प्रसार भारती
Prasar Bharati
भारत का लोक सेवा प्रसारक
India's Public Service Broadcaster
कार्यालयः अपर महानिदेशक (अभि॰) (उतरी क्षेत्र)
Office of the Additional Director General (E) (NZ)
आकाशवाणी एवं दूरदर्शन
Akashwani & Doordarshan
आठवां तल, सूचना भवन, सी.जी.ओ. कॉम्प्लेक्स, नई दिल्ली 110003
8th floor, Soochna Bhawan, CGO Complex, New Delhi-110003

सत्यम् शिवम् सुन्दरम्

Jaisalmer/2V/3/2024-25/Instt/(Hauling Antenna) **Dated: 03.12.2024**

Subject: Shifting, hauling and fixing of 6 bay antenna with associated work at 300mtr RCC tower Ramgarh, Jaisalmer (Rajasthan).

1. The budgetary quotation of the upcoming tender is enclosed herewith to offer comments, if any by prospective bidders/firms.
2. Bidders/firms are requested to provide information about content in respect of works along with budgetary quote.
3. Bidders/firms may please submit the above detail on or before due date by e-mail to rajkishoresingh3@prasarbharati.gov.in or at following address.

R. K Singh
Assistant Director (Engg.)
Room No. 899,
O/o ADG (E)(NZ)
Akashvani & Doordarshan,
8th floor, CGO Complex,
Soochna Bhawan, New Delhi-110003
Mobile No.: 9868826690
e-mail id: rajkishoresingh3@prasarbharati.gov.in

Budgetary Quotation for: Shifting, hauling and fixing of 6 bay antenna with associated work at 300mtr RCC tower Ramgarh, Jaisalmer (Rajasthan).

Due Date to offer Comments: 17.12.2024

Enclosed:

1. Budgetary Quotation form & technical details of the upcoming tender is enclosed herewith to offer comments, if any by prospective bidders/firms.

3/12/2024

Assistant Director (Engg.)
For Add. Director General (NZ)

रवीन्द्र कुमार श्रीवास्तव / Ravinder Kumar Srivastav
सहा. निदेशक (अभि.) / Asstt. Director (Engg)

प्रसार भारती
Prasar Bharati
भारत का लोक सेवा प्रसारक
India's Public Service Broadcaster
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आठवां तल, सूचना भवन, सी.जी.ओ. कॉम्प्लेक्स, नई दिल्ली 110003
8th floor, Soochna Bhawan, CGO Complex, New Delhi-110003

Jaisalmer/2V/3/2024-25/Instt/(Hauling Antenna) **Date:**

Budgetary Quotation Form

Project: Setting up of 20kW (1+1) FM Transmitter at Akashvani HPT Ramgarh, Jaisalmer (Rajasthan).
Subject: Shifting, hauling and fixing of 6 bay antenna with associated work at 300 mtr RCC tower Ramgarh, Jaisalmer (Rajasthan).

Last date of receipt of budgetary quotation in this office: 17.12.2024 upto 12:00Hrs.
Please read carefully the terms and conditions given the enquiry quotation form.

S.No.	Description	Qty	Rates	Amount
1.	Painting of Self supported 50 meter FM Tower on 250 mtr RCC tower and tray with one coat of primer and two coats of final paints including material at All India Radio FM site Ramgarh, Jaisalmer (Rajasthan). as per specification (Annexure-1) and terms & conditions (Annexure-II) attached.	1 Job		
2	Shifting of 6 bay FM antenna with divider, branch feeder, tunner and associated equipment form D-6 Godown, Mall Road, Delhi to Ramgarh TV Tower, Jaisalmer including packing, loading, unloading and transit insurance.	1 Job		
3	Opening of 3-1/8" RF cables (2 Nos.) connection from existing TV antenna at height of approx 275 mtr and Measurement of RF cables at Transmitter end with termination at top end of cables. Re-fixing of 3⅛" RF cable at suitable height (250 to 275 mtr) with providing and fixing SS clamp 25 nos. of size 3⅛" dia.	1 Job		
4	Supply of 100 mm dia (OD) B Class pipe 18 meter and fixing with SS tower leg at height of (250 to 275mtr) by providing C channel (100mm x 50mm x 6mm) clamp & SS threaded road size 16mm (8 nos.)	1 Job		
5	Hoisting of 6 bay FM antenna with associated equipments on DD RCC Tower at height of (250 to 275 mtr) and connection with FM antenna and sealing with silicon sealant.	1 Job		
6	Measurement of 6 bay cable antenna at transmitter end of RF cable for VSWR, return loss, and matching percentage on given frequency and rectification if required.	1 Job		
7	Leakage test of RF Cable at transmitter end from dehydration and rectification of leakage if any.	1 Job		
8.	Any other work to complete the job.	1 Job		
	Total			
	GST@			
	Grand Total			

Note:

- **Time of execution as per permission of engineer incharge at HPT Ramgarh, Jaisalmer (Rajasthan).**
- **The bidder must be experienced in same kind of scope & shall submit documentary evidence with offer. The completion certificate is to be attached, issued by any Govt. Agency only.**
- **Execution of scope has to be completed without break in service at HPT Ramgarh, Jaisalmer (Rajasthan).**
- **Before submitting the offer tenderer must visit site and with prior permission of the site in-charge and submit confirmation of site visit. Technical details will be provided by In-charge of Site/I.O.**
- **The firm has to produce a list all such labour along with the address proof which are to be employed office on signing contract. The firm shall issue the identity cards to all such persons to facilitate the entry in at HPT Ramgarh, Jaisalmer (Rajasthan).**
- **Inspection will be carried out preferably in presence of authorized representative of O/o ADG (NZ), AIR & DD, 8th floor, Soochna Bhawan, CGO Complex, New Delhi-110003.**
- **Any damage or misplace in equipment will have to be provided by the firm during execution.**

1) Quantity of Material & Scope may increase or decrease as per actual requirement/constraints at site.
2) Please read carefully the terms and conditions given in this quotation form.
a) GST No: …… b) PAN No……
3) **Delivery at:** 20kW (1+1) FM Transmitter at HPT Ramgarh, Jaisalmer (Rajasthan).
4) **Consignee:** Installation officer, HPT Ramgarh, Jaisalmer (Rajasthan).
5) **Completion Period:** Execution/Completion of scope within 60days from the date of order.
6) **Validity:** 120days
7) **Payment terms:**
- 97% Payment on completion/execution of scope in good condition at site.
- Balance payment of 03% will be paid after guarantee/warranty period of one year. However payment can be released against FDR/Account Payee Demand Draft/Banker's Cheque of equivalent amount in favour of Chief Engineer (NZ), AIR & DD, New Delhi valid for guarantee period at least.

8) **Performance Security:**
- The firm/supplier/contractor should submit performance security deposit in the form of FDR from a schedule commercial bank valid for one year in favour of Chief Engineer (NZ), AIR & DD, New Delhi.
- The performance security deposit shall be 03% of cost of the order/contract value.
- For release of security deposit/performance security, the firm will submit his claim along with a certificate from the ultimate consignee that equipment supplied/SITC executed against this order has performed satisfactorily during its warranty/guarantee period and department have not suffered any loss/inconvenience on this account.

9) **Declaration:** We declare that all the conditions as given in the quotation form have been read by us.

Name (in capital) _____
(Seal & Signature of the Bidder)

Annexure-I

1. Inspection of self support tower and tightening of all the nut-bolts of tower.
2. Submitting report about rust & deformities in member of tower (if any)
3. Repainting of Self supported 50 meter FM Tower & tray with one coat of primer and two coats of final paints including material
4. Painting material, brush etc supplied by firm. Scope of work for Painting 50 meter Self supported Tower on 250 mtr RCC Tower.
5. All the personal working on tower should be insured. Firm shall be required to produce the insurance paper to the Work Supervisory Authority on demand.
6. The firm has to produce a list all such worker along with the address which are to be Employed Office on signing contract. The firm shall issue the identity cards to all such persons to facilitate the entry in Complex.
7. No chemicals of any kind whatsoever are to be used. The practice of mixing kerosene oil with paint is strictly forbidden.
8. The firm shall ensure that all the safety precautions are taken during the execution of Job like wearing of Helmets and safety belts etc
9. Scraping of old damaged paint with proper equipment/tools and cleaning all the dust particles.
10. Before applying The primer coat the physical status will be checked by the IO./authorized departmental person.
11. After applying single coat of primer (Zinc chromate). The primer coat shall be allowed to dry for minimum 48 hrs before the applying next coat of paint.
12. Painting of tower along with tray with enemal paint of reputed make such as Berger/Asian/of approved shade & colour or as per previously painted shade job include with all the material ,safety tools ,labour etc and other item required for completion of job.

Scope of work for Painting 50 meter Tower on 250 mtr RCC tower.

1.	Name of Job	Painting of 50 meter Self supported Tower at All India Radio 20 kW FM site in Rajasthan.
2.	Locations where Tower painting is to be done along with the height and type is given the **Quotation form**	50 meter Self supported Tower All India Radio FM site Ramgarh, Jaisalmer (Rajasthan).
3.	Time allowed during the day for the painting	Subjected to the good visibility. Painting would not be carried out under the conditions in which water is liable to condense on the surface.
4.	Painting of Tower	The tower should be painted in alternative bands of international orange and white terminating with orange band both at top and bottom. There should be no alteration or change in existing system of band.
5.	Preparation of surface	All dust, dirt grease and rust if any, should be thoroughly removed with soap or detergent. After degreasing and cleaning when the surface is dry, without too much delay a coat of zinc chromate primer shall be applied. The primer coat shall be allowed to dry for a minimum of 72 hours before application of next coat of paints.
6.	Coats of paint	Two coats of paints shall be applied. The first coat shall be allowed to dry for at least 48 hours before the second coat is applied. The painting coat of high quality exterior gloss paint shall be applied.
7.	Specifications for painting	The primer, paint and thinner used should meet the under mentioned specification. **IS-2074-1962: Ready Mix paint red oxide Zinc Chrome priming.** **IS-2932-1964: Synthetic enamel exterior type paint.** **IS-1745-1961: Petroleum Hydrocarbon Solvents (Thinner).** All the paints for the different coats shall be compatible with each other and shall be of the same make
8.	Type of painting	Brush Painting
9.	Compliance	A point-by-point compliance statement in respect of all the points laid down in scope of work including acceptance of all terms and conditions of tender papers.
10.	Liquidated damages	The successful bidder will be required to complete the work within six weeks from the date of work order. If the bidder is unable to complete the work within the stipulated time after placing the order for reasons not attributable to him, the authority will allow such additional time as he may consider justified without liquidated damage and without altering the terms and conditions of bidder to complete the work within the stipulated time or extended time, the authority has the right to impose a liquidated damage @ ½% of the work contract value per week or part thereof. The bidder's liability for delay, however, shall not exceed 5% of the total material value
11.	Paying Authority	The O/o ADG (E) NZ, Soochna Bhawan, CGO Complex, New Delhi-110003.
12	**NOTE**	
a.	All the personal working on tower should be insured. Firm shall be required to produce the insurance paper to the Work Supervisory Authority on demand.	
b.	The firm has to produce a list all such worker along with the address which are to be Employed Office on signing contract. The firm shall issue the identity cards to all such persons to facilitate the entry in Complex.	
c.	No chemicals of any kind whatsoever are to be used. The practice of mixing kerosene oil with paint is strictly forbidden.	
d.	The firm shall ensure that all the safety precautions are taken during the execution of Job like wearing of Helmets and safety belts etc.	

- Scraping of old damaged paint with proper equipment/tools and cleaning all the dust particles before applying the primer coat.
- The physical status will be checked by the IO./authorized departmental person. After applying single coat of primer (Zinc chromate). The primer coat shall be allowed to dry for minimum 48 hrs before the applying next coat of paint.
- Painting of tower along with tray with enemal paint of reputed make such as Berger/Asian/of approved shade & colour or as per previously painted shade job include with all the material, safety tools, labour etc and other item required for completion of job.

Annexure-II

GENERAL TERMS AND CONDITIONS FOR SMOOTH EXECUTION OF WORK AT SITE:-

1. All Tools, plants, implements, winch machine, labor and supervisors, as required, to be provided by the bidder. Bidder has to provide necessary insurance of the labour at his own cost before commencing the supply. Proper safety measure to be adhered by the bidder in respect of materials and manpower.
2. Other working systems should not be damaged causing disruption of ongoing Transmission. Any damage caused to the property at site while carrying out the work has to be made good by the Bidder at his own cost.
3. The bidder shall complete and include all minor/major items and accessories which may not have been enumerated in this scope of supply but which are useful and necessary for completion of supply at his own cost.
4. Prior approval of the purchaser, in writing, shall be obtained, if the bidder desires to sublet or assign any section of the work associated with supply. Such permission of consent shall not, however discharge the bidder from his liabilities in this contract or any part thereof.
5. The bidder shall make his own arrangements for the storage of materials and their safe custody at site for the entire SUPPLY.
6. Bidder shall repair all damages to the purchaser's building, property, equipment etc. whatso-ever arising from the project and in the course of such supply and throughout the period during which the safety of property of the purchaser is guaranteed.
7. The bidder shall indemnify and hold harmless the purchaser against any claims in respect of damages to building, property situated nearby, not belonging to the purchaser, how-soever arising in course of such supply and throughout the period of guarantee.
8. The bidder shall discharge all obligations under the Indian workmen's compensation act, any local, state laws and regulations in so far as it affects the workmen in his employment. All the workman/labours employed/hired for the work should be covered with applicable insurance for any injury, accident/death and also all the applicable labour laws should be followed by the contractor including their payment and wages.
9. The bidder shall make his own arrangement for employing labour (skilled & unskilled) and shall make his own arrangement for providing accommodation for his workmen at site or elsewhere.
10. The bidder shall hold the purchaser and his employees safe, harmless and immune from any liability that may arise out of infringements of patents and copyright associated with design, fabrication and modification supply as applicable.
11. The Scope of supply tendered are available in the complete bid documents which can be viewed / downloaded free of cost from e-tender portal.

Name (in capital)_____

Seal & Signature of the Bidder

ARRAYCOM (INDIA) LTD.
FM antenna system

Type	:	FMC-06/P/6 (6x1) Omni-Directional
SIRA RADIO SYSTEMS Ref.	:	CO 240269
Code	:	160016046
Power handling capacity	:	≥ 45 kW
Operating frequency	:	TBD MHz
Polarization	:	Circular

Tender Ref. No. 12(117)11/6-BayAntenna/2024/699/D(P-S)Cell dated 07-02-2024 for "Supply of 6 Bay Circularly polarized side mount (Pole type) VHF FM Antenna with Omni-directional pattern."

Location TBD station
(State TBD)

BROADCAST

Ed. 01 - 29/08/2024

by KATHREIN SIRA RADIO SYSTEMS

KATHREIN

INDEX

Antenna system FMC-06/P/6 (6x1)

SECTION 1

DESCRIPTIONS AND ELECTRICAL DATA

BROADCAST

by KATHREIN SIRA RADIO SYSTEMS

KATHREIN

SIRA RADIO SYSTEMS KATHREIN	**FM Antenna system type** **FMC-06/P/6 (6x1)**

GENERAL DESCRIPTION

The antenna system type FMC-06/P/6 has an aperture of six bays with one element each bay, total of six elements. This system is an array of circularly polarized elements suitably designed for omnidirectional pattern, side or top mounted on supporting tower.

Each element is provided with a special pipe clamp 75 ÷ 114 mm* diameter and is individually fed through a 1-5/8” EIA input. The max power handling capability is 12.5kW; it is protected against ice and snow by means of feedpoint radome.

The FMC-06/P elements is mounted at 45° with respect to the vertical axis.

The material used to manufacture the external parts are of stainless steel and nickel plated brass; internal parts of brass and nickel plated brass and some silver plated components; radomes are made of fibreglass.

The antenna splitting system is made with coaxial cables and power splitters, whose type and dimensions are chosen in accordance to the desidered power handling capability, gain and pattern.

Power dividers and are made of copper and brass, silver plated comppnents.

Clamps are made of hot dip galvanized steel.

All fasteners are made of stainless steel or non corrosive material.

Insulators are made of high quality Teflon.

All joints will be made completely air tight & water tight.

All antenna system components are watertight and tested separately in the factory.

The electrical phases of each cable has also been checked.

* suggested OD=101mm

SIRA RADIO SYSTEMS KATHREIN	**ELECTRICAL AND MECHANICAL CHARACTERISTICS** **ANTENNA TYPE FMC-06/P/6 (6x1)**

FREQUENCY BAND	: 88 MHz - 108 MHz
POWER HANDLING CAPACITY **(At 40° C ambient temperature)**	: >= 45 KW
POLARIZATION	: CIRCULAR
HORIZONTAL RADIATION PATTERNS	: SEE ANNEXE
VERTICAL RADIATION PATTERNS	: SEE ANNEXE
DOWNWARD BEAM TILT	: 1° for entire operating frequency range
NULL FILLING	: 10%
F/B RATIO **(Horizontal patterns)**	: NA
PEAK GAIN **(Referred to λ/2 dipole, including losses of branch cables, power divider, tilt and null fill)**	: ≥ 5.5 dBd
INPUT IMPEDANCE	: 50 Ω unbalanced
V.S.W.R. **(On main power divider input)**	: Less than 1.2: 1.0 for 100 to 108 MHz. Less than 1.1: 1.0 for operating frequency (the operating frequency(s) shall be intimated later at the time of placement of the order).
INPUT CONNECTOR	: 3-1/8" EIA Flanged
HEIGHT OF ARRAY	: 13850 mm (with 2600mm typical spacing)
TOTAL NET WEIGHT **(without supporting hardware)**	: ~ 240 kg
WIND LOAD	: ≤ 400 kg @ 180Km/h : ≤ 485 kg @ 198Km/h
PRESSURIZABLE **(20 ÷ 30 kPa)**	: Yes, up to feedpoint dipole

SIRA RADIO SYSTEMS KATHREIN	**ELECTRICAL AND MECHANICAL CHARACTERISTICS** **ANTENNA TYPE FMC-06/P/6 (6x1)**

OPERATING TEMPERATURE	: -5 - +50°C
RELATIVE HUMIDITY	: 95% Non Condensing

1424607/2024/Tx Design Division - P&D Unit

SIRA RADIO SYSTEMS	**Antenna system Peak Gain**	KATHREIN

Pg	=	Ag + Hg - Cl - Sl - Bl - Nl - Ol
Pg [dBd]	=	Peak Gain (referred to λ/2 dipole)
Ag [dBd]	=	Average Gain - intrinsic gain of the vertical aperture
Hg [dBd]	=	Total horizontal directivity
(a) Cl [dBd]	=	Branch feeder cable losses
(b) Sl [dBd]	=	Splitter losses
(c) Bl [dBd]	=	Beam tilt losses
(d) Nl [dBd]	=	Null fill losses
(e) Ol [dBd]	=	Other losses

Antenna type FMC-06/P/6 (6x1) - OMNIDIRECTIONAL

CIRCULAR polarization

Component			**H**	**V**	**H**	**V**	**H**	**V**
Frequency [MHz]			**88.0**	**88.0**	**98.0**	**98.0**	**108.0**	**108.0**
Ag [dBd]		=	4.533	4.540	4.920	4.928	5.200	5.232
Hg [dBd]		=	1.690	1.740	1.880	1.570	2.380	1.560
(a) Cl [dBd]		=	0.090	0.090	0.100	0.100	0.100	0.100
(b) Sl [dBd]		=	0.009	0.009	0.009	0.009	0.009	0.009
(c) Bl [dBd]		=	0.005	0.050	0.005	0.005	0.005	0.005
(d) Nl [dBd]		=	0.260	0.260	0.320	0.320	0.390	0.390
(e) Ol [dBd]	FMC-06/P	=	0.010	0.010	0.010	0.010	0.010	0.010
Pg [dBd]		=	**5.849**	**5.861**	**6.356**	**6.054**	**7.066**	**6.278**

TECHNICAL
DOCUMENTATION

Horizontal and Vertical Patterns

BROADCAST

Horizontal Component

by KATHREIN
SIRA
RADIO SYSTEMS

KATHREIN

THEORETICAL HORIZONTAL PATTERN

Frequency 88.00 MHz (Logarithmic scale)

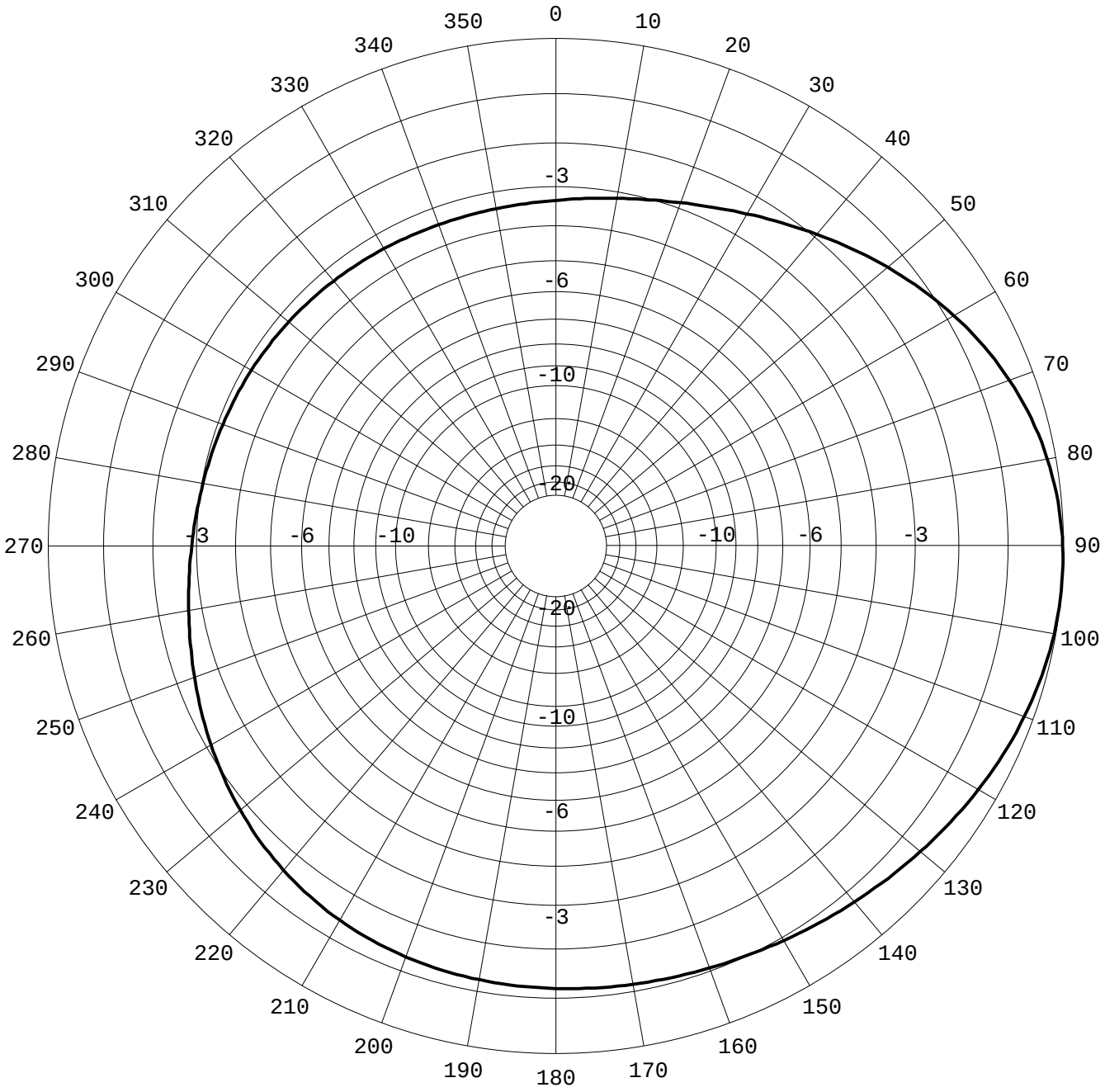

TABLE OF CALCULATED VALUES

degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB
0	-3.34	60	-0.85	120	-0.34	180	-1.19	240	-2.12	300	-3.20
1	-3.33	61	-0.81	121	-0.36	181	-1.19	241	-2.15	301	-3.21
2	-3.32	62	-0.76	122	-0.39	182	-1.20	242	-2.18	302	-3.21
3	-3.30	63	-0.71	123	-0.41	183	-1.20	243	-2.21	303	-3.22
4	-3.28	64	-0.67	124	-0.43	184	-1.20	244	-2.24	304	-3.23
5	-3.27	65	-0.63	125	-0.45	185	-1.21	245	-2.27	305	-3.23
6	-3.25	66	-0.58	126	-0.47	186	-1.21	246	-2.30	306	-3.24
7	-3.23	67	-0.54	127	-0.50	187	-1.22	247	-2.33	307	-3.25
8	-3.21	68	-0.50	128	-0.52	188	-1.22	248	-2.36	308	-3.26
9	-3.18	69	-0.47	129	-0.54	189	-1.23	249	-2.39	309	-3.26
10	-3.16	70	-0.43	130	-0.56	190	-1.23	250	-2.42	310	-3.27
11	-3.14	71	-0.39	131	-0.58	191	-1.23	251	-2.45	311	-3.28
12	-3.11	72	-0.36	132	-0.60	192	-1.24	252	-2.48	312	-3.28
13	-3.09	73	-0.33	133	-0.63	193	-1.25	253	-2.50	313	-3.29
14	-3.06	74	-0.30	134	-0.65	194	-1.25	254	-2.53	314	-3.30
15	-3.03	75	-0.27	135	-0.67	195	-1.25	255	-2.56	315	-3.31
16	-3.00	76	-0.24	136	-0.69	196	-1.26	256	-2.59	316	-3.31
17	-2.97	77	-0.21	137	-0.71	197	-1.27	257	-2.61	317	-3.32
18	-2.93	78	-0.19	138	-0.73	198	-1.28	258	-2.64	318	-3.33
19	-2.90	79	-0.16	139	-0.75	199	-1.28	259	-2.66	319	-3.34
20	-2.86	80	-0.14	140	-0.77	200	-1.29	260	-2.69	320	-3.34
21	-2.83	81	-0.12	141	-0.78	201	-1.30	261	-2.71	321	-3.35
22	-2.79	82	-0.10	142	-0.80	202	-1.31	262	-2.73	322	-3.36
23	-2.75	83	-0.09	143	-0.82	203	-1.32	263	-2.75	323	-3.36
24	-2.71	84	-0.07	144	-0.84	204	-1.33	264	-2.78	324	-3.37
25	-2.67	85	-0.06	145	-0.86	205	-1.34	265	-2.80	325	-3.38
26	-2.62	86	-0.05	146	-0.87	206	-1.35	266	-2.82	326	-3.38
27	-2.58	87	-0.03	147	-0.89	207	-1.36	267	-2.84	327	-3.39
28	-2.54	88	-0.02	148	-0.91	208	-1.37	268	-2.86	328	-3.39
29	-2.49	89	-0.02	149	-0.92	209	-1.39	269	-2.87	329	-3.40
30	-2.44	90	-0.01	150	-0.94	210	-1.40	270	-2.89	330	-3.40
31	-2.39	91	-0.01	151	-0.95	211	-1.41	271	-2.91	331	-3.41
32	-2.35	92	-0.00	152	-0.96	212	-1.43	272	-2.92	332	-3.41
33	-2.30	93	-0.00	153	-0.98	213	-1.45	273	-2.94	333	-3.42
34	-2.25	94	0.00	154	-0.99	214	-1.46	274	-2.95	334	-3.42
35	-2.19	95	-0.00	155	-1.00	215	-1.48	275	-2.97	335	-3.43
36	-2.14	96	-0.00	156	-1.02	216	-1.50	276	-2.98	336	-3.43
37	-2.09	97	-0.01	157	-1.03	217	-1.52	277	-2.99	337	-3.43
38	-2.04	98	-0.01	158	-1.04	218	-1.53	278	-3.01	338	-3.43
39	-1.98	99	-0.02	159	-1.05	219	-1.55	279	-3.02	339	-3.44
40	-1.93	100	-0.02	160	-1.06	220	-1.58	280	-3.03	340	-3.44
41	-1.87	101	-0.03	161	-1.07	221	-1.60	281	-3.04	341	-3.44
42	-1.82	102	-0.04	162	-1.08	222	-1.62	282	-3.05	342	-3.44
43	-1.76	103	-0.05	163	-1.09	223	-1.64	283	-3.06	343	-3.44
44	-1.71	104	-0.06	164	-1.09	224	-1.67	284	-3.07	344	-3.44
45	-1.65	105	-0.08	165	-1.10	225	-1.69	285	-3.08	345	-3.44
46	-1.60	106	-0.09	166	-1.11	226	-1.72	286	-3.09	346	-3.44
47	-1.54	107	-0.10	167	-1.12	227	-1.74	287	-3.10	347	-3.43
48	-1.49	108	-0.12	168	-1.13	228	-1.77	288	-3.11	348	-3.43
49	-1.43	109	-0.13	169	-1.13	229	-1.79	289	-3.12	349	-3.43
50	-1.38	110	-0.15	170	-1.14	230	-1.82	290	-3.12	350	-3.42
51	-1.32	111	-0.17	171	-1.14	231	-1.85	291	-3.13	351	-3.42
52	-1.27	112	-0.18	172	-1.15	232	-1.88	292	-3.14	352	-3.41
53	-1.21	113	-0.20	173	-1.16	233	-1.91	293	-3.15	353	-3.41
54	-1.16	114	-0.22	174	-1.16	234	-1.94	294	-3.16	354	-3.40
55	-1.11	115	-0.24	175	-1.17	235	-1.96	295	-3.16	355	-3.39
56	-1.05	116	-0.26	176	-1.17	236	-2.00	296	-3.17	356	-3.39
57	-1.00	117	-0.28	177	-1.17	237	-2.03	297	-3.18	357	-3.38
58	-0.95	118	-0.30	178	-1.18	238	-2.06	298	-3.18	358	-3.37
59	-0.90	119	-0.32	179	-1.18	239	-2.09	299	-3.19	359	-3.35

Frequency 88.00 MHz

Horizontal Plane

Array data file = not_specified

THEORETICAL HORIZONTAL PATTERN

Frequency 98.00 MHz (Logarithmic scale)

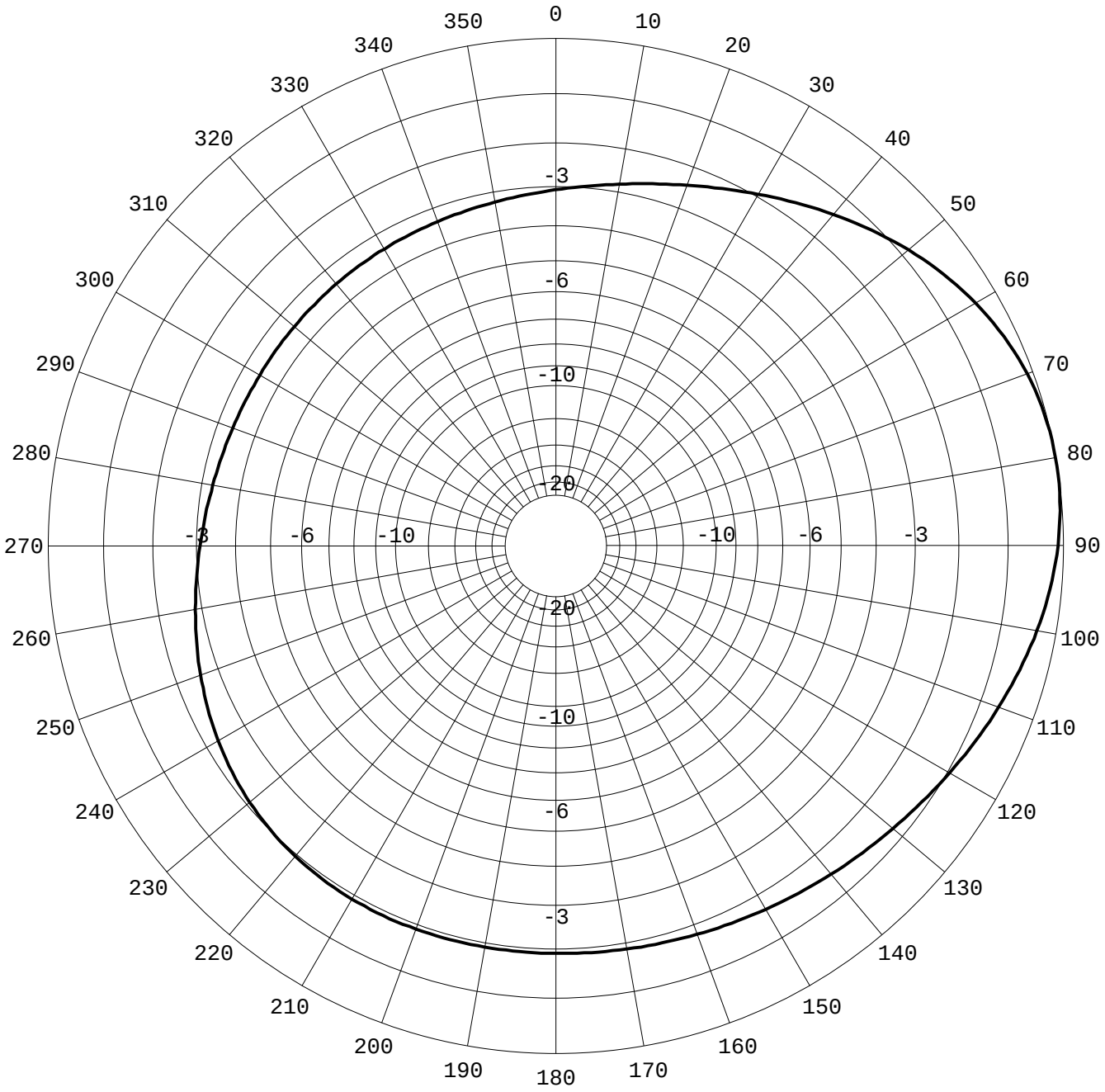

TABLE OF CALCULATED VALUES

degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB
0	-3.08	60	-0.39	120	-0.96	180	-1.91	240	-2.30	300	-3.44
1	-3.06	61	-0.35	121	-0.99	181	-1.91	241	-2.32	301	-3.44
2	-3.04	62	-0.32	122	-1.02	182	-1.91	242	-2.35	302	-3.45
3	-3.02	63	-0.29	123	-1.05	183	-1.91	243	-2.37	303	-3.45
4	-2.99	64	-0.25	124	-1.08	184	-1.91	244	-2.40	304	-3.45
5	-2.96	65	-0.22	125	-1.11	185	-1.91	245	-2.43	305	-3.45
6	-2.93	66	-0.19	126	-1.13	186	-1.91	246	-2.45	306	-3.45
7	-2.91	67	-0.17	127	-1.16	187	-1.91	247	-2.48	307	-3.45
8	-2.88	68	-0.14	128	-1.19	188	-1.91	248	-2.51	308	-3.45
9	-2.85	69	-0.12	129	-1.21	189	-1.91	249	-2.54	309	-3.45
10	-2.81	70	-0.10	130	-1.24	190	-1.91	250	-2.56	310	-3.45
11	-2.78	71	-0.08	131	-1.27	191	-1.91	251	-2.59	311	-3.45
12	-2.75	72	-0.06	132	-1.29	192	-1.91	252	-2.62	312	-3.45
13	-2.71	73	-0.05	133	-1.31	193	-1.91	253	-2.65	313	-3.45
14	-2.68	74	-0.03	134	-1.34	194	-1.90	254	-2.68	314	-3.45
15	-2.64	75	-0.02	135	-1.36	195	-1.90	255	-2.71	315	-3.45
16	-2.60	76	-0.01	136	-1.38	196	-1.90	256	-2.74	316	-3.45
17	-2.56	77	-0.01	137	-1.41	197	-1.90	257	-2.76	317	-3.45
18	-2.52	78	-0.00	138	-1.43	198	-1.90	258	-2.79	318	-3.45
19	-2.48	79	0.00	139	-1.45	199	-1.90	259	-2.82	319	-3.45
20	-2.43	80	0.00	140	-1.47	200	-1.90	260	-2.84	320	-3.44
21	-2.39	81	-0.00	141	-1.49	201	-1.90	261	-2.87	321	-3.44
22	-2.34	82	-0.00	142	-1.51	202	-1.89	262	-2.90	322	-3.44
23	-2.30	83	-0.01	143	-1.53	203	-1.89	263	-2.92	323	-3.43
24	-2.25	84	-0.02	144	-1.55	204	-1.89	264	-2.95	324	-3.43
25	-2.20	85	-0.02	145	-1.56	205	-1.89	265	-2.98	325	-3.43
26	-2.15	86	-0.03	146	-1.58	206	-1.89	266	-3.00	326	-3.42
27	-2.10	87	-0.05	147	-1.60	207	-1.90	267	-3.02	327	-3.42
28	-2.05	88	-0.06	148	-1.62	208	-1.90	268	-3.05	328	-3.42
29	-2.00	89	-0.08	149	-1.63	209	-1.90	269	-3.07	329	-3.41
30	-1.95	90	-0.09	150	-1.65	210	-1.90	270	-3.09	330	-3.41
31	-1.89	91	-0.11	151	-1.66	211	-1.91	271	-3.11	331	-3.41
32	-1.84	92	-0.13	152	-1.68	212	-1.91	272	-3.14	332	-3.40
33	-1.78	93	-0.15	153	-1.69	213	-1.91	273	-3.16	333	-3.40
34	-1.73	94	-0.17	154	-1.71	214	-1.92	274	-3.17	334	-3.40
35	-1.67	95	-0.20	155	-1.72	215	-1.92	275	-3.20	335	-3.39
36	-1.62	96	-0.22	156	-1.73	216	-1.93	276	-3.21	336	-3.38
37	-1.56	97	-0.25	157	-1.75	217	-1.93	277	-3.23	337	-3.38
38	-1.51	98	-0.27	158	-1.76	218	-1.94	278	-3.25	338	-3.37
39	-1.45	99	-0.30	159	-1.77	219	-1.95	279	-3.26	339	-3.36
40	-1.39	100	-0.33	160	-1.78	220	-1.96	280	-3.28	340	-3.36
41	-1.34	101	-0.36	161	-1.79	221	-1.97	281	-3.29	341	-3.35
42	-1.28	102	-0.39	162	-1.80	222	-1.98	282	-3.31	342	-3.34
43	-1.23	103	-0.42	163	-1.81	223	-1.99	283	-3.32	343	-3.33
44	-1.17	104	-0.45	164	-1.82	224	-2.00	284	-3.33	344	-3.32
45	-1.12	105	-0.48	165	-1.83	225	-2.01	285	-3.34	345	-3.31
46	-1.06	106	-0.51	166	-1.84	226	-2.03	286	-3.35	346	-3.30
47	-1.01	107	-0.54	167	-1.84	227	-2.04	287	-3.36	347	-3.29
48	-0.95	108	-0.58	168	-1.85	228	-2.06	288	-3.37	348	-3.28
49	-0.90	109	-0.61	169	-1.86	229	-2.07	289	-3.38	349	-3.27
50	-0.85	110	-0.64	170	-1.87	230	-2.09	290	-3.39	350	-3.26
51	-0.80	111	-0.67	171	-1.87	231	-2.11	291	-3.40	351	-3.24
52	-0.75	112	-0.70	172	-1.88	232	-2.12	292	-3.40	352	-3.23
53	-0.70	113	-0.74	173	-1.88	233	-2.14	293	-3.41	353	-3.21
54	-0.65	114	-0.77	174	-1.89	234	-2.16	294	-3.41	354	-3.20
55	-0.61	115	-0.80	175	-1.89	235	-2.18	295	-3.42	355	-3.18
56	-0.56	116	-0.83	176	-1.89	236	-2.20	296	-3.42	356	-3.16
57	-0.52	117	-0.87	177	-1.90	237	-2.23	297	-3.43	357	-3.14
58	-0.47	118	-0.90	178	-1.90	238	-2.25	298	-3.43	358	-3.12
59	-0.43	119	-0.93	179	-1.90	239	-2.27	299	-3.44	359	-3.11

Frequency 98.00 MHz

Horizontal Plane

Array data file = not_specified

THEORETICAL HORIZONTAL PATTERN

Frequency 108.00 MHz (Logarithmic scale)

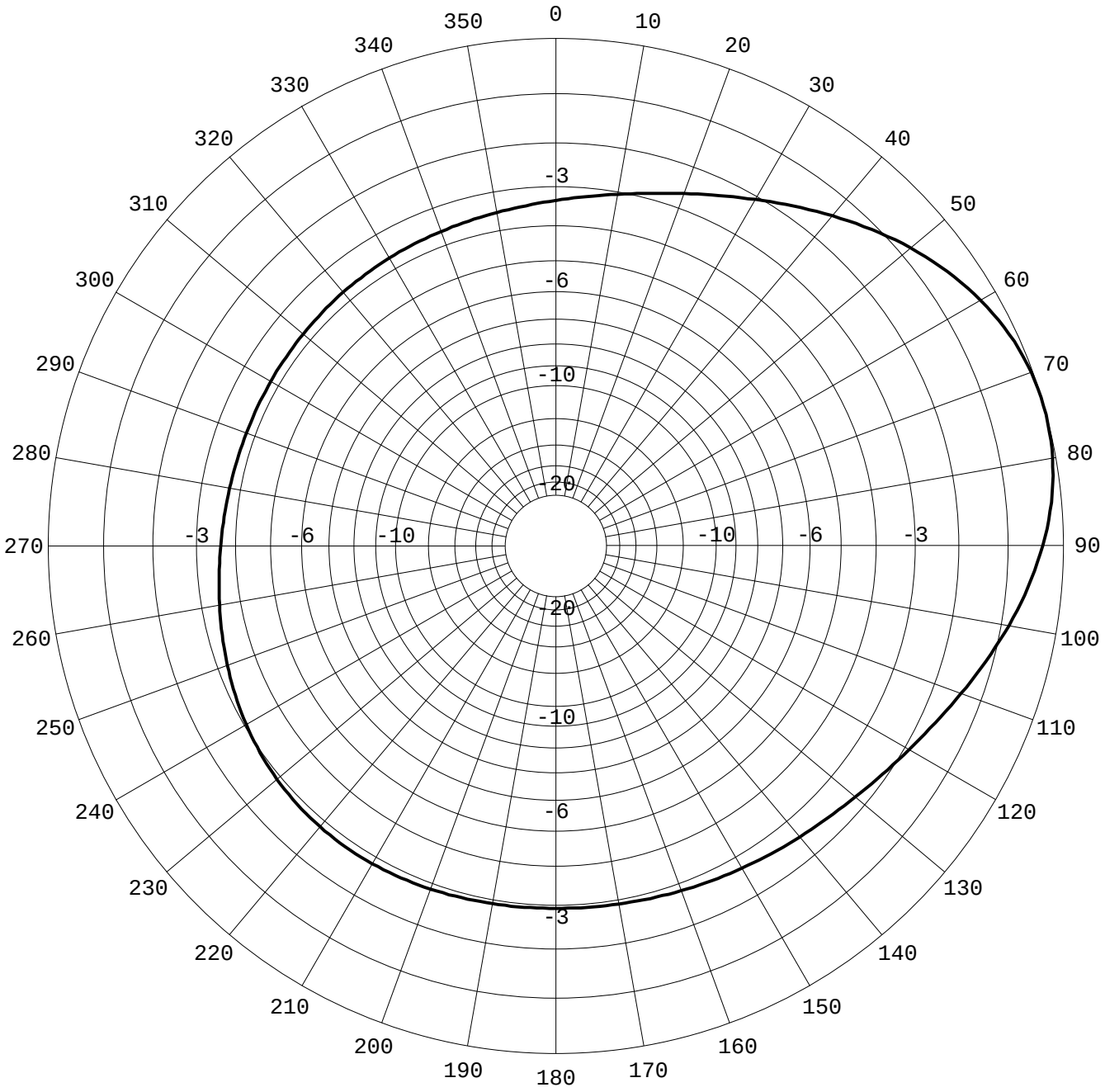

TABLE OF CALCULATED VALUES

degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB
0	-3.35	60	-0.29	120	-1.90	180	-2.92	240	-3.05	300	-3.77
1	-3.32	61	-0.25	121	-1.94	181	-2.92	241	-3.07	301	-3.77
2	-3.30	62	-0.22	122	-1.98	182	-2.92	242	-3.09	302	-3.77
3	-3.27	63	-0.18	123	-2.02	183	-2.92	243	-3.11	303	-3.77
4	-3.25	64	-0.15	124	-2.06	184	-2.92	244	-3.12	304	-3.77
5	-3.22	65	-0.12	125	-2.10	185	-2.92	245	-3.14	305	-3.76
6	-3.19	66	-0.10	126	-2.13	186	-2.92	246	-3.16	306	-3.76
7	-3.16	67	-0.08	127	-2.17	187	-2.91	247	-3.19	307	-3.76
8	-3.13	68	-0.06	128	-2.20	188	-2.91	248	-3.20	308	-3.76
9	-3.10	69	-0.04	129	-2.23	189	-2.91	249	-3.23	309	-3.76
10	-3.06	70	-0.02	130	-2.26	190	-2.90	250	-3.25	310	-3.76
11	-3.02	71	-0.01	131	-2.29	191	-2.90	251	-3.27	311	-3.75
12	-2.99	72	-0.01	132	-2.32	192	-2.89	252	-3.28	312	-3.75
13	-2.95	73	-0.00	133	-2.35	193	-2.89	253	-3.31	313	-3.75
14	-2.91	74	0.00	134	-2.38	194	-2.89	254	-3.33	314	-3.74
15	-2.87	75	-0.00	135	-2.40	195	-2.88	255	-3.35	315	-3.74
16	-2.82	76	-0.01	136	-2.43	196	-2.88	256	-3.37	316	-3.74
17	-2.78	77	-0.01	137	-2.45	197	-2.87	257	-3.39	317	-3.73
18	-2.73	78	-0.02	138	-2.47	198	-2.86	258	-3.41	318	-3.73
19	-2.69	79	-0.04	139	-2.49	199	-2.86	259	-3.43	319	-3.73
20	-2.64	80	-0.05	140	-2.52	200	-2.86	260	-3.45	320	-3.72
21	-2.59	81	-0.07	141	-2.54	201	-2.85	261	-3.47	321	-3.72
22	-2.53	82	-0.09	142	-2.55	202	-2.85	262	-3.48	322	-3.72
23	-2.48	83	-0.12	143	-2.57	203	-2.84	263	-3.50	323	-3.71
24	-2.43	84	-0.15	144	-2.59	204	-2.84	264	-3.52	324	-3.71
25	-2.37	85	-0.17	145	-2.61	205	-2.83	265	-3.54	325	-3.70
26	-2.31	86	-0.21	146	-2.63	206	-2.83	266	-3.55	326	-3.70
27	-2.26	87	-0.24	147	-2.64	207	-2.82	267	-3.57	327	-3.69
28	-2.20	88	-0.28	148	-2.66	208	-2.82	268	-3.58	328	-3.69
29	-2.14	89	-0.32	149	-2.68	209	-2.82	269	-3.60	329	-3.69
30	-2.08	90	-0.36	150	-2.69	210	-2.82	270	-3.61	330	-3.68
31	-2.01	91	-0.40	151	-2.71	211	-2.82	271	-3.62	331	-3.68
32	-1.95	92	-0.45	152	-2.72	212	-2.81	272	-3.64	332	-3.67
33	-1.89	93	-0.49	153	-2.73	213	-2.81	273	-3.65	333	-3.66
34	-1.82	94	-0.54	154	-2.75	214	-2.81	274	-3.66	334	-3.66
35	-1.76	95	-0.59	155	-2.76	215	-2.81	275	-3.67	335	-3.65
36	-1.69	96	-0.64	156	-2.77	216	-2.81	276	-3.68	336	-3.65
37	-1.63	97	-0.69	157	-2.78	217	-2.82	277	-3.69	337	-3.64
38	-1.56	98	-0.75	158	-2.80	218	-2.82	278	-3.70	338	-3.64
39	-1.50	99	-0.80	159	-2.81	219	-2.82	279	-3.71	339	-3.63
40	-1.43	100	-0.86	160	-2.82	220	-2.82	280	-3.71	340	-3.62
41	-1.36	101	-0.91	161	-2.83	221	-2.83	281	-3.72	341	-3.61
42	-1.30	102	-0.97	162	-2.84	222	-2.83	282	-3.73	342	-3.60
43	-1.23	103	-1.02	163	-2.84	223	-2.84	283	-3.73	343	-3.60
44	-1.17	104	-1.08	164	-2.85	224	-2.84	284	-3.74	344	-3.59
45	-1.10	105	-1.13	165	-2.86	225	-2.85	285	-3.74	345	-3.58
46	-1.04	106	-1.19	166	-2.87	226	-2.86	286	-3.75	346	-3.57
47	-0.98	107	-1.25	167	-2.88	227	-2.87	287	-3.75	347	-3.56
48	-0.91	108	-1.30	168	-2.88	228	-2.88	288	-3.76	348	-3.55
49	-0.85	109	-1.36	169	-2.89	229	-2.89	289	-3.76	349	-3.54
50	-0.80	110	-1.41	170	-2.90	230	-2.90	290	-3.76	350	-3.52
51	-0.74	111	-1.46	171	-2.90	231	-2.91	291	-3.76	351	-3.51
52	-0.68	112	-1.52	172	-2.91	232	-2.92	292	-3.77	352	-3.49
53	-0.63	113	-1.57	173	-2.91	233	-2.94	293	-3.77	353	-3.48
54	-0.57	114	-1.62	174	-2.91	234	-2.95	294	-3.77	354	-3.46
55	-0.52	115	-1.67	175	-2.92	235	-2.97	295	-3.77	355	-3.45
56	-0.47	116	-1.72	176	-2.92	236	-2.98	296	-3.77	356	-3.43
57	-0.42	117	-1.76	177	-2.92	237	-3.00	297	-3.77	357	-3.41
58	-0.38	118	-1.81	178	-2.92	238	-3.02	298	-3.77	358	-3.39
59	-0.33	119	-1.85	179	-2.92	239	-3.03	299	-3.77	359	-3.37

Frequency 108.00 MHz

Horizontal Plane

Array data file = not_specified

THEORETICAL VERTICAL PATTERN

(Linear scale)

Frequency 88.00 MHz Total antenna

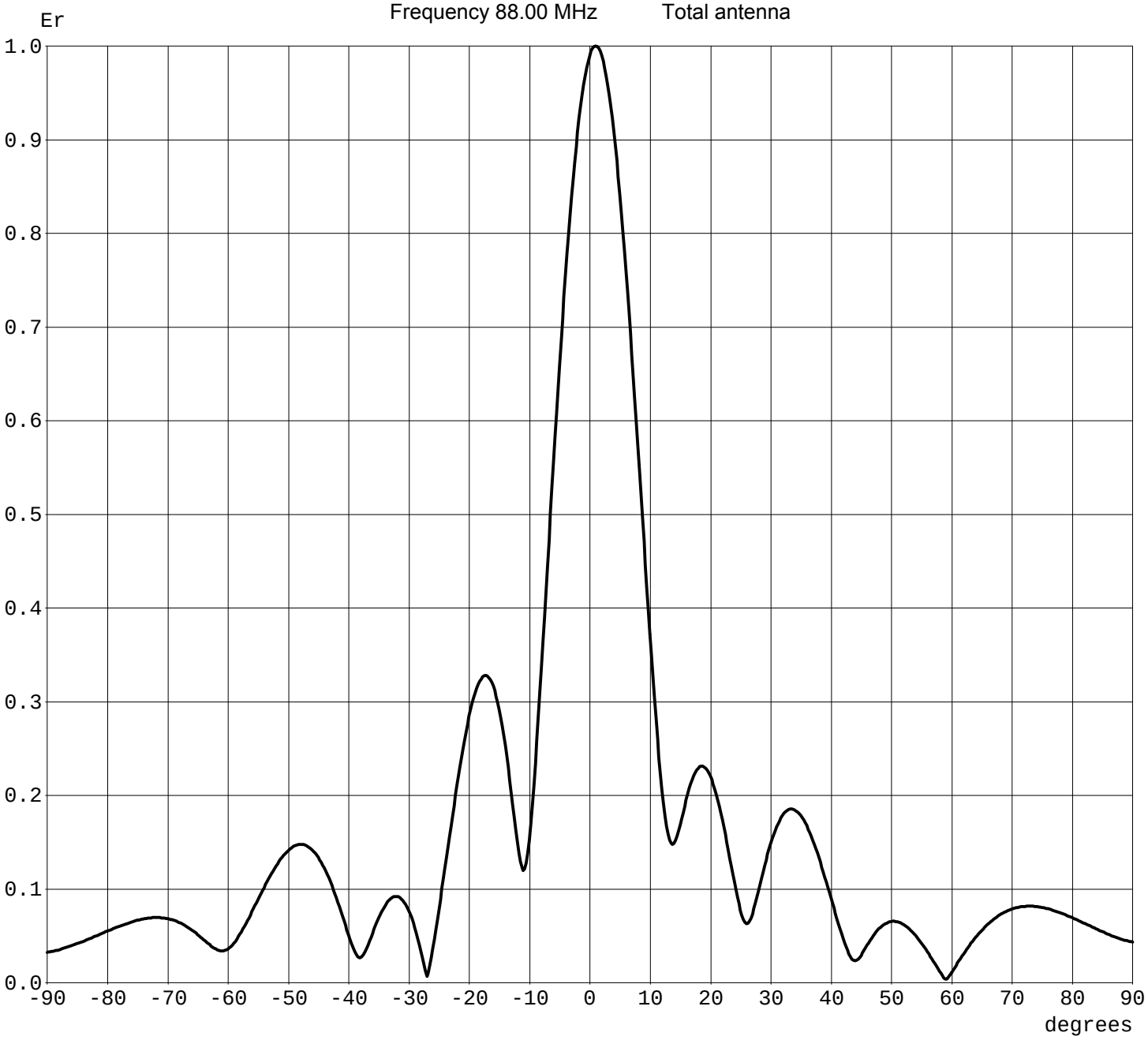

TABLE OF CALCULATED VALUES

degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er
-90.0	0.03	-60.0	0.04	-30.0	0.08	0.0	0.99	30.0	0.15	60.0	0.01
-89.5	0.03	-59.5	0.04	-29.5	0.07	0.5	1.00	30.5	0.16	60.5	0.02
-89.0	0.03	-59.0	0.04	-29.0	0.06	1.0	1.00	31.0	0.17	61.0	0.02
-88.5	0.03	-58.5	0.05	-28.5	0.05	1.5	1.00	31.5	0.17	61.5	0.03
-88.0	0.03	-58.0	0.05	-28.0	0.03	2.0	0.99	32.0	0.18	62.0	0.03
-87.5	0.04	-57.5	0.06	-27.5	0.02	2.5	0.98	32.5	0.18	62.5	0.04
-87.0	0.04	-57.0	0.06	-27.0	0.01	3.0	0.96	33.0	0.18	63.0	0.04
-86.5	0.04	-56.5	0.07	-26.5	0.02	3.5	0.94	33.5	0.19	63.5	0.04
-86.0	0.04	-56.0	0.08	-26.0	0.04	4.0	0.91	34.0	0.18	64.0	0.05
-85.5	0.04	-55.5	0.08	-25.5	0.06	4.5	0.88	34.5	0.18	64.5	0.05
-85.0	0.04	-55.0	0.09	-25.0	0.08	5.0	0.84	35.0	0.18	65.0	0.06
-84.5	0.04	-54.5	0.09	-24.5	0.10	5.5	0.80	35.5	0.17	65.5	0.06
-84.0	0.04	-54.0	0.10	-24.0	0.12	6.0	0.76	36.0	0.17	66.0	0.06
-83.5	0.05	-53.5	0.11	-23.5	0.14	6.5	0.72	36.5	0.16	66.5	0.06
-83.0	0.05	-53.0	0.11	-23.0	0.17	7.0	0.67	37.0	0.15	67.0	0.07
-82.5	0.05	-52.5	0.12	-22.5	0.19	7.5	0.62	37.5	0.14	67.5	0.07
-82.0	0.05	-52.0	0.12	-22.0	0.21	8.0	0.57	38.0	0.13	68.0	0.07
-81.5	0.05	-51.5	0.13	-21.5	0.23	8.5	0.52	38.5	0.12	68.5	0.07
-81.0	0.05	-51.0	0.13	-21.0	0.25	9.0	0.47	39.0	0.11	69.0	0.08
-80.5	0.05	-50.5	0.14	-20.5	0.27	9.5	0.42	39.5	0.10	69.5	0.08
-80.0	0.05	-50.0	0.14	-20.0	0.28	10.0	0.37	40.0	0.09	70.0	0.08
-79.5	0.06	-49.5	0.14	-19.5	0.30	10.5	0.33	40.5	0.08	70.5	0.08
-79.0	0.06	-49.0	0.15	-19.0	0.31	11.0	0.28	41.0	0.07	71.0	0.08
-78.5	0.06	-48.5	0.15	-18.5	0.32	11.5	0.24	41.5	0.06	71.5	0.08
-78.0	0.06	-48.0	0.15	-18.0	0.32	12.0	0.21	42.0	0.05	72.0	0.08
-77.5	0.06	-47.5	0.15	-17.5	0.33	12.5	0.18	42.5	0.04	72.5	0.08
-77.0	0.06	-47.0	0.15	-17.0	0.33	13.0	0.16	43.0	0.03	73.0	0.08
-76.5	0.06	-46.5	0.14	-16.5	0.32	13.5	0.15	43.5	0.03	73.5	0.08
-76.0	0.06	-46.0	0.14	-16.0	0.32	14.0	0.15	44.0	0.02	74.0	0.08
-75.5	0.07	-45.5	0.14	-15.5	0.31	14.5	0.16	44.5	0.02	74.5	0.08
-75.0	0.07	-45.0	0.13	-15.0	0.29	15.0	0.17	45.0	0.03	75.0	0.08
-74.5	0.07	-44.5	0.13	-14.5	0.27	15.5	0.18	45.5	0.03	75.5	0.08
-74.0	0.07	-44.0	0.12	-14.0	0.25	16.0	0.19	46.0	0.04	76.0	0.08
-73.5	0.07	-43.5	0.12	-13.5	0.23	16.5	0.21	46.5	0.04	76.5	0.08
-73.0	0.07	-43.0	0.11	-13.0	0.20	17.0	0.22	47.0	0.05	77.0	0.08
-72.5	0.07	-42.5	0.10	-12.5	0.18	17.5	0.22	47.5	0.05	77.5	0.08
-72.0	0.07	-42.0	0.09	-12.0	0.15	18.0	0.23	48.0	0.06	78.0	0.07
-71.5	0.07	-41.5	0.08	-11.5	0.13	18.5	0.23	48.5	0.06	78.5	0.07
-71.0	0.07	-41.0	0.07	-11.0	0.12	19.0	0.23	49.0	0.06	79.0	0.07
-70.5	0.07	-40.5	0.06	-10.5	0.13	19.5	0.23	49.5	0.06	79.5	0.07
-70.0	0.07	-40.0	0.05	-10.0	0.15	20.0	0.22	50.0	0.07	80.0	0.07
-69.5	0.07	-39.5	0.04	-9.5	0.19	20.5	0.21	50.5	0.07	80.5	0.07
-69.0	0.07	-39.0	0.03	-9.0	0.23	21.0	0.20	51.0	0.06	81.0	0.07
-68.5	0.07	-38.5	0.03	-8.5	0.28	21.5	0.19	51.5	0.06	81.5	0.06
-68.0	0.06	-38.0	0.03	-8.0	0.34	22.0	0.17	52.0	0.06	82.0	0.06
-67.5	0.06	-37.5	0.03	-7.5	0.39	22.5	0.16	52.5	0.06	82.5	0.06
-67.0	0.06	-37.0	0.04	-7.0	0.44	23.0	0.14	53.0	0.06	83.0	0.06
-66.5	0.06	-36.5	0.04	-6.5	0.50	23.5	0.12	53.5	0.05	83.5	0.06
-66.0	0.06	-36.0	0.05	-6.0	0.55	24.0	0.11	54.0	0.05	84.0	0.06
-65.5	0.05	-35.5	0.06	-5.5	0.61	24.5	0.09	54.5	0.05	84.5	0.06
-65.0	0.05	-35.0	0.07	-5.0	0.66	25.0	0.08	55.0	0.04	85.0	0.05
-64.5	0.05	-34.5	0.08	-4.5	0.71	25.5	0.07	55.5	0.04	85.5	0.05
-64.0	0.05	-34.0	0.08	-4.0	0.76	26.0	0.06	56.0	0.03	86.0	0.05
-63.5	0.04	-33.5	0.09	-3.5	0.80	26.5	0.07	56.5	0.03	86.5	0.05
-63.0	0.04	-33.0	0.09	-3.0	0.84	27.0	0.07	57.0	0.02	87.0	0.05
-62.5	0.04	-32.5	0.09	-2.5	0.88	27.5	0.08	57.5	0.02	87.5	0.05
-62.0	0.04	-32.0	0.09	-2.0	0.91	28.0	0.10	58.0	0.01	88.0	0.05
-61.5	0.03	-31.5	0.09	-1.5	0.94	28.5	0.11	58.5	0.01	88.5	0.05
-61.0	0.03	-31.0	0.09	-1.0	0.96	29.0	0.12	59.0	0.00	89.0	0.04
-60.5	0.03	-30.5	0.08	-0.5	0.98	29.5	0.14	59.5	0.01	89.5	0.04

Frequency 88.00 MHz

Vertical Plane

Total antenna

THEORETICAL VERTICAL PATTERN

(Linear scale)

Frequency 98.00 MHz Total antenna

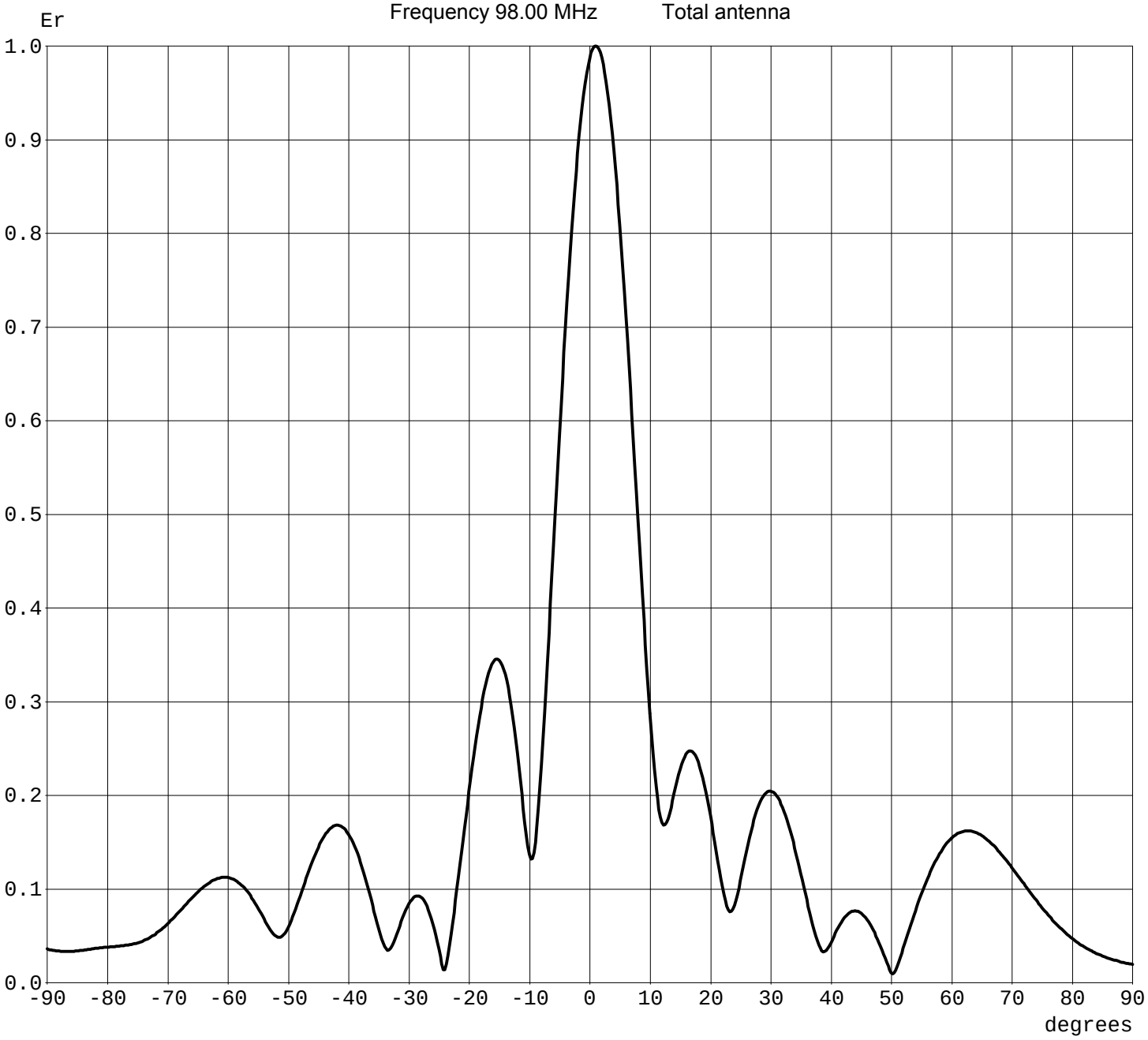

TABLE OF CALCULATED VALUES

degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er
-90.0	0.04	-60.0	0.11	-30.0	0.08	0.0	0.99	30.0	0.20	60.0	0.15
-89.5	0.04	-59.5	0.11	-29.5	0.09	0.5	1.00	30.5	0.20	60.5	0.16
-89.0	0.03	-59.0	0.11	-29.0	0.09	1.0	1.00	31.0	0.20	61.0	0.16
-88.5	0.03	-58.5	0.11	-28.5	0.09	1.5	1.00	31.5	0.19	61.5	0.16
-88.0	0.03	-58.0	0.11	-28.0	0.09	2.0	0.99	32.0	0.19	62.0	0.16
-87.5	0.03	-57.5	0.10	-27.5	0.09	2.5	0.97	32.5	0.18	62.5	0.16
-87.0	0.03	-57.0	0.10	-27.0	0.08	3.0	0.95	33.0	0.17	63.0	0.16
-86.5	0.03	-56.5	0.09	-26.5	0.07	3.5	0.92	33.5	0.16	63.5	0.16
-86.0	0.03	-56.0	0.09	-26.0	0.06	4.0	0.89	34.0	0.14	64.0	0.16
-85.5	0.03	-55.5	0.09	-25.5	0.05	4.5	0.85	34.5	0.13	64.5	0.16
-85.0	0.03	-55.0	0.08	-25.0	0.04	5.0	0.81	35.0	0.12	65.0	0.16
-84.5	0.03	-54.5	0.07	-24.5	0.02	5.5	0.76	35.5	0.10	65.5	0.15
-84.0	0.03	-54.0	0.07	-24.0	0.01	6.0	0.71	36.0	0.09	66.0	0.15
-83.5	0.03	-53.5	0.06	-23.5	0.03	6.5	0.66	36.5	0.07	66.5	0.15
-83.0	0.04	-53.0	0.06	-23.0	0.05	7.0	0.61	37.0	0.06	67.0	0.15
-82.5	0.04	-52.5	0.05	-22.5	0.07	7.5	0.55	37.5	0.05	67.5	0.14
-82.0	0.04	-52.0	0.05	-22.0	0.10	8.0	0.50	38.0	0.04	68.0	0.14
-81.5	0.04	-51.5	0.05	-21.5	0.13	8.5	0.44	38.5	0.03	68.5	0.14
-81.0	0.04	-51.0	0.05	-21.0	0.15	9.0	0.39	39.0	0.03	69.0	0.13
-80.5	0.04	-50.5	0.05	-20.5	0.18	9.5	0.33	39.5	0.04	69.5	0.13
-80.0	0.04	-50.0	0.06	-20.0	0.20	10.0	0.29	40.0	0.04	70.0	0.12
-79.5	0.04	-49.5	0.07	-19.5	0.23	10.5	0.24	40.5	0.05	70.5	0.12
-79.0	0.04	-49.0	0.07	-19.0	0.25	11.0	0.21	41.0	0.06	71.0	0.11
-78.5	0.04	-48.5	0.08	-18.5	0.27	11.5	0.18	41.5	0.06	71.5	0.11
-78.0	0.04	-48.0	0.09	-18.0	0.29	12.0	0.17	42.0	0.07	72.0	0.11
-77.5	0.04	-47.5	0.10	-17.5	0.31	12.5	0.17	42.5	0.07	72.5	0.10
-77.0	0.04	-47.0	0.11	-17.0	0.32	13.0	0.17	43.0	0.07	73.0	0.10
-76.5	0.04	-46.5	0.12	-16.5	0.34	13.5	0.19	43.5	0.08	73.5	0.09
-76.0	0.04	-46.0	0.13	-16.0	0.34	14.0	0.20	44.0	0.08	74.0	0.09
-75.5	0.04	-45.5	0.14	-15.5	0.35	14.5	0.22	44.5	0.08	74.5	0.08
-75.0	0.04	-45.0	0.14	-15.0	0.34	15.0	0.23	45.0	0.07	75.0	0.08
-74.5	0.04	-44.5	0.15	-14.5	0.34	15.5	0.24	45.5	0.07	75.5	0.08
-74.0	0.04	-44.0	0.16	-14.0	0.33	16.0	0.24	46.0	0.07	76.0	0.07
-73.5	0.05	-43.5	0.16	-13.5	0.31	16.5	0.25	46.5	0.06	76.5	0.07
-73.0	0.05	-43.0	0.16	-13.0	0.30	17.0	0.25	47.0	0.06	77.0	0.07
-72.5	0.05	-42.5	0.17	-12.5	0.27	17.5	0.24	47.5	0.05	77.5	0.06
-72.0	0.05	-42.0	0.17	-12.0	0.25	18.0	0.24	48.0	0.04	78.0	0.06
-71.5	0.05	-41.5	0.17	-11.5	0.22	18.5	0.22	48.5	0.03	78.5	0.06
-71.0	0.06	-41.0	0.17	-11.0	0.19	19.0	0.21	49.0	0.03	79.0	0.05
-70.5	0.06	-40.5	0.16	-10.5	0.16	19.5	0.20	49.5	0.02	79.5	0.05
-70.0	0.06	-40.0	0.16	-10.0	0.14	20.0	0.18	50.0	0.01	80.0	0.05
-69.5	0.07	-39.5	0.15	-9.5	0.13	20.5	0.16	50.5	0.01	80.5	0.04
-69.0	0.07	-39.0	0.15	-9.0	0.15	21.0	0.14	51.0	0.02	81.0	0.04
-68.5	0.07	-38.5	0.14	-8.5	0.19	21.5	0.12	51.5	0.03	81.5	0.04
-68.0	0.08	-38.0	0.13	-8.0	0.23	22.0	0.10	52.0	0.04	82.0	0.04
-67.5	0.08	-37.5	0.12	-7.5	0.29	22.5	0.09	52.5	0.05	82.5	0.04
-67.0	0.08	-37.0	0.11	-7.0	0.34	23.0	0.08	53.0	0.06	83.0	0.03
-66.5	0.09	-36.5	0.09	-6.5	0.40	23.5	0.08	53.5	0.07	83.5	0.03
-66.0	0.09	-36.0	0.08	-6.0	0.47	24.0	0.08	54.0	0.08	84.0	0.03
-65.5	0.09	-35.5	0.07	-5.5	0.53	24.5	0.09	54.5	0.09	84.5	0.03
-65.0	0.10	-35.0	0.06	-5.0	0.59	25.0	0.11	55.0	0.09	85.0	0.03
-64.5	0.10	-34.5	0.05	-4.5	0.64	25.5	0.12	55.5	0.10	85.5	0.03
-64.0	0.10	-34.0	0.04	-4.0	0.70	26.0	0.14	56.0	0.11	86.0	0.03
-63.5	0.10	-33.5	0.03	-3.5	0.75	26.5	0.15	56.5	0.12	86.5	0.02
-63.0	0.11	-33.0	0.04	-3.0	0.80	27.0	0.17	57.0	0.12	87.0	0.02
-62.5	0.11	-32.5	0.04	-2.5	0.85	27.5	0.18	57.5	0.13	87.5	0.02
-62.0	0.11	-32.0	0.05	-2.0	0.89	28.0	0.19	58.0	0.14	88.0	0.02
-61.5	0.11	-31.5	0.06	-1.5	0.92	28.5	0.20	58.5	0.14	88.5	0.02
-61.0	0.11	-31.0	0.07	-1.0	0.95	29.0	0.20	59.0	0.15	89.0	0.02
-60.5	0.11	-30.5	0.08	-0.5	0.97	29.5	0.20	59.5	0.15	89.5	0.02

Frequency 98.00 MHz

Vertical Plane

Total antenna

THEORETICAL VERTICAL PATTERN

(Linear scale)

Frequency 108.00 MHz Total antenna

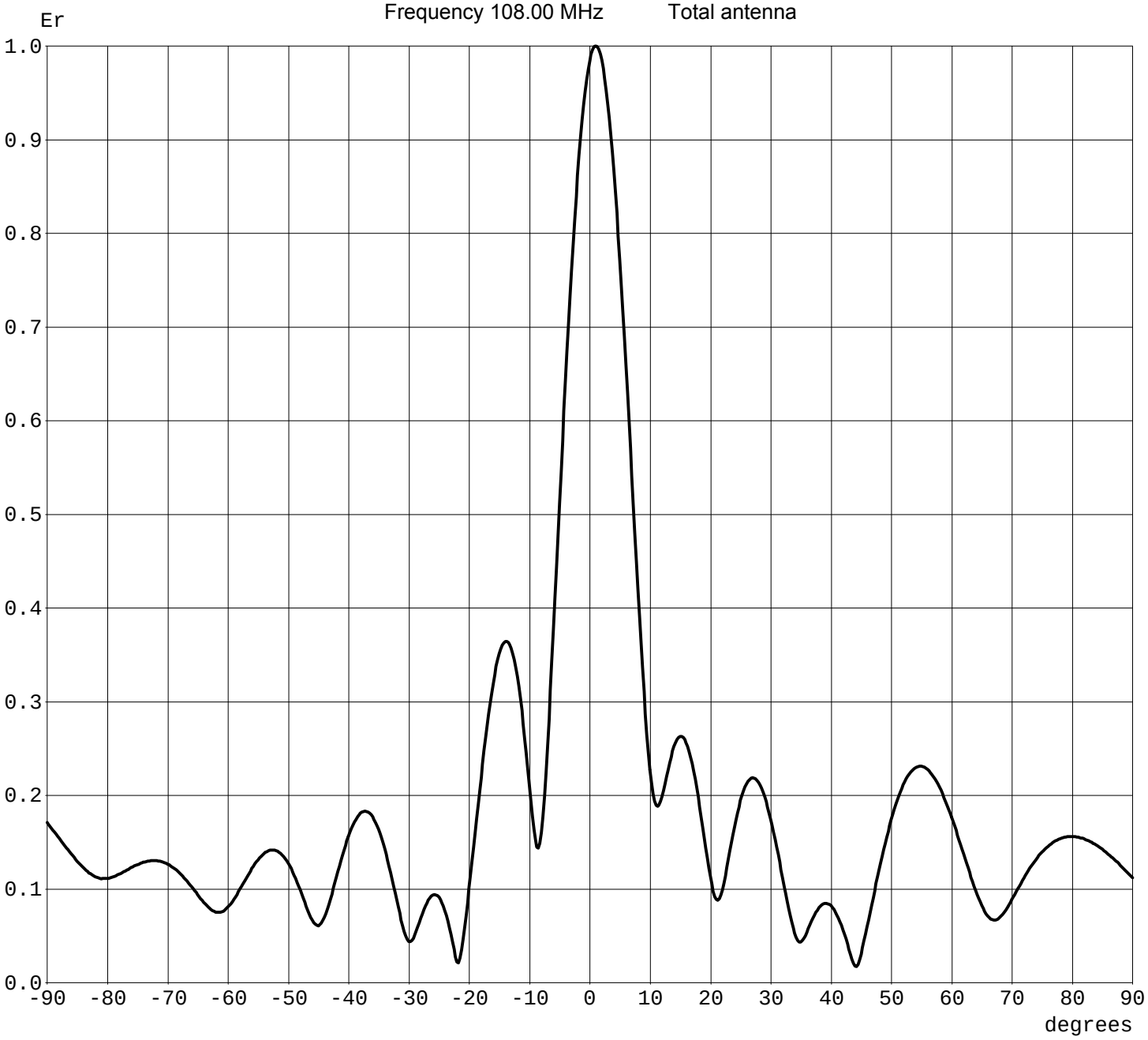

TABLE OF CALCULATED VALUES

degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er
-90.0	0.17	-60.0	0.08	-30.0	0.04	0.0	0.98	30.0	0.17	60.0	0.18
-89.5	0.17	-59.5	0.08	-29.5	0.04	0.5	1.00	30.5	0.16	60.5	0.17
-89.0	0.16	-59.0	0.09	-29.0	0.05	1.0	1.00	31.0	0.14	61.0	0.16
-88.5	0.16	-58.5	0.09	-28.5	0.06	1.5	1.00	31.5	0.13	61.5	0.15
-88.0	0.15	-58.0	0.10	-28.0	0.07	2.0	0.98	32.0	0.11	62.0	0.14
-87.5	0.15	-57.5	0.10	-27.5	0.08	2.5	0.97	32.5	0.09	62.5	0.13
-87.0	0.15	-57.0	0.11	-27.0	0.08	3.0	0.94	33.0	0.08	63.0	0.12
-86.5	0.14	-56.5	0.12	-26.5	0.09	3.5	0.91	33.5	0.06	63.5	0.11
-86.0	0.14	-56.0	0.12	-26.0	0.09	4.0	0.87	34.0	0.05	64.0	0.10
-85.5	0.13	-55.5	0.13	-25.5	0.09	4.5	0.82	34.5	0.05	64.5	0.09
-85.0	0.13	-55.0	0.13	-25.0	0.09	5.0	0.77	35.0	0.04	65.0	0.08
-84.5	0.13	-54.5	0.13	-24.5	0.09	5.5	0.72	35.5	0.05	65.5	0.08
-84.0	0.12	-54.0	0.14	-24.0	0.08	6.0	0.66	36.0	0.05	66.0	0.07
-83.5	0.12	-53.5	0.14	-23.5	0.07	6.5	0.60	36.5	0.06	66.5	0.07
-83.0	0.12	-53.0	0.14	-23.0	0.05	7.0	0.54	37.0	0.07	67.0	0.07
-82.5	0.11	-52.5	0.14	-22.5	0.04	7.5	0.48	37.5	0.07	67.5	0.07
-82.0	0.11	-52.0	0.14	-22.0	0.02	8.0	0.42	38.0	0.08	68.0	0.07
-81.5	0.11	-51.5	0.14	-21.5	0.03	8.5	0.36	38.5	0.08	68.5	0.07
-81.0	0.11	-51.0	0.14	-21.0	0.05	9.0	0.31	39.0	0.08	69.0	0.08
-80.5	0.11	-50.5	0.13	-20.5	0.07	9.5	0.26	39.5	0.08	69.5	0.08
-80.0	0.11	-50.0	0.13	-20.0	0.10	10.0	0.23	40.0	0.08	70.0	0.09
-79.5	0.11	-49.5	0.12	-19.5	0.13	10.5	0.20	40.5	0.08	70.5	0.09
-79.0	0.11	-49.0	0.11	-19.0	0.16	11.0	0.19	41.0	0.07	71.0	0.10
-78.5	0.11	-48.5	0.11	-18.5	0.19	11.5	0.19	41.5	0.06	71.5	0.11
-78.0	0.12	-48.0	0.10	-18.0	0.22	12.0	0.20	42.0	0.06	72.0	0.11
-77.5	0.12	-47.5	0.09	-17.5	0.25	12.5	0.21	42.5	0.05	72.5	0.12
-77.0	0.12	-47.0	0.08	-17.0	0.27	13.0	0.23	43.0	0.04	73.0	0.12
-76.5	0.12	-46.5	0.07	-16.5	0.30	13.5	0.24	43.5	0.02	73.5	0.13
-76.0	0.12	-46.0	0.07	-16.0	0.32	14.0	0.25	44.0	0.02	74.0	0.13
-75.5	0.12	-45.5	0.06	-15.5	0.34	14.5	0.26	44.5	0.02	74.5	0.14
-75.0	0.13	-45.0	0.06	-15.0	0.35	15.0	0.26	45.0	0.03	75.0	0.14
-74.5	0.13	-44.5	0.06	-14.5	0.36	15.5	0.26	45.5	0.04	75.5	0.14
-74.0	0.13	-44.0	0.07	-14.0	0.36	16.0	0.26	46.0	0.06	76.0	0.15
-73.5	0.13	-43.5	0.08	-13.5	0.36	16.5	0.25	46.5	0.07	76.5	0.15
-73.0	0.13	-43.0	0.09	-13.0	0.36	17.0	0.23	47.0	0.09	77.0	0.15
-72.5	0.13	-42.5	0.10	-12.5	0.34	17.5	0.22	47.5	0.11	77.5	0.15
-72.0	0.13	-42.0	0.11	-12.0	0.33	18.0	0.20	48.0	0.12	78.0	0.15
-71.5	0.13	-41.5	0.12	-11.5	0.30	18.5	0.18	48.5	0.13	78.5	0.15
-71.0	0.13	-41.0	0.14	-11.0	0.28	19.0	0.15	49.0	0.15	79.0	0.16
-70.5	0.13	-40.5	0.15	-10.5	0.24	19.5	0.13	49.5	0.16	79.5	0.16
-70.0	0.13	-40.0	0.16	-10.0	0.21	20.0	0.11	50.0	0.17	80.0	0.16
-69.5	0.12	-39.5	0.16	-9.5	0.18	20.5	0.10	50.5	0.18	80.5	0.16
-69.0	0.12	-39.0	0.17	-9.0	0.15	21.0	0.09	51.0	0.19	81.0	0.16
-68.5	0.12	-38.5	0.18	-8.5	0.14	21.5	0.09	51.5	0.20	81.5	0.15
-68.0	0.12	-38.0	0.18	-8.0	0.16	22.0	0.10	52.0	0.21	82.0	0.15
-67.5	0.11	-37.5	0.18	-7.5	0.20	22.5	0.11	52.5	0.22	82.5	0.15
-67.0	0.11	-37.0	0.18	-7.0	0.25	23.0	0.13	53.0	0.22	83.0	0.15
-66.5	0.11	-36.5	0.18	-6.5	0.31	23.5	0.15	53.5	0.23	83.5	0.15
-66.0	0.10	-36.0	0.18	-6.0	0.38	24.0	0.17	54.0	0.23	84.0	0.15
-65.5	0.10	-35.5	0.17	-5.5	0.44	24.5	0.18	54.5	0.23	84.5	0.14
-65.0	0.09	-35.0	0.16	-5.0	0.51	25.0	0.19	55.0	0.23	85.0	0.14
-64.5	0.09	-34.5	0.15	-4.5	0.58	25.5	0.20	55.5	0.23	85.5	0.14
-64.0	0.09	-34.0	0.14	-4.0	0.64	26.0	0.21	56.0	0.23	86.0	0.14
-63.5	0.08	-33.5	0.13	-3.5	0.70	26.5	0.22	56.5	0.22	86.5	0.13
-63.0	0.08	-33.0	0.12	-3.0	0.76	27.0	0.22	57.0	0.22	87.0	0.13
-62.5	0.08	-32.5	0.10	-2.5	0.81	27.5	0.22	57.5	0.21	87.5	0.13
-62.0	0.08	-32.0	0.09	-2.0	0.86	28.0	0.21	58.0	0.21	88.0	0.12
-61.5	0.07	-31.5	0.07	-1.5	0.90	28.5	0.21	58.5	0.20	88.5	0.12
-61.0	0.08	-31.0	0.06	-1.0	0.94	29.0	0.20	59.0	0.19	89.0	0.12
-60.5	0.08	-30.5	0.05	-0.5	0.96	29.5	0.19	59.5	0.19	89.5	0.12

Frequency 108.00 MHz

Vertical Plane

Total antenna

TECHNICAL
DOCUMENTATION

Horizontal and Vertical Patterns

BROADCAST

Vertical Component

by KATHREIN
SIRA
RADIO SYSTEMS

KATHREIN

THEORETICAL HORIZONTAL PATTERN

Frequency 88.00 MHz (Logarithmic scale)

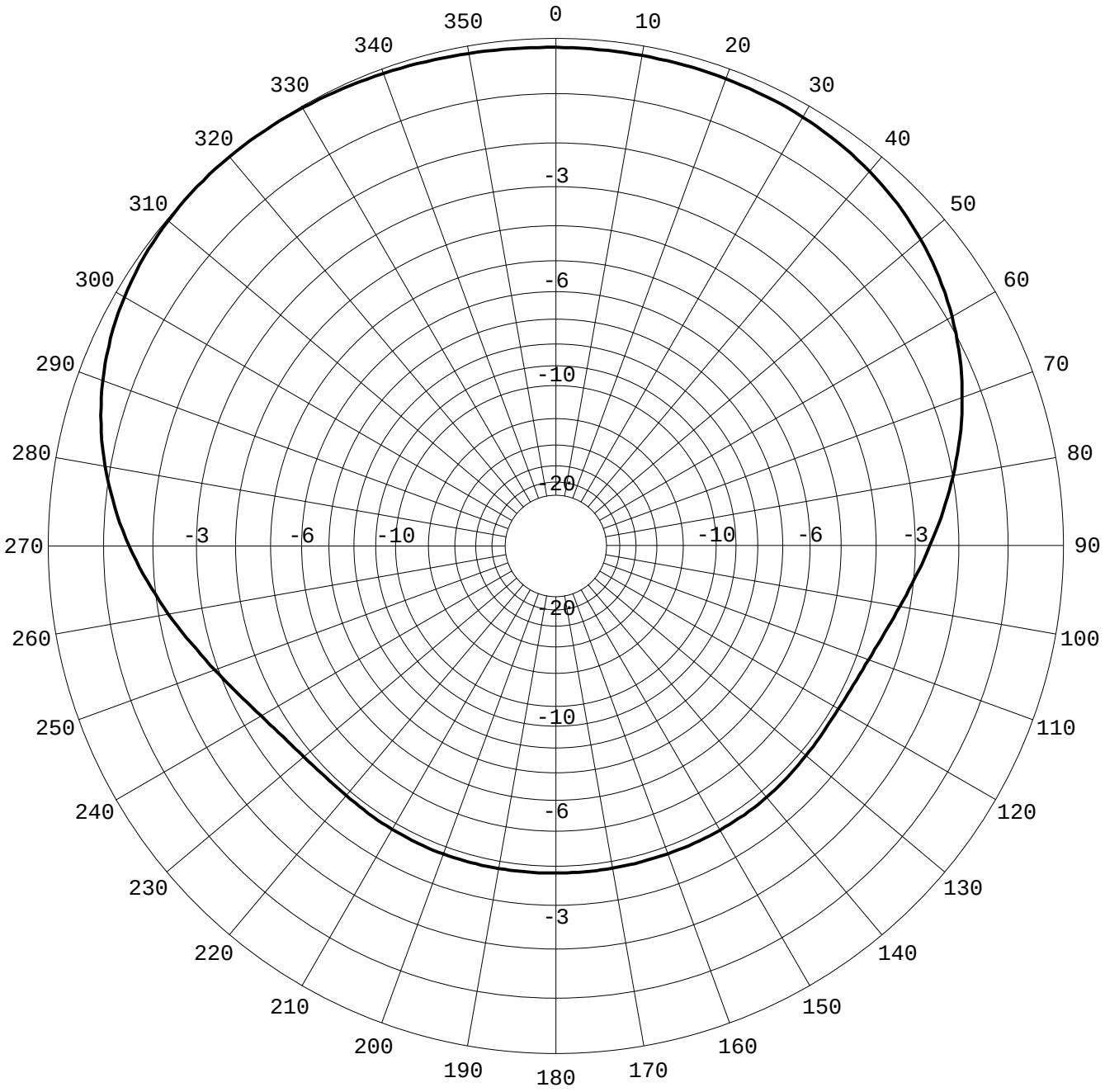

TABLE OF CALCULATED VALUES

degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB
0	-0.16	60	-0.90	120	-3.84	180	-3.81	240	-3.48	300	-0.17
1	-0.16	61	-0.94	121	-3.84	181	-3.81	241	-3.43	301	-0.15
2	-0.16	62	-0.98	122	-3.84	182	-3.81	242	-3.38	302	-0.13
3	-0.16	63	-1.03	123	-3.85	183	-3.81	243	-3.33	303	-0.11
4	-0.17	64	-1.08	124	-3.85	184	-3.81	244	-3.28	304	-0.10
5	-0.17	65	-1.12	125	-3.85	185	-3.81	245	-3.22	305	-0.08
6	-0.17	66	-1.17	126	-3.84	186	-3.81	246	-3.17	306	-0.07
7	-0.17	67	-1.23	127	-3.84	187	-3.80	247	-3.11	307	-0.06
8	-0.17	68	-1.28	128	-3.84	188	-3.80	248	-3.05	308	-0.05
9	-0.17	69	-1.33	129	-3.83	189	-3.80	249	-2.98	309	-0.04
10	-0.17	70	-1.39	130	-3.83	190	-3.80	250	-2.92	310	-0.03
11	-0.17	71	-1.44	131	-3.82	191	-3.80	251	-2.85	311	-0.02
12	-0.17	72	-1.50	132	-3.82	192	-3.80	252	-2.79	312	-0.02
13	-0.17	73	-1.56	133	-3.81	193	-3.80	253	-2.72	313	-0.01
14	-0.17	74	-1.62	134	-3.81	194	-3.80	254	-2.65	314	-0.01
15	-0.18	75	-1.68	135	-3.80	195	-3.79	255	-2.58	315	-0.01
16	-0.18	76	-1.74	136	-3.80	196	-3.79	256	-2.51	316	-0.00
17	-0.18	77	-1.80	137	-3.80	197	-3.79	257	-2.44	317	-0.00
18	-0.18	78	-1.86	138	-3.79	198	-3.79	258	-2.37	318	0.00
19	-0.18	79	-1.93	139	-3.79	199	-3.79	259	-2.29	319	0.00
20	-0.18	80	-1.99	140	-3.79	200	-3.79	260	-2.22	320	-0.00
21	-0.19	81	-2.06	141	-3.79	201	-3.79	261	-2.15	321	-0.00
22	-0.19	82	-2.12	142	-3.78	202	-3.79	262	-2.08	322	-0.00
23	-0.19	83	-2.19	143	-3.78	203	-3.79	263	-2.00	323	-0.01
24	-0.19	84	-2.25	144	-3.78	204	-3.79	264	-1.93	324	-0.01
25	-0.20	85	-2.32	145	-3.78	205	-3.80	265	-1.86	325	-0.01
26	-0.20	86	-2.38	146	-3.78	206	-3.80	266	-1.79	326	-0.01
27	-0.21	87	-2.45	147	-3.78	207	-3.80	267	-1.72	327	-0.02
28	-0.21	88	-2.52	148	-3.78	208	-3.80	268	-1.65	328	-0.02
29	-0.22	89	-2.58	149	-3.78	209	-3.81	269	-1.58	329	-0.03
30	-0.23	90	-2.65	150	-3.78	210	-3.81	270	-1.51	330	-0.03
31	-0.23	91	-2.71	151	-3.78	211	-3.81	271	-1.45	331	-0.04
32	-0.24	92	-2.77	152	-3.79	212	-3.82	272	-1.38	332	-0.04
33	-0.25	93	-2.84	153	-3.79	213	-3.82	273	-1.32	333	-0.05
34	-0.26	94	-2.90	154	-3.79	214	-3.83	274	-1.25	334	-0.05
35	-0.27	95	-2.96	155	-3.79	215	-3.83	275	-1.19	335	-0.06
36	-0.28	96	-3.02	156	-3.79	216	-3.83	276	-1.13	336	-0.06
37	-0.29	97	-3.08	157	-3.79	217	-3.84	277	-1.07	337	-0.07
38	-0.31	98	-3.13	158	-3.80	218	-3.84	278	-1.02	338	-0.07
39	-0.32	99	-3.19	159	-3.80	219	-3.84	279	-0.96	339	-0.08
40	-0.33	100	-3.24	160	-3.80	220	-3.85	280	-0.91	340	-0.09
41	-0.35	101	-3.29	161	-3.80	221	-3.85	281	-0.85	341	-0.09
42	-0.37	102	-3.34	162	-3.80	222	-3.85	282	-0.80	342	-0.10
43	-0.39	103	-3.39	163	-3.80	223	-3.84	283	-0.75	343	-0.10
44	-0.41	104	-3.44	164	-3.80	224	-3.84	284	-0.70	344	-0.11
45	-0.43	105	-3.48	165	-3.81	225	-3.84	285	-0.66	345	-0.11
46	-0.45	106	-3.52	166	-3.81	226	-3.83	286	-0.61	346	-0.12
47	-0.47	107	-3.56	167	-3.81	227	-3.82	287	-0.57	347	-0.12
48	-0.50	108	-3.60	168	-3.81	228	-3.81	288	-0.53	348	-0.13
49	-0.52	109	-3.63	169	-3.81	229	-3.80	289	-0.49	349	-0.13
50	-0.55	110	-3.66	170	-3.81	230	-3.78	290	-0.45	350	-0.13
51	-0.58	111	-3.69	171	-3.81	231	-3.76	291	-0.42	351	-0.14
52	-0.61	112	-3.72	172	-3.81	232	-3.74	292	-0.38	352	-0.14
53	-0.64	113	-3.74	173	-3.81	233	-3.72	293	-0.35	353	-0.14
54	-0.67	114	-3.76	174	-3.81	234	-3.69	294	-0.32	354	-0.15
55	-0.71	115	-3.78	175	-3.81	235	-3.66	295	-0.29	355	-0.15
56	-0.74	116	-3.79	176	-3.81	236	-3.63	296	-0.26	356	-0.15
57	-0.78	117	-3.81	177	-3.81	237	-3.60	297	-0.24	357	-0.15
58	-0.82	118	-3.82	178	-3.81	238	-3.56	298	-0.21	358	-0.16
59	-0.86	119	-3.83	179	-3.81	239	-3.52	299	-0.19	359	-0.16

Frequency 88.00 MHz

Horizontal Plane

Array data file = not_specified

THEORETICAL HORIZONTAL PATTERN

Frequency 98.00 MHz (Logarithmic scale)

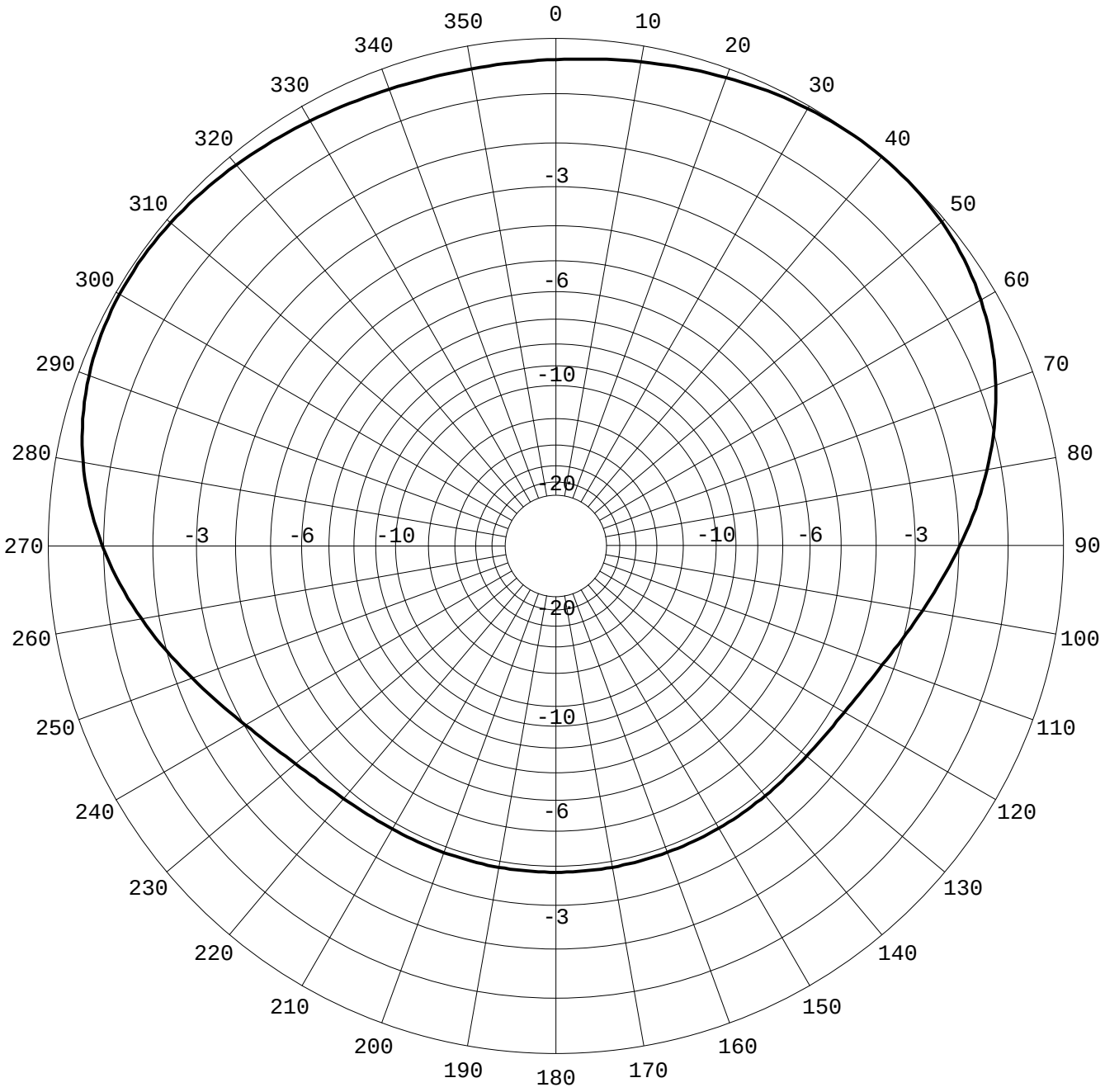

TABLE OF CALCULATED VALUES

degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB
0	-0.37	60	-0.29	120	-3.66	180	-3.83	240	-3.02	300	-0.07
1	-0.37	61	-0.32	121	-3.68	181	-3.83	241	-2.96	301	-0.07
2	-0.36	62	-0.36	122	-3.70	182	-3.83	242	-2.90	302	-0.07
3	-0.35	63	-0.39	123	-3.72	183	-3.83	243	-2.84	303	-0.07
4	-0.34	64	-0.43	124	-3.74	184	-3.83	244	-2.78	304	-0.07
5	-0.33	65	-0.47	125	-3.76	185	-3.83	245	-2.71	305	-0.07
6	-0.32	66	-0.51	126	-3.77	186	-3.83	246	-2.64	306	-0.07
7	-0.31	67	-0.55	127	-3.78	187	-3.83	247	-2.57	307	-0.07
8	-0.30	68	-0.60	128	-3.79	188	-3.83	248	-2.50	308	-0.08
9	-0.29	69	-0.65	129	-3.80	189	-3.83	249	-2.43	309	-0.09
10	-0.28	70	-0.70	130	-3.81	190	-3.83	250	-2.36	310	-0.09
11	-0.27	71	-0.75	131	-3.82	191	-3.83	251	-2.29	311	-0.10
12	-0.26	72	-0.80	132	-3.82	192	-3.83	252	-2.22	312	-0.11
13	-0.25	73	-0.86	133	-3.83	193	-3.84	253	-2.14	313	-0.11
14	-0.23	74	-0.91	134	-3.83	194	-3.84	254	-2.07	314	-0.12
15	-0.22	75	-0.97	135	-3.83	195	-3.84	255	-2.00	315	-0.13
16	-0.21	76	-1.03	136	-3.84	196	-3.84	256	-1.92	316	-0.14
17	-0.20	77	-1.09	137	-3.84	197	-3.84	257	-1.85	317	-0.15
18	-0.19	78	-1.15	138	-3.84	198	-3.84	258	-1.78	318	-0.16
19	-0.17	79	-1.21	139	-3.84	199	-3.84	259	-1.71	319	-0.17
20	-0.16	80	-1.28	140	-3.84	200	-3.83	260	-1.64	320	-0.18
21	-0.15	81	-1.35	141	-3.84	201	-3.83	261	-1.57	321	-0.19
22	-0.14	82	-1.41	142	-3.84	202	-3.83	262	-1.50	322	-0.21
23	-0.12	83	-1.48	143	-3.84	203	-3.83	263	-1.43	323	-0.22
24	-0.11	84	-1.55	144	-3.84	204	-3.83	264	-1.36	324	-0.23
25	-0.10	85	-1.62	145	-3.84	205	-3.83	265	-1.29	325	-0.24
26	-0.09	86	-1.69	146	-3.84	206	-3.83	266	-1.23	326	-0.25
27	-0.08	87	-1.76	147	-3.84	207	-3.83	267	-1.16	327	-0.26
28	-0.07	88	-1.83	148	-3.84	208	-3.83	268	-1.10	328	-0.27
29	-0.06	89	-1.91	149	-3.84	209	-3.82	269	-1.04	329	-0.29
30	-0.05	90	-1.98	150	-3.84	210	-3.82	270	-0.98	330	-0.29
31	-0.04	91	-2.05	151	-3.84	211	-3.82	271	-0.92	331	-0.31
32	-0.03	92	-2.12	152	-3.84	212	-3.81	272	-0.87	332	-0.31
33	-0.03	93	-2.19	153	-3.84	213	-3.81	273	-0.81	333	-0.32
34	-0.02	94	-2.27	154	-3.84	214	-3.80	274	-0.76	334	-0.33
35	-0.01	95	-2.34	155	-3.84	215	-3.79	275	-0.71	335	-0.34
36	-0.01	96	-2.41	156	-3.84	216	-3.79	276	-0.66	336	-0.35
37	-0.01	97	-2.48	157	-3.84	217	-3.78	277	-0.62	337	-0.36
38	-0.00	98	-2.55	158	-3.84	218	-3.77	278	-0.57	338	-0.37
39	-0.00	99	-2.62	159	-3.84	219	-3.76	279	-0.53	339	-0.37
40	0.00	100	-2.69	160	-3.84	220	-3.74	280	-0.49	340	-0.38
41	0.00	101	-2.75	161	-3.84	221	-3.73	281	-0.45	341	-0.39
42	-0.00	102	-2.82	162	-3.84	222	-3.71	282	-0.41	342	-0.39
43	-0.01	103	-2.88	163	-3.84	223	-3.69	283	-0.38	343	-0.39
44	-0.01	104	-2.95	164	-3.84	224	-3.67	284	-0.35	344	-0.40
45	-0.01	105	-3.01	165	-3.84	225	-3.65	285	-0.32	345	-0.40
46	-0.02	106	-3.07	166	-3.84	226	-3.62	286	-0.29	346	-0.41
47	-0.03	107	-3.12	167	-3.84	227	-3.60	287	-0.26	347	-0.41
48	-0.04	108	-3.18	168	-3.84	228	-3.57	288	-0.24	348	-0.41
49	-0.05	109	-3.23	169	-3.84	229	-3.54	289	-0.21	349	-0.41
50	-0.06	110	-3.28	170	-3.83	230	-3.50	290	-0.19	350	-0.41
51	-0.08	111	-3.33	171	-3.83	231	-3.46	291	-0.17	351	-0.41
52	-0.09	112	-3.38	172	-3.83	232	-3.42	292	-0.15	352	-0.41
53	-0.11	113	-3.42	173	-3.83	233	-3.38	293	-0.14	353	-0.41
54	-0.13	114	-3.46	174	-3.83	234	-3.34	294	-0.13	354	-0.40
55	-0.15	115	-3.50	175	-3.83	235	-3.29	295	-0.11	355	-0.40
56	-0.18	116	-3.54	176	-3.83	236	-3.24	296	-0.10	356	-0.39
57	-0.20	117	-3.57	177	-3.83	237	-3.19	297	-0.09	357	-0.39
58	-0.23	118	-3.60	178	-3.83	238	-3.14	298	-0.09	358	-0.39
59	-0.26	119	-3.63	179	-3.83	239	-3.08	299	-0.08	359	-0.38

Frequency 98.00 MHz

Horizontal Plane

Array data file = not_specified

THEORETICAL HORIZONTAL PATTERN

Frequency 108.00 MHz (Logarithmic scale)

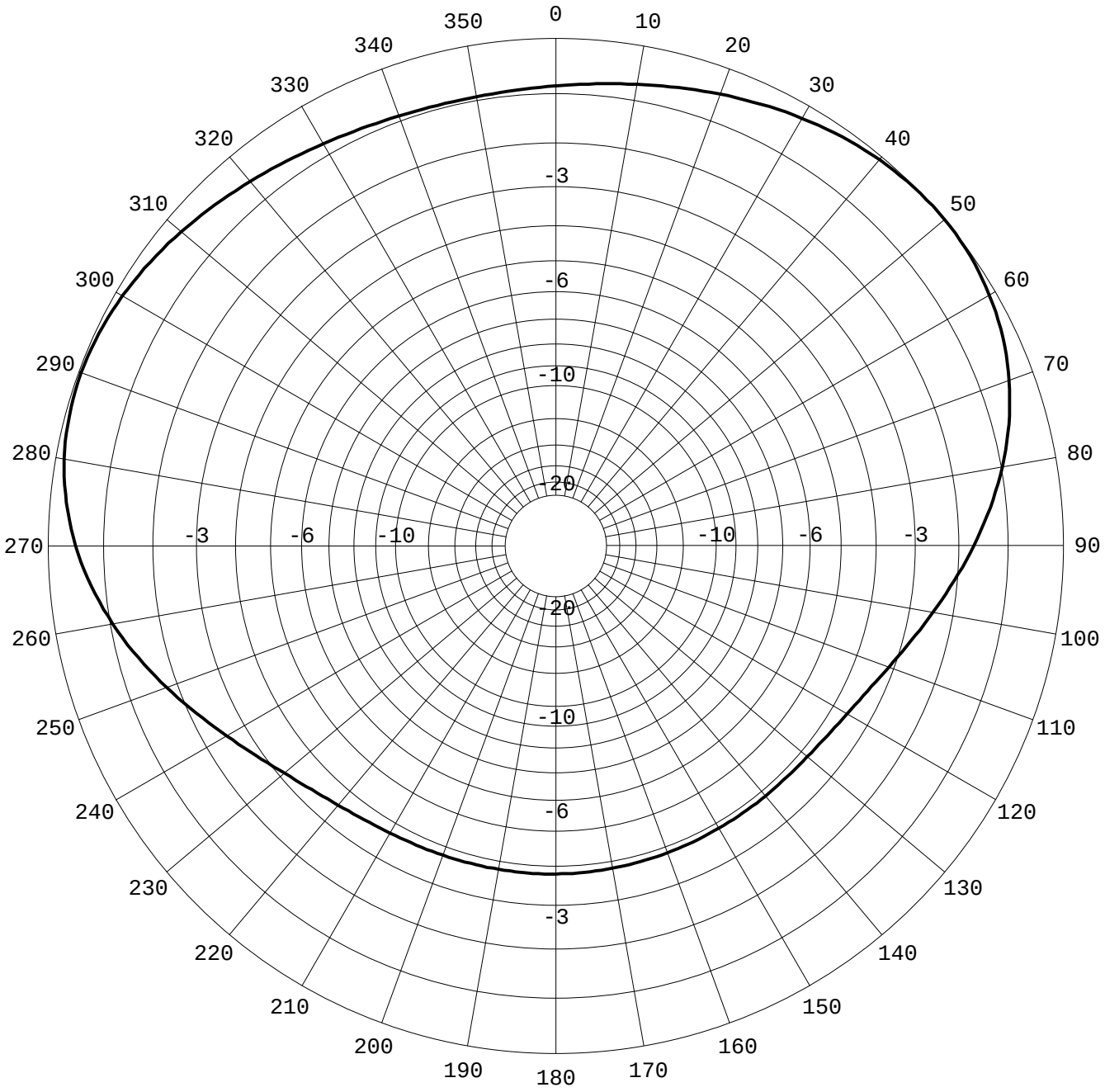

TABLE OF CALCULATED VALUES

degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB	degrees	dB
0	-0.86	60	-0.11	120	-3.57	180	-3.79	240	-2.52	300	-0.13
1	-0.85	61	-0.14	121	-3.60	181	-3.79	241	-2.44	301	-0.15
2	-0.83	62	-0.16	122	-3.63	182	-3.79	242	-2.37	302	-0.16
3	-0.82	63	-0.19	123	-3.66	183	-3.79	243	-2.30	303	-0.18
4	-0.80	64	-0.22	124	-3.68	184	-3.78	244	-2.22	304	-0.20
5	-0.79	65	-0.25	125	-3.70	185	-3.78	245	-2.15	305	-0.22
6	-0.77	66	-0.28	126	-3.72	186	-3.78	246	-2.08	306	-0.24
7	-0.75	67	-0.32	127	-3.74	187	-3.78	247	-2.00	307	-0.26
8	-0.74	68	-0.36	128	-3.76	188	-3.78	248	-1.92	308	-0.29
9	-0.72	69	-0.40	129	-3.77	189	-3.78	249	-1.85	309	-0.31
10	-0.70	70	-0.44	130	-3.78	190	-3.78	250	-1.77	310	-0.33
11	-0.68	71	-0.49	131	-3.79	191	-3.78	251	-1.69	311	-0.35
12	-0.66	72	-0.53	132	-3.80	192	-3.78	252	-1.62	312	-0.38
13	-0.63	73	-0.58	133	-3.81	193	-3.77	253	-1.55	313	-0.40
14	-0.61	74	-0.63	134	-3.81	194	-3.77	254	-1.47	314	-0.43
15	-0.59	75	-0.69	135	-3.82	195	-3.77	255	-1.40	315	-0.45
16	-0.57	76	-0.74	136	-3.82	196	-3.77	256	-1.33	316	-0.48
17	-0.55	77	-0.80	137	-3.83	197	-3.77	257	-1.26	317	-0.50
18	-0.52	78	-0.86	138	-3.83	198	-3.77	258	-1.19	318	-0.52
19	-0.50	79	-0.92	139	-3.83	199	-3.76	259	-1.12	319	-0.55
20	-0.48	80	-0.98	140	-3.83	200	-3.76	260	-1.05	320	-0.57
21	-0.45	81	-1.04	141	-3.84	201	-3.76	261	-0.99	321	-0.59
22	-0.43	82	-1.11	142	-3.84	202	-3.75	262	-0.92	322	-0.62
23	-0.41	83	-1.18	143	-3.84	203	-3.75	263	-0.86	323	-0.64
24	-0.38	84	-1.25	144	-3.84	204	-3.74	264	-0.80	324	-0.66
25	-0.36	85	-1.32	145	-3.84	205	-3.74	265	-0.74	325	-0.68
26	-0.34	86	-1.39	146	-3.84	206	-3.73	266	-0.69	326	-0.70
27	-0.31	87	-1.46	147	-3.84	207	-3.72	267	-0.63	327	-0.72
28	-0.29	88	-1.53	148	-3.84	208	-3.72	268	-0.58	328	-0.74
29	-0.27	89	-1.61	149	-3.84	209	-3.71	269	-0.53	329	-0.76
30	-0.25	90	-1.68	150	-3.84	210	-3.70	270	-0.49	330	-0.78
31	-0.23	91	-1.76	151	-3.84	211	-3.69	271	-0.44	331	-0.79
32	-0.20	92	-1.83	152	-3.84	212	-3.67	272	-0.40	332	-0.81
33	-0.18	93	-1.91	153	-3.84	213	-3.66	273	-0.36	333	-0.82
34	-0.16	94	-1.99	154	-3.84	214	-3.65	274	-0.32	334	-0.84
35	-0.15	95	-2.07	155	-3.83	215	-3.63	275	-0.29	335	-0.85
36	-0.13	96	-2.14	156	-3.83	216	-3.61	276	-0.26	336	-0.86
37	-0.11	97	-2.22	157	-3.83	217	-3.59	277	-0.23	337	-0.88
38	-0.09	98	-2.29	158	-3.83	218	-3.57	278	-0.20	338	-0.89
39	-0.08	99	-2.37	159	-3.83	219	-3.55	279	-0.17	339	-0.90
40	-0.07	100	-2.44	160	-3.83	220	-3.52	280	-0.15	340	-0.91
41	-0.05	101	-2.52	161	-3.83	221	-3.49	281	-0.13	341	-0.91
42	-0.04	102	-2.59	162	-3.82	222	-3.46	282	-0.11	342	-0.92
43	-0.03	103	-2.66	163	-3.82	223	-3.43	283	-0.09	343	-0.92
44	-0.02	104	-2.73	164	-3.82	224	-3.39	284	-0.08	344	-0.93
45	-0.01	105	-2.80	165	-3.82	225	-3.36	285	-0.07	345	-0.93
46	-0.01	106	-2.87	166	-3.82	226	-3.32	286	-0.06	346	-0.94
47	-0.00	107	-2.93	167	-3.81	227	-3.27	287	-0.06	347	-0.94
48	-0.00	108	-3.00	168	-3.81	228	-3.23	288	-0.05	348	-0.94
49	0.00	109	-3.06	169	-3.81	229	-3.18	289	-0.05	349	-0.94
50	-0.00	110	-3.12	170	-3.81	230	-3.13	290	-0.05	350	-0.93
51	-0.00	111	-3.17	171	-3.80	231	-3.08	291	-0.05	351	-0.93
52	-0.01	112	-3.23	172	-3.80	232	-3.02	292	-0.05	352	-0.93
53	-0.01	113	-3.28	173	-3.80	233	-2.97	293	-0.06	353	-0.92
54	-0.02	114	-3.33	174	-3.80	234	-2.91	294	-0.06	354	-0.92
55	-0.03	115	-3.38	175	-3.80	235	-2.85	295	-0.07	355	-0.91
56	-0.04	116	-3.42	176	-3.79	236	-2.79	296	-0.08	356	-0.90
57	-0.06	117	-3.46	177	-3.79	237	-2.72	297	-0.09	357	-0.89
58	-0.07	118	-3.50	178	-3.79	238	-2.65	298	-0.10	358	-0.88
59	-0.09	119	-3.54	179	-3.79	239	-2.58	299	-0.12	359	-0.87

Frequency 108.00 MHz

Horizontal Plane

Array data file = not_specified

THEORETICAL VERTICAL PATTERN

(Linear scale)

Frequency 88.00 MHz Total antenna

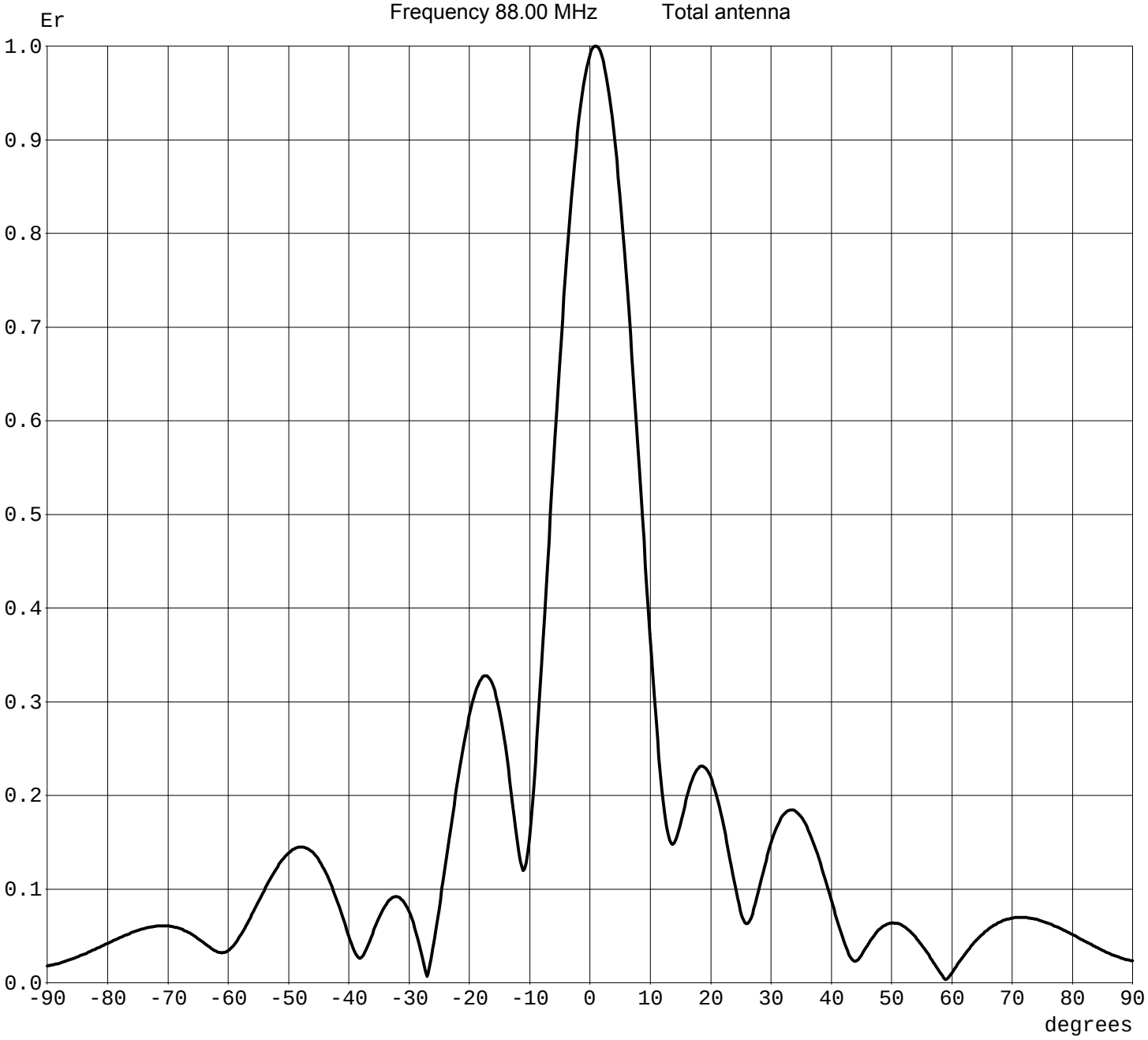

TABLE OF CALCULATED VALUES

degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er
-90.0	0.02	-60.0	0.03	-30.0	0.08	0.0	0.99	30.0	0.15	60.0	0.01
-89.5	0.02	-59.5	0.04	-29.5	0.07	0.5	1.00	30.5	0.16	60.5	0.01
-89.0	0.02	-59.0	0.04	-29.0	0.06	1.0	1.00	31.0	0.17	61.0	0.02
-88.5	0.02	-58.5	0.04	-28.5	0.05	1.5	1.00	31.5	0.17	61.5	0.02
-88.0	0.02	-58.0	0.05	-28.0	0.03	2.0	0.99	32.0	0.18	62.0	0.03
-87.5	0.02	-57.5	0.05	-27.5	0.02	2.5	0.98	32.5	0.18	62.5	0.03
-87.0	0.02	-57.0	0.06	-27.0	0.01	3.0	0.96	33.0	0.18	63.0	0.04
-86.5	0.02	-56.5	0.07	-26.5	0.02	3.5	0.94	33.5	0.18	63.5	0.04
-86.0	0.02	-56.0	0.07	-26.0	0.04	4.0	0.91	34.0	0.18	64.0	0.04
-85.5	0.03	-55.5	0.08	-25.5	0.06	4.5	0.88	34.5	0.18	64.5	0.05
-85.0	0.03	-55.0	0.09	-25.0	0.08	5.0	0.84	35.0	0.18	65.0	0.05
-84.5	0.03	-54.5	0.09	-24.5	0.10	5.5	0.80	35.5	0.17	65.5	0.05
-84.0	0.03	-54.0	0.10	-24.0	0.12	6.0	0.76	36.0	0.17	66.0	0.06
-83.5	0.03	-53.5	0.10	-23.5	0.14	6.5	0.72	36.5	0.16	66.5	0.06
-83.0	0.03	-53.0	0.11	-23.0	0.17	7.0	0.67	37.0	0.15	67.0	0.06
-82.5	0.03	-52.5	0.12	-22.5	0.19	7.5	0.62	37.5	0.14	67.5	0.06
-82.0	0.04	-52.0	0.12	-22.0	0.21	8.0	0.57	38.0	0.13	68.0	0.06
-81.5	0.04	-51.5	0.13	-21.5	0.23	8.5	0.52	38.5	0.12	68.5	0.07
-81.0	0.04	-51.0	0.13	-21.0	0.25	9.0	0.47	39.0	0.11	69.0	0.07
-80.5	0.04	-50.5	0.13	-20.5	0.27	9.5	0.42	39.5	0.10	69.5	0.07
-80.0	0.04	-50.0	0.14	-20.0	0.28	10.0	0.37	40.0	0.09	70.0	0.07
-79.5	0.04	-49.5	0.14	-19.5	0.30	10.5	0.33	40.5	0.08	70.5	0.07
-79.0	0.04	-49.0	0.14	-19.0	0.31	11.0	0.28	41.0	0.07	71.0	0.07
-78.5	0.05	-48.5	0.14	-18.5	0.32	11.5	0.24	41.5	0.06	71.5	0.07
-78.0	0.05	-48.0	0.14	-18.0	0.32	12.0	0.21	42.0	0.05	72.0	0.07
-77.5	0.05	-47.5	0.14	-17.5	0.33	12.5	0.18	42.5	0.04	72.5	0.07
-77.0	0.05	-47.0	0.14	-17.0	0.33	13.0	0.16	43.0	0.03	73.0	0.07
-76.5	0.05	-46.5	0.14	-16.5	0.32	13.5	0.15	43.5	0.02	73.5	0.07
-76.0	0.05	-46.0	0.14	-16.0	0.32	14.0	0.15	44.0	0.02	74.0	0.07
-75.5	0.05	-45.5	0.14	-15.5	0.31	14.5	0.16	44.5	0.02	74.5	0.07
-75.0	0.06	-45.0	0.13	-15.0	0.29	15.0	0.17	45.0	0.03	75.0	0.07
-74.5	0.06	-44.5	0.13	-14.5	0.27	15.5	0.18	45.5	0.03	75.5	0.06
-74.0	0.06	-44.0	0.12	-14.0	0.25	16.0	0.19	46.0	0.04	76.0	0.06
-73.5	0.06	-43.5	0.11	-13.5	0.23	16.5	0.21	46.5	0.04	76.5	0.06
-73.0	0.06	-43.0	0.11	-13.0	0.20	17.0	0.22	47.0	0.05	77.0	0.06
-72.5	0.06	-42.5	0.10	-12.5	0.18	17.5	0.22	47.5	0.05	77.5	0.06
-72.0	0.06	-42.0	0.09	-12.0	0.15	18.0	0.23	48.0	0.06	78.0	0.06
-71.5	0.06	-41.5	0.08	-11.5	0.13	18.5	0.23	48.5	0.06	78.5	0.06
-71.0	0.06	-41.0	0.07	-11.0	0.12	19.0	0.23	49.0	0.06	79.0	0.05
-70.5	0.06	-40.5	0.06	-10.5	0.13	19.5	0.23	49.5	0.06	79.5	0.05
-70.0	0.06	-40.0	0.05	-10.0	0.15	20.0	0.22	50.0	0.06	80.0	0.05
-69.5	0.06	-39.5	0.04	-9.5	0.19	20.5	0.21	50.5	0.06	80.5	0.05
-69.0	0.06	-39.0	0.03	-9.0	0.23	21.0	0.20	51.0	0.06	81.0	0.05
-68.5	0.06	-38.5	0.03	-8.5	0.28	21.5	0.19	51.5	0.06	81.5	0.05
-68.0	0.06	-38.0	0.03	-8.0	0.34	22.0	0.17	52.0	0.06	82.0	0.04
-67.5	0.06	-37.5	0.03	-7.5	0.39	22.5	0.16	52.5	0.06	82.5	0.04
-67.0	0.05	-37.0	0.04	-7.0	0.44	23.0	0.14	53.0	0.06	83.0	0.04
-66.5	0.05	-36.5	0.04	-6.5	0.50	23.5	0.12	53.5	0.05	83.5	0.04
-66.0	0.05	-36.0	0.05	-6.0	0.55	24.0	0.11	54.0	0.05	84.0	0.04
-65.5	0.05	-35.5	0.06	-5.5	0.61	24.5	0.09	54.5	0.04	84.5	0.04
-65.0	0.05	-35.0	0.07	-5.0	0.66	25.0	0.08	55.0	0.04	85.0	0.03
-64.5	0.04	-34.5	0.08	-4.5	0.71	25.5	0.07	55.5	0.04	85.5	0.03
-64.0	0.04	-34.0	0.08	-4.0	0.76	26.0	0.06	56.0	0.03	86.0	0.03
-63.5	0.04	-33.5	0.09	-3.5	0.80	26.5	0.07	56.5	0.03	86.5	0.03
-63.0	0.04	-33.0	0.09	-3.0	0.84	27.0	0.07	57.0	0.02	87.0	0.03
-62.5	0.04	-32.5	0.09	-2.5	0.88	27.5	0.08	57.5	0.02	87.5	0.03
-62.0	0.03	-32.0	0.09	-2.0	0.91	28.0	0.10	58.0	0.01	88.0	0.03
-61.5	0.03	-31.5	0.09	-1.5	0.94	28.5	0.11	58.5	0.01	88.5	0.03
-61.0	0.03	-31.0	0.09	-1.0	0.96	29.0	0.12	59.0	0.00	89.0	0.02
-60.5	0.03	-30.5	0.08	-0.5	0.98	29.5	0.14	59.5	0.01	89.5	0.02

Frequency 88.00 MHz

Vertical Plane

Total antenna

THEORETICAL VERTICAL PATTERN

(Linear scale)

Frequency 98.00 MHz Total antenna

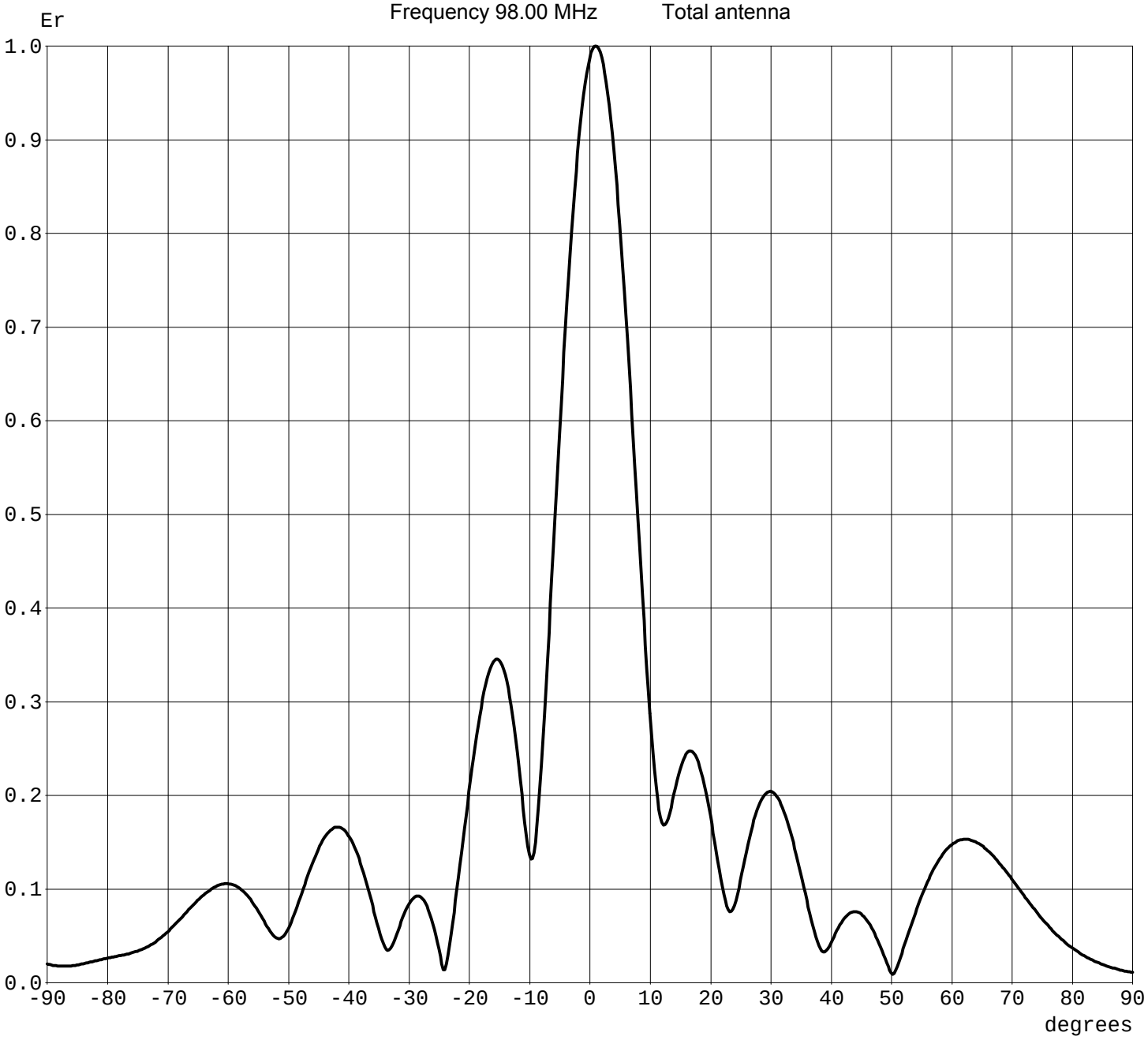

TABLE OF CALCULATED VALUES

degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er
-90.0	0.02	-60.0	0.11	-30.0	0.08	0.0	0.99	30.0	0.20	60.0	0.15
-89.5	0.02	-59.5	0.10	-29.5	0.09	0.5	1.00	30.5	0.20	60.5	0.15
-89.0	0.02	-59.0	0.10	-29.0	0.09	1.0	1.00	31.0	0.20	61.0	0.15
-88.5	0.02	-58.5	0.10	-28.5	0.09	1.5	1.00	31.5	0.19	61.5	0.15
-88.0	0.02	-58.0	0.10	-28.0	0.09	2.0	0.99	32.0	0.19	62.0	0.15
-87.5	0.02	-57.5	0.10	-27.5	0.09	2.5	0.97	32.5	0.18	62.5	0.15
-87.0	0.02	-57.0	0.09	-27.0	0.08	3.0	0.95	33.0	0.17	63.0	0.15
-86.5	0.02	-56.5	0.09	-26.5	0.07	3.5	0.92	33.5	0.16	63.5	0.15
-86.0	0.02	-56.0	0.09	-26.0	0.06	4.0	0.89	34.0	0.14	64.0	0.15
-85.5	0.02	-55.5	0.08	-25.5	0.05	4.5	0.85	34.5	0.13	64.5	0.15
-85.0	0.02	-55.0	0.08	-25.0	0.04	5.0	0.81	35.0	0.12	65.0	0.15
-84.5	0.02	-54.5	0.07	-24.5	0.02	5.5	0.76	35.5	0.10	65.5	0.14
-84.0	0.02	-54.0	0.07	-24.0	0.01	6.0	0.71	36.0	0.09	66.0	0.14
-83.5	0.02	-53.5	0.06	-23.5	0.03	6.5	0.66	36.5	0.07	66.5	0.14
-83.0	0.02	-53.0	0.05	-23.0	0.05	7.0	0.61	37.0	0.06	67.0	0.13
-82.5	0.02	-52.5	0.05	-22.5	0.07	7.5	0.55	37.5	0.05	67.5	0.13
-82.0	0.02	-52.0	0.05	-22.0	0.10	8.0	0.50	38.0	0.04	68.0	0.13
-81.5	0.02	-51.5	0.05	-21.5	0.13	8.5	0.44	38.5	0.03	68.5	0.12
-81.0	0.02	-51.0	0.05	-21.0	0.15	9.0	0.39	39.0	0.03	69.0	0.12
-80.5	0.03	-50.5	0.05	-20.5	0.18	9.5	0.33	39.5	0.04	69.5	0.11
-80.0	0.03	-50.0	0.06	-20.0	0.20	10.0	0.29	40.0	0.04	70.0	0.11
-79.5	0.03	-49.5	0.06	-19.5	0.23	10.5	0.24	40.5	0.05	70.5	0.11
-79.0	0.03	-49.0	0.07	-19.0	0.25	11.0	0.21	41.0	0.06	71.0	0.10
-78.5	0.03	-48.5	0.08	-18.5	0.27	11.5	0.18	41.5	0.06	71.5	0.10
-78.0	0.03	-48.0	0.09	-18.0	0.29	12.0	0.17	42.0	0.07	72.0	0.09
-77.5	0.03	-47.5	0.10	-17.5	0.31	12.5	0.17	42.5	0.07	72.5	0.09
-77.0	0.03	-47.0	0.11	-17.0	0.32	13.0	0.17	43.0	0.07	73.0	0.08
-76.5	0.03	-46.5	0.12	-16.5	0.34	13.5	0.19	43.5	0.08	73.5	0.08
-76.0	0.03	-46.0	0.13	-16.0	0.34	14.0	0.20	44.0	0.08	74.0	0.08
-75.5	0.03	-45.5	0.13	-15.5	0.35	14.5	0.22	44.5	0.07	74.5	0.07
-75.0	0.03	-45.0	0.14	-15.0	0.34	15.0	0.23	45.0	0.07	75.0	0.07
-74.5	0.03	-44.5	0.15	-14.5	0.34	15.5	0.24	45.5	0.07	75.5	0.06
-74.0	0.04	-44.0	0.15	-14.0	0.33	16.0	0.24	46.0	0.07	76.0	0.06
-73.5	0.04	-43.5	0.16	-13.5	0.31	16.5	0.25	46.5	0.06	76.5	0.06
-73.0	0.04	-43.0	0.16	-13.0	0.30	17.0	0.25	47.0	0.06	77.0	0.05
-72.5	0.04	-42.5	0.16	-12.5	0.27	17.5	0.24	47.5	0.05	77.5	0.05
-72.0	0.04	-42.0	0.17	-12.0	0.25	18.0	0.24	48.0	0.04	78.0	0.05
-71.5	0.05	-41.5	0.17	-11.5	0.22	18.5	0.22	48.5	0.03	78.5	0.04
-71.0	0.05	-41.0	0.16	-11.0	0.19	19.0	0.21	49.0	0.03	79.0	0.04
-70.5	0.05	-40.5	0.16	-10.5	0.16	19.5	0.20	49.5	0.02	79.5	0.04
-70.0	0.05	-40.0	0.16	-10.0	0.14	20.0	0.18	50.0	0.01	80.0	0.04
-69.5	0.06	-39.5	0.15	-9.5	0.13	20.5	0.16	50.5	0.01	80.5	0.03
-69.0	0.06	-39.0	0.14	-9.0	0.15	21.0	0.14	51.0	0.02	81.0	0.03
-68.5	0.06	-38.5	0.14	-8.5	0.19	21.5	0.12	51.5	0.03	81.5	0.03
-68.0	0.07	-38.0	0.13	-8.0	0.23	22.0	0.10	52.0	0.04	82.0	0.03
-67.5	0.07	-37.5	0.12	-7.5	0.29	22.5	0.09	52.5	0.05	82.5	0.03
-67.0	0.07	-37.0	0.11	-7.0	0.34	23.0	0.08	53.0	0.06	83.0	0.03
-66.5	0.08	-36.5	0.09	-6.5	0.40	23.5	0.08	53.5	0.06	83.5	0.02
-66.0	0.08	-36.0	0.08	-6.0	0.47	24.0	0.08	54.0	0.07	84.0	0.02
-65.5	0.08	-35.5	0.07	-5.5	0.53	24.5	0.09	54.5	0.08	84.5	0.02
-65.0	0.09	-35.0	0.06	-5.0	0.59	25.0	0.11	55.0	0.09	85.0	0.02
-64.5	0.09	-34.5	0.05	-4.5	0.64	25.5	0.12	55.5	0.10	85.5	0.02
-64.0	0.09	-34.0	0.04	-4.0	0.70	26.0	0.14	56.0	0.11	86.0	0.02
-63.5	0.10	-33.5	0.03	-3.5	0.75	26.5	0.15	56.5	0.11	86.5	0.02
-63.0	0.10	-33.0	0.04	-3.0	0.80	27.0	0.17	57.0	0.12	87.0	0.02
-62.5	0.10	-32.5	0.04	-2.5	0.85	27.5	0.18	57.5	0.13	87.5	0.01
-62.0	0.10	-32.0	0.05	-2.0	0.89	28.0	0.19	58.0	0.13	88.0	0.01
-61.5	0.10	-31.5	0.06	-1.5	0.92	28.5	0.20	58.5	0.14	88.5	0.01
-61.0	0.10	-31.0	0.07	-1.0	0.95	29.0	0.20	59.0	0.14	89.0	0.01
-60.5	0.11	-30.5	0.08	-0.5	0.97	29.5	0.20	59.5	0.14	89.5	0.01

Frequency 98.00 MHz

Vertical Plane

Total antenna

THEORETICAL VERTICAL PATTERN

(Linear scale)

Frequency 108.00 MHz Total antenna

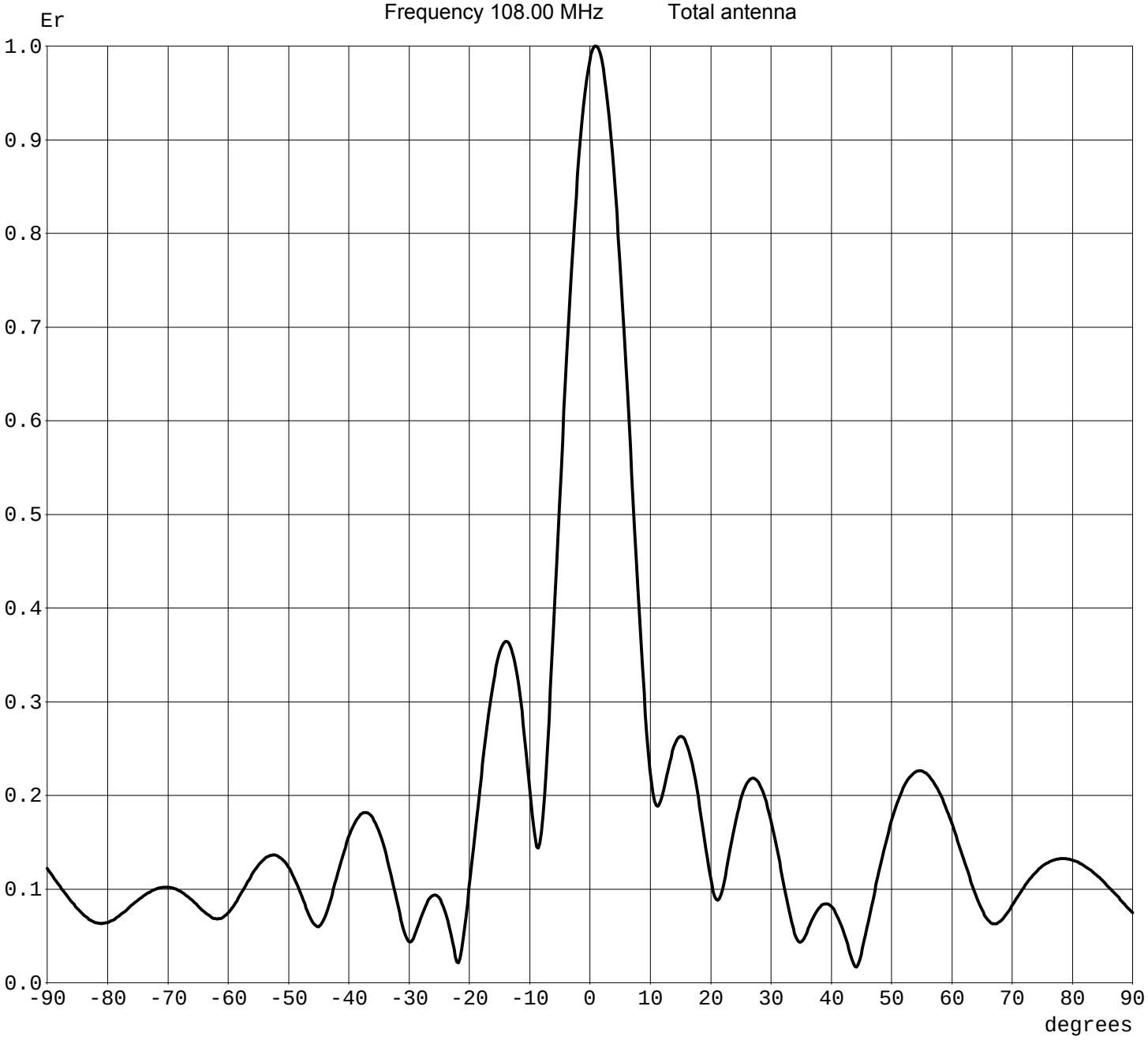

TABLE OF CALCULATED VALUES

degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er	degrees	Er
-90.0	0.12	-60.0	0.07	-30.0	0.04	0.0	0.98	30.0	0.17	60.0	0.17
-89.5	0.12	-59.5	0.08	-29.5	0.04	0.5	1.00	30.5	0.16	60.5	0.16
-89.0	0.11	-59.0	0.08	-29.0	0.05	1.0	1.00	31.0	0.14	61.0	0.15
-88.5	0.11	-58.5	0.09	-28.5	0.06	1.5	1.00	31.5	0.13	61.5	0.14
-88.0	0.10	-58.0	0.09	-28.0	0.07	2.0	0.98	32.0	0.11	62.0	0.13
-87.5	0.10	-57.5	0.10	-27.5	0.08	2.5	0.97	32.5	0.09	62.5	0.12
-87.0	0.10	-57.0	0.10	-27.0	0.08	3.0	0.94	33.0	0.08	63.0	0.11
-86.5	0.09	-56.5	0.11	-26.5	0.09	3.5	0.91	33.5	0.06	63.5	0.10
-86.0	0.09	-56.0	0.12	-26.0	0.09	4.0	0.87	34.0	0.05	64.0	0.09
-85.5	0.08	-55.5	0.12	-25.5	0.09	4.5	0.82	34.5	0.04	64.5	0.09
-85.0	0.08	-55.0	0.12	-25.0	0.09	5.0	0.77	35.0	0.04	65.0	0.08
-84.5	0.08	-54.5	0.13	-24.5	0.09	5.5	0.72	35.5	0.05	65.5	0.07
-84.0	0.07	-54.0	0.13	-24.0	0.08	6.0	0.66	36.0	0.05	66.0	0.07
-83.5	0.07	-53.5	0.13	-23.5	0.07	6.5	0.60	36.5	0.06	66.5	0.06
-83.0	0.07	-53.0	0.14	-23.0	0.05	7.0	0.54	37.0	0.07	67.0	0.06
-82.5	0.07	-52.5	0.14	-22.5	0.04	7.5	0.48	37.5	0.07	67.5	0.06
-82.0	0.06	-52.0	0.14	-22.0	0.02	8.0	0.42	38.0	0.08	68.0	0.06
-81.5	0.06	-51.5	0.13	-21.5	0.03	8.5	0.36	38.5	0.08	68.5	0.07
-81.0	0.06	-51.0	0.13	-21.0	0.05	9.0	0.31	39.0	0.08	69.0	0.07
-80.5	0.06	-50.5	0.13	-20.5	0.07	9.5	0.26	39.5	0.08	69.5	0.08
-80.0	0.06	-50.0	0.12	-20.0	0.10	10.0	0.23	40.0	0.08	70.0	0.08
-79.5	0.07	-49.5	0.12	-19.5	0.13	10.5	0.20	40.5	0.08	70.5	0.09
-79.0	0.07	-49.0	0.11	-19.0	0.16	11.0	0.19	41.0	0.07	71.0	0.09
-78.5	0.07	-48.5	0.10	-18.5	0.19	11.5	0.19	41.5	0.06	71.5	0.10
-78.0	0.07	-48.0	0.10	-18.0	0.22	12.0	0.20	42.0	0.06	72.0	0.10
-77.5	0.07	-47.5	0.09	-17.5	0.25	12.5	0.21	42.5	0.05	72.5	0.11
-77.0	0.08	-47.0	0.08	-17.0	0.27	13.0	0.23	43.0	0.04	73.0	0.11
-76.5	0.08	-46.5	0.07	-16.5	0.30	13.5	0.24	43.5	0.02	73.5	0.11
-76.0	0.08	-46.0	0.07	-16.0	0.32	14.0	0.25	44.0	0.02	74.0	0.12
-75.5	0.08	-45.5	0.06	-15.5	0.34	14.5	0.26	44.5	0.02	74.5	0.12
-75.0	0.09	-45.0	0.06	-15.0	0.35	15.0	0.26	45.0	0.03	75.0	0.12
-74.5	0.09	-44.5	0.06	-14.5	0.36	15.5	0.26	45.5	0.04	75.5	0.13
-74.0	0.09	-44.0	0.07	-14.0	0.36	16.0	0.26	46.0	0.06	76.0	0.13
-73.5	0.09	-43.5	0.08	-13.5	0.36	16.5	0.25	46.5	0.07	76.5	0.13
-73.0	0.10	-43.0	0.09	-13.0	0.36	17.0	0.23	47.0	0.09	77.0	0.13
-72.5	0.10	-42.5	0.10	-12.5	0.34	17.5	0.22	47.5	0.10	77.5	0.13
-72.0	0.10	-42.0	0.11	-12.0	0.33	18.0	0.20	48.0	0.12	78.0	0.13
-71.5	0.10	-41.5	0.12	-11.5	0.30	18.5	0.18	48.5	0.13	78.5	0.13
-71.0	0.10	-41.0	0.13	-11.0	0.28	19.0	0.15	49.0	0.15	79.0	0.13
-70.5	0.10	-40.5	0.14	-10.5	0.24	19.5	0.13	49.5	0.16	79.5	0.13
-70.0	0.10	-40.0	0.15	-10.0	0.21	20.0	0.11	50.0	0.17	80.0	0.13
-69.5	0.10	-39.5	0.16	-9.5	0.18	20.5	0.10	50.5	0.18	80.5	0.13
-69.0	0.10	-39.0	0.17	-9.0	0.15	21.0	0.09	51.0	0.19	81.0	0.13
-68.5	0.10	-38.5	0.18	-8.5	0.14	21.5	0.09	51.5	0.20	81.5	0.13
-68.0	0.10	-38.0	0.18	-8.0	0.16	22.0	0.10	52.0	0.21	82.0	0.12
-67.5	0.10	-37.5	0.18	-7.5	0.20	22.5	0.11	52.5	0.21	82.5	0.12
-67.0	0.09	-37.0	0.18	-7.0	0.25	23.0	0.13	53.0	0.22	83.0	0.12
-66.5	0.09	-36.5	0.18	-6.5	0.31	23.5	0.15	53.5	0.22	83.5	0.12
-66.0	0.09	-36.0	0.18	-6.0	0.38	24.0	0.17	54.0	0.22	84.0	0.11
-65.5	0.09	-35.5	0.17	-5.5	0.44	24.5	0.18	54.5	0.23	84.5	0.11
-65.0	0.08	-35.0	0.16	-5.0	0.51	25.0	0.19	55.0	0.23	85.0	0.11
-64.5	0.08	-34.5	0.15	-4.5	0.58	25.5	0.20	55.5	0.22	85.5	0.11
-64.0	0.08	-34.0	0.14	-4.0	0.64	26.0	0.21	56.0	0.22	86.0	0.10
-63.5	0.07	-33.5	0.13	-3.5	0.70	26.5	0.22	56.5	0.22	86.5	0.10
-63.0	0.07	-33.0	0.12	-3.0	0.76	27.0	0.22	57.0	0.21	87.0	0.10
-62.5	0.07	-32.5	0.10	-2.5	0.81	27.5	0.22	57.5	0.21	87.5	0.09
-62.0	0.07	-32.0	0.09	-2.0	0.86	28.0	0.21	58.0	0.20	88.0	0.09
-61.5	0.07	-31.5	0.07	-1.5	0.90	28.5	0.21	58.5	0.20	88.5	0.08
-61.0	0.07	-31.0	0.06	-1.0	0.94	29.0	0.20	59.0	0.19	89.0	0.08
-60.5	0.07	-30.5	0.05	-0.5	0.96	29.5	0.19	59.5	0.18	89.5	0.08

Frequency 108.00 MHz

Vertical Plane

Total antenna

TECHNICAL
DOCUMENTATION

Performance table for power and peak voltage for safety factors and working antenna details

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Power and Peak Voltage rating
- Safety Factors -

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Antenna type FMC-06/P/6 (6 bays x 1 face)

Circular polarization

FM components	Power Rating [kW] (A) (1)	Mean Power for each antenna input [kW] (B) (2)	Power Safety Factor (A/B)	Peak Voltage Rating [kV] (A)	Peak Voltage [kV] (B) (2)	Peak Voltage Safety Factor (A/B)
Panel type FMC-06/P	12.50	7.50	**1.67**	5.20	1.94	**2.69**
Coaxial branch cables 7/8" (Air dielectric) with connectors 1-5/8" EIA M	8.3	7.50	**1.11**	2.70	1.94	**1.40**
6 way power divider RFM-26 (tunable)	53.00	45.00	**1.18**	9.70	4.74	**2.05**
Antenna Inputs		**45.00**			**4.74**	

(1) At 100 MHz - 40° temperature

(2) Supposed 5 frequencies operating @ 9 kW each

GENERAL DESCRIPTION

The power distribution network of the proposed antenna system is accurately designed to achieve the required mechanical and electrical performance. The power transformation ratio of the power dividers and the electrical lengths of the branch cables are selected to vary the amplitude and the phase that it feds the individual dipoles, thereby achieving the desidered gain on the vertical and horizontal patterns.

At antenna input:

- feed the tunable power divider RFM-26 (3-1/8" size, part number 199200695) that splits into six equal parts the transmitted power,
- then by means of the 7/8" Air dielectric branch cables with 1-5/8" EIA M connectors (part number 199200692),
- reach the dipole input (FMC-06/P, part number 255010108S)

The electrical length of the branch cables is selected to achieve the required electrical tilt and null fill of the antenna.

POWER HANDLING CAPABILITY AND INSERTION LOSSES FIGURE FOR EACH ANTENNA COMPONENT			
Component name and part number	*Input / Output connectors*	*Power handling capability [kW] (@ 100MHz)*	*Insertion loss figure [dB]*
FMC-06/P dipole *part number 255010108S*	*1-5/8" EIA*	*12.50*	*0.010*
7/8" Air dielectric branch cable *part number 199200692*	*1-5/8" EIA M / 1-5/8" EIA M*	*8.3*	*0.100*
RFM-26 power divider (tunable) *part number 199200695*	*3-1/8" EIA / 1-5/8" EIA*	*53.00*	*0.009*

TECHNICAL
DOCUMENTATION

Typical return loss curves of the complete antenna system and components

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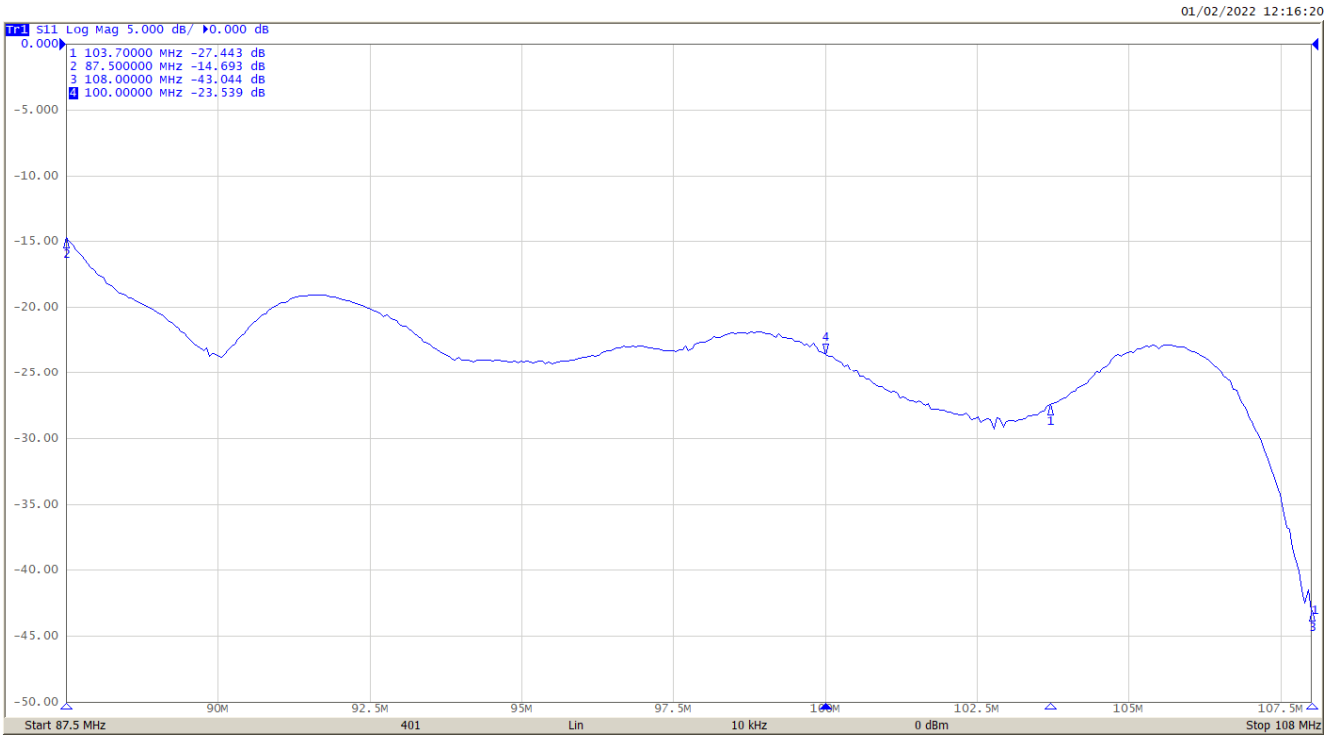
1424607/2024/Tx Design Division - P&D Unit

KATHREIN	**FM Antenna type FMC-06/P/6 (6x1) TEST REPORT JASPUR station**	SIRA RADIO SYSTEMS

Part No.: *160016041*	Serial No. : NA	Reference doc(s) : *M084*
☑ Production ☐ Repair	Production Order :	Station / C.O. : *CO 210066*

COMPLETE ANTENNA SYSTEM



☒ PASS ☐ FAIL

Operator Signature : KATHREIN BROADCAST ITALIA SRL Via Senatore Simonetta, 26 20867 Caponago MB - ITALY C.F. / P.IVA 10901840966

Date :

Test identification :	FMC-06/P/6 - Return Loss [dB]

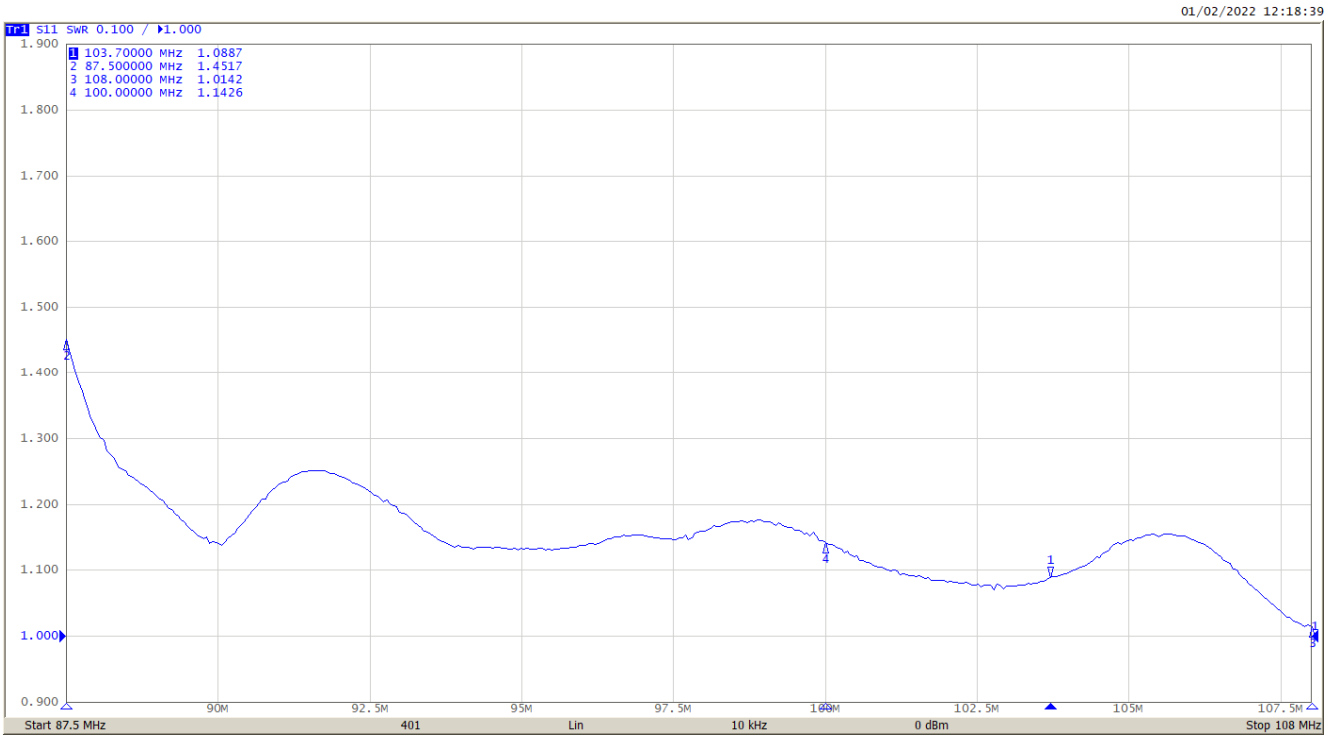
Kathrein Rep AIR Rep

Arraycom Rep AIR Rep

KATHREIN	FM Antenna type FMC-06/P/6 (6x1) TEST REPORT JASPUR station	SIRA RADIO SYSTEMS

Part No.: *160016041*	Serial No.: NA	Reference doc(s) : *M084*
☑ Production ☐ Repair	Production Order :	Station / C.O. : *CO 210066*

COMPLETE ANTENNA SYSTEM



☒ PASS ☐ FAIL

Operator Signature : KATHREIN BROADCAST ITALIA SRL, Via Senatore Simonetta, 26, 20867 Caponago MB - ITALY, C.F. / P.IVA 10901840966

Date :

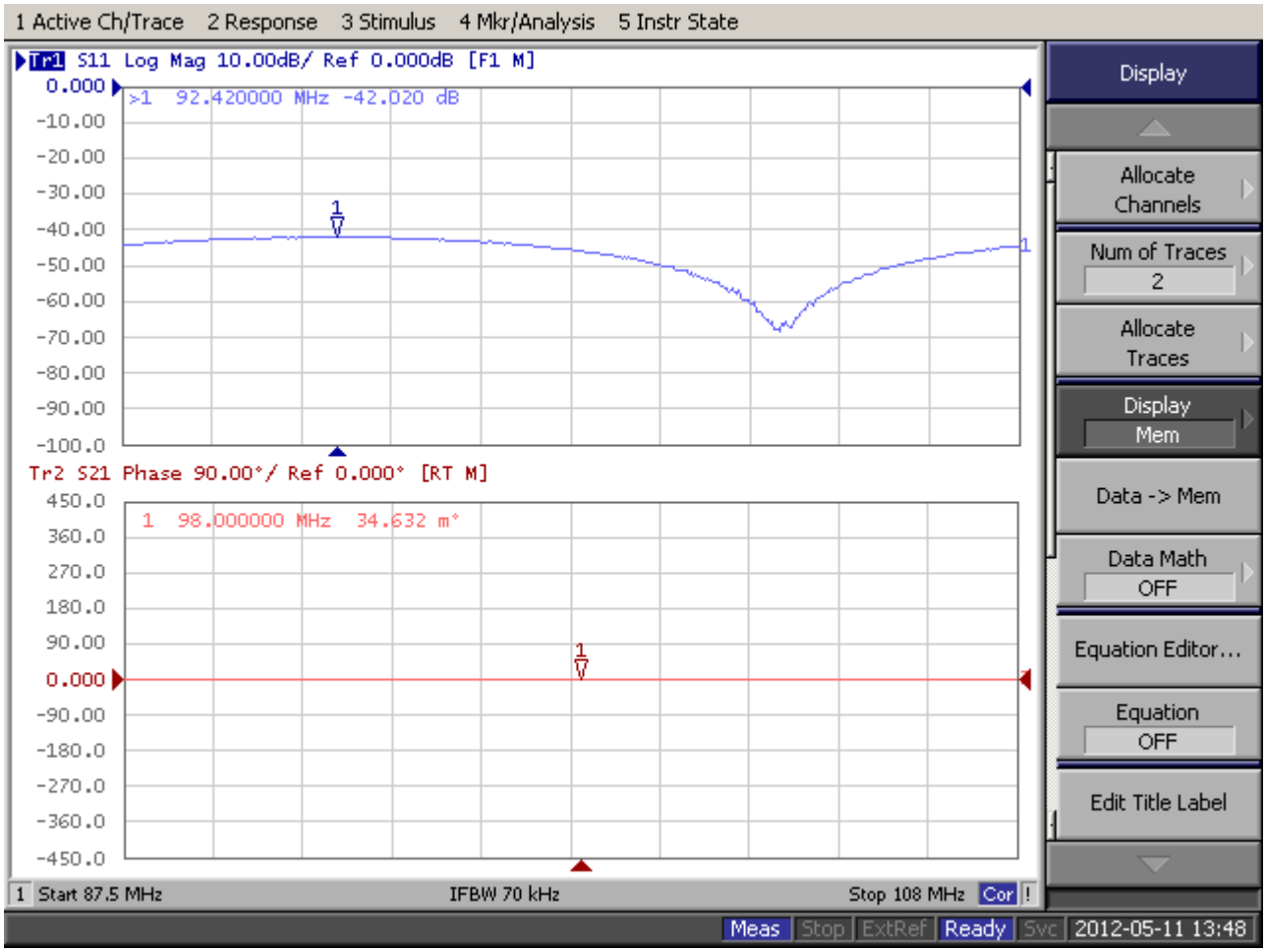
Test identification :	FMC-06/P/6 - VSWR

Kathrein Rep AIR Rep

Arraycom Rep AIR Rep

SIRA RADIO SYSTEMS KATHREIN	**TEST RESULT SHEET DEVICE** **7/8" air branch cable**	Code …….. Ed. …… Page …….

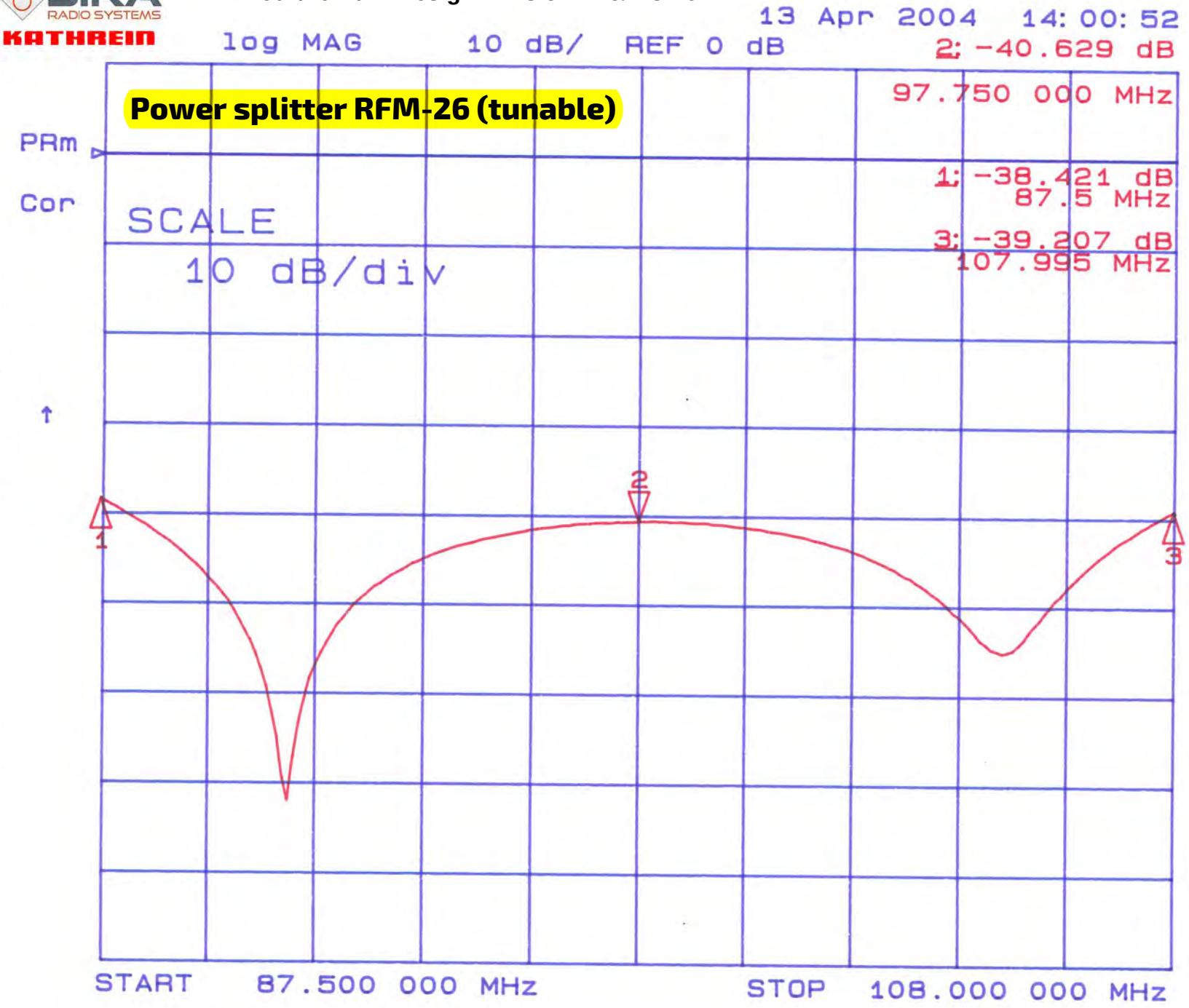
Part No.:	Serial No. :	Reference doc(s) : *M084*
☑ Production ☐ Repair	Production Order :	Station / C.O. :



Operator Signature : Date :

Test identification :	Typical Return Loss curve of coaxial cable 7/8" air

Power splitter RFM-26 (tunable)



SIRA RADIO SYSTEMS KATHREIN	**FM Antenna system type** **FMC-06/P/6 (6x1)**

LENGTHS OF COAXIAL CABLES

Refer freq. : **104** MHz

Q. ty	Cable Identification	Cable Type	Theoretical Phase (°)	Length (mm)	Notes
1	***A1***	7/8” air dielectric	TBD	TBD	/ /
1	***A2***	7/8” air dielectric	TBD	TBD	/ /
1	***A3***	7/8” air dielectric	TBD	TBD	/ /
1	***A4***	7/8” air dielectric	TBD	TBD	/ /
1	***A5***	7/8” air dielectric	TBD	TBD	/ /
1	***A6***	7/8” air dielectric	TBD	TBD	/ /

Max allowed phase errors: +/- 3° from the theoretical phases

SECTION 2

INSTALLATION, MAINTENANCE AND DRAWINGS

BROADCAST

by KATHREIN SIRA RADIO SYSTEMS

KATHREIN

SIRA RADIO SYSTEMS KATHREIN	**FM Antenna system type** **FMC-06/P/6 (6x1)**

UNPACKING

All materials should be thoroughly inspected upon their arrival for external damage. Inspect all parts, especially the radome. This will insure that any missing or damaged material can be replaced before installation.
Crate's content must be checked with the packing list.
Coaxial components not yet installed in the antenna system should be kept indoor protected from dust and/or moisture. All the coaxial cables (not yet installed) and power splitters are shipped with plastic or metallic caps in place. Do not remove these protections until each component is to be installed.

ANTENNA SYSTEM ASSEMBLING INSTRUCTIONS

- As per drawings enclosed in this handbook.

The supplied antenna system is assembled in factory and its parameters are checked. After the tests the antenna system is shipped disassembled. Installation procedure may be carried out in different ways according to installer's equipment and tools. For the installation a clear dry day is suggested.

- Install the mounting hardware* on the existing tower.
- Assemble the FMC-06/P elements as per instructions included in this handbook.
- Fasten the FMC-06/P elements on their mountings using the supplied brackets.
- Install the power splitter, tuning sections on the hardware* as per annex. During this stage, use the brackets supplied.
- Connect the antenna elements to the power splitter outputs by means of branch cables and TRS-40 adaptors supplied. For installation of cables, use the supplied tie lock.
- Install and connect the main feeder supplied to the main antenna input.

Major attention is required during the antenna hoisting in order to avoid damage to the elements and other components; Check by Teodolite (or similar device) the perfect vertical alignment of the antennas.

* = Materials not supplied by Sira Radio Systems.

ASSEMBLING PRECAUTIONS

During all stages of antenna installation please pay attention to the following instructions :

- Until actual installation is required, keep all moisture seals in place. Always keep the contact surfaces clean (inner lines and flanges). Clean if required, with alcohol or detergent, any greasy or dirty surface.
- Do not forget to insert the gasket rings (O-Rings); such rings must be properly lubricated with silicone grease.
- Make sure that flange marks are coincident.
- Check that inner lines match with their seats (if required a cone may be used to splay the inner connector).
- Fasten alternatively all nuts (with proper tightening torque as per drawings) for a uniform contact pressure on flange periphery.

SIRA RADIO SYSTEMS KATHREIN	**FM Antenna system type** **FMC-06/P/6 (6x1)**

- **During the installation of coaxial cables, pay attention to** :
  - ✓ *The minimum bending radius must be as per table below.*
  - ✓ *Not to bend cables with outside temperatures below -0°C and above +60°C.*
  - ✓ *Not to roll cables up (keep them as much straight as possible all along their lenght).*
  - ✓ *Use insulating supports, keeping them at a distance of out least 70mm one to each other.*

MINIMUM BENDING RADIUS FOR COAXIAL CABLES			
50 Ω Cable type	Single bending (mm)	Repeated bending (mm)	Recommended / maximum clamp distance (mm)
7/8" Air dielectric	100	250	500 / 900

OPERATING PRECAUTIONS

Once the antenna has been installed, before applying full power verify that:
- Installation has been carried out properly as per the enclosed drawings.
- Flanges and ring nuts are properly fastened.
- Electrical characteristics (VSWR for example) meet the listed performance.
- The typical air leakage do not exceed 0.07 standard cubic meters per day at an operating pressure between 20 to 30 kPa. (Also relate to environmental conditions)
- Gradually increase the power.

WARNING

The antenna when energised can present potentially high voltage and a high intensity R.F. field in its vicinity.
Do not touch any parts of the antenna system when energised.
All maintenance or repairs must be done with the primary voltage to the transmitter disconnected and all transmitter remote controls disabled.

PERIODICAL MAINTENANCE

For a long and trouble free operational life of the antenna system supplied, periodical checks on all the relevant parts of the system are to be carried out.

Specific checks that we would suggest to perform are:

- Make sure that no hot spots or burn signs are there on coaxial components.
- Make sure that no deformed and/or cracked coaxial components and steelwork are there.
- Make sure that all bolts & nuts, screws etc. etc. of all the coaxial components, steel plates & junctions, are correctly tightened.
- Make sure that no signs of corrosion are there either on coax. components or on any parts of the steel structures.

If any of the above defects are found during the checks, proceed immediately to rectify the defect found. In the event of serious flaws, please contact our Technical Dept. upon discovery.

SIRA RADIO SYSTEMS KATHREIN	**FM Antenna system type** **FMC-06/P/6 (6x1)**

Intervals after which these checks as well as ordinary maintenance are to be performed should not exceed two years.
Besides of the above checks, we suggest you also verify periodically that antenna system electrical performances are in line with the agreed specifications.

FINAL SET UP AND ADJUSTMENT OF THE OVERALL ARRAY

Each radiating element is tested for minimum V.S.W.R. over the operating frequency range and no further adjustments are required during installation.
All power splitters are designed for minimum V.S.W.R. across the total bandwidth of the antenna, generally no field adjustments are necessary.
After erection of the antenna, the tuneable probes included in the power divider can be adjusted, if necessary, in order to show a low standing wave ratio. The specified V.S.W.R, is guaranteed for a properly installed antenna.
For V.S.W.R. adjustment of the tuneable power divider, proceed as per follow.

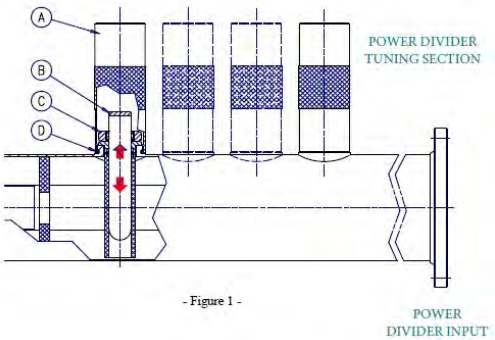
TUNABLE POWER DIVIDER INSTRUCTIONS

A tuneable power divider is a radio frequency device working on a given frequency band which can introduce concentrated capacitive or inductive compensations within an antenna system.
There are sliding stubs (two for FM and VHF band), the distance between these stubs is $\lambda/8$ thus allowing effective V.S.W.R. improvement of a sub-band in any possible antenna V.S.W.R. original condition.
For tuning operation please, carefully follow the below instructions:

See figure 1

1. Connect your Test equipment to the antenna input.
2. Carefully unscrew protective caps (item A) on the device in order not to damage any of the O-rings (item D).
3. Unlock the stop nut (item C) and loosen the stubs (item B).
4. Move stubs in and out until you reach the desired V.S.W.R. figure. This can be done on one or more stubs depending on the entity of the desired improvement.
5. Lock back stubs and stop nut once you are satisfied with improvement achieved.
6. Check that after locking V.S.W.R. is still good.

NOTE: If the system has been pressurized, pressurization will be lost when the tuning stubs covers are removed.



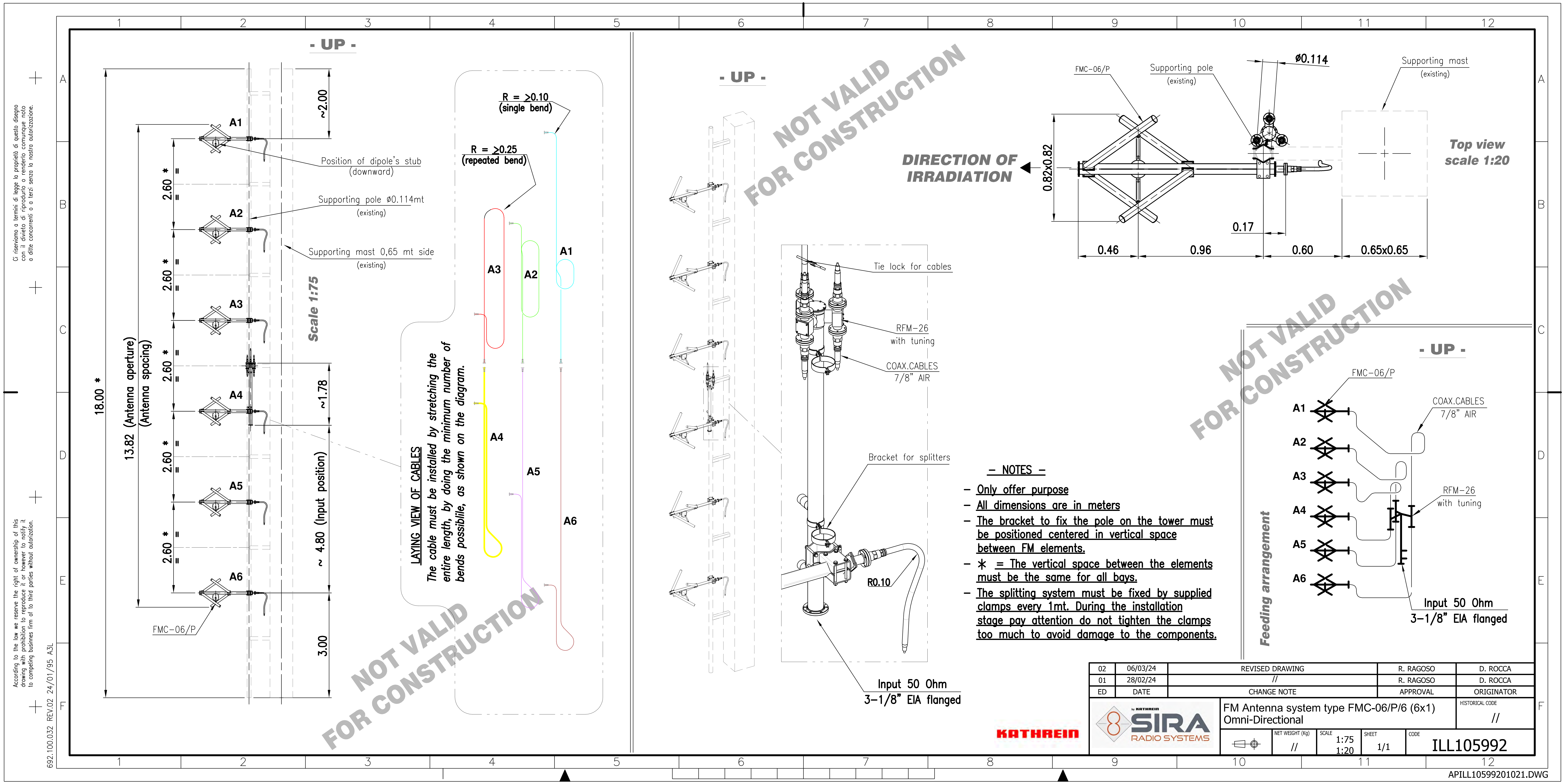
- Figure 1 -

PART LIST

KATHREIN

Antenna system	Part Number
FMC-06/P/6 (6x1)	**160016046**

Position	Description	Part number	UM	Qt.y
01	ANT/FMC-06/P 87.5-108MHZ DIP*	255010108S	NR	6
02	TER.CABLE 7/8INC with 1-5/8" EIA M connectors	199200692	NR	6
03	BAL.SPLIT. RFM 26* with tuning probes	199200695	NR	1
04	BRACKET POLE>>SPLITTER 3-1/8	1690002107	NR	2
05	HANDBOOKS STD SYSTEMS	921170999	NR	as per specs
06	HOSE CLAMPS "COLSON" 74 - 140	995852	NR	100


- UP -
A1
A2
A3
A4
A5
A6
Position of dipole's stub (downward)
Supporting pole ø0.114mt (existing)
Supporting mast 0,65 mt side (existing)
FMC-06/P
18.00 *
13.82 (Antenna aperture)
(Antenna spacing)
2.60 * =
~2.00
~1.78
~ 4.80 (Input position)
3.00
Scale 1:75
R = >0.10 (single bend)
R = >0.25 (repeated bend)
LAYING VIEW OF CABLES
The cable must be installed by stretching the entire length, by doing the minimum number of bends possibile, as shown on the diagram.
NOT VALID FOR CONSTRUCTION
DIRECTION OF IRRADIATION
Tie lock for cables
RFM-26 with tuning
COAX.CABLES 7/8" AIR
Bracket for splitters
R0.10
Input 50 Ohm
3-1/8" EIA flanged
FMC-06/P
Supporting pole (existing)
ø0.114
Supporting mast (existing)
Top view scale 1:20
0.82x0.82
0.46
0.96
0.17
0.60
0.65x0.65
- NOTES -
- Only offer purpose
- All dimensions are in meters
- The bracket to fix the pole on the tower must be positioned centered in vertical space between FM elements.
- * = The vertical space between the elements must be the same for all bays.
- The splitting system must be fixed by supplied clamps every 1mt. During the installation stage pay attention do not tighten the clamps too much to avoid damage to the components.
Feeding arrangement
02 | 06/03/24 | REVISED DRAWING | R. RAGOSO | D. ROCCA
01 | 28/02/24 | // | R. RAGOSO | D. ROCCA
ED | DATE | CHANGE NOTE | APPROVAL | ORIGINATOR
KATHREIN
SIRA RADIO SYSTEMS
FM Antenna system type FMC-06/P/6 (6x1)
Omni-Directional
HISTORICAL CODE //
NET WEIGHT (Kg) //
SCALE 1:75 1:20
SHEET 1/1
CODE ILL105992
APILL10599201021.DWG
692.100.032 REV.02 24/01/95 A3L
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TECHNICAL
DOCUMENTATION

Datasheets of the proposed components

BROADCAST

by KATHREIN
SIRA
RADIO SYSTEMS

KATHREIN

1424607/2024/Tx Design Division - P&D Unit

FMC-06

FM TOP OR SIDEMOUNT DIPOLE

FEATURES

- circular/elliptical polarization
- broadband 87.5 ÷ 108 MHz

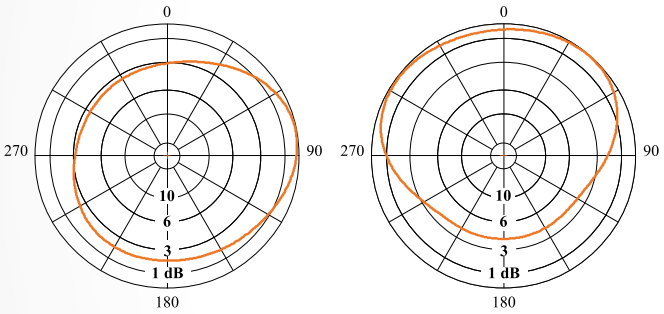
ELECTRICAL DATA

ANTENNA TYPE	FMC-06	FMC-06/P
FREQUENCY RANGE	87.5 ÷ 108 MHz	
IMPEDANCE	50 ohm	
CONNECTOR	7/8" EIA	1-5/8" EIA
MAX POWER	7.5 kW	12.5 kW
VSWR	≤ 1.4	
POLARIZATION	Circular/Elliptical	
GAIN (referred to half wave dipole)	-1.5 dB	
HALF POWER BEAMWIDTH	Omnidirectional ± 1.5 dB in free space Omnidirectional ± 2 dB with ø 100 pole	
LIGHTNING PROTECTION	All metal parts DC grounded	

MECHANICAL DATA

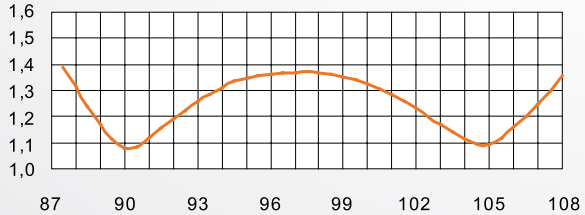
DIMENSIONS mm (in)	1550 x 846 x 846 (61.02 x 33.31 x 33.31)	
WEIGHT kg (lb)	22.5 (49.6)	23.5 (51.8)
WIND SURFACE m^2 (ft^2)	0.17 (1.83) front 0.38 (4.1) side	
WIND LOAD kN (lbf) at 160 km/h (100 mph)	0.21 (47.2) front 0.46 (103.4) side	
MAX WIND VELOCITY km/h (mph)	220 (136.7)	
MATERIALS	brass, aluminium, stainless steel, hot dip galvanized steel (bracket) teflon, fiberglass (radome)	
ICING PROTECTION	Feed point radome	
RADOME COLOUR	Grey (standard)	
MOUNTING mm (in)	With special pipe clamps ø 75 ÷ 150 (2.95 ÷ 5.9)	

RADIATION PATTERNS (Mid Band)



Horizontal Component **Vertical Component**

VSWR



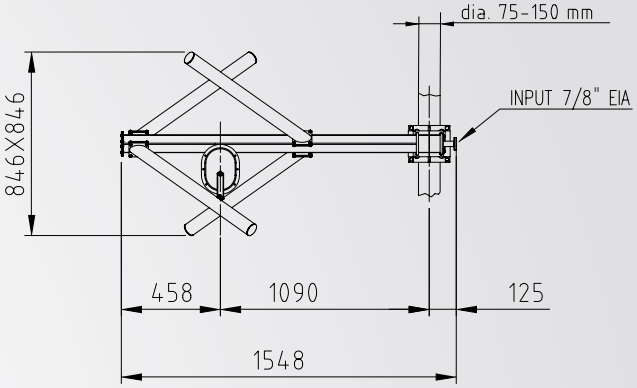
FREQ. (MHz)

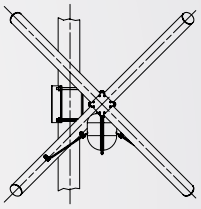
FMC-06

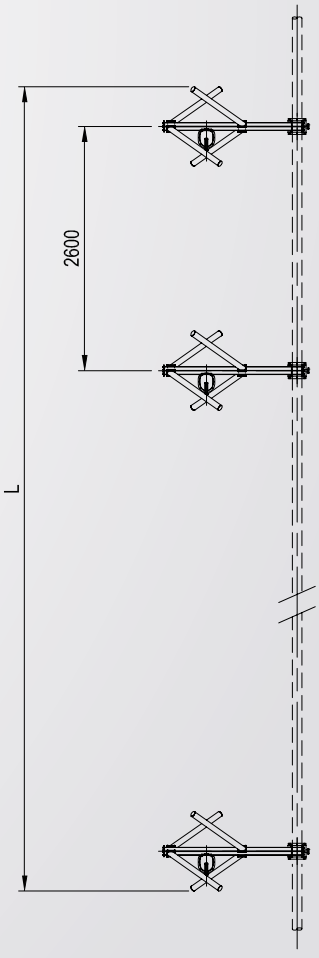
FM TOP OR SIDEMOUNT DIPOLE

FEATURES

- radiating systems with FMC-06 dipole
- omnidirectional patterns







ELECTRICAL DATA

FREQUENCY RANGE	87.5 ÷ 108 MHz
IMPEDANCE	50 ohm
CONNECTOR	EIA flange according to system power rating
POWER RATING	The antenna system can accept any power according to requirements
VSWR (in the operating frequency)	≤ 1.35 without fine matcher ≤ 1.25 with one fine matcher ≤ 1.1 with two fine matchers
POLARIZATION	Circular/Elliptical
GAIN	Refer to table
VERTICAL PATTERN	Null fill, beam tilt and special requirements to order
OTHER FEATURES	The antenna system can be supplied in split feed configuration (two equal halves). Each half can accept full power.

MECHANICAL DATA

HEIGHT OF ARRAY	Subject to number of bays
TOTAL NET WEIGHT	Refer to table
WIND LOAD	Refer to table
PRESSURIZABLE	Yes
RADOME COLOUR	Grey (standard)
MOUNTING HARDWARE	One clamp for pole, supplied

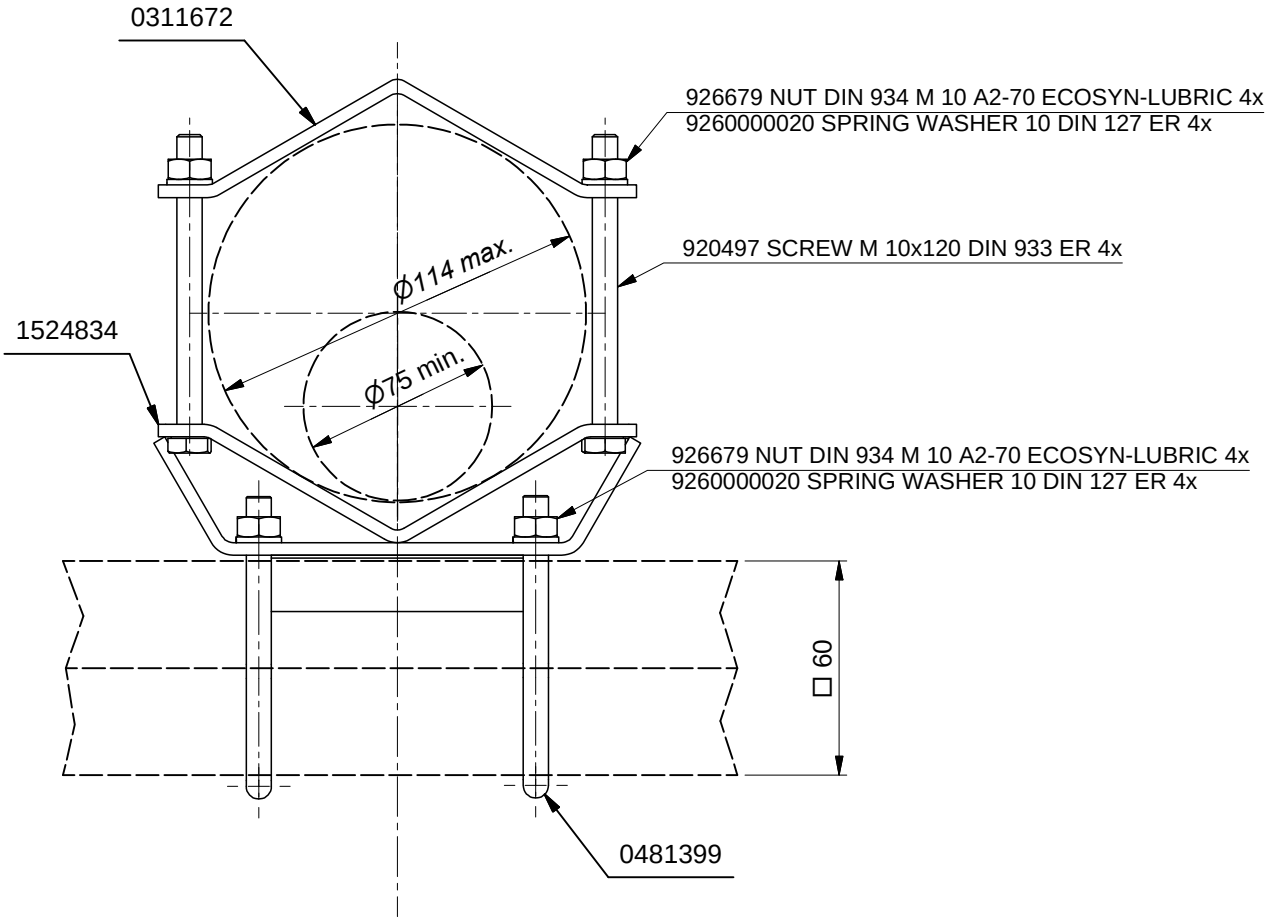
TECHNICAL DATA

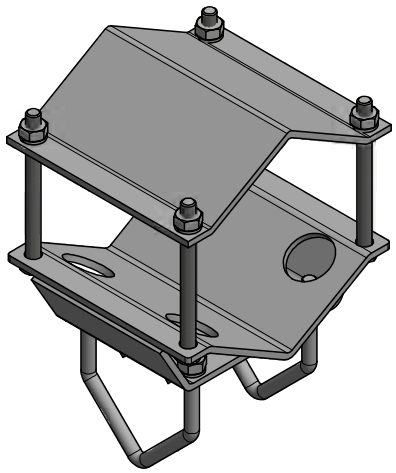
NUMBER OF BAYS	PANELS PER BAY	GAIN dB (1)	GAIN TIMES (1)	WEIGHT (2) kg (lb)	ANTENNA HEIGHT L m (ft)	WIND LOAD (3) kN (lbf)
2	1	1.5	1.41	55 (121)	3.45 (11.3)	0.93 (209)
4	1	4.5	2.82	115 (254)	8.65 (28.4)	1.86 (418)
6	1	6.2	4.17	175 (386)	13.85 (45.4)	2.80 (629)
8	1	7.5	5.62	260 (573)	19.05 (62.5)	3.73 (839)
12	1	9.2	8.32	385 (849)	29.45 (96.6)	5.60 (1259)

(1) referred to half wave dipole. Losses of power distribution network not included.
(2) without mounting hardware, for FMC-06 dipole
(3) v= 160 km/h (100 mph)

All dimensions are in millimeters

1424607/2024/Tx Design Division - P&D Unit





9330000202 ETICHETTA IMBALLO / TYPE PACKING

9308641 SNAP BAG

B	08/05/2018	101023	SAINI M.	PIROLA M.
A	18/12/2017	E17N003	SAINI M.	CRIPPA B.
ED	DATE	CHANGE NOTE	APPROVAL	ORIGINATOR

SIRA Member of the Kathrein Group

STAFFA COMPLETA
CLAMP ASSEMBLY

HISTORICAL CODE

NET WEIGHT (Kg)	SCALE	SHEET	CODE
5,00 kg	1:3	1/1	1690000526

692.100.004 REV.02 24/01/95 A4

COAXIAL BRANCH CABLES

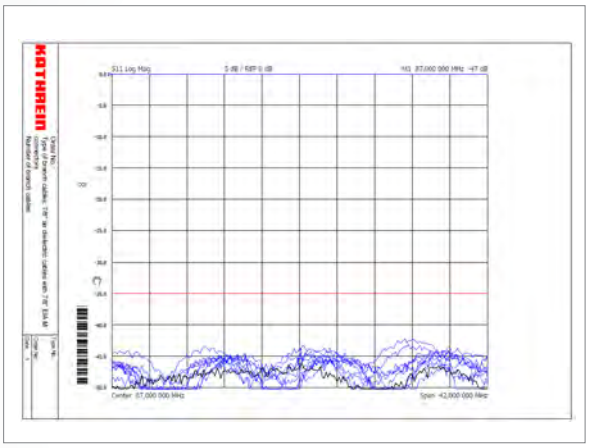
7/8" AIR DIELECTRIC WITH CONNECTORS

FEATURES

- flanged connectors EIA or EIA male
- DIN connectors type male
- low insertion losses
- low V.S.W.R

GENERAL FEATURES

FREQUENCY RANGE		0.1 ÷ 860 MHz
IMPEDANCE		50 ohm
RETURN LOSS*		≥ 32 dB
MAX MEAN POWER		See table below (typical)
OPERATING TEMPERATURE RANGE		-40 to +70° C (-40 to +158° F)
CONNECTORS		See table below
WEIGHT		See table below
PRESSURIZATION		Typical operating pressure 30KPa
CABLES MATERIALS	- Outer conductor	Corrugated copper
	- Inner conductor	copper tube
	- Dielectric	Helical Polyethylene spacer, PE strip
JACKET MATERIAL		Polyethylene, PE



BRANCH CABLES WITH CONNECTORS

TYPE	CONNECTORS	IMPEDANCE	ATTENUATION** (dB)	WEIGHT*** (Kg)
7/8" AIR DIELECTRIC	7/16 M	50ohm	A/100*L + 0.02	0.79*L+1.1
7/8" AIR DIELECTRIC	7/8" EIA M	50ohm	A/100*L + 0.02	0.79*L+1.4
7/8" AIR DIELECTRIC	7/8" EIA	50ohm	A/100*L + 0.02	0.79*L+1.36
7/8" AIR DIELECTRIC	1-5/8" EIA M	50ohm	A/100*L + 0.02	0.79*L+4.4
7/8" AIR DIELECTRIC	1-5/8" EIA	50ohm	A/100*L + 0.02	0.79*L+4.0

*Typical value for a max length of 10mt, terminated with connectors
**A = cable attenuation at different frequencies as per next table
***L = branch cables length [mt]
Note: M = male

STANDARD CONDITIONS FOR ATTENUATION AND POWER CAPABILITY

- V.S.W.R. = 1.0
- Ambient temperature 40°C (104°F) for power capability
- Ambient temperature 20°C (68°F) for attenuation

COAXIAL BRANCH CABLES

7/8" AIR DIELECTRIC WITH CONNECTORS

BRANCH CABLES WITH CONNECTORS

FREQUENCY (MHz)	ATTENUATION dB per 100mt (A)	BRANCH CABLES WITH 7/16 M CONNECTORS POWER (kW)	BRANCH CABLES WITH 7/8" EIA CONNECTORS POWER (kW)*	BRANCH CABLES WITH 1-5/8" EIA CONNECTORS POWER (kW)*
2	0.16	25	61.0	61.0
88	1.10	4.6	8.5	8.5
100	1.18	4.3	8.3	8.3
108	1.23	4.1	8.0	8.0
174	1.57	3.2	5.5	5.5
200	1.69	3	5.0	5.0
300	2.08	2.5	4.5	4.5
450	2.57	2	3.5	3.5
500	2.72	1.9	3.3	3.3
600	3	1.7	3.0	3.0
700	3.25	1.6	2.7	2.7
800	3.50	1.5	2.5	2.5
900	3.75	1.3	2.0	2.0

*Values valid for branch cables terminated with EIA or EIA M connectors

STANDARD CONDITIONS FOR ATTENUATION AND POWER CAPABILITY

- V.S.W.R. = 1.0
- Ambient temperature 40°C (104°F) for power capability
- Ambient temperature 20°C (68°F) for attenuation

CONNECTORS FOR COAXIAL CABLES

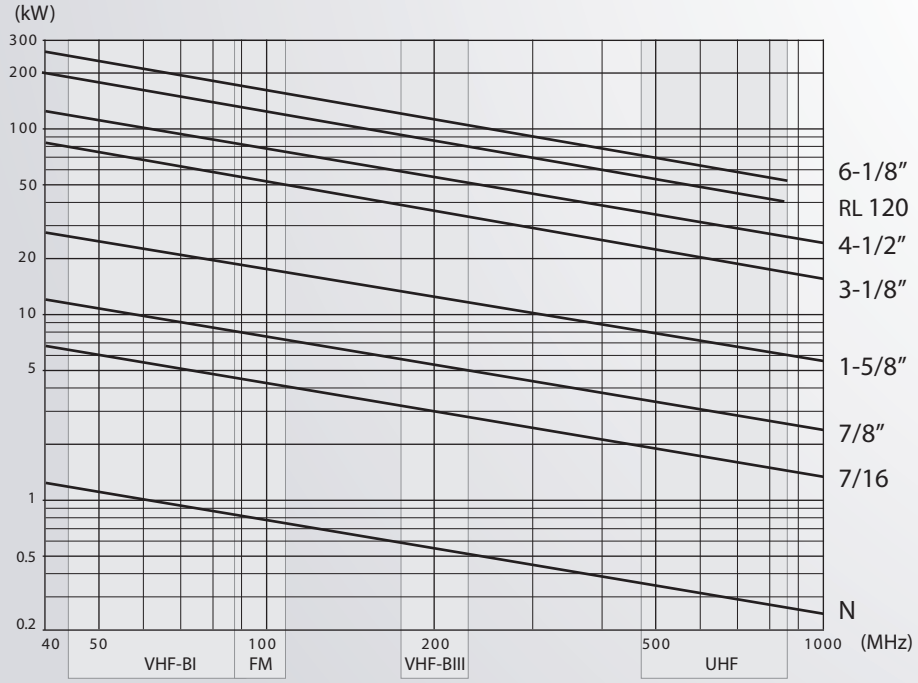
FEATURES

- flanged connectors
- low insertion losses
- low V.S.W.R

GENERAL FEATURES

FREQUENCY RANGE		0.1 ÷ 860 MHz
IMPEDANCE		50 ohm
RETURN LOSS		≥ 32 dB
MAX MEAN POWER		See table below
OPERATING TEMPERATURE RANGE		-40 to +70° C (-40 to +158° F)
CONNECTOR		See table below
WEIGHT		See table below
PRESSURIZATION		Typical operating pressure 30KPa
MATERIALS	- External body	Polished brass Cu Zn Sn (Try-Alloy)
	- Inner conductor	Silver plated brass
	- Insulator	Teflon
EXTERNAL FINISHING		Nickel plating

MAX MEAN POWER



STANDARD CONDITIONS:

- V.S.W.R. = 1.0
- Ambient temperature 40°C (104°F)
- Atmospheric Pressure, dry air
- Inner Conductor Temperature 120°C (248°F)

CONNECTORS FOR COAXIAL CABLES

STANDARD TYPES

TYPE	CONNECTORS	FOR CABLE TYPE	WEIGHT (Kg)
CNN-23	7/16 M	7/8" AIR DIELECTRIC CABLES 50ohm*	0.55
CNN-25	7/8" EIA M	7/8" AIR DIELECTRIC CABLES 50ohm*	0.70
CNN-27	7/8" EIA	7/8" AIR DIELECTRIC CABLES 50ohm*	0.68
CNN-28	1-5/8" EIA M	7/8" AIR DIELECTRIC CABLES 50ohm*	2.2
CNN-29	1-5/8" EIA	7/8" AIR DIELECTRIC CABLES 50ohm*	2.0
CNN-31	1-5/8" EIA	1-5/8" AIR DIELECTRIC CABLES 50ohm*	2.3

Note: M = male
*Connectors are suitable for different type of air dielectric cables. Contact us for more information

FM COAXIAL SPLITTERS

FEATURES

- broadband power dividers
- low insertion loss
- low V.S.W.R

GENERAL FEATURES

FREQUENCY RANGE		87.5 ÷ 108 MHz
IMPEDANCE		50 ohm
RETURN LOSS (typical)		≥ 32 dB with outputs ≥ 7/8" size ≥ 28 dB with outputs 7/16 F size
POWER RATING *		See table
OPERATING TEMPERATURE RANGE		-40 to +70° C (-40 to +158° F)
CONNECTORS		See table
NUMBER OF WAYS		See table
WEIGHT		See table
PRESSURIZATION		Typical operating pressure 300hPa (300mBar)
MATERIALS	- External body	Polished copper, polished brass
	- Inner conductor	Silver plated brass, polished brass, deoxidized aluminium
	- Insulator	Teflon
EXTERNAL FINISHING		Painted RAL 7001, Nickel plating

* mean power , ambient temperature 40° C (104° F) , atmosphere pressure, dry air

STANDARD TYPES

TYPE	INPUT CONNECTOR	OUTPUT CONNECTORS		DIMENSIONS mm (in)			POWER RATING (kW)			WEIGHT	FIGURE
		Nr.	TYPE	A	B	C (Ø)	87.5 MHz	98 MHz	108 MHz	Kg (lb)	
RFM-52	7/8" EIA	2	7/16 F	1621 (63.8)	103 (4.1)	25 (0.98)	8.2	7.7	7.3	4.5 (9.9)	1
RFM-53	7/8" EIA	3	7/16 F	1621 (63.8)	103 (4.1)	25 (0.98)	8.2	7.7	7.3	4.7 (10)	1
RFM-54	7/8" EIA	4	7/16 F	1621 (63.8)	103 (4.1)	25 (0.98)	8.2	7.7	7.3	5 (11)	1
RFM-56	7/8" EIA	6	7/16 F	1621 (63.8)	104 (4.1)	25 (0.98)	8.2	7.7	7.3	5.3 (12)	1
RFM-64	1-5/8" EIA	4	7/16 F	1671 (65.8)	103 (4.1)	41.8 (1.6)	18.4	17.2	16.4	6.5 (14)	1
RFM-66	1-5/8" EIA	6	7/16 F	1666 (65.6)	104 (4.1)	41.8 (1.6)	18.8	17.9	17	6.8 (15)	1
RFM-68	1-5/8" EIA	8	7/16 F	1738 (68.4)	166 (6.5)	41.8 (1.6)	18.8	17.9	17	9 (20)	1

FM COAXIAL SPLITTERS

STANDARD TYPES

TYPE	INPUT CONNECTOR	OUTPUT CONNECTORS		DIMENSIONS mm (in)			POWER RATING (kW)			WEIGHT	FIGURE
		Nr.	TYPE	A	B	C (Ø)	87.5 MHz	98 MHz	108 MHz	Kg (lb)	
RFM-12	1-5/8" EIA	2	7/8" EIA	1761 (69.3)	206 (8.1)	41.8 (1.6)	16.4	15.4	14.6	7.1 (16)	2
RFM-13	1-5/8" EIA	3	7/8" EIA	1761 (69.3)	206 (8.1)	41.8 (1.6)	18.8	17.9	17	8.5 (19)	2
RFM-14	1-5/8" EIA	4	7/8" EIA	1761 (69.3)	206 (8.1)	41.8 (1.6)	18.8	17.9	17	9 (20)	2
RFM-15	1-5/8" EIA	5	7/8" EIA	1761 (69.3)	206 (8.1)	41.8 (1.6)	18.8	17.9	17	9.1 (20)	2
RFM-16	1-5/8" EIA	6	7/8" EIA	1761 (69.3)	206 (8.1)	41.8 (1.6)	18.8	17.9	17	9.6 (21)	2
RFM-18	1-5/8" EIA	8	7/8" EIA	1761 (69.3)	206 (8.1)	41.8 (1.6)	18.8	17.9	17	11 (24)	2
RFM-144	3-1/8" EIA	4	7/8" EIA	1686 (66.4)	248 (9.8)	79.4 (3.1)	33	31	29	14 (31)	2
RFM-146	3-1/8" EIA	6	7/8" EIA	1686 (66.4)	248 (9.8)	79.4 (3.1)	49	46	44	20 (44)	2
RFM-148	3-1/8" EIA	8	7/8" EIA	1686 (66.4)	248 (9.8)	79.4 (3.1)	56	53	50	22 (49)	2
RFM-22	3-1/8" EIA	2	1-5/8" EIA	1777 (70)	219 (8.6)	79.4 (3.1)	37	36	34	16 (35)	2
RFM-23	3-1/8" EIA	3	1-5/8" EIA	1777 (70)	309 (12.2)	79.4 (3.1)	56	53	50	20 (44)	2
RFM-24	3-1/8" EIA	4	1-5/8" EIA	1777 (70)	309 (12.2)	79.4 (3.1)	56	53	50	21 (46)	2
RFM-25	3-1/8" EIA	5	1-5/8" EIA	1777 (70)	280 (11)	79.4 (3.1)	56	53	50	25 (55)	2
RFM-26	3-1/8" EIA	6	1-5/8" EIA	1777 (70)	280 (11)	79.4 (3.1)	56	53	50	27 (60)	2
RFM-294	4-1/2" EIA	4	1-5/8" EIA	1777 (70)	349 (13.7)	106 (4.2)	75	71	68	28 (62)	2
RFM-295	4-1/2" EIA	5	1-5/8" EIA	1777 (70)	349 (13.7)	106 (4.2)	84	80	75	29 (64)	2
RFM-296	4-1/2" EIA	6	1-5/8" EIA	1777 (70)	349 (13.7)	106 (4.2)	84	80	75	38 (84)	2
RFM-202	4-1/2" EIA	2	3-1/8" EIA M	1764 (69.4)	330 (13)	106 (4.2)	84	80	75	28 (62)	3
RFM-204	4-1/2" EIA	4	3-1/8" EIA	1785 (70.3)	428 (16.9)	106 (4.2)	84	80	75	46.5 (103)	2
RFM-232	6-1/8" EIA	2	4-1/2" EIA M	1790 (70.5)	400 (15.7)	156 (6.1)	168	160	150	35 (77)	3

figure "1"

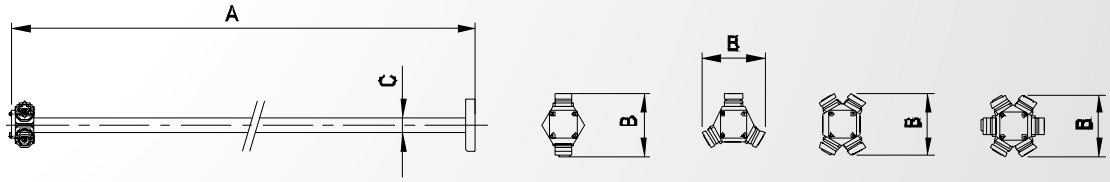


figure "2"

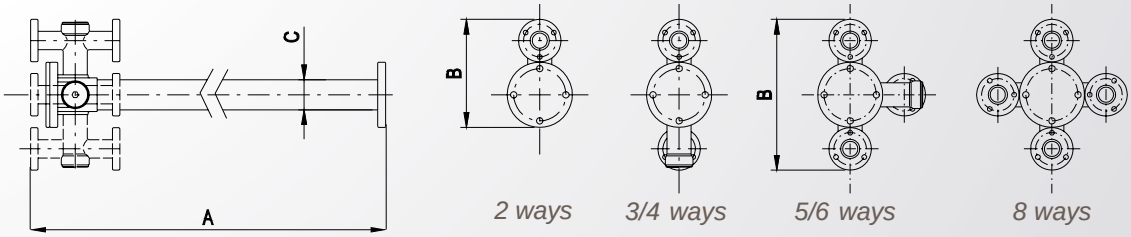
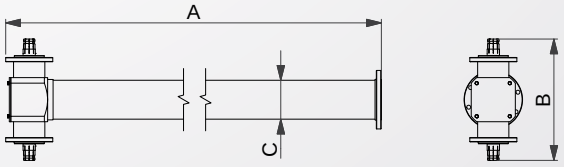
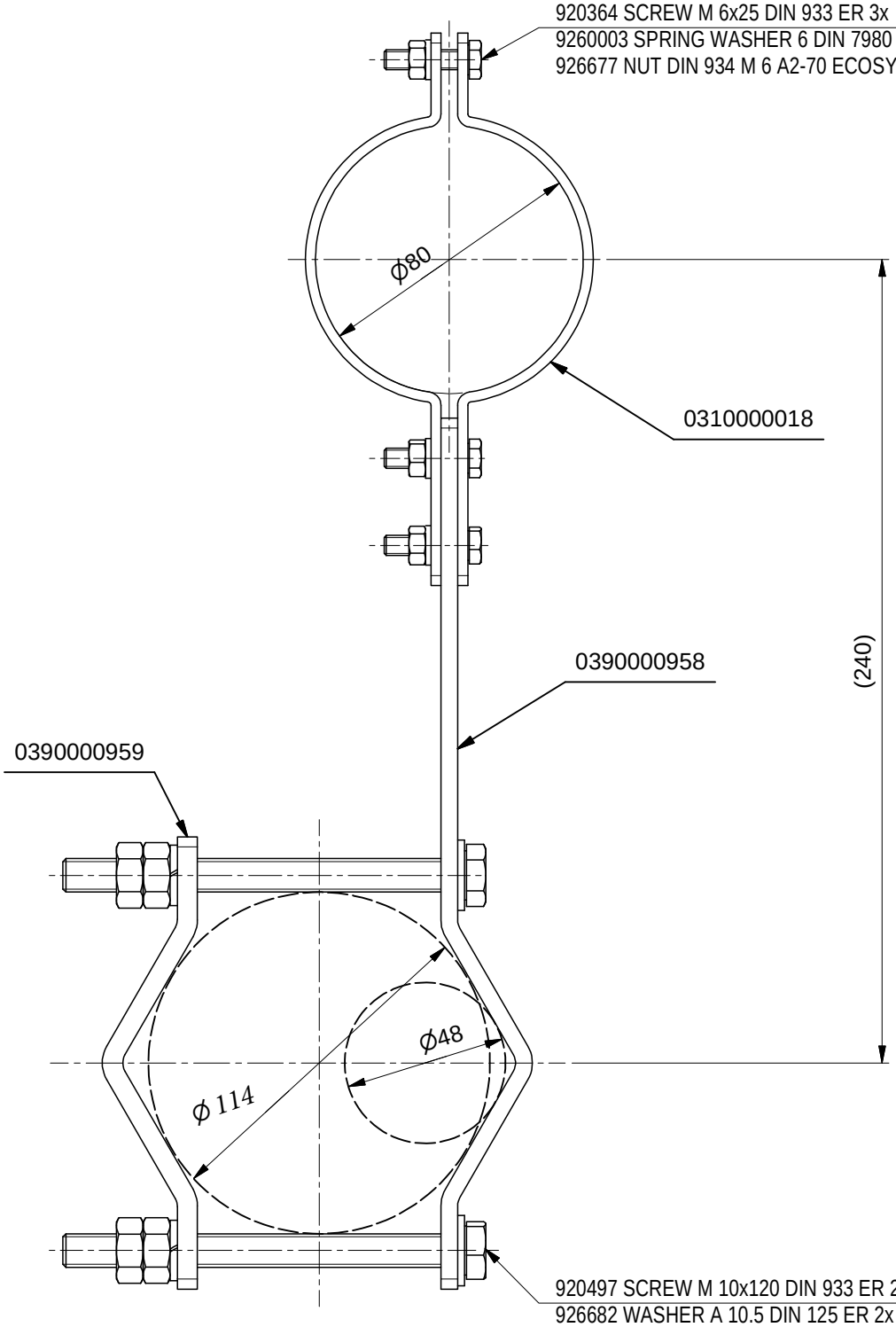


figure "3"



THE PARTICULAR MUST BE FREE OF BURRS AND SHARP EDGES,CLEAN FROM RESIDUAL CHIPPINGS AND LUBRICANTS PROCESSING,PACKAGED AND IDENTIFIED.

THE PARTICULAR MUST BE PROVIDED DISASSEMBLED



9330000959 TYPE PACKING
930209 TUBULAR FILM

COPPIE DI SERRAGGIO SECONDO SPECIFICA 93513444
TIGHTENING TORQUES AS FOR SPECIFICATION 93513444

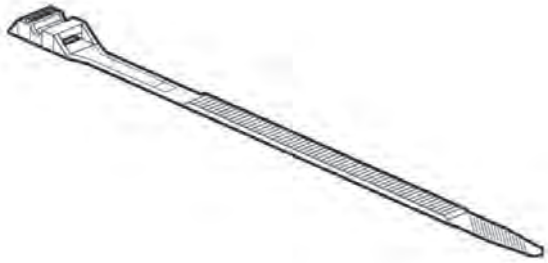
ED	DATE	CHANGE NOTE	APPROVAL	ORIGINATOR
A	19/12/2018	E18N002	SAINI M.	FERRARI M.

SIRA Member of the Kathrein Group

STAFFA A PALO PER RIP. 3-1/8"
BRACKET POLE SPLITTER 3-1/8"

HISTORICAL CODE 209250110

NET WEIGHT (Kg)	SCALE	SHEET	CODE
1.25 kg	1 : 2	1 / 1	1690002107



■ Performance

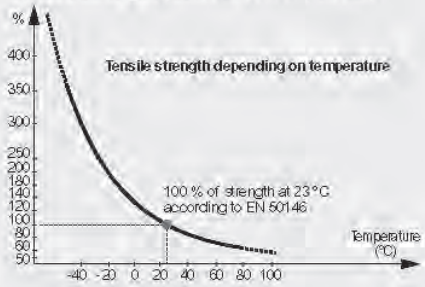
Conform to EN 62275 type 1 (NFC 68-146)
"cable ties for electrical installations"
Test conditions :
- Temperature : 23 °C
- Relative humidity of air : 50 %
- Traction speed : 25.4 mm/min

■ Technical data

Constant high quality

Type tests
- Raw material test
- Product test on the production line and in the laboratory
- Packaging test

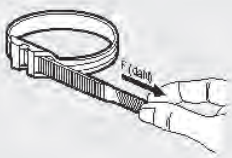
Tensile strength (according to EN 50146)



Quality of tensile strength

Cat. Nos.	Diagram (A) - Max. ratchet force (daN)	Diagram (B) - Tensile strength: Test dia. (mm) According to EN 50146	Diagram (B) - Tensile strength: Min. strength (daN)
0319 13	4	20	36
0319 16	5	26	53
0319 19	5	26	53
0319 20	5.5	74	53
0319 21	5.5	74	53
0319 22	4	20	22
0319 25	4	20	22

(A)



(B)

Fire resistance

- Flame retardant
- Conform to UL 94 requirements, HB classification
- Glow-wire flammability resistance according to IEC 60695-2-11 : 650 °C
- Oxygen index (LOI) according to EN ISO 4589-1/ASTM D 2863-00 : 20 %
- Low fire hazard polyamide

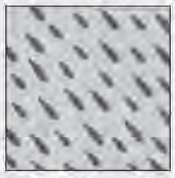
UV protected according to norm IEC 62275 type 1

UV protected black cable ties for outdoor use
These black cable ties have successfully undergone UV resistance and climatic ageing tests representing actual conditions of use
These cycles combine a 1000 hours radiance under arc or xenon lamp according to ISO 4892-2 method 1

Resistance to external agents

- Good resistance to oils, greases, petroleum products, saline mist and diluted acids

Resistance to rain



- Humidity absorption: ≤ 0.7%

Resistance to low temperatures

- Assembly –30°C
- Fitted –40°C

Resistance to sun

Maximum temperatures :
- 85°C continuous
- 100°C @ 1000 hrs
- UV resistant

Colson approvals

Oxygen index : EN ISO 4589-1 and ASTM D 2863-00, 20 %
Corrosiveness of fumes : NFC 20-453, < 5 %
Flame retardancy : UL 94 HB

Type	Colson black
UV protection	yes
Polyamide material	12
Teeth	external
Halogen free(1)	yes
Humidity absorbtion(2)	<0.7 %
Operating temperature	
- 20,000 hrs	85 °C
- 1,000 hrs	100 °C
Resistance to low temperatures	
- fitted	-40 °C
- assembly	-30 °C
Flame retardancy	UL 94 HB
Oxygen index (LOI) (EN ISO 4589-1/ASTM D 2863-00)	20 %
Self-extinguishing(3)	650 °C

(1) Conform to Class I ASTM D 4066
(2) Conform to ISO 62 (EH 0-23°C
(3) Conform to IEC 60695-2-11

■ Colson traceability

Each Colson cable tie can be identified, underlining Legrand's commitment to the consumer, so that you can always be sure you are using a genuine Colson

ED	DATE	CHANGE NOTE	APPROVAL	ORIGINATOR
A	11/12/2017	E17I012	SAINI M.	CRIPPA B.

SIRA Member of the Kathrein Group

FASCETTA COLSON 74-140
HOSE CLAMP

HISTORICAL CODE 505701024

NET WEIGHT (Kg)	SCALE	SHEET	CODE
0,009		1/1	995852

TECHNICAL
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Materials used in the antenna system

BROADCAST

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SIRA
RADIO SYSTEMS

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LIST OF MATERIALS

TYPE	NAME	COMPOSITION
Rubber	Silicone	
Plastic Material	Polyethylene	
Copper Alloy	Brass OT 58	PCuZn40Pb2 UNI 5705
Copper Alloy	Brass OT 63	PCuZn37 UNI 4892
Copper Alloy	Brass castings	Zn 12/16 - Si 3/5 - Pb 0,5 - Cu the rest
Steel	Stainless Steel AISI 304	C 0,07 - Si 1,0 - Mn 2,0 - Cr 17,0/19,0 - Ni 8,0/11,0
Steel	Stainless Steel for Screws	
Plastic Material	Mylar	
Aluminium Alloy	Anticorodal 63	Si 0,4 - Mg 07 - Cu 0,1 - Fe 0,35 - MnZnTiCr 0,4 - Al the rest
Aluminium Alloy	11/S	Si 0,4 - Fe 0,7 - Cu 5,2/5,8 - Zn0,3 - Pb0,4/0,6 - Bi0,4/0,6 - Al the rest
Aluminium Alloy	Peraluman 350	Mg 3,5 - Mn 0,3 - Fe 0,4 - Si 0,3 - ZnTi0,2 - Al the rest
Aluminium Alloy	Aluminium castings	Si 1,8/2,3 - Mg 0,55/0,75 - Mn0,6/0,8
Aluminium Alloy	Aluminium castings	G. AlSi9MnMg UNI 3051
Aluminium Alloy	Aluminium castings	GD-AlSi12Cu2Fe UNI5076-74
Plastic Material	Teflon	
Copper Alloy	Beryllium Copper	Cu33Be25
Copper Alloy	Beryllium Copper	25BeCu
Plastic Material	POM	
Plastic Material	PVC	
Plastic Material	POX	
Plastic Material	REXOLITE 1422	
Material equipment	Resistor	
Cardboard		
Packing Material	Polyurethane foam	
Brass		CuZn 16Si2Pb1
Steel	S355JR	
Steel	S235JR	
Steel	INVAR	Ni 36 - C 0,03 - Si 0,2 - Mn 0,3 - Fe the rest
Soft solder		
Flux Welding for soft solder		
Brazing Alloy	Silver Alloy DIN EN 1044: AG104	Ag 45 - Cu 27 - Zn - 25,5 - Sn 2,5 (Al 0,001/Bi 0,030/P0,008/Cd0,010/Pb0,025/Si0,05)

Brazing Alloy	Silver Alloy DIN EN 1044: AG206	Ag 20 - Cu 44 - Zn 36 (Al 0,001/Bi 0,030/P0,008/Cd0,010/Pb0,025/Si0,05)
Brazing Alloy	Silver Alloy DIN EN 1044: AG102	Ag 56 - Cu 22 - Zn 17 - Sn 5 (Al 0,001/Bi 0,030/P0,008/Cd0,010/Pb0,025/Si0,05)
Flux Welding for brazing alloy	H paste	Idrossifluoroborato Potassium 67/73% - Water 27/33 %
Rubber	Adhesive tape CELLOFLEX 301	Polymer EPDM
Galvanic treatment	Pickling and Chemical polishing	1) EKOMET 5 (activator for deoxidation): aqueous active mixture of nonionic surfactants with 90% biodegradable, organic inhibitors, polyglycols and complexing 2) DEOXIL 2007 (passivating): aqueous mixture of diammonium phosphate, phosphoric acid, surfactant biodegradability of 90% organic inhibitors, polyglycols and complexing 3) TAUTON 72 (protective aqueous): aqueous mixture of nonionic surfactants by biodegradation of 90% organic inhibitors and deactivators.
Galvanic treatment	Silver	
Galvanic treatment	Chemical Nickel	
Galvanic treatment	Passivation SurTec	
Galvanic treatment	Hot dip galvanizing.	
Galvanic treatment	Gold	
Galvanic treatment	Galvanization	
Galvanic treatment	Electrolytic nickel	
Plastic material	Noryl	
Plastic material	SMC (fiberglass)	

TYPE	NAME	COMPOSITION	PERCENTAGE
Steel	Stainless Steel AISI 304	Carbon (C)	0,07
		Silicon (Si)	1
		Manganese (Mn)	2
		Chrome (Cr)	17
		Nickel (Ni)	10
		Iron (Fe)	69,93
Steel	X8CrNiS 18-9 DIN EN10088	Iron (Fe)	68,54
		Chrome (Cr)	18
		Nickel (Ni)	9
		Manganese (Mn)	2
		Silicon (Si)	1
		Copper (Cu)	1
		Sulfur (S)	0,25
		Nitrogen (N)	0,11
		Carbon (C)	0,1
Copper Alloy	Brass OT 58 UNI 5705-05	Copper (Cu)	58,00
		Zinc (Zn)	39,48
		Lead (Pb)	2,05
		Iron (Fe)	0,15
		Nickel (Ni)	0,15
		Tin (Sn)	0,15
		Aluminium (Al)	0,02
Copper Alloy	Brass OT 63 UNI 4892	Copper (Cu)	62,85
		Zinc (Zn)	37
		Nickel (Ni)	0,15
Copper Alloy	Brass CuZn39Pb3	Copper (Cu) Zinc (Zn) Lead (Pb) Iron (Fe) Nickel (Ni) Tin (Sn)	57,55 39 3 0,15 0,15 0,15
Copper Alloy	Bronze	Copper (Cu)	85
		Lead (Pb)	5
		Zinc (Zn)	5
		Tin (Sn)	5
Copper Alloy	Boillat B05 "NL"	Copper (Cu) Zinc (Zn) Silicon (Si) Lead (Pb)	81 16 2 1
Copper	Copper	Copper (Cu)	100
Aluminium Alloy	Anticorodal 6060	Aluminium (Al)	98,37
		Magnesium (Mg)	0,48
		Silicon (Si)	0,45
		Iron (Fe)	0,2
		Zinc (Zn)	0,15
		Copper (Cu)	0,1
		Manganese (Mn)	0,1
		Titanium (Ti)	0,1
		Chrome (Cr)	0,05
Aluminium Alloy	11/S	Aluminium (Al)	92,1
		Copper (Cu)	5,5
		Iron (Fe)	0,7
		Silicon (Si)	0,4

		Lead (Pb)	0,5
		Bismuth (Bi)	0,5
		Zinc (Zn)	0,3
Aluminium Alloy	Peraluman 300 UNI 5754	Aluminium (Al)	95
		Silicon (Si)	0,4
		Iron (Fe)	0,4
		Copper (Cu)	0,1
		Manganese (Mn)	0,5
		Magnesium (Mg)	3,1
		Chrome (Cr)	0,3
		Zinc (Zn)	0,2
Steel	S235JR	Iron (Fe)	97,846
		Carbon (C)	0,2
		Manganese (Mn)	1,4
		Phosphorus (P)	0,045
		Sulfur (S)	0,045
		Nitrogen (N)	0,014
		Copper (Cu)	0,45
Brazing Alloy	Silver Alloy DIN EN 1044: AG104	Silver (Ag)	45
		Copper (Cu)	27
		Zinc (Zn)	25,5
		Tin (Sn)	2,5
Brazing Alloy	Silver Alloy DIN EN 1044: AG206	Silver (Ag)	20
		Copper (Cu)	44
		Zinc (Zn)	36
Brazing Alloy	Silver Alloy DIN EN 1044: AG102	Silver (Ag)	56
		Copper (Cu)	22
		Zinc (Zn)	17
		Tin (Sn)	5
Copper Alloy	Beryllium Copper	Copper (Cu)	97,2
		Beryllium (Be)	2
		Cobalt (Co)	0,3
		Nickel (Ni)	0,3
		Iron (Fe)	0,2
Plastic Material	Polyethylene	Polyethylene (PE)	100
Plastic Material	Teflon (P.T.F.E.)	Polytetrafluoroethylene (PTFE)	100
Plastic Material	Acetal Copolymer	Polyoxymethylene (POM)	100
Plastic Material	PVC	Polyvinylchloride (PVC)	100
Plastic Material	Mylar	Polyethylene Terephthalate (PET)	100
Plastic Material	Nylon	Polyamide (PA)	100
Plastic Material	REXOLITE 1422	Polystyrene (PS)	100
Plastic Material	Silicone	Silicon (Si)	100
Polymer	E-GLASS FIBERS UNSATURED POLYESTER	Polymer (UPE XL1)	100

TECHNICAL
DOCUMENTATION

Photos and Test Setup of the Antenna System

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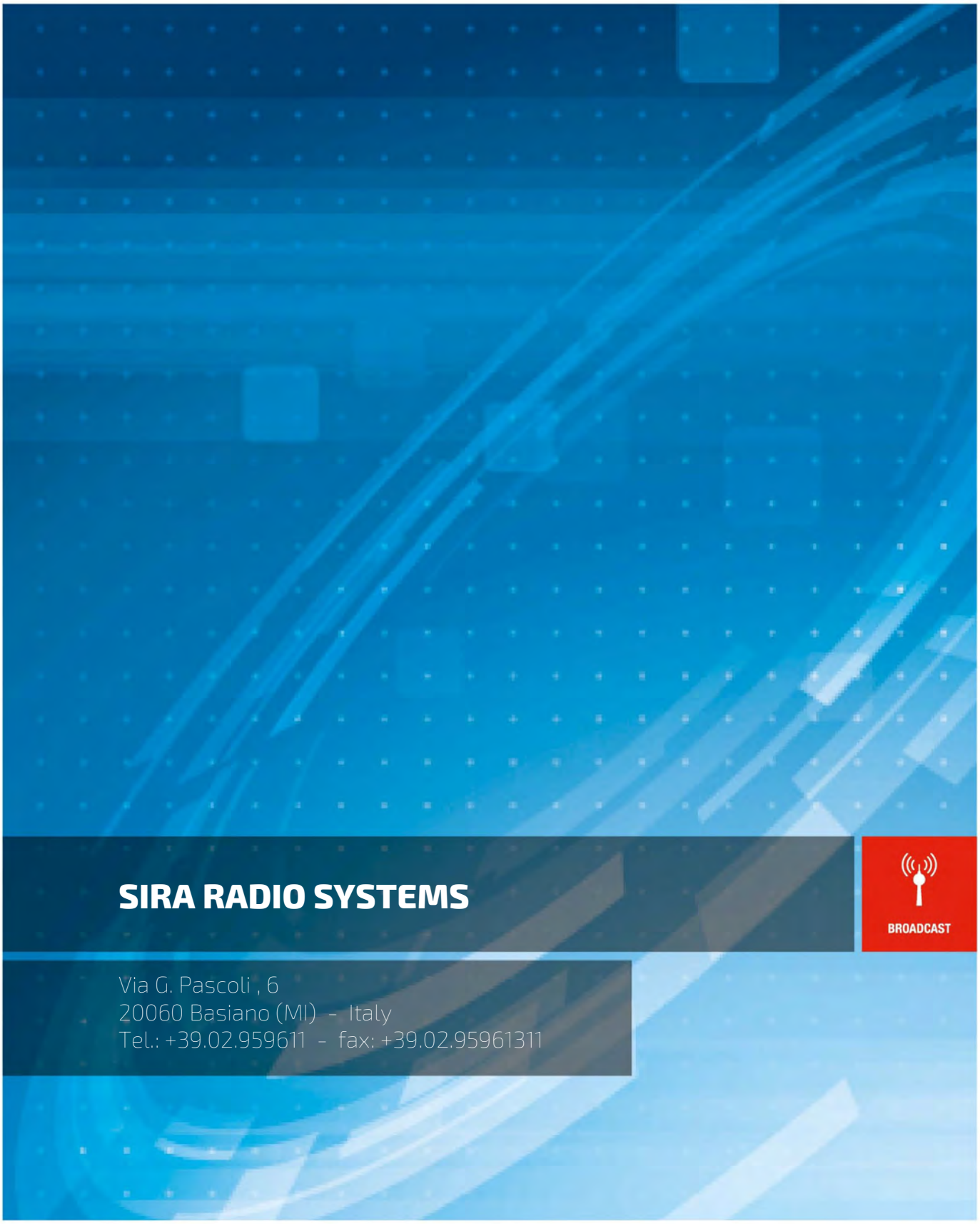
Antenna installation

Antenna installation

Phases and Amplitude - VSWR test of Antenna Systems

Pressurization test of Antenna Systems



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