



FCC RADIO TEST REPORT

FCC ID	: UZ7WCMTB
Equipment	: Touch Computer
Brand Name	: Zebra
Model Name	: WCMTB
Applicant	 Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742
Manufacturer	: Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742
Standard	FCC Part 15 Subpart C §15.247

The product was received on Feb. 08, 2023 and testing was performed from Feb. 10, 2023 to Apr. 03, 2023. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu Sporton International Inc. Wensan Laboratory No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issue Date
FR311909C	01	Initial issue of report	Mar. 31, 2023
FR311909C	FR311909C02Add Sample 2 information and dataThis report is an updated version, replacing the report issued on Mar. 31, 2023.		Apr. 06, 2023



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)	Power Output Measurement	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
	45 047(d)	Conducted Band Edges	Pass	-
3.4	15.247 (u)	Conducted Spurious Emission	Pass	-
		Radiated Band Edges and Radiated		1.40 dB
3.5	15.247(d)	Spurious Emission	Pass	under the limit at
			ļ′	2390.000 MHz
		1	1	15.38 dB
3.6	15.207	AC Conducted Emission	Pass	under the limit at
		ļ!	ļ'	0.190 MHz
3.7	15.203	Antenna Requirement	Pass	-

Conformity Assessment Condition:

 The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.

2. The measurement uncertainty please refer to each test result in "Uncertainty of Evaluation".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Keven Cheng Report Producer: Cindy Liu

1 General Description

1.1 Product Feature of Equipment Under Test

	Product Information
Equipment	Touch Computer
Brand Name	Zebra
Model Name	WCMTB
Sample 1	Scanner(SE4710)
Sample 2	Scanner(SE5500)
FCC ID	UZ7WCMTB
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/LTE/5G NR/NFC/GNSS WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80/VHT160 WLAN 11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE
HW Version	DV
SW Version	13-09-16.00-TG-U00-STD-ATH-04
FW Version	FUSION_QA_4_1.0.0.017_T
MFD	16MAR23
EUT Stage	Identical Prototype

Remark: The EUT's information above was declared by manufacturer.

Specification of Accessories						
Battery 1 Standard Battery (3800mAh)	Brand Name	Zebra	Model Number	BT-000473		

Suppor	Support Unit used in test configuration and system						
Battery 2 Standard BLE Beacon Battery (3800mAh)	Brand Name	Zebra	Model Number	BT-000473B			
Battery 3 Extended Battery (5200mAh)	Brand Name	Zebra	Model Number	BT-000473E			
Adapter USB Wall Charger	Brand Name	Zebra	Part Number	PWR-WUA5V12W0US			
Earphone 1 3.5mm PTT Headset	Brand Name	Zebra	Part Number	HDST-35MM-PTT1-01			
Earphone 2 USB-C Audio Headset	Brand Name	Zebra	Part Number	HDST-USBC-PTT1-01			
USB Cable (Type C to Type A)	Brand Name	Zebra	Part Number	CBL-TC5X-USBC2A-01			
Type C-Audio Cable (Type C to 3.5mm)	Brand Name	Zebra	Part Number	ADP-USBC-35MM1-01			
Trigger Handle	Brand Name	Zebra	Part Number	TRG-TC2L-SNP1-01			



1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard					
Tx/Rx Channel Frequency Range	x Channel Frequency Range 2412 MHz ~ 2462 MHz				
Maximum Output Power to Antenna	MIMO <ant. 7+8=""> 802.11b : 23.71 dBm / 0.2350 W 802.11g : 23.61 dBm / 0.2296 W 802.11n HT20 : 22.37 dBm / 0.1726 W 802.11n HT40 : 22.46 dBm / 0.1762 W 802.11ac VHT20: 22.42 dBm / 0.1746 W 802.11ac VHT40: 22.61 dBm / 0.1824 W 802.11ax HE20: 22.47 dBm / 0.1766 W 802.11ax HE40: 22.66 dBm / 0.1845 W</ant.>				
99% Occupied Bandwidth	MIMO <ant. 7=""> 802.11b : 13.64 MHz 802.11g : 18.18 MHz 802.11ax HE20 : 19.63 MHz 802.11ax HE40 : 38.06 MHz MIMO <ant. 8=""> 802.11b : 13.84 MHz 802.11g : 18.18 MHz 802.11g : 18.18 MHz 802.11ax HE20 : 20.18 MHz</ant.></ant.>				
Antenna Type / Gain	<ant. 7="">: IFA Anten <ant. 8="">: IFA Anten</ant.></ant.>	na with gain -1.20 na with gain -1.79	6 dBi 9 dBi		
Type of Modulation	802.11b : DSSS (DB 802.11g/n : OFDM (B 802.11ac : OFDM (B 802.11ax : OFDMA (BPSK / QPSK / 160	8PSK / DQPSK / 1 8PSK / QPSK / 1 8PSK / QPSK / 16 0000 / 64000 / 2	CCK) 6QAM / 64QAM) 6QAM / 64QAM / 2 56QAM / 1024QA	56QAM) M)	
Antenna Function Description	802.11 b/g/n/ac/ax MIMO 802.11 ax	Ant. 7 V	Ant. 8 V		
	TXBF	V	V		

Remark:

- 1. MIMO Ant. 7+8 Directional Gain is a calculated result from MIMO Ant. 7 and MIMO Ant. 8. The formula used in calculation is documented in section 1.2.1.
- 2. Power of MIMO Ant. 7 + Ant.8 is a calculated result from sum of the power MIMO Ant. 7 and MIMO Ant. 8.
- 3. 802.11ax Support Tx Beamforming mode, and the manufacturer declares that Tx Beamforming power/EIRP is less than CDD mode 3dbm, so CDD mode cover Tx Beamforming mode.
- 4. The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

1.2.1 Antenna Directional Gain

<For CDD Mode>

Follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)f)ii)

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows:

For power measurements on IEEE 802.11 devices,

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

 $G_{\mbox{\scriptsize ANT}}$ is set equal to the gain of the antenna having the highest gain.

For PSD measurements, the directional gain calculation.

Array Gain = 10 log(NANT/NSS) dB.

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

 N_{SS} = the number of independent spatial streams of data;

 N_{ANT} = the total number of antennas

 $g_{j,k} = 10^{G_k/20}$ if the *k*th antenna is being fed by spatial stream *j*, or zero if it is not; G_k is the gain in dBi of the kth antenna.

As minimum N_{SS}=1 is supported by EUT, the formula can be simplified as:

Directional gain = $10^{100} \log[(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2 / N_{ANT}] dBi$

Where G1, G2....GN denote single antenna gain.

The directional gain "DG" is calculated as following table.

			DG	DG	Power	PSD
			for	for	Limit	Limit
	Ant 7	Ant 8	Power	PSD	Reduction	Reduction
	(dBi)	(dBi)	(dBi)	(dBi)	(dB)	(dB)
2.4GHz	-1.26	-1.79	-1.26	1.49	0.00	0.00

Calculation example:

If a device has two antenna, G_{ANT1} = -1.26dBi; G_{ANT2} = -1.79dBi Directional gain of power measurement = max(-1.26, -1.79) + 0 = -1.26 dBi Directional gain of PSD derived from formula which is 10 x log { { [10^ (-1.26 dBi / 20) + 10^ (-1.79 dBi / 20)] ^ 2 } / 2 } = 1.49 dBi

Power and PSD limit reduction = Composite gain - 6dBi, (min = 0)

<For TXBF modes>

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

 N_{SS} = the number of independent spatial streams of data;

 N_{ANT} = the total number of antennas

 $g_{j,k} = 10^{G_k/20}$ if the *k*th antenna is being fed by spatial stream *j*, or zero if it is not; G_k is the gain in dBi of the kth antenna.

The EUT supports beamforming for 802.11ac modes.

The directional gain calculation is following F)2)e)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain "DG" is calculated as following table.

			DG	DG	Power	PSD
			for	for	Limit	Limit
	Ant 7	Ant 8	Power	PSD	Reduction	Reduction
	(dBi)	(dBi)	(dBi)	(dBi)	(dB)	(dB)
2.4GHz	-1.26	-1.79	1.49	1.49	0.00	0.00

Calculation example:

Directional gain is derived from formula which is

10 x log { { [10^ (-1.26 dBi / 20) + 10^ (-1.79 dBi / 20)] ^ 2 } / 2 } = 1.49 dBi

Power and PSD limit reduction = Composite gain - 6dBi, (min = 0)



1.3 Modification of EUT

No modifications made to the EUT during the testing.

1.4 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Toot Site No	Sporton Site No.
Test Site NO.	TH05-HY, CO07-HY, 03CH11-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

1.5 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

- 1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
- 2. The TAF code is not including all the FCC KDB listed without accreditation.
- 3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	1	2412	7	2442
	2	2417	8	2447
2400 2482 5 MU-	3	2422	9	2452
2400-2483.5 MHZ	4	2427	10	2457
	5	2432	11	2462
	6	2437		



2.2 Test Mode

This device support 26/52/106/242/484-tone RU.

The PSD of partial RU is reduced to be smaller than full RU according to TCB workshop interim guidance Oct. 2018.

The 802.11ax mode is investigated among different tones, full resource units (RU), partial resource units. The partial RU has no higher power than full RU's, thus the full RU is chosen as main test configuration.

The 242-tone RU is covered by 20MHz channel, 484-tone RU is covered by 40MHz channel.

The SISO mode conducted power is covered by MIMO mode per chain, so only the MIMO mode is tested.

The power for 802.11n and 802.11ac mode is smaller than 802.11ax mode, so all other conducted and radiated test is covered by 802.11ax mode.

The final test modes include the worst data rates for each modulation shown in the table below.

MIMO Antenna

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20 (Covered by HE20)	MCS0
802.11n HT40 (Covered by HE40)	MCS0
802.11ac VHT20 (Covered by HE20)	MCS0
802.11ac VHT40 (Covered by HE40)	MCS0
802.11ax HE20	MCS0
802.11ax HE40	MCS0

Remark: The conducted power level of each chain in MIMO mode is equal or higher than SISO mode.

Test Cases		
AC Conducted	Mode 1 :WLAN (2.4GHz) Link + Bluetooth Link + Camera (Rear) + Battery 1 +	
Emission	USB Cable (Charging from Adapter) for Sample 1	



<Sample 1 with Battery 1>

Ch #	2400-2483.5 MHz			
UII. #	802.11b	802.11g	802.11ax HE20	802.11ax HE40
Low	01	01	01	03
Middle	06	06	06	06
High	11	11	11	09

<Sample 1 with Battery 2>

Ch. #	2400-2483.5 MHz
	802.11g
Low	01
Middle	-
High	-

<Sample 1 with Battery 3>

Ch. #	2400-2483.5 MHz
	802.11g
Low	01
Middle	-
High	-

<Sample 2 with Battery 1>

Ch. #	2400-2483.5 MHz
	802.11g
Low	01
Middle	-
High	-

Remark: For radiation spurious emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.



2.3 Connection Diagram of Test System





<WLAN Tx Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	ASUS	RT-AC52	N/A	N/A	Unshielded, 1.8 m
2.	Notebook	Dell	P79G	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	Bluetooth Earphone	Kinyo	BTE-3622	N/A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility "QRCT v4.0.00206.0" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB). = 4.2 + 10 = 14.2 (dB)



3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
- 2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- 5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) \ge 3 * RBW.
- 6. Measure and record the results in the test report.

3.1.4 Test Setup



EUT

Spectrum Analyzer



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

MIMO <Ant. 7+8>

<802.11b>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11g>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



<802.11ax HE20>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11ax HE40>







3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna with directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

- 1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
- 2. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.
- 5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
- 2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz.
 Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.
- 7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (c): Measure and add $10 \log(N_{ANT}) dB$.

With this technique, spectrum measurements are performed at each output of the device, but rather than summing the spectra or the spectral peaks across the outputs, the quantity 10 $log(N_{ANT})$ dB is added to each spectrum value before comparing to the emission limit. The addition of 10 $log(N_{ANT})$ dB serves to apportion the emission limit among the N_{ANT} outputs so that each output is permitted to contribute no more than 1/N_{ANT} th of the PSD limit.

3.3.4 Test Setup



Spectrum Analyzer



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

<802.11b>



<802.11g>





<802.11ax HE20>



<802.11ax HE40>



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
- The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup





3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Number of TX = 2, Ant. 7 (Measured)





Test Mode :	802.11b	Test Channel :	06
100k	Hz PSD reference Level	Cł	nannel Plot
Spectrum Ref Lovel 20.00 dBm Offset 31 Att 20 dB 9 IPk Maxi Interference 10 dBm Interference 10 dBm Interference -10 dBm Interference -30 dBm Interference -40 dBm Interference -50 dBm Interference -50 dBm Interference -70 dBm Interference -70 dBm Interference -70 dBm Interference Interference Interference -70 dBm Interference Interference Interference Anterference Interference -70 dBm Interference Interference Interference	30 dB @ RBW 100 kHz 1.1 ms @ VBW 300 kHz Mode Sweep M111 1.1.82 dBm 2.4379950 GHz M111 2.4379950 GHz M111 1.1.82 dBm		
Spuriou	us Emission 30MHz~1GHz	Spurious Em	ission 1GHz~26.5GHz
Spectrum Ref Level 20.00 dBm Offset 31 Att 10 dB SWT 30 ID dBm 10 dBm 10 dBm 10 dBm 10 dBm -10 dBm -10 dBm -10 dBm -10 dBm -10 dBm -20 dBm -1.8.180 dBm -30 dBm -60 dBm -70 dBm -70 dBm -70 dBm -80 dBm -10 dBm -70	30 dB @ RBW 100 kHz 0.1 ms @ VBW 300 kHz MI[1] -47.12 dBm 770.4570 MHz Image: State of the state of t	Spectrum Ref Level 20.00 dBm Att 10 dB SWT 255 ms In dB M1 10 dBm -10 dBm -10 dBm -20 dBm -30 dBm -40 dBm -30 dBm -50 dBm -70 dBm -70 dBm	BW 100 IH2 BW 300 IH2 Mode Sweep M1[1] 10.18 dBm 2.436680 GH2 M2[1] M2[1] -34.17 dBm 15.562140 GH2 M2[1] -34.17 dBm 15.562140 GH2 M2 -34.17 dBm 15.562140 GH2 M2 -34.17 dBm 15.562140 GH2 M2 -3000 H2 M2 -3000 H2 M2 -3000 H2 M2 -3000 H2
Date: 1.MAR.2023 20:20:02	Measuring 🚺 🦗 🥼	Date: 1.MAR.2023 20:20:22	Measuring 🗰 🦛 🥼











Test Mode :	802.11g	Test Channel :)6
100k	Hz PSD reference Level	Ch	annel Plot
Spectrum Offset 30.00 dbm Offset 31 Att 20 db SWT ID dbm M1 0 dbm 10 dbm M1 0 dbm -10 dbm	.30 db e RBW 100 kHz		
GF 2.437 GHz Date: 1.MAR.2023 21:05:10 Spurior	us Emission 30MHz~1GHz	Spurious Emi	ssion 1GHz~26.5GHz
Spectrum Ref Level 20.00 dBm Offset 33 Att 10 dB SWT 3	30 d8 ● RBW 100 kHz ©.1 ms ● VBW 300 kHz Mode Sweep	Spectrum Ref Level 20.00 dBm Offset 31.30 dB RB Att 10 dB SWT 255 ms VB	₩ 100 kHz ₩ 300 kHz W 300 kHz
1Pk View 10 dBm 0 dBm -10 dBm	M1[1] -47.05 dBm 947.3470 MHz		M1[1] 6.09 dBm 2.432630 GHz
-20. d8m - 01 -20.950 d8m		-20.d8m01 -20.950 d8m	
-60 d8m	30001 pts	-50 dBm	30001 pts Stop 26.5 GHz
Date: 1.MAR.2023 21:05:45		Date: 1.MAR.2023 21:06:07	





















Test Mode :	802.11ax HE40	Test Channel : 06
100	KHz PSD reference Level	Channel Plot
Spectrum		
Att 20 dB SWT	1 ms VBW 300 kHz Mode Sweep	_
The max	M1[1] 3.3 2.421992	JBm GHz
10 dBm		
0 dBm	falsenhabelighededen og presek ok algeboer og alle borke her her her her her her her her her he	
-10 dBm		_
-20 dBm		
-30 dBm		
renovation	1 Weisen	ulu,
-40 dBm		
-50 dBm		_
-60 dBm		—
-70 dBm		_
CF 2.437 GHz	1001 pts Span 57.12	iHz _
	Measuring	
Date: 1.MAR.2023 22:20:03		
Spurio	us Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
•		•
Spectrum		Spectrum
Ref Level 20.00 dBm Offset 3	31.30 dB • RBW 100 kHz	Ref Level 20.00 dBm Offset 31.30 dB RBW 100 kHz E 4tt 10 dB SWT 255 ms = VBW 200 kHz
ID UB 3WT ID UB 3WT	30.1 ms • VBW 300 km2 M00e Sweep	
10 dBm	957.532	10 dbm 4/11
		17.647120 GHz
U dBm		
-10 dBm		
-20 dBm		
-30 dBm		
-40 dBm		
150.dBm		
-60 dBm		-60 dam-
70 40-		
-70 dBm		-70 0011
Start 30.0 MHz	30001 pts Stop 1.0	Hz Start 1.0 GHz 30001 pts Stop 26.5 GHz
Date: 1.MAR.2023 22:20:44	riedsuring	Date: 1.MAR.2023 22:21:01







Number of TX = 2, Ant. 8 (Measured)





Test Mode :	802.11b	Test Channel :	06
100k	Hz PSD reference Level	Cr	nannel Plot
Spectrum Ref Level 20.00 dBm Offset 31 Att 20 dB SWT SWT I D dBm	30 dB = RBW 100 kHz 1.1 ms = VBW 300 kHz Mode Sweep		
Spurio	us Emission 30MHz~1GHz	Spurious Em	ission 1GHz~26.5GHz
Spectrum Ref Level 20.00 dBm Offset 31 Att 10 dB SWT 3 IPL View 10 dBm 10 dBm 10 dBm 10 dBm 10 dBm 10 dBm 10 dBm -10 dBm -10 dBm -10 dBm -10 dBm -30 dBm -17.480 dBm -30 dBm -40 dBm -30 dBm -10 dBm -17.480 dBm -30 dBm -30 dBm -30 dBm -40 dBm -50 dBm -50 dBm -50 dBm -50 dBm -50 dBm -70 dBm -50 dBm -50 dBm -50 dBm	30 dB @ RBW 100 kHz 3.1 ms @ VBW 300 kHz Mode Sweep M1[1] 979.3880 MHz 979.3880 MHz M1[1] 979.3880 MHz M1[1] 979.3880 MHz M1[1] 979.3880 MHz M1 M1 M1 M1 M2 M2 M3 M4 M4	Spectrum Ref Level 20.00 dBm Offset 31.30 dB R f 10 dB SWT 255 ms VI 10 dB SWT 255 ms VI 10 dB	3W 100 kHz Mode Sweep M1[1] 12.68 dBm
Date: 1.MAR.2023 20:24:14	edou pra actor Lo Gre	Date: 1.MAR.2023 20:24:36	Measuring











Test Mode :	802.11g	Test Channel : 06	
100k	Hz PSD reference Level	Chan	nel Plot
Spectrum Ref Level 20.00 dBm Offset 3 Att 20 dB PJPk Max M 10 dBm M -10 dBm M -20 dBm	Image: NSU reference Level 1.30 dB • RBW 100 kHz 1 ms • VBW 300 kHz Mode Sweep M1[1] 9.84 dBm 2.4319800 GHz MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM		
Date: 1.MAR.2023 21:09:09	us Emission 30MHz~1GHz	Spurious Emissi	ion 1GHz~26.5GHz
Spectrum Ref Level 20.00 dBm Offset 3 Att 10 dB SWT 3	1.30 dB ● RBW 100 kHz 30.1 ms ● VBW 300 kHz Mode Sweep	Spectrum Ref Level 20.00 dBm Offset 31.30 dB RBW 100 Att 10 dB SWT 255 ms VBW 300	0 kHz 0 kHz Mode Sweep
PPL View D dBm D d	M1[1] -47.55 dBm 754.8410 MHz 754.8410 MHz 1 754.8410 MHz 1 1	• 10 dBm • 0 •	M1[1] 6.74 dBm 2.434300 GHz M2[1] -34.51 dBm 15.800000 GHz 15.800000 GHz 15.80000 GHZ 15.800000 GHZ 15.800000 GHZ 15.800000 GHZ 15.8000000 GHZ 15.8000000000000000000000000000000000000
Date: 1.MAR.2023 21:10:52		Date: 1.MAR.2023 21:11:10	







Test Mode :	802.11ax HE20	Test Channel : 01
100k	Hz PSD reference Level	Channel Plot
Spectrum Ref Level 20.00 dBm Offset 31 • 1Pk Max 10 dBm 10 dBm 0 dBm -20 dBm -20 dBm -20 dBm -30 dBm -50 dBm -50 dBm -70 dBm -70 dBm	30 dB = RBW 100 kHz 1.1 ms = VBW 300 kHz Made Sweep M1[1] 8.55 dB M1[1] 8.55 dB M1[1] 8.55 dB M1[1] 8.55 dB M1[1] 100 kHz M1[1] 8.55 dB M1[1] M1[1] 8.55 dB M1[1] M1[1] 8.55 dB M1[1] M1[1]	Spectrum Image: Constraint of the second secon
Date: 1.MAR.2023 21:31:26	us Emission 30MHz~1GHz	Date: 1.MAR.2023 21:32:22 Spurious Emission 1GHz~26.5GHz
Spectrum Ref Level 20.00 dBm Offset 31. Att 10 dB SWT 30	.30 dB ● RBW 100 kHz 0.1 ms ● VBW 300 kHz Mode Sweep	Spectrum Image: Constraint of the second secon
DPL View D dBm D dBm O dBm -10 dBm -20 dBm O1 -21.450 dBm -30 dBm -40 dBm	M1[1] 46.55 de 984.8520 Mi 984.8520 Mi Image: State of the state of t	e1Pk View M1[1] 4.52 dBm 10 dBm -M2[1] 2.409600 GHz 0 dBm -M2[1] 17.619920 GHz 0 dBm - - -10 dBm - - -30 dBm - - -40 dBm - - -40 dBm - -
-60 dBm -70	30001 pts Stop 1.0 GH; Measuring	-60 dBm -70 dBm -70 dBm -70 dBm Start 1.0 GHz 30001 pts Start 1.0 GHz 30001 pts Date: 1.1MAR.2023 21:32:08



Test Mode :	802.11ax HE20	Test Channel :	06				
100	kHz PSD reference Level	CI	Channel Plot				
Spectrum Ref Level 20.00 dBm Offset Att 20 dB SWT ID k Max 10 dBm Max	31.30 dB • RBW 100 kHz 1.1 ms • VBW 300 kHz Mode Sweep M1 M1 M1 M1 M1 M1 M1 M1 M1 M1	7.98 dBm 119669 GHz					
-10 dBm -ad/beh/Www -30 dBm -40 dBm -50 dBm							
-60 dBm -70 dBm CF 2.437 GHz Date: 1.MAR.2023 21:39:10	1001 pts Span 28.	.4625 MHz)					
Spurio	ous Emission 30MHz~1GHz	Spurious Em	ission 1GHz~26.5GHz				
Spectrum Ref Level 20.00 dBm Offset Att 10 dB SWT IDk View 10 dBm 0 0 0 dBm 0 0 0 0 -10 dBm 0 0 0 0 -30 dBm 0 -22.020 dBm -30 dBm -40 dBm -60 dBm -60 dBm -60 dBm -70 dBm -70 dBm -70 dBm -70 dBm	31.30 dB • RBW 100 kHz 30.1 ms • VBW 300 kHz Mode Sweep M1[1] 692 M1[1] 69	Spectrum Ref Level 20.00 dBm Offset 31.30 dB = R 47.42 dBm 10 dB SWT 255 ms V 9.7000 MHz 0 dBm 10 dB gm 10 dB gm V 0 dBm	BW 100 kHz BW 300 kHz M1[1] 4.63 dBm 2.433480 GHz M2[1] 3.9.1 dBm 15.885130 GHz				
Start 30.0 MHz	30001 pts Sta	Start 1.0 GHz Date: 1.MAR.2023 21:40:10	30001 pts Stop 26.5 GHz				



Test Mode	:	802.11ax	HE20			Test	Channel	:	11				
	100kl	Hz PSD ro	eference L	_evel				C	hannel I	Plot			
Spectrum						Spectrur	n						₽
Ref Level 20.00 dBm Att 20 dB	Offset 31. SWT 1	30 dB 👄 RBW 100 k 1.1 ms 👄 VBW 300 k	Hz Hz Mode Sweep			Ref Leve	20 dBm Offse 20 dB SWT	et 31.30 dB 👄 F 8 ms 👄 V	RBW 100 kHz /BW 300 kHz M	ode Sweep			
●1Pk Max			M1[1]		6.73 dBm	●1Pk View				M1[1]		-35	i.47 dBm
10 dBm				2.4	669838 GHz	10 dBm						2.4841	LO30 GHz
0 dBm	whendred	handrenny	monortenational	warmany		0 dBm	- And Andrewson and a	wide					
10 d8m						10 dBm							
-10 dBm						-10 0811							
-20 dBm				× ×	n	-20 dBm-	D1 -23.270 dBm						
N. JURANA					Wester	-30 dBm		Think N	1				
-40 dBm									Mittal al Mittal Market	ANN	ana	, Nichter und sie	vidadaanin
-50 dBm						-50 dBm							
-60 d8m						-60 dBm							
oo abiii						oo abiii							
-70 dBm						-70 dBm-		F1					
CF 2.462 GHz		100	L pts	Span 27	7.4125 MHz	Start 2.43	GHz		8001 pts			Stop 2.5	565 GHz
			Measu		///		Л			Measur	ing 🚺		///
Date: 1.MAR.2023 21:	40:40					Date: 1.MA	R.2023 21:48:10						
S	puriou	ıs Emissi	on 30MHz	z~1GHz			Spurie	ous Em	ission 1	GHz~2	6.5GH	z	
Spectrum					Ē	Spectrur							
Ref Level 20.00 dBm	Offset 31.	30 dB 👄 RBW 100 k	Hz		(v	Ref Leve	20.00 dBm Offse	et 31.30 dB 👄 F	RBW 100 kHz				(♥)
Att 10 dB ID dB	SWI 30	J.1 ms 🖶 VBW 300 k	Hz Mode Sweep			Att 1Pk View	10 08 501	255 ms 🖷 🕻	VBW 300 KHZ M	ode Sweep			
10 10-			M1[1]	62	-46.74 dBm 9.6830 MHz	to dow				M1[1]		2.453	3.60 dBm 3030 GHz
10 dBm						M1				_m2[1]		15.895	5330 GHz
0 dBm						0 dBm							
-10 dBm						-10 dBm							
-20 dBm						-20 dBm							
-30 dBm	dBm					-30 dBm-	+D1 -23.270 dBm			M2			
										And In Am	halanda a		
-40 dBm			MI		1 also	-40 dBm—	and the selected of the second	وجوارا القلاء ومروال وروروا	a dia manda di ang pada si	HT BALLER	And and the state of the		the hold see
A FO A BOARD AND A DECEMPTION AND A DECE	مية السرق إيراء إير ها الترم محمد الرواب المراجع عن الرواب المراجع	ماه المنافقة ويرجعها ومحمد الطاقة هليان. ماه الانتقاعة ويرجعها ويجمع المانية المنافقة والمانية	and a second		Sports Statistics	and the second se	and the state of the second	ditan enditionità difficienta	And the second s				
-60 dBm						-60 dBm							
-70 dBm						-70 dBm-							
Start 30.0 MHz		3000	1 pts Measu	ring 🚺 🖬 🕯	op 1.0 GHz	Start 1.0 0	GHz		30001 pts	Measur	ing	Stop 2	6.5 GHz
Date: 1.MAR.2023 21:	47:10				111.	Date: 1.MA	R.2023 21:47:40						111



Test Mode :	802.11ax HE40	Test Chan	nel : 03	
100	kHz PSD reference Level		Channel Plot	
Spectrum Ref Level 20.00 dBm Offset Att 20 dB SWT PIPk Max 10 dBm 0 dBm -10 dBm -20 dBm	31.30 dB • RBW 100 kHz 1.1 ms • VBW 300 kHz Mode Sweep M1[1]	Spectrum Ref Level 20.00 dBm 6.57 dBm 2.4170070 GHz 0 dBm -10 dBm -20 dBm -20 dBm -10 dBm	Offset 31.30 dB RBW 100 kHz Mode Sweep SWT 8 ms VBW 300 kHz Mode Sweep	-30.33 dBm 2.3999240 GHz
-40 dBm -50 dBm -60 dBm -70		So dem 	8001 pts	Stop 2,445 GHz
Spectrum Ref Level 20.00 dBm Offset Att 10 dB SWT	31.30 db • RBW 100 kHz 30.1 ms • VBW 300 kHz Mode Sween	2 Spectrum Ref Level 20.00 dBm Att 10 dB	Offset 31.30 dB • RBW 100 kHz SWT 255 ms • VBW 300 kHz Mode Sween	20.3GHZ (♥)
10 dB SWT 10 dB SWT 10 dB SWT 10 dB SWT 10 dBm 0 dBm 0 dBm -10 dBm -20 dBm -20 dBm -30 dBm -30 dBm -40 dBm -50 dBm -70 dBm -70 dBm Start 30.0 MHz	30.1 ms • vBW 300 kH2 Mode Sweep	Att 10 dB -46.91 dBm 9 Pk View 9 Pk View 10 dBm 0 dBm 10 dBm 10 dBm 0 dBm -10 dBm	SW1 255 ms VBW 300 kH2 Mode Sweep M1[1]	2.59 dBm 2.424990 GHz -34.30 dBm 17.638620 GHz
Date: 1.MAR.2023 22:12:48		Date: 1.MAR.2023 22:	13:07	



Test Mode :	802.11ax HE40	Test Channel :	06			
100k	Hz PSD reference Level	Channel Plot				
Spectrum Ref Level 20.00 dBm Offset 3 10 dBm 0 0 dBm 0 -10 dBm	1.30 dB = RBW 100 kHz Image: Mode Sweep 1.30 dB = RBW 100 kHz Mode Sweep M1[1] 4.16 dBr M1[1] <th></th> <th></th>					
Spectrum	us Emission 30MHz~1GHz ্ল	Spurious Em	nission 1GHz~26.5GHz			
Ref Level 20.00 dBm Offset 3 Att 10 dB SWT	1.30 dB RBW 100 kHz 30.1 ms VBW 300 kHz Mode Sweep	Ref Level 20.00 dBm Offset 31.30 dB = 1 Att 10 dB SWT 255 ms = 1	RBW 100 kHz VBW 300 kHz Mode Sweep			
1Pk View 10 dBm 10 dBm 0 dBm -10 dBm -20 dBm -20 dBm -30 dBm -30 dBm -40 dBm -40 dBm -50 dBm -70	M1[1] 46.15 dBr 982.9120 MH 982.9120 M		M1[1] 0.77 dBm 2.431700 GHz 			
Date: 1.MAR.2023 22:23:00		Date: 1.MAR.2023 22:23:43				



Test Mode :	802.11ax HE40		Test Chann	iel : 09		
10	0kHz PSD reference	e Level		Chanı	nel Plot	
Caratana			(free stream)			
Ref Level 20.00 dBm Offs	et 31.30 dB 👄 RBW 100 kHz		Ref Level 20.00 dBm	Offset 31.30 dB 👄 RBW 100	kHz	
Att 20 dB SW1 IPk Max	F 1.1 ms VBW 300 kHz Mode Swee	əb	Att 20 dB IPk View	SWT 8 ms - VBW 300	kHz Mode Sweep	
	M1[1]	4.21 dBm 2.4557780 GHz			M1[1]	-34.86 dBm 2.4875280 GHz
10 dBm-	M1		10 dBm-			
0 dBm	ala market alaphatic baser preserver about	- Investallishad at the	o deni la setta ana ante	With State Party and		
-10 dBm			-10 dBm			
-20 dBm			-20 dBm			
			D1 -25.790 dt	Bm		
-3U asm		When how we have	30 dBm	Mala Helinian and		والمتعالية المتعالية
-40 dBm			-40 dBm		(ARCAN ALANA ARCAN ARCAN ARCAN ARCAN	and an
-50 dBm			-50 dBm			
-60 dBm			-60 dBm			
-70 dBm			-70 dBm-	F1		
CF 2.452 GHz	1001 pts	Span 55.62 MHz	Start 2.43 GHz	800	01 pts	Stop 2.565 GHz
		leasuring			Measuring	
Spur	Tous Emission 30M	HZ~1GHZ	Spi	urious Emissi	on 1GHZ~26.	5GHZ
Spectrum			Spectrum			
Att 10 dB SW1	et 31.30 dB 👄 RBW 100 kHz 7 30.1 ms 👄 VBW 300 kHz - Mode Swee	əp	Att 10 dB	Offset 31.30 dB RBW 100 SWT 255 ms VBW 300	kHz kHz Mode Sweep	
●1Pk View	M1[1]	-46.82 dBm	●1Pk View		M1[1]	1.37 dBm
10 dBm		928.8210 MHz	10 dBm		M2[1]	2.453880 GHz -35.02 dBm
0 dBm			M1			15.863030 GHz
-10 dBm			-10 d2m			
-20 dBm			-20 dBm			
-30 dBm			-30 dem	Bm	M2	
-40 dBm			.40 d8m		March day an	
-+o ubii		M1	- Culture and a second	and the second		
CSCI CIB III and the tradicities of the state of the stat	a fan fersteren in de ferse in de felse en jere ferste ferste felste en sen de en felse en sen ferste felse in Negel felse en sen felse in de en jere gegen de felse in de en sen en sen sen sen felse in de felse in de felse					
-60 dBm			-60 dBm			
-70 dBm			-70 dBm			
Start 30.0 MHz	30001 pts	Stop 1.0 GHz	Start 1.0 GHz	300	01 pts	Stop 26.5 GHz
Date: 1.MAR.2023 22:31:01			Date: 1.MAR.2023 22:3	11:28		

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
- 2. The EUT is 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.
- 3. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
- 4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".

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- 7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".
- 8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW = 100 kHz for f < 1 GHz; VBW \ge RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3 MHz for $f \ge 1$ GHz for peak measurement.

For average measurement:

- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



Spectrum Analyzer / Receiver

For radiated test from 1GHz to 18GHz





For radiated test above 18GHz



3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.



3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission	Conducted Limit (dBµV)				
(MHz)	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.

3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

- 1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
- 6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
- 7. The frequency range from 150 kHz to 30 MHz is scanned.
- Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.



3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 20, 2022	Feb. 22, 2023~ Apr. 03, 2023	Sep. 19, 2023	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1212	1GHz~18GHz	Mar. 10, 2022	Feb. 22, 2023~ Mar. 08, 2023	Mar. 09, 2023	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-01620	1GHz~18GHz	Aug. 24, 2022	Mar. 09, 2023~ Apr. 03, 2023	Aug. 23, 2023	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA9170	00993	18GHz~40GHz	Nov. 24, 2022	Feb. 22, 2023~ Apr. 03, 2023	Nov. 23, 2023	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 09, 2022	Feb. 22, 2023~ Apr. 03, 2023	Nov. 08, 2023	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-30 3	17100018000 55007	1GHz~18GHz	Jun. 15, 2022	Feb. 22, 2023~ Apr. 03, 2023	Jun. 14, 2023	Radiation (03CH11-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	Jun. 28, 2022	Feb. 22, 2023~ Apr. 03, 2023	Jun. 27, 2023	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 07, 2022	Feb. 22, 2023~ Apr. 03, 2023	Oct. 06, 2023	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Feb. 22, 2023~ Apr. 03, 2023	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Feb. 22, 2023~ Apr. 03, 2023	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Feb. 22, 2023~ Apr. 03, 2023	N/A	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Feb. 22, 2023~ Apr. 03, 2023	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 10, 2022	Feb. 22, 2023~ Mar. 06, 2023	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 07, 2023	Mar. 07, 2023~ Apr. 03, 2023	Mar. 06, 2024	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz-30MHz	Mar. 10, 2022	Feb. 22, 2023~ Mar. 06, 2023	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	30MHz-18GHz	Mar. 10, 2022	Feb. 22, 2023~ Mar. 06, 2023	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801595/2	30MHz-18GHz	Nov. 23, 2022	Feb. 22, 2023~ Mar. 06, 2023	Nov. 22, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801595/2	30MHz-40GHz	Mar. 07, 2023	Mar. 07, 2023~ Apr. 03, 2023	Mar. 06, 2024	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	9K~30M	Mar. 07, 2023	Mar. 07, 2023~ Apr. 03, 2023	Mar. 06, 2024	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	30MHz-40GHz	Mar. 07, 2023	Mar. 07, 2023~ Apr. 03, 2023	Mar. 06, 2024	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-15 30-8000-40SS	SN11	1.53GHz Low Pass Filter	Sep. 12, 2022	Feb. 22, 2023~ Apr. 03, 2023	Sep. 11, 2023	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0SS	SN3	3GHz High Pass Filter	Sep. 12, 2022	Feb. 22, 2023~ Apr. 03, 2023	Sep. 11, 2023	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTM-303B	TP140325	N/A	Nov. 07, 2022	Feb. 22, 2023~ Apr. 03, 2023	Nov. 06, 2023	Radiation (03CH11-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Feb. 16, 2023	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Feb. 16, 2023	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBE CK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Nov. 01, 2022	Feb. 16, 2023	Oct. 31, 2023	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 16, 2022	Feb. 16, 2023	Mar. 15, 2023	Conduction (CO07-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 01, 2022	Feb. 16, 2023	Nov. 30, 2023	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Mar. 04, 2022	Feb. 16, 2023	Mar. 03, 2023	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	9kHz~7GHz	Fed. 24, 2022	Feb. 16, 2023	Feb. 23, 2023	Conduction (CO07-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 17, 2022	Feb. 10, 2023~ Mar. 08, 2023	Nov. 16, 2023	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO 12 (NO:113)	10MHz~6GHz	Dec. 13, 2022	Feb. 10, 2023~ Mar. 08, 2023	Dec. 12, 2023	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101905	10Hz - 40GHz(amp)	Aug. 03, 2022	Feb. 10, 2023~ Mar. 08, 2023	Aug. 02, 2023	Conducted (TH05-HY)



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence	
of 95% ($U = 2Uc(v)$)	3.46 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	6 30 dB
of 95% (U = 2Uc(y))	0.50 UB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence	4 40 dB
of 95% (U = 2Uc(y))	4.40 UB

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.80 dB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	5 20 dP
of 95% (U = 2Uc(y))	5.30 dB

Appendix A. Test Result of Conducted Test Items

Test Engineer:	River Tsai / Hank Hsu	Temperature:	21~25	°C
Test Date:	2023/2/10~2023/3/8	Relative Humidity:	51~54	%

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TEST RESULTS DATA 6dB and 99% Occupied Bandwidth

	2.4GHz Band MIMO											
Mod. Data Rate NT			CH.	Freq. (MHz)	99% Occ (M	upied BW Hz)	6dB (M	BW Hz)	6dB BW Limit (MHz)	Pass/Fail		
					Ant7	Ant8	Ant7	Ant8				
11b	1Mbps	2	1	2412	13.39	13.34	8.08	8.10	0.50	Pass		
11b	1Mbps	2	6	2437	13.64	13.84	8.10	8.10	0.50	Pass		
11b	1Mbps	2	11	2462	13.44	13.44	8.12	8.10	0.50	Pass		
11g	6Mbps	2	1	2412	17.08	17.18	16.10	15.98	0.50	Pass		
11g	6Mbps	2	6	2437	18.18	18.18	16.34	16.34	0.50	Pass		
11g	6Mbps	2	11	2462	17.13	17.13	16.08	16.10	0.50	Pass		

TEST RESULTS DATA Average Output Power

2.4GHz Band MIMO																		
Mod. Data Rate		Ntx	CH.	Freq. (MHz)	Average Conducted Power (dBm)		e ed	Conducted Power Limit (dBm)		DG (dBi)		DG EIRP (dBi) (dBm)		EIRP Power Limit (dBm)		Pass /Fail		
					Ant7	Ant8	SUM	Ant7	Ant8	Ant7	Ant8	Ant7	Ant8	Ant7	Ant8			
11b	1Mbps	2	1	2412	20.40	20.80	23.61	30.	.00	-1.	26	22	.35	36	.00	Pass		
11b	1Mbps	2	6	2437	20.50	20.90	23.71	30.	.00	-1.	26	22	.45	36	.00	Pass		
11b	1Mbps	2	11	2462	20.70	20.70	23.71	30.	.00	-1.	26	22	22.45		22.45		.00	Pass
11g	6Mbps	2	1	2412	20.10	20.20	23.16	30.	.00	-1.	26	21.90		36	.00	Pass		
11g	6Mbps	2	6	2437	20.40	20.80	23.61	30.	.00	-1.	-1.26		22.35		22.35 36.00		.00	Pass
11g	6Mbps	2	11	2462	19.20	19.20	22.21	30.	.00	-1.	26	20.95		36	.00	Pass		
HT20	MCS0	2	1	2412	19.10	19.60	22.37	30.	.00	-1.	26	21.11		36	.00	Pass		
HT20	MCS0	2	6	2437	19.10	19.50	22.31	30.	.00	-1.26		-1.26 21.05		36	.00	Pass		
HT20	MCS0	2	11	2462	18.60	18.70	21.66	30.	.00	-1.	-1.26		-1.26 20.40		.40	36	.00	Pass
HT40	MCS0	2	3	2422	19.30	19.60	22.46	30.	.00	-1.26 21.20		.20	36	.00	Pass			
HT40	MCS0	2	6	2437	18.20	18.40	21.31	30.	.00	-1.	26	20	.05	36	.00	Pass		
HT40	MCS0	2	9	2452	18.20	18.20	21.21	30.	.00	-1.	26	19	.95	36	.00	Pass		
VHT20	MCS0	2	1	2412	19.10	19.70	22.42	30.	.00	-1.	26	21	.16	36	.00	Pass		
VHT20	MCS0	2	6	2437	19.10	19.60	22.37	30.	.00	-1.	26	21	.11	36	.00	Pass		
VHT20	MCS0	2	11	2462	18.60	18.80	21.71	30.	.00	-1.	-1.26 20.45		.45	36	.00	Pass		
VHT40	MCS0	2	3	2422	19.50	19.70	22.61	30	.00	-1.	-1.26		-1.26 21.35		.35	36	.00	Pass
VHT40	MCS0	2	6	2437	18.20	18.50	21.36	30	.00	-1.	26	20.10		36	.00	Pass		
VHT40	MCS0	2	9	2452	18.20	18.30	21.26	30	.00	-1.26		20.00		36	.00	Pass		

Note: Measured power (dBm) has offset with cable loss.

<u>TEST RESULTS DATA</u> Peak Power Spectral Density

	2.4GHz Band MIMO													
Mod. Da Ra	Data	Nтx	CH.	Freq.		Peak PSD (dBm/3kHz))	D (d	G Bi)	Peak Lii (dBm/	: PSD mit /3kHz)	Pass/Fail		
	Nate			(101112)	Ant7	Ant8	Worse + 3.01	Ant7	Ant8	Ant7	Ant8			
11b	1Mbps	2	1	2412	-3.86	-3.29	-0.28	1.4	49	8.	00	Pass		
11b	1Mbps	2	6	2437	-3.32	-2.55	0.46	1.49		8.	00	Pass		
11b	1Mbps	2	11	2462	-2.76	-3.13	0.25	1.4	1.49		1.49		00	Pass
11g	6Mbps	2	1	2412	-6.11	-5.91	-2.90	1.49		1.49 8.00		Pass		
11g	6Mbps	2	6	2437	-6.40	-6.28	-3.27	1.49		8.	00	Pass		
11g	6Mbps	2	11	2462	-7.22	-8.15	-4.21	1.49		1.49		8.	00	Pass

Measured power density (dBm) has offset with cable loss.

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TEST RESULTS DATA 6dB and 99% Occupied Bandwidth

	2.4GHz Band MIMO											
Mod.	Data Rate	Ντx	CH.	Freq. (MHz)	RU Config	99% Occupied BW (MHz)		BW 6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail	
						Ant7	Ant8	Ant7	Ant8	Ī		
HE20	MCS0	2	1	2412	Full	19.38	19.43	18.85	18.55	0.50	Pass	
HE20	MCS0	2	6	2437	Full	19.63	20.18	19.03	18.98	0.50	Pass	
HE20	MCS0	2	11	2462	Full	19.38	19.38	19.00	18.28	0.50	Pass	
HE40	MCS0	2	3	2422	Full	37.96	37.96	37.52	37.44	0.50	Pass	
HE40	MCS0	2	6	2437	Full	38.06	38.16	38.08	38.16	0.50	Pass	
HE40	MCS0	2	9	2452	Full	37.86	37.86	37.20	37.08	0.50	Pass	