

Werkskalibrierschein Nr. / Factory Calibration Certificate No. RS2512039120D805

Gegenstand der Kalibrierung:
Equipment under Calibration: BBHA 9120 D Double Ridge Horn Antenna 1-18 GHz

Hersteller:
Manufacturer: SCHWARZBECK Mess-Elektronik

Serien-Nr.:
Serial Number: 805

Auftraggeber:
Customer: Musterkundennamen
Musterstraße 42
15008 Musterort

Kalibrierverfahren:
Calibration Method: SAE ARP 958 E

Messunsicherheit:
Measurement Uncertainty: ±1.1 dB Gain, Antenna Factor ($f \leq 15$ GHz)
±1.3 dB Gain, Antenna Factor ($f > 15$ GHz)

Datum der Kalibrierung:
Date of calibration: 03-DEC-2025

Ausstellungsdatum:
Date of issue: 03-DEC-2025

Bearbeiter:
Operator: Dipl.-Ing. Musternamen

Zeichnungsberechtigter:
Authorized signatory: Dipl.-Ing. Musternamen

Ergebnis der Kalibrierung:
Calibration Results: Daten innerhalb der Spezifikation
Data compliant to specification

Zur Kalibrierung wurden Messmittel oder Normale verwendet, die entweder direkt oder indirekt durch Ableitung physikalischer Grundgrößen unter Berücksichtigung des internationalen Einheitensystems (SI) auf nationale und internationale Normale rückführbar sind. Falls keine nationalen oder internationalen Normale existieren, erfolgte die Rückführung auf Schwarzbeck-Werksnormale.

The test equipment used for calibration purposes is either directly or indirectly traceable to national or international standards, applying worldwide approved techniques and the International System of Units (SI). In cases where no national or international standards exist, the traceability was based on Schwarzbeck laboratory standards.

Die angewandten Verfahren und Methoden bei Kalibrierung und Qualitätssicherung entsprechen den Vorgaben in EN ISO/IEC 17025 bzw. DIN EN ISO 9001.

The procedures and methods applied for calibration and quality management are in accordance with EN ISO/IEC 17025 and DIN EN ISO 9001.

Firmenstempel:
Firm stamp

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- **Messunsicherheit** *Measurement uncertainty*

Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor $k = 2$ ergibt. Sie wurde gemäß EA-4/02 M:2022 "Ermittlung der Messunsicherheit bei Kalibrierungen" ermittelt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95% im zugeordneten Werteintervall.

The stated expanded measurement uncertainty is obtained by multiplying the standard uncertainty by the coverage factor $k = 2$. It has been determined in accordance with EA-4/02 M:2022 "Evaluation of the Uncertainty of Measurement in Calibration". The value of the measurand lies within the assigned range of values with a probability of 95%.

- **Gebrauchsnormale** *Working Standards*

Messmittel: <i>Measurement Equipment:</i>	Hersteller: <i>Manufacturer:</i>	Kalibrierung: <i>Calibrated:</i>	Kalibrierschein Nr.: <i>Cal. Certificate No.:</i>
Netzwerkanalysator ZNB40	Rohde & Schwarz	2025-03	1020A300785141

- **Umgebungsbedingungen** *Environmental conditions*

Temperatur:
Ambient temperature : (23 ± 3) °C

Relative Luftfeuchte:
Relative humidity (50 ± 20) %

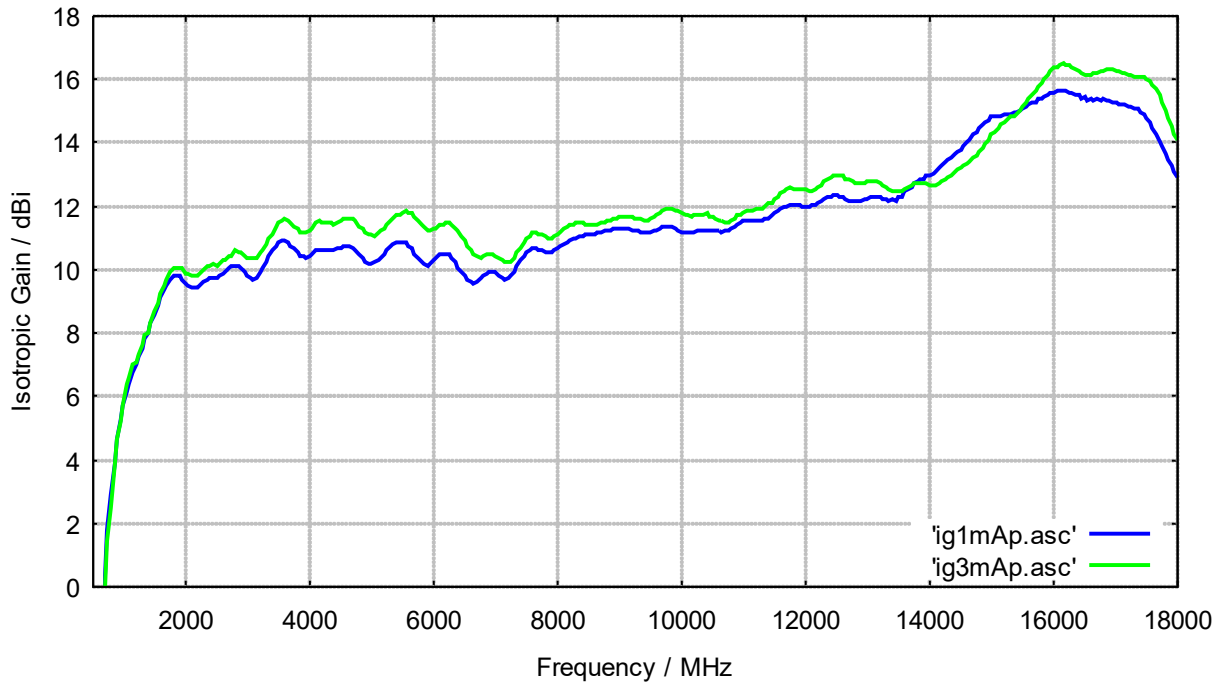
Kalibrierdaten gültig für 1 m und 3 m Messentfernung (Apertur)
 Calibration data valid for distances of 1 m and 3 m measured from antenna aperture



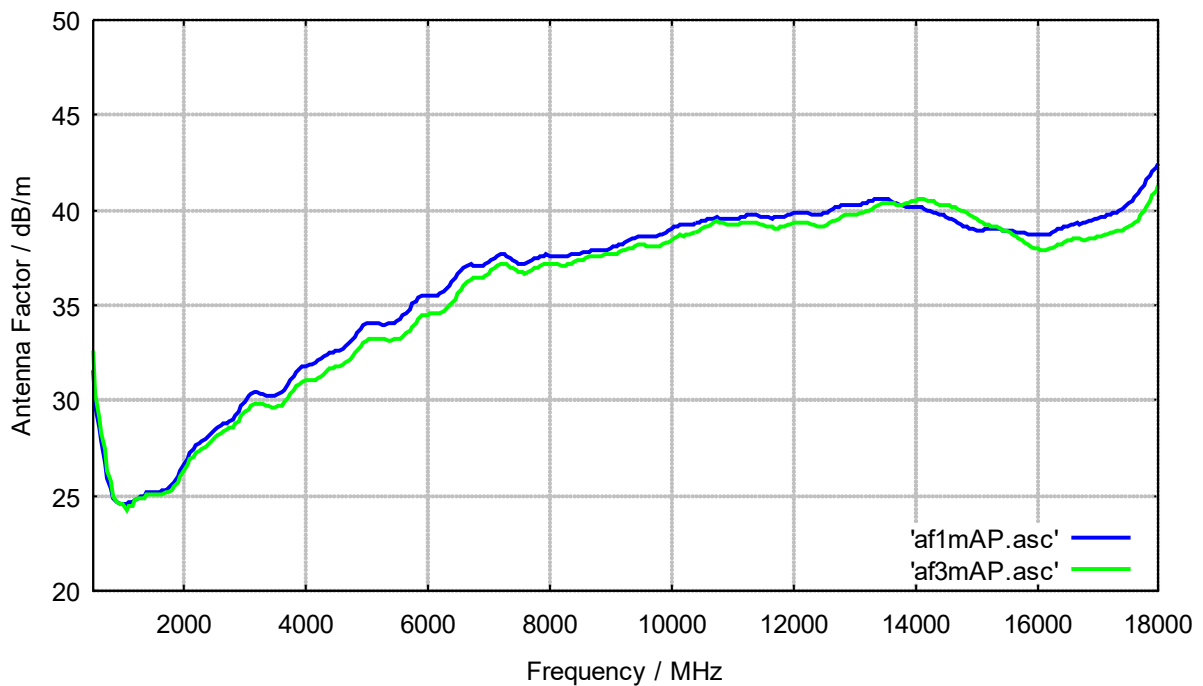
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• **Messergebnisse** *Measurement results*

Isotropiegewinn



Antennen-Wandlungsmaß



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Frequency	Isotropic gain 1 m Ap.	Antenna factor 1 m Ap.	Isotropic gain 3 m Ap.	Antenna factor 3 m Ap.
[MHz]	[dBi]	[dB/m]	[dBi]	[dB/m]
800.00	2.94	25.34	2.49	25.79
850.00	3.92	24.89	3.88	24.93
900.00	4.68	24.62	4.65	24.65
950.00	5.27	24.50	5.24	24.53
1000.00	5.68	24.54	5.68	24.54
1050.00	6.13	24.51	6.40	24.24
1100.00	6.42	24.63	6.60	24.45
1150.00	6.76	24.67	7.00	24.43
1200.00	7.00	24.80	7.10	24.70
1250.00	7.26	24.90	7.29	24.87
1300.00	7.51	24.99	7.63	24.87
1350.00	7.84	24.99	7.95	24.88
1400.00	8.01	25.13	8.03	25.11
1450.00	8.33	25.12	8.34	25.11
1500.00	8.59	25.15	8.66	25.08
1550.00	8.88	25.15	8.93	25.10
1600.00	9.12	25.18	9.27	25.03
1650.00	9.35	25.22	9.48	25.09
1700.00	9.52	25.31	9.69	25.14
1750.00	9.70	25.38	9.90	25.18
1800.00	9.78	25.55	10.03	25.30
1850.00	9.83	25.73	10.06	25.50
1900.00	9.78	26.02	10.06	25.74
1950.00	9.68	26.34	10.02	26.00
2000.00	9.58	26.66	9.89	26.35
2050.00	9.50	26.96	9.86	26.60
2100.00	9.46	27.20	9.78	26.88
2150.00	9.44	27.43	9.83	27.04
2200.00	9.43	27.64	9.80	27.27
2250.00	9.56	27.70	9.91	27.35
2300.00	9.64	27.81	9.99	27.46
2350.00	9.70	27.94	10.12	27.52
2400.00	9.72	28.10	10.13	27.69
2450.00	9.73	28.27	10.15	27.85
2500.00	9.74	28.44	10.12	28.06
2550.00	9.79	28.56	10.17	28.18
2600.00	9.85	28.67	10.28	28.24
2650.00	9.94	28.74	10.31	28.37
2700.00	10.03	28.82	10.40	28.45
2750.00	10.12	28.89	10.45	28.56
2800.00	10.14	29.02	10.58	28.58
2850.00	10.12	29.20	10.53	28.79
2900.00	10.03	29.44	10.57	28.90
2950.00	9.90	29.72	10.42	29.20
3000.00	9.79	29.97	10.38	29.38
3050.00	9.71	30.20	10.36	29.55
3100.00	9.69	30.36	10.34	29.71
3150.00	9.77	30.42	10.33	29.86
3200.00	9.90	30.42	10.52	29.80
3250.00	10.08	30.38	10.61	29.85
3300.00	10.25	30.34	10.80	29.79
3350.00	10.45	30.27	10.98	29.74

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Frequency	Isotropic gain 1 m Ap.	Antenna factor 1 m Ap.	Isotropic gain 3 m Ap.	Antenna factor 3 m Ap.
[MHz]	[dBi]	[dB/m]	[dBi]	[dB/m]
3400.00	10.63	30.22	11.12	29.73
3450.00	10.74	30.24	11.35	29.63
3500.00	10.85	30.25	11.47	29.63
3550.00	10.90	30.32	11.53	29.69
3600.00	10.91	30.44	11.59	29.76
3650.00	10.87	30.60	11.56	29.91
3700.00	10.76	30.82	11.50	30.08
3750.00	10.65	31.05	11.37	30.33
3800.00	10.54	31.28	11.27	30.55
3850.00	10.42	31.51	11.19	30.74
3900.00	10.40	31.64	11.16	30.88
3950.00	10.36	31.79	11.16	30.99
4000.00	10.43	31.83	11.23	31.03
4050.00	10.50	31.87	11.32	31.05
4100.00	10.58	31.90	11.45	31.03
4150.00	10.61	31.97	11.52	31.06
4200.00	10.62	32.06	11.49	31.19
4250.00	10.61	32.18	11.50	31.29
4300.00	10.62	32.27	11.47	31.42
4350.00	10.61	32.38	11.46	31.53
4400.00	10.62	32.47	11.44	31.65
4450.00	10.64	32.55	11.49	31.70
4500.00	10.69	32.59	11.51	31.77
4550.00	10.76	32.62	11.61	31.77
4600.00	10.76	32.72	11.61	31.87
4650.00	10.76	32.81	11.60	31.97
4700.00	10.68	32.98	11.59	32.07
4750.00	10.62	33.13	11.53	32.22
4800.00	10.51	33.33	11.38	32.46
4850.00	10.39	33.54	11.29	32.64
4900.00	10.25	33.77	11.17	32.85
4950.00	10.20	33.91	11.08	33.03
5000.00	10.17	34.03	11.09	33.11
5050.00	10.22	34.07	11.06	33.23
5100.00	10.29	34.08	11.15	33.22
5150.00	10.39	34.07	11.24	33.22
5200.00	10.49	34.05	11.30	33.24
5250.00	10.62	34.00	11.43	33.19
5300.00	10.71	34.00	11.52	33.19
5350.00	10.77	34.02	11.62	33.17
5400.00	10.83	34.04	11.72	33.15
5450.00	10.85	34.10	11.75	33.20
5500.00	10.85	34.18	11.79	33.24
5550.00	10.84	34.27	11.83	33.28
5600.00	10.76	34.42	11.81	33.37
5650.00	10.64	34.62	11.76	33.50
5700.00	10.51	34.83	11.65	33.69
5750.00	10.35	35.06	11.51	33.90
5800.00	10.24	35.25	11.41	34.08
5850.00	10.17	35.39	11.33	34.23
5900.00	10.14	35.50	11.21	34.43
5950.00	10.20	35.51	11.24	34.47

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Frequency	Isotropic gain 1 m Ap.	Antenna factor 1 m Ap.	Isotropic gain 3 m Ap.	Antenna factor 3 m Ap.
[MHz]	[dBi]	[dB/m]	[dBi]	[dB/m]
6000.00	10.28	35.50	11.27	34.51
6050.00	10.38	35.48	11.30	34.56
6100.00	10.46	35.47	11.39	34.54
6150.00	10.49	35.51	11.42	34.58
6200.00	10.50	35.57	11.45	34.62
6250.00	10.46	35.68	11.46	34.68
6300.00	10.35	35.86	11.41	34.80
6350.00	10.23	36.05	11.30	34.98
6400.00	10.08	36.26	11.20	35.14
6450.00	9.93	36.48	11.07	35.34
6500.00	9.79	36.69	10.90	35.58
6550.00	9.66	36.88	10.74	35.80
6600.00	9.61	37.00	10.59	36.02
6650.00	9.58	37.10	10.47	36.21
6700.00	9.61	37.13	10.44	36.30
6750.00	9.71	37.10	10.39	36.42
6800.00	9.80	37.07	10.40	36.47
6850.00	9.89	37.04	10.46	36.47
6900.00	9.94	37.06	10.51	36.49
6950.00	9.93	37.13	10.49	36.57
7000.00	9.90	37.22	10.43	36.69
7050.00	9.81	37.37	10.37	36.81
7100.00	9.75	37.50	10.30	36.95
7150.00	9.69	37.62	10.26	37.05
7200.00	9.71	37.66	10.23	37.14
7250.00	9.78	37.65	10.24	37.19
7300.00	9.92	37.57	10.37	37.12
7350.00	10.10	37.45	10.55	37.00
7400.00	10.28	37.32	10.69	36.91
7450.00	10.43	37.23	10.85	36.81
7500.00	10.57	37.15	10.99	36.73
7550.00	10.63	37.15	11.07	36.71
7600.00	10.67	37.17	11.15	36.69
7650.00	10.64	37.25	11.14	36.75
7700.00	10.60	37.35	11.11	36.84
7750.00	10.58	37.43	11.09	36.92
7800.00	10.55	37.51	11.07	36.99
7850.00	10.53	37.59	11.01	37.11
7900.00	10.56	37.61	11.01	37.16
7950.00	10.58	37.65	11.04	37.19
8000.00	10.67	37.61	11.11	37.17
8050.00	10.71	37.63	11.17	37.17
8100.00	10.80	37.59	11.27	37.12
8150.00	10.86	37.58	11.33	37.11
8200.00	10.92	37.58	11.39	37.11
8250.00	10.95	37.60	11.44	37.11
8300.00	11.01	37.59	11.45	37.15
8350.00	11.02	37.63	11.45	37.20
8400.00	11.06	37.65	11.46	37.25
8450.00	11.09	37.67	11.42	37.34
8500.00	11.10	37.71	11.43	37.38
8550.00	11.10	37.76	11.44	37.42

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Frequency	Isotropic gain 1 m Ap.	Antenna factor 1 m Ap.	Isotropic gain 3 m Ap.	Antenna factor 3 m Ap.
[MHz]	[dBi]	[dB/m]	[dBi]	[dB/m]
8600.00	11.12	37.79	11.42	37.49
8650.00	11.15	37.81	11.43	37.53
8700.00	11.17	37.84	11.47	37.54
8750.00	11.20	37.86	11.46	37.60
8800.00	11.21	37.90	11.53	37.58
8850.00	11.25	37.91	11.56	37.60
8900.00	11.28	37.93	11.57	37.64
8950.00	11.32	37.94	11.62	37.64
9000.00	11.32	37.98	11.65	37.65
9050.00	11.30	38.05	11.67	37.68
9100.00	11.29	38.11	11.68	37.72
9150.00	11.27	38.18	11.68	37.77
9200.00	11.25	38.25	11.66	37.84
9250.00	11.22	38.32	11.63	37.91
9300.00	11.20	38.39	11.61	37.98
9350.00	11.17	38.47	11.60	38.04
9400.00	11.15	38.53	11.55	38.13
9450.00	11.14	38.59	11.56	38.17
9500.00	11.18	38.59	11.58	38.19
9550.00	11.22	38.60	11.64	38.18
9600.00	11.26	38.61	11.72	38.15
9650.00	11.30	38.61	11.78	38.13
9700.00	11.35	38.61	11.82	38.14
9750.00	11.36	38.64	11.89	38.11
9800.00	11.37	38.67	11.93	38.11
9850.00	11.34	38.75	11.89	38.20
9900.00	11.28	38.85	11.86	38.27
9950.00	11.25	38.93	11.83	38.35
10000.00	11.19	39.03	11.80	38.42
10050.00	11.15	39.11	11.74	38.52
10100.00	11.16	39.15	11.73	38.58
10150.00	11.14	39.21	11.68	38.67
10200.00	11.17	39.22	11.74	38.65
10250.00	11.21	39.22	11.71	38.72
10300.00	11.23	39.25	11.71	38.77
10350.00	11.25	39.27	11.71	38.81
10400.00	11.26	39.30	11.77	38.79
10450.00	11.25	39.35	11.69	38.91
10500.00	11.24	39.40	11.65	38.99
10550.00	11.21	39.48	11.57	39.12
10600.00	11.21	39.52	11.56	39.17
10650.00	11.18	39.59	11.52	39.25
10700.00	11.22	39.59	11.48	39.33
10750.00	11.25	39.60	11.46	39.39
10800.00	11.30	39.59	11.56	39.33
10850.00	11.37	39.56	11.61	39.32
10900.00	11.42	39.55	11.70	39.27
10950.00	11.47	39.54	11.73	39.28
11000.00	11.52	39.53	11.80	39.25
11050.00	11.53	39.56	11.82	39.27
11100.00	11.54	39.59	11.85	39.28
11150.00	11.52	39.65	11.88	39.29



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Frequency	Isotropic gain 1 m Ap.	Antenna factor 1 m Ap.	Isotropic gain 3 m Ap.	Antenna factor 3 m Ap.
[MHz]	[dBi]	[dB/m]	[dBi]	[dB/m]
11200.00	11.53	39.67	11.89	39.31
11250.00	11.53	39.71	11.91	39.33
11300.00	11.56	39.72	11.93	39.35
11350.00	11.59	39.73	11.95	39.37
11400.00	11.63	39.73	12.07	39.29
11450.00	11.71	39.69	12.12	39.28
11500.00	11.77	39.66	12.20	39.23
11550.00	11.84	39.63	12.30	39.17
11600.00	11.89	39.62	12.39	39.12
11650.00	11.96	39.59	12.46	39.09
11700.00	11.98	39.60	12.53	39.05
11750.00	12.02	39.60	12.57	39.05
11800.00	12.01	39.65	12.55	39.11
11850.00	12.02	39.67	12.55	39.14
11900.00	12.01	39.72	12.53	39.20
11950.00	12.00	39.77	12.53	39.24
12000.00	11.99	39.81	12.52	39.28
12050.00	12.00	39.84	12.47	39.37
12100.00	12.03	39.85	12.50	39.38
12150.00	12.06	39.85	12.55	39.36
12200.00	12.11	39.84	12.61	39.34
12250.00	12.16	39.82	12.68	39.30
12300.00	12.22	39.80	12.76	39.26
12350.00	12.30	39.75	12.83	39.22
12400.00	12.31	39.78	12.91	39.18
12450.00	12.33	39.79	12.95	39.17
12500.00	12.33	39.83	12.99	39.17
12550.00	12.31	39.88	12.97	39.22
12600.00	12.26	39.97	12.94	39.29
12650.00	12.25	40.01	12.85	39.41
12700.00	12.18	40.12	12.83	39.47
12750.00	12.17	40.16	12.76	39.57
12800.00	12.14	40.22	12.72	39.64
12850.00	12.14	40.26	12.70	39.70
12900.00	12.17	40.26	12.69	39.74
12950.00	12.20	40.27	12.72	39.75
13000.00	12.25	40.25	12.75	39.75
13050.00	12.26	40.27	12.75	39.78
13100.00	12.31	40.26	12.75	39.82
13150.00	12.27	40.33	12.75	39.85
13200.00	12.31	40.32	12.72	39.91
13250.00	12.21	40.45	12.67	39.99
13300.00	12.24	40.46	12.60	40.10
13350.00	12.14	40.59	12.53	40.20
13400.00	12.21	40.55	12.47	40.29
13450.00	12.18	40.61	12.47	40.32
13500.00	12.28	40.55	12.46	40.37
13550.00	12.31	40.55	12.45	40.41
13600.00	12.45	40.44	12.53	40.36
13650.00	12.53	40.39	12.58	40.34
13700.00	12.62	40.33	12.66	40.29
13750.00	12.73	40.26	12.71	40.28

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[MHz]	[dBi]	[dB/m]	[dBi]	[dB/m]
13800.00	12.77	40.25	12.72	40.30
13850.00	12.84	40.21	12.71	40.34
13900.00	12.87	40.21	12.72	40.36
13950.00	12.94	40.17	12.69	40.42
14000.00	12.95	40.19	12.66	40.48
14050.00	13.05	40.12	12.65	40.52
14100.00	13.07	40.13	12.66	40.54
14150.00	13.19	40.05	12.70	40.54
14200.00	13.27	40.00	12.77	40.50
14250.00	13.38	39.92	12.83	40.47
14300.00	13.45	39.88	12.89	40.44
14350.00	13.55	39.81	12.99	40.37
14400.00	13.63	39.76	13.07	40.32
14450.00	13.72	39.70	13.13	40.29
14500.00	13.80	39.65	13.20	40.25
14550.00	13.91	39.57	13.26	40.22
14600.00	14.01	39.50	13.33	40.18
14650.00	14.09	39.45	13.40	40.14
14700.00	14.25	39.32	13.50	40.07
14750.00	14.34	39.26	13.59	40.01
14800.00	14.48	39.15	13.69	39.94
14850.00	14.55	39.10	13.82	39.83
14900.00	14.67	39.01	13.95	39.73
14950.00	14.73	38.98	14.08	39.63
15000.00	14.80	38.94	14.25	39.49
15050.00	14.81	38.96	14.35	39.42
15100.00	14.85	38.95	14.45	39.35
15150.00	14.83	39.00	14.57	39.26
15200.00	14.87	38.99	14.65	39.21
15250.00	14.86	39.03	14.71	39.18
15300.00	14.90	39.01	14.80	39.11
15350.00	14.93	39.01	14.84	39.10
15400.00	14.97	39.00	14.92	39.05
15450.00	15.04	38.96	15.04	38.96
15500.00	15.09	38.94	15.14	38.89
15550.00	15.16	38.89	15.24	38.81
15600.00	15.20	38.88	15.38	38.70
15650.00	15.27	38.84	15.49	38.62
15700.00	15.29	38.85	15.63	38.51
15750.00	15.37	38.80	15.77	38.40
15800.00	15.38	38.81	15.89	38.30
15850.00	15.47	38.75	16.01	38.21
15900.00	15.50	38.75	16.16	38.09
15950.00	15.56	38.72	16.24	38.04
16000.00	15.60	38.70	16.35	37.95
16050.00	15.64	38.69	16.40	37.93
16100.00	15.66	38.70	16.45	37.91
16150.00	15.64	38.74	16.48	37.90
16200.00	15.65	38.76	16.46	37.95
16250.00	15.57	38.87	16.43	38.01
16300.00	15.57	38.89	16.39	38.07
16350.00	15.49	39.00	16.32	38.17



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Frequency	Isotropic gain 1 m Ap.	Antenna factor 1 m Ap.	Isotropic gain 3 m Ap.	Antenna factor 3 m Ap.
[MHz]	[dBi]	[dB/m]	[dBi]	[dB/m]
16400.00	15.48	39.04	16.27	38.25
16450.00	15.39	39.15	16.21	38.33
16500.00	15.42	39.15	16.16	38.41
16550.00	15.34	39.26	16.15	38.45
16600.00	15.40	39.22	16.15	38.47
16650.00	15.35	39.30	16.19	38.46
16700.00	15.40	39.27	16.21	38.46
16750.00	15.35	39.35	16.25	38.45
16800.00	15.39	39.34	16.28	38.45
16850.00	15.34	39.41	16.29	38.46
16900.00	15.34	39.44	16.32	38.46
16950.00	15.28	39.52	16.29	38.51
17000.00	15.26	39.57	16.26	38.57
17050.00	15.23	39.62	16.24	38.61
17100.00	15.21	39.67	16.20	38.68
17150.00	15.17	39.74	16.18	38.73
17200.00	15.15	39.78	16.14	38.79
17250.00	15.14	39.82	16.11	38.85
17300.00	15.08	39.90	16.08	38.90
17350.00	15.07	39.94	16.08	38.93
17400.00	14.96	40.07	16.06	38.97
17450.00	14.89	40.17	16.04	39.02
17500.00	14.75	40.33	15.99	39.09
17550.00	14.63	40.48	15.92	39.19
17600.00	14.43	40.70	15.80	39.33
17650.00	14.29	40.86	15.68	39.47
17700.00	14.04	41.14	15.48	39.70
17750.00	13.87	41.33	15.27	39.93
17800.00	13.63	41.60	15.02	40.21
17850.00	13.47	41.78	14.78	40.47
17900.00	13.25	42.03	14.51	40.77
17950.00	13.09	42.21	14.28	41.02
18000.00	12.88	42.45	14.07	41.26