

TEST REPORT

Report No.: 23061037HKG-001

Spin Master Toys Far East Ltd.

Application For Certification
(Original Grant)

FCC ID: PQN66812RX2G4R1

Transceiver – 2.4GHz RC Car

Prepared and Checked by:

Approved by:

Signed on File

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Lead Engineer

Date: September 21, 2023

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TEST REPORT

GENERAL INFORMATION

Grantee:	Spin Master Toys Far East Ltd.
Grantee Address:	Room 1113, 11/F., Chinachem Golden Plaza, 77 Mody Road, Tsim Sha Tsui East, Kowloon, Hong Kong.
FCC ID:	PQN66812RX2G4R1
FCC Model(s):	66812RX2G4
Additional Model(s):	6067880, 6068269, 1087951, 1088370
Type of EUT:	Transceiver
Description of EUT:	MJC RDC Grave Digger Trax Vehicle (66812RX2G4), MJC RDC GraveDiggerTrax WLMX GBL1pkSLD (6067880, 6068269, 1087951, 1088370)
Brand Name:	MJC RDC Grave Digger Trax Vehicle
Serial Number:	N/A
Sample Receipt Date:	May 03, 2023
Date of Test:	May 09, 2023 to June 26, 2023
Report Date:	September 21, 2023
Environmental Conditions:	Temperature: +10 to 40°C Relative 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.

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SUMMARY OF TEST RESULT

Test Items	FCC Part 15 Section	Results
Transmitter Power Line Conducted Emissions	15.207	Not Applicable
Radiated Emission	15.249, 15.209	Complied
Radiated Emission on the Bandedge		Complied
Radiated Emission in Restricted Bands	15.205	Complied

The equipment under test is found to be complying with the following standards:

FCC Part 15, October 1, 2021 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 20dB 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 expected variations in temperature and supply voltage were considered.

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1.0 GENERAL DESCRIPTION

1.1 Product Description

The Equipment Under Test (EUT), is a portable 2.4GHz Transceiver (Car Unit) for a RC Car. The sample supplied operated on 43 channels, normally at 2420 - 2465MHz. The channels are shown in below table.

2420	2421	2422	2423	2424
2425	2426	2427	2428	2430
2431	2432	2433	2434	2435
2436	2437	2438	2439	2441
2442	2443	2444	2446	2447
2448	2449	2450	2451	2452
2453	2454	2455	2456	2457
2458	2459	2460	2461	2462
2463	2464	2465		

The EUT is powered by 2 x 3.2V Lithium-ion batteries. After switching on the EUT, the car will be moved forward or backward and turned left and right based on the switches pressed in the controller.

The Models: 6067880, 6068269, 1087951 and 1088370 are the same as the Model: 66812RX2G4 in hardware aspect as declared by client. The models are different in model number only as declared by client.

Antenna Type: Internal, Integral

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.

The Certificate procedure of controller for this car (with FCC ID: PQN66812TX2G4) has already granted previously.

1.3 Test Methodology

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 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.

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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 6.4VDC (2 x 3.2V fully-charged Lithium-ion Batteries).

For maximizing emissions, 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 reported in Exhibit 3.0.

The unit was operated standalone and placed in the center of the turntable.

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.

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. For these excepted or not mentioned standards, Cl 4.2.2 of ILAC-G8:09/2019 decision rules will be reference and guard band will be equal to our measurement uncertainty with 95% confidence level (k=2). In case, the measured value is within guard band region, undetermined decision will be used.

2.5 Support Equipment List and Description

Not Applicable

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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 dB μ V/m
 RA = Receiver Amplitude (including preamplifier) in dB μ V
 AF = Antenna Factor in dB
 CF = Cable Attenuation 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 dB μ V/m
 RR = RA - AG - AV in dB μ V
 LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29.0 dB and average factor of 5.0 dB are subtracted, giving a field strength of 27.0 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA	=	52.0 dB μ V/m		
AF	=	7.4 dB	RR	= 18.0 dB μ V
CF	=	1.6 dB	LF	= 9.0 dB
AG	=	29.0 dB		
AV	=	5.0 dB		
FS	=	RR + LF		
FS	=	18.0 + 9.0 = 27.0 dB μ V/m		

Level in μ V/m = Common Antilogarithm [(27.0 dB μ V/m)/20] = 22.4 μ V/m

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 938.405 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 10.8 dB

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RADIATED EMISSIONS

Model: 66812RX2G4
Date of Test: May 09, 2023
Worst-Case Operating Mode: Transmitting

Table 1

Pursuant to FCC Part 15 Section 15.249 Requirement

Lowest Channel

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	2420.000	79.5	33	29.4	75.9	94.0	-18.1
V	2400.000	43.8	33	29.4	40.2	54.0	-13.8
H	4840.000	26.8	33	34.9	28.7	54.0	-25.3
V	7260.000	20.6	33	37.9	25.5	54.0	-28.5
V	9680.000	28.2	33	40.4	35.6	54.0	-18.4
H	12100.000	29.1	33	40.5	36.6	54.0	-17.4
H	14520.000	35.8	33	38.4	41.2	54.0	-12.8

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	2420.000	102.4	33	29.4	98.8	114.0	-15.2
V	2400.000	63.9	33	29.4	60.3	74.0	-13.7
H	4840.000	42.7	33	34.9	44.6	74.0	-29.4
V	7260.000	34.4	33	37.9	39.3	74.0	-34.7
V	9680.000	41.4	33	40.4	48.8	74.0	-25.2
H	12100.000	43.5	33	40.5	51.0	74.0	-23.0
H	14520.000	48.9	33	38.4	54.3	74.0	-19.7

- Notes: 1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative value in the margin column shows emission below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emissions within the restricted band meet the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 66812RX2G4
Date of Test: May 09, 2023
Worst-Case Operating Mode: Transmitting

Table 2

Pursuant to FCC Part 15 Section 15.249 Requirement

Middle Channel

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	2441.000	79.9	33	29.4	76.3	94.0	-17.7
V	4882.000	30.8	33	34.9	32.7	54.0	-21.3
H	7323.000	28.3	33	37.9	33.2	54.0	-20.8
V	9764.000	28.6	33	40.4	36.0	54.0	-18.0
H	12205.000	30.9	33	40.5	38.4	54.0	-15.6
V	14646.000	35.4	33	38.4	40.8	54.0	-13.2

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	2441.000	102.2	33	29.4	98.6	114.0	-15.4
V	4882.000	49.4	33	34.9	51.3	74.0	-22.7
H	7323.000	41.7	33	37.9	46.6	74.0	-27.4
V	9764.000	41.8	33	40.4	49.2	74.0	-24.8
H	12205.000	44.7	33	40.5	52.2	74.0	-21.8
V	14646.000	48.8	33	38.4	54.2	74.0	-19.8

- Notes:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative value in the margin column shows emission below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emissions within the restricted band meet the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 66812RX2G4
Date of Test: May 09, 2023
Worst-Case Operating Mode: Transmitting

Table 3

Pursuant to FCC Part 15 Section 15.249 Requirement

Highest Channel

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	2465.000	80.5	33	29.4	76.9	94.0	-17.1
H	2483.500	44.5	33	29.4	40.9	54.0	-13.1
V	4930.000	30.7	33	34.9	32.6	54.0	-21.4
V	7395.000	21.6	33	37.9	26.5	54.0	-27.5
V	9860.000	28.8	33	40.4	36.2	54.0	-17.8
V	12325.000	29.7	33	40.5	37.2	54.0	-16.8
H	14790.000	34.8	33	38.4	40.2	54.0	-13.8

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	2465.000	102.8	33	29.4	99.2	114.0	-14.8
H	2483.500	58.0	33	29.4	54.4	74.0	-19.6
V	4930.000	50.2	33	34.9	52.1	74.0	-21.9
V	7395.000	36.3	33	37.9	41.2	74.0	-32.8
V	9860.000	42.0	33	40.4	49.4	74.0	-24.6
V	12325.000	44.6	33	40.5	52.1	74.0	-21.9
H	14790.000	48.4	33	38.4	53.8	74.0	-20.2

- Notes: 1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative value in the margin column shows emission below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emissions within the restricted band meet the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 66812RX2G4
Date of Test: May 10, 2023
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)
H	97.294	15.8	16	12.0	11.8	43.5	-31.7
H	208.480	15.4	16	17.0	16.4	43.5	-27.1
V	344.401	13.2	16	24.0	21.2	46.0	-24.8
V	495.721	16.4	16	26.0	26.4	46.0	-19.6
V	682.689	19.1	16	29.0	32.1	46.0	-13.9
H	938.405	18.2	16	33.0	35.2	46.0	-10.8

- Notes:
1. 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%.

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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.

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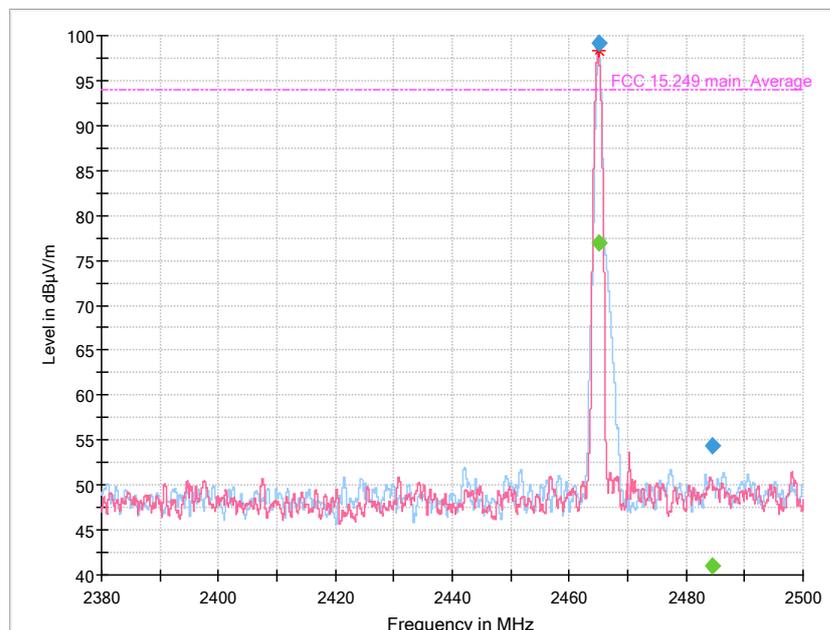
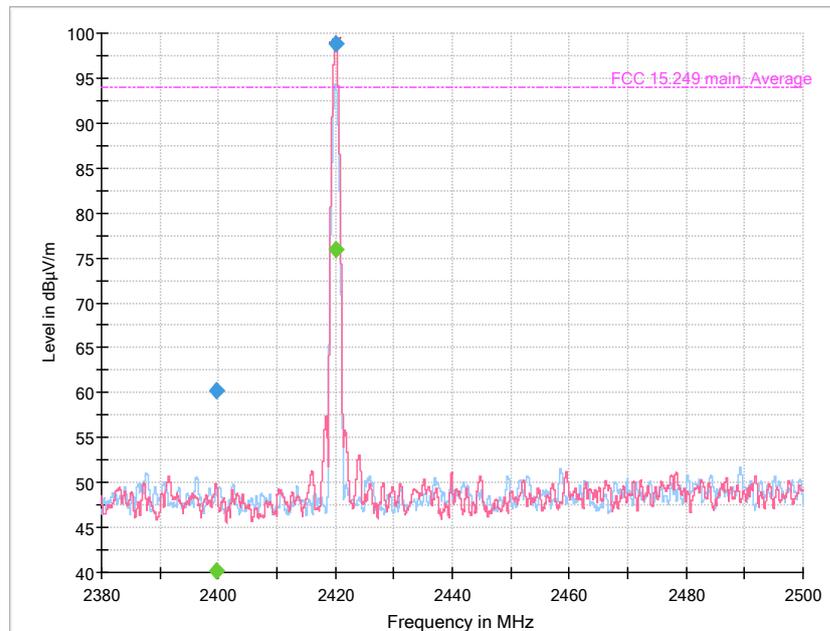
8.0 MISCELLANEOUS INFORMATION

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

8.1 Radiated Emission on the Bandedge

The emission of bandedge data were shown on the above radiated data table of 1 & 3 respectively.

Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50dB below the level of the fundamental or to the general radiated emissions limits in Section 15.209, whichever is the lesser attenuation, which meet the requirement of Part 15.249(d).



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8.2 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.

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).

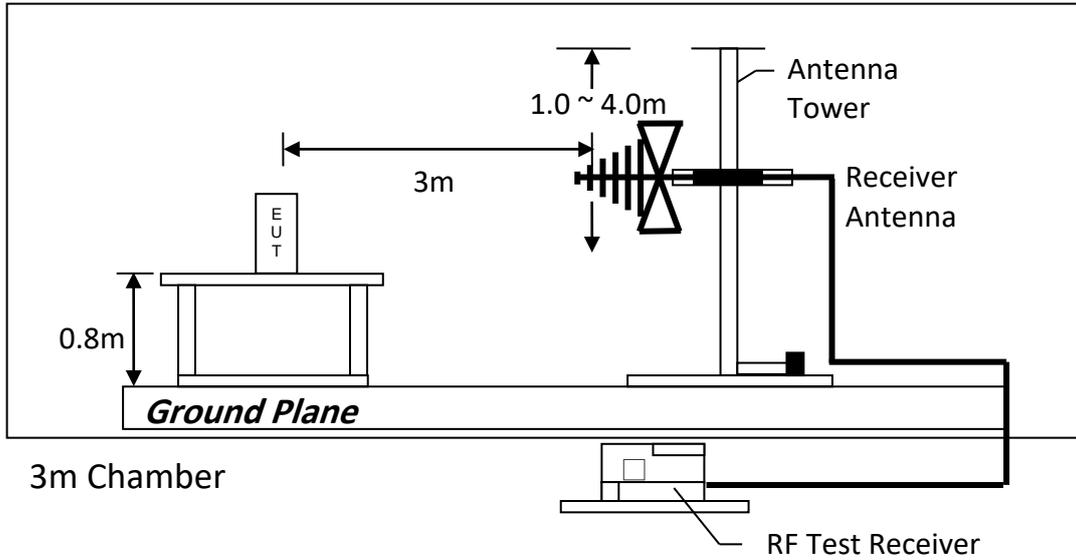
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion 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 10 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.

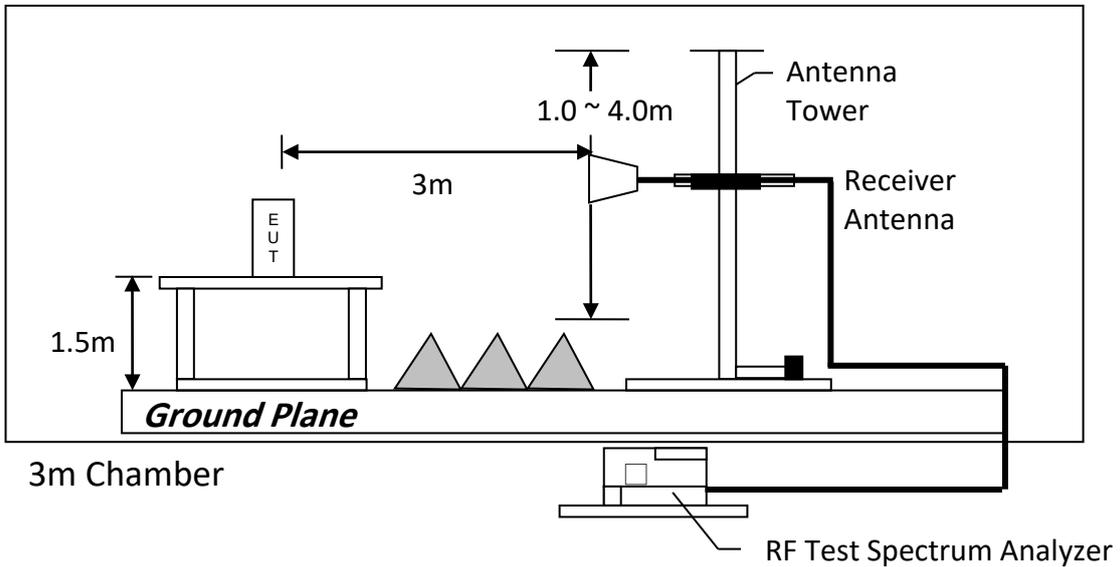
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8.2.1 Radiated Emission Test Setup

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



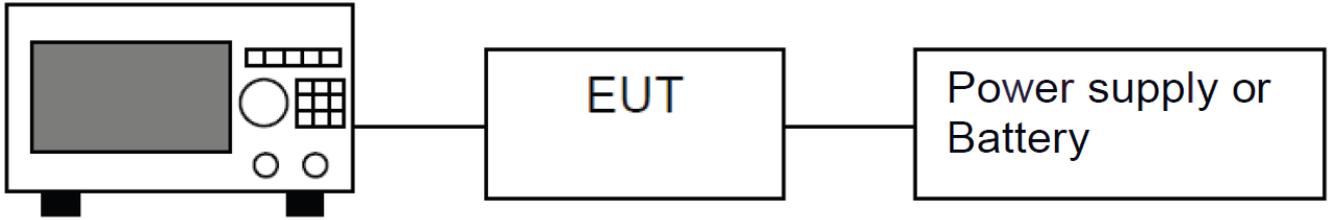
Test setup of radiated emissions up to 1GHz



Test setup of radiated emissions above 1GHz

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8.3 Occupied Bandwidth



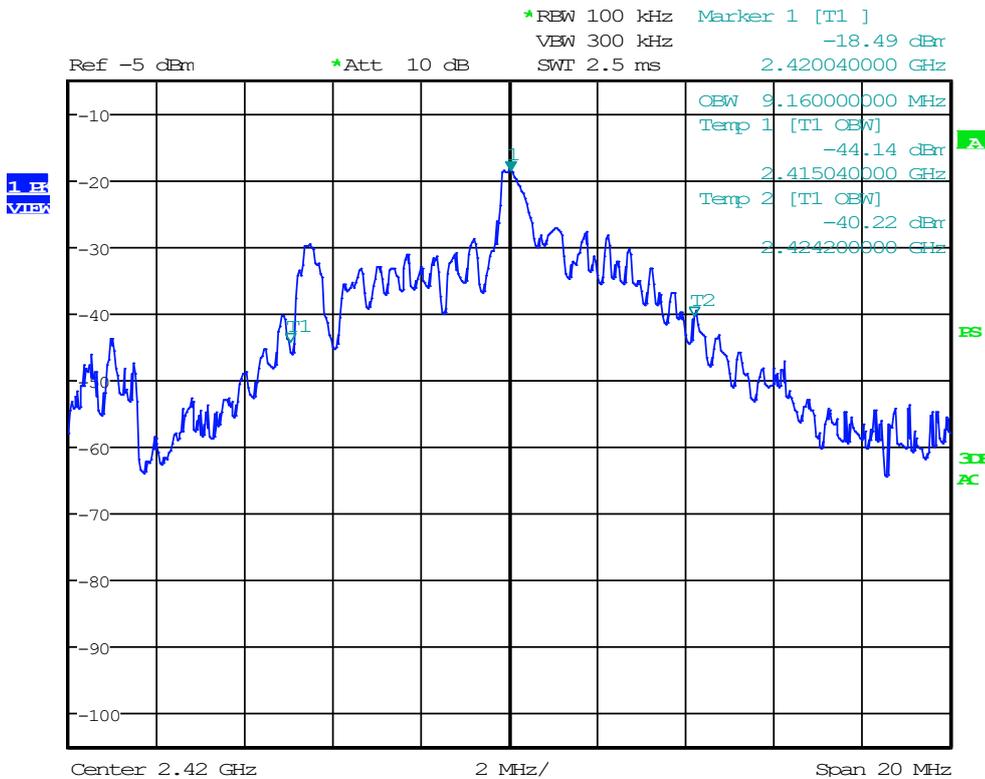
Spectrum Analyzer

Block diagram of Test setup

Occupied Bandwidth Results:

	Occupied Bandwidth (kHz)
Low Channel: 2420	9160
Middle Channel: 2441	8960
High Channel: 2465	7560

The worst case is shown as below:



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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 & Bandedge Measurement

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	December 13, 2023	August 26, 2023	December 06, 2023

Equipment	Log Periodic Antenna	Double Ridged Guide Antenna	Active Loop H-field (9kHz to 30MHz)
Registration No.	EW-3243	EW-1133	EW-3302
Manufacturer	EMCO	EMCO	EMCO
Model No.	3148B	3115	6502
Calibration Date	June 03, 2021	May 26, 2021	September 08, 2022
Calibration Due Date	June 30, 2023	August 26, 2023	September 08, 2023

Equipment	RF Pre-amplifier (9kHz to 6000MHz)	2.4GHz Notch Filter	14m Double Shield RF Cable (9kHz - 6GHz)
Registration No.	EW-3006b	EW-3435	EW-2376
Manufacturer	SCHWARZBECK	MICROWAVE	RADIALL
Model No.	BBV9718	N0324413	n m/br56/bnc m 14m
Calibration Date	February 15, 2022	June 16, 2022	January 26, 2022
Calibration Due Date	August 15, 2023	September 16, 2023	July 26, 2023

Equipment	RF Cable 14m (1GHz to 26.5GHz)	14m Double Shield RF Cable (20MHz to 6GHz)	Pyramidal Horn Antenna
Registration No.	EW-2781	EW-2074	EW-0905
Manufacturer	GREATBILLION	RADIALL	EMCO
Model No.	SMA m/SHF5MPU /SMA m ra14m,26G	N(m)-RG142-BNC(m) L=14M	3160-09
Calibration Date	November 24, 2021	December 10, 2021	July 20, 2021
Calibration Due Date	July 24, 2023	August 10, 2023	August 20, 2023

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2) OBW Measurement

Equipment	EMI Test Receiver (9kHz to 26.5GHz)
Registration No.	EW-3156
Manufacturer	ROHDESCHWARZ
Model No.	ESR26
Calibration Date	September 26, 2022
Calibration Due Date	September 26, 2023

3) Control Software for Radiated Emission

Software Information	
Software Name	EMC32
Manufacturer	ROHDESCHWARZ
Software version	10.50.40

END OF TEST REPORT