

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 : March 14, 2019
Test Report No. : NK-19-R-008
Test Site : Nemko Korea Co., Ltd.

FCC ID
IC

**MBBA118
11657A-A118**

Brand Name

Linkplay

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 2
Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)
EUT Type: Linkplay Wireless Smart Audio Module

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.

 Mar 14, 2019

Tested By : Yonghwan Kim
Engineer

 Mar. 14. 2019

Reviewed By : Seungyong Shin
Technical Manager

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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 Issue2.

Responsible Party :	Anam Electronics Co., Ltd. 27, Digital-ro 27ga-gil, Guro-gu, Seoul, 08375, Republic of Korea
Contact Person :	Byeong Seob, Lee
Manufacturer :	Linkplay Technology, Inc. 5225 Canyon Crest Dr. Riverside, CA 92507, USA

- FCC ID: MBBA118
- IC: 11657A-A118
- Model: A118
- HVIN: A118
- Brand Name: Linkplay
- EUT Type: Linkplay Wireless Smart Audio Module
- Classification: Part 15 Spread Spectrum Transmitter (DSS)
- Applied Standard: FCC 47 CFR Part 15.247 and IC RSS-247 Issue 2
- Test Procedure(s): ANSI C63.10-2013
- Dates of Test: January 28, 2019 ~ February 19, 2019
- Place of Test: 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 : MBBA118 and IC : 11657A-A118.**

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

The site address 155 & 159, Osan-Ro, Mohyeon-Eup, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 16885 KOREA, REPUBLIC OF.

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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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 Bluetooth 4.2 module supporting BDR/EDR/LE mode.

The Laptop was used to control the EUT to transmit the wanted TX channel continuously (duty cycle< 98%) by the testing program (ADB) supported by manufacturer.

The operating voltage of EUT was 3.4 Vdc supplied from jig board connected to USB port on Laptop PC.

The EUT was tested at the lowest, middle and the highest channels 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

Frequency	Mode	Modulation	Power setting Level
2402 MHz ~ 2480 MHz	BDR	GFSK	7
2402 MHz ~ 2480 MHz	EDR	$\pi/4$ DQPSK	7
2402 MHz ~ 2480 MHz	EDR	8DPSK	7

3.1.2 Table of Test channels

Frequency band	Modulation	Test Channel (CH)	Frequency (MHz)
2.4 GHz	GFSK, $\pi/4$ DQPSK, 8DPSK	0	2402
		39	2442
		78	2480

3.1.3 Antenna Information

Frequency band	Modulation	Antenna TX mode	Support CDD	Support MIMO
2.4 GHz	GFSK, $\pi/4$ DQPSK, 8DPSK	☒ 1TX, ☐ 2TX	☐ Yes, ☒ No	☐ Yes, ☒ No

3.1.4 Additional Information Related to Testing

The cable and attenuator loss from 30MHz to 26.5GHz was reflected in spectrum analyzer with correction factor for all conducted testing.

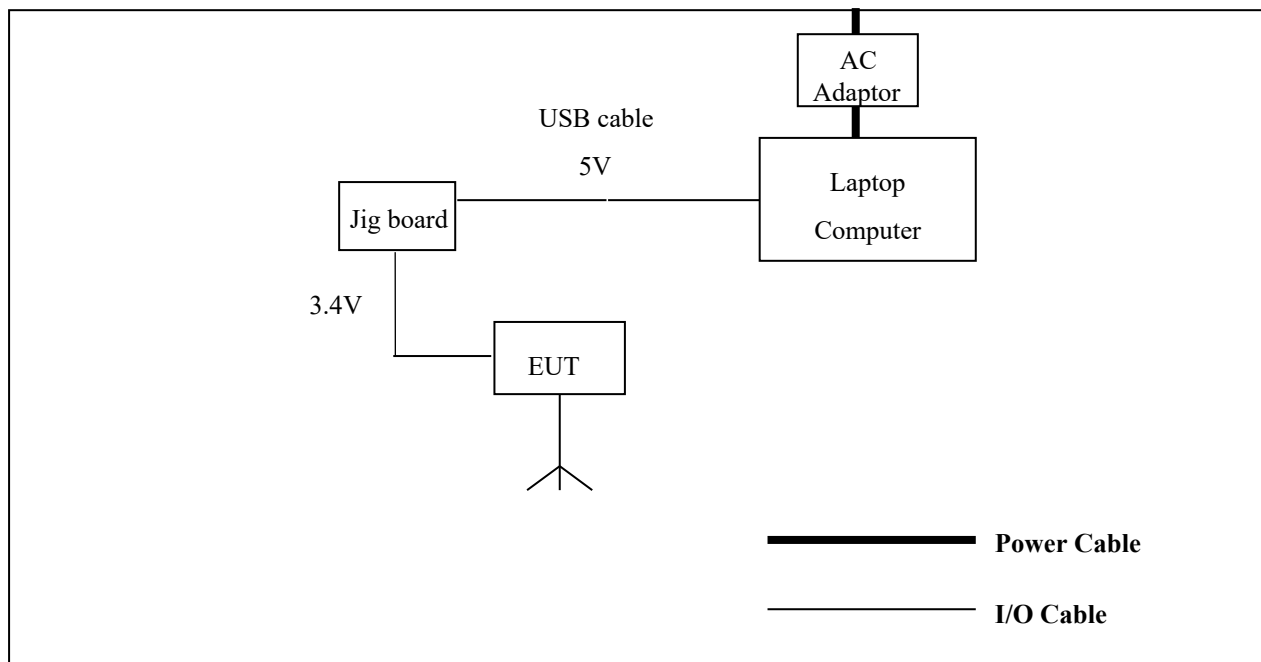
3.1.5 Table of Test modes

Test Items	Modulation	Test Channel (CH)
Conducted Emissions	GFSK	39
Radiated Emissions	GFSK	39
20 dB Bandwidth	GFSK, $\pi/4$ DQPSK, 8DPSK	0/39/78
Carrier Frequency Separation	GFSK, $\pi/4$ DQPSK, 8DPSK	0/39/78
Transmitter Average Time of Occupancy	GFSK, $\pi/4$ DQPSK, 8DPSK	0/39/78
Number of Hopping Channels	GFSK, $\pi/4$ DQPSK, 8DPSK	0/39/78
Peak Output Power and E.I.R.P	GFSK, $\pi/4$ DQPSK, 8DPSK	0/39/78
Conducted Spurious Emission, Radiated Spurious Emission, Band edge Emission	GFSK, $\pi/4$ DQPSK, 8DPSK	0/39/78

3.2 Support Equipment

EUT	Anam Electronics Co., Ltd. Model : A118	S/N: N/A
Laptop Computer	HP Model : G62-355TU	FCC DOC S/N : CNF0489WDT
AC/DC Adapter	HP Model : PPP009D 1.5 m unshielded power cable	FCC DOC S/N : WBGSV0ACXZH162

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Anam Electronics Co., Ltd. Linkplay Wireless Smart Audio Module** FCC ID: **MBBA118**, IC: **11657A-A118**.

Specifications:

EUT Type	Linkplay Wireless Smart Audio Module
Model Name	A118
Brand Name	Linkplay
Frequency of Operation	2402 MHz ~ 2480 MHz
Peak Output Power (Conducted)	7.37 dBm
FCC Classification	FCC Part 15 Spread Spectrum Transmitter (DSS)
Spreading Method	Frequency Hopping Spread Spectrum (FHSS)
Number of Channels	79 CH
Modulations	GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna Gain (peak)	5.6 dBi
Antenna Setup	1TX / 1RX
Voltage	3.4 Vdc
Temperature Range	-20 °C ~ +55 °C
Size (W x H x D)	About 42 mm x 10 mm x 54 mm
Weight	About 18 g
HVIN (Hardware Version Number)	A118
FVIN (Firmware Version Identification Number)	V3.6.6720
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
Radiated Emission	15.209	RSS-GEN Issue 4 8.9	Complies	
20dB Bandwidth	15.247(a)(1)	RSS-247 Issue 2 5.1	Complies	
Carrier Frequency Separation	15.247(a)(1)	RSS-247 Issue 2 5.1	Complies	
Transmitter Average Time of Occupancy	15.247(a)(1)(iii)	RSS-247 Issue 2 5.1	Complies	
Peak Output Power and E.I.R.P	15.247(b)(1)	RSS-247 Issue 2 5.4	Complies	
Conducted Spurious Emission	15.247(d)	RSS-247 Issue 2 5.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-247 Issue 2 5.5	Complies	
Number of Hopping channels	15.247(a)(1)(iii)	RSS-247 Issue 2 5.1	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Anam Electronics Co., Ltd. Linkplay Wireless Smart Audio Module FCC ID: MBBA118, IC: 11657A-A118** is in compliance with Part 15.247 of the FCC Rule and RSS-247 Issue 2 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 Electronics Co., Ltd. Linkplay Wireless Smart Audio Module FCC ID: MBBA118, IC: 11657A-A118** is **permanently attached** and there are no provisions for connection to an external antenna. It complies with the requirement of §15.203.

Used Antenna	
Model name	Max. gain (dBi)
W619-1B235B-A	5.60
W619-1B110B-A2	4.87
W619-1B170B-A	5.60
W548-1G240B-A	5.42

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.

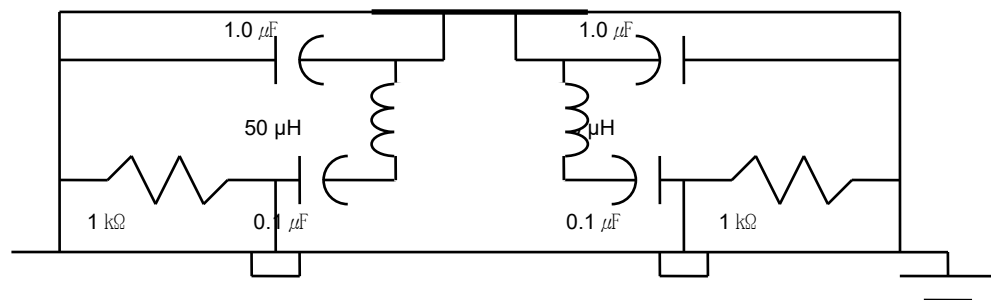


Fig. 2. LISN Schematic Diagram

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) 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.

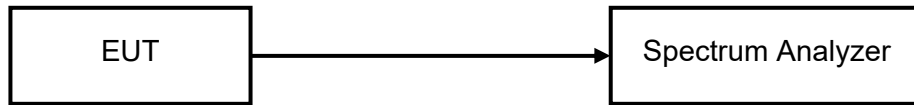
At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in ANSI 63.10-2013 section 11.12. Peak emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3kHz, Detector = Peak, Trace mode = max hold. Allow max hold to run for at least 50 times (1/duty cycle) traces.

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 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

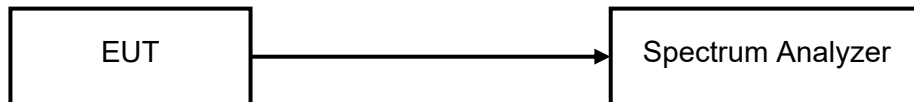
Sweep = auto

Detector function = peak

Trace = max hold

7.3 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

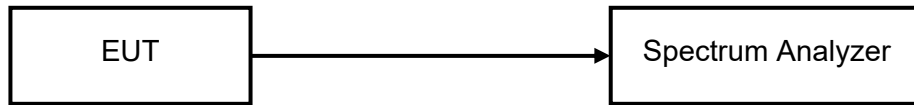
Detector function = peak

Trace = max hold

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

7.4 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 shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.

VBW $\geq$ RBW

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

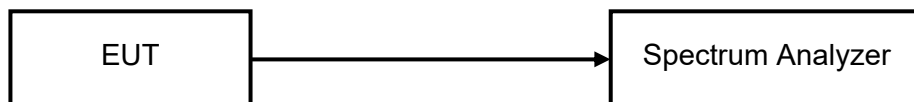
Detector function = Peak

Trace = Single sweep

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

7.5 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

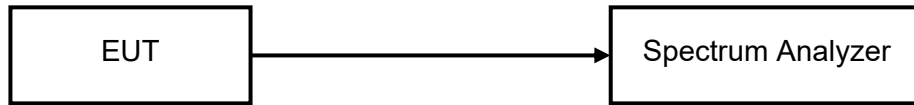
Sweep = Auto

Detector function = Peak

Trace = Max hold

7.6 Peak Output Power and E.I.R.P

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

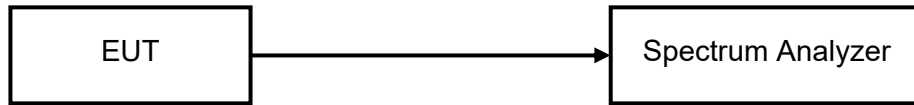
Detector function = peak

Trace = max hold

E.I.R.P is calculated according to KDB412172 D01 Determining ERP and EIRP v01r01

7.7 Conducted Spurious Emission

Test Setup



Test Procedure

Measurements are made over the 30 MHz to 26.5 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, RSS-GEN Issue 4 8.8

Result

Frequency (MHz)	Level (dB μ V)		*) Factor (dB)	**) Line	Limit (dB μ V)		Margin (dB)	
	Q-Peak	Average			Q-Peak	Average	Q-Peak	Average
0.15	55.0	44.4	10.50	N	65.8	55.8	10.8	11.4
0.16	55.9	45.2	10.50	N	65.4	55.4	9.5	10.2
0.23	46.6	38.5	10.50	L	62.3	52.3	15.7	13.8
0.31	37.0	30.4	10.50	L	60.0	50.0	23.0	19.6
0.39	29.9	17.9	10.50	N	58.1	48.1	28.2	30.2
11.39	36.2	29.0	11.00	L	60.0	50.0	23.8	21.0

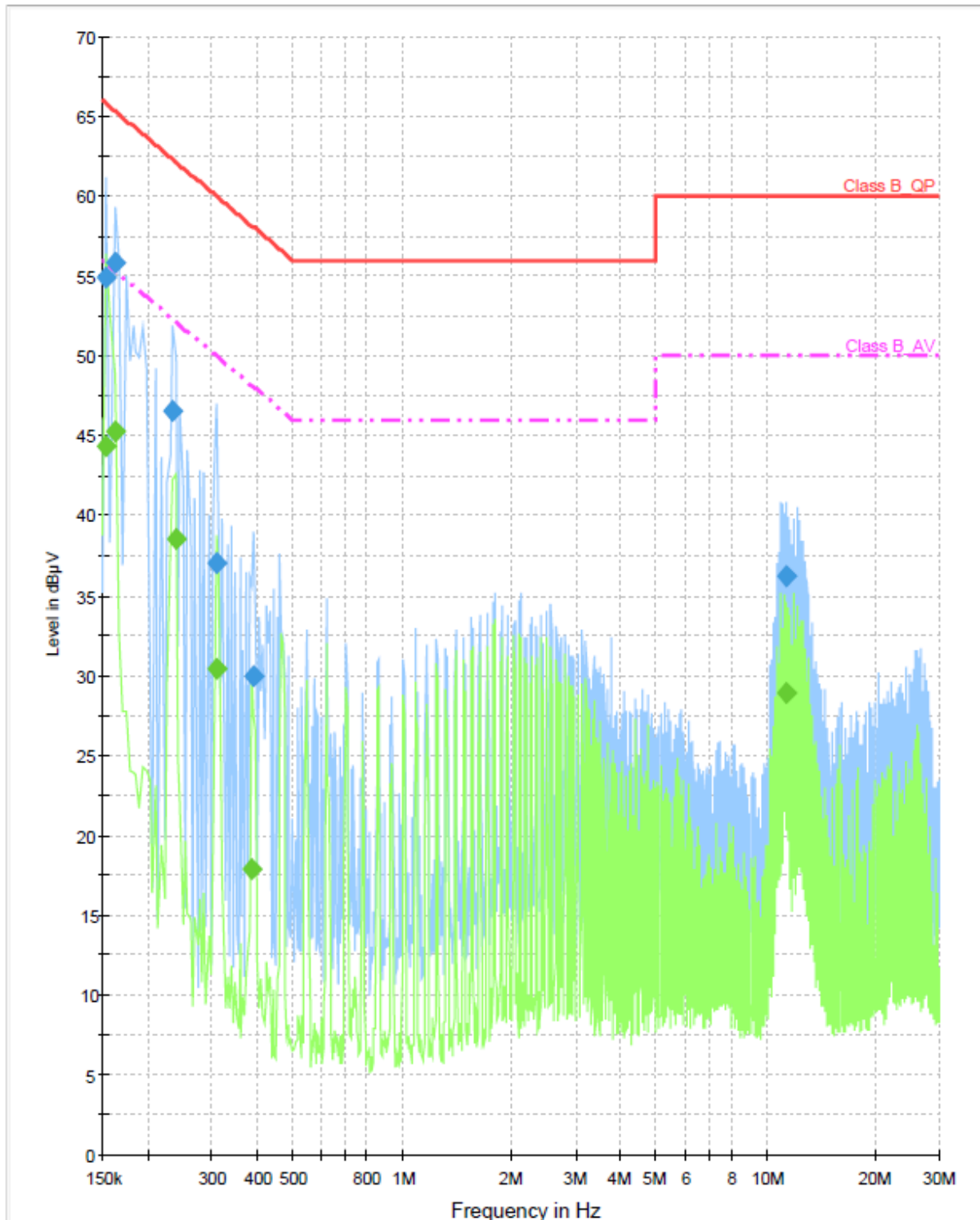
Line Conducted Emissions Tabulated Data

Notes:

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

PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Line + Neutral)



TEST DATA

8.2 Radiated Emissions

FCC §15.209, IC RSS-Gen Issue 4 8.9

Result

Frequency	Reading	Pol*	Antenna Heights	Turntable	AF+CL+Amp	Result	Limit	Margin
(MHz)	(dB μ V/m)	(H/V)	(cm)	Angles (°)	(dB)**	(dB μ V/m)	(dB μ V/m)	(dB)
36.14	38.26	V	100	210	-23.7	14.6	40.0	25.4
53.55	33.04	V	170	108	-21.8	11.2	40.0	28.8
119.56	63.96	H	295	252	-25.5	38.5	43.5	5.0
119.99	63.87	H	312	279	-25.5	38.4	43.5	5.1
122.10	67.09	H	270	262	-25.9	41.2	43.5	2.3
135.08	55.95	H	170	62	-27.2	28.8	43.5	14.8

Radiated Measurements at 3meters

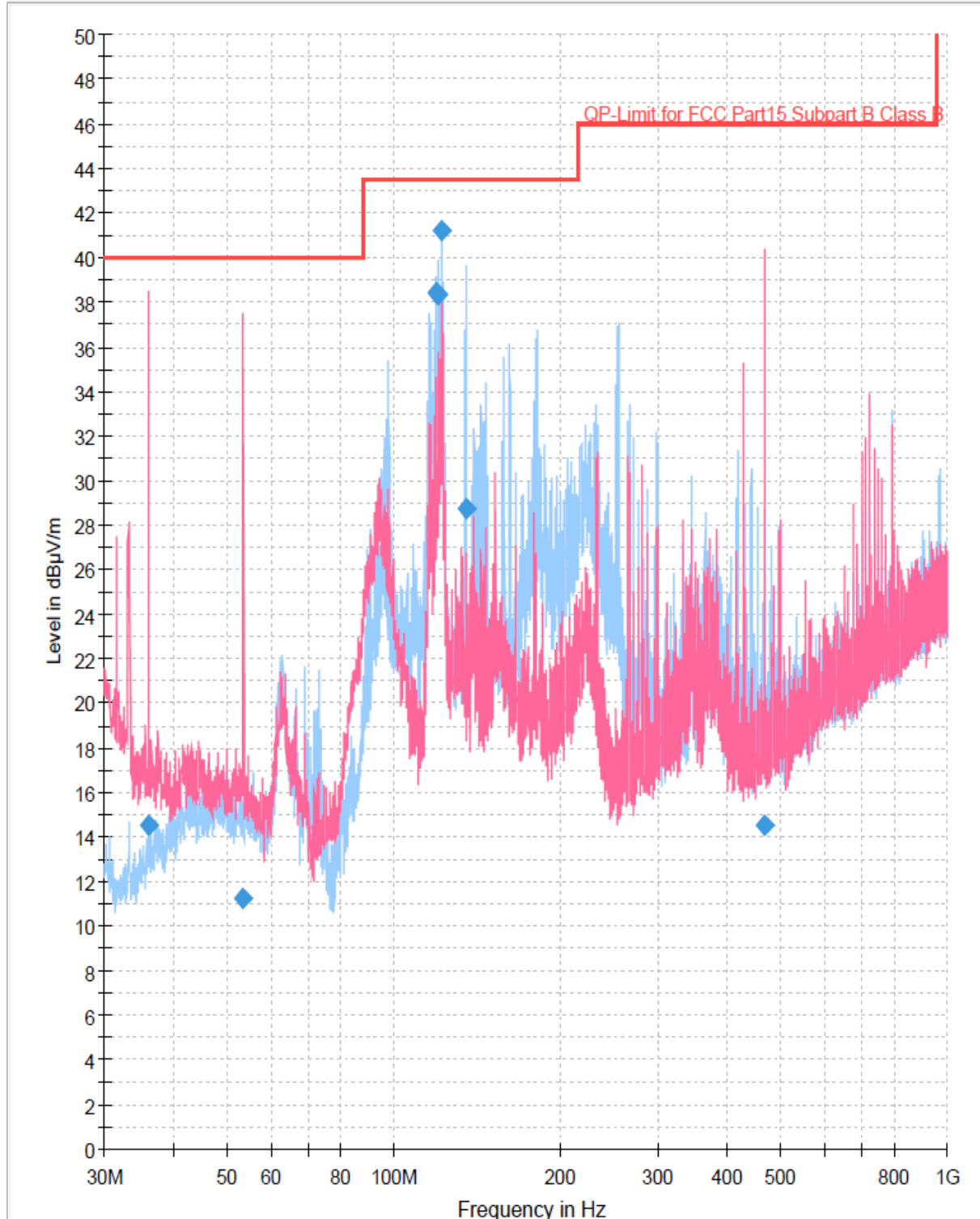
Notes:

1. All modes were measured and the worst-case emission was reported.
2. *Pol. H = Horizontal, V = Vertical
3. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
4. Measurements using CISPR quasi-peak mode below 1 GHz.
5. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.
6. Highest channel (2480MHz) in GFSK modulation is the worst case.
7. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
8. The limit is on the FCC §15.209 and RSS-Gen Issue4 8.9.

PLOTS OF EMISSIONS

Worst Case

Radiated emission below 1GHz_2480 MHz_GFSK modulation



TEST DATA

8.3 20 dB Bandwidth

FCC §15.247(a)(2), IC RSS-247 Issue 2 5.2

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

Result

Modulation	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	Limit (MHz)	99% emission bandwidth (MHz)
GFSK	Lowest	2402	1.00	Non Specified	0.86
GFSK	Middle	2441	1.00	Non Specified	0.86
GFSK	Highest	2480	0.97	Non Specified	0.86
$\pi/4$ DQPSK	Lowest	2402	1.28	Non Specified	1.17
$\pi/4$ DQPSK	Middle	2441	1.28	Non Specified	1.16
$\pi/4$ DQPSK	Highest	2480	1.28	Non Specified	1.17
8DPSK	Lowest	2402	1.28	Non Specified	1.16
8DPSK	Middle	2441	1.27	Non Specified	1.16
8DPSK	Highest	2480	1.27	Non Specified	1.16

PLOTS OF EMISSIONS

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



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



PLOTS OF EMISSIONS

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



20 dB Bandwidth, π /4DQPSK modulation, Lowest Channel (2402 MHz)



PLOTS OF EMISSIONS

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



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

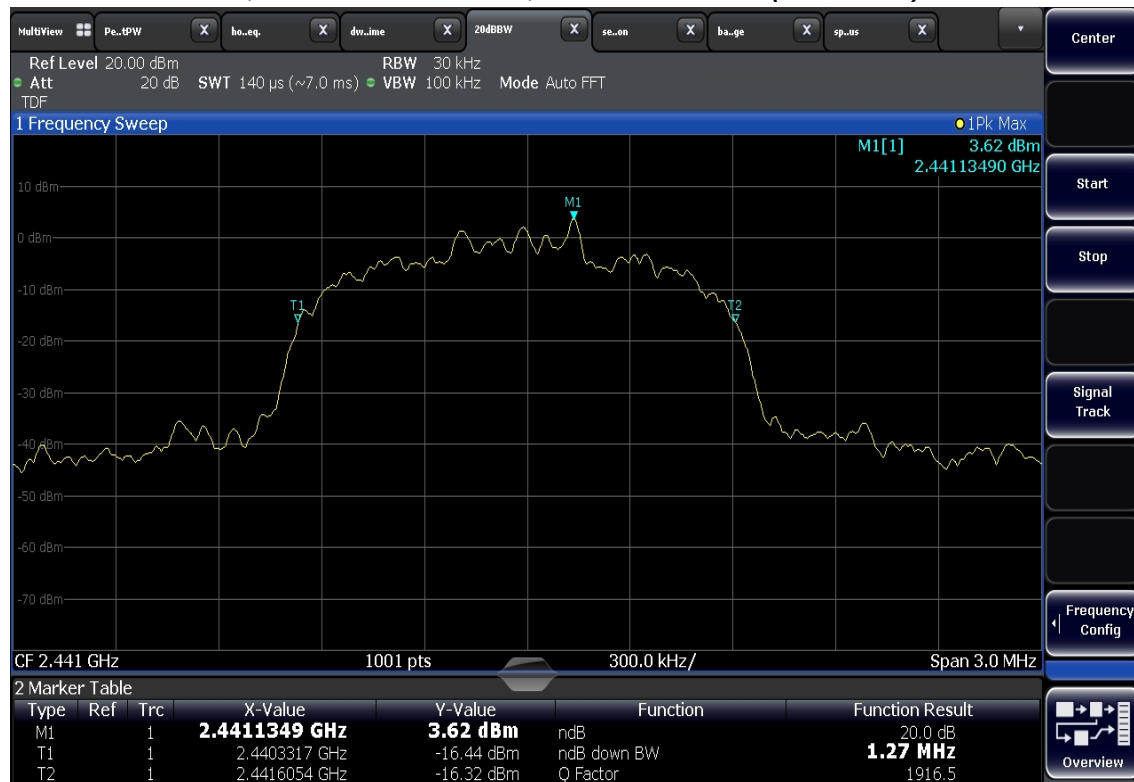


PLOTS OF EMISSIONS

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



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



PLOTS OF EMISSIONS

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



TEST DATA

8.4 Carrier Frequency Separation

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

Test Mode : Set to Hopping mode

Result

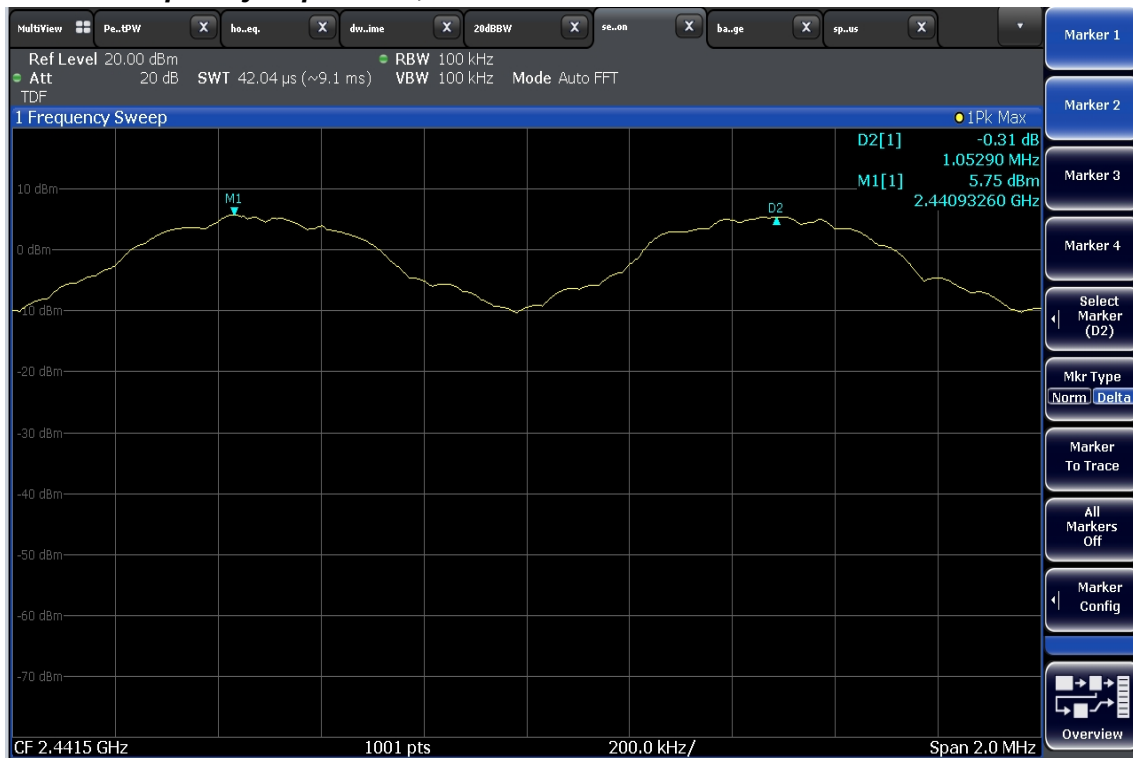
Modulation	Carrier Frequency Separation (kHz)	Limit (2/3 of 20dB Bandwidth) (kHz)
GFSK	1.05	0.67
$\pi/4$ DQPSK	1.01	0.85
8DPSK	1.03	0.85

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 modulation



Carrier Frequency Separation, $\pi/4$ DQPSK modulation

