

Prüfbericht-Nr.: Test report no.:	CN21YWPZ (LP0002-WiFi5G) 001	Auftrags-Nr.: Order no.:	238516263	Seite 1 von 40 Page 1 of 40
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2021-06-10	
Auftraggeber: Client:	青島智動精工電子有限公司 青島經濟技術開發區前灣港路 218 巷 1 棟廠房全幢 2 層			
Prüfgegenstand: Test item:	Wifi module			
Bezeichnung / Typ-Nr.: Identification / Type no.:	ZDGF7668AU-C			
Auftrags-Inhalt: Order content:	NCC LP0002 Test Report (WiFi 5GHz)			
Prüfgrundlage: Test specification:	NCC Low-power Radio-frequency Devices Technology Regulations LP0002 (2020) Section 5.7			
Wareneingangsdatum: Date of sample receipt:	2021-06-15			
Prüfmuster-Nr.: Test sample no:	A003073250-006 A003073250-005			
Prüfzeitraum: Testing period:	2021-06-22 - 2021-07-02			
Ort der Prüfung: Place of testing:	EMC/RF Taipei Testing Site			
Prüflaboratorium: Testing laboratory:	Taipei Testing Laboratories			
Prüfergebnis*: Test result*:	Pass			
überprüft von: compiled by:	genehmigt von: authorized by:			
Datum: Date: 2021-07-07				
Stellung / Position:	Jack Wang Senior Project Engineer	Ausstellungsdatum: Issue date: 2021-07-07	Brenda Chen Senior Project Manager	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
5 = mangelhaft N/T = nicht getestet				
5 = poor N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				

TEST SUMMARY

Report Section	NCC Clause	Test Item	Result
5.1.1	LP0002 5.7.8 & 5.7.3.1(2)(C) & 5.7.3.1(4)(C) & 5.7.3.2(3) & 5.7.3.3(3)	Antenna Requirement	Pass
5.1.2	LP0002 5.7.3.1(4)(A) & 5.7.3.2(1) & 5.7.3.3(1)	Maximum Conducted Output Power	Pass
5.1.3	LP0002 5.7.2.3	26 dB Bandwidth	Pass
5.1.4	LP0002 5.7.5	6 dB Bandwidth (U-NII-3 Band only)	Pass
5.1.5	LP0002 5.7.3.1(4)(B) & 5.7.3.2(2) & 5.7.3.3(2)	Power Spectral Density	Pass
5.1.6	LP0002 5.7.4	Radiated Spurious Emissions and Band Edges	Pass
5.1.7	LP0002 5.7.7.2	Dynamic Frequency Selection	Pass
5.2.1	LP0002 3.3	Mains Conducted Emission	Pass
6.1	LP0002 6.20.2	RF Exposure Compliance	Pass

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

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HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN21YWPZ (LP0002- WiFi5G) 001	Original Release	2021-07-07

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A - Test Result of Conducted

Appendix B - Test Result of Radiated Emissions & Mains Conducted Emission

Appendix SP - Photographs of Test Setup

Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
NCC Low-power Radio-frequency Devices Technical Regulations LP0002 (2020) (109 年 7 月 1 日)
ANSI C63.10:2013
KDB 789033 D02 General UNII Test Procedures New Rules v02r01
KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
KDB 662911 D01 Multiple Transmitter Output v02r01

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 226631
ISED Registration No.: 25563

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.30 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.30 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.54 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.52 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Wifi module. It contains a WLAN compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	Wifi module
Type Identification	ZDGF7668AU-C
Brand Name	Qingdao Intelligent&Precise Electronics Co., Ltd

Technical Specification of EUT

Item	EUT information
Operating Frequency	Band 1: 5180 MHz ~ 5240 MHz Band 2: 5260 MHz ~ 5320 MHz Band 3: 5500 MHz ~ 5700 MHz Band 4: 5745 MHz ~ 5825 MHz
Channel Number	Band 1: 4 for 802.11a, 802.11n HT20 / 802.11ac VHT20 2 for 802.11n HT40 / 802.11ac VHT40 1 for 802.11ac VHT80 Band 2: 4 for 802.11a, 802.11n HT20 / 802.11ac VHT20 2 for 802.11n HT40 / 802.11ac VHT40 1 for 802.11ac VHT80 Band 3: 11 for 802.11a, 802.11n HT20 / 802.11ac VHT20 5 for 802.11n HT40 / 802.11ac VHT40 2 for 802.11ac VHT80 Band 4: 5 for 802.11a, 802.11n HT20 / 802.11ac VHT20 2 for 802.11n HT40 / 802.11ac VHT40 1 for 802.11ac VHT80
Data Rate	802.11a: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to MCS7 802.11ac: up to MCS9
Operation Voltage	5 Vdc
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Maximum Output Power (mW)	5180 ~ 5240 MHz: 51.62 5260 ~ 5320 MHz: 54.52 5500 ~ 5720 MHz: 55.05 5745 ~ 5825 MHz: 58.45

Item	EUT information
Maximum EIRP (mW)	5260 ~ 5320 MHz: 122.62 5500 ~ 5720 MHz: 123.81
DFS Mode	Slave without radar detection
Antenna Information	Refer to 5.1.1
Accessory Device	Refer to 4.4

Note: There're two antennas (Ant 0 and Ant 1) used for WiFi function. 802.11a supports SISO mode only, and 802.11n/ac supports MIMO mode.

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output expected by the customer and is going to be fixed on the firmware of the final end product.

Table for Parameters of Test Software Setting

802.11a		802.11n HT20 / 802.11ac VHT20		802.11n HT40 / 802.11ac VHT40		802.11ac VHT80	
Channel	Power Setting	Channel	Power Setting	Channel	Power Setting	Channel	Power Setting
36	19/ 17	36	1D	38	1C	42	1D
40	19/ 17	40	1D	46	1F	58	1E
48	19 / 18	48	1D	54	1F	106	18
52	1E / 1C	52	1F	62	1E	122	1E
60	1E / 1E	60	1F	102	19	155	1E
64	1E / 1C	64	1F	110	1F		
100	1F / 1D	100	1F	134	1F		
116	1F / 1D	116	1F	151	22		
140	1D / 1B	140	18	159	22		
149	22 / 22	149	22				
157	22 / 21	157	22				
165	22 / 22	165	22				

4.2 Carrier Frequency and Channel

Band	Channel	Frequency (MHz)	802.11a 802.11n HT20 802.11ac VHT20	802.11n HT40 802.11ac VHT40	802.11ac VHT80
U-NII-1 (Band 1)	36	5180	V		
	38	5190		V	
	40	5200	V		
	42	5210			V
	44	5220	V		
	46	5230		V	
	48	5240	V		
U-NII-2A (Band 2)	52	5260	V		
	54	5270		V	
	56	5280	V		
	58	5290			V
	60	5300	V		
	62	5310		V	
	64	5320	V		
U-NII-2C (Band 3)	100	5500	V		
	102	5510		V	
	104	5520	V		
	106	5530			V
	108	5540	V		
	110	5550		V	
	112	5560	V		
	116	5580	V		
	118	5590		V	
	120	5600	V		
	122	5610			V
	124	5620	V		
	126	5630		V	
	128	5640	V		
	132	5660	V		
	134	5670		V	
	136	5680	V		
	140	5700	V		
U-NII-3 (Band 4)	149	5745	V		
	151	5755		V	
	153	5765	V		
	155	5775			V
	157	5785	V		
	159	5795		V	
	161	5805	V		
	165	5825	V		

4.3 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed as below.

Test Software	QATool_Dbg
---------------	------------

The samples were used as follows:

A003073250-006

A003073250-005

Full test was applied on all test modes, but only worst case was shown.

The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and receivers.

Modulation Mode	Tx Function
802.11a	1TX (SISO)
802.11n HT20	2TX (MIMO)
802.11n HT40	2TX (MIMO)
802.11ac VHT20	2TX (MIMO)
802.11ac VHT40	2TX (MIMO)
802.11ac VHT80	2TX (MIMO)

* The modulation and bandwidth are similar for 802.11n mode HT20/HT40 and 802.11ac mode VHT20/VHT40, therefore investigated worse case as representative mode in test report.

EUT Configure Mode	Applicable To				Description
	Antenna Port Conducted Measurement	Radiated Spurious Emissions above 1 GHz	Radiated Spurious Emissions below 1 GHz	Mains Conducted Emission	
-	√	√	√	√	-

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on **Z-plane**.
2. "-" means no effect.

Antenna Port Conducted Measurement

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
-	802.11a	5180-5240	36 to 48	36, 40, 48	6.0
-		5260-5320	52 to 64	52, 60, 64	
-		5500-5700	100 to 140	100, 116, 140	
-		5745-5825	149 to 165	149, 157, 165	
-	802.11n HT20	5180-5240	36 to 48	36, 40, 48	6.5
-		5260-5320	52 to 64	52, 60, 64	
-		5500-5700	100 to 140	100, 116, 140	
-		5745-5825	149 to 165	149, 157, 165	
-	802.11n HT40	5180-5240	38 to 46	38, 46	MCS0
-		5260-5320	54 to 62	54, 62	
-		5500-5700	102 to 134	102, 110, 134	
-		5745-5825	151 to 159	151, 159	
-	802.11ac VHT80	5180-5240	42	42	MCS0
-		5260-5320	58	58	
-		5500-5700	106 to 122	106, 122	
-		5745-5825	155	155	

Radiated Spurious Emissions (Above 1 GHz)

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
Tx					
-	802.11a	5180-5240	36 to 48	36, 40, 48	6.0
-		5260-5320	52 to 64	52, 60, 64	
-		5500-5700	100 to 140	100, 116, 140	
-		5745-5825	149 to 165	149, 157, 165	
-	802.11n HT20	5180-5240	36 to 48	36, 40, 48	6.5
-		5260-5320	52 to 64	52, 60, 64	
-		5500-5700	100 to 140	100, 116, 140	
-		5745-5825	149 to 165	149, 157, 165	
-	802.11n HT40	5180-5240	38 to 46	38, 46	MCS0
-		5260-5320	54 to 62	54, 62	
-		5500-5700	102 to 134	102, 110, 134	
-		5745-5825	151 to 159	151, 159	
-	802.11ac VHT80	5180-5240	42	42	MCS0
-		5260-5320	58	58	
-		5500-5700	106 to 122	106, 122	
-		5745-5825	155	155	
Rx					
	802.11n HT40	5180-5240	36 to 48	46	MCS0
	802.11a	5260-5320	52 to 64	52	6.0
	802.11n HT40	5500-5700	102 to 134	134	MCS0
	802.11n HT20	5745-5825	149 to 165	157	6.5

Radiated Spurious Emissions (Below 1 GHz)

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
Tx / Rx					
-	802.11n HT40	5180-5240	38 to 46	46	MCS0
-	802.11a	5260-5320	52 to 64	52	6.0
-	802.11n HT40	5500-5700	102 to 134	134	MCS0
-	802.11n HT20	5745-5825	149 to 165	157	6.5

Mains Conducted Emission Test

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
-	802.11a	5260-5320	52 to 64	52	6.0

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	24-24.6 °C	50.4-66.9 %	Andy Chen
Radiated Spurious Emissions above 1 GHz	22.3-24.3 °C	57-62 %	Eagle Tsai
Radiated Spurious Emissions below 1 GHz	22.3-24.3 °C	57-62 %	Eagle Tsai
Mains Conducted Emission	19.5 °C	61 %	Simon Tsai

4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

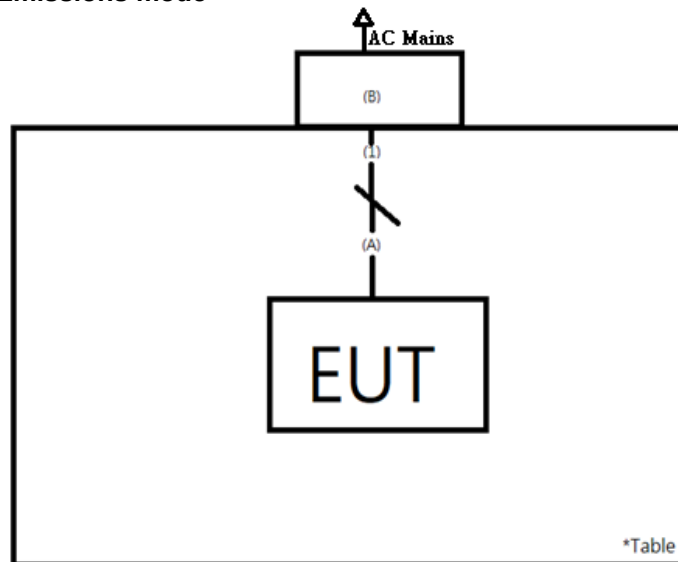
None

Support Unit

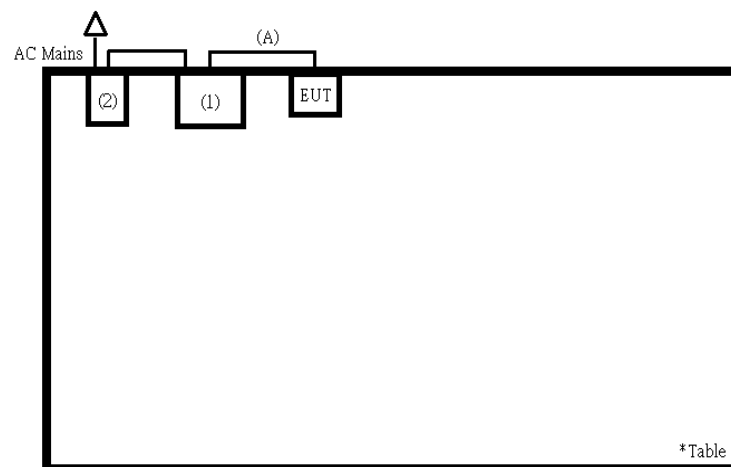
Support Unit								
No	Description	Brand	Model	S/N	Shielded	Ferrite Core (Qty)	Length (cm)	Remark
A	USB Cable (fixture)	UGREEM	TUV-QD	N/A	NO	0	110	Radiated
B	Notebook	Lenovo	TP00007A	N/A	-	-	-	
1	USB Cable	Pro-best	MK-USBMF-3M	N/A	YES	NO	300	
A	USB Cable (fixture)	UGREEM	TUV-QD	N/A	NO	0	110	Mains Conducted
1	Notebook	HP	15s-du0007TX	CND93662VF	-	-	-	
2	Adapter	HP	TPN-CA16	N/A	NO	NO	180	

4.5 Test Setup Diagram

<Radiated Spurious Emissions mode>

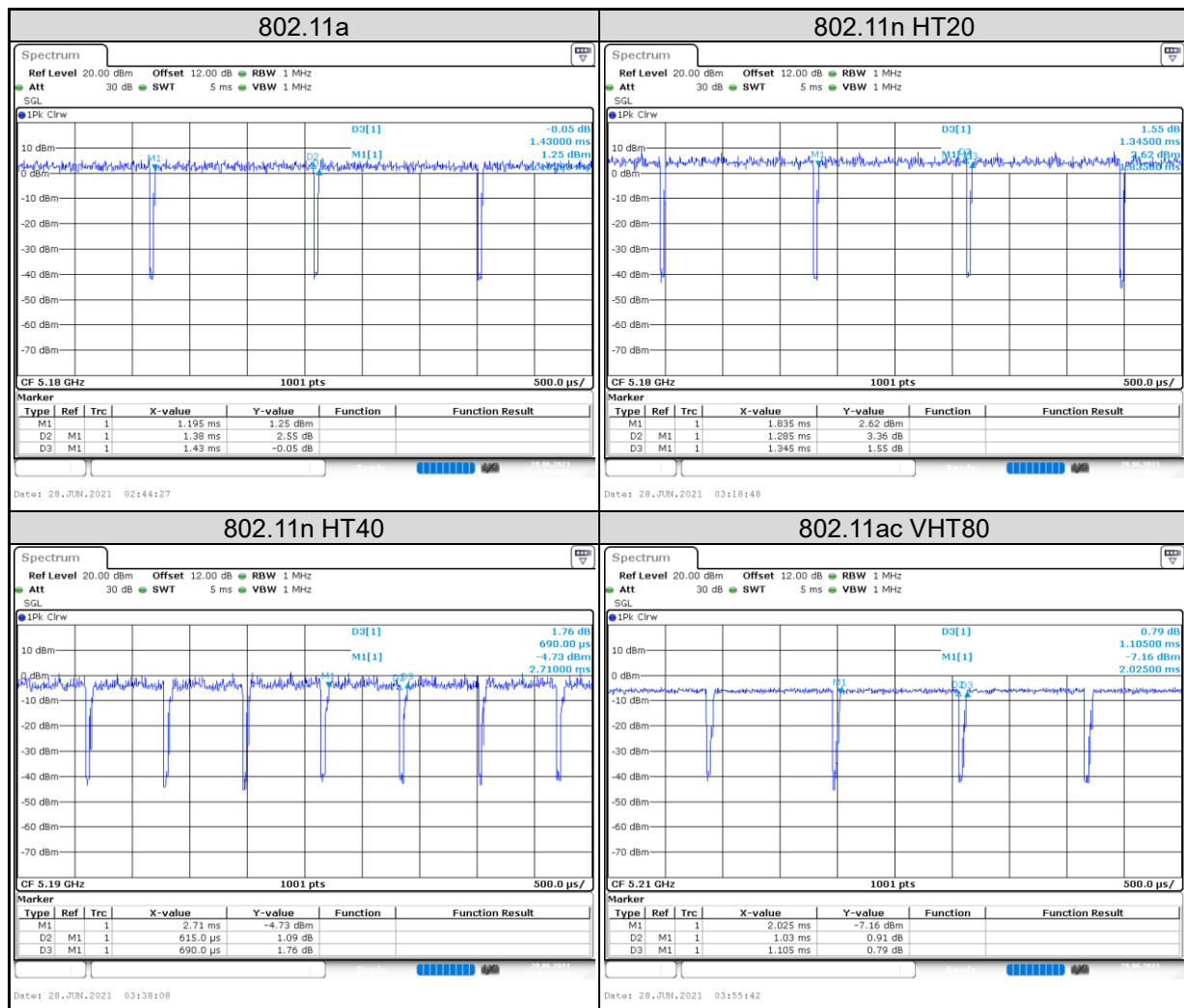


<Mains Conducted Emission mode>



4.6 Duty Cycle of Test Signal

Mode	On + Off Time (ms)	On Time (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11a	1.43	1.38	96.50	0.15
802.11n HT20	1.345	1.285	95.54	0.20
802.11n HT40	0.690	0.615	89.13	0.50
802.11ac VHT80	1.105	1.03	93.21	0.31



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only

According to the manufacturer declaration, the antenna information is as listed below. The antenna is with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

ANT	Brand Name	Model No.	Antenna Type	Antenna Gain (dBi)
0	中天訊	7668-C-WIFI-2	PIFA Antenna	3.52
1	中天訊	7668-C-WIFI-1	PIFA Antenna	3.44

Note: The directional gain is 6.49 dBi.

Refer to EUT photo for details.

5.1.2 Maximum Conducted Output Power

Limit

Operation Band	EUT Category	Limit
U-NII-1	Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p $\leq$ 125 mW (21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
	Fixed point-to-point Access Point	1 Watt (30 dBm)
	Indoor Access Point	1 Watt (30 dBm)
	Mobile and Portable client device	250 mW (24 dBm)
U-NII-2A	---	250 mW (24 dBm) or 11 dBm + 10 log B*
U-NII-2C	---	250 mW (24 dBm) or 11 dBm + 10 log B*
U-NII-3	---	1 Watt (30 dBm)

Note: B* is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

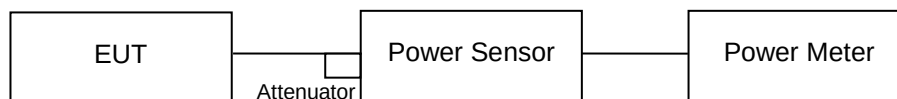
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20 MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2021/3/24	2022/3/23	2021/6/22	2021/6/30
Power Sensor	Anritsu	MA2411B	1725269	2021/3/24	2022/3/23	2021/6/22	2021/6/30

Test Procedures

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst and set the detector to AVERAGE. Duty factor is not added to measured value.

Test Result
<802.11a>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)		Max. Power		Limit (dBm)
		Ant 0	Ant 1	(dBm)	(mW)	
36	5180	11.73	11.60	11.73	14.89	24.00
40	5200	11.79	11.44	11.79	15.10	24.00
48	5240	11.96	11.75	11.96	15.70	24.00
52	5260	13.89	13.87	13.89	24.49	24.00
60	5300	14.37	14.15	14.37	27.35	24.00
64	5320	14.44	14.07	14.44	27.80	24.00
100	5500	14.49	14.11	14.49	28.12	24.00
116	5580	14.57	14.23	14.57	28.64	24.00
140	5700	13.19	12.76	13.19	20.84	24.00
149	5745	15.77	15.39	15.77	37.76	30.00
157	5785	15.80	15.51	15.80	38.02	30.00
165	5825	15.63	15.14	15.63	36.56	30.00

Note:
For U-NII-2A, U-NII-2C Band:

1. $11 \text{ dBm} + 10\log(20.02) = 24.01 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(20.02) = 24.01 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(19.98) = 24.01 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(21.10) = 24.24 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(21.14) = 24.25 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(21.66) = 24.36 \text{ dBm} > 24 \text{ dBm}$.

<802.11n HT20>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)		Total Power		Limit (dBm)
		Ant 0	Ant 1	(dBm)	(mW)	
36	5180	12.91	14.11	16.56	45.31	24.00
40	5200	13.27	14.06	16.69	46.70	24.00
48	5240	13.39	13.50	16.46	44.21	24.00
52	5260	13.91	13.95	16.94	49.44	24.00
60	5300	14.12	13.98	17.06	50.83	24.00
64	5320	13.98	14.70	17.37	54.52	24.00
100	5500	14.07	14.47	17.28	53.52	24.00
116	5580	14.06	14.71	17.41	55.05	24.00
140	5700	10.65	11.22	13.95	24.86	24.00
149	5745	14.39	14.91	17.67	58.45	30.00
157	5785	14.31	14.77	17.56	56.97	30.00
165	5825	14.47	13.86	17.19	52.31	30.00

Note:
For U-NII-2A, U-NII-2C Band:
Ant 0

1. $11 \text{ dBm} + 10\log(20.98) = 24.22 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(20.34) = 24.08 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(20.34) = 24.08 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(20.46) = 24.11 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(20.50) = 24.12 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(20.30) = 24.07 \text{ dBm} > 24 \text{ dBm}$.

Ant 1

1. $11 \text{ dBm} + 10\log(21.90) = 24.40 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(22.90) = 24.60 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(22.74) = 24.57 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(21.18) = 24.26 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(22.62) = 24.54 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(20.46) = 24.11 \text{ dBm} > 24 \text{ dBm}$.

<802.11n HT40>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)		Total Power		Limit (dBm)
		Ant 0	Ant 1	(dBm)	(mW)	
38	5190	12.46	13.05	15.78	37.80	24.00
46	5230	14.28	13.95	17.13	51.62	24.00
54	5270	13.78	14.01	16.91	49.05	24.00
62	5310	13.32	13.41	16.38	43.41	24.00
102	5510	11.25	11.43	14.35	27.23	24.00
110	5550	13.43	12.94	16.20	41.71	24.00
134	5670	13.65	13.41	16.54	45.10	24.00
151	5755	14.41	14.53	17.48	55.98	30.00
159	5795	14.13	14.65	17.41	55.06	30.00

Note:

For U-NII-2A, U-NII-2C Band:

Ant 0

1. $11 \text{ dBm} + 10\log(68.17) = 29.34 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(41.08) = 27.14 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(53.15) = 28.25 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(67.93) = 29.32 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(55.62) = 28.45 \text{ dBm} > 24 \text{ dBm}$.

Ant 1

1. $11 \text{ dBm} + 10\log(64.66) = 29.11 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(60.18) = 28.79 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(41.08) = 27.14 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(46.91) = 27.71 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(48.51) = 27.86 \text{ dBm} > 24 \text{ dBm}$.

<802.11ac VHT80>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)		Total Power		Limit (dBm)
		Ant 0	Ant 1	(dBm)	(mW)	
42	5210	12.53	13.16	15.87	38.61	24.00
58	5290	12.54	12.86	15.71	37.27	24.00
106	5530	10.76	10.40	13.59	22.88	24.00
122	5610	13.18	12.68	15.95	39.33	24.00
155	5775	12.68	13.01	15.86	38.53	30.00

Note:

For U-NII-2A, U-NII-2C Band:

Ant 0

1. $11 \text{ dBm} + 10\log(81.36) = 30.10 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(81.68) = 30.12 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(80.88) = 30.08 \text{ dBm} > 24 \text{ dBm}$.

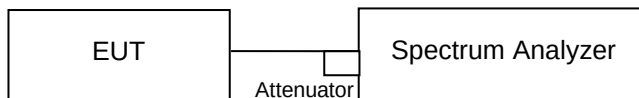
Ant 1

1. $11 \text{ dBm} + 10\log(81.36) = 30.10 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(81.20) = 30.10 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(81.04) = 30.09 \text{ dBm} > 24 \text{ dBm}$.

5.1.3 26 dB Bandwidth

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/6/22	2021/7/2

Test Procedure

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

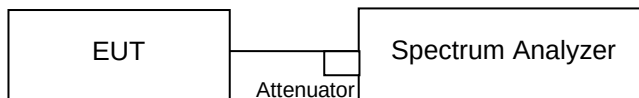
Test Results

Please refer to Appendix A

5.1.4 6 dB Bandwidth (5725-5850MHz)

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/6/22	2021/7/2

Test Procedure

MEASUREMENT PROCEDURE REF

- Set resolution bandwidth (RBW) = 100 kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Results

Please refer to Appendix A

5.1.5 Power Spectral Density

Limit

For the 5.15~5.25GHz Bands:

For mobile and portable client devices in the 5.15~5.25GHz band, the Maximum Power spectral density shall not exceed 11dBm/MHz. For an indoor access point operating in the band 5.15~5.25GHz, the maximum power spectral density shall not exceed 17dBm/MHz.

For the 5.25~5.35GHz and 5.47~5.725GHz Bands:

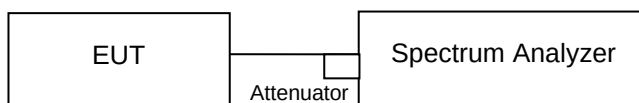
The maximum power spectral density shall not exceed 11dBm/MHz.

For the 5.745~5.85GHz Bands:

The maximum power spectral density shall not exceed 30dBm/500kHz.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/6/22	2021/7/2

Test Procedure

For U-NII-1, U-NII-2A, U-NII-2C band:

Using method SA-2

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW $\geq$ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to "free run".
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value and add 10 log (1/duty cycle)

※For U-NII-3:

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 500 kHz, Set VBW $\geq$ 3 RBW, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 500 kHz band segment within the fundamental EBW.
4. Sweep time = auto, trigger set to "free run".
5. Trace average at least 100 traces in power averaging mode.
6. Record the max value and add $10 \log (1/\text{duty cycle})$

For MIMO mode, calculation method follows FCC KDB 662911 Method 2) a) of power density measurement using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

Test Results

Please refer to Appendix A

5.1.6 Radiated Spurious Emissions

Limit

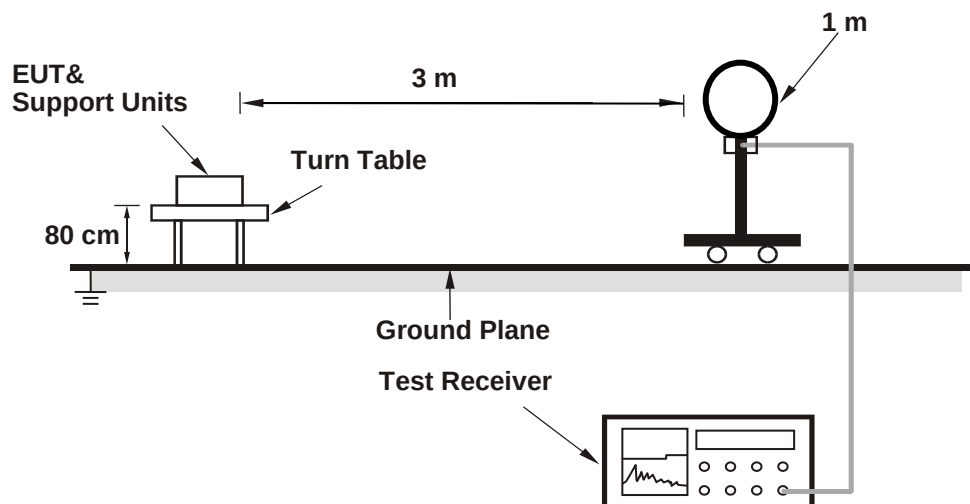
Radiated emissions which fall in the restricted bands, as defined in LP0002 (2020): 3.5, must comply with the radiated emission limits specified in LP0002 (2020): 3.6.

Emissions radiated outside the specified frequency bands must comply with the radiated emission limits specified in LP0002 (2020): 3.6.

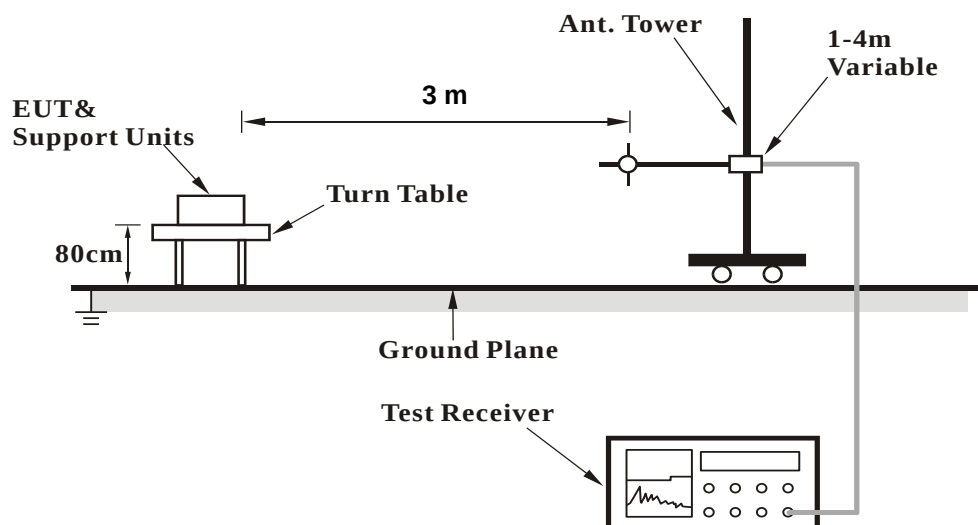
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

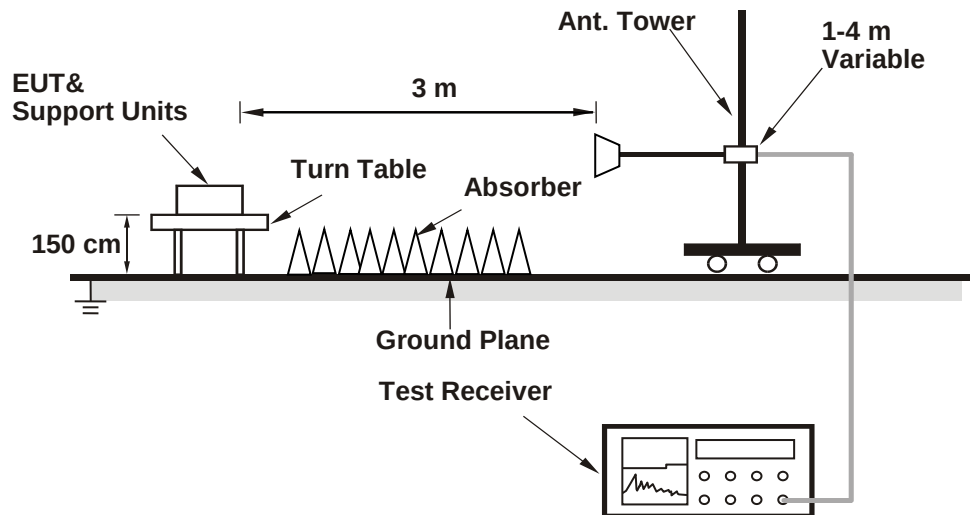
<Radiated Emissions below 30 MHz>



<Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101509	2021/3/24	2022/3/23
Receiver	R&S	ESR7	102108	2021/3/17	2022/3/16
Bilog Antenna	SCHWARZBECK	VULB-9168	00950	2021/1/25	2022/1/24
Horn Antenna	ETS-Lindgren	3117	00218929	2020/11/6	2021/11/5
LF-AMP	Agilent	8447D	2727A05146	2021/2/1	2022/1/31
HF-AMP + AC source	EMCI	EMC051845SE	980635	2021/2/1	2022/1/31
HF-AMP + AC source	EMCI	EMC184045SE	980656	2021/2/9	2022/2/8
Horn Antenna	SCHWARZBECK	BBHA 9170	00890	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800057/4EA	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	802244/4	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37203/4	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800897/2EA	2021/3/11	2022/3/10
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800902/2EA	2021/3/11	2022/3/10
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801026/2EA	2021/3/11	2022/3/10
Loop Antenna	Chance Most	EMCILPA600 +calibration	287	2021/1/18	2022/1/17

Test Procedures**For Radiated Emissions below 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel (OPEN), perpendicular (CLOSE), and ground-parallel (GROUND) orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated Emissions above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

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Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix B.

5.1.7 Dynamic Frequency Selection

Limit

<DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection>

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
<p>Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.</p> <p>Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.</p> <p>Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	

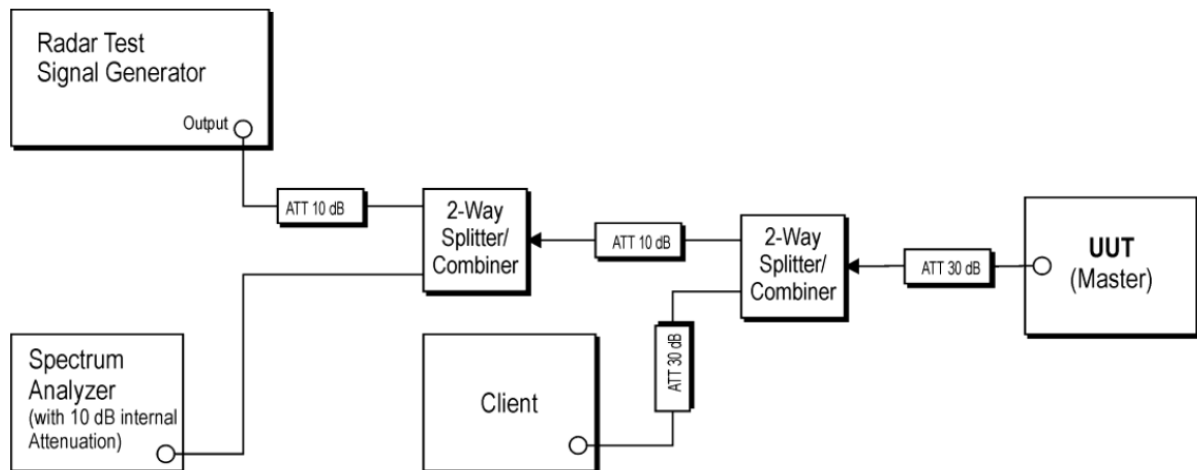
<DFS Response Requirement Values>

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
<p>Note 1: <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p>Note 2: The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel</i> move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.</p> <p>Note 3: During the <i>U-NII Detection Bandwidth</i> detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.</p>	

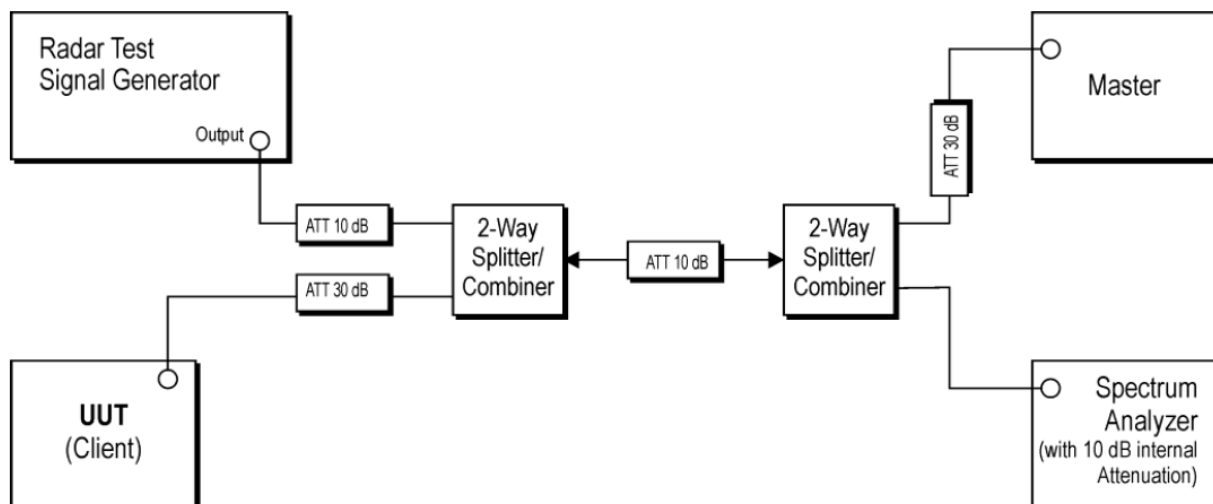
Kind of Test Site Shielded room

Test Setup

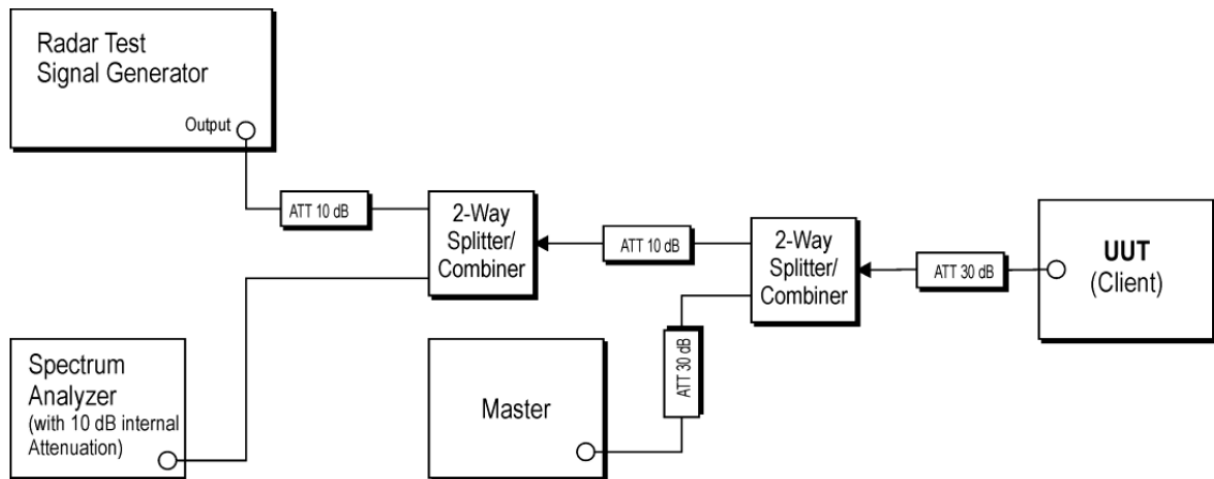
<Setup for Master with injection at the Master>



<Setup for Client with injection at the Master>



<Setup for Client with injection at the Client>



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	Agilent	N9010A	MY53470241	2021/6/15	2022/6/14	2021/6/22	2021/7/2
MXG Vector Signal Generator	Agilent	N5182B	MY53050524	2021/3/25	2022/3/24	2021/6/22	2021/7/2

Requirement

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>DFS Detection Threshold</i>	Yes	Not required
<i>Channel Closing Transmission Time</i>	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>U-NII Detection Bandwidth and Statistical Performance Check</i>	All BW modes must be tested	Not required
<i>Channel Move Time and Channel Closing Transmission Time</i>	Test using widest BW mode available	Test using the widest BW mode available for the link
<i>All other tests</i>	Any single BW mode	Not required

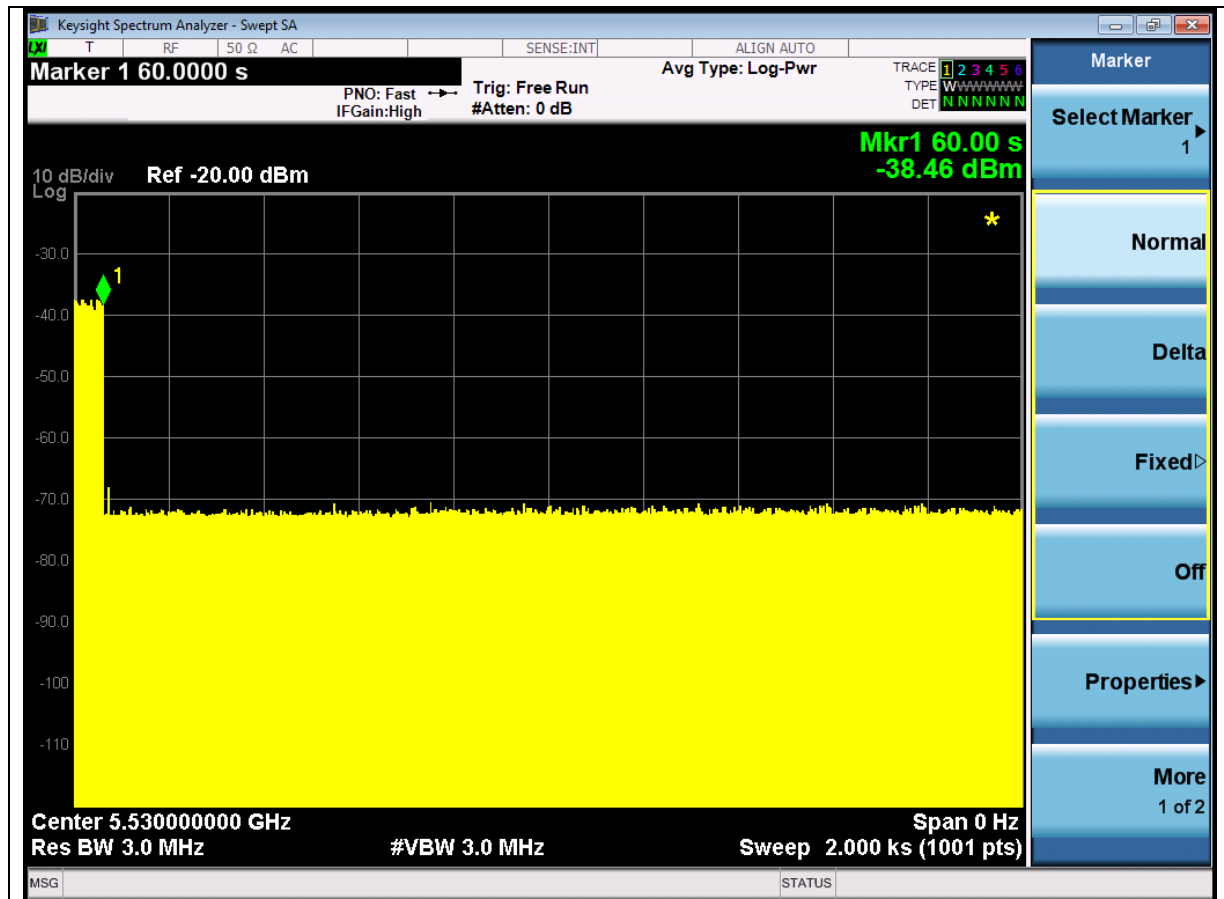
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

Test Results

<802.11ac VHT80>

Non-occupancy period

Channel (MHz)	Limit (minute)	Result
5530	30	Pass

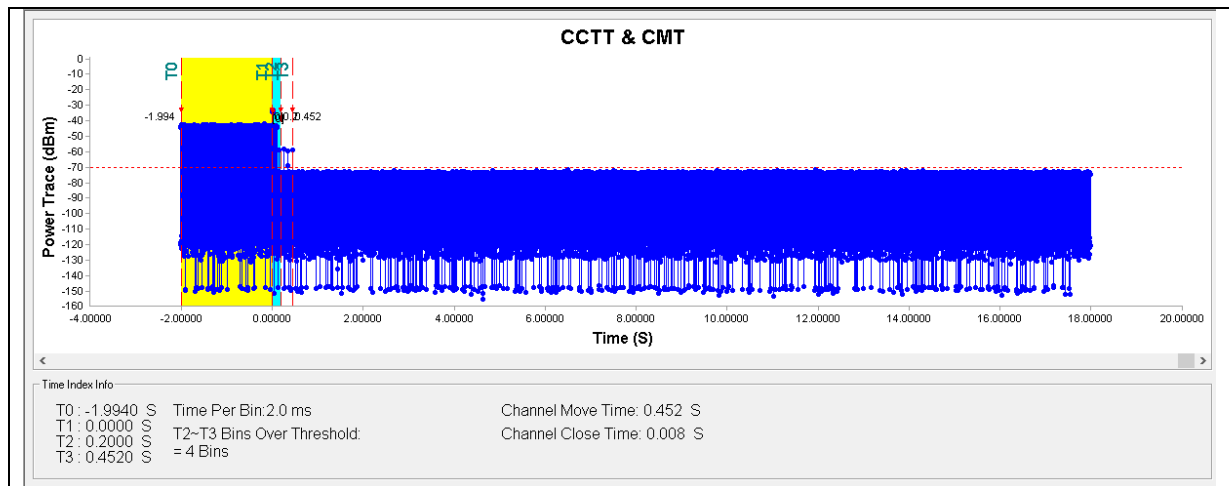


Channel Moving Time

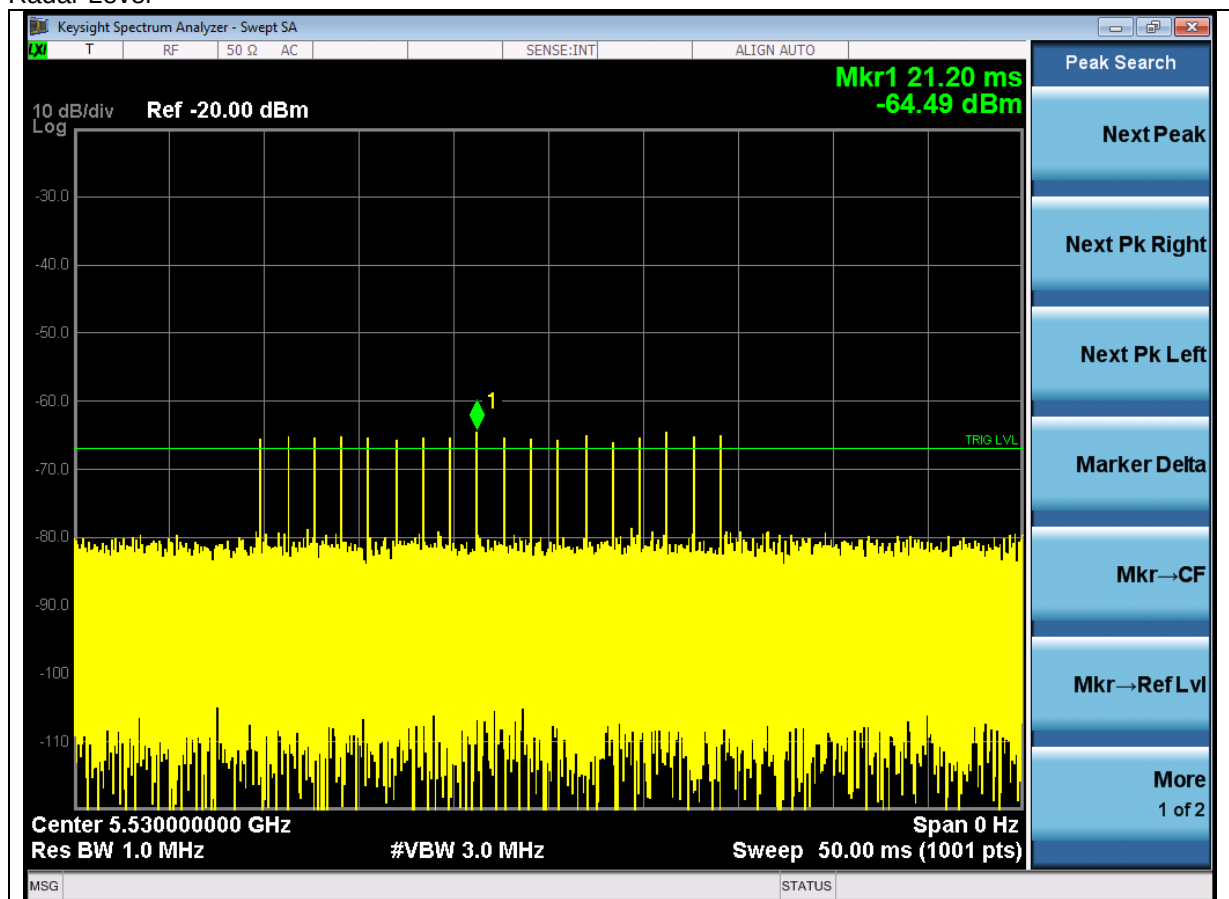
Channel (MHz)	Channel Move Time (s)	Limit (s)	Result
5530	0.452	10	Pass

Channel Closing Transmission Time

Channel (MHz)	Channel Closing Transmission Time (ms)	Limit (ms)	Result
5530	8	200	Pass



Radar Level



5.2 Mains Emission

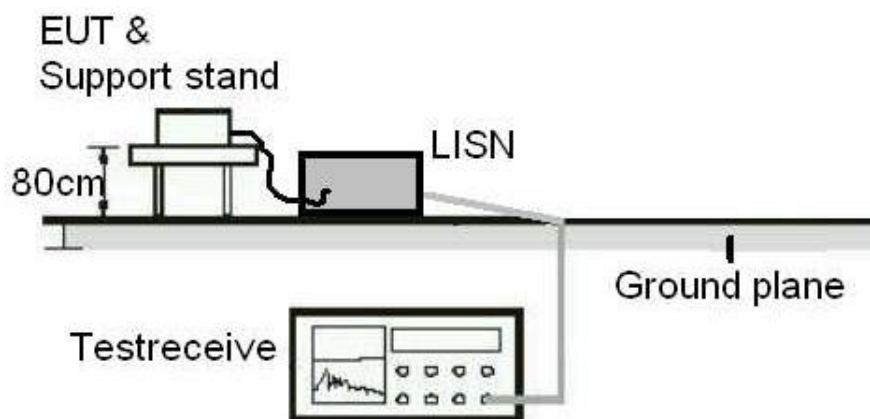
5.2.1 Mains Conducted Emission

Limit

Mains Conducted emission as defined in LP0002 standard must comply with the mains conducted emission limits.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
TWO-LINE V-NETWORK	R&S	ENV216	1816064	2020/9/10	2021/9/9
EMI Test Receiver	R&S	ESCI	1816063	2020/11/17	2021/11/16
RF Cable	N/A	N/A	EMC-003	2020/11/15	2021/11/14

Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

Test Results

Please refer to Appendix B.

6. Safety Human Exposure

6.1 RF Exposure Compliance

6.1.1 Power Density

Results

Separation distance is more than 20 cm, thus mobile device exposure limits can be applied.

Maximum Exposure:

Power to Antenna (dBm)	17.67 dBm
Antenna Gain	3.52 dBi
Power+Ant Gain	131.5 mW
Distance	20 cm
S=	0.026 mW/cm ²

Limit: 1 mW/cm²

Limit

0.3-1.34 MHz	(100) mW/cm ²
1.34-30 MHz	(180/f ²) mW/cm ²
30-300 MHz	0.2 mW/cm ²
300-1500 MHz	f/1500 mW/cm ²
1500-100,000 MHz	1.0 mW/cm ²