TCT 通测检测 TESTING CENTRE TECHNOLOGY

TEST REPORT

FCC ID: PTSPURDESK500U

Product: Passive UHF RFID Reader

Model No.: PUR-Desk-500U-4CH-P

Additional Model No.: N/A

Trade Mark: RF-Embedded Technology

Report No.: TCT191031E017

Issued Date: Nov. 22, 2019

Issued for:

RF-Embedded GmbH

Kufsteiner Str. 11, Oberaudorf, 83080, Germany

Issued By:

Shenzhen Tongce Testing Lab.

1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

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1. Test Certification

Product:	Passive UHF RFID Reader
Model No.:	PUR-Desk-500U-4CH-P
Additional Model No.:	N/A
Trade Mark:	RF-Embedded Technology
Applicant:	RF-Embedded GmbH
Address:	Kufsteiner Str. 11, Oberaudorf, 83080, Germany
Manufacturer:	RF-Embedded GmbH
Address:	Kufsteiner Str. 11, Oberaudorf, 83080, Germany
Date of Test:	Nov. 01, 2019 – Nov. 21, 2019
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:	Brave Zeng	***Date:***	***Nov. 21, 2019***
Reviewed By:	Beryl Zhao	***Date:***	***Nov. 22, 2019***
Approved By:	Tomsin	***Date:***	***Nov. 22, 2019***

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2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna Requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(2)	PASS
20dB Occupied Bandwidth	§15.247 (a)(1)	PASS
Carrier Frequencies Separation	§15.247 (a)(1)	PASS
Hopping Channel Number	§15.247 (a)(1)	PASS
Dwell Time	§15.247 (a)(1)	PASS
Radiated Emission	§15.205/§15.209	PASS
Band Edge	§15.247(d)	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

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3. EUT Description

Product:	Passive UHF RFID Reader
Model No.:	PUR-Desk-500U-4CH-P
Additional Model No.:	N/A
Trade Mark:	RF-Embedded Technology
Hardware Version:	V1.0
Software Version:	Kernel – v02.22
Operation Frequency:	902.75MHz~927.25MHz
Number of Channel:	50
Modulation Type:	GFSK
Modulation Technology:	FHSS
Antenna Type:	External Antenna
Antenna Gain:	-22dBi
Power Supply:	AC 120V/60Hz
AC adapter:	Adapter Information: MODEL: GST25A12 INPUT: AC 100-240V, 50/60Hz, 0.6A OUTPUT: DC 12V, 2.08A, 25W MAX.

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Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	902.75MHz	13	909.25MHz	26	915.75MHz	39	922.25MHz
1	903.25MHz	14	909.75MHz	27	916.25MHz	40	922.75MHz
2	903.75MHz	15	910.25MHz	28	916.75MHz	41	923.25MHz
3	904.25MHz	16	910.75MHz	29	917.25MHz	42	923.75MHz
4	904.75MHz	17	911.25MHz	30	917.75MHz	43	924.25MHz
5	905.25MHz	18	911.75MHz	31	918.25MHz	44	924.75MHz
6	905.75MHz	19	912.25MHz	32	918.75MHz	45	925.25MHz
7	906.25MHz	20	912.75MHz	33	919.25MHz	46	925.75MHz
8	906.75MHz	21	913.25MHz	34	919.75MHz	47	926.25MHz
9	907.25MHz	22	913.75MHz	35	920.25MHz	48	926.75MHz
10	907.75MHz	23	914.25MHz	36	920.75MHz	49	927.25MHz
11	908.25MHz	24	914.75MHz	37	921.25MHz		
12	908.75MHz	25	915.25MHz	38	921.75MHz		
Remark: Channel 0, 25 & 49 have been tested.							

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4. General Information

4.1. Test environment and mode

Operating Environment:		
Condition	Conducted Emission	Radiated Emission
Temperature:	25.0 °C	25.0 °C
Humidity:	55 % RH	55 % RH
Atmospheric Pressure:	1010 mbar	1010 mbar
Test Mode:		
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations with Fully-charged battery	
The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case(Z axis) are shown in Test Results of the following pages.		

4.2. Description of Support Units

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

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

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.

3. For conducted measurements (Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

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5. Facilities and Accreditations

5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098

  Shenzhen Tongce Testing Lab

  The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

  The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

5.2. Location

Shenzhen Tongce Testing Lab

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

Tel: 86-755-27673339

5.3. Measurement Uncertainty

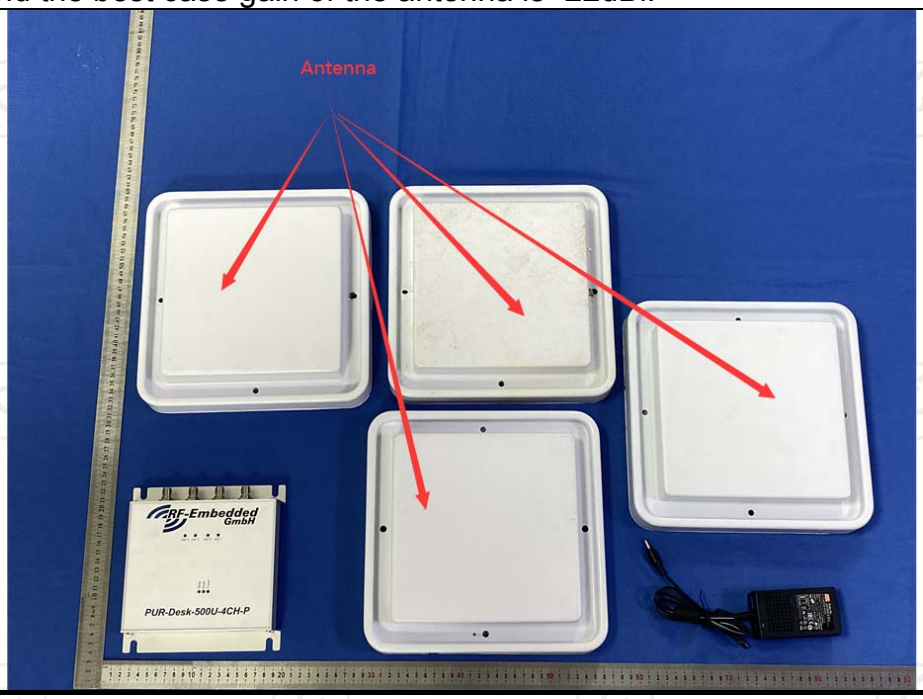
The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.92dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

6. Test Results and Measurement Data

6.1. Antenna requirement

Standard requirement:	FCC Part15 C 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(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
E.U.T Antenna:	
The antenna is external antenna which uses a unique coupling to the intentional radiator, and the best case gain of the antenna is -22dBi.	



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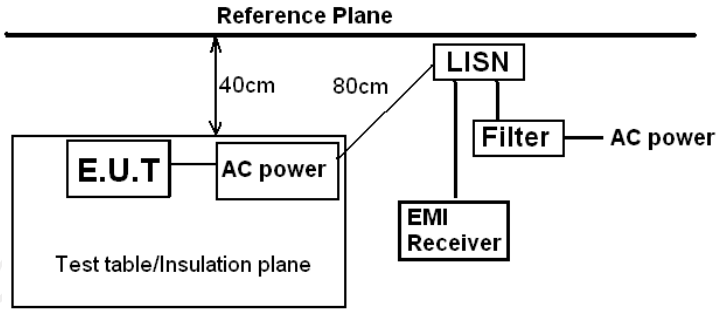
6.2. Conducted Emission

6.2.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>150 kHz to 30 MHz</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9 kHz, VBW=30 kHz, Sweep time=auto</td></tr>
<tr><td>Limits:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></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>
</td></tr>
<tr><td>Test Setup:</td><td> 

Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m</td></tr>
<tr><td>Test Mode:</td><td>Refer to item 4.1</td></tr>
<tr><td>Test Procedure:</td><td>1. The E.U.T is connected to an adapter through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).
3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</td></tr>
<tr><td>Test Result:</td><td>PASS</td></tr>
</table>

6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Test Receiver	R&S	ESPI	101402	Jul. 29, 2020
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 11, 2020
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Sep. 08, 2020
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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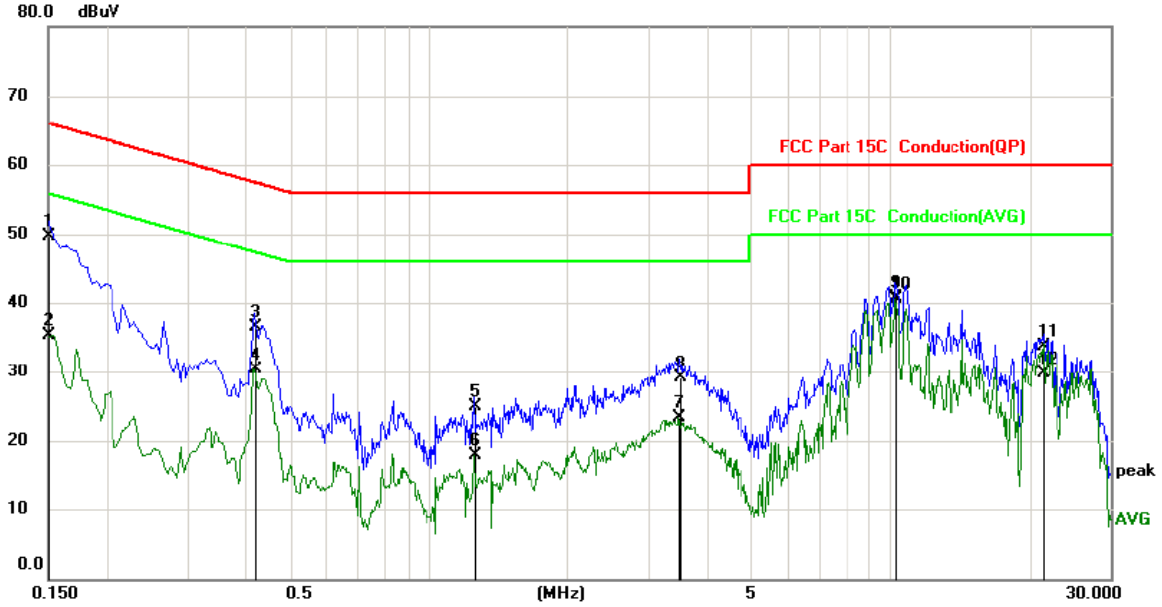
6.2.3. Test data

Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



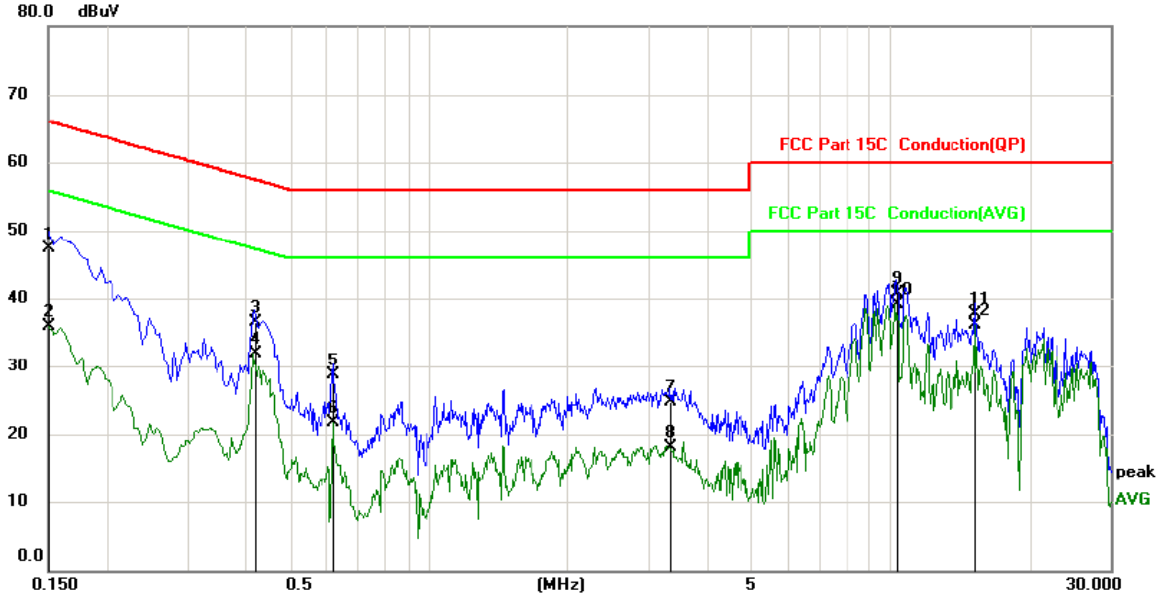
Site | Phase: L1 | Temperature: 25
Limit: FCC Part 15C Conduction(QP) | Power: AC 120V/60Hz | Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	39.56	10.12	49.68	66.00	-16.32	QP	
2		0.1500	25.26	10.12	35.38	56.00	-20.62	AVG	
3		0.4200	26.34	10.13	36.47	57.45	-20.98	QP	
4		0.4200	20.26	10.13	30.39	47.45	-17.06	AVG	
5		1.2570	14.75	10.12	24.87	56.00	-31.13	QP	
6		1.2570	7.82	10.12	17.94	46.00	-28.06	AVG	
7		3.4890	13.12	10.13	23.25	46.00	-22.75	AVG	
8		3.4980	19.04	10.13	29.17	56.00	-26.83	QP	
9		10.2795	30.46	10.15	40.61	60.00	-19.39	QP	
10	*	10.2795	30.27	10.15	40.42	50.00	-9.58	AVG	
11		21.4395	23.46	10.21	33.67	60.00	-26.33	QP	
12		21.4395	19.59	10.21	29.80	50.00	-20.20	AVG	

Note:

Freq. = Emission frequency in MHz
Reading level (dBμV) = Receiver reading
Corr. Factor (dB) = LISN factor + Cable loss
Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)
Limit (dBμV) = Limit stated in standard
Over (dB) = Measurement (dBμV) – Limits (dBμV)
Q.P. =Quasi-Peak
AVG =average
Any value more than 10dB below limit have not been specifically reported.
** is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz*

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site | Phase: N | Temperature: 25

Limit: FCC Part 15C Conduction(QP) | Power: AC 120V/60Hz | Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	37.26	10.12	47.38	66.00	-18.62	QP	
2		0.1500	25.88	10.12	36.00	56.00	-20.00	AVG	
3		0.4200	26.34	10.13	36.47	57.45	-20.98	QP	
4		0.4200	21.72	10.13	31.85	47.45	-15.60	AVG	
5		0.6225	18.59	10.13	28.72	56.00	-27.28	QP	
6		0.6225	11.63	10.13	21.76	46.00	-24.24	AVG	
7		3.3450	14.56	10.13	24.69	56.00	-31.31	QP	
8		3.3450	8.05	10.13	18.18	46.00	-27.82	AVG	
9		10.3200	30.53	10.15	40.68	60.00	-19.32	QP	
10	*	10.3200	29.04	10.15	39.19	50.00	-10.81	AVG	
11		15.2790	27.46	10.18	37.64	60.00	-22.36	QP	
12		15.2790	25.90	10.18	36.08	50.00	-13.92	AVG	

Note1:

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

Limit (dBμV) = Limit stated in standard

Over (dB) = Measurement (dBμV) – Limits (dBμV)

Q.P. =Quasi-Peak

AVG =average

Any value more than 10dB below limit have not been specifically reported.

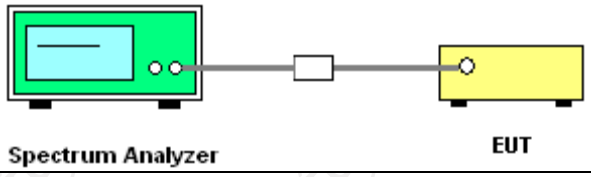
** is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.*

Note2:

Measurements were conducted in all three channels (high, middle, low), and the worst case Mode (Lowest channel) was submitted only.

6.3. Conducted Output Power

6.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(2)
Test Method:	KDB 558074 D01 v05r02
Limit:	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.
Test Result:	PASS

6.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 11, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 11, 2020

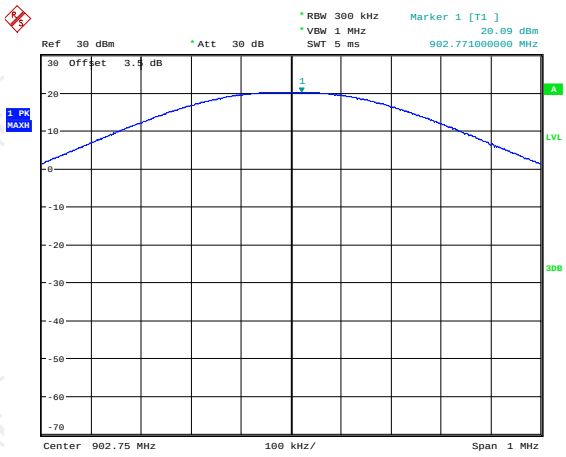
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.3.3. Test Data

Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	20.09	30.00	PASS
Middle	19.88	30.00	PASS
Highest	19.84	30.00	PASS

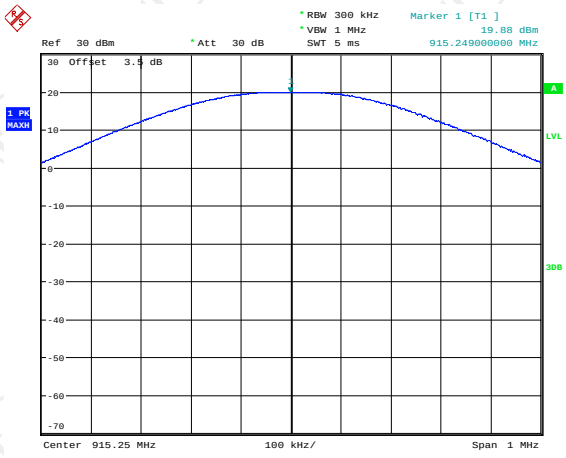
Test plots as follows:

Lowest channel



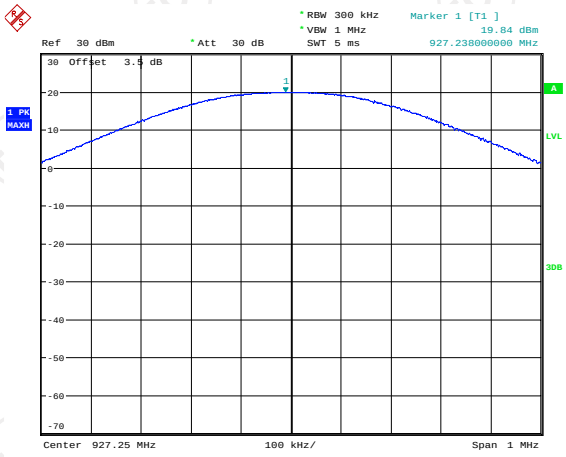
Date: 30.JUL.2019 10:32:20

Middle channel



Date: 30.JUL.2019 11:51:10

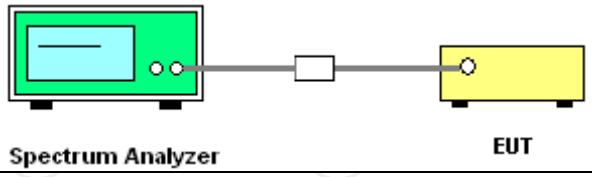
Highest channel



Date: 30.JUL.2019 12:00:12

6.4. 20dB Occupy Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	KDB 558074 D01 v05r02
Limit:	The 20 dB bandwidth of the hopping channel is less than 250 kHz， the system shall use at least 50 hopping frequencies；if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel; 1%≤RBW ≤5% of the 20 dB bandwidth; VBW≥3RBW; Sweep = auto; Detector function = peak; Trace = max hold. 4. Measure and record the results in the test report.
Test Result:	PASS

6.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 11, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 11, 2020

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.4.3. Test data

Test channel	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
Lowest	134.19	250	PASS
Middle	131.41	250	PASS
Highest	129.81	250	PASS

Remark: The EUT has 50 hopping frequencies, so the limit is 250kHz.

Test plots as follows:

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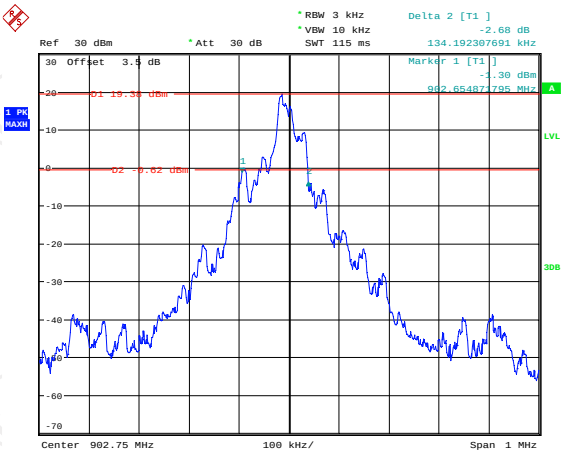
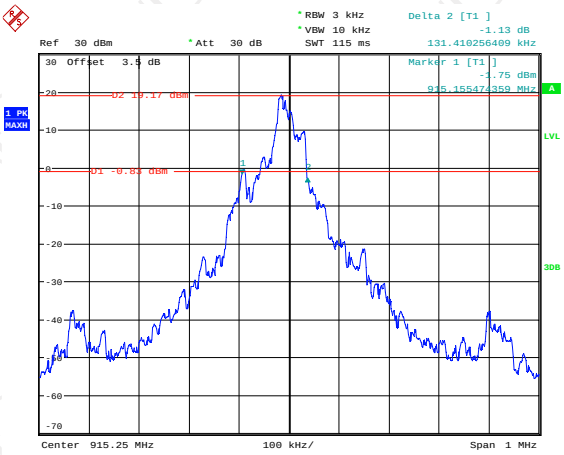
Lowest channel



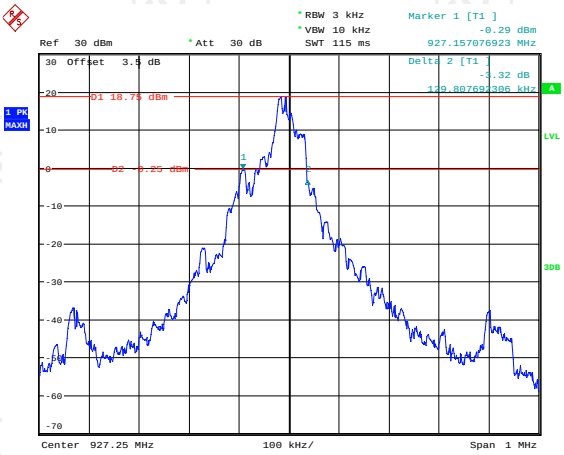
Date: 30.JUL.2019 10:24:02

Middle channel



Date: 30.JUL.2019 11:52:48

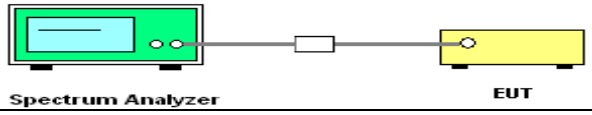
Highest channel



Date: 30.JUL.2019 12:02:37

6.5. Carrier Frequencies Separation

6.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	KDB 558074 D01 v05r02
Limit:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
Test Setup:	
Test Mode:	Hopping mode
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Enable the EUT hopping function. 4. Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels; RBW is set to approximately 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold. 5. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Record the value in report.
Test Result:	PASS

6.5.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 11, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 11, 2020

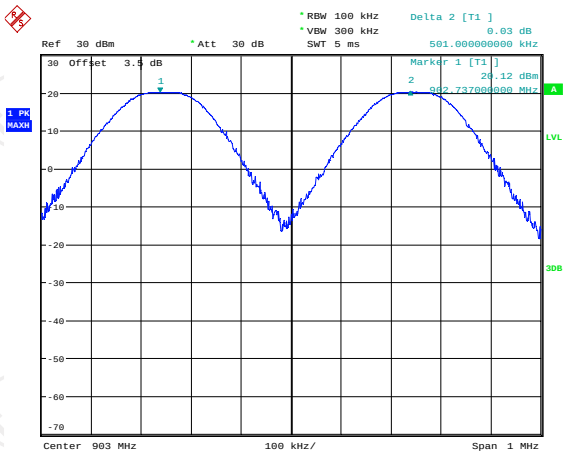
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.5.3. Test data

Test channel	Carrier Frequencies Separation (kHz)	Conclusion
Lowest	501	PASS
Middle	501	PASS
Highest	502	PASS

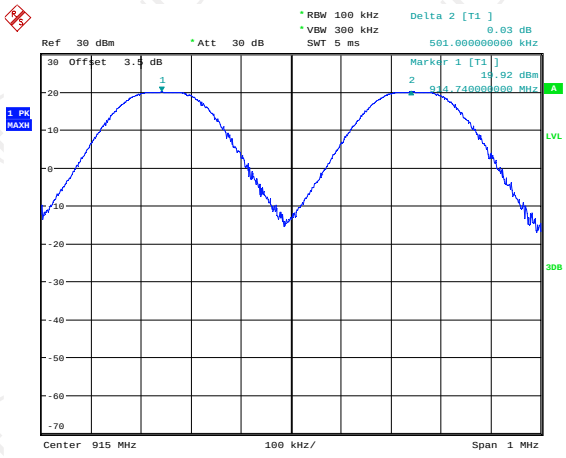
Test plots as follows:

Lowest channel



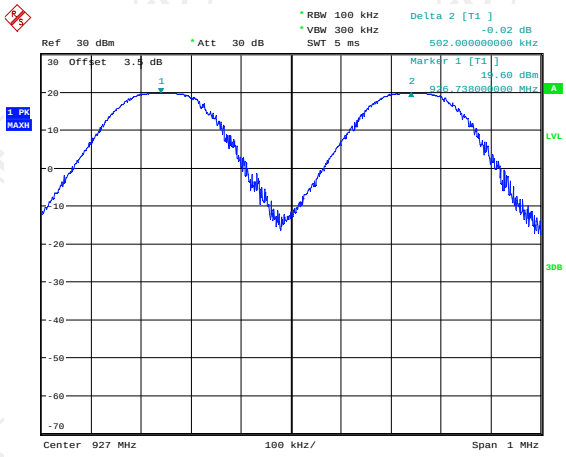
Date: 30.JUL.2019 11:00:14

Middle channel



Date: 30.JUL.2019 11:48:28

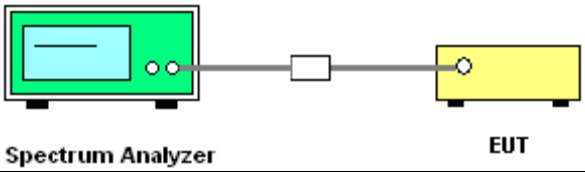
Highest channel



Date: 30.JUL.2019 11:55:28

6.6. Hopping Channel Number

6.6.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	KDB 558074 D01 v05r02
Limit:	If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.
Test Setup:	
Test Mode:	Hopping mode
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Enable the EUT hopping function. 4. Use the following spectrum analyzer settings: Span = the frequency band of operation; set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold. 5. The number of hopping frequency used is defined as the number of total channel. 6. Record the measurement data in report.
Test Result:	PASS

6.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 11, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 11, 2020

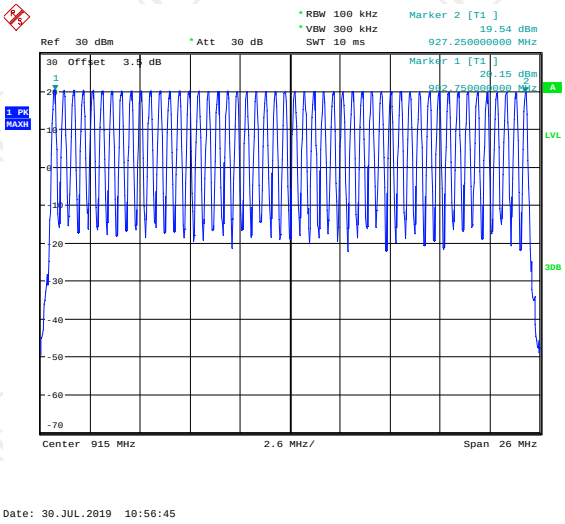
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.6.3. Test data

Hopping channel numbers	Limit	Result
50	≥50	PASS

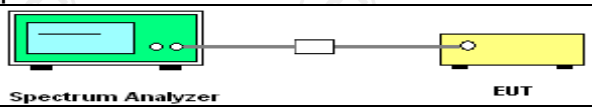
Remark: 20db bandwidth$_{max}$ = 134.19kHz, so the limit is 50.

Test plots as follows:



6.7. Dwell Time

6.7.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	KDB 558074 D01 v05r02
Limit:	For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.
Test Setup:	
Test Mode:	Hopping mode
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Enable the EUT hopping function. 4. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold. 5. Measure and record the results in the test report.
Test Result:	PASS

6.7.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 11, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 11, 2020

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to*

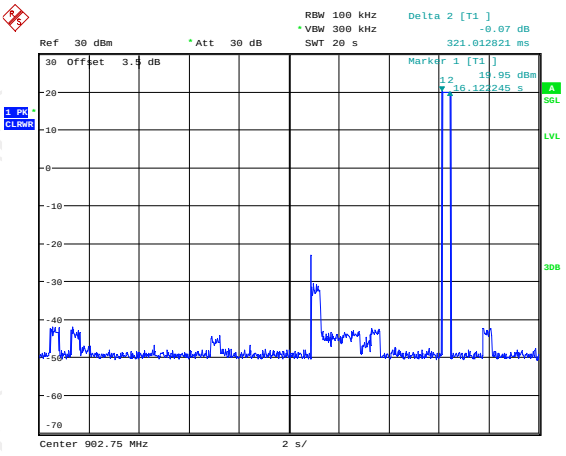
international system unit (SI).

6.7.3. Test Data

Channel	Dwell time (second)	Limit (second)	Result
Lowest	0.321	0.4	PASS
Middle	0.353	0.4	PASS
Highest	0.385	0.4	PASS

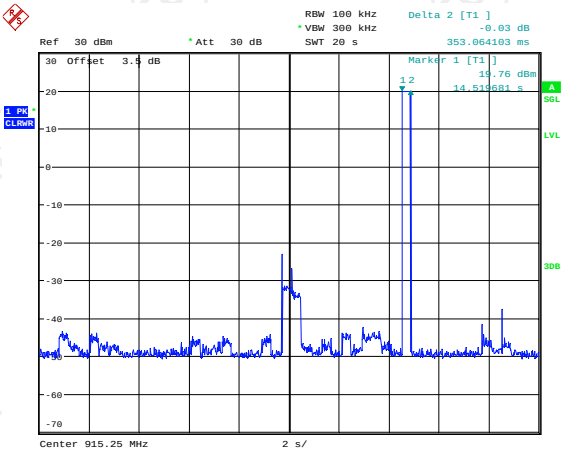
Test plots as follows:

Lowest channel



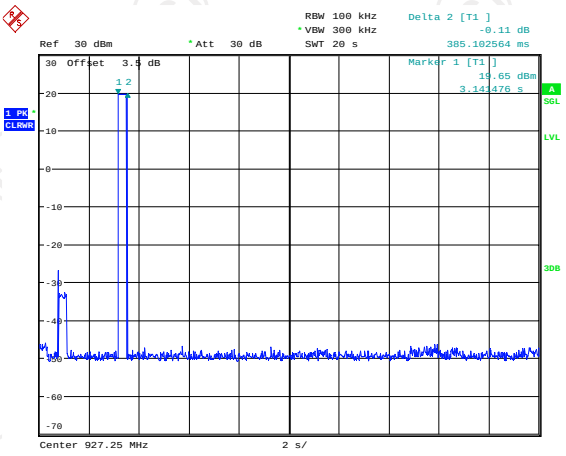
Date: 30.JUL.2019 11:11:52

Middle channel



Date: 30.JUL.2019 11:16:49

Highest channel



Date: 30.JUL.2019 11:38:33

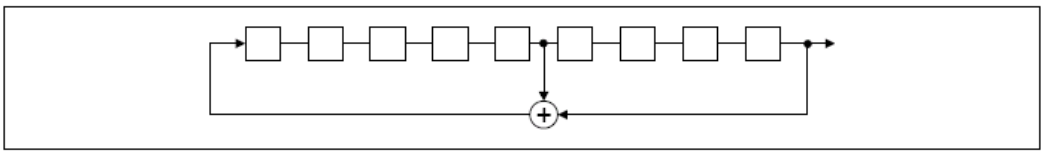
6.8. Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

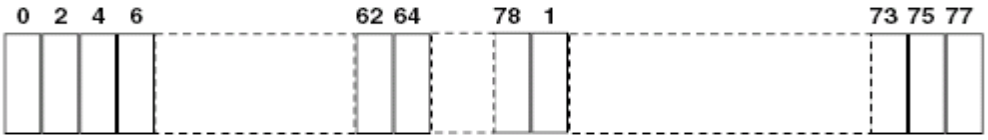
EUT Pseudorandom Frequency Hopping Sequence

The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones; i.e. the shift register is initialized with nine ones.
• Number of shift register stages: 9
• Length of pseudo-random sequence: 2^9 -1 = 511 bits
• Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

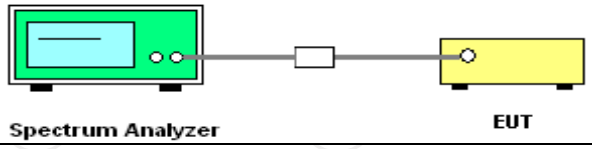
An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.
The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

6.9. Conducted Band Edge Measurement

6.9.1. Test Specification

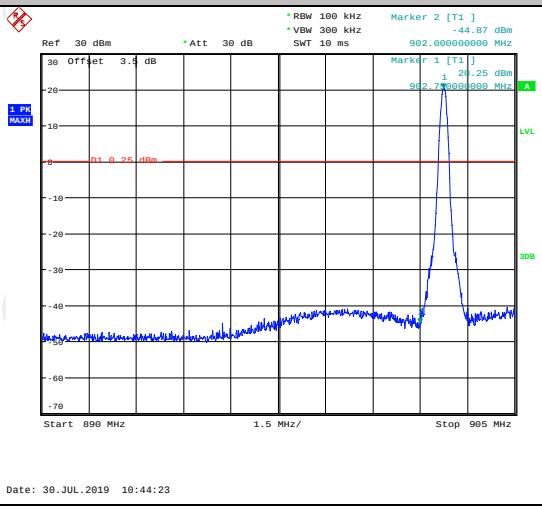
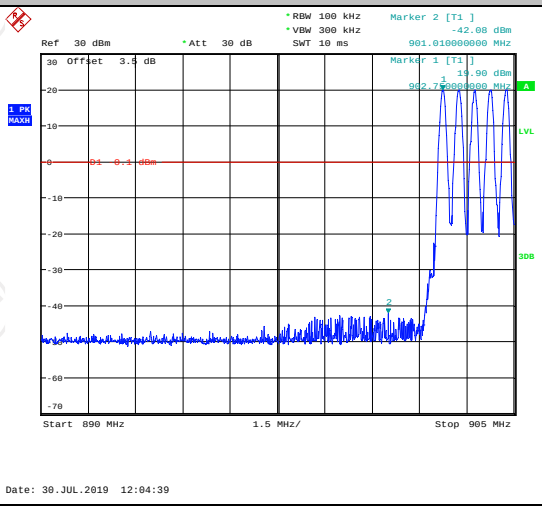
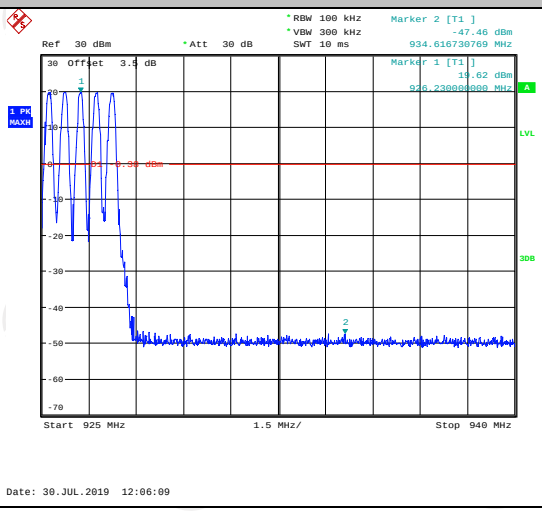
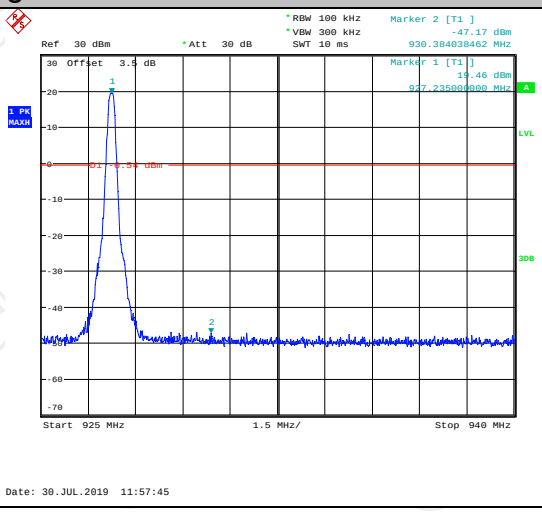
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB 558074 D01 v05r02
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. Set to the maximum power setting and enable the EUT transmit continuously. 2. Set RBW = 100 kHz (≥1% span=10MHz), VBW = 300 kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used. 3. Enable hopping function of the EUT and then repeat step 2 and 3. 4. Measure and record the results in the test report.
Test Result:	PASS

6.9.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 11, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 11, 2020

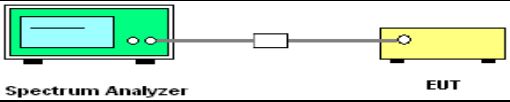
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.9.3. Test Data

Test channel:	Lowest channel
	
No-hopping mode	Hopping mode
Test channel:	Highest channel
	
No-hopping mode	Hopping mode

6.10. Conducted Spurious Emission Measurement

6.10.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB 558074 D01 v05r02
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. 4. Measure and record the results in the test report. 5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

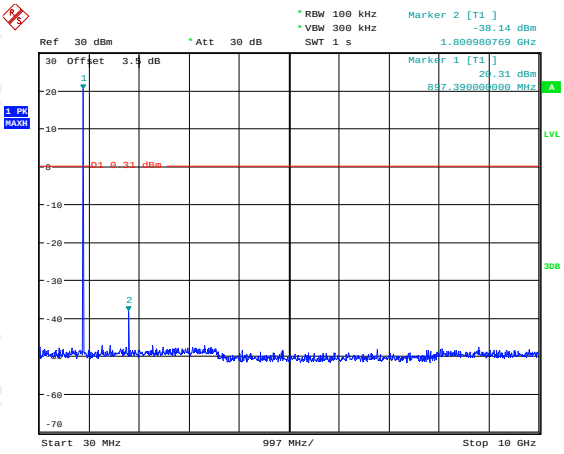
6.10.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2020
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ40	200061	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 11, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 11, 2020

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

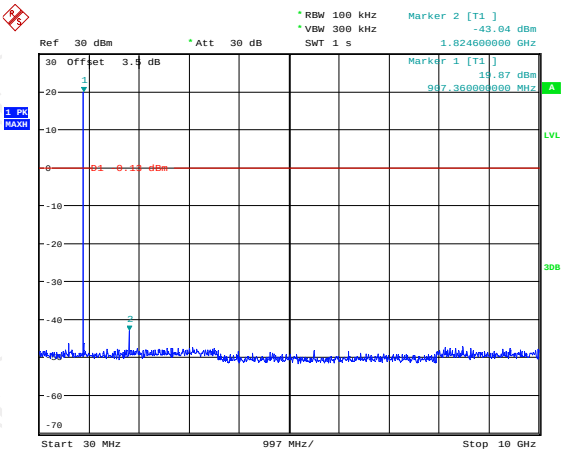
6.10.3. Test Data

Lowest Channel



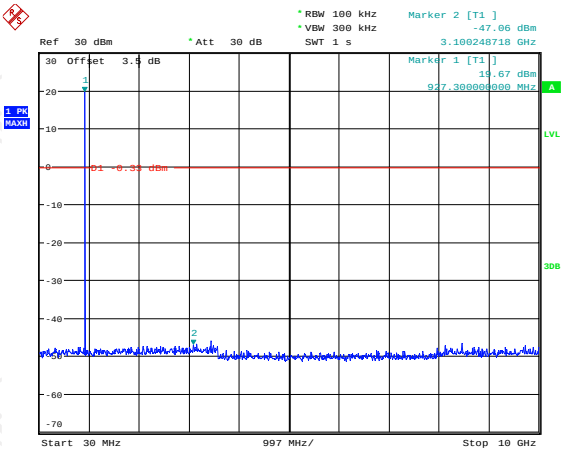
Date: 30.JUL.2019 10:50:27

Middle Channel



Date: 30.JUL.2019 11:49:59

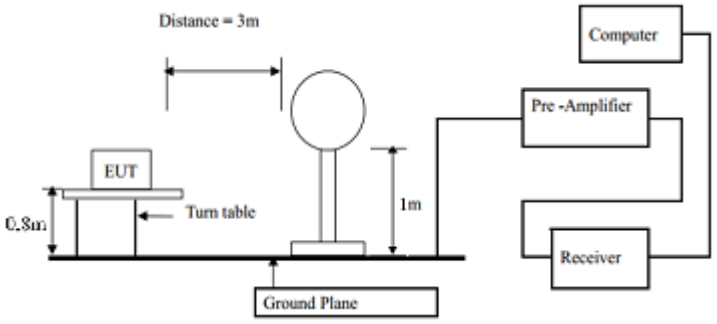
Highest Channel



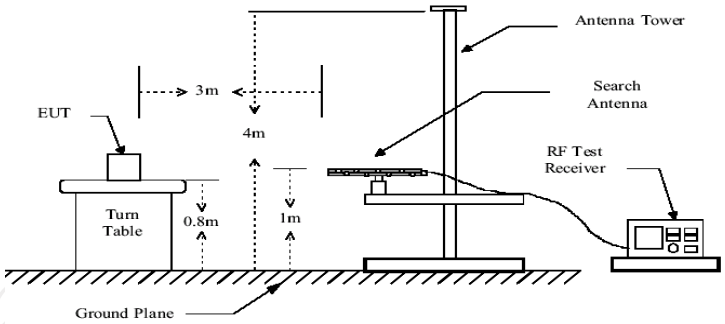
Date: 30.JUL.2019 11:59:20

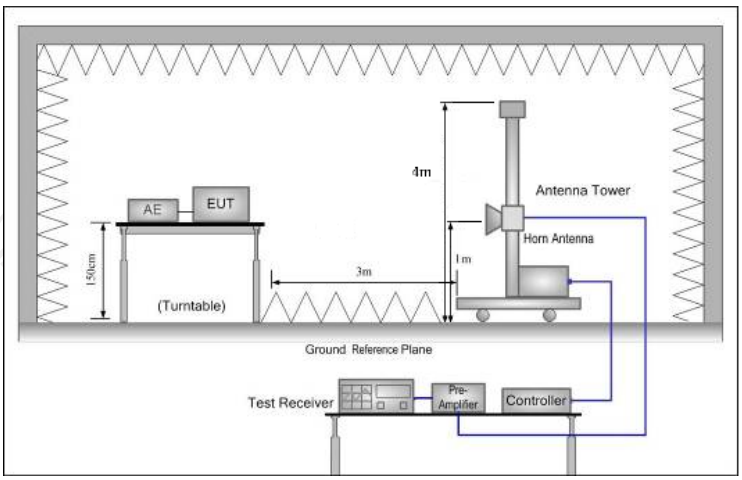
6.11. Radiated Spurious Emission Measurement

6.11.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>9 kHz to 10 GHz</td></tr>
<tr><td>Measurement Distance:</td><td>3 m</td></tr>
<tr><td>Antenna Polarization:</td><td>Horizontal & Vertical</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>9kHz- 150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Field Strength (microvolts/meter)</td><td>Measurement Distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(KHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(KHz)</td><td>30</td></tr>
<tr><td>1.705-30</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
<table>
<tr><td>Frequency</td><td>Field Strength (microvolts/meter)</td><td>Measurement Distance (meters)</td><td>Detector</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>3</td><td>Average</td></tr>
<tr><td>5000</td><td>3</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions below 30MHz
 

30MHz to 1GHz</td></tr>
</table>

<table>
<tr><td></td><td>


Above 1GHz


</td></tr>
<tr><td>Test Mode:</td><td>Transmitting mode with modulation</td></tr>
<tr><td>Test Procedure:</td><td>1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10:2013 Measurement Guidelines.
2. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is 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</td></tr>
</table>

	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. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=120 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak (3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time =N1*L1+N2*L2+...+Nn-1*LNn-1+Nn*Ln Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + 20*log(Duty cycle) Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
Test results:	PASS

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6.11.2. Test Instruments

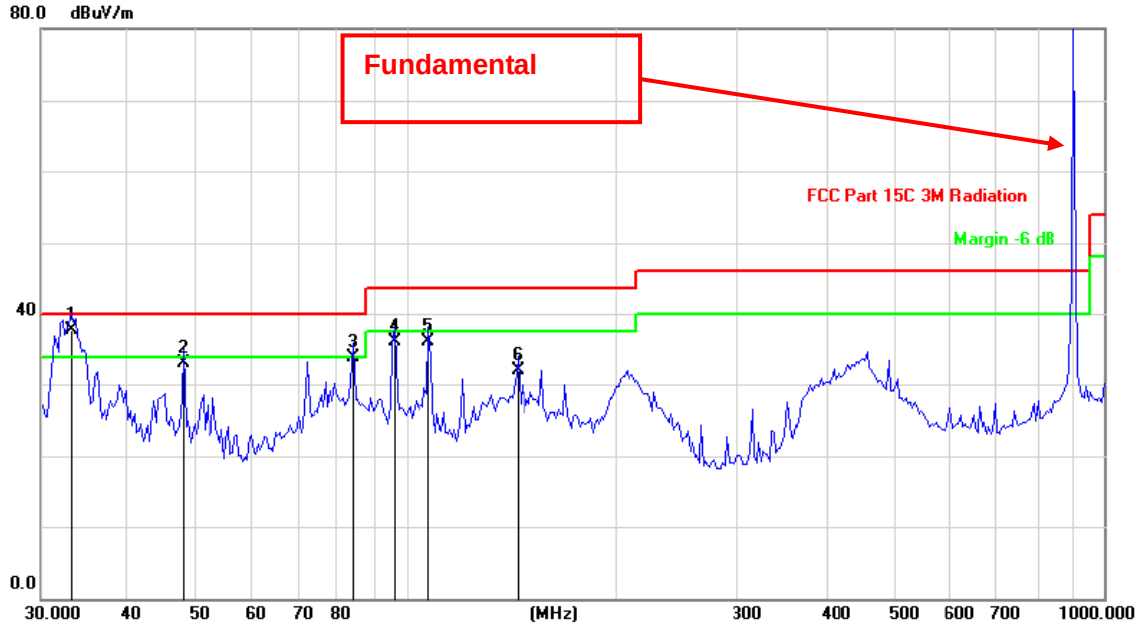
Radiated Emission Test Site (966)				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Test Receiver	ROHDE&SCHWARZ	ESIB7	100197	Jul. 29, 2020
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ40	200061	Sep. 11, 2020
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 08, 2020
Pre-amplifier	HP	8447D	2727A05017	Sep. 08, 2020
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 11, 2020
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 06, 2020
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 06, 2020
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 06, 2020
Antenna Mast	Keleto	RE-AM	N/A	N/A
Coax cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 08, 2020
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Sep. 08, 2020
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

Please refer to following diagram for individual

Below 1GHz

Horizontal:



Site
Polarization: *Horizontal*
Temperature: 25
Limit: FCC Part 15C 3M Radiation
Power:
Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	33.1015	48.63	-11.02	37.61	40.00	-2.39	QP
2		48.0392	43.41	-10.22	33.19	40.00	-6.81	QP
3		84.2839	47.85	-14.01	33.84	40.00	-6.16	QP
4		96.3229	44.98	-8.89	36.09	43.50	-7.41	QP
5		107.7853	44.81	-8.67	36.14	43.50	-7.36	QP
6		144.7898	48.34	-16.17	32.17	43.50	-11.33	QP

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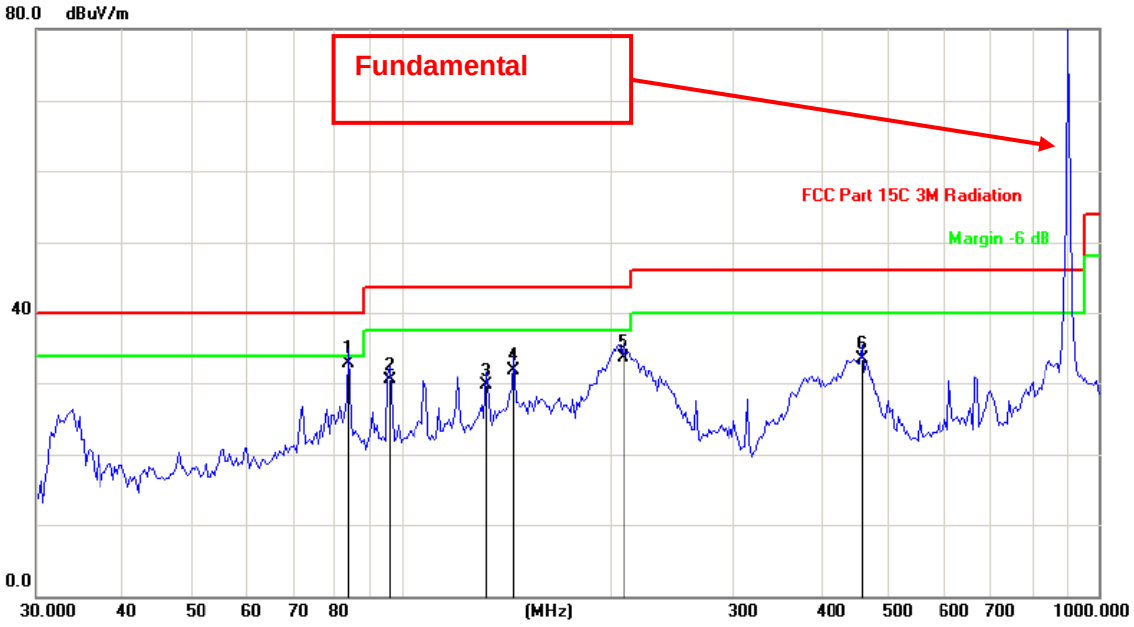
Vertical:



Site
Polarization: *Vertical*
Temperature: 25
Limit: FCC Part 15C 3M Radiation
Power:
Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	84.2839	46.85	-14.01	32.84	40.00	-7.16	QP
2		96.3229	39.45	-8.89	30.56	43.50	-12.94	QP
3		132.1489	45.20	-15.56	29.64	43.50	-13.86	QP
4		144.7898	48.11	-16.17	31.94	43.50	-11.56	QP
5		208.6579	47.43	-13.76	33.67	43.50	-9.83	QP
6		458.3987	41.60	-8.17	33.43	46.00	-12.57	QP

Note: *1.The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported*

2. Measurements were conducted in all three channels (high, middle, low) and the worst case Mode (Lowest channel) was submitted only.

3. Freq. = Emission frequency in MHz

Measurement (dBμV/m) = Reading level (dBμV) + Corr. Factor (dB)

Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

Limit (dBμV/m) = Limit stated in standard

Over (dB) = Measurement (dBμV/m) – Limits (dBμV/m)

Any value more than 10dB below limit have not been specifically reported.

** is meaning the worst frequency has been tested in the test frequency range*

Above 1GHz

Low channel: 902.75 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
1805.50	H	45.72	---	0.66	46.38	---	74	54	-7.62
2708.25	H	37.15	---	9.50	46.65	---	74	54	-7.35
---	H	---	---	---	---	---	---	---	---
1805.50	V	44.37	---	0.66	45.03	---	74	54	-8.97
2708.25	V	38.90	---	9.50	48.40	---	74	54	-5.60
---	V	---	---	---	---	---	---	---	---

Middle channel: 915.25 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
1830.50	H	43.53	---	0.99	44.52	---	74	54	-9.48
2745.75	H	38.28	---	9.87	48.15	---	74	54	-5.85
---	H	---	---	---	---	---	---	---	---
1830.50	V	44.06	---	0.99	45.05	---	74	54	-8.95
2745.75	V	37.81	---	9.87	47.68	---	74	54	-6.32
---	V	---	---	---	---	----	---	---	---

High channel: 927.75 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
1855.50	H	46.19	---	1.33	47.52	---	74	54	-6.48
2783.25	H	38.64	---	10.22	48.86	---	74	54	-5.14
---	H	---	---	---	---	---	---	---	---
1855.50	V	47.30	---	1.33	48.63	---	74	54	-5.37
2783.25	V	37.17	---	10.22	47.39	---	74	54	-6.61
---	V	---	---	---	---	---	---	---	---

Note:

1. *Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier*
2. *Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
4. *Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.*
5. *Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.*
6. *All the restriction bands are compliance with the limit of 15.209.*

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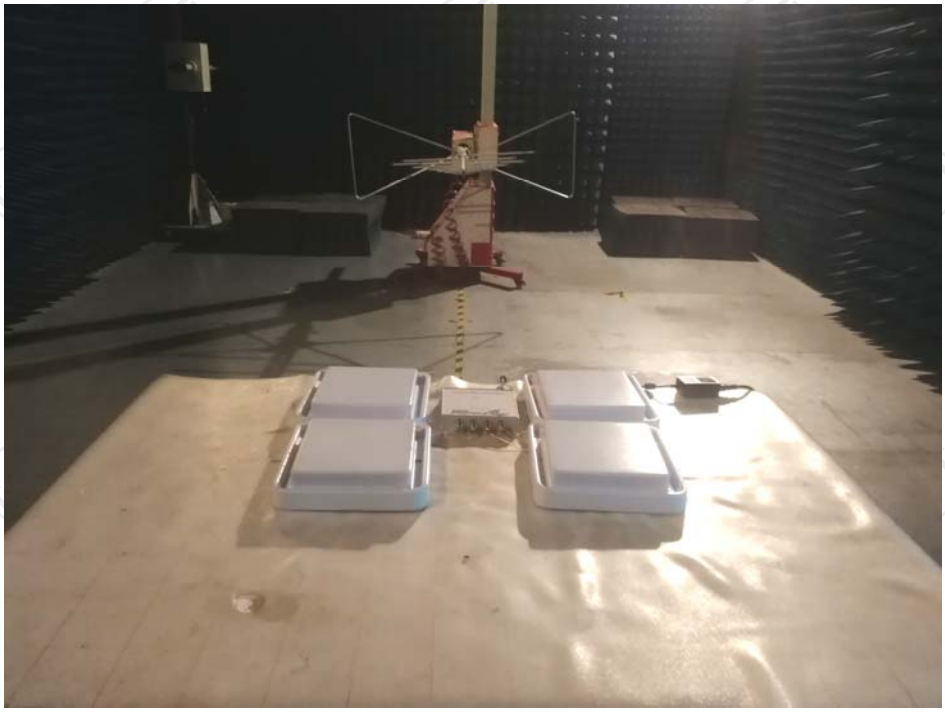
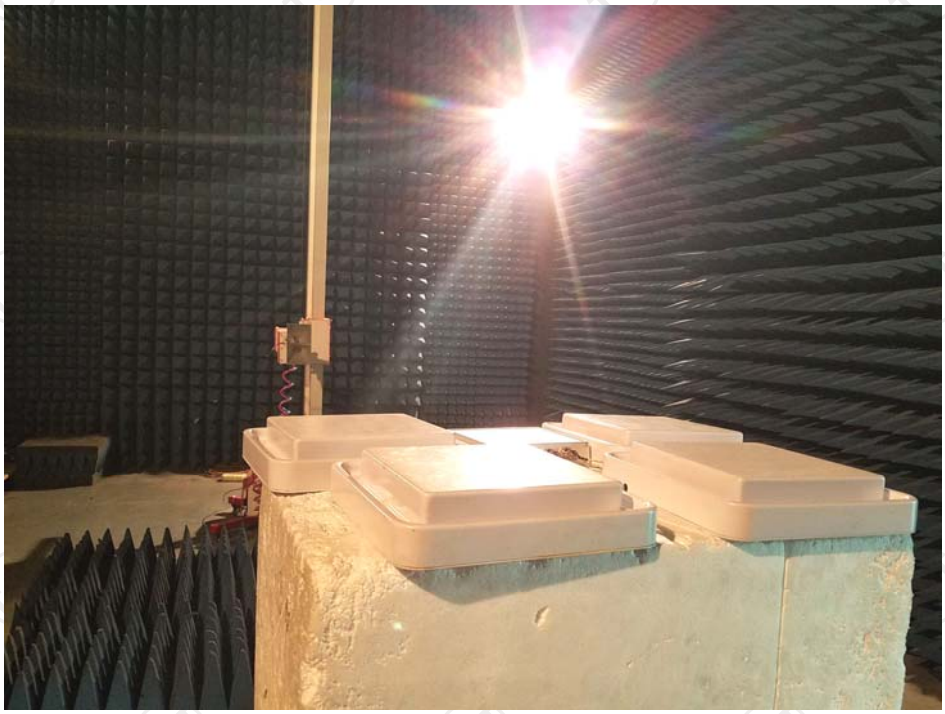
Appendix A: Photographs of Test Setup

Product: Passive UHF RFID Reader
Model: PUR-Desk-500U-4CH-P
Radiated Emission





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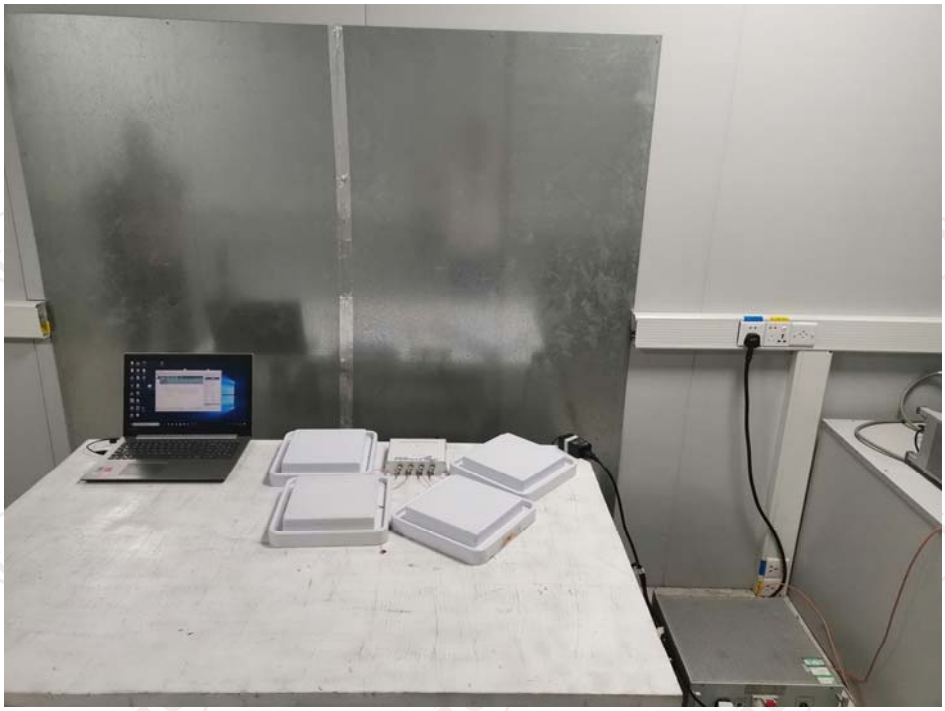
Conducted Emission

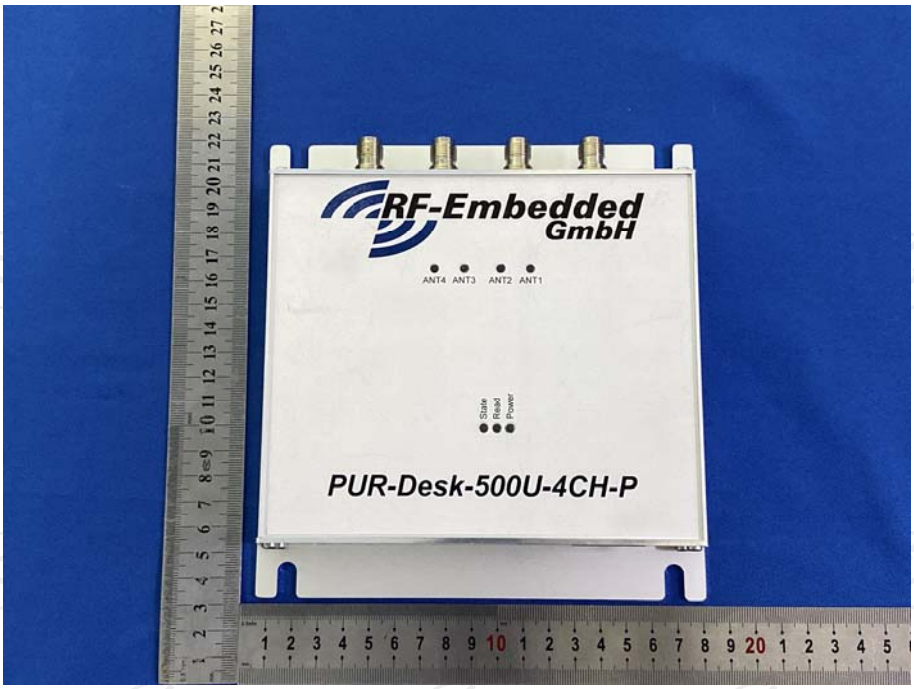


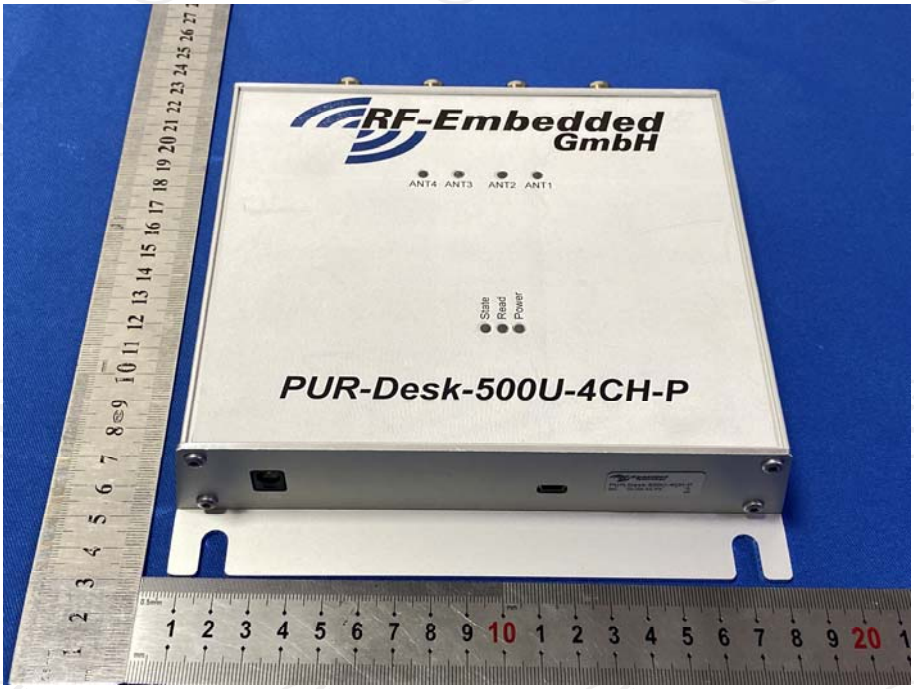
Appendix B: Photographs of EUT

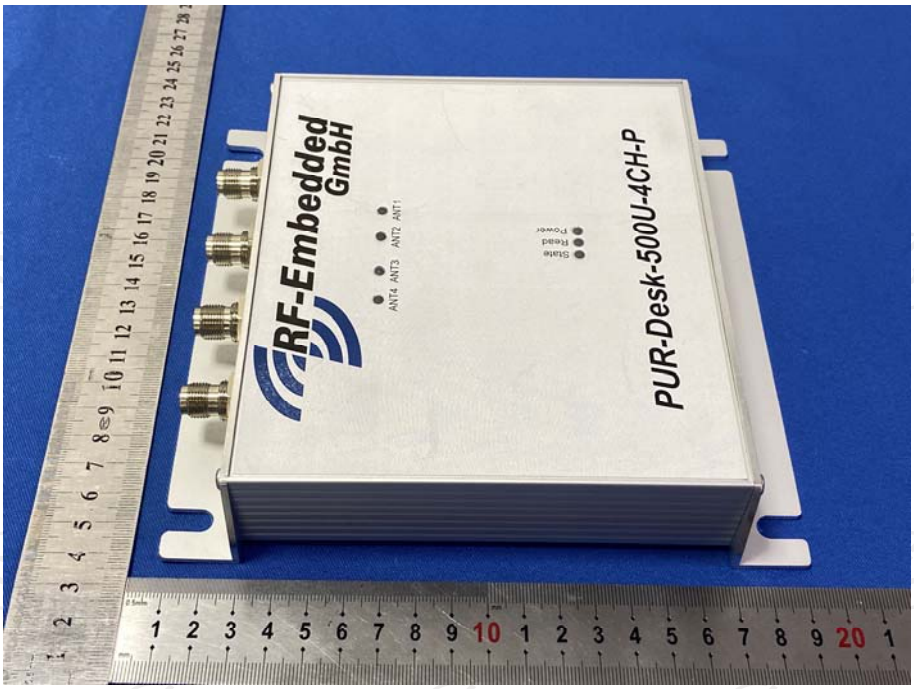
Product: Passive UHF RFID Reader

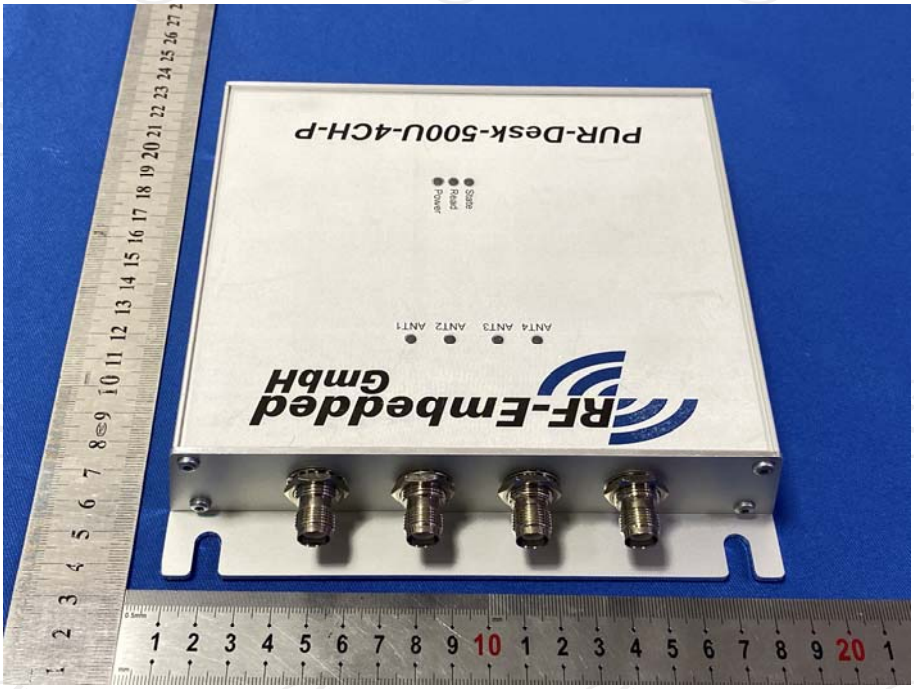
Model: PUR-Desk-500U-4CH-P

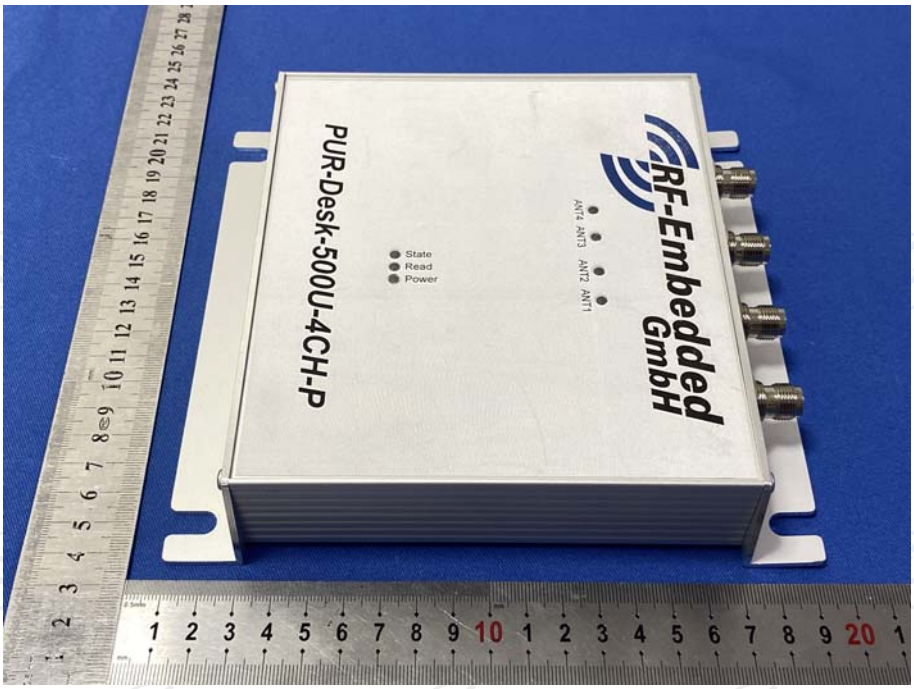
External Photos

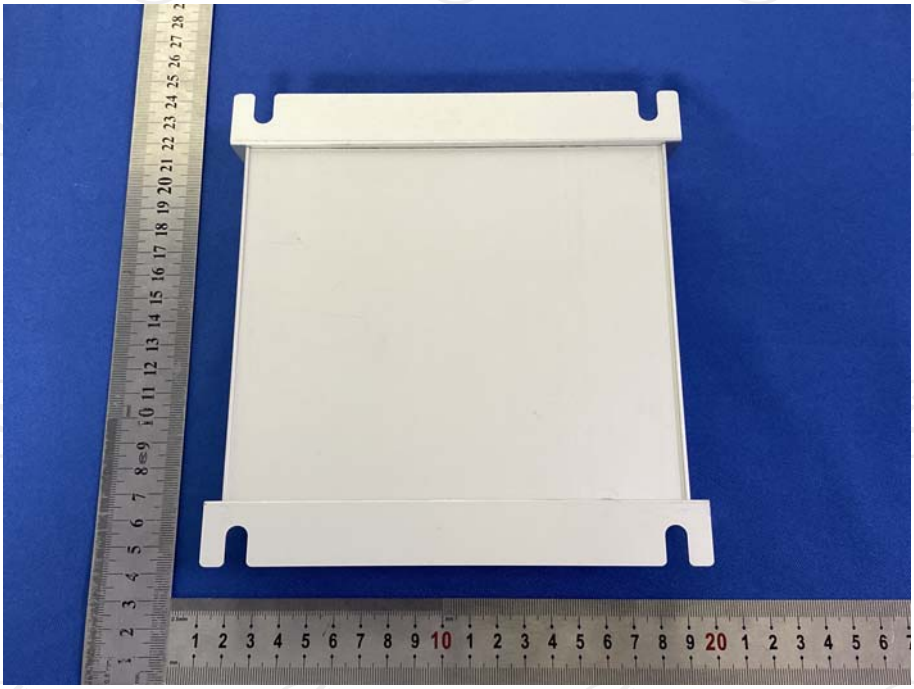




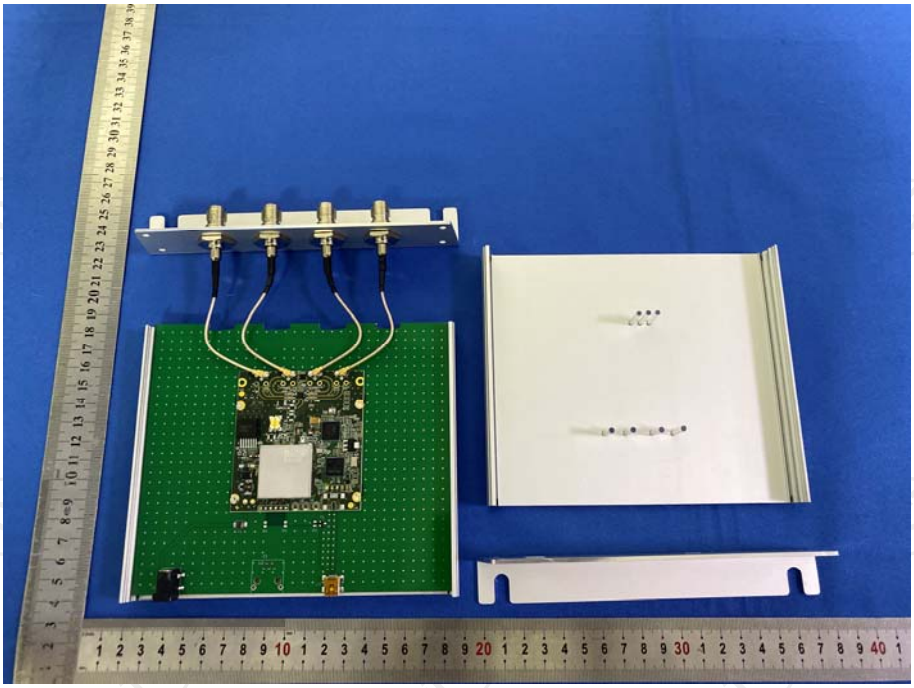

RF-Embedded GmbH
PUR-Desk-500U-4CH-P
ANT4 ANT3 ANT2 ANT1
Power
Field
State

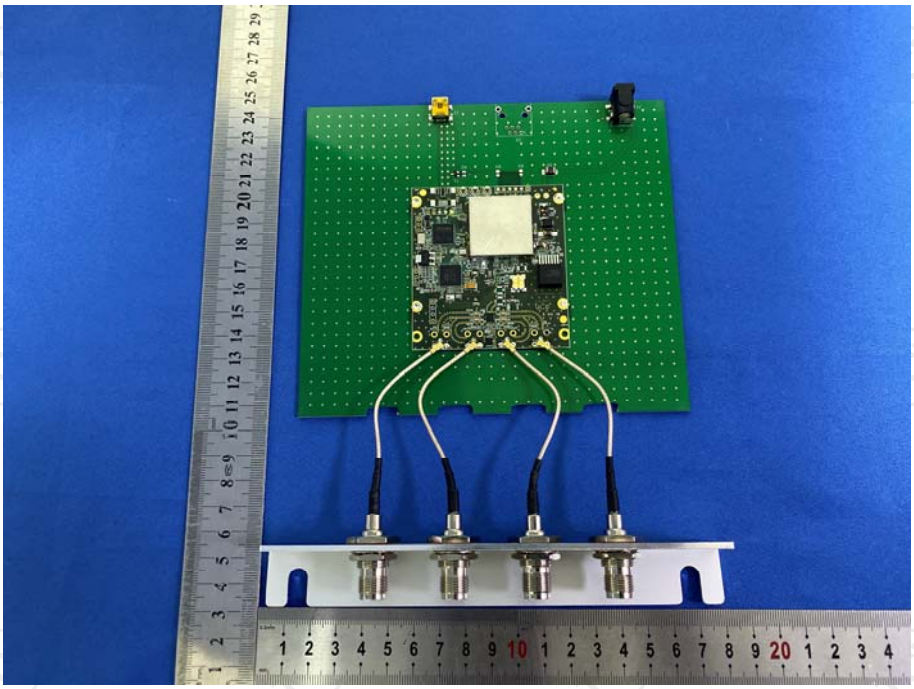

PUR-Desk-500U-4CH-P
RF-Embedded GmbH
ANT4 ANT3 ANT2 ANT1
Power
Field
State


PUR-Desk-500U-4CH-P
RF-Embedded GmbH
State
Read
Power
ANT4
ANT3
ANT2
ANT1



Product: Passive UHF RFID Reader
Model: PUR-Desk-500U-4CH-P
Internal Photos





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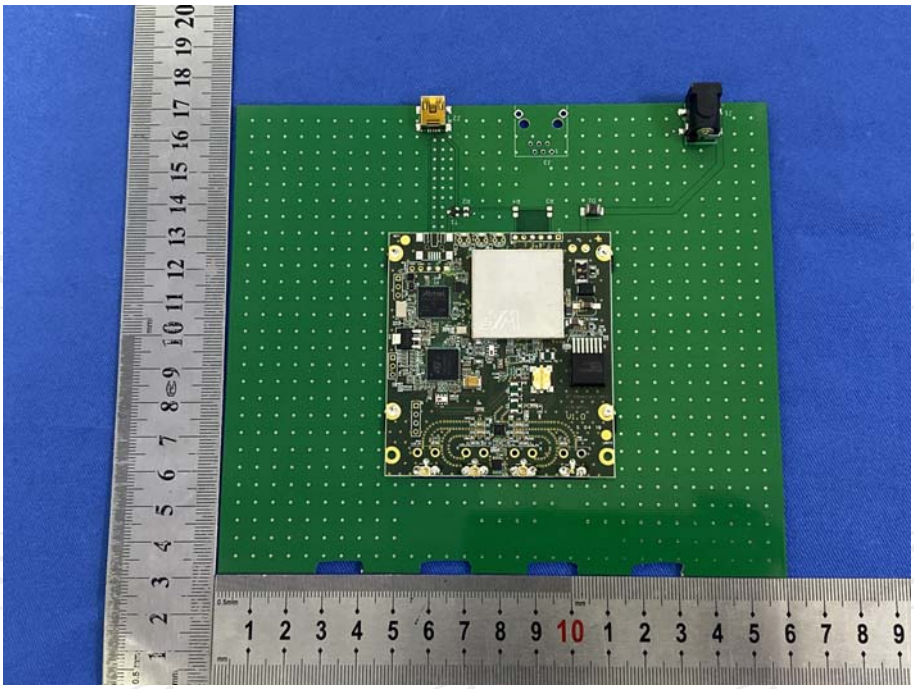

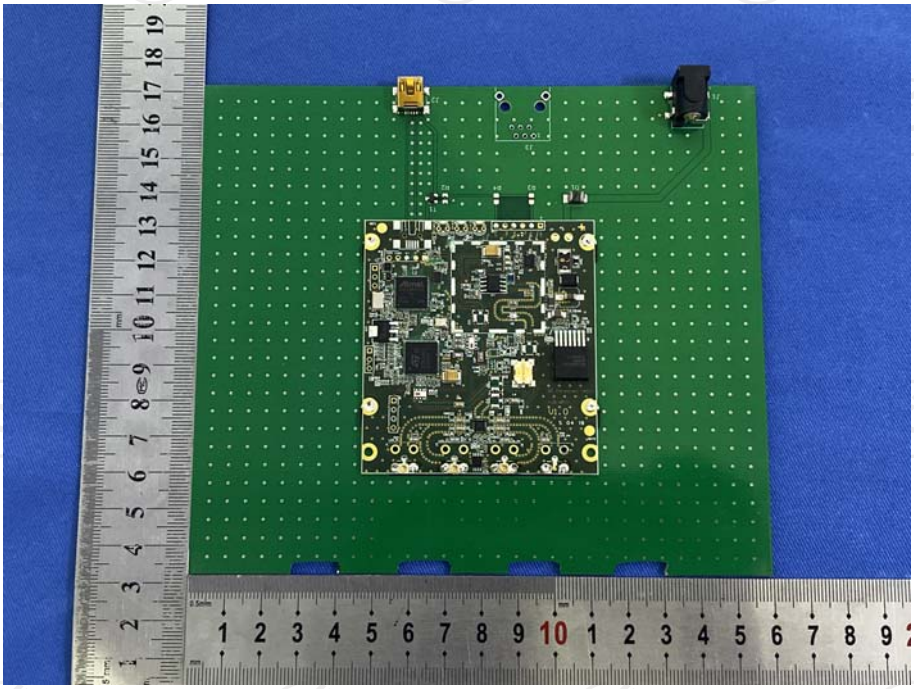

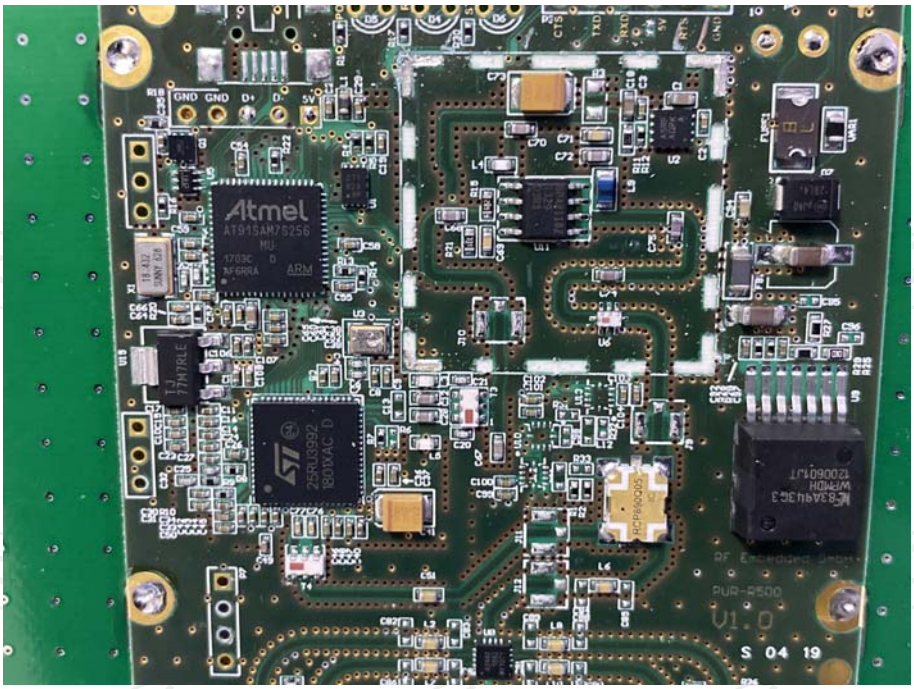

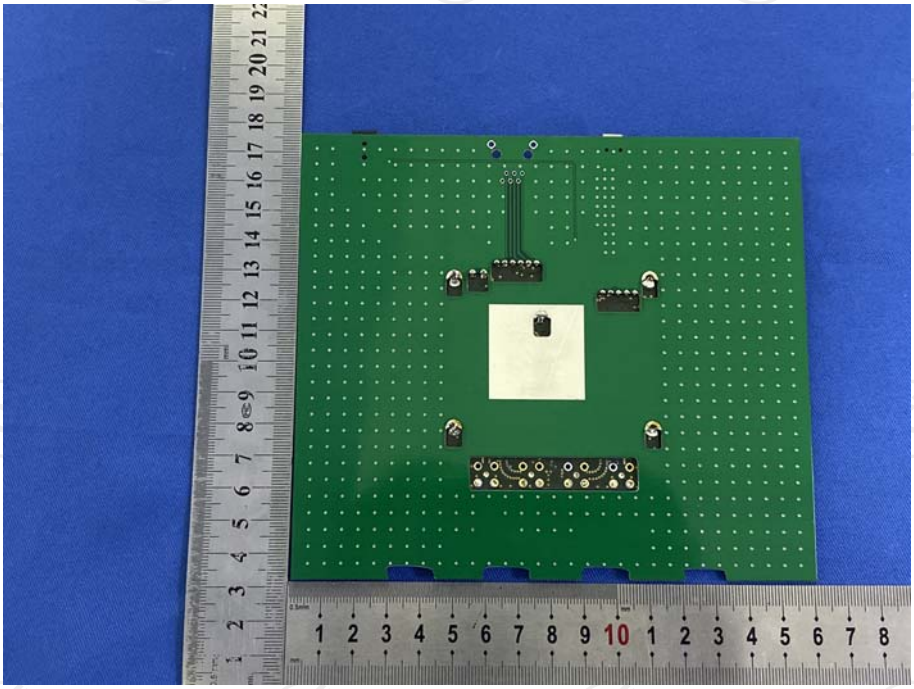

********END OF REPORT********