

## **Data Format Documentation**

Instrument: Micro rain radar 2<sup>nd</sup> generation (MRR2), GCPEX Field Campaign

### **Overview:**

At each of the five GCPEX ground instrumentation sites a vertically pointing MRR2 was located nearby the disdrometers, precipitation gauges and other ambient weather sensors. This dataset only contains that collected by the NASA MRR2 instruments, which were located at the sites referred to as Huronia, CARE and SteamShow. The NASA MRR2 deployed at Huronia experienced a component failure soon after deployment, and thus no useable MRR2 data was collected at this site during the campaign.

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### **Data Organization:**

The MRR2 data set is contained within daily compressed (via gzip) tar archives. The daily archive is named with the following convention,

mrr\_gcpeX\_\_[site]\_[latitude\_longitude]\_[date].tar.gz

where [site] = site name (e.g., CARE)  
[latitude\_longitude]=geographic location of instrument  
(e.g., N363442.07\_W0972640.90 is North 36°34'42.07" and West 97°26'40.90")  
[date] = YYYYmmDD (e.g., 20110422)

and consists of ASCII formatted files containing measurements of the received spectral power and parameters derived from the measurements.

The following files are contained within the tar archive:

- \*.raw: (i.e., raw data or raw spectrum) raw mean spectral power received by the radar over 10 seconds for each height step
- \*.pro: (i.e., processed or instantaneous data) spectral reflectivity corrected for noise and attenuation, drop size distribution, spectral drop density, fall velocity, attenuation, radar reflectivity, and integral rainfall parameters (e.g., rain rate, liquid water content) derived from one raw spectrum (methods described in Peters et al. 2005 and Peters et al. 2010)
- \*.ave: (i.e., averaged data) contains the same parameters as the processed data derived except from multiple raw spectra integrated over 60 seconds

**File Format:**

Format of each file in MRR data set:

Level 0: raw spectrum data (\*.raw)

Format: ASCII

Format of each line:

*SEE APPENDIX*

Level 1: processed or instantaneous data (\*.pro)

Format: ASCII

Format of each line:

*SEE APPENDIX*

Level 2: averaged data (\*.ave)

Format: ASCII

Format of each line:

*SEE APPENDIX*

**Disclaimer:**

*Since the derived fields (e.g., attenuation, radar reflectivity, rain rate, liquid water content) in level 1 and 2 data assume rain and no vertical wind, caution should be used when using these derived fields if any snow may have been falling or in the presence of strong vertical motions (Peters et al. 2005). Attenuation correction is only performed for PIA  $\leq$  10 dB (Peters et al. 2010).*

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References:

Peters, Gerhard, Bernd Fischer, Hans Münster, Marco Clemens, Andreas Wagner, 2005: Profiles of Raindrop Size Distributions as Retrieved by Microrain Radars. *J. Appl. Meteor.*, **44**, 1930–1949.

doi: <http://dx.doi.org/10.1175/JAM2316.1>

Peters, Gerhard, Bernd Fischer, Marco Clemens, 2010: Rain Attenuation of Radar Echoes Considering Finite-Range Resolution and Using Drop Size Distributions. *J. Atmos. Oceanic Technol.*, **27**, 829–842.

doi: <http://dx.doi.org/10.1175/2009JTECHA1342.1>

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*Last Updated: July 5, 2013*

## APPENDIX

*The pages included in this Appendix are taken from the MRR-2 User Manual (METEK GmbH 2008) with expressed written consent of METEK GmbH.*

METEK GmbH, 2008: MRR-2 Micro rain radar User Manual. METEK GmbH, Elmshorn, Germany, 46 pp.

## 6.3 Instantaneous and averaged data

### 6.3.1 Format description

Instantaneous and averaged data are archived in two separate directory structures (see chapter 7.1.2 Data Recording on page 40). Optional recording of so called raw data, which represent the unprocessed measuring data of the MRR-2, is only useful for special purposes.

The data format is human readable ASCII text. Each data set consists of one line. The order of the data lines and the used identifiers are listed below:

| Identifier | Meaning                              | Unit            | Remark   |
|------------|--------------------------------------|-----------------|--|
| MRR        | <i>Header Line</i>                   | n.A.            |  |
| H          | <i>Height</i>                        | m               |  |
| TF         | <i>Transfer Function</i>             | dimensionless   |  |
| Fnn        | <i>Spectral Reflectivities</i>       | dB              | $10 \cdot \log ?_{nn}$ with $?_{nn}$ in $m^{-1}$<br>$nn$ from $\min(h)$ to $\max(h)$ <sup>3</sup>              |
| Dnn        | <i>Drop Size</i>                     | mm              | Center of size class   |
| Nnn        | <i>Spectral Drop Densities</i>       | $m^{-3}mm^{-1}$ | $N(D_{nn})$ <sup>3</sup>   |
| PIA        | <i>Path Integrated Attenuation</i>   | dB              |  |
| Z          | <i>Radar Reflectivity</i>            | dBZ             | $10 \log \left( \sum_{nn=\min(h)}^{nn=\max(h)} N(D_{nn}) D_{nn}^6 \right)$<br>$nn$ from $\min(h)$ to $\max(h)$ |
| z          | <i>Attenuated Radar Reflectivity</i> | dBZ             | Z-PIA  |
| RR         | <i>Rain Rate</i>                     | $mm h^{-1}$     |  |
| LWC        | <i>Liquid Water Contents</i>         | $g m^{-3}$      |  |
| W          | <i>Fall Velocity</i>                 | $m s^{-1}$      |  |

<sup>1)</sup> See *MRR-Physical Basics* for details.

The measured data are displayed in lines following the header. For each measured variable there is one line starting with a 3-character identifier of the variable. Each line represents a profile of this variable, i.e. a function versus height. Each data entry is 7 characters wide. Height is running from left to right

<sup>3</sup> See *MRR-Physical Basics* for details.

in increments according to the chosen height resolution of the MRR. Invalid or not calculable values are coded as 7 consecutive space characters. Space characters—at the end of a line are omitted in order to save disk space. So lines can have different lengths although representing the same number of height steps.

## **MRR – Header Line**

*Entries common to instantaneous and averaged data:*

The header line marks the beginning of a data set. It starts with the identifying string "MRR", a space character and a date/time stamp.

The date/time stamp consists of 12 digits (format *YYMMDDhhmmss*), a single space character and the name of the time zone. This name starts with the string „UTC“ and is optionally followed by an offset value (format  $\pm hh$  or  $\pm hhss$ ).

The end of the header line shows a data quality parameter consisting of the identifying string "MDQ", a single space character and a 3digit number between 0 and 100. It is the percentage of valid spectra collected during the averaging interval. Spectra can be invalid due to saturation of the AD converter – caused either by extreme precipitation or by some interference.

*Entries only in averaged data:*

Averaging time in seconds ("AVE"), height resolution in meters ("STP"), height of the ground level above sea level in meters ("ASL"), sampling rate ("SMP") of the RADAR signal in the time domain (unit: Hz), parameters for the automatic noise level adjustment ("NF0" and "NF1" without unit), version number of the MRR Service ("SVS"), version number of the MRR firmware ("DVS"), serial number of the MRR ("DSN") and the calibration constant ("CC").

Each of the parameters in the header line starts with a delimiting space character, the 3-character identifier as shown above in the parentheses and a field of 6 characters for the numerical value (except of the serial number, which can consist of up to 10 numeric characters between 0 and 9).

Example (Each entry of the header line is shown in a separate line of the table) :

|                         |  |
|-------------------------|--|
| MRR*090612040200<br>UTC | The header line dates from June 12 <sup>th</sup> , 2009, 4:02 AM, UTC. |
| AVE***60                | Averaging time is 60 seconds.  |
| STP***35                | Height resolution is 35 meters.  |
| ASL***147               | The radar is sited 147 meters above sea level.                         |
| SMP*125e3               | Sampling rate is 125,000 Hz.   |
| NF0*1.000               | Noise level 0 set to 1.000 (used only in older versions).              |
| NF1*0.000               | Noise level 1 set to 0.000 (used only in older versions).              |
| SVS*5.20                | Version number of the MRR Service is 5.20.                             |
| DVS*5.10                | Version number of the MRR firmware is 5.10.                            |
| DSN*020704              | Serial number of the MRR is 020704.                                    |
| CC*2066000              | Calibration constant is 2066000.                                       |
| MDQ*100                 | Percentage of valid spectra is 100.                                    |

## H - Height

Argument of the following data profiles corresponding to the settings described in chapter 6.2.3, page 20, and chapter 6.2.4, page 23. The units are meters above the radar system.

## TF - Transfer Function

To each height step a value of the Transfer Function is assigned by which raw data are divided.

## Fnn with nn from 0 to 63 - FFT Spectra

Each line represents a profile of spectral reflectivity corresponding to the spectral bin *nn*. As **Fnn** is corrected for the receiver noise floor negative values can occur, if the signal to noise ratio is low. These entries cannot be presented in the logarithmic domain and are replaced by space characters.

## Dnn with nn from min(h) to max(h) - Drop Sizes

The drop size is described by the diameter of an equivolumic sphere. The spectral bins of drop numbers are of variable width in the size domain (in contrast with spectral bins in the frequency- and velocity-domain). In addition, the

widths of the size bins are slightly height dependent. Therefore the assignment of frequency-bin-index  $nn$  to diameter  $D$  is listed explicitly for each bin and height. The center of each size class is displayed.

### **Nnn with $nn$ from $\min(h)$ to $\max(h)$ - Spectral Drop Densities**

With the knowledge of the frequency of the Doppler-shift the calculation of the corresponding drop fall velocity is possible (equation 1.4.3.2 in MRR Physical Basics). Thus each FFT-line stands for a drop size interval. Chapter 2 in the Physical Basics shows how to derive from the received spectral power the number of drops for this drop size class, and finally – by division through the variable class width – the spectral drop densities.

Only a sub-set of all 64 spectral bins is considered for the calculation. The lower ( $\min(h)$ ) and upper limit ( $\max(h)$ ) depends on the height as described in MRR Physical Basics (Fig. 7).

In case of negative values of  $F_{nn}$  negative drop number densities are calculated. Although they have no physical meaning they are retained in order to avoid statistical biases.

### **PIA - Path Integrated Attenuation<sup>1)</sup>**

The two-way Path integrated attenuation by rain drops is calculated as described in chapter 3.2 MRR-Physical Basis and is used for correction of  $N_{nn}$ ,  $Z$ ,  $RR$  and  $LWC$ .

### **$z$ - Attenuated Radar Reflectivity<sup>2)</sup>**

$z$  is the radar reflectivity factor (see chapter 3.1 MRR-Physical Basics) without attenuation correction

### **$Z$ - Radar Reflectivity<sup>2)</sup>**

$Z$  is the radar reflectivity factor (see chapter 3.1 MRR-Physical Basics)

### **$RR$ - Rain Rate<sup>2)</sup>**

$RR$  is the rain rate (see chapter 3.3 MRR-Physical Basics)

**LWC - Liquid Water Content<sup>2)</sup>**

LWC is the liquid water content (see equation 3.2.1 MRR-Physical Basics)

*<sup>2)</sup> In case of low signal to noise ratio negative values can occur. Although they have no physical meaning they are retained in order to avoid statistical biases.*

**W - Fall Velocity**

W is the characteristic falling velocity.

(First Moment of the Doppler spectrum, see chapter 3.4 MRR-Physical Basics).

The width of velocity-bins can be derived from the maximum number of height steps, the sampling rate (as shown in the header line) and the wave length of the RADAR signal. 32 height steps and 64 lines per step are calculated. For a sampling frequency of 125 kHz and a transmit frequency of 24.15 GHz, the resolution of the fall velocity can be calculated as:

$$\frac{125 \text{ kHz}}{2} \frac{1}{32 \cdot 64} \frac{299700 \text{ km/s}}{2 \cdot 24 \text{ GHz}} = 0.1905 \text{ m/s}$$



6.3.2 Example

Instantaneous and averaged data files have the same structure except of the header lines. The part of the header line, which is underlined in the example below, is only present in averaged data:

Table with 35 columns: MRR, 70, 105, 140, SFT, 60, SFT, 35, AST, 0, SFT, 125, 3, NFO, 1, 0, 0, 0, SFT, 5, 2, 0, DVS, 5, 1, 0, DSN, 0, 2, 0, 7, 0, 4, CC, 2, 0, 6, 6, 0, 0, 0, MDO, 1, 0, 0. The table contains numerical data for various radar parameters.

|     |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| F62 | -74.68 | -83.22 | -89.67 | -94.20 | -99.14 | -96.15 | -96.31 | -94.53 | -90.54 | -96.13 | -87.92 | -85.77 | -85.93 | -86.04 | -85.03 | -87.00 | -85.23 | -84.66 | -85.12 | -85.47 | -84.28 | -83.23 | -81.32 | -79.25 | -77.93 | -78.24 | -77.84 | -79.75 | -80.12 |        |        |        |
| F63 | -67.85 | -76.90 | -84.03 | -89.87 | -92.92 | -94.40 | -95.56 | -96.37 | -95.40 | -89.14 | -87.78 | -87.08 | -87.75 | -88.04 | -87.75 | -88.04 | -89.17 | -88.99 | -88.60 | -89.17 | -87.09 | -86.36 | -84.27 | -81.27 | -78.07 | -80.61 | -80.05 | -79.80 | -82.65 | -81.75 |        |        |
| F64 | -24.56 | -24.54 | -24.50 | -24.48 | -24.43 | -24.43 | -24.43 | -24.43 | -24.43 | -24.39 | -24.37 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 | -24.36 |        |        |
| D04 | 2.456  | 2.454  | 2.450  | 2.448  | 2.443  | 2.443  | 2.443  | 2.443  | 2.443  | 2.439  | 2.437  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  | 2.436  |        |        |
| D05 | 2.817  | 2.814  | 2.812  | 2.809  | 2.807  | 2.805  | 2.802  | 2.800  | 2.798  | 2.795  | 2.793  | 2.791  | 2.788  | 2.786  | 2.784  | 2.781  | 2.779  | 2.776  | 2.774  | 2.772  | 2.769  | 2.767  | 2.765  | 2.763  | 2.761  | 2.759  | 2.757  | 2.755  | 2.753  | 2.751  |        |        |
| D06 | 3.185  | 3.182  | 3.179  | 3.177  | 3.174  | 3.171  | 3.168  | 3.165  | 3.162  | 3.159  | 3.156  | 3.153  | 3.150  | 3.147  | 3.144  | 3.141  | 3.138  | 3.135  | 3.132  | 3.129  | 3.127  | 3.124  | 3.121  | 3.119  | 3.117  | 3.115  | 3.113  | 3.111  | 3.109  | 3.107  |        |        |
| D07 | 3.582  | 3.579  | 3.575  | 3.572  | 3.569  | 3.565  | 3.562  | 3.558  | 3.554  | 3.551  | 3.548  | 3.545  | 3.542  | 3.539  | 3.536  | 3.533  | 3.530  | 3.527  | 3.524  | 3.521  | 3.518  | 3.515  | 3.512  | 3.509  | 3.506  | 3.503  | 3.500  | 3.497  | 3.494  | 3.491  |        |        |
| D08 | 3.952  | 3.949  | 3.945  | 3.942  | 3.938  | 3.934  | 3.930  | 3.926  | 3.922  | 3.918  | 3.914  | 3.910  | 3.906  | 3.902  | 3.898  | 3.894  | 3.890  | 3.886  | 3.882  | 3.878  | 3.874  | 3.870  | 3.866  | 3.862  | 3.858  | 3.854  | 3.850  | 3.846  | 3.842  | 3.838  |        |        |
| D09 | 4.324  | 4.321  | 4.317  | 4.313  | 4.309  | 4.305  | 4.301  | 4.297  | 4.293  | 4.289  | 4.285  | 4.281  | 4.277  | 4.273  | 4.269  | 4.265  | 4.261  | 4.257  | 4.253  | 4.249  | 4.245  | 4.241  | 4.237  | 4.233  | 4.229  | 4.225  | 4.221  | 4.217  | 4.213  | 4.209  |        |        |
| D10 | 4.747  | 4.742  | 4.737  | 4.733  | 4.729  | 4.725  | 4.721  | 4.717  | 4.713  | 4.709  | 4.705  | 4.701  | 4.697  | 4.693  | 4.689  | 4.685  | 4.681  | 4.677  | 4.673  | 4.669  | 4.665  | 4.661  | 4.657  | 4.653  | 4.649  | 4.645  | 4.641  | 4.637  | 4.633  | 4.629  |        |        |
| D11 | 5.162  | 5.157  | 5.152  | 5.148  | 5.144  | 5.140  | 5.136  | 5.132  | 5.128  | 5.124  | 5.120  | 5.116  | 5.112  | 5.108  | 5.104  | 5.100  | 5.096  | 5.092  | 5.088  | 5.084  | 5.080  | 5.076  | 5.072  | 5.068  | 5.064  | 5.060  | 5.056  | 5.052  | 5.048  | 5.044  |        |        |
| D12 | 5.587  | 5.580  | 5.574  | 5.567  | 5.560  | 5.554  | 5.547  | 5.540  | 5.533  | 5.526  | 5.520  | 5.513  | 5.506  | 5.500  | 5.493  | 5.487  | 5.480  | 5.473  | 5.467  | 5.460  | 5.453  | 5.447  | 5.440  | 5.433  | 5.426  | 5.420  | 5.413  | 5.406  | 5.400  | 5.393  |        |        |
| D13 | 6.023  | 6.016  | 6.009  | 6.001  | 5.993  | 5.986  | 5.979  | 5.971  | 5.964  | 5.956  | 5.949  | 5.941  | 5.934  | 5.927  | 5.920  | 5.912  | 5.904  | 5.897  | 5.890  | 5.883  | 5.875  | 5.868  | 5.861  | 5.854  | 5.847  | 5.840  | 5.833  | 5.826  | 5.819  | 5.812  |        |        |
| D14 | 6.471  | 6.463  | 6.455  | 6.446  | 6.438  | 6.430  | 6.422  | 6.414  | 6.406  | 6.398  | 6.390  | 6.382  | 6.374  | 6.366  | 6.358  | 6.350  | 6.342  | 6.334  | 6.326  | 6.318  | 6.310  | 6.302  | 6.294  | 6.286  | 6.278  | 6.270  | 6.262  | 6.254  | 6.246  | 6.238  |        |        |
| D15 | 6.945  | 6.922  | 6.913  | 6.904  | 6.895  | 6.886  | 6.877  | 6.868  | 6.859  | 6.850  | 6.841  | 6.832  | 6.823  | 6.814  | 6.805  | 6.796  | 6.787  | 6.778  | 6.769  | 6.760  | 6.751  | 6.742  | 6.733  | 6.724  | 6.715  | 6.706  | 6.697  | 6.688  | 6.679  | 6.670  |        |        |
| D16 | 7.405  | 7.395  | 7.385  | 7.375  | 7.365  | 7.355  | 7.345  | 7.335  | 7.325  | 7.315  | 7.305  | 7.295  | 7.285  | 7.275  | 7.265  | 7.255  | 7.245  | 7.235  | 7.225  | 7.215  | 7.205  | 7.195  | 7.185  | 7.175  | 7.165  | 7.155  | 7.145  | 7.135  | 7.125  | 7.115  |        |        |
| D17 | 7.892  | 7.881  | 7.870  | 7.859  | 7.849  | 7.838  | 7.827  | 7.816  | 7.805  | 7.794  | 7.783  | 7.772  | 7.761  | 7.750  | 7.739  | 7.728  | 7.717  | 7.706  | 7.695  | 7.684  | 7.673  | 7.662  | 7.651  | 7.640  | 7.629  | 7.618  | 7.607  | 7.596  | 7.585  | 7.574  |        |        |
| D18 | 8.394  | 8.382  | 8.370  | 8.358  | 8.346  | 8.333  | 8.321  | 8.309  | 8.297  | 8.284  | 8.272  | 8.260  | 8.248  | 8.236  | 8.224  | 8.212  | 8.200  | 8.188  | 8.176  | 8.164  | 8.152  | 8.140  | 8.128  | 8.116  | 8.104  | 8.092  | 8.080  | 8.068  | 8.056  | 8.044  |        |        |
| D19 | 8.945  | 8.933  | 8.921  | 8.909  | 8.897  | 8.885  | 8.873  | 8.861  | 8.849  | 8.837  | 8.825  | 8.813  | 8.801  | 8.789  | 8.777  | 8.765  | 8.753  | 8.741  | 8.729  | 8.717  | 8.705  | 8.693  | 8.681  | 8.669  | 8.657  | 8.645  | 8.633  | 8.621  | 8.609  | 8.597  |        |        |
| D20 | 9.545  | 9.533  | 9.521  | 9.509  | 9.497  | 9.485  | 9.473  | 9.461  | 9.449  | 9.437  | 9.425  | 9.413  | 9.401  | 9.389  | 9.377  | 9.365  | 9.353  | 9.341  | 9.329  | 9.317  | 9.305  | 9.293  | 9.281  | 9.269  | 9.257  | 9.245  | 9.233  | 9.221  | 9.209  | 9.197  |        |        |
| D21 | 10.205 | 10.193 | 10.181 | 10.169 | 10.157 | 10.145 | 10.133 | 10.121 | 10.109 | 10.097 | 10.085 | 10.073 | 10.061 | 10.049 | 10.037 | 10.025 | 10.013 | 10.001 | 9.989  | 9.977  | 9.965  | 9.953  | 9.941  | 9.929  | 9.917  | 9.905  | 9.893  | 9.881  | 9.869  | 9.857  | 9.845  |        |
| D22 | 10.945 | 10.933 | 10.921 | 10.909 | 10.897 | 10.885 | 10.873 | 10.861 | 10.849 | 10.837 | 10.825 | 10.813 | 10.801 | 10.789 | 10.777 | 10.765 | 10.753 | 10.741 | 10.729 | 10.717 | 10.705 | 10.693 | 10.681 | 10.669 | 10.657 | 10.645 | 10.633 | 10.621 | 10.609 | 10.597 | 10.585 |        |
| D23 | 11.775 | 11.763 | 11.751 | 11.739 | 11.727 | 11.715 | 11.703 | 11.691 | 11.679 | 11.667 | 11.655 | 11.643 | 11.631 | 11.619 | 11.607 | 11.595 | 11.583 | 11.571 | 11.559 | 11.547 | 11.535 | 11.523 | 11.511 | 11.499 | 11.487 | 11.475 | 11.463 | 11.451 | 11.439 | 11.427 | 11.415 |        |
| D24 | 12.705 | 12.693 | 12.681 | 12.669 | 12.657 | 12.645 | 12.633 | 12.621 | 12.609 | 12.597 | 12.585 | 12.573 | 12.561 | 12.549 | 12.537 | 12.525 | 12.513 | 12.501 | 12.489 | 12.477 | 12.465 | 12.453 | 12.441 | 12.429 | 12.417 | 12.405 | 12.393 | 12.381 | 12.369 | 12.357 | 12.345 |        |
| D25 | 13.745 | 13.733 | 13.721 | 13.709 | 13.697 | 13.685 | 13.673 | 13.661 | 13.649 | 13.637 | 13.625 | 13.613 | 13.601 | 13.589 | 13.577 | 13.565 | 13.553 | 13.541 | 13.529 | 13.517 | 13.505 | 13.493 | 13.481 | 13.469 | 13.457 | 13.445 | 13.433 | 13.421 | 13.409 | 13.397 | 13.385 |        |
| D26 | 14.905 | 14.893 | 14.881 | 14.869 | 14.857 | 14.845 | 14.833 | 14.821 | 14.809 | 14.797 | 14.785 | 14.773 | 14.761 | 14.749 | 14.737 | 14.725 | 14.713 | 14.701 | 14.689 | 14.677 | 14.665 | 14.653 | 14.641 | 14.629 | 14.617 | 14.605 | 14.593 | 14.581 | 14.569 | 14.557 | 14.545 |        |
| D27 | 16.205 | 16.193 | 16.181 | 16.169 | 16.157 | 16.145 | 16.133 | 16.121 | 16.109 | 16.097 | 16.085 | 16.073 | 16.061 | 16.049 | 16.037 | 16.025 | 16.013 | 16.001 | 15.989 | 15.977 | 15.965 | 15.953 | 15.941 | 15.929 | 15.917 | 15.905 | 15.893 | 15.881 | 15.869 | 15.857 | 15.845 |        |
| D28 | 17.655 | 17.643 | 17.631 | 17.619 | 17.607 | 17.595 | 17.583 | 17.571 | 17.559 | 17.547 | 17.535 | 17.523 | 17.511 | 17.499 | 17.487 | 17.475 | 17.463 | 17.451 | 17.439 | 17.427 | 17.415 | 17.403 | 17.391 | 17.379 | 17.367 | 17.355 | 17.343 | 17.331 | 17.319 | 17.307 | 17.295 |        |
| D29 | 19.285 | 19.273 | 19.261 | 19.249 | 19.237 | 19.225 | 19.213 | 19.201 | 19.189 | 19.177 | 19.165 | 19.153 | 19.141 | 19.129 | 19.117 | 19.105 | 19.093 | 19.081 | 19.069 | 19.057 | 19.045 | 19.033 | 19.021 | 19.009 | 18.997 | 18.985 | 18.973 | 18.961 | 18.949 | 18.937 | 18.925 | 18.913 |
| D30 | 21.115 | 21.103 | 21.091 | 21.079 | 21.067 | 21.055 | 21.043 | 21.031 | 21.019 | 21.007 | 20.995 | 20.983 | 20.971 | 20.959 | 20.947 | 20.935 | 20.923 | 20.911 | 20.899 | 20.887 | 20.875 | 20.863 | 20.851 | 20.839 | 20.827 | 20.815 | 20.803 | 20.791 | 20.779 | 20.767 | 20.755 |        |
| D31 | 23.165 | 23.153 | 23.141 | 23.129 | 23.117 | 23.105 | 23.093 | 23.081 | 23.069 | 23.057 | 23.045 | 23.033 | 23.021 | 23.009 | 22.997 | 22.985 | 22.973 | 22.961 | 22.949 | 22.937 | 22.925 | 22.913 | 22.901 | 22.889 | 22.877 | 22.865 | 22.853 | 22.841 | 22.829 | 22.817 | 22.805 |        |
| D32 | 25.445 | 25.433 | 25.421 | 25.409 | 25.397 | 25.385 | 25.373 | 25.361 | 25.349 | 25.337 | 25.325 | 25.313 | 25.301 | 25.289 | 25.277 | 25.265 | 25.253 | 25.241 | 25.229 | 25.217 | 25.205 | 25.193 | 25.181 | 25.169 | 25.157 | 25.145 | 25.133 | 25.121 | 25.109 | 25.097 | 25.085 |        |
| D33 | 27.995 | 27.983 | 27.971 | 27.959 | 27.947 | 27.935 | 27.923 | 27.911 | 27.899 | 27.887 | 27.875 | 27.863 | 27.851 | 27.839 | 27.827 | 27.815 | 27.803 | 27.791 | 27.779 | 27.767 | 27.755 | 27.743 | 27.731 | 27.719 | 27.707 | 27.695 | 27.683 | 27.671 | 27.659 | 27.647 | 27.635 |        |
| D34 | 30.865 | 30.853 | 30.841 | 30.829 | 30.817 | 30.805 | 30.793 | 30.781 | 30.769 | 30.757 | 30.745 | 30.733 | 30.721 | 30.709 | 30.697 | 30.685 | 30.673 | 30.661 | 30.649 | 30.637 | 30.625 | 30.613 | 30.601 | 30.589 | 30.577 | 30.565 | 30.553 | 30.541 | 30.529 | 30.517 | 30.505 |        |
| D35 | 34.015 | 34.003 | 33.991 | 33.979 | 33.967 | 33.955 | 33.943 | 33.931 | 33.919 | 33.907 | 33.895 | 33.883 | 33.871 | 33.859 | 33.847 | 33.835 | 33.823 | 33.811 | 33.799 | 33.787 | 33.775 | 33.763 | 33.751 | 33.739 | 33.727 | 33.715 | 33.703 | 33.691 | 33.679 | 33.667 | 33.655 |        |
| D36 | 37.455 | 37.443 | 37.431 | 37.419 | 37.407 | 37.395 | 37.383 | 37.371 | 37.359 | 37.347 | 37.335 | 37.323 | 37.311 | 37.299 | 37.287 | 37.275 | 37.263 | 37.251 | 37.239 | 37.227 | 37.215 | 37.203 | 37.191 | 37.179 | 37.167 | 37.155 | 37.143 | 37.131 | 37.119 | 37.107 | 37.095 |        |
| D37 | 41.205 | 41.193 | 41.181 | 41.169 | 41.157 | 41.145 | 41.133 | 41.121 | 41.109 | 41.097 | 41.085 | 41.073 | 41.061 | 41.049 | 41.037 | 41.025 | 41.013 | 41.001 | 39.989 | 39.977 | 39.965 | 39.953 | 39.941 | 39.929 | 39.917 | 39.905 | 39.893 | 39.881 | 39.869 | 39.857 | 39.845 |        |
| D3  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |

|      |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| N34  | 15543  | 19429  | 18430  | 15880  | 15100  | 16759  | 15610  | 13544  | 13375  | 14668  | 16884  | 18871  | 18722  | 18590  | 19172  | 17529  | 20454  | 20027  | 17849  | 17282  | 15318  | 15391  | 16430  | 23729  | 35545  | 46676  | 43087  | 31116  | 15240  | 4622.4 | 1196.3 |        |  |
| N35  | 11074  | 14746  | 13021  | 11318  | 11080  | 11857  | 10535  | 9071.8 | 9153.5 | 10891  | 12100  | 13423  | 13959  | 13631  | 13374  | 12554  | 14989  | 14600  | 13282  | 13155  | 11733  | 13308  | 14872  | 18890  | 24295  | 28910  | 25386  | 16667  | 7517.4 | 1769.8 | 372.01 |        |  |
| N36  | 8063.7 | 10718  | 8927.8 | 7966.0 | 7954.2 | 8413.8 | 7584.7 | 6429.2 | 6668.3 | 7912.6 | 8156.4 | 8572.4 | 8241.6 | 9262.2 | 9187.0 | 8380.0 | 9491.1 | 9687.6 | 9774.1 | 9585.0 | 8641.0 | 10461  | 12281  | 14376  | 15828  | 15629  | 12579  | 7542.3 | 3299.7 | 699.22 | 127.95 |        |  |
| N37  | 5579.9 | 7232.0 | 5896.5 | 5342.4 | 5529.4 | 6050.6 | 5548.5 | 4679.9 | 4724.6 | 5237.0 | 5312.6 | 5556.1 | 5978.6 | 5945.9 | 6001.2 | 5351.7 | 5813.2 | 6361.6 | 6982.7 | 6806.1 | 6566.6 | 7816.2 | 8969.7 | 9791.1 | 10116  | 8644.9 | 5594.9 | 2947.6 | 1201.5 | 236.46 | 50.288 |        |  |
| N38  | 3660.6 | 4631.9 | 3782.0 | 3554.0 | 3882.1 | 4301.2 | 3788.2 | 3094.7 | 3073.3 | 3388.5 | 3572.4 | 3826.3 | 4115.9 | 3848.7 | 3753.9 | 3401.1 | 3693.0 | 4212.3 | 4742.4 | 4694.6 | 4822.6 | 5578.4 | 6223.4 | 6570.3 | 6224.6 | 4805.3 | 2510.5 | 1149.9 | 428.02 | 73.016 | 40.260 |        |  |
| N39  | 2451.6 | 3052.0 | 2462.6 | 2454.8 | 2701.9 | 2879.9 | 2516.2 | 1986.3 | 1970.7 | 2224.8 | 2389.8 | 2510.6 | 2621.3 | 2340.3 | 2308.5 | 2145.4 | 2363.8 | 2776.2 | 3040.2 | 2991.0 | 3206.6 | 3590.5 | 4066.8 | 4184.1 | 3400.7 | 2300.2 | 1009.4 | 447.38 | 153.45 | 23.465 | 45.138 |        |  |
| N40  | 5819.3 | 1324.6 | 9783.6 | 9297.6 | 1069.6 | 1628.0 | 1859.3 | 1260.1 | 1359.4 | 1528.2 | 1594.2 | 1857.1 | 1456.4 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 |  |
| N41  | 5819.3 | 1324.6 | 9783.6 | 9297.6 | 1069.6 | 1628.0 | 1859.3 | 1260.1 | 1359.4 | 1528.2 | 1594.2 | 1857.1 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 | 1450.0 |  |
| N42  | 559.59 | 801.97 | 590.94 | 560.59 | 570.14 | 570.07 | 448.00 | 478.44 | 513.44 | 509.34 | 483.11 | 472.63 | 466.78 | 408.14 | 449.80 | 443.00 | 503.02 | 542.48 | 648.21 | 783.12 | 818.78 | 829.53 | 748.53 | 768.85 | 260.57 | 132.16 | 51.57  | 21.089 | 5.7236 | 1.2082 | 41.131 |        |  |
| N43  | 311.72 | 452.26 | 341.63 | 311.89 | 298.49 | 296.60 | 243.05 | 266.12 | 315.43 | 285.84 | 267.08 | 259.91 | 236.88 | 207.13 | 222.80 | 211.03 | 240.93 | 268.09 | 351.68 | 453.51 | 472.69 | 455.83 | 358.53 | 206.85 | 103.39 | 45.136 | 16.576 | 5.5499 | 1.1879 | 0.1858 | 1.2911 | 32.235 |  |
| N44  | 169.68 | 239.35 | 178.44 | 164.85 | 152.13 | 148.30 | 137.29 | 172.38 | 192.97 | 159.46 | 138.54 | 126.42 | 111.82 | 93.173 | 92.717 | 91.467 | 109.10 | 127.54 | 181.40 | 233.85 | 246.11 | 239.27 | 169.73 | 76.829 | 36.747 | 15.236 | 5.1847 | 1.0163 | 0.1858 | 1.2911 | 32.235 |        |  |
| N45  | 81.786 | 121.41 | 84.666 | 81.660 | 79.681 | 78.907 | 77.345 | 103.17 | 113.45 | 92.542 | 68.828 | 57.519 | 50.597 | 37.522 | 33.149 | 36.609 | 47.387 | 54.895 | 82.849 | 112.99 | 119.13 | 115.14 | 76.344 | 28.340 | 11.652 | 4.4790 | 1.2523 | 0.1501 | 0.1087 | 1.4566 | 27.688 |        |  |
| N46  | 34.401 | 57.447 | 38.938 | 39.926 | 41.450 | 43.409 | 45.297 | 54.883 | 60.493 | 52.144 | 33.413 | 25.366 | 20.018 | 12.808 | 11.334 | 13.548 | 17.845 | 20.532 | 31.125 | 48.112 | 29.404 | 9.4621 | 3.2046 | 1.0200 | 0.1508 | 0.1471 | 0.2992 | 1.2458 | 21.402 |        |        |        |  |
| N47  | 14.599 | 25.105 | 17.415 | 18.311 | 18.017 | 21.264 | 26.064 | 29.209 | 30.549 | 26.836 | 16.089 | 11.018 | 7.6411 | 4.1295 | 3.6462 | 5.7951 | 6.7475 | 5.6561 | 16.130 | 19.956 | 17.000 | 9.3864 | 2.6096 | 0.7768 | 0.0222 | 0.0214 | 0.0118 | 0.3312 | 0.8860 | 14.571 |        |        |  |
| N48  | 6.0655 | 10.083 | 6.7792 | 6.7683 | 6.5345 | 9.1416 | 12.917 | 15.288 | 15.165 | 12.710 | 7.4520 | 4.6330 | 3.0609 | 1.3419 | 1.6967 | 1.8734 | 2.5597 | 4.3964 | 6.1000 | 4.8768 | 2.2767 | 0.5247 | 0.0722 | 0.0227 | 9.6e-4 | 0.0267 | 0.2702 | 0.6419 | 8.2911 |        |        |        |  |
| N49  | 2.5061 | 3.6136 | 2.2706 | 1.9711 | 2.0213 | 3.5677 | 5.5743 | 7.8399 | 7.7926 | 5.9892 | 3.3414 | 1.7142 | 0.9998 | 0.3713 | 0.1577 | 0.3096 | 0.3850 | 0.3988 | 0.6132 | 1.0605 | 1.1634 | 0.4705 | 0.1001 | 0.0409 | 0.0489 | 0.0142 | 0.0276 | 0.2706 | 0.4230 | 4.0321 |        |        |  |
| NS0  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS1  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS2  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS3  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS4  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS5  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS6  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS7  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS8  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS9  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS10 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS11 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS12 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS13 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS14 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS15 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS16 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS17 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS18 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS19 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS20 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS21 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS22 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS23 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS24 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS25 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS26 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS27 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS28 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS29 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS30 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS31 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS32 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS33 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS34 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS35 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS36 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS37 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS38 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS39 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS40 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS41 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS42 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS43 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS44 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS45 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |
| NS46 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |  |

## 6.4 Raw data

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### 6.4.1 Format Description

Each data block in a **raw data** file begins with a header line which contains the date, the time and the time zone of the following data block. This line is preceded by the letter T and a colon (T means time). The format of the date/time stamp is YYMMDDhhmmss, which means year, month, day, hour, minute and second with 2 digits each. Date, time and time zone are separated by a space character. The header line is supplemented with the version number of the MRR firmware (following the identifier DVS), the serial number ( of the MRR (following the identifier DSN), the calibration constant of the MRR (following the identifier CC) and the percentage of valid spectra (following the identifier MDQ).

The next data lines contains the measuring heights. It begins with the capital letter M, a colon, the small letter h, two space characters, and an equals sign (M means measured value, h means height). The following numbers (9 digits decimal each) represent the measuring heights in meters.

The height line is followed by the line of the transfer function. It starts with the capital character M, a colon, the capital letters T and F and one space character. The rest of that line represents the values of the transfer function for each height step ( 9 digits decimal each).

The line of the transfer function is followed by 64 data lines. Each one starts with the capital character M, a colon, the small letter f, and a 2-digit number of the spectra line (0 to 63). The rest of these lines represent the received spectral signal power in engineering units for each height step (9 digits decimal each).

The raw spectra include the receiver noise floor.

### 6.4.2 Example

|         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          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|          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          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|          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |         |
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| NR1000= | 0.010322 | 0.011622 | 0.014175 | 0.019862 | 0.017583 | 0.015484 | 0.013419 | 0.025114 | 0.033231 | 0.030018 | 0.027520 | 0.025616 | 0.024239 | 0.023622 | 0.023077 | 0.022592 | 0.022165 | 0.021794 | 0.021475 | 0.021205 | 0.020982 | 0.020803 | 0.020665 | 0.020565 | 0.020491 | 0.020431 | 0.020384 | 0.020348 | 0.020322 | 0.020305 | 0.020296 | 0.020294 | 0.020298 | 0.020307 | 0.020321 | 0.020339 | 0.020361 | 0.020387 | 0.020416 | 0.020447 | 0.020479 | 0.020512 | 0.020546 | 0.020581 | 0.020616 | 0.020651 | 0.020686 | 0.020721 | 0.020756 | 0.020791 | 0.020826 | 0.020861 | 0.020896 | 0.020931 | 0.020966 | 0.021001 | 0.021036 | 0.021071 | 0.021106 | 0.021141 | 0.021176 | 0.021211 | 0.021246 | 0.021281 | 0.021316 | 0.021351 | 0.021386 | 0.021421 | 0.021456 | 0.021491 | 0.021526 | 0.021561 | 0.021596 | 0.021631 | 0.021666 | 0.021701 | 0.021736 | 0.021771 | 0.021806 | 0.021841 | 0.021876 | 0.021911 | 0.021946 | 0.021981 | 0.022016 | 0.022051 | 0.022086 | 0.022121 | 0.022156 | 0.022191 | 0.022226 | 0.022261 | 0.022296 | 0.022331 | 0.022366 | 0.022401 | 0.022436 | 0.022471 | 0.022506 | 0.022541 | 0.022576 | 0.022611 | 0.022646 | 0.022681 | 0.022716 | 0.022751 | 0.022786 | 0.022821 | 0.022856 | 0.022891 | 0.022926 | 0.022961 | 0.022996 | 0.023031 | 0.023066 | 0.023101 | 0.023136 | 0.023171 | 0.023206 | 0.023241 | 0.023276 | 0.023311 | 0.023346 | 0.023381 | 0.023416 | 0.023451 | 0.023486 | 0.023521 | 0.023556 | 0.023591 | 0.023626 | 0.023661 | 0.023696 | 0.023731 | 0.023766 | 0.023801 | 0.023836 | 0.023871 | 0.023906 | 0.023941 | 0.023976 | 0.024011 | 0.024046 | 0.024081 | 0.024116 | 0.024151 | 0.024186 | 0.024221 | 0.024256 | 0.024291 | 0.024326 | 0.024361 | 0.024396 | 0.024431 | 0.024466 | 0.024501 | 0.024536 | 0.024571 | 0.024606 | 0.024641 | 0.024676 | 0.024711 | 0.024746 | 0.024781 | 0.024816 | 0.024851 | 0.024886 | 0.024921 | 0.024956 | 0.024991 | 0.025026 | 0.025061 | 0.025096 | 0.025131 | 0.025166 | 0.025201 | 0.025236 | 0.025271 | 0.025306 | 0.025341 | 0.025376 | 0.025411 | 0.025446 | 0.025481 | 0.025516 | 0.025551 | 0.025586 | 0.025621 | 0.025656 | 0.025691 | 0.025726 | 0.025761 | 0.025796 | 0.025831 | 0.025866 | 0.025901 | 0.025936 | 0.025971 | 0.026006 | 0.026041 | 0.026076 | 0.026111 | 0.026146 | 0.026181 | 0.026216 | 0.026251 | 0.026286 | 0.026321 | 0.026356 | 0.026391 | 0.026426 | 0.026461 | 0.026496 | 0.026531 | 0.026566 | 0.026601 | 0.026636 | 0.026671 | 0.026706 | 0.026741 | 0.026776 | 0.026811 | 0.026846 | 0.026881 | 0.026916 | 0.026951 | 0.026986 | 0.027021 | 0.027056 | 0.027091 | 0.027126 | 0.027161 | 0.027196 | 0.027231 | 0.027266 | 0.027301 | 0.027336 | 0.027371 | 0.027406 | 0.027441 | 0.027476 | 0.027511 | 0.027546 | 0.027581 | 0.027616 | 0.027651 | 0.027686 | 0.027721 | 0.027756 | 0.027791 | 0.027826 | 0.027861 | 0.027896 | 0.027931 | 0.027966 | 0.028001 | 0.028036 | 0.028071 | 0.028106 | 0.028141 | 0.028176 | 0.028211 | 0.028246 | 0.028281 | 0.028316 | 0.028351 | 0.028386 | 0.028421 | 0.028456 | 0.028491 | 0.028526 | 0.028561 | 0.028596 | 0.028631 | 0.028666 | 0.028701 | 0.028736 | 0.028771 | 0.028806 | 0.028841 | 0.028876 | 0.028911 | 0.028946 | 0.028981 | 0.029016 | 0.029051 | 0.029086 | 0.029121 | 0.029156 | 0.029191 | 0.029226 | 0.029261 | 0.029296 | 0.029331 | 0.029366 | 0.029401 | 0.029436 | 0.029471 | 0.029506 | 0.029541 | 0.029576 | 0.029611 | 0.029646 | 0.029681 | 0.029716 | 0.029751 | 0.029786 | 0.029821 | 0.029856 | 0.029891 | 0.029926 | 0.029961 | 0.030006 | 0.030041 | 0.030076 | 0.030111 | 0.030146 | 0.030181 | 0.030216 | 0.030251 | 0.030286 | 0.030321 | 0.030356 | 0.030391 | 0.030426 | 0.030461 | 0.030496 | 0.030531 | 0.030566 | 0.030601 | 0.030636 | 0.030671 | 0.030706 | 0.030741 | 0.030776 | 0.030811 | 0.030846 | 0.030881 | 0.030916 | 0.030951 | 0.030986 | 0.031021 | 0.031056 | 0.031091 | 0.031126 | 0.031161 | 0.031196 | 0.031231 | 0.031266 | 0.031301 | 0.031336 | 0.031371 | 0.031406 | 0.031441 | 0.031476 | 0.031511 | 0.031546 | 0.031581 | 0.031616 | 0.031651 | 0.031686 | 0.031721 | 0.031756 | 0.031791 | 0.031826 | 0.031861 | 0.031896 | 0.031931 | 0.031966 | 0.032001 | 0.032036 | 0.032071 | 0.032106 | 0.032141 | 0.032176 | 0.032211 | 0.032246 | 0.032281 | 0.032316 | 0.032351 | 0.032386 | 0.032421 | 0.032456 | 0.032491 | 0.032526 | 0.032561 | 0.032596 | 0.032631 | 0.032666 | 0.032701 | 0.032736 | 0.032771 | 0.032806 | 0.032841 | 0.032876 | 0.032911 | 0.032946 | 0.032981 | 0.033016 | 0.033051 | 0.033086 | 0.033121 | 0.033156 | 0.033191 | 0.033226 | 0.033261 | 0.033296 | 0.033331 | 0.033366 | 0.033401 | 0.033436 | 0.033471 | 0.033506 | 0.033541 | 0.033576 | 0.033611 | 0.033646 | 0.033681 | 0.033716 | 0.033751 | 0.033786 | 0.033821 | 0.033856 | 0.033891 | 0.033926 | 0.033961 | 0.034006 | 0.034041 | 0.034076 | 0.034111 | 0.034146 | 0.034181 | 0.034216 | 0.034251 | 0.034286 | 0.034321 | 0.034356 | 0.034391 | 0.034426 | 0.034461 | 0.034496 | 0.034531 | 0.034566 | 0.034601 | 0.034636 | 0.034671 | 0.034706 | 0.034741 | 0.034776 | 0.034811 | 0.034846 | 0.034881 | 0.034916 | 0.034951 | 0.034986 | 0.035021 | 0.035056 | 0.035091 | 0.035126 | 0.035161 | 0.035196 | 0.035231 | 0.035266 | 0.035301 | 0.035336 | 0.035371 | 0.035406 | 0.035441 | 0.035476 | 0.035511 | 0.035546 | 0.035581 | 0.035616 | 0.035651 | 0.035686 | 0.035721 | 0.035756 | 0.035791 | 0.035826 | 0.035861 | 0.035896 | 0.035931 | 0.035966 | 0.036001 | 0.036036 | 0.036071 | 0.036106 | 0.036141 | 0.036176 | 0.036211 | 0.036246 | 0.036281 | 0.036316 | 0.036351 | 0.036386 | 0.036421 | 0.036456 | 0.036491 | 0.036526 | 0.036561 | 0.036596 | 0.036631 | 0.036666 | 0.036701 | 0.036736 | 0.036771 | 0.036806 | 0.036841 | 0.036876 | 0.036911 | 0.036946 | 0.036981 | 0.037016 | 0.037051 | 0.037086 | 0.037121 | 0.037156 | 0.037191 | 0.037226 | 0.037261 | 0.037296 | 0.037331 | 0.037366 | 0.037401 | 0.037436 | 0.037471 | 0.037506 | 0.037541 | 0.037576 | 0.037611 | 0.037646 | 0.037681 | 0.037716 | 0.037751 | 0.037786 | 0.037821 | 0.037856 | 0.037891 | 0.037926 | 0.037961 | 0.038006 | 0.038041 | 0.038076 | 0.038111 | 0.038146 | 0.038181 | 0.038216 | 0.038251 | 0.038286 | 0.038321 | 0.038356 | 0.038391 | 0.038426 | 0.038461 | 0.038496 | 0.038531 | 0.038566 | 0.038601 | 0.038636 | 0.038671 | 0.038706 | 0.038741 | 0.038776 | 0.038811 | 0.038846 | 0.038881 | 0.038916 | 0.038951 | 0.038986 | 0.039021 | 0.039056 | 0.039091 | 0.039126 | 0.039161 | 0.039196 | 0.039231 | 0.039266 | 0.039301 | 0.039336 | 0.039371 | 0.039406 | 0.039441 | 0.039476 | 0.039511 | 0.039546 | 0.039581 | 0.039616 | 0.039651 | 0.039686 | 0.039721 | 0.039756 | 0.039791 | 0.039826 | 0.039861 | 0.039896 | 0.039931 | 0.039966 | 0.040001 | 0.040036 | 0.040071 | 0.040106 | 0.040141 | 0.040176 | 0.040211 | 0.040246 | 0.040281 | 0.040316 | 0.040351 | 0.040386 | 0.040421 | 0.040456 | 0.040491 | 0.040526 | 0.040561 | 0.040596 | 0.040631 | 0.040666 | 0.040701 | 0.040736 | 0.040771 | 0.040806 | 0.040841 | 0.040876 | 0.040911 | 0.040946 | 0.040981 | 0.041016 | 0.041051 | 0.041086 | 0.041121 | 0.041156 | 0.041191 | 0.041226 | 0.041261 | 0.041296 | 0.041331 | 0.041366 | 0.041401 | 0.041436 | 0.041471 | 0.041506 | 0.041541 | 0.041576 | 0.041611 | 0.041646 | 0.041681 | 0.041716 | 0.041751 | 0.041786 | 0.041821 | 0.041856 | 0.041891 | 0.041926 | 0.041961 | 0.042006 | 0.042041 | 0.042076 | 0.042111 | 0.042146 | 0.042181 | 0.042216 | 0.042251 | 0.042286 | 0.042321 | 0.042356 | 0.042391 | 0.042426 | 0.042461 | 0.042496 | 0.042531 | 0.042566 | 0.042601 | 0.042636 | 0.042671 | 0.042706 | 0.042741 | 0.042776 | 0.042811 | 0.042846 | 0.042881 | 0.042916 | 0.042951 | 0.042986 | 0.043021 | 0.043056 | 0.043091 | 0.043126 | 0.043161 | 0.043196 | 0.043231 | 0.043266 | 0.043301 | 0.043336 | 0.043371 | 0.043406 | 0.043441 | 0.043476 | 0.043511 | 0.043546 | 0.043581 | 0.043616 | 0.043651 | 0.043686 | 0.043721 | 0.043756 | 0.043791 | 0.043826 | 0.043861 | 0.043896 | 0.043931 | 0.043966 | 0.044001 | 0.044036 | 0.044071 | 0.044106 | 0.044141 | 0.044176 | 0.044211 | 0.044246 | 0.044281 | 0.044316 | 0.044351 | 0.044386 | 0.044421 | 0.044456 | 0.044491 | 0.044526 | 0.044561 | 0.044596 | 0.044631 | 0.044666 | 0.044701 | 0.044736 | 0.044771 | 0.044806 | 0.044841 | 0.044876 | 0.044911 | 0.044946 | 0.044981 | 0.045016 | 0.045051 | 0.045086 | 0.045121 | 0.045156 | 0.045191 | 0.045226 | 0.045261 | 0.045296 | 0.045331 | 0.045366 | 0.045401 | 0.045436 | 0.045471 | 0.045506 | 0.045541 | 0.045576 | 0.045611 | 0.045646 | 0.045681 | 0.045716 | 0.045751 | 0.045786 | 0.045821 | 0.045856 | 0.045891 | 0.045926 | 0.045961 | 0.046006 | 0.046041 | 0.046076 | 0.046111 | 0.046146 | 0.046181 | 0.046216 | 0.046251 | 0.046286 | 0.046321 | 0.046356 | 0.046391 | 0.046426 | 0.046461 | 0.046496 | 0.046531 | 0.046566 | 0.046601 | 0.046636 | 0.046671 | 0.046706 | 0.046741 | 0.046776 | 0.046811 | 0.046846 | 0.046881 | 0.046916 | 0.046951 | 0.046986 | 0.047021 | 0.047056 | 0.047091 | 0.047126 | 0.047161 | 0.047196 | 0.047231 | 0.047266 | 0.047301 | 0.047336 | 0.047371 | 0.047406 | 0.047441 | 0.047476 | 0.047511 | 0.047546 | 0.047581 | 0.047616 | 0.047651 | 0.047686 | 0.047721 | 0.047756 | 0.047791 | 0.047826 | 0.047861 | 0.047896 | 0.047931 | 0.047966 | 0.048001 | 0.048036 | 0.048071 | 0.048106 | 0.048141 | 0.048176 | 0.048211 | 0.048246 | 0.048281 | 0.048316 | 0.048351 | 0.048386 | 0.048421 | 0.048456 | 0.048491 | 0.048526 | 0.048561 | 0.048596 | 0.048631 | 0.048666 | 0.048701 | 0.048736 | 0.048771 | 0.048806 | 0.048841 | 0.048876 | 0.048911 | 0.048946 | 0.048981 | 0.049016 | 0.049051 | 0.049086 | 0.049121 | 0.049156 | 0.049191 | 0.049226 | 0.049261 | 0.049296 | 0.049331 | 0.049366 | 0.049401 | 0.049436 | 0.049471 | 0.049506 | 0.049541 | 0.049576 | 0.049611 | 0.049646 | 0.049681 | 0.049716 | 0.049751 | 0.049786 | 0.049821 | 0.049856 | 0.049891 | 0.049926 | 0.049961 | 0.050006 | 0.050041 | 0.050076 | 0.050111 | 0.050146 | 0.050181 | 0.050216 | 0.050251 | 0.050286 | 0.050321 | 0.050356 | 0.050391 | 0.050426 | 0.050461 | 0.050496 | 0.050531 | 0.050566 | 0.050601 | 0.050636 | 0.050671 | 0.050706 | 0.050741 | 0.050776 | 0.050811 | 0.050846 | 0.050881 | 0.050916 | 0.050951 | 0.050986 | 0.051021 | 0.051056 | 0.051091 | 0.051126 | 0.051161 | 0.051196 | 0.051231 | 0.051266 | 0.051301 | 0.051336 | 0.051371 | 0.051406 | 0.051441 | 0.051476 | 0.051511 | 0.051546 | 0.051581 | 0.051616 | 0.051651 | 0.051686 | 0.051721 | 0.051756 | 0.051791 | 0.051826 | 0.051861 | 0.05189 |
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