



FCC RADIO TEST REPORT

FCC ID : Z8H89FT0048

Equipment : ePMP 5GHz Force 300-13 SM, cnVision Client MICRO 13 dBi,
ePMP 5GHz Force 300-19 SM, cnVision Client MAXr 19 dBi

Brand Name : Cambium Networks

Model Name : ePMP 5GHz Force 300-13 SM, cnVision Client MICRO 13 dBi,
ePMP 5GHz Force 300-19 SM, cnVision Client MAXr 19 dBi

Model Number : C050900P704A, C050900P904A

Applicant : Cambium Networks Inc.
3800 Golf Road, Suite 360 Rolling Meadows, IL 60008, USA

Manufacturer : Cambium Networks, Ltd.
Ashburton, TQ13 7UP, UK

Standard : 47 CFR FCC Part 90 Subpart Y

The product was received on Dec. 25, 2019, and testing was started from Dec. 25, 2019 and completed on Dec. 25, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI/TIA-603-D-2010, 47 CFR FCC Part 90 Subpart Y, ANSI C63.26-2015 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.


Approved by: Cliff Chang

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A16_3 Ver1.0



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	2.1046/90.1215(a)	Maximum Conducted Output Power	PASS	-
3.2	2.1049/90.210(m)	Emission Mask	PASS	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Cindy Peng



1 General Description

1.1 Product Information

1.1.1 Specification Information

RF General Information			
Frequency Range (MHz)	Modulation	Ch. Frequency (MHz)	Channel Bandwidth (MHz)
4940-4990	QPSK	4950-4980	20

Band	Mode	Modulation	BWch (MHz)	Nant
4.9G	11j	QPSK	20	2

Channel Bandwidth	Carrier Frequency (MHz)	Carrier Frequency (MHz)
20 MHz	4950	4967.5
	4952.5	4970
	4955	4972.5
	4957.5	4975
	4960	4977.5
	4962.5	4980
	4965	-

**1.1.2 Antenna Information**

Ant.	Port	Brand	Model Name	Type	Connector	Gain (dBi)
1	1	TSKY	180-100-1051R	Patch	I-PEX	13
	2	TSKY	180-100-1051R	Patch	I-PEX	13
2	1	TSKY	180-100-1077R	Patch	I-PEX	19
	2	TSKY	180-100-1077R	Patch	I-PEX	19

Note 1: The above information was declared by manufacturer.

Note 2: The array gain of the antenna is 0dBi.

Note 3: The EUT has two antennas, and each antenna has two ports. (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
4.94-4.99GHz_802.11j_20MHz_Nss1_2TX	0.992	0.03	8.115m	300

Note:

- ♦ DC is Duty Cycle.
- ♦ DCF is Duty Cycle Factor.

1.1.4 EUT Operational Condition

EUT Power Type	From PoE		
Test Software Version	QSPR Version 5.0-00086		
Device Type	<input type="checkbox"/> Low power device	<input checked="" type="checkbox"/> High power device	

Note: The above information was declared by manufacturer.



1.1.5 Table for Multiple Listing

The difference for each equipment names/model names is shown as below:

Equipment Name	Model Name	Model Number	Equip antenna	Chip	Description
ePMP 5GHz Force 300-13 SM	ePMP 5GHz Force 300-13 SM	C050900P704A	Ant. 1 / 2	IPQ4019	The difference served as marketing strategy.
cnVision Client MICRO 13 dBi	cnVision Client MICRO 13 dBi	C050900P704A	Ant. 1 / 2	IPQ4019	
ePMP 5GHz Force 300-19 SM	ePMP 5GHz Force 300-19 SM	C050900P904A	Ant. 1 / 2	IPQ4019	
cnVision Client MAXr 19 dBi	cnVision Client MAXr 19 dBi	C050900P904A	Ant. 1 / 2	IPQ4019	

Note 1: The above information was declared by manufacturer.

Note 2: From the above models, model: ePMP 5GHz Force 300-13 SM was selected as representative model for the test and its data was recorded in this report.

1.1.6 Table for Class III Change

This product is an extension of original one reported under Sporton project number: 932717-02.

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
For Chip IPQ4019: Adding 4.9G function for the equipment name/model name "ePMP 5GHz Force 300-13 SM, ePMP 5GHz Force 300-19 SM", and supports 20 MHz bandwidth only.	1. Maximum Conducted Output Power. 2. Emission Mask. Chip IPQ4029 has been completed all testing (Refer to Sporton project number: 932717-04 for detail information). Thus after evaluating, only above test items need to be re-tested.
Based on Chip IPQ4019: 1. Adding two equipment name/model name "cnVision Client MICRO 13 dBi, cnVision Client MAXr 19 dBi". (The difference between original equipment name/model name and new equipment name/model name, please refer to the section 1.1.5 for detail) 2. Changing the model number to "C050900P704A, C050900P904A" from "C058900P701A, C058900P801A".	It does not need to test.



1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 90 Subpart Y
- ♦ ANSI/TIA-603-D-2010
- ♦ FCC KDB 552295 D01v03
- ♦ FCC KDB 662911 D01 v02r01
- ♦ FCC KDB 412172 D01 v01r01
- ♦ FCC KDB 971168 D01 v03r01

1.3 Testing Information

Testing Location		
<input type="checkbox"/>	HWA YA	ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL : 886-3-327-3456 FAX : 886-3-327-0973
<input checked="" type="checkbox"/>	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. TEL : 886-3-656-9065 FAX : 886-3-656-9085

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-CB	Ekko Hsieh	24.8~25.9°C / 57~60%	Dec. 25, 2019

Test site Designation No. TW0006 with FCC

Test site registered number IC 4086D with Industry Canada.

1.4 Measurement Uncertainty

Test Items	Uncertainty	Remark
Conducted Emission	2.4 dB	Confidence levels of 95%



2 Test Configuration

2.1 Test Channel Mode

Mode	Power Setting
4.94-4.99GHz_802.11j_20MHz_Nss1_2TX	-
4950MHz	20
4965MHz	20
4980MHz	20.5

2.2 Worst Case Modulation Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Maximum Conducted Output Power Emission Mask
Test Condition	Conducted measurement at transmit chains

Note1: For Emission Mask test, only the higher gain antenna "Ant. 2" was tested and recorded in the report.

Note2: The EUT was powered by PoE, and the PoE was for measurement only, would not be marketed.

Equipment	Brand Name	Model Name	FCC ID
PoE	Cambium Networks	NET-P15-30IN	N/A

2.3 EUT Operation during Test

During the test, "QSPR Version 5.0-00086" under WIN 7 was executed the test program to control the EUT continuously transmit RF signal.

2.4 Accessories

N/A

2.1 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A
B	PoE	Cambium Networks	NET-P15-30IN	N/A

3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 Limit of Maximum Conducted Output Power

The transmitting power of stations operating in the 4940-4990 MHz band must not exceed the maximum limits in this table.

Channel Bandwidth (MHz)	Low Power Device Peak Transmitter Power (dBm)	High Power Device Peak Transmitter Power (dBm)
1	7.0	20.0
5	14.0	27.0
10	17.0	30.0
15	18.8	31.8
20	20.0	33.0

Maximum Conducted Output Power Definition:

The maximum conducted output power is measured as a conducted emission over any interval of continuous transmission using instrumentation calibrated in terms of an RMS-equivalent voltage. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true maximum conducted output power measurement conforming to the definitions in this paragraph for the emission in question.

3.1.2 Measuring Instruments and Setting

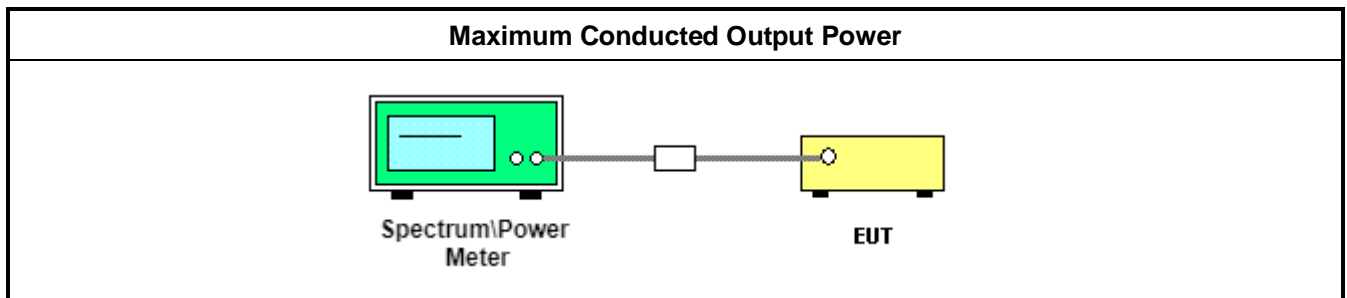
Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Average

Spectrum Parameters	Setting
Detector	Peak
Center Frequency	Low / middle / high channels
RBW / VBW	1MHz / 3MHz

3.1.3 Test Procedures for Maximum Conducted Output Power

Using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

3.1.4 Test Setup



3.1.5 Test Deviation

There is no deviation with the original standard.

3.1.6 Test Result of Maximum Conducted Output Power

Refer as Appendix A



3.2 Emission Mask Measurement

3.2.1 Limit of Emission Mask

Emission Mask M: For high power transmitters (greater than 20 dBm) operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

- (1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB
- (2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: $568 \log (\% \text{ of (BW)/45})$ dB.
- (3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: $26 + 145 \log (\% \text{ of (BW)/50})$ dB.
- (4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: $32 + 31 \log (\% \text{ of (BW)/55})$ dB attenuation.
- (5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: $40 + 57 \log (\% \text{ of (BW)/100})$ dB attenuation.
- (6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 or $55 + 10 \log (P)$ dB, whichever is the lesser attenuation. (P in watts)

The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least 1% of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

3.2.2 Measuring Instruments and Setting

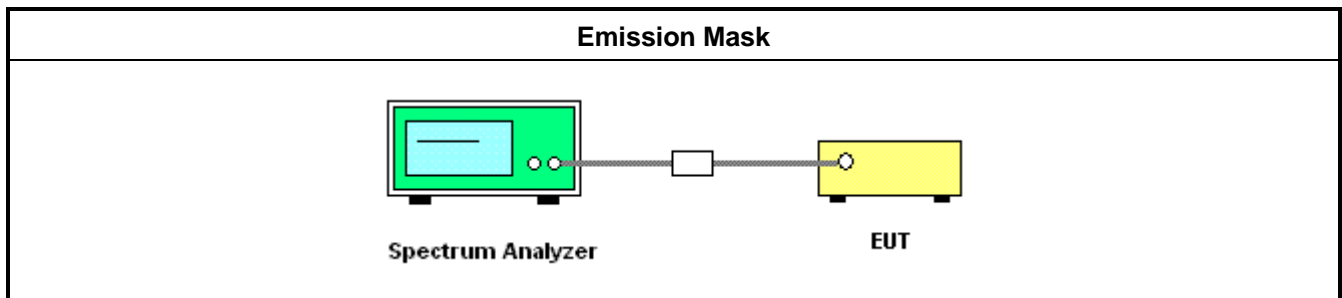
Please refer to section 4 in this report. The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth of the signal
RBW	at least 1% of the occupied bandwidth
VBW	BW=3 x RBW, Mask=30kHz
Detector	Peak
Trace	Max Hold

3.2.3 Test Procedures

1. The EUT transmitter was connected to a spectrum analyzer through an appropriate 50 ohm attenuator. Used measurement function of spectrum to measure the 99% occupied bandwidth.
2. The reference level for the mask was set using the highest average power of the fundamental emission measured across the channel bandwidth using a RBW of at least 1% of the occupied bandwidth of the fundamental emission and a VBW of 30 kHz.

3.2.4 Test Setup



3.2.5 Test Deviation

There is no deviation with the original standard.

3.2.6 Test Result of Emission Mask

Refer as Appendix B



4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Feb. 25, 2019	Feb. 24, 2020	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-06	1 GHz – 26.5 GHz	Oct. 07, 2019	Oct. 06, 2020	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz – 26.5 GHz	Oct. 07, 2019	Oct. 06, 2020	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz – 26.5 GHz	Oct. 07, 2019	Oct. 06, 2020	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz – 26.5 GHz	Oct. 07, 2019	Oct. 06, 2020	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Oct. 07, 2019	Oct. 06, 2020	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-28	1 GHz – 26.5 GHz	Nov. 18, 2019	Nov. 17, 2020	Conducted (TH01-CB)
Power Sensor	Agilent	E9327A	US40442088	50MHz~18GHz	Jan. 15, 2019	Jan. 14, 2020	Conducted (TH01-CB)
Power Meter	Agilent	E4416A	GB41291199	50MHz~18GHz	Jan. 15, 2019	Jan. 14, 2020	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.



Average Power Result

Appendix A

Summary

Mode	Power (dBm)	Power (W)
4.94-4.99GHz	-	-
802.11j_20MHz_Nss1_2TX	23.03	0.201



Average Power Result

Appendix A

Result

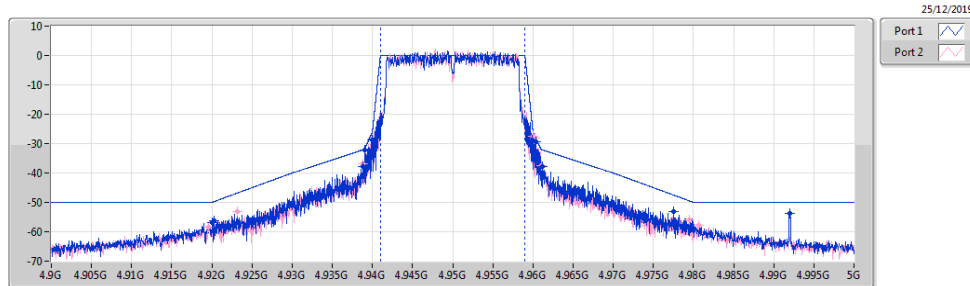
Mode	Result	DG (dBi)	Port 1 (dBm)	Port 2 (dBm)	Power (dBm)	Power Limit (dBm)
4.94-4.99GHz_802.11j_20MHz_Nss1_2TX	-	-	-	-	-	
4950MHz	Pass	19.00	19.40	19.62	22.52	33.00
4965MHz	Pass	19.00	19.36	19.57	22.48	33.00
4980MHz	Pass	19.00	19.94	20.09	23.03	33.00
4.94-4.99GHz_802.11j_20MHz_Nss1_2TX	-	-	-	-	-	
4950MHz	Pass	13.00	19.40	19.62	22.52	33.00
4965MHz	Pass	13.00	19.36	19.57	22.48	33.00
4980MHz	Pass	13.00	19.94	20.09	23.03	33.00

DG = Directional Gain; **Port n** = Port n output power

4.94-4.99GHz_802.11j_20MHz_Nss1_2TX

Mask

4950MHz

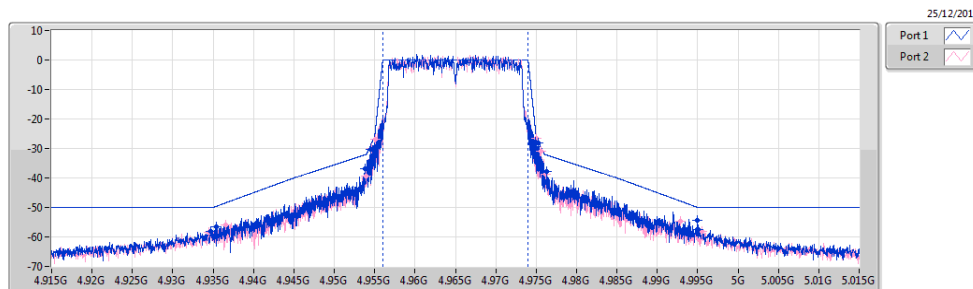


F-Start(Hz)	F-Stop(Hz)	RBW(Hz)	VBW(Hz)	Detector	Freq(Hz)	Level(dBm)	Limit(dBm)	Margin(dB)	Port	Remark	Ref.Limit(dB)
4.9G	4.92G	200k	30k	RMS	4.92G	-56.96	-50.00	-6.96	1	-	-
4.92G	4.93G	200k	30k	RMS	4.92024G	-56.38	-49.76	-6.62	1	-	-
4.93G	4.939G	200k	30k	RMS	4.93878G	-37.67	-32.19	-5.48	1	-	-
4.939G	4.94G	200k	30k	RMS	4.93907G	-32.17	-31.59	-0.58	1	-	-
4.94G	4.941G	200k	30k	RMS	4.94003G	-28.88	-25.17	-3.71	1	-	-
4.941G	4.959G	200k	30k	RMS	4.95G	17.80	Inf	-Inf	1	Ref.CP 18M	-
4.959G	4.96G	200k	30k	RMS	4.95995G	-28.66	-24.70	-3.96	1	-	-
4.96G	4.961G	200k	30k	RMS	4.96032G	-29.43	-27.93	-1.50	1	-	-
4.961G	4.97G	200k	30k	RMS	4.96118G	-37.94	-32.16	-5.78	1	-	-
4.97G	4.98G	200k	30k	RMS	4.9775G	-53.07	-47.50	-5.57	1	-	-
4.98G	5G	200k	30k	RMS	4.99196G	-53.60	-50.00	-3.60	1	-	-
4.9G	4.92G	200k	30k	RMS	4.91964G	-58.37	-50.00	-8.37	2	-	-
4.92G	4.93G	200k	30k	RMS	4.92316G	-53.09	-46.84	-6.25	2	-	-
4.93G	4.939G	200k	30k	RMS	4.93882G	-36.77	-32.16	-4.61	2	-	-
4.939G	4.94G	200k	30k	RMS	4.93901G	-32.29	-31.96	-0.33	2	-	-
4.94G	4.941G	200k	30k	RMS	4.94001G	-28.73	-25.64	-3.09	2	-	-
4.941G	4.959G	200k	30k	RMS	4.95G	17.80	Inf	-Inf	2	Ref.CP 18M	-
4.959G	4.96G	200k	30k	RMS	4.96G	-27.49	-25.95	-1.54	2	-	-
4.96G	4.961G	200k	30k	RMS	4.96023G	-28.00	-27.40	-0.60	2	-	-
4.961G	4.97G	200k	30k	RMS	4.96104G	-37.48	-32.03	-5.45	2	-	-
4.97G	4.98G	200k	30k	RMS	4.97944G	-55.99	-49.44	-6.55	2	-	-
4.98G	5G	200k	30k	RMS	4.98064G	-57.77	-50.00	-7.77	2	-	-

4.94-4.99GHz_802.11j_20MHz_Nss1_2TX

Mask

4965MHz

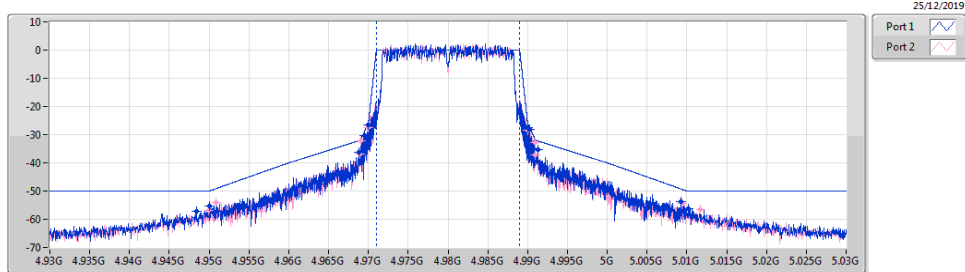


F-Start(Hz)	F-Stop(Hz)	RBW(Hz)	VBW(Hz)	Detector	Freq(Hz)	Level(dBm)	Limit(dBm)	Margin(dB)	Port	Remark	Ref.Limit(dB)
4.915G	4.935G	200k	30k	RMS	4.93468G	-57.99	-50.00	-7.99	1	-	-
4.935G	4.945G	200k	30k	RMS	4.93536G	-56.71	-49.64	-7.07	1	-	-
4.945G	4.954G	200k	30k	RMS	4.95378G	-36.85	-32.19	-4.66	1	-	-
4.954G	4.955G	200k	30k	RMS	4.95447G	-30.17	-29.16	-1.01	1	-	-
4.955G	4.956G	200k	30k	RMS	4.955G	-29.70	-25.90	-3.80	1	-	-
4.956G	4.974G	200k	30k	RMS	4.965G	17.80	Inf	-Inf	1	Ref.CP 18M	-
4.974G	4.975G	200k	30k	RMS	4.97495G	-27.86	-24.80	-3.06	1	-	-
4.975G	4.976G	200k	30k	RMS	4.97525G	-28.25	-27.48	-0.77	1	-	-
4.976G	4.985G	200k	30k	RMS	4.97627G	-37.67	-32.24	-5.43	1	-	-
4.985G	4.995G	200k	30k	RMS	4.99494G	-54.44	-49.94	-4.50	1	-	-
4.995G	5.015G	200k	30k	RMS	4.99508G	-57.35	-50.00	-7.35	1	-	-
4.915G	4.935G	200k	30k	RMS	4.93444G	-58.48	-50.00	-8.48	2	-	-
4.935G	4.945G	200k	30k	RMS	4.93656G	-55.83	-48.44	-7.39	2	-	-
4.945G	4.954G	200k	30k	RMS	4.95396G	-39.24	-32.03	-7.21	2	-	-
4.954G	4.955G	200k	30k	RMS	4.9546G	-29.86	-28.41	-1.45	2	-	-
4.955G	4.956G	200k	30k	RMS	4.95507G	-26.94	-24.23	-2.71	2	-	-
4.956G	4.974G	200k	30k	RMS	4.965G	17.86	Inf	-Inf	2	Ref.CP 18M	-
4.974G	4.975G	200k	30k	RMS	4.97499G	-26.62	-25.79	-0.84	2	-	-
4.975G	4.976G	200k	30k	RMS	4.97558G	-30.94	-29.48	-1.46	2	-	-
4.976G	4.985G	200k	30k	RMS	4.97614G	-38.89	-32.13	-6.76	2	-	-
4.985G	4.995G	200k	30k	RMS	4.99286G	-54.66	-47.86	-6.80	2	-	-
4.995G	5.015G	200k	30k	RMS	4.99556G	-58.25	-50.00	-8.25	2	-	-

4.94-4.99GHz_802.11j_20MHz_Nss1_2TX

Mask

4980MHz



F-Start(Hz)	F-Stop(Hz)	RBW(Hz)	VBW(Hz)	Detector	Freq(Hz)	Level(dBm)	Limit(dBm)	Margin(dB)	Port	Remark	Ref.Limit(dB)
4.93G	4.95G	200k	30k	RMS	4.9484G	-57.14	-50.00	-7.14	1	-	-
4.95G	4.96G	200k	30k	RMS	4.95G	-55.28	-50.00	-5.28	1	-	-
4.96G	4.969G	200k	30k	RMS	4.96877G	-36.34	-32.21	-4.13	1	-	-
4.969G	4.97G	200k	30k	RMS	4.9695G	-30.36	-28.98	-1.38	1	-	-
4.97G	4.971G	200k	30k	RMS	4.97001G	-26.56	-25.74	-0.82	1	-	-
4.971G	4.989G	200k	30k	RMS	4.98G	18.40	Inf	-Inf	1	Ref.CP 18M	-
4.989G	4.99G	200k	30k	RMS	4.98997G	-27.63	-25.32	-2.31	1	-	-
4.99G	4.991G	200k	30k	RMS	4.9903G	-28.19	-27.79	-0.40	1	-	-
4.991G	5G	200k	30k	RMS	4.99125G	-35.22	-32.22	-3.00	1	-	-
5G	5.01G	200k	30k	RMS	5.0093G	-53.83	-49.30	-4.53	1	-	-
5.01G	5.03G	200k	30k	RMS	5.01024G	-56.16	-50.00	-6.16	1	-	-
4.93G	4.95G	200k	30k	RMS	4.94996G	-56.73	-50.00	-6.73	2	-	-
4.95G	4.96G	200k	30k	RMS	4.95086G	-53.93	-49.14	-4.79	2	-	-
4.96G	4.969G	200k	30k	RMS	4.96898G	-36.90	-32.02	-4.88	2	-	-
4.969G	4.97G	200k	30k	RMS	4.96904G	-32.06	-31.76	-0.30	2	-	-
4.97G	4.971G	200k	30k	RMS	4.97G	-27.55	-25.95	-1.60	2	-	-
4.971G	4.989G	200k	30k	RMS	4.98G	18.41	Inf	-Inf	2	Ref.CP 18M	-
4.989G	4.99G	200k	30k	RMS	4.98998G	-28.46	-25.48	-2.98	2	-	-
4.99G	4.991G	200k	30k	RMS	4.99097G	-32.79	-31.82	-0.97	2	-	-
4.991G	5G	200k	30k	RMS	4.991G	-37.15	-32.00	-5.15	2	-	-
5G	5.01G	200k	30k	RMS	5.00942G	-54.36	-49.42	-4.94	2	-	-
5.01G	5.03G	200k	30k	RMS	5.01164G	-56.70	-50.00	-6.70	2	-	-