

Electromagnetic Emission

FCC MEASUREMENT REPORT

CERTIFICATION

OF

FCC PART15 Subpart B COMPLIANCE

PRODUCT : U-Pointer 2
MODEL/TYPE NO : U2-TA01, U2-TB01, U2-TU01, U2-TB02, U2-TU02, U3-TA01, U3-TB01, U3-TU01
FCC ID : W5N-U2-TA01
TRADE NAME : -
APPLICANT : IScommunications Co., Ltd.
201, Sinmorgondan, Moradong, 9 Mora-ro 192 beon-gil,
Sasang-gu, Busan, Korea
Arnold, Lee / Manager
FCC CLASSIFICATION : JBP : Part 15 Class B Computer Device Peripheral
FCC RULE PART(S) : FCC Part 15 Subpart B Class B
FCC PROCEDURE : Certification
DATES OF TEST : October 30, 2015
DATES OF ISSUE : November 09, 2015
TEST REPORT No. : BWS-15-EF-0055
TEST LAB. : BWS Tech., Inc. (Registration No. : 287786)

This U-Pointer 2 has been tested in accordance with the measurement procedures specified in ANSI C63.4-2009 at the BWS TECH/EMC Test Laboratory and has been shown to be complied with the electromagnetic emission limits specified in FCC Rule Part15 Subpart B Section15.107 and 15.109

I attest to the accuracy of data. All measurement 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. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

November 09, 2015

(Date)



Byung-Sam, Chun
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Laboratory Division

BWS TECH Inc.

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FCC TEST REPORT

Scope – Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)

1. General Information

Applicant Information

Company Name : IScommunications Co., Ltd.
Company Address : 201, Sinmorgondan, Moradong, 9 Mora-ro 192 beon-gil, Sasang-gu, Busan, Korea
Phone/Fax : Tel No. : +82-70-7169-0819 Fax No. : +82-2-2611-6604

Manufacturer Information

Company Name : IScommunications Co., Ltd.
Company Address : 201, Sinmorgondan, Moradong, 9 Mora-ro 192 beon-gil, Sasang-gu, Busan, Korea
Phone/Fax : Tel No. : +82-70-7169-0819 Fax No. : +82-2-2611-6604

- **EUT Type** : U-Pointer 2
- **Model Number** : U2-TA01, U2-TB01, U2-TU01, U2-TB02, U2-TU02, U3-TA01, U3-TB01, U3-TU01
- **FCC Identifier** : W5N-U2-TA01
- **S/N** : Prototype
- **FCC Rule Part(s)** : FCC Part 15 Subpart B Class B
- **Test Procedure** : ANSI C63.4-2009
- **Dates of Tests** : October 30, 2015
- **Place of Tests :** : BWS TECH Inc.
EMC Testing Lab (FCC Registration Number : 287786)
611-1, Maesan-ri, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do
449-853, Korea
TEL: +82 31 333 5997 FAX: +82 31 333 0017
- **Test Report No.** : BWS-15-EF-0055

2. Description of Test Facility

The measurement for radiated emission test were practiced at the open area test site of BWS TECH Inc. Measurement for conducted emission test were practiced at the semi EMC Anechoic Chamber test site of BWS TECH Inc. facility located at **611-1, Maesan-ri, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, Korea**. The site is constructed in conformance with the requirements of the ANSI C63.4-2009 and CISPR Publication 16. The BWS TECH measurement facility has been filed to the Commission with the FCC for 3 and 10 meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-2009 and registered to the Federal Communications Commission(Registration Number : 287786).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009) was used in determining radiated and conducted emissions from the IScommunications Co., Ltd. U-Pointer 2 Model : U2-TA01.

3. Product Information

3.1 Variations covered by this report

- Model Difference: U2-TA01, U2-TB01, U2-TU01, U2-TB02, U2-TU02,
U3-TA01, U3-TB01, U3-TU01

3.2 Additional Information Related to Testing: N/A

4. Description of Tests

4.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2009. The measurement was performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω / 50 uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1 m x 1.5 m x 0.8 m wooden table which is placed 40 cm away from the vertical wall and 1.5 m away from the side wall of the chamber room. Two LISNs are bonded to bottom plane of the shielded room. The EUT is powered from the Com-power LISN and the support equipment is powered from the another Com-power LISN. Power to the LISNs is filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the Com-power LISN. All interconnecting cables more than 1 m were shortened by non-inductive bundling (serpentine fashion) to a 1 m length. 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 RF output of the LISN was connected to the Signal Analyzer Spectrum Analyzer to determine the frequency producing the max. Emission from the EUT. The frequencies are producing the max. Level was reexamined using the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 MHz to 30 MHz. The bandwidth of the Spectrum Analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

4.2 Radiated Emission Measurement

Preliminary measurements were made at indoors 3 meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.

Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth with respect to the antenna was noted for each frequency found. The spectrum was scanned from 30 MHz to 1000 MHz using bilog antenna and above 1000 MHz, linearly polarized double ridge horn antennas were used. Above 1 GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies which were selected as bottom, middle and top frequency in the operating band. Emission levels from the EUT with various configurations were examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 10-meter test range using bilog antenna. The output from the antenna was connected, via a pre-selector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer (for above 1 GHz). The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120 kHz (1 MHz for measurement above 1 GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission. The EUT, support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 m x 1.5 m table. The turntable containing the system was rotated and the antenna height was varied 1 m to 4 m and stopped at the azimuth or height producing the maximum emission.

Each emission was maximized by varying the mode of operating frequencies of the EUT. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20 dB/decade) as per section 15.31(f).

Photographs of the worst-case emission test setup can be seen in Appendix 1.

5. Test Condition

5.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner which tends to maximize its emission level in a typical application.

Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/2009 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were conducted at 10 meter open field test site.

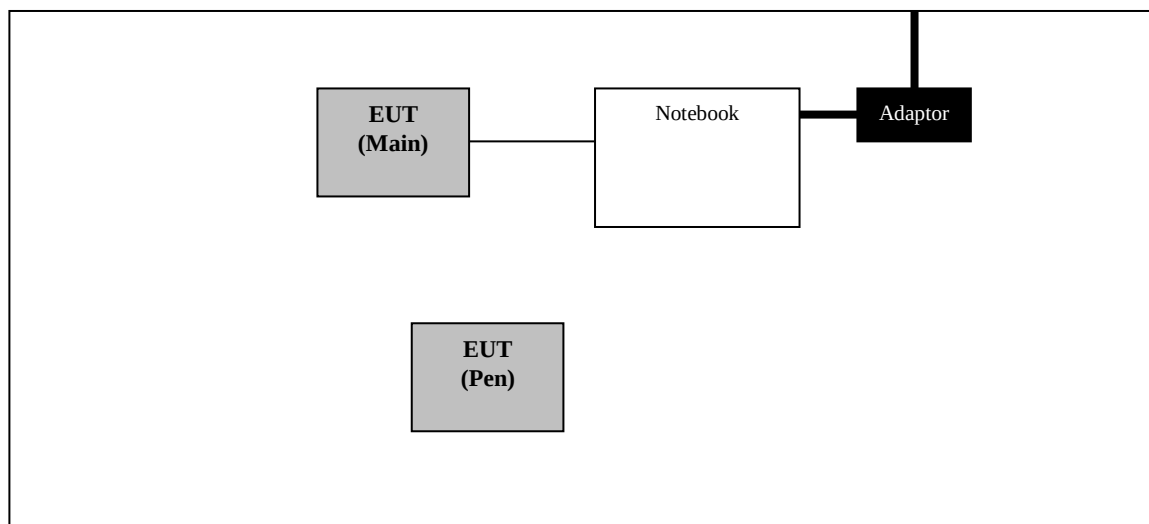
5.2 EUT operation

EUT was tested according to the following operation modes provided by the specifications given by the manufacturer, and reported the worst emissions.

Operation Modes	Worst Case
Normal condition operated by i-Pro 4 software	☒

5.3 Test System layout on EUT and peripherals

— Interface cable — Power cable



5.4 Peripherals / Support Equipment Used

Following peripheral devices and interface cables were connected during the measurement:

Type of Peripheral Equipment Used:

Description	Model Name	Serial No.	Manufacturer	FCC ID
EUT	U2-TA01	Prototype	IScommunications Co., Ltd.	W5N-U2-TA01
Notebook	S550(MULTI/7P)	302QCWC556873	LG	N/A
Notebook Adaptor	PA-1400-14	L9130B05007875	LITE-ON TECHNOLOGY CO., LTD	N/A

Type of Cables Used:

Device from	Device to	Type of Cable	Length(m)	Type of shield
EUT(Main)	Notebook	USB	5.0	Shielded
Notebook	Adaptor	DC IN	2.0	Unshielded

6. TEST RESULTS

6.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

FCC Rule Parts	Measurement Required	Result
15.107(a)	Conducted Emissions	Passed by – 11.94 dB(Quasi-Peak Mode) Passed by – 15.31 dB(CISPR Average Mode)
15.109(a)	Radiated Emissions	Below 1 GHz Passed by – 8.42 dB

The data collected shows that the IScommunications Co., Ltd. U-Pointer 2 Model : U2-TA01 complies with technical requirements of the Part 15.107 and 15.109 of the FCC Rules.

6.2 Conducted Emissions

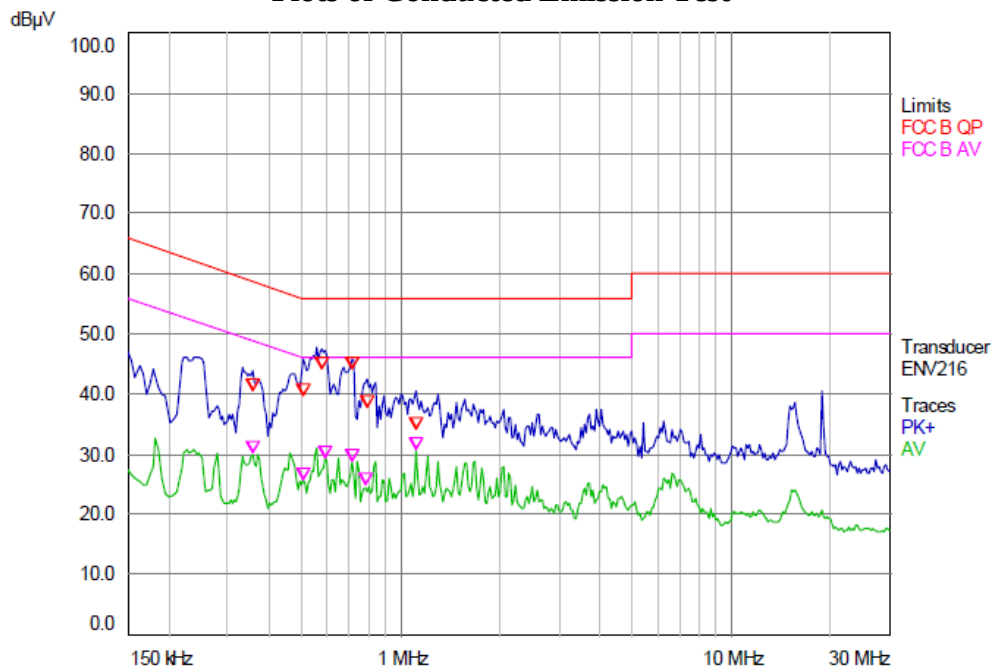
EUT : U-Pointer 2 Model: U2-TA01 (SN: Prototype)
Limit apply to : FCC Part15 Subpart B Class B Section 15.107(a)
Test Date : October 30, 2015
Operating Condition : Normal condition operated by i-Pro 4 software
Test Condition : AC 120 V, 60 Hz (Hot/Neutral)
Environment Condition : Temperature: 21 °C, Humidity Level : 43 % R.H.
Result : Passed by – 11.94 dB(Quasi-Peak Mode)
Passed by – 15.31 dB(CISPR Average Mode)

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Tabulated Conducted Emission Test Data

Detector Mode ; CISPR Quasi-Peak Mode (6 dB Bandwidth : 9 kHz).

Plots of Conducted Emission Test



Final Measurement Results

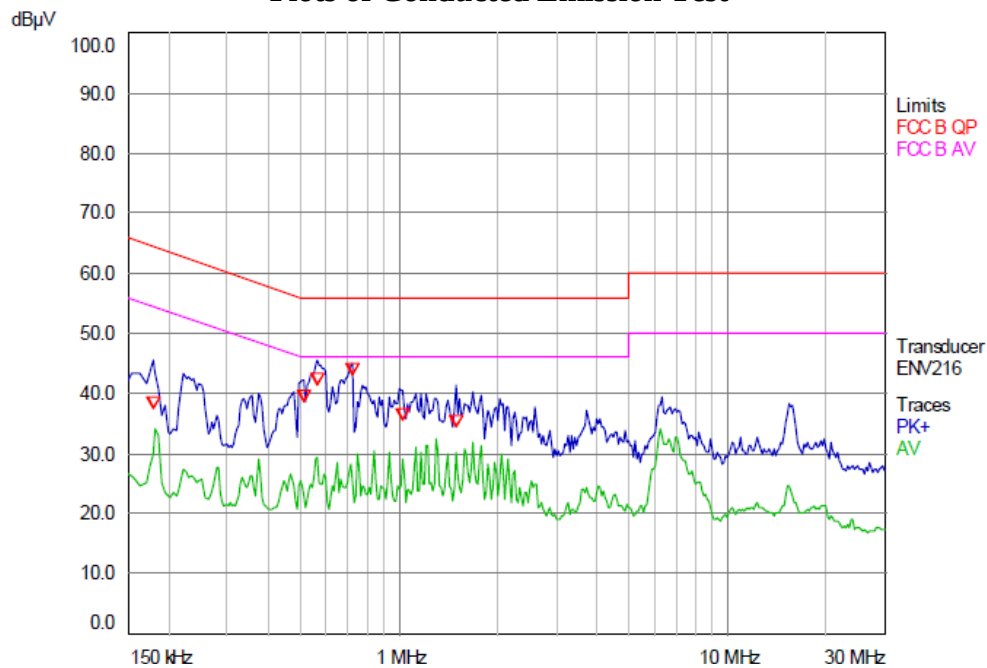
Trace	Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.358	40.54	58.77	-18.23		
2 CA	0.358	30.15	48.77	-18.62		
1 QP	0.508	39.56	56.00	-16.44		
2 CA	0.508	25.73	46.00	-20.27		
1 QP	0.576	44.06	56.00	-11.94		
2 CA	0.592	29.38	46.00	-16.62		
1 QP	0.716	44.01	56.00	-11.99		
2 CA	0.716	28.76	46.00	-17.24		
2 CA	0.78	24.75	46.00	-21.25		
1 QP	0.792	37.74	56.00	-18.26		
1 QP	1.112	34.18	56.00	-21.82		
2 CA	1.116	30.69	46.00	-15.31		

Test Mode: Hot

Model Name: U2-TA01

Classification: FCC Part 15 Subpart B Class B

Plots of Conducted Emission Test



Final Measurement Results

Trace	Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.178	37.52	64.58	-27.06		
1 QP	0.512	38.63	56.00	-17.37		
1 QP	0.564	41.37	56.00	-14.63		
1 QP	0.72	43.16	56.00	-12.84		
1 QP	1.024	35.44	56.00	-20.56		
1 QP	1.496	34.24	56.00	-21.76		

Test Mode: Neutral

Model Name: U2-TA01

Classification: FCC Part 15 Subpart B Class B

NOTES:

- Margin = Limit - Emission Level
- All modes of operation were investigated and the worst-case emissions are reported.
See the plots in next pages.
- Measurement uncertainty estimated at 3.718 dB.
The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

6.3 Radiated Emissions

EUT : U-Pointer 2 Model: U2-TA01 (SN: Prototype)
Limit apply to : FCC Part15 Subpart B Class B Section 15.109(a)
Test Date : October 30, 2015
Operating Condition : Normal condition operated by i-Pro 4 software
Test Condition : AC 120 V, 60 Hz
Environment Condition : Below 1 GHz Temperature : 10 °C, Humidity Level : 34 % R.H.
Above 1 GHz Temperature : 22 °C, Humidity Level : 42 % R.H.
Result : Below 1 GHz Passed by – 8.42 dB

Radiated Emission Test Data

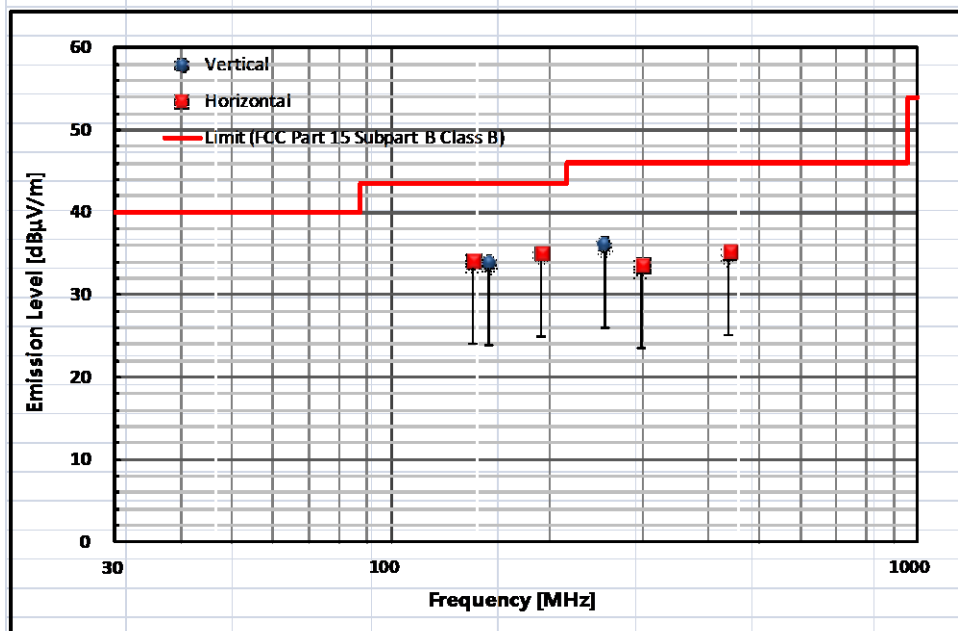
The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Detector mode : CISPR Quasi-Peak mode

30 MHz - 1000 MHz (6 dB Bandwidth : 120 kHz)

Measurement Distance : 3 meters

Frequency [MHz]	Reading [dBμV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	Limit [dBμV/m]	Emission Level [dBμV/m]	Margin [dB]
143.72	19.57	H	13.40	1.23	43.52	34.20	9.32
153.84	18.90	V	13.73	1.28	43.52	33.90	9.62
193.57	23.11	H	10.57	1.43	43.52	35.10	8.42
254.21	22.23	V	12.23	1.64	46.02	36.10	9.92
298.64	18.16	H	13.75	1.80	46.02	33.70	12.32
437.41	17.00	H	16.06	2.14	46.02	35.20	10.82



NOTES :

- * H : Horizontal polarization , ** V : Vertical polarization
- Emission Level = Reading + Antenna factor + Cable loss - AMP Gain
- Margin value = Limit - Emission Level
- All other emissions not reported were more than 25 dB below the permitted limit.
- Measurement uncertainty estimated at 5.552 dB.

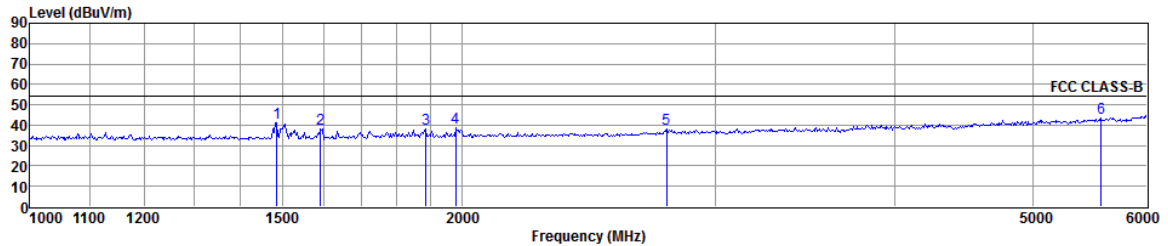
The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

Detector mode : CISPR Peak mode, CISPR Average mode

1 GHz - 6 GHz (6 dB Bandwidth : 1 MHz)

Measurement Distance : 3 meters

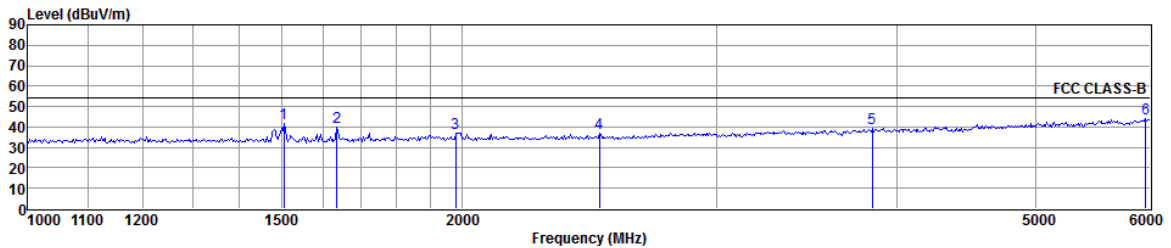
Horizontal



Site : SVSWR Chamber
Condition: FCC CLASS-B 3m BBHA9120D517_2014 HORIZONTAL
eut :
mode :
memo :

	Freq	ReadAntenna Level	Preamp Factor	Cable Loss	Aux Factor	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1	1485.84	52.18	25.57	40.44	3.67	0.00	40.98	54.00	-13.02	100 150 Peak
2	1593.38	48.95	25.70	40.46	3.82	0.00	38.01	54.00	-15.99	100 190 Peak
3	1885.67	48.12	26.06	40.48	4.24	0.00	37.94	54.00	-16.06	100 210 Peak
4	1979.14	48.83	26.17	40.50	4.37	0.00	38.87	54.00	-15.13	100 170 Peak
5	2776.81	46.69	27.31	41.02	4.94	0.00	37.92	54.00	-16.08	100 150 Peak
6	5575.03	45.09	31.27	40.43	7.33	0.00	43.26	54.00	-10.74	100 150 Peak

Vertical



Site : SVSWR Chamber
Condition: FCC CLASS-B 3m BBHA9120D517_2014 VERTICAL
eut :
mode :
memo :

	Freq	ReadAntenna Level	Preamp Factor	Cable Loss	Aux Factor	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1	1504.59	52.90	25.58	40.44	3.70	0.00	41.74	54.00	-12.26	100 60 Peak
2	1636.79	50.83	25.76	40.46	3.88	0.00	40.01	54.00	-13.99	100 180 Peak
3	1979.14	47.14	26.17	40.50	4.37	0.00	37.18	54.00	-16.82	100 150 Peak
4	2489.31	46.77	26.87	41.21	4.66	0.00	37.09	54.00	-16.91	100 160 Peak
5	3847.42	46.22	28.92	41.58	5.97	0.00	39.53	54.00	-14.47	100 50 Peak
6	5957.15	44.14	32.11	40.09	7.69	0.00	43.85	54.00	-10.15	100 120 Peak

NOTES :

1. Emission Level = Reading + Antenna factor + Cable loss - AMP Gain
2. Margin value = Limit - Emission Level
3. Measurement uncertainty estimated at 4.642 dB.

The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

7. Sample Calculation and Other Information

7.1 Sample Calculations

$$\text{dB}\mu\text{V} = 20 \log_{10} (\mu\text{V}/\text{m})$$

$$\mu\text{V} = 10^{(\text{dB}\mu\text{V}/20)}$$

EX. 1.

@ 193.57 MHz Class B limit = 43.52 dB μ V/m

Reading = 23.11 dB μ V(calibrated level)

Antenna factor + Cable Loss - AMP Gain = 12.00 dB

Total = 35.10 dB μ V/m

Margin = 35.10 - 43.52 = -8.42 dB

8.42 dB ; below limit

8. TEST EQUIPMENTS LIST

The listing below denotes the test equipments utilized for the test(s).

Equipment Type	Model	Manufacture	Serial No	Cal Due Date	Use
Test Receiver	ESPI	ROHDE & SCHWARZ	100063	01. 12. 2016	☒
#2 Conducted Cable_2.7m	N/A	N/A	N/A	N/A	☒
LISN	ENV216	ROHDE & SCHWARZ	100324	01. 12. 2016	☒
Impuls-Begrenzer Pulse Limiter	ESH3-Z2	ROHDE & SCHWARZ	100092	01. 12. 2016	☒
CE CHAMBER	N/A	SY Corporation	N/A	N/A	☒
Bilog Antenna	VULB 9160	SCHWARZBECK	9160-3122	04. 02. 2016	☒
EMI Receiver	ESVN30	ROHDE & SCHWARZ	832854/010	01. 12. 2016	☒
Chamber Cable_3m	M17/164-00001	Surprenant	N/A	N/A	☒
Chamber Cable_10m	SUCOFLEX 104	Hubersuhner	325898/4	N/A	☒
RE_Below 1GHz CHAMBER	N/A	SY Corporation	N/A	N/A	☒
Horn Antenna	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D 517	10. 16. 2016	☒
Test Receiver	ESPI	ROHDE & SCHWARZ	100012	01. 12. 2016	☒
RF Amplifier	PAM-118A	COM-POWER	551019	07. 20. 2016	☒
Chamber Cable_2m	SUCOFLEX 104	Hubersuhner	317392/4	N/A	☒
Chamber Cable_10m	SUCOFLEX 104	Hubersuhner	323837/4	N/A	☒
Antenna Master	N/A	AUDIX	N/A	N/A	☒
Antenna Turntable Controller	ACT	AUDIX	N/A	N/A	☒
RE_Above 1 GHz CHAMBER	N/A	SeoYoungEMC	N/A	N/A	☒
CE Software	ES-SCAN	ROHDE & SCHWARZ	Version 2.50	N/A	☒
RE Software	E3	AUDIX	Version 6.111227d	N/A	☒