	L4A-DFDR-1M5-P	L4A-DMDM-1M5-P
F4A-DMDF-1M-P	F4A-DMDM-2M-P	L4A-DMDF-1M-P	L4A-DMDM-2M-P
F4A-DMDF-2M-P	F4A-DMDM-2M5-P	L4A-DMDF-2M-P	L4A-DMDM-2M5-P
F4A-DMDF-3M-P	F4A-DMDM-3M-P		L4A-DMDM-3M-P

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5.4.3 Leoni / Rosenberger

Leoni Flexline cables were previously approved. These used Rosenberger connectors. Leoni no longer supply RF cable and logistics to the UK market.

5.4.3.1 Cable and Connectors

Leoni cables should not be deployed as new to the MBNL network. These are legacy only. Connectors are supplied by Rosenberger.

Legacy Cables (Leoni Rosenberger)										
Cable	Size	Metal / Type	Connector		Connector		Connector		Grounding Kit	
			Type	Male Straight	Type	Female Straight	Type	Male Right Angle	Type	Product Code
FlexLine 1/2" R	1/2"	Cu		60S1C7-C03N1		60K1C7-C03N1		60S2C7-C03N1		SLGK004-C03-xxx
FlexLine 1/2" S	1/2"	Cu		60S1C7-C08N1		60K1C7-C08N1		60S2C7-C08N1		SLGK004-C08-xxx
FlexLine 7/8" R	7/8"	Cu		60S1C7-C05N1		60K1C7-C05N1		60S215-C05N1		SLGK004-C05-xxx
FlexLine 7/8" R-Low-loss	7/8"	Cu		60S1C7-CX5N1		60K1C7-CX5N1				SLGK004-C05-xxx
FlexLine 7/8" S	7/8"	Cu		60S115-C15N1		60K115-C15N1		60S215-C15N1		
FlexLine 1-1/4" R	1 1/4"	Cu		60S1D7-C06N1		60K1D7-C06N1				SLGK004-C06-xxx
FlexLine 1-1/4" R-Low-loss	1 1/4"	Cu		60S1D7-C06N1		60K1D7-C06N1				SLGK004-C06-xxx
FlexLine 1-5/8" R	1 5/8"	Cu		60S1D7-C07N1		60K1D7-C07N1				SLGK004-C07-xxx
FlexLine 1-5/8" R-Low-loss	1 5/8"	Cu		60S1D7-C07N1		60K1D7-C07N1				SLGK004-C07-xxx

Grounding kits are IP67 rated.

5.4.3.2 Factory Made Jumpers

Leoni are not providing Factory Made Jumpers.

Rosenberger factory made jumpers are not approved for use.

5.4.4 Quadrant

Approved Quadrant factory made jumpers are their 'S' type IP68 molded ½" jumper assemblies.

Connector Sex	
S	IP68 unmated
R	~~Non waterproof~~

Length	
05	500mm
10	1000mm
15	1500mm

Cable Type and Size Code	
D	1/2" Standard Flex
K	1/2" Superflex

JMPS/1512K

Connector Codes	
0	7/16 male
1	7/16 female
2	7/16 angle male

S Type Factor Jumpers

YES	Factory Assembled
YES	Soldered Connectors
YES	RL - Individually Tested
YES	PIM - Batch Tested
YES	Batch Tracable
YES	Connector Stress Relief
YES	Premium Product (Low IM)
YES	IP68 (un mated)



Quadrant 1/2" Jumper Cable - 'S-type' IP68 Moulded Other lengths available			
1/2" Superflex (K)		1/2" Standard Flex (D)	
JMPS/1012K	JMPS/1000K	JMPS/1012D	JMPS/1000D
JMPS/1512K	JMPS/2000K	JMPS/1512D	JMPS/2000D
JMPS/1001K	JMPS/3000K	JMPS/1001D	JMPS/3000D
JMPS/2001K	JMPS/4000K	JMPS/2001D	JMPS/4000D
JMPS/3001K	JMPS/5000K	JMPS/3001D	JMPS/5000D

5.4.5 Rosenberger

See Leoni / Rosenberger section.

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5.4.6 Spinner

Approved Spinner factory made jumpers are their SPINNERFlex ½" jumper assemblies.





SPINNERFlex Factor Jumpers

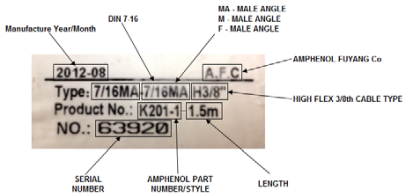
SPINNER	YES	Factory Assembled
	YES	Soldered Connectors
	YES	RL - Individually Tested
	YES	PIM - Batch Tested
	YES	Batch Tracable
	YES	Cable Stress Relief - Integral Connector Gasket
	YES	Premium Product (Low IM)
	YES	IP68



Spinner SPINNERFlex Jumpers Other lengths available			
1/2" Superflex (SF)		1/2" Standard Flex (LF)	
BN J5 39 96 (1m F / MR)	BN J5 33 91 (1m M / M)		BN 20 34 47 (1m M / M)
BN J5 38 32 (1.5m F / MR)	BN J5 37 98 (1.5m M / M)		BN 20 39 79 (1.5m M / M)
BN J5 39 60 (1m M / F)	BN J5 33 88 (2.0m M / M)	BN 20 44 90 (1m M / F)	
BN J5 39 61 (1.5m M / F)	BN J5 37 99 (2.5m M / M)		BN 20 52 84 (2.5m M / M)
BN J5 37 94 (2.0m M / F)	BN J5 33 98 (3.0m M / M)	BN 20 96 05 (2m M / F)	

5.4.7 Amphenol Fuyang Co.

Amphenol jumpers are used by NSN for the Node B jumper and UCU jumpers, supplied by ICD in the UK. **Only** the products detailed below, are approved for use. Other product ranges are not approved.



Amphenol Factor Jumpers

Amphenol RF	YES	Factory Assembled
	YES	Soldered Connectors
	YES	RL - Individually Tested
	YES	PIM - Batch Tested
	YES	Batch Tracable
	YES	Cable Stress Relief
	YES	Premium Product (Low IM)
	YES	IP68



Amphenol Fuyang Co Jumpers			
3/8" High Flex (H)		1/2" High Flex (H)	
K201-1 1.0m (MA-MA)	K187-2 1.0m (MA-F)	K16-9 1.5m (MA-F)	TBC 1.0m (M / M)
K201-1 1.5m (MA-MA)	K187-2 1.5m (MA-F)	K16-9 2.0m (MA-F)	TBC 1.5m (M / M)
K201-1 2.0m (MA-MA)	K136-2 1.0m (MA-M)	TBC 1.0m (M / F)	TBC 2.0m (M / M)
K201-1 2.5m (MA-MA)	K136-2 1.5m (MA-M)	TBC 1.5m (M / F)	

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6 Antennas

Antenna type, bearing and tilt will be detailed in the RDS and approved antennas are detailed in *GSDD082 Antennas.*

For grounding and labelling refer to other sections.

Antenna AGL (Above Ground Level) is antenna height from ground level to the MID point of the antenna.

6.1 Design

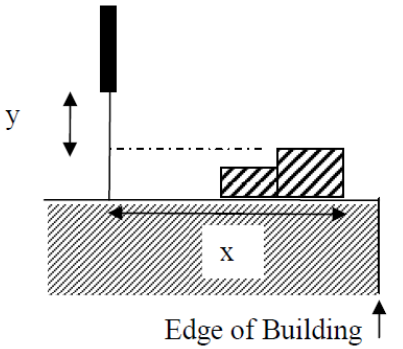
6.1.1 ICNIRP

ICNIRP compliance and certificates in accordance with *GSDD008 ICNIRP Compliance Certification*

6.1.2 Clipping Angles

Ensure that no objects are within the near field of the antenna (60m). Antennas should be mounted as close as safely possible to the rooftop edges to enable effective use of antenna tilting and avoid clipping issues.

6.1.2.1 Figure – Clipping Angles



Clipping Angle Requirements:-

- Building height < 20m; clipping angle >= 20 degrees (i.e..x=2.7, y=1)
- Building height > 20m; clipping angle >= 30 degrees (i.e..x=1.7, y=1)

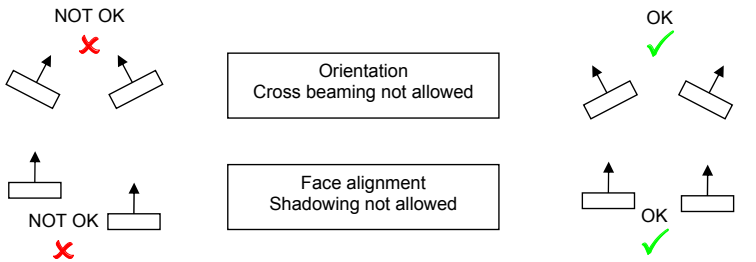
Note: on streetworks sites consider double decker buses.

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6.1.3 Cross Beaming and Shadowing

Antennas shall be installed to avert cross beaming and shadowing.

6.1.3.1 Figure – Cross Beaming and Shadowing



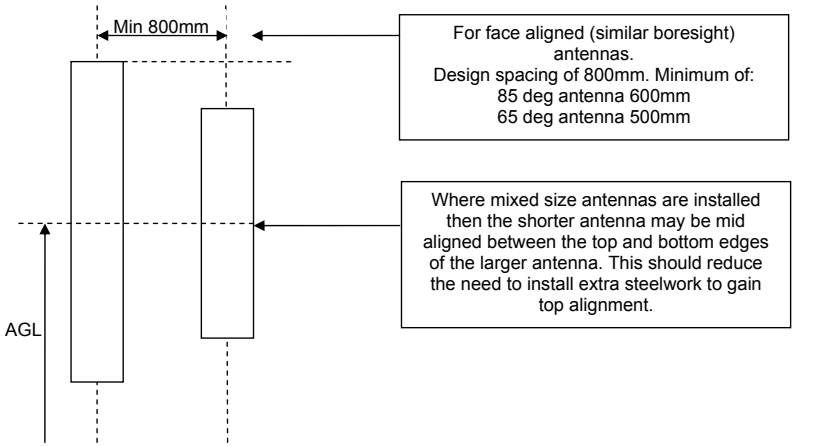
6.1.4 Antenna Vertical and Horizontal Alignment

Vertical isolation of antennas is 500mm.

Horizontal separation for antennas with a similar boresight is detailed below. Antennas of different sectors (different boresight) do not have minimum separation.

Lesser separations shall be by consent of Cell Planner or detailed in structure / project specific documentation.

6.1.4.1 Figure – Antenna Vertical and Horizontal Alignment



6.1.5 Separation from Other Operators Antennas

“Antenna spacings Between GSM & UMTS Operators”, ref. Spec 261Inter-Operator Antenna Forum (IOAF) document.

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6.2 Installation

Antennas will be installed using the approved brackets. Antenna manufacturer brackets can vary from light weight to heavy weight depending on antenna being deployed and tilts required. Special brackets / mount systems are sometimes provided for shrouded structures or structures with limited space. Only approved solutions provided by the structure manufacturer should be used in these instances.

Brackets should **NOT** be fully tightened when adjusting bearing or tilt as this may result in antenna being twisted or bowed. Antennas will not be skewed to the vertical.

Sector ID should be written on antenna with black permanent marker, for ease of identification in site photos.

It is good practice to check / set antenna Electrical Tilt on the ground, prior to installation.

6.2.1 Grounding

Refer to Grounding section

6.2.2 Commissioning

Commissioning and tolerances are specified in *RD10011_GSDD054 / LEE003 – Commissioning & Testing of Cellular Antenna System.*

6.2.3 RF Hazard Labels

Antennas shall have RF Hazard labels installed per - *GSDD007 Health & Safety Signage*

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7 Remote Electrical Tilt (RET)

7.1 RET Installation and Commissioning

GSDD0XX (currently *S2029 RET (Remote Electrical Tilt)* – being updated for AISG MHA) document details how to install and commission VET / RET systems.

RET Commissioning results will be logged in the *RD10011_GSDD054 Certificate of Conformance Form (COC)*.

7.2 Application of Remote Electrical Tilt Systems

It is now MBNL strategy to install RET enabled antennas as the preferred choice were new antennas are being deployed or replaced.

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8 Mast Head Amplifiers (MHA)

MHA is generic term used for all LNA, TMA, ASC etc. Their function is to amplify the Rx (Uplink) signal as near to the antenna as possible, so the weak receive signal can overcome noise / loss in the feeder system. They require DC power to operate and may have AISG functionality, so may form part of the RET AISG circuit.

Latest approved MHA and their use are detailed in: *GSDD093 Mast Head Amplifiers*

MHA type specified on the RDS. Used on all 3G sites except in exceptional circumstances, as detailed by the Cell Planner. Used on most 2G sites except for Nortel S8000 equipment.

MHA types on a site for a given technology should not be mixed.

General features to consider:

1. DC powered via Bias Ts at the equipment end. Bias Ts can be integral to the equipment or separate units inserted into the feeder circuit with male / female DIN7-16 connectors and an SMA cable for DC power. This will either be up one or both feeders on each sector.
2. DC current is critical as all MHAs have an operational DC current range (mA). If the DC current draw is too low (circuit problem) or too high (MHA alarm) then the MHA is NOT functioning.
3. When DC power is provided via the BTS / Node B then the MHA type must be confirmed within the telecoms equipment. **Of particular importance when changing / upgrading MHA types.** This may require changing of BTS / Node B parameters either remotely or locally. This will set current draw alarm levels and AISG communications.
4. Modern units tend to come as
    a. dual units in a single housing. One for each antenna polarity.
    b. **MBNL standard is to have fixed Port 2 BTS port for the DC power and Port 1 for AISG communication**.
5. AISG functionality is available (may not be used) on more recent units. It is normal practice to have one BTS port dedicated to DC power and the other to AISG. Future units may auto select.
6. Wideband MHAs work on both 1800 and 2100. However their power consumption is normally higher (more amps) so they may require a separate DC power source (PDU) which is connected to the Bias Ts via an SMA cable.
7. Most single technology (2G or 3G) amps can be DC powered from proprietary DC power sources they have lower power consumption.
8. Where MHAs come as single units, mounted as a pair, DC power will be require for each individual amp. E.g. NSN WMHA-Bs.
9. DC blocking may be required in some site configurations. Wideband Triasx Mk2 and UCU incorporate DC blocking within them.
10. Some MHAs incorporate a combiner. For example LGP ALNA 1800 (P000296) combines the Tx and Rx within the amplifier.
11. Input voltage is normally 12Vdc and gain typically 12dB.
12. Where diplexors / triplexors / combiners are installed in a feeder circuit then both DC and AISG bypass must be considered, or the correct setting selected (in the case of UCUs).

8.1 Installation

Where reasonably practicable will be installed in accessible positions as close as is practical to the antenna. Antenna jumper max length is 2m. On rooftop cell sites they should be located so they are accessible without the need for **cherry picker / abseil** access or other specialist access equipment. Greenfield sites, typically on antenna mount poles.

Where practicable MHAs will be mounted vertical with the antenna connectors at the top. Some MHAs have weep / vent holes and unless specifically detailed in documentation shall be mounted

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vertically. Each MHA has specific requirements detailed in *GSDD093 Mast Head Amplifiers.*

MHAs are normally supplied with their own brackets and are normally mounted with:

1. stainless steel banding or stainless jubilee clips, top and bottom
2. mechanically to cable tray / unistrut with nuts, bolts flats and springs.
3. to walls using rawl plugs and screws
4. Some older MHAs will need a stand off / feeder management bracket to enable mounting.

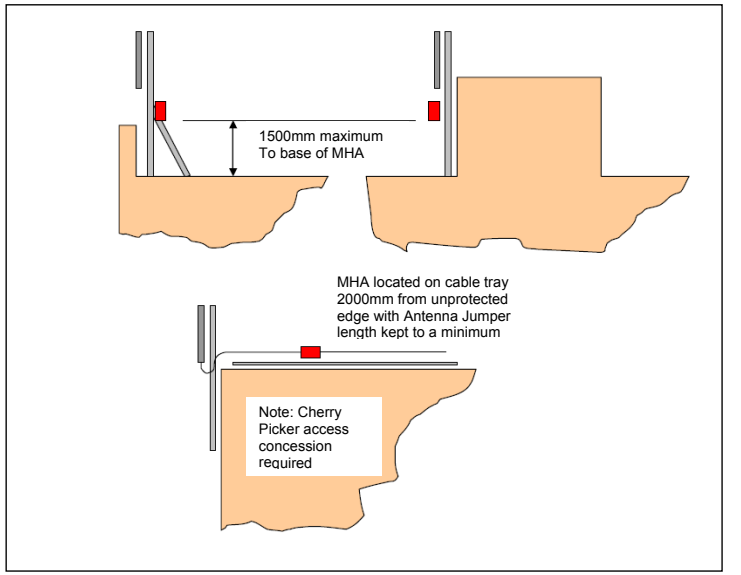
On Towers is it is normal practice to install on the back of antenna pole, as close to antenna as possible.

Where space is restricted or in an internal cabinet, specific mounting instructions / brackets will be detailed in manufacturer's literature or MBNL Equipment documentation.

Unused AISG ports will be capped.

Unused DIN 7-16 ports will be weatherproofed as detailed in the Weatheproofing section.

8.1.1.1 Figure – MHA Positioning



Refer to Appendices for T-Mobile GSM Legacy Site Configurations including ALNA LGP MHA and Ericsson dEDB.

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9 Combiners and Diplexors

For grounding and labelling refer to other sections.

Various GSDD documents covering UCUs in the reference document section.

9.1 Diplexors / Triplexors

Where required these shall be installed near to the antennas or BTS / Node B equipment using standard jumper lengths.

Mounting is normally by 2No jubilee clips.

9.2 UCU

Refer to equipment documentation

10 Special Site Types

Details of solutions excluded from this document but the rigging principle still apply. Only if specifically documented is it permissible to deviate from the rigging principles detailed in this document.

10.1 Microcell Sites

Excluded from this document

10.2 Temporary / Mobile / Cell on Wheels (COW)

Excluded from this document

10.3 Internal Distributed Antenna Systems

Excluded from this document

10.4 Remote Radio Heads / Units

Not currently deployed on MBNL network.

10.5 Distributed Antenna Systems (DAS)

Excluded from this document

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11 Feeder System Installation

For grounding, labelling and structural loading refer to other sections.

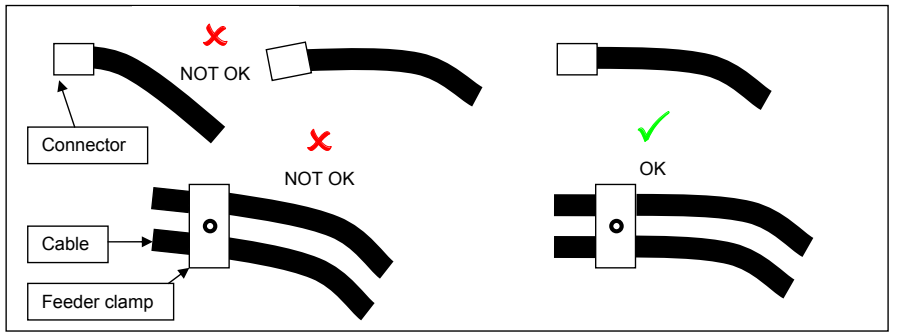
11.1 Approved Feeder Fixing / Support Methods

Feeders shall be supported in such a way that they cannot be moved by wind or any other form of physical interference.

Manufacturers minimum bend radius (multiple bends) shall be adhered to. Feeder performance is based on its holding its circular shape. The following is **NOT ACCEPTABLE**:

1. Dents / depressions / deformations / ovality – damage incurred during transit or installation.
2. Kinked feeder – this is where uneven feeder forming has resulted in a sharp depression in the outer conductor.
3. Popped jacket – this is where the jacket has 'popped' off of the outer conductor underneath during forming
4. Cables leaving a connector or a clamp at an angle. Feeders shall be formed to minimize stress on connector approach. Cables shall be straight and perpendicular when approaching a connector: 7/8" feeder min 100mm straight, ½" jumpers can be reduced to 50mm straight.

11.1.1.1 Figure – Feeder Forming

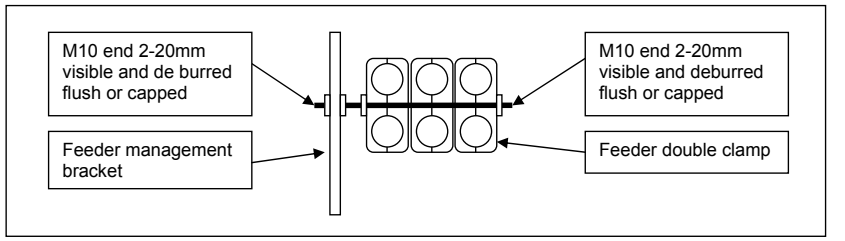


Methods of fixing feeder cables

- Double cable clamps at **1.0m intervals**, manufacturer approved for cable type installed. Exceptions:
  - End main feeder clamps, at a jumper interface, shall be clamped within 200mm of the final main feeder connector.
  - If transitioning from cable ladder / tray to a tower / cabin / cabinet then a maximum unsupported length of 1.5m is allowed. As long as there is at least 4 feeders of minimum 7/8" size, and there is in a mid point flying clamp, no more than 750mm from either end.
- Max number of 3No clamps per M10 stud, with larger feeders on the bottom if mixed.
- Feeders are not to cross over and are to run in a neat and consistent manner. GSM and UMTS main feeder runs should be located on separate studs. Exception is where all 2G and 3G feeders can be fitted on single M10 stud. This is normally when running to a single antenna on a rooftop or a larger tower; assume 3G on the bottom as it would be the larger feeder.
- M10 stainless stud with flats, springs and washers will fix double feeder clamps. If springs not used then double nuts on ends and all spacer nuts. **Maximum of 20mm** and a minimum of 2mm visible after tightening. Any cut ends shall be deburred and flush or capped.

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11.1.1.2 Figure – Feeder Studding



- M10 main feeder stud shall bolt direct to cable tray, cable ladder or galvanized feeder management brackets. Limited capacity alternatives, normally used for managing jumpers etc. are:
  - Stainless banding (min ½", 11m) using a Remadaptor / BPA50 may be used. Maximum capacity of 6No cables up to 7/8" or 4No cables if larger than 7/8".
  - Stainless jubilee / hose clip (min ½", 11mm) using a Remadaptor / BPA50 may be used. Maximum capacity of 4No cables up to 7/8" or 2No cables if larger than 7/8".
  - M10 MKD / CTL galvanized clamp (with lock nut) may be used if connected onto structural steelwork. Should not be used for 6No main feeder runs up a tower but may be used under a grillage or around a headframe. Maximum capacity 6No cables up to 7/8" or 4No cables if larger than 7/8".
- Hoist socks – typically used in streetworks poles. End shall be secured taking the weight of the feeder so that it does not stress the final connectors. It is preferred that these are bolted or d-shackled into position or attached to the amplifier mounting bracket (as detailed in previous MBNL documentation).
- Catenary wire – rarely used, only to be used in exceptional circumstances. This is the use of wire to hold a feeder in position. This can be integral to the feeder, or separate.
- Cable ties – may only be used to secure ½" jumper tails inside equipment cabins / cabinets / rooms.
- Where feeders are to run parallel to existing transmission cables over distances greater than 1m, they must be spaced a minimum of 75mm away, wherever possible.
- Screened Power cables may be fixed to the sides of cable trays but should be clearly labelled to identify it as a power cable.

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11.2 Feeder Management System

All feeder management system components shall be galvanized or stainless steel.

Where practicable, the existing feeder cable may be re-positioning on the cable tray to make space for additional feeder cables. This requirement should be assessed at the initial site visit and the condition of the existing feeders must be visually inspected by the SWC prior to the start of the rigging.

Generally, additional cable tray for new feeders shall be avoided wherever possible unless the use of additional cable tray can be justified either from a cost or reduced losses viewpoint. The SWC is to highlight this and any feeder faults to the PM directly after the initial site visit.

Feeders shall be installed in such a manner that minimises the associated wind loading, particularly in the case of masts, towers and roof structures.

All feeder routes shall be designed to ensure that the minimum bend radius of the cable is not exceeded.

11.2.1 Cable Tray / Ladder

- Tray shall be galvanised heavy duty perforated metal heavy duty tray with double edge return to BS EN 61537
- All cable tray tees, intersection units, fish plates and sets shall be purpose made by the manufacturer.
- Where possible full lengths of cable gantry shall be used to reduce joints and cuts. All cuts in the cable gantry, and cable gantry lid, shall have all burrs removed and cold galvanizing spray such as Galvafroid shall be applied.
- Cable trays shall be supported by mild steel galvanised brackets at regular intervals of 1.2m maximum and at 255mm from bends and tees
- All feeder routes shall be designed to minimise exposure of feeders to falling ice / objects.
- For cable sizes up to 1¼", **300mm** cable ladder / tray shall be used, for feeder sizes of 15/8"and above a minimum of **450mm** cable ladder / tray shall be used.
- For feeder cable runs to individual antennas the size of the cable tray should be reduced relative to the number of cables required, allowing for GSM and UMTS feeders.
- All trays and ladders shall stand off walls and floor or roof finishes by 50mm minimum to allow for access underneath to attach feeder clamps and to allow water to drain completely. Special attention should be paid to areas of a rooftop site where ponding may occur, these areas should be avoided or cable tray raised, where the area cannot be avoided.
- Under no circumstances shall feeder tray or ladder be attached to cabins which do not have a pre-installed unistrut (or similar) connecting point.
- The use of cable tray lid should be avoided unless damage is likely to be caused to the feeder cables or where specified by the site provider. Step-over bridges shall not be used unless specifically requested by the Site Provider or required for Health and Safety reasons where the cable tray crosses a designated access/escape route.

11.2.2 Gantry Poles

Poles shall be used to support feeder tray or ladder above head height.

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11.2.3 Glands

The feeder entry point into any accommodation shall be via the approved entry gland. All glands should be left properly sealed / blanked off on completion of works.

- Cabin glands are typically manufactured by Roxtec.
- Equipment cabinet glands can vary depending on supplier.
- Drip loops, refer to other section.

DO NOT LEAVE, or as a minimum photograph and report in handover pack;

- Visible air gaps
- Two cables through a single gland
- Open glands

11.2.4 Towers

Feeder cables for towers shall be installed in accordance with the manufacturer's specified method of feeder support.

Where feeder cables are fixed to third party towers, an appropriate method of feeder support shall be designed by the SWC with approval sought from the tower owner. All feeder cables should be accessible from the ladder without the need for additional specialist access equipment wherever possible. If a cherry picker or some other form of access is required to a tower which is normally accessible, the SWC must indicate this requirement to the PM via the FIXIT process.

11.2.5 Feeder Management Brackets

Appropriate brackets (4 hole or 6 hole) and fixing bolts (U or N) shall be used and installed at intervals of 1000mm max.

11.2.6 Feeder cables fixed without the use of cable tray

On some site, the use of cable tray may not be practicable / necessary. For example where there is existing steelwork or a suitable wall/parapet, studding may be fixed directly (e.g. chemical anchor). Specific approval for this type of feeder support MUST be obtained from the site owner with attention paid to possible maintenance work that may require temporary removal/re-location of the feeder cables.

11.2.7 Ducts

Ducts used for feeders should be 150mm diameter. Where 7/8" feeders, or more than 6 No ½" are ducted then more than one duct should be supplied.

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11.3 Weatherproofing

Where exposed to the weather or water, ALL DIN 7-16 connections will be weatherproofed. Including but not limited to: main feeder connector at a streetworks pole hatch, main feeder to jumper connections, antenna and MHA connections.

11.3.1 Generic Weatherproofing

This will be with layers of:

1. PVC
2. Butyl or Self Amalg
3. PVC – final wrap secured with a cable tie at end to stop it unraveling. A feeder identification label cable tie can be used.

11.3.2 Drip Loops

As feeder cables approach equipment entry points they shall be installed so as to fall away from the equipment, preventing water running along the feeder cables onto the gland or opening. In addition a cable tie shall be added to each feeder within 150mm of the cable entry to act as a drip point.

11.3.3 Exclusions

The following DIN 7-16 connectors do not require application of weatherproofing:

1. DIN 7-16 connections inside a cabin or cabinet.
2. Equipment cabinet underside bulkhead connections where protected from the elements.
3. UCU outdoor units with outdoor covers and with factory* made jumpers.
4. Flexi outdoor unit's angle connector with factory* made jumpers.
5. Kathrein 4 port antennas (742234 and 742236 type) where final connection is with a factory* made jumper.

* - If jumpers are made on site the rear of the connector requires additional weatherproofing.

11.3.4 Open / Unused / Un connected DIN 7-16 Ports

Jumpers may be left on site in readiness for equipment installation or some antenna ports may be left unused. If left unconnected then for:

1. Un-used antenna / MHA ports:
    a. install a pig tail between unused antenna / MHA ports OR
    b. install an IP rated cap OR
    c. a "non IP" rated connector cap and PVC wrap secured with a cable tie.
2. Jumpers being left in readiness for equipment installation:
    a. a connector cap and PVC wrap secured with a cable tie. Cover jumper sets in a plastic bag and fix upright.

11.3.5 Other Connectors (N-Type etc)

If connectors other than DIN 7-16 are deployed, where they are **not** inside communication cabin, room or cabinet, they will have additional weatherproofing applied per manufacturer's instructions or per the 'Generic Weatherproofing' detailed above, covering the entire connector pair and the mating.

11.3.6 Grounding Kits

Grounding kits with integral IP68 weatherproofing do not require additional weatherproofing. E.g.

- Andrew – Compact Sureground
- RFS - GKSpeed

Other ground kits (not IP 68) shall be waterproofed in accordance with the manufacturer's instructions and 'Generic Weatherproofing' detailed above.

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11.4 Grounding of Cellular Antenna System

The outdoor Cellular Antenna System shall be grounded to the site ground points / steelwork / LPE on site providing:

1. safety from inadvertent energisation, from AC, DC and RF power sources.
2. discharge path for lightning energy to limit damage to equipment and for safety of building

All grounding connections shall be made by means of a corrosion resistant nut, bolt and spring washer assembly which shall be smeared with a corrosion inhibiting compound. All components of the grounding connection shall also be smeared with a corrosion inhibiting compound.

Grounding cables should follow smooth curves in the direction of travel of antenna lightning strike. They should not change direction more than 45 degrees.

Maximum 2 (two) ground cables per grounding bolt.

Where ground wires are made up on site then 16mm green yellow copper shall be used. Ends will be crimp lugged to suit grounding point bolt size M6/8/10. Length should be kept to a minimum, normally max 300mm.

11.4.1 Grounding Points

Ground points shall be selected so as not to interfere, obstruct or be dependent on the installation / removal of other pieces of equipment. It should not be possible to inadvertently disconnect a ground by working on another piece of equipment.

Typical Grounding Points	Not Allowed
Copper Earth Bars LPE copper tape (25x3mm) Specified grounding point Cable tray / ladder direct connection Pipe Bond / Rainwater Pipe Bond / Tenby Earth Strap (to pipe / pole) M10 MKD / CTL clamp Vacant bolt position Feeder management bracket spare hole as long as this does not block off space on feeder management or on a separate dedicated ‘grounding bracket’	Equipment mounting bracketry bolts Feeder management stud Structural bolts Painted or powder coated surface in an earth connection

11.4.2 Main Feeder Grounding

Approved feeder grounding kits are supplied by feeder manufacturer, and should use integral IP68 weatherproofing. E.g; Andrew – Compact Sure Ground, RFS - GKSpeed

A single main feeder ground may satisfy more than one of the requirements listed below. Main Feeder grounding shall be applied:

1. Antenna end within 2.0m of the antenna, or MHA where deployed.
2. Tower bottom – ground connection to the feeder on the vertical drop prior to the bend. Ground to be made to the tower or cable gantry. In a streetworks pole ground main feeder at inspection hatch.
3. Vertical rise greater than 2.0m, working away from the antennas. Normally on a rooftop, Ground installed on the horizontal approach to the rise.
4. Final approach to Cabin / Cabinet / Equipment / Equipment Room, within 2.5m.
    a. Where feeders are contained in underground ducts or it is not practical to ground within 2.5m of the cabinet, there is no requirement to ground the feeders inside the duct or before entering the cabinet, however, feeders must be grounded at the main

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vertical to horizontal drop prior to entering a duct. (e.g. in the case of a rooftop site with equipment at ground level.)

5. Additional feeder ground shall be made
    b. to the cable at mid point of feeder runs where the length of the run between bonds would be greater than 30m.

11.4.3 Grounding other Outdoor Equipment – Antennas / MHA / Combiner / Diplexors / UCU

These will be grounded when installed outdoors, or installed in MHA / combiner cabinets. When installed in communications racks they will be earth bonded per product specific documentation / manufacturer's instructions

11.4.3.1 Antennas

Kathrein, Powerwave and Cellmax antennas used by MBNL do not require a separate ground. Some legacy antenna may require a separate ground as specified by the manufacturer.

11.4.3.2 MHA / Diplexors / Triplexors / Combiners

All to be grounded to their ground points unless grounding is integral via their mount brackets.

11.4.3.3 Cable Tray / Gantry Poles / Cable Ladder / Support Steelwork

Lightning Protection and earthing installed and tested as detailed in *M3006 Lighting Protection and Earthing* or equivalent GSDD document. Generally:

- Gantry poles are to be bonded to the LPE with 25x3mm tape.
- Joints between two pieces of cable tray / ladder should be made with fish plates and an equipotential bond made between them. Cable cover brackets should provide electrical continuity to the tray, if not a bond is required.
- Ends of cable tray runs shall be bonded to the LPE with 25x3mm tape. Within 5m of the end and intermediate LPE bonds will be made as appropriate on long cable tray runs.

11.4.4 Lightning Finials

Not currently required. If deployed they should be installed such to provide a 45 degree downward cone of protection providing 200mm clearance above upper most piece of telecommunications equipment (normally the antenna).

11.4.5 Outside of Scope

1. The metalwork on all sites is bonded to earth and each site has Lightning Protection earthing installed and tested as detailed in *M3006 Lighting Protection and Earthing* or equivalent GSDD document. All metalwork on site is bonded to earth
2. Connecting telecommunications equipment, equipment cabinets and cabins to site earth and the LPE system.
3. Earth bonding of transmission dishes and feeders.
4. RET earthing
5. Microwave earthing
6. Earthing of Remote Radio Units and cables
7. Equipment installed inside equipment racks / cabins / cabinets / rooms will be earthed in accordance with manufacturer's requirements.

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12 Labeling of Cellular Antenna System

12.1 Feeder Labeling

Feeder cables shall be labeled using the Hellermann Tyton TIPTAG pre-printed labeling system, Type TIPTAG11, 65x11mm. These labels are fixed to the feeder, **for all radiating frequencies**, using cable ties at the following locations:

- Within max 100mm from the connector on each feeder / jumper
- On the main feeder within 1000mm (Labels required both internally and externally)
  - of the cable entering the equipment cabin or internal room.
  - At any location entering and exiting an area where the feeders are not visible, e.g. risers inside buildings, cable ducts, inside and outside of cabins and troughs. (Note: this is not required for monopole tower structures.)

The Operator ID will normally be left blank. Instances where required would be on the Node B / BTS jumper coming from a UCU / MRC because at this point the jumpers are single operator and there is more than one operator on the site, so they need to be distinguishable.

12.1.1.1 Table - Label Template Key

"X Y Z"

Template Key	GSM	UMTS	LTE
X - Operator ID	**n/a** – no operator ID, normally only applicable on main feeder **E** – Everything Everywhere, **H** – H3G **O** – Orange, **T** – T-Mobile		
Y - Sector	**C1, C2, C3, C4, C5, C6 etc.**	**uA, uB, uC, uD, uE, uF etc.**	**eA, eB, eC, eD, eE, eF etc.**
Z - Antenna Port	**A1, A2, A3, A4 etc**	**1, 2, 3, 4 etc**	**1, 2, 3, 4 etc**
Frequency - Colour	**Example Labels**		
	GSM	**UMTS**	**LTE**
800 - Green	**C1A1**	**uA1**	**eA1** **EeA1 / HeA1**
900 - Orange	**C1A1**	**uA1**	**eA1**
1800 – Red	**C1A1** **OC1A1 / TC1A1**	**uA1**	**eA1** **EeA1 / HeA1**
2100 - Blue	**C1A1**	**uA1** **EuA1 / HuA1** **TuA1 / OuA1**	**eA1**
2600 - Yellow	**C1A1**	**uA1**	**EeA1** **(EE only)**

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12.1.1.2 Table - 800 Labels (GREEN)

Template	Cable carrying BOTH Operators at this Fx
'x'e'y'z'	eA1
Cable carrying ONLY a Single Operator at this Fx	
HeB1	EeB1

eA1 – Label rarely used. Current 800 LTE configurations have separate systems for each Operator.

12.1.1.3 Table - 1800 Labels (RED) – for EE GSM only, or EE (GSM & LTE)

Template	Cable carrying EE at this Fx
'x'C'y'A'z'	C1A1
Example: Second / Single Operator, if run separately	
TC3A2	OC3A2

EE – C1A1- labels are the default on the majority of the 1800 network. Where EE GSM only or EE (GSM & LTE) run on the same cables, from the same equipment, then standard legacy GSM labels ONLY may be retained / used. As it is implicit, and must be assumed, that LTE will be on **ALL** EE 1800 systems going forward.

EE – EeA1 labels would only be used in a situation where the cables where they run to EE LTE equipment only. This should only rarely occur, also see section below.

12.1.1.4 Table - 1800 Labels (RED) – for H3G LTE or LTE only

Template	Cable carrying BOTH Operators at this Fx
'x'e'y'z'	eA1
Cable carrying ONLY a Single Operator at this Fx	
HeB1	EeB1

eA1 – Label rarely used. Current 1800 LTE configurations have separate systems for each Operator.

H3G – HeA1 – labels should be used on cables where H3G LTE is deployed. In theory, should double label the main feeder if taking both H3G 1800 and EE1800 although this is unlikely. It's more likely that these labels will be needed to double lable main feeders diplexed with 2100, typically via UCUs.

EE – EeA1 labels would only be used in a situation where the cables where they run to EE LTE equipment only. This should only rarely occur, also see section above.

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12.1.1.5 Table - 2100 Labels (BLUE)

Template	Cable carrying BOTH Operators at this Fx
'x'u'y'z'	uA1
Cable carrying ONLY a Single Operator at this Fx	
HuB1	EuB1

Majority of sites have shared main feeders, use uA1 type label.

Typically only use Operator prefix labels coming from a Combiner (UCU) to the Node B.

12.1.1.6 Table - 2600 Labels (YELLOW)

Template	ONLY EE at this Fx
'x'e'y'z'	EeA1

All 2600 labels to be 'E' prefixed as only EE has a 2600 License.

12.1.2 Internal Equipment Jumpering

Where there are space restrictions for labeling on internal equipment jumpering then a flag tie (GCA Part No MAR100F) shall be used with dyno printed or hand written (permanent marker black) label per convention detailed above.

12.2 Bias T Label

Bias T (WHITE) MHA DC Feed

On consolidated sites with Nokia Flexi equipment an MHA DC Power label is required to be connected to the UCU jumper, port 2 feeder. This shall be white with black text.

Exception: some MHA require dual feed then a lable will be needed on UCU jumper port 1 and port 2. E.G. WMHA-B.

12.3 Re-labeling of Existing Feeders

Where works are being undertaken regarding the feeder line, feeders should be re-labelled appropriately in that location. It is not a requirement to totally re-lable legacy systems unless there is a change of use and a new radiating technology is added / removed.

What is left on site needs to clearly reflect the RF frequency that is operational in a feeder.

12.3.1 Legacy Labeling Conventions

For reference, the legacy feeder labeling conventions are shown in Appendices.

12.3.2 TX/RX Labeling Statement

It should be noted that on all new works (including upgrades to existing sites and new sites) all feeders will be assumed transmit/receive, therefore the historic requirement for TX/RX labeling has been removed.

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12.4 RF Hazard Labels

Antennas shall have RF Hazard labels installed per - *GSDD007 Health & Safety Signage*

12.5 Aluminium Feeder Site Sign

Aluminium Feeder Cable Installed signage will be prominently displayed on any site where AL feeder has been installed. This is to notify site operatives and deter possible vandals.



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12.6 Temporary Rigging Labeling

Some project works, may require temporary rigging works by an SWC that will leave a site in a non RDS compliant configuration. As these changes are not identifiable in Spectrum, (thus to Operations) then it is necessary to clearly identify the 'temporary rigging'. Examples of such MBNL Working Level Instructions:

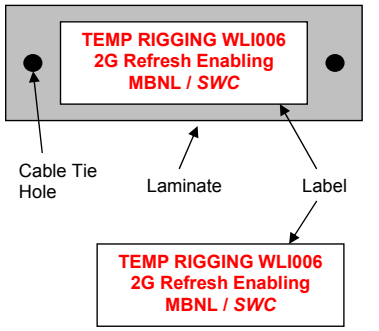
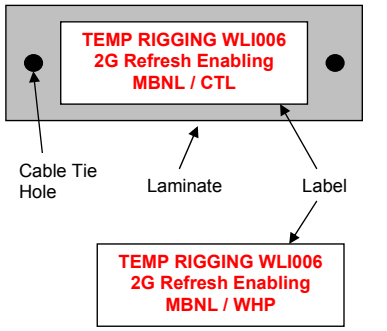
WLI004 – 2G Refresh – Temporary Install of dEDBs to Allow ALNA Replacement in Advance of Huawei Refresh

WLI006 – Feeder Preparation for 2G Refresh

With respect to WLI006 in particular:

In addition to standard feeder labeling, all temporary rigging enabling components: cable & RF components (jumpers, dEDBs, etc), that will be removed by Huawei when completing 2g Refresh, will have a **Temp Rigging Label** attached. Jumpers – each end, dEDB – visible side.

Temp Rigging Label labels should be white with **Bold Red Text**. It is recommended that laminated address labels are used and cable tied, to attach. Indoors address labels can be affixed direct or plasticized sticky labels can be used. It is not necessary for these labels to be Hellermann Tyton TIPTAG pre-printed.

Temp Rigging Label Template	Examples
	

12.7 Other Labels

- RET Label - Refer to RET documentation - *S2029 RET (Remote Electrical Tilt)*
- Fiber and DC Labels – Refer to RRU / documentation
- Feeder Length Labels - Labels detailing the length of the component feeder types, at the final equipment connection, are not currently required.
- Microwave Labels - Out of scope, please refer to Microwave installation documentation

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13 References and Related Documents

MBNL documentation covers current Projects and legacy information for the MBNL radio access network. These have a variety of reference numbers and can be downloaded from:

MBNL Intranet - mbnl.co.uk

ADC Build Extranet - adcbuild.com

Document lists are relevant at time of publication.

13.1 MBNL Documents (In Particular)

RD10012_GSDD004A *- Rigging – Feeder Systems*

RD10011_GSDD054 / LEE003 *– Certificate of Conformance (COC) – Form*

RD10011_GSDD054 / LEE003 *- Rigging I&C Certificate (RICC) – Form*

13.1.1.1 MBNL WLI and BLI

WLI001 *- 2G REFRESH Triasx wideband MHA WLI*

WLI002 *- 2G MHA WLI1 (2)*

WLI003 *- Rules to implement regarding the number of sectors and types of antenna to implement*

WLI004 *- 2G REFRESH ALNA TMA SWAPS WLI*

WLI006 *- 2G Refresh Feeder Preparation*

BLI013 *- Configuration requirements for RD0341 & RD0376*

BLI015 *- 2G Refresh RBS2000 Multiple Cabinets*

BLI016 *- Configuration requirements for Kaelus MHA*

BLI018 *- BLI on how to deploy MHAs on space diversity sites with large special separation*

BLI023 *- Diplexor 2G DC Blocking on Wideband Sites*

BLI024 *- Enabling Works for 1800 Network Integration 2G and 4G*

BLI027 *- Splitters for Omni to Trisector*

BLI029 *- 2G Refresh – Huawei 3900 Tail Connection Point*

BLI031 *- Addition of EE 2G onto 3G 4 sector sites using split sectors*

Temporary Guidance on MHA usage V1.0

13.1.1.2 MBNL LEC and LED

LECB003 *– RF Design Guidelines for RAN Cell Sites*

LECB012 *- MBNL Radio Planning Guidelines*

LECB023 *– MBNL Antenna System Planning, Deployment and Upgrades Project Godiva*

LECB027 *– Network Design - Antenna Subsystem Strategy*

LED017 *- MBNL Node B Configurations 3UK*

LED017 *- MBNL Node B Configurations EE*

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13.1.1.3 MBNL GSDD

RD10012_GSDD004A *- Rigging – Feeder Systems*

GSDD007 *- Health & Safety Signage*

GSDD008 *- ICNIRP Compliance Certification*

GSDD011 *- POW/FREDO Cabinets*

GSDD021 *- WREA to WREB Installation Requirements*

GSDD022 *- Flexi BTS Installation Guidelines for Stacked Option (Without Enclosure)*

GSDD023 *- Parasitic Conversion of Nokia WIN B to House a Flexi-BTS*

GSDD024 *- VRC to Flexi Stack*

GSDD025 *- IBBU Back to Back*

GSDD026 *- Flexi BTS Installation Guidelines for (Existing) VRE Cabinet*

GSDD028 *- Flexi Site Deployment within Equipment Rooms and Cabins*

GSDD035 *- Triasx WBTMA (Wideband Tower Mounted Amplifier)*

GSDD036 *- Jumper Schedule*

GSDD037 *- IBBU Upgrade with Flexi Stack*

GSDD039 *- H3G Streetworks & Macro Structure Upgrade Solutions*

GSDD040 *- Drawing Standards*

GSDD050 *- 2g / 3g UCU – (Universal Combiner Unit)*

GSDD051 *- Pre-Construction HSE Document Requirements and Checks*

RD10011_GSDD054 / LEE003 *– Commissioning & Testing of Cellular Antenna System*

GSDD059 *- Current Product List*

GSDD060 *- Secure Flexi BTS Cabinet – Guidelines for Detailed Design of Streetworks Sites including upgrades*

GSDD061 *- Parasitic Conversion of IBBU cabinet – Overview DRAFT*

GSDD062 *- Ordering and Installing UCUs*

GSDD063 *- NEC RAN-Swap Infrastructure Guidelines (Cabins and Internal Rooms)*

GSDD070 *- Cabin and Equipment Room Cooling Assessment and Solution*

GSDD072 *- Summary of Parasitic Conversions*

GSDD082 *- Antennas*

GSDD083 *- Universal Combiner Unit (UCU) within the Phoenix Cabinet*

GSDD091 *- 3G >3 Sector Deployment*

GSDD093 *- Mast Head Amplifiers*

GSDD097 *- Flexi Site Deployment in Indoor and Outdoor Racks with UCU*

GSDD098 *- 2g Refresh-GSDD098 Huawei BTS 3900A Adapter Plates*

GSDD099 *- 2G Refresh - deDbs Recycling Process*

GSDD100 *- Ex OUK Roadside Upgrade Guidelines - Strategy and High Level Power*

GSDD102 *- 2G Refresh Small Cabin Site Strategy*

TAN001 *Flexi Plinth Detail*

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13.2 MBNL Legacy Documents

Mxxx Mechanical & Electrical series documentation

Qxxx Quality series documentation

Rxxx Rigging series documentation

Sxxxx Structural series documentation

M3006 Lighting Protection and Earthing

Q1007 How to create a 'Fixit'

~~*R2003 Alan Dick WBTMA (Wideband Tower Mounted Amplifier)*~~ **– Superseded with *GSDD035***

~~*R3001 Rigging Design and Construction for Macro Sites (GSM & UMTS)*~~ **- Superseded with *RD10012_GSDD004A***

R3002 Streetworks Sites

R3005 Outdoor Equipment Connections

R3006 Nortel S8000 Feeder Connection Details

R3007 Ericsson RBS2202 Feeder Connection Details

R3008 Diplexing Feeders for GSM/UMTS Sites (Feeder Sharing)

R3009 Ericsson RBS2106 and RBS2106i Rigging Connections

R3010 Ericsson RBS2206 Rigging Connections

~~*R4001 Macro Sites – Rigging / Feeder Design Principles*~~ **Superseded with *RD10012_GSDD004A***

S1010 Handover Documentation, Audit and Quality

S1016 Handover Documents

S1020 FIXIT Process and Requirements

~~*S2010 Health & Safety Signage*~~ **– Superseded with GSDD007**

S2029 RET (Remote Electrical Tilt)

S3011 3G (UMTS) Site Upgrade for existing T-Mobile Cell Sites

S3001 Macro Site Design

ESL001 Operations Site Access & Outages Procedure

13.3 EE Legacy Documents

PROC7 Implementation Antenna Alignment Procedure

PROC9 Everything Everywhere PCN Antenna and Feeder Installation Procedure

PROC51 Implementation Testing and Commissioning of GSM and UMTS Antenna and Feeder Systems Procedure

PROC2573 Base Station Shutdown Procedure

13.4 Other

"Antenna spacings Between GSM & UMTS Operators", ref. Spec *261Inter-Operator Antenna Forum* (IOAF) document

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14 Definitions / Acronyms

Term	Definition / Description
ACU	Antenna Control Unit
ADC	Acquisition Design and Construction contractor. Contract company with overall responsibility for the delivery of a project.
ADCBuild	ADC Build Extranet - adcbuild.com
AGL	Above Ground Level is antenna height from ground level to the bottom of the antenna.
AISG	Antenna Interface Standards Group http://www.aisg.org.uk/
Antenna Jumper	Final jumper connecting onto an antenna.
Broadband	A unit covering 2G and 3G, also see Wideband
BTS	Base Transceiver Station, the 2G radio equipment at a RAN site
BTS Jumper	Initial jumper connecting onto an BTS/NodeB towards the main feeder cable, diplexor, MRC, UCU etc
Carrier	A frequency range covering a single UK operator's sub division of their sub band. E.g. UMTS is divided into 5MHz carriers.
Cell Planner	Engineer responsible for the RAN design and site requirements. Documented in the RDS.
Cellular Antenna System	Includes all feeders, connections, grounding, MHA, combiners, antennas from the antenna to the final radio equipment (BTS / NodeB) connection.
COC	Certificate of Conformance – Cellular Antenna System handover document bringing together the various commissioning results.
Contractor	Company undertaking cellular antenna system rigging works.
Consolidation	MBNL process of converting T-Mobile and H3G RAN sites to MORAN configuration.
Combiner	Generic term for a sub band diplexor / triplexor. Example an MRC or a UCU.
Combiner Jumper	Jumper connecting onto a Combiner towards the main feeder cable.
DAS	Distributed Antenna System
Diamond Network / Programme	MBNL Network improvement / consolidation programme.
Diplexor	A combiner unit designed to combine 2G and 3G Tx and Rx signals onto a common feeder /antenna system
Dorset	Orange street cabinet
EE	Everything Everywhere joint venture between Deutsche Telecom (T-Mobile UK) and France Telecom (Orange UK)
Flexi	NSN 3G Node B modular system used by MBNL
Fredo	MBNL street cabinet
Full Band	A frequency range covering all UK operators for given technology 900 / 1800 / 2100
Godiva	MBNL project under which T-mobile and H3G RAN sites were consolidated to MORAN configuration. Project phase one end date 10/10/10.
H3G	Hutchison 3G (Three), 3UK
Integration Contractor	Contractor responsible for the integration of a Node B / BTS. Often the responsibility of NSN or Huawei, fulfilled by one of their contractors.

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Cont'd

Term	Definition / Description
Main Feeder	Main feeder connecting BTS / Node B to the antenna / MHA.
MET	Manual Electrical Tilt is where the antennas electrical tilt can be manually adjusted at the antenna. May be with or without motors.
MBNL	Mobile Broadband Network Limited
MEAS	The BT Ethernet used by MBNL
MHA	Mast Head Amplifier - For ease "MHA" will be used when refereeing generically to all LNA (Low Noise Amplifiers) also referred to as TMA, ASC etc. This active DC powered device amplifies the uplink / receive signal as near as possible to the antenna.
MHA Jumper	Feeder cable between MHA towards the main feeder
MORAN	Multiple-Operator Radio Access Network configuration
MRC	Multi Radio Combiner - combines the 3G H3G and T-Mobile sub bands onto a common feeder / antenna system. (supplied by Nokia)
MRC Jumper	Jumper running from the MRC toward the main feeder or 2G/3G diplexor
Node B	Industry name for the 3G radio equipment at a RAN site
Node B Jumper	Initial jumper connecting onto an BTS/NodeB towards the main feeder cable, diplexor, MRC, UCU etc
NSN	Nokia Siemens Networks
Optimisation	The process which follows a drive test of a given Cluster and which is intended to make adjustments to the performance of a site or sites to improve the corresponding cluster coverage and/or capacity.
Orange	Orange UK a partner of EE
Project	Generic term referring to scope and requirements under a specific Project or Contractual arrangements.
RAMS	Risk Assessment and Method Statements
RAN	Radio Access Network - consist of the RF and transmission systems of mobile telecommunications system providing the interface between the user device (Ue) and the core network (CN).
RCE	Remote Control Unit
RCU	RealTilt Control Unit providing RET AISG interface to Node B.
RCUA	NSN RCU
RDS	Rigging Data Sheet – details the existing and required radio requirements for a cell site. Owned by the Cell Planner.
RET	Remote Electrical Tilt is the addition of AISG control system to enabling tilting of the antennas from a Remote location, other than the site itself.
RET Cable	Generic term for AISG cable assemblies.
RET Motor	Motorised device that adjust electrical tilt of an antenna.
RICC	Rigging Installation and Commissioning Certificate, an Excel document recording antenna installation, sweep test results and schematic.
Rigging Contractor	See Contractor

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Cont'd

Term	Definition / Description
SiteNet	Site and project document repository on ADCBuild.
Small Works Contractor (**SWC**)	Contractor to MBNL for works as contracted, varying from acquisition, design, civils, rigging, integration and maintenance.
Splitter	Generic term for a passive device that splits one RF transmission path into two, normally full band (3dB loss)
SRF	Supply Request Form – details the required free issue equipment / materials.
Sub Band	A frequency range covering a single UK operator's frequency allocation for given technology 900 / 1800 / 2100. Operators Sub Band
T-Mobile	T mobile UK a partner of EE
TMA	Tower Mounted Amplifier - generically referred to as an MHA TMA-D: Duplexed Tower Mount Amplifier that combines Tx and Rx ports from the radio system and connects to a single antenna. TMA-S: A receive only Tower Mount Amplifier is installed between the receiving antenna and the radio to boost weak signals. TMA-DD: A dual duplex tower mount amplifier used for radio systems with a single transmission line connection for transmit and receive.
UCU	Universal Combiner Unit. A 3G combiner unit with 2G/3G diplexor in the same case. The combiner is designed to combine the 3G Tx and Rx bands RF outputs of T-Mobile& H3G onto a common feeder / antenna system while the diplexor unit takes the 3G single and combines 2G and 3G Tx and Rx signals onto a common feeder /antenna system
UCU Jumper	Jumper connecting onto a UCU towards the main feeder cable.
VET	Variable Electrical Tilt is the addition of AISG control system to enabling tilting of the antennas from a safe location on the site.
Wideband	A unit covering 2G and 3G, also see Broadband
2 Port System	A '2 Port System' refers to the number of antennas (connectors) used by either a 2G or 3G system in a particular sector e.g. a X-Polarised Antenna (i.e. x2 connectors) is a x2 Port System (i.e. x2 antennas)

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15 Appendix A – Outline Small Works Contractor Role / Responsibilities

Per the Project work instruction produce an approved site design, RAMS, plan the works and install / make modification on Cellular Antenna System either returning it to operation or on preparation for BTS / Node B installation.

The following items and responsibilities **may be undertaken** by the Small Works Contactor.

1. Access on line systems for documentation and site specific information.
2. Produce Cellular Antenna System planning and detailed design.
    - May include, but not limited to, CAD drawing, SRF, other documents, costs, RAMS as required by CDM / Project structure / services provided.
    - Structural loading assessment
    - The Cellular Antenna System is to be designed by the Contractor to required specifications / performance criteria. Any deviations shall be detailed in either:
        - other MBNL project / equipment specific documentation
        - by a written concession (RDS comments, FIXIT or other format) as required by the Project.
    - Health and Safety documentation (RAMS)
    - ICNIRP certificate.
3. Management of free issue equipment
4. Supply of rigging materials, from approved manufacturers as appropriate: jumpers, feeders, tails, connectors weatherproofing, grounding, labeling, cleats/claps/studs and glands / gland fillers. Additionally steel work and cable management, as may be required by Project
5. Supply services for: delivery of materials, access equipment/machines, signage / barriers, notifications, and communications between Network Operations / Site Provider / Local Councils, as required by Project.
6. Ensure that all personnel have appropriate and up to date (including but not limited to):
    a. Health and Safety equipment and PPE: steel toe cap boots, high visibility jackets, hard hats / bump caps, goggles, harnesses, ropes etc as necessary by RAMS.
    b. Equipment Certifications: electrical PAT testing, test equipment calibrations (Site Master, GPS alignment), NARDA (or equivalent) personal RF monitor.
    c. Training Certificates for works they are undertaking: RF awareness, rooftop access, climbing certification, fitness report, machine operations, first aid, tower rescue, etc
    d. Authorisations: client site access (Arqiva)
7. Planning and installation of Cellular Antenna System including:
    e. Health and Safety documentation (RAMS) as required by CDM / Project structure / services provided.
    f. Complying with Network Operational requirements for equipment outages
    g. Complying with Network Operational requirements for access to/from site, equipment shut down and site restoration.
    h. Complying with site provider on any site location specific requirements.
8. Commissioning, Certification and Handover (normally with ADC Build upload), of the cellular

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antenna system in accordance with :

- RD10011_GSDD054 Certificate of Conformity and other handover documentation as defined in
- S1016 of the Site Design Manual and the main Contract.

9 It is normally the Cell Planner / Project's responsibility to update radio planning / operational systems.

10 Audits will be carried out from the office and on site as the Project requires.

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16 Appendix B – Supplier and Manufacturer Contacts

16.1.1.1 Table – Supplier and Manufacturer Contacts

Company	Contact Details	Materials / Service / Training
COMMSCOPE® ANDREW® A CommScope Company Andrew INSTITUTE CommScope (Andrew)	Use Anixter for UK distribution of Andrew Brand Products Tel: 0121 322 7155 andrewsales@anixter.com www.comscope.com **Andrews Institute Connector Training** Jean-Claude Huntzinger (Trainer) Tel: 07712770541 huntzinger@btinternet.com	Feeder cable, connector, grounding, weatherproofing and prep tools. Factory made jumpers Connector Attachment Training (Certified Course)
RFS RFS (UK) Ltd	9 Haddenham Business Park, Pegasus Way, Haddenham, Aylesbury, Bucks HP17 8LJ Tel: 01844 294 900 we-are@rfsworld.com www.rfsworld.com **RFS Connector Training** Mr Dave Hutchings – Training Manager RFS (UK) Ltd. Tel: 01844 294 900 dave.hutchings@rfsworld.com	Feeder cable, connector, grounding, weatherproofing and prep tools. Factory made jumpers Connector Attachment Training (Certified Course)
LEONI LEONI Special Cables	Ferbane Business & Technology Park, Aughaboy, Ferbane, County Offaly. Ireland. Ph: +353 / (0) 90 / 6453840 John Grehan (john.grehan@lsc.leoni.com) www.leoni-special-cables.com	Legacy Cable Supplier
Rosenberger Rosenberger	Rosenberger Micro-Coax Ltd James S Stubbs +44 (0) 1189 810023 Office +44 (0) 7980 730423 Mobile James@rmcoax.com	Connectors for Leoni cables

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16.1.1.2 Table – Supplier and Manufacturer Contacts (Cont'd)

Company	Contact Details	Materials / Service / Training
Amphenol	Amphenol InfoCom Europe Hoofdveste 19, 3992 DH Houten The Netherlands Tel: +31(0)306 358 000	Factory made jumpers NSN Suppliers for Flexi jumpers
ICD	I.C.D Units 8/9 Bridle Close, Finedon Road Industrial Estate, Wellingborough, Northants, NN8 4RN Tel:- +44(0)1933 446464	Amphenol UK Supplier / Agent
Quadrant	Quadrant Connections Ltd, Unit 1, A1(M) , Business Centre, 151 Dixons Hill Road, Welham Green, Hatfield, Herts, AL9 7JE Nick Hester NHester@quadrantconnections.com] Tel: 01707 636600 Fax: 01707 636638 Website: www.quadrantconnections.com Email: sales@quadrantconnections.com	Factory made jumpers
Spinner	Spinner United Kingdom Ltd, Suite 8, Phoenix House, Golborne Enterprise Park, Golborne, Warrington, WA3 3DP Frank Woods DDI: +44 [0] 1942 275222 Mobile: +44 [0] 7810 483586 Email: frank.woods@spinner-group.com Web: www.spinner-group.com	Factory made jumpers
Castle Microwave	Castle Microwave Ltd, 5 The Pentangle, Park Street, Newbury, Berkshire, RG14 1EA Aarron Parsons Mobile: 0044 (0) 7585 975511 Tel: +44 (0)1635 271300 aarron.parsons@castlemicrowave.com www.castlemicrowave.com	Sales / Hire of test equipment
Electro Rent	Tel: 0845 077 2900 www.electrorent-europe.com	Sales / Hire of test equipment
Livingston	Livingston UK Ltd, Livingston House, 2 Queens Road, Teddington, Middlesex, TW11 0LB, England Tel: +44(0)20 8943 5151 Mob: +44 (0) 7789 984 505 Nasim.Hyder@livingston.com www.livingston.co.uk	Sales / Hire of test equipment

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16.1.1.3 Table – Supplier and Manufacturer Contacts (Cont'd)

Company	Contact Details	Materials / Service / Training
HellermannTyton Hellermann Tyton	Pennycross Close, Plymouth, Devon PL2 3NX Tel: 01752 701 261	TIPTAG Pre-printed labeling system Type TIPTAG11, 65x11mm
 Graphicshow Cable Accessories (GCA) Ltd	Unit 3, Ronell Place, 41A Shire Hill Industrial Estate , Saffron Walden, Essex CB11 3AQ Tel: +44(0)1799 516 016 sales@gcaltd.co.uk / www.gcaltd.co.uk	Pre-printed TIPTAG feeder labels TIPTAG11 , 65x11mm Flag ties, Cable clamps and adaptors, Weatherproofing accessories, MKD, CTL Tenby earth straps
Anritsu Anritsu	Anritsu EMEA Ltd, 200 Capability Green, Luton Bedfordshire, LU1 3LU Phone: +44 (0)1582 433280 Fax: +44 (0)1582 731303 http://www.anritsu.com/en-GB/home.aspx	Sweep Test Training Test Equipment
ROHDE&SCHWARZ Rhode & Schwarz	ROHDE & SCHWARZ UK Ltd., Ancells, Business Park, Fleet, Hampshire GU51 2UZ Tel: (0) 1252 818 888 Tel: Sales & Service + (0) 1252 818888 Email: contact.uk@rohde-schwarz.com www.rohde-schwarz.co.uk	Sweep Test Training Test Equipment
furse WJ Furse & Co Ltd	Thomas & Betts Ltd / Furse, Wilford Road, Nottingham, NG2 1EB Phone: +44 (0)115 964 3700 Fax: +44 (0)115 986 0538 Email: enquiry@furse.com	Grounding and earthing materials

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17 Appendix C –Typical Rigging Materials and Tools

17.1.1.1 Figure – Example Feeder Management Components

Note: images in table below not to scale.

½" Double Feeder Clamp 	7/8" Double Feeder Clamp 	1-5/8" Double Feeder Clamp 	M10 Stud with nuts, flats and spring and end cap 
Feeder Management Bracket 	U – Bolt 	N – Bolt 	Feeder Hoist Sock 
MKD / CTL clamp 	D Shackle 	BPA50 / "Remadaptor" 	7/8" or 5-50 Feeder Male Connector 

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17.1.1.2 Figure – Example Feeder Management Components (cont'd)

Note: images in table below not to scale

Banding tensioning tool and guillotine banding tool 	Banding Coil 	Banding Buckles 	Stainless Steel Hose Clip / Jubilee Clip 
GK SPEED Feeder Grounding Kit 	Marker Tie / Flag Tie 	Copper Tube Terminals for MHA earth 	Tenby Earth strap / lug 

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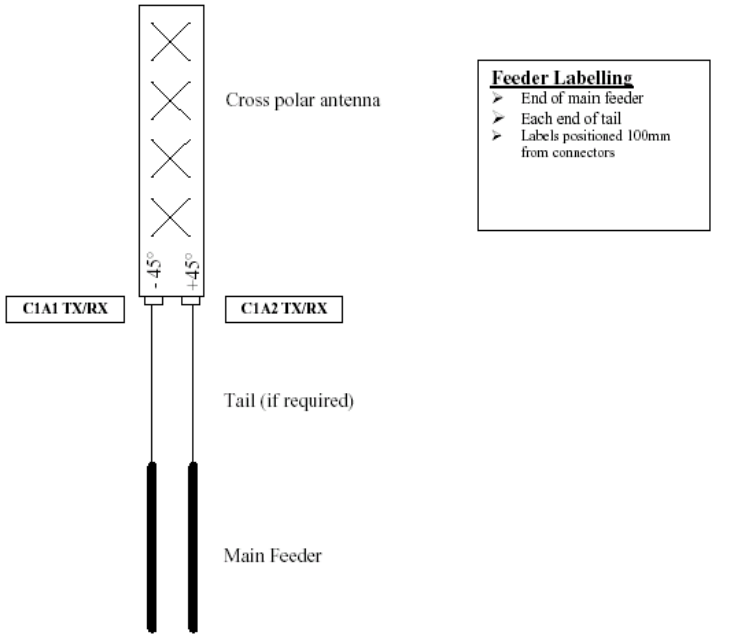
18 Appendix L1 - T-Mobile GSM Legacy Site Configurations

Legacy document extract and some references may be out of date

The following diagrams show the antenna configurations generally used on T-Mobile (UK) cell sites although the type and manufacturer of the antenna and TMA may vary.

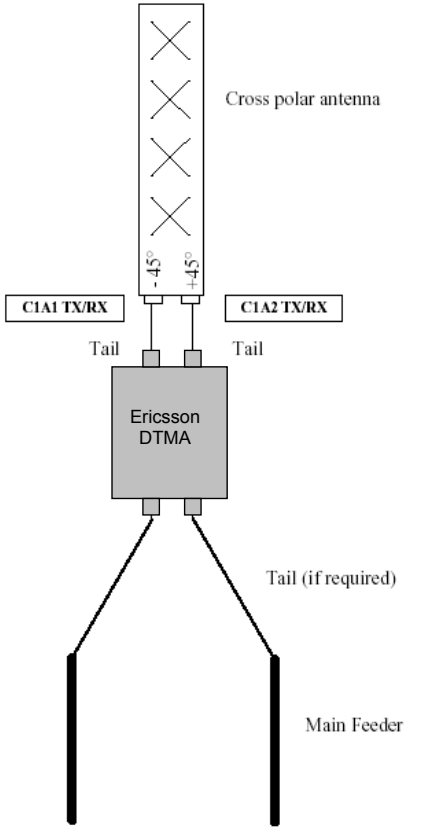
18.1 Ericsson RBS2206

18.1.1 CDU G and CDUF(up to 12 trx / sector) with no TMA's



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18.1.2 CDU G and CDUF (up to 12 trx / sector) with Ericsson ddTMA



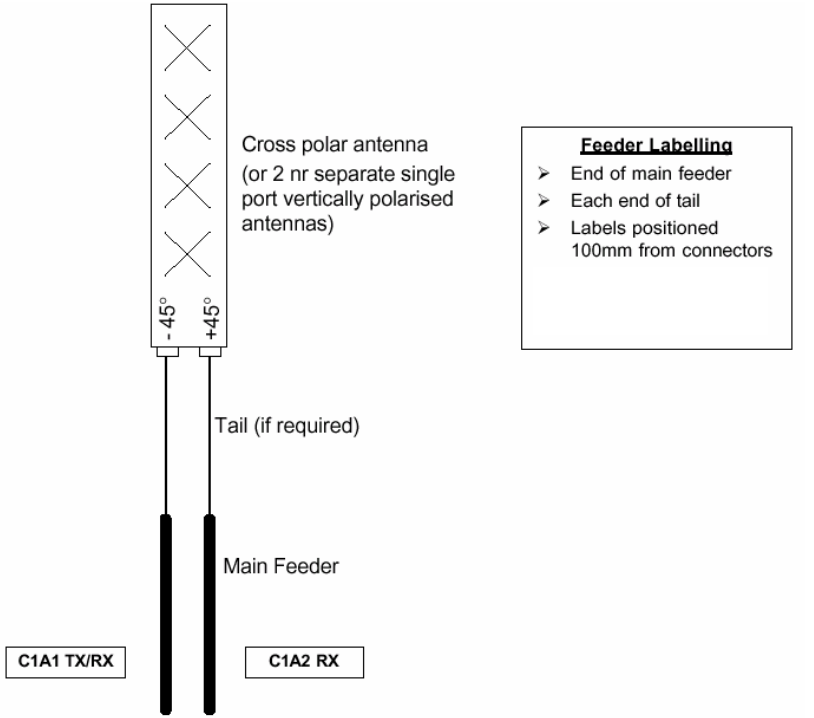
Feeder Labelling

- End of main feeder
- Each end of tail
- Labels positioned 100mm from connectors

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18.2 Ericsson RBS2202

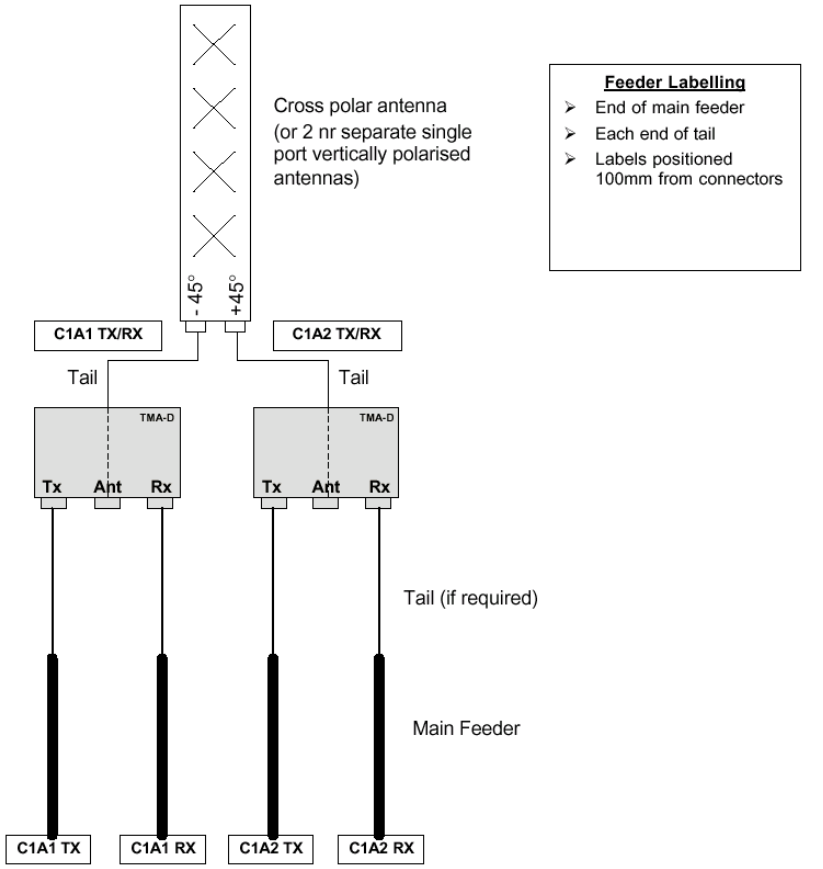
18.2.1 CDU C+ and CDU dD with no TMA's



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18.2.2 CDU A, CDU D, CDU C+ with TMA's (ALNA's)

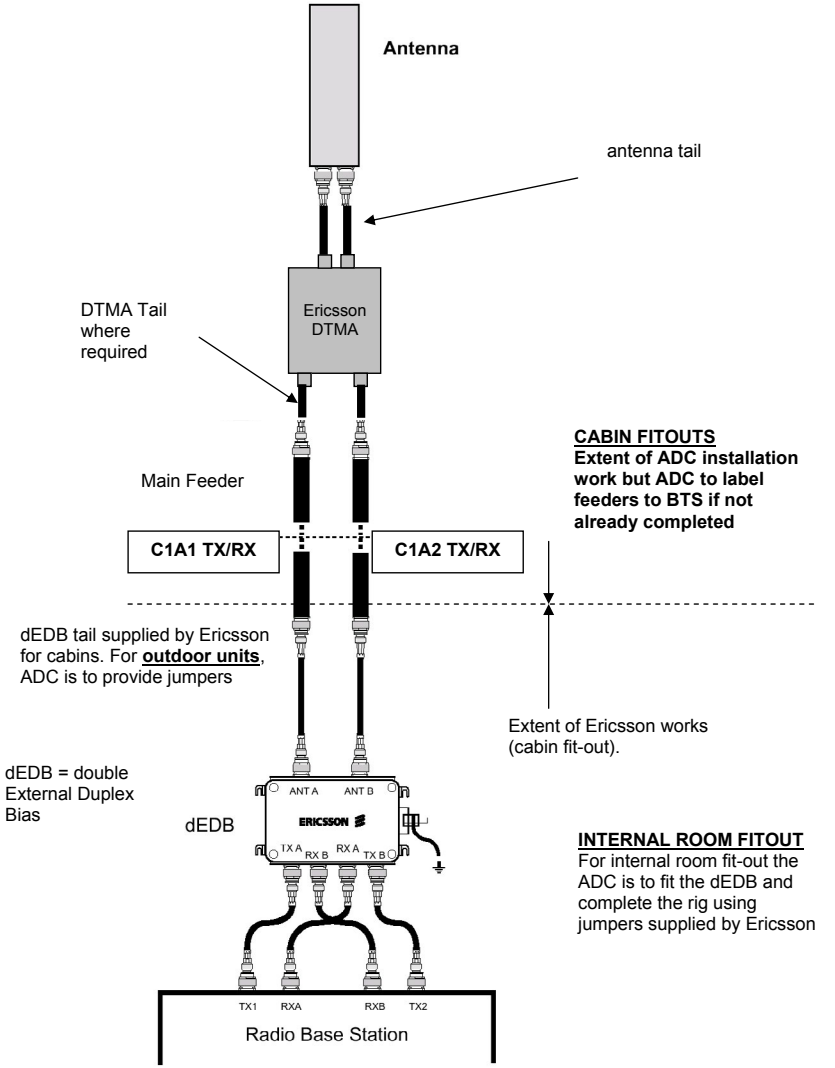
(Note: where 1 rack used for CDU C+, C1A2 TX to be installed for expansion and terminated in the cabin)



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18.2.3 Non Duplexed CDU A, CDU D, CDU C+ with Ericsson ddTMA

Sites where Ericsson ddTMA's are deployed should be rigged in accordance with the schematic given below. Where this configuration is used, a dEDB will be required to separate the Tx and Rx signals (previously combined by the ddTMA) prior to entry into the BTS. The scope of works for the ADC varies depending on whether the site requires a cabin, internal room or cabinets. For guidance on the options, see Section 11 of this document.



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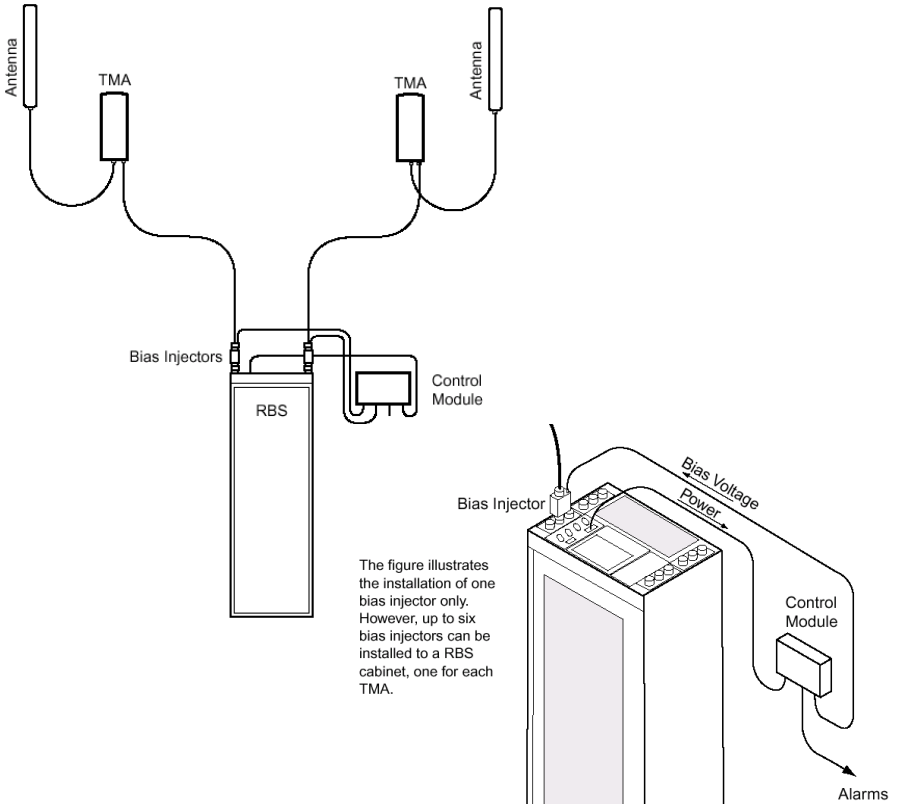
18.2.4 CDU dD (Duplexed), CDU dC+ (Duplexed) with Ericsson ddTMA

Sites where Ericsson ddTMA's are deployed should be rigged in accordance with the schematic given below. Where the output from the BTS is duplexed (TX and RX combined), there is no requirement for the double External Duplex Bias (dEDB) detailed in 7.2.3. The main feeder should be terminated at the BTS onto the bias tee installed onto the BTS port directly in accordance with the requirements contained within this document and document R4001 of the SDM (ie where flexible $^{7}/_{8}$" feeder cable is used, directly from the TMA to the BTS port)

The diagram below shows 2 separate antennas but may be a single cross polar antenna as detailed in the previous diagrams.

The control module, bias tees and all associated cabling is supplied and installed by Ericsson as part of the cabin fit-out.

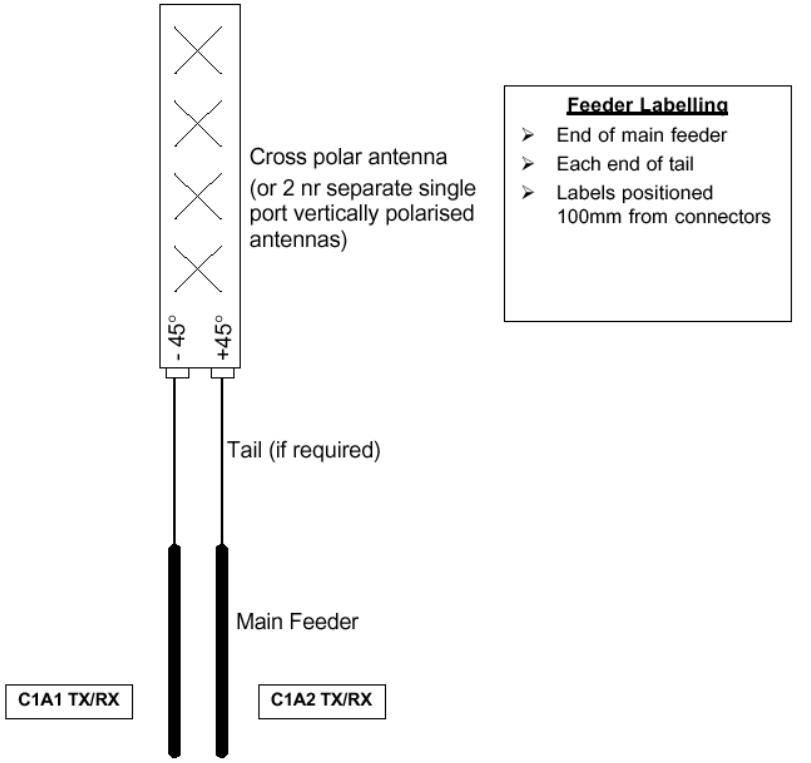
Where this configuration is used, a control module will be required to power the TMAs. The scope of works for the ADC varies depending on whether the site requires a cabin, internal room or cabinets.



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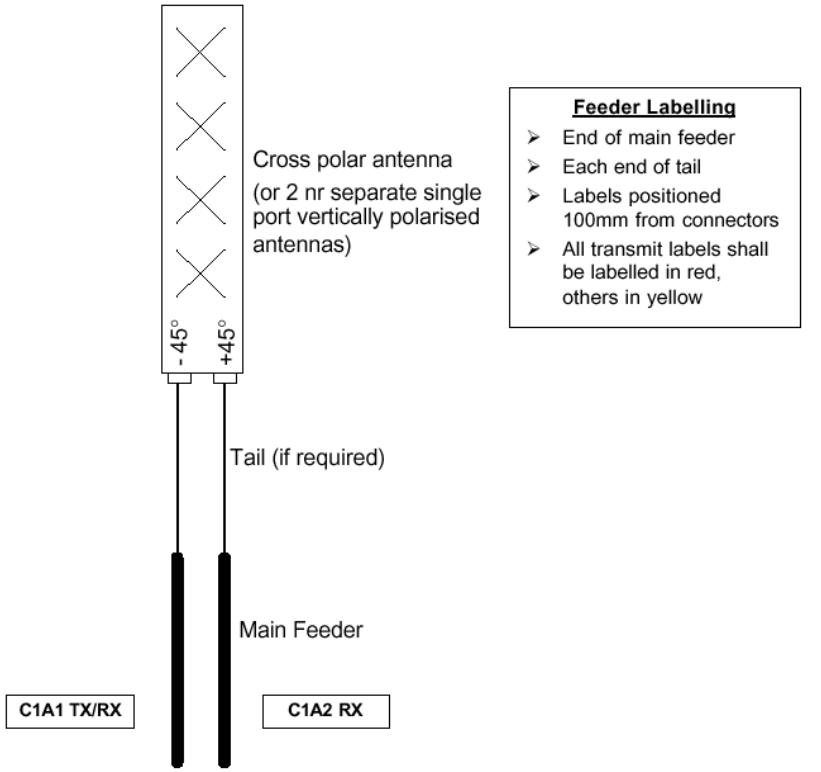
18.3 Nortel S8000

18.3.1 H2D, DPX – 1, 2 or 3 racks, H4D 3 racks



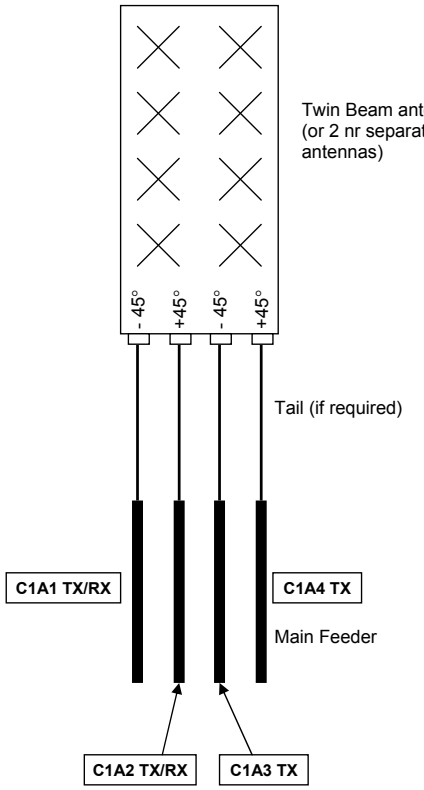
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18.3.2 Nortel S8000 with cavity combiners



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18.3.3 4xH2D



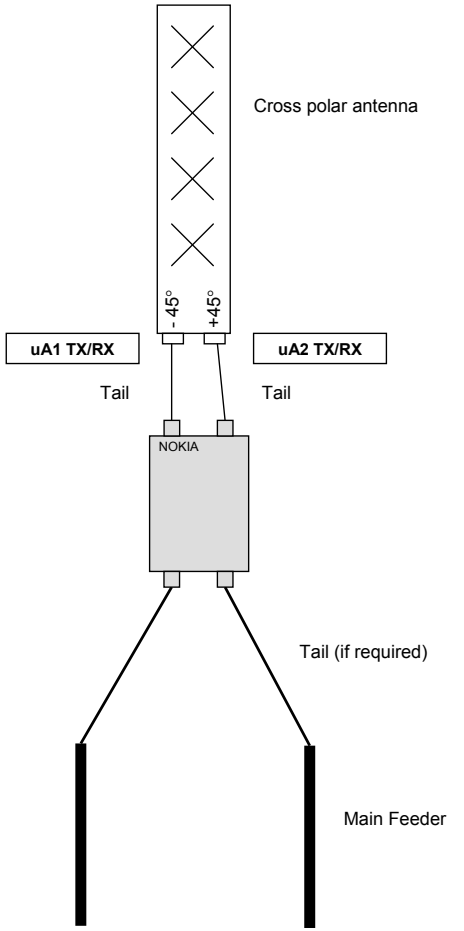
Feeder Labelling

- End of main feeder
- Each end of tail
- Labels positioned 100mm from connectors
- All transmit labels shall be labelled in red, others in yellow

18.4 Nokia Ultrasite (UMTS)

The Nokia dTMA incorporates two TMA's within a single unit. 3 TMA's are required per site, ie one for each antenna.

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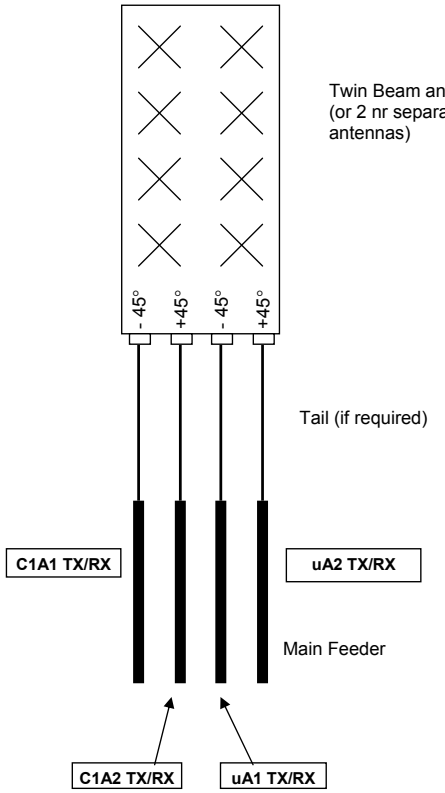
Feeder Labelling

- End of main feeder
- Each end of tail
- Labels positioned 100mm from connectors
- All transmit labels shall be labelled in blue, others in green

18.5 4 Port Antenna (GSM / UMTS)

The 4-port antennas incorporates 2 wideband (GSM / UMTS) antenna located adjacent to each other but wrapped in the same casing.

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Feeder Labelling

- End of main feeder
- Each end of tail
- Labels positioned 100mm from connectors

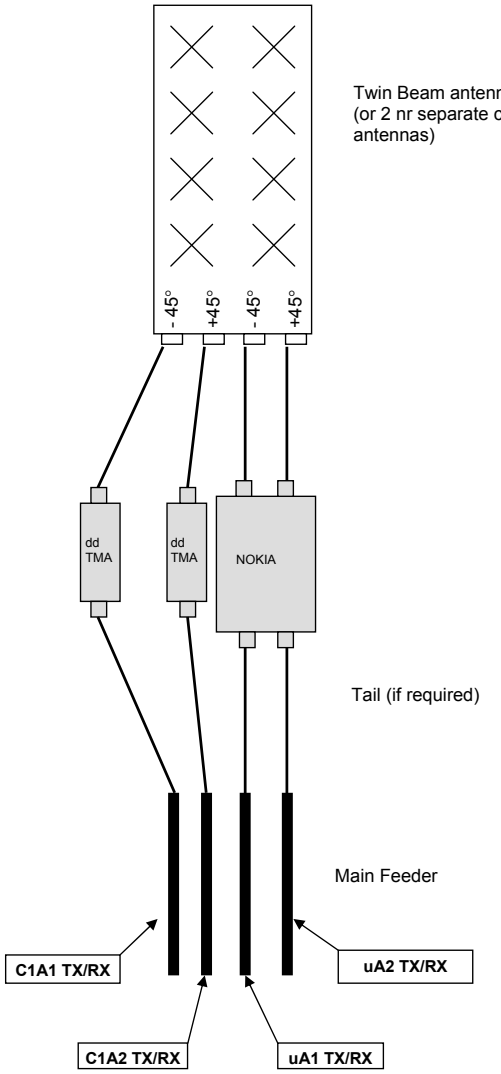
NOTE:

Where a 4-port antenna is used, the convention will be that the GSM antenna will be on the left and the UMTS on the right when viewed from the front of the antenna.

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18.6 4 Port Antenna (GSM / UMTS) with TMA's

The 4-port antennas incorporates 2 wideband (GSM / UMTS) antenna located adjacent to each other but wrapped in the same casing. Where ddTMA are used to duplex the GSM signal, the rigging from the antenna to the BTS and UMTS is to be as shown for the two port antennas in sections 7.1.2 and 7.5 respectively of this document.



Feeder Labelling

- End of main feeder
- Each end of tail
- Labels positioned 100mm from connectors

NOTE:

Where a 4-port antenna is used, the convention will be that the GSM antenna will be on the left and the UMTS on the right when viewed from the front of the antenna.

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18.7 Reduced equipment greenfield monopole REGM

For rigging details relating specifically to the Reduced Equipment Greenfield Monopole, refer to Site Design manual Document *S2001*, sections 4.3.1 and 7.2.3.

Feeder groudning is to be as for Phase 4 streetworks towers – refer to *Site Design Manual document R3002*.

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19 Appendix L2 - Double External Duplex Bias (dEDB)

Legacy document extract and some references may be out of date

Where sites are to be deployed using Non Duplex configurations and ddTMA's, the site will require a double External Duplex Bias (dEDB). The various build options using these units are detailed below.

Ericsson Product code	SAP Description	SAP Material No.
KRC131 187/1	**KRC131 187/1 EXT DUPLEX BIAS**	**1000944**



Ericsson dEDB

19.1.1 Cabin Fitout (RBS2202)

Where a cabin is to be deployed, the dEDB will be fitted by Ericsson as part of the cabin build. The dEDB units will be located on frames fitted over the BTS. Ericsson will rig the tails from the BTS to the dEDB and connect the 500mm starters from the dEDB ready for the ADC to connect the main feeders.



dEDB Support Frame in Large Cabin

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dEDB Fitted to support frame

19.1.2 Internal Room Fitout (RBS2202)

For internal rooms, the dEDB and standard tails will be supplied by Ericsson for installation by the ADC. It may not be possible to locate the dEDB units sufficiently close to the BTS to enable the standard BTS jumper tails to be used. In this case, the location of the dEDBs are to be agreed with the T-Mobile (UK) PM and Cell Planner and certified pre-made BTS jumpers of the required length are to be installed and connected between the dEDB and the BTS. The ADC ***MUST*** take any increased length of jumper into his loss calculations for main feeder sizing together with the dEDB (0.3dB).

19.1.3 Cabinets Fitout (RBS2102)

For sites where Ericsson ddTMAs are deployed in conjunction with RBS 2102 cabinets, the ddTMAs are supplied by Ericsson and are to be fitted externally to a frame located as close as practical to the BTS. The ADC is to construct the frame, fit the dEDBs and supply jumpers between the dEDB and BTS. However, if convenient, the dEDBs can be fixed to the cable tray. Certified pre-made BTS jumpers (Generally to be LCF78-50 type or equivalent) of the required length are to be installed and connected between the dEDB and the BTS. The ADC ***MUST*** take any increased length of jumper into his loss calculations for main feeder sizing together with the dEDB (0.3dB). Schematic details of the frame can be found on drawing TDP/14023978 in the Typical Details pack. For further guidance on the location and installation of the dEDB, details see SDM doc R3005

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20 Appendix L3 – Legacy Feeder Labeling

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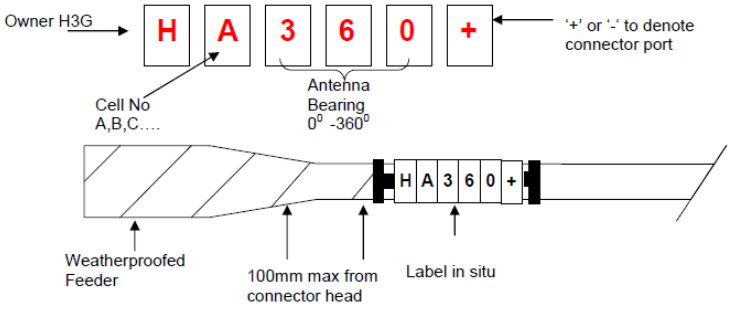
20.1 H3G Legacy Feeder Labeling

The following is to facilitate clear and accurate identification of Hutchison 3g feeders throughout their route on 3G only sites.

Generally antennas and their associated feeders are reference labelled from the left, as viewed from the ground, facing the site.

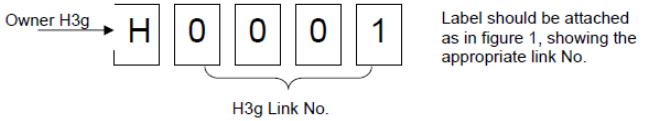
The label and cable ties supplier was Partex Ltd, Birmingham 01675 463670, Type: PK2 cable marking (width 11.3mm), PKH70 70mm holder & PKB cable tie.

Figure 1, Example Label – Sector.



(Feeder Identification Cont…)

Figure 2, Example Label – Microwave.



20.2 T-Mobile Legacy Feeder Labeling

20.2.1 GSM labelling convention – pre July 2006

Receive only labels shall be yellow, all others shall be red. i.e. a TX/RX is red.

(RED) **C1A1 TX/RX** **C2A1 RX** (YELLOW)

Main feeders were labelled in accordance with the Rigging Data Sheet provided by the T-Mobile (UK) Project Manager using the following conventions:

CxAy TX/RX, e.g. C1A1 TX/RX

Where 'x' is the sector number, i.e. 1, 2 or 3

and 'y' is the antenna number or 'Ant No' on the Rigging Data Sheet

and 'TX' is the function as taken from the Rigging Data Sheet

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Note that where TMA's (ALNA LPG on rigging datasheet) are deployed on Ericsson sites, the TMA combines the TX and RX into one feeder. Where a TX and RX are combined, the antenna jumper should be labelled CxAy_TX/RX.

20.2.2 UMTS labeling convention – pre July 2006

Receive only feeders shall be labelled in light green, all other feeders shall be labelled in dark blue.

i.e. a TX/RX is blue.

(BLUE) **uA1 TX/RX** **uB1 RX** (GREEN)

Main feeders were labelled in accordance with the Rigging Data Sheet provided by the T-Mobile (UK) Project Manager using the following conventions:

uxy TX/RX, e.g. uA1 TX/RX

where 'x' is the sector letter, i.e. A, B or C

and 'y' is the antenna number or 'Ant No' on the Rigging Data Sheet

and 'TX/RX' is the function as taken from the Rigging Data Sheet

20.2.3 4-port antenna labeling convention – pre July 2006

Where 4 port antennas are to be deployed (i.e. GSM + UMTS antennas in the same housing) the convention will be as follows:

When viewed from the front of the antenna, the GSM antenna with be on the left and the UMTS antenna will be on the right. The rigging of the antennas was carried out to this convention unless agreed with the T-Mobile (UK) PM.

20.2.4 GSM Labeling convention – post July 2006

ALL feeders shall be labelled as TX/RX regardless of what is stated on the RDS. **I.e. all GSM labels shall be RED**.

C1A1 TX/RX (RED)

Main feeders were labelled in accordance with the Rigging Data Sheet provided by the T-Mobile (UK) Project Manager using the following conventions:

CxAy_TX/RX, e.g. C1A1_TX/RX

Where 'x' is the sector number, i.e. 1, 2 or 3

and 'y' is the antenna number or 'Ant No' on the Rigging Data Sheet

Note that where TMA's (ALNA LPG on rigging datasheet) are deployed on Ericsson sites, the TMA combines the TX and RX into one feeder. Where a TX and RX are combined, the antenna jumper should be labelled CxAy_TX/RX.

20.2.5 UMTS labelling convention – post July 2006

ALL feeders shall be labelled as TX/RX regardless of what is stated on the RDS. **I.e. all labels for UMTS shall be BLUE**.

uA1 TX/RX (BLUE)

Main feeders were labelled in accordance with the Rigging Data Sheet provided by the T-Mobile (UK) Project Manager using the following conventions:

uxy_TX/RX, e.g. uA1_TX/RX

where 'x' is the sector letter, i.e. A, B or C

and 'y' is the antenna number or 'Ant No' on the Rigging Data Sheet

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20.2.6 4-port antenna labeling convention – post July 2006

Where 4 port antennas are to be deployed (i.e. GSM + UMTS antennas in the same housing) the convention will be as follows:

When viewed from the front of the antenna, the GSM antenna with be on the left and the UMTS antenna will be on the right. The rigging of the antennas shall be carried out to this convention unless agreed with the T-Mobile (UK) PM.

20.3 Orange UK Legacy Feeder Labeling

From *PROC9*

6 FEEDER IDENTIFICATION

6.1 Convention

This scheme is intended to cover all EE sites. For the inevitable small number of odd sites that cannot be fitted into this labelling convention it is suggested that the nearest practical approximation be used.

All site drawings will reflect the actual labelling scheme used. In the event of any conflict, the current issue of the site drawing will be taken as correct.

Without exception, whenever it is necessary to specify an antenna's orientation in degrees, this must be made in degrees east of grid north.

Currently only the prefixes A, B, C, E, F, and G will be used for antennas regardless of type of mounting structure or building. In the future other prefixes may have to be used.

Note "E" kits are being deployed at any bearing as defined by the planner not just at 30 degree bearing bit could be any additional sector.

Note all microwave dishes use D only.

6.2 2G Omni Site

Antenna Designation	Label
Transmit/Receive	A1
Diverse Receive	A2

Table 5 Omni or single sector labelling

6.3 2G 3 Sector Site

Antenna Designation	Bearing /°	Array 1 Label
Transmit/Receive	0 ETN	A1
Diverse Receive	0 ETN	A2
Transmit/Receive	120 ETN	B1
Diverse Receive	120 ETN	B2
Transmit/Receive	240 ETN	C1
Diverse Receive	240 ETN	C2

Table 6 3 Sector GSM labelling

- For vertical diversity, the upper antenna is designated A1, B1 or C1.
- For single or bi-sector sites, use the designations for the deployed sectors only.

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6.4 2G and 3G 3 Sector Site

Antenna Designation	Bearing /°	Array 1 Label	Technology
Transmit/Receive	0 ETN	A1	GSM
Diverse Receive	0 ETN	A2	GSM
Transmit/Receive	0 ETN	A3	WCDMA
Diverse Receive	0 ETN	A4	WCDMA
Transmit/Receive	120 ETN	B1	GSM
Diverse Receive	120 ETN	B2	GSM
Transmit/Receive	120 ETN	B3	WCDMA
Diverse Receive	120 ETN	B4	WCDMA
Transmit/Receive	240 ETN	C1	GSM
Diverse Receive	240 ETN	C2	GSM
Transmit/Receive	240 ETN	C3	WCDMA
Diverse Receive	240 ETN	C4	WCDMA

Table 7 3 Sector GSM + UMTS labelling

6.5 2G and 3G Six Sector Site

Antenna Designation	Bearing /°	Array 1 Label	Technology
Transmit/Receive	330 ETN	A1	GSM
Diverse Receive	330 ETN	A2	GSM
Transmit/Receive	330 ETN	A3	WCDMA
Diverse Receive	330 ETN	A4	WCDMA
Transmit/Receive	90 ETN	B1	GSM
Diverse Receive	90 ETN	B2	GSM
Transmit/Receive	90 ETN	B3	WCDMA
Diverse Receive	90 ETN	B4	WCDMA
Transmit/Receive	210 ETN	C1	GSM
Diverse Receive	210 ETN	C2	GSM
Transmit/Receive	210 ETN	C3	WCDMA
Diverse Receive	210 ETN	C4	WCDMA
Transmit/Receive	30 ETN	E1	GSM
Diverse Receive	30 ETN	E2	GSM
Transmit/Receive	30 ETN	E3	WCDMA
Diverse Receive	30 ETN	E4	WCDMA
Transmit/Receive	150 ETN	F1	GSM
Diverse Receive	150 ETN	F2	GSM
Transmit/Receive	150 ETN	F3	WCDMA
Diverse Receive	150 ETN	F4	WCDMA
Transmit/Receive	270 ETN	G1	GSM
Diverse Receive	270 ETN	G2	GSM
Transmit/Receive	270 ETN	G3	WCDMA
Diverse Receive	270 ETN	G4	WCDMA

Table 8 6 Sector GSM + UMTS labelling

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21 Appendix L4 – Legacy T-Mobile Grounding

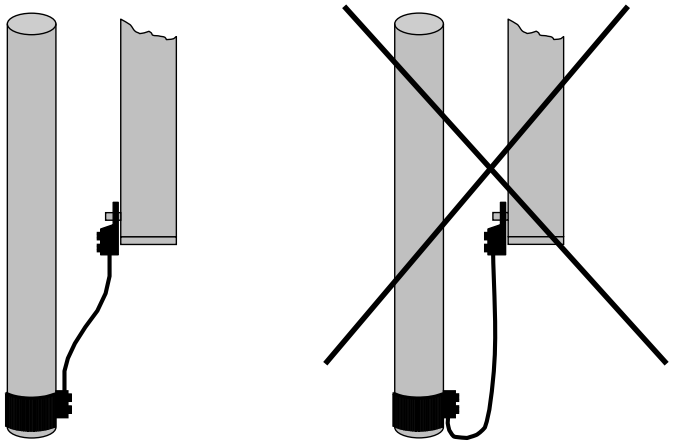
Legacy document extract and some references may be out of date

21.1 Bonding of antennas, TMA's and transmission dishes

The two approved methods for earth bonding of antennas, TMA's and transmission dishes are detailed below. For UMTS sites, each Nokia TMA must be to earth bonded back to the lightning system using a dedicated green/yellow earth cable fixed between the earth studs located in the base of the units and taken onto a good earthing connection.

It should be noted that Kathrein, Powerwave and Cellmax antennas used in the T-Mobile (UK) GSM and UMTS networks do not require to be earthed. Support steelwork however should be earthed in accordance with the requirements of the Mechanical and Electrical section of the SDM.

Earthing cables should not change direction and should follow smooth curves as shown in the sketch below.



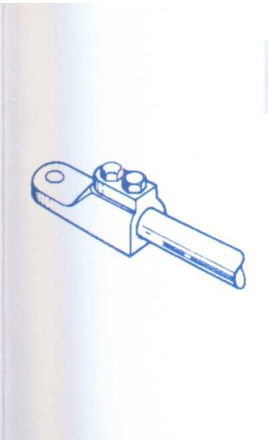
CORRECT WRONG

21.1.1 Earth Bond Type 1 – Bare Solid Circular Conductor

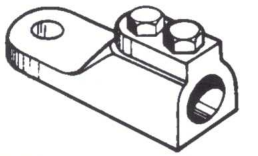
The following bond type shall be used for the bonding of antennas (where earth studs are provided), TMA's and transmission dishes. Where a lightning protection finial is provided with the antenna and also with the antenna support pole, the antenna finial shall be removed where the top of the antenna is below the top of the finial fixed to the antenna pole. The antenna shall still be bonded where an earthing point is provided.

By means of a 'Screw Type Cable Socket' (as Furse Type SX450 Aluminium) bond an 8mm diameter bare aluminium conductor (as Furse CD080) to the earthing stud provided on the antenna, TMA or dish unit (where provided), then route bare solid aluminium conductor to antenna mounting pole and terminate at a 'Pipe Bond' (as Furse BN176 aluminium) to be clamped securely around the antenna mounting pole. (Clean pole for good electrical contact and apply Furse conductive compound).

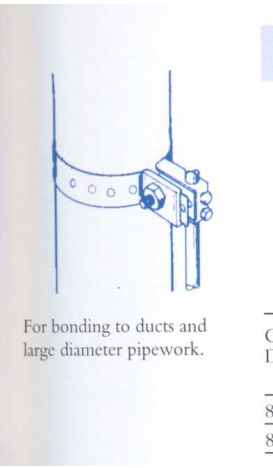
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STRAIGHT SETSCREW TYPE CABLE SOCKET

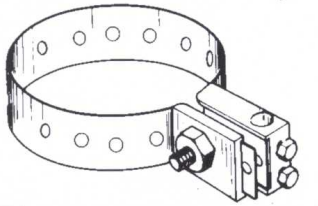


Conductor Dia.mm	Palm Hole Dia.mm	Conductor Material	Wgt. (kg) each	Cat. no.
8	12	Copper	0.11	SX450
8	12	Aluminium	0.05	SX455



For bonding to ducts and large diameter pipework.

PIPE BOND



Conductor Dia. mm	Pipe Dia. mm	Conductor Material	Wgt. (kg) each	Cat. no.
8	50-200	Copper	0.46	BN175
8	50-200	Aluminium	0.25	BN176

21.1.2 Earth Bond Type 2 – 25mm2 Stranded Copper Cable with Green/Yellow PVC Insulation

Connect 25mm^2 stranded copper cable with green/yellow PVC insulation to antenna, TMA or transmission dish by means of 25mm^2 compression terminal (as Furse FCT50,12) and secure to pipe bond (as Furse BN175 copper) as per manufacturers recommended instructions. Any cable lengths over 500mm shall be secured to nearby steelwork.

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