

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

CLASS II & IV PC REPORT

	Qualcomm Atheros, Inc.
Applicant:	1700 Technology Drive, San Jose, CA 95110
Product Name:	2x2 802.11A/B/G/N/AC WiFi + Bluetooth Module
Brand Name:	Qualcomm Atheros
Model No.:	QCNFA324
Model Difference:	N/A
Report Number:	ER/2020/A0068
FCC ID	HLZ-QCNFA324
IC:	1754F-QCNFA324
FCC Rule Part:	§15.247, Cat: DTS
IC RSS:	RSS-247 issue 2 Feb 2017
Issue Date:	December 10, 2020
Date of Test:	October 22, 2020 - November 17, 2020
Date of EUT Received:	October 22, 2020

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Approved By:

Jim Chang / Manager

Jun Chang



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Revision History				
Report Number	Revision	Description	Issue Date	Remark
ER/2020/A0068	Rev.00	Original.	December 10, 2020	Revised By: Violetta Tang

Note:

1 · Disclaimer

Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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GENERAL INFORMATION 1

1.1 Product description

Product Name:	Notebook Computer
Brand Name:	acer
Model No. of Host:	C722, C722T
Model Difference:	N/A
Hardware Version:	N/A
Software Version:	N/A
EUT Series No.:	N8A6UWW001036116907600
Model No. of BT/WLAN Module:	QCNFA324
Class II & Class IV	2x2 802.11A/B/G/N/AC WiFi + Bluetooth Module INSTALLED IN
Permissive change:	Notebook Computer
Power Supply:	11.4Vdc from Rechargeable Li-polymer Battery or 5 / 9 / 12 / 15 / 20Vdc from AC/DC Adapter

Wi-Fi 802.11	Frequency Range	Channels	Rated Power (Peak) / EIRP	Modulation Technology	
b		11	24.10 dBm / 25.16 dBm	DSSS	
g	2412-2462		27.43 dBm / 24.65 dBm		
n_HT20 /			27.38 dBm / 24.39 dBm	OFDM	
ac_VHT20					
n_HT40 /	0400 0450	7	24.00 dDm / 20.02 dDm		
ac_VHT40	2422-2492	1	24.89 0Bm / 20.83 0Bm		
Modulation type:		CCK, DQPSK, DBPSK for DSSS			
Modulation type.		64QAM,	16QAM, QPSK, BPSK for OFDM	1	
Transistion Rate		802.11 b: 1/2/5.5/11 Mbps			
		802.11 g			
		802.11 n_20MHz: 6.5 – 144.4Mbps			
		802.11 n	_40MHz: 13.5 – 300.0Mbps		

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1.2 Antenna Designation

Antenna Type	Supplier	Main / Aux	Antenna Part No.	Freq.	Peak Antenna Gain (dBi)	Worst Antenna Gain
	14/10	Main		2.4GHz	1.21	V
PIFA WNC	Aux	N/A	2.4GHz	-0.2		
Note: Pre-scanned was done on the above 2 antennas, the MIMO mode results higher emission						
at 2.4GHz. Therefore, the completed set of measurement was done on the antenna to be pre-						
sented on this test report.						

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1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247 FCC KDB 558074 D01 DTS Meas. Guidance v05r02 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 RSS-247 issue 2 Feb. 2017 RSS-Gen. issue 5, Amendment 1, March 2019 ANSI C63.10:2013

1.4 Test Facility

SGS Taiwan Ltd. Central RF Lab (TAF code 3702) No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 FCC Designation number: TW0027 ISED CAB identifier: TW3702

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.2 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site. There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Configuration of Tested System Fig. 2-1 Radiated Emission



Fig. 2-2 Conducted (Antenna Port)



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2	Notebook	Lenovo	L430	PK-126TN	N/A	N/A
3	USB-RJ45 Cable	abio	CA-USB-RJ45B	N/A	N/A	N/A

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SUMMARY OF TEST RESULTS 3

FCC Rules	IC Rules	Description Of Test	Result
§15.247(b) (3)	RSS-247 §5.4 d	Peak Output Power	Compliant
§15.247(d) §15.209	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10 RSS-Gen §6.13	Radiated Band Edge & Radiated Spurious Emission	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

11 channels are provided for 802.11b/g/n 20M.

CHANNEL	FREQUENCY (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

9 chann <u>els are provided for 802.11r</u>	<u>ו 40M</u>
---	--------------

CHANNEL	FREQUENCY (MHz)
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452

4.2 The Worst Test Modes and Channel Details

- 1. The EUT has been tested under operating condition.
- 2. aTest program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
- 3. Investigation has been done on all the possible configurations for searching the worst case.

The given UE is pre-scanned among below modes.

Modulation	Tra	Transmission Chain			Multiple Transmission Spatial
🛛 802.11 b	⊠ Ch0	🛛 Ch1	\Box Ch2	🗆 Ch3	🛛 2TX
⊠ 802.11 g	⊠ Ch0	🛛 Ch1	□ Ch2	□ Ch3	🛛 2TX
🛛 802.11 n	⊠ Ch0	🛛 Ch1	🗆 Ch2	□ Ch3	🛛 MIMO

4. Therefore, below summary is the modes of test configuration that yield the highest reading and generate the highest emission chosen to carry out the relevantly mandatory test items.

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4.3 Radiated Emission Test:

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT					
RADIATED EMISSION TEST (BELOW 1 GHz)										
802.11g	1 to 11	6	OFDM	6	2TX					
802.11n 40M	3 to 9	6	OFDM	MCS8	MIMO					
	RADIAT	ED EMISSIC	ON TEST (ABOVE	E 1 GHz)						
802.11b	1 to 11	1,6,11	DSSS	1	2TX					
802.11g	1 to 11	1,6,11	OFDM	6	2TX					
802.11n 20M	1 to 11	1,6,11	OFDM	MCS8	MIMO					
802.11n 40M	3 to 9	3,6,9	OFDM	MCS8	MIMO					
Note:										
The field strength High.	The field strength of radiation emission was measured as NB Plane for channel Low, Mid and High.									

4.4 Antenna Port Conducted Mesurement:

CONDUCTED TEST										
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT					
802.11b	1 to 11	1,6,11	DSSS	1	2TX					
802.11g	1 to 11	1,6,11	OFDM	6	2TX					
802.11n 20M	1 to 11	1,6,11	OFDM	MCS8	MIMO					
802.11n 40M	3 to 9	3,6,9	OFDM	MCS8	MIMO					

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty				
Peak Output Power	+/- 0.84 dB				
Temperature	+/- 0.65 °C				
Humidity	+/- 4.6 %				
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%				

Radiated Spurious Emission	Measurement Uncertainty
	9kHz~30MHz: +-2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
Polarization: Vertical	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
	9kHz~30MHz: +-2.3dB
	30MHz - 167MHz: +/- 4.22dB
Delevientien, Henisentel	167MHz -500MHz: +/- 3.44dB
Polarization: Horizontal	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

- 1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
- 2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 PEAK OUTPUT POWER MEASUREMENT

6.1 Standard Applicable

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

Note:

As per section F. 2). e). (ii) of FCC KDB 662911 D01

If antenna gains are not equal and each transmit antenna is driven by only one spatial stream, directional gain may be calculated by either of the following formulas.

• DirectionalGain =
$$10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

NSS = the number of independent spatial streams of data;

NANT = the total number of antennas

 $g_{j,k} = /20$ 10Gk if the kth antenna is being fed by spatial stream j, or zero if it is not;

 G_k is the gain in dBi of the kth antenna.

The antenna gain is not grater than 6 dBi. Therefore, reduction of power is not required.

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6.2 Measurement Equipment Used

Conducted Emission Test Site										
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.					
TYPE		NUMBER	NUMBER	CAL.						
Power Meter	Anritsu	ML2496A	1804001	02/20/2020	02/19/2021					
Power Sensor	Anritsu	MA2411B	1726104	02/20/2020	02/19/2021					
Power Sensor	Anritsu	MA2411B	1726107	02/20/2020	02/19/2021					
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2020	01/01/2021					

6.3 Test Set-up



6.4 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

Power Meter:

It is used as the auxiliary test equipment to conduct the output power measurement.

4. Record the max. Reading as observed from Spectrum or Power Meter.

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6.5 Measurement Result:

6.5.1 Peak & Avg

802.1	1b_2TX						
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dPm)	Limit (dBm)	RESULT
			CH 0	CH 1	(автт)		
1	2412	1	19.65	20.30	23.00	30.00	PASS
6	2437	1	20.42	21.44	23.97	30.00	PASS
11	2462	1	20.47	21.64	24.10	30.00	PASS
802.1	1b_2TX						
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Max. Avg. Output include tune up tolerance Power	Limit (dBm)	RESULT
			CH 0	CH 1	(dBm)		
1	2412	1	17.40	17.95	20.75	30.00	PASS
6							
1 T	2437	1	18.05	18.80	21.50	30.00	PASS
11	2437 2462	1	18.05 17.86	18.80 19.11	21.50 21.59	30.00 30.00	PASS PASS
11	2437 2462	1	18.05 17.86	18.80 19.11	21.50 21.59	30.00 30.00	PASS PASS
11 802.1	2437 2462 1g_2TX	1	18.05 17.86	18.80 19.11	21.50 21.59	30.00 30.00	PASS PASS

	(11112)	Indic		<i>,</i> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,							
			CH 0	CH 1	(авті)						
1	2412	6	20.20	20.68	23.46	30.00	PASS				
6	2437	6	24.03	24.78	27.43	30.00	PASS				
11	2462	6	19.01	20.25	22.68	30.00	PASS				
802.11g_2TX											
сн	Freq. (MHz)	Avg. Output Data Power Rate (dBm)		Max. Avg. Output include tune up tolerance Power	Limit (dBm)	RESULT					
					(dD)						
1			CH 0	CH 1	(abm)						
1	2412	6	CH 0 12.64	CH 1 13.63	(dBm) 16.41	30.00	PASS				
1 6	2412 2437	6 6	CH 0 12.64 17.41	CH 1 13.63 18.21	16.41 21.08	30.00 30.00	PASS PASS				

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802.1	1n_HT20	м мімо)				
сн	Freq. (MHz)	Data Rate	Peak (Po (dE CH 0	Dutput wer 3m) CH 1	Total Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS8	19.08	19.77	22.45	30.00	PASS
6	2437	MCS8	24.17	24.57	27.38	30.00	PASS
11	2462	MCS8	19.26	20.14	22.73	30.00	PASS
802.1	1n_HT20	м мімо	1	e			
сн	Freq. (MHz)	Data Rate	Avg. (Po (dE	Dutput wer 3m)	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	0440	MCCO	10.00	12.40	15.65	20.00	DACC
6	2412	MCSO	17.29	12.40	10.00	30.00	PASS
0	2437	MCSO	11.30	17.00	20.82	30.00	PASS
11	2402	10030	11.20	12.11	15.59	30.00	FA00
802.1	1n_HT40	м мімо)				
сн	Freq. (MHz)	Data Rate	Peak (Po (dE CH 0	Dutput wer 3m) CH 1	Total Peak Output Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS8	17.20	18.02	20.64	30.00	PASS
6	2437	MCS8	21.52	22.22	24.89	30.00	PASS
9	2452	MCS8	15.27	16.34	18.85	30.00	PASS
802.1	1n_HT40	м мімо			•		-
СН	Freq. (MHz)	Data Rate	Avg. (Po (dE CH 0	Dutput wer 3m) CH 1	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS8	9.68	10.21	13.47	30.00	PASS
6	2437	MCS8	13.33	14.12	17.26	30.00	PASS
9	2452	MCS8	7.40	8.22	11.35	30.00	PASS

* Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.

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6.5.2 EIRP

802.11b_2TX											
сн	Freq. (MHz)	Data Rate	Avg. C Pov (dE	Dutput wer Bm)	Total Avg. Output Power	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT		
			CH 0	CH 1	(abiii)	(аы)					
1	2412	1	17.40	17.95	20.75	3.57	24.32	36	PASS		
6	2437	1	18.05	18.80	21.50	3.57	25.07	36	PASS		
11	2462	1	17.86	19.11	21.59	3.57	25.16	36	PASS		

802.11a 2TX

СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm) CH 0 CH 1		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	6	12.64	13.63	16.41	3.57	19.98	36	PASS
6	2437	6	17.41	18.21	21.08	3.57	24.65	36	PASS
11	2462	6	12.48	13.45	16.24	3.57	19.81	36	PASS

802.11n_HT20M MIMO

СН	Freq. (MHz)	Data Rate	Avg. C Pov (dE	Dutput wer Bm)	Total Avg. Output Power	Antenna Gain	EIRP (dBm)	Limit (dBm)	RESULT
			CH 0	CH 1	(aBm)	(abi)			
1	2412	MCS8	19.08	19.77	15.65	3.57	19.22	36	PASS
6	2437	MCS8	24.17	24.57	20.82	3.57	24.39	36	PASS
11	2462	MCS8	19.26	20.14	15.39	3.57	18.96	36	PASS

802 11n HT40M MIMO

СН	Freq. (MHz)	Data Rate	Avg.C Pov (dB)utput wer 8m)	Total Avg. Output Power	Antenna Gain	EIRP (dBm)	Limit (dBm)	RESULT
			CH 0	CH 1	(aBm)	(abi)			
3	2422	MCS8	9.68	10.21	13.47	3.57	17.04	36	PASS
6	2437	MCS8	13.33	14.12	17.26	3.57	20.83	36	PASS
9	2452	MCS8	7.40	8.22	11.35	3.57	14.92	36	PASS

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7 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

7.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 and RSS-Gen §8.9 Table 5 and 6 limit as below. And according to §15.33(a) (1) & RSS-Gen §6.13.2.a for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level $(dB\mu V/m) = 20 \log Emission level (dB\mu V/m)$

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7.2 Measurement Equipment Used:

966 Chamber					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE		NUMBER	NUMBER	CAL.	
Horn Antenna	Schwarzbeck	BBHA9170	184	12/25/2019	12/24/2020
Horn Antenna	Schwarzbeck	BBHA9120D	D803	12/20/2019	12/19/2020
Bi-log Antenna	TESEO	CBL 6112D	35242 & AT- N0555	01/13/2020	01/12/2021
Loop Antenna	ETS.LINDGREN	6502	148045	10/19/2020	10/18/2021
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/21/2020	04/20/2021
EMI Test Re- ceiver	R&S	ESCI 7	100759	07/13/2020	07/12/2021
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	01/02/2020	01/01/2021
Pre-Amplifier	EMC Instru- ments	EMC051825	980152	01/02/2020	01/01/2021
Pre-Amplifier	HP	8447D	2944A09469	01/02/2020	01/01/2021
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2020	01/01/2021
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	01/02/2020	01/01/2021
High Pass Filter	WI	WHKX4.0/18G- 10SS	22	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	succoflex 102	MY2622/2	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	succoflex 104A	800086/4a	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	EMC 104-SM- SM-2000	160123	01/02/2020	01/01/2021

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7.3 Test SET-UP

(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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7.4 Measurement Procedure

- 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasipeak (QP) at frequency below 1 GHz.
- 7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
- 8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
- 9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- 10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
- 12. Repeat above procedures until all default test channel measured were complete.

7.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = *Field Strength*

CL = Cable Attenuation Factor (Cable Loss) AG = Amplifier Gain

RA = Reading Amplitude

AF = Antenna Factor

The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)

Actual $FS(dB\mu V/m) = SPA$. Reading $Ievel(dB\mu V) + Factor(dB)$

 $Factor(dB) = Antenna Factor(dB\mu V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)$

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7.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) & RSS-GEN §6.13.2 was not reported.

7.7 Measurement Result

Note:

- 1. Refer to next page spectrum analyzer data chart and tabular data sheets.
- 2. Measurements are completed at peak and average level, the mark of average is the highest emission in restricted bands

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7.7.1 Radiated Band Edge Measurement Result:

Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-10-29
Test Frequency	:2412 MHz	Temp./Humi.	:23.2/62
Test Mode	:Bandedge CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2382.20	Average	39.21	7.49	46.70	54.00	-7.30
2382.20	Peak	49.24	7.49	56.73	74.00	-17.27
2390.00	Average	38.15	7.46	45.61	54.00	-8.39
2390.00	Peak	48.00	7.46	55.46	74.00	-18.54

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Margin

dB

-7.39

-17.15

-8.22

-18.55

54.00

74.00



Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-10-29
Test Frequency	:2412 MHz	Temp./Humi.	:23.2/62
Test Mode	:Bandedge CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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38.32

47.99

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7.46

7.46

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Average

Peak

2390.00

2390.00

f (886-2) 2298-0488

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45.78

55.45



Report Number :ER/2020/A0068 Test Site	SAC I Chamber
Operation Mode :802.11b Test Dat	te :2020-10-29
Test Frequency :2462 MHz Temp./H	lumi. :23.2/62
Test Mode :Bandedge CH High Antenna	Pol. :VERTICAL
EUT Pol :NB Plane Enginee	r :Neo



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Margin

dB

-6.48 -15.47

-6.25

-15.12

54.00

74.00



Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-10-29
Test Frequency	:2462 MHz	Temp./Humi.	:23.2/62
Test Mode	:Bandedge CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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40.29

51.42

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7.46

7.46

58.88

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Peak

2487.70



:ER/2020/A0086	Test Site	:SAC I Chamber
:802.11g	Test Date	:2020-10-29
:2412 MHz	Temp./Humi.	:23.2/62
:Bandedge CH Low	Antenna Pol.	:VERTICAL
:NB Plane	Engineer	:Neo
	:ER/2020/A0086 :802.11g :2412 MHz :Bandedge CH Low :NB Plane	:ER/2020/A0086Test Site:802.11gTest Date:2412 MHzTemp./Humi.:Bandedge CH LowAntenna Pol.:NB PlaneEngineer



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Report Number	:ER/2020/A0086	Test Site	:SAC I Chamber
Operation Mode	:802.11g	Test Date	:2020-10-29
Test Frequency	:2412 MHz	Temp./Humi.	:23.2/62
Test Mode	:Bandedge CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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:ER/2020/A0086	Test Site	:SAC I Chamber
:802.11g	Test Date	:2020-10-29
:2462 MHz	Temp./Humi.	:23.2/62
:Bandedge CH High	Antenna Pol.	:VERTICAL
:NB Plane	Engineer	:Neo
	:ER/2020/A0086 :802.11g :2462 MHz :Bandedge CH High :NB Plane	:ER/2020/A0086Test Site:802.11gTest Date:2462 MHzTemp./Humi.:Bandedge CH HighAntenna Pol.:NB PlaneEngineer



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Test Frequency	:2462 MHz	Temp./Humi.	:23.2/62
Test Mode	:Bandedge CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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dB

-15.34

74.00



Report Number	:ER/2020/A0086	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-10-30
Test Frequency	:2412 MHz	Temp./Humi.	:23.2/64
Test Mode	:Bandedge CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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7.46

58.66

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Peak

2390.00

dB

-16.33

74.00



Report Number	:ER/2020/A0086	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-10-30
Test Frequency	:2412 MHz	Temp./Humi.	:23.2/64
Test Mode	:Bandedge CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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7.46

57.67

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Peak

2390.00

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:ER/2020/A0086	Test Site	:SAC I Chamber
:802.11n20	Test Date	:2020-10-30
:2462 MHz	Temp./Humi.	:23.2/64
:Bandedge CH High	Antenna Pol.	:VERTICAL
:NB Plane	Engineer	:Neo
	:ER/2020/A0086 :802.11n20 :2462 MHz :Bandedge CH High :NB Plane	:ER/2020/A0086Test Site:802.11n20Test Date:2462 MHzTemp./Humi.:Bandedge CH HighAntenna Pol.:NB PlaneEngineer



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Report Number	:ER/2020/A0086	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-10-30
Test Frequency	:2462 MHz	Temp./Humi.	:23.2/64
Test Mode	:Bandedge CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Margin

dB

-6.70

-6.94

-6.40

-10.24

54.00

74.00

54.00

74.00



2388.60

2388.60

2390.00

2390.00

:ER/2020/A0086	Test Site	:SAC I Chamber
:802.11n40	Test Date	:2020-10-30
:2422 MHz	Temp./Humi.	:23.2/64
:Bandedge CH Low	Antenna Pol.	:VERTICAL
:NB Plane	Engineer	:Neo
	:ER/2020/A0086 :802.11n40 :2422 MHz :Bandedge CH Low :NB Plane	:ER/2020/A0086Test Site:802.11n40Test Date:2422 MHzTemp./Humi.:Bandedge CH LowAntenna Pol.:NB PlaneEngineer



39.84

59.60

40.14

56.30

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7.46

7.46

7.46

7.46

47.30

67.06

47.60

63.76

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Average

Peak

Average

Peak

Margin

dB

-6.71

-7.38

-7.66

-11.94

74.00

54.00

74.00



2388.36

2390.00

2390.00

:ER/2020/A0086	Test Site	:SAC I Chamber
:802.11n40	Test Date	:2020-10-30
:2422 MHz	Temp./Humi.	:23.2/64
:Bandedge CH Low	Antenna Pol.	:HORIZONTAL
:NB Plane	Engineer	:Neo
	:ER/2020/A0086 :802.11n40 :2422 MHz :Bandedge CH Low :NB Plane	:ER/2020/A0086Test Site:802.11n40Test Date:2422 MHzTemp./Humi.:Bandedge CH LowAntenna Pol.:NB PlaneEngineer



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59.16

38.88

54.60

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Peak

Average

Peak

f (886-2) 2298-0488

7.46

7.46

7.46

66.62

46.34

62.06

dB

-11.28

74.00



:ER/2020/A0086	Test Site	:SAC I Chamber
:802.11n40	Test Date	:2020-10-30
:2452 MHz	Temp./Humi.	:23.2/64
:Bandedge CH High	Antenna Pol.	:VERTICAL
:NB Plane	Engineer	:Neo
	:ER/2020/A0086 :802.11n40 :2452 MHz :Bandedge CH High :NB Plane	:ER/2020/A0086Test Site:802.11n40Test Date:2452 MHzTemp./Humi.:Bandedge CH HighAntenna Pol.:NB PlaneEngineer



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only

55.26

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7.46

62.72

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Peak

2485.10

Margin

dB

-5.78

-12.10

-5.58

-7.93

54.00

74.00



)
AL
)



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only

40.96

58.61

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7.46

7.46

48.42

66.07

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Average

Peak

2484.80

2484.80



7.7.2 Below 1GHz Worst-Case Emission:

Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11g	Test Date	:2020-11-07
Test Frequency	:2437 MHz	Temp./Humi.	:22.8/74
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
32.91	Peak	41.15	-6.15	35.00	40.00	-5.00
44.55	Peak	46.78	-12.35	34.43	40.00	-5.57
68.80	Peak	51.05	-17.22	33.83	40.00	-6.17
240.49	Peak	44.15	-10.12	34.03	46.00	-11.97
576.11	Peak	38.84	-4.42	34.42	46.00	-11.58
959.26	Peak	35.35	1.64	36.99	46.00	-9.01

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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11g	Test Date	:2020-11-07
Test Frequency	:2437 MHz	Temp./Humi.	:22.8/74
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
188.11	Peak	43.68	-13.06	30.62	43.50	-12.88
240.49	Peak	45.83	-10.12	35.71	46.00	-10.29
282.20	Peak	39.70	-8.78	30.92	46.00	-15.08
359.80	Peak	38.64	-6.82	31.82	46.00	-14.18
479.11	Peak	40.83	-5.37	35.46	46.00	-10.54
959.26	Peak	36.70	1.64	38.34	46.00	-7.66

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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-07
Test Frequency	:2437 MHz	Temp./Humi.	:22.8/74
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
32.91	Peak	43.13	-6.15	36.98	40.00	-3.02
68.80	Peak	51.50	-17.22	34.28	40.00	-5.72
240.49	Peak	43.36	-10.12	33.24	46.00	-12.76
479.11	Peak	38.73	-5.37	33.36	46.00	-12.64
576.11	Peak	38.67	-4.42	34.25	46.00	-11.75
959.26	Peak	35.91	1.64	37.55	46.00	-8.45

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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-07
Test Frequency	:2437 MHz	Temp./Humi.	:22.8/74
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
240.49	Peak	45.24	-10.12	35.12	46.00	-10.88
285.11	Peak	39.45	-8.73	30.72	46.00	-15.28
359.80	Peak	37.83	-6.82	31.01	46.00	-14.99
479.11	Peak	41.21	-5.37	35.84	46.00	-10.16
740.04	Peak	40.00	-1.74	38.26	46.00	-7.74
959.26	Peak	37.29	1.64	38.93	46.00	-7.07

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7.7.3 Above 1GHz Emission:

Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-11-04
Test Frequency	:2412 MHz	Temp./Humi.	:22.8/56
Test Mode	:Tx CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-11-04
Test Frequency	:2412 MHz	Temp./Humi.	:22.8/56
Test Mode	:Tx CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-11-05
Test Frequency	:2462 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11b	Test Date	:2020-11-05
Test Frequency	:2462 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11g	Test Date	:2020-11-05
Test Frequency	:2412 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11g	Test Date	:2020-11-05
Test Frequency	:2412 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11g	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11g	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Operation Mode	:802.11g	Test Date	:2020-11-05
Test Frequency	:2462 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Operation Mode	:802.11g	Test Date	:2020-11-05
Test Frequency	:2462 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-11-05
Test Frequency	:2412 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo

97 Level (dBuV/r	n)					
90			·			
80						
70						
60			·			
50	2		1 1 1 1 	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
40						
30						
20						
10			·			
0	6100	11200	16300	21400	26500	
1000	0100.	Frequency (MI	losoo. lz)	21400.	20000	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4824.00	Average	25.86	14.56	40.42	54.00	-13.58
4824.00	Peak	35.66	14.56	50.22	74.00	-23.78

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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-11-05
Test Frequency	:2412 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-11-05
Test Frequency	:2462 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n20	Test Date	:2020-11-05
Test Frequency	:2462 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-05
Test Frequency	:2422 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-05
Test Frequency	:2422 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo

97 Level (dBuV/m	1)	· · ·				
90						
80						
70						
60		L				
50						
	2					
40						
30						
20						
10						
0 <mark></mark>	6100.	11200. Frequency (Mi	16300. Hz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4874 00	Average	24 47	14 85	39 32	54 00	-14 68
4074.00	Deale	24.47	14.05	09.0Z	34.00	-14.00
48/4.00	Реак	30.80	14.85	45.65	74.00	-28.35

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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-05
Test Frequency	:2437 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-05
Test Frequency	:2452 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:VERTICAL
EUT Pol	:NB Plane	Engineer	:Neo



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Report Number	:ER/2020/A0068	Test Site	:SAC I Chamber
Operation Mode	:802.11n40	Test Date	:2020-11-05
Test Frequency	:2452 MHz	Temp./Humi.	:22.5/57
Test Mode	:Tx CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:NB Plane	Engineer	:Neo



~ End of Report ~

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