Prüfbericht-Nr.: *Test report no.:*	CN22MB93 (P15C-WiFi) 001	**Auftrags-Nr.:** *Order no.*:	238547861	
Kunden-Referenz-Nr.: *Client reference no.:*	N/A	**Auftragsdatum:** *Order date:*	2022-09-14	
Auftraggeber: *Client:*	Adtran Inc 901 Explorer Blvd. Huntsville			
Prüfgegenstand: *Test item:*	2x2 AX Dual-band AP			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	BSAP 6020			
Auftrags-Inhalt: *Order content*:	FCC Part 15C Test report (WiFi 2.4GHz)			
Prüfgrundlage: *Test specification:*	FCC 47CFR Part 15: Subpart C Section 15.247			

Wareneingangsdatum: *Date of sample receipt:*	2022-09-16
Prüfmuster-Nr.: *Test sample no:*	A003337100-001
Prüfzeitraum: *Testing period:*	2022-10-08 - 2022-11-19
Ort der Prüfung: *Place of testing:*	EMC/RF Taipei Testing Site
Prüflaboratorium: *Testing laboratory:*	Taipei Testing Laboratories
Prüfergebnis*: *Test result*:*	Pass

überprüft von: *compiled by:*		**genehmigt von:** authorized by:	
Datum: *Date:* 2023-02-09	Ethan Shao	**Ausstellungsdatum:** *Issue date:* 2023-02-09	Brenda Chen
Stellung / *Position:*	Assistant Project Engineer	**Stellung** / *Position:*	Senior Project Manager

Sonstiges / *Other:*

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
V05

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.247(b) & 15.203	Antenna Requirement	Pass
5.1.2	15.247(b)(3)	Peak Output Power	Pass
5.1.3	15.247(a)(2)	6 dB Bandwidth	Pass
5.1.3	2.1049	99% Occupied Bandwidth	Pass
5.1.4	15.247(e)	Power Spectral Density	Pass
5.1.5	15.247(d)	Conducted Spurious Emissions and Band Edges	Pass
5.1.6	15.247(d) & 15.205 & 15.209	Radiated Spurious Emissions and Band Edges	Pass
5.2.1	15.207	Mains Conducted Emission	Pass

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

Contents

HISTORY OF THIS TEST REPORT 5

1. GENERAL REMARKS 6
1.1 COMPLEMENTARY MATERIALS 6
1.2 DECISION RULE OF CONFORMITY 6

2. TEST SITES 7
2.1 TEST LABORATORY 7
2.2 TEST FACILITY 7
2.3 TRACEABILITY 8
2.4 CALIBRATION 8
2.5 MEASUREMENT UNCERTAINTY 8

3. GENERAL PRODUCT INFORMATION 9
3.1 PRODUCT FUNCTION AND INTENDED USE 9
3.2 SYSTEM DETAILS AND RATINGS 9
3.3 NOISE GENERATING AND NOISE SUPPRESSING PARTS 10
3.4 SUBMITTED DOCUMENTS 10

4. TEST SET-UP AND OPERATION MODES 11
4.1 PRINCIPLE OF CONFIGURATION SELECTION 11
4.2 CARRIER FREQUENCY AND CHANNEL 11
4.3 TEST OPERATION AND TEST SOFTWARE 12
4.4 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT 14
4.5 TEST SETUP DIAGRAM 14
4.6 DUTY CYCLE OF TEST SIGNAL 16

5. TEST RESULTS 17
5.1 TRANSMITTER REQUIREMENT & TEST SUITES 17
5.1.1 Antenna Requirement 17
5.1.2 Peak Output Power 18
5.1.3 6 dB Bandwidth and 99% Occupied Bandwidth 25
5.1.4 Power Spectral Density 26
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100 kHz Bandwidth 27
5.1.6 Radiated Spurious Emissions and Band Edges 28
5.2 MAINS EMISSION 33
5.2.1 Mains Conducted Emission 33

APPENDIX A - TEST RESULT OF CONDUCTED

APPENDIX B - TEST RESULT OF RADIATED EMISSIONS & MAINS CONDUCTED EMISSION

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN22MB93 (P15C-WiFi) 001	Original Release	2023-02-09

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:
Appendix A - Test Result of Conducted
Appendix B - Test Result of Radiated Emissions & Mains Conducted Emission
Appendix SP - Photographs of Test Setup
Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.247
FCC 47CFR Part 2: Subpart J Section 2.1049
ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02
KDB 662911 D01 Multiple Transmitter Output v02r01

1.2 Decision Rule of Conformity

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

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

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

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 180491
ISED Registration No.: 25563

2.3 Traceability

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

2.4 Calibration

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

2.5 Measurement Uncertainty

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

Emission Measurement Uncertainty

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

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a 2x2 AX Dual-band AP. It contains a WLAN compatible module enabling the user to communicate data through a Wireless interface.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	2x2 AX Dual-band AP
Type Identification	BSAP 6020
FCC ID	HDCBSAP6020

Technical Specification of EUT

Item	EUT information	
Operating Frequency	2412 MHz ~ 2462 MHz	
Channel Number	802.11b/g/n/ac/ax HT20/VHT20/HE20: 11 802.11n/ac/ax HT40/VHT40/HE40: 7	
Data Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n/ac/ax: up to MCS11	
Operation Voltage	12 Vdc (Adapter) 54 Vdc (POE Injector)	
Modulation	DSSS (DBPSK, DQPSK, CCK) OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) OFDMA (1024QAM)	
Maximum Output Power (mW)	CDD Mode	802.11b: 598.53
		802.11g: 675.37
		802.11n HT20: 689.57
		802.11n HT40: 473.96
		802.11ac VHT20: 684.75
		802.11ac VHT40: 474.05
		802.11ax HE20: 709.66
		802.11ax HE40: 494.55
	Beamforming Mode	802.11ac VHT20: 342.4
		802.11ac VHT40: 237.04
		802.11ax HE20: 354.85
		802.11ax HE40: 247.29
Antenna Information	Refer to 5.1.1	
Accessory Device	Refer to 4.4	

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

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

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

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

Table for Parameters of Test Software Setting

802.11b		802.11g		802.11n HT20 802.11ac VHT20 802.11ax HE20		802.11n HT40 802.11ac VHT40 802.11ax HE40	
Channel	Power Setting	Channel	Power Setting	Channel	Power Setting	Channel	Power Setting
1	23	1	18	1	16.5	3	17
6	22.5	2	20	2	20.5	6	18.5
10	20.5	6	23	6	23	8	17
11	19.5	11	21	11	20	9	15.5

4.2 Carrier Frequency and Channel

802.11b, 802.11g, 802.11n HT20, 802.11ac VHT20, 802.11ax HE20:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432		
6	2437		
7	2442		

802.11n HT40, 802.11ac VHT40, 802.11ax HE40:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442
4	2427	8	2447
5	2432	9	2452
6	2437		

4.3 Test Operation and Test Software

Setup for testing: Test samples are provided with a LAN interface which makes it possible to control them through a test software installed on a notebook computer.
This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed as below.

Test Software	QSPR

The samples were used as follows:
A003337100-001

Full test was applied on all test modes, but only worst case was shown.
The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and receivers.

Modulation Mode	Tx Function
802.11b	2TX (MIMO)
802.11g	2TX (MIMO)
802.11n HT20	2TX (MIMO)
802.11n HT40	2TX (MIMO)
802.11ac VHT20	2TX (MIMO)
802.11ac VHT40	2TX (MIMO)
802.11ax HE20	2TX (MIMO)
802.11ax HE40	2TX (MIMO)

* The modulation and bandwidth are similar for 802.11n mode HT20/HT40 and 802.11ac mode VHT20/VHT40 and 802.11ax mode HE20/HE40, therefore investigated worse case as representative mode in test report.
** For Beamforming mode, only the output power is evaluated and presented in this report.

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

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

Antenna Port Conducted Measurement

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Date Rate (Mbps)
CDD	802.11b	1 to 11	1, 6, 10, 11	1.0
	802.11g	1 to 11	1, 2, 6, 11	6.0
	802.11n HT20 (Power only)	1 to 11	1, 2, 6, 11	MCS0
	802.11n HT40 (Power only)	3 to 9	3, 6, 8, 9	MCS0
	802.11ac VHT20 (Power only)	1 to 11	1, 2, 6, 11	NSS1 MCS0
	802.11ac VHT40 (Power only)	3 to 9	3, 6, 8, 9	NSS1 MCS0
	802.11ax HE20	1 to 11	1, 2, 6, 11	NSS1 MCS0
	802.11ax HE40	3 to 9	3, 6, 8, 9	NSS1 MCS0
Beamforming (Power only)	802.11ac VHT20	1 to 11	1, 2, 6, 11	NSS1 MCS0
	802.11ac VHT40	3 to 9	3, 6, 8, 9	NSS1 MCS0
	802.11ax HE20	1 to 11	1, 2, 6, 11	NSS1 MCS0
	802.11ax HE40	3 to 9	3, 6, 8, 9	NSS1 MCS0

Radiated Spurious Emissions (Above 1 GHz)

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Date Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	1.0
-	802.11g	1 to 11	1, 6, 11	6.0
-	802.11ax HE20	1 to 11	1, 6, 11	NSS1 MCS0
-	802.11ax HE40	3 to 9	3, 6, 9	NSS1 MCS0

Radiated Spurious Emissions (Below 1 GHz)

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Date Rate (Mbps)
-	802.11ax HE20	1 to 11	6	NSS1 MCS0

Mains Conducted Emission

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

EUT Configure Mode	Mode
-	WLAN 2.4GHz + WLAN 5GHz

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	21.5 °C	59 %	Nick Guan
Radiated Spurious Emissions above 1 GHz	23.1-24.8 °C	60-63 %	Ivan Chiang
Radiated Spurious Emissions below 1 GHz	23.1-24.8 °C	60-63 %	Ivan Chiang
Mains Conducted Emission	20 °C	51 %	Ray Huang

4.4 Special Accessories and Auxiliary Equipment

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

Accessory of EUT

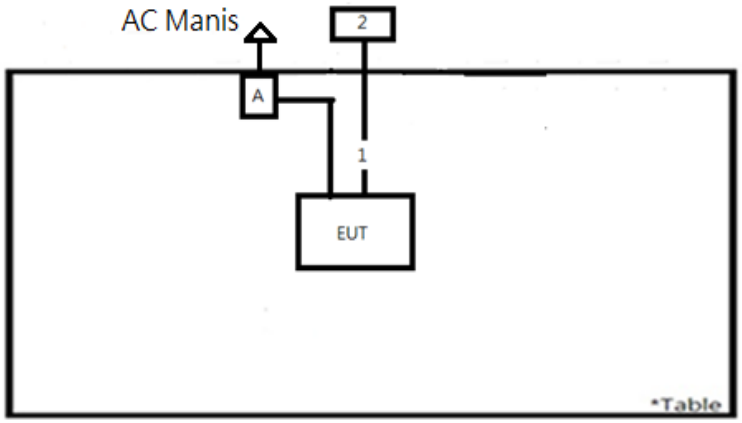
None

Support Unit

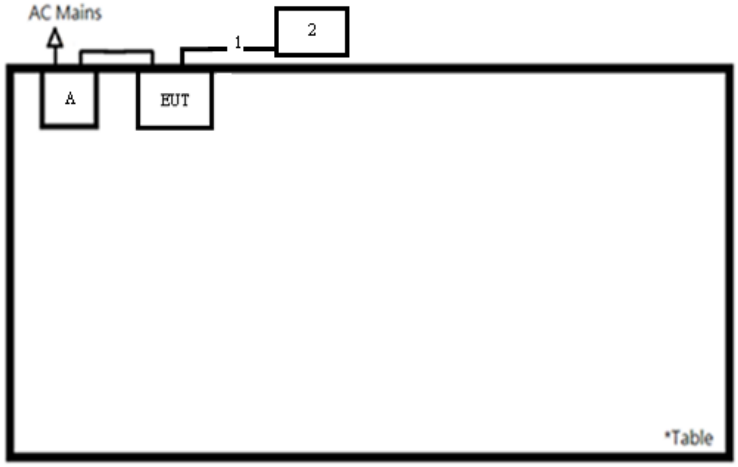
Support Unit								
No	Description	Brand	Model	S/N	Shielded	Ferrite Core (Qty)	Length (cm)	Remark
A	Adapter	Emplus	PA1024-120HUB200	N/A	NO	NO	100	Radiated
1	RJ 45	TUV	TUV-01	N/A	-	-	-	
2	Notebook	Lenovo	81BL	MP1DCD6Y	-	-	-	
A	Adapter	Emplus	PA1024-120HUB200	N/A	NO	NO	100	Mains Conducted
1	Notebook	Lenovo	81BL	MP1DCD6Y	-	-	-	
2	LAN Cable	TUV	TUV-001	NO	NO	NO	300	

4.5 Test Setup Diagram

<Radiated Spurious Emissions mode>



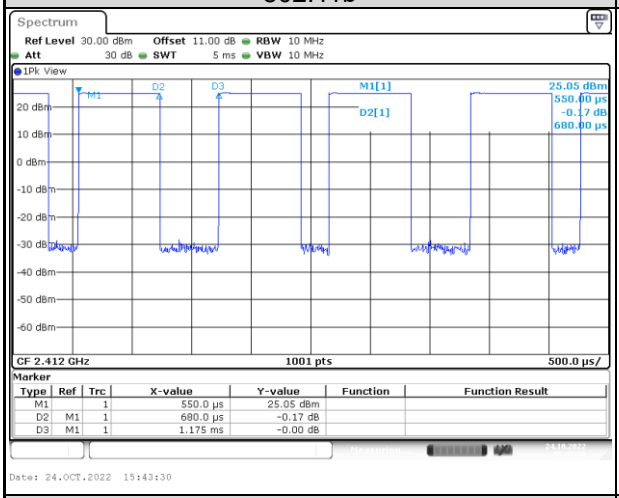
<Mains Conducted Emission mode>



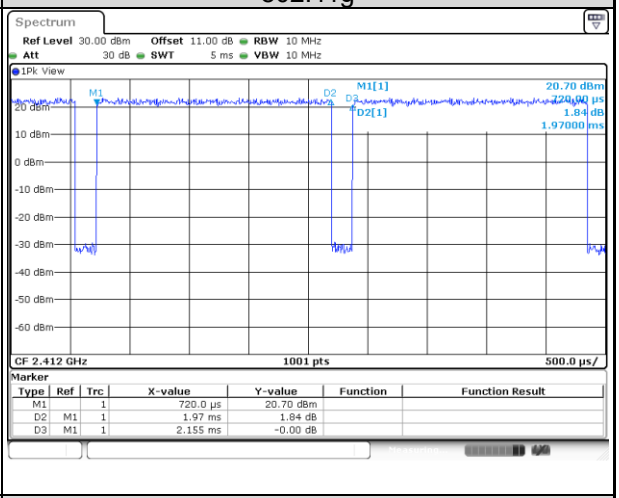
4.6 Duty Cycle of Test Signal

Mode	On + Off Time (ms)	On Time (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11b	1.18	0.68	57.87	2.38
802.11g	2.16	1.97	91.42	0.39
802.11ax HE20	6.24	5.44	87.18	0.60
802.11ax HE40	5.78	5.40	93.43	0.30

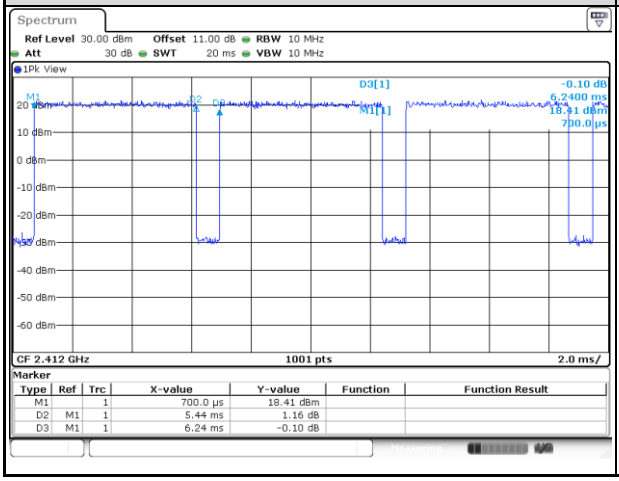
802.11b



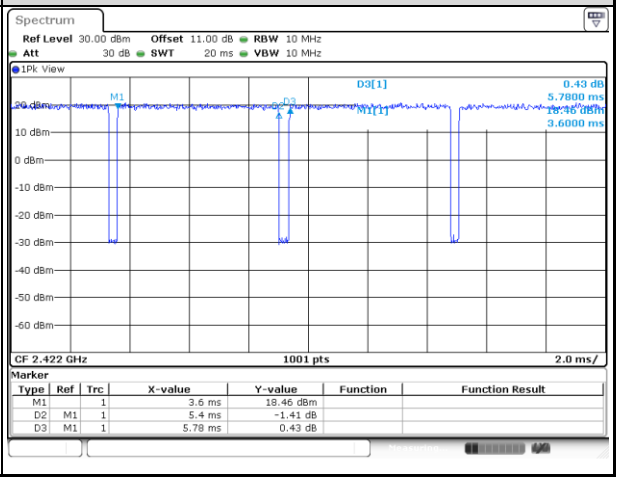
802.11g



802.11ax HE20



802.11ax HE40



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only

The gain value is derived from Antenna datasheet, the EUT's antenna specifications are described as below. The antenna is used with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

ANT		Gain (dBi)	Antenna Type
1		3.80	PIFA
2		3.80	PIFA
Max Peak Gain		3.80	-
CDD Mode	Power Directional Gain	3.80	-
	PSD Directional Gain	6.81	-
Beamforming Mode	Power Directional Gain	6.81	-
	PSD Directional Gain	6.81	-

Note: PSD Directional Gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots. + 10^{GN/20})^2 / N_{ANT}]$

Refer to EUT photo for details.

5.1.2 Peak Output Power

Limit 1 watt (30 dBm)

Kind of Test Site Shielded room

Test Setup

Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2022/3/15	2023/3/14	2022/10/25	2022/11/11
Power Sensor	Anritsu	MA2411B	1725269	2022/3/15	2023/3/14	2022/10/25	2022/11/11

Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.
Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

Test Result

Peak Output Power

CDD Mode

<802.11b>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
1	2412	24.83	24.69	27.77	598.53	30
6	2437	24.25	24.58	27.43	553.15	30
10	2457	22.35	22.69	25.53	357.57	30
11	2462	21.10	21.49	24.31	269.75	30

<802.11g>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
1	2412	23.21	23.24	26.24	420.27	30
2	2417	24.72	24.86	27.80	602.68	30
6	2437	25.32	25.25	28.30	675.37	30
11	2462	24.94	24.87	27.92	618.79	30

<802.11n HT20>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
1	2412	21.43	22.63	25.08	322.23	30
2	2417	25.03	25.14	28.10	645.01	30
6	2437	25.31	25.44	28.39	689.57	30
11	2462	24.15	24.63	27.41	550.42	30

<802.11n HT40>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
3	2422	22.66	23.17	25.93	391.99	30
6	2437	23.41	24.06	26.76	473.96	30
8	2447	22.33	22.32	25.34	341.61	30
9	2452	20.26	21.09	23.71	234.70	30

<802.11ac VHT20>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
1	2412	21.54	21.98	24.78	300.32	30
2	2417	25.03	25.05	28.05	638.31	30
6	2437	25.33	25.36	28.36	684.75	30
11	2462	24.10	24.65	27.39	548.78	30

<802.11ac HT40>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
3	2422	22.59	23.18	25.91	389.52	30
6	2437	23.40	24.07	26.76	474.05	30
8	2447	22.34	21.79	25.08	322.40	30
9	2452	20.48	21.52	24.04	253.59	30

<802.11ax HE20>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
1	2412	22.37	23.08	25.75	375.82	30
2	2417	25.34	25.21	28.29	673.87	30
6	2437	25.46	25.54	28.51	709.66	30
11	2462	24.79	24.98	27.90	616.08	30

<802.11ax HE40>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
3	2422	22.78	23.35	26.08	405.94	30
6	2437	23.60	24.24	26.94	494.55	30
8	2447	22.36	22.68	25.53	357.54	30
9	2452	20.59	21.29	23.96	249.14	30

Beamforming Mode

<802.11ac VHT20>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
1	2412	18.53	18.97	21.77	150.17	29.19
2	2417	22.02	22.04	25.04	319.18	29.19
6	2437	22.32	22.35	25.35	342.40	29.19
11	2462	21.09	21.64	24.38	274.41	29.19

<802.11ac VHT40>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
3	2422	19.58	20.17	22.90	194.77	29.19
6	2437	20.39	21.06	23.75	237.04	29.19
8	2447	19.33	18.78	22.07	161.21	29.19
9	2452	17.47	18.51	21.03	126.80	29.19

<802.11ax HE20>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
1	2412	19.36	20.07	22.74	187.92	29.19
2	2417	22.33	22.20	25.28	336.96	29.19
6	2437	22.45	22.53	25.50	354.85	29.19
11	2462	21.78	21.97	24.89	308.06	29.19

<802.11ax HE40>

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)		Total Power		Limit (dBm)
		Ant 1	Ant 2	(dBm)	(mW)	
3	2422	19.77	20.34	23.07	202.99	29.19
6	2437	20.59	21.23	23.93	247.29	29.19
8	2447	19.35	19.67	22.52	178.78	29.19
9	2452	17.58	18.28	20.95	124.58	29.19

Average Power

CDD Mode

<802.11b>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
1	2412	22.36	22.17	25.28	337.00
6	2437	21.67	22.16	24.93	311.33
10	2457	19.56	19.90	22.74	188.09
11	2462	18.62	19.11	21.88	154.25

<802.11g>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
1	2412	17.88	17.96	20.93	123.89
2	2417	19.79	20.01	22.91	195.51
6	2437	22.61	21.93	25.29	338.34
11	2462	20.32	20.52	23.43	220.37

<802.11n HT20>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
1	2412	16.08	16.36	19.23	83.80
2	2417	19.80	19.95	22.89	194.35
6	2437	21.79	21.93	24.87	306.96
11	2462	19.04	19.11	22.09	161.64

<802.11n HT40>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
3	2422	17.22	17.40	20.32	107.68
6	2437	18.26	18.56	21.42	138.77
8	2447	16.75	17.30	20.04	101.02
9	2452	15.60	15.50	18.56	71.79

<802.11ac VHT20>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
1	2412	16.11	16.33	19.23	83.79
2	2417	19.83	19.94	22.90	194.79
6	2437	21.52	21.90	24.72	296.79
11	2462	18.88	19.03	21.97	157.25

<802.11ac VHT40>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
3	2422	17.06	17.23	20.16	103.66
6	2437	18.13	18.33	21.24	133.09
8	2447	16.65	17.29	19.99	99.82
9	2452	15.35	15.62	18.50	70.75

<802.11ax HE20>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
1	2412	16.22	16.35	19.30	85.03
2	2417	19.85	19.97	22.92	195.92
6	2437	21.80	22.22	25.03	318.08
11	2462	19.05	19.24	22.16	164.30

<802.11ax HE40>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
3	2422	17.24	17.46	20.36	108.68
6	2437	18.28	18.59	21.45	139.57
8	2447	16.84	17.32	20.10	102.26
9	2452	15.65	15.80	18.74	74.75

Beamforming Mode

<802.11ac VHT20>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
1	2412	13.10	13.32	16.22	41.90
2	2417	16.82	16.93	19.89	97.40
6	2437	18.51	18.89	21.71	148.40
11	2462	15.87	16.02	18.96	78.63

<802.11ac VHT40>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
3	2422	14.05	14.22	17.15	51.83
6	2437	15.12	15.32	18.23	66.55
8	2447	13.64	14.28	16.98	49.91
9	2452	12.34	12.61	15.49	35.38

<802.11ax HE20>

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
1	2412	13.21	13.34	16.29	42.52
2	2417	16.84	16.96	19.91	97.97
6	2437	18.79	19.21	22.02	159.05
11	2462	16.04	16.23	19.15	82.15

<802.11ax HE40>

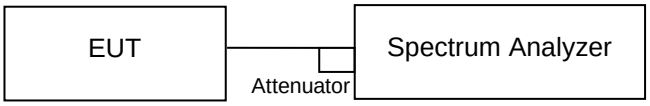
Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power	
		Ant 1	Ant 2	(dBm)	(mW)
3	2422	14.23	14.45	17.35	54.35
6	2437	15.27	15.58	18.44	69.79
8	2447	13.83	14.31	17.09	51.13
9	2452	12.64	12.79	15.73	37.38

5.1.3 6 dB Bandwidth and 99% Occupied Bandwidth

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2022/10/25	2022/11/11
Thermal Chamber	Giant Force	GHT-150-40-CP-SD	MAA1902-010	2022/3/2	2023/3/1	2022/10/25	2022/11/11

Test Procedure

a. Set resolution bandwidth (RBW) = 100 kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
f. For 99% occupied bandwidth measurement, the transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

Test Results

Please refer to Appendix A.

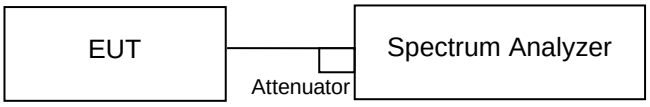
5.1.4 Power Spectral Density

Limit

The power spectral density shall not be greater than 8 dBm in any 3 kHz band.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2022/10/25	2022/11/11
Thermal Chamber	Giant Force	GHT-150-40-CP-SD	MAA1902-010	2022/3/2	2023/3/1	2022/10/25	2022/11/11

Test Procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

Test Results

Please refer to Appendix A.

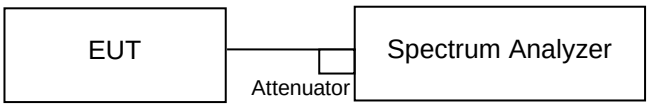
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100 kHz Bandwidth

Limit

20 dB (below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.)

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2022/10/25	2022/11/11
Thermal Chamber	Giant Force	GHT-150-40-CP-SD	MAA1902-010	2022/3/2	2023/3/1	2022/10/25	2022/11/11

Test Procedure

Measurement procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement procedure OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Test Results

Please refer to Appendix A.

5.1.6 Radiated Spurious Emissions and Band Edges

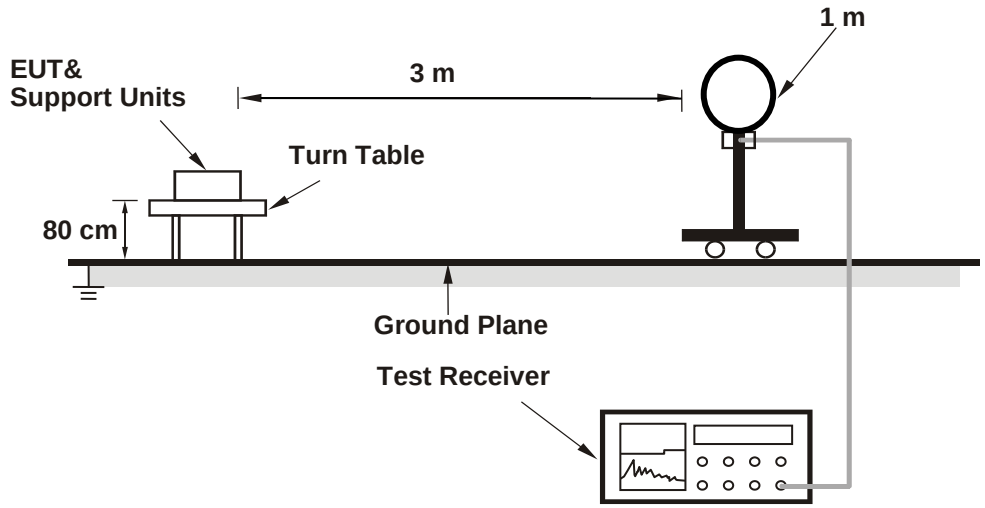
Limit

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).
Emissions radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in §15.247(d).

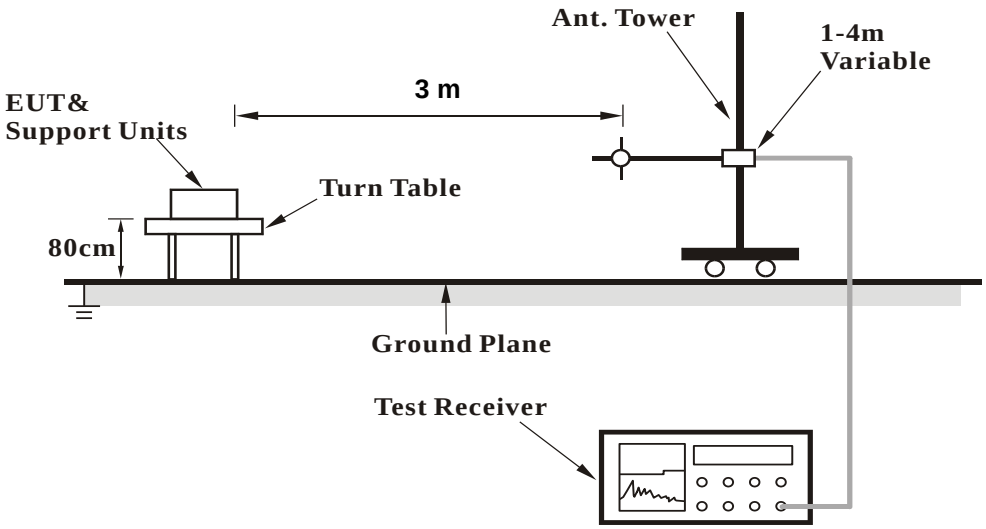
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

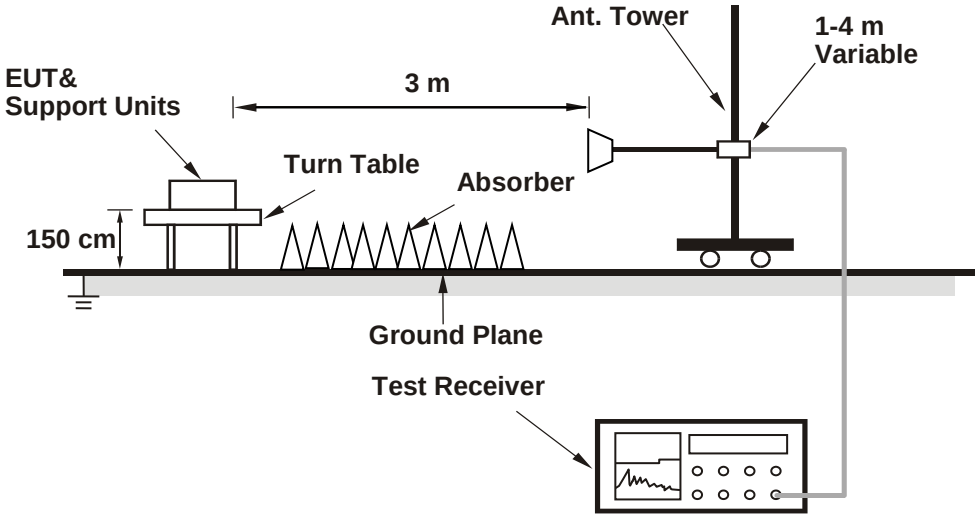
<Radiated Emissions below 30 MHz>



<Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



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

Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Above 1 GHz					
Signal Analyzer	R&S	FSV40	101508	2022/4/13	2023/4/12
Horn Antenna	ETS-Lindgren	3117	00218930	2021/12/20	2022/12/19
HF-AMP + AC source	EMCI	EMC051845SE	980633	2022/2/16	2023/2/15
HF-AMP + AC source	EMCI	EMC184045SE	980657	2022/2/16	2023/2/15
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2022/3/29	2023/3/28
Signal Analyzer	R&S	FSV40	101508	2022/4/13	2023/4/12
30 MHz ~ 1 GHz					
Receiver	R&S	ESR7	102108	2022/4/28	2023/4/27
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2022/4/6	2023/4/5
LF-AMP	Agilent	8447D	2944A107722	2022/3/22	2023/3/21
Below 30 MHz					
Receiver	R&S	ESR7	102108	2022/4/28	2023/4/27
Microwave Cable	SUCOFLEX 104EA	800056/4EA	804680/4	2022/3/22	2023/3/21
Loop Antenna	SCHWARZBECK	FMZB 1519B	00215	2021/12/8	2022/12/7

Test Procedures

For Radiated Emissions below 30 MHz

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

Note:

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

For Radiated Emissions above 30 MHz

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

Note:

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

Test Results

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

Please refer to Appendix B.

5.2 Mains Emission

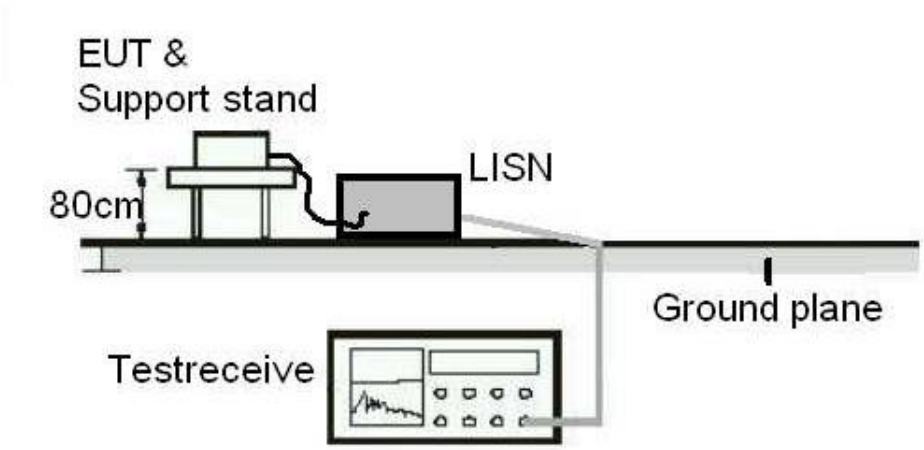
5.2.1 Mains Conducted Emission

Limit

Mains Conducted Emission as defined in §15.207 must comply with the mains conducted emission limits.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Two-Line V-Network	Rohde & Schwarz	ENV216	101938	2022/9/22	2023/9/21
EMI Test Receiver	R&S	ESR	102109	2022/2/25	2023/2/24

Test Procedures

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

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

Test Results

Please refer to Appendix B.