LTA
Laboratory for Test & Approval Co.,Ltd.

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Dates of Tests: Nov 14 ~ Dec 20, 2019
Test Report S/N: LR500111912F
Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID. **2ADIYWP-100**

APPLICANT **SMARTSOUND CORPORATION**

Equipment Class	**:**	**Digital Transmission System (DTS)**
Manufacturing Description	**:**	**Smart Pet Healthcare Device**
Manufacturer	**:**	**SMARTSOUND CORPORATION**
Model name	**:**	**WP-100**
Test Device Serial No.:	**:**	**Identical prototype**
Rule Part(s)	**:**	**FCC Part 15.247 Subpart C ; ANSI C-63.10-2013**
Frequency Range	**:**	**2402 MHz ~ 2480 MHz**
Max. Output Power	**:**	**Max -0.25 dBm**
Data of issue	**:**	**Dec 20, 2019**

This test report is issued under the authority of:

JaBeom.Koo

Ja-Beom Koo, Manager

The test was supervised by:

고경훈

Gyeong Hun Ko, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

NVLAP®

NVLAP LAB Code.: 200723-0

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1. General information

1-1 Test Performed

Company name : LTA Co., Ltd.

Address : 243, Jubug-ri,Yangji-Myeon,Youngin-Si, Kyunggi-Do, Korea. 449-822

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E-mail : chahn@ltalab.com

Telephone : +82-31-323-6008

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Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2020-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	649054	2021-04-11	FCC CAB
VCCI	JAPAN	C-4948,	2020-09-10	VCCI registration
VCCI	JAPAN	T-2416,	2020-09-10	VCCI registration
VCCI	JAPAN	R-4483(10 m),	2020-10-15	VCCI registration
VCCI	JAPAN	G-847	2022-06-13	VCCI registration
IC	CANADA	5799A-1	2021-06-16	IC filing
KOLAS	KOREA	NO.551	2021-08-20	KOLAS accredited Lab.

2. Information about test item

2-1 Client & Manufacturer

Company name	:	SMARTSOUND CORPORATION
Address	:	4F, 171, Yangjeacheon-ro, Gangnam-gu, Seoul, South Korea
Tel / Fax	:	TEL No : +82-10-9270-2720 / FAX No : +82-2-575-2201
Model name	:	WP-100

2-2 Equipment Under Test (EUT)

Date of receipt	:	Dec 20. 2019
EUT condition	:	Pre-production, not damaged
Antenna type	:	Chip Antenna
Frequency Range	:	2402 MHz ~ 2480 MHz
RF output power	:	Max -0.25 dBm
Number of channels	:	40
Type of Modulation	:	GFSK
Power Source	:	DC 3.7 V
Firmware Version	:	V1.0.0

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz)	2402	2440	2480

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
Notebook	CR720	MS-1736	MSI

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	N/A
15.247(b)	Transmitter Peak Output Power	< 1 Watt		N/A
15.247(d)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz		N/A
15.247(d)	Band Edge	> 20 dBc		N/A
15.209	Radiated Spurious Emissions	Emission	Radiated	C
15.207	AC Conducted Emissions	Emissions	Conducted	NA
15.203	Antenna requirement	-	-	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

N/A : The product replaces this test with a certificate using an authenticated module.

→ Antenna Requirement
SMARTSOUND CORPORATION FCC ID : 2ADIYWP-100 unit complies with the requirement of §15.203.
The antenna type is Chip Antenna

The sample was tested according to the following specification:
*FCC Parts 15.247; ANSI C-63.4-2014
*FCC KDB Publication No. 558074 D01 v05r02
*FCC TCB Workshop 2012, April

3.2 Technical Characteristics Test

3.2.1 6 dB Bandwidth

Procedure:

The bandwidth at 6 dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 5 MHz, 30 MHz

VBW = 100 kHz (VBW ≥ RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data : N/A

Minimum Standard:

6 dB Bandwidth < 500 kHz

Measurement Setup

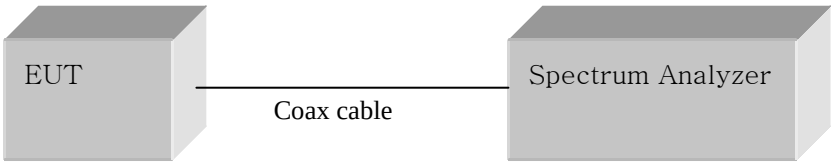


Figure 1: Measurement setup for the carrier frequency separation

3.2.2 Peak Output Power Measurement

Procedure:

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1MHz Span = auto

VBW = 3MHz (VBW ≥ 3 * RBW) Sweep = auto

Detector function = peak

Measurement Data :N/A

Minimum Standard:

Peak output power	< 1 W

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

3.2.3 Power Spectral Density

Procedure:

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The spectrum analyzer is set to:

RBW = 3 kHz (3kHz≤RBW≤100kHz)	Span = 1.5 times the DTS bandwidth
VBW = 10 kHz (3 * RBW)	Sweep = auto
Detector function = peak	Trace = max hold

Measurement Data : N/A

Minimum Standard:

Power Spectral Density	< 8 dBm @ 3 kHz BW

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

3.2.4 Band - edge

Procedure:

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz	VBW = 100 kHz
Span = 40 MHz, 80 MHz	Detector function = peak
Trace = max hold	Sweep = auto

Radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

The spectrum analyzer is set to:

Center frequency = the highest, the lowest channels

PEAK:	RBW = VBW = 1 MHz, Sweep=Auto
Average:	RBW = 1 MHz, VBW=10 Hz, Sweep=Auto
Measurement Distance:	3 m
Polarization:	Horizontal / Vertical

Measurement Data: N/A

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the require ment.
- See next pages for actual measured spectrum plots.

Minimum Standard:	> 20 dBc

3.2.5 Conducted Spurious Emissions

Procedure:

The test follows KDB558074. The conducted spurious emissions were measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, set the marker on the peak of any spurious emission recorded.

The spectrum analyzer is set to:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions

RBW = 100 kHz Sweep = auto

VBW = 100 kHz Detector function = peak

Trace = max hold

Measurement Data: N/A

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the require ment.
- See next pages for actual measured spectrum plots.

Minimum Standard:	> 20 dBc

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

3.2.6 Radiated Spurious Emissions

Procedure:

The EUT was placed on a 0.8 m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10^{th} harmonic.

RBW = 100 kHz (30 MHz ~ 1 GHz) VBW ≥ RBW

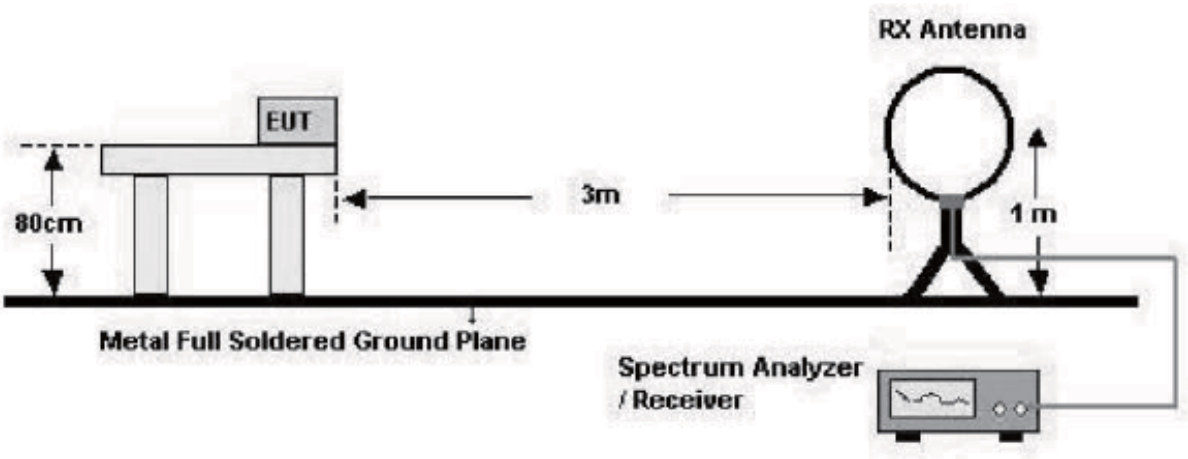
= 1 MHz (1 GHz ~ 10^{th} harmonic)

Span = 100 MHz Detector function = peak

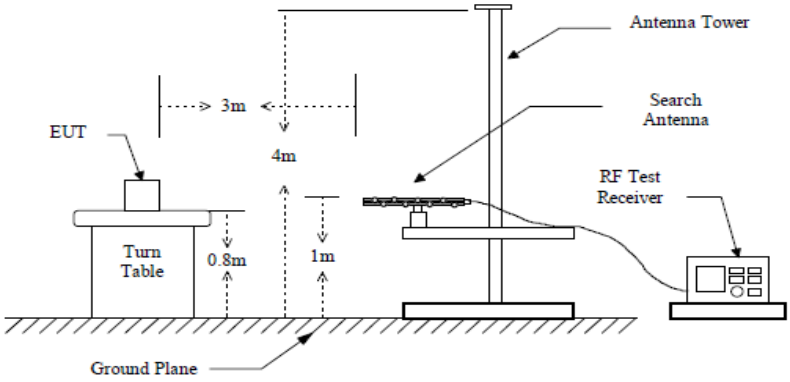
Trace = max hold Sweep = auto

Note : Attach worst-case data in accordance with ANSI C63.10-2013 6.3.4.

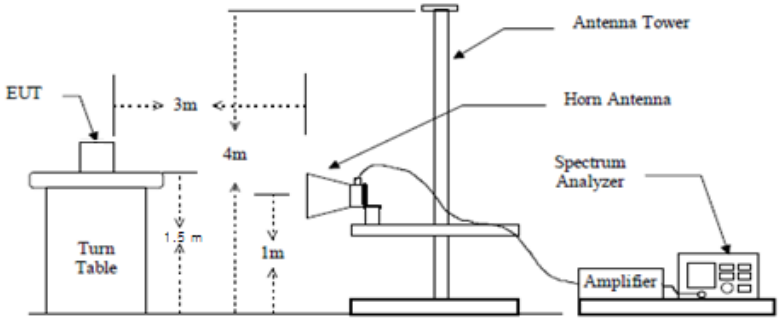
below 30 MHz



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



Measurement Data: Complies

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30 MHz.

Minimum Standard: FCC Part 15.209(a)

Frequency (MHz)	Limit (uV/m) @ 3 m
0.009 ~ 0.490	2400/F(kHz) **(@ 300 m)**
0.490 ~ 1.705	24000/F(kHz) **(@ 30 m)**
1.705 ~ 30	30**(@ 30 m)**
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-80 6 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

Measurement Data: (9 kHz – 30 MHz)

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Correction Factor Antenna	Correction Factor Amp.Gain+Cable	Limits [dBuV/m] AV	Limits [dBuV/m] Peak	Result [dBuV/m] AV	Result [dBuV/m] Peak	Margin [dB] AV	Margin [dB] Peak
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
*No emissions were detected at a level greater than 20 dB below limit.											
-	-	-	-	-	-	-	-	-	-	-	-

*No emissions were detected at a level greater than 20 dB below limit.

Measurement Data : Low (Above 1 GHz)

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Correction Factor Antenna-Amp.Gain+Cable	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV	Margin [dB] Peak
15823	24.20	47.80	H	23.92	54	74	48.12	71.72	5.88	2.88
16462	23.88	47.16	H	24.45	54	74	48.33	71.61	5.67	2.39
-	-	-	-	-	-	-	-	-	-	-

- No other emissions were detected at a level greater than 20 dB below limit.

Measurement Data : Mid (Above 1 GHz)

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Correction Factor Antenna-Amp.Gain+Cable	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV	Margin [dB] Peak
11640	23.11	46.86	H	20.16	54	74	43.27	67.02	10.73	6.98
15872	24.16	47.87	H	23.92	54	74	48.08	71.79	5.92	2.21
-	-	-	-	-	-	-	-	-	-	-

- No other emissions were detected at a level greater than 20 dB below limit.

Measurement Data : High (Above 1 GHz)

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Correction Factor Antenna-Amp.Gain+Cable	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV	Margin [dB] Peak
16241	24.12	48.06	H	24.25	54	74	48.37	72.31	5.63	1.69
16954	23.33	46.77	H	24.25	54	74	47.58	71.02	6.42	2.98
-	-	-	-	-	-	-	-	-	-	-

- No other emissions were detected at a level greater than 20 dB below limit.

Measurement Data : Low(Below 1 GHz)

Frequency [MHz]	Reading [dBuV/m]	Pol.	Correction Factor Antenna-Amp.Gain+Cable	Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
254.68	50.68	V	-18.50	46	32.18	13.82
318.45	49.83	V	-16.30	46	33.53	12.47
446.01	48.53	V	-13.20	46	35.33	10.67

- No other emissions were detected at a level greater than 20 dB below limit.

Measurement Data : Mid (Below 1 GHz)

Frequency [MHz]	Reading [dBuV/m]	Pol.	Correction Factor Antenna-Amp.Gain+Cable	Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
254.80	51.67	V	-18.49	46	33.18	12.82
319.18	52.53	V	-16.29	46	36.24	9.76
446.13	50.56	V	-13.20	46	37.36	8.64

- No other emissions were detected at a level greater than 20 dB below limit.

Measurement Data : High (Below 1 GHz)

Frequency [MHz]	Reading [dBuV/m]	Pol.	Correction Factor Antenna-Amp.Gain+Cable	Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
255.28	54.05	V	-18.48	46	35.54	10.46
319.42	50.24	V	-16.27	46	33.97	12.03
446.37	47.60	V	-13.19	46	34.41	11.59

- No other emissions were detected at a level greater than 20 dB below limit.

[Below 1Ghz LOW]

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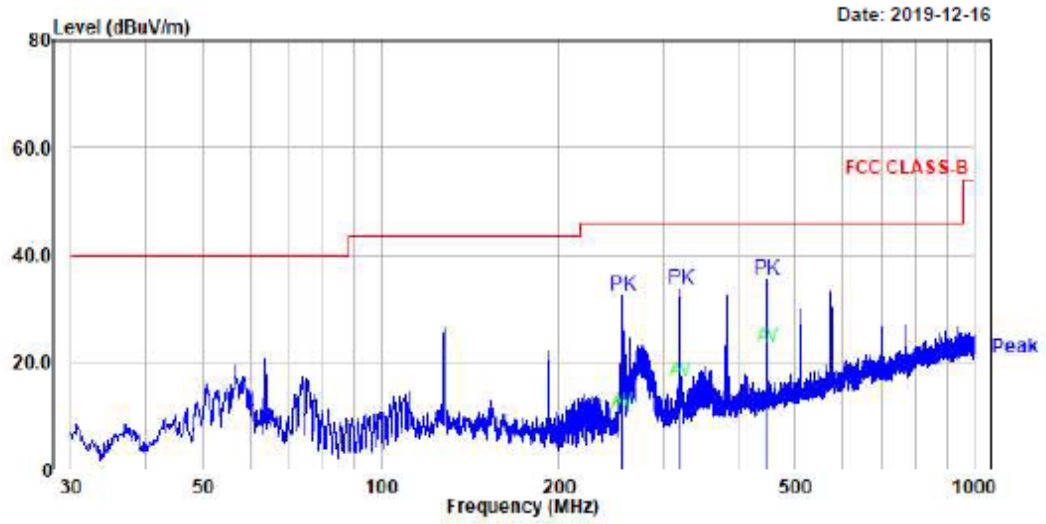
EUT/Model No.: WP-100 Temp/Humi: BLE LOW

Test Mode : 고경훈 Tested by:

Power :



No.	Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
	MHz	dBµV	dB	dBµV/m	dBµV/m	dB	cm	deg	
1.	254.68	29.30	-18.50	10.80	46.00	35.20	100	149	vertical
2.	254.68	50.68	-18.50	32.18	46.00	13.82	100	149	vertical
3.	318.45	32.70	-16.30	16.40	46.00	29.60	114	0	vertical
4.	318.45	49.83	-16.30	33.53	46.00	12.47	114	0	vertical
5.	446.01	35.81	-13.20	22.61	46.00	23.39	158	147	vertical
6.	446.01	48.53	-13.20	35.33	46.00	10.67	100	32	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

[Below 1GHz MID]

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EUT/Model No.: WP-100 Temp/Humi: BLE MID

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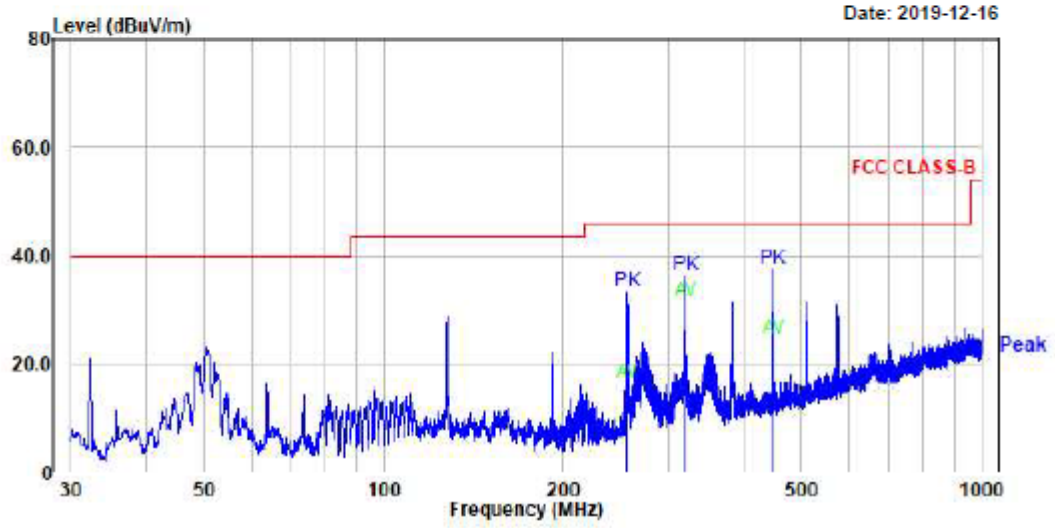

No.	Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
	MHz	dBµV	dB	dBµV/m	dBµV/m	dB	cm	deg	
1.	254.80	34.79	-18.49	16.30	46.00	29.70	100	66	vertical
2.	254.80	51.67	-18.49	33.18	46.00	12.82	100	66	vertical
3.	319.18	47.81	-16.29	31.52	46.00	14.48	100	66	vertical
4.	319.18	52.53	-16.29	36.24	46.00	9.76	100	66	vertical
5.	446.13	37.61	-13.20	24.41	46.00	21.59	100	114	vertical
6.	446.13	50.56	-13.20	37.36	46.00	8.64	100	114	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

[Below 1GHz HIGH]

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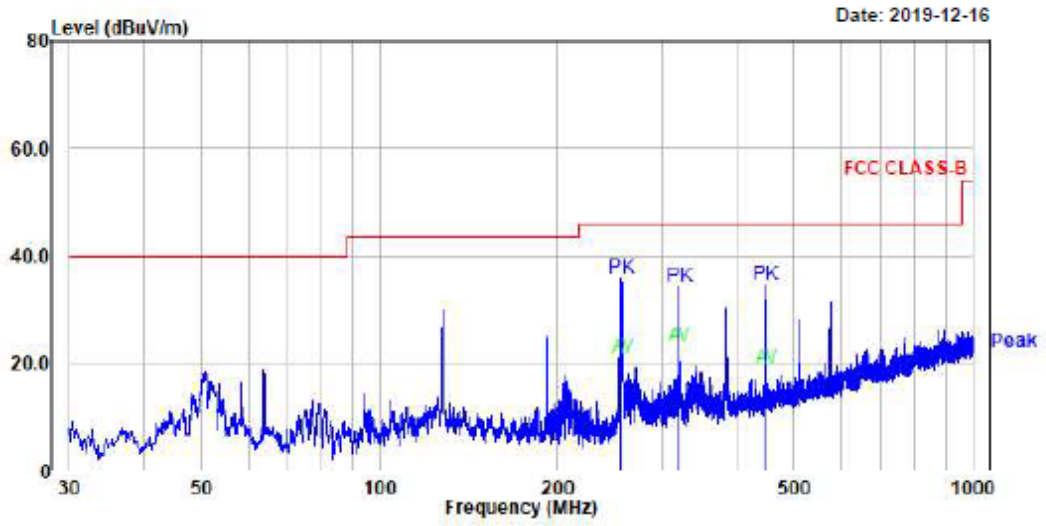
EUT/Model No.: WP-100 Temp/Humi: BLE HIGH

Test Mode : 고경훈 Tested by:

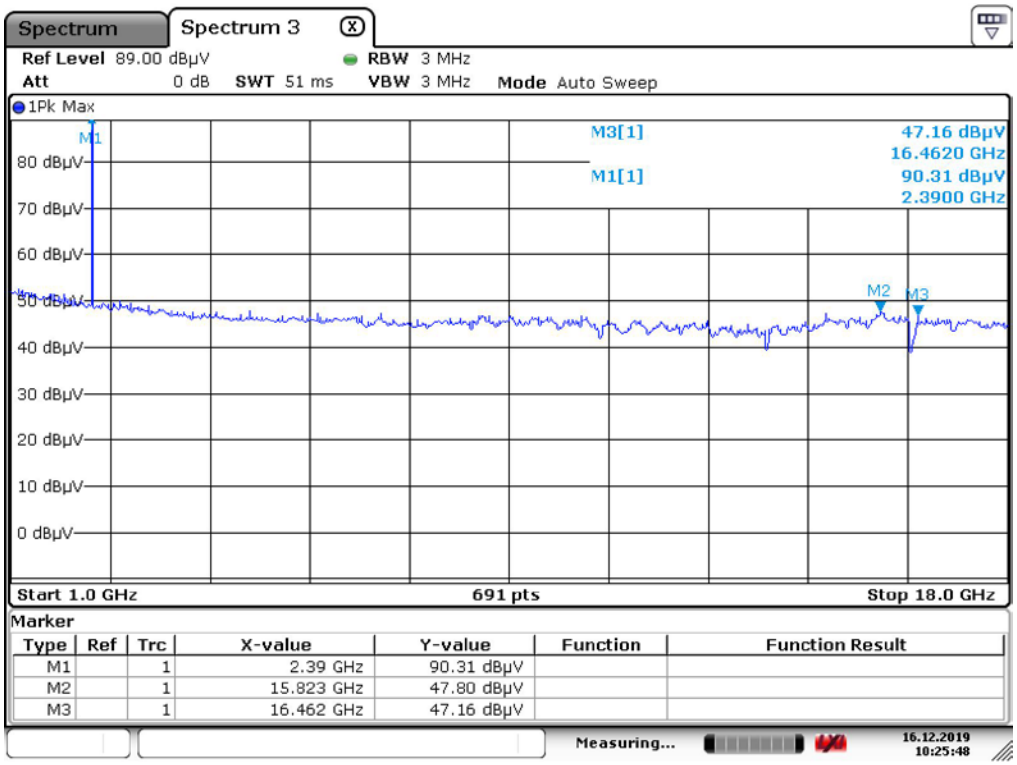
Power :



No.	Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
	MHz	dBµV	dB	dBµV/m	dBµV/m	dB	cm	deg	
1.	255.28	39.40	-18.48	20.92	46.00	25.08	100	114	vertical
2.	255.28	54.05	-18.48	35.57	46.00	10.43	100	114	vertical
3.	319.42	39.10	-16.27	22.83	46.00	23.17	100	130	vertical
4.	319.42	50.24	-16.27	33.97	46.00	12.03	100	130	vertical
5.	446.37	32.01	-13.19	18.82	46.00	27.18	100	14	vertical
6.	446.37	47.60	-13.19	34.41	46.00	11.59	100	14	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

[Above 1GHz LOW]



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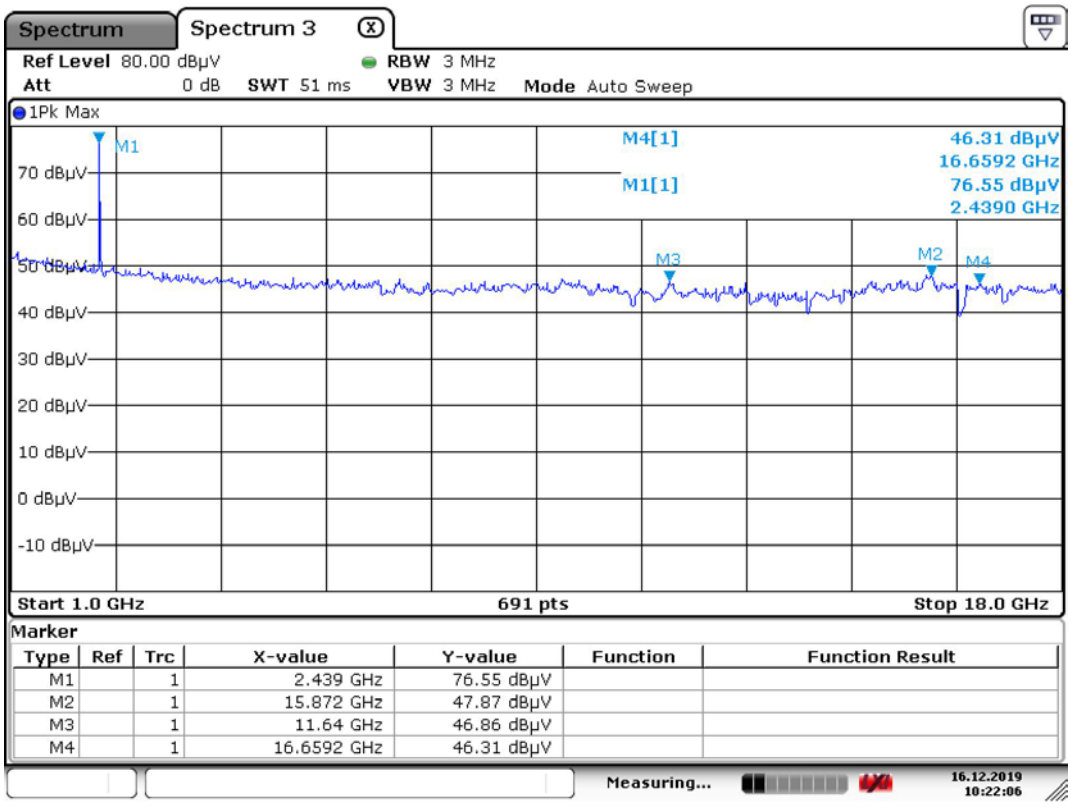
[Above 1GHz MID]



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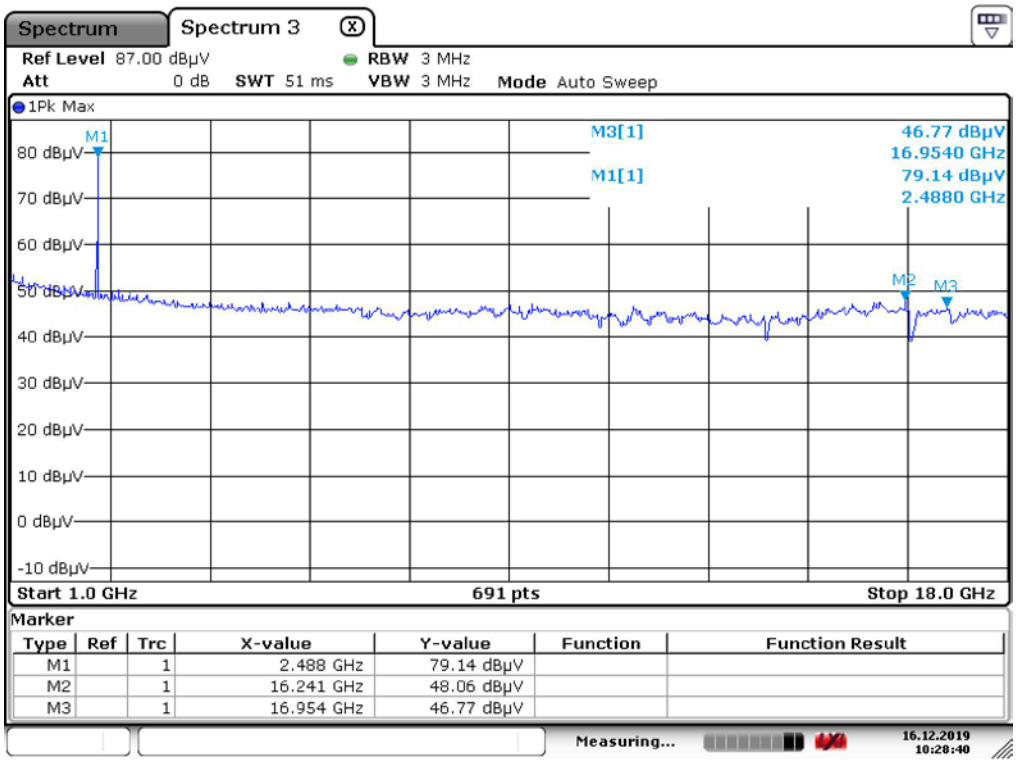
[Above 1GHz HIGH]



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3.2.6 AC Conducted Emissions

Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: NA

Minimum Standard: FCC Part 15.207(a) / EN 55022

Class B

Frequency Range	quasi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

APPENDIX

TEST EQUIPMENT USED FOR TESTS

	Use	Description	Model No.	Serial No.	Manufacturer	Interval	Last Cal. Date
1		Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2019-09-07
2		Signal Generator (~3.2 GHz)	8648C	3623A02597	HP	1 year	2019-03-21
3		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2019-09-06
4		Attenuator (3 dB)	8491A	37822	HP	1 year	2019-09-07
5		Attenuator (10 dB)	8491A	63196	HP	1 year	2019-09-07
6	■	EMI Test Receiver (~7 GHz)	ESCI7	100722	R&S	1 year	2019-09-07
7	■	RF Amplifier (~1.3 GHz)	8447D OPT 010	2944A07684	HP	1 year	2019-09-07
8	■	RF Amplifier (1~26.5 GHz)	8449B	3008A02126	HP	1 year	2019-03-21
9	■	Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2018-08-04
10	■	DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2018-03-21
11		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2018-03-21
12	■	TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2019-04-17
13		Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2019-03-21
14		Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
15		DC Power Supply	6674A	3637A01657	Agilent	-	-
17	■	Power Meter	EPM-441A	GB32481702	HP	1 year	2019-03-21
18	■	Power Sensor	8481A	3318A94972	HP	1 year	2019-09-07
19		Audio Analyzer	8903B	3729A18901	HP	1 year	2019-09-07
20		Modulation Analyzer	8901B	3749A05878	HP	1 year	2019-09-07
21		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2019-09-07
22		Stop Watch	HS-3	812Q08R	CASIO	2 year	2019-03-21
23		LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2019-09-07
24		Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2019-03-21
25		UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2019-03-21
26		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2019-03-21
27		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2019-03-21
28		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2019-03-21
29		Signal Generator(100 kHz ~ 40 GHz)	SMB100A03	177621	R&S	1 year	2019-03-21
30	■	Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2019-03-21
31	■	Active Loop Antenna	FMZB 1519	1519-031	SCHWARZBECK	2 year	2019-02-26