FCC TEST REPORT

Test report

On Behalf of

STEELMATE CO., LTD.

For

Tire Pressure Monitoring System

Model No.: BSE152, TP-77,TP-S11,ET-910AE,TP-S9,TP-S10,TP-S12, TP-S13, TP-S14, TP-S15, TP-S16, TP-S17, TP-S18, TP-S19, TP-S20, TP-U1,TP-90, TP-90 Pro, TP-91, TP-92, TP-V3, TP-V4

FCC ID: Q6WBSE152

Prepared for :	STEELMATE CO., LTD. Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan City, Guangdong, P.R. China
Prepared By :	Shenzhen Tongzhou Testing Co.,Ltd 1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China
Date of Test:	2022/6/20 ~ 2022/6/28
Date of Report:	2022/6/28
Report Number:	TZ220603360-E

The test report apply only to the specific sample(s) tested under stated test conditions
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

TEST RESULT CERTIFICATION

Applicant's name	:	STEELMATE CO., LTD.
Address	:	Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan City, Guangdong, P.R. China
Manufacture's Name	:	STEELMATE CO., LTD.
Address	:	Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan City, Guangdong, P.R. China
Product description		
Trade Mark	:	STEEL MATE
Product name	:	Tire Pressure Monitoring System
Model and/or type reference	:	BSE152, TP-77,TP-S11,ET-910AE,TP-S9,TP-S10,TP-S12, TP-S13, TP-S14, TP-S15, TP-S16, TP-S17, TP-S18, TP-S19, TP-S20, TP-U1,TP-90, TP-90 Pro, TP-91, TP-92, TP-V3, TP-V4
Standards	:	FCC Rules and Regulations Part 15.231 ANSI C63.10:2013

Date of Test ..... :

Date (s) of performance of tests	:	2022/6/20 ~ 2022/6/28
Date of Issue	:	2022/6/28
Test Result	:	Pass

Testing Engineer : Anna Hu

(Anna Hu)

Technical Manager : Hugo Chen

(Hugo Chen)

Authorized Signatory : Andy Zhang

(Andy Zhang)

Revision History

Revision	Issue Date	Revisions	Revised By
000	2022/6/28	Initial Issue	Andy Zhang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Tire Pressure Monitoring System
Model Number	:	BSE152, TP-77,TP-S11,ET-910AE,TP-S9,TP-S10,TP-S12, TP-S13, TP-S14, TP-S15, TP-S16, TP-S17, TP-S18, TP-S19, TP-S20, TP-U1,TP-90, TP-90 Pro, TP-91, TP-92, TP-V3, TP-V4
Model Declaration	:	All the same except for the model name
Test Model	:	BSE152
Power Supply	:	DC 3.0V by battery (Range: DC 2.0 – 3.3V)
Hardware version	:	v.1
Software version	:	v.1
Sample ID	:	TZ220603360–1#
SRD		
Frequency Range	:	433.92MHz
Channel Number	:	1
Modulation Technology	:	ASK
Antenna Type And Gain		Integral Antenna, 0.0dBi (Max.)

Note1: Antenna position refer to EUT Photos

Note2: the information in above table was supplied by the applicant

1.2. Objective

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

1.3. Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:
- Temperature: 15-35ºC
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

1.4. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate

1.5. External I/O Cable

I/O Port Description	Quantity	Cable

1.6. Description of Test Facility

FCC
Designation Number: CN1275
Test Firm Registration Number: 167722
Shenzhen Tongzhou Testing Co.,Ltd has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA
Certificate Number: 5463.01
Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

IC
ISED#: 22033
CAB identifier: CN0099
Shenzhen Tongzhou Testing Co.,Ltd has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

1.7. 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 Shenzhen Tongzhou Testing Co.,Ltd’s 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.

1.8. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.08dB	(1)
		30MHz~1000MHz	±4.42dB	(1)
		1GHz~40GHz	±4.06dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±2.23dB	(1)

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

1.9. Description of Test Modes

The EUT was placed in a RF test mode for testing of the transmitter and in normal mode of operation for testing the digital circuitry or receiver. In both modes the carrier current device within the EUT was operational.

1.10. Antenna System

The directional gains of antenna used for transmitting refer to section 1.1 of this report, and EUT uses an integral antenna which is permanently attached.

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 Tongzhou Testing Co.,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 normal operating mode. The TX frequency that was fixed which 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 15.231 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. 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 turn table, which is 1.5 m above ground plane. 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

2.4. Instrument Calibration

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

2.5. Test Mode

The EUT has been tested under engineering mode. The field strength of radiation emission was measured in the following position: EUT stand-up position (Y axis), lie-down position (X, Z axis).
The worst case of X axis was reported.

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen Tongzhou Testing Co.,Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Rules	Description of test	Sample ID	Result
§15.203	Antenna Requirement	TZ220603360–1#	Compliant
§15.205	Restricted Band	TZ220603360–1#	Compliant
§15.209	General Requirement	TZ220603360–1#	Compliant
§15.231 (e)	Radiated Emissions	TZ220603360–1#	Compliant
§15.231 (c)	20dB Bandwidth Testing	TZ220603360–1#	Compliant
§15.231 (e)	Deactivation Testing	TZ220603360–1#	Compliant
§15.231	Duty cycle Factor	TZ220603360–1#	Compliant

Remark: The measurement uncertainty is not included in the test result.

5. TEST ITEMS and RESULTs

5.1. Transmitter Deactivation Time

FCC 15.231 (e)

5.1.1. Limit

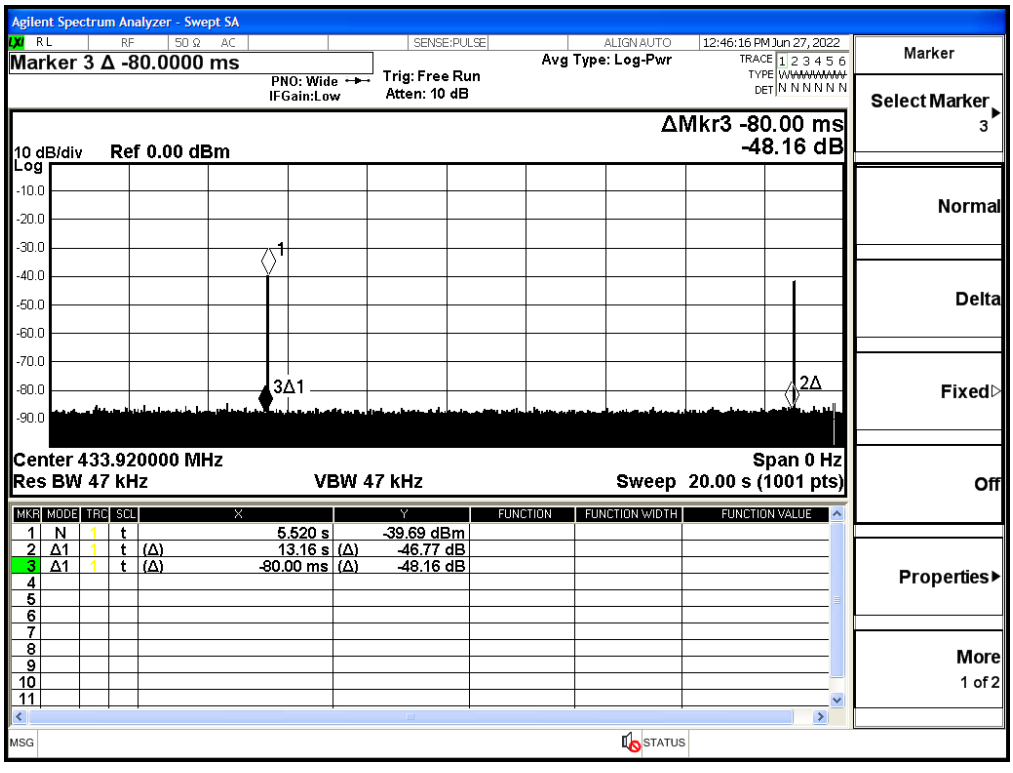
devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

5.1.2. Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

5.1.3. Test Result

Frequency (MHz)	Activation Time (s)	Upper Limit(s)	silent period(s)	Lower Limit(s)	Conclusion
433.92	0.06	1	13.16	10	PASS



5.2. Transmitter Field Strength of Emissions

5.2.1. Limit

FCC §15.231 (e)

In addition to the provisions of § 15.205, the field strength of emissions from Intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500[1]	50 to 150[1]
174-260	1,500	150
260-470	1,500 to 5,000[1]	150 to 500[1]
Above 470	5,000	500

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, μV/m at 3 meters = 22.7273 (F) - 2454.5455; for the band 260-470 MHz, μV/m at 3 meters = 16.6667(F) - 2833.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 – 13.41	322 - 335.4		

1 Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

2 Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 72 MHz, 76 88 MHz, 174 216 MHz or 470 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipments 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 / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

5.2.3. Test Procedures

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.

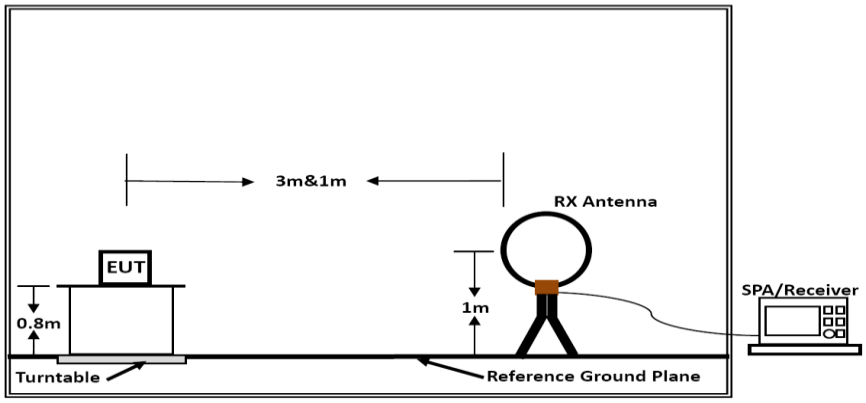
--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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.

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.

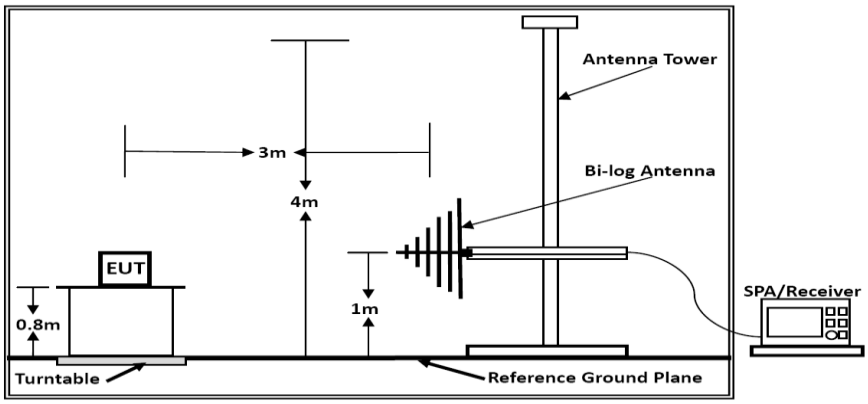
5.2.4. Test Setup

For radiated emissions below 30MHz



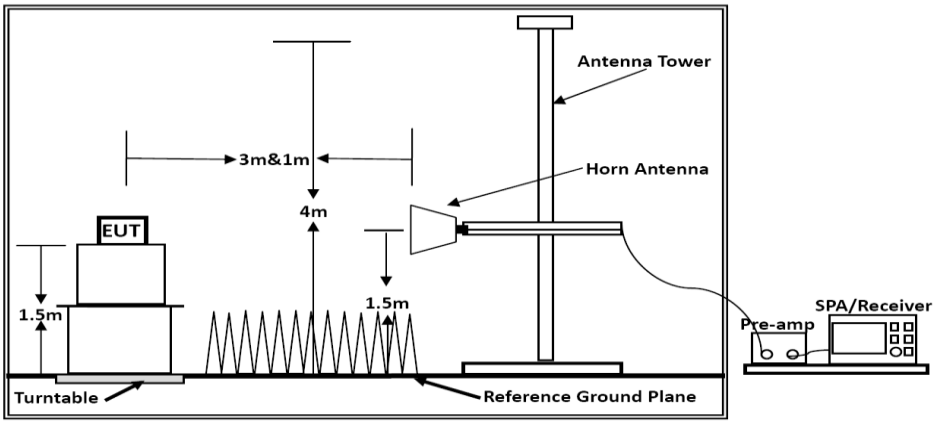
Below 30MHz

For radiated emissions From 30MHz to 1GHz



Below 1GHz

For radiated emissions From Above 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 if applicable.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Results of Radiated Emissions (9 kHz ~30MHz)

Temperature	25℃	Humidity	60%
Test Engineer	Anna Hu	Configurations	Automatically

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

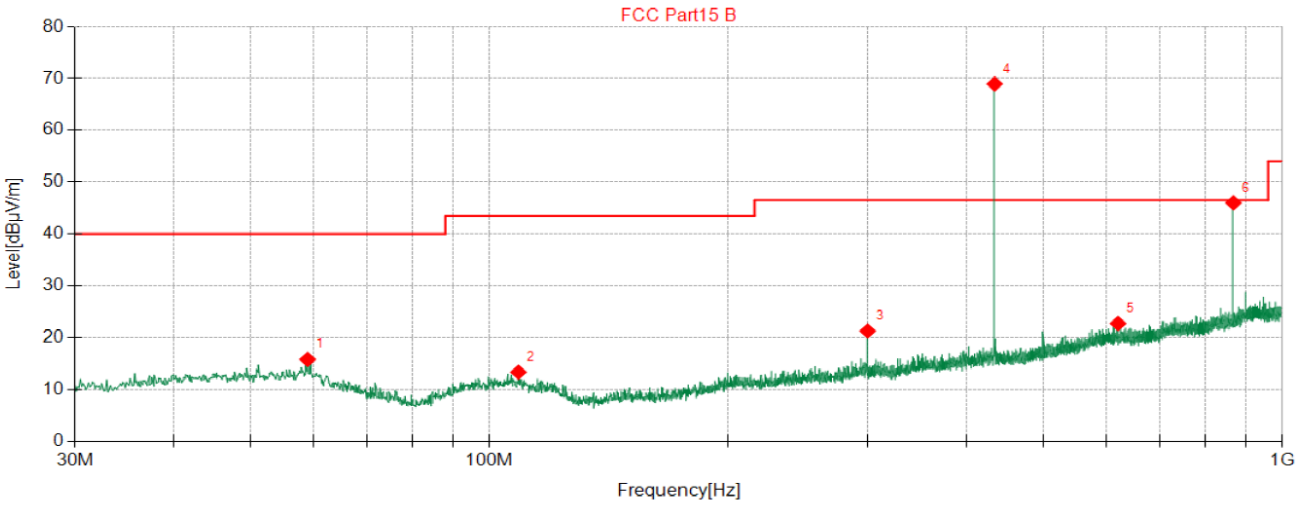
Note:
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

5.2.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	25℃	Humidity	60%
Test Engineer	Anna Hu	Configurations	TX



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	58.97	30.71	-14.93	15.78	40.00	24.22	100	127	Vertical
2	108.8	28.89	-15.58	13.31	43.50	30.19	100	308	Vertical
3	300.0	33.37	-12.11	21.26	46.50	25.24	200	125	Vertical
4	433.8	78.39	-9.44	68.95	46.50	-22.45	100	100	Vertical
5	620.8	28.51	-5.80	22.71	46.50	23.79	100	196	Vertical
6	867.9	48.40	-2.40	46.00	46.50	0.50	100	0	Vertical

Note:

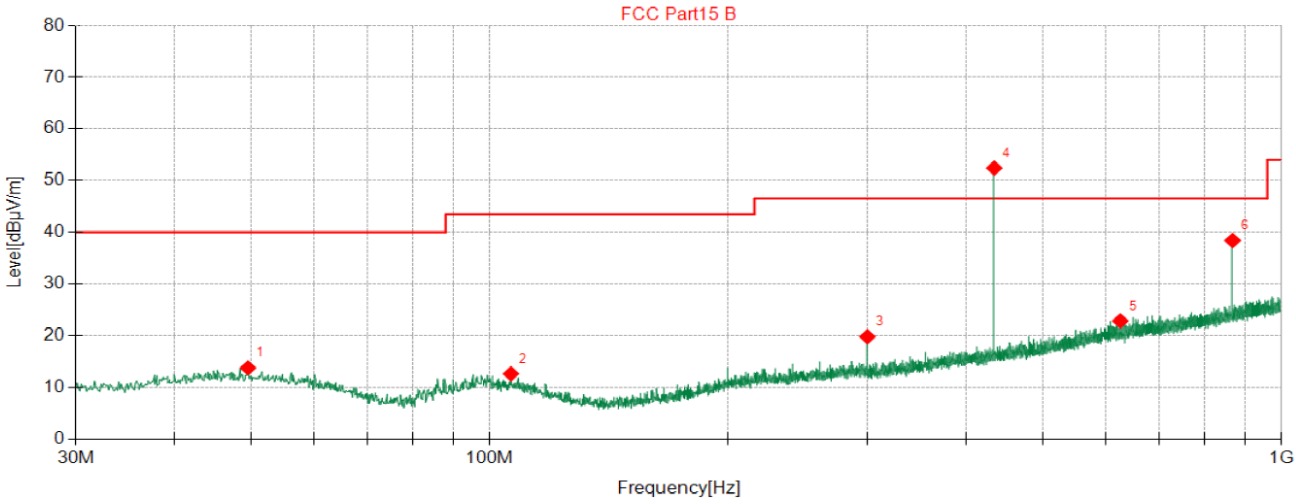
1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]

2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty cycle factor(dB)	Average value (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Polarization
433.8	68.95	92.86	23.91	-9.66	59.29	72.86	13.57	Vertical
867.9	46.00	72.86	26.86	-9.66	36.34	52.86	16.52	Vertical

Note:

1. *Peak Margin [dB] = Peak Limit [dBµV/m] - Peak Level [dBµV/m]*
2. *Average value [dBµV/m] = Peak Level [dBµV/m] + Duty cycle factor [dB]*
3. *Average Margin [dB] = Average Limit [dBµV/m] - Average Level [dBµV/m]*



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	49.52	27.89	-14.15	13.74	40.00	26.26	100	317	Horizontal
2	106.3	28.60	-16.00	12.60	43.50	30.90	300	288	Horizontal
3	300.0	32.58	-12.81	19.77	46.50	26.73	100	338	Horizontal
4	433.8	61.79	-9.37	52.42	46.50	-5.92	100	238	Horizontal
5	626.1	28.10	-5.27	22.83	46.50	23.67	300	2	Horizontal
6	867.8	40.03	-1.63	38.40	46.50	8.10	100	44	Horizontal

Note:

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]

2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty cycle factor(dB)	Average value (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Polarization
433.8	52.42	92.86	40.44	-9.66	42.76	72.86	30.1	52.42
867.9	38.4	72.86	34.46	-9.66	28.74	52.86	24.12	38.4

Note:

1. Peak Margin [dB] = Peak Limit [dBµV/m] - Peak Level [dBµV/m]

2. Average value [dBµV/m] = Peak Level [dBµV/m] + Duty cycle factor [dB]

3. Average Margin [dB] = Average Limit [dBµV/m] - Average Level [dBµV/m]

5.2.8. Results of Radiated Emissions (1GHz-5GHz)

Temperature	25℃	Humidity	60%
Test Engineer	Anna Hu	Configurations	Harmonics Emissions/ Spurious Emission

Peak Value				
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
1301.74	53.74	74	20.26	Horizontal
1735.7	49.21	74	24.79	Horizontal
1301.74	54.72	74	19.28	Vertical
1735.7	49.2	74	24.8	Vertical

Note:

1. Margin [dB] = Limit [dBμV/m] - Level [dBμV/m]

Average Value						
Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
1301.74	53.74	-9.66	44.08	54	9.92	Horizontal
1735.7	49.21	-9.66	39.55	54	14.45	Horizontal
1301.74	54.72	-9.66	45.06	54	8.94	Vertical
1735.7	49.2	-9.66	39.54	54	14.46	Vertical

Note:

1. Average value [dBμV/m] = Level [dBμV/m] + Duty cycle factor [dB]

2. Margin [dB] = Limit [dBμV/m] - Average value [dBμV/m]

Other note:

1. Measuring frequencies from 9k~10th harmonic (ex. 5GHz), No emission found between lowest internal used/generated frequency to 30MHz.

2. Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 5GHz) were made with an instrument using Peak detector mode.

3. Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5.3. 20dB Bandwidth Emissions

FCC 15.231 (c)

5.3.1. Limit

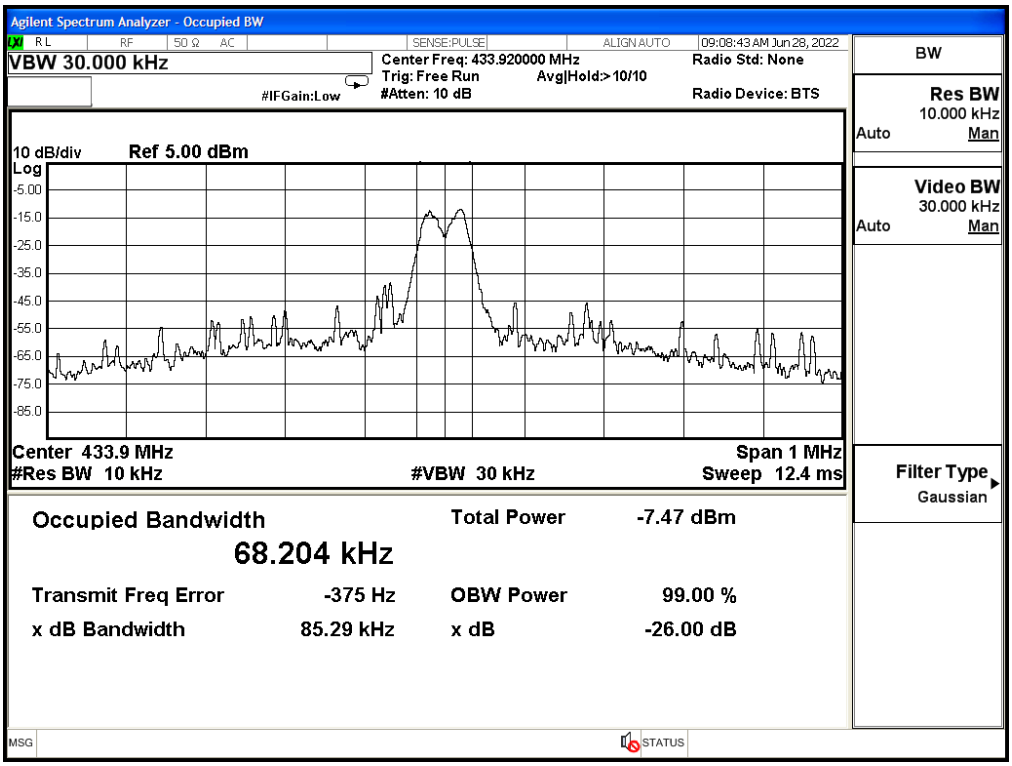
The bandwidth of the emission shall be no wider than 0.25% of the centre frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3.2. Test Procedure

With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna which was connected to the spectrum analyzer with the START and STOP frequencies set to the EUT's operation band.

5.3.3. Test Data

Center Frequency of operation MHz	Maximum allowed bandwidth kHz	Measured 20dB bandwidth kHz	Result
433.92	1084.80	85.29	PASS
Maximum allowed bandwidth:	☒0.25% of the centre operating frequency ☐0.5% of the centre operating frequency		
RBW: VBW:	☒10kHz ☐100kHz ☐other kHz ☒30kHz ☐300kHz ☐other kHz		



5.4. Duty cycle

5.4.1. Limit

No dedicated limit specified in the Rules.

5.4.2. Test Procedure

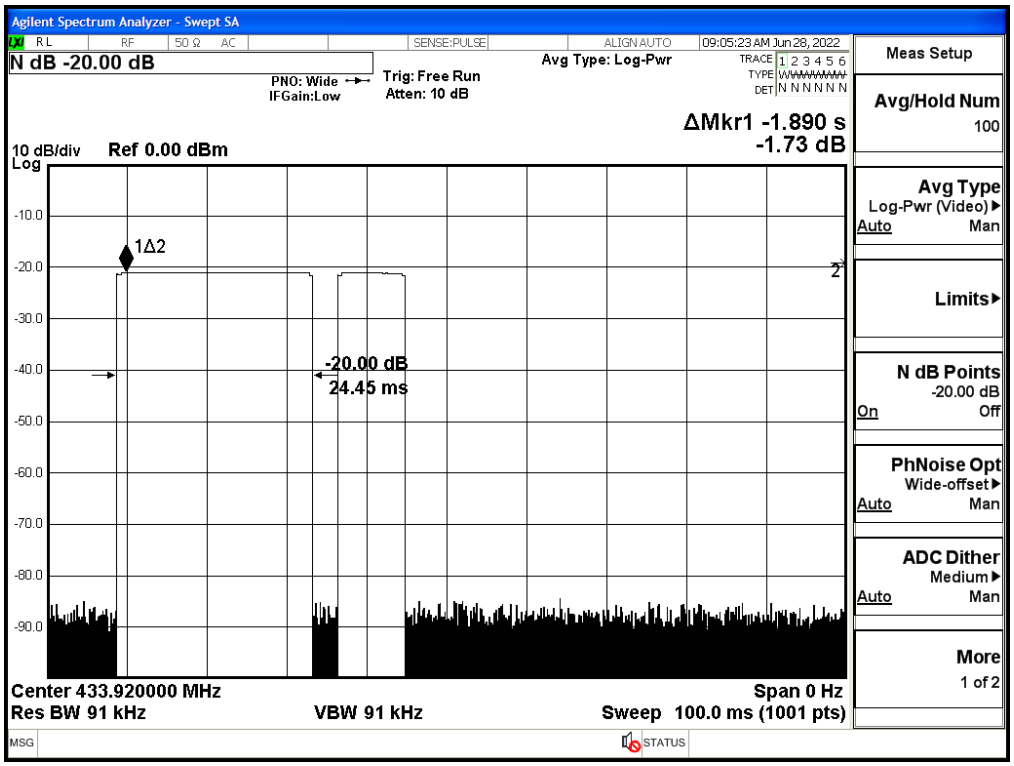
5.4.2.1. Place the EUT on the table and set it in transmitting mode.
5.4.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
5.4.2.3. Set centre frequency of spectrum analyzer=operating frequency.
5.4.2.4. Set the spectrum analyzer as RBW=100 kHz, VBW=100 KHz, Span=0Hz, Adjust Sweep time.
5.4.2.5. Repeat above procedures until all frequency measured was complete.

5.4.3. Test Data

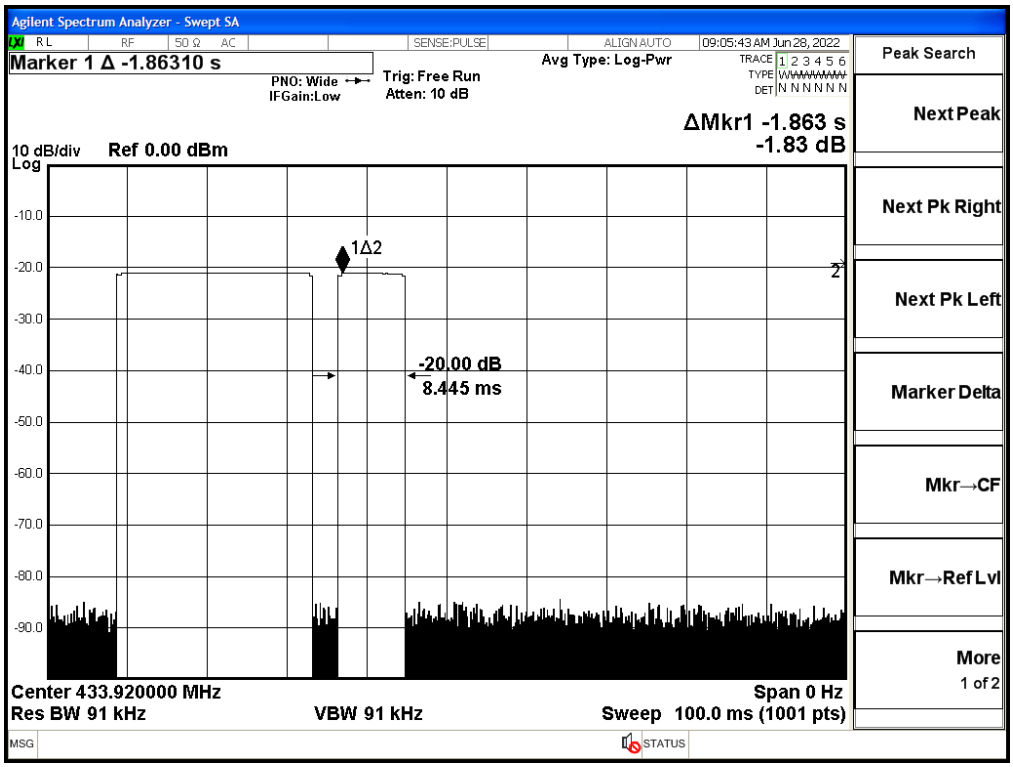
Ton = 24.45*1 + 8.445*12 = 32.895(ms)
Tp =100 (ms)
Duty cycle= Ton/ Tp*100%=32.895/100*100%=32.895%
DC Correction Factor= 20log (Ton/Tp) =20log (0.32895) = -9.66 dB

Note1: The signal bandwidth was measured and less than 100 kHz RBW, so PDCF factor is not required to correct the fundamental signal peak result.
Note2: the period of the signal is more than 100ms.so use 100ms to calculate the duty cycle.

Ton Plot–pluse 1@Length: 24.45ms,Count: 1



Ton Plot-pluse 2@Length: 8.445ms,Count: 1


Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:PULSE
ALIGN AUTO
09:05:43 AM Jun 28, 2022
Marker 1 Δ -1.86310 s
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE WWWWW
DET N N N N N
ΔMkr1 -1.863 s
-1.83 dB
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1Δ2
2
-20.00 dB
8.445 ms
Center 433.920000 MHz
Res BW 91 kHz
VBW 91 kHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

5.5. Antenna Requirement

FCC 15.203

5.5.1. Standard Applicable

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 antenna gain and type refer to section 1.1 of this report;

5.5.2. Result

Compliant.

6. LIST OF MEASURING EQUIPMENTS

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2022/1/13	2023/1/12
2	Power Sensor	Agilent	U2021XA	MY5365004	2022/1/13	2023/1/12
3	Power Meter	Agilent	U2531A	TW53323507	2022/1/13	2023/1/12
4	Loop Antenna	schwarzbeck	FMZB1519B	00023	2019/11/16	2022/11/15
5	Wideband Antenna	schwarzbeck	VULB 9163	958	2019/11/16	2022/11/15
6	Horn Antenna	schwarzbeck	9120D-1141	1574	2019/11/16	2022/11/15
7	EMI Test Receiver	R&S	ESCI	100849/003	2022/1/12	2023/1/11
8	Controller	MF	MF7802	N/A	N/A	N/A
9	Amplifier	schwarzbeck	BBV 9743	209	2022/1/12	2023/1/11
10	Amplifier	Tonscend	TSAMP-0518 SE	--	2022/1/12	2023/1/11
11	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	N/A	2022/1/12	2023/1/11
12	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	N/A	2022/1/14	2023/1/13
12	Artificial Mains	ROHDE & SCHWARZ	ENV 216	101333-IP	2022/1/13	2023/1/12
14	EMI Test Software	ROHDE & SCHWARZ	ESK1	V1.71	N/A	N/A
15	RE test software	Tonscend	JS32-RE	V2.0.2.0	N/A	N/A
16	Test Software	Tonscend	JS1120-3	V2.5.77.0418	N/A	N/A

7. TEST SETUP Photographs of EUT

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

8. Exterior Photographs of the EUT

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

9. INTERIOR Photographs of the EUT

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

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