

TEST REPORT

Product : BeaglePlay
Trade mark : Beagleboard.org
Model/Type reference : BeaglePlay
Serial Number : N/A
Report Number : EED32P80002502
FCC ID : Z4T-BBP23010V1
Date of Issue : Feb. 21, 2023
Test Standards : 47 CFR Part 15 Subpart C
Test result : PASS

Prepared for:

Seed Technology Co., Ltd
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Prepared by:

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Check No.: 5404030123



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3 Version

Version No.	Date	Description
00	Feb. 21, 2023	Original

4 Test Summary

Test Item	Test Requirement	Result
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203/15.247 (c)	PASS
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	PASS
DTS Bandwidth	47 CFR Part 15 Subpart C Section 15.247 (a)(2)	PASS
Maximum Conducted Output Power	47 CFR Part 15 Subpart C Section 15.247 (b)(3)	PASS
Maximum Power Spectral Density	47 CFR Part 15 Subpart C Section 15.247 (e)	PASS
Band Edge Measurements	47 CFR Part 15 Subpart C Section 15.247(d)	PASS
Conducted Spurious Emissions	47 CFR Part 15 Subpart C Section 15.247(d)	PASS
Radiated Spurious Emission & Restricted bands	47 CFR Part 15 Subpart C Section 15.205/15.209	PASS
Remark: Company Name and Address shown on Report, the sample(s) and sample Information were provided by the applicant who should be responsible for the authenticity which CTI hasn't verified.		

5 General Information

5.1 Client Information

Applicant:	Seeed Technology Co., Ltd
Address of Applicant:	9F, Building G3, TCL International E city, Zhongshanyuan Road, Nanshan, Shenzhen, China.
Manufacturer:	Seeed Technology Co., Ltd
Address of Manufacturer:	9F, Building G3, TCL International E city, Zhongshanyuan Road, Nanshan, Shenzhen, China.
Factory:	Shenzhen Xinxian Technology Co., Limited
Address of Factory:	F5, Building B17, Hengfeng Industrial City, No. 739 Zhoushi Rd, Baoan District, Shenzhen, Guangdong, P.R.C.

5.2 General Description of EUT

Product Name:	BeaglePlay
Model No.:	BeaglePlay
Trade mark:	Beagleboard.org
Product Type:	Portable
Operation Frequency:	902MHz~928MHz
Modulation Type:	LORA Chirp Spread Spectrum
Transfer Bandwidth:	☒ 750kHz
Number of Channel:	10
Antenna Type:	PCB Antenna
Antenna Gain:	1.81dBi
Power Supply:	DC 5V
Test Voltage:	DC 5V
Sample Received Date:	Jan. 03, 2023
Sample tested Date:	Jan. 03, 2023 to Feb. 16, 2023

Channel	Frequency
1	906MHz
2	908MHz
3	910MHz
4	912MHz
5	914MHz
6	916MHz
7	918MHz
8	920MHz
9	922MHz
10	924MHz

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)	906MHz
The middle channel (CH5)	914MHz
The highest channel (CH10)	924MHz

5.3 Test Configuration

EUT Test Software Settings:				
Software:		Setup_SmartRF_Studio_7		
EUT Power Grade:		Power level is built-in set parameters and cannot be changed and selected		
Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.				
Test Mode	Modulation	Bandwidth	Channel	Frequency(MHz)
Mode a	LORA	750kHz	CH1	906
Mode b	LORA	750kHz	CH5	914
Mode c	LORA	750kHz	CH10	924

5.4 Test Environment

Operating Environment:	
Radiated Spurious Emissions:	
Temperature:	22~25.0 °C
Humidity:	50~55 % RH
Atmospheric Pressure:	1010mbar
Conducted Emissions:	
Temperature:	22~25.0 °C
Humidity:	50~55 % RH
Atmospheric Pressure:	1010mbar
RF Conducted:	
Temperature:	22~25.0 °C
Humidity:	50~55 % RH
Atmospheric Pressure:	1010mbar

5.5 Description of Support Units

The EUT has been tested with associated equipment below.
support equipment

Description	Manufacturer	Model No.	Certification	Supplied by
Netbook	DELL	Latitude 3490	FCC&CE	CTI

5.6 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd

Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China

Telephone: +86 (0) 755 33683668 Fax: +86 (0) 755 33683385

No tests were sub-contracted.

FCC Designation No.: CN1164

5.7 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-40GHz)
3	Radiated Spurious emission test	3.3dB (9kHz-30MHz)
		4.3dB (30MHz-1GHz)
		4.5dB (1GHz-18GHz)
		3.4dB (18GHz-40GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

6 Equipment List

RF test system					
Equipment	Manufacturer	Mode No.	Serial Number	Cal. Date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Communication test set	R&S	CMW500	107929	07-06-2022	07-05-2023
Signal Generator	R&S	SMBV100A	1407.6004K02- 262149-CV	09-09-2022	09-08-2023
Spectrum Analyzer	R&S	FSV40	101200	08-01-2022	07-31-2023
RF control unit(power unit)	MWRF-test	MW100-RFCB	MW220620CTI-42	07-06-2022	07-05-2023
high-low temperature test chamber	Dong Guang Qin Zhuo	LK-80GA	QZ20150611879	12-19-2022	12-18-2023
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	06-16-2022	06-15-2023
BT&WI-FI Automatic test software	MWRF-test	MTS 8310	2.0.0.0	---	---

Conducted disturbance Test					
Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Receiver	R&S	ESCI	100435	05-04-2022	05-05-2023
Temperature/ Humidity Indicator	Defu	TH128	/	---	---
LISN	R&S	ENV216	100098	03-01-2022	02-28-2023
Barometer	changchun	DYM3	1188	---	---

3M Semi-anechoic Chamber (2)- Radiated disturbance Test					
Equipment	Manufacturer	Model	Serial No.	Cal. Date	Due Date
3M Chamber & Accessory Equipment	TDK	SAC-3	---	05/22/2022	05/21/2025
Receiver	R&S	ESC17	100938-003	09/28/2022	09/27/2023
TRILOG Broadband Antenna	schwarzbeck	VULB 9163	9163-618	05/22/2022	05/21/2023
Multi device Controller	matur	NCD/070/10711112	---	---	---
Horn Antenna	ETS-LINGREN	BBHA 9120D	9120D-1869	04/15/2021	04/14/2024
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04/17/2021	04/16/2024
Microwave Preamplifier	Agilent	8449B	3008A02425	06/20/2022	06/19/2023

3M full-anechoic Chamber					
Equipment	Manufacturer	Model No.	Serial Number	Cal. Date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
RSE Automatic test software	JS Tonscend	JS36-RSE	10166	---	---
Receiver	Keysight	N9038A	MY57290136	03-01-2022	02-28-2023
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-01-2022	02-28-2023
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-01-2022	02-28-2023
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-1148	04-28-2021	04-27-2024
Horn Antenna	Schwarzbeck	BBHA 9170	9170-832	04-15-2021	04-14-2024
Horn Antenna	ETS-LINDGREN	3117	57407	07-04-2021	07-03-2024
Preamplifier	EMCI	EMC184055SE	980597	04-20-2022	04-19-2023
Preamplifier	EMCI	EMC001330	980563	04-13-2022	04-12-2023
Preamplifier	JS Tonscend	TAP-011858	AP21B806112	07-29-2022	07-28-2023
Communication test set	R&S	CMW500	102898	12-23-2022	12-22-2023
Temperature/Humidity Indicator	biaozhi	GM1360	EE1186631	02-21-2022	02-20-2023
Fully Anechoic Chamber	TDK	FAC-3	---	01-09-2021	01-08-2024
Cable line	Times	SFT205-NMSM-2.50M	394812-0001	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0002	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0003	---	---
Cable line	Times	SFT205-NMSM-2.50M	393495-0001	---	---
Cable line	Times	EMC104-NMNM-1000	SN160710	---	---
Cable line	Times	SFT205-NMSM-3.00M	394813-0001	---	---
Cable line	Times	SFT205-NMNM-1.50M	381964-0001	---	---
Cable line	Times	SFT205-NMSM-7.00M	394815-0001	---	---
Cable line	Times	HF160-KMKM-3.00M	393493-0001	---	---

7 Test results and Measurement Data

7.1 Antenna Requirement

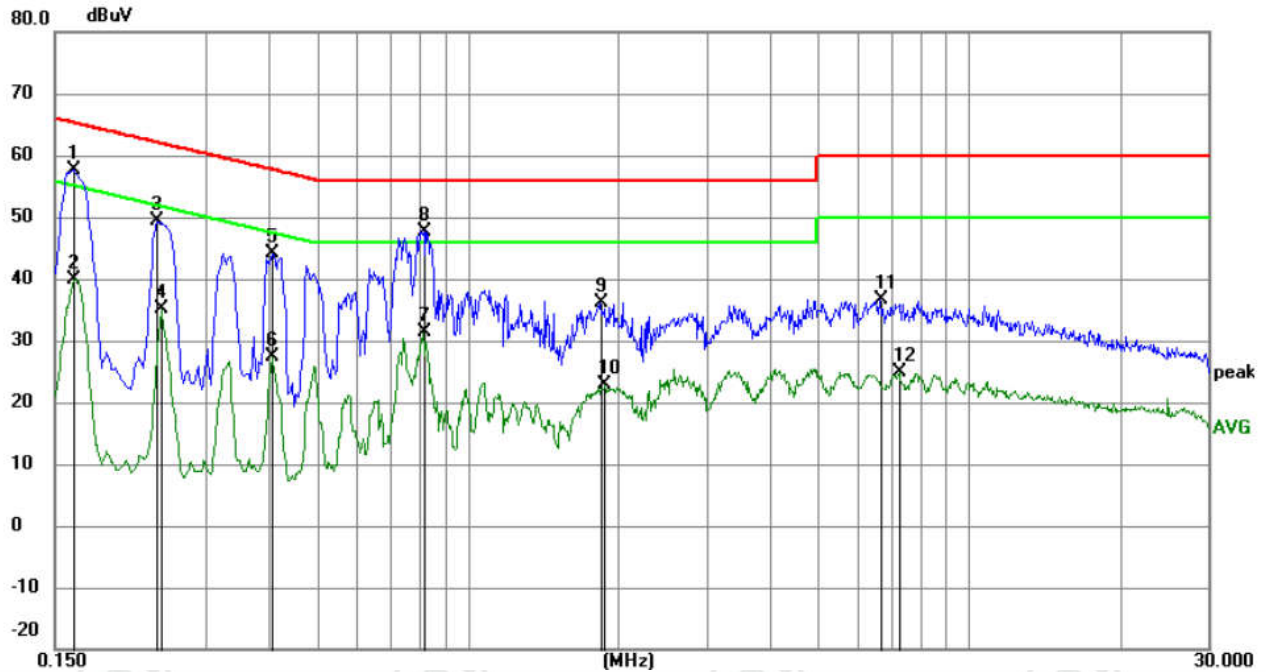
Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, 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. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	Please see Internal photos
The antenna is PCB Antenna. The best case gain of the antenna is 1.81dBi.	

7.2 Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207																
Test Method:	ANSI C63.10: 2013																
Test Frequency Range:	150kHz to 30MHz																
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto																
Limit:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table> * Decreases with the logarithm of the frequency.			Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)																
	Quasi-peak	Average															
0.15-0.5	66 to 56*	56 to 46*															
0.5-5	56	46															
5-30	60	50															
Test Setup:																	

Measurement Data

Live line:

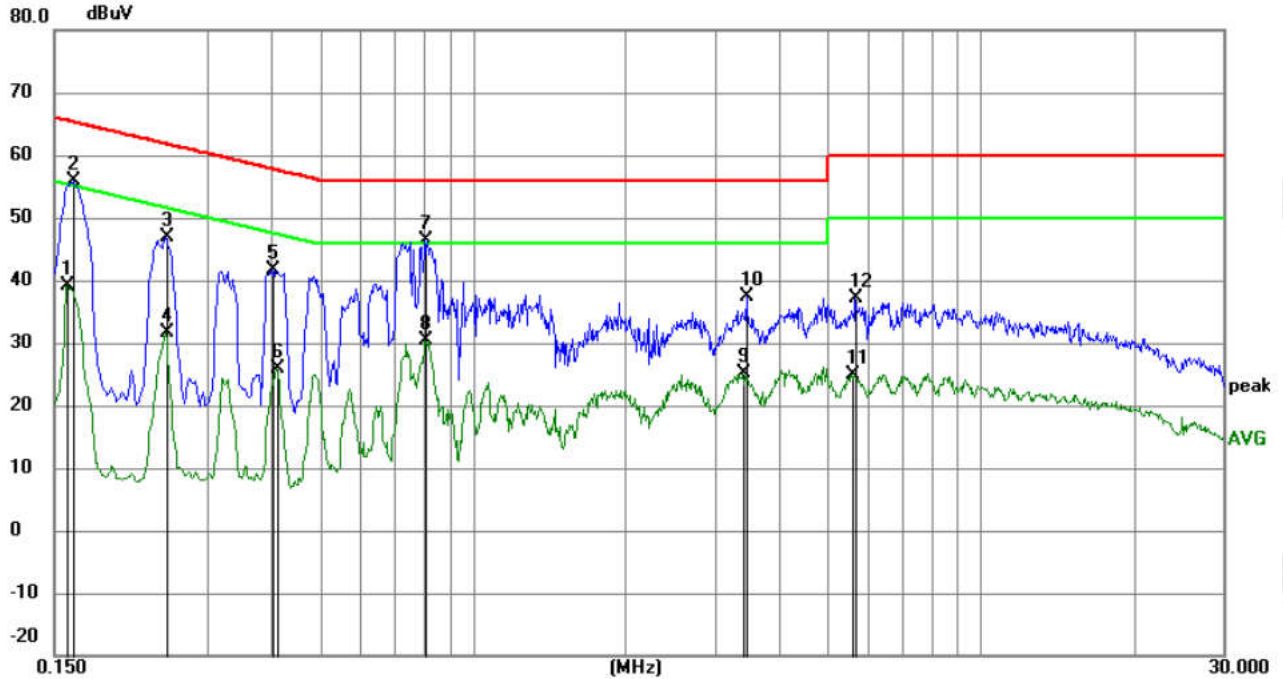


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	*	0.1635	47.75	9.87	57.62	65.28	-7.66	QP	
2		0.1635	30.04	9.87	39.91	55.28	-15.37	AVG	
3		0.2400	39.38	9.95	49.33	62.10	-12.77	QP	
4		0.2445	25.21	9.96	35.17	51.94	-16.77	AVG	
5		0.4065	34.25	9.97	44.22	57.72	-13.50	QP	
6		0.4065	17.44	9.97	27.41	47.72	-20.31	AVG	
7		0.8158	21.45	9.85	31.30	46.00	-14.70	AVG	
8		0.8204	37.82	9.85	47.67	56.00	-8.33	QP	
9		1.8419	26.34	9.80	36.14	56.00	-19.86	QP	
10		1.8779	12.98	9.79	22.77	46.00	-23.23	AVG	
11		6.6615	26.91	9.79	36.70	60.00	-23.30	QP	
12		7.2600	14.99	9.79	24.78	50.00	-25.22	AVG	

Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.
3. If the Peak value under Average limit, the Average value is not recorded in the report.

Neutral line:

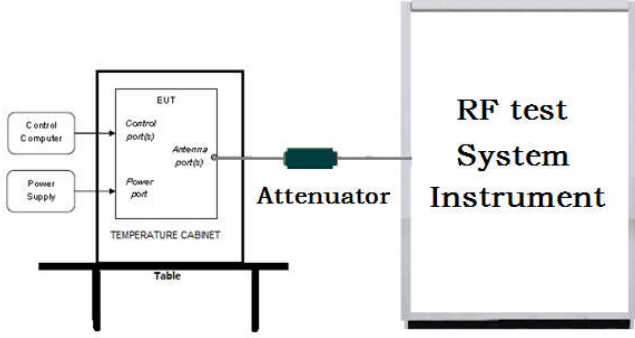


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1590	29.32	9.87	39.19	55.52	-16.33	AVG	
2	*	0.1635	45.91	9.87	55.78	65.28	-9.50	QP	
3		0.2490	36.96	9.97	46.93	61.79	-14.86	QP	
4		0.2490	21.65	9.97	31.62	51.79	-20.17	AVG	
5		0.4020	31.70	9.97	41.67	57.81	-16.14	QP	
6		0.4110	16.03	9.97	26.00	47.63	-21.63	AVG	
7		0.8069	36.59	9.85	46.44	56.00	-9.56	QP	
8		0.8069	20.54	9.85	30.39	46.00	-15.61	AVG	
9		3.4035	15.38	9.79	25.17	46.00	-20.83	AVG	
10		3.4665	27.49	9.78	37.27	56.00	-18.73	QP	
11		5.5860	15.16	9.78	24.94	50.00	-25.06	AVG	
12		5.6760	27.36	9.78	37.14	60.00	-22.86	QP	

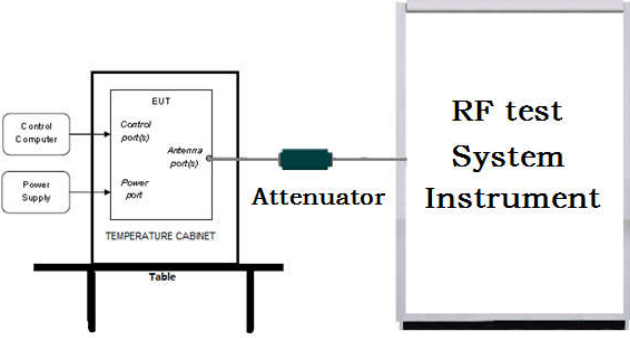
Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.
3. If the Peak value under Average limit, the Average value is not recorded in the report.

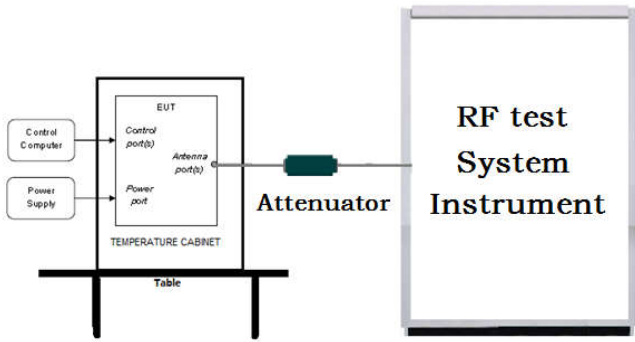
7.3 Maximum Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10 2013
Test Setup:	 Remark: Offset=Cable loss+ attenuation factor.
Test Procedure:	- Set the RBW $\geq$ DTS bandwidth. - Set VBW $\geq 3 \times$ RBW. - Set span $\geq 3 \times$ RBW - Sweep time = auto couple. - Detector = peak. - Trace mode = max hold. - Allow trace to fully stabilize. - Use peak marker function to determine the peak amplitude level. - Set the RBW $\geq$ DTS bandwidth. - Set VBW $\geq 3 \times$ RBW. - Set span $\geq 3 \times$ RBW - Sweep time = auto couple. - Detector = RMS. - Trace mode = max hold. - Allow trace to fully stabilize. - Use peak marker function to determine the peak amplitude level.
Limit:	30dBm
Test Mode:	Refer to clause 5.3
Test Results:	Refer to Appendix LORA DTS

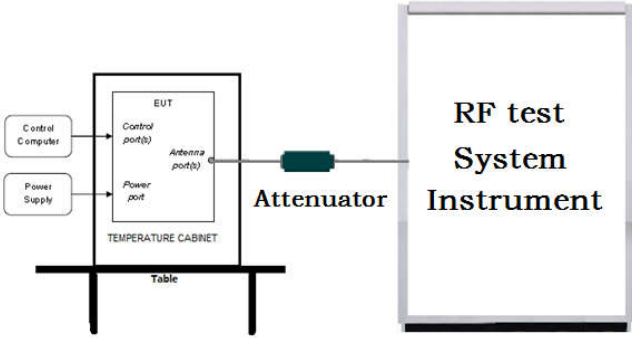
7.4 DTS Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10 2013
Test Setup:	 Remark: Offset=Cable loss+ attenuation factor.
Test Procedure:	a) Set RBW = 100 kHz. b) Set the VBW $\geq [3 \times \text{RBW}]$. c) Detector = peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
Limit:	$\geq 500 \text{ kHz}$
Test Mode:	Refer to clause 5.3
Test Results:	Refer to Appendix LORA DTS

7.5 Maximum Power Spectral Density

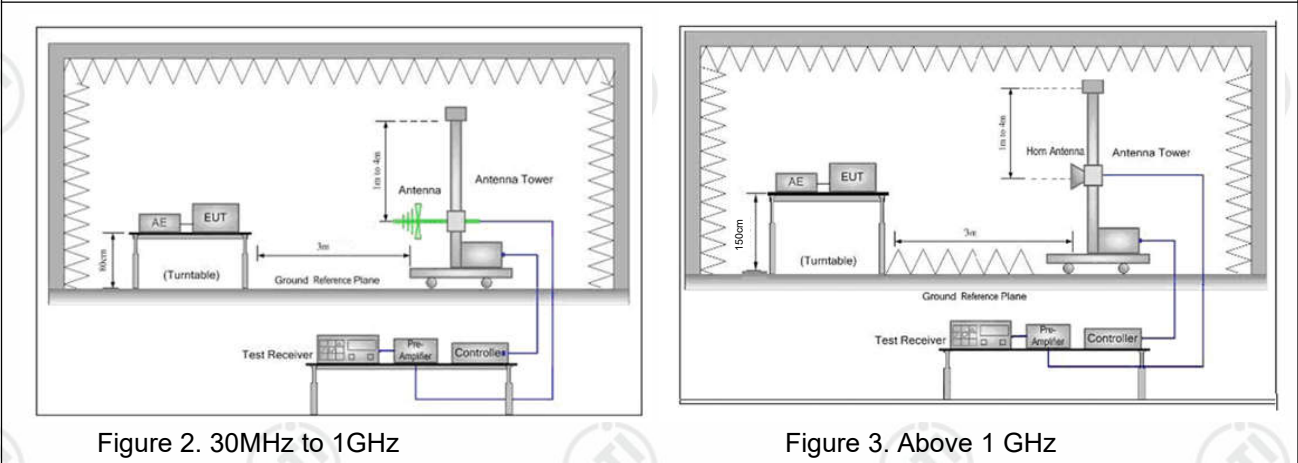
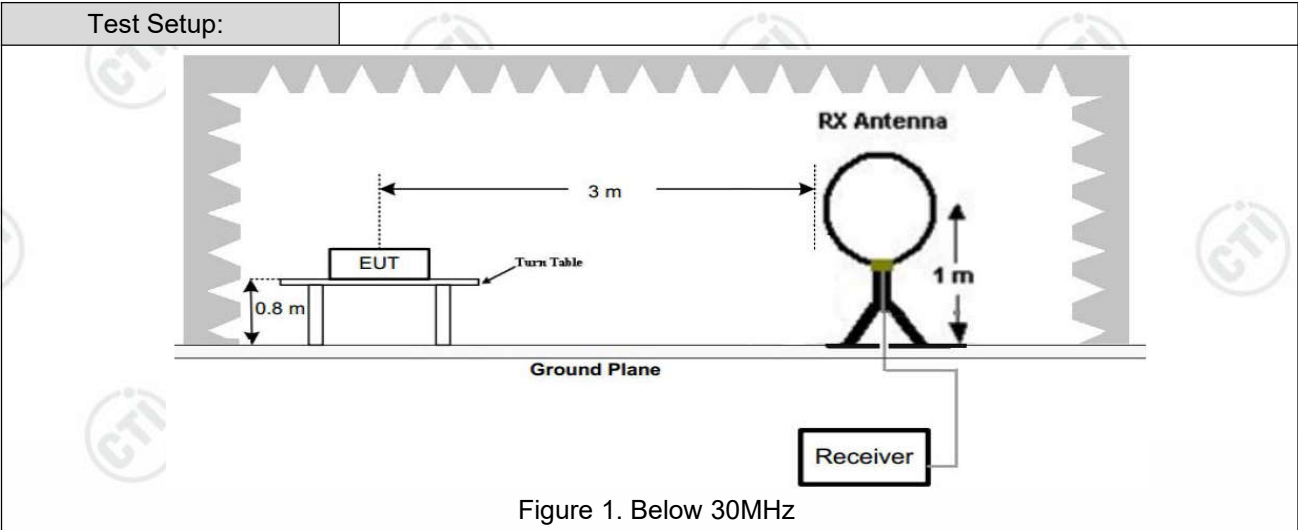
Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 2013
Test Setup:	 Remark: Offset=Cable loss+ attenuation factor.
Test Procedure:	a) Set analyzer center frequency to DTS channel center frequency. b) Set the span to 1.5 times the DTS bandwidth. c) Set the RBW to $3 \text{ kHz} < \text{RBW} < 100 \text{ kHz}$. d) Set the VBW $> [3 \times \text{RBW}]$. e) Detector = RMS. f) Sweep time = auto couple. g) Trace mode = average. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum amplitude level within the RBW. j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.
Limit:	$\leq 8.00 \text{ dBm}/3 \text{ kHz}$
Test Mode:	Refer to clause 5.3
Test Results:	Refer to Appendix LORA DTS

7.6 Band Edge measurements and Conducted Spurious Emission

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10 2013
Test Setup:	 Remark: Offset=Cable loss+ attenuation factor.
Test Procedure:	a) Set RBW =100KHz. b) Set VBW = 300KHz. c) Sweep time = auto couple. d) Detector = RMS. e) Trace mode = max hold. f) Allow trace to fully stabilize. g) Use peak marker function to determine the peak amplitude level.
Limit:	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.
Test Mode:	Refer to clause 5.3
Test Results:	Refer to Appendix LORA DTS

7.7 Radiated Spurious Emission & Restricted bands

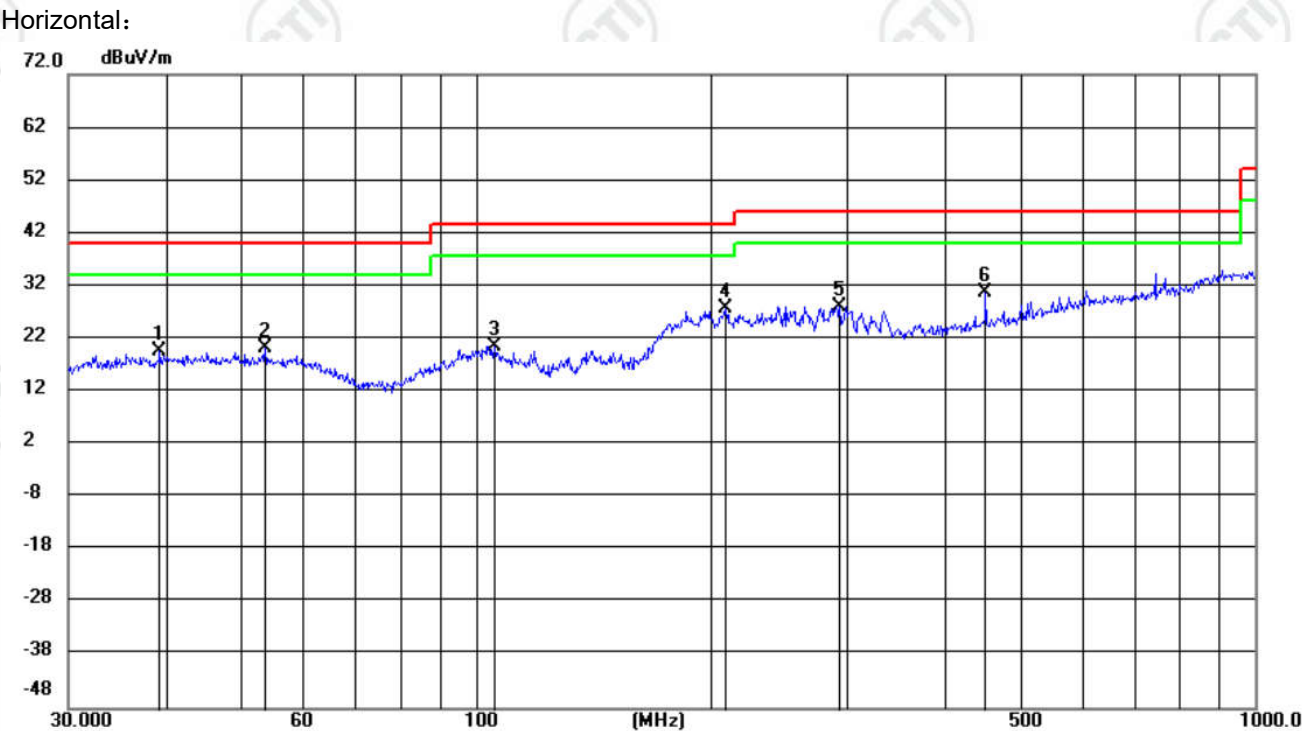
Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 2013				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10kHz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					



Test Procedure:	a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. Note: For the radiated emission test above 1GHz: Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. c. 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. d. 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. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. 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. g. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the highest channel (2480MHz) h. 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. i. Repeat above procedures until all frequencies measured was complete.
Test Mode:	Refer to clause 5.3
Test Results:	Pass

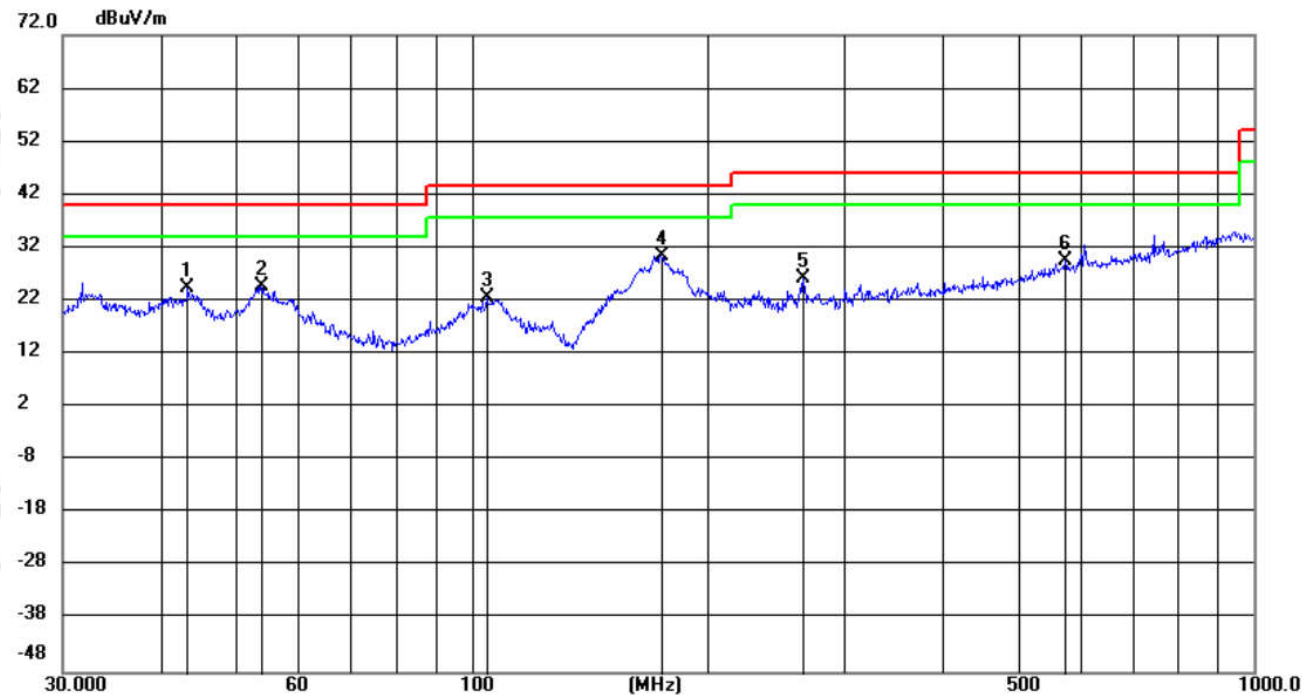
Radiated Spurious Emission below 1GHz:

For Lora Single transmission:
During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes, only the worst case lowest channel was recorded in the report.



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Antenna	Table	
		MHz	Level	Factor	ment			Height	Degree	
			dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		39.2991	5.34	14.41	19.75	40.00	-20.25	QP	200	4
2		53.6931	6.23	14.01	20.24	40.00	-19.76	QP	200	4
3		105.6415	7.37	13.24	20.61	43.50	-22.89	QP	200	166
4		209.3129	13.58	14.10	27.68	43.50	-15.82	QP	100	356
5		293.0842	11.12	17.01	28.13	46.00	-17.87	QP	100	142
6	*	451.1350	10.30	20.49	30.79	46.00	-15.21	QP	100	356

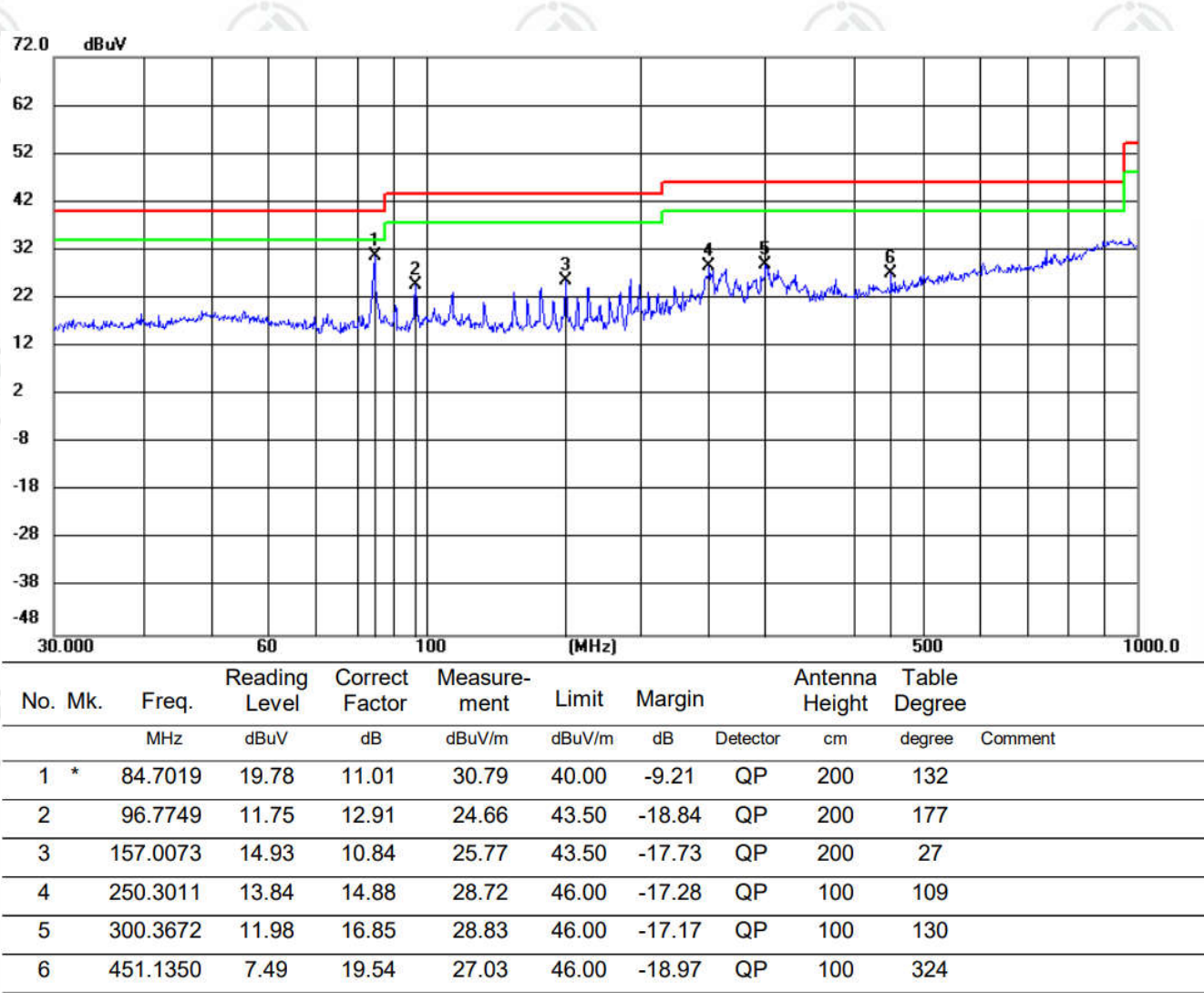
Vertical:



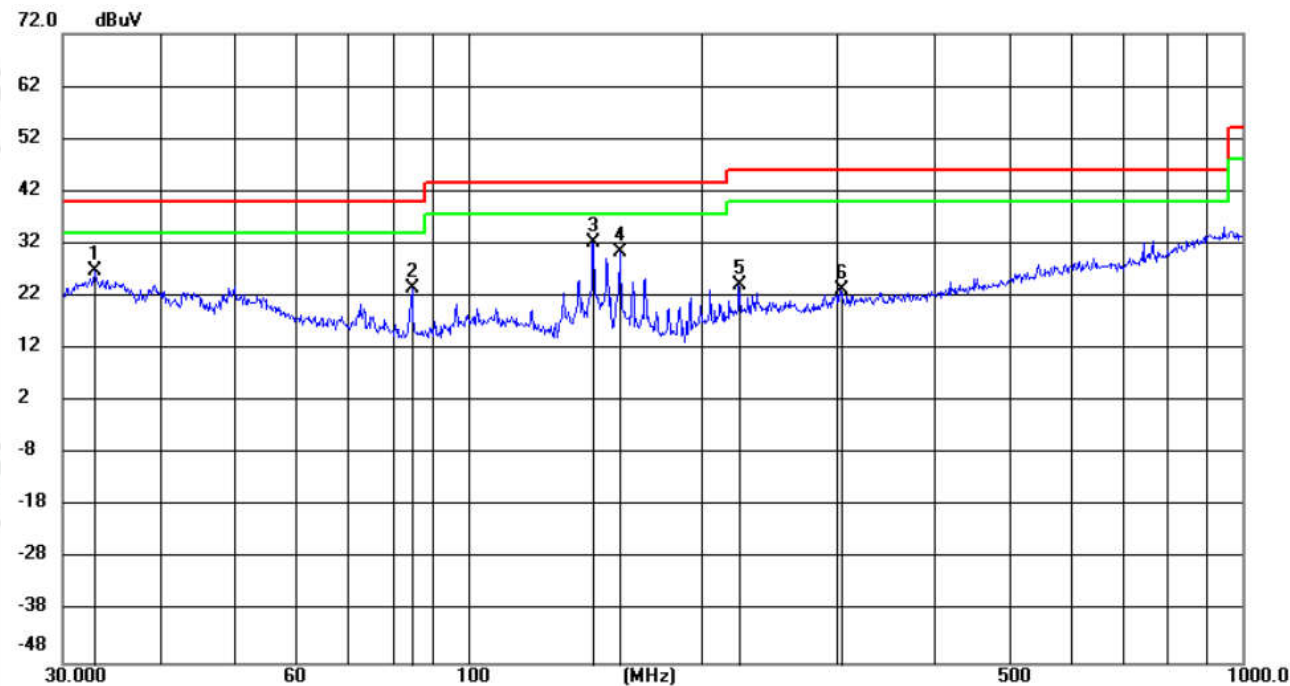
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		43.3534	9.94	14.45	24.39	40.00	-15.61	QP	100	175
2		53.6932	10.65	14.01	24.66	40.00	-15.34	QP	100	277
3		104.5361	9.20	13.40	22.60	43.50	-20.90	QP	100	4
4	*	174.4241	19.24	11.28	30.52	43.50	-12.98	QP	100	319
5		265.6757	10.17	16.06	26.23	46.00	-19.77	QP	200	278
6		574.6258	6.14	23.40	29.54	46.00	-16.46	QP	200	308

For Lora + Wi-Fi simultaneous transmission:
During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes, only the worst case lowest channel of LoRa and lowest channel of 2.4GHz 802.11n MIMO simultaneous transmission was recorded in the report.

Horizontal:



Vertical:



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Antenna	Table	
		MHz	Level	Factor	ment			Height	Degree	
			dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		32.9791	13.97	12.83	26.80	40.00	-13.20	QP	100	198
2		84.7019	12.46	11.01	23.47	40.00	-16.53	QP	200	215
3	*	144.8418	21.12	11.10	32.22	43.50	-11.28	QP	100	134
4		157.0074	19.68	10.84	30.52	43.50	-12.98	QP	100	187
5		223.7334	10.31	13.82	24.13	46.00	-21.87	QP	200	139
6		302.4812	6.26	16.89	23.15	46.00	-22.85	QP	100	48

Radiated Spurious Emission above 1GHz:

For Lora Single transmission:

Mode:		LORA Transmitting				Test_Frequency:		906 MHz	
NO	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1812.4542	-24.63	77.46	52.83	74.00	21.17	Pass	H	PK
2	2718.5146	-22.19	74.17	51.98	74.00	22.02	Pass	H	PK
3	3624.575	-20.49	73.78	53.29	74.00	20.71	Pass	H	PK
4	5769.718	-13.45	55.60	42.15	74.00	31.85	Pass	H	PK
5	6340.356	-13.03	57.81	44.78	74.00	29.22	Pass	H	PK
6	9158.7439	-8.06	53.28	45.22	74.00	28.78	Pass	H	PK
7	1811.8541	-24.63	77.31	52.68	74.00	21.32	Pass	V	PK
8	2718.5146	-22.19	76.78	54.59	74.00	19.41	Pass	V	PK
9	3623.3749	-20.50	72.82	52.32	74.00	21.68	Pass	V	PK
10	6340.9561	-13.02	62.15	49.13	74.00	24.87	Pass	V	PK
11	7249.4166	-11.84	57.98	46.14	74.00	27.86	Pass	V	PK
12	9057.9372	-8.48	56.51	48.03	74.00	25.97	Pass	V	PK
13	2719.1146	-22.19	72.44	50.25	54.00	3.75	Pass	V	AV

Mode:		LORA Transmitting				Test_Frequency:		914 MHz	
NO	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1828.6552	-24.55	77.96	53.41	74.00	20.59	Pass	H	PK
2	2742.5162	-22.09	73.97	51.88	74.00	22.12	Pass	H	PK
3	3656.9771	-20.34	74.05	53.71	74.00	20.29	Pass	H	PK
4	4908.0605	-16.24	55.12	38.88	74.00	35.12	Pass	H	PK
5	6399.76	-12.89	56.71	43.82	74.00	30.18	Pass	H	PK
6	7769.0513	-11.35	54.01	42.66	74.00	31.34	Pass	H	PK
7	1010.2007	-25.38	66.42	41.04	74.00	32.96	Pass	V	PK
8	1827.4552	-24.55	77.57	53.02	74.00	20.98	Pass	V	PK
9	2741.3161	-22.10	78.12	56.02	74.00	17.98	Pass	V	PK
10	3655.177	-20.36	72.79	52.43	74.00	21.57	Pass	V	PK
11	6399.1599	-12.89	63.29	50.40	74.00	23.60	Pass	V	PK
12	9141.9428	-8.23	56.97	48.74	74.00	25.26	Pass	V	PK
13	2743.1162	-22.09	72.45	50.36	54.00	3.64	Pass	V	AV

Mode:		LORA Transmitting				Test_Frequency:		924 MHz	
NO	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1396.0264	-26.80	59.45	32.65	74.00	41.35	Pass	H	PK
2	1848.4566	-24.45	77.23	52.78	74.00	21.22	Pass	H	PK
3	2772.5182	-21.97	76.58	54.61	74.00	19.39	Pass	H	PK
4	3695.3797	-20.18	71.31	51.13	74.00	22.87	Pass	H	PK
5	6469.3646	-12.86	57.29	44.43	74.00	29.57	Pass	H	PK
6	7689.246	-10.96	54.17	43.21	74.00	30.79	Pass	H	PK
7	2773.1182	-21.97	71.17	49.20	54.00	4.80	Pass	H	AV
8	1848.4566	-24.45	78.08	53.63	74.00	20.37	Pass	V	PK
9	2772.5182	-21.97	79.91	57.94	74.00	16.06	Pass	V	PK
10	3696.5798	-20.17	70.90	50.73	74.00	23.27	Pass	V	PK
11	4621.2414	-16.75	58.80	42.05	74.00	31.95	Pass	V	PK
12	6466.3644	-12.86	63.64	50.78	74.00	23.22	Pass	V	PK
13	7755.2504	-11.26	54.73	43.47	74.00	30.53	Pass	V	PK
14	2771.9181	-21.97	72.18	50.21	54.00	3.79	Pass	V	AV

For Lora + Wi-Fi simultaneous transmission:

During the test, the Radiates Emission from above 1GHz was performed in all modes, only the worst case lowest channel of LoRa and lowest channel of 2.4GHz 802.11n MiMO simultaneous transmission was recorded in the report.

Mode:		LORA + 802.11n mimo				Test_Frequency:		906 MHz+2412 MHz	
NO	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1811.6812	3.37	63.59	66.96	74.00	7.04	Pass	H	PK
2	2718.5719	5.46	52.53	57.99	74.00	16.01	Pass	H	PK
3	3625.0417	-20.26	66.87	46.61	74.00	27.39	Pass	H	PK
4	4824.1216	-16.22	71.65	55.43	74.00	18.57	Pass	H	PK
5	7440.296	-11.34	50.86	39.52	74.00	34.48	Pass	H	PK
6	11148.5432	-6.31	49.33	43.02	74.00	30.98	Pass	H	PK
7	1812.2812	3.37	44.78	48.15	54.00	5.85	Pass	H	AV
8	2717.7718	5.46	43.23	48.69	54.00	5.31	Pass	H	AV
9	4825.1217	-16.22	64.33	48.11	54.00	5.89	Pass	H	AV
10	1811.6812	3.37	58.22	61.59	74.00	12.41	Pass	V	PK
11	3625.0417	-20.26	63.08	42.82	74.00	31.18	Pass	V	PK
12	4824.1216	-16.22	69.32	53.10	74.00	20.90	Pass	V	PK
13	7406.2938	-11.48	50.45	38.97	74.00	35.03	Pass	V	PK
14	11444.563	-6.17	49.84	43.67	74.00	30.33	Pass	V	PK
15	13752.7168	-1.70	47.71	46.01	74.00	27.99	Pass	V	PK
16	1812.2812	3.37	45.89	49.26	54.00	4.74	Pass	V	AV

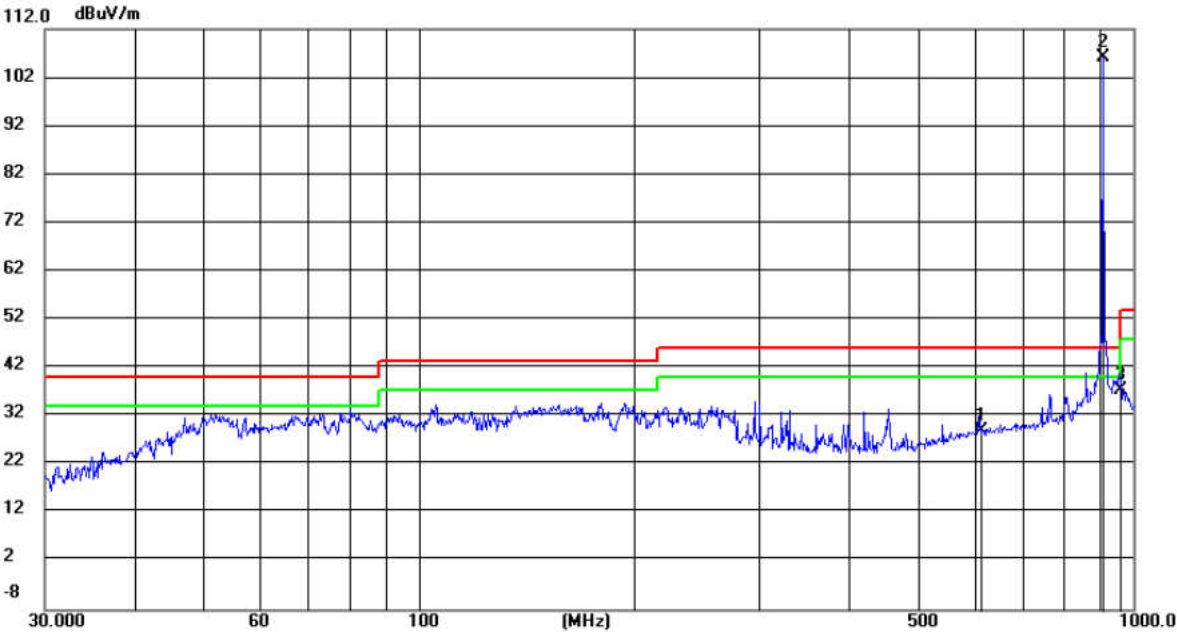
Remark:

- 1) 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
- 2) Scan from 9kHz to 25GHz, the disturbance above 10GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

Restricted bands:

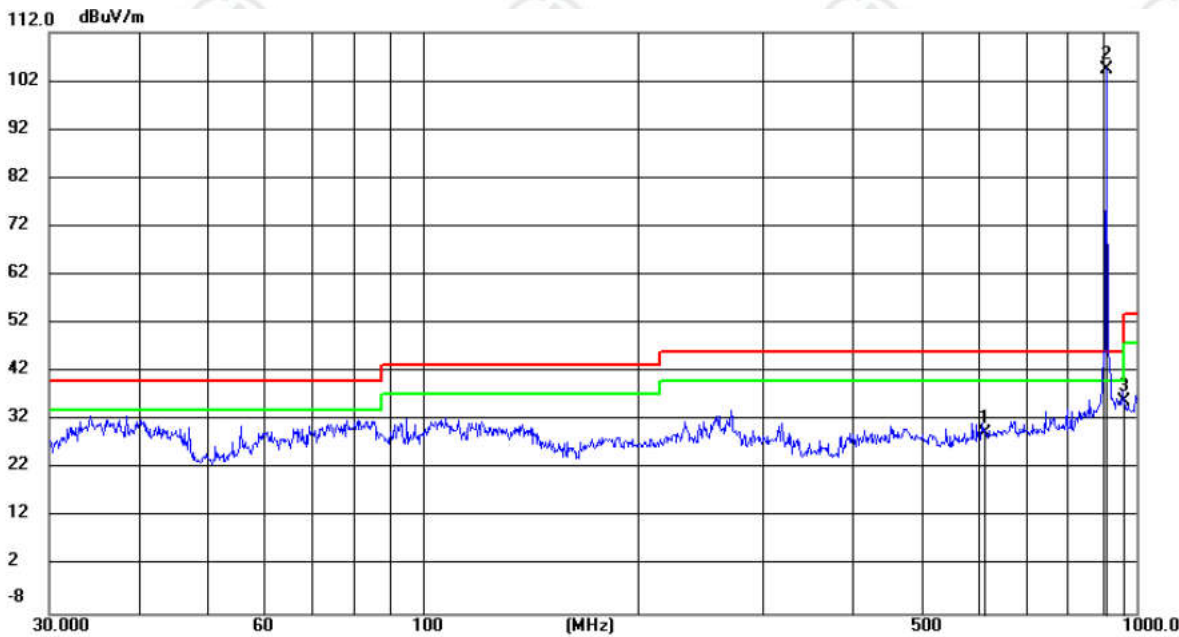
Test plot as follows:

Mode:	LoRa	Test_Frequency:	906MHz
Polarity:	Horizontal		



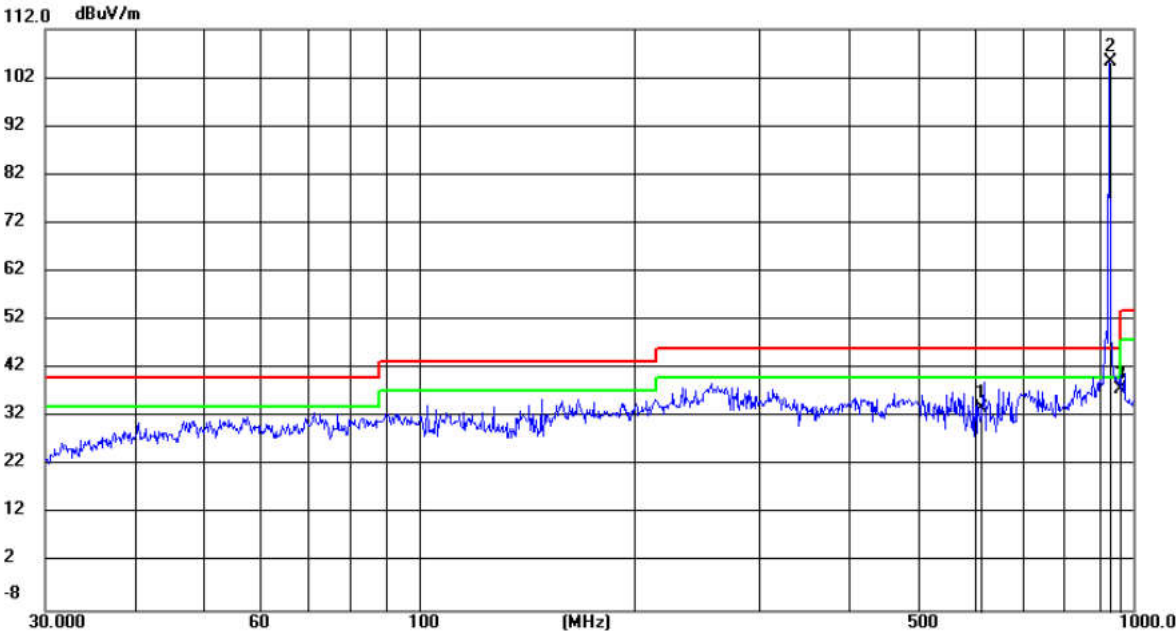
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		614.0000	4.92	24.13	29.05	46.00	-16.95	peak	100	330
2	*	906.4824	77.82	28.46	106.28	46.00	60.28	peak	200	356
3		960.0000	8.67	28.71	37.38	46.00	-8.62	peak	100	40

Mode:	LoRa	Test_Frequency:	906MHz
Polarity:	Vertical		



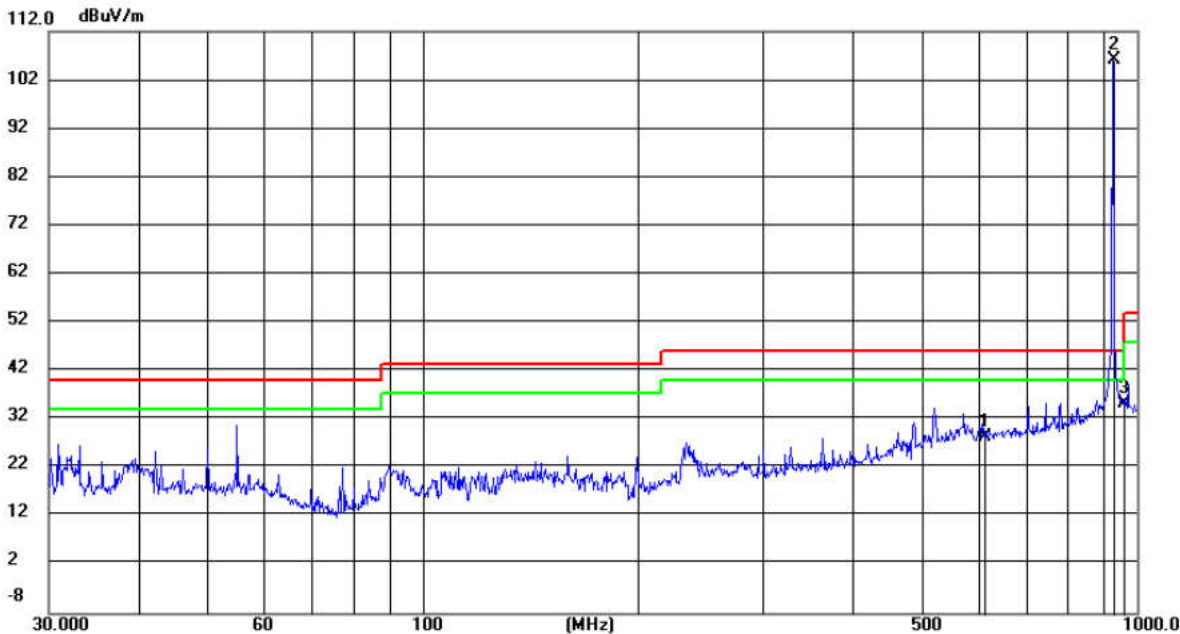
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		614.0000	5.16	24.13	29.29	46.00	-16.71	peak	100	356
2	*	906.4824	76.04	28.46	104.50	46.00	58.50	peak	200	10
3		960.0000	7.31	28.71	36.02	46.00	-9.98	peak	100	4

Mode:	LoRa	Test_Frequency:	924MHz
Polarity:	Horizontal		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		614.0000	9.68	24.13	33.81	46.00	-12.19	peak	100	4
2	*	925.7563	76.68	28.54	105.22	46.00	59.22	peak	200	356
3		960.0000	8.95	28.71	37.66	46.00	-8.34	peak	100	354

Mode:	LoRa	Test_Frequency:	924MHz
Polarity:	Vertical		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		614.0000	4.25	24.13	28.38	46.00	-17.62	peak	100	340
2	*	925.7563	77.63	28.54	106.17	46.00	60.17	peak	200	319
3		960.0000	6.69	28.71	35.40	46.00	-10.60	peak	100	268

Note:
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 -Correct Factor
Correct Factor = Preamplifier Factor- Antenna Factor-Cable Factor

8 Appendix LORA DTS

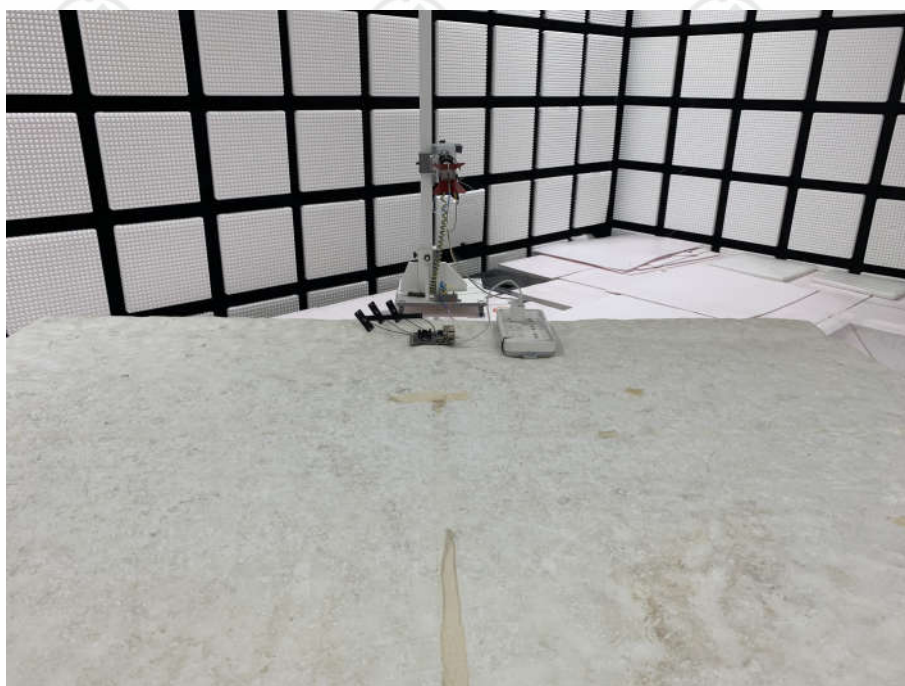
Refer to Appendix: LORA DTS of EED32P80002502.

9 PHOTOGRAPHS OF TEST SETUP

Test model No.: BeaglePlay



Radiated spurious emission Test Setup-1(Below 1GHz)



Radiated spurious emission Test Setup-2(Above 1GHz)



Radiated spurious emission Test Setup-3(Above 1GHz)
There are absorbing materials under the ground.



Conducted Emissions Test Setup

10 PHOTOGRAPHS OF EUT Constructional Details

Refer to Report No. EED32P80002501 for EUT external and internal photos.

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CTI, this report can't be reproduced except in full.

*** End of Report ***