

Nemko Korea Co., Ltd.

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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Anam Electronics Co., Ltd.
27, Digital-ro 27ga-gil, Guro-gu, Seoul,
08375, Republic of Korea.
Attn. : Byeong-Seob, Lee

Dates of Issue : September 21, 2016

Test Report No. : NK-16-R-083

Test Site : Nemko Korea Co., Ltd.

**FCC ID
IC****MBBVERSE
11657A-VERSE****Brand Name****MARTIN LOGAN****Contact Person**

Anam Electronics Co., Ltd.
27, Digital-ro 27ga-gil, Guro-gu, Seoul,
08375, Republic of Korea.
Byeong-Seob, Lee
Telephone No. : +82-2-6424-4881

Applied Standard: FCC 47 CFR Part 15.247 and IC RSS-247 Issue 1
Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)
EUT Type: SOUNDBAR

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

 Sep 21, 2016

Tested By : Wonho Son
Engineer

 Sep 21, 2016

Reviewed By : Deokha Ryu
Technical Manager

TABLE OF CONTENTS

1. Scope	4
2. Introduction (Site Description)	5
2.1 Test facility	5
2.2 Accreditation and listing	6
3. Test Conditions & EUT Information	7
3.1 Operation During Test	7
3.1.1 Table of test power setting	7
3.1.2 Table of test channels	7
3.1.3 Antenna TX mode information	7
3.1.4 Additional Information Related to testing	7
3.1.5 Others Information	8
3.2 Support Equipment	8
3.3 Setup Drawing	8
3.4 EUT Information	9
4. Summary of Test Results	10
5. Recommendation / Conclusion	11
6. Antenna Requirements	11
7. Description of Test	12
7.1 Conducted Emissions	12
7.2 Radiated Emissions	13
7.3 20 dB Bandwidth	14
7.4 Carrier Frequency Separation	14
7.5 Transmitter Average Time of Occupancy	15
7.6 Number of Hopping Channels	15
7.7 Maximum Peak Output Power	16
7.8 Conducted Spurious Emissions	16

8.	Test Data	17
8.1	Conducted Emissions	17
8.2	Radiated Emissions	20
8.3	20 dB Modulated Bandwidth	22
8.4	Carrier Frequency Separation	28
8.5	Transmitter Average Time of Occupancy	31
8.6	Number of Hopping Channels	33
8.7	Peak Output Power and E.I.R.P	34
8.8	Conducted Spurious Emissions	40
8.9	Radiated Spurious Emissions	56
8.10	Radiated Bandedge	62
9.	Test Equipment	65
10	Accuracy of Measurement	66

1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15 and IC RSS-247 Issue1

Responsible Party :	Anam Electronics Co., Ltd. 27, Digital-ro 27ga-gil, Guro-gu, Seoul, 08375, Republic of Korea
Contact Person :	Byeong Seob, Lee
Manufacturer :	Paradigm Electronics Inc 205 Annagem Blvd, Mississauga, ON, L7G 5J4, CANADA

- FCC ID : MBBVERSE
- IC : 11657A-VERSE
- Model: VERSE
- Brand Name: MARTIN LOGAN
- EUT Type: SOUNDBAR
- Classification: Part 15 Spread Spectrum Transmitter
- Applied Standard: FCC 47 CFR Part 15 subpart C and IC RSS-247 Issue 1
- Test Procedure(s): ANSI C63.10-2013
- Dates of Test: July 04, 2016 ~ August 11, 2016
- Place of Tests: Nemko Korea Co., Ltd.

2. INTRODUCTION

2.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in determining radiated and conducted emissions emanating from **Anam Electronics Co., Ltd. FCC ID : MBBVERSE and IC : 11657A-VERSE.**

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address 159, Osan-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 16885, Republic of Korea.

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014 according to §2.948.









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EMC Lab.
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Cheoin-gu, Yongin-si, Gyeonggi-do,
16885, Republic of Korea.
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Fig. 1. The map above shows the Seoul in Korea vicinity area.

The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type		Accreditation number
	CAB Accreditation for DOC	Designation No. KR0026
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
	Canada IC Registered site	Site No. 2040E
	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
	EMC CBTL	-
	KCC(RRL)Designated Lab.	Registration No. KR0026

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the transceiver which is the Bluetooth 4.1 module supporting BDR/EDR/LE mode. The Laptop was used to control the EUT to transmit the wanted TX channel by the testing program (Bluetest) which manufacturer supported. The Laptop was removed after controlling the EUT to transmit the wanted signal. The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

3.1.1 Table of test power setting

Mode	Frequency Band	Power Setting Level	
GFSK/ $\pi/4$ DQPSK/ 8DPSK	2402 MHz ~ 2480 MHz	Ext. Power	255
		Int. Power	50

3.1.2 Table of test channels

Frequency band	Mode	Test Channel (CH)	Frequency (MHz)
2.4 GHz	GFSK, $\pi/4$ DQPSK, 8DPSK	0	2402
		39	2441
		78	2480

3.1.3 Antenna TX mode information

Frequency band	Mode	Antenna TX mode	Support MIMO
2.4 GHz	GFSK, $\pi/4$ DQPSK, 8DPSK	<input checked="" type="checkbox"/> 1TX, <input type="checkbox"/> 2TX	<input type="checkbox"/> Yes, <input checked="" type="checkbox"/> No

3.1.4. Additional Information Related to Testing

The cable and attenuator loss from 30MHz to 25GHz was reflected in spectrum analyzer with correction factor for all conducted testing.

3.1.5 Other information

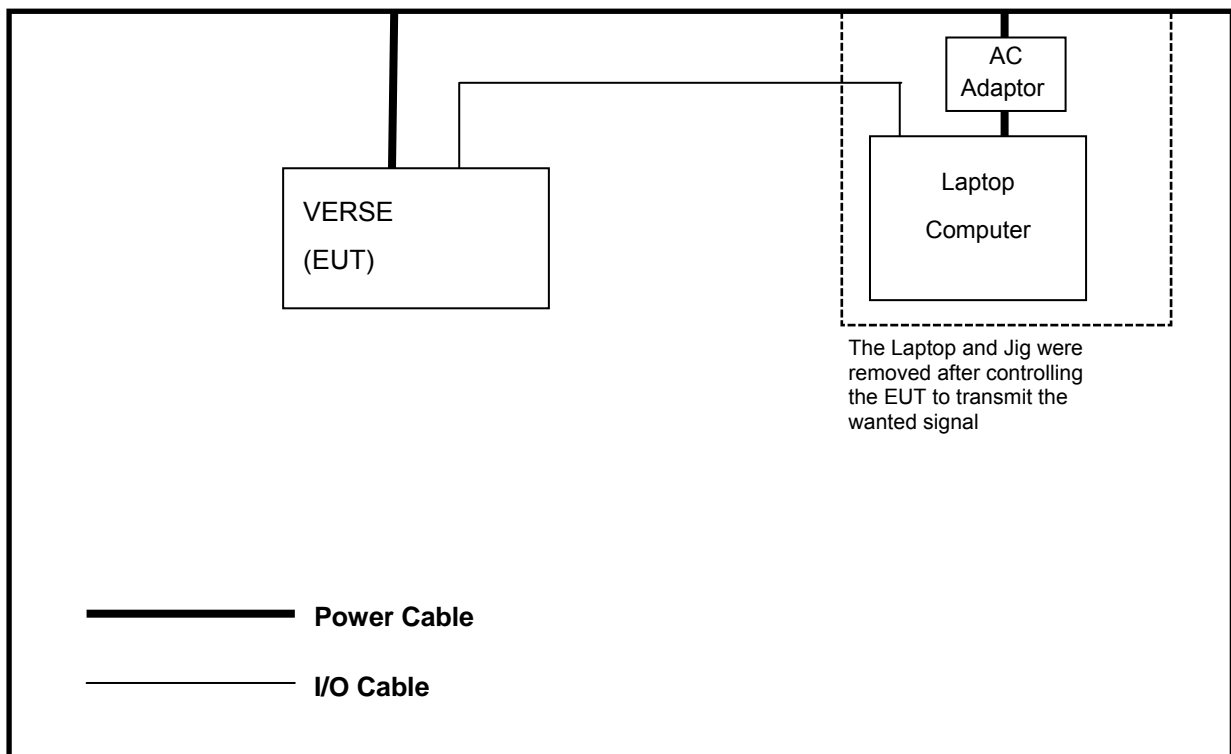
RF modules certified as below are installed in this device.

Product name	Module name	Remark
Wireless Adapter Card	RS4	Data transmission device operated in 2.4 GHz band

3.2 Support Equipment

EUT	Anam Electronics Co., Ltd. Model : VERSE	S/N: N/A
Laptop Computer	Samsung Electronics Co., Ltd. Model : NT-R580 1.5 m shielded pin connector cable	FCC DOC S/N : ZNU793BZ200566M
AC/DC Adapter	LI SHIN INTERNATIONAL ENTERPRISE CORP. Model : AD-9019S 1.5 m unshielded power cable	FCC DOC S/N : CNBA4400215AD2VH9BQ9 226

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Anam SOUNDBAR FCC ID: MBBVERSE, IC: 11657A-VERSE.**

This unit supports full qualified Bluetooth 4.1 with EDR/LE standard system.

Specifications:

EUT Type	SOUNDBAR
Model Name	VERSE
Brand Name	MARTIN LOGAN
RF Frequency	2402 MHz ~ 2480 MHz
Peak Power Output (Conducted)	8.61 dBm
FCC Classification	FCC Part 15 Spread Spectrum Transmitter (DSS)
Method/System	Frequency Hopping Spread Spectrum (FHSS)
Channel Number	79 ch
Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna Gain (Peak)	0 dBi
Antenna Setup	1TX / 1RX
Voltage	Operating Voltage : 100 Vac ~ 240 Vac Test Voltage : 120 Vac
Temperature Range	0 °C ~ +50 °C
Size (W x H x D)	Table Mount : About 8.9 cm x 117 cm x 12.7 cm Wall Mount : About 12.7 cm x 117 cm x 9.9 cm
Weight	About 5.4 kg
H/W Status	
S/W Status	
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
Conducted Emission	15.207	RSS-GEN Issue 4 8.8	Complies	
Radiated Emission	15.209	RSS-GEN Issue 4 8.9	Complies	
20dB Bandwidth	15.247(a)(1)	RSS-247 Issue 1 5.1	Complies	
Carrier Frequency Separation	15.247(a)(1)	RSS-247 Issue 1 5.1(2)	Complies	
Transmitter Average Time of Occupancy	15.247(a)(1)(iii)	RSS-247 Issue 1 5.1(4)	Complies	
Peak Output Power and E.I.R.P	15.247(b)(1)	RSS-247 Issue 1 5.4(2)	Complies	
Conducted Spurious Emission	15.247(d)	RSS-247 Issue 1 5.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-247 Issue 1 5.5	Complies	
Number of Hopping channels	15.247(a)(1)(iii)	RSS-247 Issue 1 5.1(4)	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Anam SOUNDBAR FCC ID: MBBVERSE, IC: 11657A-VERSE** is in compliance with Part 15.247 of the FCC Rule and RSS-247 Issue 1 of the IC specification.

6. ANTENNA REQUIREMENTS

§15.203 of the FCC Rules part 15 Subpart C

: 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 of the **Anam SOUNDBAR FCC ID: MBBVERSE, IC: 11657A-VERSE** is **permanently attached** and there are no provisions for connection to an external antenna. It complies with the requirement of §15.203.

7. DESCRIPTION OF TESTS

7.1 Conducted Emissions

The Line conducted emission test facility is located inside a 4 x 7 x 2.5 meter shielded enclosure. It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6. A 1 m x 1.5 m wooden table 0.8 m height is placed 0.4 m away from the vertical wall and 1.5 m away from the side of wall of the shielded room. Rohde & Schwarz (ESH3-Z5) and (ESH2-Z5) of the 50 ohm/50 μ H Line Impedance Stabilization Network (LISN) are bonded to the shielded room. The EUT is powered from the Rohde & Schwarz LISN (ESH3-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH2-Z5). Power to the LISNs are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1 / 2 ". If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs, All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentine fashion) to a 1 meter length. Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150 kHz to 30 MHz with 200 msec sweep time. The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30). The detector functions were set to CISPR quasi-peak mode & average mode. The bandwidth of receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; whichever determined the worst case emission.

Each EME reported was calibrated using the R&S signal generator.

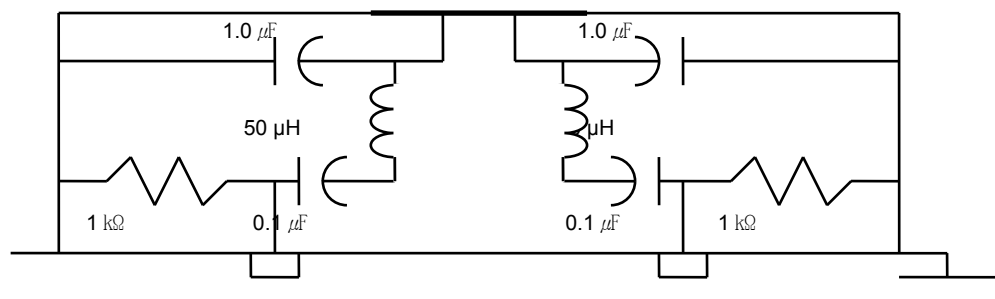


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.10-2013.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9163). Above 1 GHz, Horn antenna (Schwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz) was used.

For emissions testing at below 1GHz, The test equipment was placed on turntable with 0.8 m above ground. For emission measurements above 1 GHz, The test equipment was placed on turntable with 1.5 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0° to 360° and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

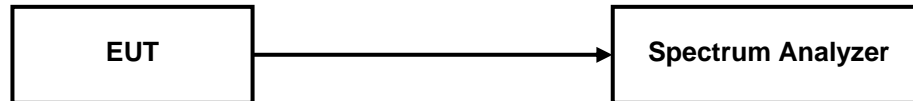
At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in ANSI C63.10-2013. Peak emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 1 kHz, Detector = Peak, Trace mode = max hold.

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

Radiated Emissions Limits per 47 CFR 15.209(a) and Radiated Emissions Limits per RSS-GEN Issue 4 8.9

7.3 20 dB Bandwidth

Test Setup



Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer.

Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 1% to 5% of the OBW

VBW = approximately 3 x RBW

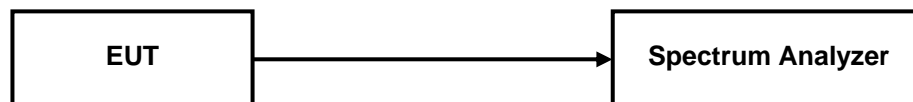
Sweep = auto

Detector function = peak

Trace = max hold

7.4 Carrier Frequency Separation

Test Setup



Test Procedure

The EUT must have its hopping function enabled. The following spectrum analyzer setting is used.

Span = wide enough to capture the peaks of two adjacent channels

RBW \geq approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel

VBW \geq RBW

Sweep = auto

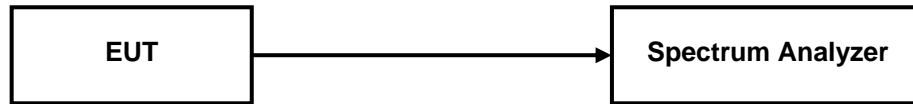
Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

7.5 Transmitter Average Time of Occupancy

Test Setup



Test Procedure

The transmitter output is connected to a spectrum analyzer. The following spectrum analyzer setting is used.

Span = Zero span, centered on a hopping channel

RBW $\gg 1 / T$, where T is the expected dwell time per channel.

VBW \geq RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

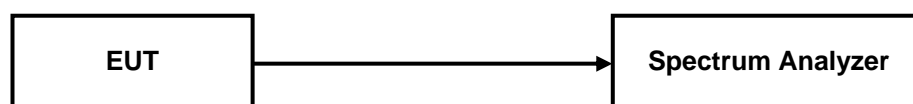
Detector function = Peak

Trace = Single sweep

Use the marker-delta function to determine the width of pulse

7.6 Number of Hopping Channels

Test Setup



Test Procedure

Span = The frequency band of operation.

RBW = less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

VBW \geq RBW

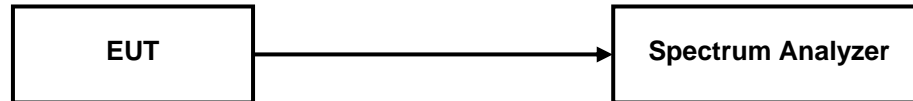
Sweep = Auto

Detector function = Peak

Trace = Max hold

7.7 Peak Output Power

Test Setup



Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer.

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 20 dB bandwidth of the emission being measured

VBW \geq RBW

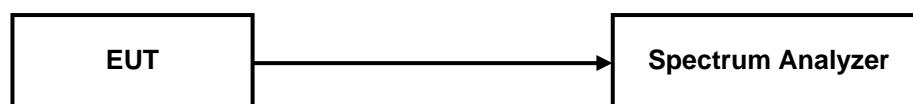
Sweep = auto

Detector function = peak

Trace = max hold

7.8 Conducted Spurious Emission

Test Setup



Test Procedure

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the Lowest, middle and highest channels.

RBW = 100kHz

VBW = 300kHz

Sweep = auto

Detector function = peak

Trace = max hold

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, IC RSS-GEN Issue 4 8.8

Frequency (MHz)	Level (dB μ V)		*) Factor (dB)	**) Line	Limit (dB μ V)		Margin (dB)	
	Q-Peak	CAverage			Q-Peak	Average	Q-Peak	Average
0.68	42.9	32.8	10.15	L	56.0	46.0	13.1	13.2
2.67	42.9	33.1	10.32	L	56.0	46.0	13.1	12.9
3.11	42.5	34.7	10.35	L	56.0	46.0	13.5	11.3
3.64	42.4	34.5	10.38	L	56.0	46.0	13.6	11.5
4.17	42.9	32.1	10.42	L	56.0	46.0	13.1	13.9
5.06	43.4	34.9	10.48	L	60.0	50.0	16.6	15.1

Line Conducted Emissions Tabulated Data

Notes:

- Measurements using CISPR quasi-peak mode & average mode.
- All modes of operation were investigated and the worst -case emission are reported. See attached Plots.
- *) Factor = LISN + Cable Loss
- **) LINE : L = Line , N = Neutral
- 2480MHz was the worst case channel.
- The limit is on the FCC §15.207 and IC RSS-GEN issue4 8.8.

PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Line)

Nemko Korea (NK-16-R-083)

29 Jul 2016 15:19

Conducted Emissions

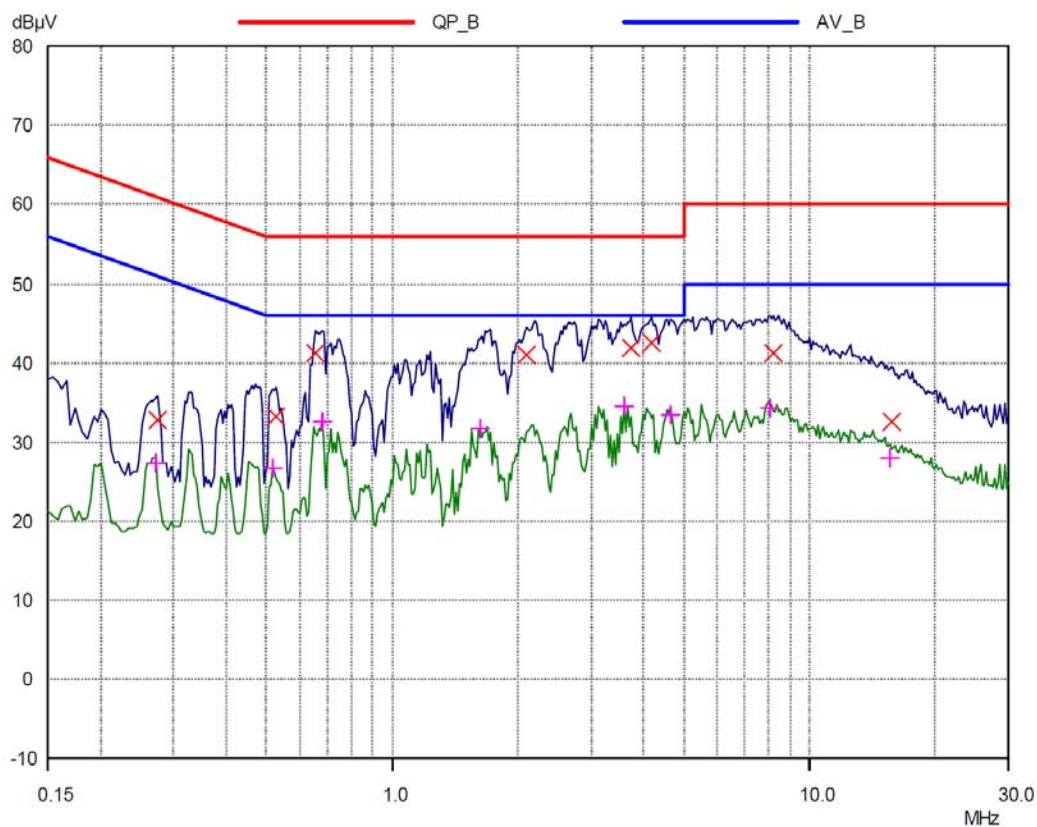
EUT: SOUNDBAR
Manuf: Anam Electronics Co., Ltd.
Op Cond: a.c. 120 V, 60 Hz (BT)
Operator: Wonho.Son
Test Spec: FCC Part 15
Comment: MODEL : VERSE
LINE : Line
Result File: r079_l.dat

Scan Settings (1 Range)

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Line

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 8
Acc Margin: 60 dB



PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Neutral)

Nemko Korea (NK-16-R-083)

29 Jul 2016 15:05

Conducted Emissions

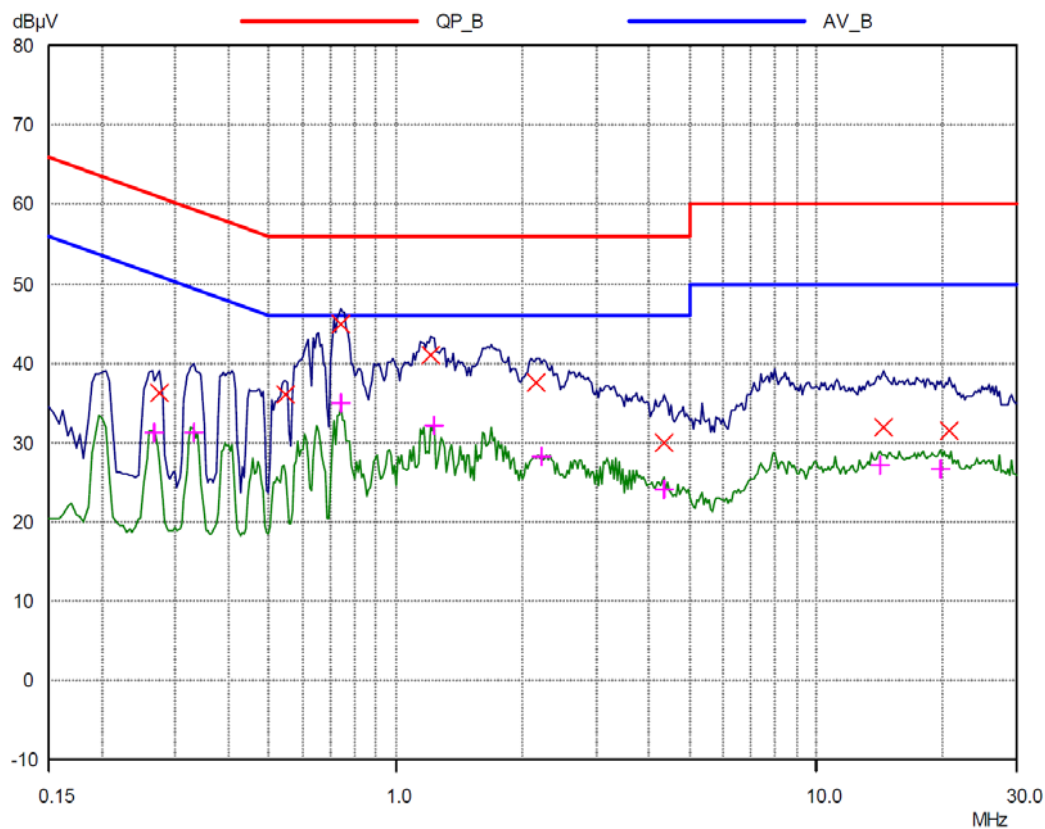
EUT: SOUNDBAR
Manuf: Anam Electronics Co., Ltd.
Op Cond: a.c. 120 V, 60 Hz (BT)
Operator: Wonho.Son
Test Spec: FCC Part 15
Comment: MODEL : VERSE
LINE : Neutral
Result File: r079_n.dat :

Scan Settings (1 Range)

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Neutral

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 8
Acc Margin: 60 dB



TEST DATA

8.2 Radiated Emissions

FCC §15.209, IC RSS-GEN Issue 4 8.9

Result

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
98.09	60.30	H	317	177	-23.5	36.8	43.5	6.7
270.32	58.40	V	100	168	-20.4	38.0	46.0	8.0
319.45	54.60	H	100	285	-19.0	35.6	46.0	10.4
368.63	56.70	H	100	135	-17.2	39.5	46.0	6.5
500.01	52.20	V	130	293	-13.5	38.7	46.0	7.3
909.35	44.10	V	100	327	-6.7	37.4	46.0	8.6

Radiated Measurements at 3 meters

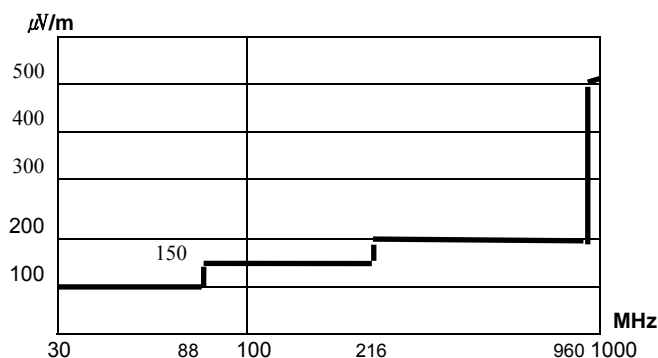


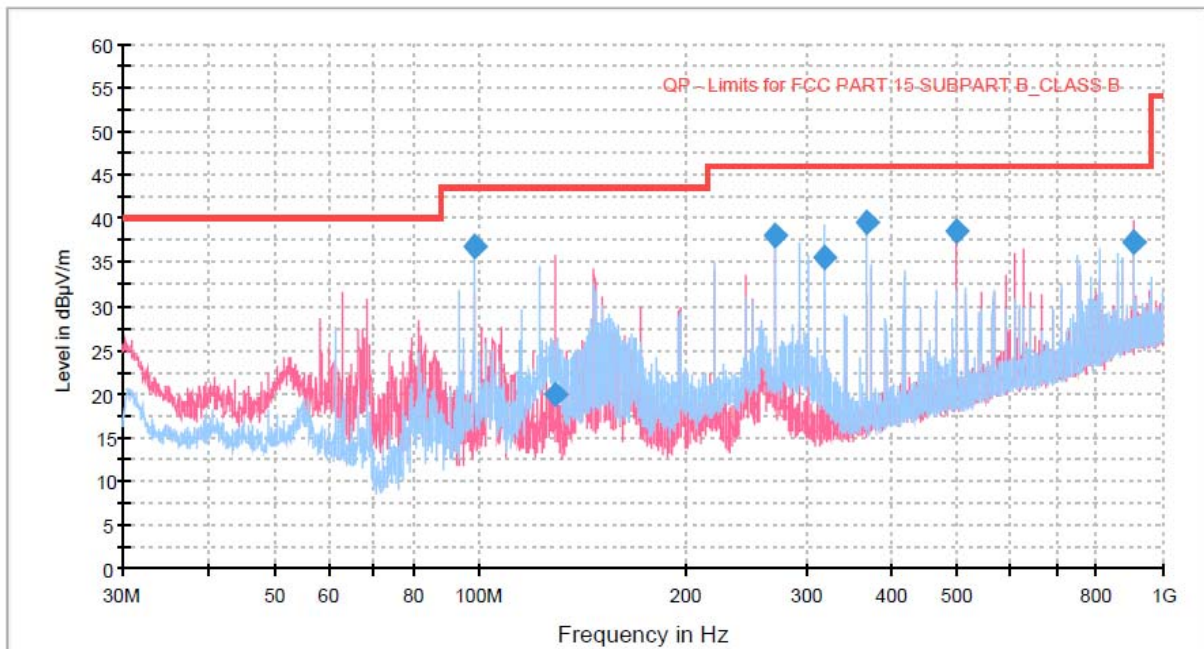
Fig. 3. Limits at 3 meters

Notes:

1. All modes were measured and the worst-case emission was reported.
2. The radiated limits are shown on Figure 3. Above 1GHz the limit is 500 μ V /m.
3. *Pol. H = Horizontal, V = Vertical
4. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
5. Measurements using CISPR quasi-peak mode below 1 GHz.
6. The radiated emissions testing were made by rotating the receive antenna with horizontal, Vertical polarization. The worst date was recorded.
7. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

PLOTS OF EMISSIONS

Worst Case : 2480 MHz (below 1GHz) GFSK modulation



TEST DATA

8.3 20 dB Modulated Bandwidth

FCC §15.247(a)(1)(iii), IC RSS-247 Issue 1, 5.1

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Modulation Mode	Frequency (MHz)	Result (kHz)	Limit (kHz)
GFSK	2402	841.8	Non specified
GFSK	2441	889.8	Non specified
GFSK	2480	889.4	Non specified
$\pi/4$ DQPSK	2402	1230.0	Non specified
$\pi/4$ DQPSK	2441	1220.0	Non specified
$\pi/4$ DQPSK	2480	1220.0	Non specified
8DPSK	2402	1260.0	Non specified
8DPSK	2441	1250.0	Non specified
8DPSK	2480	1260.0	Non specified

PLOTS OF EMISSIONS

20 dB Bandwidth, Lowest Channel (2402 MHz, GFSK Mode)



20 dB Bandwidth, Middle Channel (2441 MHz, GFSK Mode)



PLOTS OF EMISSIONS

20 dB Bandwidth, Highest Channel (2480 MHz, GFSK Mode)



20 dB Bandwidth, Lowest Channel (2402 MHz, $\pi/4$ DQPSK Mode)



PLOTS OF EMISSIONS

20 dB Bandwidth, Middle Channel (2441 MHz, $\pi/4$ DQPSK Mode)



20 dB Bandwidth, Highest Channel (2480 MHz, $\pi/4$ DQPSK Mode)



PLOTS OF EMISSIONS

20 dB Bandwidth, Lowest Channel (2402 MHz, 8DPSK Mode)



20 dB Bandwidth, Middle Channel (2441 MHz, 8DPSK Mode)



PLOTS OF EMISSIONS

20 dB Bandwidth, Highest Channel (2480 MHz, 8DPSK Mode)



TEST DATA

8.4 Carrier Frequency Separation

FCC §15.247(a)(1), IC RSS-247 Issue 1, 5.1(2)

Test Mode : Set to Hopping mode

Result

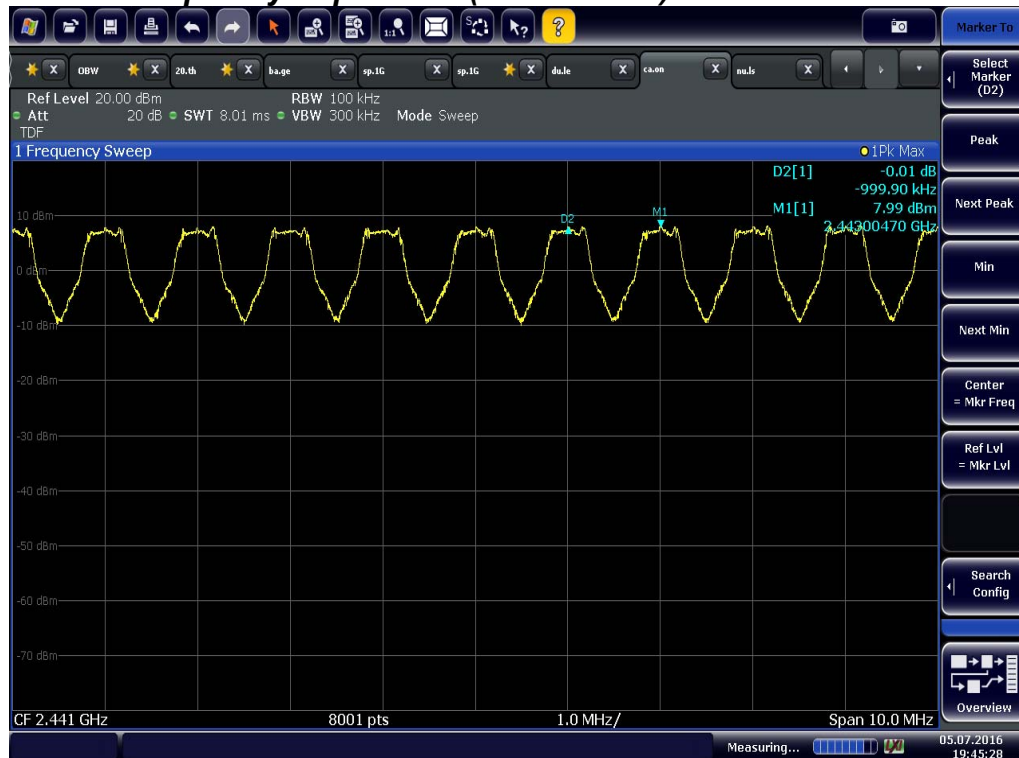
Modulation Mode	Carrier Frequency Separation (kHz)	Limit (2 / 3 of 20dB Bandwidth) (kHz)	Margin (kHz)
GFSK	999.9	593.2	406.7
$\pi/4$ DQPSK	1004.9	820.0	184.9
8DPSK	1001.1	840.0	161.1

Note:

The EUT complies with the minimum channel separation requirement when it is operating **1x/EDR mode using 79 channels** and when operating in **AFH mode using 20 channels**.

PLOTS OF EMISSIONS

Carrier Frequency Separation (GFSK Mode)



Carrier Frequency Separation ($\pi/4$ DQPSK Mode)



PLOTS OF EMISSIONS

Carrier Frequency Separation (8DPSK Mode)

