

FCC Test Report

FCC ID : JVPWDC10TC
Equipment : InstaShow Button
Model No. : WDC10TC
Brand Name : BenQ
Applicant : BenQ Corporation
Address : 16 Jihu Road, Neihu, Taipei 114, Taiwan
Standard : 47 CFR FCC Part 15.407
Received Date : Apr. 01, 2019
Tested Date : Apr. 08 ~ Apr. 30, 2019

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:


Along Chen / Assistant Manager

Approved by:

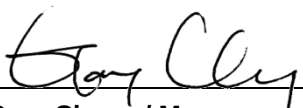

Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR940101AN	Rev. 01	Initial issue	May 07, 2019

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.159MHz 53.67 (Margin -11.85dB) - QP	Pass
15.407(b) 15.209	Radiated Emissions	[dBuV/m at 3m]: 5150.00MHz 51.99(Margin -2.01dB) - AV	Pass
15.407(a)	Emission Bandwidth	Meet the requirement of limit	Pass
15.407(e)	6dB bandwidth	Meet the requirement of limit	Pass
15.407(a)	RF Output Power	Max Power [dBm]: 5150-5250MHz: 16.7 5725-5850MHz: 16.8	Pass
15.407(a)	Peak Power Spectral Density	Meet the requirement of limit	Pass
15.407(g)	Frequency Stability	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared values of gain for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of the gain.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	Data Rate / MCS
5150-5250	ac (VHT40)	5190-5230	38-46 [2]	2	MCS 0-9
Note 1: RF output power specifies that Maximum Conducted Output Power.					
Note 2: 802.11ac uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.					

RF General Information					
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	Data Rate / MCS
5725-5850	ac (VHT40)	5755-5795	151-159 [2]	2	MCS 0-9
Note 1: RF output power specifies that Maximum Conducted Output Power.					
Note 2: 802.11ac uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.					

1.1.2 Antenna Details

Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)	
			5150~5250	5725~5850
66722133B1-050	PCB Dipole	UFL	5.08	4.76
F-F0010019-1	PCB Dipole	UFL	3.26	3.73

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from host
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1.1.4 Accessories

Accessories		
No.	Equipment	Description
1	USB type-C cable	Undetachable, 5.3cm shielded without core 2 colors of insulating glue are used for internal connector. One is black, the other is transparent.

1.1.5 Channel List

For Frequency band 5150-5250 MHz	
VHT40	
Channel	Frequency(MHz)
38	5190
46	5230

For Frequency band 5725~5850 MHz	
VHT40	
Channel	Frequency(MHz)
151	5755
159	5795

1.1.6 Test Tool and Duty Cycle

Test Tool	MT7612E_AP_QA_Tool, version: 1.0.3.11		
Duty Cycle and Duty Factor	Mode	Duty Cycle (%)	Duty Factor (dB)
	VHT40	90.81%	0.42

1.1.7 Power Index of Test Tool

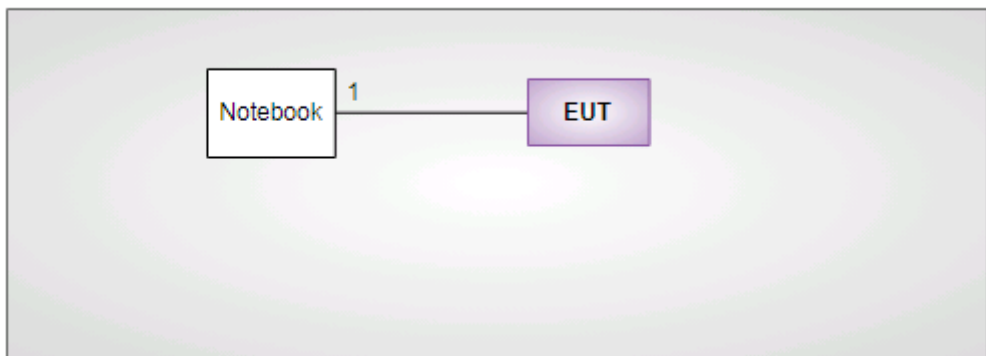
For Frequency band 5150-5250 MHz		
Modulation Mode	Test Frequency (MHz)	Power Index
VHT40	5190	14/13
VHT40	5230	14/13

For Frequency band 5725~5850 MHz		
Modulation Mode	Test Frequency (MHz)	Power Index
VHT40	5755	15/13
VHT40	5795	15/13

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Inspiron 15 5570	DoC	---

1.3 Test Setup Chart

Test Setup Diagram	
	
No.	Signal cable / Length (m)
1	USB type-C, 5.3cm shielded.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Jan. 08, 2019	Jan. 07, 2020
LISN	R&S	ENV216	101579	Mar. 08, 2019	Mar. 07, 2020
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 23, 2018	Oct. 22 2019
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 27, 2018	Dec. 26, 2019
Receiver	R&S	ESR3	101658	Dec. 11, 2018	Dec. 10, 2019
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 18, 2018	Jul. 17, 2019
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 18, 2018	Dec. 17, 2019
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019
Preamplifier	EMC	EMC02325	980225	Jul. 20, 2018	Jul. 19, 2019
Preamplifier	Agilent	83017A	MY39501308	Oct. 04, 2018	Oct. 03, 2019
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019
RF Cable	EMC	EMC104-SM-SM-8000	181106	Oct. 08, 2018	Oct. 07, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 08, 2018	Oct. 07, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 08, 2018	Oct. 07, 2019
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	160502	Oct. 08, 2018	Oct. 07, 2019
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 08, 2018	Oct. 07, 2019
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Oct. 08, 2018	Oct. 07, 2019
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Jan. 07, 2019	Jan. 06, 2020
TEMP&HUMIDITY CHAMBER	GIANT FORCE	GCT-225-40-SP-SD	MAF1212-002	Dec. 05, 2018	Dec. 04, 2019
Power Meter	Anritsu	ML2495A	1241002	Oct. 09, 2018	Oct. 08, 2019
Power Sensor	Anritsu	MA2411B	1207366	Oct. 09, 2018	Oct. 08, 2019
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Testing Applied Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.407

ANSI C63.10-2013

FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

FCC KDB 412172 D01 Determining ERP and EIRP v01r01

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$))

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	± 34.130 Hz
Conducted power	± 0.808 dB
Frequency error	$\pm 1 \times 10^{-9}$
Power density	± 0.583 dB
Conducted emission	± 2.715 dB
AC conducted emission	± 2.92 dB
Radiated emission ≤ 1 GHz	± 3.41 dB
Radiated emission > 1 GHz	± 4.59 dB
Time	$\pm 0.1\%$
Temperature	± 0.4 °C

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	24°C / 66%	Akun Chung
Radiated Emissions	03CH01-WS	23-26°C / 61-66%	Aska Huang\ Roger Lu
RF Conducted	TH01-WS	23°C / 61%	Felix Sung

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- ISED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

For Frequency band 5150-5250 MHz				
Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	VHT40	5230	MCS 0	---
Radiated Emissions ≤1GHz	VHT40	5230	MCS 0	---
RF Output Power Radiated Emissions >1GHz Emission Bandwidth Peak Power Spectral Density	VHT40	5190 / 5230	MCS 0	---
Frequency Stability	Un-modulation	5230	---	---

For Frequency band 5725-5850 MHz				
Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	VHT40	5755	MCS 0	---
Radiated Emissions ≤1GHz	VHT40	5755	MCS 0	---
Radiated Emissions >1GHz Emission Bandwidth 6dB bandwidth Peak Power Spectral Density	VHT40	5755 / 5795	MCS 0	---
Frequency Stability	Un-modulation	5795	---	---

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

3.1.2 Test Procedures

1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V / 60Hz.

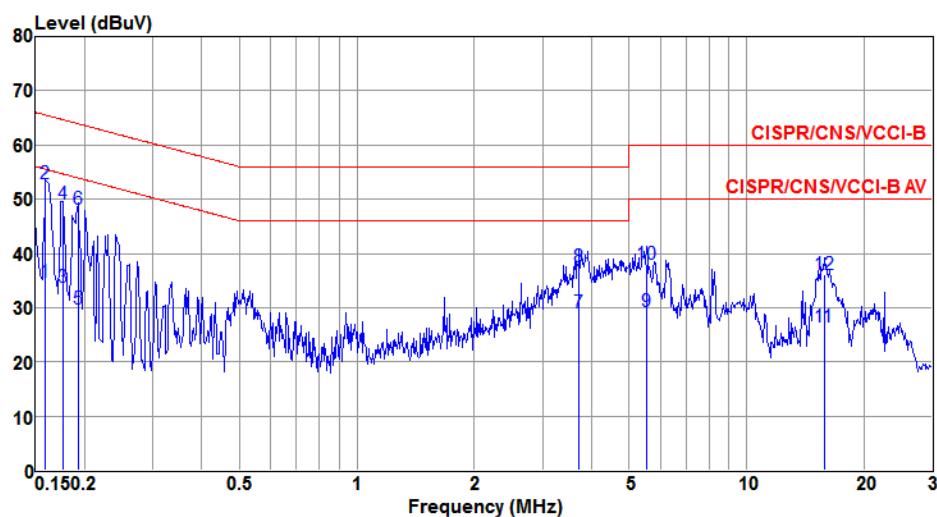
3.1.3 Test Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions

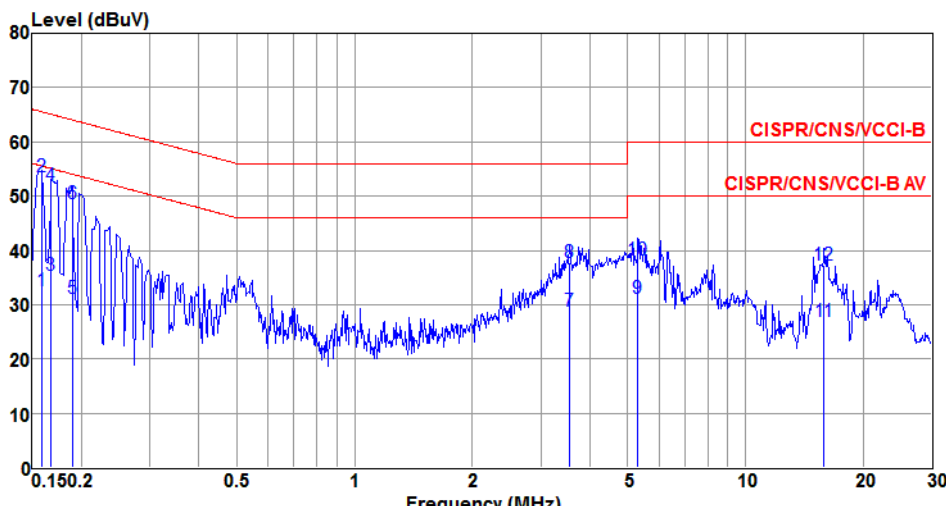
Modulation	VHT40	Test Freq. (MHz)	5230
Power Phase	Line		



	Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark
1	0.159	34.75	55.52	-20.77	25.17	9.53	0.05	Average
2*	0.159	52.95	65.52	-12.57	43.37	9.53	0.05	QP
3	0.177	33.86	54.64	-20.78	24.26	9.54	0.06	Average
4	0.177	49.16	64.64	-15.48	39.56	9.54	0.06	QP
5	0.192	29.84	53.93	-24.09	20.23	9.54	0.07	Average
6	0.192	48.14	63.93	-15.79	38.53	9.54	0.07	QP
7	3.720	29.01	46.00	-16.99	19.13	9.61	0.27	Average
8	3.720	37.48	56.00	-18.52	27.60	9.61	0.27	QP
9	5.535	29.18	50.00	-20.82	19.22	9.62	0.34	Average
10	5.535	38.08	60.00	-21.92	28.12	9.62	0.34	QP
11	15.801	26.51	50.00	-23.49	16.28	9.66	0.57	Average
12	15.801	36.13	60.00	-23.87	25.90	9.66	0.57	QP

Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB).
 2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).

Modulation	VHT40	Test Freq. (MHz)	5230
Power Phase	Neutral		

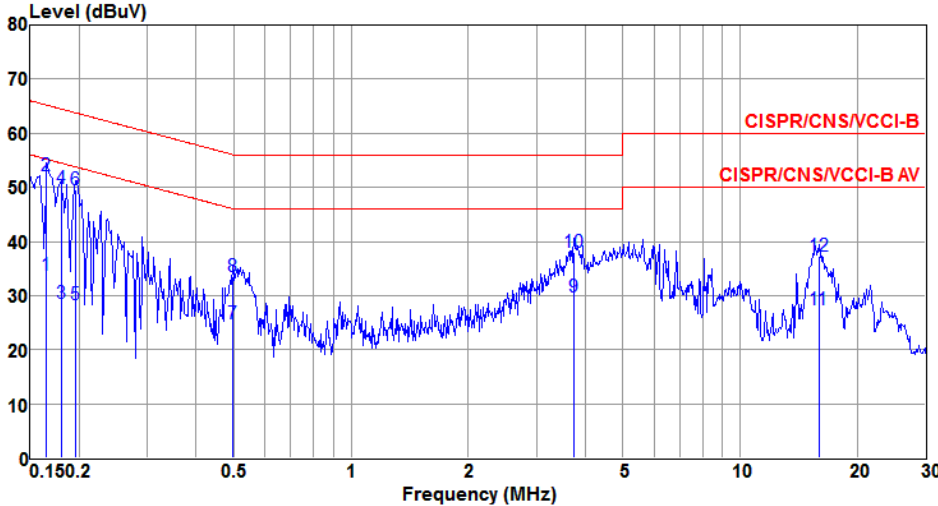


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.159	32.62	55.52	-22.90	23.00	9.57	0.05	Average
2*	0.159	53.67	65.52	-11.85	44.05	9.57	0.05	QP
3	0.168	35.46	55.08	-19.62	25.83	9.57	0.06	Average
4	0.168	51.97	65.08	-13.11	42.34	9.57	0.06	QP
5	0.189	31.21	54.06	-22.85	21.56	9.58	0.07	Average
6	0.189	48.53	64.06	-15.53	38.88	9.58	0.07	QP
7	3.547	28.72	46.00	-17.28	18.80	9.66	0.26	Average
8	3.547	37.81	56.00	-18.19	27.89	9.66	0.26	QP
9	5.305	31.19	50.00	-18.81	21.18	9.68	0.33	Average
10	5.305	38.32	60.00	-21.68	28.31	9.68	0.33	QP
11	15.885	26.91	50.00	-23.09	16.56	9.78	0.57	Average
12	15.885	37.32	60.00	-22.68	26.97	9.78	0.57	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Modulation	VHT40	Test Freq. (MHz)	5755
Power Phase	Line		

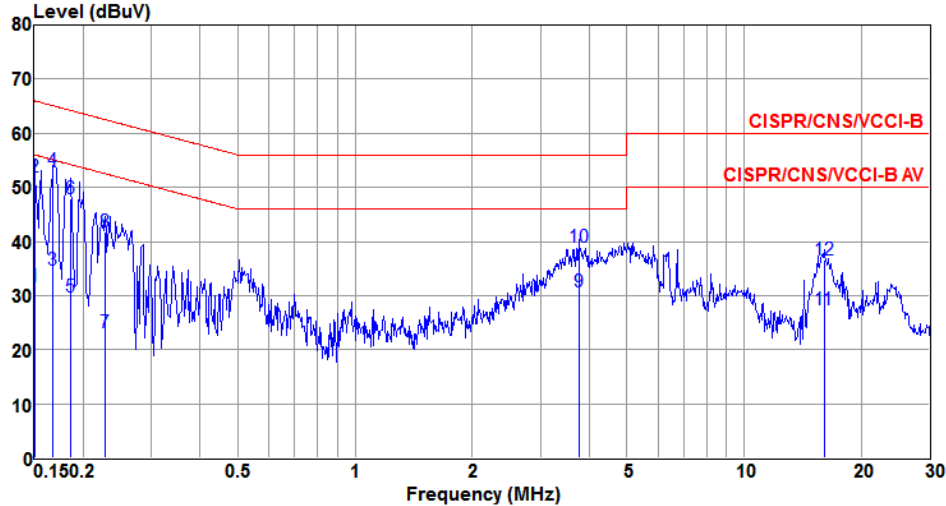


Freq	Level	Limit	Over	Read	LISN	cable	Remark	
MHz	dBuV	dBuV	Limit	Level	factor	loss		
			dB	dBuV	dB	dB		
1	0.165	33.87	55.21	-21.34	24.28	9.53	0.06	Average
2*	0.165	52.25	65.21	-12.96	42.66	9.53	0.06	QP
3	0.180	28.59	54.50	-25.91	18.99	9.54	0.06	Average
4	0.180	49.74	64.50	-14.76	40.14	9.54	0.06	QP
5	0.195	28.31	53.80	-25.49	18.70	9.54	0.07	Average
6	0.195	49.54	63.80	-14.26	39.93	9.54	0.07	QP
7	0.497	24.67	46.05	-21.38	15.01	9.58	0.08	Average
8	0.497	33.42	56.05	-22.63	23.76	9.58	0.08	QP
9	3.740	29.67	46.00	-16.33	19.79	9.61	0.27	Average
10	3.740	38.00	56.00	-18.00	28.12	9.61	0.27	QP
11	15.970	27.27	50.00	-22.73	17.04	9.66	0.57	Average
12	15.970	37.35	60.00	-22.65	27.12	9.66	0.57	QP

Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB).

2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).

Modulation	VHT40	Test Freq. (MHz)	5755
Power Phase	Neutral		



The graph displays the radio frequency interference (RFI) level in dBuV across a frequency range from 0.150 MHz to 30 MHz. The y-axis represents the level in dBuV, ranging from 0 to 80. The x-axis represents the frequency in MHz, with major ticks at 0.150, 0.2, 0.5, 1, 2, 5, 10, 20, and 30. Two red lines represent the CISPR/CNS/VCCI-B and CISPR/CNS/VCCI-B AV limits. The blue line represents the measured RFI level, which shows significant peaks at low frequencies (below 1 MHz) and a more stable level between 1 MHz and 30 MHz. The measured level is generally below the limits, with some peaks reaching up to 50 dBuV at low frequencies.

	Freq	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.150	31.57	56.00	-24.43	21.95	9.57	0.05	Average
2	0.150	52.04	66.00	-13.96	42.42	9.57	0.05	QP
3	0.168	34.80	55.08	-20.28	25.17	9.57	0.06	Average
4*	0.168	53.06	65.08	-12.02	43.43	9.57	0.06	QP
5	0.186	29.82	54.20	-24.38	20.17	9.58	0.07	Average
6	0.186	48.01	64.20	-16.19	38.36	9.58	0.07	QP
7	0.228	23.18	52.52	-29.34	13.52	9.59	0.07	Average
8	0.228	41.82	62.52	-20.70	32.16	9.59	0.07	QP
9	3.759	30.60	46.00	-15.40	20.67	9.66	0.27	Average
10	3.759	39.01	56.00	-16.99	29.08	9.66	0.27	QP
11	16.055	27.28	50.00	-22.72	16.93	9.78	0.57	Average
12	16.055	36.69	60.00	-23.31	26.34	9.78	0.57	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).

Note 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

3.2 Emission Bandwidth

3.2.1 Limit of Emission bandwidth

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

3.2.2 Test Procedures

26dB Bandwidth

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW, Detector = Peak.
3. Trace mode = max hold.
4. Measure the maximum width of the emission that is 26 dB down from the peak of the emission.

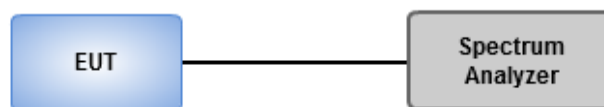
Occupied Bandwidth

1. Set RBW = 1 % to 5 % of the OBW.
2. Set VBW $\geq$ 3 RBW.
3. Sample detection and single sweep mode shall be used.
4. Use the 99 % power bandwidth function of the instrument.

6dB Bandwidth

1. Set RBW = 100kHz, VBW = 300kHz.
2. Detector = Peak, Trace mode = max hold.
3. Allow the trace to stabilize.
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.

3.2.3 Test Setup



3.2.4 Test Result of Emission Bandwidth

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
5.15-5.25GHz	-	-	-	-	-
802.11ac VHT40_Nss1,(MCS0)_2TX	46.377M	36.207M	36M2D1D	40.145M	36.016M
5.725-5.85GHz	-	-	-	-	-
802.11ac VHT40_Nss1,(MCS0)_2TX	35.072M	36.102M	36M1D1D	35.072M	36.022M

Max-N dB = Maximum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;

Max-OBW = Maximum 99% occupied bandwidth;

Min-N dB = Minimum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;

Min-OBW = Minimum 99% occupied bandwidth;

Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)	Port 2-N dB (Hz)	Port 2-OBW (Hz)
802.11ac VHT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-
5190MHz	Pass	Inf	40.87M	36.102M	46.377M	36.199M
5230MHz	Pass	Inf	40.145M	36.016M	41.014M	36.207M
5755MHz	Pass	500k	35.072M	36.022M	35.072M	36.102M
5795MHz	Pass	500k	35.072M	36.098M	35.072M	36.076M

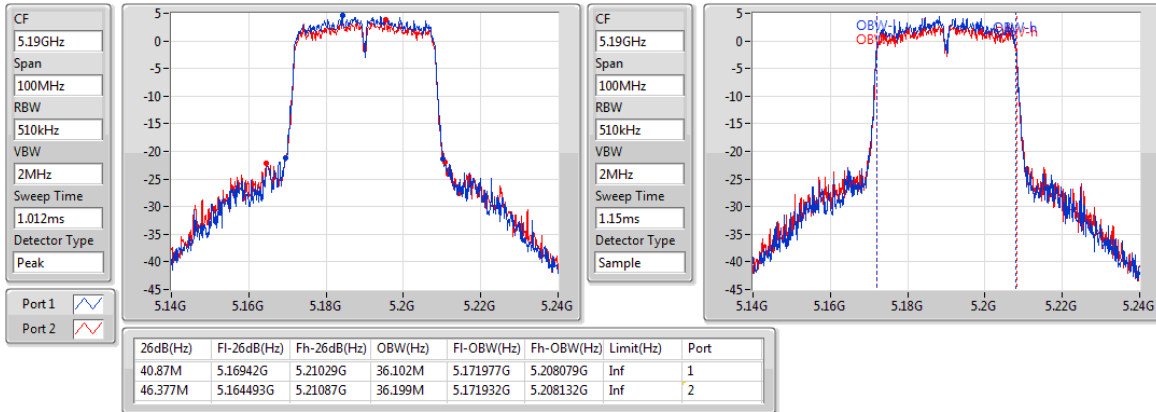
Port X-N dB = Port X 6dB down bandwidth for 5.725-5.85GHz band / 26dB down bandwidth for other band

Port X-OBW = Port X 99% occupied bandwidth;

802.11ac VHT40_Nss1,(MCS0)_2TX

EBW

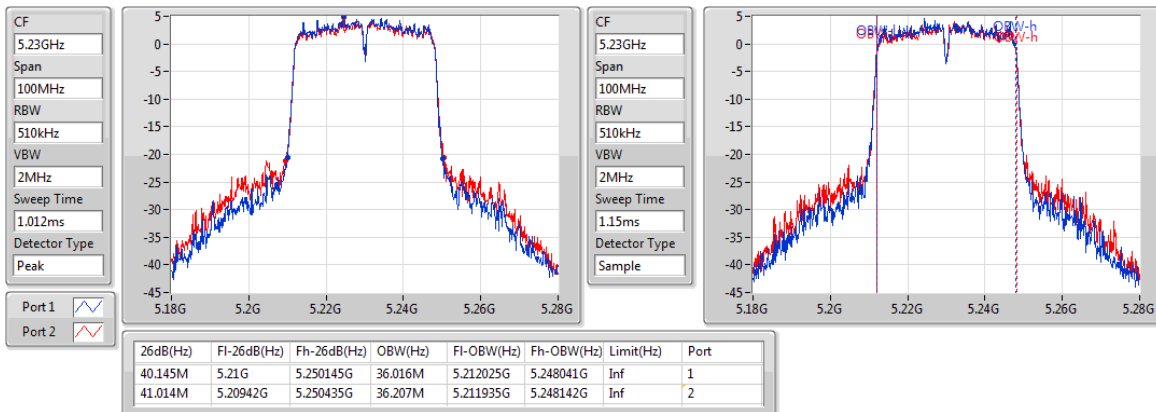
5190MHz



802.11ac VHT40_Nss1,(MCS0)_2TX

EBW

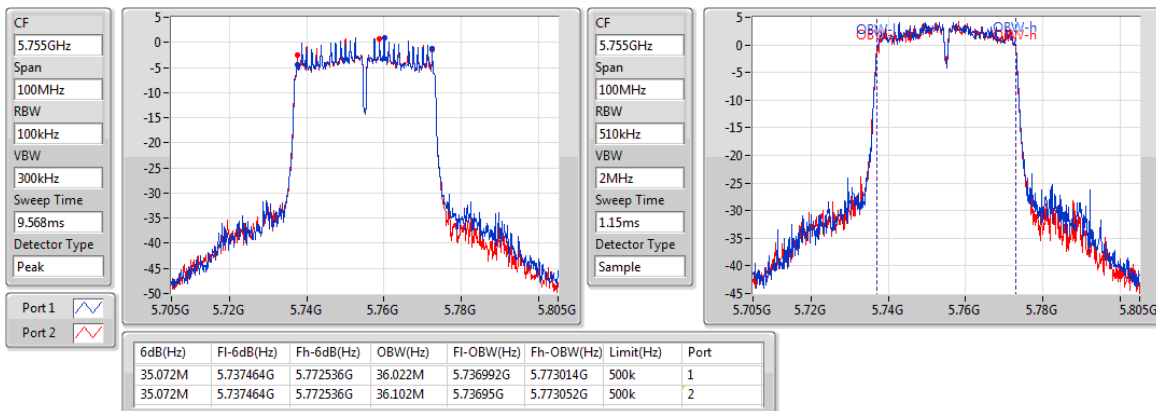
5230MHz



802.11ac VHT40_Nss1,(MCS0)_2TX

EBW

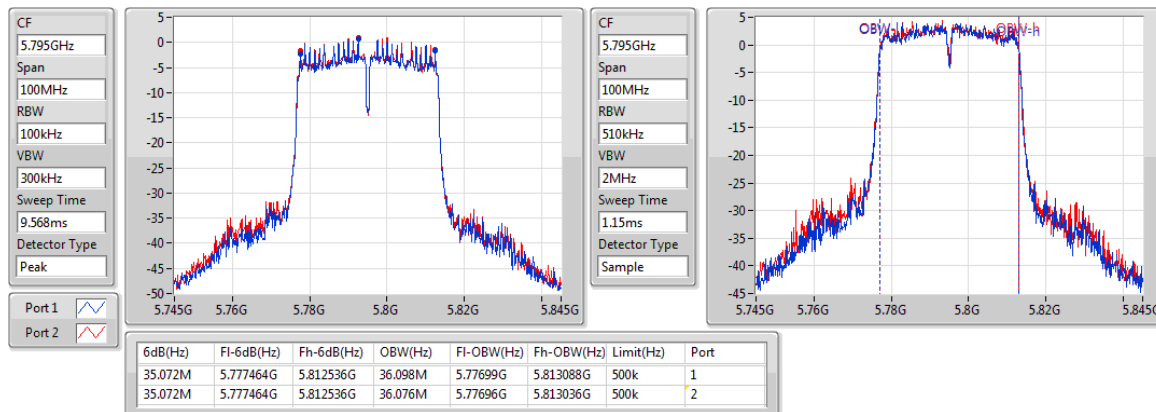
5755MHz



802.11ac VHT40_Nss1,(MCS0)_2TX

EBW

5795MHz



3.3 RF Output Power

3.3.1 Limit of RF Output Power

Frequency band 5150-5250 MHz		
Operating Mode		Limit
☐	Outdoor access point	Conducted Power: 1 W The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm)
☐	Indoor access point	Conducted Power: 1 W
☐	Fixed point-to-point access points	Conducted Power: 1 W
☒	Client devices	Conducted Power: 250 mW

Frequency Band (MHz)	Limit
☒ 5725 ~ 5850	Conducted Power: 1 W

3.3.2 Test Procedures

Method PM-G (Measurement using a gated RF average power meter)

Measurements is performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

3.3.3 Test Setup



3.3.4 Test Result of Maximum Conducted Output Power

Summary

Mode	Total Power (dBm)	Total Power (W)	EIRP (dBm)	EIRP (W)
5.15-5.25GHz	-	-	-	-
802.11ac VHT40_Nss1,(MCS0)_2TX	16.70	0.04677	21.78	0.15066
5.725-5.85GHz	-	-	-	-
802.11ac VHT40_Nss1,(MCS0)_2TX	16.80	0.04786	21.56	0.14322

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
802.11ac VHT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-
5190MHz	Pass	5.08	13.51	13.67	16.60	24.00	21.68	30.00
5230MHz	Pass	5.08	13.63	13.74	16.70	24.00	21.78	30.00
5755MHz	Pass	4.76	13.74	13.84	16.80	30.00	21.56	36.00
5795MHz	Pass	4.76	13.68	13.79	16.75	30.00	21.51	36.00

DG = Directional Gain; **Port X** = Port X output power

3.4 Peak Power Spectral Density

3.4.1 Limit of Peak Power Spectral Density

Frequency band 5150-5250 MHz		
Operating Mode		Limit
☐	Outdoor access point	17 dBm / MHz
☐	Indoor access point	17 dBm / MHz
☐	Fixed point-to-point access points	17 dBm / MHz
☒	Client devices	11 dBm / MHz

Frequency Band (MHz)		Limit
☒	5725 ~ 5850	30 dBm /500 kHz

3.4.2 Test Procedures

For 5150 ~ 5250 MHz

Duty cycle < 98 %

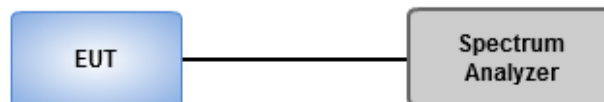
1. Set RBW = 1 MHz, VBW = 3 MHz, Detector = RMS.
2. Set sweep time $\geq 10 \times (\text{number of points in sweep}) \times (\text{total on/off period of the transmitted signal})$.
3. Perform a single sweep.
4. Use the peak marker function to determine the maximum amplitude level.
5. Add $10 \log(1/x)$, where x is the duty cycle.

For 5725 ~ 5850 MHz

Duty cycle < 98 %

1. Set RBW = 500 kHz, VBW = 3 MHz, Detector = RMS.
2. Set sweep time $\geq 10 \times (\text{number of points in sweep}) \times (\text{total on/off period of the transmitted signal})$.
3. Perform a single sweep.
4. Use the peak marker function to determine the maximum amplitude level.
5. Add $10 \log(1/x)$, where x is the duty cycle.

3.4.3 Test Setup



3.4.4 Test Result of Peak Power Spectral Density

Summary

Mode	PD (dBm/RBW)	EIRP PD (dBm/RBW)
5.15-5.25GHz	-	-
802.11ac VHT40_Nss1,(MCS0)_2TX	0.35	8.44
5.725-5.85GHz	-	-
802.11ac VHT40_Nss1,(MCS0)_2TX	-1.13	6.64

RBW = 500kHz for 5.725-5.85GHz band / 1MHz for other band;

Result

Mode	Result	DG (dBi)	Port 1 (dBm/ RBW)	Port 2 (dBm/ RBW)	PD (dBm/ RBW)	PD Limit (dBm/ RBW)	EIRP PD (dBm/ RBW)	EIRP PD Limit (dBm/ RBW)
802.11ac VHT40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-
5190MHz	Pass	8.09	-3.31	-2.50	0.10	8.91	8.19	17.00
5230MHz	Pass	8.09	-2.87	-2.35	0.35	8.91	8.44	17.00
5755MHz	Pass	7.77	-4.40	-4.09	-1.26	28.23	6.51	36.00
5795MHz	Pass	7.77	-4.11	-4.10	-1.13	28.23	6.64	36.00

RBW = 500kHz for 5.725-5.85GHz band / 1MHz for other band;

PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X power density;

DG = Directional Gain

For 5.15 ~ 5.25 GHz

Directional Gain = $5.08 + 10 \cdot \log(2/1) = 8.09 \text{ dBi} > 6 \text{ dBi}$

Limit shall be reduced to 11 dBm – (8.09 dBi – 6 dBi) = 8.91 dBm

For 5.725 ~ 5.85 GHz

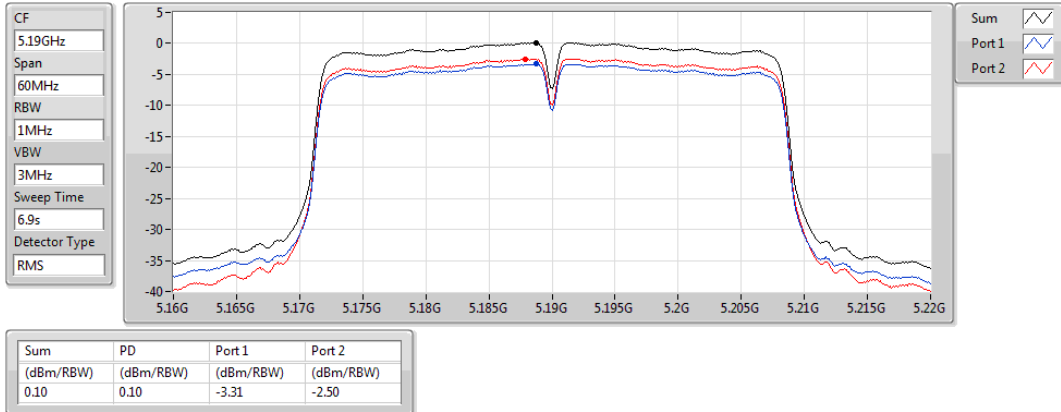
Directional Gain = $4.76 + 10 \cdot \log(2/1) = 7.77 \text{ dBi} > 6 \text{ dBi}$

Limit shall be reduced to 30 dBm – (7.77 dBi – 6 dBi) = 28.23 dBm

802.11ac VHT40_Nss1,(MCS0)_2TX

PSD

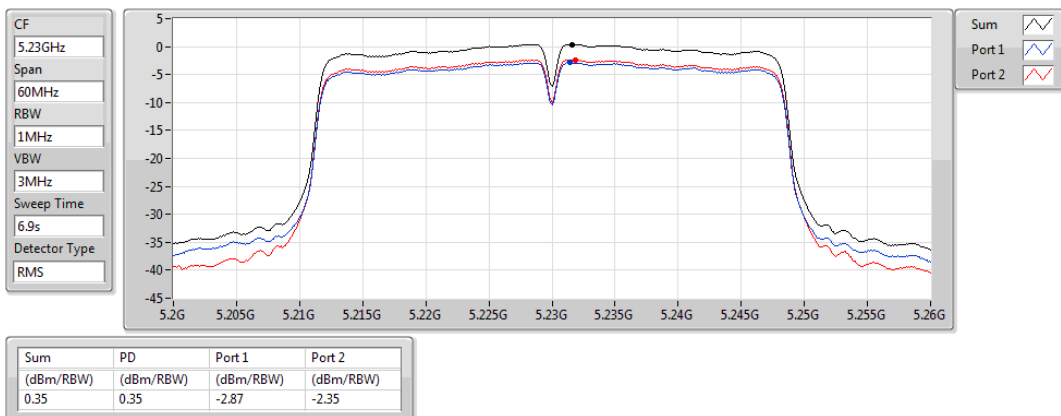
5190MHz



802.11ac VHT40_Nss1,(MCS0)_2TX

PSD

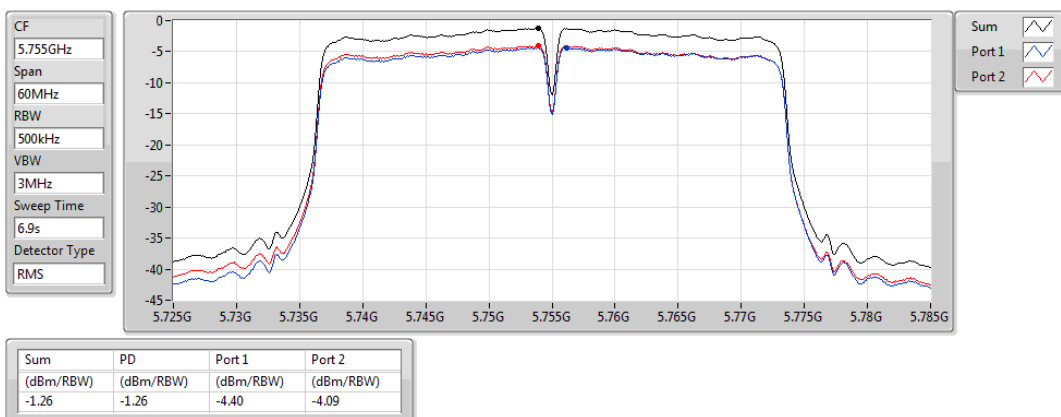
5230MHz



802.11ac VHT40_Nss1,(MCS0)_2TX

PSD

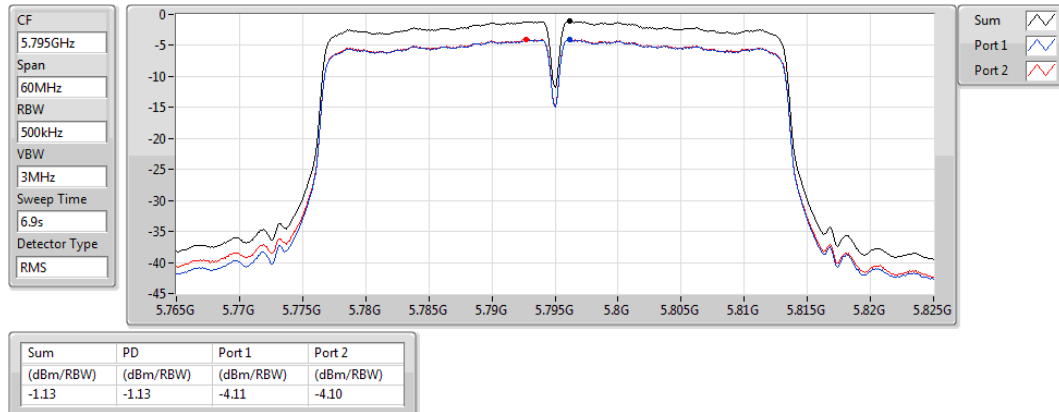
5755MHz



802.11ac VHT40_Nss1,(MCS0)_2TX

PSD

5795MHz



3.5 Transmitter Radiated and Band Edge Emissions

3.5.1 Limit of Transmitter Radiated and Band Edge Emissions

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9~90 kHz, 110~490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

Un-restricted band emissions above 1GHz Limit	
Operating Band	Limit
5.15 - 5.25 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.725 - 5.850 GHz	All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Note 1: Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

3.5.2 Test Procedures

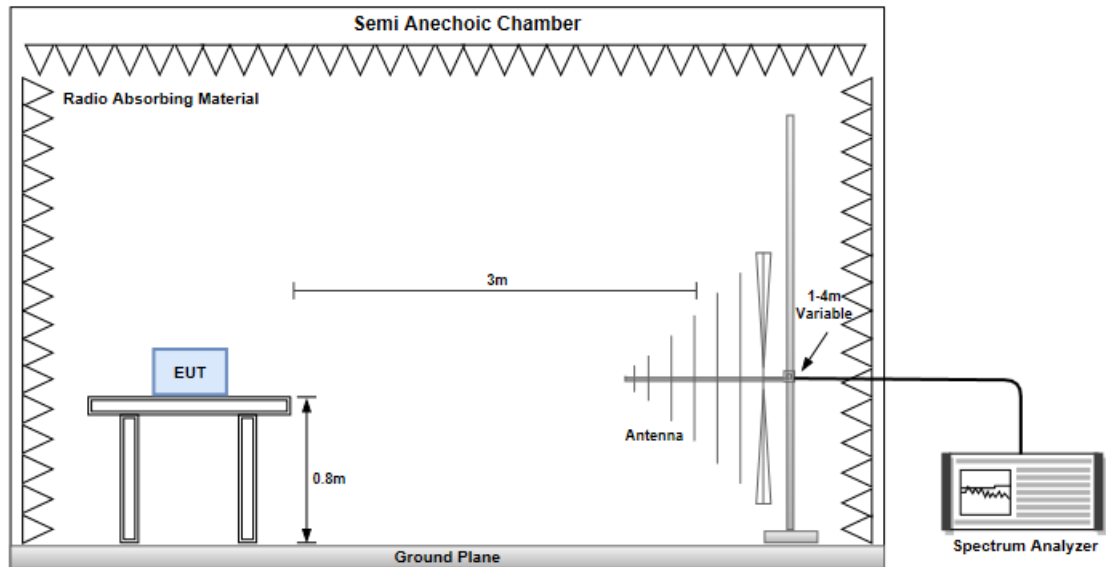
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

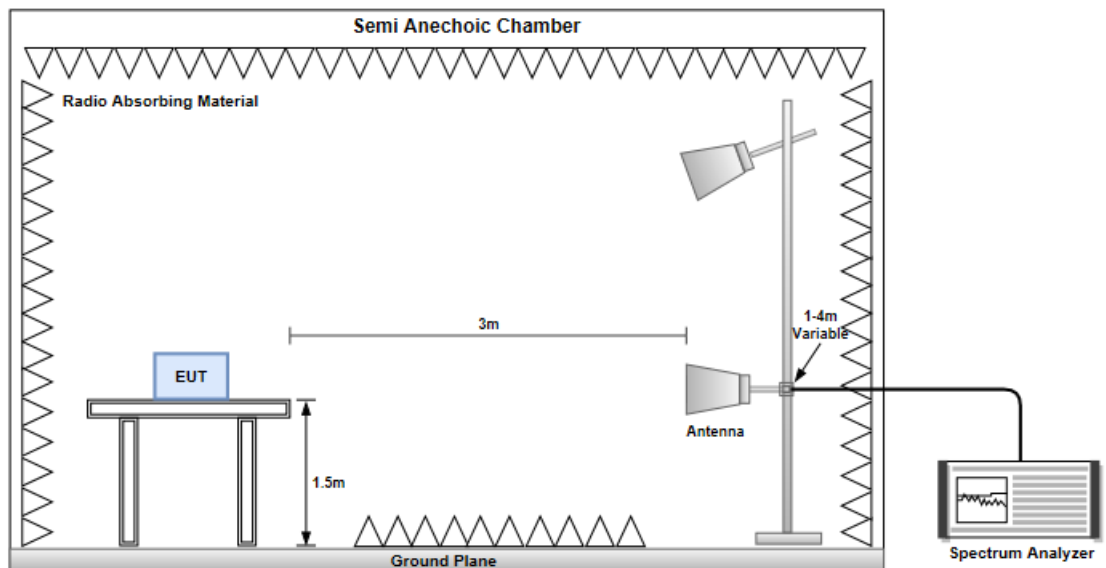
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

3.5.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	VHT40	Test Freq. (MHz)	5230
Polarization	Horizontal		
Level (dBuV/m)			

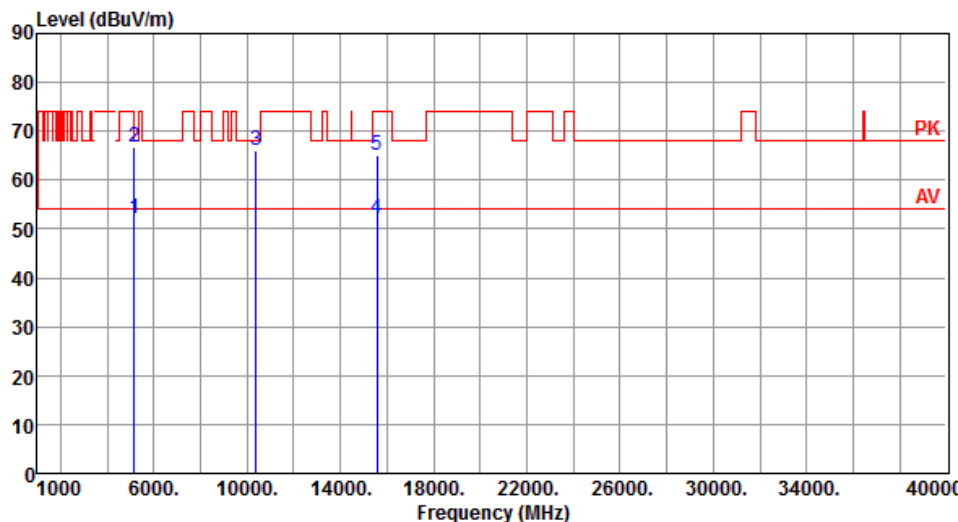
Modulation	VHT40	Test Freq. (MHz)	5230
Polarization	Vertical		
</			

Modulation	VHT40	Test Freq. (MHz)	5755
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation	VHT40	Test Freq. (MHz)	5755
Polarization	Vertical		
Level (dBUV/m) <			

3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz) for VHT40

Modulation	VHT40	Test Freq. (MHz)	5190
Polarization	Horizontal		



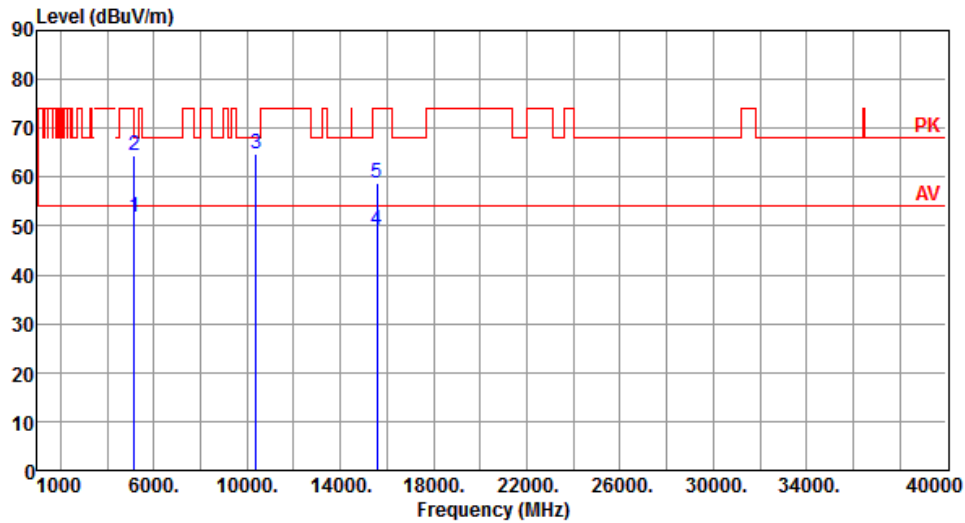
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	51.99	54.00	-2.01	47.45	4.54	Average	340	85
2	5150.00	66.72	74.00	-7.28	62.18	4.54	Peak	340	85
3	10380.00	66.16	68.20	-2.04	52.32	13.84	Peak	190	170
4	15570.00	51.98	54.00	-2.02	37.79	14.19	Average	100	305
5	15570.00	65.16	74.00	-8.84	50.97	14.19	Peak	100	305

Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

Modulation	VHT40	Test Freq. (MHz)	5190
Polarization	Vertical		



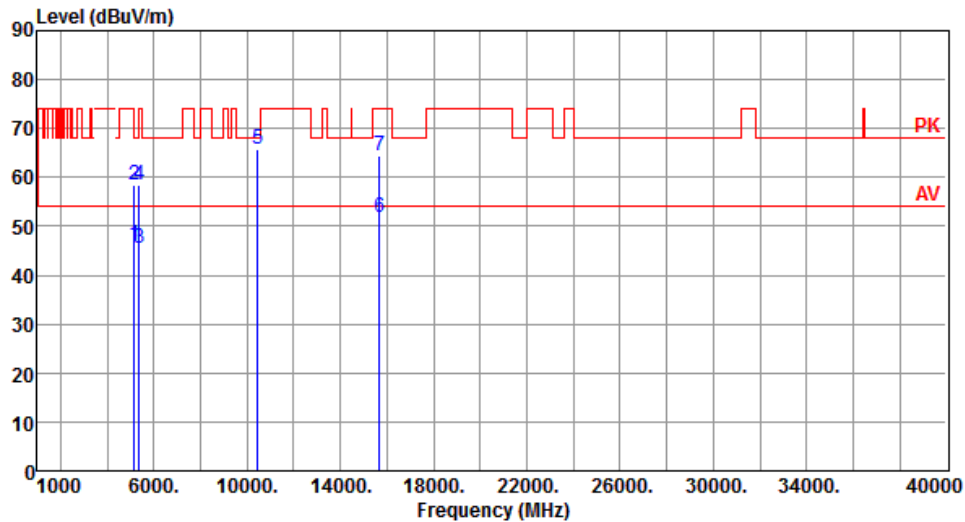
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	51.73	54.00	-2.27	47.19	4.54	Average	313	155
2	5150.00	64.56	74.00	-9.44	60.02	4.54	Peak	313	155
3	10380.00	64.66	68.20	-3.54	50.82	13.84	Peak	185	162
4	15570.00	48.99	54.00	-5.01	34.80	14.19	Average	100	287
5	15570.00	58.62	74.00	-15.38	44.43	14.19	Peak	100	287

Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

Modulation	VHT40	Test Freq. (MHz)	5230
Polarization	Horizontal		

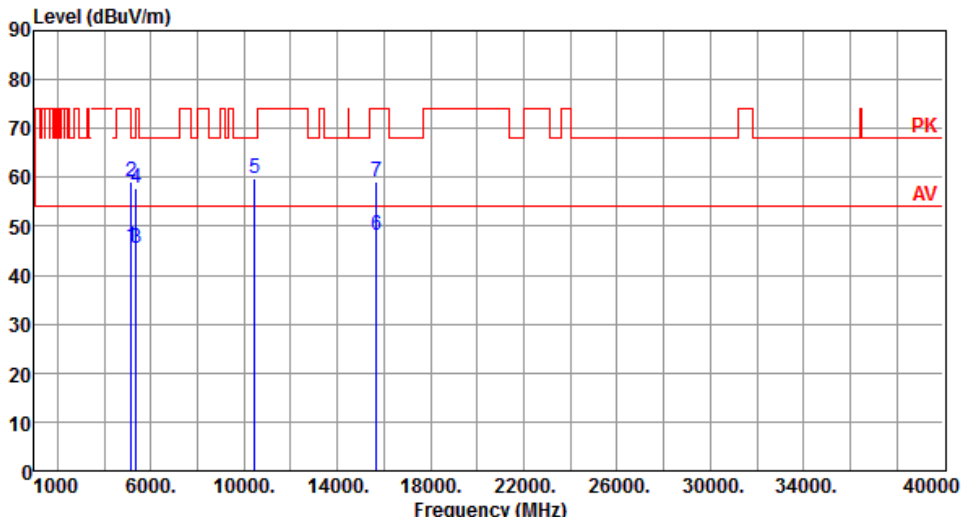


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	46.03	54.00	-7.97	41.49	4.54	Average	339	95
2	5150.00	58.55	74.00	-15.45	54.01	4.54	Peak	339	95
3	5350.00	45.44	54.00	-8.56	41.31	4.13	Average	339	95
4	5350.00	58.55	74.00	-15.45	54.42	4.13	Peak	339	95
5	10460.00	65.88	68.20	-2.32	51.99	13.89	Peak	195	165
6	15690.00	51.79	54.00	-2.21	37.86	13.93	Average	100	301
7	15690.00	64.55	74.00	-9.45	50.62	13.93	Peak	100	301

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

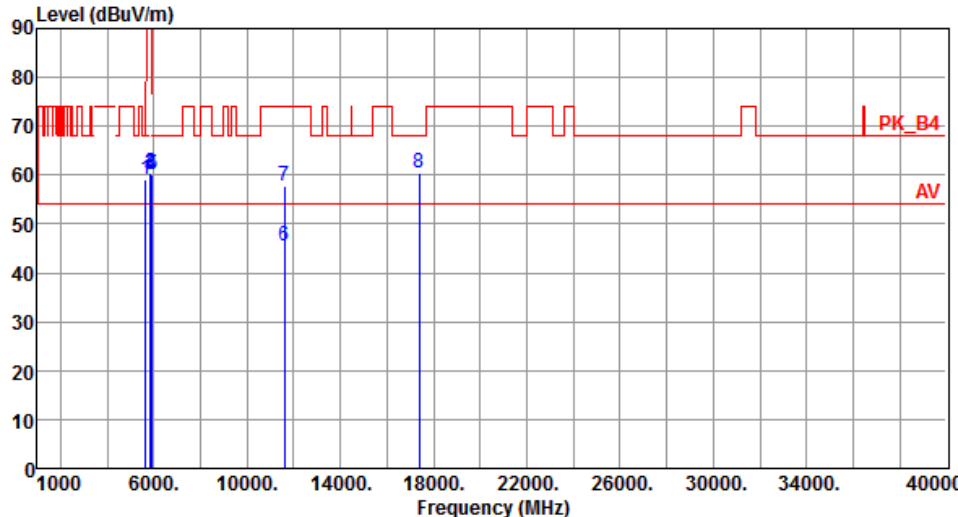
*Factor includes antenna factor , cable loss and amplifier gain

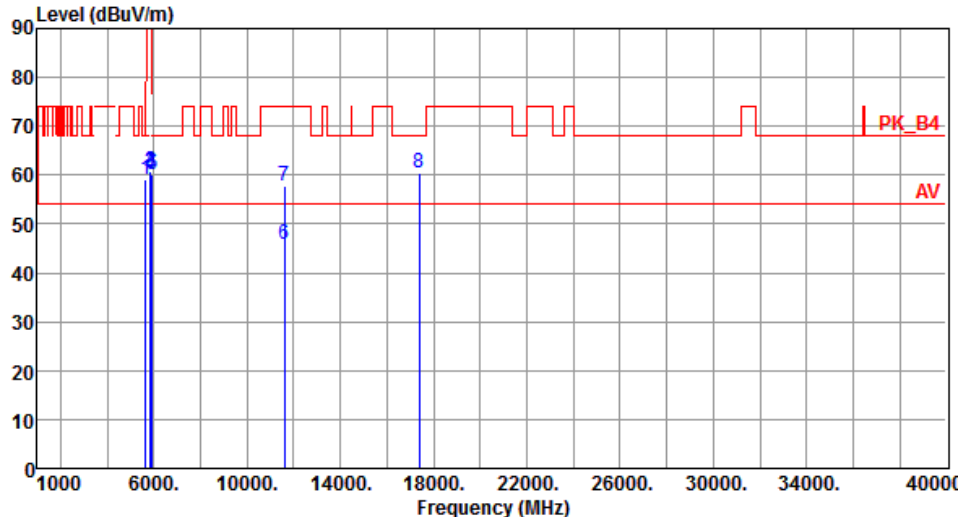
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	VHT40	Test Freq. (MHz)	5230																																																																																																				
Polarization	Vertical																																																																																																						
Level (dBuV/m)  Frequency (MHz) <table><thead><tr><th></th><th>Freq.</th><th>Emission</th><th>Limit</th><th>Margin</th><th>SA</th><th>Factor</th><th>Remark</th><th>ANT</th><th>Turn</th></tr><tr><th></th><th>MHz</th><th>level</th><th>dBuV/m</th><th>dB</th><th>reading</th><th>dB</th><th></th><th>High</th><th>Table</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>cm</th><th>deg</th></tr></thead><tbody><tr><td>1</td><td>5150.00</td><td>45.88</td><td>54.00</td><td>-8.12</td><td>41.34</td><td>4.54</td><td>Average</td><td>260</td><td>181</td></tr><tr><td>2</td><td>5150.00</td><td>58.98</td><td>74.00</td><td>-15.02</td><td>54.44</td><td>4.54</td><td>Peak</td><td>260</td><td>181</td></tr><tr><td>3</td><td>5350.00</td><td>45.55</td><td>54.00</td><td>-8.45</td><td>41.42</td><td>4.13</td><td>Average</td><td>260</td><td>181</td></tr><tr><td>4</td><td>5350.00</td><td>57.85</td><td>74.00</td><td>-16.15</td><td>53.72</td><td>4.13</td><td>Peak</td><td>260</td><td>181</td></tr><tr><td>5</td><td>10460.00</td><td>59.66</td><td>68.20</td><td>-8.54</td><td>45.77</td><td>13.89</td><td>Peak</td><td>112</td><td>150</td></tr><tr><td>6</td><td>15690.00</td><td>48.15</td><td>54.00</td><td>-5.85</td><td>34.22</td><td>13.93</td><td>Average</td><td>100</td><td>284</td></tr><tr><td>7</td><td>15690.00</td><td>59.21</td><td>74.00</td><td>-14.79</td><td>45.28</td><td>13.93</td><td>Peak</td><td>100</td><td>284</td></tr></tbody></table>					Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn		MHz	level	dBuV/m	dB	reading	dB		High	Table									cm	deg	1	5150.00	45.88	54.00	-8.12	41.34	4.54	Average	260	181	2	5150.00	58.98	74.00	-15.02	54.44	4.54	Peak	260	181	3	5350.00	45.55	54.00	-8.45	41.42	4.13	Average	260	181	4	5350.00	57.85	74.00	-16.15	53.72	4.13	Peak	260	181	5	10460.00	59.66	68.20	-8.54	45.77	13.89	Peak	112	150	6	15690.00	48.15	54.00	-5.85	34.22	13.93	Average	100	284	7	15690.00	59.21	74.00	-14.79	45.28	13.93	Peak	100	284
	Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn																																																																																														
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Modulation	VHT40	Test Freq. (MHz)	5755
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	VHT40	Test Freq. (MHz)	5755
Polarization	Vertical		
Level (dBuV/m) </			

Modulation	VHT40	Test Freq. (MHz)	5795																																																																																										
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 <table><tr><th></th><th>Freq. MHz</th><th>Emission level dBUV/m</th><th>Limit dBUV/m</th><th>Margin dB</th><th>SA reading dBUV</th><th>Factor dB</th><th>Remark</th><th>ANT High cm</th><th>Turn Table deg</th></tr><tr><td>1</td><td>5650.00</td><td>59.11</td><td>68.20</td><td>-9.09</td><td>54.14</td><td>4.97</td><td>Peak</td><td>325</td><td>316</td></tr><tr><td>2</td><td>5850.00</td><td>60.43</td><td>122.20</td><td>-61.77</td><td>54.62</td><td>5.81</td><td>Peak</td><td>325</td><td>316</td></tr><tr><td>3</td><td>5855.00</td><td>60.11</td><td>110.80</td><td>-50.69</td><td>54.28</td><td>5.83</td><td>Peak</td><td>325</td><td>316</td></tr><tr><td>4</td><td>5875.00</td><td>60.05</td><td>105.20</td><td>-45.15</td><td>54.15</td><td>5.90</td><td>Peak</td><td>325</td><td>316</td></tr><tr><td>5</td><td>5925.00</td><td>60.00</td><td>68.20</td><td>-8.20</td><td>53.91</td><td>6.09</td><td>Peak</td><td>325</td><td>316</td></tr><tr><td>6</td><td>11590.00</td><td>45.65</td><td>54.00</td><td>-8.35</td><td>31.76</td><td>13.89</td><td>Average</td><td>100</td><td>10</td></tr><tr><td>7</td><td>11590.00</td><td>57.95</td><td>74.00</td><td>-16.05</td><td>44.06</td><td>13.89</td><td>Peak</td><td>100</td><td>10</td></tr><tr><td>8</td><td>17385.00</td><td>60.55</td><td>68.20</td><td>-7.65</td><td>42.80</td><td>17.75</td><td>Peak</td><td>100</td><td>20</td></tr></table>					Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg	1	5650.00	59.11	68.20	-9.09	54.14	4.97	Peak	325	316	2	5850.00	60.43	122.20	-61.77	54.62	5.81	Peak	325	316	3	5855.00	60.11	110.80	-50.69	54.28	5.83	Peak	325	316	4	5875.00	60.05	105.20	-45.15	54.15	5.90	Peak	325	316	5	5925.00	60.00	68.20	-8.20	53.91	6.09	Peak	325	316	6	11590.00	45.65	54.00	-8.35	31.76	13.89	Average	100	10	7	11590.00	57.95	74.00	-16.05	44.06	13.89	Peak	100	10	8	17385.00	60.55	68.20	-7.65	42.80	17.75	Peak	100	20
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg																																																																																				
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8	17385.00	60.55	68.20	-7.65	42.80	17.75	Peak	100	20																																																																																				
Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).																																																																																													

Modulation	VHT40	Test Freq. (MHz)	5795																																																																																										
Polarization	Vertical																																																																																												
 <table><tr><th></th><th>Freq. MHz</th><th>Emission level dBUV/m</th><th>Limit dBUV/m</th><th>Margin dB</th><th>SA reading dBUV</th><th>Factor dB</th><th>Remark</th><th>ANT High cm</th><th>Turn Table deg</th></tr><tr><td>1</td><td>5650.00</td><td>59.15</td><td>68.20</td><td>-9.05</td><td>54.18</td><td>4.97</td><td>Peak</td><td>100</td><td>5</td></tr><tr><td>2</td><td>5850.00</td><td>60.73</td><td>122.20</td><td>-61.47</td><td>54.92</td><td>5.81</td><td>Peak</td><td>100</td><td>5</td></tr><tr><td>3</td><td>5855.00</td><td>60.52</td><td>110.80</td><td>-50.28</td><td>54.69</td><td>5.83</td><td>Peak</td><td>100</td><td>5</td></tr><tr><td>4</td><td>5875.00</td><td>60.23</td><td>105.20</td><td>-44.97</td><td>54.33</td><td>5.90</td><td>Peak</td><td>100</td><td>5</td></tr><tr><td>5</td><td>5925.00</td><td>60.11</td><td>68.20</td><td>-8.09</td><td>54.02</td><td>6.09</td><td>Peak</td><td>100</td><td>5</td></tr><tr><td>6</td><td>11590.00</td><td>45.95</td><td>54.00</td><td>-8.05</td><td>32.06</td><td>13.89</td><td>Average</td><td>241</td><td>140</td></tr><tr><td>7</td><td>11590.00</td><td>57.75</td><td>74.00</td><td>-16.25</td><td>43.86</td><td>13.89</td><td>Peak</td><td>241</td><td>140</td></tr><tr><td>8</td><td>17385.00</td><td>60.55</td><td>68.20</td><td>-7.65</td><td>42.80</td><td>17.75</td><td>Peak</td><td>100</td><td>320</td></tr></table>					Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg	1	5650.00	59.15	68.20	-9.05	54.18	4.97	Peak	100	5	2	5850.00	60.73	122.20	-61.47	54.92	5.81	Peak	100	5	3	5855.00	60.52	110.80	-50.28	54.69	5.83	Peak	100	5	4	5875.00	60.23	105.20	-44.97	54.33	5.90	Peak	100	5	5	5925.00	60.11	68.20	-8.09	54.02	6.09	Peak	100	5	6	11590.00	45.95	54.00	-8.05	32.06	13.89	Average	241	140	7	11590.00	57.75	74.00	-16.25	43.86	13.89	Peak	241	140	8	17385.00	60.55	68.20	-7.65	42.80	17.75	Peak	100	320
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3.6 Frequency Stability

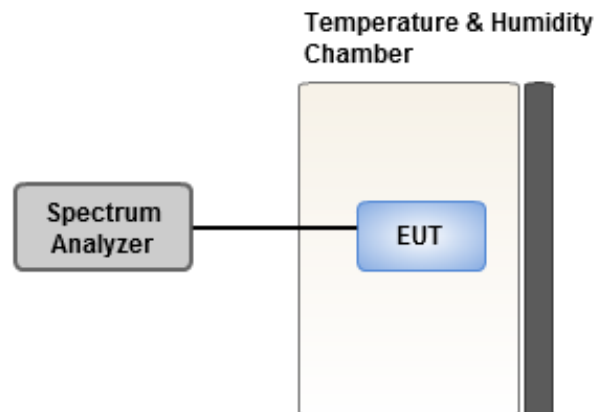
3.6.1 Limit of Frequency Stability

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

3.6.2 Test Procedures

1. The EUT is installed in an environment test chamber with external power source.
2. Set the chamber to operate at 20 centigrade and external power source to output at nominal voltage of EUT.
3. A sufficient stabilization period at each temperature is used prior to each frequency measurement.
4. When temperature is stabled, measure the frequency stability.
5. The test shall be performed under normal and extreme condition for temperature and voltage.

3.6.3 Test Setup



3.6.4 Test Result of Frequency Stability

Frequency: 5230 MHz	Frequency Drift (ppm)			
Temperature (°C)	0 minute	2 minutes	5 minutes	10 minutes
T20°C Vmax	6.76	5.80	6.65	6.10
T20°C Vmin	4.37	4.06	4.12	4.28
T50°C Vnom	3.60	3.20	4.04	3.40
T40°C Vnom	3.57	3.73	3.74	3.42
T30°C Vnom	3.11	2.90	2.83	3.09
T20°C Vnom	4.26	3.63	3.57	3.58
T10°C Vnom	3.49	3.55	3.51	3.11
T0°C Vnom	4.26	3.50	4.88	4.40
T-10°C Vnom	3.32	2.79	3.19	3.18
T-20°C Vnom	1.37	1.59	1.54	1.43
T-30°C Vnom	1.06	1.16	1.14	1.51
Vnom [Vac]: 120		Vmax [Vac]: 138		Vmin [Vac]: 102
Tnom [°C]: 20		Tmax [°C]: 50		Tmin [°C]: -30

Frequency: 5795 MHz	Frequency Drift (ppm)			
Temperature (°C)	0 minute	2 minutes	5 minutes	10 minutes
T20°C Vmax	6.66	6.54	6.61	7.19
T20°C Vmin	4.55	4.12	3.97	4.46
T50°C Vnom	3.02	3.41	3.31	3.17
T40°C Vnom	3.50	3.42	3.37	2.99
T30°C Vnom	3.48	3.38	3.53	3.51
T20°C Vnom	4.80	4.26	4.34	4.08
T10°C Vnom	2.80	3.30	3.62	3.64
T0°C Vnom	4.36	4.36	3.88	4.26
T-10°C Vnom	3.83	3.30	3.69	3.52
T-20°C Vnom	1.81	2.23	2.19	1.77
T-30°C Vnom	1.30	1.02	1.26	1.34
Vnom [Vac]: 120		Vmax [Vac]: 138		Vmin [Vac]: 102
Tnom [°C]: 20		Tmax [°C]: 50		Tmin [°C]: -30

4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

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Kwei Shan

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No. 3-1, Lane 6, Wen San 3rd St.,
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Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

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Email: ICC_Service@icertifi.com.tw

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