TABLE OF CONTENTS

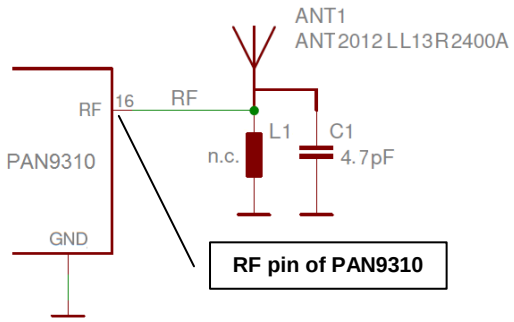
1. TRACE LAYOUT AND DIMENSIONS INCLUDING SPECIFIC DESIGN

1.1. DETAILED ENGINEERING REFERENCE

1.1.1. Answer 11 item 1a:

The PAN9310 module has a 50 Ohm RF pin (SMD pad). The antenna trace to be connected to the RF pin has to be matched to 50ohm impedance. Therefor the following antenna trace with the components and design has to be used.

Schematic:



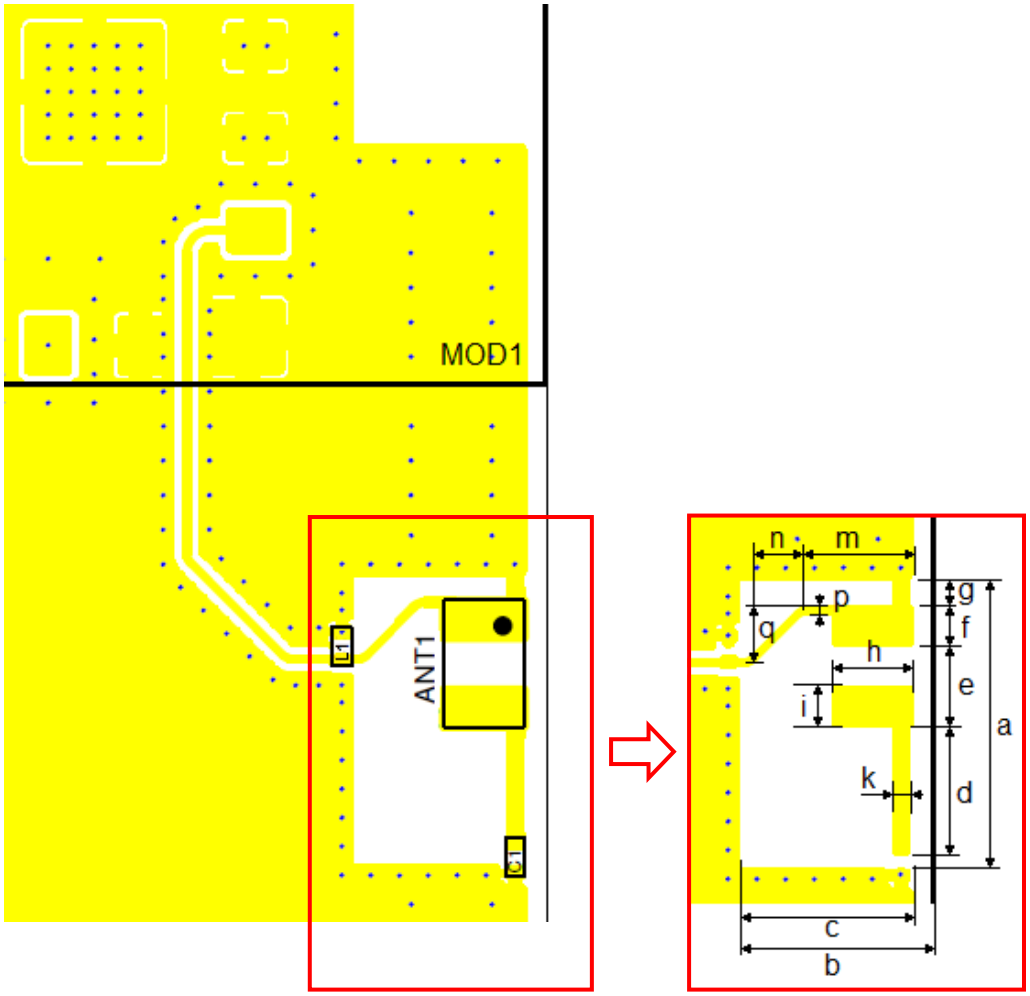
Reference parts:

- PCB: FR4, 4-Layer (Nan-Ya NP140)
- ANT1: ANT2012LL13R2400A (YAGEO)
- C1: CAP-C 4,7pF 25V= +/-0,1p 0201 COG MURATA
- L1: NC

Antenna and trace layout design:

- Trace Target Impedance is 50 Ohm
- Trace Width Layer 1 is 150 µm
- Trace Distance Layer 1 to Ground Layer 1 is 140 µm
- Trace Distance Layer 1 to Ground Layer 2 is 107,2 µm
- Substrate Thickness between Layer 1 and Layer 2 is 107,2 µm
- Trace length shall not exceed 2 cm

PCB layout extract from RF pin (SMD pad) of PAN9310 to chip antenna:



Item	Layer 1	Layer 2	Layer 3	Layer 4
a	5,00 mm	5,00 mm	5,00 mm	5,50 mm
b	3,30 mm	3,30 mm	3,30 mm	3,55 mm
c	3,00 mm	3,00 mm	3,00 mm	3,25 mm
d	2,25 mm	-	-	-
e	1,40 mm	-	-	-
f	0,70 mm	-	-	-
g	0,45 mm	-	-	-
h	1,40 mm	-	-	-
i	0,70 mm	-	-	-
k	0,30 mm	-	-	-
m	1,90 mm	-	-	-
n	0,90 mm	-	-	-
p	0,15 mm	-	-	-
q	1,00 mm	-	-	-
Micro Via	0,10 mm		0,10 mm	
Burried Via	-	0,30 mm		-

1.1.2. Answer 11 item 1b, c:

Only following chip antennas are listed:

- YAGEO ANT2012LL13R2400A

Specification:

SPECIFICATION

Table 1

DESCRIPTION	VALUE
Centre Frequency	2.45 GHz
Bandwidth	85 MHz (Typ.)
Polarization	Linear
Azimuth Beamwidth	Omni-directional
Peak Gain	2.72 dBi (Typ.)
Impedance	50 Ω
Operating Temperature	- 40~105 ℃
Maximum Power	1 W
Termination	Ni / Sn (Environmentally-Friendly Leadless)
Resistance to Soldering Heats	260℃ , 10sec.

NOTE

1. The specification is defined on Yageo evaluation board

DIMENSIONS

Table 2 Machinical Dimension

	DIMENSION
L (mm)	2 ±0.20
W (mm)	1.25 ±0.20
T (mm)	1.00 ±0.20

OUTLINES

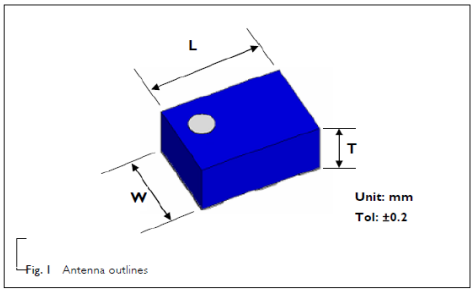
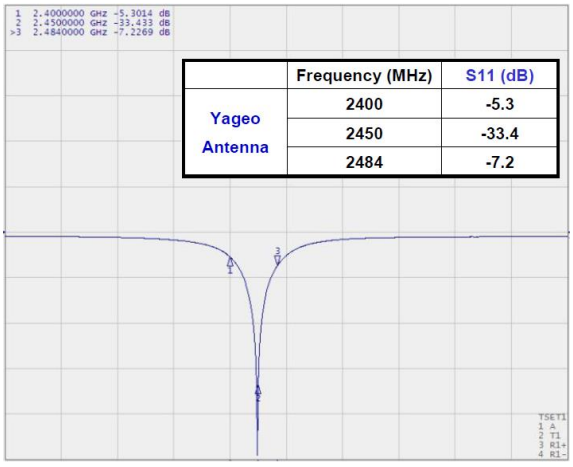


Fig. 1 Antenna outlines

Measurement of S11 parameter:



Measurement of Peak gain and Efficiency:

3D	Frequency (MHz)	S11 (dB)	Peak gain (dBi)	Ave. gain (dBi)	Efficiency (%)
Yageo Antenna	2400	-5.3	-1.1	-5.2	29.6
	2450	-33.4	0.8	-3.2	47.0
	2484	-7.2	-0.9	-4.9	32.1

On reference design the listed chip antenna has a Peak gain of +0.8 dBi.

1.1.3. Answer 11 item 1d:

Above data for PCB layout can be requested in original Cad format by writing an email to wireless@eu.panasonic.com

1.1.4. Answer 11 item 2:

If using an chip antenna for ANT1 the part C1 has to be mounted. For C1 the manufacturer has to be muRata 0201/COG/4.7pF/25V/±0,1p. L1 don't have to be mounted.

1.1.5. Answer 11 item 3:

The impedance S11 of the antenna including the trace shall be measured with a network analyser.

1.1.6. Answer 11 item 4:

In the production the output power of the radiated emissions shall be measured with a spectrum analyser.

2. HISTORY FOR THIS DOCUMENT

Revision Version	Date Datum	Modification / Remarks Änderungen / Bemerkungen
1.0	25.11.2015	Puplished Version for FCC Website