

AP750WRe
Antenna PCB-000047-000-D
Radiation Pattern & Gain
Specifications
(Release)

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1 Overview

1.1 Preface

This document describes the radiation pattern and gain specifications for the PCB-000047-000-D, which operates in the following 5 GHz and 6GHz U-NII bands

1. 5 GHz UNII-1 (5150 MHz to 5250 MHz) and UNII2a (5250 MHz to 5350 MHz)
2. 5 GHz UNII-2C band (5470 MHz to 5725 MHz)
3. 5 GHz UNII-3 band (5745 MHz to 5825 MHz)
4. 6 GHz UNII-5 band (5925 MHz to 6425 MHz)
5. 6 GHz UNII-7 band (6525 MHz to 6875 MHz)

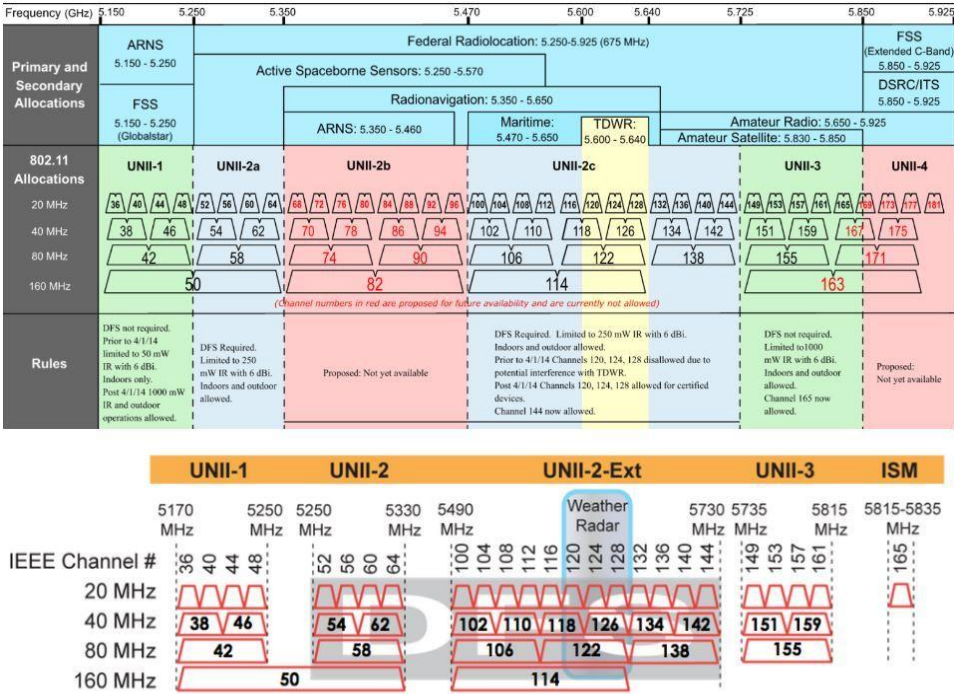
The PCB-000047-000-D, has been certified to be compliant when operated with the Outdoor Wi-Fi 7 Access Point AP750WRe:

Model Number:AP750WRe

HW Version:v1.x

FCCID:2AGMR-AP750WRE

IC:TBD



1.2 Contributors

Name	Role
Van Hoang Nguyen	Director of Engineering

1.3 Revision History

Version	Change Summery	Author	Date
0.1 (Draft)	Document Created	Van Hoang Nguyen	Feb. 13, 2024
1.0 Release	First release	Van Hoang Nguyen	June 12, 2024

1.4 Applicable PCB Part Numbers

Description	PCB Part Numbers
Flexible Omni-directional antenna in 5GHz and 6GHz	Everest Networks PCB-000047-000-D
	Everest Networks PCB-000047-00x-x

1.5 Antenna Measurements

1.5.1 Measurement Methods:

Measurement is performed over the air in a shielded anechoic chamber (NSI-MI compact range 4-110GHz) and the Antenna Under Test (AUT) is operating in radiated mode.

1.5.2 Measurement Equipment

Equipment	Manufacturer	Model & Serial number	Last calibration
Standard Feed Horn 1-18GHz	ETS-Lindgren	#3115 / #6532	n/a
Signal source	NSI-MI	ELE-SRC-DS(1010279) / 006	November 15, 2021
Vector Field Analyser	NSI-MI	ELE-VFA-S01 (100675-S01)/034	November 29, 2021

1.6 Photos of PCB-000047-000-D

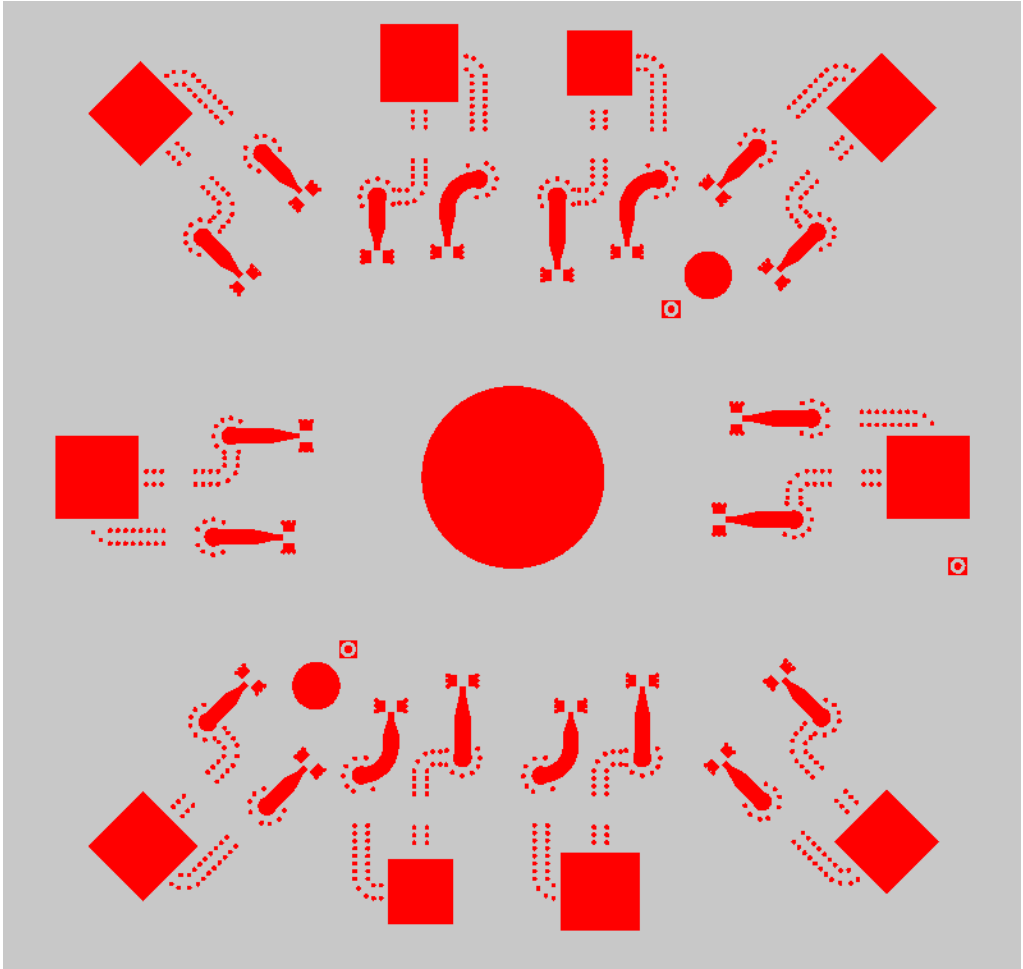


Figure 1 – Drawing of Everest Networks omni-directional antenna PCB-000047-000-D

1.7 AUT Descriptions and Summary

The PCB-000047-000-D has 5 pairs of antennas arranging in opposite side as shown in Figure 1. Each antenna is a dual-fed microstrip patch, that has a vertical polarization and horizontal polarization. Therefore, there are a total of 10 microstrip patch antennas and 20 input ports. The location and assignment of antenna to its operating frequency band is summarized in Table 1.

Table 1 – Location and Assignment of Antenna Frequency band of operation

UNII frequency band	North + South Coverage	East + West Coverage	NorthEast + SouthWest Coverage	NorthWest + SouthEast Coverage
UNII-3				Port 1, 2, 3, 4
UNII-1+2a	Port 5, 6, 7, 8			
UNII-2c		Port 10, 12,		

		14, 16		
UNII-7		Port 9, 11, 13, 15		
UNII-5			Port 17, 18, 19, 20	

Each pair of patches is designed to tune in for specific frequency band and has a similar gain and radiation pattern in its corresponding frequency band of operation. The maximum measured gain is determined to be 5 dBi

Table 2 – Maximum Gain

UNII frequency band	North + South Coverage (Port 5, 6, 7, 8)	East + West Coverage (Port 10, 12, 14, 16 And Port 9, 11, 13, 15)	NorthEast + SouthWest Coverage (Port 17, 18, 19, 20)	NorthWest + SouthEast Coverage (Port 1,2,3,4)
UNII-3				5 dBi
UNII-1+2a	5 dBi			
UNII-2c		5 dBi		
UNII-7		5 dBi		
UNII-5			5dBi	

2 Antenna Pattern and Gain in 5GHz and 6GHz band

Since all antennas are of microstrip patch type and properly sized to operate at its corresponding frequency band, the radiation pattern and performance of individual microstrip patch in vertical and horizontal polarization are very similar. A slight difference is the result of the ground dimension of each microstrip patch. This section presents measured antenna pattern and maximum gain in 5GHz and 6GHz band of exemplary selected microstrip patches.

2.1 5 GHz Frequency Band

2.1.1 Port 10 (Vertical Polarization) Radiation Pattern in Elevation at 5660 MHz

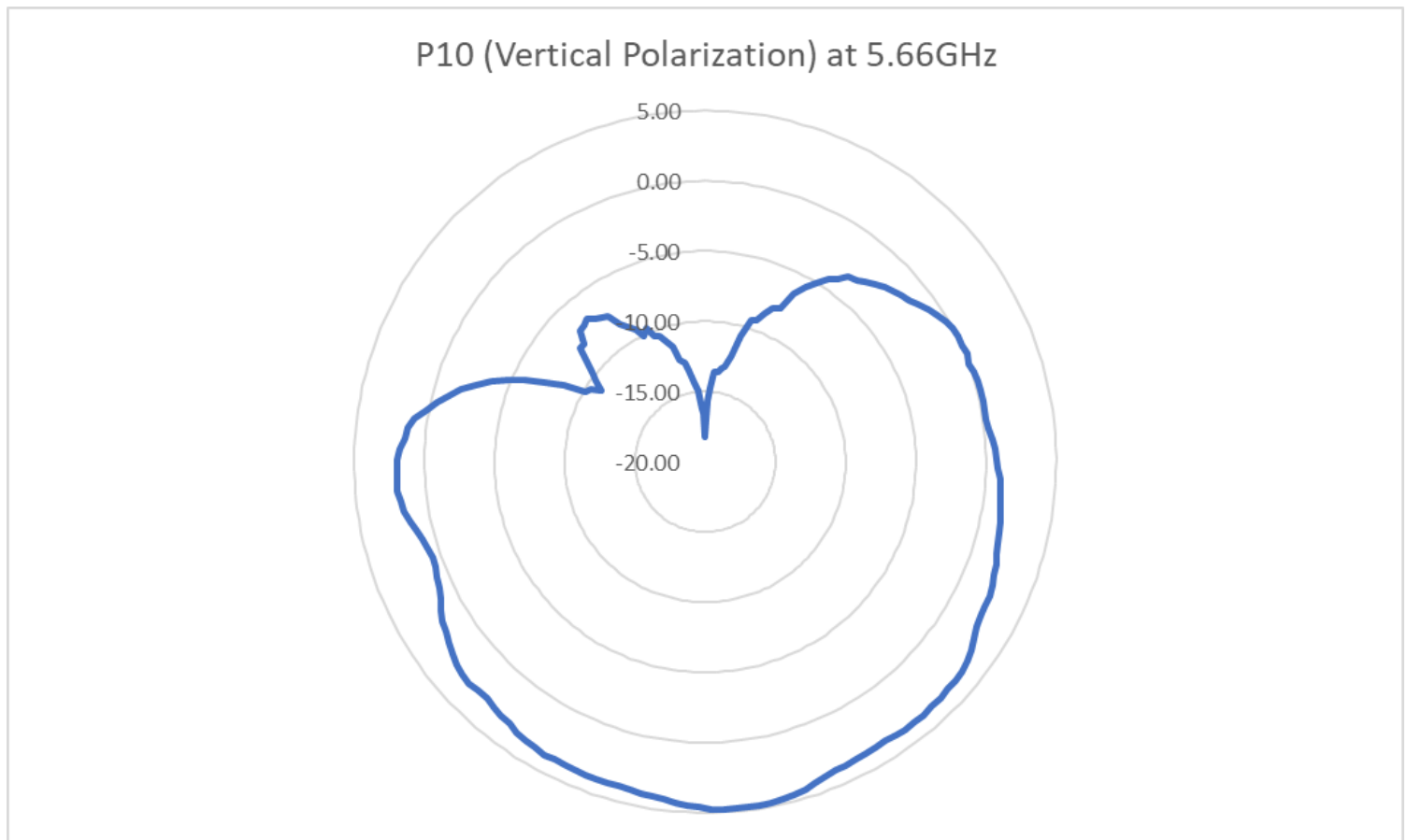


Figure 2 - Port 10, Vertical polarization, Elevation cut at 5660.00 MHz

2.1.2 Port 10 Gain table at 5660 MHz – Vertical Polarization

Angle	Gain	Angle	Gain	Angle	Gain	Angle	Gain
1	-18.26	46	0.78	91	4.74	136	1.93
2	-15.65	47	0.89	92	4.62	137	1.93
3	-14.71	48	1.08	93	4.51	138	1.81
4	-13.54	49	1.13	94	4.35	139	1.46
5	-13.53	50	1.25	95	4.24	140	1.34
6	-13.21	51	1.36	96	4.17	141	0.94
7	-13.10	52	1.42	97	4.09	142	0.23
8	-12.21	53	1.55	98	3.95	143	-0.40
9	-10.70	54	1.65	99	3.91	144	-1.10
10	-9.43	55	1.79	100	3.96	145	-1.89
11	-9.32	56	2.03	101	3.88	146	-2.70
12	-8.63	57	2.09	102	3.91	147	-3.69
13	-8.10	58	2.25	103	3.85	148	-4.83
14	-7.84	59	2.41	104	3.79	149	-5.88
15	-6.52	60	2.43	105	3.80	150	-7.36
16	-5.66	61	2.46	106	3.83	151	-8.62
17	-5.05	62	2.65	107	3.72	152	-10.16
18	-4.31	63	2.91	108	3.59	153	-10.40
19	-3.94	64	3.22	109	3.50	154	-11.07
20	-3.35	65	3.49	110	3.24	155	-10.32
21	-3.15	66	3.66	111	3.21	156	-9.68
22	-2.85	67	3.65	112	3.12	157	-8.89
23	-2.50	68	3.65	113	2.93	158	-7.96
24	-2.15	69	3.77	114	2.98	159	-7.94
25	-1.86	70	3.75	115	3.08	160	-7.07
26	-1.70	71	3.86	116	2.99	161	-7.01
27	-1.47	72	3.82	117	2.86	162	-6.77
28	-1.14	73	3.83	118	2.62	163	-7.10
29	-0.77	74	3.71	119	2.36	164	-7.31
30	-0.46	75	3.63	120	2.13	165	-7.59
31	-0.17	76	3.65	121	1.89	166	-8.48
32	0.08	77	3.71	122	1.57	167	-8.90
33	0.14	78	3.76	123	1.24	168	-9.34
34	0.10	79	3.83	124	0.94	169	-10.01
35	0.14	80	3.87	125	0.86	170	-9.64
36	-0.01	81	4.02	126	0.59	171	-10.37
37	0.14	82	4.20	127	0.60	172	-10.54
38	0.28	83	4.42	128	0.69	173	-10.99
39	0.22	84	4.58	129	0.87	174	-11.52
40	0.25	85	4.63	130	1.14	175	-12.56
41	0.19	86	4.74	131	1.45	176	-12.79
42	0.24	87	4.77	132	1.77	177	-13.46
43	0.35	88	4.80	133	1.90	178	-14.29
44	0.48	89	4.76	134	2.03	179	-14.93
45	0.65	90	4.79	135	1.98	180	-16.24

Table 3 - Port 10 Gain table at 5660 MHz – Horizontal Polarization

2.2 6GHz Frequency Band

2.2.1 Port 18 (Horizontal Polarization) Radiation Pattern in Elevation at 6175 MHz

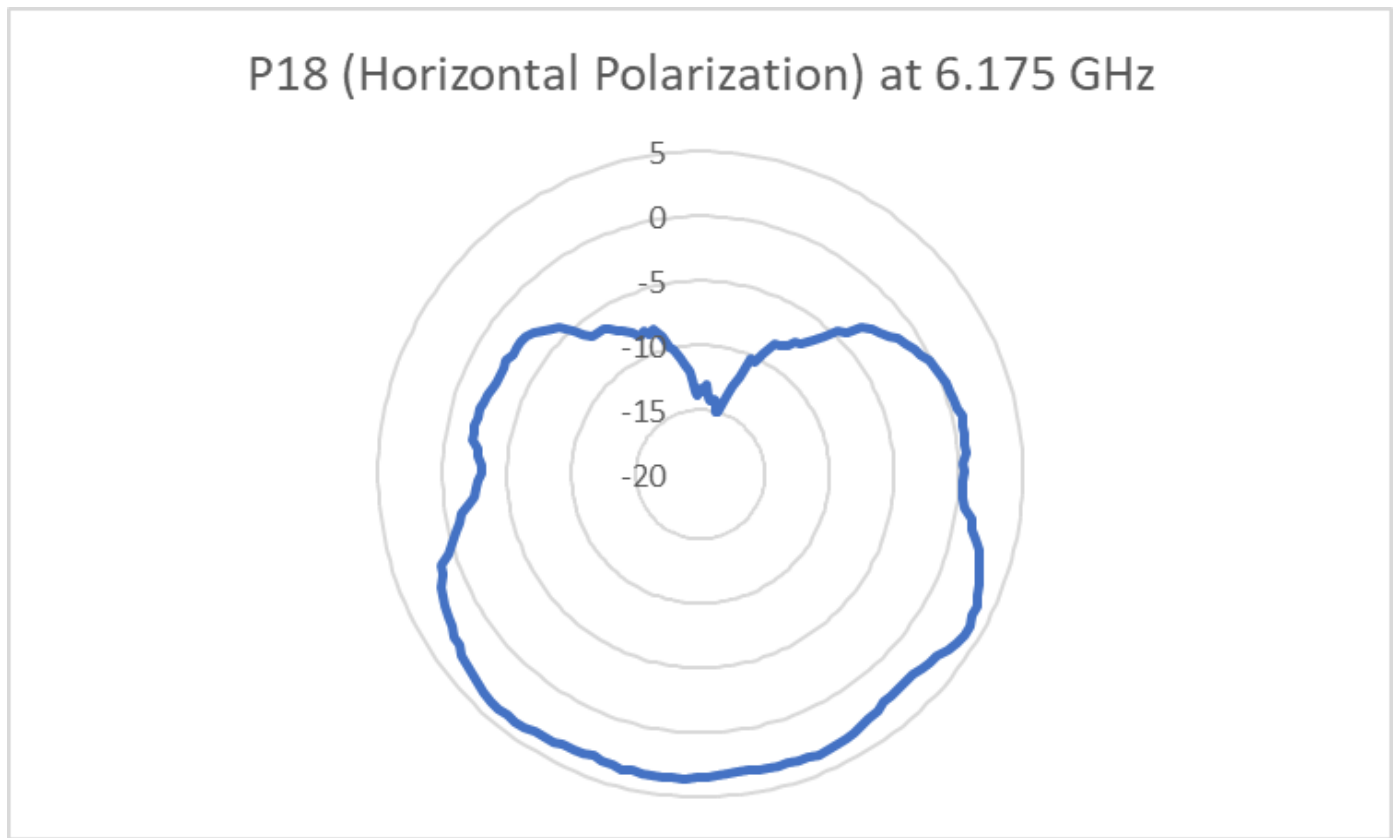


Figure 3 - Port 18, Horizontal polarization, Elevation cut at 6175 MHz

2.2.2 Port 18 Gain table at 6175 MHz – Horizontal Polarization

Angle	Gain	Angle	Gain	Angle	Gain	Angle	Gain
1	-13.30	46	0.46	91	3.52	136	-2.77
2	-13.63	47	0.28	92	3.54	137	-3.04
3	-12.96	48	0.39	93	3.64	138	-2.99
4	-14.00	49	0.37	94	3.62	139	-2.65
5	-14.29	50	0.66	95	3.65	140	-2.59
6	-14.10	51	1.29	96	3.62	141	-2.10
7	-14.26	52	1.54	97	3.65	142	-2.12
8	-15.06	53	1.87	98	3.56	143	-2.11
9	-15.02	54	2.44	99	3.67	144	-2.18
10	-13.56	55	2.72	100	3.53	145	-2.12
11	-12.68	56	2.91	101	3.50	146	-2.25
12	-11.84	57	3.16	102	3.35	147	-2.32
13	-10.25	58	3.38	103	3.52	148	-2.56
14	-10.29	59	3.74	104	3.52	149	-2.67
15	-9.42	60	3.77	105	3.51	150	-2.64
16	-8.38	61	3.97	106	3.71	151	-2.66
17	-8.31	62	4.02	107	3.70	152	-2.51
18	-7.93	63	3.87	108	3.75	153	-2.76
19	-7.40	64	3.52	109	3.89	154	-2.67
20	-7.30	65	3.12	110	3.94	155	-2.74
21	-6.39	66	3.03	111	3.94	156	-2.81
22	-5.59	67	2.79	112	4.01	157	-3.09
23	-4.61	68	2.67	113	3.91	158	-3.49
24	-4.21	69	2.68	114	3.82	159	-3.88
25	-3.06	70	2.64	115	3.63	160	-4.13
26	-2.50	71	2.63	116	3.47	161	-5.19
27	-2.20	72	2.59	117	3.36	162	-5.85
28	-1.85	73	2.88	118	3.25	163	-6.40
29	-1.40	74	2.97	119	2.89	164	-6.41
30	-1.11	75	3.12	120	2.88	165	-6.53
31	-0.80	76	3.30	121	2.60	166	-6.75
32	-0.58	77	3.37	122	2.50	167	-7.24
33	-0.21	78	3.45	123	2.27	168	-7.37
34	-0.11	79	3.52	124	2.14	169	-7.89
35	0.07	80	3.62	125	1.98	170	-8.40
36	0.26	81	3.43	126	1.44	171	-8.10
37	0.34	82	3.42	127	1.28	172	-8.42
38	0.41	83	3.34	128	0.51	173	-8.11
39	0.53	84	3.46	129	0.01	174	-8.94
40	0.80	85	3.29	130	-0.53	175	-9.87
41	0.65	86	3.28	131	-0.99	176	-10.15
42	0.64	87	3.19	132	-1.17	177	-10.89
43	0.55	88	3.18	133	-1.87	178	-11.32
44	0.69	89	3.34	134	-2.31	179	-11.99
45	0.34	90	3.43	135	-2.50	180	-13.53

Table 4 - Port 18 Gain table at 6175 MHz – Horizontal Polarization

2.3 Directional Gain Calculation for Cross-polarized and Space Diversity antennas of PCB-000047-000-D

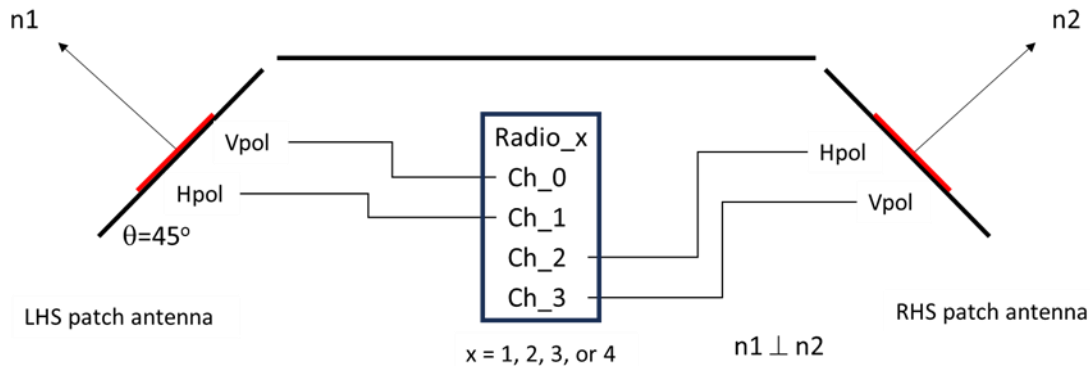


Figure 4 - Illustration directional antenna PCB-000047-000-D in its final assembled form. The antenna segments are conformed a 45-degree angle with the horizontal plane. The four (04) RF radio channels are connected to the vertical and horizontal polarizations of the left and right microstrip patch antennas.

The right-hand side (RHS) and left-hand side (LHS) patch antennas have their normal vectors that are perpendicular. Thus, the radiation patterns of the antennas are orthogonal in space. The four RF chains are uncorrelated, therefore, each of the four EIRP or ERP must be individually below the limit for the following reasons:

1. Ch_0 and Ch_1 connect to Vpol and Hpol inputs of the LHS patch, which is a cross-polarized antenna.
2. Ch_2 and Ch_3 connect to Hpol and Vpol inputs of the RHS patch, which is a cross-polarized antenna.
3. The LHS and RHS patches are orthogonal in space, and
4. Radiation patterns of LHS and RHS antenna patches are non-overlapping, the directional gain $DG = 0$ dB.

3 References

- [1] FCC document KDB 662911 D01 Multiple Transmitter Output v02r01, October 31, 2013
 [2] AP 10.4 Programmer's Guide, March 16, 2016