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TEST REPORT

Report No. ..... :	**CHTEW21050090**	Report Verification:
Project No.....:	**SHT2104006201EW**	
FCC ID ..... :	**TV7CPGI52XL**	
Applicant's name ..... :	**Mikrotikls SIA**	
Address.....:	Brivibas gatve 214i, Riga, LV-1039, Latvia	
Test item description ..... :	**cAP XL ac**	
Trade Mark .....:	MikroTik	
Model/Type reference.....:	RBcAPGi-5acD2nD-XL-US	
Listed Model(s) .....:	-	
Standard ..... :	**FCC CFR Title 47 Part 15 Subpart E Section 15.407**	
Date of receipt of test sample.....:	Apr. 13, 2021	
Date of testing.....:	Apr. 14, 2021- May. 17, 2021	
Date of issue.....:	May. 18, 2021	
Result..... .....:	**PASS**	

Compiled by (Position+Printed name+Signature):	File administrator Silvia Li	Silvia Li
Supervised by (Position+Printed name+Signature):	Project Engineer Aaron Fang	Aaron.Fang
Approved by (Position+Printed name+Signature):	RF Manager Hans Hu	Hans Hu

Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd.**
Address.....:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

Contents

1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

– FCC Rules Part 15.407: General technical requirements.

– ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

– KDB789033 D02 v02r01: GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

– KDB662911 D01 Multiple Transmitter Output v02r01: Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)

– KDB662911 D02 MIMO with Cross-Polarized Antennas v01: MIMO with Cross-Polarized Antenna

1.2. Report version

Revision No.	Date of issue	Description
N/A	2021-05-18	Original

2. TEST DESCRIPTION

Report clause	Test Items	Standard Requirement	Result
5.1	Antenna Requirement	15.203/15.247(c)	PASS
5.2	AC Conducted Emission	15.207	PASS
5.3	Maximum Conducted Output Power	15.407(a)	PASS
5.4	Maximum Power Spectral Density	15.407(a)	PASS
5.5	26dB Bandwidth and 99% Ocuppy bandwith	15.407(a)	PASS
5.6	6dB Bandwidth	15.407(a)	PASS
5.7	Band edge	15.407(b)	PASS
5.8	Radiated Spurious Emissions	15.209	PASS
5.9	Frequency Stability	15.407(g)	PASS

Note:

– The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	Mikrotikls SIA
Address:	Brivibas gatve 214i, Riga, LV-1039, Latvia
Manufacturer:	Mikrotikls SIA
Address:	Brivibas gatve 214i, Riga, LV-1039, Latvia

3.2. Product Description

Name of EUT:	cAP XL ac
Trade Mark:	MikroTik
Model No.:	RBcAPGi-5acD2nD-XL-US
Listed Model(s):	-
Power supply:	DC 24V
Hardware version:	r4
Software version:	RouterOS 6.48.1

3.3. Radio Specification Description

Support type[*1]	☒ 802.11a	☒ 802.11n(HT20)	☒ 802.11n(HT40)
	☒ 802.11ac(HT20)	☒ 802.11ac(HT40)	☒ 802.11ac(HT80)
Function:	☐ Outdoor AP	☒ Indoor AP	☐ Fixed P2P
	☐ Client		
Modulation:	BPSK, QPSK, 16QAM, 64QAM		
Operation frequency:	☒ Band I:	5180MHz~5240MHz	
	☒ Band IV:	5745MHz~5825MHz	
Supported Bandwidth	20MHz:	802.11ac,802.11n, 802.11a	
	40MHz:	802.11ac,802.11n	
	80MHz:	802.11ac	
Antenna type:	PCB patch Antenna		
Antenna gain:	5.5dBi		

Note:

*1: only show the RF function associated with this report.

3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
Connect information:	Phone: 86-755-26715499 E-mail: cs@szhtw.com.cn http://www.szhtw.com.cn	
Qualifications	Type	Accreditation Number
	FCC	762235

4. TEST CONFIGURATION

4.1. Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channels which were tested. The Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the below .

Band	Test Channel	20MHz		40MHz		80MHz	
		Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
I	CH_L	36	5180	38	5190	-	-
	CH_M	44	5220	-	-	42	5210
	CH_H	48	5240	46	5230	-	-
IV	CH_L	149	5745	151	5755	-	-
	CH_M	157	5785	-	-	155	5775
	CH_H	165	5825	159	5795	-	-

4.2. Descriptions of Test mode

Preliminary tests were performed in different data rates, final test modes are considering the modulation and worse data rates as below table.

Modulation	Data rate
802.11a	6Mbps
802.11n(HT20)/ 802.11ac(HT20)	MCS0
802.11n(HT40)/ 802.11ac(HT40)	MCS0
802.11ac(HT80)	MCS0

4.3. Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit.
For AC power line conducted emissions:
The EUT was set to connect with the WLAN AP under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data Recorded in the report.

4.4. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The following peripheral devices and interface cables were connected during the measurement:

Whether support unit is used?					
✓ No					
Item	Equipement	Trade Name	Model No.	FCC ID	Power cord
1					
2					

4.5. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.6. Measurement uncertainty

Test Item	Measurement Uncertainty
AC Conducted Emission (150kHz~30MHz)	3.02 dB
Radiated Emission (30MHz~1000MHz	4.90 dB
Radiated Emissions (1GHz~25GHz)	4.96 dB
Peak Output Power	0.51 dB
Power Spectral Density	0.51 dB
Conducted Spurious Emission	0.51 dB
6dB Bandwidth	70 Hz
Frequency error	70 Hz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.7. Equipment Used during the Test

● Conducted Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	HTWE0114	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2020/10/19	2021/10/18
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2020/10/15	2021/10/14
●	Pulse Limiter	R&S	HTWE0033	ESH3-Z2	100499	2020/10/15	2021/10/14
●	RF Connection Cable	HUBER+SUHNER	HTWE0113-02	ENVIROFLEX_142	EF-NM-BNCM-2M	2020/10/15	2021/10/14
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-6th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2020/10/19	2021/10/18
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2021/04/06	2022/04/05
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0123	VULB9163	538	2021/04/06	2022/04/05
●	Pre-Amplifer	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2020/11/13	2021/11/12
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2020/05/27	2021/05/26
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX104	501184/4	2020/05/27	2021/05/26
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-7th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	N/A	2018/09/27	2021/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2020/10/20	2021/10/19
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2020/04/01	2023/03/31
●	Broadband Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	BBHA9170472	2018/10/11	2021/10/11
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2020/11/13	2021/11/12
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2020/05/23	2021/05/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-01	6m 18GHz S Serisa	N/A	2021/05/07	2022/05/08
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-02	6m 3GHz RG Serisa	N/A	2021/05/07	2022/05/08
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-03	6m 3GHz RG Serisa	N/A	2021/05/07	2022/05/08
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-04	6m 3GHz RG Serisa	N/A	2021/05/07	2022/05/08
●	RF Connection Cable	HUBER+SUHNER	HTWE0121-01	6m 18GHz S Serisa	N/A	2021/05/07	2022/05/08
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

●	RF Conducted Method					
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal and spectrum Analyzer	R&S	FSV40	100048	2020/10/19	2021/10/18
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2020/10/19	2021/10/18
●	Power Meter	Anritsu	ML249A	N/A	2020/10/19	2021/10/18
○	Radio communication tester	R&S	CMW500	137688-Lv	2020/10/19	2021/10/18

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, 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.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

The product has two external antennas, both two are 5.5dBi antenna gain, and the product is a CDD device with the same gain, according to KDB 662911 D01 section F, the Directional gain=Gant + Array gain

For power spectral density measurements on all antenna, Array gain=10log(Nant/Nss) dB, Nss =1.

Directional gain=Gant + Array gain=5.5+10log(2/1)=8.5dBi

For power measurements on IEEE 802.11 devices, Array gain=0 dB for Nant≤4

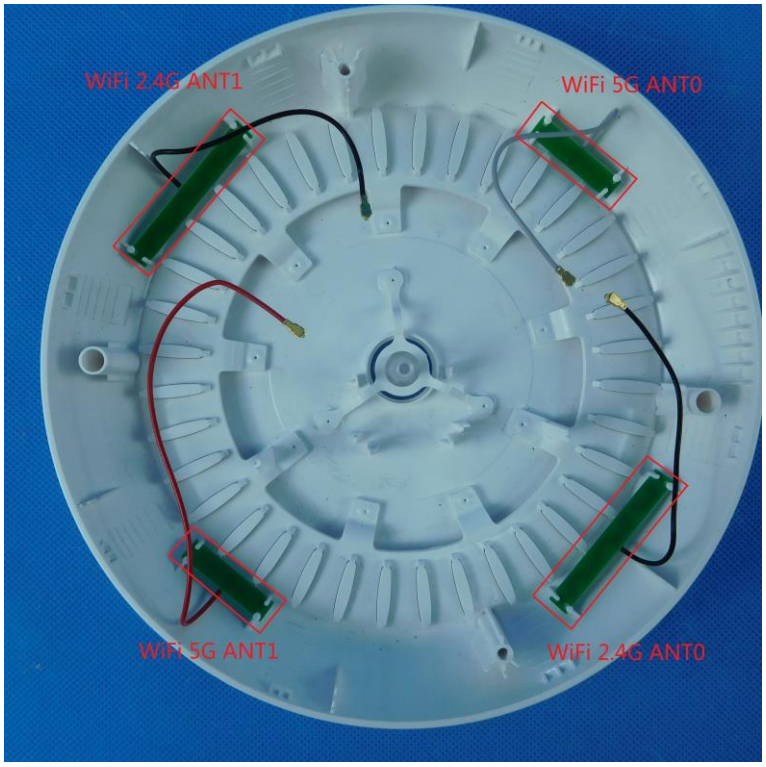
Directional gain=Gant + Array gain=5.5+0=5.5dBi

Power limit=30dBm.

5150-5250 band PSD limit=17dBm/MHz-(G_{Tx}-6)dB=17-(8.5-6)=14.5dBm/MHz

5725-5850 band PSD limit=30dBm/500KHz-(G_{Tx}-6)dB=30-(8.5-6)=27.5dBm/500KHz

please refer to the below antenna photo.



5.2. AC Conducted Emission

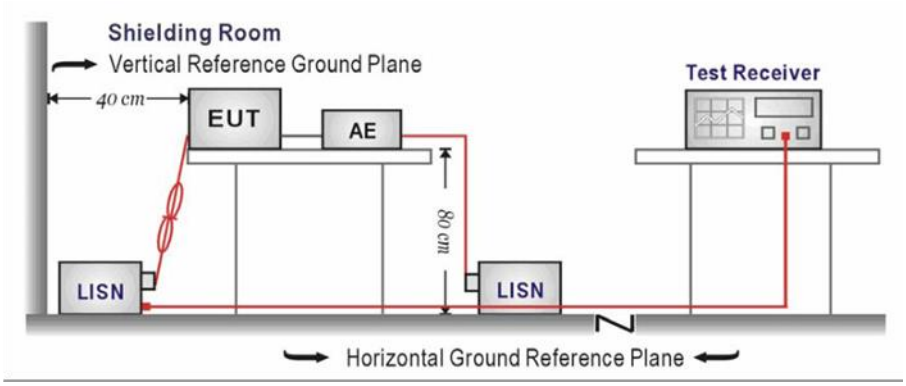
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

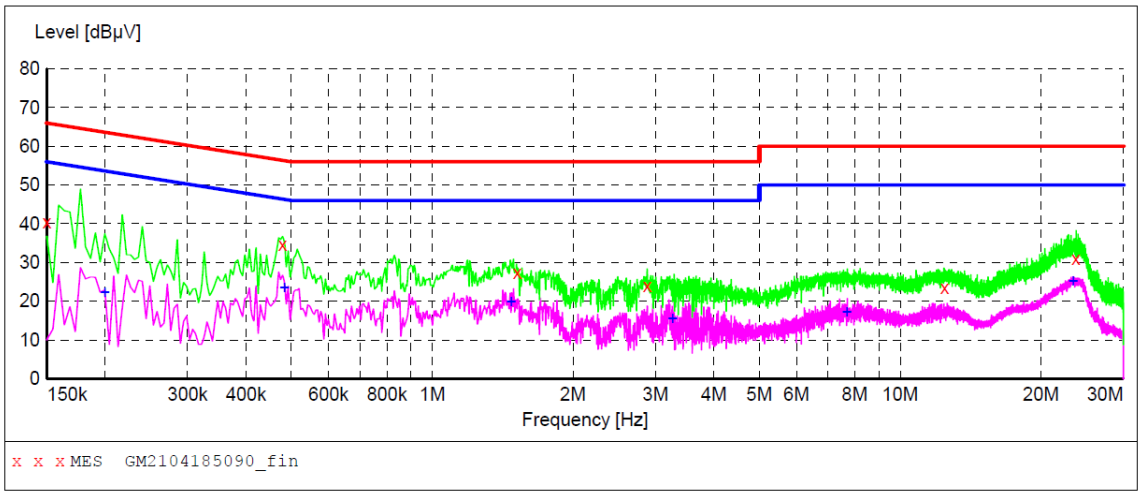
TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

Test Line:	L



MEASUREMENT RESULT: "GM2104185090_fin"

4/19/2021 5:59PM

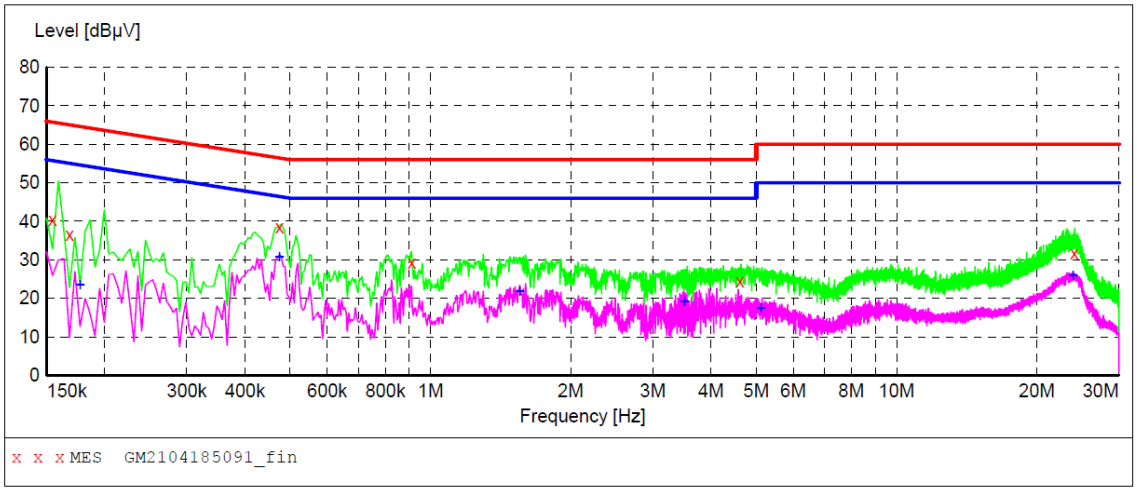
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	40.40	10.2	66	25.6	QP	L1	GND
0.478500	34.70	10.2	56	21.7	QP	L1	GND
1.518000	27.30	10.2	56	28.7	QP	L1	GND
2.877000	24.00	10.2	56	32.0	QP	L1	GND
12.444000	23.40	10.4	60	36.6	QP	L1	GND
23.730000	30.90	10.5	60	29.1	QP	L1	GND

MEASUREMENT RESULT: "GM2104185090_fin2"

4/19/2021 5:59PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.199500	22.30	10.2	54	31.3	AV	L1	GND
0.483000	23.40	10.2	46	22.9	AV	L1	GND
1.473000	19.90	10.2	46	26.1	AV	L1	GND
3.264000	15.50	10.2	46	30.5	AV	L1	GND
7.683000	17.20	10.3	50	32.8	AV	L1	GND
23.410500	25.10	10.5	50	24.9	AV	L1	GND

Test Line:	N



MEASUREMENT RESULT: "GM2104185091_fin"

4/19/2021 6:02PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	40.40	10.2	66	25.4	QP	N	GND
0.168000	36.50	10.2	65	28.6	QP	N	GND
0.474000	38.40	10.2	56	18.0	QP	N	GND
0.910500	29.40	10.2	56	26.6	QP	N	GND
4.614000	24.40	10.2	56	31.6	QP	N	GND
24.045000	31.70	10.5	60	28.3	QP	N	GND

MEASUREMENT RESULT: "GM2104185091_fin2"

4/19/2021 6:02PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.177000	23.40	10.2	55	31.2	AV	N	GND
0.474000	30.80	10.2	46	15.6	AV	N	GND
1.554000	21.70	10.2	46	24.3	AV	N	GND
3.502500	19.10	10.2	46	26.9	AV	N	GND
5.113500	17.50	10.2	50	32.5	AV	N	GND
23.919000	25.80	10.5	50	24.2	AV	N	GND

5.3. Maximum Conducted Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart E Section 15.407(a):

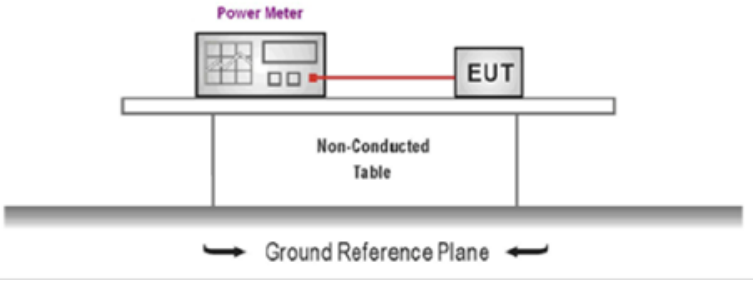
For the 5.15~5.25GHz band:

- Outdoor AP
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).
  if G_{Tx}>6dBi, then P_{out} =30-(G_{Tx}-6). e.i.r.p. at any elevation angle above 30 degrees≤125mW (21dBm)
- Indoor AP
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).
  if G_{Tx}>6dBi, then Pout =30-(G_{Tx}-6).
- Point-to-point AP
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).
  if G_{Tx}>23dBi, then Pout =30-(G_{Tx}-23).
- Client devices
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 250W (24dBm).
  if G_{Tx}>6dBi, then Pout =24-(G_{Tx}-6).

For the 5.725~5.85GHz band:

- Point-to-multipoint systems (P2M)
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).
  if G_{Tx}>6dBi, then P_{out} =30-(G_{Tx}-6).
- Point-to-point systems (P2P)
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was tested according to KDB789033 Section E-3-b)
2. The maximum conducted output power may be measured using a broadband AVG RF power meter.
3. Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor.
4. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.
5. Record the measurement data.
6. **TEST MODE:**

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

Please refer to appendix A on the appendix report

5.4. Power Spectral Density

LIMIT

FCC CFR Title 47 Part 15 Subpart E Section 15.407(a):

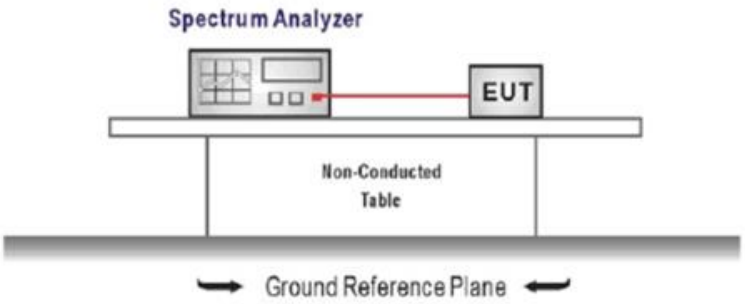
For the 5.15~5.25GHz band:

- Outdoor AP
  The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz.
  if G_{Tx}>6dBi, then PSD =17-(G_{Tx}-6).
- Indoor AP
  The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz.
  if G_{Tx}>6dBi, then PSD =17-(G_{Tx}-6).
- Point-to-point AP
  The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz.
  if G_{Tx}>23dBi, then PSD =17-(G_{Tx}-23).
- Client devices
  The peak power spectral density (PSD) shall not exceed the lesser of 11dBm/MHz.
  if G_{Tx}>6dBi, then PSD =11-(G_{Tx}-6).

For the 5.725~5.85GHz band:

- Point-to-multipoint systems (P2M)
  The peak power spectral density (PSD) shall not exceed the lesser of 30dBm/500kHz.
  if G_{Tx}>6dBi, then PSD =30-(G_{Tx}-6).
- Point-to-point systems (P2P)
  The peak power spectral density (PSD) shall not exceed the lesser of 30dBm/500kHz.

TEST CONFIGURATION



TEST PROCEDURE

1. According KDB 789033 D02 – Section F
2. Analyzer was setting as follow:
   Center frequency: test channel
   Span was set to encompass the entire emission bandwidth of the signal
   RBW=1MHz for devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz
   RBW=500kHz for devices operating in the band 5.725-5.85 GHz
   VBW ≥ 3 RBW
   Number of sweep points > 2 x (span/RBW)
   Sweep time = auto
   Detector = Peak
   Trigger was set to free run for all modes, trace was averaged over 100 sweeps
3. The peak search function of the spectrum analyzer was used to find the peak of the spectrum.

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

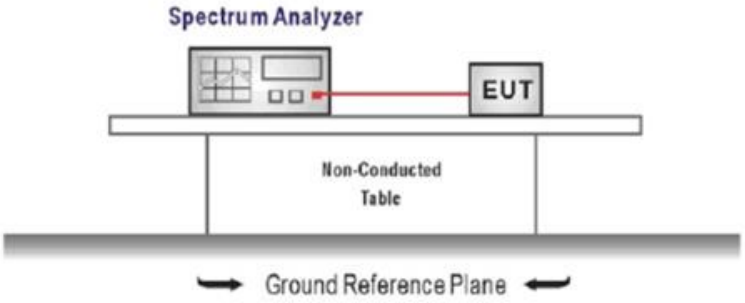
Please refer to appendix B on the appendix report

5.5. 26dB bandwidth and 99% Occupy bandwidth

LIMIT

The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033 D02 , and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

TEST CONFIGURATION



TEST PROCEDURE

1. According KDB 789033 D02 – Section C, 26dB bandwidth test as follow
   a) Set RBW = approximately 1% of the emission bandwidth.
   b) Set the VBW > RBW.
   c) Detector = Peak.
   d) Trace mode = max hold.
   e) Measure the maximum width of the emission that is 26 dB down from the maximum 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%.

2. According KDB 789033 D02 – Section D, 99% bandwidth test as follow
   a). Set center frequency to the nominal EUT channel center frequency.

   b). Set span = 1.5 times to 5.0 times the OBW.

   c). Set RBW = 1% to 5% of the OBW

   d). Set VBW ≥ 3 RBW

   e). Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

   f). Use the 99% power bandwidth function of the instrument

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

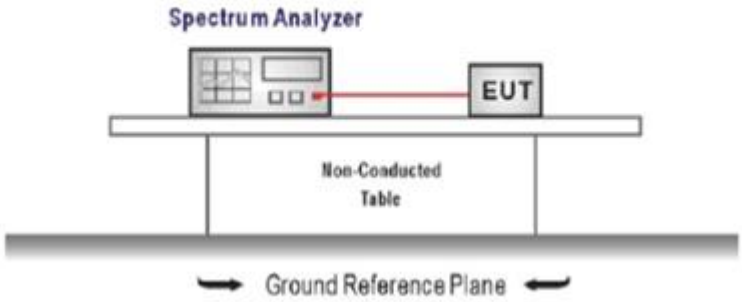
Please refer to appendix C and D on the appendix report

5.6. 6dB Bandwidth

LIMIT

FCC CFR Title 47 Part 15 Subpart E Section 15.407(e)
Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz

TEST CONFIGURATION



TEST PROCEDURE

1. C Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
   Center Frequency =test channel center frequency
   Span=2 x emission bandwidth
   RBW = 100 kHz, VBW ≥ 3 × RBW
   Sweep time= auto couple
   Detector = Peak
   Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission, and record the pertinent measurements.

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

Please refer to appendix E on the appendix report

5.7. Band edge

LIMIT

FCC CFR Title 47 Part 15 Subpart E Section 15.407(b)

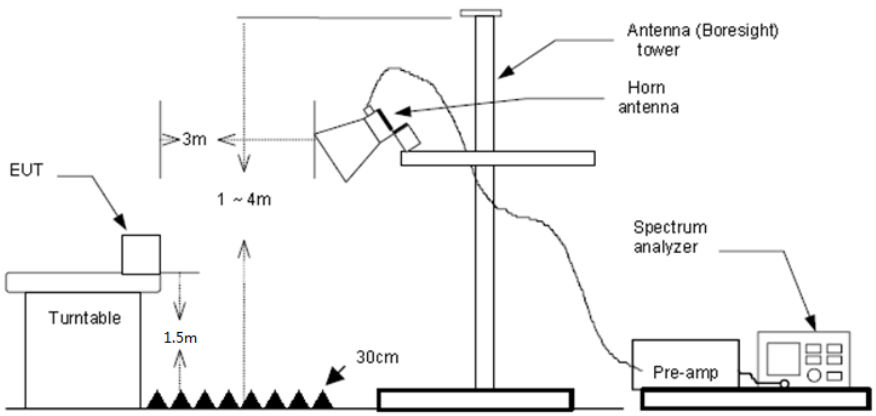
Un-restricted band emissions above 1GHz			
Operating Band	Frequency	EIRP Limit	Value
5150-5250MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5250-5350MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5470-5725MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5725-5850 MHz	1GHz-5.65GHz	-27 dBm/MHz(68.2dBuV/m)@3m	Peak
	5.65GHz-5.7GHz	-27*dBm/MHz to 10dBm/MHz (68.2* dBuV/m to 105.6dBuV/m)	Peak
	5.7GHz-5.72GHz	10*dBm/MHz to 15.6dBm/MHz (105.6*dBuV/m to 110.8dBuV/m)	Peak
	5.72GHz-5.725GHz	15.6*dBm/MHz to 27dBm/MHz (110.8dBuV/m to* 122.2dBuV/m)	Peak
	5.85GHz-5.855GHz	27dBm/MHz to 15.6*dBm/MHz (122.2dBuV/m to110.8* dBuV/m)	Peak
	5.855GHz-5.875GHz	15.6dBm/MHz to 10*dBm/MHz (110.8dBuV/m to 105.6* dBuV/m	Peak
	5.875GHz-5.925GHz	10dBm/MHz to -27*dBm/MHz (105.6dBuV/m to 68.2* dBuV/m)	Peak
	Above 5.925GHz	-27 dBm/MHz(68.2dBuV/m)@3m	Peak

* Increase/Decreases with the linearly of the frequency.

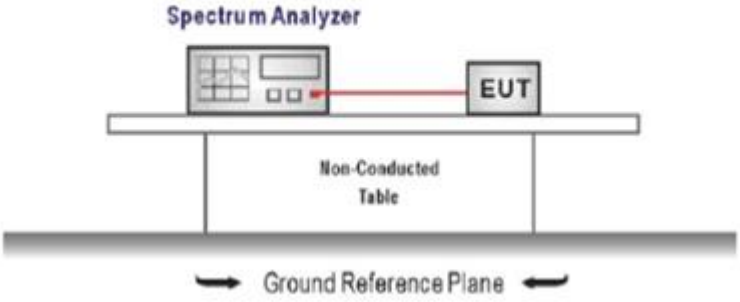
For emission above 1GHz and in restricted band, according to FCC KDB 789033 D02 General UNII Test Procedure, all emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit. E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

TEST CONFIGURATION

Radiated:



Conducted :



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find themaximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1MHz, VBW=3MHz PEAK detector for Peak value.
   RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 4.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Conducted Band Edge Test Data

Please refer to appendix F on the appendix report

Radiated Band Edge Test Data

Band: I			Worst mode: 802.11n(HT20)		Test channel: CH_L		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
5150.00	19.10	27.99	54.00	26.01	8.89	Vertical	Average
5150.00	25.30	34.19	68.20	34.01	8.89	Vertical	Peak
5150.00	17.80	26.69	54.00	27.31	8.89	Horizontal	Average
5150.00	24.97	33.86	68.20	34.34	8.89	Horizontal	Peak

Band: I			Worst mode: 802.11 n(HT20)		Test channel: CH_H		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
5350.00	17.49	26.03	54.00	27.97	8.54	Vertical	Average
5350.00	22.97	31.51	68.20	36.69	8.54	Vertical	Peak
5350.00	17.65	26.19	54.00	27.81	8.54	Horizontal	Average
5350.00	23.70	32.24	68.20	35.96	8.54	Horizontal	Peak

Band: IV			Worst mode: 802.11 n(HT20)		Test channel: CH_L		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
5725.00	16.98	25.98	54.00	28.02	9.00	Vertical	Average
5725.00	23.40	32.40	68.20	35.80	9.00	Vertical	Peak
5725.00	17.86	26.86	54.00	27.14	9.00	Horizontal	Average
5725.00	24.18	33.18	68.20	35.02	9.00	Horizontal	Peak

Band: IV			Worst mode: 802.11 n(HT20)		Test channel: CH_H		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
5850.00	18.53	28.30	54.00	25.70	9.77	Vertical	Average
5850.00	22.78	32.55	68.20	35.65	9.77	Vertical	Peak
5850.00	17.95	27.72	54.00	26.28	9.77	Horizontal	Average
5850.00	24.12	33.89	68.20	34.31	9.77	Horizontal	Peak

Remark:

1. *Final Level =Receiver Read level + Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. Pre-scan all modulation mode and antenna. *802.11a, 802.11n, 802.11ac mode* in the report only displays the worst antenna information. The worst antenna is antenna MIMO.

5.8. Radiated Spurious Emissions

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209 and Part 15 Subpart E Section 15.407

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

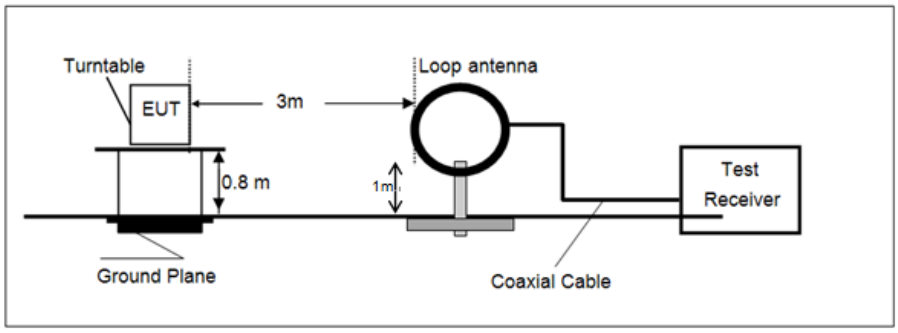
Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

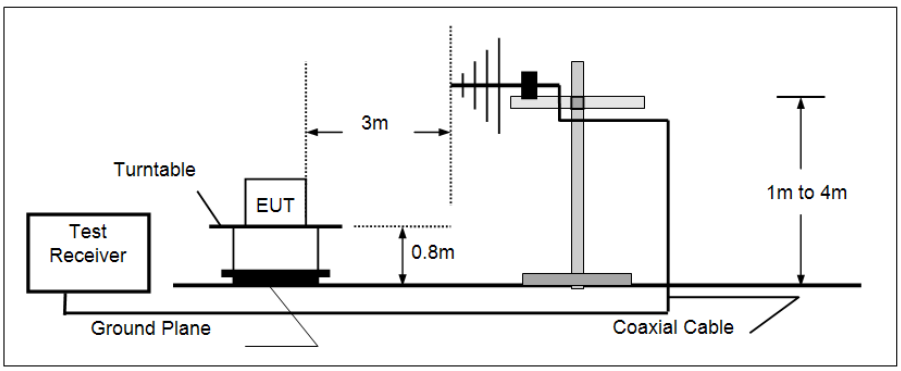
Unwanted emissions below 1GHz and Restricted band emissions above 1GHz		
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

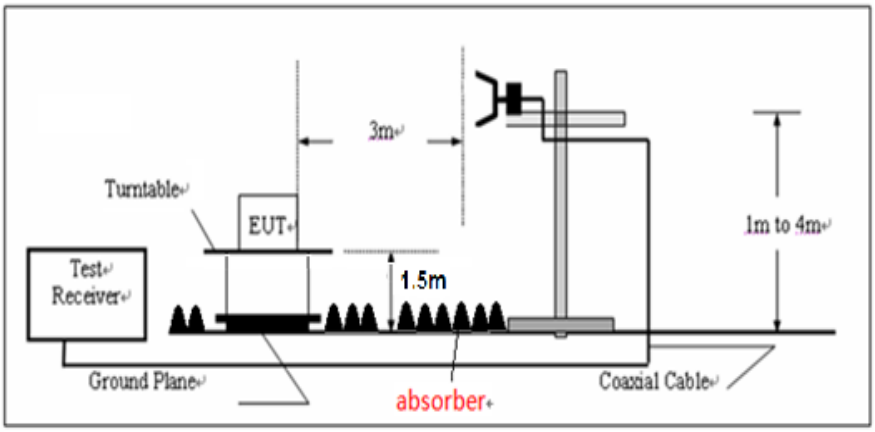
- 9KHz ~30MHz



- 30MHz ~ 1GHz



➢ Above 1GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
   a) Span shall wide enough to fully capture the emission being measured;
   b) Below 1 GHz:
      RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
      If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
   c) From 1 GHz to 10th harmonic:
      RBW=1MHz, VBW=3MHz Peak detector for Peak value.
      RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

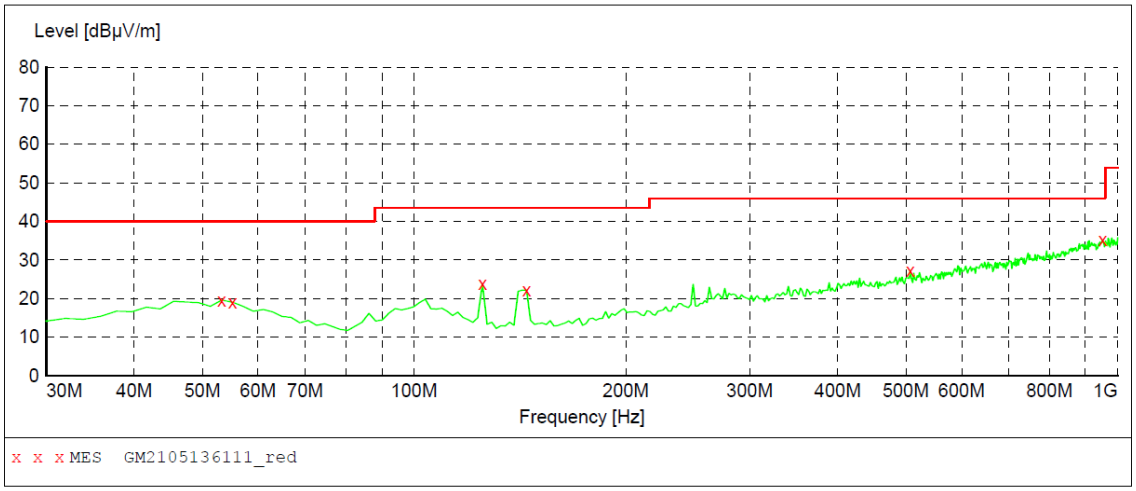
TEST Data

TEST DATA FOR 9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

TEST DATA FOR 30MHz-1GHz

Polarization:	Horizontal

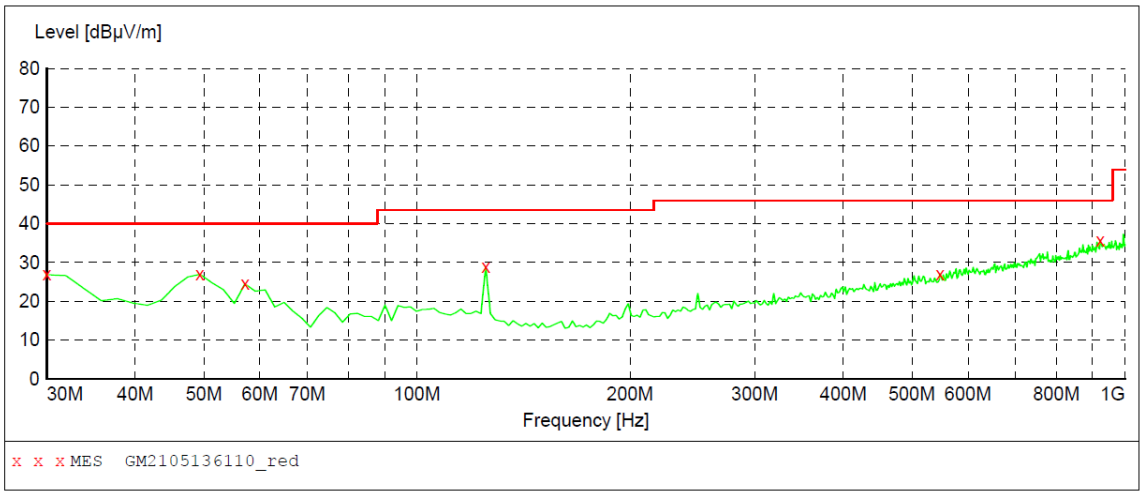


MEASUREMENT RESULT: "GM2105136111_red"

5/13/2021 8:31PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.280000	19.60	-8.9	40.0	20.4	QP	100.0	275.00	HORIZONTAL
55.220000	19.10	-9.1	40.0	20.9	QP	100.0	67.00	HORIZONTAL
125.060000	23.80	-13.3	43.5	19.7	QP	100.0	29.00	HORIZONTAL
144.460000	22.20	-14.2	43.5	21.3	QP	100.0	29.00	HORIZONTAL
507.240000	27.30	-1.6	46.0	18.7	QP	100.0	321.00	HORIZONTAL
951.500000	35.20	7.7	46.0	10.8	QP	100.0	248.00	HORIZONTAL

Polarization:	Vertical



MEASUREMENT RESULT: "GM2105136110_red"

5/13/2021 8:29PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	26.90	-12.4	40.0	13.1	QP	100.0	107.00	VERTICAL
49.400000	26.90	-8.8	40.0	13.1	QP	100.0	56.00	VERTICAL
57.160000	24.50	-9.4	40.0	15.5	QP	100.0	80.00	VERTICAL
125.060000	28.90	-13.3	43.5	14.6	QP	100.0	153.00	VERTICAL
547.980000	27.10	-0.6	46.0	18.9	QP	100.0	347.00	VERTICAL
922.400000	35.80	7.5	46.0	10.2	QP	100.0	129.00	VERTICAL

Remark:
Transd=Cable lose+ Antenna factor- Pre-amplifier; Margin=Limit -Level

TEST DATA FOR Above 1GHz

Band: I			Worst mode: 802.11n(HT20)		Test channel: CH_L		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
2457.00	23.67	21.43	68.20	46.77	-2.24	Vertical	Peak
4663.06	27.95	34.10	74.00	39.90	6.15	Vertical	Peak
7381.72	28.44	43.75	74.00	30.25	15.31	Vertical	Peak
9628.91	30.46	47.58	68.20	20.62	17.12	Vertical	Peak
1298.16	22.32	16.75	68.20	51.45	-5.57	Horizontal	Peak
4182.78	28.12	31.84	74.00	42.16	3.72	Horizontal	Peak
7170.22	27.08	41.90	68.20	26.30	14.82	Horizontal	Peak
9286.69	28.40	46.16	68.20	22.04	17.76	Horizontal	Peak

Band: I			Worst mode: 802.11n(HT20)		Test channel: CH_M		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
1248.22	23.07	17.37	68.20	50.83	-5.70	Vertical	Peak
4156.34	27.19	30.76	74.00	43.24	3.57	Vertical	Peak
6761.91	29.11	42.41	68.20	25.79	13.30	Vertical	Peak
9082.53	28.72	45.41	74.00	28.59	16.69	Vertical	Peak
1449.44	20.93	15.33	74.00	58.67	-5.60	Horizontal	Peak
4560.25	27.01	32.61	74.00	41.39	5.60	Horizontal	Peak
6231.69	27.29	38.21	68.20	29.99	10.92	Horizontal	Peak
9054.63	29.09	45.80	74.00	28.20	16.71	Horizontal	Peak

Band: I			Worst mode: 802.11n(HT20)		Test channel: CH_H		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
1417.13	21.67	16.08	74.00	57.92	-5.59	Vertical	Peak
2222.00	23.37	20.54	74.00	53.46	-2.83	Vertical	Peak
5185.94	26.85	35.80	68.20	32.40	8.95	Vertical	Peak
9101.63	29.46	46.13	74.00	27.87	16.67	Vertical	Peak
1245.28	21.93	16.22	68.20	51.98	-5.71	Horizontal	Peak
2166.19	22.31	18.99	68.20	49.21	-3.32	Horizontal	Peak
5185.94	27.19	36.14	68.20	32.06	8.95	Horizontal	Peak
8994.41	28.02	44.73	68.20	23.47	16.71	Horizontal	Peak

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *Measuring frequencies from 1 GHz to 40GHz.*
4. *Pre-scan all modulation mode and antenna. 802.11a, 802.11n, 802.11ac mode in the report only displays the worst antenna information. The worst antenna is antenna MIMO.*

Band: IV			Worst mode: 802.11n(HT20)		Test channel: CH_L		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
1383.34	21.52	15.94	74.00	58.06	-5.58	Vertical	Peak
4106.41	26.65	29.94	74.00	44.06	3.29	Vertical	Peak
7941.31	28.14	44.40	68.20	23.80	16.26	Vertical	Peak
9671.50	29.65	46.81	68.20	21.39	17.16	Vertical	Peak
1815.16	22.20	16.40	68.20	51.80	-5.80	Horizontal	Peak
4005.06	27.83	30.86	74.00	43.14	3.03	Horizontal	Peak
6427.03	27.14	38.76	68.20	29.44	11.62	Horizontal	Peak
8105.81	29.36	45.68	74.00	28.32	16.32	Horizontal	Peak

Band: IV			Worst mode: 802.11n(HT20)		Test channel: CH_M		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
1361.31	22.11	16.53	74.00	57.47	-5.58	Vertical	Peak
2266.06	21.89	19.34	74.00	54.66	-2.55	Vertical	Peak
4666.00	26.04	32.21	74.00	41.79	6.17	Vertical	Peak
8029.44	27.90	44.13	74.00	29.87	16.23	Vertical	Peak
1265.84	22.58	16.92	68.20	51.28	-5.66	Horizontal	Peak
3182.56	29.92	30.67	68.20	37.53	0.75	Horizontal	Peak
7145.25	27.92	42.60	68.20	25.60	14.68	Horizontal	Peak
9483.50	28.96	46.86	74.00	27.14	17.90	Horizontal	Peak

Band: IV			Worst mode: 802.11n(HT20)		Test channel: CH_H		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
1198.28	23.12	17.27	74.00	56.73	-5.85	Vertical	Peak
3665.78	29.85	31.39	74.00	42.61	1.54	Vertical	Peak
7913.41	27.77	44.06	68.20	24.14	16.29	Vertical	Peak
9323.41	28.55	46.34	74.00	27.66	17.79	Vertical	Peak
1361.31	22.13	16.55	74.00	57.45	-5.58	Horizontal	Peak
4746.78	26.76	33.45	74.00	40.55	6.69	Horizontal	Peak
7521.25	27.85	43.36	74.00	30.64	15.51	Horizontal	Peak
10919.94	28.02	45.79	74.00	28.21	17.77	Horizontal	Peak

Remark:

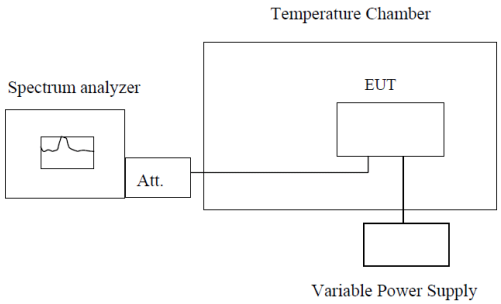
1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *Measuring frequencies from 1 GHz to 40GHz.*
4. *Pre-scan all modulation mode and antenna. 802.11a, 802.11n, 802.11ac mode in the report only displays the worst antenna information. The worst antenna is antenna MIMO.*

5.9. Frequency stability

LIMIT

Within Operation Band

TEST CONFIGURATION



Note : Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The equipment under test was connected to an external power supply.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25℃ operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to –20℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached..

TEST MODE:

Please refer to the clause 4.3

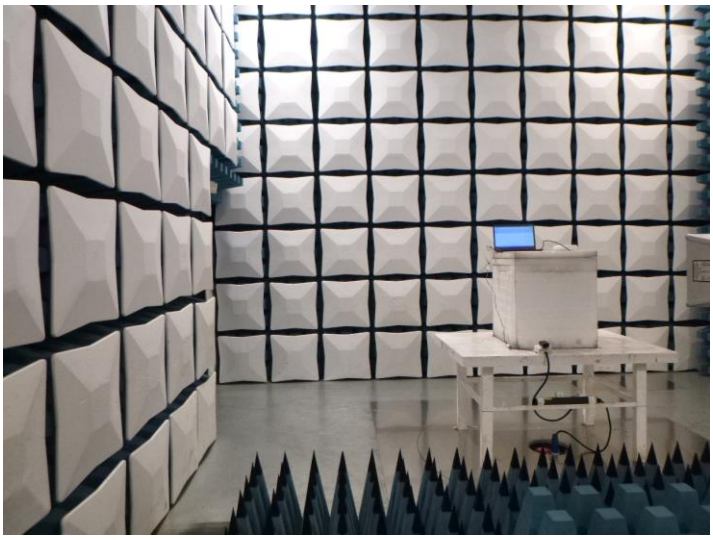
TEST RESULT

☒ **Passed** ☐ **Not Applicable**

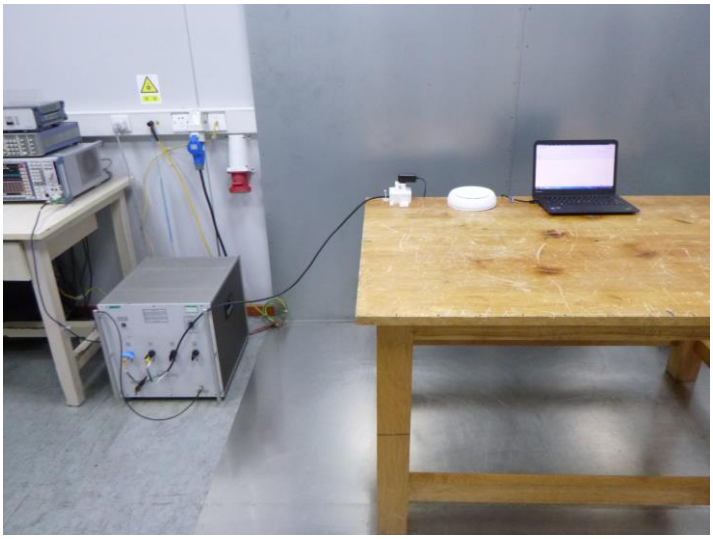
Please refer to appendix G on the appendix report

6. TEST SETUP PHOTOS

Radiated Emission



AC Conducted Emission



7. EXTERANAL AND INTERNAL PHOTOS

Reference to the test report No. CHTEW21050089

8. APPENDIX REPORT