

FCC 47 CFR PART 15 SUBPART C ISED RSS-247 Issue 2

CERTIFICATION TEST REPORT

For

2.4GHz Wi-Fi/ Bluetooth module

MODEL NUMBER: ESP32-C3-WIZ2012

PROJECT NUMBER: 4789839465

REPORT NUMBER: 4789839465-2

FCC ID: 2AGBW-WIZ2012

IC: 20812-WIZ2012

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Prepared for

Signify (China) Investment Co., Ltd

Prepared by

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	05/19/2021	Initial Issue	



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PASS

PASS

1. ATTESTATION OF TEST RESULTS

CFR 47 Part 15 Subpart C

ISED RSS-247 ISSUE 2

Applicant Information

Company Name: Address:	Signify (China) Investment Co., Ltd #204, Block 2, 690 Bibo Road, Zhang Shanghai, China	Jiang High-Tech Park,
Manufacturer Information Company Name: Address:	Signify (China) Investment Co., Ltd #204, Block 2, 690 Bibo Road, Zhang Shanghai, China	Jiang High-Tech Park,
EUT Description Product Name: Model Name: Sample Number: Data of Receipt Sample: Date Tested:	2.4GHz Wi-Fi/ Bluetooth module ESP32-C3-WIZ2012 3686975 Mar. 08, 2021 Mar. 09, 2021~ May. 18, 2021	
	APPLICABLE STANDARDS	
ST	ANDARD	TEST RESULTS



Summary of Test Results						
Clause	Test Items	FCC/IC Rules	Test Results			
1	6dB Bandwidth and 99% Occupied Bandwidth	FCC Part 15.247 (a) (2) RSS-247 Clause 5.2 (a) ISED RSS-Gen Clause 6.7	Complied			
2	Peak Conducted Output Power	FCC Part 15.247 (b) (3) RSS-247 Clause 5.4 (d)	Complied			
3	Power Spectral Density	FCC Part 15.247 (e) RSS-247 Clause 5.2 (b)	Complied			
4	Conducted Bandedge and Spurious Emission	FCC Part 15.247 (d) RSS-247 Clause 5.5	Complied			
5	Radiated Bandedge and Spurious Emission	FCC Part 15.247 (d) FCC Part 15.209 FCC Part 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9	Complied			
6	Conducted Emission Test For AC Power Port	FCC Part 15.207 RSS-GEN Clause 8.8	Complied			
7	Antenna Requirement	FCC Part 15.203 RSS-GEN Clause 6.8	Complied			
Remark: 1) The mea						

FCC CFR 47 Part 2, FCC CFR 47 Part 15C and ISED RSS-247 ISSUE 2> when <Accuracy Method>

Prepared By:

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, CFR 47 FCC Part 2, CFR 47 FCC Part 15, ANSI C63.10-2013, ISED RSS-247 Issue 2 and ISED RSS-GEN Issue 5.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	A2LA (Certificate No.: 4829.01) UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA. FCC (FCC Designation No.: CN1247) UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules. IC (IC Designation No.: 25056) UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.
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Note 1: All tests measurement facilities use to collect the measurement data are located at No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, People's Republic of China

Note 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS.

Note 3: The test anechoic chamber in UL-CCIC COMPANY LIMITED had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.



4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty	
Conduction emission	3.1dB	
Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	3.4dB	
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	3.4dB	
Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	3.9dB (1GHz-18Gz)	
	4.2dB (18GHz-26.5Gz)	
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Product Name:	2.4GHz Wi-Fi/ Bluetooth module
Model No.:	ESP32-C3-WIZ2012
Operating Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz BT:2402 MHz to 2480MHz
	This report just for the BT part
Type of Modulation:	IEEE for 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE for 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n (HT20 and HT40): OFDM (64QAM, 16QAM, QPSK, BPSK) BT:GFSK
Test software of EUT:	EspRFTestTool (manufacturer declare)
Antenna Type:	Ceramic antenna
Antenna Gain:	Antenna1: 5.19 dBi
	Remark: This data is provided by customer and our lab isn't responsible for this data



5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency (MHz)	Channel Number	Max Output Power (dBm)
BLE	2402-2480	0-39[40]	3.98

5.3. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	11	2424	22	2446	33	2468
1	2404	12	2426	23	2448	34	2470
2	2406	13	2428	24	2450	35	2472
3	2408	14	2430	25	2452	36	2474
4	2410	15	2432	26	2454	37	2476
5	2412	16	2434	27	2456	38	2478
6	2414	17	2436	28	2458	39	2480
7	2416	18	2438	29	2460		
8	2418	19	2440	30	2462		
9	2420	20	2442	31	2464		
10	2422	21	2444	32	2468		



5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
BLE-1M	CH 0, CH 19, CH 39	2402MHz, 2440MHz, 2480MHz
BLE-2M	CH 0, CH 19, CH 39	2402MHz, 2440MHz, 2480MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test S	oftware	EspRFTestTool		
Test Mode	Transmit Antenna	Test Channel		
Test Mode	Number	CH 00	CH 19	CH 39
BLE-1M	1	9	9	9
BLE-2M	1	9	9	9



5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	Ceramic antenna	5.19

Test Modulation	Transmit and Receive Mode	Description
GFSK	⊠1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.



5.7. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests				
Relative Humidity	55 ~ 65%				
Atmospheric Pressure:	1025Pa				
Temperature	TN	23 ~ 28°C			
	VL	N/A			
Voltage:	VN	AC 120V			
	VH	N/A			

Note: VL= Lower Extreme Test Voltage VN= Nominal Voltage VH= Upper Extreme Test Voltage TN= Normal Temperature



5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Description
1	Laptop	ThinkPad	E550c	N/A
2	Fixed Frequency Board	N/A	N/A	Supply by Customer
3	AC adapter	AC/DA ADAPTER	N/A	INPUT:100-240V~50/60Hz OUTPUT:5V 1A (Supply by UL Lab)

I/O PORT

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	N/A	N/A	N/A	N/A	N/A

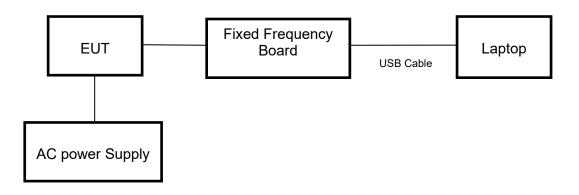
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	USB Cable	NA	NA	100cm Length (Supply by UL Lab)

TEST SETUP

The EUT can work in an engineer mode with a software through a table PC.

SETUP DIAGRAM FOR TESTS





5.9. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions (Instrument)									
Used	Equipment	Manufacturer	Мос	del No.	Seri	al No.	Upper Last Cal.	Last Cal.	Next Cal.
\checkmark	EMI Test Receiver	R&S	ESR3		12	6700	2019-12-12	2020-12-05	2021-12-04
\checkmark	Two-Line V-Network	R&S	EN	IV216	12	6701	2019-12-12	2020-12-05	2021-12-04
\checkmark	Artificial Mains Networks	R&S	E١	NY81	12	6711	2019-12-12	2020-12-05	2021-12-04
				Soft	ware				
Used	Des	cription		Ma	Inufac	turer	Name	Version	
\checkmark	Test Software for (Conducted distur	bance		R&S		EMC32	Ver. 9.25	
		Ra	diated	d Emissi	ions (Instrum	ent)		
Used	Equipment	Manufacturer	Мос	del No.	Seri	al No.	Upper Last Cal.	Last Cal.	Next Cal.
$\mathbf{\nabla}$	Spectrum Analyzer	Keysight	N9	010B	MY57	110128	2020-05-10	2021-05-09	2022-05-08
\checkmark	EMI test receiver	R&S	ES	SR26	126	7603	2019-12-12	2020-12-05	2021-12-04
\checkmark	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZ	B 1513	513	8-265	N/A	2018-06-15	2021-06-14
\checkmark	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1		17	7821	N/A	2019-01-28	2022-01-27
\checkmark	Receiver Antenna (1GHz-18GHz)	R&S	H	F907	12	6705	2018-01-29	2019-01-28	2022-01-27
\checkmark	Receiver Antenna (18GHz-26.5GHz)	Schwarzbeck	BBHA9170		12	6706	2019-02-06	2020-12-05	2021-12-04
V	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-1G18-50		1414()-13467	2019-03-18	2020-12-05	2021-12-04
V	Pre-amplification (To 26.5GHz)	R&S	SCI	U-26D	134	4668	2019-02-06	2020-09-27	2021-09-26
N	Band Reject Filter	Wainwright	2350 2483.5	CJV8-)-2400- 5-2533.5- 0SS		1	2020-05-10	2021-05-09	2022-05-08
V	Highpass Filter	Wainwright	2700	KX10-)-3000-)0-40SS		2	2020-05-10	2021-05-09	2022-05-08
				Soft	ware				
Used	Descr	iption		Manufac	turer		Name	Version	
\checkmark	Test Software for R	adiated disturbar	nce	Tonsce	end		JS32	V1.0	
			0	Other ins	trume	ents			
Used	Equipment	Manufacturer	Model No.		Seri	al No.	Upper Last Cal.	Last Cal.	Next Cal.
	Spectrum Analyzer	Keysight	N9	010B	MY57	110128	2020-05-10	2021-05-09	2022-05-08
	Power Meter	Keysight	U20	021XA	MY57	110002	2020-05-10	2021-05-09	2022-05-08



6. MEASUREMENT METHODS

No.	Test Item	KDB Name	Section
1	6dB Bandwidth/99% Bandwidth	KDB 558074 D01 15.247 Meas Guidance v05r02	8.2
2	Peak Output Power	KDB 558074 D01 15.247 Meas Guidance v05r02	8.3.1.3/8.3.2.3
3	Power Spectral Density	KDB 558074 D01 15.247 Meas Guidance v05r02	8.4
4	Out-of-band emissions in non-restricted bands	KDB 558074 D01 15.247 Meas Guidance v05r02	8.5
5	Out-of-band emissions in restricted bands	KDB 558074 D01 15.247 Meas Guidance v05r02	8.6
6	Band-edge	KDB 558074 D01 15.247 Meas Guidance v05r02	8.7
7	Conducted Emission Test For AC Power Port	ANSI C63.10-2013	6.2



7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

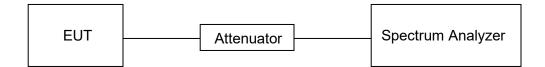
<u>LIMITS</u>

None; for reporting purposes only

PROCEDURE

FCC KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP



TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	56%
Atmosphere Pressure	101kPa	Test Voltage	AC120V

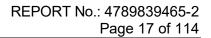
RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)	Final Setting VBW (KHz)
BLE -1M	2.093	2.5005	0.837	83.7	0.77	0.48	1
BLE -2M	1.056	1.8775	0.562	56.2	2.50	0.95	1

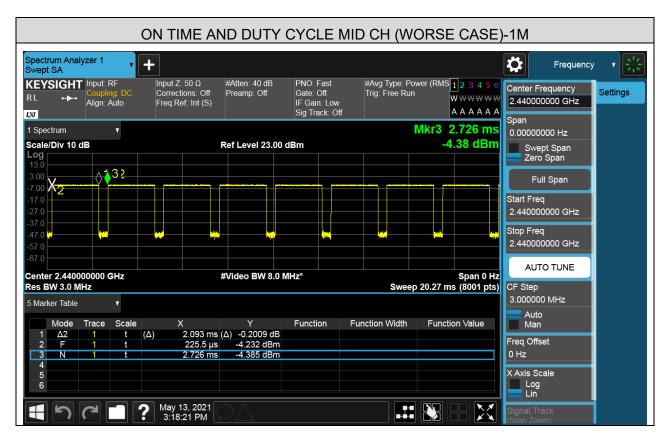
Note: 1) Duty Cycle Correction Factor=10log(1/x).

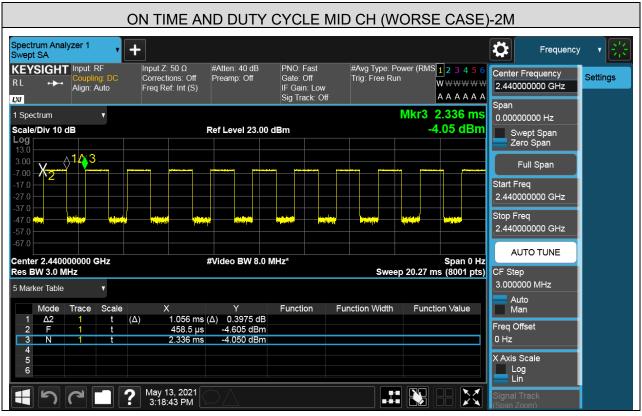
2) Where: x is Duty Cycle (Linear)

3) Where: T is On Time (transmit duration)









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7.2. 6 dB BANDWIDTH AND 99% OCCUPIED BANDWIDTH

LIMITS

FCC Part15 (15.247) Subpart C, ISED RSS-247 ISSUE 2							
Section Test Item Limit Frequency Range (MHz)							
CFR 47 FCC 15.247(a)(2) ISED RSS-247 5.2 (a) 6 dB Bandwidth		≥ 500KHz	2400-2483.5				
ISED RSS-Gen Clause 6.7	99% Occupied Bandwidth	For reporting purposes only	2400-2483.5				

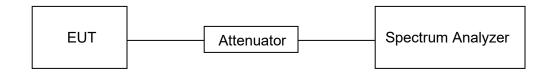
TEST PROCEDURE

Refer to FCC KDB 558074, connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
	For 6dB Bandwidth :100kHz For 99% Occupied Bandwidth :1% to 5% of the occupied bandwidth
IV BW	For 6dB Bandwidth : ≥3 × RBW For 99% Occupied Bandwidth : ≥3×RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP





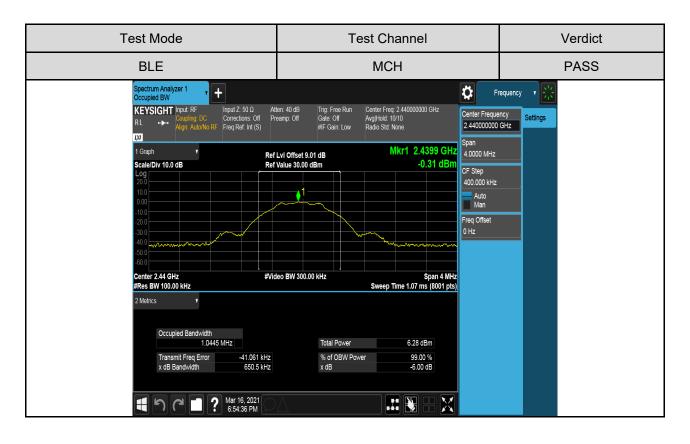
RESULTS

Test Mode	Test Channel	6dB bandwidth (MHz)	99% bandwidth (MHz)	Result
	LCH	0.6366	1.0297	Pass
BLE-1M	MCH	0.6505	1.0250	Pass
	НСН	0.6397	1.0283	Pass
	LCH	1.100	2.0341	Pass
BLE-2M	MCH	1.100	2.0363	Pass
	НСН	1.093	2.0368	Pass

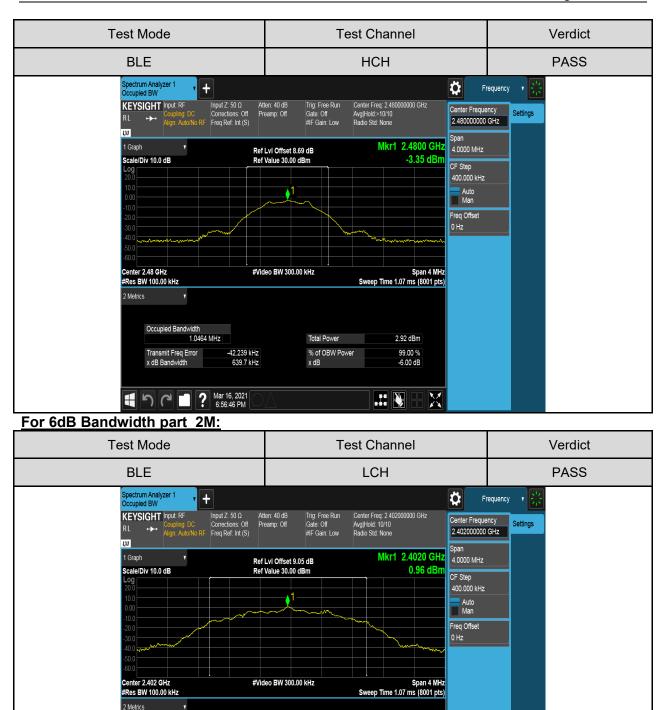


<u>Test Graphs</u>









Total Power

% of OBW Power x dB 7.60 dBm

99.00 %

-6.00 dB

 \mathbb{X}

Occupied Bandwidth

Transmit Freq Error x dB Bandwidth

2.0384 MHz

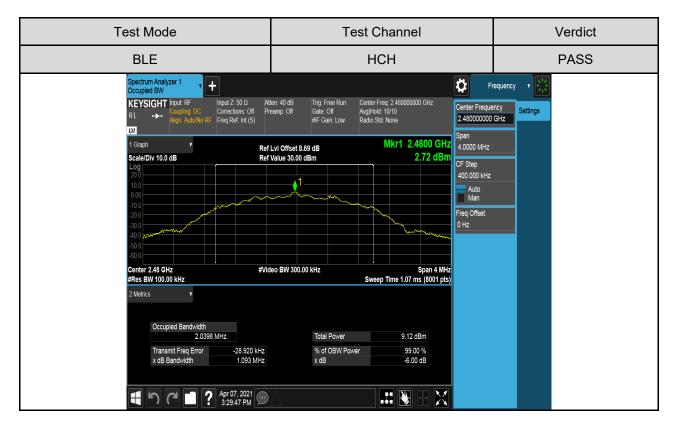
モア (* C* E* ? Apr 07, 2021 🗩

-36.439 kHz

1.100 MHz



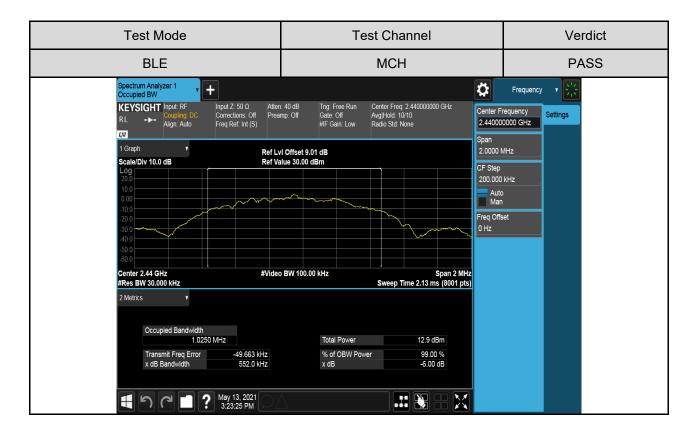


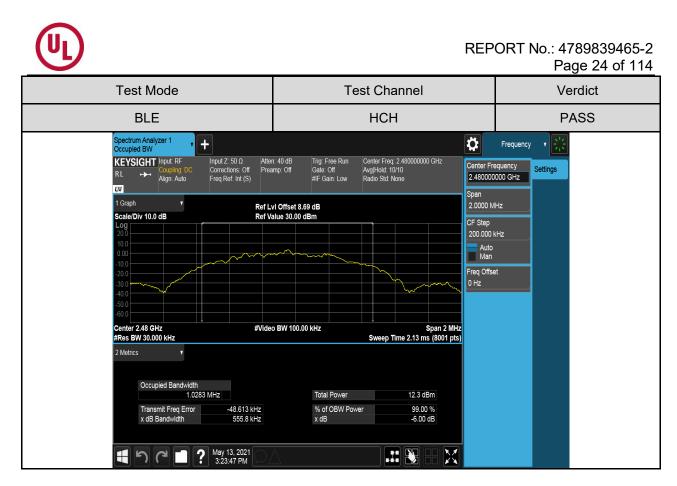




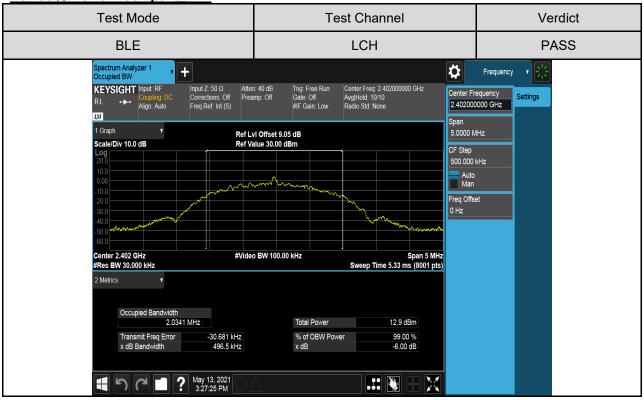
For 99% Bandwidth part_1M:



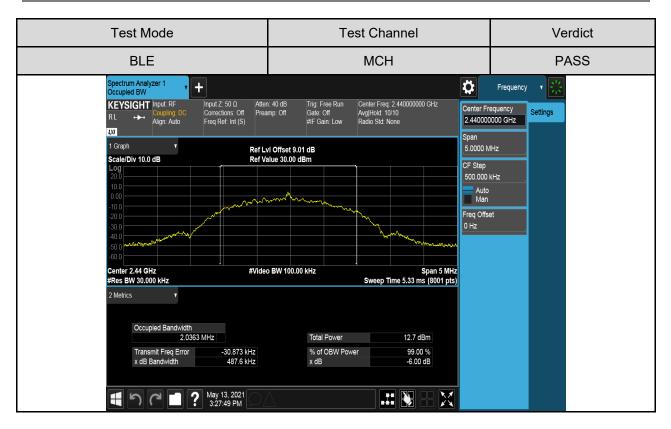


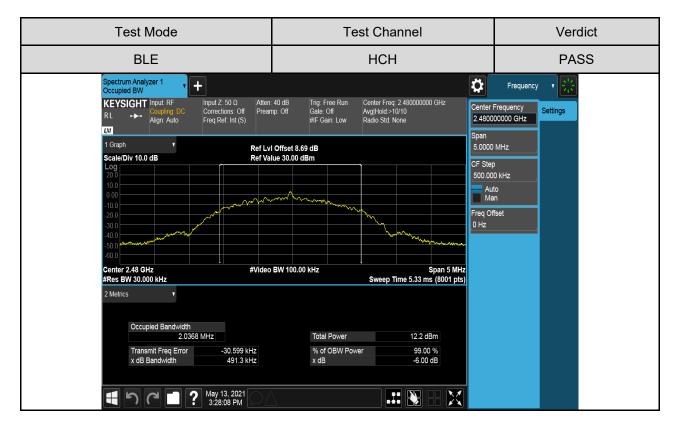


For 99% Bandwidth part 2M:











7.3. CONDUCTED OUTPUT POWER

<u>LIMITS</u>

FCC Part15 (15.247) Subpart C, ISED RSS-247 ISSUE 2				
Section Test Item Limit Frequency Range (MHz)				
CFR 47 FCC 15.247(b)(3) ISED RSS-247 5.4 (d)	Output Power	1 watt or 30dBm	2400-2483.5	

Note: For b/g/n HT20 mode the average data is for reference only.

TEST PROCEDURE

Place the EUT on the table and set it in the transmitting mode.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.

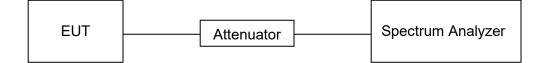
Measure the power of each channel.

Peak Detector used for Peak result.

TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	56%
Atmosphere Pressure	101kPa	Test Voltage	AC120V

TEST SETUP



RESULTS

Test Mode	Test Channel	Maximum Peak	LIMIT
Test Mode	Test Channel	Conducted Output Power(dBm)	dBm
	LCH	2.26	30
BLE-1M	MCH	3.36	30
	HCH	3.69	30
	LCH	2.35	30
BLE-2M	MCH	3.56	30
	HCH	3.98	30



Test Moo	le	Te	est Channel		Ve	rdict
BLE			LCH		PA	ASS
Spectrum Analyzer 1 Swept SA	+				Frequency	· · ₩
KEYSIGHT Input: RF R L Coupling: DC Align: Auto	Input Z: 50 Ω #Atten: 40 Corrections: Off Preamp: 0 Freq Ref: Int (S)		#Avg Type: Power (RMS Avg Hold: 43/100 Trig: Free Run	MWWWWW PPPPP	Center Frequency 2.402000000 GHz	Settings
1 Spectrum v Scale/Div 10 dB Log		fset 9.05 dB 30.00 dBm	Mkr1 2.401 88	6 25 GHz 2.26 dBm	Span 2.00000000 MHz Swept Span	
20.0					Zero Span Full Span	
10.0	\ 1				Start Freq 2.401000000 GHz	
-10.0					Stop Freq 2.403000000 GHz	
-20.0					AUTO TUNE CF Step	
-40.0					200.000 kHz Auto Man	
-60.0					Freq Offset 0 Hz	
Center 2.402000 GHz #Res BW 3.0 MHz		W 8.0 MHz	Spa #Sweep 100 n	an 2.000 MHz	X Axis Scale Log Lin	
1 7 7 1 1	May 17, 2021				Signal Track (Span Zoom)	

Test Mod	le	Τe	est Channel		Verd	ict
BLE			MCH		PAS	S
		Off Gate: Off IF Gain: Low Sig Track: Off ffset 9.01 dB 30.00 dBm	#Avg Type: Power (RM Avg Hold 43/100 Trig: Free Run MKr1 2.439 90	S 12 3 4 5 6 MWWWWW P P P P P P P D1 00 GHz 3.36 dBm	Frequency	ettings
-30.0 -40.0 -50.0 -60.0 Center 2.440000 GHz #Res BW 3.0 MHz		W 8.0 MHz		van 2.000 MHz ms (8001 pts)	CF Step 200.000 kHz Auto Man Freq Offset 0 Hz X Axis Scale Log Lin Signal Track (Span Zoom)	

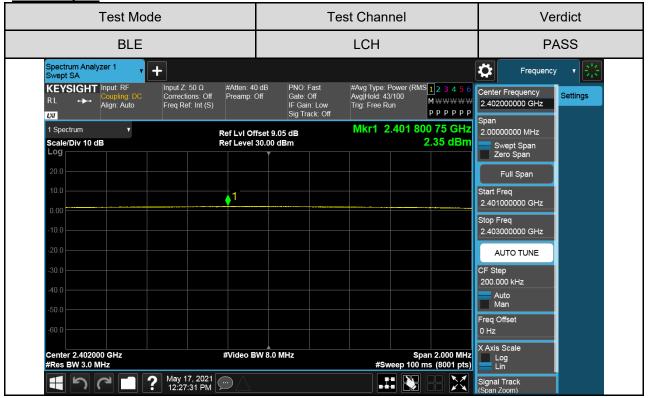


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Test Mode		Т	est Channel		Vero	dict
BLE			НСН		PAS	SS
Spectrum Analyzer 1					Frequency	- * **
Coupling: DC C	nput Z: 50 Ω #Atten: 40 Corrections: Off Freq Ref: Int (S)		#Avg Type: Power (RMS Avg Hold: 43/100 Trig: Free Run	M WWWWWW PPPPPP	2.48000000 GHz	Settings
1 Spectrum ▼ Scale/Div 10 dB Log	Ref LvI Off Ref Level 3	fset 8.69 dB 30.00 dBm	Mkr1 2.479 87	7 75 GHz 3.69 dBm	Span 2.00000000 MHz Swept Span	
20.0					Zero Span Full Span	
0.00	<u></u> 1				Start Freq 2.479000000 GHz	
-10.0					Stop Freq 2.481000000 GHz	
-30.0					CF Step 200.000 kHz	
-40.0					Auto Man	
-60.0					Freq Offset 0 Hz X Axis Scale	
Center 2.480000 GHz #Res BW 3.0 MHz		W 8.0 MHz	#Sweep 100 m	n 2.000 MHz is (8001 pts)	Log Lin	
	May 17, 2021 12:24:52 PM				Signal Track (Span Zoom)	

FOR 2M part





Test Mod	le	Τe	est Channel		Vei	rdict
BLE			MCH		PA	SS
Spectrum Analyzer 1 Swept SA	+				Frequency	
KEYSIGHT Input: RF R L ↔ Coupling: DC Align: Auto ↓√	Input Z: 50 Ω #Atten: 40 Corrections: Off Preamp: 0 Freq Ref: Int (S)		#Avg Type: Power (RMS Avg Hold: 43/100 Trig: Free Run	⁵ 123456 М ₩₩₩₩₩ РРРРРР	Center Frequency 2.440000000 GHz	Settings
1 Spectrum Scale/Div 10 dB Log		fset 9.01 dB 30.00 dBm	Mkr1 2.440 04	5 00 GHz 3.56 dBm	Span 2.00000000 MHz Swept Span	
20.0					Zero Span Full Span	
0.00		♦ ¹			Start Freq 2.439000000 GHz	
-10.0					Stop Freq 2.441000000 GHz	
-30.0					AUTO TUNE CF Step 200.000 kHz	
-40.0					Auto Man	
-60.0					Freq Offset 0 Hz X Axis Scale	
Center 2.440000 GHz #Res BW 3.0 MHz		W 8.0 MHz	#Sweep 100 n	an 2.000 MHz ns (8001 pts)	Log Lin	
	May 17, 2021				Signal Track (Span Zoom)	

Test Mode	Test Channel	Verdict
BLE	НСН	PASS
Spectrum Analyzer 1 Swept SA		Frequency 🔹 🔀
KEYSIGHT Input: RF Input Z: 50 Ω #Atten: 4 R L<	Off Gate: Off Avg[Hold: 43/100 M₩₩₩₩₩ IF Gain: Low Trig: Free Run PPPPP Sig Track: Off PPPPP	Center Frequency 2.480000000 GHz
		Span 2.0000000 MHz Swept Span
20.0		Zero Span Full Span
10.0		Start Freq 2.479000000 GHz
-10.0		Stop Freq 2.481000000 GHz
-20.0		AUTO TUNE CF Step 200.000 kHz
-40.0		Auto Man
-60.0		Freq Offset 0 Hz
#Res BW 3.0 MHz	W 8.0 MHz Span 2.000 MHz #Sweep 100 ms (8001 pts)	X Axis Scale Log Lin
H N R I ? May 17, 2021		Signal Track (Span Zoom)



7.4. POWER SPECTRAL DENSITY

LIMITS

FCC Part15 (15.247) Subpart C, ISED RSS-247 ISSUE 2					
Section Test Item Limit Frequency Range (MHz)					
CFR 47 FCC §15.247 (e) ISED RSS-247 5.2 (b)	Power Spectral Density	8 dBm/3 kHz	2400-2483.5		

TEST PROCEDURE

Refer to FCC KDB 558074, connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	3 kHz ≤ RBW ≤100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

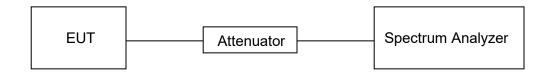
Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	56%
Atmosphere Pressure	101kPa	Test Voltage	AC120V

TEST SETUP





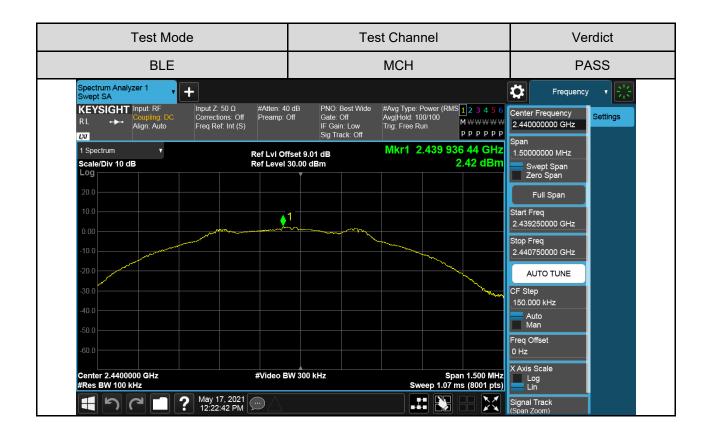
RESULTS

Test Mode	Test Channel	Maximum Peak power spectral density (dBm/100kHz)	Result
	LCH	1.31	Pass
BLE-1M	MCH	2.42	Pass
	НСН	3.12	Pass
	LCH	1.69	Pass
BLE-2M	MCH	1.98	Pass
	НСН	2.33	Pass



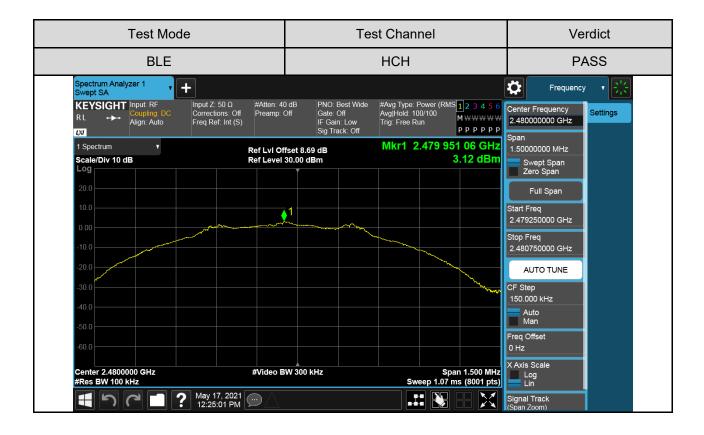
Test Graphs: For 1M part:



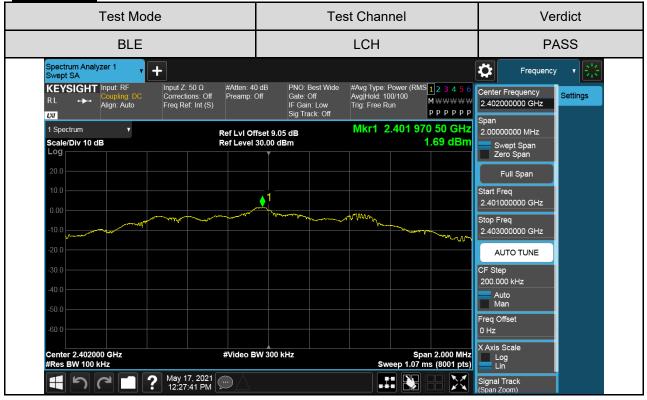


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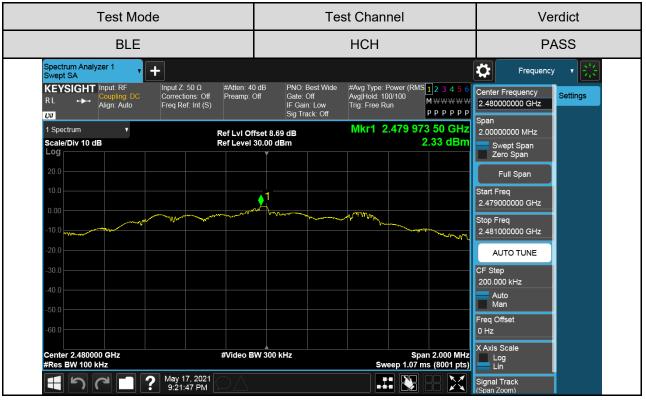
For 2M part:



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7.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) Subpart C, ISED RSS-247 ISSUE 2		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d) ISED RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

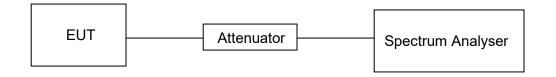
Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level.

TEST SETUP





TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	56%
Atmosphere Pressure	101kPa	Test Voltage	AC120V

Part I :Conducted Bandedge

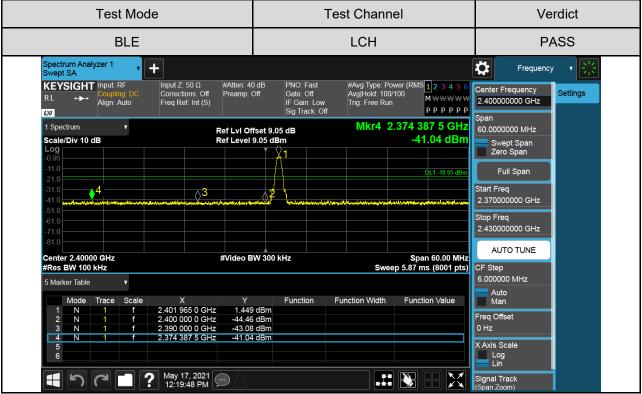
RESULTS TABLE

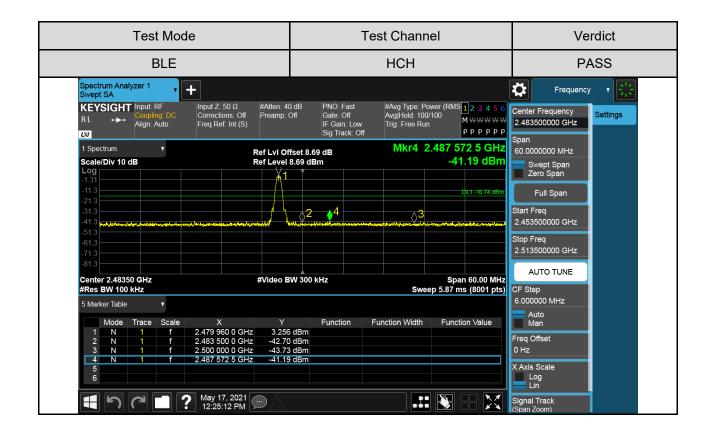
Test Mode	Test Channel	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
LCH		1.449	-41.04	-18.55	PASS
BLE-1M	НСН	3.256	-41.19	-16.74	PASS
	LCH	0.5567	-41.30	-19.44	PASS
BLE-2M	НСН	3.706	-40.03	-16.29	PASS



TEST GRAPHS

For 1M part:





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For 2M part:

Test Mode	Test Channel	Verdict
BLE	LCH	PASS
Spectrum Analyzer 1 Swept SA ↓ KEYSIGHT RL Input RF Coupling, DC Align: Auto Input Z: 50 Ω Freq Ref: Int (S) #Atten: 40 Preamp: C V ↑ Ref Lvl Off Scale/Div 10 dB Ref Lvl Off Log 0.95 0.10 4 -11.0 -4 -11.0 -4 -11.0 -4	0 dB PNO: Fast #Avg Type: Power (RMS 1 2 3 4 5 6 Avg Hold: 100/100 Trg: Free Run P P P P P P P P P P P P P P P P P P P	Frequency Center Frequency 2.400000000 GHz Span 60.000000 MHz Swept Span Carro Span Full Span Start Freq 2.370000000 GHz Start Freq 2.370000000 GHz Start Freq 2.370000000 GHz Start Freq 2.430000000 GHz Start Freq 2.430000000 GHz Start Freq 2.430000000 GHz Start Freq 2.430000000 GHz Carto Tune Consol MHz Auto Auto Man Freq Offset
3 N 1 f 2.390 0000 0 GHz -41.68 4 N 1 f 2.380 402 5 GHz -41.30 5 6 -		0 Hz K Axis Scale Log Lin Signal Track Span Zoom)

Test Mode	Test Channel	Verdict
BLE	НСН	PASS
Spectrum Analyzer 1 THE Swept SA		Frequency
KEYSIGHT Input: RF Input: Z: 50 Ω #Atten: 4 RL Align: Auto Freq Ref: Int (S) Preamp:	Off Gate: Off Avg Hold:>100/100 M₩₩₩₩₩ IF Gain: Low Trig: Free Run M₩₩₩₩₩₩ Sig Track: Off PPPPP	Center Frequency 2.483500000 GHz
1 Spectrum v Ref Lvl Of Scale/Div 10 dB Ref Level Log	fset 8.69 dB Mkr4 2.494 045 0 GHz	Span 60.000000 MHz Swept Span Zero Span
-11.3 -21.3 -31.3	0L1-16.29 dBm	Full Span Start Freq
-41.3 -51.3 -61.3 -71.3		2.453500000 GHz Stop Freq 2.513500000 GHz
	W 300 kHz Span 60.00 MHz	AUTO TUNE
#Res BW 100 kHz 5 Marker Table v Mode Trace Scale X Y	Function Function Width Function Value	CF Step 6.000000 MHz Auto Man
2 N 1 f 2.483 500 0 GHz -43.90 3 N 1 f 2.500 000 0 GHz -44.80 4 N 1 f 2.494 045 0 GHz -40.00 5	i dBm	rreq Offset D Hz (Axis Scale
6 May 17, 2021 12:33:28 PM		Log Lin Signal Track Span Zoom)

Part II :Conducted Emission

Test Mode	Channel	Pref(dBm)	Puw(dBm)	Verdict
	LCH	1.21	<limit< td=""><td>PASS</td></limit<>	PASS
BLE-1M	MCH	2.58	<limit< td=""><td>PASS</td></limit<>	PASS
	НСН	2.73	<limit< td=""><td>PASS</td></limit<>	PASS
	LCH	1.39	<limit< td=""><td>PASS</td></limit<>	PASS
BLE-2M	MCH	2.79	<limit< td=""><td>PASS</td></limit<>	PASS
	HCH	3.06	<limit< td=""><td>PASS</td></limit<>	PASS

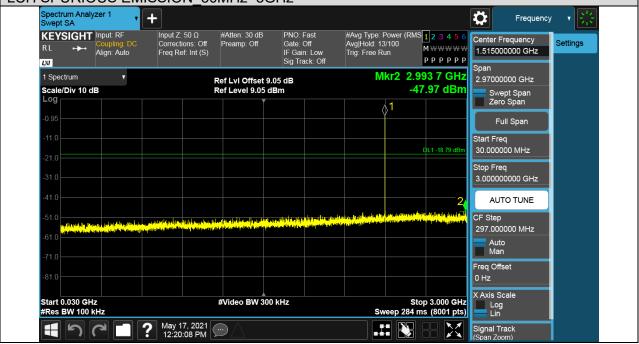
Test Plots For 1M part

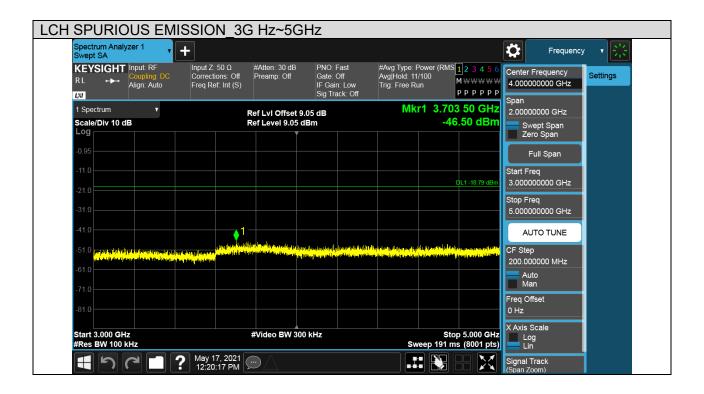
Test Mode	Channel	Verdict
BLE	LCH	PASS



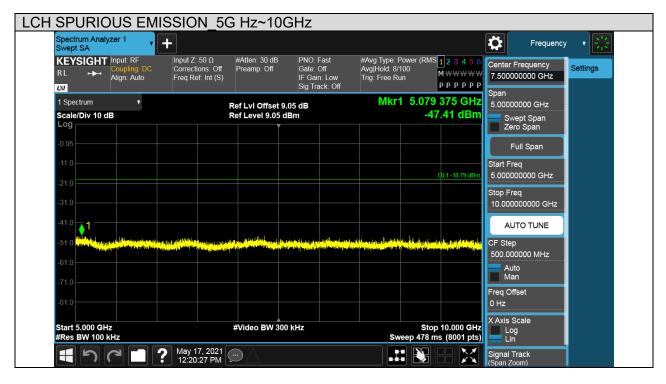












LCH SPURIOUS EMISSION_10G Hz~15GHz





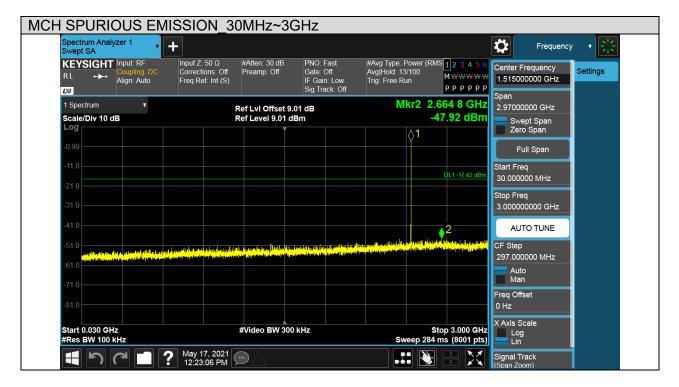
LCH SPURIC	DUS EMISSI	ON_15GHz~	25GHz			
Spectrum Anal Swept SA	yzer 1 🔹 🕇				Frequency	〇〇字
KEYSIGHT RL ↔	Coupling: DC Corr	t Ζ: 50 Ω #Atten: 30 (rections: Off Preamp: Of Ref: Int (S)		Trig: Free Run	3 4 5 6 Center Frequency 20.000000000 GHz Span	Settings
1 Spectrum Scale/Div 10 c	, ™	Ref LvI Offs Ref Level 9.		Mkr1 23.733 75 -45.63	GHZ 10.000000 GHz	
-0.95					Zero Span Full Span	
-11.0				DL1 -1	Start Freq 8.79 dBm 15.000000000 GHz	
-21.0					Stop Freq 25.00000000 GHz	
-41.0				1	AUTO TUNE	
	india any amin'ny amin'	en and a faith and a bind and a bind and a bind a bind and and a bind and a bind a bind and a bind a bind a bin A bind a bind A bind a bind	n militar ar fra ann an a	a haliya hana hila kara kitu dan dan yang mangkara karang na Ang mana karang karang karang karang mangkarang karang mangkarang karang mangkarang karang karang karang karang Mang mana karang kara	CF Step 1.00000000 GHz	
-61.0					Auto Man	
-81.0					Freq Offset 0 Hz	
Start 15.000 G #Res BW 100	kHz	#Video BW	/ 300 kHz	Stop 25.0 Sweep 956 ms (80		
		y 17, 2021 :20:49 PM			Signal Track (Span Zoom)	

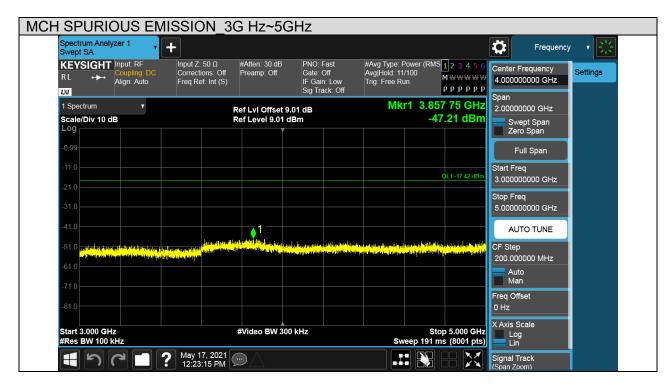


Test Mode	Channel	Verdict
BLE	MCH	PASS

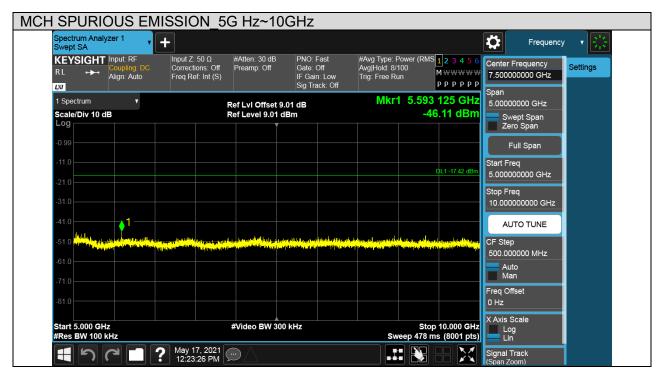




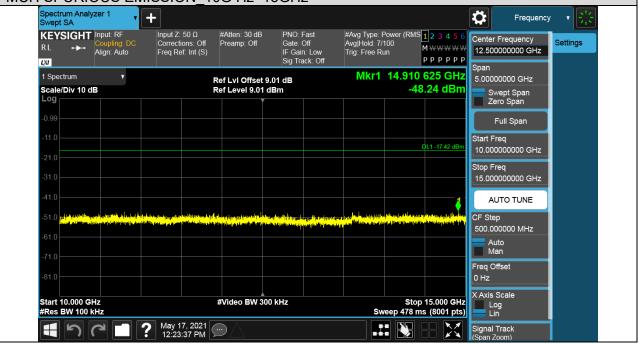








MCH SPURIOUS EMISSION_10G Hz~15GHz





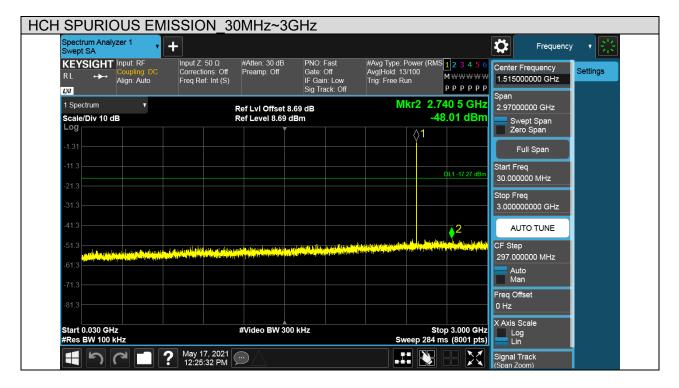
MCH SPURI	OUS EMIS	SION_15	GHz~25G	Hz				
Spectrum Anal Swept SA	yzer 1 🔹 🕇 🕇						Frequency	- * 詳
KEYSIGHT RL ↔→• ਯ	Coupling: DC		Preamp: Off G	'NO: Fast 6ate: Off ⁻ Gain: Low ig Track: Off	#Avg Type: Powe Avg Hold: 4/100 Trig: Free Run	r (RMS <mark>1</mark> 23456 М \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Center Frequency 20.000000000 GHz	Settings
1 Spectrum Scale/Div 10 c	۲ IB		ef LvI Offset 9.01 d ef Level 9.01 dBm	В	Mkr1 2	3.748 75 GHz -45.55 dBm	Span 10.0000000 GHz Swept Span	
-0.99							Zero Span Full Span	
-11.0						DL1 -17.42 dBm	Start Freq 15.000000000 GHz	
-31.0							Stop Freq 25.000000000 GHz	
-41.0 -51.0	a kalle por Jelson ky kana kisa da anga kisa. Manga kale anga kana kana kana kana kana kana kana	lighter and the printer of the	sophiblith (100 paintille) a The first start of the painting of the	ne hanles distriction of entry	ling a site bill still also her a solat del		AUTO TUNE CF Step	
-61.0							1.000000000 GHz Auto Man	
-71.0							Freq Offset 0 Hz	
Start 15.000 G #Res BW 100		#	Video BW 300 kHz	2	Sweep	Stop 25.000 GHz 956 ms (8001 pts)	X Axis Scale Log Lin	
1	C [?	May 17, 2021 12:23:47 PM					Signal Track (Span Zoom)	



Test Mode	Channel	Verdict
BLE	HCH	PASS













HCH SPURIOUS EMISSION_10G Hz~15GHz





HCH SPURIC	OUS EMISSI	ON_15GHz~2	25GHz			
Spectrum Analy Swept SA	zer 1 🔹 🕇				Frequency	、 米
	Coupling: DC Corre	Z: 50 Ω #Atten: 30 df ctions: Off Preamp: Off Ref: Int (S)	B PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Power (RMS 1 2 3 4 5 (Avg Hold: 4/100 Trig: Free Run M WWWWW P P P P P P	20.00000000 GHz	Settings
1 Spectrum Scale/Div 10 di Log	B	Ref LvI Offse Ref Level 8.6		Mkr1 22.508 75 GH -46.19 dBn	10.0000000 GHz	
-1.31					Zero Span Full Span	
-11.3				DL1 -17.27 dBn	Start Freq 15.00000000 GHz	
-31.3					Stop Freq 25.00000000 GHz	
-41.3 -51.3 61.1 - 11.	k kalenda tilla som allanns jall sänga allandasis in den sis jär Annan sing kannan singen som allandasis allandasis in den sis sisse singer som allandasis in den sisse singer		leine an friter og gregen et del blender Stylte helden som gregen som et andere som et andere som et alle som et alle	1 Den lin 1991 Harris de alexandre a const fille d'al 1990 anil fa 1966 (1990 Anil and anil a state a constant a constant d'alexandre a constant de la constant de la constant de la constant	AUTO TUNE CF Step	
-61.3					1.000000000 GHz Auto Man	
-71.3					Freq Offset 0 Hz	
Start 15.000 GF #Res BW 100 k		#Video BW	300 kHz	Stop 25.000 GH Sweep 956 ms (8001 pts		
		17, 2021 26:13 PM			Signal Track (Span Zoom)	



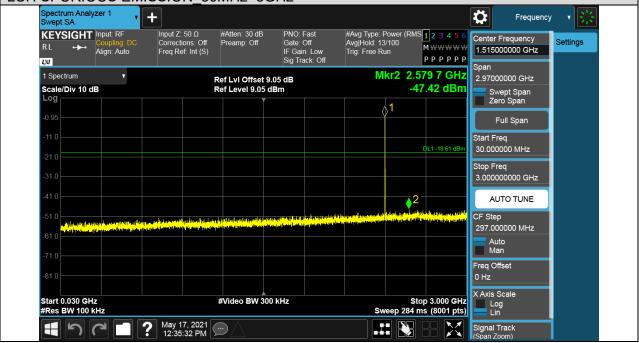
For 2M part:

Test Mode	Channel	Verdict
BLE	LCH	PASS







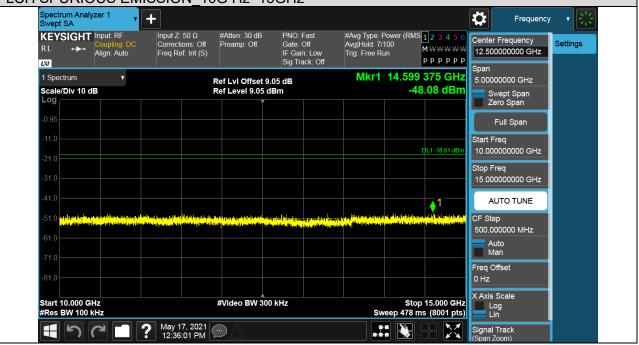








LCH SPURIOUS EMISSION_10G Hz~15GHz





LCH SPURIC	LCH SPURIOUS EMISSION 15GHz~25GHz						
Spectrum Anal Swept SA	yzer 1 🔹 🕂				Frequency	· → 🔆	
KEYSIGHT RL ↔→	Coupling: DC Corr	t Z: 50 Ω #Atten: 30 dE ections: Off Preamp: Off Ref: Int (S)	B PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Power (RMS 1 2 3 4 5 6 Avg Hold: 4/100 Trig: Free Run P P P P P P	20.00000000 GHz	Settings	
1 Spectrum Scale/Div 10 c	v 1B	Ref LvI Offse Ref Level 9.0		Mkr1 23.598 75 GHz -45.25 dBm	10.0000000 GHz		
-0.95					Zero Span Full Span		
-11.0				DL1 -18.61 dBm	Start Freq 15.00000000 GHz		
-31.0					Stop Freq 25.000000000 GHz		
-41.0	digadent increditions of a start	and a special state of the stat	datesian () ya wana ya kuta na kuta kuta kuta kuta kuta kuta kuta kut	1. Recommended that the state of particular to the state of the	AUTO TUNE		
-61.0	and i a fina a sharing and an				1.00000000 GHz		
-71.0					Man Freq Offset 0 Hz		
Start 15.000 G		#Video BW 3	300 kHz	Stop 25.000 GHz	X Axis Scale Log		
#Res BW 100		y 17, 2021 36:12 PM		Sweep 956 ms (8001 pts)	Lin Signal Track (Span Zoom)		



Test Mode	Channel	Verdict
BLE	MCH	PASS

