QM28014

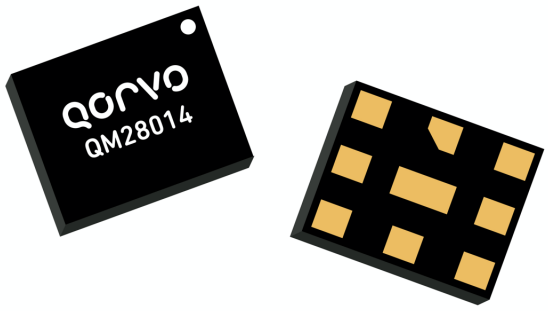
MHB, GNSS, and 2.4G WiFi Antennaplexer

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

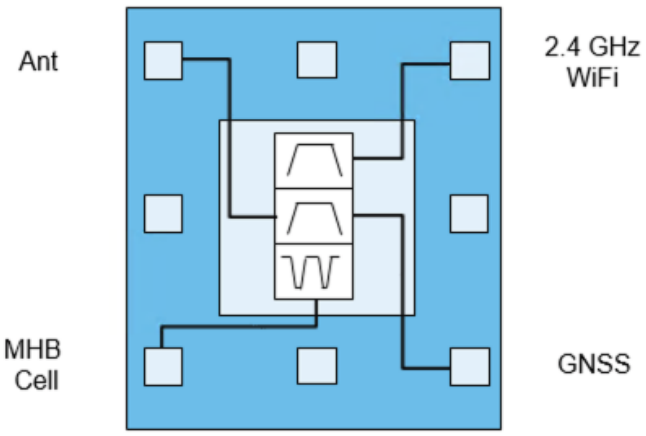
The QM28014 is a compact filter module designed to meet the strict requirements of out of band attenutation while optimizing for insertion loss of MHB Cellular, GNSS, and 2.4G WLAN from 1427 MHz – 2690 MHz, 1559.05 MHz – 1605.89 MHz, and 2403 MHz – 2481 MHz respectively.

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

PRELIMINARY

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

PRELIMINARY

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

PRELIMINARY

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

PRELIMINARY

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

PRELIMINARY

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.

PRELIMINARY

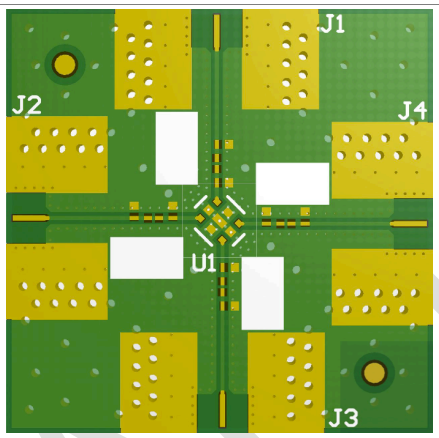
QM28014EVB PCB Information

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				

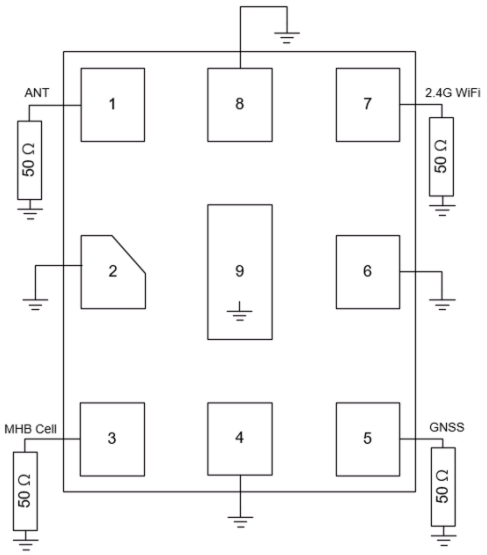
Total thickness: 40 MILS +/-10%

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

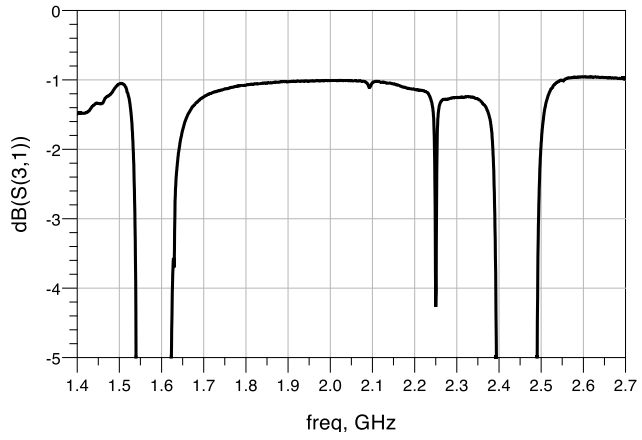
Ref. Des.	Value	Description	Manuf.	Part number
U1	N/A	MHB, GNSS, and 2.4G WiFi Antennaplexer	Qorvo	QM28014
PCB	N/A	Printed Circuit Board		QM28014-4000

PRELIMINARY

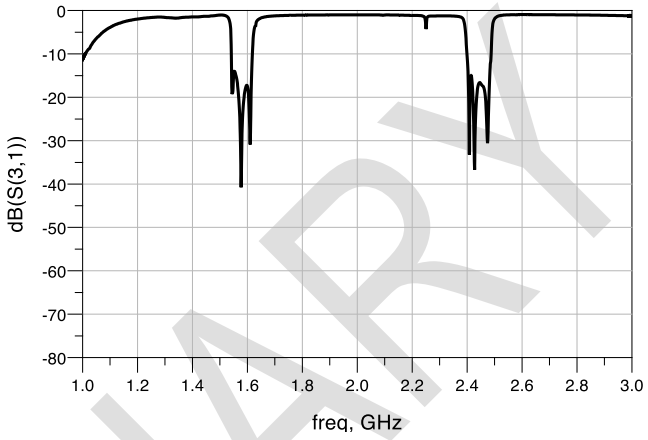
MHB Insertion Loss and Attenuation Plots

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

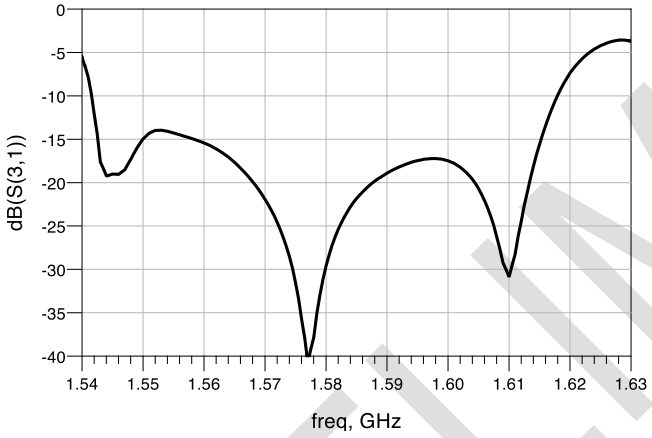
MHB Pass Band



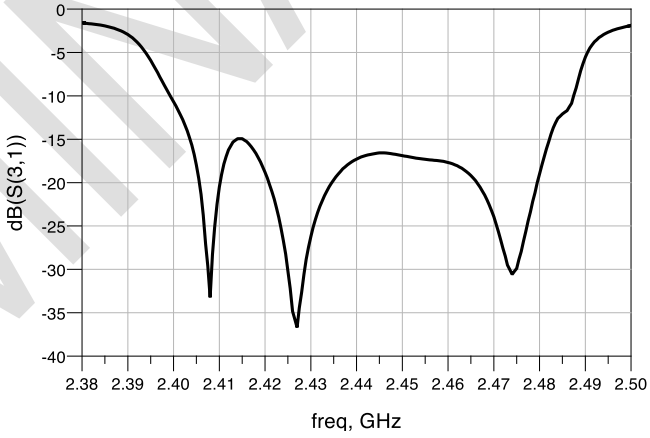
MHB Narrow Band



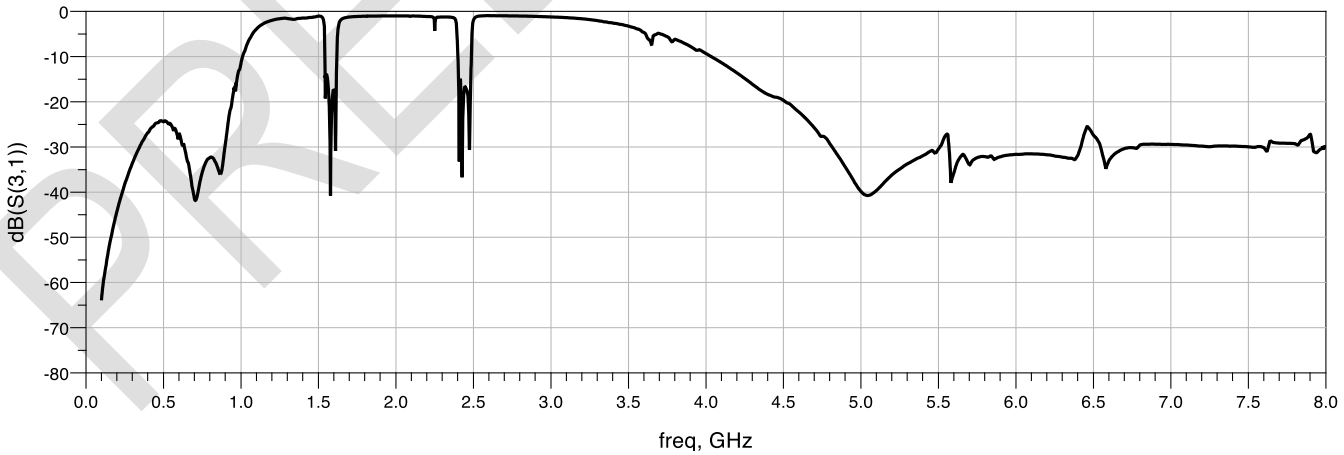
MHB Cell GNSS Atten



MHB Cell WiFi Atten



MHB Wide Band

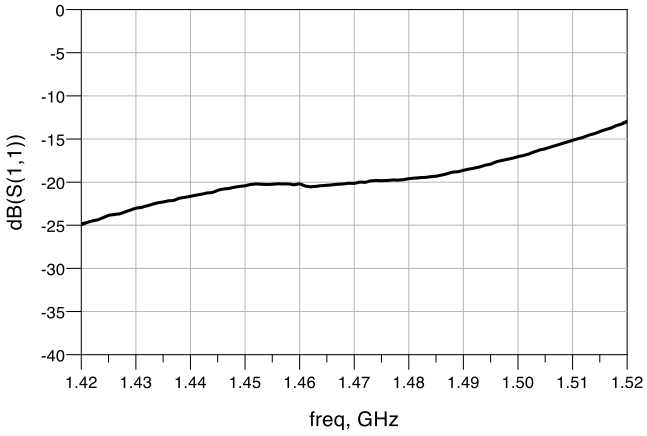


PRELIMINARY

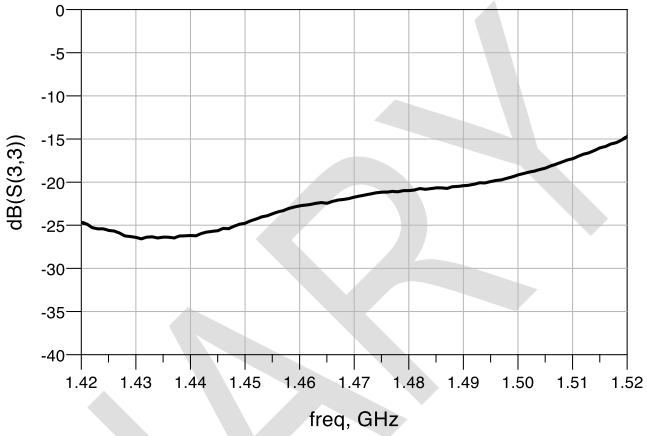
MHB Return Loss Plots

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

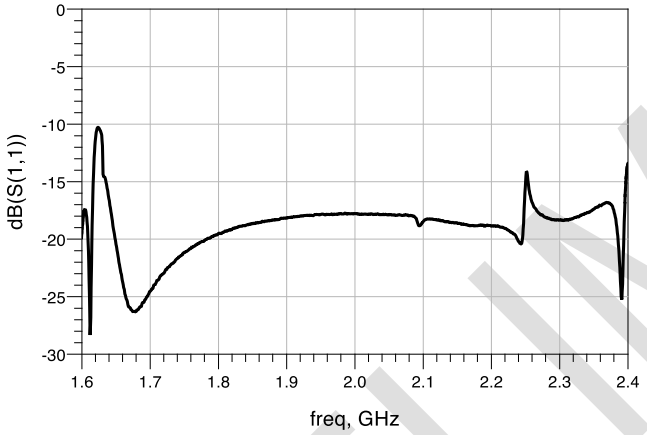
LMB ANT Port Return Loss



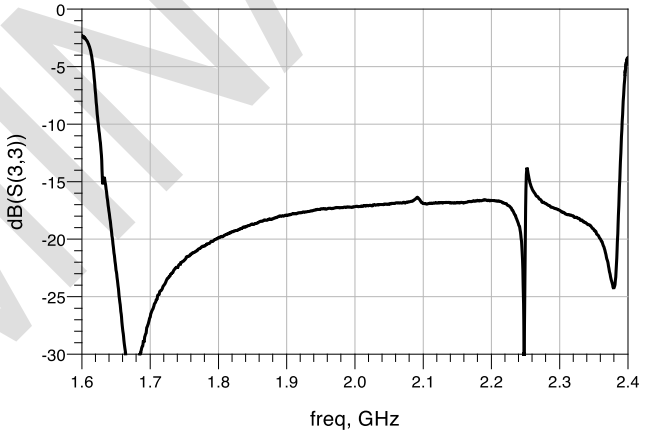
LMB Port Return Loss



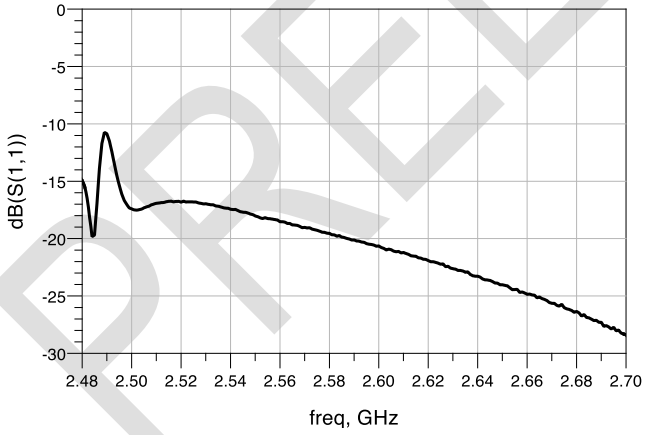
MHB MB ANT Port Return Loss



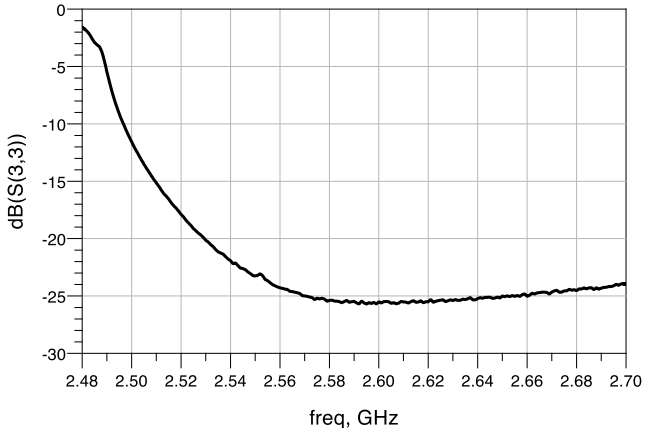
MHB MB Port Return Loss



MHB HB ANT Port Return Loss



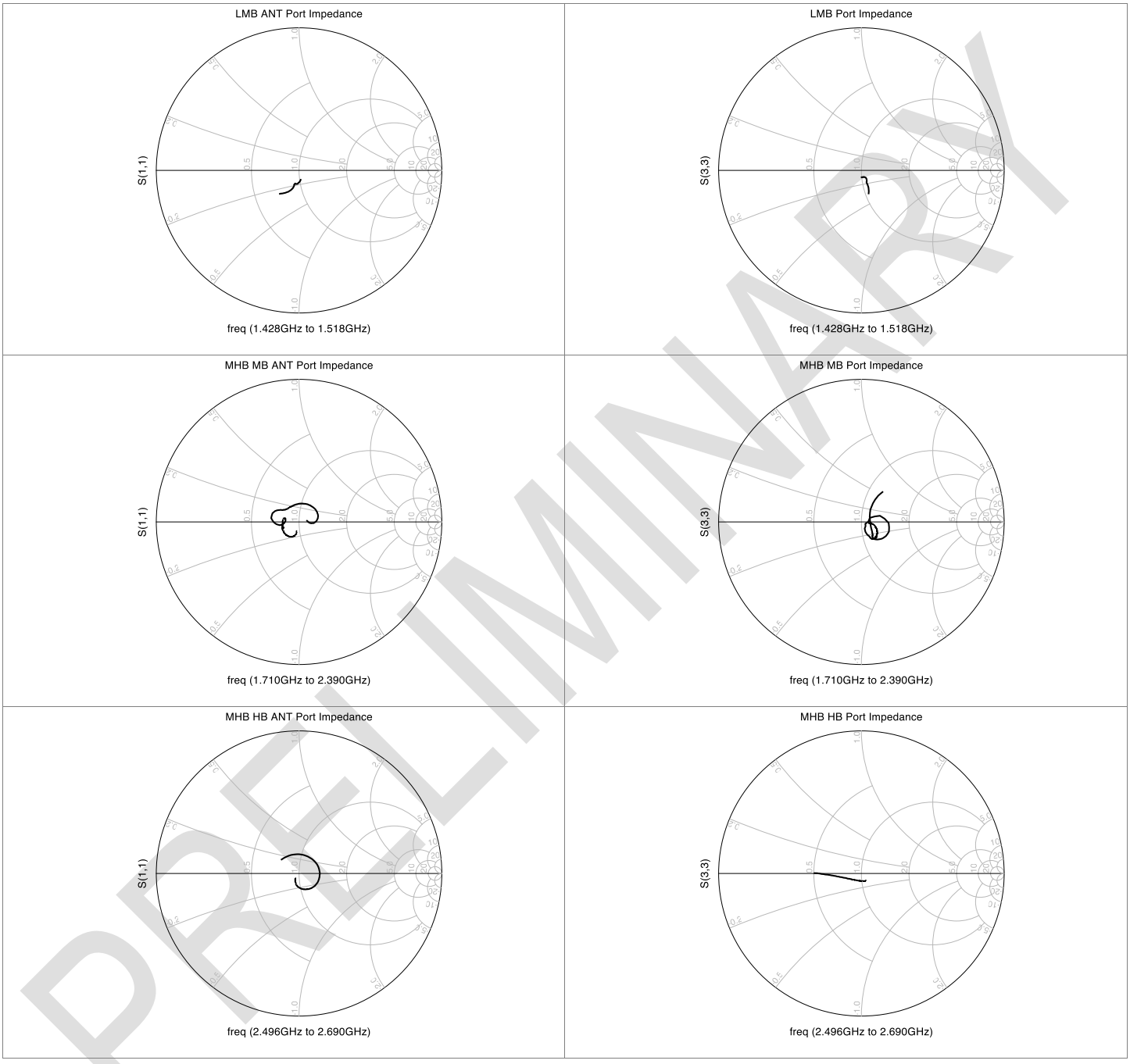
MHB HB Port Return Loss



PRELIMINARY

MHB Impedance Plots

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

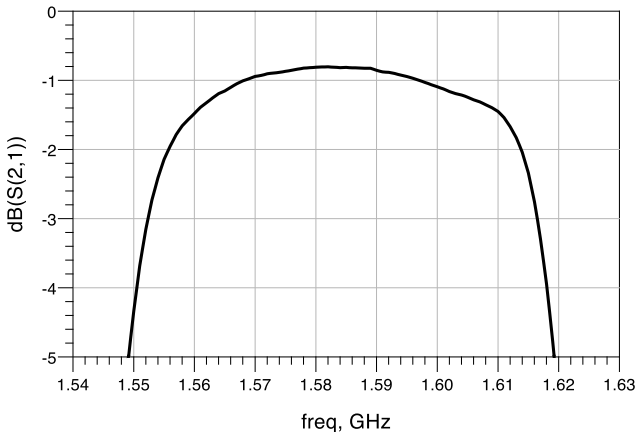


PRELIMINARY

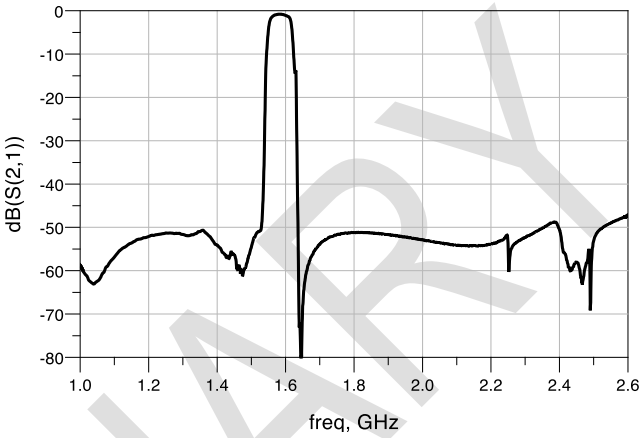
GNSS Insertion Loss and Attenuation Plots

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

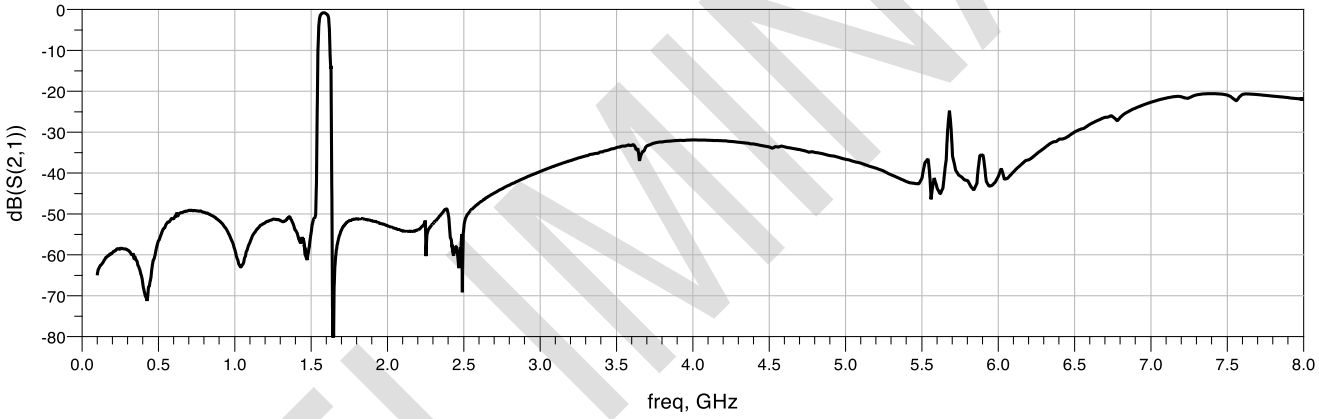
GNSS Pass Band



GNSS Narrow Band



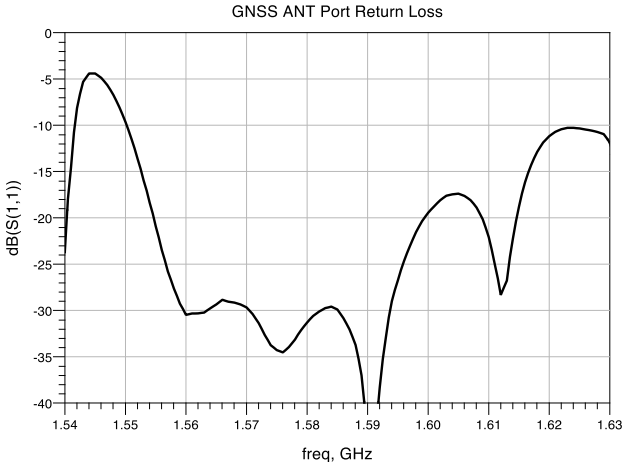
GNSS Wide Band

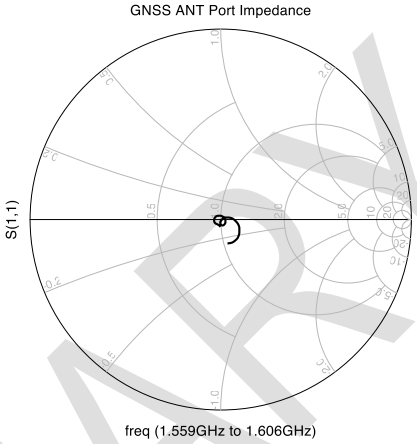


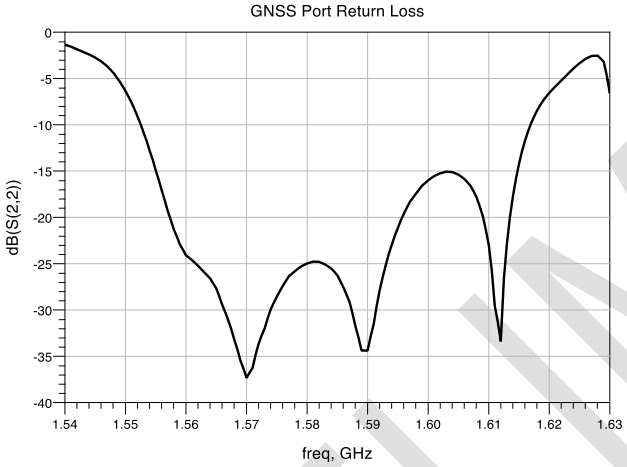
PRELIMINARY

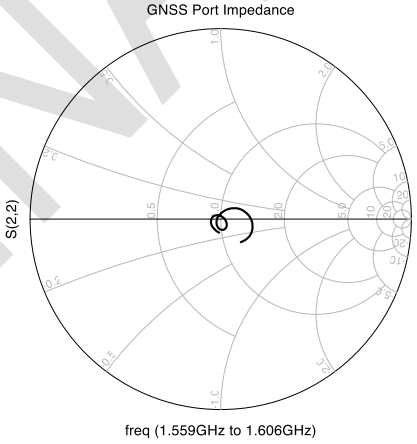
GNSS Return Loss and Impedance Plots

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







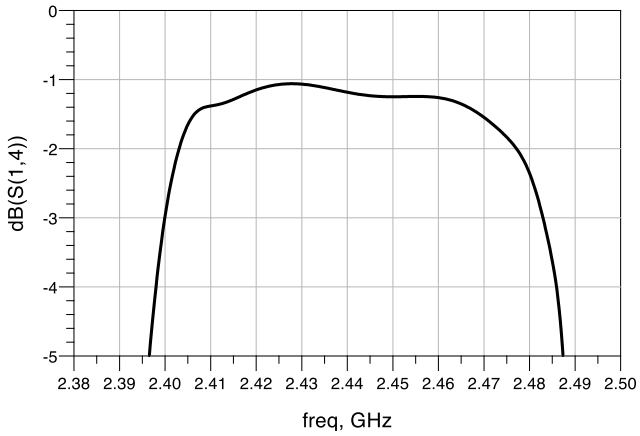


PRELIMINARY

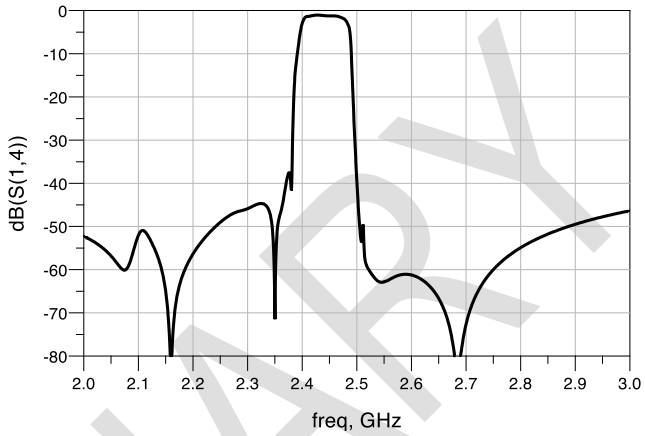
2.4GHz WiFi Insertion Loss and Attenuation Plots

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

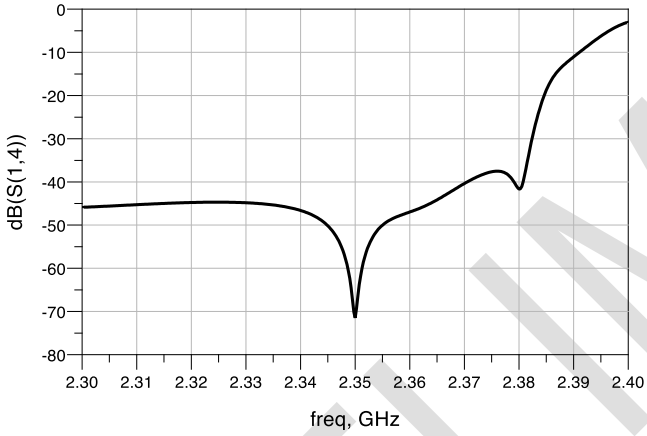
2.4G Wi-Fi Pass Band



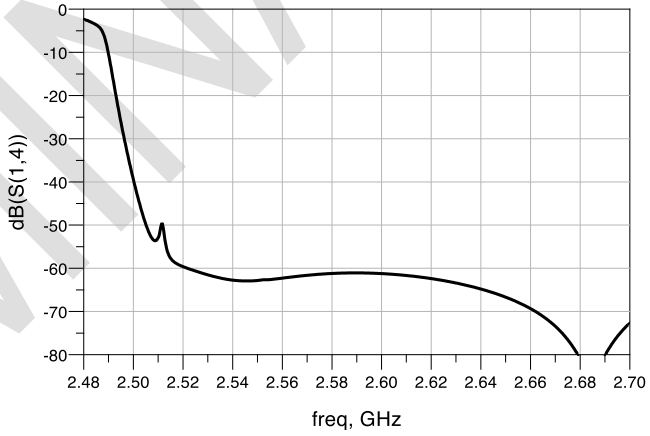
2.4G Wi-Fi Narrow Band



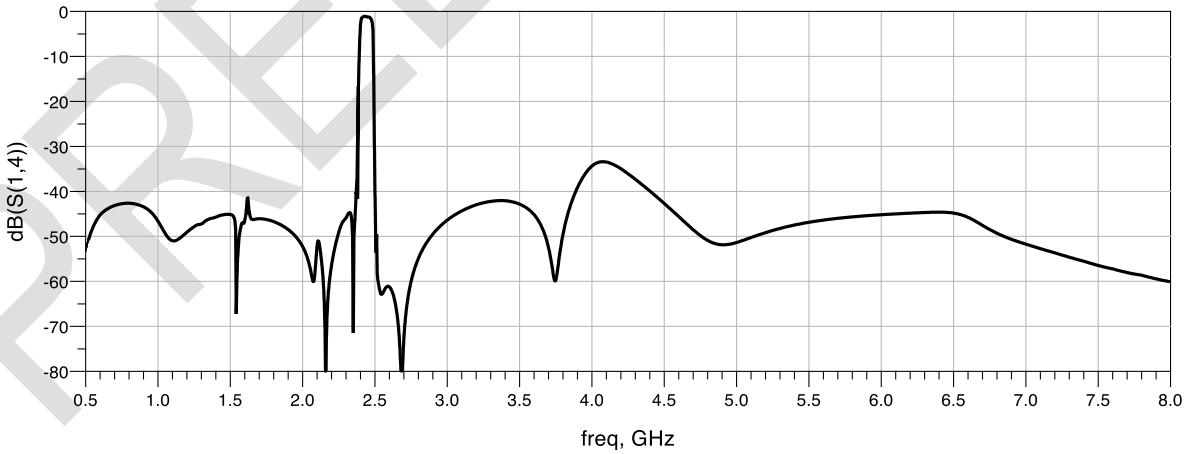
2.4G Wi-Fi B40 Attenuation



2.4G Wi-Fi B41 Attenuation



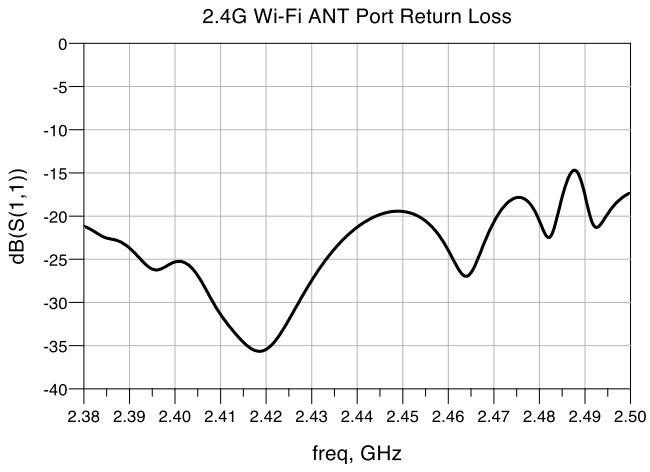
2.4G Wi-Fi Wide Band

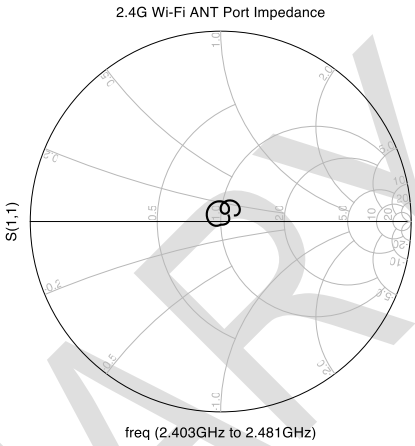


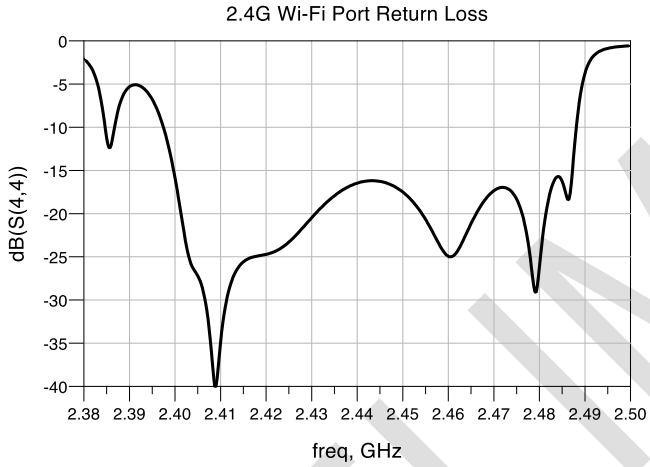
PRELIMINARY

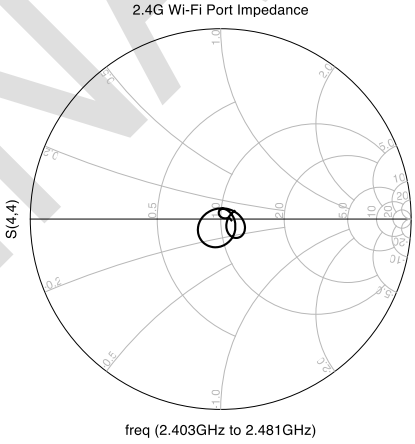
2.4GHz WiFi Return Loss and Impedance Plots

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





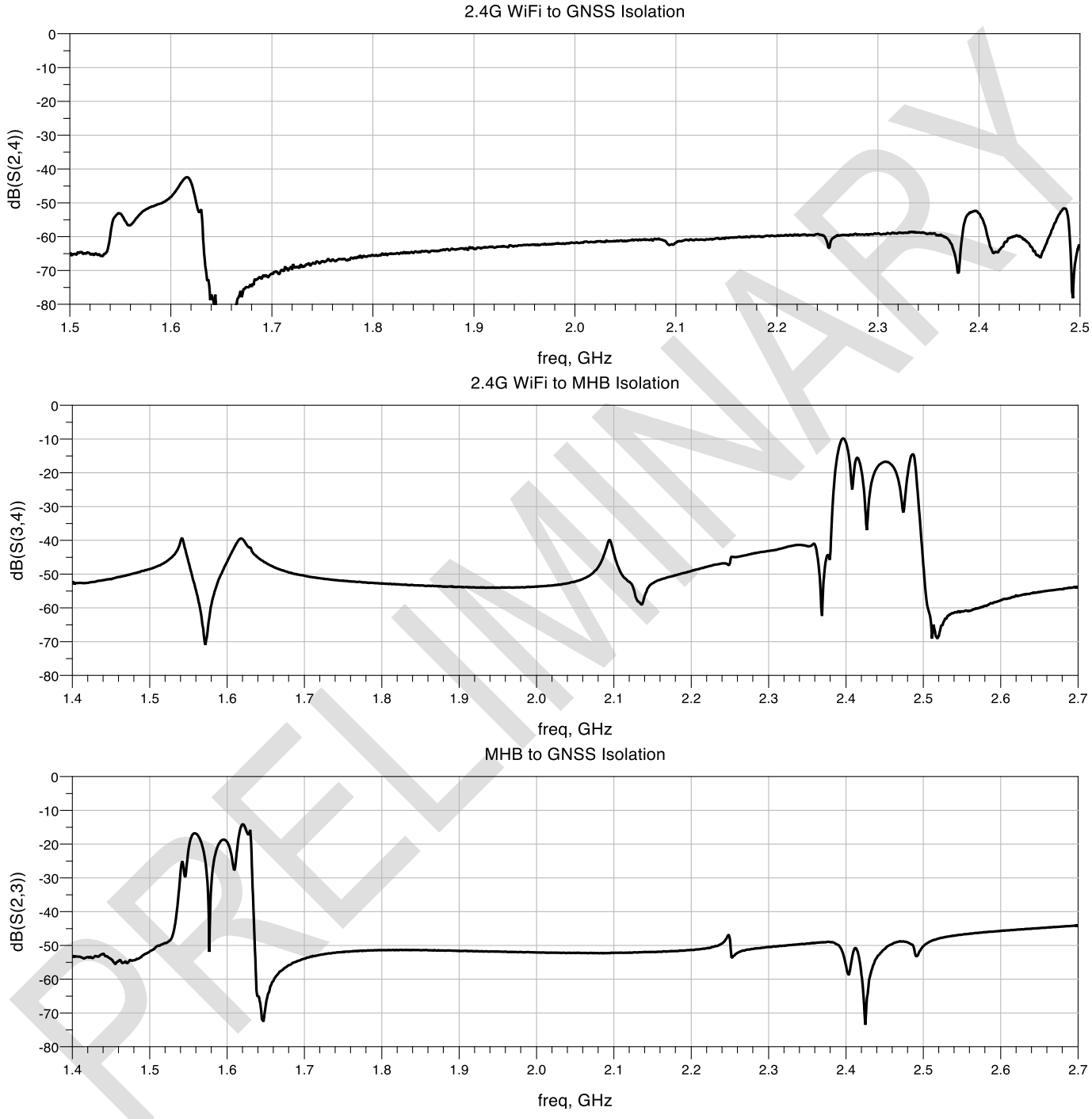




PRELIMINARY

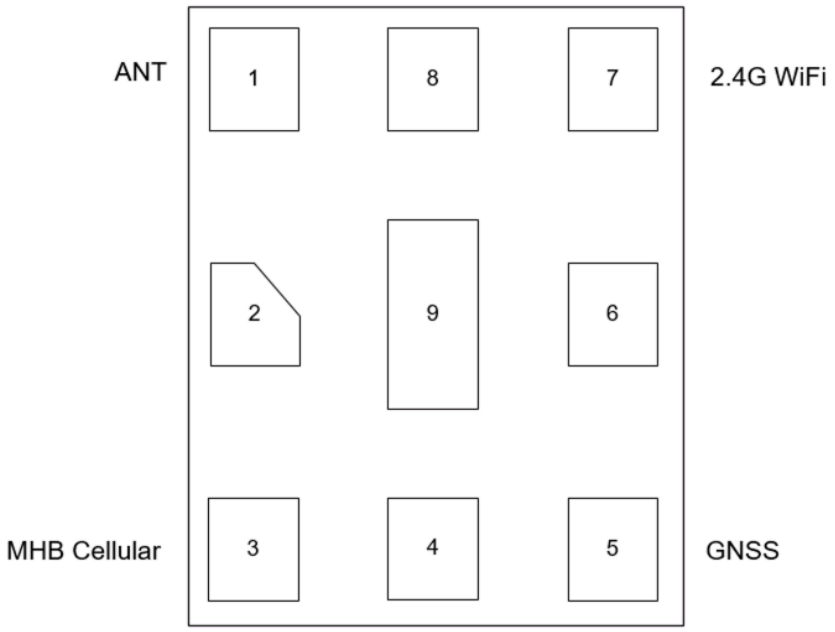
Isolation Plots

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



PRELIMINARY

Pin Configuration and Description



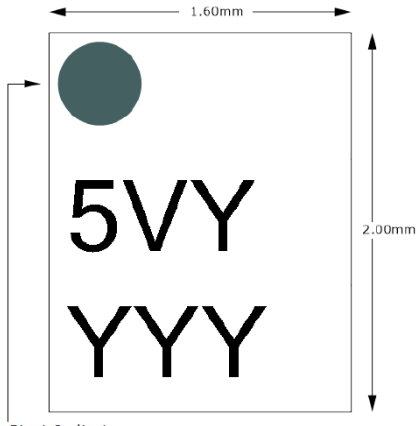
Top View

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

PRELIMINARY

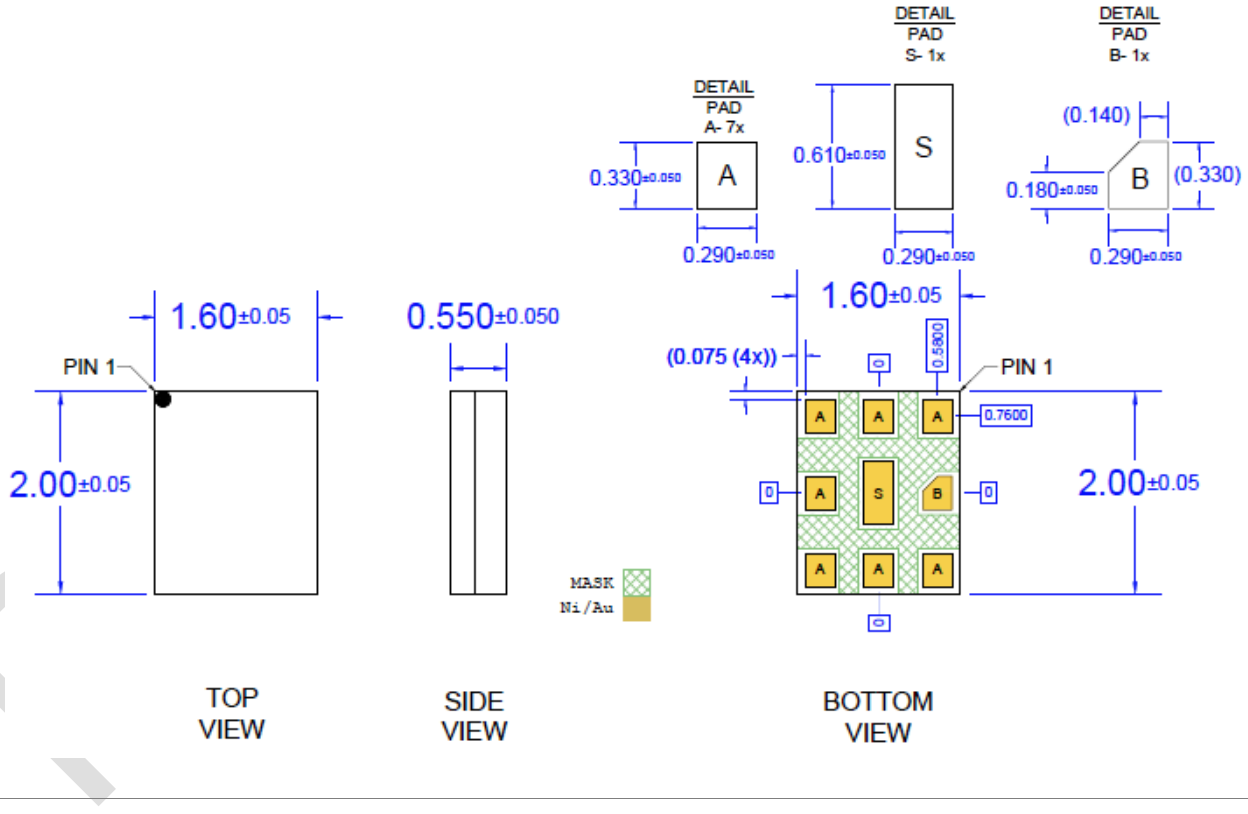
Part Marking and Package Outline Dimensions

Part Marking Diagram – Top View



Pin 1 Indicator
Trace Code to be assigned by SubCon
(where YYYY indicates the Trace Code)
"5V" is the product code.

Package Outline Dimension Drawing

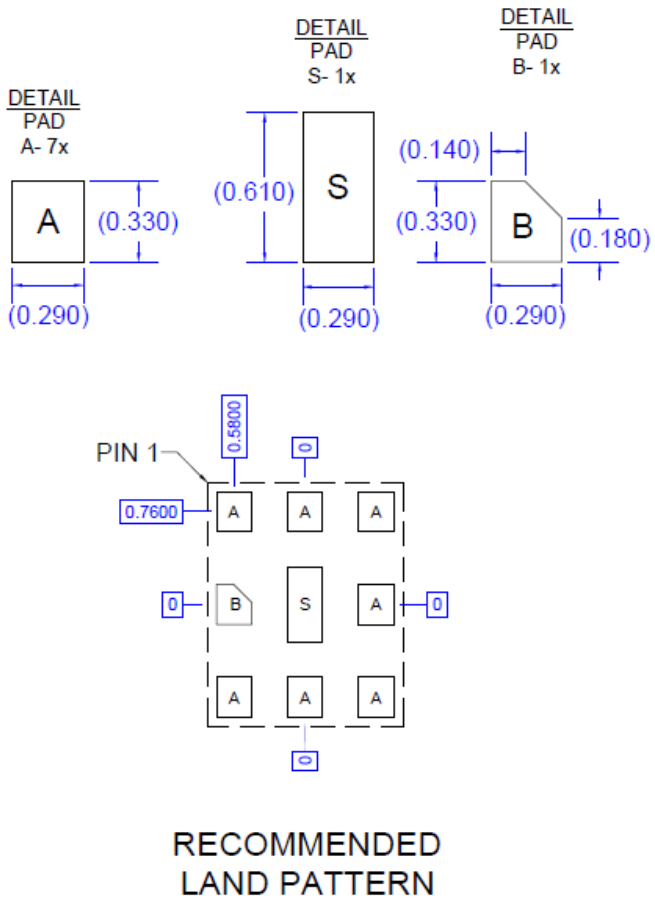
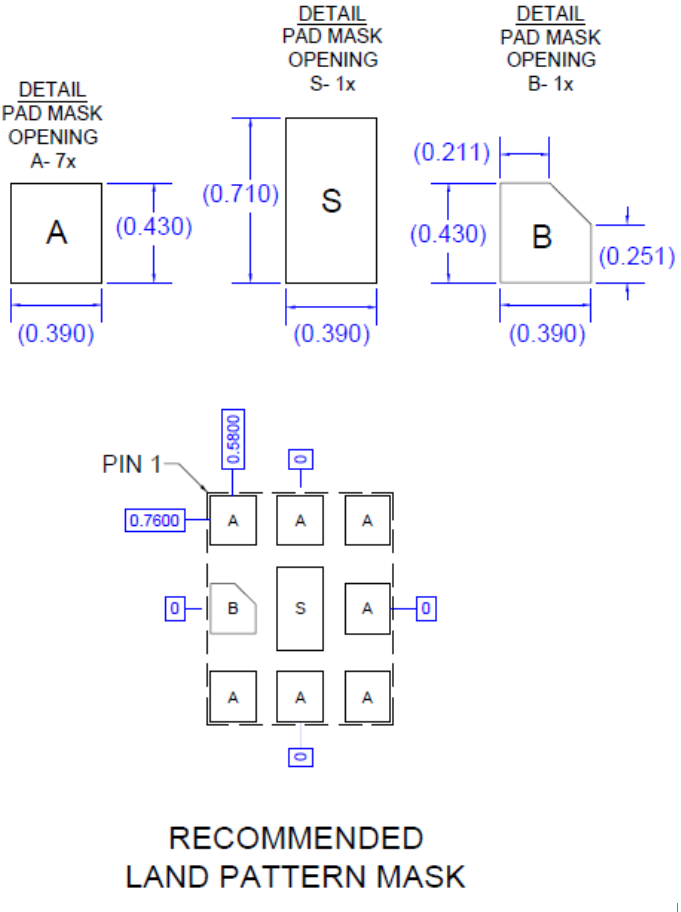


Notes:

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

PRELIMINARY

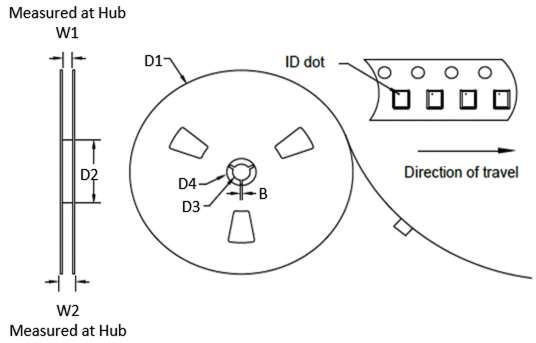
Land Pattern and Mask Dimensions

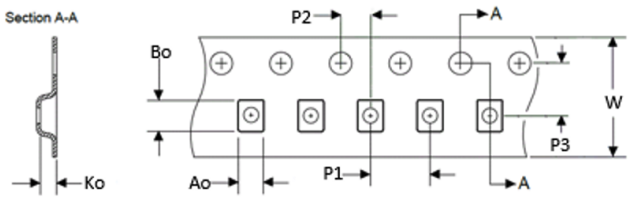
Recommended Land Pattern Drawing – Top View	Recommended Land Pattern Mask Drawing – Top View
	

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

PRELIMINARY

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)

PRELIMINARY

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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PRELIMINARY

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

PRELIMINARY