ANNEX A

ANTENNA TEST RESULTS ON

Martec PLB

Kannad XS3-GPS

35407-2

1 - ADMINISTRATION

1. WORK ORDER : Reference ITS : E7555

1. TEST TEAM : Benoît

1. SCHEDULE : 9 & 10 November 2006

2 - PURPOSE

The radiation tests of the dedicated radio beacon are performed in INTESPACE EMC Laboratory in compliance with the test methods described in the COSPAS-SARSAT 406 MHz distress beacon type approval standard : C/S T 007- Issue 4 Revision 1 October 2006.
Two antenna test configurations are cheked :
1) The Beacon on the C/S T.007 Ground Plane Fig B2
2) The Beacon on RAM, Test Configuration Fig B.5, for all Devices that Might be required to Operate Without a Ground Plane

3 - RADIO BEACON IDENTIFICATIONS

Manufacturer :	MARTEC
Model N° :	Kannad XS3-GPS (Opale project)
PN / SN :	35407-2
Antenna :	Martec Integrated Whip Antenna

4 - TEST SITE DESCRIPTION

Tests are performed in an anechoic chamber (size 16 m x 10 m x 11 m)
Walls, ceilling and doors are lined with EMERSON CUMING foams VHP 36 and VHP 26 type.
The Beacon is placed as shown on figure N° 1, B2, B5, B6 and N° 3.

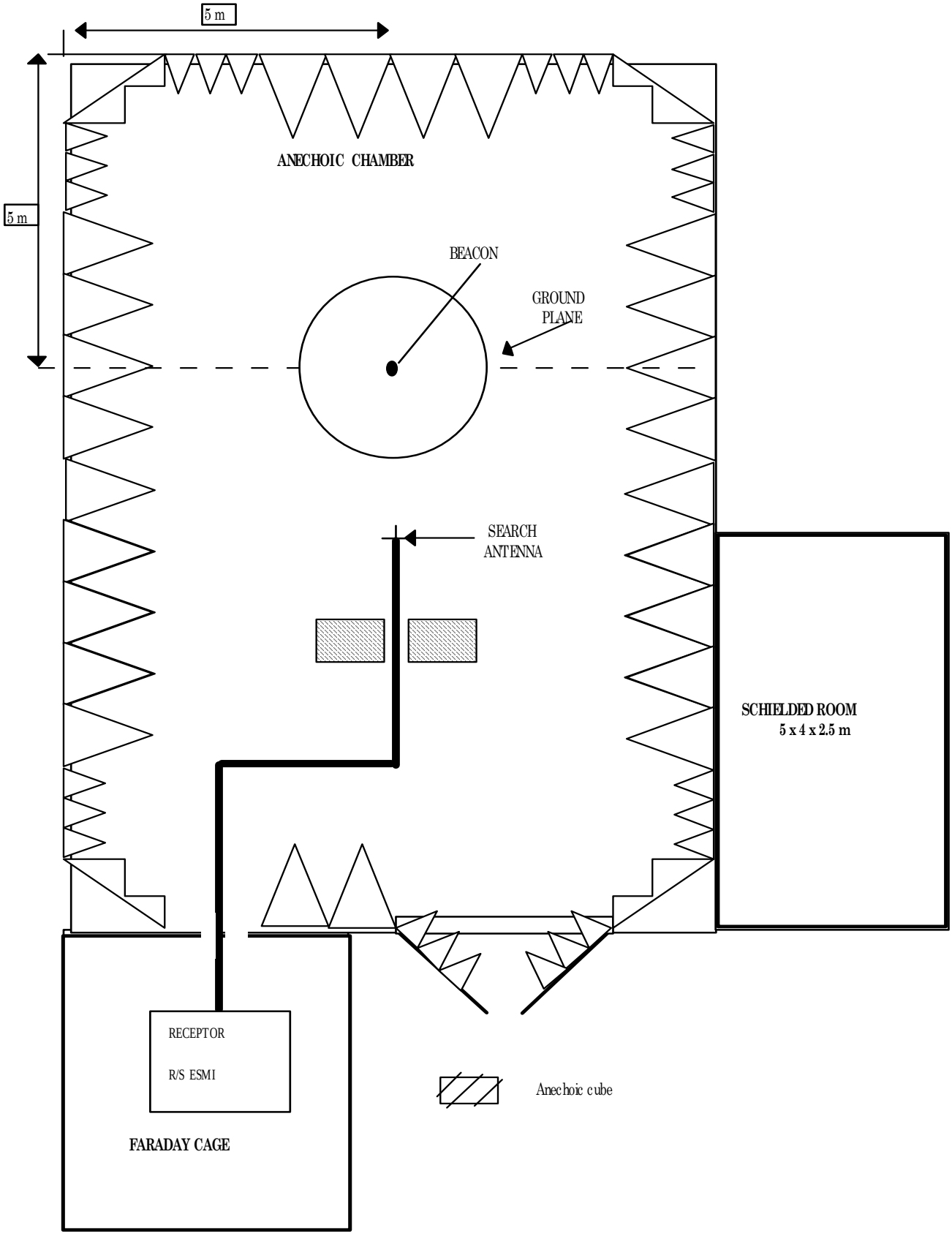
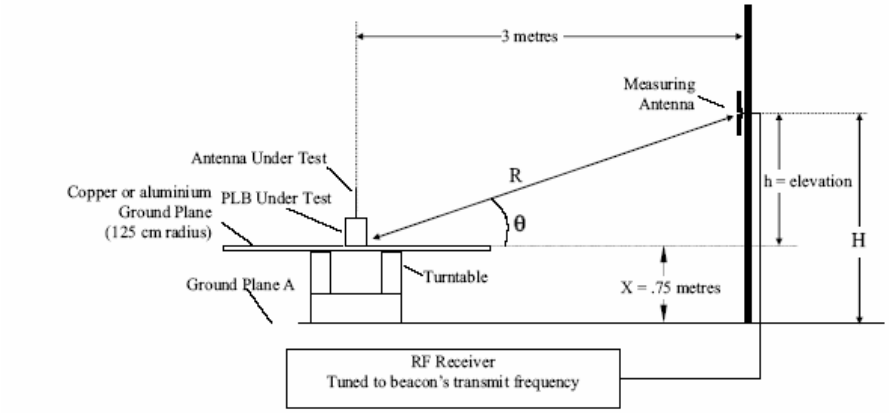

5 m
5 m
ANECHOIC CHAMBER
BEACON
GROUND
PLANE
SEARCH
ANTENNA
SCHIELDED ROOM
5 x 4 x 2.5 m
RECEPTOR
R/S ESMI
FARADAY CAGE
Anechoic cube

FIGURE 1

Figure B.2: Test Configuration for "PLB-like" Devices (e.g. PLB, survival ELT, automatic portable ELT)



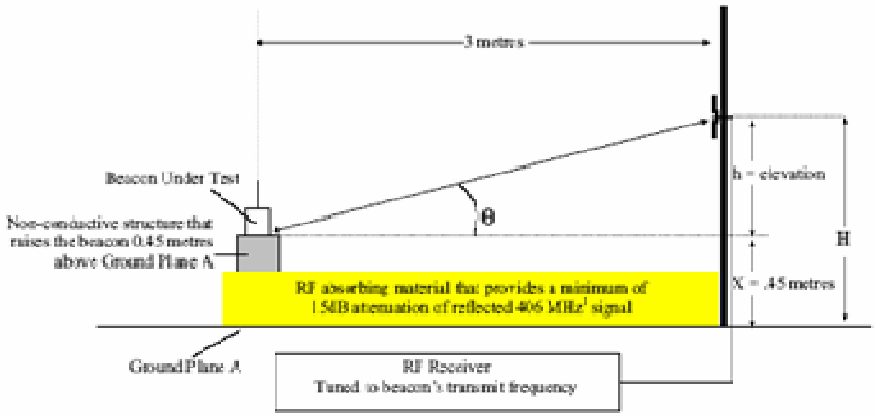
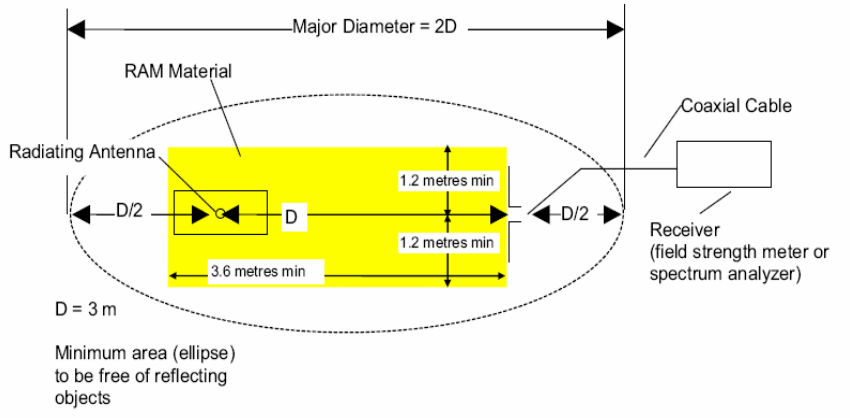


Figure B.5: Additional Test Configuration for all Devices that Might be Required to Operate Without a Ground Plane

Figure B.6: Test Site Plan View with RAM Material



5 - TEST METHOD

The test method describes here after, according to "C/S T 007 - Issue 4 -Revision 1 - October 2006"
test sequences is executed for 406 MHz frequency .
The Beacon or the Beacon Antenna placed on center of the electrical ground plane (as show Fig B & Fig 3) the following measurements are performed :

1/ Determination of E field strength in term of dBµV/m at 3 m far from the Beacon Antenna for all direction (0° to 360° by step of 30°) and for all search antenna elevation (10° to 50° by step of 10°).
Lenght of search antenna is adjusted to proper l/2 λ conditions .
For alls positions the induced voltage is measured with search antenna in vertical and horizontal direction .

2/ Beacon antenna polarization is determined .

3/ An EIRP (Equivalent Isotropically Radiated Power) from the Beacon Antenna is calculated

4/ EIRP is corrected with EOL (end of life factor)

5/ Actual EIRP are compared to specified EIRP to be in the range :
- 1.6 W to 20 W (+ 32 dBm to + 43 dBm) in conf B.3
- 1 W to 20 W (+ 30 dBm to + 43 dBm) in conf B.5

6 - TESTS EQUIPMENTS

6.1. SEARCH ANTENNA

- Linear antenna (dipole)
  Manufacturer : EMCO 3121C-DB4
  P/N / S/N : 9904-1436
  Antenna Factor : 20,9 dB
  Calibration validity : Feb 2007

6.2. SPECTRUM ANALYSER

• Manufacturer	HP 8566	
Reference :	RF : 85660B	FI : 85662A
Serial number :	2449A01077	2403A08359
Calibration validity :	nov-06	

6.3. CABLES

- 2x10 m cable SUCOFLEX type N
  Cable loss at 406 MHz is : 3,5 dB

7 - TESTS OPERATIONS

7.1. EMISSION FIELD STRENGTH FROM BEACON

Beacon electric field strength is obtained from measurement of the output voltage (dBµV RMS) at antenna port (typical set up are shown figure N° 3 for 406 MHz) and computed with following parameters :

- Antenna factor of search antenna AF in dB
- Directivity factor of the vertical search antenna Dm in dB
  (Theoritical directivity shown paragraph B-5-4 of C/S T007) as :

$$Dm = 20 \log [\cos (90 \times \sin q) / \cos q]$$

- Cable loss L = 3,5 dB at 406 MHz
- DF : distance factor in dB - To calculate field at a constant distance (3 m) from Beacon due to the elevation of the search antenna.
- Power correction factor : end of life correction factor EOL is calculated from the difference between RF power measured during test and end of life power after 24/48 hours operation. This factor is applied to correct EIRP as shown on final test result table
- The measurements are performed on the carrier signal, just before to apply the modulation.
- The effective field strength at 3 m from Beacon is computed from :
  Linear Antenna (Dipole) : EdBµV/m = UdBµV + AF - Dm + L + DF
  RHCP Antenna (Spiral Cone) : EdBµV/m = UdBµV + AF + L + DF (the search antenna point to the BUT antenna)

7.2. POWER CORRECTION FACTORS

EOL factor

TEST FREQUENCY	RF Power measured at Ambient Temp. Test	RF Power measured at the end of Operating Lifetime Test	Loss Factor EIRPLOSS
406 MHz BEACON	36,1 dBm	36,0 dBm	0,1 dB

8 - RADIATED POWER CALCULATIONS

8.1. EFFECTIVE ISOTROPICALLY RADIATED POWER OF BEACON

EIRP of Beacon is directly calculated from equation :

$$EIRP = E^2 \times D^2 / 30$$

EIRP = W
E = V/m
D = m

Results shown in table N° C1 are given in dBm where :

$$EIRP\ dBm = 10 \log (EIRP\ W) + 30$$

and apparent antenna gain :

$$GidB = EIRPdBm - RF\ PowerdBm$$

9 - SUCCESS CRITERIA

- For B.2 test configuration : 90% of Beacon measurements must be equal or greater than 1,6 W EIRP (32 dBm) . and less than 20 W EIRP (43 dBm)
- For B.2 test configuration : 80% of Beacon measurements must be equal or greater than 1W EIRP (30 dBm) . and less than 20 W EIRP (43 dBm)

10 - BEACON ANTENNA POLARIZATION

Beacon antenna polarization is checked according to C/S T007 procedure paragraph B9 . The Beacon antenna polarization is declared linear when 80 % of induced voltage measurement Vv and Vh differ by at least 10 dB.
If more than 20 % of the induced voltage measurement (Vv, Vh) are within 10 dB of each other the Antenna Polarization is considered Circular .

Antenna model	**C/S T.007 Test Conf.**	**Min difference (Vv - Vh)** (See C1b Tables)		**C/S T.007 Antenna Polarization**
		min	% < 10dB	
Integrated Whip Antenna	B2	0,6 dB	27%	Like circular

11 - BEACON MECHANICAL SET UP

Beacon 0°axis is identified with 0° azimuth direction of turn table .
Antenna is the center of rotation of azimuth angle.

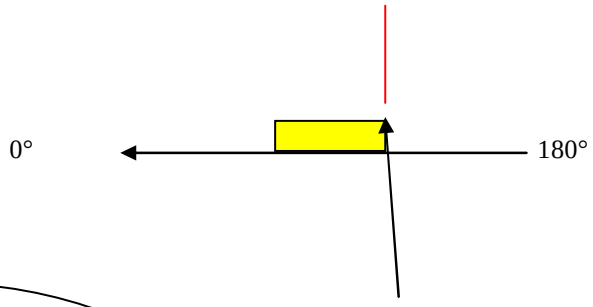
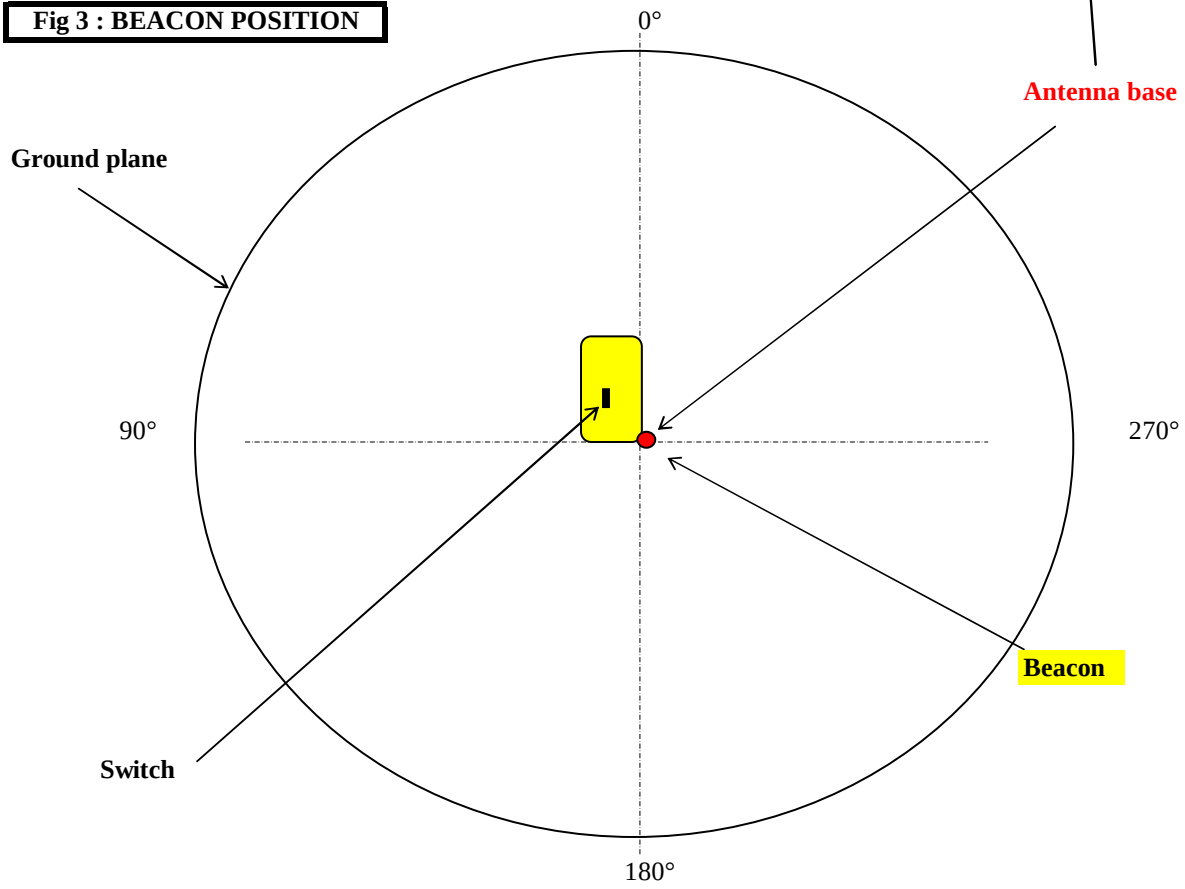


Fig 3 : BEACON POSITION



NOT TO SCALE

12 - RESULTS

Test frequency	C/S T.007 Polarization	Reference EIRP (W)	Measurement EIRP
406 MHz BEACON	Like circular	1.6 < EIRP Ref< 20	According tables F-B.

CONCLUSIONS

According to the laboratory measurement uncertainties (+/- 2,3 dB) and C/S T.007 measurement tolerance the Beacon Antenna can be declared in EIRP Ref tolerance

406 MHz BEACON ANTENNA TEST RESULTS - B2 Test Configuration

Beacon Model : Kannad XS3-GPS
Antenna Model : Integrated Whip Antenna
Test Configuration : For "PLB-like" Devices (Figure B2)

Table F-B.1/1 : Equivalent Isotropically Radiated Power (dBm) / Antenna Gain (dBi)

Azimuth Angle (degrees)	Elevation Angle(degrees)									
	10		20		30		40		50	
	dBm	dBi	dBm	dBi	dBm	dBi	dBm	dBi	dBm	dBi
0	38,85	2,75	41,35	5,25	39,19	3,09	31,98	-4,12	~~29,36~~	~~-6,74~~
30	38,76	2,66	41,25	5,15	39,18	3,08	32,71	-3,39	30,64	-5,46
60	38,54	2,44	41,24	5,14	39,22	3,12	33,09	-3,01	31,93	-4,17
90	38,51	2,41	41,10	5,00	39,24	3,14	33,07	-3,03	32,46	-3,64
120	38,60	2,50	41,10	5,00	39,10	3,00	33,00	-3,10	32,85	-3,25
150	38,72	2,62	41,10	5,00	38,90	2,80	32,37	-3,73	32,48	-3,62
180	38,82	2,72	41,10	5,00	39,06	2,96	32,13	-3,97	31,71	-4,39
210	38,93	2,83	41,11	5,01	38,98	2,88	31,07	-5,03	~~30,21~~	~~-5,89~~
240	39,02	2,92	41,10	5,00	38,95	2,85	30,61	-5,49	~~27,95~~	~~-8,15~~
270	39,02	2,92	41,30	5,20	39,04	2,94	30,46	-5,64	~~25,72~~	~~-10,38~~
300	38,92	2,82	41,20	5,10	39,05	2,95	30,88	-5,22	~~24,79~~	~~-11,31~~
330	39,02	2,92	41,34	5,24	38,84	2,74	31,58	-4,52	~~26,91~~	~~-9,19~~
Overall Gain Variation (dB)	0,51		0,25		0,40		2,62		7,68	

$ERP_{max\ EOL}$ = **MAX [**ERP_{max}, (ERP_{max} - ERP_{LOSS}**]** = **MAX (** 41,24 41,14 **)** = 41,24 dBm

$ERP_{min\ EOL}$ = **MIN [**ERP_{min}, (ERP_{min} - ERP_{LOSS}**]** = **MIN (** 30,46 30,36 **)** = 30,36 dBm

Note : Values with stricken-out text are removed for calculating the EIRP maximum and EIRP minimum

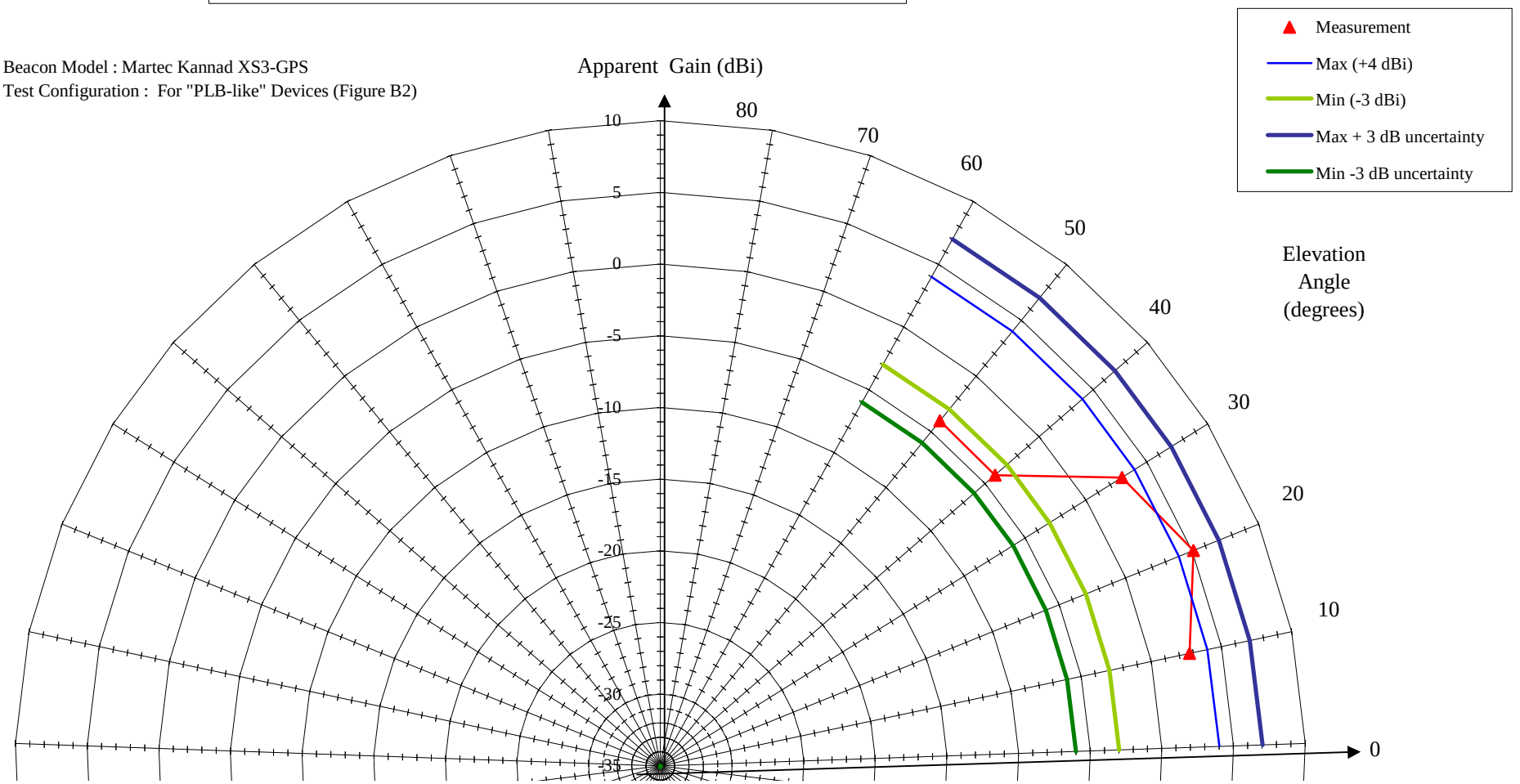
Table F-B.2/1 : INDUCED Voltage Measurements Vv / Vh (dBµV)

Azimuth Angle (Degrees)	**Elevation Angle (Degrees)**									
	10		**20**		**30**		**40**		**50**	
	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh
0	109,49	90,60	111,58	92,90	108,56	95,40	99,66	92,90	93,65	93,00
30	109,39	90,60	111,48	92,70	108,56	95,30	100,46	93,30	95,95	92,70
60	109,19	89,50	111,48	91,80	108,66	93,90	101,16	91,40	98,15	91,00
90	109,19	84,40	111,38	85,40	108,76	90,00	101,46	85,90	99,15	87,70
120	109,29	79,60	111,38	83,70	108,66	84,00	101,46	81,70	99,65	86,10
150	109,39	85,50	111,38	83,80	108,46	85,30	100,66	87,90	99,05	89,10
180	109,49	86,70	111,38	85,50	108,56	91,10	99,86	92,80	97,95	90,70
210	109,59	87,50	111,38	87,70	108,46	91,90	98,56	92,80	96,25	90,10
240	109,69	87,20	111,38	85,30	108,46	90,70	98,36	91,20	94,25	86,60
270	109,69	86,00	111,58	84,40	108,56	90,20	98,66	87,40	92,55	78,20
300	109,59	86,30	111,48	86,30	108,56	90,60	99,16	86,50	90,85	84,60
330	109,69	86,90	111,58	92,50	108,26	93,90	99,56	90,70	91,15	90,60
Min (Vv-Vh)	18,8		17,6		13,2		5,8		0,6	

Antenna Polarization : Like Circular

Antenna diagram versus elevation angle comparison with theoritical limits

Beacon Model : Martec Kannad XS3-GPS
Test Configuration : For "PLB-like" Devices (Figure B2)



406 MHz BEACON ANTENNA TEST RESULTS - B5 Test Configuration

Beacon Model : Kannad XS3-GPS
Antenna Model : Integrated Whip Antenna
Test Configuration For all Devices that Might be Required to Operate Without a Ground Plane

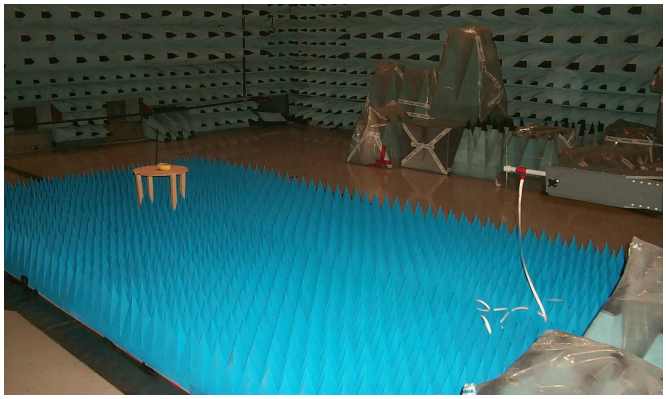


Table F-B.3 : Equivalent Isotropically Radiated Power (dBm) / Antenna Gain (dBi)

Azimuth Angle (degrees)	Elevation Angle(degrees)									
	10		20		30		40		50	
	dBm	dBi	dBm	dBi	dBm	dBi	dBm	dBi	dBm	dBi
0	35,76	-0,34	36,12	0,02	33,38	-2,72	30,82	-5,28	~~26,39~~	~~-9,71~~
90	34,87	-1,23	35,80	-0,30	33,62	-2,48	34,07	-2,03	31,09	-5,01
180	35,21	-0,89	35,63	-0,47	34,16	-1,94	33,22	-2,88	31,30	-4,80
270	35,34	-0,76	35,35	-0,75	32,77	-3,33	30,76	-5,34	~~27,99~~	~~-8,11~~
Overall Gain Variation (dB)	0,89		0,77		1,39		**3,31**		**4,91**	

$ERP_{LOSS} = Pt_{AMB} - Pt_{EOL}$: 0,1 dB

$ERP_{max\ EOL}$ = **MAX [**ERP_{max}, (ERP_{max} - ERP_{LO} **MAX (** 36,12 36,02 **)** = 36,12 dBm

$ERP_{min\ EOL}$ = **MIN [**ERP_{min}, (ERP_{min} - ERP_{LOS} **MIN (** 30,76 30,66 **)** = 30,66 dBm

Note : Values with stricken-out text are removed for calculating the EIRP maximum and EIRP minimum

Antenna diagram versus elevation angle comparison with theoritical limits

Beacon Model : Martec Kannad XS3-GPS
Test Configuration : For all Devices that Might be Required to Operate Without a Ground Plane