



Test Report

FCC Part15 Subpart F

Product Name : UWB SiP Module
Model No. : GSUB-0002
FCC ID : 2A5EY-GSUB-0002

Applicant : GOERTEK MICROELECTRONICS INC.
Address : F Building, Phase II, Qingdao International
Innovation Park, No.1, Keyuanwei 1st Road,
Laoshan District, Qingdao Shandong

Date of Receipt : Feb. 23, 2022
Test Date : Feb. 25, 2022~ May. 10, 2022
Issued Date : Jun. 07, 2022
Report No. : 2220606R-RF-US-P06V06
Report Version : V1.1

The test results presented in this report relate only to the object tested.

The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.

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Test Report Certification

Issued Date : Jun. 07, 2022

Report No. : 2220606R-RF-US-P06V06



Product Name : UWB SiP Module

Applicant : GOERTEK MICROELECTRONICS INC.

Address : F Building, Phase II, Qingdao International Innovation Park,
No.1, Keyuanwei 1st Road, Laoshan District, Qingdao
Shandong

Manufacturer : GOERTEK MICROELECTRONICS INC.

Address : F Building, Phase II, Qingdao International Innovation Park,
No.1, Keyuanwei 1st Road, Laoshan District, Qingdao
Shandong

Factory : GOERTEK MICROELECTRONICS INC.

Address : F Building, Phase II, Qingdao International Innovation Park,
No.1, Keyuanwei 1st Road, Laoshan District, Qingdao
Shandong

Model No. : GSUB-0002

Brand Name : Goermicro

FCC ID : 2A5EY-GSUB-0002

Test Voltage : DC5 V

Applicable Standard : FCC CFR Title 47 Part 15 Subpart F
ANSI C63.10: 2013 ANSI C63.4: 2014

Test Result : Complied

Performed Location : DEKRA Testing & Certification (Suzhou) Co., Ltd.
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TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098
FCC Designation Number: CN1199

Documented By : 
(Project Engineer: Tim Cao)

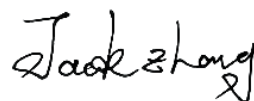
Approved By : 
(Engineer Supervisor: Jack Zhang)

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
2220606R-RF-US-P06V06	V1.0	Initial Issued Report	May. 25, 2022
2220606R-RF-US-P06V06	V1.1	Standard information added to Page44 and Page57	Jun. 07, 2022

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

Product Name	UWB SiP Module
Model No.	GSUB-0002
Working Voltage	VDD1、 VDD2、 VDDMCU: 3V VUSB:5V
Frequency Range	6250-8250MHz
Channel Number	2
Channel List	CH5: 6489.6MHz CH9:7987.2MHz
Antenna Type	Chip Antenna

1.2. Mode of Operation

Test Mode
Mode 1: Transmit CH5
Mode 2: Transmit CH9

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.

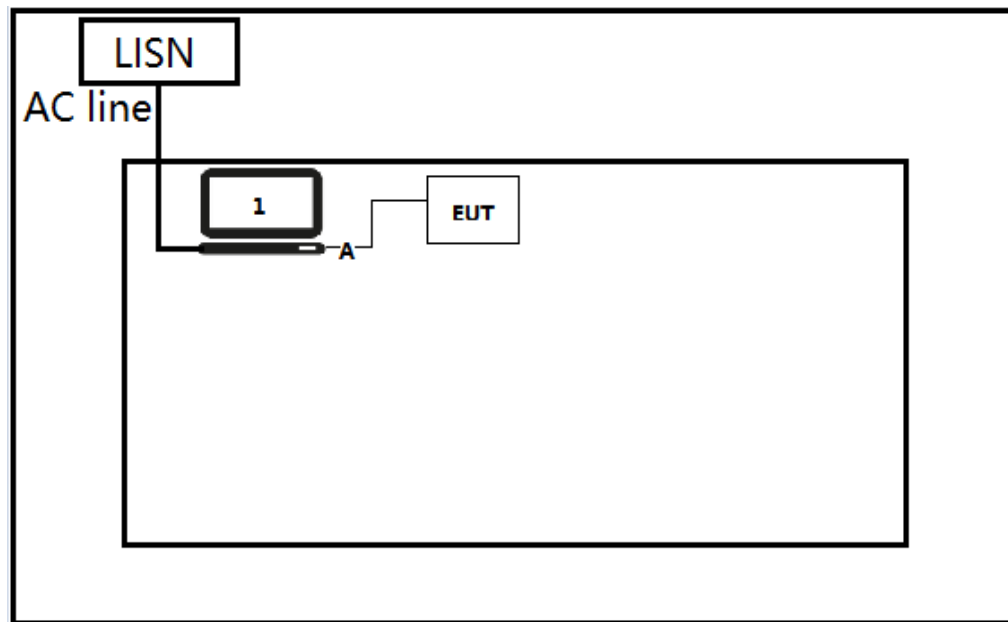
1.3. Tested System Details

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

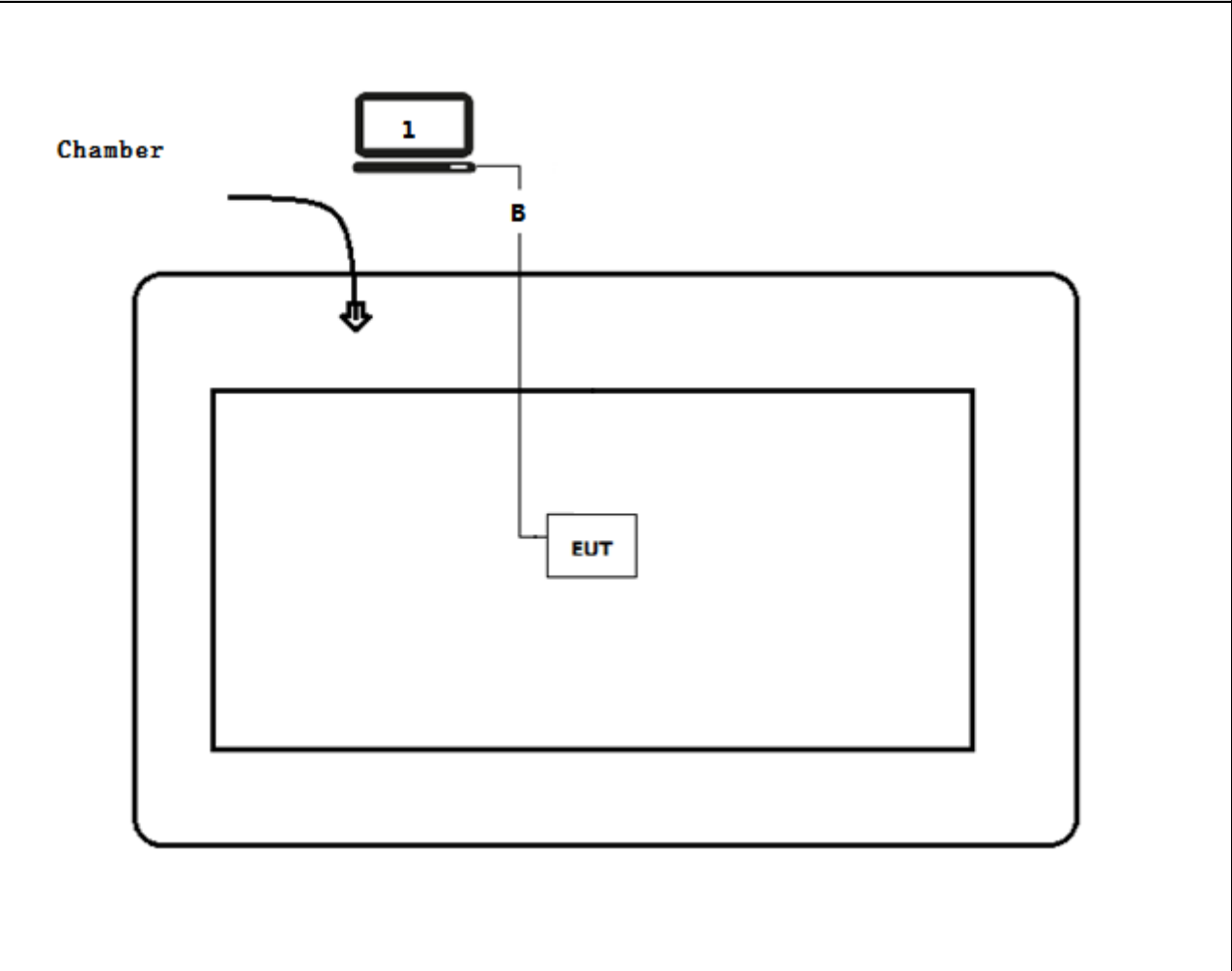
Product		Manufacturer	Model No.	Serial No.	Power Cord
1	N/A	N/A	N/A	N/A	N/A

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 as shown in Section 2.4.
2	Run the software “nRF Connect” on the notebook computer.
3	Open the serial port and enter the corresponding commands to configure the test mode, test channel, test power and data rate.
4	Verify that the EUT works properly.

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

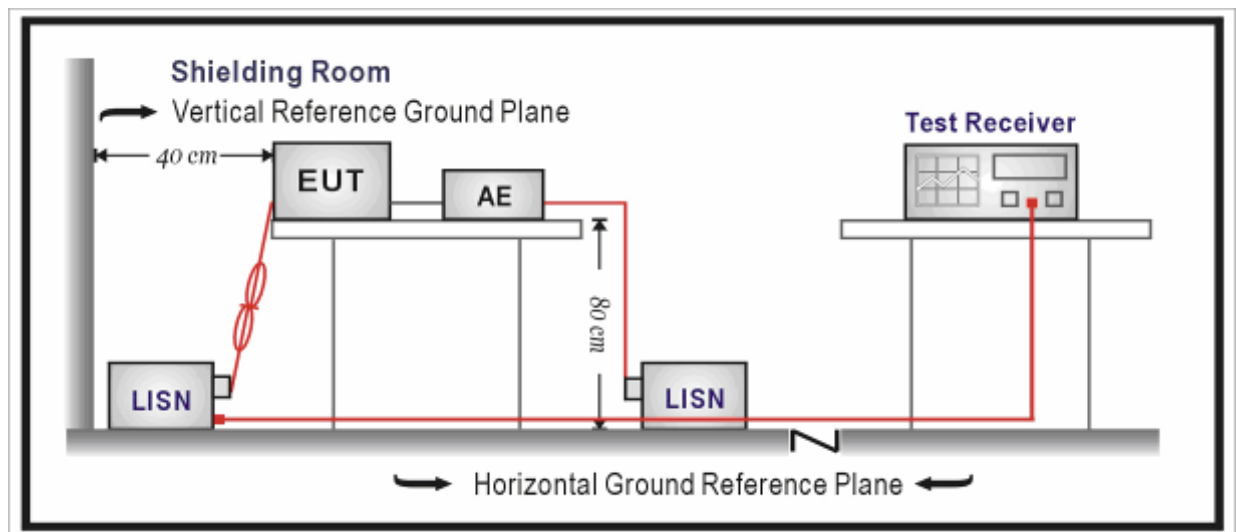
3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	05/Jun/77	2022.07.10
Two-Line V-Network	R&S	ENV216	13/Jan/80	2022.08.14
Two-Line V-Network	R&S	ENV216	23/Aug/76	2023.03.11
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	N/A
50ohm Termination	SHX	TF2	07081403	2022.09.03
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2022.07.08

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

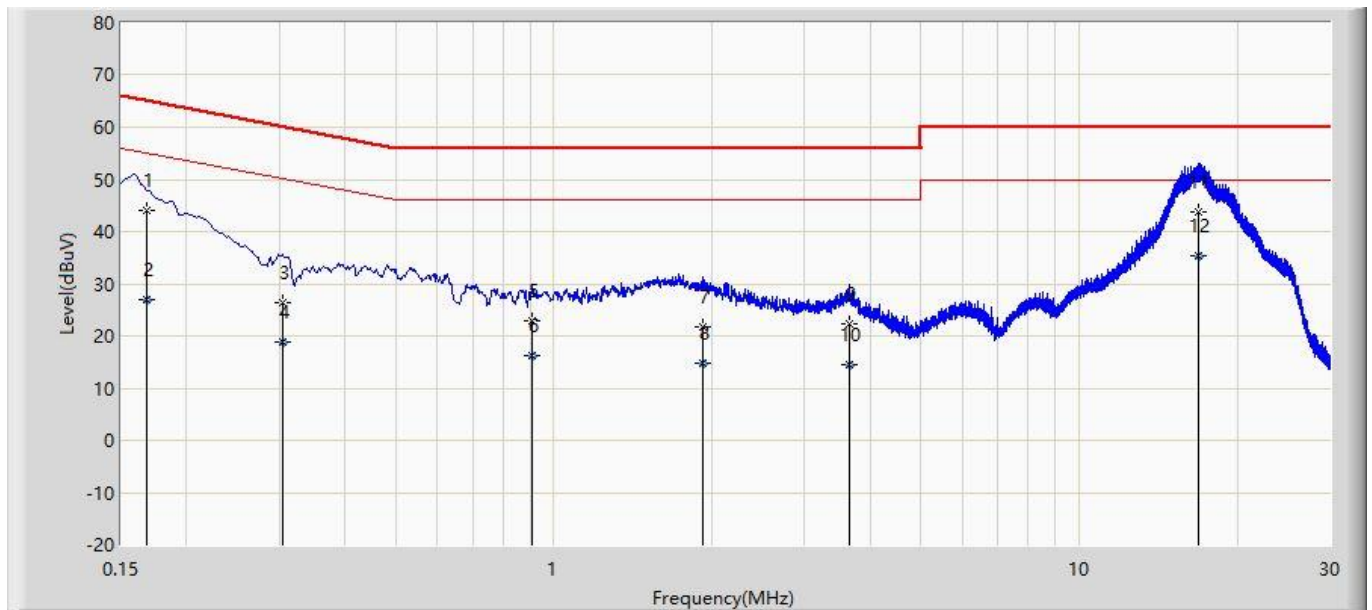
The EUT was setup according to ANSI C63.4: 2014, and tested according to FCC 47CFR 15.207 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces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

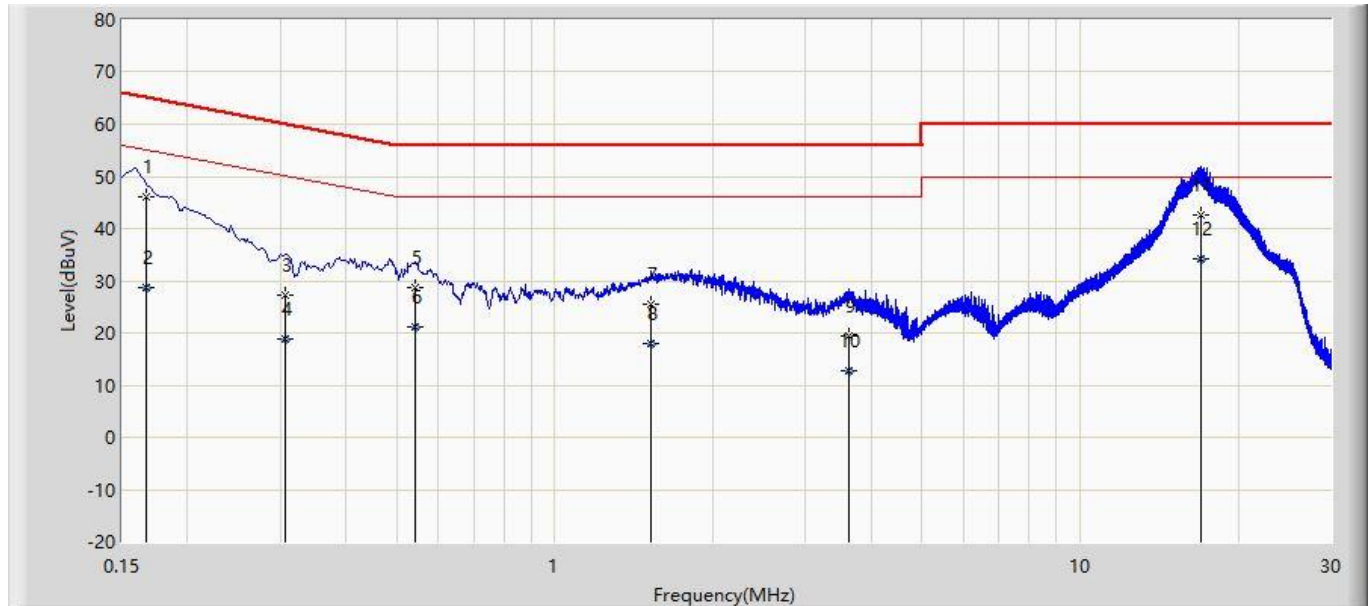
3.6. Test Result

Profile: 2220606R	Page No.: 1
Engineer: Pengchengyang	
Site: AC5 TR1	Time: 2022/05/10 - 22:31
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101190(0.009-30MHz)	Polarity: Neutral
EUT: UWB SiP Module	Power: DC 5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		0.168	44.134	34.561	-20.901	65.036	9.573	QP
2		0.168	27.099	17.526	-27.937	55.036	9.573	AV
3		0.305	26.236	16.639	-33.862	60.099	9.598	QP
4		0.305	18.953	9.356	-31.146	50.099	9.598	AV
5		0.910	22.981	13.345	-33.019	56.000	9.636	QP
6		0.910	16.281	6.645	-29.719	46.000	9.636	AV
7		1.925	21.872	12.197	-34.128	56.000	9.675	QP
8		1.925	14.865	5.190	-31.135	46.000	9.675	AV
9		3.651	22.232	12.480	-33.768	56.000	9.752	QP
10		3.651	14.461	4.708	-31.539	46.000	9.752	AV
11		16.843	43.758	33.567	-16.242	60.000	10.191	QP
12	*	16.843	35.269	25.078	-14.731	50.000	10.191	AV

Profile: 2060600R	Page No.: 2
Engineer: Pengchengyang	
Site: AC5 TR1	Time: 2022/05/10 - 22:31
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101190(0.009-30MHz)	Polarity: Line
EUT: UWB SiP Module	Power: DC 5V
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		0.167	46.049	36.466	-19.056	65.105	9.583	QP
2		0.167	28.638	19.055	-26.467	55.105	9.583	AV
3		0.307	27.155	17.552	-32.883	60.038	9.604	QP
4		0.307	18.939	9.335	-31.099	50.038	9.604	AV
5		0.541	28.646	19.021	-27.354	56.000	9.625	QP
6		0.541	21.107	11.482	-24.893	46.000	9.625	AV
7		1.525	25.477	15.821	-30.523	56.000	9.656	QP
8		1.525	18.104	8.448	-27.896	46.000	9.656	AV
9		3.619	19.327	9.570	-36.673	56.000	9.757	QP
10		3.619	12.702	2.945	-33.298	46.000	9.757	AV
11		16.921	42.518	32.346	-17.482	60.000	10.172	QP
12	*	16.921	34.206	24.033	-15.794	50.000	10.172	AV

4. Radiated Emission

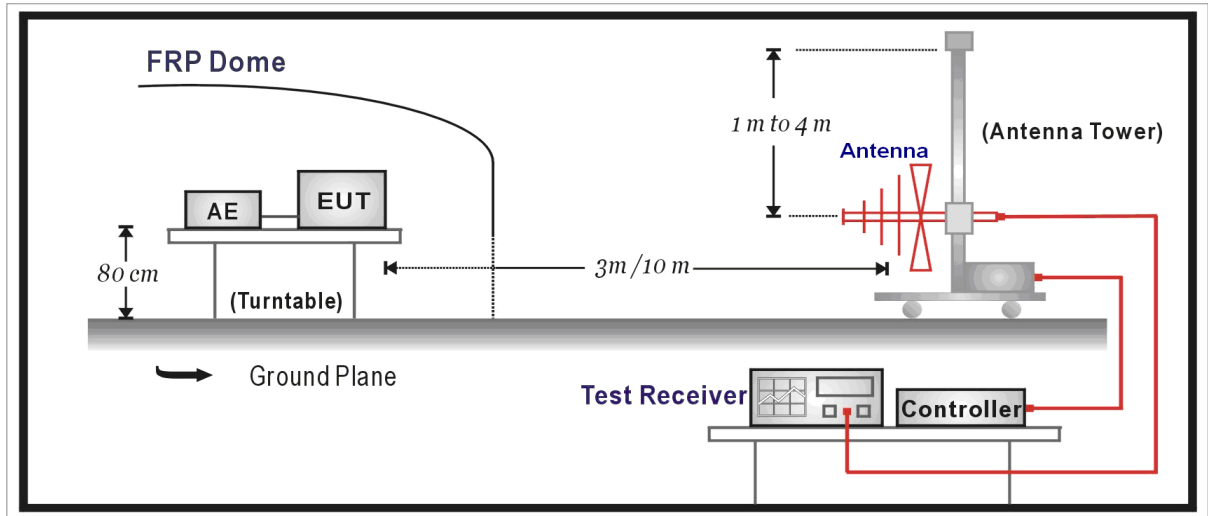
4.1. Test Equipment

Radiated Emission(Below 1GHz) / AC-3					
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100176	2021.08.15	2022.08.14
Loop Antenna	R&S	HFH2-Z2	833799/003	2022.03.02	2023.03.01
Bilog Antenna	Teseq GmbH	CBL6112D	27613	2021.08.23	2022.08.22
Coaxial Cable	Huber+Suhner	RG 214	AC3-C	2022.03.29	2023.03.28
Temperature/Humidity Meter	RTS	RTS-8S	AC3-TH	2021.11.23	2022.11.22
Dekra test software	Dekra	-	-	-	-
Note: All equipment are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.					

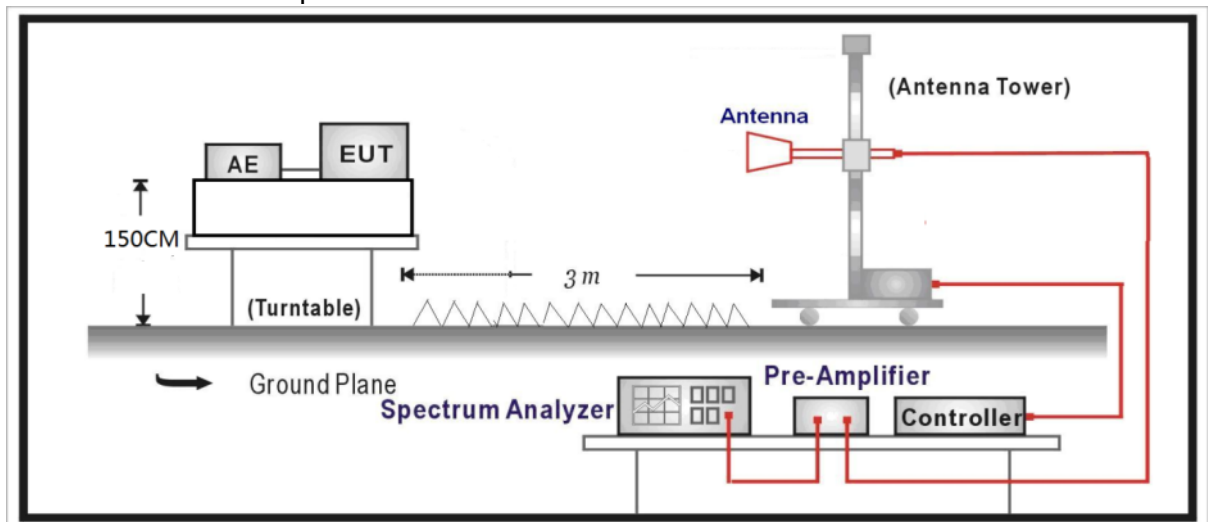
Radiated Emission(Above 1GHz) / AC-5					
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date	Cal. Due Date
EXASpectrum Analyzer	Keysight	N9010A	MY55370495	2022.03.18	2023.03.17
Preamplifier	EMCI	EMC184045SE	980263	2021.06.08	2022.06.07
DRG Horn Antenna	ETS-Lindgren	3117	00167055	2021.08.23	2022.08.22
Broad-BandHorn Antenna	Schwarzbeck	BBHA9170	294	2021.04.14	2023.04.13
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2022.03.29	2023.03.28
Coaxial Cable	ROSENBERGER	LA1-C011-2000/3000	AC5-40G	2022.03.18	2023.03.17
Temperature/Humidity Meter	RTS	RTS-8S	AC5-TH	2021.07.09	2022.07.08
Dekra test software	Dekra	-	-	-	-
Note: All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.					

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 μ 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 μ V/m) = 20 log E field strength (μ V/m)

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

Part 15.519:

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.

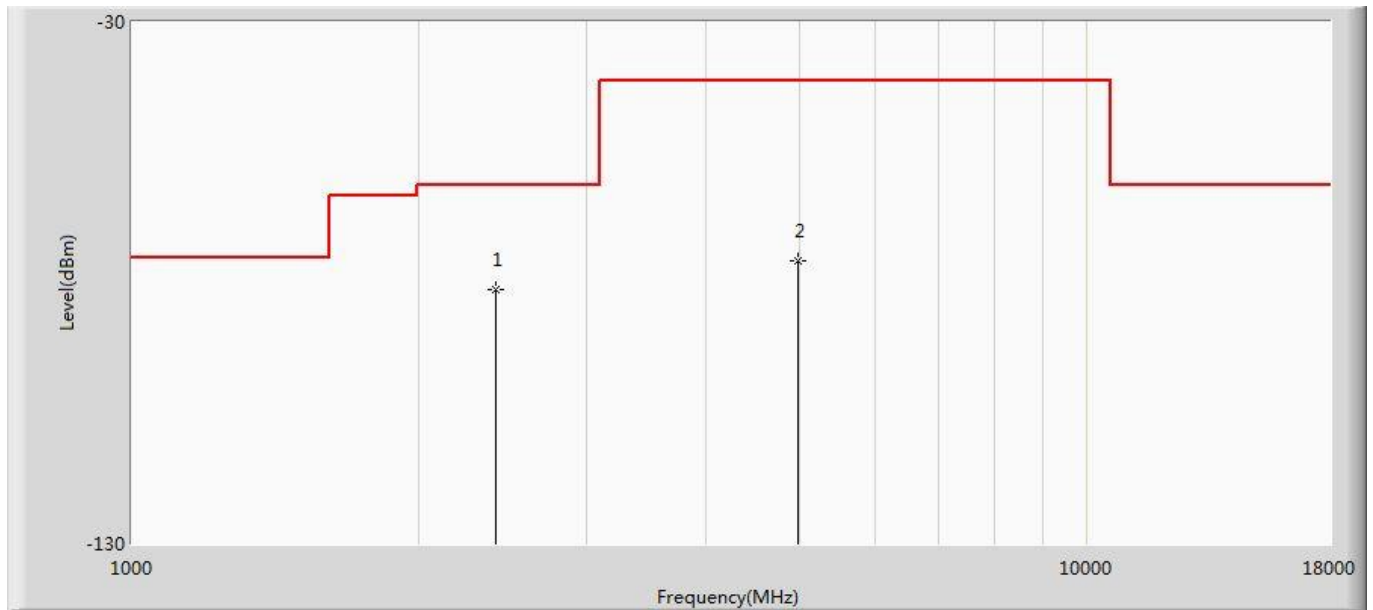
4.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB

below 1G is defined as ± 3.8 dB

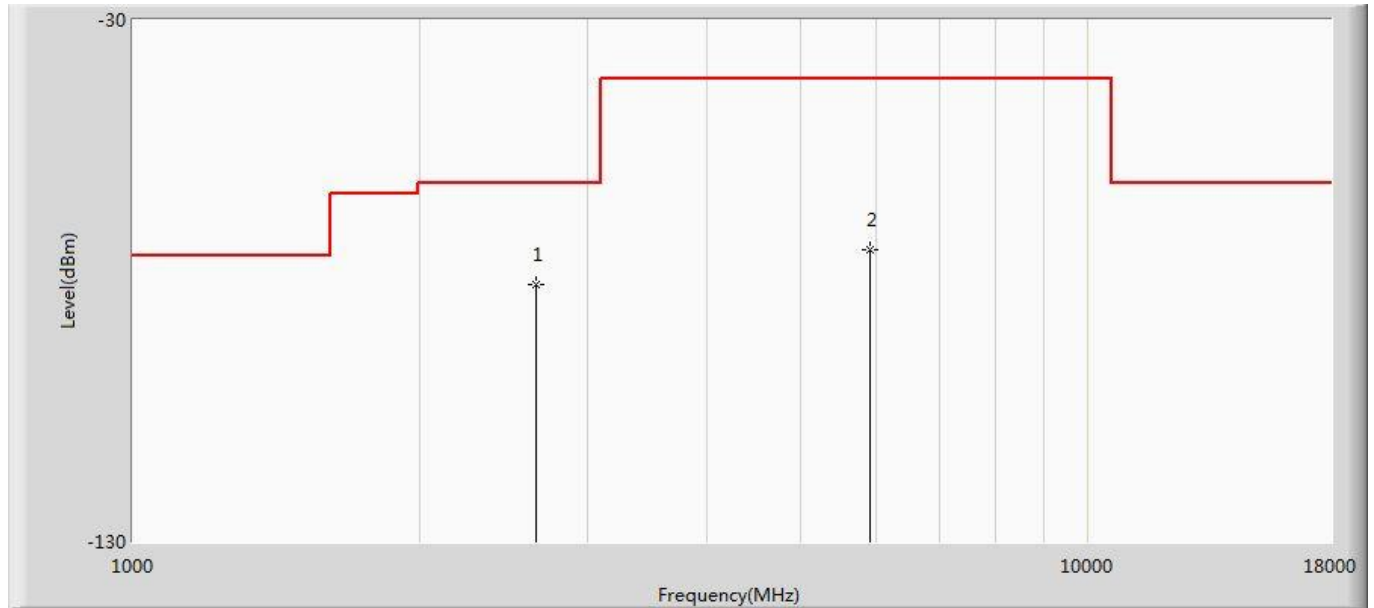
4.6. Test Result

Profile: 2220606R	Page No.: 9
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:47
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-H	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1: Transmit at CH5 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	2411.000	-81.386	-89.486	-20.086	-61.300	8.100	PK
2		4995.000	-75.811	-91.491	-34.511	-41.300	15.680	PK

Profile: 2220606R	Page No.: 10
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:47
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-V	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1: Transmit at CH5 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	2649.000	-80.734	-89.224	-19.434	-61.300	8.490	PK
2		5930.000	-74.065	-91.015	-32.765	-41.300	16.950	PK

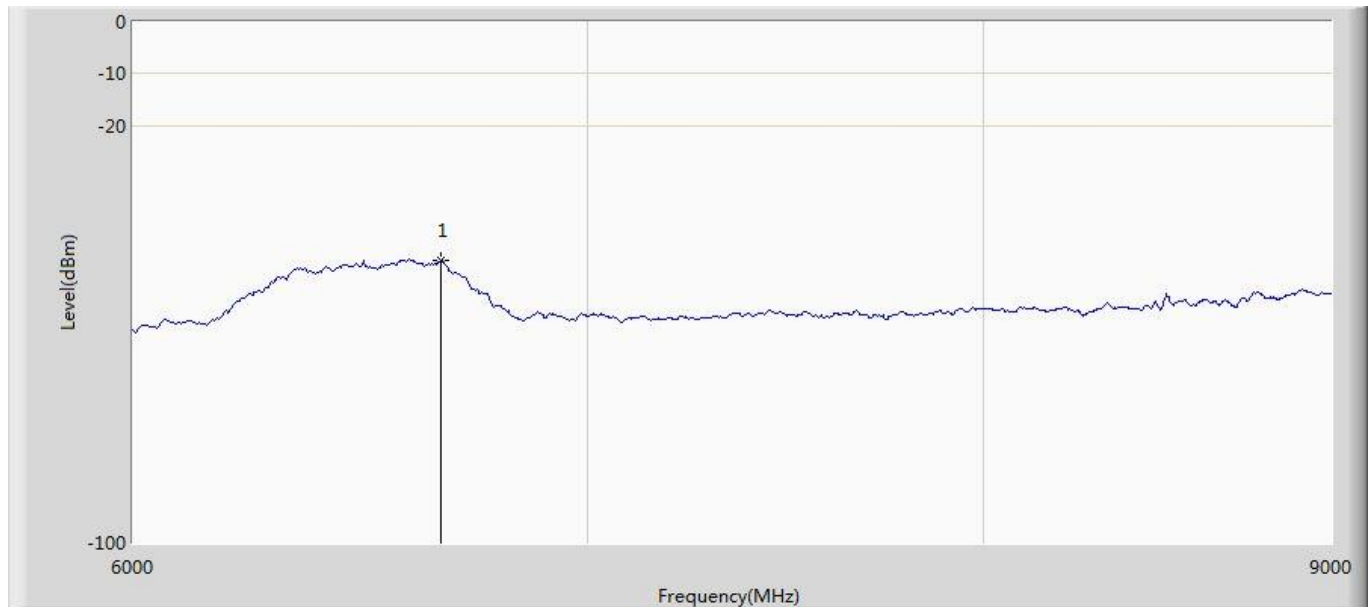
Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
H	6660	-66.5	20.722	-45.778	-41.3	-4.478	RMS

Note 1: Measure Level = Reading Level + Factor.

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

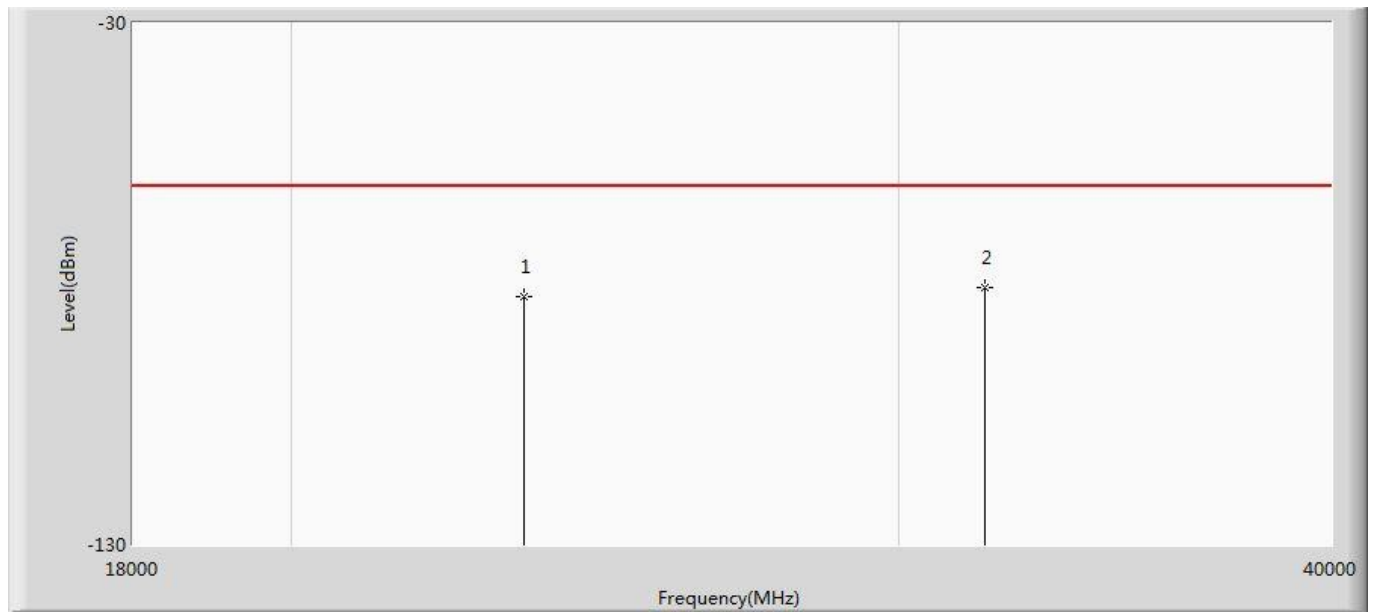
Note 3: The test result of vertical polarity is more than 6db below the limit, so the data of vertical polarity is not shown in the report.

Profile: 2220606R	Page No.: 21
Engineer: Neil	
Site: AC6	Time: 2022/04/22 - 13:57
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-H	Polarity: Horizontal
EUT: UWB SiP Module	Power: AC 230V/50Hz
Note: Transmit at CH5 by UWB	



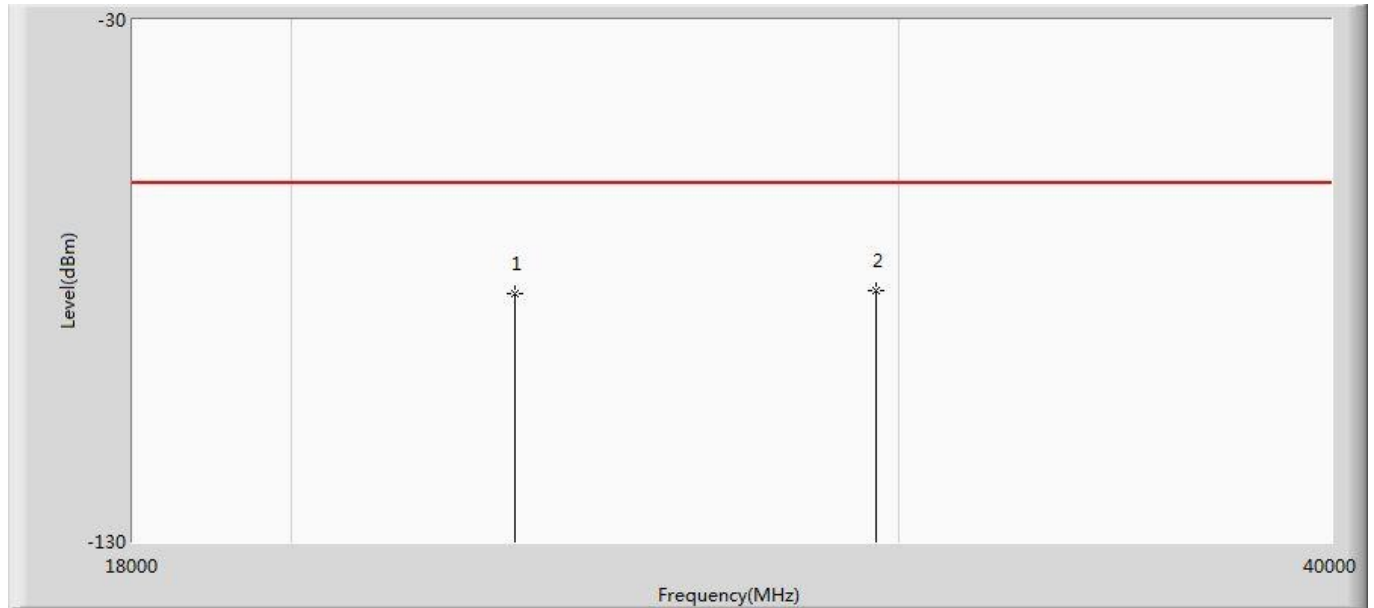
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		6660.000	-45.778	-66.500	NaN	NaN	20.722	PK

Profile: 2220606R	Page No.: 13
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:47
Limit: FCC-15.519	Margin: 0
Probe: 18-40G	Polarity:
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1: Transmit at CH5 by UWB	



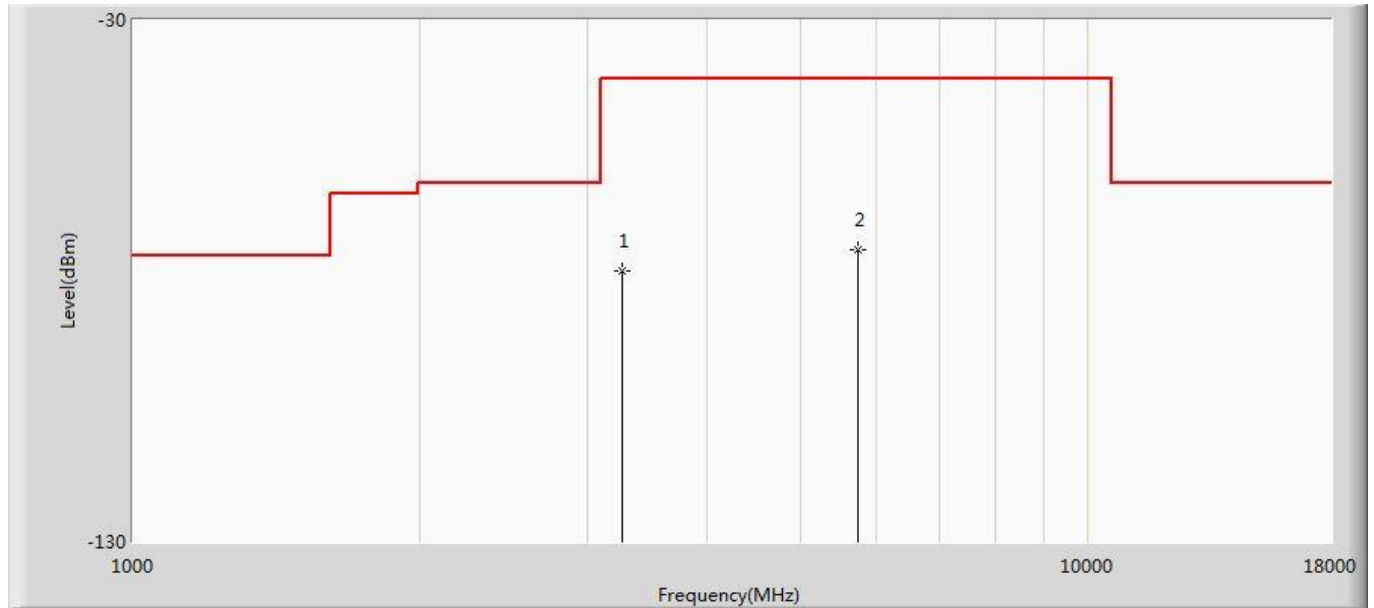
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		23368.000	-82.576	-91.044	-21.276	-61.300	8.468	PK
2	*	31750.000	-80.620	-91.032	-19.320	-61.300	10.412	PK

Profile: 2220606R	Page No.: 14
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:48
Limit: FCC-15.519	Margin: 0
Probe: 18-40G	Polarity:
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1: Transmit at CH5 by UWB	



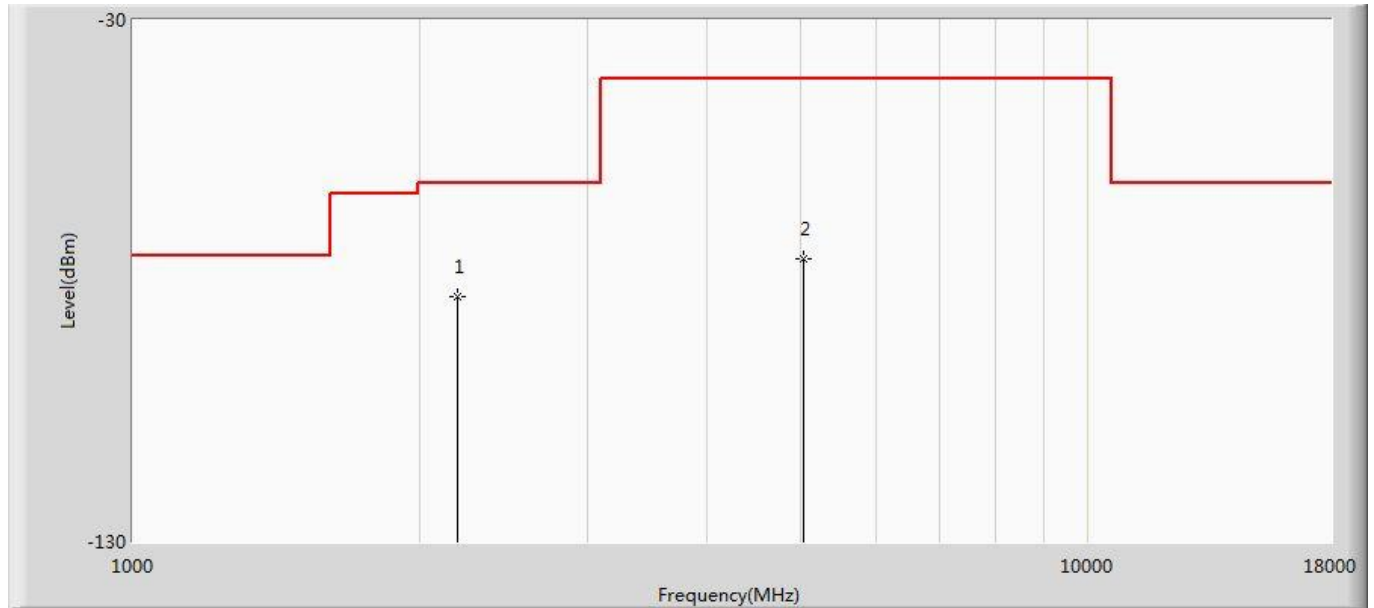
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		23214.000	-82.590	-91.028	-21.290	-61.300	8.438	PK
2	*	29550.000	-81.855	-91.698	-20.555	-61.300	9.843	PK

Profile: 2220606R	Page No.: 11
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:47
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-H	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2: Transmit at CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		3261.000	-78.130	-88.890	-36.830	-41.300	10.760	PK
2	*	5743.000	-74.051	-91.281	-32.751	-41.300	17.230	PK

Profile: 2220606R	Page No.: 12
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:47
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-V	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2: Transmit at CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	2190.000	-82.958	-90.668	-21.658	-61.300	7.710	PK
2		5046.000	-75.838	-91.268	-34.538	-41.300	15.430	PK

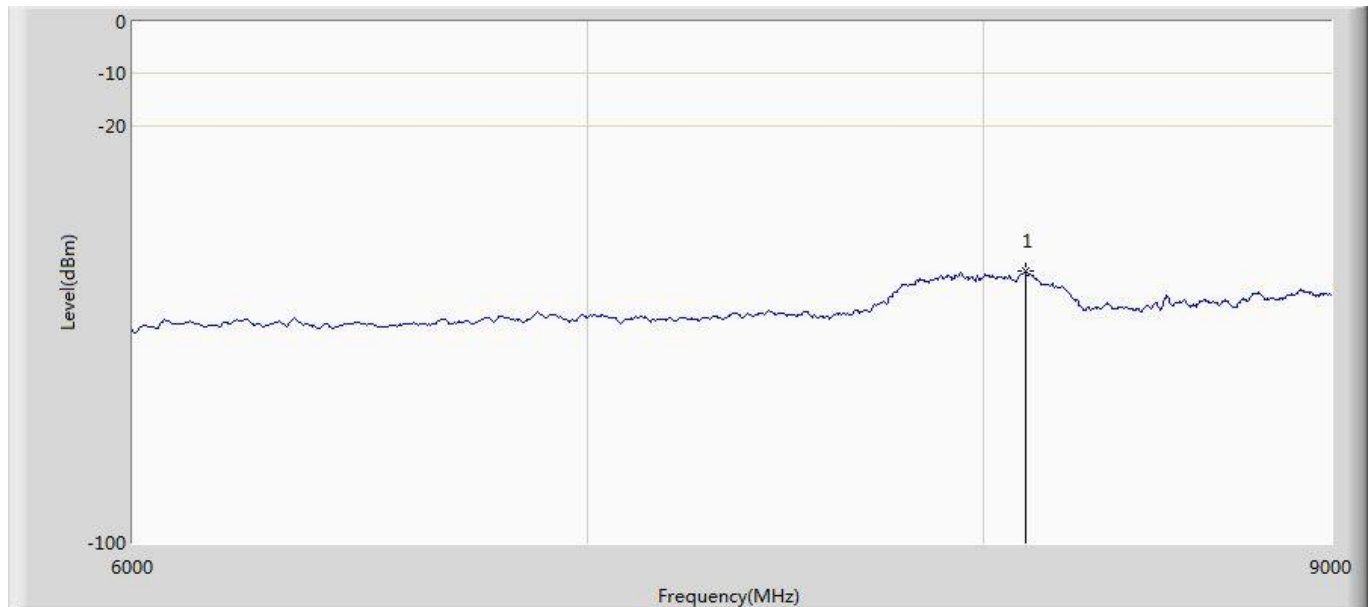
Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
H	8115	-70.16	22.189	-47.962	-41.3	-6.662	RMS

Note 1: Measure Level = Reading Level + Factor.

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

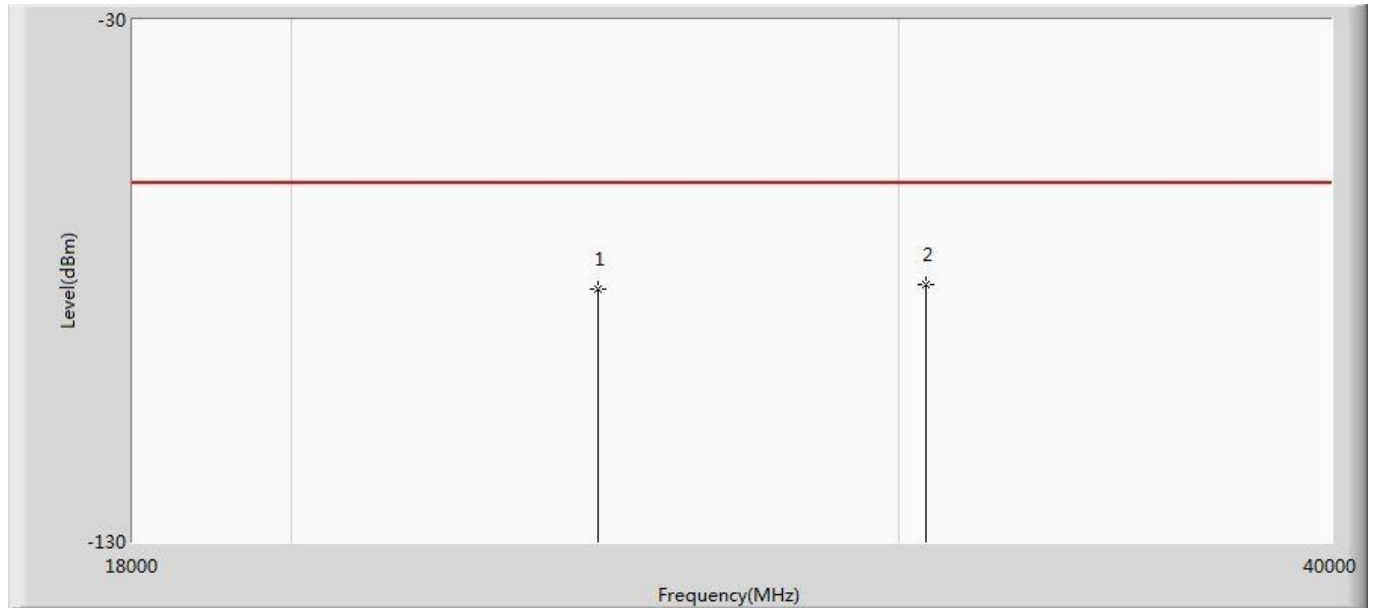
Note 3: The test result of vertical polarity is more than 6db below the limit, so the data of vertical polarity is not shown in the report.

Profile: 2220606R	Page No.: 23
Engineer: Neil	
Site: AC6	Time: 2022/04/22 - 14:09
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-H	Polarity: Horizontal
EUT: UWB SiP Module	Power: AC 230V/50Hz
Note: Transmit at CH9 by UWB	



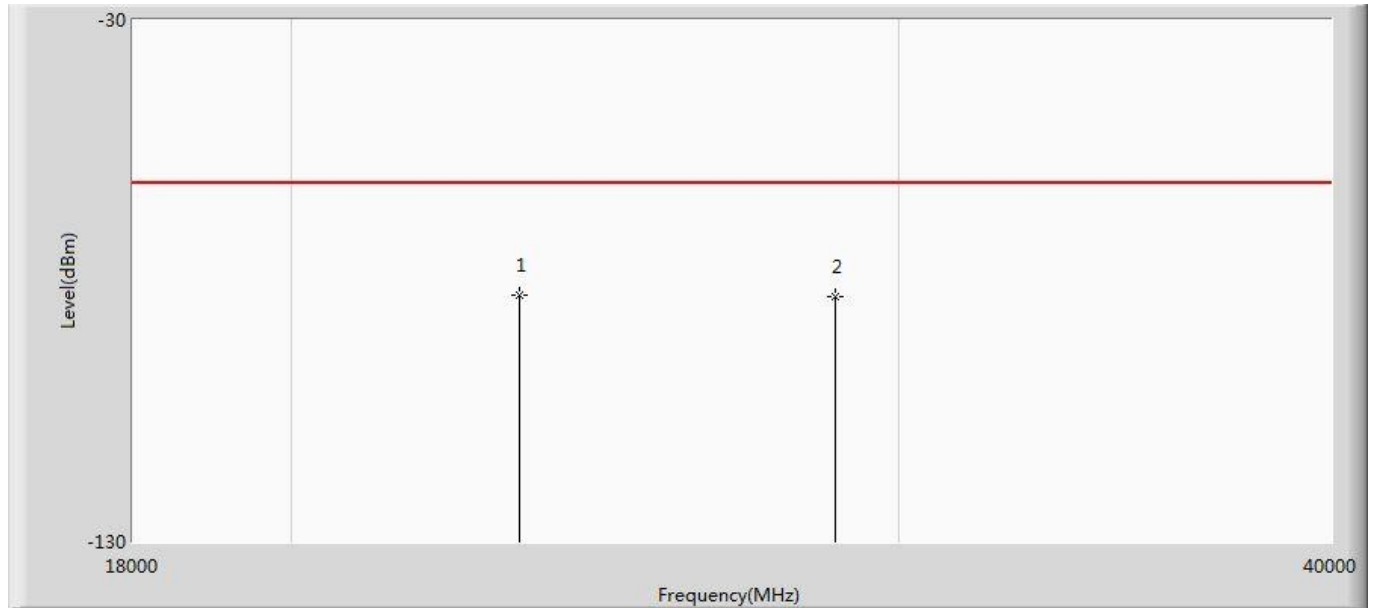
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		8115.000	-47.962	-70.160	NaN	NaN	22.198	PK

Profile: 2220606R	Page No.: 15
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:48
Limit: FCC-15.519	Margin: 0
Probe: 18-40G	Polarity:
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2: Transmit at CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		24534.000	-81.696	-90.400	-20.396	-61.300	8.704	PK
2	*	30540.000	-80.765	-90.859	-19.465	-61.300	10.094	PK

Profile: 2220606R	Page No.: 16
Engineer: Neil	
Site: AC5	Time: 2022/04/22 - 14:48
Limit: FCC-15.519	Margin: 0
Probe: 18-40G	Polarity:
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2: Transmit at CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	23302.000	-82.773	-91.228	-21.473	-61.300	8.455	PK
2		28758.000	-83.156	-92.806	-21.856	-61.300	9.650	PK

Test Result	Pass
-------------	------

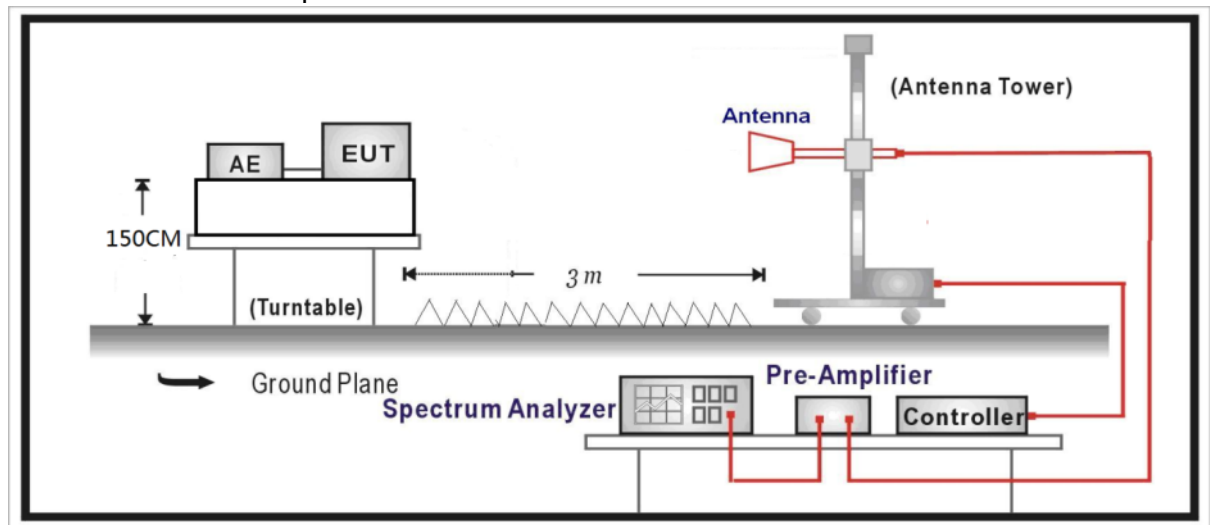
5. Radiated Emission in GPS Band

5.1. Test Equipment

Radiated Emission(Above 1GHz) / AC-5					
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date	Cal. Due Date
EXASpectrum Analyzer	Keysight	N9010A	MY55370495	2022.03.18	2023.03.17
Preamplifier	EMCI	EMC184045SE	980263	2021.06.08	2022.06.07
DRG Horn Antenna	ETS-Lindgren	3117	00167055	2021.08.23	2022.08.22
Broad-BandHorn Antenna	Schwarzbeck	BBHA9170	294	2021.04.14	2023.04.13
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2022.03.29	2023.03.28
Coaxial Cable	ROSENBERGER	LA1-C011-2000/3000	AC5-40G	2022.03.18	2023.03.17
Temperature/Humidity Meter	RTS	RTS-8S	AC5-TH	2021.07.09	2022.07.08
Dekra test software	Dekra	-	-	-	-
Note: All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.					

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 1 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.

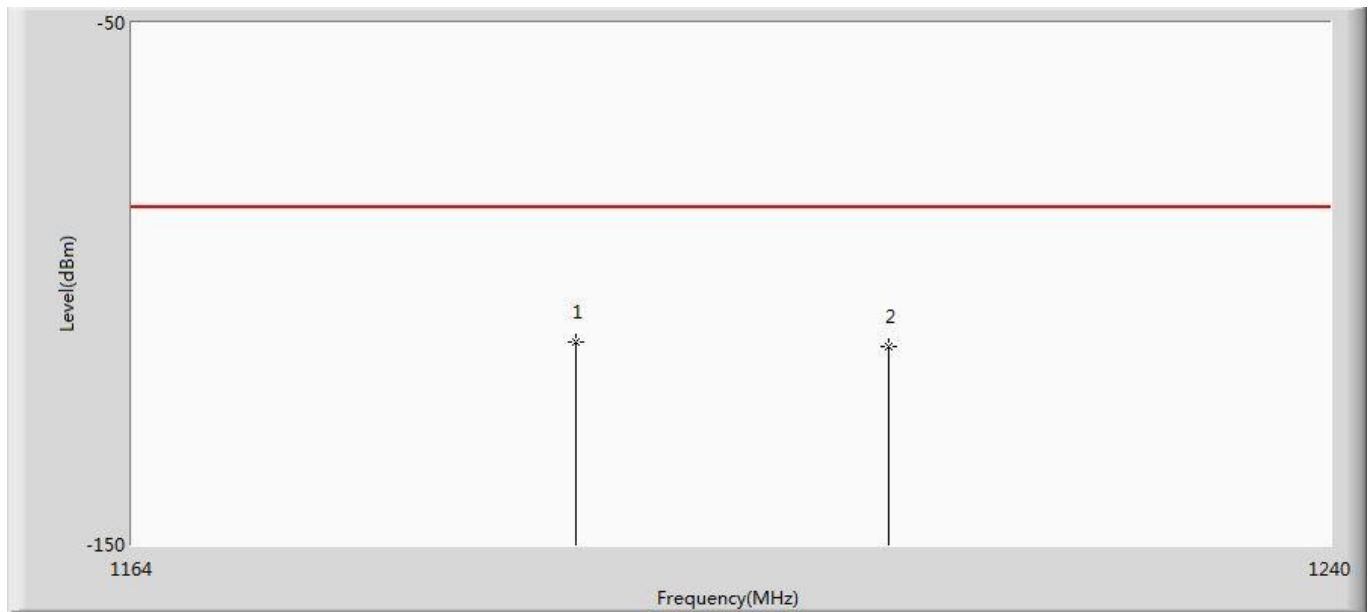
Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

5.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB

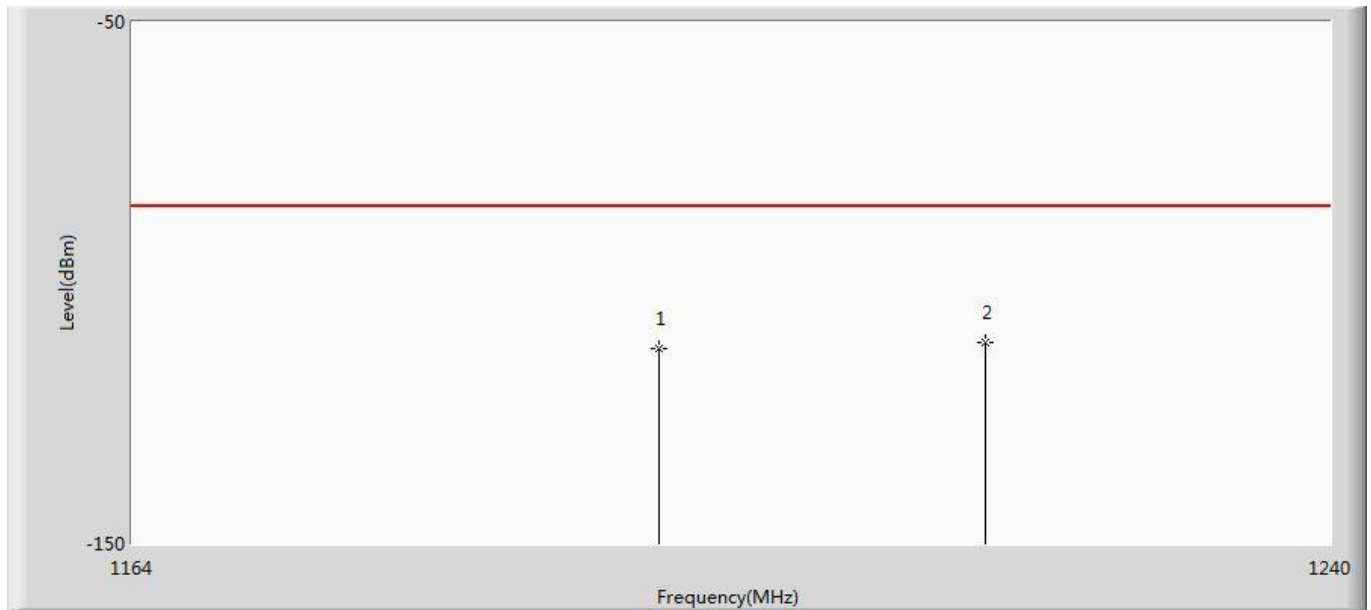
5.6. Test Result

Profile: 2220606R	Page No.: 9
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1:Transmit at CH5 by UWB	



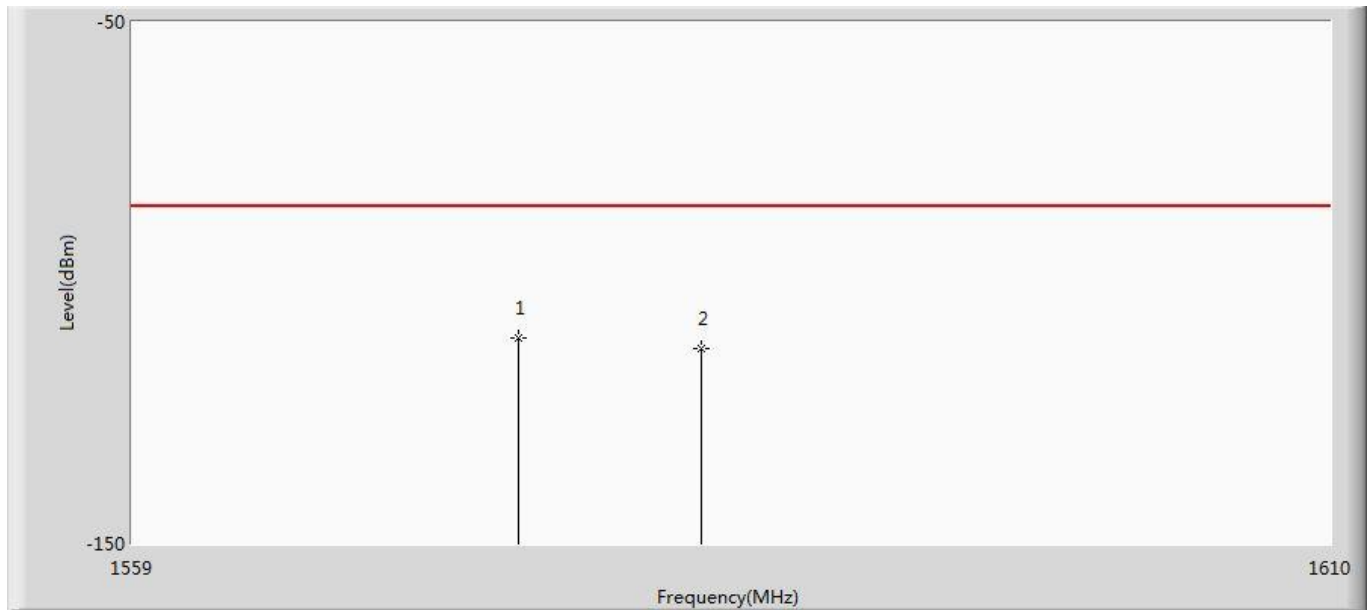
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1191.626	-111.285	-94.968	-25.985	-85.300	-16.316	PK
2		1211.462	-111.931	-95.655	-26.631	-85.300	-16.276	PK

Profile: 2220606R	Page No.: 10
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1:Transmit at CH5 by UWB	



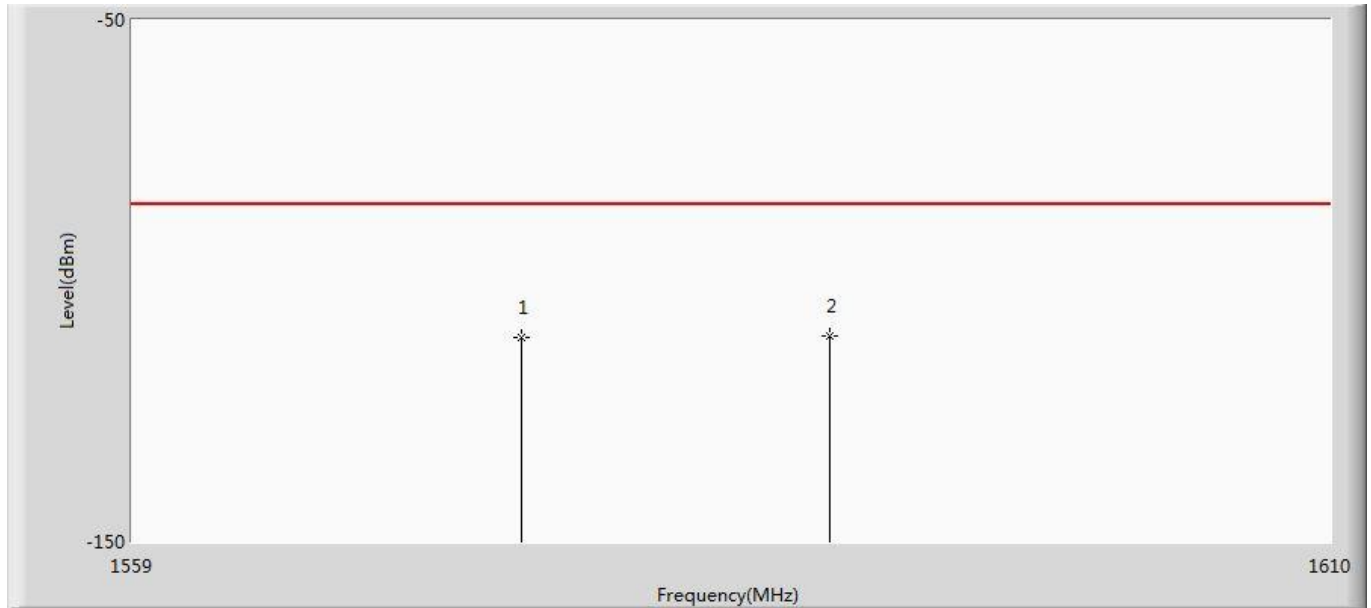
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		1196.832	-112.546	-96.212	-27.246	-85.300	-16.334	PK
2	*	1217.618	-111.500	-95.292	-26.200	-85.300	-16.209	PK

Profile: 2220606R	Page No.: 11
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1:Transmit at CH5 by UWB	



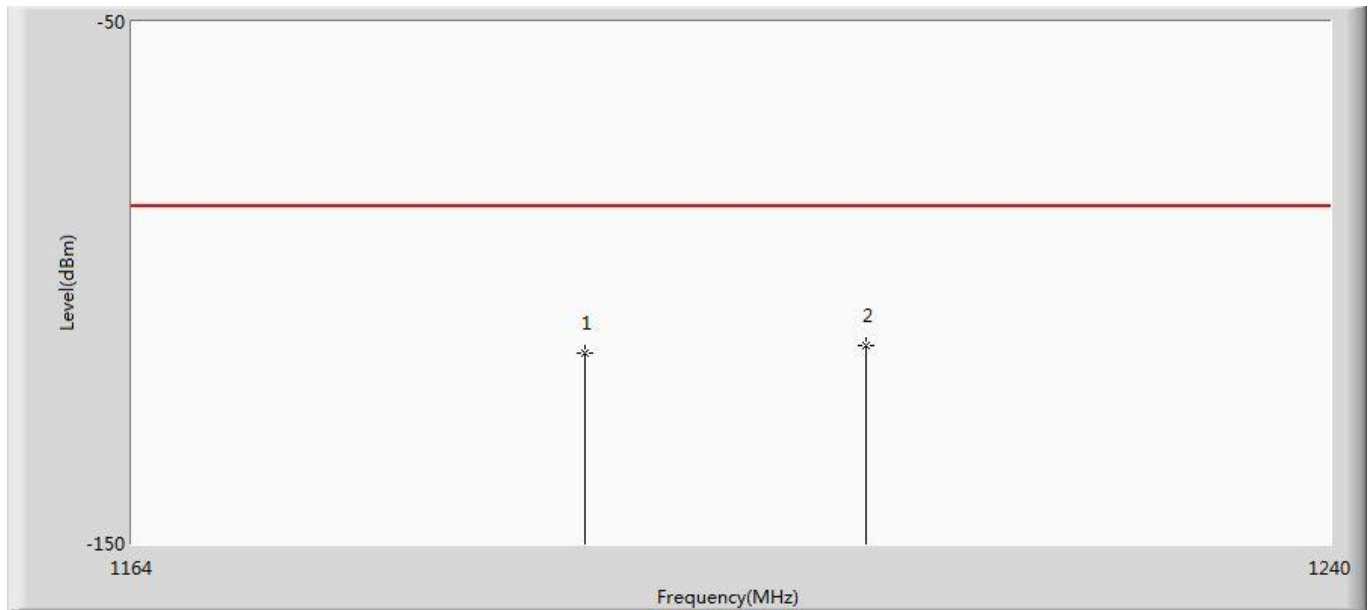
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1575.295	-110.663	-95.308	-25.363	-85.300	-15.355	PK
2		1583.021	-112.553	-97.365	-27.253	-85.300	-15.188	PK

Profile: 2220606R	Page No.: 12
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1:Transmit at CH5 by UWB	



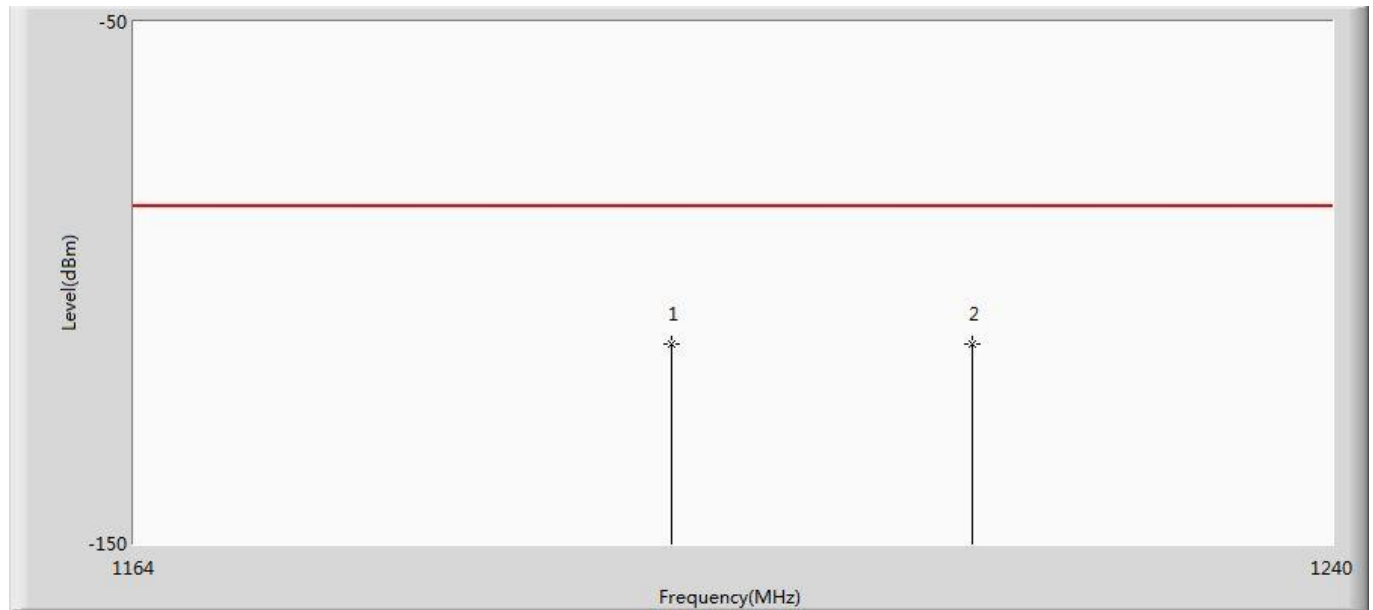
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		1575.422	-110.873	-95.520	-25.573	-85.300	-15.352	PK
2	*	1588.529	-110.668	-95.611	-25.368	-85.300	-15.057	PK

Profile: 2220606R	Page No.: 13
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2:Transmit at CH9 by UWB	



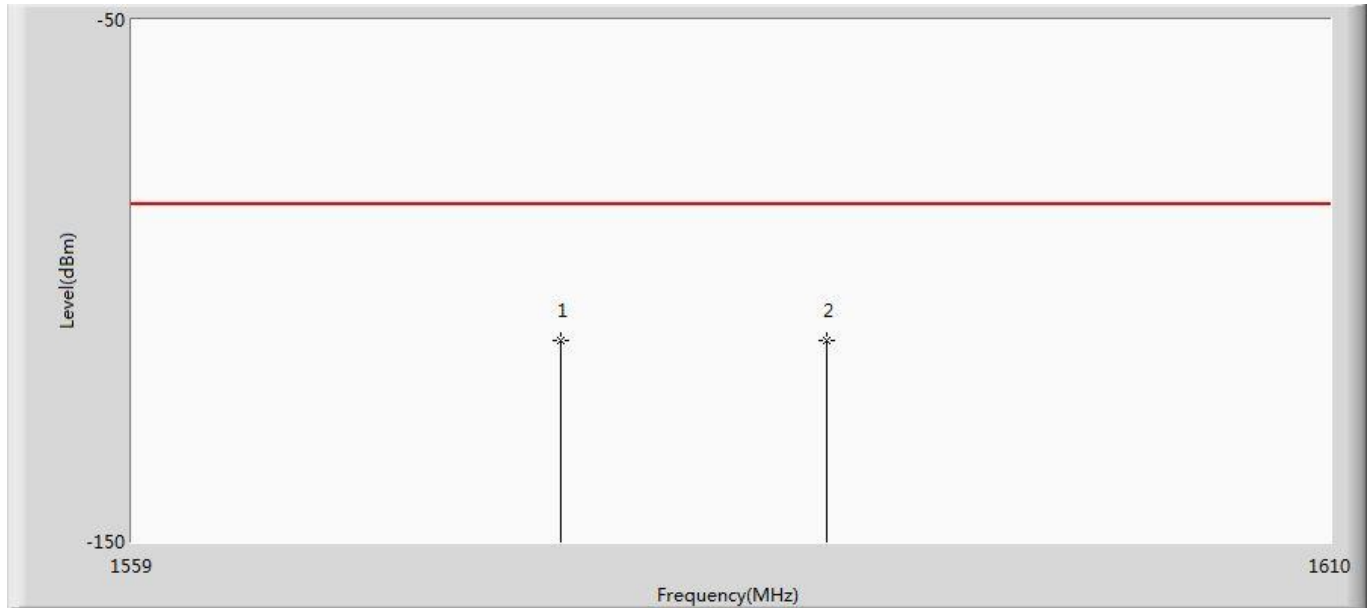
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		1192.234	-113.435	-97.116	-28.135	-85.300	-16.319	PK
2	*	1209.980	-111.955	-95.663	-26.655	-85.300	-16.292	PK

Profile: 2220606R	Page No.: 14
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2:Transmit at CH9 by UWB	



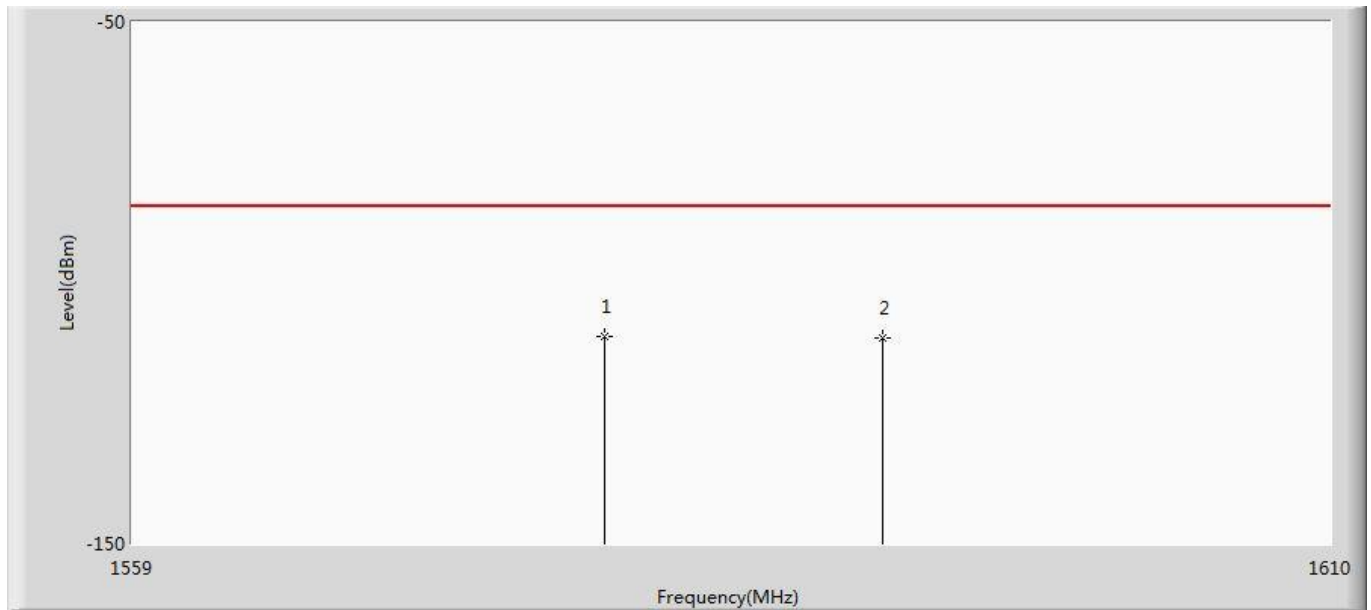
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		1197.478	-111.848	-95.512	-26.548	-85.300	-16.337	PK
2	*	1216.668	-111.749	-95.530	-26.449	-85.300	-16.218	PK

Profile: 2220606R	Page No.: 15
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2:Transmit at CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1577.054	-111.353	-96.029	-26.053	-85.300	-15.324	PK
2		1588.376	-111.358	-96.297	-26.058	-85.300	-15.061	PK

Profile: 2220606R	Page No.: 16
Engineer: Carlosshen	
Site: AC5	Time: 2022/05/10 - 14:34
Limit: FCC-15.519	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2:Transmit at CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1	*	1578.916	-110.379	-95.094	-25.079	-85.300	-15.285	PK
2		1590.798	-110.552	-95.548	-25.252	-85.300	-15.003	PK

Test Result	Pass
-------------	------

6. Operational Limitations

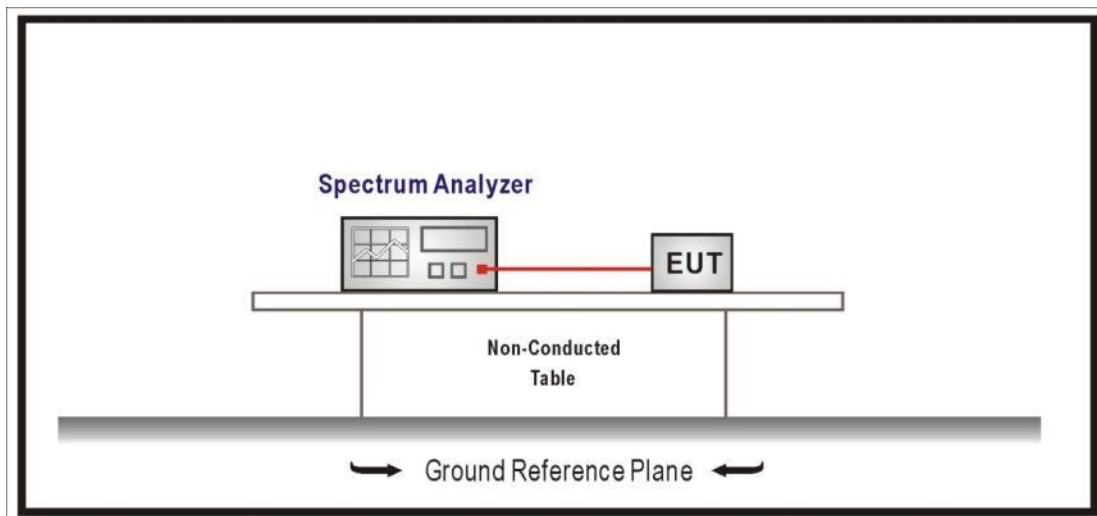
6.1. Test Equipment

Operational Limitations/ TR8

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2021.07.11	2022.07.10
EXA Spectrum Analyzer	Keysight	N9010A	MY55370495	2021.08.12	2022.08.11
MXA Signal Analyzer	Keysight	N9020A	MY56060147	2021.07.11	2022.07.10
4TX MIMO Power Sensor	Keysight	X8750A	MY59400102	2022.02.09	2023.02.08
Coaxial Cable	Woken	SFL402	F02-150410-044	2021.12.30	2022.12.29
Temperature/Humidity Meter	RTS	RTS-8S	RF08	2021.07.09	2022.07.08

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

6.2. Test Setup



6.3. Limit

Standard: FCC Part 15 Subpart F Paragraph 15.519 (a)(1)

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.

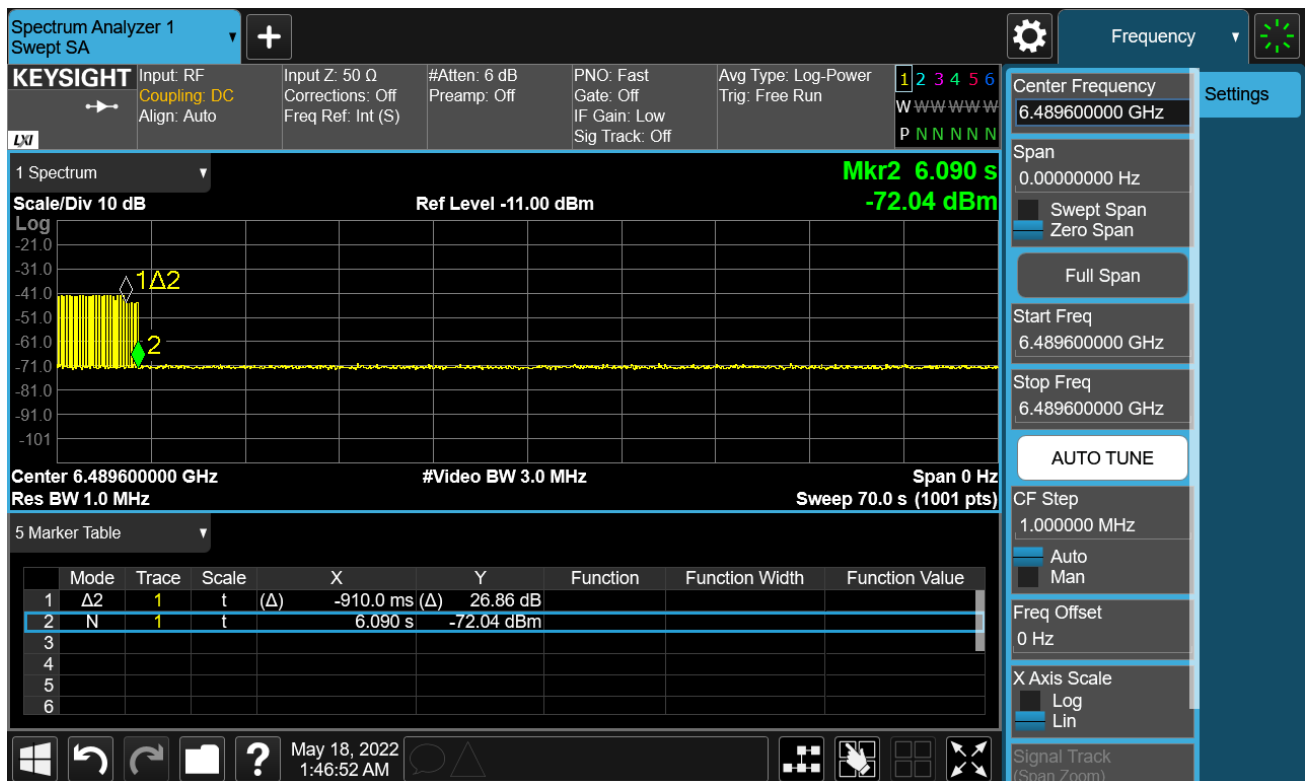
6.5. Uncertainty

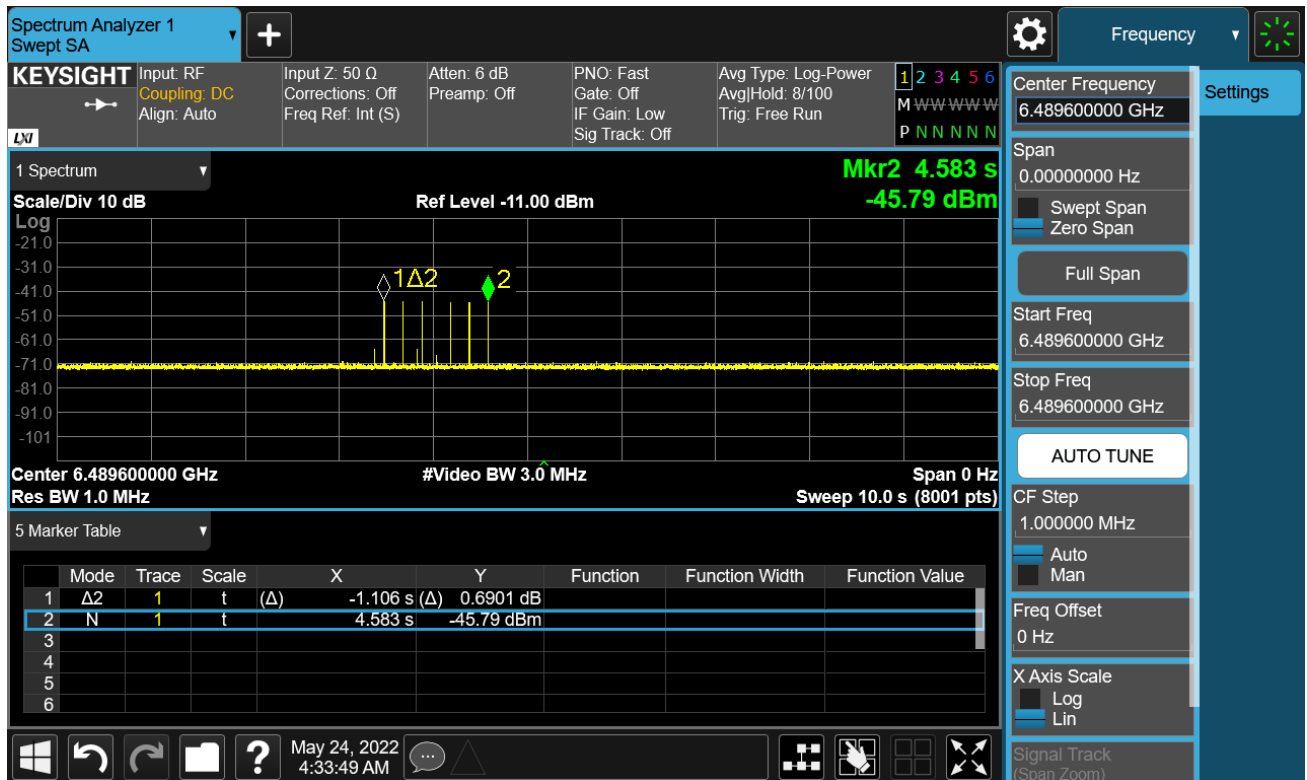
The measurement uncertainty is defined as $\pm 2\text{ms}$

6.6. Test Result

Product	:	UWB SiP Module
Test Item	:	Operational Limitations
Test Site	:	AC-5
Test Mode	:	Mode 1: Transmit CH5

Frequency (MHz)	Duration from removing the acknowledgement from the associated receiver to stop transmission (s)	Limit (s)	Result
6489.6	4.583	10	Pass

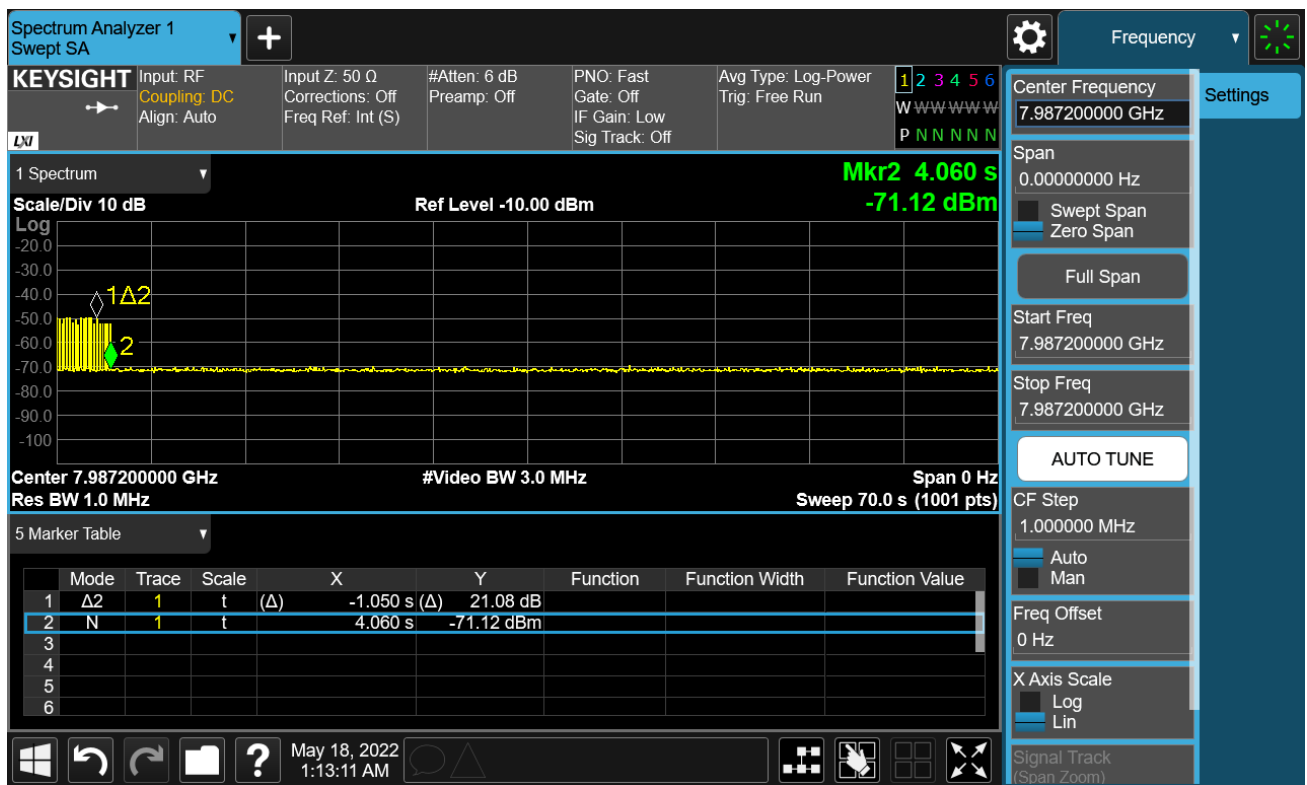


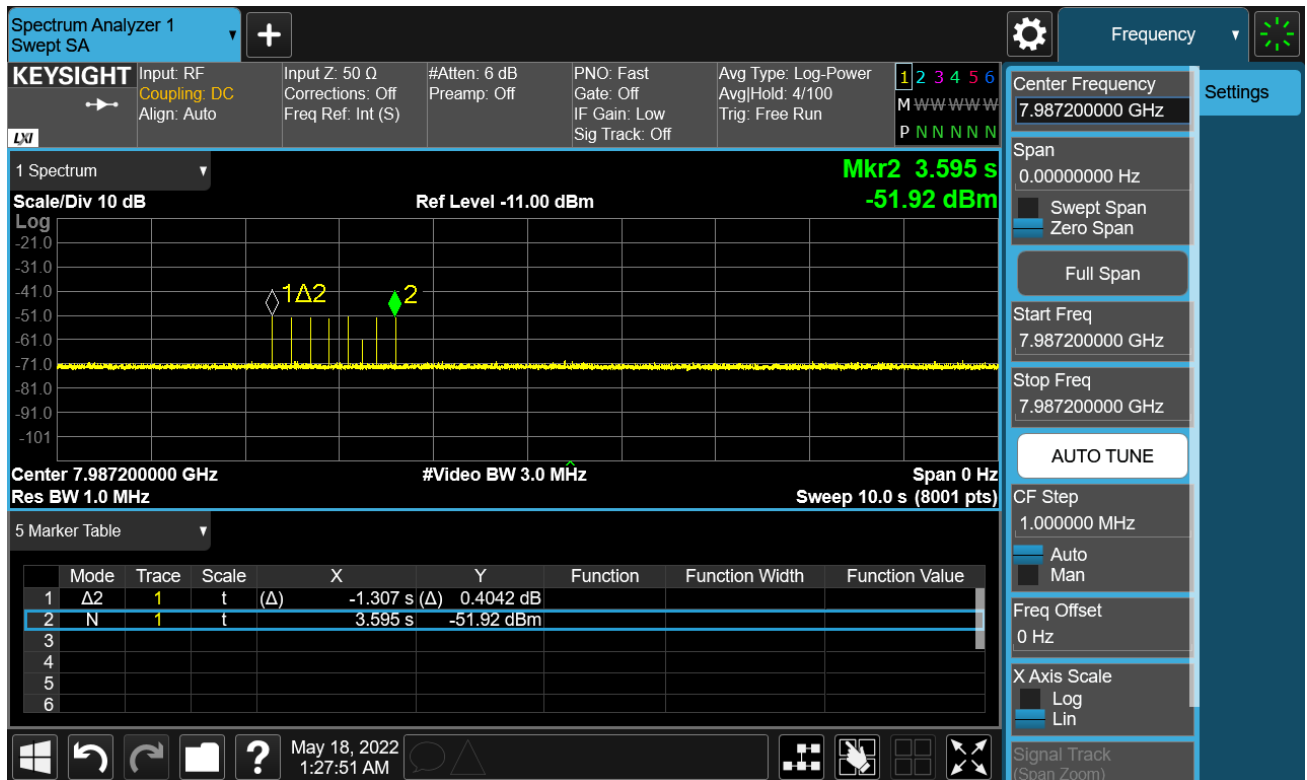


Note: The device starts transmitting and it stops transmitting in 4.583s without ACK .

Product	:	UWB SiP Module
Test Item	:	Operational Limitations
Test Site	:	AC-5
Test Mode	:	Mode 2: Transmit CH9

Frequency (MHz)	Duration from removing the acknowledgement from the associated receiver to stop transmission (s)	Limit (s)	Result
7987.2	3.595	10	Pass





Note: The device starts transmitting and it stops transmitting in 3.595s without ACK .

7. 10dB Bandwidth

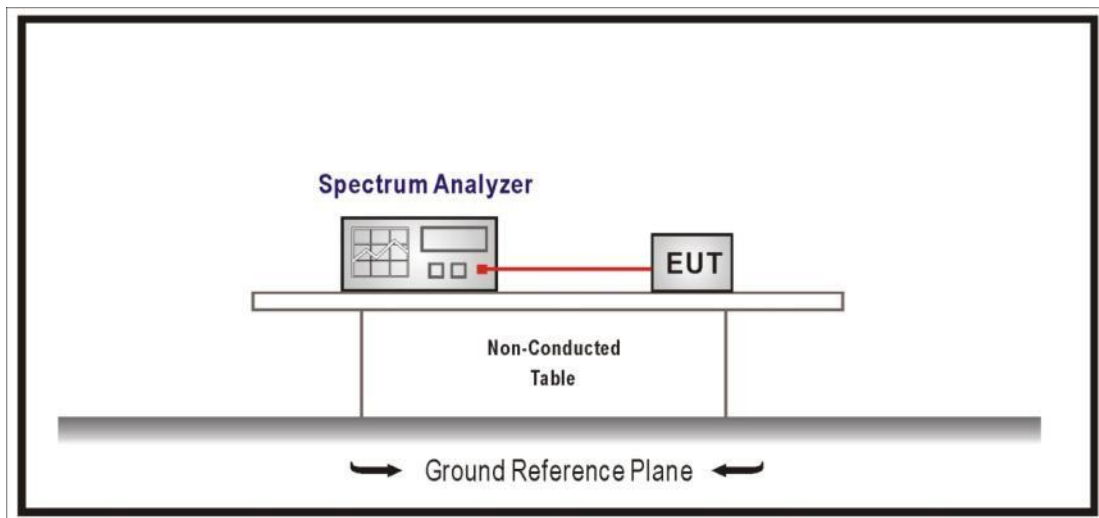
7.1. Test Equipment

10dB Bandwidth/ TR8

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2021.07.11	2022.07.10
EXA Spectrum Analyzer	Keysight	N9010A	MY55370495	2021.08.12	2022.08.11
MXA Signal Analyzer	Keysight	N9020A	MY56060147	2021.07.11	2022.07.10
4TX MIMO Power Sensor	Keysight	X8750A	MY59400102	2022.02.09	2023.02.08
Coaxial Cable	Woken	SFL402	F02-150410-044	2021.12.30	2022.12.29
Temperature/Humidity Meter	RTS	RTS-8S	RF08	2021.07.09	2022.07.08

Note: All equipment is 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 = 2.0 GHz, use 10dB bandwidth function to test the result.

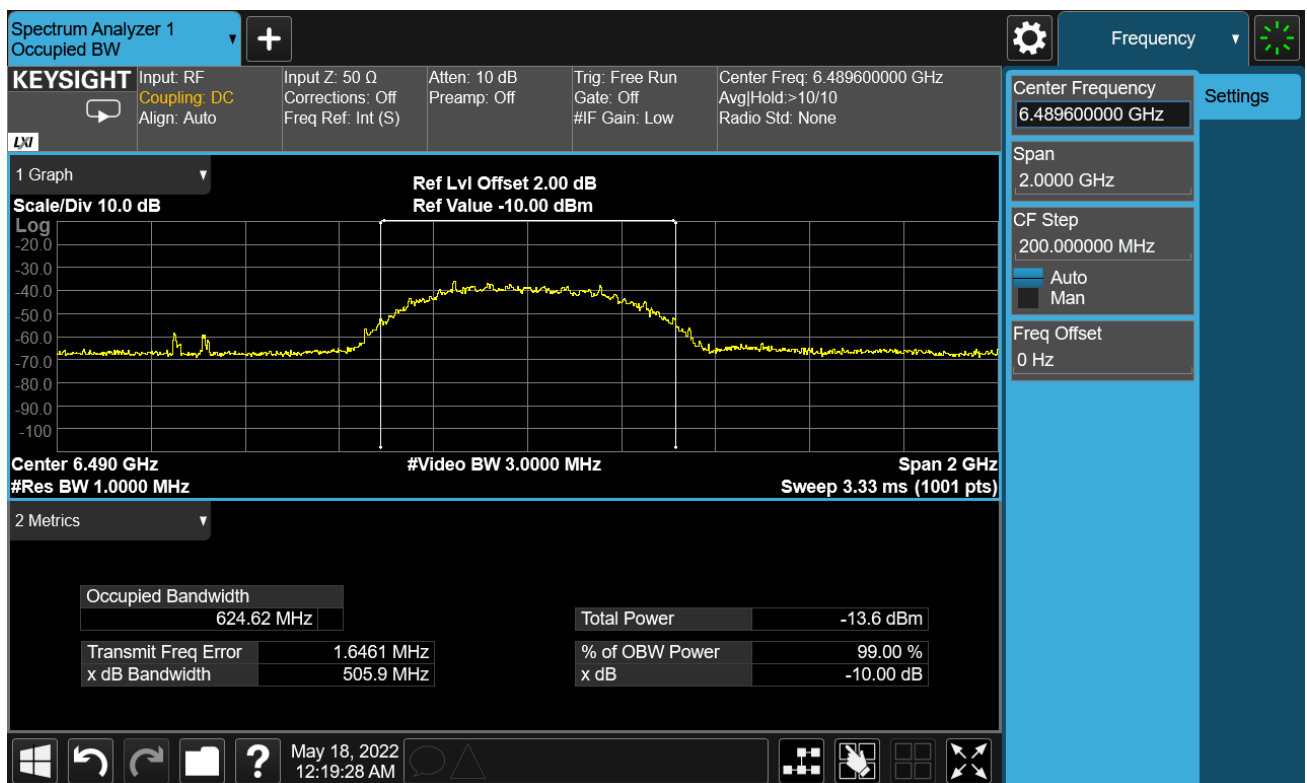
7.5. Uncertainty

The measurement uncertainty is defined as ± 1 kHz

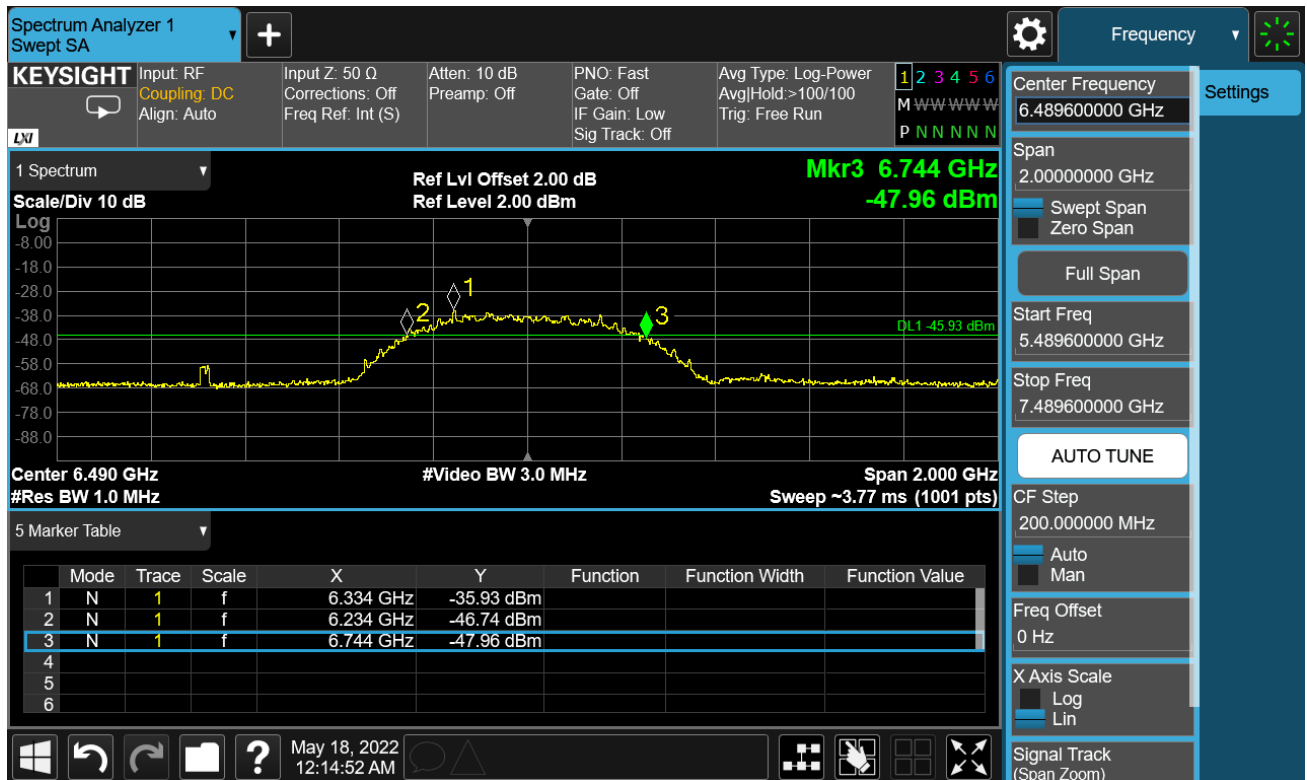
7.6. Test Result

Product	:	UWB SiP Module
Test Item	:	10dB Bandwidth
Test Site	:	AC-5
Test Mode	:	Mode 1: Transmit CH5

Frequency (MHz)	10dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
6489.6	505.9	624.62	500	Pass

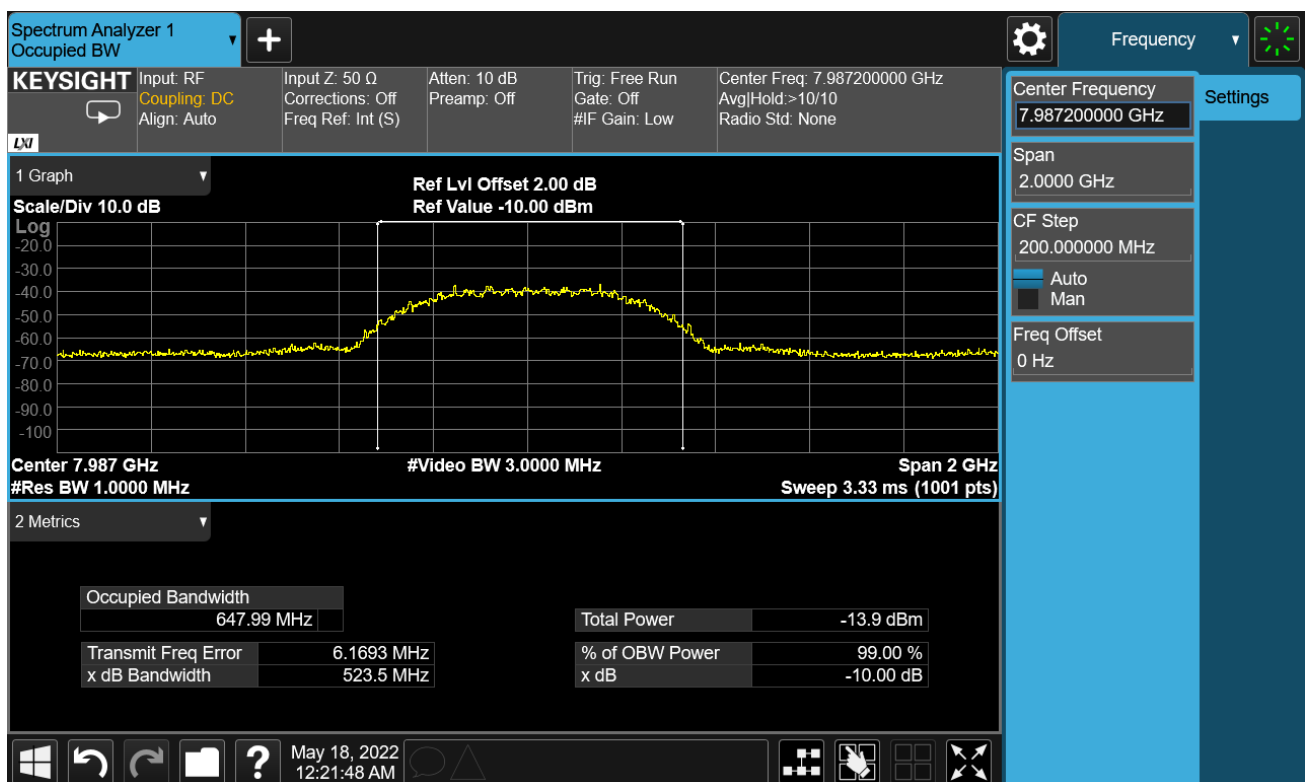


Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	Limit (MHz)		Result
			Lower Frequency	Upper Frequency	
6489.6	6234	6744	3100	10600	Pass

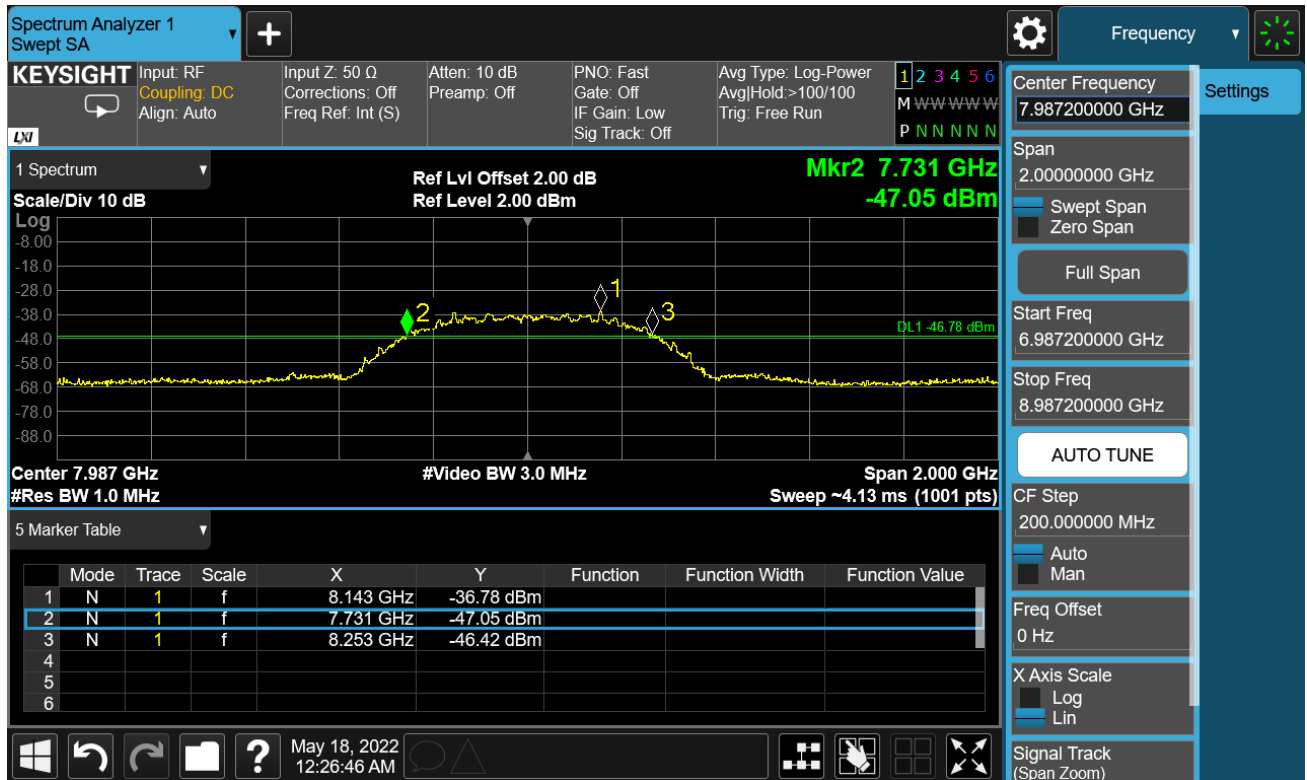


Product	:	UWB SiP Module
Test Item	:	10dB Bandwidth
Test Site	:	AC-5
Test Mode	:	Mode 2: Transmit CH9

Frequency (MHz)	10dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
7987.2	523.5	647.99	500	Pass



Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	Limit (MHz)		Result
			Lower Frequency	Upper Frequency	
7987.2	7731	8253	3100	10600	Pass



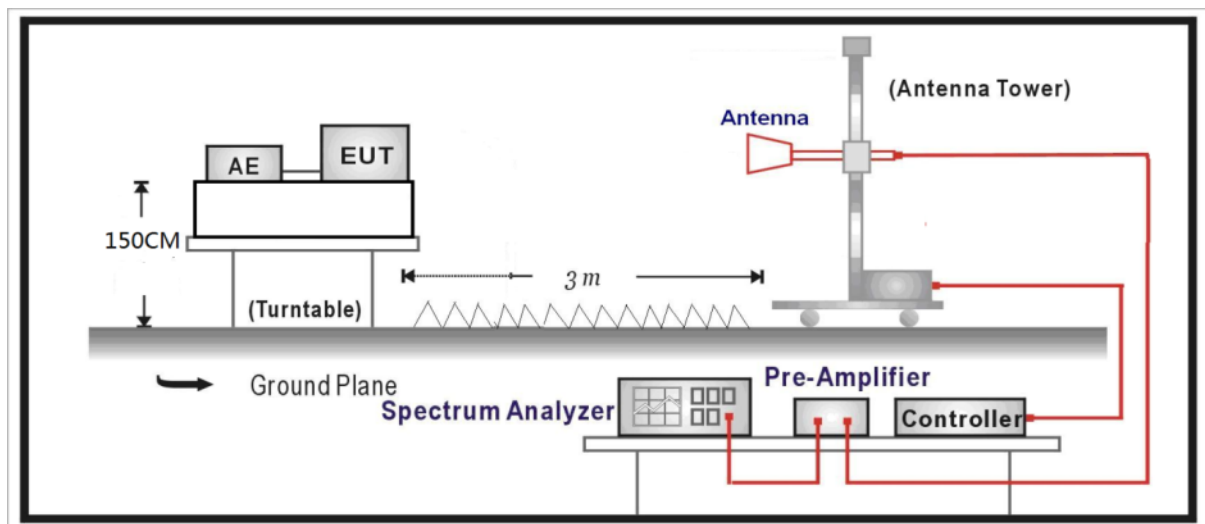
8. EIRP

8.1. Test Equipment

Radiated Emission(Above 1GHz) / AC-5					
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date	Cal. Due Date
EXASpectrum Analyzer	Keysight	N9010A	MY55370495	2022.03.18	2023.03.17
Preamplifier	EMCI	EMC184045SE	980263	2021.06.08	2022.06.07
DRG Horn Antenna	ETS-Lindgren	3117	00167055	2021.08.23	2022.08.22
Broad-BandHorn Antenna	Schwarzbeck	BBHA9170	294	2021.04.14	2023.04.13
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2022.03.29	2023.03.28
Coaxial Cable	ROSENBERGER	LA1-C011-2000/3000	AC5-40G	2022.03.18	2023.03.17
Temperature/Humidity Meter	RTS	RTS-8S	AC5-TH	2021.07.09	2022.07.08
Dekra test software	Dekra	-	-	-	-

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

8.2. Test Setup



8.3. Limit

Standard: FCC Part 15 Subpart F Paragraph 15.519 (e)

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, f_M. 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 = 8MHz, VBW = 8MHz, so the EIRP limit is $20 \log (8/50) = -15.918$ dBm.

8.5. Uncertainty

The measurement uncertainty is defined as ± 3.9 dB

8.6. Test Result

Product	:	UWB SiP Module
Test Item	:	EIRP
Test Site	:	AC-5
Test Mode	:	Mode 1: Transmit CH5

Chain	CH	Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
Ant 0	05	H	6644	-38.633	19.960	-18.673	-15.918	-2.755	PK
		V	6334	-47.207	20.064	-28.143	-15.918	-12.225	PK

Note 1: Measure Level = Reading Level + Factor.

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

Note 3: The RBW = 8MHz, so the EIRP limit is $20 \log (8/50) = -15.918$ dBm.

Product	:	UWB SiP Module
Test Item	:	EIRP
Test Site	:	AC-5
Test Mode	:	Mode 2: Transmit CH9

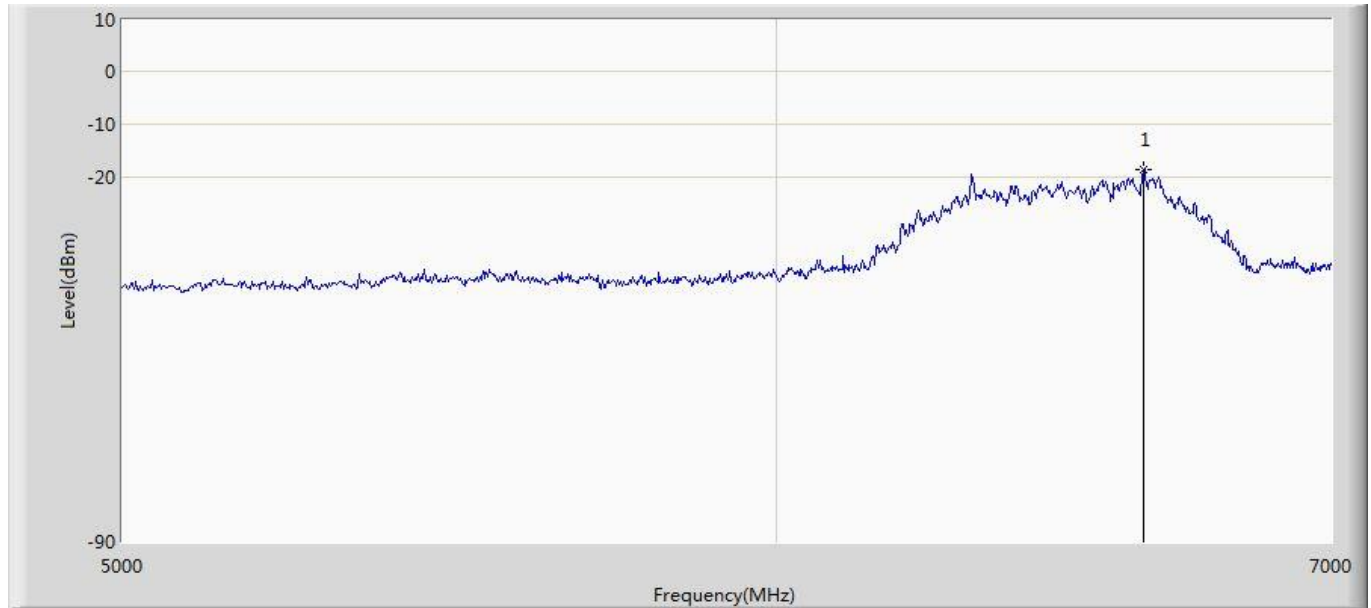
Chain	CH	Antenna	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
Ant 0	09	H	7830	-42.115	21.104	-21.011	-15.918	-5.093	PK
		V	8144	-49.353	21.531	-27.822	-15.918	-11.904	PK

Note 1: Measure Level = Reading Level + Factor.

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

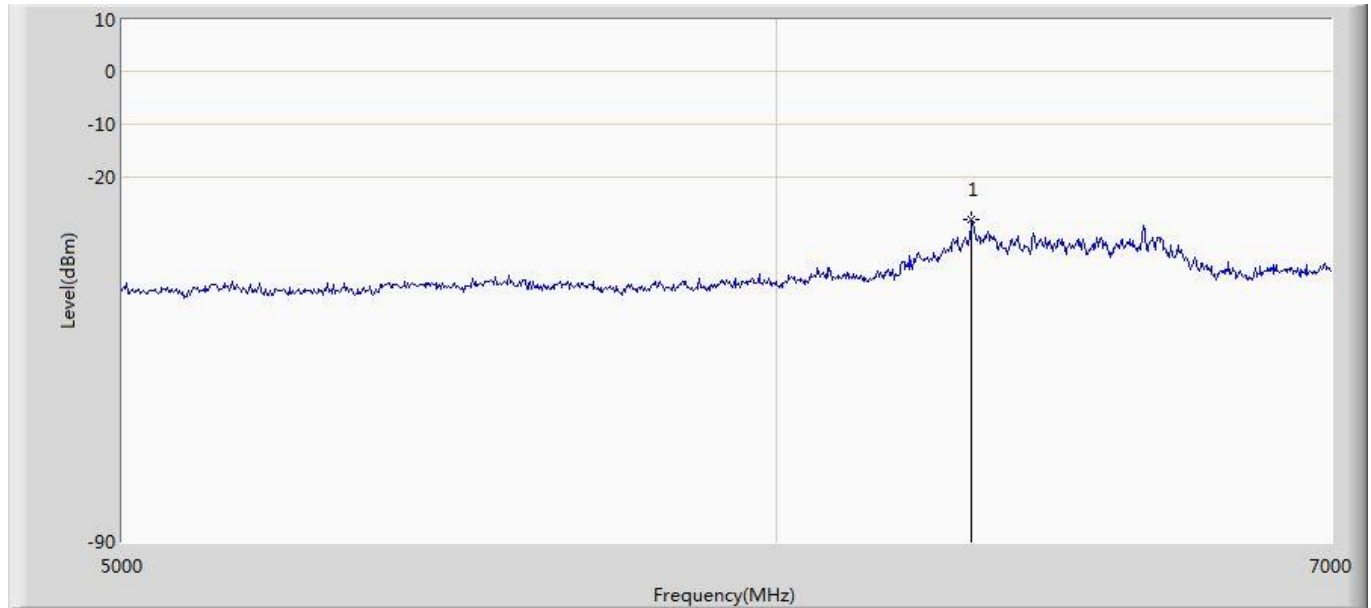
Note 3: The RBW = 8MHz, so the EIRP limit is $20 \log (8/50) = -15.918$ dBm.

Profile: 2220606R	Page No.: 1
Engineer: Neil	
Site: AC5	Time: 2022/04/19 - 11:03
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-H	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1: Transmit CH5 by UWB	



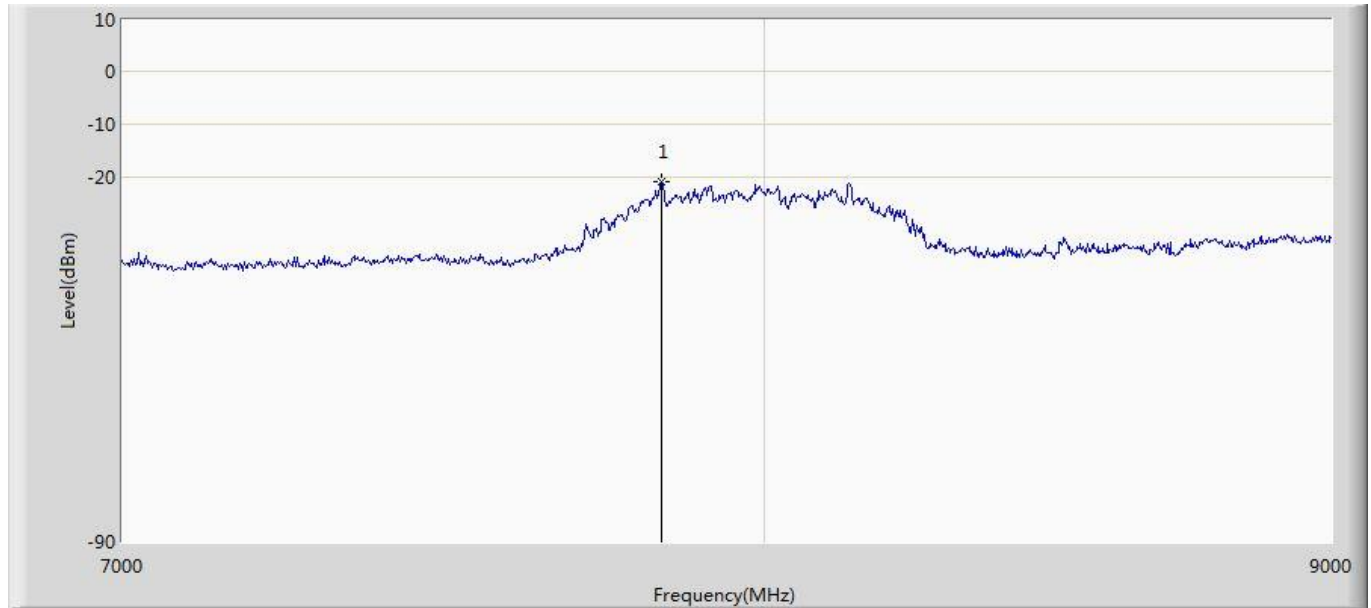
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		6644.000	-18.673	-38.633	NaN	NaN	19.960	PK

Profile: 2220606R	Page No.: 2
Engineer: Neil	
Site: AC6	Time: 2022/04/19 - 11:09
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-V	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 1: Transmit CH5 by UWB	



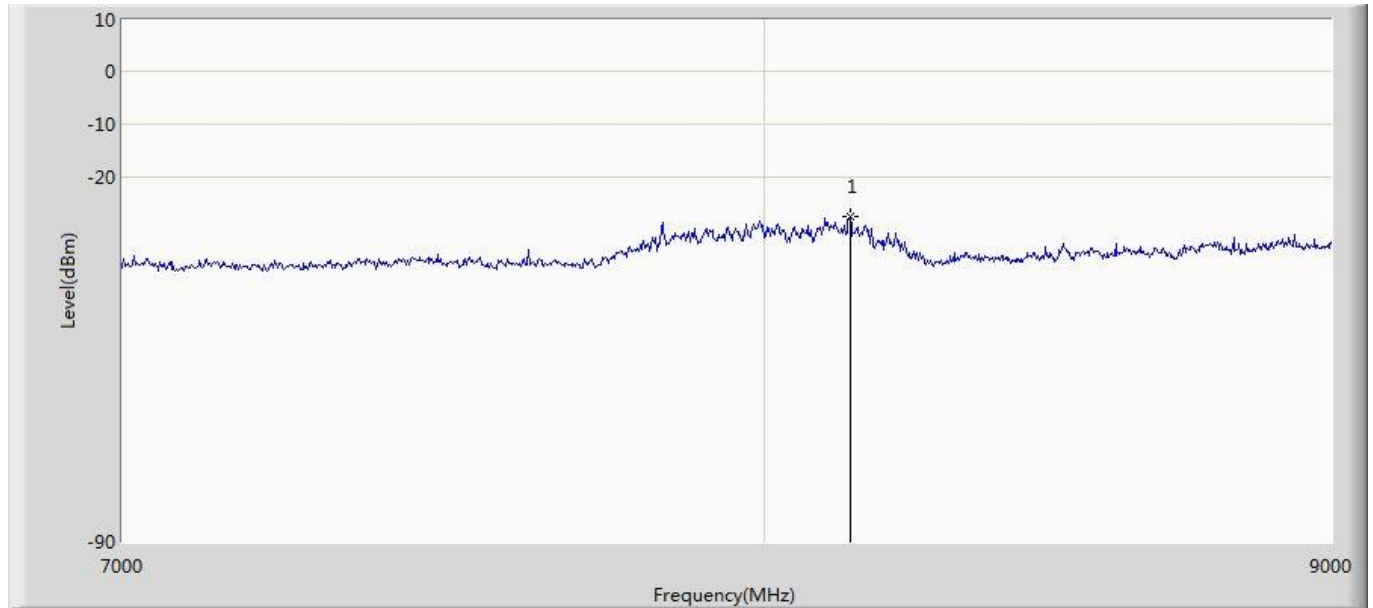
No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		6334.000	-28.143	-48.207	NaN	NaN	20.064	PK

Profile: 2220606R	Page No.: 3
Engineer: Neil	
Site: AC6	Time: 2022/04/19 - 13:51
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-H	Polarity: Horizontal
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2: Transmit CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		7830.000	-21.011	-42.115	NaN	NaN	21.104	PK

Profile: 2220606R	Page No.: 4
Engineer: Neil	
Site: AC6	Time: 2022/04/19 - 13:51
Limit: FCC-15.519	Margin: 0
Probe: 1-18G AMP-V	Polarity: Vertical
EUT: UWB SiP Module	Power: DC 5V
Note: Mode 2: Transmit CH9 by UWB	



No	Mark	Frequency (MHz)	Measure Level (dBm)	Reading Level (dBm)	Over Limit (dB)	Limit (dBm)	Factor (dB)	Type
1		8144.000	-27.822	-49.353	NaN	NaN	21.531	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.

_____ The End _____