



FCC RADIO TEST REPORT

FCC ID : MSQ-RTGW00
Equipment : Wireless-AC3100 Dual Band Gigabit Router
Brand Name : ASUS
Model Name : RT-AC3100, RT-AC88R, RT-AC88U
Applicant : ASUSTeK COMPUTER INC.
4F, No. 150, Li-Te Rd., Peitou, Taipei 112, Taiwan
Manufacturer (1) : ASKEY TECHNOLOGY (JIANG SU) LTD
NO1388, Jiao Tong Road, Wujiang Economic
Technological Development Area Jiangsu Province
215200 China
Manufacturer (2) : Compal Networking (KunShan) Co., LTD.
No. 520, Nabbang Rd., Economic & Technical
Development Zone Kunshan, Jiangsu Province China
Standard : 47 CFR FCC Part 15.247

The product was received on Nov. 29, 2018, and testing was started from Jan. 26, 2019 and completed on Jan. 29, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.


Approved by: Sam Chen

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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History of this test report

TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB Ver1.0

Page Number : 3 of 21
Issued Date : Feb. 01, 2019
Report Version : 01



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.207	AC Power-line Conducted Emissions	PASS	-
3.2	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Cindy Peng



1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
2400-2483.5	b, g, n (HT20), ac (VHT20)	2412-2462	1-11 [11]
2400-2483.5	n (HT40), ac (VHT40)	2422-2452	3-9 [7]

<For 3TX>

Band	Mode	BWch (MHz)	Nant
2.4G	11b	20	3
2.4G	11g	20	3
2.4G	n (HT20)	20	3
2.4G	n (HT20)-BF	20	3
2.4G	ac (VHT20)	20	3
2.4G	ac (VHT20)-BF	20	3
2.4G	n (HT40)	40	3
2.4G	n (HT40)-BF	40	3
2.4G	ac (VHT40)	40	3
2.4G	ac (VHT40)-BF	40	3

<For 4TX>

Band	Mode	BWch (MHz)	Nant
2.4G	11b	20	4
2.4G	11g	20	4
2.4G	n (HT20)	20	4
2.4G	n (HT20)-BF	20	4
2.4G	ac (VHT20)	20	4
2.4G	ac (VHT20)-BF	20	4
2.4G	n (HT40)	40	4
2.4G	n (HT40)-BF	40	4
2.4G	ac (VHT40)	40	4
2.4G	ac (VHT40)-BF	40	4

**Note:**

- ♦ 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- ♦ 11g, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- ♦ VHT20, VHT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM modulation.
- ♦ BWch is the nominal channel bandwidth.
- ♦ Nss-Min is the minimum number of spatial streams.
- ♦ Nant is the number of outputs. e.g., 2(2,3) means have 2 outputs for port 2 and port 3. 2 means have 2 outputs for port 1 and port 2.

1.1.2 Antenna Information

Set	Brand	P/N	Antenna Type	Connector	Gain (dBi)		Color Ring
					2.4GHz	5GHz	
1	PSA	RFDPA171300SBLB809	Dipole Antenna	Reversed-SMA	2.25	3.37	Red
2	PSA	RFDPA171300SBLB810	Dipole Antenna	Reversed-SMA	2.25	3.37	Black
3	PSA	RFDPA171300SBLB811	Dipole Antenna	Reversed-SMA	2.20	3.36	Black
4	PSA	RFDPA171300SBLB812	Dipole Antenna	Reversed-SMA	2.18	3.19	Black
5	PSA	RFDPA171300SBLB813	Dipole Antenna	Reversed-SMA	2.20	3.36	Red
6	PSA	RFDPA171300SBLB814	Dipole Antenna	Reversed-SMA	2.18	3.19	Red
7	WHA YU	C660-510345-A(SRF2015719)	Dipole Antenna	Reversed-SMA	2.25	3.20	Red
8	WHA YU	C660-510346-A(SRF2015720)	Dipole Antenna	Reversed-SMA	2.25	3.20	Black
9	WHA YU	C660-510364-A(SRF20151386)	Dipole Antenna	Reversed-SMA	1.9	3.3	Black
10	WHA YU	C660-510365-A(SRF20151717)	Dipole Antenna	Reversed-SMA	1.9	3.3	Red

Note1: The above information was declared by manufacturer.

Note2: 1. The EUT has ten sets of antenna and there are four antennas for each set.

2. Both antennas above are the same type. Besides, only set 1 antenna was selected to perform the test and written in this report due to the highest gain.

For IEEE 802.11a/b/g/n/ac mode:**For 2.4GHz and 5GHz (3TX/3RX) function:**

Port 1, Port 2 and Port 3 can be used as transmitting/receiving antenna.

Port 1, Port 2 and Port 3 could transmit/receive simultaneously.

For 2.4GHz and 5GHz (4TX/4RX) function:

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.

Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.

**1.1.3 EUT Operational Condition**

EUT Power Type	From power adapter		
Beamforming Function	☒ With beamforming	☐ Without beamforming	
	The product has beamforming function for 802.11n/ac in 2.4GHz/5GHz.		
Function	☒ Point-to-multipoint	☐ Point-to-point	

Note: The above information was declared by manufacturer.

1.1.4 Table for Multiple Listing

The EUT has three model numbers which are identical to each other in all aspects except for the following table:

Model No.	LAN Port	Heat sink color
RT-AC88U	8 LAN ports	Silver, Red
RT-AC3100	4 LAN ports	Silver, Black
RT-AC88R	8 LAN ports	Silver, Red

From the above models, model: RT-AC88U was selected as representative model for the test and its data was recorded in this report.



1.1.5 Table for Adapter detail

(1) The difference between adapter 1 and adapter 4 as below:

Adapter1 (model: ADP-45BW B)			
Design No	MFG TITLE	MFG PART	DESCRIPTION
Q1	AUK	SMK0760F	FET 600V 7A 1.2ohm TO-220F-3P
Q1	ST	STP6NK60ZFP	FET 600V 6A 1.2ohm TO-220FP-3P
Q1	TOSHIBA	TK10A60DR(STA4,X)	FET 600V 10A 750mohm TO-220SIS-3P
D101	ST	STPS20S100CT	DIO SBD 20A 100V TO-220AB-3P C.C.
D101	ST	STPS20SM100ST	DIO SBD 20A 100V TO-220AB-3P
D101	ST	STPS30SM100ST	DIO SBD 30A 100V TO-220AB-3P
IC31	ON	DAP022ASN65T1G	IC ASIC PWM CURRENT MODE TSOP-6P SMD
IC131	TI	TL432BIDBZR	IC VOL REF ADJ 2.495V 100mA 0.5%
IC131	NXP	TL431BMFDT	IC VOL REF ADJ 2.495V 100mA 0.5%
IC131	DIODES	AS431ANTR-G1	IC VOL REF ADJ 2.5V 100mA 0.5% SOT-23-3P
IC32	EVERLIGHT	EL816M(Y)(D)-VG	PHOTO TR 50mA 80V DIP-4P 150%-300%
IC32	SHARP	PC123Y92FZ0F	PHOTO TR 50mA 70V DIP-4P 160%-300%
IC32	Renesas	PS2561DL1-1Y-V-A(G)	EOL PHOTO TR 40mA 80V DIP-4P 150%-300%
CX1	EUROPTRONIC	MPX2224K30B15LXD20	CAP X2 MP PC 305VAC 0.22uF K S15
CX1	OKAYA	LE224-MX-30-C3.2	CAP X2 MP PC 300VAC 0.22uF K S15
CX1	HUA	MKP-224K0275AB115S-G	CAP X2 MP PC 275VAC 0.22uF K S15
FL1	DELTA	HFV-MP13202	LINE FILTER T14 14mH MIN
FL101	DELTA	LFV-MP13303	LINE FILTER T10 17uH MIN
T1	DELTA	MV-MP13167	TRANSFORMER MAIN RM10 1mH +/-5%
C1	NICHICON	UPT2G680MHD3	CAP AL 400V 68uF M 16*25 P7.5
C1	NCC	EKMG401ELL680ML25S	CAP AL 400V 68uF M 16*25 P7.5
C1	L-Tec	TYJ2GM680K25O	CAP AL 400V 68uF M 16*25 P7.5
CY1	MURATA	DE1B3KX221KNHAN99F	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
CY1	TDK	CD70-B2GA221KYVK	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
CY1	WALSIN	YP0AH221K061DASDAB	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
Adapter4 (model: ADP-45BW B)			
Design No	MFG TITLE	MFG PART	DESCRIPTION
Q1	TOSHIBA	TK10A60DR(STA4,X)	FET 600V 10A 750mohm TO-220SIS-3P
Q1	FUJI	FMV11N60ES	FET 600V 11A 750mohm TO-220F-3P
D101	ST	STPS20S100CT	DIO SBD 20A 100V TO-220AB-3P C.C.
D101	ST	STPS20H100CT	DIO SBD 20A 100V TO-220AB-3P C.C.
D101	ST	STPS30H100CT	DIO SBD 30A 100V TO-220AB-3P C.C.
IC31	NeoEnergy	DAP022AT	IC ASIC PWM CURRENT MODE SOT-26-6P SMD
IC131	LITE-ON	LA431OCRPA	IC REGU ADJ 2.495V 100mA 0.4% SOT-23R-3P
IC131	TI	TL432BIDBZR	IC VOL REF ADJ 2.495V 100mA 0.5%
IC131	NXP	TL431BMFDT	IC VOL REF ADJ 2.495V 100mA 0.5%



IC32	EVERLIGHT	EL816M(Y)(D)-VG	PHOTO TR 50mA 80V DIP-4P 150%-300%
IC32	SHARP	PC123Y92FZ0F	PHOTO TR 50mA 70V DIP-4P 160%-300%
IC32	TOSHIBA	TLP785F(D4-GRH,F	PHOTO TR 60mA 80V DIP-4P 150%-300%
CX1	HUA	MKP-334K0275AB115S-G	CAP X2 MP PC 275VAC 0.33uF K S15
CX1	HUA	MKP-334K0275AB115S-P	CAP X2 MP PC 275VAC 0.33uF K S15
CX1	EUROPTRONIC	MPX2334K30B15LXD31	CAP X2 MP PC 305VAC 0.33uF K S15
FL1	DELTA	HFV-MP15027	LINE FILTER T16 12.7mH MIN
FL101	DELTA	LFV-MP13171	LINE FILTER T6 1.55uH MIN
T1	DELTA	MV-MP15037	TRANSFORMER MAIN RM10 1000uH +/-5%
C1	NCC	EKMG401ELL680ML25S	CAP AL 400V 68uF M 16*25 P7.5
CY1	MURATA	DE1B3KX221KNHAN99F	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
CY1	WALSIN	YP0AH221K061DASDAB	CAP Y1/X1 CD 250VAC 220pF K B TP VI10

(2) The difference between adapter 2 and adapter 5 as below:

Adapter 2 (model: AD883J20)	Adapter 5 (model: AD883J20)
Type: 010KLF BAH	Type: 010K-3LF

(3) The difference between adapter 3 and adapter 6 as below:

Adapter 3 (model: ADP-65DW B)			
Design No	MFG TITLE	MFG PART	DESCRIPTION
Q1	AUK	SMK0760F	FET 600V 7A 1.2ohm TO-220F-3P
Q1	ST	STP6NK60ZFP	FET 600V 6A 1.2ohm TO-220FP-3P
Q1	TOSHIBA	TK10A60DR(STA4,X)	FET 600V 10A 750mohm TO-220SIS-3P
D101	ST	STPS20S100CT	DIO SBD 20A 100V TO-220AB-3P C.C.
D101	ST	STPS20SM100ST	DIO SBD 20A 100V TO-220AB-3P
D101	ST	STPS30SM100ST	DIO SBD 30A 100V TO-220AB-3P
IC31	ON	DAP022ASN65T1G	IC ASIC PWM CURRENT MODE TSOP-6P SMD
IC131	TI	TL432BIDBZR	IC VOL REF ADJ 2.495V 100mA 0.5%
IC131	NXP	TL431BMFDT	IC VOL REF ADJ 2.495V 100mA 0.5%
IC131	DIODES	AS431ANTR-G1	IC VOL REF ADJ 2.5V 100mA 0.5% SOT-23-3P
IC32	EVERLIGHT	EL816M(Y)(D)-VG	PHOTO TR 50mA 80V DIP-4P 150%-300%
IC32	SHARP	PC123Y92FZ0F	PHOTO TR 50mA 70V DIP-4P 160%-300%
IC32	Renesas	PS2561DL1-1Y-V-A(G)	EOL PHOTO TR 40mA 80V DIP-4P 150%-300%
CX1	EUROPTRONIC	MPX2224K30B15LXD20	CAP X2 MP PC 305VAC 0.22uF K S15
CX1	OKAYA	LE224-MX-30-C3.2	CAP X2 MP PC 300VAC 0.22uF K S15
CX1	HUA	MKP-224K0275AB115S-G	CAP X2 MP PC 275VAC 0.22uF K S15
FL1	DELTA	HFV-MP13202	LINE FILTER T14 14mH MIN
FL101	DELTA	LFV-MP13303	LINE FILTER T10 17uH MIN
T1	DELTA	MV-MP13167	TRANSFORMER MAIN RM10 1mH +/-5%
C1	NICHICON	UPT2G680MHD3	CAP AL 400V 68uF M 16*25 P7.5
C1	NCC	EKMG401ELL680ML25S	CAP AL 400V 68uF M 16*25 P7.5
C1	L-Tec	TYJ2GM680K25O	CAP AL 400V 68uF M 16*25 P7.5



CY1	MURATA	DE1B3KX221KNHAN99F	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
CY1	TDK	CD70-B2GA221KYVK	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
CY1	WALSIN	YP0AH221K061DASDAB	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
Adapter 6 (model: ADP-65DW B)			
Design No	MFG TITLE	MFG PART	DESCRIPTION
Q1	TOSHIBA	TK10A60DR(STA4,X)	FET 600V 10A 750mohm TO-220SIS-3P
Q1	FUJI	FMV11N60ES	FET 600V 11A 750mohm TO-220F-3P
D101	ST	STPS20S100CT	DIO SBD 20A 100V TO-220AB-3P C.C.
D101	ST	STPS20H100CT	DIO SBD 20A 100V TO-220AB-3P C.C.
D101	ST	STPS30H100CT	DIO SBD 30A 100V TO-220AB-3P C.C.
IC31	NeoEnergy	DAP022AT	IC ASIC PWM CURRENT MODE SOT-26-6P SMD
IC131	LITE-ON	LA431OCRPA	IC REGU ADJ 2.495V 100mA 0.4% SOT-23R-3P
IC131	TI	TL432BIDBZR	IC VOL REF ADJ 2.495V 100mA 0.5%
IC131	NXP	TL431BMFDT	IC VOL REF ADJ 2.495V 100mA 0.5%
IC32	EVERLIGHT	EL816M(Y)(D)-VG	PHOTO TR 50mA 80V DIP-4P 150%-300%
IC32	SHARP	PC123Y92FZ0F	PHOTO TR 50mA 70V DIP-4P 160%-300%
IC32	TOSHIBA	TLP785F(D4-GRH,F	PHOTO TR 60mA 80V DIP-4P 150%-300%
CX1	HUA	MKP-334K0275AB115S-G	CAP X2 MP PC 275VAC 0.33uF K S15
CX1	HUA	MKP-334K0275AB115S-P	CAP X2 MP PC 275VAC 0.33uF K S15
CX1	EUROPTRONIC	MPX2334K30B15LXD31	CAP X2 MP PC 305VAC 0.33uF K S15
FL1	DELTA	HFV-MP15027	LINE FILTER T16 12.7mH MIN
FL101	DELTA	LFV-MP13171	LINE FILTER T6 1.55uH MIN
T1	DELTA	MV-MP15037	TRANSFORMER MAIN RM10 1000uH +/-5%
C1	NCC	EKMG401ELL680ML25S	CAP AL 400V 68uF M 16*25 P7.5
CY1	MURATA	DE1B3KX221KNHAN99F	CAP Y1/X1 CD 250VAC 220pF K B TP VI10
CY1	WALSIN	YP0AH221K061DASDAB	CAP Y1/X1 CD 250VAC 220pF K B TP VI10

1.1.6 Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR531828-13AA

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Adding two adapters "Adapter 7, Model Name: AD2066320 and Adapter 8, Model Name: ADP-45BW Y".	1. AC Power-line Conducted Emissions. 2. Emissions in Restricted Frequency Bands Below 1GHz.
2. Adding two types for 802.11ac (VHT80+80) mode "Type 1, 5210+5290 MHz and Type 2, 5530+5610 MHz". 3. Adding 5GHz band 2 and band 3 (5250~5350 MHz, 5470~5725 MHz) for this device.	It doesn't need to verify 2.4GHz test.



1.2 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15
- ♦ ANSI C63.10-2013
- ♦ FCC KDB 558074 D01 v05
- ♦ FCC KDB 662911 D01 v02r01

1.3 Testing Location Information

Testing Location				
☐	HWA YA	ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)	TEL : 886-3-327-3456	FAX : 886-3-327-0973
☒	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.	TEL : 886-3-656-9065	FAX : 886-3-656-9085

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
Radiated Below 1GHz	03CH01-CB	KJ Chang	22°C / 54%	Jan. 26, 2019
AC Conduction	CO02-CB	Max Lin	22°C / 61%	Jan. 29, 2019

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.0 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%

2 Test Configuration of EUT

2.1 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral
Operating Mode	CTX
There are two modes of EUT, one is "WLAN 5GHz" and the other is "WLAN 2.4GHz". "WLAN 5GHz" has been evaluated to be the worst case of original test report, so the measurement will follow this same test configuration.	
1	EUT With Adapter 7 - WLAN 5GHz
2	EUT With Adapter 8 - WLAN 5GHz
For operating mode 1 is the worst case and it was record in this test report.	

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode < 1GHz	CTX
1	EUT With Adapter 7 - WLAN 5GHz
2	EUT With Adapter 7 - WLAN 2.4GHz
3	EUT With Adapter 8 - WLAN 5GHz
4	EUT With Adapter 8 - WLAN 2.4GHz
For operating mode 3 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	CTX

The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation
Operating Mode	
1	WLAN 2.4GHz + WLAN 5GHz
Refer to Sporton Test Report No.: FA531828-15 for Co-location RF Exposure Evaluation.	

Note: The EUT can only be used at laying position.

2.2 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.



2.3 Accessories

Power	Brand	Model	Rating
Adapter 1	ASUS	ADP-45BW B	Input: 100-240V ~ 50-60Hz, 1.2A Output: 19V, 2.37A
Adapter 2	ASUS	AD883J20	Input: 100-240V ~ 50-60Hz, 1.0A Output: 19V, 2.37A
Adapter 3	ASUS	ADP-65DW B	Input: 100-240V ~ 50-60Hz, 1.5A Output: 19V, 3.42A
Adapter 4	ASUS	ADP-45BW B	Input: 100-240V ~ 50-60Hz, 1.2A Output: 19V, 2.37A
Adapter 5	ASUS	AD883J20	Input: 100-240V ~ 50-60Hz, 1.0A Output: 19V, 2.37A
Adapter 6	ASUS	ADP-65DW B	Input: 100-240V ~ 50-60Hz, 1.5A Output: 19V, 3.42A
Adapter 7	ASUS	AD2066320	Input: 100-240V ~ 50/60Hz 1.0A Output: 19V, 2.37A
Adapter 8	ASUS	ADP-45BW Y	Input: 100-240V ~ 50-60Hz 1.2A Output: 19V, 2.37A
Other			
RJ-45 cable*1: Non-shielded, 1.5m			

Note: The power adapter does not affect the test result of RF tests, so only adapter 1 was tested and recorded in this report.

2.4 Support Equipment

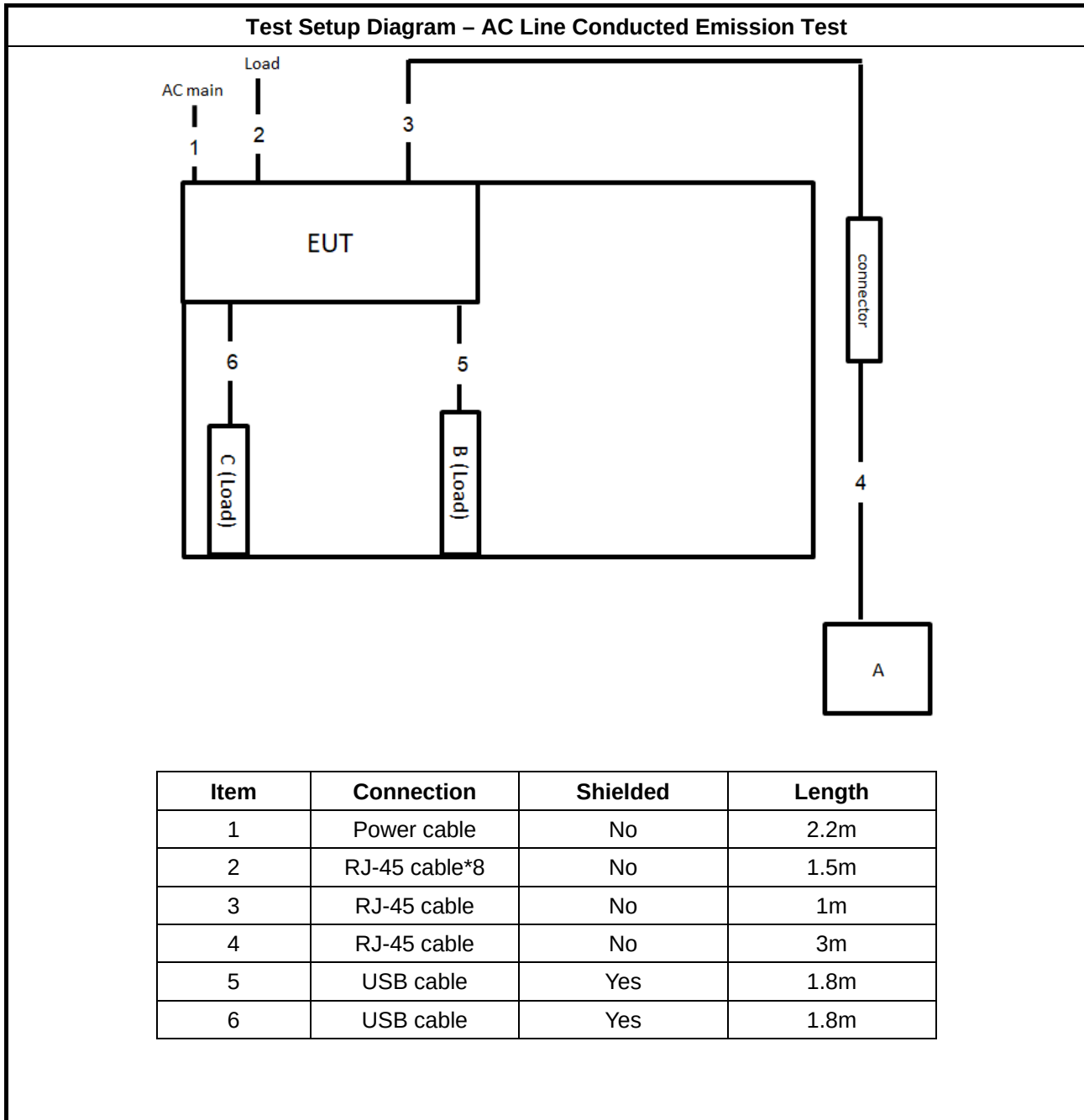
For Test Site No: CO02-CB

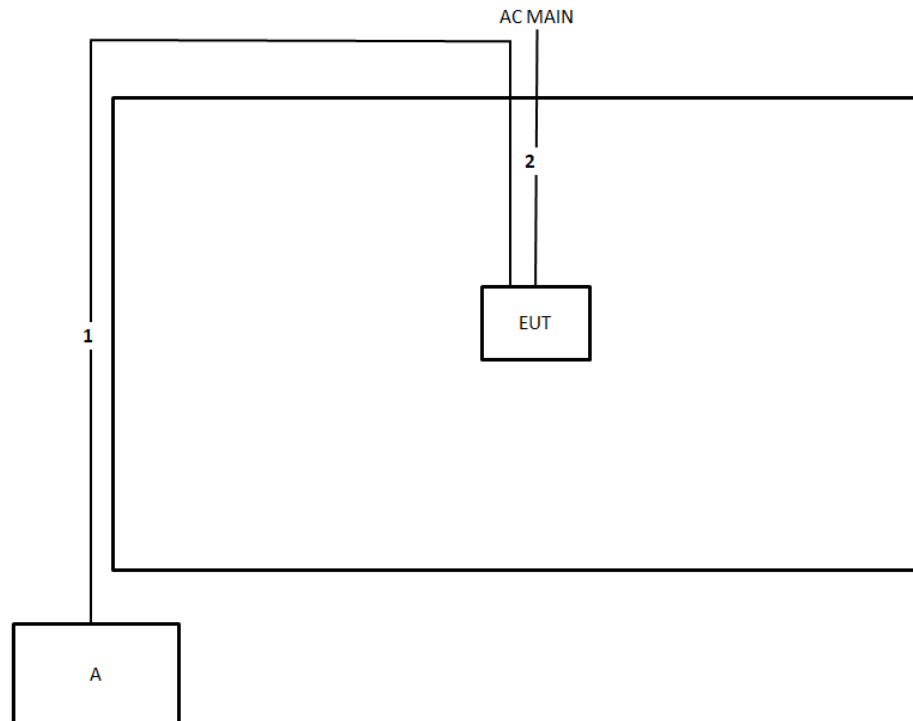
Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	NB	DELL	E6430	N/A
B	Flash disk3.0	Transcend	JetFlash-700	N/A
C	Flash disk3.0	Transcend	JetFlash-700	N/A

For Test Site No: 03CH01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A

2.5 Test Setup Diagram



Test Setup Diagram - Radiated Test < 1GHz


Item	Connection	Shielded	Length
1	RJ-45 cable	No	10m
2	Power cable	No	2.2m



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

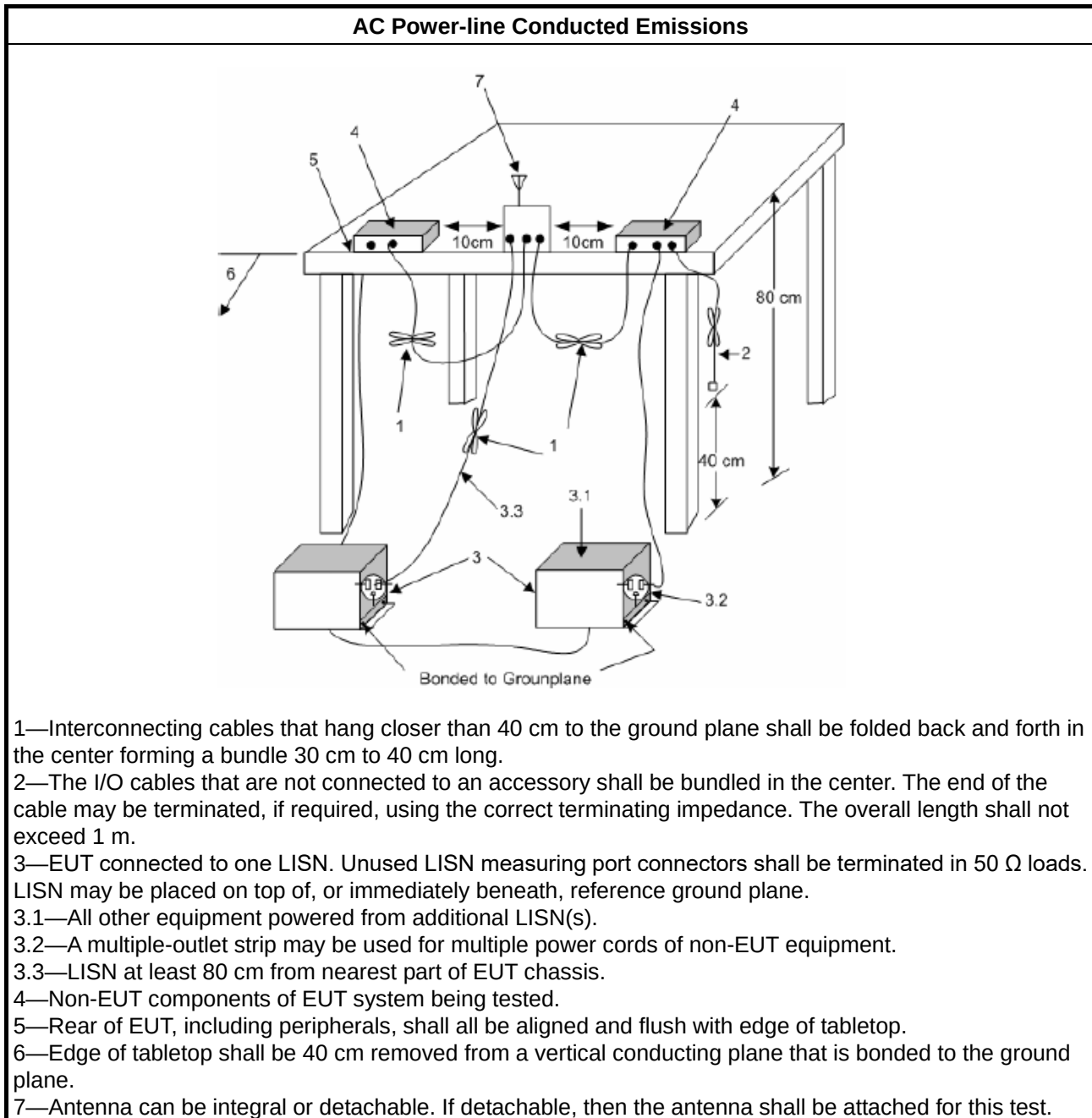
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method
☒ Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup



3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A



3.2 Emissions in Restricted Frequency Bands

3.2.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.2.2 Measuring Instruments

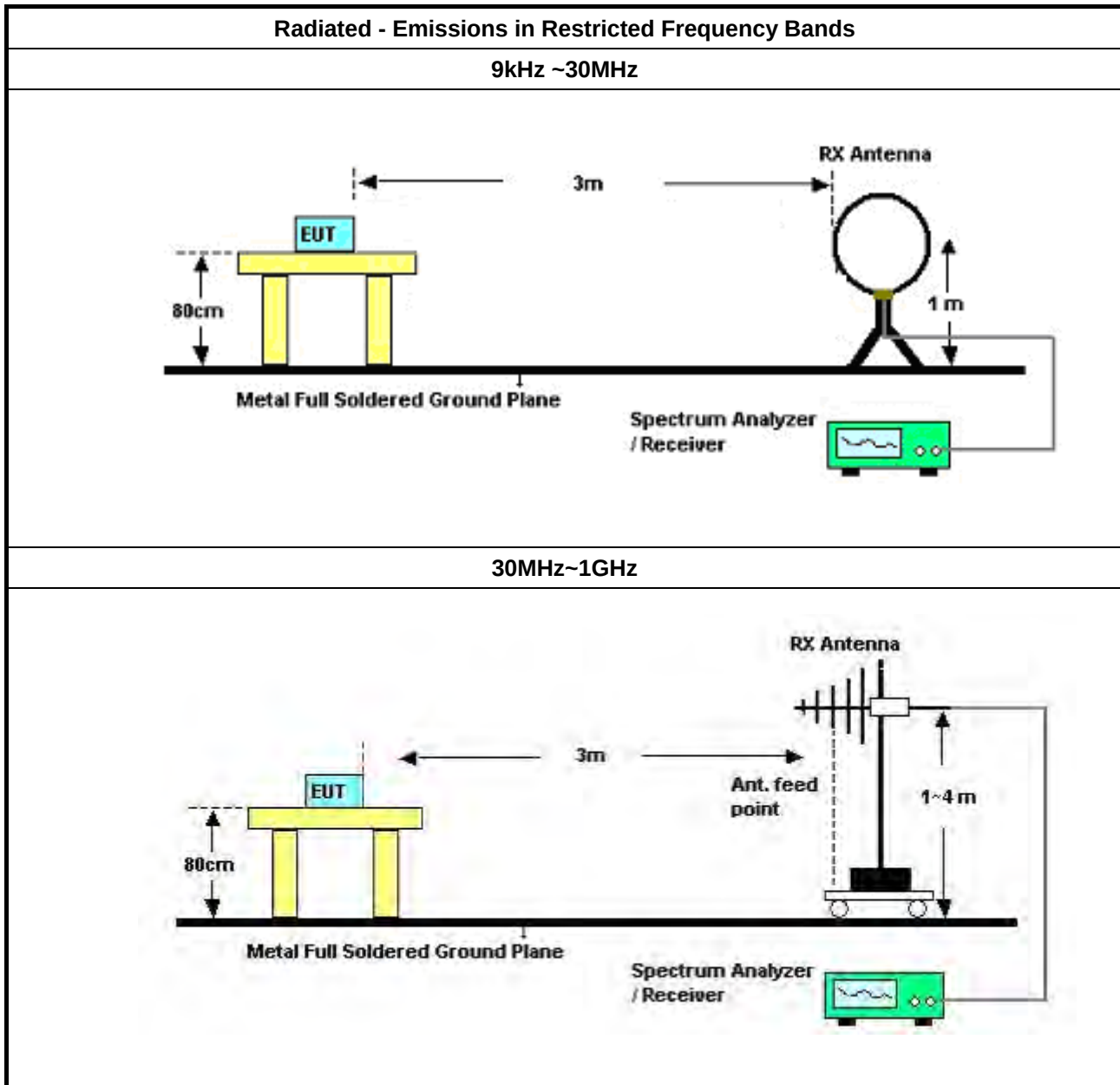
Refer a test equipment and calibration data table in this test report.



3.2.3 Test Procedures

Test Method	
The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
For the transmitter unwanted emissions shall be measured using following options below:	
	Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.
	☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle $\geq 98\%$).
	☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).
	☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW $\geq 1/T$).
	☐ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\geq 1/T$, where T is pulse time.
	☐ Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
	☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.
For the transmitter band-edge emissions shall be measured using following options below:	
	Refer as FCC KDB 558074 clause 8.7 & C63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.
	Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
	For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB
	For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.

3.2.4 Test Setup



3.2.5 Emissions in Restricted Frequency Bands (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.

3.2.6 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix B



4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
LISN	Schwarzbeck	NSLK 8127	8127650	9kHz ~ 30MHz	Nov. 21, 2018	Nov. 20, 2019	Conduction (CO02-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 05, 2018	Nov. 04, 2019	Conduction (CO02-CB)
EMI Receiver	Agilent	N9038A	MY52260140	9kHz ~ 8.4GHz	Jan. 16, 2019	Jan. 15, 2020	Conduction (CO02-CB)
COND Cable	Woken	Cable	2	0.15MHz ~ 30MHz	Nov. 06, 2018	Nov. 05, 2019	Conduction (CO02-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO02-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2018	Mar. 15, 2019	Radiation (03CH01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 27, 2018	Aug. 26, 2019	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980332	20MHz ~ 3GHz	May 02, 2018	May 01, 2019	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100080	9kHz~40GHz	Oct. 03, 2018	Oct. 02, 2019	Radiation (03CH01-CB)
EMI Test Receiver	R&S	ESCS	100359	9kHz ~ 2.75GHz	Jul. 03, 2018	Jul. 02, 2019	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)

Note: Calibration Interval of instruments listed above is one year.

N.C.R. means Non-Calibration required.



AC Power-line Conducted Emissions Result

Appendix A

AC Power-line Conducted Emissions Result																																																																																																																																														
Operating Mode		1			Power Phase			Line																																																																																																																																						
Operating Function		CTX																																																																																																																																												
Level (dBuV) 80 70 60 50 40 30 20 10 0 0.150.2 0.5 1 2 5 10 20 30 Frequency (MHz) Date: 2019-01-29 Time: 20:02:01 CISPR_B_QP CISPR_B_AV <table><tr><th>Freq</th><th>Level</th><th>Over</th><th>Limit</th><th>Read</th><th>LISN</th><th>Cable</th><th rowspan="2">Remark</th><th rowspan="2">Pol/Phase</th></tr><tr><th>MHz</th><th>dBuV</th><th>Limit</th><th>Line</th><th>Level</th><th>Factor</th><th>Loss</th></tr><tr><th></th><th></th><th>dB</th><th>dBuV</th><th>dBuV</th><th>dB</th><th>dB</th><th></th><th></th></tr><tr><td>1</td><td>0.1500</td><td>36.35</td><td>-19.65</td><td>56.00</td><td>26.18</td><td>10.15</td><td>0.02 Average</td><td>LINE</td></tr><tr><td>2</td><td>0.1500</td><td>48.10</td><td>-17.90</td><td>66.00</td><td>37.93</td><td>10.15</td><td>0.02 QP</td><td>LINE</td></tr><tr><td>3</td><td>0.1976</td><td>34.02</td><td>-19.69</td><td>53.71</td><td>23.85</td><td>10.15</td><td>0.02 Average</td><td>LINE</td></tr><tr><td>4</td><td>0.1976</td><td>41.47</td><td>-22.24</td><td>63.71</td><td>31.30</td><td>10.15</td><td>0.02 QP</td><td>LINE</td></tr><tr><td>5</td><td>0.4260</td><td>37.59</td><td>-9.74</td><td>47.33</td><td>27.41</td><td>10.16</td><td>0.02 Average</td><td>LINE</td></tr><tr><td>6</td><td>0.4260</td><td>43.20</td><td>-14.13</td><td>57.33</td><td>33.02</td><td>10.16</td><td>0.02 QP</td><td>LINE</td></tr><tr><td>7</td><td>0.4564</td><td>39.75</td><td>-7.01</td><td>46.76</td><td>29.57</td><td>10.16</td><td>0.02 Average</td><td>LINE</td></tr><tr><td>8</td><td>0.4564</td><td>44.54</td><td>-12.22</td><td>56.76</td><td>34.36</td><td>10.16</td><td>0.02 QP</td><td>LINE</td></tr><tr><td>9</td><td>4.2242</td><td>27.02</td><td>-18.98</td><td>46.00</td><td>16.73</td><td>10.22</td><td>0.07 Average</td><td>LINE</td></tr><tr><td>10</td><td>4.2242</td><td>38.79</td><td>-17.21</td><td>56.00</td><td>28.50</td><td>10.22</td><td>0.07 QP</td><td>LINE</td></tr><tr><td>11</td><td>10.2876</td><td>32.85</td><td>-17.15</td><td>50.00</td><td>22.47</td><td>10.31</td><td>0.07 Average</td><td>LINE</td></tr><tr><td>12</td><td>10.2876</td><td>40.49</td><td>-19.51</td><td>60.00</td><td>30.11</td><td>10.31</td><td>0.07 QP</td><td>LINE</td></tr></table>										Freq	Level	Over	Limit	Read	LISN	Cable	Remark	Pol/Phase	MHz	dBuV	Limit	Line	Level	Factor	Loss			dB	dBuV	dBuV	dB	dB			1	0.1500	36.35	-19.65	56.00	26.18	10.15	0.02 Average	LINE	2	0.1500	48.10	-17.90	66.00	37.93	10.15	0.02 QP	LINE	3	0.1976	34.02	-19.69	53.71	23.85	10.15	0.02 Average	LINE	4	0.1976	41.47	-22.24	63.71	31.30	10.15	0.02 QP	LINE	5	0.4260	37.59	-9.74	47.33	27.41	10.16	0.02 Average	LINE	6	0.4260	43.20	-14.13	57.33	33.02	10.16	0.02 QP	LINE	7	0.4564	39.75	-7.01	46.76	29.57	10.16	0.02 Average	LINE	8	0.4564	44.54	-12.22	56.76	34.36	10.16	0.02 QP	LINE	9	4.2242	27.02	-18.98	46.00	16.73	10.22	0.07 Average	LINE	10	4.2242	38.79	-17.21	56.00	28.50	10.22	0.07 QP	LINE	11	10.2876	32.85	-17.15	50.00	22.47	10.31	0.07 Average	LINE	12	10.2876	40.49	-19.51	60.00	30.11	10.31	0.07 QP	LINE
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Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit. Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)																																																																																																																																														



AC Power-line Conducted Emissions Result

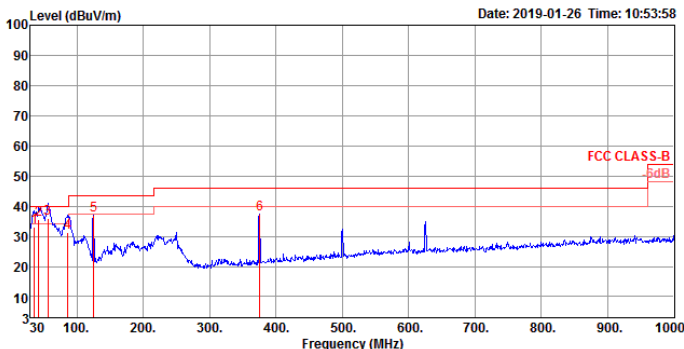
Appendix A

AC Power-line Conducted Emissions Result																																																																																																																																																					
Operating Mode		1			Power Phase		Neutral																																																																																																																																														
Operating Function		CTX																																																																																																																																																			
Level (dBuV) 80 70 60 50 40 30 20 10 0 0.150.2 0.5 1 2 5 10 20 30 Frequency (MHz) Date: 2019-01-29 Time: 20:01:17 CISPR_B_QP CISPR_B_AV <table><tr><th></th><th>Freq</th><th>Level</th><th>Over</th><th>Limit</th><th>Read</th><th>LISN</th><th>Cable</th><th>Remark</th><th>Pol/Phase</th></tr><tr><th></th><th>MHz</th><th>dBuV</th><th>dB</th><th>dBuV</th><th>dBuV</th><th>dB</th><th>dB</th><th></th><th></th></tr><tr><td>1</td><td>0.1540</td><td>35.97</td><td>-19.81</td><td>55.78</td><td>25.82</td><td>10.13</td><td>0.02</td><td>Average</td><td>NEUTRAL</td></tr><tr><td>2</td><td>0.1540</td><td>46.12</td><td>-19.66</td><td>65.78</td><td>35.97</td><td>10.13</td><td>0.02</td><td>QP</td><td>NEUTRAL</td></tr><tr><td>3</td><td>0.4328</td><td>30.23</td><td>-16.97</td><td>47.20</td><td>20.07</td><td>10.14</td><td>0.02</td><td>Average</td><td>NEUTRAL</td></tr><tr><td>4</td><td>0.4328</td><td>39.67</td><td>-17.53</td><td>57.20</td><td>29.51</td><td>10.14</td><td>0.02</td><td>QP</td><td>NEUTRAL</td></tr><tr><td>5</td><td>0.4588</td><td>38.16</td><td>-8.55</td><td>46.71</td><td>28.00</td><td>10.14</td><td>0.02</td><td>Average</td><td>NEUTRAL</td></tr><tr><td>6</td><td>0.4588</td><td>44.74</td><td>-11.97</td><td>56.71</td><td>34.58</td><td>10.14</td><td>0.02</td><td>QP</td><td>NEUTRAL</td></tr><tr><td>7</td><td>4.1356</td><td>26.63</td><td>-19.37</td><td>46.00</td><td>16.38</td><td>10.18</td><td>0.07</td><td>Average</td><td>NEUTRAL</td></tr><tr><td>8</td><td>4.1356</td><td>38.57</td><td>-17.43</td><td>56.00</td><td>28.32</td><td>10.18</td><td>0.07</td><td>QP</td><td>NEUTRAL</td></tr><tr><td>9</td><td>4.4071</td><td>27.60</td><td>-18.40</td><td>46.00</td><td>17.34</td><td>10.19</td><td>0.07</td><td>Average</td><td>NEUTRAL</td></tr><tr><td>10</td><td>4.4071</td><td>38.47</td><td>-17.53</td><td>56.00</td><td>28.21</td><td>10.19</td><td>0.07</td><td>QP</td><td>NEUTRAL</td></tr><tr><td>11</td><td>10.3422</td><td>32.46</td><td>-17.54</td><td>50.00</td><td>22.12</td><td>10.27</td><td>0.07</td><td>Average</td><td>NEUTRAL</td></tr><tr><td>12</td><td>10.3422</td><td>41.42</td><td>-18.58</td><td>60.00</td><td>31.08</td><td>10.27</td><td>0.07</td><td>QP</td><td>NEUTRAL</td></tr></table>											Freq	Level	Over	Limit	Read	LISN	Cable	Remark	Pol/Phase		MHz	dBuV	dB	dBuV	dBuV	dB	dB			1	0.1540	35.97	-19.81	55.78	25.82	10.13	0.02	Average	NEUTRAL	2	0.1540	46.12	-19.66	65.78	35.97	10.13	0.02	QP	NEUTRAL	3	0.4328	30.23	-16.97	47.20	20.07	10.14	0.02	Average	NEUTRAL	4	0.4328	39.67	-17.53	57.20	29.51	10.14	0.02	QP	NEUTRAL	5	0.4588	38.16	-8.55	46.71	28.00	10.14	0.02	Average	NEUTRAL	6	0.4588	44.74	-11.97	56.71	34.58	10.14	0.02	QP	NEUTRAL	7	4.1356	26.63	-19.37	46.00	16.38	10.18	0.07	Average	NEUTRAL	8	4.1356	38.57	-17.43	56.00	28.32	10.18	0.07	QP	NEUTRAL	9	4.4071	27.60	-18.40	46.00	17.34	10.19	0.07	Average	NEUTRAL	10	4.4071	38.47	-17.53	56.00	28.21	10.19	0.07	QP	NEUTRAL	11	10.3422	32.46	-17.54	50.00	22.12	10.27	0.07	Average	NEUTRAL	12	10.3422	41.42	-18.58	60.00	31.08	10.27	0.07	QP	NEUTRAL
	Freq	Level	Over	Limit	Read	LISN	Cable	Remark	Pol/Phase																																																																																																																																												
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1	0.1540	35.97	-19.81	55.78	25.82	10.13	0.02	Average	NEUTRAL																																																																																																																																												
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9	4.4071	27.60	-18.40	46.00	17.34	10.19	0.07	Average	NEUTRAL																																																																																																																																												
10	4.4071	38.47	-17.53	56.00	28.21	10.19	0.07	QP	NEUTRAL																																																																																																																																												
11	10.3422	32.46	-17.54	50.00	22.12	10.27	0.07	Average	NEUTRAL																																																																																																																																												
12	10.3422	41.42	-18.58	60.00	31.08	10.27	0.07	QP	NEUTRAL																																																																																																																																												
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RSE below 1GHz Result

Appendix B

RSE below 1GHz Result																																																																																																												
Operating Mode		3			Polarization			Vertical																																																																																																				
Operating Function		CTX																																																																																																										
Level (dBuV/m) Date: 2019-01-26 Time: 10:53:58  <table><tr><th></th><th>Freq</th><th>Level</th><th>Limit</th><th>Over</th><th>Read</th><th>CableAntenna</th><th>Preamp</th><th>A/Pos</th><th>T/Pos</th><th>Remark</th><th>Pol/Phase</th></tr><tr><th></th><th>MHz</th><th>dBuV/m</th><th>dBuV/m</th><th>dB</th><th>dBuV</th><th>dB</th><th>dB/m</th><th>dB</th><th>cm</th><th>deg</th><th></th></tr><tr><td>1</td><td>35.82</td><td>32.90</td><td>40.00</td><td>-7.10</td><td>41.47</td><td>0.77</td><td>22.25</td><td>31.59</td><td>100</td><td>120 QP</td><td>VERTICAL</td></tr><tr><td>2</td><td>42.61</td><td>35.57</td><td>40.00</td><td>-4.43</td><td>48.06</td><td>0.87</td><td>18.32</td><td>31.68</td><td>100</td><td>239 QP</td><td>VERTICAL</td></tr><tr><td>3</td><td>56.19</td><td>35.89</td><td>40.00</td><td>-4.11</td><td>53.35</td><td>0.94</td><td>13.40</td><td>31.80</td><td>100</td><td>0 QP</td><td>VERTICAL</td></tr><tr><td>4</td><td>86.26</td><td>31.29</td><td>40.00</td><td>-8.71</td><td>47.47</td><td>1.16</td><td>14.51</td><td>31.85</td><td>125</td><td>350 QP</td><td>VERTICAL</td></tr><tr><td>5</td><td>125.06</td><td>36.94</td><td>43.50</td><td>-6.56</td><td>48.79</td><td>1.44</td><td>18.60</td><td>31.89</td><td>100</td><td>90 Peak</td><td>VERTICAL</td></tr><tr><td>6</td><td>375.32</td><td>37.26</td><td>46.00</td><td>-8.74</td><td>44.98</td><td>2.51</td><td>21.88</td><td>32.11</td><td>150</td><td>290 Peak</td><td>VERTICAL</td></tr></table>														Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase		MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		1	35.82	32.90	40.00	-7.10	41.47	0.77	22.25	31.59	100	120 QP	VERTICAL	2	42.61	35.57	40.00	-4.43	48.06	0.87	18.32	31.68	100	239 QP	VERTICAL	3	56.19	35.89	40.00	-4.11	53.35	0.94	13.40	31.80	100	0 QP	VERTICAL	4	86.26	31.29	40.00	-8.71	47.47	1.16	14.51	31.85	125	350 QP	VERTICAL	5	125.06	36.94	43.50	-6.56	48.79	1.44	18.60	31.89	100	90 Peak	VERTICAL	6	375.32	37.26	46.00	-8.74	44.98	2.51	21.88	32.11	150	290 Peak	VERTICAL
	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase																																																																																																	
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RSE below 1GHz Result

Appendix B

RSE below 1GHz Result																																																																																																												
Operating Mode	3					Polarization			Horizontal																																																																																																			
Operating Function	CTX																																																																																																											
Level (dBuV/m) Date: 2019-01-26 Time: 11:00:36 Frequency (MHz) <table><thead><tr><th></th><th>Freq</th><th>Level</th><th>Limit</th><th>Over</th><th>Read</th><th>CableAntenna</th><th>Preamp</th><th>A/Pos</th><th>T/Pos</th><th>Remark</th><th>Pol/Phase</th></tr><tr><th></th><th>MHz</th><th>dBuV/m</th><th>dBuV/m</th><th>dB</th><th>dBuV</th><th>dB</th><th>dB/m</th><th>dB</th><th>cm</th><th>deg</th><th></th></tr></thead><tbody><tr><td>1</td><td>94.99</td><td>34.23</td><td>43.50</td><td>-9.27</td><td>48.64</td><td>1.24</td><td>16.21</td><td>31.86</td><td>200</td><td>114 Peak</td><td>HORIZONTAL</td></tr><tr><td>2</td><td>125.06</td><td>38.56</td><td>43.50</td><td>-4.94</td><td>50.41</td><td>1.44</td><td>18.60</td><td>31.89</td><td>300</td><td>57 Peak</td><td>HORIZONTAL</td></tr><tr><td>3</td><td>250.19</td><td>35.77</td><td>46.00</td><td>-10.23</td><td>46.81</td><td>2.04</td><td>18.90</td><td>31.98</td><td>100</td><td>360 Peak</td><td>HORIZONTAL</td></tr><tr><td>4</td><td>375.32</td><td>41.25</td><td>46.00</td><td>-4.75</td><td>48.97</td><td>2.51</td><td>21.88</td><td>32.11</td><td>100</td><td>185 QP</td><td>HORIZONTAL</td></tr><tr><td>5</td><td>500.45</td><td>33.21</td><td>46.00</td><td>-12.79</td><td>38.70</td><td>2.94</td><td>23.83</td><td>32.26</td><td>200</td><td>144 Peak</td><td>HORIZONTAL</td></tr><tr><td>6</td><td>625.58</td><td>37.21</td><td>46.00</td><td>-8.79</td><td>41.16</td><td>3.28</td><td>25.21</td><td>32.44</td><td>150</td><td>360 Peak</td><td>HORIZONTAL</td></tr></tbody></table>														Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase		MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		1	94.99	34.23	43.50	-9.27	48.64	1.24	16.21	31.86	200	114 Peak	HORIZONTAL	2	125.06	38.56	43.50	-4.94	50.41	1.44	18.60	31.89	300	57 Peak	HORIZONTAL	3	250.19	35.77	46.00	-10.23	46.81	2.04	18.90	31.98	100	360 Peak	HORIZONTAL	4	375.32	41.25	46.00	-4.75	48.97	2.51	21.88	32.11	100	185 QP	HORIZONTAL	5	500.45	33.21	46.00	-12.79	38.70	2.94	23.83	32.26	200	144 Peak	HORIZONTAL	6	625.58	37.21	46.00	-8.79	41.16	3.28	25.21	32.44	150	360 Peak	HORIZONTAL
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