

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

PARTIAL REPORT

OF

Applicant:	CALAMP WIRELESS NETWORKS CORPORATION 2200 Faraday Ave, Suite 220, Carlsbad, CA 92008
Product Name:	LMU5541 Broadband Router/Tracker
Brand Name:	CalAmp
Model No.:	LMU5541LW
Model Difference:	N/A
Report Number:	ER/2019/C0115
FCC ID:	APV-5541LW
IC:	5843C-5541LW
FCC Rule Part:	§15.247, Cat: DTS
IC RSS:	RSS-247 issue 2 Feb 2017
Issue Date:	Jan. 15, 2020
Date of Test:	Dec. 13, 2019 ~ Jan. 07, 2020
Date of EUT Re- ceived:	Dec. 13, 2019

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory 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:

Vito Pei / Asst. Supervisor



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Revision History					
Report Number Revision Description Issue Date Remark					
ER/2019/C0115	Rev.00	Original.	Jan. 15, 2020	Revised By: Stefanie Yu	

Note:

Test data is referenced from cross authorization(s)

Measurement results in the original test report 2323ERM.005A1 under FCC ID: RI7WE866C3 / IC: 5131A-WE866C3 are partially leveraged in this test report with Radiated Emission Test to demonstrate compliance.

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GENERAL INFORMATION 1

1.1 Product description

Product Name:	LMU5541 Broadband Router/Tracker	
Brand Name:	CalAmp	
Model No.:	LMU5541LW	
Model Difference:	N/A	
Hardware Version:	Rev E	
Software Version:	LMU,166 V4.1a	
Power Supply:	12Vdc from Car Battery & 3.7Vdc from Rechargeable Li-ion Battery	
	Battery: Model No.: GSP633248, Supplier: N/A	

Wi-Fi 802.11	Frequency Range	Channels		Rated Power (dBm)	Modulation Technology
b				16.24	DSSS,
g	2412-2462	11		17.70	
n_HT20 ax_HEW20			HT:	19.49	OFDM
n_HT40 n_HEW40	2422-2452	7	HT:	16.67	
Modulation type:			PSK, DBPSk 16QAM, QPS	(for DSSS K, BPSK for OFDM	
802.11 b: 1/2/5.5/11 Mbps 802.11 g: 6/9/12/18/24/36/48/54 Mbps Transistion Rate 802.11 n_HT20MHz: 6.5 - 72.2 Mbps 802.11 n_HT40MHz: 13.5 - 150.0 Mbps 802.11 ax_HEW20MHz: 8 -143.4 Mbps					

WLAN Modular Report

WLAN:	Test Lab: DEKRA Certification. Inc. Applicant: Telit Communication s.p.a Model Number: WE866C3-P Report Number: 2323ERM.005A
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1.2 Antenna Designation

Туре	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
PIFA	TAOGLAS	MA284.LBIC.001	2402-2480	-2.21

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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 v05r01 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. Electronics & Communication Laboratory (TAF code 0513)

No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803

FCC Designation number: TW0001

ISED CAB identifier: TW0513

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.

1.7 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,

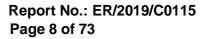
the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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SYSTEM TEST CONFIGURATION 2

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 Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 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.

2.3.3 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.

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2.4 Configuration of Tested System

Fig. 2-1 Radiated Emission configuration

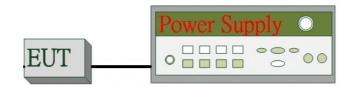


Table 2-1 Equipment Used in Tested System

ltem	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	DC Power Supply	Agilent	E3640A	MY52410006	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(4)	Peak Output Power	Compliant
§15.205 §15.209 §15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10 RSS-Gen §6.13	Radiated Band Edge and Spurious Emission	N/A, Refer to modular report.
§15.203 §15.247(b)	RSS- Gen §6.8	Antenna Requirement	Compliant

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DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

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

FREQUENCY
(MHz)
2412
2417
2422
2427
2432
2437
2442
2447
2452
2457
2462

9 channels are provided for 802.11n 40M

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

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 gevin UE is pre-scanned among below modes.
- 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	1, 6, 11	OFDM	6	Ch0				
	RADIAT	ED EMISSIC	N TEST (ABOVE	E 1 GHz)					
802.11b	1 to 11	1, 6, 11	DSSS	1	Ch0				
802.11g	1 to 11	1, 6, 11	OFDM	6	Ch0				
802.11n 20M	1 to 11	1, 6, 11	OFDM	MCS 0	MIMO				
802.11n 40M	3 to 9	3, 6, 9	OFDM	MCS 0	MIMO				
Noto									

Note:

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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MEASUREMENT UNCERTAINTY 5

Test Items	Uncertainty		
AC Power Line Conducted Emission	+/- 2.586 dB		
Peak Output Power	+/- 0.84 dB		
6dB Bandwidth	+/- 51.33 Hz		
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB		
Peak Power Density	+/- 1.3 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					
Delevier Menticel	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					
Delevization, Hevizantel	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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CONDUCTED EMISSION TEST 6

6.1 Standard Applicable

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

	Limits						
Frequency range	dB(uV)					
MHz	Quasi-peak	Average					
0.15 to 0.50	66 to 56	56 to 46					
0.50 to 5	56	46					
5 to 30	60	50					
Note							
1. The lower limit shall apply at the transition frequencies							
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50							

MHz.

6.2 Measurement Equipment Used

N/A

6.3 EUT Setup

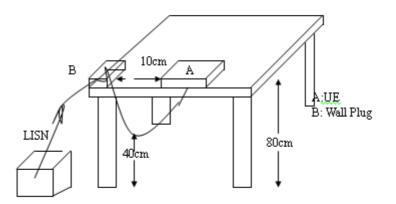
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

- 1. The EUT was placed on a table which is 0.8m above ground plane.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all phases of power being supplied by given UE are completed

6.6 Measurement Result

N/A, powered from car battery.

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7 PEAK OUTPUT POWER MEASUREMENT

7.1 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 FCC KDB 662911 D01

Unequal antenna gains, with equal transmit powers. For antenna gains given by G1, G2, ..., GN dBi.

(i) If transmit signals are correlated, then Directional gain

=10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/N_{ANT}$] dBi

[Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

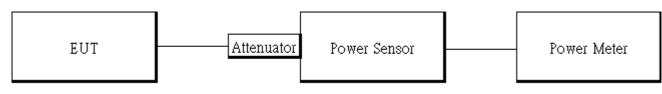
The antenna gain is not grater than 6 dBi. Therefore, reduction of power is not required.

7.2 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1804001	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726104	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726107	02/13/2019	02/12/2020
Attenuator	Mini-Circuit	BW- S10W2+	4	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW- S10W2+	4	01/02/2020	01/01/2021

7.3 Test Set-up

Power Meter:



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7.4 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.

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

7.5 Measurement Result

802.11b Ch0								
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT			
1	2412	1	15.24	30.00	PASS			
2	2417	1	16.13	30.00	PASS			
6	2437	1	16.24	30.00	PASS			
10	2457	1	16.23	30.00	PASS			
11	2462	1	15.37	30.00	PASS			
802.1 [°]	1b Ch0							
сн	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT			
1	2412	1	12.73	30.00	PASS			
2	2417	1	13.83	30.00	PASS			
6	2437	1	13.85	30.00	PASS			
10	2457	1	13.78	30.00	PASS			
11	2462	1	12.80	30.00	PASS			

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0UZ.1	1g Ch0	<u> </u>			1	
СН	Freq. (MHz)	Data Rate	Peak Output Power	Limit (dBm)	RESULT	
	(101112)	Nate	(dBm)	(ubiii)		
1	2412	6	16.38	30.00	PASS	
2	2417	6	17.70	30.00	PASS	
6	2437	6	17.11	30.00	PASS	
10	2457	6	17.31	30.00	PASS	
11	2462	6	17.05	30.00	PASS	
802.1	1g Ch0					
			Max. Avg. Output			
СН	Freq.	Data	include tune up	Limit	RESULT	
СП	(MHz)	Rate	tolerance Power	(dBm)	RESULT	
			(dBm)			
1	2412	6	10.19	30.00	PASS	
2	2417	6	11.39	30.00	PASS	
6	2437	6	11.15	30.00	PASS	
10	2457	6	11.16	30.00	PASS	
11	2462	6	10.70	30.00	PASS	
0004	4	Micho				
80Z.T	1n_HT20		Deek Qutnut			
<u></u>	Freq.	Data	Peak Output	Limit	ргеш т	
СН	(MHz)	Rate	Power	(dBm)	RESULT	
			(dBm)		.	
1	2412	MCS0	18.60	30.00	PASS	
2	2417	MCS0	19.49	30.00	PASS	
6	2437	MCS0	19.26	30.00	PASS	
10	2457	MCS0	19.37	30.00	PASS	
11	2462	MCS0	18.76	30.00	PASS	
802.1	1n_HT20	M Ch0				
	_		Max. Avg. Output			
СН	Freq.	Data	include tune up	Limit	RESULT	
	(MHz)	Rate	tolerance Power	(dBm)		
			(dBm)			
1	2412	MCS0	11.93	30.00	PASS	
2	2417	MCS0	12.73	30.00	PASS	
6	2437	MCS0	12.84	30.00	PASS	
10	2457	MCS0	12.76	30.00	PASS	
11	2462	MCS0	11.98	30.00	PASS	



802.11n_HT40M Ch0								
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT			
3	2422	MCS0	16.67	30.00	PASS			
4	2427	MCS0	16.26	30.00	PASS			
6	2437	MCS0	16.18	30.00	PASS			
8	2447	MCS0	16.15	30.00	PASS			
9	2452	MCS0	16.03	30.00	PASS			
802.1 [°]	1n_HT40	M Ch0						
СН	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power	Limit (dBm)	RESULT			
3	2422	MCS0	(dBm)	20.00	PASS			
4	2422	MCS0 MCS0	8.86 9.01	30.00 30.00	PASS			
6	2437	MCS0	8.96	30.00	PASS			
8	2447	MCS0	8.77	30.00	PASS			
9	2452	MCS0	8.82	30.00	PASS			

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EIRP

802.11b Ch0										
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT			
1	2412	1	12.73	-2.21	10.52	36	PASS			
2	2417	1	13.83	-2.21	11.62	36	PASS			
6	2437	1	13.85	-2.21	11.64	36	PASS			
10	2457	1	13.78	-2.21	11.57	36	PASS			
11	2462	1	12.80	-2.21	10.59	36	PASS			
		-		-		•				

802.11	802.11g Ch0									
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT			
1	2412	6	10.19	-2.21	7.98	36	PASS			
2	2417	6	11.39	-2.21	9.18	36	PASS			
6	2437	6	11.15	-2.21	8.94	36	PASS			
10	2457	6	11.16	-2.21	8.95	36	PASS			
11	2462	6	10.70	-2.21	8.49	36	PASS			

802.11	802.11n_HT20M Ch0									
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT			
1	2412	MCS0	11.93	-2.21	9.72	36	PASS			
2	2417	MCS0	12.73	-2.21	10.52	36	PASS			
6	2437	MCS0	12.84	-2.21	10.63	36	PASS			
10	2457	MCS0	12.76	-2.21	10.55	36	PASS			
11	2462	MCS0	11.98	-2.21	9.77	36	PASS			

802.11	802.11n_HT40M Ch0										
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT				
3	2422	MCS0	8.86	-2.21	6.65	36	PASS				
4	2427	MCS0	9.01	-2.21	6.80	36	PASS				
6	2437	MCS0	8.96	-2.21	6.75	36	PASS				
8	2447	MCS0	8.77	-2.21	6.56	36	PASS				
9	2452	MCS0	8.82	-2.21	6.61	36	PASS				



8 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

8.1 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 limit as below.

And according to §15.33(a) (1), 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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8.2 Measurement Equipment Used:

	966 Chamber				
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
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	01/10/2019	01/09/2020
Loop Antenna	ETS.LINDGREN	6502	148045	10/15/2019	10/14/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/10/2019	12/09/2020
EMI Test Receiver	R&S	ESCI 7	1166.5950.07	07/04/2019	07/03/2020
EXA Spectrum Ana- lyzer	KEYSIGHT	N9010A	MY51440113	07/15/2019	07/14/2020
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	01/02/2020	01/01/2021
Pre-Amplifier	EMC Instru- ments	EMC051825	980152	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instru- ments	EMC051825	980152	01/02/2020	01/01/2021
Pre-Amplifier	HP	8447D	2944A09469	01/02/2019	01/01/2020
Pre-Amplifier	HP	8447D	2944A09469	01/02/2020	01/01/2021
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2020	01/01/2021
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	01/02/2019	01/01/2020
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	01/02/2019	01/01/2020
High Pass Filter	WI	WHKX4.0/18G- 10SS	22	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	succoflex 102	MY2622/2	01/02/2019	01/01/2020

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Coaxial Cable	Huber Suhner	succoflex 102	MY2622/2	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	succoflex 104A	800086/4a	01/02/2019	01/01/2020
Coaxial Cable	Huber Suhner	succoflex 104A	800086/4a	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	EMC 104-SM- SM-2000	160123	01/02/2019	01/01/2020
Coaxial Cable	Huber Suhner	EMC 104-SM- SM-2000	160123	01/02/2020	01/01/2021

NOTE: N.C.R refers to Not Calibrated Required.

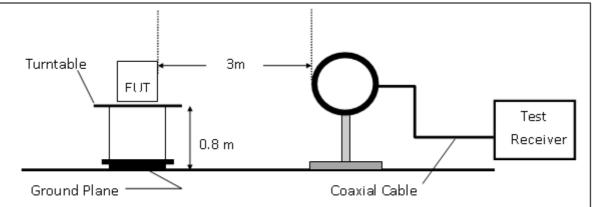
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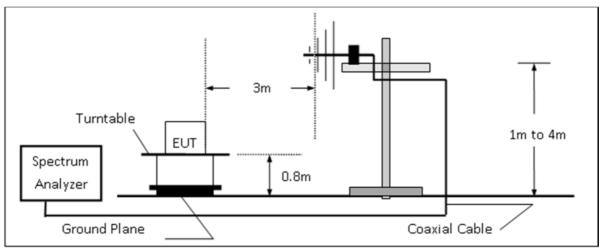


8.3 Test SET-UP





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



Turntable Зm 1m to 4m EUT Spectrum 1.5m Analyzer Ground Plane Absorber Coaxial Cable

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

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8.4 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 Quasi-peak (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.

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8.5 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

AF = Antenna Factor

RA = Reading Amplitude

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

8.6 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.

8.7 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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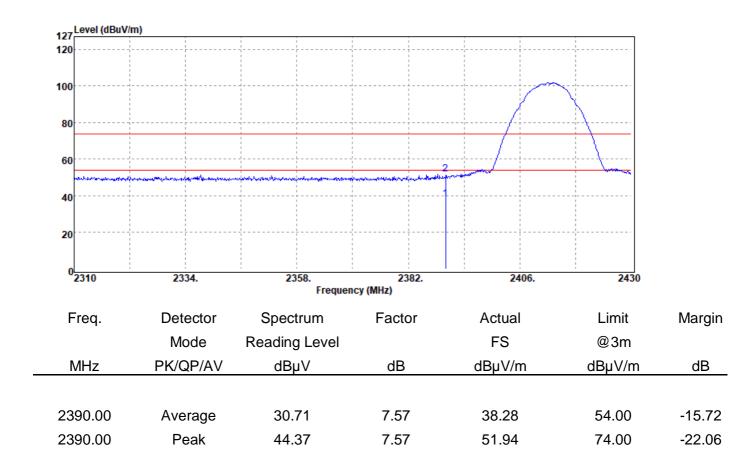
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8.7.1 Radiated Band Edge Measurement Result

Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11b	Temp./Humi.	:22.6/64
Test Channel	:2412 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH Low	Engineer	:Thomas
EUT Pol	:E2 Plane		



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2430

Margin

dB

-15.82

-22.48

Limit

@3m

dBµV/m

54.00

74.00

2406.

Actual

FS

dBµV/m

38.18

51.52

2382.

Factor

dB

7.57

7.57



80

60

40

20

0<mark>_____</mark>2310

Freq.

MHz

2390.00

2390.00

2334.

Detector

Mode

PK/QP/AV

Average

Peak

Report Number Operation Mode Test Channel Test Mode EUT Pol	:ER/2019/C0115 :802.11b :2412 MHz :Bandedge CH Low :E2 Plane	Ter	st Date mp./Humi. tenna Pol. gineer	:2020-01-06 :22.6/64 :HORIZONTAL :Thomas
120				
100				· · ·

2358.

Spectrum

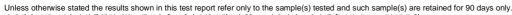
Reading Level

dBµV

30.61

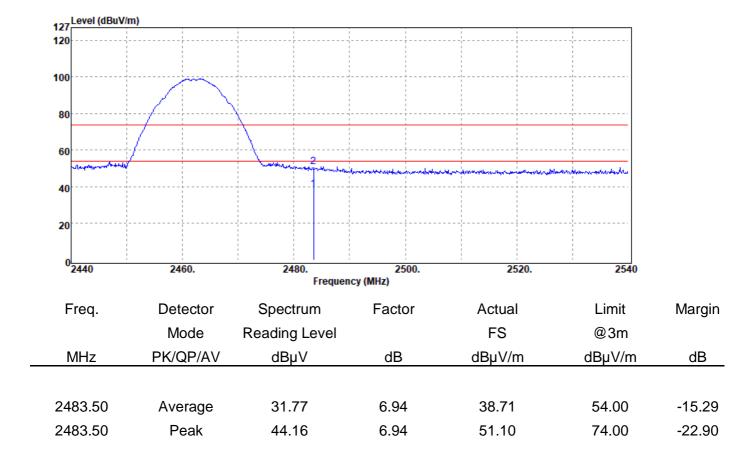
43.95

Frequency (MHz)



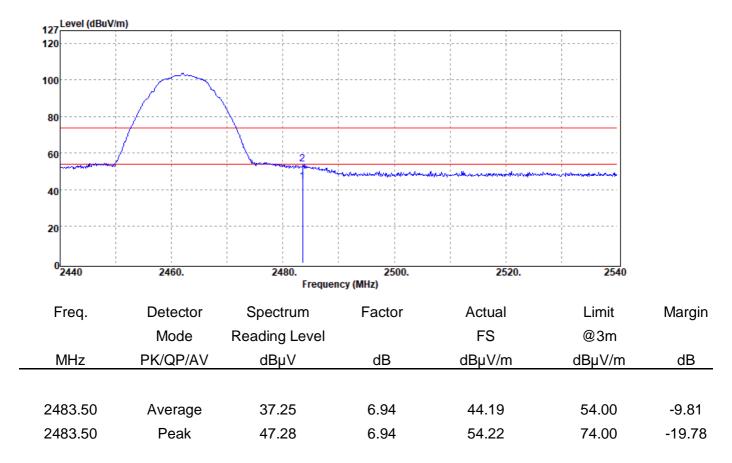


Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11b	Temp./Humi.	:22.6/64
Test Channel	:2462 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		



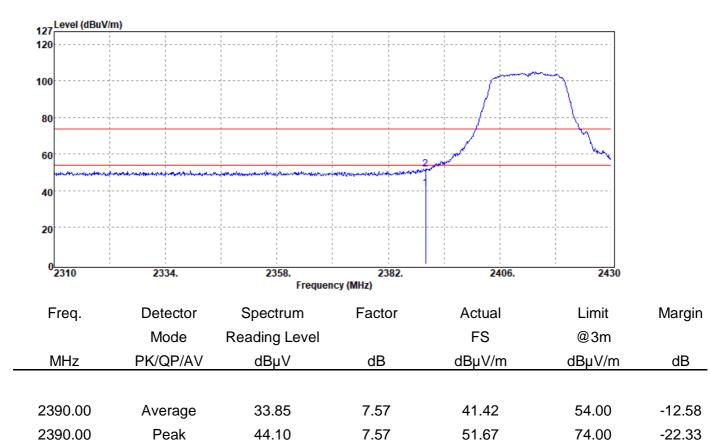


Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11b	Temp./Humi.	:22.6/64
Test Channel	:2462 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		



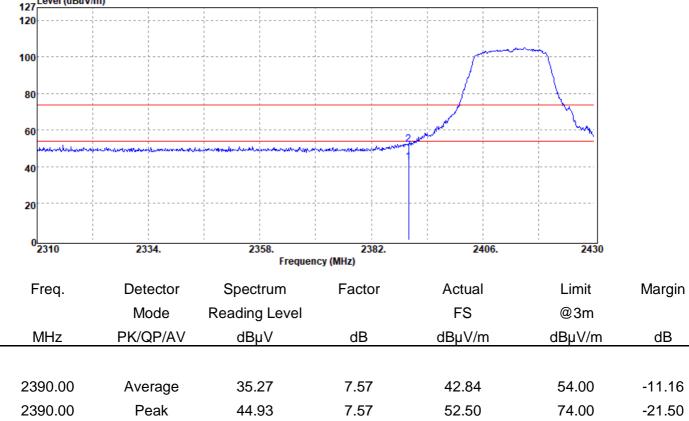


Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11g	Temp./Humi.	:22.6/64
Test Channel	:2412 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH Low	Engineer	:Thomas
EUT Pol	:E2 Plane		



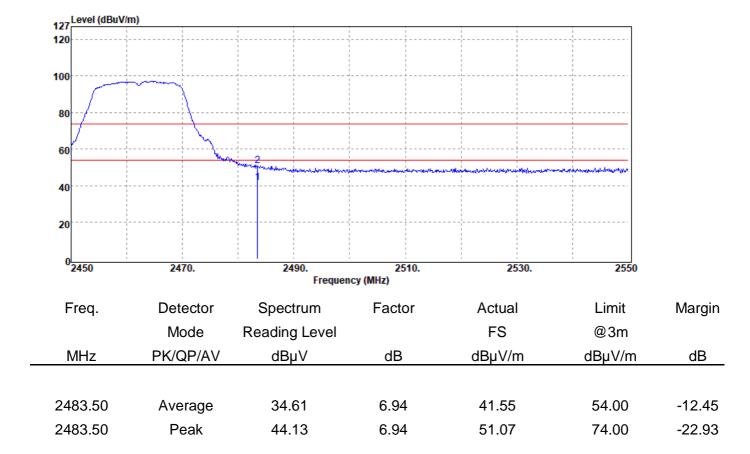


Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11g	Temp./Humi.	:22.6/64
Test Channel	:2412 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH Low	Engineer	:Thomas
EUT Pol	:E2 Plane		
Level (dBuV/m)			



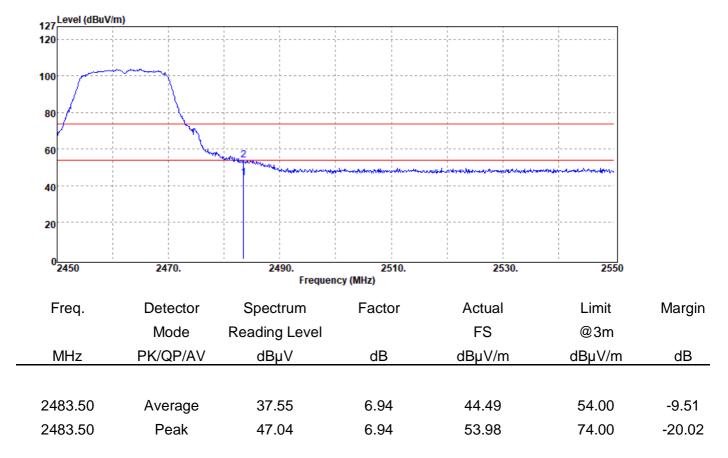


Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11g	Temp./Humi.	:22.6/64
Test Channel	:2462 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		



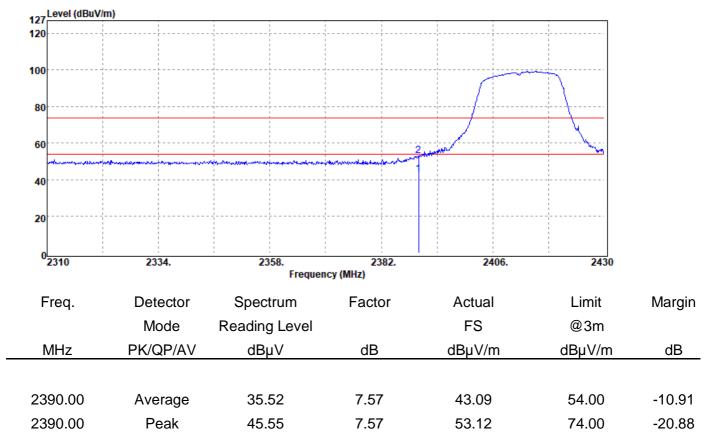


Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11g	Temp./Humi.	:22.6/64
Test Channel	:2462 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		





Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11n20	Temp./Humi.	:22.6/64
Test Channel	:2412 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH Low	Engineer	:Thomas
EUT Pol	:E2 Plane		



2430

2406.



80

60

40

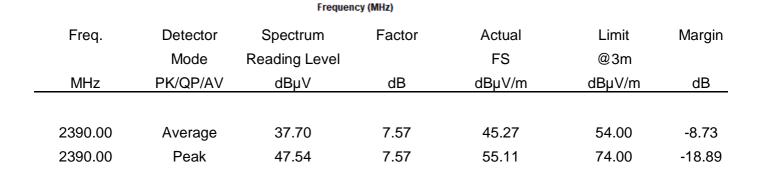
20

0<mark>_____</mark>2310

2334.

Report Number Operation Mode Test Channel Test Mode EUT Pol	:ER/2019/C0115 :802.11n20 :2412 MHz :Bandedge CH Low :E2 Plane	Test Date Temp./Humi. Antenna Pol Engineer	:2020-01-06 :22.6/64 : HORIZONTAL :Thomas
127 Level (dBuV/m)	i i i i	i i i	
120		·····	
100			

2358.

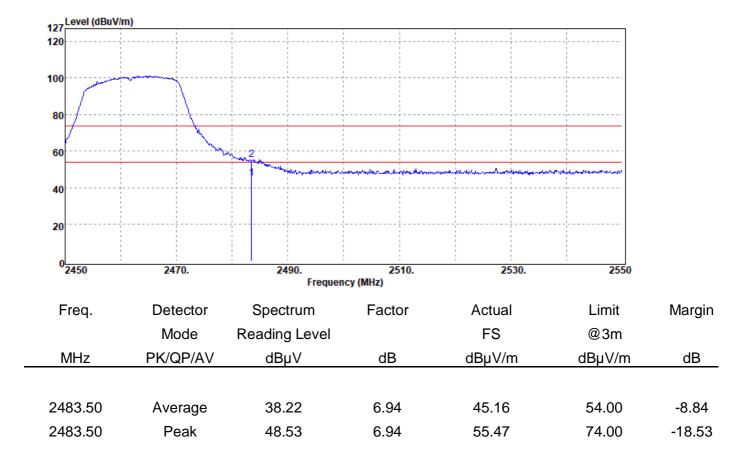


2382.

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Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11n20	Temp./Humi.	:22.6/64
Test Channel	:2462 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		

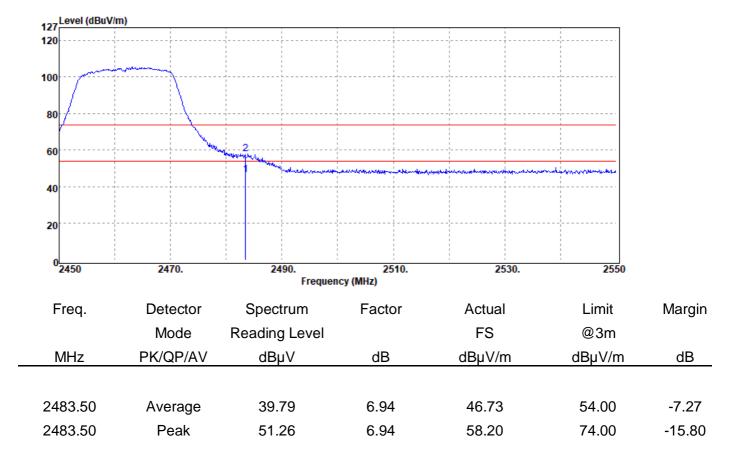


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Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11n20	Temp./Humi.	:22.6/64
Test Channel	:2462 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		



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Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11n40	Temp./Humi.	:22.6/64
Test Channel	:2422 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH Low	Engineer	:Thomas
EUT Pol	:E2 Plane		

127	el (dBuV/m	1)		:			
120							
100							
80					/		
60				2	www.mar.		
40		antheanan an	****	and a second and a second and a second			
20							
			i i i				
0 231	10	2334.	2358. Frequen	2382. cy (MHz)	2406.	2430	
⁰ 231		2334. Detector			2406. Actual	2430 Limit	Margir
			Frequen	cy (MHz)			Margir
	q.	Detector	Frequen Spectrum	cy (MHz)	Actual	Limit	Margir dB
Fre MH	q. Iz	Detector Mode PK/QP/AV	Frequen Spectrum Reading Level dBµV	cy (MHz) Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	dB
Fre	q. Iz	Detector Mode	Frequen Spectrum Reading Level	cy (MHz) Factor	Actual FS	Limit @3m	dB
Fre MH	eq. Iz 9.20	Detector Mode PK/QP/AV	Frequen Spectrum Reading Level dBµV	cy (MHz) Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	dB -9.33
Fre- <u>MH</u> 2389	eq. 1 <u>z</u> 0.20 0.20	Detector Mode PK/QP/AV Average	Frequent Spectrum Reading Level dBµV 37.10	cy (MHz) Factor <u>dB</u> 7.57	Actual FS dBµV/m 44.67	Limit @3m dBµV/m 54.00	Margir dB -9.33 -13.94 -9.18



40

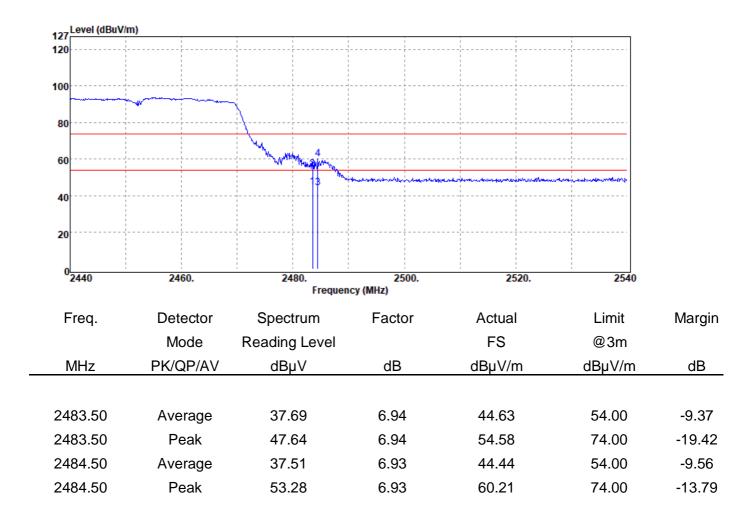
Report Number	:ER/2019/C0115		Test Date	:2020-01-06
Operation Mode	:802.11n40		Temp./Humi.	:22.6/64
est Channel	:2422 MHz		Antenna Pol.	:HORIZONTAL
est Mode	:Bandedge CH Low		Engineer	:Thomas
UT Pol	:E2 Plane			
127 Level (dBuV/m)				
120	······			
100				
80				
60		2	Wa _{nu}	
mounds when we wanted	any production of the second	and the strategic st		

20						
0 <mark></mark> 2310	2334.	2358. Frequenc	2382. cy (MHz)	2406.	2430	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Average	38.03	7.57	45.60	54.00	-8.40
2390.00	Peak	54.40	7.57	61.97	74.00	-12.03

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Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11n40	Temp./Humi.	:22.6/64
Test Channel	:2452 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		

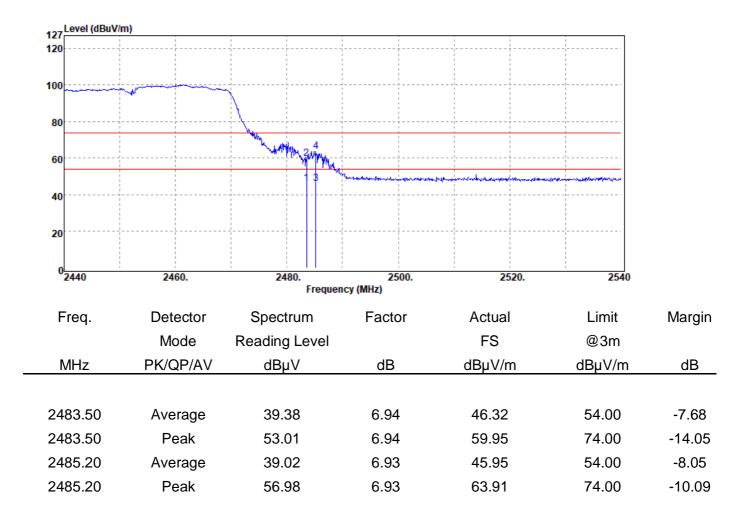


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Report Number	:ER/2019/C0115	Test Date	:2020-01-06
Operation Mode	:802.11n40	Temp./Humi.	:22.6/64
Test Channel	:2452 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH High	Engineer	:Thomas
EUT Pol	:E2 Plane		



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8.7.2 Below 1GHz Worst-Case Emission:

Report Number	:ER/2019/C0115
Operation Mode	:802.11g
Test Channel	:2437 MHz
Test Mode	:Tx CH Mid
EUT Pol	:E2 Plane

263.77

373.38

516.94

661.47

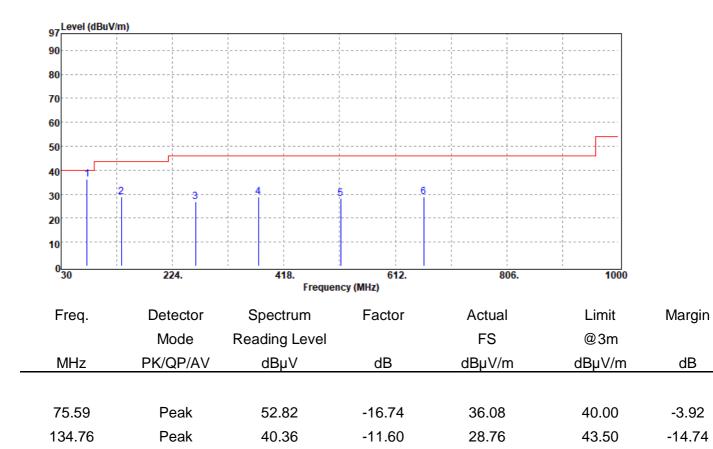
Peak

Peak

Peak

Peak

Test Date	:2020-01-07
Temp./Humi.	:22.6/64
Antenna Pol.	:VERTICAL
Engineer	:Thomas



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35.14

35.78

32.59

31.61

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-8.43

-6.97

-4.40

-2.66

26.71

28.81

28.19

28.95

46.00

46.00

46.00

46.00

-19.29

-17.19

-17.81

-17.05

Test Date



:ER/2019/C0115

Report Number

0 <u></u> 30	224.	418.	612. ency (MHz)	806.	1000
10					
20					
30	2 3		5	6	
40		4			
50					
60					
70					
80	· · · · · · · · · · · · · · · · · · ·				
90	·				
97					
ΓPol	:E2 Plane				
t Mode	:Tx CH Mid			Engineer	:Thomas
t Channel	:2437 MHz			Antenna Pol.	:HORIZON
eration Mode	:802.11g			Temp./Humi.	

Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level		FS	@3m	
PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
Peak	46.93	-15.33	31.60	40.00	-8.40
Peak	42.60	-12.29	30.31	46.00	-15.69
Peak	37.20	-7.82	29.38	46.00	-16.62
Peak	41.28	-6.97	34.31	46.00	-11.69
Peak	32.16	-3.54	28.62	46.00	-17.38
Peak	29.41	0.60	30.01	46.00	-15.99
	Mode PK/QP/AV Peak Peak Peak Peak Peak	ModeReading LevelPK/QP/AVdBµVPeak46.93Peak42.60Peak37.20Peak41.28Peak32.16	Mode Reading Level PK/QP/AV dBµV dB Peak 46.93 -15.33 Peak 42.60 -12.29 Peak 37.20 -7.82 Peak 41.28 -6.97 Peak 32.16 -3.54	Mode Reading Level FS PK/QP/AV dBμV dB dBμV/m Peak 46.93 -15.33 31.60 Peak 42.60 -12.29 30.31 Peak 37.20 -7.82 29.38 Peak 41.28 -6.97 34.31 Peak 32.16 -3.54 28.62	Mode Reading Level FS @3m PK/QP/AV dBμV dB dBμV/m dBμV/m Peak 46.93 -15.33 31.60 40.00 Peak 42.60 -12.29 30.31 46.00 Peak 37.20 -7.82 29.38 46.00 Peak 41.28 -6.97 34.31 46.00 Peak 32.16 -3.54 28.62 46.00

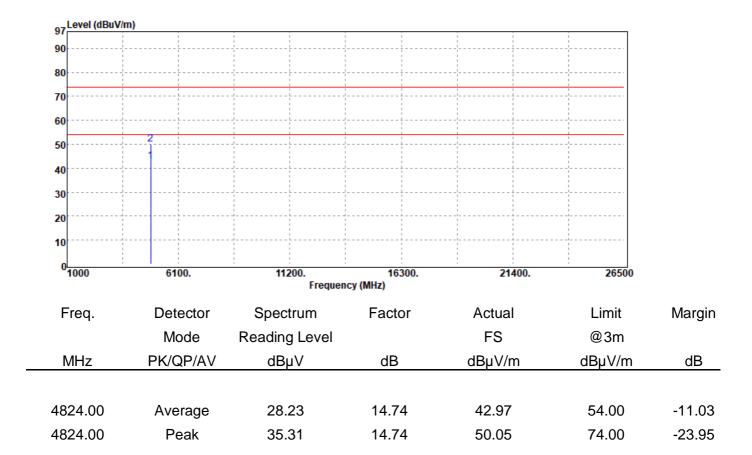
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8.7.3 Above 1GHz Emission:

Report Number	:ER/2019/C0115
Operation Mode	:802.11b
Test Channel	:2412 MHz
Test Mode	:Tx CH Low
EUT Pol	:E2 Plane

Test Date	:2020-01-06
Temp./Humi.	:22.6/64
Antenna Pol.	:VERTICAL
Engineer	:Thomas



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Test Date



:ER/2019/C0115

Report Number

4824.00

4824.00

Average

Peak

peration Mo est Channel est Mode UT Pol		W		Temp./Humi. Antenna Pol. Engineer		ΓAL
97	/m)					
90						
80						
70						
60					!	
50	2					
40						
30						
20						
10						
0 <mark></mark>	6100.	11200. Frequen	16300. cy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margir
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB

14.74

14.74

40.40

50.15

25.66

35.41

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54.00

74.00

-13.60

-23.85

:2019-12-31

Test Date



:ER/2019/C0115

Report Number

4874.00

4874.00

Average

Peak

peration Mode est Channel est Mode	:802.11b :2437 MHz :Tx CH Mi			Temp./Humi. Antenna Pol. Engineer		
UT Pol	:E2 Plane					
97 Level (dBuV/m)						
97						
80						
70		· · · · · · · · · · · · · · · · · · ·				
60						
50	2	·				
40		·	 			
30		·				
20			 			
10			 			
0 1000	6100.	11200. Frequence	16300. cy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB

15.04

15.04

44.03

51.13

28.99

36.09

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54.00

74.00

-9.97

-22.87

:2019-12-31

Test Date

47.97



:ER/2019/C0115

Report Number

4874.00

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11b :2437 MH :Tx CH M :E2 Plane	id		Temp./Humi. Antenna Pol. Engineer		ΓAL
97						
90						
80						
70	 					
60						
50	2					
40						
30						
20						
10						
01000	6400	44.200	46200	24.400	26500	
1000	6100.	11200. Frequer	16300. Icy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz I	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4874.00	Average	26.99	15.04	42.03	54.00	-11.97

15.04

32.93

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74.00

-26.03

Test Date



:ER/2019/C0115

Report Number

4924.00

4924.00

Average

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11b :2462 MHz :Tx CH High :E2 Plane			Temp./Humi. Antenna Pol. Engineer		
97 Level (dBuV/m)			·	:	·	
90	·					
80						
70					 - 	
60					 - 	
50					1 	
40					 - - 	
30					 - 	
20					1 	
10						
0 <mark>1000</mark>	6100.	11200. Frequen	16300. cy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB

28.85

36.97

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15.17

15.17

44.02

52.14

54.00

74.00

-9.98

-21.86

Test Date



:ER/2019/C0115

Report Number

4924.00

4924.00

Average

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11b :2462 MH :Tx CH Hi :E2 Plane	lz igh		Temp./Humi. Antenna Pol. Engineer		ΓAL
97 Level (dBuV/m)					;	
90						
80						
70				· · · · · · · · · · · · · · · · · · ·		
60						
	2					
50	1					
40						
30						
20				, , , , , , , , , , , , , , , , , , ,		
10						
0 ¹ 1000	6100.	11200. Frequen	16300. cy (MHz)	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

15.17

15.17

41.95

47.95

26.78

32.78

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54.00

74.00

-12.05

-26.05

26500

Margin

dB

-16.47

-27.61

Limit

@3m

dBµV/m

54.00

74.00

Test Date

21400.

Actual

FS

dBµV/m

37.53

46.39



:ER/2019/C0115

Report Number

10

0 1000

Freq.

MHz

4824.00

4824.00

6100.

Detector

Mode

PK/QP/AV

Average

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11g :2412 MHz :Tx CH Low :E2 Plane			•	a Pol.	:22.6/64 :VERTIC :Thomas	CAL
97						-	1
90				 		 	
80				 			
70		- L		 		 - 	
60				 		 	
50	2	 		 		 - - 	
40				 		 - 	
30				 		 - 	
20			 	 		 	

Frequency (MHz)

16300.

Factor

dB

14.74

14.74

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11200.

Spectrum

Reading Level

dBµV

22.79

31.65

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Test Date



:ER/2019/C0115

Report Number

4824.00

4824.00

Average

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11g :2412 MHz :Tx CH Low :E2 Plane			Temp./Humi. Antenna Pol. Engineer		ĀL
97 Level (dBuV/m)						
90			i i i i i i i i i i i i i i i i i i i			
80						
70			 			
60			J			
502						
40	· · · · · · · · · · · · · · · · · · ·				- - - -	
30						
20			· · · · · · · · · · · · · · · · · · ·			
10			1 1 1 1 1 1 1 1 1 1			
0 <mark></mark> 1000	6100.	11200. Frequer	16300. ncy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB

14.74

14.74

34.82

44.47

20.08

29.73

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54.00

74.00

-19.18

-29.53

Test Date



:ER/2019/C0115

Report Number

4874.00

4874.00

Average

Peak

est C	ation Mode Channel Mode Pol	:802.11g :2437 MH :Tx CH M :E2 Plane	id		Temp./Humi. Antenna Pol. Engineer		
97	Level (dBuV/m)				· ·		
90							
80							
70		 					
60							
50		2					
40							
30						1 	
20						1 	
10						1 	
0	1000	6100.	11200. Frequen	16300. cy (MHz)	21400.	26500	
F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
Ν	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB

15.04

15.04

36.36

45.67

21.32

30.63

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54.00

74.00

-17.64

-28.33

Test Date



:ER/2019/C0115

Report Number

4874.00

•		:802.11g :2437 MH :Tx CH Mi :E2 Plane	id		Temp./Humi. Antenna Pol. Engineer		ΓAL
07	Level (dBuV/m)						
90							
80							
70		 		1 1 1	1 1 1 I 1 1 1 1 1 1 1 1 1		
60							
50		 		i i I I J I J I I			
		2					
40		1					
30			- J	J !			
20							
10							
0	1000	6100.	11200.	16300.	21400.	26500	
	1000	0100.		ncy (MHz)	21400.	20000	
F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
48	74.00	Average	20.16	15.04	35.20	54.00	-18.80

15.04

43.82

28.78

Peak

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74.00

-30.18

Test Date



:ER/2019/C0115

Report Number

eration Mode	:802.11g			Temp./Humi.	:22.6/64
st Channel	:2462 MHz			Antenna Pol.	:VERTICAL
st Mode	:Tx CH High			Engineer	:Thomas
T Pol	:E2 Plane				
97 					
90					
80					
70					
60		L			
50					
40	2	 			
30		 			
20		 			
10					
0 <mark>1000</mark>	6100.	11200.	16300. ncy (MHz)	21400.	26500

F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
N	1Hz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
492	24.00	Average	20.95	15.17	36.12	54.00	-17.88
492	24.00	Peak	29.69	15.17	44.86	74.00	-29.14

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Test Date



:ER/2019/C0115

Report Number

peration Mode	:802.11g			Temp./Humi.	:22.6/64
st Channel	:2462 MHz			Antenna Pol.	:HORIZONTAI
st Mode	:Tx CH High	1		Engineer	:Thomas
JT Pol	:E2 Plane				
97 Level (dBuV/m)					
90					
80					
70	· · · · · · · · · · · · · · · · · · ·				
60					
50	2				
40					
30				· · · · · · · · · · · · · · · · · · ·	
20					
10					
0 <mark></mark>	6100.	11200. Freque	16300. ency (MHz)	21400.	26500
Frea.	Detector			Actual	Limit

	Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
_	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
	4924.00	Average	19.69	15.17	34.86	54.00	-19.14
	4924.00	Peak	28.59	15.17	43.76	74.00	-30.24

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Test Date



:ER/2019/C0115

Report Number

4824.00

4824.00

Average

Peak

Ν	MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
U	1000	6100.	11200. Freque	16300. ncy (MHz)	21400.	26500	
10							
20							
30							
40							
50		2					
60		 					
70				· · · · · · · · · · · · · · · · · · ·		 	
80							
97 90	Level (dBuV/m)						
Test N EUT I	Pol	:Tx CH Lc :E2 Plane			Engineer	:Thomas	
•	ation Mode Channel	:802.11n2 :2412 MH			Temp./Humi. Antenna Pol.		

21.67

30.15

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14.74

14.74

36.41

44.89

54.00

74.00

-17.59

-29.11

Test Date



:ER/2019/C0115

Report Number

4824.00

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11n2 :2412 MH: :Tx CH Lo :E2 Plane	0 z		Temp./Humi. Antenna Pol. Engineer		ΓAL
97 Level (dBuV/m)						
90						
80						
70						
60						
50						
40						
30						
20	 					
10	 					
0 <mark></mark> 1000	6100.	11200. Freque	16300. ncy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4824.00	Average	20.08	14.74	34.82	54.00	-19.18

14.74

43.77

29.03

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74.00

-30.23

Test Date



:ER/2019/C0115

Report Number

Operation Mod Test Channel Test Mode EUT Pol	e :802.11n2 :2437 MH :Tx CH M :E2 Plane	20 Iz id		Temp./Humi. Antenna Pol. Engineer		
97 Level (dBuV/m)						
90						
80						
70						
60			· · · · · · · · · · · · · · · · · · ·			
50	2					
40			· · · · · · · · · · · · · · · · · · ·			
30						
20						
10						
0		44000	40000	24400		
1000	6100.	11200. Frequer	16300. ncy (MHz)	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	22.18	15.04	37.22	54.00	-16.78

15.04

50.14

35.10

Peak

4874.00

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74.00

-23.86

Test Date



:ER/2019/C0115

Report Number

4874.00

Peak

•		:802.11n2 :2437 MH :Tx CH M :E2 Plane	20 Iz id		Temp./Humi. Antenna Pol. Engineer		ΓAL
07	Level (dBuV/m)						
97 90				· · · · · · · · · · · · · · · · · · ·			
80							
70				i i ji			
60							
50				· · · · · · · · · · · · · · · · · · ·			
40		2					
30							
20				· · · · · · · · · · · · · · · · · · ·			
10							
U	1000	6100.	11200. Frequer	16300. ncy (MHz)	21400.	26500	
F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
N	ЛНz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
48	74.00	Average	20.34	15.04	35.38	54.00	-18.62

15.04

44.10

29.06

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74.00

-29.90

Test Date



:ER/2019/C0115

Report Number

4924.00

Peak

Operation Mode Test Channel		:802.11n20 :2462 MHz				I. :VERTICAL	
Test Mod	e	:Tx CH F	•		Engineer	:Thomas	
EUT Pol		:E2 Plan	e				
97	(dBuV/m)						
90							
80							
70							
60							
50		2					
40							
30							
20							
10							
0 <mark></mark>		6100.	11200.	16300.	21400.	26500	
1000		0100.		uency (MHz)	21400.	20300	
Freq		Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Leve	l	FS	@3m	
MHz		PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4924.0	00	Average	21.32	15.17	36.49	54.00	-17.51

29.94

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15.17

45.11

74.00

-28.89

Test Date



:ER/2019/C0115

Report Number

4924.00

Peak

Operation Mode Test Channel Test Mode EUT Pol		:802.11n2 :2462 MH :Tx CH H :E2 Plane	20 Iz igh		Temp./Humi. Antenna Pol. Engineer	:22.6/64 :HORIZONTAL :Thomas	
ozLev	vel (dBuV/m)						
97							
80							
70		 					
60							
50 · · ·		2					
40							
30		L					
20							
10	 					1 1 	
0	00	6100.	11200.	16300.	21400.	26500	
				ncy (MHz)	211001	20000	
Fre	eq.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
M	Ηz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4924	4.00	Average	19.98	15.17	35.15	54.00	-18.85

15.17

44.90

29.73

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-29.10

74.00

Test Date



:ER/2019/C0115

Report Number

4844.00

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11n4 :2422 MH :Tx CH Lo :E2 Plane	0 z		Temp./Humi. Antenna Pol. Engineer		
97 Level (dBuV/m)						
90		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		
80	1 1 1 1 1					
70	 		· · · · · · · · · · · · · · · · · · ·			
60	 					
50	 		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		
40						
30						
20	 					
10	 					
0 <mark></mark> 1000	6100.	11200. Freque	16300. ncy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4844.00	Average	20.83	14.87	35.70	54.00	-18.30

30.51

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14.87

45.38

-28.62

74.00

Test Date

43.32



:ER/2019/C0115

Report Number

Opera	ation Mode	:802.11n4	0		Temp./Humi.	:22.6/64	
Test C	Channel	:2422 MH	Z		Antenna Pol.	:HORIZON	ΓAL
Test N	/lode	:Tx CH Lo	W		Engineer	:Thomas	
EUT F	Pol	:E2 Plane					
07	Level (dBuV/m)						
90-							
80			· · · · · · · · · · · · · · · · · · ·				
70			· · · · · · · · · · · · · · · · · · ·				
60			·	· · · · · · · · · · · · · · · · · · ·			
50			·	· · · · · · · · · · · · · · · · · · ·			
40		2					
30							
20						1	
10							
Ŭ1	1000	6100.	11200. Freque	16300. ncy (MHz)	21400.	26500	
F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
•		Mode	Reading Level		FS	@3m	margin
N	ЛНz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
	/II IZ						
484	44.00	Average	19.62	14.87	34.49	54.00	-19.51
.0			=		00	00	

14.87

28.45

Peak

4844.00

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74.00

-30.68

Test Date



:ER/2019/C0115

Report Number

Deration Mode Test Channel Test Mode EUT Pol	:802.11n4 :2437 MH :Tx CH Mi :E2 Plane	0 z d		Temp./Humi. Antenna Pol. Engineer		
97 Level (dBuV/m)						
90	·					
80						
70						
60			· · · · · · · · · · · · · · · · · · ·			
502						
40		· · · · · · · · · · · · · · · · · · ·				
30		· · · · · · · · · · · · · · · · · · ·				
20						
10					 	
0						
0 <mark>1000</mark>	6100.	11200. Frequer	16300. ncy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4874.00	Average	20.95	15.04	35.99	54.00	-18.01

29.93

Peak

4874.00

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15.04

44.97

74.00

-29.03

Test Date



:ER/2019/C0115

Report Number

4874.00

Operation Mode Test Channel Test Mode EUT Pol		e :802.11n4 :2437 MH :Tx CH M	:802.11n40 :2437 MHz :Tx CH Mid :E2 Plane			:22.6/64 :HORIZON ⁻ :Thomas	ΓAL
07	Level (dBuV/m)						
97							
80				· · · · · · · · · · · · · · · · · · ·			
70			1 1 1 - J	 	1 1 1 1 1 1	I 	
60							
50				· · · · · · · · · · · · · · · · · · ·		1	
		2					
40							
30				J 			
20							
10				· · · · · · · · · · · · · · · · · · ·			
0	1000	6100.	11200.	16300.	21400.	26500	
				ncy (MHz)		20000	
F	Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
15	374.00	Average	19.51	15.04	34.55	54.00	-19.45
+0	J. T. OO	Average	13.01	10.04	04.00	54.00	-13. 4 J

15.04

44.95

29.91

Peak

74.00

-29.05

Test Date

44.27



:ER/2019/C0115

Report Number

4904.00

Peak

Operation Mode Test Channel Test Mode EUT Pol	e :802.11n4 :2452 MH :Tx CH H	:802.11n40 :2452 MHz :Tx CH High :E2 Plane			:22.6/64 :VERTICAL :Thomas	
97 						
90						
80	 					
70	 					
60	 					
50						
40	2					
30						
20						
10						
0		44000	40000	24.400		
0 <mark>1000</mark>	6100.	11200. Frequer	16300. ncy (MHz)	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
1001.00		00.00	45.40	00.07	54.00	47.00
4904.00	Average	20.88	15.19	36.07	54.00	-17.93

29.08

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15.19

-29.73

74.00

Test Date



:ER/2019/C0115

Report Number

4904.00

Peak

Operation Mode Test Channel Test Mode EUT Pol	:802.11n40 :2452 MHz :Tx CH High :E2 Plane			Temp./Humi. Antenna Pol. Engineer		ΓAL
97 Level (dBuV/m)						
90						
80						
70		 		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
60						
50						
40	2		· · · · · · · · · · · · · · · · · · ·			
30						
20						
10						
0 ¹ 1000	6100.	11200. Frequer	16300. ncy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4904.00	Average	19.76	15.19	34.95	54.00	-19.05

28.68

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15.19

43.87

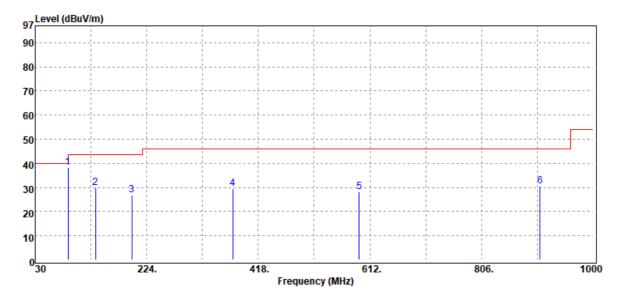
74.00

-30.13



Co-location (BT+WLAN 2.4G)

Report Number	:ER/2019/C0115	Test Date	:2020-01-07
Operation Mode	:BR(1M)/802.11b	Temp./Humi.	:22.5/61
Test Channel	:2441 MHz/2437 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Mid/Tx CH Mid	Engineer	:Thomas
EUT Pol	:E2 Plane		



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
87.23	Peak	53.74	-15.33	38.41	40.00	-1.59
134.76	Peak	41.54	-11.60	29.94	43.50	-13.56
197.81	Peak	39.52	-12.59	26.93	43.50	-16.57
373.38	Peak	36.37	-6.97	29.40	46.00	-16.60
593.57	Peak	31.81	-3.54	28.27	46.00	-17.73
907.85	Peak	29.46	1.08	30.54	46.00	-15.46

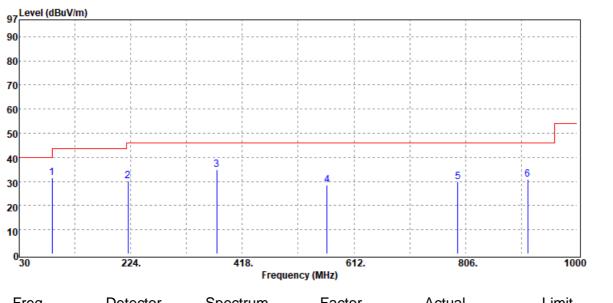
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Report Number :ER/2019/C0115 Operation Mode :BR(1M)/802.11b **Test Channel** :2441 MHz/2437 MHz Test Mode :Tx CH Mid/Tx CH Mid EUT Pol :E2 Plane

Test Date :2020-01-07 Temp./Humi. :22.5/61 Antenna Pol. :HORIZONTAL Engineer :Thomas



	Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
_	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
	87.23	Peak	46.73	-15.33	31.40	40.00	-8.60
	219.15	Peak	42.50	-12.24	30.26	46.00	-15.74
	373.38	Peak	41.88	-6.97	34.91	46.00	-11.09
	565.44	Peak	32.54	-4.15	28.39	46.00	-17.61
	792.42	Peak	30.95	-1.08	29.87	46.00	-16.13
	913.67	Peak	29.85	0.92	30.77	46.00	-15.23

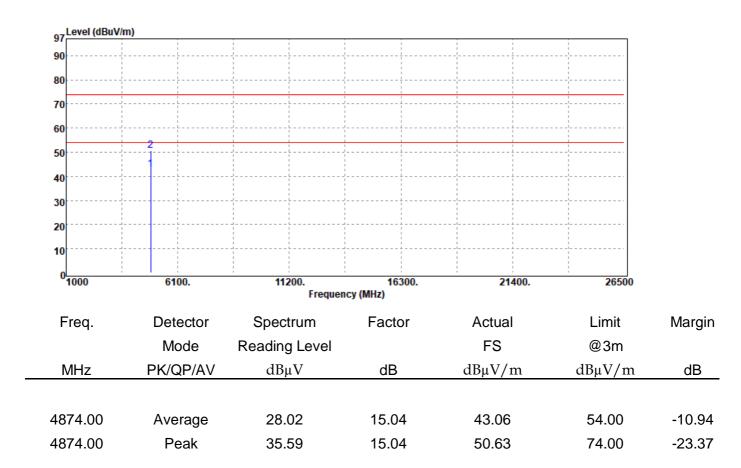
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Report Number :ER/2019/C0115 **Operation Mode** :BR(1M)/802.11b **Test Channel** :2441 MHz/2437 MHz Test Mode :Tx CH Mid/Tx CH Mid EUT Pol :E2 Plane

Test Date :2020-01-07 Temp./Humi. :22.5/61 Antenna Pol. : VERTICAL Engineer :Thomas



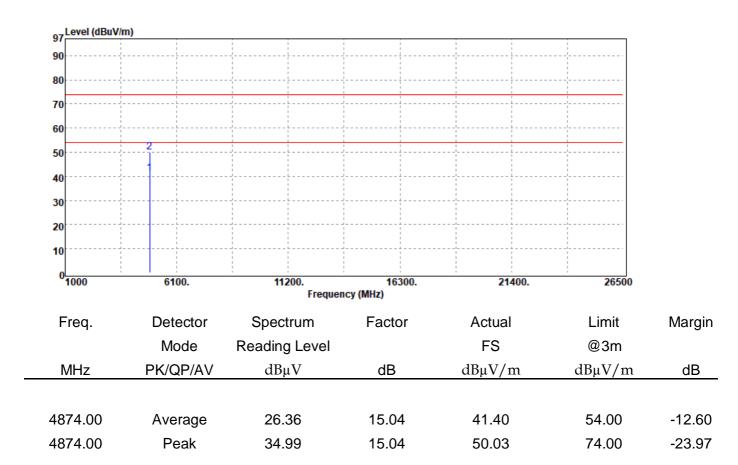
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Report Number :ER/2019/C0115 **Operation Mode** :BR(1M)/802.11b **Test Channel** :2441 MHz/2437 MHz Test Mode :Tx CH Mid/Tx CH Mid EUT Pol :E2 Plane

Test Date :2020-01-07 Temp./Humi. :22.5/61 Antenna Pol. :HORIZONTAL Engineer :Thomas



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ANTENNA REQUIREMENT 9

9.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device. If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

9.2 Antenna Connected Construction

The antenna is designed unique RF connector and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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