

FCC RF EXPOSURE EVALUATION REPORT

Product Name: Router
Trade Mark: AMTC, Boulanger, STRONG, essentiel b
Model No.: WR1819M
Add. Model No.: WR****M (* from 0 to 9)
Report Number: 220725611RFC-4
Test Standards: FCC 47 CFR Part 1 Subpart I
FCC ID: 2AHVH-WR1819M
Test Result: PASS
Date of Issue: September 7, 2023

Prepared for:

Shen Zhen MTC Co., LTD
MTC Industry Park, 1st Lilang Road, Xialilang community, Nanwan
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Prepared by:

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Version

Version No.	Date	Description
V1.0	September 7, 2023	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Shen Zhen MTC Co., LTD
Address of Applicant:	MTC Industry Park, 1st Lilang Road, Xialilang community, Nanwan street, Longgang district, Shenzhen, China
Manufacturer:	Shen Zhen MTC Co., LTD
Address of Manufacturer:	MTC Industry Park, 1st Lilang Road, Xialilang community, Nanwan street, Longgang district, Shenzhen, China

1.2 EUT INFORMATION

Product Name:	Router		
Model No.:	WR1819M		
Add. Model No.:	WR****M (* from 0 to 9)		
Trade Mark:	AMTC, Boulanger, STRONG, essentiel b		
DUT Stage:	Production Unit		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n/ax	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac/ax
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac/ax
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac/ax
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac/ax
Sample Received Date:	July 25, 2022		
Sample Tested Date:	August 22, 2022 to October 27, 2022		
Note: The additional model WR****M (* from 0 to 9) is identical with the test model WR1819M except the model number for marketing purpose.			

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

For 2.4 GHz ISM Band of Wi-Fi		
Frequency Band:	2400 MHz to 2483.5 MHz	
Frequency Range:	2412 MHz to 2462 MHz	
Support Standards:	IEEE 802.11b/g/n-HT20/n-HT40/ax-HE20/ax-HE40	
Type of Modulation:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11ax: ☒ OFDM (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK) ☒ OFDMA (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)	
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS7(72.2 Mbps) IEEE 802.11n-HT40: Up to MCS7(150 Mbps) IEEE 802.11ax-HE20/ HE40: Up to MCS11	
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20/ax-HE20: 11 IEEE 802.11n-HT40/ax-HE40: 9	
Channel Separation:	5 MHz	
Antenna Type:	Integral Antenna	
Antenna Gain: (Provided by the customer)	5 dBi	
Directional gain:	5 dBi	
Maximum Peak Power:	SISO_ Ant. 0	IEEE 802.11b: 20.47 dBm IEEE 802.11g: 23.09 dBm
	SISO_ Ant. 1	IEEE 802.11b: 18.63 dBm IEEE 802.11g: 23.09 dBm
	MIMO_ Ant. 0+1	IEEE 802.11n-HT20: 25.33 dBm IEEE 802.11n-HT40: 25.54 dBm IEEE 802.11AX-HE20: 21.35 dBm IEEE 802.11AX-HE40: 21.40 dBm

For 5 GHz U-NII Bands of Wi-Fi		
Frequency Bands:	5150 MHz to 5250 MHz (U-NII-1)	
	5250 MHz to 5350 MHz (U-NII-2A)	
	5470 MHz to 5725 MHz (U-NII-2C)	
	5 725 MHz to 5 850 MHz (U-NII-3)	
Frequency Ranges:	5180 MHz to 5240 MHz	
	5260 MHz to 5320 MHz	
	5500 MHz to 5700 MHz	
	5 745 MHz to 5 825 MHz	
Support Standards:	IEEE 802.11a/n/ac/ax	
TPC Function:	Not Support	
DFS Operational mode:	Master	
Type of Modulation:	IEEE 802.11a/n: OFDM (64QAM, 16QAM, QPSK, BPSK)	
	IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)	
	IEEE 802.11ax: ☒ OFDM (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK) ☒ OFDMA (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)	

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Channel Spacing:	IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20: 20 MHz				
	IEEE 802.11n-HT40/ac-VHT40/ax-HE40: 40 MHz				
	IEEE 802.11ac-VHT80/ax-HE80: 80 MHz				
Data Rate:	IEEE 802.11a: Up to 54 Mbps				
	IEEE 802.11n: Up to MCS15				
	IEEE 802.11ac-VHT20: Up to MCS8				
	IEEE 802.11ac-VHT40/VHT80: Up to MCS9				
	IEEE 802.11ax-HE20/HE40/HE80: Up to MCS11				
Number of Channels:	5150 MHz to 5350 MHz: 8 for 802.11a/n-HT20/ac-VHT20/ax-HE20 4 for 802.11n-HT40/ac-VHT40/ax-HE40 2 for 802.11ac-VHT80/ax-HE80				
	5470 MHz to 5725 MHz: 11 for 802.11a/n-HT20/ac-VHT20/ax-HE20 5 for 802.11n-HT40/ac-VHT40/ax-HE40 2 for 802.11ac-VHT80/ax-HE80				
	5725 MHz to 5850 MHz: 5 for IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20 2 for IEEE 802.11n-HT40/ac-VHT40/ax-HE40 1 for IEEE 802.11ac-VHT80/ax-HE80				
Antenna Type:	Chain 0	Integral Antenna			
	Chain 1	Integral Antenna			
Antenna Gain: (Provided by the customer)	Chain 0	5150 MHz to 5250 MHz: 5 dBi			
		5250 MHz to 5350 MHz: 5 dBi			
		5470 MHz to 5725 MHz: 5 dBi			
		5725 MHz to 5850 MHz: 5 dBi			
	Chain 1	5150 MHz to 5250 MHz: 5 dBi			
		5250 MHz to 5350 MHz: 5 dBi			
		5470 MHz to 5725 MHz: 5 dBi			
		5725 MHz to 5850 MHz: 5 dBi			
Maximum EIRP (dBm):	SISO_Chain 0	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:	14.68	14.46	14.92	17.23
	SISO_Chain 1	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:	17.62	17.50	15.75	17.31
	MIMO_Chain 0+1	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11n-HT20:	15.69	15.71	15.60	16.56
	IEEE 802.11n-HT40:	13.38	13.04	14.35	17.58
	IEEE 802.11ac-VHT20:	15.38	15.42	15.43	16.32
	IEEE 802.11ac-VHT40:	13.08	12.74	14.04	17.20
	IEEE 802.11ac-VHT80:	9.51	9.38	9.68	13.21
	IEEE 802.11ax-HE20:	13.64	13.39	13.88	14.87
	IEEE 802.11ax-HE40:	12.21	12.10	12.42	15.12
	IEEE 802.11ax-HE80:	8.08	7.98	8.28	12.96

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1.4 OTHER INFORMATION

Test channels for 2.4 GHz ISM Band of Wi-Fi				
Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20 IEEE 802.11ax-HE20	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40 IEEE 802.11ax-HE40	2422 MHz to 2452 MHz	Channel 3	Channel 6	Channel 9
		2422 MHz	2437 MHz	2452 MHz

Test channels for 5 GHz U-NII Bands of Wi-Fi				
Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11a IEEE 802.11n-HT20 IEEE 802.11ac-VHT20 IEEE 802.11ax-HE20	5150 MHz to 5250 MHz	Channel 36	Channel 44	Channel 48
		5180 MHz	5220 MHz	5240 MHz
	5250 MHz to 5350 MHz	Channel 52	Channel 60	Channel 64
		5260 MHz	5300 MHz	5320 MHz
	5470 MHz to 5725 MHz	Channel 100	Channel 116	Channel 140
		5500 MHz	5580 MHz	5700 MHz
IEEE 802.11n-HT40 IEEE 802.11ac-VHT40 IEEE 802.11ax-HE40	5150 MHz to 5250 MHz	Channel 149	Channel 157	Channel 161
		5745 MHz	5785 MHz	5805 MHz
	5250 MHz to 5350 MHz	Channel 38	--	Channel 46
		5190 MHz	--	5230 MHz
	5470 MHz to 5725 MHz	Channel 54	--	Channel 62
		5270 MHz	--	5310 MHz
IEEE 802.11ac-VHT80 IEEE 802.11ax-HE80	5150 MHz to 5250 MHz	Channel 102	Channel 110	Channel 134
		5510 MHz	5550 MHz	5670 MHz
	5250 MHz to 5350 MHz	Channel 151	--	Channel 159
		5755 MHz	--	5795 MHz
	5470 MHz to 5725 MHz	--	Channel 42	--
		--	5210 MHz	--
IEEE 802.11ac-VHT80 IEEE 802.11ax-HE80	5150 MHz to 5250 MHz	--	Channel 58	--
		--	5290 MHz	--
	5250 MHz to 5350 MHz	Channel 106	--	Channel 122
		5530 MHz	--	5610 MHz
	5470 MHz to 5725 MHz	--	Channel 155	--
		--	5775 MHz	--

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1.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC 47 CFR Part 1 Subpart I

All test items have been performed and recorded as per the above standards

1.6 TEST LOCATION

All tests were performed at:

Shenzhen UnionTrust Quality and Technology Co., Ltd.

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1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

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None.

2. EQUIPMENT LIST

Please refer to the RF test report.

3. MPE EVALUATION

3.1 REFERENCE DOCUMENTS FOR EVALUATION

No.	Identity	Document Title
1	FCC 47 CFR Part 1 Subpart I	PROCEDURES IMPLEMENTING THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969
2	KDB 447498 D01 General RF Exposure Guidance v06	RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES

3.2 MPE COMPLIANCE REQUIREMENT

3.2.1 Limits

According to §1.1307(b)(1), system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Limits for Occupational / Controlled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	F/300	6
1500-100000	/	/	5	6

Limits for General Population / Uncontrolled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100000	/	/	1	30

Note: f = frequency in MHz; * = Plane-wave equivalents power density.

3.2.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

3.3 MPE CALCULATION METHOD

$$S = PG/4\pi R^2 = EIRP/4\pi R^2$$

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S = power density (in appropriate units, e.g., mw/cm²)

P = power input to the antenna (in appropriate units, e.g., mw)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor is normally numeric gain.

R = distance to the center of radiation of the antenna (in appropriate units, e.g., cm)

3.4 MPE CALCULATION RESULTS

Note: For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

3.4.1 For WLAN

For Wi-Fi function, operating at 2412MHz to 2462 MHz for IEEE802.11b/g/n
operating at 5150 MHz to 5250 MHz for IEEE802.11a/n/ac/ax
operating at 5250 MHz to 5350 MHz for IEEE802.11a/n/ac/ax
operating at 5470 MHz to 5725 MHz for IEEE802.11a/n/ac/ax
operating at 5725 MHz to 5850 MHz for IEEE802.11a/n/ac/ax

3.4.1.1 Antenna Type:

Chain 0: Integral Antenna

Chain 1: Integral Antenna

3.4.1.2 Antenna Gain:

Chain 0: 2412 MHz to 2462 MHz: 5 dBi
5150 MHz to 5250 MHz: 5 dBi
5250 MHz to 5350 MHz: 5 dBi
5470 MHz to 5725 MHz: 5 dBi
5725 MHz to 5850 MHz: 5 dBi

Chain 1: Same as chain 0

For MIMO mode (2Tx/2Rx), there are two transmission antennas. Both Chain 0 and Chain 1 used at the same time and antenna ports have uniform output powers. The Chain 0 and Chain 1 antenna ports can be used alone. The transmit signals are correlated with each other.

$$\text{The directional gain} = G_{\text{ANT}} + 10 \log(N_{\text{ANT}}) \text{ dBi} = 2 + 10 \log(2) = 5.01 \text{ dBi}$$

For SISO mode (1Tx/1Rx), there are two transmission antennas. Both Chain 0 and Chain 1 used at the same time and antenna ports have uniform output powers. The Chain 0 and Chain 1 antenna ports cannot be used alone

$$\text{The antenna gain} = \text{Chain 0 or Chain 1} = 2 \text{ dBi}$$

3.4.1.3 Results for WLAN

Operating Mode		Freq.	Declared maximum conducted average output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value
		(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mw/cm ²)	
SISO	IEEE 802.11b	2412-2462	17	2	5	24	251.19	1	0.0500
	IEEE 802.11g	2412-2462	14	1	5	20	100.00	1	0.0199
	IEEE 802.11a	5180-5240	16	2	5	23	199.53	1	0.0397
		5260-5320	16	2	5	23	199.53	1	0.0397
		5500-5700	15	1	5	21	125.89	1	0.0251
		5745-5825	16	2	5	23	199.53	1	0.0397

Operating Mode		Ant.	Freq.	Declared maximum conducted average output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value	MIMO	
			(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mw/cm ²)		MPE Value Note1	Limit
MIMO	IEEE 802.11n-HT20	0	2412-2462	13	1	5	19	79.43	1	0.0158	0.0316	1
		1		13	1	5	19	79.43	1	0.0158		
	IEEE 802.11n-HT40	0	2422-2452	13	1	5	19	79.43	1	0.0158	0.0316	1
		1		13	1	5	19	79.43	1	0.0158		
	IEEE 802.11ax-HE20	0	2412-2462	9	1	5	15	31.62	1	0.0063	0.0126	1
		1		9	1	5	15	31.62	1	0.0063		
	IEEE 802.11ax-HE40	0	2422-2452	9	1	5	15	31.62	1	0.0063	0.0126	1
		1		9	1	5	15	31.62	1	0.0063		
	IEEE 802.11n-HT20 IEEE 802.11ac-VHT 20	0	5180-5240	10	2	5	17	50.12	1	0.0100	0.0299	1
		1		13	2	5	20	100.00	1	0.0199		
		0	5260-5320	10	2	5	17	50.12	1	0.0100	0.0299	1
		1		13	2	5	20	100.00	1	0.0199		
		0	5500-5700	12	2	5	19	79.43	1	0.0158	0.0316	1
		1		12	2	5	19	79.43	1	0.0158		
		0	5745-5825	13	2	5	20	100.00	1	0.0199	0.0316	1
		1		13	2	5	20	100.00	1	0.0199		
	IEEE 802.11n-HT40 IEEE 802.11ac-VHT 40	0	5190-5230	8	2	5	15	31.62	1	0.0063	0.0189	1
		1		11	2	5	18	63.10	1	0.0126		
		0	5270-5310	8	2	5	15	31.62	1	0.0063	0.0189	1
		1		11	2	5	18	63.10	1	0.0126		
		0	5510-5670	10	2	5	17	50.12	1	0.0100	0.0226	1
		1		11	2	5	18	63.10	1	0.0126		
		0	5755-5795	14	2	5	21	125.89	1	0.0251	0.0226	1
		1		14	2	5	21	125.89	1	0.0251		
	IEEE	0	5230	4	1	5	10	10.00	1	0.0020	0.006	

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Operating Mode	Ant.	Freq.	Declared maximum conducted average output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value	MIMO	
		(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mw/cm ²)		MPE Value Note1	Limit
802.11ac-VHT 80	1	5230	7	1	5	13	19.95	1	0.0040		1
	0	5290	4	1	5	10	10.00	1	0.0020	0.006	1
	1		7	1	5	13	19.95	1	0.0040		
	0	5530-5610	6	1	5	12	15.85	1	0.0032	0.006	1
	1		6	1	5	12	15.85	1	0.0032		
	0	5775	9	1	5	15	31.62	1	0.0063	0.0142	1
	1		10	1	5	16	39.81	1	0.0079		
IEEE 802.11ax-HE20(SU)	0	5180-5240	8	2	5	15	31.62	1	0.0063	0.0189	1
	1		11	2	5	18	63.10	1	0.0126		
	0	5260-5320	8	2	5	15	31.62	1	0.0063	0.0189	1
	1		11	2	5	18	63.10	1	0.0126		
	0	5500-5700	10	2	5	17	50.12	1	0.0100	0.02	1
	1		10	2	5	17	50.12	1	0.0100		
	0	5745-5825	11	2	5	18	63.10	1	0.0126	0.02	1
	1		11	2	5	18	63.10	1	0.0126		
	0	5190-5230	7	2	5	14	25.12	1	0.0050	0.015	1
	1		10	2	5	17	50.12	1	0.0100		
	0	5270-5310	7	2	5	14	25.12	1	0.0050	0.015	1
	1		10	2	5	17	50.12	1	0.0100		
	0	5510-5670	9	2	5	16	39.81	1	0.0079	0.0158	1
	1		9	2	5	16	39.81	1	0.0079		
	0	5755-5795	11	2	5	18	63.10	1	0.0126	0.0158	1
	1		11	2	5	18	63.10	1	0.0126		
	0	5230	3	1	5	9	7.94	1	0.0016	0.0048	1
	1		6	1	5	12	15.85	1	0.0032		
	0	5290	3	1	5	9	7.94	1	0.0016	0.0048	1
	1		6	1	5	12	15.85	1	0.0032		
	0	5530-5610	5	1	5	11	12.59	1	0.0025	0.005	1
	1		5	1	5	11	12.59	1	0.0025		
	0	5775	10	1	5	16	39.81	1	0.0079	0.005	1
	1		9	1	5	15	31.62	1	0.0063		

Note1: MPE Value(MIMO)=(MPE1/LIMIT1+MPE2/LIMIT2)

3.4.2 Simultaneous Multi-band Transmission MPE Analysis

3.4.4.1 List of Mode for Simultaneous Multi-band Transmission

No.	Configurations	Support/Not Support
1	2.4G_WLAN + 5G_WLAN	Support

3.4.4.2 Results for transmit simultaneously

No.	Configurations	Maximum MPE Value			Limits
		2.4G WLAN	5G WLAN	Transmit simultaneously	
1	2.4G_WLAN + 5G_WLAN	0.0500	0.0316	0.0816	1

Note:

According to KDB 447498 D01 General RF Exposure Guidance v06, At the transmit simultaneously calculation method is as follows:

Transmit simultaneously MPE = Σ of MPE ratios

MPE ratios = Field strengths or power density / MPE limit at the test frequency

APPENDIX 1 PHOTOS OF TEST SETUP

N/A

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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