

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No. : OT-18O-RED-127
AGR No. : A188A-301
Applicant : NURI Telecom Co., Ltd
Address : NURI Bld, 16 Sapyeong-daero, Seocho-gu, Seoul, Korea, 06552
Manufacturer : NURI Telecom Co., Ltd.
Address : NURI Bld, 16 Sapyeong-daero, Seocho-gu, Seoul, Korea, 06552
FCC ID. : 2AD28NAMR-C108SR
Type of Equipment : PLC Modem - All other devices
Model Name : NAMR-C108SR
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 20 pages (including this page)
Date of Incoming : October 22, 2018
Date of Issuing : October 24, 2018

SUMMARY

The equipment complies with the requirement of *FCC CFR 47 PART 15 SUBPART B Class A, Section 15.101*.
 This test report contains only the results of a single test of the sample supplied for the examination.
 It is not a general valid assessment of the features of the respective products of the mass-production.

Reviewed by: 
 Jae-Beom, Cho / General Manager
 ONETECH Corp.

Approved by: 
 Gea Won, Lee / Managing Director
 ONETECH Corp.

CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE	4
2. GENERAL INFORMATION.....	5
2.1 PRODUCT DESCRIPTION.....	5
2.2 MODEL DIFFERENCES	5
2.3 RELATED SUBMITTAL(S) / GRANT(S)	5
2.4 TEST SYSTEM DETAILS	5
2.5 TEST METHODOLOGY	5
2.6 TEST FACILITY	6
3. SYSTEM TEST CONFIGURATION.....	7
3.1 JUSTIFICATION	7
3.2 MODE OF OPERATION DURING THE TEST.....	7
3.3 CABLE DESCRIPTION	7
3.4 EQUIPMENT MODIFICATIONS	7
3.5 CONFIGURATION OF TEST SYSTEM	7
4. PRELIMINARY TEST	8
4.1 AC POWER LINE CONDUCTED EMISSION TEST	8
4.2 RADIATED EMISSION TEST	8
5. FINAL RESULT OF MEASUREMENT	9
5.1 CONDUCTED EMISSION TEST	9
5.1.1 Test data for TX Mode.....	9
5.1.2 TEST DATA FOR RX MODE	11
5.2 RADIATED EMISSION TEST	13
5.2.1 Test data for TX Mode.....	13
6. FIELD STRENGTH CALCULATION	15
7. LIST OF TEST EQUIPMENT.....	16
APPENDIX I - TEST SET-UP PHOTOS: (CONDUCTED EMISSION)	17
APPENDIX II - TEST SET-UP PHOTOS: (RADIATED EMISSION).....	18
APPENDIX III - PHOTOGRAPHS REPORT	19

Revision History

Rev. No.	Issued Report No.	Issued Date	Revisions	Section Affected
0	OT-18O-RED-127	October 24, 2018	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : NURI Telecom Co., Ltd
Address : NURI Bld, 16 Sapyeong-daero, Seocho-gu, Seoul, Korea, 06552

Manufacturer : NURI Telecom Co., Ltd.
Address : NURI Bld, 16 Sapyeong-daero, Seocho-gu, Seoul, Korea, 06552

Factory : NURI Telecom Co., Ltd.
Address : 363, Green-ro, Naju-si, Jeollanam-do, Republic of Korea

FCC ID. : 2AD28NAMR-C108SR
Model Name : NAMR-C108SR
Brand Name : N/A
Date : October 24, 2018

DEVICE TYPE	ALL OTHER DEVICES
E.U.T. DESCRIPTION	PLC Modem
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.4: 2014
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 (CLASS A)
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	10 m, semi anechoic chamber

- . The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. GENERAL INFORMATION

2.1 Product Description

The NURI Telecom Co., Ltd, Model NAMR-C108SR (referred to as the EUT in this report) is a PLC Modem. Product specification described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	Plastic & Metal
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1 MHz)	Main System Clock: 24MHz RTC Clock : 32.768KHz G3-PLC : 154KHz ~ 487KHz
ELECTRICAL RATING	DC 12 V
NUMBER OF PCB LAYERS (P. C. BOARD NAME)	4 Layers
EXTERNAL CONNECTOR	AC IN, Meter Interface Pin Header

2.2 Model Differences

-. None.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Test System Details

The model numbers for all the equipments, which were used in the tested system, is:

Model	Manufacturer	Description	Connected to
NAMR-C108SR	NURI Telecom Co., Ltd.	PLC Modem (EUT)	-
NDC-I632	NURI Telecom Co., Ltd.	Data Concentrator	EUT
N/A	N/A	Debug Board	EUT

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4: 2014. Radiated testing was performed at a distance of 10 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at:

- 1) 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea
- 2) 12-5, Jinsaegol-gil 75 beon-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666/ T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. SYSTEM TEST CONFIGURATION

3.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
MAIN BOARD	N/A	N/A	N/A

3.2 Mode of operation during the test

- . The EUT was connected to Concentrator with a power cord and PLC TX and using Debug Board, RX communication was being confirmed by Tera-Term program of laptop computer while testing.
- . Input power condition during the measurements was AC 120 V~, 60 Hz.

3.3 Cable Description

Ports Name	Shielded	Ferrite Bead	Metal Shell	Length (m)	Connected to
AC IN	N	N	N	1.5	LISN
Meter Interface Pin Header	N	N	N	1.2	Debug Board

3.4 Equipment Modifications

- . None.

3.5 Configuration of Test System

- Line Conducted Test: The EUT was connected to LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.4: 2014 7.3.3 to determine the worse operating conditions.
- Radiated Emission Test: Preliminary radiated emission test was conducted using the procedure in ANSI C63.4: 2014 8.3.1.1 to determine the worse operating conditions. Final radiated emission test was conducted at 10 m semi anechoic chamber.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emission Test

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worst operating condition (Please check one only)
TX Mode	X
RX Mode	X

4.2 Radiated Emission Test

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worst operating condition (Please check one only)
TX Mode	X
RX Mode	X

5. FINAL RESULT OF MEASUREMENT

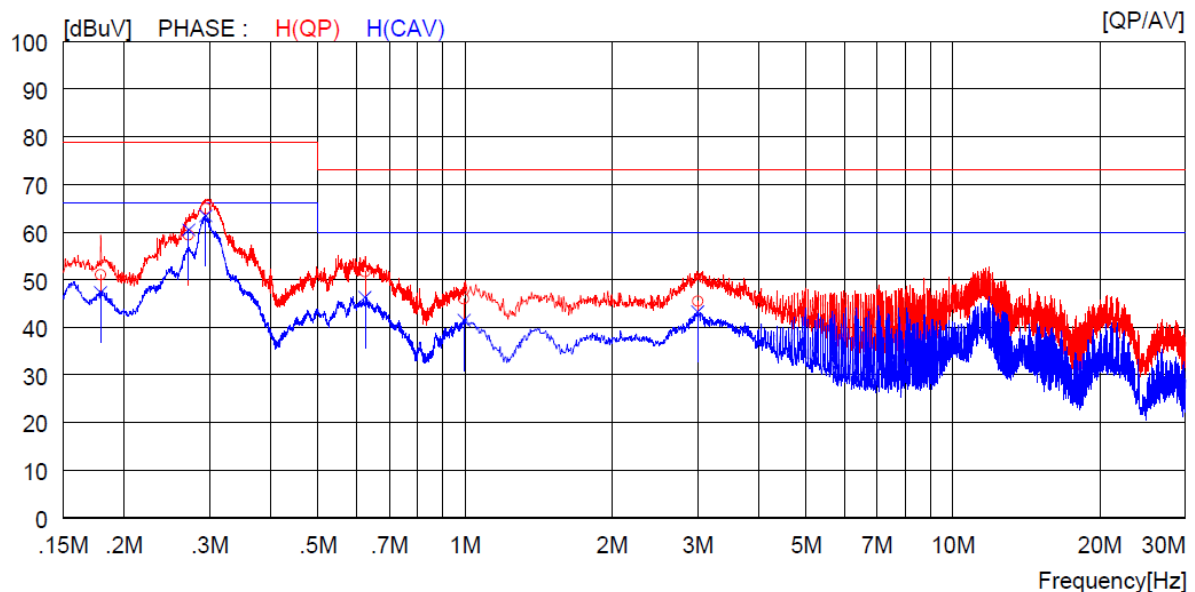
Preliminary test was done in normal operation mode. And the final measurement was selected for the maximized emission level.

5.1 Conducted Emission Test

5.1.1 Test data for TX Mode

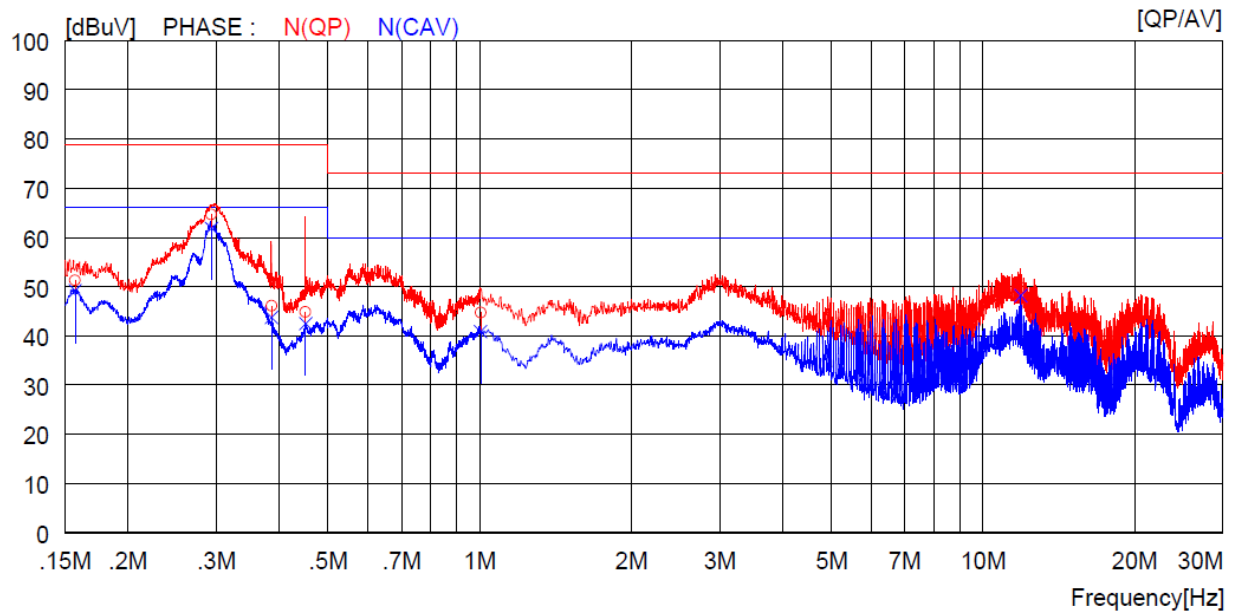
Humidity Level : 50.6 % R.H. Temperature: 23.3 °C
Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.107 (a)
Type of Test : CLASS A
Result : PASSED BY 2.6 dB at 0.29400 MHz under CISPR-Average detector mode on HOT Line

EUT : NAMR-C108SR Date: October 23, 2018
Detector : Q.P (6 dB Bandwidth: 9 kHz)
Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.17900	41.1	----	9.9	51.0	----	79.0	----	28.0	----	H (QP)
2	0.27100	49.5	----	9.9	59.4	----	79.0	----	19.6	----	H (QP)
3	0.29400	55.0	----	9.9	64.9	----	79.0	----	14.1	----	H (QP)
4	0.62300	41.6	----	10.0	51.6	----	73.0	----	21.4	----	H (QP)
5	0.99400	36.0	----	10.0	46.0	----	73.0	----	27.0	----	H (QP)
6	3.00000	35.5	----	10.0	45.5	----	73.0	----	27.5	----	H (QP)
7	0.17900	----	37.4	9.9	----	47.3	----	66.0	----	18.7	H (CAV)
8	0.27100	----	50.6	9.9	----	60.5	----	66.0	----	5.5	H (CAV)
9	0.29400	----	53.5	9.9	----	63.4	----	66.0	----	2.6	H (CAV)
10	0.62300	----	36.3	10.0	----	46.3	----	60.0	----	13.7	H (CAV)
11	0.99400	----	31.5	10.0	----	41.5	----	60.0	----	18.5	H (CAV)
12	3.00000	----	33.2	10.0	----	43.2	----	60.0	----	16.8	H (CAV)

Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15700	41.4	----	9.9	51.3	----	79.0	----	27.7	----	N (QP)
2	0.29300	54.8	----	9.9	64.7	----	79.0	----	14.3	----	N (QP)
3	0.38600	36.2	----	9.9	46.1	----	79.0	----	32.9	----	N (QP)
4	0.45100	34.8	----	10.0	44.8	----	79.0	----	34.2	----	N (QP)
5	1.00400	34.7	----	10.0	44.7	----	73.0	----	28.3	----	N (QP)
6	11.89000	39.6	----	10.2	49.8	----	73.0	----	23.2	----	N (QP)
7	0.15700	----	39.3	9.9	----	49.2	----	66.0	----	16.8	N (CAV)
8	0.29300	----	52.0	9.9	----	61.9	----	66.0	----	4.1	N (CAV)
9	0.38600	----	33.9	9.9	----	43.8	----	66.0	----	22.2	N (CAV)
10	0.45100	----	32.5	10.0	----	42.5	----	66.0	----	23.5	N (CAV)
11	1.00400	----	30.9	10.0	----	40.9	----	60.0	----	19.1	N (CAV)
12	11.89000	----	38.0	10.2	----	48.2	----	60.0	----	11.8	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

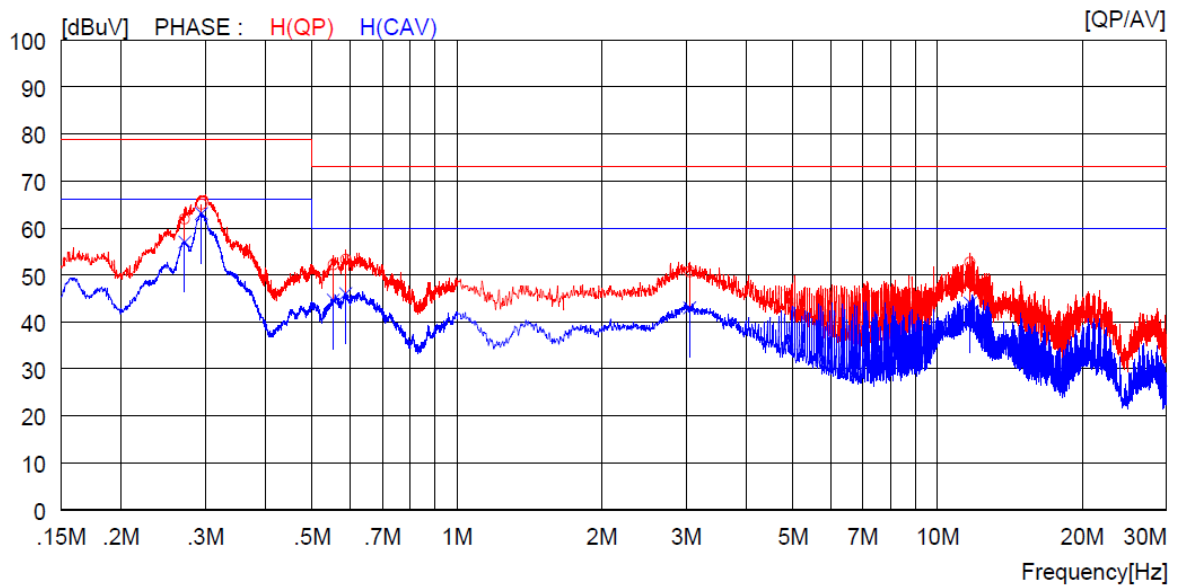
The result level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Won-Kyun, Yim / Engineer

5.1.2 Test data for RX Mode

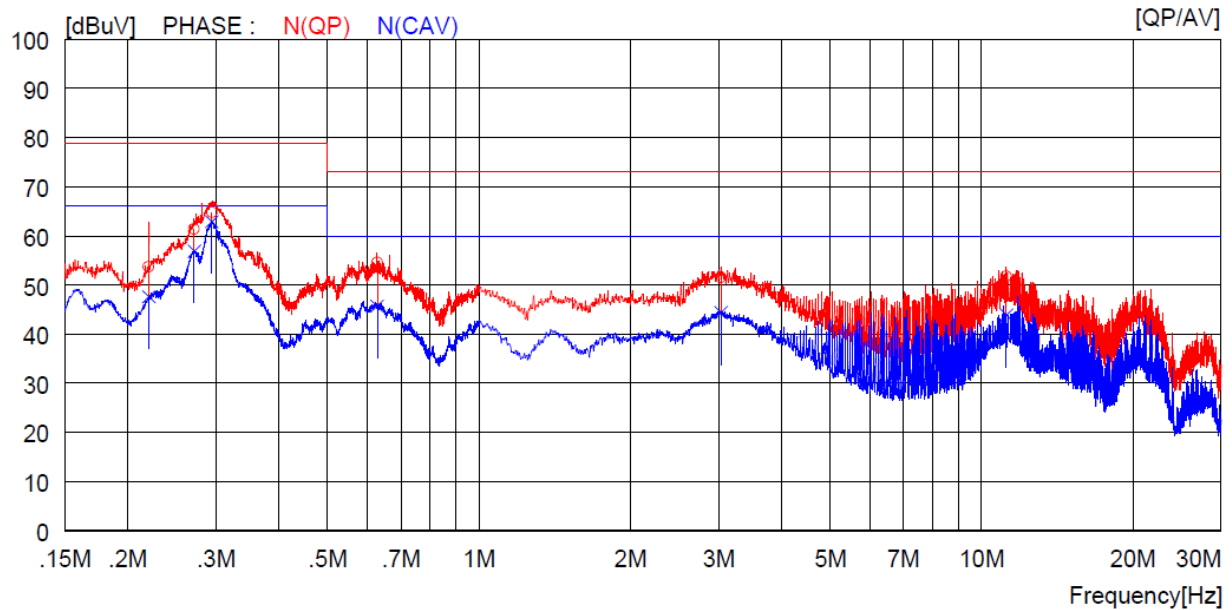
Humidity Level : 50.6 % R.H. Temperature: 23.3 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.107 (a)
 Type of Test : CLASS A
 Result : PASSED BY 2.9 dB at 0.29400 MHz under CISPR-Average detector mode on HOT Line

EUT : NAMR-C108SR Date: October 23, 2018
 Detector : Q.P (6 dB Bandwidth: 9 kHz)
 Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.27100	52.0	----	9.9	61.9	----	79.0	----	17.1	----	H (QP)
2	0.29400	55.1	----	9.9	65.0	----	79.0	----	14.0	----	H (QP)
3	0.55300	42.2	----	10.0	52.2	----	73.0	----	20.8	----	H (QP)
4	0.58700	43.3	----	10.0	53.3	----	73.0	----	19.7	----	H (QP)
5	3.05200	40.6	----	10.0	50.6	----	73.0	----	22.4	----	H (QP)
6	11.70000	42.5	----	10.2	52.7	----	73.0	----	20.3	----	H (QP)
7	0.27100	----	47.1	9.9	----	57.0	----	66.0	----	9.0	H (CAV)
8	0.29400	----	53.2	9.9	----	63.1	----	66.0	----	2.9	H (CAV)
9	0.55300	----	34.6	10.0	----	44.6	----	60.0	----	15.4	H (CAV)
10	0.58700	----	36.0	10.0	----	46.0	----	60.0	----	14.0	H (CAV)
11	3.05200	----	33.0	10.0	----	43.0	----	60.0	----	17.0	H (CAV)
12	11.70000	----	33.8	10.2	----	44.0	----	60.0	----	16.0	H (CAV)

Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.22000	43.8	----	9.9	53.7	----	79.0	----	25.3	----	N (QP)
2	0.27100	51.5	----	9.9	61.4	----	79.0	----	17.6	----	N (QP)
3	0.29400	54.9	----	9.9	64.8	----	79.0	----	14.2	----	N (QP)
4	0.62700	44.5	----	10.0	54.5	----	73.0	----	18.5	----	N (QP)
5	3.02800	41.5	----	10.0	51.5	----	73.0	----	21.5	----	N (QP)
6	11.21000	41.6	----	10.2	51.8	----	73.0	----	21.2	----	N (QP)
7	0.22000	----	37.7	9.9	----	47.6	----	66.0	----	18.4	N (CAV)
8	0.27100	----	47.0	9.9	----	56.9	----	66.0	----	9.1	N (CAV)
9	0.29400	----	53.0	9.9	----	62.9	----	66.0	----	3.1	N (CAV)
10	0.62700	----	35.7	10.0	----	45.7	----	60.0	----	14.3	N (CAV)
11	3.02800	----	34.4	10.0	----	44.4	----	60.0	----	15.6	N (CAV)
12	11.21000	----	33.7	10.2	----	43.9	----	60.0	----	16.1	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The result level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Won-Kyun, Yim / Engineer

5.2 Radiated Emission Test

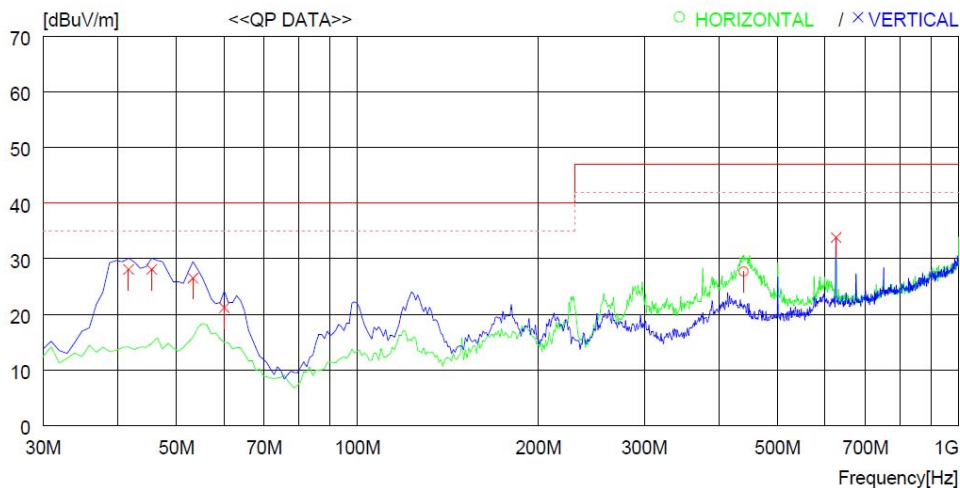
The following table shows the highest levels of radiated emission on both polarizations of horizontal and vertical.

5.2.1 Test data for TX Mode

5.2.1.1 Test data

Humidity Level : 51.0 % R.H. Temperature: 24.1 °C
Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.109 (g)
Type of Test : CLASS A
Result : PASSED BY 11.9 dB at 41.640 MHz

EUT : NAMR-C108SR Date: October 22, 2018
Frequency Range : 30 MHz ~ 1 000 MHz
Detector : Q.P (6 dB Bandwidth: 120 kHz)
Distance : 10 m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	439.341	32.7	16.1	7.1	28.2	27.7	47.0	19.3	100	359
----- Vertical -----										
2	41.640	41.3	13.6	1.2	28.0	28.1	40.0	11.9	100	0
3	45.520	40.2	13.9	2.0	28.0	28.1	40.0	11.9	100	0
4	53.280	39.0	13.4	2.1	28.0	26.5	40.0	13.5	100	278
5	60.070	33.6	13.2	2.4	28.0	21.2	40.0	18.8	100	198
6	625.577	34.2	19.3	8.8	28.5	33.8	47.0	13.2	100	235

Remark: Margin (dB) = Limit – Result and Result = Reading Quasi-Peak + Antenna Factor + Loss – Gain

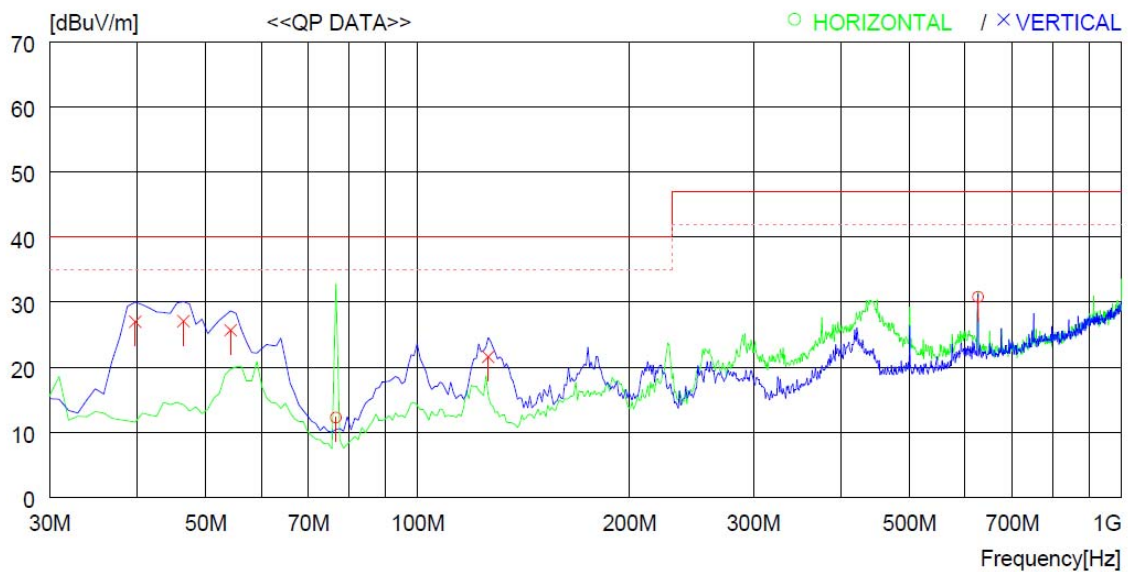
Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Tested by: Won-Kyun, Yim / Engineer

5.2.2 Test data for RX Mode

Humidity Level : 51.0 % R.H. Temperature: 24.1 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.109 (g)
 Type of Test : CLASS A
 Result : PASSED BY 12.9 dB at 46.490 MHz

EUT : NAMR-C108SR Date: October 22, 2018
 Frequency Range : 30 MHz ~ 1 000 MHz
 Detector : Q.P (6 dB Bandwidth: 120 kHz)
 Distance : 10 m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	76.560	30.0	7.6	2.7	28.0	12.3	40.0	27.7	200	250
2	625.577	31.2	19.3	8.8	28.5	30.8	47.0	16.2	200	359
----- Vertical -----										
3	39.700	40.8	13.3	0.9	28.0	27.0	40.0	13.0	100	359
4	46.490	39.3	13.8	2.0	28.0	27.1	40.0	12.9	100	359
5	54.250	38.2	13.3	2.2	28.0	25.7	40.0	14.3	100	65
6	126.030	36.8	9.2	3.4	27.8	21.6	40.0	18.4	100	359

Remark: Margin (dB) = Limit – Result and Result = Reading Quasi-Peak + Antenna Factor + Loss – Gain
 Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Tested by: Won-Kyun, Yim / Engineer

6. FIELD STRENGTH CALCULATION

Meter readings are compared to the specification limit correcting for antenna and cable losses.

+	Meter reading	(dB μ V)
+	Cable Loss	(dB)
+	Antenna Factor	(dB/m)
		<hr/>
=	Corrected Reading	(dB μ V/m)
Margin (dB)		
	Specification Limit	(dB μ V/m)
-	Corrected Reading	(dB μ V/m)
		<hr/>
=	dB Relative to Spec	(\pm dB)

7. LIST OF TEST EQUIPMENT

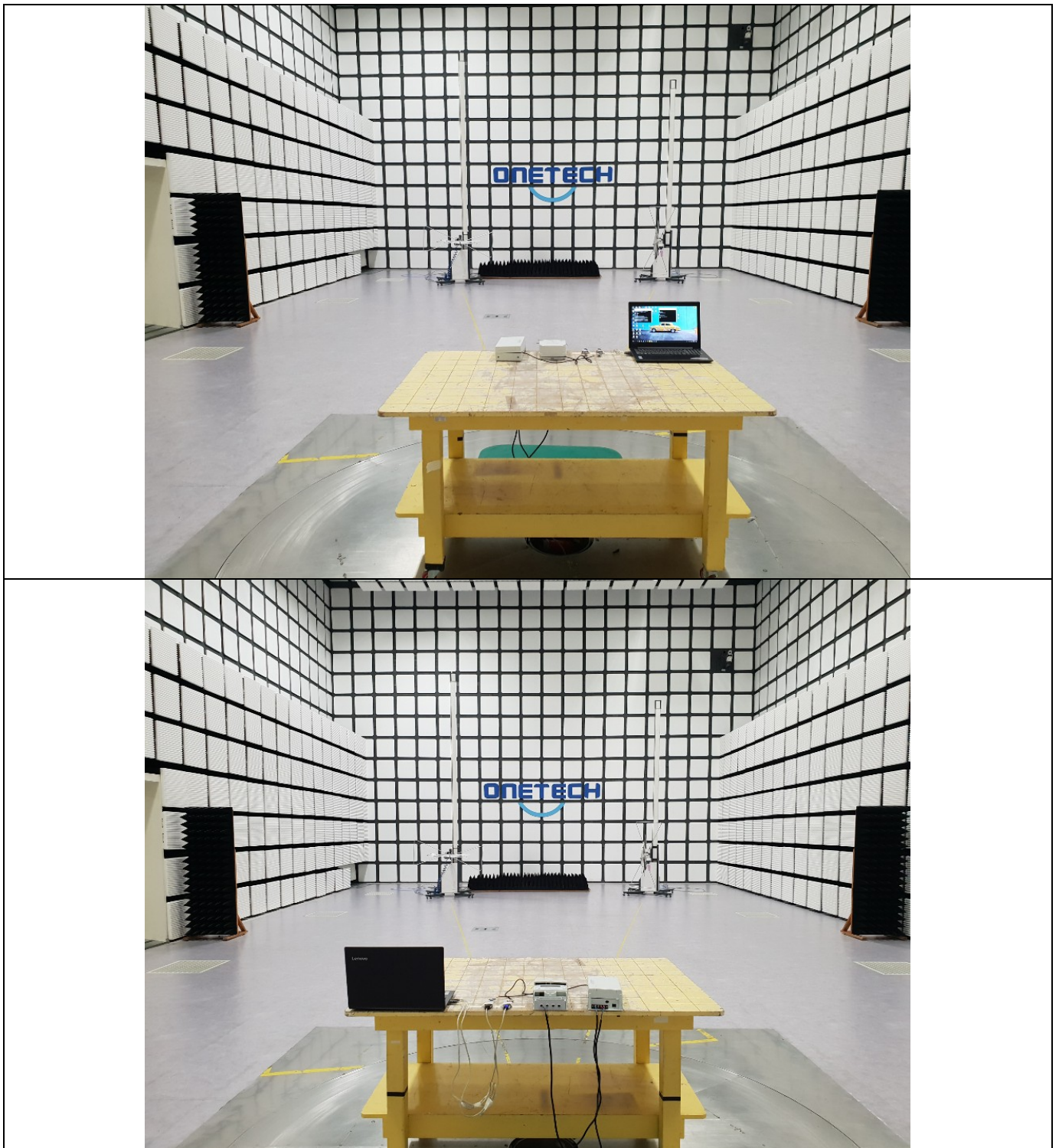
No.	EQUIPMENTS	MFR.	MODEL	SER. NO.	LAST CAL	DUE CAL	USE
1.	Test receiver	R & S	ESCI	101012	Oct. 27, 2017	One Year	■
2.			ESCI	101013	Mar. 28, 2018	One Year	■
3.			ESR	101470	Oct. 27, 2017	One Year	■
4.	Amplifier	Sonoma	310N	312544	Mar. 28, 2018	One Year	■
5.		Instrument	310N	312545	Mar. 28, 2018	One Year	■
6.		Hewlett Packard	8447D	2944A07777	Mar. 29, 2018	One Year	□
7.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-419	Aug. 14, 2018	Two Years	■
8.			VULB9163	9163-255	Jun. 05, 2018	Two Years	■
9.	Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9120D295	Aug 16, 2017	Two Years	□
10.	Amplifier	Schwarzbeck	BBV9718	310	Mar. 30, 2018	One Year	□
11.	LISN	EMCO	3825/2	9109-1867	Mar. 28, 2018	One Year	□
12.				9109-1869	Apr. 11, 2018	One Year	□
13.		Schwarzbeck	NSLK 8128	8128-216	Mar. 28, 2018	One Year	■
14.			NSLK 8126	8126-404	Apr. 04, 2018	One Year	□
15.			NSLK 8126	8126-479	Oct. 24, 2017	One Year	□
16.	Transient Limiter	Hewlett Packard	11047A	3107A02762	Mar. 28, 2018	One Year	■
17.	Controller	Innco System	CO3000	CO3000/904 /37211215/L	N/A	N/A	■
18.			CO3000	N/A	N/A	N/A	□
19.	Turn Table	Innco System	DT3000	930611	N/A	N/A	■
20.			DT5000-3t-Teagplatten	N/A	N/A	N/A	□
21.	Antenna Master	Innco System	MA-4000XPET	MA4000/509 /37211215/L	N/A	N/A	■
22.			MA4000-EP	N/A	N/A	N/A	■

Remark: Mark ■ mean used equipment.

APPENDIX I - TEST SET-UP PHOTOS: (Conducted emission)



APPENDIX II - TEST SET-UP PHOTOS: (Radiated emission)



APPENDIX III - PHOTOGRAPHS REPORT



