QM28012

L5 GPS-LMB/GNSS/2.4GHz WiFi/5GHz WiFi 6E Antennaplexer

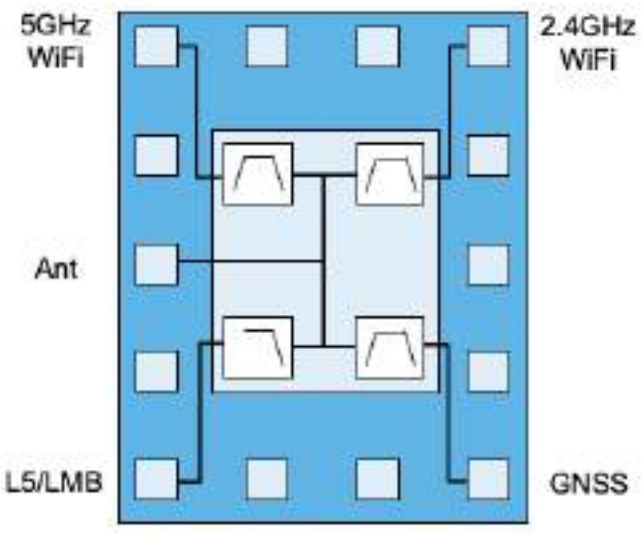
Product Overview

The QM28012 is a compact, high-performance filter module designed to meet the strict requirements for L5 GPS-LMB Cell, GNSS, 2.4G WLAN and 5G WLAN from 1100 MHz – 1518 MHz, 1559.05 MHz – 1605.89 MHz, 2403 – 2481 MHz, and 5150 MHz – 7125 MHz respectively.

The QM28012 is part of Qorvo's family of Antennaplexers using patented technology to meet the high performance expectations of insertion loss and rejection for LTE/NR cellular, L1/L5 GPS, and WLAN systems under all operating conditions

The QM28012 uses common module packing techniques to achieve a compact 2.0 mm x 1.6 mm footprint.

Functional Block Diagram



Top View

16 Pin 2.0 x 1.6mm leadless SMT package

Key Features

- Compact Form-Factor: 2.0 mm x 1.6 mm
- Highly selective filters achieving low insertion loss and high attenuation over full bandwidth
- Single antenna port quadplexing
- RoHS Compliant, Pb-Free Module Package
- Supports 5GHz WiFi 6E

Applications

- For L5 GPS-LMB Cell, GNSS, 2.4GHz WLAN and 5GHz WLAN
- GPS, LTE, 5G, and WiFi 6E Handsets

Ordering Information

Part Number	Description
QM28012EVB	Evaluation Board (EVB)
QM28012SB	Sample bag of 5 pieces
QM28012SR	Sample reel of 100 pieces
QM28012TR13	13 inch reel of 10k pieces

Absolute Maximum Ratings(1)

Parameter	Condition	Rating	UNITS
Storage Temperature		-40 to +90	°C
Operating Case Temperature		-30 to +85	
RF Input Power (Pin5, 2.4GHz WiFi)	2403 MHz – 2481 MHz	+24	dBm
RF Input Power (Pin8, 5GHz WiFi 6E)	5150 MHz – 5925 MHz	+24	dBm
	5925 MHz – 6425 MHz		
	6425 MHz – 7125 MHz		
RF Input Power (Pin12, L5 GPS-LMB Cell)	1100 MHz – 1470 MHz	+30	dBm
RF Input Power (Pin6, ANT)	1100 MHz – 1518 MHz	+15	dBm
	1559 MHz – 1606 MHz		
	2403 MHz – 2481 MHz		
	5150 MHz – 5925 MHz		
	5925 MHz – 6425 MHz		
	6425 MHz – 7125 MHz		

Notes:

1. Operation of this device outside the parameter ranges given above may cause permanent damage.

Electrical Specifications[1] L5 GPS-LMB Cell - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1100 MHz – 1496 MHz	-	0.9[2]	1.3	dB
	1496 MHz – 1518 MHz	-	1.1[2]	2.5	
VSWR (L5 GPS-LMB Cell)	1100 MHz – 1496 MHz	-	1.7:1	2:1	-
	1496 MHz – 1518 MHz	-	2:1	2.7:1	
VSWR (ANT)	1100 MHz – 1518 MHz	-	1.7:1	2:1	-
Attenuation	1559 MHz – 1606 MHz	15	20	-	dB
	2403 MHz – 2421 MHz (WiFi CH1)[3]	15	23	-	
	2408 MHz – 2426 MHz (WiFi CH2)[3]	15	22	-	
	2413 MHz – 2431 MHz (WiFi CH3)[3]	15	22	-	
	2418 MHz – 2436 MHz (WiFi CH4)[3]	16	21	-	
	2423 MHz – 2446 MHz (WiFi CH5-6)[3]	16	21	-	
	2433 MHz – 2456 MHz (WiFi CH7-8)[3]	15	21	-	
	2443 MHz – 2461 MHz (WiFi CH9)[3]	14	20	-	
	2443 MHz – 2466 MHz (WiFi CH10)[3]	14	19	-	
	2453 MHz – 2471 MHz (WiFi CH11)[3]	13	19	-	
	2458 MHz – 2476 MHz (WiFi CH12)[3]	13	18	-	
	2463 MHz – 2481 MHz (WiFi CH13)[3]	14	18	-	
	5150 MHz – 5925 MHz	23	25	-	
	5925 MHz – 6425 MHz	30	35	-	
	6425 MHz – 7125 MHz	8	21	-	

Notes:
1. All specifications are based on the Qorvo schematic for the main reference design
2. Typical specified as average at room temperature
3. Integrated over each 18MHz 2.4GHz WiFi Channel

Electrical Specifications[1] L1 GNSS - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1559.05 MHz – 1563.15 MHz	-	1.2[2]	1.6	dB
	1574.39 MHz – 1576.45 MHz	-	1.0[2]	1.5	
	1597.55 MHz – 1605.89 MHz	-	1.4[2]	2.4	
VSWR (GNSS)	1559.05 MHz – 1563.15 MHz	-	1.1:1	2:1	-
	1574.39 MHz – 1576.45 MHz	-	1.1:1	2:1	
	1597.55 MHz – 1605.89 MHz	-	1.5:1	2:1	
VSWR (ANT)	1559.05 MHz – 1563.15 MHz	-	1.1:1	2:1	-
	1574.39 MHz – 1576.45 MHz	-	1.2:1	2:1	
	1597.55 MHz – 1605.89 MHz	-	1.5:1	2:1	
Attenuation	10 MHz – 960 MHz	45	49	-	dB
	777 MHz – 787 MHz	45	54	-	
	1427.9 MHz – 1462.9 MHz	45	59	-	
	1640 MHz – 1695 MHz	45	51	-	
	1670 MHz – 1785 MHz	48	50	-	
	1786 MHz – 1797 MHz	49	50	-	
	1850 MHz – 1910 MHz	49	52	-	
	1910 MHz – 1980 MHz	48	54	-	
	2010 MHz – 2025 MHz	47	57	-	
	2305 MHz – 2315 MHz	45	58	-	
	2403 MHz – 2426 MHz (WiFi CH1-2)[3]	41	56	-	
	2413 MHz – 2436 MHz (WiFi CH3-4)[3]	41	55	-	
	2423 MHz – 2451 MHz (WiFi CH5-7)[3]	41	54	-	
	2438 MHz – 2456 MHz (WiFi CH8)[3]	41	53	-	
	2443 MHz – 2461 MHz (WiFi CH9)[3]	41	52	-	
	2448 MHz – 2471 MHz (WiFi CH10-11)[3]	41	51	-	
	2458 MHz – 2476 MHz (WiFi CH12)[3]	41	50	-	
	2463 MHz – 2481 MHz (WiFi CH13)[3]	41	51	-	
	2500 MHz – 2570 MHz	40	45	-	
	2570 MHz – 2690 MHz	35	44	-	
	3400 MHz – 3600 MHz	25	42	-	
	4400 MHz – 4900 MHz	27	54	-	
	5150 MHz – 5925 MHz	25	45	-	
	5925 MHz – 6425 MHz	43	51	-	
	6425 MHz – 7125 MHz	34	43	-	

Notes:
1. All specifications are based on the Qorvo schematic for the main reference design
2. Typical specified as average at room temperature
3. Integrated over each 18MHz channel

Electrical Specifications[1] 2.4GHz WiFi - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	2403 MHz – 2421 MHz[2] (WiFi CH1)	-	1.8	2.2	dB
	2408 MHz – 2426 MHz[2] (WiFi CH2)	-	1.6	2	
	2413 MHz – 2456 MHz[2] (WiFi CH3-8)	-	1.4	2	
	2443 MHz – 2461 MHz[2] (WiFi CH9)	-	1.3	2	
	2448 MHz – 2466 MHz[2] (WiFi CH10)	-	1.4	2	
	2453 MHz – 2471 MHz[2] (WiFi CH11)	-	1.5	2.2	
	2458 MHz – 2476 MHz[2] (WiFi CH12)	-	1.6	2.5	
	2463 MHz – 2481 MHz[2] (WiFi CH13)	-	1.7	2.9	
VSWR (Wi-Fi)	2403 MHz – 2481 MHz	-	1.5:1	2.2:1	-
VSWR (ANT)	2403 MHz – 2481 MHz	-	1.6:1	2.2:1	-
Attenuation	925 MHz – 960 MHz	33	43	-	dB
	1559 MHz – 1606 MHz	33	37	-	
	2110 MHz – 2170 MHz	31	36	-	
	2300 MHz – 2370 MHz[3]	31	36	-	
	2500 MHz – 2505 MHz (+25 to +85C)[3]	13	39	-	
	2500 MHz – 2505 MHz (-30 to +25C)[3]	7	39	-	
	2505 MHz – 2690 MHz[3]	35	36	-	
	4800 MHz – 5000 MHz	40	47	-	
	5150 MHz – 5925 MHz	35	41	-	
	5925 MHz – 6425 MHz	39	44	-	
	6425 MHz – 7125 MHz	35	39	-	
	7200 MHz – 7500 MHz	34	36	-	

Notes:
1. All specifications are based on the Qorvo schematic for the main reference design
2. Integrated over each 18MHz 2.4GHz WiFi Channel
3. Integrated over 5MHz bandwidth

Electrical Specifications[1] 5GHz WiFi 6E - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	5150 MHz – 5925 MHz	-	0.9[2]	1.5	dB
	5925 MHz – 6425 MHz	-	1.0[2]	1.6	
	6425 MHz – 7125 MHz	-	1.4[2]	4	
VSWR (5GHz WiFi 6E)	5150 MHz – 5925 MHz	-	1.6:1	2:1	-
	5925 MHz – 6425 MHz	-	1.4:1	2:1	
	6425 MHz – 7125 MHz	-	1.8:1	2.7:1	
VSWR (ANT)	5150 MHz – 5925 MHz	-	1.6:1	2:1	-
	5925 MHz – 6425 MHz	-	1.3:1	2:1	
	6425 MHz – 7125 MHz	-	1.7:1	2.6:1	
Attenuation	824 MHz – 2170 MHz	29	31	-	dB
	2400 MHz – 2500 MHz	20	36	-	
	10300 MHz – 11850 MHz	22	39	-	
	15450 MHz – 17775 MHz	18	35	-	

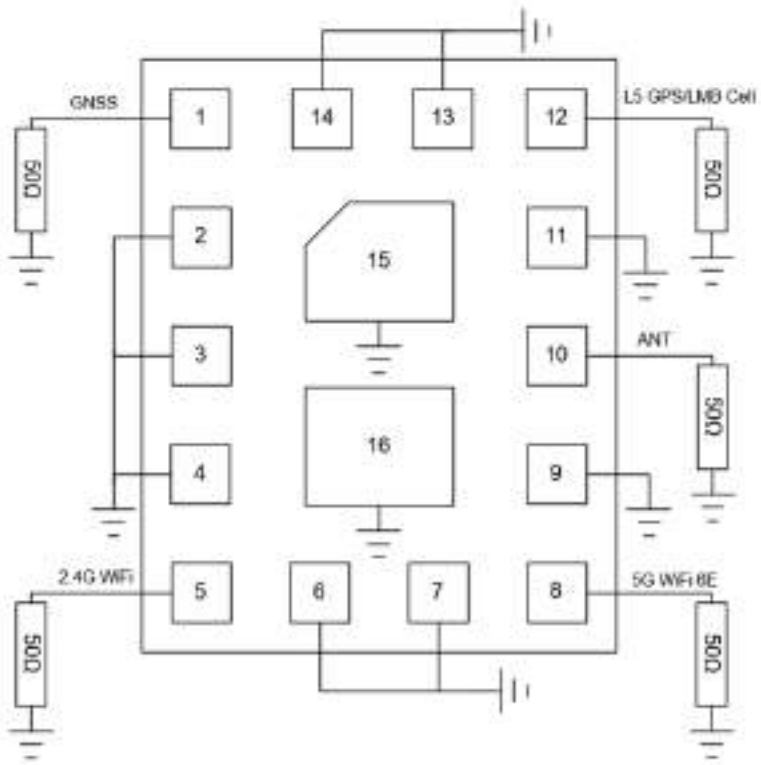
Notes:
1. All specifications are based on the Qorvo schematic for the main reference design
2. Typical specified as average at room temperature

Electrical Specifications[1] Cross-Isolations

Parameter	Conditions	Min.	Typ.	Max.	Units
L5 GPS-LMB to L1 GNSS	1100 MHz – 1518 MHz	30	50	-	dB
	1559.05 MHz – 1605.89 MHz	17	22	-	
L5 GPS-LMB to 2.4G WiFi	1100 MHz – 1518 MHz	30	38	-	dB
	2403 MHz – 2481 MHz	14	19	-	
L5 GPS-LMB to 5G WiFi 6E	1100 MHz – 1518 MHz	30	34	-	dB
	5150 MHz – 5925 MHz	20	27	-	
	5925 MHz – 6425 MHz	31	35	-	
	6425 MHz – 7125 MHz	14	21	-	
L1 GNSS to 2.4G WiFi	1559.05 MHz – 1605.89 MHz	30	38	-	dB
	2403 MHz – 2481 MHz	30	52	-	
L1 GNSS to 5G WiFi 6E	1559.05 MHz – 1605.89 MHz	30	35	-	dB
	5150 MHz – 5925 MHz	30	45	-	
	5925 MHz – 6425 MHz	43	53	-	
	6425 MHz – 7125 MHz	40	48	-	
2.4G WiFi to 5G WiFi 6E	2403 MHz – 2481 MHz	30	40	-	dB
	5150 MHz – 5925 MHz	30	47	-	
	5925 MHz – 6425 MHz	34	43	-	
	6425 MHz – 7125 MHz	35	41	-	

Notes:
1. All specifications are based on the Qorvo schematic for the main reference design

Application Circuit Schematic



Note:

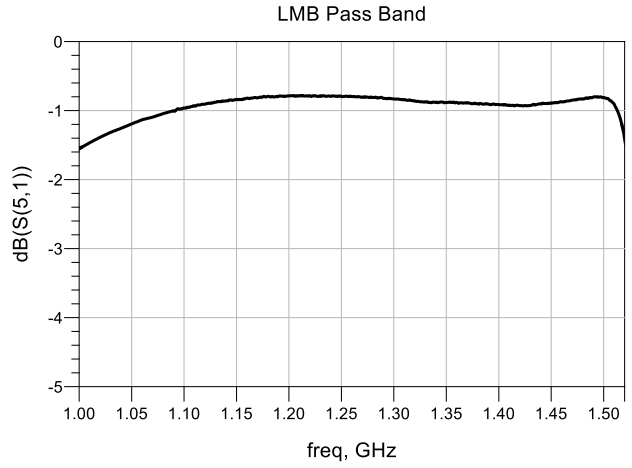
1. All RF ports internally matched to 50 ohm impedance
2. Recommend connecting all ground pins together on PCB
3. Recommend adding Pi network close to each RF port for phone level tuning/optimization

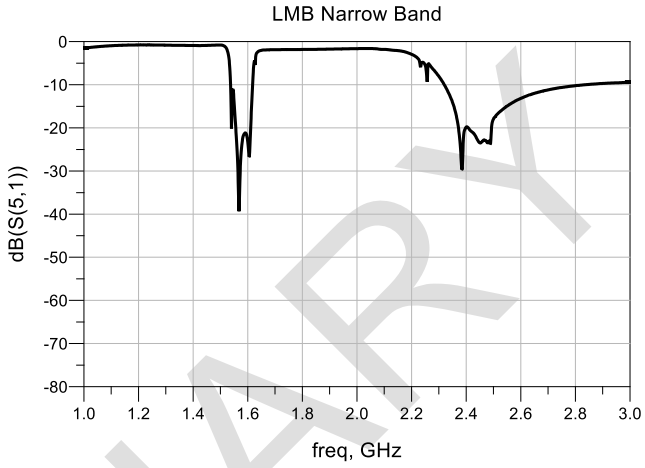
Bill of Materials

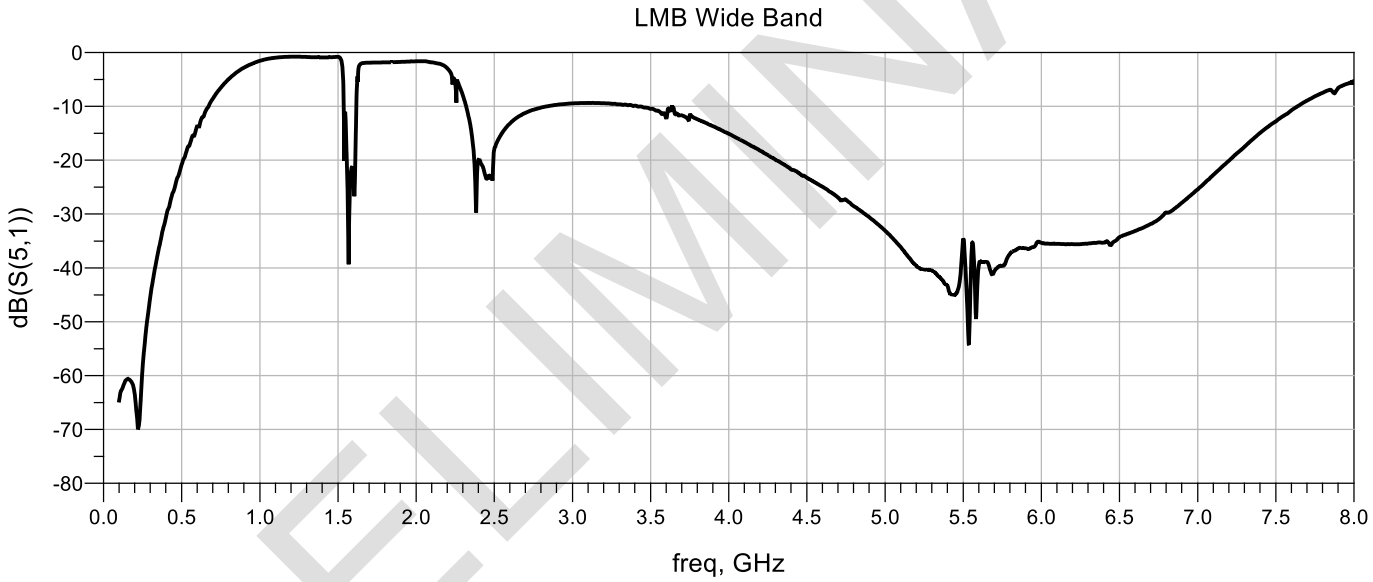
Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	L5 GPS-LMB/GNSS/2.4GHz WiFi/5GHz WiFi 6E Antennaplexer	Qorvo	QM28012
PCB	N/A	4-layer Printed Circuit Board		QM28012-4000

L5 GPS-LMB Insertion Loss and Attenuation

Test conditions unless otherwise noted: Temp. = +25 °C

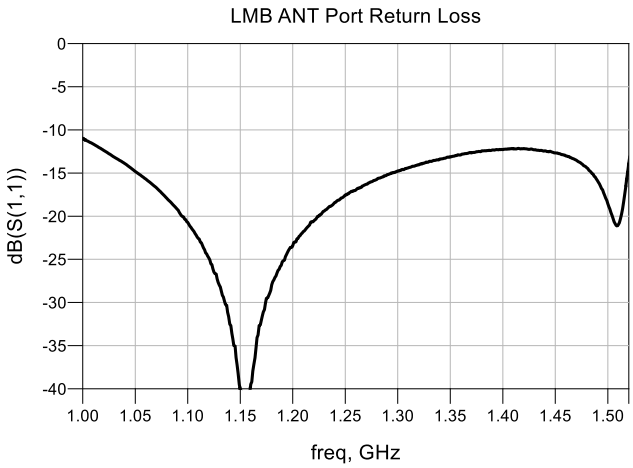


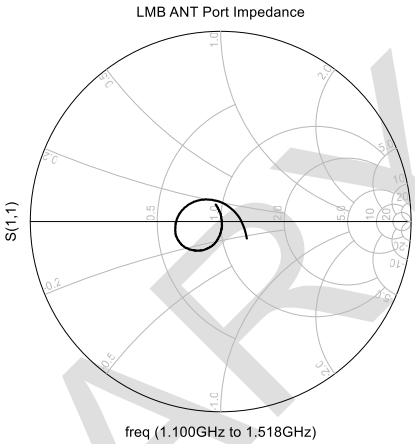


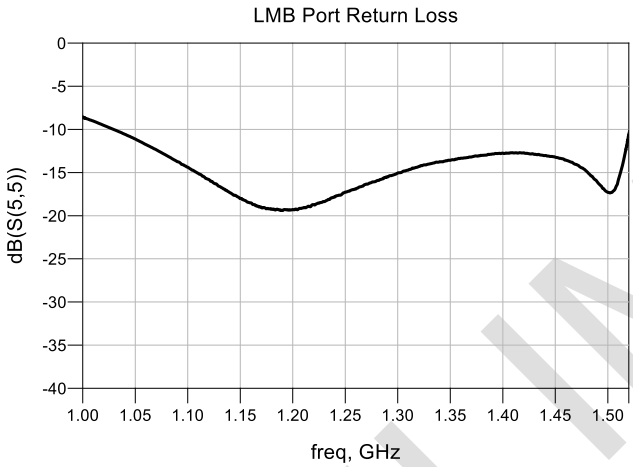


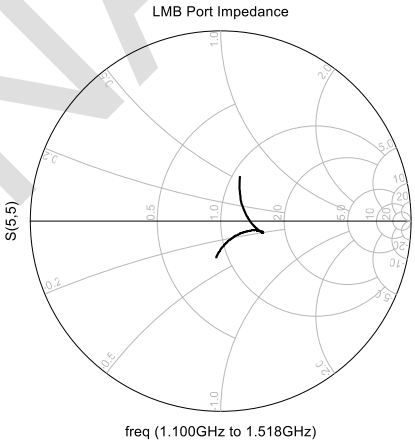
L5 GPS-LMB Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25 °C



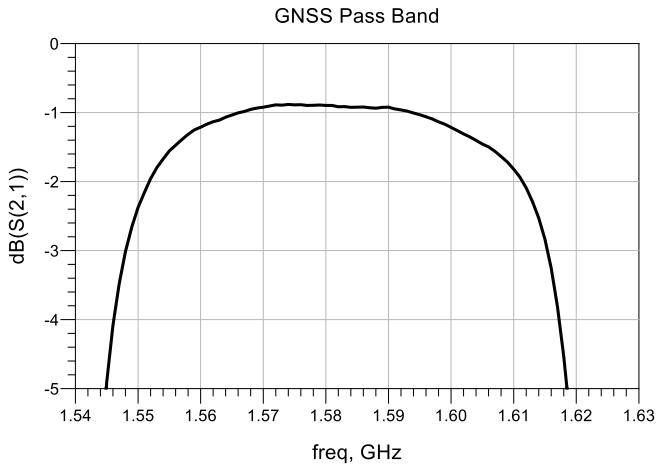


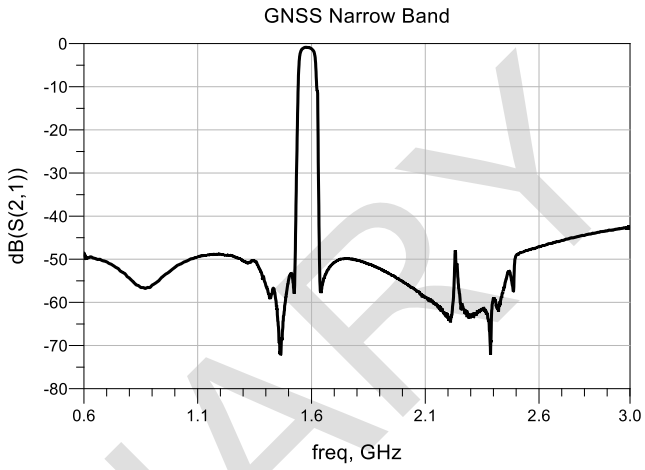


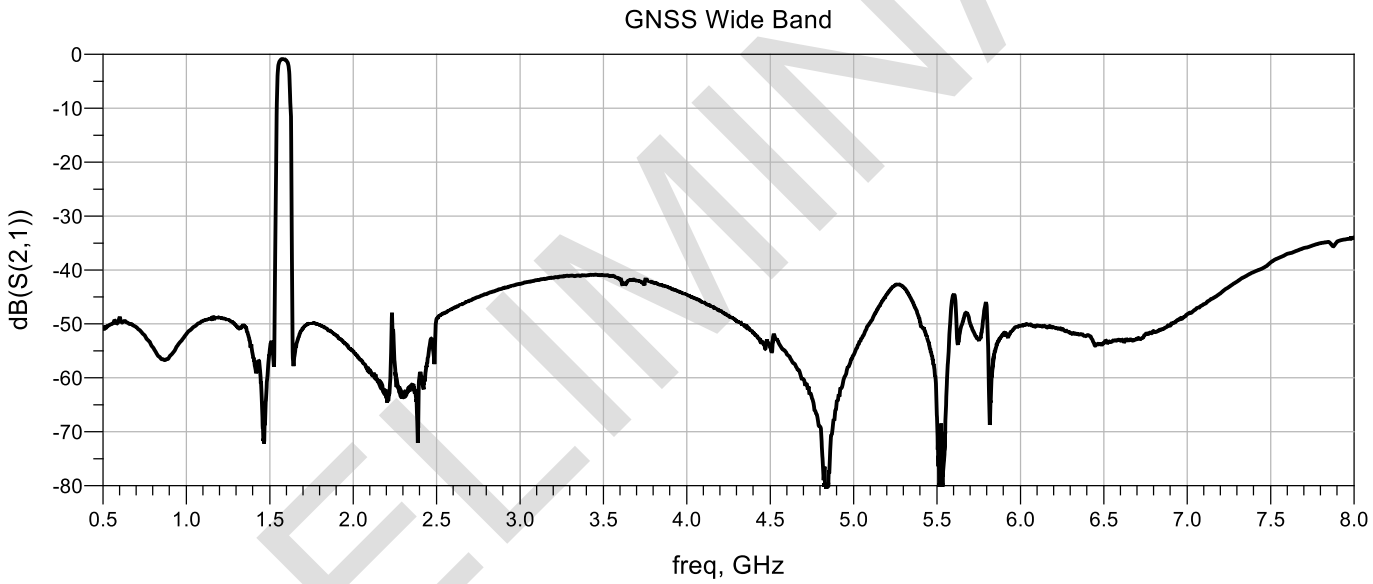


GNSS Insertion Loss and Attenuation

Test conditions unless otherwise noted: Temp. = +25 °C

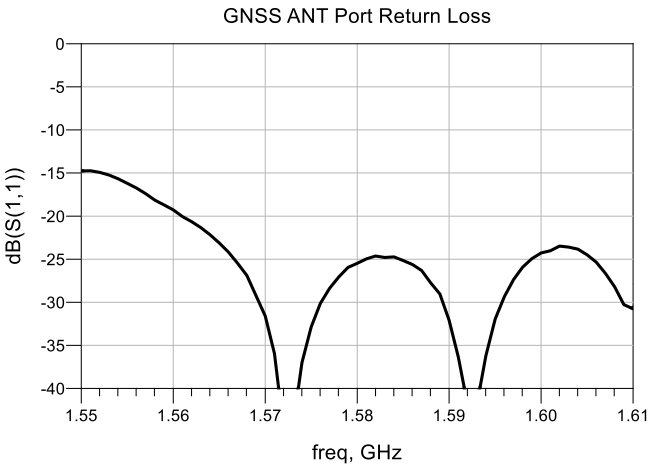


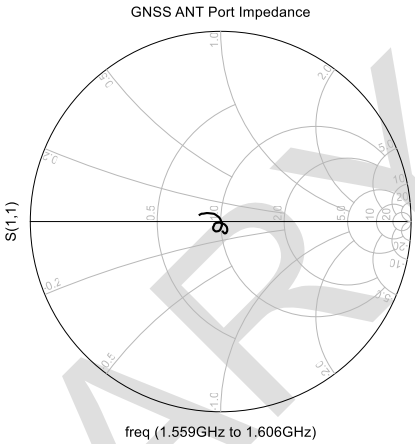


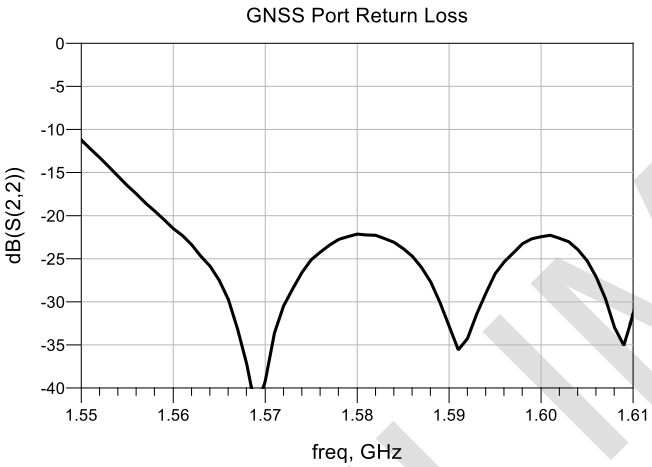


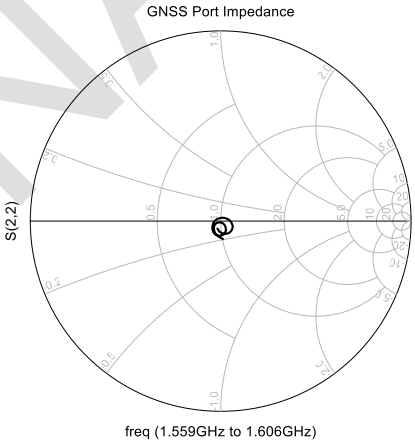
GNSS Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25 °C





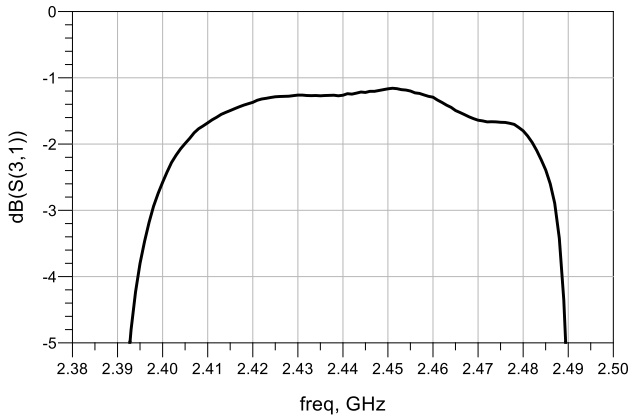




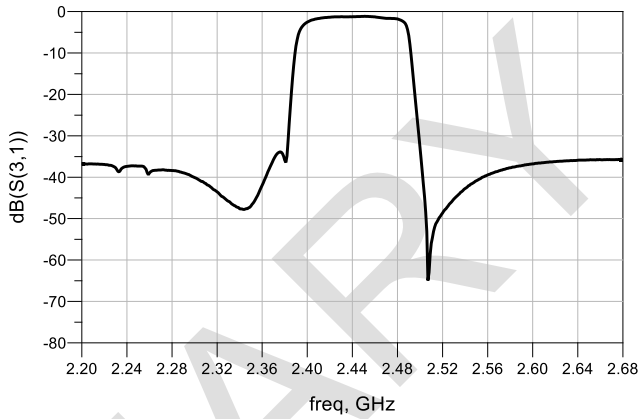
2.4GHz WiFi Insertion Loss and Attenuation

Test conditions unless otherwise noted: Temp. = +25 °C

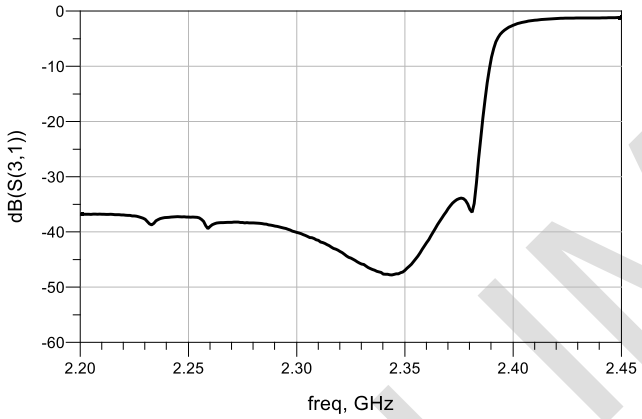
2.4GHz WiFi Pass Band



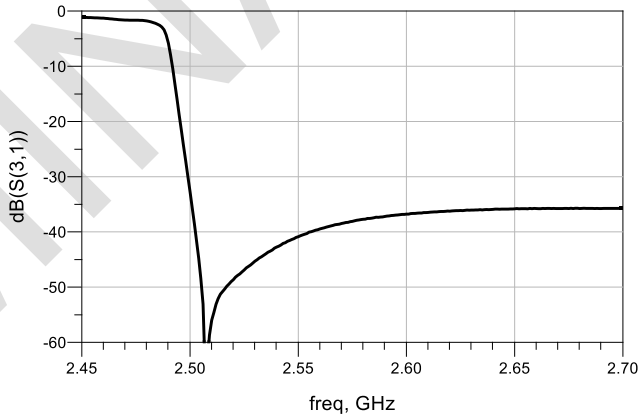
2.4GHz WiFi Narrow Band



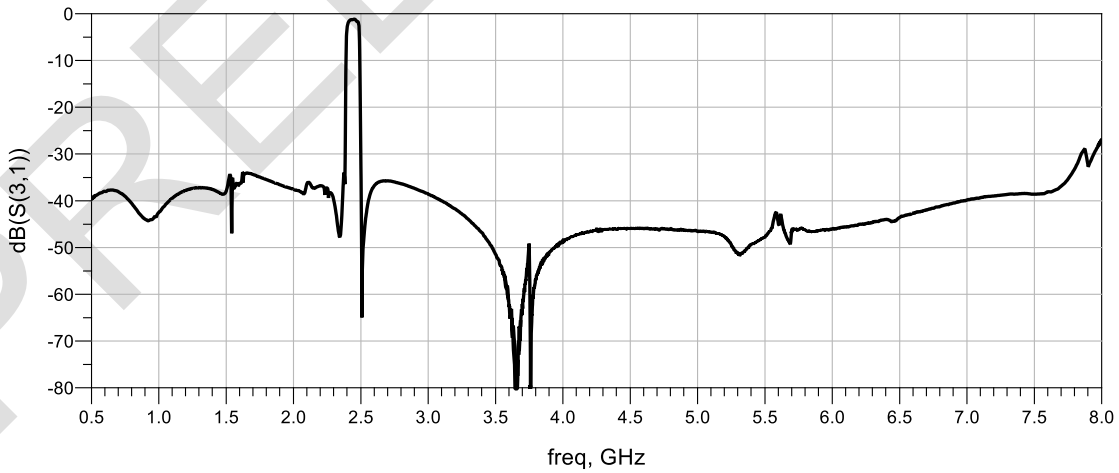
2.4GHz WiFi B40 Atten



2.4GHz WiFi B41 Atten

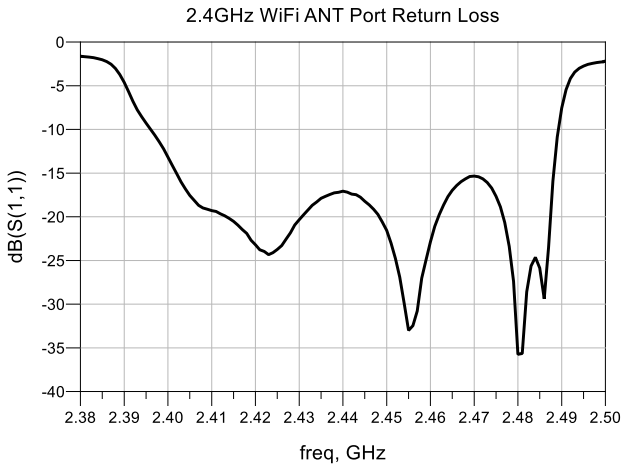


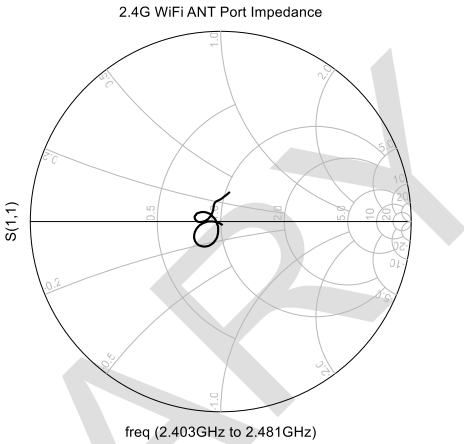
2.4GHz WiFi Wide Band

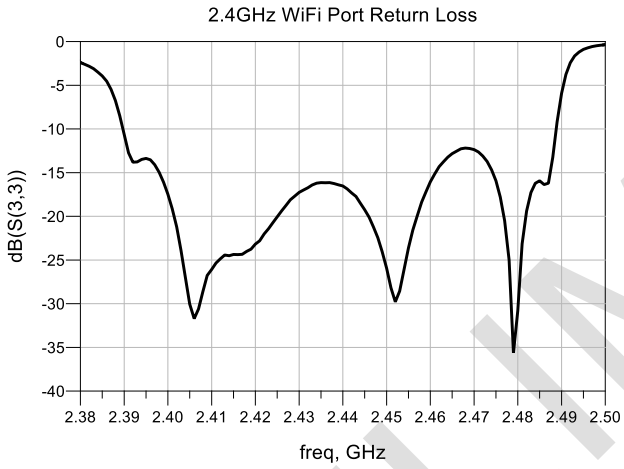


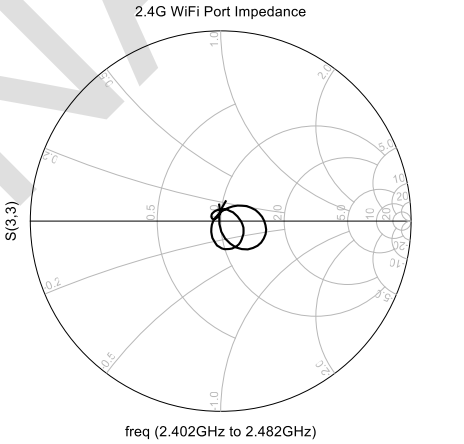
2.4GHz WiFi Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25 °C





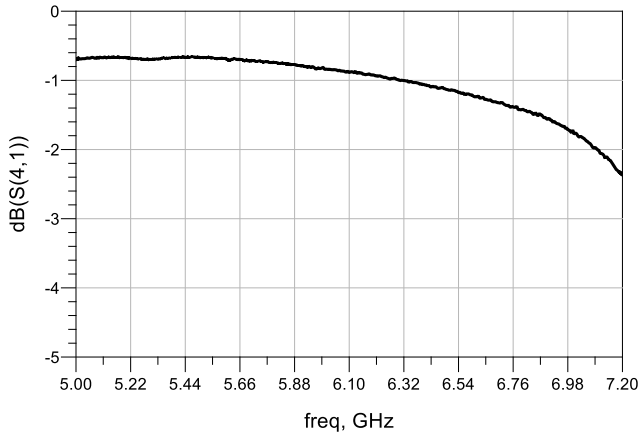




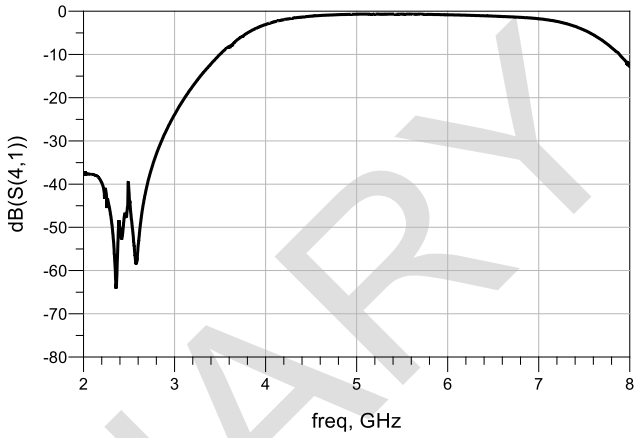
5GHz WiFi Insertion Loss and Attenuation

Test conditions unless otherwise noted: Temp. = +25 °C

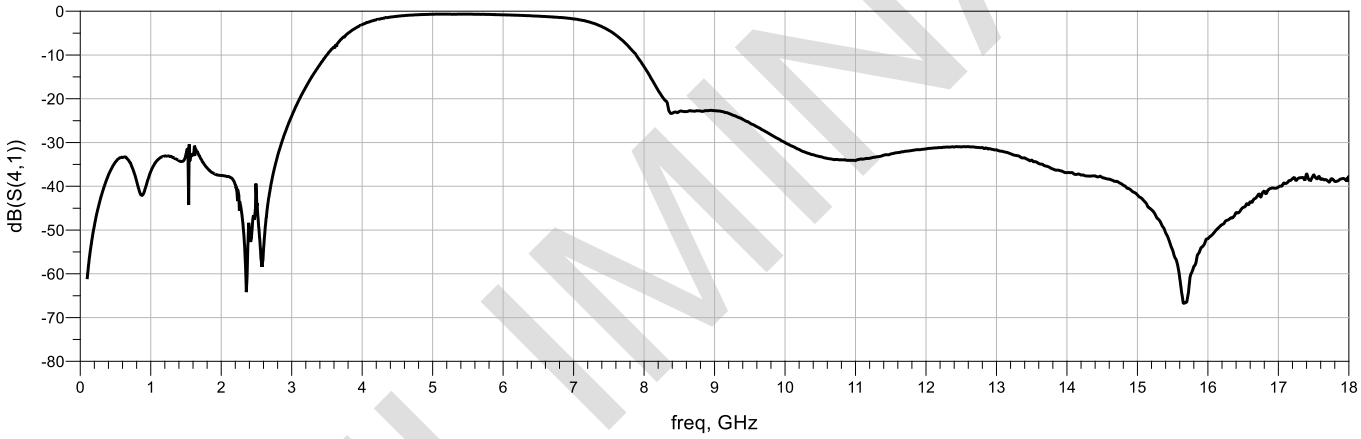
5GHz WiFi6E Pass Band



5GHz WiFi6E Narrow Band

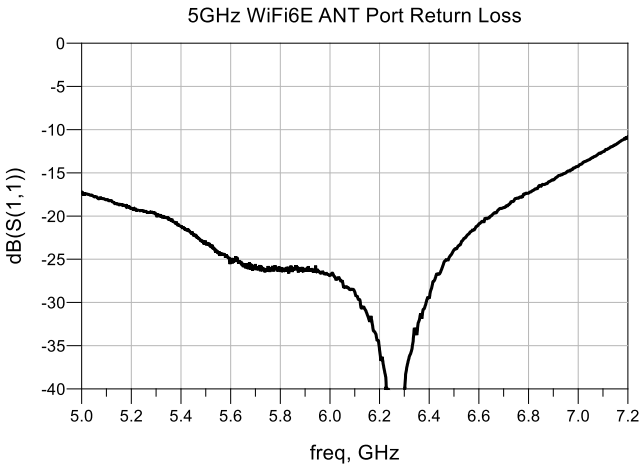


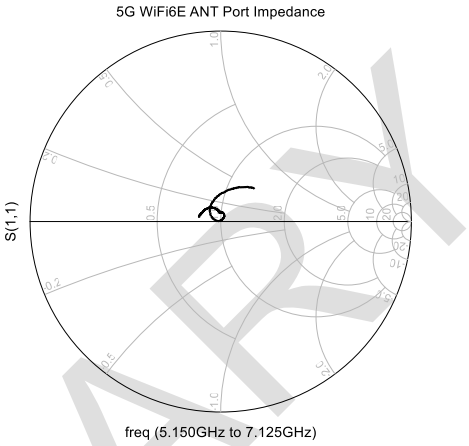
5GHz WiFi6E Wide Band

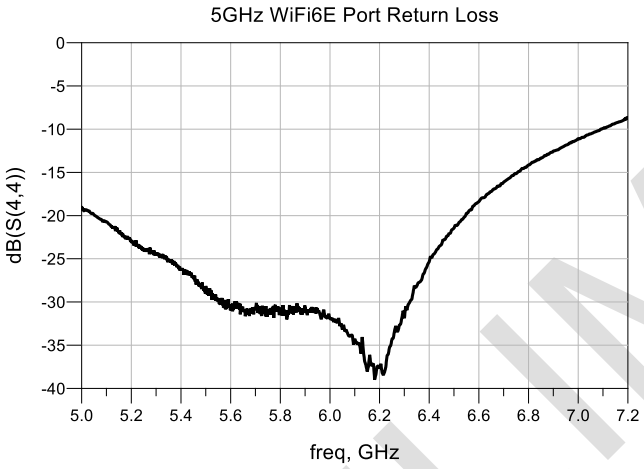


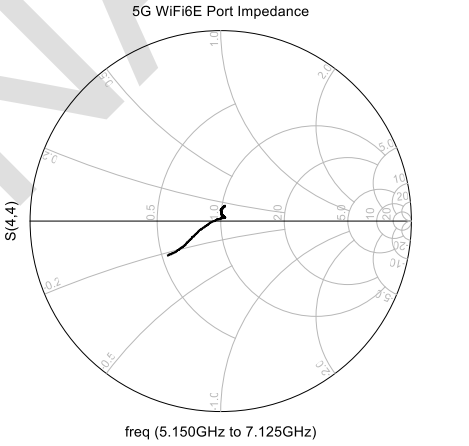
5GHz WiFi Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25 °C





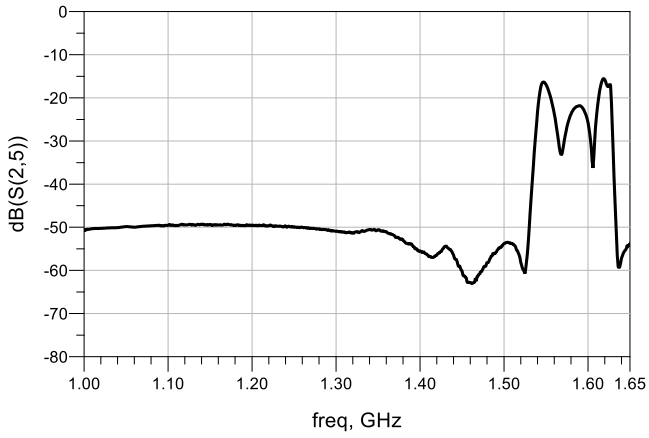




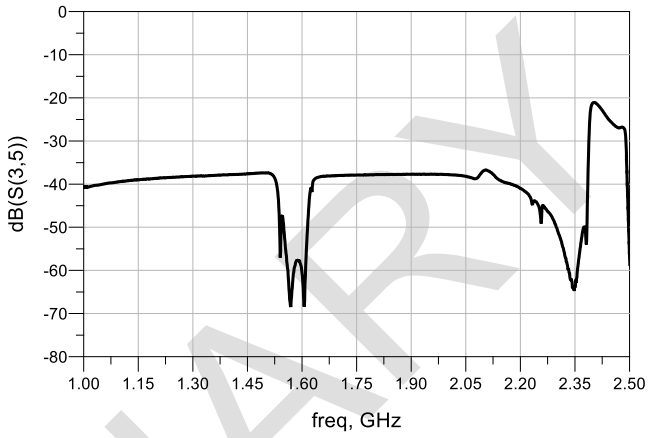
Isolation

Test conditions unless otherwise noted: Temp. = +25 °C

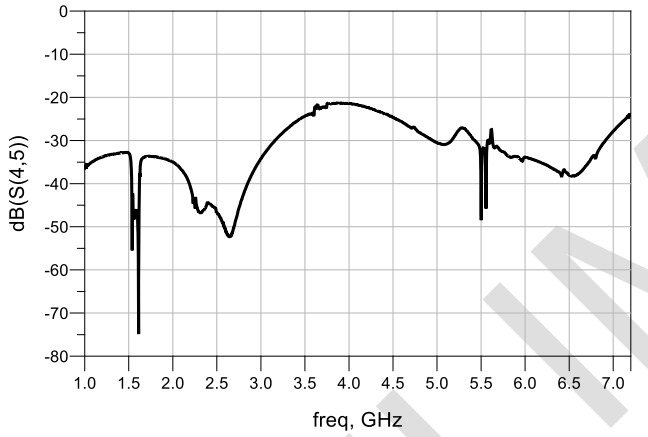
LMB-GNSS Isolation



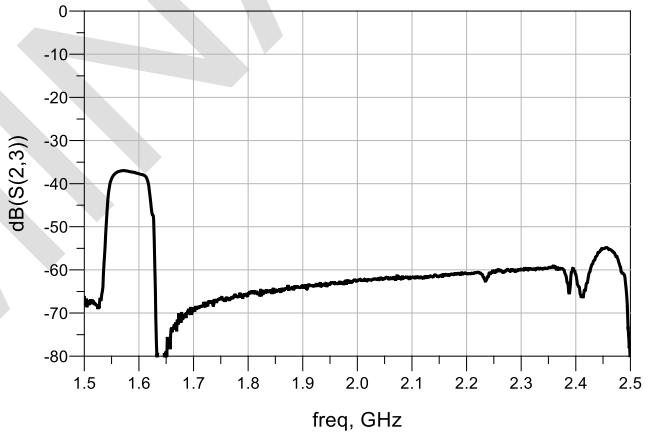
LMB-2.4G WiFi Isolation



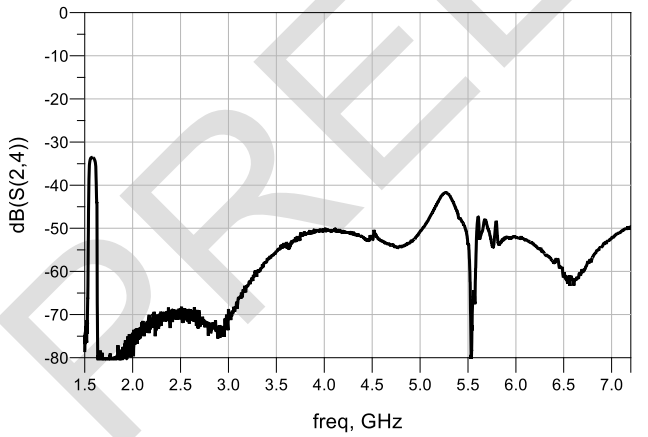
LMB-5G WiFi6E Isolation



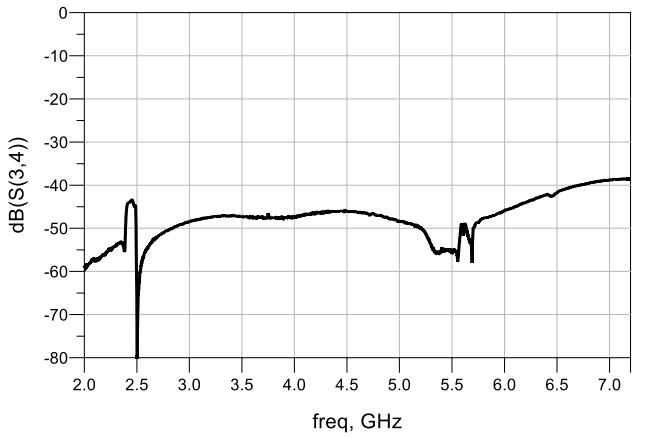
GNSS-2.4G WiFi Isolation



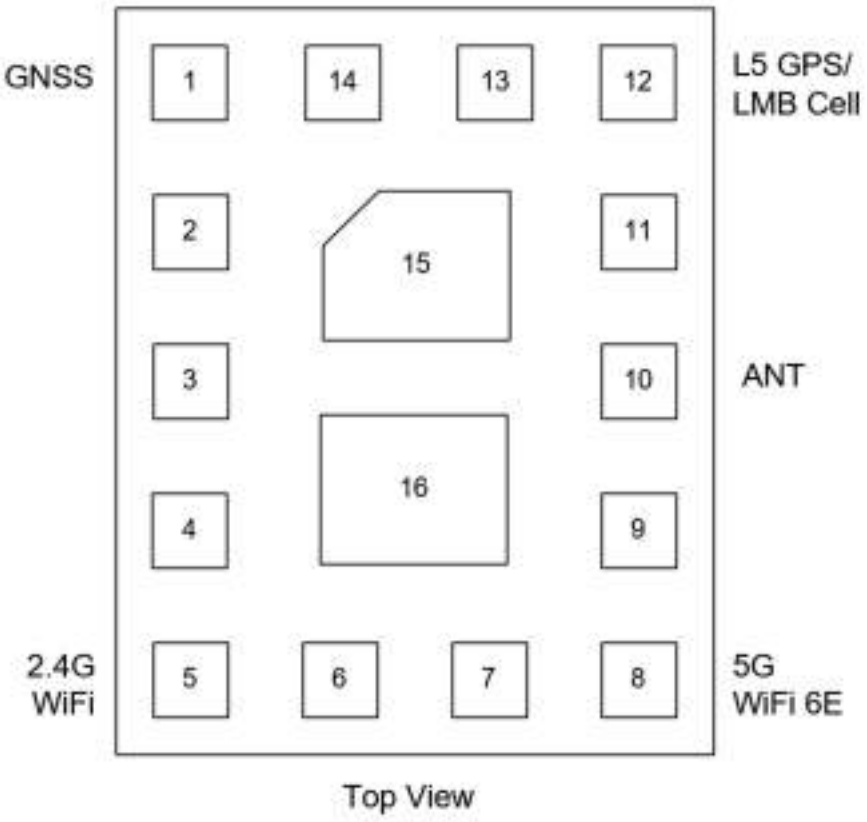
GNSS-5G WiFi6E Isolation



2.4G-5G WiFi6E Isolation



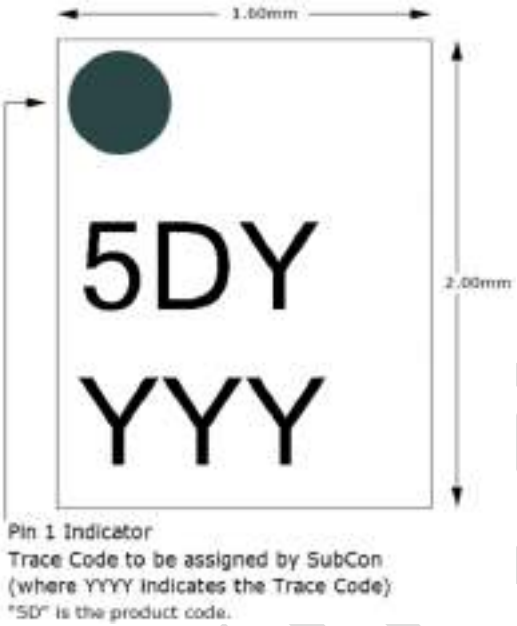
Pin Configuration and Description



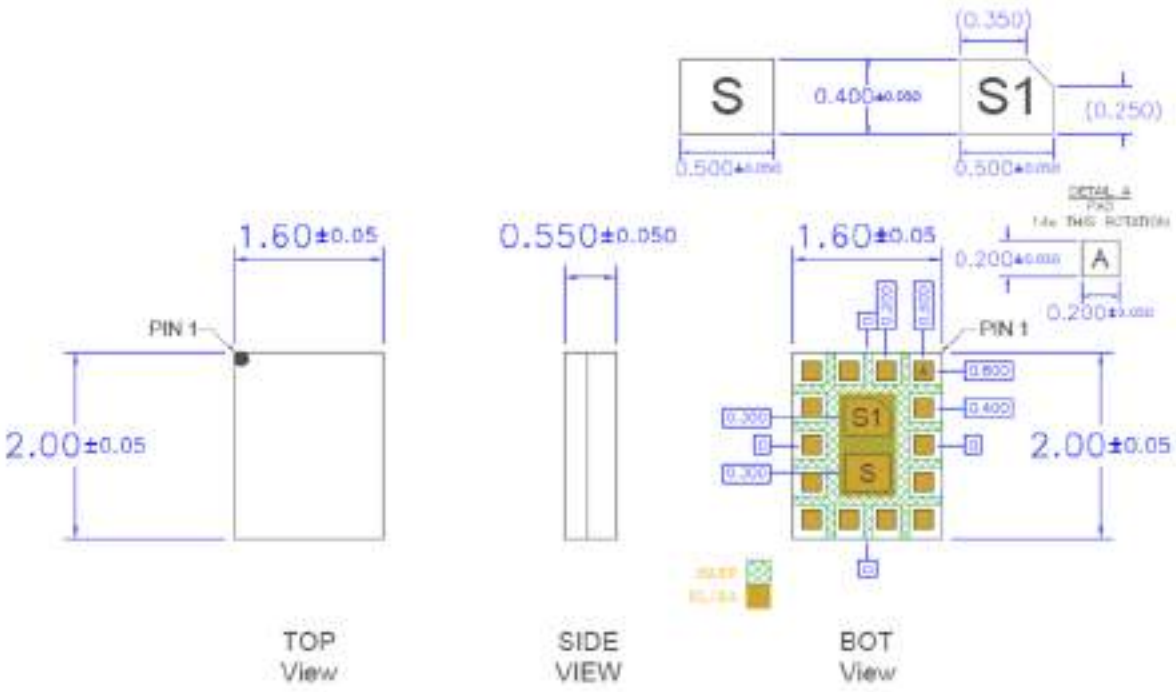
Pin Number	Label	Description
1	GNSS	GNSS Port
5	2.4GHz WiFi	2.4GHz WiFi Port
8	5GHz WiFi 6E	5GHz WiFi 6E Port
10	ANT	Antenna Port
12	L5 GPS/LMB Cell	L5 GPS/LMB Cell Port
2,3,4,6,7,9,11, 13,14,15,16	GND	Ground

Part Marking and Dimensions

Package Marking Diagram



Package Outline Dimension Drawing



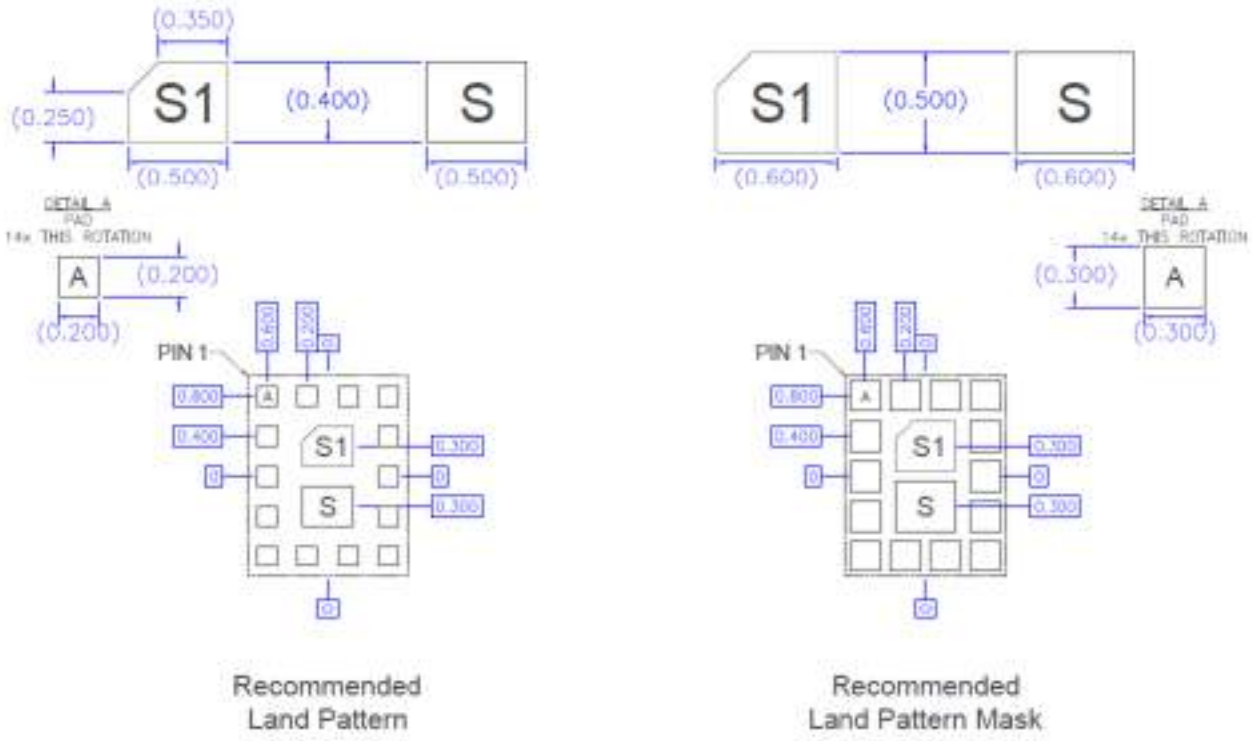
Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.

The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

Land Pattern and Mask Dimensions

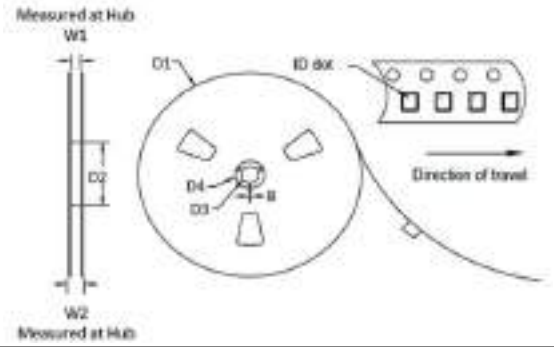
Recommended Land Pattern and Land Pattern Mask Dimensions – Top View

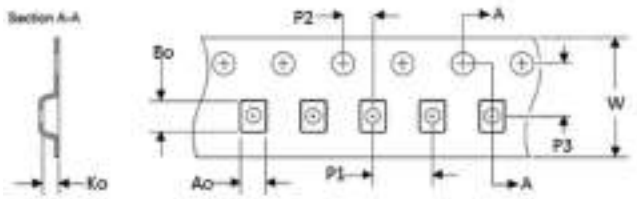


Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.

Tape and Reel Information





Feature	Measure	Symbol	Size (mm)
Flange	Diameter	D1	330.0
	Thickness	W2	18.2
	Space Between Flange	W1	12.8
Hub	Outer Diameter	D2	102.0
	Arbor Hole Diameter	D3	13.0
	Key Slit Width	B	2.0
	Key Slit Diameter	D4	20.0

Feature	Measure	Symbol	Size (mm)
Cavity	Length	Ao	1.8
	Width	Bo	2.2
	Depth	Ko	0.8
	Pitch	P1	4.0
Centerline Distance	Cavity to Perforation (Length)	P2	2.0
	Cavity to Perforation (Width)	P3	5.5
Carrier Tape	Width	W	12.0

(Unless otherwise specified, all dimension tolerances per EIA-481)

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1B	ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free
- Qorvo Green

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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REVISION HISTORY

Revision	Date (MMDDYYYY)	Description
A	01212020	Initial Document
B	09102020	Updated specs and plots
C	04162021	Updated specs

QM28014

MHB, GNSS, and 2.4G WiFi Antennaplexer

Product Overview

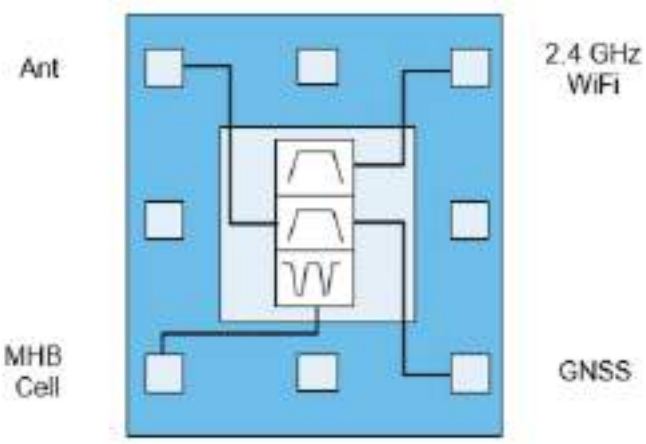
The QM28014 is part of Qorvo's family of antennaplexers using patented technology to meet the high performance expectations of insertion loss and rejection for Cellular, GNSS, and WLAN systems under all operating conditions

The QM28014 is a compact filter module designed to meet the strict requirements of out of band attenuation while optimizing for insertion loss of MHB Cellular, GNSS, and 2.4G WLAN from 1427 MHz – 2690 MHz, 1559.05 MHz – 1605.89 MHz, and 2403 MHz – 2481 MHz respectively.

The QM28014 uses common module packaging techniques to achieve a compact 2.0 mm x 1.6 mm footprint.

9 Pin 2.0mm x 1.6mm x 0.6mm leadless SMT package

Functional Block Diagram



Top View

Key Features

- Compact Form-Factor: 2.0 mm x 1.6 mm
- Highly selective filters achieving low insertion loss and high attenuation over full bandwidth
- Single antenna port, antennaplexing
- RoHS Compliant, Pb-Free Module Package

Applications

- For cellular handsets with MHB (including NR), GNSS, and 2.4GHz WLAN

Ordering Information

Part Number	Description
QM28014EVB	Evaluation Board (EVB)
QM28014SB	Sample bag of 5 pieces
QM28014SR	Sample reel of 100 pieces
QM28014TR13	13 inch reel of 10k pieces

Absolute Maximum Ratings[1]

Parameter		Conditions		Rating	UNITS
Storage Temperature				-40 to +90	°C
Operating Case Temperature				-30 to +85	°C
RF Input Power (Pin7, 2.4GHz WiFi)		2403 MHz – 2481 MHz	CW, +55C, 5k hours	+24	dBm
RF Input Power (Pin3, MHB Cellular)		1427 MHz – 1470 MHz	CW, +55C, 5k hours	+30	dBm
		1710 MHz – 2315 MHz			
		2500 MHz – 2570 MHz			
		2300 MHz – 2370 MHz	40% Dutycycle 55C, 5k hours	+31.5	dBm
		2370 MHz – 2390 MHz		+31.5	
		2390 MHz – 2400 MHz		RX Only	
		2496 MHz – 2690 MHz		+31.5	
RF Input Power[2]	Pin 7, 2.4G WiFi	2403 MHz – 2481 MHz	CW, +55C, 5k hours	+22	dBm
	Pin 3, MHB Cellular	1427 MHz – 1470 MHz		+28	
		1710 MHz – 2315 MHz			
		2500 MHz – 2570 MHz			
		2300 MHz – 2370 MHz	40% Dutycycle 55C, 5k hours	+30	
		2370 MHz – 2390 MHz		+30	
		2390 MHz – 2400 MHz		RX Only	
		2496 MHz – 2690 MHz		+30	
RF Input Power (Pin1, ANT)		1427 MHz – 1518 MHz	CW, +55C, 5k hours	+15	dBm
		1559 MHz – 1606 MHz			
		1710 MHz – 2400 MHz			
		2403 MHz – 2481 MHz			
		2496 MHz – 2690 MHz			

1. Operation of this device outside the parameter ranges given above may cause permanent damage.
2. Power applied simultaneously

Electrical Specifications[1] MHB - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1427 MHz – 1518 MHz	-	1.2[2]	1.7	dB
	1710 MHz – 2200 MHz	-	1.1[2]	1.4	
	2300 MHz – 2370 MHz	-	1.2[2]	1.8	
	2370 MHz – 2390 MHz	-	1.7[2]	4[3]	
	2390 MHz – 2400 MHz	-	6.4[2]	12[3][4]	
	2496 MHz – 2500 MHz	-	2.2[2]	4[5]	
	2500 MHz – 2505 MHz	-	1.7[2]	2.8[5]	
	2505 MHz – 2690 MHz	-	1.0[2]	2.4	
VSWR (MHB)	1427 MHz – 1518 MHz	-	1.4:1	2.0:1	-
	1710 MHz – 2200 MHz	-	1.4:1	2.0:1	
	2300 MHz – 2370 MHz	-	1.3:1	2.0:1	
	2370 MHz – 2390 MHz	-	1.8:1	2.0:1	
	2390 MHz – 2400 MHz	-	4.5:1	5.3:1	
	2496 MHz – 2690 MHz	-	2.1:1	4.8:1	
VSWR (ANT)	1427 MHz – 1518 MHz	-	1.5:1	2.0:1	-
	1710 MHz – 2200 MHz	-	1.3:1	2.0:1	
	2300 MHz – 2370 MHz	-	1.3:1	2.0:1	
	2370 MHz – 2390 MHz	-	1.3:1	2.0:1	
	2390 MHz – 2400 MHz	-	1.5:1	2.0:1	
	2496 MHz – 2690 MHz	-	1.5:1	3.0:1	
Attenuation	1559 MHz – 1606 MHz	10	15	-	dB
	2403 MHz – 2481 MHz[6]	13	17	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature
3. Specified from -30˚C to +25˚C
4. Integrated over any 5MHz bandwidth
5. Specified from +25˚C to +85˚C
6. Integrated over each 18MHz WiFi Channel

Electrical Specifications[1] L1 GNSS - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1559.05 MHz – 1563.15 MHz	-	1.4[2]	2.2	dB
	1574.39 MHz – 1576.45 MHz	-	0.8[2]	1.1	
	1597.55 MHz – 1605.89 MHz	-	1.1[2]	1.6	
VSWR (GNSS)	1559.05 MHz – 1563.15 MHz	-	1.2:1	2.0:1	-
	1574.39 MHz – 1576.45 MHz	-	1.1:1	2.0:1	
	1597.55 MHz – 1605.89 MHz	-	1.4:1	2.0:1	
VSWR (ANT)	1559.05 MHz – 1563.15 MHz	-	1.1:1	2.0:1	
	1574.39 MHz – 1576.45 MHz	-	1.1:1	2.0:1	
	1597.55 MHz – 1605.89 MHz	-	1.3:1	2.0:1	
Attenuation	10 MHz – 960 MHz	48	49	-	dB
	777 MHz – 787 MHz	48	49	-	
	1427.9 MHz – 1462.9 MHz	47	57	-	
	1640 MHz – 1695 MHz	49	55	-	
	1695 MHz – 1710 MHz	48	54	-	
	1710 MHz – 1785 MHz	46	52	-	
	1786 MHz – 1797 MHz	46	52	-	
	1850 MHz – 1910 MHz	46	52	-	
	1910 MHz – 1980 MHz	46	52	-	
	2010 MHz – 2025 MHz	46	54	-	
	2305 MHz – 2315 MHz	49	52	-	
	2403 MHz – 2481 MHz[3]	45	55	-	
	2500 MHz – 2570 MHz	46	49	-	
	2570 MHz – 2690 MHz	43	45	-	
	3400 MHz – 3600 MHz	32	33	-	
	4400 MHz – 4900 MHz	30	32	-	
	5150 MHz – 5925 MHz	10	24	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature
3. Integrated over each 18MHz WiFi channel

Electrical Specifications[1] 2.4GHz WiFi - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	2403 MHz – 2421 MHz[2] (WiFi CH1)	-	1.8	2.4	dB
	2408 MHz – 2426 MHz[2] (WiFi CH2)	-	1.6	2	
	2413 MHz – 2446 MHz[2] (WiFi CH3-6)	-	1.5	2	
	2433 MHz – 2466 MHz[2] (WiFi CH7-10)	-	1.5	2	
	2453 MHz – 2471 MHz[2] (WiFi CH11)	-	1.6	2.1	
	2458 MHz – 2476 MHz[2] (WiFi CH12)	-	1.7	2.4	
	2463 MHz – 2481 MHz[2] (WiFi CH13)	-	1.9	3	
VSWR (WiFi)	2403 MHz – 2481 MHz	-	1.5:1	2.0:1	-
VSWR (ANT)	2403 MHz – 2481 MHz	-	1.5:1	2.0:1	
Attenuation	925 MHz – 960 MHz	40	41	-	dB
	1559 MHz – 1606 MHz	41	44	-	
	2110 MHz – 2170 MHz	34	50	-	
	2300 MHz – 2370 MHz	39	43	-	
	2500 MHz – 2505 MHz	26	48	-	
	2505 MHz – 2690 MHz	45	57	-	
	4800 MHz – 5000 MHz	31	48	-	
	7200 MHz – 7500 MHz	25	30	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Integrated over each 18MHz WiFi Channel

Electrical Specifications[1] Isolation

Parameter		Conditions	Min.	Typ.	Max.	Units
Isolation	2.4G WiFi – GNSS	1559.05 MHz – 1605.89 MHz	43	46	-	dB
		2403 MHz – 2481 MHz	48	53	-	
	2.4G WiFi – MHB	1427 MHz – 1518 MHz	43	46	-	
		1710 MHz – 2200 MHz	30	40	-	
		2300 MHz – 2370 MHz	38	41	-	
		2370 MHz – 2390 MHz	8	13	-	
		2390 MHz – 2400 MHz	7	10	-	
		2496 MHz – 2690 MHz	16	37	-	
		2403 MHz – 2481 MHz	6	14	-	
	MHB – GNSS	1559.05 MHz – 1605.89 MHz	12	16	-	
		1427 MHz – 1518 MHz	48	50	-	
		1710 MHz – 2200 MHz	46	51	-	
		2300 MHz – 2370 MHz	46	49	-	
		2370 MHz – 2390 MHz	46	49	-	
		2390 MHz – 2400 MHz	46	50	-	
		2496 MHz – 2690 MHz	43	44	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.

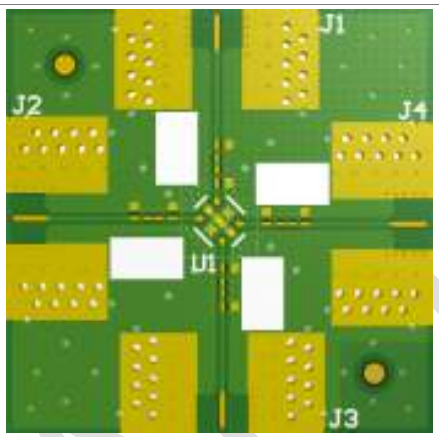
QM28014EVB PCB Information

Layer	Name	Material	Thickness	Constant	Board Layer Stack
1	Top Overlay				
2	Top Solder	Solder Resist	0.79mil	3.5	
3	L1	Copper	0.70mil		
4	Dielectric1	FR-408HR	4.10mil	3.3	
5	L2	Copper	0.70mil		
6	Dielectric 2	FR-408HR	26.00mil	3.6	
7	L3	Copper	0.70mil		
8	Dielectric 3	FR-408HR	4.10mil	3.3	
9	L4	Copper	0.70mil		
10	Bottom Solder	Solder Resist	0.79mil	3.5	
11	Bottom Overlay				

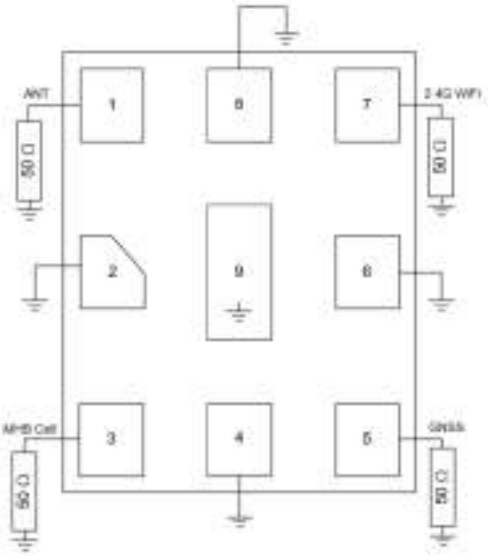
Total thickness:40 MILS +/-10%

Where:

- J1 = 2.4G WiFi
- J2 = ANT
- J3 = MHB
- J4 = GNSS



Application Circuit Schematic



Top View

Note:

1. All RF ports internally matched to 50 ohm impedance
2. Recommend connecting all ground pins together on PCB
3. Recommend adding Pi network close to each RF port for phone level tuning/optimization

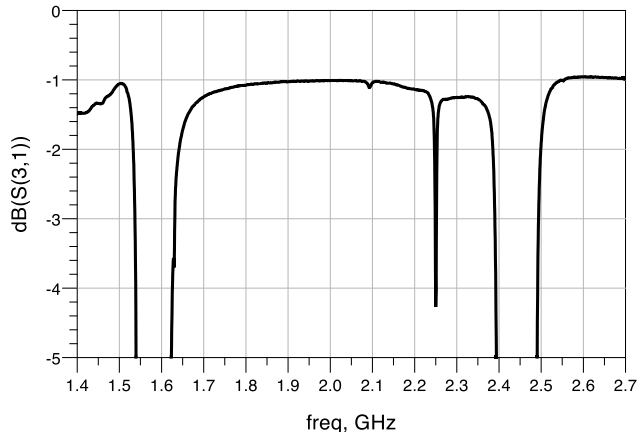
Bill of Materials

Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	MHB, GNSS, and 2.4G WiFi Antennaplexer	Qorvo	QM28014
PCB	N/A	Printed Circuit Board		QM28014-4000

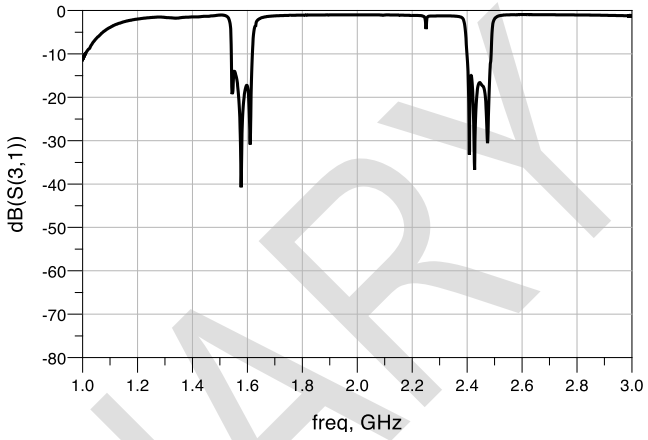
MHB Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

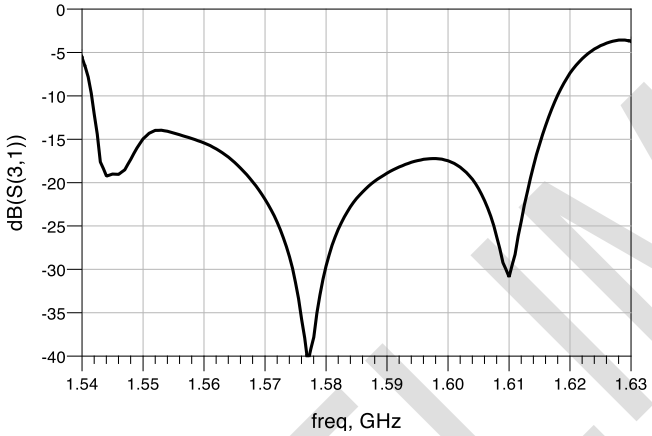
MHB Pass Band



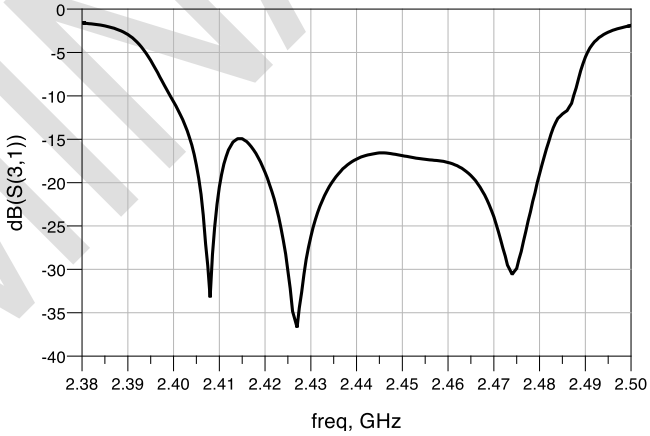
MHB Narrow Band



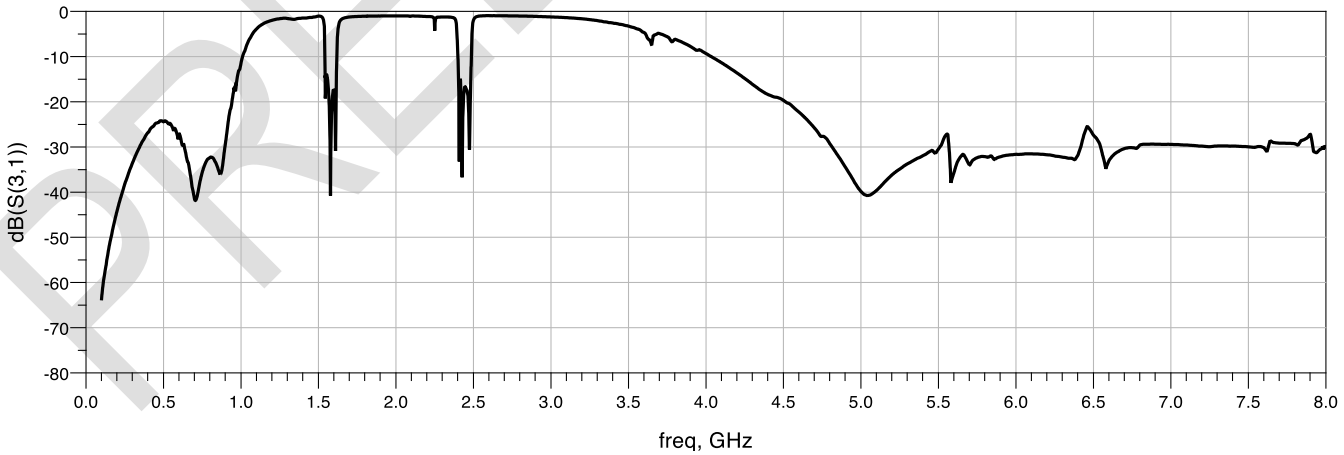
MHB Cell GNSS Atten



MHB Cell WiFi Atten



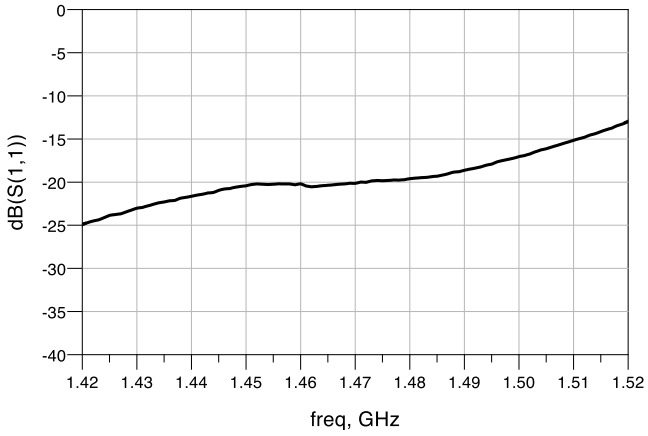
MHB Wide Band



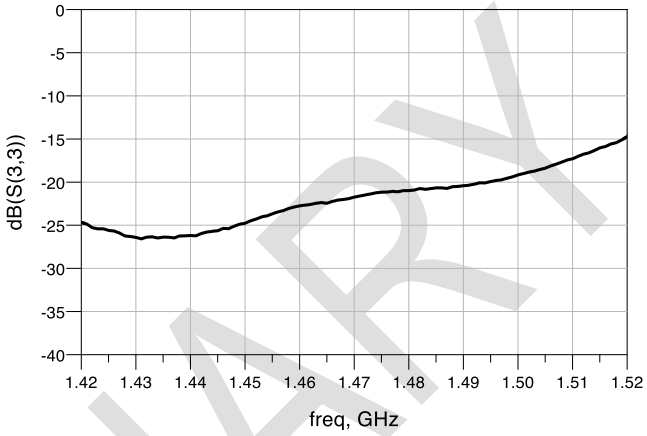
MHB Return Loss Plots

Test conditions unless otherwise noted: Temp. = +25 °C

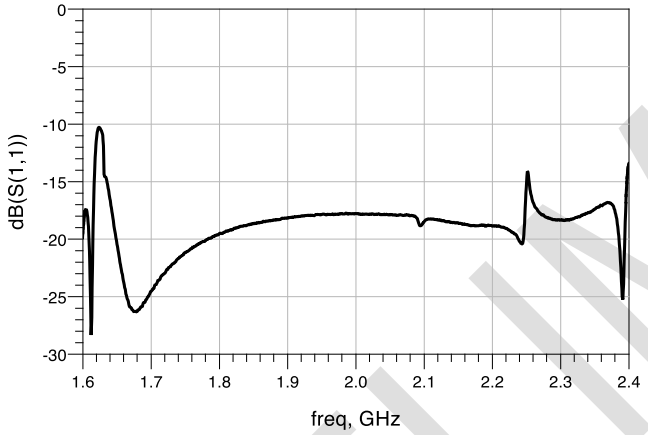
LMB ANT Port Return Loss



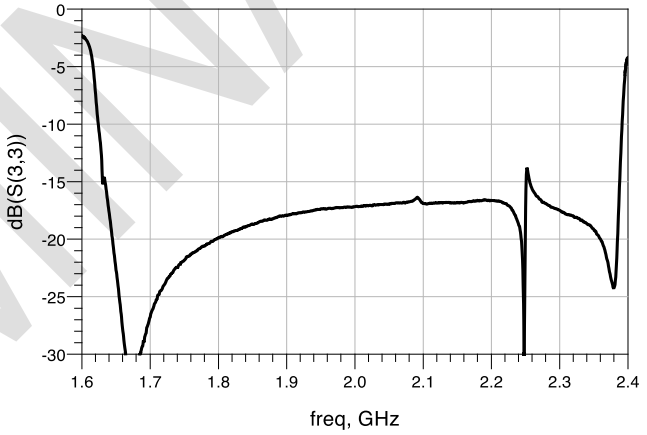
LMB Port Return Loss



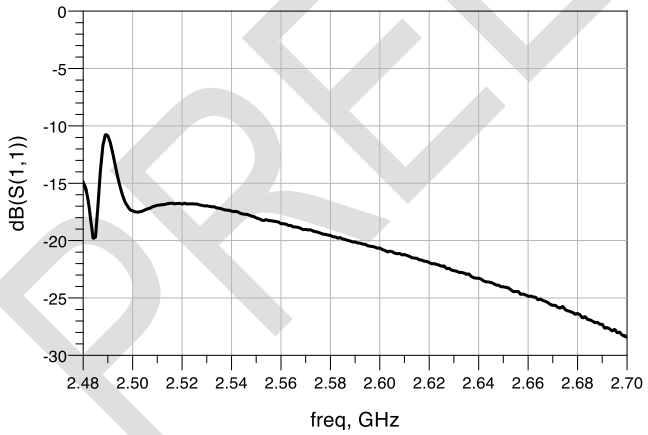
MHB MB ANT Port Return Loss



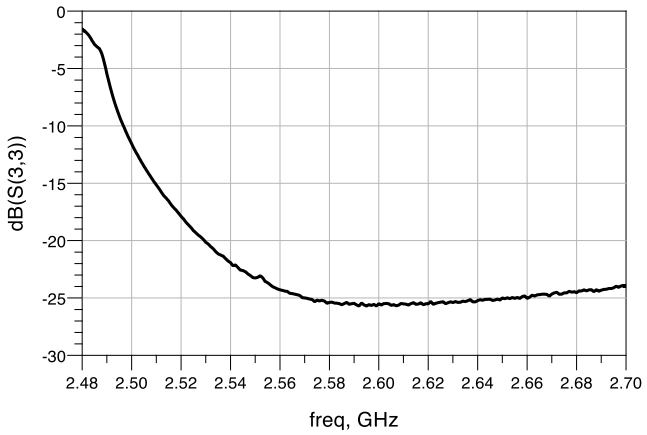
MHB MB Port Return Loss



MHB HB ANT Port Return Loss

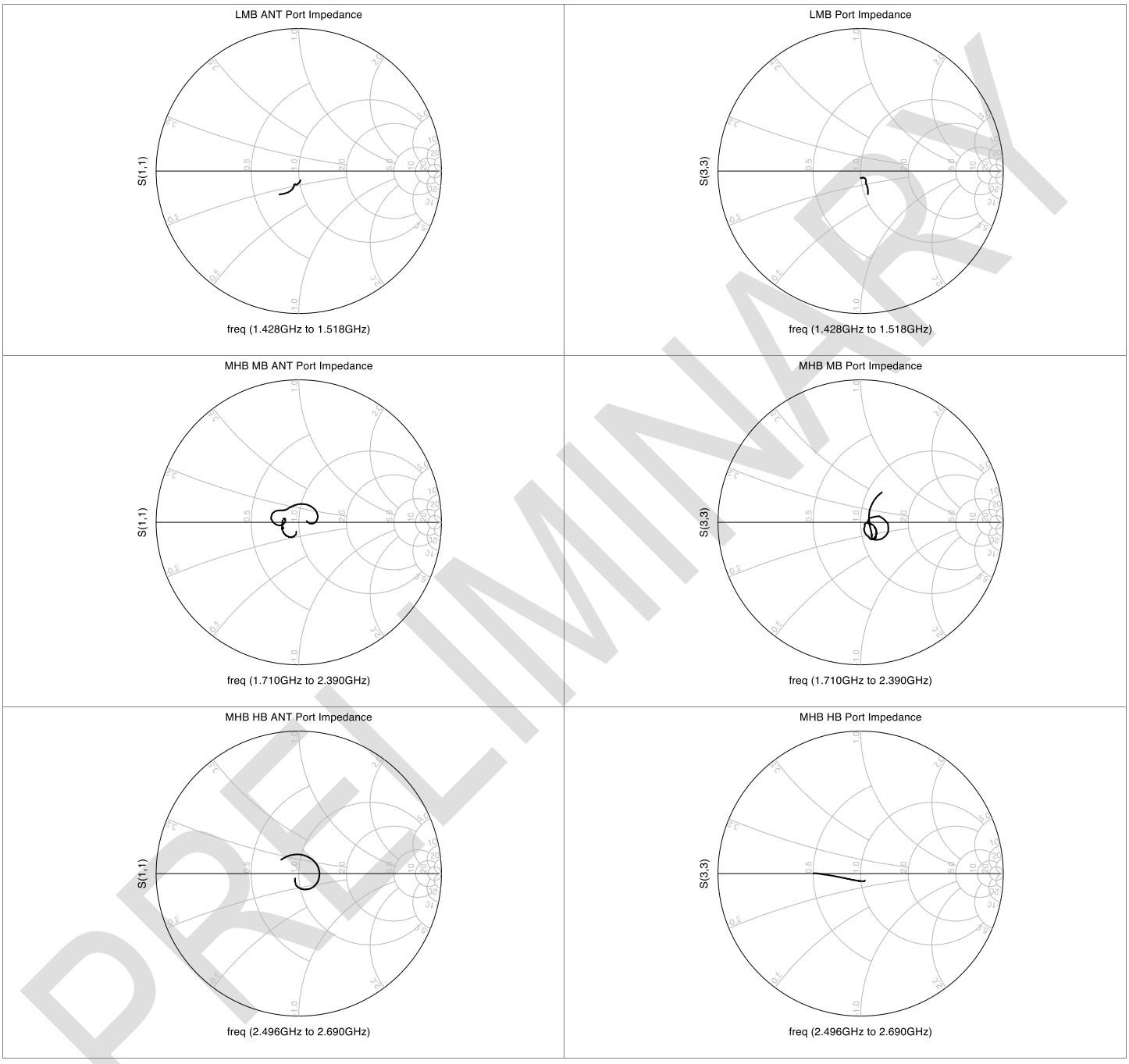


MHB HB Port Return Loss



MHB Impedance Plots

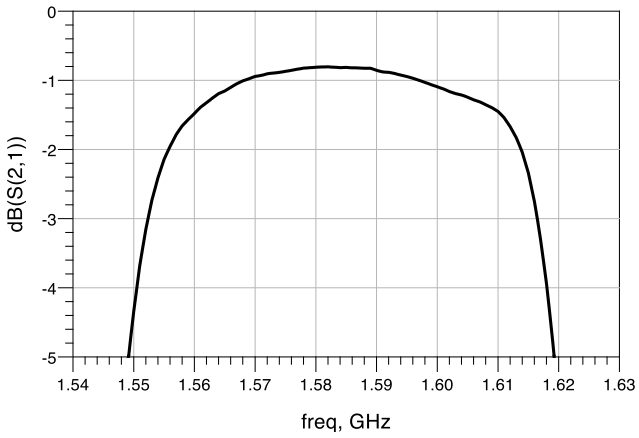
Test conditions unless otherwise noted: Temp. = +25 °C



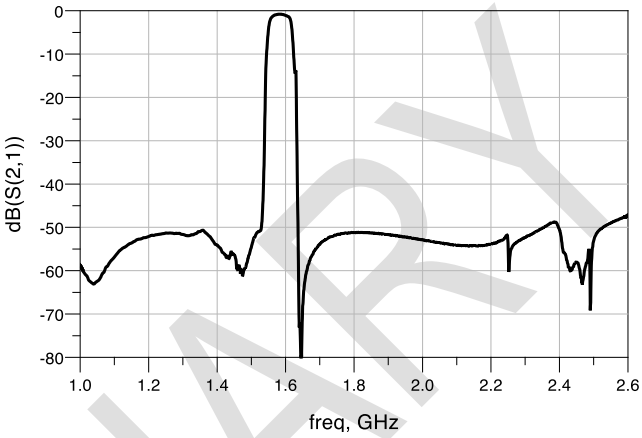
GNSS Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

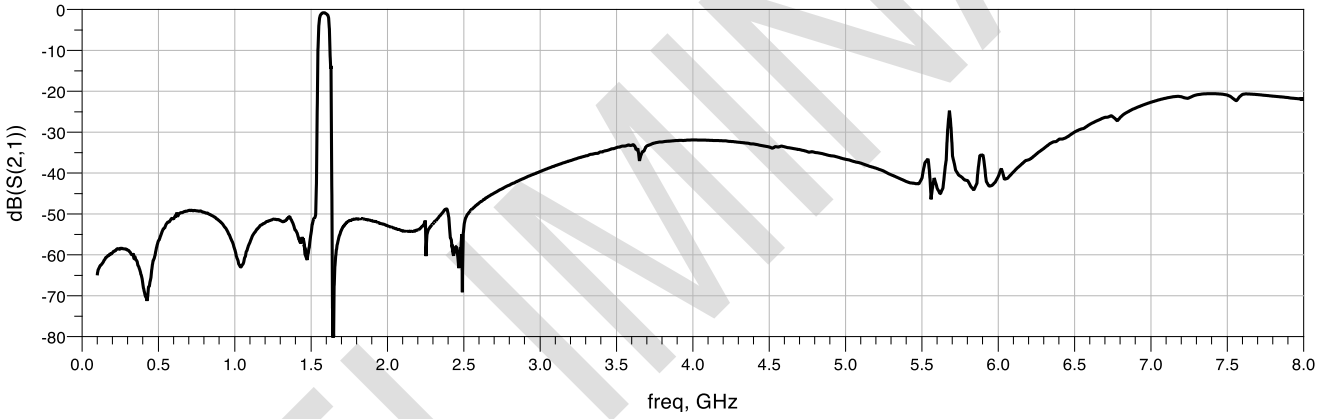
GNSS Pass Band



GNSS Narrow Band

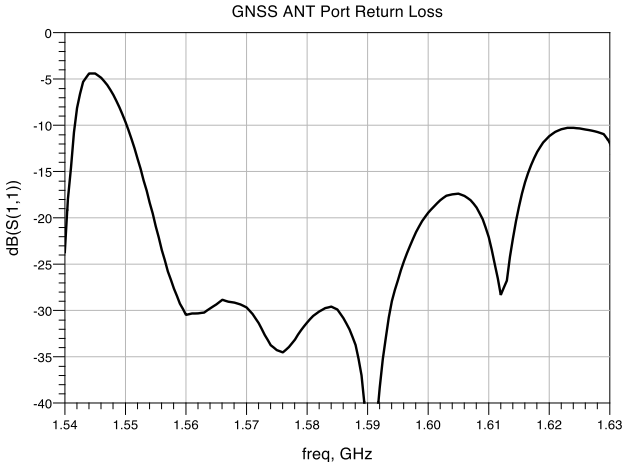


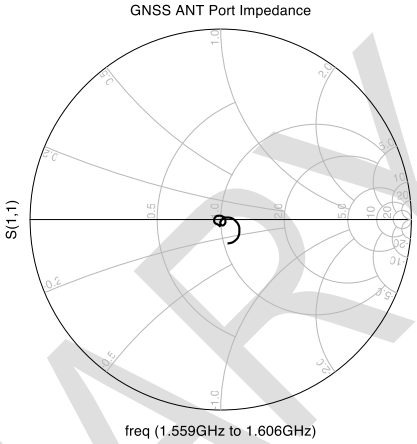
GNSS Wide Band

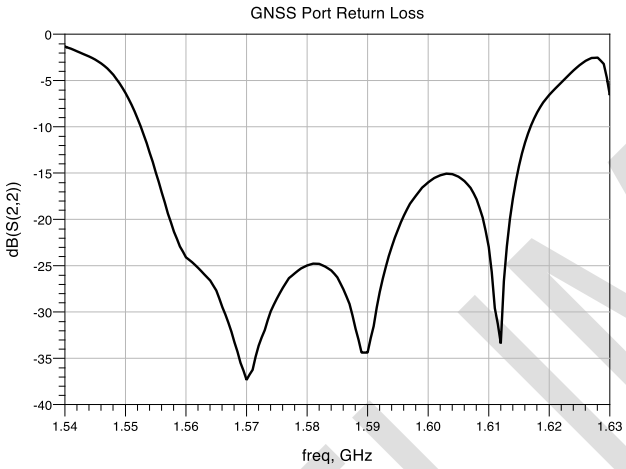


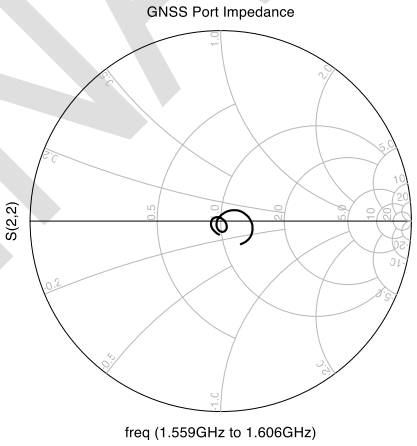
GNSS Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C





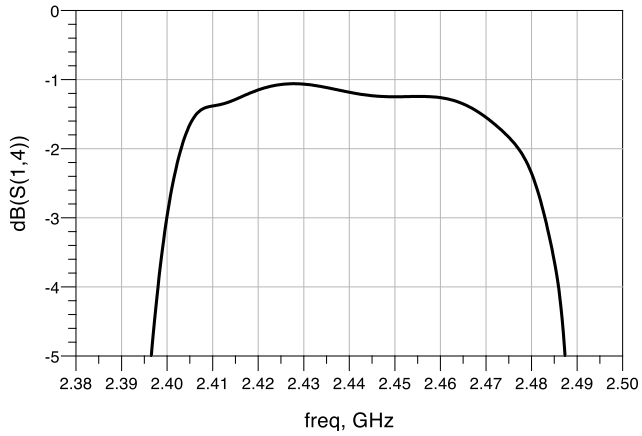




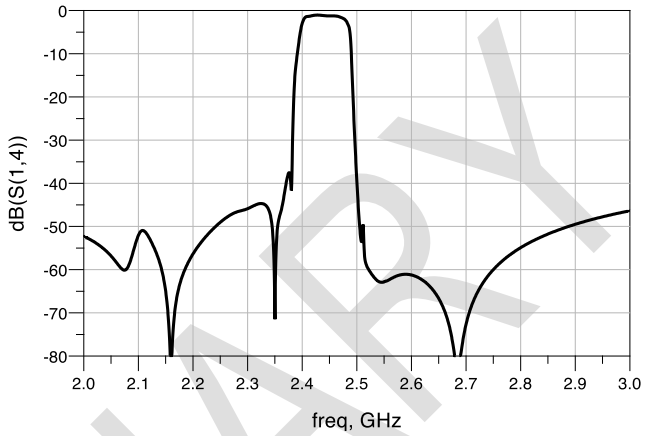
2.4GHz WiFi Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

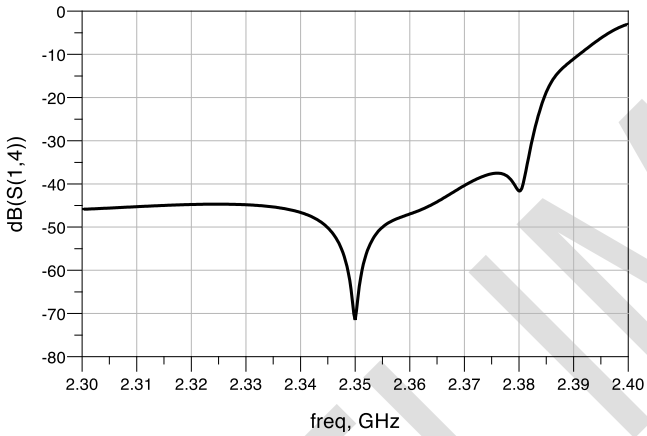
2.4G Wi-Fi Pass Band



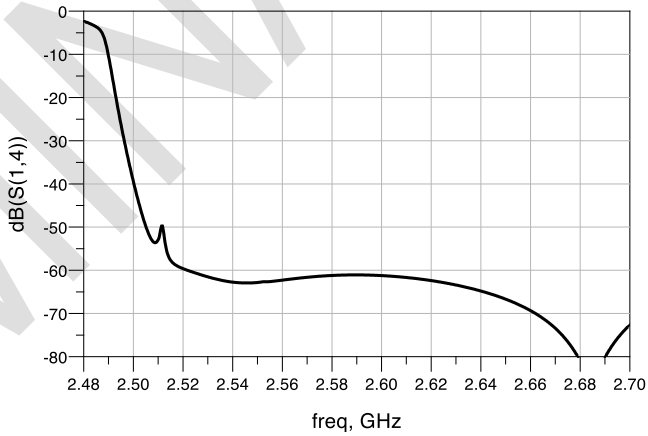
2.4G Wi-Fi Narrow Band



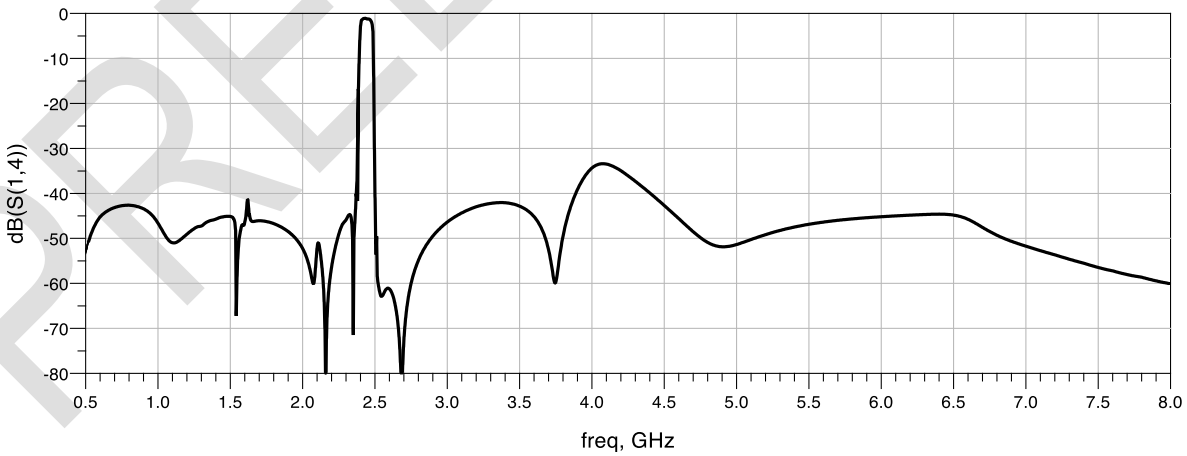
2.4G Wi-Fi B40 Attenuation



2.4G Wi-Fi B41 Attenuation

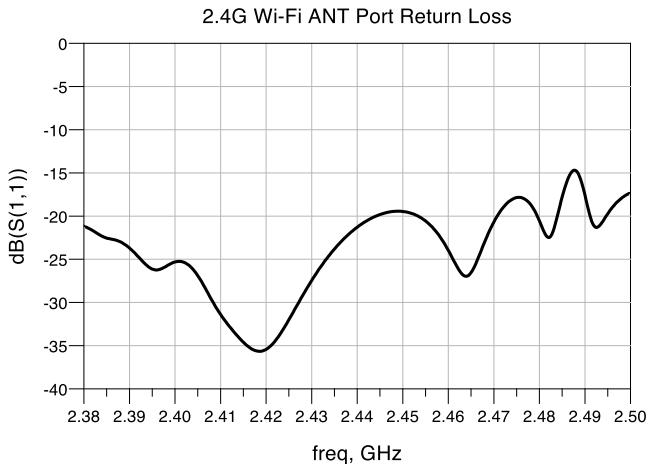


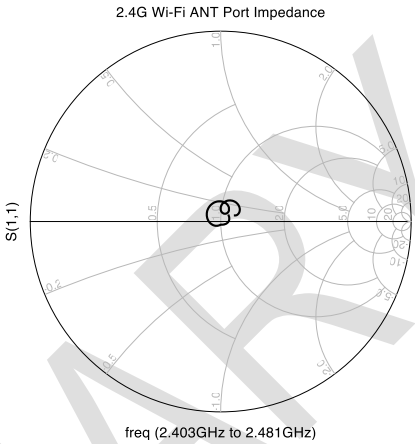
2.4G Wi-Fi Wide Band

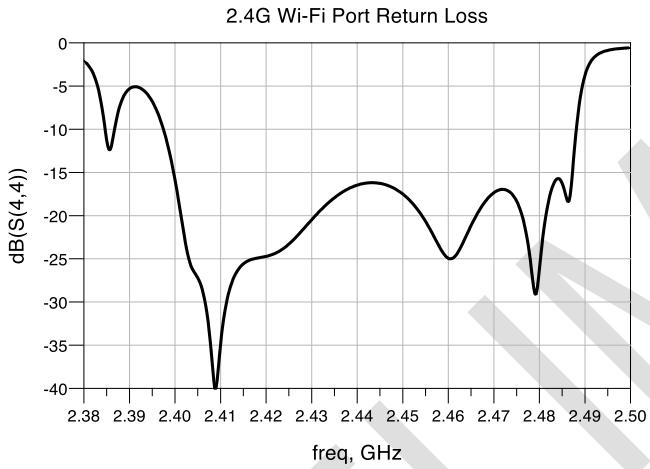


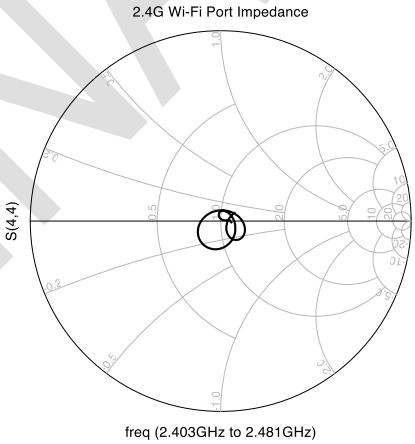
2.4GHz WiFi Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C



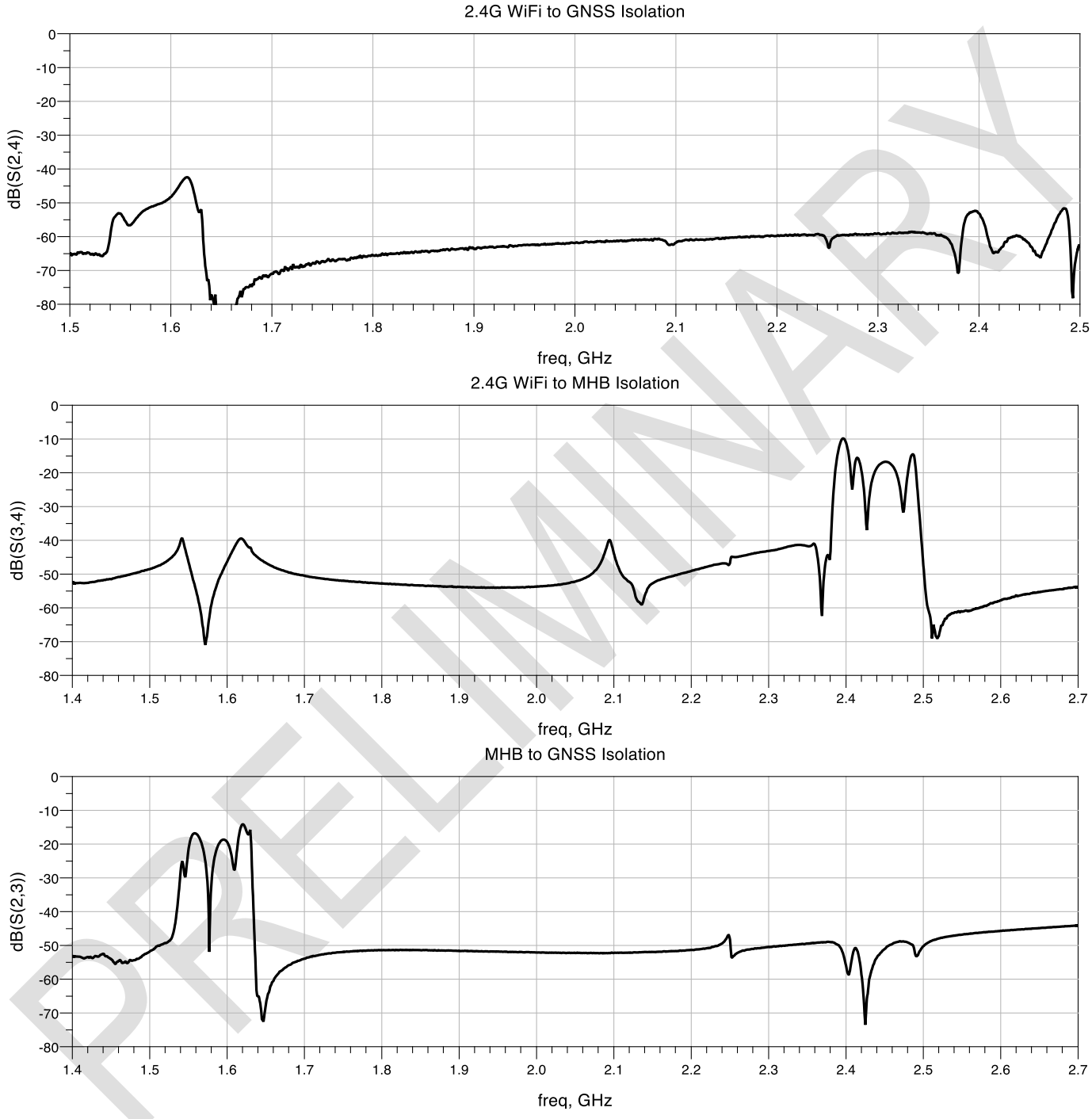




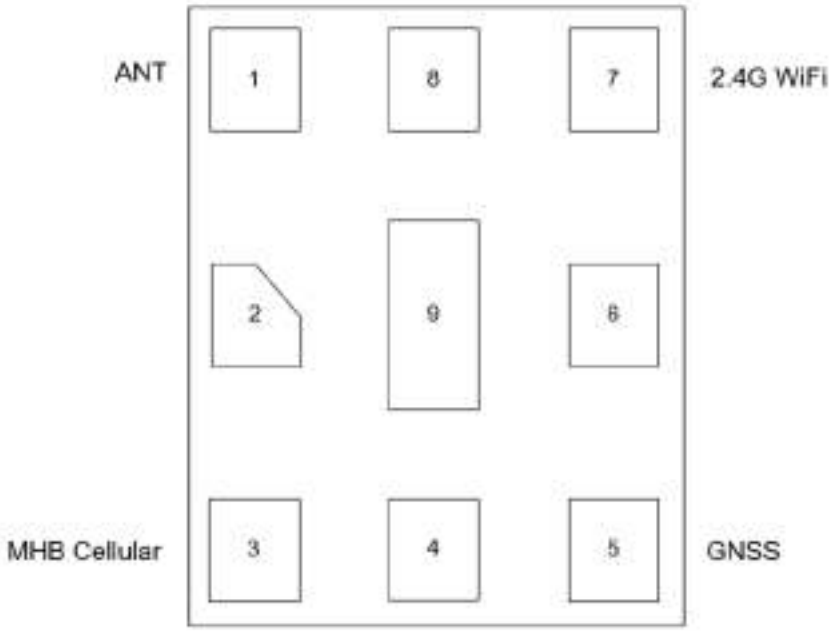


Isolation Plots

Test conditions unless otherwise noted: Temp. = +25 °C



Pin Configuration and Description

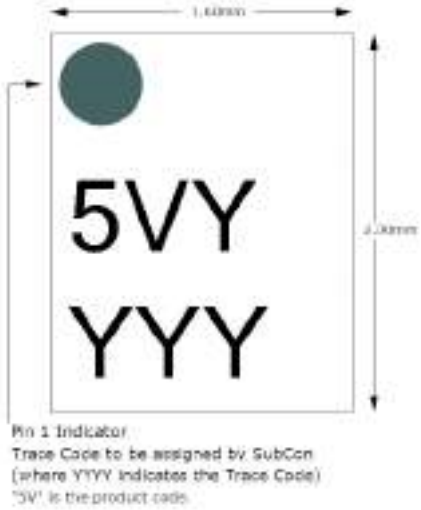


Top View

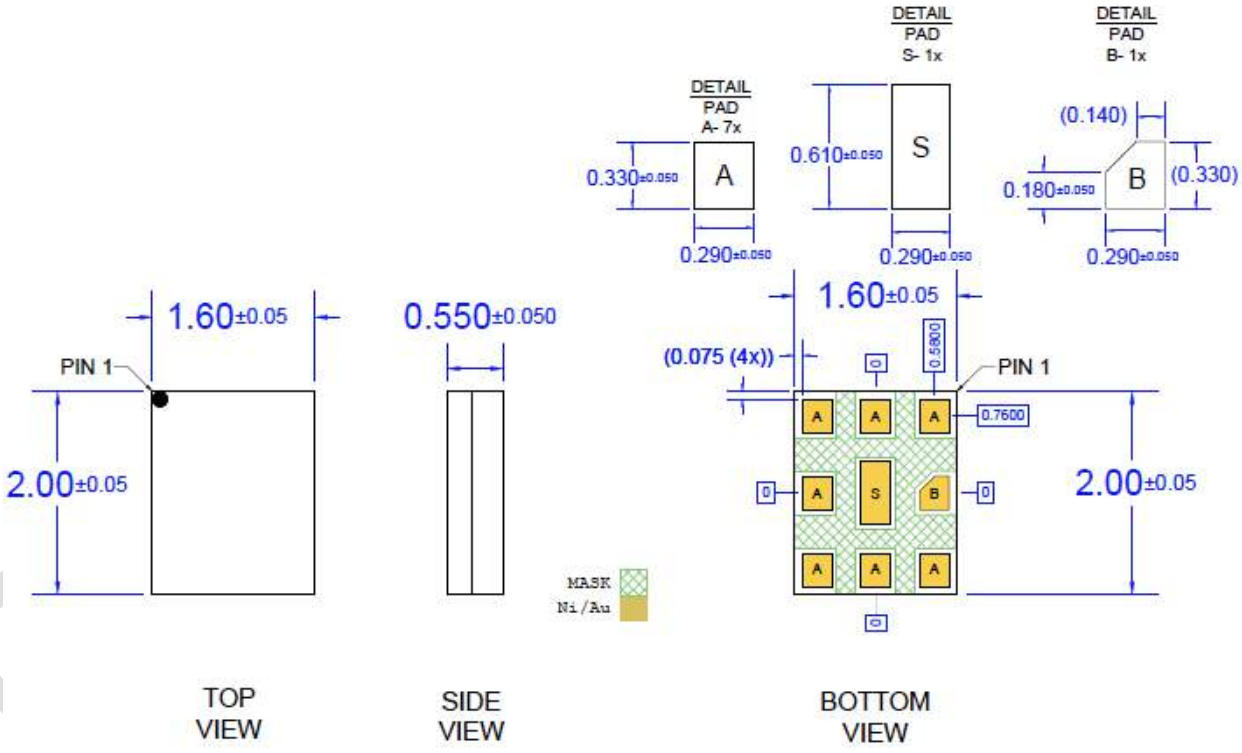
Pin Number	Label	Description
1	ANT	Antenna Port
3	MHB Cellular	MHB Cellular Port
5	GNSS	GNSS Port
7	2.4G WiFi	2.4G WiFi Port
2, 4, 6, and 8	GND	Ground
9	GND	Package Ground

Part Marking and Package Outline Dimensions

Part Marking Diagram – Top View



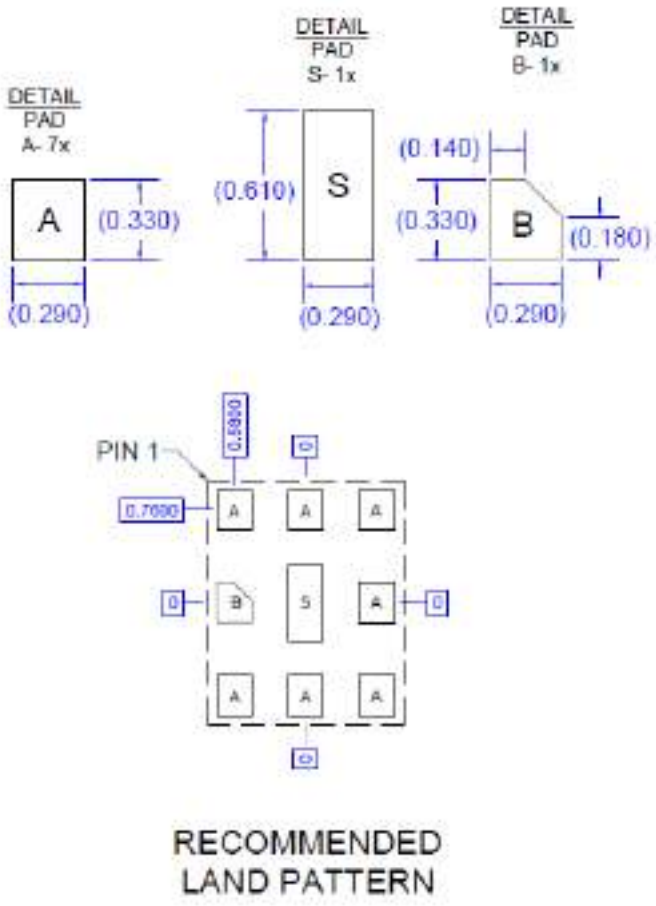
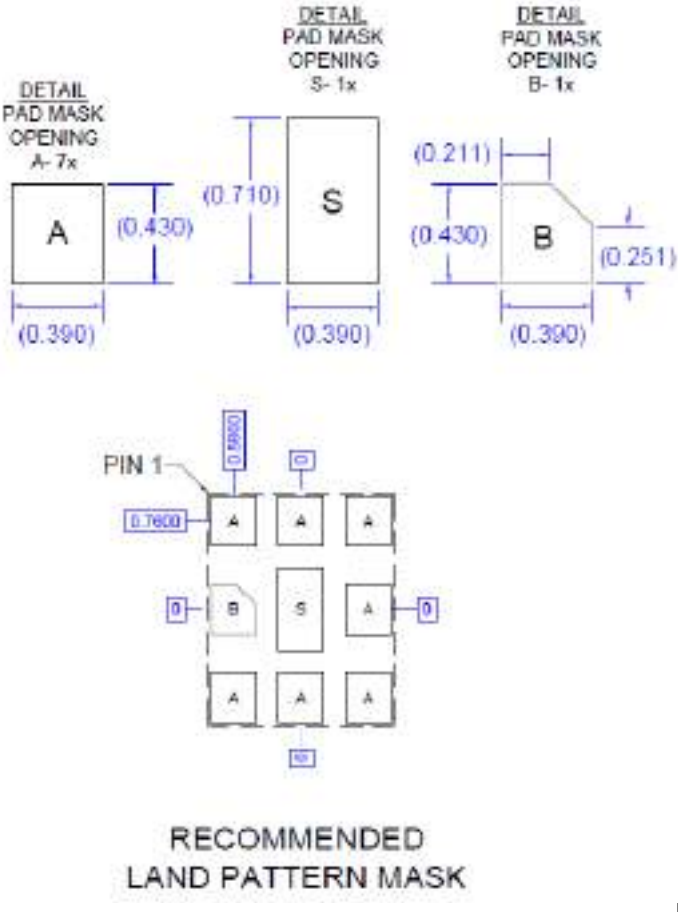
Package Outline Dimension Drawing



Notes:

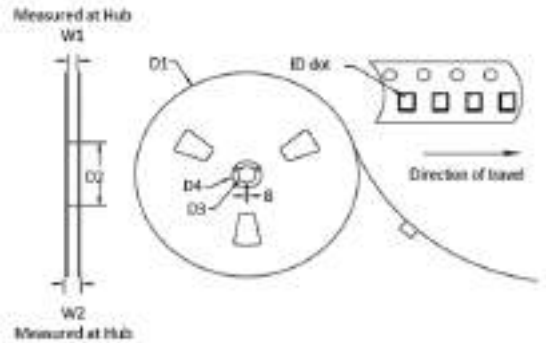
1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

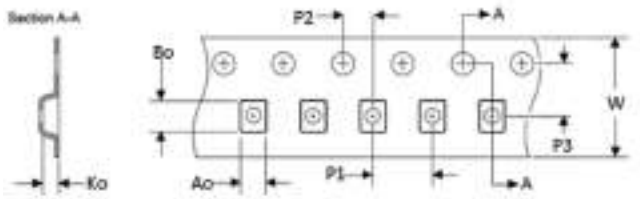
Land Pattern and Mask Dimensions

Recommended Land Pattern Drawing – Top View	Recommended Land Pattern Mask Drawing – Top View
	

Notes:
1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.

Tape and Reel Information





Feature	Measure	Symbol	Size (mm)
Flange	Diameter	D1	330.0
	Thickness	W2	14.4
	Space Between Flange	W1	8.4
Hub	Outer Diameter	D2	102.0
	Arbor Hole Diameter	D3	13.0
	Key Slit Width	B	2.0
	Key Slit Diameter	D4	20.0

Feature	Measure	Symbol	Size (mm)
Cavity	Length	Ao	1.8
	Width	Bo	2.2
	Depth	Ko	0.8
	Pitch	P1	4.0
Centerline Distance	Cavity to Perforation (Length)	P2	2.0
	Cavity to Perforation (Width)	P3	3.5
Carrier Tape	Width	W	8

(Unless otherwise specified, all dimension tolerances per EIA-481)

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1B	ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
  - Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free
- Qorvo Green

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

Important Notice

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REVISION HISTORY

Revision	Date (YYYYMMDD)	Description
A	20200114	Initial Document
B	20200205	Updated Pinout
C	20200507	Updated with measured data
D	20200624	Updated power handling
E	20200707	Updated electrical specifications
F	20200713	Updated specifications to include 2390-2400MHz
G	20200716	Updated GNSS attenuation spec

QM28011

MHB, 2.4G Wi-Fi, and UHB/5G Wi-Fi 6E Antenna Triplexer

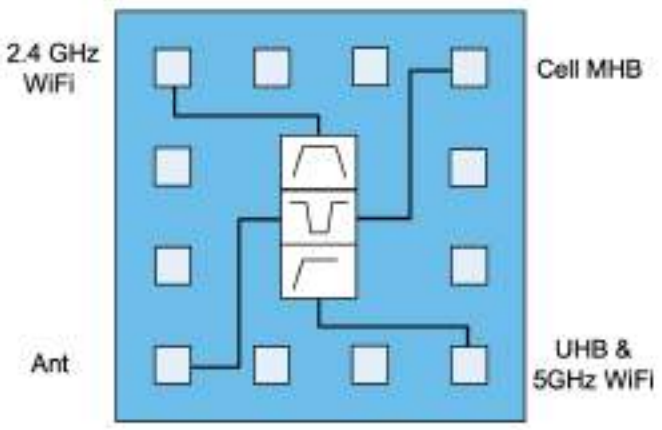
Product Overview

The QM28011 is a compact, high-performance filter module designed to meet the strict requirements of both WLAN and LTE/nR from 1700-2400 MHz, 2496-2690 MHz, and 3300-7125 MHz

The QM28011 leverages the Qorvo's patented technology to ensure minimal transmit insertion loss in all bands being multiplexed without loading each other. The QM28011 module has also been designed with high cross-isolation which is critical to ensure the best overall performance.

The QM28011 uses common module packing techniques to achieve a compact 2.0 mm x 2.0 mm footprint.

Functional Block Diagram



Top View

12 Pin 2.0 x 2.0mm leadless SMT package

Key Features

- Compact Form-Factor: 2.0mm x 2.0mm
- Highly selective filters achieving low insertion loss and high attenuation over full bandwidth
- Rejection in 2.4GHz WLAN of 10dB minimum
- Single antenna port, triplexing
- RoHS Compliant, Pb-Free Module Package
- Supports Wi-Fi 6E

Applications

- For 2.4GHz and 5GHz WLAN, GSM HB, B1/n1, B2/n2, B3/n3, B4, B7/n7, B11, B21, B25/n25, B30, B32, B66/n66 FDD-LTE and B34/n34, B38/n38, B39/n39, B40/n40, B41/n41, B42, B48 TDD-LTE, n77, n78, and n79 applications
- LTE and 5G handsets

Ordering Information

Part Number	Description
QM28011EVB	Evaluation Board (EVB)
QM28011SB	Sample bag of 5 pieces
QM28011SR	Sample reel of 100 pieces
QM28011TR13	13 inch reel of 10k pieces

Absolute Maximum Ratings(1)

Parameter		Condition		Rating	UNITS
Storage Temperature				-40 to +85	°C
Operating Case Temperature				-30 to +85	°C
RF Input Power (Pin10, Cell MB/HB)		CW, 55°C, 5k hours		+30	dBm
RF Input Power (Pin7, UHB & 5GHz Wi-Fi 6E)		CW, 55°C, 5k hours		+30	dBm
RF Input Power (Pin1, Wi-Fi)		CW, 55°C, 5k hours		+26	dBm
RF Input Power (2)	Pin10, Cell MB/HB	1427.9 MHz – 2200 MHz	FD-LTE/5G-NR 100% DC, 55°C, 5k hours	+28	dBm
		2500 MHz – 2570 MHz			
		2300 MHz – 2390 MHz	TD-LTE/5G-NR 40% DC, 55°C, 5k hours	+28	dBm
		2496 MHz – 2690 MHz			
	Pin1, Wi-Fi	2403 MHz – 2481 MHz	CW, 55°C, 5k hours	+24	dBm
RF Input Power (2)	Pin7, UHB	3300 MHz – 5000 MHz	TD-LTE/5G-NR 40% DC, 55°C, 5k hours	+28	dBm
	Pin1, Wi-Fi	2403 MHz – 2481MHz	CW, 55°C, 5k hours	+24	

1. Operation of this device outside the parameter ranges given above may cause permanent damage.
2. RF Applied Simultaneously

Electrical Specifications[1] 2.4GHz Wi-Fi - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	2403 MHz – 2421 MHz[2] (Wi-Fi CH1)	-	1.9	2.2	dB
	2408 MHz – 2426 MHz[2] (Wi-Fi CH2)	-	1.7	1.9	
	2413 MHz – 2431 MHz[2] (Wi-Fi CH3)	-	1.5	1.7	
	2418 MHz – 2436 MHz[2] (Wi-Fi CH4)	-	1.4	1.6	
	2423 MHz – 2446 MHz[2] (Wi-Fi CH5-6)	-	1.3	1.6	
	2433 MHz – 2456 MHz[2] (Wi-Fi CH7-8)	-	1.4	1.7	
	2443 MHz – 2466 MHz[2] (Wi-Fi CH9-10)	-	1.5	1.8	
	2453 MHz – 2471 MHz[2] (Wi-Fi CH11)	-	1.6	1.9	
	2458 MHz – 2476 MHz[2] (Wi-Fi CH12)	-	1.7	2.1	
	2463 MHz – 2481 MHz[2] (Wi-Fi CH13)	-	1.8	2.5	
VSWR (Wi-Fi)	2403 MHz – 2481 MHz	-	1.3:1	2.0:1	-
VSWR (ANT)	2403 MHz – 2481 MHz	-	1.3:1	2.0:1	
Attenuation	617 MHz – 960 MHz	40	41	-	dB
	1427.9 MHz – 1510.9 MHz	42	43	-	
	1559 MHz – 1606 MHz	42	43	-	
	1710 MHz – 2200 MHz	35	43	-	
	2300 MHz – 2370 MHz	33	50	-	
	2496 MHz – 2505 MHz[3]	16	31	-	
	2505 MHz – 2690 MHz	40	47	-	
	3200 MHz – 3300 MHz	45	50	-	
	3300 MHz – 3400 MHz	45	52	-	
	3400 MHz – 3800 MHz	46	53	-	
	3800 MHz – 4200 MHz	51	55	-	
	4400 MHz – 5000 MHz	52	59	-	
	4800 MHz – 4970 MHz	56	60	-	
	5150 MHz – 5850 MHz	55	60	-	
	5925 MHz – 7125 MHz	37	45	-	

Notes:
1. All specifications include expected temperature and process guardbands
2. Integrated over each 18MHz channel
3. Specified from +5°C to +85°C

Electrical Specifications[1] Cell MB/HB - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1427.9 MHz – 1510.9 MHz	-	0.74[2]	1.1	dB
	1574 MHz – 2200 MHz	-	0.78[2]	1.4	
	2300 MHz – 2370 MHz	-	1.5[2]	2.8	
	2370 MHz – 2385 MHz	-	2.8[2]	9.0	
	2385 MHz – 2390 MHz	-	5.7[2]	14.0	
	2496 MHz – 2510 MHz	-	2.1[2]	6.0	
	2510 MHz – 2570 MHz	-	1.3[2]	2.0	
	2515 MHz – 2675 MHz	-	1.3[2]	1.8	
	2570 MHz – 2690 MHz	-	1.3[2]	1.8	
VSWR (Cell MB/HB)	1427.9 MHz – 1510.9 MHz	-	1.7:1	2.0:1	-
	1574 MHz – 2200 MHz	-	1.4:1	2.0:1	
	2300 MHz – 2370 MHz	-	1.3:1	2.0:1	
	2496 MHz – 2510 MHz	-	2.7:1	4.0:1	
	2510 MHz – 2570 MHz	-	1.9:1	2.3:1	
	2570 MHz – 2690 MHz	-	1.5:1	2.0:1	
VSWR (ANT)	1427.9 MHz – 1510.9 MHz	-	1.6:1	2.0:1	-
	1574 MHz – 2200 MHz	-	1.4:1	2.0:1	
	2300 MHz – 2370 MHz	-	1.2:1	2.0:1	
	2496 MHz – 2510 MHz	-	1.6:1	2.0:1	
	2510 MHz – 2570 MHz	-	1.5:1	2.0:1	
	2570 MHz – 2690 MHz	-	1.4:1	2.0:1	
Attenuation	2418 MHz – 2471 MHz[3] (Wi-Fi CH4-11)	15	16	-	dB
	3300 MHz – 3400 MHz	10	19	-	
	3400 MHz – 3800 MHz	15	21	-	
	3800 MHz – 4200 MHz	20	23	-	
	4400 MHz – 5000 MHz	29	32	-	
	5000 MHz – 5150 MHz	37	39	-	
	5150 MHz – 5925 MHz	38	40	-	
	5925 MHz – 7125 MHz	38	45	-	

Notes:
1. All specifications include expected temperature and process guardbands
2. Typical specified as average at room temperature
3. Integrated over each 18 MHz channel

Electrical Specifications[1] UHB & 5GHz Wi-Fi 6E - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	3300 MHz – 3400 MHz	-	1.4	1.8	dB
	3400 MHz – 3600 MHz	-	0.9	1.3	
	3600 MHz – 4200 MHz	-	0.7	1.1	
	4400 MHz – 5000 MHz	-	0.5	0.7	
	5150 MHz – 5925 MHz	-	0.4	0.7	
	5925 MHz – 7125 MHz	-	0.3	0.7	
VSWR (UHB & 5GHz Wi-Fi 6E)	3300 MHz – 3400 MHz	-	1.2:1	2.0:1	-
	3400 MHz – 5925 MHz	-	1.3:1	2.0:1	
	5925 MHz – 7125 MHz	-	1.1:1	2.0:1	
VSWR (ANT)	3300 MHz – 3400 MHz	-	1.2:1	2.0:1	-
	3400 MHz – 5925 MHz	-	1.4:1	2.0:1	
	5925 MHz – 7125 MHz	-	1.1:1	2.0:1	
Attenuation	100 MHz – 2300 MHz	18	20	-	dB
	2300 MHz – 2400 MHz	20	24	-	
	2400 MHz – 2690 MHz	15	21	-	

Notes:

1. All specifications include expected temperature and process guardbands

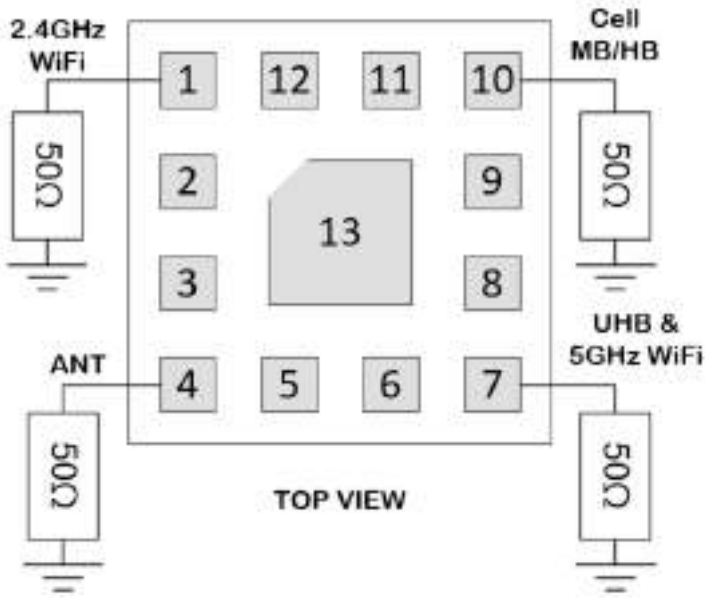
Electrical Specifications[1] Isolations

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Cell MB/HB – 2.4GHz Wi-Fi	1427.9 MHz – 2200 MHz	37	42	-	dB
	2300 MHz – 2370 MHz	37	47	-	
	2403 MHz – 2481 MHz[2]	15	16	-	
	2496 MHz – 2505 MHz[3]	17	30	-	
	2505 MHz – 2690 MHz	40	47	-	
Isolation Cell MB/HB – UHB & 5GHz Wi-Fi 6E	1427.9 MHz – 2400 MHz	19	20	-	dB
	2400 MHz – 2480 MHz	30	40	-	
	2496 MHz – 2690 MHz	15	24	-	
	3300 MHz – 5925 MHz	15	22	-	
	5925 MHz – 7125 MHz	40	46	-	
Isolation UHB & 5GHz Wi-Fi 6E – 2.4GHz Wi-Fi	5925 MHz – 7125 MHz	43	46	-	dB
	3300 MHz – 5925 MHz	48	51	-	
	2403 MHz – 2481 MHz	20	33	-	

Notes:

1. All specifications include expected temperature and process guardbands
2. Integrated over each 18 MHz channel
3. Specified from +5°C to +85°C

Application Circuit Schematic



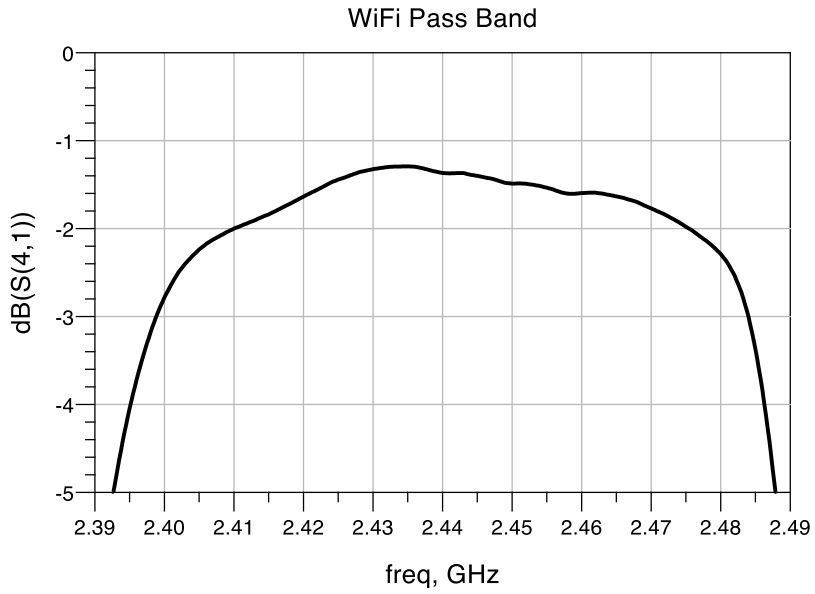
Note:
All ports are matched to 50 ohm impedance

Bill of Materials

Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	MHB, 2.4G Wi-Fi, and UHB/5G Wi-Fi 6E Antenna Triplexer	Qorvo	QM28011
PCB	N/A	10-layer Printed Circuit Board		QM28011-4000

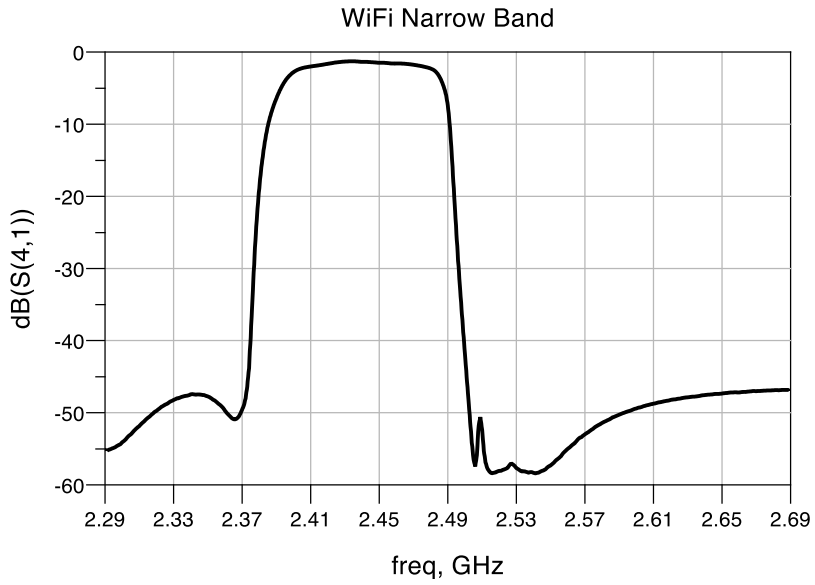
WiFi Insertion Loss

Test conditions unless otherwise noted: Temp. = +25°C



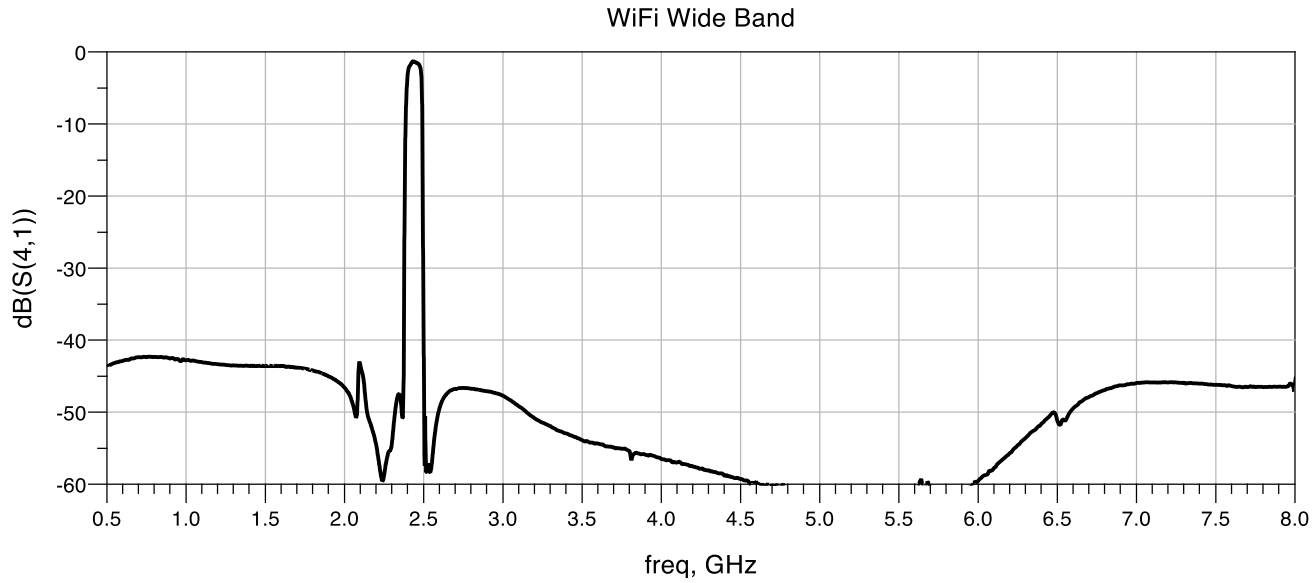
WiFi Attenuation

Test conditions unless otherwise noted: Temp. = +25°C



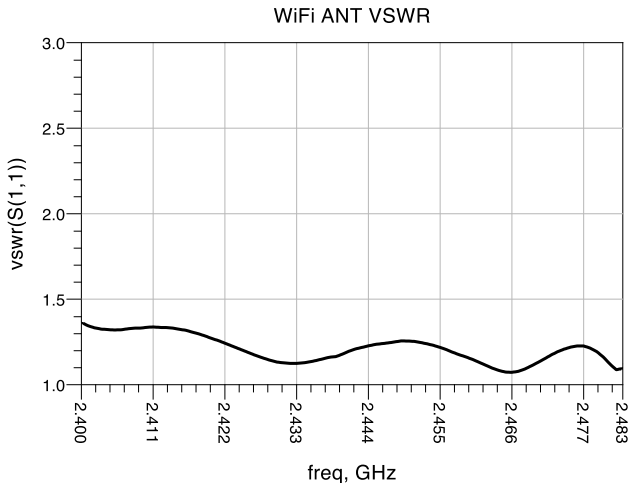
WiFi Attenuation Wideband

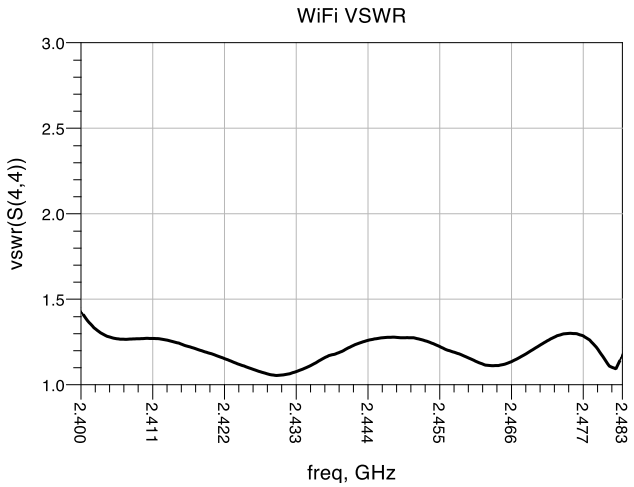
Test conditions unless otherwise noted: Temp. = +25°C



WiFi VSWR

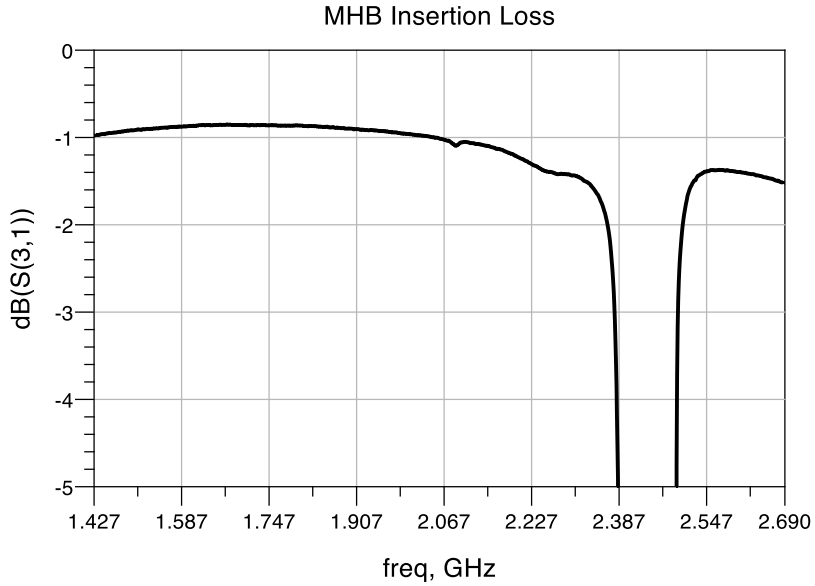
Test conditions unless otherwise noted: Temp. = +25°C





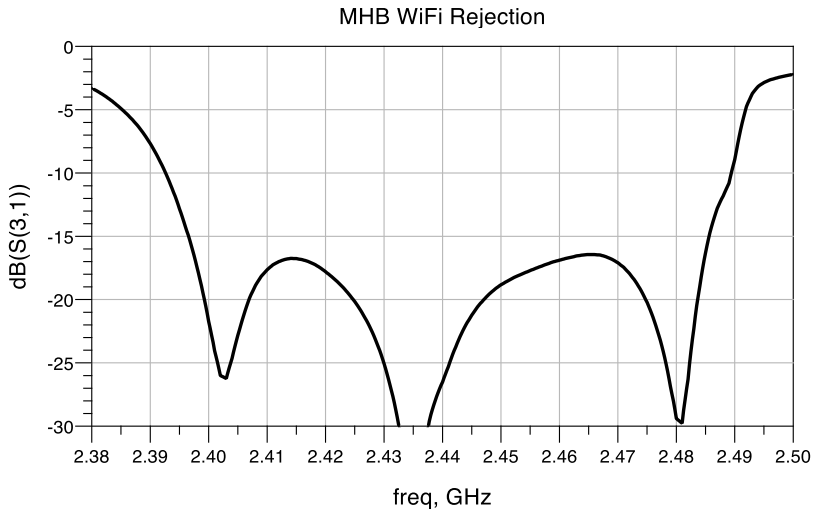
MHB Insertion Loss

Test conditions unless otherwise noted: Temp. = +25°C



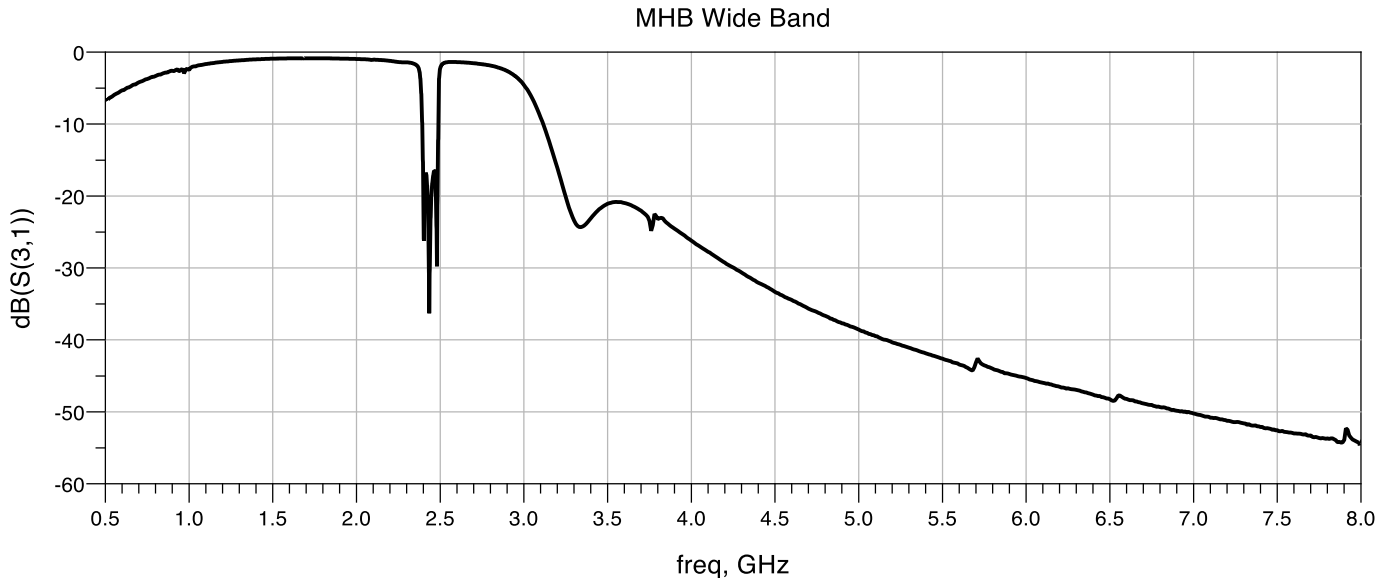
MHB Attenuation at WiFi Band

Test conditions unless otherwise noted: Temp. = +25°C



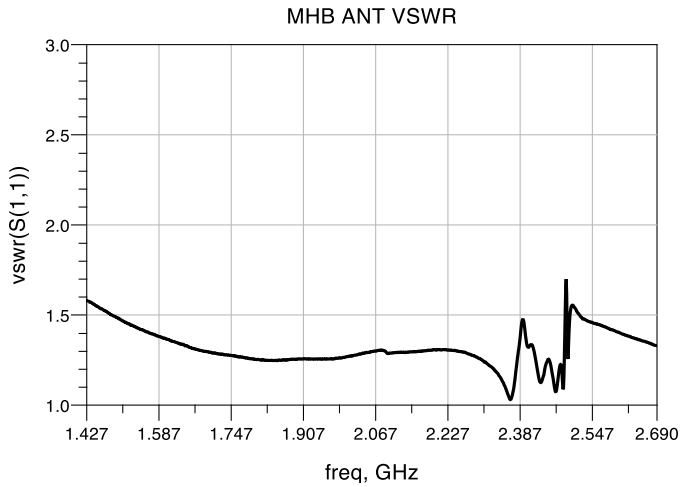
MHB Wideband

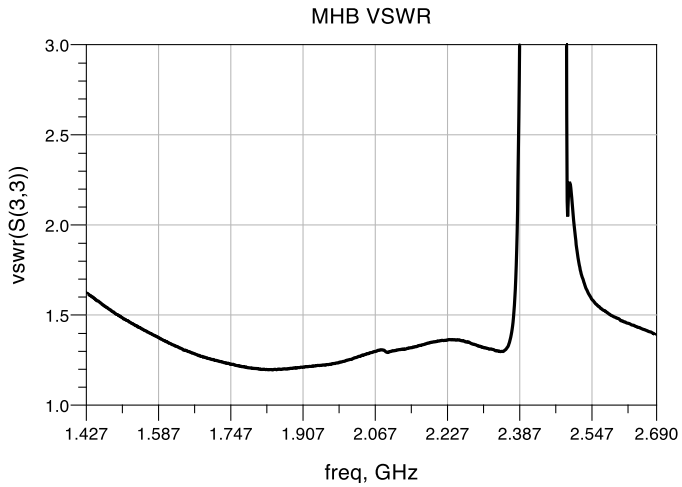
Test conditions unless otherwise noted: Temp. = +25°C



MHB VSWR

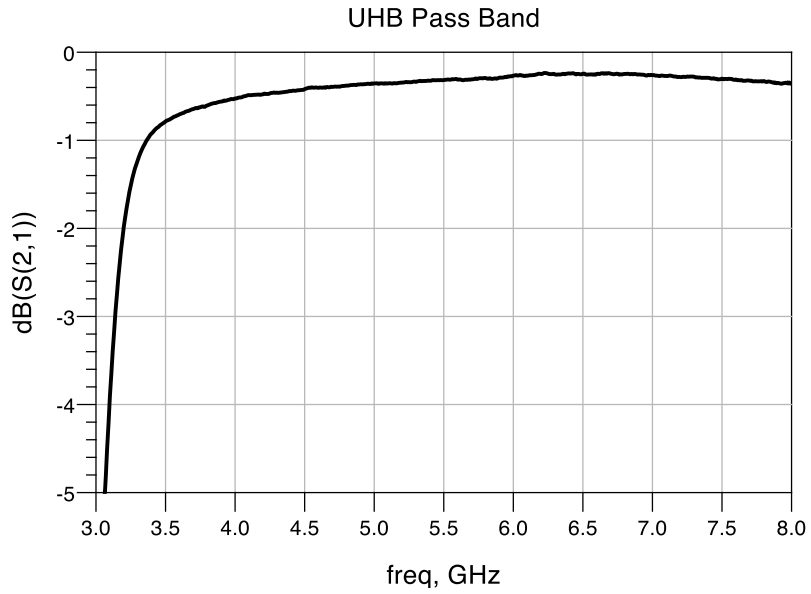
Test conditions unless otherwise noted: Temp. = +25°C





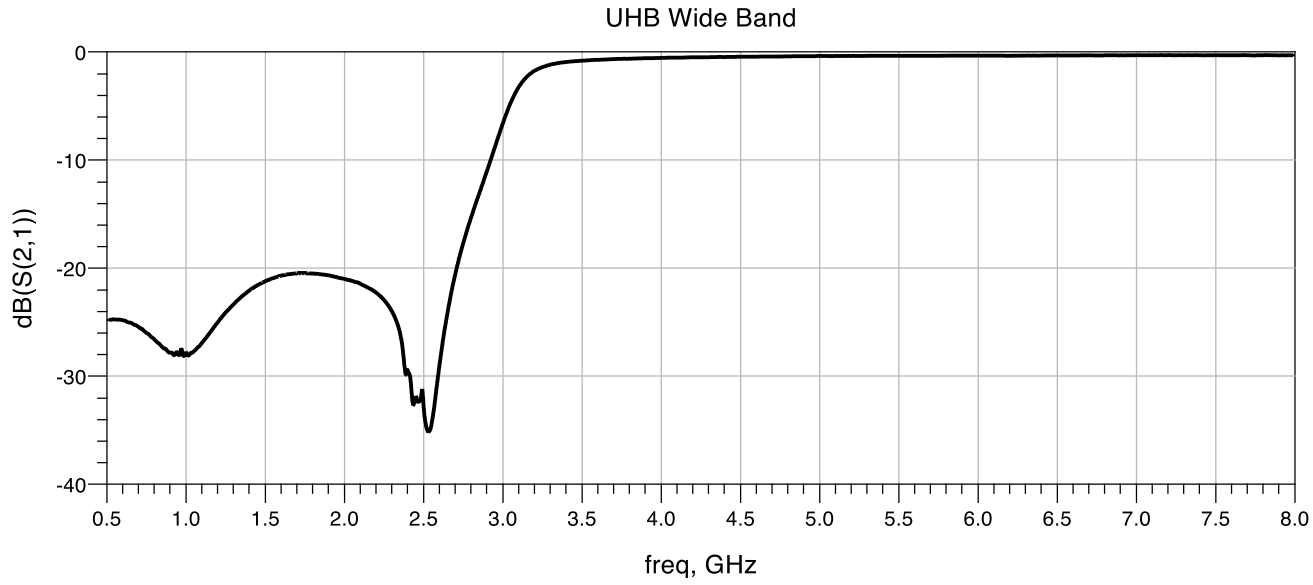
UHB Insertion Loss

Test conditions unless otherwise noted: Temp. = +25°C



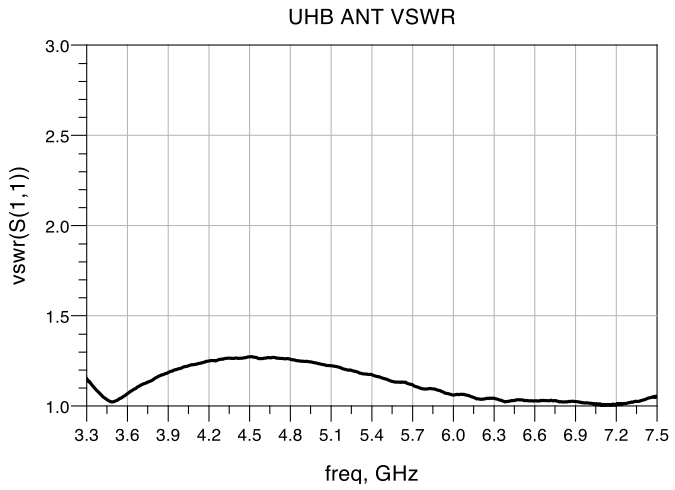
UHB Wideband

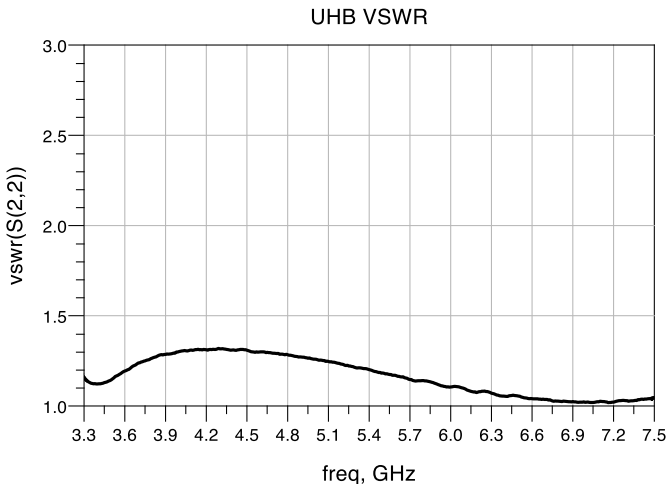
Test conditions unless otherwise noted: Temp. = +25°C



UHB VSWR

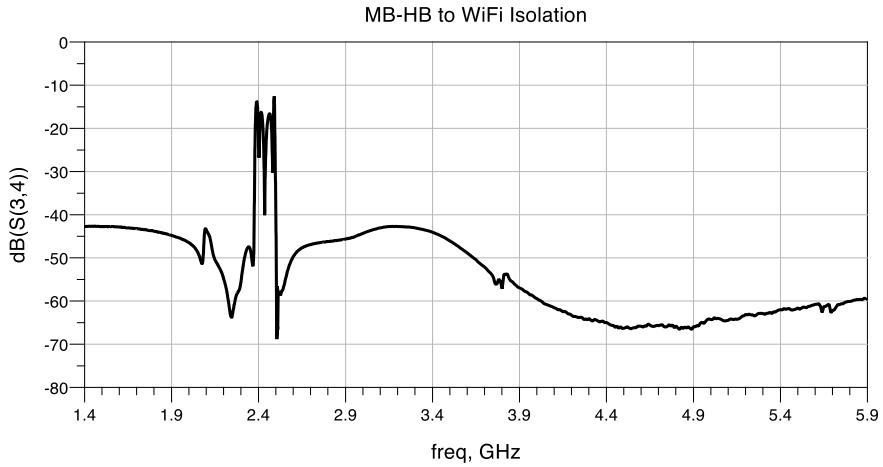
Test conditions unless otherwise noted: Temp. = +25°C

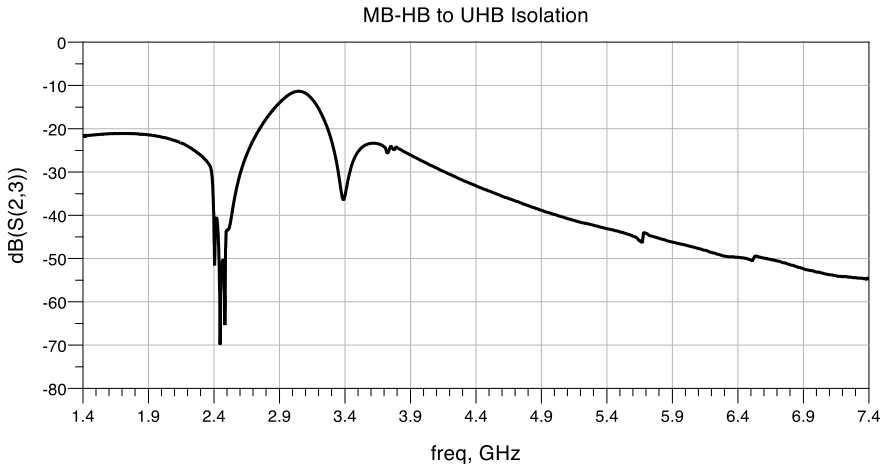


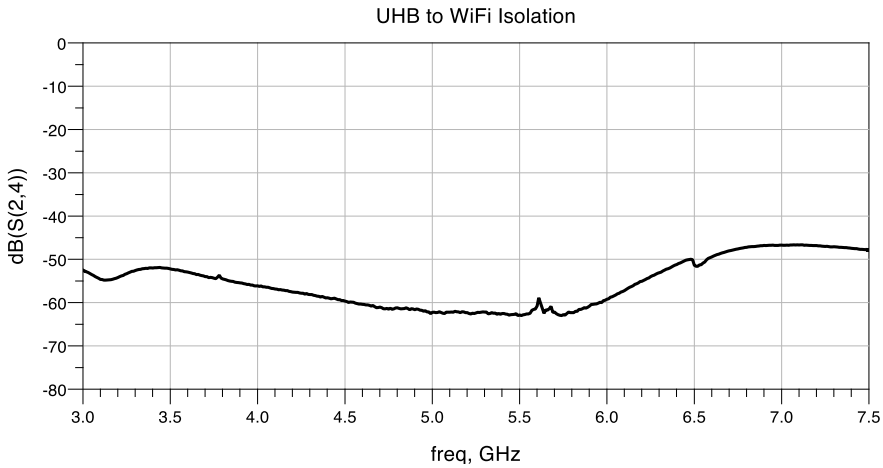


ISOLATION

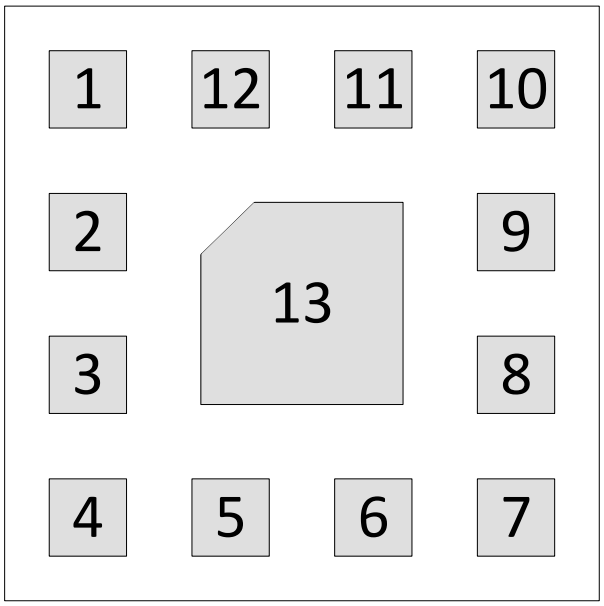
Test conditions unless otherwise noted: Temp. = +25°C







Pin Configuration and Description

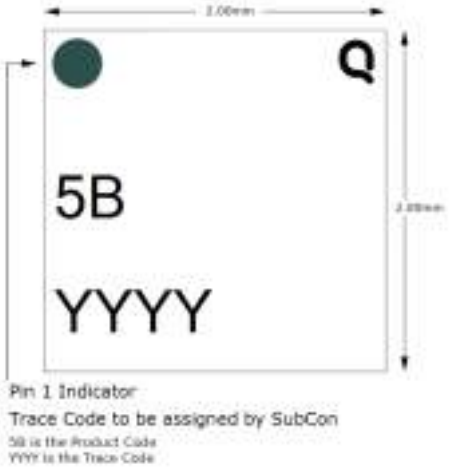


Top View

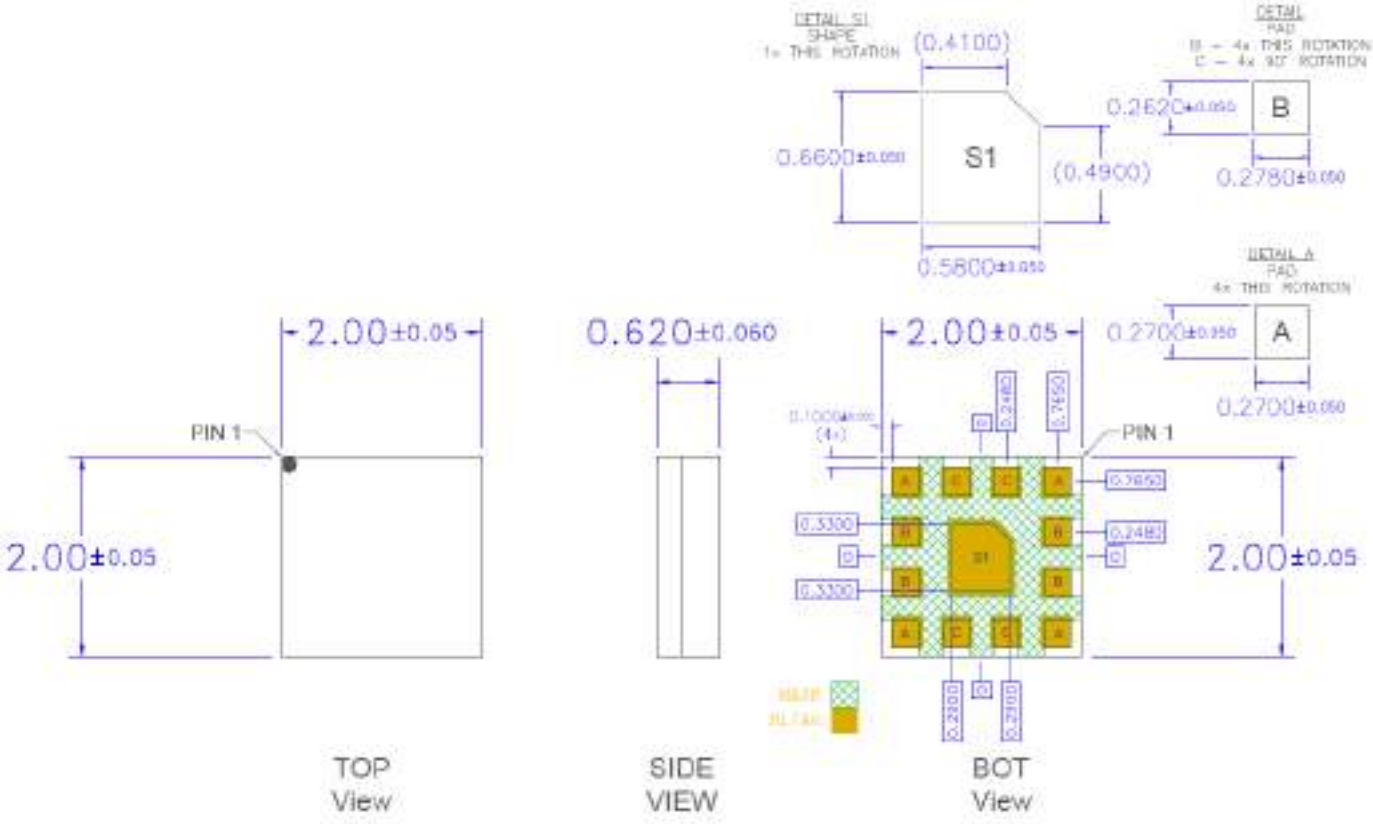
Pin Number	Label	Description
1	2.4 GHz WiFi	2.4 GHz Wi-Fi Port
4	ANT	Antenna Port
7	UHB & 5GHz Wi-Fi 6E	Ultra High Band Cellular Port
10	Cell MB/HB	Mid / High Band Cellular Port
2, 3, 5, 6, 8, 9, 11, and 12	GND	Ground
13	GND	Package Ground

Package Marking and Dimensions

Package Marking Diagram

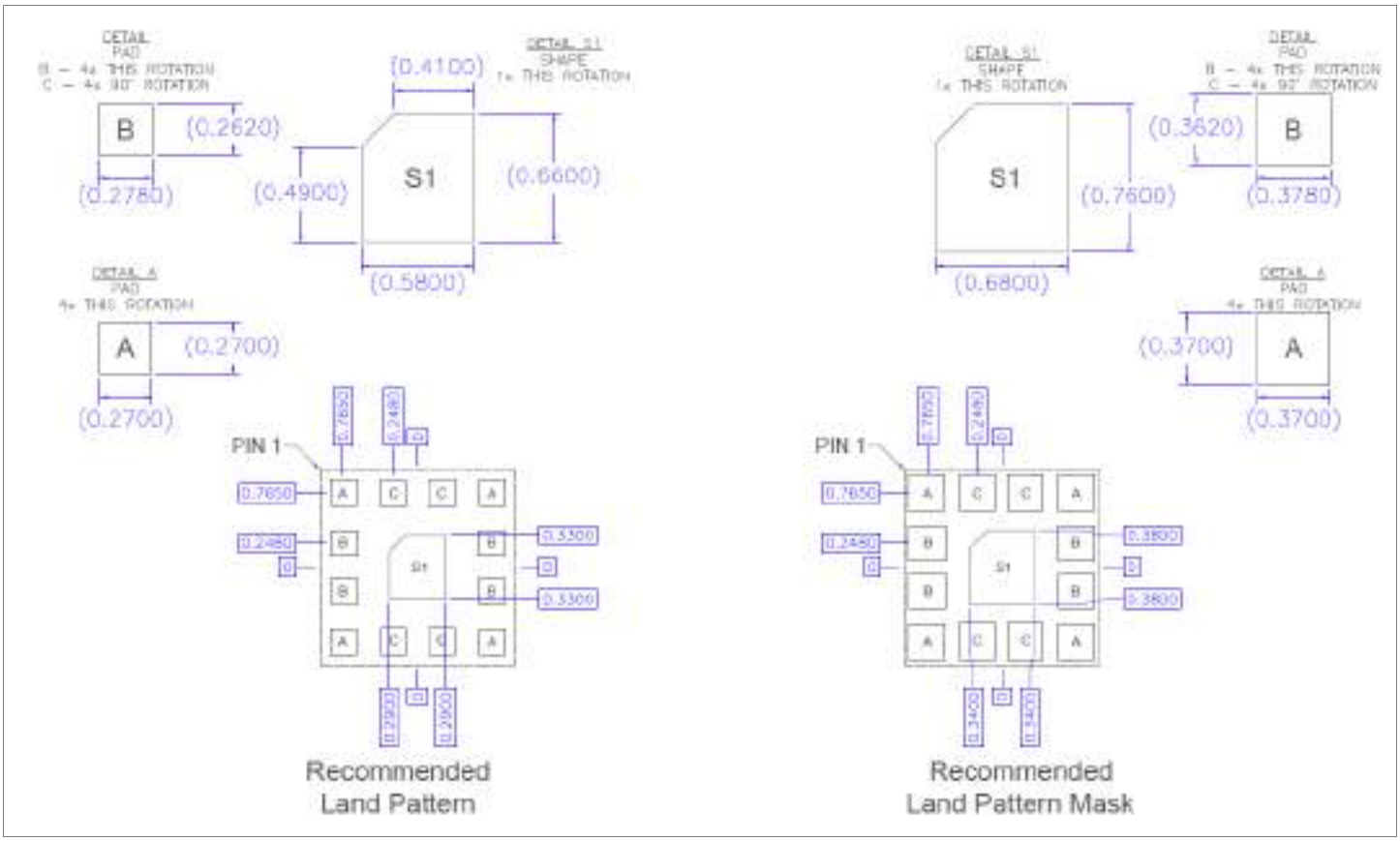


Package Outline Dimension Drawing



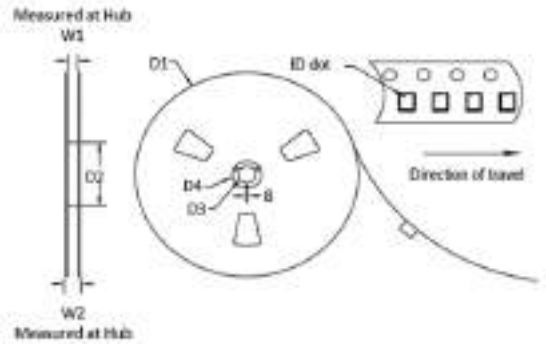
Notes:
1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

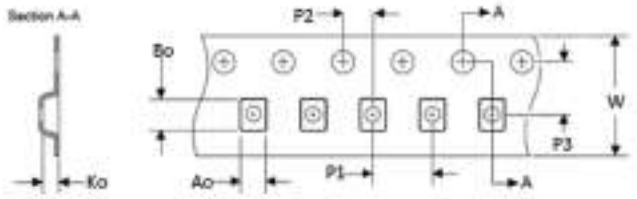
Mechanical Information



ES France - Département RF & Hyperfréquences - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 60 - Fax. 01 47 01 16 22 - e-mail: hyper@es-france.com - Site Web: www.es-france.com

Tape and Reel Information





Feature	Measure	Symbol	Size (mm)
Flange	Diameter	D1	330.0
	Thickness	W2	18.2
	Space Between Flange	W1	12.8
Hub	Outer Diameter	D2	102.0
	Arbor Hole Diameter	D3	13.0
	Key Slit Width	B	2.0
	Key Slit Diameter	D4	20.0

Feature	Measure	Symbol	Size (mm)
Cavity	Length	Ao	2.2
	Width	Bo	2.2
	Depth	Ko	0.95
	Pitch	P1	4.0
Centerline Distance	Cavity to Perforation (Length)	P2	2.0
	Cavity to Perforation (Width)	P3	5.5
Carrier Tape	Width	W	12.0

(Unless otherwise specified, all dimension tolerances per EIA-481)

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1B	ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
  - Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free
- Qorvo Green

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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REVISION HISTORY

Revision	Date (YYYYMMDD)	Description
E	20200421	Initial Production Release
F	20200824	Added 5G Wi-Fi 6E specifications
G	20200903	Added simultaneous power handling specs

QM28007

GNSS, 2.4G WiFi, and 5G WiFi6E Antennaplexer

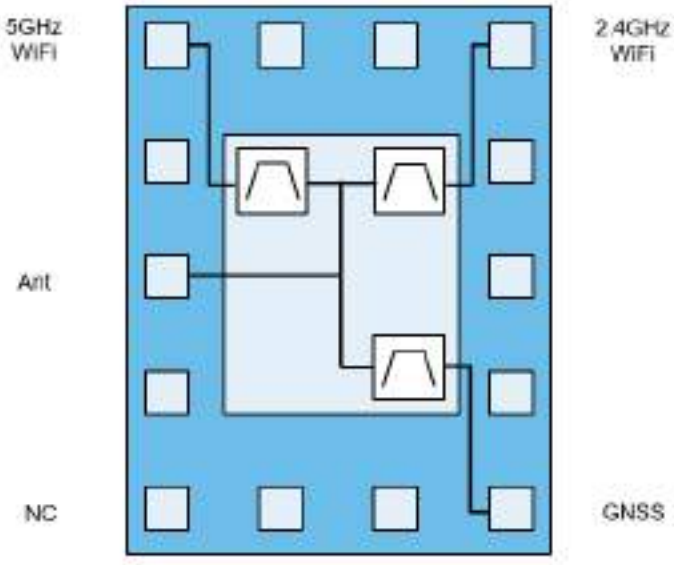
Product Overview

The QM28007 is part of Qorvo's family of antennaplexers using patented technology to meet the high performance expectations of insertion loss and rejection for GNSS and WiFi systems under all operating conditions

The QM28007 is a compact filter module designed to meet the strict requirements of out of band attenuation while optimizing for insertion loss of GNSS, 2.4G WLAN and 5G WiFi6E from 1559.05 MHz – 1605.89 MHz, 2403 MHz – 2481 MHz, and 5150 MHz – 7125 MHz

The QM28007 uses common module packaging techniques to achieve a compact 2.0 mm x 1.6 mm footprint.

Functional Block Diagram



Top View

2.0 x 1.6 x 0.6 mm

Key Features

- Compact Form-Factor: 2.0 mm x 1.6 mm
- Highly selective filters achieving low insertion loss and high attenuation over full bandwidth
- Single antenna port, triplexing
- RoHS Compliant, Pb-Free Module Package

Applications

- For GNSS, 2.4GHz WLAN and 5G WiFi6E

Ordering Information

Part Number	Description
QM28007EVB	Evaluation Board (EVB)
QM28007SB	Sample bag of 5 pieces
QM28007SR	Sample reel of 100 pieces
QM28007TR13	13 inch reel of 10k pieces

Absolute Maximum Ratings

Parameter	Conditions	Rating	Units
Storage Temperature		TBD	°C
Operating Case Temperature		-30 to +85	°C
RF Input Power (Pin 5, 2.4GHz WiFi)	2403 MHz – 2481 MHz	TBD	dBm
RF Input Power (Pin 8, 5GHz WiFi6E)	5150 MHz – 5925 MHz	TBD	dBm
	5925 MHz – 6425 MHz		
	6425 MHz – 7125 MHz		
RF Input Power (Pin 10, ANT)	1559 MHz – 1606 MHz	TBD	dBm
	2403 MHz – 2481 MHz		
	5150 MHz – 5925 MHz		
	5925 MHz – 6425 MHz		
	6425 MHz – 7125 MHz		

Operation of this device outside the parameter ranges given above may cause permanent damage.

Electrical Specifications[1] L1 GNSS - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1559.05 MHz – 1563.15 MHz	-	1.3[2]		dB
	1574.39 MHz – 1576.45 MHz	-	1.0[2]		
	1597.55 MHz – 1605.89 MHz	-	1.2[2]		
VSWR (GNSS)	1559.05 MHz – 1563.15 MHz	-	1.5:1		-
	1574.39 MHz – 1576.45 MHz	-	1.5:1		
	1597.55 MHz – 1605.89 MHz	-	1.7:1		
VSWR (ANT)	1559.05 MHz – 1563.15 MHz	-	1.6:1		
	1574.39 MHz – 1576.45 MHz	-	1.5:1		
	1597.55 MHz – 1605.89 MHz	-	1.6:1		
Attenuation	10 MHz – 960 MHz		42	-	dB
	777 MHz – 787 MHz		42	-	
	788 MHz – 798 MHz		42	-	
	1427.9 MHz – 1462.9 MHz		51	-	
	1640 MHz – 1695 MHz		34	-	
	1695 MHz – 1710 MHz		50	-	
	1710 MHz – 1785 MHz		49	-	
	1786 MHz – 1797 MHz		49	-	
	1850 MHz – 1910 MHz		51	-	
	1910 MHz – 1980 MHz		53	-	
	2010 MHz – 2025 MHz		60	-	
	2305 MHz – 2315 MHz		57	-	
	2401 MHz – 2483 MHz		38	-	
	2500 MHz – 2570 MHz		33	-	
	2570 MHz – 2690 MHz		40	-	
	2496 MHz – 2690 MHz		33	-	
	3400 MHz – 3600 MHz		33	-	
	4400 MHz – 4900 MHz		44	-	
	5150 MHz – 5925 MHz		49	-	
	5925 MHz – 6425 MHz		63	-	
	6425 MHz – 7125 MHz		58	-	

Notes:
1. All specifications are based on the Qorvo schematic for the main reference design
2. Typical specified as average at room temperature

Electrical Specifications[1] 2.4GHz WiFi - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	2403 MHz – 2421 MHz[2] (WiFi CH1)	-	2.0		dB
	2408 MHz – 2426 MHz[2] (WiFi CH2)	-	1.7		
	2413 MHz – 2431 MHz[2] (WiFi CH3)	-	1.6		
	2418 MHz – 2436 MHz[2] (WiFi CH4)	-	1.5		
	2423 MHz – 2461 MHz[2] (WiFi CH5-9)	-	1.5		
	2448 MHz – 2466 MHz[2] (WiFi CH10)	-	1.6		
	2453 MHz – 2471 MHz[2] (WiFi CH11)	-	1.7		
	2458 MHz – 2476 MHz[2] (WiFi CH12)	-	2.0		
	2463 MHz – 2481 MHz[2] (WiFi CH13)	-	2.2		
VSWR (WiFi)	2403 MHz – 2481 MHz	-	1.6:1		-
VSWR (ANT)	2403 MHz – 2481 MHz	-	1.9:1		
Attenuation	663 MHz – 698 MHz		51	-	dB
	699 MHz – 716 MHz		51	-	
	704 MHz – 748 MHz		50	-	
	777 MHz – 787 MHz		50	-	
	788 MHz – 798 MHz		50	-	
	814 MHz – 862 MHz		50	-	
	832 MHz – 862 MHz		50	-	
	880 MHz – 915 MHz		50	-	
	925 MHz – 960 MHz		50	-	
	1427.9 MHz – 1462.9 MHz		52	-	
	1559 MHz – 1606 MHz		53	-	
	1710 MHz – 1755 MHz		53	-	
	1710 MHz – 1785 MHz		54	-	
	1850 MHz – 1915 MHz		62	-	
	1880 MHz – 1920 MHz		64	-	
	1920 MHz – 1980 MHz		61	-	
	2010 MHz – 2025 MHz		57	-	
	2110 MHz – 2170 MHz		52	-	
	2300 MHz – 2370 MHz		48	-	
	2370 MHz – 2380 MHz		38	-	
	2380 MHz – 2390 MHz		17	-	
	2496 MHz – 2501 MHz		18	-	
	2500 MHz – 2505 MHz		45	-	
	2505 MHz – 2690 MHz		57	-	
	3400 MHz – 3600 MHz		55	-	
	3550 MHz – 3700 MHz		52	-	
	3300 MHz – 3800 MHz		46	-	
	3300 MHz – 4200 MHz		46	-	
	4400 MHz – 5000 MHz		51	-	
	4806 MHz – 4960 MHz		53	-	
	4800 MHz – 5000 MHz		51	-	
	5150 MHz – 5925 MHz		42	-	
	5925 MHz – 6425 MHz		44	-	
	6425 MHz – 7125 MHz		41	-	
	7200 MHz – 7500 MHz		33	-	

Notes:-

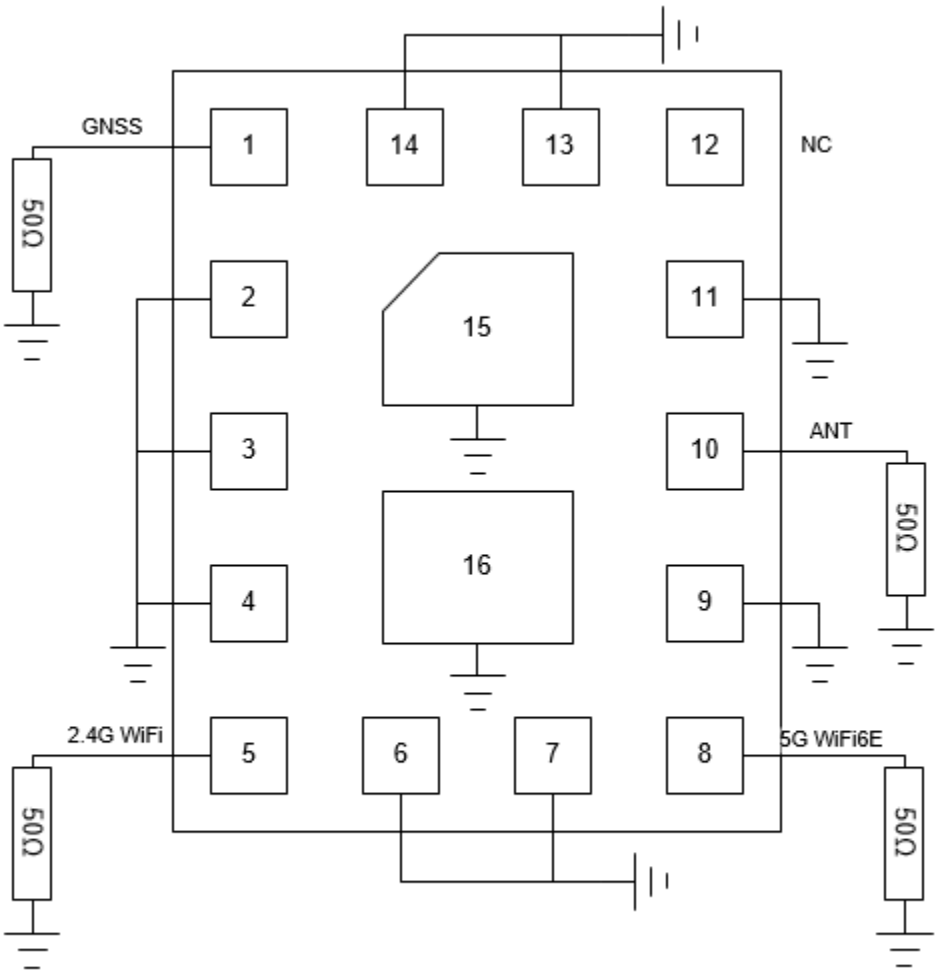
1. All specifications are based on the Qorvo schematic for the main reference design
2. Integrated over each 18MHz WiFi Channel

Electrical Specifications[1] 5GHz WiFi6E - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	5150 MHz – 5925 MHz	-	1.3[2]		dB
	5925 MHz – 6425 MHz	-	0.9[2]		
	6425 MHz – 7125 MHz	-	1.1[2]		
VSWR (5GHz WiFi6E)	5150 MHz – 5925 MHz	-	1.6:1		-
	5925 MHz – 6425 MHz	-	1.3:1		
	6425 MHz – 7125 MHz	-	1.7:1		
VSWR (ANT)	5150 MHz – 5925 MHz	-	1.7:1		-
	5925 MHz – 6425 MHz	-	1.3:1		
	6425 MHz – 7125 MHz	-	1.9:1		
Attenuation	663 MHz – 698 MHz		27	-	dB
	699 MHz – 716 MHz		27	-	
	704 MHz – 748 MHz		27	-	
	777 MHz – 787 MHz		27	-	
	788 MHz – 798 MHz		27	-	
	814 MHz – 862 MHz		27	-	
	832 MHz – 862 MHz		27	-	
	880 MHz – 915 MHz		27	-	
	824 MHz – 2170 MHz		23	-	
	1427.9 MHz – 1462.9 MHz		40	-	
	1559 MHz – 1606 MHz		27	-	
	1710 MHz – 1755 MHz		39	-	
	1710 MHz – 1785 MHz		39	-	
	1850 MHz – 1915 MHz		32	-	
	1880 MHz – 1920 MHz		32	-	
	1920 MHz – 1980 MHz		30	-	
	2010 MHz – 2025 MHz		28	-	
	2300 MHz – 2400 MHz		23	-	
	2400 MHz – 2500 MHz		26	-	
	2496 MHz – 2690 MHz		24	-	
	3400 MHz – 3600 MHz		38	-	
	3550 MHz – 3700 MHz		34	-	
	3300 MHz – 3800 MHz		34	-	
	3300 MHz – 4200 MHz		34	-	
	3300 MHz – 4100 MHz		35	-	
	4400 MHz – 5000 MHz		2	-	
	10300 MHz – 11850 MHz		41	-	
	15450 MHz – 17775 MHz		33	-	

Notes:
1. All specifications are based on the Qorvo schematic for the main reference design
2. Typical specified as average at room temperature

Application Circuit Schematic



Top View

Notes:

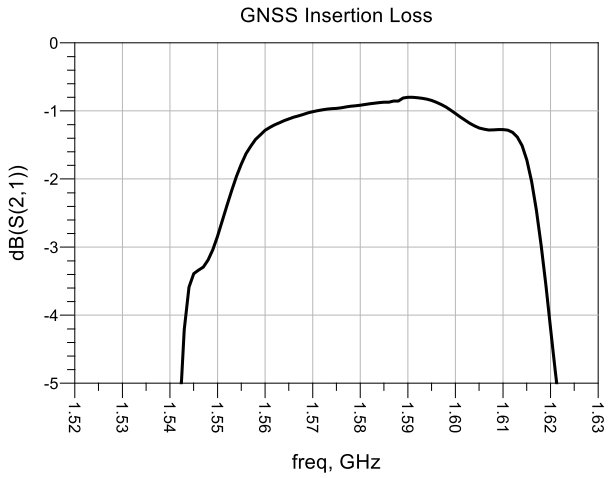
1. All RF ports internally matched to 50 ohm impedance
2. Recommend connecting all ground pins together on PCB

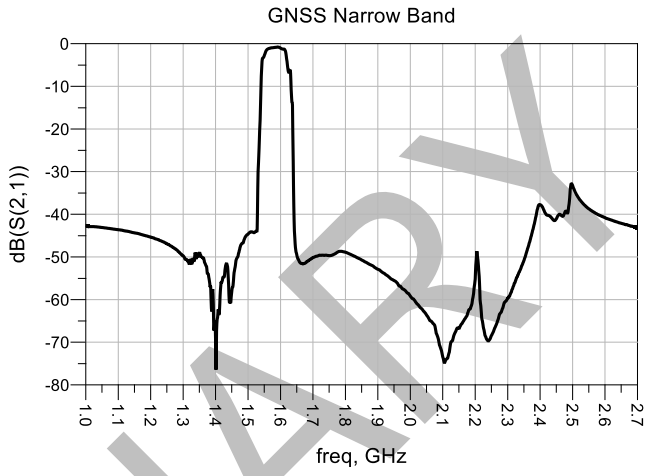
Bill of Materials

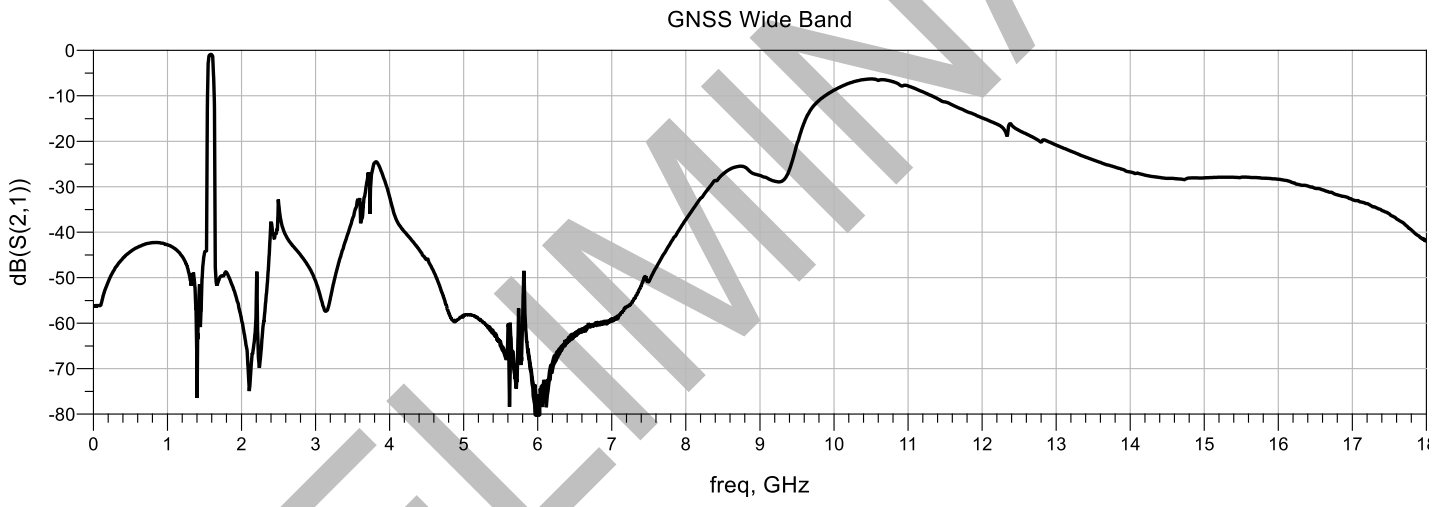
Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	GNSS, 2.4G WiFi, and 5G WiFi6E Antennaplexer	Qorvo	QM28007
PCB	N/A	4-layer Printed Circuit Board		QM28007-4000

GNSS Insertion Loss and Attenuation

Test conditions unless otherwise noted: Temp. = +25°C

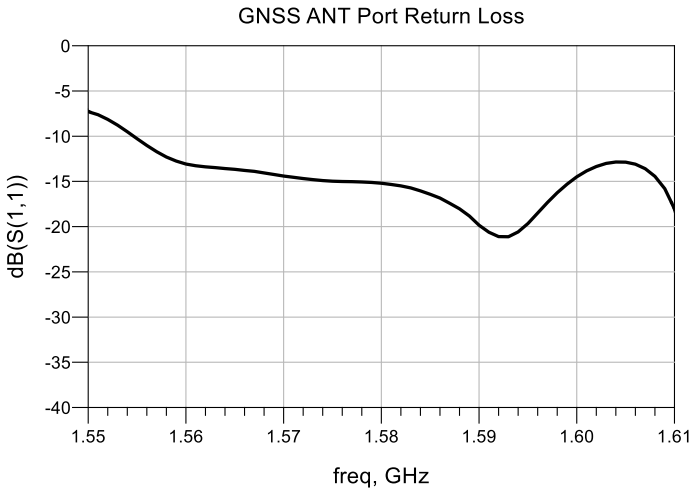


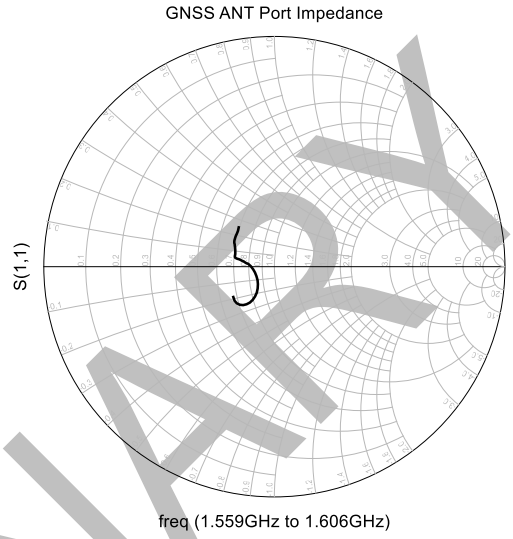


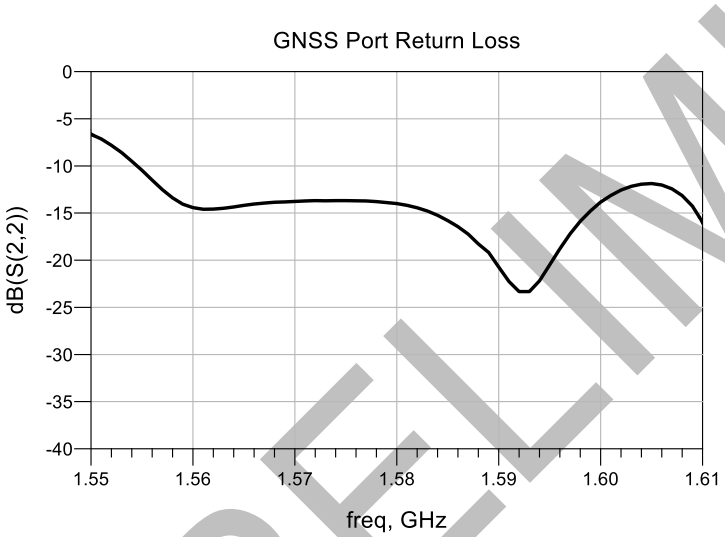


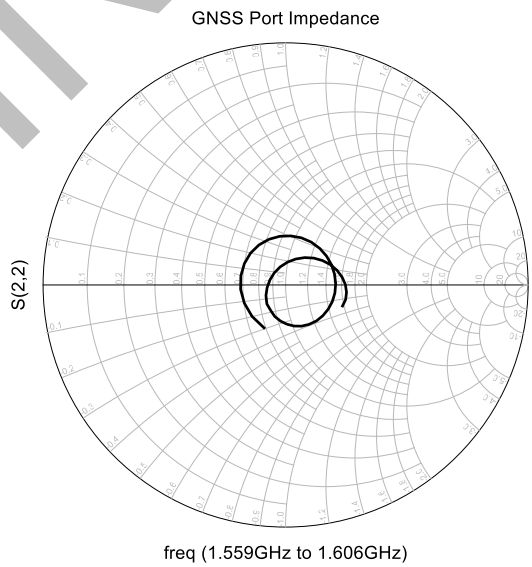
GNSS Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25°C





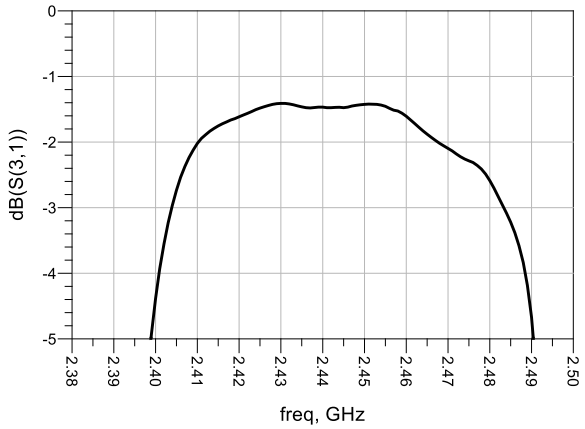




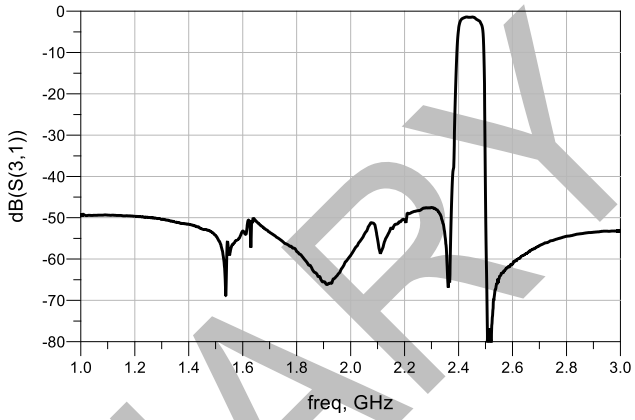
2.4GHz WiFi Insertion Loss and Attenuation

Test conditions unless otherwise noted: Temp. = +25°C

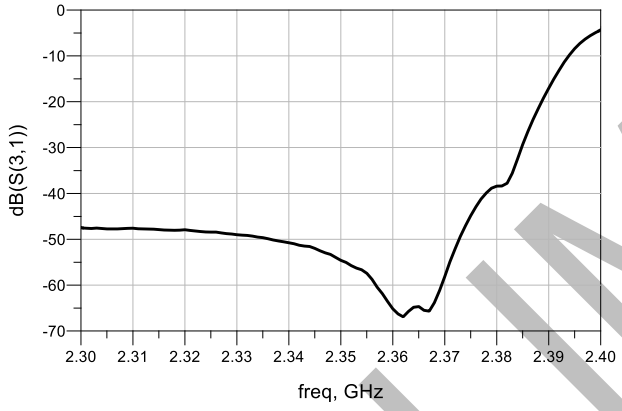
2.4GHz WiFi Insertion Loss



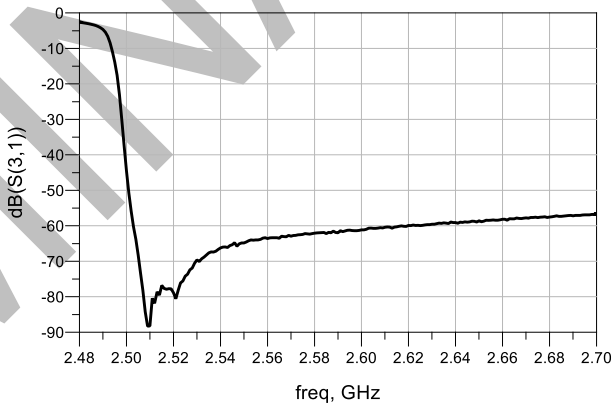
2.4GHz WiFi Narrow Band



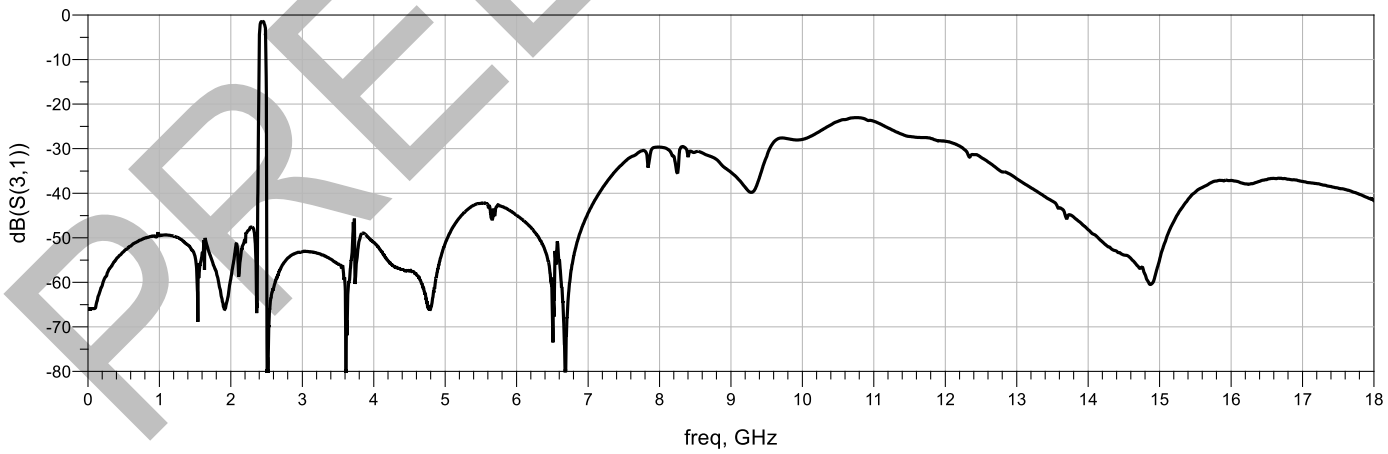
2.4GHz WiFi B40 Attenuation



2.4GHz WiFi B41 Attenuation

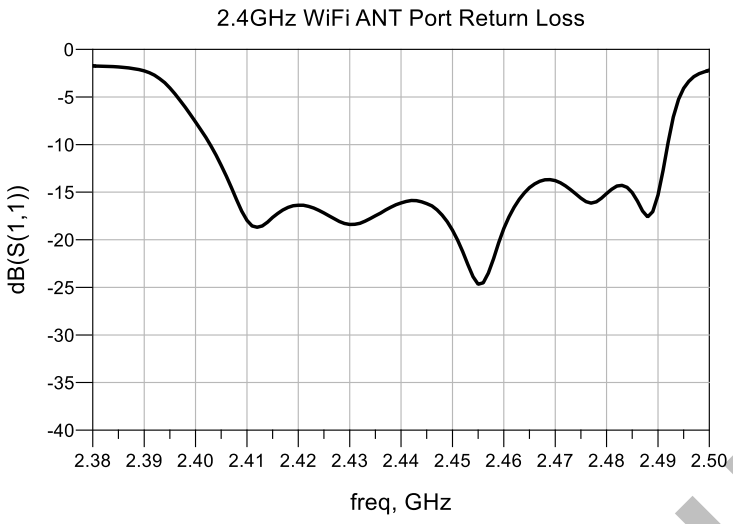


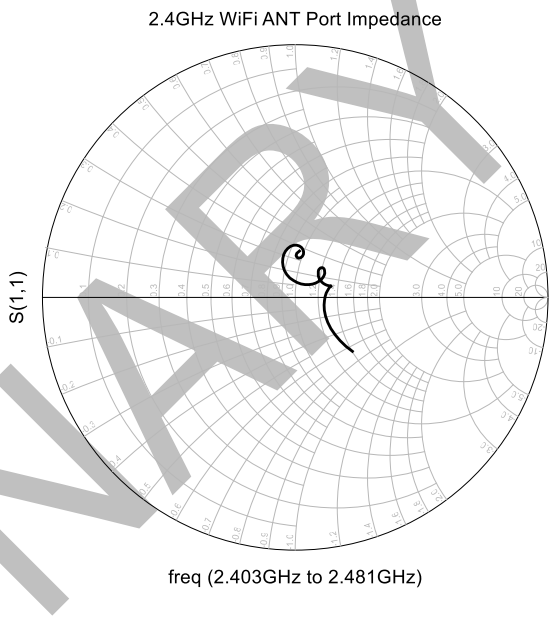
2.4GHz WiFi Wide Band

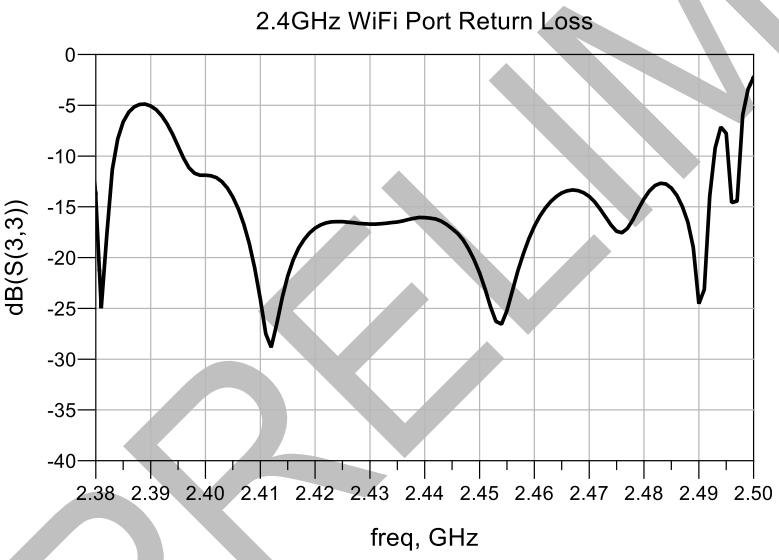


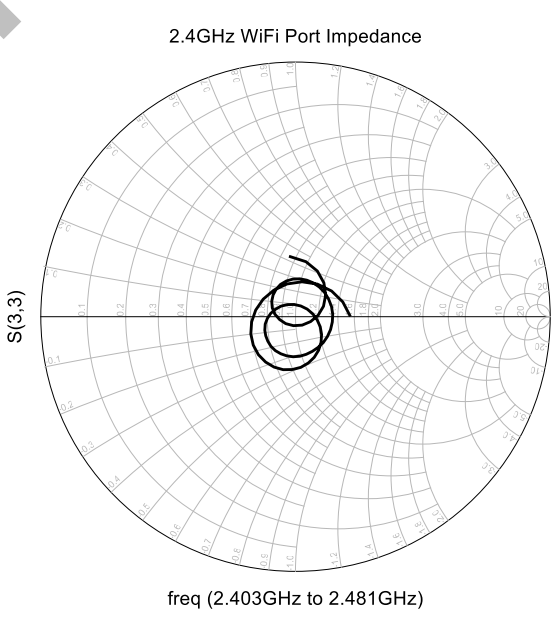
2.4GHz WiFi Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25°C





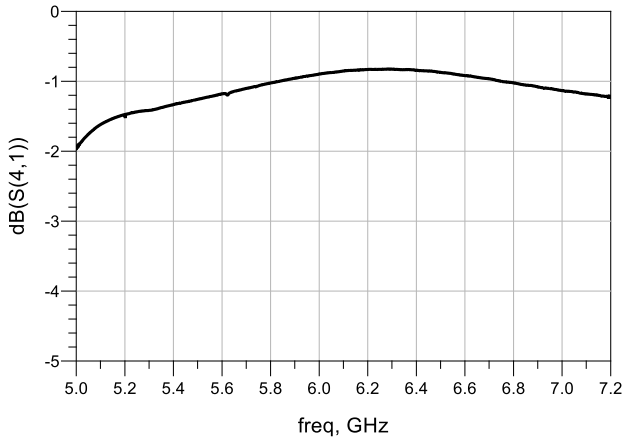




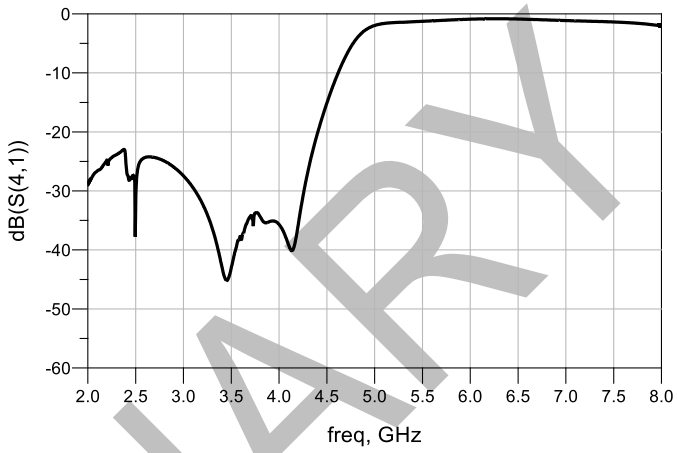
5GHz WiFi6E Insertion Loss and Attenuation

Test conditions unless otherwise noted: Temp. = +25°C

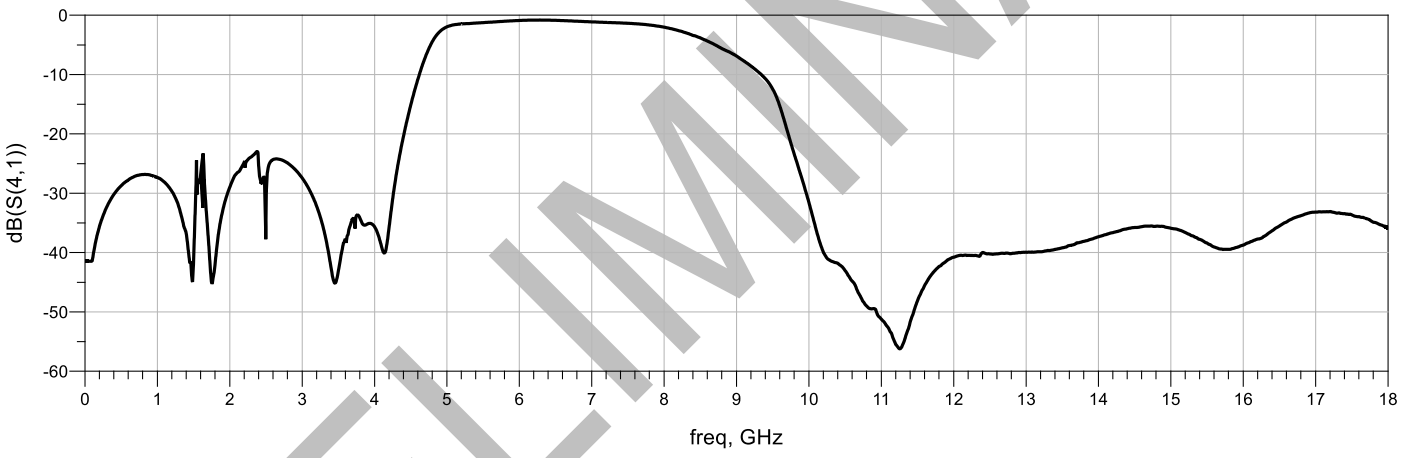
5GHz WiFi Insertion Loss



5GHz WiFi Narrow Band



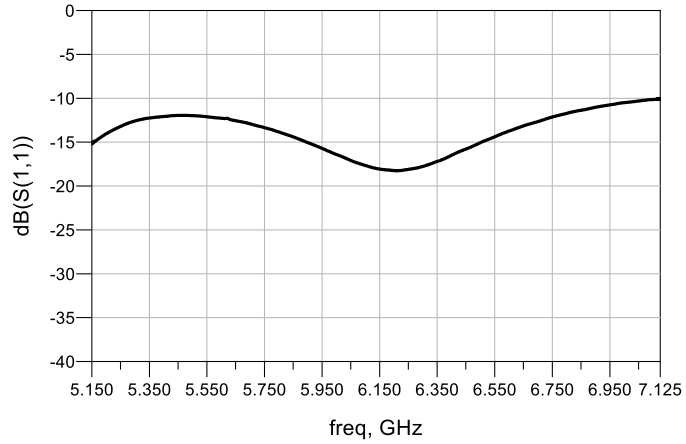
5GHz WiFi Wide Band



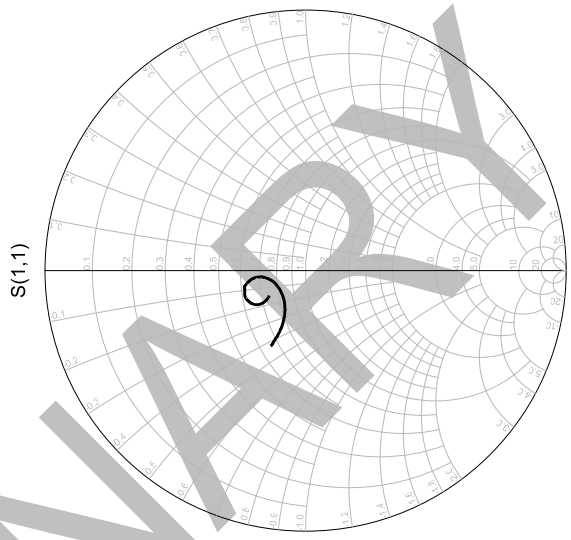
5GHz WiFi6E Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25°C

5GHz WiFi ANT Port Return Loss

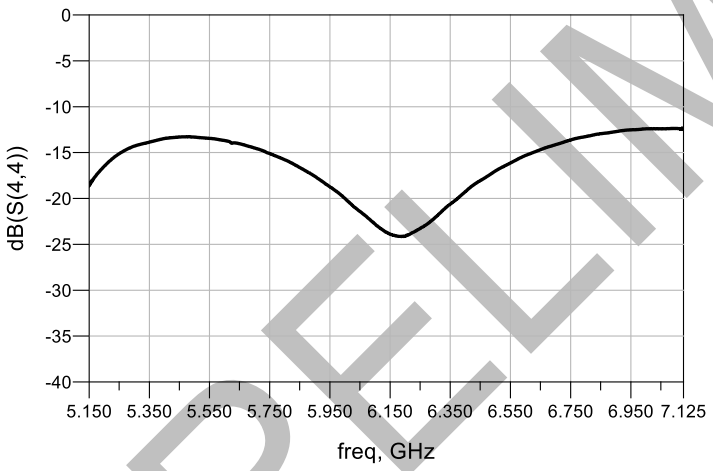


5GHz WiFi ANT Port Impedance

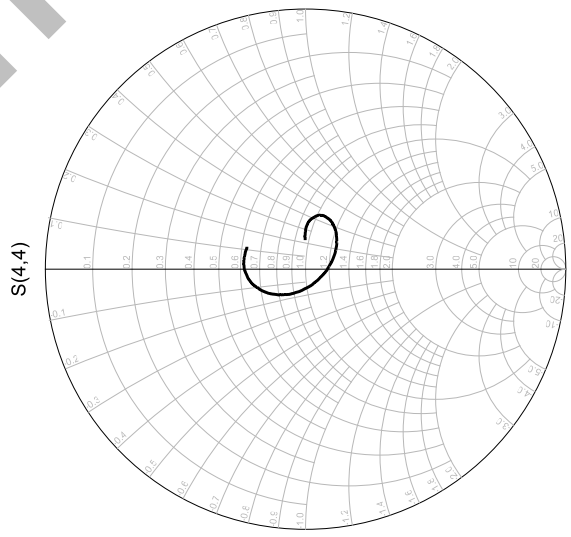


freq (5.150GHz to 7.125GHz)

5GHz WiFi Port Return Loss

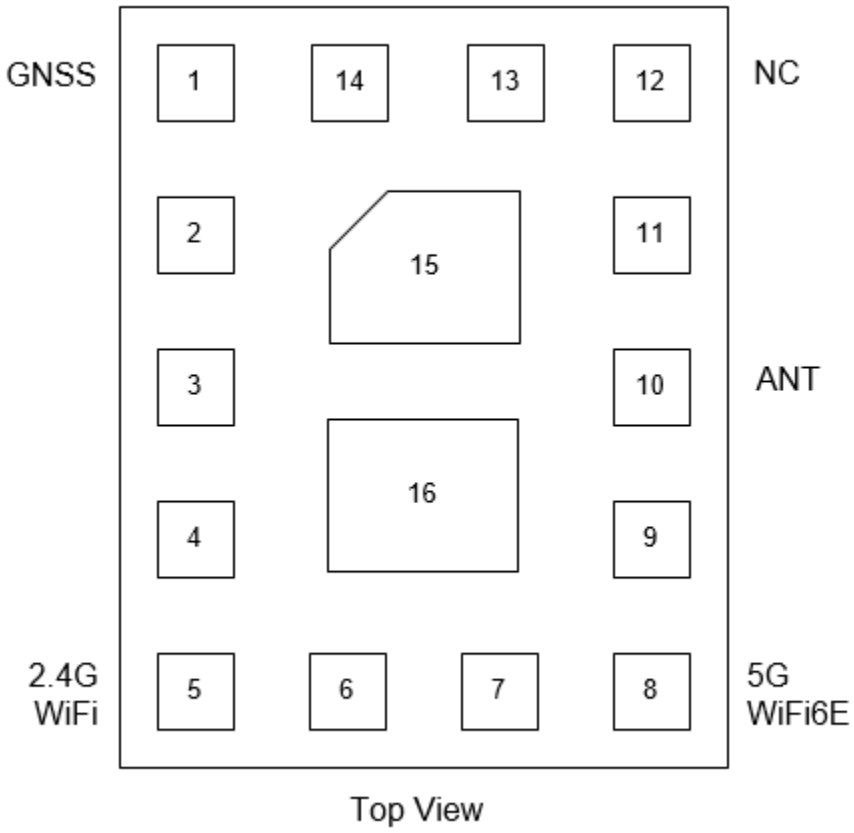


5GHz WiFi Port Impedance



freq (5.150GHz to 7.125GHz)

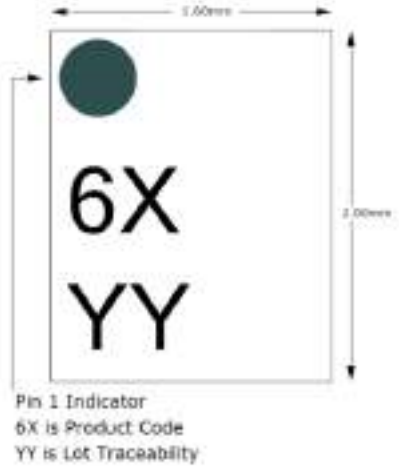
Pin Configuration and Description



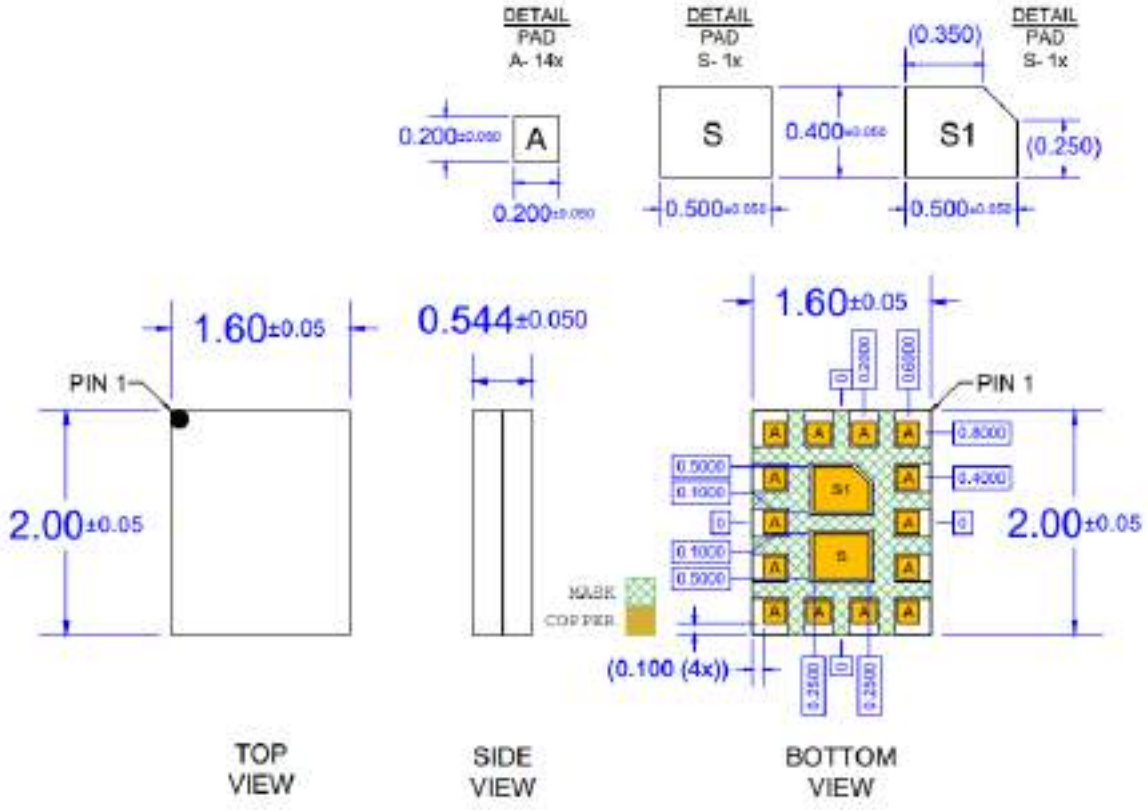
Pin Number	Label	Description
1	GNSS	GNSS Port
5	2.4GHz WiFi	2.4GHz WiFi Port
8	5GHz WiFi6E	5GHz WiFi6E Port
10	ANT	ANT Port
12	NC	No Connect
2, 3, 4, 6, 7, 9, 11, 13, and 14	GND	Ground
15 and 16	GND	Package Ground

Part Marking and Dimensions

Part Marking Diagram – Top View



Package Outline Dimension Drawing

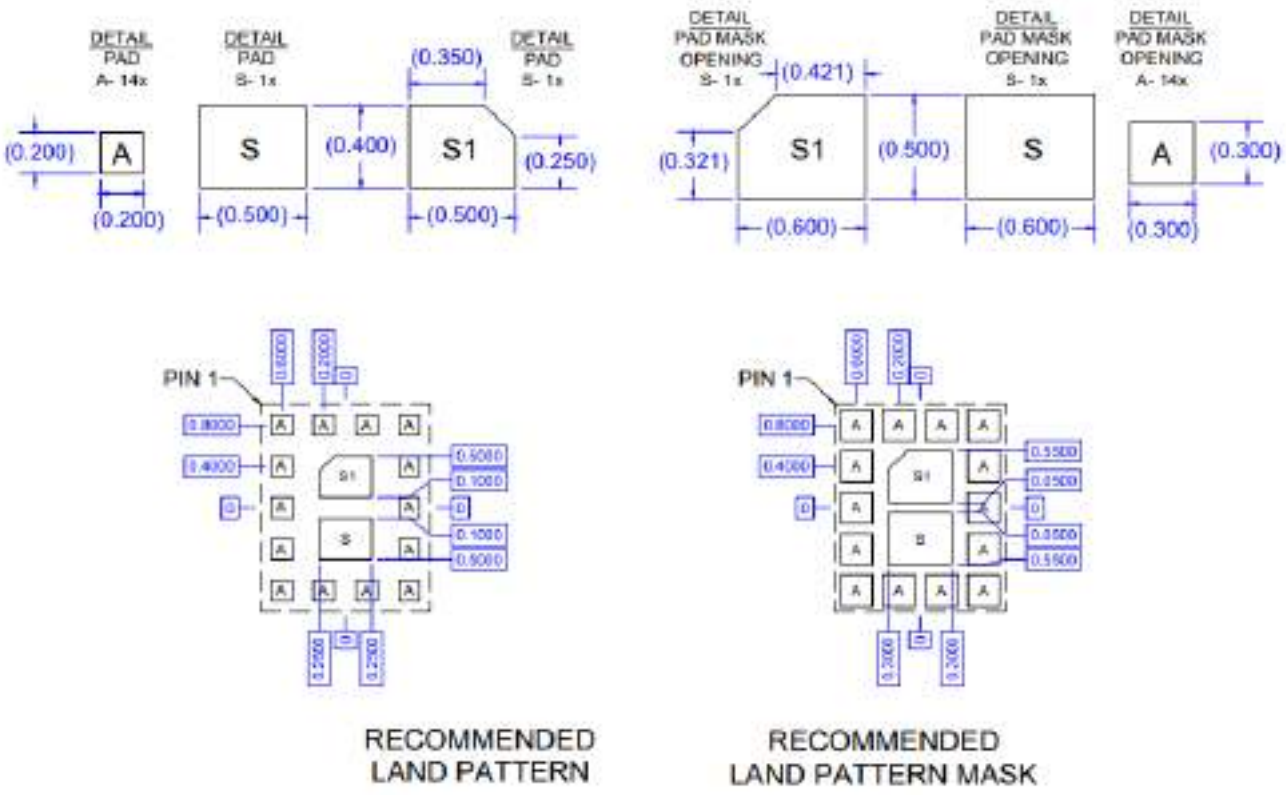


Notes:

1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

Land Pattern and Mask Dimensions

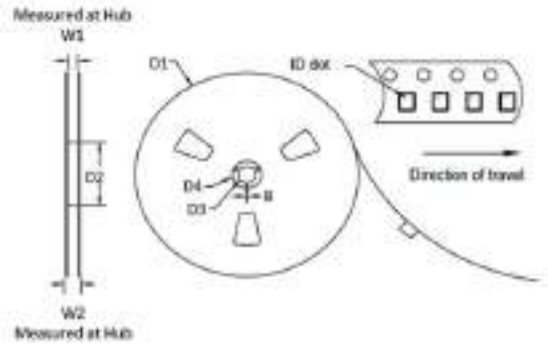
Recommended Land Pattern and Land Pattern Mask Drawing – Top View

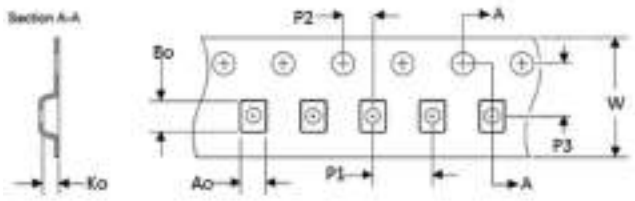


Notes:

1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.

Tape and Reel Information





Feature	Measure	Symbol	Size (mm)
Flange	Diameter	D1	330.0
	Thickness	W2	18.2(max)
	Space Between Flange	W1	12.8(min)
Hub	Outer Diameter	D2	102.0
	Arbor Hole Diameter	D3	13.0
	Key Slit Width	B	2.0
	Key Slit Diameter	D4	20.0

Feature	Measure	Symbol	Size (mm)
Cavity	Length	Ao	1.8
	Width	Bo	2.2
	Depth	Ko	0.8
	Pitch	P1	4.0
Centerline Distance	Cavity to Perforation (Length)	P2	2.0
	Cavity to Perforation (Width)	P3	5.5
Carrier Tape	Width	W	8.0

(Unless otherwise specified, all dimension tolerances per EIA-481)

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class TBD	ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class TBD	ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level TBD	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free
- Qorvo Green

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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REVISION HISTORY

Revision	Date	Description
A	20210203	Initial Document
B	20210309	Updated specs
C	20210503	Updated specs

QM28017

GNSS, MHB and UHB/5G WiFi Antennaplexer

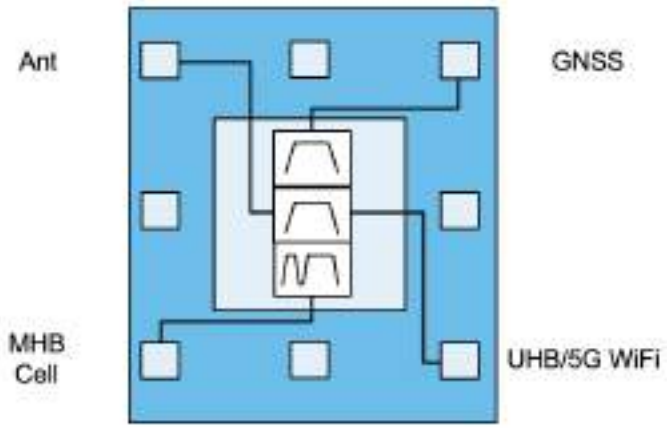
Product Overview

The QM28017 is part of Qorvo's family of antennaplexers using patented technology to meet the high performance expectations of insertion loss and rejection for GNSS, MHB Cellular and UHB/5GHz WiFi systems under all operating conditions

The QM28017 is a compact filter module designed to meet the strict requirements of out of band attenutation while optimizing for insertion loss of GNSS, MHB Cellular, and UHB/5GHz WiFi from 1559.05 MHz – 1605.89 MHz, 1427.9 MHz – 2690 MHz, and 3300 MHz – 5925 MHz respectively.

The QM28017 uses common module packaging techniques to achieve a compact 2.0 mm x 1.6 mm footprint.

Functional Block Diagram



Top View

9 Pin 2.0mm x 1.6mm x 0.6mm leadless SMT package

Key Features

- Compact Form-Factor: 2.0 mm x 1.6 mm
- Highly selective filters achieving low insertion loss and high attenuation over full bandwidth
- Single antenna port, antennaplexing
- RoHS Compliant, Pb-Free Module Package

Applications

- For devices with GNSS, MHB (including NR), and UHB/5GHz WiFi (including NR and LAA)

Ordering Information

Part Number	Description
QM28017EVB	Evaluation Board (EVB)
QM28017SB	Sample bag of 5 pieces
QM28017SR	Sample reel of 100 pieces
QM28017TR13	13 inch reel of 10k pieces

Absolute Maximum Ratings

Parameter	Conditions		Rating	UNITS
Storage Temperature			-40 to +90	°C
Operating Case Temperature			-30 to +85	°C
RF Input Power (Pin3, MHB Cellular)	1427.9 MHz – 1470 MHz FD-LTE 5MHz Channel, 1RB, 24RB offset, +55C, 5k hours		+29	dBm
	1710 MHz – 2300 MHz FD-LTE 5MHz Channel, 1RB, 24RB offset, +55C, 5k hours		+29	
	2300 MHz – 2400 MHz TD-LTE 5MHz Channel, 1RB, 24RB offset, +55C, 5k hours		+32	
	2496 MHz – 2690 MHz TD-LTE 5MHz Channel, 1RB, 24RB offset, +55C, 5k hours		+32	
RF Input Power (Pin5, UHB/5G WiFi)	3300 MHz – 5000 MHz TD-LTE 5MHz Channel, 1RB, 24RB offset, +55C, 5k hours		+32	dBm
	5150 MHz – 5925 MHz CW, +55C, 5k hours		+24	
RF Input Power (Pin1, ANT)	1427.9 MHz – 1518 MHz	CW, +55C, 5k hours	+15	dBm
	1559 MHz – 1606 MHz			
	1710 MHz – 2400 MHz			
	2496 MHz – 2690 MHz			
	3300 MHz – 5925 MHz			

Operation of this device outside the parameter ranges given above may cause permanent damage.

Electrical Specifications[1] L1 GNSS - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1559.05 MHz – 1563.15 MHz	-	1.2[2]	1.7	dB
	1574.39 MHz – 1576.45 MHz	-	0.9[2]	1.1	
	1597.55 MHz – 1605.89 MHz	-	1.3[2]	1.9	
VSWR (GNSS)	1559.05 MHz – 1563.15 MHz	-	1.2:1	2.0:1	-
	1574.39 MHz – 1576.45 MHz	-	1.1:1	2.0:1	
	1597.55 MHz – 1605.89 MHz	-	1.3:1	2.0:1	
VSWR (ANT)	1559.05 MHz – 1563.15 MHz	-	1.2:1	2.0:1	
	1574.39 MHz – 1576.45 MHz	-	1.1:1	2.0:1	
	1597.55 MHz – 1605.89 MHz	-	1.4:1	2.0:1	
Attenuation	10 MHz – 960 MHz	46	49	-	dB
	777 MHz – 787 MHz	48	50	-	
	1427.9 MHz – 1462.9 MHz	49	53	-	
	1695 MHz – 1710 MHz	56	63	-	
	1710 MHz – 1785 MHz	54	62	-	
	1850 MHz – 1910 MHz	51	66	-	
	1910 MHz – 1980 MHz	45	69	-	
	2010 MHz – 2025 MHz	45	64	-	
	2305 MHz – 2315 MHz	45	51	-	
	2403 MHz – 2481 MHz[3]	42	46	-	
	2500 MHz – 2570 MHz	40	44	-	
	2570 MHz – 2690 MHz	39	42	-	
	3400 MHz – 3600 MHz	43	46	-	
	4400 MHz – 4900 MHz	43	53	-	
	5150 MHz – 5925 MHz	25	46	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature
3. Integrated over each 18MHz WiFi channel

Electrical Specifications[1] MHB - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1427.9 MHz – 1518 MHz	-	0.8[2]	1.9	dB
	1710 MHz – 2200 MHz	-	0.9[2]	1.3	
	2300 MHz – 2370 MHz	-	1.0[2]	1.4	
	2370 MHz – 2390 MHz	-	1.0[2]	1.4	
	2390 MHz – 2400 MHz	-	1.0[2]	1.4	
	2496 MHz – 2500 MHz	-	1.1[2]	1.5	
	2500 MHz – 2505 MHz	-	1.1[2]	1.5	
	2505 MHz – 2690 MHz	-	1.2[2]	2.2	
VSWR (MHB)	1427.9 MHz – 1470 MHz	-	1.3:1	2.0:1	-
	1470 MHz – 1518 MHz	-	1.9:1	2.5:1	
	1710 MHz – 2200 MHz	-	1.4:1	2.0:1	
	2300 MHz – 2370 MHz	-	1.3:1	2.0:1	
	2370 MHz – 2390 MHz	-	1.2:1	2.0:1	
	2390 MHz – 2400 MHz	-	1.2:1	2.0:1	
	2496 MHz – 2690 MHz	-	1.2:1	2.0:1	
VSWR (ANT)	1427.9 MHz – 1518 MHz	-	1.6:1	2.0:1	-
	1710 MHz – 2200 MHz	-	1.5:1	2.0:1	
	2300 MHz – 2370 MHz	-	1.3:1	2.0:1	
	2370 MHz – 2390 MHz	-	1.3:1	2.0:1	
	2390 MHz – 2400 MHz	-	1.3:1	2.0:1	
	2496 MHz – 2690 MHz	-	1.2:1	2.0:1	
Attenuation	1559 MHz – 1606 MHz	18	22	-	dB
	3300 MHz – 5000 MHz	13	20	-	
	5150 MHz – 5925 MHz	17	25	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature

Electrical Specifications[1] UHB/5G WIFI - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	3300 MHz – 3400 MHz	-	1.3[2]	2.5	dB
	3400 MHz – 3800 MHz	-	0.8[2]	1.7	
	3800 MHz – 4200 MHz	-	0.7[2]	1.0	
	4400 MHz – 5000 MHz	-	0.6[2]	1.2	
	5150 MHz – 5925 MHz	-	0.8[2]	2.0	
VSWR (UHB/5G WiFi)	3300 MHz – 5000 MHz	-	1.4:1	2.0:1	-
	5150 MHz – 5925 MHz	-	1.5:1	2.0:1	
VSWR (ANT)	3300 MHz – 5000 MHz	-	1.4:1	2.0:1	
	5150 MHz – 5925 MHz	-	1.5:1	2.0:1	
Attenuation	1427.9 MHz – 1518 MHz	26	28	-	dB
	1559 MHz – 1606 MHz	26	28	-	
	1710 MHz – 2400 MHz	18	23	-	
	2496 MHz – 2690 MHz	18	25	-	
	10300 MHz – 11850 MHz	18	33	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature

Electrical Specifications[1] Isolation

Parameter		Conditions	Min.	Typ.	Max.	Units
Isolation	GNSS – MHB	1559 MHz – 1606 MHz	18	23	-	dB
		1427.9 MHz – 1518 MHz	41	45	-	
		1710 MHz – 2400 MHz	35	47	-	
		2496 MHz – 2690 MHz	38	42	-	
	GNSS – UHB/5G WiFi	1559 MHz – 1606 MHz	27	29	-	
		3300 MHz – 5000 MHz	42	46	-	
		5150 MHz – 5925 MHz	35	45	-	
	MHB – UHB/5G WiFi	1427.9 MHz – 1518 MHz	28	31	-	
		1710 MHz – 2400 MHz	20	24	-	
		2496 MHz – 2690 MHz	18	26	-	
		3300 MHz – 5000 MHz	12	20	-	
		5150 MHz – 5925 MHz	26	30	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.

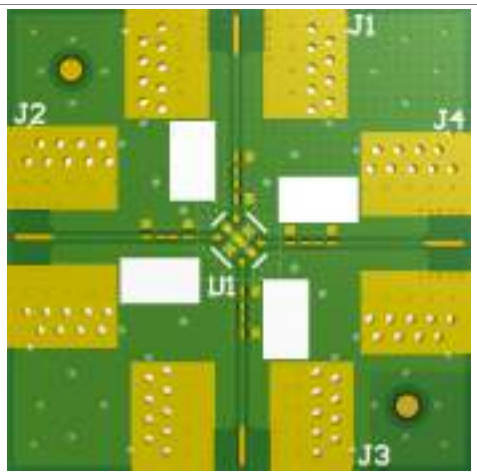
QM28017EVB PCB Information

Layer	Name	Material	Thickness	Constant	Board Layer Stack
1	Top Overlay				
2	Top Solder	Solder Resist	0.78mil	3.5	
3	L1	Copper	0.70mil		
4	Dielectric1	FR-408HR	4.10mil	3.3	
5	L2	Copper	0.70mil		
6	Dielectric 2	FR-408HR	26.00mil	3.6	
7	L3	Copper	0.70mil		
8	Dielectric 3	FR-408HR	4.10mil	3.3	
9	L4	Copper	0.70mil		
10	Bottom Solder	Solder Resist	0.78mil	3.5	
11	Bottom Overlay				

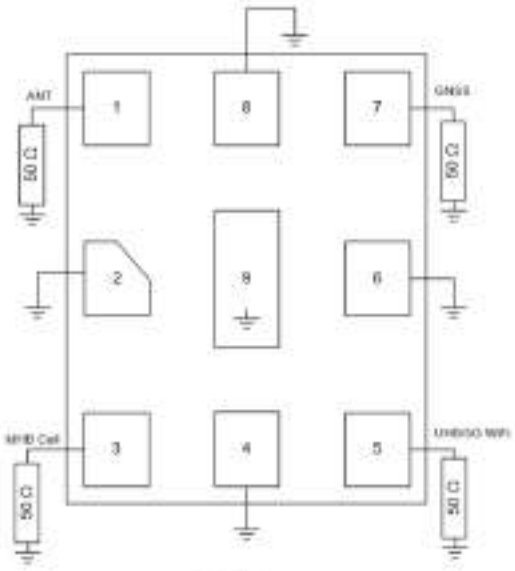
Total thickness:40 MILS +/-10%

Where:

- J1 = GNSS
- J2 = ANT
- J3 = MHB
- J4 = UHB/5G



Application Circuit Schematic



Top View

Note:

1. All RF ports internally matched to 50 ohm impedance
2. Recommend connecting all ground pins together on PCB
3. Recommend adding Pi network close to each RF port for phone level tuning/optimization

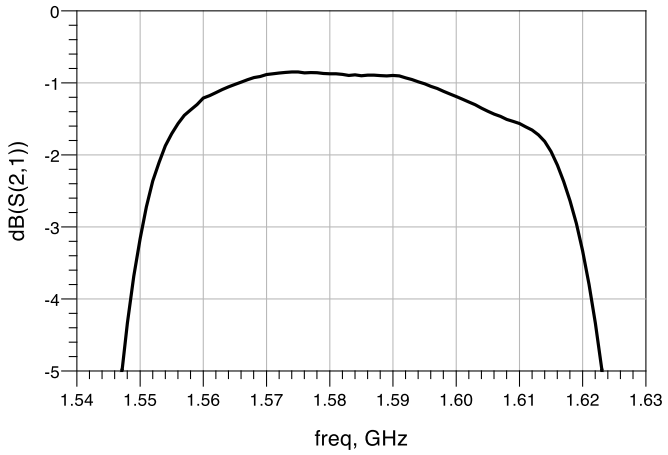
Bill of Materials

Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	GNSS, MHB and UHB/5G WiFi Antennaplexer	Qorvo	QM28017
PCB	N/A	Printed Circuit Board		QM28017-4000

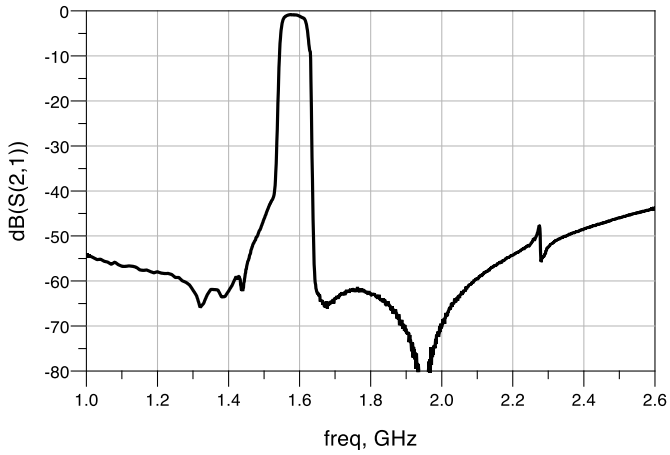
GNSS Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

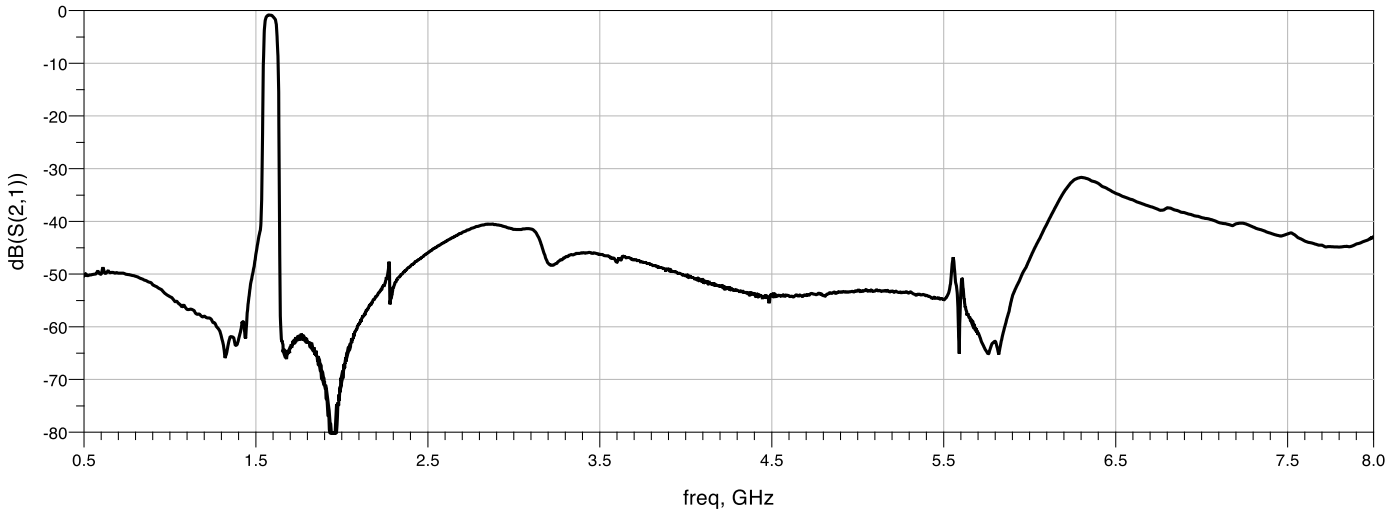
GNSS Pass Band



GNSS Narrow Band

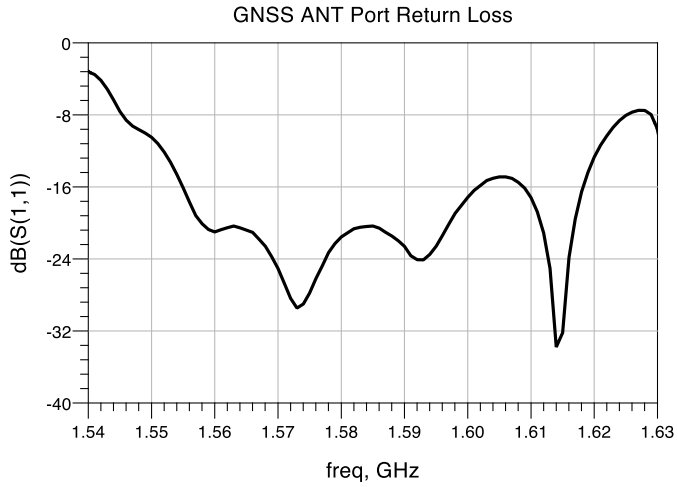


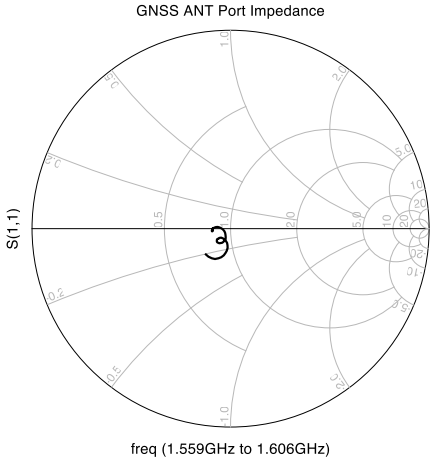
GNSS Wide Band

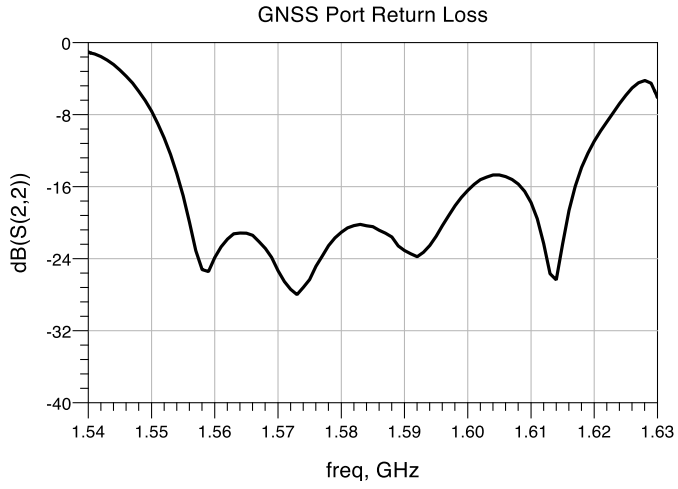


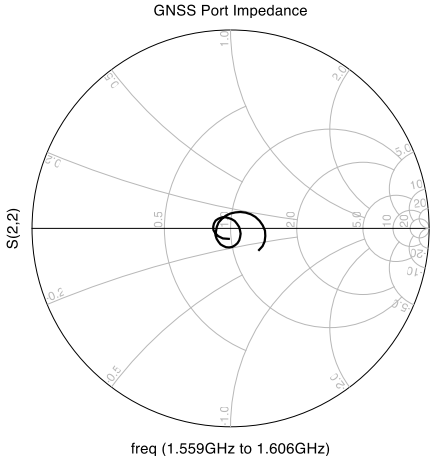
GNSS Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C





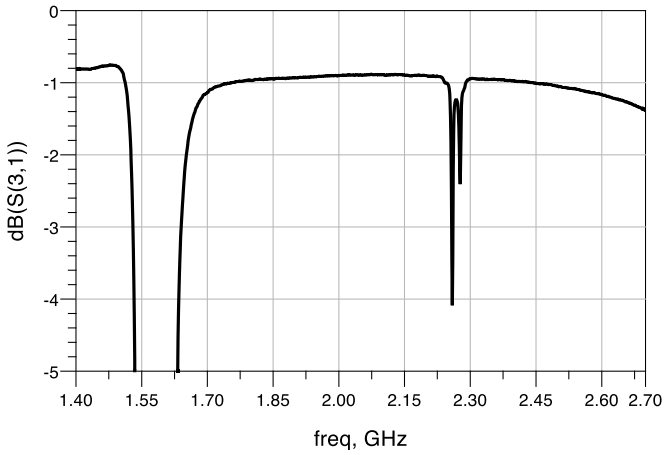




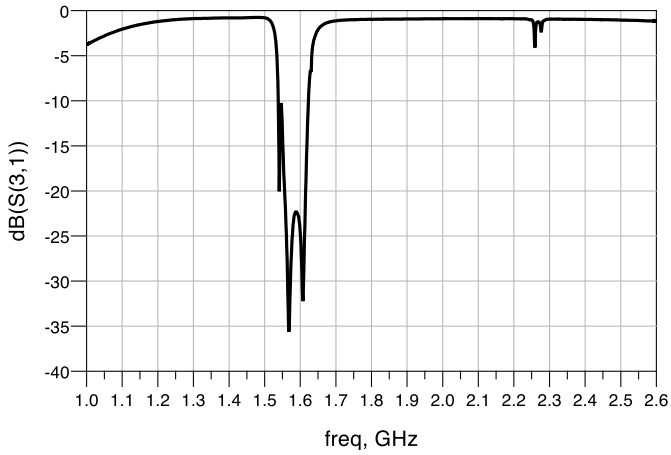
MHB Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

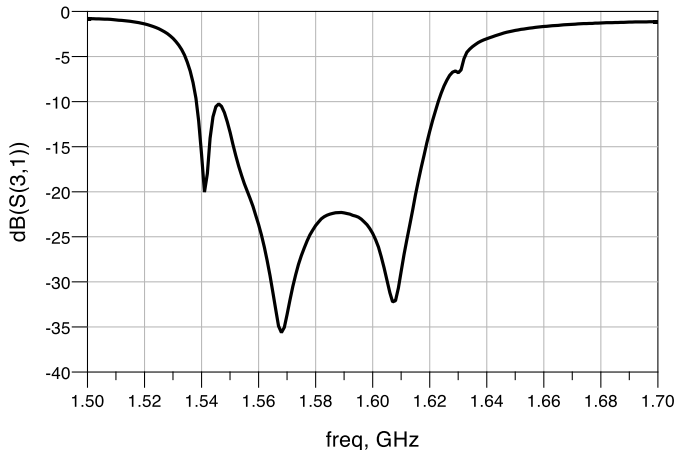
MHB Pass Band



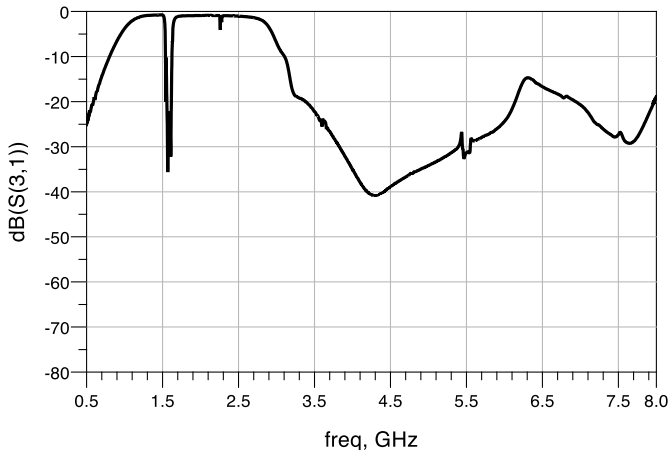
MHB Narrow Band



MHB GNSS Rejection

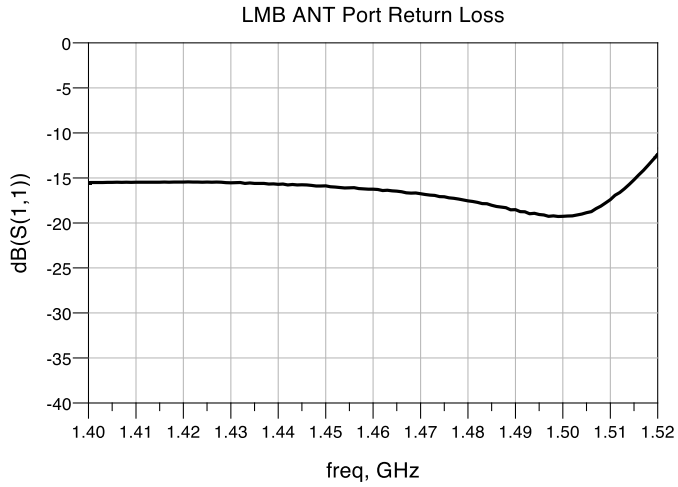


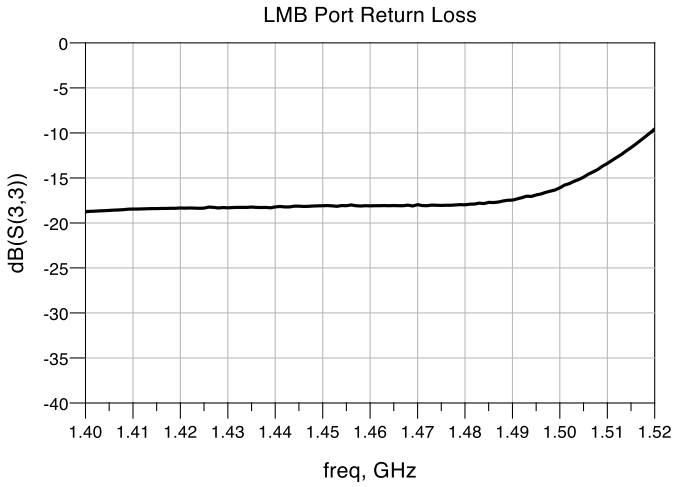
MHB Wide Band

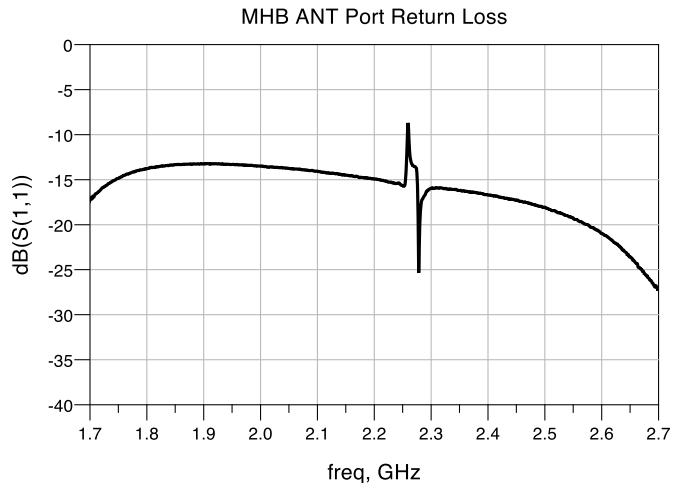


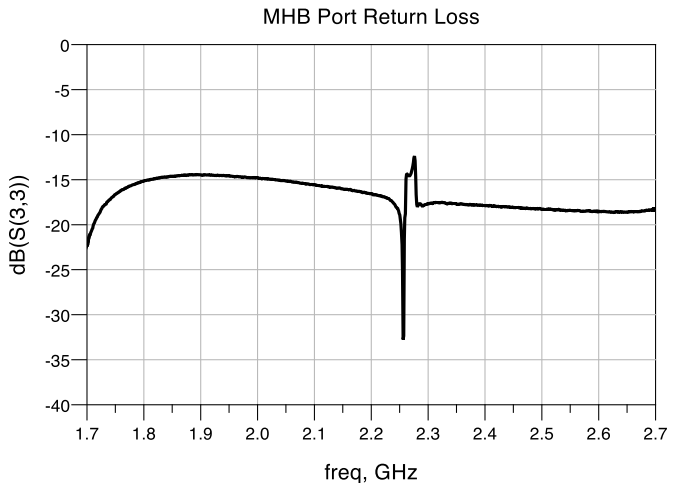
MHB Return Loss Plots

Test conditions unless otherwise noted: Temp. = +25 °C





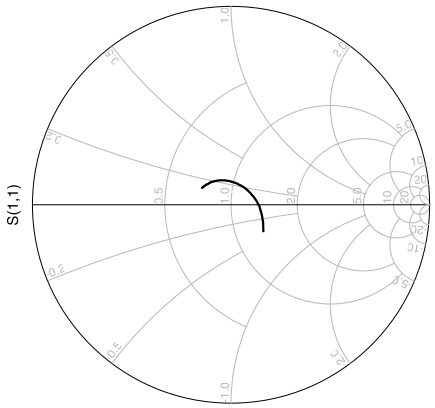




MHB Impedance Plots

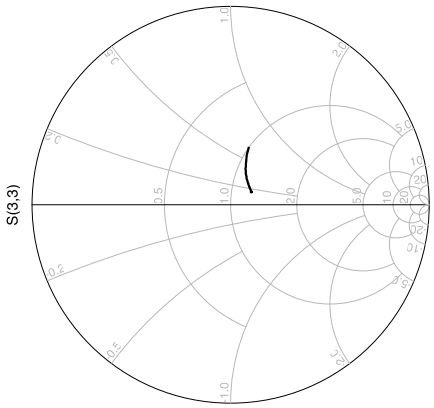
Test conditions unless otherwise noted: Temp. = +25 °C

LMB ANT Port Impedance



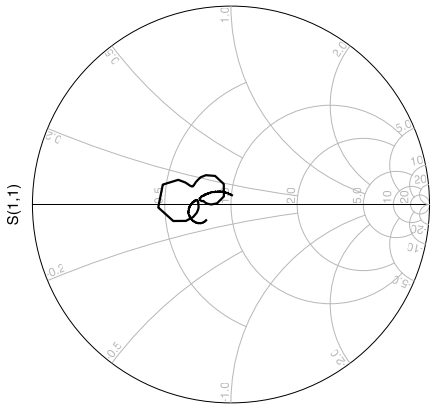
freq (1.428GHz to 1.518GHz)

LMB Port Impedance



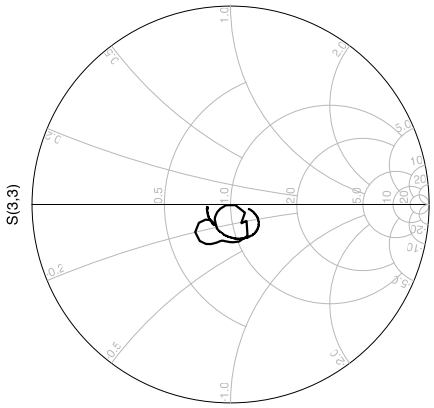
freq (1.428GHz to 1.518GHz)

MHB ANT Port Impedance



freq (1.710GHz to 2.690GHz)

MHB Port Impedance

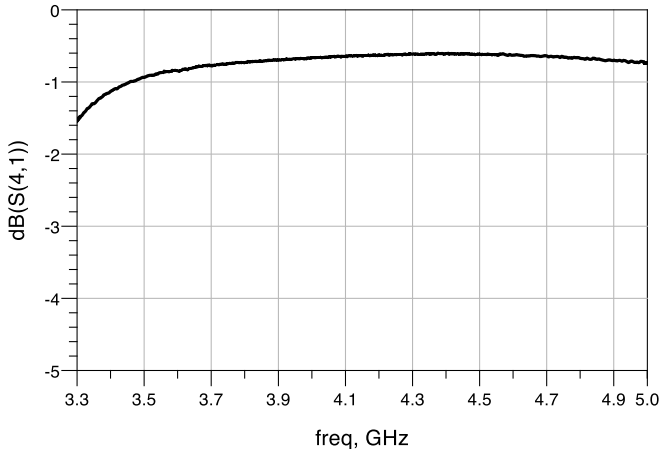


freq (1.710GHz to 2.690GHz)

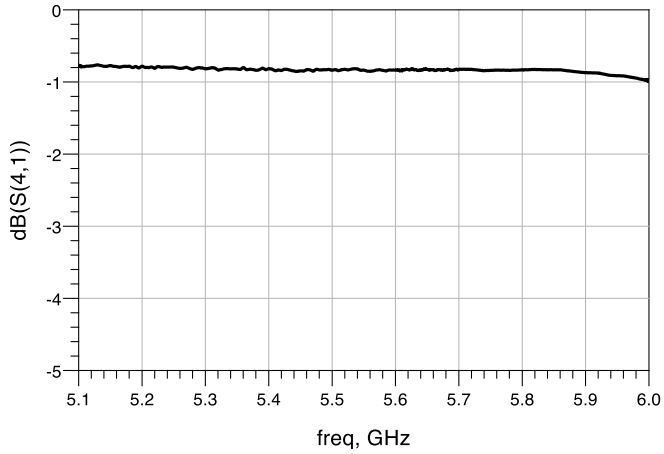
UHB/5G WIFI Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

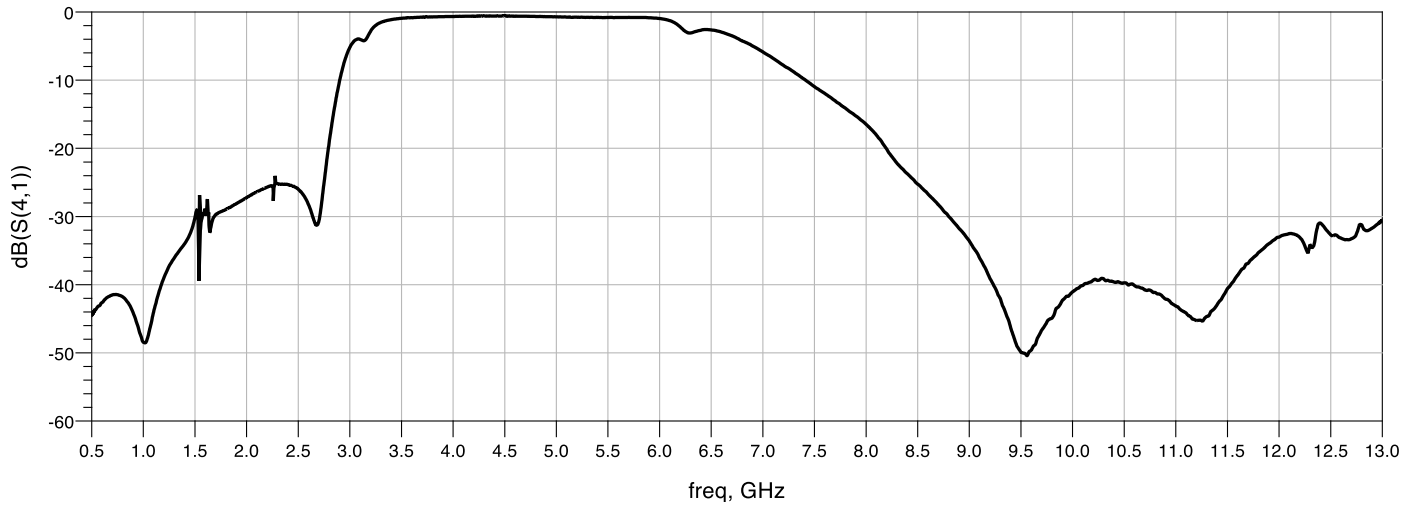
UHB Pass Band



5G WiFi Pass Band

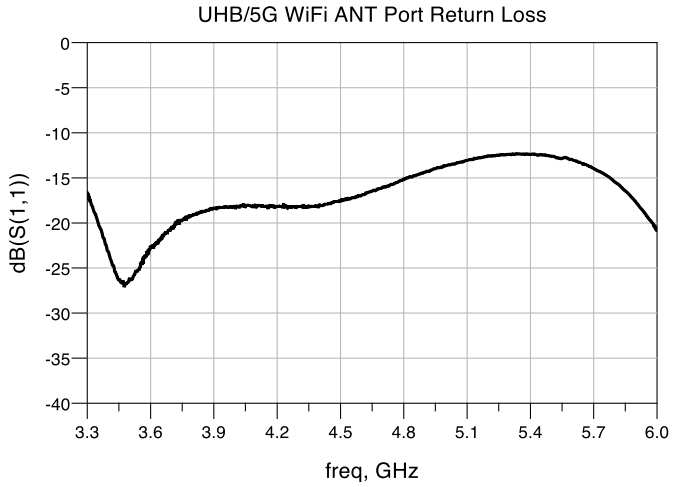


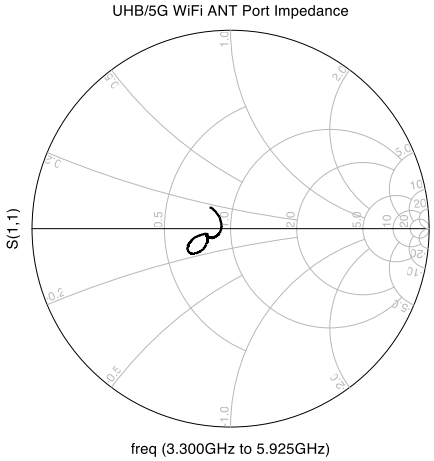
UHB/5G WiFi Wide Band

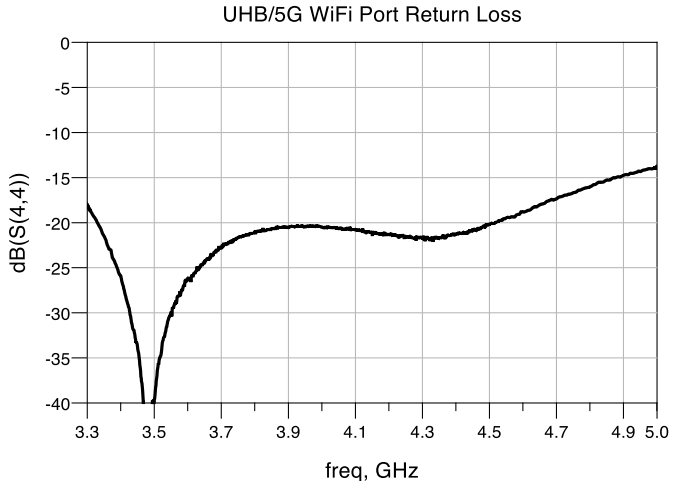


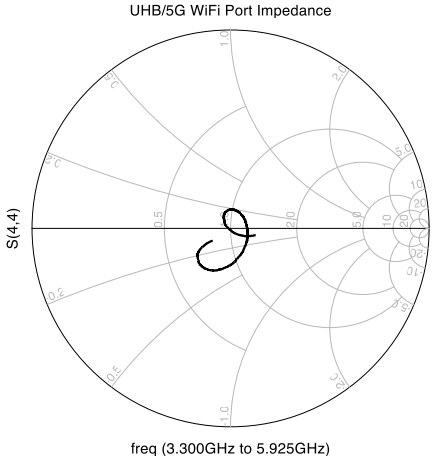
UHB/5G WIFI Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C



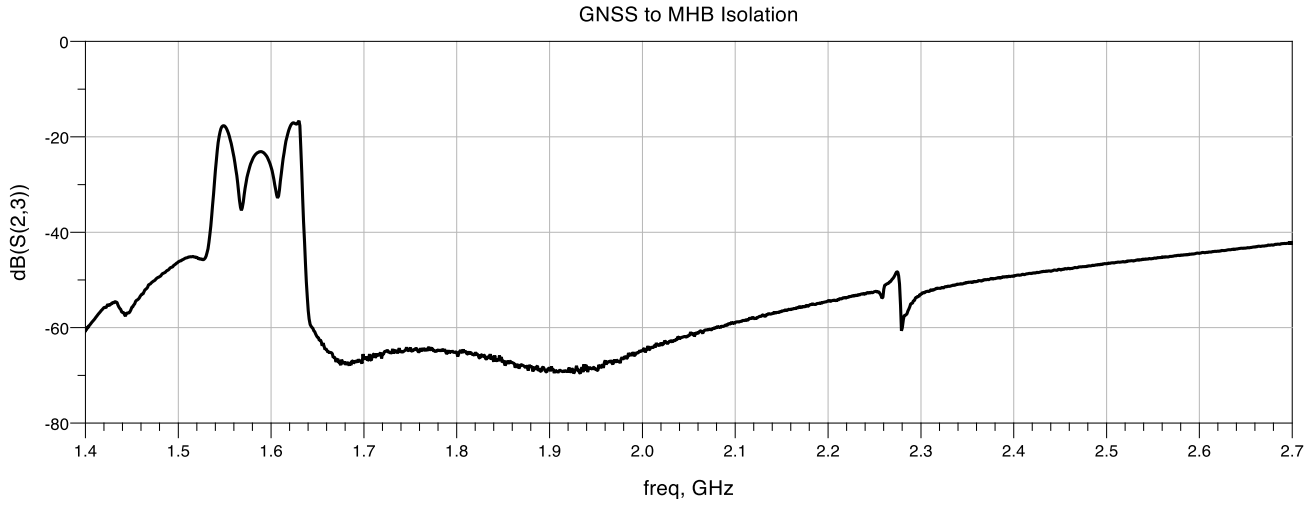


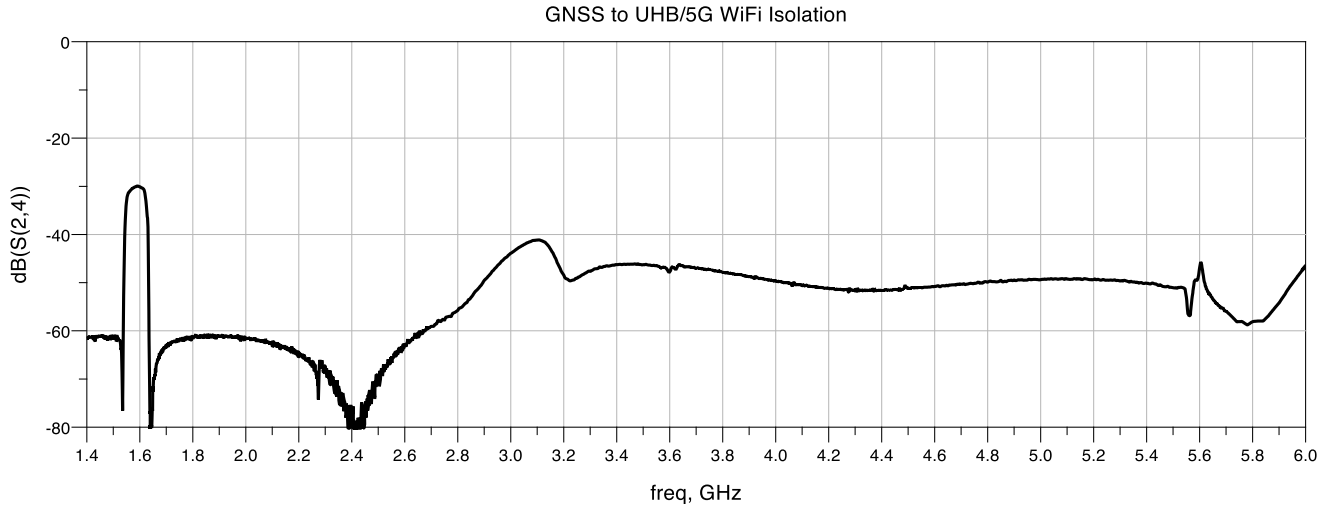


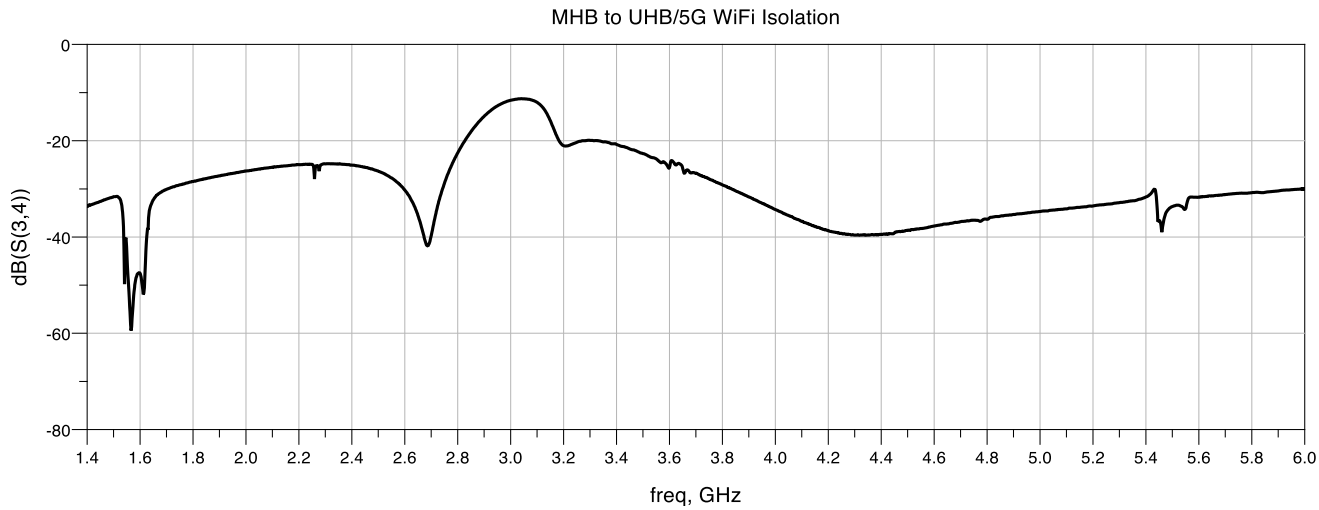


Isolation Plots

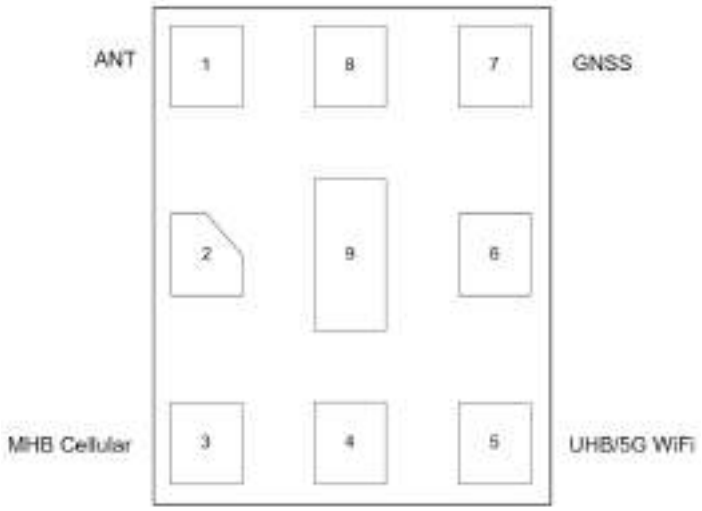
Test conditions unless otherwise noted: Temp. = +25 °C







Pin Configuration and Description

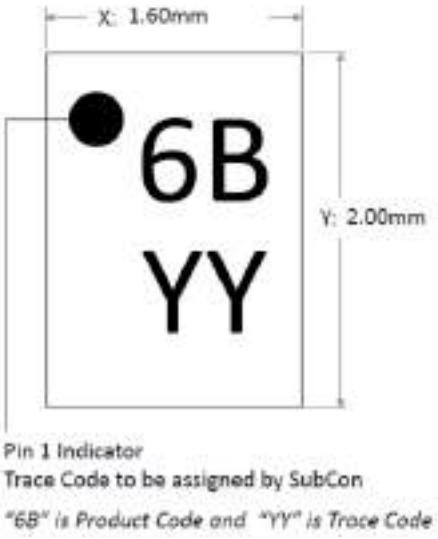


Top View

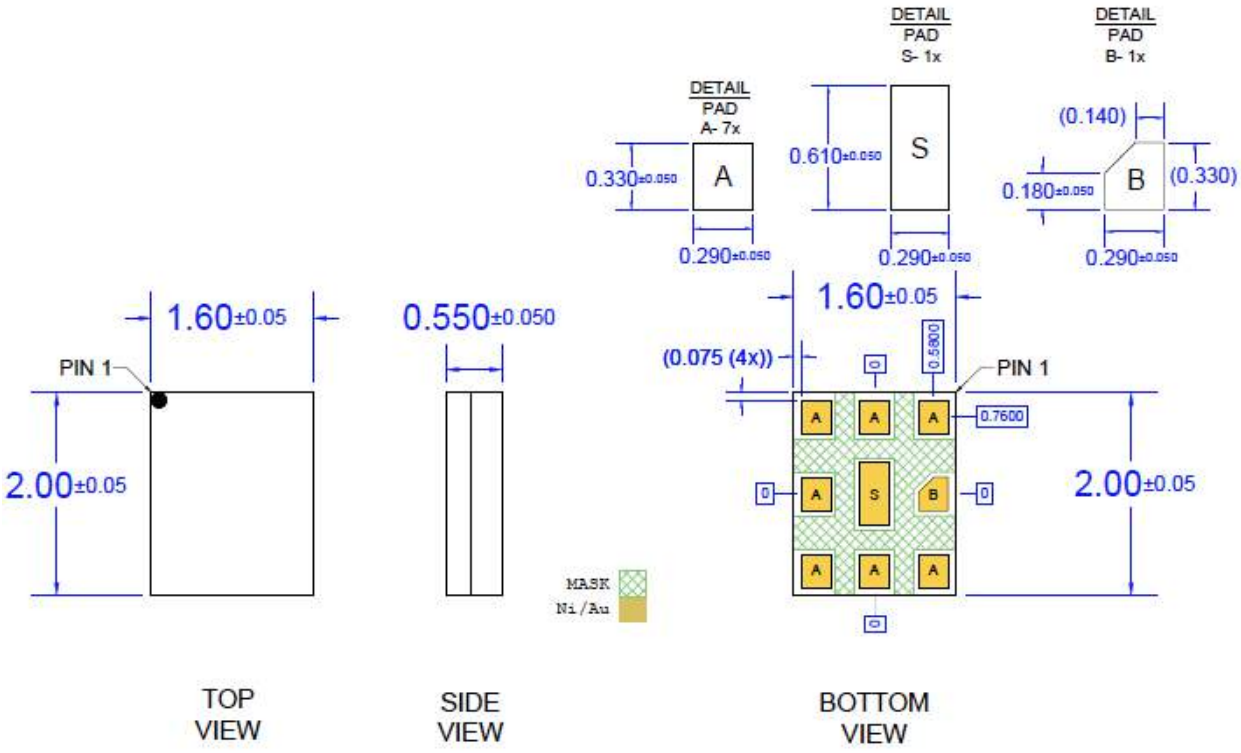
Pin Number	Label	Description
1	ANT	Antenna Port
3	MHB Cellular	MHB Cellular Port
5	UHB/5G WIFI	UHB/5G WIFI Port
7	GNSS	GNSS Port
2, 4, 6, and 8	GND	Ground
9	GND	Package Ground

Part Marking and Package Outline Dimensions

Part Marking Diagram – Top View



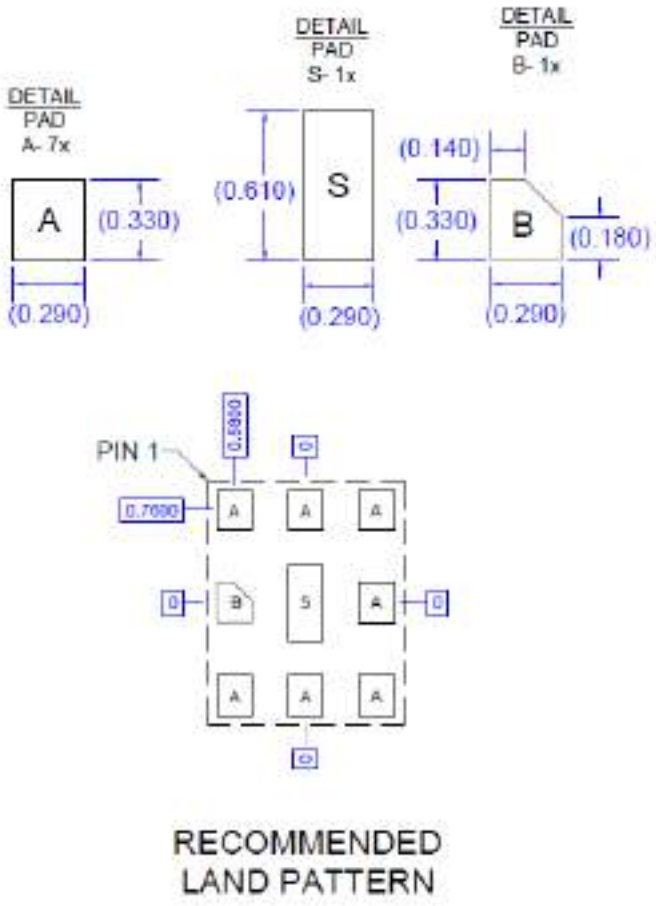
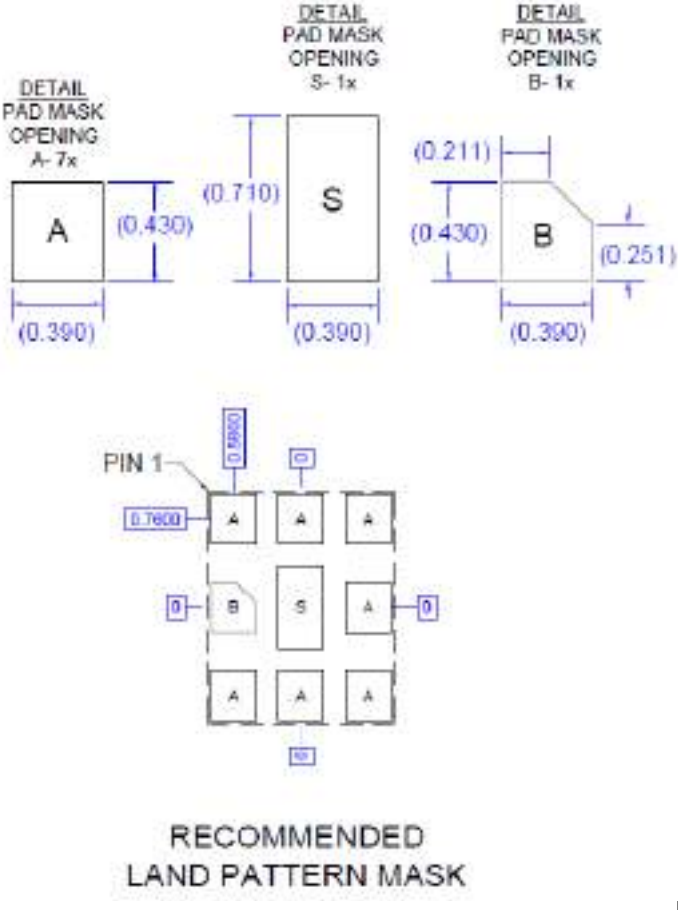
Package Outline Dimension Drawing



Notes:

1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

Land Pattern and Mask Dimensions

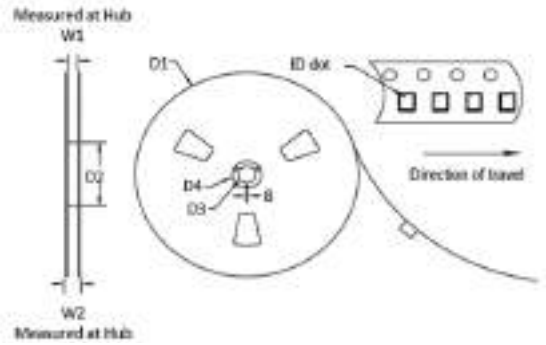
Recommended Land Pattern Drawing – Top View	Recommended Land Pattern Mask Drawing – Top View
	

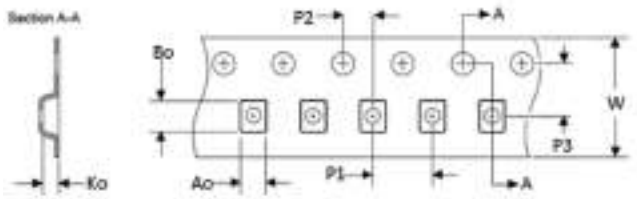
Notes:

1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.

ES France - Département RF & Hyperfréquences - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 60 - Fax. 01 47 01 16 22 - e-mail: hyper@es-france.com - Site Web: www.es-france.com

Tape and Reel Information





Feature	Measure	Symbol	Size (mm)
Flange	Diameter	D1	330.0
	Thickness	W2	14.4
	Space Between Flange	W1	8.4
Hub	Outer Diameter	D2	102.0
	Arbor Hole Diameter	D3	13.0
	Key Slit Width	B	2.0
	Key Slit Diameter	D4	20.0

Feature	Measure	Symbol	Size (mm)
Cavity	Length	Ao	1.8
	Width	Bo	2.2
	Depth	Ko	0.8
	Pitch	P1	4.0
Centerline Distance	Cavity to Perforation (Length)	P2	2.0
	Cavity to Perforation (Width)	P3	3.5
Carrier Tape	Width	W	8

(Unless otherwise specified, all dimension tolerances per EIA-481)

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1B	ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free
- Qorvo Green

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

Important Notice

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REVISION HISTORY

Revision	Date (YYYYMMDD)	Description
D	20201006	Production Release

QM28005

L5 GPS, GNSS, 2.4G WiFi, and 5G WiFi6E Antennaplexer

Product Overview

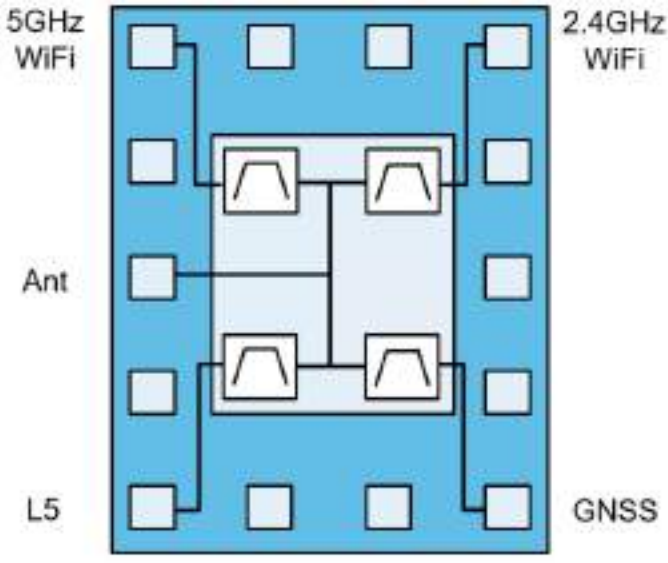
The QM28005 is part of Qorvo's family of antennaplexers using patented technology to meet the high performance expectations of insertion loss and rejection for L5 GPS, GNSS and WLAN systems under all operating conditions

The QM28005 is a compact filter module designed to meet the strict requirements of out of band attenutation while optimizing for insertion loss of L5 GPS, GNSS, 2.4G WLAN and 5G WLAN from 1166.22 MHz – 1186.68 MHz, 1559.05 MHz – 1605.89 MHz, 2403 MHz – 2481 MHz, and 5150 MHz – 7125 MHz respectively.

The QM28005 uses common module packaging techniques to achieve a compact 2.0 mm x 1.6 mm footprint.

16 Pin 2.0mm x 1.6mm x 0.6mm leadless SMT package

Functional Block Diagram



Top View

Key Features

- Compact Form-Factor: 2.0 mm x 1.6 mm
- Highly selective filters achieving low insertion loss and high attenuation over full bandwidth
- Single antenna port quadplexing
- RoHS Compliant, Pb-Free Module Package

Applications

- For L5 GPS, GNSS, 2.4GHz WLAN and 5GHz WLAN to include WiFi6E

Ordering Information

Part Number	Description
QM28005EVB	Evaluation Board (EVB)
QM28005SB	Sample bag of 5 pieces
QM28005SR	Sample reel of 100 pieces
QM28005TR13	13 inch reel of 10k pieces

Absolute Maximum Ratings

Parameter	Conditions	Rating	UNITS
Storage Temperature		-40 to +90	°C
Operating Case Temperature		-30 to +85	°C
RF Input Power (Pin5, 2.4GHz WiFi)	2403 MHz – 2481 MHz	+24	dBm
RF Input Power (Pin8, 5GHz WiFi6E)	5150 MHz – 5925 MHz	+24	dBm
	5925 MHz – 6425 MHz		
	6425 MHz – 7125 MHz		
RF Input Power (Pin10, ANT)	1166 MHz – 1187 MHz	+15	dBm
	1559 MHz – 1606 MHz		
	2403 MHz – 2481 MHz		
	5150 MHz – 5925 MHz		
	5925 MHz – 6425 MHz		
	6425 MHz – 7125 MHz		

Operation of this device outside the parameter ranges given above may cause permanent damage.

Electrical Specifications[1] L5 GPS - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1166.22 MHz – 1186.68 MHz	-	1.2[2]	1.45	dB
VSWR (L5 GPS)	1166.22 MHz – 1186.68 MHz	-	1.2:1	2:1	-
VSWR (ANT)		-	1.2:1	2:1	
Attenuation	10 MHz – 915 MHz	39	40	-	dB
	1427.9 MHz – 1462.9 MHz	38	44	-	
	1710 MHz – 1980 MHz	45	52	-	
	2300 MHz – 2400 MHz	49	51	-	
	2329.9 MHz – 2375.9 MHz	51	55	-	
	2403 MHz – 2481 MHz	49	51	-	
	2496 MHz – 2690 MHz	43	46	-	
	3300 MHz – 4200 MHz	50	53	-	
	4400 MHz – 5000 MHz	51	54	-	
	5150 MHz – 5925 MHz	54	58	-	
	5925 MHz – 6425 MHz	54	62	-	
	6425 MHz – 7125 MHz	49	65	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature

Electrical Specifications[1] L1 GNSS - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	1559.05 MHz – 1563.15 MHz	-	1.2 [2]	1.6	dB
	1574.39 MHz – 1576.45 MHz	-	0.9 [2]	1.1	
	1597.55 MHz – 1605.89 MHz	-	1.1 [2]	1.8	
VSWR (GNSS)	1559.05 MHz – 1563.15 MHz	-	1.3:1	2:1	-
	1574.39 MHz – 1576.45 MHz	-	1.1:1	2:1	
	1597.55 MHz – 1605.89 MHz	-	1.2:1	2:1	
VSWR (ANT)	1559.05 MHz – 1563.15 MHz	-	1.4:1	2:1	
	1574.39 MHz – 1576.45 MHz	-	1.2:1	2:1	
	1597.55 MHz – 1605.89 MHz	-	1.4:1	2:1	
Attenuation	10 MHz – 960 MHz	50	52	-	dB
	777 MHz – 787 MHz	57	61	-	
	1427.9 MHz – 1462.9 MHz	41	44	-	
	1640 MHz – 1695 MHz	29	50	-	
	1695 MHz – 1710 MHz	50	66	-	
	1710 MHz – 1785 MHz	51	62	-	
	1786 MHz – 1797 MHz	51	63	-	
	1850 MHz – 1910 MHz	49	65	-	
	1910 MHz – 1980 MHz	48	58	-	
	2010 MHz – 2025 MHz	47	55	-	
	2305 MHz – 2315 MHz	45	49	-	
	2403 MHz – 2481 MHz	43	46	-	
	2500 MHz – 2570 MHz	38	40	-	
	2570 MHz – 2690 MHz	39	41	-	
	3400 MHz – 3600 MHz	39	41	-	
	4400 MHz – 4900 MHz	43	50	-	
	5150 MHz – 5925 MHz	11	35	-	
	5925 MHz – 6425 MHz	34	44	-	
	6425 MHz – 7125 MHz	19	26	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature

Electrical Specifications[1] 2.4GHz WiFi - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	2403 MHz – 2421 MHz[2] (WiFi CH1)	-	2	2.1	dB
	2408 MHz – 2426 MHz[2] (WiFi CH2)	-	1.5	1.7	
	2413 MHz – 2456 MHz[2] (WiFi CH3-8)	-	1.3	1.6	
	2443 MHz – 2471 MHz[2] (WiFi CH9-11)	-	1.3	1.6	
	2458 MHz – 2476 MHz[2] (WiFi CH12)	-	1.2	1.6	
	2463 MHz – 2481 MHz[2] (WiFi CH13)	-	1.4	2	
VSWR (WiFi)	2403 MHz – 2481 MHz	-	1.7:1	2:1	-
VSWR (ANT)	2403 MHz – 2481 MHz	-	1.6:1	2.5:1	
Attenuation	925 MHz – 960 MHz	37	41	-	dB
	1559 MHz – 1606 MHz	35	37	-	
	2110 MHz – 2170 MHz	32	34	-	
	2300 MHz – 2370 MHz	38	42	-	
	2500 MHz – 2505 MHz[3]	16	24	-	
	2505 MHz – 2690 MHz	27	41	-	
	4800 MHz – 5000 MHz	37	45	-	
	7200 MHz – 7500 MHz	27	38	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Integrated over each 18MHz WiFi Channel
3. Integrated over 5MHz Channel

Electrical Specifications[1] 5GHz WiFi6E - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	5150 MHz – 5925 MHz	-	1.2[2]	1.7	dB
	5925 MHz – 6425 MHz	-	1.3[2]	2	
	6425 MHz – 7125 MHz	-	2.6[2]	5	
VSWR (5GHz WiFi6E)	5150 MHz – 5925 MHz	-	1.6:1	2:1	-
	5925 MHz – 6425 MHz	-	1.6:1	2:1	
	6425 MHz – 7125 MHz	-	1.6:1	2:1	
VSWR (ANT)	5150 MHz – 5925 MHz	-	1.7:1	2.2:1	
	5925 MHz – 6425 MHz	-	2.2:1	3.2:1	
	6425 MHz – 7125 MHz	-	2.9:1	4.6:1	
Attenuation	824 MHz – 1166 MHz	29	30	-	dB
	1166 MHz – 1187 MHz	29	30	-	
	1187 MHz – 1559 MHz	29	30	-	
	1559 MHz – 1606 MHz	29	30	-	
	1606 MHz – 2170 MHz	29	30	-	
	2400 MHz – 2500 MHz	21	28	-	
	10300 MHz – 11850 MHz	12	39	-	
	15450 MHz – 17775 MHz	21	31	-	

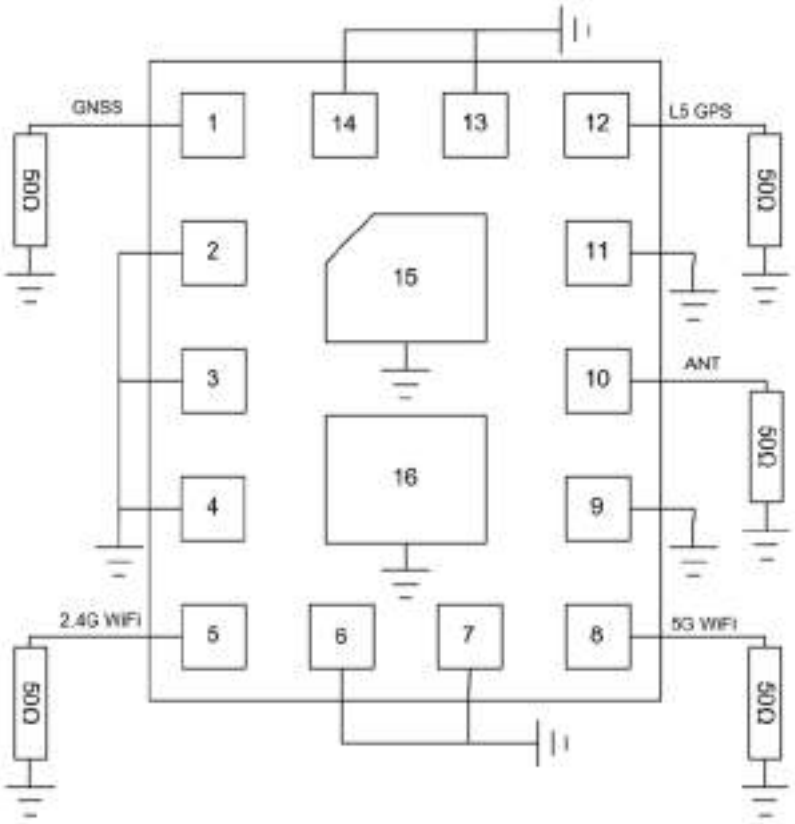
Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.
2. Typical specified as average at room temperature

Electrical Specifications[1] Isolation

Parameter		Conditions	Min.	Typ.	Max.	Units
Isolation	GNSS – L5 GPS	1559.05 MHz – 1605.89 MHz	46	48	-	dB
		1166.22 MHz – 1186.68 MHz	49	50	-	
	GNSS – 2.4G WiFi	1559.05 MHz – 1605.89 MHz	37	38	-	
		2403 MHz – 2481 MHz	43	47	-	
	GNSS – 5G WiFi6E	1559.05 MHz – 1605.89 MHz	34	36	-	
		5150 MHz – 5925 MHz	20	33	-	
		5925 MHz – 6425 MHz	35	45	-	
		6425 MHz – 7125 MHz	22	28	-	
	L5 GPS – 2.4G WiFi	1166.22 MHz – 1186.68 MHz	39	40	-	
		2403 MHz – 2481 MHz	48	50	-	
	L5 GPS – 5G WiFi6E	1166.22 MHz – 1186.68 MHz	34	36	-	
		5150 MHz – 5925 MHz	55	62	-	
		5925 MHz – 6425 MHz	53	69	-	
		6425 MHz – 7125 MHz	50	68	-	
	2.4 G WiFi – 5G WiFi6E	2403 MHz – 2481 MHz	27	34	-	
		5150 MHz – 5925 MHz	23	35	-	
		5925 MHz – 6425 MHz	30	41	-	
		6425 MHz – 7125 MHz	36	42	-	

Notes:
1. All specifications are based on the applications circuit and Min/Max is specified over -30˚C to +85˚C unless otherwise noted.

Application Circuit Schematic



Note:

1. All RF ports internally matched to 50 ohm impedance
2. Recommend connecting all ground pins together on PCB
3. Recommend adding Pi network close to each RF port for phone level tuning/optimization

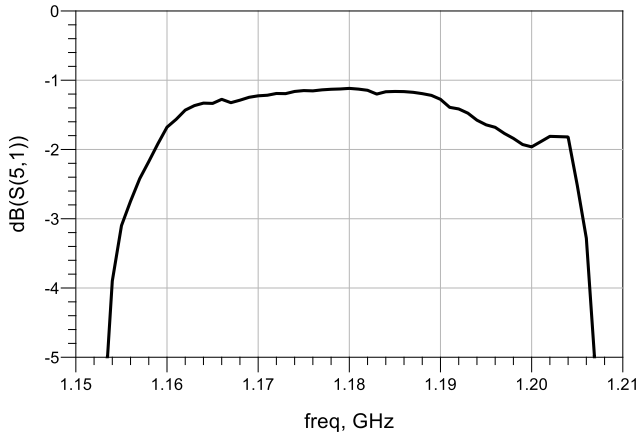
Bill of Materials

Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	L5 GPS, GNSS, 2.4G WiFi, and 5G WiFi6E Antennaplexer	Qorvo	QM28005
PCB	N/A	4-layer Printed Circuit Board		QM28005-4000

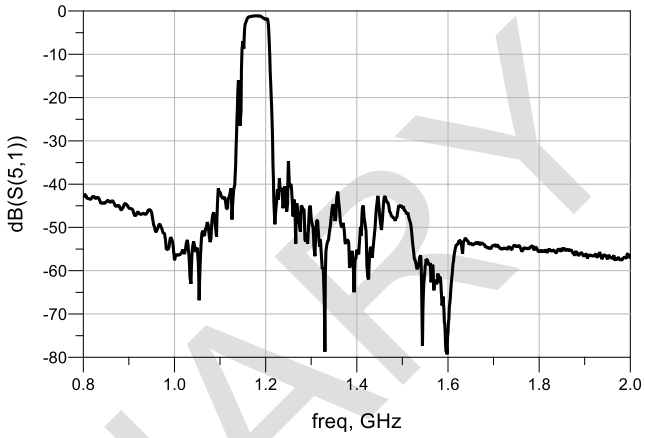
L5 GPS Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

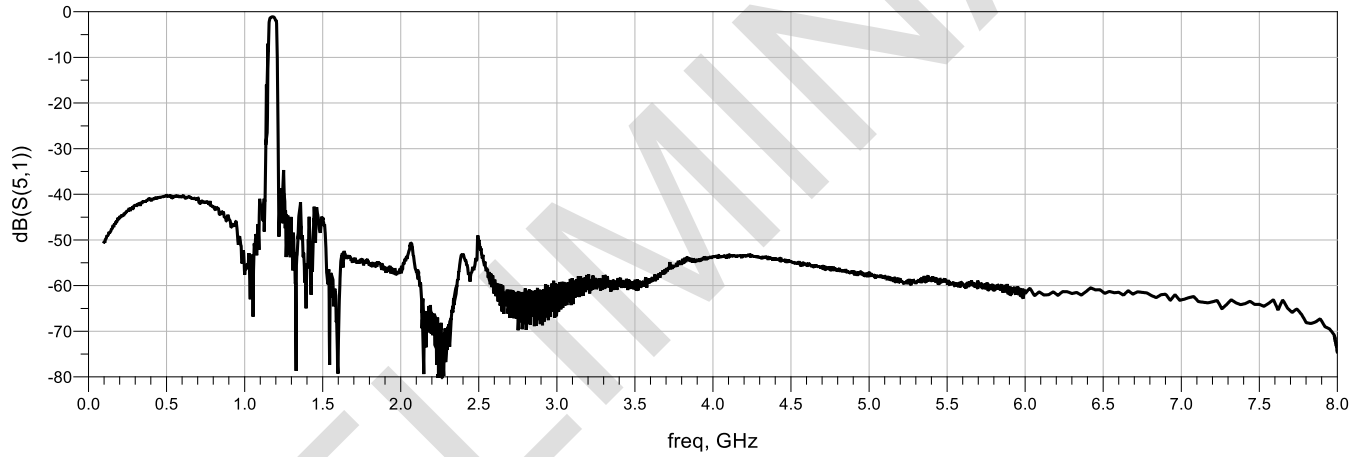
L5 GPS Pass Band



L5 GPS Narrow Band

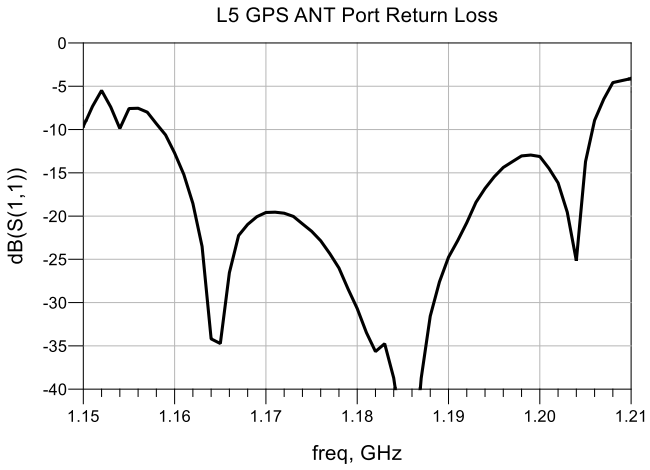


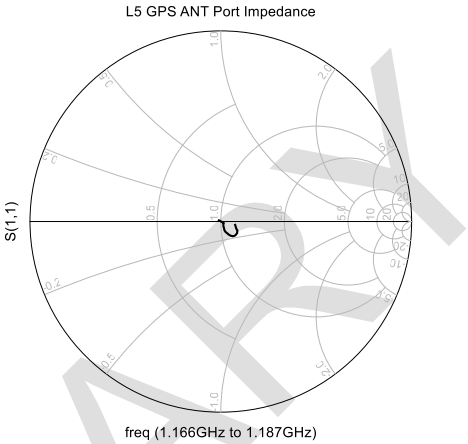
L5 GPS Wide Band

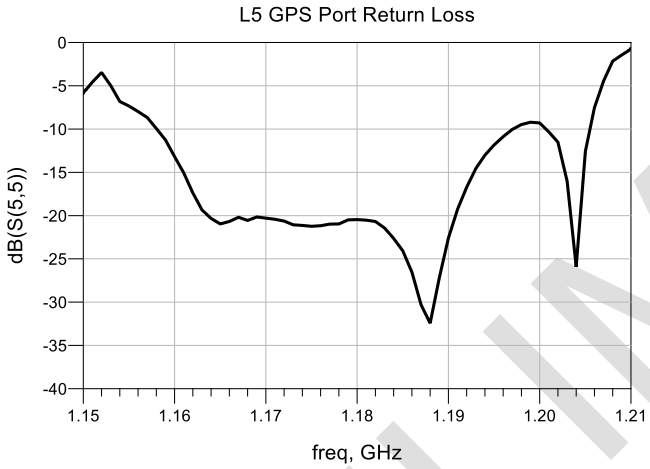


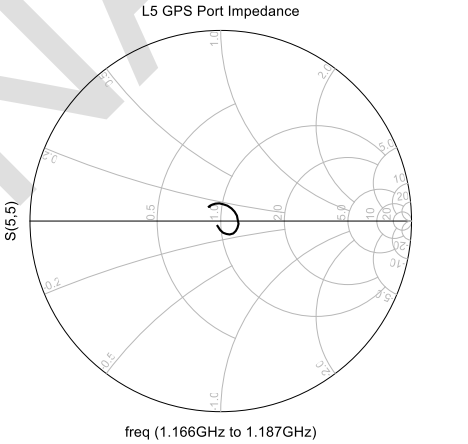
L5 GPS Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C





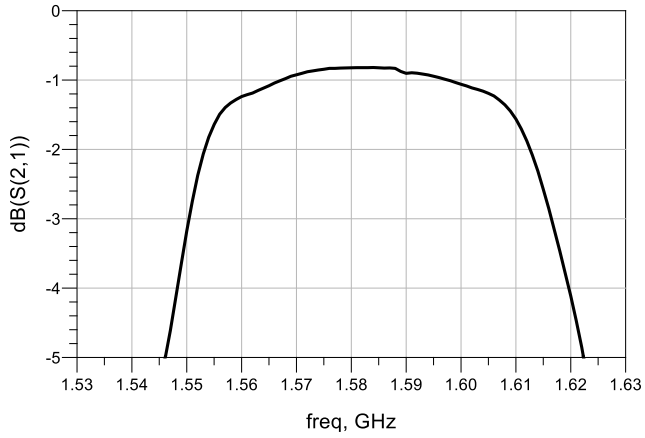




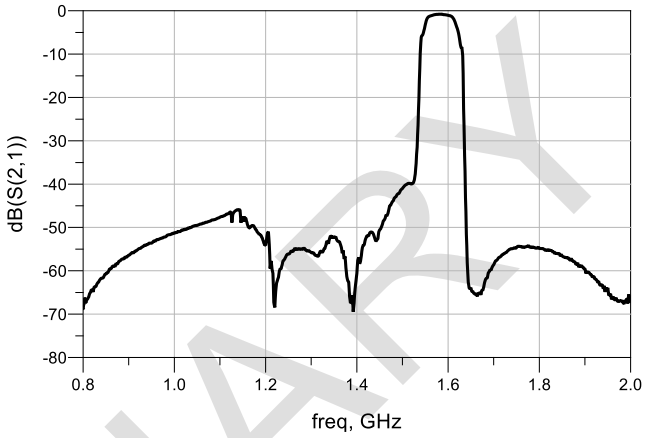
GNSS Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

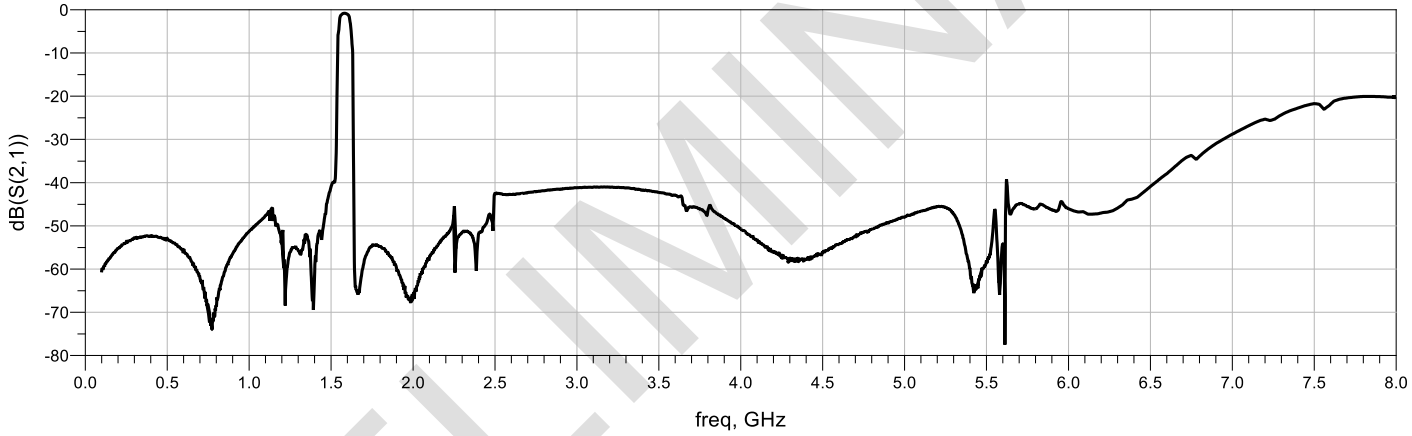
GNSS Pass Band



GNSS Narrow Band

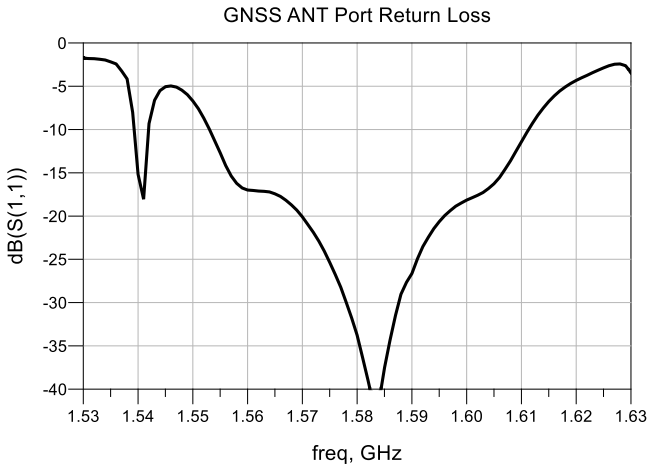


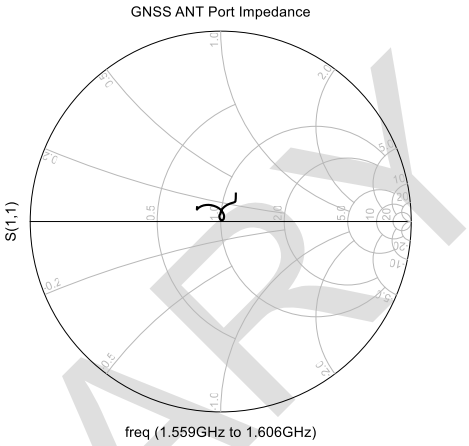
GNSS Wide Band

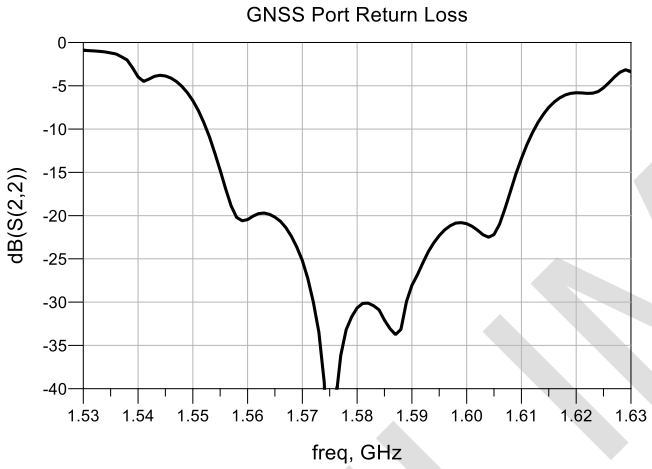


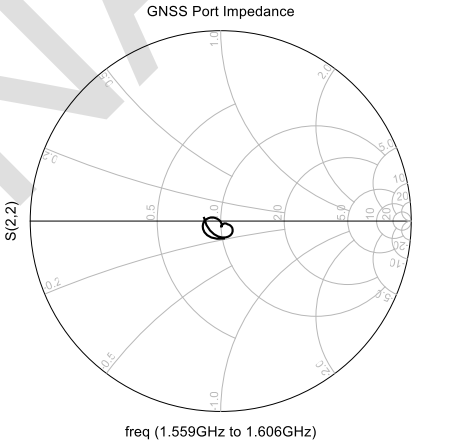
GNSS Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C





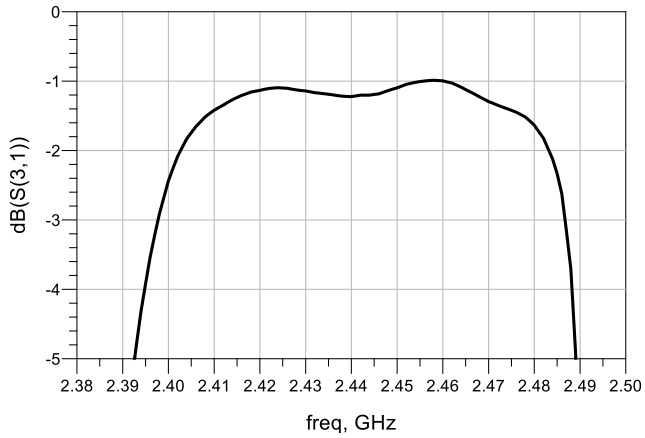




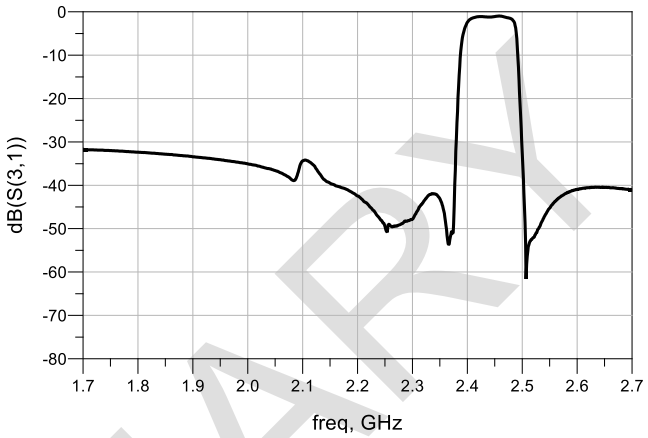
2.4GHz WiFi Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

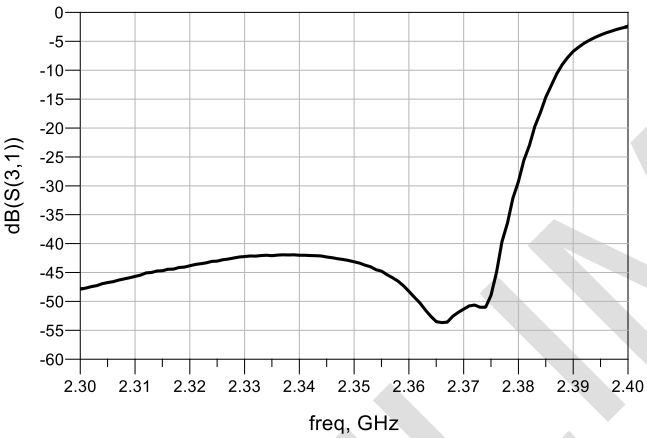
2.4G WiFi Pass Band



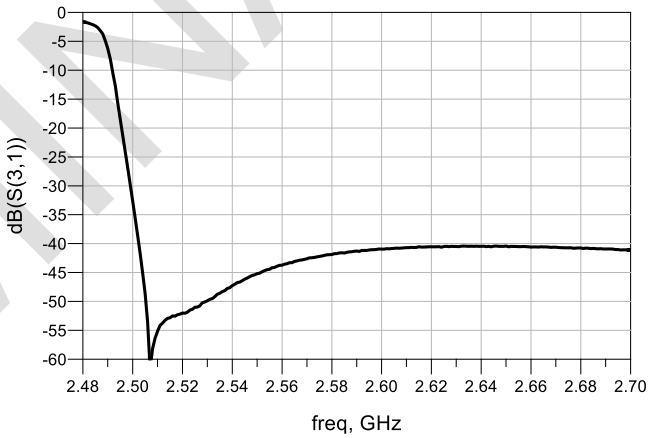
2.4G WiFi Narrow Band



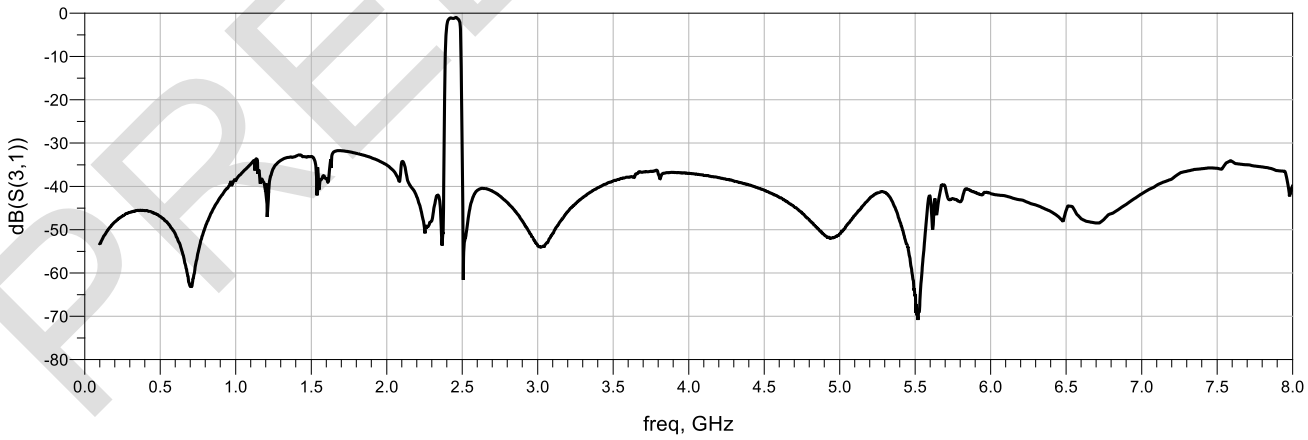
2.4G WiFi B40 Attenuation



2.4G WiFi B41 Attenuation

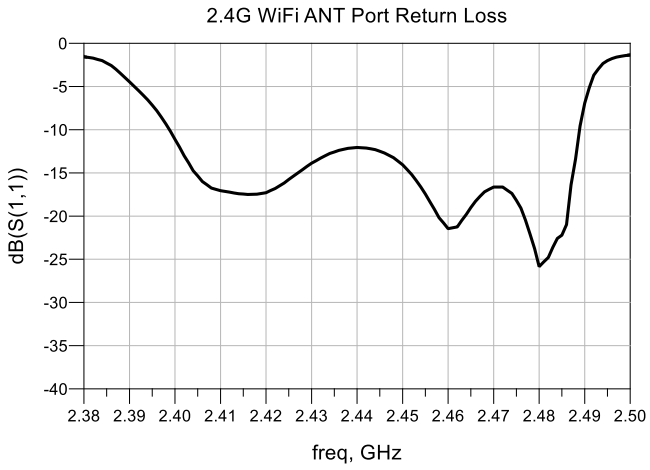


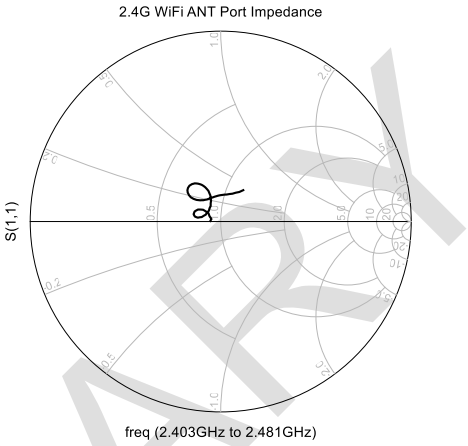
2.4G WiFi Wide Band

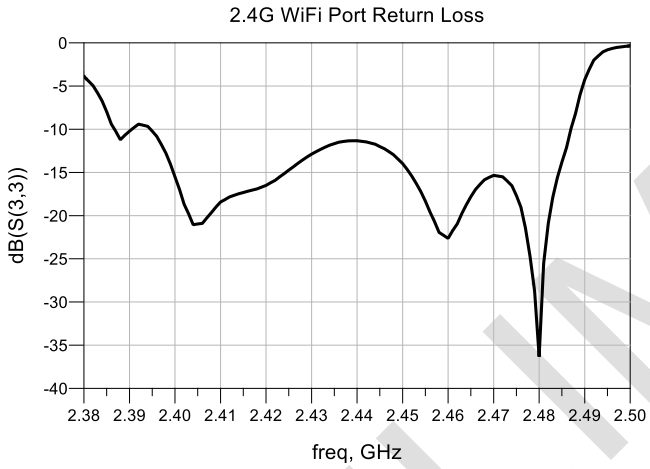


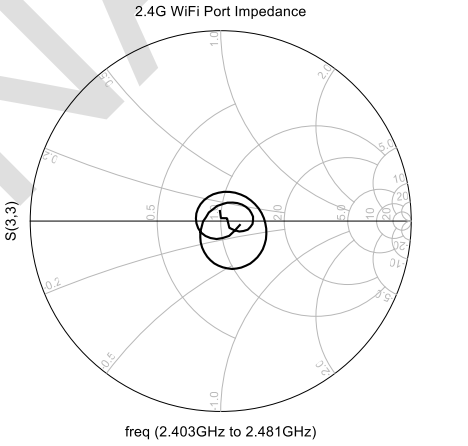
2.4GHz WiFi Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C





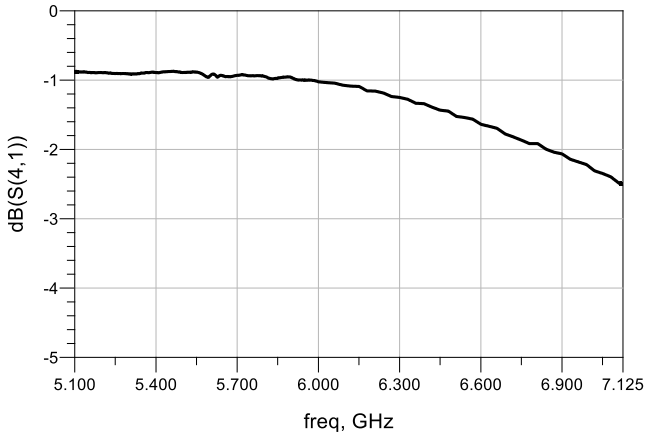




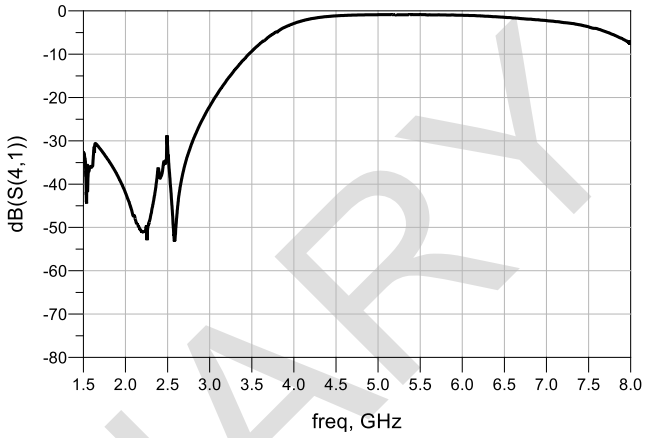
5GHz WiFi6E Insertion Loss and Attenuation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

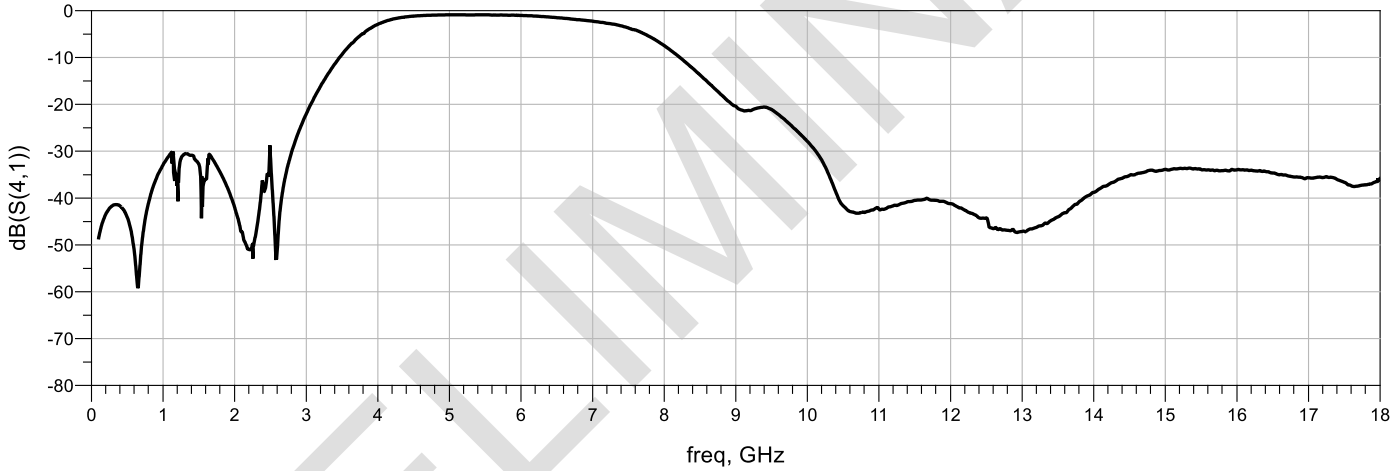
5G WiFi Pass Band



5G WiFi Narrow Band

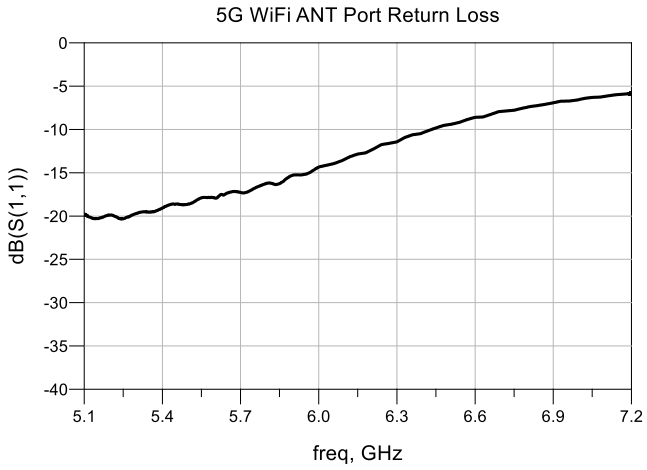


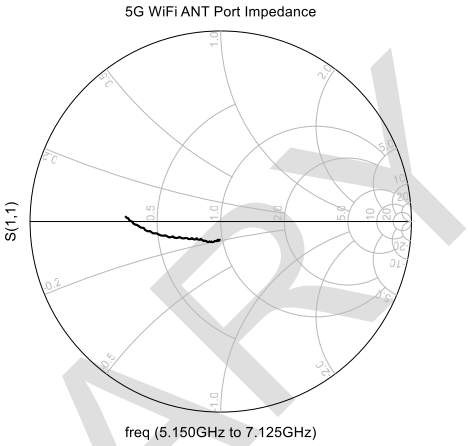
5G WiFi Wide Band

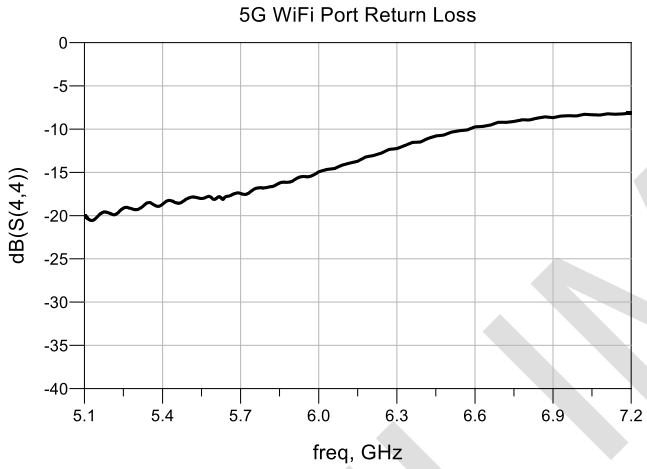


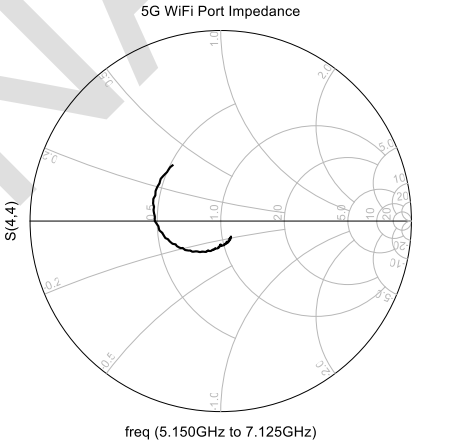
5GHz WiFi6E Return Loss and Impedance Plots

Test conditions unless otherwise noted: Temp. = +25 °C





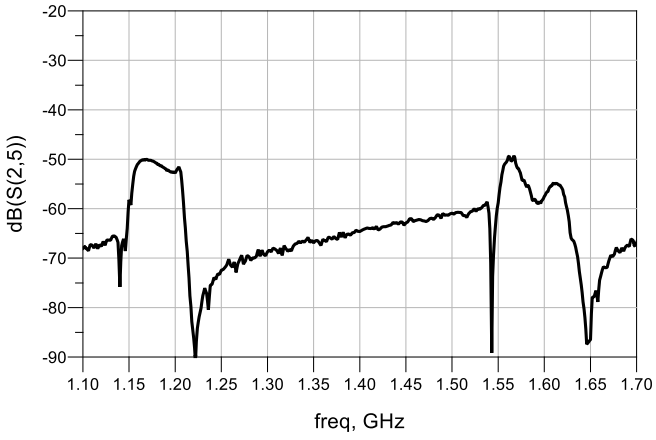




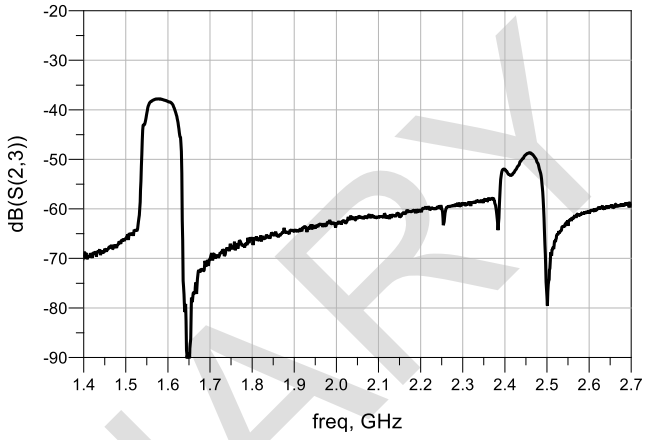
Isolation Plots

Test conditions unless otherwise noted: Temp. = +25 °C

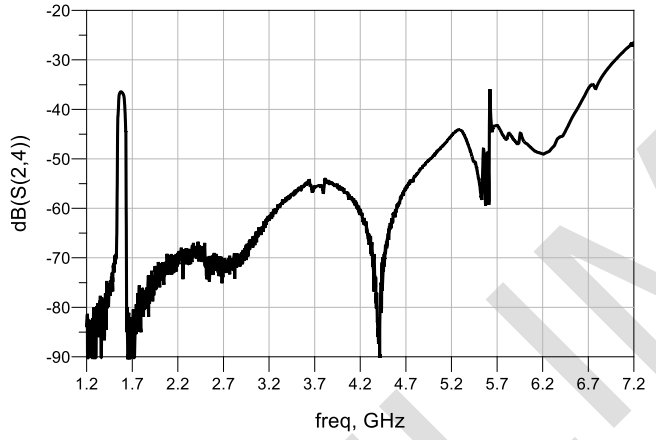
GNSS to L5 GPS Isolation



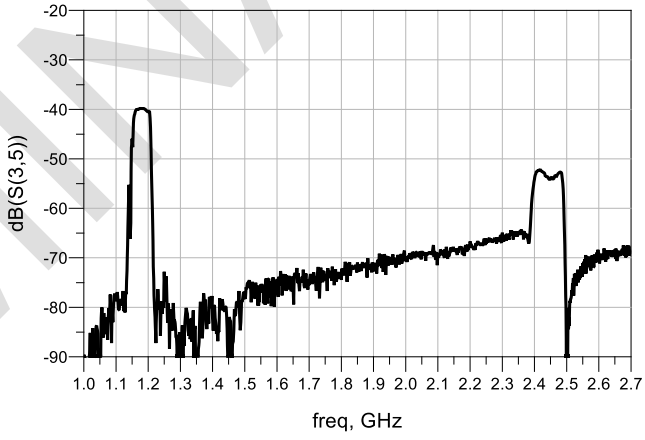
GNSS to 2.4GHz WiFi Isolation



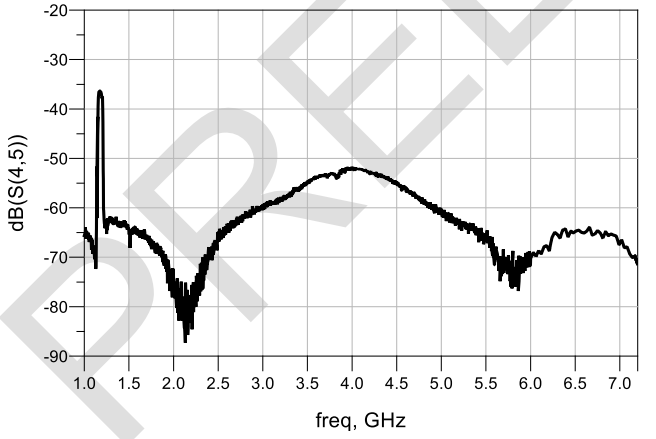
GNSS to 5G WiFi Isolation



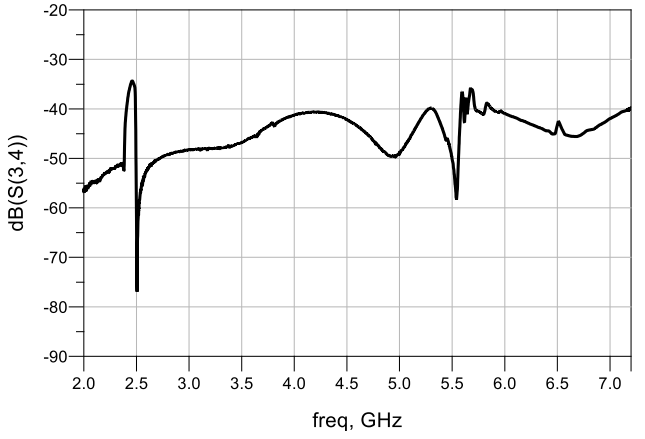
2.4GHz WiFi to L5 Isolation



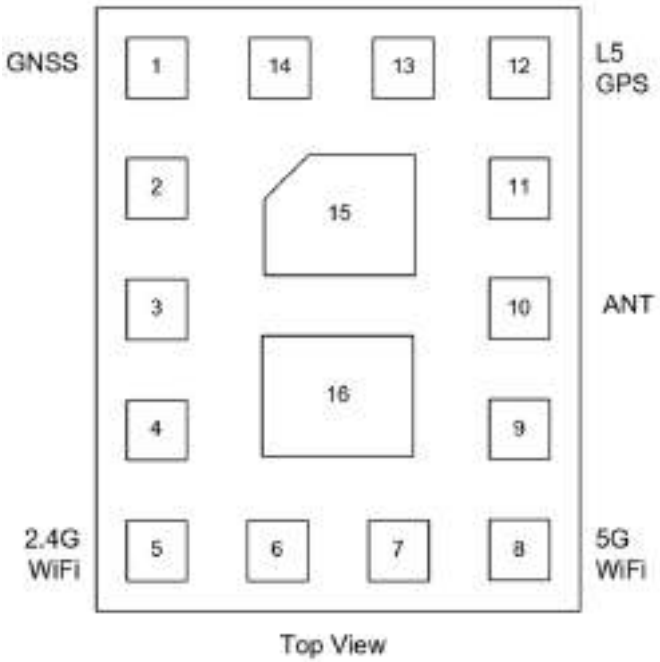
5GHz WiFi to L5 Isolation



2.4GHz WiFi to 5GHz WiFi Isolation



Pin Configuration and Description

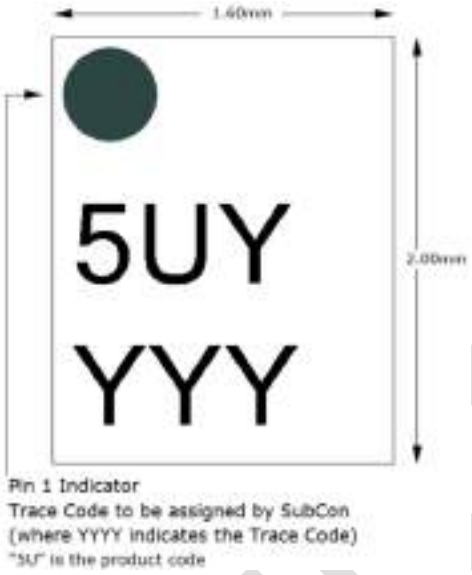


Top View

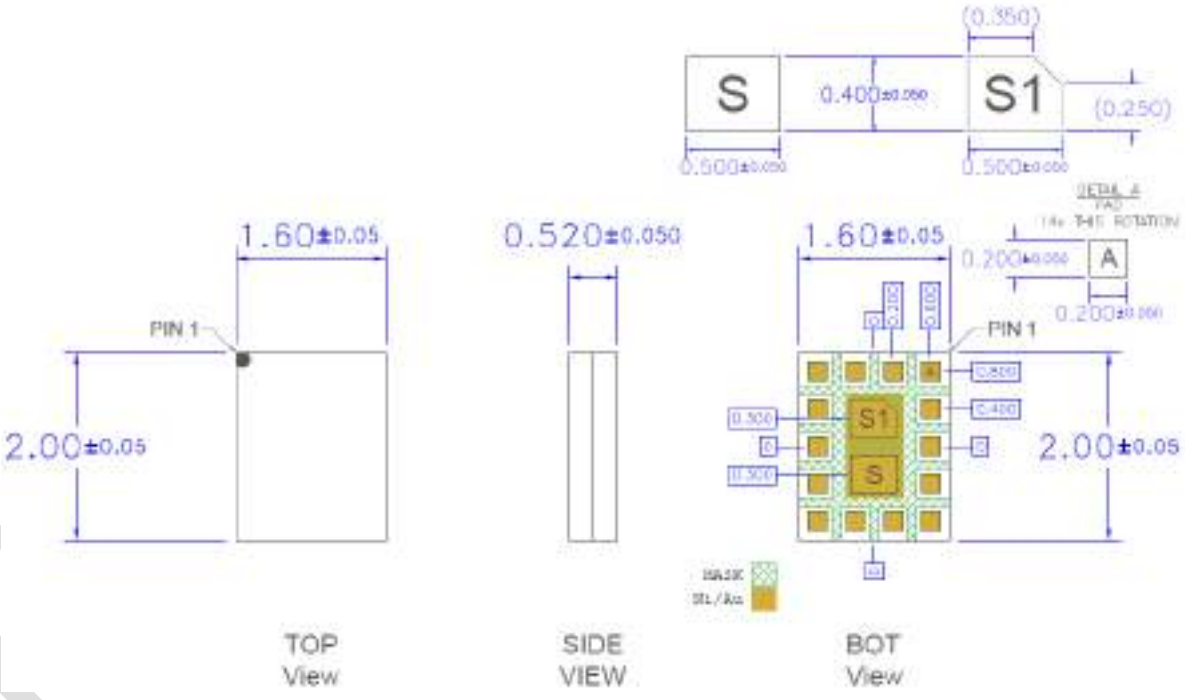
Pin Number	Label	Description
1	GNSS	GNSS Port
5	2.4G WiFi	2.4 GHz WiFi Port
8	5G WiFi	5 GHz WiFi Port
10	ANT	Antenna Port
12	L5 GPS	L5 GPS Port
2, 3, 4, 6, 7, 9, 11, 13, and 14	GND	Ground
15 and 16	GND	Package Ground

Part Marking and Dimensions

Part Marking Diagram – Top View



Package Outline Dimension Drawing

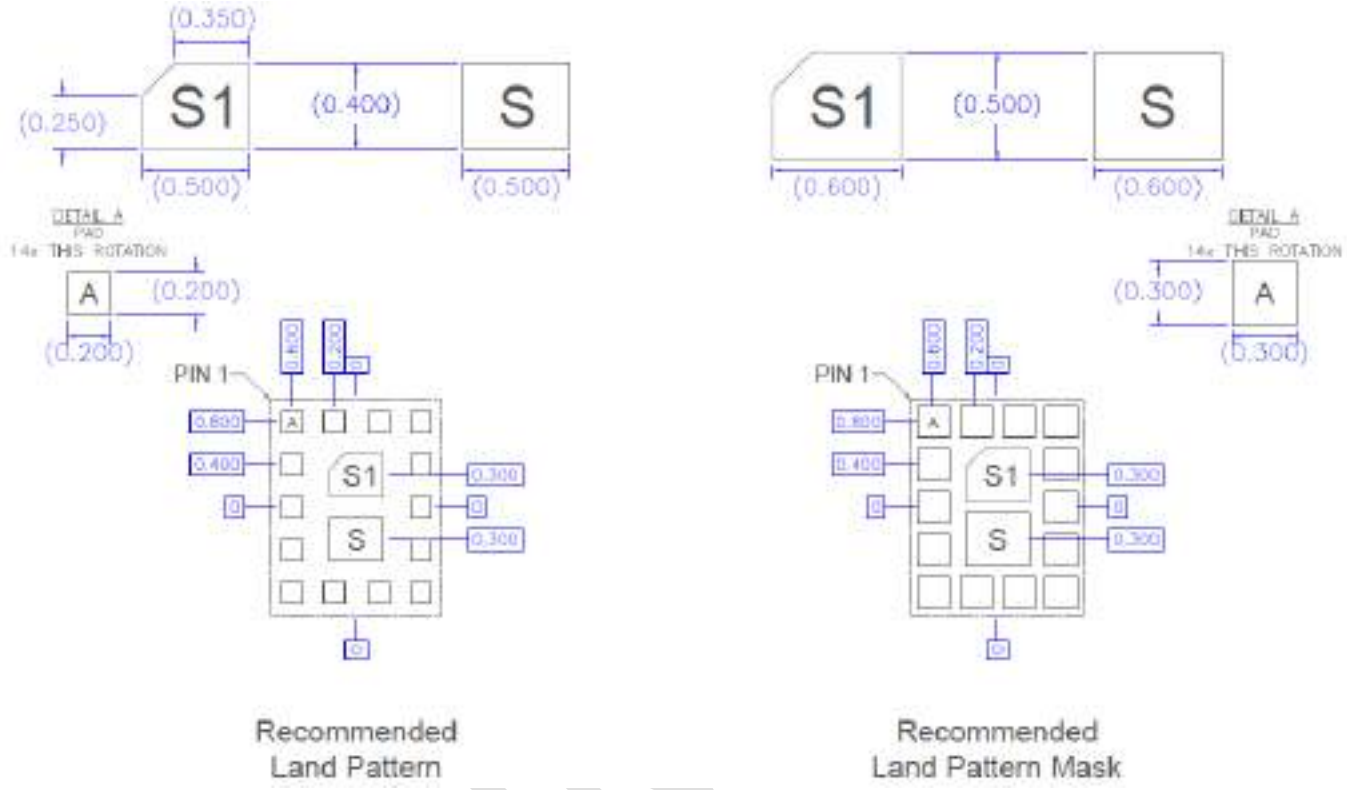


Notes:

1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

Land Pattern and Mask Dimensions

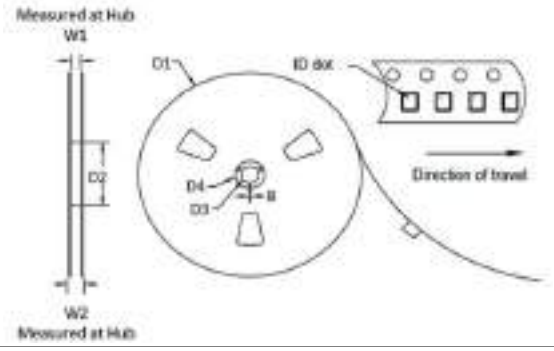
Recommended Land Pattern and Land Pattern Mask Drawing – Top View

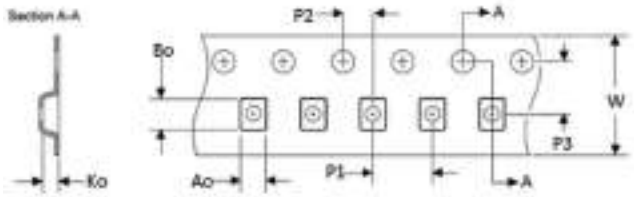


Notes:

1. All dimensions are in millimeters.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.

Tape and Reel Information





Feature	Measure	Symbol	Size (mm)
Flange	Diameter	D1	330.0
	Thickness	W2	18.2
	Space Between Flange	W1	12.8
Hub	Outer Diameter	D2	102.0
	Arbor Hole Diameter	D3	13.0
	Key Slit Width	B	2.0
	Key Slit Diameter	D4	20.0

Feature	Measure	Symbol	Size (mm)
Cavity	Length	Ao	1.8
	Width	Bo	2.2
	Depth	Ko	0.8
	Pitch	P1	4.0
Centerline Distance	Cavity to Perforation (Length)	P2	2.0
	Cavity to Perforation (Width)	P3	5.5
Carrier Tape	Width	W	12.0

(Unless otherwise specified, all dimension tolerances per EIA-481)

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1A	ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free
- Qorvo Green

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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REVISION HISTORY

Revision	Date (YYYYMMDD)	Description
A	20200121	Initial Document
B	20200720	Updated specs
C	20210119	Updated specs

QM22450

2.4G and 5G WiFi6E Antennaplexer

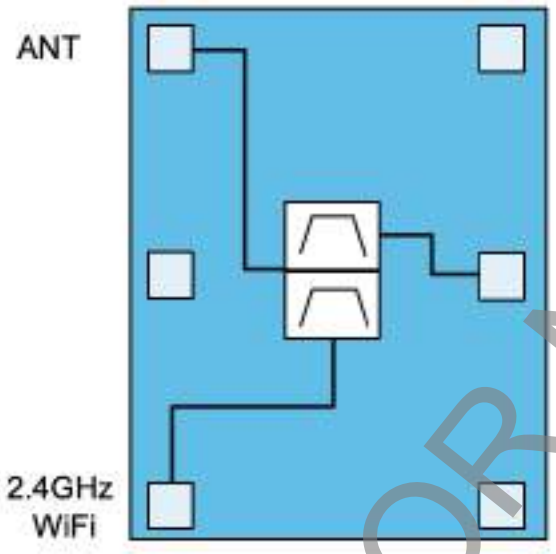
Product Overview

The QM22450 is part of Qorvo's family of antennaplexers designed to maximize performance and create space in 4G/5G handsets.

The QM22450 leverages Qorvo's patented technology to diplex 2.4GHz and 5GHz WLAN and ensure minimal transmit insertion loss while providing LTE/NR coexistence.

The QM22450 uses common module packing techniques to achieve a compact 1.4 mm x 1.1 mm footprint.

Functional Block Diagram



Bottom View

6 Pin 1.4 x 1.1mm leadless SMT package

Key Features

- Compact Form-Factor: 1.4 mm x 1.1 mm x 0.6 mm
- Highly selective filters achieving low insertion loss and high attenuation over full bandwidth
- Single antenna port, diplexing
- RoHS Compliant, Pb-Free Module Package
- Supports Wi-Fi 6E

Applications

- For 2.4GHz and 5GHz WLAN

Ordering Information

Part Number	Description
QM22450EVB	Evaluation Board (EVB)
QM22450SB	Sample bag of 5 pieces
QM22450SR	Sample reel of 100 pieces
QM22450TR13	13 inch reel of 15k pieces

Absolute Maximum Ratings

Parameter	Condition		Rating	UNITS
Storage Temperature			-40 to +90	°C
Operating Case Temperature			-30 to +85	°C
RF Input Power (Pin2, 5GHz WiFi 6E)	5150 MHz – 7125 MHz	CW, +55C, 5k hours	+24	dBm
RF Input Power (Pin4, 2.4GHz WiFi)	2403 MHz – 2481 MHz	CW, +55C, 5k hours	+24	dBm
RF Input Power (Pin6, ANT)	2403 MHz – 2481 MHz	CW, +55C, 5k hours	+15	dBm
	5150 MHz – 7125 MHz			

Operation of this device outside the parameter ranges given above may cause permanent damage.

Electrical Specifications[1] 2.4GHz WiFi - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	2403 MHz – 2421 MHz[2] (WiFi CH1)	-	1.2	1.6	dB
	2408 MHz – 2426 MHz[2] (WiFi CH2)	-	1.1	1.4	
	2413 MHz – 2471 MHz[2] (WiFi CH3-11)	-	1.1	1.5	
	2458 MHz – 2476 MHz[2] (WiFi CH12)	-	1.2	1.6	
	2463 MHz – 2481 MHz[2] (WiFi CH13)	-	1.3	1.8	
VSWR (Wi-Fi)	2403 MHz – 2481 MHz	-	1.9:1	2.2:1	-
VSWR (ANT)	2403 MHz – 2481 MHz	-	1.8:1	2.2:1	
Attenuation	925 MHz – 960 MHz	32	34	-	dB
	1559 MHz – 1606 MHz	30	32	-	
	2110 MHz – 2170 MHz	25	32	-	
	2300 MHz – 2370 MHz	37	41	-	
	2500 MHz – 2505 MHz[3]	13	41	-	
	2505 MHz – 2690 MHz	30	35	-	
	3200 MHz – 3300 MHz	32	40	-	
	3300 MHz – 3400 MHz	34	41	-	
	3400 MHz – 3800 MHz	34	41	-	
	3800 MHz – 4200 MHz	35	39	-	
	4800 MHz – 5000 MHz	31	35	-	
	5000 MHz – 5150 MHz	28	35	-	
	5150 MHz – 5925 MHz	28	33	-	
	5925 MHz – 7125 MHz	31	32	-	
	7200 MHz – 7500 MHz	34	37	-	

Notes:
1. All specifications include expected temperature and process guardbands
2. Integrated over each 18MHz channel
3. Integrated over 5MHz channel

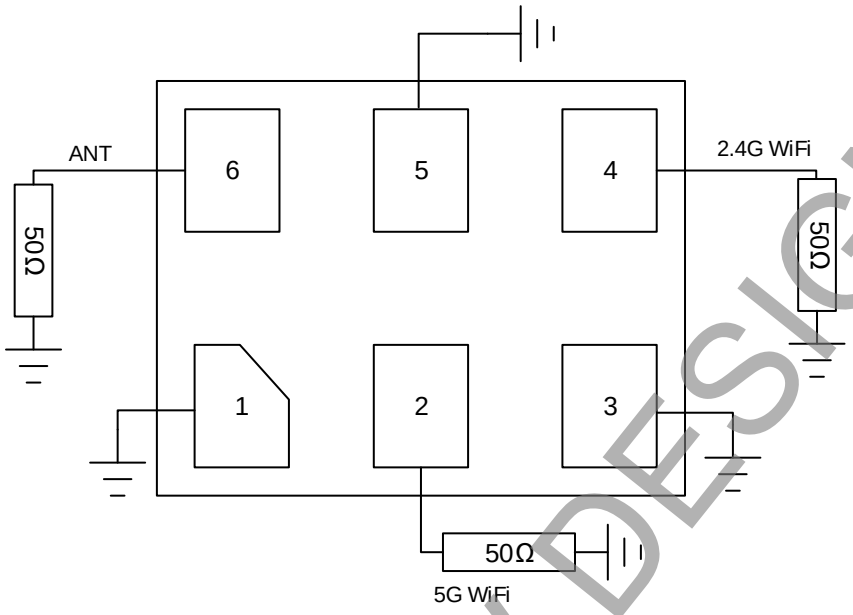
Electrical Specifications[1] 5GHz WiFi - Antenna

Parameter	Conditions	Min.	Typ.	Max.	Units
Insertion Loss	5150 MHz – 5925 MHz	-	1.0	1.3	dB
	5925 MHz – 7125 MHz	-	1.0	1.7	
VSWR (5GHz WiFi 6E)	5150 MHz – 5925 MHz	-	1.3:1	2.0:1	-
	5925 MHz – 7125 MHz	-	1.4:1	2.0:1	
VSWR (ANT)	5150 MHz – 5925 MHz	-	1.3:1	2.0:1	
	5925 MHz – 7125 MHz	-	1.6:1	2.0:1	
Attenuation	824 MHz – 2170 MHz	25	27	-	dB
	1559 MHz – 1606 MHz	26	28	-	
	2300 MHz – 2400 MHz	36	37	-	
	2400 MHz – 2500 MHz	29	39	-	
	2496 MHz – 2690 MHz	25	31	-	
	3300 MHz – 3400 MHz	23	26	-	
	3400 MHz – 3800 MHz	8	14	-	
	10300 MHz – 11850 MHz	23	34	-	
	15450 MHz – 17775 MHz	19	35	-	

Notes:

1. All specifications include expected temperature and process guardbands

Application Circuit Schematic



Note:

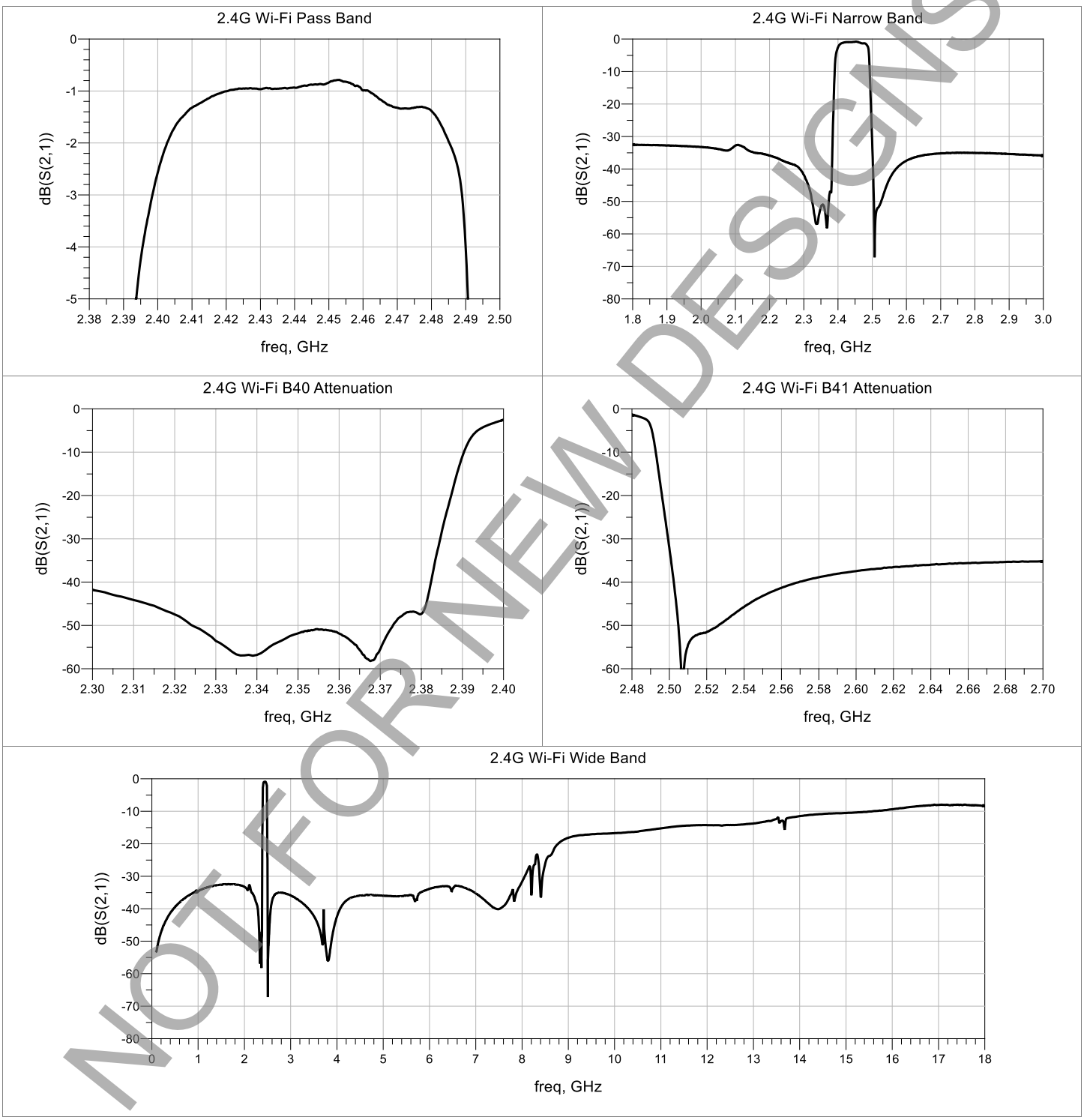
All ports are matched to 50 ohm impedance

Bill of Materials

Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	2.4G and 5G Wi-Fi 6E Antennaplexer	Qorvo	QM22450
PCB	N/A	4-layer Printed Circuit Board	Various	QM22450-4000

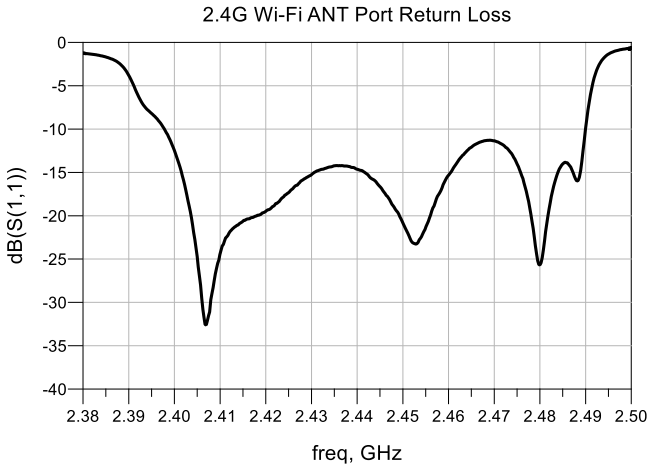
2.4GHz WiFi Insertion Loss and Attenuation

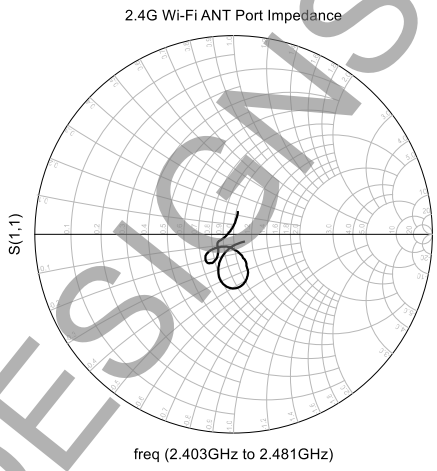
Test conditions unless otherwise noted: Temp. = +25°C

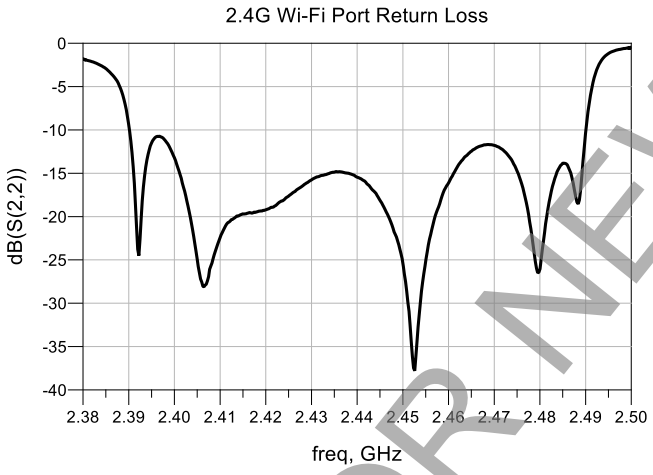


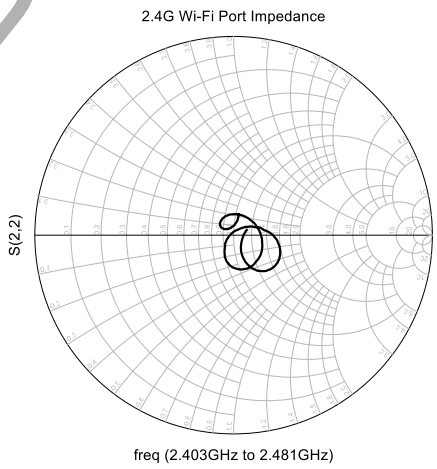
2.4GHz WiFi Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25°C



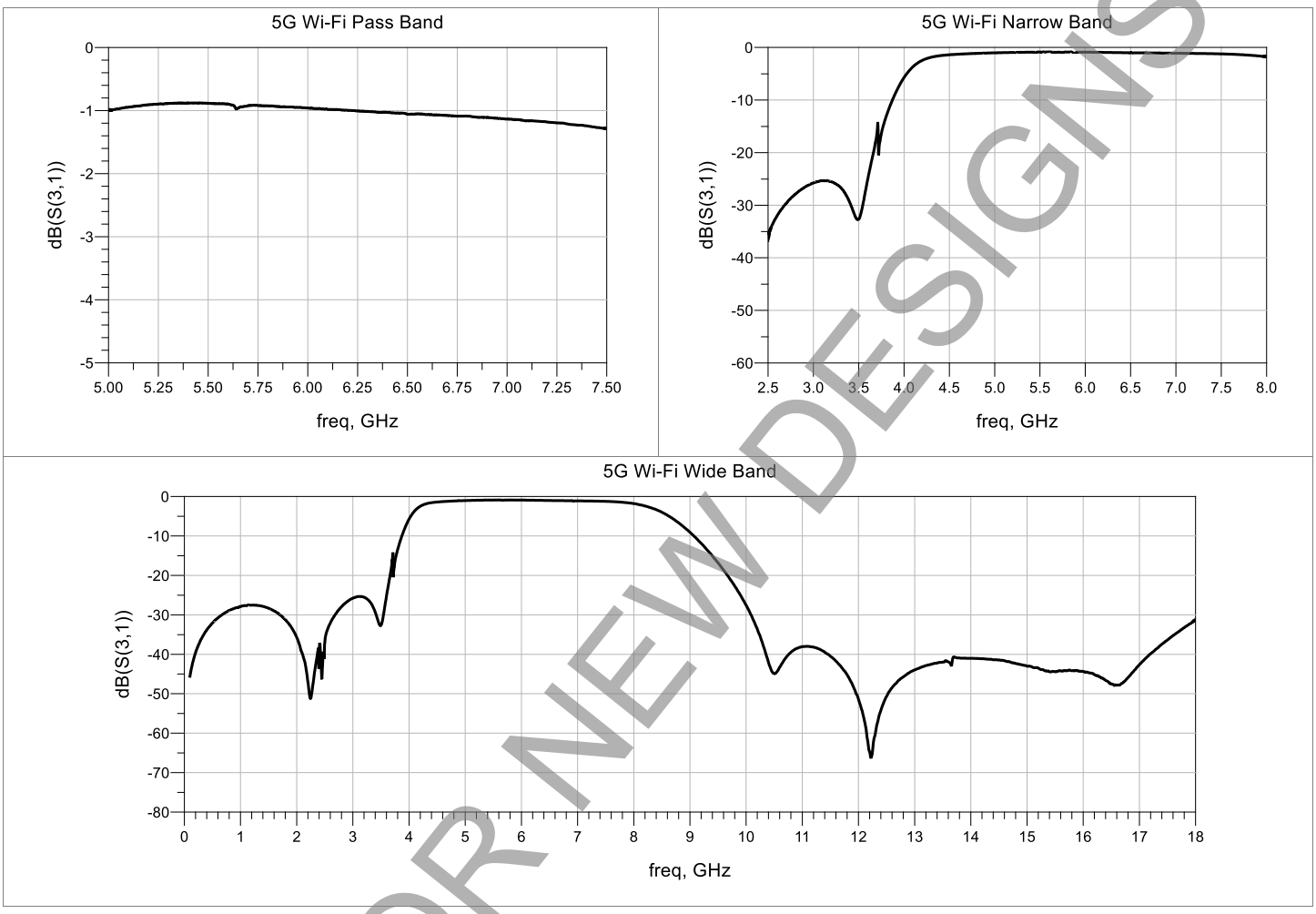






5GHz WiFi Insertion Loss and Attenuation

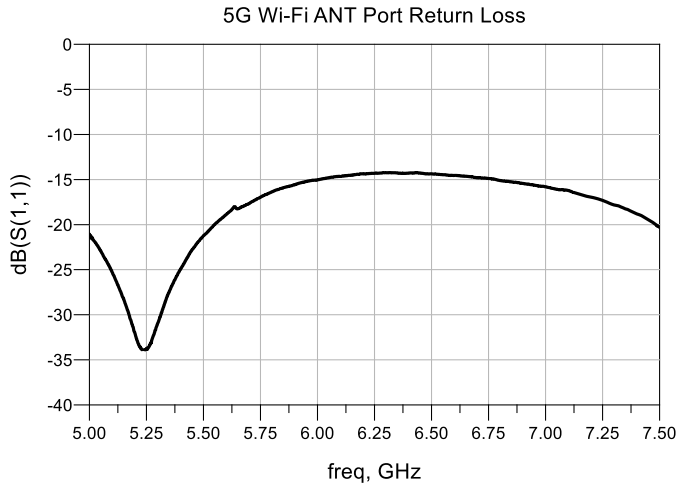
Test conditions unless otherwise noted: Temp. = +25°C

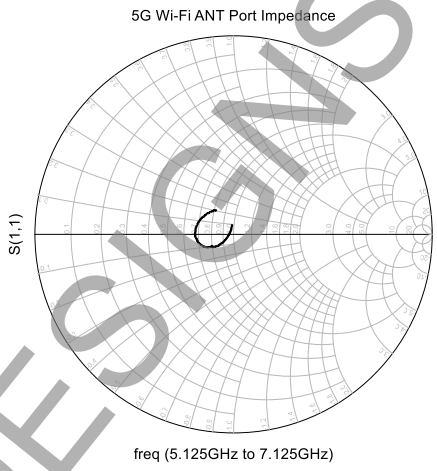


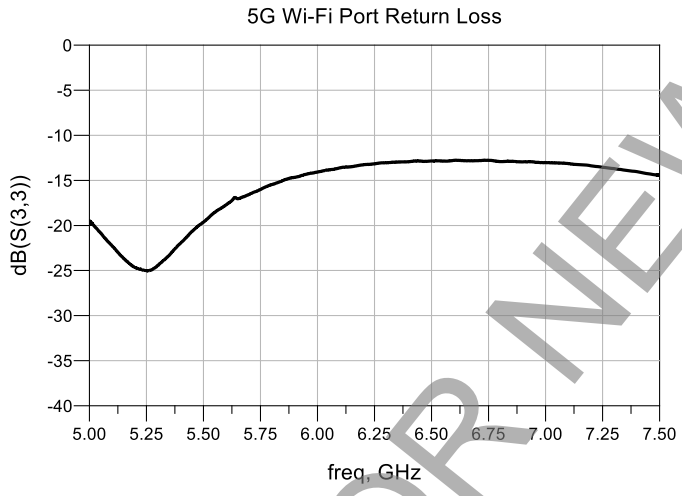
ES France - Département RF & Hyperfréquences - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 60 - Fax. 01 47 01 16 22 - e-mail: hyper@es-france.com - Site Web: www.es-france.com

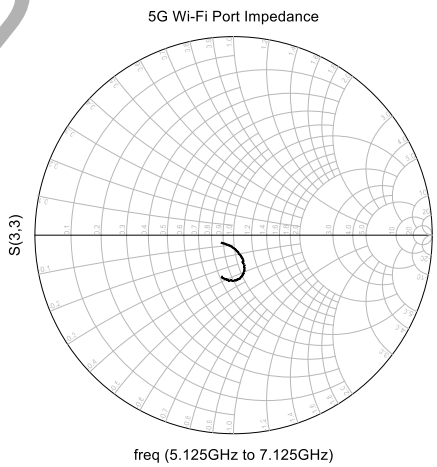
5GHz WiFi Return Loss and Impedance

Test conditions unless otherwise noted: Temp. = +25°C

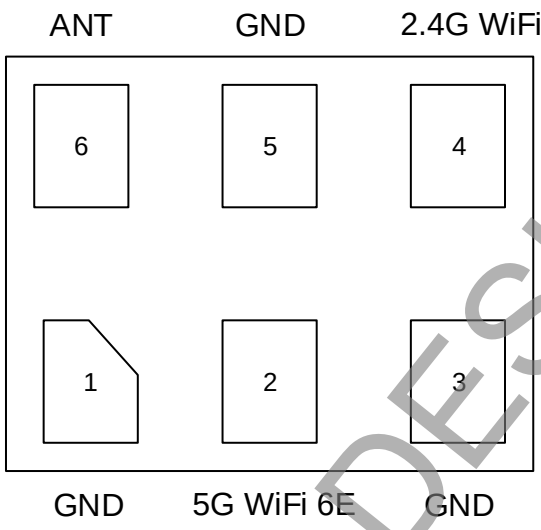








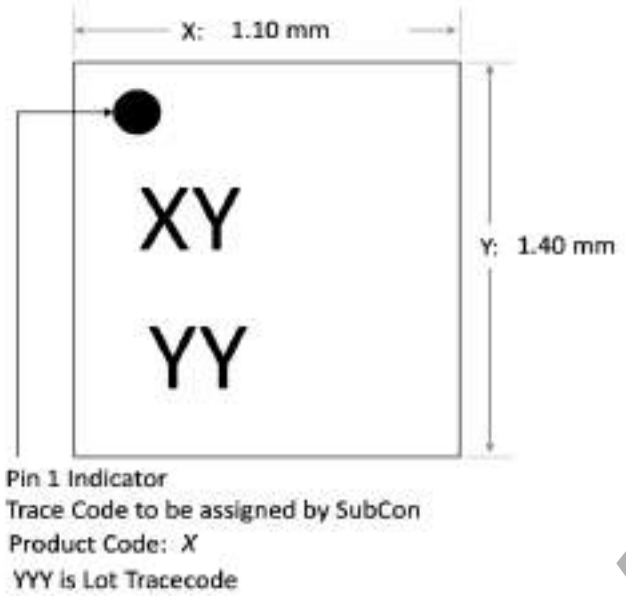
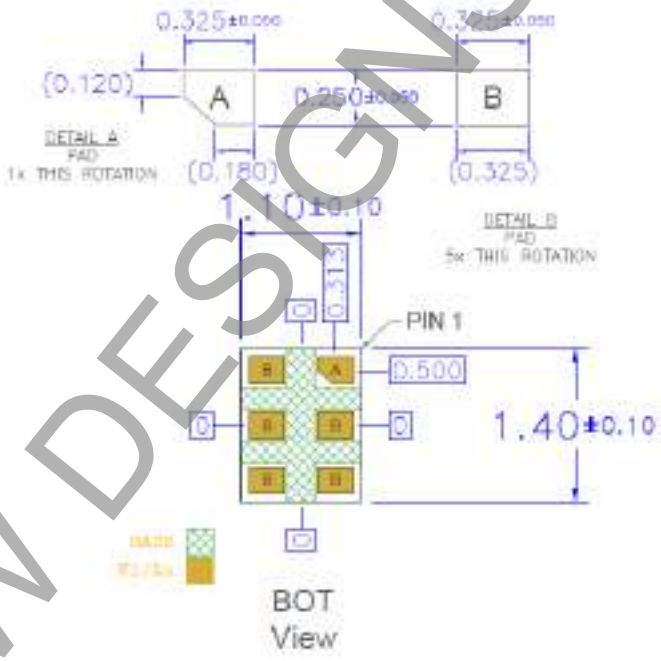
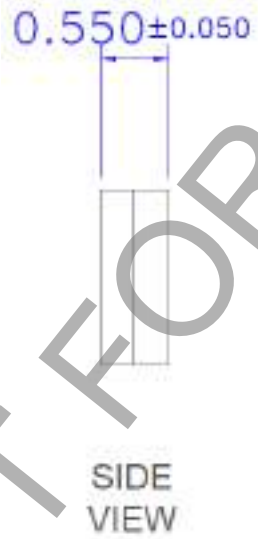
Pin Configuration and Description



Top View

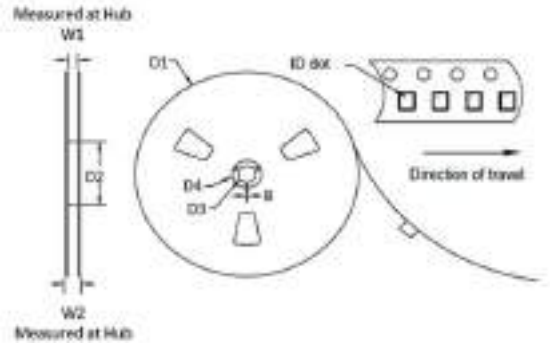
Pin Number	Label	Description
2	5GHz WiFi 6E	5 GHz Wi-Fi Port
4	2.4GHz WiFi	2.4GHz Wi-Fi Port
6	ANT	Antenna Port
1, 3, and 5	GND	Ground

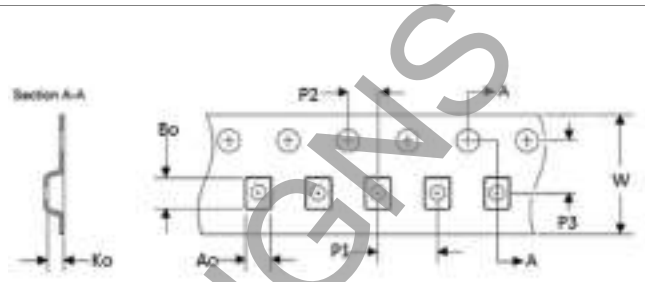
Part Marking and Dimensions

Package Marking Diagram	Package Outline Dimension Drawing – Bottom View
	
Package Outline Dimension Drawing – Side View	**Recommended Land Pattern - Top View**
	

Notes:
1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

Tape and Reel Information





Feature	Measure	Symbol	Size (mm)
Flange	Diameter	D1	330.0
	Thickness	W2	18.2
	Space Between Flange	W1	12.8
Hub	Outer Diameter	D2	102.0
	Arbor Hole Diameter	D3	13.0
	Key Slit Width	B	2.0
	Key Slit Diameter	D4	20.0

Feature	Measure	Symbol	Size (mm)
Cavity	Length	Ao	1.3
	Width	Bo	1.6
	Depth	Ko	0.74
	Pitch	P1	4.0
Centerline Distance	Cavity to Perforation (Length)	P2	2.0
	Cavity to Perforation (Width)	P3	5.5
Carrier Tape	Width	W	12.0

(Unless otherwise specified, all dimension tolerances per EIA-481)

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1B	ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_40_2$) Free
- PFOS Free
- SVHC Free
- Qorvo Green

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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REVISION HISTORY

Revision	Date (YYYYMMDD)	Description
D	20200911	Initial Production Release
E	20210204	Updated notes – “NOT FOR NEW DESIGNS” and “ Contact local sales team for alternate”

QM22246

WiFi Extractor Filter

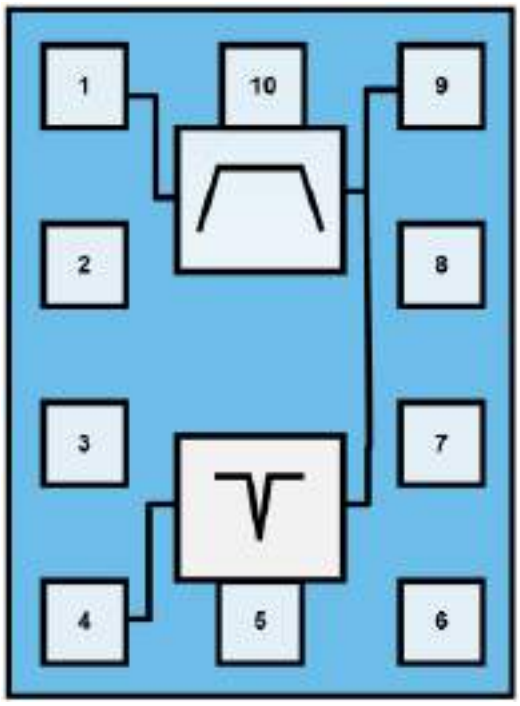
Product Overview

The QM22246 is a high-performance Bulk Acoustic Wave (BAW) filter module designed to meet the strict LTE/NR requirements for use in LTE/NR from 699–2400 MHz & 2496–2690 MHz and WLAN requirements. External tuning options enable extension of performance up through B42.

QM22246 is specifically designed to meet the high performance expectations of insertion loss and rejection for LTE/NR and WLAN systems under all operating conditions. QM22246 allows diplexing the Cellular path and a filtered WiFi path to one antenna port.

The QM22246 uses common module packaging techniques to achieve the industry standard 1.5 x 1.1 x 0.70 mm footprint.

Functional Block Diagram



Top View

10 Pin 1.5 X 1.1 mm leadless SMT Package

Key Features

- Highly selective BAW filters achieving low insertion loss and high attenuation over full bandwidth and operating conditions
- Rejection in WLAN band of 10dB minimum
- Single antenna port, diplexing
- High power handling capability for GSM front end application
- Performance -30 to +85 ºC
- RoHS compliant, Pb-free module package

Applications

- For WLAN and B7/n7 FDD and B38/n38, B40/n40 & B41/n41 TDD-LTE/NR applications
- LTE/NR handset, datacards, mobile routers

Ordering Information

Part Number	Description
QM22246EVB	Evaluation Board
QM22246SB	5pc Sample bag
QM22246SR	100pcs on 7” Reel
QM22246TR13-15K	15,000pcs on 13” Reel

Absolute Maximum Ratings(1)

Parameter	Conditions	Rating
Storage Temperature		-40 to +100°C
Operable Temperature (2)		-30 to +85°C
RF Input Power (3)		
- RF2 (Cell Port)	5,000hours at 55°C	+28dBm with CW 100% Duty Cycle Equivalent to +34dBm with CW 25% Duty Cycle
- RF3 (WiFi Port)	CW, 5,000hours at 55°C	+24dBm
RF Input Power (RF3 WiFi Port Only)	CW, 5,000hours at 55°C	+24dBm
Peak RF Input Power		
- RF2 (Cell Port)	Max duration of 0.5sec.	+40dBm
- RF3 (WiFi Port)	Max duration of 0.5sec.	+30dBm

1. Operation of this device outside the parameter ranges given may cause permanent damage.
2. No damage
3. TX power presence at RF2 and RF3 simultaneously

Electrical Specifications – RF1 to RF2 (ANT - CELL)

Unless otherwise specified: Temp = -30 to +85°C

Parameter	Frequency Range	Condition	Min.	Typ.	Max	Units
Insertion Loss	699 to 960 MHz		-	1.1	1.7	dB
	1427.9 to 1510.9 MHz		-	0.7	1	
	1574 to 1615 MHz		-	0.6	1	
	1710 to 2170 MHz		-	0.8	1.2	
	2300 to 2370 MHz		-	2	3.1	
	2370 to 2377.5 MHz		-	2.7	5.7	
	2496 to 2510 MHz		-	1.8	4	
	2510 to 2570 MHz		-	0.9	2	
	2570 to 2690 MHz		-	0.7	1	
	3400 to 3600 MHz		-	1.3	2.1	
Passband Ripple (pk-pk)	2300 to 2370 MHz	Over any 20MHz Bandwidth	-	0.6	1.5	dB
	2496 to 2510 MHz		-	1	2.6	
	2510 to 2690 MHz	Over any 20MHz Bandwidth	-	0.3	1	
Attenuation	2402 to 2480 MHz	Integrated over 1 MHz	15	18	-	dB
	ISM Channel 1	Integrated over 19 MHz	17	24	-	
	ISM Channel 2	Integrated over 19 MHz	17	22	-	
	ISM Channel 3	Integrated over 19 MHz	16	20	-	
	ISM Channel 4	Integrated over 19 MHz	16	19	-	
	ISM Channel 5	Integrated over 19 MHz	16	19	-	
	ISM Channel 6	Integrated over 19 MHz	16	20	-	
	ISM Channel 7	Integrated over 19 MHz	16	20	-	
	ISM Channel 8	Integrated over 19 MHz	17	23	-	
	ISM Channel 9	Integrated over 19 MHz	19	27	-	
	ISM Channel 10	Integrated over 19 MHz	20	29	-	
	ISM Channel 11	Integrated over 19 MHz	20	27	-	
	ISM Channel 12	Integrated over 19 MHz	17	23	-	
	ISM Channel 13	Integrated over 19 MHz	17	20	-	
VSWR (in/out)	2300 to 2370 MHz (In/Out)		-	1.2	2.0	-
	2496 to 2510 MHz (In)		-	2	3.2	
	2496 to 2510 MHz (Out)		-	2.2	3.5	
	2510 to 2570 MHz (In)		-	1.6	2.1	
	2510 to 2570 MHz (Out)		-	1.7	2.2	
	2570 to 2690 MHz (In/Out)		-	1.2	2.0	

Electrical Specifications – RF1 to RF3 (ANT - WIFI)

Unless otherwise specified: Temp = -30 to +85℃

Parameter	Frequency Range	Conditions	Min.	Typ.	Max	Units
Insertion Loss	2402 to 2480 MHz		-	2.1	3.5	dB
	2402 to 2480 MHz	Integrated over 1 MHz	-	2	3.0	
	ISM Channel 1 to 12	Integrated over 19 MHz	-	1.6	2.0	
	ISM Channel 13	Integrated over 19 MHz	-	1.4	2.2	
Passband Ripple (pk-pk)	2402 to 2480 MHz	Over any 20MHz Bandwidth	-	0.8	1.9	dB
		Entire passband	-	1	1.9	
Attenuation	10 to 1549 MHz		40	47	-	dB
	1549 to 1615 MHz		40	47	-	
	1710 to 1990 MHz		35	45	-	
	2110 to 2170 MHz		34	43	-	
	2300 to 2370 MHz		44	46	-	
	2496 to 2501 MHz	Integrated over 5 MHz	18	41	-	
	2500 to 2570 MHz	Integrated over 5 MHz	35(1)	50	-	
			41(2)	50	-	
	2570 to 2690 MHz		42	45	-	
	3300 to 4200 MHz		42	43	-	
VSWR(in/out)	2402 to 2480 MHz		-	1.6	2.1	-

Note:
1. Specified from -30˚C to +25˚C
2. Specified from +25˚C to +85˚C

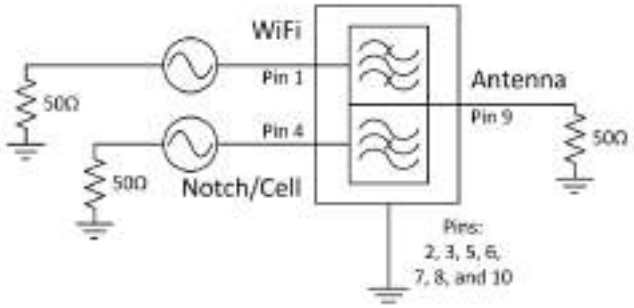
Electrical Specifications – RF2 to RF3 (CELL - WIFI)

Unless otherwise specified: Temp = -30 to +85℃

Parameter	Frequency Range	Conditions	Min.	Typ.	Max	Units
Isolation, RF2 to RF3	2300 to 2370 MHz		42	47	-	dB
	2570 to 2690MHz		42	45	-	
	2500 to 2510 MHz		25(1)	46	-	
			32(2)	46	-	
	2510 to 2570 MHz		35	51	-	
	2370 to 2400 MHZ		12	16	-	

Note:
1. Specified from -30˚C to +25˚C
2. Specified from +25˚C to +85˚C

Application Circuit Schematic and Layout



Bill of Material

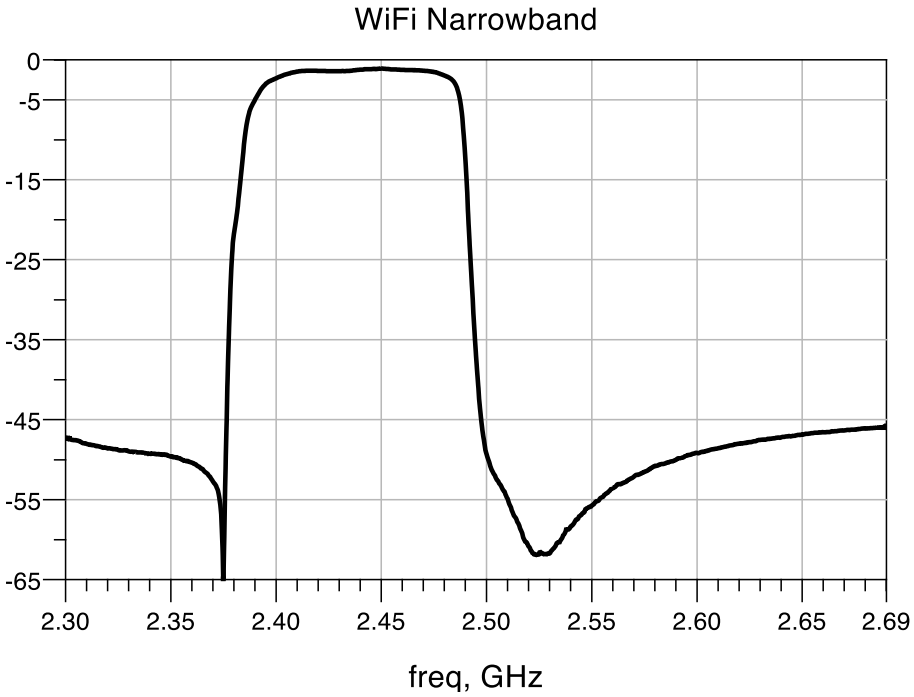
Ref. Des.	Value	Description	Manuf.	Part number
PCB	N/A	3-Layer	Multiple	QM22246-EVB

WiFi Insertion Loss

Test conditions unless otherwise noted: Temp. = +25 °C

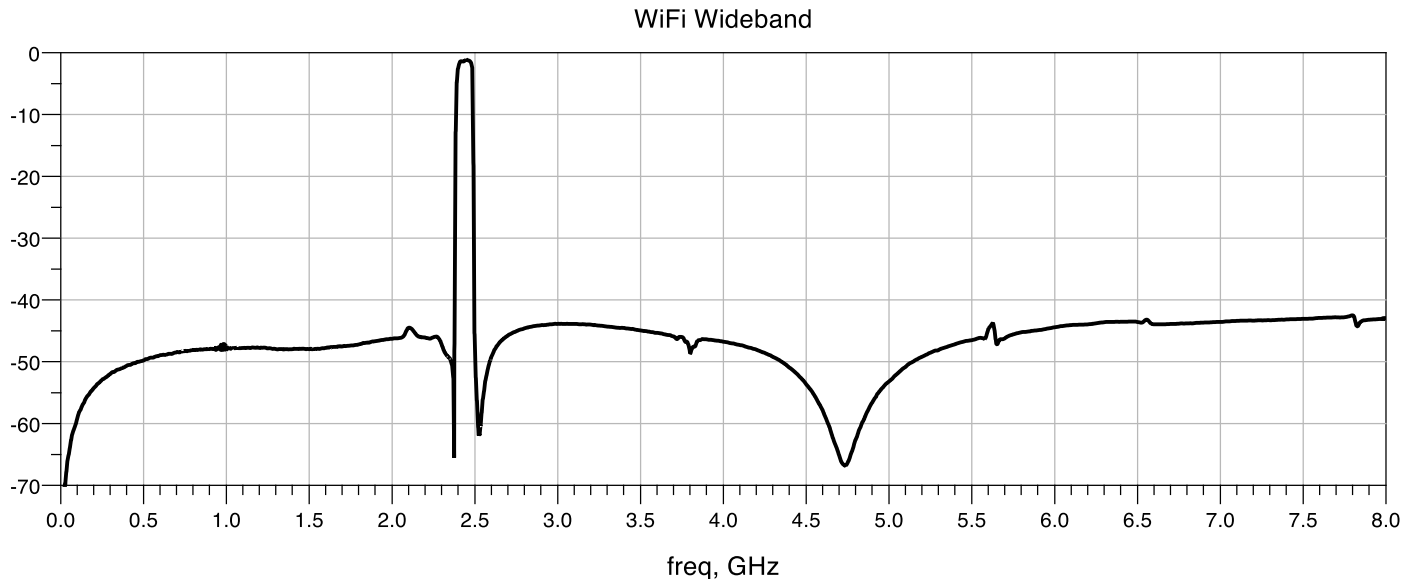
WiFi Attenuation

Test conditions unless otherwise noted: Temp. = +25 °C



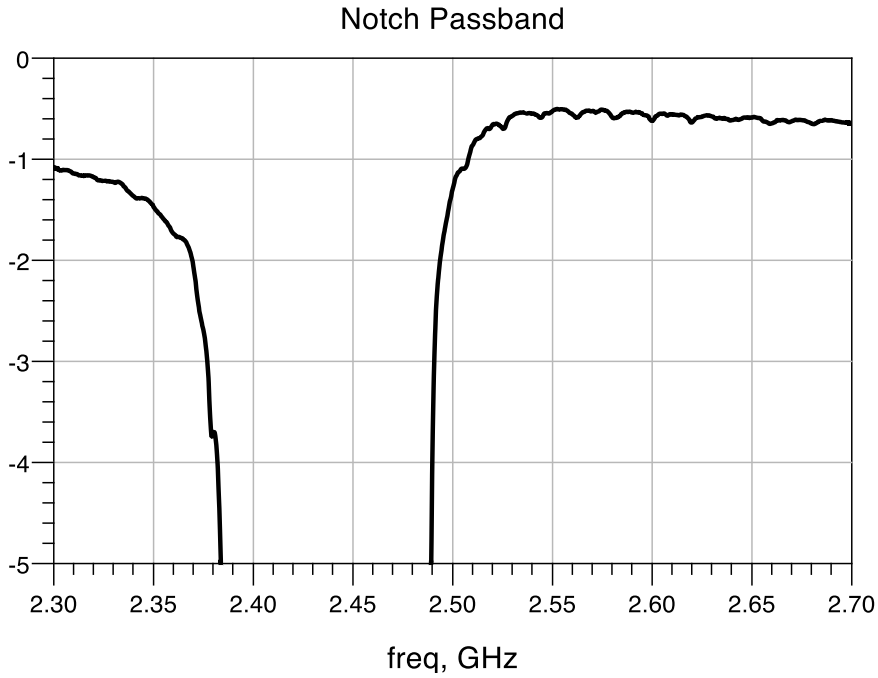
WiFi Attenuation Wideband

Test conditions unless otherwise noted: Temp. = +25 °C



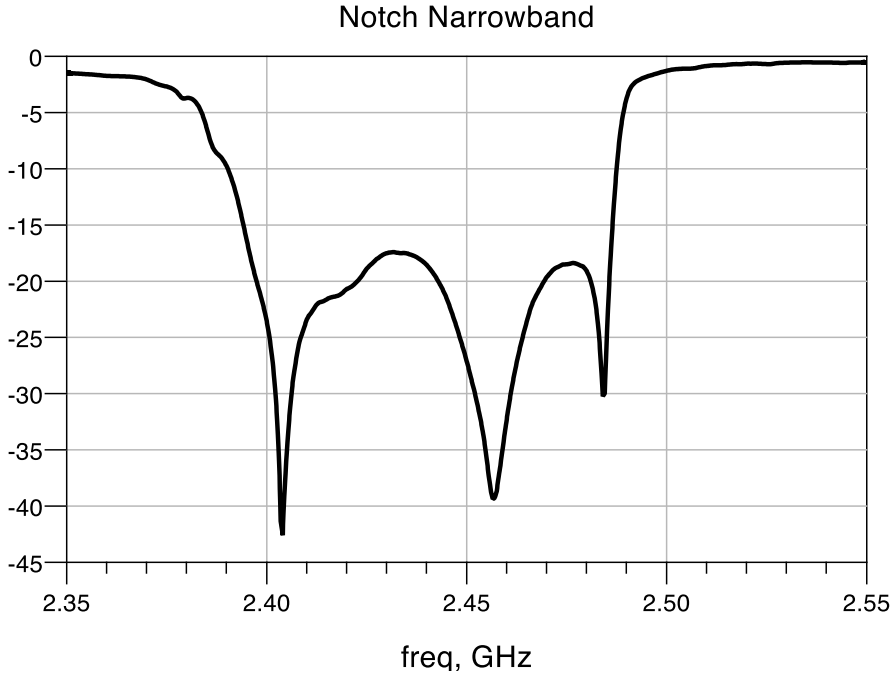
Cell Insertion Loss

Test conditions unless otherwise noted: Temp. = +25 °C



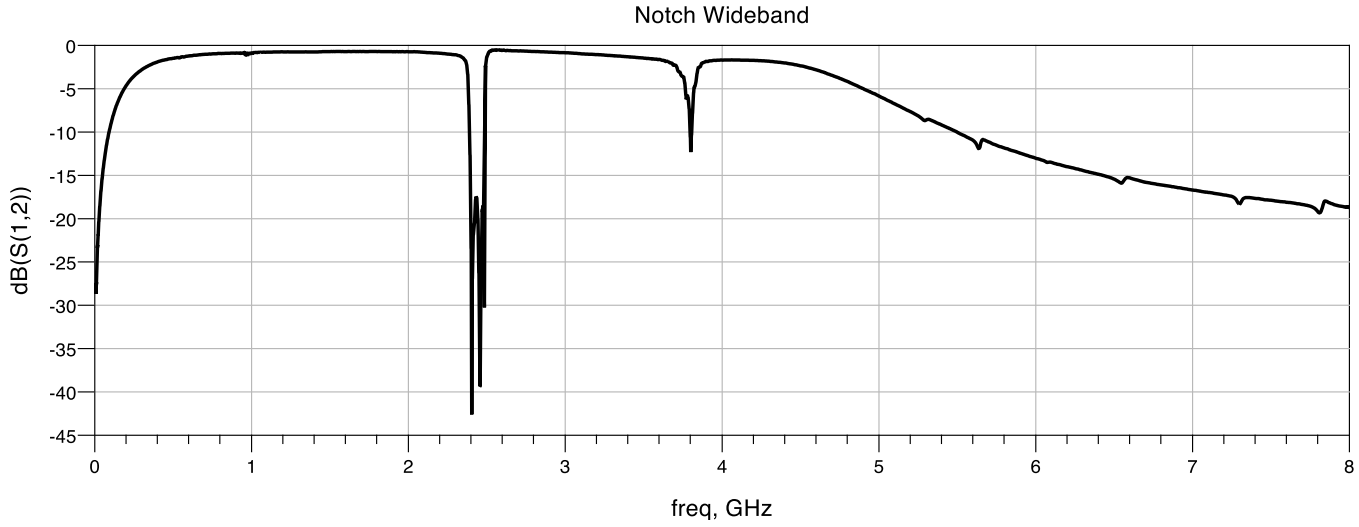
Cell Attenuation

Test conditions unless otherwise noted: Temp. = +25 °C



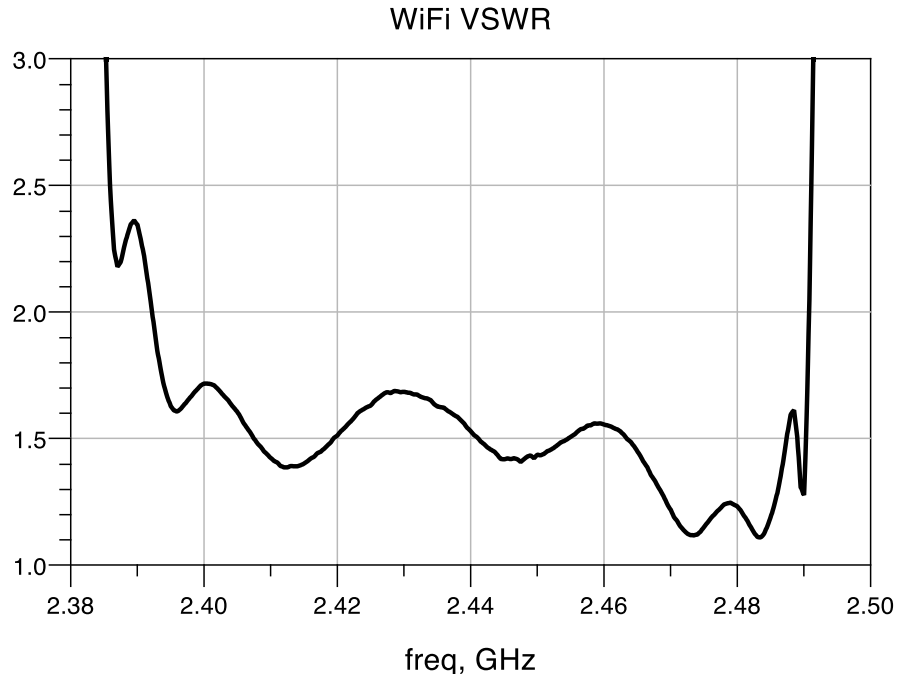
Cell Attenuation Wideband

Test conditions unless otherwise noted: Temp. = +25 °C



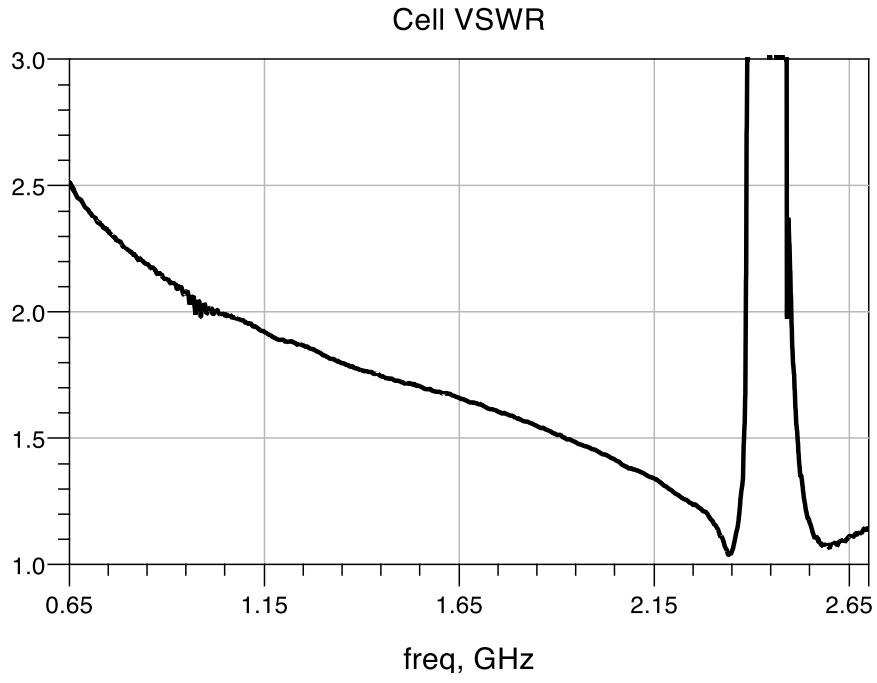
WiFi VSWR

Test conditions unless otherwise noted: Temp. = +25 °C



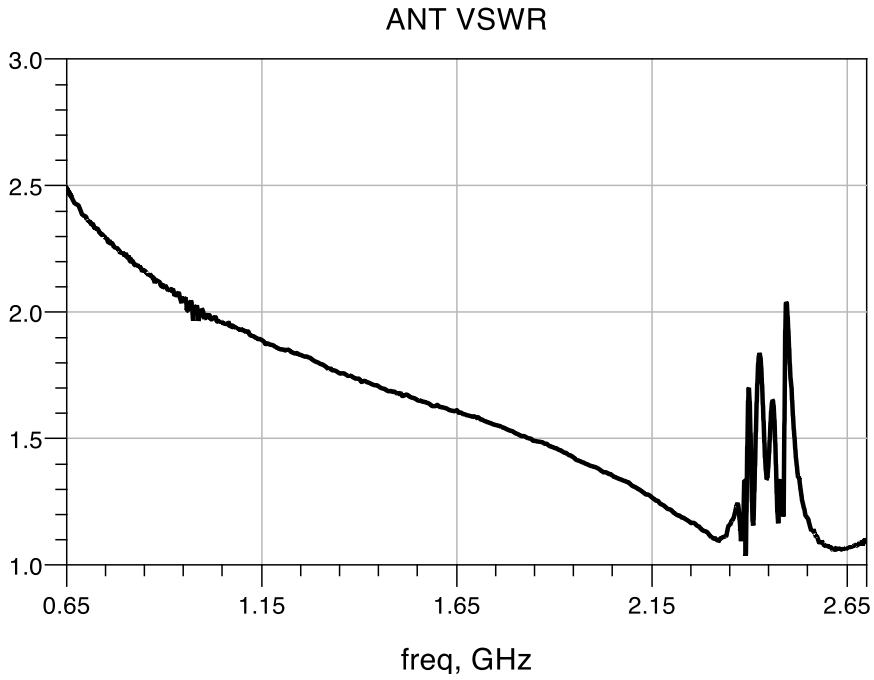
Cell VSWR

Test conditions unless otherwise noted: Temp. = +25 °C



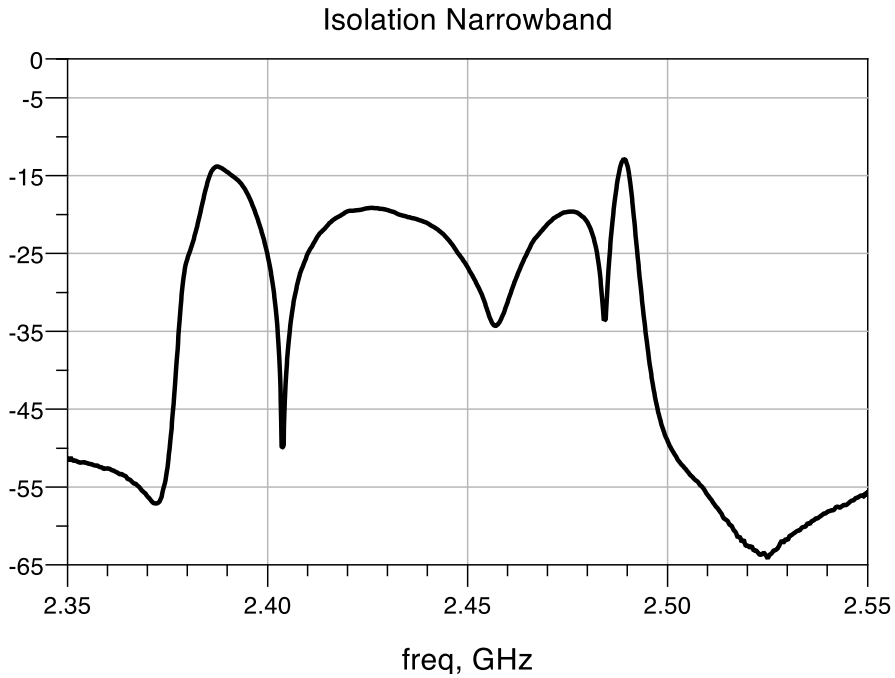
Antenna VSWR

Test conditions unless otherwise noted: Temp. = +25 °C

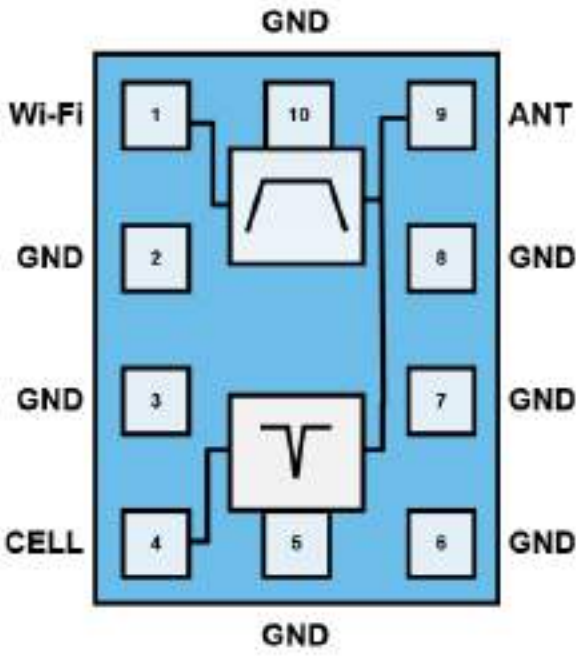


Isolation

Test conditions unless otherwise noted: Temp. = +25 °C



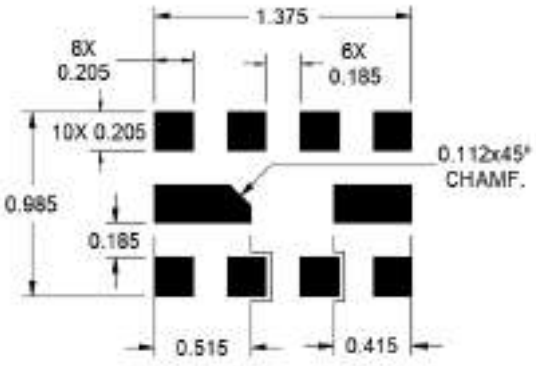
Pin Configuration and Description



Top View

Pin Number	Label	Description
1	RF3	Wi-Fi Filter Input / Output
4	RF2	Cell Filter Output
9	RF1	Antenna
2,3,5,6,7,8,10	Ground	Device ground

PCB Mounting Pattern

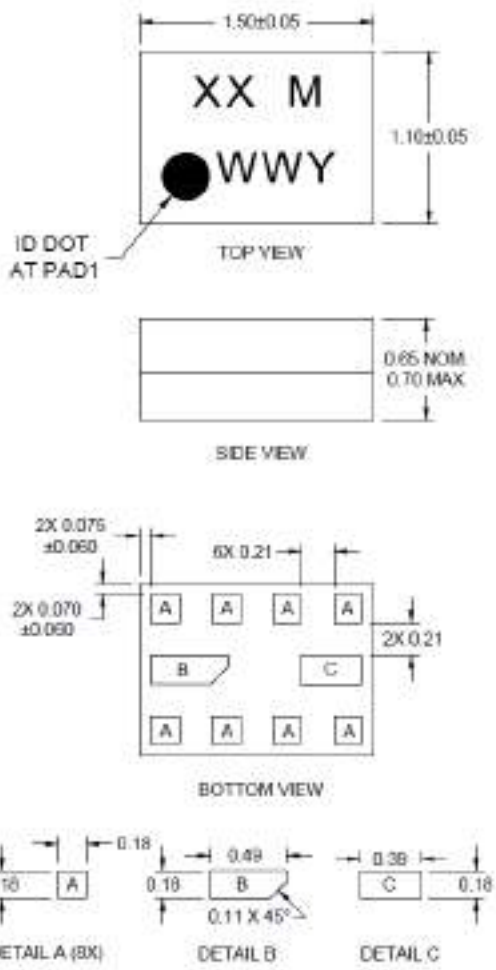


Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. This drawing specifies the mounting pattern used on the Qorvo evaluation board for this product. Some modification may be necessary to suit end user assembly materials and processes.

Mechanical Information

Package Marking and Dimensions



Package Style: CSP
Dimensions: 1.5 mmx 1.1 mmx 0.65 mm

Package for Surface Mount Technology
Terminations: *Au* plating 0.5 - 1.0µm, over a 2-6µm *Ni* Plating
Approximate weight 2.6mg

All dimensions shown are nominal in millimeters.

Marking Code uniquely identifies Part Number

XX=E5

M=Manufacturing Site Code (Blank for Apopka, C for Costa Rica)

The Date Code consists of:

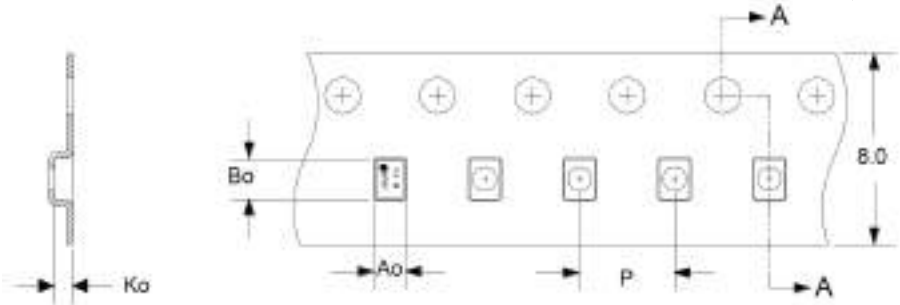
WW = 2 digit week

Y=The last digit of the year

An asterisk (*) left of the marking code indicates prototype

Tape and Reel Information

Direction of travel of carrier tape



Pocket Tape Dimensions			
Ao	1.25	1.30	1.35
Bo	1.65	1.70	1.75
Ko	0.68	0.73	0.78
P	-	4.00	-

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B	JS-001
ESD – Charged Device Model (CDM)	Class C3	JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- SVHC Free

REVISION HISTORY

Revision	Date (YYYYMMDD)	Description
C	20180129	• Initial production release
D	20180503	• Updated specs
E	20180626	• Updated ordering information and specs
F	20180702	• Updated ordering information
G	20180831	• Updated power handling specs
H	20200824	• Corrected PCB Mounting Pattern diagram dimensions
I	20200918	• Updated simultaneous power handling

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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Email: customer.support@qorvo.com

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