Test Report

FCC Part15 Subpart F & RSS 220

Product Name	:	UWB device
Model No.	:	X4M05
FCC ID	:	2AD9QX4M05
IC	:	22782-X4M05

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. 23rd, 2017
Report No.	:	1772023R-RF-US-P06V02
Report Version	:	V1.2

Test Report Certification

Issued Date : Aug. 23rd, 2017
Report No. : 1772023R-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.	:	X4M05
FCC ID	:	2AD9QX4M05
IC	:	22782-X4M05
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

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(Engineering Manager: Harry Zhao)

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
1772023R-RF-US-P06V02	V1.0	Initial Issued Report	Jul. 12th, 2017
1772023R-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
1772023R-RF-US-P06V02	V1.2	Update the operational limitations data.	Aug. 23rd, 2017

1. General Information

1.1. EUT Description

Product Name	UWB device
Model No.	X4M05
Working Voltage	DC 3V~5.5V
Hardware version	000153-005
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:

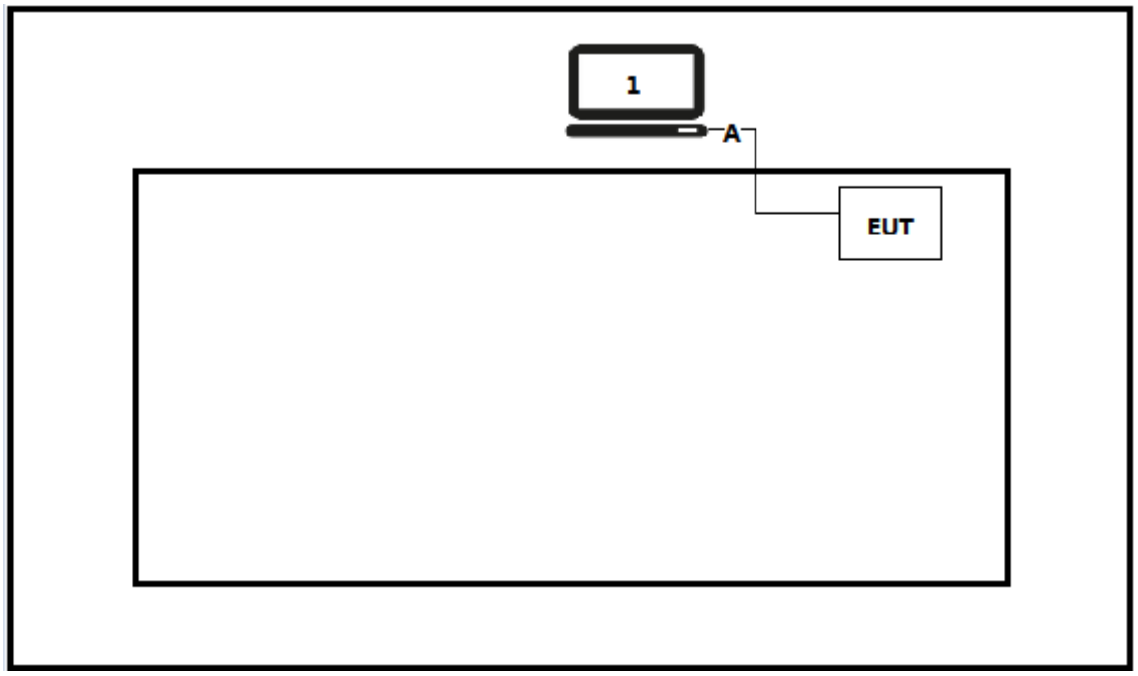
1. Regards to the frequency band operation: the lowest、middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

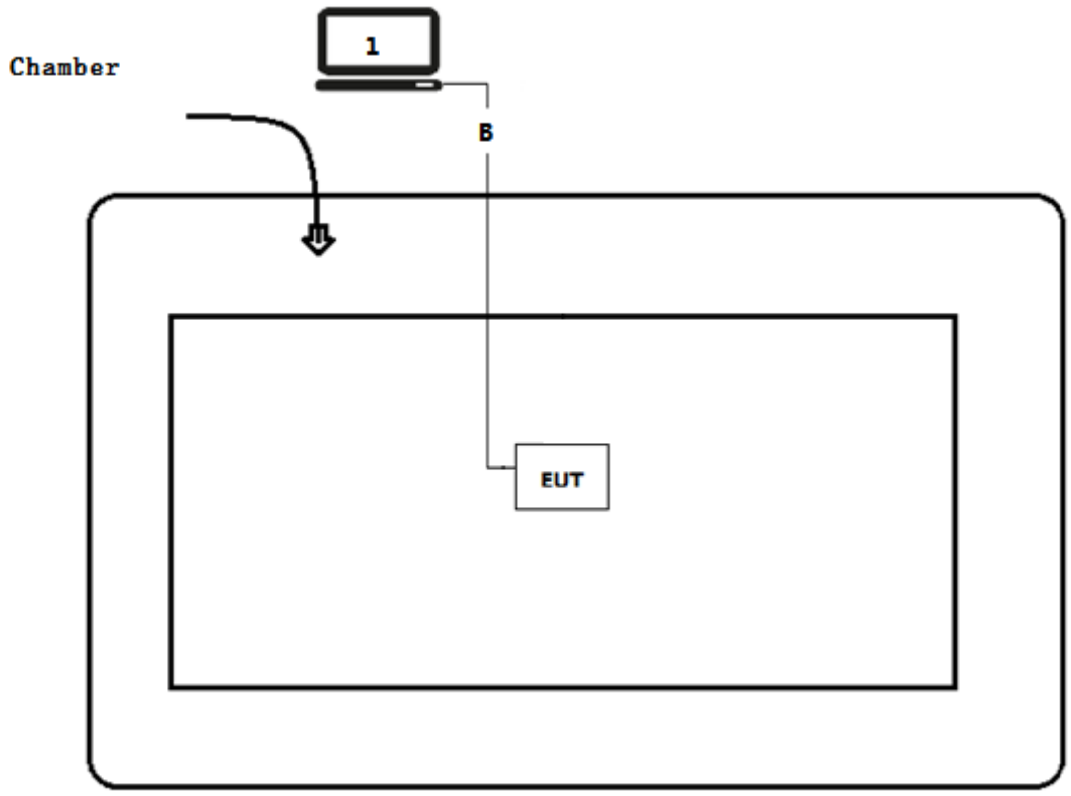
1.3. Tested System Details

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

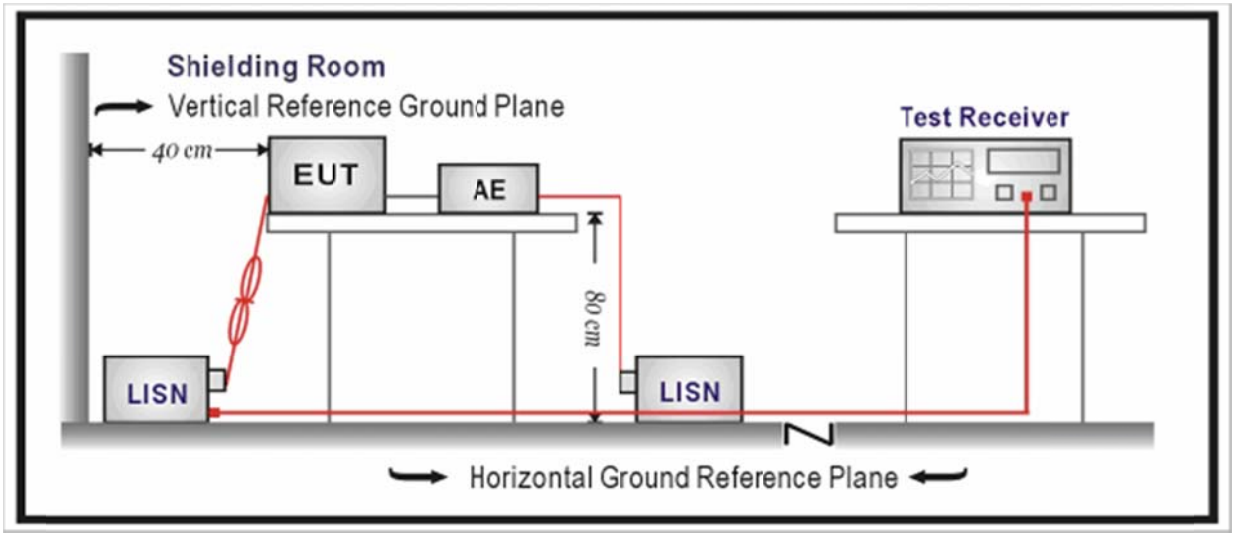
3.1. Test Equipment

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

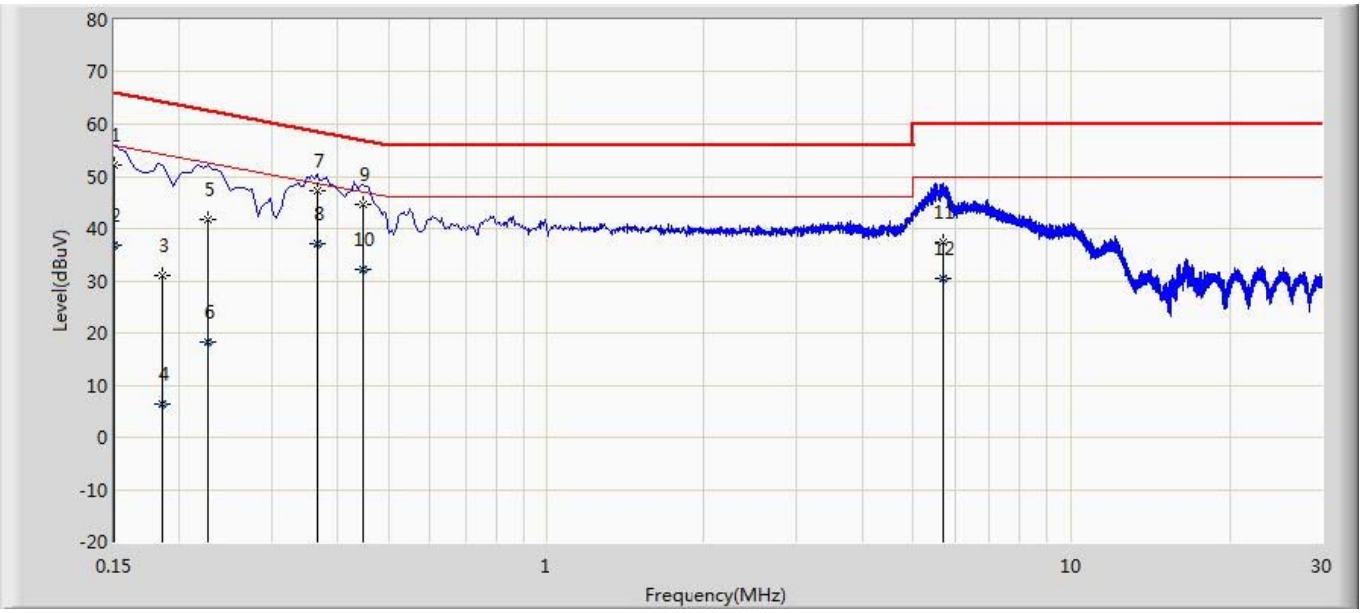
The EUT was setup according to ANSI C63.4: 2014, and tested according to FCC 47CFR 15.207 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces 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 ± 2.02 dB

3.6. Test Result

Site: TR1	Time: 2017/07/12 - 18:01
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		0.150	52.134	42.513	-13.866	66.000	9.600	0.021	0.000	QP
2		0.150	36.709	27.088	-19.291	56.000	9.600	0.021	0.000	AV
3		0.186	31.147	21.527	-33.066	64.213	9.593	0.027	0.000	QP
4		0.186	6.243	-3.376	-47.970	54.213	9.593	0.027	0.000	AV
5		0.226	41.787	32.166	-20.808	62.595	9.590	0.031	0.000	QP
6		0.226	18.228	8.607	-34.367	52.595	9.590	0.031	0.000	AV
7	*	0.366	47.355	37.728	-11.236	58.591	9.590	0.037	0.000	QP
8		0.366	36.957	27.330	-11.634	48.591	9.590	0.037	0.000	AV
9		0.446	44.618	34.984	-12.331	56.949	9.590	0.044	0.000	QP
10		0.446	32.251	22.618	-14.698	46.949	9.590	0.044	0.000	AV
11		5.674	37.353	27.575	-22.647	60.000	9.627	0.152	0.000	QP
12		5.674	30.474	20.695	-19.526	50.000	9.627	0.152	0.000	AV

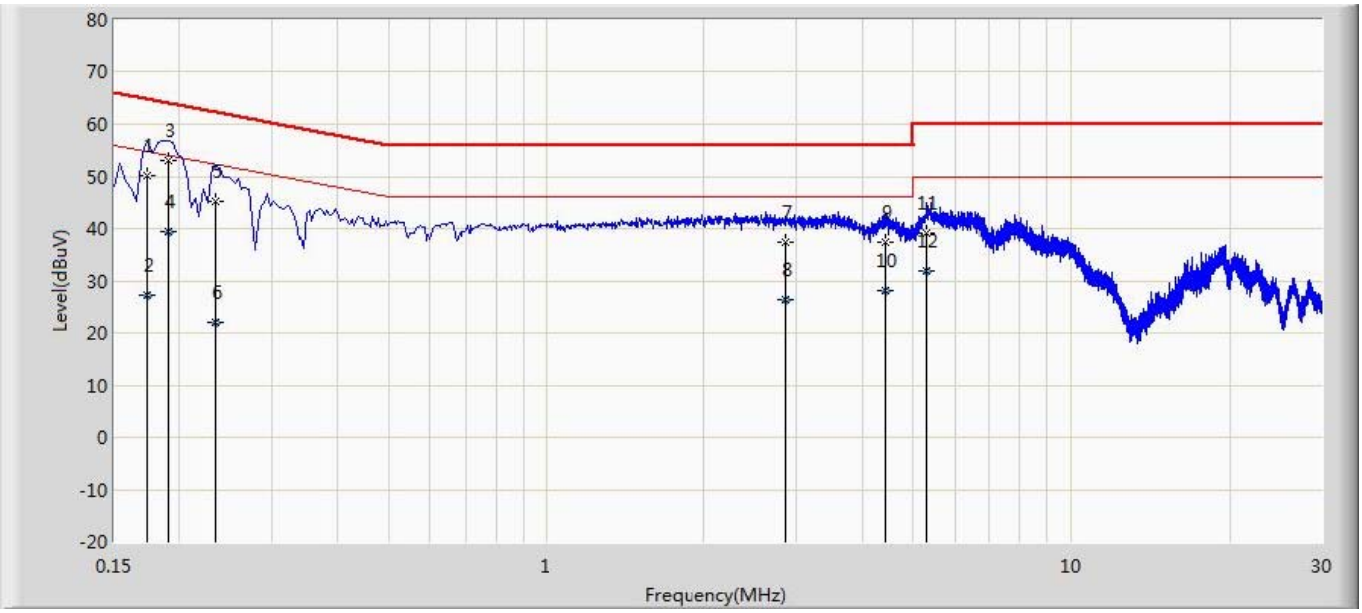
Note:

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: 2017/07/12 - 18:02
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		0.174	50.261	40.662	-14.506	64.767	9.575	0.024	0.000	QP
2		0.174	27.353	17.754	-27.414	54.767	9.575	0.024	0.000	AV
3	*	0.190	52.986	43.387	-11.051	64.037	9.572	0.028	0.000	QP
4		0.190	39.387	29.788	-14.650	54.037	9.572	0.028	0.000	AV
5		0.234	45.209	35.607	-17.098	62.307	9.572	0.030	0.000	QP
6		0.234	22.087	12.486	-30.220	52.307	9.572	0.030	0.000	AV
7		2.862	37.459	27.756	-18.541	56.000	9.596	0.107	0.000	QP
8		2.862	26.470	16.767	-19.530	46.000	9.596	0.107	0.000	AV
9		4.430	37.487	27.746	-18.513	56.000	9.606	0.135	0.000	QP
10		4.430	27.998	18.258	-18.002	46.000	9.606	0.135	0.000	AV
11		5.290	39.169	29.407	-20.831	60.000	9.613	0.149	0.000	QP
12		5.290	31.891	22.129	-18.109	50.000	9.613	0.149	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).

4. Radiated Emission

4.1. Test Equipment

Radiated Emission / AC-2

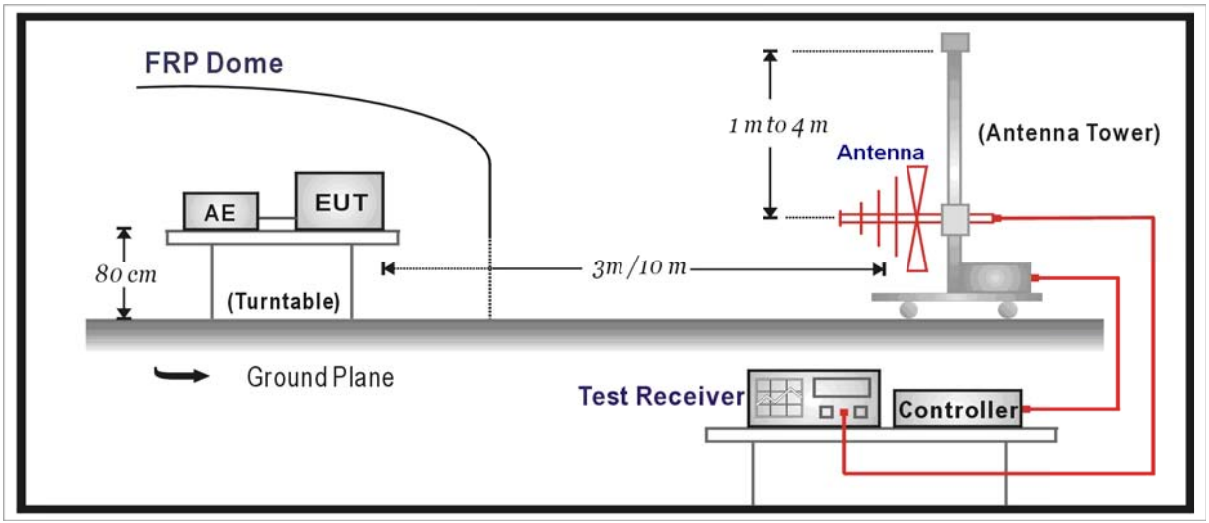
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2018.03.10
Loop Antenna	R&S	HFH2-Z2	833799/003	2017.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2017.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2018.02.28
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH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

Radiated Emission / AC-5

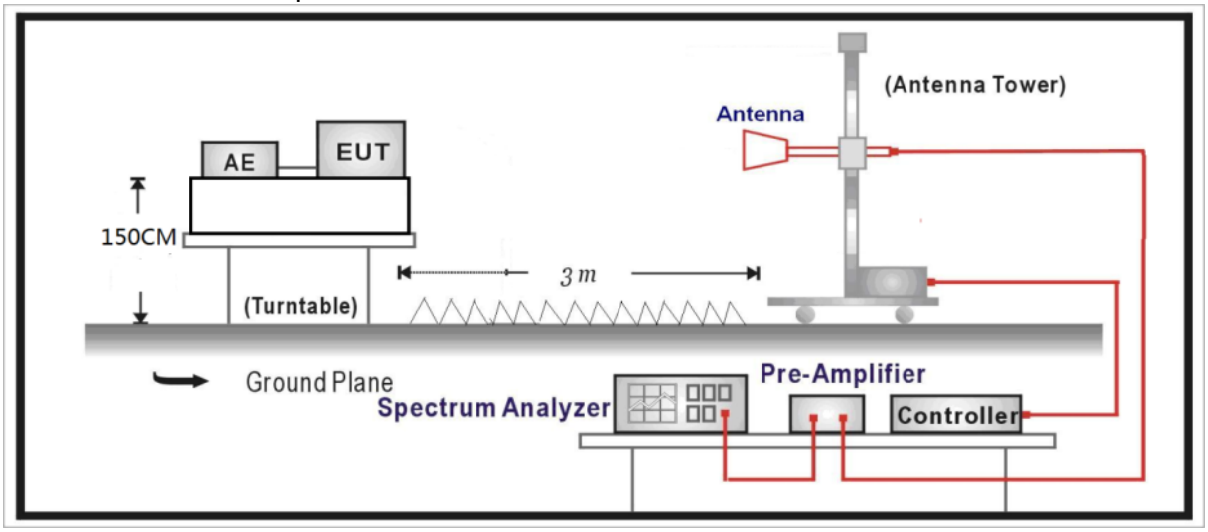
Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2018.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2018.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2018.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2017.10.15
Broad-Band Horn Antenna	Schwarzbeck	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

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 μV/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 μV/m) = 20 log E field strength (μV/m)

Note 4: E field strength (dB μV/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 ± 3.9 dB
below 1G is defined as ± 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	7069.000	-47.281	4.301	-42.980	-41.3(Note3)	-1.680	PK
		H	14580.000	-59.973	12.471	-47.502	N/A	N/A	PK
		H	14580.000	-77.246	12.471	-64.775	-61.3	-3.475	AV
		V	7018.000	-46.343	3.435	-42.908	-41.3(Note3)	-1.608	PK
		V	10580.000	-59.886	10.482	-48.134	-41.3(Note3)	-6.834	PK

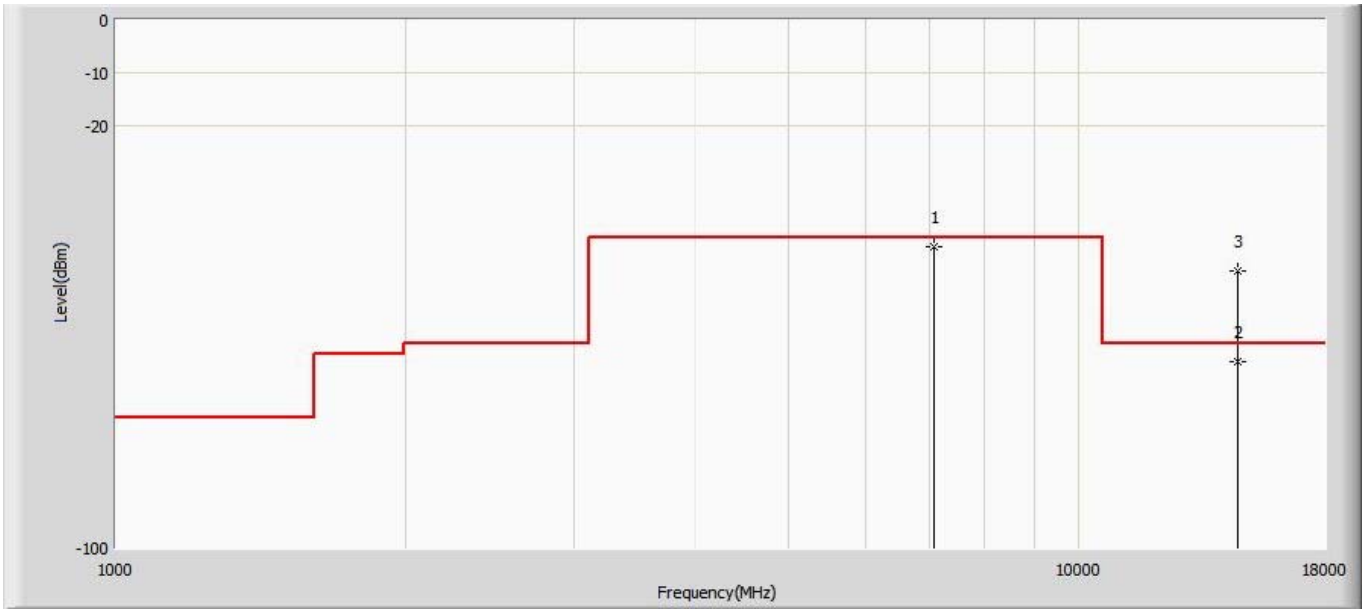
Note: 1. Measure Level = Reading Level + Factor.

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.

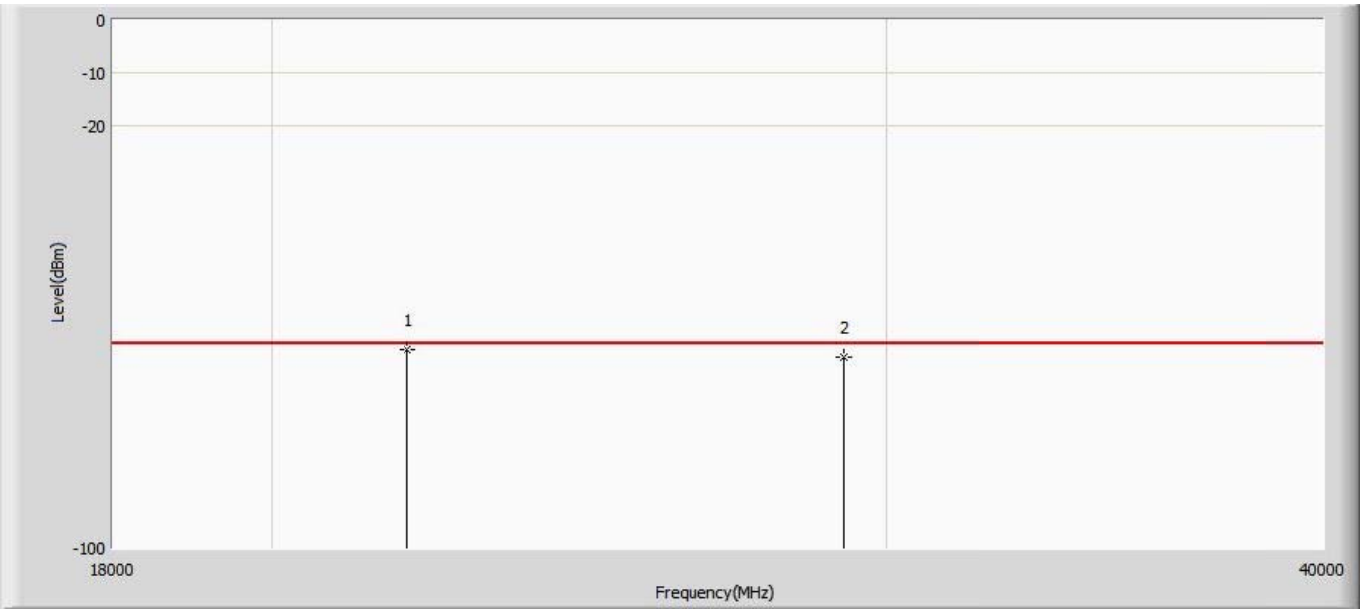
Note 4: E field strength (dB μV/m) = EIRP (dBm) + 95.2

Site: AC5	Time: 2017/07/11 - 14:02
Limit: UWB-1	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M05	Power: DC5V
Note: Mode1	



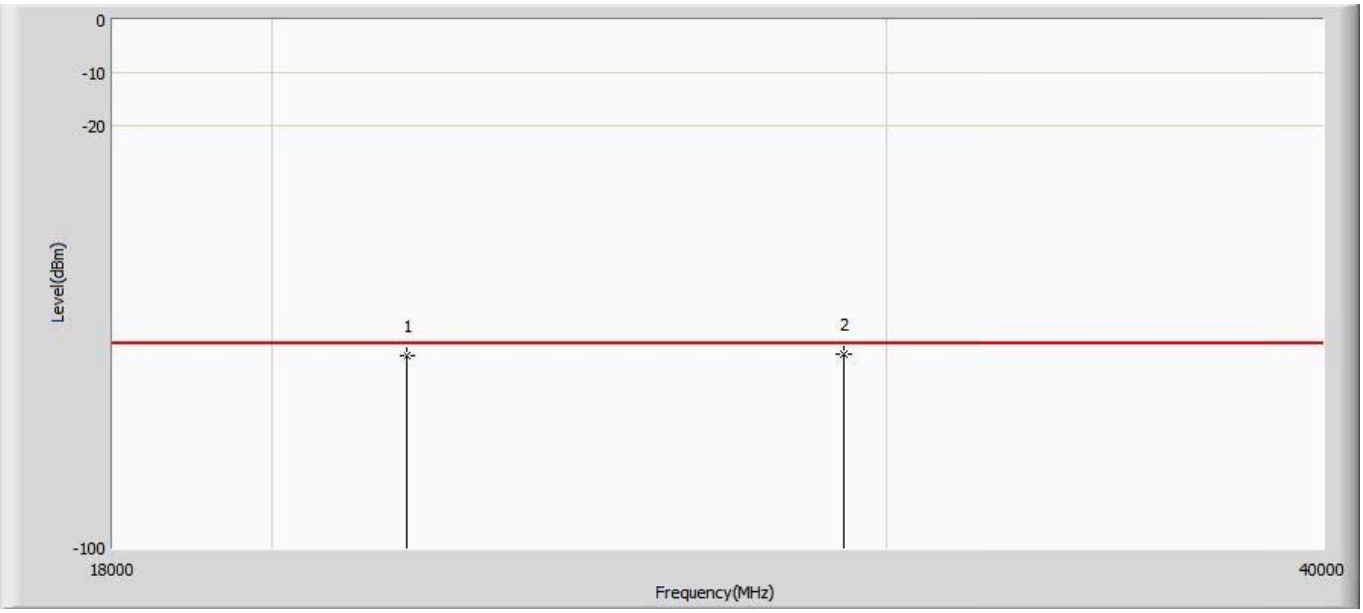
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		7069.000	-42.980	-47.281	-1.680	-41.300	4.301	PK
2		14580.000	-64.775	-77.246	-3.475	-61.300	12.471	AV
3	*	14580.000	-47.502	-59.973	N/A	N/A	12.471	PK

Site: AC5	Time: 2017/08/08 - 17:05
Limit: UWB-1	Margin: 0
Probe: 18-40G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M05	Power: DC5V
Note: Mode1	



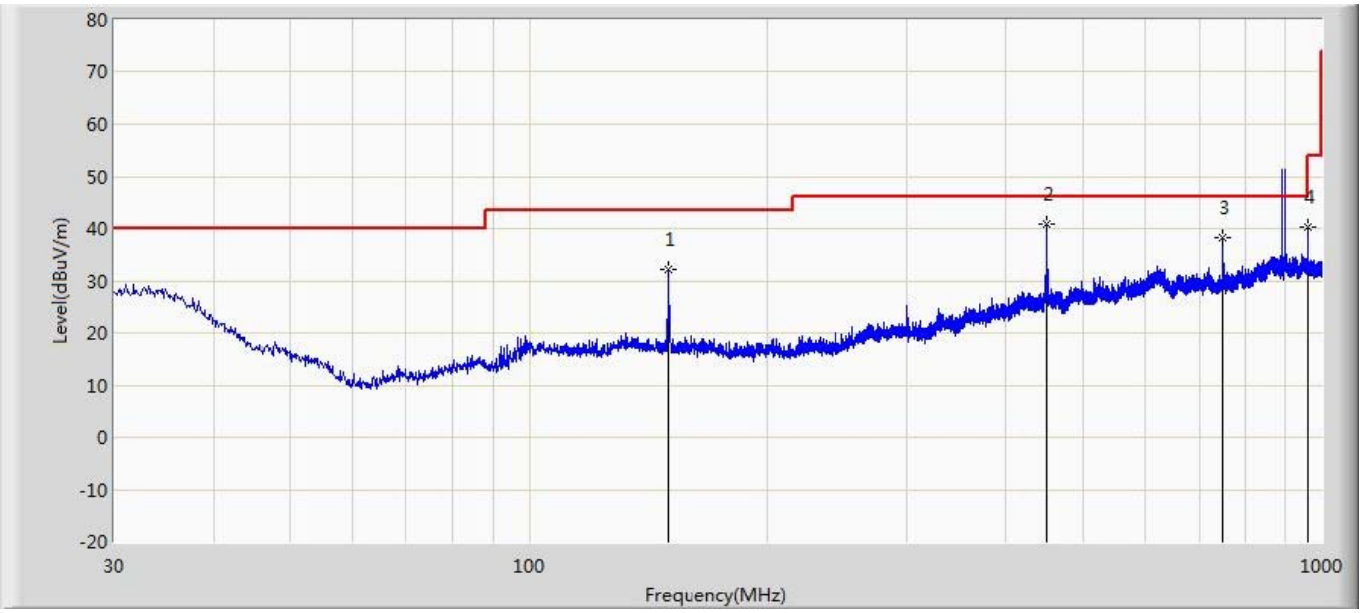
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	21870.000	-62.498	-55.866	-1.198	-61.300	-6.632	PK
2		29160.000	-63.828	-67.412	-2.528	-61.300	3.584	PK

Site: AC5	Time: 2017/08/08 - 17:05
Limit: UWB-1	Margin: 0
Probe: 18-40G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M05	Power: DC5V
Note: Mode1	



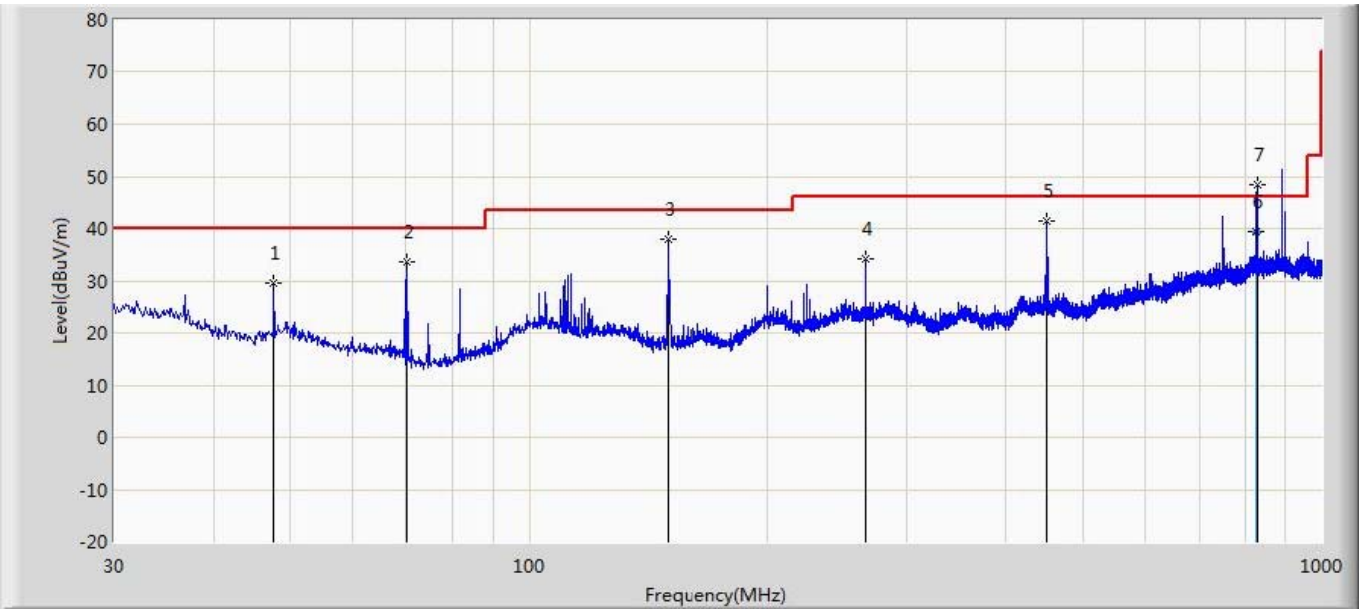
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		21870.000	-63.490	-56.689	-2.190	-61.300	-6.801	PK
2	*	29160.000	-63.354	-65.840	-2.054	-61.300	2.486	PK

Site: AC2	Time: 2017/07/03 - 14:48
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Horizontal
EUT: UWB device	Power: AC 120V/60Hz
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	32.287	15.299	-11.213	43.500	16.988	PK
2	*	450.010	40.980	14.055	-5.020	46.000	26.925	PK
3		750.225	38.349	8.748	-7.651	46.000	29.601	PK
4		960.230	40.375	7.451	-13.625	54.000	32.924	PK

Site: AC2	Time: 2017/07/03 - 14:50
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Vertical
EUT: UWB device	Power: AC 120V/60Hz
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		47.824	29.624	10.700	-10.376	40.000	18.924	PK
2		70.255	33.525	18.579	-6.475	40.000	14.946	PK
3		150.038	37.930	19.891	-5.570	43.500	18.038	PK
4		266.316	34.317	10.768	-11.683	46.000	23.550	PK
5		450.010	41.411	15.357	-4.589	46.000	26.054	PK
6		825.610	39.326	6.700	-6.674	46.000	32.626	QP
7	*	826.491	48.445	15.780	2.445	46.000	32.665	PK

Test Result	Pass

5. Radiated Emission in GPS Band

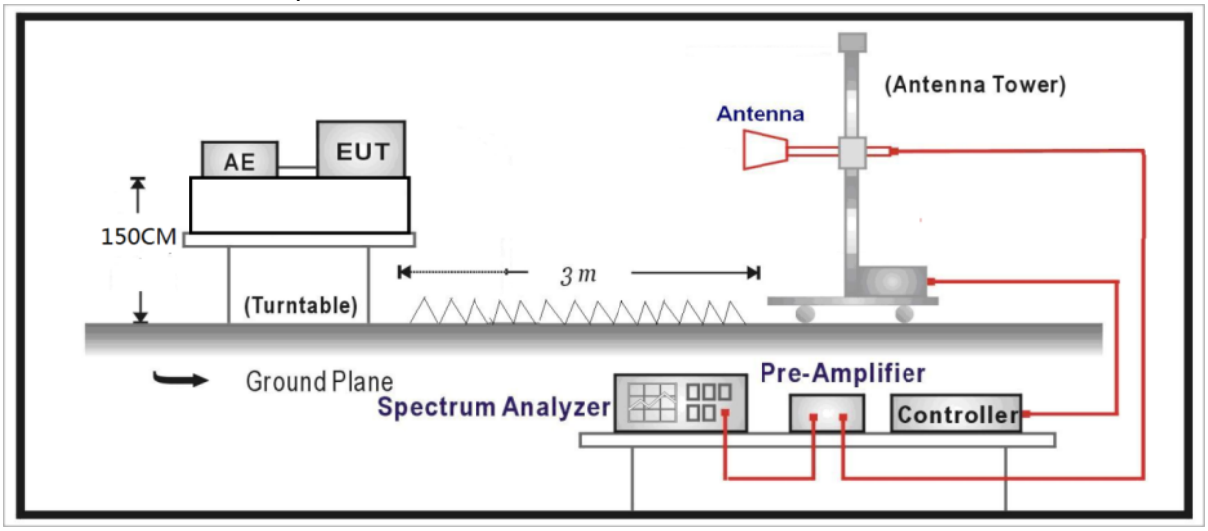
5.1. Test Equipment

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 ± 3.9 dB

5.6. Test Result

Mode 1: Transmitter

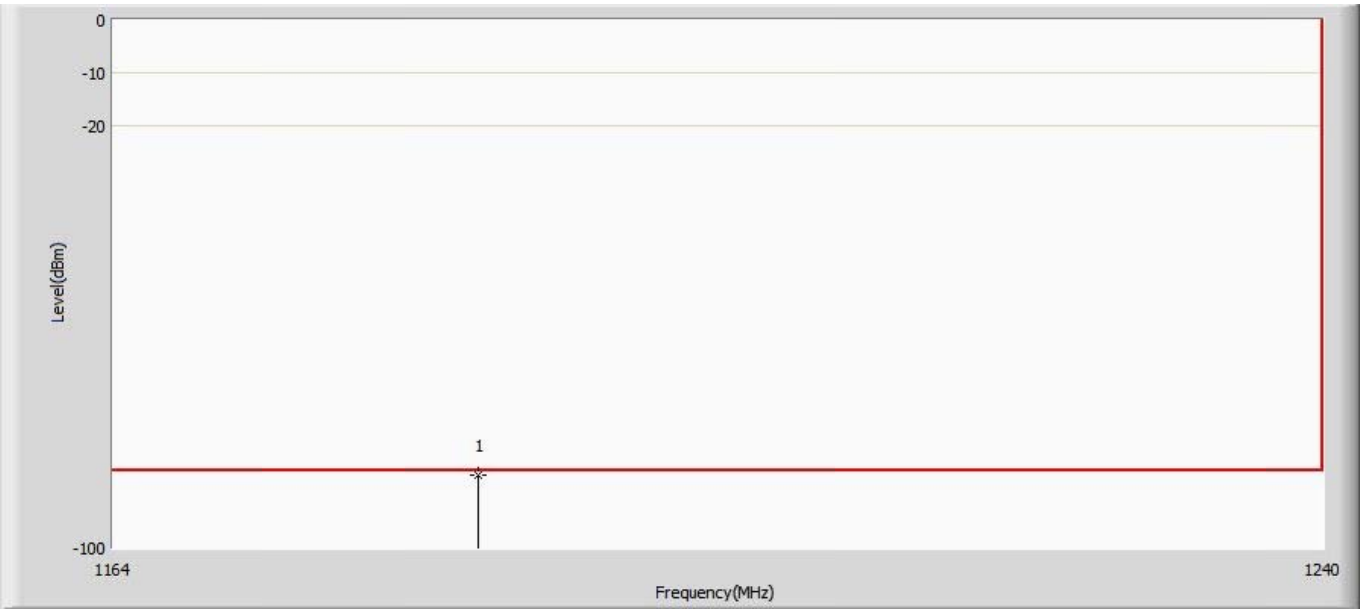
Chain	CH	Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
Ant 0	1	H	1186.452	-81.390	-4.969	-86.359	-85.3(Note2)	-1.059	PK
		V	1210.029	-84.257	-4.837	-89.094	-85.3(Note2)	-3.794	PK
		H	1582.947	-78.743	-4.389	-83.132	N/A	N/A	PK
		H	1582.947	-82.184	-4.389	-86.573	-85.3	-1.273	AV
		V	1583.939	-83.365	-4.391	-87.756	-85.3(Note2)	-2.456	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.

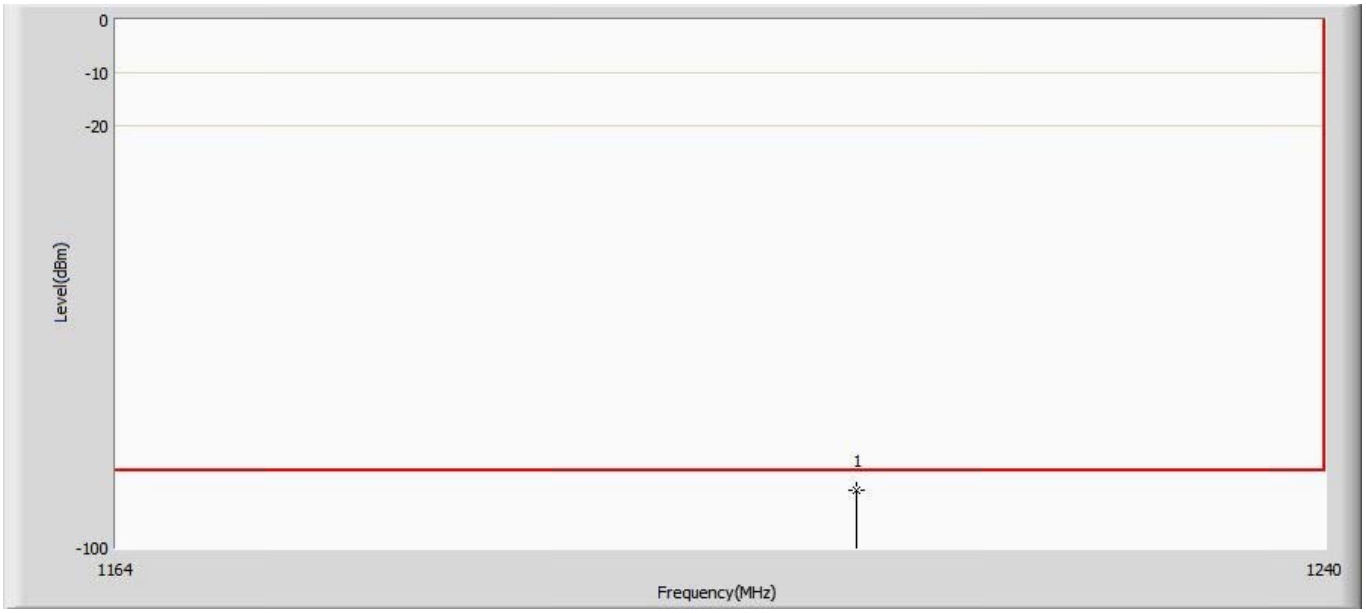
Note 3: E field strength (dB μV/m) = EIRP (dBm) + 95.2

Site: AC5	Time: 2017/07/11 - 14:02
Limit: UWB-4	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M05	Power: DC5V
Note: Mode1	



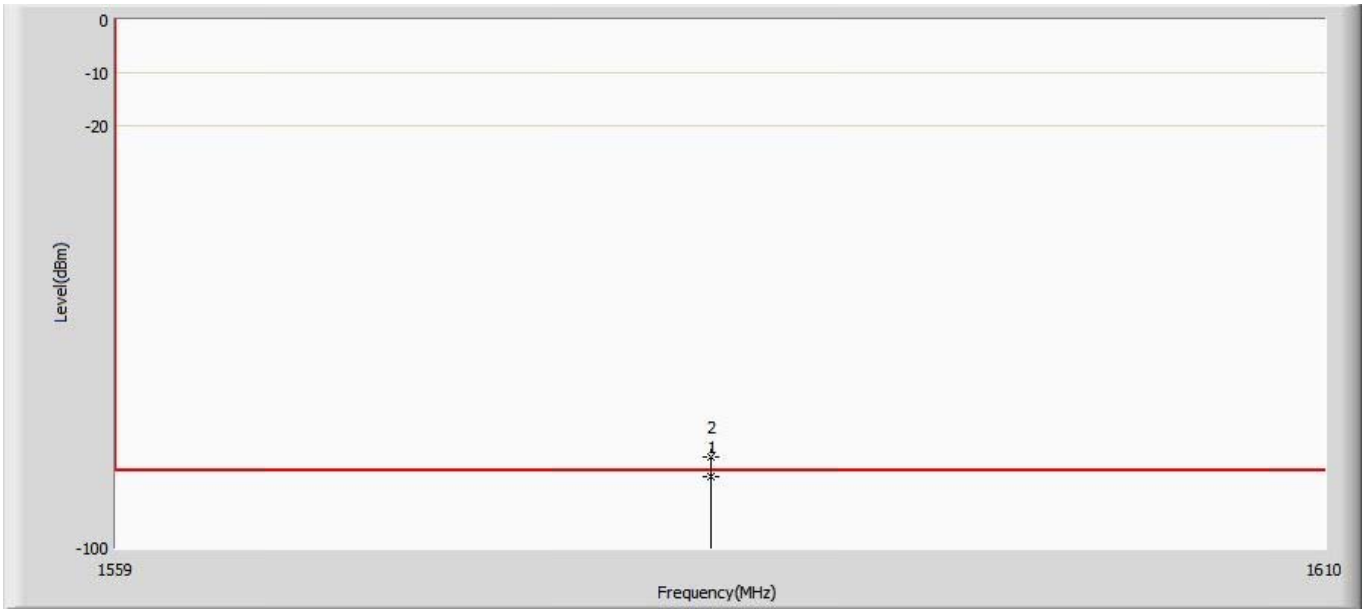
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1186.452	-86.359	-81.390	-1.059	-85.300	-4.969	PK

Site: AC5	Time: 2017/07/11 - 14:05
Limit: UWB-4	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Vertical
EUT: X4M05	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1210.029	-89.094	-84.257	-3.794	-85.300	-4.837	PK

Site: AC5	Time: 2017/07/11 - 14:03
Limit: UWB-4	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Vertical
EUT: X4M05	Power: DC5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		1583.939	-86.575	-82.184	-1.275	-85.300	-4.391	AV
2	*	1583.939	-82.756	-78.365	N/A	N/A	-4.391	PK

Test Result	Pass

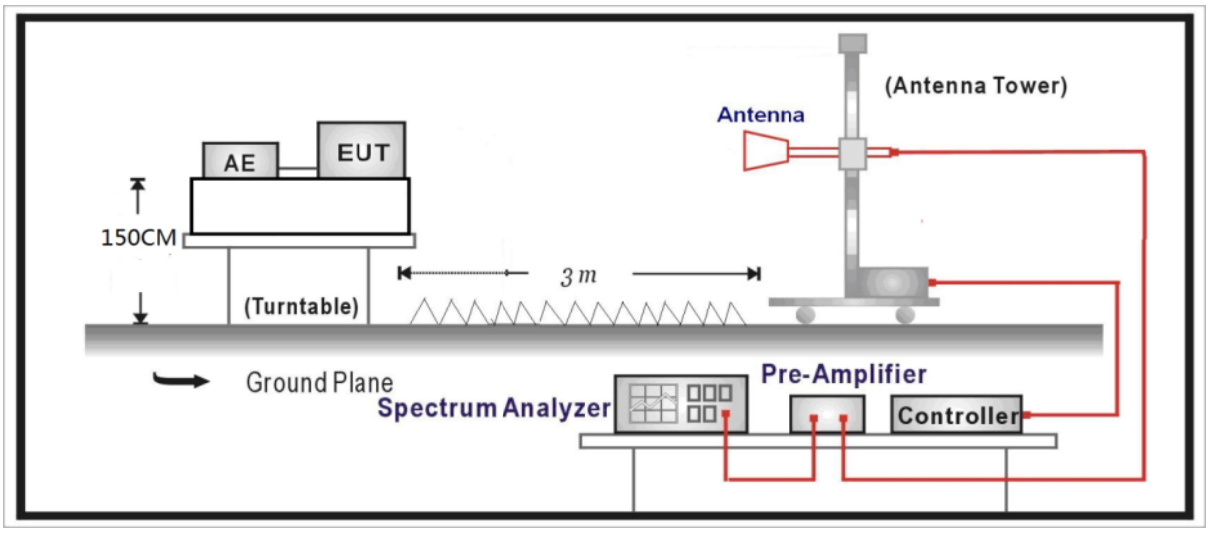
6. Operational Limitations

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.

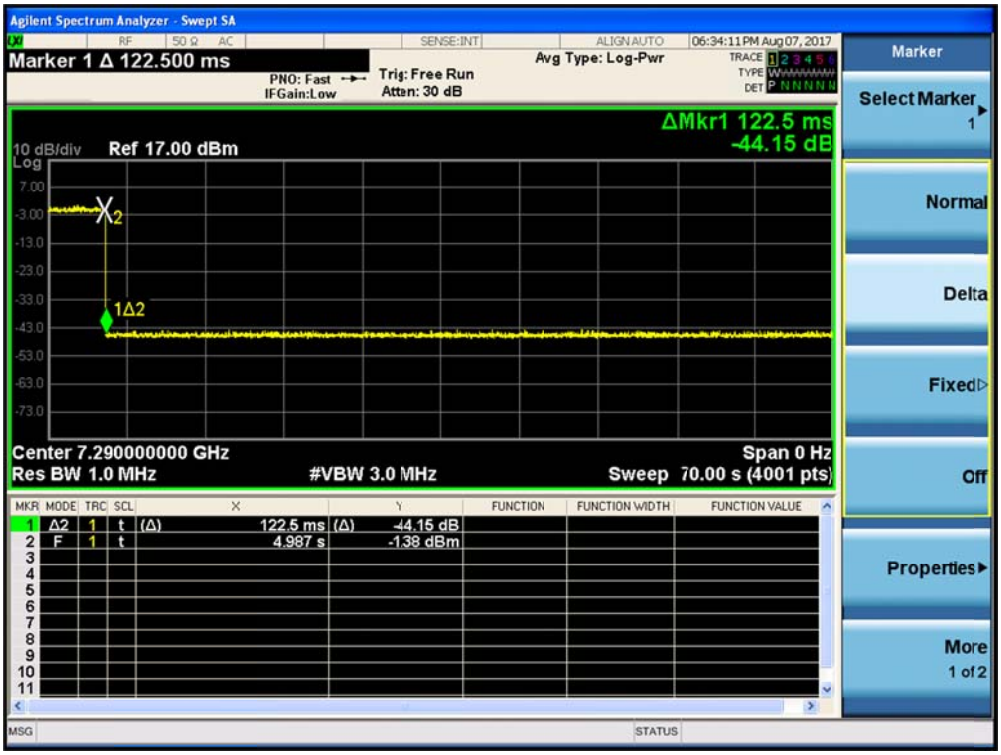
6.5. Uncertainty

The measurement uncertainty is defined as ± 2ms

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	1830	10	Pass



Note: The device starts transmitting and it stops transmitting in 1830ms without ACK .

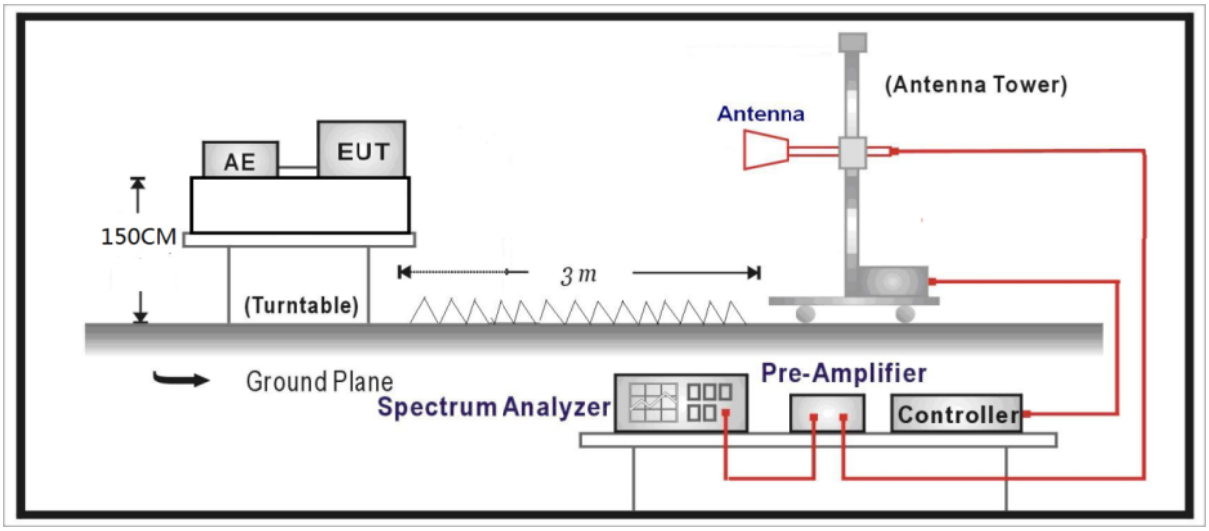
7. 10dB Bandwidth

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-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
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.

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.

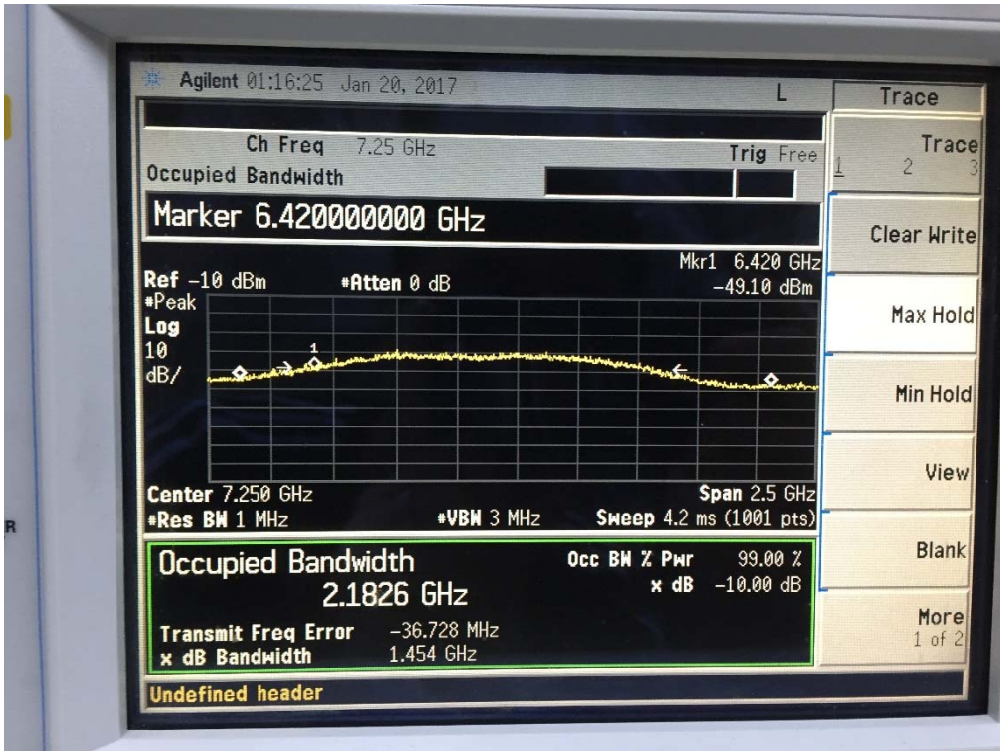
7.5. Uncertainty

The measurement uncertainty is defined as ± 1 kHz

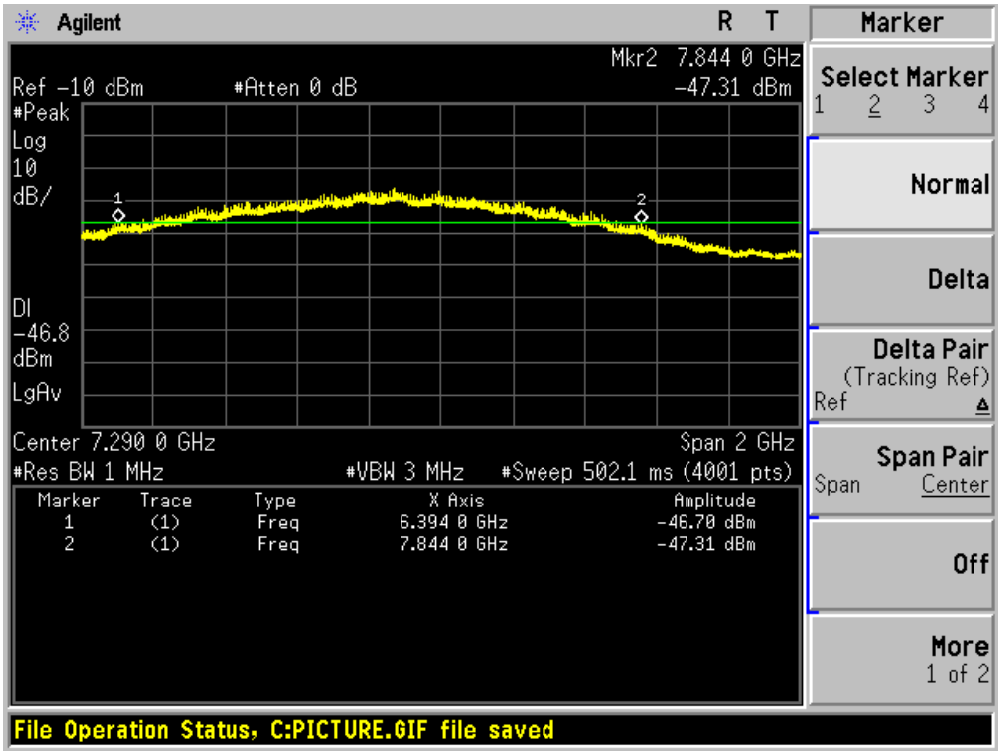
7.6. Test Result

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	1454	2182.6	500	Pass



Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	Limit (MHz)		Result
			Lower Frequency	Upper Frequency	
7290	6394.0	7844.0	3100	10600	Pass



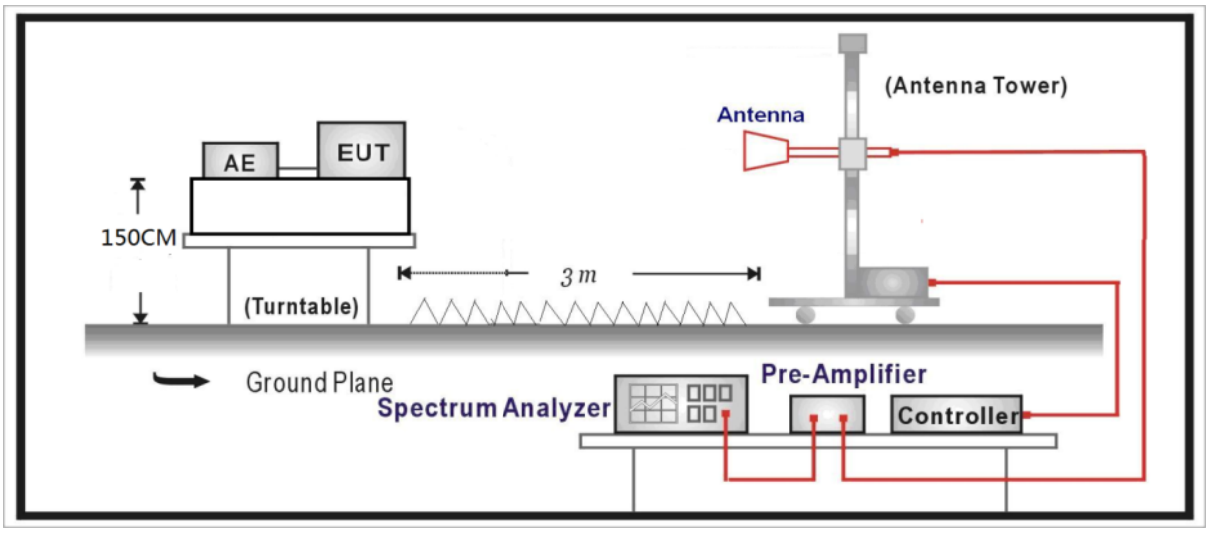
8. EIRP

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-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
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(dBuV/m) = P(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 ± 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	7227.500	-35.951	4.397	-31.554	-24.437	-7.117	PK
		V	7027.500	-45.478	3.462	-42.016	-24.437	-17.579	PK

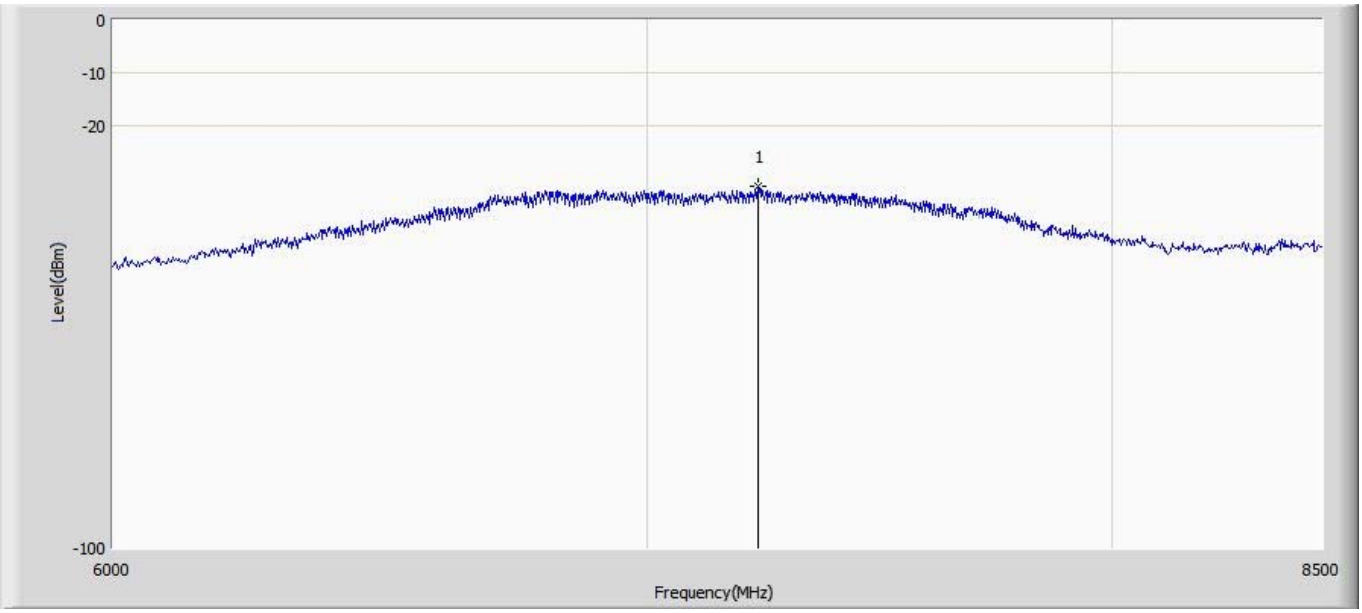
Note: 1. Measure Level = Reading Level + Factor.

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 (dBμV/m) = EIRP (dBm) + 95.2

Note 4: The RBW = 3MHz, so the EIRP limit is 20 log (3/50) = -24.437 dBm.

Site: AC5	Time: 2017/07/11 - 14:03
Limit: FCC Part15F	Margin: 0
Probe: 1-18G(2016.12.1 Change)	Polarity: Horizontal
EUT: X4M05	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	-31.554	-35.951	-7.117	-24.437	4.397	PK

9. Antenna Requirement

9.1. Limit

Antenna Requirement Limit
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.

9.2. Result

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

The End