

MR-TR-2.5-D15xx/MR-TR-2.5-C1xxx

**Multi Rate Transponder and Converter
for
Dense Wavelength Division Multiplexing
and
Coarse Wavelength Division Multiplexing**

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Revision history

Current revision of this document is the uppermost in the table below.

Revision	Replaces	Date	Change description
3	2	2007-10-26	New front page and removed old logo.
2	1	2007-09-07	Added Materials Declaration and EFUP; updated EC Declaration of Conformity.
1	0	16/06/05	Added CWDM information.
0	C	19/05/05	First final version.
C	B	13/05/05	Minor changes.
B	A	10/05/05	Updated preliminary version. Minor changes in specification, table for bit rate inserted.
A	-	03/05/05	Preliminary version.

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1 Product overview

The **flashlink** MR-TR-2.5G-D15xx is a multi bit-rate converter and transponder module providing high performance media conversion for various signal formats from 19.4Mbps up to 2488Mbps. The unit can be configured as an Electrical to Optical or an Optical to Electrical converter, or as an Optical to Optical Transponder. This state of the art unit offers a high sensitivity PIN diode and narrowband ultrastabilised DWDM laser technology. Unmatched signal accuracy, even in critical applications with pathological signal patterns makes the MR-TR-2.5G-D15xx the first choice for all optical transport demands.

The **flashlink** DWDM system uses only wavelengths in accordance with the ITU-T G.692 recommendation. If the module is to be used together with existing third party DWDM systems the exact wavelength needs to be specified. MR-TR-2.5G-C1xxx also supports CWDM wavelengths according to ITU-T G.694 from $1470\pm 6\text{nm}$ up to $1610\pm 6\text{nm}$.

The MR-TR-2.5G-D15xx can transport all HD and SD signal formats in addition to DVB-ASI and SMPTE 310. It can perform optical refreshing, reclocking and wavelength swapping for a DWDM wavelength for SDH/SONET and Gigabit Ethernet in addition to all the broadcast signal formats.

The input sensitivity is typically better than -20dBm . This will allow for a range of 50km, using high quality Single Mode fiber at 2488Mbps, for a 16 channel DWDM system.

The optical output comes with a sophisticated 1550nm DFB DWDM laser covering the demands of short, medium and long haul applications. MR-TR-2.5G-C1xxx come with DFB lasers from $1470\pm 6\text{nm}$ up to $1610\pm 6\text{nm}$. The open system platform of Network Electronics DWDM multiplexing technology allows easy interoperability with third party fiber optical systems.

The electrical input is equipped with a multi rate cable equaliser providing an equalisation of typically 100m of high quality coax cable at 1485Mbps. A distribution amplifier with 2 outputs reduces the need for additional DA's (for DVB-ASI only one can be used).

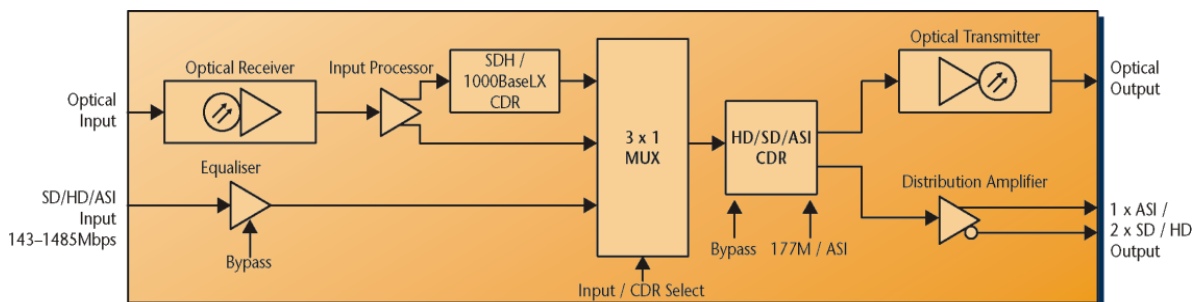


Figure 1: MR-TR-2.5G Multi Rate Transponder for DWDM / CWDM.

1.1 Product versions

MR-TR-2.5G-D15xx is available in the following versions:

Part No.	Wavelength	Part No.	Wavelength
MR-TR-2.5G-D1549.32	1549.32nm laser	MR-TR-2.5G-D1550.92	1550.92nm laser
MR-TR-2.5G-D1552.52	1552.52nm laser	MR-TR-2.5G-D1554.13	1554.13nm laser
MR-TR-2.5G-D1555.75	1555.75nm laser	MR-TR-2.5G-D1557.36	1557.36nm laser
MR-TR-2.5G-D1558.98	1558.98nm laser	MR-TR-2.5G-D1560.61	1560.61nm laser
MR-TR-2.5G-D1530.33	1530.33nm laser	MR-TR-2.5G-D1531.90	1531.90nm laser
MR-TR-2.5G-D1533.47	1533.47nm laser	MR-TR-2.5G-D1535.04	1535.04nm laser
MR-TR-2.5G-D1536.61	1536.61nm laser	MR-TR-2.5G-D1538.19	1538.19nm laser
MR-TR-2.5G-D1539.77	1539.77nm laser	MR-TR-2.5G-D1541.35	1541.35nm laser

Optionally all wavelengths in the ITU-T G.692 recommendation are available on request.

MR-TR-2.5G-C1xxx is available in the following versions:

Part No.	Wavelength	Part No.	Wavelength
MR-TR-2.5G-C1470	1470± 6nm 0dBm DFB laser	MR-TR-2.5G-C1550	1550± 6nm 0dBm DFB laser
MR-TR-2.5G-C1490	1490± 6nm 0dBm DFB laser	MR-TR-2.5G-C1570	1570± 6nm 0dBm DFB laser
MR-TR-2.5G-C1510	1510± 6nm 0dBm DFB laser	MR-TR-2.5G-C1590	1590± 6nm 0dBm DFB laser
MR-TR-2.5G-C1530	1530± 6nm 0dBm DFB laser	MR-TR-2.5G-C1610	1610± 6nm 0dBm DFB laser

2 Specifications

2.1 Optical input

Data rate optical:	19.4 – 2488 Mbps.
Sensitivity:	
- HD-SDI (1485 Mbps):	Better than -20dBm,
- SDI (270 Mbps):	Better than -20dBm,
- SDH / SONET (2488 Mbps):	Better than -20dBm,
- 1000BaseLX (1250Mbps):	Better than -20dBm.
Detector overload threshold:	Min. -6dBm.
Detector damage threshold:	>+1dBm.
Optical wavelength:	2 nd & 3 rd opt. window, 1310nm and 1550nm.
Transmission circuit fiber:	Single Mode.
Connector return loss:	>40dB w/ SM fiber.
Connector:	SC/UPC.

2.2 Optical output

Transmission circuit fiber:	Single Mode.
Light source:	DFB laser.
Optical power:	0 dBm.
Optical centre wavelength:	- According to ITU-T G.692 for DWDM wavelengths, - According to ITU-T G.694 for CWDM wavelengths.
Max. wavelength drift:	- $\pm 0.16\text{nm}$ for DWDM versions, - $\pm 6\text{nm}$ for CWDM versions.
Temperature range:	0 - +40 degC.
Jitter (UI = Unit Interval):	- Max. 0.135UI @ 270Mbps, - Max. 0.2UI @ 1485Mbps.
Connector return loss:	>40dB w/ SM fiber.
Max. reflected power:	4%.
Connector:	SC/UPC.

2.3 Electrical

Power:	+5V DC / 10W Max, 5W Typically.
Control:	Control system for access to setup and module status with BITE (Built-In Test Equipment).

2.4 Electrical input

Data rate NRZ:	19.4 – 1485 Mbps.
Equalisation:	Automatic, Cable equaliser and reclocker can be bypassed to support bitrates down to 2Mbps.
Impedance:	75 ohm.
Return loss:	>15dB @ 1485MHz.

Signal level: Nom. 800mV.
Connector: BNC.

2.5 Electrical output

Number of outputs: 2.
Connector: BNC.
Impedance: 75 ohm.
Return loss: >15dB @ 1485MHz.
Jitter (UI = Unit Interval): Max. 0.2UI.
Peak to peak signal level: 0.8V $\pm$ 0.1V.
Signal polarity:

- 1 non-inverting,
- 1 inverting.

2.6 Standards

Supported standards for electrical and optical ports:

SMPTE: SMPTE 292, SMPTE 259M, SMPTE 297, SMPTE 305,
SMPTE 310.
DVB-ASI: EN50083-9.

Additional supported standards for the optical ports, only optical transponder configuration:

SDH / SONET: STM1 / OC3,
STM4 / OC12,
STM16 / OC48.
Gigabit Ethernet: IEEE 802.3
1000BaseLX for SM fiber.

3 Configuration

3.1 Format configuration

The MR-TR-2.5G can support a number of different formats. The correct configuration can either be set with a DIP switch or with the GYDA Control System. The layout of MR-TR-2.5G is shown in the drawing below with the DIP switch to the upper left position.

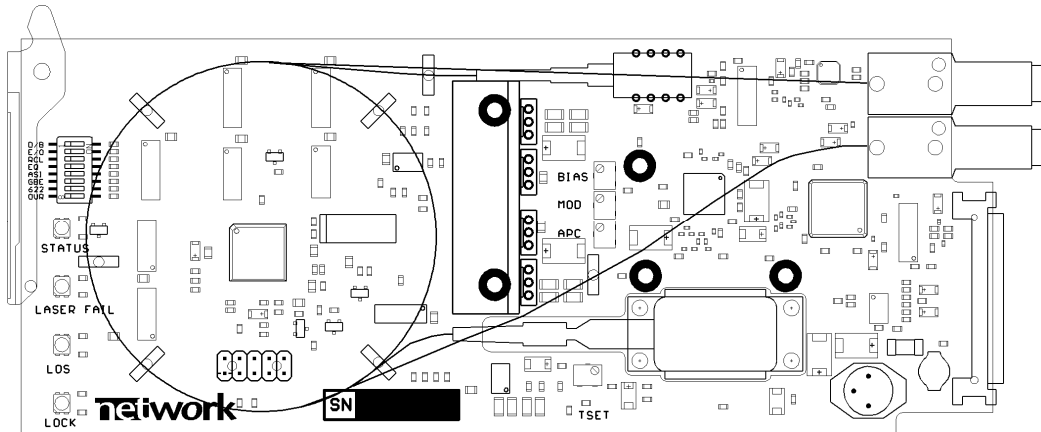


Figure 2: MR-TR-2.5G-D15xx board layout.

DIP switch configuration must be set according to the table below:

Switch #	Label	Function, DIP = ON	Function, DIP = OFF	Comment
1	D/B	Broadcast format support	Datacom format support	Format mode
2	E/O	Optical input selected	Electrical input selected	Transponder mode
3	RCL	Reclocker ON	Reclocker Bypass	Reclocker mode
4	EQ	Cable equaliser ON	Cable equaliser Bypass	Equaliser mode
5	ASI	DVB-ASI Reclocker support	SDI 177Mbps Reclocker support	Only when Broadcast format support selected
6	GBE	2488 Mbps or Gigabit Ethernet Reclocking	155 or 622 Mbps Reclocking	Only when Datacom format support selected
7	622	622 Mbps or Gigabit Ethernet Reclocking	155 Mbps or 2488 Mbps Reclocking	Only when Datacom format support selected
8	OVR	Override GYDA control Config. with DIP switch	GYDA control Config. with GYDA	Select configuration from GYDA

Bit Rate	GBE (BR1)	622 (BR2)
155Mbps	Off	Off
622Mbps	Off	On
2488Mbps	On	Off
Gigabit Ethernet	On	On

All DIP switches are off when pointing towards the release handle.

When a “Broadcast format support” is selected, all clock rates for HD-SDI, SDI and DVB-ASI are automatically configured by the module itself.

3.2 Configuration examples

Typical configurations for MR-TR-2.5G:

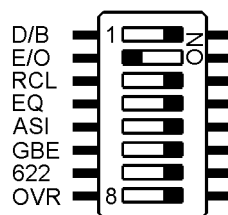


Figure 3: HD-SDI, SDI, DVB-ASI Electrical to Optical Converter.

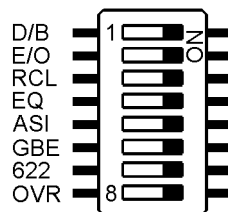


Figure 4: HD-SDI, SDI, DVB-ASI Optical to Electrical Converter and Optical to Optical transponder.

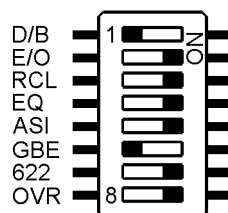


Figure 5: SDH/SONET - STM-4/OC-12 Optical to Optical Transponder.

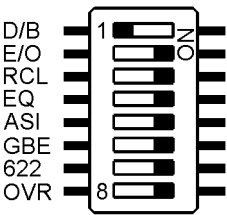


Figure 6: Gigabit Ethernet - 1000BaseLX Optical to Optical Transponder.

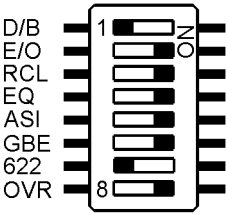


Figure 7: 2488Mbps STM-16 / OC-48 Optical to Optical Transponder.

4 Connector module

The MR-TR-2.5G-D15xx has a dedicated connector module: MR-TR-C1. This module is mounted at the rear of the sub-rack. The module is shown in the figure below.

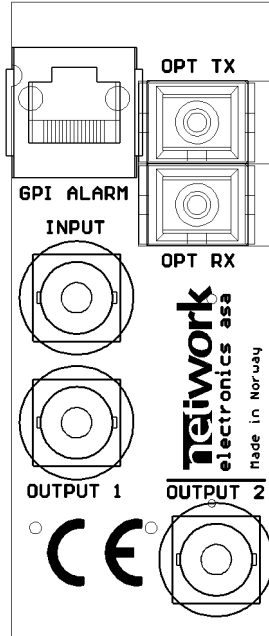


Figure 8: Connector module for MR-TR-2.5G.

In typical use a MR-TR-2.5G / MR-TR-2.5G-D15xx module at each end will be used. The electrical input signal is connected to the INPUT BNC on the transmitting MR-TR-2.5G, and the electrical output is connected to the OUTPUT 1 or OUTPUT 2 BNC on the receiving MR-TR-2.5G. Please note that OUTPUT 2 has an inverted signal, so formats like DVB-ASI can not be used on this output.

4.1 Mounting the connector module

The details of how the connector module is mounted, is found in the user manual for the sub-rack frame FR-2RU-10-2.

This manual is also available from our web site:

<http://www.network-electronics.com/>.

4.2 Terminal format support

The different input and output ports on MR-TR-2.5G can support a number of formats. The table below shows which signal formats are supported on the selected terminals.

Terminal format support:

Terminal	Function	Supported Format	Mode
INPUT	Electrical input	HD-SDI, SDI, DVB-ASI, SMPTE310, Transparent ¹	Input
OPT RX	Optical Input (Receiver)	HD-SDI, SDI, DVB-ASI, SMPTE310, STM-1 opt., STM-4, OC-3 opt., OC-12, STM-16, OC-48, Transparent ¹	Input
OUTPUT 1	Electrical Output – Non inverted	HD-SDI, SDI, DVB-ASI, SMPTE310, Transparent ¹	Output
OUTPUT 2	Electrical Output – Inverted	HD-SDI, SDI, Transparent ¹	Output
OPT TX	Optical Output (Transmitter)	HD-SDI, SDI, DVB-ASI, SMPTE310, STM-1 opt., STM-4, OC-3 opt., OC-12, STM-16, OC-48, Transparent ¹	Output
GPI ALARM	Open Collector Alarms	Wired alarms	OC Output

¹ MR-TR-2.5G has a “Transparent mode”. In this mode all reclockers and CDR’s are switched off and no jitter attenuation will be performed. This mode may be used for non-standard or unsupported bit rates over shorter distances and up to 1 Gbps.

5 Module status

The status of the module can be monitored in three ways.

1. GYDA System Controller (optional).
2. GPI at the rear of the sub-rack.
3. LED's at the front of the sub-rack.

Of these three, the GPI and the LED's are mounted on the module itself, whereas the GYDA System Controller is a separate module giving detailed information on the card status. The functions of the GPI and the LED's are described in sections 5.1 and 5.2. The GYDA controller is described in a separate user manual.

5.1 GPI Alarm – Module status outputs

These outputs can be used for wiring up alarms for third party control systems. The GPI outputs are open collector outputs, sinking to ground when an alarm is triggered. The GPI connector is shown in figure below.

MR-TR-2.5G module GPI pinning:

Signal	Name	Pin #	Mode
Status	General error status for the module	Pin 1	Open Collector
Laser Fail	Laser Fail Alarm	Pin 2	Open Collector
LOS	Los Of Signal	Pin 3	Open Collector
LOCK	Reclocker in Lock	Pin 4	Open Collector
Ground	0 volt pin	Pin 8	0V.

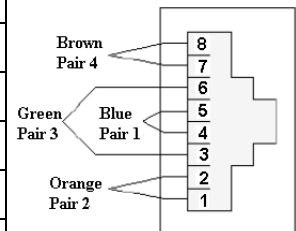


Figure 9: GPI output.

Electrical Maximums for GPI outputs

Max current: 100mA

Max voltage: 30V

5.2 Front panel – Status monitoring

The status of the module can be easily monitored visually by the LED's at the front of the module. The LED's are visible through the front panel as shown in the figure below.

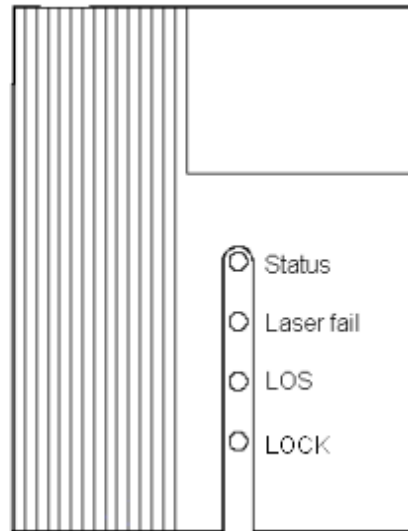


Figure 10: Front panel indicators for the MR-TR-2.5G.

The MR-TR-2.5G has 4 LED's each showing a status corresponding to the GPI pinning.

Diode \ State	Red LED	Green LED	No light
Status	Module is faulty	Module is OK Module power is OK	Module has no power
Laser fail	Laser is malfunctioning and the APC cannot keep the output power within range.	Laser is OK	
LOS	Loss of signal No optical input signal.	Optical input signal Present	
LOCK	Re-clocker is out of lock	Re-clocker is in lock on a supported signal format	

6 Laser safety precautions

Guidelines to limit hazards from laser exposure.

All the available EO units in the flashlink® range include a laser. Therefore this note on laser safety should be read thoroughly. The lasers emit light at 1310 nm or 1550 nm. This means that the human eye cannot see the beam, and the blink reflex cannot protect the eye. (The human eye can see light between 400 nm to 700 nm).

A laser beam can be harmful to the human eye (depending on laser power and exposure time), therefore:

Note!

BE CAREFUL WHEN CONNECTING / DISCONNECTING FIBER PIGTAILS (ENDS).

NEVER LOOK DIRECTLY INTO THE PIGTAIL OF THE LASER/FIBER.

NEVER USE MICROSCOPES, MAGNIFYING GLASSES OR EYE LOUPES TO LOOK INTO A FIBER END.

USE LASER SAFETY GOGGLES BLOCKING LIGHT AT 1310 nm AND AT 1550 nm.

Instruments exist to verify light output power: Power meters, IR-cards etc.

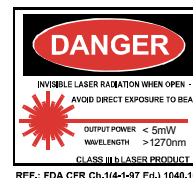
Flashlink® features:

All the laser module cards in the flashlink® product range, are Class 1 laser products according to IEC 825-1 1993, and class I according to 21 CFR 1040.10 when used in normal operation.

More details can be found in the user manual for the FR-2RU-10-2 frame.

Maximum output power²: 5 mW.

Operating wavelengths: > 1270 nm.



² Max power is for safety analysis only and does not represent device performance.

General environmental requirements for flashlink[®] equipment

1. The equipment will meet the guaranteed performance specification under the following environmental conditions:
 - Operating room temperature range: 0° C to 40° C
 - Operating relative humidity range: < 90% (non-condensing)

2. The equipment will operate without damage under the following environmental conditions:
 - Temperature range: -10° C to 55° C
 - Relative humidity range: < 95% (non-condensing)

Product Warranty

The warranty terms and conditions for the product(s) covered by this manual follow the General Sales Conditions by Network Electronics ASA. These conditions are available on the company web site of Network Electronics ASA:

www.network-electronics.com

Materials declaration and recycling information

Materials declaration

For product sold into China after 1st March 2007, we comply with the “Administrative Measure on the Control of Pollution by Electronic Information Products”. In the first stage of this legislation, content of six hazardous materials has to be declared. The table below shows the required information.

組成名稱 Part Name	Toxic or hazardous substances and elements					
	鉛 Lead (Pb)	汞 Mercury (Hg)	鎘 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr(VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
MR-TR-2.5G-D15xx	X	O	O	O	O	O
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.						

Environmentally-friendly use period

The manual must include a statement of the “environmentally friendly use period”.

This is defined as the period of normal use before any hazardous material is released to the environment. The guidance on how the EFUP is to be calculated is not finalised at the time of writing. See

<http://www.aeanet.org/GovernmentAffairs/qfLeOpAaZXaMxqGjSFbEidSdPNtpT.pdf>

for an unofficial translation of the draft guidance. For our own products, Network Electronics has chosen to use the *50 year figure* recommended in this draft regulation. Network Electronics suggests the following statement on An “Environmentally Friendly Use Period” (EFUP) setting out normal use:

EFUP is the time the product can be used in normal service life without leaking the hazardous materials. We expect the normal use environment to be in an equipment room at controlled temperature range (0°C - 40°C) with moderate humidity (< 90%, non-condensing) and clean air, not subject to vibration or shock.

Further, a statement on any hazardous material content, for instance, for a product that uses some tin/lead solders:

Where a product contains potentially hazardous materials, this is indicated on the product by the appropriate symbol containing the EFUP. The hazardous material content is limited to lead (Pb) in some solders. This is extremely stable in normal use and the EFUP is taken as 50 years, by comparison with the EFUP given for Digital Exchange/Switching Platform in equipment in Appendix A of “General Rule of Environment-Friendly Use Period of Electronic Information Products”. This is indicated by the product marking:



It is assumed that while the product is in normal use, any batteries associated with real-time clocks or battery-backed RAM will be replaced at the regular intervals.

The EFUP relates only to the environmental impact of the product in normal use, it does not imply that the product will continue to be supported for 50 years.

Recycling information

Network Electronics provides assistance to customers and recyclers through our web site <http://www.network-electronics.com>. Please contact Network Electronics' Customer Support for assistance with recycling if this site does not show the information you require.

Where it is not possible to return the product to Network Electronics or its agents for recycling, the following general information may be of assistance:

- Before attempting disassembly, ensure the product is completely disconnected from power and signal connections.

- All major parts are marked or labelled to show their material content.

- Depending on the date of manufacture, this product may contain lead in solder.

Some circuit boards may contain battery-backed memory devices.

EC Declaration of Conformity

network

MANUFACTURER	Network Electronics ASA P.B. 1020, N-3204 SANDEFJORD, Norway	
AUTHORISED REPRESENTATIVE (Established within the EEA)	Not applicable	
MODEL NUMBER(S)	MR-TR-2.5G-D15xx	
DESCRIPTION	Multi Rate Transponder and Converter for Dense Wavelength Division Multiplexing and Coarse Wavelength Division Multiplexing	
DIRECTIVES this equipment complies with	LVD 73/23/EEC EMC 89/336/EEC	
HARMONISED STANDARDS applied in order to verify compliance with Directive(s)	EN 55103-1:1996 EN 55103-2:1996 EN 60950-1:2006	
TEST REPORTS ISSUED BY	Notified/Competent Body	Report no:
	Nemko	10689
TECHNICAL CONSTRUCTION FILE NO	Not applicable	
YEAR WHICH THE CE-MARK WAS AFFIXED	2004	
TEST AUTHORIZED SIGNATORY		
MANUFACTURER	AUTHORISED REPRESENTATIVE (Established within EEA)	Date of Issue
	Not applicable	2007-09-07
		Place of Issue
		Sandefjord, Norway

Name	Thomas Øhrbom
Position	Quality Manager (authorised signature)