



Test Report No.: W7L-P23030020RF02



Certificate #6613.01

# FCC TEST REPORT



Applicant	Marquardt GmbH
Address	Schloss-str.16,78604 Rietheim-Weilheim,Germany

Manufacturer or Supplier	Marquardt GmbH
Address	Schloss-str.16,78604 Rietheim-Weilheim,Germany
Product	V216 keyfob
Brand Name	Marquardt
Model	GK2
FCC ID:	IYZGK2
Date of tests	Jun. 08, 2023 ~ Aug. 18, 2023

The tests have been carried out according to the requirements of the following standard:

**FCC Part 15, Subpart F, Section 15.519**

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Prepared by Chao Wu Engineer / Mobile Department	Approved by Peibo Sun Manager / Mobile Department
	
Date: Aug. 18, 2023	Date: Aug. 18, 2023

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Test Report No.: W7L-P23030020RF02

## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P23030020RF02	Original release	Aug. 18, 2023

## 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart F(Section 15.519)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	Powered by battery(Note)
15.519(a)(1)	Shutoff Timing Requirements	PASS	Meet the requirement of limit.
15.503(d) 15.519(b)	UWB bandwidth	PASS	Meet the requirement of limit.
15.519(c)/ 15.209 15.519(d)	Radiated Emissions	PASS	Meet the requirement of limit.
15.519(e)	Peak Level of the Emission	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used
<p><b>*Test Lab Information Reference</b></p> <p><b>Lab :</b> Huarui 7Layers High Technology (Suzhou) Co., Ltd.</p> <p><b>Lab Address:</b> Tower N, Innovation Center, 88 Zhuyi Road, High-tech District, Suzhou City, Anhui Province</p> <p><b>Accredited Test Lab Cert 6613.01</b></p> <p>The FCC Site Registration No. is 434559; The Designation No. is CN1325.</p>			

Note :

1. Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

## 2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	UNCERTAINTY
AC Power Conducted emissions	±2.70dB
Radiated emissions (30MHz~1GHz)	±4.98dB
Radiated emissions (1GHz ~6GHz)	±4.70dB
Radiated emissions (6GHz ~18GHz)	±4.60dB
Radiated emissions (18GHz ~40GHz)	±4.12dB
Conducted emissions	±4.01dB
Occupied Channel Bandwidth	±43.58KHz
Conducted Output power	±2.06dB
Power Spectral Density	±0.85 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .



### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

PRODUCT*	V216 keyfob
BRAND NAME*	Marquardt
MODEL NAME*	GK2
FCC ID*	IYZGK2
NOMINAL VOLTAGE*	3.0Vdc (battery)
MODULATION TYPE*	BPM-BPSK
FREQUENCY*	CH5: 6489.6MHz/ CH9: 7987.2MHz
HW VERSION*	232803
SW VERSION*	232100
ANTENNA TYPE*	PCB Antenna with 3.2dBi gain for CH5 PCB Antenna with 3.3dBi gain for CH9
I/O PORTS*	Refer to user's manual
CABLE SUPPLIED*	N/A
EXTREME TEMPERATURE*	-20 ~ 60°C
EXTREME VOLTAGE*	EUT 2.5V ~ EUT 3.3V
EQUIPMENT TYPE	Hand-held Communication Devices

**NOTE:**

1. \*Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information , Test Lab is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.
2. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

**4. List of Accessory:**

ACCESSORIES	BRAND	MANUFACTURER	MODEL	SPECIFICATION
Battery	Panasonic	Panasonic Corporation	CR2450	Capacity:3.0 Vdc, 620mAh

### 3.2 DESCRIPTION OF TEST MODES

CHANNEL	FREQUENCY
5	6489.6MHz
9	7987.2MHz

#### 3.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs of the test configuration for reference.

#### 3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

EUT CONFIGURE MODE	APPLICABLE TO						DESCRIPTION
	RE ≥ 1G	RE < 1G	PLC	BW	PE&AE	STR	
-	√	√	-	√	√	√	DC 3V by battery

Where **RE ≥ 1G**: Radiated Emission above 1GHz      **RE < 1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission      **BW**: 10dB Bandwidth measurement  
**PE&AE**: Peak power and maximum average emissions  
**STR**: Shutoff Timing Requirements

#### RADIATED EMISSION TEST (BELOW 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	UWB	5, 9	5	BPM-BPSK

#### RADIATED EMISSION TEST (ABOVE 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	UWB	5, 9	5 · 9	BPM-BPSK



**UWB BANDWIDTH MEASUREMENT:**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.

Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	UWB	5, 9	5, 9	BPM-BPSK

**PEAK POWER AND MAXIMUM AVERAGE EMISSIONS**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.

Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	UWB	5, 9	5, 9	BPM-BPSK

**SHUTOFF TIMING REQUIREMENTS:**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.

Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	UWB	5, 9	9	BPM-BPSK



**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
RE<1G	23deg. C, 53%RH	DC 3V from battery	Chao Wu
RE≥1G	23deg. C, 53%RH	DC 3V from battery	Chao Wu
BW	20deg. C, 55%RH	DC 3V from battery	Chao Wu
PE&AE	23deg. C, 53%RH	DC 3V from battery	Chao Wu
STR	23deg. C, 53%RH	DC 3V from battery	Chao Wu



### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart F, Section 15.519**

**ANSI C63.10-2013**

All test items have been performed and recorded as per the above standards.

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	N/A	N/A	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A

## 4 TEST TYPES AND RESULTS

### 4.1 RADIATED EMISSION

#### 4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

##### Below 960MHz

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:

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3

##### NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

##### Above 960MHz

1. 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:

Frequency in MHz	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

2. In addition to the radiated emission limits specified in the table in paragraph (a)(b) 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:

Frequency in MHz	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

3. The calculation below has been used for the test, in order to translate the Limit to 1m test distance.

According to the ANSI C63.10-2013:

$$E(\text{dB}\mu\text{V}/\text{m}) = \text{EIRP}(\text{dBm}) + 95.2,$$

$$3\text{m to } 1\text{m test distance : Distance Correction Factor}(\text{db}) = 20 \cdot \log(1/3) = -9.54\text{db}$$

So Field Strength(@3m) = Field Strength(@1m) + Distance Correction Factor,

For radiated emission measurement:

Margin = Field Strength(@3m) - Limit(@3m) = Field Strength(@1m) + Distance Correction Factor - Limit(@3m) = Field Strength(@1m) - (**Limit(@3m) - Distance Correction Factor**), so (**Limit(@3m) - Distance Correction Factor**) can treat as 1m Field Strength Limit.

For Limit above 960MHz, It's EIRP limit, So we can translate it to Field Strength Limit(@1m), by the equation below:

$$\text{Field Strength Limit}(@1\text{m}) = \text{EIRP Limit}(@3\text{m}) + 95.2 - \text{Distance Correction Factor}(3\text{m to } 1\text{m})$$

So 1m test distance Field Strength Limit is:

FCC @1m Distance	
Frequency in MHz	Field Strength in dBμV/m
960-1610	29.44
1610-1990	41.44
1990-3100	43.44
3100-10600	63.44
Above 10600	43.44

FCC @1m Distance	
Frequency	Field Strength in dBμV/m
1 164-1 240 MHz	19.44
1 559-1 610 MHz	19.44

#### 4.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Pre-Amplifier	R&S	SCU18F1	100815	Aug.30,22	Aug.29,24
Pre-Amplifier	R&S	SCU08F1	101028	Sep.16,22	Sep.15,24
Signal Generator	R&S	SMB100A	182185	Feb.16,22	Feb.15,24
3m Fully-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-01Chamber	Nov.25,22	Nov.24,25
3m Semi-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-02Chamber	Nov.25,22	Nov.24,25
EMI TEST Receiver	R&S	ESW44	101973	Feb.25,22	Feb.24,24
Bilog Antenna	SCHWARZBEC K	VULB 9163	1264	Feb.28,22	Feb.27,24
Horn Antenna	ETS-LINDGREN	3117	227836	Aug.22,22	Aug.21,24
Horn Antenna (18GHz-40GHz)	Steatite Q-par Antennas	QMS 00880	23486	Feb.23,22	Feb.22,24
Horn Antenna	Steatite Q-par Antennas	QMS 00208	23485	Aug.22,22	Aug.21,24
Loop Antenna	SCHWARZ	HFH2-Z2/Z2E	100976	Feb.23,22	Feb.22,24
WIDEBANDRADIO COMMUNICATION TESTER	R&S	CMW500	169399	Jun.27,22	Jun.26,24
Test Software	ELEKTRA	ELEKTRA4.32	N/A	N/A	N/A
Open Switch and Control Unit	R&S	OSP220	101964	N/A	N/A
DC Source	HYELEC	HY3010B	551016	Aug.31,22	Aug.30,24
Hygrothermograph	DELI	20210528	SZ014	Sep.06,22	Sep.05,24
PC	LENOVO	E14	HRSW0024	N/A	N/A
TMC-AMI18843A(CA BLE)	R&S	HF290-NMNM- 7.00M	N/A	N/A	N/A
TMC-AMI18843A(CA BLE)	R&S	HF290-NMNM- 4.00M	N/A	N/A	N/A
CABLE	R&S	W13.02	N/A	Apr.28,23	Oct.27,23
CABLE	R&S	W12.14	N/A	Apr.28,23	Oct.27,23

- NOTE:**
1. The calibration interval of the above test instruments is 6 months or 24 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
  2. The test was performed in 3m Chamber.
  3. The FCC Site Registration No. is 434559; The Designation No. is CN1325.

#### 4.1.3 TEST PROCEDURES

1. The EUT was placed on the top of a rotating table 0.8 meters (below 960MHz) and 1.5 meters (above 960MHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters (below 960MHz) and 1 meters (above 960MHz) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. For below 30MHz, a loop antenna with its vertical plane is placed 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
6. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be performed using fresh batteries. The turntable was rotated to maximize the emission level.

#### **NOTE:**

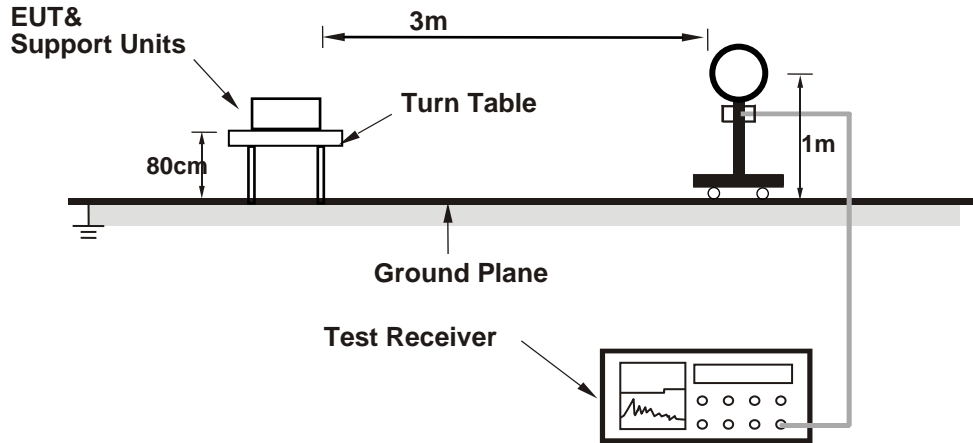
1. The resolution bandwidth of test receiver/spectrum analyzer is 120KHz and video bandwidth is 300kHz for Quasi-peak detection at frequency below 960MHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Average detection at frequency above 960MHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1KHz and the video bandwidth is 3KHz for Average detection at frequency range from 1164-1240MHz & 1559-1610MHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes, the worst-case test configuration was reported on the file test setup photo.

#### 4.1.4 DEVIATION FROM TEST STANDARD

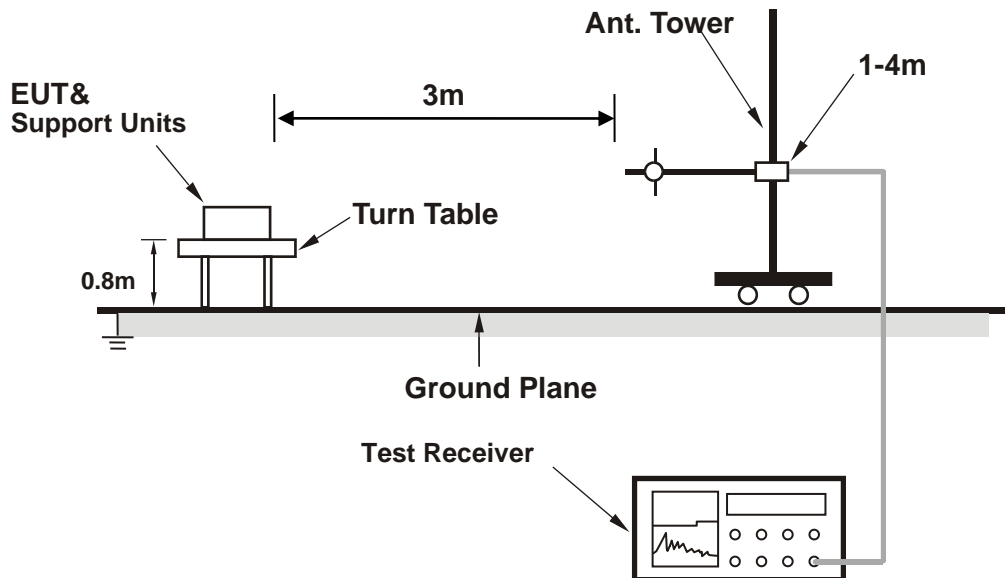
No deviation.

#### 4.1.5 TEST SETUP

##### Below 30MHz test setup



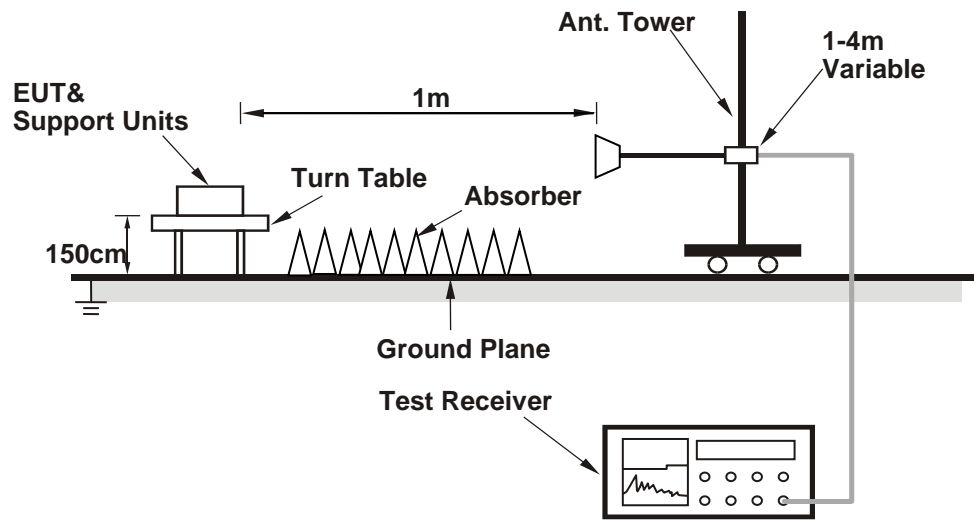
##### Below 960MHz test setup



**Note:** For the actual test configuration, please refer to the attached file (Test Setup Photo).



Above 960MHz test setup



**Note:** For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT OPERATING CONDITIONS

- Placed the EUT on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.

### 4.1.7 TEST RESULTS

NOTE : The 9K~30MHz amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report

**Radiated Emissions Test Data Below 960 MHz:**

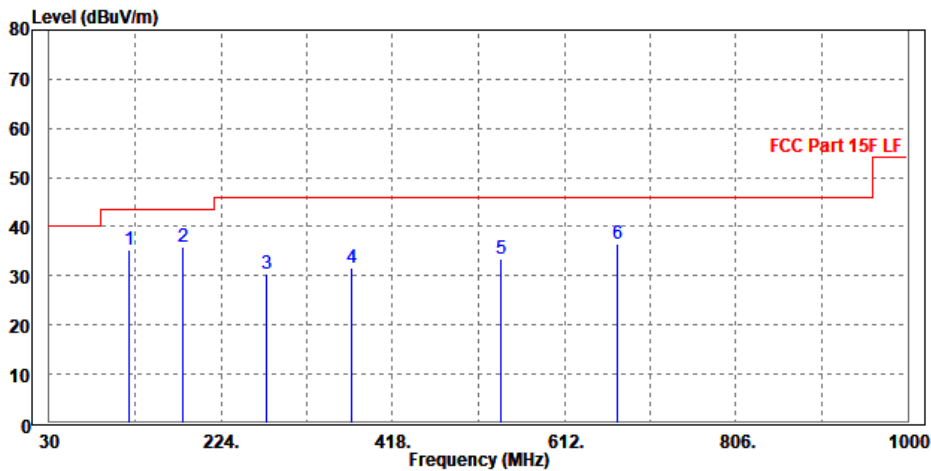
<b>CHANNEL</b>	TX Channel 5	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 960MHz		

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	120.210	35.42	62.18	43.50	-8.08	-26.76	Peak	Horizontal
2 PP	180.350	35.83	60.12	43.50	-7.67	-24.29	Peak	Horizontal
3	275.410	30.57	52.22	46.00	-15.43	-21.65	Peak	Horizontal
4	372.410	31.76	51.52	46.00	-14.24	-19.76	Peak	Horizontal
5	540.220	33.48	50.17	46.00	-12.52	-16.69	Peak	Horizontal
6	672.140	36.51	51.11	46.00	-9.49	-14.60	Peak	Horizontal

**REMARKS:**

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
2. Margin value = Emission level – Limit value.
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.



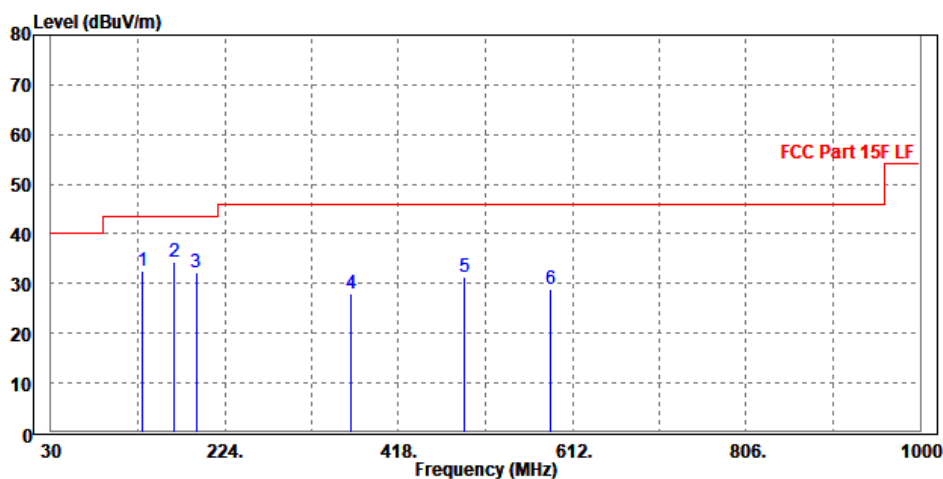
<b>CHANNEL</b>	TX Channel 5	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 960MHz		

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	131.850	32.48	60.20	43.50	-11.02	-27.72	Peak	Vertical
2 PP	167.740	34.25	59.00	43.50	-9.25	-24.75	Peak	Vertical
3	191.990	32.17	56.40	43.50	-11.33	-24.23	Peak	Vertical
4	365.620	27.89	47.72	46.00	-18.11	-19.83	Peak	Vertical
5	491.720	31.34	49.24	46.00	-14.66	-17.90	Peak	Vertical
6	587.750	28.98	45.11	46.00	-17.02	-16.13	Peak	Vertical

**REMARKS:**

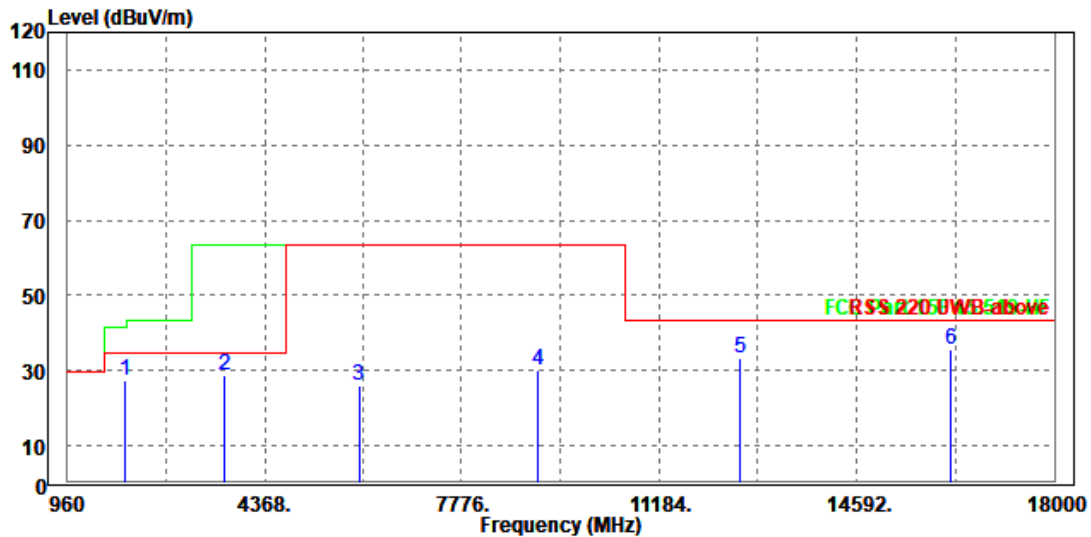
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
2. Margin value = Emission level – Limit value.
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.



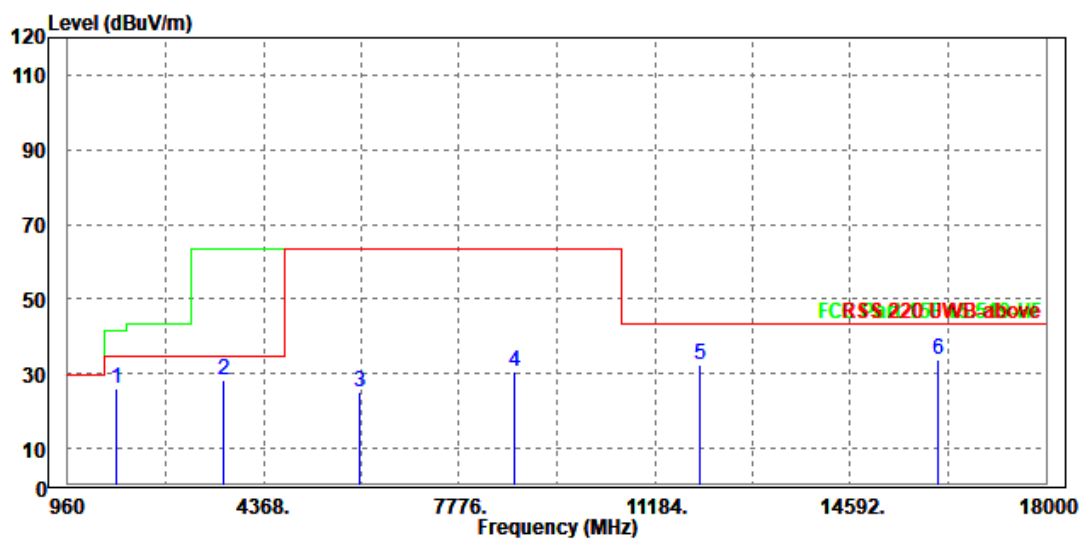
Radiated Emissions above 960 MHz:

CHANNEL	TX Channel 5	DETECTOR FUNCTION	Average (AV)
FREQUENCY RANGE	960MHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1952	27.38	34.52	41.44	-14.06	33.42	5.58	46.14	100	34	Average
3669	28.59	30.23	63.44	-34.85	35.93	7.91	45.48	150	100	Average
5998	26.06	23.49	63.44	-37.38	38.1	9.97	45.5	200	124	Average
9109	30	22.32	63.44	-33.44	39.17	12.52	44.01	150	133	Average
12594	33.09	20.06	43.44	-10.35	41.68	14.95	43.6	100	260	Average
16215	35.41	17.81	43.44	-8.03	43.51	16.91	42.82	100	320	Average



ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1799	26.02	35.64	41.44	-15.42	31.16	5.35	46.13	150	154	Average
3669	28.27	31.57	63.44	-35.17	34.27	7.91	45.48	100	56	Average
6032	25.3	24.07	63.44	-38.14	36.73	9.99	45.49	150	352	Average
8752	30.68	24.63	63.44	-32.76	38.1	12.03	44.08	200	245	Average
11982	32.18	20.36	43.44	-11.26	40.07	14.65	42.9	124	326	Average
16130	33.69	17.08	43.44	-9.75	42.61	16.94	42.94	100	347	Average



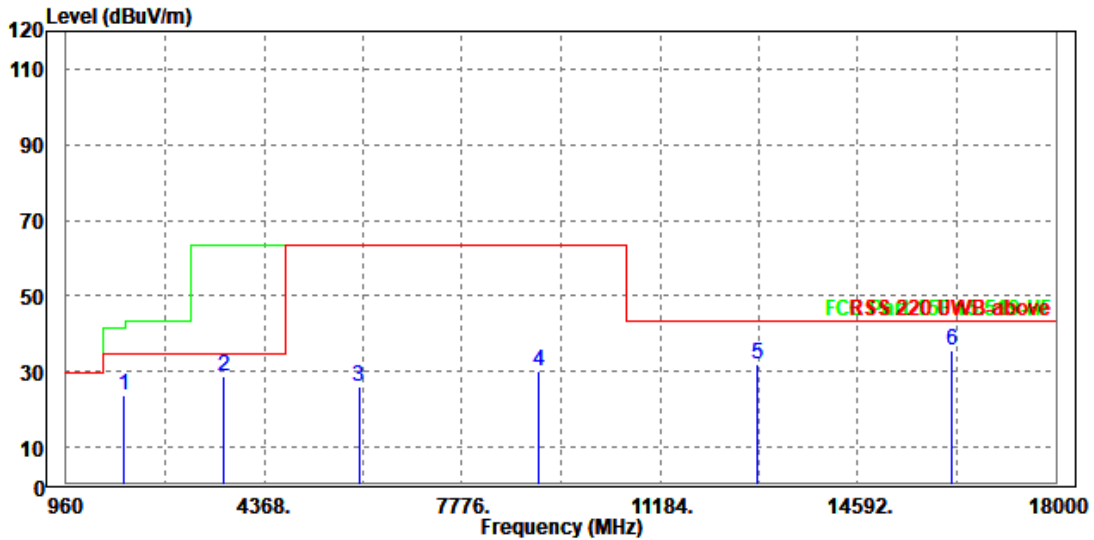
**REMARKS:**

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Emission level – Limit value.
2. The emission levels of other frequencies were greater than 20dB margin.

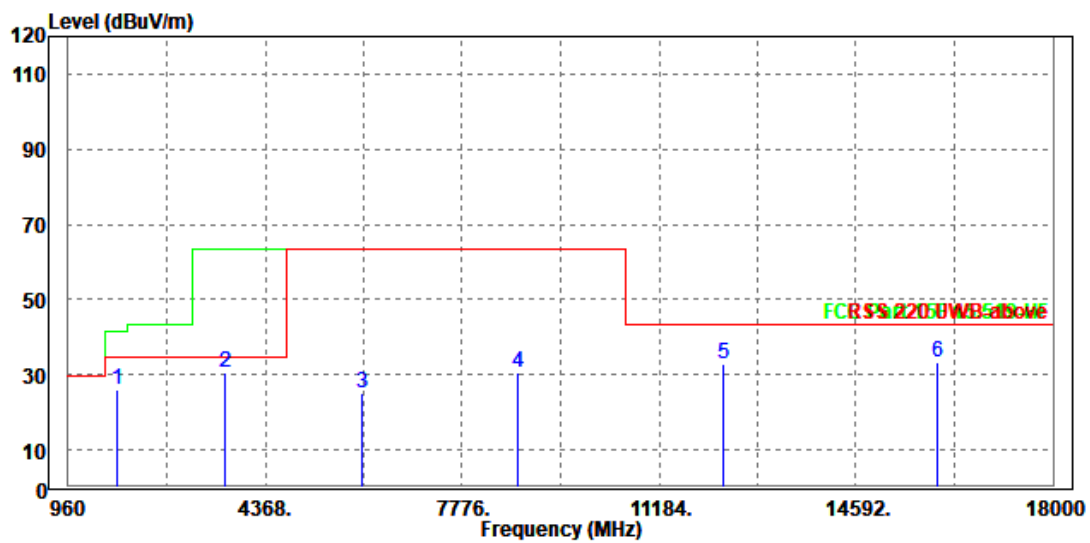


<b>CHANNEL</b>	TX Channel 9	<b>DETECTOR FUNCTION</b>	Average (AV)
<b>FREQUENCY RANGE</b>	960MHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1952	23.92	31.06	41.44	-17.52	33.42	5.58	46.14	150	356	Average
3669	28.92	30.56	63.44	-34.52	35.93	7.91	45.48	100	232	Average
5998	26.06	23.49	63.44	-37.38	38.1	9.97	45.5	150	100	Average
9109	30	22.32	63.44	-33.44	39.17	12.52	44.01	200	70	Average
12849	32.06	18.86	43.44	-11.38	41.88	15.23	43.91	100	0	Average
16215	35.41	17.81	43.44	-8.03	43.51	16.91	42.82	150	178	Average



ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1799	26.04	35.66	41.44	-15.4	31.16	5.35	46.13	150	34	Average
3669	30.34	33.64	63.44	-33.1	34.27	7.91	45.48	200	67	Average
6032	25.3	24.07	63.44	-38.14	36.73	9.99	45.49	150	178	Average
8752	30.68	24.63	63.44	-32.76	38.1	12.03	44.08	100	239	Average
12288	32.65	20.49	43.44	-10.79	40.62	14.77	43.23	200	256	Average
16011	33.52	17.22	43.44	-9.92	42.42	17	43.12	100	14	Average



**REMARKS:**

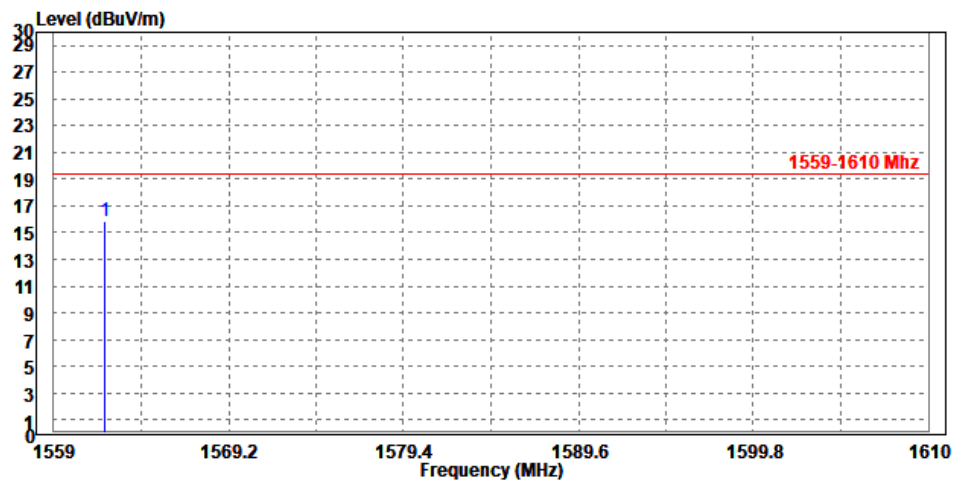
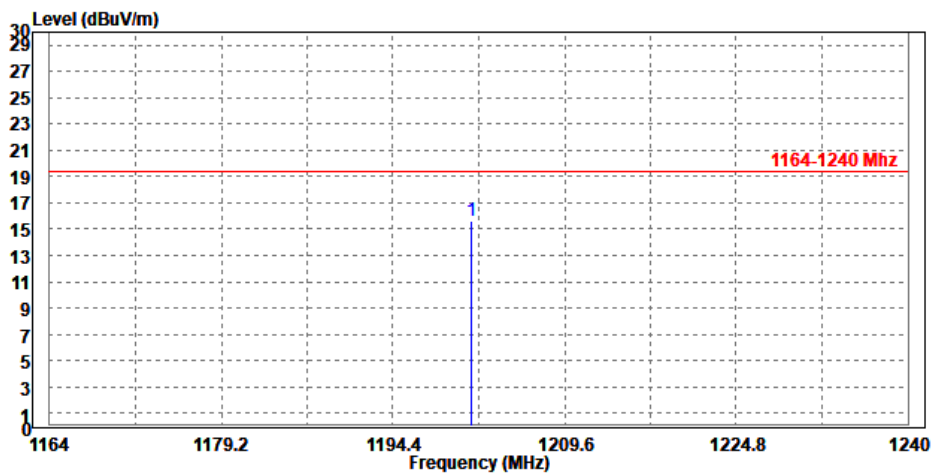
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Emission level – Limit value.
2. The emission levels of other frequencies were greater than 20dB margin.



**Radiated Emissions Test Data in The GPS Bands:**

<b>CHANNEL</b>	TX Channel 5	<b>DETECTOR FUNCTION</b>	Average (AV)
<b>FREQUENCY RANGE</b>	1164 – 1240 MHz and 1559- 1610 MHz		

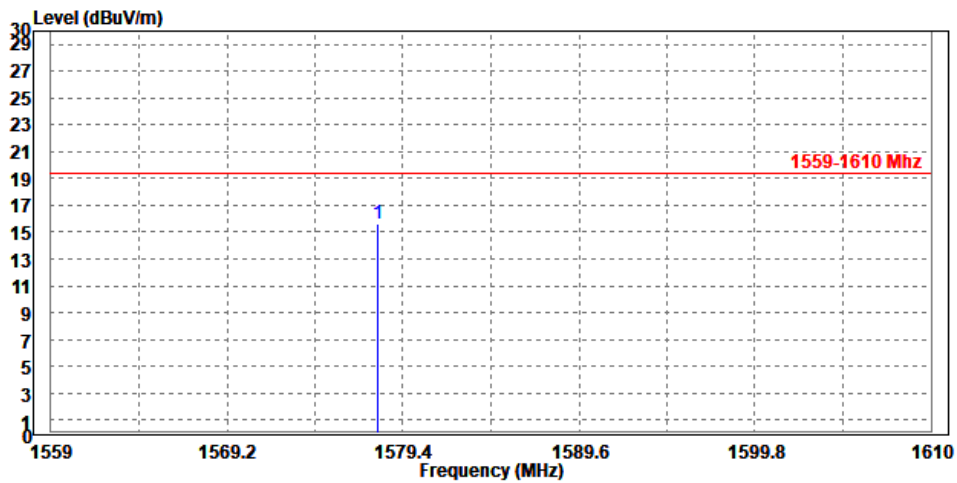
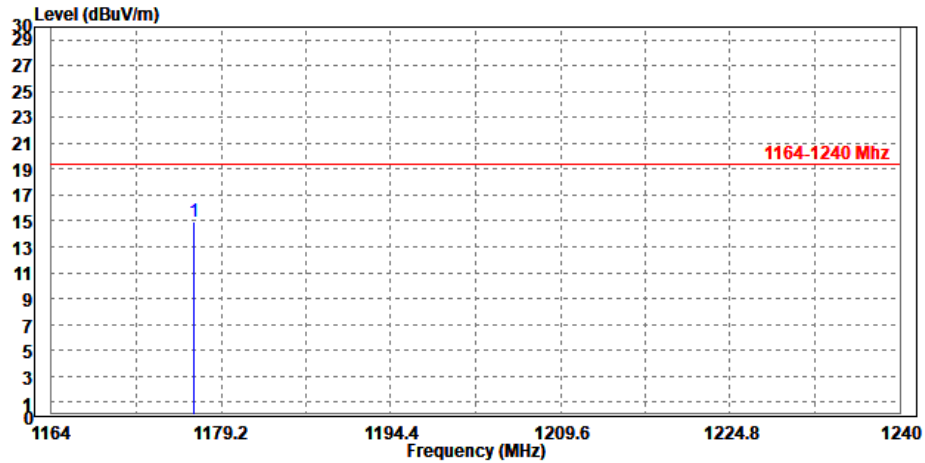
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1201.392	15.65	28.25	19.44	-3.79	29.26	4.26	46.12	100	45	Average
1562.009	15.85	26.72	19.44	-3.59	30.3	4.96	46.13	150	310	Average







ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1176.768	14.93	28.03	19.44	-4.51	28.8	4.22	46.12	150	169	Average
1577.921	15.64	26.55	19.44	-3.8	30.23	4.99	46.13	200	320	Average



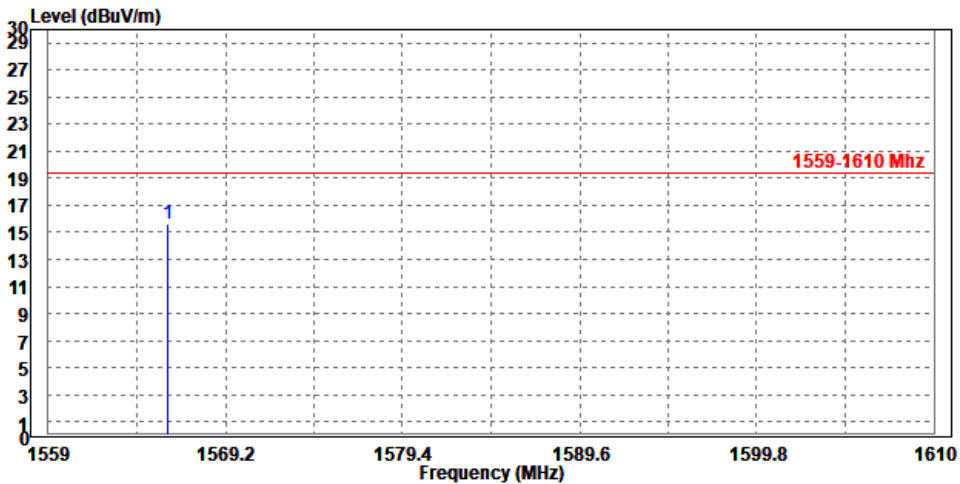
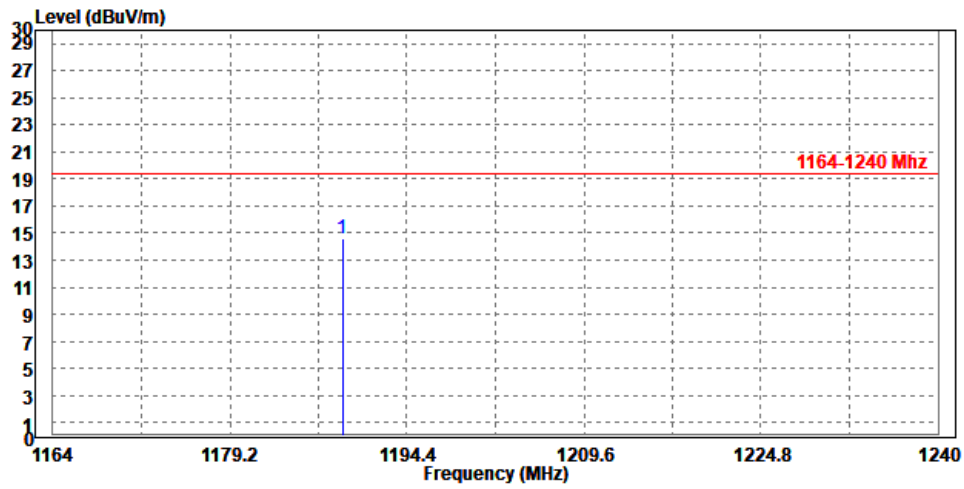
**REMARKS:**

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Emission level – Limit value.
- The emission levels of other frequencies were greater than 20dB margin.



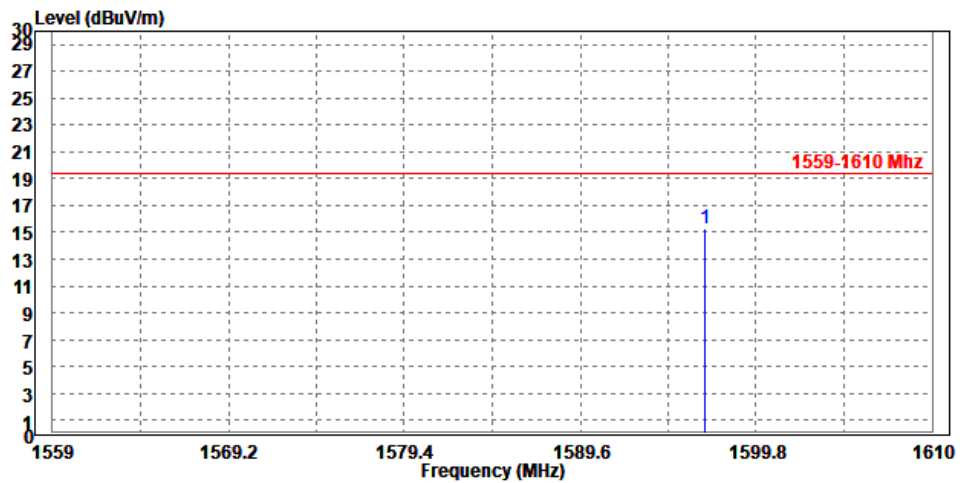
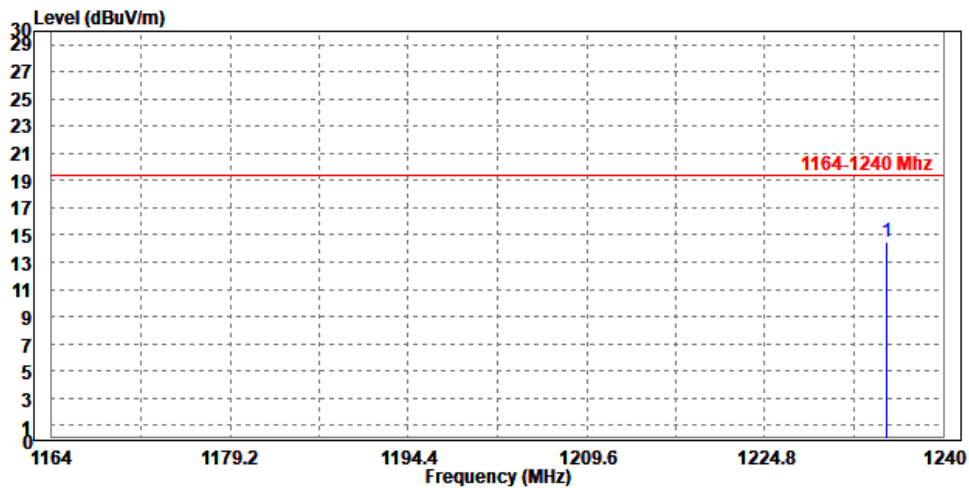
<b>CHANNEL</b>	TX Channel 9	<b>DETECTOR FUNCTION</b>	Average (AV)
<b>FREQUENCY RANGE</b>	1164 – 1240 MHz and 1559- 1610 MHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1188.852	14.62	27.26	19.44	-4.82	29.24	4.24	46.12	150	167	Average
1565.885	15.63	26.46	19.44	-3.81	30.33	4.97	46.13	100	34	Average





ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 1 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1235.136	14.51	27.3	19.44	-4.93	29	4.33	46.12	150	267	Average
1596.791	15.26	26.06	19.44	-4.18	30.31	5.02	46.13	100	189	Average



**REMARKS:**

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Emission level – Limit value.
2. The emission levels of other frequencies were greater than 20dB margin.



## 4.2 UWB BANDWIDTH

### 4.2.1 LIMITS OF UWB BANDWIDTH

FCC 15.503(d) 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.

FCC 15.519(3)(b) The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

### 4.2.2 TEST INSTRUMENTS

Same as 4.1.2

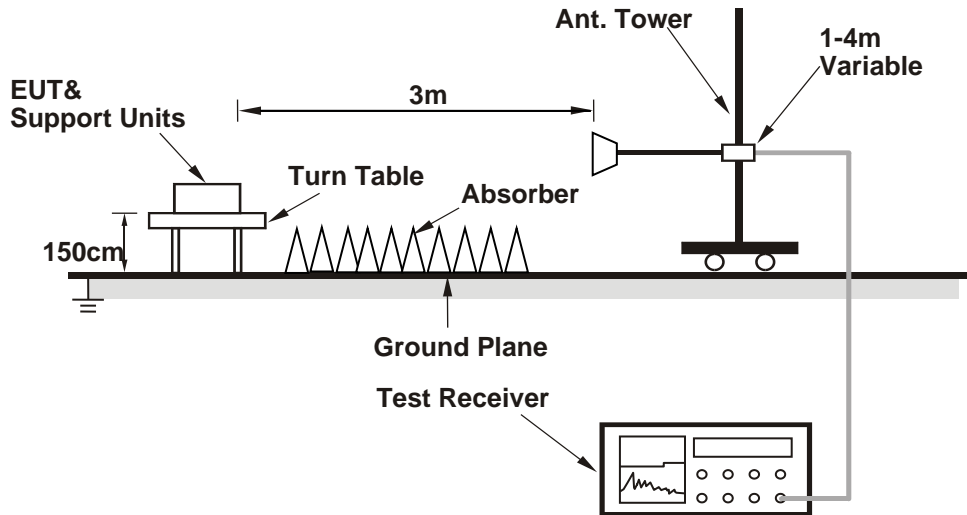
#### 4.2.3 TEST PROCEDURES

1. Set the center frequency of the channel under test
2. Set resolution bandwidth (RBW) = 1MHz
3. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 10 dB relative to the maximum level measured in the fundamental emission.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.2.5 TEST SETUP

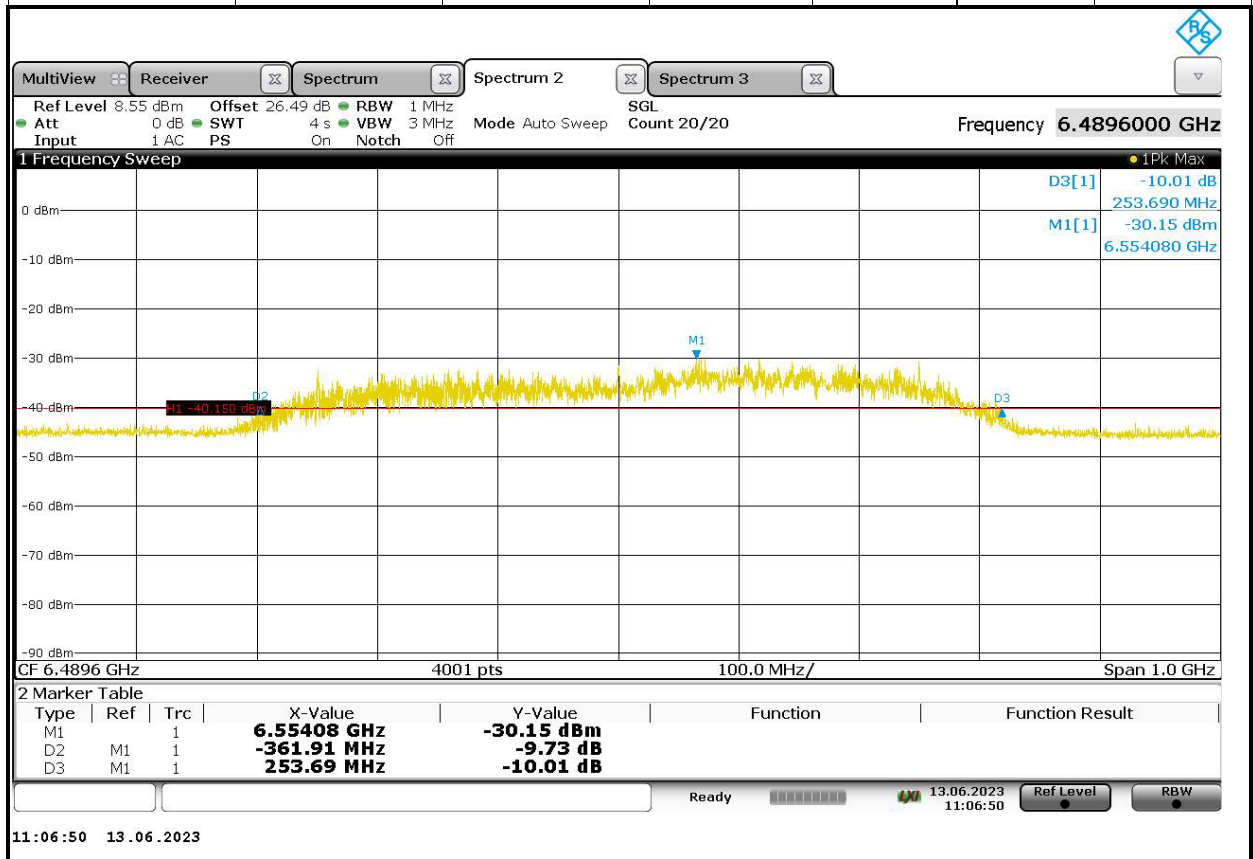


#### 4.2.6 EUT OPERATING CONDITIONS

The sample provided by client to enable the EUT under transmission condition continuously.

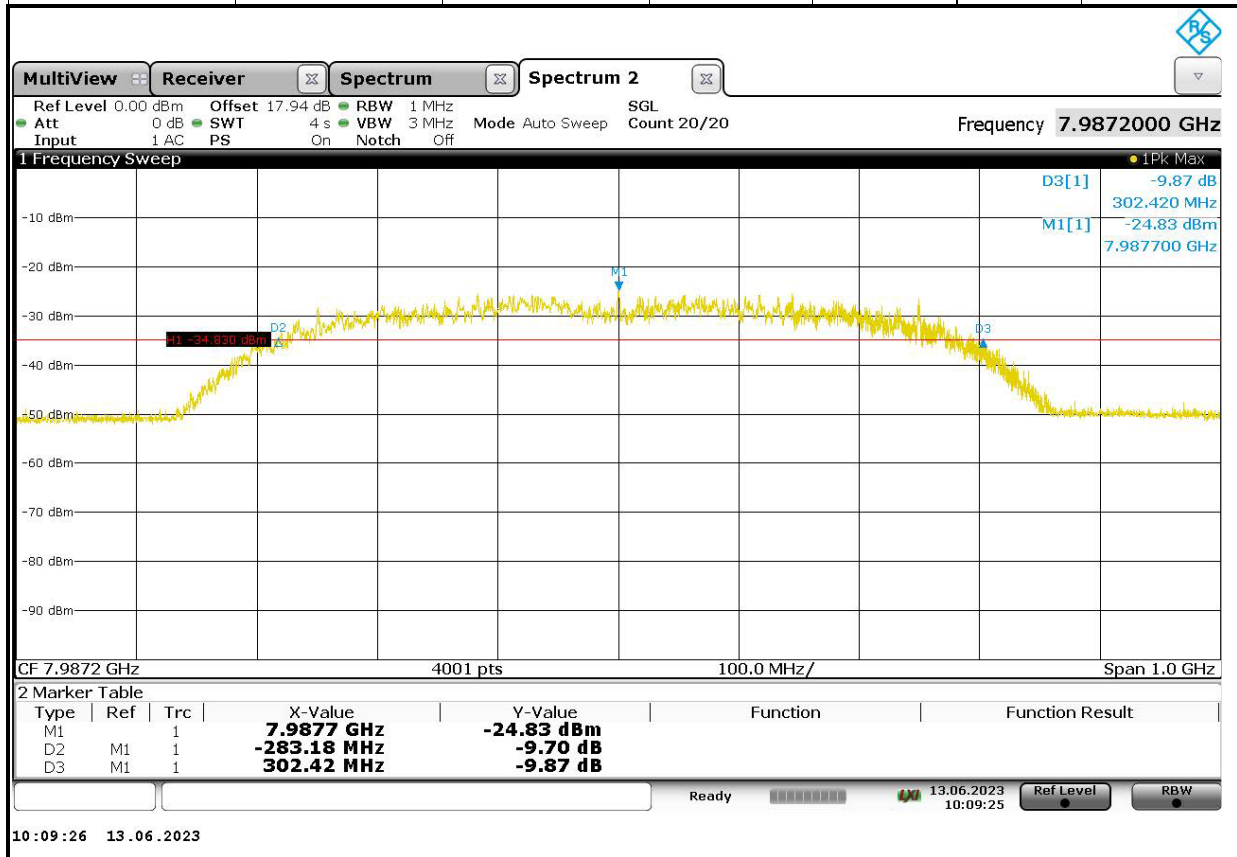
4.2.7 TEST RESULTS

Frequency(MHz)	Measured Frequencies		Limit (MHz)	10dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
	FL (MHz)	FH (MHz)				
6489.6	6192.17	6807.77	FL > 3100 and FH < 10600	615.6	≥500	Pass



Note: FL=M1+D2 , FH=M1+D3 , 10DB BANDWIDTH= FH-FL

Frequency(MHz)	Measured Frequencies		Limit (MHz)	10dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
	FL (MHz)	FH (MHz)				
7987.2	7704.52	8290.12	FL > 3100 and FH < 10600	585.6	≥500	Pass



Note: FL=M1+D2 , FH=M1+D3 , 10DB BANDWIDTH=FH-FL



### **4.3 PEAK POWER AND MAXIMUM AVERAGE EMISSIONS**

#### **4.3.1 LIMITS**

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP.

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  $E(\text{dBuV/m}) = P(\text{dBm EIRP}) + 95.2$ .

47 CFR 15.519(c) 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:

<b>Frequency in MHz</b>	<b>EIRP in dBm</b>
3100-10600	-41.3

#### **4.3.2 TEST INSTRUMENTS**

Same as 4.1.2

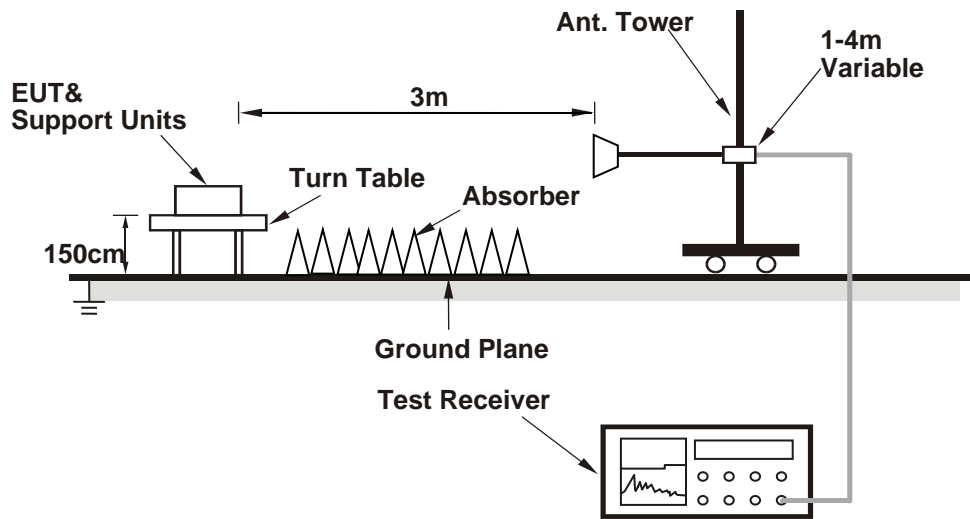
### 4.3.3 TEST PROCEDURES

1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak/RMS Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

### 4.3.5 TEST SETUP



### 4.3.6 EUT OPERATING CONDITIONS

The sample provided by client to enable the EUT under transmission condition continuously.

### 4.3.7 TEST RESULTS

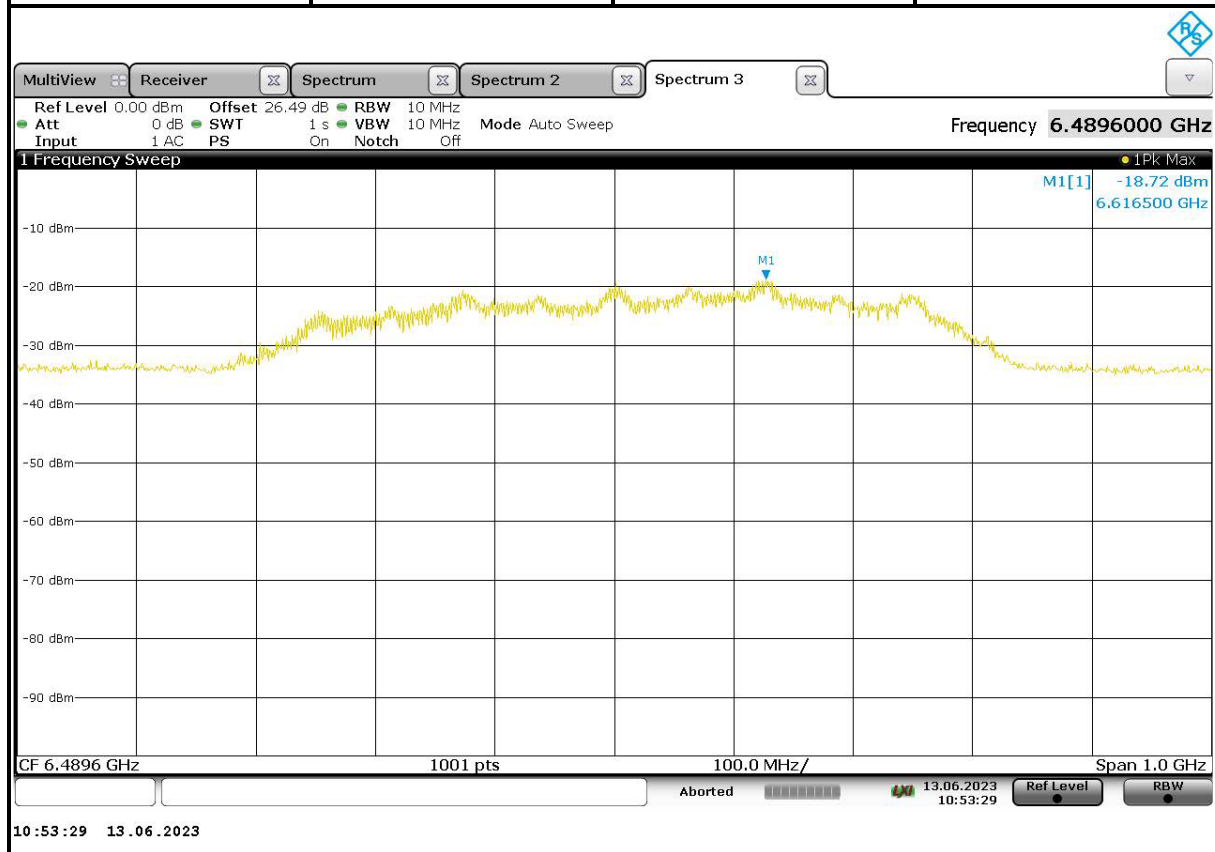
#### Peak Power Emissions

**NOTE:**

The RBW=10MHz, VBW=10MHz, so the EIRP limit is  $0\text{dBm} + 20 \log(10/50) = -13.98\text{dBm}/10\text{MHz}$ .

<b>CHANNEL</b>	TX Channel 5	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>TEST FREQUENCY</b>	6489.6MHz		

Frequency (MHz)	Peak Value (dBm/10MHz)	EIRP Limit (dBm/10MHz)	Pass/Fail
6489.6	-18.72	-13.98	Pass

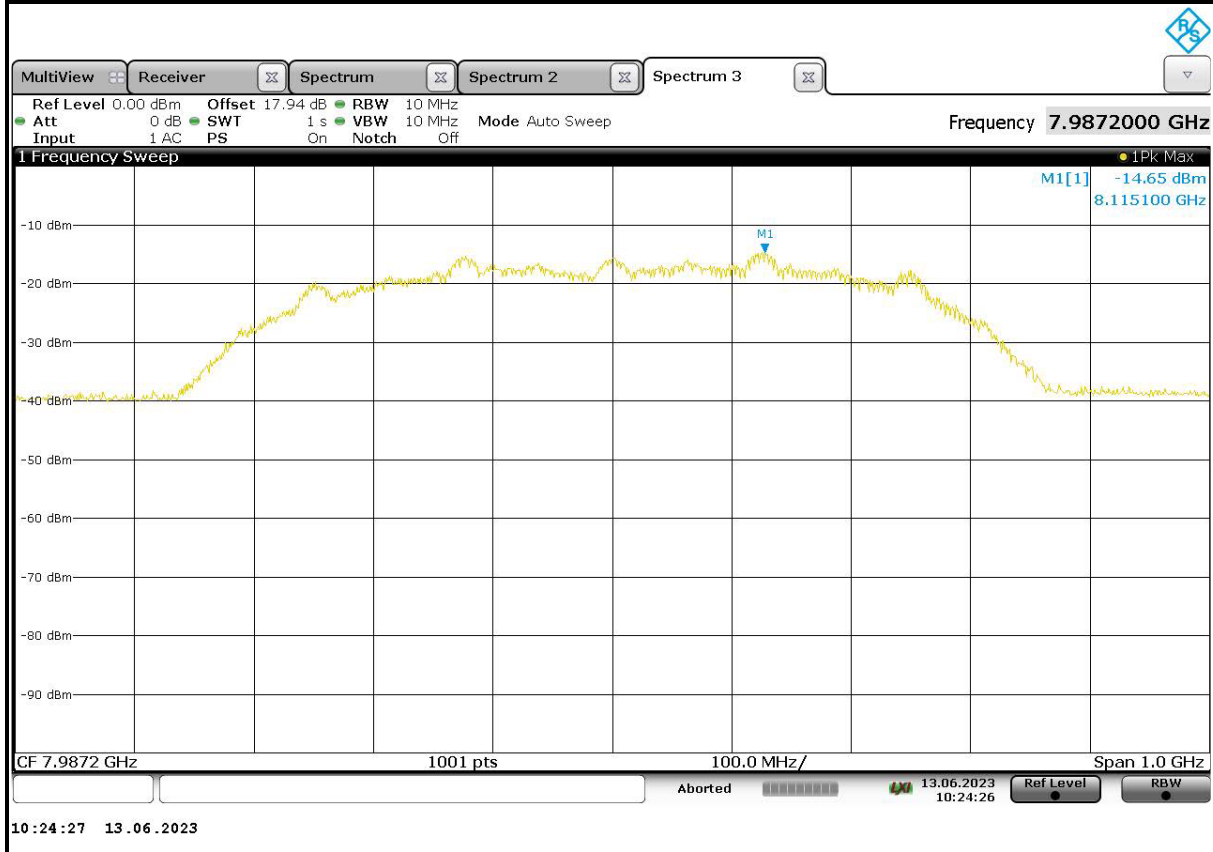




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<b>CHANNEL</b>	TX Channel 9	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>TEST FREQUENCY</b>	7987.2MHz		

Frequency (MHz)	Peak Value (dBm/10MHz)	EIRP Limit (dBm/10MHz)	Pass/Fail
7987.2	-14.65	-13.98	Pass

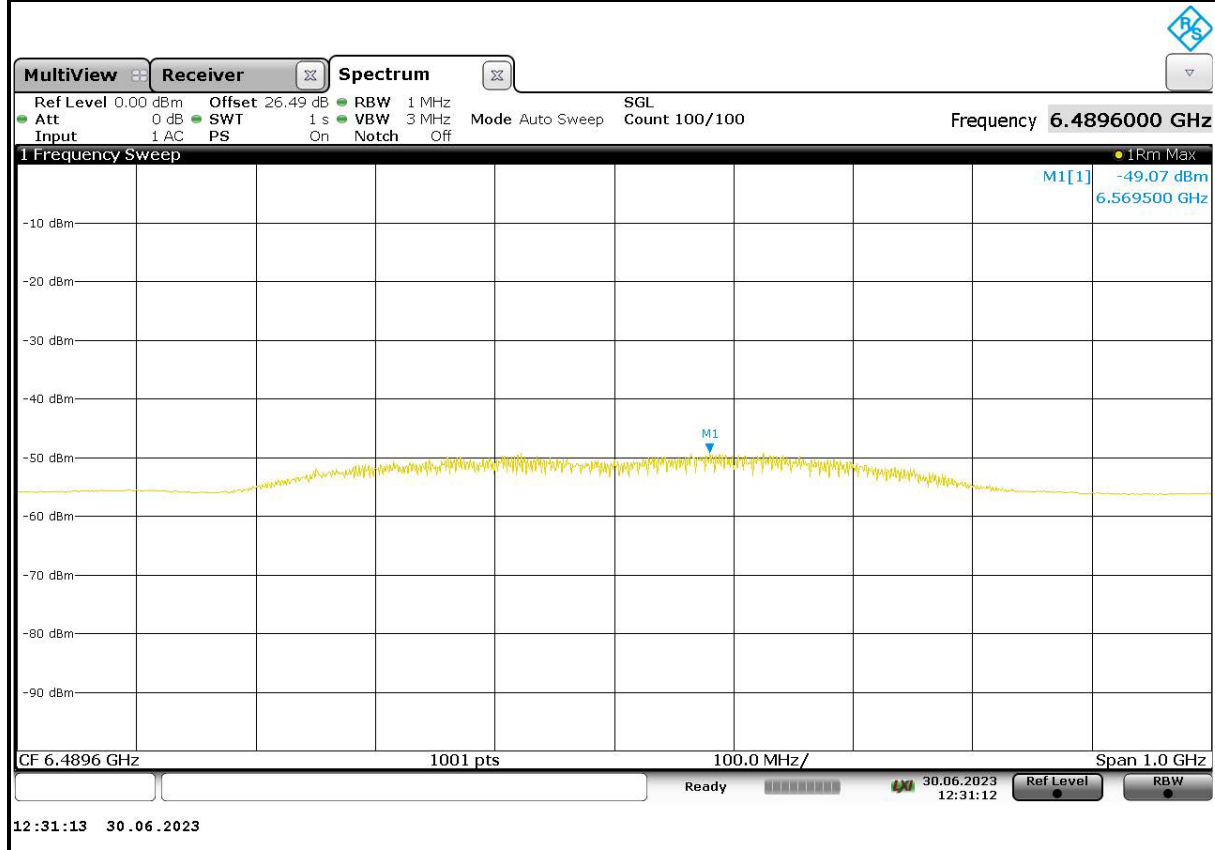




Average Power Emissions

CHANNEL	TX Channel 5	DETECTOR FUNCTION	Average (RMS)
TEST FREQUENCY	6489.6MHz		

Frequency (MHz)	Peak Value (dBm)	EIRP Limit (dBm)	Pass/Fail
6489.6	-49.07	-41.3	Pass

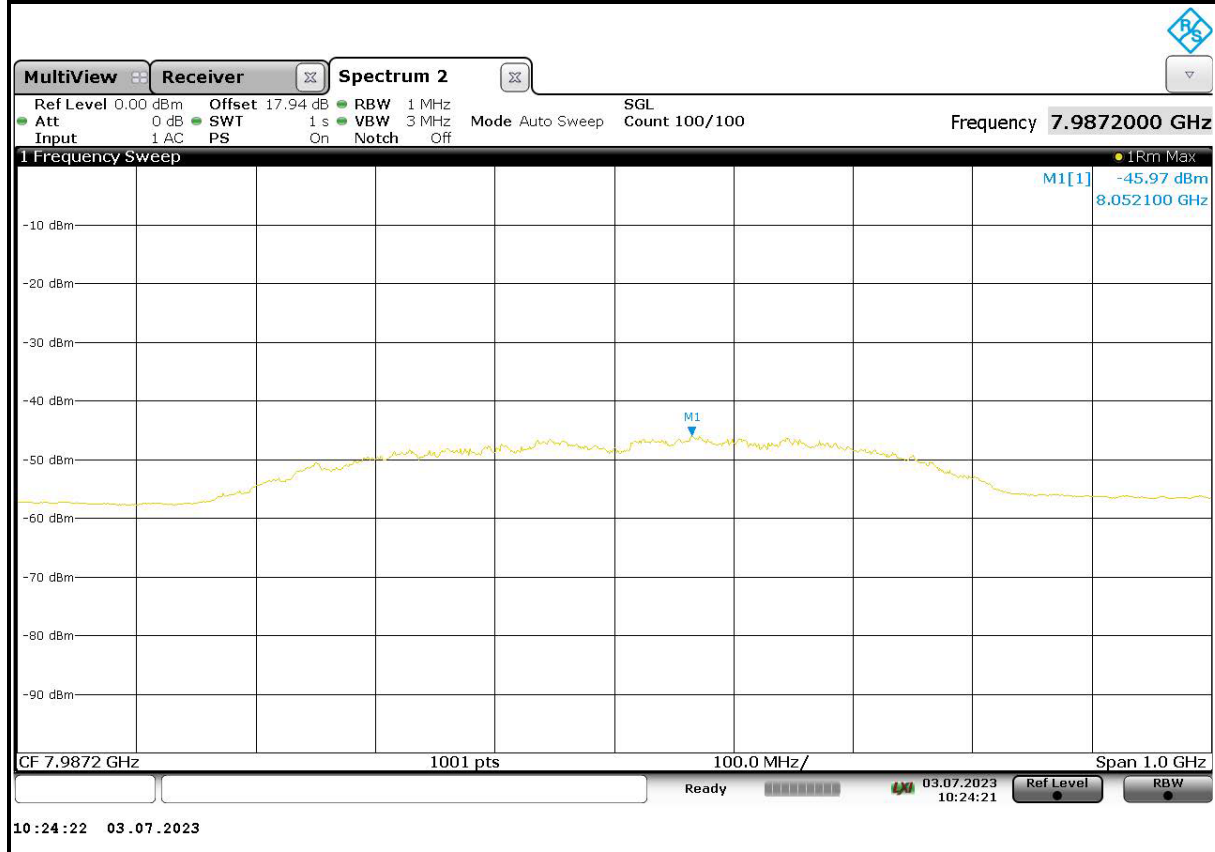




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<b>CHANNEL</b>	TX Channel 9	<b>DETECTOR FUNCTION</b>	Average (RMS)
<b>TEST FREQUENCY</b>	7987.2MHz		

Frequency (MHz)	Peak Value (dBm)	EIRP Limit (dBm)	Pass/Fail
7987.2	-45.97	-41.3	Pass



## 4.4 SHUTOFF TIMING REQUIREMENTS

### 4.4.1 LIMITS OF SHUTOFF TIMING REQUIREMENTS

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.

### 4.4.2 TEST INSTRUMENTS

Same as 4.1.2

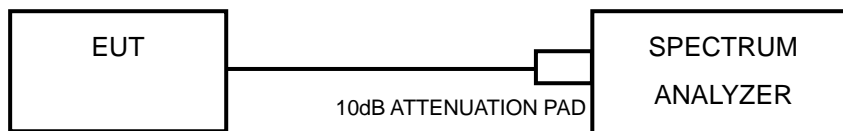
### 4.4.3 TEST PROCEDURES

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer set the center frequency, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the transmission duration was measured and recorded.

### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

### 4.4.5 TEST SETUP



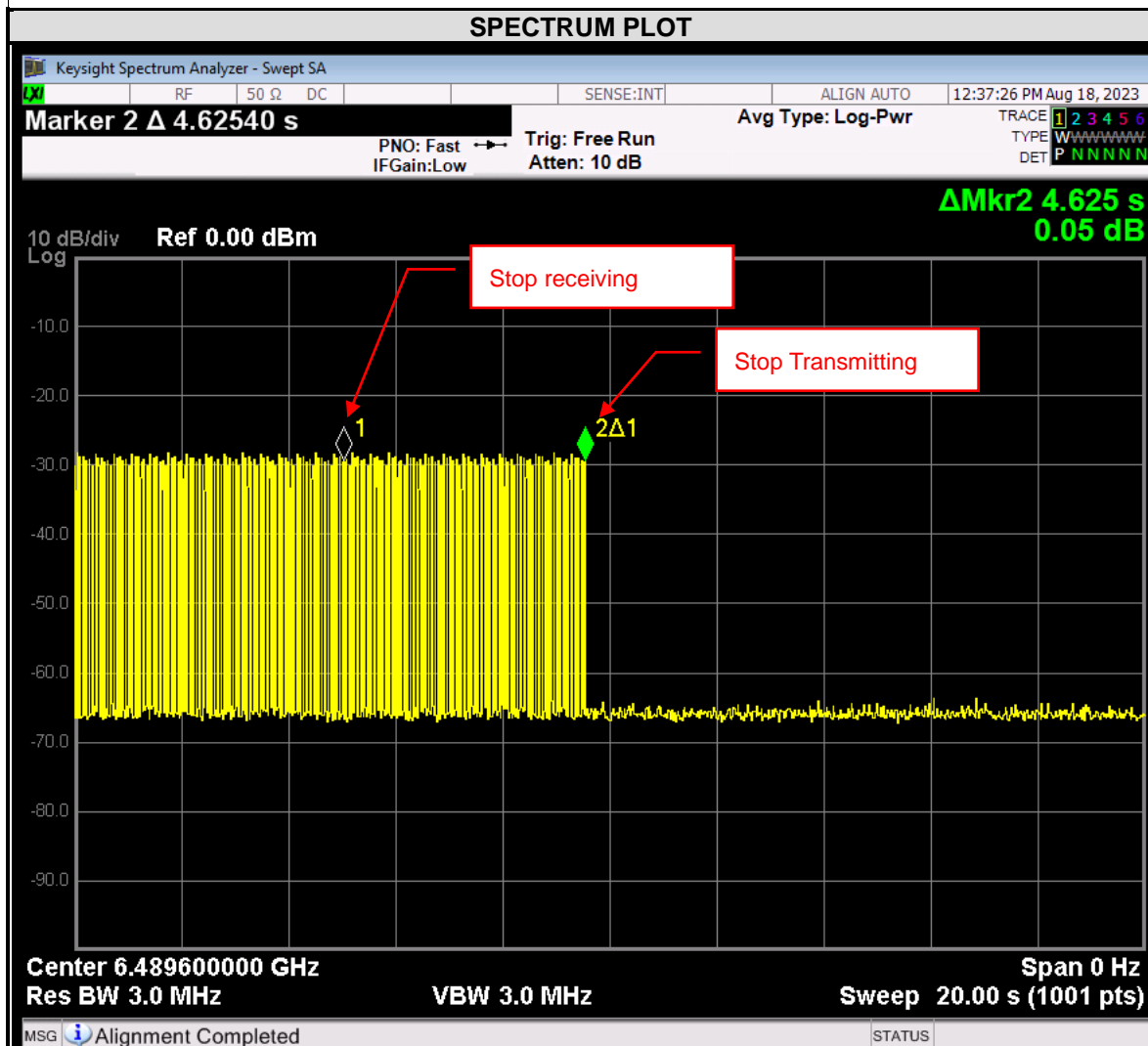
### 4.4.6 EUT OPERATING CONDITIONS

- a) Turned on the power of all equipment.
- b) EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.

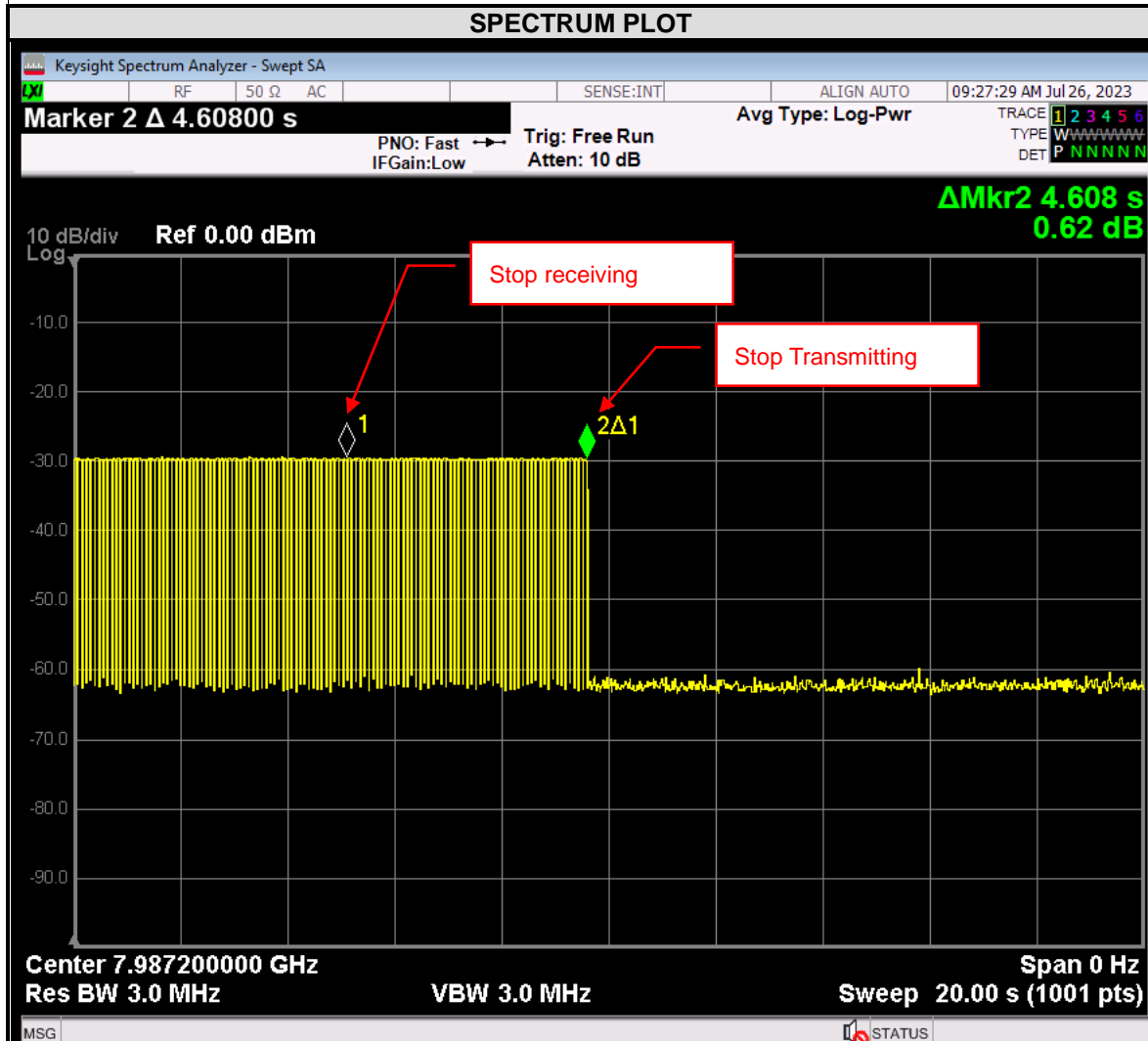


4.4.7 TEST RESULTS

FREQUENCY (MHz)	MEASUREMENT RESULT (sec)	MAXIMUM LIMIT (sec)	PASS/FAIL
6489.6	4.625	10	PASS



FREQUENCY (MHz)	MEASUREMENT RESULT (sec)	MAXIMUM LIMIT (sec)	PASS/FAIL
7987.2	4.608	10	PASS





## 5 ANTENNA REQUIREMENTS

The antenna of the UWB device shall be factory-installed and shall not be made modifiable by users.

**Verdict:**

The Sample is configured with a PCB antenna, it can't be made modifiable by users.



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## 6 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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## **7 APPENDIX A - Modifications recorders for engineering changes to the eut BY THE LAB**

No any modifications are made to the EUT by the lab during the test.

**---END---**