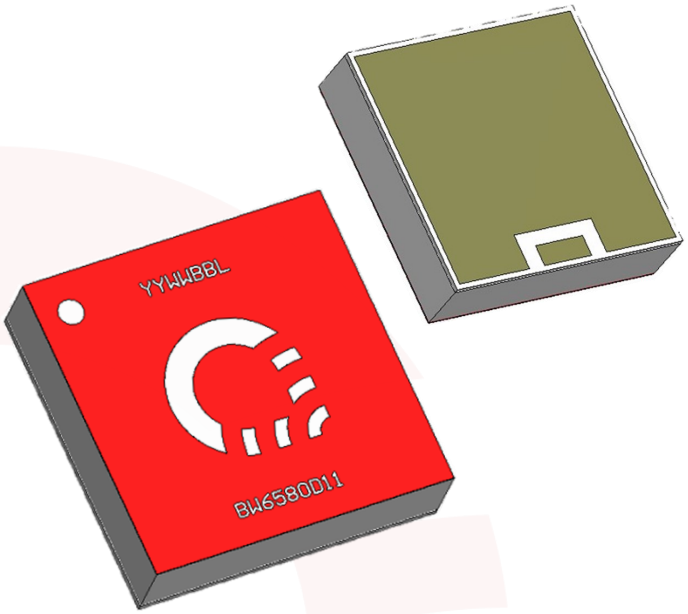
AntennaWare

AW-BW-6580D11

6.5 and 8GHz UWB BodyWave™ Antenna

Description

A dual band 6.5 and 8 GHz Ultra-Wideband SMD BodyWave™ Antenna



2 Pin, 12.0 mm x 12.0 mm x 3.2 mm

Features

Key features of the dual band BodyWave™ 6.5GHz and 8GHz UWB antenna for wireless wearable applications are:

- For UWB Applications in Channels 5 and 9
- Stable Return Loss
- Minimal Impedance Detuning at Different Antenna-Tissue Separation Distances
- Predictable On-Body Radiation Performance
- Ease of Integration
- Increased Coverage

Applications

The BodyWave™ antenna can be used in a wide range of wearable applications including:

- Sports Tracking Wearables
- Intercom Bodypacks
- Audio Headphones
- Medical vital signs monitors
- Motion capture sensors
- AR/VR headsets

1. Introduction

The BodyWave™ antenna is a SMD mounted antenna, designed primarily for application in wearable devices operating at UWB channels. In this datasheet we show performance at channel 5 and 9, covering the frequency band (6500 and 8000 MHz). Bodywave™ has a number of features which makes it significantly better suited to wearable applications than existing commercially available off-the-shelf antennas used in wearables or on other difficult platforms.

Resistance to Detuning and Radiation Performance Variation

The most important characteristic of the BodyWave™ antenna is the greatly increased coverage it can provide when compared to existing wearable antennas. Shadowing caused by the human body will cause large nulls in the radiation pattern of a body-mounted antenna and will greatly affect the range and reliability of a wearable device, especially in unpredictable and dynamic applications. However, the BodyWave™ antenna is designed to increase coverage in directions obscured by the human body, with 10 dB – 20 dB increased forward path gain in NLoS directions when compared to existing commercially available chip antennas.

Ease of Integration

The BodyWave™ antenna is extremely resistant to detuning caused by close human body proximity, a major issue with antennas in wearable applications. The BodyWave™ antenna is also resistant to radiation performance variation caused by ground plane dimension variation and the on-ground design allows components, batteries, connectors, etc to be placed immediately below the antenna on the opposite side of the ground plane. This improves integration and removes the need for bespoke shaped PCB ground planes, which can cause spurious radiation.

Increased Coverage

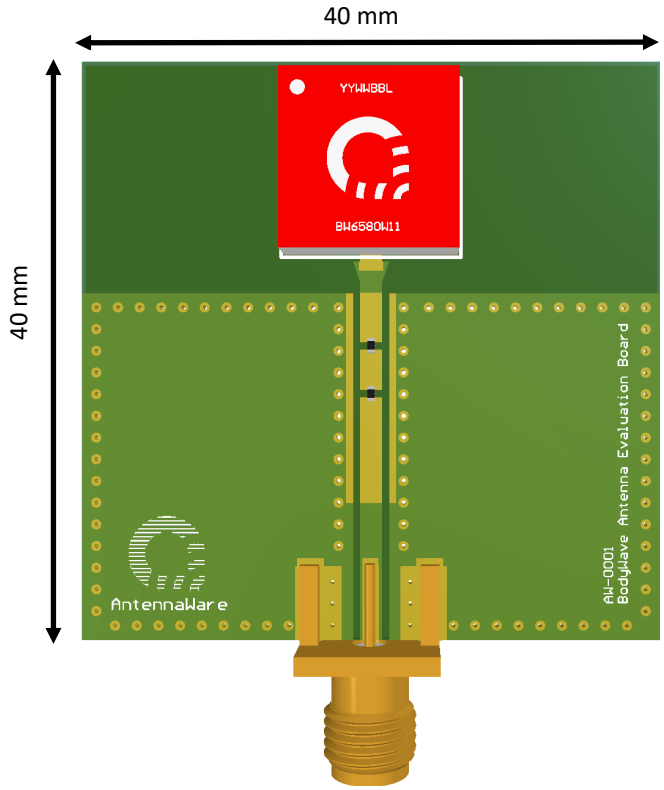
The antenna's compact form factor, makes it easily integrable into miniaturised wearable devices and requires minimal RF expertise to integrate onto a PCB (although the antenna is self-resonant in the 6250 – 6750 MHz & 7750—8250 MHz UWB bands, impedance matching may be required due to enclosure encapsulation, feeding method, etc.). The antenna also has high radiation efficiency despite its miniature size, even in close proximity with the human body.

2. Technical Specifications

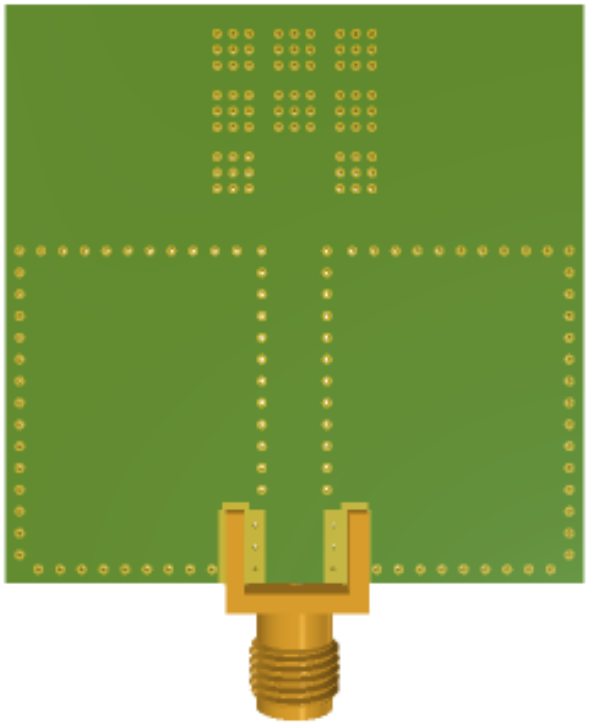
Electrical Specifications		
Parameter	**Unit**	**Value**
Frequency Range		
UWB CH5	MHz	6250-6750
UWB CH9	MHz	7750-8250
Radiation Pattern		Omnidirectional
Impedance	Ω	50
Avg. Free Space Efficiency		
UWB CH5	dB	-1.52
UWB CH9	dB	-2.27
Avg. On-Body Efficiency		
UWB CH5- 10mm Spacing	dB	-2.87
UWB CH5 - 05mm Spacing	dB	-3.39
UWB CH9 - 10mm Spacing	dB	-3.25
UWB CH9 - 05mm Spacing	dB	-3.57
Peak Gain		
@ 6.5 GHz	dBi	2.8
@ 8 GHz	dBi	2.3
Mounting Style	-	Surface Mount (SMD)
Polarization	-	Linear
Mechanical Specifications		
Dimensions	mm	12 x 12 x 3.2
Weight	Grams (g)	0.8
Environmental Specifications		
Operating Temperatures	Celsius (°C)	-55 to +125
RoHs Compliant	-	Yes
SVHC Compliant	-	Yes

3. Evaluation Board

The RF performance of the BodyWave™ antenna was measured on the following evaluation board. Smaller PCBs can be used.



Top Side



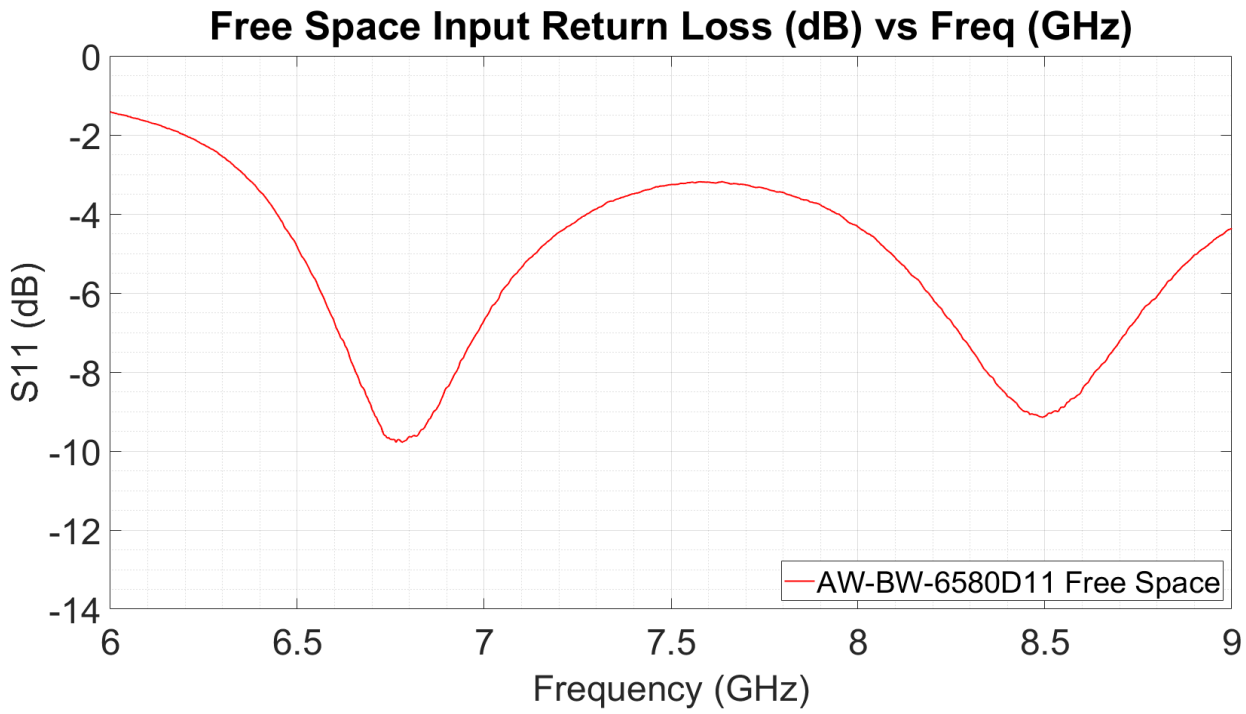
Bottom Side

***Evaluation Boards available upon request ***

Evaluation Board Parameter	Value
Dimensions (mm)	40 x 40
Connector Type	SMA
Feed Type	50Ω, Grounded Coplanar Waveguide
Substrate	RO4350B
Substrate Height (mm)	0.76
Copper Thickness (um)	35
Operation	On-Ground
Matching Topology	None

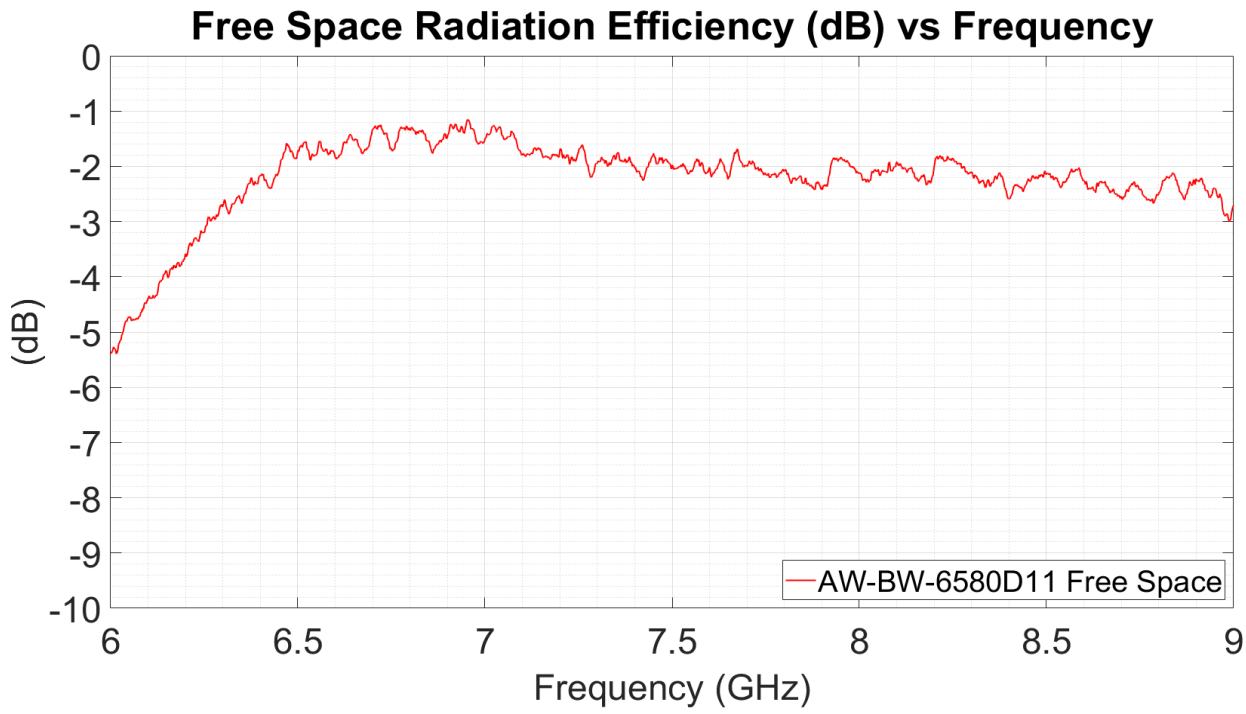
4. Antenna Characteristics

4.1 Return Loss



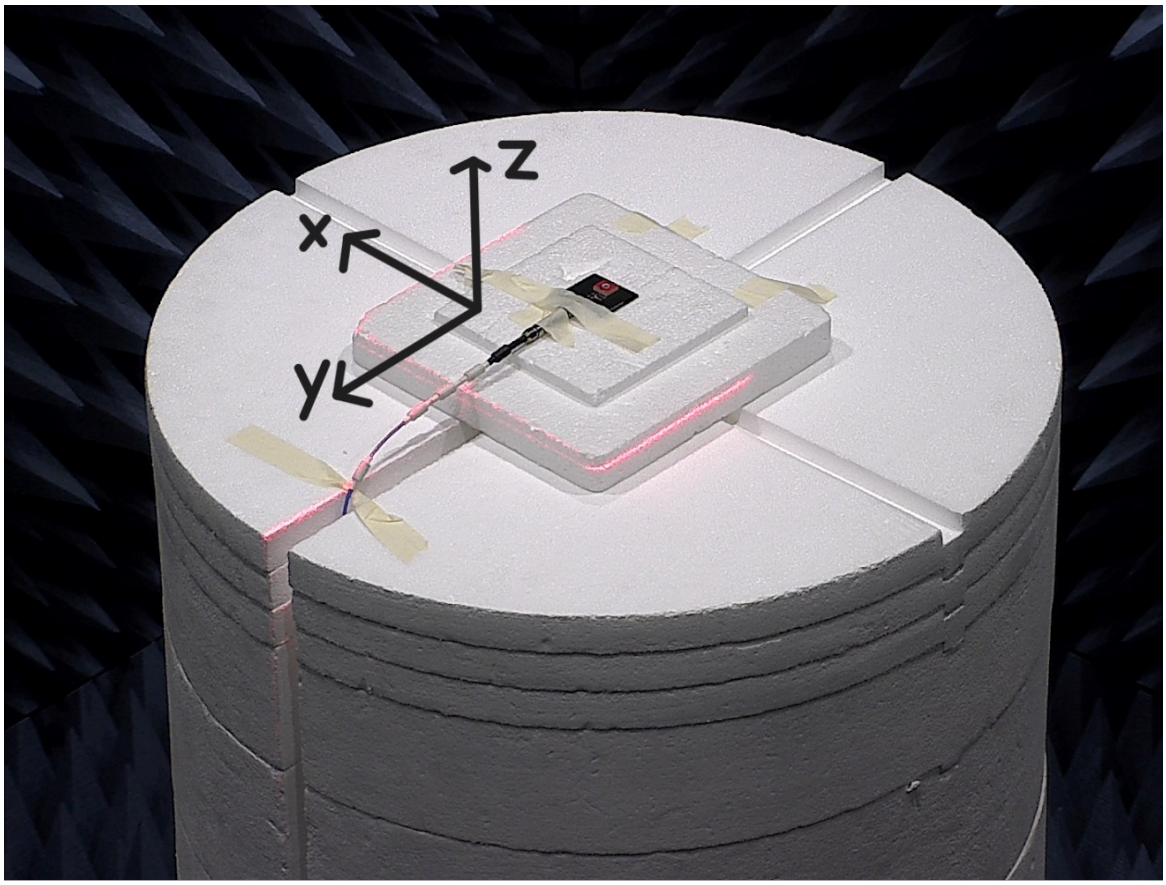
4.2 Radiation Efficiency

Note :- The radiation efficiency was measured using a reverberation chamber.

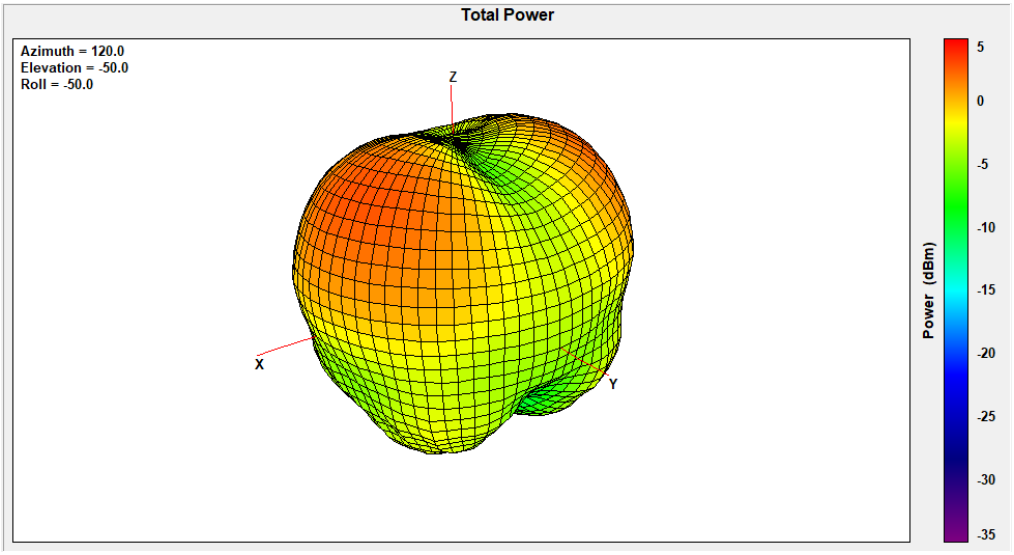
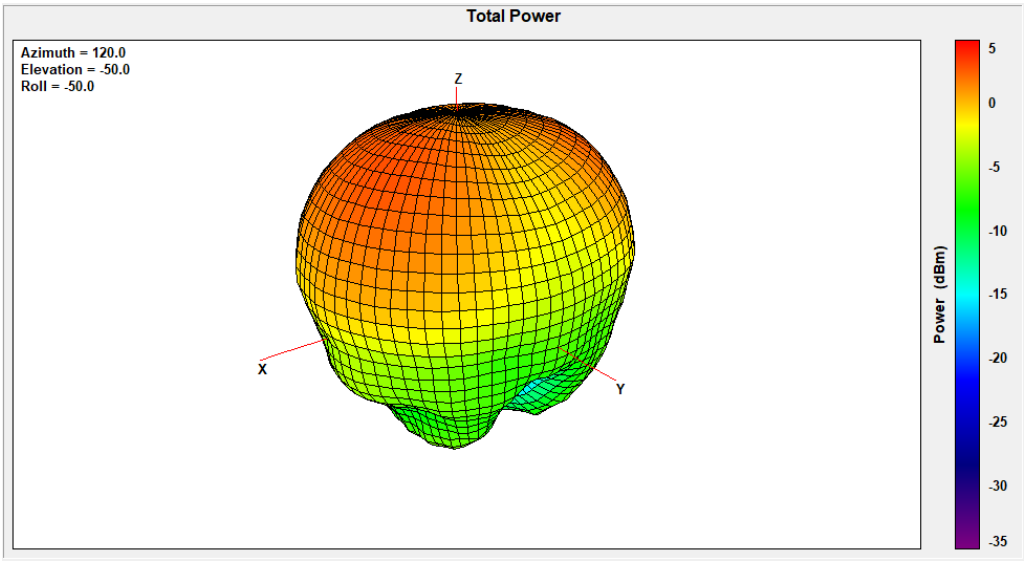


5. Radiation Patterns

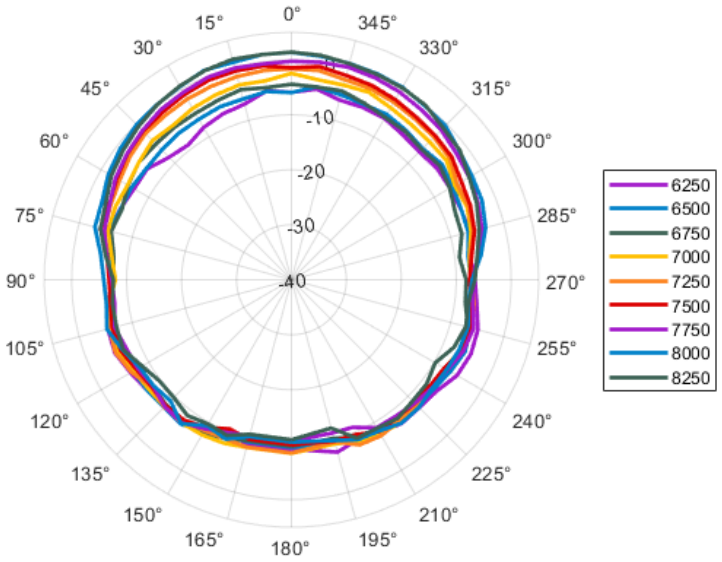
5.1 Test Setup



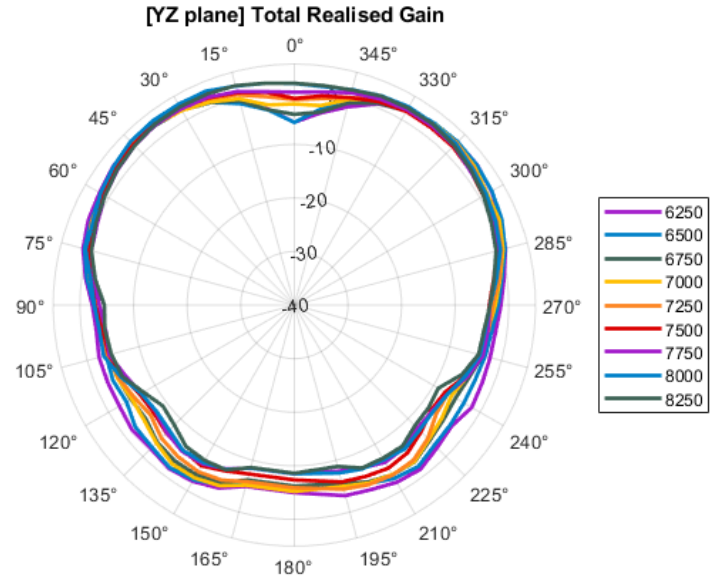
5.2 - 3D and 2D Radiation Patterns

UWB Centre Freq. **UWB CH5 -** **6.5 GHz**	
UWB Centre Freq. **UWB CH9 -** **8 GHz**	

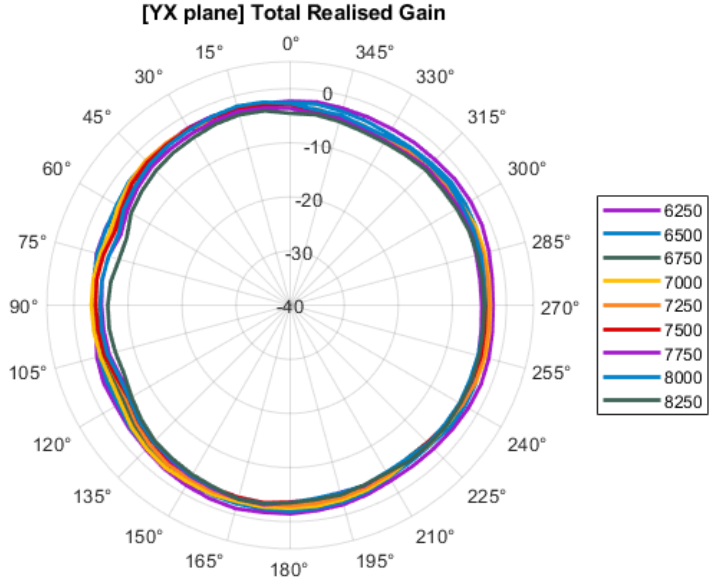
[XZ plane] Total Realised Gain



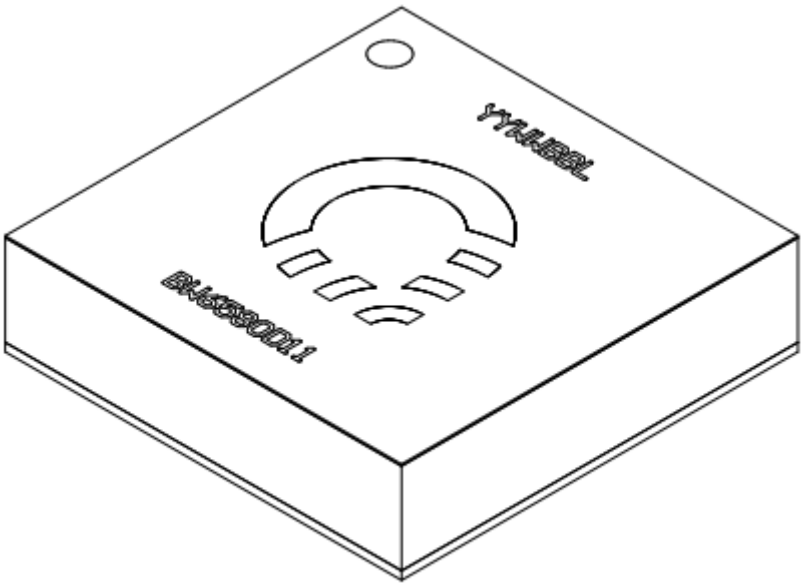
[YZ plane] Total Realised Gain



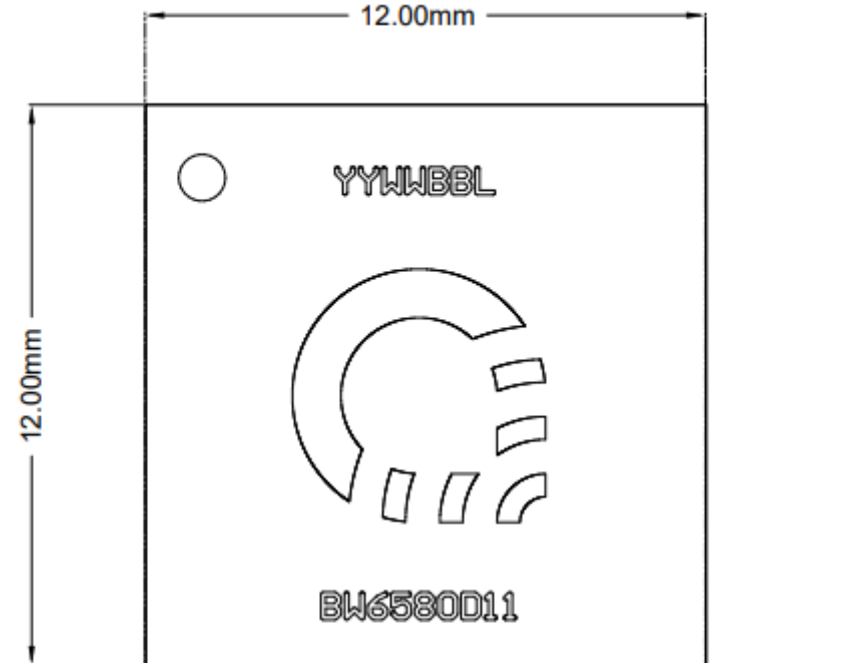
[YX plane] Total Realised Gain



6. Mechanical Drawings



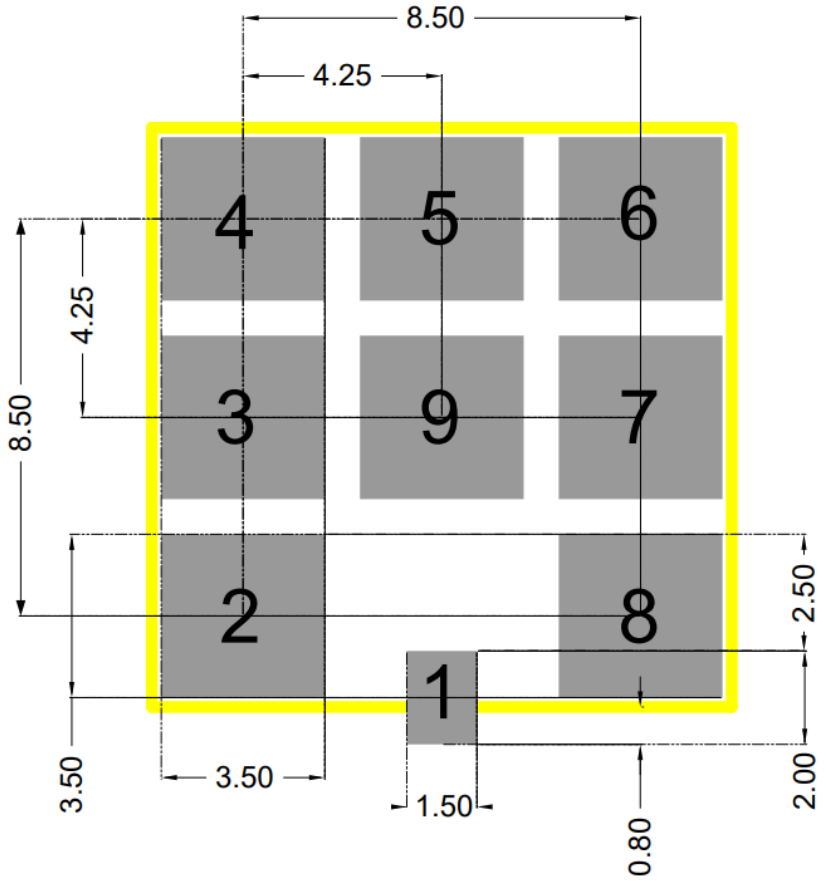
ISOMETRIC VIEW



TOP VIEW

SIDE VIEW

7. PCB Footprint Information



Note: All dimensions are in mm

PIN:	Description
1	50 Ohm Feed
2-9	GND

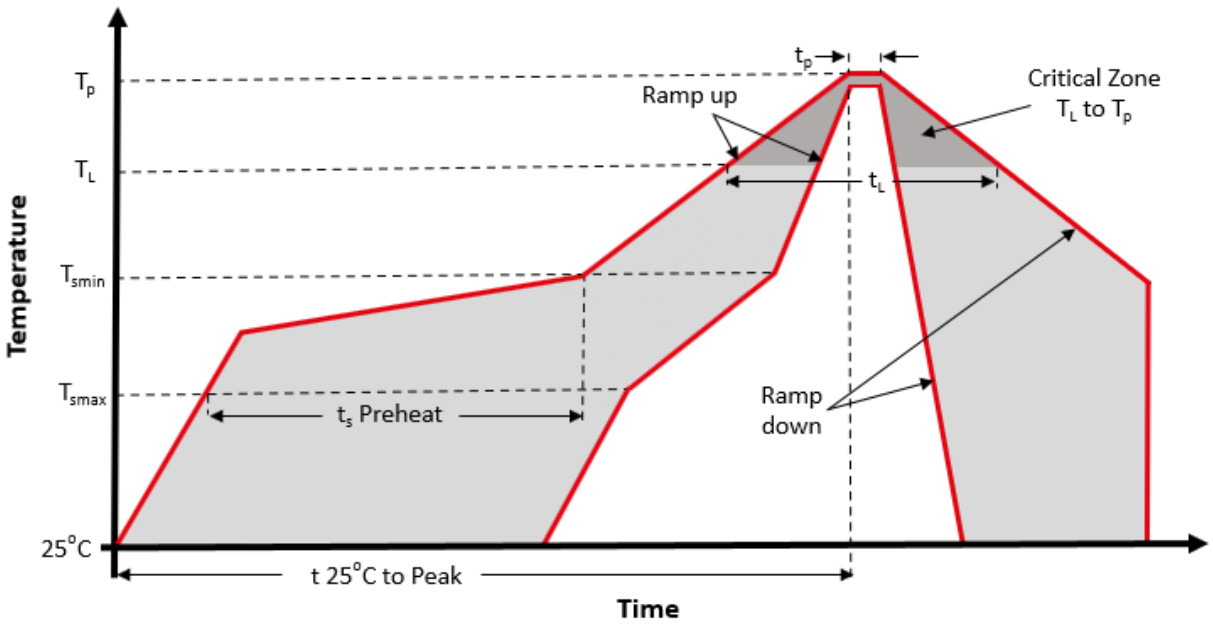
Recommendations :

- Maintain a 2 mm separation from the edge of the PCB and other components.
- Maintain a minimum 2mm separation from the enclosure to the top or edge of the BodyWave™ Antenna.
- Increasing BodyWave™ Antenna separation from the edge of PCB will improve wearable performance.
- A minimum of a 3-component matching network at the feed is recommended.
- Power planes, traces, and components can be placed on PCB layers underneath the ground layer used by the BodyWave™ Antenna.

8. Recommended Reflow Temperature Profile

The BodyWave™ Antenna can be assembled using the Pb-free IPC/JEDEC J-STD-020C standard with the recommended temperature profile shown below.

Electrical	Profile Features	Pb-Free Assembly
Ramp-Up	Avg. Ramp-up Rate (T_{smax} to T_p)	3°C/ second (max.)
Preheat	Temperature Min (T_{smin}) Temperature Max (T_{smax}) Time t_s (T_{smin} to T_{smax})	150°C 200°C 60-180 seconds
Reflow	Temperature (T_L) Total Time above T_L (t_L)	217°C 60-150 seconds
Peak	Temperature (T_p) Time (t_p)	260 °C 20-40 seconds
Ramp-Down	Rate	6 °C/second (max.)
Time from 25 °C to Peak Temperature	-	8 minutes max

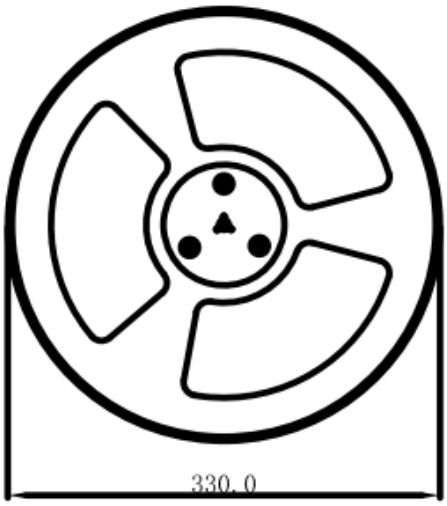


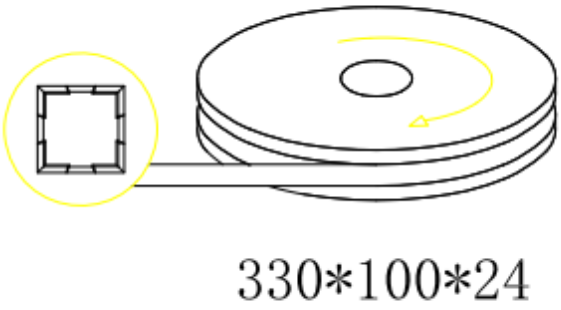
9. Packaging

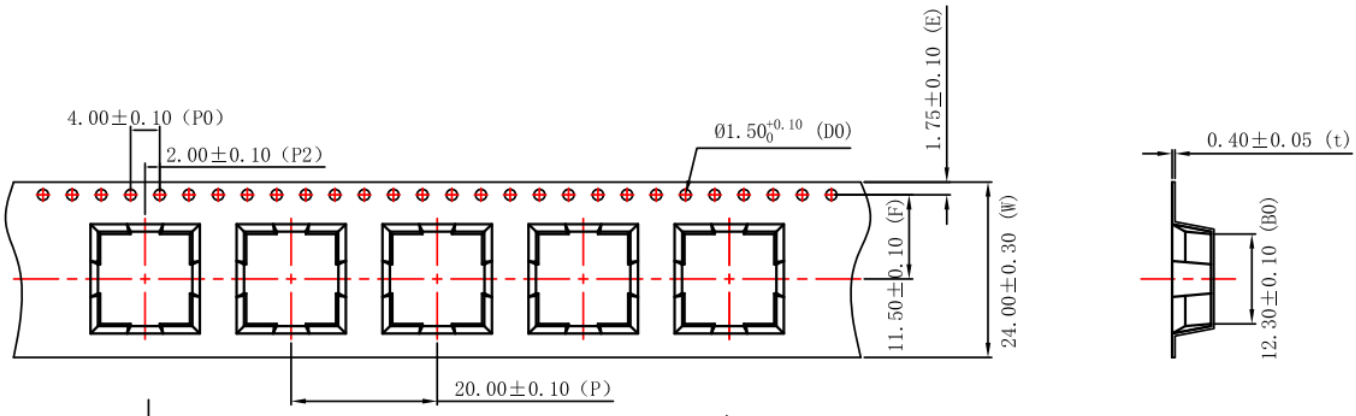
500 pc AW-BW-6580D11 per reel

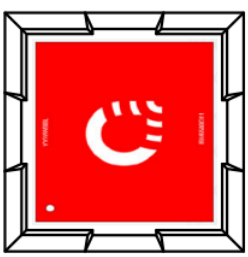
Dimensions - Ø330 * 24mm

Weight*- Reel + 500pc - 845g

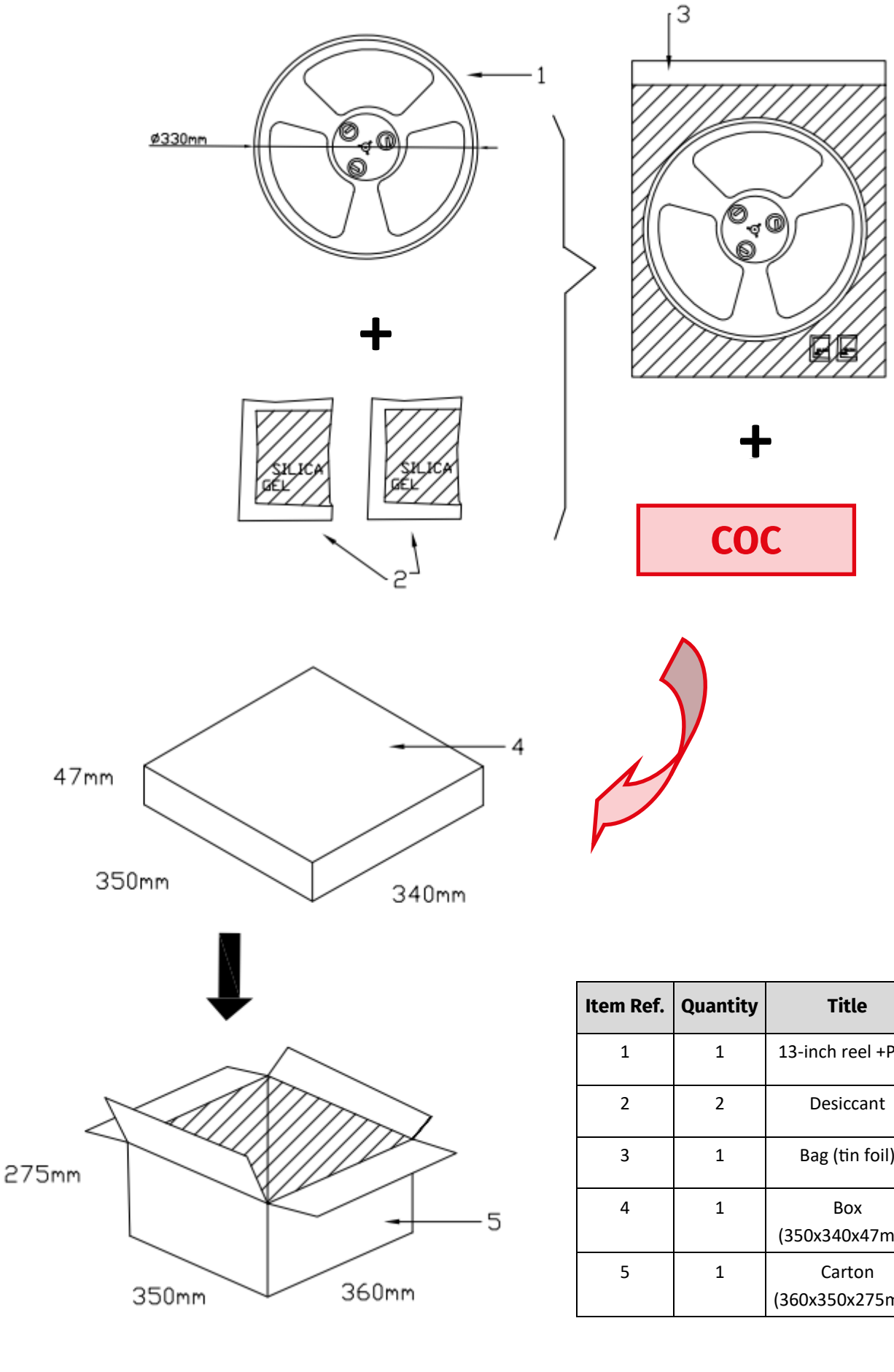








* Weight is currently estimated and TBC on production intent parts when available.



Item Ref.	Quantity	Title	Weight
1	1	13-inch reel +PCB	845g
2	2	Desiccant	2g
3	1	Bag (tin foil)	50g
4	1	Box (350x340x47mm)	260g
5	1	Carton (360x350x275mm)	650g + 5 layers

10. Wearable Performance Application Note

10.1 RF Wearable Testbed

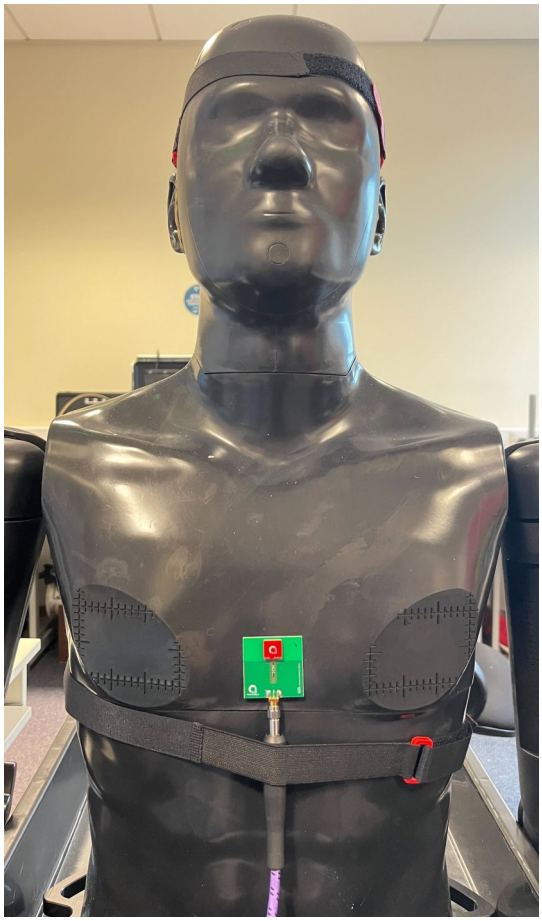
To simulate body mounted performance, the Speag mmW-POPEYE10 Phantom Upper Body which includes chest, abdomen and head phantoms was used. (See below figure).

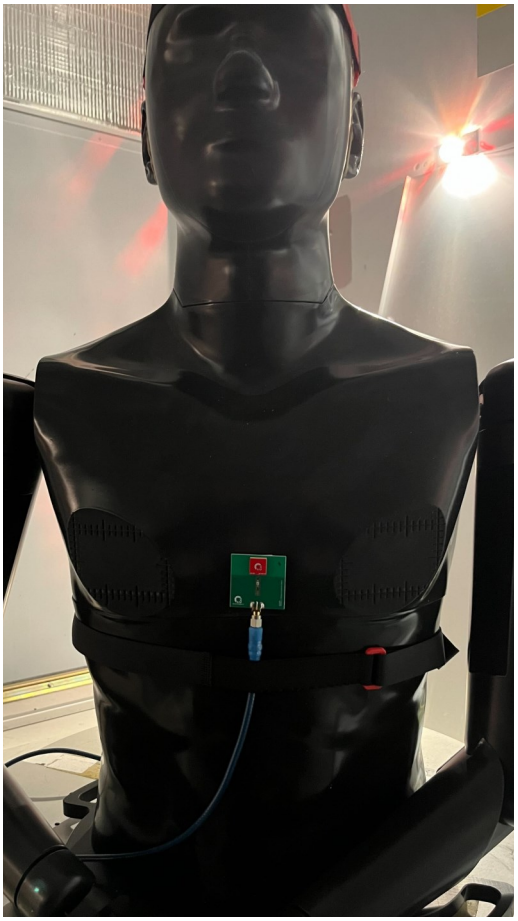
Speag mmW-POPEYE10 Phantom Upper Body Features :-

- **Frequency Range :-** 3 to > 100GHz
- **Dimensions :-** 356 mm x 212 mm x 770 mm (l x w x h).
- **Materials :-** Comprised of a lossy silicone-carbon based material with realistic losses for body-mounted devices. It is supported by a conductive inner skeleton providing a conductive connection between the head and abdomen.
- **Added Features :-** A special low-loss silicone coating is applied to mmW-POPEYE10 that extends the frequency range beyond 100 GHz. Thus permitting simulating any realistic human posture and entire range of device usage.

Dimensions meet requirements for conservative testing (further information is available upon request).

- **Note :-** More information about this phantom can be found at the website: www.speag.swiss/

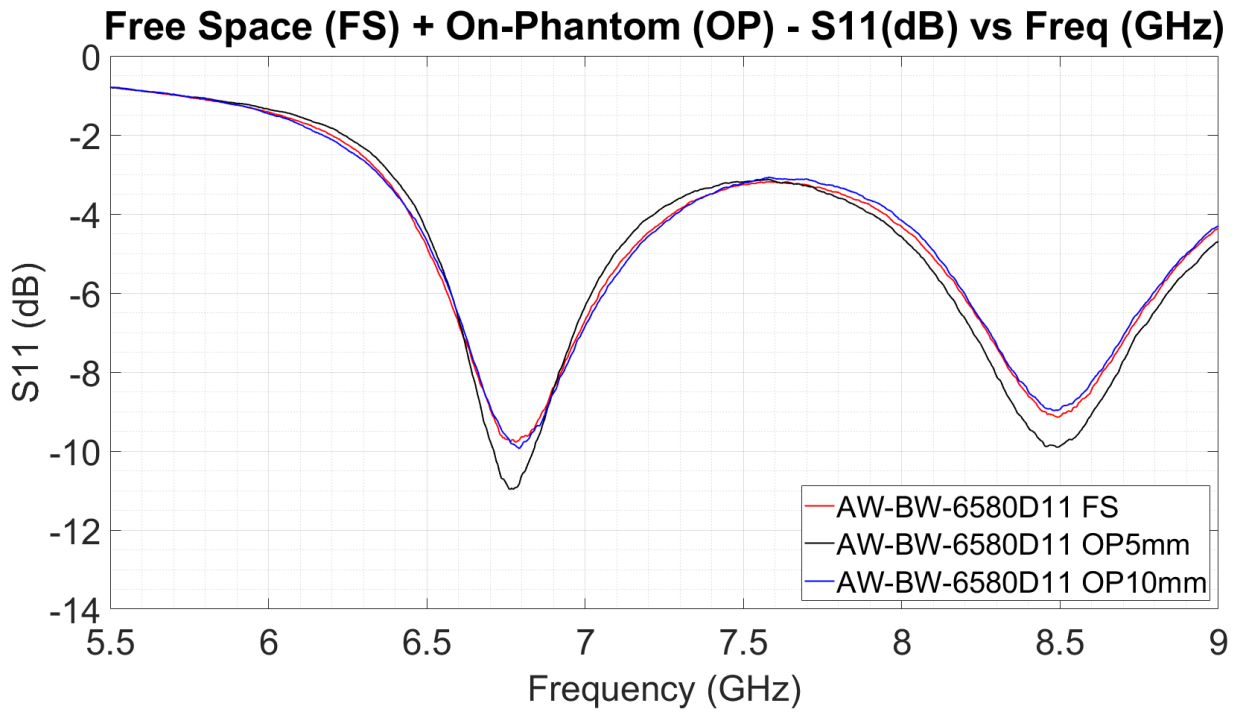




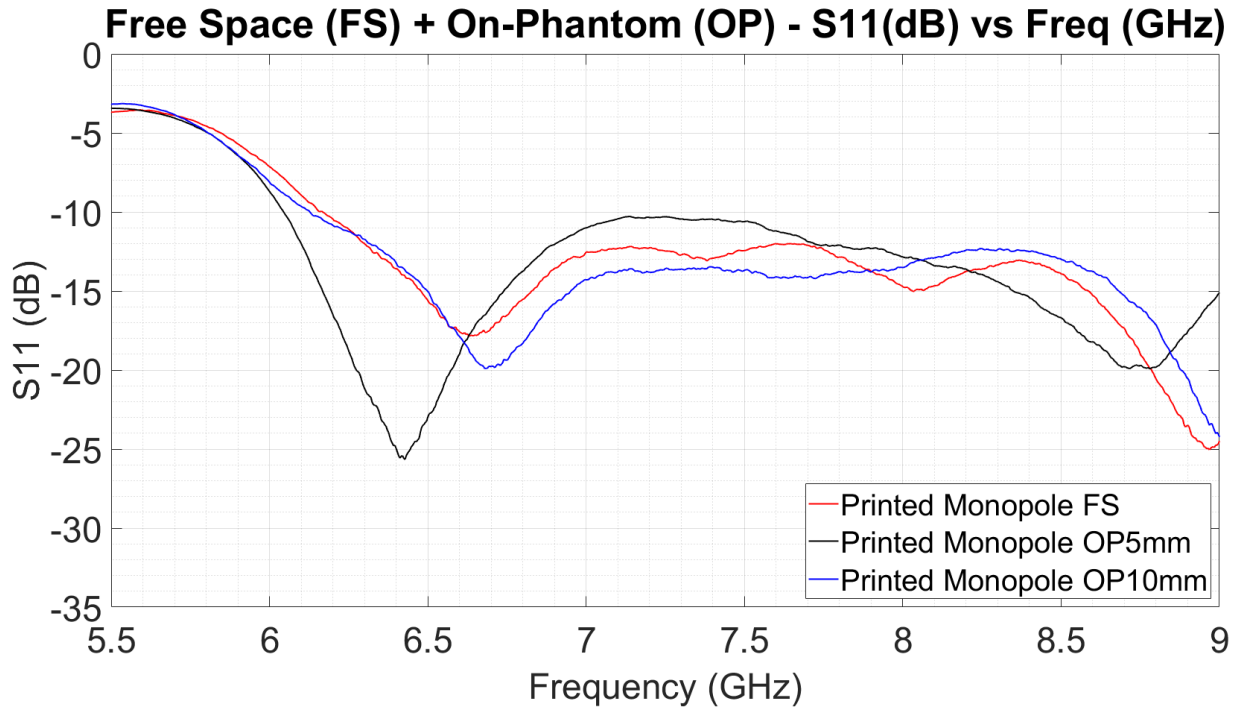
10.2 On-Body Antenna Performance

The return loss image below highlights the BodyWave™ Antenna's strong resistance to detuning normally caused by varying proximity to the human body compared to an existing commonly used UWB Printed Flared Monopole. This greatly increases reliability by reducing unpredictable antenna detuning once integrated into a wearable device.

Return Loss (dB) :- AW-BW-6580D11



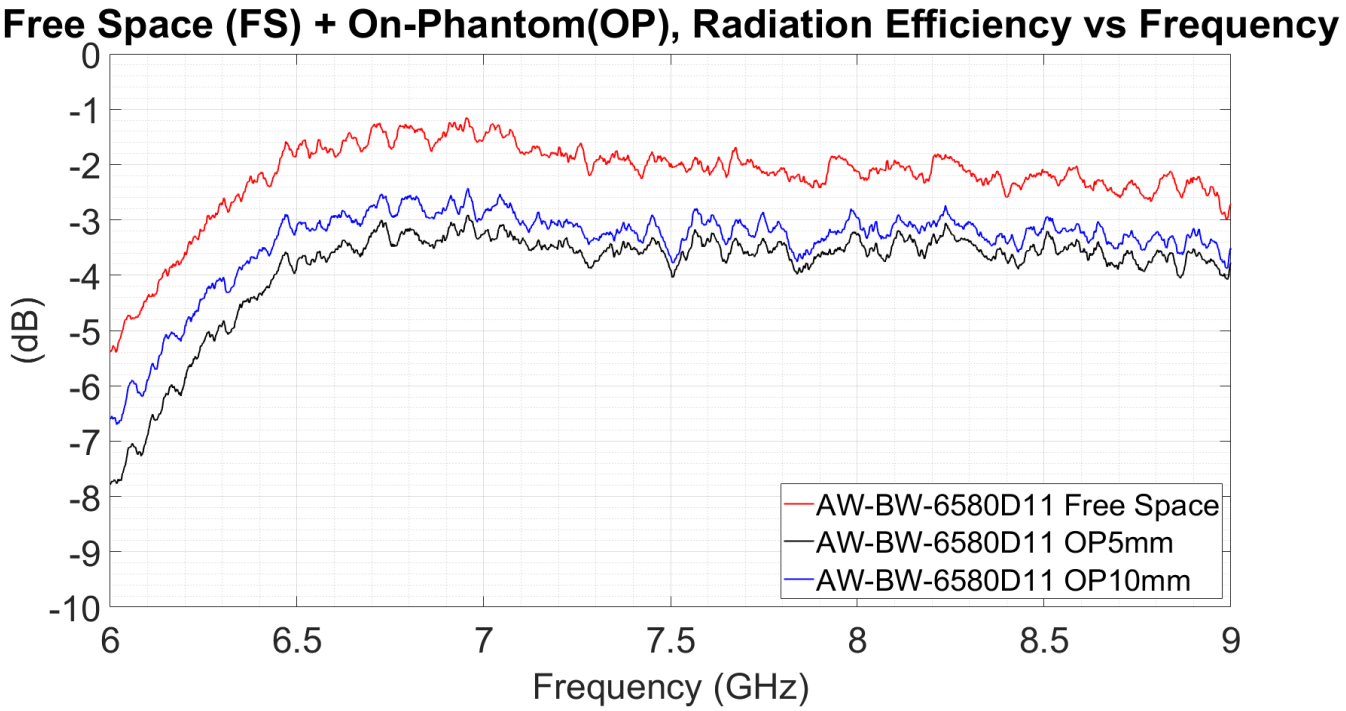
Return Loss (dB) :- Printed Flared Monopole



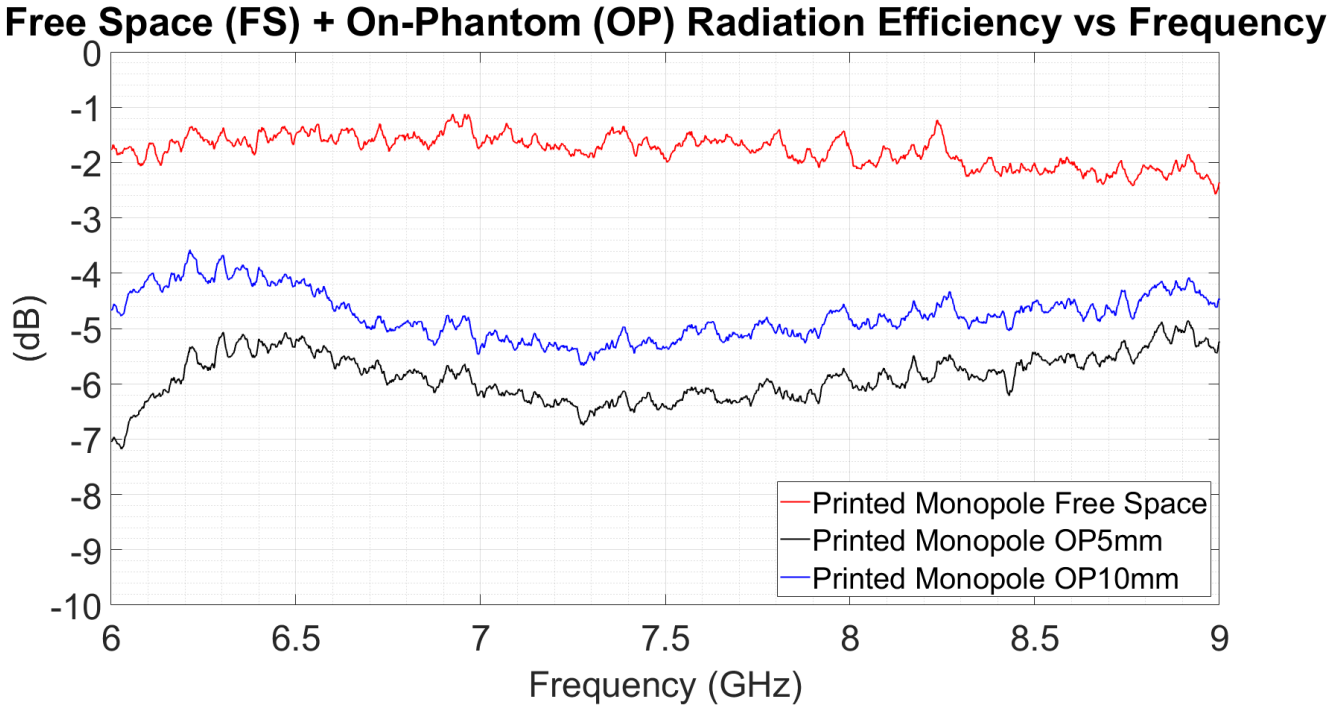
10.3 On-Body Radiation Efficiency

From the On-Body Radiation Efficiency comparison. The BodyWave™ Antenna shows a reduced variation in Radiation Efficiency Performance when situated in a challenging operating environment such as mounted on the human body. In contrast to an existing commonly used Printed Flared Monopole solution, it can be seen that the performance variation and degradation is much greater for the Printed Flared Monopole when situated On-Body.

Radiation Efficiency (dB) :- AW-BW-6580D11



Radiation Efficiency (dB) :- Printed Flared Monopole



AntennaWare

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