

# TEST REPORT

**Product Name** : Solar wireless reversing system  
**Brand Mark** : N/A  
**Model No.** : TW1, TW2, TW3, Solar 2, Solar 3,  
SUNGO 2, SUNGO3, RVW-Solar2-C1,  
RVW-Solar2-C2, RVW-Solar0-C1,  
RVW-Solar0-C2, RVW-Solar3  
**FCC ID** : IK4TW1  
**Report Number** : BLA-EMC-202102-A1202  
**Date of Sample Receipt** : 2021/2/2  
**Date of Test** : 2021/2/2 to 2021/3/31  
**Date of Issue** : 2021/4/6  
**Test Standard** : 47 CFR Part 15, Subpart C 15.247  
**Test Result** : Pass

Prepared for:

**Shenzhen Auto-vox Technology Co.,Ltd.**  
**602-605, building B, chengshanhai center, Bantian street, Longgang District, Shenzhen**

Prepared by:

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2021/4/6



**REPORT REVISE RECORD**

<b>Version No.</b>	<b>Date</b>	<b>Description</b>
00	2021/4/6	Original

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## 1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	N/A
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Pass

## 2 GENERAL INFORMATION

<b>Applicant</b>	Shenzhen Auto-vox Technology Co.,Ltd.
<b>Address</b>	602-605, building B, chengshanhai center, Bantian street, Longgang District, Shenzhen
<b>Manufacturer</b>	Shenzhen Auto-vox Technology Co.,Ltd.
<b>Address</b>	602-605, building B, chengshanhai center, Bantian street, Longgang District, Shenzhen
<b>Factory</b>	Shenzhen Auto-vox Technology Co.,Ltd.
<b>Address</b>	NO.5 Floor,Block F, NO.10 Weikangde Industrial Area, Shangxue Technology Park, Bantian, Longgang District, Shenzhen, China
<b>Product Name</b>	Solar wireless reversing system
<b>Test Model No.</b>	TW1

## 3 GENERAL DESCRIPTION OF E.U.T.

<b>Hardware Version</b>	RX:V2.1 TX:V1.2
<b>Software Version</b>	RX:B-V01-044-20201207-2 TX:B-V01-044-20201029-2
<b>Operation Frequency:</b>	2406.501 MHz ~ 2473.001MHz
<b>Modulation Type:</b>	GFSK
<b>Channel Spacing:</b>	3.5MHz
<b>Number of Channels:</b>	20 (declared by the client)
<b>Antenna Type:</b>	External ANT
<b>Antenna Gain:</b>	2.0dBi(declared by the client)

Operation Frequency each of channel					
Channel	Frequency	Channel	Frequency	Channel	Frequency
1CH	2406.501 MHz	15CH	2455.501 MHz		
2CH	2410.001 MHz	16CH	2459.001 MHz		
3CH	2413.501 MHz	17CH	2462.501 MHz		
4CH	2417.001 MHz	18CH	2466.001 MHz		
5CH	2420.501 MHz	19CH	2469.501 MHz		
6CH	2424.001 MHz	20CH	2473.001 MHz		
7CH	2427.501 MHz				
8CH	2431.001 MHz				
9CH	2434.501 MHz				
10CH	2438.001 MHz				
11CH	2441.501 MHz				
12CH	2445.001 MHz				
13CH	2448.501 MHz				
14CH	2452.001 MHz				

## Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel(CH1)	2406.5MHz
The Middle channel(CH3)	2441.5MHz
The Highest channel(CH1)	2473.0MHz

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#### 4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	+25°C	12Vdc

#### 5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
TX	Keep the EUT in transmitting mode with modulation
Remark: Only the data of the worst mode would be recorded in this report.	

#### 6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission(9kHz-30MHz)	±4.34dB
Radiated Emission(30Mz-1000MHz)	±4.24dB
Radiated Emission(1GHz-18GHz)	±4.68dB
AC Power Line Conducted Emission(150kHz-30MHz)	±3.45dB



## 7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
PC	HASEE	K610D	N/A	N/A

## 8 LABORATORY LOCATION

All tests were performed at:  
BlueAsia of Technical Services(Shenzhen) Co., Ltd.  
Building C, No. 107, Shihuan Road, Shiyuan Sub-District, Baoan District, Shenzhen, Guangdong Province,  
China  
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673  
No tests were sub-contracted.

## 9 TEST INSTRUMENTS LIST

Test Equipment Of Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Shield room	SKET	833	N/A	2020/11/25	2023/11/24
Receiver	R&S	ESPI3	101082	2020/10/12	2021/10/11
LISN	R&S	ENV216	3560.6550.15	2020/10/12	2021/10/11
LISN	AT	AT166-2	AKK1806000003	2020/10/12	2021/10/11
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A

Test Equipment Of Conducted Band Edges Measurement					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

Test Equipment Of Radiated Spurious Emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	2020/11/10	2023/11/9
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Receiver	R&S	ESR7	101199	2020/10/12	2021/10/11
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2020/9/26	2022/9/25
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	2020/9/26	2022/9/25

Amplifier	SKET	PA-000318G-45	N/A	2020/10/16	2021/10/15
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2020/9/26	2022/9/25
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

**Test Equipment Of Radiated Emissions which fall in the restricted bands**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	2020/11/10	2023/11/9
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Receiver	R&S	ESR7	101199	2020/10/12	2021/10/11
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2020/9/26	2022/9/25
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	2020/9/26	2022/9/25
Amplifier	SKET	PA-000318G-45	N/A	2020/10/16	2021/10/15
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2020/9/26	2022/9/25
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

**Test Equipment Of Conducted Spurious Emissions**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11

Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

**Test Equipment Of Power Spectrum Density**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

**Test Equipment Of Conducted Peak Output Power**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

**Test Equipment Of Minimum 6dB Bandwidth**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

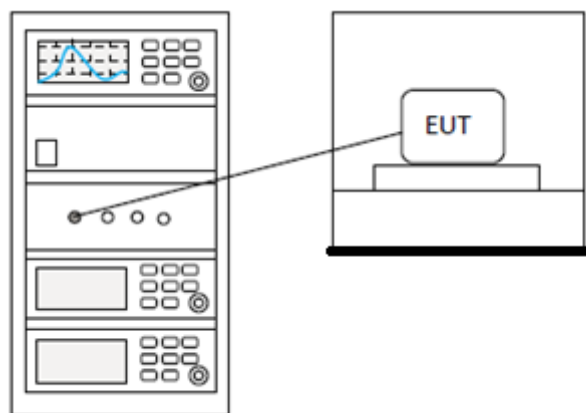
## 10 CONDUCTED BAND EDGES MEASUREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Sven
Temperature	25°C
Humidity	52%

### 10.1 LIMITS

<b>Limit:</b>	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
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### 10.2 BLOCK DIAGRAM OF TEST SETUP



### 10.3 TEST DATA

**Pass: Please Refer To Appendix: For Details**

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## 11 RADIATED SPURIOUS EMISSIONS

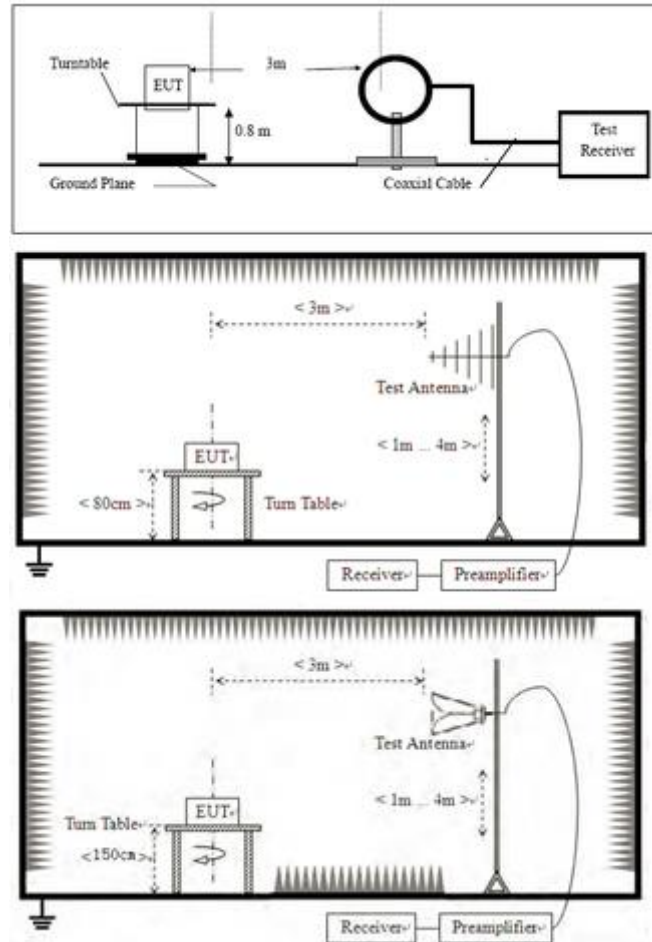
<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 6.4,6.5,6.6
<b>Test Mode (Pre-Scan)</b>	TX Low channel;TX middle channel;TX high channel
<b>Test Mode (Final Test)</b>	TX Low channel;TX middle channel;TX high channel
<b>Tester</b>	Sven
<b>Temperature</b>	25°C
<b>Humidity</b>	52%

### 11.1 LIMITS

<b>Frequency(MHz)</b>	<b>Field strength(microvolts/meter)</b>	<b>Measurement distance(meters)</b>
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
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

## 11.2 BLOCK DIAGRAM OF TEST SETUP



## 11.3 PROCEDURE

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna 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.
- 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.



- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

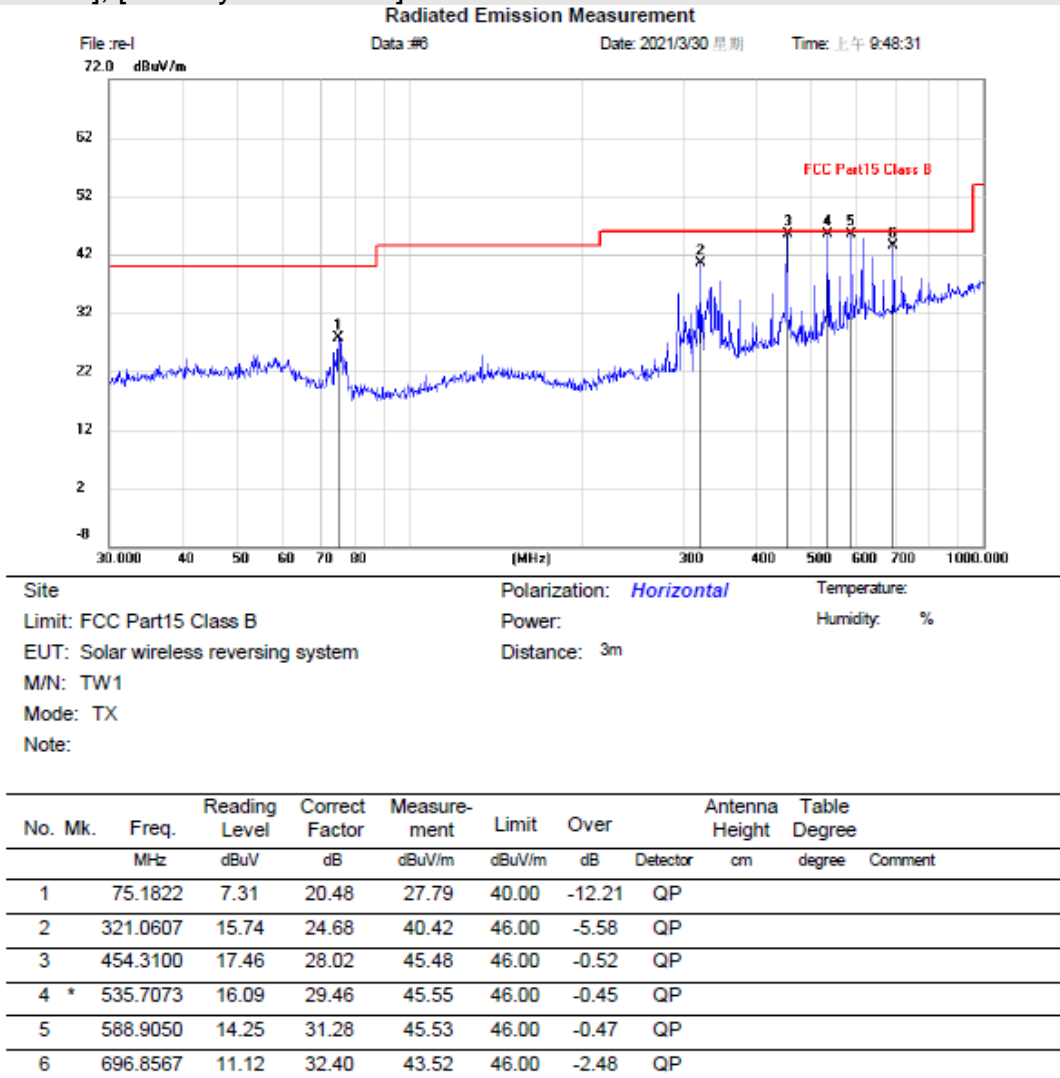
Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:  
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor + Preamplifier Factor
- 3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. fundamental frequency is blocked by filter, and only spurious emission is shown.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

### 11.4 TEST DATA

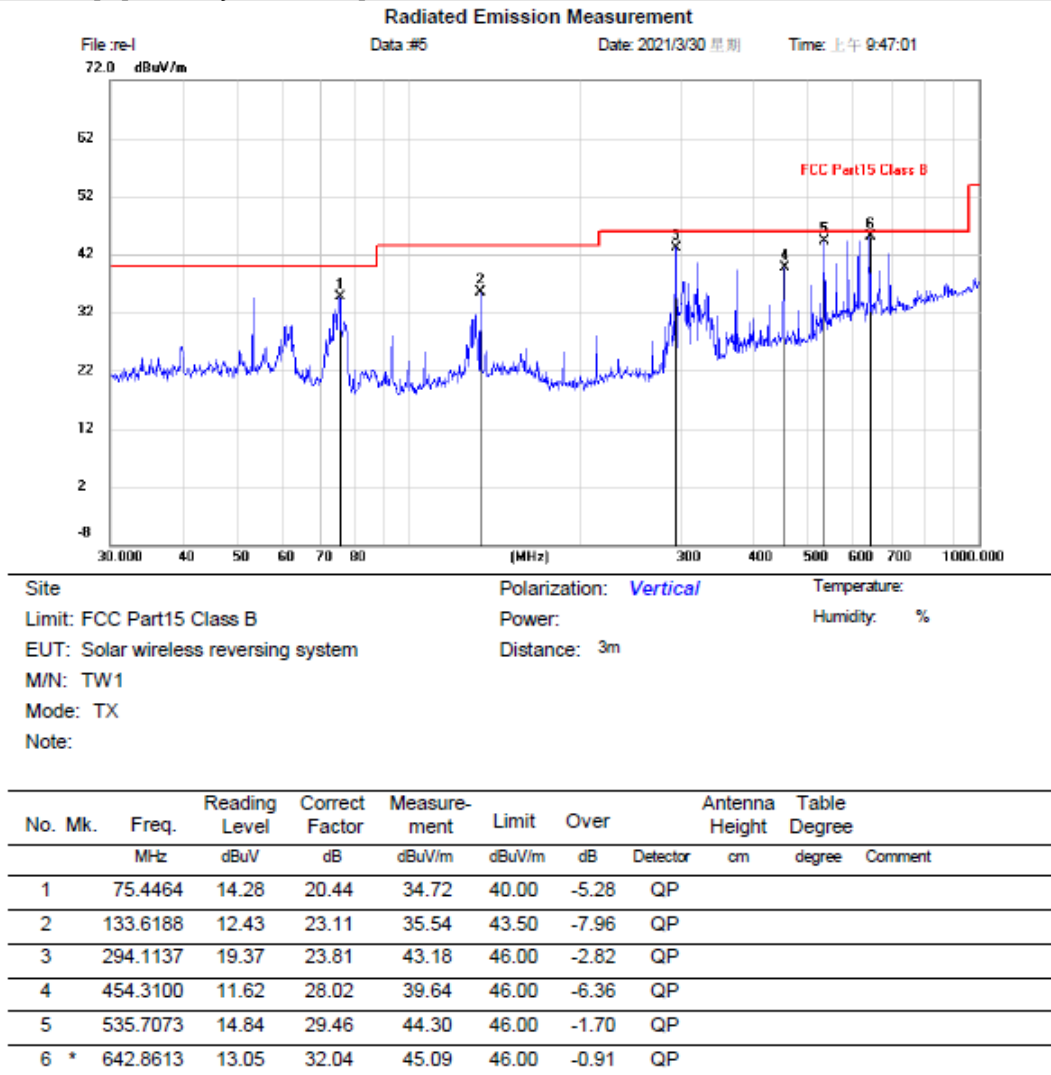
Below 1GHz:

[TestMode: TX]; [Polarity: Horizontal]



**Test Result: Pass**

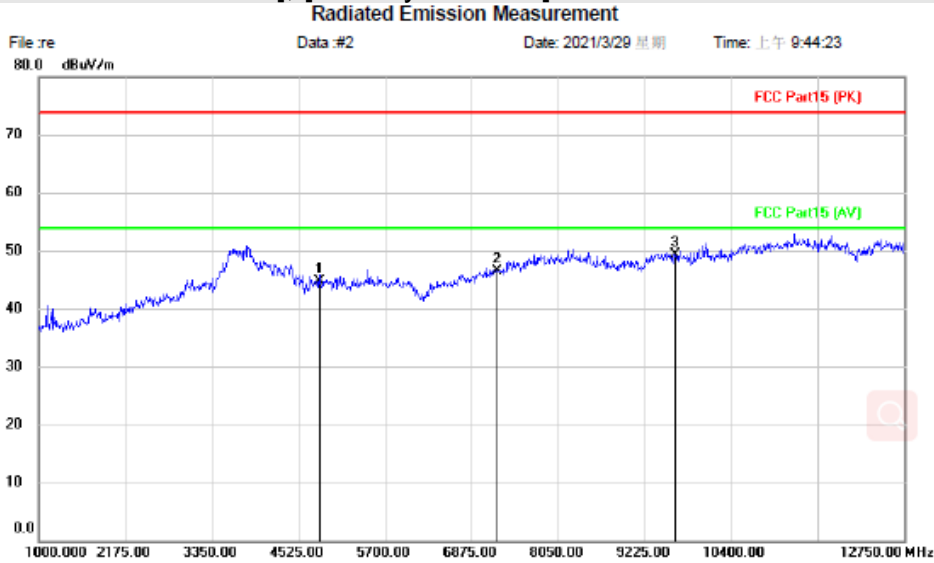
[TestMode: TX]; [Polarity: Vertical]



**Test Result: Pass**

Above 1GHz:

[TestMode: TX Low channel]; [Polarity: Vertical]



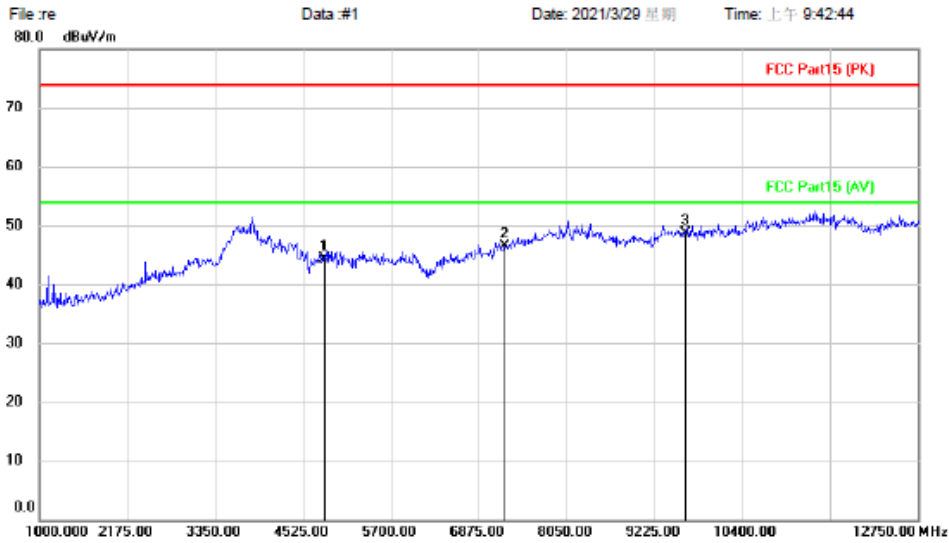
Site	Polarization: <i>Vertical</i>	Temperature:
Limit: FCC Part15 (PK)	Power:	Humidity: %
EUT: Solar wireless reversing system	Distance: 3m	
M/N: TW1		
Mode: TX-L		
Note:		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		4813.000	41.10	3.68	44.78	74.00	-29.22	peak		
2		7219.500	40.47	6.01	46.48	74.00	-27.52	peak		
3	*	9626.000	39.94	9.33	49.27	74.00	-24.73	peak		

**Test Result: Pass**

[TestMode: TX Lowest channel]; [Polarity: Horizontal]

Radiated Emission Measurement

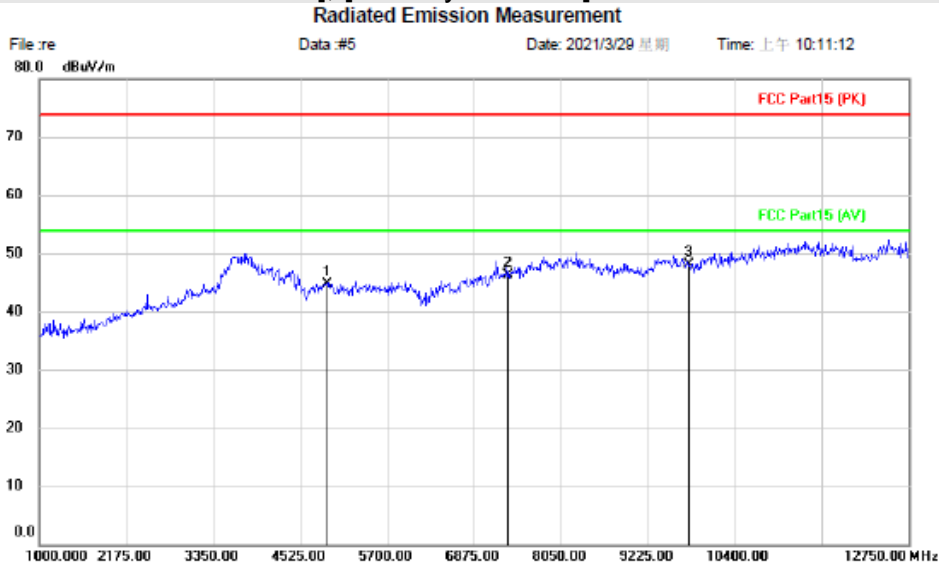


Site: Polarization: *Horizontal* Temperature:  
 Limit: FCC Part15 (PK) Power: Humidity: %  
 EUT: Solar wireless reversing system Distance: 3m  
 M/N: TW1  
 Mode: TX-L  
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1		4813.000	40.66	3.68	44.34	74.00	-29.66	peak		
2		7219.500	40.51	6.01	46.52	74.00	-27.48	peak		
3	*	9626.000	39.45	9.33	48.78	74.00	-25.22	peak		

**Test Result: Pass**

[TestMode: TX middle channel]; [Polarity: Vertical]



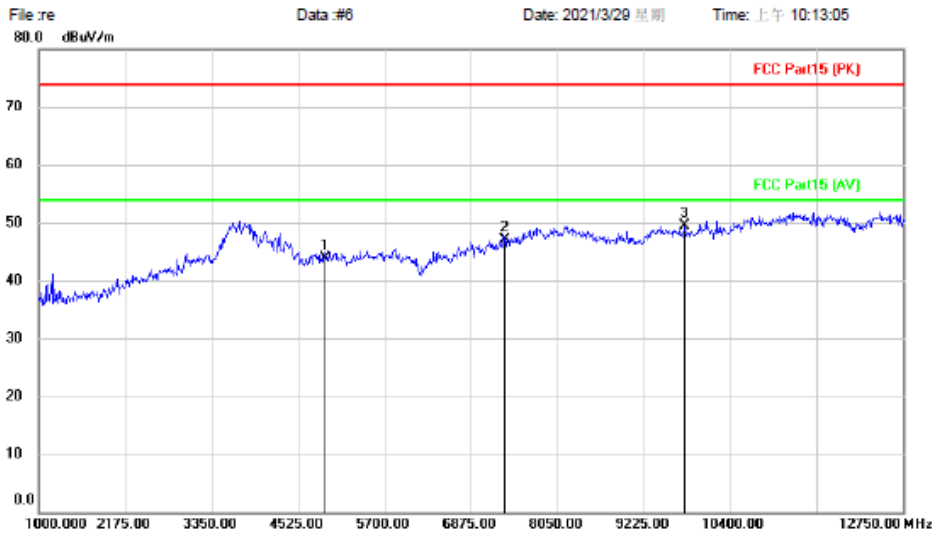
Site    Polarization: *Vertical*                      Temperature:                      Humidity: %  
 Limit: FCC Part15 (PK)                      Power:                      Distance: 3m  
 EUT: Solar wireless reversing system  
 M/N: TW1  
 Mode: TX-M  
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	
1		4884.000	41.45	3.34	44.79	74.00	-29.21	peak		
2		7326.000	39.80	6.44	46.24	74.00	-27.76	peak		
3	*	9768.000	38.55	9.63	48.18	74.00	-25.82	peak		

**Test Result: Pass**

[TestMode: TX Middle channel]; [Polarity: Horizontal]

Radiated Emission Measurement

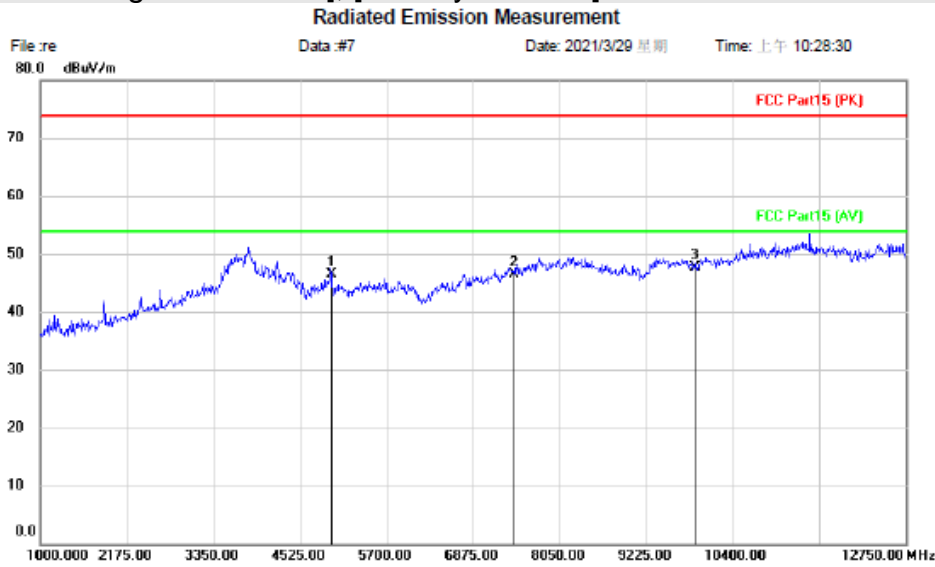


Site: Polarization: *Horizontal* Temperature:   
 Limit: FCC Part15 (PK) Power: Humidity: %   
 EUT: Solar wireless reversing system Distance: 3m   
 M/N: TW1   
 Mode: TX-M   
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		4884.000	40.62	3.34	43.96	74.00	-30.04			peak
2		7326.000	40.72	6.44	47.16	74.00	-26.84			peak
3	*	9768.000	39.80	9.63	49.43	74.00	-24.57			peak

**Test Result: Pass**

[TestMode: TX highest channel]; [Polarity: Vertical]



Site Polarization: *Vertical* Temperature:   
 Limit: FCC Part15 (PK) Power: Humidity: %   
 EUT: Solar wireless reversing system Distance: 3m   
 M/N: TW1   
 Mode: TX-H   
 Note:

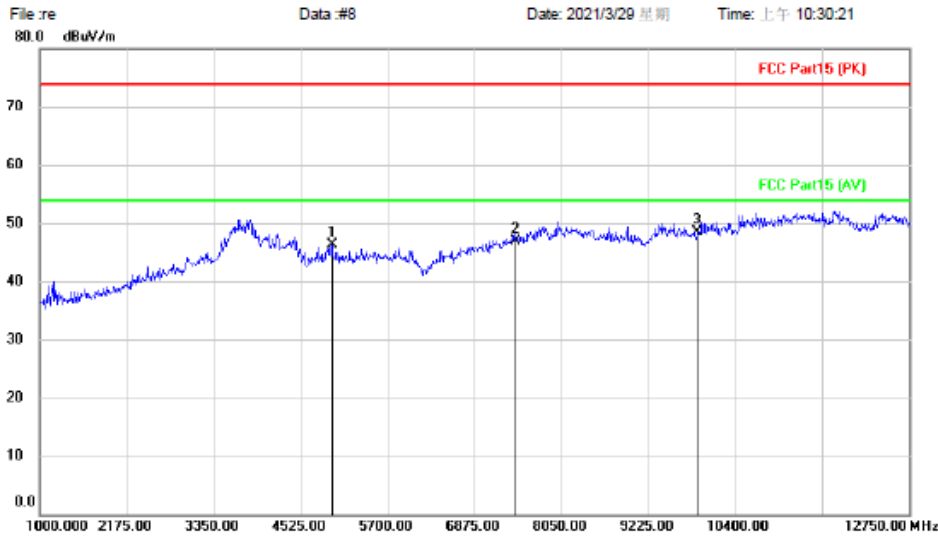
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		4946.000	42.87	3.64	46.51	74.00	-27.49	peak		
2		7419.000	39.66	6.80	46.46	74.00	-27.54	peak		
3	*	9892.000	37.62	10.05	47.67	74.00	-26.33	peak		

**Test Result: Pass**



[TestMode: TX highest channel]; [Polarity: Horizontal]

Radiated Emission Measurement



Site: Polarization: *Horizontal* Temperature:   
 Limit: FCC Part15 (PK) Power: Humidity: %   
 EUT: Solar wireless reversing system Distance: 3m   
 M/N: TW1   
 Mode: TX-H   
 Note:

No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	4946.000	42.63	3.64	46.27	74.00	-27.73	peak		
2	7419.000	40.15	6.80	46.95	74.00	-27.05	peak		
3 *	9892.000	38.49	10.05	48.54	74.00	-25.46	peak		

**Test Result: Pass**

## 12 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

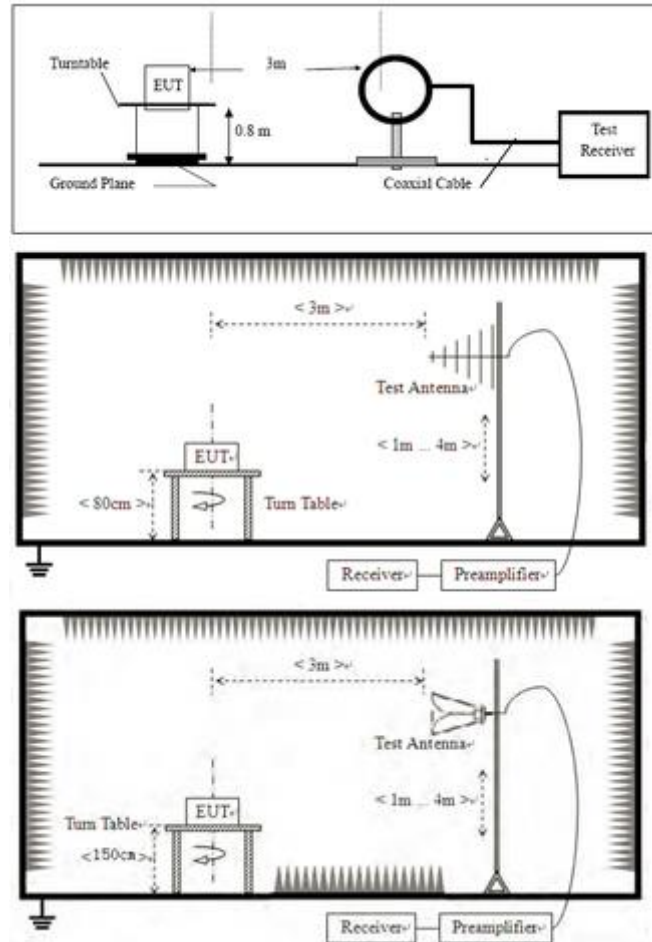
<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 6.10.5
<b>Test Mode (Pre-Scan)</b>	TX Low channel;TX high channel
<b>Test Mode (Final Test)</b>	TX Low channel;TX high channel
<b>Tester</b>	Sven
<b>Temperature</b>	25°C
<b>Humidity</b>	52%

### 12.1 LIMITS

<b>Frequency(MHz)</b>	<b>Field strength(microvolts/meter)</b>	<b>Measurement distance(meters)</b>
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
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

## 12.2 BLOCK DIAGRAM OF TEST SETUP



## 12.3 PROCEDURE

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna 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.
- 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

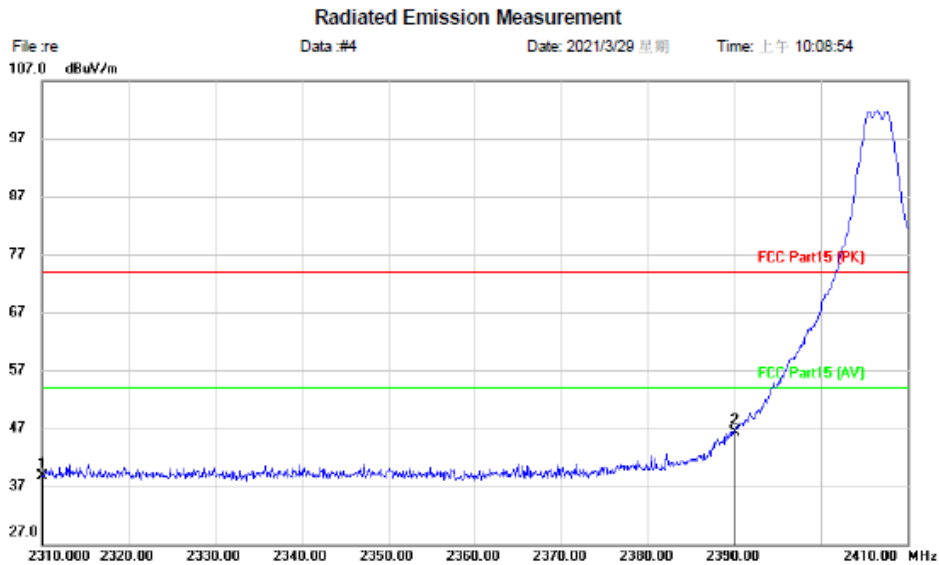
Remark 1:  $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamp Factor}$

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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### 12.4 TEST DATA

[TestMode: TX Low channel]; [Polarity: Horizontal]



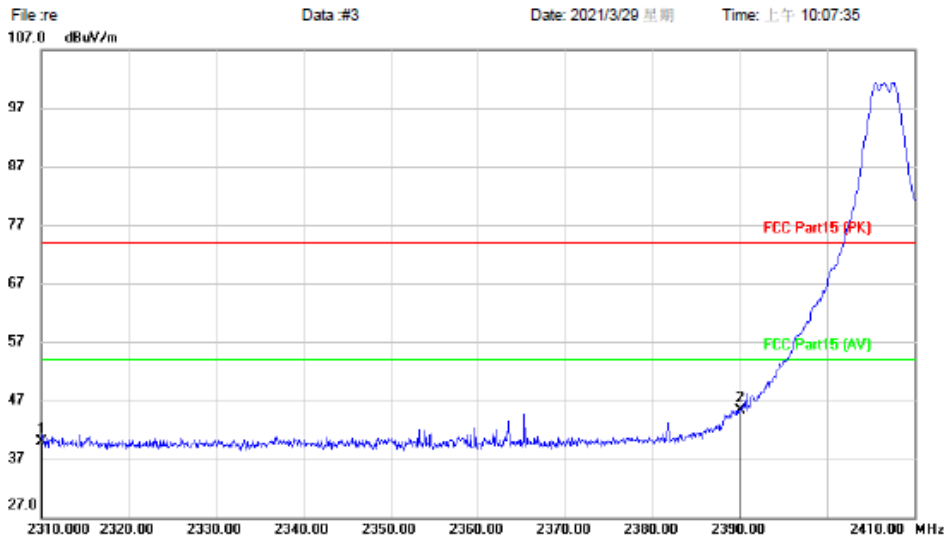
Site	Polarization: <i>Horizontal</i>	Temperature:
Limit: FCC Part15 (PK)	Power:	Humidity: %
EUT: Solar wireless reversing system	Distance: 3m	
M/N: TW1		
Mode: TX-L		
Note:		

No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree
1	2310.000	43.28	-4.61	38.67	74.00	-35.33	peak	
2 *	2390.000	50.53	-4.27	46.26	74.00	-27.74	peak	

**Test Result: Pass**

[TestMode: TX Low channel]; [Polarity: Vertical]

Radiated Emission Measurement



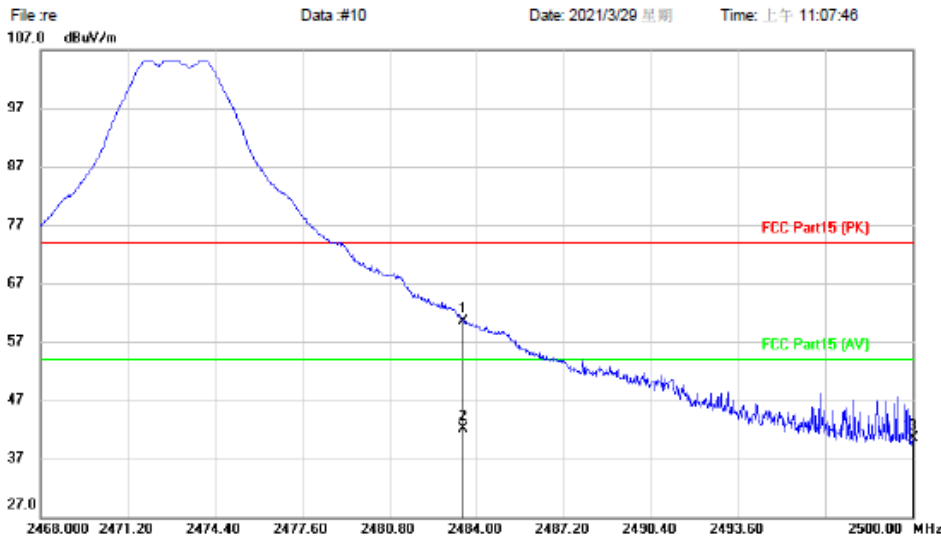
Site: Polarization: *Vertical* Temperature:   
 Limit: FCC Part15 (PK) Power: Humidity: %   
 EUT: Solar wireless reversing system Distance: 3m   
 M/N: TW1   
 Mode: TX-L   
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	
1		2310.000	44.46	-4.61	39.85	74.00	-34.15	peak		
2	*	2390.000	49.57	-4.27	45.30	74.00	-28.70	peak		

Test Result: Pass

[TestMode: TX high channel]; [Polarity: Horizontal]

Radiated Emission Measurement



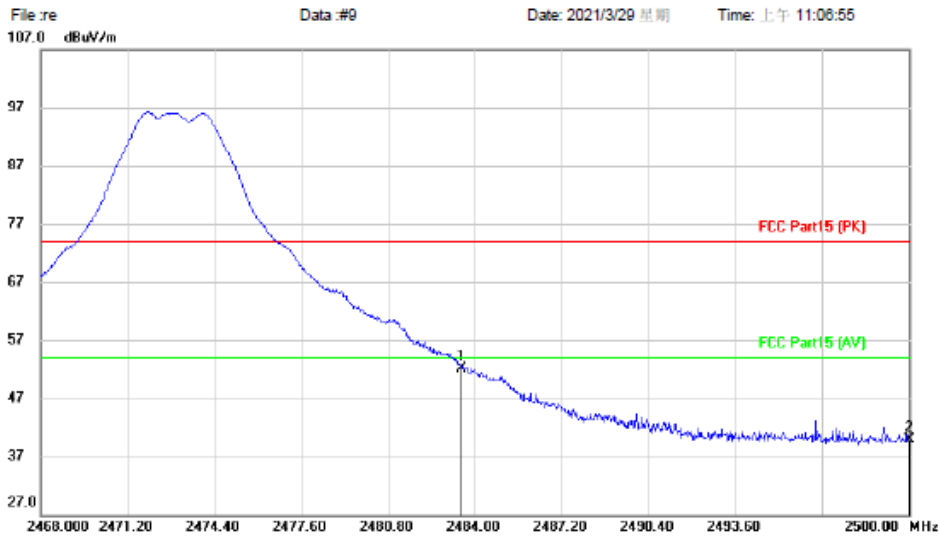
Site: Polarization: *Horizontal* Temperature:   
 Limit: FCC Part15 (PK) Power: Humidity: %   
 EUT: Solar wireless reversing system Distance: 3m   
 M/N: TW1   
 Mode: TX-H   
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2483.500	64.33	-3.84	60.49	74.00	-13.51			peak
2	*	2483.500	46.01	-3.84	42.17	54.00	-11.83			AVG
3		2500.000	44.29	-3.78	40.51	74.00	-33.49			peak

Test Result: Pass

[TestMode: TX high channel]; [Polarity: Vertical]

**Radiated Emission Measurement**



Site:      Polarization: *Vertical*      Temperature:      Humidity: %  
 Limit: FCC Part15 (PK)      Power:      Distance: 3m  
 EUT: Solar wireless reversing system  
 M/N: TW1  
 Mode: TX-H  
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1	*	2483.500	55.98	-3.84	52.14	74.00	-21.86	peak			
2		2500.000	43.67	-3.78	39.89	74.00	-34.11	peak			

**Test Result: Pass**



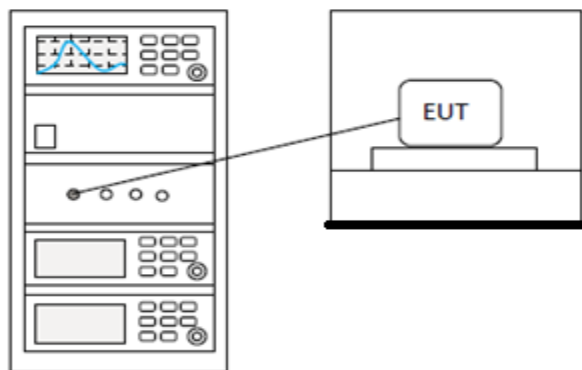
### 13 CONDUCTED SPURIOUS EMISSIONS

<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Sven
<b>Temperature</b>	25°C
<b>Humidity</b>	52%

#### 13.1 LIMITS

<b>Limit:</b>	<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).</p>
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#### 13.2 BLOCK DIAGRAM OF TEST SETUP



#### 13.3 TEST DATA

**Pass: Please Refer To Appendix: For Details**

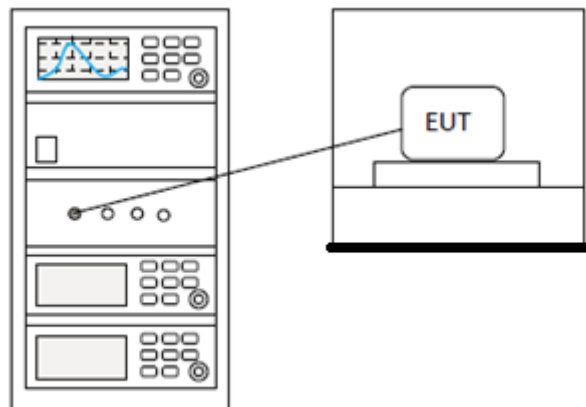
## 14 POWER SPECTRUM DENSITY

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.10.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Sven
Temperature	25°C
Humidity	52%

### 14.1 LIMITS

<b>Limit:</b>	$\leq 8\text{dBm}$ in any 3 kHz band during any time interval of continuous transmission
---------------	--

### 14.2 BLOCK DIAGRAM OF TEST SETUP



### 14.3 TEST DATA

<b>Pass: Please Refer To Appendix: For Details</b>
--

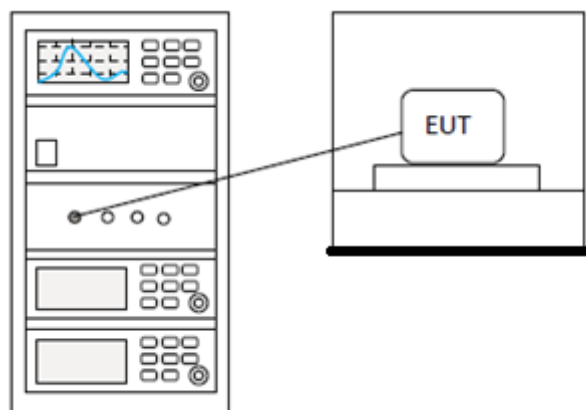
## 15 CONDUCTED PEAK OUTPUT POWER

<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 7.8.5
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Sven
<b>Temperature</b>	25°C
<b>Humidity</b>	52%

### 15.1 LIMITS

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for $\geq 50$ hopping channels
	0.25 for $25 \leq$ hopping channels $< 50$
	1 for digital modulation
2400-2483.5	1 for $\geq 75$ non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

### 15.2 BLOCK DIAGRAM OF TEST SETUP



### 15.3 EST DATA

**Pass: Please Refer To Appendix: For Details**

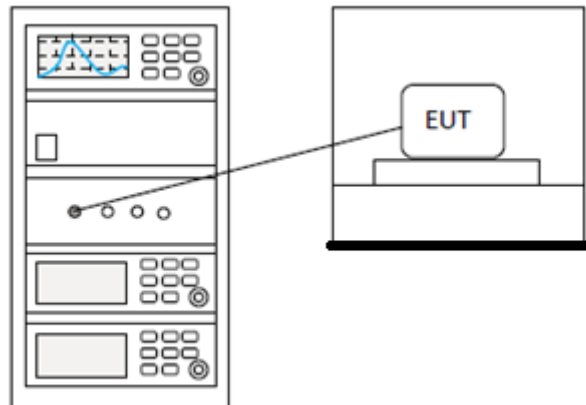
## 16 MINIMUM 6DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.8.1
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Sven
Temperature	25°C
Humidity	52%

### 16.1 LIMITS

<b>Limit:</b>	≥500 kHz
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### 16.2 BLOCK DIAGRAM OF TEST SETUP



### 16.3 TEST DATA

**Pass: Please Refer To Appendix: For Details**

## 17 ANTENNA REQUIREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	N/A

### CONCLUSION

Standard Requirement:

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 an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of an so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.0dBi.



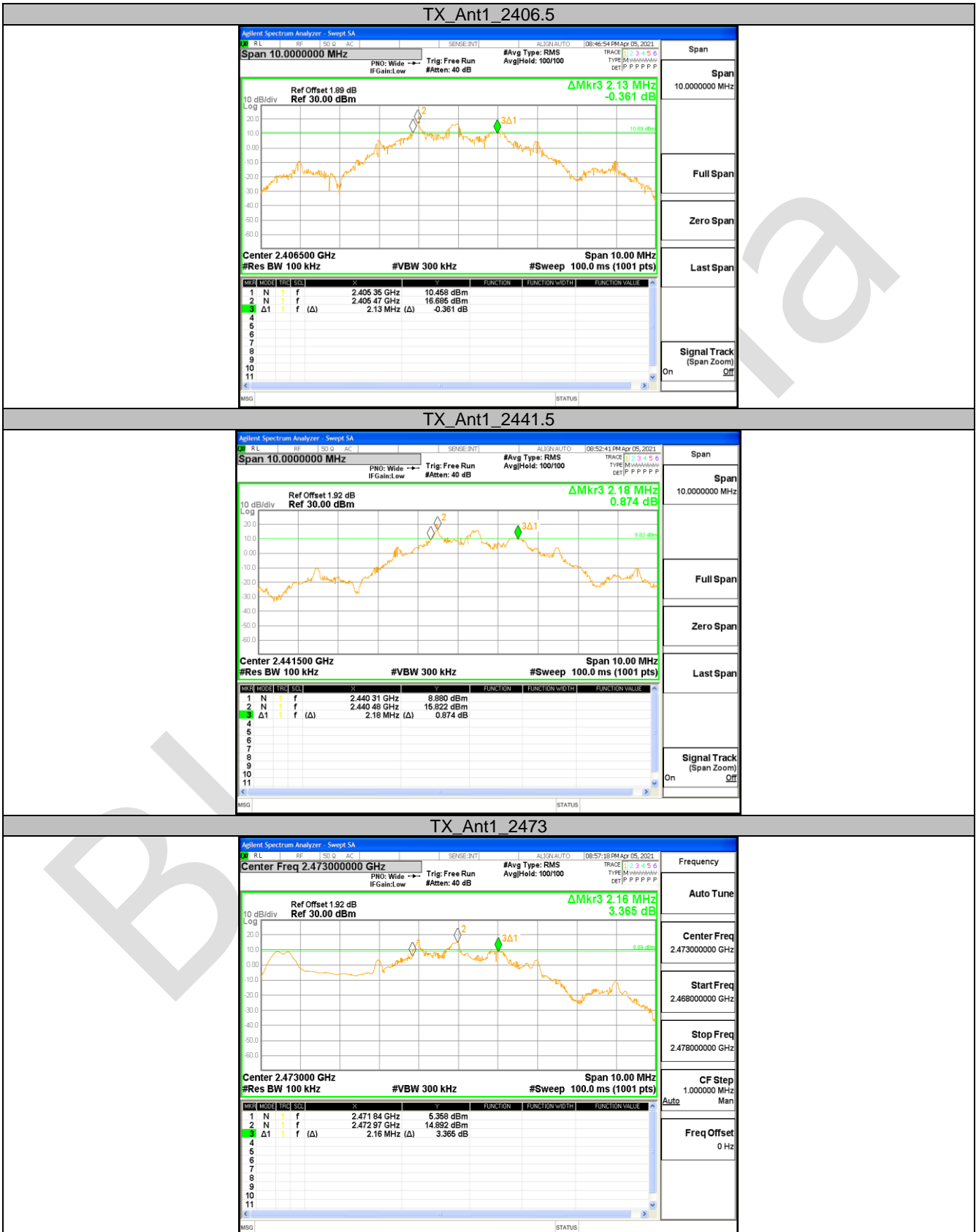
## 18 APPENDIX

### 18.1 APPENDIX : DTS BANDWIDTH

#### Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
TX	Ant1	2406.5	2.130	2405.350	2407.480	$\geq 0.5$	PASS
		2441.5	2.180	2440.310	2442.490	$\geq 0.5$	PASS
		2473	2.160	2471.840	2474.000	$\geq 0.5$	PASS

### Test Graphs



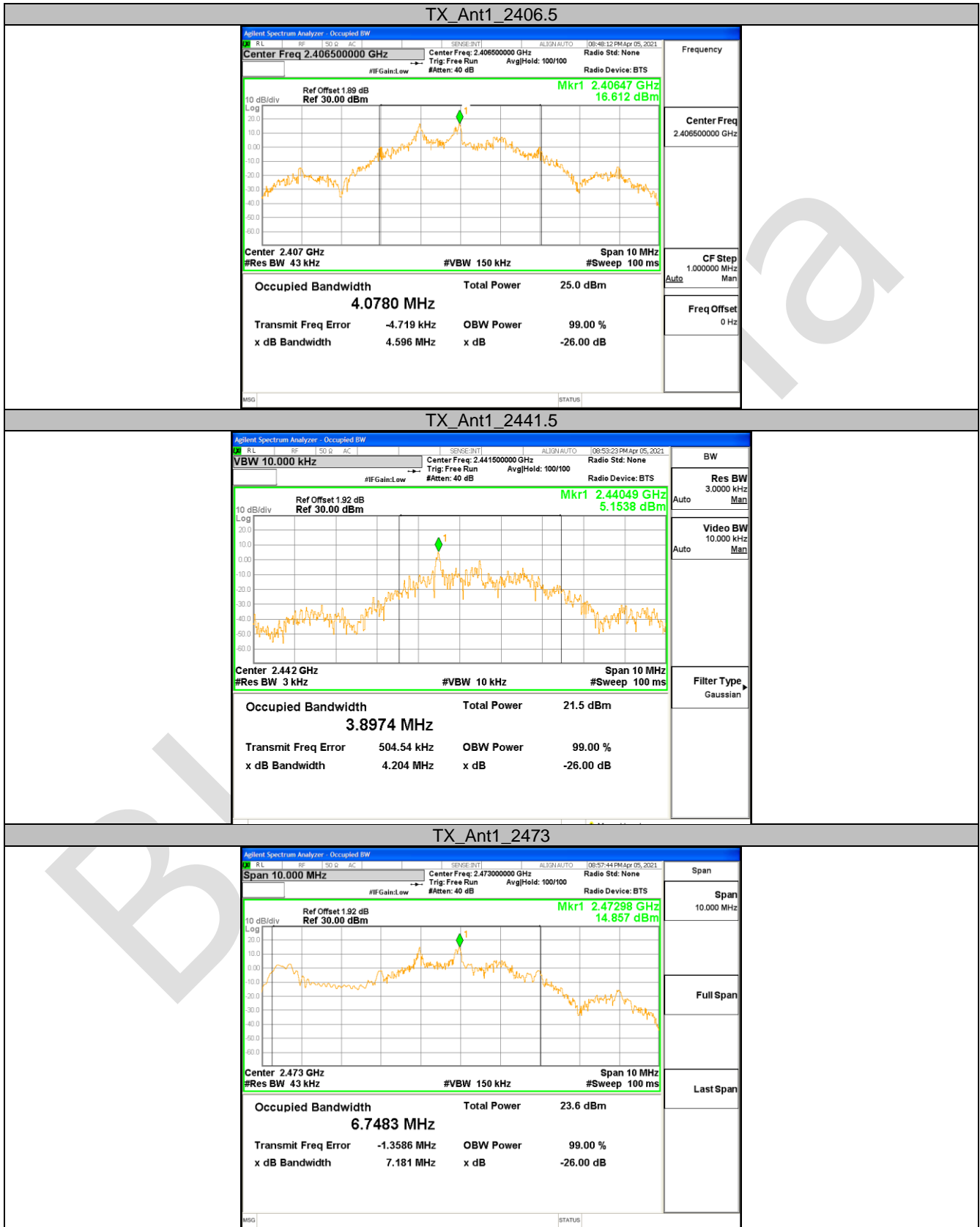
**18.2 APPENDIX : OCCUPIED CHANNEL BANDWIDTH****Test Result**

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
TX	Ant1	2406.5	4.0780	2404.456	2408.534	---	PASS
		2441.5	3.8974	2439.556	2443.453	---	PASS
		2473	6.7483	2468.267	2475.016	---	PASS

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### Test Graphs

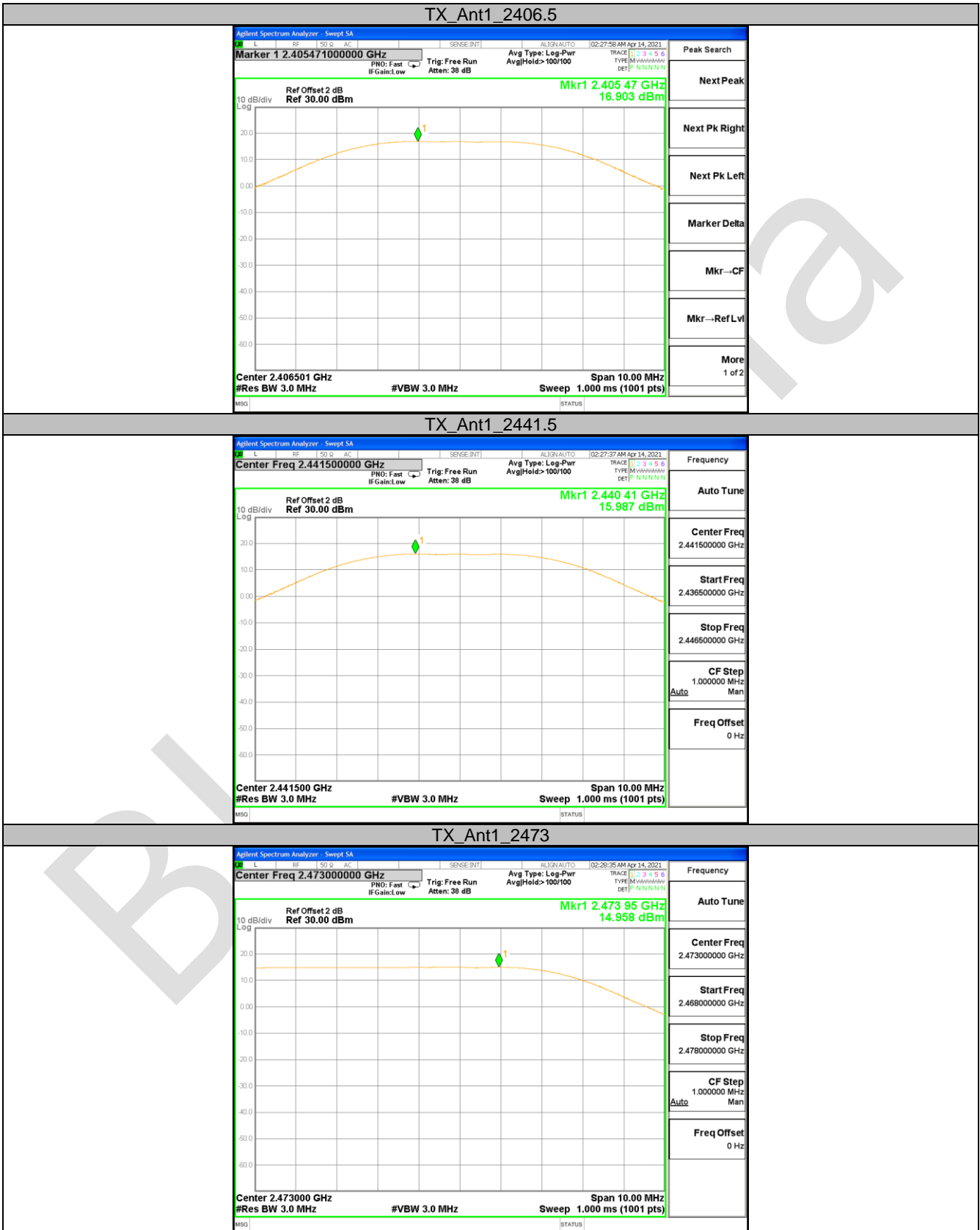


**18.3 APPENDIX : MAXIMUM CONDUCTED OUTPUT POWER****Test Result**

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
TX	Ant1	2406.5	16.90	<=30	PASS
		2441.5	15.99	<=30	PASS
		2473	14.96	<=30	PASS

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### Test Graphs

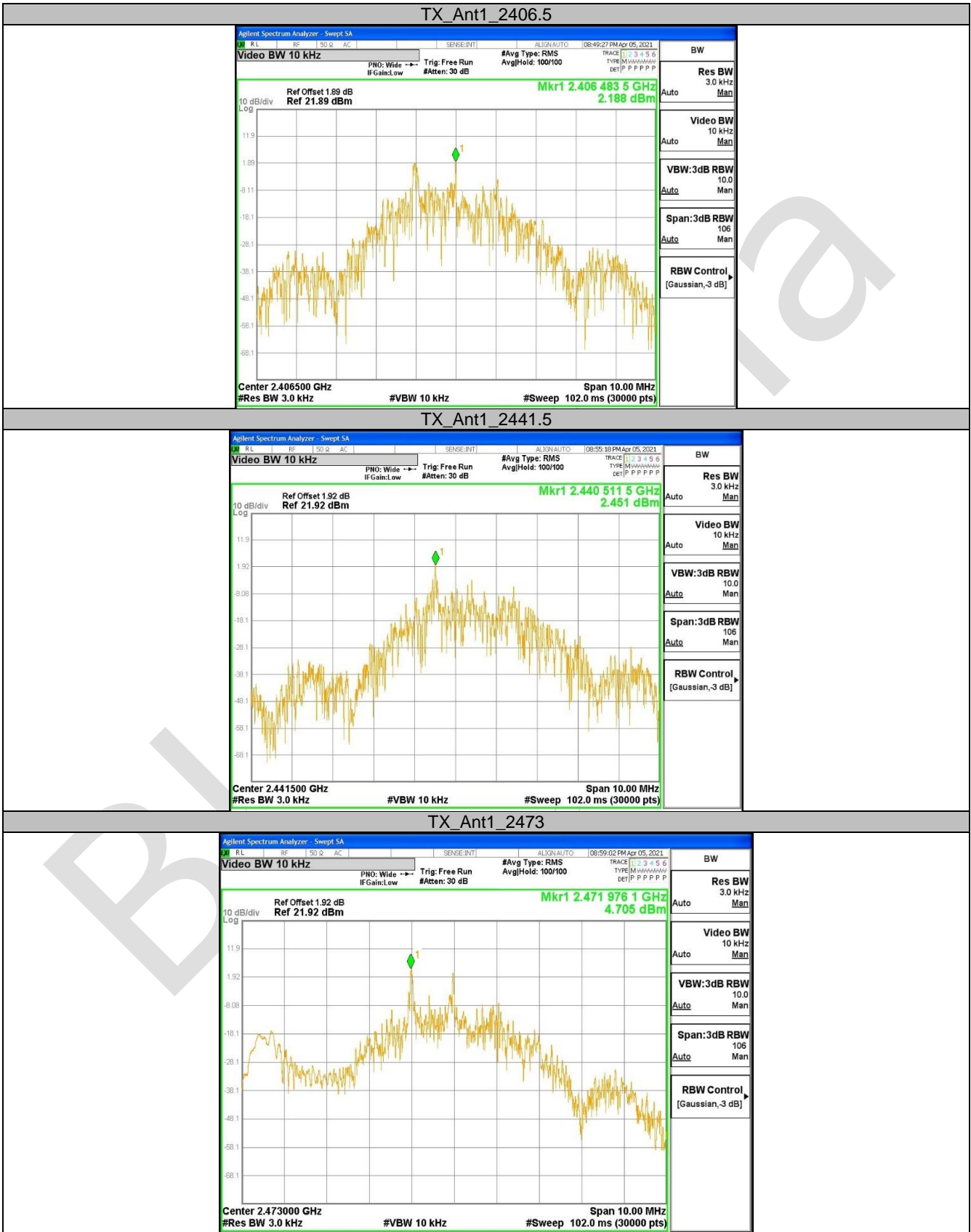


**18.4 APPENDIX : MAXIMUM POWER SPECTRAL DENSITY****Test Result**

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
TX	Ant1	2406.5	2.19	<=8	PASS
		2441.5	2.45	<=8	PASS
		2473	4.71	<=8	PASS

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### Test Graphs



**18.5 APPENDIX : BAND EDGE MEASUREMENTS****Test Result**

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
TX	Ant1	Low	2406.5	16.57	-45.67	<=-3.43	PASS
		High	2473	14.88	-53.26	<=-5.12	PASS

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### Test Graphs

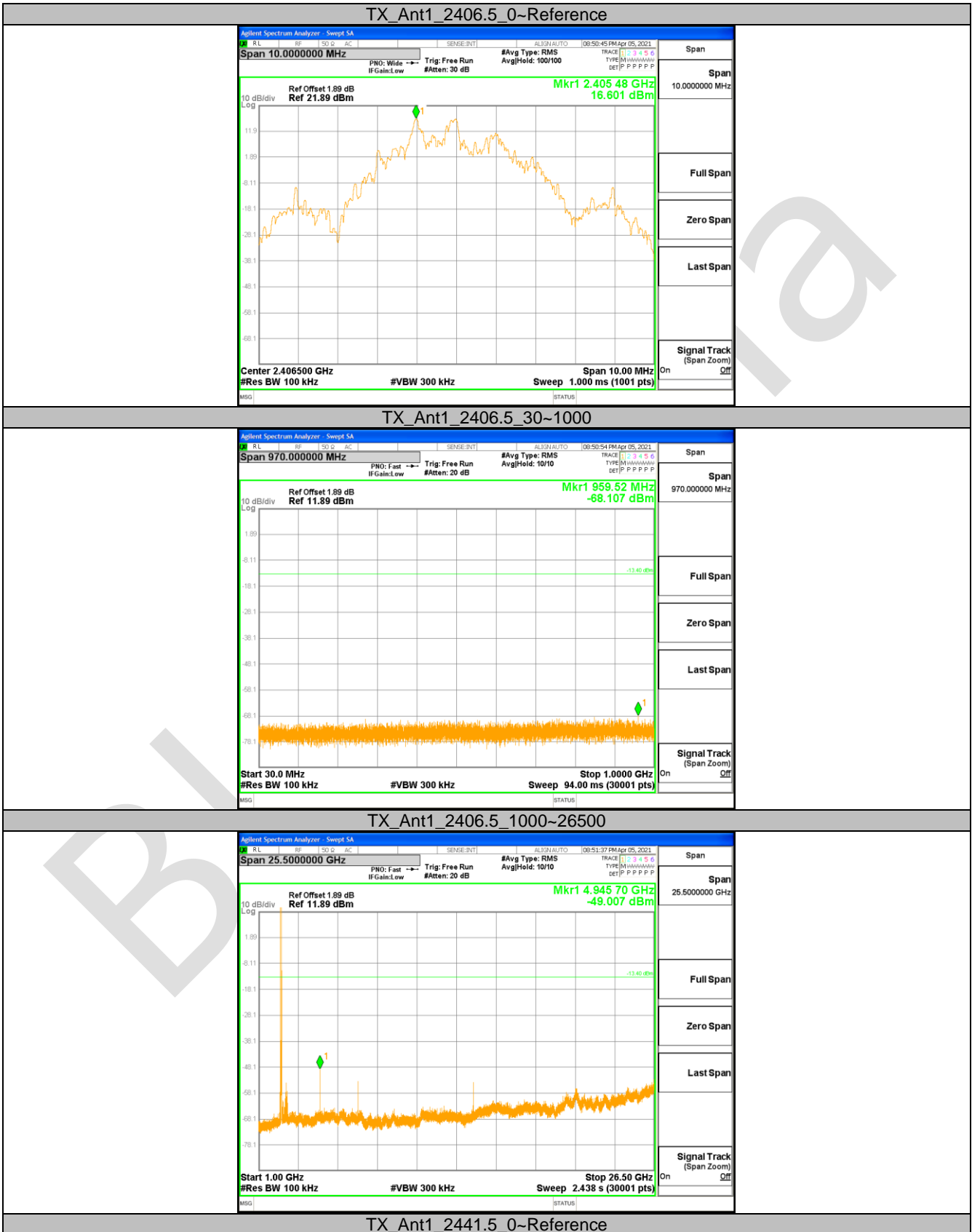


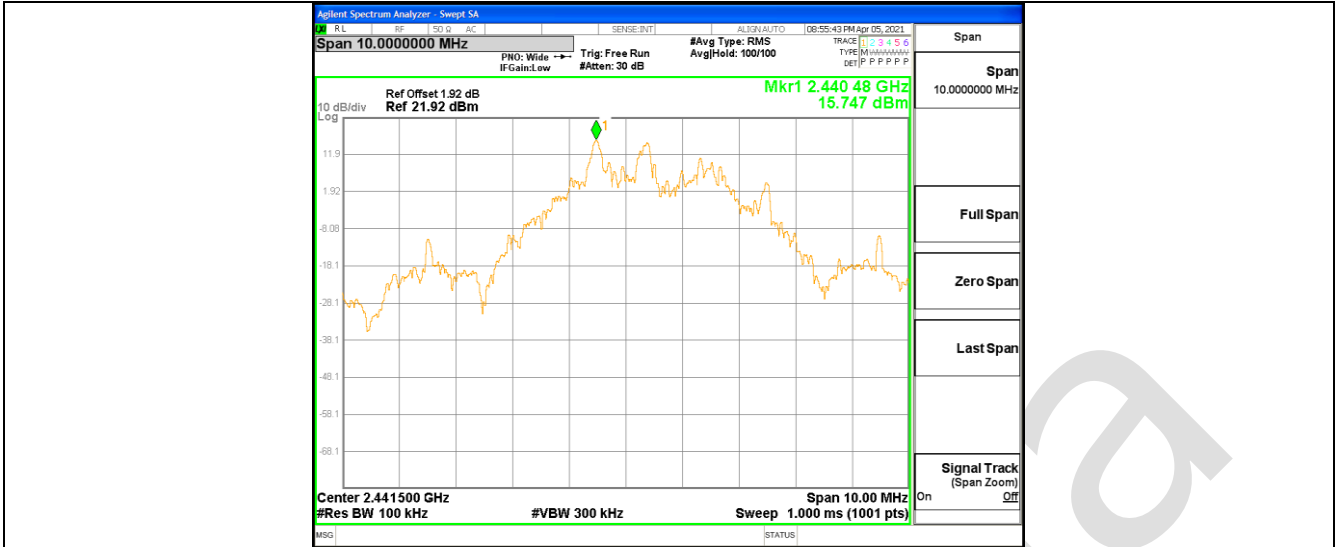
**18.6 APPENDIX : CONDUCTED SPURIOUS EMISSION**
**Test Result**

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
TX	Ant1	2406.5	Reference	16.60	16.60	---	PASS
			30~1000	30~1000	-68.107	<=-13.399	PASS
			1000~26500	1000~26500	-49.007	<=-13.399	PASS
		2441.5	Reference	15.75	15.75	---	PASS
			30~1000	30~1000	-68.15	<=-14.253	PASS
			1000~26500	1000~26500	-49.236	<=-14.253	PASS
		2473	Reference	15.14	15.14	---	PASS
			30~1000	30~1000	-66.774	<=-14.857	PASS
			1000~26500	1000~26500	-45.311	<=-14.857	PASS

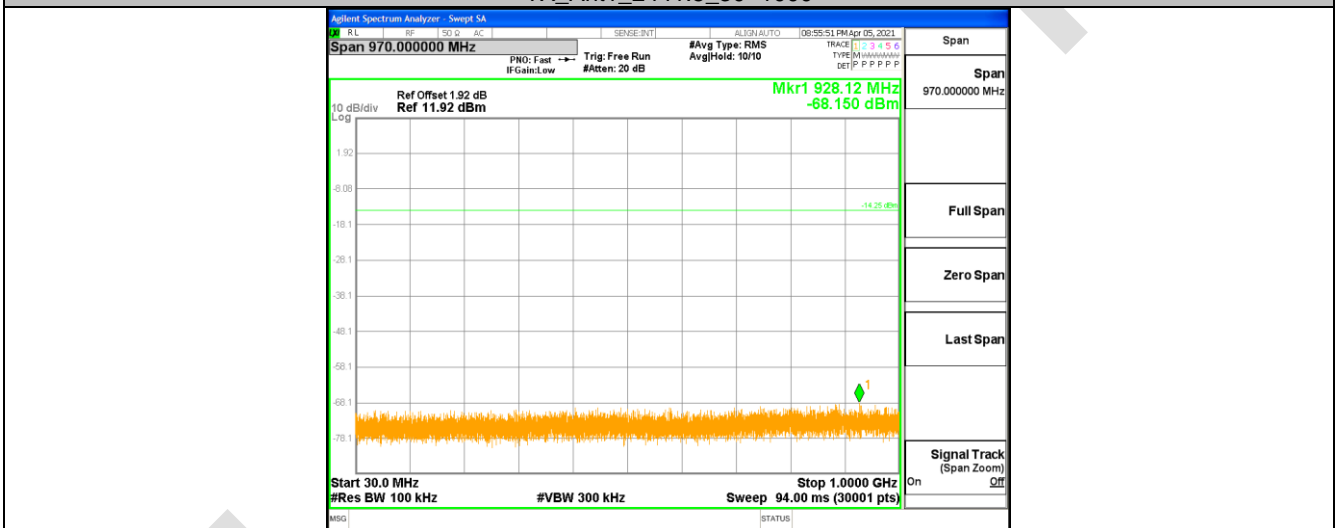


### Test Graphs

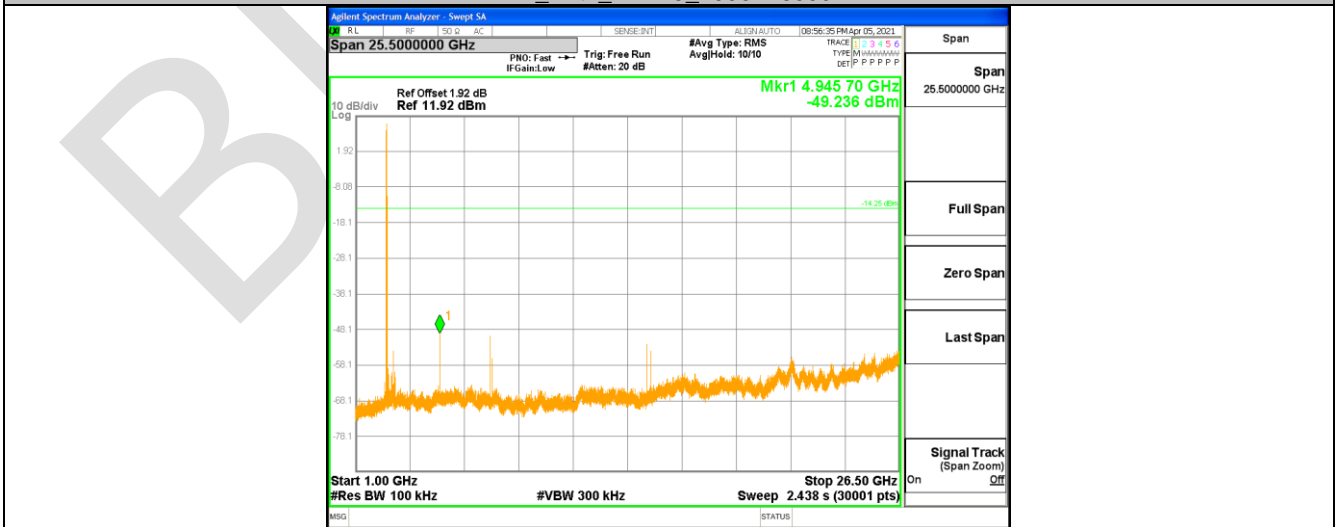




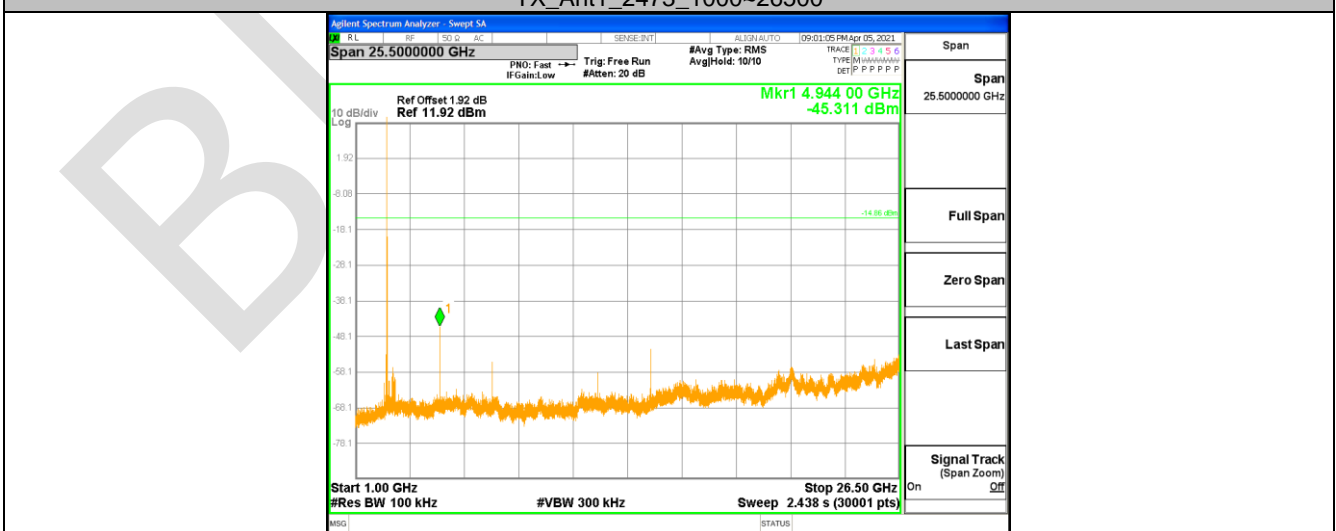
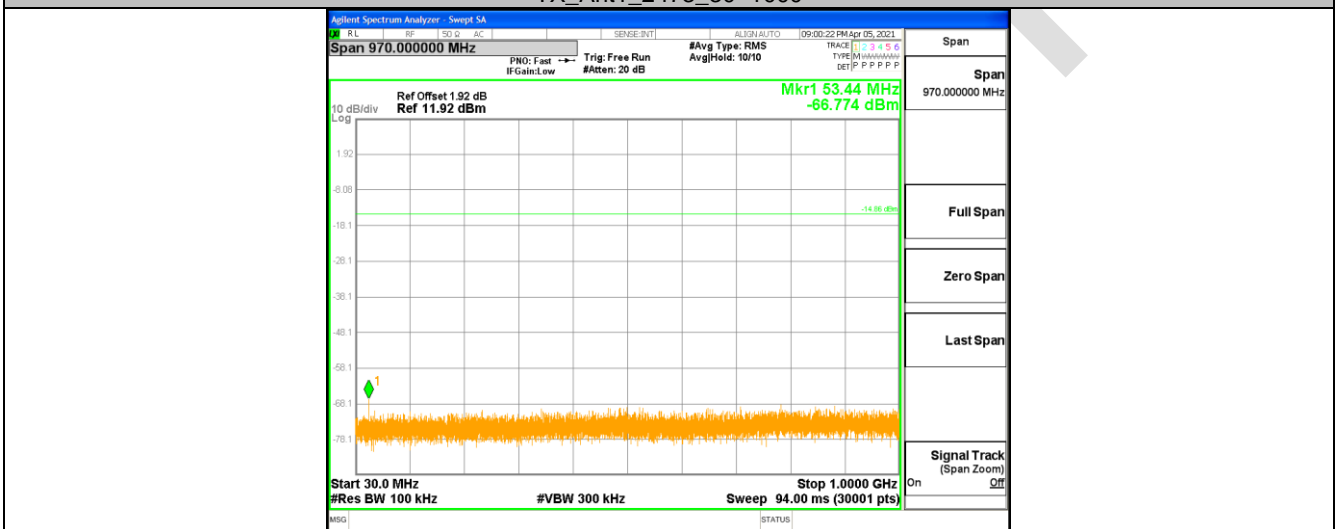
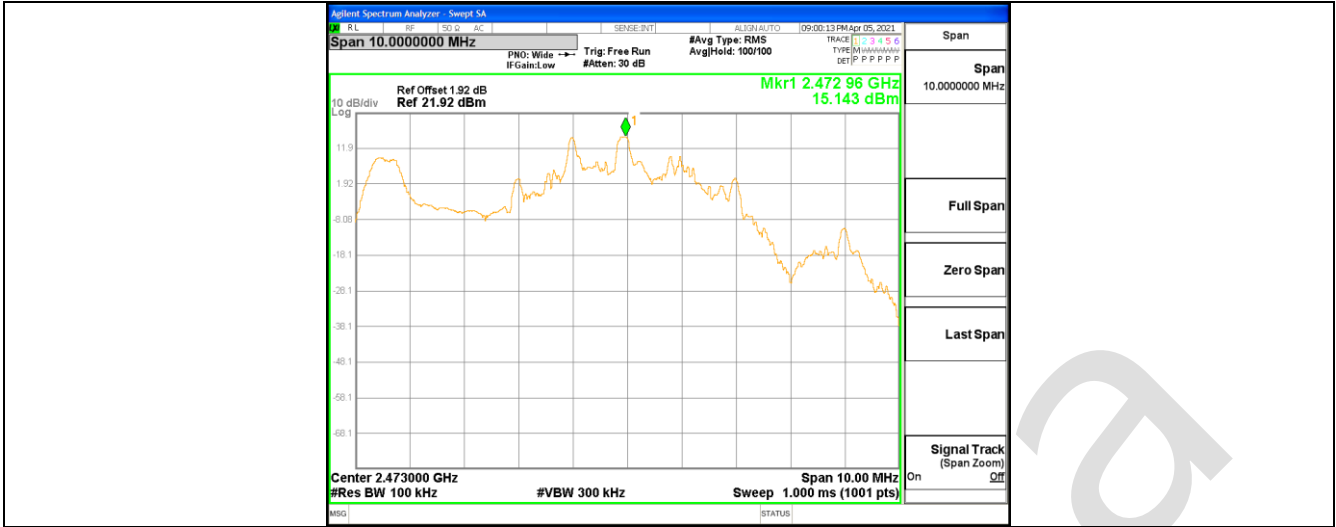
TX\_Ant1\_2441.5\_30~1000



TX\_Ant1\_2441.5\_1000~26500

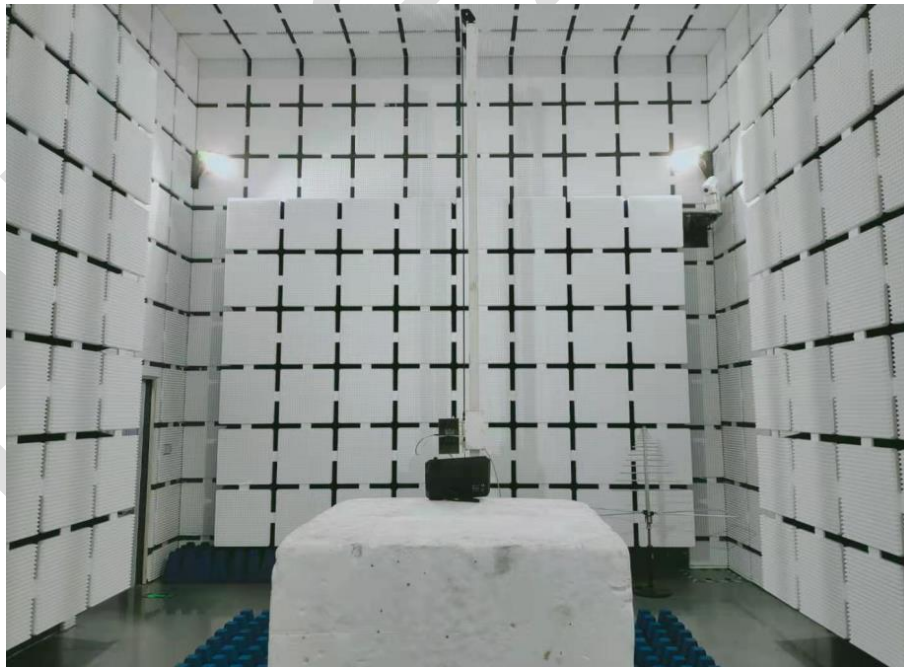
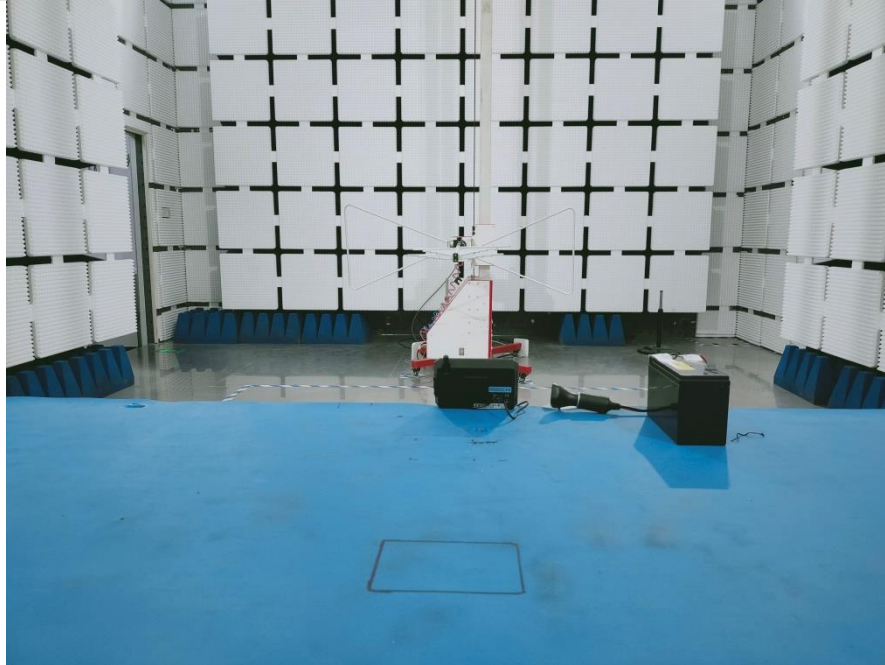


TX\_Ant1\_2473\_0~Reference



## APPENDIX A: PHOTOGRAPHS OF TEST SETUP

### Radiated Spurious Emissions



## APPENDIX B: PHOTOGRAPHS OF EUT

Reference to the test report No. BLA-EMC-202102-A1201

**---END OF REPORT---**

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