

# ELECTROMAGNETIC EMISSIONS **COMPLIANCE REPORT**



Applicant:	GOOGLE LLC 1600 Amphitheatre Parkway Mountain View, CA 94043
Product Name:	Wireless Streaming Device
Brand Name:	GOOGLE
Model No.:	GJQ9T
Model Difference:	N/A
Report Number:	ER/2021/40062
FCC ID:	A4RGJQ9T
IC:	10395A-GJQ9T
Issue Date:	July 7, 2021
Date of Test:	April 21, 2021 ~ May 10, 2021
Date of EUT Received:	February 19, 2021

Approved By Mun Cary Blue Yang

# 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 comply with FCC rule part §15.247, ISED RSS-247.

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

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. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製。



Revision History					
Report Number	Revision	Description	Issue Date	Revised By	
ER/2021/40062	00	Original.	July 7, 2021	Elle Chang	

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#### **GENERAL INFORMATION** 1

# **1.1 Product Description**

Product Name:	Wireless Streaming Device
Brand Name:	GOOGLE
Model No.:	GJQ9T
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	Conducted: G1878051 Radiated: G1878050
Power Supply:	USB 5V

# **1.2 RF Specification**

Wi-Fi 802.11	Frequency Range	Channels	Rated Power (dBm)	Modulation Technology
b			22.02	DSSS,
g	2412-2462	11	26.16	
n_HT20			26.08	OFDM
Modulation	type:	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM		
Transistion	Rate	802.11 b: 1/2/5.5/11 Mbps 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11 n HT20MHz: 6.5 – 72.2 Mbps		

# **1.3 Antenna Designation**

Antenna Type	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain		
Dipole	2.4GHz	2.13	-		
Note: Antenna information is provided by the applicant.					

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# 1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 RSS-247 issue 2 Feb. 2017 RSS-Gen Issue 5, Amendment 2, February 2021 ANSI C63.10:2013

# 1.5 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designa- tion number	IC CAB identifier
		SAC 1		
		SAC 3		
		Conduction 1		
	No.134, Wu Kung Road, New Taipei	Conducted 1		
	Industrial Park, Wuku District, New	Conducted 2	TW0027	
	Taipei City, Taiwan.	Conducted 3		
		Conducted 4		TW3702
		Conducted 5		
SGS Taiwan Ltd.		Conducted 6		
Central RF Lab.	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction A	TW0028	
(TAF code 3702)		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

# **1.6 Special Accessories**

There are no special accessories used while test was conducted.

# 1.7 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 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.

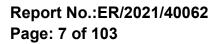
# 2.3.3 Radiated Emissions

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 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 Conducted (Antenna Port) Emission Configuration



# Fig 2-2 Radiated Emission



# Fig 2-3 Conduction (AC Power Line) Radiated Emission



Table 2-1	Equipment	Used in	Tested	System
-----------	-----------	---------	--------	--------

ltem	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	T440P	PC-014TAK	N/A	N/A
3.	Notebook	Lenovo	T440P	PC-083PVC 15/10	N/A	N/A

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#### SUMMARY OF TEST RESULTS 3

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	RSS-247 §5.4 d	Peak Output Power	Compliant
§15.247(a)(2)	RSS-247 §5.2 a RSS-Gen §6.7	Emission Bandwidth	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 & Conducted Band Edge and Spurious Emission	Compliant
§15.247(e)	RSS-247 §5.2 b	Power Spectral Density	Compliant
§15.203 §15.247(b)	N/A	Antenna Requirement	Compliant

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#### **DESCRIPTION OF TEST MODES** 4

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

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# 4.2 The Worst Test Modes and Channel Details

- 1. The EUT has been tested under operating condition.
- 2. Test 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.

Modulation	Transmission Chain	Single Transmission Spatial	Multiple Transmission Spatial
🛛 802.11 b	🖾 Ch0 🗆 Ch1 🗆 Ch2 🗆 Ch3	🖂 1TX	□ 2TX
🛛 802.11 g	🖾 Ch0 🗆 Ch1 🗆 Ch2 🗆 Ch3	🛛 1TX	🗆 2TX
🛛 802.11 n	🖾 Ch0 🗆 Ch1 🗆 Ch2 🗆 Ch3	⊠ SISO	
□ 802.11 ax	□ Ch0 □ Ch1 □ Ch2 □ Ch3		

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:

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT		
RADIATED EMISSION TEST (BELOW 1 GHz)						
1 to 11	6	OFDM	6	Ch0		
RADIATED EMISSION TEST (ABOVE 1 GHz)						
1 to 11	1, 6, 11	DSSS	1	Ch0		
1 to 11	1, 6, 11	OFDM	6	Ch0		
1 to 11	1, 6, 11	OFDM	MCS 0	Ch0		
	CHANNEL <b>RADIAT</b> 1 to 11 <b>RADIAT</b> 1 to 11 1 to 11	CHANNEL         CHANNEL           RADIATED EMISSIO           1 to 11         6           RADIATED EMISSIO           1 to 11         1, 6, 11           1 to 11         1, 6, 11	CHANNELCHANNELMODULATIONRADIATED EMISSION TEST (BELOV1 to 116OFDMRADIATED EMISSION TEST (ABOVE1 to 111, 6, 11DSSS1 to 111, 6, 11OFDM	AVAILABLE CHANNELTESTED CHANNELMODULATIONRATE (Mbps)RADIATED EMISSION TEST (BELOW 1 GHz)1 to 116OFDM6RADIATED EMISSION TEST (ABOVE 1 GHz)1 to 111, 6, 11DSSS11 to 111, 6, 11OFDM6		

Note: The field strength of radiation emission was measured as EUT three orthogonal plans, E1 / E2 / H, are positioned to pre-scan the emission generating the highest one. The worst position is tested, and recorded.

# 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	Ch0	
802.11g	1 to 11	1, 6, 11	OFDM	6	Ch0	
802.11n 20M	1 to 11	1, 6, 11	OFDM	MCS 0	Ch0	

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#### **MEASUREMENT UNCERTAINTY** 5

Test Items	Unc	ertainty	
AC Power Line Conducted Emission	+/-	2.34	dB
Peak Output Power	+/-	1	dB
6dB Bandwidth & 99% Bandwidth	+/-	1.53	Hz
100 KHz Bandwidth Of Frequency Band Edges	+/-	1.69	dB
Peak Power Density	+/-	1.53	dB
Temperature	+/-	0.4	°C
Humidity	+/-	3.5	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty						
	+/-	2.64	dB	9kHz~30MHz		
Delevizetiene Ventioel	+/-	4.93	dB	30MHz - 1000MHz		
Polarization: Vertical	+/-	4.81	dB	1GHz - 18GHz		
	+/-	4.52	dB	18GHz - 40GHz		
	+/-	2.64	dB	9kHz~30MHz		
	+/-	4.45	dB	30MHz - 1000MHz		
Polarization: Horizontal	+/-	4.81	dB	1GHz - 18GHz		
	+/-	4.52	dB	18GHz - 40GHz		

# 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.

Frequency range	Limits 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

Radiated Emission Test Site: Conduction 1							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUM- BER	LAST CAL.	CAL DUE.		
EMI Test Receiver	R&S	ESCI 7	100759	07/13/2020	07/12/2021		
LISN	SCHWARZ- BECK	NSLK 8127	8127-465	04/09/2021	04/08/2022		
Coaxial Cables	N/A	Coaxial Ca- ble	161207	12/07/2020	12/06/2021		
Test Software	audix	e3	Ver. 6.11- 20180413	N.C.R	N.C.R		

# 6.3 EUT Setup

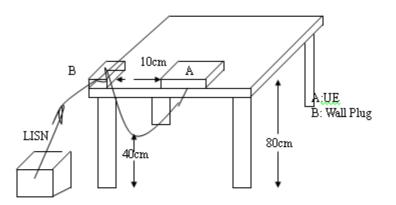
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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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

Note: Refer to next page for measurement data and plots. Note2: The \* reveals the worst-case results that closet to the limit.

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. . .

0.18

0.21

0.25

0.27

0.59

. ....

# AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:ER-2021-4	40062		Test Site	:Conduction 6	6F
Test Mode	:WLAN 2.4	G		Test Date	:2021-04-23	
Power	:AC 120V/6	60Hz		Temp./Humi.	:25.1/62	
Probe	:L			Engineer	:Ricky Chen	
Note:	:					
80 Level (dBuV)						
70						
60						
50						
<b>40</b>	e A					
40 7 7	when and					
30		Atra_				
20		N.M. m				
10		$\sim \sim \sim$	my why way why	mine white and a second	and maple states to a state galander	
0.15 0.2	0.5	1 2 Freque	? ncy (MHz)	5 10	20 30	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
TTEq.	Mode	Reading Level		FS	Linin	Margin
MHz		-	٩D		dDu)/	٩D
	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.40	Deele	44.47	0.04		05.40	00.00
0.16	Peak	44.47	0.04	44.51	65.43	-20.92

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44.57

44.93

43.05

41.33

42.28

Peak

Peak

Peak

Peak

Peak

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0.04

0.04

0.04

0.04

0.14

44.61

44.97

43.09

41.37

42.42

-19.94

-18.13

-18.77

-19.66

-13.58

64.55

63.10

61.86

61.03

56.00



# Report No.: ER/2021/40062 Page: 17 of 103

Report Number Test Mode Power Probe Note:	:ER-2021-4 :WLAN 2.4 :AC 120V/6 :N :	G		Test Site Test Date Temp./Humi. Engineer	:Conduction 6 :2021-04-23 :25.1/62 :Ricky Chen	)F
80 Level (dBuV) 70 60						
50 1 2 3 40 40 30 20	pmm.A		·····			
10 0 0.15 0.2	0.5		ncy (MHz)	5 10	zakuriuluma.juriujatam 20 30	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz F	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.16	Peak	44.61	0.10	44.71	65.43	-20.72
0.19	Peak	45.11	0.10	45.21	64.11	-18.90
0.22	Peak	44.14	0.10	44.24	62.92	-18.68
0.26 0.29	Peak Peak	42.25 39.95	0.10 0.11	42.35 40.06	61.47 60.46	-19.12 -20.40
	Average	39.95 26.57	0.11	40.06 26.75	46.00	-20.40 -19.25
0.60	QP	38.83	0.18	39.01	40.00 56.00	-16.99

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#### DUTY CYCLE OF TEST SIGNAL 7

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

# 7.1 Measurement Procedure:

- 1. Set span = Zero
- 2. RBW = 8MHz
- 3. VBW = 8MHz,
- 4. Detector = Peak

# 7.2 Duty Cycle:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log ( 1/Duty Cycle )	1/T (kHz)	VBW setting (kHz)
802.11b	98.90	0.05	0.12	0.01
802.11g	93.27	0.30	0.70	1.00
802.11n_20	92.84	0.32	0.75	1.00

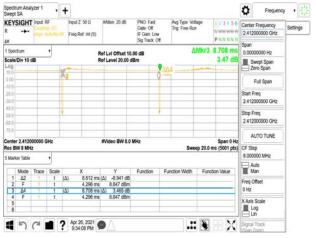
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# 7.3 Duty Cycle test plots

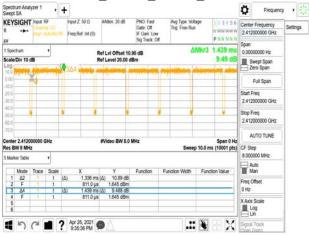
# 802.11b\_20MHz\_Chain0\_2412MHz



## 802.11g\_20MHz\_Chain0\_2412MHz



### 802.11n\_20MHz\_Chain0\_2412MHz



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# 8 PEAK OUTPUT POWER MEASUREMENT

# 8.1 Standard Applicable

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt and the e.i.r.p. shall not exceed 4 W.

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.

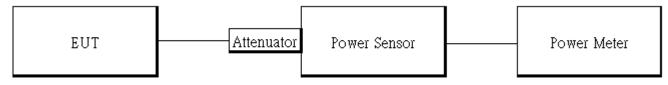
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

# 8.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 2							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUM- BER	LAST CAL.	CAL DUE.		
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022		
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022		
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022		
Attenuator	Mini-Circuit	BW- S10W2+	2	12/16/2020	12/15/2021		

# 8.3 Test Set-up

Power Meter:



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# 8.4 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.

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# 8.5 Measurement Result

### 8.5.1 Peak & Avg

802.1	1b Ch0				
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	20.65	30.00	PASS
2	2417	1	21.94	30.00	PASS
6	2437	1	21.91	30.00	PASS
10	2457	1	22.02	30.00	PASS
11	2462	1	19.57	30.00	PASS
802.1	1b Ch0				
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	17.80	30.00	PASS
2	2417	1	19.15	30.00	PASS
6	2437	1	19.12	30.00	PASS
10	2457	1	19.16	30.00	PASS
11	2462	1	16.61	30.00	PASS

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802.1	1g Ch0				
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	25.77	30.00	PASS
2	2417	6	25.97	30.00	PASS
3	2422	6	26.12	30.00	PASS
6	2437	6	26.10	30.00	PASS
9	2452	6	26.16	30.00	PASS
10	2457	6	26.07	30.00	PASS
11	2462	6	25.32	30.00	PASS
802.1	1g Ch0			•	
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	16.07	30.00	PASS
2	2417	6	16.92	30.00	PASS
3	2422	6	18.12	30.00	PASS
6	2437	6	18.10	30.00	PASS
9	2452	6	18.15	30.00	PASS
10	2457	6	17.14	30.00	PASS
11	2462	6	15.24	30.00	PASS

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802.1	1n_HT20	N Ch0				
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT	
1	2412	MCS0	24.63	30.00	PASS	
2	2417	MCS0	25.47	30.00	PASS	
3	2422	MCS0	26.02	30.00	PASS	
6	2437	MCS0	25.93	30.00	PASS	
9	2452	MCS0	26.08	30.00	PASS	
10	2457	MCS0	25.81	30.00	PASS	
11	2462	MCS0	24.84	30.00	PASS	
802.1	802.11n_HT20M Ch0					
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Limit (dBm)	RESULT	
4						
1	2412	MCS0	14.90	30.00	PASS	
2	2412 2417	MCS0 MCS0	14.90 15.68	30.00 30.00	PASS PASS	
· ·						
2	2417	MCS0	15.68	30.00	PASS	
2	2417 2422	MCS0 MCS0	15.68 18.00	30.00 30.00	PASS PASS	
2 3 6	2417 2422 2437	MCS0 MCS0 MCS0	15.68 18.00 17.71	30.00 30.00 30.00	PASS PASS PASS	

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# 8.5.2 EIRP

802.11	1b Ch0						
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	1	17.80	2.13	19.93	36	PASS
2	2417	1	19.15	2.13	21.28	36	PASS
6	2437	1	19.12	2.13	21.25	36	PASS
10	2457	1	19.16	2.13	21.29	36	PASS
11	2462	1	16.61	2.13	18.74	36	PASS
802.11	1g Ch0						
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	6	16.07	2.13	18.20	36	PASS
2	2417	6	16.92	2.13	19.05	36	PASS
3	2422	6	18.12	2.13	20.25	36	PASS
6	2437	6	18.10	2.13	20.23	36	PASS
9	2452	6	18.15	2.13	20.28	36	PASS
10	2457	6	17.14	2.13	19.27	36	PASS
11	2462	6	15.24	2.13	17.37	36	PASS
802.11	1n_HT20N	1 Ch0					
СН	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	14.90	2.13	17.03	36	PASS
2	2417	MCS0	15.68	2.13	17.81	36	PASS
3	2422	MCS0	18.00	2.13	20.13	36	PASS
6	2437	MCS0	17.71	2.13	19.84	36	PASS
9	2452	MCS0	17.90	2.13	20.03	36	PASS
10	2457	MCS0	16.60	2.13	18.73	36	PASS
11	2462	MCS0	14.87	2.13	17.00	36	PASS

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# 9 EMISSION BANDWIDTH MEASUREMENT

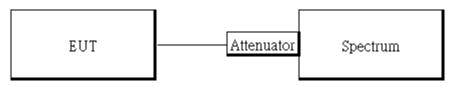
# 9.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz.

# 9.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUM- BER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY60240503	12/11/2020	12/10/2021
Attenuator	Mini-Circuit	BW- S10W2+	2	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021

# 9.3 Test Set-up



# 9.4 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 spectrum analyzer.
- 4. Set the spectrum analyzer as

RBW= 100kHz , VBW = 3 X RBW, Span= 2 to 5 times of the OBW, Sweep=auto, Detector = Peak, and Max hold for -6dB Bandwidth test.

 Set the spectrum analyzer as RBW= 1 % to 5% of 99% Bandwidth , VBW ≥ 3 X RBW, Span= large enough to capture all products of the modulation process,

Sweep=auto,

Detector = Peak, and Max hold for 99% Bandwidth test.

- 6. Turn on the 99% bandwidth function, max reading.
- 7. Repeat above procedures until all test default channel is completed

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## 9.5 6dB Bandwidth

802.11b Ch0			
Freq.	6dB BW	Limit	Result
(MHz)	(kHz)	(kHz)	Result
2412	9048.00	> 500	PASS
2437	9065.00	> 500	PASS
2462	9067.00	> 500	PASS
802.11g Ch0			
Freq.	6dB BW	Limit	Result
(MHz)	(kHz)	(kHz)	Result
2412	15220.00	> 500	PASS
2437	16300.00	> 500	PASS
2462	15210.00	> 500	PASS
802.11_n_HT20 Ch0			
Freq.	6dB BW	Limit	Result
(MHz)	(kHz)	(kHz)	Nesult
2412	15220.00	> 500	PASS
2437	17320.00	> 500	PASS

15200.00

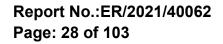
> 500

PASS

\*Refer to next page for plots

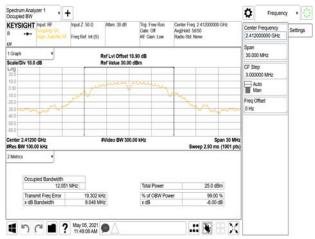
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2462

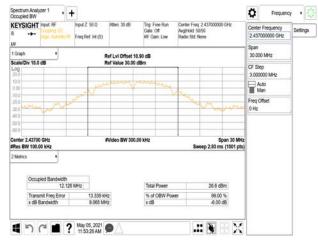




### 802.11b\_20MHz\_Chain0\_2412MHz



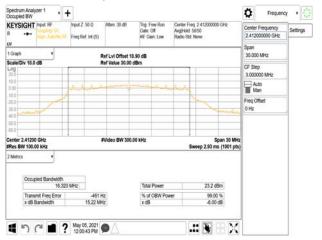
#### 802.11b\_20MHz\_Chain0\_2437MHz



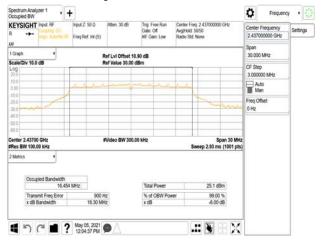
#### 802.11b\_20MHz\_Chain0\_2462MHz



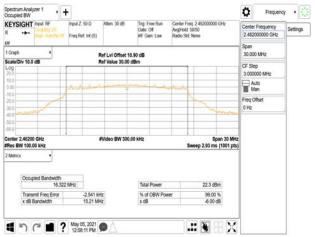
#### 802.11g\_20MHz\_Chain0\_2412MHz



#### 802.11g\_20MHz\_Chain0\_2437MHz



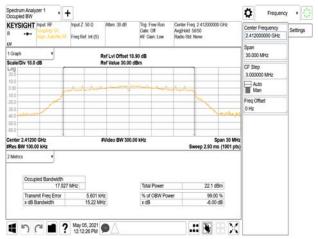
#### 802.11g\_20MHz\_Chain0\_2462MHz



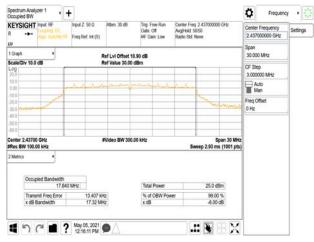
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### 802.11n 20MHz Chain0 2412MHz



#### 802.11n\_20MHz\_Chain0\_2437MHz



#### 802.11n\_20MHz\_Chain0\_2462MHz



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# 9.6 99% Bandwidth

### 802.11b Ch0

Freq.	99% BW
(MHz)	(MHz)
2412	12.082
2437	12.167
2462	12.016

#### 802.11g Ch0

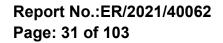
Freq.	99% BW
(MHz)	(MHz)
2412	16.694
2437	16.945
2462	16.663

### 802.11n\_HT20M Ch0

Freq. (MHz)	99% BW (MHz)
2412	17.752
2437	17.994
2462	17.752

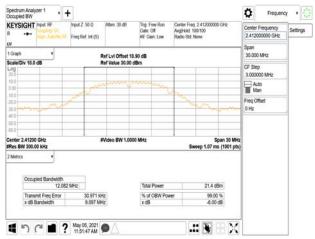
\*Refer to next page for plots

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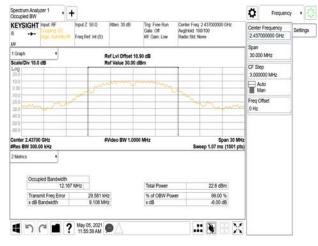




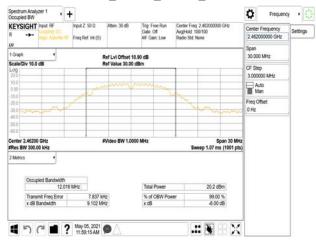
### 802.11b\_20MHz\_Chain0\_2412MHz



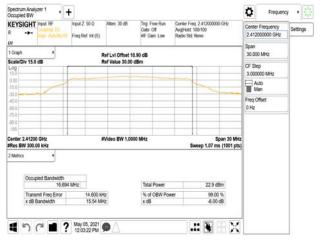
#### 802.11b\_20MHz\_Chain0\_2437MHz



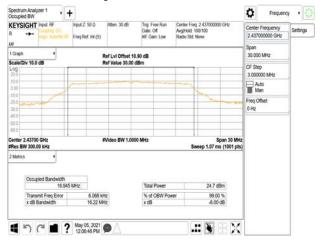
#### 802.11b\_20MHz\_Chain0\_2462MHz



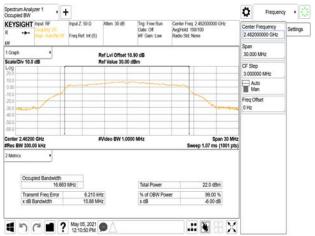
#### 802.11g\_20MHz\_Chain0\_2412MHz



#### 802.11g\_20MHz\_Chain0\_2437MHz



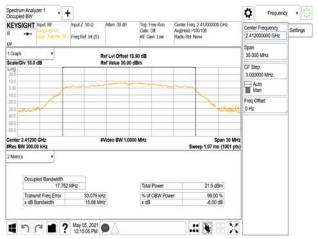
#### 802.11g\_20MHz\_Chain0\_2462MHz



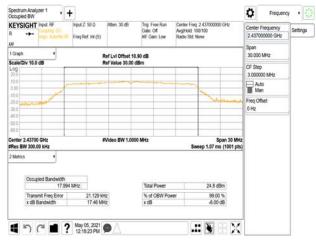
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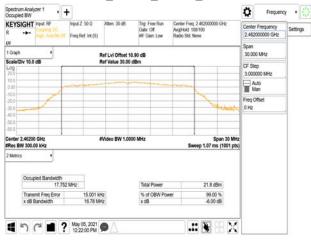
### 802.11n 20MHz Chain0 2412MHz



#### 802.11n\_20MHz\_Chain0\_2437MHz



#### 802.11n\_20MHz\_Chain0\_2462MHz



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# **10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT**

# 10.1 Standard Applicable

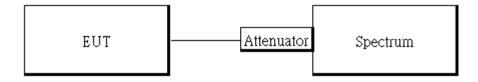
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

# **10.2 Measurement Equipment Used**

	Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUM-	LAST CAL.	CAL DUE.	
EXA Spectrum Analyzer	KEYSIGHT	N9010B	BER MY60240503	12/11/2020	12/10/2021	
		BW-				
Attenuator	Mini-Circuit	S10W2+	2	12/16/2020	12/15/2021	
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021	

# 10.3 Test SET-UP



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# **10.4 Measurement Procedure**

# **Reference Level of Emission Limit:**

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 100kHz & VBW = 300 kHz.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level.

# **Conducted Band Edge:**

- 1. To connect Antenna Port of EUT to Spectrum.
- 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 spectrum analyzer.
- 4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
- 5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
- 6. Mark the highest reading of the emission as the reference level measurement.
- 7. Set DL as the limit = reading on marker of reference level measurement 20dBm
- 8. Mark the highest readings of the emissions outside of 2400MHz~2483.5MHz.
- 9. Repeat above procedures until all default test channel (low, middle, and high) was complete.

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# **Conducted Spurious Emission:**

- 1. To connect Antenna Port of EUT to Spectrum
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Set RBW = 100 kHz & VBW= 300 kHz, Detector =Peak, Sweep = Auto.
- 4. Allow trace to fully stabilize.
- 5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
- 6. Repeat above procedures until all default test channel measured were complete.

# 10.5 Measurement Result

Reference Level of Limit 802.11b mode			
Freq.	PSD	Reference Level of Limit	
(MHz)	(dBm)	(dBm)	
2412	9.17	-10.83	
2437	10.60	-9.40	
2462	8.19	-11.81	

Reference Level of Limit 802.11g mode				
Freq.	PSD	Reference Level of Limit		
(MHz)	(dBm)	(dBm)		
2412	4.82	-15.18		
2437	6.73	-13.27		
2462	3.89	-16.11		

Reference Level of Limit 802.11n20 mode				
Freq.	PSD	Reference Level of Limit		
(MHz)	(dBm)	(dBm)		
2412	3.79	-16.21		
2437	6.93	-13.07		
2462	4.10	-15.90		

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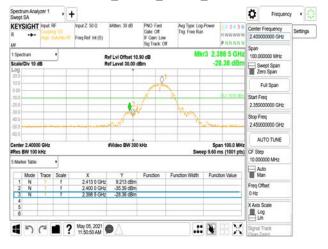
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## Band Edge

802.11b\_20MHz\_Chain0\_2412MHz

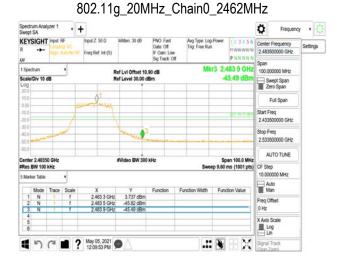


#### 802.11b\_20MHz\_Chain0\_2462MHz

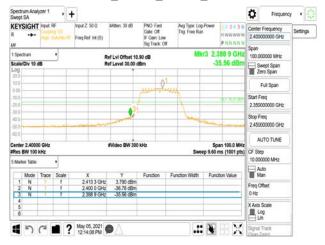


#### 802.11g\_20MHz\_Chain0\_2412MHz

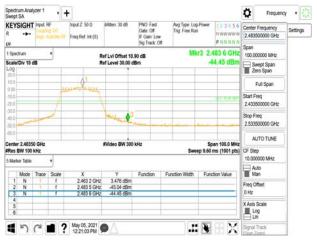




#### 802.11n\_20MHz\_Chain0\_2412MHz



#### 802.11n\_20MHz\_Chain0\_2462MHz



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## **Reference Level**

802.11b 20MHz Chain0 2412MHz



802.11b\_20MHz\_Chain0\_2437MHz

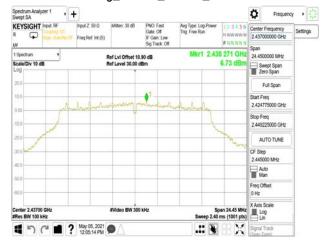


#### 802.11b\_20MHz\_Chain0\_2462MHz





802.11g\_20MHz\_Chain0\_2437MHz



#### 802.11g\_20MHz\_Chain0\_2462MHz



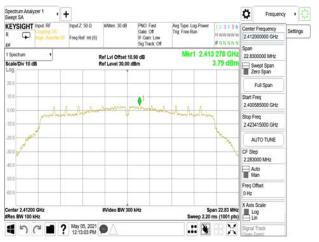
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#### 802.11n\_20MHz\_Chain0\_2412MHz



802.11n\_20MHz\_Chain0\_2437MHz



#### 802.11n\_20MHz\_Chain0\_2462MHz



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## **Spurious Emission**

#### 802.11b 20MHz Chain0 2412MHz

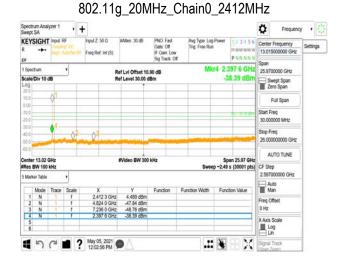


#### 802.11b\_20MHz\_Chain0\_2437MHz



#### 802.11b\_20MHz\_Chain0\_2462MHz

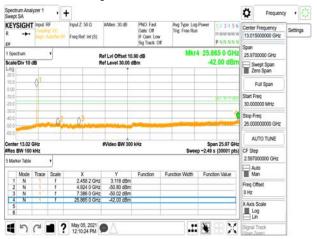




#### 802.11g\_20MHz\_Chain0\_2437MHz



#### 802.11g\_20MHz\_Chain0\_2462MHz



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## 802.11n\_20MHz\_Chain0\_2412MHz



## 802.11n\_20MHz\_Chain0\_2437MHz



#### 802.11n\_20MHz\_Chain0\_2462MHz



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# 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

## **11.1 Standard Applicable**

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 ( $\mu$ V/m)

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## **11.2 Measurement Equipment Used:**

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUM- BER	LAST CAL.	CAL DUE.
Horn Antenna	Schwarzbeck	BBHA9170	184	12/11/2020	12/10/2021
Horn Antenna	Schwarzbeck	BBHA9120D	1441	10/16/2020	10/15/2021
Bi-log Antenna	SCHWAZBECK	VULB9168	378	08/06/2020	08/05/2021
Loop Antenna	ETS.LIND- GREN	6502	148045	10/19/2020	10/18/2021
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY60240503	12/11/2020	12/10/2021
EMI Test Receiver	R&S	ESCI 7	100759	07/13/2020	07/12/2021
Pre-Amplifier	HP	8449B	3008A00578	12/16/2020	12/15/2021
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	12/16/2020	12/15/2021
Pre-Amplifier	HP	8447D	2944A07676	12/16/2020	12/15/2021
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	12/16/2020	12/15/2021
High Pass Filter	WI	WHKX4.0/18G- 10SS	22	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2636/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104	340057/4	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104PEA	800052/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2621/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2617/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2630/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY22962/2	12/16/2020	12/15/2021
Site Cal	SGS	SAC III chamber	N/A	01/01/2021	12/31/2021
Test Software	audix	e3	Ver. 6.11- 20180413	N.C.R	N.C.R

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

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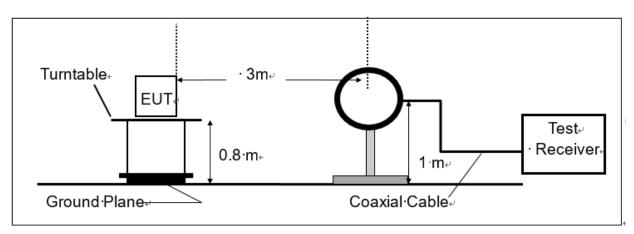
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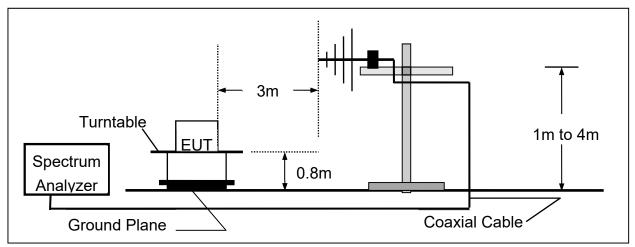


## 11.3 Test SET-UP

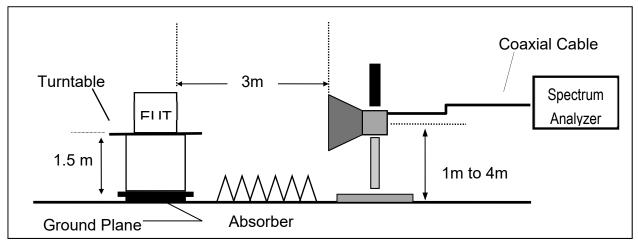
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(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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## 11.4 Measurement Procedure

- 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
- 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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## 11.5 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)

## 11.6 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.

## 11.7 Measurement Result

## Note:

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

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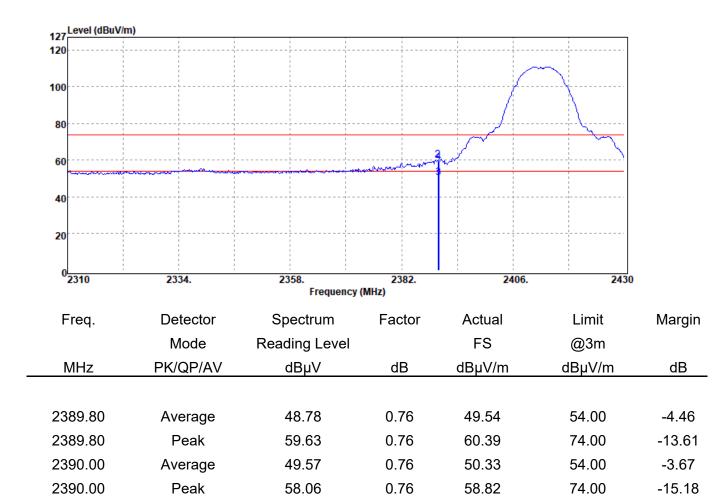
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## Report No.: ER/2021/40062 Page: 46 of 103

## 11.7.1 Radiated Band Edge Measurement Result

Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin

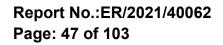


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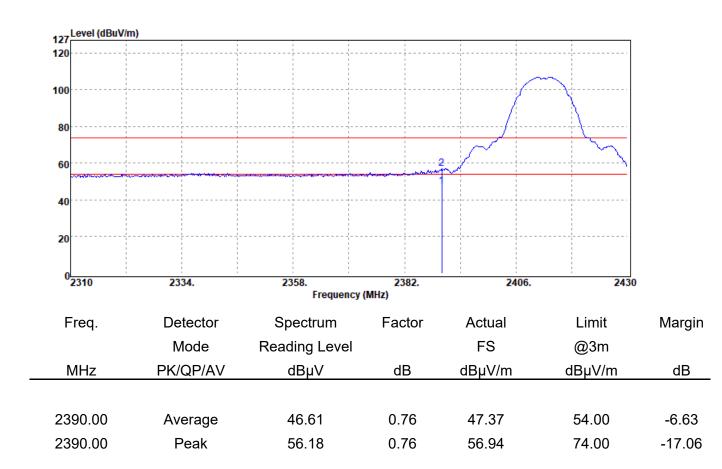
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t (886-2) 2299-3279





EUT Pol	:H Plane	Engineer	:Nick Lin
Test Mode	:Bandedge CH Low	Antenna Pol.	:HORIZONTAL
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Operation Mode	:802.11b	Test Date	:2021-04-22
Report Number	:ER-2021-40062	Test Site	:SAC III Chamber



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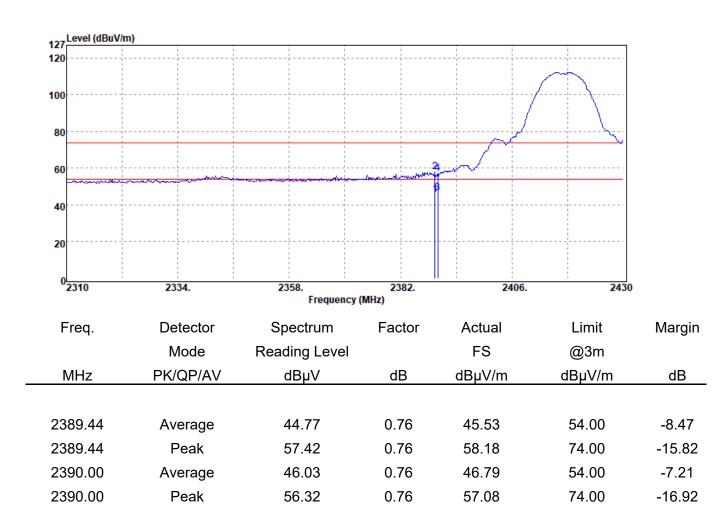
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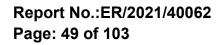
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:ER-2021-40062	Test Site	:SAC III Chamber
:802.11b	Test Date	:2021-04-22
:2417 MHz	Temp./Humi.	:24.1/63
:Bandedge CH Low	Antenna Pol.	:VERTICAL
:H Plane	Engineer	:Nick Lin
	:802.11b :2417 MHz :Bandedge CH Low	:802.11b Test Date :2417 MHz Temp./Humi. :Bandedge CH Low Antenna Pol.

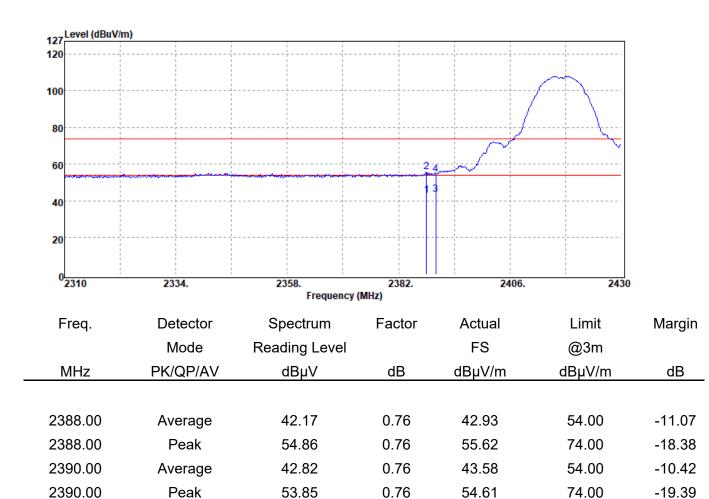


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Report Number:ER-2021-40062Test Site:SAC III	Chamber
Operation Mode :802.11b Test Date :2021-04	1-22
Test Frequency:2417 MHzTemp./Humi.:24.1/63	
Test Mode :Bandedge CH Low Antenna Pol. :HORIZO	ONTAL
EUT Pol :H Plane Engineer :Nick Lin	ı



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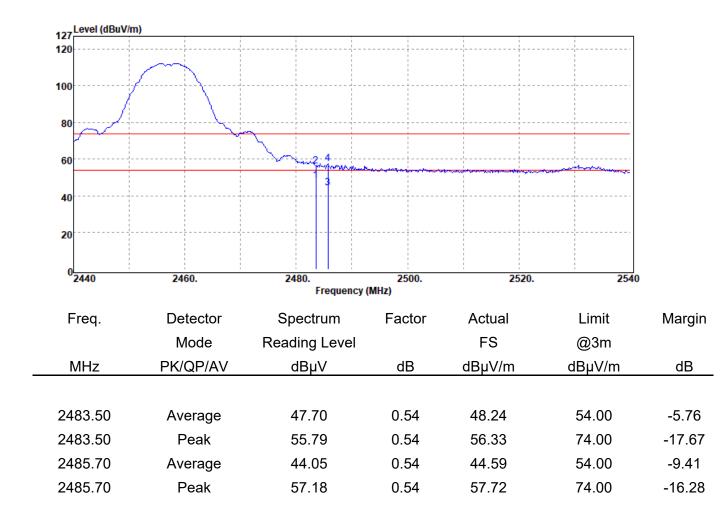
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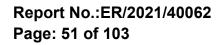
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Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2457 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin



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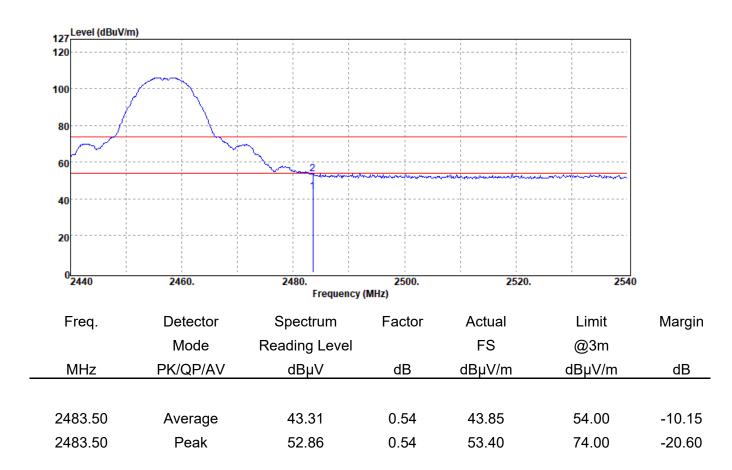
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2457 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Nick Lin

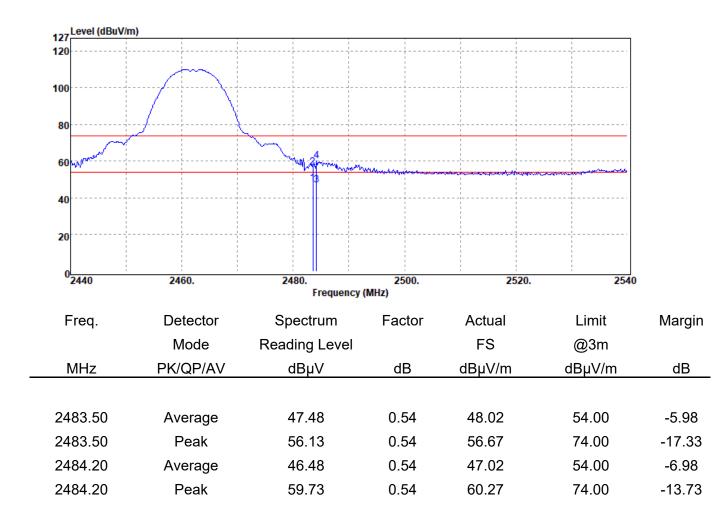


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Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin



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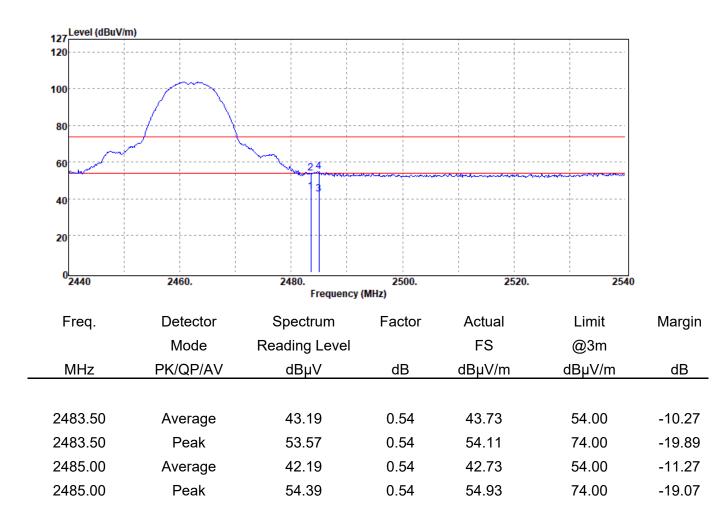
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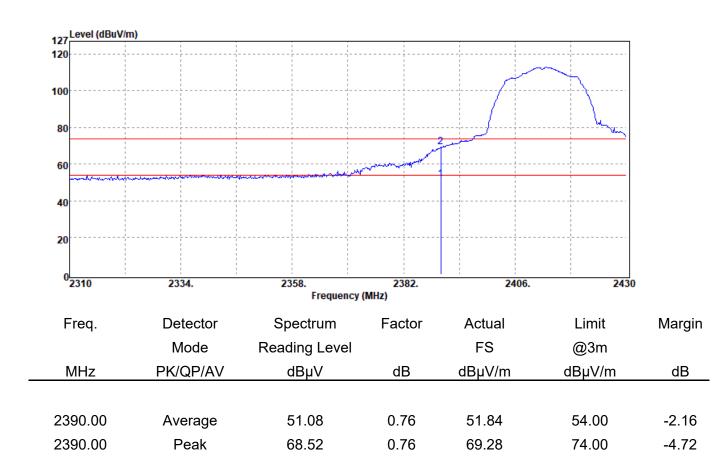
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Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
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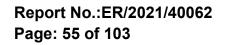


Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
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Test Mode	:Bandedge CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin



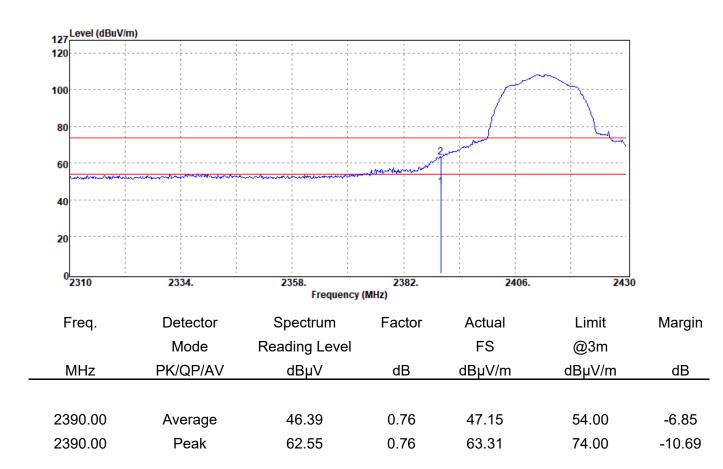
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Nick Lin



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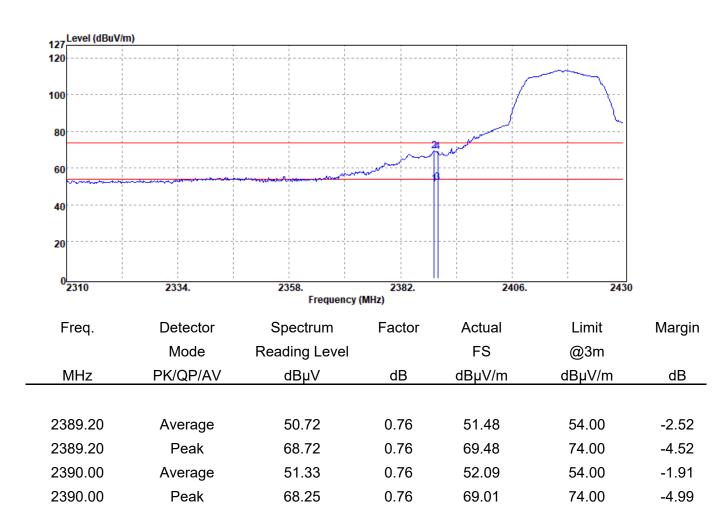
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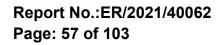


Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2417 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin



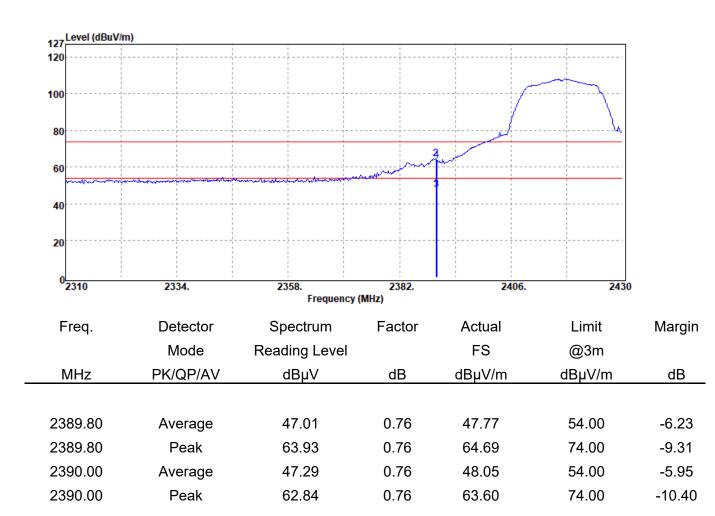
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2417 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Nick Lin



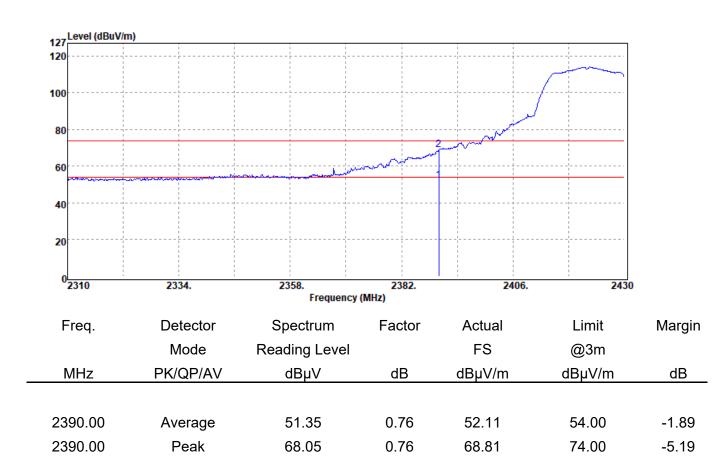
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:ER-2021-40062	Test Site	:SAC III Chamber
:802.11g	Test Date	:2021-04-22
:2422 MHz	Temp./Humi.	:24.1/63
:Bandedge CH Low	Antenna Pol.	:VERTICAL
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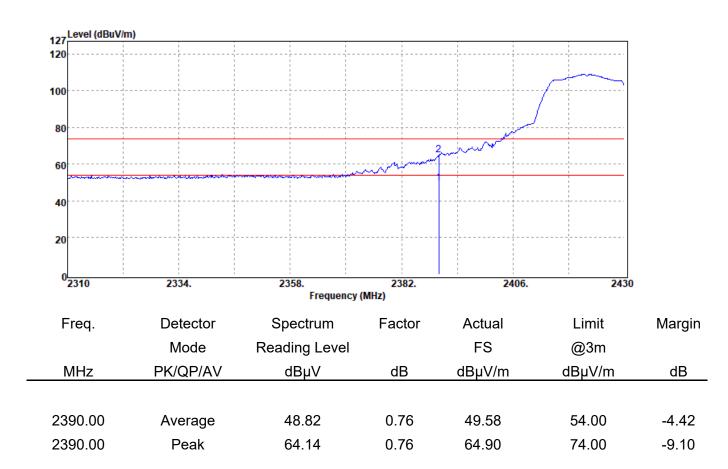


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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2422 MHz	Temp./Humi.	:24.1/63
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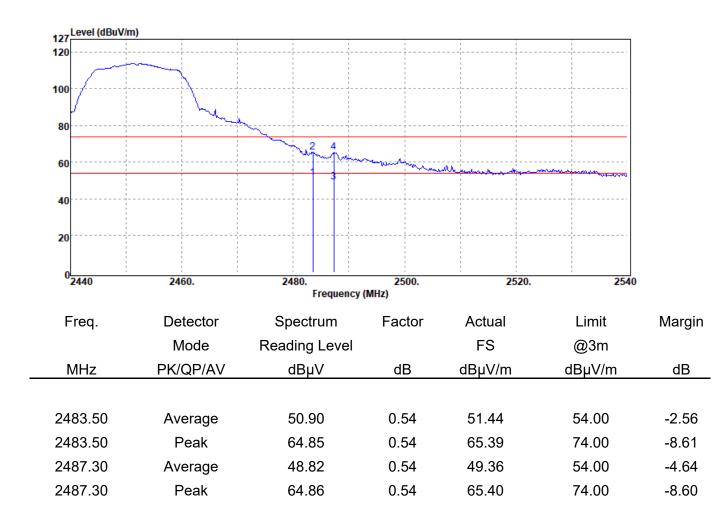


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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
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EUT Pol	:H Plane	Engineer	:Nick Lin



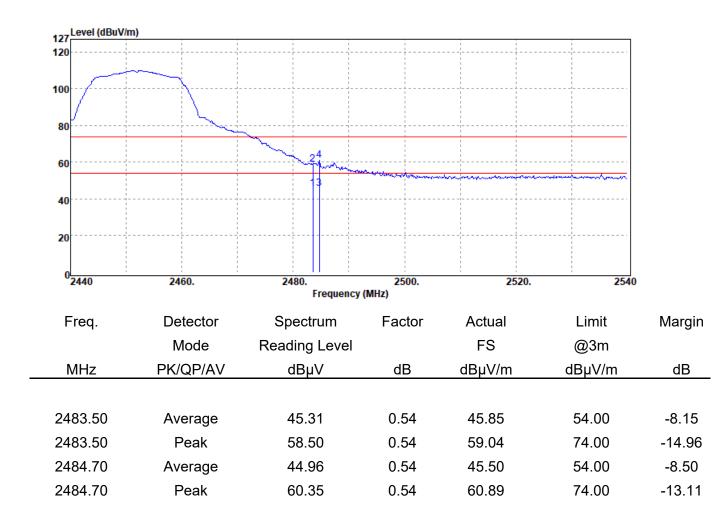
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2452 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Nick Lin



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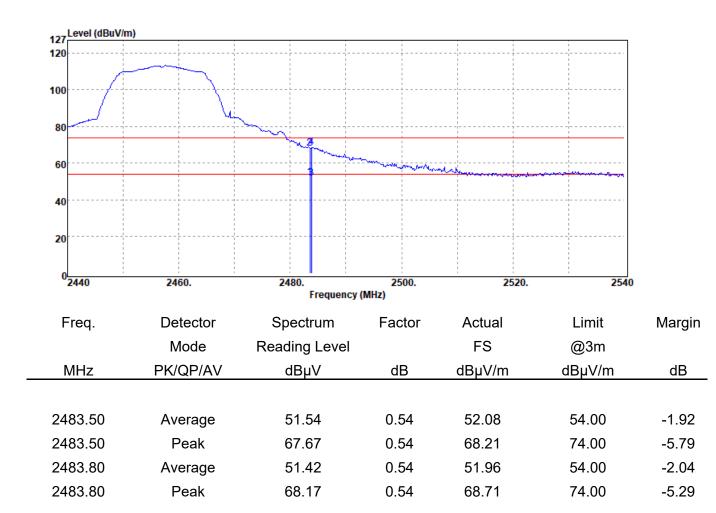
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2457 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin

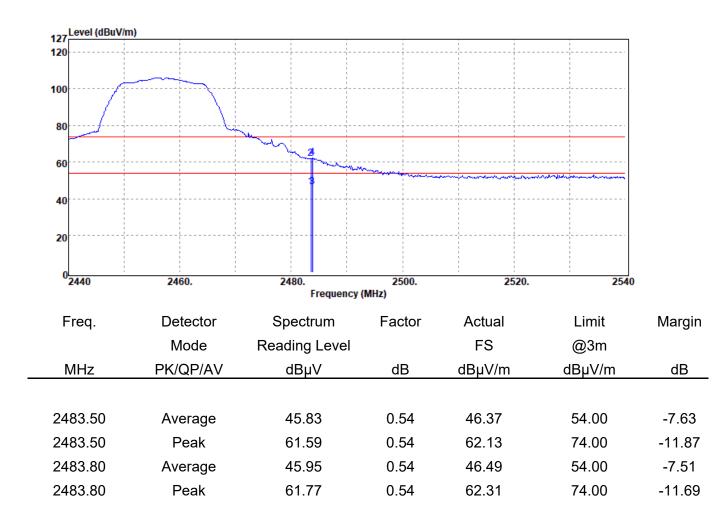


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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2457 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Nick Lin



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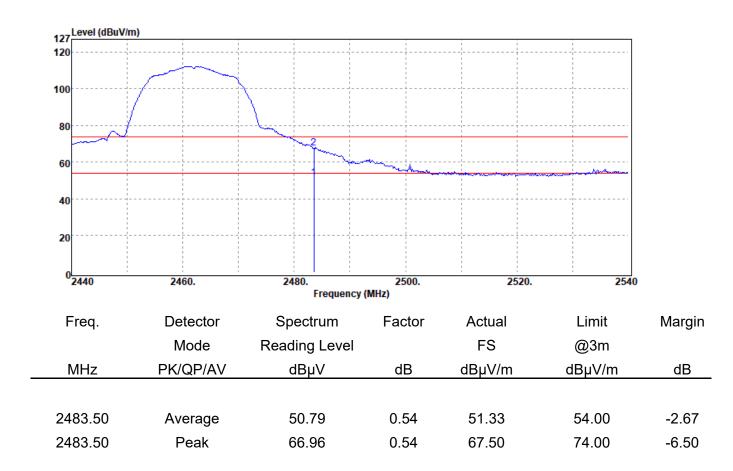
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
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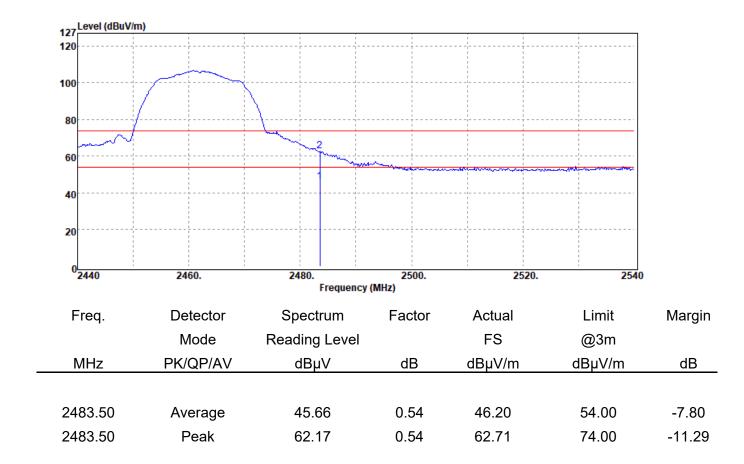


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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
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EUT Pol	:H Plane	Engineer	:Nick Lin



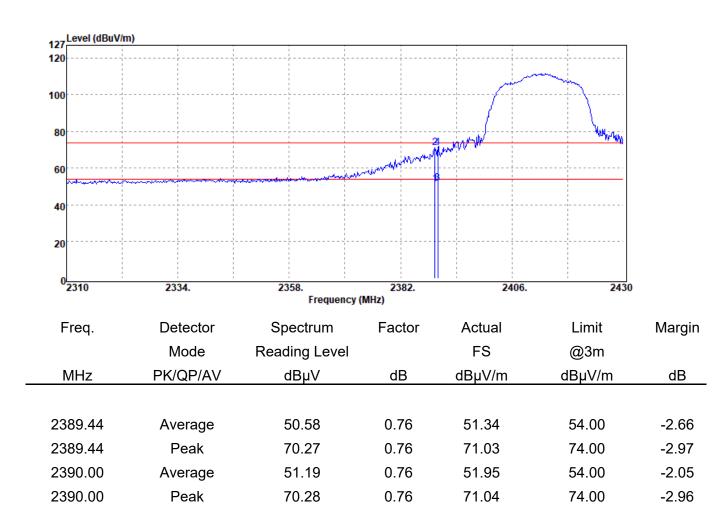
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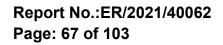
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin

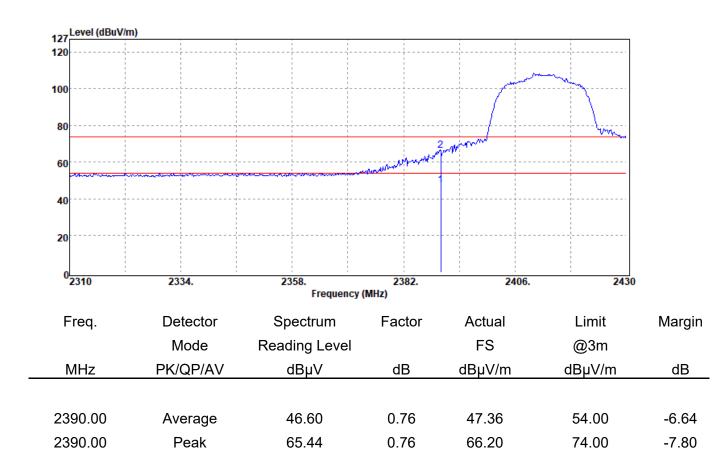


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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
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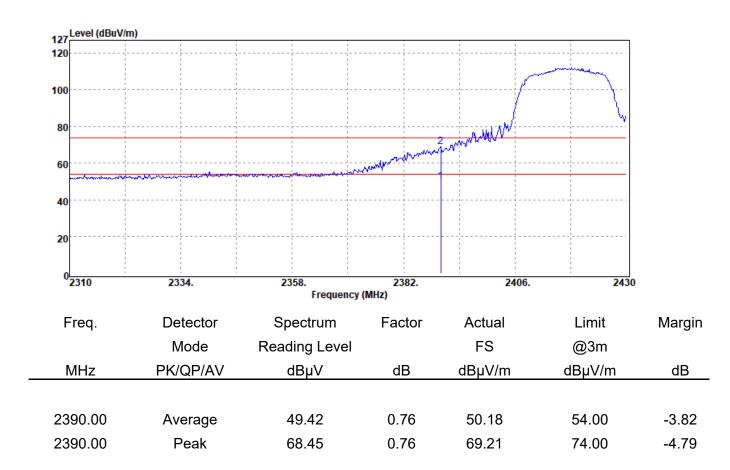


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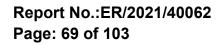


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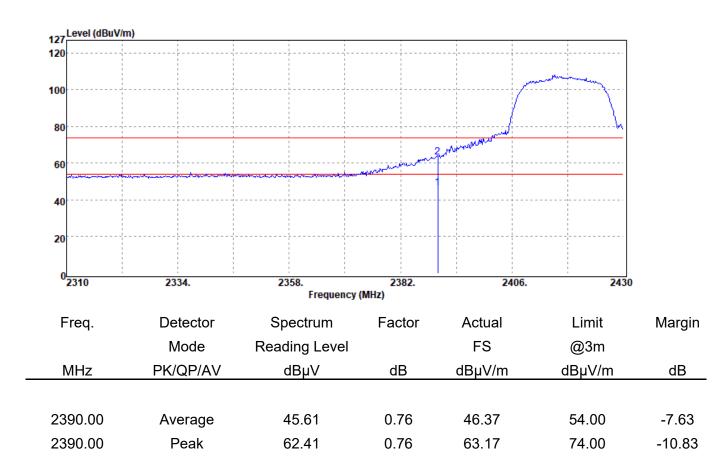
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2417 MHz	Temp./Humi.	:24.1/63
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EUT Pol	:H Plane	Engineer	:Nick Lin



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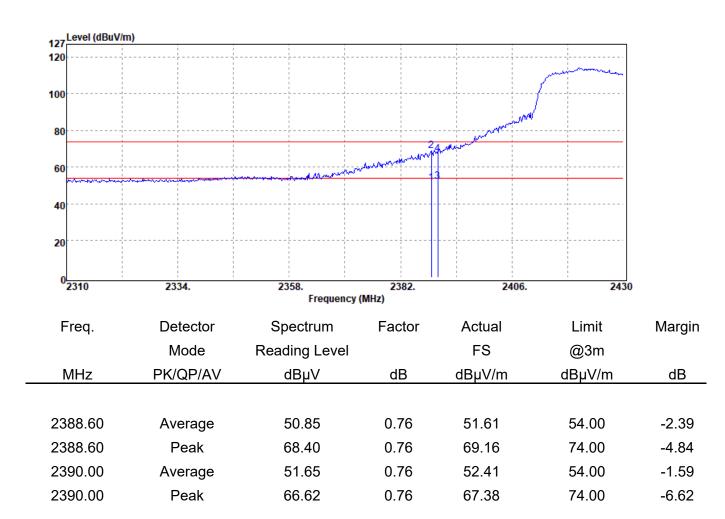
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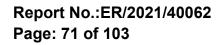
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
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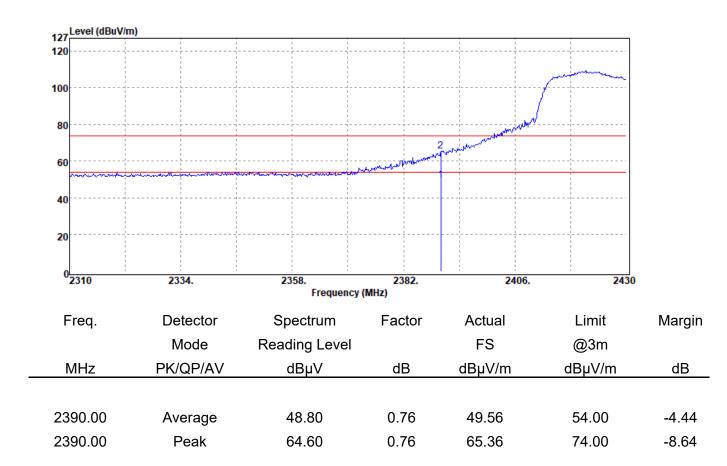


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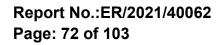


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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber



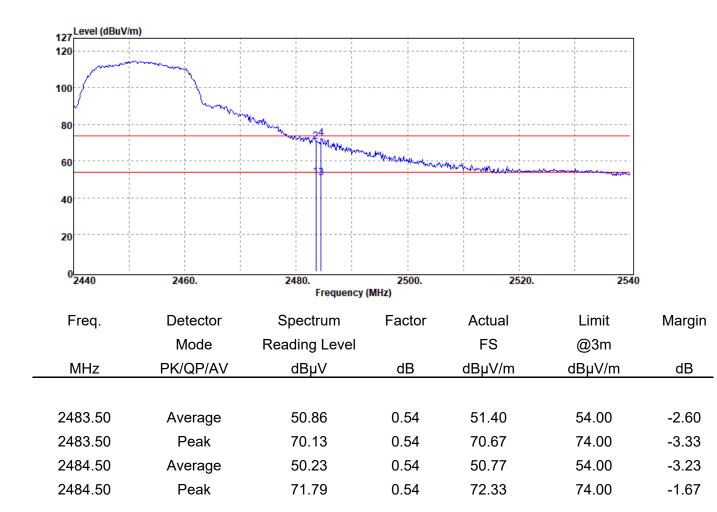
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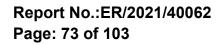


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Operation Mode	:802.11n20	Test Date	:2021-04-22
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Test Mode	:Bandedge CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin



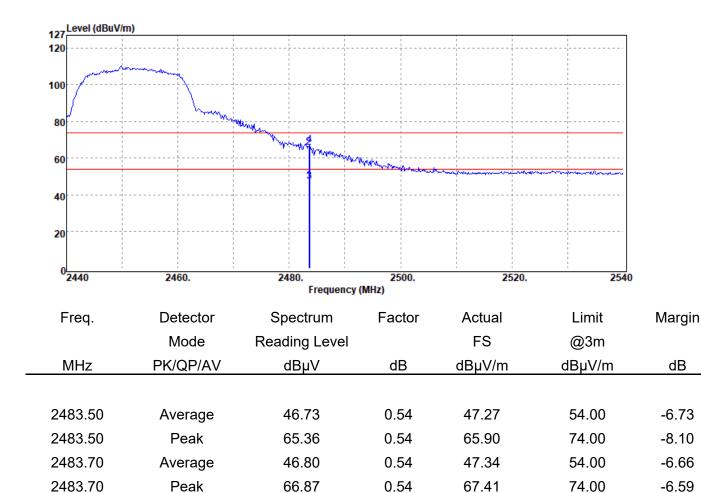
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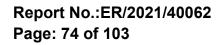


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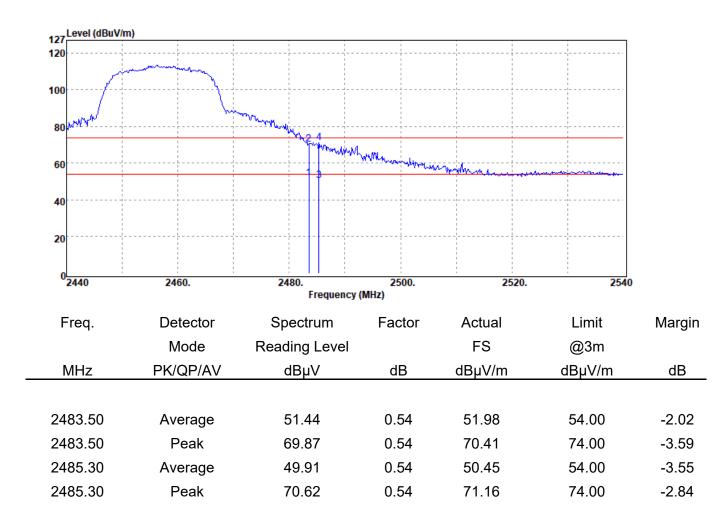
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2457 MHz	Temp./Humi.	:24.1/63
Test Mode	:Bandedge CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Nick Lin

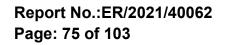


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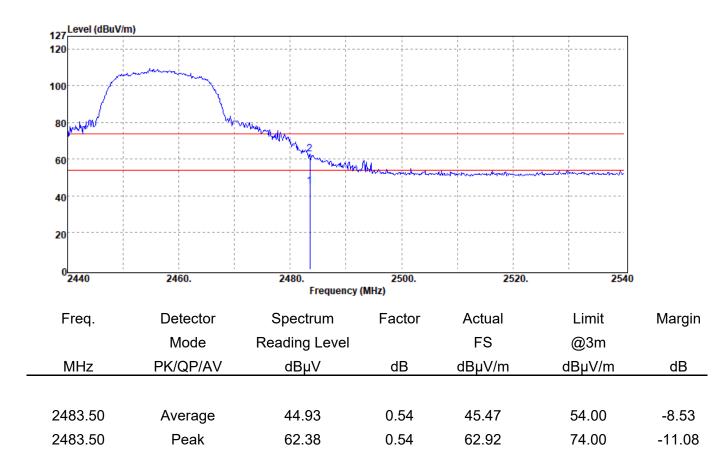
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2457 MHz	Temp./Humi.	:24.1/63
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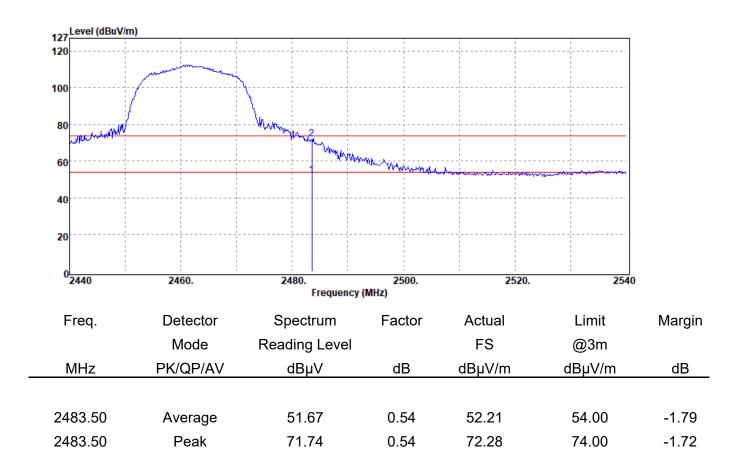
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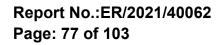
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Test Mode	:Bandedge CH High	Antenna Pol.	:VERTICAL
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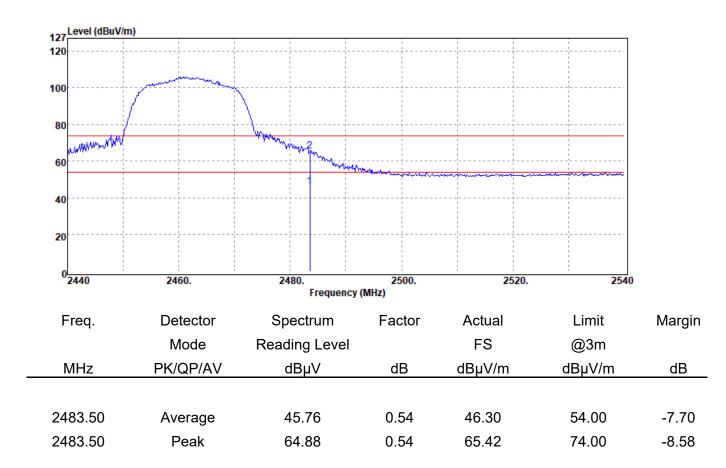
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EUT Pol	:H Plane	Engineer	:Nick Lin



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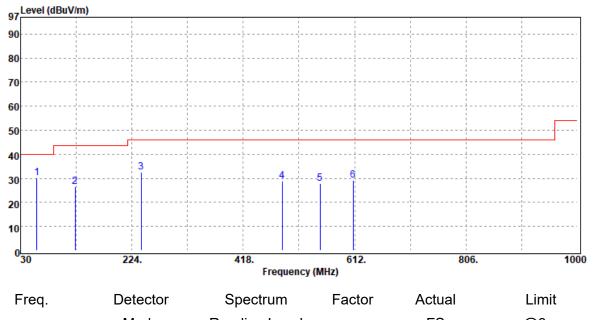
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#### 11.7.2 Below 1GHz Worst-Case Emission:

Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2437 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
58.13	Peak	39.36	-9.10	30.26	40.00	-9.74
125.06	Peak	35.92	-9.37	26.55	43.50	-16.95
240.49	Peak	41.42	-8.80	32.62	46.00	-13.38
485.90	Peak	31.68	-2.97	28.71	46.00	-17.29
551.86	Peak	29.34	-1.46	27.88	46.00	-18.12
609.09	Peak	28.52	0.72	29.24	46.00	-16.76

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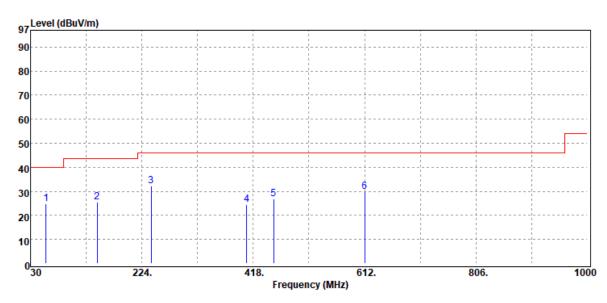
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:ER-2021-40062	Test Site	:SAC III Chamber
:802.11g	Test Date	:2021-04-22
:2437 MHz	Temp./Humi.	:24.1/63
:Tx CH Mid	Antenna Pol.	:HORIZONTAL
:H Plane	Engineer	:Ricky Chen
	:802.11g :2437 MHz :Tx CH Mid	:2437 MHz Temp./Humi. :Tx CH Mid Antenna Pol.



Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level		FS	@3m	
PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
Peak	33.78	-8.99	24.79	40.00	-15.21
Peak	33.54	-7.87	25.67	43.50	-17.83
Peak	40.93	-8.80	32.13	46.00	-13.87
Peak	29.22	-4.60	24.62	46.00	-21.38
Peak	29.34	-2.65	26.69	46.00	-19.31
Peak	29.36	0.62	29.98	46.00	-16.02
	Mode PK/QP/AV Peak Peak Peak Peak Peak Peak	ModeReading LevelPK/QP/AVdBµVPeak33.78Peak33.54Peak40.93Peak29.22Peak29.34	Mode         Reading Level           PK/QP/AV         dBµV         dB           Peak         33.78         -8.99           Peak         33.54         -7.87           Peak         40.93         -8.80           Peak         29.22         -4.60           Peak         29.34         -2.65	Mode         Reading Level         FS           PK/QP/AV         dBμV         dB         dBμV/m           Peak         33.78         -8.99         24.79           Peak         33.54         -7.87         25.67           Peak         40.93         -8.80         32.13           Peak         29.22         -4.60         24.62           Peak         29.34         -2.65         26.69	ModeReading LevelFS@3mPK/QP/AVdBμVdBdBμV/mdBμV/mPeak33.78-8.9924.7940.00Peak33.54-7.8725.6743.50Peak40.93-8.8032.1346.00Peak29.22-4.6024.6246.00Peak29.34-2.6526.6946.00

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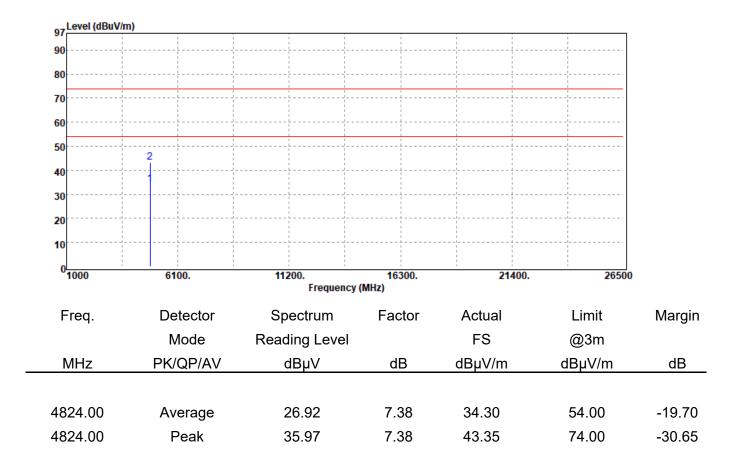
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### 11.7.3 Above 1GHz Emission:

Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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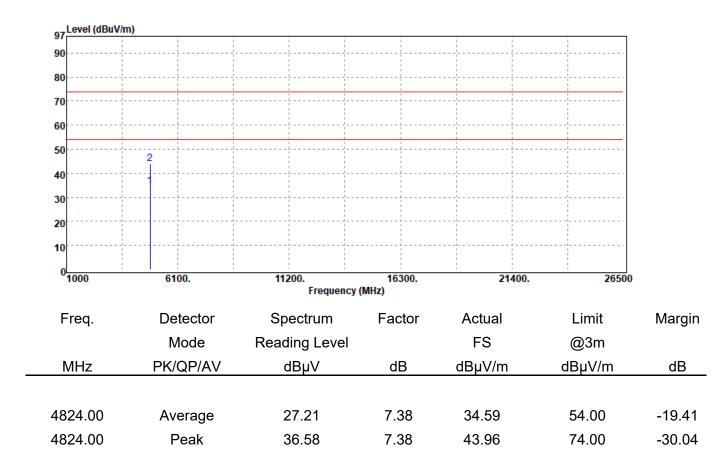


### Report No.:ER/2021/40062 Page: 81 of 103

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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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.

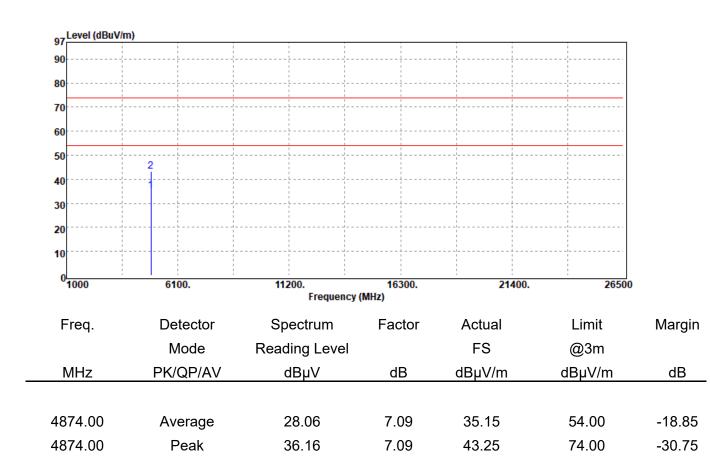
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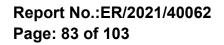
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Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2437 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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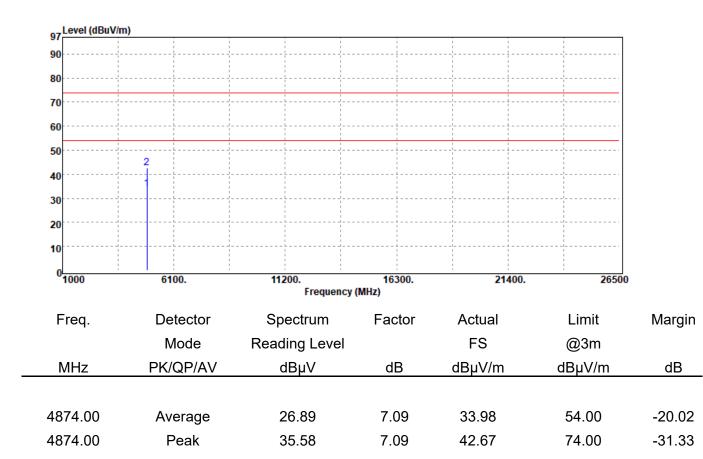
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2437 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



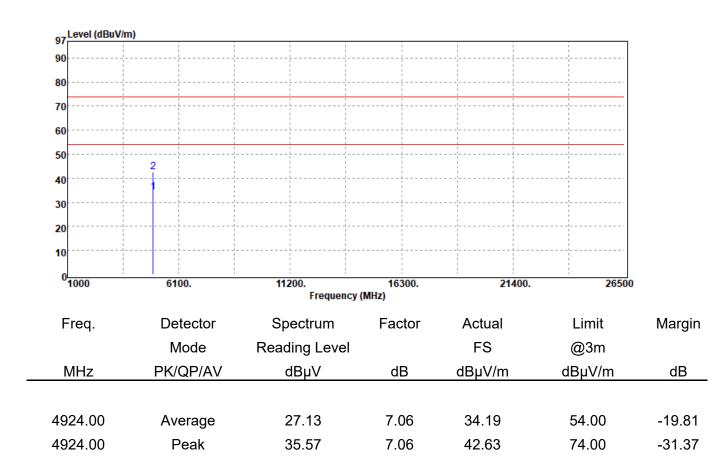
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



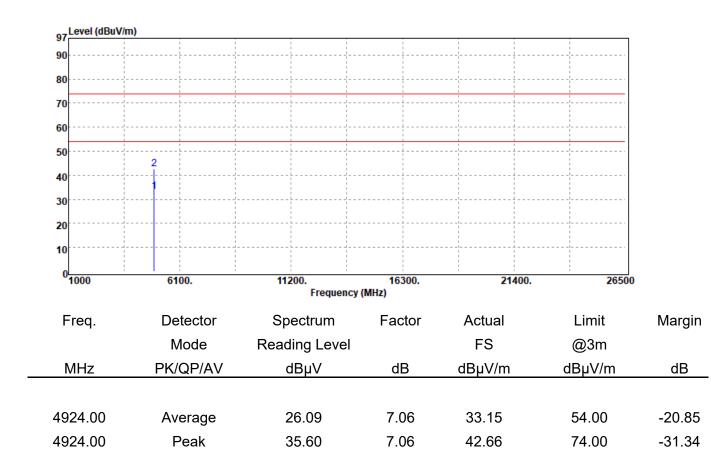
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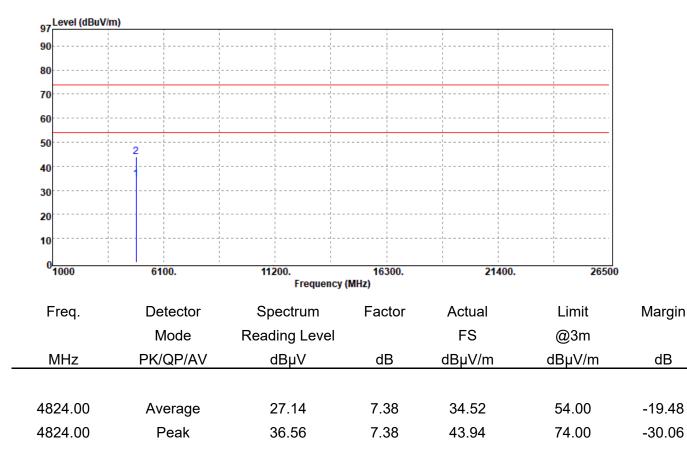
Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11b	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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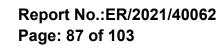


Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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eration Mode		10002		Test Date	:2021-04-22
ort Number	:ER-2021-	40062		Test Site	:SAC III Cha

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	Frequency	(MHz)	

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	27.26	7.38	34.64	54.00	-19.36
4824.00	Peak	35.69	7.38	43.07	74.00	-30.93

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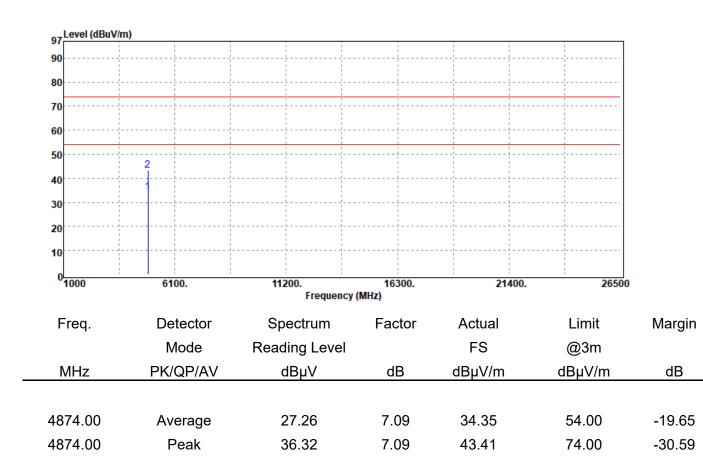
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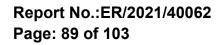


Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2437 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



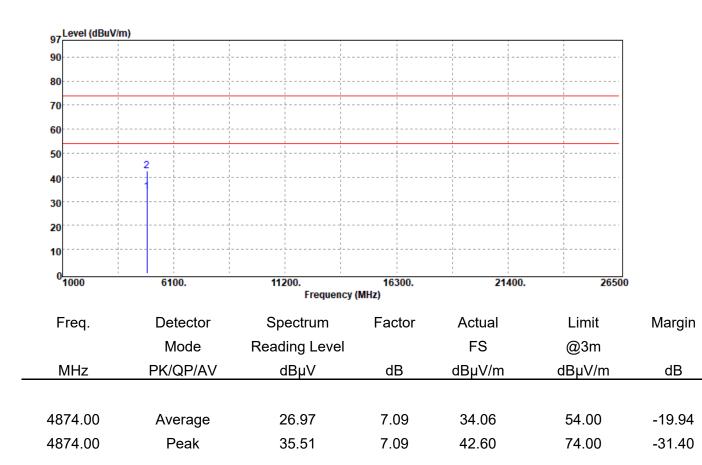
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2437 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



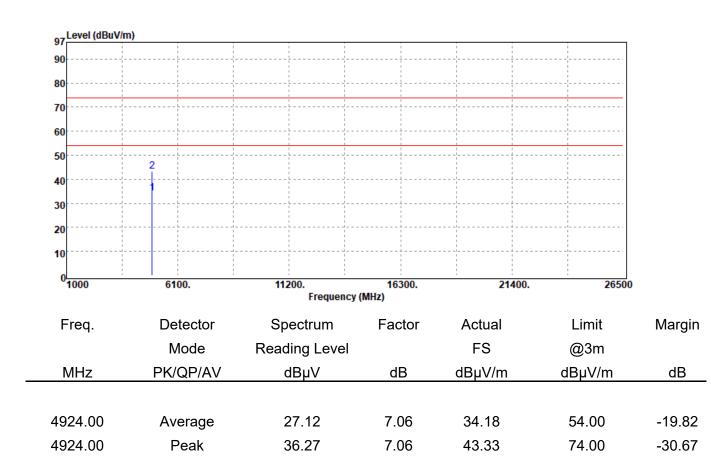
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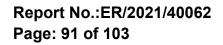


Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



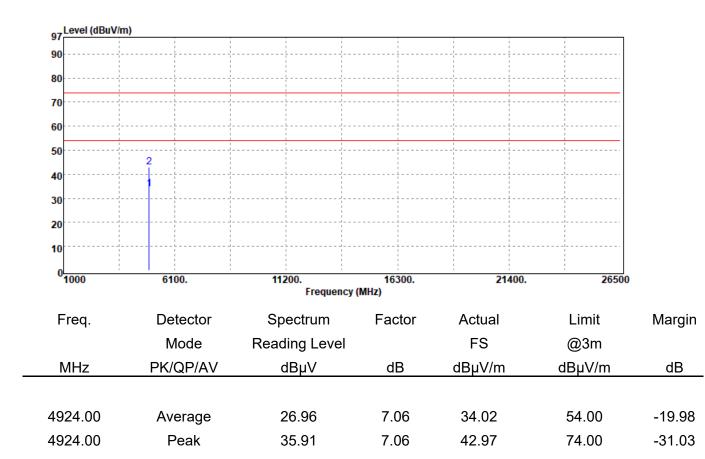
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11g	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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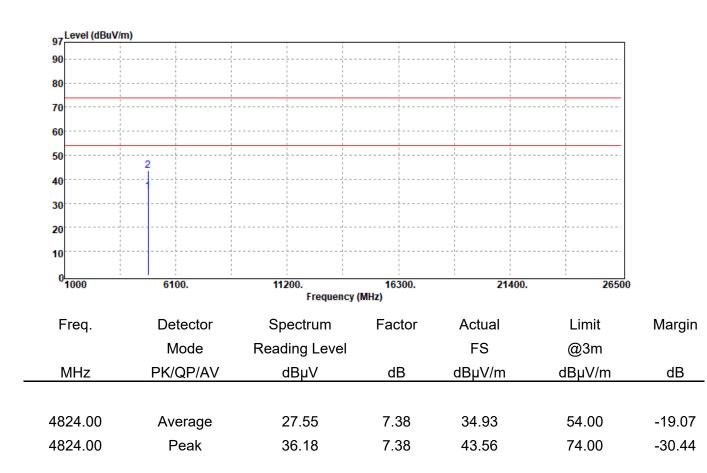
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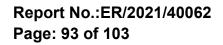
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Low	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen

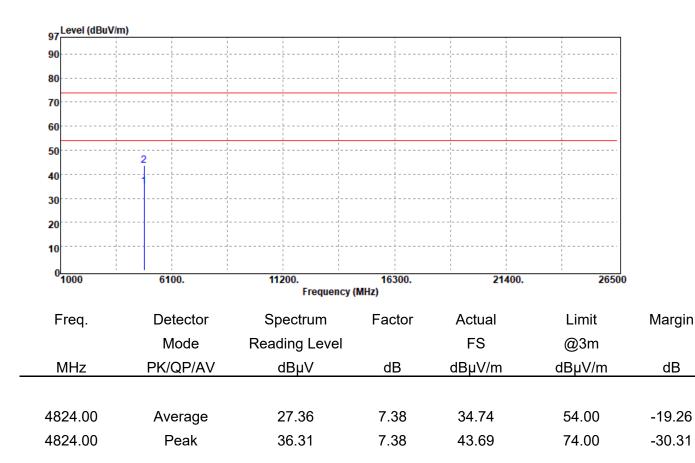


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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2412 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Low	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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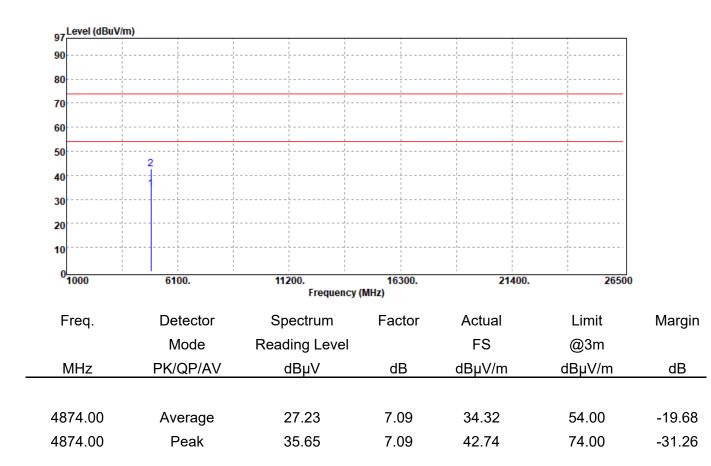
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2437 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Mid	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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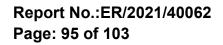
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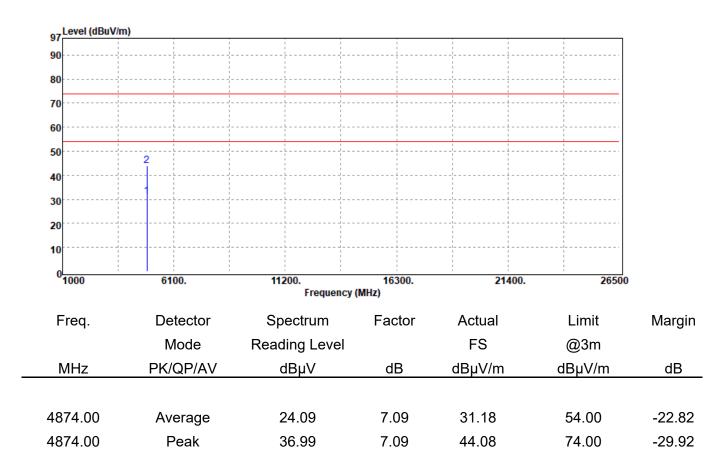
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2437 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH Mid	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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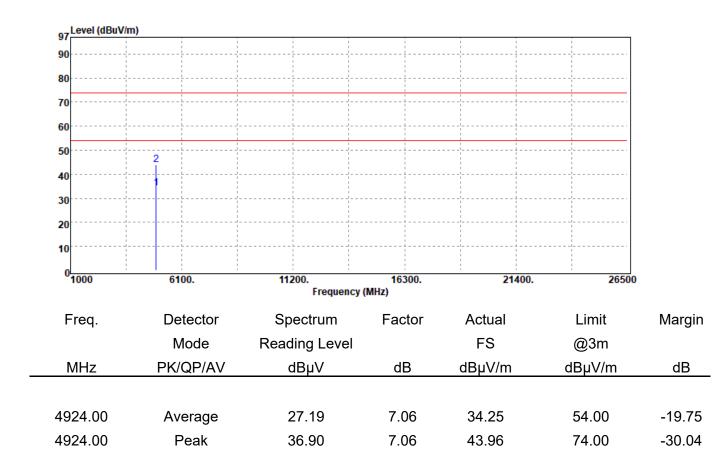
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Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH High	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ricky Chen
	C C		_

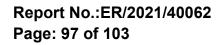


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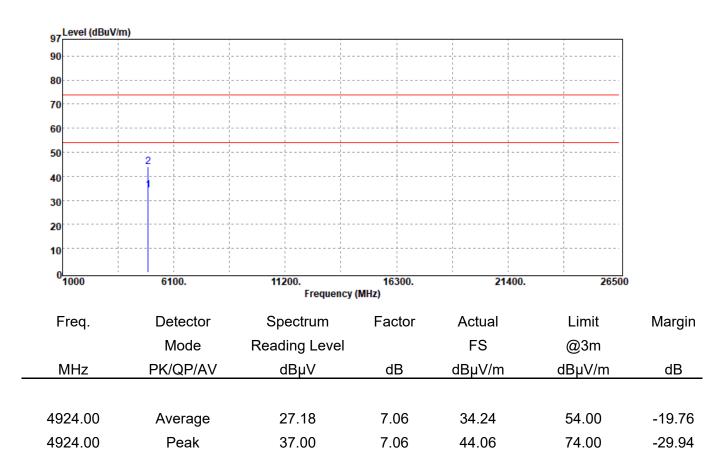
台灣檢驗科技股份有限公司

t (886-2) 2299-3279





Report Number	:ER-2021-40062	Test Site	:SAC III Chamber
Operation Mode	:802.11n20	Test Date	:2021-04-22
Test Frequency	:2462 MHz	Temp./Humi.	:24.1/63
Test Mode	:Tx CH High	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ricky Chen



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# **12 POWER SPECTRAL DENSITY**

# 12.1 Standard Applicable

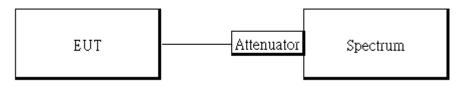
### Per Part 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

## 12.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 2							
EQUIPMENT TYPE MFR MODEL SERIAL NUM- NUMBER BER				LAST CAL.	CAL DUE.		
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY60240503	12/11/2020	12/10/2021		
Attenuator	Mini-Circuit	BW- S10W2+	2	12/16/2020	12/15/2021		
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021		

#### 12.3 Test Set-up



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# **12.4 Measurement Procedure**

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 3 kHz & VBW = 10 kHz.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level.

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### 12.5 Measurement Result

### 12.5.1 Power spectral density

POWER DENSITY 802.11b						
Freq.	Ch0	PSD	Limit	Result		
(MHz)	PSD	(dBm/3kHz)	(dBm/3kHz)	Result		
2412	-4.35	-4.35	8.00	PASS		
2437	-3.27	-3.27	8.00	PASS		
2462	-6.01	-6.01	8.00	PASS		

POWER DENSITY 802.11g						
Freq.	Ch0	PSD	Limit	Result		
(MHz)	PSD	(dBm/3kHz)	(dBm/3kHz)	Nesult		
2412	-8.07	-8.07	8.00	PASS		
2437	-6.13	-6.13	8.00	PASS		
2462	-8.7	-8.70	8.00	PASS		

POWER DENSITY 802.11n HT20						
Freq.	Ch0	PSD	Limit	Result		
(MHz)	PSD	(dBm/3kHz)	(dBm/3kHz)	Nesuit		
2412	-8.78	-8.78	8.00	PASS		
2437	-6.59	-6.59	8.00	PASS		
2462	-8.81	-8.81	8.00	PASS		

\*Refer to next page for plots

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#### 802.11b 20MHz Chain0 2412MHz



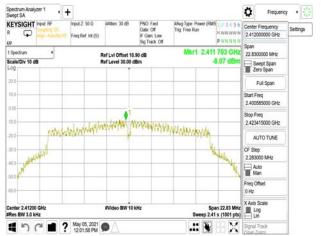
802.11b\_20MHz\_Chain0\_2437MHz



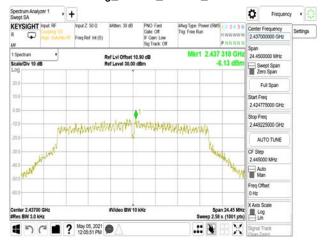
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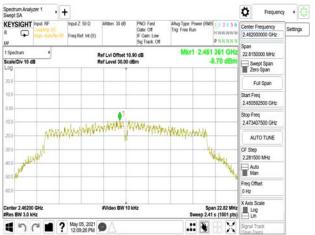
#### 802.11g 20MHz Chain0 2412MHz



802.11g\_20MHz\_Chain0\_2437MHz



#### 802.11g\_20MHz\_Chain0\_2462MHz



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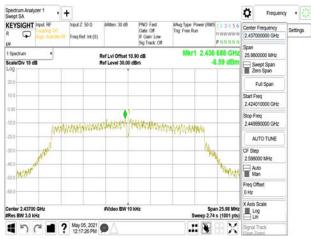
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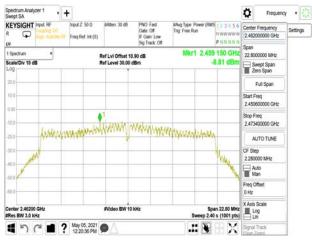
#### 802.11n\_20MHz\_Chain0\_2412MHz



802.11n\_20MHz\_Chain0\_2437MHz



#### 802.11n\_20MHz\_Chain0\_2462MHz



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# **13 ANTENNA REQUIREMENT**

# 13.1 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.

## **13.2 Antenna Connected Construction**

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

~ End of Report ~

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