



Certificate #4312.01

RF EXPOSURE EVALUATION REPORT

Product Name: 5-Port SMB UC/Networking Convergence Wireless Gateway
Trade Mark: GRANDSTREAM
Model No.: GCC6010W
Report Number: 24031410094RFC-4
Test Standards: FCC 47 CFR Part 1 Subpart I
FCC ID: YZZGCC6010W
Test Result: PASS
Date of Issue: June 18, 2024

Prepared for:

Grandstream Networks, Inc.
126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Prepared by: David Chen
 David Chen
 Senior Project Engineer

Reviewed by: Robben Chen
 Robben Chen
 Assistant Manager

Approved by: Billy Li
 Billy Li
 Technical Director

Date: June 18, 2024

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Version

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V1.0	June 18, 2024	Original

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Grandstream Networks, Inc.
Address of Applicant:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA
Manufacturer:	Grandstream Networks, Inc.
Address of Manufacturer:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

1.2 EUT INFORMATION

Product Name:	5-Port SMB UC/Networking Convergence Wireless Gateway		
Model No.:	GCC6010W		
Trade Mark:	GRANDSTREAM		
DUT Stage:	Identical Prototype		
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:	March 14, 2024		
Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.			

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/n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ax: OFDM/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/HT40: Up to MCS15 IEEE 802.11ax-HE20/ HE40: Up to MCS11	
Number of Channels:	IEEE 802.11b/g/n-HT20/ax-HE20: 11 IEEE 802.11n-HT40/ax-HE40: 7	
Channel Separation:	5 MHz	
Antenna Type: (Provided by the customer)	Antenna 0	PCB Antenna
	Antenna 1	PCB Antenna
Antenna Gain: (Provided by the customer)	Antenna 0	4.16 dBi
	Antenna 1	4.71 dBi

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)				
	5725 MHz to 5850 MHz (U-NII-3)				
Frequency Ranges:	5180 MHz to 5240 MHz				
	5260 MHz to 5320 MHz				
	5500 MHz to 5720 MHz				
	5745 MHz to 5825 MHz				
Support Standards:	IEEE 802.11a/n/ac/ax				
TPC Function:	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/OFDMA (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)				
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				
	IEEE 802.11ac-VHT160/ax-HE160: 160 MHz				
Data Rate:	IEEE 802.11a: Up to 54 Mbps				
	IEEE 802.11n: Up to MCS23				
	IEEE 802.11ac-VHT20: Up to MCS8				
	IEEE 802.11ac-VHT40/VHT80/VHT160: Up to MCS9				
	IEEE 802.11ax-HE20/HE40/HE80/HE160: 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 1 for 802.11ac-VHT160/ax-HE160				
	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 1 for 802.11ac-VHT160/ax-HE160				
	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: (Provided by the customer)	Antenna 0:	PCB Antenna			
	Antenna 1:	PCB Antenna			
	Antenna 2:	PCB Antenna			
Antenna Gain (dBi): (Provided by the customer)	Antenna	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	Antenna 0:	6.5	6.5	6.5	6.5
	Antenna 1:	5.67	5.67	5.67	5.67
	Antenna 2:	4.5	4.5	4.5	4.5

Shenzhen UnionTrust Quality and Technology Co., Ltd.

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Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

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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 - 5250 MHz	Channel 36	Channel 44	Channel 48
		5180 MHz	5220 MHz	5240 MHz
	5250 - 5350 MHz	Channel 52	Channel 60	Channel 64
		5260 MHz	5300 MHz	5320 MHz
	5470 - 5725 MHz	Channel 100	Channel 120	Channel 140/ Channel 144
		5500 MHz	5600 MHz	5700 MHz/ 5720MHz
5725 - 5850 MHz	Channel 144/ Channel 149	Channel 157	Channel 165	
	5720MHz/ 5745 MHz	5785 MHz	5825 MHz	
IEEE 802.11n-HT40 IEEE 802.11ac-VHT40 IEEE 802.11ax-HE40	5150 - 5250 MHz	Channel 38	--	Channel 46
		5190 MHz	--	5230 MHz
	5250 - 5350 MHz	Channel 54	--	Channel 62
		5270 MHz	--	5310 MHz
	5470 - 5725 MHz	Channel 102	Channel 118	Channel 134/ Channel 142
		5510 MHz	5590 MHz	5670 MHz/ 5710MHz
5725 - 5850 MHz	Channel 142/ Channel 151	--	Channel 159	
	5710MHz/ 5755 MHz	--	5795 MHz	
IEEE 802.11ac-VHT80 IEEE 802.11ax-HE80	5150 - 5250 MHz	--	Channel 42	--
		--	5210 MHz	--
	5250 - 5350 MHz	--	Channel 58	--
		--	5290 MHz	--
	5470 - 5725 MHz	Channel 106	--	Channel 138
		5530 MHz	--	5610 MHz/ 5569 MHz
5725 - 5850 MHz	Channel 138	Channel 155	--	
	5610 MHz/	5775 MHz	--	
IEEE 802.11ac-VHT160	5150 - 5350 MHz	Channel 50		

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IEEE 802.11ax-HE160		5250 MHz
	5470 - 5725 MHz	Channel 114
		5570 MHz

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 DEVIATION FROM STANDARDS

None.

1.7 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER

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	KDB 662911 D01 Multiple Transmitter Output v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

3.2 MPE COMPLIANCE REQUIREMENT

3.2.1 Limits

3.2.1.1 FCC 47 CFR Part 1 Subpart I

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 equivalent 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

FCC 47 CFR Part 1 Subpart I

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

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 = 20cm 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/ax and operating at 5180 MHz to 5240 MHz for IEEE802.11a/n/ac/ax and operating at 5260 MHz to 5320 MHz for IEEE802.11a/n/ac/ax and operating at 5500 MHz to 5720 MHz for IEEE802.11a/n/ac/ax and operating at 5745 MHz to 5820 MHz for IEEE802.11a/n/ac/ax

3.4.1.1 Antenna Type:

PCB Antenna

Antenna Gain:

Chain 0: 2412MHz to 2462 MHz: 4.16dBi

Chain 1: 2412MHz to 2462 MHz: 4.71dBi

Chain 0: 5150 MHz to 5250 MHz: 6.5dBi

5250 MHz to 5350 MHz: 6.5dBi

5470 MHz to 5725 MHz: 6.5dBi

5725 MHz to 5850 MHz: 6.5dBi

Chain 1: 5150 MHz to 5250 MHz: 5.67dBi

5250 MHz to 5350 MHz: 5.67dBi

5470 MHz to 5725 MHz: 5.67dBi

5725 MHz to 5850 MHz: 5.67dBi

Chain 2: 5150 MHz to 5250 MHz: 4.5dBi

5250 MHz to 5350 MHz: 4.5dBi

5470 MHz to 5725 MHz: 4.5dBi

5725 MHz to 5850 MHz: 4.5dBi

3.4.1.2 Results for FCC 47 CFR Part 1 Subpart I

For SISO (1TX/1RX) Mode

Operating Mode	Freq.	Ant.	Declared maximum conducted avg output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value	
	(MHz)									(dBm)
SISO	IEEE 802.11b	2412-2462	Ant 0	19	1	4.16	24.16	260.6154	1	0.0518
		Ant 1	19	1	4.71	24.71	295.8012	1	0.0588	
	IEEE 802.11g	2412-2462	Ant 0	19	1	4.16	24.16	260.6154	1	0.0518
		Ant 1	19	1	4.71	24.71	295.8012	1	0.0588	
	IEEE 802.11a	5180-5240	Ant 0	22	1	6.5	29.50	891.2509	1	0.1773
			Ant 1	22	1	5.67	28.67	736.2071	1	0.1465
			Ant 2	22	1	4.5	27.50	562.3413	1	0.1119
		5260-5320	Ant 0	20	1	6.5	27.50	562.3413	1	0.1119
			Ant 1	20	1	5.67	26.67	464.5153	1	0.0924
			Ant 2	20	1	4.5	25.50	354.8134	1	0.0706
		5500-5720	Ant 0	18	3	6.5	27.50	562.3413	1	0.1119
			Ant 1	18	3	5.67	26.67	464.5153	1	0.0924
			Ant 2	18	3	4.5	25.50	354.8134	1	0.0706
	5745-5825	Ant 0	19	1	6.5	26.50	446.6836	1	0.0889	
		Ant 1	19	1	5.67	25.67	368.9776	1	0.0734	
Ant 2		19	1	4.5	24.50	281.8383	1	0.0561		

For MIMO (3TX/RX) Mode

Operating Mode	Freq.	Ant.	Declared maximum conducted avg output power	Max. positive Tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value	MIMO		
	(MHz)									(dBm)	(dBi)	(dBm)
MIMO (3TX/3RX)	IEEE 802.11n-HT20 802.11ax-HE20	2412-2462	Ant 0	18	1	4.16	23.16	207.0141	1	0.0412	0.0824	1
		Ant 1	18	1	4.16	23.16	207.0141	1	0.0412			
	IEEE 802.11n-HT40 802.11ax-HE40	2422-2452	Ant 0	19	1	4.16	24.16	260.6154	1	0.0518	0.1036	1
		Ant 1	19	1	4.16	24.16	260.6154	1	0.0518			
MIMO (3TX/3RX)	IEEE 802.11n-HT20 802.11ac-VHT20 802.11ax-HE20	5180-5240	Ant 0	18	1	6.5	25.50	354.8134	1	0.0706	0.1734	1
			Ant 1	18	1	5.67	24.67	293.0893	1	0.0583		
			Ant 2	18	1	4.5	23.50	223.8721	1	0.0445		
		5260-5320	Ant 0	12	1	6.5	19.50	89.1251	1	0.0177	0.0435	1
			Ant 1	12	1	5.67	18.67	73.6207	1	0.0146		
			Ant 2	12	1	4.5	17.50	56.2341	1	0.0112		
	5500-5720	Ant 0	12	3	6.5	21.50	141.2538	1	0.0281	0.069	1	
		Ant 1	12	3	5.67	20.67	116.6810	1	0.0232			
		Ant 2	12	3	4.5	19.50	89.1251	1	0.0177			
	5745-5825	Ant 0	18	3.5	6.5	28.00	630.9573	1	0.1255	0.3084	1	
		Ant 1	18	3.5	5.67	27.17	521.1947	1	0.1037			

Shenzhen UnionTrust Quality and Technology Co., Ltd.

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Fax: +86-755-28230886

E-mail: info@uttlab.com

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Operating Mode	Freq.	Ant.	Declared maximum conducted avg output power	Max. positive Tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value	MIMO		
	(MHz)									(dBm)	(dBi)	(dBm)
		Ant 2	18	3.5	4.5	26.00	398.1072	1	0.0792			
IEEE 802.11n-HT40 802.11ac-VHT40 802.11ax-HE40	5190-5230	Ant 0	14	1.5	6.5	22.00	158.4893	1	0.0315	0.0774	1	
		Ant 1	14	1.5	5.67	21.17	130.9182	1	0.0260			
		Ant 2	14	1.5	4.5	20.00	100.0000	1	0.0199			
	5270-5310	Ant 0	14	1.5	6.5	22.00	158.4893	1	0.0315	0.0774	1	
		Ant 1	14	1.5	5.67	21.17	130.9182	1	0.0260			
		Ant 2	14	1.5	4.5	20.00	100.0000	1	0.0199			
	5510-5670	Ant 0	12	3.5	6.5	22.00	158.4893	1	0.0315	0.0774	1	
		Ant 1	12	3.5	5.67	21.17	130.9182	1	0.0260			
		Ant 2	12	3.5	4.5	20.00	100.0000	1	0.0199			
	5755-5795	Ant 0	16	3	6.5	25.50	354.8134	1	0.0706	0.1734	1	
		Ant 1	16	3	5.67	24.67	293.0893	1	0.0583			
		Ant 2	16	3	4.5	23.50	223.8721	1	0.0445			
MIMO (3TX/3RX)	5210	Ant 0	12	2.5	6.5	21.00	125.8925	1	0.0250	0.0615	1	
		Ant 1	12	2.5	5.67	20.17	103.9920	1	0.0207			
		Ant 2	12	2.5	4.5	19.00	79.4328	1	0.0158			
	5290	Ant 0	13	1.5	6.5	21.00	125.8925	1	0.0250	0.0615	1	
		Ant 1	13	1.5	5.67	20.17	103.9920	1	0.0207			
		Ant 2	13	1.5	4.5	19.00	79.4328	1	0.0158			
	5530	Ant 0	7	1.5	6.5	15.00	31.6228	1	0.0063	0.0155	1	
		Ant 1	7	1.5	5.67	14.17	26.1216	1	0.0052			
		Ant 2	7	1.5	4.5	13.00	19.9526	1	0.0040			
	5690	Ant 0	14	1	6.5	21.50	141.2538	1	0.0281	0.0690	1	
		Ant 1	14	1	5.67	20.67	116.6810	1	0.0232			
		Ant 2	14	1	4.5	19.50	89.1251	1	0.0177			
	5775	Ant 0	15	1	6.5	22.50	177.8279	1	0.0354	0.0869	1	
		Ant 1	15	1	5.67	21.67	146.8926	1	0.0292			
		Ant 2	15	1	4.5	20.50	112.2018	1	0.0223			
	IEEE 802.11ac-VHT160 802.11ax-HE160	5250	Ant 0	12	1	6.5	19.50	89.1251	1	0.0177	0.0435	1
			Ant 1	12	1	5.67	18.67	73.6207	1	0.0146		
			Ant 2	12	1	4.5	17.50	56.2341	1	0.0112		

Shenzhen UnionTrust Quality and Technology Co., Ltd.

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Operating Mode	Freq.	Ant.	Declared maximum conduct ed avg output power	Max. positive Toleranc e according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value	MIMO	
	(MHz)									(dBm)	(dBi)
	5570	Ant 0	7	1	6.5	14.50	28.1838	1	0.0056	0.0137	1
		Ant 1	7	1	5.67	13.67	23.2809	1	0.0046		
		Ant 2	7	1	4.5	12.50	17.7828	1	0.0035		

Shenzhen UnionTrust Quality and Technology Co., Ltd.

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3.4.2 Simultaneous Multi-band Transmission MPE Analysis

3.4.2.1 List of Mode for Simultaneous Multi-band Transmission

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

3.4.2.2 Results for transmit simultaneously

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No.	Configurations	Maximum MPE Value			Limits
		2.4G WLAN	5G WLAN	Transmit simultaneously	
1	2.4G _WLAN + 5G_WLAN	0.1036	0.3084	0.4120	1

Note:

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

$$\text{Transmit simultaneously MPE} = \Sigma \text{ of MPE ratios}$$

$$\text{MPE ratios} = \text{Field strengths or power density} / \text{MPE limit at the test frequency}$$

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 ***

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.
