

# Test Report

## FCC Part15 Subpart F & RSS 220

Product Name : UWB device  
Model No. : X4M02  
FCC ID : 2AD9QX4M02  
IC : 22782-X4M02

Applicant : Novelda AS

Address : Garverivegen 2, NO-3850 Kviteseid, Norway

Date of Receipt : Jul. 05th, 2017

Test Date : Jun. 29th, 2017~ Jun. 30th, 2017

Issued Date : Aug. 17th, 2017

Report No. : 1772022R-RF-US-P06V02

Report Version : V1.2

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by any agency of the government.

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# Test Report Certification

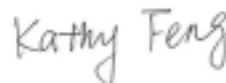
Issued Date : Aug. 17th, 2017

Report No. : 1772022R-RF-US-P06V02



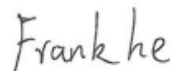
Product Name : UWB device  
Applicant : Novelda AS  
Address : Garverivegen 2, NO-3850 Kviteseid, Norway  
Manufacturer : Novelda AS  
Address : Garverivegen 2, NO-3850 Kviteseid, Norway  
Model No. : X4M02  
FCC ID : 2AD9QX4M02  
IC : 22782-X4M02  
EUT Voltage : DC 3V~5.5V  
Applicable Standard : FCC CFR Title 47 Part 15 Subpart F: 2015  
RSS-GEN Issue4; RSS-220 Issue1  
ANSI C63.10: 2013; ANSI C63.4: 2014  
Test Result : Complied  
Performed Location : DEKRA Testing & Certification (Suzhou) Co., Ltd.  
No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006,  
Jiangsu, China  
TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098  
FCC Registration Number: 800392; IC Lab Code: 4075B

Documented By :



( Adm. Specialist: Kathy Feng )

Reviewed By :



(Senior Engineer: Frank He )

Approved By :



(Engineering Manager: Harry Zhao )

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**History of This Test Report**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
1772022R-RF-US-P06V02	V1.0	Initial Issued Report	Jul. 12th, 2017
1772022R-RF-US-P06V02	V1.1	Added 18~40GHz data in the report and separate Radiated Emission in GPS band and Operational Limitations two items in the report.	Aug. 11th, 2017
1772022R-RF-US-P06V02	V1.2	Update the operational limitations data.	Aug. 17th, 2017

**1. General Information****1.1. EUT Description**

Product Name	UWB device
Model No.	X4M02
Working Voltage	DC 3V~5.5V
Hardware version	000164-010
Software version	XE 2.5.0-alpha.7
Frequency Range	6~8.5GHz
Channel Number	1
Antenna Type	PCB Antenna

## 1.2. Mode of Operation

Test Mode
Mode 1: Transmit

Note:

1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

**1.3. Tested System Details**

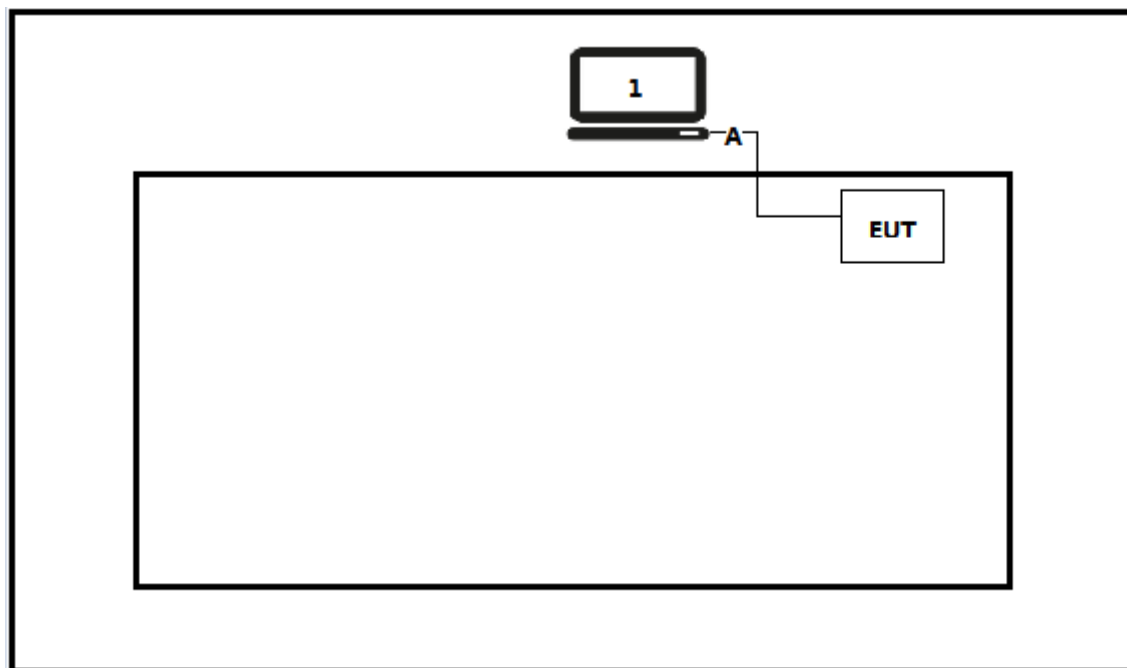
The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	N/A	N/A	N/A	N/A	N/A

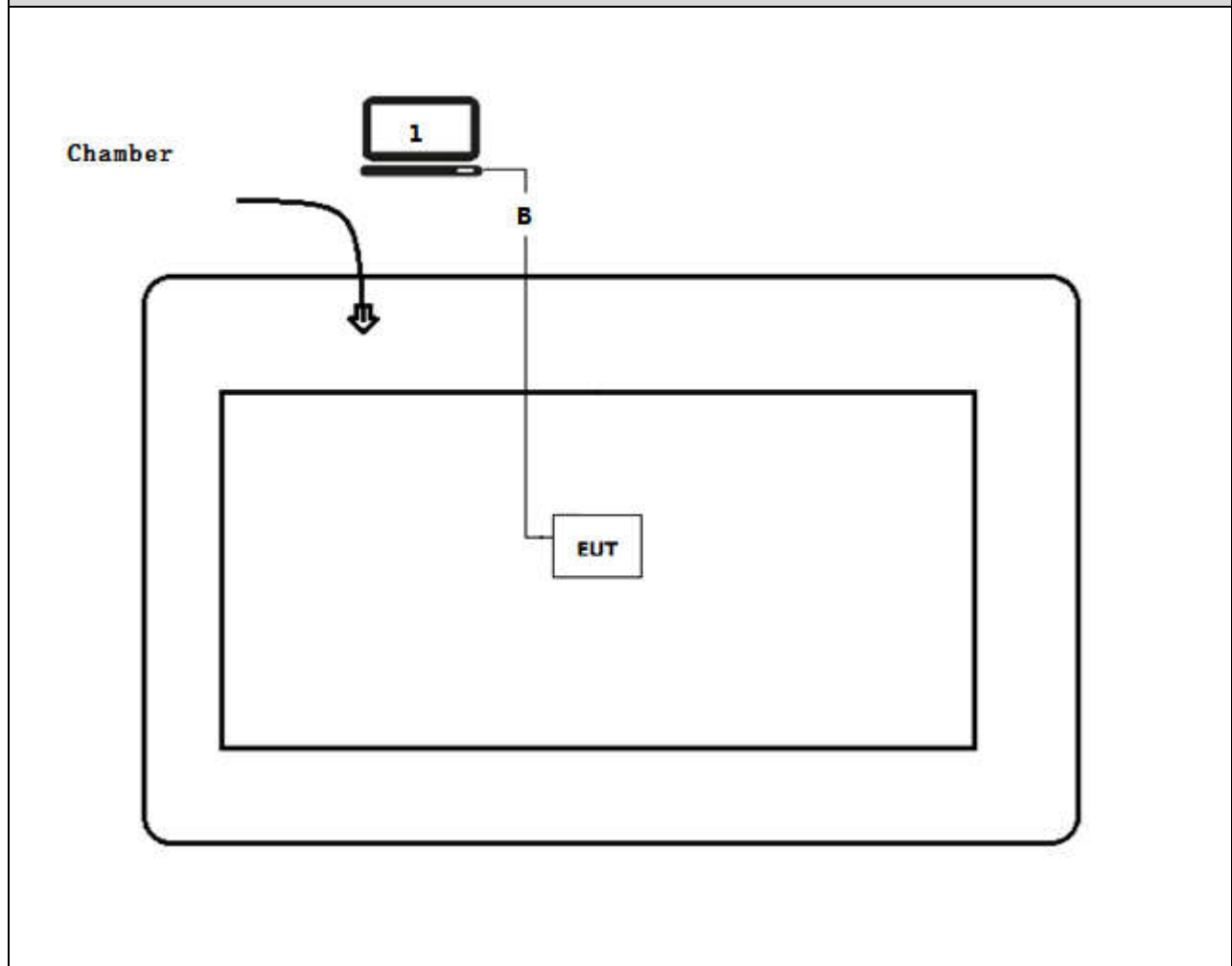


## 1.4. Configuration of Tested System

Test setup Diagram- AC Line Conducted Emission Test



## Test setup Diagram- Radiated Emission



Signal Cable Type		Signal Cable Description
A	USB cable	3m with shield
B	USB cable	3m with shield

### 1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of all equipment. and start to test

## 2. Technical Test

### 2.1. Summary of Test Result

- ☒ No deviations from the test standards  
☐ Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.207	Yes	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.209; FCC CFR Title 47 Part 15 Subpart F: 2015 15.519(c)	Yes	No
Radiated Emission in GPS band	FCC CFR Title 47 Part 15 Subpart F: 2015 15.519(d)	Yes	No
Operational Limitations	FCC CFR Title 47 Part 15 Subpart F: 2015 15.519(a)	Yes	No
10dB Bandwidth	FCC CFR Title 47 Part 15 Subpart F: 2015 Section 15.503(a)	Yes	No
EIRP	FCC CFR Title 47 Part 15 Subpart F: 2015 Section 15.521(g)	Yes	No
Antenna Requirement	FCC CFR Title 47 Part 15 Subpart F: 2015 Section 15.203	Yes	No

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	RSS GEN Issue4 Clause 8.8	Yes	No
Radiated Emission	RSS GEN Issue4 Clause 8.9; RSS 220 Issue1 Clause 5.3(c)	Yes	No
Radiated Emission in GPS band	RSS 220 Issue1 Clause 5.3(d)	Yes	No
Operational Limitations	RSS 220 Issue1 Clause 5.3(b)	Yes	No
10dB Bandwidth	RSS 220 Issue1 Clause 5.1(a)	Yes	No
EIRP	RSS 220 Issue1 Clause 5.3(e)	Yes	No
Antenna Requirement	RSS GEN Issue4 Clause 8.3	Yes	No

## 2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

### 3. Conducted Emission

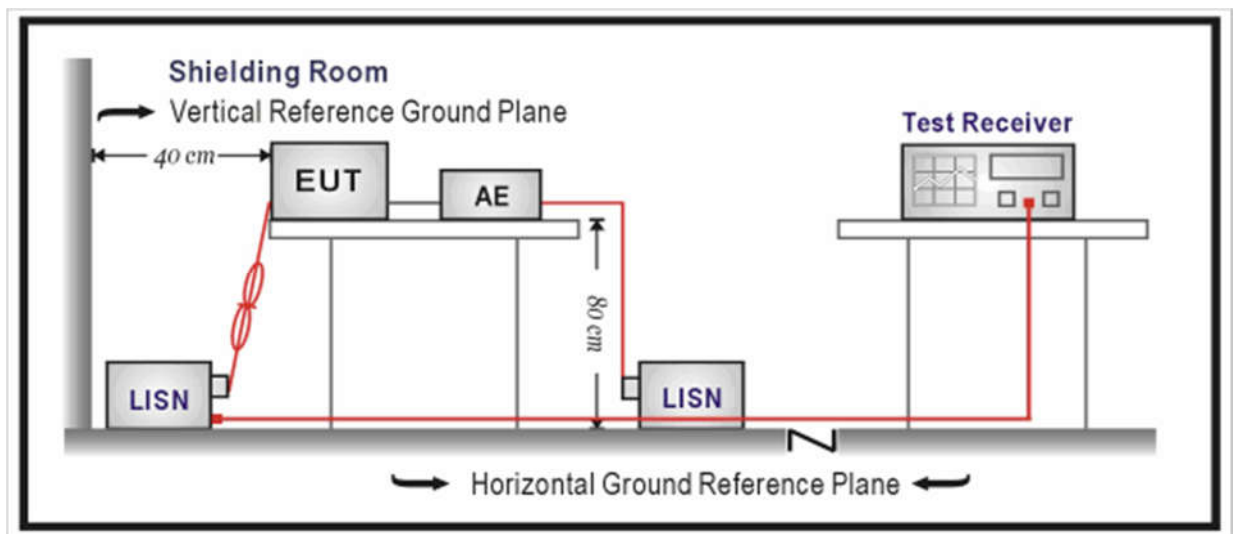
#### 3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100726	2017.09.16
Two-Line V-Network	R&S	ENV216	100043	2017.08.07
Two-Line V-Network	R&S	ENV216	100044	2017.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	N/A
50ohm Termination	SHX	TF2	07081401	2017.09.16
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2018.01.07

Note: All equipment are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

#### 3.2. Test Setup



### 3.3. Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 – 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

### 3.4. Test Procedure

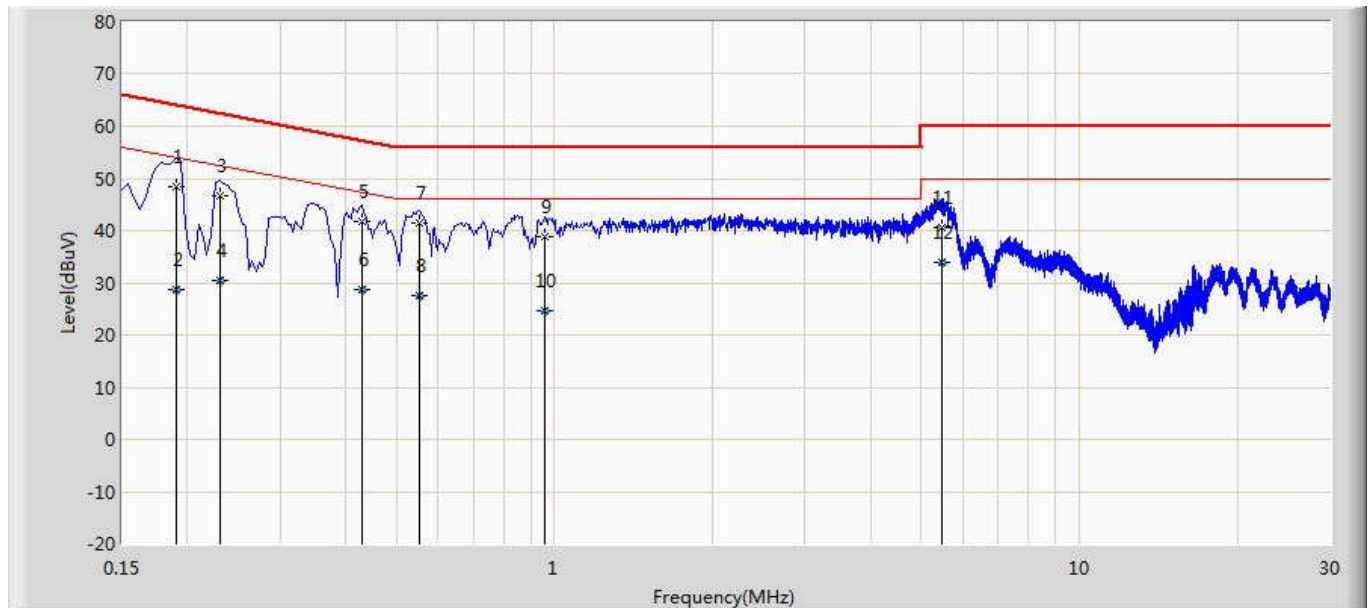
The EUT was setup according to ANSI C63.4: 2014, and tested according to FCC 47CFR 15.207 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

### 3.5. Uncertainty

The measurement uncertainty is defined as  $\pm 2.02$  dB

### 3.6. Test Result

Site: TR1	Time: 2017/07/09 - 08:41
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Line
EUT: UWB device	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Probe (dB)	Cable (dB)	Amp (dB)	Type
1		0.190	48.418	38.798	-15.619	64.037	9.592	0.028	0.000	QP
2		0.190	28.759	19.140	-25.277	54.037	9.592	0.028	0.000	AV
3		0.230	46.712	37.092	-15.738	62.450	9.590	0.030	0.000	QP
4		0.230	30.361	20.740	-22.089	52.450	9.590	0.030	0.000	AV
5		0.430	41.769	32.138	-15.484	57.253	9.590	0.041	0.000	QP
6		0.430	28.685	19.054	-18.568	47.253	9.590	0.041	0.000	AV
7	*	0.554	41.474	31.837	-14.526	56.000	9.590	0.047	0.000	QP
8		0.554	27.538	17.901	-18.462	46.000	9.590	0.047	0.000	AV
9		0.958	38.978	29.316	-17.022	56.000	9.599	0.064	0.000	QP
10		0.958	24.517	14.855	-21.483	46.000	9.599	0.064	0.000	AV
11		5.466	40.679	30.902	-19.321	60.000	9.625	0.153	0.000	QP
12		5.466	33.846	24.068	-16.154	50.000	9.625	0.153	0.000	AV

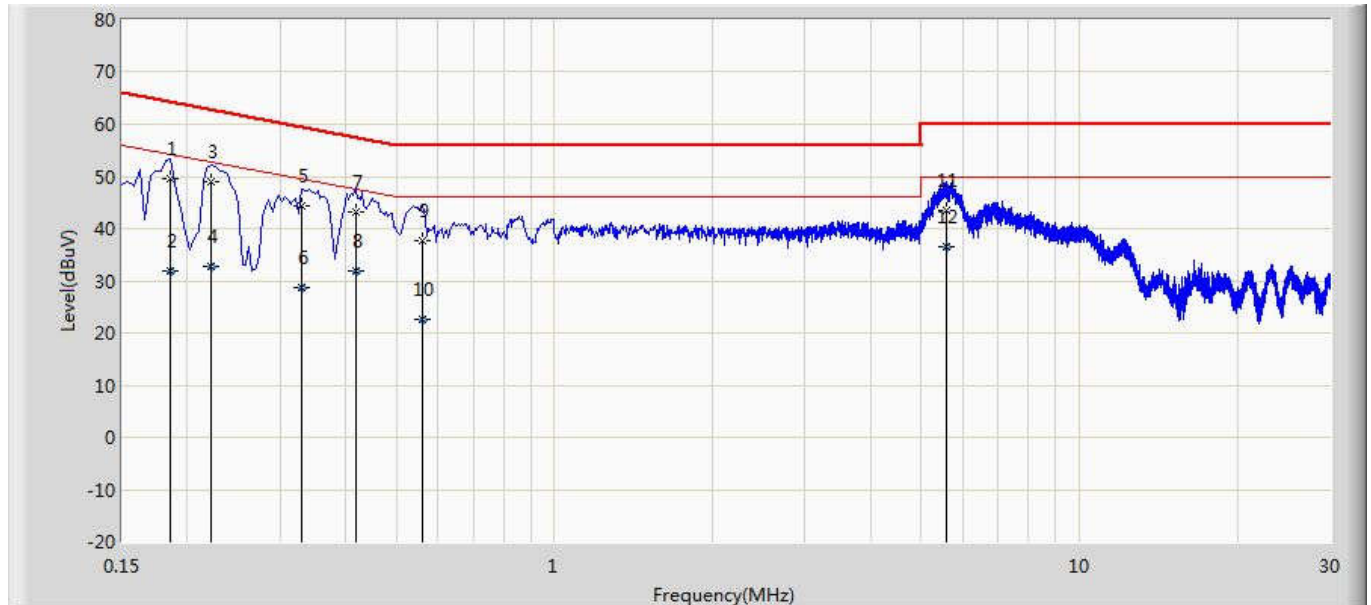
Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.



2. " \* ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Factor(Probe+Cable-Amp).

Site: TR1	Time: 2017/07/09 - 08:44
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Neutral
EUT: UWB device	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Probe (dB)	Cable (dB)	Amp (dB)	Type
1		0.186	49.705	40.106	-14.508	64.213	9.573	0.027	0.000	QP
2		0.186	32.007	22.407	-22.207	54.213	9.573	0.027	0.000	AV
3		0.222	49.006	39.403	-13.738	62.744	9.571	0.031	0.000	QP
4		0.222	32.811	23.208	-19.933	52.744	9.571	0.031	0.000	AV
5		0.330	44.370	34.763	-15.081	59.451	9.575	0.033	0.000	QP
6		0.330	28.589	18.981	-20.862	49.451	9.575	0.033	0.000	AV
7		0.418	43.255	33.638	-14.233	57.488	9.578	0.039	0.000	QP
8		0.418	31.961	22.344	-15.527	47.488	9.578	0.039	0.000	AV
9		0.562	37.794	28.160	-18.206	56.000	9.589	0.045	0.000	QP
10		0.562	22.493	12.859	-23.507	46.000	9.589	0.045	0.000	AV
11		5.586	43.378	33.608	-16.622	60.000	9.616	0.154	0.000	QP
12	*	5.586	36.409	26.640	-13.591	50.000	9.616	0.154	0.000	AV

#### Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. " \* ", means this data is the worst emission level.

## 4. Radiated Emission

### 4.1. Test Equipment

#### Radiated Emission / AC-2

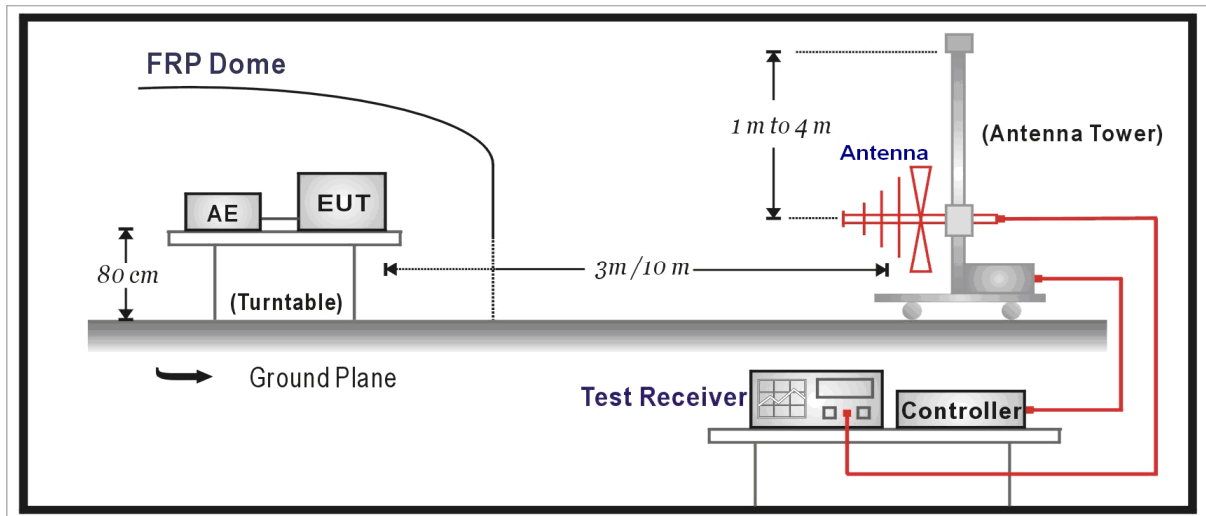
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2018.03.10
Loop Antenna	R&S	HFH2-Z2	833799/003	2017.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2017.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2018.02.28
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2018.01.07

#### Radiated Emission / AC-5

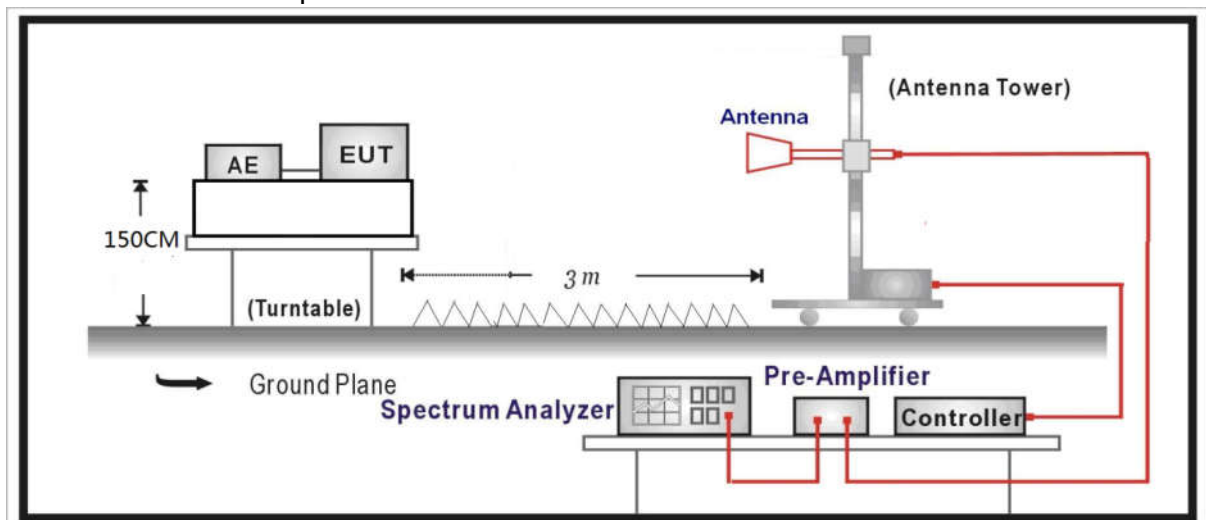
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2018.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2018.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2018.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2017.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	733	2018.02.26
DRG Horn	ETS-Lindgren	3117	00167055	2017.07.16
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2018.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2018.02.28
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2018.01.07

## 4.2. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



### 4.3. Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dB $\mu$ V/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dB  $\mu$  V/m) = 20 log E field strength (  $\mu$  V/m)

Note 4: E field strength (dB  $\mu$  V/m) = EIRP (dBm) + 95.2

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Fundamental frequency (MHz)	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

#### 4.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2014 & ANSI C63.10: 2013 for compliance to FCC 47CFR 15.519 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground for below 1GHz and 1.5 meter above ground for above 1GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2014 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz. The video bandwidth are normally three times of resolution bandwidth.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

#### 4.5. Uncertainty

The measurement uncertainty above 1G is defined as  $\pm 3.9$  dB

below 1G is defined as  $\pm 3.8$  dB

#### 4.6. Test Result

##### Mode 1: Transmitter

Chain	CH	Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
Ant 0	1	H	6916.000	-49.165	4.195	-44.970	-41.3(Note3)	-3.67	PK
		H	7086.000	-51.085	4.301	-46.784	-41.3(Note3)	-5.484	PK
		V	7018.000	-36.347	3.435	-32.912	N/A	N/A	PK
		V	7018.000	-49.109	3.435	-45.674	-41.3	-4.374	AV
		V	14580.000	-59.886	11.752	-48.134	N/A	N/A	PK
		V	14580.000	-76.938	11.752	-65.186	-61.3	-3.886	AV

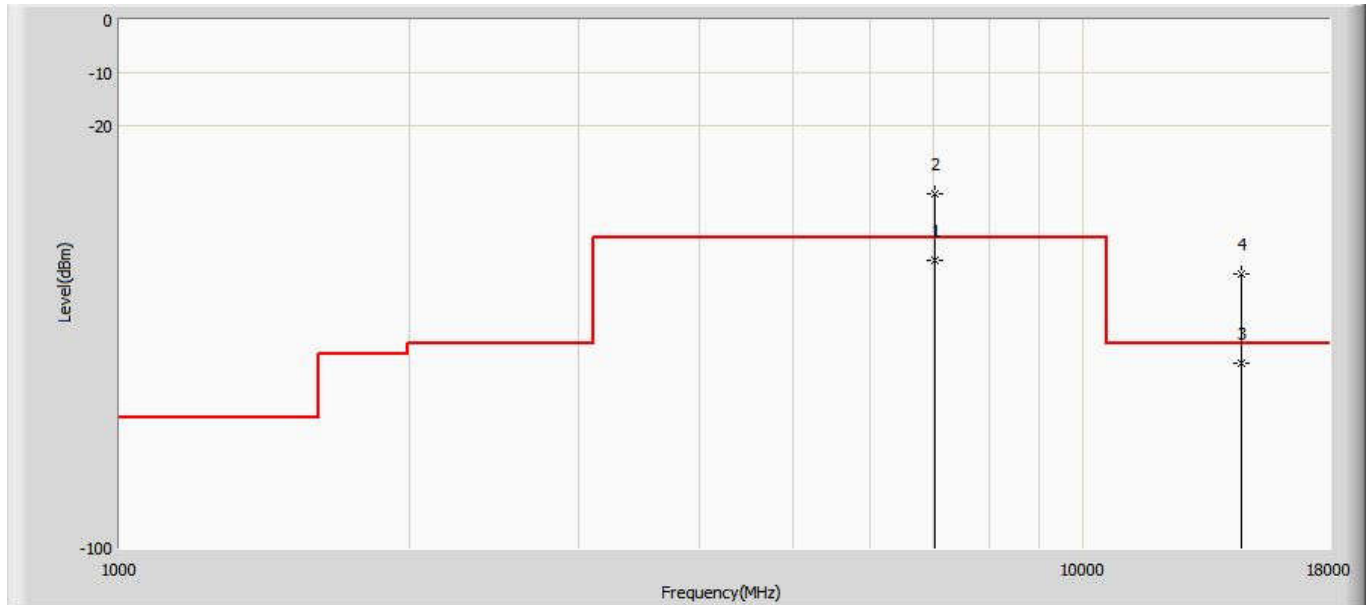
Note: 1. Measure Level = Reading Level + Factor.

Note: 2. The test frequency range, 9kHz~30MHz, 18GHz~40GHz, both of the worst case are at least 20dB below the limits, therefore no data appear in the report.

Note: 3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Note 4: E field strength (dB  $\mu$  V/m) = EIRP (dBm) + 95.2

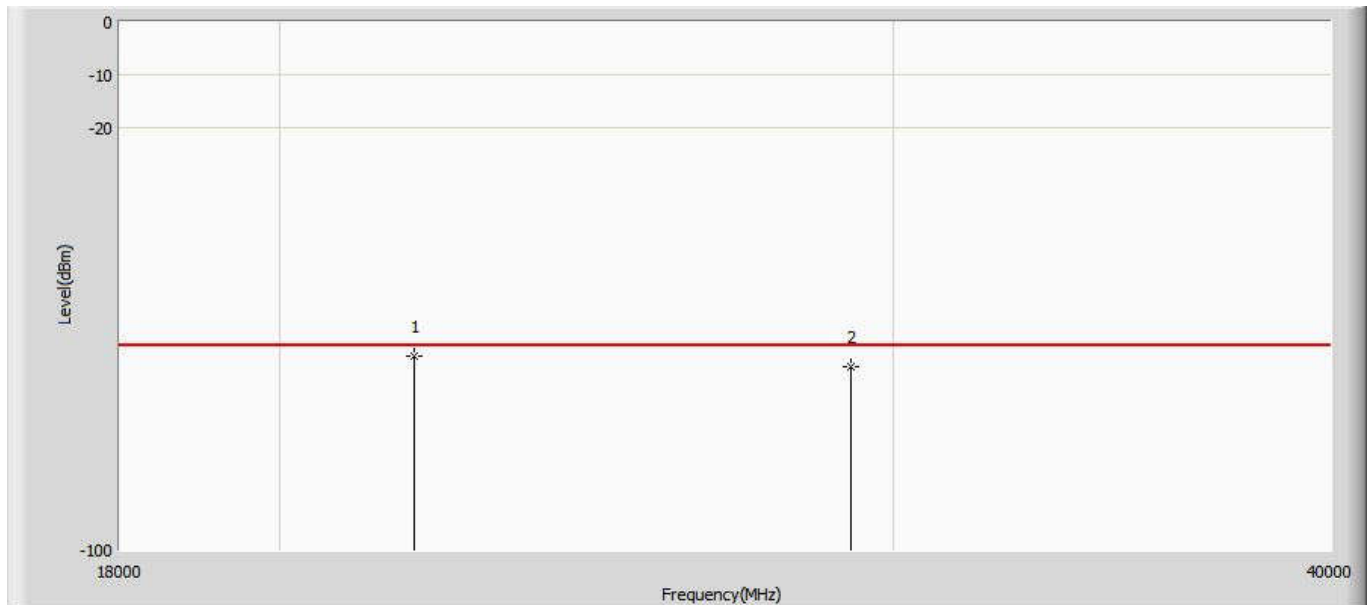
Site: AC5	Time: 2017/07/11 - 14:02
Limit: UWB-1	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Vertical
EUT: X4M02	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		7018.000	-45.674	-49.109	-4.374	-41.300	3.435	AV
2		7018.000	-32.912	-36.347	8.388	-41.300	3.435	PK
3		14580.000	-65.186	-76.938	-3.886	-61.300	11.752	AV
4	*	14580.000	-48.134	-59.886	13.166	-61.300	11.752	PK

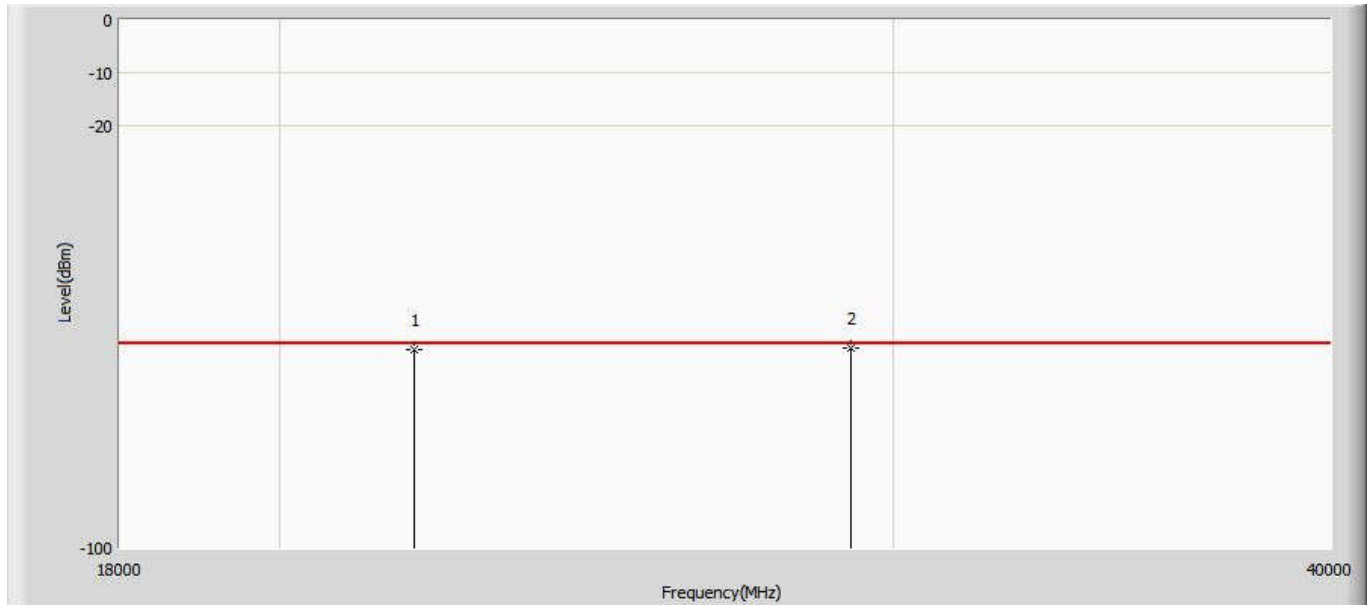


Site: AC5	Time: 2017/08/08- 17:29
Limit: UWB-1	Margin: 0
Probe: 18-40G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M02	Power: DC5V
Note: Mode1	



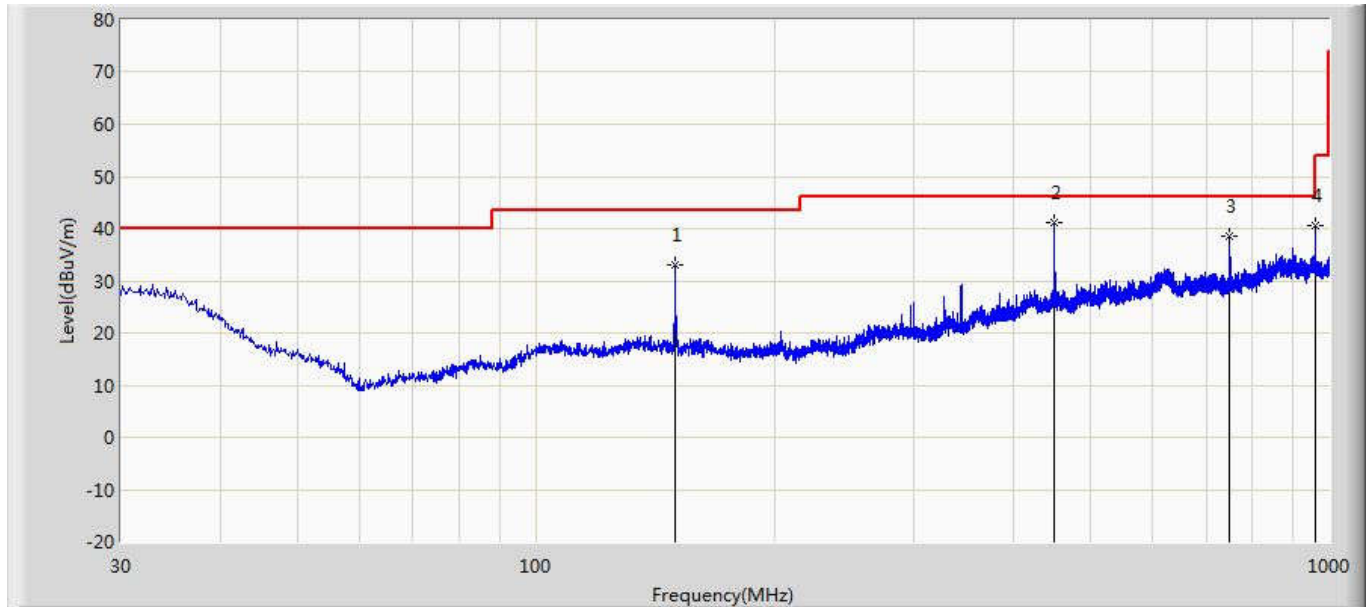
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	21870.000	-63.354	-56.722	-2.054	-61.300	-6.632	PK
2		29160.000	-65.461	-69.045	-4.161	-61.300	3.584	PK

Site: AC5	Time: 2017/08/08 - 17:29
Limit: UWB-1	Margin: 0
Probe: 18-40G(2016.12.1 Change)	Polarity: Vertical
EUT: X4M02	Power: DC5V
Note: Mode1	



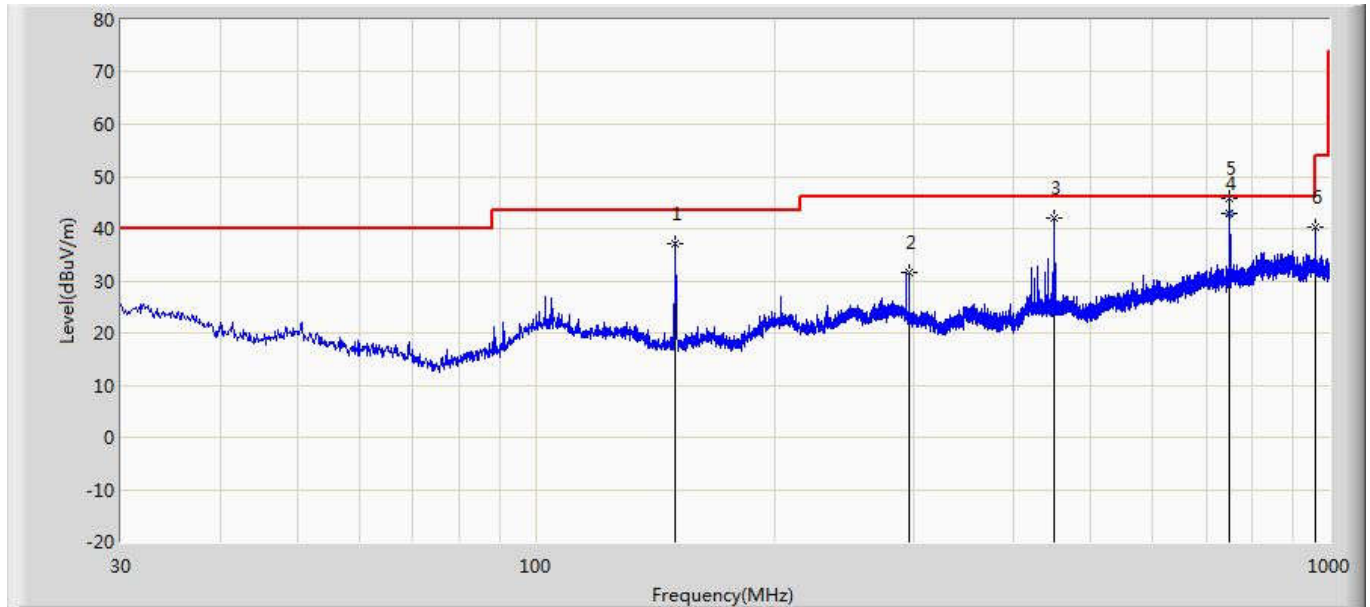
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		21870.000	-62.476	-55.675	-1.176	-61.300	-6.801	PK
2	*	29160.000	-62.112	-64.598	-0.812	-61.300	2.486	PK

Site: AC2	Time: 2017/07/03 - 15:01
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Horizontal
EUT: UWB device	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		149.916	32.972	15.984	-10.528	43.500	16.988	PK
2	*	450.010	41.266	14.341	-4.734	46.000	26.925	PK
3		750.104	38.682	9.081	-7.318	46.000	29.601	PK
4		960.109	40.654	7.722	-13.346	54.000	32.932	PK

Site: AC2	Time: 2017/07/03 - 15:02
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Vertical
EUT: UWB device	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		149.916	37.023	18.989	-6.477	43.500	18.034	PK
2		295.538	31.649	7.651	-14.351	46.000	23.998	PK
3		450.010	42.169	16.115	-3.831	46.000	26.054	PK
4		749.923	42.957	12.100	-3.043	46.000	30.857	QP
5	*	749.982	45.838	14.977	-0.162	46.000	30.861	PK
6		960.109	40.211	7.348	-13.789	54.000	32.863	PK

Test Result	Pass
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## 5. Radiated Emission in GPS Band

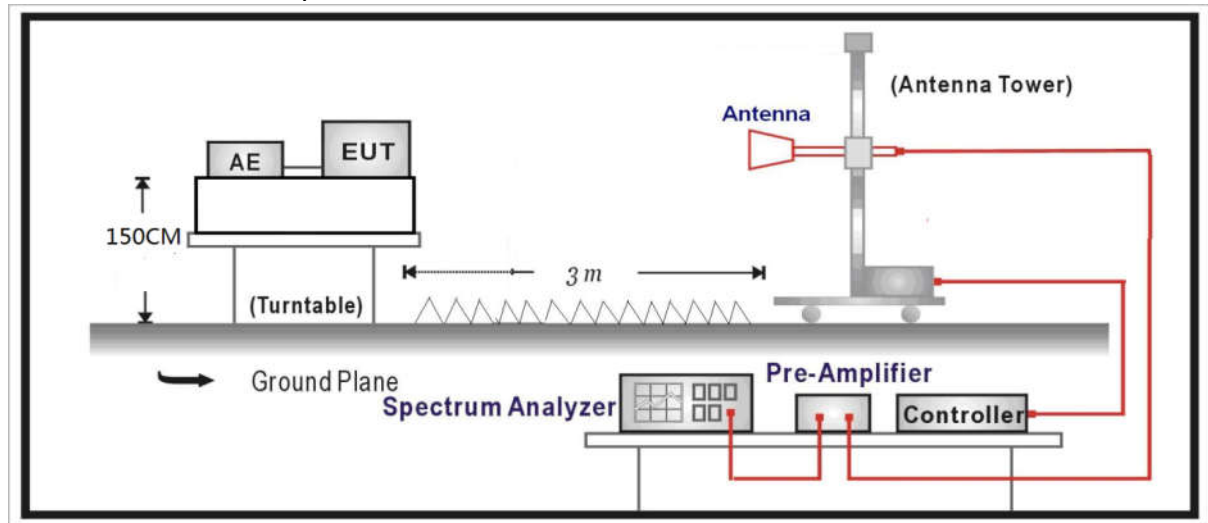
### 5.1. Test Equipment

#### Radiated Emission in GPS Band/ AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2018.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2018.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2018.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2017.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	733	2018.02.26
DRG Horn	ETS-Lindgren	3117	00167055	2017.07.16
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2018.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2018.02.28
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2018.01.07

## 5.2. Test Setup

Above 1GHz Test Setup:



### 5.3. Limit

In addition to the radiated emission limits specified in the table in paragraph (c) of this section, 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 kHz:

Fundamental frequency (MHz)	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

### 5.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2014 & ANSI C63.10: 2013 for compliance to FCC 47CFR 15.519 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2014 on radiated measurement.

The resolution bandwidth is 1kHz. The video bandwidth are normally three times of resolution bandwidth.

The frequency range from 1164-1240MHz & 1559-1610MHz is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

### 5.5. Uncertainty

The measurement uncertainty above 1G is defined as  $\pm 3.9$  dB

## 5.6. Test Result

Mode 1: Transmitter

Chain	CH	Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
Ant 0	1	H	1214.623	-84.668	-4.908	-89.576	-85.3(Note2)	-4.276	PK
		V	1226.745	-85.242	-4.794	-90.036	-85.3(Note2)	-4.736	PK
		H	1586.736	-82.808	-4.356	-87.164	-85.3(Note2)	-1.864	PK
		V	1580.471	-81.534	-4.394	-85.928	-85.3(Note2)	-0.628	PK

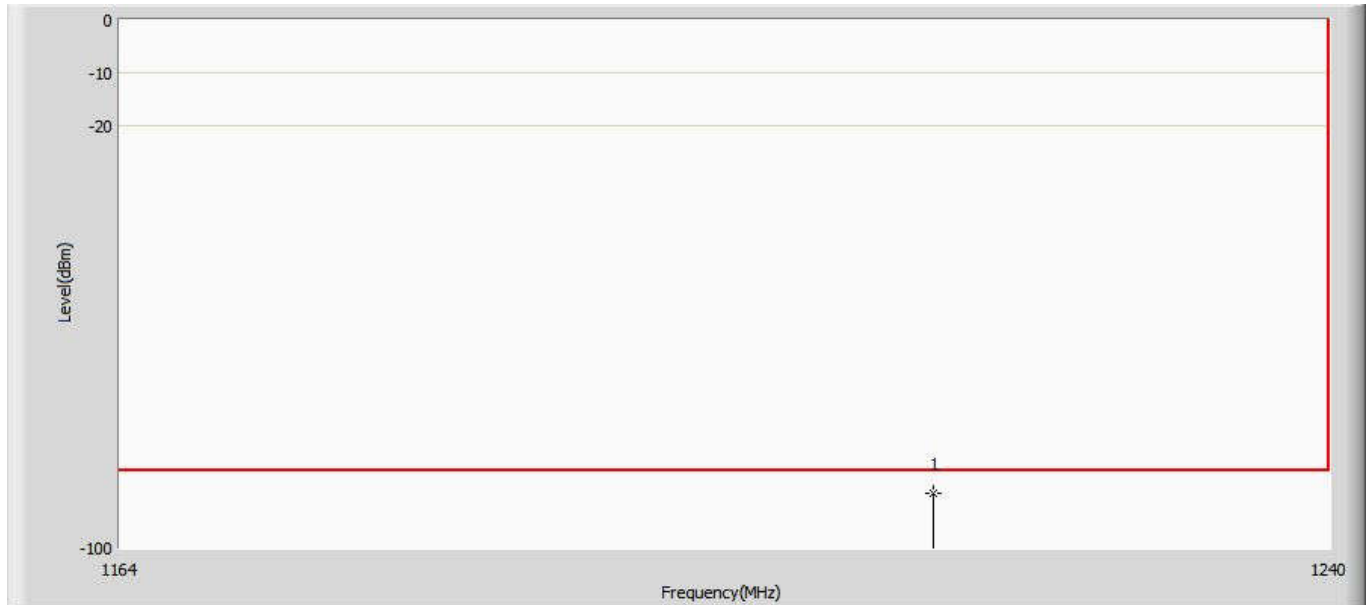
Note: 1. Measure Level = Reading Level + Factor.

Note: 2. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Note 3: E field strength (dB  $\mu$  V/m) = EIRP (dBm) + 95.2

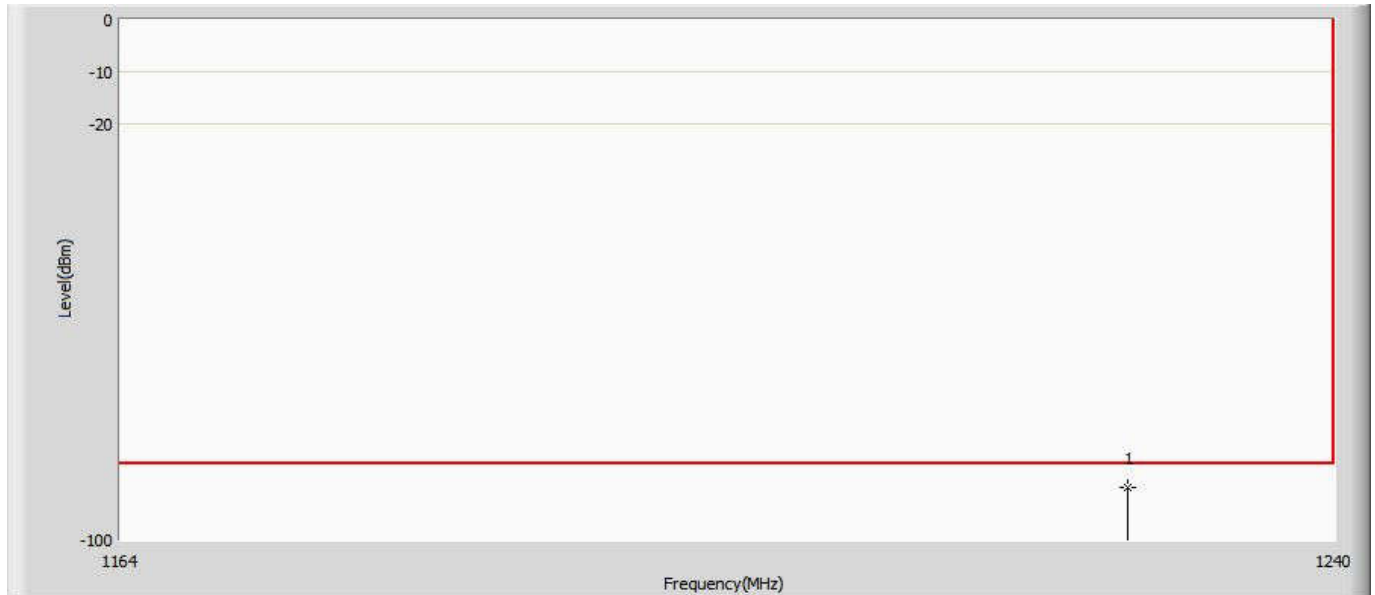


Site: AC5	Time: 2017/07/11 - 14:02
Limit: UWB-4	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M02	Power: DC5V
Note: Mode1	



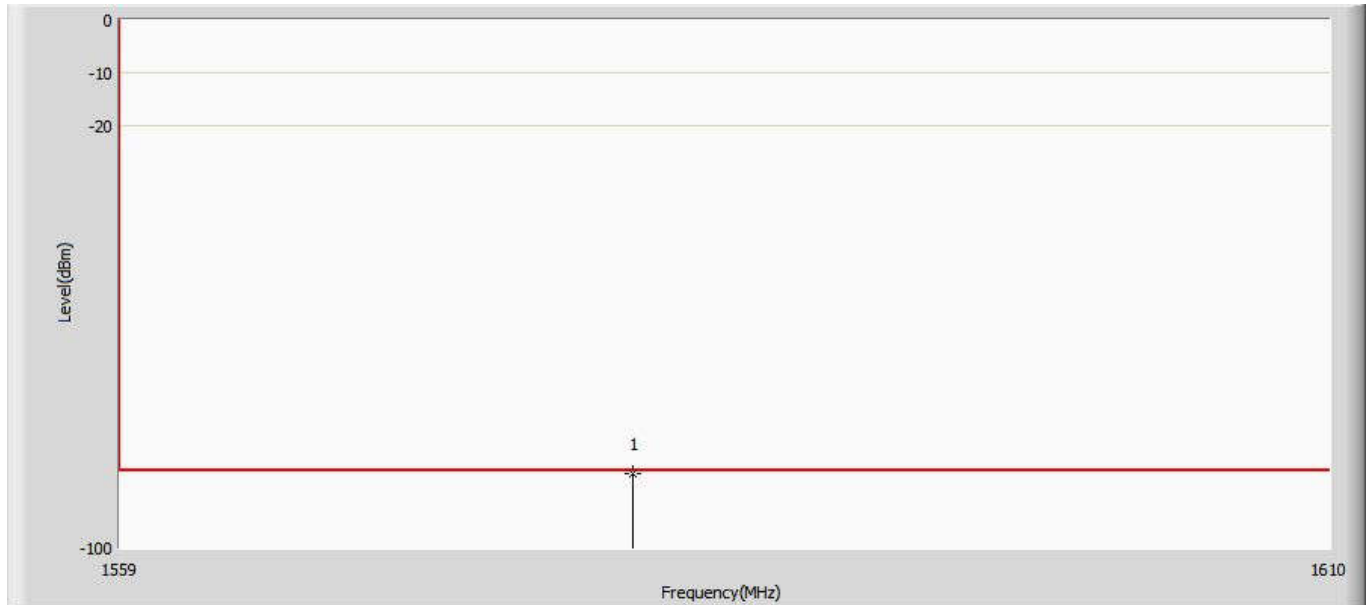
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1214.623	-89.576	-84.668	-4.276	-85.300	-4.908	PK

Site: AC5	Time: 2017/07/11 - 14:04
Limit: UWB-4	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M02	Power: DC5V
Note: Mode1	



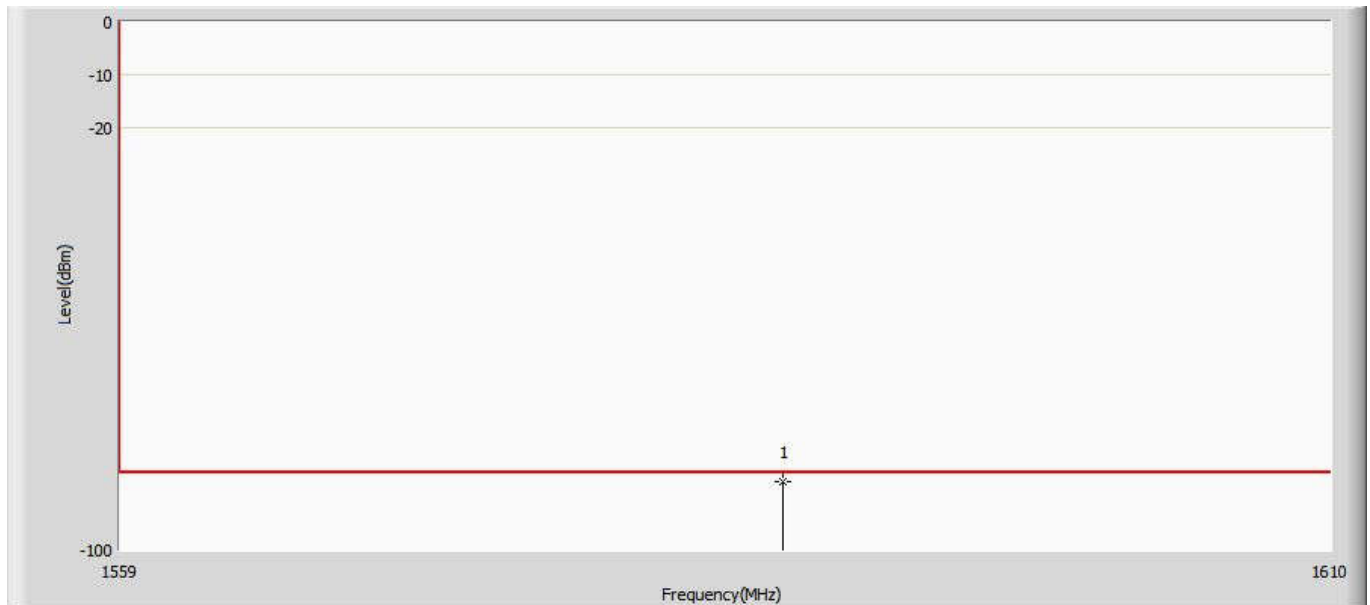
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1226.745	-90.036	-85.242	-4.736	-85.300	-4.794	PK

Site: AC5	Time: 2017/07/11 - 14:03
Limit: UWB-4	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Vertical
EUT: X4M02	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1580.471	-85.928	-81.534	-0.628	-85.300	-4.394	PK

Site: AC5	Time: 2017/07/11 - 14:05
Limit: UWB-4	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Vertical
EUT: X4M02	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1586.736	-87.164	-82.808	-1.864	-85.300	-4.356	PK

Test Result	Pass
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## 6. Operational Limitations

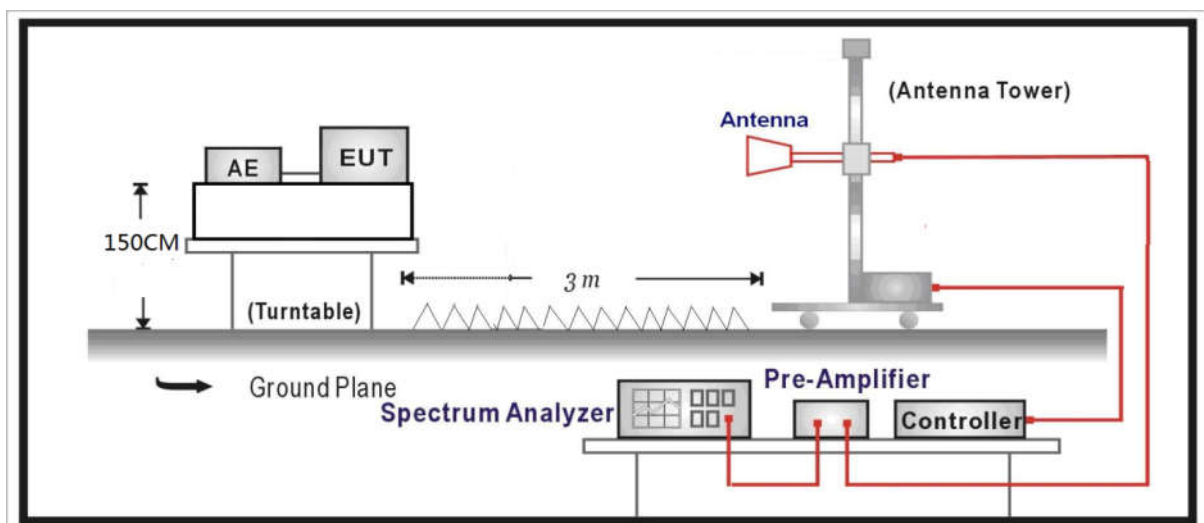
### 6.1. Test Equipment

Operational Limitations / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2018.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2018.05.03
Preamplifier	QuieTek	AP-040G	CHM-090600 1	2018.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2017.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	733	2018.02.26
DRG Horn	ETS-Lindgren	3117	00167055	2017.07.16
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2018.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2018.02.28
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2018.01.07

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 6.2. Test Setup



### 6.3. Limit

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.

#### **6.4. Test Procedure**

The EUT was tested according to ANSI C63.10: 2013 for compliance to FCC 47CFR 15F requirements.

Set RBW = 1 MHz, VBW = 3 MHz, Span = 0 Hz, remove the acknowledgement from the associated receiver to test the result.

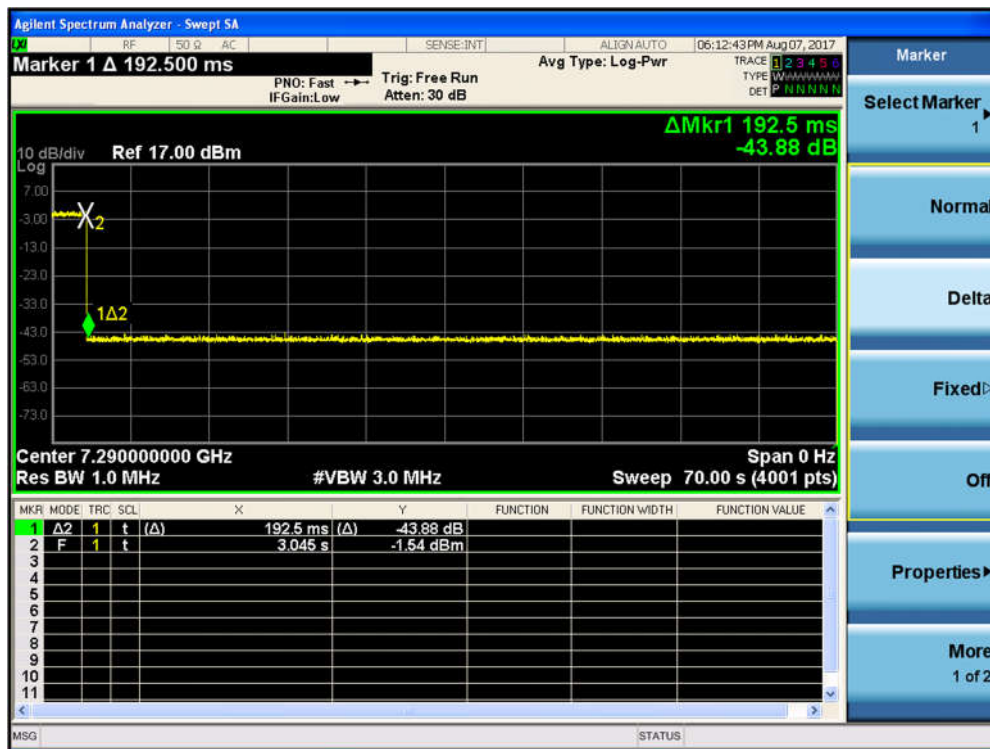
#### **6.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 2\text{ms}$

## 6.6. Test Result

Product	:	UWB device
Test Item	:	Operational Limitations
Test Site	:	AC-5
Test Mode	:	Mode 1: Transmit

Frequency (MHz)	Duration from removing the acknowledgement from the associated receiver to stop transmission (ms)	Limit (s)	Result
7290	780.0	10	Pass







Note: The device starts transmitting and it stops transmitting in 780ms without ACK .

## 7. 10dB Bandwidth

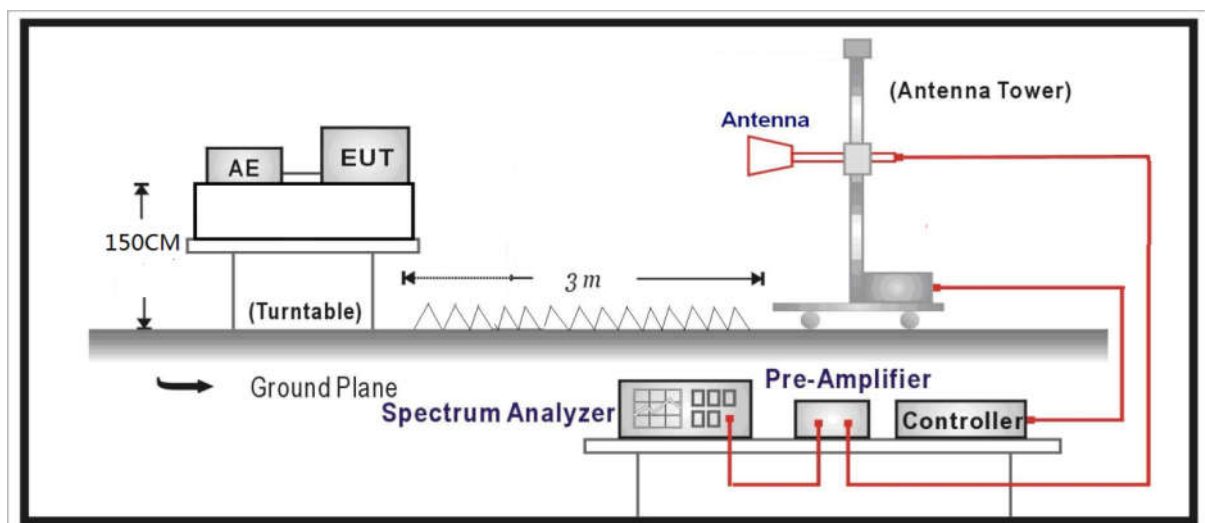
### 7.1. Test Equipment

10dB Bandwidth / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2018.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2018.05.03
Preamplifier	QuieTek	AP-040G	CHM-090600 1	2018.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2017.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	733	2018.02.26
DRG Horn	ETS-Lindgren	3117	00167055	2017.07.16
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2018.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2018.02.28
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2018.01.07

Note: All equipment are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 7.2. Test Setup



### **7.3. 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 MHz, regardless of the fractional bandwidth.

The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

#### **7.4. Test Procedure**

The EUT was tested according to ANSI C63.10: 2013 for compliance to FCC 47CFR 15.503(a) requirements.

Set RBW = 1 MHz, VBW = 3 MHz, Span = 2.5 GHz, use 10dB bandwidth function to test the result.

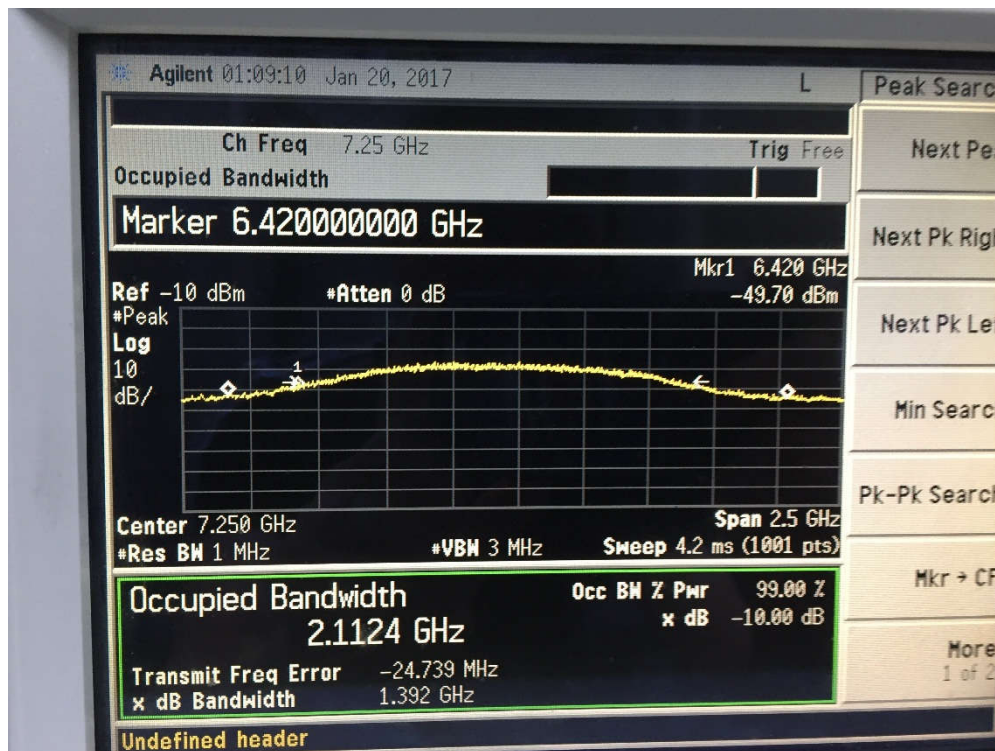
#### **7.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 1$  kHz

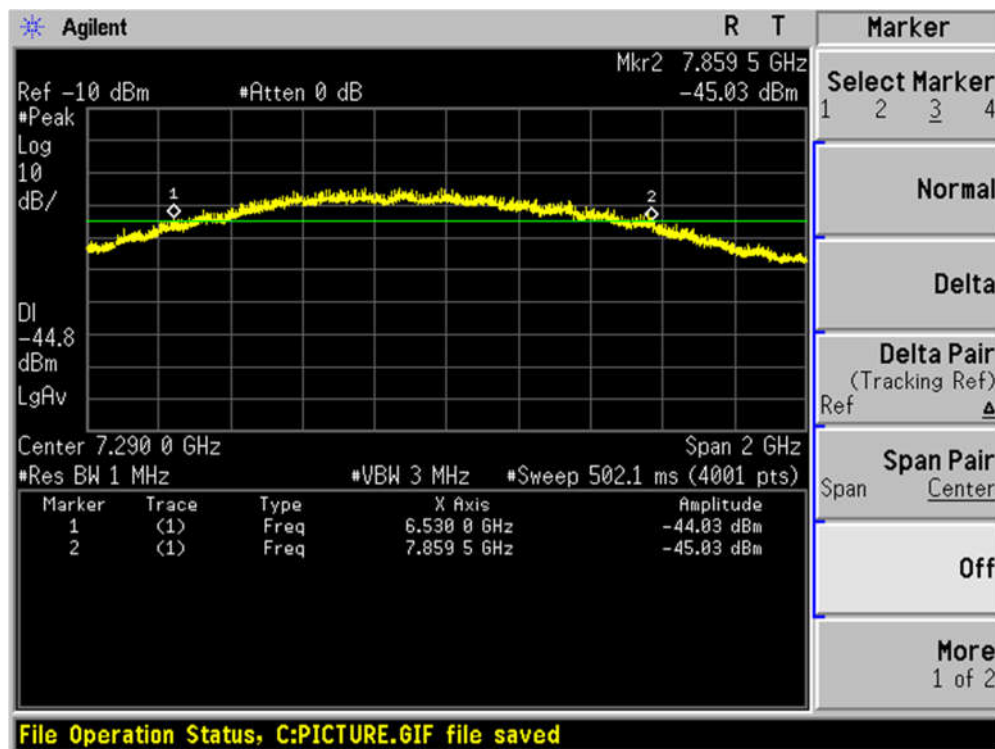
## 7.6. Test Result

Product	:	UWB device
Test Item	:	10dB Bandwidth
Test Site	:	AC-5
Test Mode	:	Mode 1: Transmit

Frequency (MHz)	10dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
7290	1392	2112.4	500	Pass



Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	Limit (MHz)		Result
			Lower Frequency	Upper Frequency	
7290	6530.0	7859.5	3100	10600	Pass



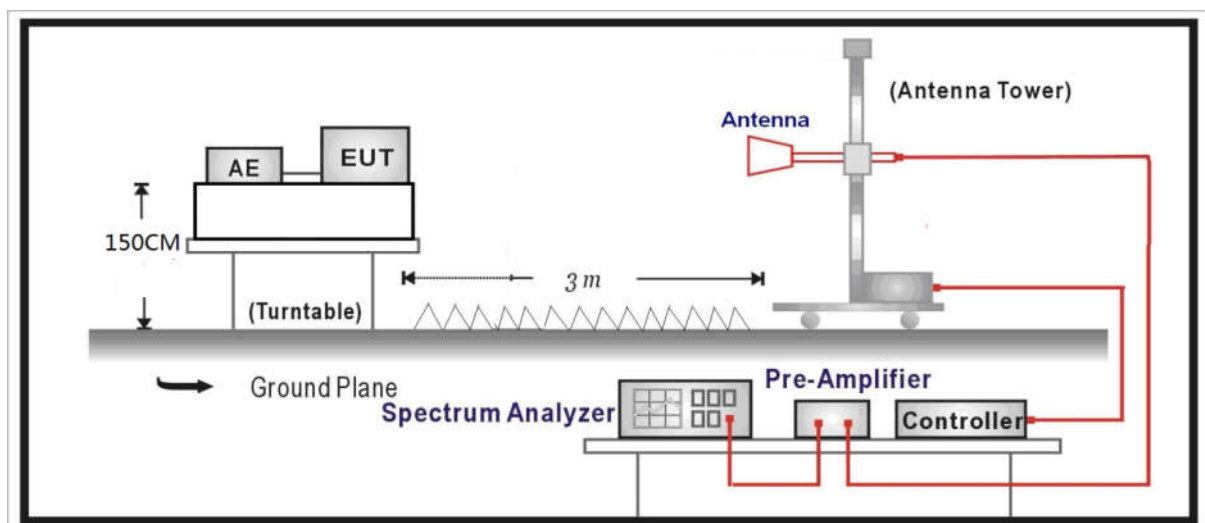
## 8. EIRP

### 8.1. Test Equipment

EIRP / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2018.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2018.05.03
Preamplifier	QuieTek	AP-040G	CHM-090600 1	2018.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2017.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	733	2018.02.26
DRG Horn	ETS-Lindgren	3117	00167055	2017.07.16
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2018.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2018.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2018.02.28
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2018.01.07
Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.				

### 8.2. Test Setup



### 8.3. Limit

When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, fM. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be  $20 \log (RBW/50)$  dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using  $E(\text{dBuV/m}) = P(\text{dBm EIRP}) + 95.2$ . If RBW is greater than 3 MHz, the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.



#### 8.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2014 & ANSI C63.10: 2013 for compliance to FCC 47CFR 15.521(g) requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2014 on radiated measurement.

Note: The RBW = 3MHz, VBW = 3MHz, so the EIRP limit is  $20 \log (3/50) = -24.437$  dBm.

#### 8.5. Uncertainty

The measurement uncertainty is defined as  $\pm 3.9$  dB

**8.6. Test Result**

Product	:	UWB device
Test Item	:	EIRP
Test Site	:	AC-5
Test Mode	:	Mode 1: Transmit

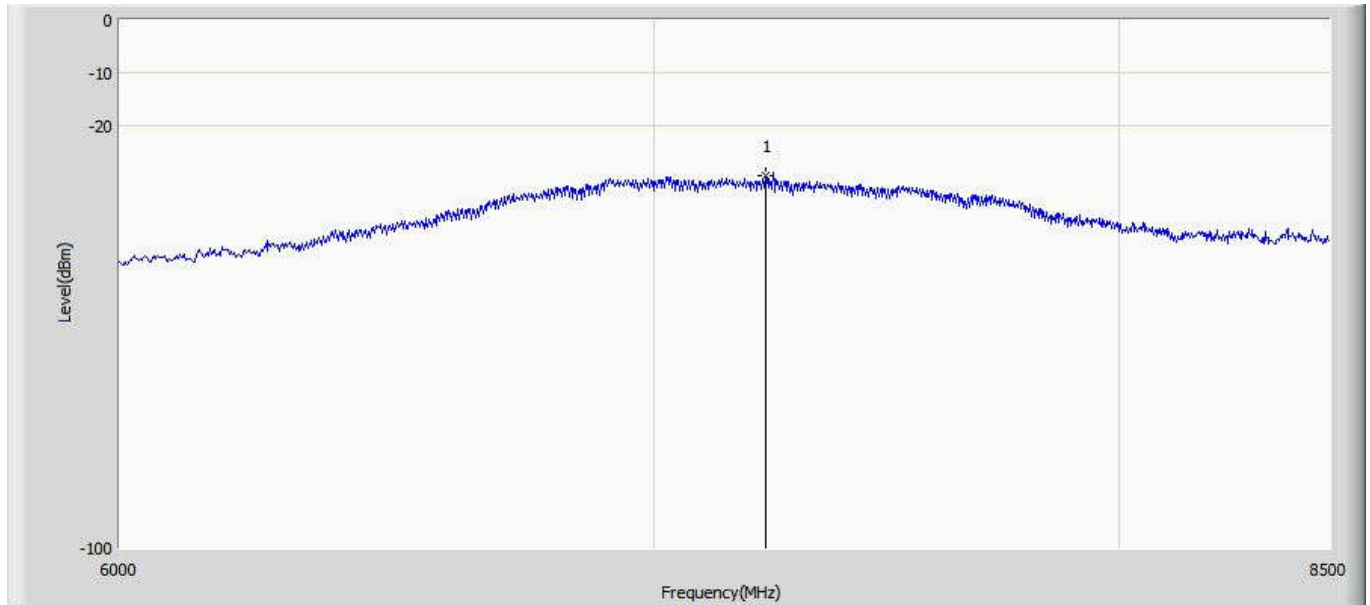
Chain	CH	Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
Ant 0	1	H	7182.5	-35.822	4.363	-31.459	-24.437	-7.022	PK
		V	7227.500	-34.020	4.397	-29.623	-24.437	-5.186	PK

Note 1: Measure Level = Reading Level + Factor.

Note 2: E field strength (dB  $\mu$  V/m) = EIRP (dBm) + 95.2

Note 3: The RBW = 3MHz, so the EIRP limit is  $20 \log (3/50) = -24.437$  dBm.

Site: AC5	Time: 2017/07/11 - 14:02
Limit: FCC 15.519	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M02	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		7227.500	-29.623	-34.020	-9.583	-24.437	4.397	PK

## 9. Antenna Requirement

### 9.1. Limit

Antenna Requirement Limit
<p>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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.</p>

### 9.2. Result

The EUT use permanently attached antennas and comply with FCC 15.203.  
Please refer to the attached "Internal Photograph".

\_\_\_\_\_ The End \_\_\_\_\_