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TEST REPORT

Report No.: 24020611HKG-001

Dyson Inc

Application For Certification
(Original Grant)

FCC ID: QVHHD1718001

Transceiver

Prepared and Checked by:	**Approved by:**
Signed On File Leung Chun Ning, Peter Assistant Engineer	Digitally signed by Herbert Wong Location: Intertek Testing Services Hong Kong Limited Wong Cheuk Ho, Herbert Assistant Supervisor Date: February 22, 2024

TEST REPORT

GENERAL INFORMATION

Grantee:	Dyson Inc
Grantee Address:	1330 W Fulton St 5th Fl, Chicago, Illinois, 60607, United States
Contact Person:	Andrew Wingerter
Brand Name:	Dyson
Model:	HD17, HD18
Type of EUT:	Transceiver
Description of EUT:	Hair Dryer
Serial Number:	Not Labelled
FCC ID:	QVHHD1718001
Date of Sample Submitted:	February 7, 2024
Date of Test:	February 7, 2024 to February 15, 2024
Report No.:	24020611HKG-001
Report Date:	February 22, 2024
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%
Conclusion:	Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 Certification.

TEST REPORT

SUMMARY OF TEST RESULT

Test Specification	Reference	Results
Transmitter Power Line Conducted Emissions	15.207	Pass
Transmitter Field Strength Frequency Stability	15.225	Pass
Radiated Emission Radiated Emission on the Bandedge	15.209	Pass
Radiated Emission in Restricted Bands	15.205	Pass

The equipment under test is found to be complying with the following standards:
FCC Part 15, October 1, 2022 Edition

Note:
1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the pervisions of this section.
2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

TEST REPORT

TABLE OF CONTENTS

TEST REPORT

1.0 GENERAL DESCRIPTION

1.1 Product Description

The Equipment Under Test (EUT), is a 13MHz RFID device for a hair dryer. The sample supplied operated on a single channel, 13.56MHz.

The EUT is powered by 120VAC. After placing the RFID tag at the tip and switching on the EUT, air with different strength and temperature will be exhausted based on the buttons pressed on the hair dryer.

Antenna Type: 3 wire turn antenna

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is a single application for certification of a transceiver.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). All radiated measurements were performed in an 3m Chamber. Preliminary scans were performed in the 3m Chamber only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the “Justification Section” of this Application.

1.4 Test Facility

The 3m Chamber and conducted measurement facility used to collect the radiated data is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong SAR, China. This test facility and site measurement data have been placed on file with the FCC and IC No. 2042H.

TEST REPORT

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The device was powered by 120VAC.

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emission at and above 30 MHz, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step-by-step procedure for maximizing emissions led to the data report in Exhibit 3.0.

The rear of unit shall be flushed with the rear of the table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

There are 2 different models for this EUT, HD17 and HD18. These 2 models are different in colour and length of adaptor cable only as declared by client. HD17 has 2.0m cable cord length while HD18 has 3.2m cable cord length. Both models are tested and only the worst-case data is shown in this report.

2.2 EUT Exercising Software

The EUT Exercise program (if any) used during radiated testing was designed to exercise the various system components in a manner similar to a typical use.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Measurement Uncertainty

Decision Rule for compliance: For FCC/IC standard, the measured value must be within the limits of applicable standard without accounting for the measurement uncertainty. For EN/IEC/HKTA/HKTC standard, conformity rules will be used as per standard directly excepted EN/IEC 61000-3-2, EN/IEC 61000-3-3, HKTA1004, HKCA1008, HKTA1019, HKTA1020, HKTA1041 and HKTA1044.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

TEST REPORT

2.5 Support Equipment List and Description

Not Applicable

TEST REPORT

3.0 EMISSION RESULTS

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG - AV

where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF

where FS = Field Strength in dBµV/m
RR = RA - AG - AV in dBµV
LF = CF + AF in dB

Assume a receiver reading of 52.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 52.0 dBµV/m
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
AV = 5.0 dB
FS = RR + LF
FS = 18 + 9 = 27 dBµV/m

RR = 18.0 dBµV
LF = 9.0 dB

Level in µV/m = Common Antilogarithm [(27 dBµV/m)/20] = 22.4 µV/m

TEST REPORT

3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 922.158 MHz

For electronic filing, the worst-case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 10.2 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 0.4470 MHz

For electronic filing, the worst-case line-conducted configuration photographs are saved with filename: Setup Photos.pdf.

3.5 Conducted Emission Data

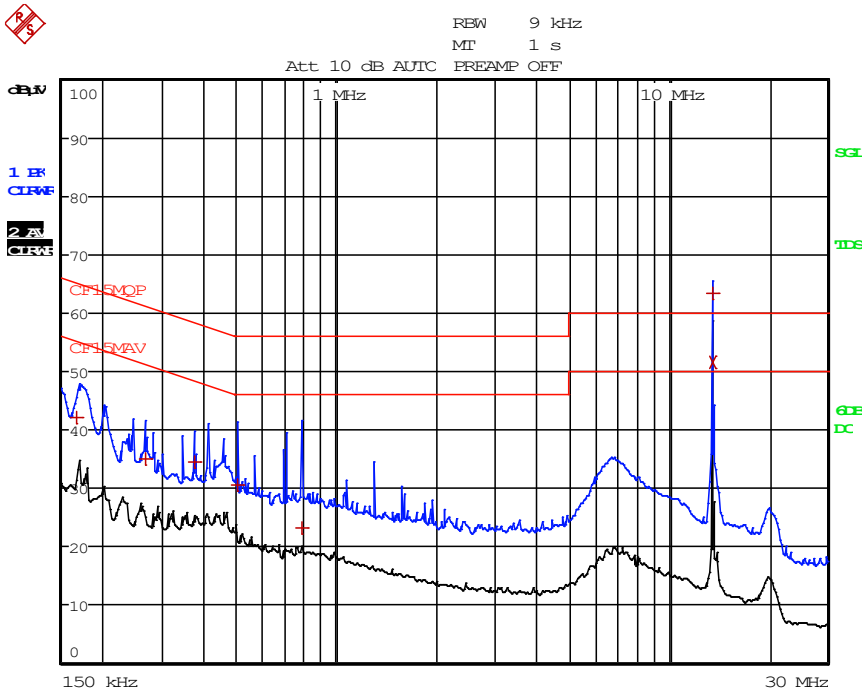
The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 10.7 dB

TEST REPORT

CONDUCTED EMISSION

Model: HD17
Date of Test: February 07, 2024
Worst-Case Operating Mode: Transmitting (with antenna installed)



EDIT PEAK LIST (Final Measurement Results)

Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

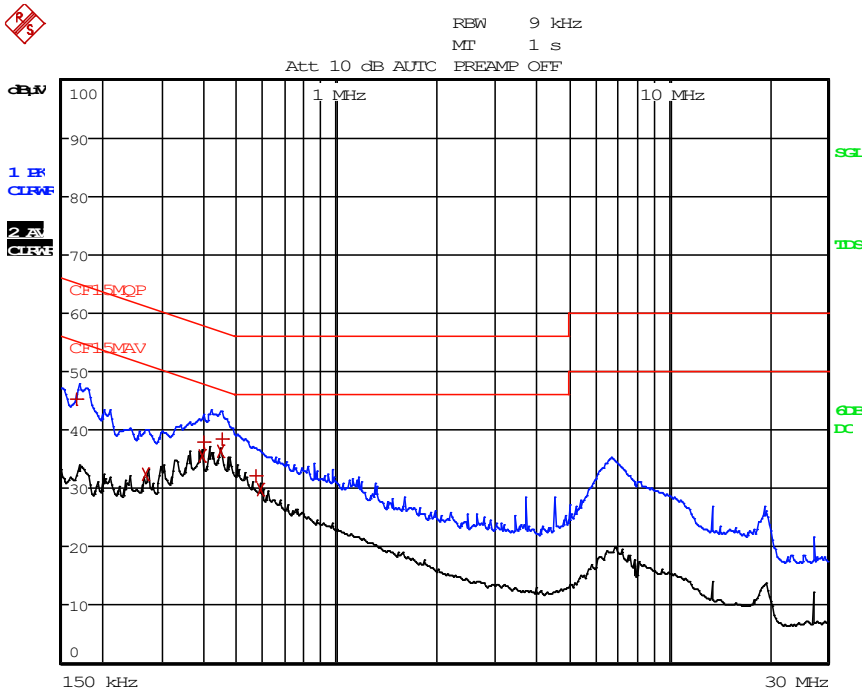
	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	168 kHz	42.00	L1	-23.05
1	Quasi Peak	267 kHz	35.16	N	-26.04
1	Quasi Peak	375 kHz	34.49	N	-23.89
1	Quasi Peak	505.5 kHz	30.64	N	-25.35
1	Quasi Peak	784.5 kHz	23.15	N	-32.84
1	Quasi Peak	13.56 MHz	63.36	L1	3.36
2	CISPR Average	13.56 MHz	51.67	N	1.67

NOTES:
1. Measurement Uncertainty is ±4.2dB at a level of confidence of 95%.
2. The AC line conducted tests with the antenna attached were performed to determine if the EUT complies with the 15.207 limits outside the transmitter's fundamental emission band.

TEST REPORT

CONDUCTED EMISSION

Model: HD17
Date of Test: February 07, 2024
Worst-Case Operating Mode: Transmitting (with dummy load in place of antenna)



EDIT PEAK LIST (Final Measurement Results)

Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	168 kHz	45.26	N	-19.79
2	CISPR Average	271.5 kHz	32.33	N	-18.73
2	CISPR Average	393 kHz	35.63	N	-12.36
1	Quasi Peak	397.5 kHz	37.97	N	-19.92
2	CISPR Average	447 kHz	36.25	L1	-10.67
1	Quasi Peak	451.5 kHz	38.35	L1	-18.49
1	Quasi Peak	573 kHz	32.26	L1	-23.73
2	CISPR Average	591 kHz	29.83	L1	-16.16

NOTES:
1. Measurement Uncertainty is ±4.2dB at a level of confidence of 95%.
2. The AC line conducted emissions were retested with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band.

TEST REPORT

RADIATED EMISSIONS

Model: HD18
Date of Test: February 15, 2024
Worst-Case Operating Mode: Transmitting

Table 1
Pursuant to FCC Part 15 Section 15.225 Requirement

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Distance Factor (-dB)	Calculated at 30m (dBµV/m)	Limit at 30m (dBµV/m)	Margin (dB)
O	13.560	52.9	0	10.8	63.7	40.0	23.7	84.0	-60.3
O	27.120	1.6	0	9.5	11.1	40.0	-28.9	29.5	-58.4

NOTES:
1. Quasi-Peak Detector Data unless otherwise stated.
2. All measurements were made at 3 meters.
3. Negative value in the margin column shows emission below limit.
4. Loop antenna is used for the emissions below 30MHz.
5. Emissions within the restricted band meet the requirement of FCC Part 15 Section 15.205.
6. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

Model: HD18
Date of Test: February 15, 2024
Worst-Case Operating Mode: Transmitting

Table 4
Pursuant to FCC Part 15 Section 15.209 Requirement

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
V	157.434	17.3	16	16.0	17.3	43.5	-26.2
V	165.194	17.0	16	17.0	18.0	43.5	-25.5
H	352.525	21.8	16	24.0	29.8	46.0	-16.2
H	379.685	24.1	16	24.0	32.1	46.0	-13.9
V	700.028	18.3	16	30.0	32.3	46.0	-13.7
H	922.158	18.8	16	33.0	35.8	46.0	-10.2

NOTES:
1. Quasi-Peak Detector Data unless otherwise stated.
2. All measurements were made at 3 meters.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emissions within the restricted band meet the requirement of FCC Part 15 Section 15.205.
6. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

3.6 Frequency Stability

FCC Part 15 Section 15.225

Data Table
Frequency Deviation with Voltage Variation

Operating Frequency: 13.560020MHz

Test Voltage (V)	Temperature (°C)	Measured Frequency (MHz)	Frequency Error (%)	Limit (%)
120	+ 50	13.559940	-0.0005900	±0.01
	+ 40	13.559950	-0.0005162	±0.01
	+ 30	13.559980	-0.0002950	±0.01
	+ 20	13.560020	0	±0.01
	+ 10	13.560030	0.0000737	±0.01
	0	13.560010	-0.0000737	±0.01
	- 10	13.560060	0.0002950	±0.01
	- 20	13.560120	0.0007375	±0.01

Nominal Frequency: 13.560020MHz

Temperature (°C) Humidity (%)	Voltage	Frequency (MHz)	Frequency Error (%)	Limit (%)	Result
20°C 0%	102	13.559920	-0.0007375	±0.01	Pass
20°C 0%	120	13.560020	0	±0.01	Pass
20°C 0%	138	13.559990	-0.0002212	±0.01	Pass

The device is deemed to comply with the requirement of FCC15.225(e). New batteries were used to power the EUT. Data was taken for different time durations, when the EUT just reached the required temperature at startup, after 2 minutes, after 5 minutes and after 10 minutes. Only the worst-case data is shown in the above table.

TEST REPORT

4.0 EQUIPMENT PHOTOGRAPHS

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

5.0 PRODUCT LABELLING

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

6.0 TECHNICAL SPECIFICATIONS

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

7.0 INSTRUCTION MANUAL

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

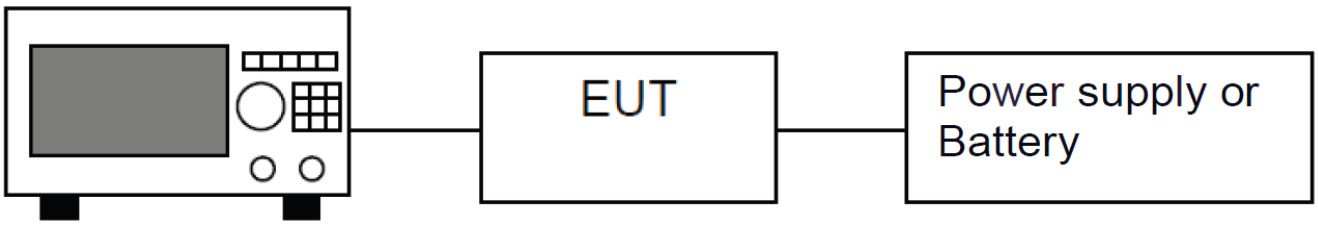
TEST REPORT

8.0 MISCELLANEOUS INFORMATION

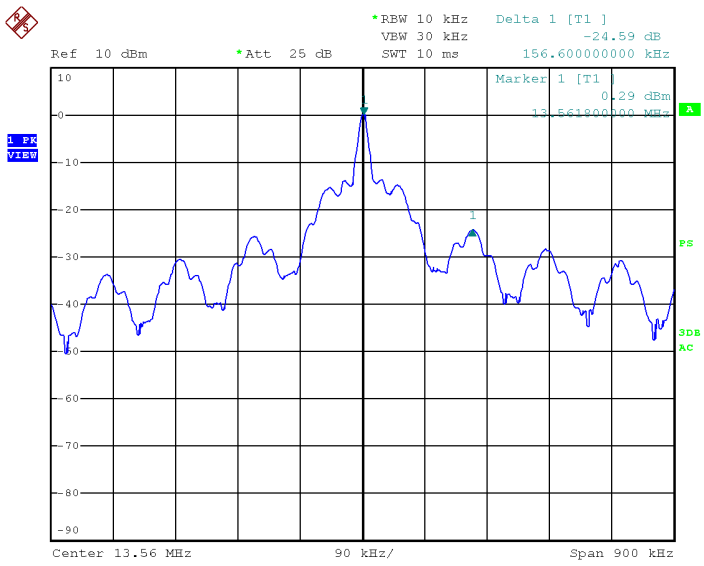
The miscellaneous information includes details of the test procedure and measured bandwidth.

8.1 Measured Bandwidth

The following graph shows the fundamental emission is confined in the specified band. The emission of the fundamental is 23.7 dBµV/m and it is below the limit of 50.5 dBµV/m in the range of (13.410-13.553MHz) and (13.710-14.010MHz) and the limit of 40.5 dBµV/m in the frequency range of (13.110-14.410MHz) and (13.710-14.010MHz). In the frequency range from 13.110-14.010MHz, we cannot find any emission higher than the fundamental emission. Therefore, they meet the requirement of Section 15.225(a), (b), (c), & (d).



Block diagram of Test setup



TEST REPORT

8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. Since the transmitter transmits the RF signal continuously.

8.3 Calculation of Average Factor

N/A

TEST REPORT

8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately 0.8m in height above the ground plane for emission measurement at or below 1GHz and 1.5m in height above the ground plane for emission measurement above 1GHz. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz.

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.10 (2013).

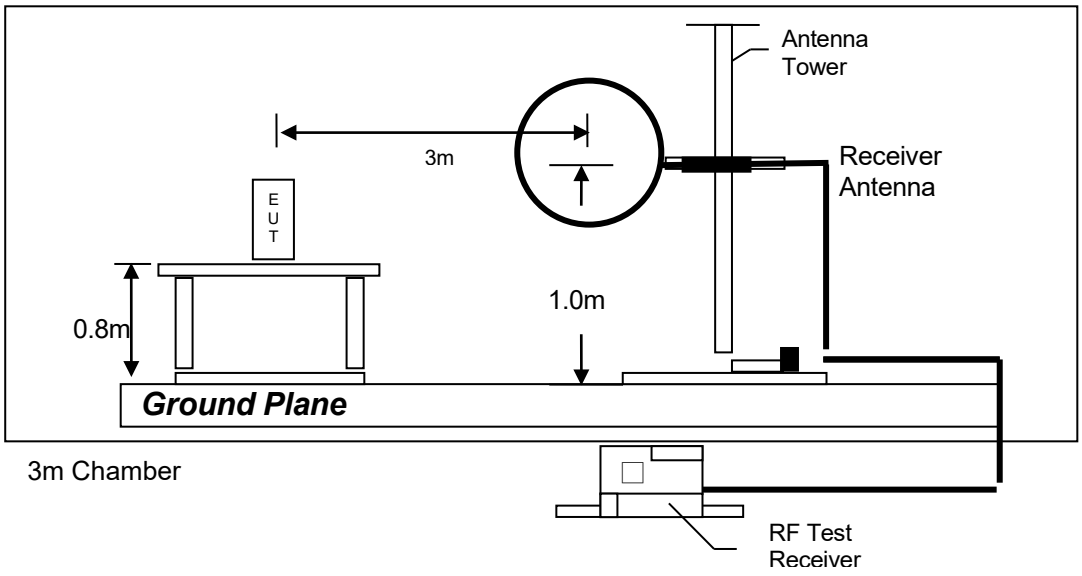
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

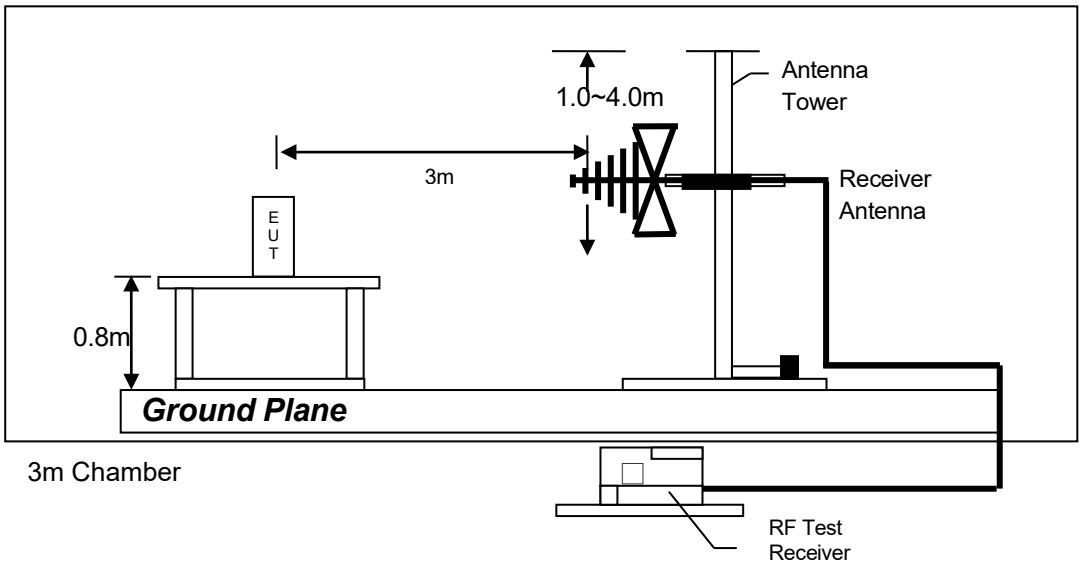
TEST REPORT

8.4.1 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions 9kHz to 30MHz



Test setup of radiated emissions 30MHz to 1GHz

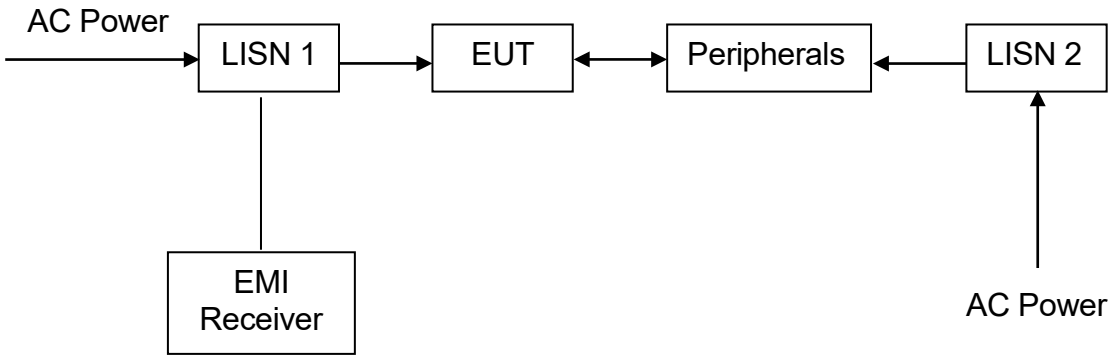
TEST REPORT

8.4.2 Conducted Emission Test Procedures

For tabletop equipment, the EUT along with its peripherals were placed on a 1.0m(W)×1.5m(L) and 0.8m in height wooden table. For floor-standing equipment, the EUT and all cables were insulated, if required, from the ground plane by up to 12 mm of insulating material. The EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled.

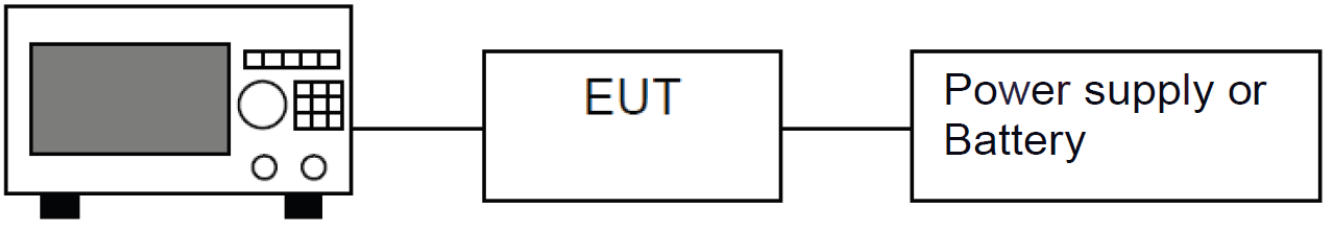
All connecting cables of EUT and peripherals were moved to find the maximum emission.

8.4.3 Conducted Emission Test Setup



TEST REPORT

8.5 Occupied Bandwidth

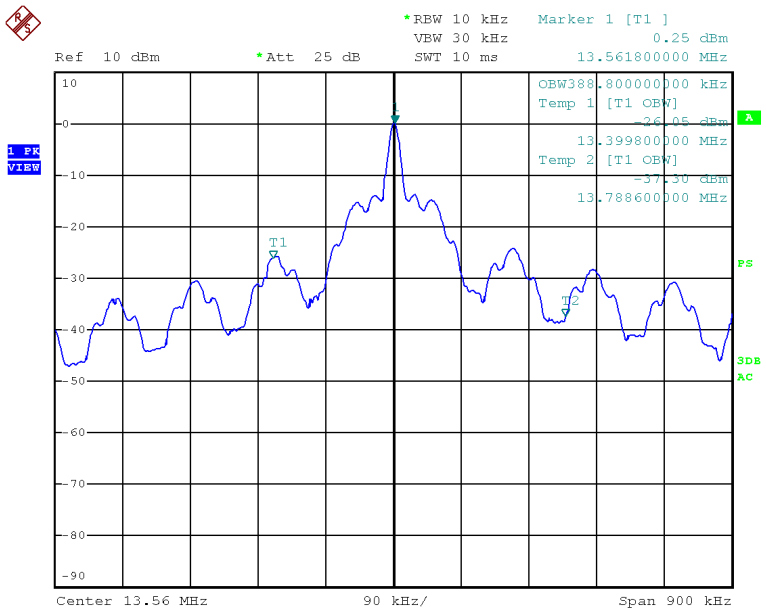


Block diagram of Test setup

Occupied Bandwidth Results:

Frequency (MHz)	Occupied Bandwidth (kHz)
13.56MHz	388.8

The worst case is shown as below



TEST REPORT

9.0 CONFIDENTIALITY REQUEST

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

10.0 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	Signal and Spectrum Analyzer (10Hz to 40GHz)	Biconical Antenna (30MHz to 300MHz)	EMI Test Receiver 7GHz
Registration No.	EW-3016	EW-3242	EW-3603
Manufacturer	ROHDESCHWARZ	EMCO	ROHDESCHWARZ
Model No.	FSV40	3110C	ESR7
Calibration Date	December 13, 2022	May 26, 2021	December 06, 2022
Calibration Due Date	March 13, 2024	February 26, 2024	March 06, 2024

Equipment	Log Periodic Antenna	Active Loop H-field (9kHz to 30MHz)	RF Preamplifier (9kHz to 6000MHz)
Registration No.	EW-3243	EW-3302	EW-3006b
Manufacturer	EMCO	EMCO	SCHWARZBECK
Model No.	3148B	6502	BBV9718
Calibration Date	June 03, 2021	September 08, 2022	February 15, 2022
Calibration Due Date	March 30, 2024	March 08, 2024	May 15, 2024

Equipment	14m Double Shield RF Cable (9kHz - 6GHz)	14m Double Shield RF Cable (20MHz to 6GHz)
Registration No.	EW-2376	EW-2074
Manufacturer	RADIALL	RADIALL
Model No.	n m/br56/bnc m 14m	N(m)-RG142-BNC(m) L=14M
Calibration Date	January 26, 2022	December 10, 2021
Calibration Due Date	April 26, 2024	March 10, 2024

2) Conducted Emissions Test

Equipment	RF Cable 240cm (RG142) (9kHz to 30MHz)	Artificial Mains Network	EMI Test Receiver 7GHz
Registration No.	EW-2454	EW-2874	EW-3603
Manufacturer	RADIALL	ROHDESCHWARZ	ROHDESCHWARZ
Model No.	Bnc m st / 142 / bnc mra 240cm	ENV-216	ESR7
Calibration Date	June 13, 2023	January 24, 2022	December 06, 2022
Calibration Due Date	June 13, 2024	April 24, 2024	March 26, 2024

TEST REPORT

3) Bandedge Measurement

Equipment	EMI Test Receiver 7GHz	RF Cable 240cm (RG142) (9kHz to 30MHz)
Registration No.	EW-3603	EW-2454
Manufacturer	ROHDESCHWARZ	RADIALL
Model No.	ESR7	Bnc m st / 142 / bnc mra 240cm
Calibration Date	December 06, 2022	June 13, 2023
Calibration Due Date	March 06, 2024	June 13, 2024

4) Frequency Error Measurement

Equipment	RF Cable 240cm (RG142) (9kHz to 30MHz)	Signal and Spectrum Analyzer (10Hz to 40GHz)	Temperature &Humidity Chamber
Registration No.	EW-2454	EW-3016	EW-2517
Manufacturer	RADIALL	ROHDESCHWARZ	KINGSON
Model No.	Bnc m st / 142 / bnc mra 240cm	FSV40	KTHD-410TBS
Calibration Date	June 13, 2023	December 13, 2022	April 01, 2022
Calibration Due Date	June 13, 2024	March 13, 2024	March 30, 2024

5) OBW Measurement

Equipment	RF Cable 240cm (RG142) (9kHz to 30MHz)	EMI Test Receiver 7GHz
Registration No.	EW-2454	EW-3603
Manufacturer	RADIALL	ROHDESCHWARZ
Model No.	Bnc m st / 142 / bnc mra 240cm	ESR7
Calibration Date	June 13, 2023	December 06, 2022
Calibration Due Date	June 13, 2024	March 06, 2024

6) Control Software for Radiated Emission

Software Information	
Software Name	EMC32
Manufacturer	ROHDESCHWARZ
Software version	10.50.40

END OF TEST REPORT