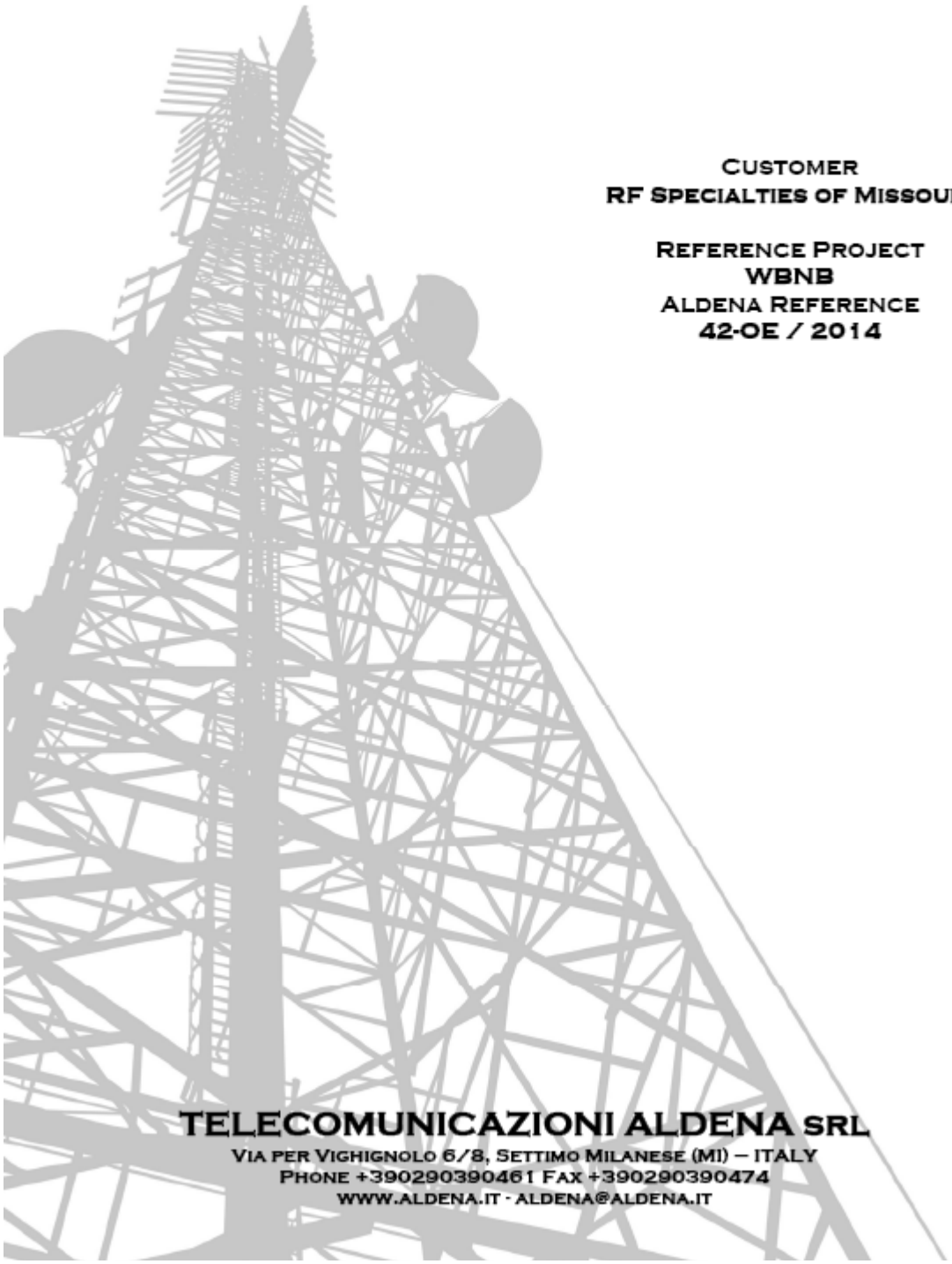
FM ANTENNA

The Reliable Antennas



CUSTOMER
RF SPECIALTIES OF MISSOURI

REFERENCE PROJECT
WBNB
ALDENA REFERENCE
42-OE / 2014

TELECOMUNICAZIONI ALDENA SRL
VIA PER VIGHIGNOLO 6/8, SETTIMO MILANESE (MI) – ITALY
PHONE +390290390461 FAX +390290390474
WWW.ALDENA.IT - ALDENA@ALDENA.IT

Document:	**Report of Test**
Customer	**RF Specialties of Missouri**
End User:	**The Power Foundation**
Frequency (Ch.)	**91.3 MHz, CH 217C2**
Call sign	**WBNB(FM)**
City:	**Equality, Alabama**

The objective of this test was to demonstrate the directional characteristics of an antenna composed by four ALP0802712S log periodic antennas mounted on a metallic triangular mast to be installed at the WBNB(FM) facility as authorized by the FCC in construction permit BPED-20140310AED.

This test characterizes only the radiation characteristics of the antenna when mounted on the tower/structure as described. It does not represent or imply any guarantee of specific coverage which can be influenced by factors beyond the scope of this test.

REFERENCE DATA:

FCC Construction Permit BPED-20140310AED.
FCC CP Horizontal Plane azimuth pattern.

RESULTS:

The following Figures are the results of the measurements from our pattern range:

Figure 1A - Measured Composite Azimuth Pattern
Figure 1B - Tabulation of the Horizontal Polarization for the Measured Azimuth Pattern
Figure 1C - Tabulation of the Vertical Polarization for the Measured Azimuth Pattern
Figure 1D - Tabulation of the Measured Composite Azimuth Pattern
Figure 1E - Antenna Vertical Pattern
Figure 1F - Tabulation of Antenna Vertical Pattern
Figure 1G - Tabulation of FCC CP pattern
Figure 1H - WBNB FCC CP and composite antenna patterns

METHOD OF DIRECTIONALIZATION:

Three bay of the Aldena ALP0802712S were mounted on a triangular metallic tower.
See Figure 2 for mechanical detail of mounting structure and Figure 2a for power splitting distribution.

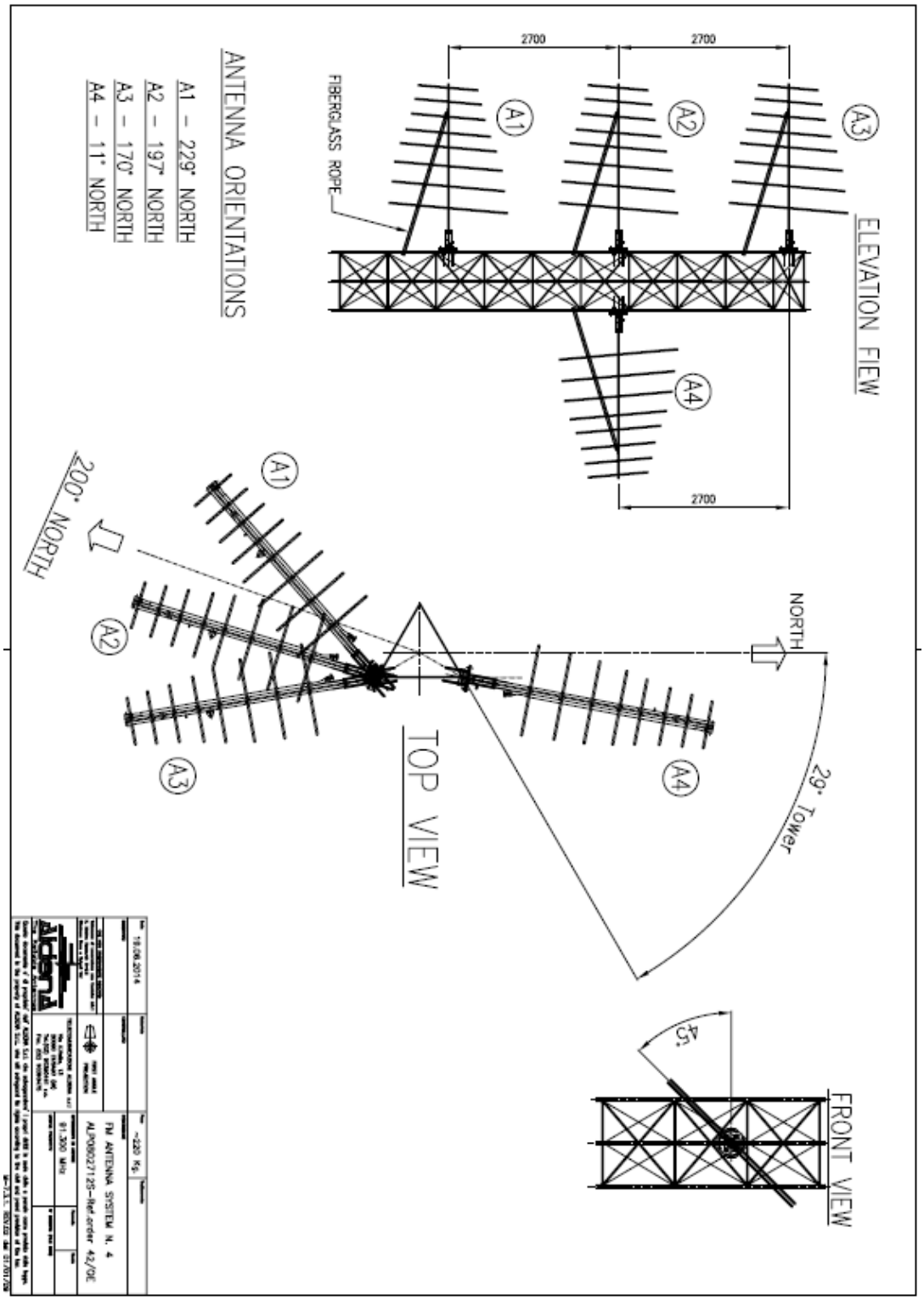


Figure.2 – Antenna support tower

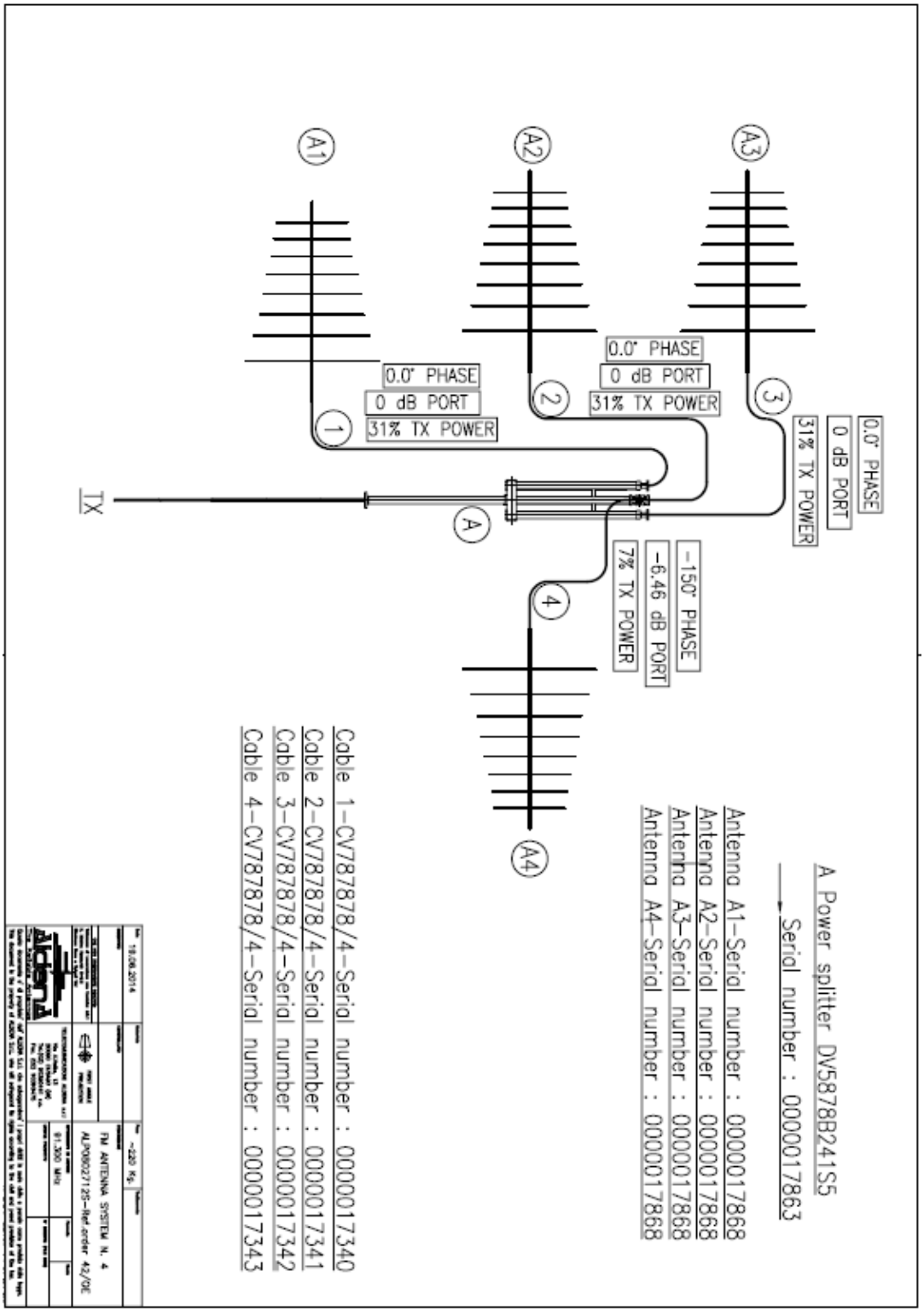


Figure.2a – Antenna power distribution

METHOD OF MEASUREMENT:
A three levels of the Aldena ALP0802712S were set up on the Aldena full scale antenna pattern measuring range.

SUPERVISION:
Mr. Angelo Brustia graduated from Politecnico di Milano University in 1991 with the degree of laurea in Electronic Engineering - Transmission system specialist. He has been directly involved with design and development of RF equipment (radio-links), broadcast antennas and filter systems since 1992. His experience includes eight years as an RF Engineer for Siemens TLC Spa, four years in Telsa as Antenna Branch Technical Director, and ten years in Telecomunicazioni Aldena as Technical Director.

EQUIPMENT:
The pattern range consists of a metallic rotating structure equipped with position indicator and a platform (9 m height from ground level) on which are placed the antenna support and the antenna under test.

The transmitting antenna is placed 101 meters away from the rotating structure and it can be moved along a rail from ground level until 15m height. The transmitting antenna is mounted on a moving structure to changing its position quickly. Several antennas are available on the test range covering frequencies from 80 MHz to 900 MHz in both linear polarization and from 87 MHz to 108 MHz in circular polarization.

The complete measurement system is controlled by a computer running proprietary software. The transmitted signal is fed by a ½" foam cable to minimize attenuation. The receiving antenna is fed by a RG-214 double shielded coax cable to achieve the best flexibility during antenna rotation.

The control building is equipped with:
Rhode & Schwarz Model ZNC3 Network Analyzer
PC Based Controller
Laser Printer
Wide band 17 dB 1w RF amplifiers
20W VHF amplifier for 87-108 MHz band
All testing is carried out in strict accordance with approved procedures under our ISO9001:2008 quality program.

TEST PROCEDURES:

Antenna under test (A.U.T.) is mounted at ground level on a custom tower structure (Fig.3 & 4).

Figure 3 – Antenna bracket

Figure 4 – A.U.T.

The system is then elevated at 9 m height by means of a metallic arm placed on the rotating platform (Fig.5)

Fig.5 - A.U.T. on measure tower

The transmitting antenna is elevated from ground to the specified height to measure the antenna pattern at the same height as the A.U.T. (equatorial pattern measurement) or at different heights (tilt pattern measurement) – Fig.6

Fig.6- Transmitting antenna

Depending on A.U.T. polarity the transmitting antenna will have linear polarization or selectable polarization (linear H, linear V, or circular)

Before the pattern/gain measurements are taken the system is “calibrated” by connecting the transmitting and receiving sides to compensate phase and amplitude of the cable feeding both antennas. In this way we can perform the measurement of the A.U.T. antennas without errors due to additional feeding cable attenuation and phase.

Respectfully submitted by:

Angelo Brustia
Director of Engineering

July 4th, 2014

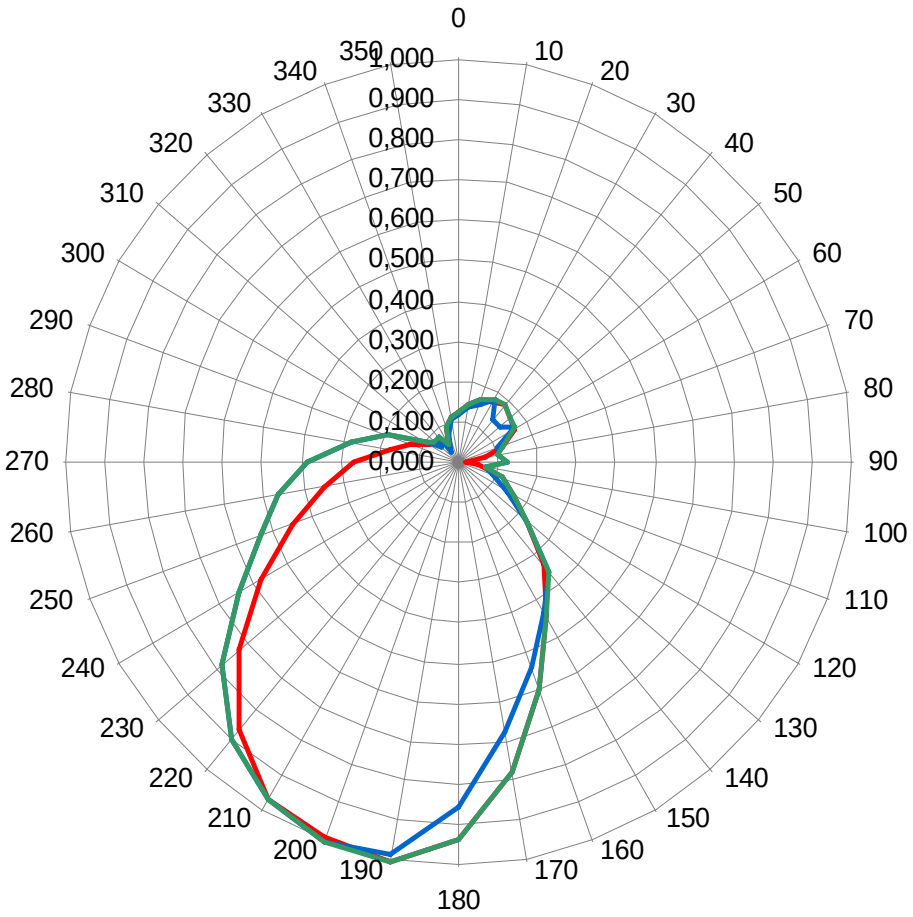


Figure 1A - Measured Composite Azimuth Pattern – Green
Measured Azimuth Horizontal Component Pattern- Red
Measured Azimuth Vertical Component Pattern- Blue

Azimut	Relative Field	Azimut	Relative Field	Azimut	Relative Field	Azimut	Relative Field
0	0,122	90	0,017	180	0,930	270	0,264
10	0,145	100	0,050	190	1,000	280	0,172
20	0,170	110	0,116	200	0,990	290	0,128
30	0,176	120	0,167	210	0,962	300	0,084
40	0,187	130	0,229	220	0,862	310	0,081
50	0,171	140	0,331	230	0,720	320	0,052
60	0,162	150	0,439	240	0,577	330	0,050
70	0,114	160	0,600	250	0,446	340	0,093
80	0,069	170	0,780	260	0,347	350	0,108

Figure 1B - Tabulation of the Horizontal Polarization for the Measured Azimuth Pattern

Azimut	Relative Field	Azimut	Relative Field	Azimut	Relative Field	Azimut	Relative Field
0	0,117	90	0,121	180	0,850	270	0,380
10	0,136	100	0,066	190	0,980	280	0,280
20	0,157	110	0,090	200	1,000	290	0,190
30	0,181	120	0,143	210	0,961	300	0,094
40	0,135	130	0,228	220	0,897	310	0,058
50	0,134	140	0,350	230	0,776	320	0,078
60	0,166	150	0,423	240	0,641	330	0,028
70	0,108	160	0,538	250	0,531	340	0,075
80	0,100	170	0,680	260	0,460	350	0,106

Figure 1C - Tabulation of the Vertical Polarization for the Measured Azimuth Pattern

Azimut	Relative Field	Azimut	Relative Field	Azimut	Relative Field	Azimut	Relative Field
0	0,122	90	0,121	180	0,930	270	0,380
10	0,145	100	0,066	190	1,000	280	0,280
20	0,170	110	0,116	200	1,000	290	0,190
30	0,181	120	0,167	210	0,962	300	0,094
40	0,187	130	0,229	220	0,897	310	0,081
50	0,171	140	0,350	230	0,776	320	0,078
60	0,166	150	0,439	240	0,641	330	0,050
70	0,114	160	0,600	250	0,531	340	0,093
80	0,100	170	0,780	260	0,460	350	0,108

Figure 1D - Tabulation of the Measured Composite Azimuth Pattern

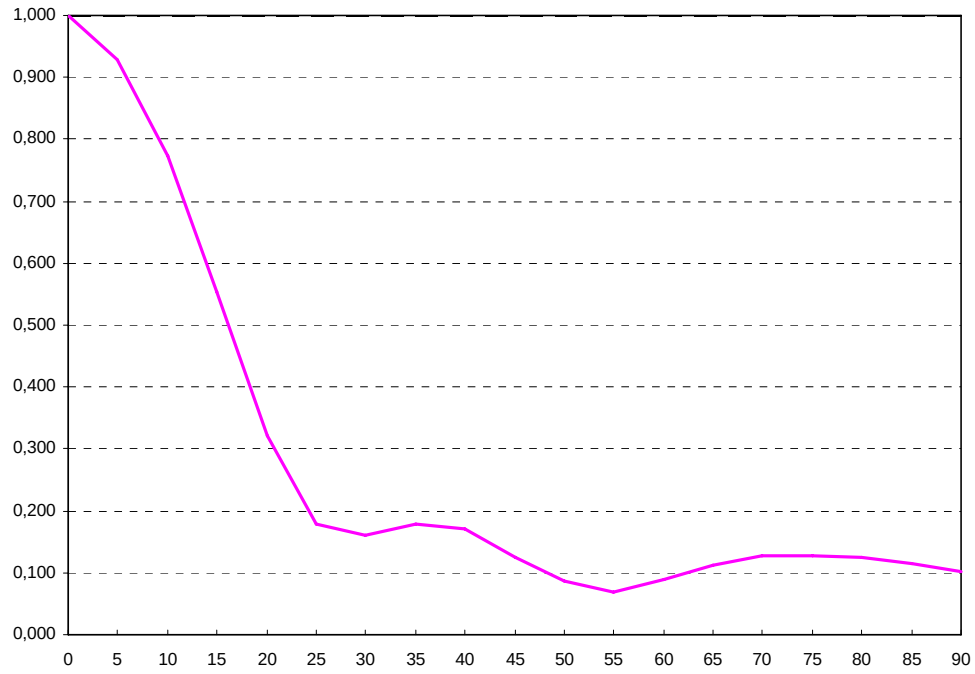


Figure 1E - Antenna Vertical Pattern

Elevation	Relative Field
0	1,000
5	0,928
10	0,772
15	0,554
20	0,321
25	0,179
30	0,160
35	0,179
40	0,170
45	0,126

Azimut	Relative Field
50	0,087
55	0,068
60	0,089
65	0,113
70	0,128
75	0,127
80	0,125
85	0,115
90	0,102

Figure 1F - Tabulation of Antenna Vertical Pattern

Azimut	Relative Field
0	0,199
10	0,201
20	0,193
30	0,189
40	0,188
50	0,187
60	0,196
70	0,199
80	0,192

Azimut	Relative Field
90	0,201
100	0,227
110	0,274
120	0,336
130	0,423
140	0,532
150	0,640
160	0,804
170	1,000

Azimut	Relative Field
180	1,000
190	1,000
200	1,000
210	1,000
220	1,000
230	0,875
240	0,757
250	0,622
260	0,501

Azimut	Relative Field
270	0,400
280	0,323
290	0,266
300	0,217
310	0,198
320	0,179
330	0,200
340	0,199
350	0,201

Figure 1G - Tabulation of Composite FCC patterns

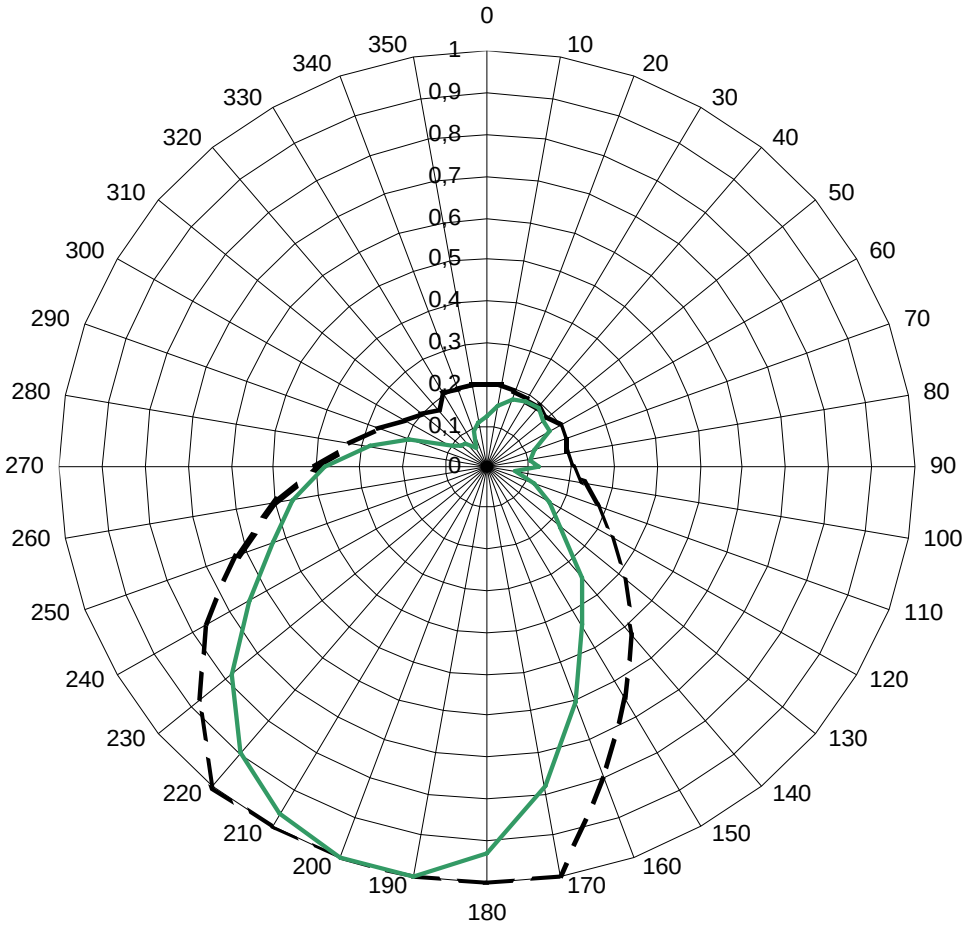


Figure 1H - WBNB FCC CP and composite antenna patterns

Results from measurements

Test conditions

Antennas are connected by means of a unbalanced splitting network and are mounted on a metallic triangular mast as in Fig. 2

Polarization:	45° slant polarization	
Frequency:	91.3 MHz	
Horizontal plane		
Horizontal component RMS value:	0.454	
Vertical component RMS value:	0.458	
Horizontal pattern gain:	4.858	(6.86 dB)
Vertical pattern gain:	4.773	(6.79 dB)
Horizontal plane composite diagram		
Composite RMS:	0.472	
Elevation diagram		
Elevation RMS:	0.404	
Elevation pattern gain :	1.529	
Antenna horizontal system gain		
H.pol Horiz. pattern gain x Elevation pattern gain:	7.43	(8.71dB)
V.pol Horiz. pattern gain x Elevation pattern gain:	7.3	(8.63 dB)
Percentage of authorized FCC pattern	86.61%	

ERP divided by horizontal power gain equals antenna input power (H)

26 kW ERP divided by 7.43 equals 3.5 kW.