TEST REPORT

of

FCC Part 15 Subpart F §15.519

FCC ID : Q48-AUHS-3190-AM

Equipment Under Test	:	UWB Wireless USB dongle
Model Name	:	AUHS-3190-AM
Serial No.	:	N/A
Applicant	:	ABCO
Manufacturer	:	ABCO
Date of Test(s)	:	2013.08.19 ~ 2013.08.23
Date of Issue	:	2013.09.26

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Hyunchae You** **Date:** **2013.09.26**

Approved By: **Feel Jeong** **Date:** **2013.09.26**

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 400-2, Gomae-dong, Giheung-gu, Yongin-si, Gyeonggi-do, Korea 446-901

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

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1.2. Details of Applicant

Applicant : ABCO
Address : 31, Dunchon-daero 388 Beon-gil, Jungwon-gu, Seongnam-si Gyeonggi-do, Korea
Contact Person : Hyun Soo, Kim
Phone No. : +82-31-730-5188

1.3. Details of Factory Information

Applicant : ABCO
Address : 31, Dunchon-daero 388 Beon-gil, Jungwon-gu, Seongnam-si Gyeonggi-do, Korea

1.4. Description of EUT

Kind of Product	UWB Wireless USB dongle
Model Name	AUHS-3190-AM
Serial Number	N/A
Power Supply	DC 5 V
Frequency Range	3 168 ㎒ ~ 4 752 ㎒
Modulation Technique	MB-OFDM
Number of Channels	3 Sub-band (please refer to the section 1.10)
Antenna Type	Internal type (Chip Antenna)

1.5. Declaration by the manufacturer

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1.6. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	R&S	SMR40	100540	Jan. 08, 2013	Annual	Jan. 08, 2014
Spectrum Analyzer	R&S	FSV30	101004	Jul. 20, 2013	Annual	Jul. 20, 2014
Spectrum Analyzer	Agilent	N9030A	MY53120526	Jul. 30, 2013	Annual	Jul. 30, 2014
Low Pass Filter	Mini circuits	NLP-1200+	V9500401023-1	Jul. 02, 2013	Annual	Jul. 02, 2014
Preamplifier	H.P.	8447D	1726A01265	Sep.17, 2012	Annual	Sep.17, 2013
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Jun. 13, 2013	Annual	Jun. 13, 2014
Preamplifier	MITEQ Inc.	AFS42-00101800-25-S	900699	Jul. 07, 2013	Annual	Jul. 07, 2014
Test Receiver	R & S	ESCI7	100778	Feb. 15, 2013	Annual	Feb. 15, 2014
Bilog Antenna	SCHWARZBECK	VULB9163	9163-390	Apr. 19, 2012	Biennial	Apr. 19, 2014
Turn Table	DT-3000S-3T	INN-CO	N/A	N.C.R.	N.C.R.	N.C.R.
Test Receiver	ESCI7	R&S	100778	Feb. 15, 2013	Annual	Feb. 15, 2014
Horn Antenna	R&S	HF906	100608	Aug. 13, 2012	Biennial	Aug. 13, 2014
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170431	May 15, 2012	Biennial	May 15, 2014
Antenna Master	MA4000-EP	INN-CO	N/A	N.C.R.	N.C.R.	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (21.5 m × 13.0 m × 9.0 m)	N/A	N.C.R.	N.C.R.	N.C.R.
EMI Test Receiver	R & S	ESU8	100128	Jan. 25, 2013	Annual	Jan. 25, 2014
Two-Line V-Network	R & S	ENV216	101180	May 15, 2013	Annual	May 15, 2014

1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C § 15.519		
Standard section	**Test Item(s)**	**Result**
15.519(a)	Operational Limitations	-
15.519(c) /15.209	Radiated Emissions	Complied
15.519(d)	Radiated Emissions in GPS Bands	Complied
15.519(b)	UWB Bandwidth	Complied
15.519(e)	Peak Emissions within a 50 ㎒ Bandwidth	Complied
15.207	Transmitter AC Power Line Conducted Emission	Complied
15.203	Antenna Requirement	Complied

1.8. Test Procedure(s)

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 ㎑ to 40 ㎓ (ANSI C63.4-2003)

1.9. Sample calculation

Where relevant, the following sample calculation is provided:

1.9.1. Radiation test

Field strength level (㏈㎶/m) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) - amplifier gain(㏈)

1.10. Test mode description

Test Mode	Sub-band	Frequency (㎒)
1	1	3 432
2	2	3 960
3	3	4 488

Note.
After pre-testing each mode, the worst mode 3 was the worst situation and only the data was presented in the following sections
< Except for “Radiated Emissions in GPS Bands”, “UWB Bandwidth Measurement”, “Peak Emission Measurement”>.

EUT configure mode	Applicable to					Description
	RE<1G	RE≥1G	GPS	UB	PE	Frequency (㎒)
1	-	-	√	√	√	3 432
2	-	-	√	√	√	3 960
3	√	√	√	√	√	4 488

Where **RE<1G** : Radiated Emission below 1 ㎓ **RE≥1G** : Radiated Emission above 1 ㎓
UB : UWB Bandwidth **PE** : Peak Emission
GPS : Radiated Emissions in GPS Bands

1.11. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL006898	Initial
1	F690501/RF-RTL006898-1	Revise Calibration date

2. Operational Limitations

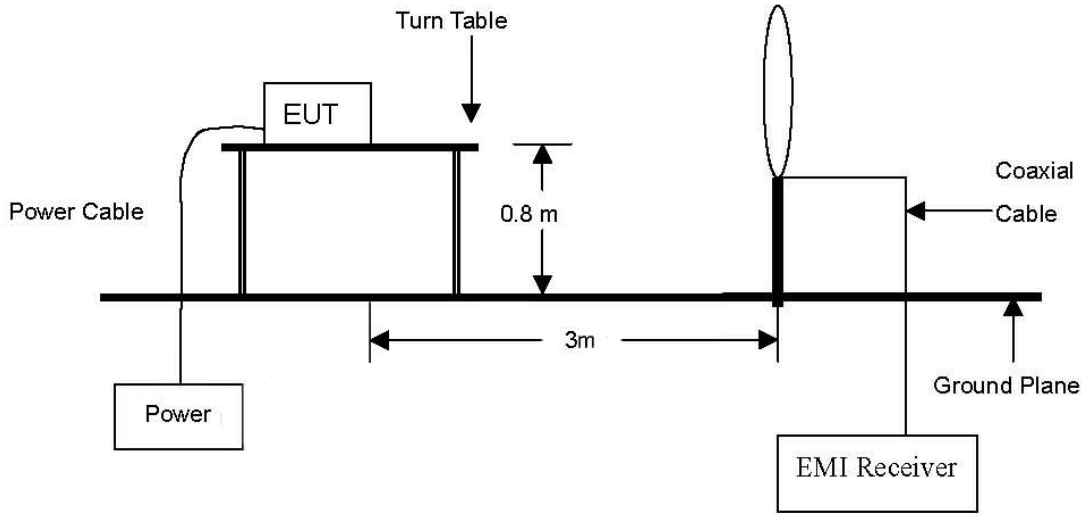
2.1. Test result of Operational restriction

Operation Restriction	Informed the applicant	Not applicabe	User Manual informed	Passed
■ 47 CFR FCC Part 15 Subpart F 15.519(a)				
UWB devices operating under the provisions of this section must be hand held, i.e.,they are relatively small devices that are primarily hand held while being operated and do not employ a fixed infrastructure. **[A transmitter that had been connected to portable device e.g. Laptop PC… and be considered sufficient to demonstrate not a fixed infrastructure application.]**	■			■
(1) The radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver				
A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting. **[The applicant has been informed of this requirement]**	■			■
(2) Outdoor mounted antennas				
The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device. **[The applicant has been informed of this requirement. Also this product's antenna type is chip antenna]**	■			■
(5) Indoors or Outdoors				
UWB devices operating under the provisions of this section may operate indoors or outdoors. **[The applicant has been informed of this requirement.]**	■			■

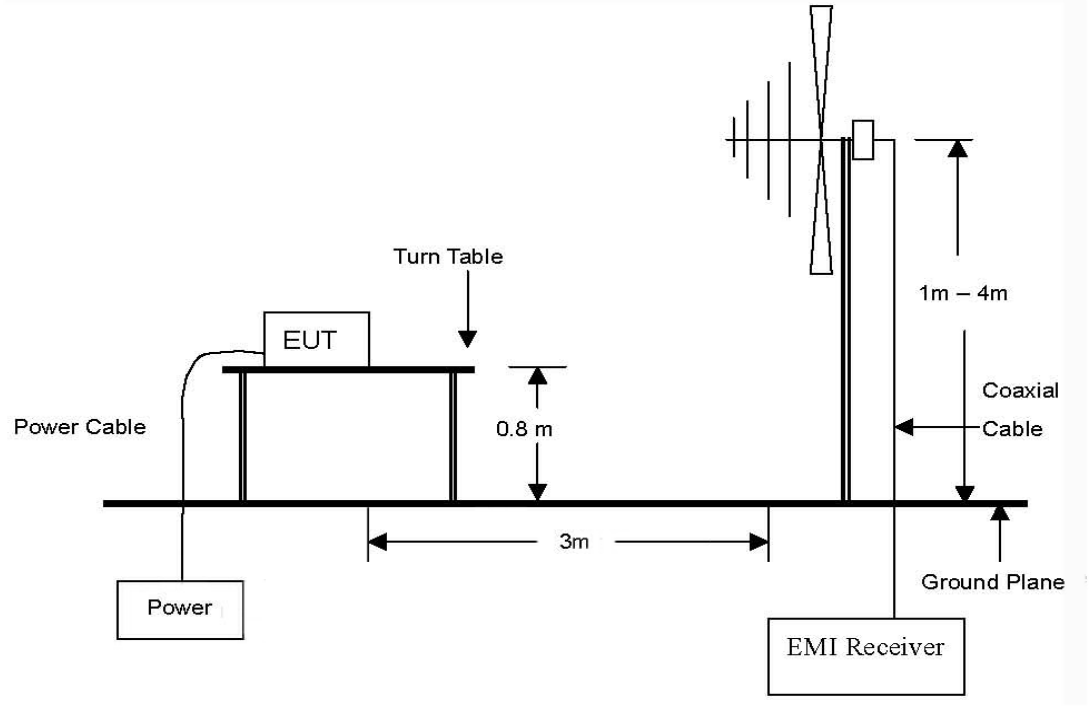
3. Radiated Emissions

3.1. Test Setup

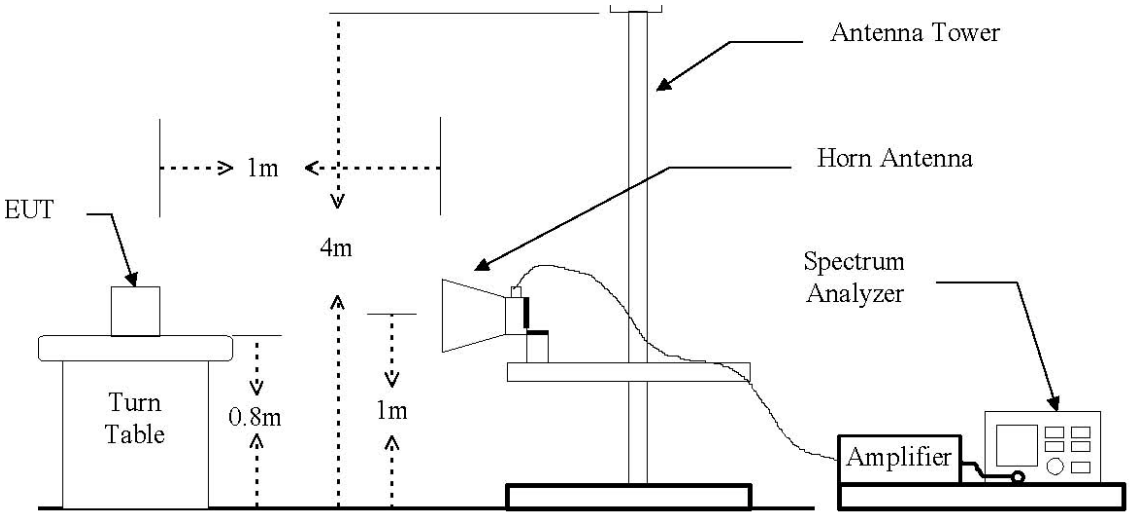
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission .The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



3.2. Limit

3.2.1. Radiated emission limits, general requirements

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 – 0.490	2400/F(㎑)	300
0.490 – 1.705	24000/F(㎑)	30
1.705 – 30.0	30	30
30 -88	100**	3
88 -216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241

The radiated emissions above 960 ㎒ from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 ㎒:

Freq. (㎒)	EIRP (㏈ m)	E- Field (㏈㎶/m) at 3 m	E- Field (㏈㎶/m) at 1 m
960-1 610	-75.3	19.9	29.44
1 610-1 990	-63.3	31.9	41.44
1 990-3 100	-61.3	33.9	43.44
3 100-10 600	-41.3	53.9	63.44
10 600 above	-61.3	33.9	43.44

Note 1: This may be converted to a peak field strength level at 3 meters using E(㏈㎶/m) = P(㏈ m EIRP) + 95.2 ㏈.

Note 2: Above 960 ㎒ shall be extrapolated to the specified distance using an extrapolation factor of 20 ㏈ /decade form 3 m to 1 m. Distance extrapolation factor = 20 log (specific distance [3 m] / test distance [1 m]) (㏈); Limit line = specific limits (㏈㎶/m) + distance extrapolation factor [9.54 ㏈].

From 47 CFR Section 15.521(c): Emissions from digital circuitry used to enable the operation of the UWB transmitter shall comply with the limits in Section 15.209 of this chapter, rather than the limits specified in this subpart, provided it can be clearly demonstrated that those emissions from the UWB device are due solely to emissions from digital circuitry contained within the transmitter and that the emissions are not intended to be radiated from the transmitter's antenna. Emissions from associated digital devices, as defined in Section 15.3(k) of this chapter, e.g., emissions from digital circuitry used to control additional functions or capabilities other than the UWB transmission, are subject to the limits contained in Subpart B of Part 15 of this chapter.
The radiated emissions from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209.

3.3. Test Procedures

a. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable for measured the frequency range below 960 ㎒ and antenna tower was placed below 1 meters far away from the turntable for measured the frequency range above 960 ㎒

b. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

c. The height of the broadband and receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

d. For each suspected emissions, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

e. The measurements made over the frequency range from 9 ㎑ to 960 ㎒ were maximized using an EMI receiver with peak detector capabilities. Measurements of the radiated field from 9 ㎑ to 960 ㎒ were made with the measurement antenna located a distance of 3 meters from the EUT. If the emissions level of the EUT in peak mode was 3 ㏈ lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 ㏈ margin will be repeated one by one using the quasi-peak method for below 1 ㎓ .

f. Measurements above 960 ㎒ were maximized using a spectrum analyzer with RMS detector capabilities. A spectrum analyzer was used for the final measurements utilizing an RMS detector at the frequencies with the largest amplitudes. The prescribed RBW of 1 ㎒ and VBW of 3 ㎒, and a1 msec averaging time were used for these measurements. Measurements of the radiated field at frequencies above 960 ㎒ were made with the measurement antenna located a distance of below 1 meter from the EUT.

g. The spectrum between 9 ㎑ and 960 ㎒ contained no intentional radiation and lies below the limits. The spectrum from 960 ㎒ to18 ㎓ contained intentional UWB signals between 3100 ㎒ and 10600 ㎒ and lie below the limits. No other emissions above 10 600 ㎒ were detected. The maximum frequency tested was 40 ㎓ .

h. Per 47 CFR, Part 15, Subpart F, §15.521© (§15.209) all digital emissions from the transmitter not intended to be radiated from the antenna port meet the 15.209 subpart C limits.

i. Additional measurements in the 960 ㎒ to 40 ㎓ range were performed to determine the nature of all unintentional emissions in this span. Conducted antenna port measurement and terminated antenna port measurement were done in the 960 ㎒ to 8 ㎓ range show that all noise peaks have the same frequency and polarization and are determined to be emission from the digital circuit and are not radiated from the antenna.

The spectrum analyzer is set to:

Frequency = 1000 ㎒ ~ 10th carrier harmonic or 40 ㎓

RBW = 1 ㎒

VBW = 3 ㎒ (VBW ≥RBW)

Detector function = RMS or Average

Span = auto

Sweep = 1 msec averaging time were used for these measurement frequencies

3.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

3.4.1. Radiated Emission (Worst case_Bandgroup1_ Sub-band 3)

The frequency spectrum from 30 ㎒ to 960 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈. All reading values are peak values.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP + CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
33.68	31.78	Peak	H	12.31	-24.55	19.54	40.0	20.46
73.04	35.29	Peak	H	8.62	-24.19	19.72	40.0	20.28
172.78	33.44	Peak	H	9.32	-23.02	19.74	43.5	23.76
299.95	29.80	Peak	V	13.06	-22.10	20.76	46.0	25.24
381.33	31.47	Peak	H	14.69	-22.42	23.74	46.0	22.26
664.09	33.96	Peak	V	19.48	-22.11	31.33	46.0	14.67
Above 700.00	Not detected	-	-	-	-	-	-	-

Remark:

1. This test would be performed in the 3 m distance
2. Actual = Reading + AF + AMP + CL

3.4.2. Spurious Radiated Emission

The frequency spectrum above 960 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈. Sub-band 3 is worst case

Operating Mode: Sub-band 3

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP+CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*1 194.13	50.26	Average	V	24.93	-37.92	37.27	54.00	16.73
*1 213.43	46.25	Average	V	24.98	-37.89	33.34	54.00	20.66
*1 570.07	48.62	Average	V	26.06	-37.15	37.53	54.00	16.47
4 357.12	57.87	RMS	V	32.71	-32.02	58.56	63.44	4.88
8 982.08	32.87	RMS	V	37.19	-24.45	45.61	63.44	17.83
Above 9 000.00	Not detected	-	-	-	-	-	-	-

Remarks;

1. "*" means the digital cirquitry frequency, * emissions from digital circuitry used to enable the operation of the UWB transmitter shall comply with the limits in 47 CFR, Part 15, Sunpart C, §15.209
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
3. Average test would be performed if the peak result were greater than the average limit.
4. Actual = Reading + AF + AMP + CL
5. The test are measured in the 1 m distance

4. Radiated Emissions in GPS Bands

4.1. Test Setup

Same as section 3.1. of this report

4.2. Limit

In addition to the radiated emission limits specified in the table in paragraph 4.5.1 of this report, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 ㎑ .

Freq. (㎒)	EIRP (㏈ m)	E- Field (㏈㎶/m) at 3m	E- Field (㏈㎶/m) at 1m
1 164-1 240	-85.3	9.9	19.44
1 559-1 610	-85.3	9.9	19.44

Note 1: This may be converted to a peak field strength level at 3 meters using E(㏈㎶/m) = P(㏈ m EIRP) + 95.2 ㏈. Note 2: Above 960 ㎒ shall be extrapolated to the specified distance using an extrapolation factor of 20 ㏈/decade form 3 m to 1 m. Distance extrapolation factor = 20 log (specific distance [3 m] / test distance [1m]) (㏈); Limit line = specific limits (㏈㎶/m) + distance extrapolation factor [9.54 ㏈].

4.3. Test Procedures

a. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1 meters far away from the turntable.
b. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
c. The height of the broadband and receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
d. For each suspected emissions, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
e. Measurements frequencies were maximized using a spectrum analyzer with RMS detector capabilities. A spectrum analyzer was used for the final measurements utilizing an RMS detector at the frequencies with the largest amplitudes. The prescribed RBW of 10 ㎑ and VBW of 10 ㎑ , and a 1 msec averaging time were used for these measurements.
f. Per 47 CFR, Part 15, Subpart F, §15.521© (§15.209) all digital emissions from the transmitter not intended to be radiated from the antenna port meet the 15.209 subpart C limits.

The spectrum analyzer is set to:
frequency = 1 164~1 240 ㎒ / 1 559~1 610 ㎒
RBW = 10 ㎑
VBW = 10 ㎑ (VBW ≥ RBW)
Detector function = RMS
Span = auto
Sweep = 1 msec averaging time were used for these measurement frequencies

Operating Mode: 1 164-1 240 ㎒ for GPS band at 1 m

A. Sub-band 1 (3 432 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 176.00	30.53	RMS	V	24.87	-37.96	17.44	19.44	2.00
1 224.00	29.45	RMS	V	25.02	-37.86	16.61	19.44	2.83

B. Sub-band 2 (3 960 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 196.00	28.25	RMS	V	24.93	-37.93	15.25	19.44	4.19
1 209.00	28.11	RMS	V	24.97	-37.90	15.18	19.44	4.26

C. Sub-band 3 (4 488 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 194.00	30.13	RMS	V	24.93	-37.92	17.14	19.44	2.30
1 213.00	26.43	RMS	V	24.98	-37.89	13.52	19.44	5.92

Remarks;

1. Actual = Reading + AF + AMP + CL
2. The test are measured in the 1 m distance

Operating Mode: 1 559-1 610 ㎒ for GPS band at 1 m

A. Sub-band 1 (3 432 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 576.00	28.08	RMS	V	26.08	-37.14	17.02	19.44	2.42
1 599.00	28.03	RMS	V	26.15	-37.10	17.08	19.44	2.36

B. Sub-band 2 (3 960 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 560.00	28.43	RMS	V	26.03	-37.16	17.30	19.44	2.14
1 599.00	28.12	RMS	V	26.15	-37.10	17.17	19.44	2.27

C. Sub-band 3 (4 488 ㎒)

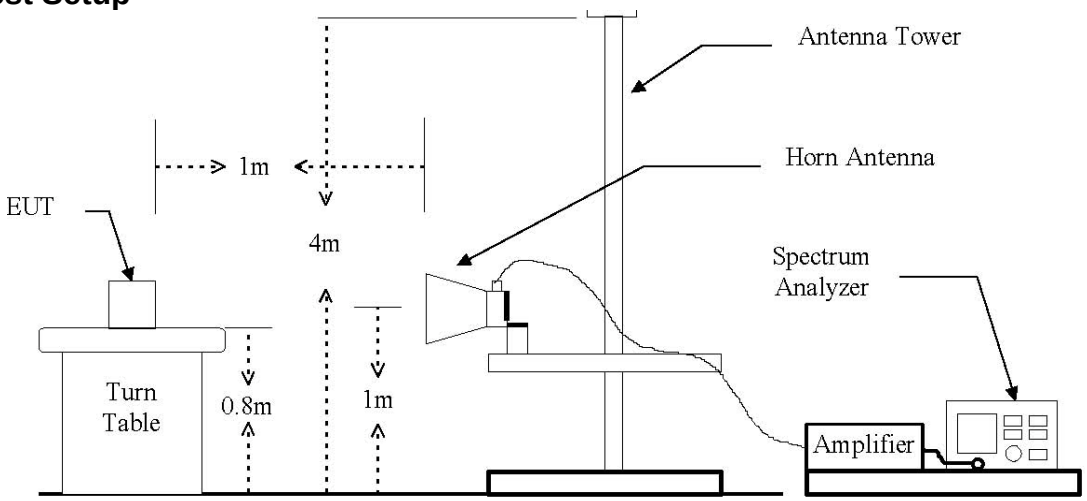
Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 560.00	28.08	RMS	V	26.03	-37.16	16.95	19.44	2.49
1 570.00	27.26	RMS	V	26.06	-37.15	16.17	19.44	3.27

Remarks;

1. Actual = Reading + AF + AMP + CL
2. The test are measured in the 1 m distance

5. UWB Bandwidth

5.1. Test Setup



5.2. Limit

Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 ㎒, regardless of the fractional bandwidth.

The UWB bandwidth is the frequency band bounded by the points that are 10 ㏈ below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.

Center frequency. The center frequency, f_C, equals $(f_H + f_L)/2$.

Fractional bandwidth. The fractional bandwidth equals $2(f_H – f_L)/ (f_H + f_L)$. The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 ㎒ and 10,600 ㎒.

5.3. Test Procedure

1. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.

2. The horn receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

3. For maximum emission amplitude, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading and was used to determine the frequency at which the highest radiated emission occurs, f_M. Next, the points that are 10 ㏈ or more below the highest radiated emission were observed in a search from f_M in both the lower and higher frequency direction in the measured frequency EIRP graph, they are denoted as f_L and f_H, respectively. The UWB bandwidth is the difference between f_L and f_H.

4. The individual UWB bandwidths were measured for each BAND_ID (nb) of the UWB spectrum. Both horizontal and vertical polarizations were taken into account to determine the full UWB BW on the maximized (in azimuth and elevation) signals.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 10 ㎒

VBW = 10 ㎒ (VBW ≥ RBW)

Sweep = auto

Trace = max hold

Detector function = peak

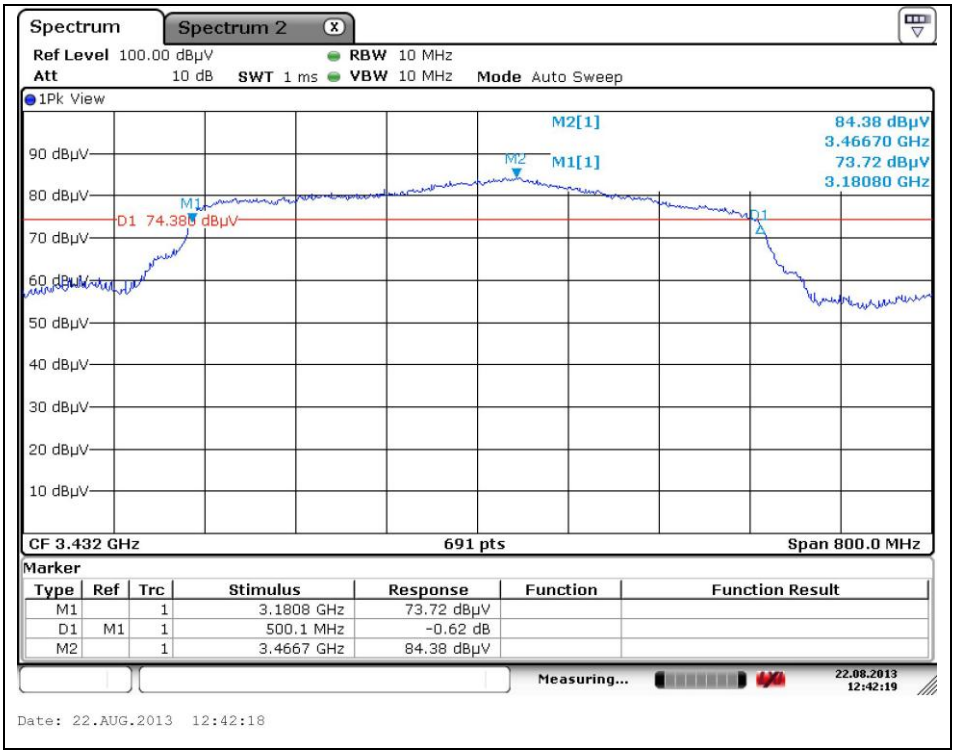
5.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

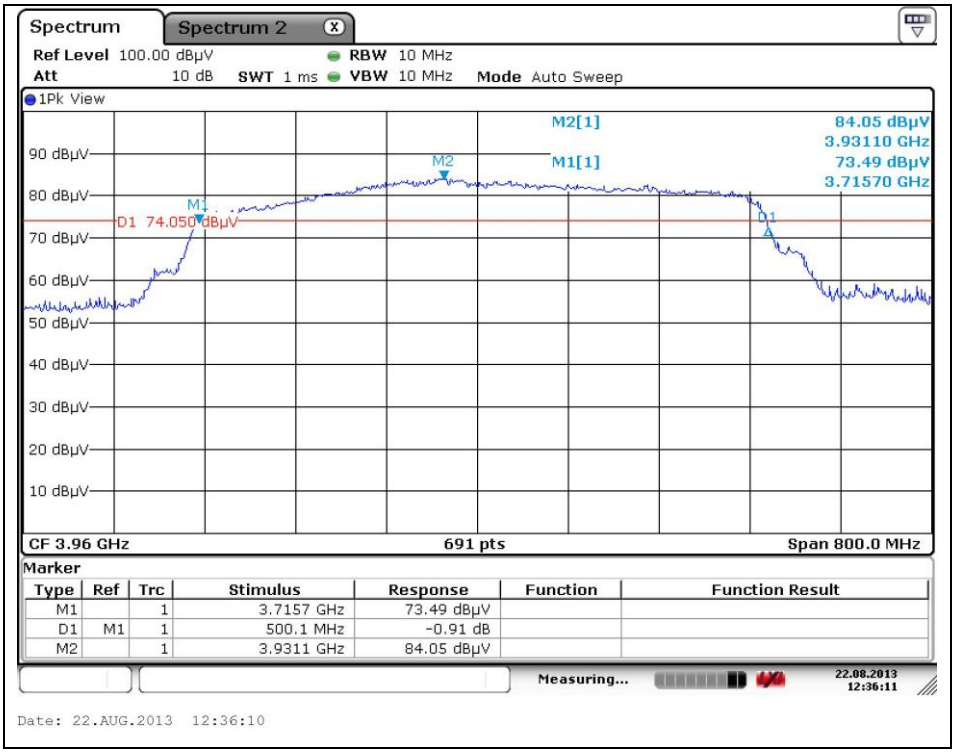
Operation Mode	Channel	Channel Frequency (㎒)	UWB Bandwidth (㎒)
Band Group 1	Sub-band 1	3 432	500.1
	Sub-band 2	3 960	500.1
	Sub-band 3	4 488	508.2

UWB Bandwidth

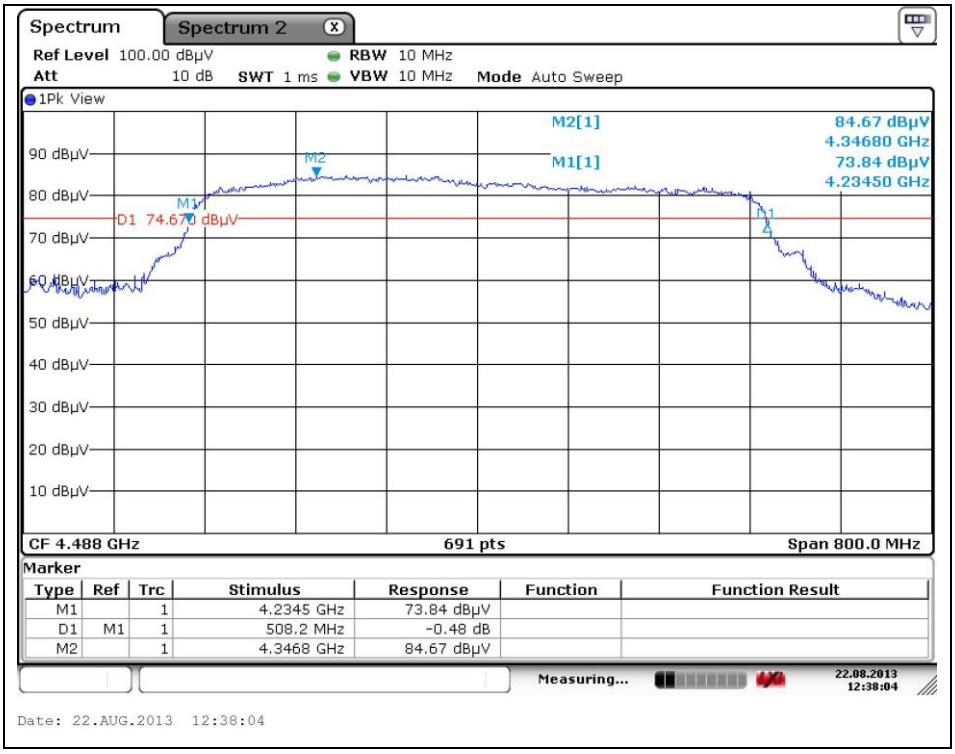
Sub-band 1



Sub-band 2



Sub-band 3



6. Peak Emissions within a 50 ㎒ Bandwidth

6.1. Test Setup

Same as section 5.1. of this report

6.2. Limit

There is a limit on the peak level of the emissions contained within a 10 ㎒ bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 ㏈m EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, EIRP limit has to be adjusted by the resolution bandwidth ratio of 20log(RBW/50) ㏈, where RBW is the resolution bandwidth used for the measurement expressed in ㎒. In addition, This may be converted to a peak field strength level at 3 meters using E(㏈㎶/m) = P(㏈ m EIRP) + 95.2 ㏈. And Peak emission shall be extrapolated to the specified distance using an extrapolation factor of 20 ㏈/decade form 3m to 1m. Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (㏈); Limit line = specific limits (㏈㎶) + distance extrapolation factor [9.54 ㏈]

Peak EIRP limit ㏈m (RB / VB : 50 ㎒)	Peak EIRP limit ㏈m (RB / VB: 10 ㎒)	E- Field (㏈㎶/m) at 3m (RB / VB: 10 ㎒)	E- Field (㏈㎶/m) at 1 m (RB / VB: 10 ㎒)
0	-13.97	81.23	90.77

6.3. Test Procedure

1. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1 meters far away from the turntable.
2. The horn receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
3. For maximum peak emission amplitude, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading and was used to determine the frequency at which the highest radiated emission occurs, f_M.
4. The individual UWB bandwidths were measured for each BAND_ID (nb) of the UWB spectrum. Both horizontal and vertical polarizations were taken into account to determine the full UWB BW on the maximized (in azimuth and elevation) signals.
5. A spectrum analyzer was used for the final measurement utilizing a peak detector at the frequency with the largest amplitude. The prescribed resolution bandwidth of 50 ㎒ was not supported by the spectrum analyzer. However, when a peak measurement is required, The resolution bandwidth for this measurement was set to 10 ㎒, and the measurement was centered on the frequency at which the highest radiated emission occurred, f_M. The video bandwidth was 10 ㎒.

The spectrum analyzer is set to:

RBW = 10 ㎒	Span = 600 ㎒
VBW = 10 ㎒	Sweep = auto
Detector function = peak	Trace = max hold

6.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

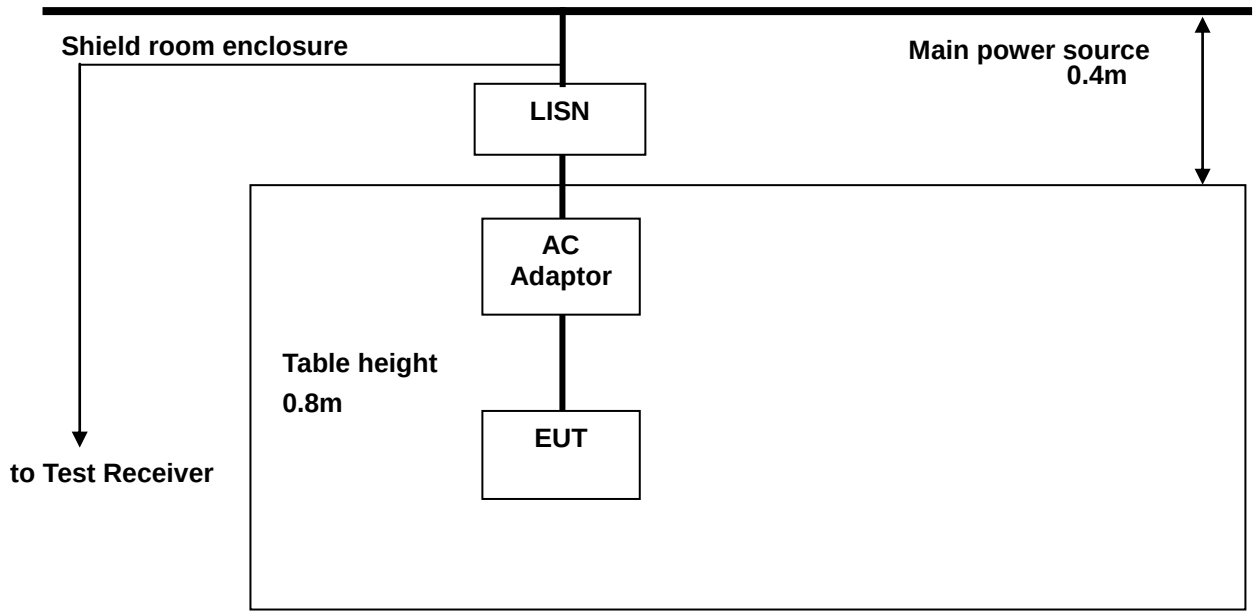
Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 432	84.56	Peak	V	30.86	-33.51	81.91	90.77	8.86
3 960	84.44	Peak	V	32.21	-32.55	84.10	90.77	6.67
4 488	85.38	Peak	V	32.85	-31.78	86.45	90.77	4.32
3 432	79.33	Peak	H	30.86	-33.51	76.68	90.77	14.09
3 960	79.15	Peak	H	32.21	-32.55	78.81	90.77	11.96
4 488	80.01	Peak	H	32.85	-31.78	81.08	90.77	9.69

Remarks;

1. Actual = Reading + AF + AMP + CL

7. Transmitter AC Power Line Conducted Emission

7.1. Test Setup



7.2. Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (㏈㎶)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

7.3. Test Procedures

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.
AC line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4-2003

1. The test procedure is performed in a 6.5m × 3.6m× 3.6m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT were moved to find the maximum emission.

7.4. Test Results (Worst case_Bandgroup1_ Sub-band 3)

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

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Frequency range : 0.15 ㎒ – 30 ㎒
Measured Bandwidth : 9 ㎑

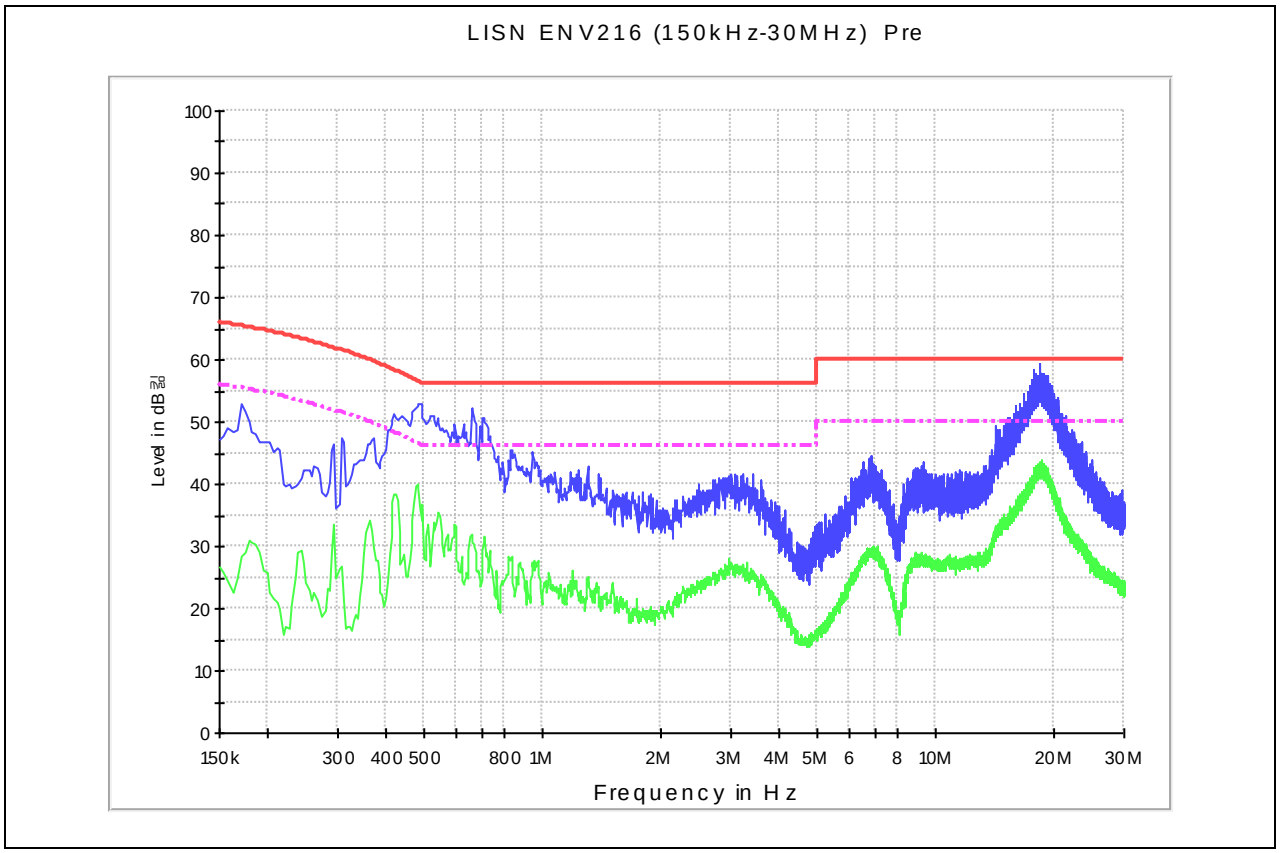
FREQ.	LEVEL(dB㎶)		LINE	LIMIT(dB㎶)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.49	48.25	36.32	N	56.24	46.24	7.99	9.92
0.66	45.38	32.80	N	56.00	46.00	10.62	13.20
3.09	34.09	27.30	N	56.00	46.00	21.92	18.70
6.82	36.81	29.88	N	60.00	50.00	23.19	20.12
9.26	34.42	28.30	N	60.00	50.00	25.58	21.70
18.27	52.14	42.63	N	60.00	50.00	7.86	7.37
0.51	51.36	39.51	H	56.00	46.00	4.64	6.49
0.73	44.43	30.88	H	56.00	46.00	11.57	15.12
3.11	32.06	23.93	H	56.00	46.00	23.94	22.07
6.90	37.28	31.07	H	60.00	50.00	22.72	18.93
9.87	31.50	25.15	H	60.00	50.00	28.50	24.85
18.51	50.58	42.34	H	60.00	50.00	9.42	7.66

Note ;

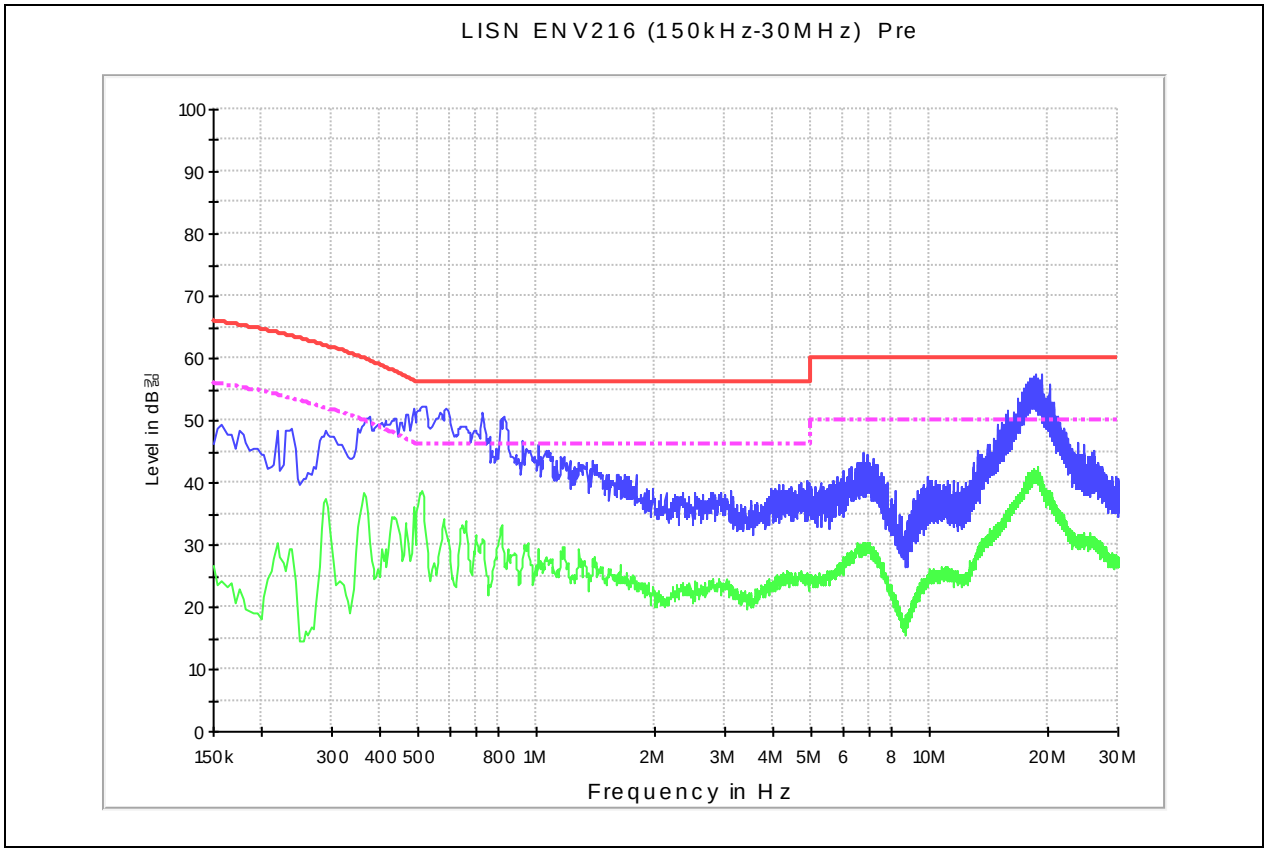
1. Line (H): Hot, Line (N): Neutral
2. All modes of operation were investigated and the worst-case emissions are reported using Test mode 3
3. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section of the Title 47 CFR.
4. Traces shown in plot mad using a peak detector and average detector
5. Deviations to the Specifications: None.

Plots of Conducted Power line

Test mode : (Neutral)



Test mode : (Hot)



8. Antenna Requirement

8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, 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.

8.2. Antenna Connected Construction

Antenna used in this product is Integral Chip type