

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	Askey Computer Corporation 10F, No 119, JianKang Rd., Zhonghe Dist., New Taipei City, Taiwan 23585
Product Name:	Cat 12 Indoor CPE
Brand Name:	Verizon
Model No.:	ASK-RTL108
Model Difference:	N/A
Report Number:	E2/2019/B0013
FCC ID:	H8N-ASK-RTL108
FCC Rule Part:	§15.247, Cat: DTS
Issue Date:	Mar. 06, 2020
Date of Test:	Nov. 26, 2019 ~ Mar. 04, 2020
Date of EUT Re- ceived:	Nov. 26, 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: \_\_\_\_\_\_CHUN; CHIZEH, CHIEN

Chun Chieh Chen / Supervisor



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Revision History								
Report Number	Report Number Revision Description Issue Date Remark							
E2/2019/B0013	Rev.00	Original.	Mar. 06, 2020	Revised By: Yuri Tsai				

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#### **GENERAL INFORMATION** 1

#### **1.1 Product description**

Product Name:	Cat 12 Indo	Cat 12 Indoor CPE				
Brand Name:	Verizon	Verizon				
Model No.:	ASK-RTL1	ASK-RTL108				
Model Difference:	N/A	N/A				
Hardware Version:	REV 3.0	REV 3.0				
Software Version:	N/A					
	12Vdc from	n AC/DC Adapter				
Power Supply:	Adapter:	Adapter: 2. Model No.:PS24L120K2000UD, Supplier:FLYPOWER 2. Model No.:WB-24J12FU, Supplier: Asian Power Devices Inc.				

Wi-Fi 802.11	Frequency Range	Channels	Rated Power (dBm)	Modulation Technology		
b		28.81				
g	2412-2462	11	27.64			
n_HT20			29.30	OFDM		
n_HT40	2422-2452	7	26.90			
Modulation	Modulation type: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM					
Antenna De	Antenna Designation: PIFA Antenna, Antenna Gain: 1.87dBi (ANT1) / 2.37dBi (ANT2)					
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_20MHz: 6.5 – 144.4Mbps 802.11 n_40MHz: 13.5 – 300.0Mbps						

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## 1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247 FCC KDB 558074 D01 DTS Meas. Guidance v05r02 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 ANSI C63.10:2013

# 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory (TAF code 0513) No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333

FCC Designation number: TW0002

# 1.4 Special Accessories

There are no special accessories used while test was conducted.

## **1.5 Equipment Modifications**

There was no modification incorporated into the EUT.

# 1.6 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 & Conduction (AC Power Line)



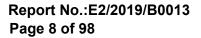
Fig. 2-2 Conducted (Antenna Port) Configuration Emission



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	T460p	P0001013	Shielded	Unshielded

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#### SUMMARY OF TEST RESULTS 3

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Emission Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.205 §15.209 §15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.203 §15.247(b)	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.

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

9 channels are provided for 802.11n 40M

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

# 4.2 The Worst Test Modes and Channel Details

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

The gevin UE is pre-scanned among below modes.

Modulation	Tr	ansmiss	ion Chai	Multiple Transmission Spatial	
🛛 802.11 b	⊠ Ch0	🛛 Ch1	$\Box$ Ch2	$\Box$ Ch3	⊠ 2TX
⊠ 802.11 g	⊠ Ch0	🛛 Ch1	$\Box$ Ch2	$\Box$ Ch3	⊠ 2TX
🛛 802.11 n	⊠ Ch0	🛛 Ch1	□ Ch2	$\Box$ Ch3	🛛 MIMO

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

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#### 4.3 Radiated Emission Test:

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT			
RADIATED EMISSION TEST (BELOW 1 GHz)								
802.11g	1 to 11	1, 6, 11	OFDM	6	2TX			
	RADIATED EMISSION TEST (ABOVE 1 GHz)							
802.11b	1 to 11	1, 6, 11	DSSS	1	2TX			
802.11g	1 to 11	1, 6, 11	OFDM	6	2TX			
802.11n 20M	1 to 11	1, 6, 11	OFDM	MCS 8	MIMO			
802.11n 40M	3 to 9	3, 6, 9	OFDM	MCS 8	MIMO			

#### Note:

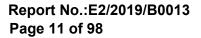
The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

#### 4.4 Antenna Port Conducted Mesurement:

CONDUCTED TEST							
MODE	AVAILABLE CHANNEL			DATA RATE (Mbps)	ANTENNA PORT		
802.11b	1 to 11	1, 6, 11	DSSS	1	2TX		
802.11g	1 to 11	1, 6, 11	OFDM	6	2TX		
802.11n 20M	1 to 11	1, 6, 11	OFDM	MCS 8	MIMO		
802.11n 40M	3 to 9	3, 6, 9	OFDM	MCS 8	MIMO		

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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				
	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				
	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.

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	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

Conducted Emission Test Site							
EQUIPMENT	EQUIPMENT MFR MODEL SERIAL LAST CAL				CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
LISN	TESEQ	NNB 51	36076	02/13/2019	02/12/2020		
EMI Test Receiver	R&S	ESCI	101342	04/26/2019	04/25/2020		

#### 6.3 EUT Setup

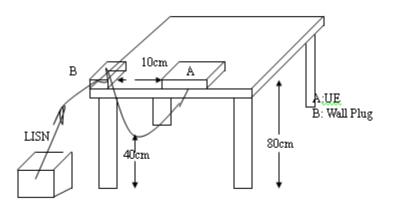
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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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.
- 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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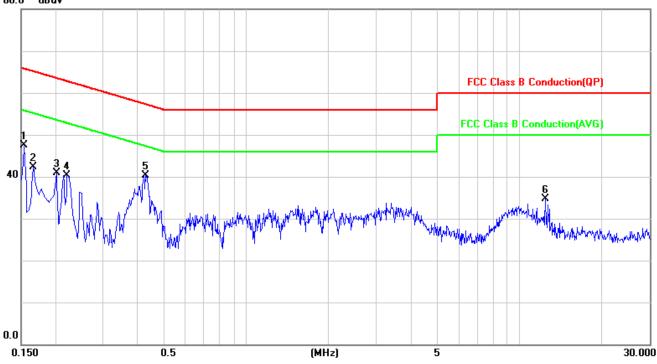
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# AC POWER LINE CONDUCTED EMISSION TEST DATA

Description:	Operation (2.4G)	Date:	2019/12/18
Line:	L1	Temp.(°C)/Hum.(%):	22.6(°C)/69%
Test Voltage:	AC 120V/60Hz	Test By:	Kailin
Reoprt Number:	E2/2019/B0013		
Note:	Adapter - PS24L120K2000UD		

80.0 dBu¥



		Freq.	Reading	Factor	Measurement	Limit	Over	
No.	Mk.	(MHz)	(dBuV)	( dB )	(dBuV)	(dBuV)	(dB)	Detector
1		0.1540	28.04	19.47	47.51	65.78	-18.27	peak
2		0.1660	22.91	19.49	42.40	65.16	-22.76	peak
3		0.2020	21.38	19.55	40.93	63.53	-22.60	peak
4		0.2220	20.79	19.56	40.35	62.74	-22.39	peak
5	*	0.4300	20.60	19.71	40.31	57.25	-16.94	peak
6		12.4620	14.65	19.98	34.63	60.00	-25.37	peak

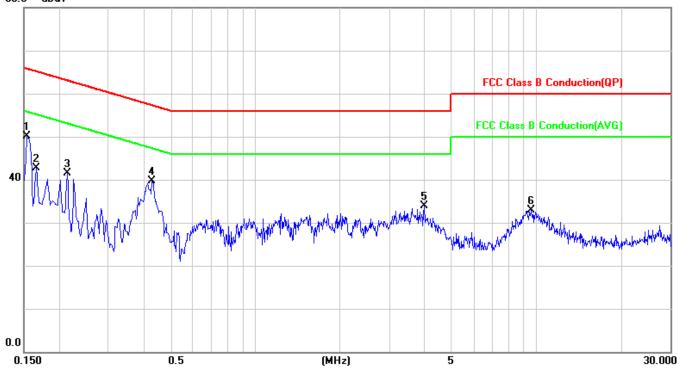
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Description:	Operation (2.4G)	Date:	2019/12/18
Line:	Ν	Temp.(°C)/Hum.(%):	22.6(°C)/69%
Test Voltage:	AC 120V/60Hz	Test By:	Kailin
Reoprt Number:	E2/2019/B0013		
Note:	Adapter - PS24L120K2000UD		

80.0 dBu¥

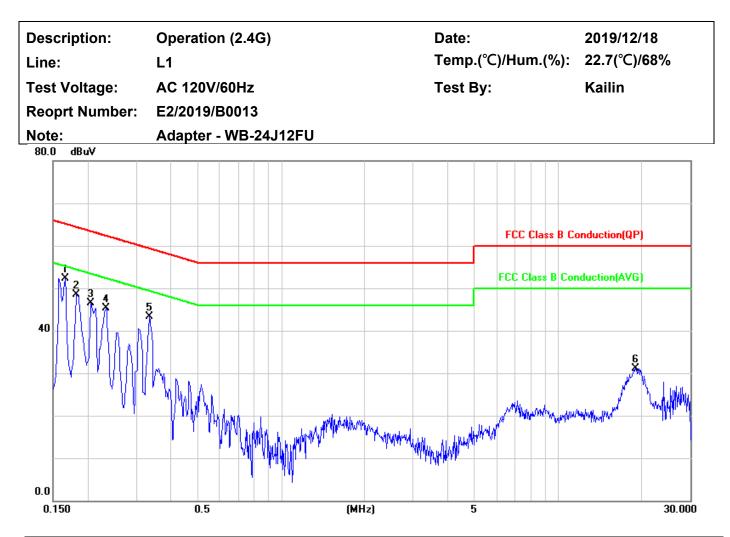


No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
		(MHz)	(dBuV)	( dB )	(dBuV)	(dBuV)	( dB )	
1	*	0.1540	30.31	19.70	50.01	65.78	-15.77	peak
2		0.1660	22.90	19.72	42.62	65.16	-22.54	peak
3		0.2140	21.70	19.79	41.49	63.05	-21.56	peak
4		0.4300	19.72	19.92	39.64	57.25	-17.61	peak
5		3.9980	13.76	20.15	33.91	56.00	-22.09	peak
6		9.6100	12.64	20.19	32.83	60.00	-27.17	peak

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No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
		(MHz)	(dBuV)	( dB )	(dBuV)	(dBuV)	( dB )	
1	*	0.1660	52.20	0.06	52.26	65.16	-12.90	peak
2		0.1820	48.50	0.09	48.59	64.39	-15.80	peak
3		0.2060	46.28	0.13	46.41	63.37	-16.96	peak
4		0.2340	45.16	0.13	45.29	62.31	-17.02	peak
5		0.3340	43.13	0.13	43.26	59.35	-16.09	peak
6		19.0540	30.34	0.86	31.20	60.00	-28.80	peak

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Description: Line:	Operation (2.4G) N	Date Tem	: p.(°C)/Hum.(%):	2019/12/18 22.7(°C)/68%	
Test Voltage:	AC 120V/60Hz	Test	By:	Kailin	
Reoprt Number	: E2/2019/B0013		-		
Note: 80.0 dBu¥	Adapter - WB-24J12	FU			
			FCC Class B C	onduction(QP)	
1 2			FCC Class B Co	nduction(AVG)	
3 4					
40	λŇ			6	
	My Manager and and a		New Marken Marken Marken	warmer huge whether	
	1 Aba na ula Manahada baa	Marmal Hopman a law might have the well	Martin .	www. whi	
0.0					
0.150	0.5	(MHz)	5	30.000	

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
		(MHz)	(dBuV)	( dB )	(dBuV)	(dBuV)	( dB )	
1	*	0.1660	51.23	0.05	51.28	65.16	-13.88	peak
2		0.1900	49.83	0.09	49.92	64.04	-14.12	peak
3		0.2060	44.40	0.11	44.51	63.37	-18.86	peak
4		0.2340	42.77	0.11	42.88	62.31	-19.43	peak
5		6.7620	27.07	0.32	27.39	60.00	-32.61	peak
6		18.8940	29.15	0.55	29.70	60.00	-30.30	peak

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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:

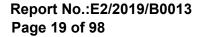
- 1. Set span = Zero
- 2. RBW = 8MHz
- 3. VBW = 8MHz,
- 4. Detector = Peak

# 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	99.04	0.04	0.08	0.01
802.11g	94.29	0.26	0.48	1.00
802.11n_20	90.28	0.44	1.02	2.00
802.11n_40	76.66	1.15	2.02	3.00

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# 7.3 Duty Cycle test plots

Agent Spectrum Analyzer - Swart SA	(SERVER SATI	4.104 4010	03:44:32 PMDec 02, 2015	
Center Freq 2.437000000 GHz	1.0.0	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TVTE WWWWWW 001 P NNNNH	Frequency
Ref Offset 11.5 dB 10 dB/div Ref 30.00 dBm		۵	Mkr3 12.55 ms 0.96 dB	Auto Tune
		<b>3</b> ∆4		Center Freq 2.437000000 GHz
300				Start Fred 2.437000000 GHz
40.0				Stop Fred 2,437000000 GH:
Center 2.437000000 GHz Res BW 8 MHz #VBW	1 8.0 MHz	Sweep 20	Span 0 Hz .00 ms (5001 pts)	CF Step 8.000000 MH Auto Mar
1 Δ2 t (Δ) 12.43 ms (Δ)   2 F t 1.908 ms (Δ)   3 Δ4 t (Δ) 12.65 ms (Δ)   4 F t (Δ) 12.65 ms (Δ)   5 5 5 5 5   7 7 7 7 7	0.70 dB 14.25 dBm 0.96 dB 14.25 dBm			Freq Offsel 0 Hz
8 9 10 11	-			

### Duty Cycle\_802.11g\_20MHz\_Chain0\_2437MHz

									and the	alyz=+1	um As	Specto		
Frequency	MDec 02, 2019 1 2 3 4 5 6 E WWWWW	TRAC	e Log-Pwr	Avg Typ		Trig: Fr	Fast ++-	0 GHz	00000		eq 2	Fre		Cer
Auto Tune	189 ms	Mkr3 2.	Δ	-	dB	#Atten:	cLow	IFGa	11.5 dE				iB/di	10.
Center Free 2.437000000 GH:	-	(deptor		-	in the second	1. II.		1304		1	-	1		20.0
Start Free 2.437000000 GH														10.0
Stop Fre 2,437000000 GH						¥		V				10		30 ( 40 ( 50 ( 80 (
CF Ste 8.000000 MH Auto Ma			Sweep 10.			8.0 MH	#VBW		1000		MH	V.8	nter s BV	Res
Freq Offse 0 H				3100	dB Sm dB	7.7 5.95 c 7.2 5.95 c	ms (Δ)	2.064		(A) (A)	1	11	Δ2	12
				-										7 8 9 10 11
			STARIS											nia.

# Duty Cycle\_802.11b\_20MHz\_Chain0\_2437MHz Duty Cycle\_802.11n\_20MHz\_Chain0\_2437MHz

	trum Analyzar - Jose									و البر
Center Fr	eq 2.43700			1	REEDAT	Avg Typ	e: Log-Pwr	TRACE	Dec 02: 2015	Frequency
1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	1 L -	P IF(	NO: Fast 🕶 GalecLow	#Atten: 3	0 dB	-		05	PNNNNN	Auto Tun
0 dB/div	Ref Offset 11 Ref 30.00		_	_			Δ	Mkr3 1.0 -7	.05 dB	
20.0 10.0	-	1Δ2 3Δ4	-	-	-	-	initi dilita	lideri naderi	-	Center Fre 2.437000000 GH
0.0										Start Fre 2.437000000 GH
30 0 40 0 90 0	Y			V	¥.		*			Stop Fre 2.437000000 GH
enter 2.4 es BW 8		SHz	#VBW	8.0 MHz			Sweep 10	Sr .00 ms (10		CF Ste 8.000000 MH Auto Mi
1 Δ2 2 F 1 Δ4 4 F 5 6	t (Δ) t t (Δ) t	92	14.0 us (Δ) 11.0 us 190 ms (Δ) 11.0 us	-1.25 12.61 di -7.05 12.61 di	dB Bm dB					Freq Offs 0 F
7 8 9 10 11										
671		_					STARUS	n.		

# Duty Cycle\_802.11n\_40MHz\_Chain0\_2437MHz

Apres	petro						_										-				
enter	Fre	q 2			0000	G		1		Free	E SAT	-	Ave	Туре		g-Pw		13:46:03 ( TRA)	E11 2	145	Frequency
) dB/di				t 11.		P	NO: Fa	ow		n: 30			-				ΔΜ	kr3 6	647.0 0.01	) µ:	s Auto Tur
	-		8∆4	-	-	-	-	-	-	-	<b>n</b> (**	ei	<b>Mire</b>	-	• •	-	-	-	ANNIA	-	Center Fre 2.437000000 GH
0.0																					Start Fre 2.437000000 GH
00	-		1		*					*	¥		125	×	×	)				•	Stop Fra 2.437000000 Gi
enter es BW	181	<b>NHz</b>		0 G	Hz		#	VBW	8.0 N	Hz	_		TION	SI	-	-	-	s ms (1	-	pts	
1 42	1	1	(A)		-	4	96.0 µ	s (A)	-5	92 d	в		incom.		-			050240			-
2 F Δ4 F 5	ł	1	(A)	_		6-	89.0 µ 47.0 µ 89.0 µ	s (Δ)	0	3 dB 0 01 d 3 dB	B	_				_				Ξ	FreqOffs
7				_	-	_						_				_		_			
0			_	_	_	_	_		_	_	-	_	_		_	_	1	_	_		
										-	_	_								161	
																GTAI					-

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#### PEAK OUTPUT POWER MEASUREMENT 8

# 8.1 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.

# 8.2 Measurement Equipment Used ducted Emission Test Sit

	Condu	cted Emission	i rest site		
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Attenuator	Marvelous	MVE2213-10	RF31	11/20/2019	11/19/2020
Power Meter	Anritsu	ML2496A	1804002	03/26/2019	03/25/2020
Power Sensor	Anritsu	MA2411B	1726105	03/26/2019	03/25/2020
Power Sensor	Anritsu	MA2411B	1726106	03/26/2019	03/25/2020

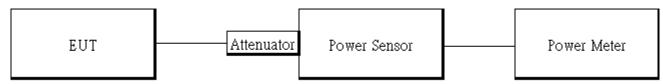
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# 8.3 Test Set-up

Power Meter:



# 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.

## 8.5 Measurement Result

802.1	1b Ch0				
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	26.22	30.00	PASS
6	2437	1	26.91	30.00	PASS
11	2462	1	26.55	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	24.93	30.00	PASS
6	2437	1	25.51	30.00	PASS
11	2462	1	24.81	30.00	PASS

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Cł	+	Freq. (MHz)	Data Rate	Po	Output ower Bm)		₋imit 1Bm)	RES	ULT
1		2412	1	2	5.12	3	0.00	PAS	SS
6	)	2437	1	2	6.75	3	0.00	PAS	SS
11	1	2462	1	2	5.81	3	0.00	PAS	SS
802	2.11b	Ch1							
Cł	1	Freq. (MHz)	Data Rate	includ tolerar	rg. Output e tune up ice Power Bm)		₋imit 1Bm)	RES	ULT
1		2412	1	2	2.89	3	0.00	PA	SS
6	)	2437	1	2	5.41	3	0.00	PAS	SS
11	1	2462	1	2	4.21	3	0.00	PAS	SS
.11b_2	2TX								
Fr	req.	Data		c Output Power	Total Pea Output Po		Lim	it	RI

СН	Freq. (MHz)	Data Rate		wer	Total Peak Output Power	Limit (dBm)	RESULT
	、 <i>,</i>		CH 0	CH 1	(dBm)		
1	2412	1	25.82	23.22	27.72	30.00	PASS
6	2437	1	25.28	26.03	28.68	30.00	PASS
11	2462	1	25.43	26.14	28.81	30.00	PASS
802.1	1b_2TX						
			Avg. C	Dutput	Max. Avg. Output		
СЦ	Freq.	Data	Avg. C Po	•	Max. Avg. Output include tune up	Limit	
СН	Freq. (MHz)	Data Rate	Ŭ	wer	<b>°</b> .	Limit (dBm)	RESULT
СН	· ·		Po	wer	include tune up		RESULT
<b>СН</b>	· ·		Pov (dE	wer Bm)	include tune up tolerance Power		<b>RESULT</b> PASS
	(MHz)	Rate	Pov (dE CH 0	ver Sm) CH 1	include tune up tolerance Power (dBm)	(dBm)	



802.11	lg Ch0				
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	26.02	30.00	PASS
6	2437	6	26.56	30.00	PASS
11	2462	6	26.09	30.00	PASS
802.11	lg Ch0		·		
СН	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	6	21.01	30.00	PASS
6	2437	6	21.46	30.00	PASS
11	2462	6	21.05	30.00	PASS
802.2	11g Ch1				
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	25.91	30.00	PASS
6	2437	6	26.42	30.00	PASS
11	2462	6	26.01	30.00	PASS
802.1	l1g Ch1				
СН	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	6	20.97	30.00	PASS
6	2437	6	21.40	30.00	PASS
11	2462	6	20.89	30.00	PASS
R	-				

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802.1	1g_2T	X								
СН	Free (MH	·		Dutput wer CH 1	Total P Output P (dBm	ower	Lim (dBn		RESU	JLT
1	241	2 6	24.39	24.03	27.22		30.0	0	PAS	S
6	243	7 6	24.43	24.83	27.64	ļ	30.0	0	PAS	S
11	246	2 6	24.27	24.36	27.33	}	30.0	0	PAS	SS
802.1	1g_2T	X								
СН	Free (MH	·	Po	Dutput wer 3m)	Max. Avg. ( include tu tolerance	ine up	Lim (dBn	-	RESL	JLT
			CH 0	CH 1	(dBm	)				
1	241	2 6	18.08	17.53	21.08	}	30.0	n	PAS	SS
								0		-
6	243	7 6	18.21	18.36	21.55		30.0		PAS	
6 11	243 246		18.21 18.07	18.36 17.83	<b>21.5</b> 5 21.22	5	30.0 30.0	0		S
11	246		18.07			5		0	PAS	S

26.79

27.22

26.45

Max. Avg. Output

include tune up

tolerance Power (dBm)

22.74

23.15

21.95

30.00

30.00

30.00

Limit

(dBm)

30.00

30.00

30.00

PASS

PASS PASS

RESULT

PASS

PASS

PASS

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2412

2437

2462

802.11n\_HT20M Ch0

Freq.

(MHz)

2412

2437

2462

MCS0

MCS0

MCS0

Data

Rate

MCS0

MCS0

MCS0

1

6

11

СН

1

6

11

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	СН	Freq. (MHz)	Data Rate	P	Output ower IBm)		imit IBm)	RES	ULT
	1	2412	MCS0	2	6.62	3	0.00	PA	SS
	6	2437	MCS0	2	7.15	3	0.00	PA	SS
	11	2462	MCS0	2	6.34	3	0.00	PA	SS
	802.1	1n_HT2	DM Ch1						
	СН	Freq. (MHz)	Data Rate	includ tolerar	vg. Output e tune up nce Power IBm)		imit IBm)	RES	
	1	2412	MCS0	2	2.62	3	0.00	PA	
	6	2437	MCS0	2	3.09	3	0.00	PA	SS
	11	2462	MCS0	2	1.90	3	0.00	PA	SS
.11	n_HT	20M MIN	10						
1	Freq	. Dat	a	Output Total Pea ower Output Po			Limi	it	RE

СН	Freq. (MHz)	Data Rate	Peak ( Pov	Dutput wer	Total Peak Output Power	Limit (dBm)	RESULT
	(11112)	Nute	CH 0	CH 1	(dBm)	(dBh)	
1	2412	MCS8	25.86	25.65	28.77	30.00	PASS
6	2437	MCS8	26.01	26.55	29.30	30.00	PASS
11	2462	MCS8	25.03	25.28	28.17	30.00	PASS
802.1	1n_HT20	M MIMO					
			Avg. C	Dutput	Max. Avg. Output		
СЦ	Freq.	Data	Po	wer	include tune up	Limit	
СН	Freq. (MHz)	Data Rate	Pov (dE		include tune up tolerance Power	Limit (dBm)	RESULT
СН					•		RESULT
CH 1			(dE	Bm)	tolerance Power		RESULT PASS
	(MHz)	Rate	(dE CH 0	Sm) CH 1	tolerance Power (dBm)	(dBm)	



802.11	In_HT40	VI Ch0			
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	25.48	30.00	PASS
6	2437	MCS0	25.69	30.00	PASS
9	2452	MCS0	25.64	30.00	PASS
802.11	In_HT40	VI Ch0			
СН	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	20.21	30.00	PASS
6	2437	MCS0	20.32	30.00	PASS
9	2452	MCS0	19.81	30.00	PASS
802.1	11n_HT4	0M Ch1			
СН	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	25.37	30.00	PASS
6	2437	MCS0	25.61	30.00	PASS
9	2452	MCS0	25.55	30.00	PASS
802.	11n_HT4	0M Ch1			
СН	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	20.15	30.00	PASS
6	2437	MCS0	20.20	30.00	PASS
9	2452	MCS0	19.76	30.00	PASS



802.1	802.11n_HT40M MIMO						
СН	Freq. (MHz)	Data Rate	Peak C Pov	Dutput wer	Total Peak Output Power	Limit (dBm)	RESULT
	(101112)	Naic	CH 0	CH 1	(dBm)	(abii)	
3	2422	MCS8	23.55	23.48	26.53	30.00	PASS
6	2437	MCS8	23.89	23.88	26.90	30.00	PASS
9	2452	MCS8	23.71	23.15	26.45	30.00	PASS
802.1	1n_HT40	M MIMO					
СН	Freq. (MHz)	Data Rate	U	Dutput wer Bm)	Max. Avg. Output include tune up tolerance Power	Limit (dBm)	RESULT
			CH 0	CH 1	(dBm)		
3	2422	MCS8	16.32	15.91	20.28	30.00	PASS
6	2437	MCS8	16.29	16.33	20.47	30.00	PASS
9	2452	MCS8	15.78	15.71	19.91	30.00	PASS

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

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#### **6DB BANDWIDTH MEASUREMENT** 9

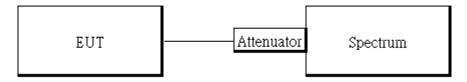
# 9.1 Standard Applicable

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

# 9.2 Measurement Equipment Used

Conducted Emission Test Site							
EQUIPMENT MFR MODEL SERIAL LAST							
ТҮРЕ		NUMBER	NUMBER	CAL.			
DC Block	PASTERNACK	PE8210	RF32	11/20/2019	11/19/2020		
Spectrum Analyzer	Agilent	N9010A	MY5712020 0	03/06/2019	03/05/2020		
Attenuator	Marvelous	MVE2213-10	RF31	11/20/2019	11/19/2020		

## 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. For 6dB Bandwidth:

Set the spectrum analyzer as RBW = 100 kHz, VBW = 3\*RBW, Span = 30M/50MHz, Detector=peak, Sweep=auto.

5. Mark the peak frequency and –6dB (upper and lower) frequency.

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#### 9.5 6dB Bandwidth

802.11b Ch0				
Freq.	6dB BW	Limit	Result	
(MHz)	(kHz)	(kHz)	Result	
2412	10110.00	> 500	PASS	
2437	10040.00	> 500	PASS	
2462	8099.00	> 500	PASS	

802.	11b	Ch1

802.11a Ch1

Freq.	6dB BW	Limit	Result
(MHz)	(kHz)	(kHz)	Result
2412	10090.00	> 500	PASS
2437	10100.00	> 500	PASS
2462	11080.00	> 500	PASS

#### 802.11g Ch0

Freq.	6dB BW	Limit	Result
(MHz)	(kHz)	(kHz)	Result
2412	15730.00	> 500	PASS
2437	15960.00	> 500	PASS
2462	15750.00	> 500	PASS

802.11_n_HT20 Ch0					
Freq.	6dB BW	Limit	Result		
(MHz)	(kHz)	(kHz)	Result		
2412	15740.00	> 500	PASS		
2437	16160.00	> 500	PASS		
2462	15740.00	> 500	PASS		

eeening enin					
Freq.	6dB BW	Limit	Result		
(MHz)	(kHz)	(kHz)	Result		
2412	15920.00	> 500	PASS		
2437	16050.00	> 500	PASS		
2462	16060.00	> 500	PASS		

#### 802.11\_n\_HT20 Ch1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16580.00	> 500	PASS
2437	16580.00	> 500	PASS
2462	17170.00	> 500	PASS

#### 802.11\_n\_HT40 Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result	Fre (MH
2422	35500.00	> 500	PASS	242
2437	35200.00	> 500	PASS	243
2452	35160.00	> 500	PASS	245

#### 802.11\_n\_HT40 Ch1

Freq.	6dB BW	Limit	Result
(MHz)	(kHz)	(kHz)	Result
2422	35170.00	> 500	PASS
2437	35180.00	> 500	PASS
2452	35760.00	> 500	PASS

\*Refer to next page for plots

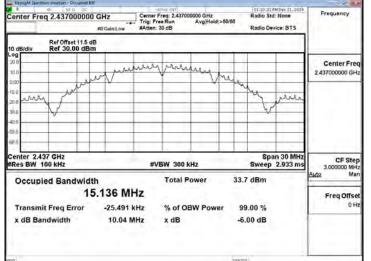


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#### OBW 6dB\_802.11b\_20MHz\_Chain0\_2412MHz

Keysight Spect	own Rowyan - Occurrent B	N.					10.000		
Center Fre	eq 2.41200000	IFGain:1.trw	Center Fr		0000 GHz Avg Hold	: 50/50	Radio St	d: None wice: BTS	Frequency
10 dB/div	Ref Offset 11.5 d Ref 30.00 dBr		_				_		
20.0 10.0 0.00	M	mm	unny	prin	my	min			Center Freq 2.412000000 GHz
-10.0 200 -20.0 -30.0 -40.0	W						V	winter	
50.0 60.0									
Center 2.4 #Res BW			#VE	300 k	Hz			an 30 MHz 2.933 ms	CF Step 3.000000 MHz
Occup	ied Bandwid 1	th 6.858 MH	Ηz	Total P	ower	30.	8 dBm		Auto Man Freg Offset
	it Freg Error indwidth	94.935 k 10.11 M		% of Ol x dB	3W Pow		9.00 % 6.00 dB		0 Hz
(SIG)						STAT	(8)	-	

#### OBW 6dB 802.11b\_20MHz\_Chain0\_2437MHz



#### OBW 6dB 802.11b 20MHz Chain0 2462MHz

A	Xeguity Stattone Inversion Counsel IIV Entropy Stattone Inversion Counsel IIV Entropy Stattone II Statton									
10 dB/div										
20.0 10.0		1 m	un	Jamas	may				Center Fred 2.452000000 GHz	
10.00	Jun 1	JAN V		-	V.	Muy		-		
20.0 30.0 worker	w		-	-			20	June		
50.0	*					-				
00.0 Center 2,46	2.045							an 30 MHz		
#Res BW 10			#\	/BW 300 P	kHz			2.933 ms	CF Step 3.000000 MH	
Occupie	ed Bandwid			Total P	ower	31.4	4 dBm		Auto Mar	
	1:	3.641 M	Hz						Freq Offse	
	Freq Error	-54.067		% of O	BW Power		9.00 %		0.43	
x dB Ban	dwidth	8.099	MHz	x dB		-6.	00 dB			
ASIG( )						STATU				

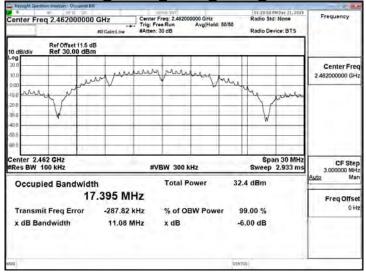
#### OBW 6dB\_802.11b\_20MHz\_Chain1\_2412MHz

Keysight Spectrum	n Rhallyzet i Occupied I	W.							2 2 L
Center Freq	2.41200000	0 GHz #FGain:1.trw	Trig: F	Freq: 2.4120 Free Run 1: 30 dB	00000 GHz Avg Hold	; 50/50	Radio St	MDH 11,3014 d: None wice: BTS	Frequency
10 dB/div	Ref Offset 11.5 Ref 30.00 dB								
10.0		mm	un	Vinn	many	men			Center Free 2.412000000 GH
10.0	M			-	-		The last	para	
-50.0	v						V		
60.0 Center 2.413 #Res BW 10			#	VBW 300	KHZ			an 30 MHz 2.933 ms	CF Step 3.000000 MH
Occupie	d Bandwid	th 6.361 M	Hz	Total F	ower	32	.4 dBm		Auto Ma
Transmit x dB Ban	Freq Error dwidth	-143.79 10.09		% of O x dB	BW Powe		9.00 % 5.00 dB		0.0
(SGN)						<b>STAT</b>	va)		

#### OBW 6dB 802.11b 20MHz Chain1 2437MHz

Keysight Spectro	Ver Resigner - Occupied I/	r .		onea (mm)			Int at an	PM Dec 21, 2019	2 2 L	
Center Free	q 2.437000000	GHz #FGain:1.trw	Center	Freq: 2,43700 ee Run	0000 GHz Avg Hold	1: 50/50	Radio Std: None Radio Device: BTS		Frequency	
10 dB/div	Ref Offset 11.5 dB 0 dB/div Ref 30.00 dBm ee									
20.0 10.0		mm	un	Vin	may	mu			Center Fred 2.437000000 GH:	
000 10.0 - AAA 20.0	a mar	U.		-			My /	vin		
30.0 40.0	V						V			
50.0. 90.0.										
Center 2.43 Res BW 1			#V	BW 300 k	Hz		Sp Sweep	an 30 MHz 2.933 ms	CF Step 3.000000 MH	
Occupi	ed Bandwidt	h		Total P	ower	33.	4 dBm		Auto Mar	
	16	6.595 MI	Ηz						Freq Offsel	
Transmi	t Freq Error	-1.247	KHz	% of O	W Pow	er 9	9.00 %		0 Ha	
x dB Bar	ndwidth	10.10 N	IHz	x dB		-6	.00 dB			
56						STAT	(m)			

#### OBW 6dB 802.11b 20MHz Chain1 2462MHz



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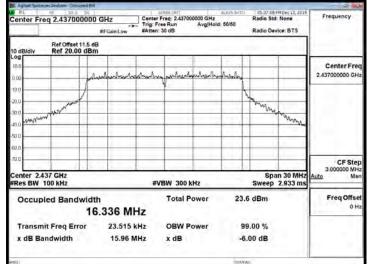


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#### OBW 6dB\_802.11g\_20MHz\_Chain0\_2412MHz

Center Fre	eq 2.412000	0000 G	Hz FGain:Low	Center F		0000 GHz Avg Hold	acion avi 1: 50/50	TU.	Radio Der		Frequency
Ref Offset 11.5 dB 10 dB/div Ref 20.00 dBm Log											
		polle	Mullisoto	whenho	Jacobarte	mheath	atreathy				Center Freq 2.412000000 GHz
-10.0 -20.0	me	1			1			ł	mu		
-30.0 -50.0	J-MVY	-			-				- Surd	W.W.W.	
30.0 80.0								F			
Center 2.4				#V	BW 300 k	Hz				an 30 MHz 2.933 ms	CF Step 3.000000 MHz Auto Man
Occupi	ied Bandv		328 MI	Hz	Total P	ower	2	3.6	dBm		Freq Offset 0 Hz
	it Freq Erro ndwidth		-26.672 15.73 M		OBW P	ower		22	.00 % 00 dB		
usici i							्या	NT NO	-		

#### OBW 6dB 802.11g 20MHz Chain0 2437MHz



#### OBW 6dB 802.11g 20MHz Chain0 2462MHz

Center Fre	eq 2.462000	000 G	Hz FGain:Low		0000 GHz Avg Hold	ación au 1: 50/50	PMDec 12, 2019 I: None vice: BTS	Frequency			
10 dB/div	Ref Offset 11.5 dB 0 dB/div Ref 20.00 dBm og										
10.0 0.00		polis	human	unda	persbach	and yearlay	Anna				Center Fred 2.462000000 GH:
-10.0 -20.0 -30.0	Minter	1						L.	wyon	mana	
-200 -200 -200 -500									_	North	
70.0											CF Step 3.000000 MH
Center 2.4 #Res BW				#VI	300 k	Hz	_	S		an 30 MHz 2.933 ms	Auto Mar
Occupi	ied Bandw		336 MI	Hz	Total P	ower	2	3.5 d	Bm		Freq Offse 0 H
	it Freq Erro ndwidth	r	-36.229 I 15.75 N		OBW P x dB	ower		99.00 -6.00			
ASQ I							570	ATMS	_		

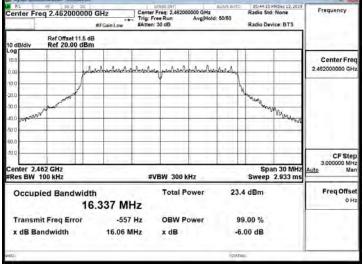
#### OBW 6dB\_802.11g\_20MHz\_Chain1\_2412MHz

Ag Spell	m Alkalyzer Occu				-					
Center Fre	g 2.41200	0000 Gł	Hz Gain:Low	Center Fr		0000 GHz Avg Hold	: 50/50	Radio St	Wice: BTS	Frequency
10 dB/div	Ref Offset Ref 20.00		-							
10.0		polonis	- harallara	marking	mannal	mhailis	docul			Center Fre 2.412000000 GH
-10.0	June	1	_					h winny		
-30.0 -40.0	14KP								White and	
-70.0										
Center 2.4 #Res BW 1				#VE	SW 300 k	Hz			an 30 MHz 2.933 ms	CF Stej 3.000000 MH <u>Auto</u> Ma
Occupi	ed Band		44 MI	Hz	Total P	ower	23	.0 dBm		Freq Offse 0 H
Transmi	t Freq Err	or	18.552	kHz	OBW P	ower	1	99.00 %		
x dB Ba	ndwidth		15.92 N	MHz	x dB		-	6.00 dB		
usia i	_		-				70%	THE		

#### OBW 6dB 802.11g 20MHz Chain1 2437MHz

	m Analyzer Oc		n.				1-1-2					
Center Fre		0000		Z Tain:Low	Center Fr			50/50	10	Radio Std Radio Dev		Frequency
10 dB/div	Ref Offset 11.5 dB 10 dB/div Ref 20.00 dBm 0 g											
10.0			Ann	manha	montary	pentral	ndunha	Arlen,				Center Free 2.437000000 GHz
-10.0	and a	1			_				1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
20.0 40.0 mmmm	Mar	+	-	_	_	_				244	Whent	
800		1	_									
Center 2.4		11	-		#VE	SW 300 k	Hz				n 30 MHz 2.933 ms	CF Step 3.000000 MH Auto Mar
Occup	ied Ban			29 MI	łz	Total P	ower	23	3.8	dBm		Freq Offse 0 H:
	it Freq En Indwidth			1.473 k 16.05 N		OBW P x dB	ower			.00 % )0 dB		
vesici i								577.0	THE	-		

# OBW 6dB 802.11g 20MHz Chain1 2462MHz



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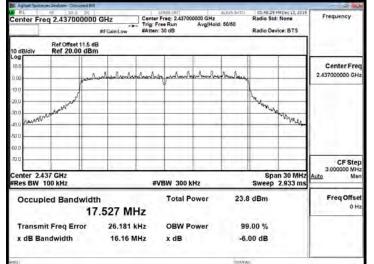


#### Report No.: E2/2019/B0013 Page 32 of 98

#### OBW 6dB\_802.11n\_20MHz\_Chain0\_2412MHz

Agine Specific	m Analyze Occupied BV	Y		sense unt		acises auto		PMDec 12, 2019	1
Center Fre	eq 2.412000000	#FGain:Low	Center	Freq: 2.41200 ree Run	Avg Hold		Radio St		Frequency
10 dB/div	Ref Offset 11.5 d Ref 20.00 dBr		-			_			
0.00	- Juni	hardranthanthe	how	in minute	mbrok	Andreas			Center Freq 2.412000000 GHz
-10.0	menun						1 mas	manna	
-30.0 -40.0 -80.0								. Martine	
700 -700									CF Step 3.000000 MHz
Center 2.4 #Res BW 1			#\	/BW 300 k	Hz	1		an 30 MHz 2.933 ms	<u>Auto</u> Man
Occupi	ied Bandwidt 1	th 7.499 M	Hz	Total P	ower	23.0	8 dBm		Freq Offset 0 Hz
	it Freq Error ndwidth	-19.243 15.74 M		OBW P x dB	ower		9.00 % .00 dB		
usici i			_			TITATU	6		

#### OBW 6dB 802.11n 20MHz Chain0 2437MHz



#### OBW 6dB 802.11n 20MHz Chain0 2462MHz

Center Fre	g 2.4620000		Center F		0000 GHz Avg Hold	ación auto d: 50/50	Radio St	PMDec 12, 2019 d: None wice: BTS	Frequency
10 dB/div	Ref Offset 11.5 Ref 20.00 dE								-
10.0 0.00	m	Trachante	-lowlass	malual	enhalu	Mulan			Center Fred 2.462000000 GH:
10.0 20.0	man						who		1.1
30.0 47.0 Mar Jaw 1 50.0		_		-				manna	
70.0									
Center 2.4 #Res BW 1			#VE	300 k	Hz			an 30 MHz 2.933 ms	CF Step 3.000000 MH Auto Mar
Occupi	ed Bandwid	ith 7.496 M	Hz	Total P	ower	23.6	5 dBm		Freq Offsel 0 H:
	it Freq Error ndwidth	-35.775 15.74 I		OBW Pe x dB	ower		0.00 % 00 dB		
ASG I						TTATM	6		

#### OBW 6dB\_802.11n\_20MHz\_Chain1\_2412MHz

Agriner Spolin on Analyzer Co.	NORT IV	_	SERVE INT	-	Risa B/TC	Lan. et al.	MDec 12, 2019	2 2 10
Center Freq 2.4120		Trig: I	r Freq: 2.41200 Free Run h: 30 dB	Avg Hold		Radio Std	None	Frequency
10 dB/div Ref 20.0								
100	mahasheed	mathemath	ay we show	antreatre	Mainher			Center Fre 2.412000000 GH
100 200 300			1			Sume.		
-200 WHAM MAR							man	
80.0 -70.0								
Center 2.412 GHz #Res BW 100 kHz		#	VBW 300	Hz			n 30 MHz 2.933 ms	CF Stej 3.000000 MH Auto Ma
Occupied Band	width 17.525	MHz	Total P	ower	23.	2 dBm		Freq Offse 0 H
Transmit Freq Er	ror 18.	056 kHz	OBW P	ower	99	9.00 %		
x dB Bandwidth	16	.58 MHz	x dB		-6.	80 00.		
vsg i					TONTO	6		

#### OBW 6dB 802.11n 20MHz Chain1 2437MHz

Center Fre		00000 GI	Hz Gain:Low	Center F			adios auto 50/50	Radio Str	PMDec 12, 2019 d: None vice: BTS	Frequency
10 dB/div	Ref Offset Ref 20.0		1.4							1
		perulner	healmark	Mun	perderich	ab-hailha	Nasahres			Center Freq 2.437000000 GHz
-20.0	Manuall			-				tum		
-30.0 -47.0 200	NN			_					monte	
80.0	-									
Center 2.4 #Res BW 1				#VE	3W 300 P	(Hz			an 30 MHz 2.933 ms	CF Step 3.000000 MHz Auto Man
Occupi	ied Band		12 M	Ηz	Total P	ower	24.1	l dBm		Freq Offset 0 Hz
	it Freq En ndwidth		-18 16.58 N		OBW P x dB	ower		9.00 % 00 dB		
usia i							TATATM		_	

#### R5:51:91 PMDec 1 Padio Std: None ter Freq 2.462000000 GHz Center Fried 3 Trig: Free Run #Atten: 30 dB Frequency Avg Hold: 50/50 -Radio Device: BTS #IFGaintLo Ref Offset 11.5 dB Ref 20.00 dBm Center Free CF Step Span 30 MH Sweep 2.933 m enter 2.462 GHz Res BW 100 kHz #VBW 300 kHz Occupied Bandwidth Total Power 23.6 dBm Freq Offse OH 17.524 MHz -2.973 kHz **OBW Power** 99.00 % **Transmit Freq Error** 17.17 MHz x dB Bandwidth x dB -6.00 dB

OBW 6dB 802.11n 20MHz Chain1 2462MHz

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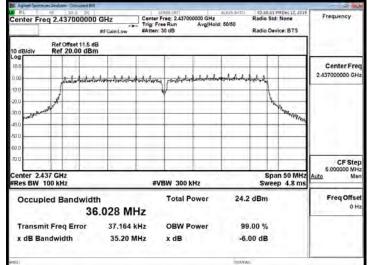


#### Report No.: E2/2019/B0013 Page 33 of 98

#### OBW 6dB\_802.11n\_40MHz\_Chain0\_2422MHz

	m Akalyze - Concret			-	-				a 2 10
Center Fre	eq 2.4220000		Center F		0000 GHz Avg Hold	1: 50/50	Radio	27 PMDec 12, 2019 Std: None Device: BTS	Frequency
10 dB/div	Ref Offset 11.5 Ref 20.00 dl								
	hadedad	which separation that	herbertering	ranstandar	latertate	totati	and		Center Freq 2.422000000 GHz
-20.0 -20.0	$\mathcal{A}$			*				AND AND AND AND	
40.0 30.0 20.0									
700 Center 2.4								pan 50 MHz eep 4.8 ms	CF Step 5.000000 MHz Auto Man
#Res BW 100 kHz Occupied Bandwidth 36.050 MHz			1.1	#VBW 300 kHz Total Power		24.3	24.2 dBm		Freq Offset 0 Hz
Transmit Freq Error-56.305 klx dB Bandwidth35.50 MI				99.00 % -6.00 dB					
usia i						TOWN	6		

#### OBW 6dB 802.11n 40MHz Chain0 2437MHz



#### \OBW 6dB 802.11n 40MHz Chain0 2452MHz

Center Fre	eq 2.45200000	0 GHz #IFGain:Low	Center F		0000 GHz Avg Hold	105 BUTC	Radio S	to PMDec 12, 2019 td: None Device: BTS	Frequency
10 dB/div	Ref Offset 11.5 d Ref 20.00 dB								-
	Mahalasha	terd paral portroduce	haddalana	mantipolor	hadrydanleg	robalachu	holdy		Center Freq 2.452000000 GHz
-10.0 -20.0 -30.0				1				Stand and the	
40.0 30.0 40.0									
Center 2.4			#VI	3W 300 k	Hz			pan 50 MHz sep 4.8 ms	CF Step 5.000000 MH: Auto Mar
Occup	ied Bandwid 3	<sup>th</sup> 5.796 MI	Hz	Total P	ower	24.2	dBm		Freq Offse 0 H
	it Freq Error Indwidth	-57.756 I 35.16 N		OBW P x dB	ower		.00 % 00 dB		
uesia i						STATIS	-		

#### OBW 6dB\_802.11n\_40MHz\_Chain1\_2422MHz

Ag Spell	m Analys								-9.14		0.2.00
Center Fre	eq 2.4	2200	0000 GI	Hz Gain:Low	Center F		0000 GHz Avg Hold	100 B/TO	Radio	92 PMDec 12, 2019 Std: None Device: BTS	Frequency
10 dB/div			11.5 dB 0 dBm	-	_			_	_		
0.00		Thinks	ant a traphy	mbulartu	hostedary	mentionly	habelede	postudiadas	Industry		Center Free 2.422000000 GH
-20.0	wand					ď				Anna Anna	1.1
-20.0 -20.0 -20.0											
-700											CF Step
Center 2.4 #Res BW			-		#VI	3W 300 k	Hz			pan 50 MHz eep 4.8 ms	5.000000 MH Auto Mar
Occup	ied B	land		51 M	Hz	Total P	ower	23.9	dBm		Freq Offse 0 H
Transm	it Free	q Err	or	48.438	kHz	OBW P	ower	99	.00 %		
x dB Ba	andwid	dth		35.17 N	MHz	x dB		-6.	00 dB		
usia i					_			TONTOS	-		L

#### OBW 6dB 802.11n 40MHz Chain1 2437MHz

	um Altalyzer Oco		_							2 2 10
							Radio S	B PMDec 12, 2019 td: None evice: BTS	Frequency	
10 dB/div	Ref Offset Ref 20.0		-							1
10.0 0.00	plantas	haterbar	opaAs-As-bad	absolution	pijatuska	h-forfinites	palminutin	-		Center Freq 2.437000000 GHz
-10.0 -20.0 -30.0	whit				-				and a stand of the stand	1.
500				_					Whe .	
-700										CF Step 5.000000 MHz
Center 2.4 #Res BW			-	#V8	300 W	Hz	_		ep 4.8 ms	
Occupied Bandwidth 35.934 MH						24.4	24.4 dBm		Freq Offset 0 Hz	
Transmit Freq Error-11.959 kx dB Bandwidth35.18 M					ower		0.00 % 00 dB			
							TTA THE	-		

#### 95:59:91 PMDec 1 Padio Std: None er Freq 2.452000000 GHz Center Frieg: 3 Trig: Free Run #Atten: 30 dB Avg|Hold: 50/50 Frequency 2.452 -Radio Device: BTS #IFGaintLe Ref Offset 11.5 dB Ref 20.00 dBm Center Free CF Step Span 50 MH Sweep 4.8 m er 2.452 GHz Res BW 100 kHz #VBW 300 kHz SV Occupied Bandwidth Total Power 24.3 dBm Freq Offse OH 36.002 MHz -52.808 kHz **OBW Power** 99.00 % **Transmit Freg Error** x dB Bandwidth 35.76 MHz x dB -6.00 dB

OBW 6dB 802.11n 40MHz Chain1 2452MHz

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# 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

## **10.1 Standard Applicable**

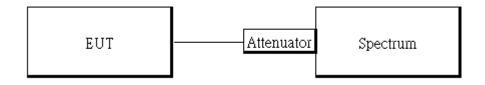
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

#### **10.2 Measurement Equipment Used**

	Conducted Emission Test Site							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
ТҮРЕ		NUMBER	NUMBER	CAL.				
DC Block	PASTERNACK	PE8210	RF32	11/20/2019	11/19/2020			
Spectrum Analyzer	Agilent	N9010A	MY5712020 0	03/06/2019	03/05/2020			
Attenuator	Marvelous	MVE2213-10	RF31	11/20/2019	11/19/2020			

#### 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.Use the peak marker function to determine the maximum amplitude level.
- 9. 802.11n MIMO mode: offset is set following "measure and add 10 Log (N)" on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application.

### Note:

For the test of PSD at MIMO mode, the highest emission of worst case employing Measure and add 10 log (N) technical is reported on this report after the comparison between Main Antenna at single transmitting mode and Aux that yields the higher value. The MIMO transmitting mode produces higher value of outcome.

## 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 1 20dBm
- 8. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
- 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.
- 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	17.85	-2.15				
2437	20.58	0.58				
2462	19.27	-0.73				

Refere	Reference Level of Limit 802.11g mode						
Freq.	PSD	Reference Level of Limit					
(MHz)	(dBm)	(dBm)					
2412	10.86	-9.14					
2437	11.41	-8.59					
2462	10.79	-9.21					

Reference Level of Limit 802.11n20 mode							
Freq.	PSD	Reference Level of Limit					
(MHz)	(dBm)	(dBm)					
2412	12.92	-7.08					
2437	13.54	-6.46					
2462	11.72	-8.28					

Reference Level of Limit 802.11n40 MODE						
Freq.	PSD	Reference Level of Limit				
(MHz)	(dBm)	(dBm)				
2422	7.08	-12.92				
2437	7.92	-12.08				
2452	6.73	-13.27				

Note

MIMO Cable Loss 14.51 dB

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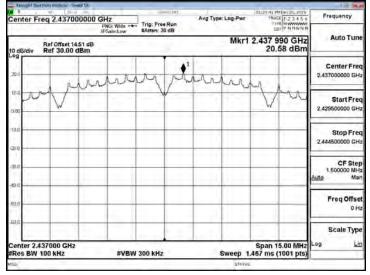
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### Reference Level\_802.11b\_20MHz\_2412MHz

Frequency	MDec 21, 2019	r PR	ype: Log-Pwr	Avg Ty	Trig: Free Run	Hz	000000 G	eq 2.4120	enter F
Auto Tun	95 GHz 85 dBm	1 2.410	Mkr1		#Atten: 30 dB	PNC: Wide 🔸	4.51 dB	Ref Offset 14 Ref 30.00	0 dBJdiv
Center Free 2.412000000 GH					the re	hrh			20.0
Start Free 2,404500000 GH	m	N				1	A Martin	V	10.00 0.000
Stop Fre 2.419500000 GH									10,0
CF Stej 1.500000 MH Auto Ma									30.0
Freq Offse 0 H									s0.0
Scale Type .og <u>Li</u> e	5.00 MHz	Span 1.457 ms	Sween 1		300 kHz	#VBV	2	12000 GHz	Center 2.4

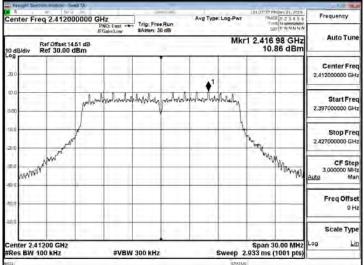
#### Reference Level\_802.11b\_20MHz\_2437MHz



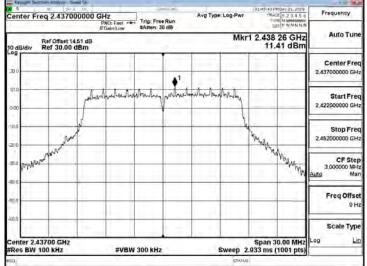
#### Reference Level 802.11b 20MHz 2462MHz

Reveal Concerns and the Concerns and the	SPACE INT.	- Jackson	01:29:36 PMDec 21, 2019	51816
Center Freq 2.462000000 GHz	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr	THE ST WWWWW	Frequency
Ref Offset 14.51 dB 0 dB/div Ref 30.00 dBm	BATTER: JU CD	Mkr1	2.460 995 GHz 19.27 dBm	Auto Tune
zoo	in ra	A.A		Center Freq 2,46200000 GHz
m and the	V		Mus	Start Freq 2,454500000 GHz
				Stop Freq 2.459500000 GHz
				CF Step 1.500000 MHz Auto Man
ao				Freq Offset 0 Hz
and				Scale Type
Center 2.462000 GHz #Res BW 100 kHz #VBW	300 kHz	Sweep 1.	Span 15.00 MHz 467 ms (1001 pts)	
sa)		STATUS		

### Reference Level\_802.11g\_20MHz\_2412MHz



#### Reference Level 802.11g 20MHz 2437MHz



#### enter Freq 2.462000000 GHz Frequency Avg Type: Log-Pwr Trig: Free Run sAtten: 30 dB Auto Tun Mkr1 2.466 98 GHz 10.79 dBm Ref Offset 14.51 dB Ref 30.00 dBm Center Fre 2.462000000 GH • all when the hours Start Fre 2.447000000 GH Stop Fre 2.477000000 GH Will War CF Step 3 000000 Ma Freq Offse 0 H Scale Type Span 30.00 MH Sweep 2.933 ms (1001 pts er 2.46200 GHz BW 100 kHz L) #VBW 300 kHz

Reference Level\_802.11g\_20MHz\_2462MHz

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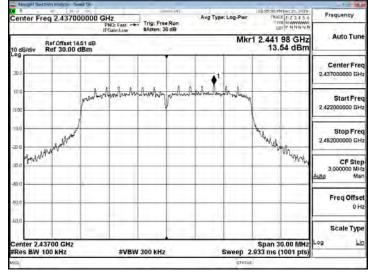
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### Report No.: E2/2019/B0013 Page 38 of 98

### Reference Level\_802.11n\_20MHz\_2412MHz

219.8							013.	and second pro-	Report States	- 14
Frequency	10ec21,2019 E 1:23456 E 14 WWWW	TRAC	e: Log-Pwr	Avg Typ	ig: Free Run	ast Tris	0000 GHz	q 2.41200	nter Fre	Cen
Auto Tun	01 GHz 92 dBm	1 2.417	Mkr		Atten: 30 dB		IFGain 51 dB	Ref Offset 14. Ref 30.00 d	dB/div P	10 di
Center Free 2,412000000 GH				•	-				1	.200
Start Free 2.397000000 GH			Minishing	hahah	entring produce	hartowhe	menthemilieu		1	10.0 0.00
Stop Free 2.427000000 GH	Winning	Walt						Maran		-10,0
CF Step 3.000000 MH Auto Ma	WWWWW							Jan .	West.	-30.0
Freq Offse 0 H						_		-		-50.0
Scale Type	0.00 MHz	Span 3 933 ms	Sweep 2.		0 KHz	#VBW 300			nter 2.41	
			STATUS						1	vsia)

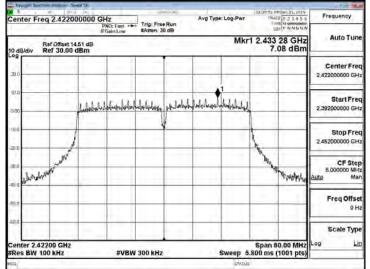
### Reference Level 802.11n 20MHz 2437MHz



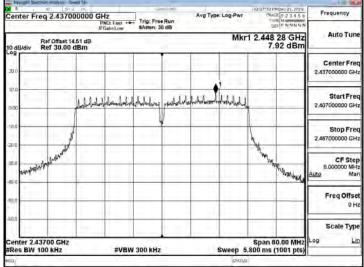
### Reference Level\_802.11n\_20MHz\_2462MHz

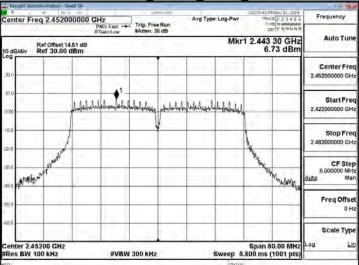
Appaged To		-013	_							219.8
enter F	req 2.4620	00000 G	HZ NO: Fast +++	Trig: Free	Run	Avg Type	Log-Pwr	TRA	HDec 21, 2019 CE (* 2 3 4 5 6 HE M WWWWWW ET (* N N N N N	Frequency
0 dB/div	Ref Offset 1 Ref 30.00	4.51 dB	Gaintainw	sAtten: 30	dð		Mkr	1 2.466	98 GHz 72 dBm	Auto Tun
0.0			-			<b>A</b> 1				Center Fre 2,462000000 GH
0.00		mailme	theophication	whenhy	ptollarvite	Nuthin	Murthay			Start Fre 2,447000000 GF
0,0	. March	1					Ť.	There		Stop Fre 2.477000000 GH
aa yuw	printer							M	WWWWW	CF Ste 3.000000 Mi Auto Mi
sa.o	_					_				Freq Offse
enter 2.	46200 GHz	-						Span 3	10.00 MHz	Scale Typ
Res BW	100 kHz	-	#VBW	300 kHz		1	Sweep 2.		(1001 pts)	
sia							STATUS			

### Reference Level 802.11n 40MHz 2422MHz



#### Reference Level 802.11n 40MHz 2437MHz





#### Reference Level 802.11n 40MHz 2452MHz

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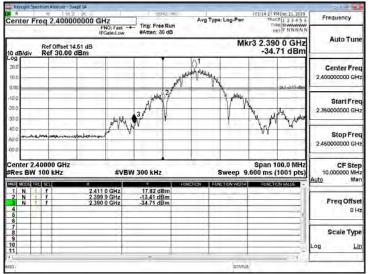
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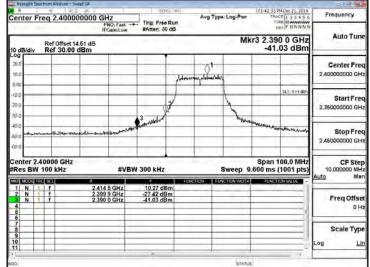
## Band Edge\_802.11b\_20MHz\_2412MHz



## Band Edge\_802.11b\_20MHz\_2462MHz

L 1 8 1							Anityper - Syr	American A	veice this	
Frequency	101:34:52 PM Dec 21, 2019 78:401 1 2 3 4 5 5 DEP 51 2 2 4 5 5 DEP 51 2 2 4 5 5	Type: Log-Pwr	Avg	Trig: Free Rur	HZ PNO: Fast	00000 G	2.48350	Freq 2	ter l	R Cen
Auto Tune	r3 2.483 6 GHz -40.71 dBm	Mk	-	#Atten: 30 dB	FGaineLow	4.51 dB	f Offset 14		B/div	
Center Free 2.483500000 GH	DL1-5 /Supp.				HUNAL Ha	Masserry				20.0 10.0
Start Fre 2.433500000 GH			-	Han yrun 3-	1	/	Mather			100 20.0 30.0
Stop Fre 2.533500000 GH	uadop (ny fatisain de Travelina	**********	wanne	Venil			1. I	Very	Var	40.0 50.0 60.0
CF Step 10.000000 MH Auto Ma	Span 100.0 MHz 600 ms (1001 pts)	Sweep 9.		300 kHz	#VB\			2,4835 N 100	s BV	#Re:
Freq Offse 0 H	HUNDLOUW WESSE		FORSTER	19.27 dBm -40.87 dBm -40.71 dBm	0 GHz 3 5 GHz 3 6 GHz	2,483			NNN	1 2 3 4 5
Scale Typ Log <u>Li</u>								-	_	6 7 8 9 10 11
		STATUS		-					-	+1_

## Band Edge\_802.11g\_20MHz\_2412MHz



### Band Edge\_802.11g\_20MHz\_2462MHz

518 <b>1</b>							Aniivaer - Sw	Sectrum		
Frequency	784CE 1 2 3 4 5 6	Avg Type: Log-Pwr	IN I	1 00	17	00000 GH		Fred		i ii
	DET P NNNNN	1. 1. C. P. C.		#Atten: 30	NO: Fast -+ Gain:Low	P	2.40000	rioq	40	
Auto Tun	r3 2.483 6 GHz -40.68 dBm	Mki					f Offset 14		B/di	10 d
	Summer 2011						-			.og
Center Fre 2.483500000 GH					0	-				10.0
2,48300000 GH					Halabeta	Annalstein				
	DL1 -8-21 dBin					1			1.	0.00
StartFre						1	- /			100
2.433500000 GH			. Th		1		1			20.0
	1		3	man			the		T.	30.0
Stop Fre	ะค <sub>า</sub> ครป <sub>าสาร</sub> แปร้านี้แรงประสารการก	accorringence	Stampreduce	early)			-	onnum	wh	40.0
2.533500000 GH				-						-50 0 60 0
	Span 100.0 MHz						50 GHz	2 4 0 2 0	1	11
CF Ste 10.000000 MH	600 ms (1001 pts)	Sweep 9.		300 kHz	#VBW			N 100		
Auto Ma	FUNCTION VALUE	HUNCTION WIDTH	FBMS	1°		8		THE SU	MARCE	
		-		10.87 dE	0 GHz 5 GHz	2.467	-	11	NN	1 2
Freq Offse			1	-40.68 dE	6 GHz	2.483		1	N	3
0 H			-							4
-			-				-	-		6
Scale Typ			-		-		-	-	_	8
Log Li		_	-				-	_		10
1			-	*	- I	_	-	-	-	11
1		STATUS								90

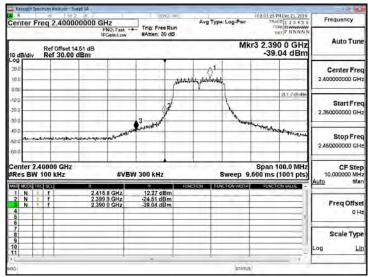
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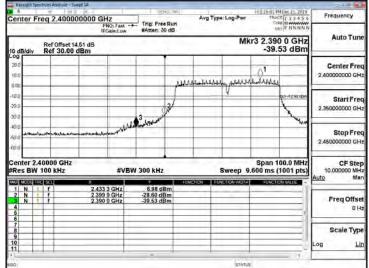
## Band Edge\_802.11n\_20MHz\_2412MHz



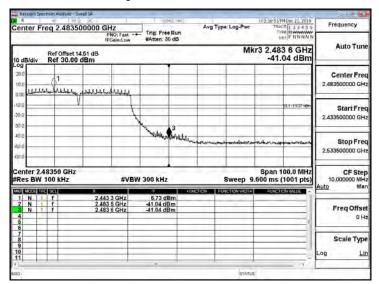
Band Edge\_802.11n\_20MHz\_2462MHz

Keytip t Spectrum Anilivzer -					01816
Center Freq 2.483	PNO: Fast ++	Trig: Free Run	Avg Type: Log-Pwr	102:15:55 PMDec 21, 2019 7RACE 1 2 3 4 5 5 DEPE SAMMAN DET P NNNNN	Frequency
Ref Offset 10 dB/div Ref 30.0		#Atten: 30 dB	Mk	r3 2.483 6 GHz -38.88 dBm	Alute Trune
20.0	unun annen				Center Free 2.483500000 GH:
100 -100 -200 -300				DLI-8:39/d8m	Start Free 2,433500000 GH
400 genellentrigtendelet 500 600		and a second and a second as	elilanaiseasyteaannaasta	*****	Stop Free 2.533500000 GH
Center 2.48350 GHz #Res BW 100 kHz		V 300 kHz	Sweep 9.	Span 100.0 MHz 600 ms (1001 pts)	CF Step 10.000000 MH Auto Mat
1 N F 2 N F 3 N F 4	2.467 0 GHz 2.483 5 GHz 2.483 6 GHz	11.93 dBm -40.36 dBm -38.88 dBm			Freq Offse 0 H
6 7 8 9 10					Scale Type
		-	STATUS		Log <u>Lir</u>

## Band Edge\_802.11n\_40MHz\_2422MHz



Band Edge\_802.11n\_40MHz\_2452MHz



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### Report No.: E2/2019/B0013 Page 41 of 98

### Spurious Emission\_802.11b\_20MHz\_2412MHz

	ent SA						518 44
Center Freq 13.015		Tria: Free Run		e: Log-Pwr	17.000	123455	Frequency
Ref Offset 14 10 dB/div Ref 30.00	IFGaind.zw	#Atten: 30 dB	Atten: 30 dB SAtten: 30 dB Mkr4 2.398 5 GH: -8.16 dBn				
20.0 1 10.0							Center Free 13.015000000 GH
0.00 4 4						it	Start Fre 30.000000 MH
40.0	2 13	the second second	and the second	1	1.1.1	1.1	
50.0							
50.0 60.0 Center 13.02 GHz		W 300 kHz		Sweep 2	Span 25 482 s (30	.97 GHz 001 pts)	26.00000000 GH CF Ste 2.597000000 GH
50.0 Center 13.02 GHz Res BW 100 kHz CE 100 HZ EX	#VB	14,55 dBm	FORCION		Span 25 482 s (30	001 pts)	26.00000000 GF CF Ste 2.597000000 GF
500 600 Center 13.02 GHz Res BW 100 KHz 1 N 1 T 2 N 1 T 3 N 1 T 3 N 1 T	#VB		FUNCTION F1		.482 s (30	001 pts)	26.00000000 GH CF Ste 2.597000000 GH Auto Ma
500 Center 13.02 GHz Res BW 100 kHz T N 1 f 2 N 1 f 3 N 1 f	#VB 2 412 3 GHz 4 824 0 GHz 7 236 0 GHz	14,55 dBm -45,11 dBm -46,41 dBm	FUNCTION		.482 s (30	001 pts)	Stop Free 25.00000000 GH 2.59700000 GH Auto Mai Freq Offse 0 H Scale Type Log List

### Spurious Emission\_802.11b\_20MHz\_2437MHz

218 44						erpt SA	PUPITI HIGHIYZKY-1	( Times	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
Frequency	25:41 PMDe: 21, 2019 FRACE 1 2 3 4 5 6	pe: Log-Pwr	Avg	TWISEPPER	Hz	000000 G	a 13.01	Fre	a nter
	DET P N N N N	-		Trig: Free Run #Atten: 30 dB	NO: Fast = Gaind aw	P! IFC			
Auto Tun	2.395 9 GHz -28.45 dBm	Mkr4					Ref Offset Ref 30.0		dB/div
Center Fre		-	_				1		0
13.015000000 GH	141 0.58 dBm		+	-		-	1	-	0
									0
Start Fre 30.000000 MH							4	_	0
			-	-	-		1	-	0 —
Stop Fre			-	Non-		An inde	-	aut	0
26.00000000 GH						1.1.1		-	9
CF Ste 2.597000000 GH	oan 25.97 GHz 2 s (30001 pts)		-	300 kHz	#VBI		02 GHz 00 kHz		
Auto Ma	FUNCTION VALUE	FUNCTION WOTH	UNCTION			x			MODE
Freq Offse				18.61 dBm -44.78 dBm	4 GHz 0 GHz	4,874	1	1	NNN
OH			_	-47.13 dBm -28.45 dBm	9 GHz	2.395	1	1	N
Scale Typ			_						
Log Li			-		_				
	· · · ·		_	~	1			-	-
		STATIAS					_		-

### Spurious Emission 802.11b 20MHz 2462MHz

519	5 PMDe: 21.2019							pt 53,	Stallyzer - San	actrum il	NOT NO	ke B
Frequency	RACE 123456	TRU	e: Log-Pwr	Avg T	PROCEDUT.	Tria: Fre	Hz	00000 G			ter F	
	DET P N NN N N					#Atten: 3	AD: Fast = laind.nw	IFC				
Auto Tur	36 0 GHz 7.83 dBm		Mkr						Offset 14		Bidiv	o di
			1	1			1	Dill	1	di		og
Center Fre		-	-	-	-	-	-		-	- 11	-	20.0
13.015000000	0.1-071-00			1	1		1		-		-	10.0
							-					0,00
Start Fre												10,0
30.000000 Mi				-			-	-				20.0
	1		1	-				2			-	30,0
Stop Fre	-	-	a secold a second			( anner and	-	See anna	-		2.4	A0.07
26.00000000 GH						the party of the last						50.0
							-	-	-		-	50.0
CF Ste 2.597000000 GF	25.97 GHz (30001 pts)		Sweep 2			/ 300 kHz	#VB			3.02 0		
Auto Mi	CTION VALUE	FUNC	WITTON WOTH	ICTION		7		x	1	HE 901	NODE T	102
						17.04 d		2.463		1 1	N	12
Freq Offs					Bm	-45.34 dl	GHz	4.924		1 1	N	3
01				-	Bm	-37.83 d	GHZ	25.736	-	1 1	N	5
				-	-					-	-	67
Scale Typ				_			-					8
	100	_		-	-		-				-	9
log L	-	-			-	-	1		_		1	11

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Spurious Emission\_802.11g\_20MHz\_2412MHz

Keysigel Talettum Roslyzer - Swept 54				218 44
Center Freq 13.01500000		Avg Type: Log-Pwr	101:43:00 PMDec 21, 2019 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 14.51 dB	PNO: Fast Trig: Free Run IFGaindlaw #Atten: 30 dB	Mkr	4 2.399 3 GHz	Auto Tune
10 dB/div Ref 30.00 dBm			-31.12 dBm	
20.0				Center Free 13.015000000 GH
-10.0			.DL1-6114 allen	StartFree
30.0	.3			30.000000 MH
50.0 60.0	the state of the second st			Stop Fre 26.00000000 GH
Center 13.02 GHz #Res BW 100 kHz	#VBW 300 kHz		Span 25.97 GHz 482 s (30001 pts)	CF Ste 2.597000000 GH Auto Ma
1 N 1 f 2, 2 N 1 f 4,	418 4 GHz 9.33 dBm	FUNCTION FUNCTION WOTH	FUNCTION VALUE	
3 N 1 1 7.	824 0 GHz 45.91 dBm 236 0 GHz 47.64 dBm 399 3 GHz 31.12 dBm			Freq Offse 0 H
7 8 9				Scale Type
10				Log Lin
wsg.)		STATUS	,	_

### Spurious Emission\_802.11g\_20MHz\_2437MHz

R 1 30 50	Georget SA				218 44		
Center Freq 13.01	PNO: Fast	Trig: Free Run	Avg Type: Log-Pwr	PRACE 1 2 3 4 5 6 THE MUMMUMU DET F NINNN	Frequency		
10 dB/div Ref 0ffset	IFGaind rw	dB Mkr4 25.596 6 GHz					
20.0 10.0					Center Free 13.015000000 GH		
0.00 10.0 20.0 30.0				DL1 4.59 gbm	Start Free 30.000000 MH		
40.0 50.0 60.0	North Contraction				Stop Free 26.00000000 GH		
Center 13.02 GHz Res BW 100 kHz	#VBW	300 KHz		Span 25.97 GHz 482 s (30001 pts)	CF Step 2.597000000 GH Auto Ma		
1 N 1 f 2 N 1 f 3 N 1 f 5 6	2.442 6 GHz 4.874 0 GHz 7.311 0 GHz 25.596 6 GHz	7.89 dBm -46.25 dBm -47.46 dBm -37.61 dBm	MCYCIN FUNCTION MIDTH	+UNCTION VALUE	Freg Offse 0 H		

### Spurious Emission\_802.11g\_20MHz\_2462MHz

Reyspirit Time	thum soulyzer-d			-	-		01157:05 PHDe		518 6
enter Fr		5000000 GH	Fast	Trig: Free Ru #Atten: 30 dE	A	vg Type: Log-Pwr	TRACE	23456	Frequency
dB/div	Ref Offset	14.51 dB	1511W	extren: 30 de		Mk	4 25.786 2 -38.20		Auto Tune
10 1.0	Q1		_					_	Center Free 13.015000000 GH
							DL1	-621 dbn	Start Free 30.000000 MH
	-							-	Stop Fre 26.00000000 GH
enter 13. Res BW	100 kHz		#VBW	300 KHz	CONC. CONC.	Sweep	Span 25.9 2.482 s (3000	01 pts)	CF Step 2.597000000 GH Auto Ma
		2,468 6 G 4,924 0 G 7,386 0 G 25,786 2 G	Hz	7.19 dBm -46.50 dBm -47.41 dBm -38.20 dBm					Freq Offse 0 H
N 1 5 7 8 9 9									Scale Typ
4						STATU	4	•	

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### Report No.: E2/2019/B0013 Page 42 of 98

### Spurious Emission\_802.11n\_20MHz\_2412MHz

218 4								Rollyzer-Swep		yaget (	- 11
Frequency	12:04:00 PMDet 21, 2019 PRACE 1 2 3 4 5 6 TITE M WWWWW	Log-Pwr	Avg Type	MELTINT.	and and	Hz	00000 GI	13.01500		ter	er
	DET P NNNNN				#Atten: 3	IO: Fast ++					,
Auto Tun	2.399 3 GHz -29.66 dBm	Mkr4						f Offset 14.5 f 30.00 d		B/div	
Center Fre			-	-	_			1	-		.og
13.015000000 GH							-		-		10.0
-	11.1-7 cli dim	-		_		-	_			_	10.00
Start Fre 30.000000 MH				-		-		4		-	20.0
			-							-	30.0
Stop Fre			in the second second	(disident		a total			-		40.0
25.00000000 GH			10.0	-	-					-	60.0
CF Ste 2.597000000 GH	Span 25.97 GHz 82 s (30001 pts)				300 kHz	#VBW		GHz kHz	13.02 N 10		
<u>Auto</u> Ma	FUNCTION VALUE	CTION WOTH	CTION		8.77 dt	GHz	2.414 9			N	1
Freq Offse				3m 3m	-46.25 dE -47.96 dE -29.66 dE	GHz	4.824 0 7.236 0 2.399 3			NNN	23
Scale Typ		-		-							5678
			-	-		-		-	-	-	9 10
Log Li		1		1	~	1		1			<u>îî</u>
		STATIAL									sa

### Spurious Emission\_802.11n\_20MHz\_2437MHz

218 44							REAL 24	I MORE THE	ectrorite	10113	
Frequency	90 PH Dec 21, 2019 PRACE 1 2 3 4 5 6		Type: Log-Pwr		SERVER	Hz	000000 G		req	ter F	e a Cen
Auto Tun	DET P NNNNN			-	Trig: Free Run #Atten: 30 dB	ND: Fast - Gaind aw	p				
AutoTune	742 9 GHz 7.88 dBm		Mkr					f Offset		3/div	
Center Fre	-	-	-		-			1	Ó	-	20.0 10.0
13.01500000 GH	11.1 - 1 - 10 - 10-	-	-			-			-		0.00
Start Free 30.000000 MH						-				1	10.0 -20.0
Stop Fre	-		and the design	(In selection		3	2 0				-30.0
26.00000000 GH				MILLION							50.0 -60.0
CF Ster 2.597000000 GH Auto Ma	n 25.97 GHz (30001 pts)		Sweep		300 KHz	#VB		GHz kHz			
Auto Mai	ACTION VALUE	TH FU	FUNCTION WOTH	FUNCTION	9,09 dBm	6 GHz	2 447			N	1
Freq Offse 0 H					-45.19 dBm -44.79 dBm -37.88 dBm	0 GHz 0 GHz	4.874		1	N N N	23456
Scale Type									-		7 8 9
Log Lin											10 11
					-			-	_	_	11

### Spurious Emission\_802.11n\_20MHz\_2462MHz

Reysond Sta	ectrum Rollyza	er-Swept SA	-				218
Center F	req 13.0	15000000 GHz	Trig: Free	Run	g Type: Log-Pwr	192116:29 PMDec 21, 2019 TRACE 1: 2:3 4 5 6 THE MANNESS	Frequency
	Betotte	IFGainda		dB	Mki	4 25.824 3 GHz	Auto Tun
0 dB/div		.00 dBm				-37.19 dBm	-
20.0	1						Center Fre
10.0	0						13.015000000 GH
0.00					-	X1-826-00m	
10,0			-				Start Fre
20.0			1			4	30.000000 MF
40.0		A2 A3			10. A 10. A 10.		
50.0	-	and the second second		10000			Stop Fre
60.0							26.00000000 GH
	3.02 GHz					Span 25.97 GHz	CF Ste
	100 kHz	#	VBW 300 kHz	_	Sweep	2.482 s (30001 pts)	2.597000000 GH Auto Ma
1 N	2 90	2.465 1 GHz	7.57 dB		FUNCTION WIDTH	FUNCTION VALUE	Citato Inte
2 N 3 N	1	4,924 0 GHz 7,386 0 GHz	-44.64 dB	11			Freq Offse
4 N 1	1	25.824 3 GH	-37.19 dB	n			OH
6							-
8							Scale Typ
10							Log Li
-				-	100		
50					STATU	0	

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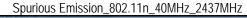
SGS Taiwan Ltd. No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134 號 t (886-2) 2299-3279

台灣檢驗科技股份有限公司

f (886-2) 2298-0488

### Spurious Emission\_802.11n\_40MHz\_2422MHz

Reyspirit Sper	chum Rollyzer-Se			_					51844
enter Fr	eq 13.015	000000 GH	Z Fast	Trig: Free Ru	Avg	Type: Log-Pwr	TRA	CE 1 2 3 4 5 6 TE MWWWWW ST P NNNN	Frequency
100		IFGa	ind nw	#Atten: 30 dB		-	-	10 M 10 M	Auto Tune
0 dB/div	Ref Offset 1 Ref 30.00					M		8 5 GHz .01 dBm	Autoruna
90.0 0.0				_	_				Center Free
0.0	9								13.015000000 GH
0.0	-				_	_		D.1-1292-Dm	Start Free
00	4			-					30.000000 MH
0.0	land	2 3				IS IS HE AR			Stop Free
00							1		26.00000000 GH
enter 13 Res BW		1 1	#VBW	300 kHz	-	Sweep	Span : 2.482 s (3	25.97 GHz 30001 pts)	CF Stej 2.597000000 GH
RE MODE TH		×			FUNCTION	FUNCTION MOTH	FUNCT	CONVALUE -	Auto Mai
1 N 1 2 N 1 3 N 1 4 N 1 5	1	2.427 9 4.844 0 7.266 0 2.398 5	GHz	5.55 dBm -45.04 dBm -46.34 dBm -33.01 dBm	-				Freq Offse
5 6 7 8 9			-						Scale Type
9				_				-	Log Lin
					-	-			



			SEMERAT		DK [	50 12	107	1	-
Frequency	02:07:47 PMDec 21, 2019 FRACE 1 2 3 4 5 6	vg Type: Log-Pwr		_	0000 GHz			Fre	ter
	DET PNNNN		: Free Run en: 30 dB	st	PNO: Fast IFGaind av				
Auto Tune	4 2.397 6 GHz -36.64 dBm	Mkr				Offset 14.5 30.00 dB			B/div
Center Free 13.015000000 GH			-				Q1		-
Start Free 30.000000 MH	D.1.100						4		
Stop Fre 26.00000000 GH				-	and a statement			-	-
CF Ste 2.597000000 GH	Span 25.97 GHz 482 s (30001 pts)	Swaan 2	kHz	VBW	#V		02 GI 00 k		
	the states have	Sweep z.					_	-	
Auto Ma	FUNCTION VALUE				x				
Auto Ma Freq Offse 0 H			09 dBm 29 dBm 33 dBm 54 dBm		× 2.426 2 GHz 4.874 0 GHz 7.311 0 GHz 2.397 6 GHz			1	N N N N

### Spurious Emission\_802.11n\_40MHz\_2452MHz

KeysigH To	ectrum Roslyzer-									518 10
Center F		5000000 GH	Z Fast	Trig: Free R	Lun	vg Type: Lo			ec 21, 2019 1 2 3 4 5 6 M WWWWW F NNNNN	Frequency
1.22	_	IFG	walnu	#Atten: 30 c	6	_		-	10.00	Auto Tune
0 dB/div	Ref Offset Ref 30.0				-		MKr4 :	-36.2	7 GHz 7 dBm	
30.0		-		_		-	_	-		Center Free
0.0	- gi			-						13.015000000 GH
0.0		_					_		with the second	Start Fre
0.0	-			-			-			30.000000 MH
10.0	1000	A2 +3			1.1.1					-
00	and states in the				-					Stop Fre 26.00000000 GH
enter 1	3.02 GHz 100 kHz		#VBW	300 kHz		SW	eep 2.4	Span 25.		CF Ste 2.597000000 GH
		×		JOURNE	FUNCTION	EUNITO		EUNHOW		Auto Ma
1 N 2 N 3 N 4 N 5	1	2,443 5 4,904 0 7,356 0 25,879 7	GHz	4.31 dBn -44.12 dBn -47.50 dBn -36.27 dBn	1					Freq Offse 0 H
5 6 7 8 9 0					-					Scale Typ
9			-		-	+	-		=	Log Li
<u> </u>	1-1		d.			-			- )F	
9						_	STATIAS		_	



# 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

## 11.1 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.
- Emission level (dBµV/m) = 20 log Emission level (dBµV/m)

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## **11.2 Measurement Equipment Used:**

		966 Chamber			
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband An- tenna	SCHWAZBECK	VULB 9168	9168-617	11/04/2019	11/03/2020
Horn Antenna	Schwarzbeck	BBHA9170	185	08/07/2019	08/06/2020
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/12/2019	06/11/2020
Loop Antenna	ETS.LINDGREN	6502	143303	04/25/2019	04/24/2020
3m Site NSA	SGS	966 chamber D	N/A	07/12/2019	07/11/2020
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	06/10/2019	06/09/2020
Pre-Amplifier	<b>EMC</b> Instruments	EMC184045B	980135	11/20/2019	11/19/2020
Pre-Amplifier	<b>EMC</b> Instruments	EMC9135	980234	11/20/2019	11/19/2020
Pre-Amplifier	<b>EMC</b> Instruments	EMC12630SE	980271	11/20/2019	11/19/2020
Attenuator	Woken	WATT-218FS-1 0	RF25	11/20/2019	11/19/2020
High Pass Filter	R&S	F13 HPF 3GHz	RF64	11/20/2019	11/19/2020
Low Pass Filter	EWT	EWT-56-0019	RF46	11/20/2019	11/19/2020
Notch Filter	EWT	EWT-54-0038	RF55	11/20/2019	11/19/2020
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/20/2019	11/19/2020
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/20/2019	11/19/2020
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17413/4	11/20/2019	11/19/2020

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## Measurement Equipment Used For Simultaneous:

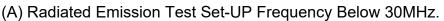
	966 Chamber								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.				
Broadband Antenna	SCHWAZBEC K	VULB 9168	9168-617	11/04/2019	11/03/2020				
Broadband Antenna	TESEQ	CBL 6112D	35240	09/09/2019	09/08/2020				
Horn Antenna	Schwarzbeck	BBHA9120D	1187	01/10/2020	01/09/2021				
Horn Antenna	Schwarzbeck	BBHA9170	185	08/07/2019	08/06/2020				
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/12/2019	06/11/2020				
3m Site NSA	SGS	966 chamber D	N/A	07/12/2019	07/11/2020				
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	06/10/2019	06/09/2020				
Pre-Amplifier	EMC Instru- ments	EMC330	980096	11/20/2019	11/19/2020				
Pre-Amplifier	EMC Instru- ments	EMC0011830	980199	11/20/2019	11/19/2020				
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	11/20/2019	11/19/2020				
Pre-Amplifier	EMC Instru- ments	EMC9135	980234	11/20/2019	11/19/2020				
Pre-Amplifier	EMC Instru- ments	EMC12630SE	980271	11/20/2019	11/19/2020				
Highpass Filter	Micro Tronics	BRM50701-01	G008	11/20/2019	11/19/2020				
High Pass Filter	Micro-Tronics	G003	RF99	11/20/2019	11/19/2020				
Notch Filter	Woken	EWT-54-0037	RF54	11/20/2019	11/19/2020				
Notch Filter	Woken	EWT-54-0038	RF55	11/20/2019	11/19/2020				
Lowpass Filter	Woken	EWT-56-0019	RF46	11/20/2019	11/19/2020				
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/20/2019	11/19/2020				
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/20/2019	11/19/2020				
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17413/4	11/20/2019	11/19/2020				
Radio Communica- tion Analyer	Anritsu	MT8821C	6262044739	12/06/2019	12/05/2020				

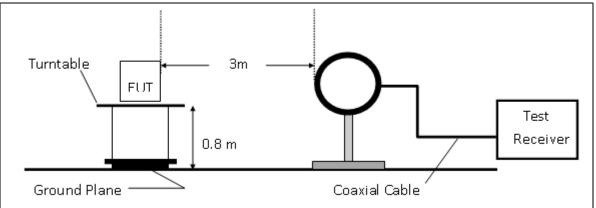
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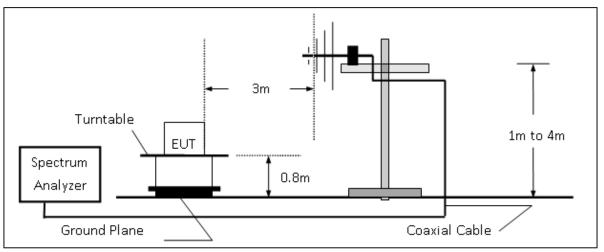


## 11.3 Test SET-UP

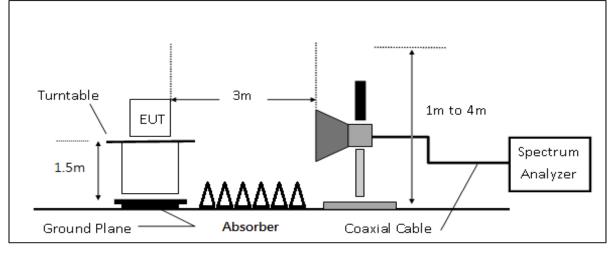




## (B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



## (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.
- 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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## **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* 

RA = Reading Amplitude AF = Antenna Factor

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

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) was not reported.

## **11.7 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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## 11.7.1 Radiated Band Edge Measurement Result

9/B0013

LOW

Report Number	:E2/2019/B0
Operation Mode	:802.11b
Test Channel	:2412 MHz
Test Mode	:BE CH LO
EUT Pol	:E2 Plan

2387.28

2390.00

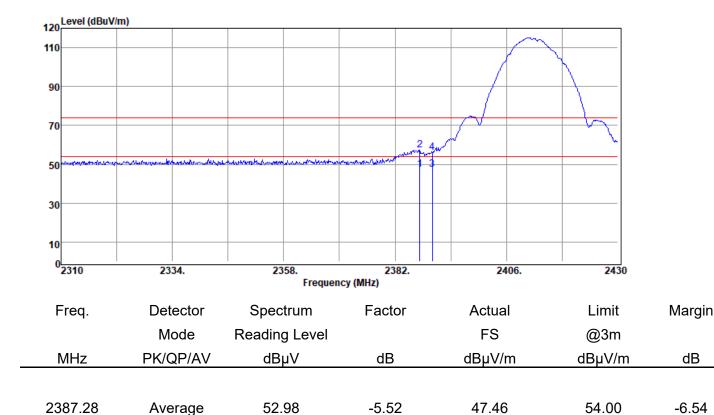
2390.00

Peak

Average

Peak

Test Date	:2019-12-12
Temp./Humi.	:22.2/58
Antenna Pol.	:VERTICAL
Engineer	:Kailin



-5.52

-5.52

-5.52

57.23

47.47

56.21

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62.75

52.99

61.73

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74.00

54.00

74.00

-16.77

-6.53

-17.79

2430

Test Date

2406.



·E2/2019/B0013

**Report Number** 

10

0 2310

2334.

Operation Mode Test Channel Test Mode EUT Pol	:802.11b :2412 MHz :BE CH LOW :E2 Plan		Temp./Humi. Antenna Pol. Engineer	:22.2/58 :HORIZONTAL :Kailin
120 Level (dBuV/m)				
110			-p	<u> </u>
90				
70				
50	าแล้งระสมออกทางการสารแขทรงไทยการสอกเป็นกำรรมส	2 gran		
30				

Frequency (MHz) Freq. Detector Spectrum Factor Actual Limit Margin **Reading Level** FS Mode @3m PK/QP/AV MHz dBµV dB dBµV/m dBµV/m dB 2386.56 Average 54.71 -5.53 49.18 54.00 -4.82 2386.56 Peak 63.23 -5.53 57.70 74.00 -16.30 2390.00 Average 55.12 -5.52 49.60 54.00 -4.40 2390.00 -17.19 Peak 62.33 -5.52 56.81 74.00

2382.

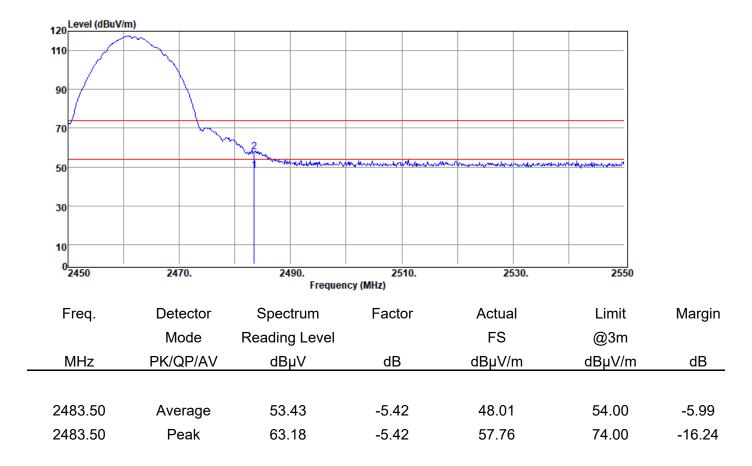
Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

2358.

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Report Number	:E2/2019/B0013	Test Date	:2019-12-12
Operation Mode	:802.11b	Temp./Humi.	:22.2/58
Test Channel	:2462 MHz	Antenna Pol.	:VERTICAL
Test Mode	:BE CH HIGH	Engineer	:Kailin
EUT Pol	:E2 Plan		



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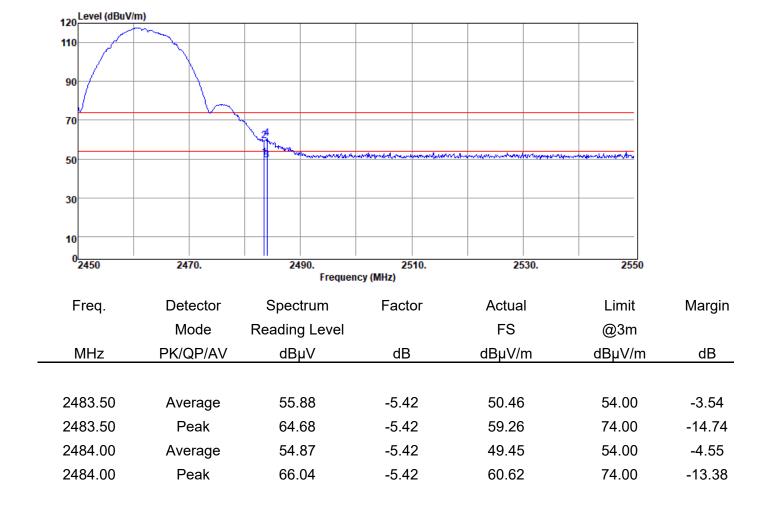
:HORIZONTAL

:22.2/58

:Kailin



Report Number	:E2/2019/B0013	Test Date
Operation Mode	:802.11b	Temp./Humi.
Test Channel	:2462 MHz	Antenna Pol.
Test Mode	:BE CH HIGH	Engineer
EUT Pol	:E2 Plan	



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Test Date

52.15

70.98



:E2/2019/B0013

**Report Number** 

2390.00

2390.00

Average

Peak

Operation Mode	:802.11g				Т	[emp./	Humi.	:22.2/54	
Test Channel	:2412 MHz				A	Antenr	a Pol.	:VERTICA	L
Test Mode	:BE CH LO\	N			E	Engine	er	:Kailin	
EUT Pol	:E2 Plan								
120 Level (dBuV/m)								1	
110						<u>(</u>	$\sim$	m	
90								June 1	
70				7				·····	
wante and an Ara bei and an Araba	and a with a strain with the state of the strain	and a second	and the state of the	marked -					
50									
30									
10									
0 2310	2334.	2358. Frequer	23 Icy (MHz)	382.		24	06.	2430	
Freq.	Detector	Spectrum	Fact	or		Actua	I	Limit	Margin
	Mode	Reading Level				FS	•	@3m	
MHz	PK/QP/AV	dBµV	dB	5	с	lBμV/ι	n	dBµV/m	dB
		•							

57.67

76.50

-5.52

-5.52

-1.85

-3.02

54.00

74.00

Test Date



:E2/2019/B0013

**Report Number** 

2390.00

2390.00

Average

Peak

Opera	ation Mode	e :802.11g				Temp./	Humi.	:22.2/54	
Test C	Channel	:2412 MHz	2			Antenr	na Pol.	:HORIZO	NTAL
Test N	lode	:BE CH LC	W			Engine	er	:Kailin	
EUT F	Pol	:E2 Plan							
120	Level (dBuV/m	1)							
110							~~~~	~	
						/			
90									
70					20.	and the second s		- The second	
70									
50	karlestationarian manafait	an a		and the state of t	AND CONTRACT				
30									
10									
	2310	2334.	2358.		82.		06.	2430	
	2310	2334.		ncy (MHz)	02.	2-		2450	
F	req.	Detector	Spectrum	Facto	or	Actua	I	Limit	Margin
		Mode	Reading Level			FS		@3m	
<u> </u>	MHz	PK/QP/AV	dBµV	dB		dBµV/	n	dBµV/m	n dB
<u> </u>	MHz		-	dB			n	-	n dB

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56.05

74.45

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-5.52

-5.52

50.53

68.93

54.00

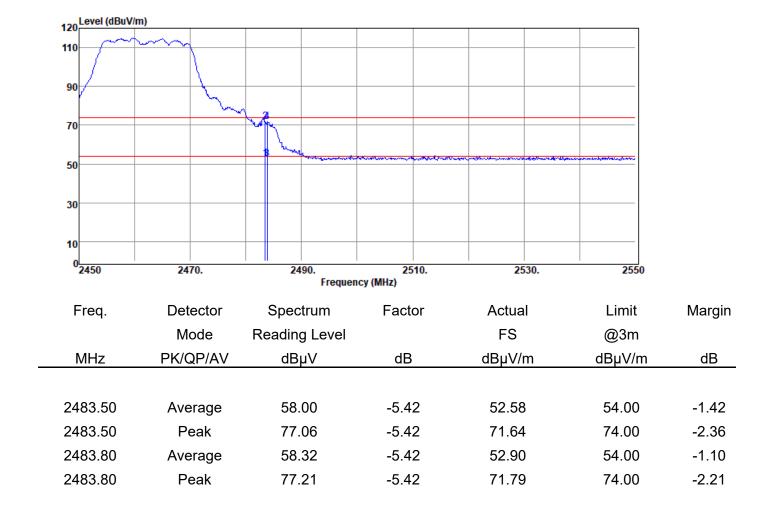
74.00

-3.47

-5.07



Report Number	:E2/2019/B0013	Test Date	:2019-12-13
Operation Mode	:802.11g	Temp./Humi.	:22.1/54
Test Channel	:2462 MHz	Antenna Pol.	:VERTICAL
Test Mode	:BE CH HIGH	Engineer	:Kailin
EUT Pol	:E2 Plan		



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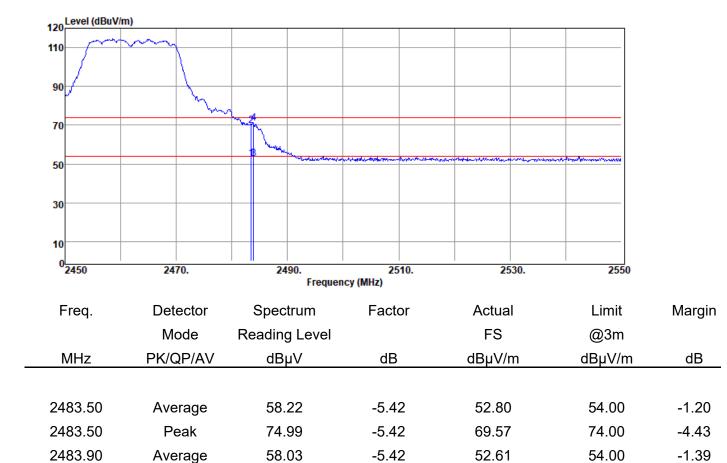


2483.90

Peak

Report Number	:E2/2019/B0013
Operation Mode	:802.11g
Test Channel	:2462 MHz
Test Mode	:BE CH HIGH
EUT Pol	:E2 Plan

Test Date	:2019-12-13
Temp./Humi.	:22.1/54
Antenna Pol.	:HORIZONTAL
Engineer	:Kailin



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76.59

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-5.42

71.17

74.00

-2.83

Test Date



:E2/2019/B0013

**Report Number** 

2390.00

Peak

Operation Mode	:802.11n20			Temp./Humi.	:22.2/54	
Test Channel	:2412 MHz	2		Antenna Pol.	:VERTICAL	
Test Mode	:BE CH LC	W		Engineer	:Kailin	
EUT Pol	:E2 Plan					
120 Level (dBuV/m)						
110						
90					+	
70						
50 the second second	na anti-anti-anti-anti-anti-anti-anti-anti-	ม <sub>ีสถาสถา</sub> ให้ระหระบบของ <sub>การ</sub> เหมือ <sub>่างมาส</sub> ารกระบบราสุรักษ์สารทำ	and the company of the State of			
30						
50						
10						
0 <mark></mark> 2310	2334.	2358.	2382.	2406.	2430	
		Frequen	cy (MHz)			
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	58.98	-5.52	53.46	54.00	-0.54

76.45

-5.52

70.93

74.00

-3.07

2430

Test Date

2406.



:E2/2019/B0013

**Report Number** 

02310

2334.

Operation Mode	:802.11n20		Temp./Humi.	:22.2/54
Test Channel	:2412 MHz		Antenna Pol.	:HORIZONTAL
Test Mode	:BE CH LOW		Engineer	:Kailin
EUT Pol	:E2 Plan			
120 Level (dBuV/m)				
110				
90				+
70		2		
		June 1		
50	analalaritesta analatista andro andra andra andra andra analaritesta analaritesta analatista analatista anal	were -		
30				
10				
0				

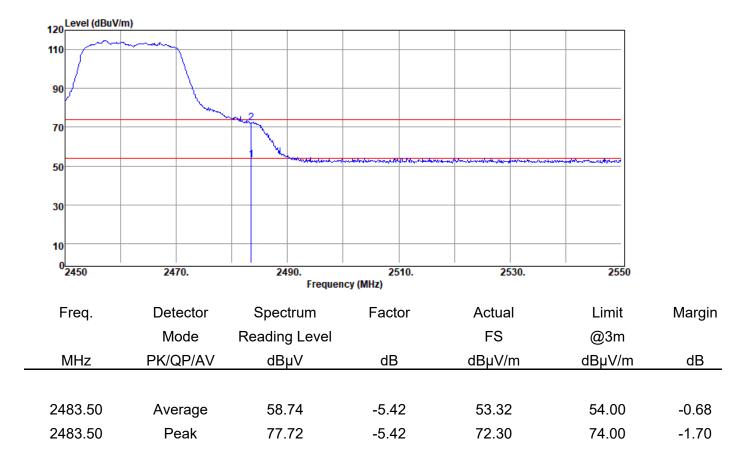
2382. Frequency (MHz)

2358.

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	59.01	-5.52	53.49	54.00	-0.51
2390.00	Peak	78.52	-5.52	73.00	74.00	-1.00



Report Number	:E2/2019/B0013	Test Date	:2019-12-13
Operation Mode	:802.11n20	Temp./Humi.	:22.2/54
Test Channel	:2462 MHz	Antenna Pol.	:VERTICAL
Test Mode	:BE CH HIGH	Engineer	:Kailin
EUT Pol	:E2 Plan		

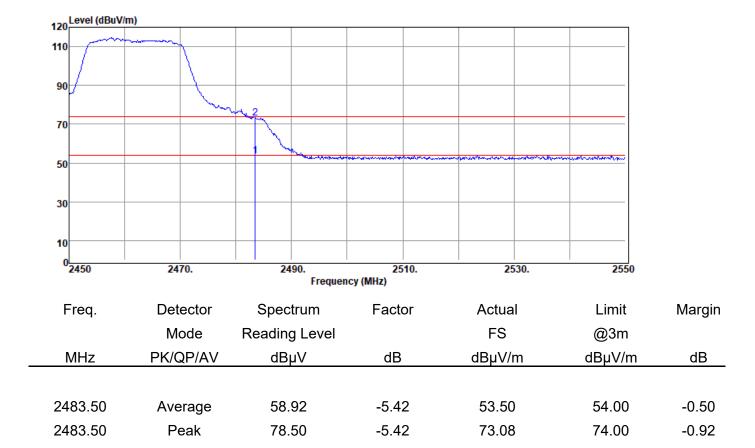


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Report Number	:E2/2019/B0013	Test
Operation Mode	:802.11n20	Tem
Test Channel	:2462 MHz	Ante
Test Mode	:BE CH HIGH	Engi
EUT Pol	:E2 Plan	

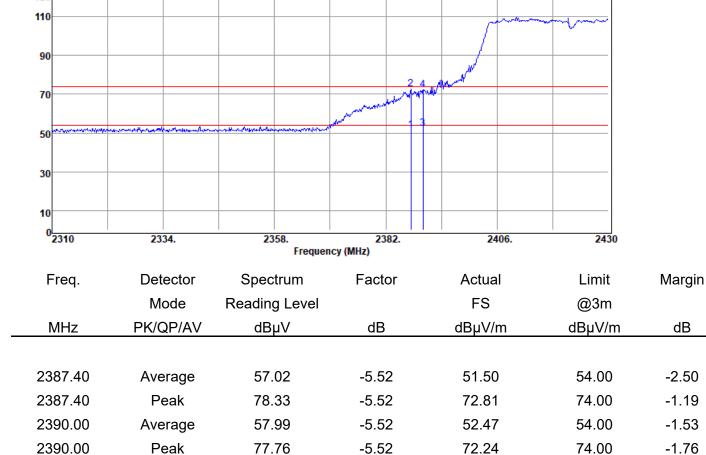
Test Date	:2019-12-13
Temp./Humi.	:22.2/54
Antenna Pol.	:HORIZONTAL
Engineer	:Kailin



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Report Number	:E2/2019/B	0013		Test Da	ate	:2019-12	2-13
Operation Mode	:802.11n40			Temp./	/Humi.	:22.0/55	
Test Channel	:2422 MHz			Antenr	na Pol.	:VERTIC	AL
Test Mode	:BE CH LO	W		Engine	er	:Kailin	
EUT Pol	:E2 Plan						
120 Level (dBuV/m)				 			



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2388.60

2390.00

2390.00

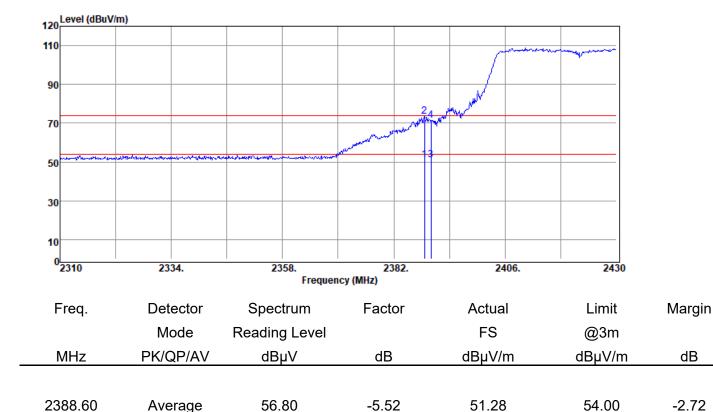
Report Number	:E2/2019/B0013
Operation Mode	:802.11n40
Test Channel	:2422 MHz
Test Mode	:BE CH LOW
EUT Pol	:E2 Plan

Peak

Average

Peak

Test Date	:2019-12-13
Temp./Humi.	:22.0/55
Antenna Pol.	:HORIZONTAL
Engineer	:Kailin



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78.91

56.71

76.85

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-5.52

-5.52

-5.52

73.39

51.19

71.33

74.00

54.00

74.00

-0.61

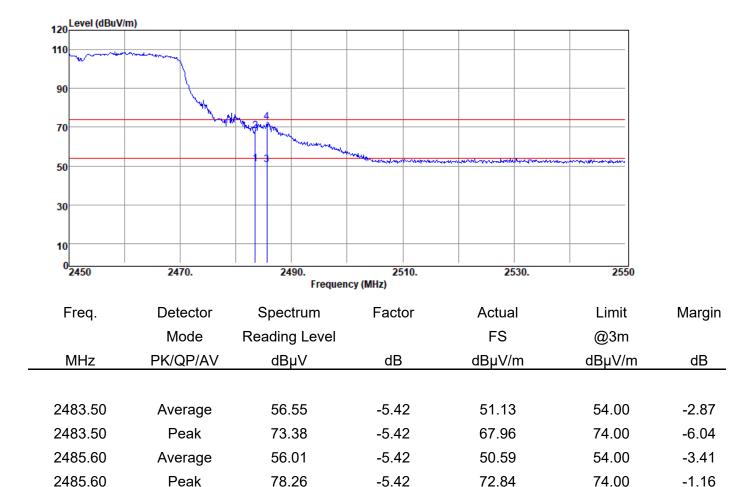
-2.81

-2.67



Report Number	:E2/2019/B0013
Operation Mode	:802.11n40
Test Channel	:2452 MHz
Test Mode	:BE CH HIGH
EUT Pol	:E2 Plan

Test Date	:2019-12-13
Temp./Humi.	:22.2/54
Antenna Pol.	:VERTICAL
Engineer	:Kailin



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2485.10

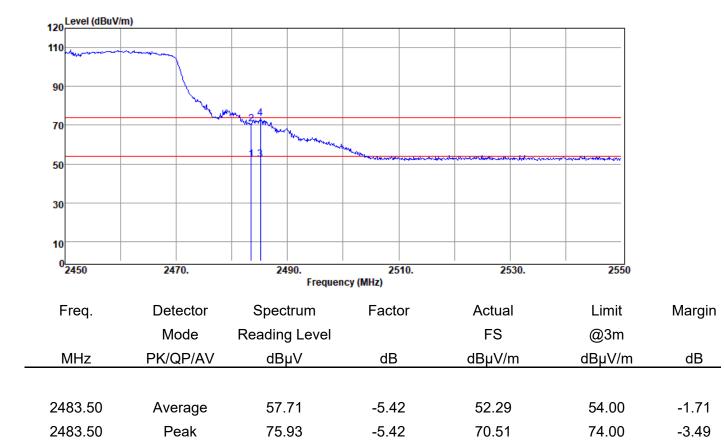
2485.10

Average

Peak

Report Number	:E2/2019/B0013
Operation Mode	:802.11n40
Test Channel	:2452 MHz
Test Mode	:BE CH HIGH
EUT Pol	:E2 Plan

Test Date	:2019-12-13
Temp./Humi.	:22.2/54
Antenna Pol.	:HORIZONTAL
Engineer	:Kailin



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57.66

78.85

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-5.42

-5.42

52.24

73.43

54.00

74.00

-1.76

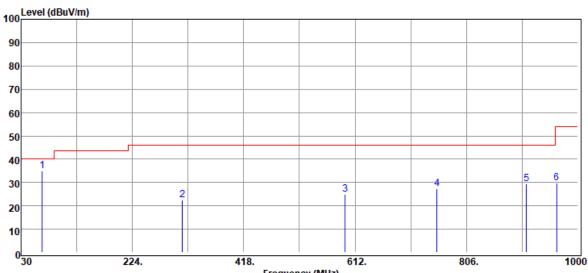
-0.57



## 11.7.2 Below 1GHz Worst-Case Emission:

Report Number	:E2/2019/B0013
Operation Mode	:802.11b
Test Channel	:2437 MHz
Test Mode	:TX CH MID
EUT Pol	:E2 Plan

Test Date	:2019-12-13
Temp./Humi.	:22.4/56
Antenna Pol.	:VERTICAL
Engineer	:Kailin



Frequency (I	MHz)
--------------	------

Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
66.86	Peak	53.37	-18.59	34.78	40.00	-5.22
311.30	Peak	37.79	-15.18	22.61	46.00	-23.39
594.54	Peak	33.96	-9.03	24.93	46.00	-21.07
754.59	Peak	33.98	-6.63	27.35	46.00	-18.65
910.76	Peak	34.55	-5.12	29.43	46.00	-16.57
963.14	Peak	34.07	-4.25	29.82	54.00	-24.18

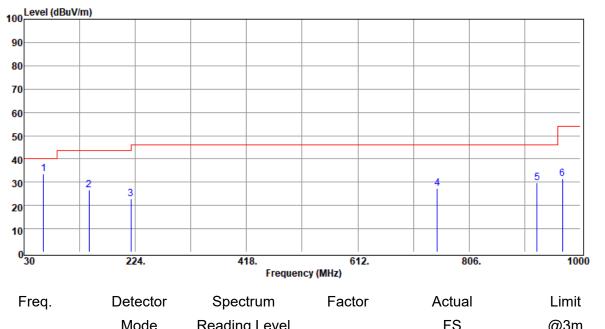
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Margin



Report Number	:E2/2019/B0013	Test Date	:2019-12-13
Operation Mode	:802.11b	Temp./Humi.	:22.4/56
Test Channel	:2437 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:TX CH MID	Engineer	:Kailin
EUT Pol	:E2 Plan		



Mode	Reading Level		FS	@3m	
PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
Peak	51.77	-18.09	33.68	40.00	-6.32
Peak	43.18	-16.70	26.48	43.50	-17.02
Peak	41.38	-18.59	22.79	46.00	-23.21
Peak	34.02	-6.73	27.29	46.00	-18.71
Peak	34.64	-4.78	29.86	46.00	-16.14
Peak	35.75	-4.10	31.65	54.00	-22.35
	PK/QP/AV Peak Peak Peak Peak Peak	PK/QP/AV dBµV Peak 51.77 Peak 43.18 Peak 41.38 Peak 34.02 Peak 34.64	PK/QP/AV dBµV dB   Peak 51.77 -18.09   Peak 43.18 -16.70   Peak 41.38 -18.59   Peak 34.02 -6.73   Peak 34.64 -4.78	PK/QP/AVdBµVdBdBµV/mPeak51.77-18.0933.68Peak43.18-16.7026.48Peak41.38-18.5922.79Peak34.02-6.7327.29Peak34.64-4.7829.86	PK/QP/AVdBµVdBdBµV/mdBµV/mPeak51.77-18.0933.6840.00Peak43.18-16.7026.4843.50Peak41.38-18.5922.7946.00Peak34.02-6.7327.2946.00Peak34.64-4.7829.8646.00

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## 11.7.3 Above 1GHz Emission:

Report Number	:E2/2019/B0013
Operation Mode	:802.11b
Test Channel	:2412 MHz
Test Mode	:TX CH LOW
EUT Pol	:E2 Plan

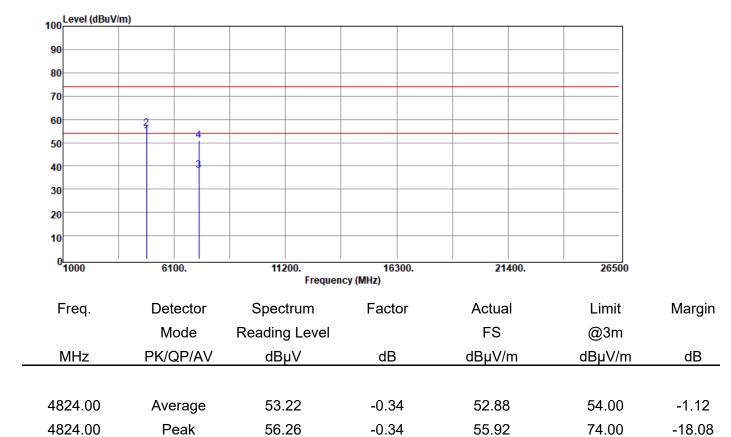
7236.00

7236.00

Average

Peak

Test Date	:2019-12-12
Temp./Humi.	:22.2/58
Antenna Pol.	:VERTICAL
Engineer	:Kailin



5.52

5.52

38.04

50.74

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32.52

45.22

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54.00

74.00

-15.96

-23.26

Test Date



·F2/2019/B0013

**Report Number** 

10

Opera			:E2/2019/B0013 :802.11b :2412 MHz :TX CH LOW :E2 Plan							Temp./Humi. :22.2/58 Antenna Pol. :HORIZONT Engineer :Kailin			
	Level (dBuV/	m)											
100		,											1
90													
50													
80													
70													
60		2	,										
		1											
50				- 4	4 I								
40					-								
				· `	1								
30													
20													
					1	1	1	1	1	1		1	1

0 <mark>1000</mark>	6100.	11200. Frequen	16300. Icy (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
4824.0	0 Average	53.03	-0.34	52.69	54.00	-1.31
4824.0	0 Peak	55.45	-0.34	55.11	74.00	-18.89
7236.0	0 Average	30.13	5.52	35.65	54.00	-18.35
7236.0	0 Peak	41.26	5.52	46.78	74.00	-27.22

26500

Test Date

21400.



:E2/2019/B0013

**Report Number** 

0<mark>1000</mark>

6100.

Operation Mode Test Channel Test Mode EUT Pol	:24 :TX	:802.11b :2437 MHz :TX CH MID :E2 Plan						Temp./Humi. Antenna Pol. Engineer		AL
100 Level (dBuV/m)										
90										
80										
70										
60	2	4								
50		3								
40										
30										
20										
10										

11200. 16300. Frequency (MHz)

Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
 MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4874.00	Average	52.68	-0.42	52.26	54.00	-1.74
4874.00	Peak	56.86	-0.42	56.44	74.00	-17.56
7311.00	Average	39.66	5.89	45.55	54.00	-8.45
7311.00	Peak	49.75	5.89	55.64	74.00	-18.36

26500

Test Date

21400.



:E2/2019/B0013

**Report Number** 

10

0<mark>\_\_\_\_\_</mark>

6100.

Operation Mode:802.11bTest Channel:2437 MHzTest Mode:TX CH MIDEUT Pol:E2 Plan					)		Temp./ Antenr Engine	a Pol.	:22.2/58 :HORIZ0 :Kailin		
100	evel (dBuV/	m)					1				1
90											
80											
70											
60											
50		- 2	) 		4						
				:	3						
40											
30											
20											

11200. 16300. Frequency (MHz)

Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
Average	50.64	-0.42	50.22	54.00	-3.78
Peak	53.45	-0.42	53.03	74.00	-20.97
Average	35.27	5.89	41.16	54.00	-12.84
Peak	46.99	5.89	52.88	74.00	-21.12
	Mode PK/QP/AV Average Peak Average	ModeReading LevelPK/QP/AVdBµVAverage50.64Peak53.45Average35.27	ModeReading LevelPK/QP/AVdBµVdBAverage50.64-0.42Peak53.45-0.42Average35.275.89	Mode Reading Level FS   PK/QP/AV dBμV dB dBμV/m   Average 50.64 -0.42 50.22   Peak 53.45 -0.42 53.03   Average 35.27 5.89 41.16	Mode Reading Level FS @3m   PK/QP/AV dBμV dB dBμV/m dBμV/m   Average 50.64 -0.42 50.22 54.00   Peak 53.45 -0.42 53.03 74.00   Average 35.27 5.89 41.16 54.00

Test Date



:E2/2019/B0013

**Report Number** 

4924.00

4924.00

7386.00

7386.00

Average

Peak

Average

Average

Opera	tion Mode	:80	)2.11b			Temp./Humi.	:22.2/58	
Test C	hannel	:24	62 MHz			Antenna Pol.	:VERTICAL	
Test M	lode	:T>	с СН НІС	GH		Engineer	:Kailin	
EUT F	Pol	:E2	2 Plan					
100	Level (dBuV/m)			,				
90								
80								
70								
60		2						
50		1	4					
40			3					
30								
20								
10								
0	1000	61	00.	11200.	16300.	21400.	26500	
					cy (MHz)			
F	req.	Det	ector	Spectrum	Factor	Actual	Limit	Margin
		Μ	ode	Reading Level		FS	@3m	
	MHz	PK/C	QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB

-0.61

-0.61

5.35

5.35

50.42

55.35

41.47

49.46

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51.03

55.96

36.12

44.11

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54.00

74.00

54.00

54.00

-3.58

-18.65

-12.53 -4.54

Test Date



:E2/2019/B0013

**Report Number** 

4924.00

4924.00

7386.00

7386.00

Average

Peak

Average

Peak

Operation Mode		:80	:802.11b					Temp./Humi.		:22.2/58	
Test Channel		:24	:2462 MHz					Antenna Pol.		:HORIZONTAL	
Test Mode		:TX	:TX CH HIGH					Engineer			
EUT Pol		:E2	:E2 Plan								
100 Level (dBuV/m)											
90											
80											
70											
60											
50		2	4								
40											
30											
20											
10											
	1000	640		41200	4620	0	244	100	2650		
0 1000 6100. 11200. 16300. 21400. 26500 Frequency (MHz)											
Freq.		Detector		Spectrum	Spectrum Factor		Actual		Limit	Margin	
		Мо	ode	Reading Level			FS		@3m		
MHz		PK/QP/AV		dBµV	dB		dBµV/m		dBµV/n	n dB	

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50.23

54.74

31.26

42.13

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-0.61

-0.61

5.35

5.35

49.62

54.13

36.61

47.48

54.00

74.00

54.00

74.00

-4.38

-19.87

-17.39

-26.52

Test Date



:E2/2019/B0013

**Report Number** 

4824.00

Peak

Operation Mode	:802.11g	:802.11g			:22.2/55	
Test Channel	:2412 MHz	<u>.</u>		Antenna Pol.	:VERTICAL	
Test Mode	:TX CH LC	W		Engineer	:Kailin	
EUT Pol	:E2 Plan					
100 Level (dBuV/m)						
90						
80						
70						
60						
50	2					
40	1					
30						
20						
10						
0 1000	6100.	11200. Frequent	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
4824.00	Average	34.55	-0.34	34.21	54.00	-19.79

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45.66

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-0.34

45.32

74.00

-28.68

Test Date

43.43



:E2/2019/B0013

**Report Number** 

4824.00

Opera	tion Mode	:80	2.11g	0010				Temp.	/Humi.	:22.2/55	
Test C	Channel	:24	12 MHz					Anteni	na Pol.	:HORIZO	NTAL
Test N	lode	:TX	CH LO	W				Engine	eer	:Kailin	
EUT F	Pol	:E2	2 Plan								
100	Level (dBuV/m)										
90											
80								_			
70											
60											
50											
40		2									
30		_									
20		_									
10		_									
0	1000	61	00	11:	200.	16	300.	21	400.	26500	
						ncy (MHz)		-		20000	
F	req.	Det	ector	Spec	trum	Fact	or	Actua	d	Limit	Margin
		M	ode	Reading	g Level			FS		@3m	
[	MHz	PK/C	QP/AV	dB	μV	dB		dBµV/	m	dBµV/m	n dB
48	24.00	Ave	erage	35.	01	-0.3	4	34.67	7	54.00	-19.33

-0.34

43.77

Peak

74.00

-30.57

Test Date

46.39



:E2/2019/B0013

**Report Number** 

4874.00

Peak

-	tion Mode hannel	:802.11g :2437 MHz			Temp./Humi. Antenna Pol.	:22.2/55 :VERTICAL	
Test M		:TX CH M			Engineer	:Kailin	
EUT P		:E2 Plan			g		
	evel (dBuV/m)						
100							
90							
80							
70							
60							
50		2					
40							
30							
20							
10							
0L 1	1000	6100.	11200. Frequer	16300. ncy (MHz)	21400.	26500	
_			-				
F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
N	/IHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
487	74.00	Average	35.27	-0.42	34.85	54.00	-19.15

-0.42

46.81

74.00

-27.61

Test Date

48.14



:E2/2019/B0013

**Report Number** 

4874.00

Peak

•	tion Mode	:802.11g					Temp./		:22.2/55	
Test C	hannel	:2437 M	Hz				Antenr	na Pol.	:HORIZO	NTAL
Test N	lode	:TX CH	MID				Engine	eer	:Kailin	
EUT P	Pol	:E2 Plar	1							
	Level (dBuV/m)									
90										
80										
70										
60										
50		2								
40										
30										
20										
10										
0	1000	6100.	112	200. Frequen	163 Icy (MHz)	300.	21	400.	26500	
F	req.	Detector	Spec	trum	Facto	or	Actua	l	Limit	Margin
		Mode	Reading	g Level			FS		@3m	
N	ИНz	PK/QP/A	/ dBj	JV	dB		dBµV/	m	dBµV/m	u dB
48	74.00	Average	35.	63	-0.42	2	35.21		54.00	-18.79

-0.42

48.56

74.00

-25.86

Test Date

43.69



:E2/2019/B0013

**Report Number** 

4924.00

Peak

Operati Test Ch	ion Mode		)2.11g 162 MHz					-	/Humi. na Pol.	:22.2/56 :VERTIC	AI
Test Mo			CH HI					Engine		:Kailin	
EUT Po			2 Plan					0			
too Le	evel (dBuV/m)										
100 90											
80											
70											
60											
50		2									
40		-									
30											
20											
10											
0	000	61	<b>00.</b>	11:	200. Frequer	16: Icy (MHz)	300.	21	<b>400.</b>	26500	1
Fr	eq.	Det	tector	Spec	trum	Fact	or	Actua	al	Limit	Margin
		М	ode	Readin	g Level			FS		@3m	
M	lHz	PK/0	QP/AV	dB	μV	dB		dBµV/	m	dBµV/n	n dB
492	24.00	Ave	erage	33.	.98	-0.6	1	33.37	7	54.00	-20.63

-0.61

44.30

74.00

-30.31

Test Date



:E2/2019/B0013

**Report Number** 

4924.00

Peak

Test C	tion Mode Channel	:802.11g :2462 MHz			Temp./Humi. Antenna Pol.	:22.2/56 :HORIZONT/	٩L
Test M		:TX CH HI	GH		Engineer	:Kailin	
EUT F	Pol	:E2 Plan					
100	Level (dBuV/m)						
90							
80							
70							
60							
50							
40		2					
30							
20							
10							
0	1000	6100.	11200. Frequer	16300. icy (MHz)	21400.	26500	
-	<u>.</u>	<b>D</b> / /					· · ·
F	req.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
N	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
49	24.00	Average	34.86	-0.61	34.25	54.00	-19.75

-0.61

45.73

46.34

74.00

-28.27

Test Date



:E2/2019/B0013

**Report Number** 

4824.00

Peak

Operation Mode		:802.11n20			:22.4/56	
Test Channel	:2412 MHz	2		Antenna Pol.	:VERTICAL	
Test Mode	:TX CH LC	W		Engineer	:Kailin	
EUT Pol	:E2 Plan					
100 Level (dBuV/m	1)					
90						
80						
70						
60						
50	2					
40						
30						
20						
10						
0 1000	6100.	11200.	16300.	21400.	26500	
		Frequen				
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	35.86	-0.34	35.52	54.00	-18.48

-0.34

45.15

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.

45.49

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74.00

-28.85

Test Date



:E2/2019/B0013

**Report Number** 

4824.00

Peak

Operation Mode	:802.11n20			Temp./Humi.	:22.4/56	
Test Channel	:2412 MHz	2		Antenna Pol.	:HORIZONT/	4L
Test Mode	:TX CH LC	W		Engineer	:Kailin	
EUT Pol	:E2 Plan					
100 Level (dBuV/m)						
90						
80						
70						
60						
50	2	2				
40						
30						
20						
10						
01000	6100.	11200.	16300.	21400.	26500	
		Frequen	cy (MHz)			
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					- /	
4824.00	Average	35.00	-0.34	34.66	54.00	-19.34

-0.34

44.62

44.96

74.00

-29.38

Test Date



:E2/2019/B0013

**Report Number** 

4874.00

Peak

Opera	tion Mode	e :802.11n20				Temp.	/Humi.	:22.4/56			
Test C	Channel	:24	37 MHz					Anteni	na Pol.	:VERTIC	AL
Test M	lode	:TX	CH MI	D				Engine	eer	:Kailin	
EUT F	Pol	:E2	Plan								
100	Level (dBuV/m)										
90											
80											
70											
60											
50		2									
40		1									
30											
20											
10											
0	1000	610	00.	11:	200.	16	300.	21	400.	26500	)
						ncy (MHz)					
F	req.	Det	ector	Spec	trum	Fact	or	Actua	al	Limit	Margin
		Mo	ode	Readin	g Level			FS		@3m	
	MHz	PK/G	QP/AV	dB	μV	dB		dBµV/	m	dBµV/n	n dB
48	74.00	Ave	erage	40.	.13	-0.4	2	39.72	1	54.00	-14.29

-0.42

49.42

49.84

74.00

-24.58

Test Date

47.82



:E2/2019/B0013

**Report Number** 

4874.00

Peak

Opera	tion Mode	:802.11n	20		Temp	./Humi. :22.4/56	
Test C	Channel	:2437 M	Hz		Anten	na Pol. :HORIZO	ONTAL
Test M	lode	:TX CH I	MID		Engin	eer :Kailin	
EUT F	Pol	:E2 Plan					
100	Level (dBuV/m)						
90							
80							
70							
60							
50		2					
40							
30							
20							
10							
	1000		44000				-
	1000	6100.	11200.	Frequency (MHz)	300. 2 <sup>.</sup>	1400. 2650	U
F	req.	Detector	Spectru	m Fact	or Actua	al Limit	Margin
		Mode	Reading L	evel	FS	@3m	
	MHz	PK/QP/AV	′ dBµV	dB	dBµV	/m dBµV/r	n dB
48	74.00	Average	35.91	-0.4	2 35.4	9 54.00	-18.51

-0.42

48.24

74.00

-26.18

Test Date

46.24



:E2/2019/B0013

**Report Number** 

4924.00

Peak

Operation Mode		:802.11n20			:22.4/56	
Test Channel	:2462 MHz	<u>.</u>		Antenna Pol.	:VERTICAL	
Test Mode	:TX CH HI	GH		Engineer	:Kailin	
EUT Pol	:E2 Plan					
100 Level (dBuV/m)						
90						
80						
70						
60						
50	2					
40						
30						
20						
10						
0 <mark></mark>	6100.	11200.	16300.	21400.	26500	
		Frequen	cy (MHz)			
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	36.22	-0.61	35.61	54.00	-18.39

-0.61

46.85

74.00

-27.76

Test Date



:E2/2019/B0013

**Report Number** 

4924.00

Operation Mod	e :802.11n20	:802.11n20			:22.4/56	AL.		
Test Channel	:2462 MHz			Antenna Pol.	:HORIZONTA	AL.		
Test Mode	:TX CH HI	GH		Engineer	:Kailin			
EUT Pol	:E2 Plan							
100 Level (dBuV/i	m)							
90								
80								
70								
60								
50	2							
40								
30								
20								
10								
0 <mark>1000</mark>	6100.	11200. Frequer	16300. icy (MHz)	21400.	26500			
<b>F</b> ace a	Detector			A stual	Linait	Manain		
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	37.26	-0.61	36.65	54.00	-17.35		

-0.61

47.25

47.86

Peak

74.00

-26.75

Test Date



:E2/2019/B0013

**Report Number** 

Operation Mode	:802.11n40			Temp./Humi.	:22.6/56	
Test Channel	:2422 MHz	2		Antenna Pol.	:VERTICAL	
Test Mode	:TX CH LC	W		Engineer	:Kailin	
EUT Pol	:E2 Plan					
100 Level (dBuV/m)						
90						
80						
70						
60						
50						
40	2					
30						
20						
10						
0 1000	6100.	11200.	16300.	21400.	26500	
		Frequen				
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4844.00	Average	37.12	-0.33	36.79	54.00	-17.21

-0.33

44.39

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44.72

Peak

4844.00

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74.00

-29.61

Test Date

44.00



:E2/2019/B0013

**Report Number** 

4844.00

Peak

Opera	tion Mode	:802.11	n40				Temp./	/Humi.	:22.6/56	
Test C	Channel	:2422 N	1Hz				Antenr	na Pol.	:HORIZO	NTAL
Test M	lode	:TX CH	LOW				Engine	er	:Kailin	
EUT F	Pol	:E2 Pla	n							
100	Level (dBuV/m)									
90										
80										
70										
60										
50										
40		2								
30										
20										
10										
	1000	6100.	11:	200. Frequer	163 1cy (MHz)	300.	21	400.	26500	
F	req.	Detector	- Spec	trum	Facto	or	Actua	ıl	Limit	Margin
		Mode	Reading	g Level			FS		@3m	
1	MHz	PK/QP/A	V dB	μV	dB		dBµV/i	m	dBµV/m	dB
48	44.00	Average	37.	03	-0.3	3	36.70	)	54.00	-17.30

-0.33

44.33

74.00

-30.00

Test Date

44.25



:E2/2019/B0013

**Report Number** 

4874.00

Peak

Operation Mo	ode :802.11n4			Temp./Humi.	:22.6/56	
Test Channel	:2437 MH	z		Antenna Pol.	:VERTICAL	
Test Mode	:TX CH M	ID		Engineer	:Kailin	
EUT Pol	:E2 Plan					
100 Level (dBu	V/m)					
90						
80						
70						
60						
50	2					
40	2					
30	1					
20						
10						
0 <mark>0</mark>	6100.	11200.	16300.	21400.	26500	
		Frequen	icy (MHz)			
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	32.95	-0.42	32.53	54.00	-21.47

-0.42

44.67

74.00

-29.75

Test Date

45.31



:E2/2019/B0013

**Report Number** 

4874.00

Peak

Opera	tion Mode	:802.11n40			Temp./Humi.	:22.6/56	
Test C	Channel	:2437 MHz	2		Antenna Pol.	:HORIZONT/	AL.
Test M	lode	:TX CH MI	D		Engineer	:Kailin	
EUT F	Pol	:E2 Plan					
100	Level (dBuV/m)						
90							
80							
70							
60							
50		2					
40		1					
30		1					
20							
10							
0	1000	6100.	11200.	16300.	21400.	26500	
		01001		icy (MHz)	21100	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	33.27	-0.42	32.85	54.00	-21.15

-0.42

45.73

74.00

-28.69

Test Date



:E2/2019/B0013

**Report Number** 

4904.00

Peak

Opera	tion Mode		2.11n40					Temp.	/Humi.	:22.6/56	
Test C	hannel	:245	52 MHz					Anteni	na Pol.	:VERTIC	AL
Test M	lode	:TX	CH HIG	θH				Engine	er	:Kailin	
EUT F	Pol	:E2	Plan								
100	Level (dBuV/m)			1		1			1		
90											
80											
70											
60											
50		2									
40		-									
30		1									
20											
10											
0	1000	610	0.	11:	200.		300.	21	<b>400.</b>	26500	)
					Frequer	icy (MHz)					
F	req.	Dete	ector	Spec	trum	Fact	or	Actua	ıl	Limit	Margin
		Мо	ode	Reading	g Level			FS		@3m	
	MHz	PK/Q	P/AV	dB	μV	dB		dBµV/	m	dBµV/n	n dB
49	04.00	Ave	rage	31.	22	-0.5	1	30.71		54.00	-23.29

-0.51

43.44

43.95

74.00

-30.56

Test Date



:E2/2019/B0013

**Report Number** 

4904.00

Peak

Operation Mode	:802.11n4(			Temp./Humi.	:22.6/56	
Test Channel	:2452 MHz	2		Antenna Pol.	:HORIZONTA	4L
Test Mode	:TX CH HI	GH		Engineer	:Kailin	
EUT Pol	:E2 Plan			J. J		
100 Level (dBuV/m)						
90						
80						
70						
60						
50	0					
40	2					
30	1					
20						
10						
0 <mark></mark>		44000	40000			
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
4904.00	Average	31.94	-0.51	31.43	54.00	-22.57

-0.51

43.50

44.01

74.00

-30.50



### Simultaneous: (2.4G WIFI + WWAN)

Report Number	:E2/2019/B0013
Operation Mode	:802.11b + LTE B2
Test Frequency	:2412 MHz + 1860 MHz
Test Mode	:TX CH LOW
EUT Pol	:E2 Plan

Test Date	:2020-03-04
Temp./Humi.	:20.7/68
Antenna Pol.	:VERTICAL
Engineer	:Kailin

100 Level (dBu						
90						
80						
70						
60	2 4 6					
50	35	-				
40		8				
30		7				
20						
10						
0 <sup>L</sup> 1000	6100.	11200. Free	16300. quency (MHz)	21400.	26500	
Freq.	Detecto	or Spectrum	Factor	Actual	Limit	Margin
		1	i deter	Actual	LIIIII	Margin
	Mode	•		FS	@3m	wargin
MHz		Reading Leve				dB
MHz	Mode	Reading Leve	el	FS	@3m	-
MHz 3720.00	Mode	Reading Leve AV dBµV	el	FS	@3m	-
	Mode PK/QP//	Reading Leve AV dBµV le 18.24	el dB	FS dBµV/m	@3m dBµV/m	dB
3720.00	Mode <u>PK/QP//</u> Averag	Reading Leve AV dBµV le 18.24 28.31	el <u>dB</u> 32.56	FS dBµV/m 50.80	@3m <u>dBµV/m</u> 54.00	dB -3.20
3720.00 3720.00	Mode <u>PK/QP//</u> Averag Peak	Reading Leve AV dBµV le 18.24 28.31 le 17.59	el dB 32.56 32.56	FS dBµV/m 50.80 60.87	@3m dBµV/m 54.00 74.00	dB -3.20 -13.13
3720.00 3720.00 4824.00	Mode PK/QP// Averag Peak Averag	Reading Leve AV dBμV le 18.24 28.31 le 17.59 26.54	el <u>dB</u> 32.56 32.56 35.16	FS dBµV/m 50.80 60.87 52.75	@3m dBµV/m 54.00 74.00 54.00	dB -3.20 -13.13 -1.25
3720.00 3720.00 4824.00 4824.00 5580.00	Mode PK/QP// Averag Peak Averag Peak	Reading Leve AV dBµV le 18.24 28.31 le 17.59 26.54 le 16.98	el <u>dB</u> 32.56 32.56 35.16 35.16	FS dBµV/m 50.80 60.87 52.75 61.70	@3m dBµV/m 54.00 74.00 54.00 74.00	dB -3.20 -13.13 -1.25 -12.30
3720.00 3720.00 4824.00 4824.00	Mode PK/QP// Averag Peak Averag Peak Averag	Reading Leve AV dBµV le 18.24 28.31 le 17.59 26.54 le 16.98 25.96	el <u>dB</u> 32.56 32.56 35.16 35.16 36.00	FS dBµV/m 50.80 60.87 52.75 61.70 52.98	@3m dBµV/m 54.00 74.00 54.00 74.00 54.00	dB -3.20 -13.13 -1.25 -12.30 -1.02

SGS Taiwan Ltd. No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134號

:2020-03-04

Test Date



:E2/2019/B0013

**Report Number** 

1	.EZ/2019/L	50015				
Operation Mode	:802.11b +	LTE B2		Temp./Humi.	:20.7/68	
Test Frequency	:2412 MHz	z + 1860 MHz		Antenna Pol.	:HORIZONT/	AL.
Test Mode	:TX CH LC	W		Engineer	:Kailin	
EUT Pol	:E2 Plan					
100 Level (dBuV/m)						
90						
80						
70						
60 2	4 6					
50	3 5					
40	8					
30	7					
20						
10						
0 <mark></mark> 1000		44200	46200	21400	20500	
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
3720.00	Average	18.26	32.56	50.82	54.00	-3.18
3720.00	Peak	27.61	32.56	60.17	74.00	-13.83
4824.00	Average	17.62	35.16	52.78	54.00	-1.22
4824.00	<b>_</b>	26.77	35.16	61.93	74.00	-12.07
	Peak	20.11				
5580.00	Peak Average	16.93	36.00	52.93	54.00	-1.07
5580.00 5580.00						-1.07 -11.09
	Average	16.93	36.00	52.93	54.00	
5580.00	Average Peak	16.93 26.91	36.00 36.00	52.93 62.91	54.00 74.00	-11.09



# **12 POWER SPECTRAL DENSITY**

## 12.1 Standard Applicable

Per Part 15.247 (e)

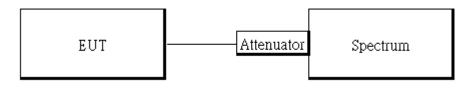
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

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								
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.				
ТҮРЕ		NUMBER	NUMBER	CAL.					
DC Block	PASTERNACK	PE8210	RF32	11/20/2019	11/19/2020				
Spectrum Analyzer	Agilent	N9010A	MY5712020 0	03/06/2019	03/05/2020				
Attenuator	Marvelous	MVE2213-10	RF31	11/20/2019	11/19/2020				

### 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. For defining Restricted Band Edge Limit:

Set the RBW = 100kHz & VBW = 300 kHz

- 6. Detector = peak.
- 7. Sweep time = auto couple.
- 8. Trace mode = max hold.
- 9. Allow trace to fully stabilize.
- 10. Use the peak marker function to determine the maximum amplitude level.
- 11.802.11n MIMO mode: offset is set following "measure and add 10 Log (N)" on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application.

## Note:

For the test of PSD at MIMO mode, the highest emission of worst case employing Measure and add 10 log (N) technical is reported on this report after the comparison between Main Antenna at single transmitting mode and Aux that yields the higher value. The MIMO transmitting mode produces higher value of outcome

## 12.5 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.

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### 12.6 Power spectral density

	POWER DENSITY 802.11b							
Freq.	PSD	Limit	Result					
(MHz)	(dBm/3kHz)	(dBm/3kHz)	Result					
2412	0.94	8.00	PASS					
2437	2.71	8.00	PASS					
2462	1.92	8.00	PASS					

POWER DENSITY 802.11g								
Freq.	PSD	Limit	Result					
(MHz)	(dBm/3kHz)	(dBm/3kHz)	RESUIL					
2412	-6.87	8.00	PASS					
2437	-5.73	8.00	PASS					
2462	-5.22	8.00	PASS					

POWER DENSITY 802.11n HT20								
Freq.	PSD	PSD Limit Resu						
(MHz)	(dBm/3kHz)	(dBm/3kHz)	Nesul					
2412	-3.82	8.00	PASS					
2437	-3.38	8.00	PASS					
2462	-5.22	8.00	PASS					

POWER DENSITY 802.11n HT40								
Freq.	PSD Limit D							
(MHz)	(dBm/3kHz)	(dBm/3kHz)	Result					
2422	-8.61	8.00	PASS					
2437	-8.48	8.00	PASS					
2452	-9.07	8.00	PASS					

Note

MIMO Cable Loss 14.51 dB

\*Refer to next page for plots

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### Power Density 802.11b 20MHz 2412MHz

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D dB/div Ref 30.00	Auto Tun						
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20.01					CF Ste 1.500000 MH		
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ND.			570703				

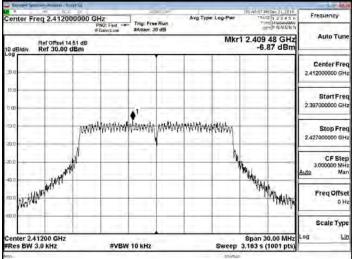
### Power Density\_802.11b\_20MHz\_2437MHz

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mound they been		Y		Mar	Stop Free 2.444500000 GH
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20.0					Freq Offse 0 H
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Center 2.437000 GHz Res BW 3.0 kHz	#VBW	10 kHz	Sweep	Span 15,00 MHz 1,582 s (1001 pts)	100 10

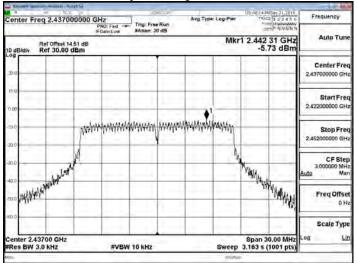
#### Power Density 802 11b 20MHz 2462MHz

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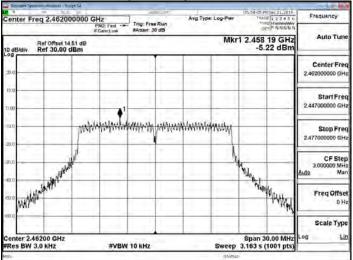
#### Power Density\_802.11g\_20MHz\_2412MHz



#### Power Density\_802.11g\_20MHz\_2437MHz



#### Power Density\_802.11g\_20MHz\_2462MHz



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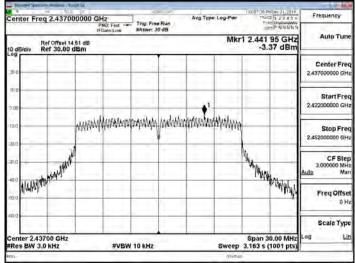


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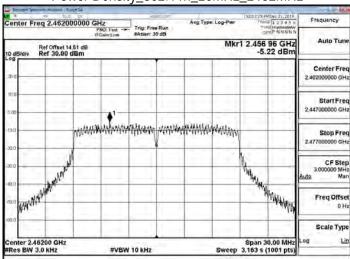
#### Power Density 802.11n 20MHz 2412MHz

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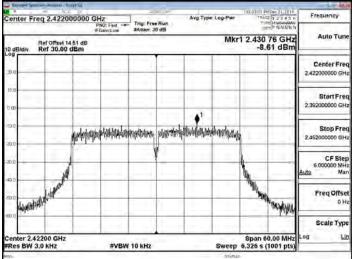
### Power Density\_802.11n\_20MHz\_2437MHz



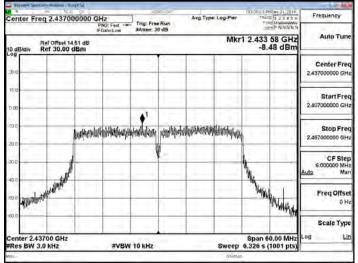
#### Power Density\_802.11n\_20MHz\_2462MHz



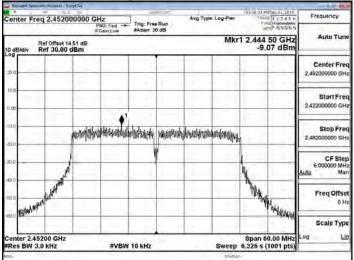
## Power Density\_802.11n\_40MHz\_2422MHz



#### Power Density 802.11n 40MHz 2437MHz



#### Power Density\_802.11n\_40MHz\_2452MHz



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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 as permanently attached and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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