TAOGLAS

Datasheet

Quantum 5G Smart Antenna

Part No:
KHA16.24C

Description:

Quantum 28GHz 5G Phased Array Smart Antenna

Features:

Patent Pending Design

5GNR 26.5 – 29.5GHz Smart Antenna

16 Antenna Elements

H-Pol and V-Pol Ports for Dual Linear Performance

Dimensions: 86.5 x 97 x 22.4mm

CE Certified

RoHS & REACH Compliant

1. Introduction

The Taoglas Quantum KHA16.24C is a 2D phased array antenna with integrated beamformer RFICs to provide full amplitude and phase control across the 16 elements comprising the array. This active array is integrated into a multi-layer PCB that contains (4) Summit 2629 Beam-Forming ICs (BFICs) and 16 antenna elements; layers provided for power optimization and thermal control, digital control, and RF feed lines all in the footprint of 53x84 mm. The array has separate H and V-pol ports for dual linear performance, scanning along both azimuth and elevation axes. It is designed to operate from 26.5 to 29.5 GHz, making this ideal for 5G applications.

Designed for use in 5G millimeter-wave systems, the KHA.16.24C can be interfaced with customer supplied transceiver and baseband assemblies for home, enterprise, and in-building applications. The provided SPI programming interface (download here for RevB) (download here for RevC) allows direct access to the beamformer chipsets to control the device configuration. Note that the latest revisions of this array (RevC) contain 36 total elements, only 16 of which are active elements. The antenna has up to 2 GHz impedance bandwidth which gives upwards of 2Gbps data rates which is well suited for fixed and mobile broadband capacity hungry Next Generation Networks.

The provided SPI interface allows direct access to the beamformer chipsets to control the device configuration. The KHA16.24C features higher than 20 dB cross pol rejection making it less susceptible to interference from undesired signals. This array can be directly connected using standard 2.92mm SMA connectors

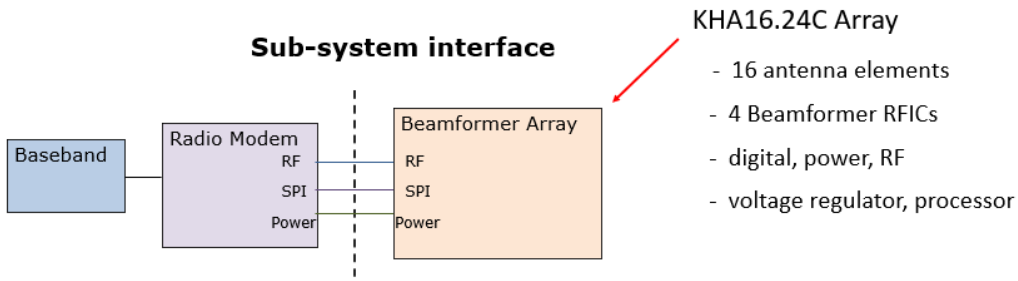
The KHA16.24C uses four Ka-Band 5G beamformer chipsets that supports four Tx/Rx radiating elements each, includes all requisite beam steering controls for 5-bit phase and gain control, and operates in a half duplex fashion to enable a single antenna to support both Tx and Rx operation. Antenna feed paths are shared for both transmit and receive operation.

Phased arrays (static or scanned beam) can direct or modify their radiation beam through varying the relative phase and amplitude of each element (or groups of elements) in the array. The variable phase delay enables steering of the beam. The RF signal from the radio is input into a Tx/Rx module. In the Tx/Rx module, the RF signal is divided by a 4-way RF splitter. Each output of the splitter is then connected to a RF path comprising phase shifter, amplifier and low-pass filter.

The included command-line interface allows the end-user to adjust beam steering angles, configure for transmit or receive modes, and adjust amplitude and/or phase per channel in the beam formers.

Requirement	Value	Comments
Frequency Range	26.5 to 29.5 GHz	
Gain over field of view	15 dBi	Gain to be met over scan angles along major axes
Peak gain at Boresight	17 dBi	
Polarization	Dual Linear	
Azimuth Scan Range	± 45°	
Elevation Scan Range	± 30°	
Cross Pol Isolation	-20 dB	Goal of -25 dB is targeted
EIRP	47 dBm	
Return Loss	8 dB	Over frequency and scan range
Array form factor	4 x 4 element configuration	

Table 1: Requirements



Interface requirements:

RF: single coaxial connector

SPI: 3, 4 wire SPI

Power: DC

1. RF connectors service both H and V-pol
2. Beam steering commands provided over SPI interface from Modem/Baseband
3. DC supply voltage with maximum 30W power requirement

Figure 1: Sub-system Interface

KHA16.24C Array

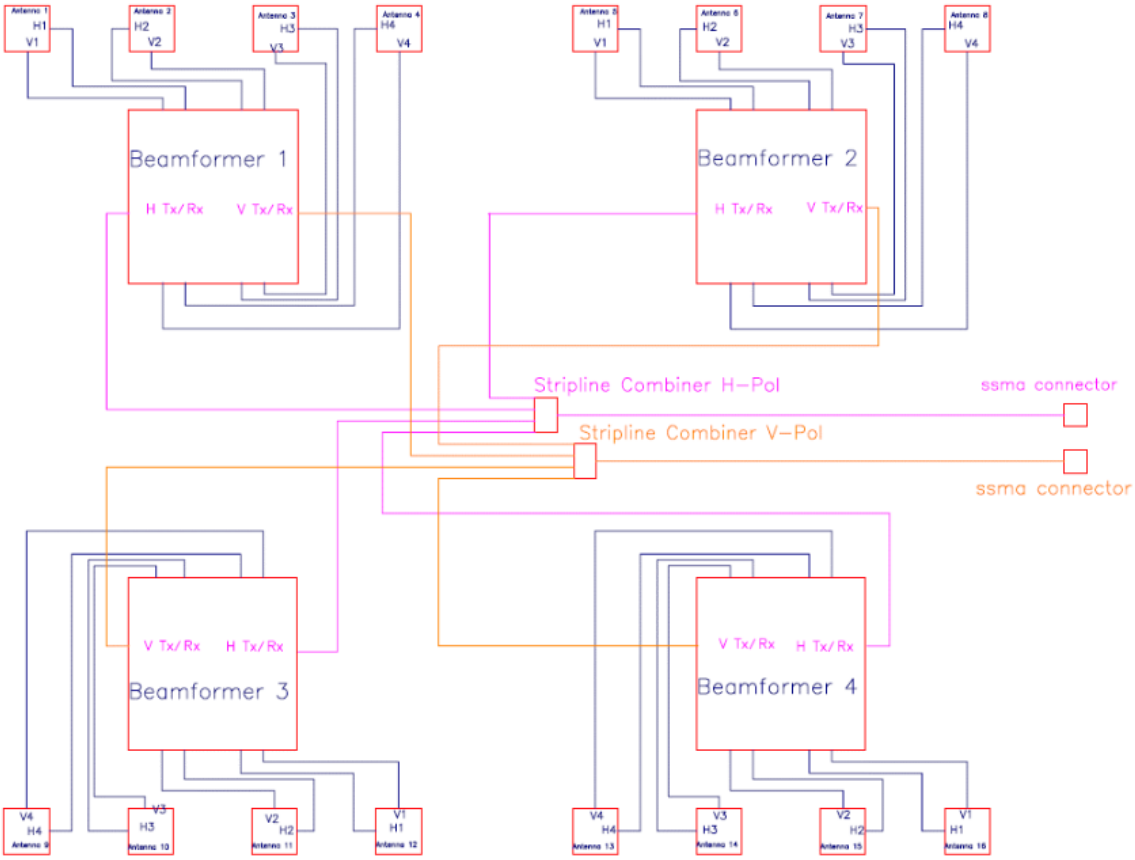


Figure 2: Beamformer Configuration

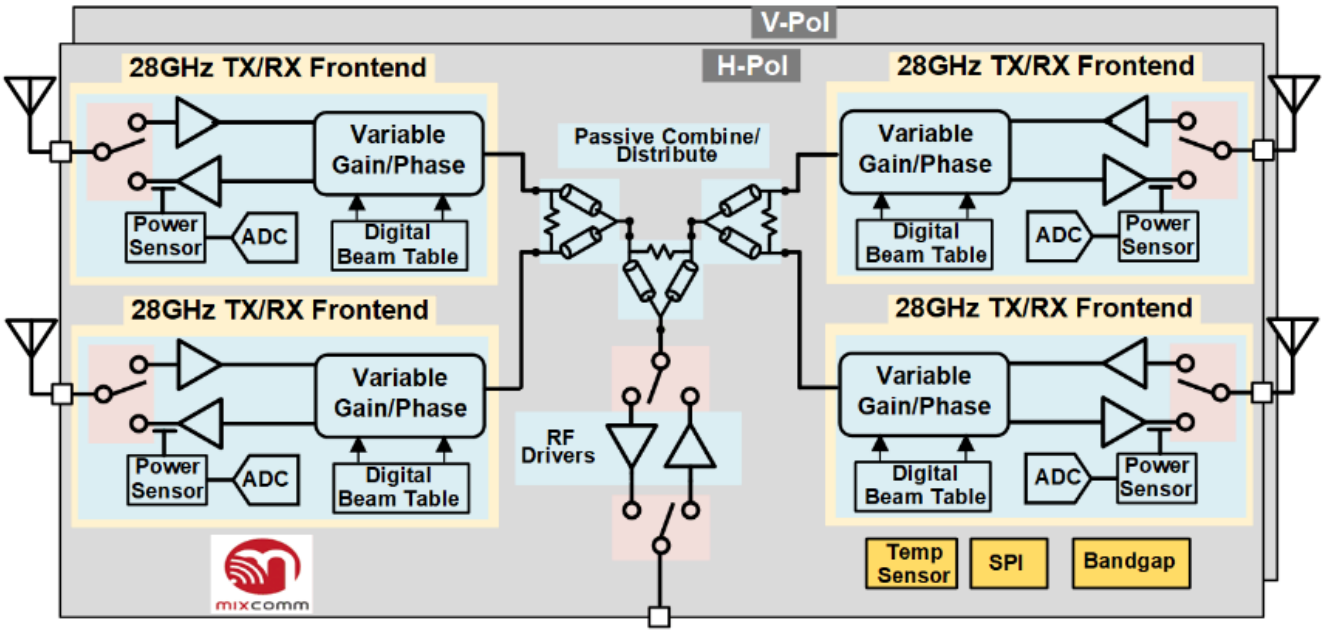


Figure 3: Beamformer RFIC Characteristics

- Four-element Dual-pol. TX/RX with Independent Polarization Beam Directions
- High-Power, High-Efficiency SOI CMOS Power Amplifiers
- State-of-the-art Low-Noise Amplifiers and Low-Loss T/R Switching
- Ultra-low Transmit and Receive-Mode Power Consumption
- 6-bit full-360° Phase Shifting and 0.5dB-step 16dB-range Variable Gain in Each Path
- Fully calibrated for Gain/Phase Matching Across ICs
- Extensive On-chip Temperature and Power Sensing
- On-chip Gain Control for Temperature Compensation
- High-Speed SPI with Large On-Chip Beam Table Storage
- Wafer-Level Chip-Scale Package (WLCSP) compatible with low-cost PCB manufacturing
- Support for Large-Scale Arrays through Multiple Chip-Addressing Modes

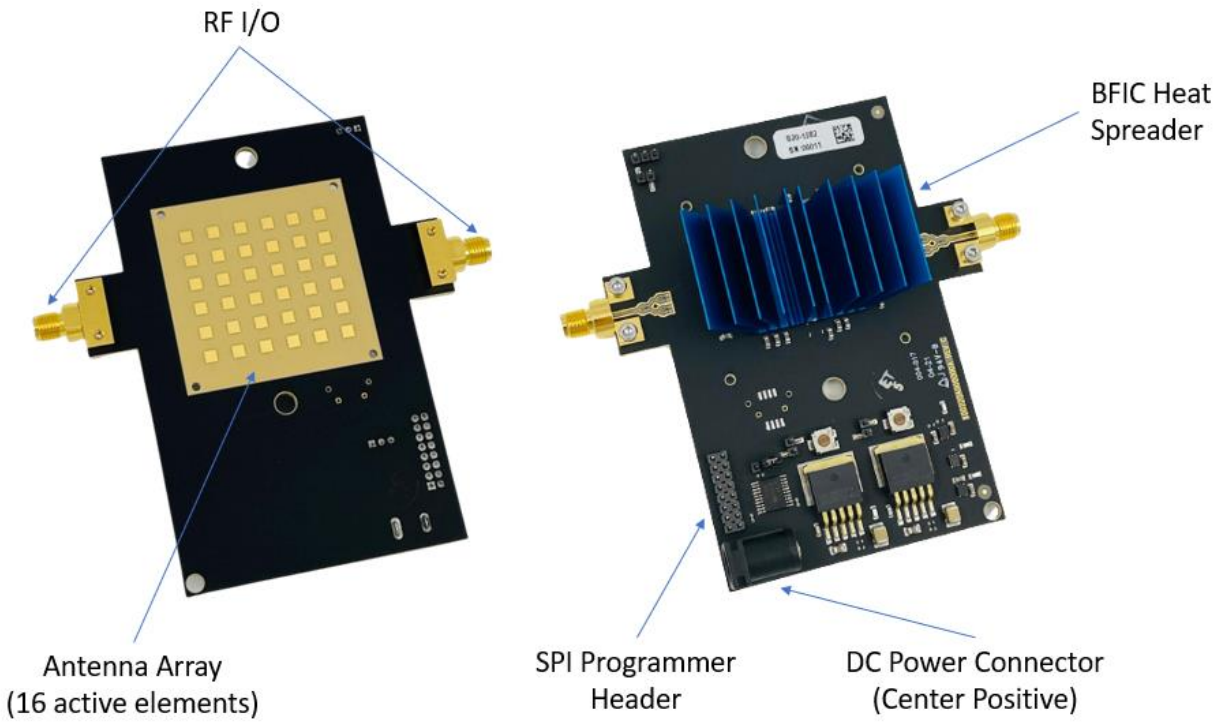


Figure 4: Interfacing with the Hardware

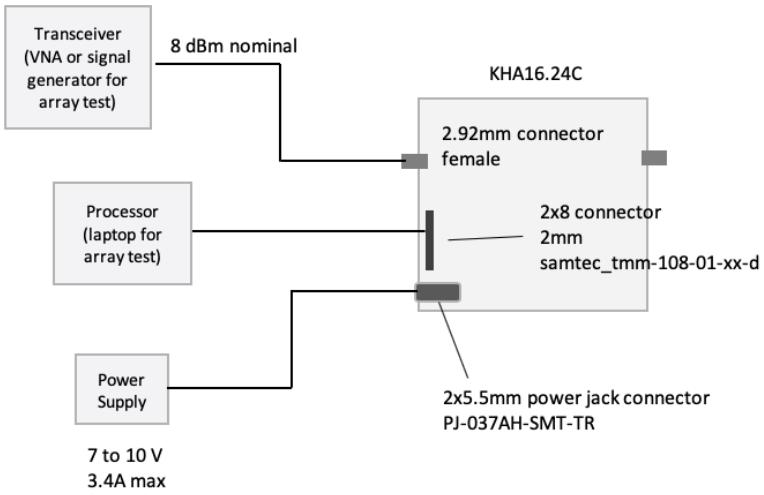


Figure 5: Configuration for Array Test or Integration

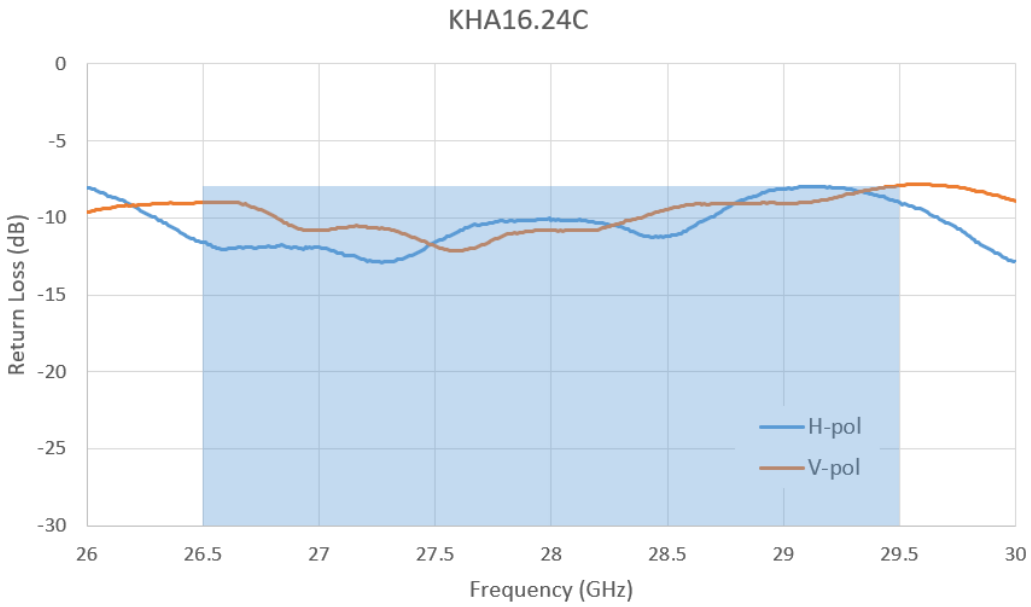
2. Specifications

Electrical	
Frequency Band	**26.5 to 29.5 GHz**
Peak Gain (dBi)	Varies from 14 to 17 dBi
Max VSWR	<2.2:1
Radiation Properties	Steered directional beam
Polarization	Dual-Linear
Cross-Pol Isolation	-25 dB
Impedance	50Ω
DC Power Requirement	5-9V; 7V nominal
Current Consumption	3.4A Max

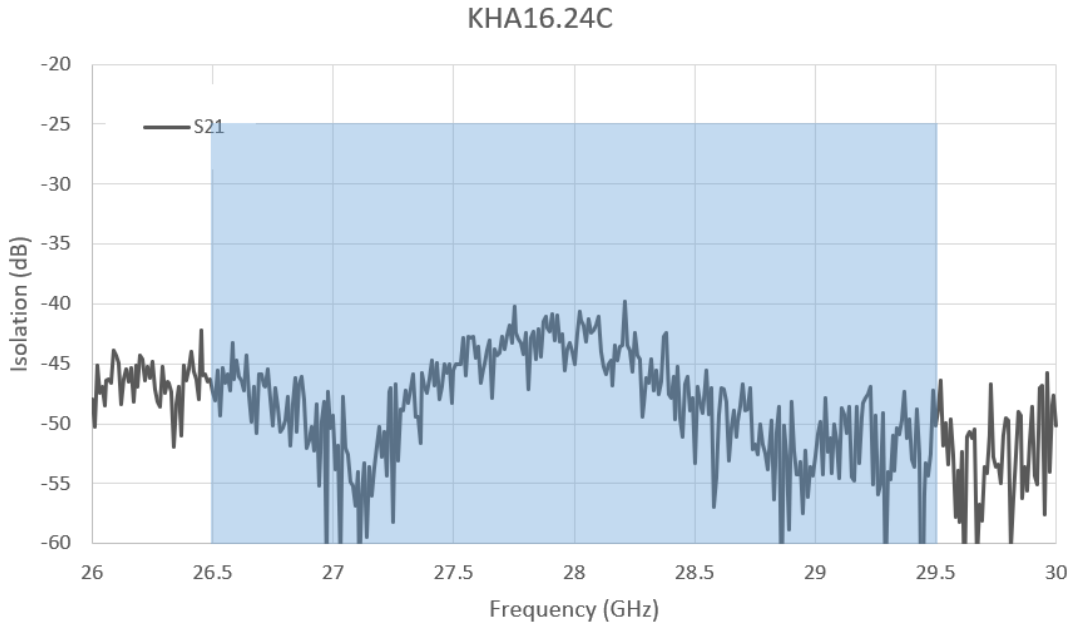
Mechanical	
Dimension	86.5 * 97 * 22.4 mm
Material	Multi-layer PCB
Termination	Ag (environmental Pb free) - Solder Pad
EVB Connector	2.9mm-Female
Weight	10g
Environmental	
Temperature Range	-40°C to 85°C
Humidity	Non-condensing 65°C 95% RH

3. Antenna Characteristics

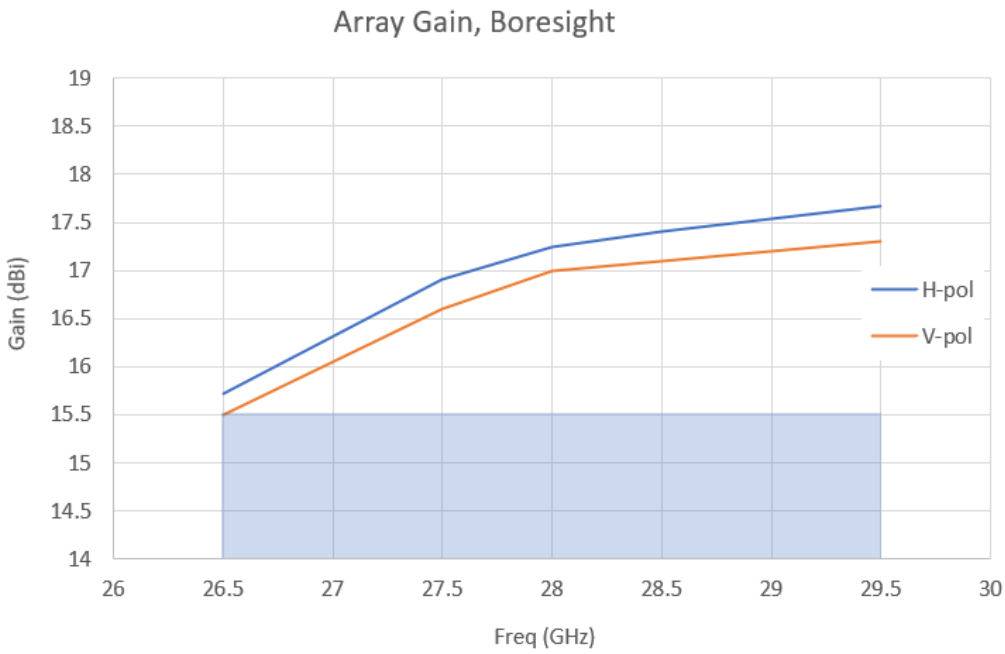
3.1 Return Loss



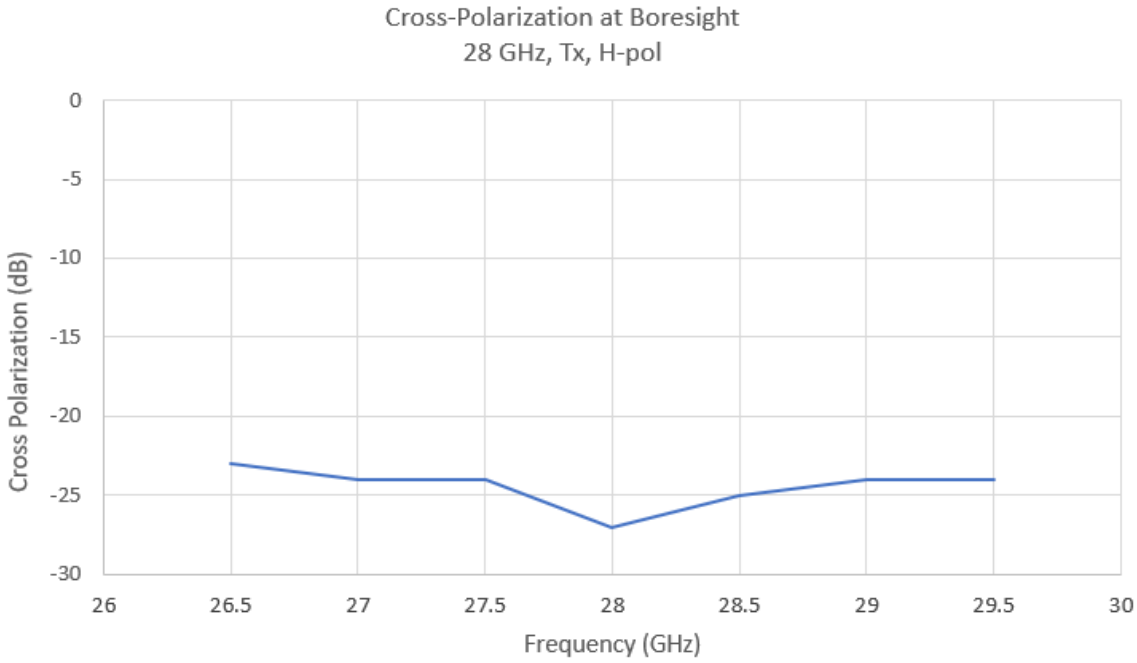
3.2 Port to Port Isolation



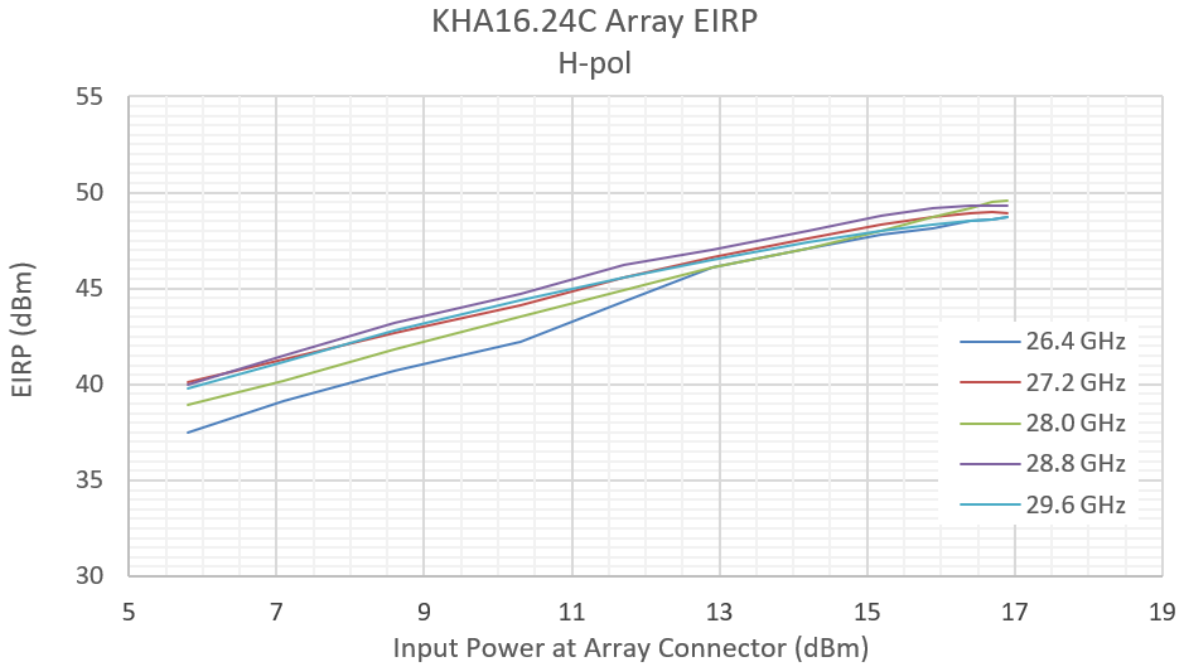
3.3 Peak Gain

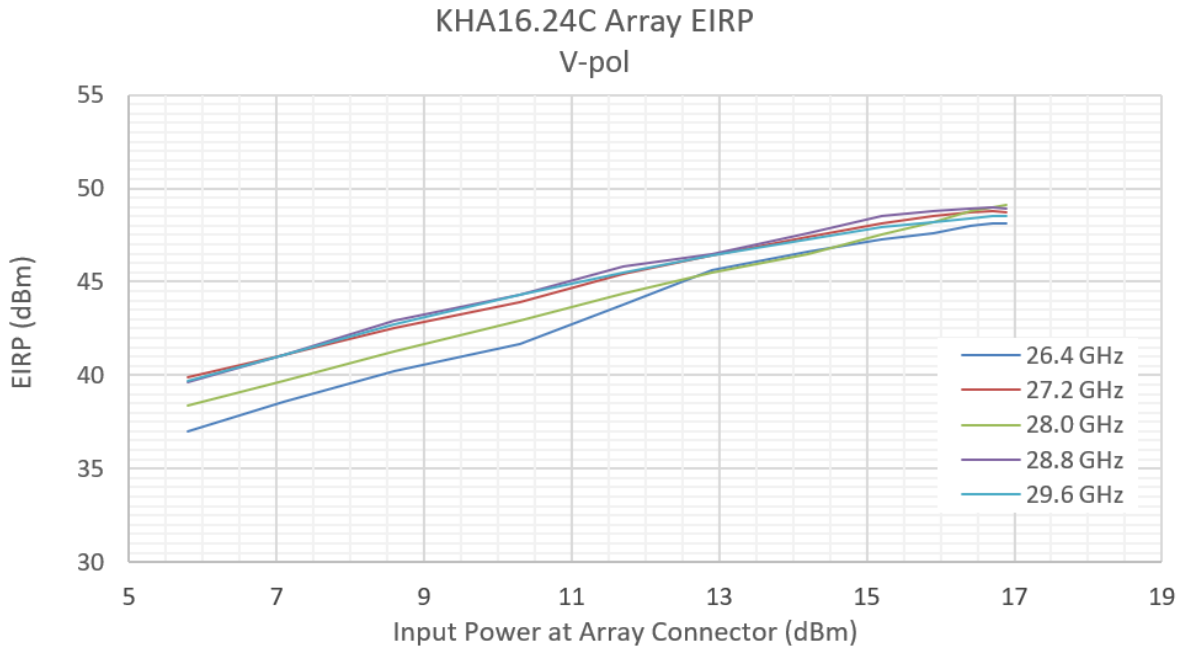


3.4 Cross Polarization Isolation



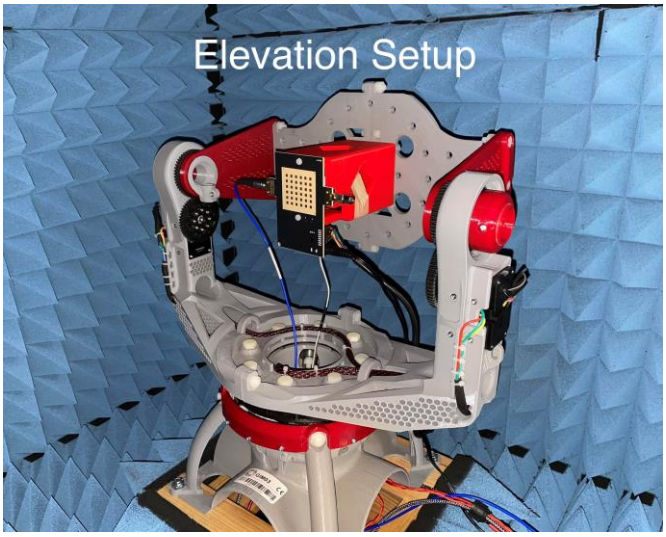
3.5 EIRP

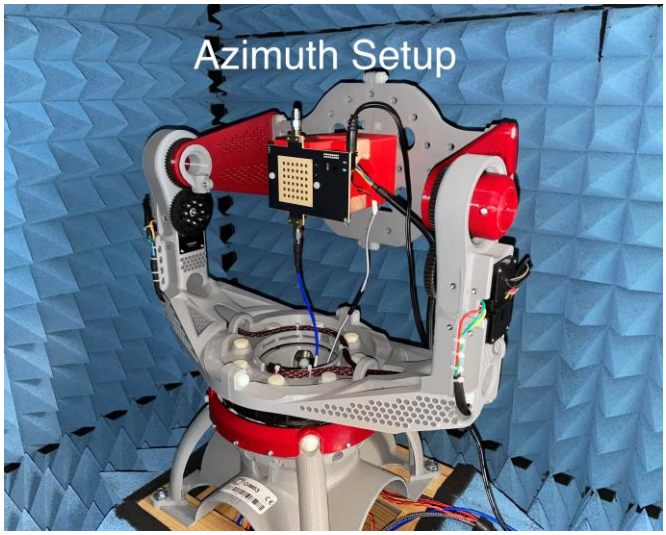

KHA16.24C Array EIRP
H-pol
EIRP (dBm)
55
50
45
40
35
30
5
7
9
11
13
15
17
19
Input Power at Array Connector (dBm)
26.4 GHz
27.2 GHz
28.0 GHz
28.8 GHz
29.6 GHz

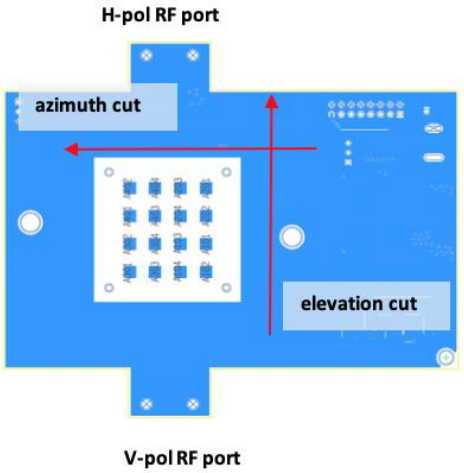

KHA16.24C Array EIRP
V-pol
EIRP (dBm)
55
50
45
40
35
30
5
7
9
11
13
15
17
19
Input Power at Array Connector (dBm)
26.4 GHz
27.2 GHz
28.0 GHz
28.8 GHz
29.6 GHz

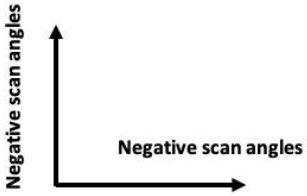
4. Radiation Patterns

4.1 Test Setup



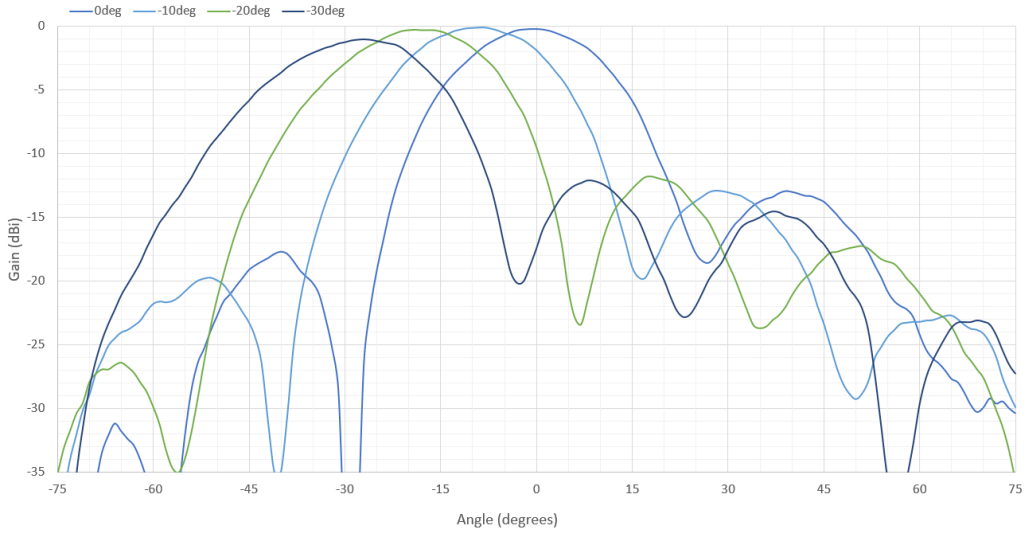




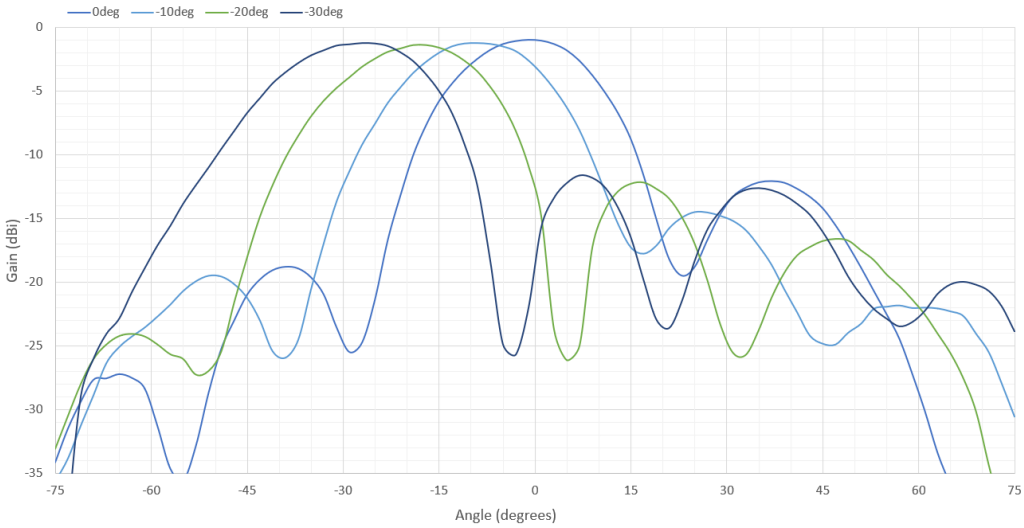


4.2 2D Radiation Patterns

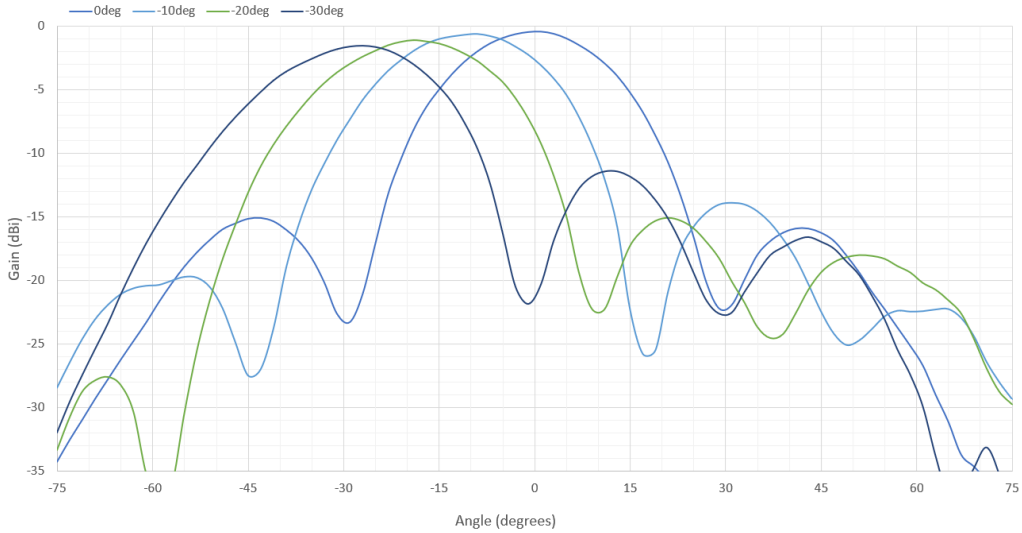
28.0GHz Elevation Scan, H-pol



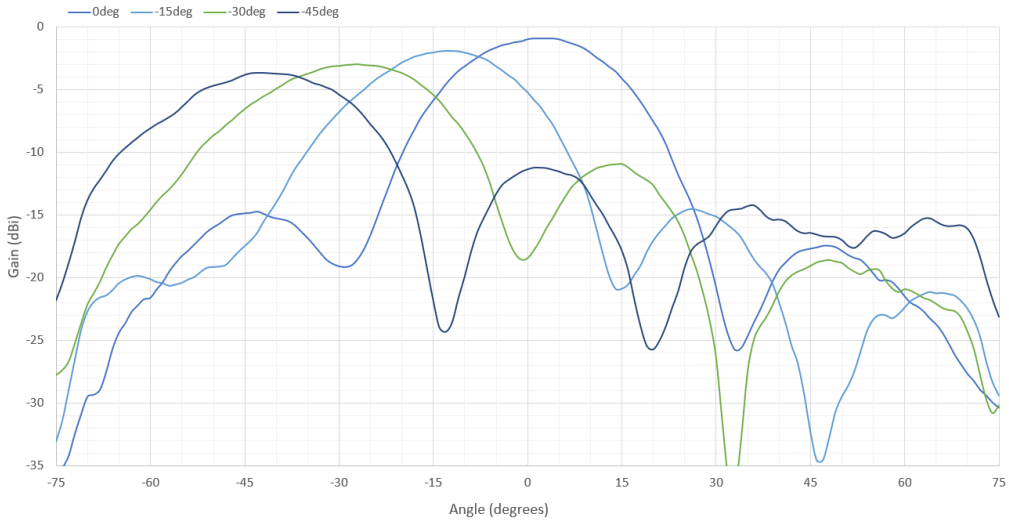
29.2GHz Elevation Scan, H-pol



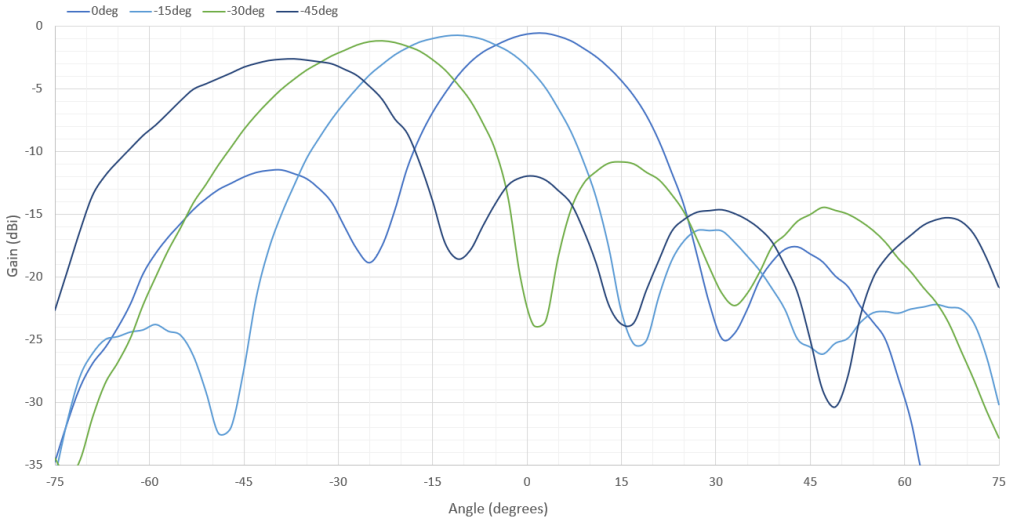
26.8GHz Elevation Scan, H-pol



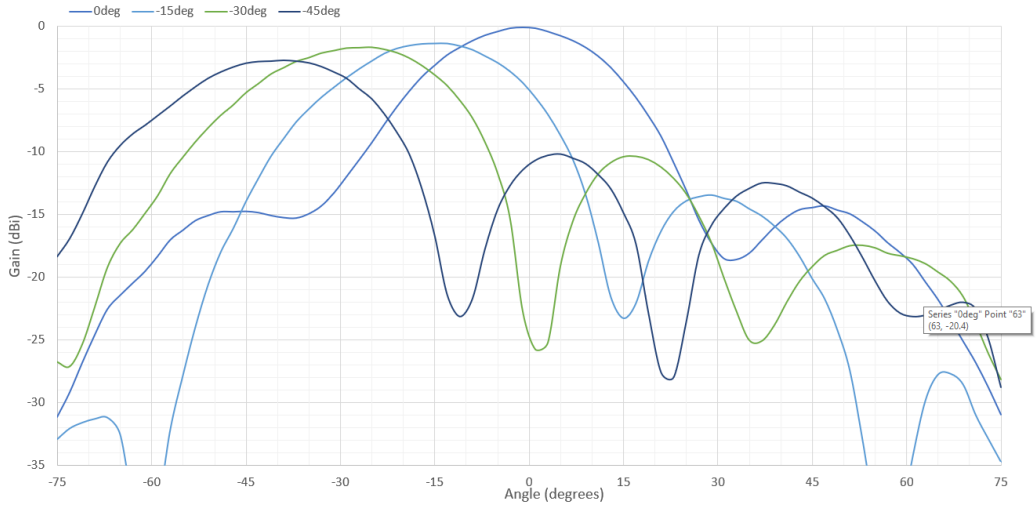
28.0GHz Azimuth Scan, V-pol

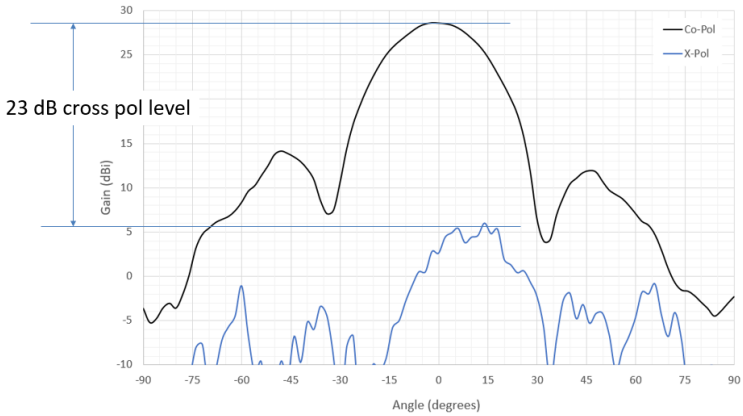


29.2GHz Azimuth Scan, V-pol



26.8GHz Azimuth Scan, V-pol



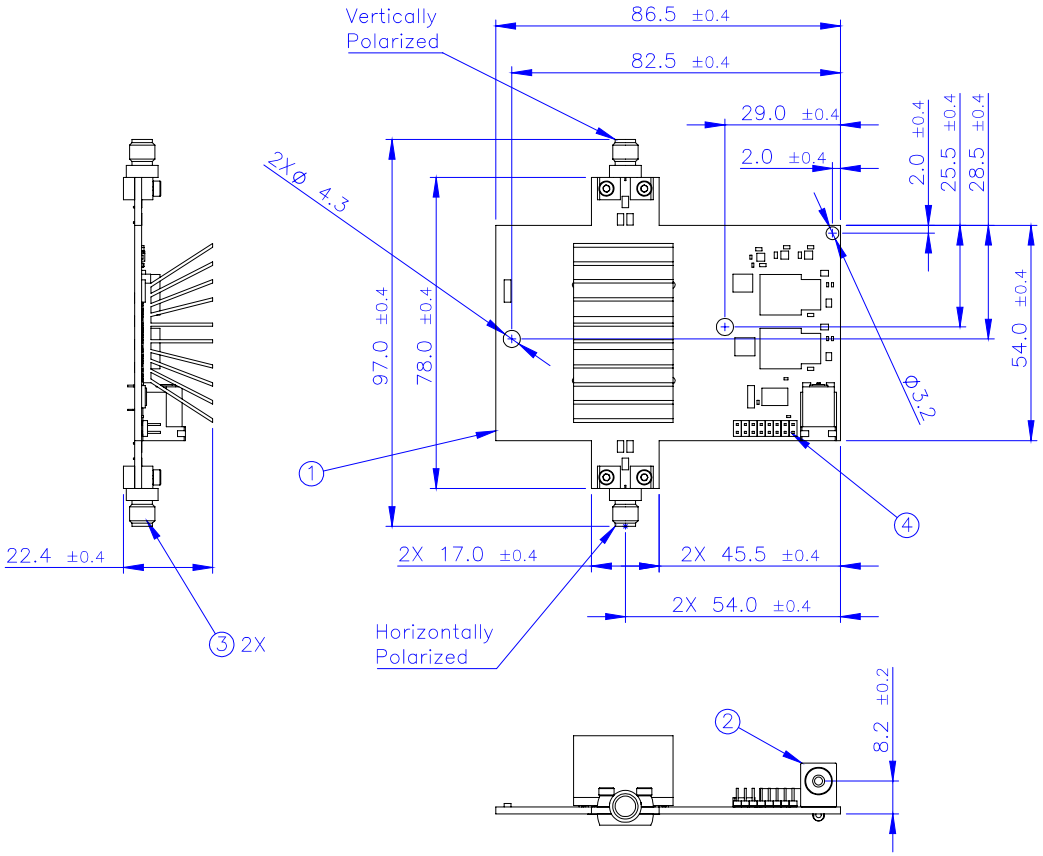


Boresight radiation pattern, Co and cross-pol, 28.0 GHz, H-pol

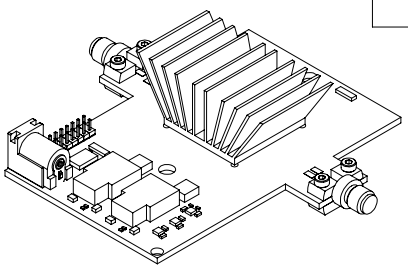
5. Mechanical Drawing (Units: mm)

REV	ZONE	DESCRIPTION	ENG	APPROVED	DATE
D01	All	Initial design	S.Elliott	XXX	6/12/2020

ISO NO.: EDW-XX-8-XXXX
STATE: Draft
NOTES: 1. All material must be RoHS compliant
2. The connector orientation has a fixed position to the antenna as per drawing.



ITEM NO.	DESCRIPTION	MATERIAL	Finish	QTY.
1	KHA16.24C PCBA	FR4 1.8t	Black	1
2	Pwr Jack 2x5.5mm	Plastic	Black	1
3	2.92mm End Launch Jack	Brass	Gold Plated	2
4	2 x 8 x 2mm Processer Conn	Brass/Plastic	Gold Plated	1



APPROVED BY: (NAME)	TAOGLAS. TW Design Centre
CHECK BY: T.Perry	This drawing and its inherent design concepts are property of Taoglas. Not to be copied or given to third parties without the written consent of Taoglas.
DRAWN BY: S. Elliott	
DATE: 6/12/2020	TITLE : 26.5 – 29.5GHz Steerable Fan Beam 16 Element Antenna with 24dBm Tx Power and MixComm RFIC
UNLESS OTHERWISE SPECIFIED TOLERANCES ON: XX.±0.5 X.±0.3 .X±0.2 .XX±0.1 .XXX±0.05	PART NO. : KHA16.24C
THIRD ANGLE PROJECTION	UNIT: mm / SCALE: 1:1.5 / PAGES: 1/1 / REV. D01

Changelog for the datasheet

SPE-20-8-057 – KHA16.24C

Revision: C	
Date:	2021-04-06
Notes:	Updated Radiation Patterns Updated Introduction
Author:	Derrick Jones

Revision: B	
Date:	2020-06-24
Notes:	Updated Radiation Patterns Updated Introduction
Author:	David Connolly

Revision: A (Original First Release)	
Date:	2020-05-12
Notes:	Original Release
Author:	Jeff Shamblin

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