

TEST REPORT

Report No.: 22111172HKG-001

Three Champions Enterprise Co., Ltd.

Application For Original Grant of 47 CFR Part 15 Certification

D BT EB BLUSH

FCC ID: 2AVGC3CBT221ST

Prepared and Checked by:

Approved by:

Signed on File

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Date: February 22, 2023

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TEST REPORT

GENERAL INFORMATION

Grantee:	Three Champions Enterprise Co., Ltd.
Grantee Address:	Flat E-105, 3/F., Tak Wing Industrial Building, 3 Tsun Wen Road, Tuen Mun, N.T., Hong Kong.
Manufacturer:	Dongguan Maoxuan Co., Ltd.
Manufacturer Address:	No. 22, Wu Song Road, YuWu Industrial Area, DongCheng District, Dongguan, Guangdong Province, China.
FCC Specification Standard:	FCC Part 15, October 1, 2021 Edition
FCC ID:	2AVGC3CBT221ST
FCC Model(s):	81254-5, 81349-3
Type of EUT:	Transceiver
Description of EUT:	D BT EB BLUSH
Brand Name:	Not Applicable
Sample Receipt Date:	November 30, 2022
Date of Test:	November 30, 2022 to February 03, 2023
Report Date:	February 22, 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.

TEST REPORT

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

Note: 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.

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

FCC Part 15, October 1, 2021 Edition

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TEST REPORT

1.0 GENERAL DESCRIPTION

1.1 Product Description

The Equipment Under Test (EUT), is a portable 2.4GHz BT and BLE Transceiver for a Bluetooth Earbuds. The earbuds have 2 modes, the BT mode and the BLE mode. For the BT mode, the sample supplied operated on 79 channels, normally at 2402 – 2480 MHz. The channels are separated with 1MHz spacing. For the BLE mode, the sample supplied operated on 40 channels, normally at 2402 – 2480 MHz. The channels are separated with 2 MHz spacing.

The EUT is powered by 1 x 3.7V Lithium-ion battery for each side of earbuds. After switching on the EUT, the EUT, the earbuds can be paired up with a smartphone and will be used to play different sound based on the sound received from the paired smartphone.

The Model: 81349-3 is the same as the Model: 81254-5 in hardware aspect as declared by client. The difference in model number serves as marketing strategy 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.

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 3.7VDC (1 x 3.7V Lithium-ion Battery).

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 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

There was no special software to exercise the devices. Once the unit is powered up, it transmits the RF Signal continuously.

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, CI 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.

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.

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 dBμV/m
RA	=	Receiver Amplitude (including preamplifier) in dBμV
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 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 29.0 dB and average factor of 5.0 dB are subtracted, giving a field strength of 27.0 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	RR = 18.0 dBμV
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 dBμV/m	

Level in μV/m = Common Antilogarithm [(27.0 dBμV/m)/20] = 22.4 μV/m

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 9608 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 8.5 dB

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RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BT Mode

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	2402.000	78.0	33	29.4	74.4	94.0	-19.6
V	4804.000	35.7	33	34.9	37.6	54.0	-16.4
H	7206.000	28.4	33	37.9	33.3	54.0	-20.7
V	9608.000	33.3	33	40.4	40.7	54.0	-13.3
H	12010.000	31.0	33	40.5	38.5	54.0	-15.5
V	14412.000	35.1	33	40.0	42.1	54.0	-11.9

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	2402.000	90.5	33	29.4	86.9	114.0	-27.1
V	4804.000	46.8	33	34.9	48.7	74.0	-25.3
H	7206.000	42.7	33	37.9	47.6	74.0	-26.4
V	9608.000	45.5	33	40.4	52.9	74.0	-21.1
H	12010.000	44.1	33	40.5	51.6	74.0	-22.4
V	14412.000	48.6	33	40.0	55.6	74.0	-18.4

- 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 meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BT Mode

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	2440.000	77.0	33	29.4	73.4	94.0	-20.6
H	4880.000	40.0	33	34.9	41.9	54.0	-12.1
V	7320.000	29.5	33	37.9	34.4	54.0	-19.6
H	9760.000	33.0	33	40.4	40.4	54.0	-13.6
V	12200.000	31.0	33	40.5	38.5	54.0	-15.5
V	14640.000	36.3	33	38.4	41.7	54.0	-12.3

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	2440.000	90.4	33	29.4	86.8	114.0	-27.2
H	4880.000	49.5	33	34.9	51.4	74.0	-22.6
V	7320.000	42.9	33	37.9	47.8	74.0	-26.2
H	9760.000	45.6	33	40.4	53.0	74.0	-21.0
V	12200.000	44.6	33	40.5	52.1	74.0	-21.9
V	14640.000	49.9	33	38.4	55.3	74.0	-18.7

- 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 meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BT Mode

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)
V	2480.000	75.4	33	29.4	71.8	94.0	-22.2
H	4960.000	42.3	33	34.9	44.2	54.0	-9.8
V	7440.000	28.8	33	37.9	33.7	54.0	-20.3
V	9920.000	34.6	33	40.4	42.0	54.0	-12.0
V	12400.000	31.2	33	40.5	38.7	54.0	-15.3
V	14880.000	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	2480.000	87.8	33	29.4	84.2	114.0	-29.8
H	4960.000	51.4	33	34.9	53.3	74.0	-20.7
V	7440.000	42.3	33	37.9	47.2	74.0	-26.8
V	9920.000	46.9	33	40.4	54.3	74.0	-19.7
V	12400.000	44.6	33	40.5	52.1	74.0	-21.9
V	14880.000	49.4	33	38.4	54.8	74.0	-19.2

- 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 meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BLE Mode

Table 4

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)
H	2402.000	84.5	33	29.4	80.9	94.0	-13.1
V	4804.000	34.2	33	34.9	36.1	54.0	-17.9
V	7206.000	30.6	33	37.9	35.5	54.0	-18.5
V	9608.000	38.1	33	40.4	45.5	54.0	-8.5
V	12010.000	31.0	33	40.5	38.5	54.0	-15.5
H	14412.000	35.2	33	40.0	42.2	54.0	-11.8

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	2402.000	106.7	33	29.4	103.1	114.0	-10.9
V	4804.000	48.1	33	34.9	50.0	74.0	-24.0
V	7206.000	46.8	33	37.9	51.7	74.0	-22.3
V	9608.000	53.5	33	40.4	60.9	74.0	-13.1
V	12010.000	44.4	33	40.5	51.9	74.0	-22.1
H	14412.000	48.7	33	40.0	55.7	74.0	-18.3

- 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 meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BLE Mode

Table 5

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	2440.000	85.3	33	29.4	81.7	94.0	-12.3
V	4880.000	34.4	33	34.9	36.3	54.0	-17.7
V	7320.000	33.6	33	37.9	38.5	54.0	-15.5
H	9760.000	34.5	33	40.4	41.9	54.0	-12.1
V	12200.000	31.1	33	40.5	38.6	54.0	-15.4
V	14640.000	36.4	33	38.4	41.8	54.0	-12.2

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	2440.000	102.5	33	29.4	98.9	114.0	-15.1
V	4880.000	48.1	33	34.9	50.0	74.0	-24.0
V	7320.000	51.3	33	37.9	56.2	74.0	-17.8
H	9760.000	50.3	33	40.4	57.7	74.0	-16.3
V	12200.000	44.7	33	40.5	52.2	74.0	-21.8
V	14640.000	50.1	33	38.4	55.5	74.0	-18.5

- 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 meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BLE Mode

Table 6

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)
V	2480.000	82.6	33	29.4	79.0	94.0	-15.0
V	4960.000	35.6	33	34.9	37.5	54.0	-16.5
V	7440.000	30.1	33	37.9	35.0	54.0	-19.0
V	9920.000	36.8	33	40.4	44.2	54.0	-9.8
V	12400.000	31.5	33	40.5	39.0	54.0	-15.0
V	14880.000	36.1	33	38.4	41.5	54.0	-12.5

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	2480.000	100.7	33	29.4	97.1	114.0	-16.9
V	4960.000	49.3	33	34.9	51.2	74.0	-22.8
V	7440.000	46.1	33	37.9	51.0	74.0	-23.0
V	9920.000	52.0	33	40.4	59.4	74.0	-14.6
V	12400.000	45.5	33	40.5	53.0	74.0	-21.0
V	14880.000	49.8	33	38.4	55.2	74.0	-18.8

- 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 meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BLE Mode

Table 7

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	159.010	15.6	16	16.0	15.6	43.5	-27.9
H	260.011	14.4	16	21.0	19.4	46.0	-26.6
H	378.715	16.3	16	24.0	24.3	46.0	-21.7
H	571.866	18.1	16	28.0	30.1	46.0	-15.9
V	709.243	20.6	16	30.0	34.6	46.0	-11.4
H	930.766	17.8	16	33.0	34.8	46.0	-11.2

- 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 meets the requirement of FCC Part 15 Section 15.205.
 6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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RADIATED EMISSIONS

Model: 81254-5
Date of Test: February 03, 2023
Worst-Case Operating Mode: BT Mode

Table 8

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	31.576	24.6	16	10.0	18.6	40.0	-21.4
H	242.794	16.2	16	19.0	19.2	46.0	-26.8
V	346.584	14.8	16	24.0	22.8	46.0	-23.2
H	487.840	16.9	16	26.0	26.9	46.0	-19.2
V	697.845	18.7	16	30.0	32.7	46.0	-13.3
V	952.349	18.4	16	33.0	35.4	46.0	-10.6

- 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 meets the requirement of FCC Part 15 Section 15.205.
 6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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 and calculation of factor such as pulse desensitization and averaging factor (calculation and timing diagram).

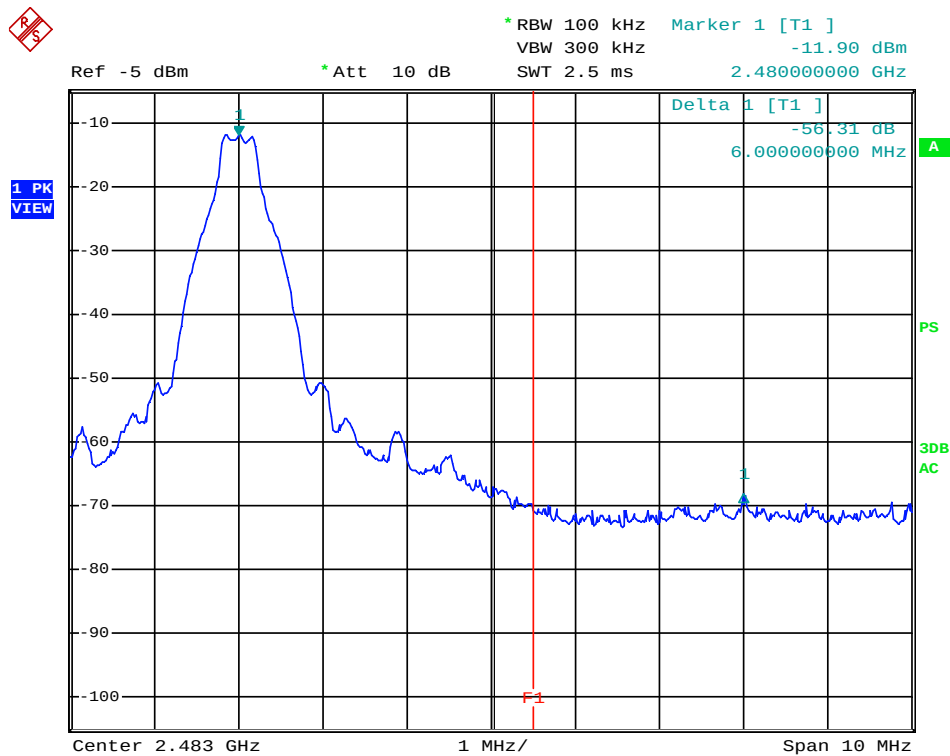
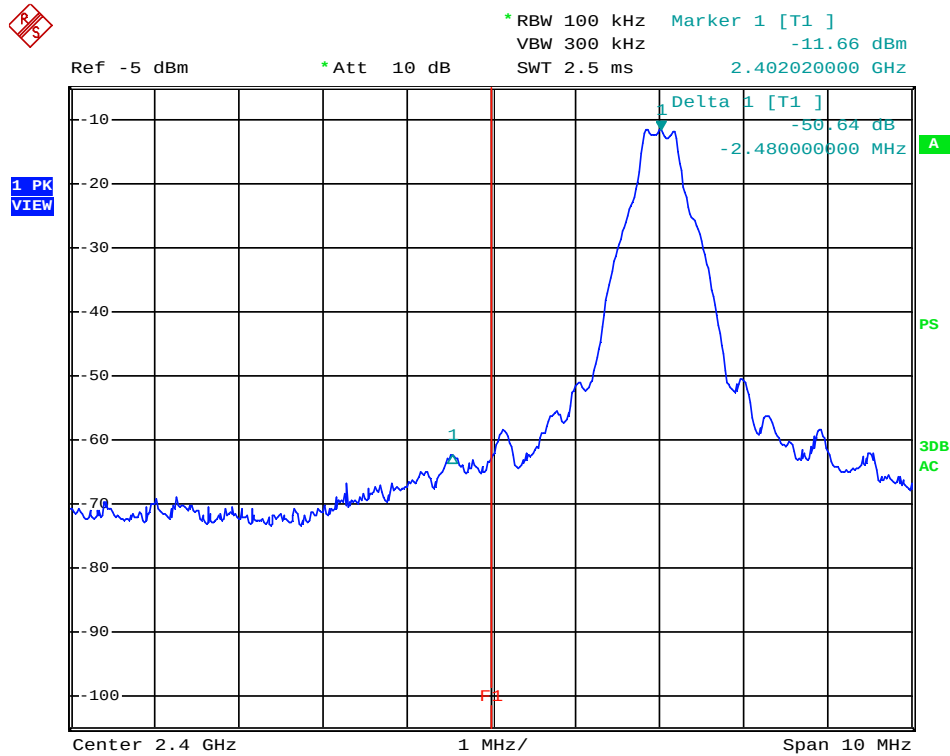
8.1 Radiated Emission on the Bandedge

From the following plots, they show that the fundamental emissions are confined in the specified band (2400MHz to 2483.5MHz). In case of the fundamental emissions are within two standard bandwidths from the bandedge, the delta measurement technique is used for determining bandedge compliance. Standard bandwidth is the bandwidth specified by ANSI C63.10 (2013) for frequency being measured.

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).

TEST REPORT

PEAK MEASUREMENT (BT Mode)



TEST REPORT

PEAK MEASUREMENT (BT Mode)

Bandedge compliance is determined by applying marker-delta method, i.e. (Bandedge Plot).

Lower Bandedge

Peak Resultant Field Strength = Fundamental Emissions (Peak Value) – delta from the plot

= 86.9 dB μ V/m - 50.6 dB

= 36.3 dB μ V/m

Average Resultant Field Strength = Fundamental Emissions (Average Value) – delta from the plot

= 74.4 dB μ V/m - 50.6 dB

= 23.8 dB μ V/m

Upper Bandedge

Peak Resultant Field Strength = Fundamental Emissions (Peak Value) – delta from the plot

= 84.2 dB μ V/m - 56.3 dB

= 27.9 dB μ V/m

Average Resultant Field Strength = Fundamental Emissions (Average Value) – delta from the plot

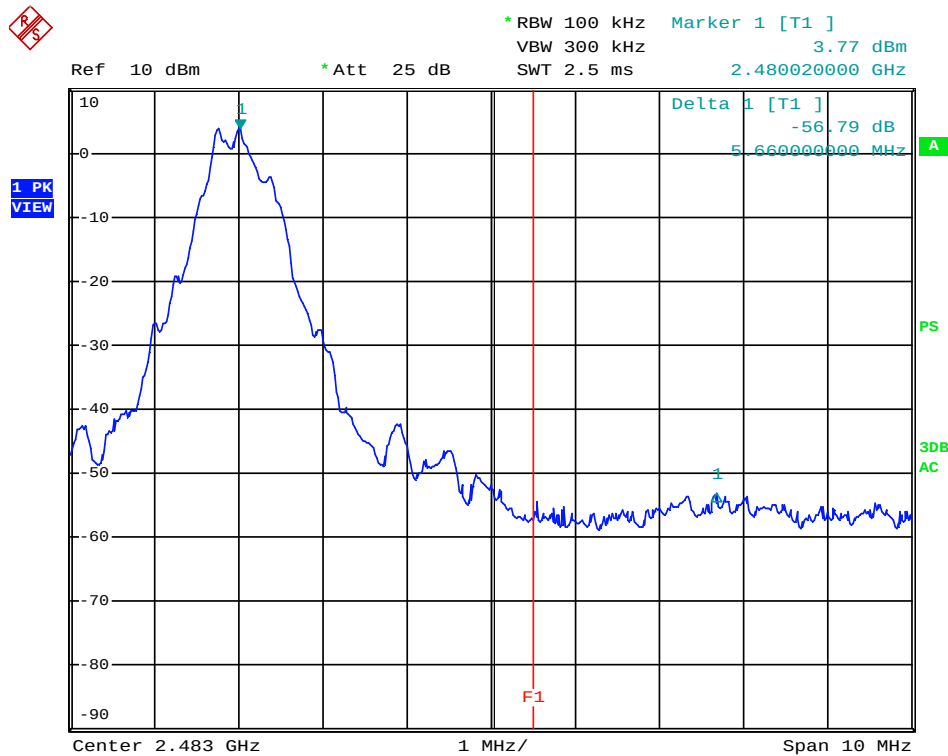
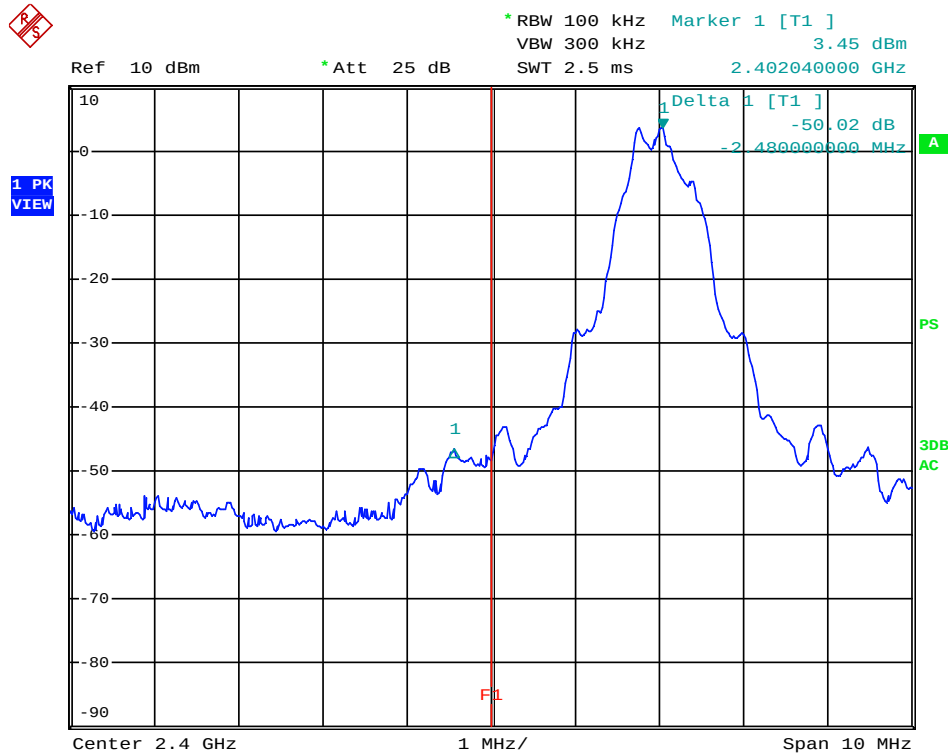
= 71.8 dB μ V/m - 56.3 dB

= 15.5 dB μ V/m

The resultant field strength meets the general radiated emission limit in Section 15.209, which does not exceed 74 dB μ V/m (Peak Limit) and 54 dB μ V/m (Average Limit).

TEST REPORT

PEAK MEASUREMENT (BLE Mode)



TEST REPORT

PEAK MEASUREMENT (BLE Mode)

Bandedge compliance is determined by applying marker-delta method, i.e. (Bandedge Plot).

Lower Bandedge

Peak Resultant Field Strength = Fundamental Emissions (Peak Value) – delta from the plot

$$= 103.1 \text{ dB}\mu\text{V/m} - 50.0 \text{ dB}$$

$$= 53.1 \text{ dB}\mu\text{V/m}$$

Average Resultant Field Strength = Fundamental Emissions (Average Value) – delta from the plot

$$= 80.9 \text{ dB}\mu\text{V/m} - 50.0 \text{ dB}$$

$$= 30.9 \text{ dB}\mu\text{V/m}$$

Upper Bandedge

Peak Resultant Field Strength = Fundamental Emissions (Peak Value) – delta from the plot

$$= 97.1 \text{ dB}\mu\text{V/m} - 56.8 \text{ dB}$$

$$= 40.3 \text{ dB}\mu\text{V/m}$$

Average Resultant Field Strength = Fundamental Emissions (Average Value) – delta from the plot

$$= 79.0 \text{ dB}\mu\text{V/m} - 56.8 \text{ dB}$$

$$= 22.2 \text{ dB}\mu\text{V/m}$$

The resultant field strength meets the general radiated emission limit in Section 15.209, which does not exceed 74 dBμV/m (Peak Limit) and 54 dBμV/m (Average Limit).

TEST REPORT

8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately $625\mu s$ for a digital "1" bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 3MHz, so the pulse desensitivity factor is 0dB.

8.3 Calculation of Average Factor

Not Applicable

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 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).

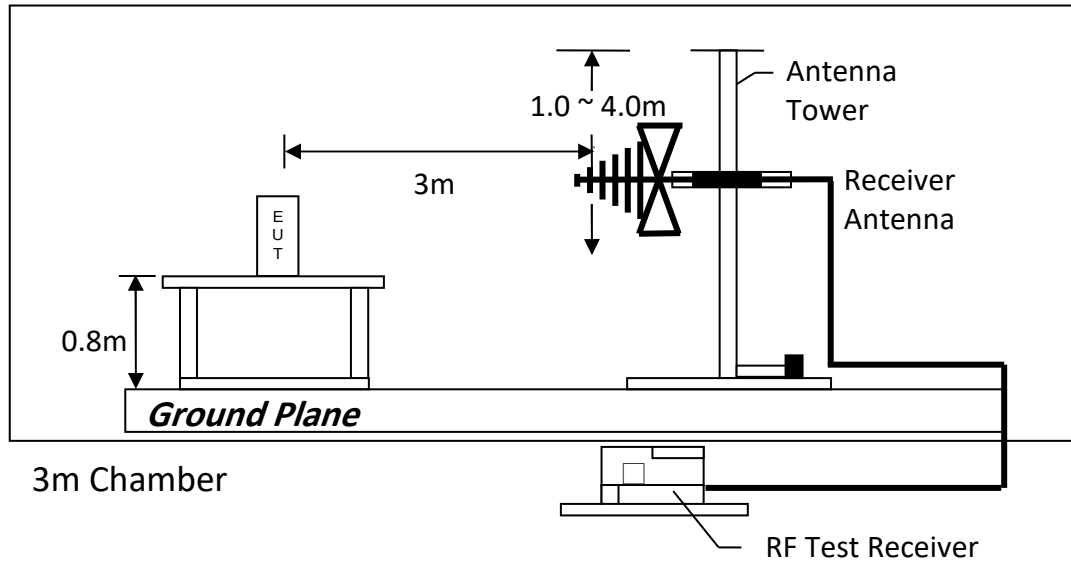
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion 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 3 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.

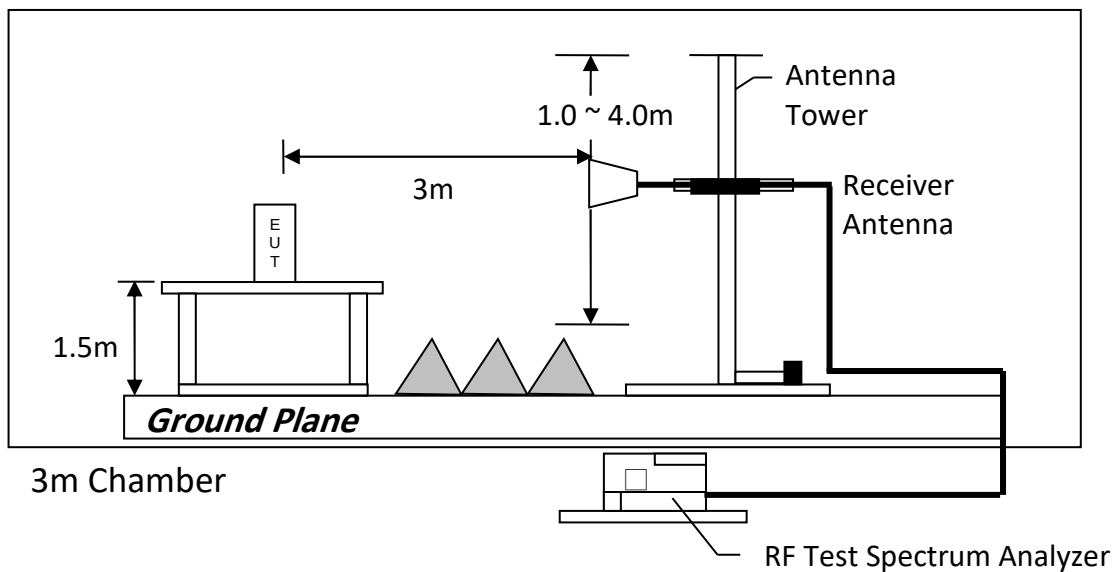
TEST REPORT

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 up to 1GHz



Test setup of radiated emissions above 1GHz

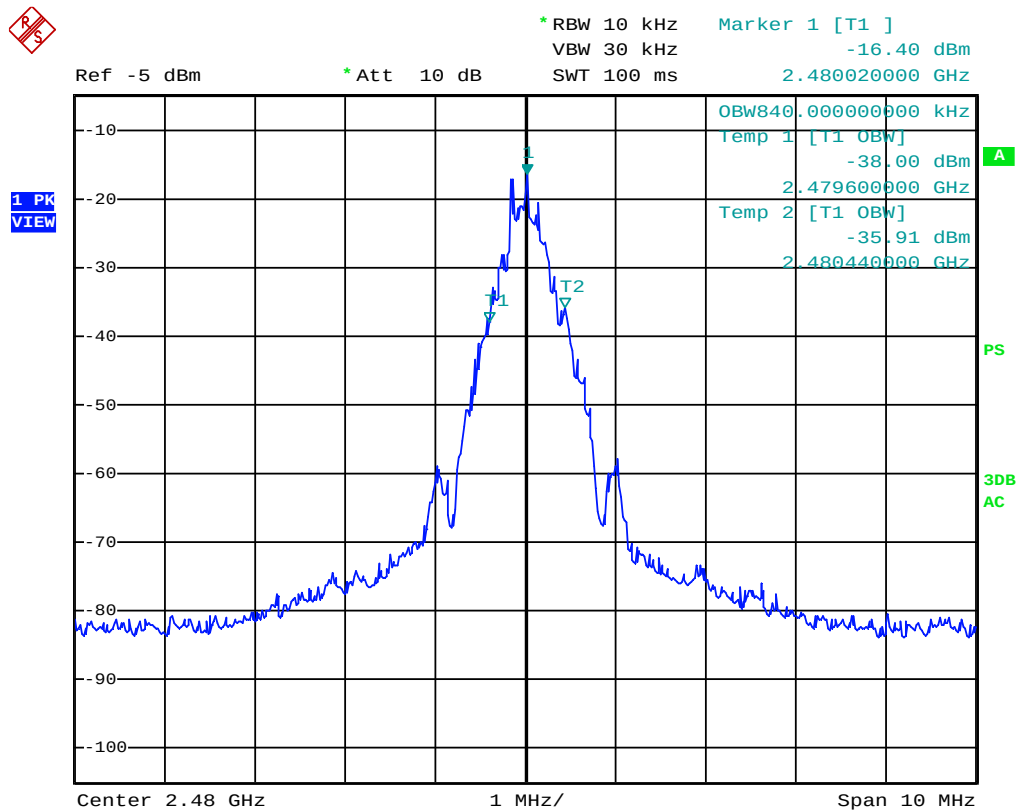
TEST REPORT

8.5 Occupied Bandwidth

Occupied Bandwidth Results: BT Mode

Frequency (MHz)	Occupied Bandwidth (kHz)
Low Channel: 2402	820
Middle Channel: 2442	820
High Channel: 2480	840

The worst case is shown as below:



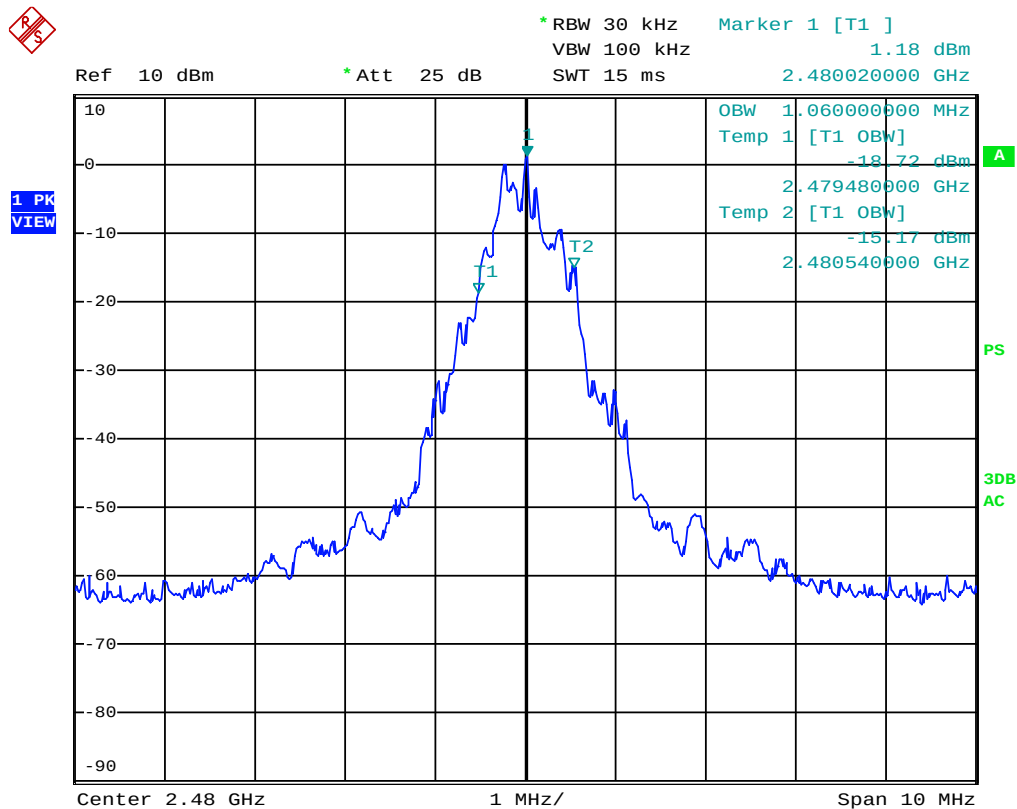
TEST REPORT

8.5 Occupied Bandwidth (Cont'd)

Occupied Bandwidth Results: BLE Mode

Frequency (MHz)	Occupied Bandwidth (kHz)
Low Channel: 2402	1020
Middle Channel: 2442	1040
High Channel: 2480	1060

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	EMI Test Receiver (9kHz to 26.5GHz)	Biconical Antenna (30MHz to 300MHz)	EMI Test Receiver (9kHz to 26.5GHz)
Registration No.	EW-3156	EW-3242	EW-3156
Manufacturer	ROHDESCHWARZ	EMCO	ROHDESCHWARZ
Model No.	ESR26	3110C	ESR26
Calibration Date	September 26, 2022	May 26, 2021	September 26, 2022
Calibration Due Date	September 26, 2023	May 26, 2023	September 26, 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	March 30, 2023	February 26, 2023	September 08, 2023

Equipment	RF Preamplifier (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	February 15, 2023	June 16, 2023	April 26, 2023

Equipment	Pyramidal Horn Antenna
Registration No.	EW-0905
Manufacturer	EMCO
Model No.	3160-09
Calibration Date	July 20, 2021
Calibration Due Date	April 20, 2023

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2) Bandedge Measurement

Equipment	EMI Test Receiver (9kHz to 26.5GHz)	5m RF Cable (40GHz)
Registration No.	EW-3156	EW-2701
Manufacturer	ROHDESCHWARZ	RADIALL
Model No.	ESR26	Sma m-m 5m 40G
Calibration Date	September 26, 2022	November 24, 2021
Calibration Due Date	September 26, 2023	February 24, 2023

3) 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

4) Control Software for Radiated Emission

Software Information	
Software Name	EMC32
Manufacturer	ROHDESCHWARZ
Software version	10.50.40

END OF TEST REPORT