

TEST REPORT

Product Name: LR1302 LoRaWAN Gateway Module
FCC ID: 2BDNA-LR1302-ELE
Trademark: N/A
Model Number: LR1302-SPI-US915, LR1302-USB-US915
Prepared For: Shenzhen Elecrow Limited
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Sample Received Date: Oct. 31, 2023
Sample tested Date: Oct. 31, 2023 to Dec. 12, 2023
Issue Date: Dec. 12, 2023
Report No.: CTB231109035RF
Test Standards: FCC Part15.247
ANSI C63.10:2013
Test Results: PASS
Remark: This is RFID radio test report.

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Approved by:



Bin Mei / Director

Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

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(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB231109035RF	Dec. 12, 2023	Original	Valid

2. TEST SUMMARY

3. The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	Pass
Radiated Spurious emissions	47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS
Band edge and RF Conducted Spurious Emissions	47 CFR Part 15 Subpart C Section 15.247(d)/15.205(a)	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15 Subpart C Section 15.247 (b)(3)	ANSI C63.10-2013	PASS
Bandwidth	47 CFR Part 15 Subpart C Section 15.247 (a)(2)	ANSI C63.10-2013	PASS
Power Spectral Density	47 CFR Part 15 Subpart C Section 15.247 (e)	ANSI C63.10-2013/ KDB 558074 D01v05r02	PASS
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203/15.247 (b)	/	PASS

Remark:

Test according to ANSI C63.10-2013.

4.

5. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Item	Uncertainty
Occupancy bandwidth	$U=\pm 54.3\text{Hz}$
Conducted output power Above 1G	$U=\pm 1.0\text{dB}$
Conducted output power below 1G	$U=\pm 0.9\text{dB}$
Power Spectral Density , Conduction	$U=\pm 1.0\text{dB}$
Conduction spurious emissions	$U=\pm 2.8\text{dB}$
Out of band emission	$U=\pm 54\text{Hz}$
3m camber Radiated spurious emission(30MHz-1GHz)	$U=\pm 4.3\text{dB}$
3m chamber Radiated spurious emission(1GHz-18GHz)	$U=\pm 4.5\text{dB}$
humidity uncertainty	$U=\pm 5.3\%$
Temperature uncertainty	$U=\pm 0.59^{\circ}\text{C}$
Supply voltages	$U=\pm 3\%$
Time	$U=\pm 5\%$

6. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	LR1302-SPI-US915, LR1302-USB-US915
Model Description:	All the model are the same circuit and RF module, only for model name. Test sample model: LR1302-SPI-US915
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	915 MHz
Max. RF output power:	20.614dBm
Type of Modulation:	ASK
Antenna installation:	External antenna
Antenna Gain:	3.35dBi
Ratings:	DC 5V charging from adapter

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Data Cable	Power Cord
1.	Adapter	JIYIN	JY-05100C	/	/	1.

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

CH	Frequency (MHz)
1	915

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Test mode
1	915MHz

4.6 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(AC):	120
Normal Temperature(°C)	23
Low Temperature(°C)	0
High Temperature(°C)	40

7. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

Item	Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	2024.07.05
2	Power Sensor	Agilent	U2021XA	MY56120032	2024.07.05
3	Power Sensor	Agilent	U2021XA	MY56120034	2024.07.05
4	Communication test set	R&S	CMW500	108058	2024.07.05
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	2024.07.05
6	Signal Generator	Agilent	N5181A	MY50140365	2024.07.05
7	Vector signal generator	Agilent	N5182A	MY47420195	2024.07.05
8	Communication test set	Agilent	E5515C	MY50102567	2024.07.06
9	2.4 GHz Filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	2024.07.05
10	5 GHz Filter	Shenxiang	MSF5150-5850 MS-1155	20181015001	2024.07.06
11	Filter	Xingbo	XBLBQ-DZA120	190821-1-1	2024.07.06
12	BT&WI-FI Automatic test software	Microwave	MTS8000	Ver. 2.0.0.0	/
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	2024.10.30
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	2024.07.05
15	234G Automatic test software	Microwave	MTS8200	Ver. 2.0.0.0	/
16	966 chamber	C.R.T.	966	/	2024.08.11
17	Receiver	R&S	ESPI	100362	2024.07.05
18	Amplifier	HP	8447E	2945A02747	2024.07.05
19	Amplifier	Agilent	8449B	3008A01838	2024.07.05
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2024.07.08
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	2024.07.08

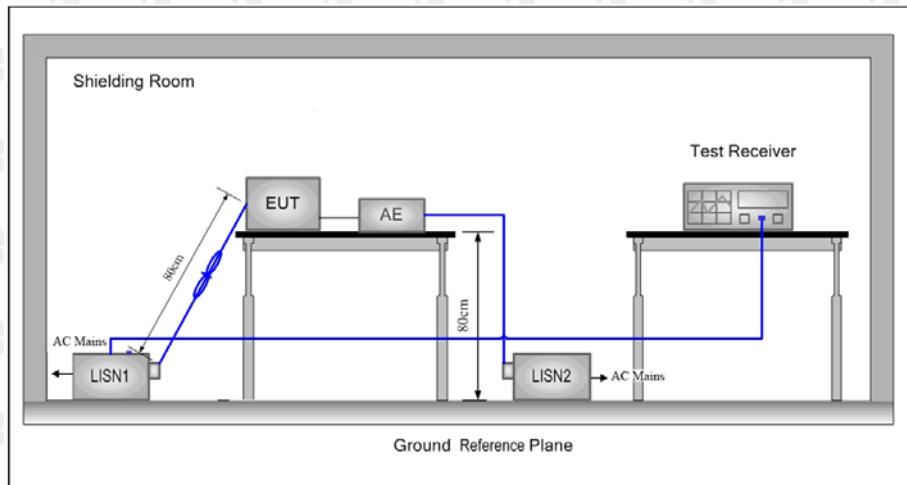
22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	/
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	2024.07.08
24	loop antenna	ZHINAN	ZN30900A	GTS534	/
25	40G Horn antenna	A/H/System	SAS-574	588	2024.10.30
26	Amplifier	AEROFLEX	Aeroflex	097	2024.07.05

Continuous disturbance					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	ROHDE&SCHWARZ	ESH3-Z5	100318	2024.07.05
2	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	2024.07.05
3	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428/003	2024.07.05
4	Coaxial cable	ZDECL	Z302S-NJ-SMA J-12M	18091905	2024.07.05
5	ISN	Schwarzbeck	NTFM8158	183	2024.07.05
6	Communication test set	Agilent	E5515C	MY50102567	2024.07.05
7	Communication test set	R&S	CMW500	108058	2024.07.05
8	EZ-EMC	Frad	EMC-con3A1.1	/	/

Radiated emission					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	01911	2024.07.08
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2024.07.08
3	Amplifier	Agilent	8449B	3008A01838	2024.07.05
4	Amplifier	HP	8447E	2945A02747	2024.07.05
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428/003	2024.07.05
6	Coaxial cable	ETS	RFC-SNS-100- NMS-80 NI	/	2024.07.05
7	Coaxial cable	ETS	RFC-SNS-100- NMS-20 NI	/	2024.07.05
8	Coaxial cable	ETS	RFC-SNS-100- SMS-20 NI	/	2024.07.05
9	Coaxial cable	ETS	RFC-NNS-100 -NMS-300 NI	/	2024.07.05
10	Communication test set	Agilent	E5515C	MY50102567	2024.07.05
11	Communication test set	R&S	CMW500	108058	2024.07.05
12	EZ-EMC	Frad	EMC-con3A1.1	/	/

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

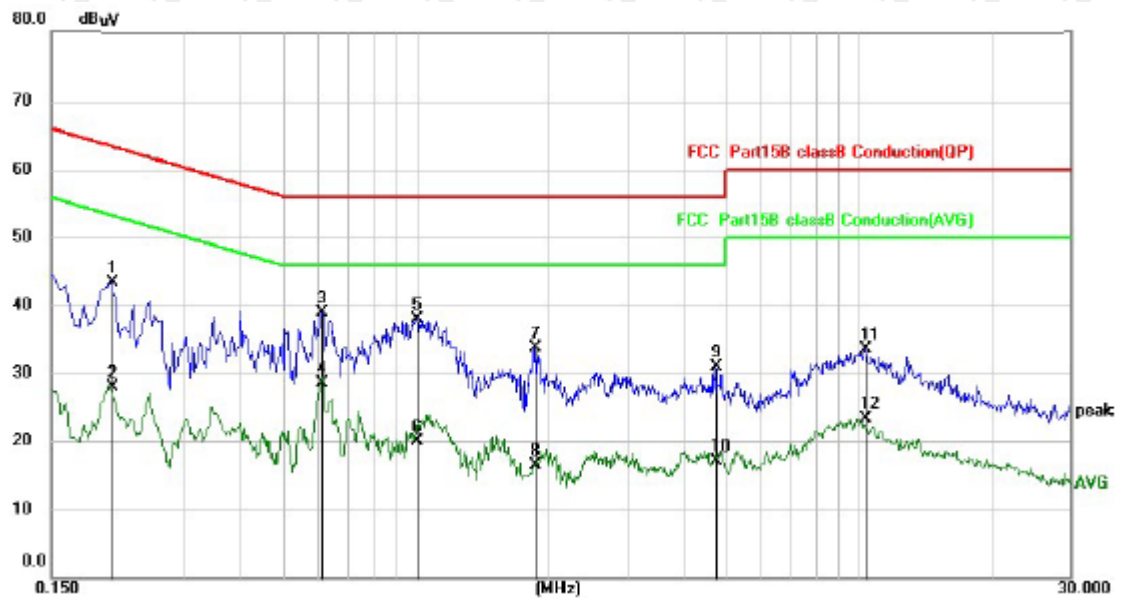
* Decreasing linearly with the logarithm of the frequency

6.3 Test procedure

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

6.4 Test Result

LR1302-SPI-US915:
Test Specification: Line
AC 120V 60Hz

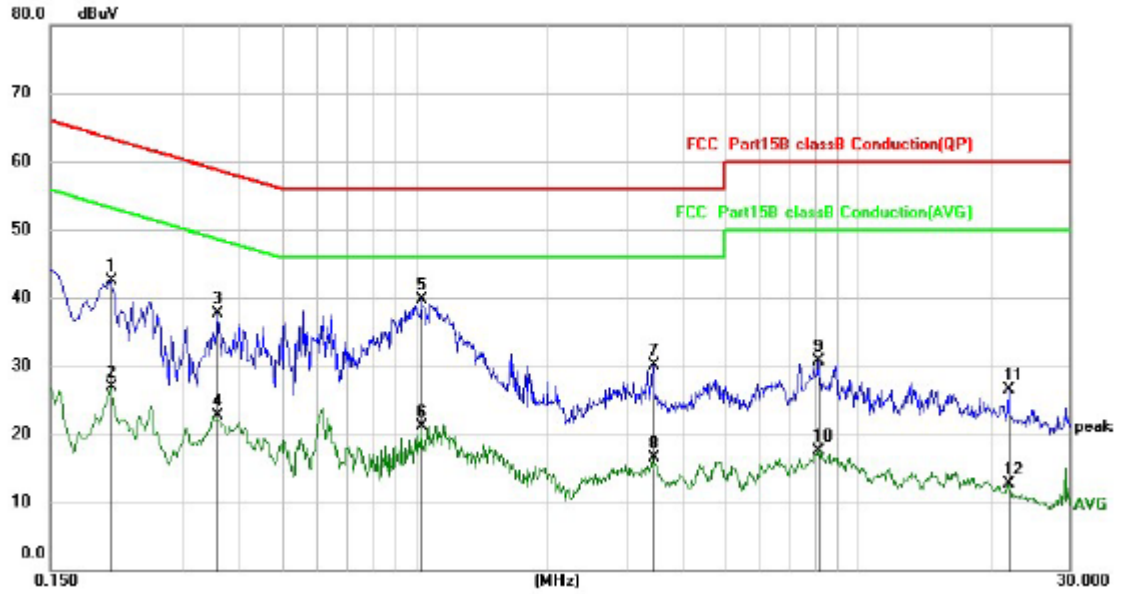


No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector
1		0.2060	33.35	9.95	43.30	63.37	-20.07	QP
2		0.2060	17.90	9.95	27.85	53.37	-25.52	AVG
3	*	0.6140	28.87	10.01	38.88	56.00	-17.12	QP
4		0.6140	18.58	10.01	28.59	46.00	-17.41	AVG
5		1.0020	27.89	10.01	37.90	56.00	-18.10	QP
6		1.0020	9.99	10.01	20.00	46.00	-26.00	AVG
7		1.8500	23.72	10.08	33.80	56.00	-22.20	QP
8		1.8500	6.35	10.08	16.43	46.00	-29.57	AVG
9		4.7260	20.59	10.35	30.94	56.00	-25.06	QP
10		4.7260	6.67	10.35	17.02	46.00	-28.98	AVG
11		10.3060	22.84	10.59	33.43	60.00	-26.57	QP
12		10.3060	12.73	10.59	23.32	50.00	-26.68	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

Test Specification: Neutral
AC 120V 60Hz

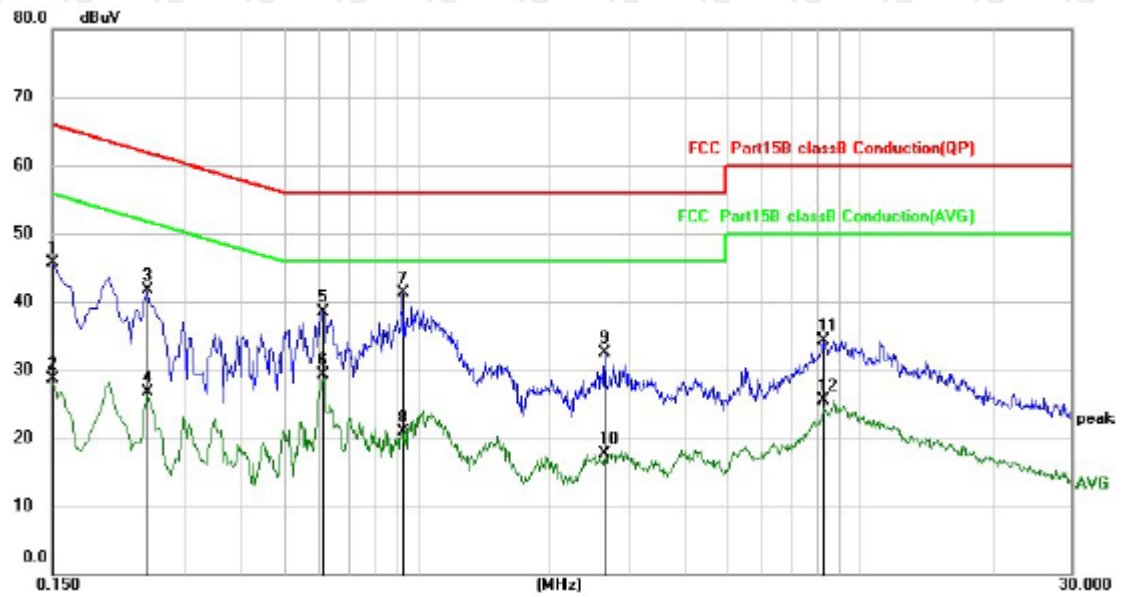


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.2060	32.59	9.95	42.54	63.37	-20.83	QP
2		0.2060	16.92	9.95	26.87	53.37	-26.50	AVG
3		0.3580	27.64	9.97	37.61	58.77	-21.16	QP
4		0.3580	12.64	9.97	22.61	48.77	-26.16	AVG
5	*	1.0339	29.73	10.01	39.74	56.00	-16.26	QP
6		1.0339	11.04	10.01	21.05	46.00	-24.95	AVG
7		3.4420	19.95	10.23	30.18	56.00	-25.82	QP
8		3.4420	6.31	10.23	16.54	46.00	-29.46	AVG
9		8.1260	20.18	10.54	30.72	60.00	-29.28	QP
10		8.1260	7.00	10.54	17.54	50.00	-32.46	AVG
11		21.9420	15.70	10.89	26.59	60.00	-33.41	QP
12		21.9420	1.79	10.89	12.68	50.00	-37.32	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

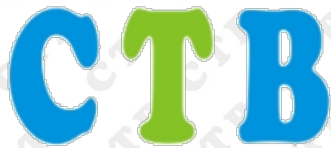
LR1302-USB-US915:
Test Specification: Line
AC 120V 60Hz



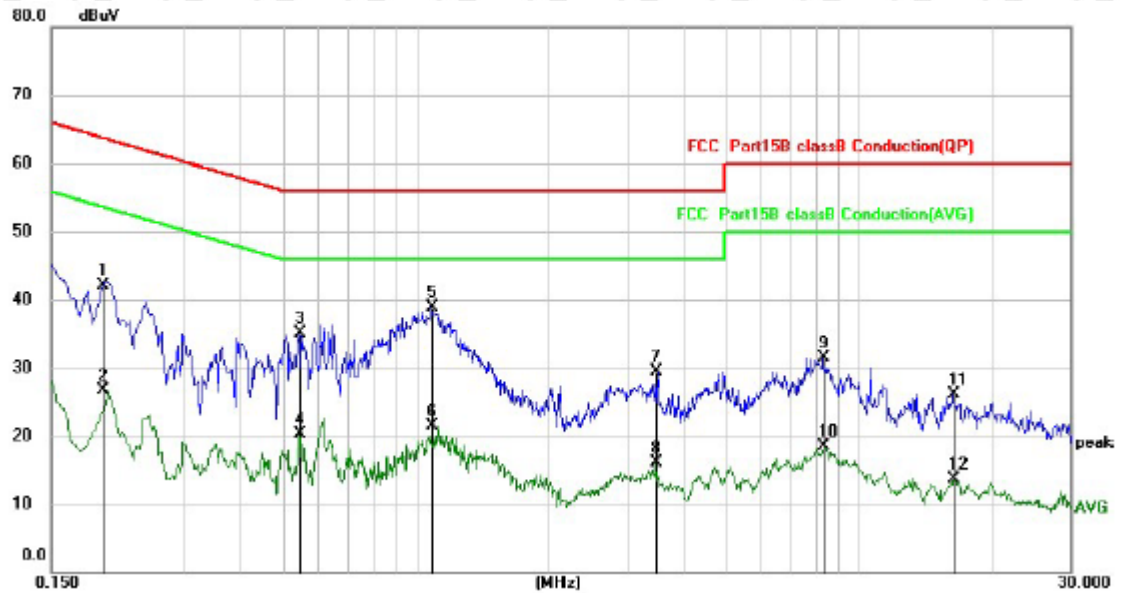
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.1500	35.85	9.95	45.80	66.00	-20.20	QP
2		0.1500	18.75	9.95	28.70	56.00	-27.30	AVG
3		0.2460	31.72	9.96	41.68	61.89	-20.21	QP
4		0.2460	16.74	9.96	26.70	51.89	-25.19	AVG
5		0.6140	28.51	10.01	38.52	56.00	-17.48	QP
6		0.6140	19.24	10.01	29.25	46.00	-16.75	AVG
7	*	0.9260	31.29	10.01	41.30	56.00	-14.70	QP
8		0.9260	10.94	10.01	20.95	46.00	-25.05	AVG
9		2.6500	22.41	10.15	32.56	56.00	-23.44	QP
10		2.6500	7.50	10.15	17.65	46.00	-28.35	AVG
11		8.2700	23.84	10.55	34.39	60.00	-25.61	QP
12		8.2700	14.86	10.55	25.41	50.00	-24.59	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit



Test Specification: Neutral
AC 120V 60Hz



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector
		MHz	Level	Factor	ment	dBuV	dB	
1		0.1965	32.22	9.95	42.17	63.76	-21.59	QP
2		0.1965	16.81	9.95	26.76	53.76	-27.00	AVG
3		0.5460	25.04	10.00	35.04	56.00	-20.96	QP
4		0.5460	10.27	10.00	20.27	46.00	-25.73	AVG
5	*	1.0859	28.95	10.02	38.97	56.00	-17.03	QP
6		1.0859	11.43	10.02	21.45	46.00	-24.55	AVG
7		3.4900	19.18	10.23	29.41	56.00	-26.59	QP
8		3.4900	5.90	10.23	16.13	46.00	-29.87	AVG
9		8.2940	21.04	10.55	31.59	60.00	-28.41	QP
10		8.2940	8.00	10.55	18.55	50.00	-31.45	AVG
11		16.3420	15.30	10.75	26.05	60.00	-33.95	QP
12		16.3420	2.97	10.75	13.72	50.00	-36.28	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement - Limit

7. RADIATED SPURIOUS EMISSION

7.1 Block Diagram Of Test Setup

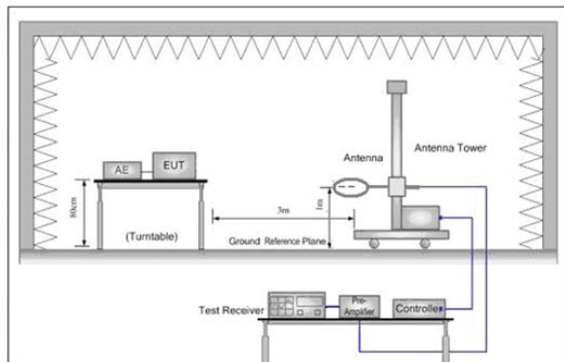


Figure 1. Below 30MHz

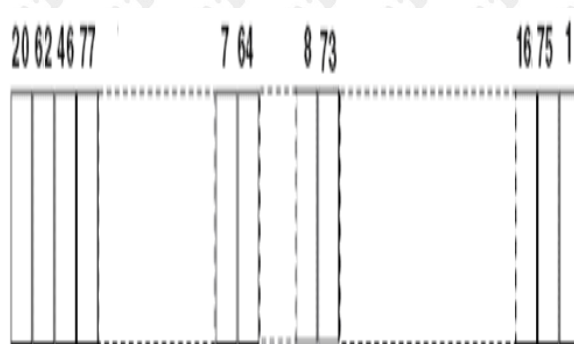


Figure 2. 30MHz to 1GHz

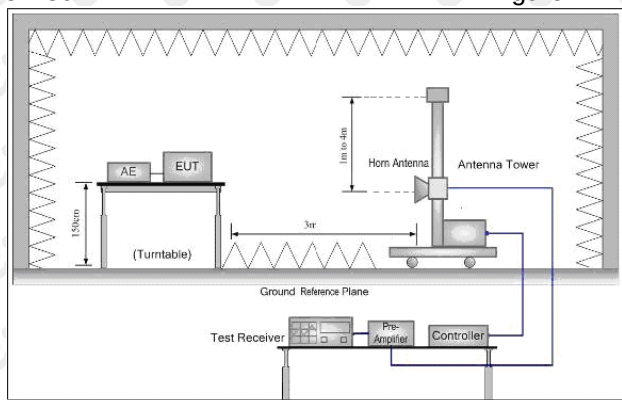


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (microvolt/meter)	Limit (dBμV/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: a.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.

b. The lower limit shall apply at the transition frequencies.

c. Emission level(dBuV/m)=20log Emission level(uV/m)

7.3 Test procedure

Below 1GHz test procedure as below:

- a.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.
- 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 rota table 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.

Above 1GHz test procedure as below:

- g.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
- h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- j.Repeat above procedures until all frequencies measured was complete.

Receiver set:

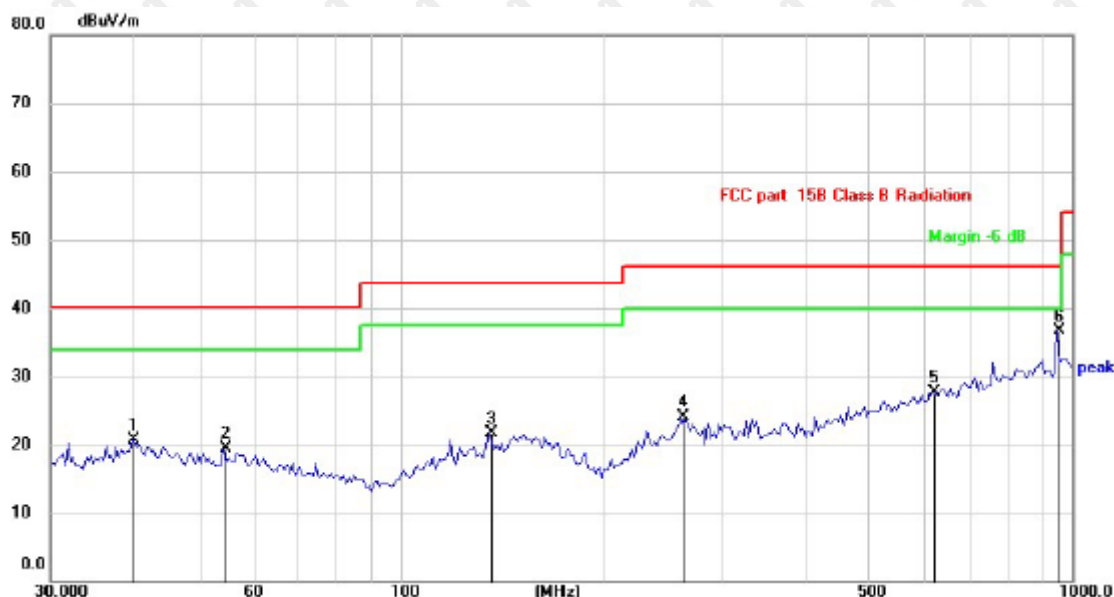
Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

7.4 Test Result

LR1302-SPI-US915:

Below 1GHz Test Results:

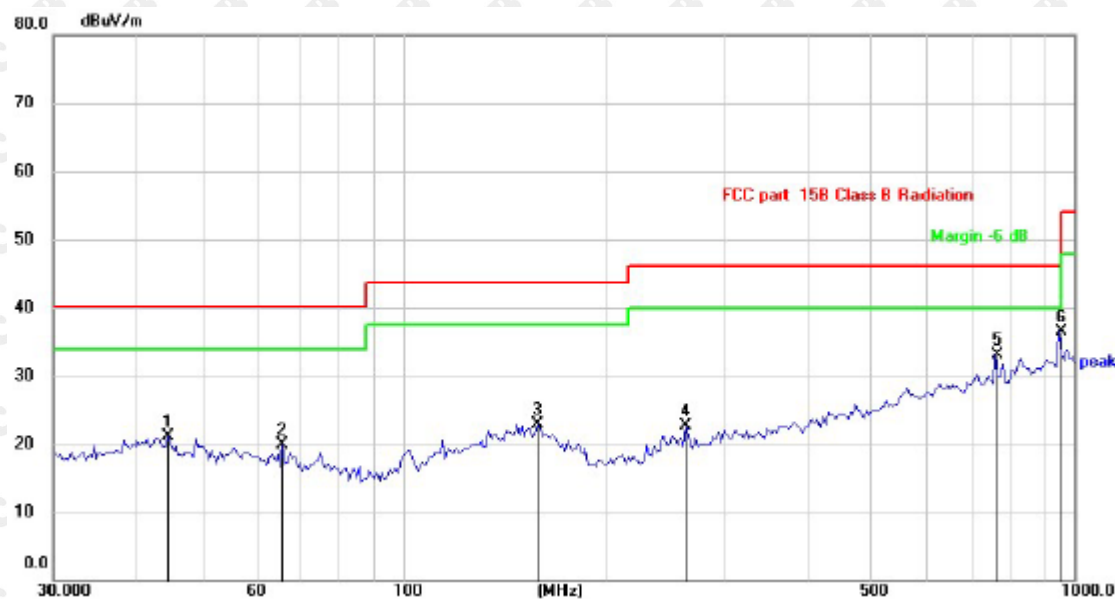
Antenna polarity: H



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		40.0644	25.47	-4.78	20.69	40.00	-19.31	QP
2		54.4516	26.23	-6.68	19.55	40.00	-20.45	QP
3		135.5062	26.23	-4.58	21.65	43.50	-21.85	QP
4		261.5164	30.59	-6.40	24.19	46.00	-21.81	QP
5		617.4534	24.77	2.97	27.74	46.00	-18.26	QP
6	*	948.7610	29.33	7.36	36.69	46.00	-9.31	QP

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

Antenna polarity: V



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		44.5087	26.74	-5.61	21.13	40.00	-18.87	QP
2		66.0342	27.36	-7.53	19.83	40.00	-20.17	QP
3		158.6677	26.32	-3.48	22.84	43.50	-20.66	QP
4		263.8190	29.03	-6.30	22.73	46.00	-23.27	QP
5		762.0385	27.30	5.71	33.01	46.00	-12.99	QP
6	*	948.7610	29.09	7.36	36.45	46.00	-9.55	QP

Remark: 1. Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

2. The margin of 9K-30MH measurement exceeds 20dB, so the test chart is not included.

LR1302-USB-US915:

Below 1GHz Test Results:

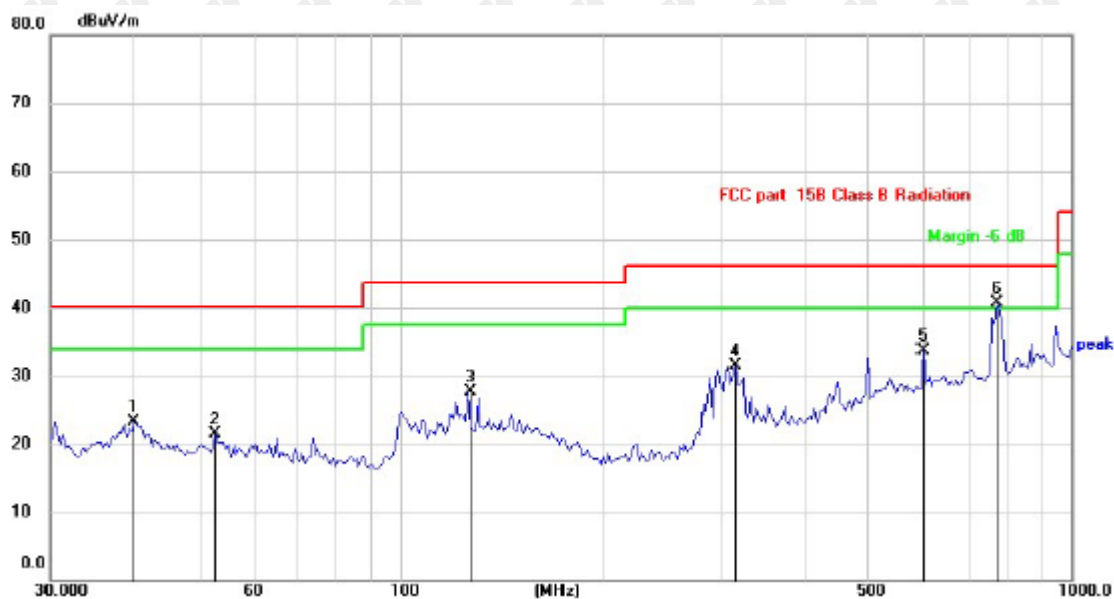
Antenna polarity: H



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		39.3681	25.96	-4.94	21.02	40.00	-18.98	QP
2		120.9109	32.83	-5.22	27.61	43.50	-15.89	QP
3		176.2686	29.10	-5.07	24.03	43.50	-19.47	QP
4		308.9126	40.92	-4.51	36.41	46.00	-9.59	QP
5		500.3011	29.73	0.05	29.78	46.00	-16.22	QP
6	*	775.5169	33.52	5.96	39.48	46.00	-6.52	QP

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

Antenna polarity: V



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		40.0644	28.03	-4.78	23.25	40.00	-16.75	QP
2		53.0382	28.26	-6.67	21.59	40.00	-18.41	QP
3		126.3286	32.75	-4.98	27.77	43.50	-15.73	QP
4		317.1445	35.76	-4.30	31.46	46.00	-14.54	QP
5		601.4265	31.08	2.66	33.74	46.00	-12.26	QP
6	*	775.5169	34.80	5.96	40.76	46.00	-5.24	QP

Remark: 1. Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

2. The margin of 9K-30MH measurement exceeds 20dB, so the test chart is not included.

LR1302-SPI-US915:

Above 1 GHz Test Results:

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1830	108.38	-5.84	52.69	74	-21.31	peak
1830	95.55	-5.84	43.65	54	-10.35	AVG
2745	56.40	-3.64	52.76	74	-21.24	peak
2745	47.09	-3.64	43.45	54	-10.55	AVG
3660	58.25	-0.95	57.30	74	-16.70	peak
3660	48.11	-0.95	47.16	54	-6.84	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	Detector Type
1830	108.33	-5.84	52.69	74	-21.31	peak
1830	95.46	-5.84	43.65	54	-10.35	AVG
2745	56.26	-3.64	52.62	74	-21.38	peak
2745	47.13	-3.64	43.49	54	-10.51	AVG
3660	58.14	-0.95	57.19	74	-16.81	peak
3660	48.19	-0.95	47.24	54	-6.76	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

LR1302-USB-US915:

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1830	108.27	-5.71	52.67	74	-21.33	peak
1830	95.19	-5.71	45.61	54	-8.39	AVG
2745	56.03	-3.51	52.52	74	-21.48	peak
2745	46.83	-3.51	43.32	54	-10.68	AVG
3660	58.03	-0.82	57.21	74	-16.79	peak
3660	47.84	-0.82	47.02	54	-6.98	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

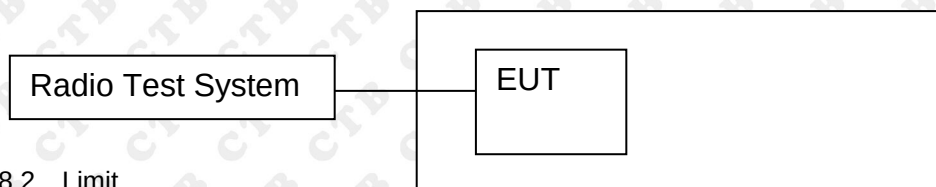
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1830	108.33	-5.71	52.67	74	-21.33	peak
1830	95.08	-5.71	45.61	54	-8.39	AVG
2745	56.07	-3.51	52.56	74	-21.44	peak
2745	46.81	-3.51	43.30	54	-10.70	AVG
3660	57.99	-0.82	57.17	74	-16.83	peak
3660	47.94	-0.82	47.12	54	-6.88	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark:

- (1) Measuring frequencies from 1 GHz to the 25 GHz .
- (2) All modes of operation were investigated and the worst-case emissions are reported.
- (3) Radiated emission test from 9kHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9kHz to 30MHz and not recorded in this report.

8. BAND EDGE AND RF CONDUCTED SPURIOUS EMISSIONS

8.1 Block Diagram Of Test Setup



8.2 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. 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)).

8.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:

Below 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

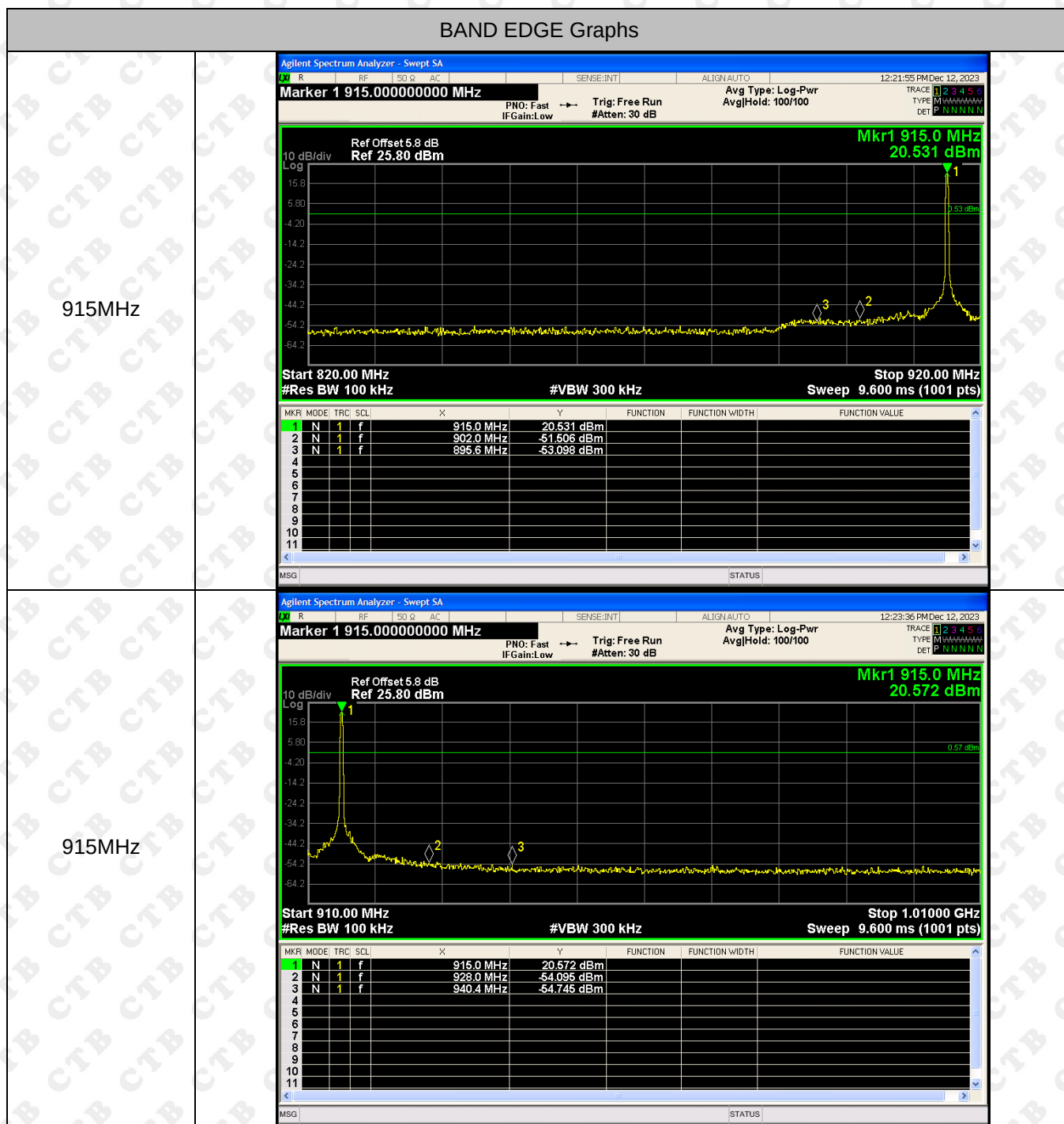
Detector function = peak, Trace = max hold

Above 30MHz:

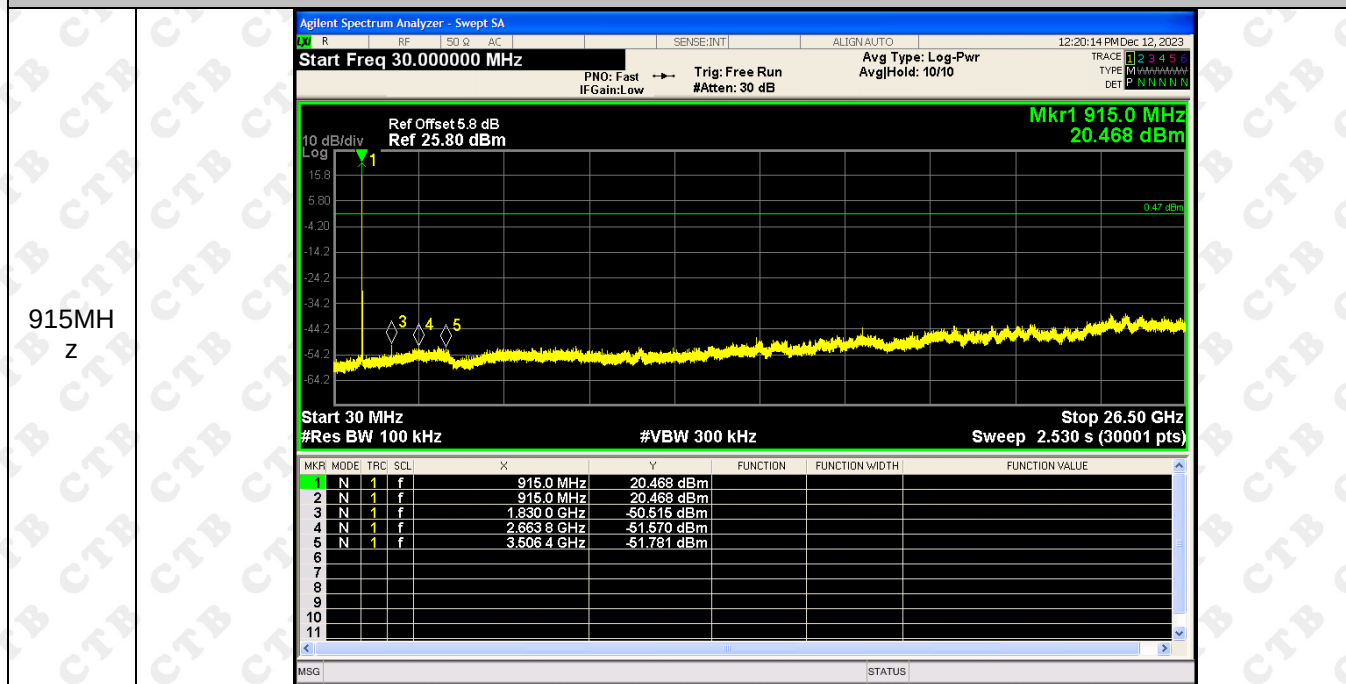
RBW = 100KHz, VBW = 300KHz, Sweep = auto

Detector function = peak, Trace = max hold

8.4 Test Result

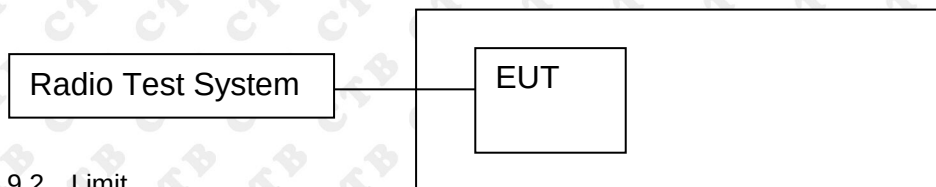


RF Conducted Spurious Emissions Graphs



9. COUDUCTED PEAK OUTPUT POWER

9.1 Block Diagram Of Test Setup



9.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Output Power	1 watt or 30dBm	2400-2483.5	PASS

9.3 Test procedure

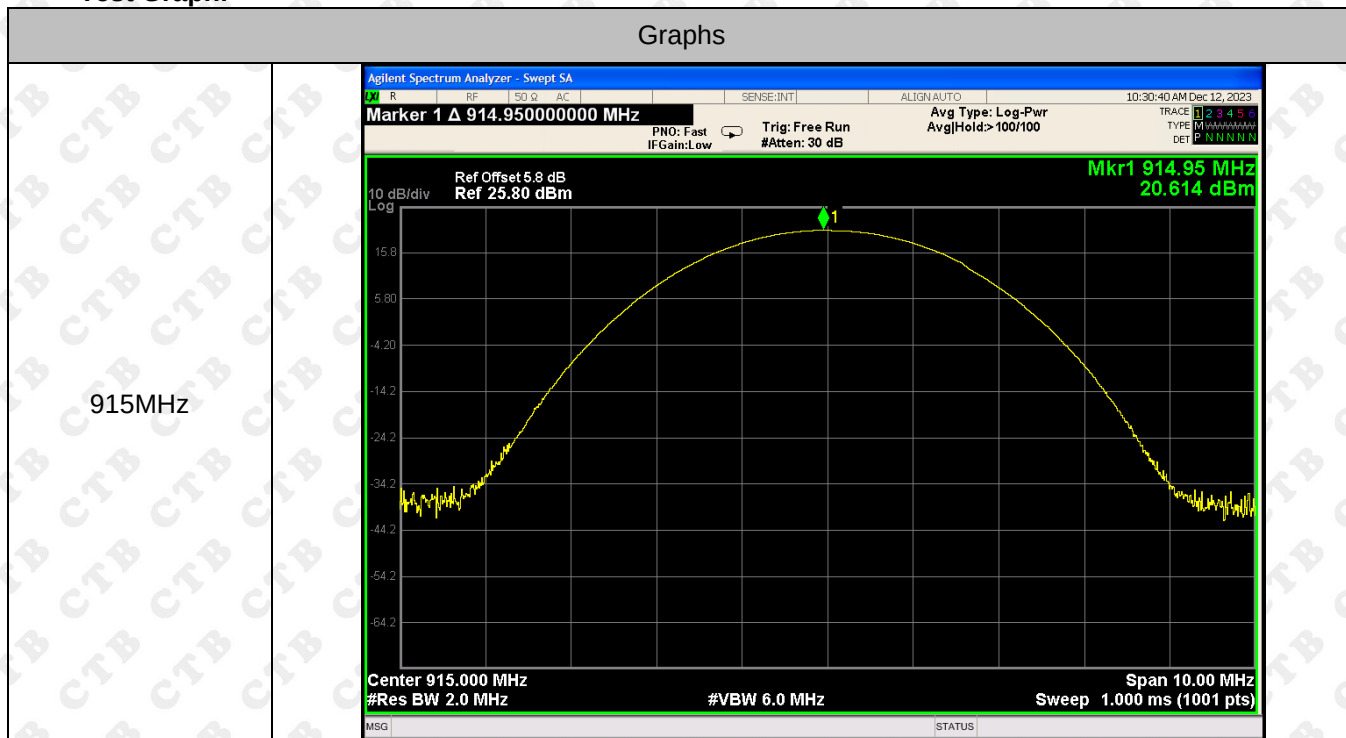
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 2MHz. VBW = 6MHz. Channel power measurement. Sweep = auto; Detector Function = peak.
3. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

9.4 Test Result

Antenna Gain: 1.0dBi

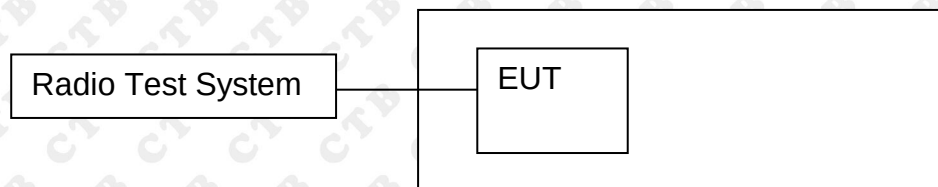
Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
915MHz	20.614	30	PASS

Test Graph:



10. 6DB OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	915	PASS

10.3 Test procedure

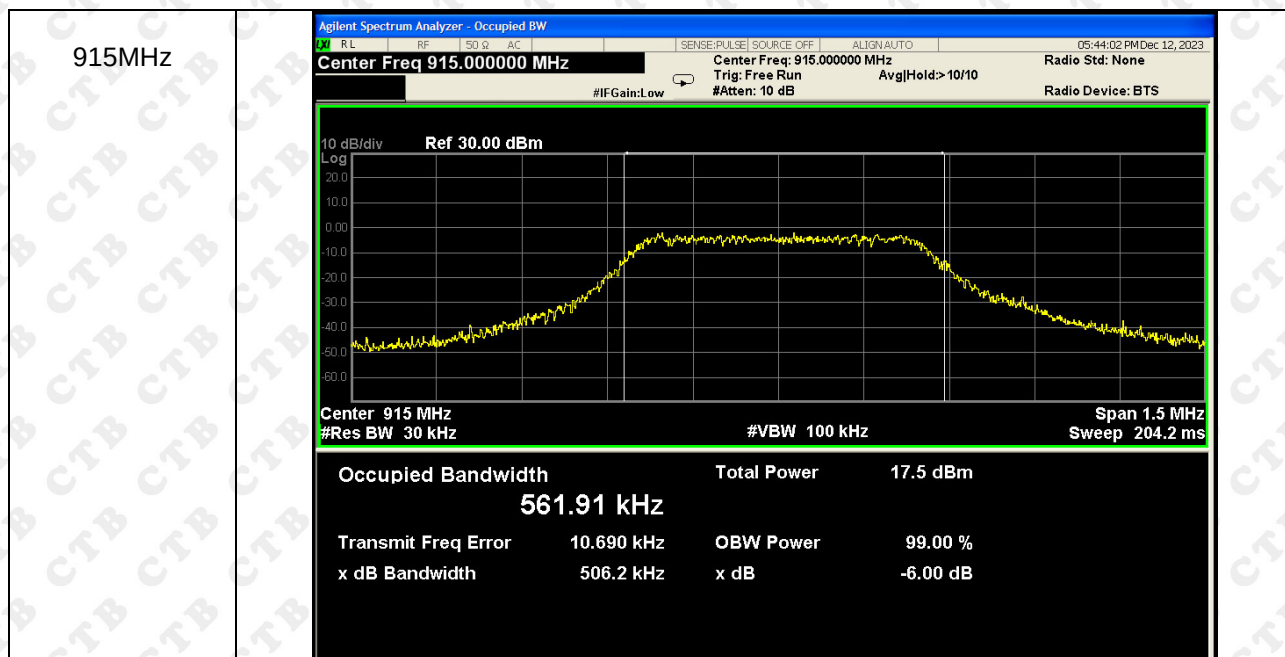
1. Rem1. Set RBW = 3 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

10.4 Test Result

Frequency	6dB Bandwidth (kHz)	Result
915MHz	0.506	PASS

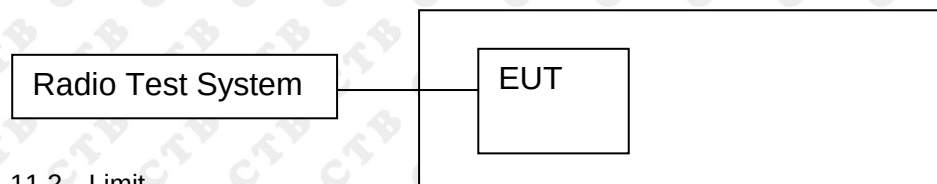
Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

Test Graph:



11. CARRIER FREQUENCIES SEPARATION

11.1 Block Diagram Of Test Setup



11.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

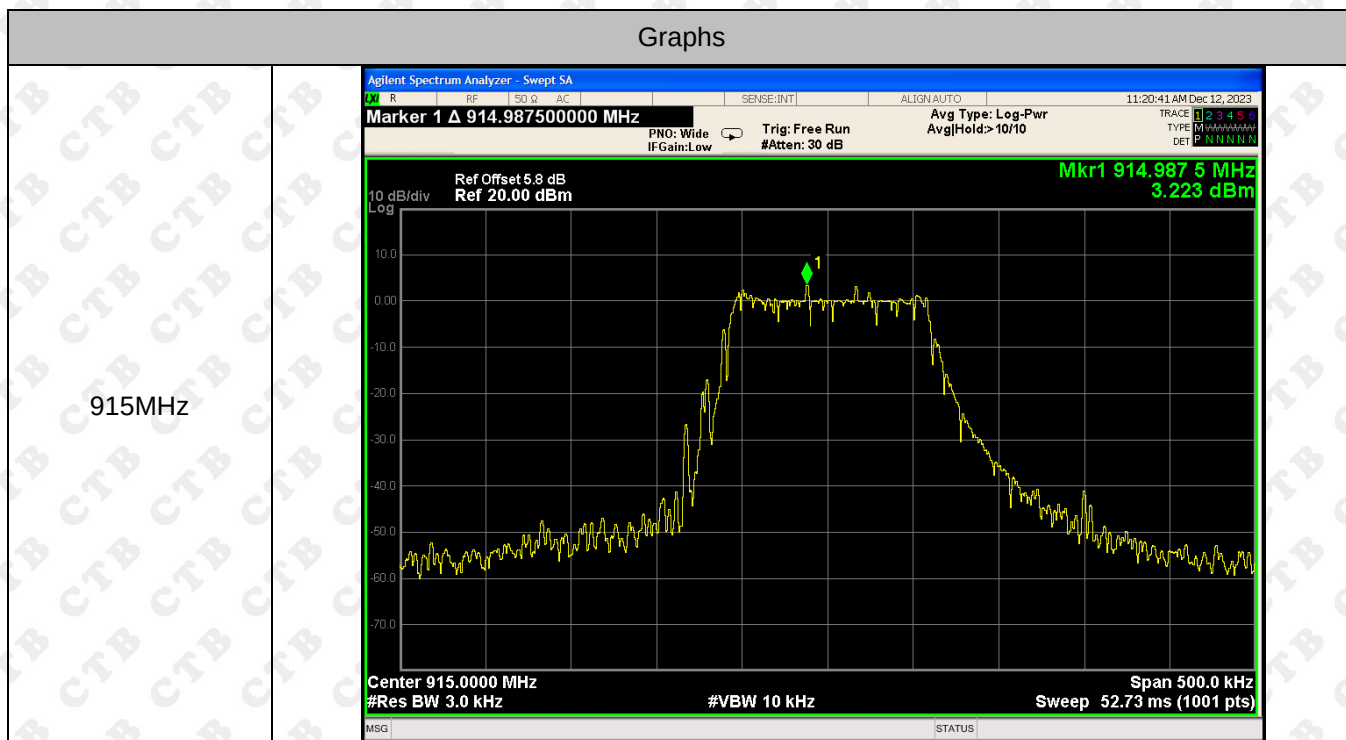
11.3 Test procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

11.4 Test Result

Channel.	Power Spectral Density (dBm/3KHz)	Limit(dBm/3KHz)	Verdict
915MHz	3.223	8	PASS

Test Graph



12. ANTENNA REQUIREMENT

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:

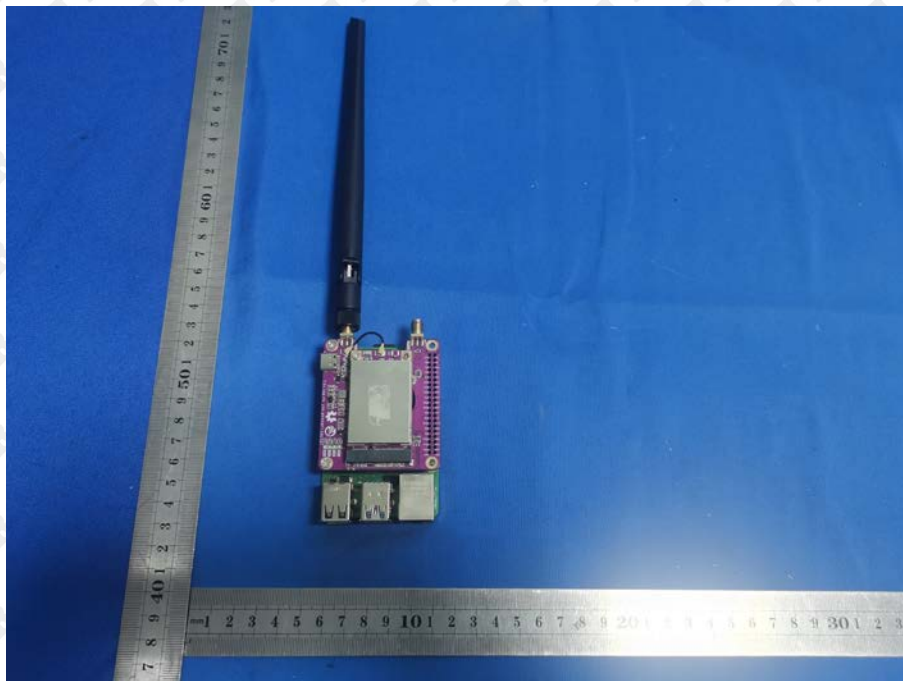
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output 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:

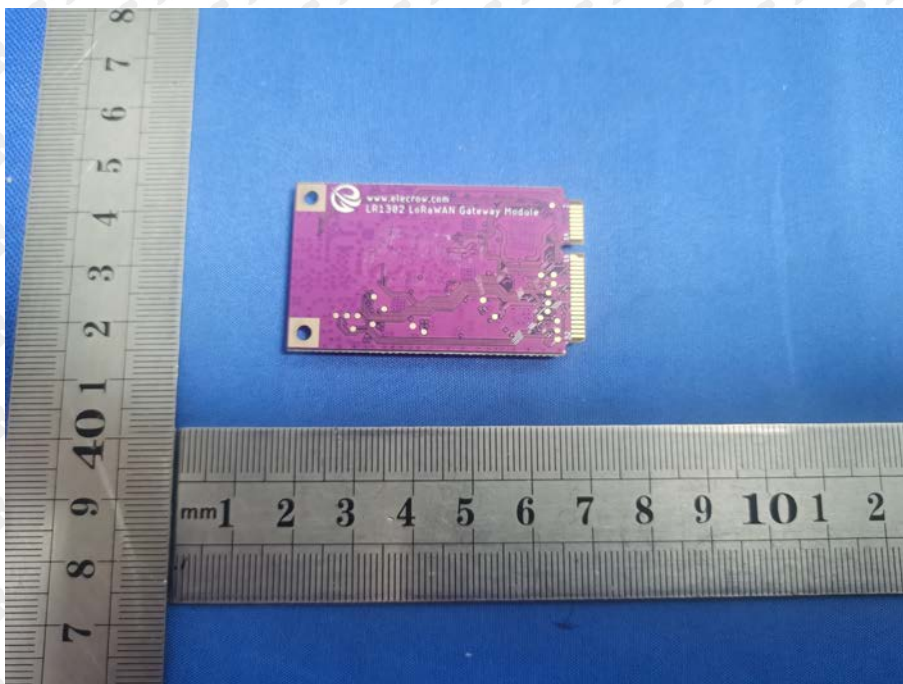
The antenna is External Antenna and no consideration of replacement. The best case gain of the antenna is 3.35dBi.

13. EUT PHOTOGRAPHS

EUT Photo 1



EUT Photo 2



14. EUT TEST SETUP PHOTOGRAPHS

LR1302-SPI-US915:
Radiated Emissions

Below 1G



Above 1G

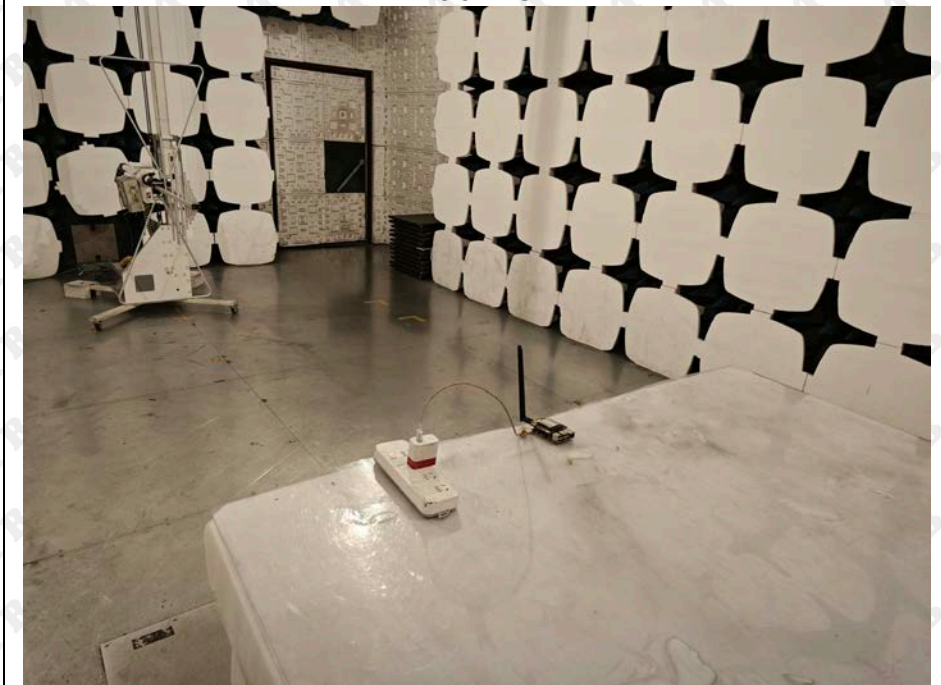


Conducted emission

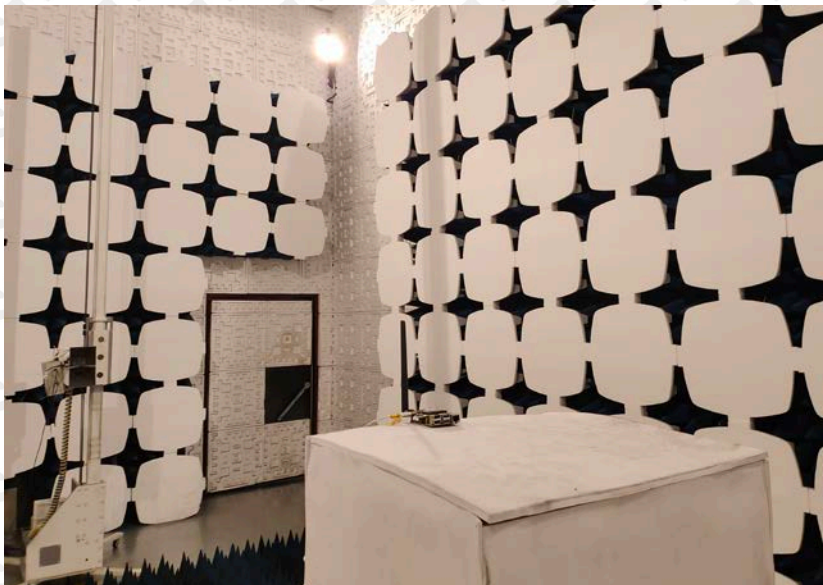


LR1302-USB-US915:
Radiated Emissions

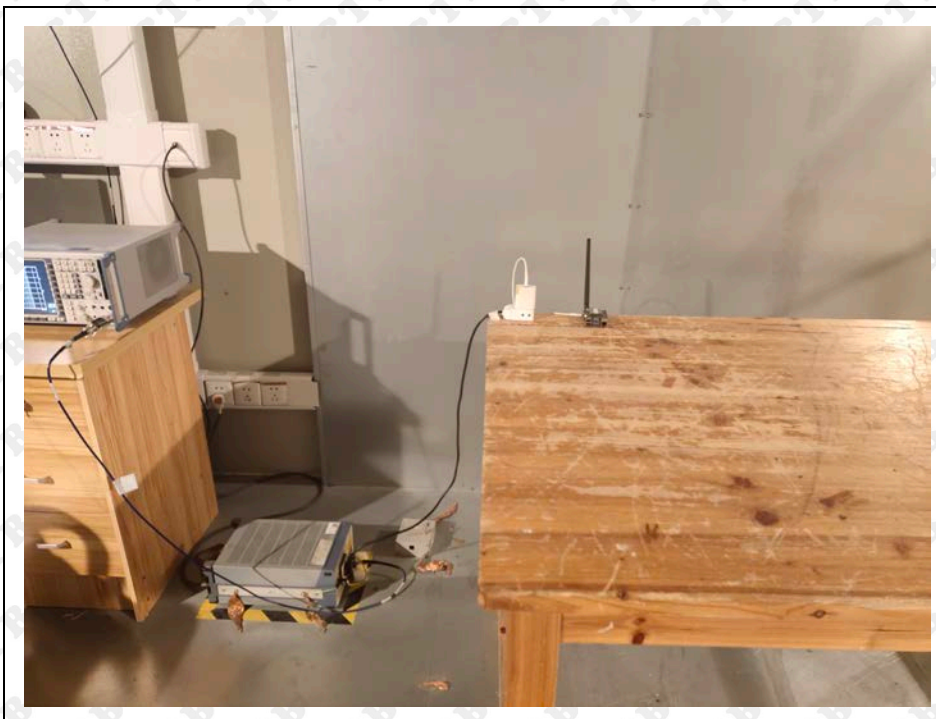
Below 1G



Above 1G



Conducted emission



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