FCC TEST REPORT

FOR

Stillwater Designs and Audio, Inc.

Powerbar Remote

Test Model: KPBRC

Prepared for	:	Stillwater Designs and Audio, Inc.
Address	:	3100 N. Husband Stillwater, OK 74075, USA
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd
Address	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Tel	:	(+86)755-82591330
Fax	:	(+86)755-82591332
Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	May 19, 2021
Number of tested samples	:	2
Sample number	:	210324018A-1, 210324018A-2
Sample number	:	Prototype
Date of Test	:	May 19, 2021 ~ May 31, 2021
Date of Report	:	June 03, 2021

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FCC TEST REPORT

FCC CFR 47 PART 15 C(15.249)

Report Reference No.	**:**	**LCS210324018AEA**
Date of Issue.....	:	June 03, 2021
Testing Laboratory Name	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name	**:**	**Stillwater Designs and Audio, Inc.**
Address.....	:	3100 N. Husband Stillwater, OK 74075, USA
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.249) / ANSI C63.10: 2013
Test Report Form No.....	:	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2019-03

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Test Item Description.	**:**	**Powerbar Remote**
Trade Mark	:	Kicker
Test Model.....	:	KPBRC
Ratings.....	:	DC 3.7V by Rechargeable Li-ion Battery, 180mAh
Result	**:**	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Vera Deng	Jin Wang	Gavin Liang
Vera Deng/ Administrators	Jin Wang/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCS210324018AEA**	June 03, 2021 Date of issue

Test Model.....	: KPBRC
EUT.....	: Powerbar Remote
Applicant.....	**: Stillwater Designs and Audio, Inc.**
Address.....	: 3100 N. Husband Stillwater, OK 74075, USA
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: INNOVATIVE AUDIO INTERNATIONAL CO., LTD**
Address.....	: 5th Rd, 4th District, LiLin square, LiLin Town, Huizhou City, Guangdong province, China, 516035
Telephone.....	: /
Fax.....	: /
Factory.....	**: INNOVATIVE AUDIO INTERNATIONAL CO., LTD**
Address.....	: 5th Rd, 4th District, LiLin square, LiLin Town, Huizhou City, Guangdong province, China, 516035
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	June 03, 2021	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	:	Powerbar Remote
Test Model	:	KPBRC
Power Supply	:	DC 3.7V by Rechargeable Li-ion Battery, 180mAh
Hardware Version	:	/
Software Version	:	/
Frequency Range	:	2460MHz
Channel Number	:	1 channels(2460MHz)
Modulation Type	:	GFSK
Antenna Description	:	Internal antenna, 0 dBi (Max.)

1.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

1.3. External I/O

I/O Port Description	Quantity	Cable
Micro USB Port	1	N/A

1.4. Description of Test Facility

NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.
FCC Test Firm Registration Number: 254912

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10:2013 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

Operates in the unlicensed ISM Band at 2.4GHz. With basic data rate feature, the data rates can be up to 1 Mb/s by modulating the RF carrier using GFSK techniques. The EUT works in the X-axis, Y-axis, Z-axis. The following operating modes were applied for the related test items. All test modes were tested, only the result of the worst case was recorded in the report.

Mode of Operations	Frequency Range (MHz)	Data Rate (Mbps)
GFSK	2460	/
For Conducted Emission		
Test Mode	/	
For Radiated Emission		
Test Mode	TX Mode	

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX.

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is directly placed on the ground. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turntable, which is directly placed on the ground. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

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3. CONNECTION DIAGRAM OF TEST SYSTEM

3.1. Justification

The system was configured for testing in a continuous transmit condition. Continuous transmitting was pre-programmed. It'll keep transmitting with modulated signal at the lowest channel by installing the battery.

3.2. EUT Exercise Software

Press the Up button, and set the equipment to work.

3.3. Special Accessories

N/A.

3.4. Block Diagram/Schematics

Please refer to the related document.

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

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4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C §15.249		
FCC Rules	**Description Of Test**	**Result**
§15.203	Antenna Requirement	Compliant
§15.207(a)	Power Line Conducted Emissions	Compliant
§15.205(a), §15.209(a), §15.249(a), §15.249(c)	Radiated Emissions Measurement	Compliant
§15.249 (d)	Band Edges Measurement	Compliant
§2.1049	99% and 20 dB Bandwidth	Compliant

Remark:
N/A - Not Applicable for this device!!!*

5. ANTENNA REQUIREMENT

5.1. Standard Applicable

According to § 15.203 and RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.2. Antenna Connected Construction

The EUT use an internal antenna and maximum antenna gain is 0 dBi, antenna cannot replacement, meets FCC Part §15.203 antenna requirement. Please see EUT photo for details.

5.3. Results

Compliance.

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6. POWER LINE CONDUCTED EMISSIONS (NOT APPLICABLE)

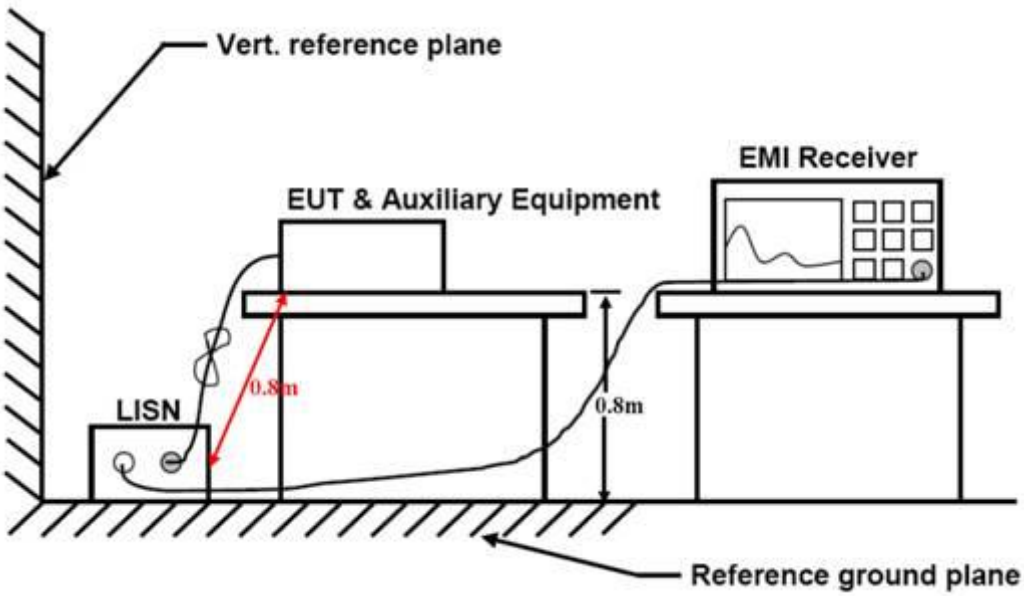
6.1. Standard Applicable

According to §15.207 (a) & RSS-Gen § 8.8: For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

6.2. Block Diagram of Test Setup



6.3. Test Results

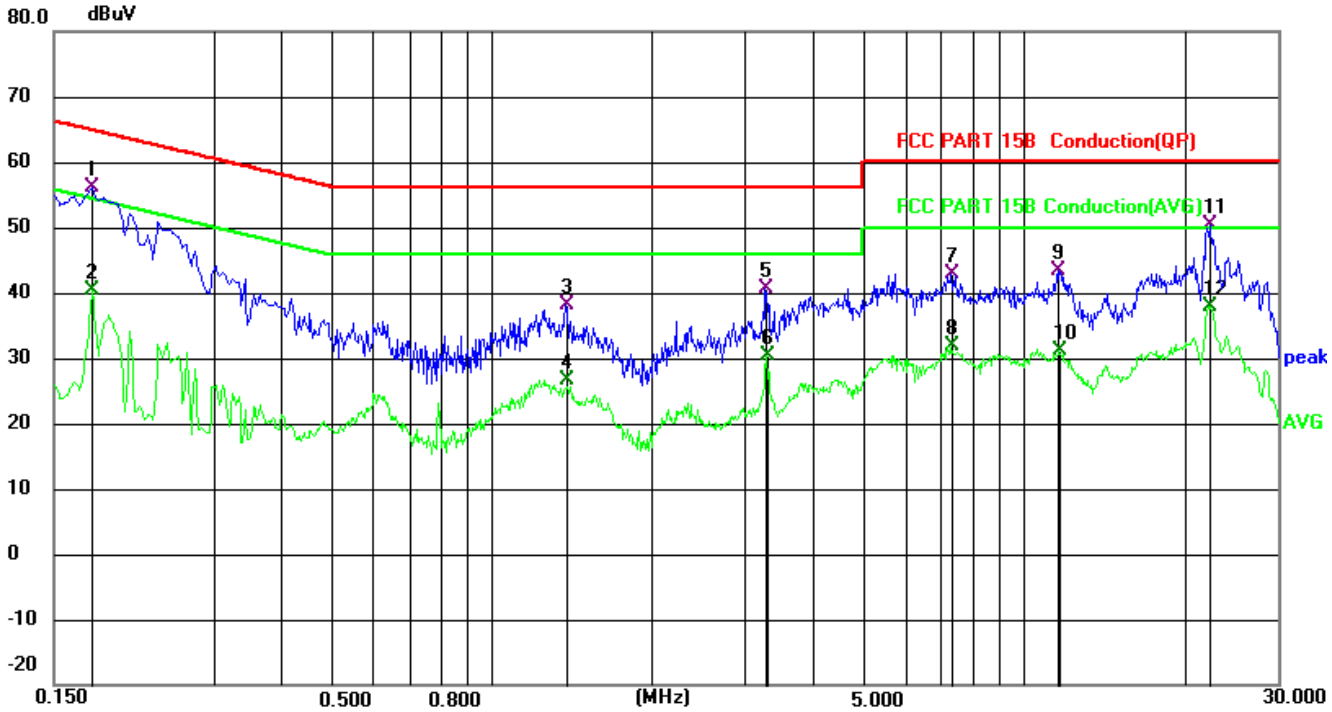
PASS.

The test data please refer to following page.

Temperature	23.3℃	Humidity	53.7%
Test Engineer	Carl Fu	Test Mode	TX

AC Conducted Emission of charge from PC mode @ AC 120V/60Hz @ GFSK (worst case)

Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1771	44.63	11.53	56.16	64.62	-8.46	QP	
2		0.1771	28.75	11.53	40.28	54.62	-14.34	AVG	
3		1.3786	25.96	12.15	38.11	56.00	-17.89	QP	
4		1.3786	14.48	12.15	26.63	46.00	-19.37	AVG	
5		3.2731	28.20	12.42	40.62	56.00	-15.38	QP	
6		3.2821	17.88	12.42	30.30	46.00	-15.70	AVG	
7		7.3096	30.59	12.31	42.90	60.00	-17.10	QP	
8		7.3096	19.57	12.31	31.88	50.00	-18.12	AVG	
9		11.5756	30.57	12.91	43.48	60.00	-16.52	QP	
10		11.6656	18.22	12.93	31.15	50.00	-18.85	AVG	
11		22.4071	37.20	13.27	50.47	60.00	-9.53	QP	
12		22.4071	24.57	13.27	37.84	50.00	-12.16	AVG	

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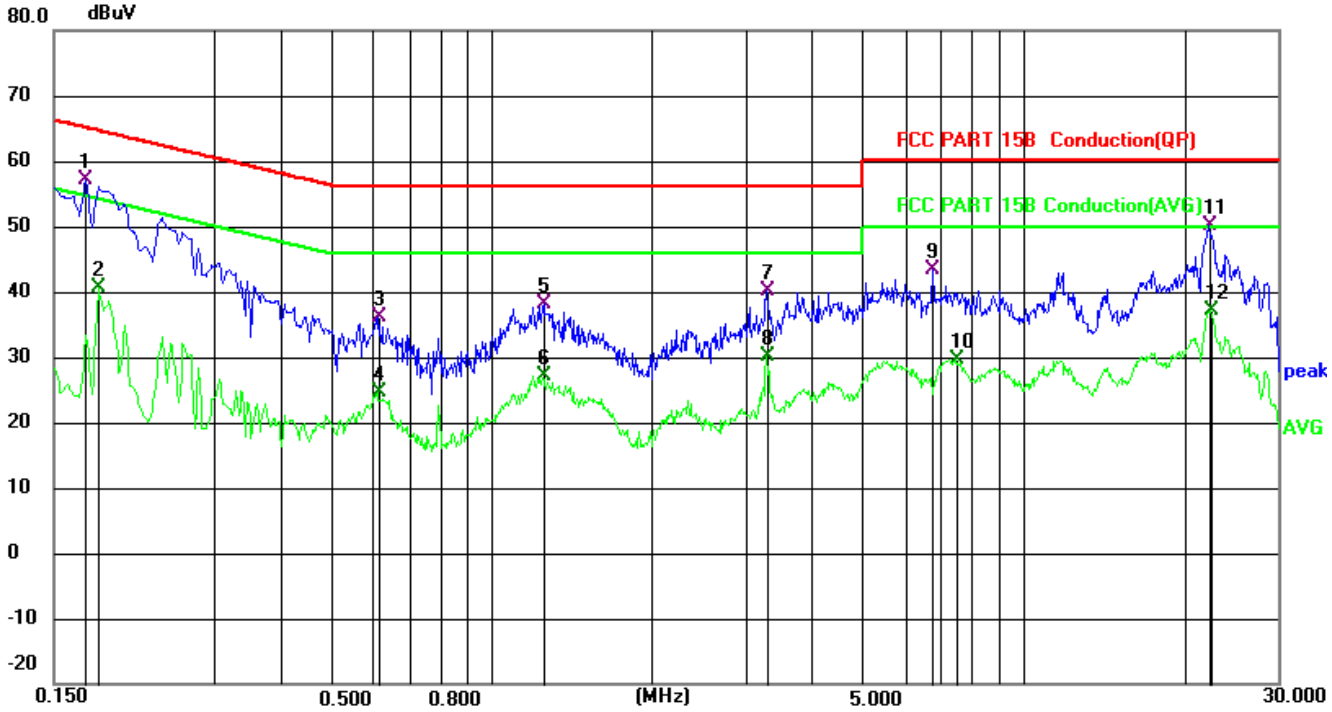
Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1726	45.71	11.52	57.23	64.83	-7.60	QP	
2		0.1816	28.98	11.53	40.51	54.41	-13.90	AVG	
3		0.6136	24.56	11.53	36.09	56.00	-19.91	QP	
4		0.6136	13.13	11.53	24.66	46.00	-21.34	AVG	
5		1.2526	25.94	12.08	38.02	56.00	-17.98	QP	
6		1.2526	15.03	12.08	27.11	46.00	-18.89	AVG	
7		3.2821	27.68	12.41	40.09	56.00	-15.91	QP	
8		3.2821	17.77	12.41	30.18	46.00	-15.82	AVG	
9		6.7426	31.14	12.26	43.40	60.00	-16.60	QP	
10		7.4581	17.32	12.31	29.63	50.00	-20.37	AVG	
11		22.1866	37.02	13.05	50.07	60.00	-9.93	QP	
12		22.4611	23.96	13.09	37.05	50.00	-12.95	AVG	

***Note: 1.Pre-scan all modes and recorded the worst case results in this report (GFSK).
2. Measure= Reading level + Correct factor, Margin= Measure - Limit

7. RADIATED EMISSION MEASUREMENT

7.1. Standard Applicable

According to FCC § 15.249: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) and 15.249 limit in the table below has to be followed.

Fundamental Frequency	Field Strength of fundamental (millivolts/meter)	Field Strength of harmonics (microvolts/meter)
902-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

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

According to RSS-210 B.10:

The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

7.2. Instruments Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

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Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

7.3. Test Procedure

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.0 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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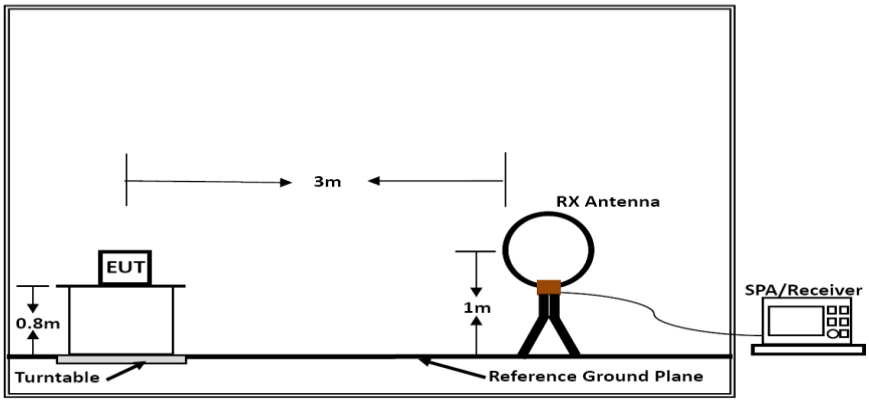
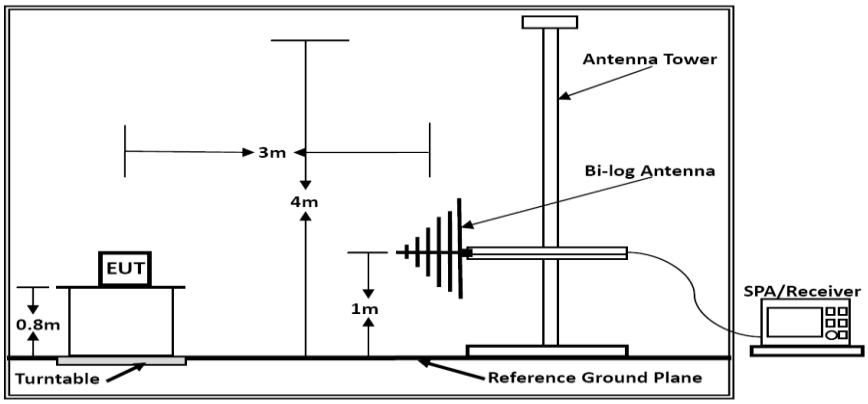
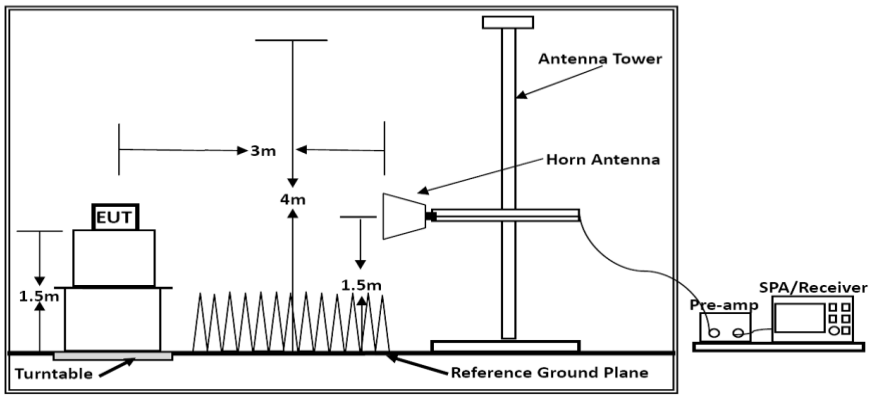
7.4. Block Diagram of Test Setup



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

7.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

7.6. Test Results of Radiated Emissions (9 KHz~30 MHz)

Temperature	24.6℃	Humidity	54.1%
Test Engineer	Kay Hu	Configurations	2460MHz

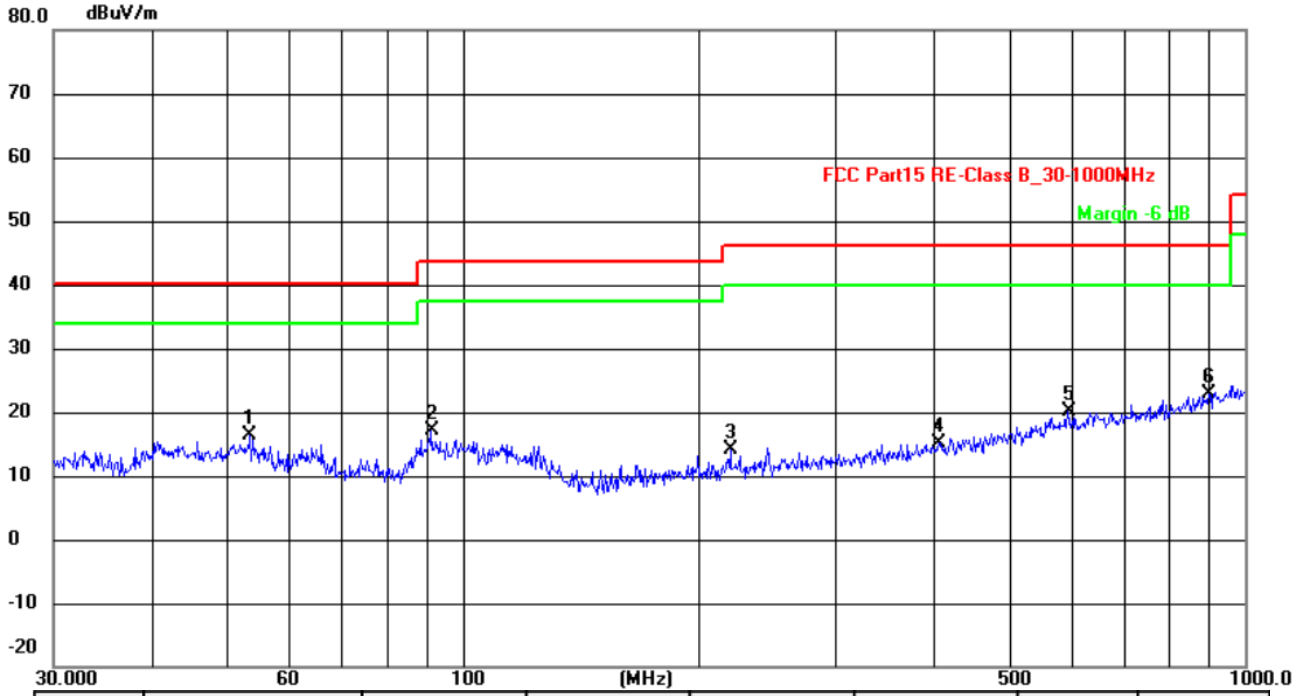
Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

7.7. Test Results of Radiated Emissions (30 MHz – 1000 MHz)

Temperature	24.6℃	Humidity	54.1%
Test Engineer	Kay Hu	Configurations	2460MHz

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	53.5052	45.56	-29.26	16.30	40.00	-23.70	QP
2	91.1746	45.97	-28.81	17.16	43.50	-26.34	QP
3	219.8449	44.10	-30.07	14.03	46.00	-31.97	QP
4	406.0880	40.77	-25.73	15.04	46.00	-30.96	QP
5	593.0497	41.97	-21.93	20.04	46.00	-25.96	QP
6	900.1474	41.16	-18.28	22.88	46.00	-23.12	QP

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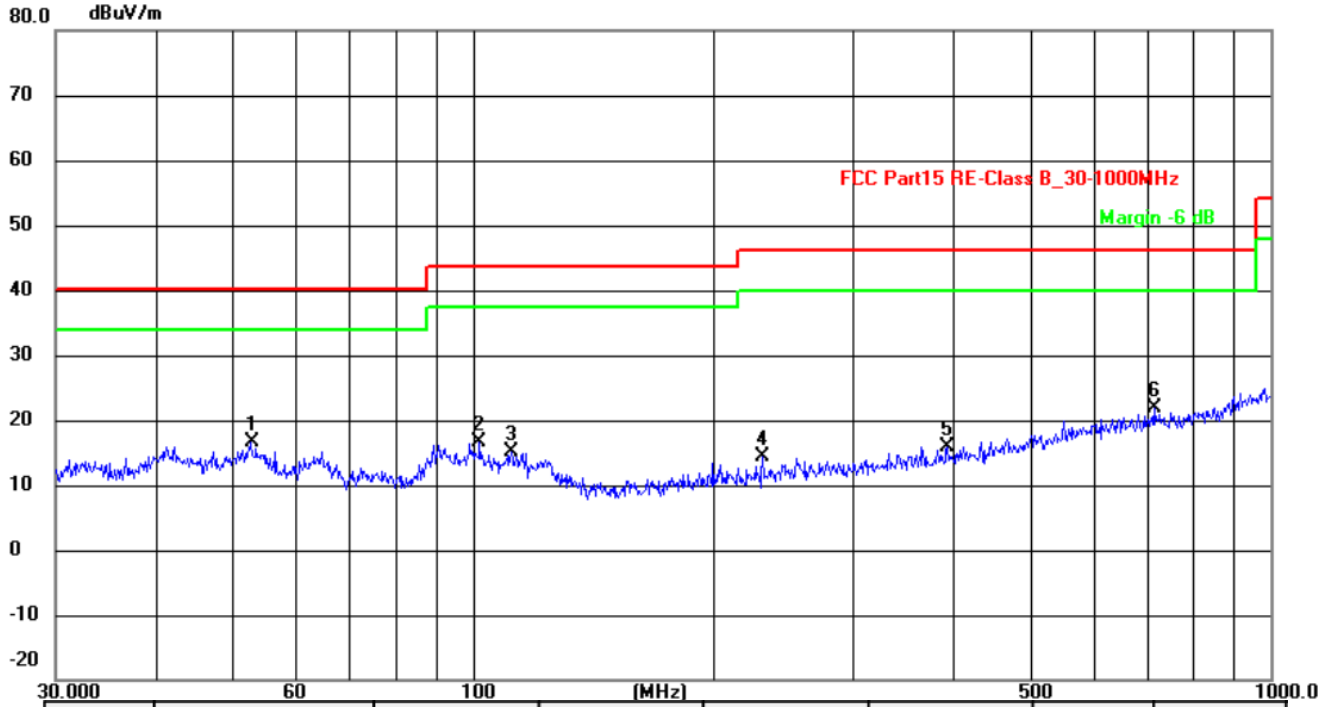
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	52.7600	45.66	-29.15	16.51	40.00	-23.49	QP
2	102.0013	44.10	-27.46	16.64	43.50	-26.86	QP
3	111.7379	43.20	-27.98	15.22	43.50	-28.28	QP
4	230.9067	44.30	-29.84	14.46	46.00	-31.54	QP
5	393.4723	41.99	-26.00	15.99	46.00	-30.01	QP
6	714.1733	42.58	-20.66	21.92	46.00	-24.08	QP

Note:

1). Pre-scan all modes and recorded the worst case results in this report (GFSK).

2). Emission level (dBuV/m) = 20 log Emission level (uV/m).

3). Corrected Reading: Antenna Factor + Cable Loss + Reading Level = Level.

Margin = Limit - Measured Level

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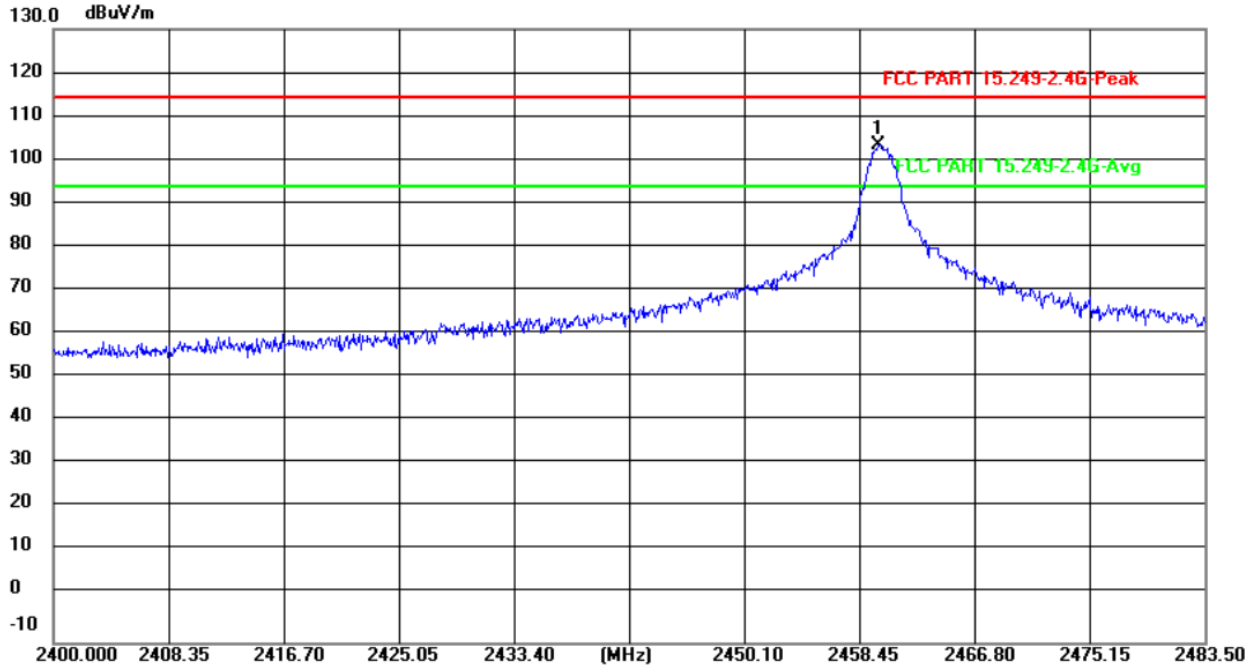
7.8. Results for Radiated Emissions (1 – 26 GHz)

Temperature	24.6℃	Humidity	54.1%
Test Engineer	Kay Hu	Configurations	2460MHz

Horizontal

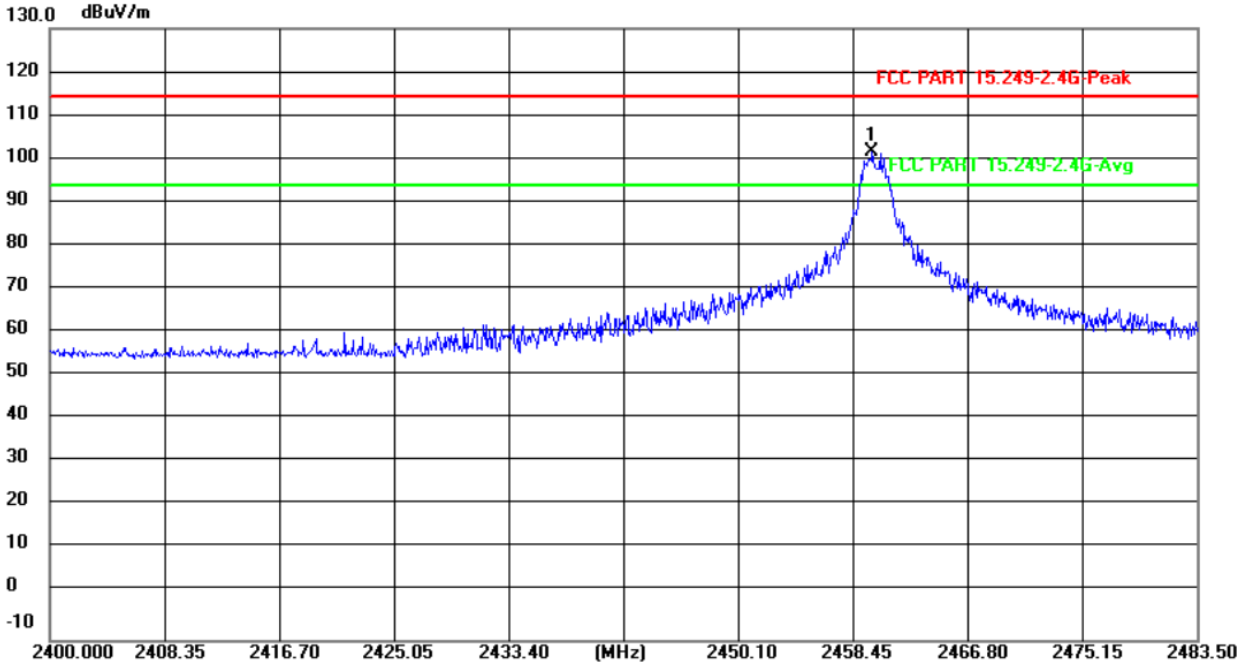


Site 966 chamber #1 Polarization: ***Horizontal*** Temperature: 24.6 (C)

Limit: FCC PART 15.249-2.4G-Peak Power: DC Humidity: 54.1 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2459.869	98.68	4.90	103.58	114.00	-10.42	QP

Vertical



Site 966 chamber #1 Polarization: ***Vertical*** Temperature: 24.6 (C)

Limit: FCC PART 15.249-2.4G-Peak Power: DC Humidity: 54.1 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2459.869	106.82	-5.16	101.66	114.00	-12.34	QP

Note: The pesk is smaller than AVG limit, so you not need evaluate AVG.

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4920.00	45.84	33.06	35.04	3.94	47.80	74.00	-26.20	Peak	Horizontal
4920.00	34.73	33.06	35.04	3.94	36.69	54.00	-17.31	Average	Horizontal
4920.00	46.19	33.06	35.04	3.94	48.15	74.00	-25.85	Peak	Vertical
4920.00	32.52	33.06	35.04	3.94	34.48	54.00	-19.52	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz - 10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.

2). Radiated emissions measured in frequency range from 9 KHz - 10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.

3). 18~25 GHz at least have 20dB margin. No recording in the test report.

4). Corrected Reading: Ant.Fac. + Cab.Loss + Reading Level - Pre.Fac. = Measured Level.

Margin = Limit - Measured Level

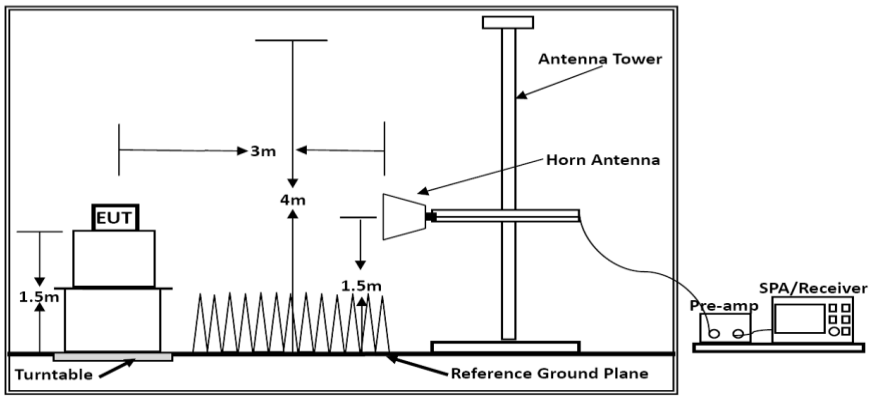
8. RESULTS FOR BAND EDGE TESTING

8.1. Standard Applicable

According to FCC §15.249 (d): Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

According to RSS-210 B.10 (b): Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

8.2. Test Setup Layout



Above 1GHz

8.3. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

8.4. Test Procedures

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

8.5. Measuring Instruments and Setting

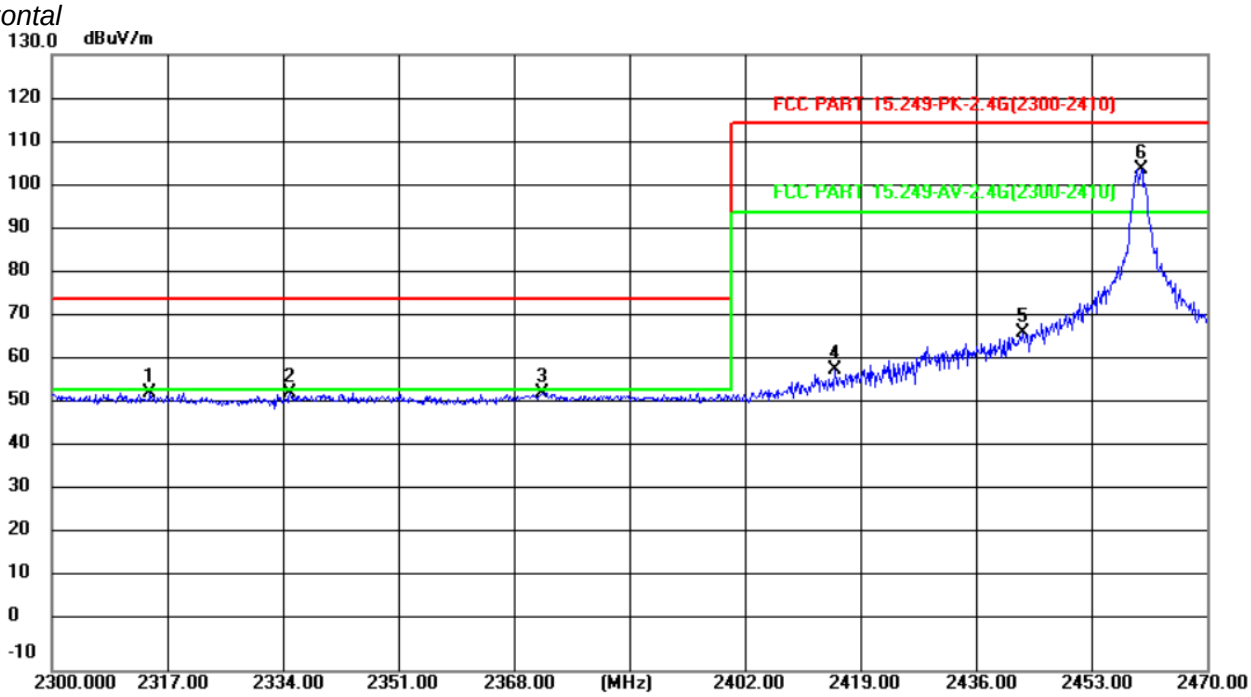
Temperature	24.6℃	Humidity	54.1%
Test Engineer	Kay Hu		

PASS

Remark:

1. *The other emission levels were very low against the limit.*
2. *The average measurement was not performed when the peak measured data under the limit of average detection.*
3. *Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;*
4. *Please refer to following test plots;*

Horizontal



Site 966 chamber #1 Polarization: ***Horizontal*** Temperature: 24.6 (C)

Limit: FCC PART 15.249-PK-2.4G(2300-2410) Power: DC Humidity: 54.1 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2314.450	49.10	4.02	53.12	74.00	-20.88	QP
2	2335.020	49.13	4.00	53.13	74.00	-20.87	QP
3	2372.250	49.10	3.99	53.09	74.00	-20.91	QP
4	2415.260	54.11	4.20	58.31	114.00	-55.69	QP
5	2442.970	62.24	4.64	66.88	114.00	-47.12	QP
6	2460.310	99.05	4.92	103.97	114.00	-10.03	QP

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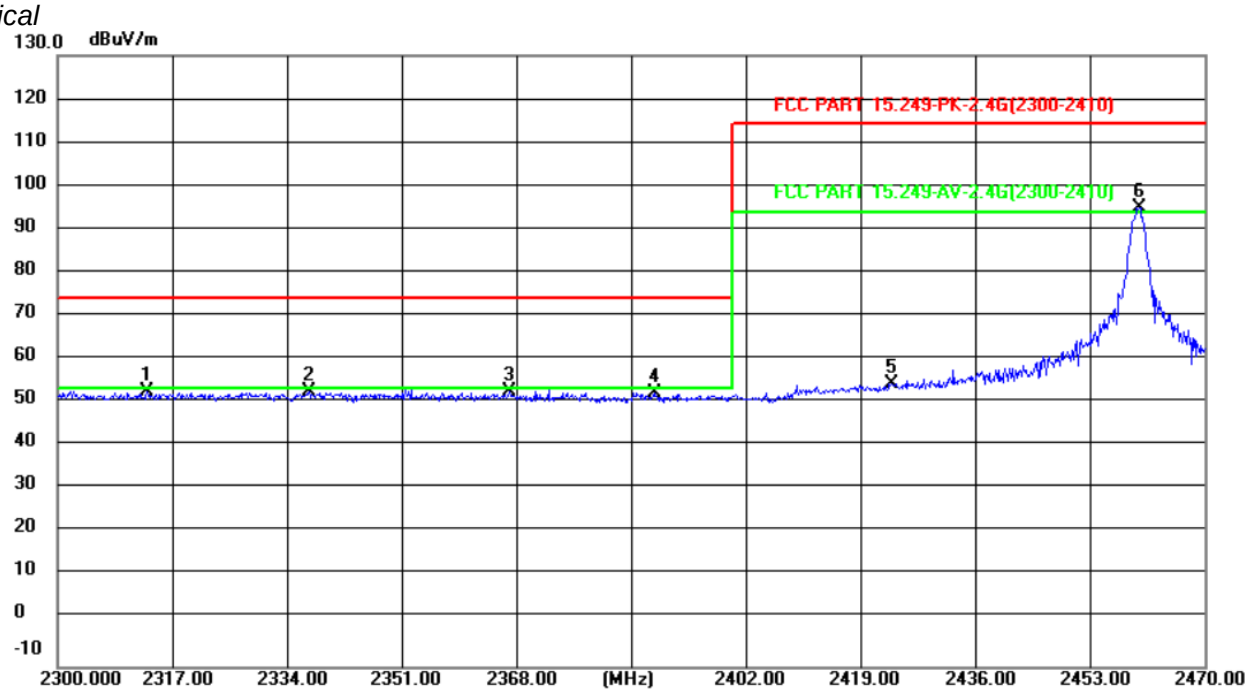
Vertical

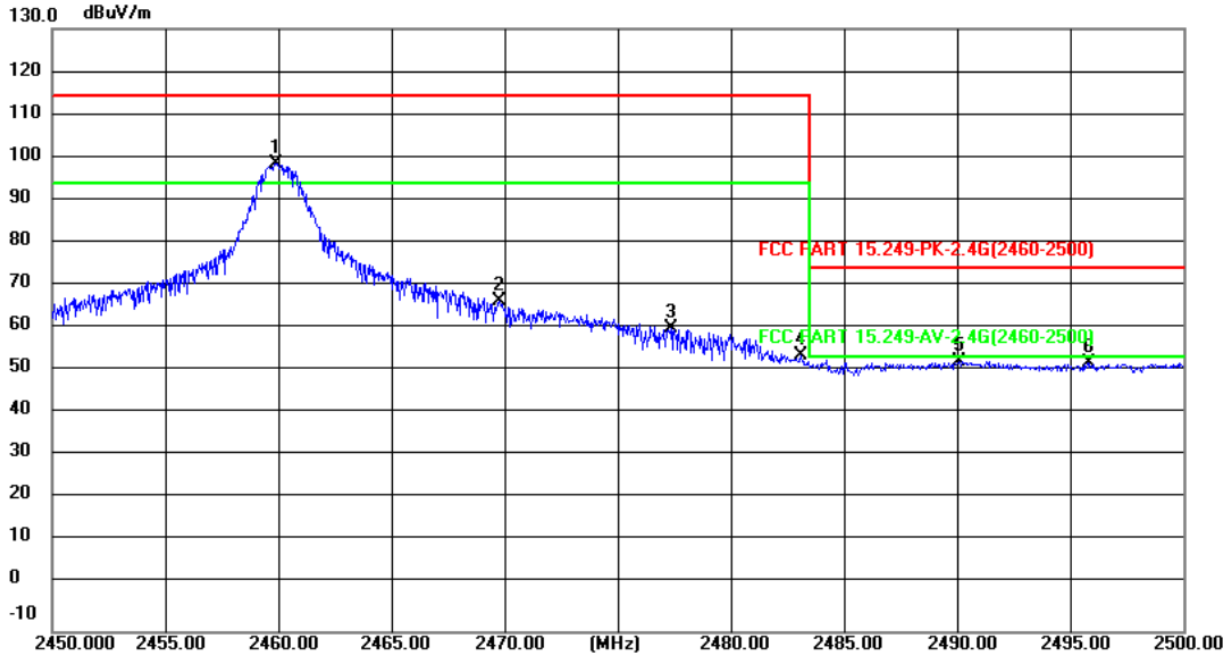


Site 966 chamber #1 Polarization: ***Vertical*** Temperature: 24.6 (C)

Limit: FCC PART 15.249-PK-2.4G(2300-2410) Power: DC Humidity: 54.1 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2313.260	59.54	-6.53	53.01	74.00	-20.99	QP
2	2337.230	59.50	-6.47	53.03	74.00	-20.97	QP
3	2366.980	59.42	-6.39	53.03	74.00	-20.97	QP
4	2388.400	59.31	-6.33	52.98	74.00	-21.02	QP
5	2423.590	60.81	-5.84	54.97	114.00	-59.03	QP
6	2460.310	100.31	-5.14	95.17	114.00	-18.83	QP

Horizontal

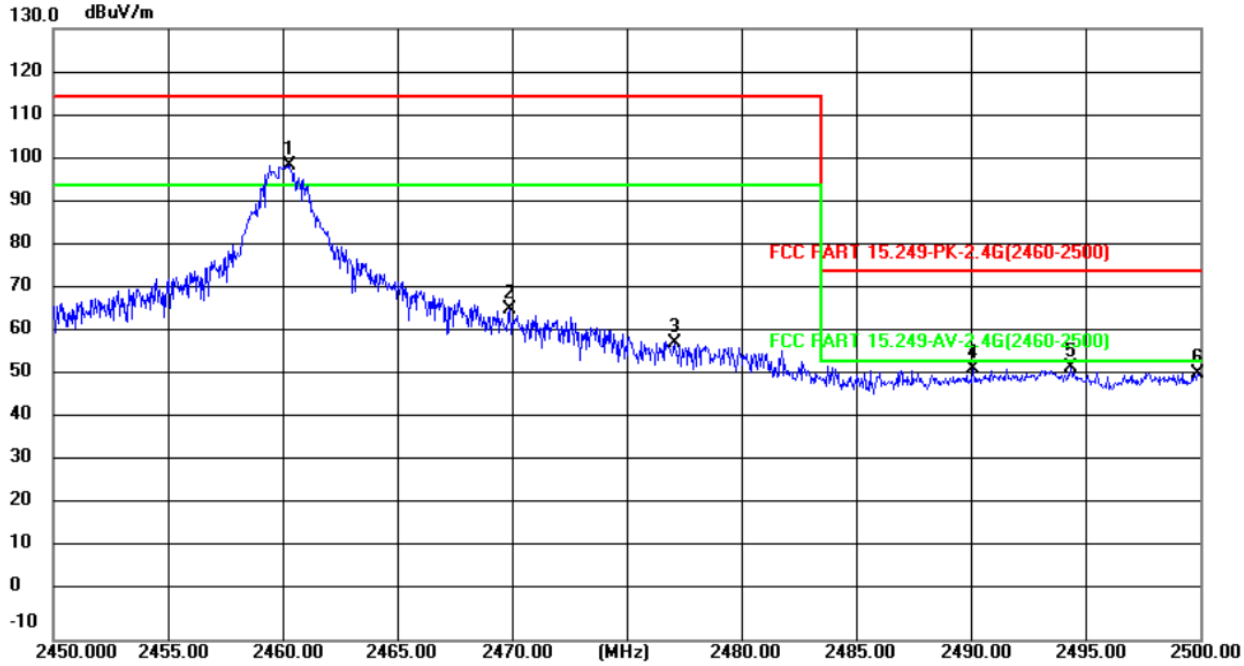


Site 966 chamber #1 Polarization: ***Horizontal*** Temperature: 24.6 (C)

Limit: FCC PART 15.249-PK-2.4G(2460-2500) Power: DC Humidity: 54.1 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2459.900	93.90	4.90	98.80	114.00	-15.20	QP
2	2469.750	61.76	5.06	66.82	114.00	-47.18	QP
3	2477.350	55.36	5.16	60.52	114.00	-53.48	QP
4	2483.100	48.95	5.25	54.20	114.00	-59.80	QP
5	2490.100	47.43	5.37	52.80	74.00	-21.20	QP
6	2495.850	47.11	5.46	52.57	74.00	-21.43	QP

Vertical



Site 966 chamber #1 Polarization: ***Vertical*** Temperature: 24.6 (C)

Limit: FCC PART 15.249-PK-2.4G(2460-2500) Power: DC Humidity: 54.1 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2460.300	103.99	-5.15	98.84	114.00	-15.16	QP
2	2469.900	70.61	-4.97	65.64	114.00	-48.36	QP
3	2477.100	63.02	-4.84	58.18	114.00	-55.82	QP
4	2490.100	56.66	-4.59	52.07	74.00	-21.93	QP
5	2494.350	57.10	-4.52	52.58	74.00	-21.42	QP
6	2499.900	55.57	-4.41	51.16	74.00	-22.84	QP

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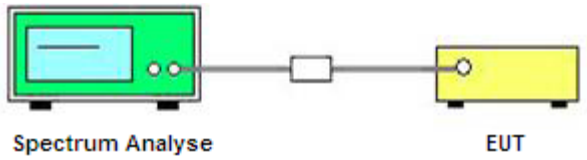
9. 99% OCCUPIED BANDWIDTH AND 20 DB BANDWIDTH MEASUREMENT

9.1. Standard Applicable

According to § 2.1049 and RSS-Gen section 6.7 “The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.”

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

9.2. Block Diagram of Test Setup



9.3. Test Procedure

Use the following spectrum analyzer settings:

Span = 3MHz

RBW = 30 KHz

VBW = 100 KHz

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

9.4. Test Results

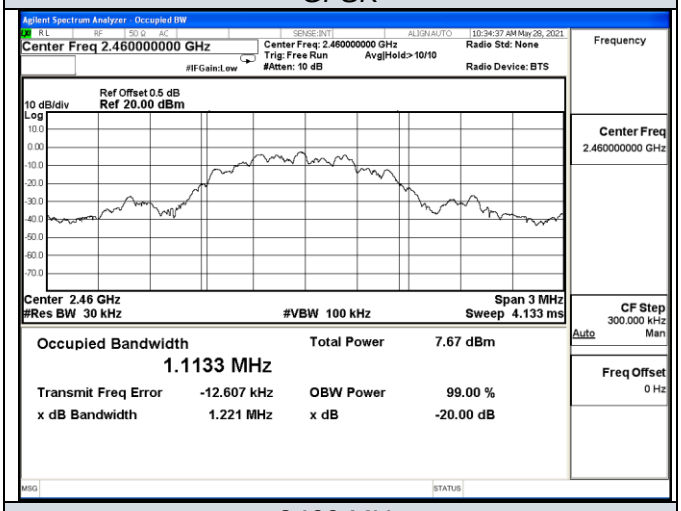
Temperature	24.6℃	Humidity	54.1%
Test Engineer	Kay Hu		

Test Result of 99% and 20dB Bandwidth Measurement			
Test Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)
2460	1.221	1.1133	Non-Specified

Remark:

1. *Test results including cable loss;*
2. *Please refer following test plots;*

GFSK



2460 MHz

10. LIST OF MEASURING EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Meter	R&S	NRVS	100444	2020-06-22	2021-06-21
2	Power Sensor	R&S	NRV-Z81	100458	2020-06-22	2021-06-21
3	Power Sensor	R&S	NRV-Z32	10057	2020-06-22	2021-06-21
4	Test Software	Tonscend	JS1120-2	/	N/A	N/A
5	RF Control Unit	Tonscend	JS0806-2	N/A	2020-11-17	2021-11-16
6	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020-11-17	2021-11-16
7	DC Power Supply	Agilent	E3642A	N/A	2020-11-13	2021-11-12
8	EMI Test Software	EZ	EZ-EMC	/	N/A	N/A
9	3m Full Anechoic Chamber	MRDIANZI	FAC-3M	MR009	2020-06-22	2021-06-21
10	Positioning Controller	MF	MF7082	MF78020803	2020-06-22	2021-06-21
11	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2018-07-26	2021-07-25
12	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2018-07-26	2021-07-25
13	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2018-07-02	2021-07-01
14	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2020-09-20	2023-09-19
15	Broadband Preamplifier	SCHWARZBECK	BBV9745	9719-025	2020-06-22	2021-06-21
16	EMI Test Receiver	R&S	ESR 7	101181	2020-06-22	2021-06-21
17	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2020-11-17	2021-11-16
18	Broadband Preamplifier	/	BP-01M18G	P190501	2020-06-22	2021-06-21
19	RF Cable-R03m	Jye Bao	RG142	CB021	2020-06-22	2021-06-21
20	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2020-06-22	2021-06-21
21	6dB Attenuator	/	100W/6dB	1172040	2020-06-22	2021-06-21
22	3dB Attenuator	/	2N-3dB	/	2020-11-17	2021-11-16
23	EMI Test Receiver	R&S	ESPI	101840	2020-06-22	2021-06-21
24	Artificial Mains	R&S	ENV216	101288	2020-06-22	2021-06-21
25	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2020-06-22	2021-06-21
26	EMI Test Software	AUDIX	E3	/	N/A	N/A
27	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2020-06-22	2021-06-21

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11. TEST SETUP PHOTOGRAPHS OF THE EUT

Please refer to separated files for Test Setup Photos of the EUT.

12. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

13. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

----------THE END OF REPORT----------

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