Appendix A (File Formats)

A1a: LWP-Files (*.LWP), (version 1)

Variable Name	Type	# Bytes	Description
LWPCode	int	4	LWP-File Code (=934501978)
N	int	4	Number of recorded samples
LWPMin	float	4	Minimum of recorded LWP values
LWPMax	float	4	Maximum of recorded LWP values
LWPTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
LWPRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neur. Net.
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1[(1)]	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
LWP_1	float	4	LWP sample 1 [g/m^2]
LWPAng_1[(2)]	float	4	LWP angles 1 [DEG]
…	…	…	…
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[(1)]	char	1	Rainflag of sample N (0: no rain, 1: rain)
LWP_N	float	4	LWP sample N [g/m^2]
LWPAng_N[(2)]	float	4	LWP angles N [DEG]

[(1)] The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18) [(2)]
Angle is coded in the following way: Ang=sign(El) * (|El|+1000*Az), -90°<=El<100°, 0°<=Az<360°. If El>=100°, the value 1000.000 is added to Ang and El in the formula is El100°. Example: El=138.5°, Az=267.4°, Ang=1267438.5

A1b: LWP-Files (*.LWP), (version 2)

Variable Name	Type	# Bytes	Description
LWPCode	int	4	LWP-File Code (=934501000)
N	int	4	Number of recorded samples
LWPMin	float	4	Minimum of recorded LWP values
LWPMax	float	4	Maximum of recorded LWP values
LWPTimeRef	int	4	Time reference (1: UTC, 0: Local Time)

LWPRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neur. Net.
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
LWP_1	float	4	LWP sample 1 [g/m^2]
ANG_1(2)	float	4	LWP angles 1 [DEG]
…	…	…	…
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
LWP_N	float	4	LWP sample N [g/m^2]
ANG_N(2)	int	4	LWP angles N [DEG]

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18) (2)
(2) Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A2a: IWV-Files (*.IWV), (version 1)

Variable Name	Type	# Bytes	Description
IWVCode	int	4	IWV-File Code (=594811068)
N	int	4	Number of recorded samples
IWVMin	float	4	Minimum of recorded IWV values
IWVMax	float	4	Maximum of recorded IWV values
IWVTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
IWVRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neur. Net.
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
IWV_1	float	4	IWVsample 1 [kg/m^2]
IWVAng_1(2)	float	4	IWV angles 1 [DEG]
…	…	…	…
…	…	…	…
…	…	…	…

T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[(1)]	char	1	Rainflag of sample N (0: no rain, 1: rain)
IWV_N	float	4	IWV sample N [kg/m^2]
IWVAng_N[(2)]	float	4	IWV angles N [DEG]

[(1)] The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18) [(2)]
Angle is coded in the following way: Ang=sign(El) * (|El|+1000*Az), -90°<=El<100°, 0°<=Az<360°. If El>=100°, the value 1000.000 is added to Ang and El in the formula is El100°. Example: El=138.5°, Az=267.4°, Ang=1267438.5

A2b: IWV-Files (*.IWV), (version 2)

Variable Name	Type	# Bytes	Description
IWVCode	int	4	IWV-File Code (=594811000)
N	int	4	Number of recorded samples
IWVMin	float	4	Minimum of recorded IWV values
IWVMax	float	4	Maximum of recorded IWV values
IWVTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
IWVRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neur. Net.
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1[(1)]	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
IWV_1	float	4	IWVsample 1 [kg/m^2]
ANG_1[(2)]	int	4	IWV angles 1 [DEG]
…	…	…	…
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[(1)]	char	1	Rainflag of sample N (0: no rain, 1: rain)
IWV_N	float	4	IWV sample N [kg/m^2]
ANG_N[(2)]	int	4	IWV angles N [DEG]

[(1)] The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18) [(2)]
[(2)] Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A3: DLY-Files (*.DLY)

Variable Name	Type	# Bytes	Description
DLYCode	int	4	DLY-File Code (=8479000)
N	int	4	Number of recorded samples
DLYMin	float	4	Minimum of recorded total delay values
DLYMax	float	4	Maximum of recorded total delay values
DLYTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
DLYRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neur. Net.
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
WDLY_1	float	4	Wet delay sample 1 [mm]
DDLY_1	float	4	Dry delay sample 1 [mm]
ANG_1(2)	int	4	DLY angles 1 [DEG]
…	…	…	…
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
WDLY_N	float	4	Wet delay sample N [mm]
DDLY_N	float	4	Dry delay sample N [mm]
ANG_N(2)	int	4	DLY angles N [DEG]

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18) (2)
(2) Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A4a: ATN-Files (*.ATN), (version 1)

Variable Name	Type	# Bytes	Description
ATNCode	int	4	ATN-File Code (=7757564)
N	int	4	Number of recorded samples
ATNTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
ATNRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neur. Net., 3: Tmr based retrieval

FreqAnz	int	4	# of recorded frequencies
Freqs[i]	float	4 x FreqAnz	Frequencies [GHz]
ATNMin[]	float	4 x FreqAnz	Minimum of recorded ATN values
ATNMax[]	float	4 x FreqAnz	Maximum of recorded ATN values
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
ATN_1[]	float	4 x FreqAnz	ATN sample 1 (Attenuation [dB])
ANG1(2)	float	4	Observation angles, sample 1
…	…	…	…
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
ATN_N[]	float	4 x FreqAnz	ATN sample N (Attenuation [dB])
ANGN(2)	float	4	Observation angles, sample N

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18) (2)
Angle is coded in the following way: Ang=sign(El) * (|El|+1000*Az), -90°<=El<100°, 0°<=Az<360°. If El>=100°, the value 1000.000 is added to Ang and El in the formula is

El100°. Example: El=138.5°, Az=267.4°, Ang=1267438.5

A4b: ATN-Files (*.ATN), (version 2)

Variable Name	Type	# Bytes	Description
ATNCode	int	4	ATN-File Code (=7757000)
N	int	4	Number of recorded samples
ATNTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
ATNRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neur. Net., 3: Tmr based retrieval
FreqAnz	int	4	# of recorded frequencies
Freqs[i]	float	4 x FreqAnz	Frequencies [GHz]
ATNMin[]	float	4 x FreqAnz	Minimum of recorded ATN values
ATNMax[]	float	4 x FreqAnz	Maximum of recorded ATN values
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
ATN_1[]	float	4 x FreqAnz	ATN sample 1 (Attenuation [dB])

ANG1[2]	int	4	Observation angles, sample 1
…	…	…	…
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[1]	char	1	Rainflag of sample N (0: no rain, 1: rain)
ATN_N[]	float	4 x FreqAnz	ATN sample N (Attenuation [dB])
ANGN[2]	int	4	Observation angles, sample N

[1] The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)
[2] Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A5a: BRT-Files (*.BRT), (version 1)

Variable Name	Type	# Bytes	Description
BRTCode	int	4	BRT-File Code (=666666 or 666667 for SPC files)
N	int	4	Number of recorded samples
BRTTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
FreqAnz	int	4	# of recorded frequencies
Freq[]	float	4 x FreqAnz	Frequencies [GHz]
BRTMin[]	float	4 x FreqAnz	Minimum array of recorded BRT values
BRTMax[]	float	4 x FreqAnz	Maximum array of recorded BRT values
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
BRT_1[]	float	4 x FreqAnz	Br. Temp. array sample 1 [K]
ANG_1[1]	float	4	Elevation/Azimuth angle of sample 1 (DEG)
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
BRT_N[]	float	4 x FreqAnz	Br. Temp. sample N, frequency 1 [K]
ANG_N[1]	float	4	Elevation/Azimuth angle of sample N (DEG)

[1] Angle is coded in the following way: ANG=sign(Elevation) * (|Elevation|+1000*Azimuth)

A5b: BRT-Files (*.BRT), (version 2)

Variable Name	Type	# Bytes	Description
BRTCode	int	4	BRT-File Code (=666000 or 667000 for SPC files)
N	int	4	Number of recorded samples
BRTTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
FreqAnz	int	4	# of recorded frequencies
Freq[]	float	4 x FreqAnz	Frequencies [GHz]
BRTMin[]	float	4 x FreqAnz	Minimum array of recorded BRT values
BRTMax[]	float	4 x FreqAnz	Maximum array of recorded BRT values
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
BRT_1[]	float	4 x FreqAnz	Br. Temp. array sample 1 [K]
ANG_1(1)	int	4	Elevation/Azimuth angle of sample 1 (DEG)
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
BRT_N[]	float	4 x FreqAnz	Br. Temp. sample N, frequency 1 [K]
ANG_N(1)	int	4	Elevation/Azimuth angle of sample N (DEG)

(1) Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A6a: MET-Files (*.MET), Meteorological Sensors (old version)

Variable Name	Type	# Bytes	Description
METCode	int	4	MET-File Code (=599658943)
N	int	4	Number of recorded samples
METMinP	float	4	Minimum of recorded pressure values
METMaxP	float	4	Maximum of recorded pressure values
METMinT	float	4	Minimum of environmental temp. values
METMaxT	float	4	Maximum of environmental temp. values
METMinH	float	4	Minimum of recorded rel. humidity values
METMaxH	float	4	Maximum of recorded rel. humidity values
METTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)

MET_1(0)	float	4	Pressure value sample 1 [mbar]
MET_1(1)	float	4	Temp. value sample 1 [K]
MET_1(2)	float	4	Rel. humidity value sample 1 [%]
…	…	…	…
MET_N(0)	float	4	Pressure value sample N [mbar]
MET_N(1)	float	4	Temp. value sample N [K]
MET_N(2)	float	4	Rel. humidity value sample N [%]

A6b: MET-Files (*.MET), Meteorological Sensors (new version)

Variable Name	Type	# Bytes	Description
METCode	int	4	MET-File Code (=599658944)
N	int	4	Number of recorded samples
AddSensors[(1)]	char	1	8 bit field for additional sensors
METMinP	float	4	Minimum of recorded pressure values
METMaxP	float	4	Maximum of recorded pressure values
METMinT	float	4	Minimum of environmental temp. values
METMaxT	float	4	Maximum of environmental temp. values
METMinH	float	4	Minimum of recorded rel. humidity values
METMaxH	float	4	Maximum of recorded rel. humidity values
…	float	8*# of add. sensors	Minimum and Maximum values of additional sensors
METTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
MET_1(0)	float	4	Pressure value sample 1 [mbar]
MET_1(1)	float	4	Temp. value sample 1 [K]
MET_1(2)	float	4	Rel. humidity value sample 1 [%]
…	float	4*# of add. sensors	sample 1 of additional sensor values
…	…	…	…
MET_N(0)	float	4	Pressure value sample N [mbar]
MET_N(1)	float	4	Temp. value sample N [K]
MET_N(2)	float	4	Rel. humidity value sample N [%]
…	float	4*# of add. sensors	sample N of additional sensor values

(1) Additional sensors bit field: Bit0 (LSB): wind speed (km/h), Bit1: wind direction [°], Bit2: Rain Rate. If corresponding bit is 1, the additional sensor exists, otherwise it does not.

A7: OLC-Files (*.OLC), Oxygen Line Chart

Variable Name	Type	# Bytes	Description
OLCCode	int	4	OLC-File Code (=955874342)
N	int	4	Number of recorded samples
OLCMin	float	4	Minimum of recorded OL-Brt. values
OLCMax	float	4	Maximum of recorded OL-Brt. values
OLCTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
FreqAnz	int	4	# of recorded frequencies in oxygen line
Freq[i]	float	4 x FreqAnz	Frequencies [GHz]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
O2_BRT_1(i)	float	4 x FreqAnz	Brightness Temp. of oxygen line [K], sample 1
ANG1(1)	float	4	Observation angles, sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
O2_BRT_N(i)	float	4 x FreqAnz	Brightness Temp. of oxygen line [K], sample N
ANGN(1)	float	4	Observation angles, sample N

(1) Angle is coded in the following way: ANG=sign(Elevation) * (|Elevation|+1000*Azimuth)

A8(1): TPC-Files (*.TPC), Temperature Profile Chart (Full Trop.)

Variable Name	Type	# Bytes	Description
TPCCode	int	4	TPC-File Code (=780798065)
N	int	4	Number of recorded samples
TPCMin	float	4	Minimum of recorded temperature values
TPCMax	float	4	Maximum of recorded temperature values
TPCTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
TPCRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
TP_1(i)	float	4 x AltAnz	Temperature Profile [K], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
TP_N(i)	float	4 x AltAnz	Temperature Profile [K], sample N

(1)The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

A8(2): TPC-Files (*.TPC), Temperature Profile Chart (Full Trop.)

(new version with El/Az and RA /DECL coordinates included)

Variable Name	Type	# Bytes	Description
TPCCode	int	4	TPC-File Code (=780798066)
N	int	4	Number of recorded samples
TPCMin	float	4	Minimum of recorded temperature values
TPCMax	float	4	Maximum of recorded temperature values
TPCTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
TPCRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
TP_1(i)	float	4 x AltAnz	Temperature Profile [K], sample 1
TP_1_ElAz(2)	int	4	Temp. Profile's elevation / azimuth, sample 1
TP_1_RA	float	4	Temp. Profile's right ascension [DEG], samp. 1
TP_1_DEC	float	4	Temp. Profile's declination [DEG], sample 1
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
TP_N(i)	float	4 x AltAnz	Temperature Profile [K], sample N
TP_N_ElAz(2)	int	4	Temp. Profile's elevation / azimuth, sample N
TP_N_RA	float	4	Temp. Profile's right ascension [DEG], samp. N
TP_N_DEC	float	4	Temp. Profile's declination [DEG], sample N

(1)The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = quality level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

(2) Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A9: TPB-Files (*.TPB), Temperature Profile Chart (Boundary Layer)

Variable Name	Type	# Bytes	Description
TPBCode	int	4	TPB-File Code (=459769847)
N	int	4	Number of recorded samples
TPBMin	float	4	Minimum of recorded temperature values
TPBMax	float	4	Maximum of recorded temperature values
TPBTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
TPBRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1[(1)]	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
TP_1(i)	float	4 x AltAnz	Temperature Profile [K], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[(1)]	char	1	Rainflag of sample N (0: no rain, 1: rain)
TP_N(i)	float	4 x AltAnz	Temperature Profile [K], sample N

[(1)] The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

A10: WVL-Files (*.WVL), Water Vapour Line Chart

Variable Name	Type	# Bytes	Description
WVLCode	int	4	WVL-File Code (=456783953)
N	int	4	Number of recorded samples
WVLMin	float	4	Minimum of recorded WVL-Brt. values
WVLMax	float	4	Maximum of recorded WVL-Brt. values
WVLTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
FreqAnz	int	4	# of recorded frequencies in WV line
Freq[i]	float	4 x FreqAnz	Frequencies [GHz]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
WVL_BRT_1(i)	float	4 x FreqAnz	Brightness Temp. of WV line [K], sample 1
ANG1[(1)]	float	4	Observation angle, sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
WVL_BRT_N(i)	float	4 x FreqAnz	Brightness Temp. of WV line [K], sample N
ANGN[(1)]	float	4	Observation angle, sample N

(1) Angle is coded in the following way: Ang=sign(El) * (|El|+1000*Az), -90°<=El<100°, 0°<=Az<360°. If El>=100°, the value 1000.000 is added to Ang and El in the formula is El-100°. Example: El=138.5°, Az=267.4°, Ang=1267438.5

A11(1): HPC-Files (*.HPC), Humidity Profile Chart (without RH)

Variable Name	Type	# Bytes	Description
HPCCode	int	4	HPC-File Code (=117343672)
N	int	4	Number of recorded samples
HPCMin	float	4	Minimum of recorded abs. humidity values
HPCMax	float	4	Maximum of recorded abs. humidity values
HPCTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
HPCRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
HP_1(i)	float	4 x AltAnz	Humidity Profile [g/m^3], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
HP_N(i)	float	4 x AltAnz	Humidity Profile [g/m^3], sample N

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

A11(2): HPC-Files (*.HPC), Humidity Profile Chart (including RH)

Variable Name	Type	# Bytes	Description
HPCCode	int	4	HPC-File Code (=117343673)
N	int	4	Number of recorded samples
HPCMin	float	4	Minimum of recorded abs. humidity values
HPCMax	float	4	Maximum of recorded abs. humidity values
HPCTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
HPCRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
HP_1(i)	float	4 x AltAnz	Abs. Humidity Profile [g/m^3], sample 1
…	…	…	…

T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
HP_N(i)	float	4 x AltAnz	Abs. Humidity Profile [g/m^3], sample N
RHMin	float	4	Minimum of recorded rel. humidity values [%]
RHMax	float	4	Maximum of recorded rel. humidity values [%]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
HP_1(i)	float	4 x AltAnz	Rel. Humidity Profile [%], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
HP_N(i)	float	4 x AltAnz	Abs. Humidity Profile [%], sample N

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

A11(3): HPC-Files (*.HPC), Humidity Profile Chart (without RH)
(new version with El/Az and RA /DECL coordinates included)

Variable Name	Type	# Bytes	Description
HPCCode	int	4	HPC-File Code (=117343674)
N	int	4	Number of recorded samples
HPCMin	float	4	Minimum of recorded abs. humidity values
HPCMax	float	4	Maximum of recorded abs. humidity values
HPCTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
HPCRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
HP_1(i)	float	4 x AltAnz	Humidity Profile [g/m^3], sample 1
HP_1_ElAz(2)	int	4	Humidity Profile's elevation / azimuth, sample 1
HP_1_RA	float	4	Humidity Profile's right ascension [DEG], samp. 1
HP_1_DEC	float	4	Humidity Profile's declination [DEG], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
HP_N(i)	float	4 x AltAnz	Humidity Profile [g/m^3], sample N
HP_N_ElAz(2)	int	4	Humidity Profile's elevation / azimuth, sample N

HP_N_RA	float	4	Humidity Profile's right ascension [DEG], samp. N
HP_N_DEC	float	4	Humidity Profile's declination [DEG], sample N

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = quality level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

(2) Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.

Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045

Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A11(4): HPC-Files (*.HPC), Humidity Profile Chart (with RH appended)

(new version with El/Az and RA /DECL coordinates included)

Variable Name	Type	# Bytes	Description
HPCCode	int	4	HPC-File Code (=117343675)
N	int	4	Number of recorded samples
HPCMin	float	4	Minimum of recorded abs. humidity values
HPCMax	float	4	Maximum of recorded abs. humidity values
HPCTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
HPCRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
HP_1(i)	float	4 x AltAnz	Abs. Humidity Profile [g/m^3], sample 1
HP_1_ElAz(2)	int	4	Humidity Profile's elevation / azimuth, sample 1
HP_1_RA	float	4	Humidity Profile's right ascension [DEG], samp. 1
HP_1_DEC	float	4	Humidity Profile's declination [DEG], sample 1
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
HP_N(i)	float	4 x AltAnz	Abs. Humidity Profile [g/m^3], sample N
HP_N_ElAz(2)	int	4	Humidity Profile's elevation / azimuth, sample N
HP_N_RA	float	4	Humidity Profile's right ascension [DEG], samp. N
HP_N_DEC	float	4	Humidity Profile's declination [DEG], sample N
RHMin	float	4	Minimum of recorded rel. humidity values [%]
RHMax	float	4	Maximum of recorded rel. humidity values [%]

T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1[(1)]	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
HP_1(i)	float	4 x AltAnz	Rel. Humidity Profile [%], sample 1
…	…	…	…
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[(1)]	char	1	Rainflag of sample N (0: no rain, 1: rain)
HP_N(i)	float	4 x AltAnz	Abs. Humidity Profile [%], sample N

[(1)] The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = quality level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)
[(2)] Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A12: LPR-Files (*.LPR), Liquid Water Profile Chart

Variable Name	Type	# Bytes	Description
LPRCode	int	4	LPR-File Code (=4567)
N	int	4	Number of recorded samples
LPRMin	float	4	Minimum of recorded LW-density
LPRMax	float	4	Maximum of recorded LW-density
LPRTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
LPRRetrieval	int	4	0: lin. Reg., 1 : quad. Reg., 2: Neural Network
AltAnz	int	4	# of altitude layers
Alts[i]	int	4 x AltAnz	Altitudes [m]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1[(1)]	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
LWD_1(i)	float	4 x AltAnz	LW-density profile [g/m^3], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[(1)]	char	1	Rainflag of sample N (0: no rain, 1: rain)
LWD_N(i)	float	4 x AltAnz	LW-density profile [g/m^3], sample N

[(1)] The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

A13a: IRT-Files (*.IRT), (version 1)

Variable Name	Type	# Bytes	Description
IRTCode	int	4	IRT-File Code (=671112495)
N	int	4	Number of recorded samples
IRTMin	float	4	Minimum of recorded IRT values
IRTMax	float	4	Maximum of recorded IRT values
IRTTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
IRT_1	float	4	Infrared temperature [°C], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
IRT_N	float	4	Infrared temperature [°C], sample N

A13b: IRT-Files (*.IRT), (version 2)

Variable Name	Type	# Bytes	Description
IRTCode	int	4	IRT-File Code (=671112496)
N	int	4	Number of recorded samples
IRTMin	float	4	Minimum of recorded IRT values
IRTMax	float	4	Maximum of recorded IRT values
IRTTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
FreqAnz	int	4	# of recorded IRRs
Freq[]	float	4 x FreqAnz	Wavelengths [µm]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
IRT[]_1	float	4 x FreqAnz	Infrared temperatures [°C], sample 1
ANG_1[(1)]	float	4	Elevation/Azimuth angle of sample 1 (DEG)
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
IRT[]_N	float	4 x FreqAnz	Infrared temperatures [°C], sample N
ANG_N[(1)]	float	4	Elevation/Azimuth angle of sample N (DEG)

[(1)] Angle is coded in the following way: Ang=sign(El) * (|El|+1000*Az), -90°<=El<100°, 0°<=Az<360°. If El>=100°, the value 1000.000 is added to Ang and El in the formula is El-100°. Example: El=138.5°, Az=267.4°, Ang=1267438.5

A13c: IRT-Files (*.IRT), (version 3)

Variable Name	Type	# Bytes	Description
IRTCode	int	4	IRT-File Code (=671112000)
N	int	4	Number of recorded samples
IRTMin	float	4	Minimum of recorded IRT values
IRTMax	float	4	Maximum of recorded IRT values
IRTTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
FreqAnz	int	4	# of recorded IRRs
Freq[]	float	4 x FreqAnz	Wavelengths [µm]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
IRT[]_1	float	4 x FreqAnz	Infrared temperatures [°C], sample 1
ANG_1[(1)]	int	4	Elevation/Azimuth angle of sample 1 (DEG) Elevation in [-90,180], Azimuth in [0,360]
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
IRT[]_N	float	4 x FreqAnz	Infrared temperatures [°C], sample N
ANG_N[(1)]	int	4	Elevation/Azimuth angle of sample N (DEG) Elevation in [-90,180], Azimuth in [0,360]

[(1)] Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A14a: BLB-Files (*.BLB), (version 1)

Variable Name	Type	# Bytes	Description
BLBCode	int	4	BLB-File Code (=567845847)
N	int	4	Number of recorded samples
BLBMin[]	float	14*4	Minimum of recorded BLB values (14 channels, 22.24-31.4, 51.3-58)
BLBMax[]	float	14*4	Maximum of recorded BLB values (14 channels, 22.24-31.4, 51.3-58)
BLBTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
Nf	int	4	No. of frequencies (14)
Freq[]	float	Nf*4	Frequencies [GHz]
Nang	int	4	No. of scanning angles (without 0°)
Ang[]	float	Nang*4	Scanning elevation angles [DEG], without 0°

T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF/Mode_1	char	1	Rainflag/Mode of sample 1. Bit1=0: no rain, Bit1=1: rain; Bit2/3=0/0: 1st Quadrant Scan, Bit2/3=1/0:2nd Quadrant Scan, Bit2/3=0/1: Averaged Two Quadrant Scan
BT1_1[]	float	(Nang+1)*4	BTs for channel 1 (22.4 GHz) at different angles (starting with zenith), sample 1, the temperature at 0° is added to each scan (surface sensor)
…	…	…	…
BT14_1[]	float	(Nang+1)*4	BTs for channel 14 (58 GHz) at different angles (starting with zenith), sample 1, the temperature at 0° is added to each scan (surface sensor)
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF/Mode_N	char	1	Rainflag/Mode of sample N. Bit1=0: no rain, Bit1=1: rain; Bit2/3=0/0: 1st Quadrant Scan, Bit2/3=1/0:2nd Quadrant Scan, Bit2/3=0/1: Averaged Two Quadrant Scan
BT1_N[]	float	(Nang+1)*4	BTs for channel 1 (22.4 GHz) at different angles (starting with zenith), sample N, the temperature at 0° is added to each scan (surface sensor)
…	…	…	…
BT14_N[]	float	(Nang+1)*4	BTs for channel 14 (58 GHz) at different angles (starting with zenith), sample N, the temperature at 0° is added to each scan (surface sensor)

A14b: BLB-Files (*.BLB), (version 2)

Variable Name	Type	# Bytes	Description
BLBCode	int	4	BLB-File Code (=567845848)
N	int	4	Number of recorded samples
Nf	int	4	No. of frequencies
BLBMin[]	float	4*Nf	Minimum of recorded BLB values
BLBMax[]	float	4*Nf	Maximum of recorded BLB values
BLBTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
Freq[]	float	Nf*4	Frequencies [GHz]
Nang	int	4	No. of scanning angles (without 0°)
Ang[]	float	Nang*4	Scanning elevation angles [DEG], without 0°
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)

RF/Mode_1	char	1	Rainflag/Mode of sample 1. Bit1=0: no rain, Bit1=1: rain; Bit6/7=0/0: 1st Quadrant Scan, Bit6/7=1/0:2nd Quadrant Scan, Bit6/7=0/1: Averaged Two Quadrant Scan, Bit6/7=1/1: Two Independent Scans
BT1_1[]	float	(Nang+1)*4	BTs for channel 1 at different angles (starting with zenith), sample 1, the temperature at 0° is added to each scan (surface sensor)
…	…	…	…
BTNf_1[]	float	(Nang+1)*4	BTs for channel Nf at different angles (starting with zenith), sample 1, the temperature at 0° is added to each scan (surface sensor)
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF/Mode_N	char	1	Rainflag/Mode of sample N. Bit1=0: no rain, Bit1=1: rain; Bit6/7=0/0: 1st Quadrant Scan, Bit6/7=1/0:2nd Quadrant Scan, Bit6/7=0/1: Averaged Two Quadrant Scan, Bit6/7=1/1: Two Independent Scans
BT1_N[]	float	(Nang+1)*4	BTs for channel 1 at different angles (starting with zenith), sample N, the temperature at 0° is added to each scan (surface sensor)
…	…	…	…
BTNf_N[]	float	(Nang+1)*4	BTs for channel Nf at different angles (starting with zenith), sample N, the temperature at 0° is added to each scan (surface sensor)

A15: STA-Files (*.STA), Stability Indices

Variable Name	Type	# Bytes	Description
STACode	int	4	STA-File Code (=454532)
N	int	4	Number of recorded samples
STAMin[]	float	4	Minimum of recorded indices
STAMax[]	float	4	Maximum of recorded indices
STAIndexList	int	6*4	Flag for each index (1: Index present in file, 0: Index not present in file). Sequence: LI, KO, TTI, KI, SI, CAPE
STATimeRef	int	4	Time reference (1: UTC, 0: Local Time)
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1(1)	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
STA1_1	float	4	LI-sample 1 (if STAIndexList[0]=1)
…	…	…	…

STA1_6	float	4	CAPE-sample 1 (if STAIndexList[5]=1)
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N(1)	char	1	Rainflag of sample N (0: no rain, 1: rain)
STAN_1	float	4	LI-sample N (if STAIndexList[0]=1)
…	…	…	…
STAN_6	float	4	CAPE-sample N (if STAIndexList[5]=1)

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

A16a: Structure of Calibration Log-File (CAL.LOG), old version

Variable Name	Type	# Bytes	Description
STACode	int	4	CAL.LOG -File Code (=657644)
N_Gain	int	4	Number of recorded gain cal. samples
N_Noise	int	4	Number of recorded noise cal. samples
N_SkyTip	int	4	Number of recorded tip curve cal. samples
N_CH_Rec1	int	4	Number of receiver 1 channels
N_CH_Rec2	int	4	Number of receiver 2 channels
Frequ[]	float	4* ChanNo	Frequencies of Rec1 and Rec2
CalType1	int	4	Type of calibration sample 1 (0=gain, 1=noise, 2=tip curve results, 3=tip curve with full fit information)
CalTime1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
TipCurveStat1	int	4	Status of tip curve calibration (only if CalType1=2 or 3), 3 = FAILED, 2 = SUCCESS
Gain1[]	float	4* ChanNo	Gains of calibration sample 1
Tsys1[]	float	4* ChanNo	system noise temps of calibration sample 1 (only if CalType1=1 or CalType1=2 or CalType1=3)
LinCorr1[]	float	4* ChanNo	Linear correlations for calibration sample 1 (only if CalType1=2 or 3)

ChiSqr1[]	float	4* ChanNo	Chi square factors for calibration sample 1 (only if CalType1=2 or 3)
NoiseTemp1[]	float	4* ChanNo	Noise source temperatures for calibration sample 1 (only if CalType1=2 or 3)
SkyTipAngAnz1	int	4	Number of sky tip for calibration sample 1 (only if CalType1= 3)
Airmass1[]	float	4* SkyTipAngAnz1	Airmass array (only if CalType1=3)
Rec1Enable	int	4	1=Skydip enabled for Receiver 1, 0=disabled
Rec2Enable	int	4	1=Skydip enabled for Receiver 2, 0=disabled
SkyDipUs1[i][j] i=0, … , N_CH_Rec1-1 j=0, … , SkyTipAngAnz1	float	4* N_CH_Rec1* (SkyTipAngAnz1+1)	Sky dip detector voltages (only if CalType1=3). For each frequency the det. Voltage is given at all angles. The last entry is the voltage on the hot target
TauSuccess1[]	int	4* N_CH_Rec1	Flag that indicates if the Tau calculation during the skydip was successful (0=no, 1=yes, 2=yes, also skydip successful) (only if CalType1=3)
TauArr1[0][j]	float	4* SkyTipAngAnz1	Tau array for channel 1 (only if CalType1=3 and TauSuccess1 [0]=1)
LinFit1A[0]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccess1[0]=1)
LinFit1B[0]	float	4	Linear Fit parameter B (slope) for channel 1 (only if CalType1=3 and TauSuccess1[0]=1)
…	…	…	…
TauArr1[N_CH_Rec1-1][j]	float	4* SkyTipAngAnz1	Tau array for last channel (only if CalType1=3 and TauSuccess1 [N_CH_Rec1-1]=1)
LinFit1A[N_CH_Rec1-1]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccess1[N_CH_Rec1-1]=1)

LinFit1B[N_CH_Rec1-1]	float	4	Linear Fit parameter B (slope) for last channel (only if CalType1=3 and TauSuccess1 [N_CH_Rec1-1] =1)
…	…	…	…
CalTypeN	int	4	Type of calibration sample N (0=gain, 1=noise, 2=tip curce)
CalTimeN	int	4	Time of sample N (# of sec. since 1.1.2001)
TipCurveStatN	int	4	Status of tip curve calibration (only if CalTypeN=2), 3=FAILED, 2=SUCCESS
GainN[]	float	4* ChanNo	Gains of calibration sample 1
TsysN[]	float	4* ChanNo	system noise temps of calibration sample N (only if CalTypeN=1 or CalTypeN=2)
LinCorrN[]	float	4* ChanNo	Linear correlations for calibration sample N (only if CalTypeN=2)
ChiSqrN[]	float	4* ChanNo	Chi square factors for calibration sample N (only if CalTypeN=2)
NoiseTempN[]	float	4* ChanNo	Noise source temperatures for calibration sample N (only if CalTypeN=2)
SkyTipAngAnzN	int	4	Number of sky tip for calibration sample N (only if CalType1= 3)
AirmassN[]	float	4* SkyTipAngAnzN	Airmass array (only if CalType1=3)
Rec1Enable	int	4	1=Skydip enabled for Receiver 1, 0=disabled
Rec2Enable	int	4	1=Skydip enabled for Receiver 2, 0=disabled
SkyDipUsN[i][j] i=0, … , N_CH_Rec1-1 j=0, … , SkyTipAngAnzN	float	4* N_CH_Rec1* (SkyTipAngAnzN+1)	Sky dip detector voltages (only if CalType1=3). For each frequency the det. Voltage is given at all angles. The last entry is the voltage on the hot target, sample N
TauSuccessN[]	int	4* N_CH_Rec1	Flag that indicates if the Tau calculation during the skydip was successful (0=no, 1=yes, 2=yes, also skydip successful) (only if CalType1=3), sample N

TauArrN[0][j]	float	4* SkyTipAngAnzN	Tau array for channel 1 (only if CalType1=3 and TauSuccessN [0]=1)
LinFit1A[0]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccessN[0]=1)
LinFit1B[0]	float	4	Linear Fit parameter B (slope) for channel 1 (only if CalType1=3 and TauSuccessN[0]=1)
…	…	…	…
TauArr1[N_CH_Rec1 - 1][j]	float	4* SkyTipAngAnzN	Tau array for last channel (only if CalType1=3 and TauSuccessN [N_CH_Rec1 -1]=1)
LinFit1A[N_CH_Rec1 - 1]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccessN[N_CH_Rec1 - 1]=1)
LinFit1B[N_CH_Rec1 - 1]	float	4	Linear Fit parameter B (slope) for last channel (only if CalType1=3 and TauSuccessN [N_CH_Rec1 -1] =1)

with N = N_Gain + N_Noise + N_SkyTip and ChanNo = N_CH_Rec1+ N_CH_Rec2.

A16b: Structure of Calibration Log-File (CAL.LOG), new version

Variable Name	Type	# Bytes	Description
STACode	int	4	CAL.LOG -File Code (=657645)
T1	int	4	time of first sample
Tn	int	4	time of latest sample
N_Gain	int	4	Number of recorded gain cal. samples
N_Noise	int	4	Number of recorded noise cal. samples
N_SkyTip	int	4	Number of recorded tip curve cal. samples
N_CH_Rec1	int	4	Number of receiver 1 channels
N_CH_Rec2	int	4	Number of receiver 2 channels
Frequ[]	float	4* ChanNo	Frequencies of Rec1 and Rec2
CalType1	int	4	Type of calibration sample 1 (0=gain, 1=noise, 2=tip curve results, 3=tip curve with full fit information)

CalTime1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
TipCurveStat1	int	4	Status of tip curve calibration (only if CalType1=2 or 3), Bit1: if 1, rec. 1 is enabled for SKD Bit2: 0 = Failed, 1 = SUCCESS Bit3: if 1, rec. 2 is enabled for SKD Bit4: 0 = Failed, 1 = SUCCESS
Gain1[]	float	4* ChanNo	Gains of calibration sample 1
Tsys1[]	float	4* ChanNo	system noise temps of calibration sample 1 (only if CalType1=1 or CalType1=2 or CalType1=3)
LinCorr1[]	float	4* ChanNo	Linear correlations for calibration sample 1 (only if CalType1=2 or 3)
ChiSqr1[]	float	4* ChanNo	Chi square factors for calibration sample 1 (only if CalType1=2 or 3)
NoiseTemp1[]	float	4* ChanNo	Noise source temperatures for calibration sample 1 (only if CalType1=2 or 3)
SkyTipAngAnz1	int	4	Number of sky tip for calibration sample 1 (only if CalType1= 3)
Airmass1[]	float	4* SkyTipAngAnz1	Airmass array (only if CalType1=3)
Rec1Enable	int	4	1=Skydip enabled for Receiver 1, 0=disabled
Rec2Enable	int	4	1=Skydip enabled for Receiver 2, 0=disabled
SkyDipUs1[i][j] i=0, … , N_CH_Rec1-1 j=0, … , SkyTipAngAnz1	float	4* N_CH_Rec1* (SkyTipAngAnz1+1)	Sky dip detector voltages (only if CalType1=3). For each frequency the det. Voltage is given at all angles. The last entry is the voltage on the hot target
TauSuccess1[]	int	4* N_CH_Rec1	Flag that indicates if the Tau calculation during the skydip was successful (0=no, 1=yes, 2=yes, also skydip successful) (only if CalType1=3)
TauArr1[0][j]	float	4* SkyTipAngAnz1	Tau array for channel 1 (only if CalType1=3 and TauSuccess1 [0]=1)
LinFit1A[0]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccess1[0]=1)

LinFit1B[0]	float	4	Linear Fit parameter B (slope) for channel 1 (only if CalType1=3 and TauSuccess1[0]=1)
…	…	…	…
TauArr1[N_CH_Rec1-1][j]	float	4* SkyTipAngAnz1	Tau array for last channel (only if CalType1=3 and TauSuccess1 [N_CH_Rec1-1]=1)
LinFit1A[N_CH_Rec1-1]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccess1[N_CH_Rec1-1]=1)
LinFit1B[N_CH_Rec1-1]	float	4	Linear Fit parameter B (slope) for last channel (only if CalType1=3 and TauSuccess1 [N_CH_Rec1-1] =1)
…	…	…	…
CalTypeN	int	4	Type of calibration sample N (0=gain, 1=noise, 2=tip curce)
CalTimeN	int	4	Time of sample N (# of sec. since 1.1.2001)
TipCurveStatN	int	4	Status of tip curve calibration (only if CalTypeN=2) Bit1: if 1, rec. 1 is enabled for SKD Bit2: 0 = Failed, 1 = SUCCESS Bit3: if 1, rec. 2 is enabled for SKD Bit4: 0 = Failed, 1 = SUCCESS
GainN[]	float	4* ChanNo	Gains of calibration sample 1
TsysN[]	float	4* ChanNo	system noise temps of calibration sample N (only if CalTypeN=1 or CalTypeN=2)
LinCorrN[]	float	4* ChanNo	Linear correlations for calibration sample N (only if CalTypeN=2)
ChiSqrN[]	float	4* ChanNo	Chi square factors for calibration sample N (only if CalTypeN=2)
NoiseTempN[]	float	4* ChanNo	Noise source temperatures for calibration sample N (only if CalTypeN=2)
SkyTipAngAnzN	int	4	Number of sky tip for calibration sample N (only if CalType1= 3)
AirmassN[]	float	4* SkyTipAngAnzN	Airmass array (only if CalType1=3)

Rec1Enable	int	4	1=Skydip enabled for Receiver 1, 0=disabled
Rec2Enable	int	4	1=Skydip enabled for Receiver 2, 0=disabled
SkyDipUsN[i][j] i=0, … , N_CH_Rec1-1 j=0, … , SkyTipAngAnzN	float	4* N_CH_Rec1* (SkyTipAngAnzN+1)	Sky dip detector voltages (only if CalType1=3). For each frequency the det. Voltage is given at all angles. The last entry is the voltage on the hot target, sample N
TauSuccessN[]	int	4* N_CH_Rec1	Flag that indicates if the Tau calculation during the skydip was successful (0=no, 1=yes, 2=yes, also skydip successful) (only if CalType1=3), sample N
TauArrN[0][j]	float	4* SkyTipAngAnzN	Tau array for channel 1 (only if CalType1=3 and TauSuccessN [0]=1)
LinFit1A[0]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccessN[0]=1)
LinFit1B[0]	float	4	Linear Fit parameter B (slope) for channel 1 (only if CalType1=3 and TauSuccessN[0]=1)
…	…	…	…
TauArr1[N_CH_Rec1 -1][j]	float	4* SkyTipAngAnzN	Tau array for last channel (only if CalType1=3 and TauSuccessN [N_CH_Rec1 -1]=1)
LinFit1A[N_CH_Rec1 -1]	float	4	Linear Fit parameter A (offset) for channel 1 (only if CalType1=3 and TauSuccessN[N_CH_Rec1 -1]=1)
LinFit1B[N_CH_Rec1 -1]	float	4	Linear Fit parameter B (slope) for last channel (only if CalType1=3 and TauSuccessN [N_CH_Rec1 -1] =1)

A17: CBH-Files (*.CBH), Cloud Base Height

Variable Name	Type	# Bytes	Description
CBHCode	int	4	CBH-File Code (=67777499)
N	int	4	Number of recorded samples
CBHMin	float	4	Minimum of recorded CBH values
CBHMax	float	4	Maximum of recorded CBH values
CBHTimeRef	int	4	Time reference (1: UTC, 0: Local Time)

T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1[(1)]	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
CBH_1	float	4	Cloud base height [m], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N[(1)]	char	1	Rainflag of sample N (0: no rain, 1: rain)
CBH_N	float	4	Cloud base height [m], sample N

(1) The rain flag is an 8 bit array: MSB 000yyxxr LSB, r = rain information (0= no rain, 1=raining) xx = qulity level (0=not evaluated, 1=high, 2=medium, 3=low), yy = reason for reduced quality (see appendix A18)

A18: BLH-Files (*.BLH), Boundary Layer Height

Variable Name	Type	# Bytes	Description
BLHCode	int	4	BLH-File Code (=1777786)
N	int	4	Number of recorded samples
BLHMin	float	4	Minimum of recorded BLH values
BLH Max	float	4	Maximum of recorded BLH values
BLHTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
BLH _1[(1)]	float	4	Boundary layer height [m], sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
BLH _N[(1)]	float	4	Boundary layer height [m], sample N

(1) If the BLH is positive, it refers to a stable boundary layer (most likely with temp. inversion). When BLH is negative, its absolute number refers to an instable mixing layer height (Parcel condition is fulfilled, see section 4.16.5).

A19a: VLT-Files (*.VLT), Channel Voltage File (old version)

Variable Name	Type	# Bytes	Description
CBHCode	int	4	VLT-File Code (=362118746)
N	int	4	Number of recorded samples
IntTimeIndex	int	4	Integration time index (0:1sec, 1:2sec, 2:5 sec, 3:10sec, 4:20sec, 5:30sec, 6:60sec)
DiagSource[0..3]	int	4x4	Type array for the four acquisition channels; 0=disabled, 1=receiver 1 voltage data, 2=receiver 2 voltage data, 3=ambient target temp., 4=env. temp, 5=rec. 1 temp., 6=rec. 2 temp., 7=bar. Pressure, 8=rel. humidity

DataSample1, DiagSource[0]	float	4 or 7x4	Data for sample 1 (7 floats in the case of data type =1/2, one float in all other cases)
DataSample1, DiagSource[1]	float	4 or 7x4	Data for sample 1 (7 floats in the case of data type =1/2, one float in all other cases)
DataSample1, DiagSource[2]	float	4 or 7x4	Data for sample 1 (7 floats in the case of data type =1/2, one float in all other cases)
DataSample1, DiagSource[3]	float	4 or 7x4	Data for sample 1 (7 floats in the case of data type =1/2, one float in all other cases)
Time1	int	4	Time in seconds after measurement start ofr sample N
…	…	…	…
DataSampleN, DiagSource[0]	float	4 or 7x4	Data for sample N (7 floats in the case of data type =1/2, one float in all other cases)
DataSampleN, DiagSource[1]	float	4 or 7x4	Data for sample N (7 floats in the case of data type =1/2, one float in all other cases)
DataSampleN, DiagSource[2]	float	4 or 7x4	Data for sample N (7 floats in the case of data type =1/2, one float in all other cases)
DataSampleN, DiagSource[3]	float	4 or 7x4	Data for sample N (7 floats in the case of data type =1/2, one float in all other cases)
TimeN	int	4	Time in seconds after measurement start of sample N

A19b: VLT-Files (*.VLT), Channel Voltage File (new version)

Variable Name	Type	# Bytes	Description
CBHCode	int	4	VLT-File Code (=362118747)
N	int	4	Number of recorded samples
IntTimeIndex	int	4	Integration time index (0:1sec, 1:2sec, 2:5 sec, 3:10sec, 4:20sec, 5:30sec, 6:60sec)
SlaveRecord	int	4	=0: no Slave radiometer data recorded, =1: Slave radiometer data recorded
R1FAnz	int	4	Receiver 1 number of frequencies
Rec1Freqs[]	float	R1FAnz x4	Receiver 1 frequencies [GHz]
R2FAnz	int	4	Receiver 2 number of frequencies
Rec2Freqs[]	float	R2FAnz x4	Receiver 2 frequencies [GHz]
SlR1FAnz	int	4	If SlaveRecord =1: Slave Receiver 1 number of frequencies
SlRec1Freqs[]	float	SlR1FAnz x4	If SlaveRecord =1: Slave Receiver 1 frequencies [GHz]
SlR2FAnz	int	4	If SlaveRecord =1: Slave Receiver 2 number of frequencies
SlRec2Freqs[]	float	SlR2FAnz x4	If SlaveRecord =1: Slave Receiver 2 frequencies [GHz]

DiagSource[0..3]	int	4x4	Type array for the four acquisition channels; 0=disabled, 1=receiver 1 voltage data, 2=receiver 2 voltage data, 3=ambient target temp., 4=env. temp, 5=rec. 1 temp., 6=rec. 2 temp., 7=bar. Pressure, 8=rel. humidity
DataSample1, DiagSource[0]	float	4 or R1FAnz/R2FAnz x4	Data for sample 1 (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
DataSample1, DiagSource[1]	float	4 or R1FAnz/R2FAnz x4	Data for sample 1 (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
DataSample1, DiagSource[2]	float	4 or R1FAnz/R2FAnz x4	Data for sample 1 (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
DataSample1, DiagSource[3]	float	4 or R1FAnz/R2FAnz x4	Data for sample 1 (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
Time1	int	4	Time in seconds after measurement start ofr sample 1
…	…	…	…
DataSampleN, DiagSource[0]	float	4 or R1FAnz/R2FAnz x4	Data for sample N (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
DataSampleN, DiagSource[1]	float	4 or R1FAnz/R2FAnz x4	Data for sample N (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
DataSampleN, DiagSource[2]	float	4 or R1FAnz/R2FAnz x4	Data for sample N (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
DataSampleN, DiagSource[3]	float	4 or R1FAnz/R2FAnz x4	Data for sample N (R1FAnz/R2FAnz floats in the case of data type =1/2, one float in all other cases)
TimeN	int	4	Time in seconds after measurement start of sample N

A20: HKD-Files (*.HKD), Housekeeping Data File

Variable Name	Type	# Bytes	Description
HKDCode	int	4	HKD-File Code (=837854832)
N	int	4	Number of recorded samples
HKDTimeRef	int	4	Time reference (1: UTC, 0: Local Time)
HKDSelect(1)	int	4	Selects the recorded data groups of this file

T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
Alarm_1[(2)]	char	1	Alarm flag of sample 1 (0: ok, 1: alarm)
Longitude_1[(3)]	float	4	GPS longitude of sample 1 (only if bit 1 of HKDSelect is set to '1')
Latitude_1[(3)]	float	4	GPS latitude of sample 1 (only if bit 1 of HKDSelect is set to '1')
T[0,..,3]_1	float	4x4	Temperatures of sample 1. T[0]=ambient target sensor 1, T[1]=ambient target sensor 2 (if present), T[2]=humidity profiler receiver(1), T[3]=temperaure profiler receiver(2) (only if bit 2 of HKDSelect is set to '1'), unit [K]
Stab[0,1]_1	float	2x4	Temperature stability of receiver 1 and 2 (only if bit 3 of HKDSelect is set to '1'), unit [K]
Flash_1	int	4	Remaining flash memory (only if bit 4 of HKDSelect is set to '1'), unit [MBytes]
Quality_1[(4)]	int	4	Quality flags of sample 1 (only if bit 5 of HKDSelect is set to '1')
Status_1[(5)]	int	4	Status flags of sample 1 (only if bit 5 of HKDSelect is set to '1')
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
Alarm_N[(2)]	char	1	Alarm flag of sample N (0: ok, 1: alarm)
Longitude_N[(3)]	float	4	GPS longitude of sample N (only if bit 1 of HKDSelect is set to '1')
Latitude_N[(3)]	float	4	GPS latitude of sample N (only if bit 1 of HKDSelect is set to '1')
T[0,..,3]_N	float	4x4	Temperatures of sample N. T[0]=ambient target sensor 1, T[1]=ambient target sensor 2 (if present), T[2]=humidity profiler receiver(1), T[3]=temperaure profiler receiver(2) (only if bit 2 of HKDSelect is set to '1'), unit [K]
Stab[0,1]_N	float	2x4	Temperature stability of receiver 1 and 2 (only if bit 3 of HKDSelect is set to '1'), unit [K]
Flash_N	int	4	Remaining flash memory (only if bit 4 of HKDSelect is set to '1'), unit [MBytes]
Quality_N[(4)]	int	4	Quality flags of sample N (only if bit 5 of HKDSelect is set to '1')
Status_N[(5)]	int	4	Status flags of sample N (only if bit 5 of HKDSelect is set to '1')

[(1)] HKDSelect: Only the first byte of this integer value is used for selection of data groups. The meaning of the various bit settings of this byte is the following:

- Bit 1: When this bit is set to '1', the GPS-position (longitude, latitude) is recorded in this file, otherwise not.

- Bit 2: When this bit is set to '1', the temperature data is recorded in this file, otherwise not. Bit 3: When this bit is set to '1', the receiver stability data is recorded in this file, otherwise not.
- Bit 4: When this bit is set to '1', the remaining flash memory is recorded in this file, otherwise not.
- Bit 5: When this bit is set to '1', quality flags are recorded in this file, otherwise not.
- Bit 6: When this bit is set to '1', status flags are recorded in this file, otherwise not.

(2) Alarm: The alarm flag is activated in the following cases:

- interference or failure of a channel that is used in one of the retrievals
- thermal receiver stability not sufficient for measurement
- noise diode failure of one of the receivers
- ambient target thermal sensor not stable

(3) GPS longitude / latitude format: (-)DDDMM.mmmm, longitude is negative: West of 0-meridian, latitude is negative: South of equator. 'DDD' is measured in degrees (0-180 for longitude, 0-90 for latitude), 'MM' is measures in minutes ('), 'mmmm' is the decimal fraction of 'MM'. Example: longitude = -12245.50 means 122°45'30'' West, latitude -3321.25 means 33°21'15'' South.

(4) Quality Flags: This 4 byte unsigned integer is subdivided into 8 groups of 4 bits:

MSB	yyxx	yyxx	yyxx	yyxx	yyxx	yyxx	yyxx	yyxx
LSB	LP	STA	TPB	TPC	HPC	DLY	IWV	LWP

Each group represents the quality flags of a certain level 2 product (retrieved data). The 'xx' bits are coded in the following way:

- 'xx' = 0: this level 2 product is not evaluated for quality control
- 'xx' = 1: highest quality level
- 'xx' = 2: reduced quality
- 'xx' = 3: low quality. This sample should not be used.

The 'yy' bits are coding the possible reasons for reduced or low quality sampling:

- 'yy' = 0: unknown
- 'yy' = 1: possible external interference on a receiver channel or failure of a receiver channel that is used in the retrieval of this product.
- 'yy' = 2: LWP too high. At high rain rates the scattering on rain drops can mask the water vapour line completely and no humidity profiling or IWV determination is possible. Also the temperature profiling may be affected when the oxygen line channels are all saturated due to droplets.
- 'yy' = 3: free for future use.

(5) Status Flags:

- Bit 1-7: status flags for channel 1 to 7 of the humidity profiler receiver. When a bit is set '1', the corresponding channel is ok, otherwise the channel has a malfunction.
- Bit 8: not used
- Bit 9-15: status flags for channel 1 to 7 of the temperature profiler receiver. When a bit is set '1', the corresponding channel is ok, otherwise the channel has a malfunction.
- Bit 16: not used
- Bit 17: rain flag. '1' means raining, '0' = no rain
- Bit 18: dew blower speed status. '1' = high speed mode, '0' = low speed mode
- Bit 19: BL-mode flag. '1' = boundary layer scanning active, '0' = BL-mode not active

- Bit 20: '1' = sky tipping calibration running, '0' = not active
- Bit 21: '1' = gain calibration running (using internal ambient target), '0' = not active
- Bit 22: '1' = noise calibration running, '0' = not active
- Bit 23: '1' = noise diode of humidity profiler ok, '0' = noise diode not working
- Bit 24: '1' = noise diode of temperature profiler ok, '0' = noise diode not working
- Bits 25,26: receiver 1 (humidity profiler) thermal stability. '0' = unknown, not enough data samples recorded yet, '1' = stability ok, '2' = not sufficiently stable
- Bits 27,28: receiver 2 (temperature profiler) thermal stability. '0' = unknown, not enough data samples recorded yet, '1' = stability ok, '2' = not sufficiently stable
- Bit 29: power failure flag. '1' = a power failure has occurred recently. When a new MDF has been started automatically after a power failure, the '1' flag is kept for 1000 seconds and switching back to '0' afterwards. '0' = no power failure occurred.
- Bit 30: ambient target stability: Some radiometers are using two ambient target temperature sensors for monitoring the target's physical temperature. When the temperature readings of these two sensors differ by more than 0.3 K, the flag turns to '1'. '0' = sensors ok.
- Bit 31: noise diode status: '0' = noise diode is turned off for the current sample, '1' = noise diode is turned on for the current sample.

A21: ABSCAL.HIS, Absolute Calibration History File

Variable Name	Type	# Bytes	Description
HISCode	int	4	HIS-File Code (=39583209)
N	int	4	Number of calibration entries
EntryLen1	int	4	Length of entry #1 in bytes
Radiometer-ID1	int	4	1=TEMPRO, 2=HUMPRO, 3=HATPRO, 4=RPG-15-90, 5=LHATPRO, 6=RPG-150-90, 7= RPG-36-90, 8=RPG-LWP, 9=RPG-LWPU90, 10 =RPG-DP150-90, 11=HALO-KV, 12=HALO-183, 13=HALO-119-90
Cal1Type1	int	4	Calibration type receiver 1, entry #1 (0: no calibration, 1: Abs. Cal. With LN, 2:Skydip calibration)
Cal2Type1	int	4	Calibration type receiver 2, entry #1 (0: no calibration, 1: Abs. Cal. With LN, 2:Skydip calibration)
T1_1	int	4	Time of calibration receiver 1 , entry #1 (# of sec. since 1.1.2001)
T2_1	int	4	Time of calibration receiver 2 , entry #1 (# of sec. since 1.1.2001)
ATemp1_1	float	4	Ambient temperature receiver 1, entry #1 [K]
ATemp2_1	float	4	Ambient temperature receiver 2, entry #1 [K]
P1_1	float	4	Barom. pressure receiver 1, entry #1 [mbar]
P2_1	float	4	Barom. pressure receiver 2, entry #1 [mbar]

HLTemp1_1	float	4	Hotload temp. receiver 1, entry #1 [K]
HLTemp2_1	float	4	Hotload temp. receiver 2, entry #1 [K]
CLTemp1_1	float	4	Coldload temp. receiver 1, entry #1 [K]
CLTemp2_1	float	4	Coldload temp. receiver 2, entry #1 [K]
Spare[5]	float	4x5	20 spare bytes, entry #1
NRec1Ch	int	4	Number of receiver 1 channels, entry #1
ChF1[1… NRec1Ch]	float	4x NRec1Ch	Frequencies of receiver 1, entry #1
NRec2Ch	int	4	Number of receiver 2 channels, entry #1
ChF2[1… NRec2Ch]	float	4x NRec2Ch	Frequencies of receiver 2, entry #1
Calibrated1[]	int	4x(NRec1Ch+ NRec2Ch)	Calibration flags for all channels, entry #1 (0=not calibrated, 1=calibrated)
Gain1[]	float	4x(NRec1Ch+ NRec2Ch)	Receiver gains for all channels, entry #1 [V/K]
NoiseT1[]	float	4x(NRec1Ch+ NRec2Ch)	Noise diode temperature for all channels, entry #1 [K]
TSys1[]	float	4x(NRec1Ch+ NRec2Ch)	System noise temperature for all channels, entry #1 [K]
Alpha1[]	float	4x(NRec1Ch+ NRec2Ch)	Non-linearity factors for all channels, entry #1
…	…	…	…
EntryLenN	int	4	Length of entry #N in bytes
Radiometer-IDN	int	4	1=TEMPRO, 2=HUMPRO, 3=HATPRO, 4=RPG-15-90, 5=LHATPRO, 6=RPG-150-90, 7= RPG-36-90, 8=RPG-LWP, 9=RPG-LWPU90, 10 =RPG-DP150-90, 11=HALO-KV, 12=HALO-183, 13=HALO-119-90
Cal1TypeN	int	4	Calibration type receiver 1, entry #N (0: no calibration, 1: Abs. Cal. With LN, 2:Skydip calibration)
Cal2TypeN	int	4	Calibration type receiver 2, entry #N (0: no calibration, 1: Abs. Cal. With LN, 2:Skydip calibration)
T1_N	int	4	Time of calibration receiver 1 , entry #N (# of sec. since 1.1.2001)
T2_N	int	4	Time of calibration receiver 2 , entry #N (# of sec. since 1.1.2001)
ATemp1_N	float	4	Ambient temperature receiver 1, entry #N [K]
ATemp2_N	float	4	Ambient temperature receiver 2, entry #N [K]
P1_N	float	4	Barom. pressure receiver 1, entry #N [mbar]

P2_N	float	4	Barom. pressure receiver 2, entry #N [mbar]
HLTemp1_N	float	4	Hotload temp. receiver 1, entry #N [K]
HLTemp2_N	float	4	Hotload temp. receiver 2, entry #N [K]
CLTemp1_N	float	4	Coldload temp. receiver 1, entry #N [K]
CLTemp2_N	float	4	Coldload temp. receiver 2, entry #N [K]
Spare[5]	float	4x5	20 spare bytes, entry #N
NRec1Ch	int	4	Number of receiver 1 channels, entry #N
ChF1[1… NRec1Ch]	float	4x NRec1Ch	Frequencies of receiver 1, entry #N
NRec2Ch	int	4	Number of receiver 2 channels, entry #N
ChF2[1… NRec2Ch]	float	4x NRec2Ch	Frequencies of receiver 2, entry #N
Calibrated1[]	int	4x(NRec1Ch+ NRec2Ch)	Calibration flags for all channels, entry #N (0=not calibrated, 1=calibrated)
GainN[]	float	4x(NRec1Ch+ NRec2Ch)	Receiver gains for all channels, entry #N [V/K]
NoiseTN[]	float	4x(NRec1Ch+ NRec2Ch)	Noise diode temperature for all channels, entry #N [K]
TSysN[]	float	4x(NRec1Ch+ NRec2Ch)	System noise temperature for all channels, entry #N [K]
AlphaN[]	float	4x(NRec1Ch+ NRec2Ch)	Non-linearity factors for all channels, entry #N

A22a: LV0-Files (*.LV0), Level Zero (Detector Voltages) Files (old)

Variable Name	Type	# Bytes	Description
LV0Code	int	4	LV0-File Code (=111111)
N	int	4	Number of samples
MasterID(1)	int	4	ID number of Master Radiometer
SlaveID(1)	int	4	ID number of Slave Radiometer
TimeRef	int	4	Time Reference (0=Local, 1=UTC)
FreqNo	int	4	Number of Frequencies
Freqs[]	float	4*FreqNo	Frequencies [GHz]
Longitude	float	4	GPS longitude (refer to FN (3), HKD-files)
Latitude	float	4	GPS latitude (refer to FN (3), HKD-files)
Alpha[](2)	float	4*FreqNo	Alpha calibration parameters
DelT[](3)	float	4*FreqNo	DelT calibration Parameters [K]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
Ud_1[]	float	4*FreqNo	Detector Voltages [V] of sample 1
Elevation_1	float	4	Elevation Angle [°] of sample 1

Azimuth_1	float	4	Azimuth Angle [°] of sample 1
MaTambient_1	float	4	Black Body Temperature [K] of Master radiometer, sample 1
MaDigFlags_1	int	4	Digital Flags of Master radiometer, sample 1, refer to FN (5) of HKD-files
SlTambient_1	float	4	Black Body Temperature [K] of Slave radiometer, sample 1 (only if SlaveID ≠ 0)
SlDigFlags_1	int	4	Digital Flags of Slave radiometer, sample 1, refer to FN (5) of HKD-files (only if SlaveID ≠ 0)
G_1[]	float	4*FreqNo	Gain calibration parameters [V/K], sample 1
Tsys_1[]	float	4*FreqNo	System Noise Temperature calibration parameters Tsys [K], sample 1
Tn_1[]	float	4*FreqNo	Noise Diode Temperature calibration parameters Tn [K], sample 1
Tenv_1	float	4	Environmental Temperature [K] of sample 1
P_1	float	4	Barometric Pressure [mbar] of sample 1
RH_1	float	4	Relative Humidity [%] of sample 1
IRT_1	float	4	Infrared Radiometer Temperature [°C] of sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
Ud_N[]	float	4*FreqNo	Detector Voltages [V] of sample N
Elevation_N	float	4	Elevation Angle [°] of sample N
Azimuth_N	float	4	Azimuth Angle [°] of sample N
MaTambient_N	float	4	Black Body Temperature [K] of Master radiometer, sample N
MaDigFlags_N	int	4	Digital Flags of Master radiometer, sample N, refer to FN (5) of HKD-files
SlTambient_N	float	4	Black Body Temperature [K] of Slave radiometer, sample N (only if SlaveID ≠ 0)
SlDigFlags_N	int	4	Digital Flags of Slave radiometer, sample N, refer to FN (5) of HKD-files (only if SlaveID ≠ 0)
G_N[]	float	4*FreqNo	Gain calibration parameters [V/K], sample N
Tsys_N[]	float	4*FreqNo	System Noise Temperature calibration parameters Tsys [K], sample N
Tn_N[]	float	4*FreqNo	Noise Diode Temperature calibration parameters Tn [K], sample N
Tenv_N	float	4	Environmental Temperature [K] of sample N
P_N	float	4	Barometric Pressure [mbar] of sample N
RH_N	float	4	Relative Humidity [%] of sample N
IRT_N	float	4	Infrared Radiometer Temperature [°C] of sample N

A22b: LV0-Files (*.LV0), Level Zero (Detector Voltages) Files (new)

Variable Name	Type	# Bytes	Description
LV0Code	int	4	LV0-File Code (=111112)
N	int	4	Number of samples
MasterID(1)	int	4	ID number of Master Radiometer
SlaveID(1)	int	4	ID number of Slave Radiometer
TimeRef	int	4	Time Reference (0=Local, 1=UTC)
FreqNo	int	4	Number of Frequencies
Freqs[]	float	4*FreqNo	Frequencies [GHz]
IRFreqNo	int	4	Number of IRRs
IRRWLs[]	float	4*IRFreqNo	IRR wavelengths [µm]
Longitude	float	4	GPS longitude (refer to FN (3), HKD-files)
Latitude	float	4	GPS latitude (refer to FN (3), HKD-files)
Alpha[](2)	float	4*FreqNo	Alpha calibration parameters
DelT[](3)	float	4*FreqNo	DelT calibration Parameters [K]
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
Ud_1[]	float	4*FreqNo	Detector Voltages [V] of sample 1
Elevation_1	float	4	Elevation Angle [°] of sample 1
Azimuth_1	float	4	Azimuth Angle [°] of sample 1
MaTambient_1	float	4	Black Body Temperature [K] of Master radiometer, sample 1
MaDigFlags_1	int	4	Digital Flags of Master radiometer, sample 1, refer to FN (5) of HKD-files
SlTambient_1	float	4	Black Body Temperature [K] of Slave radiometer, sample 1 (only if SlaveID ≠ 0)
SlDigFlags_1	int	4	Digital Flags of Slave radiometer, sample 1, refer to FN (5) of HKD-files (only if SlaveID ≠ 0)
G_1[]	float	4*FreqNo	Gain calibration parameters [V/K], sample 1
Tsys_1[]	float	4*FreqNo	System Noise Temperature calibration parameters Tsys [K], sample 1
Tn_1[]	float	4*FreqNo	Noise Diode Temperature calibration parameters Tn [K], sample 1
Tenv_1	float	4	Environmental Temperature [K] of sample 1
P_1	float	4	Barometric Pressure [mbar] of sample 1
RH_1	float	4	Relative Humidity [%] of sample 1
IRT[]_1	float	4*IRFreqNo	Infrared Radiometer Temperatures [°C] of sample 1
…	…	…	…
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
Ud_N[]	float	4*FreqNo	Detector Voltages [V] of sample N
Elevation_N	float	4	Elevation Angle [°] of sample N

Azimuth_N	float	4	Azimuth Angle [°] of sample N
MaTambient_N	float	4	Black Body Temperature [K] of Master radiometer, sample N
MaDigFlags_N	int	4	Digital Flags of Master radiometer, sample N, refer to FN (5) of HKD-files
SlTambient_N	float	4	Black Body Temperature [K] of Slave radiometer, sample N (only if SlaveID ≠ 0)
SlDigFlags_N	int	4	Digital Flags of Slave radiometer, sample N, refer to FN (5) of HKD-files (only if SlaveID ≠ 0)
G_N[]	float	4*FreqNo	Gain calibration parameters [V/K], sample N
Tsys_N[]	float	4*FreqNo	System Noise Temperature calibration parameters Tsys [K], sample N
Tn_N[]	float	4*FreqNo	Noise Diode Temperature calibration parameters Tn [K], sample N
Tenv_N	float	4	Environmental Temperature [K] of sample N
P_N	float	4	Barometric Pressure [mbar] of sample N
RH_N	float	4	Relative Humidity [%] of sample N
IRT[]_N	float	4*IRFreqNo	Infrared Radiometer Temperatures [°C] of sample N

(1) ID number coding: 0=no rad., 1=RPG-TEMPRO, 2=RPG-HUMPRO, 3=RPG-HATPRO, 4=RPG-15-90, 5=RPR-LHUMPRO, 6=RPG-150-90, 7=RPG-36-90 8=RPG-DP150-90

(2) Alpha Parameter: Non-Linearity Parameter for radiometer which are not operated in Full-Dicke Switching mode (Dicke Switching + Noise Switching) like RPG-TEMPRO, RPG-HUMPRO, RPG-HATPRO, RPG-LHUMPRO, RPG-3690, RPG-DP150-90
Dicke Switch Leakage for radiometers that are operated in Full-Dicke Switching mode (Dicke Switching + Noise Switching) like RPG-150-90, RPG-15-90 and RPG-HATPRO-U

(3) DelT Parameter: Difference between radiometric (T_{DSr}) and physical (T_{DSp}) Dicke Switch temperature: DelT = T_{DSr} - T_{DSp}, only relevant for Full Dicke Switching radiometers

Notes on Calibrations

Relation between detector voltages U_d and scene temperatures T_{sc} :

$U_d = G\,(T_{sys} + T_{sc})^{Alpha}$, for radiometers without Full Dicke Switching Mode (Type 1) $U_d = G\,(T_{sys} + T_{sc})$, for radiometers with Full Dicke Switching Mode (Type 2)

System Noise Temperature T_{sys} , Noise Diode Temp. T_N and Gain G:

Absolute Calibrations (Hot / Cold): detector voltages on black body target (temperature $T_H = T_{amb}$): U_H , cold target (LN or Skydip, temperature T_C): U_C :

$Y = (U_H / U_C)^{1/Alpha}$, $T_{sys} = (T_H - Y * T_C)/(Y - 1)$, $0.95 < Alpha <= 1$ (sec. 4.1.3.1), Type 1
$Y = (U_H / U_C)$, $T_{sys} = (T_H - Y * T_C)/(Y - 1)$, Type 2
$G = U_H / (T_{sys} + T_H)^{Alpha}$, Type 1
$G = U_H / (T_{sys} + T_H)$, Type 2
On black body target (T_{amb}), noise diode turned off: U_{-N} , noise diode turned on: U_{+N}
$T_N = (U_{+N} / G)^{1/Alpha} - T_{sys} - T_{amb}$, Type 1
$T_N = (U_{+N} - U_{-N}) / G$, Type 2
Type 2 only: Dicke Switch (DS) ON, radiometer pointing to amb. temp. target:
$DelT = U_{DS} / G - T_{sys} - T_{DSp}$,
Dicke Switch (DS) leakage (Type 2 only): DS ON, radiometer pointing to cold target: Alpha $= (T_{DSp} + DelT - (U_{DS} / G - T_{sys})) / (T_{DSp} + DelT - T_C)$

If a liquid nitrogen cooled target is used, the following correction has to be applied:

$$\ln\left(\frac{p}{1013.25 \cdot \text{mbar}}\right) = \frac{DH}{R}\left(\frac{1}{77.35K} - \frac{1}{T_C}\right) \quad , \quad \text{Clausius - Clapeyron}$$

$T_0 = 77.36$ K is the boiling temperature at 1013.25 hPa, ΔH is the latent heat of liquid nitrogen and R is the universal gas constant.

Continuous full calibration on scene (Type 2 only): Noise Diode turned off: U_{-N} , noise diode turned on: U_{+N} , radiometers looking on scene temperature T_{sc}, Dicke switch turned ON (blocking scene), physical Dicke switch temperature T_{DSp}:

$G = (U_{+N} - U_{-N}) / T_N$, $T_{sys} = U_{-N} / G - (T_{DSp} + DelT - Alpha * (T_{DSp} - T_{sc}))$, Alpha= DS leakage (determined in absolute calibration)

Continuous noise switching on scene (Type 1 only): noise diode turned off: U_{-N} , noise diode turned on: U_{+N} (10 Hz), radiometers pointing to scene (temperature T_{sc}):

$D = (U_{+N} / U_{-N})^{1/Alpha} - 1$, $T_{sc} = (T_N - D * T_{sys}) / D$, $G = U_{-N} / (T_{sys} + T_{sc})^{Alpha}$
Calibration on ambient temp. black body target (T_{amb}): $T_{sys} = (U_d / G)^{1/Alpha} - T_{amb}$
Type 1, no noise switching:

gain calibration on ambient temp. target (T_{amb}): $G = U_d / (T_{sys} + T_{amb})^{Alpha}$ noise calibration on ambient temp. target (T_{amb}):
$D = (U_{+N} / U_{-N})^{1/Alpha} - 1$, $T_{sys} = (T_N - D * T_{amb}) / D$, $G = U_{-N} / (T_{sys} + T_{amb})^{Alpha}$

Important general note:
Be aware that at low brightness temperatures Tb <10 K and high frequencies >50 GHz you have to apply the Planck transformation, NOT the Rayleigh-Jeans approximation. The detector voltage is in general proportional to the received power but not to a brightness temperature as assumed by the Rayleigh-Jeans approximation. Therefore a Tbr calculated by Rayleigh-Jeans (the formalism used above) has to be converted to a Planck Tbp brightness temperature by the following formula:

$$T_{BP} = \frac{Ff}{\ln\left(\frac{Ff}{T_{BR}} + 1\right)} \quad , \quad \text{with} \quad Ff = f[Hz] \cdot \frac{h}{k_B}$$

A23: TRK-Files (*.TRK), Satellite Tracking File

Variable Name	Type	# Bytes	Description
TRKCode	int	4	TRK-File Code (=683403)
N	int	4	Number of recorded samples
FreqAnz	int	4	# of recorded frequencies (ATN)
Freq[]	float	4 x FreqAnz	Frequencies [GHz], ATN
SatType_1	char	1	Satellite type, e.g. “G” for GPS-Sat., sample 1
SatNo_1	char	1	Satellite number, sample 1
RF_1	char	1	Rainflag of sample 1 (0: no rain, 1: rain)
T_1	int	4	Time of sample 1 (# of sec. since 1.1.2001)
EL-ANG_1	float	4	Elevation angle of sample 1 (DEG)
AZ-ANG_1	float	4	Azimuth angle of sample 1 (DEG)
WET_DLY_1	float	4	Wet Delay of sample 1 (mm)
LWP_1	float	4	LWP of sample 1 (g/m^2)
ATN[]_1	float	4 x FreqAnz	Attenuations [dB] of sample 1
…	…	…	…
SatType_N	char	1	Satellite type, e.g. “G” for GPS-Sat., sample N
SatNo_N	char	1	Satellite number, sample N
RF_N	char	1	Rainflag of sample N (0: no rain, 1: rain)
T_N	int	4	Time of sample N (# of sec. since 1.1.2001)
EL-ANG_N	float	4	Elevation angle of sample N (DEG)
AZ-ANG_N	float	4	Azimuth angle of sample N (DEG)
WET_DLY_N	float	4	Wet Delay of sample N (mm)
LWP_N	float	4	LWP of sample N (g/m^2)
ATN[]_N	float	4 x FreqAnz	Attenuations [dB] of sample N

A24: BUFR (Version 3.0) File Format

The H-PC software is capable of data file transformations from binary (Appendix A1-A20) to ASCII (see Appendix B), netCDF and BUFR. While netCDF is a real self-explaining format (and therefore does not require any further information for decoding), BUFR is a descriptor

table based format which requires the definition of local descriptors (user defined) in the case that certain data items in the file are not listed in the WMO Table B.
The local descriptors used in the H-PC software version are listed in Table A21.1. In order to fulfil the BUFR regulations, these special descriptors are preceded by the data description operator 2 06 YYY, where YYY is the length of the local described data element in bits. E.g. the section 3 entry of a BUFR message for an atmospheric attenuation sample (refer to table A21.1), which is represented by a local descriptor, would be 2 06 016 0 21 193 (or in hex: 86 10 15 C1). The 2 06 016 operator allows a BUFR decoder software, which has no access to the information in Table A21.1, to skip the sample in the data section 4, because the operator contains its length of 16 bits.

F	X	Y	Name	Unit	Scale	Reference	Data Width [Bits]
0	14	192	IR radiometer wavelength	m	7	0	8
0	14	193	microwave frequency	Hz	-7	0	16
0	21	192	cloud liquid content	kg/m^3	6	0	16
0	21	193	atmospheric attenuation	dB	2	-10000	16

Table A24.1: Host software local descriptors.

The H-PC software changes the data width of all WMO Table B entries, which are not compatible with an integer number of a full byte (8 or 16 bits). E.g. the data width of the 'MWR water vapour content' (this is the IWV) 0 13 096 from 14 bits (Table B) to 16 bits. This is more efficient for programming and decoding of the data segment. Nowadays, extreme bit saving is not an issue anymore and additional bits, even if not used, can improve the readability of the data segment significantly.

All data files contain a 32 character 'Station Name' as the first entry in the data section 4 (descriptor 0 01 19). This name is taken from the 'Station Name' entry of the Define Local Settings menu (see section 5.18). Also the time reference is defined in all files (descriptors 0 08 025 0 26 003).
Each data item (single value or profile) is preceded by a date / time and rain flag (RF). This block of information is defined by the following descriptors:

0 04 001	Year (12 bit)
0 04 002	Month (4 bits)
2 01 127 0 04 003 2 01 000	Day (reduced from 6 to 5 bits)
0 04 004	Hour (5 bits)
0 04 005	Minutes (6 bits)
0 04 006	Seconds (6 bits)
0 20 029	Rain Flag (2 bits code table)

This sums up to a total of 40 bits = 5 bytes.

The general rule is that all data lists of single parameters (like frequency lists, altitude lists, temperature profile, humidity profile, etc.) are coded by simple replication descriptors, e.g.:

1 01 xxx 0 10 002 :	a list of xxx altitudes (e.g. in profile BUFR files)
1 01 xxx 0 12 101 :	a list of xxx dry-bulb temperatures (a temp. profile)
1 02 xxx 2 06 016 0 21 192	a list of xxx atmospheric attenuations (local descriptor)
1 03 xxx 2 01 129 0 13 003 2 01 000	a list of xxx rel. humidity values (data width extended from 7 to 8 bits)

For the replication of blocks of parameters in the data section 4, the 'Delayed Replication' mechanism is used:
Example of an absolute humidity data set replication:

1 15 000 0 31 002	delayed replication of 15 descriptors (16 bit replication factor in data section)
0 04 001	Year (12 bit)
0 04 002	Month (4 bits)
2 01 127 0 04 003 2 01 000	Day (reduced from 6 to 5 bits)
0 04 004	Hour (5 bits)
0 04 005	Minutes (6 bits)
0 04 006	Seconds (6 bits)
20 029	Rain Flag (2 bits code table)
05 039	39 replications of the next 5 descriptors
01 137	data width extended by 9 bits (from 7 to 16)
2 02 130	scale extended by 2 bits (from 3 to 5)
0 13 005	vapour density in kg/m^3
2 02 000 2 01 000	back to Table B settings

This delayed replication (16 bit number given in section 4) is representing the collection of data samples in the file. The 'Number of Data Subsets' in bytes 5-7 of section 3 is not used for this replication (and therefore set to 1), because this would replicate ALL descriptors of the section and not only a part of it. But the data file structure required here consists of a data header (e.g. station name, time reference, list of altitudes in a profile) which should not be repeated, followed by a repeated (the number of samples) block of descriptors defining each data sample (e.g. time, RF, profile of water vapour density (list), observation angles). In all profile BUFR messages, the sequence of items in the altitude list corresponds to the sequence of items in the repeated data list. E.g. in the example above, the HPC.BUF file has a list of altitudes in the data header and repeated lists of water vapour densitiy. The first altitude in the header list refers to the first vapour density data item in the repeated list. The altitude layers are constant throughout the whole data set and do not have to be repeated for each sample. This is why they are stored in the data header of section 4.

For more details about the coding of BUFR messages, please refer to WMO's FM 94 BUFR 'Guide to WMO Table Driven Code Forms', available from the WMO website's download area.

A25: Measurement Definition Files (*.MDF)

Variable Name	Type	# Bytes	Description

MDFVers	int	4	Required MDF version x 100 (e.g. 900)
RadModel	int	4	Radiometer model 0: no radiometer 1: RPG_TEMPRO 2: RPG_HUMPRO 3: RPG_HATPRO 4: RPG_15U90 5: RPG_LHATPRO 6: RPG_150U90 7: RPG_36U90 8: RPG_LWP 9: RPG_LWP_U90 10: RPG_DP150U90 11: RPG_HALO_KV 12: RPG_HALO_183 13: RPG_HALO_119_90 14: RPG_TIP_225 15: RPG_TIP_225_340 16: RPG_LWP_U72_82 17: RPG_LWP_TEMPRO 18: RPG_LHUMPRO 19: RPG_LHUM_225_340 20: RPG_TDCS 21: RPG_LHUM_243_340 22: RPG_HUMPRO_72_82 2
Reserved	int	4	-----------------------------------
EnaLWP	int	4	LWP product enable: 0: off 3: on
EnaIWV	int	4	IWV product enable: 0: off 3: on
EnaATN	int	4	ATN product enable: 0: off 3: on
EnaHKD	int	4	HKD product enable: 0: off 0x1000003F: on
EnaSPC	int	4	SPC product enable: 0: off 3: on
EnaDLY	int	4	DLY product enable: 0: off 3: on
EnaHPC	int	4	HPC product enable:

			0: off 3: on
EnaTPC	int	4	TPC product enable: 0: off 3: on
EnaTPB	int	4	TPB product enable: 0: off 3: main quadrant 4: 2^{nd} quadrant 5: bilat. Average 6: two bilateral
EnaMET	int	4	MET product enable: 0: off 3: on
EnaIRT	int	4	IRT product enable: 0: off 3: on
EnaBLB	int	4	BLB product enable: 0: off 3: main quadrant 4: 2^{nd} quadrant 5: bilat. Average 6: two bilateral
EnaBRT	int	4	BRT product enable: 0: off 3: on
TrigFlg	int	4	Meas. trigger flag: 0: immediately 1: ignore date 2: ignore hour >2: raster period [sec]
FrameRepTrig	int	4	Frame repetition trigger: 0: off 1: on
RepTrigPer	int	4	Repetition trigger period [sec]
If EnaLWP = 3			
LWPRetFnLen	int	4	LWP retrieval filename (full path) length (null term. String)
LWPRetStr[ ]	char	LWPRetFnLen	Null terminated LWP retrieval filename (full path)
If EnaIWV = 3			
IWVRetFnLen	int	4	IWV retrieval filename (full path) length (null term. String)
IWVRetStr[ ]	char	IWVRetFnLen	Null terminated IWV retrieval filename (full path)

If EnaDLY = 3			
DLYRetFnLen	int	4	DLY retrieval filename (full path) length (null term. String)
DLYRetStr[ ]	char	DLYRetFnLen	Null terminated DLY retrieval filename (full path)
If EnaATN = 3			
ATNRetFnLen	int	4	ATN retrieval filename (full path) length (null term. String)
ATNRetStr[ ]	char	ATNRetFnLen	Null terminated ATN retrieval filename (full path)
If EnaSPC = 3			
SPCRetFnLen	int	4	SPC retrieval filename (full path) length (null term. String)
SPCRetStr[ ]	char	SPCRetFnLen	Null terminated SPC retrieval filename (full path)
If EnaHPC = 3			
HPCRetFnLen	int	4	HPC retrieval filename (full path) length (null term. String)
HPCRetStr[ ]	char	HPCRetFnLen	Null terminated HPC retrieval filename (full path)
If EnaTPC = 3			
TPCRetFnLen	int	4	TPC retrieval filename (full path) length (null term. String)
TPCRetStr[ ]	char	TPCRetFnLen	Null terminated TPC retrieval filename (full path)
If EnaTPB >= 3			
TPBRetFnLen	int	4	TPB retrieval filename (full path) length (null term. String)
TPBRetStr[ ]	char	TPBRetFnLen	Null terminated TPB retrieval filename (full path)
PrefNmLen	int	4	Prefix name length (null term. string)
PrefNm	char	PrefNmLen	Null terminated prefix name
If EnaLWP = 3			
LWPIntTime	int	4	LWP integration time [sec]
If EnaIWV = 3			
IWVIntTime	int	4	IWV integration time [sec]
If EnaDLY = 3			
DLYIntTime	int	4	DLY integration time [sec]
If EnaATN = 3			
ATNIntTime	int	4	ATN integration time [sec]
If EnaHKD = 0x1000003F			
HKDIntTime	int	4	HKD integration time [sec]

If EnaSPC = 3			
SPCIntTime	int	4	SPC integration time [sec]
If EnaHPC = 3			
HPCIntTime	int	4	HPC integration time [sec]
If EnaTPC = 3			
TPCIntTime	int	4	TPC integration time [sec]
If EnaTPB >= 3			
TPBIntTime	int	4	TPB integration time [sec]
If EnaMET = 3			
METIntTime	int	4	MET integration time [sec]
If EnaIRT= 3			
IRTIntTime	int	4	IRT integration time [sec]
If EnaBLB >= 3			
BLBIntTime	int	4	BLB integration time [sec]
If EnaBRT= 3			
BRTIntTime	int	4	BRT integration time [sec]
Reserved	int	4	=1
MeasStart	int	4	Measurement start: 0: immediately 1: triggered
If MeasStart = 1 (triggered)			
StartTime(1)	int	4	Trigger mode start time [s]
Reserved	int	4	=0
RapSampFac	int	4	Rapid sampling factor (1,2,4)
MeasType	int	4	Measurement Mode: 0: LIMITED 1: UNLIMITED
If MeasType = 0 (LIMITED)			
StopDur	int	4	Stop by duration flag: 0: stop by duration 1: stop by time/date
If StopDur = 0 (stop by duration)			
DurTime	int	4	MDF duration [s]
If StopDur = 1 (stop by duration)			
StopTime(1)	int	4	MDF stop time [s]
If MeasType = 1 (UNLIMITED)			
Reserved	int	4	=0

Reserved	int	4	=0
FileBackup	int	4	File backup flag: 0: no backup, Host handshake 1: backup, Host handshake 2: backup, run without Host 3: backup, Host handshake
PrefNmLen	int	4	Prefix name length (null term. string)
PrefNm	char	PrefNmLen	Null terminated prefix name
ScanType	int	4	Scanning type: 0: constant angle 1: general scan 2: satellite tracking 3: astro tracking 4: file tracking
If ScanType = 0 (constant angle)			
ElAz(2)	int	4	Combined elev / azim. angle
If ScanType = 1 (general scan)			
ScanCnt	int	4	Number of scans
ScanStartEl[ ]	float	4 x ScanCnt	Start elevation angles [DEG]
ScanStoptEl[ ]	float	4 x ScanCnt	Stop elevation angles [DEG]
ScanIncEl[ ]	float	4 x ScanCnt	elevation increment angles [DEG]
ScanStartAz[ ]	float	4 x ScanCnt	Start azimuth angles [DEG]
ScanStoptAz[ ]	float	4 x ScanCnt	Stop azimuth angles [DEG]
ScanIncAz[ ]	float	4 x ScanCnt	azimuth increment angles [DEG]
ScanSamp[ ]	int	4 x ScanCnt	Number of samples / scan point
FrameCnt	int	4	Number of frame entries
FrameStartScn[ ]	int	4 x FrameCnt	Frame start scan number
FrameStopScn[ ]	int	4 x FrameCnt	Frame stop scan number
FrameRep[ ]	int	4 x FrameCnt	Frame repetition number
If ScanType = 2 (satellite tracking)			
TrackPer	int	4	Tracking period [s]
FirstTrk	int	4	0: first track rel. to 00:00:00 1: first track at MDF start
SatNo	int	4	No. of satellite to scan (single sat. scan)
TrackType	int	4	0: single satellite tracking 1: track all visible satellites
LowEl	float	4	Lowest tracking elevation [DEG]
LowAz	float	4	Lowest tracking azimuth [DEG]
HighAz	float	4	Highest tracking azimuth [DEG]

RadAlt	float	4	Radiometer altitude [m]
NavSrc	int	4	Navigation source: 0: GPS clock sat. vectors 1: navigation file (RINEX)
If ScanType = 3 (astro tracking)			
LowElStart	float	4	Low elev. start angle [DEG]
LowElStop	float	4	Low elev. stop angle [DEG]
CalInt	int	4	Calibration interval [s]
TrigStartEl	int	4	0: not triggered by elev. start
TrigStopEl	int	4	0: not triggered by elev. stop
TrkObject	int	4	Astro tracking object: 0: sun 1: moon 2: Mercury 3: Venus 4: Mars 5: Jupiter 6: Saturn 7: Uranus 8: Neptune 9: Fixed star
RA	float	4	Fixed star right ascension [DEG]
DECL	float	4	Fixed star declination [DEG]
OffsAng	float	4	ON/OFF switching offset [DEG]
OnOffEna	int	4	0: ON/OFF switching disabled 1: ON/OFF switching enabled
1PCalEna	int	4	0: 1P calibration disabled 1: 1P calibration enabled
If 1PCalEna = 1 (1P calibration enabled)			
1PCalPer	float	4	1P calibr. period: 0: 1 min 1: 2 min 2: 3 min 3: 5 min 4: 10 min 5: 15 min 6: 20 min 7: 30 min 8: 60 min 9: 120 min 0: 240 min 11: 360 min 12: 720 min

First1PCal	int	4	0: first cal. rel. to 00:00:00 1: first cal at MDF start
1PIntTime	float	4	1P calibr. integration time: 0: 1 sec 1: 2 sec 2: 3 sec 3: 4 sec 4: 5 sec 5: 8 sec 6: 10 sec 7: 15 sec 8: 20 sec 9: 25 sec 0: 30 sec 11: 40 sec 12: 50 sec 13: 60 sec
2PCalEna	int	4	0: 2P calibration disabled 1: 2P calibration enabled
If 2PCalEna = 1 (2P calibration enabled)			
2PCalPer	float	4	2P calibr. period: 0: 1 min 1: 2 min 2: 5 min 3: 10 min 4: 20 min 5: 30 min 6: 60 min 7: 120 min 8: 240 min 9: 360 min 10: 600 min
First2PCal	int	4	0: first cal. rel. to 00:00:00 1: first cal at MDF start
Reserved	int	4	=0
Rec1Ena	int	4	Receiver 1 enabled for 2P cal.
Rec2Ena	int	4	Receiver 2 enabled for 2P cal.
SkdEna	int	4	0: SKD calibration disabled 1: SKD calibration enabled
SkdRec1	int	4	0: Rec1 calibration disabled 1: Rec1 calibration enabled
SkdRec2	int	4	0: Rec2 calibration disabled 1: Rec2 calibration enabled

SkdAngCnt	int	4	Number of SKD angles
SkdAng[ ]	float	4 x SkdAngCnt	Array of scan angles
SkdAzi	float	4	SKD azimuth angle
SkdPer	int	4	SKD period: 0: 5 min 1: 10 min 2: 20 min 3: 30 min 4: 1 h 5: 2 h 6: 6 h 7: 12 h 8: 24 h
SkdStart	float	4	SKD first cal period: 0: relative to MDF start 1: relative to 00:00:00
Skd1stCal	float	4	SKD first cal start: 0: first cal at MDF start disabled 1: first cal at MDF start enabled
SkdBiLat	float	4	SKD bilateral tipping: 0: off 1: on
Reserved	byte	32	
SKDChi2	int	4	Chi^2 threshold: 0: on 1: off
LinCorr	int	4	Lin. correlation threshold: 0: on 1: off
StopTrig	int	4	MDF stop trigger: 1: ignore date 2: ignore hour >2: raster period [s]
Reserved	byte	8	
TPBLPer	int	4	BL period [s]
BLStart	int	4	0: BL scan relative to MDF start 1: BL scan rel. to 00:00:00
TmrOver	int	4	0: no Tmr overwrite 3: Tmr overwrite enabled
If TmrOver = 3 (Tmr overwrite enabled)			
TmrFnLen	int	4	Tmr retrieval name length (null term. string)
TmrFn	char	TmrFnLen	Null terminated Tmr retrieval name

LV0Flag	int	4	0: LV0 processing disabled 1: LV0 enabled
If SkdEna = 1 (Skydip enabled)			
Chi2Thresh	float	4	Chi^2 threshold
LinCorrThresh	float	4	Lin. Correlation threshold
Const IRRAng	float	4	Constant IRR scan angle [DEG]
IRRCoupling	int	4	0: no IRR coupling 1: IRR coupling enabled
AdjHPC	int	4	0: HPC not adjusted to IWV 1: HPC adjusted to IWV
Reserved	byte	8	
SKDRainContr	int	4	0: SKD also during rain 1: SKD omitted during rain
Reserved	byte	4	
SKDDayT	int	4	0: SKD also during daytime 1: SKD omitted during daytime

(1) Number of seconds since 1.1.2001, 00:00:00
(2) Angles are coded in the following way: first 5 decimal digits is azimuth * 100, last 5 decimal digits is elevation * 100, sign of ANG is sign of elevation.
Example 1: elevation = 145.30°, azimuth = 310.45° ➔ ANG is 1453031045
Example 2: elevation = -90.00°, azimuth = 12.32 ➔ ANG is -900001232

A26. Measurement Batch Files (*.MBF)

Variable Name	Type	# Bytes	Description
File Code	int	4	File ID (=23988557)
EntryCnt	int	4	Number of entries (MDFs)
Loop over EntryCnt MDFs (index n)			
MDFFnLen[n]	int	4	Length of null terminated MDF string (full path)
MDFFn[n][ ]	char	MDFFnLen [n]	null terminated MDF string (full path)
MDFLen[n]	int	4	Length of null terminated MDF string
MDF[n][ ]	char	MDFLen [n]	null terminated MDF string
BatRep	int	4	Batch repetition factor