



CFR 47 FCC PART 15 SUBPART E

CERTIFICATION TEST REPORT

For

WLAN+Bluetooth Module

MODEL NUMBER: LBEE5PK2AE

PROJECT NUMBER: 4790016144.1

REPORT NUMBER: 4790016144.1-AE-4

FCC ID: VPYLB2AE

ISSUE DATE: Jun. 28, 2022

Prepared for

Murata Manufacturing Co., Ltd.

Prepared by

UL-CCIC COMPANY LIMITED

No. 2, Chengwan Road, Suzhou Industrial Park, People's Republic of China

Tel: +86 512-6808 6400

Fax: +86 512-6808 4099

Website: www.ul.com

Form-ULID-008536-8 V1.0

The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report apply to the test sample(s) mentioned above at the time of the testing period only and are not to be used to indicate applicability to other similar products.



Revision History

Rev.	Issue Date	Revisions	Revised By
V0	06/28/2022	Initial Issue	



TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATIO.....	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION.....	7
4.2. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT.....	8
5.2. MAXIMUM OUTPUT POWER	9
5.3. CHANNEL LIST.....	10
5.4. TEST CHANNEL CONFIGURATION	11
5.5. POWER GRADE	12
5.6. DESCRIPTION OF AVAILABLE ANTENNAS.....	15
5.7. THE WORSE CASE POWER SETTING PARAMETER	16
5.8. DESCRIPTION OF TEST SETUP	19
5.9. MEASURING INSTRUMENT AND SOFTWARE USED	20
6. ANTENNA PORT TEST RESULTS	21
6.1. ON TIME AND DUTY CYCLE	21
6.2. 6dB/26dB BANDWIDTH	24
6.3. MAXIMUM CONDUCTED AVERAGE OUTPUT POWER.....	60
6.4. POWER SPECTRAL DENSITY.....	69
7. RADIATED TEST RESULTS	101
7.1. RESTRICTED BANDEDGE.....	107
7.2. HARMONICS AND SPURIOUS EMISSIONS.....	249
8. FREQUENCY STABILITY.....	487
9. DYNAMIC FREQUENCY SELECTION	491
10. AC POWER LINE CONDUCTED EMISSIONS	498
11. ANTENNA REQUIREMENTS.....	502



1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Murata Manufacturing Co., Ltd.
Address: 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan

Manufacturer Information

Company Name: Murata Manufacturing Co., Ltd.
Address: 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan

EUT Description

Product Name: WLAN+Bluetooth Module
Model Name: LBEE5PK2AE
Sample Number: 4059724
Data of Receipt Sample: Jul. 12, 2021
Date Tested: Jul. 23, 2021 ~ Jul. 06, 2022

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 FCC PART 15 SUBPART E	PASS



Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	6dB/26dB Bandwidth	FCC 15.407 (a)&(e)	PASS
2	Conducted Output Power	FCC 15.407 (a)	PASS
3	Power Spectral Density	FCC 15.407 (a)	PASS
4	Radiated Bandedge and Spurious Emission	FCC 15.407 (b) FCC 15.209 FCC 15.205	PASS
5	Conducted Emission Test for AC Power Port	FCC 15.207	PASS
6	Frequency Stability	FCC 15.407 (g)	PASS
7	Dynamic Frequency Selection	FCC 15.407 (h)	PASS
8	Antenna Requirement	FCC 15.203	PASS
Note: 1) The measurement result for the sample received is <Pass> according to < ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15 E> when <Accuracy Method> 2) It is a slave device without radar detection.			

Prepared By:

Tom Tang

Tom Tang

Reviewed By:

Leon Wu

Leon Wu

Authorized By:

Chris Zhong

Chris Zhong
Laboratory Leader



2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, CFR 47 FCC Part 2, CFR 47 FCC Part 15, KDB 789033 D02 v02r01, RSS-GEN Issue 5, RSS-247 Issue 2, KDB414788 D01 Radiated Test Site v01r01, KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02, KDB 905462 D03 UNII clients without radar detection New Rules v01r02, KDB 905462 D04 Operational Modes for DFS Testing New Rules v01 and KDB 905462 D06 802 11 Channel Plans New Rules v02.

3. FACILITIES AND ACCREDITATIO

Test Location	UL-CCIC Company Limited, EMC&RF Lab
Address	No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, China
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 CAB No.: CN0073) 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.

Remark 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

Remark 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 based on KDB 414788.

Remark 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 recognize 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
Uncertainty for Conduction emission test	3.1dB
Uncertainty for Radiation Emission test (include Fundamental emission) (9kHz-30MHz)	3.4dB
Uncertainty for Radiation Emission test (include Fundamental emission) (30MHz-1GHz)	3.4dB
Uncertainty for Radiation Emission test (1GHz to 40GHz) (include Fundamental emission)	3.9dB (1GHz-18Gz)
	4.2dB (18GHz-26.5Gz)
	4.6dB (26.5GHz-40Gz)
Remark: 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:	WLAN+Bluetooth Module
Model No.:	LBEE5PK2AE
Operating Frequency:	IEEE 802.11a/n/ac 20MHz: 5180MHz to 5240MHz, 5260MHz to 5320MHz, 5500MHz to 5720MHz (ISED not include 5600MHz to 5640MHz), 5745MHz to 5825MHz IEEE 802.11n/ac 40MHz: 5190MHz to 5230MHz, 5270MHz to 5310MHz, 5510MHz to 5710MHz (ISED not include 5590MHz to 5630MHz), 5755MHz-5795MHz IEEE 802.11ac 80MHz: 5210MHz, 5290MHz, 5530MHz to 5690MHz (ISED not include 5610MHz), 5775MHz
	This report just including 5G WIFI part.
Type of Modulation:	IEEE for 802.11a: BPSK, QPSK, 16QAM, 64QAM IEEE for 802.11 n HT20/HT40: BPSK, QPSK, 16QAM, 64QAM IEEE for 802.11ac: BPSK, QPSK, 16QAM, 64QAM, 256QAM
Channels Step:	Channels with 5MHz step
Rated Input	DC 3.3V
Test software of EUT:	SecureCRT (manufacturer declare)
Antenna Type:	Type 1: PCB Antenna Type 2: External Dipole Antenna
Antenna Gain:	Type 1: 3.0 dBi for 2.4G band; 3.3 dBi for 5G band Type 2: 3.4 dBi for 2.4G band; 4.75 dBi for 5G band
	Note: 1. The product has only one transmission chain and two antenna types are provided. 2. This data is provided by customer and our lab isn't responsible for this data.



5.2. MAXIMUM OUTPUT POWER

UNII-1 BAND

IEEE Std. 802.11	Frequency (MHz)	Maximum Average Conducted Power
		[dBm]
a	5150 ~ 5250	16.96
ac VHT20		16.11
ac VHT40		14.44
ac VHT80		11.18

UNII-2A BAND

IEEE Std. 802.11	Frequency (MHz)	Maximum Average Conducted Power
		[dBm]
a	5250 ~ 5350	18.21
ac VHT20		17.35
ac VHT40		15.83
ac VHT80		12.60

UNII-2C BAND

IEEE Std. 802.11	Frequency (MHz)	Max Power
		[dBm]
a	5470 ~ 5725	17.94
ac VHT20		17.07
ac VHT40		15.52
ac VHT80		12.54

UNII-3 BAND

IEEE Std. 802.11	Frequency (MHz)	Max Power
		[dBm]
a	5725 ~ 5850	17.65
ac VHT20		16.42
ac VHT40		15.06
ac VHT80		12.14

5.3. CHANNEL LIST

UNII-1 (For Bandwidth = 20 MHz)		UNII-1 (For Bandwidth = 40 MHz)		UNII-1 (For Bandwidth = 80 MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

UNII-2A (For Bandwidth = 20 MHz)		UNII-2A (For Bandwidth = 40 MHz)		UNII-2A (For Bandwidth = 80 MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	54	5270	58	5290
56	5280	62	5310		
60	5300				
64	5320				

UNII-2C (For Bandwidth = 20 MHz)		UNII-2C (For Bandwidth = 40 MHz)		UNII-2C (For Bandwidth = 80 MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	102	5510	106	5530
104	5520	110	5550	122	5610
108	5540	118	5590	138	5690
112	5560	126	5630		
116	5580	134	5670		
120	5600	142	5710		
124	5620				
128	5640				
132	5660				
136	5680				
140	5700				
144	5720				

UNII-3 (For Bandwidth = 20 MHz)		UNII-3 (For Bandwidth = 40 MHz)		UNII-3 (For Bandwidth = 80 MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				



5.4. TEST CHANNEL CONFIGURATION

UNII-1 Test Channel Configuration		
IEEE Std.	Test Channel Number	Frequency
802.11a	CH 36, CH 40, CH44, CH 48	5180 MHz, 5200 MHz, 5220MHz, 5240 MHz
802.11n HT20	CH 36, CH 40, CH44, CH 48	5180 MHz, 5200 MHz, 5220MHz, 5240 MHz
802.11n HT40	CH 38, CH 46	5190 MHz, 5230 MHz
802.11ac VHT20	CH 36, CH 40, CH44, CH 48	5180 MHz, 5200 MHz, 5220MHz, 5240 MHz
802.11ac VHT40	CH 38, CH 46	5190 MHz, 5230 MHz
802.11ac VHT80	CH 42	5210 MHz

UNII-2A Test Channel Configuration		
IEEE Std.	Test Channel Number	Frequency
802.11a	CH 52, CH 56, CH60, CH 64	5260 MHz, 5280 MHz, 5300 MHz, 5320 MHz
802.11n HT20	CH 52, CH 56, CH60, CH 64	5260 MHz, 5280 MHz, 5300 MHz, 5320 MHz
802.11n HT40	CH 54, CH 62	5270 MHz, 5310 MHz
802.11ac VHT20	CH 52, CH 56, CH60, CH 64	5260 MHz, 5280 MHz, 5300 MHz, 5320 MHz
802.11ac VHT40	CH 54, CH 62	5270 MHz, 5310 MHz
802.11ac VHT80	CH 58	5290 MHz

UNII-2C Test Channel Configuration		
IEEE Std.	Test Channel Number	Frequency
802.11a	CH 100, CH 104, CH120, CH 136, CH 140, CH 144	5500 MHz, 5520 MHz, 5600 MHz, 5680 MHz, 5700 MHz, 5720 MHz
802.11n HT20	CH 100, CH 104, CH120, CH 136, CH 140, CH 144	5500 MHz, 5520 MHz, 5600 MHz, 5680 MHz, 5700 MHz, 5720 MHz
802.11n HT40	CH 102, CH 110, CH 118, CH 126, CH 134, CH 142	5510 MHz, 5550 MHz, 5590 MHz, 5630 MHz, 5670 MHz, 5710 MHz
802.11ac VHT20	CH 100, CH 104, CH120, CH 136, CH 140, CH 144	5500 MHz, 5520 MHz, 5600 MHz, 5680 MHz, 5700 MHz, 5720 MHz
802.11ac VHT40	CH 102, CH 110, CH 118, CH 126, CH 134, CH 142	5510 MHz, 5550 MHz, 5590 MHz, 5630 MHz, 5670 MHz, 5710 MHz
802.11ac VHT80	CH 106, CH 122, CH 138	5530 MHz, 5610 MHz, 5690 MHz

UNII-3 Test Channel Configuration		
IEEE Std.	Test Channel Number	Frequency
802.11a	CH 149, CH 157, CH165	5745 MHz, 5785 MHz, 5825 MHz
802.11n HT20	CH 149, CH 157, CH165	5745 MHz, 5785 MHz, 5825 MHz
802.11n HT40	CH 151, CH 159	5755 MHz, 5795 MHz
802.11ac VHT20	CH 149, CH 157, CH165	5745 MHz, 5785 MHz, 5825 MHz
802.11ac VHT40	CH 151, CH 159	5755 MHz, 5795 MHz
802.11ac VHT80	CH 155	5775 MHz



5.5. POWER GRADE

UNII-1

IEEE Std. 802.11	Channel	Power Grade
a	36	14
	40	17
	44	17
	48	17
n HT20	36	14
	40	16
	44	16
	48	16
n HT40	38	10
	46	14
ac VHT20	36	14
	40	16
	44	16
	48	16
ac VHT40	38	10
	46	14
ac VHT80	42	11

UNII-2A

IEEE Std. 802.11	Channel	Power Grade
a	52	17
	56	17
	60	17
	64	14
n HT20	52	16
	56	16
	60	16
	64	14
n HT40	54	14
	62	10
ac VHT20	52	16
	56	16
	60	16
	64	14
ac VHT40	54	14
	62	10
ac VHT80	58	11



UNII-2C

IEEE Std. 802.11	Channel	Power Grade
a	100	13
	104	17
	108	17
	112	17
	116	17
	120	17
	124	17
	128	17
	132	17
	136	17
	140	13
	144	17
n HT20	100	12
	104	16
	108	16
	112	16
	116	16
	120	16
	124	16
	128	16
	132	16
	136	16
	140	12
	144	16
n HT40	102	10
	110	14
	118	14
	126	14
	134	10
	142	14
ac VHT20	100	12
	104	16
	108	16
	112	16
	116	16
	120	16
	124	16
	128	16
	132	16
	136	16
	140	12
	144	16
ac VHT40	102	10
	110	14
	118	14
	126	14
	134	10
	142	14
ac VHT80	106	11
	122	11
	138	11



UNII-3

IEEE Std. 802.11	Channel	Power Grade
a	149	17
	153	17
	157	17
	161	17
	165	17
ac VHT20	149	16
	153	16
	157	16
	161	16
	165	16
ac VHT40	151	14
	159	14
ac VHT80	155	11



5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency Band	Antenna Type	Maximum Antenna Gain
			(dBi)
1	UNII-1	PCB Antenna	3.3
		External Dipole Antenna	4.75
1	UNII-2A	PCB Antenna	3.3
		External Dipole Antenna	4.75
1	UNII-2C	PCB Antenna	3.3
		External Dipole Antenna	4.75
1	UNII-3	PCB Antenna	3.3
		External Dipole Antenna	4.75

IEEE Std. 802.11	Transmit and Receive Mode	Description
a20	☒ 1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.
n HT20	☒ 1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.
n HT40	☒ 1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.
ac VHT20	☒ 1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.
ac VHT40	☒ 1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.
ac VHT80	☒ 1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.
Note: 2.4 GHz WLAN& 5 GHz WLAN can't transmit simultaneously. (Declared by customer.)		



5.7. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter	
Test Software	Secure CRT

UNII-1

IEEE Std. 802.11	Rate	Channel	Test Software Setting Value
a	54M	36	14
		40	17
		44	17
		48	17
n HT20	MCS8	36	14
		40	16
		44	16
		48	16
n HT40	MCS9	38	10
		46	14
ac VHT20	MCS8	36	14
		40	16
		44	16
		48	16
ac VHT40	MCS9	38	10
		46	14
ac VHT80	MCS9	42	11

UNII-2A

IEEE Std. 802.11	Rate	Channel	Test Software Setting Value
a	54M	52	17
		56	17
		60	17
		64	14
n HT20	MCS8	52	16
		56	16
		60	16
		64	14
n HT40	MCS9	54	14
		62	10
ac VHT20	MCS8	52	16
		56	16
		60	16
		64	14
ac VHT40	MCS9	54	14
		62	10
ac VHT80	MCS9	58	11



UNII-2C

IEEE Std. 802.11	Rate	Channel	Test Software Setting Value
a	54M	100	13
		104	17
		120	17
		136	17
		140	13
		144	17
n HT20	MCS8	100	12
		104	16
		120	16
		136	16
		140	12
		144	16
n HT40	MCS9	102	10
		110	14
		118	14
		126	14
		134	10
		142	14
ac VHT20	MCS8	100	12
		104	16
		120	16
		136	16
		140	12
		144	16
ac VHT40	MCS9	102	10
		110	14
		118	14
		126	14
		134	10
		142	14
ac VHT80	MCS9	106	11
		122	11
		138	11



UNII-3

IEEE Std. 802.11	Rate	Channel	Test Software Setting Value
a	54M	149	17
		157	17
		165	17
n HT20	MCS8	149	16
		157	16
		165	16
n HT40	MCS9	151	14
		159	14
ac VHT20	MCS8	149	16
		157	16
		165	16
ac VHT40	MCS9	151	14
		159	14
ac VHT80	MCS9	155	11

Remark: Since 802.11ac VHT20/VHT40 modes are different from 802.11n HT20/HT40 only in control messages, so all the tests are performed on the worst case (802.11ac VHT20/802.11ac VHT40) mode between these 4 modes and only the worst data was recorded in this report.



5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Description
1	Laptop	ThinkPad	E590	/
2	Brix	GIGABYTE	/	/
3	DC Power Supply	Tektronix	PWS2326	INPUT: AC 230V OUTPUT: 0-32V, 6A

I/O PORT

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	RJ45	RJ45	LAN	100cm Length	/

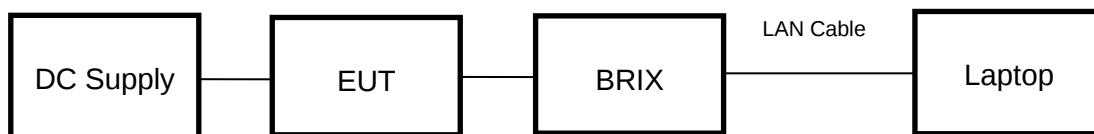
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	/	/	/	/

TEST SETUP

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

SETUP DIAGRAM FOR TESTS





5.9. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions (Instrument)							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☒	EMI Test Receiver	R&S	ESR3	126700	2020-12-05	2021-12-04	2022-12-03
☒	Two-Line V-Network	R&S	ENV216	126701	2020-12-05	2021-12-04	2022-12-03
☒	Artificial Mains Networks	R&S	ENY81	126711	2020-10-13	2021-10-12	2022-10-11
Software							
Used	Description		Manufacturer		Name	Version	
☒	Test Software for Conducted disturbance		R&S		EMC32	Ver. 9.25	
Radiated Emissions (Instrument)							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☒	Spectrum Analyzer	Keysight	N9010B	155727	2021-05-09	2022-04-09	2023-04-08
☒	EMI test receiver	R&S	ESR26	126703	2020-12-05	2021-12-04	2022-12-03
☒	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZB 1513	155456	2018-06-15	2021-06-03	2024-06-02
☒	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1	177821	2019-01-19	2022-01-18	2025-01-17
☒	Receiver Antenna (1GHz-18GHz)	R&S	HF907	126705	2019-01-27	2022-02-28	2025-02-27
☒	Receiver Antenna (18GHz-26.5GHz)	Schwarzbeck	BBHA9170	126706	2019-02-29	2022-02-28	2025-02-27
☒	Receiver Antenna (26.5GHz-40GHz)	TOYO	HAP 26-40W	155567	2020-07-22	2021-07-29	2022-07-28
☒	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-1G18-50	178825	2021-03-26	2022-03-01	2023-02-28
☒	Pre-amplification (To 26.5GHz)	R&S	SCU-26D	135391	2020-12-05	2021-12-04	2022-12-03
☒	Band Reject Filter	Wainwright	WRCJV12-5120-5150-5350-5380-40SS	3	2021-05-09	2022-05-08	2023-05-07
☒	Highpass Filter	Wainwright	WHKX10-5850-6500-1800-40SS	6	2021-05-09	2022-05-08	2023-05-07
Software							
Used	Description		Manufacturer		Name	Version	
☒	Test Software for Radiated disturbance		Tonscend		TS+	Ver. 2.5	
Other instruments							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☒	Spectrum Analyzer	Keysight	N9010B	155368	2021-05-09	2022-04-09	2023-04-08
☒	Power Meter	Keysight	U2021XA	155370	2021-05-09	2022-04-09	2023-04-08



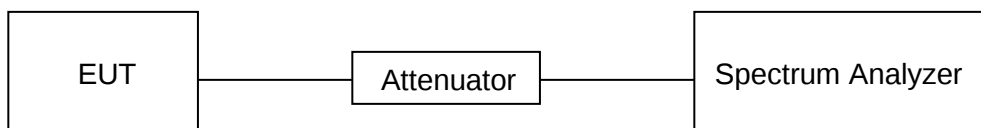
6. ANTENNA PORT TEST RESULTS

6.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

TEST SETUP



TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests
Relative Humidity	65%
Atmospheric Pressure:	101kPa
Temperature	21.5°C
Test Voltage	DC 3.3V
Test Date	05/05/2022

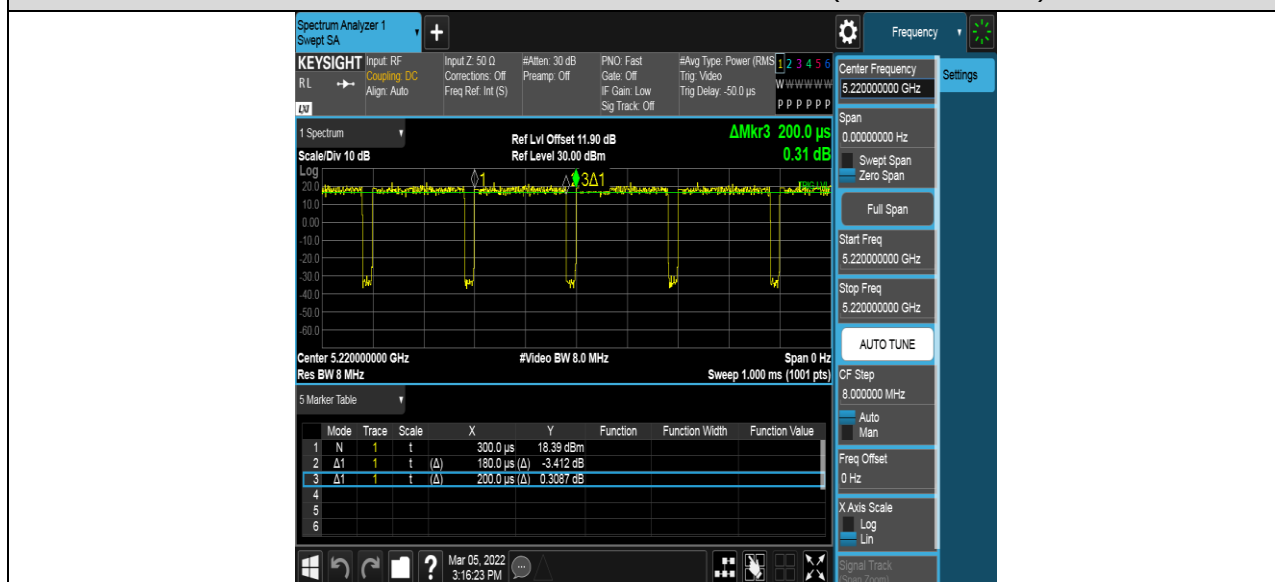
RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
11a20	0.18	0.2	0.900	90.00	0.46	5.6	6
11ac HT20	0.15	0.17	0.8824	88.24	0.54	6.6	7
11ac HT40	0.09	0.11	0.8182	81.82	0.87	11.1	12
11ac HT80	0.33	0.35	0.9429	94.29	0.26	3.03	4

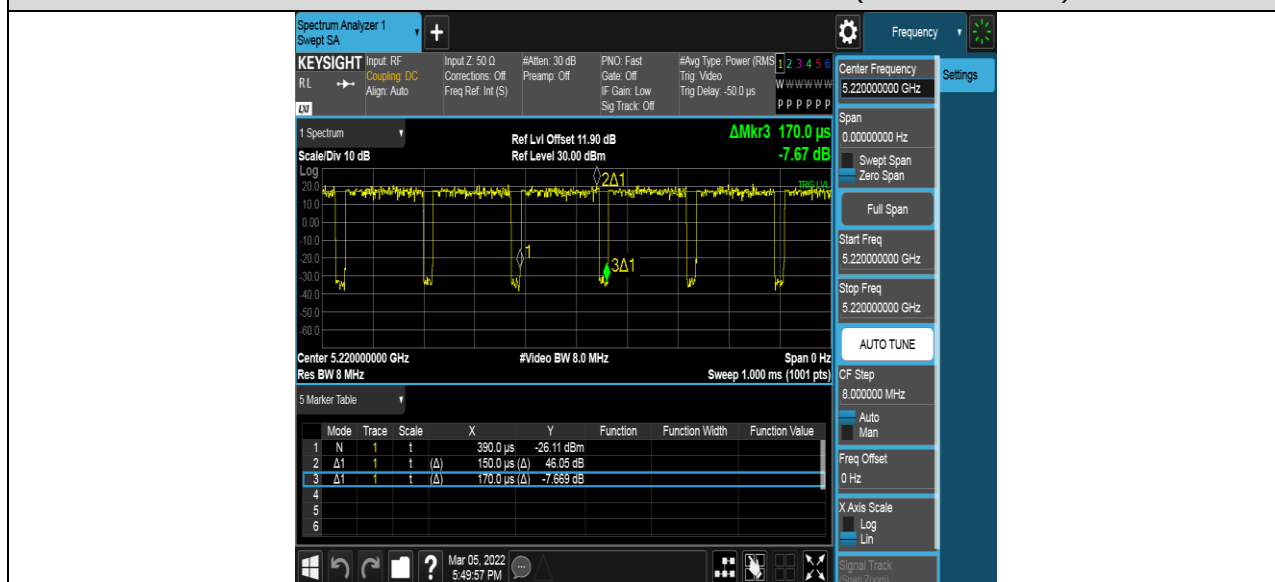
Remark:

1. Duty Cycle Correction Factor=10log (1/x).
2. Where: x is Duty Cycle (Linear)
3. Where: T is On Time
4. If that calculated VBW is not available on the analyzer then the next higher value should be used.

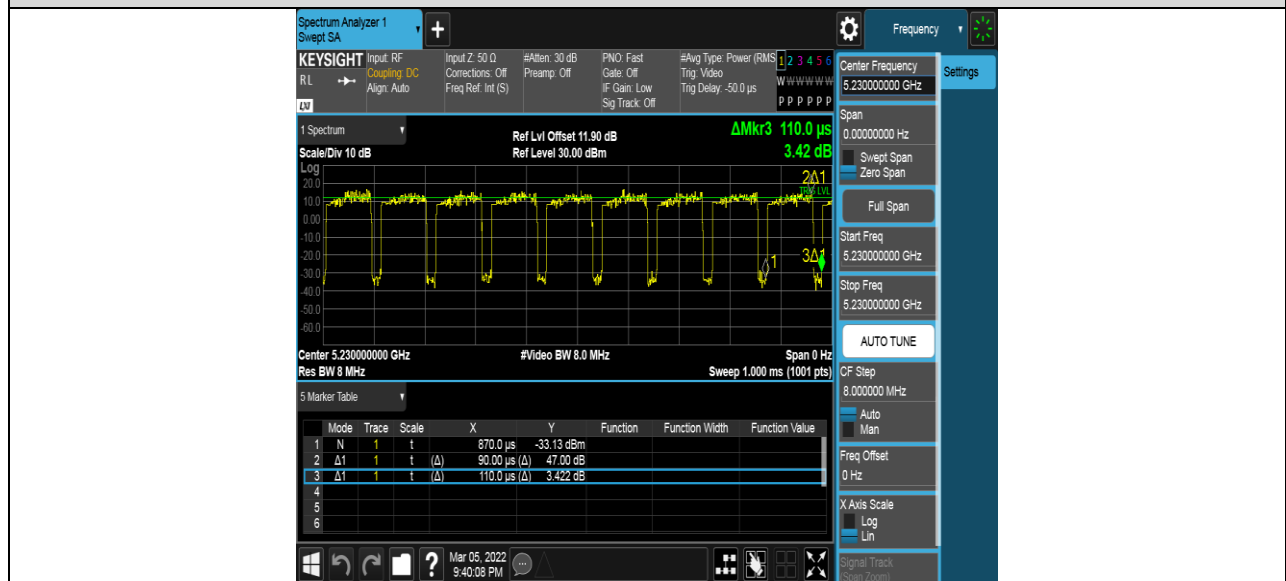
11a ON TIME AND DUTY CYCLE 5220MHz (WORSE CASE)



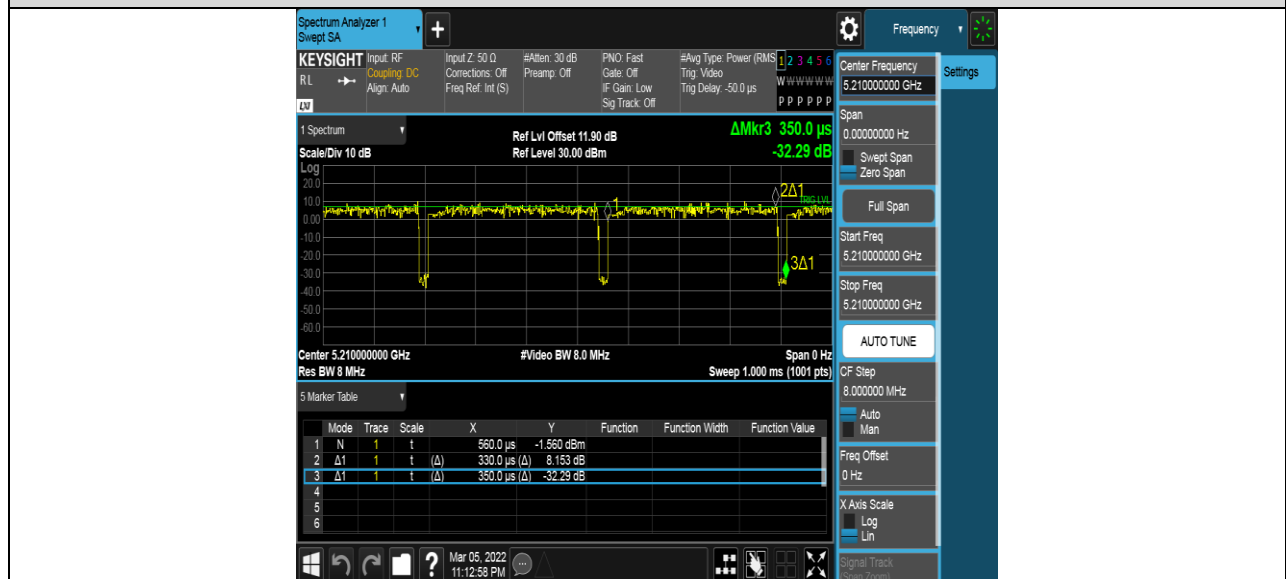
11ac20 ON TIME AND DUTY CYCLE 5220MHz (WORSE CASE)



11ac40 ON TIME AND DUTY CYCLE 5230MHz (WORSE CASE)



11ac80 ON TIME AND DUTY CYCLE 5210MHz (WORSE CASE)





6.2. 6dB/26dB BANDWIDTH

LIMITS

CFR 47 FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
26 dB Emission Bandwidth	For reporting purposes only.	5150 ~ 5250
26 dB Emission Bandwidth	For reporting purposes only.	5250 ~ 5350
26 dB Emission Bandwidth	For reporting purposes only.	5470 ~ 5725
6 dB Emission Bandwidth	The minimum 6 dB emission bandwidth shall be 500 kHz.	5725 ~ 5850

TEST PROCEDURE

Refer to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 section II.C1. for 26 dB Emission Bandwidth; section II.C2. for 6 dB Emission Bandwidth; section II.D. for 99 % Occupied Bandwidth.

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

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6 dB Emission Bandwidth: RBW=100 kHz For 26 dB Emission bandwidth: approximately 1 % of the EBW.
VBW	For 6 dB Bandwidth: $\geq 3 \times \text{RBW}$ For 26 dB Bandwidth: $> \text{RBW}$
Trace	Max hold
Sweep	Auto couple

- Use the 99 % power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.
- 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 6/26 dB relative to the maximum level measured in the fundamental emission.



Calculation for 26 dB Bandwidth of UNII-2C and UNII-3 Straddle Channel:

For Example: Fundamental Frequency: 5720 MHz

FL: 5710.60 MHz

FH: 5728.33 MHz

Turning Frequency: 5725 MHz

UNII-2C Band Portion = $5725 - 5710.60 = 14.40$ MHz

UNII-3 Band Portion = $5728.33 - 5725 = 3.30$ MHz

Calculation for 6dB Bandwidth of UNII-3 Straddle Channel:

For Example: Fundamental frequency: 5720 MHz

6 dB BW: 16.44 MHz

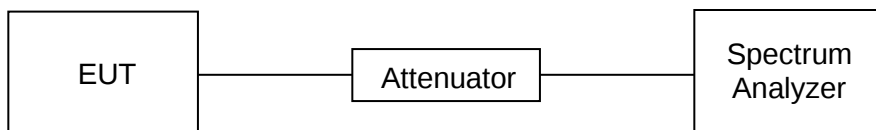
FL: 5711.76 MHz

FH: 5728.2 MHz

Turning Frequency: 5725 MHz

6 dB Bandwidth of UNII-3 band Portion = $5728.2 - 5725 = 3.2$ MHz

TEST SETUP



TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests
Relative Humidity	65%
Atmospheric Pressure:	101kPa
Temperature	21.5°C
Test Voltage	DC 3.3V
Test Date	05/05/2022



RESULTS TABLE

1) 26 dB Emission Bandwidth Part:

Test Mode	Channel	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11A	5180	20.960	5169.440	5190.400	PASS
	5200	23.000	5189.480	5212.480	PASS
	5220	23.000	5209.480	5232.480	PASS
	5240	23.040	5229.480	5252.520	PASS
	5260	27.280	5249.200	5276.480	PASS
	5280	27.320	5269.240	5296.560	PASS
	5300	27.040	5289.320	5316.360	PASS
	5320	20.840	5309.520	5330.360	PASS
	5500	21.000	5489.520	5510.520	PASS
	5520	27.440	5509.120	5536.560	PASS
	5600	27.680	5588.880	5616.560	PASS
	5680	27.360	5669.160	5696.520	PASS
	5700	21.000	5689.480	5710.480	PASS
	5720	27.400	5709.040	5736.440	PASS
	5720 UNII-2C	15.96	5709.040	5725	PASS
	5720 UNII-3	11.44	5725	5736.440	PASS
	5745	22.080	5734.160	5756.240	PASS
	5785	23.280	5774.160	5797.440	PASS
	5825	21.880	5814.240	5836.120	PASS

Test Mode	Channel	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11AC20	5180	21.440	5169.240	5190.680	PASS
	5200	21.960	5189.320	5211.280	PASS
	5220	22.640	5209.120	5231.760	PASS
	5240	21.920	5229.280	5251.200	PASS
	5260	22.560	5249.280	5271.840	PASS
	5280	23.760	5269.280	5293.040	PASS
	5300	22.040	5289.320	5311.360	PASS
	5320	21.280	5309.200	5330.480	PASS
	5500	21.280	5489.400	5510.680	PASS
	5520	22.760	5507.920	5530.680	PASS
	5600	23.880	5589.000	5612.880	PASS
	5680	25.120	5668.960	5694.080	PASS
	5700	21.240	5689.320	5710.560	PASS
	5720	23.840	5709.080	5732.920	PASS
	5720 UNII-2C	15.92	5709.080	5725	PASS
	5720 UNII-3	7.92	5725	5732.920	PASS
	5745	21.920	5734.120	5756.040	PASS
	5785	21.720	5774.120	5795.840	PASS
	5825	21.920	5814.000	5835.920	PASS



Test Mode	Channel	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11AC40	5190	40.160	5169.840	5210.000	PASS
	5230	39.680	5210.080	5249.760	PASS
	5270	39.760	5250.080	5289.840	PASS
	5310	39.840	5289.920	5329.760	PASS
	5510	40.000	5490.000	5530.000	PASS
	5550	39.840	5529.920	5569.760	PASS
	5590	40.000	5569.840	5609.840	PASS
	5630	40.480	5609.760	5650.240	PASS
	5670	40.000	5649.920	5689.920	PASS
	5710	40.240	5689.680	5729.920	PASS
	5710 UNII-2C	35.32	5689.680	5725	PASS
	5710 UNII-3	4.92	5725	5729.920	PASS
	5755	40.080	5734.760	5774.840	PASS
	5795	39.760	5774.920	5814.680	PASS

Test Mode	Channel	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11AC80	5210	81.440	5169.520	5250.960	PASS
	5290	81.120	5249.360	5330.480	PASS
	5530	81.280	5489.200	5570.480	PASS
	5610	81.120	5569.520	5650.640	PASS
	5690	81.280	5649.360	5730.640	PASS
	5690 UNII-2C	75.640	5649.360	5725	PASS
	5690 UNII-3	5.640	5725	5730.640	PASS
	5775	81.600	5734.200	5815.800	PASS



2) 6dB Minimum Emission Bandwidth

Test Mode	Channel	6db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	5745	16.360	5736.760	5753.120	0.5	PASS
	5785	16.320	5776.760	5793.080	0.5	PASS
	5825	16.360	5816.760	5833.120	0.5	PASS
11AC20	5745	17.720	5736.120	5753.840	0.5	PASS
	5785	17.640	5776.160	5793.800	0.5	PASS
	5825	17.680	5816.120	5833.800	0.5	PASS
11AC40	5755	36.400	5736.760	5773.160	0.5	PASS
	5795	36.400	5776.760	5813.160	0.5	PASS
11AC80	5775	75.680	5737.080	5812.760	0.5	PASS



TEST GRAPHS

1) For 26 dB Emission Bandwidth Part:

