



SIGNAL ANTENNA SYSTEMS

LFP-170519 Flat Panel Antenna (L-Band) versus Standard Gain Horn

Flat Panel Array (FPA) antenna technology is a novel approach to array antennas developed at Signal Antenna Systems (SAS). In this article an FPA antenna is presented. Both electrical and mechanical characteristics of the L-Band FPA antenna are discussed and compared to a conventional standard gain horn antenna.

The LFP-170519 is a low profile, waveguide radiator antenna operating in the L-Band frequency region from 1.45 GHz to 1.95 GHz. Low profile in combination with excellent efficiency and reasonably wide bandwidth are key features of the FPA antennas. Figure 1 shows a 3D model of the L-Band FPA antenna which has overall dimensions of 21.3"x19.6"x4.0". It is designed with a fiberglass cover bonded to the radiating face to protect the internal waveguide structure from the outside environment. The electrical interface is a N-type connector.

To illustrate antenna characteristics trade-offs, the LFP-170519 L-Band FPA antenna is compared to a commercially available standard gain horn antennas, specifically the L3Harris ATM model #650-441-2 and model # 430-442-2. L-Band FPA antenna design is based on the scaled version of proven X-Band FPA antenna. It is analyzed using CST Microwave Studio. FPA antenna simulated characteristics along with standard gain horn data (from datasheets) are summarized in Table 1.

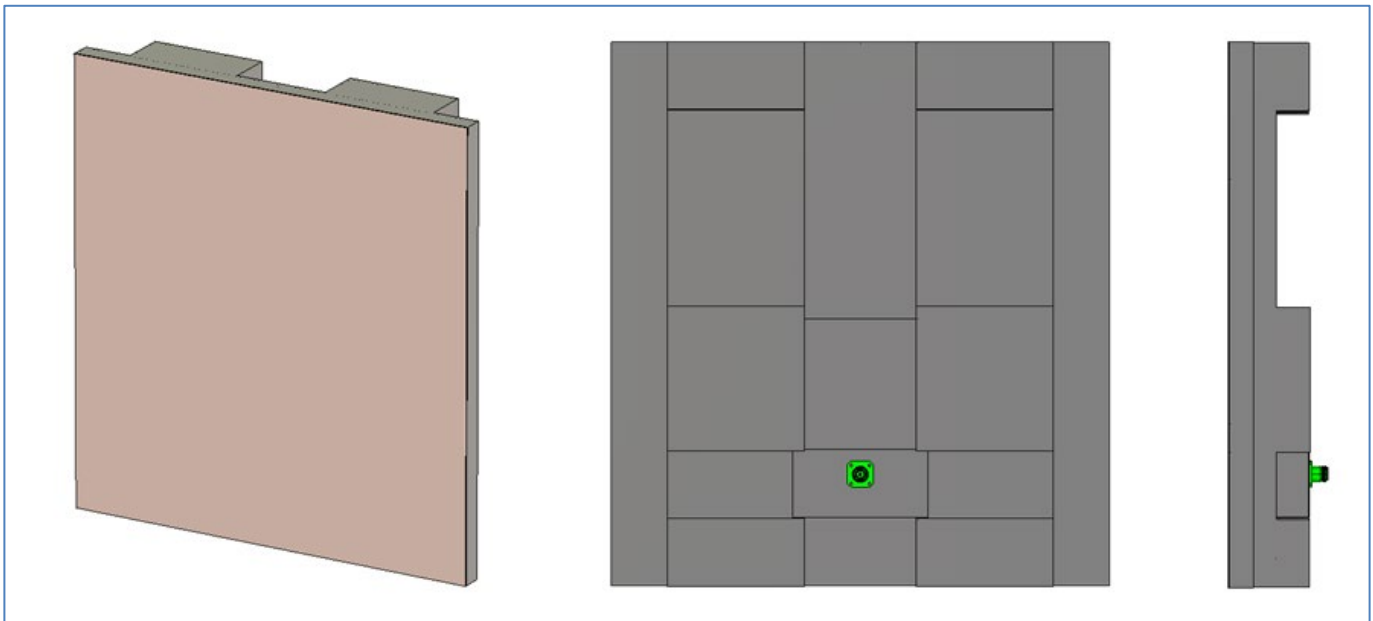


Figure 1: LFP-170519 Antenna

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TABLE 1: FPA ANTENNA and STANDARD GAIN HORN CHARACTERISTICS

	FPA Antenna (LFP-170519)	Standard Gain Horn (Model # 650-441-2)	Standard Gain Horn (Model # 430-442-2)
Frequency Band	1.45 – 1.95 GHz	1.12 - 1.70 GHz	
Bandwidth	29 %	41 %	42 %
Gain at 1.70 GHz	19.4 dBi	16.2 dBi	18.1 dBi
3-dB Beamwidth 10 GHz	E-Plane: 17.8 deg H-Plane: 18.1 deg	E-Plane: 31.1 deg H-Plane: 29.0 deg	E-Plane: 17.3 deg H-Plane: 17.4 deg
Return Loss	-12 dB (typical)	-25 dB (typical)	-25 dB (typical)
Antenna Depth	4.0"	29.4"	40.5"
Antenna Aperture Area	21.3"x19.6"x4.0"	19.9"x14.0"x29.4"	22.3"x16.2"x40.5"

Figure 2 shows realized gain and overall efficiency of the LFP-170519 FPA versus the two standard gain horn antennas. Since the compared antennas have different size apertures, direct gain comparison is not possible. For that reason, antenna efficiency is presented to allow direct comparison. FPA antenna achieved 80% efficiency over most of the operational band even with lossy fiberglass cover, while comparable 20dBi horn antenna (Model # 430-442-2) has 70% efficiency at best. It must be noted that 20dBi gain is a practical upper limit beyond which horn length becomes excessively large in depth, whereas the FPA can be "tiled" to allow larger apertures with more gain without a significant depth increase.

Figure 3 shows E and H plane radiation patterns of the FPA antenna at center frequency and band edges (1.45, 1.70, and 1.95 GHz). This L-Band FPA is designed with practically uniform amplitude taper to maximize aperture gain; as a result sidelobes are typically around -12 dB in both planes. Lastly, input return loss of the FPA antenna is shown in Figure 4. Typical return loss is below -12 dB and -10 dB worst case.

Mechanically, FPA antenna depth is only 4.0 inches while horn antenna depths are 29.4 and 40.5 inches.

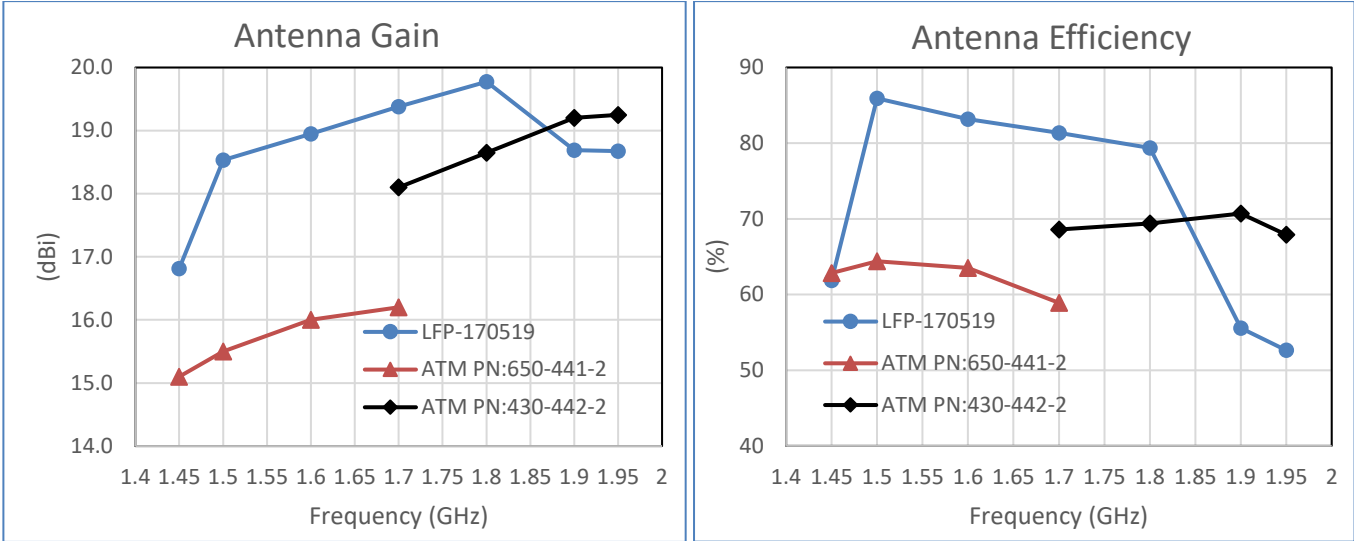


Figure 2: Gain and Efficiency Versus Frequency of LFP-170519 and Standard Gain Horns

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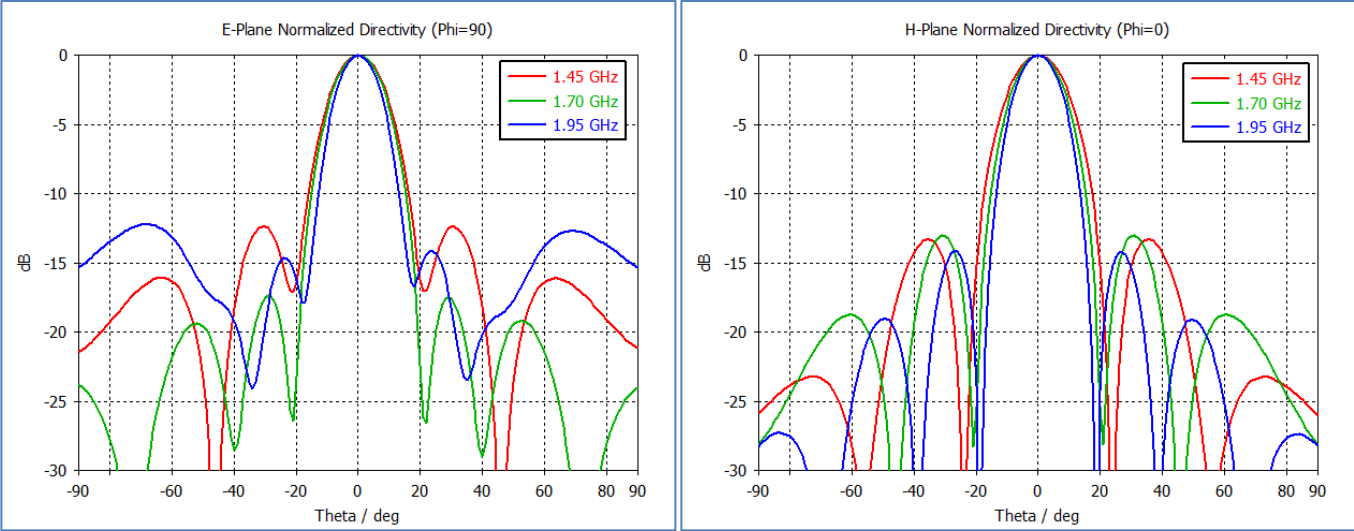


Figure 3: E and H Plane Radiation Patterns of LFP-170519

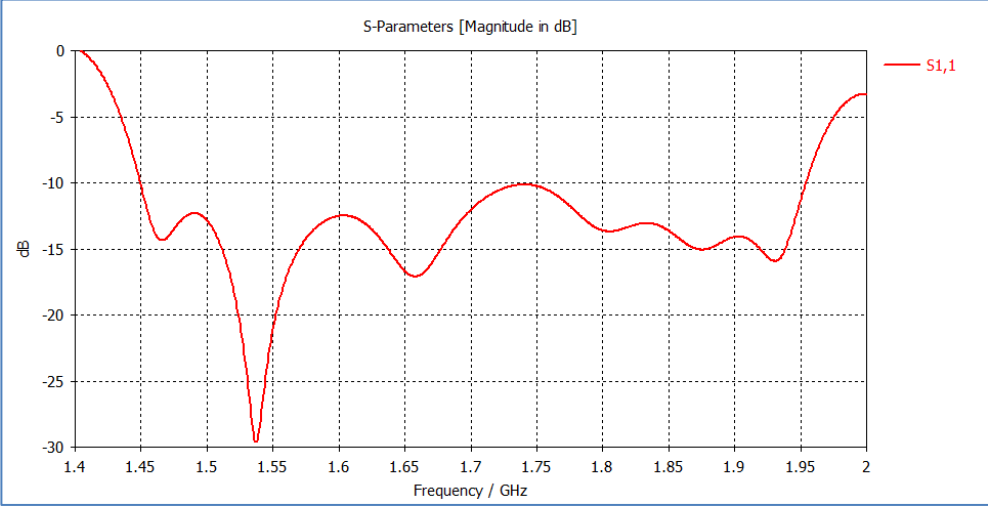


Figure 4: Return Loss of LFP-170519

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