ZD128F-E/00/en/03.08
CCS/FM6.0
FM/E 16.11.07

71072438

FM Control Drawing
960402-1070 E

Micropilot M
FMR230/231/232/233/240/244/245
FISCO-Model
PROFIBUS PA, FOUNDATION Fieldbus

Endress+Hauser
People for Process Automation

FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (Ui or Vmax), the current (Ii or Imax) and the power (Pi or Pmax) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (Uo or Voc or Vt), the current (Io or Isc or It) and the power (Po or Pmax) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and inductance (Li) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.
In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The voltage Uo (or Voc or Vt) of the associated apparatus has to be limited to the range of 14 V to 24 V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R:	15...150 Ω/km
inductance per unit length L:	0.4...1 mH/km
capacitance per unit length C:	80...200 nF/km

C = C line/line + 0.5 C line/screen, if both lines are floating or
C = C line/line + C line/screen, if the screen is connected to one line

length of spur cable:	≤ 30 m
length of trunk cable:	≤ 1 km
length of splice:	≤ 1 m.

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:
R = 90...100 Ω
C = 0...2.2 µF.
One of the allowed terminations might already be integrated in the associated apparatus.
The number of passive devices connected to the bus segment is not limited due to I.S. reasons.
If the above rules are respected, up to a total lenght of 1000 m (sum of the length of trunk cable and all spur cables), the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Intrinsically safe installation

Intrinsically safe (entity), Class I, Div. 1, Groups A, B, C, D, Hazardous Location Installation.

1. FM approved apparatus must be installed in accordance with manufacturer instructions.
2. FM approved associated apparatus must meet the following requirements:
   Uo or Voc or Vt ≤ Ui (Vmax) **and** Io or Isc or It ≤ Ii (Imax) **and** Po or Pmax ≤ Pi (Pmax).
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the National Electrical Code NFPA 70 and ANSI/ISA RP 12.06.01 (except chapter 5).
5. Multiple earthing of screen is allowed only, if high integrity equipotential system is realised between the points of bonding (see drawing No. 960373-1022 A).
6. Caution: Use only supply wires suitable for 5 K above surrounding temperature.
7. Warning: Substitution of components may impair intrinsic safety.
8. The polarity for connecting + (2) and – (1) is of no importance due to an internal rectifier.
9. In case of use of PTFE rod antenna (white), planar, parabolic, enamelled horn, type 244 or type 245 avoid electrostatic charge at the antenna; (e.g. do not rub with dry cloth; do not install within the filling curtain).
10. Apparatus with faucet: In case of disconnection of Micropilot M from the faucet (e.g. for maintenance) we recommend to secure resp. to close the faucet e.g. with an additional blind flange. The responsibility for applicability of the arrangement behooves exclusive the operator.

Division 2 and Zone 2 installation

Nonincendive, Class I, Div. 2, Groups A, B, C, D, Hazardous Location Installation.

1. Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510.
   Intrinsic safety barrier not required. Max. supply voltage 33 V. For T-code see table.
2. Nonincendive field wiring installation.
   The Nonincendive Field Wiring Circuit Concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus or associated apparatus not specifically examined in combination as a system using any of the wiring methods permitted for unclassified locations, when Vmax ≥ Voc or Vt, Ca ≥ Ci + Ccable, La ≥ Li + Lcable.
   Transmitter non incendive field wiring parameters for these current controlled circuit are as follows:
   Vmax = 33 V; Ci ≤ 5 nF; Li ≤ 10 µH; Imax = see note 3.
3. For these current controlled circuit, the parameter Imax is not required and need not to be aligned with parameter Isc and It of the associated nonincendive field wiring apparatus or associated apparatus.
4. Warning: Explosion Hazard - do not disconnect equipment unless power has been switched off or the area is known to be Non-Hazardous.
   Warning: Substitution of components may impair suitability for Class I, Division 2.

Class II, III installation

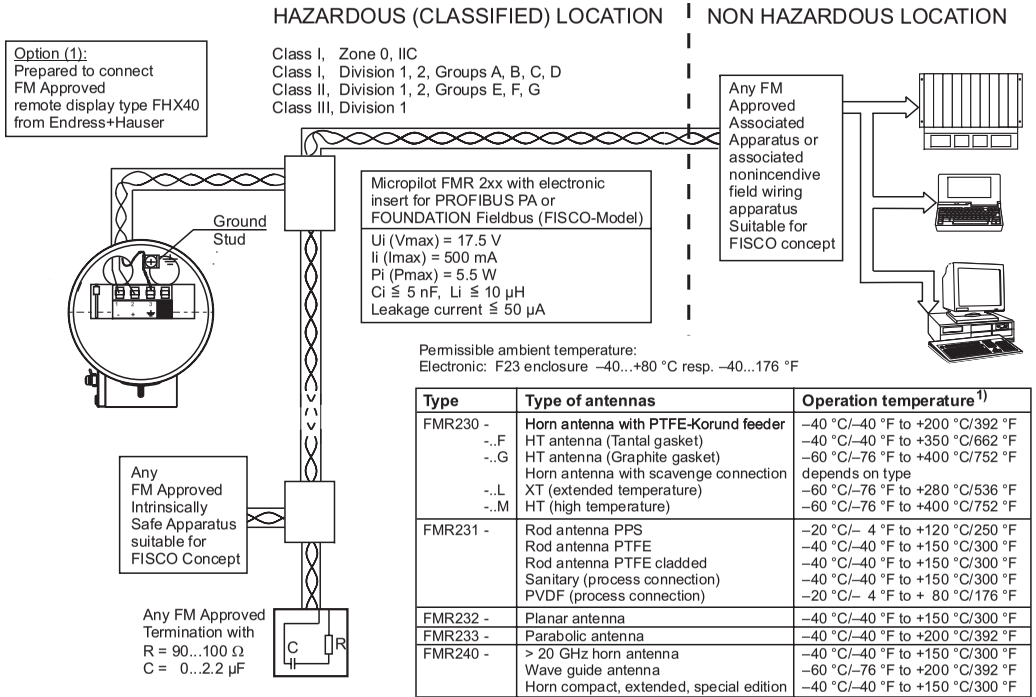
DIP for Class II and III, Div. 1, Groups E, F, G, Hazardous Location Installation.

1. Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510.
2. Use a dust tight seal at the conduit entry.

For Installaion acc. -ENTITY- Concept see Control dwg. part 960402-1071

Functional ratings:
These ratings do not supersede Hazardous Locations values Unom ≤ 33 V, Inom = 15 mA.

Area of application:
The compact instruments are suitable for use in areas subject to explosion caused by gases, vapours or mists.



Permissible ambient temperature:
Electronic: F23 enclosure –40...+80 °C resp. –40...176 °F

Type	Type of antennas	Operation temperature[1)]
FMR230 -	**Horn antenna with PTFE-Korund feeder**	–40 °C/–40 °F to +200 °C/392 °F
-..F	HT antenna (Tantal gasket)	–40 °C/–40 °F to +350 °C/662 °F
-..G	HT antenna (Graphite gasket)	–60 °C/–76 °F to +400 °C/752 °F
	Horn antenna with scavenge connection	depends on type
-..L	XT (extended temperature)	–60 °C/–76 °F to +280 °C/536 °F
-..M	HT (high temperature)	–60 °C/–76 °F to +400 °C/752 °F
FMR231 -	Rod antenna PPS	–20 °C/– 4 °F to +120 °C/250 °F
	Rod antenna PTFE	–40 °C/–40 °F to +150 °C/300 °F
	Rod antenna PTFE cladded	–40 °C/–40 °F to +150 °C/300 °F
	Sanitary (process connection)	–40 °C/–40 °F to +150 °C/300 °F
	PVDF (process connection)	–20 °C/– 4 °F to + 80 °C/176 °F
FMR232 -	Planar antenna	–40 °C/–40 °F to +150 °C/300 °F
FMR233 -	Parabolic antenna	–40 °C/–40 °F to +200 °C/392 °F
FMR240 -	> 20 GHz horn antenna	–40 °C/–40 °F to +150 °C/300 °F
	Wave guide antenna	–60 °C/–76 °F to +200 °C/392 °F
	Horn compact, extended, special edition	–40 °C/–40 °F to +150 °C/300 °F
FMR244 -	Compact antenna (PTFE capsuled)	–40 °C/–40 °F to +130 °C/266 °F
	80 mm/3", PP cladded (type 4)	–40 °C/–40 °F to + 80 °C/176 °F
FMR245 -	Compact antenna (types 3, 4)	–40 °C/–40 °F to +150 °C/302 °F
	DN50 + DN80 (types B, C, F, G)	–40 °C/–40 °F to +200 °C/392 °F

[1)] Note: take care to specific temperature ranges of antenna versions

Temperature class with/without display VU331	Permissible max. medium temperature at the antenna process connection (Tmed)	Permissible max. ambient temperature of the electronic compartment (Ta) (enclosure F23)										
		FMR230 - ..E/V/K/D/H	**FMR230 - ..L**	**FMR230 - ..M**	**FMR230 - ..F/G**	**FMR231**	**FMR232**	**FMR233**	**FMR240**	**FMR240 Wave Guide**	**FMR244**	**FMR245**
T6	+ 80 °C + 60 °C	+50/45 °C +60/55 °C	+55/50 °C +60/55 °C	+55/50 °C +60/55 °C	+55/50 °C +60/55 °C	+50/45 °C +60/55 °C	+50/45 °C +60/55 °C	+50/45 °C +60/55 °C	+55/50 °C +60/55 °C	+60/55 °C +60/55 °C	+55/50 °C +60/55 °C	+55/50 °C +60/55 °C
T5	+ 95 °C + 75 °C	+65/60 °C +75/70 °C	+70/65 °C +75/70 °C	+70/65 °C +75/70 °C	+70/65 °C +75/70 °C	+65/60 °C +75/70 °C	+65/60 °C +75/70 °C	+65/60 °C +75/70 °C	+70/65 °C +75/70 °C	+75/70 °C +75/70 °C	+70/65 °C +75/70 °C	+70/65 °C +75/70 °C
T4	+130 °C + 80 °C	+65 °C +80 °C	+75 °C +80 °C	+75 °C +80 °C	+70 °C +80 °C	+55 °C +80 °C	+65 °C +80 °C	+60 °C +80 °C	+60 °C +80 °C	+70 °C +80 °C	+65 °C +80 °C	+65 °C +80 °C
T3C (functional)	+150 °C + 80 °C	+60 °C +80 °C	+65 °C +80 °C	+70 °C +80 °C	+65 °C +80 °C	+45 °C +80 °C	+60 °C +80 °C	+45 °C +80 °C	+55 °C +80 °C	+65 °C +80 °C	not allowed	+60 °C +80 °C
T3	+195 °C + 80 °C	+45 °C +80 °C	+65 °C +80 °C	+70 °C +80 °C	+65 °C +80 °C	not allowed	not allowed	+40 °C +80 °C	not allowed	+65 °C +80 °C	not allowed	+55 °C +80 °C
T2B (functional)	+250 °C + 80 °C	+30 °C +80 °C	+60 °C +80 °C	+65 °C +80 °C	+55 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T2 (functional)	+280 °C + 80 °C	not allowed	+60 °C +80 °C	+65 °C +80 °C	+55 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T2	+290 °C + 80 °C	not allowed	not allowed	+65 °C +80 °C	+55 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T1 (functional)	+350 °C + 80 °C	not allowed	not allowed	+60 °C +80 °C	+45 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T1 (functional)	+400 °C + 80 °C	not allowed	not allowed	+60 °C +80 °C	+45 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed

Note: the applicable temperature of antenna must be within their specified limits; Tx (functional) means limited through type of antenna;
T6 and T5 requires for FF electronic enlarged derating: for ambient; 1st number = PA electronic insert; 2nd number = FF electronic insert
e.g. +60/55 °C expression means: Apparatus with PA electronic insert max. ambient at housing = +60 °C;
Apparatus with FF electronic insert max. ambient at housing = +55 °C

ZD128F-E/00/en/03.08
CCS/FM6.0
FM/E 16.11.07

FM Control Drawing
960402-1071 E

Micropilot M
FMR230/231/232/233/240/244/245
ENTITY-Model
PROFIBUS PA, FOUNDATION Fieldbus

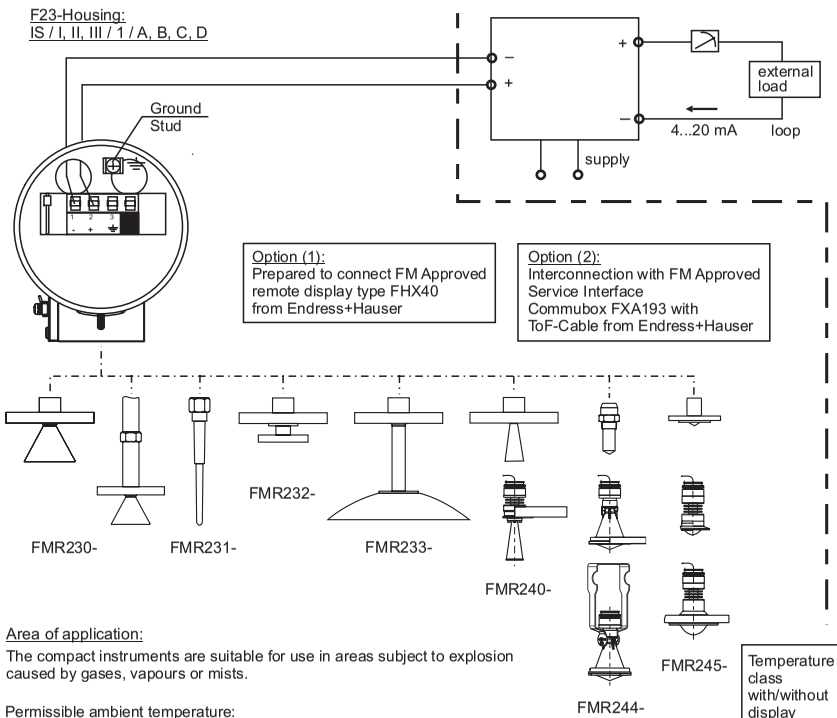
Endress+Hauser
People for Process Automation

HAZARDOUS LOCATION

Class I, Div. 1, 2, Groups A, B, C, D
Class I, Zone 0, IIC
Class II, Div. 1, 2, Groups E, F, G
Class III

NON-HAZARDOUS LOCATION

Any FM approved associated apparatus or associated nonincendive field wiring apparatus



Area of application:
The compact instruments are suitable for use in areas subject to explosion caused by gases, vapours or mists.

Permissible ambient temperature:
Electronic: F23 enclosure –40...+80 °C resp. –40...176 °F

Type	Type of antennas	Operation temperature[1)]
FMR230 -	Horn antenna with PTFE-Korund feeder	–40 °C/–40 °F to +200 °C/392 °F
-..F	HT antenna (Tantal gasket)	–40 °C/–40 °F to +350 °C/662 °F
-..G	HT antenna (Graphite gasket)	–60 °C/–76 °F to +400 °C/752 °F
	Horn antenna with scavenge connection	depends on type
-..L	XT (extended temperature)	–60 °C/–76 °F to +280 °C/536 °F
-..M	HT (high temperature)	–60 °C/–76 °F to +400 °C/752 °F
FMR231 -	Rod antenna PPS	–20 °C/– 4 °F to +120 °C/250 °F
	Rod antenna PTFE	–40 °C/–40 °F to +150 °C/300 °F
	Rod antenna PTFE cladded	–40 °C/–40 °F to +150 °C/300 °F
	Sanitary (process connection)	–40 °C/–40 °F to +150 °C/300 °F
	PVDF (process connection)	–20 °C/– 4 °F to + 80 °C/176 °F
FMR232 -	Planar antenna	–40 °C/–40 °F to +150 °C/300 °F
FMR233 -	Parabolic antenna	–40 °C/–40 °F to +200 °C/392 °F
FMR240 -	> 20 GHz horn antenna	–40 °C/–40 °F to +150 °C/300 °F
	Wave guide antenna	–60 °C/–76 °F to +200 °C/392 °F
	Horn compact, extended, special edition	–40 °C/–40 °F to +150 °C/300 °F
FMR244 -	Compact antenna (PTFE capsuled)	–40 °C/–40 °F to +130 °C/266 °F
	80 mm/3", PP cladded (type 4)	–40 °C/–40 °F to + 80 °C/176 °F
FMR245 -	Compact antenna (types 3, 4)	–40 °C/–40 °F to +150 °C/302 °F
	DN50 + DN80 (types B, C, F, G)	–40 °C/–40 °F to +200 °C/392 °F

[1)] Note: take care to specific temperature ranges of antenna versions

For Installation acc. -FISCO- Concept see Control dwg. part 960402-1070

Functional ratings:
These ratings do not supersede Hazardous Locations values Unom ≤ 33 V, Inom = 15 mA.

Notes.

Intrinsically safe installation
Intrinsically safe (entity), Class I, Div. 1, Groups A, B, C, D, Hazardous Location Installation.

1. Control room equipment may not use or generate over 250 Vrms.
2. Use FM Approved Entity-Approved intrinsic safety barrier with Voc or Vt ≤ Vmax, Isc or It ≤ Imax, Ca ≥ Ci + Ccable, La ≥ Li + Lcable barrier must be incapable of delivering more than defined value (Pmax.) to a matched load.
   Transmitter entity parameters are as follows: Vmax = 17.5 V or 24 V
   Imax = 500 mA or 250 mA
   Ci ≤ 5 nF, Li ≤ 10 µH
   Pmax = 5.5 W or 1.2 W
3. Installation should be in accordance with ANSI / ISA RP12.06.01.
   Installation of intrinsically safe systems for Hazardous (Classified) locations and the National Electrical code (ANSI / NFPA 70).
4. Warning: Substitution of components may impair intrinsic safety.
5. Intrinsic safty barrier manufacturer's installation drawing must be followed when installing this equipment.
   The configuration of the intrinsic safety barrier(s) must be FM Approved.
6. Use supply wires suitable for 5 K above surrounding ambient.
7. In case of use of PTFE rod antenna (white), planar, parabolic, enamelled horn, type 244 or type 245 avoid electrostatic charge at the antenna; (e.g. do not rub with dry cloth; do not install within the filling curtain).
8. Apparatus with faucet: In case of disconnection of Micropilot M from the faucet (e.g. for maintenance) we recommend to secure resp. to close the faucet e.g. with an additional blind flange. The responsibility for applicability of the arrangement behooves exclusive the operator.

Division 2 and Zone 2 installation
Nonincendive, Class I, Div. 2, Groups A, B, C, D, Hazardous Location Installation.

1. Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510.
   Intrinsic safety barrier not required. Max. supply voltage 33 V. For T-code see table.
2. Nonincendive field wiring installation
   The Nonincendive Field Wiring Circuit Concept allowes interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus or associated apparatus not specifically examined in combination as a system using any of the wiring methods permitted for unclassified locations, when Vmax ≥ Voc or Vt, Ca ≥ Ci + Ccable, La ≥ Li + Lcable.
   Transmitter non incendive field wiring parameters for these current controlled circuit are as follows:
   Vmax = 33 V; Ci ≤ 5 nF; Li ≤ 10 µH; Imax = see note 3.
3. For these current controlled circuit, the parameter Imax is not required and need not to be aligned with parameter Isc and It of the associated nonincendive field wiring apparatus or associated apparatus.
4. Warning: Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be Non-Hazardous.
   Warning: Substitution of components may impair suitability for Class I, Division 2.

Class II, III installation
DIP for Class II and III, Div. 1, Groups E, F, G, Hazardous Location Installation.

1. Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510.
2. Use a dust tight seal at the conduit entry.

Temperature class with/without display VU331	Permissible max. medium temperature at the antenna process connection (Tmed)	Permissible max. ambient temperature of the electronic compartment (Ta) (enclosure F23)										
		FMR230 - ..E/V/K/D/H	FMR230 - ..L	FMR230 - ..M	FMR230 - ..F/G	FMR231	FMR232	FMR233	FMR240	FMR240 Wave Guide	FMR244	FMR245
T6	+ 80 °C + 60 °C	+50/45 °C +60/55 °C	+55/50 °C +60/55 °C	+55/50 °C +60/55 °C	+55/50 °C +60/55 °C	+50/45 °C +60/55 °C	+50/45 °C +60/55 °C	+50/45 °C +60/55 °C	+55/50 °C +60/55 °C	+60/55 °C +60/55 °C	+55/50 °C +60/55 °C	+55/50 °C +60/55 °C
T5	+ 95 °C + 75 °C	+65/60 °C +75/70 °C	+70/65 °C +75/70 °C	+70/65 °C +75/70 °C	+70/65 °C +75/70 °C	+65/60 °C +75/70 °C	+65/60 °C +75/70 °C	+65/60 °C +75/70 °C	+70/65 °C +75/70 °C	+75/70 °C +75/70 °C	+70/65 °C +75/70 °C	+70/65 °C +75/70 °C
T4	+130 °C + 80 °C	+65 °C +80 °C	+75 °C +80 °C	+75 °C +80 °C	+70 °C +80 °C	+55 °C +80 °C	+65 °C +80 °C	+60 °C +80 °C	+60 °C +80 °C	+70 °C +80 °C	+65 °C +80 °C	+65 °C +80 °C
T3C (functional)	+150 °C + 80 °C	+60 °C +80 °C	+65 °C +80 °C	+70 °C +80 °C	+65 °C +80 °C	+45 °C +80 °C	+60 °C +80 °C	+45 °C +80 °C	+55 °C +80 °C	+65 °C +80 °C	not allowed	+60 °C +80 °C
T3	+195 °C + 80 °C	+45 °C +80 °C	+65 °C +80 °C	+70 °C +80 °C	+65 °C +80 °C	not allowed	not allowed	+40 °C +80 °C	not allowed	+65 °C +80 °C	not allowed	+55 °C +80 °C
T2B (functional)	+250 °C + 80 °C	+30 °C +80 °C	+60 °C +80 °C	+65 °C +80 °C	+55 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T2 (functional)	+280 °C + 80 °C	not allowed	+60 °C +80 °C	+65 °C +80 °C	+55 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T2	+290 °C + 80 °C	not allowed	not allowed	+65 °C +80 °C	+55 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T1 (functional)	+350 °C + 80 °C	not allowed	not allowed	+60 °C +80 °C	+45 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T1 (functional)	+400 °C + 80 °C	not allowed	not allowed	+60 °C +80 °C	+45 °C +80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed

Note: the applicable temperature of antenna must be within their specified limits; Tx (functional) means limited through type of antenna;
T6 and T5 requires for FF electronic enlarged derating: for ambient; 1st number = PA electronic insert; 2nd number = FF electronic insert
e.g. +60/55 °C expression means: Apparatus with PA electronic insert max. ambient at housing = +60 °C;
Apparatus with FF electronic insert max. ambient at housing = +55 °C