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Operational Manual

Passive Imaging & Radiometers (PMMW)

QUALITY
ISO 9001:2015
NSAI Certified

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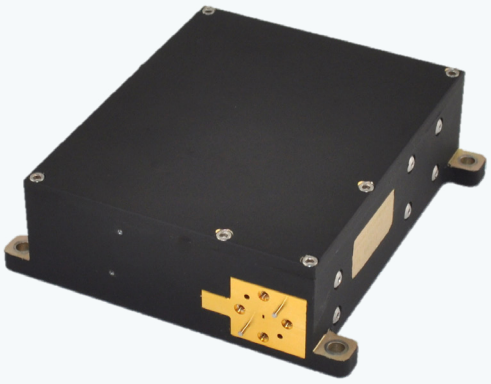
1. Introduction



Thank you for choosing a PMMW Passive Millimeter-Wave receiver. This user manual provides all the information related to installation, operation and troubleshooting of your PMMW. In order to bring out the maximum performance, we advise that you read this user's manual before using this product for the first time and consult it later should such a need arise.

The PMMW is a family of Passive Millimeter-Wave receiver components and subsystems used for non-illuminating imaging purposes at frequencies up to 300 GHz. These devices can operate as radiometric receivers based on either a direct detection or a heterodyne detection principles. They offer industry leading noise temperature performance and wide bandwidths, allowing to achieve short integration times and high resolution images.

PMMW imaging provides the unique capability to create high resolution images in low visibility conditions (e.g. through clothing, clouds or fog) and therefore useful for such an applications as concealed weapon detection and airplane landing. A low attenuation atmospheric window in the W and G bands makes these bands ideal candidate for PMMW systems. Passive imagers operate by detecting naturally emitted thermal (black body) radiation from an object. It consists of a low noise front end with high gain followed by a broadband detector operating in the square law region. The detected signal is then conditioned in a video amplifier to give the required output voltage level at room temperature measurement. Custom PMMW front-ends are available upon request.

General Safety Precautions.
To prevent property damage and personal injury, observe all instructions and warnings given in this manual.

2. List of parts

2.1 What's in the box

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7. Technical Specifications

7.1 PMMW-10-XX

Table 1. PMMW-10-XX Specifications

System Specification	Unit	Min	Typ	Max
Frequency of operation	GHz	75	-	110
Noise Figure	dB	-	4	4.5
Gain	dB	-	25	-
Sensitivity @ +25° C (*Note 1)	K	-	4.0	4.4
Video Output @ +25° C Load (*Note 2)	mV	1,000	-	1,200
Dimensions	mm		90 x 28 x13	
Weight	g		85	
Power Consumption	W		0.25 (5V @ 50mA)	

Notes:

1. Sensitivity calculated from the equation: $\Delta T = \frac{T_A + T_N}{\sqrt{\beta\tau}}$ Where: $T_A = 295\ K,$ $\beta = 35\ GHz,$ $\tau = 1\ \mu s$
2. Differential output - customer defined as FTL can adjust the video gain to give required output voltage.

The measured results are traceable only to Farran's laboratory equipment.

Due to the fact that there is no filter present in the system it is not possible to measure the noise figure performance at a specific bandwidth or frequency as the noise figure measurement is a broadband measurement hence noise figure measurements of the system are full-band measurements where the average noise figure across the full band of operation of amplifier and detector is the result.

Table 1 contains measurements for direct detect system and also has an indicative measurement of the front end Low Noise Amplifier used in the system to show the actual performance of the front end at specific frequencies, in the case of PMMW-10-XX module, the frequency of interest is 94 GHz.

Specification Definitions

Nominal value (nom.) – ensured by design, not tested. **Measured value (min, max)** – expected and warranted product performance obtained from the actual measurements of product sample. **Non-traceable measured value (n. trc. meas.)** – expected product performance obtained from the actual measurements of a product sample by means of using Farran's own equipment and methods. Traceable only to Farran laboratory equipment. **Typical data (typ.)** – value that represents the product specification met over 90% of bandwidth or a mean value. **Specifications without limits** – represent the warranted product performance; with values of no or a negligible deviation from the given value and as such have a secondary impact on the product performance.

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7. Technical Specifications

7.2 PMMW-05-XX

Table 2. PMMW-05-XX Specifications

System Specification	Unit	Value
Frequency of operation	GHz	183.3
RF Bandwidth	GHz	16 (±8)
LO Source Frequency	GHz	91.65
Noise Temperature	K	< 1200 @ +25°C
System Gain	dB	30
Gain Flatness	dB/ GHz	1.5
LO Leakage	dBc	< -50
DRO Frequency Accuracy @ 25°C	MHz	±0.5
DRO Frequency Stability	±ppm/ °C	2
RF Port Connector	-	WR-05, UG-387/UM
IF Port Connector	-	SMA Female
Power Requirements	-	+12 V @ 170 mA, +5 V @ 700 mA
Weight	kg	<0.6
Dimensions	mm	110 x 90 x 35
Coating Emissivity	-	0.9
Coating Solar Absorption	-	>95

The PMMW-05-XX DSB Noise Figure is tested using “hot and cold” measurement method at the RF input to the unit.

PMMW-05-XX temperature tests ranges from -10 °C to +40 °C with 5 °C step. The nominal operational temperature specified is +25 °C.

The measured results are traceable only to Farran’s laboratory equipment. The estimated relative measurement error was ±45K.

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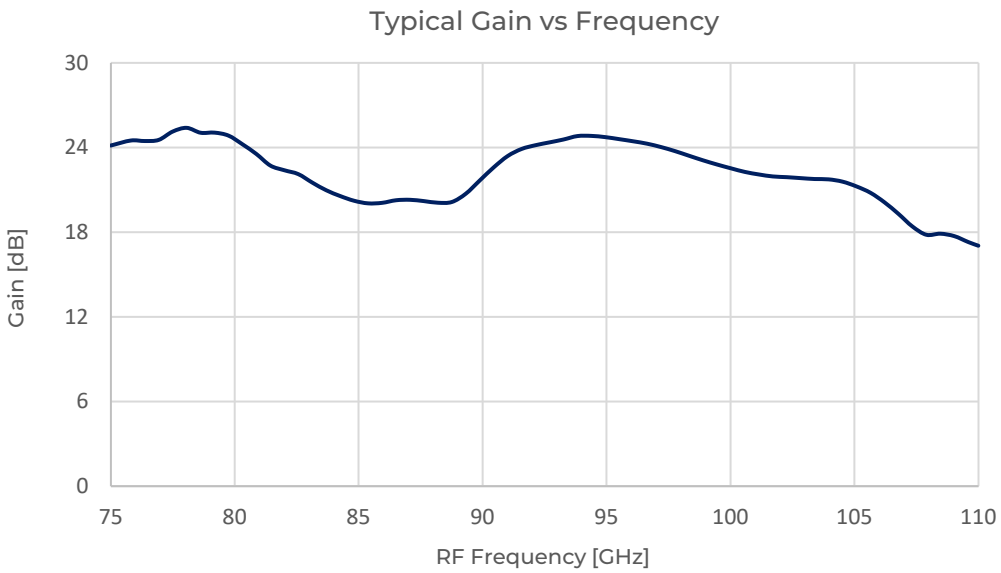
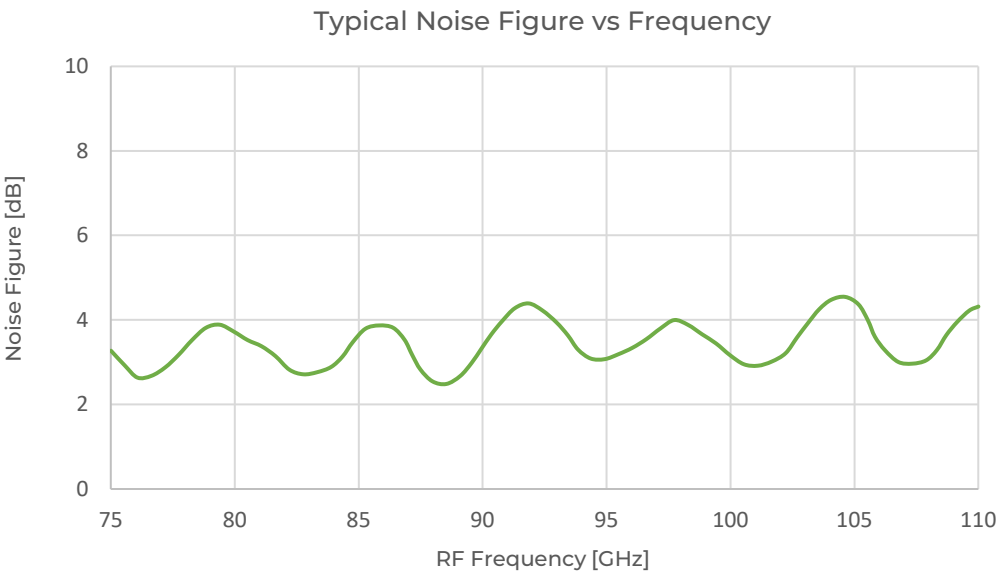
8. Typical Performance

Farran's PMMW-XX imaging front end perfomance plots are provided in this section, for all models. Unless otherwise stated, all perfomance data furnished here has been obtained from in-house measurements.

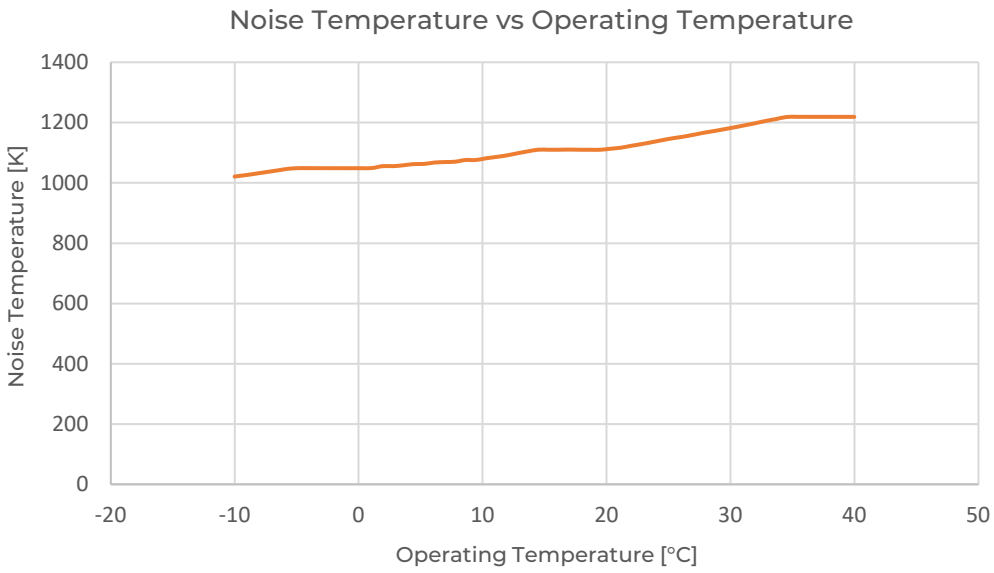
8.1 PMMW-10-XX

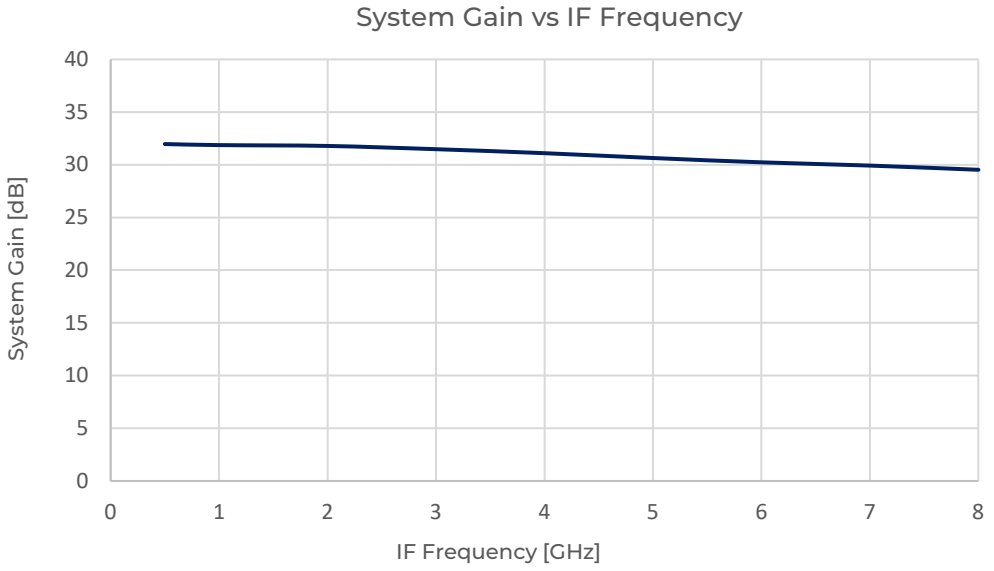




8. Typical Performance

8.2 PMMW-05-XX





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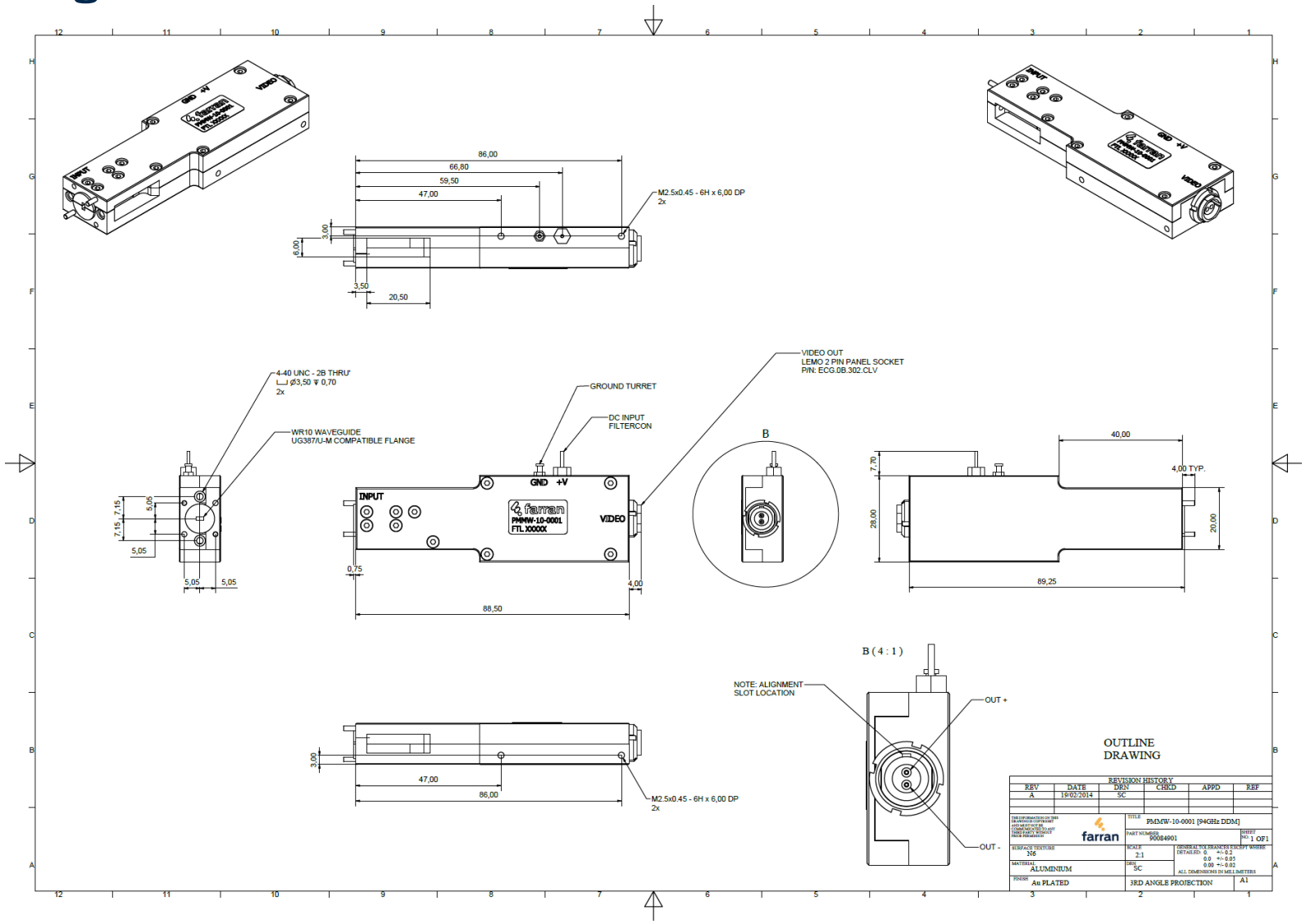
12. Appendices

12.1 Drawings

PMMW-10-XX



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12. Appendices

12.1 Drawings

PMMW-05-XX