

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 1 of 54

Applicant : SIMCom Wireless Solutions Limited
Address of Applicant : SIMCom Headquarters Building, Building 3, No.289
Linhong Road, Changning District, Shanghai,China

Product Name : Wi-Fi & BT Module
Brand Name : SIMCom
Model Name : W58
Sample Acquisition Method : Sent by Client

Sample No. : E22110054-01#05
E22110054-01#08

FCC ID : 2AJYU-8PYA00C


Standards : FCC CFR47 Part 15, Subpart E

Date of Receipt : 2023-02-15
Date of Test : 2023-03-13 ~ 2023-04-17
Date of Issue : 2023-04-17

Remark:

This report details the results of the testing carried out on one sample, the results contained in this report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 2 of 54

Contents

1	GENERAL INFORMATION	3
1.1	TESTING LABORATORY	3
1.2	DETAILS OF APPLICATION	3
1.3	DETAILS OF EUT	3
1.4	TEST METHODOLOGY	6
1.5	TEST SUMMARY	6
2	TEST CONDITION	7
2.1	ENVIRONMENTAL CONDITIONS	7
2.2	EQUIPMENT LIST	7
2.3	MEASUREMENT UNCERTAINTY	8
3	TEST SET-UP AND OPERATION MODES	9
3.1	DETAILS OF TEST MODE	9
3.2	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	10
3.3	SUPPORT SOFTWARE	10
3.4	TEST SETUP DIAGRAM	11
4	TEST RESULTS	13
4.1	TRANSMITTER REQUIREMENT & TEST SUITES	13
4.1.1	<i>Antenna Requirement</i>	13
4.1.2	<i>Maximum Conducted Output Power and E.I.R.P.</i>	14
4.1.3	<i>26dB Bandwidth and 99% Bandwidth</i>	18
4.1.4	<i>6dB Bandwidth and 99% Bandwidth</i>	20
4.1.5	<i>Maximum Conducted Output Power Spectral Density and e.i.r.p. spectral density</i>	35
4.1.6	<i>Conducted Spurious Emission</i>	39
4.1.7	<i>Radiated Emission</i>	40
4.1.8	<i>Band Edge (Restricted-band band-edge)</i>	41
4.1.9	<i>Frequency Stability</i>	42
4.2	MAINS EMISSIONS	46
4.2.1	<i>Conducted Emission on AC Mains</i>	46
5	APPENDIXES	49
5.1	PHOTOGRAPHS OF THE SAMPLE	49
5.2	SET-UP FOR CONDUCTED EMISSIONS	53
5.3	SET-UP FOR CONDUCTED RF TEST AT ANTENNA PORT	53
5.4	SET-UP FOR SPURIOUS EMISSIONS BELOW 1GHZ	54
5.5	SET-UP FOR SPURIOUS EMISSIONS ABOVE 1GHZ	54

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 3 of 54

1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Service (Shanghai) Co., Ltd.
Address	No.1298 Pingan Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Applicant Company Name	SIMCom Wireless Solutions Limited
Address	SIMCom Headquarters Building, Building 3, No.289 Linhong Road, Changning District, Shanghai,China
Contact Person	Yongsheng Li
Telephone	+86 21 3252 3134
Email	yongsheng.li@simcom.com
Manufacturer Company Name	SIMCom Wireless Solutions Limited
Address	SIMCom Headquarters Building, Building 3, No.289 Linhong Road, Changning District, Shanghai,China
Factory Company Name	SIMCom Wireless Solutions Limited
Address	SIMCom Headquarters Building, Building 3, No.289 Linhong Road, Changning District, Shanghai,China

1.3 Details of EUT

Product Name	Wi-Fi & BT Module
Brand Name	SIMCom
Test Model Name	W58
FCC ID	2AJYU-8PYA00C
Mode of Operation	WLAN 802.11a/n(HT20/40)/ac(VHT20/40/80)
Operation Frequency	Band I:5150MHz~5250MHz; Band II:5250MHz~5350MHz; Band III:5470MHz~5725MHz; Band IV: 5725MHz ~ 5850MHz
Modulation Type	256QAM, 64QAM, 16QAM, BPSK, QPSK, 128QAM, OFDM
Number of Channels	39
Channel Bandwidth	802.11a: 20MHz 802.11n: 20MHz, 40MHz 802.11ac: 20MHz, 40MHz, 80MHz
Antenna Type	External Antenna
Antenna Gain	5.60dBi

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 4 of 54

Extreme Temperature Range	-40°C ~ +85°C
Test Voltage	DC 3.3V
Extreme Voltage	Low Voltage: DC 3.2V High Voltage: DC 3.4V
Product Type	Mobile and portable for FCC standard
Hardware Version	W58_V2.02_PCB
Software Version	LE20B01V04SIM7600G22_MIFI2
RF power setting in TEST SW	802.11a: QRCT_Power level setting_12dBm 802.11n(HT20): QRCT_Power level setting_11dBm 802.11n(HT40): QRCT_Power level setting_10dBm 802.11ac(VHT20): QRCT_Power level setting_10dBm 802.11ac(VHT40): QRCT_Power level setting_9dBm 802.11ac(VHT80): QRCT_Power level setting_8dBm

Note:

1. The above information was declared by the manufacture.
2. The EUT is designed as master device.
3. The EUT do not support TPC.
4. For more details, please refer to the User's manual of the EUT.

Channel List

Frequency Band	Channel Number	Frequency
Band I: 5150MHz~5250MHz	36	5180 MHz
	38	5190 MHz
	40	5200 MHz
	42	5210 MHz
	44	5220 MHz
	46	5230 MHz
	48	5240 MHz
Band II: 5250MHz~5350MHz	52	5260 MHz
	54	5270 MHz
	56	5280 MHz
	58	5290 MHz
	60	5300 MHz
	62	5310 MHz
	64	5320 MHz

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 5 of 54

Frequency Band	Channel Number	Frequency
Band III: 5470MHz~5725MHz	100	5500 MHz
	102	5510 MHz
	104	5520 MHz
	106	5530 MHz
	108	5540 MHz
	110	5550 MHz
	112	5560 MHz
	116	5580 MHz
	118	5590 MHz
	120	5600 MHz
	122	5610 MHz
	124	5620 MHz
	126	5630 MHz
	128	5640 MHz
	132	5660 MHz
	134	5670 MHz
Band IV: 5725MHz ~ 5850MHz	136	5680 MHz
	140	5700 MHz
	149	5745 MHz
	151	5755 MHz
	153	5765 MHz
	155	5775 MHz
	157	5785 MHz
	159	5795 MHz
165	5825 MHz	

Note:

For 20MHZ bandwidth system use Channel

36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140,149,153,157,161,165;

For 40MHZ bandwidth system use Channel 38,46,54,62,102,110,118,126,134,151,159;

For 80MHZ bandwidth system use Channel 42,58,106,122,155.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 6 of 54

1.4 Test Methodology

47 CFR Part 15, Subpart E	Subpart E—Unlicensed National Information Infrastructure Devices
KDB Publication 789033 D02 v02r01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Note(s):

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test

1.5 Test Summary

Test Item	FCC Rules	Result
Antenna Requirement	FCC Part 15.407(a), 15.203	PASS
Maximum Conducted Output Power	FCC Part 15.407(a)	PASS
26dB Bandwidth and 99% Bandwidth	FCC Part 15.407(a)	PASS
6dB Bandwidth	FCC Part 15.407(e)	PASS
Maximum Conducted Output Power Spectral Density	FCC Part 15.407(a)	PASS
Conducted Spurious Emission	FCC Part 15.407(b), 15.209	PASS
Radiated Emission	FCC Part 15.407(b), 15.209, 15.205	PASS
Band Edge (Restricted-band band-edge)	FCC Part 15.407(b), 15.205, 15.209	PASS
Frequency Stability	FCC Part 15.407(g)	PASS
Conducted Emission on AC Mains	FCC Part 15.207(a)	PASS

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 7 of 54

2 Test Condition

2.1 Environmental conditions

Temperature (°C)	18-25
Humidity (%RH)	40-65
Barometric Pressure (mbar)	960-1060

2.2 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Keysight	N9020B	MY59260184	2022-08-02	2023-08-01
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2022-06-10	2023-06-09
Signal Generator	Rohde & Schwarz	SMR27	100184	2022-08-02	2023-08-01
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2022-06-10	2023-06-09
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2022-06-10	2023-06-09
V-network	SCHWARZBECK	NSLK8127	8127-902	2022-06-10	2023-06-09
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-08	2023-06-07
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2021-06-08	2023-06-07
Horn Antenna-40G	YINGLIAN	LB-180400-KF	N/A	2021-06-12	2024-06-11
Loop Antenna	SCHWARZBECK	FMZB 1513	/	2022-06-10	2023-06-09
Broadband Preamplifier	SCHWARZBECK	BBV 9718	346	2022-06-10	2023-06-09
Temperature Box	ESPEC	ECT-2	055239A	2021-12-29	2023-12-28
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2022-06-10	2023-06-09
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2022-06-10	2023-06-09
Test Software	BL	BL410_E	Version:1.0.0.117	N/A	N/A
Test Software	BL	BL410_R	Version:2.1.1.409	N/A	N/A

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 8 of 54

2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in measurement" (GUM) published by CISPR and ANSI. The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95.45%.

Parameter		Uncertainty
Antenna Port Conducted Emission	< 1GHz	± 1.5 dB
	> 1GHz	± 1.5 dB
Radiated Emission	< 1GHz	± 5.00 dB
	> 1GHz	± 4.88 dB
Conducted Emission on AC Mains	150KHz-30MHz	± 2.68 dB
Occupied Channel Bandwidth		± 5 %

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 9 of 54

3 Test Set-up and Operation Modes

3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:
For 802.11a/n(HT20), 802.11ac (VHT20)

Band I (5150 – 5250MHz)		Band II (5250 – 5350MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel (CH36)	5180MHz	The lowest channel (CH52)	5260MHz
The middle channel (CH44)	5220MHz	The middle channel (CH60)	5300MHz
The highest channel (CH48)	5240MHz	The highest channel (CH64)	5320MHz

Band III (5470 – 5725MHz)		Band IV (5725 – 5850MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel (CH100)	5500MHz	The lowest channel (CH149)	5745MHz
The middle channel (CH116)	5580MHz	The middle channel (CH157)	5785MHz
The highest channel (CH140)	5700MHz	The highest channel (CH165)	5825MHz

For 802.11n(HT40), 802.11ac (VHT40)

Band I (5150 – 5250MHz)		Band II (5250 – 5350MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel (CH38)	5190MHz	The lowest channel (CH54)	5270MHz
The highest channel (CH46)	5230MHz	The highest channel (CH62)	5310MHz

Band III (5470 – 5725MHz)		Band IV (5725 – 5850MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel (CH102)	5510MHz	The lowest channel (CH151)	5755MHz
The middle channel (CH118)	5590MHz	The highest channel (CH159)	5795MHz
The highest channel (CH134)	5670MHz		

For 802.11ac (VHT80)

Band I (5150 – 5250MHz)		Band II (5250 – 5350MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel (CH42)	5210MHz	The lowest channel (CH58)	5290MHz

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 10 of 54

Band III (5470 – 5725MHz)		Band IV (5725 – 5850MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel (CH106)	5530MHz	The lowest channel (CH155)	5775MHz
The lowest channel (CH122)	5610MHz	The lowest channel (CH155)	5775MHz

Through Pre-scan under all rate at lowest channel, the data rate as below table described is the worst case, so we choose these data rate for test.

Type	Data rate
802.11a	24Mbps
802.11n(HT20), 802.11ac (VHT20)	MCS6
802.11n(HT40), 802.11ac (VHT40)	MCS6
802.11ac (VHT80)	MCS3

The basic operation modes are:

- A. On
 - 1. WLAN mode
 - a. Transmitting
 - b. Receiving
- B. Standby
- C. Off

3.2 Special Accessories and Auxiliary Equipment

Description	Manufacturer	Model Name	Serial No.
Laptop	Lenovo	TP00083A	PF-0PRDGN 17/03
Adapter	Something High Electric(Xiamen) Company Inc.	P-050B-050200EU	N/A
EVB Debug Board	SIMCom	8PYA00-SIMCOM-EVB_V1.02	N/A
USB Cable	SIMCom	N/A	1.00m Unshielded

3.3 Support Software

Description	Manufacturer	Software Name
Software	Qualcomm	QRCT Version 4.0.00166.0

TEST REPORT

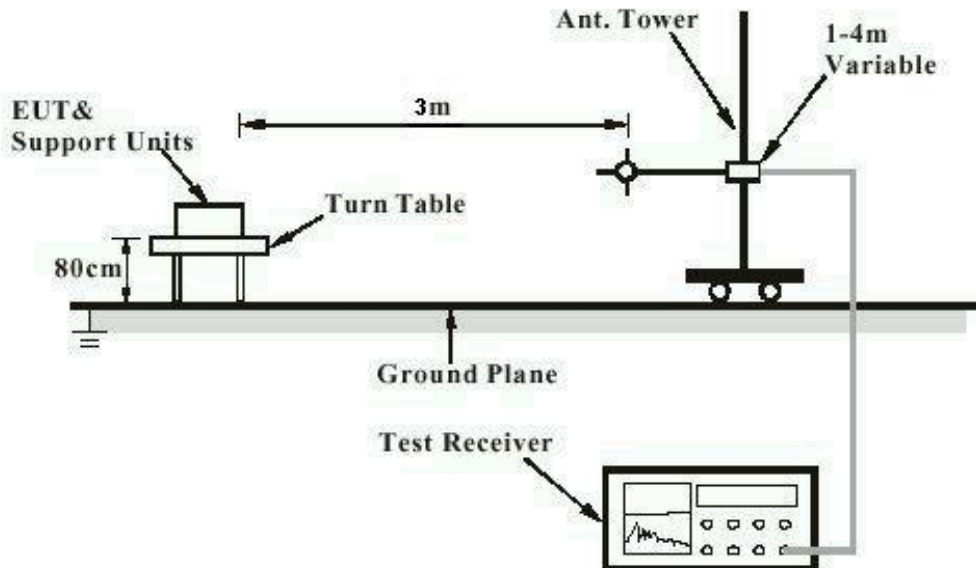
Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 11 of 54

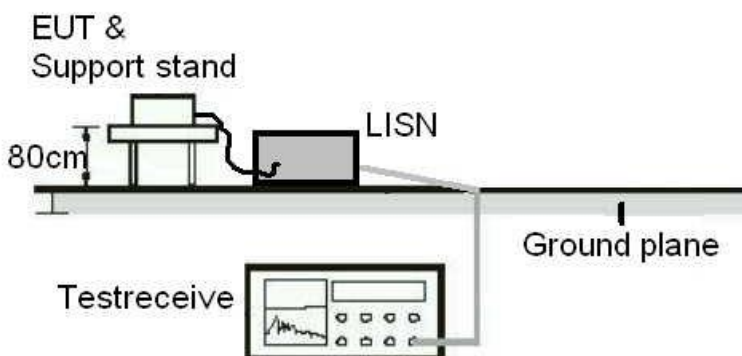
3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Configuration for Conduction Test



TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 12 of 54

Diagram of Measurement Configuration for Transmitter Test

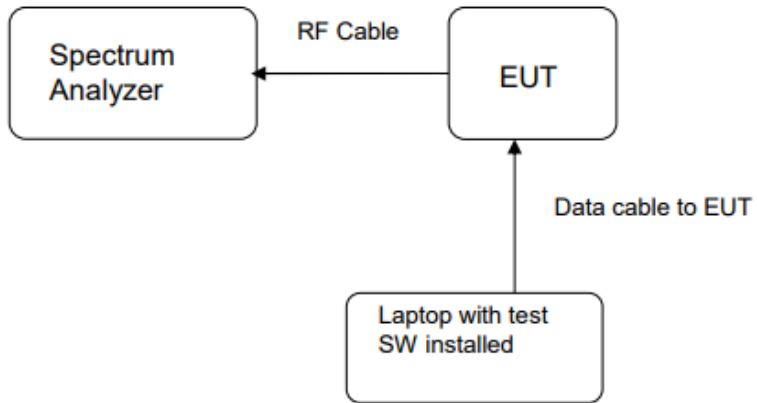
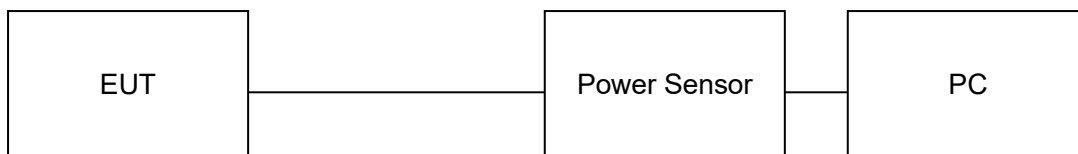


Diagram of Measurement Equipment Configuration for conducted output power setup



TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 13 of 54

4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT:

PASS

Test standard : FCC Part 15.407(a), 15.203

Requirement : The use of approved antennas only with directional gains that do not exceed 6dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 5.60dBi. The antenna is an external antenna with no possibility of replacement with a non-approved antenna by the end-user.

The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Therefore, the EUT is considered to comply with this provision.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 14 of 54

4.1.2 Maximum Conducted Output Power

RESULT:

PASS

Test standard : FCC Part 15.407(a)
 Requirement : ANSI C63.10-2013 clause 12.3.3.1, KDB 789033
 Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
 Operation Mode : A.1.a
 Ambient temperature : 24.0°C
 Relative humidity : 50%

Table 1: Maximum Conducted Output Power for Band I (5150MHz~5250MHz)

Test Mode	Duty Cycle (%)	Test Channel (MHz)	Maximum Conducted Output Power		Applicable Limit
			(dBm)	(mW)	
802.11a	78.47	5180	9.37	8.65	1W(30dBm)
		5220	9.89	9.75	
		5240	9.67	9.27	
802.11n(HT20)	71.75	5180	8.75	7.50	
		5220	9.32	8.55	
		5240	9.13	8.18	
802.11ac(VHT20)	73.09	5180	9.09	8.11	
		5220	9.97	9.93	
		5240	9.98	9.95	
802.11n(HT40)	73.09	5190	8.73	7.46	
		5230	9.42	8.75	
802.11ac(VHT40)	53.06	5190	9.10	8.13	
		5230	9.94	9.86	
802.11ac(VHT80)	63.23	5210	8.11	6.47	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.
2. 30 dBm (1 W) for master device.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 15 of 54

Table 2: Maximum Conducted Output Power for Band II (5250MHz~5350MHz)

Test Mode	Duty Cycle (%)	-26 dB Emission Bandwidth (MHz)	Test Channel (MHz)	Maximum Conducted Output Power		Applicable Limit
				(dBm)	(mW)	
802.11a	63.43	20.38	5260	15.07	32.14	250mW (24dBm)
		20.21	5300	15.63	36.56	
		20.39	5320	15.70	37.15	
802.11n(HT20)	73.32	21.58	5260	11.68	14.72	
		21.88	5300	12.29	16.94	
		21.59	5320	12.37	17.26	
802.11ac(VHT20)	74.07	21.73	5260	10.69	11.72	
		21.44	5300	11.29	13.46	
		21.43	5320	11.32	13.55	
802.11n(HT40)	59.88	43.55	5270	11.23	13.27	
		43.53	5310	11.87	15.38	
802.11ac(VHT40)	61.79	43.48	5270	10.11	10.26	
		43.42	5310	10.72	11.80	
802.11ac(VHT80)	58.40	83.07	5290	9.38	8.67	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.
2. The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 16 of 54

Table 3: Maximum Conducted Output Power for Band III (5470MHz~5725MHz)

Test Mode	Duty Cycle (%)	-26 dB Emission Bandwidth (MHz)	Test Channel (MHz)	Maximum Conducted Output Power		Applicable Limit
				(dBm)	(mW)	
802.11a	76.59	20.55	5500	14.83	30.41	250mW (24dBm)
		20.27	5580	13.95	24.83	
		21.03	5700	15.39	34.59	
802.11n(HT20)	80.99	22.29	5500	11.19	13.15	
		22.38	5580	11.12	12.94	
		22.16	5700	12.48	17.70	
802.11ac(VHT20)	78.42	22.12	5500	10.52	11.27	
		22.06	5580	10.27	10.64	
		21.93	5700	11.66	14.66	
802.11n(HT40)	48.33	42.99	5510	12.16	16.44	
		43.18	5590	11.90	15.49	
		43.32	5670	13.51	22.44	
802.11ac(VHT40)	58.58	42.83	5510	10.79	11.99	
		43.10	5590	9.83	9.62	
		43.05	5670	11.50	14.13	
802.11ac(VHT80)	62.83	88.37	5530	8.41	6.93	
		86.69	5610	8.48	7.05	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.
2. The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 17 of 54

Table 4: Maximum Conducted Output Power for Band IV (5725MHz~5850MHz)

Test Mode	Duty Cycle (%)	Test Channel (MHz)	Maximum Conducted Output Power		Applicable Limit
			(dBm)	(mW)	
802.11a	74.34	5745	16.76	47.42	1W(30dBm)
		5785	16.46	44.26	
		5825	16.36	43.25	
802.11n(HT20)	73.95	5745	14.11	25.76	
		5785	13.75	23.71	
		5825	13.65	23.17	
802.11ac(VHT20)	61.29	5745	13.79	23.93	
		5785	13.46	22.18	
		5825	13.42	21.98	
802.11n(HT40)	50.02	5755	14.22	26.42	
		5795	14.37	27.35	
802.11ac(VHT40)	60.52	5755	12.50	17.78	
		5795	12.61	18.24	
802.11ac(VHT80)	51.96	5775	10.90	12.30	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 18 of 54

4.1.3 26dB Bandwidth and 99% Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.407(a)
Requirement : ANSI C63.10-2013 clause 12.4, KDB 789033
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 24.0°C
Relative humidity : 50%

Notes:

Test plots please refer to the annex document "SHE22110054-02DE DATA WIFI5GHz-26dB Bandwidth and 99% Bandwidth EXHIBIT A"

Table 5: 26dB Bandwidth and 99% Bandwidth for Band I (5150MHz~5250 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5180	20.22	16.533
	5220	19.80	16.614
	5240	20.02	16.595
802.11n(HT20)	5180	20.79	17.736
	5220	22.23	17.718
	5240	20.89	17.733
802.11ac(VHT20)	5180	22.38	17.867
	5220	22.45	17.843
	5240	22.50	17.825
802.11n(HT40)	5190	43.98	36.433
	5230	43.84	36.472
802.11ac(VHT40)	5190	41.58	36.449
	5230	42.06	36.438
802.11ac(VHT80)	5210	85.34	76.082

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 19 of 54

Table 6: 26dB Bandwidth and 99% Bandwidth for Band II (5250MHz~5350 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5260	20.38	16.547
	5300	20.21	16.572
	5320	20.39	16.552
802.11n(HT20)	5260	21.58	17.747
	5300	21.88	17.741
	5320	21.59	17.732
802.11ac(VHT20)	5260	21.73	17.749
	5300	21.44	17.733
	5320	21.43	17.748
802.11n(HT40)	5270	43.55	36.476
	5310	43.53	36.478
802.11ac(VHT40)	5270	43.48	36.495
	5310	43.42	36.421
802.11ac(VHT80)	5290	83.07	76.163

Table 7: 26dB Bandwidth and 99% Bandwidth for Band III (5470MHz~5725MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5500	20.55	16.555
	5580	20.27	16.561
	5700	21.03	16.577
802.11n(HT20)	5500	22.29	17.825
	5580	22.38	17.854
	5700	22.16	17.868
802.11ac(VHT20)	5500	22.12	17.868
	5580	22.06	17.841
	5700	21.93	17.832
802.11n(HT40)	5510	42.99	36.456
	5590	43.18	36.515
	5670	43.32	36.502
802.11ac(VHT40)	5510	42.83	36.437
	5590	43.10	36.414
	5670	43.05	36.412
802.11ac(VHT80)	5530	88.37	76.140
	5610	86.69	76.139

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 20 of 54

4.1.4 6dB Bandwidth and 99% Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.407(e)
 Requirement : ANSI C63.10-2013 clause 12.4, KDB 789033
 Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
 Operation Mode : A.1.a
 Ambient temperature : 24.0°C
 Relative humidity : 50%

Table 8: 6dB Bandwidth and 99% Occupied Bandwidth

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Applicable Limit (MHz)
802.11a	5745	16.43	16.581	>0.5
	5785	16.41	16.586	
	5825	16.41	16.613	
802.11n(HT20)	5745	17.68	17.751	
	5785	17.69	17.743	
	5825	17.66	17.769	
802.11ac(VHT20)	5745	17.66	17.760	
	5785	17.60	17.749	
	5825	17.67	17.754	
802.11n(HT40)	5755	36.44	36.410	
	5795	36.16	36.467	
802.11ac(VHT40)	5755	36.44	36.446	
	5795	36.46	36.446	
802.11ac(VHT80)	5775	76.13	76.047	

TEST REPORT

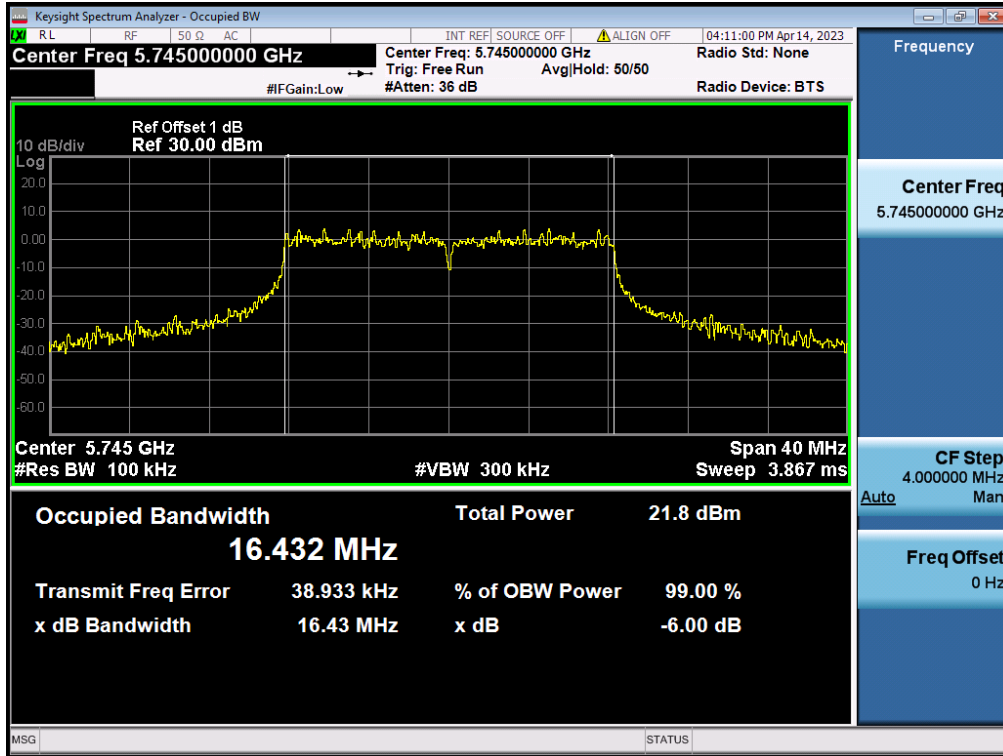
Report No.: SHE22110054-02DE

Date: 2023-04-17

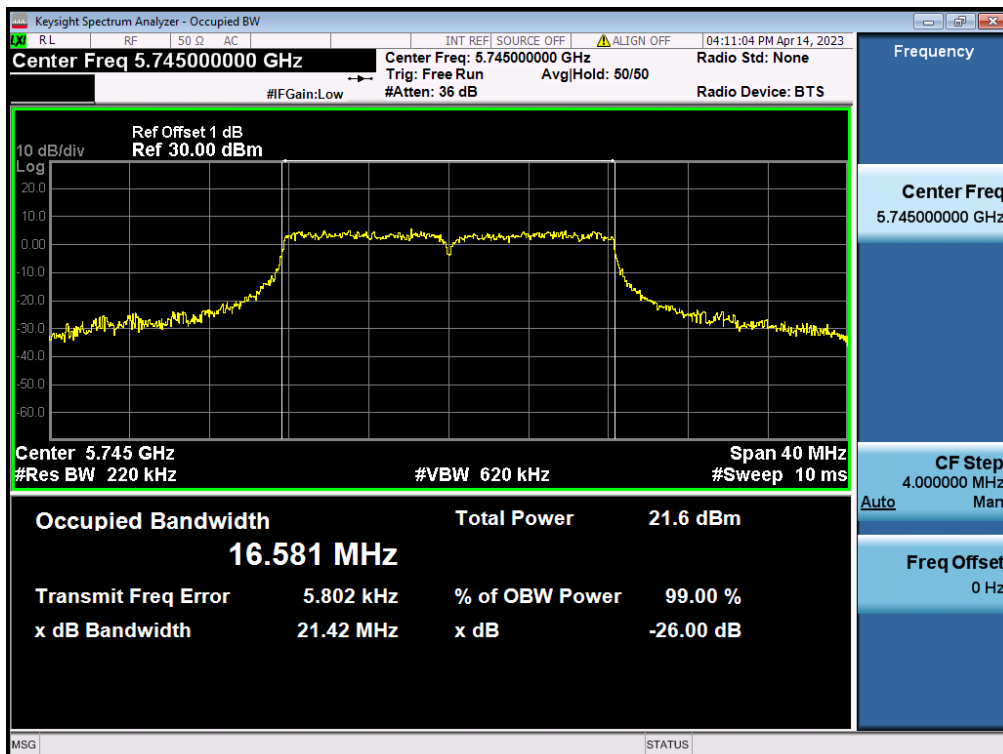
Page 21 of 54

Figure 1: 802.11a, 5745MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

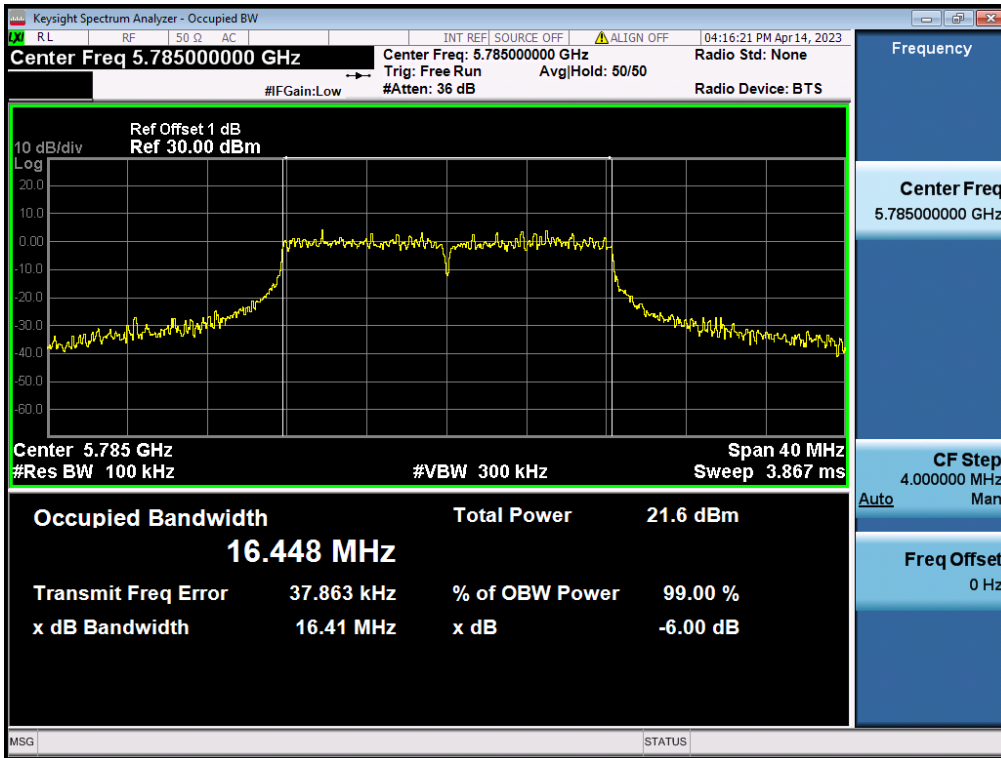
Report No.: SHE22110054-02DE

Date: 2023-04-17

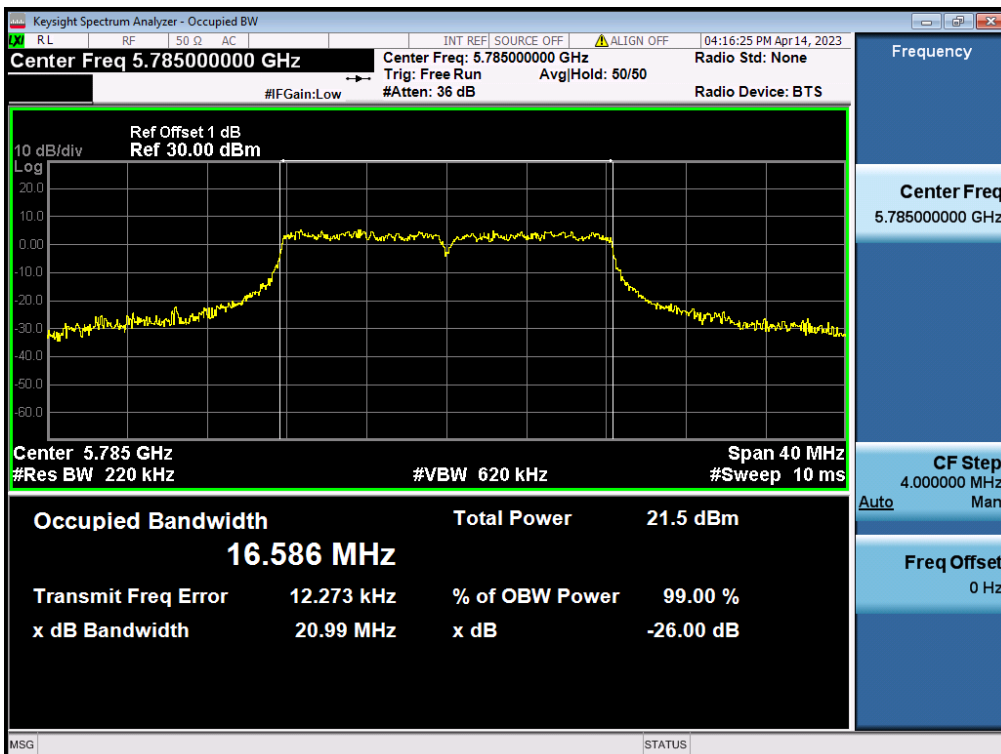
Page 22 of 54

Figure 2: 802.11a, 5785MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

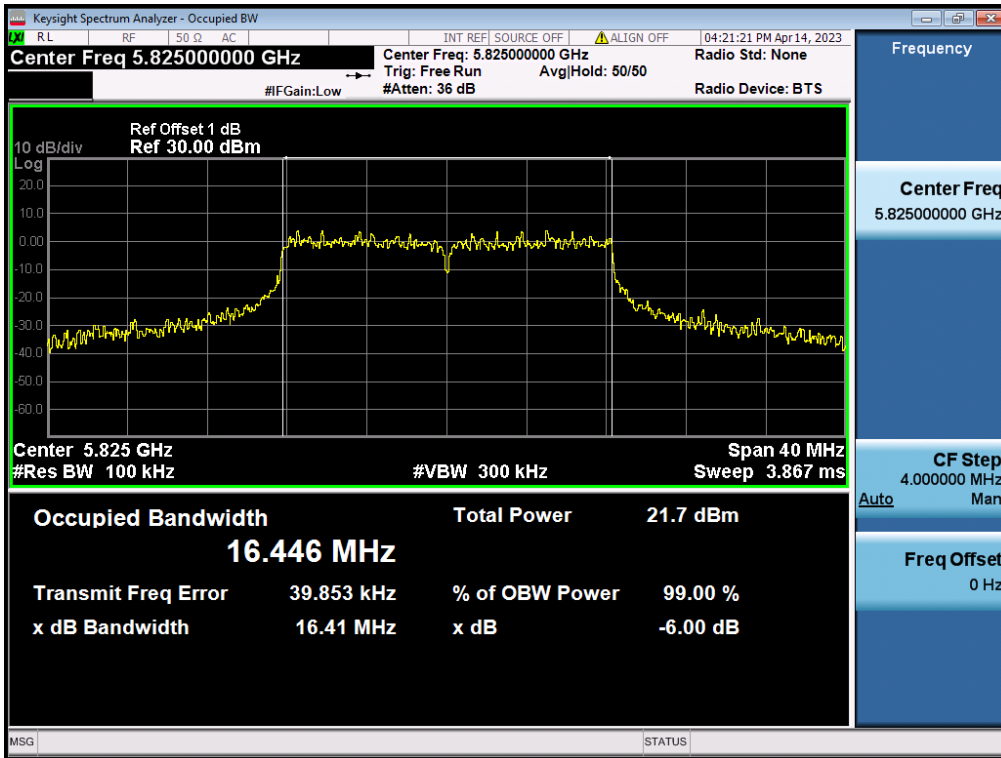
Report No.: SHE22110054-02DE

Date: 2023-04-17

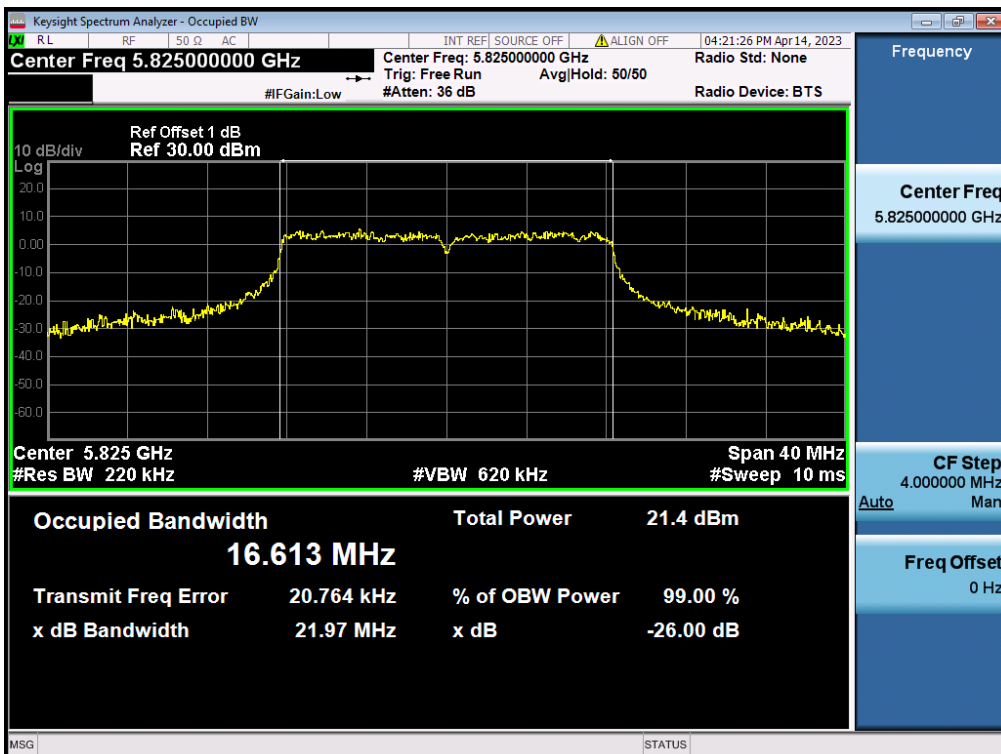
Page 23 of 54

Figure 3: 802.11a, 5825MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

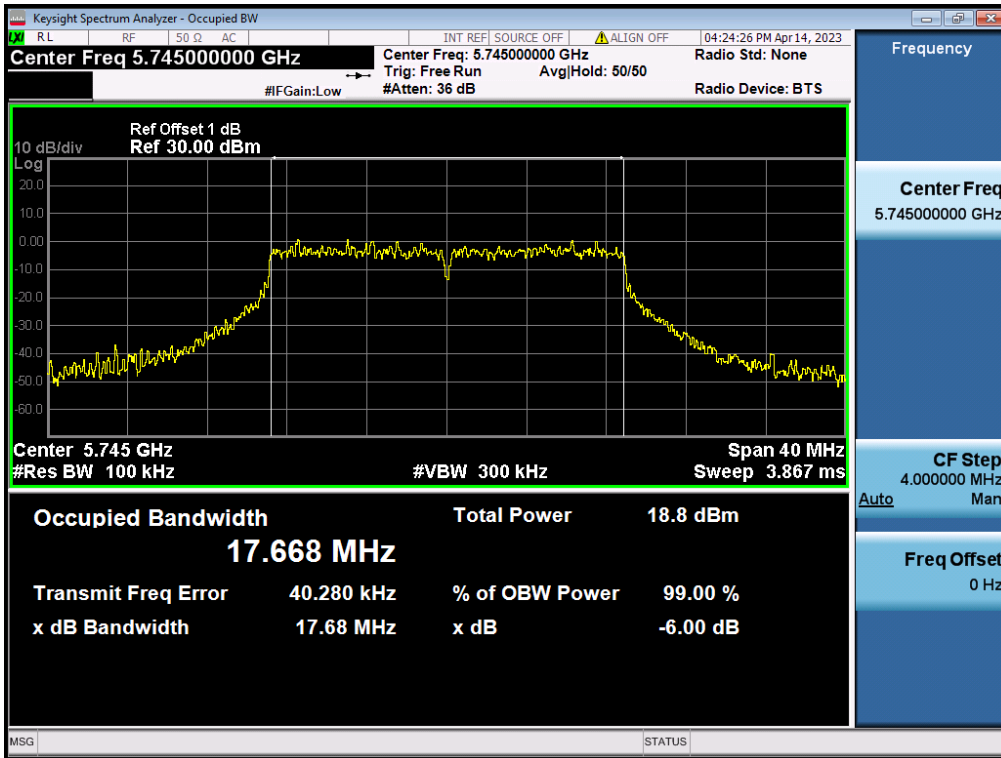
Report No.: SHE22110054-02DE

Date: 2023-04-17

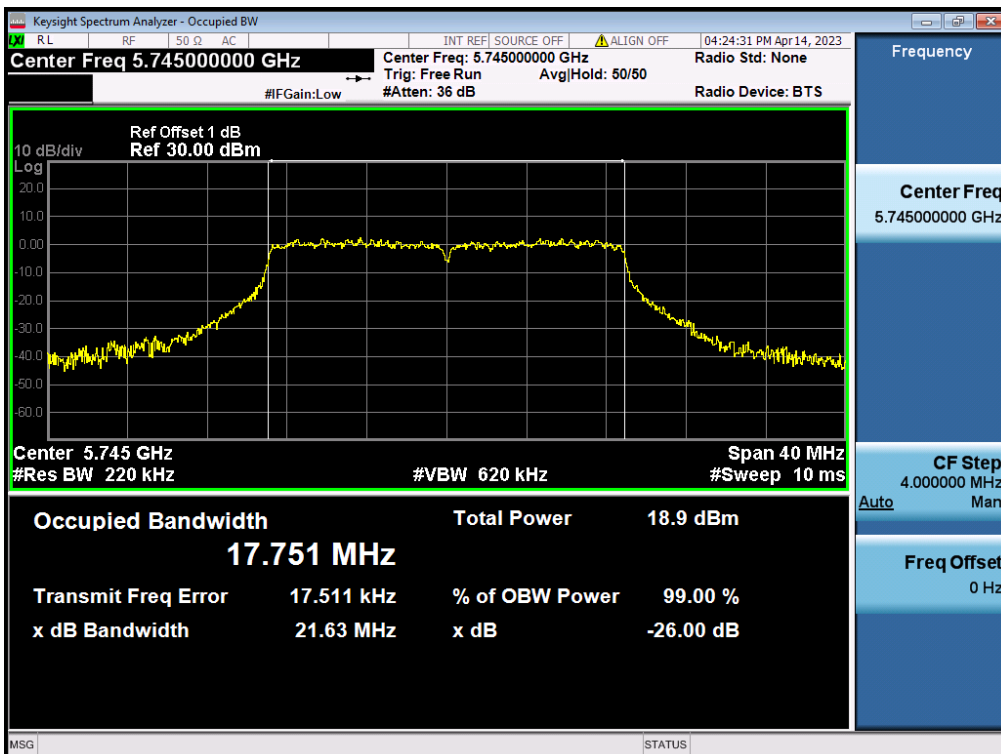
Page 24 of 54

Figure 4: 802.11n(HT20), 5745MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

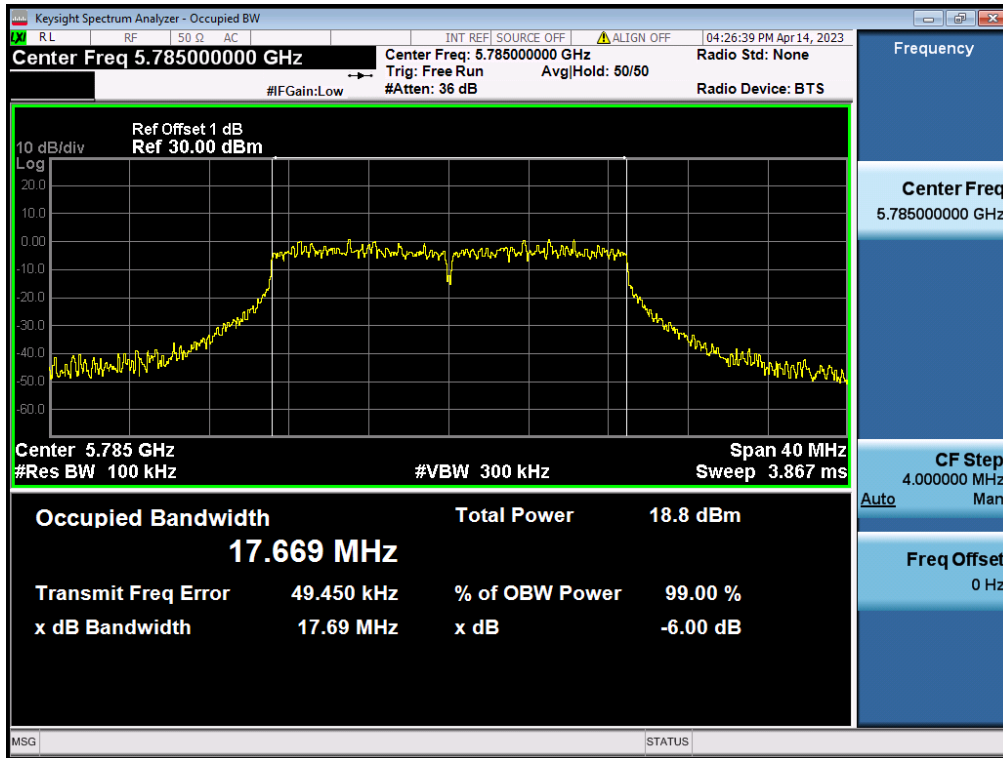
Report No.: SHE22110054-02DE

Date: 2023-04-17

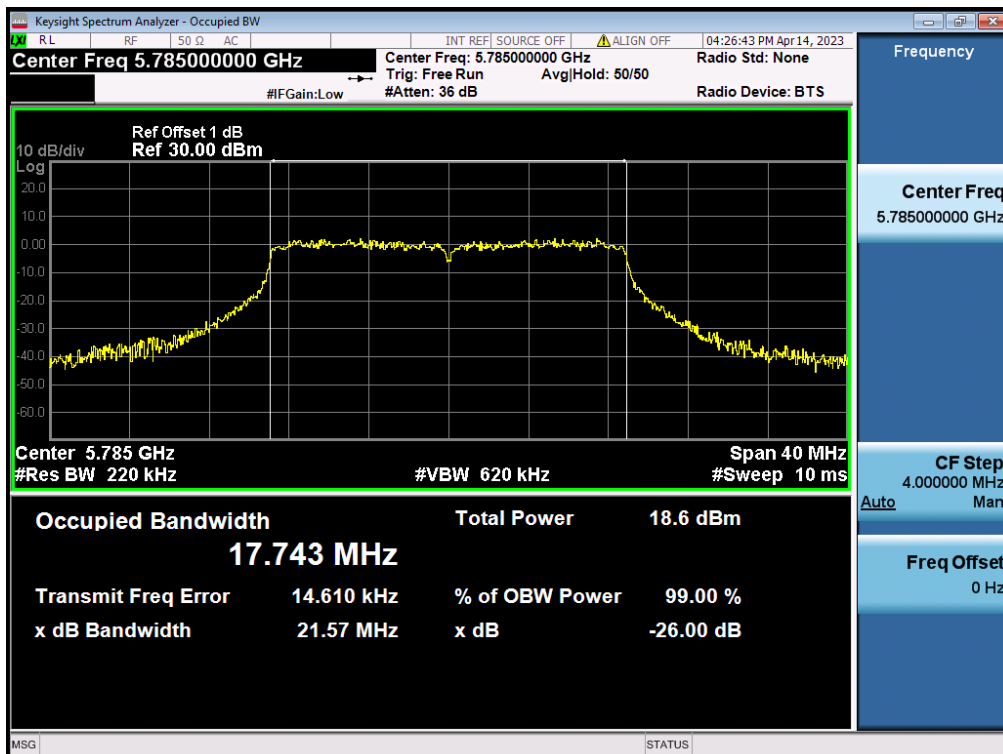
Page 25 of 54

Figure 5: The plots of 6dB Bandwidth, 802.11n(HT20), 5785MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

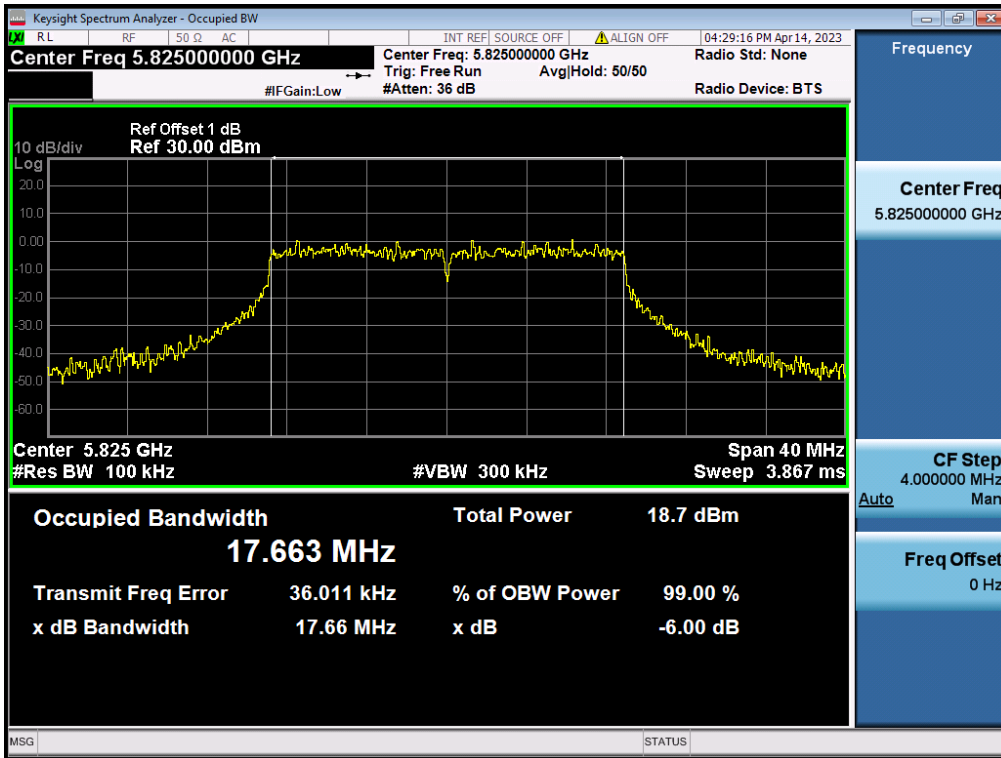
Report No.: SHE22110054-02DE

Date: 2023-04-17

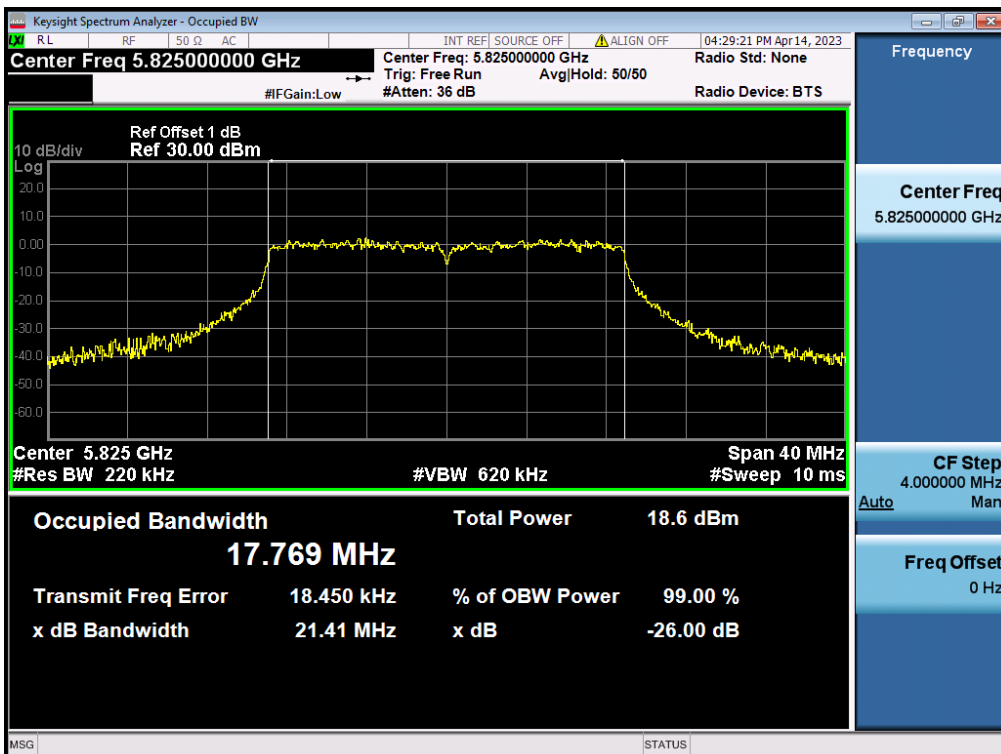
Page 26 of 54

Figure 6: The plots of 6dB Bandwidth, 802.11n(HT20), 5825MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

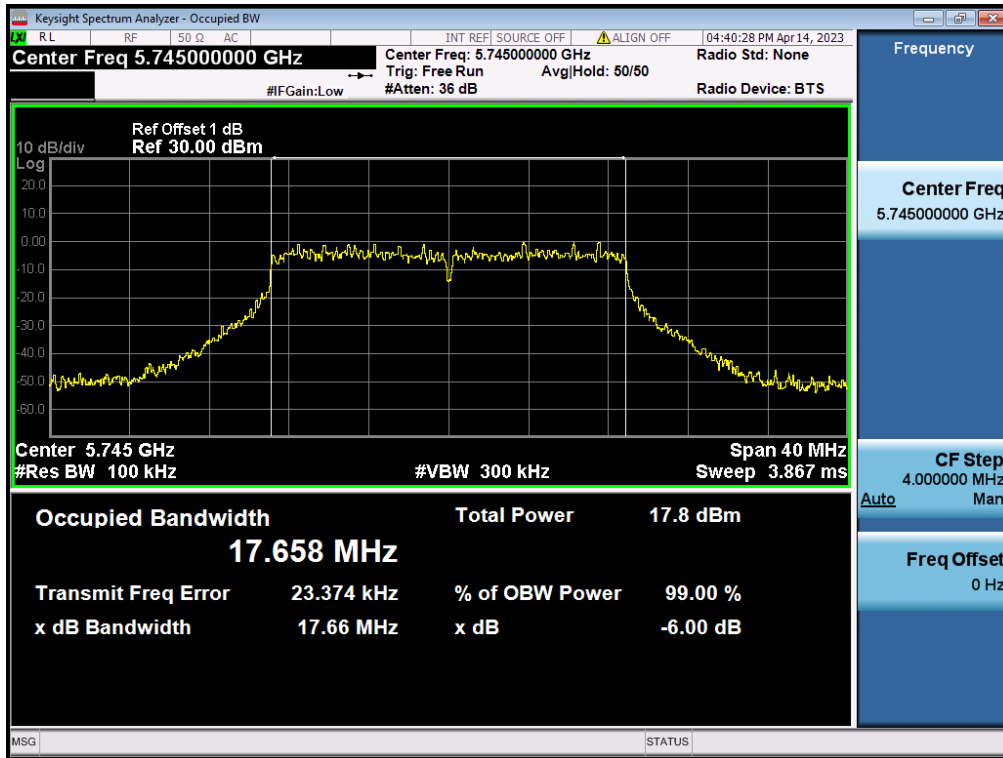
Report No.: SHE22110054-02DE

Date: 2023-04-17

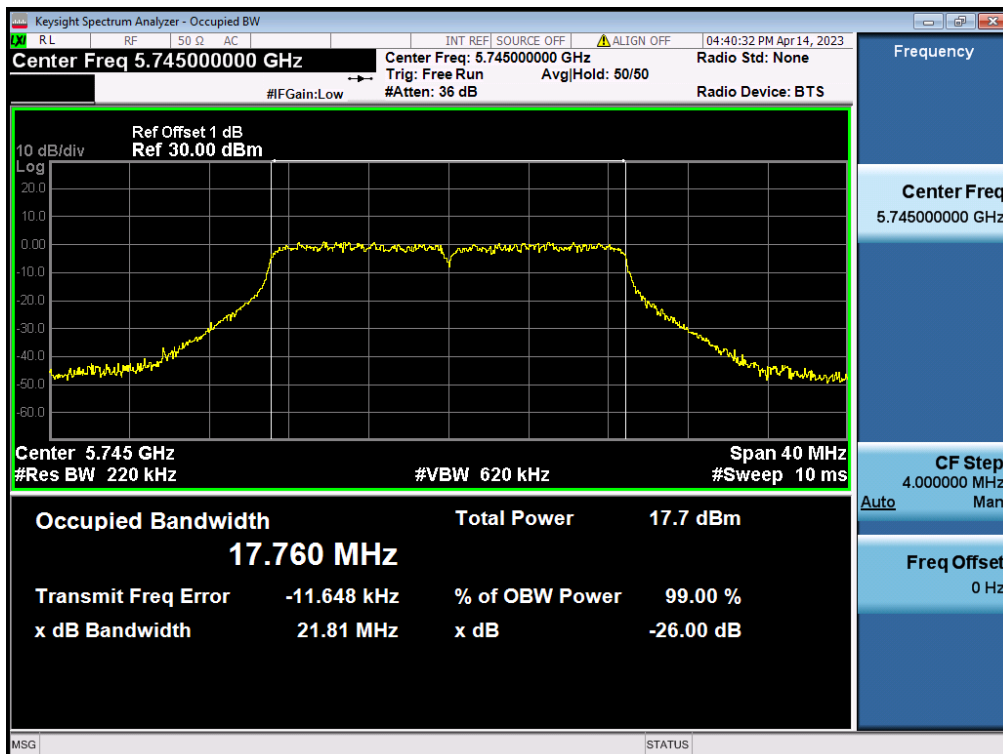
Page 27 of 54

Figure 7: The plots of 6dB Bandwidth, 802.11ac(VHT20), 5745MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



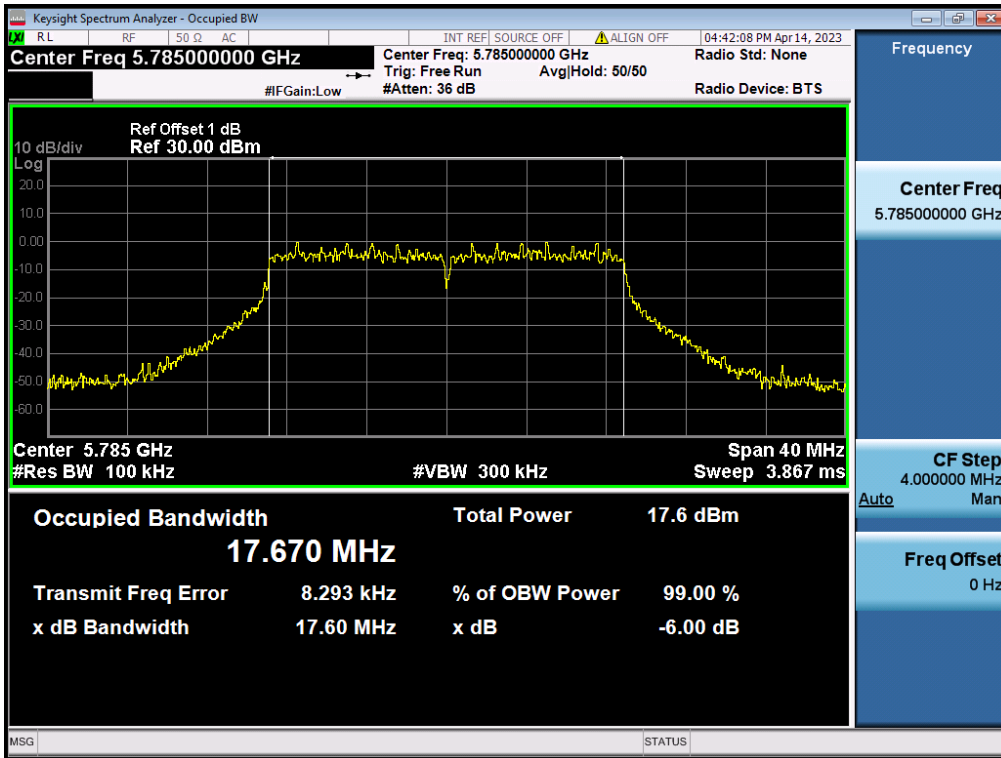
TEST REPORT

Report No.: SHE22110054-02DE

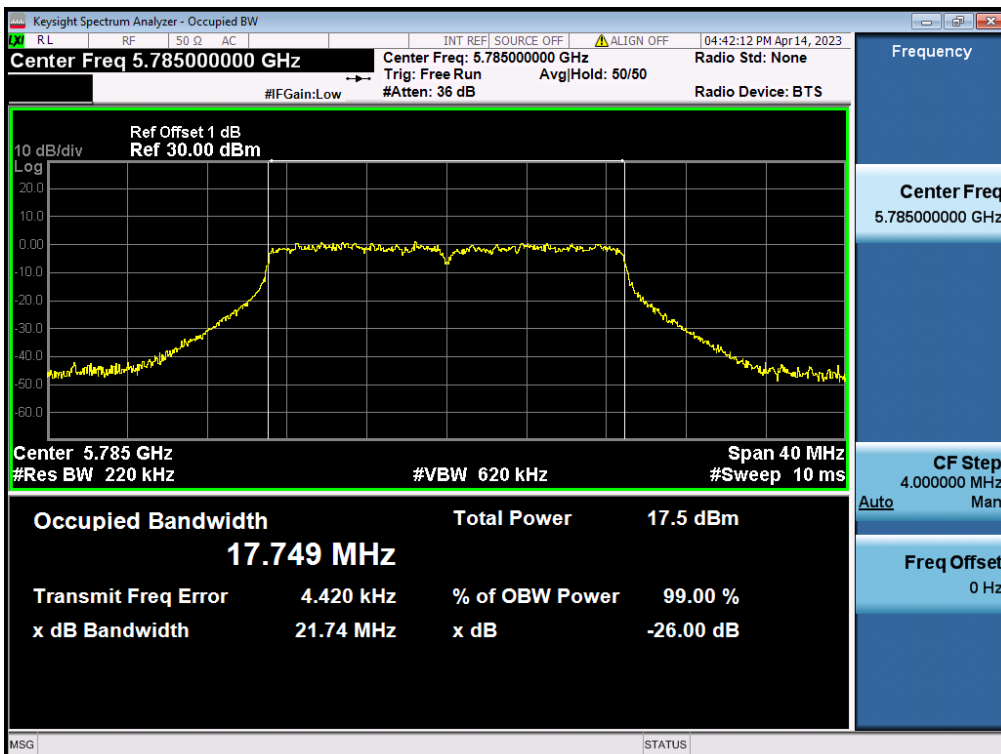
Date: 2023-04-17

Page 28 of 54

Figure 8: The plots of 6dB Bandwidth, 802.11ac(VHT20), 5785MHz
 Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



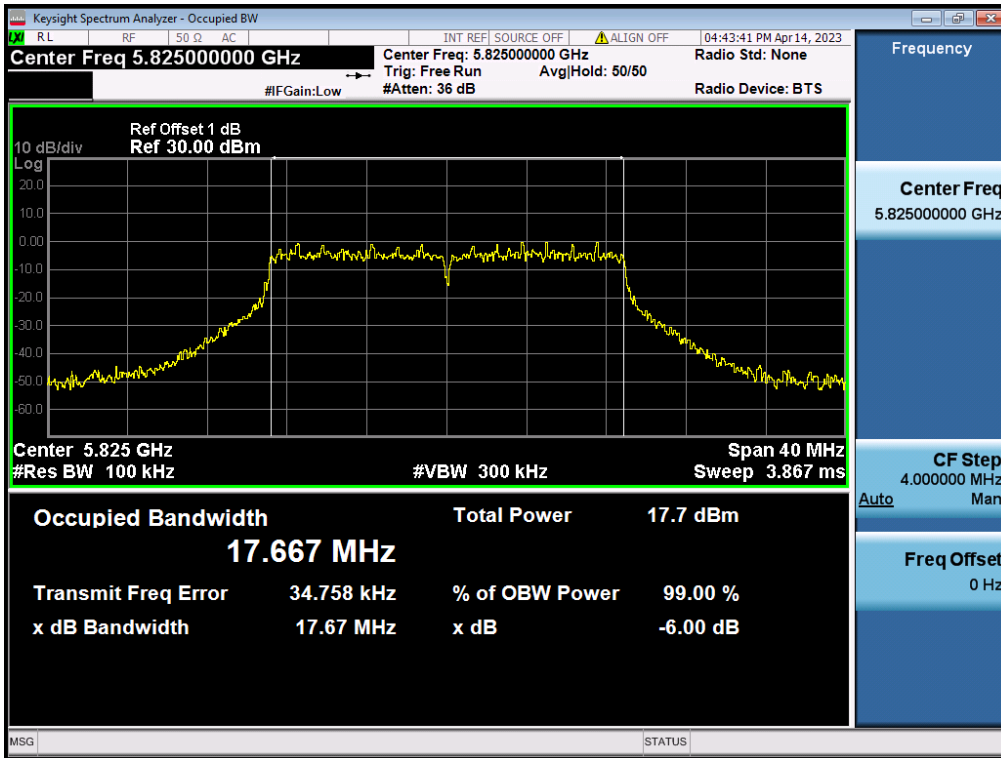
TEST REPORT

Report No.: SHE22110054-02DE

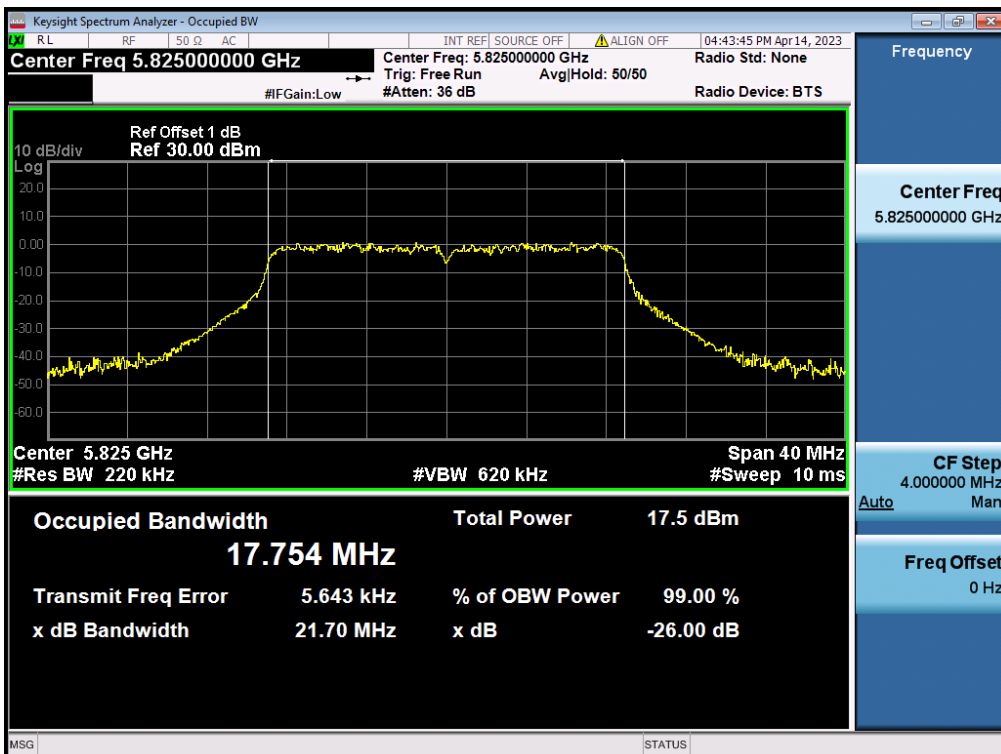
Date: 2023-04-17

Page 29 of 54

Figure 9: The plots of 6dB Bandwidth, 802.11ac(VHT20), 5825MHz
 Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

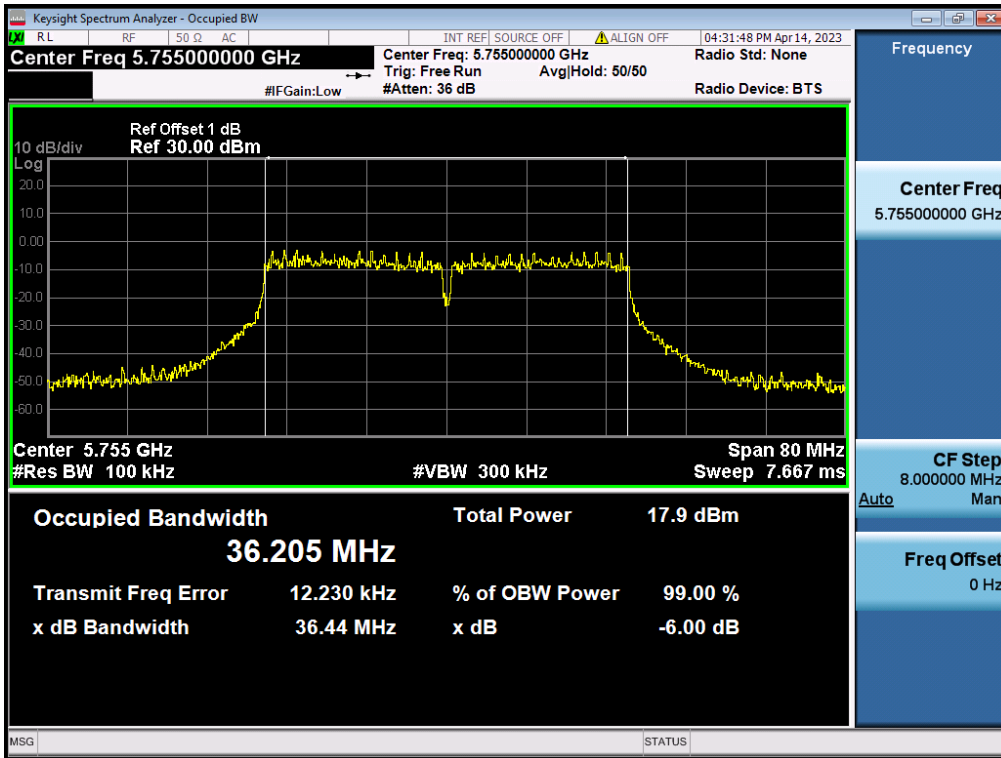
Report No.: SHE22110054-02DE

Date: 2023-04-17

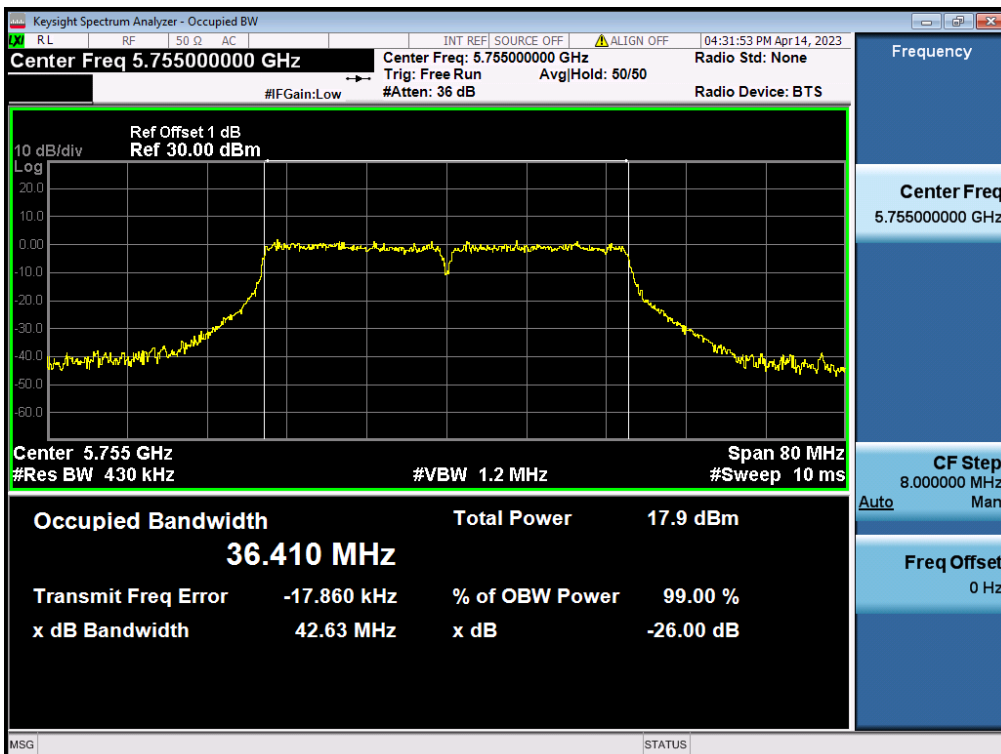
Page 30 of 54

Figure 10: The plots of 6dB Bandwidth, 802.11n(HT40), 5755MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

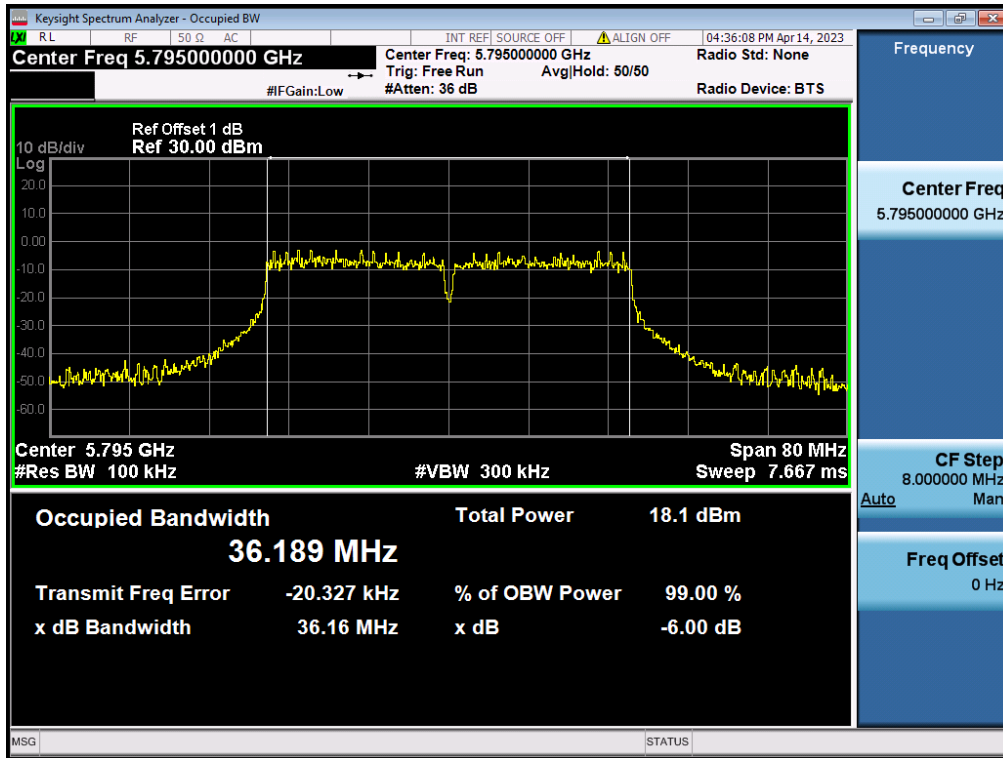
Report No.: SHE22110054-02DE

Date: 2023-04-17

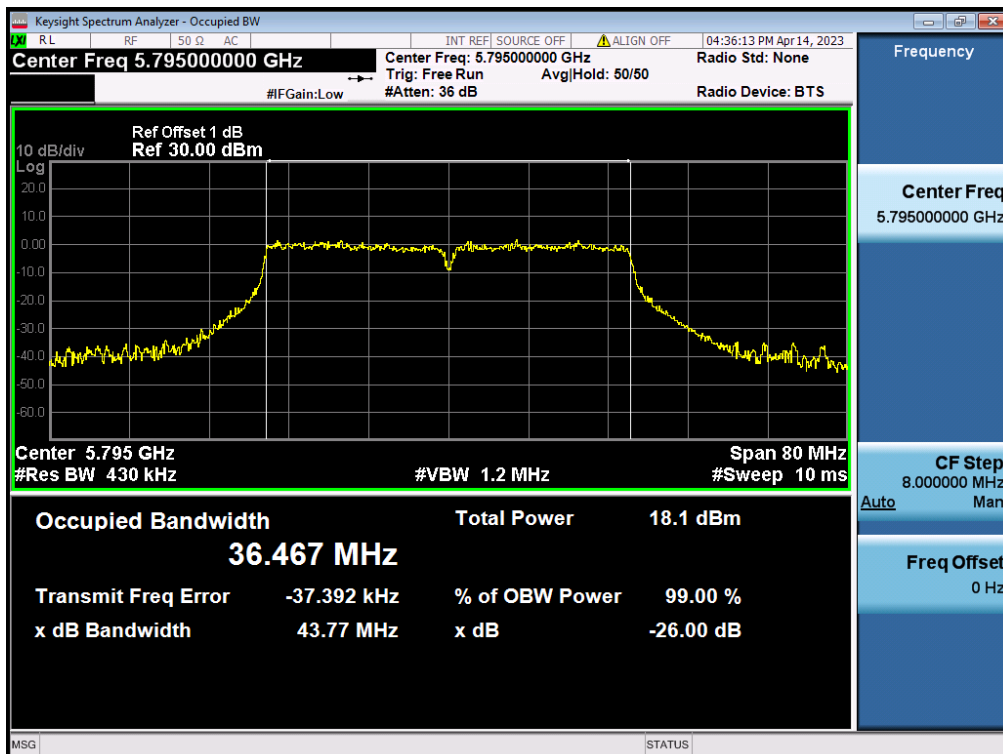
Page 31 of 54

Figure 11: The plots of 6dB Bandwidth, 802.11n(HT40), 5795MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

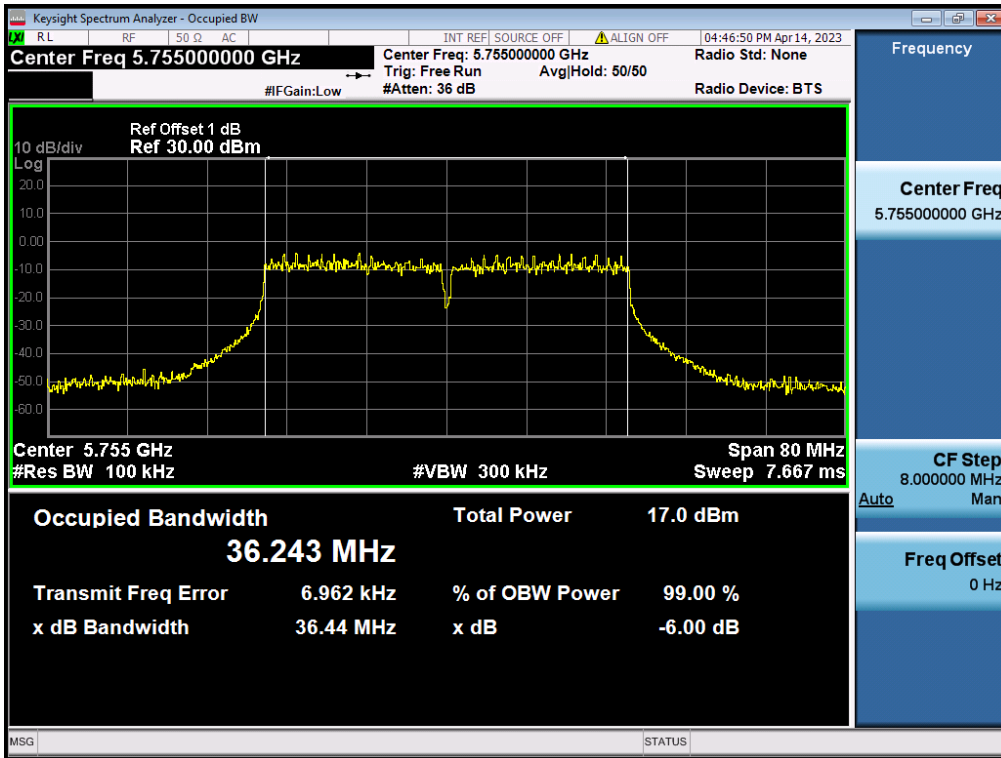
Report No.: SHE22110054-02DE

Date: 2023-04-17

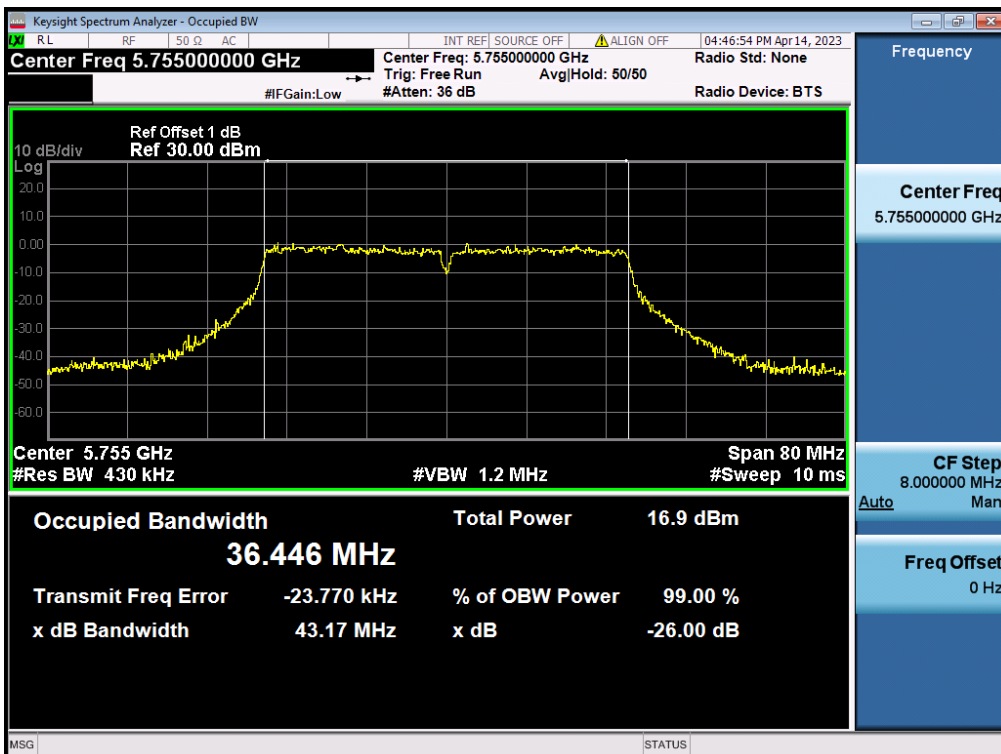
Page 32 of 54

Figure 12: The plots of 6dB Bandwidth, 802.11ac(VHT40), 5755MHz

Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



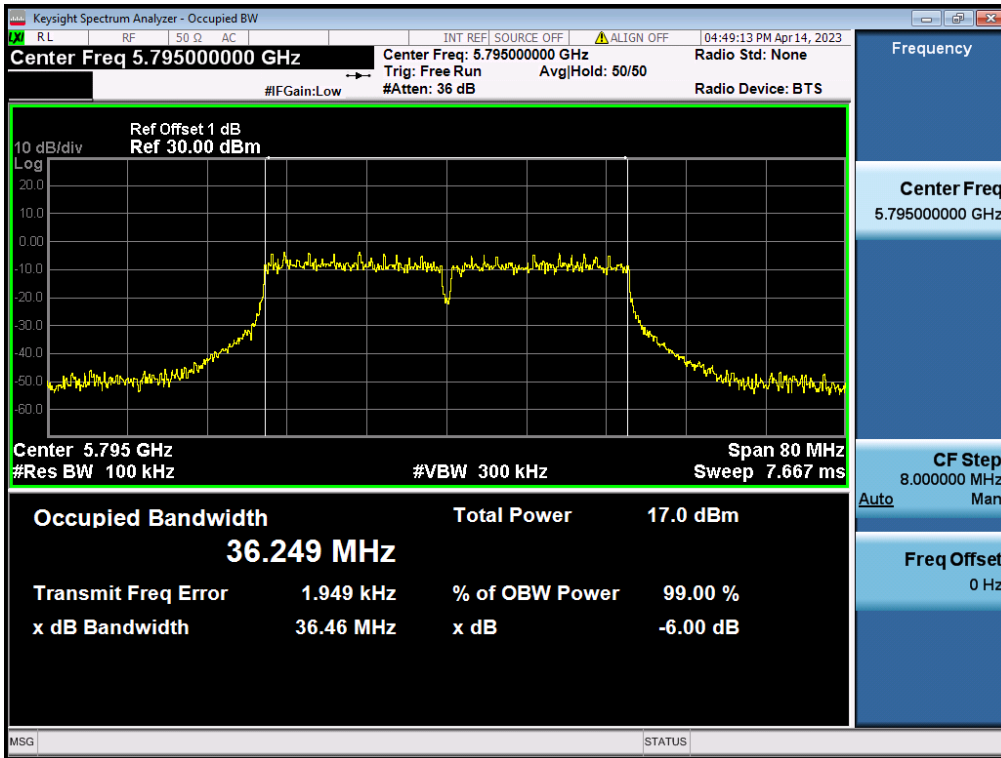
TEST REPORT

Report No.: SHE22110054-02DE

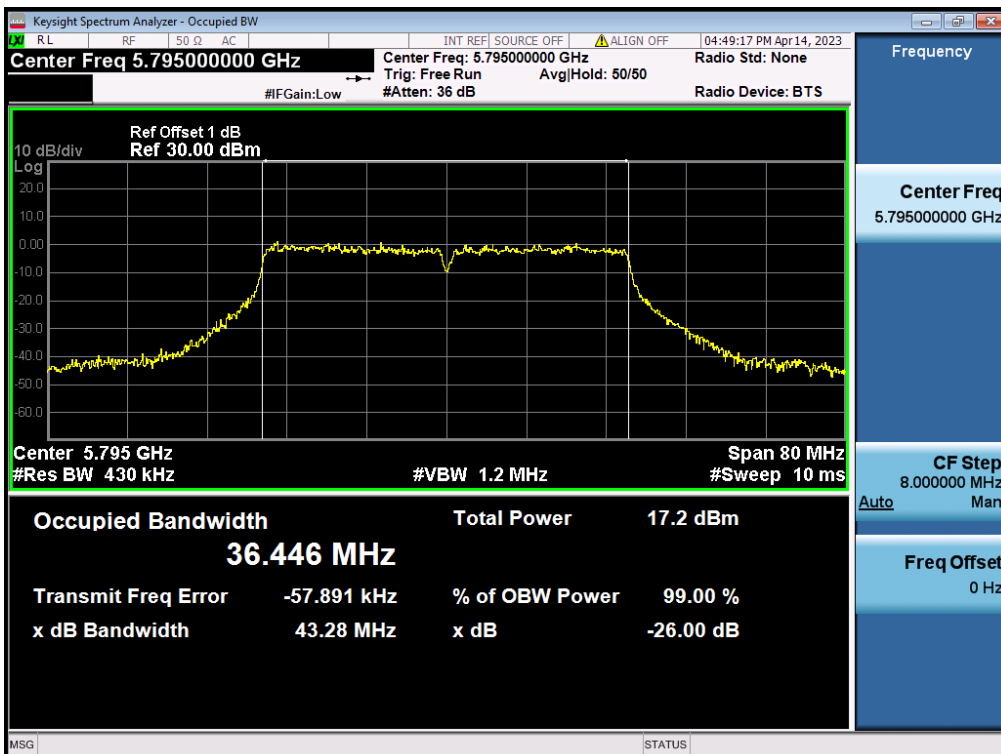
Date: 2023-04-17

Page 33 of 54

Figure 13: The plots of 6dB Bandwidth, 802.11ac(VHT40), 5795MHz
 Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



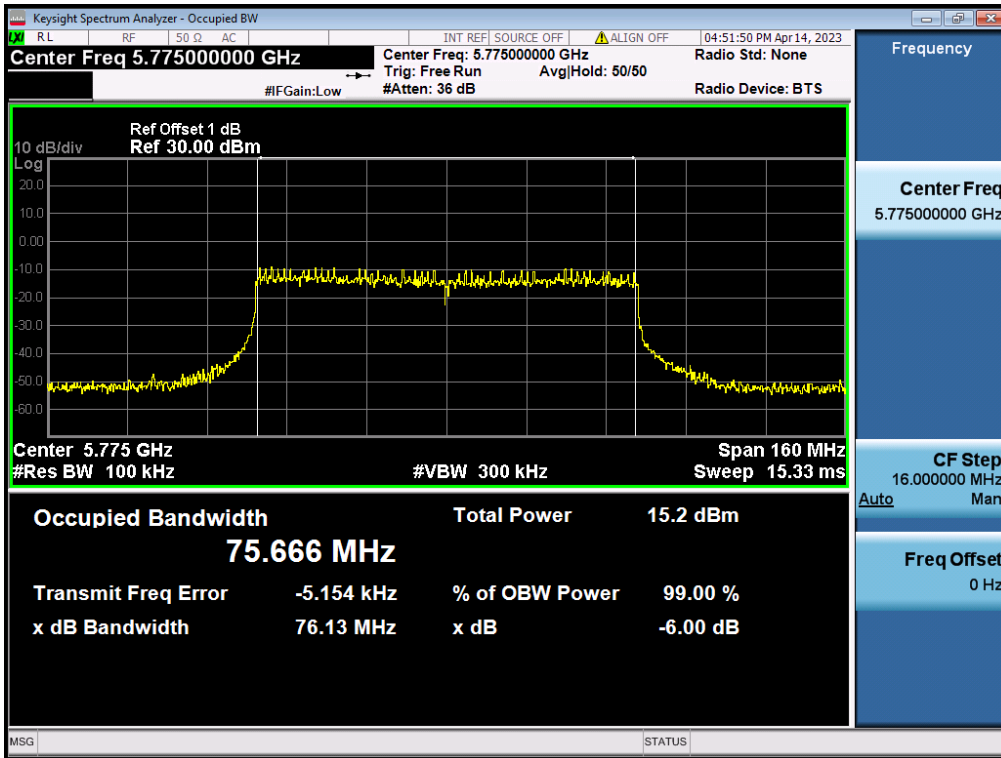
TEST REPORT

Report No.: SHE22110054-02DE

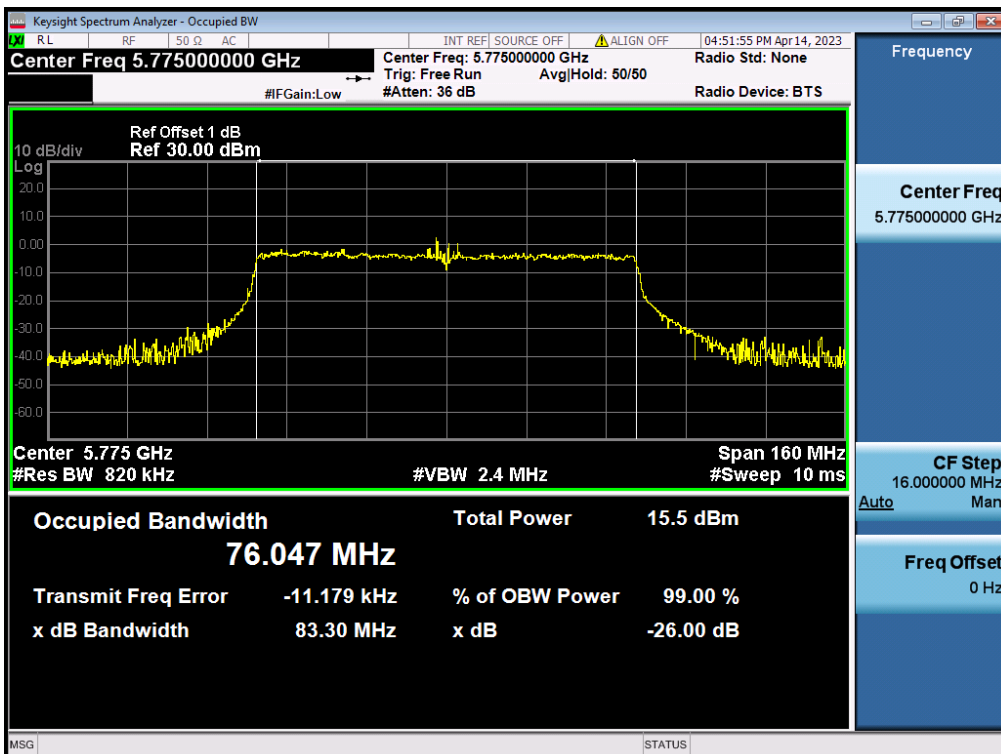
Date: 2023-04-17

Page 34 of 54

Figure 14: The plots of 6dB Bandwidth, 802.11ac(VHT80), 5775MHz
 Test Plot of -6dB Bandwidth



Test Plot of 99% Occupied Bandwidth



TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 35 of 54

4.1.5 Maximum Conducted Output Power Spectral Density

RESULT:

PASS

Test standard : FCC Part 15.407(a)
 Requirement : ANSI C63.10-2013 clause 12.5(SA-2), KDB 789033
 Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
 Operation Mode : A.1.a
 Ambient temperature : 24.0°C
 Relative humidity : 50%

Notes:

Test plots please refer to the annex document "SHE22110054-02DE DATA WIFI5GHz- Maximum Conducted Output Power Spectral Density EXHIBIT A"

Table 9: Maximum Conducted Output Power Spectral Density for Band I (5150MHz~5250MHz)

Test Mode	Duty Cycle	Test Channel (MHz)	Maximum PSD (dBm/MHz)	Applicable Limit (dBm/MHz)
802.11a	78.47	5180	3.290	17
		5220	3.947	
		5240	3.390	
802.11n(HT20)	71.75	5180	1.702	
		5220	3.741	
		5240	2.331	
802.11ac(VHT20)	73.09	5180	2.875	
		5220	3.313	
		5240	3.542	
802.11n(HT40)	73.09	5190	-1.716	
		5230	-0.302	
802.11ac(VHT40)	53.06	5190	0.039	
		5230	0.333	
802.11ac(VHT80)	63.23	5210	-4.500	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.
2. 17dBm/MHz for master device.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 36 of 54

Table 10: Maximum Conducted Output Power Spectral Density for Band II (5250MHz~5350MHz)

Test Mode	Duty Cycle	Test Channel (MHz)	Maximum PSD (dBm/MHz)	Applicable Limit (dBm/MHz)
802.11a	63.43	5260	8.939	11
		5300	9.470	
		5320	9.489	
802.11n(HT20)	73.32	5260	5.071	
		5300	6.065	
		5320	5.596	
802.11ac(VHT20)	74.07	5260	3.244	
		5300	4.030	
		5320	4.923	
802.11n(HT40)	59.88	5270	1.605	
		5310	2.038	
802.11ac(VHT40)	61.79	5270	0.751	
		5310	1.766	
802.11ac(VHT80)	58.40	5290	-4.528	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 37 of 54

Table 11: Maximum Conducted Output Power Spectral Density for Band III (5470MHz~5725MHz)

Test Mode	Duty Cycle	Test Channel (MHz)	Maximum PSD (dBm/MHz)	Applicable Limit (dBm/MHz)
802.11a	76.59	5500	8.122	11
		5580	7.985	
		5700	9.418	
802.11n(HT20)	80.99	5500	4.465	
		5580	4.188	
		5700	4.884	
802.11ac(VHT20)	78.42	5500	3.870	
		5580	2.411	
		5700	4.910	
802.11n(HT40)	48.33	5510	2.796	
		5590	1.981	
		5670	2.748	
802.11ac(VHT40)	58.58	5510	0.969	
		5590	0.613	
		5670	2.393	
802.11ac(VHT80)	62.83	5530	-4.903	
		5610	-4.444	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 38 of 54

Table 12: Maximum Conducted Output Power Spectral Density for Band IV (5725MHz~5850MHz)

Test Mode	Duty Cycle	Test Channel (MHz)	Maximum PSD (dBm/500kHz)	Applicable Limit (dBm/500kHz)
802.11a	74.34	5745	9.051	30
		5785	8.056	
		5825	8.622	
802.11n(HT20)	73.95	5745	5.519	
		5785	4.471	
		5825	5.463	
802.11ac(VHT20)	61.29	5745	5.209	
		5785	5.951	
		5825	5.699	
802.11n(HT40)	50.02	5755	3.187	
		5795	2.921	
802.11ac(VHT40)	60.52	5755	1.355	
		5795	1.575	
802.11ac(VHT80)	51.96	5775	-4.118	

Notes:

1. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 39 of 54

4.1.6 Conducted Spurious Emission

RESULT:

PASS

Test standard : FCC Part 15.407(b), 15.209,
Requirement : ANSI C63.10-2013 clause 12.7.4, KDB 789033
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 24.0°C
Relative humidity : 50%

Notes:

Test plots please refer to the annex document "SHE22110054-02DE DATA WLAN 5GHz-TX CSE EXHIBIT A".

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 40 of 54

4.1.7 Radiated Emission

RESULT:

PASS

Test standard : FCC Part 15.407(b), 15.209, 15.205
Requirement : ANSI C63.10-2013 clause 12.7.4, KDB 789033
Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 23°C
Relative humidity : 50%

Notes:

Test plots please refer to the annex document "SHE22110054-02DE DATA WIFI5GHz-TX EXHIBIT A"

1. For 9 kHz ~ 30 MHz, the amplitude of spurious emissions that are attenuated by more than 20dB below the permissible. The value has no need to be reported.
2. The spurious above 18GHz is noise only and 20dB below the limit. The value has no need to be reported.
3. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement -X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.
4. Factor = Antenna Factor + Cable loss - Amplifier gain, Over Limit= Results-Limit.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 41 of 54

4.1.8 Band Edge (Restricted-band band-edge)

RESULT:

PASS

Test standard : FCC Part 15.407(b)
Requirement : ANSI C63.10-2013 clause 12.7.4.4, KDB 789033
Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Low/High
Operation Mode : A.1.a
Ambient temperature : 25°C
Relative humidity : 53%

Notes:

Test plots please refer to the annex document "SHE22110054-02DE DATA WIFI5GHz-TX EXHIBIT A"

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.
2. Factor = Antenna Factor + Cable loss - Amplifier gain, Over Limit= Results-Limit.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 42 of 54

4.1.9 Frequency Stability

RESULT:

PASS

Test standard : FCC Part 15.407(g)

Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High

Operation Mode : A.1.a

Ambient temperature : 24.5°C

Relative humidity : 58%

Table 13: Frequency Stability

Band I (5150MHz – 5250MHz):

Voltage vs. Frequency Stability (5180MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Temp (°C)	Voltage (V)			
25	3.2V	5180.005435	1.05	±20
	3.3V	5180.006025	1.16	
	3.4V	5180.005240	1.01	

Temperature vs. Frequency Stability (5180MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Voltage (V)	Temp (°C)			
3.3V	-40	5180.007532	1.45	±20
	-30	5180.006238	1.20	
	-20	5180.005741	1.11	
	-10	5180.005648	1.09	
	0	5180.005270	1.02	
	10	5180.005365	1.04	
	20	5180.007340	1.42	
	30	5180.007851	1.52	
	40	5180.007438	1.44	
	50	5180.006921	1.34	
	60	5180.006820	1.32	
	70	5180.007245	1.40	
85	5180.006149	1.19		

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 43 of 54

Band II (5250MHz – 5350MHz):

Voltage vs. Frequency Stability (5260MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Temp (°C)	Voltage (V)			
25	3.2V	5259.998360	-0.31	±20
	3.3V	5259.997750	-0.43	
	3.4V	5259.997640	-0.45	

Temperature vs. Frequency Stability (5260MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Voltage (V)	Temp (°C)			
3.3V	-40	5259.995340	-0.89	±20
	-30	5259.998420	-0.30	
	-20	5259.997845	-0.41	
	-10	5259.996543	-0.66	
	0	5260.003210	0.61	
	10	5260.002316	0.44	
	20	5259.998350	-0.31	
	30	5259.997342	-0.51	
	40	5259.998620	-0.26	
	50	5259.998745	-0.24	
	60	5259.999320	-0.13	
	70	5260.004521	0.86	
85	5260.001362	0.26		

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 44 of 54

Band III (5470MHz – 5725MHz):

Voltage vs. Frequency Stability (5500MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Temp (°C)	Voltage (V)			
25	3.2V	5500.007623	1.39	±20
	3.3V	5500.009800	1.78	
	3.4V	5500.008541	1.55	

Temperature vs. Frequency Stability (5500MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Voltage (V)	Temp (°C)			
3.3V	-40	5500.009932	1.81	±20
	-30	5500.009374	1.70	
	-20	5500.009265	1.68	
	-10	5500.009983	1.82	
	0	5500.009593	1.74	
	10	5500.009796	1.78	
	20	5500.009398	1.71	
	30	5500.00853	1.55	
	40	5500.008742	1.59	
	50	5500.008621	1.57	
	60	5500.008675	1.58	
	70	5500.009963	1.81	
85	5500.009553	1.74		

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 45 of 54

Band IV (5725MHz – 5850MHz):

Voltage vs. Frequency Stability (5745MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Temp (°C)	Voltage (V)			
25	3.4V	5745.003867	0.67	±20
	3.8V	5745.004050	0.70	
	4.35V	5745.005230	0.91	

Temperature vs. Frequency Stability (5745MHz)

Test Conditions		Frequency (MHz)	Max. Deviation (ppm)	Limit (ppm)
Voltage (V)	Temp (°C)			
3.3V	-40	5745.001358	0.24	±20
	-30	5745.003650	0.64	
	-20	5745.004572	0.80	
	-10	5745.005271	0.92	
	0	5745.005632	0.98	
	10	5745.002845	0.50	
	20	5745.004976	0.87	
	30	5745.006280	1.09	
	40	5745.007542	1.31	
	50	5745.006384	1.11	
	60	5745.009745	1.70	
	70	5745.007341	1.28	
85	5745.006380	1.11		

Note:

The all configurations were tested respectively, but only the worst channel shown here.

TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 46 of 54

4.2 Mains Emissions

4.2.1 Conducted Emission on AC Mains

RESULT:

PASS

Test standard	: FCC Part 15.207
Requirement	: ANSI C63.10-2013 clause 6.2
Kind of test site	: Shielded room

Test setup

Input Voltage	: Which received AC 120V, 60Hz Power
Operation Mode	: A.1.a
Earthing	: Not Connected
Ambient temperature	: 23.2°C
Relative humidity	: 52%

For details refer to following test plot.

TEST REPORT

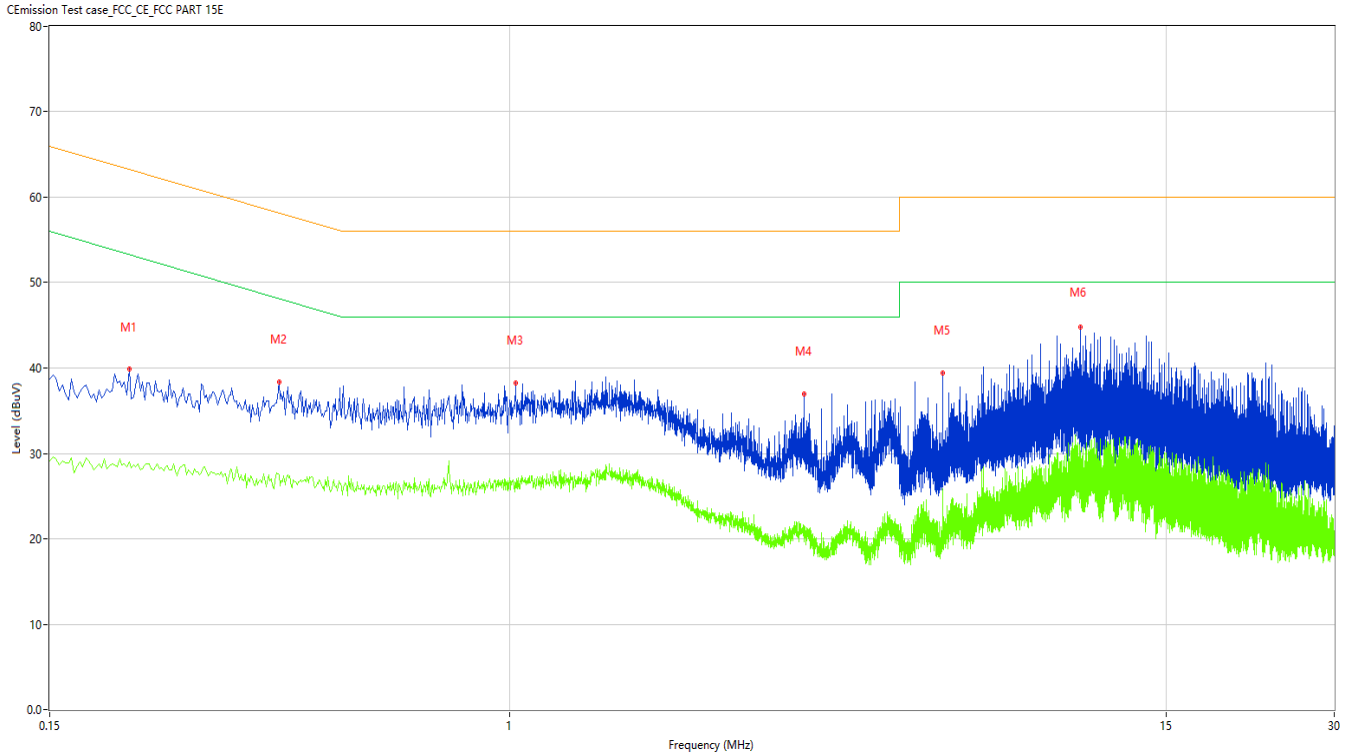
Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 47 of 54

Note: The all configurations were tested respectively, but only the worst configuration shown here.

Figure 15: Conducted Emission on AC Mains, L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.208	39.85	10.19	63.28	23.43	Peak	L	Pass
1**	0.208	28.95	10.19	53.28	24.33	AV	L	Pass
2	0.386	38.39	10.22	58.15	19.76	Peak	L	Pass
2**	0.386	27.54	10.22	48.15	20.61	AV	L	Pass
3	1.024	38.24	10.13	56.00	17.76	Peak	L	Pass
3**	1.024	26.33	10.13	46.00	19.67	AV	L	Pass
4	3.368	36.94	10.25	56.00	19.06	Peak	L	Pass
4**	3.368	21.50	10.25	46.00	24.50	AV	L	Pass
5	5.960	39.47	10.38	60.00	20.53	Peak	L	Pass
5**	5.960	25.82	10.38	50.00	24.18	AV	L	Pass
6	10.524	44.76	10.52	60.00	15.24	Peak	L	Pass
6**	10.524	29.77	10.52	50.00	20.23	AV	L	Pass

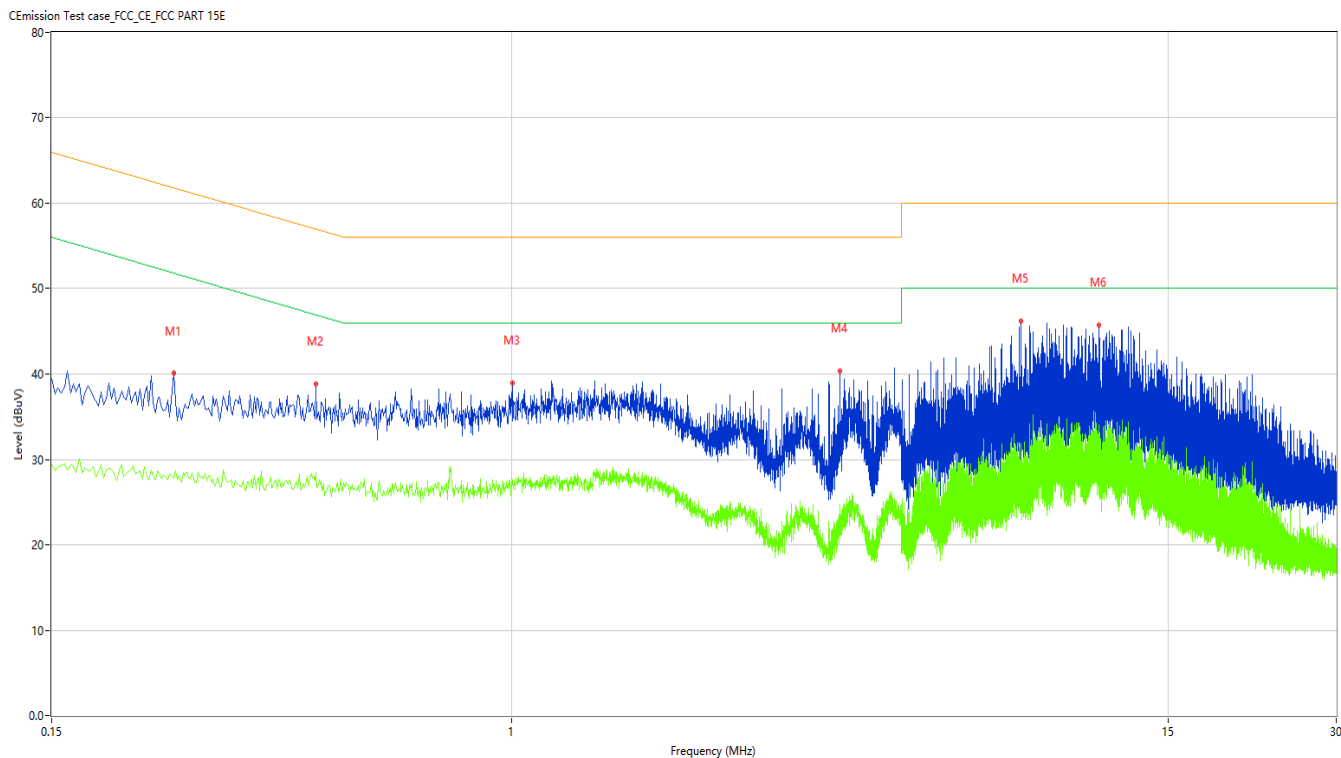
TEST REPORT

Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 48 of 54

Figure 16: Conducted Emission on AC Mains, N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.248	40.07	10.26	61.82	21.75	Peak	N	Pass
1**	0.248	27.81	10.26	51.82	24.01	AV	N	Pass
2	0.446	38.85	10.29	56.95	18.10	Peak	N	Pass
2**	0.446	28.39	10.29	46.95	18.56	AV	N	Pass
3	1.004	39.00	10.23	56.00	17.00	Peak	N	Pass
3**	1.004	27.50	10.23	46.00	18.50	AV	N	Pass
4	3.870	40.34	10.22	56.00	15.66	Peak	N	Pass
4**	3.870	24.72	10.22	46.00	21.28	AV	N	Pass
5	8.158	46.19	10.37	60.00	13.81	Peak	N	Pass
5**	8.158	31.83	10.37	50.00	18.17	AV	N	Pass
6	11.284	45.77	10.42	60.00	14.23	Peak	N	Pass
6**	11.284	34.04	10.42	50.00	15.96	AV	N	Pass

TEST REPORT

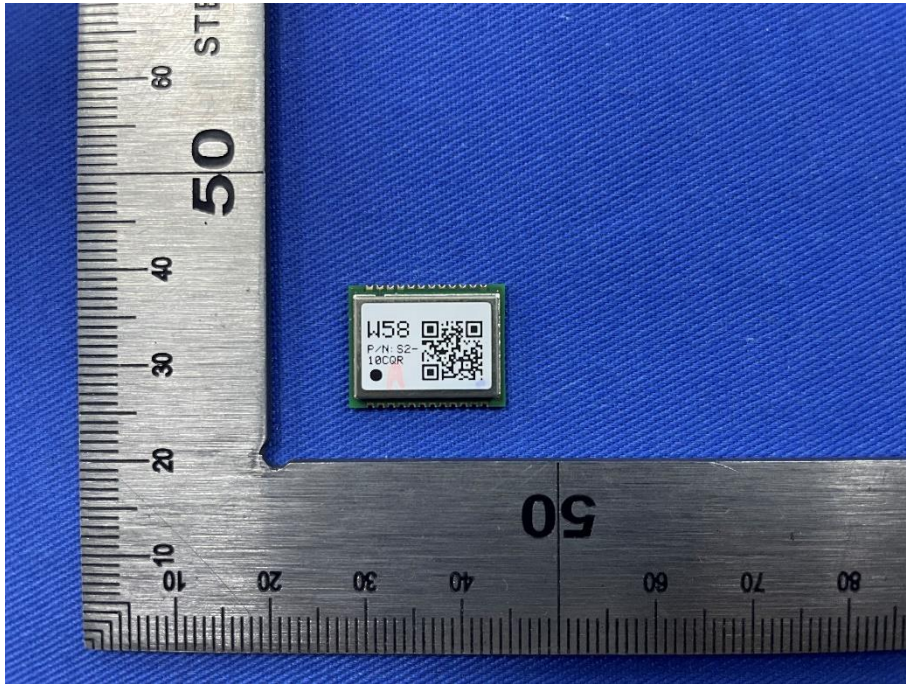
Report No.: SHE22110054-02DE

Date: 2023-04-17

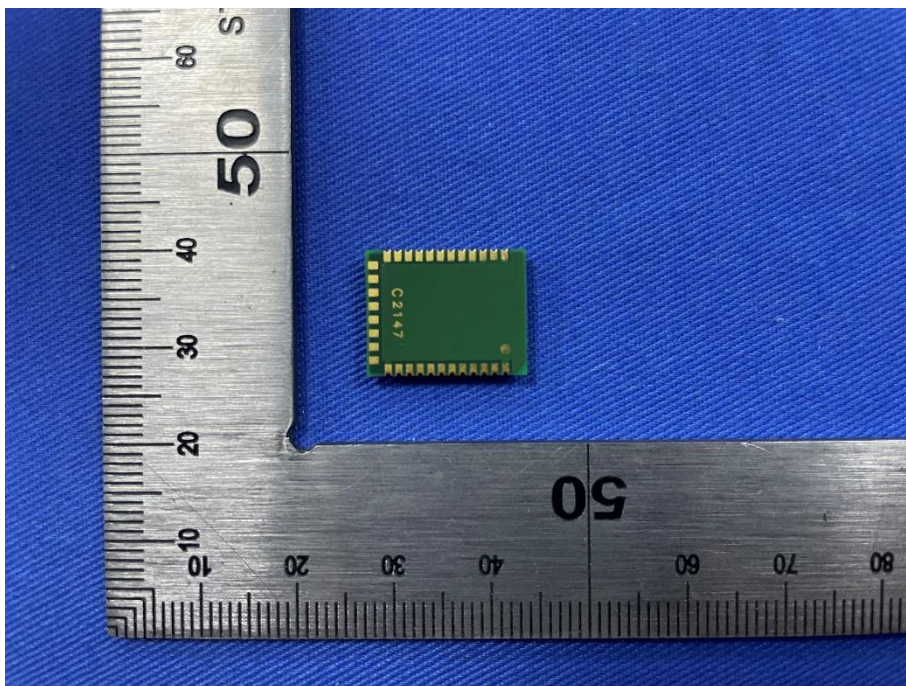
Page 49 of 54

5 Appendixes

5.1 Photographs of the Sample



Front of the sample



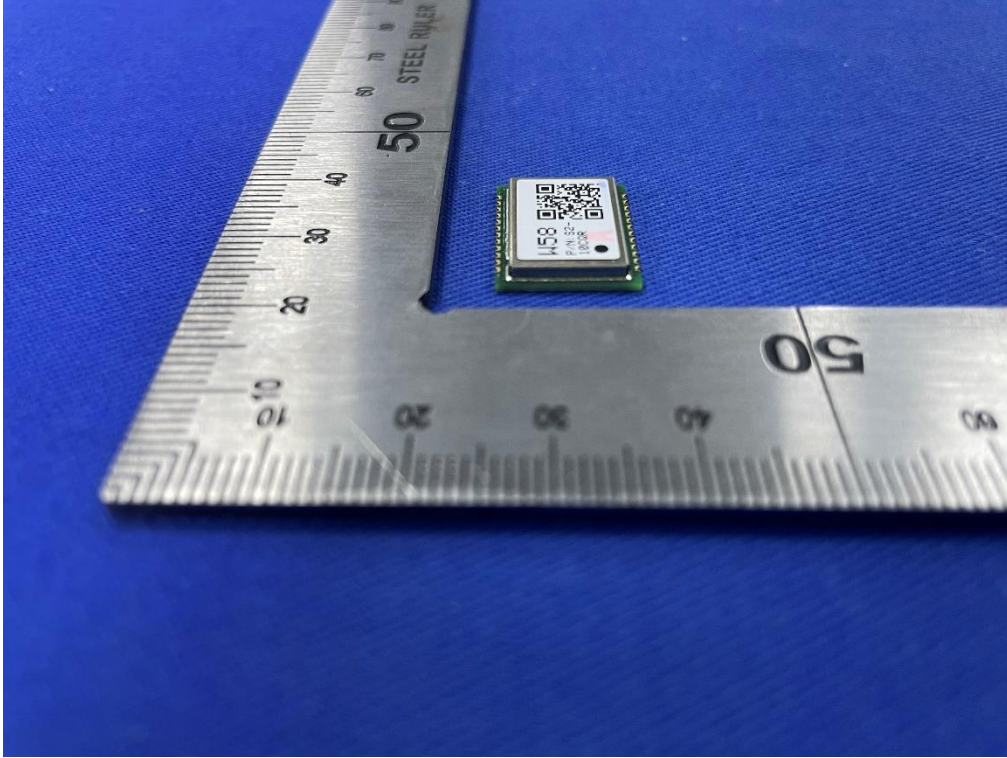
Rear of the sample

TEST REPORT

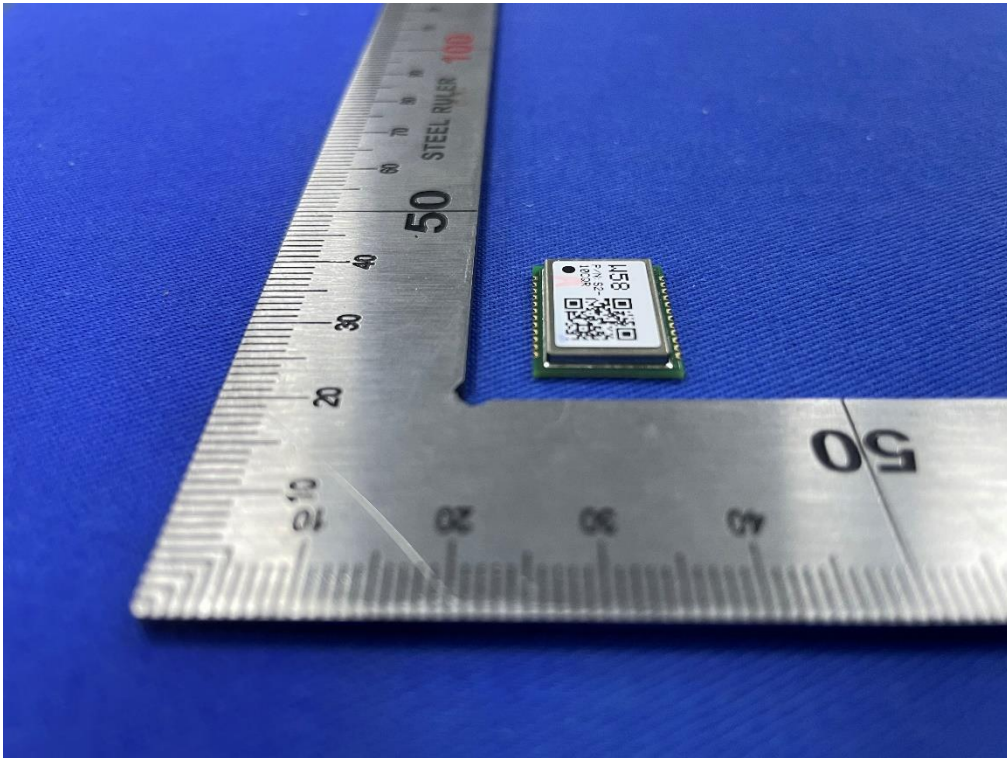
Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 50 of 54



Left of the sample



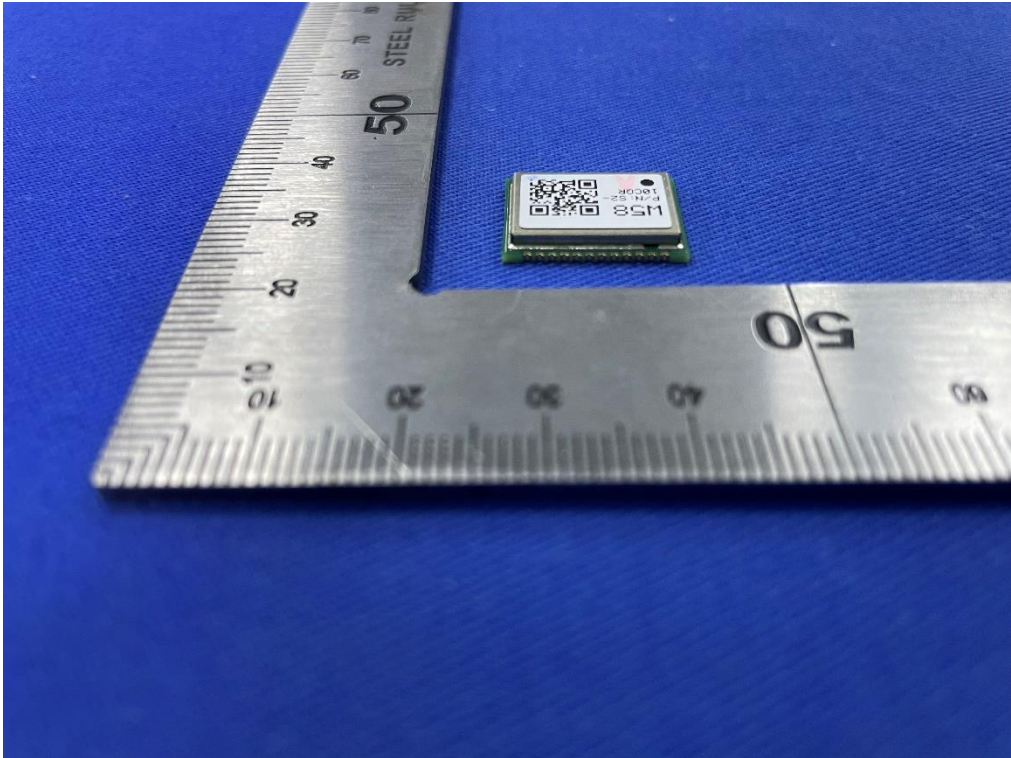
Right of the sample

TEST REPORT

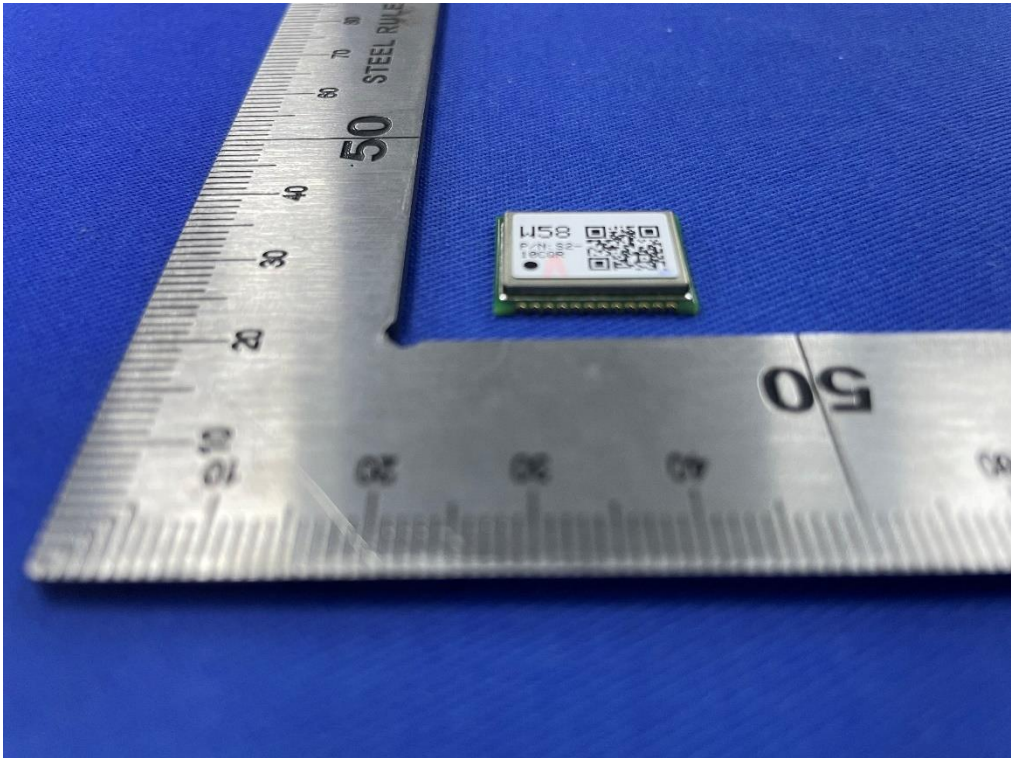
Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 51 of 54



Top of the sample



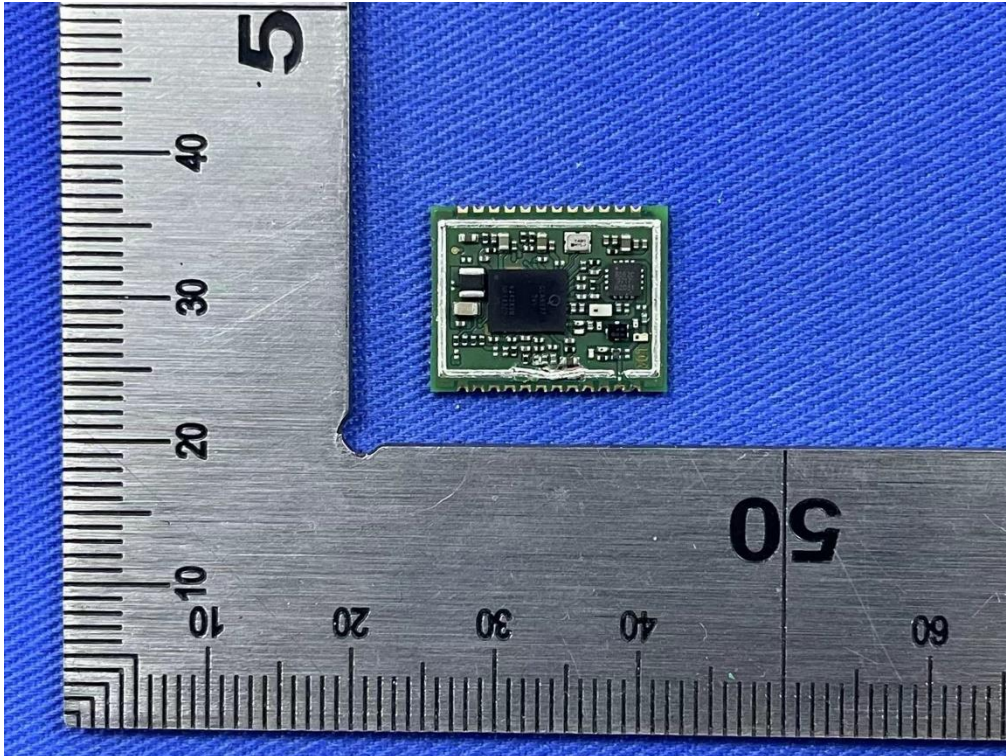
Bottom of the sample

TEST REPORT

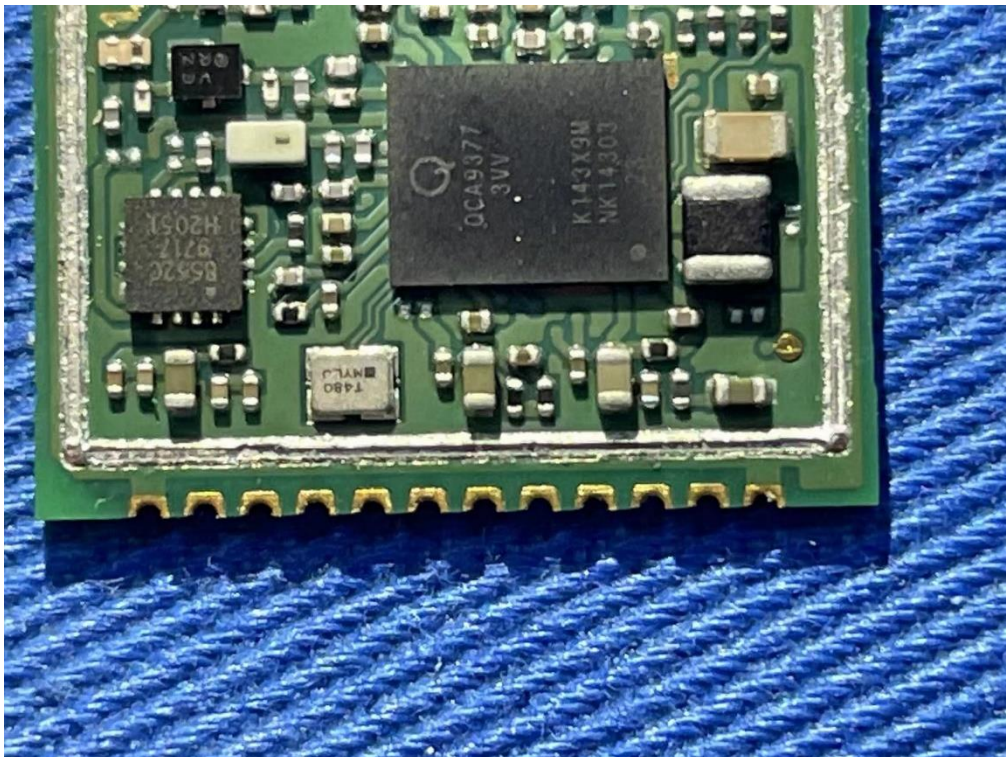
Report No.: SHE22110054-02DE

Date: 2023-04-17

Page 52 of 54



Internal-1 of the sample



Internal-2 of the sample

TEST REPORT

Report No.: SHE22110054-02DE

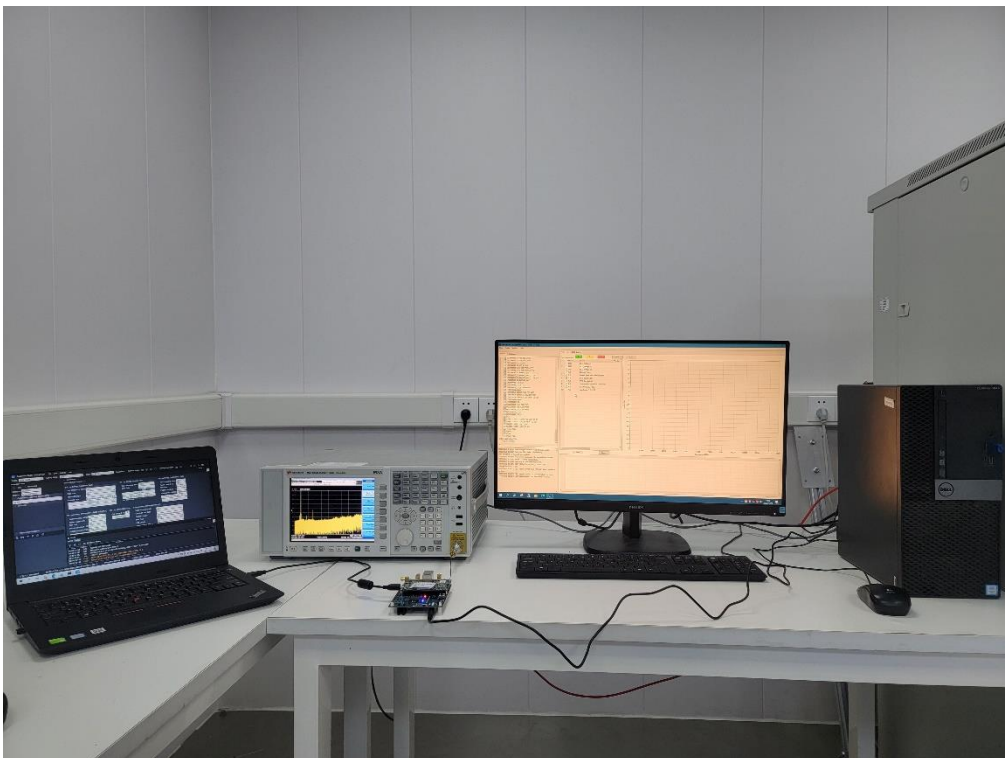
Date: 2023-04-17

Page 53 of 54

5.2 Set-up for Conducted Emissions



5.3 Set-up for Conducted RF test at Antenna Port



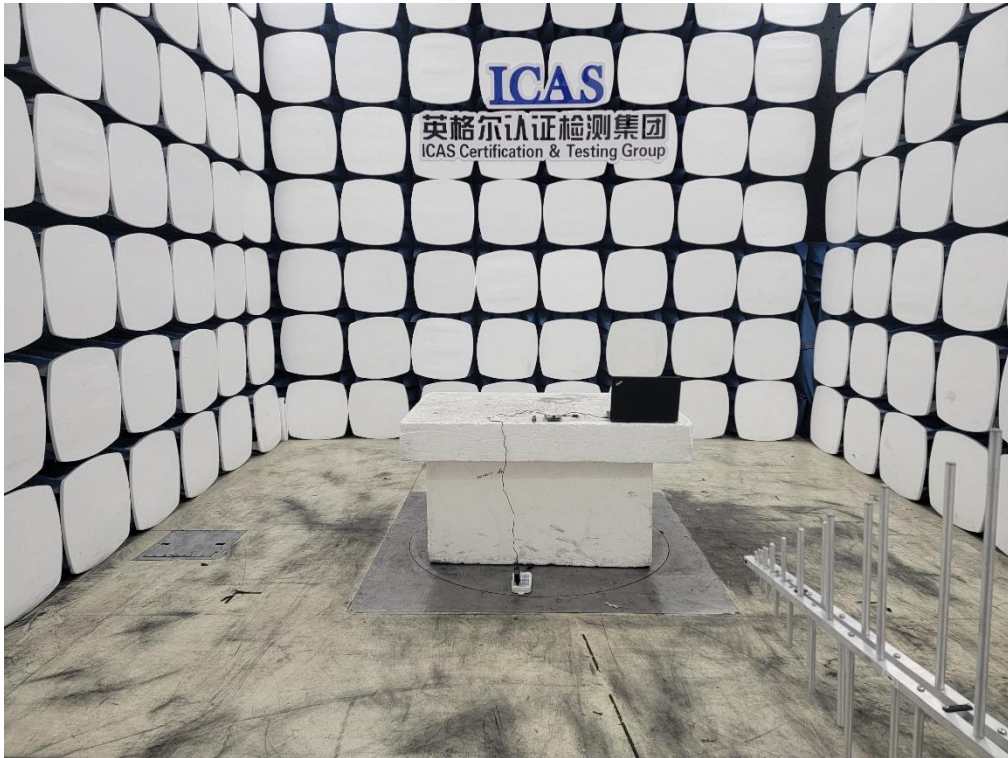
TEST REPORT

Report No.: SHE22110054-02DE

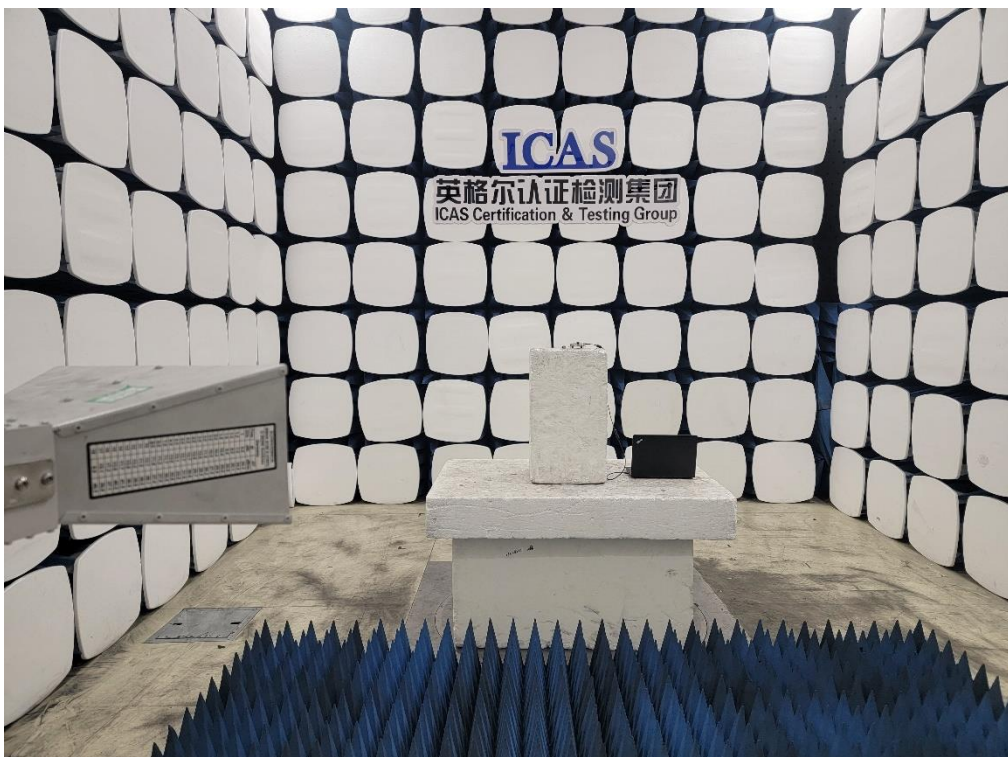
Date: 2023-04-17

Page 54 of 54

5.4 Set-up for Spurious Emissions below 1GHz



5.5 Set-up for Spurious Emissions above 1GHz



End of the report