EMI – TEST REPORT

- FCC 15.247 -

Type / Model Name	:	ARU 2400 Antenna Reader Unit
Product Description	:	RFID UHF Reader 902-928 MHz
Applicant	**:**	Kathrein Sachsen GmbH
Address	:	Lindenstrasse 3
		09241 Mühlau, Germany
Manufacturer	**:**	Kathrein Sachsen GmbH
Address	:	Lindenstrasse 3
		09241 Mühlau, Germany

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Test Report No. : T44114-01-00HU	20. May 2019 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October, 2017)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart B - Unintentional Radiators (October, 2017)

Part 15, Subpart B, Section 15.107	AC Line conducted emissions,
Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2017)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
ANSI C95.1:2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement

2 SUMMARY

GENERAL REMARKS:

The frequency range was scanned from 9 kHz to 10 GHz.

All emissions not reported in this test report were more than 10 dB below the specified limit.

The EuT is a frequency hopping system using 52 channels in the frequency band from 902 to 928 MHz.

The device transmits to each antenna in turn (not all at the same time). This function is controlled via software from the manufacturer and can not changed from the user.

The Reader was tested as a system with different antennas and with original antenna cable which was supplied by manufacturer.

For detailed information about the model and the antenna please refer to the user manual or technical documentation from the manufacturer.

The EuT is declared as Class B digital device.

It is not possible to set the EuT only in receiving mode.

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample	:	acc. to storage records
Testing commenced on	:	12. December 2018
Testing concluded on	:	30. January 2019

Checked by:

Juergen Pessinger
2019.05.21
06:52:04 +02'00'

Pessinger Jürgen

Tested by:

Markus Huber
I am the author of this document
2019.05.20 15:22:00 +02'00'

Huber Markus

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Detailed photos see Attachment A

3.2 Power supply system utilised

Power supply voltage: : Primary: 100-240 V / 50-60 Hz / 1ϕ, 24.0 V DC
Secondary: 24.0 V / DC

3.3 Short description of the EUT

The device is a UHF RFID reader. The UHF RFID Reader can read active and passive Tags in the frequency range from 902 to 928 MHz.

Number of tested samples: 1
Serial number: G0L3745426

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- TAG reading mode supplying max. 27.0 dBm
- Tx mode unmodulated at CH1, CH2, CH25, CH51, CH52
- Tx mode modulated at CH1, CH2, CH25, CH51, CH52
- Standby mode

EUT configuration:

The following peripheral devices and interface cables were connected during the measurements:

-	Test software	Model:	Supplied by manufacturer
-	Lap Top	Model:	Supplied by CSA Group Bayern GmbH
-	Antenna	Model:	See point 4.5.1.3
-	Power supply	Model :	GE18I24, S/N OFB8411071
-		Model:	
-		Model:	

- customer specific cables

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Statement regarding the usage of logos in test reports

The accreditation and notification body logos displayed in this test report are only valid for standards listed in the accreditation or notification scope of CSA Group Bayern GmbH.

4.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	86-106 kPa

4.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 % The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

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Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
20 dB Bandwidth	Center frequency of EuT	95%	± 2.5 x 10^{-7}
99% Occupied Bandwidth	Center frequency of EuT	95%	± 2.5 x 10^{-7}
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Radiated power of the fundamental wave	Center frequency of EuT	95%	± 3.71 dB
Peak conducted output power	902 MHz to 928 MHz	95%	± 0.35 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB

4.5 Measurement Protocol for FCC, VCCI and AUSTEL

4.5.1 GENERAL INFORMATION

4.5.1.1 Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.5.1.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011

4.6 Determination of worst case measurement conditions

Tests were performed with following antenna type and power supply:

- Antenna: - U-LORA-ETSI-FCC, 52010092
  - WIRA-40-linear-FCC, 52010252
  - Internal antenna
  - WRA 7070 Antenna Unit, 52010334

- Power Setting: Standby
- Power setting: 27.0 dBm
- Power setting: 23.0 dBm

- Power supply: Mean Well GE18I24

- PoE switch: D-Link, DGS-1008P
  P/N: EGS1008PM….D1E
  S/N: SY3RI4004871
  H/W Ver.: D1
  PSU: I.T.E Power Supply, NU90-J540167-I1, S/N.:418013104883

The spurious radiated emission measurement (9 kHz up to 1 GHz) was only performed with antenna WIRA-40-linear-FCC (52010252) and power setting 23.0 dBm. The spurious radiated emission measurement (1GHz up to 10 GHz) was only performed with internal antenna and power setting 27.0 dBm.

Pre measurement in the chamber shows that this configurations are the worst case configuration for the relevant spurious emission test.

To find out the worst case setting for the UHF reader for each test, pre tests were performed with different reader settings which are shown in the table “EuT operation mode”.
To keep the test report clear and simple, the tests were carried out and documented in this test report only with these worst case settings.

4.6.1 Functionality of device

Declared by manufacturer:

Example for a Hopping sequence for Kathrein UHF RFID Devices. The channel spacing is500 kHz, the center frequency of the first channel is 902.25MHz. The occupancy time is 400ms for each slot, the slot frequency is determined randomly each time before the slot is used.

Slot Number	Channel Number	Frequency (MHz)	Slot Number	Channel Number	frequency (MHz)
1	21	912.25	27	3	903.25
2	44	923.75	28	39	921.25
3	25	914.25	29	24	913.75
4	36	919.75	30	16	909.75
5	27	915.25	31	51	927.25
6	29	916.25	32	26	914.75
7	35	919.25	33	4	903.75
8	49	926.25	34	47	925.25
9	6	904.75	35	18	910.75
10	46	924.75	36	40	921.75
11	19	911.25	37	11	907.25
12	20	911.75	38	48	925.75
13	45	924.25	39	7	905.25
14	22	912.75	40	12	907.75
15	30	916.75	41	23	913.25
16	8	905.75	42	13	908.25
17	42	922.75	43	31	917.25
18	52	927.75	44	2	902.75
19	14	908.75	45	1	902.25
20	37	920.25	46	43	923.25
21	41	922.25	47	50	926.75
22	17	910.25	48	33	918.25
23	5	904.25	49	34	918.75
24	10	906.75	50	32	917.75
25	15	909.25	51	28	915.75
26	38	920.75	52	9	906.25

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

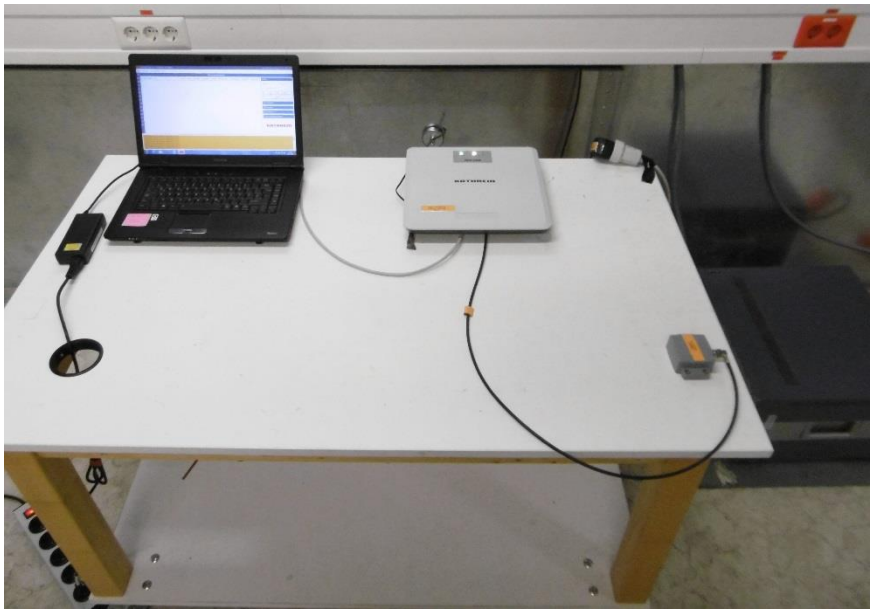
For test instruments and accessories used see section 6 Part **A 4**.

5.1.1 Description of the test location

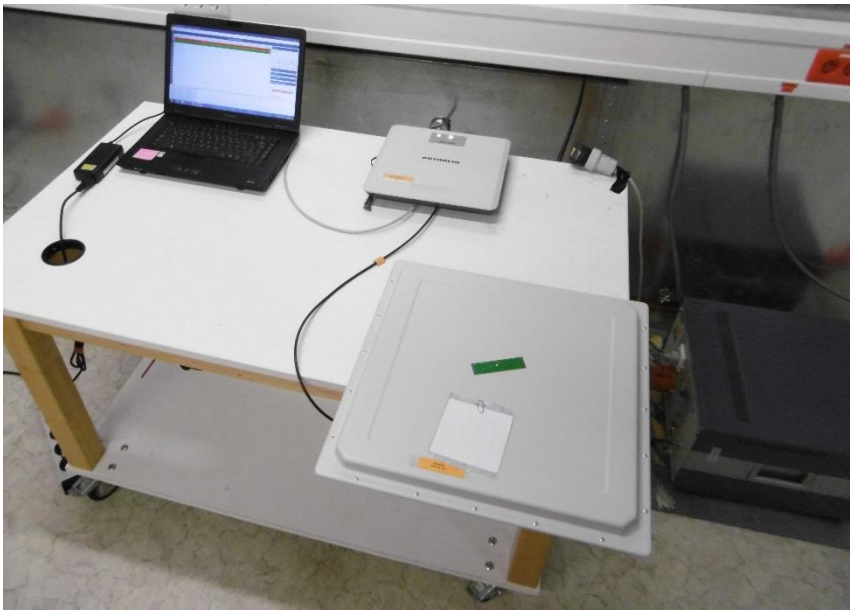
Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up

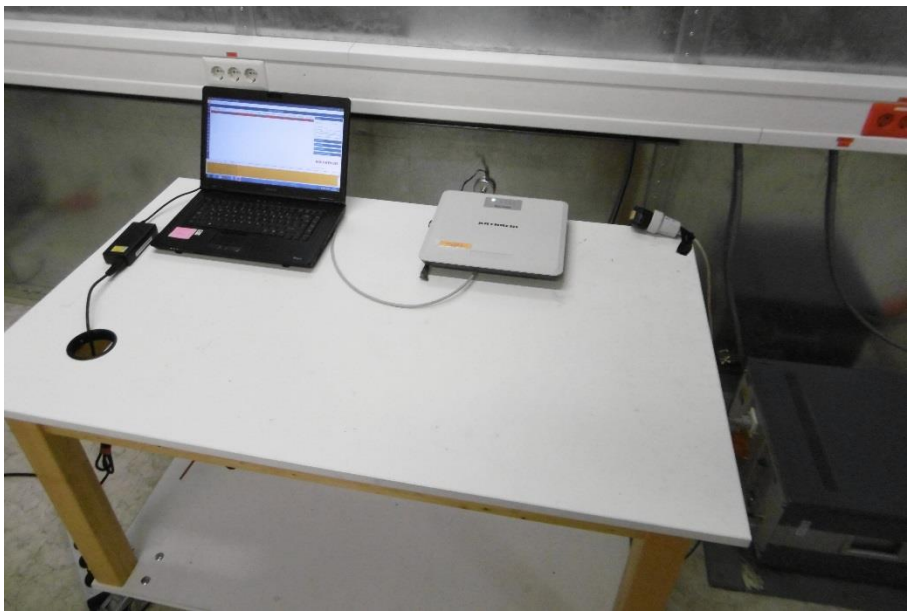
- U-LORA-ETSI-FCC, 52010092



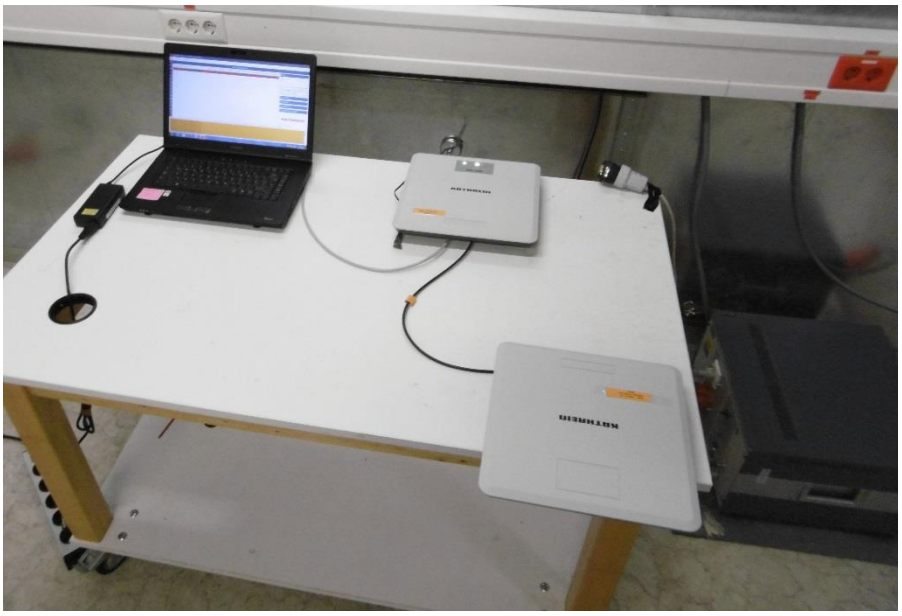
- WIRA-40-linear-FCC, 52010252



- Internal antenna:



- WRA 7070 Antenna Unit, 52010334



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- Internal antenna – powered via PoE:

5.1.3 Applicable standard

According to FCC Part 15C, Section 15.207(a):
Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

5.1.4 Description of Measurement

The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a line impedance stabilization network (LISN) with 50 Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded.
To convert between dBμV and μV, the following conversions apply:

dBμV = 20 log μV
μV = 10^(dBμV/20)

5.1.5 Test result

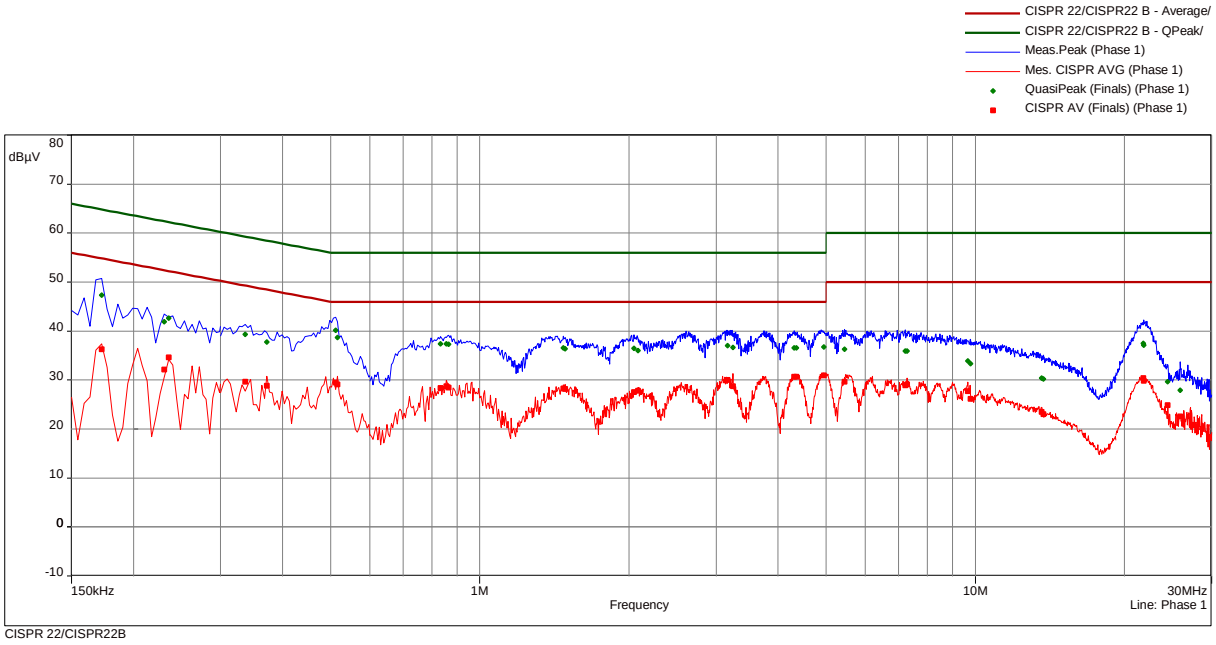
Frequency range: 0.15 MHz - 30 MHz
Min. limit margin 13.20 dB at 0.507 MHz (Standby, WRA 7070 Antenna Unit, 52010334)

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocols.

5.1.6 Test protocol

Test point L1 Result: Passed
Operation mode: Tag reading mode
Remarks: U-LORA-ETSI-FCC, 52010092



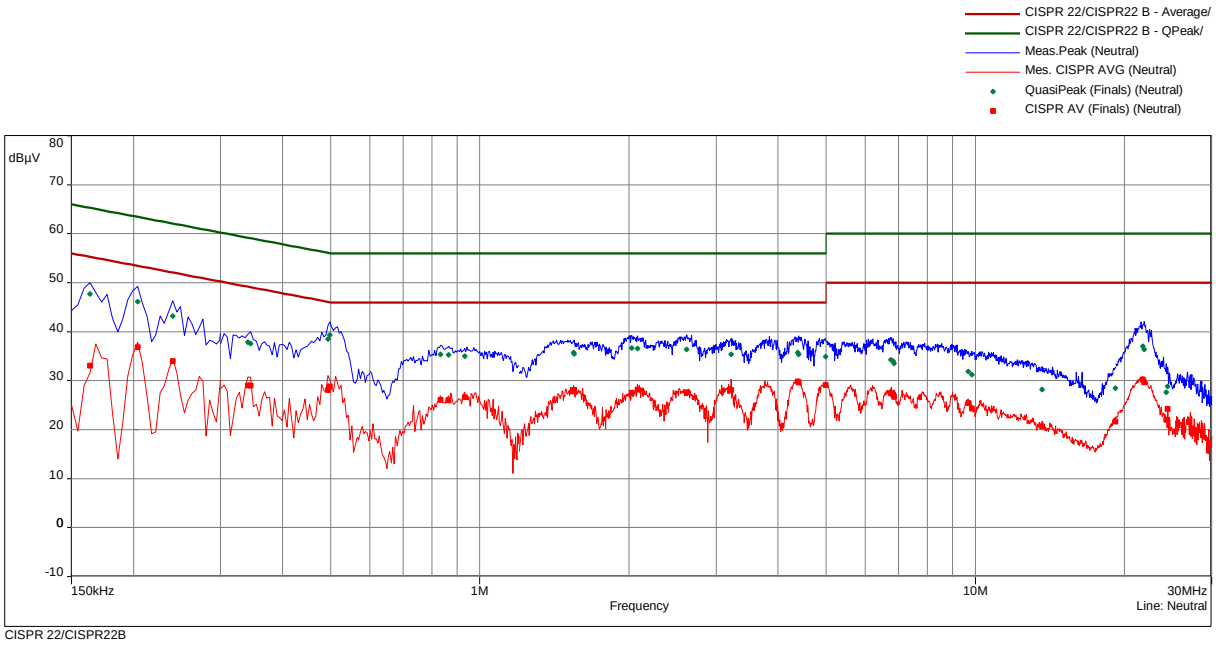
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1725	1	47.35	17.49	64.84	36.32	18.52	54.84	Phase 1	10.08
0.231	1	41.89	20.53	62.41	32.15	20.27	52.41	Phase 1	10.10
0.2355	1	42.63	19.62	62.25	34.63	17.63	52.25	Phase 1	10.10
0.336	2	39.33	19.97	59.30	29.65	19.65	49.30	Phase 1	10.13
0.372	2	37.74	20.72	58.46	28.87	19.58	48.46	Phase 1	10.14
0.5115	2	40.18	15.82	56.00	29.46	16.54	46.00	Phase 1	10.14
0.516	2	38.71	17.29	56.00	29.14	16.86	46.00	Phase 1	10.14
0.834	3	37.44	18.56	56.00	28.35	17.65	46.00	Phase 1	10.19
0.8565	3	37.39	18.61	56.00	28.72	17.28	46.00	Phase 1	10.19
0.8655	3	37.28	18.72	56.00	28.48	17.52	46.00	Phase 1	10.19
1.4745	4	36.55	19.45	56.00	28.33	17.67	46.00	Phase 1	10.25
1.488	4	36.35	19.65	56.00	28.16	17.84	46.00	Phase 1	10.25
2.046	4	36.51	19.49	56.00	27.52	18.48	46.00	Phase 1	10.27
2.0865	4	36.04	19.96	56.00	27.80	18.20	46.00	Phase 1	10.27
3.165	5	37.07	18.93	56.00	30.06	15.94	46.00	Phase 1	10.35
3.2415	5	36.65	19.35	56.00	28.70	17.30	46.00	Phase 1	10.35
4.3125	5	36.59	19.41	56.00	30.71	15.29	46.00	Phase 1	10.41
4.353	5	36.61	19.39	56.00	30.70	15.30	46.00	Phase 1	10.42
4.944	6	36.78	19.22	56.00	30.93	15.07	46.00	Phase 1	10.44
5.448	6	36.30	23.70	60.00	29.66	20.34	50.00	Phase 1	10.48
7.2255	6	35.91	24.09	60.00	28.91	21.09	50.00	Phase 1	10.61
7.284	6	35.95	24.05	60.00	29.15	20.85	50.00	Phase 1	10.61

FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
9.663	7	33.93	26.07	60.00	27.70	22.30	50.00	Phase 1	10.70
9.7845	7	33.33	26.67	60.00	26.13	23.87	50.00	Phase 1	10.70
13.605	7	30.42	29.58	60.00	23.49	26.51	50.00	Phase 1	10.99
13.7265	7	30.18	29.82	60.00	23.08	26.92	50.00	Phase 1	11.00
21.8145	8	37.47	22.53	60.00	30.36	19.64	50.00	Phase 1	11.40
21.9	8	37.13	22.87	60.00	29.89	20.11	50.00	Phase 1	11.40
24.4515	8	29.68	30.32	60.00	24.92	25.08	50.00	Phase 1	11.47
25.896	8	27.92	32.08	60.00	22.62	27.38	50.00	Phase 1	11.46

FCC ID: WJ9-ARU2400

Test point N Result: Passed
Operation mode: Tag reading mode
Remarks: U-LORA-ETSI-FCC, 52010092



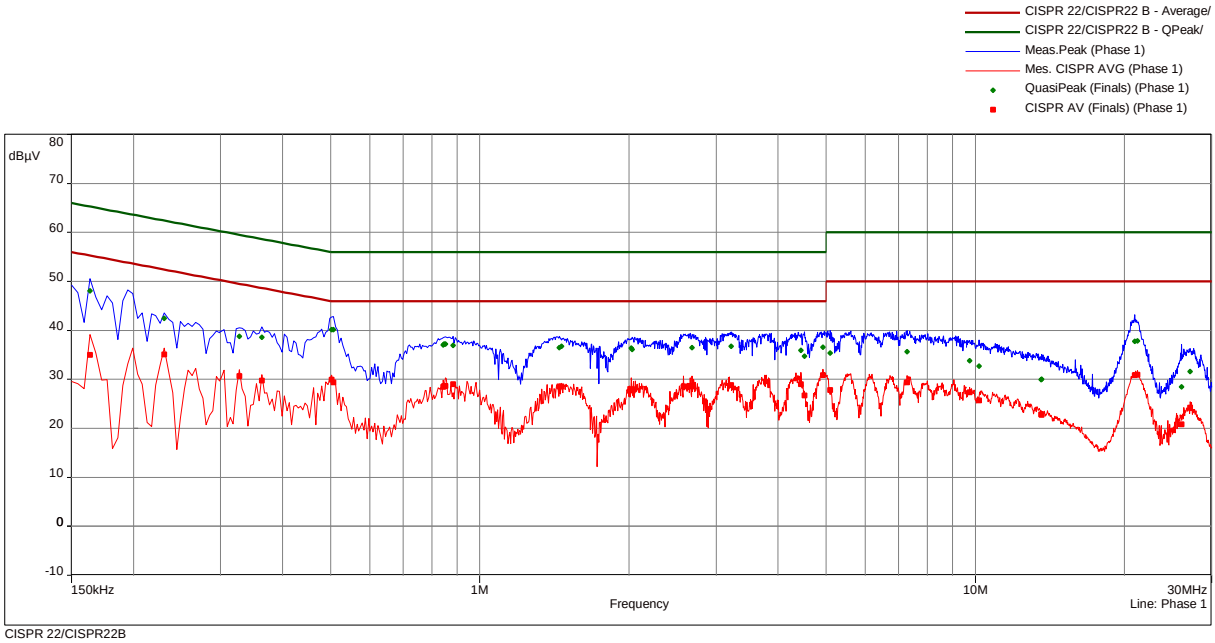
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1635	9	47.70	17.58	65.28	33.12	22.17	55.28	Neutral	10.09
0.204	9	46.13	17.32	63.45	36.81	16.63	53.45	Neutral	10.10
0.24	9	43.16	18.93	62.10	33.95	18.14	52.10	Neutral	10.11
0.3405	10	37.83	21.36	59.19	29.01	20.18	49.19	Neutral	10.14
0.345	10	37.56	21.52	59.08	29.02	20.06	49.08	Neutral	10.14
0.4935	10	38.47	17.64	56.11	28.08	18.03	46.11	Neutral	10.15
0.498	10	39.32	16.71	56.03	28.86	17.17	46.03	Neutral	10.15
0.834	11	35.34	20.66	56.00	26.07	19.93	46.00	Neutral	10.19
0.8655	11	35.26	20.74	56.00	26.00	20.00	46.00	Neutral	10.19
0.933	11	34.96	21.04	56.00	26.64	19.36	46.00	Neutral	10.19
1.5465	12	35.73	20.27	56.00	28.14	17.86	46.00	Neutral	10.27
1.551	12	35.48	20.52	56.00	27.86	18.14	46.00	Neutral	10.27
2.028	12	36.67	19.33	56.00	27.60	18.40	46.00	Neutral	10.28
2.082	12	36.58	19.42	56.00	28.24	17.76	46.00	Neutral	10.28
2.616	13	36.38	19.62	56.00	27.63	18.37	46.00	Neutral	10.33
3.2145	13	35.33	20.67	56.00	28.11	17.89	46.00	Neutral	10.36
4.38	13	35.74	20.26	56.00	29.84	16.16	46.00	Neutral	10.43
4.398	13	35.40	20.60	56.00	29.63	16.37	46.00	Neutral	10.43
4.989	14	34.93	21.07	56.00	29.16	16.84	46.00	Neutral	10.46
6.753	14	34.28	25.72	60.00	27.44	22.56	50.00	Neutral	10.59
6.825	14	34.03	25.97	60.00	27.20	22.80	50.00	Neutral	10.59
6.852	14	33.50	26.50	60.00	26.68	23.32	50.00	Neutral	10.59

FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
9.681	15	31.87	28.13	60.00	25.47	24.53	50.00	Neutral	10.69
9.8385	15	31.26	28.74	60.00	24.31	25.69	50.00	Neutral	10.69
13.6275	15	28.15	31.85	60.00	20.69	29.31	50.00	Neutral	10.96
19.176	15	28.45	31.55	60.00	21.62	28.38	50.00	Neutral	11.32
21.783	16	37.08	22.92	60.00	30.25	19.75	50.00	Neutral	11.38
21.9225	16	36.37	23.63	60.00	29.67	20.33	50.00	Neutral	11.37
24.294	16	27.62	32.38	60.00	22.07	27.93	50.00	Neutral	11.38
24.4515	16	28.83	31.17	60.00	24.25	25.75	50.00	Neutral	11.37

FCC ID: WJ9-ARU2400

Test point L1 Result: Passed
Operation mode: Tag reading mode
Remarks: WIRA-40-linear-FCC, 52010252



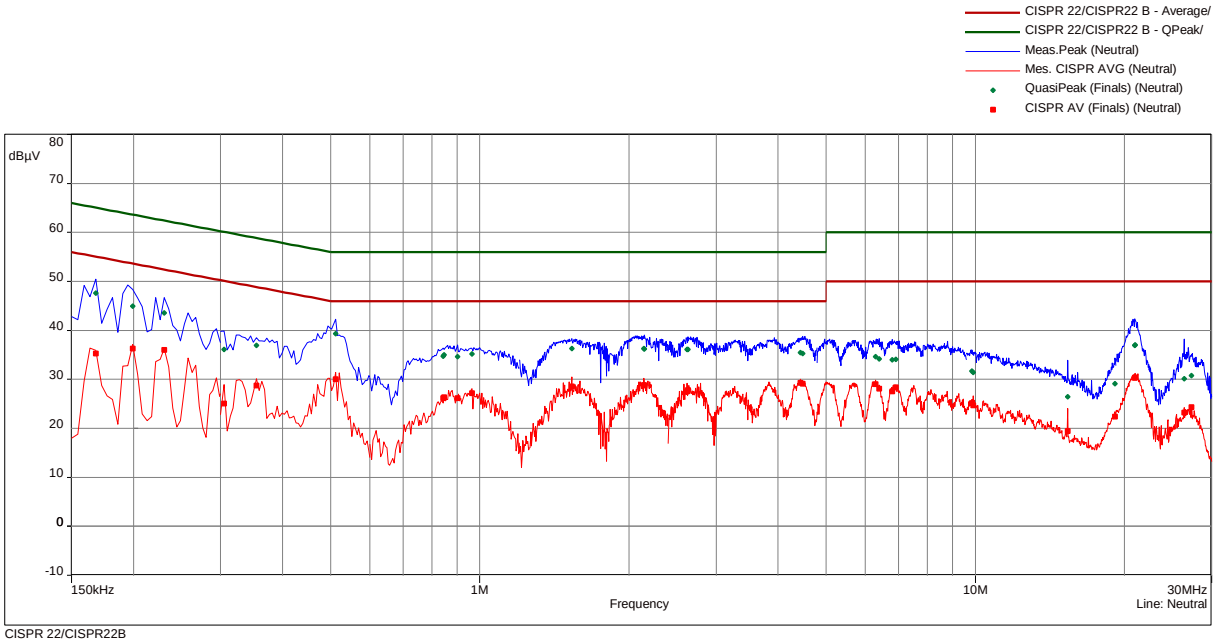
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1635	1	48.04	17.24	65.28	35.01	20.28	55.28	Phase 1	10.08
0.231	1	42.43	19.98	62.41	35.11	17.30	52.41	Phase 1	10.10
0.327	2	38.76	20.77	59.53	30.67	18.86	49.53	Phase 1	10.13
0.363	2	38.61	20.05	58.66	29.78	18.88	48.66	Phase 1	10.14
0.5025	2	40.19	15.81	56.00	29.94	16.06	46.00	Phase 1	10.14
0.507	2	40.12	15.88	56.00	29.41	16.59	46.00	Phase 1	10.14
0.843	3	37.07	18.93	56.00	28.50	17.50	46.00	Phase 1	10.19
0.8475	3	37.25	18.75	56.00	28.70	17.30	46.00	Phase 1	10.19
0.852	3	37.25	18.75	56.00	28.66	17.34	46.00	Phase 1	10.19
0.8835	3	36.95	19.05	56.00	29.04	16.96	46.00	Phase 1	10.19
1.4475	4	36.45	19.55	56.00	28.53	17.47	46.00	Phase 1	10.25
1.461	4	36.71	19.29	56.00	28.60	17.40	46.00	Phase 1	10.25

FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
2.0235	4	36.36	19.64	56.00	27.81	18.19	46.00	Phase 1	10.27
2.0325	4	36.12	19.88	56.00	27.99	18.01	46.00	Phase 1	10.27
2.679	5	36.46	19.54	56.00	28.56	17.44	46.00	Phase 1	10.33
3.2145	5	36.75	19.25	56.00	28.84	17.16	46.00	Phase 1	10.35
4.443	5	35.97	20.03	56.00	29.06	16.94	46.00	Phase 1	10.42
4.524	5	34.71	21.29	56.00	26.75	19.25	46.00	Phase 1	10.42
4.9305	6	36.53	19.47	56.00	30.84	15.16	46.00	Phase 1	10.44
5.0925	6	35.35	24.65	60.00	27.82	22.18	50.00	Phase 1	10.45
7.2795	6	35.65	24.35	60.00	29.36	20.64	50.00	Phase 1	10.61
9.7395	7	33.78	26.22	60.00	27.40	22.60	50.00	Phase 1	10.70
10.1805	7	32.73	27.27	60.00	25.74	24.26	50.00	Phase 1	10.72
13.5825	7	29.97	30.03	60.00	22.83	27.17	50.00	Phase 1	10.99
13.614	7	30.01	29.99	60.00	22.77	27.23	50.00	Phase 1	10.99
20.9955	8	37.78	22.22	60.00	30.90	19.10	50.00	Phase 1	11.37
21.261	8	37.84	22.16	60.00	30.94	19.06	50.00	Phase 1	11.38
26.103	8	28.51	31.49	60.00	20.85	29.15	50.00	Phase 1	11.46
27.1515	8	31.58	28.42	60.00	24.26	25.74	50.00	Phase 1	11.43

FCC ID: WJ9-ARU2400

Test point N Result: Passed
Operation mode: Tag reading mode
Remarks: WIRA-40-linear-FCC, 52010252



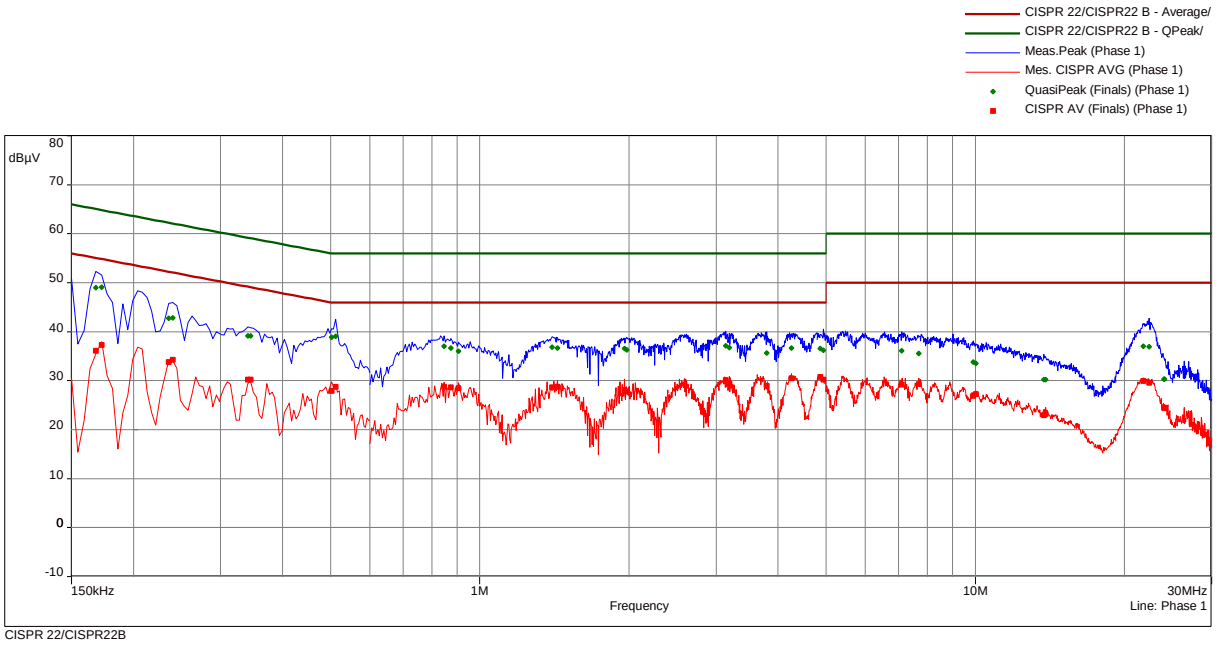
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.168	9	47.58	17.48	65.06	35.30	19.76	55.06	Neutral	10.09
0.1995	9	44.98	18.65	63.63	36.27	17.37	53.63	Neutral	10.10
0.231	9	43.53	18.88	62.41	36.05	16.36	52.41	Neutral	10.11
0.3045	10	36.07	24.05	60.12	25.04	25.08	50.12	Neutral	10.13
0.354	10	36.97	21.90	58.87	28.78	20.09	48.87	Neutral	10.14
0.5115	10	39.30	16.70	56.00	30.02	15.98	46.00	Neutral	10.15
0.843	11	34.78	21.22	56.00	26.20	19.80	46.00	Neutral	10.19
0.8475	11	34.99	21.01	56.00	26.35	19.65	46.00	Neutral	10.19
0.9015	11	34.62	21.38	56.00	26.19	19.81	46.00	Neutral	10.19
0.9645	11	35.15	20.85	56.00	27.20	18.80	46.00	Neutral	10.19
1.533	12	36.26	19.74	56.00	28.60	17.40	46.00	Neutral	10.27
2.145	12	36.28	19.72	56.00	28.85	17.15	46.00	Neutral	10.29
2.1495	12	36.20	19.80	56.00	28.70	17.30	46.00	Neutral	10.29
2.6205	13	36.08	19.92	56.00	27.55	18.45	46.00	Neutral	10.33
2.634	13	36.14	19.86	56.00	27.87	18.13	46.00	Neutral	10.33

FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
4.434	13	35.44	20.56	56.00	29.32	16.68	46.00	Neutral	10.43
4.488	13	35.29	20.71	56.00	29.10	16.90	46.00	Neutral	10.43
6.2895	14	34.60	25.40	60.00	29.00	21.00	50.00	Neutral	10.55
6.393	14	34.16	25.84	60.00	28.06	21.94	50.00	Neutral	10.56
6.798	14	33.99	26.01	60.00	27.54	22.46	50.00	Neutral	10.59
6.9195	14	34.12	25.88	60.00	28.39	21.61	50.00	Neutral	10.59
9.8385	15	31.67	28.33	60.00	25.16	24.84	50.00	Neutral	10.69
9.906	15	31.44	28.56	60.00	24.67	25.33	50.00	Neutral	10.70
15.351	15	26.43	33.57	60.00	19.47	30.53	50.00	Neutral	11.07
19.14	15	29.10	30.90	60.00	22.40	27.60	50.00	Neutral	11.32
21	16	36.99	23.01	60.00	30.32	19.68	50.00	Neutral	11.37
21.027	16	37.03	22.97	60.00	30.42	19.58	50.00	Neutral	11.37
26.4225	16	30.15	29.85	60.00	23.23	26.77	50.00	Neutral	11.32
27.309	16	30.80	29.20	60.00	24.31	25.69	50.00	Neutral	11.29

FCC ID: WJ9-ARU2400

Test point L1 Result: Passed
Operation mode: Tag reading mode
Remarks: Internal antenna



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.168	1	48.96	16.10	65.06	36.07	18.99	55.06	Phase 1	10.08
0.1725	1	49.12	15.72	64.84	37.28	17.56	54.84	Phase 1	10.08
0.2355	1	42.70	19.56	62.25	33.84	18.41	52.25	Phase 1	10.10
0.24	1	42.85	19.25	62.10	34.25	17.84	52.10	Phase 1	10.10
0.3405	2	39.11	20.08	59.19	30.23	18.96	49.19	Phase 1	10.13
0.345	2	39.19	19.89	59.08	30.20	18.88	49.08	Phase 1	10.13
0.5025	2	38.90	17.10	56.00	27.90	18.10	46.00	Phase 1	10.14
0.5115	2	39.02	16.98	56.00	28.74	17.26	46.00	Phase 1	10.14
0.8475	3	37.03	18.97	56.00	28.78	17.22	46.00	Phase 1	10.19
0.8745	3	36.66	19.34	56.00	28.62	17.38	46.00	Phase 1	10.19
0.906	3	36.05	19.95	56.00	28.51	17.49	46.00	Phase 1	10.19
1.398	4	36.87	19.13	56.00	28.64	17.36	46.00	Phase 1	10.24
1.434	4	36.66	19.34	56.00	28.79	17.21	46.00	Phase 1	10.25
1.9605	4	36.54	19.46	56.00	28.06	17.94	46.00	Phase 1	10.26
1.9785	4	36.31	19.69	56.00	27.83	18.17	46.00	Phase 1	10.26

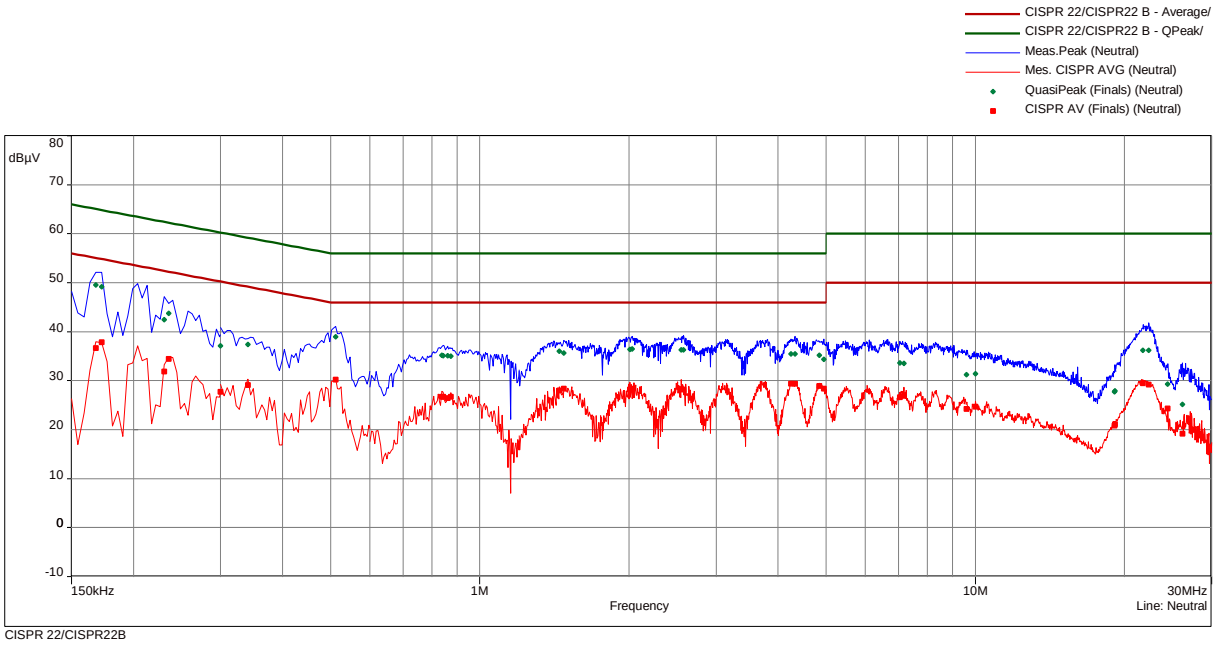
FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
3.1335	5	37.12	18.88	56.00	30.14	15.86	46.00	Phase 1	10.35
3.1875	5	36.73	19.27	56.00	29.42	16.58	46.00	Phase 1	10.35
3.795	5	35.69	20.31	56.00	28.96	17.04	46.00	Phase 1	10.37
4.254	5	36.63	19.37	56.00	30.50	15.50	46.00	Phase 1	10.41
4.8675	6	36.60	19.40	56.00	30.76	15.24	46.00	Phase 1	10.44
4.9395	6	36.19	19.81	56.00	30.24	15.76	46.00	Phase 1	10.44
7.1085	6	36.08	23.92	60.00	29.17	20.83	50.00	Phase 1	10.60
7.689	6	35.56	24.44	60.00	29.26	20.74	50.00	Phase 1	10.63
9.906	7	33.77	26.23	60.00	26.88	23.12	50.00	Phase 1	10.71
10.023	7	33.50	26.50	60.00	27.28	22.72	50.00	Phase 1	10.71
13.749	7	30.26	29.74	60.00	22.93	27.07	50.00	Phase 1	11.00
13.8705	7	30.25	29.75	60.00	23.25	26.75	50.00	Phase 1	11.01
21.8145	8	37.06	22.94	60.00	29.96	20.04	50.00	Phase 1	11.40
22.422	8	36.93	23.07	60.00	29.60	20.40	50.00	Phase 1	11.41
24.024	8	30.32	29.68	60.00	24.56	25.44	50.00	Phase 1	11.46
24.087	8	30.30	29.70	60.00	24.47	25.53	50.00	Phase 1	11.46

FCC ID: WJ9-ARU2400

Test point N
Operation mode: Tag reading mode
Remarks: Internal antenna

Result: Passed



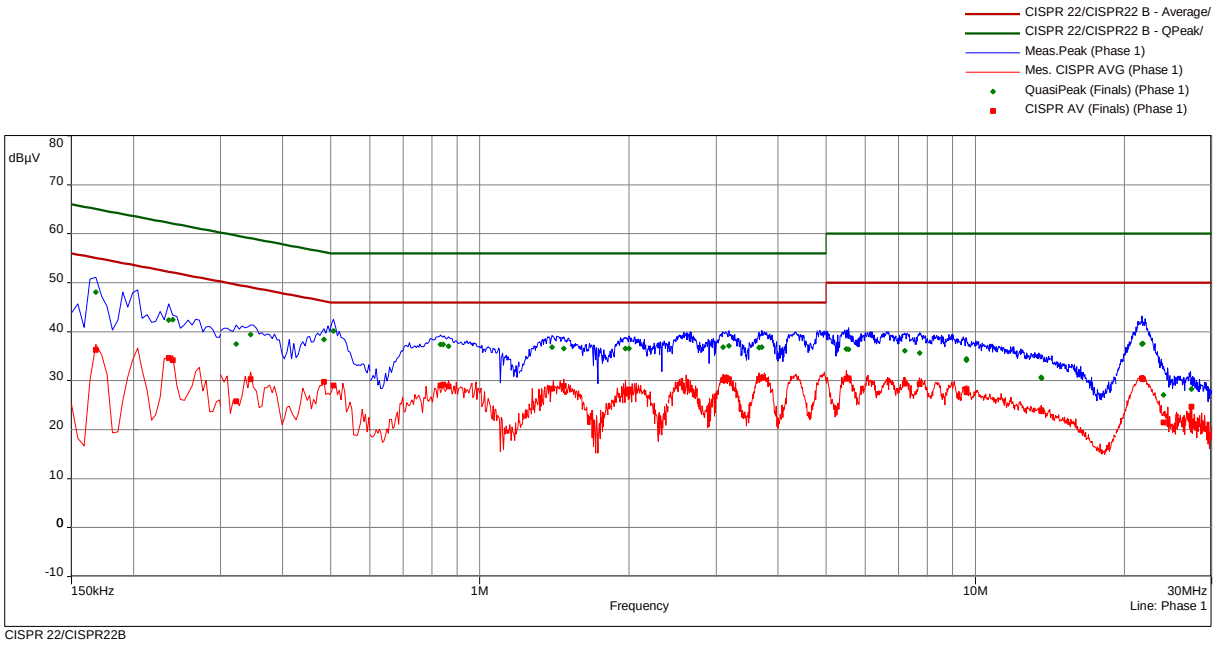
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.168	9	49.51	15.55	65.06	36.67	18.39	55.06	Neutral	10.09
0.1725	9	49.20	15.64	64.84	37.84	17.00	54.84	Neutral	10.09
0.231	9	42.44	19.97	62.41	31.84	20.57	52.41	Neutral	10.11
0.2355	9	43.74	18.51	62.25	34.43	17.82	52.25	Neutral	10.11
0.3	10	37.10	23.15	60.24	27.73	22.52	50.24	Neutral	10.13
0.3405	10	37.38	21.82	59.19	29.15	20.04	49.19	Neutral	10.14
0.5115	10	38.93	17.07	56.00	30.25	15.75	46.00	Neutral	10.15
0.8385	11	35.20	20.80	56.00	26.73	19.27	46.00	Neutral	10.19
0.843	11	35.11	20.89	56.00	26.69	19.31	46.00	Neutral	10.19
0.861	11	35.09	20.91	56.00	26.45	19.55	46.00	Neutral	10.19
0.8745	11	34.96	21.04	56.00	26.69	19.31	46.00	Neutral	10.19
1.4475	12	36.01	19.99	56.00	28.03	17.97	46.00	Neutral	10.26
1.479	12	35.61	20.39	56.00	28.36	17.64	46.00	Neutral	10.26
2.01	12	36.38	19.62	56.00	28.18	17.82	46.00	Neutral	10.28
2.0325	12	36.50	19.50	56.00	28.42	17.58	46.00	Neutral	10.28
2.5485	13	36.30	19.70	56.00	28.25	17.75	46.00	Neutral	10.33
2.5755	13	36.29	19.71	56.00	28.22	17.78	46.00	Neutral	10.33

FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
4.245	13	35.46	20.54	56.00	29.36	16.64	46.00	Neutral	10.42
4.3305	13	35.48	20.52	56.00	29.42	16.58	46.00	Neutral	10.42
4.8495	14	35.16	20.84	56.00	28.98	17.02	46.00	Neutral	10.45
4.9485	14	34.36	21.64	56.00	28.38	17.62	46.00	Neutral	10.45
7.0455	14	33.59	26.41	60.00	26.60	23.40	50.00	Neutral	10.60
7.1805	14	33.57	26.43	60.00	26.89	23.11	50.00	Neutral	10.60
9.609	15	31.28	28.72	60.00	24.24	25.76	50.00	Neutral	10.69
10.0005	15	31.45	28.55	60.00	24.66	25.34	50.00	Neutral	10.70
19.086	15	27.77	32.23	60.00	20.81	29.19	50.00	Neutral	11.32
19.1445	15	27.94	32.06	60.00	21.14	28.86	50.00	Neutral	11.32
21.8055	16	36.19	23.81	60.00	29.48	20.52	50.00	Neutral	11.37
22.3905	16	36.17	23.83	60.00	29.17	20.83	50.00	Neutral	11.37
24.4515	16	29.33	30.67	60.00	24.30	25.70	50.00	Neutral	11.37
26.193	16	25.19	34.81	60.00	19.21	30.79	50.00	Neutral	11.33

FCC ID: WJ9-ARU2400

Test point L1 Result: Passed
Operation mode: Tag reading mode
Remarks: WRA 7070 Antenna Unit, 52010334



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.168	1	48.07	16.99	65.06	36.28	18.78	55.06	Phase 1	10.08
0.2355	1	42.35	19.91	62.25	34.61	17.64	52.25	Phase 1	10.10
0.24	1	42.50	19.60	62.10	34.19	17.91	52.10	Phase 1	10.10
0.3225	2	37.47	22.18	59.64	25.85	23.80	49.64	Phase 1	10.13
0.345	2	39.44	19.64	59.08	30.35	18.73	49.08	Phase 1	10.13
0.4845	2	38.38	17.88	56.26	29.80	16.46	46.26	Phase 1	10.14
0.507	2	40.12	15.88	56.00	29.03	16.97	46.00	Phase 1	10.14
0.834	3	37.43	18.57	56.00	29.05	16.95	46.00	Phase 1	10.19
0.843	3	37.42	18.58	56.00	29.19	16.81	46.00	Phase 1	10.19
0.8655	3	36.99	19.01	56.00	28.87	17.13	46.00	Phase 1	10.19
1.398	4	36.88	19.12	56.00	28.37	17.63	46.00	Phase 1	10.24
1.479	4	36.57	19.43	56.00	28.95	17.05	46.00	Phase 1	10.25
1.9695	4	36.59	19.41	56.00	27.81	18.19	46.00	Phase 1	10.26
2.001	4	36.59	19.41	56.00	28.17	17.83	46.00	Phase 1	10.26

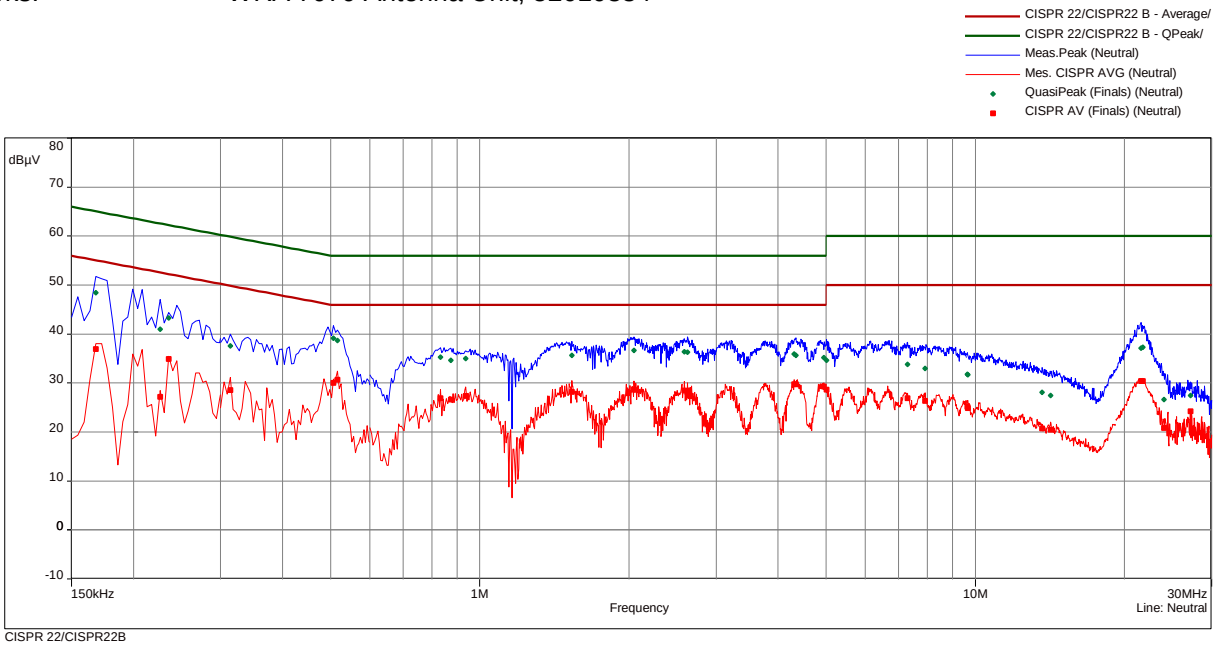
FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
3.0975	5	36.88	19.12	56.00	30.16	15.84	46.00	Phase 1	10.34
3.183	5	37.12	18.88	56.00	30.28	15.72	46.00	Phase 1	10.35
3.6645	5	36.73	19.27	56.00	30.36	15.64	46.00	Phase 1	10.36
3.7095	5	36.86	19.14	56.00	30.59	15.41	46.00	Phase 1	10.37
5.4975	6	36.45	23.55	60.00	30.37	19.63	50.00	Phase 1	10.49
5.5515	6	36.39	23.61	60.00	30.47	19.53	50.00	Phase 1	10.49
7.212	6	36.12	23.88	60.00	29.42	20.58	50.00	Phase 1	10.61
7.725	6	35.65	24.35	60.00	29.34	20.66	50.00	Phase 1	10.63
9.6045	7	34.47	25.53	60.00	28.33	21.67	50.00	Phase 1	10.70
9.609	7	34.17	25.83	60.00	27.61	22.39	50.00	Phase 1	10.70
13.587	7	30.65	29.35	60.00	24.00	26.00	50.00	Phase 1	10.99
13.623	7	30.46	29.54	60.00	23.80	26.20	50.00	Phase 1	10.99
21.6975	8	37.49	22.51	60.00	30.48	19.52	50.00	Phase 1	11.39
21.801	8	37.60	22.40	60.00	30.35	19.65	50.00	Phase 1	11.40
24.0105	8	27.06	32.94	60.00	21.49	28.51	50.00	Phase 1	11.46
27.309	8	28.33	31.67	60.00	24.68	25.32	50.00	Phase 1	11.43

FCC ID: WJ9-ARU2400

Test point N
Operation mode: Tag reading mode
Remarks: WRA 7070 Antenna Unit, 52010334

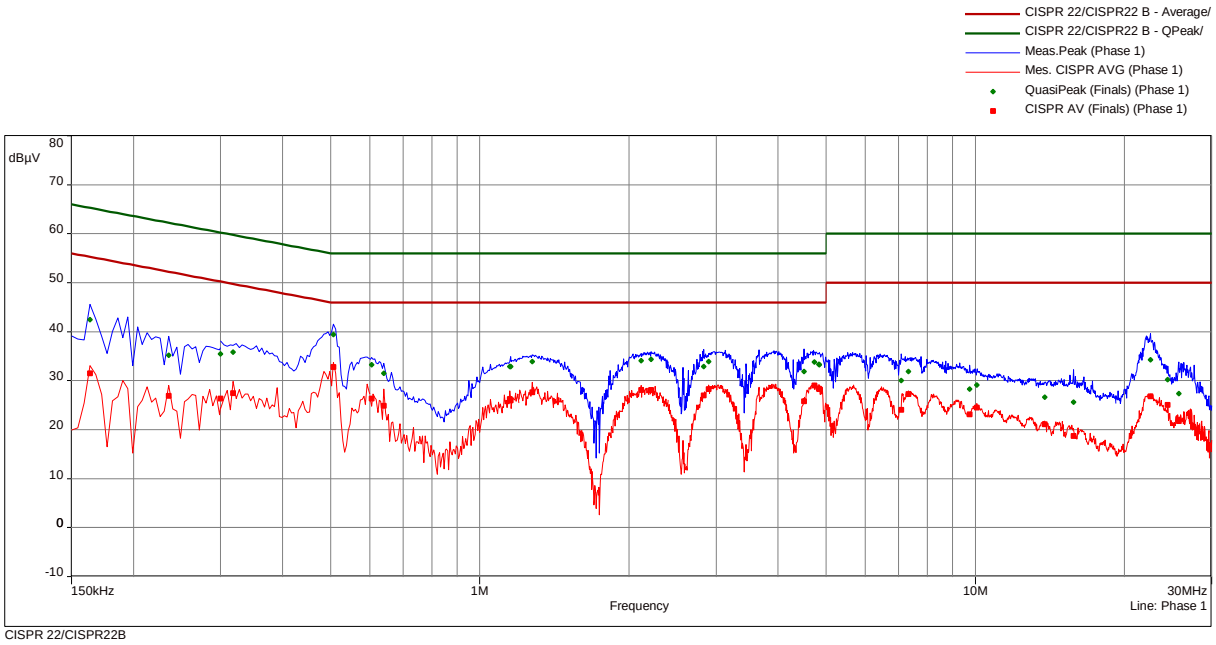
Result: Passed



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.168	9	48.44	16.62	65.06	36.97	18.09	55.06	Neutral	10.09
0.2265	9	41.01	21.57	62.58	27.15	25.43	52.58	Neutral	10.11
0.2355	9	43.32	18.93	62.25	34.93	17.32	52.25	Neutral	10.11
0.3135	10	37.57	22.31	59.88	28.61	21.27	49.88	Neutral	10.13
0.507	10	39.18	16.82	56.00	30.00	16.00	46.00	Neutral	10.15
0.516	10	38.72	17.28	56.00	30.67	15.33	46.00	Neutral	10.15
0.834	11	35.31	20.69	56.00	26.86	19.14	46.00	Neutral	10.19
0.8745	11	34.63	21.37	56.00	26.65	19.35	46.00	Neutral	10.19
0.9375	11	35.02	20.98	56.00	27.32	18.68	46.00	Neutral	10.19
1.533	12	35.61	20.39	56.00	28.19	17.81	46.00	Neutral	10.27
2.046	12	36.71	19.29	56.00	28.63	17.37	46.00	Neutral	10.28
2.589	13	36.43	19.57	56.00	28.48	17.52	46.00	Neutral	10.33
2.625	13	36.25	19.75	56.00	28.13	17.87	46.00	Neutral	10.33
4.3125	13	35.92	20.08	56.00	29.80	16.20	46.00	Neutral	10.42
4.344	13	35.62	20.38	56.00	29.81	16.19	46.00	Neutral	10.43
4.944	14	35.16	20.84	56.00	29.30	16.70	46.00	Neutral	10.45
5.0115	14	34.64	25.36	60.00	28.62	21.38	50.00	Neutral	10.46
7.302	14	33.77	26.23	60.00	26.91	23.09	50.00	Neutral	10.61
7.9185	14	33.01	26.99	60.00	26.34	23.66	50.00	Neutral	10.63
9.6405	15	31.81	28.19	60.00	25.16	24.84	50.00	Neutral	10.69
9.663	15	31.69	28.31	60.00	24.92	25.08	50.00	Neutral	10.69
13.6455	15	28.06	31.94	60.00	20.78	29.22	50.00	Neutral	10.96
14.19	15	27.42	32.58	60.00	20.45	29.55	50.00	Neutral	11.00
21.594	16	37.10	22.90	60.00	30.38	19.62	50.00	Neutral	11.37
21.783	16	37.33	22.67	60.00	30.41	19.59	50.00	Neutral	11.38
24.0195	16	26.62	33.38	60.00	20.81	29.19	50.00	Neutral	11.38
27.183	16	27.42	32.58	60.00	24.23	25.77	50.00	Neutral	11.29

FCC ID: WJ9-ARU2400

Test point L1 Result: Passed
Operation mode: Standby mode
Remarks: WRA 7070 Antenna Unit, 52010334



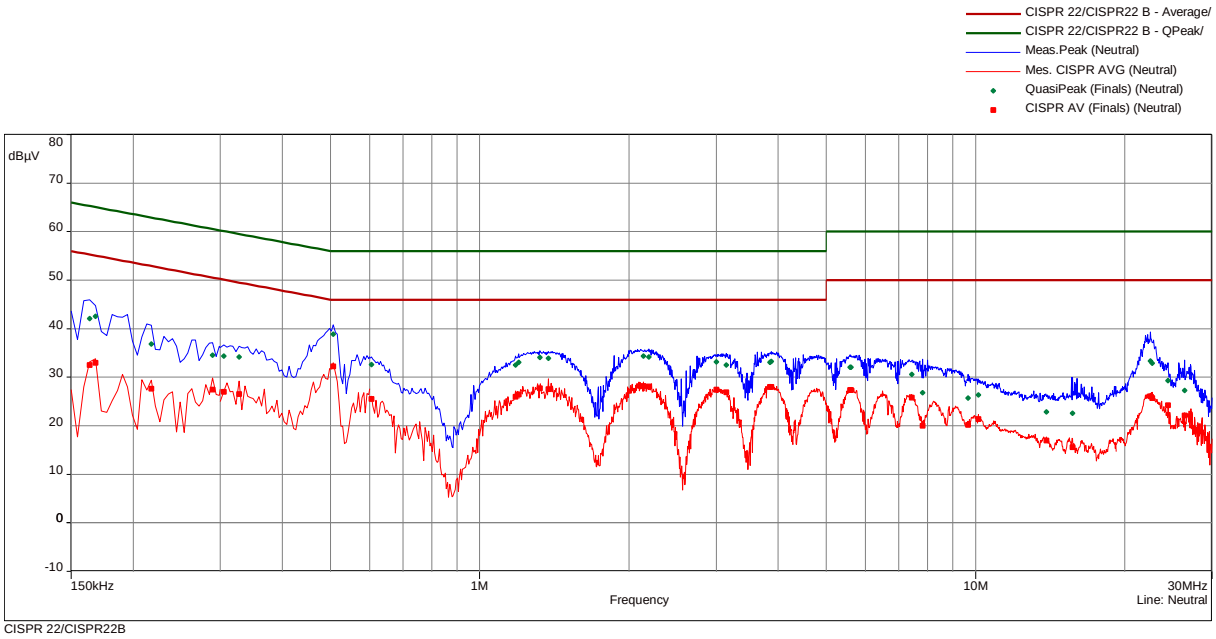
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1635	1	42.42	22.86	65.28	31.53	23.75	55.28	Phase 1	10.08
0.2355	1	35.20	27.05	62.25	26.88	25.38	52.25	Phase 1	10.10
0.3	2	35.44	24.80	60.24	26.35	23.89	50.24	Phase 1	10.12
0.318	2	35.83	23.93	59.76	27.42	22.34	49.76	Phase 1	10.13
0.507	2	39.46	16.54	56.00	32.80	13.20	46.00	Phase 1	10.14
0.6045	3	33.22	22.78	56.00	26.37	19.63	46.00	Phase 1	10.16
0.6405	3	31.47	24.53	56.00	24.90	21.10	46.00	Phase 1	10.16
1.149	3	32.89	23.11	56.00	26.26	19.74	46.00	Phase 1	10.21
1.1535	3	32.88	23.12	56.00	26.03	19.97	46.00	Phase 1	10.21
1.2765	4	33.94	22.06	56.00	27.64	18.36	46.00	Phase 1	10.23
2.118	4	34.11	21.89	56.00	28.10	17.90	46.00	Phase 1	10.28
2.217	4	34.35	21.65	56.00	28.11	17.89	46.00	Phase 1	10.29
2.832	5	32.90	23.10	56.00	27.00	19.00	46.00	Phase 1	10.34
2.8995	5	33.93	22.07	56.00	28.31	17.69	46.00	Phase 1	10.34
4.5105	5	31.84	24.16	56.00	25.76	20.24	46.00	Phase 1	10.42
4.731	5	33.80	22.20	56.00	29.00	17.00	46.00	Phase 1	10.43
4.8315	6	33.31	22.69	56.00	28.39	17.61	46.00	Phase 1	10.44
4.8495	6	33.30	22.70	56.00	28.28	17.72	46.00	Phase 1	10.44

FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
7.095	6	30.00	30.00	60.00	24.06	25.94	50.00	Phase 1	10.60
7.329	6	31.87	28.13	60.00	27.26	22.74	50.00	Phase 1	10.61
9.7395	7	28.32	31.68	60.00	23.15	26.85	50.00	Phase 1	10.70
10.068	7	29.16	30.84	60.00	24.54	25.46	50.00	Phase 1	10.71
13.8255	7	26.65	33.35	60.00	21.12	28.88	50.00	Phase 1	11.01
15.774	7	25.61	34.39	60.00	18.69	31.31	50.00	Phase 1	11.13
22.5795	8	34.32	25.68	60.00	26.78	23.22	50.00	Phase 1	11.42
24.4515	8	30.22	29.78	60.00	25.08	24.92	50.00	Phase 1	11.47
25.77	8	27.41	32.59	60.00	21.74	28.26	50.00	Phase 1	11.46

FCC ID: WJ9-ARU2400

Test point N Result: Passed
Operation mode: Standby mode
Remarks: WRA 7070 Antenna Unit, 52010334



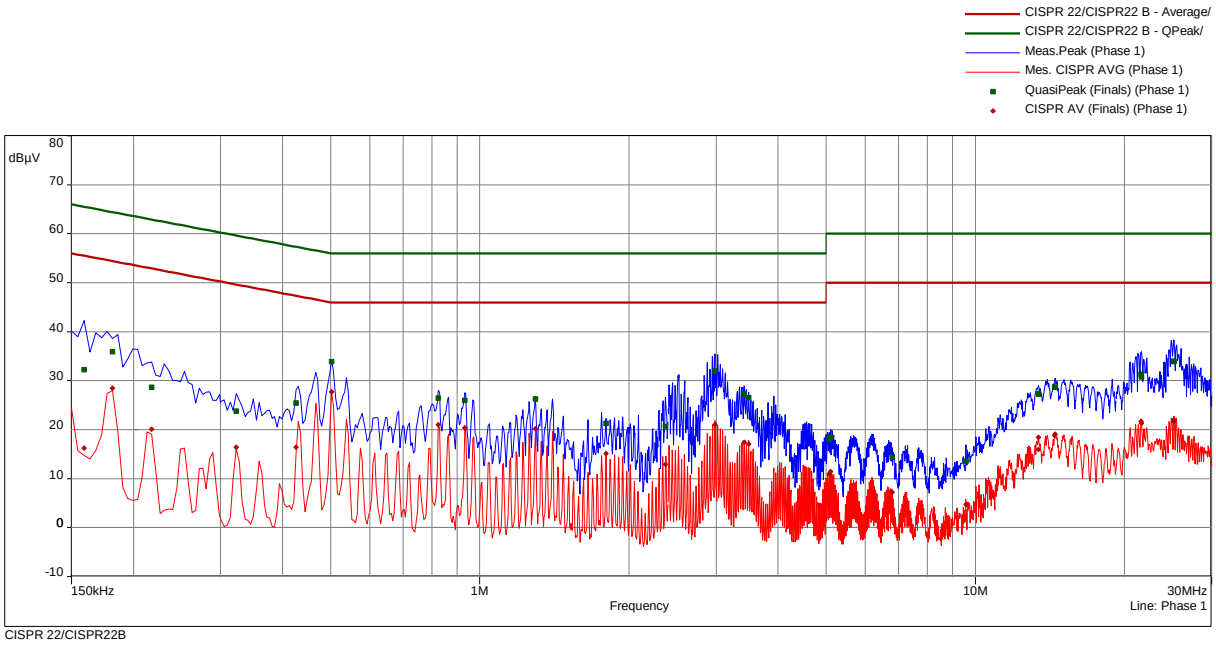
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1635	9	42.12	23.16	65.28	32.49	22.79	55.28	Neutral	10.09
0.168	9	42.58	22.48	65.06	32.95	22.11	55.06	Neutral	10.09
0.2175	9	36.81	26.10	62.91	27.60	25.31	52.91	Neutral	10.10
0.2895	9	34.51	26.03	60.54	27.47	23.06	50.54	Neutral	10.13
0.3045	10	34.38	25.74	60.12	27.04	23.08	50.12	Neutral	10.13
0.327	10	34.21	25.32	59.53	26.51	23.02	49.53	Neutral	10.14
0.507	10	38.87	17.13	56.00	32.23	13.77	46.00	Neutral	10.15
0.6045	11	32.60	23.40	56.00	25.54	20.46	46.00	Neutral	10.17
1.1805	11	32.56	23.44	56.00	25.97	20.03	46.00	Neutral	10.22
1.1985	11	33.08	22.92	56.00	26.48	19.52	46.00	Neutral	10.23
1.3215	12	34.07	21.93	56.00	27.73	18.27	46.00	Neutral	10.25
1.3755	12	33.93	22.07	56.00	27.59	18.41	46.00	Neutral	10.25
2.1405	12	34.35	21.65	56.00	28.16	17.84	46.00	Neutral	10.29
2.1945	12	34.19	21.81	56.00	28.13	17.87	46.00	Neutral	10.29
3.003	13	33.16	22.84	56.00	27.49	18.51	46.00	Neutral	10.35
3.1425	13	32.57	23.43	56.00	26.90	19.10	46.00	Neutral	10.36
3.849	13	33.10	22.90	56.00	27.98	18.02	46.00	Neutral	10.39
3.8715	13	33.24	22.76	56.00	28.04	17.96	46.00	Neutral	10.39

FCC ID: WJ9-ARU2400

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
5.583	14	32.03	27.97	60.00	27.32	22.68	50.00	Neutral	10.50
5.6055	14	32.02	27.98	60.00	27.33	22.67	50.00	Neutral	10.50
7.4325	14	30.60	29.40	60.00	25.85	24.15	50.00	Neutral	10.62
7.8195	14	26.84	33.16	60.00	20.03	29.97	50.00	Neutral	10.63
9.663	15	25.75	34.25	60.00	20.20	29.80	50.00	Neutral	10.69
10.1265	15	26.35	33.65	60.00	21.41	28.59	50.00	Neutral	10.71
13.893	15	22.83	37.17	60.00	16.99	33.01	50.00	Neutral	10.98
15.693	15	22.54	37.46	60.00	15.60	34.40	50.00	Neutral	11.10
22.5435	16	33.33	26.67	60.00	26.09	23.91	50.00	Neutral	11.38
22.7055	16	32.88	27.12	60.00	25.74	24.26	50.00	Neutral	11.38
24.4515	16	29.26	30.74	60.00	24.24	25.76	50.00	Neutral	11.37
26.4225	16	27.23	32.77	60.00	22.12	27.88	50.00	Neutral	11.32

FCC ID: WJ9-ARU2400

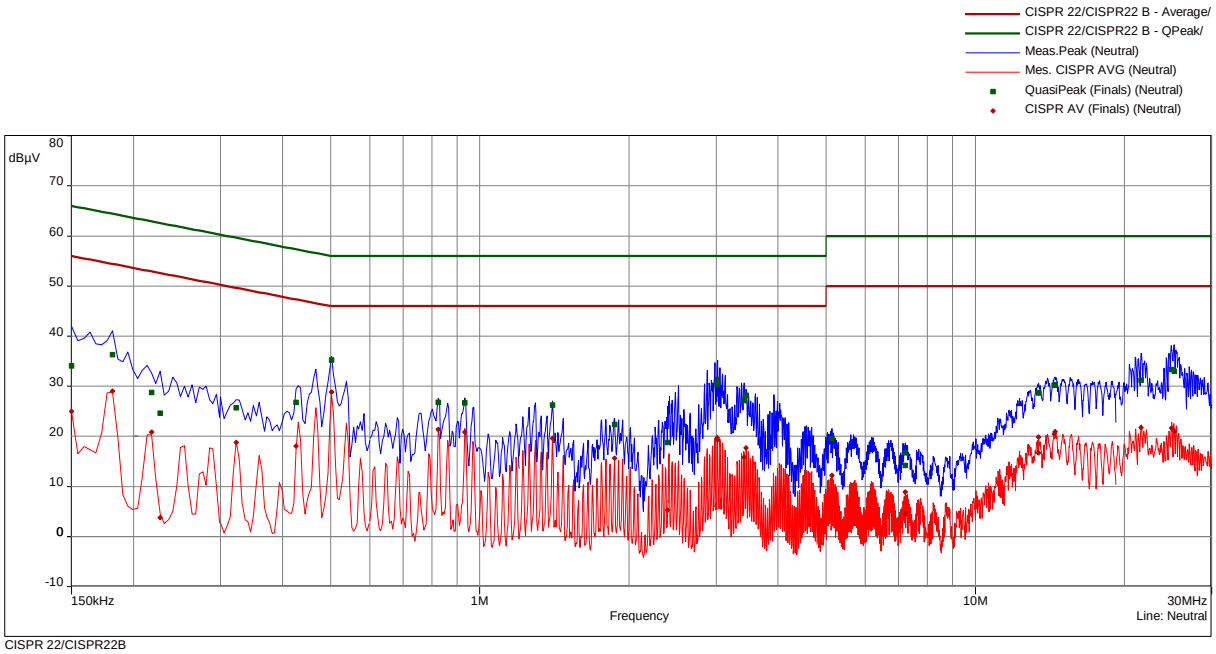
Test point L1 Result: Passed
Operation mode: Tag reading mode
Remarks: Internal antenna – powered via PoE



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.159	1	32.27	33.24	65.52	16.27	39.25	55.52	Phase 1	10.08
0.1815	1	35.96	28.45	64.42	28.43	25.99	54.42	Phase 1	10.08
0.2175	1	28.66	34.25	62.91	20.07	32.85	52.91	Phase 1	10.09
0.3225	2	23.80	35.84	59.64	16.40	33.24	49.64	Phase 1	10.13
0.426	2	25.47	31.86	57.33	16.38	30.95	47.33	Phase 1	10.14
0.5025	2	33.88	22.12	56.00	27.77	18.23	46.00	Phase 1	10.14
0.825	3	26.47	29.53	56.00	20.99	25.01	46.00	Phase 1	10.18
0.933	3	26.00	30.00	56.00	20.41	25.59	46.00	Phase 1	10.18
1.2945	4	26.28	29.72	56.00	20.15	25.85	46.00	Phase 1	10.23
1.7985	4	21.33	34.67	56.00	15.12	30.88	46.00	Phase 1	10.26
2.37	4	20.63	35.37	56.00	12.92	33.08	46.00	Phase 1	10.30
2.985	5	31.94	24.06	56.00	21.04	24.96	46.00	Phase 1	10.34
3.417	5	27.31	28.69	56.00	17.46	28.54	46.00	Phase 1	10.35
3.489	5	26.51	29.49	56.00	17.06	28.94	46.00	Phase 1	10.35
5.07	6	18.03	41.97	60.00	10.97	39.03	50.00	Phase 1	10.46
5.106	6	18.41	41.59	60.00	11.46	38.54	50.00	Phase 1	10.46
6.798	6	14.39	45.61	60.00	7.26	42.74	50.00	Phase 1	10.60
9.57	6	13.59	46.41	60.00	4.75	45.25	50.00	Phase 1	10.72
13.4115	7	27.36	32.64	60.00	18.48	31.52	50.00	Phase 1	11.05
13.4205	7	27.29	32.71	60.00	15.94	34.06	50.00	Phase 1	11.05
14.4555	7	28.67	31.33	60.00	18.84	31.16	50.00	Phase 1	11.13
14.4915	7	28.64	31.36	60.00	19.12	30.88	50.00	Phase 1	11.13
21.6075	8	31.34	28.66	60.00	21.64	28.36	50.00	Phase 1	11.53
21.6435	8	30.77	29.23	60.00	21.30	28.70	50.00	Phase 1	11.54
25.158	8	33.87	26.13	60.00	21.64	28.36	50.00	Phase 1	11.68
25.1625	8	34.02	25.98	60.00	22.02	27.98	50.00	Phase 1	11.68

FCC ID: WJ9-ARU2400

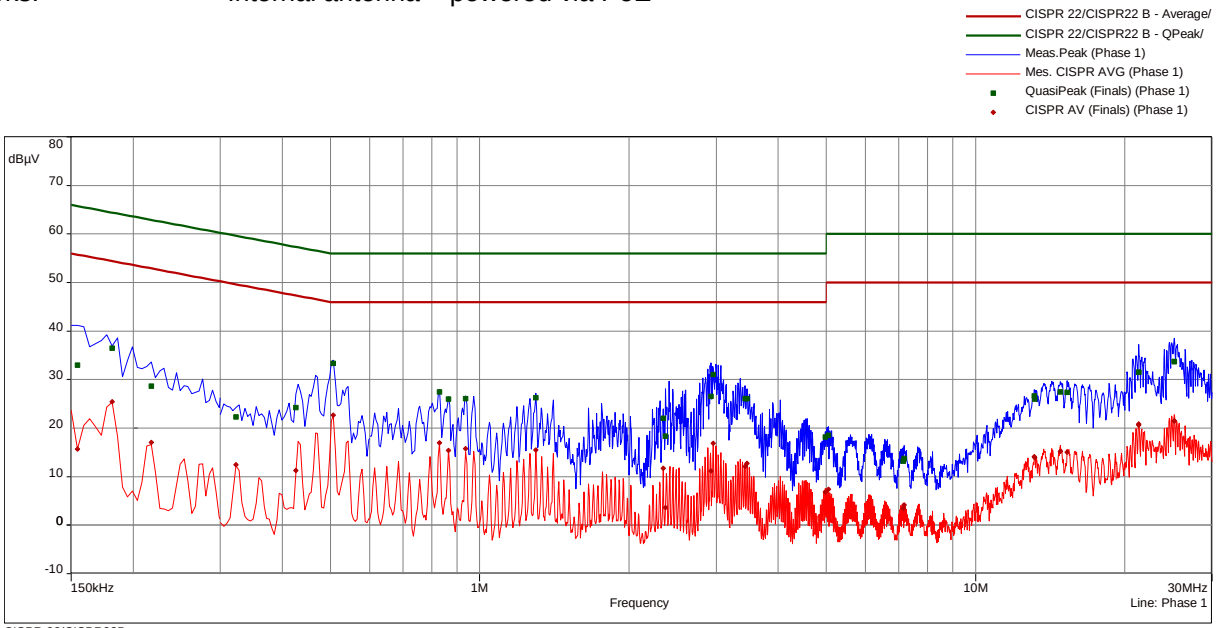
Test point N Result: Passed
Operation mode: Tag reading mode
Remarks: Internal antenna – powered via PoE



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.15	9	34.02	31.98	66.00	25.00	31.00	56.00	Neutral	10.07
0.1815	9	36.27	28.15	64.42	29.00	25.42	54.42	Neutral	10.09
0.2175	9	28.72	34.20	62.91	20.81	32.11	52.91	Neutral	10.11
0.2265	9	24.65	37.93	62.58	3.81	48.77	52.58	Neutral	10.11
0.3225	10	25.68	33.97	59.64	18.78	30.86	49.64	Neutral	10.13
0.426	10	26.81	30.52	57.33	18.09	29.24	47.33	Neutral	10.14
0.5025	10	35.19	20.81	56.00	28.86	17.14	46.00	Neutral	10.14
0.825	11	26.80	29.20	56.00	21.36	24.64	46.00	Neutral	10.18
0.933	11	26.71	29.29	56.00	20.85	25.15	46.00	Neutral	10.18
1.4025	12	26.25	29.75	56.00	19.61	26.39	46.00	Neutral	10.24
1.8705	12	22.36	33.64	56.00	15.65	30.35	46.00	Neutral	10.26
2.397	12	18.74	37.26	56.00	5.31	40.69	46.00	Neutral	10.31
3.0165	13	30.39	25.61	56.00	19.64	26.36	46.00	Neutral	10.34
3.021	13	31.35	24.65	56.00	19.31	26.69	46.00	Neutral	10.34
3.417	13	27.17	28.83	56.00	15.82	30.18	46.00	Neutral	10.35
3.4485	13	28.20	27.80	56.00	17.74	28.26	46.00	Neutral	10.35
5.1375	14	19.61	40.39	60.00	12.18	37.82	50.00	Neutral	10.45
7.2165	14	14.22	45.78	60.00	4.62	45.38	50.00	Neutral	10.58
7.221	14	16.69	43.31	60.00	8.87	41.13	50.00	Neutral	10.58
13.4025	15	28.72	31.28	60.00	19.86	30.14	50.00	Neutral	10.90
13.4115	15	28.64	31.36	60.00	16.72	33.28	50.00	Neutral	10.90
14.4465	15	30.16	29.84	60.00	20.44	29.56	50.00	Neutral	10.96
14.4825	15	30.33	29.67	60.00	20.97	29.03	50.00	Neutral	10.96
21.594	16	31.23	28.77	60.00	21.74	28.26	50.00	Neutral	11.26
24.906	16	33.32	26.68	60.00	21.62	28.38	50.00	Neutral	11.26
25.1985	16	32.94	27.06	60.00	21.01	28.99	50.00	Neutral	11.25

FCC ID: WJ9-ARU2400

Test point L1 Result: Passed
Operation mode: Standby mode
Remarks: Internal antenna – powered via PoE

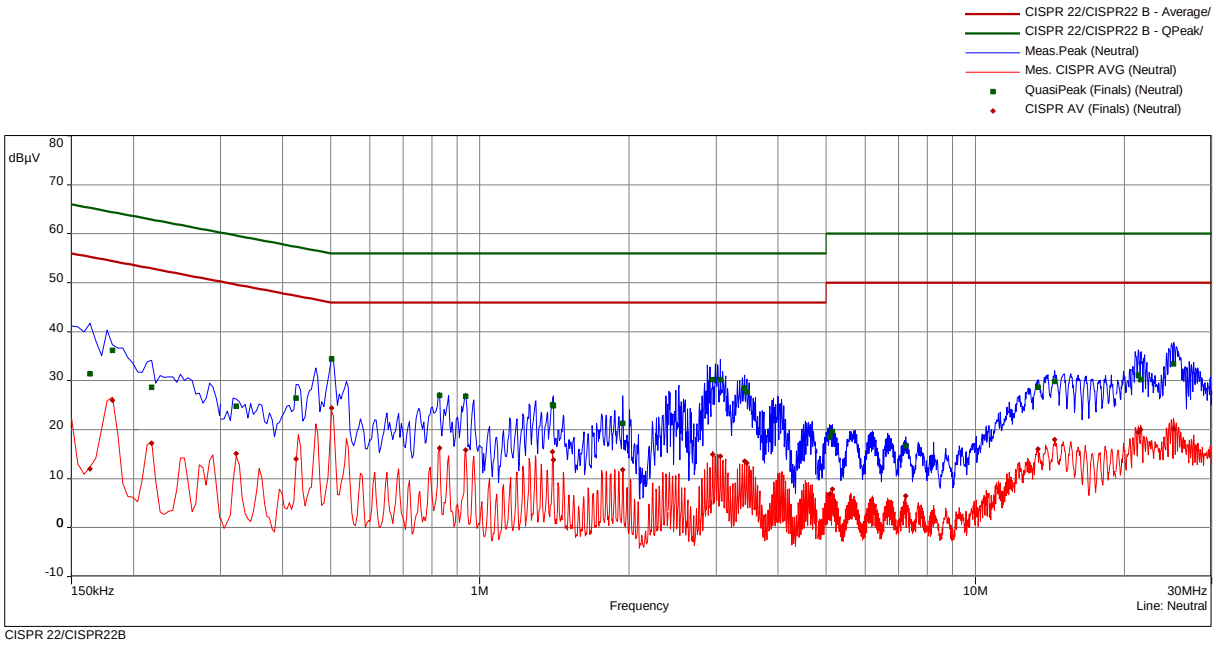


CISPR 22/CISPR22B

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1545	1	33.00	32.75	65.75	15.70	40.05	55.75	Phase 1	10.08
0.1815	1	36.50	27.92	64.42	25.39	29.03	54.42	Phase 1	10.08
0.2175	1	28.62	34.29	62.91	17.04	35.87	52.91	Phase 1	10.09
0.3225	2	22.30	37.35	59.64	12.51	37.14	49.64	Phase 1	10.13
0.426	2	24.24	33.09	57.33	11.31	36.02	47.33	Phase 1	10.14
0.507	2	33.34	22.66	56.00	22.68	23.32	46.00	Phase 1	10.14
0.8295	3	27.44	28.56	56.00	16.99	29.01	46.00	Phase 1	10.18
0.8655	3	25.99	30.01	56.00	15.43	30.57	46.00	Phase 1	10.18
0.9375	3	26.11	29.89	56.00	15.76	30.24	46.00	Phase 1	10.18
1.299	4	26.22	29.78	56.00	15.47	30.53	46.00	Phase 1	10.23
2.343	4	22.05	33.95	56.00	11.68	34.32	46.00	Phase 1	10.30
2.37	4	18.37	37.63	56.00	3.61	42.39	46.00	Phase 1	10.30
2.9265	5	26.52	29.48	56.00	11.20	34.80	46.00	Phase 1	10.34
2.958	5	31.03	24.97	56.00	16.92	29.08	46.00	Phase 1	10.34
3.4305	5	26.05	29.95	56.00	12.13	33.87	46.00	Phase 1	10.35
3.462	5	26.08	29.92	56.00	12.76	33.24	46.00	Phase 1	10.35
4.98	6	18.12	37.88	56.00	6.88	39.12	46.00	Phase 1	10.45
5.052	6	18.53	41.47	60.00	7.40	42.60	50.00	Phase 1	10.46
7.1445	6	13.20	46.80	60.00	3.43	46.57	50.00	Phase 1	10.61
7.176	6	13.79	46.21	60.00	4.18	45.82	50.00	Phase 1	10.62
13.128	7	26.63	33.37	60.00	14.16	35.84	50.00	Phase 1	11.02
13.164	7	26.00	34.00	60.00	13.97	36.03	50.00	Phase 1	11.03
14.8245	7	27.49	32.51	60.00	15.18	34.82	50.00	Phase 1	11.16
15.288	7	27.33	32.67	60.00	14.99	35.01	50.00	Phase 1	11.20
21.342	8	31.47	28.53	60.00	20.84	29.16	50.00	Phase 1	11.52
21.351	8	31.48	28.52	60.00	20.69	29.31	50.00	Phase 1	11.52
25.176	8	33.72	26.28	60.00	21.49	28.51	50.00	Phase 1	11.68
25.185	8	33.70	26.30	60.00	21.48	28.52	50.00	Phase 1	11.68

FCC ID: WJ9-ARU2400

Test point N Result: Passed
Operation mode: Standby mode
Remarks: Internal antenna – powered via PoE



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1635	9	31.38	33.90	65.28	11.99	43.30	55.28	Neutral	10.08
0.1815	9	36.24	28.18	64.42	26.02	28.40	54.42	Neutral	10.09
0.2175	9	28.67	34.24	62.91	17.27	35.65	52.91	Neutral	10.11
0.3225	10	24.82	34.83	59.64	15.12	34.52	49.64	Neutral	10.13
0.426	10	26.46	30.87	57.33	13.98	33.35	47.33	Neutral	10.14
0.5025	10	34.50	21.50	56.00	24.42	21.58	46.00	Neutral	10.14
0.8295	11	27.00	29.00	56.00	16.20	29.80	46.00	Neutral	10.18
0.9375	11	26.77	29.23	56.00	15.87	30.13	46.00	Neutral	10.18
1.4025	12	25.08	30.92	56.00	15.47	30.53	46.00	Neutral	10.24
1.407	12	24.85	31.15	56.00	13.82	32.18	46.00	Neutral	10.24
1.9425	12	21.31	34.69	56.00	11.85	34.15	46.00	Neutral	10.26
2.9535	13	30.25	25.75	56.00	14.93	31.07	46.00	Neutral	10.34
3.0615	13	30.22	25.78	56.00	14.62	31.38	46.00	Neutral	10.34
3.4215	13	28.58	27.42	56.00	13.54	32.46	46.00	Neutral	10.35
3.4575	13	27.72	28.28	56.00	13.21	32.79	46.00	Neutral	10.35
5.079	14	18.55	41.45	60.00	6.85	43.15	50.00	Neutral	10.45
5.151	14	19.68	40.32	60.00	7.88	42.12	50.00	Neutral	10.45
7.239	14	16.67	43.33	60.00	6.49	43.51	50.00	Neutral	10.59
13.398	15	28.65	31.35	60.00	16.06	33.94	50.00	Neutral	10.90
14.478	15	29.86	30.14	60.00	17.96	32.04	50.00	Neutral	10.96
21.3465	16	31.18	28.82	60.00	19.46	30.54	50.00	Neutral	11.26
21.576	16	30.25	29.75	60.00	20.05	29.95	50.00	Neutral	11.26
25.1265	16	33.41	26.59	60.00	20.16	29.84	50.00	Neutral	11.26

5.2 20 dB bandwidth

For test instruments and accessories used see section 6 Part **MB**.

5.2.1 Description of the test location

Test location: Shielded room S4

5.2.2 Photo documentation of the test set-up

5.2.3 Applicable standard

According to FCC Part 15C, Section 15.247(a):
Frequency hopping systems shall have hopping carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.2.4 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or the first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

5.2.5 Test result

Power setting 27.0 dBm:

Channel No.	-20 dB Bandwidth below peak (kHz)
CH 1 (902.25 MHz)	51.60
CH 25 (914.75 MHz)	52.20
CH 52 (927.75 MHz)	54.30

Bandwidth limit according to FCC Part15C, Section 15.247(a):

Frequency (MHz)	Hopping channels	Limit -20 dB bandwidth (kHz)
902-928	**≥ 50**	**< 250**

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

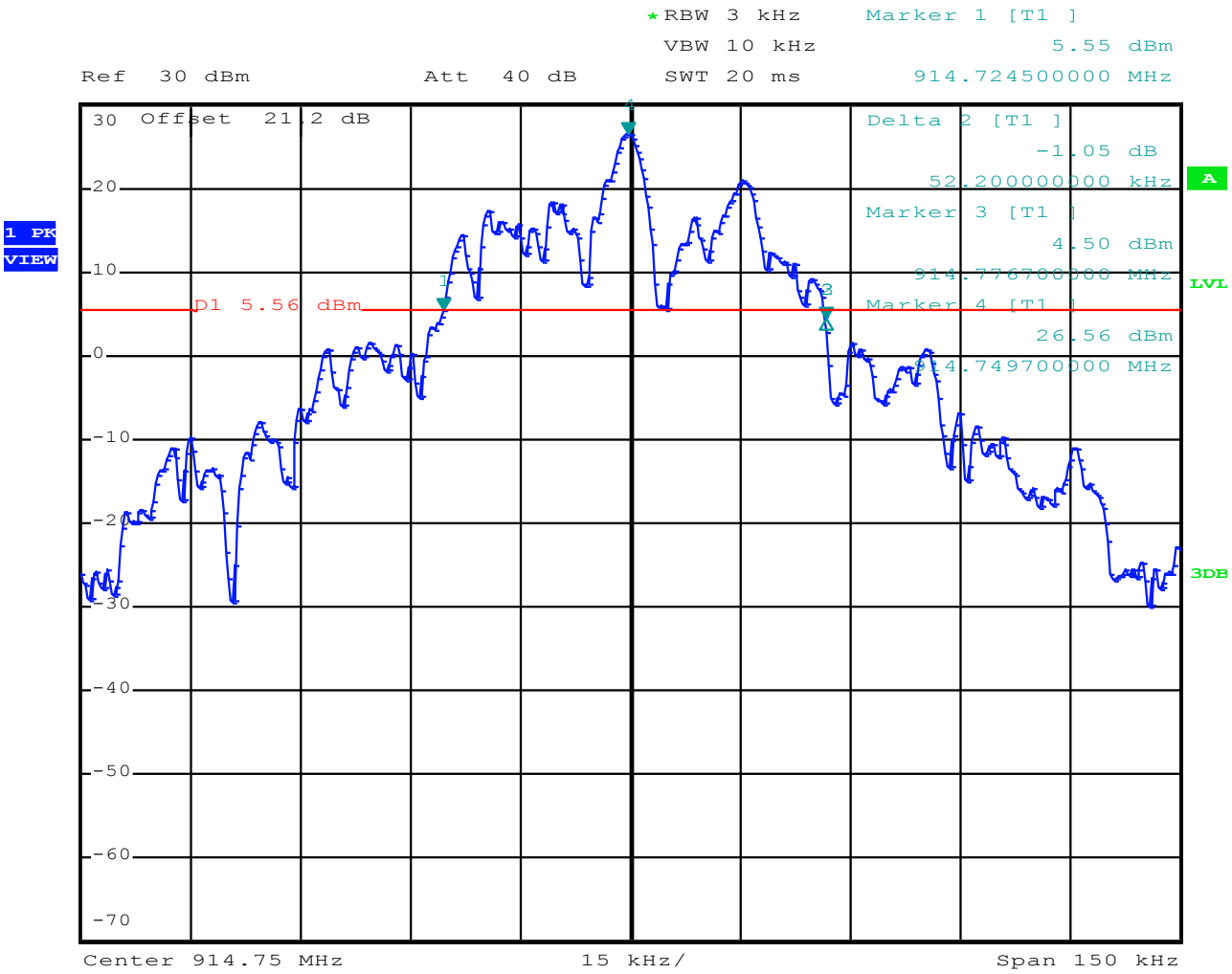
To represent the worst case, the measurement was performed with max. power setting.

5.2.6 Test protocol

Channel 1
902.25 MHz

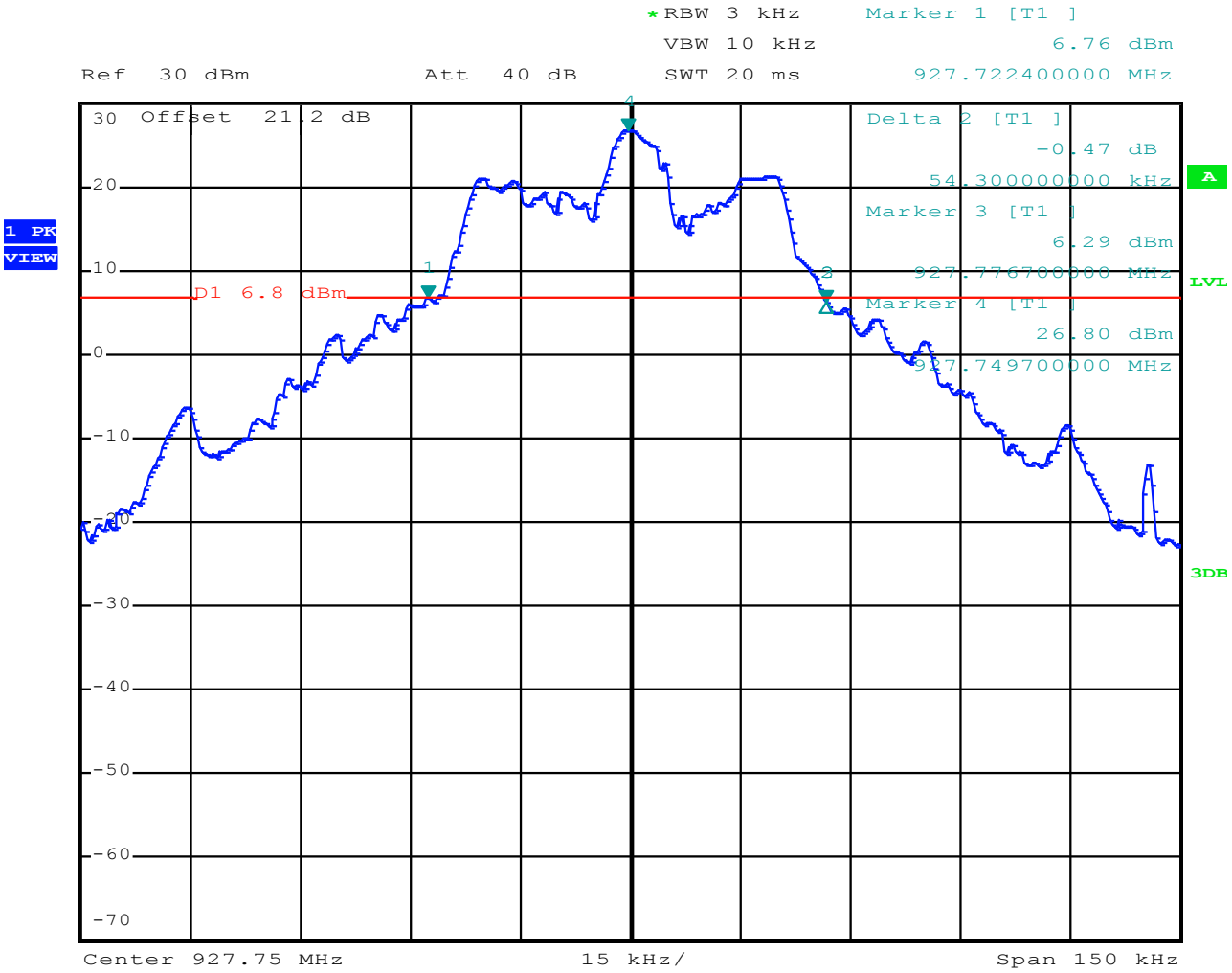
FCC ID: WJ9-ARU2400

Channel 25
914.75 MHz



FCC ID: WJ9-ARU2400

Channel 52
927.75 MHz



5.3 Maximum peak conducted output power

For test instruments and accessories used see section 6 Part **CPC 2**.

5.3.1 Description of the test location

Test location: Shielded room S4

5.3.2 Photo documentation of the test set-up

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.247(b)(2):
For frequency hopping systems operating in the 902-928 MHz band the maximum peak conducted output power shall not exceed the limit of 1 watt for systems employing at least 50 hopping channels.

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.

5.3.4 Description of Measurement

A spectrum analyzer is connected to the output of the transmitter via a suitable attenuator while EUT was operating in transmit mode using the assigned frequency.

Spectrum analyser settings:

RBW	300 kHz	Sweep time	5 ms (Auto)
VBW	1 MHz	Power Mode	Max. hold
Detector	Peak	Span	25 0 kHz

5.3.5 Test result

- Power setting 27.0 dBm

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
1	902.25	26.60	30.0	-3.4
25	914.75	26.00	30.0	-4.0
52	927.75	26.27	30.0	-3.7

- Power setting 23.0 dBm

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
1	902.25	22.65	30.0	-7.3
25	914.75	22.60	30.0	-7.4
52	927.75	22.58	30.0	-7.4

Note: Test cable loss and fixed attenuation of 20 dB are included in the analyzer reading (Transducer factor).

Peak Power Limit according to FCC Part 15C, Section 15.247(b)(2):

Frequency	Hopping channels	Hop. CH carrier frequ. separation	Peak Power Limit	
(MHz)			(dBm)	(W)
902-928	**≥ 50**		**30**	**1.0**

The requirements are **FULFILLED.**

Remarks: The conducted output power has been reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. Refer to 5.3.5 b.) above.

5.4 Spurious RF conducted emissions

For test instruments and accessories used see section 6 Part **SEC1, SEC2 and SEC3**.

5.4.1 Description of the test location

Test location: Shielded room S4

5.4.2 Photo documentation of the test set-up

5.4.3 Applicable standard

According to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency band 902 to 928 MHz, the digitally modulated 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 an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

5.4.4 Description of Measurement

A spectrum analyzer is connected to the output of the transmitter via a suitable attenuator while EUT was operating in transmit mode at the assigned frequency.

Spectrum analyzer settings:

RBW	100 kHz
VBW	300 kHz
Detector	Max. peak
Trace:	Max. hold
Sweep time	auto

5.4.5 Test result

Power setting 27.0 dBm

Hopping frequency from 902.75 to 927.25 MHz, max. level 26.87 dBm			
Frequency (GHz)	Peak power * (dBm)	Limit (-20 dB) (dBm)	Delta (dB)
2.69218	-57.59	6.87	-64.46
5.056	-56.09	6.87	-62.96
7.324	-54.41	6.87	-61.28

* Fixed attenuation of 20 dB is included in the Peak power.

The requirements are **FULFILLED.**

Remarks: All spurious emissions falling in restricted bands have been measured radiated.

For detailed results please refer to following test protocols.

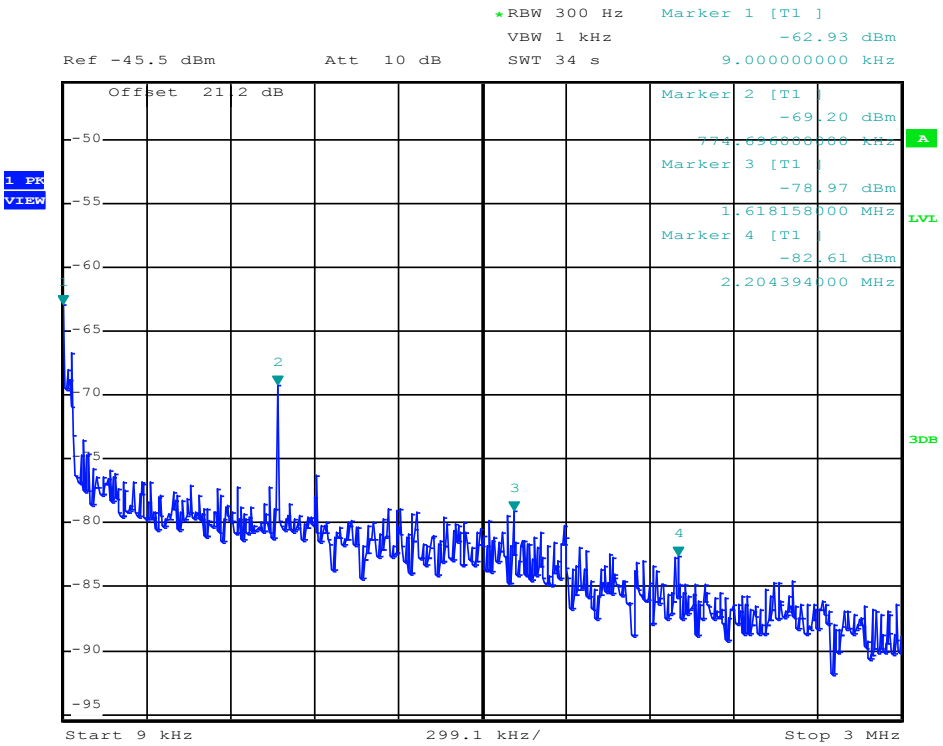
In the frequency range from 9 kHz to 30 MHz no emissions could be measured.

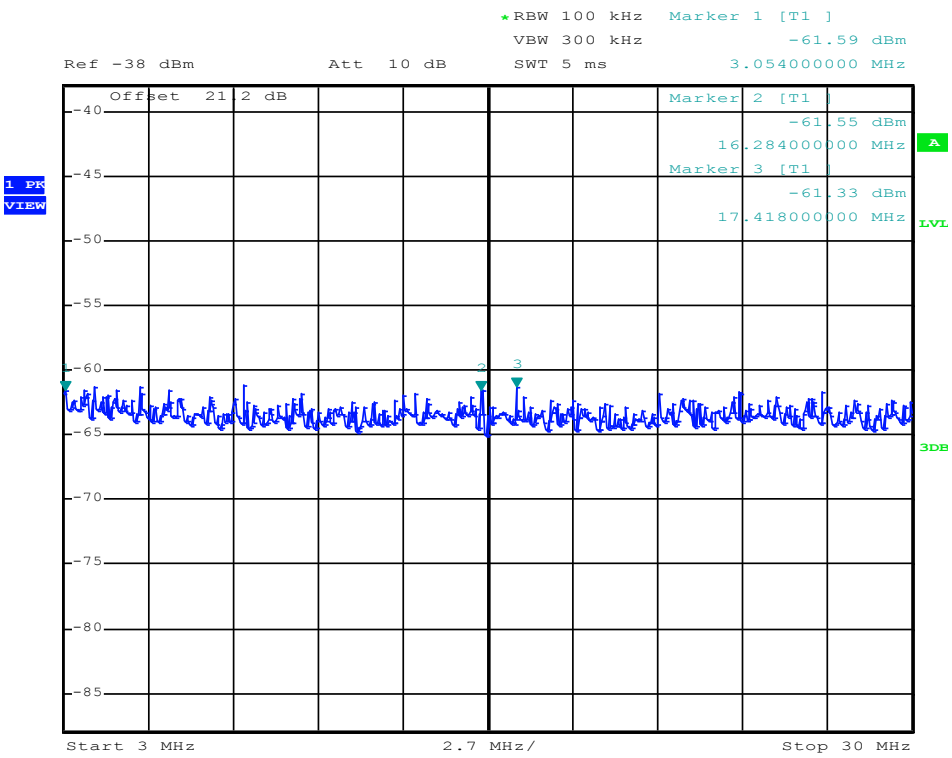
Test was performed in frequency hopping mode from 902.25 to 927.75 MHz.

This mode represents the worst case mode of the EuT.

FCC ID: WJ9-ARU2400

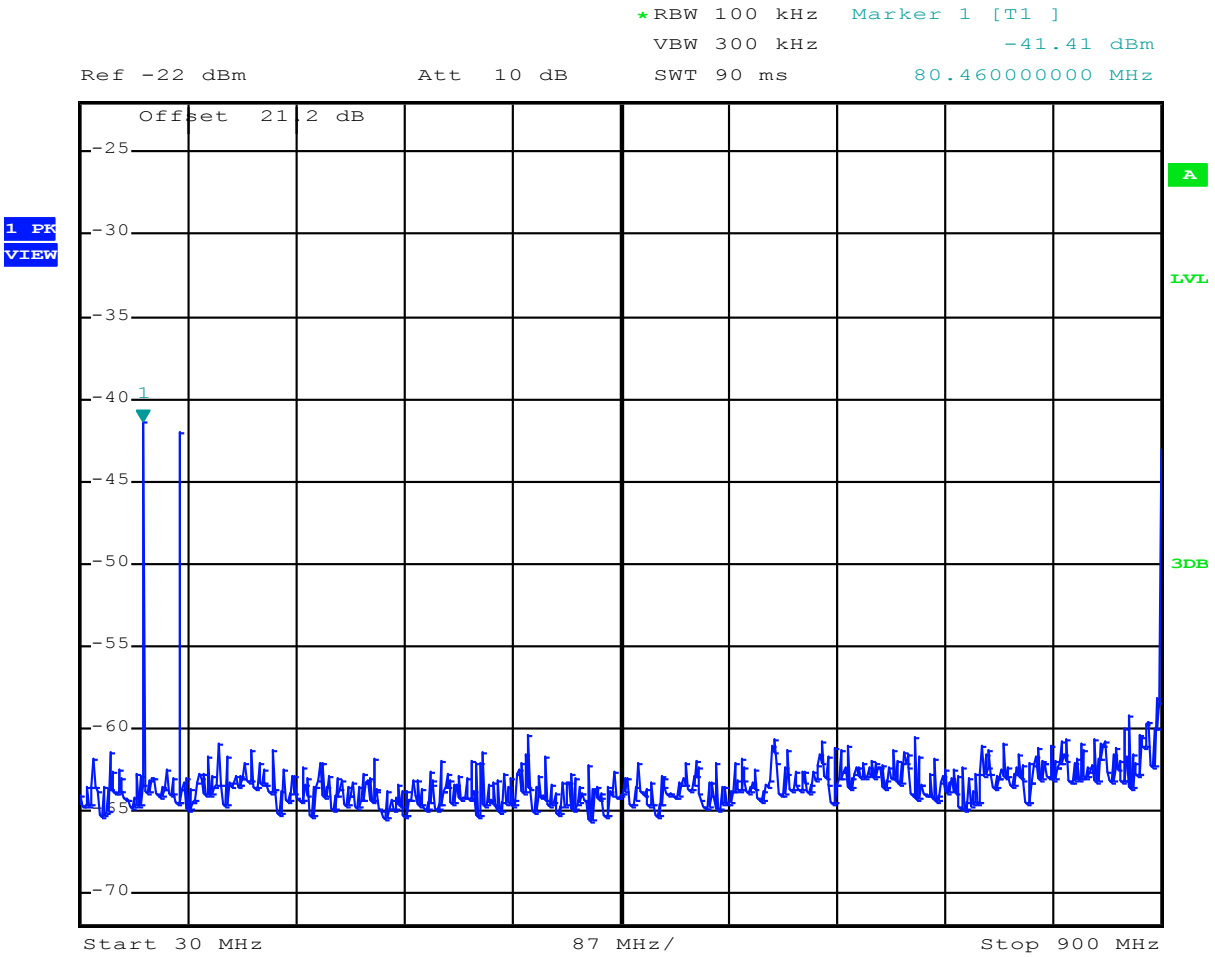
Conducted RF emission from 9 kHz to 30 MHz





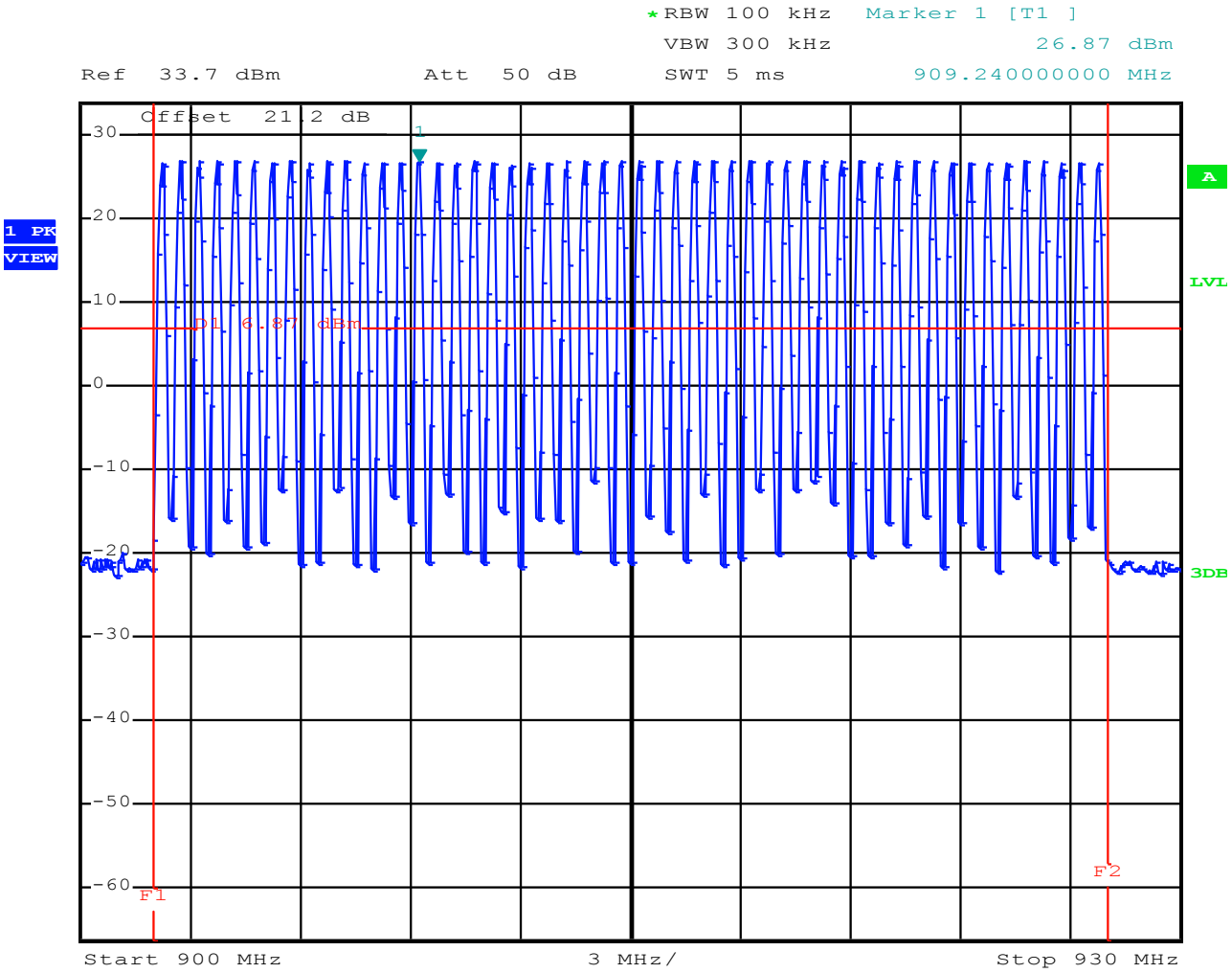
FCC ID: WJ9-ARU2400

Conducted RF emission from 30 to 1000 MHz



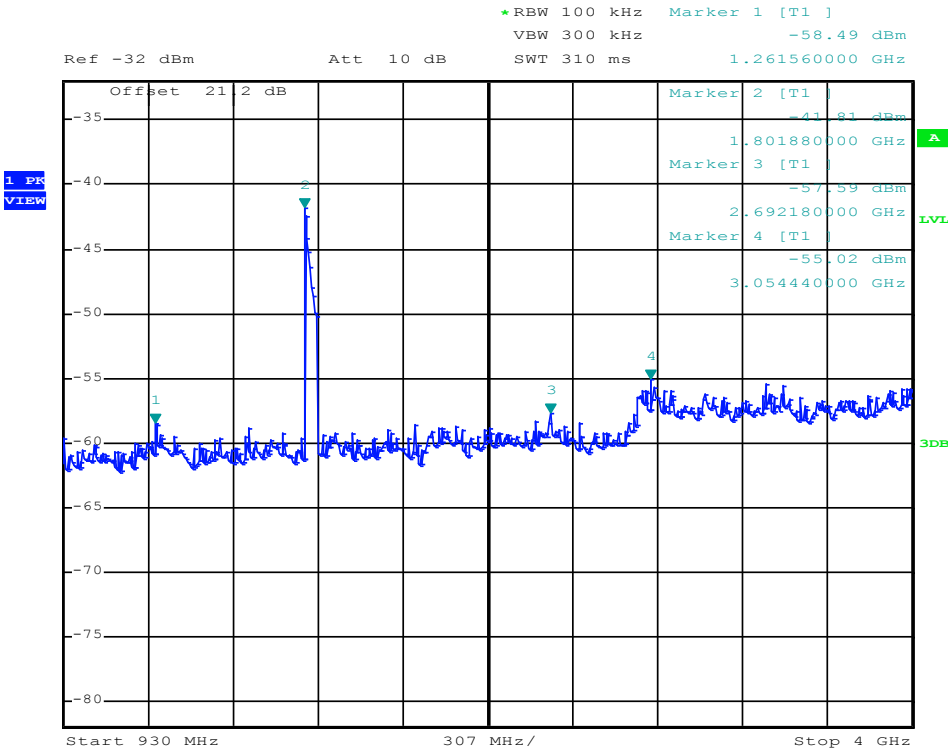
FCC ID: WJ9-ARU2400

Conducted RF emission from 30 to 1000 MHz
(Band edge)

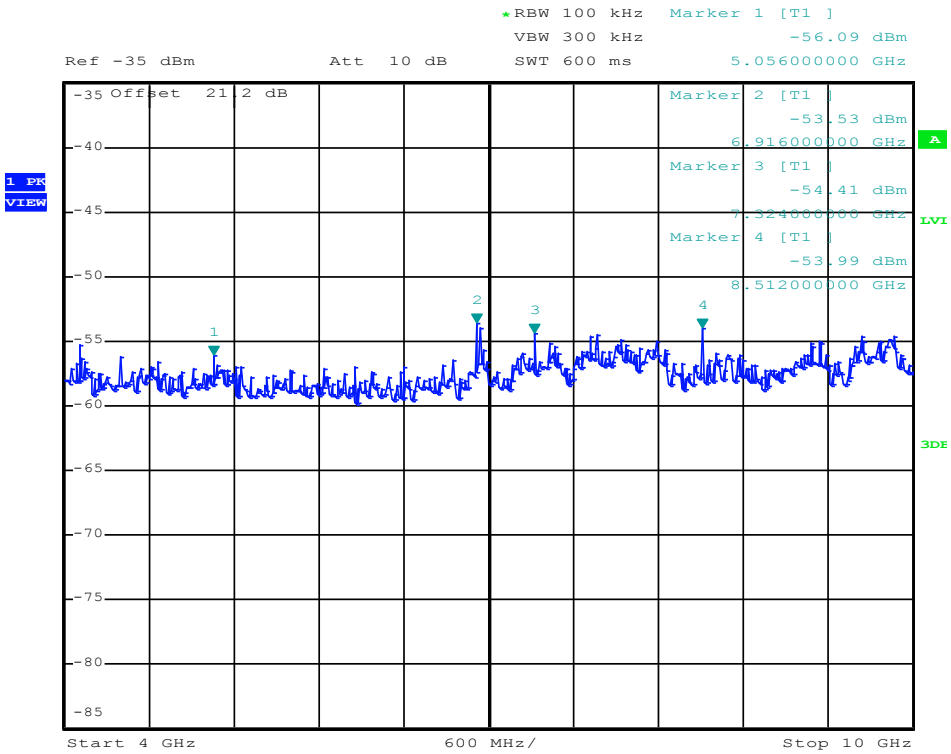


FCC ID: WJ9-ARU2400

Conducted RF emission from 1 to 10 GHz



Note: Signal level No.3 is located in restricted band.



Note: Signal level No.1 and No.3 are located in restricted band.

5.5 Spurious radiated emissions

For test instruments and accessories used see section 6 Part **SER 1, SER 2, SER 3**.

5.5.1 Description of the test location

Test location: OATS1
Test distance: 3 metres

Test location: Anechoic Chamber A1
Test distance: 3 metres

5.5.2 Photo documentation of the test set-up

- WIRA-40-linear-FCC, 52010252:

- Internal antenna:

5.5.3 Applicable standard

According to FCC Part 15, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 902 to 928 MHz, the digitally modulated 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 an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.5.4 Description of Measurement

Radiated spurious emissions from the EUT are measured in the frequency range of 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linear polarized antennas. The measurements are made with 120 kHz bandwidth and quasi-peak detection (200 Hz, 9 kHz up to 30 MHz). The EUT was placed on a 1.0 X 1.5 metres non-conducting table 80 centimetres above the ground plane. The set up of the equipment under test will be in accordance to ANSI C63.4. The antenna was positioned 3 metres horizontally from the EUT. To locate maximum emissions from the EUT the antenna is shifted in height from 1 to 4 metres, after the EUT is rotated 360 degrees. The measurement scan is made in horizontal and vertical polarization of the antenna.

For the radiated measurement up from 1 GHz to maximum frequency as specified in Section 15.33, a spectrum analyzer and appropriate linear polarized antennas are used. The EUT is placed on a 1.0 X 1.5 metres non-conducting table 80 centimetres above the ground plane. The set up of the EUT will be in accordance to ANSI C63.4. The antenna was positioned 3 m horizontally from the EUT. To locate maximum emissions the EUT was rotated 360 degrees in the fully anechoic chamber. The measurement scan is made in horizontal and vertical polarization of the antenna. For testing above 1 GHz, if the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

5.5.5 Test result

5.5.5.1 Radiated emission test f < 1 GHz

- Power setting 23.0 dBm

Frequency [kHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
536.8	24.1	19.7	9.0	20	44.1	39.7	73.0	-33.3
1073.6	23.4	18.0	9.0	20	43.4	38.0	67.0	-29.0
1342.0	21.6	15.9	9.0	20	41.6	35.9	65.0	-29.1

Note: No unwanted emissions from the EuT could be measured in the relevant frequency ranges. Only ambient nosies could be detected!

The table shows an extract of the critical values:

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
36.014	11.2	14.7	10.7	10.7	21.9	25.4	40.0	-14.6
59.973	15.6	14.1	12.1	12.1	27.7	26.2	40.0	-12.3
216.434	19.7		13.6		33.3		46.0	-12.7
240.005		15.8		14.9		30.7	46.0	-15.3
324.492	13.6		17.2		30.8		46.0	-15.2
359.994		13.4		18.1		31.5	46.0	-14.5

5.5.5.2 Radiated emission test f > 1GHz

- Power setting 27.0 dBm

Frequency (GHz)	L: PK (dBµV)	L: AV (dBµV)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(µV/m)	L: AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
2.692	44.5	41.3	1000	3.7	48.2	45.0	54.0	-9.0
5.056	45.3	38.1	1000	3.4	48.7	41.5	54.0	-13.5
7.324	40.0	36.9	1000	2.5	42.5	39.4	54.0	-14.6

*) Average values were measured with spectrum analyzer by the following settings

RBW: 1 MHz
VBW: 10 Hz
Sweep: Auto

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Radiated limits according to FCC Part 15C, Section 15.209(a) for spurious emissions:

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
0.009 - 0.490	2400/F(kHz)		300
0.490 - 1.705	24000/F(kHz)		30
1.705 - 30	30	29.5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209: (Refer to section 5.5.5.1)

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED.**

Remarks: During the test the EUT was set into TX continuous mode with normal modulation.

The measurement was performed up to the 10th harmonic (10000 MHz).

Test was performed in frequency hopping mode from 902.75 to 927.25 MHz.

This mode represents the worst case mode of the EuT.

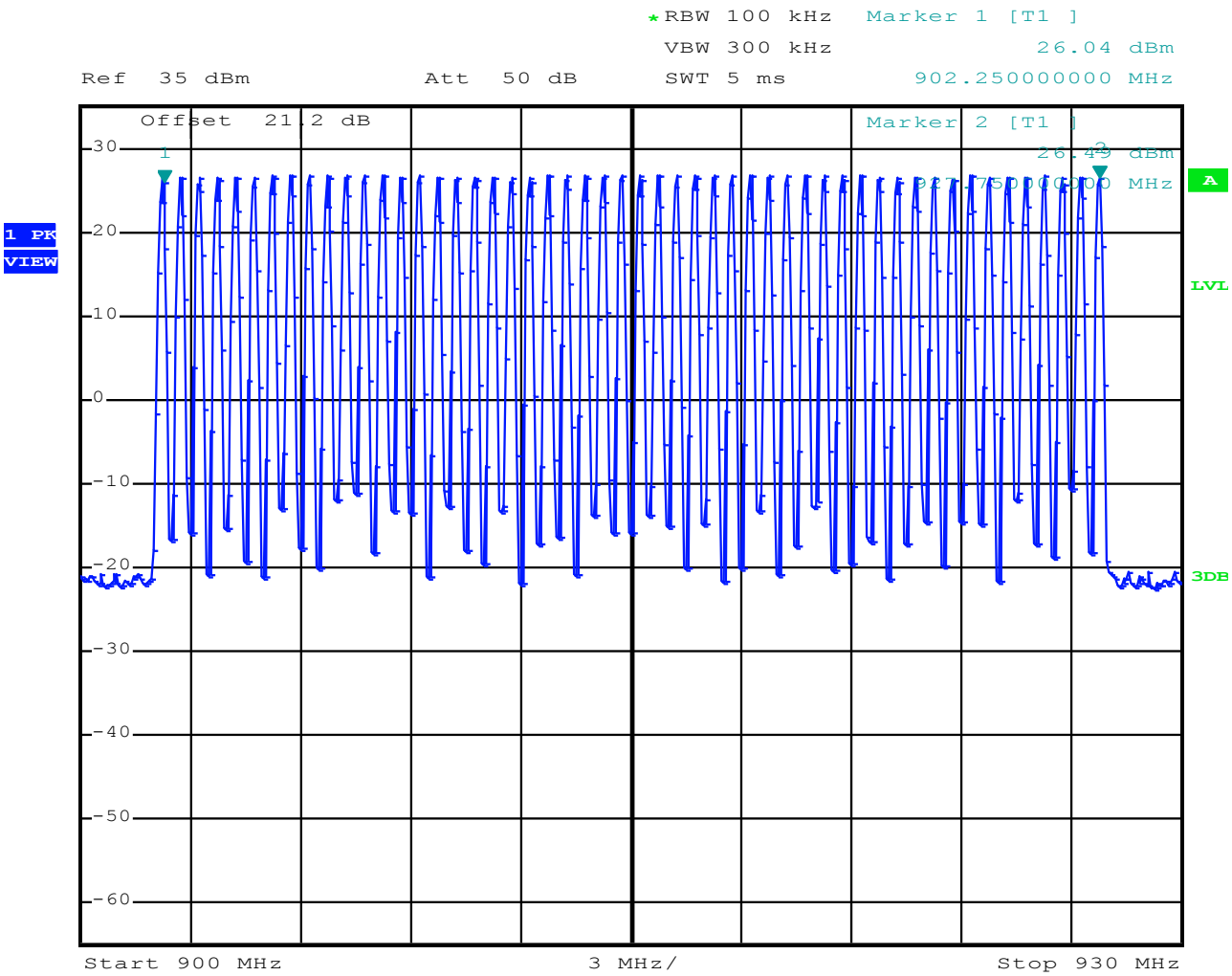
5.6 Hopping sequence

Requirement according to FCC Part 15C, Section 15.247(a):
The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

Remarks: The channel is represented by a pseudo-random hopping sequence hopping through the 54 RF-channels.

For detailed information about the hopping sequence, please refer to user manual.

5.6.1 Test protocol



5.7 Equal hopping frequency use

Requirement according to FCC Part 15C, Section 15.247(a):
Each frequency must be used equally on the average by each transmitter.

Remarks: The device fulfills the requirement according to FCC Part 15C, Section 15.247(a).

The manufacturer declares in the system manual that this function is controlled via software.

For detailed information about the hopping sequence, please refer to user manual.

5.8 Receiver input bandwidth

Requirement according to FCC Part 15C, Section 15.247(a):
The system receivers shall have input bandwidth that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signal.

Remarks: The receiver bandwidth is equal to the transmitter bandwidth in the 52 hopping channel mode.

(Declared by the manufacturer.)

For detailed information about the hopping sequence, please refer to user manual.

5.9 Dwell time

For test instruments and accessories used see section 6 Part **DC**.

5.9.1 Description of the test location

Test location: Shielded room S4

5.9.2 Photo documentation of the test set-up

5.9.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(i):
Frequency hopping systems operating in the 902-928 MHz band: The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

5.9.4 Description of Measurement

The measurement was done using a spectrum analyser in time domain function and able to store the maximum time of a period. This time period has been stored an added up the appropriate time intervals the hopping system has applied this channel.

5.9.5 Test result

Channel frequency (MHz)	Number of Bursts (in 1 time period)	Dwell time (ms)
914.75	1	396.0

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Requirement according to FCC Part15C, Section 15.247(a):

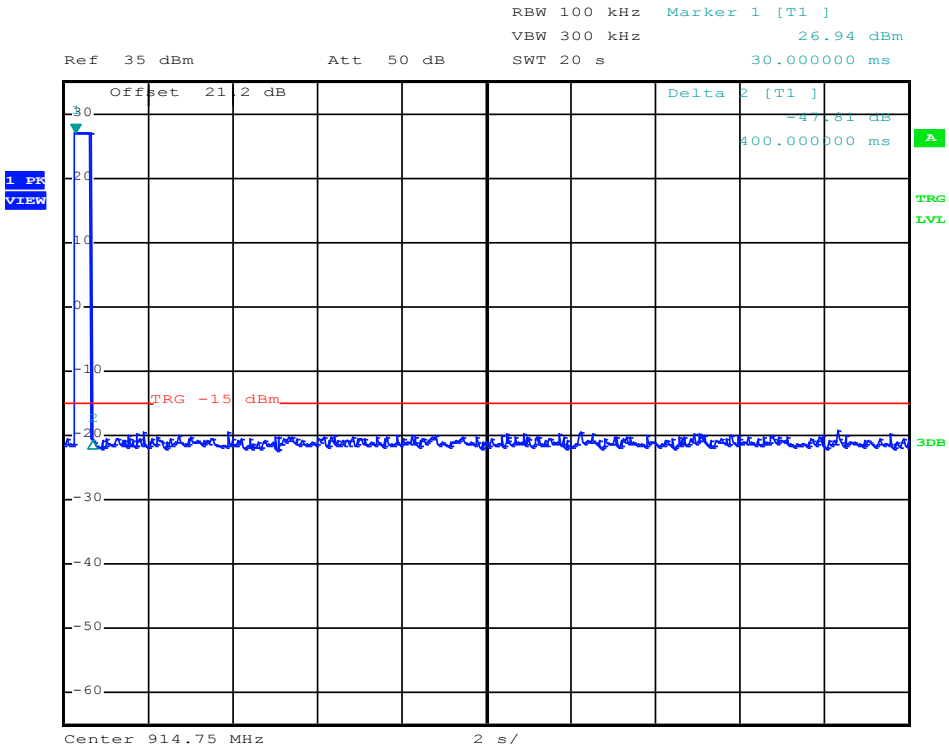
Frequency	Hopping channels	time of one period	Limit dwell time, AV
(MHz)		(s)	(ms)
902-928	**≥ 50**	**20**	**< 400**

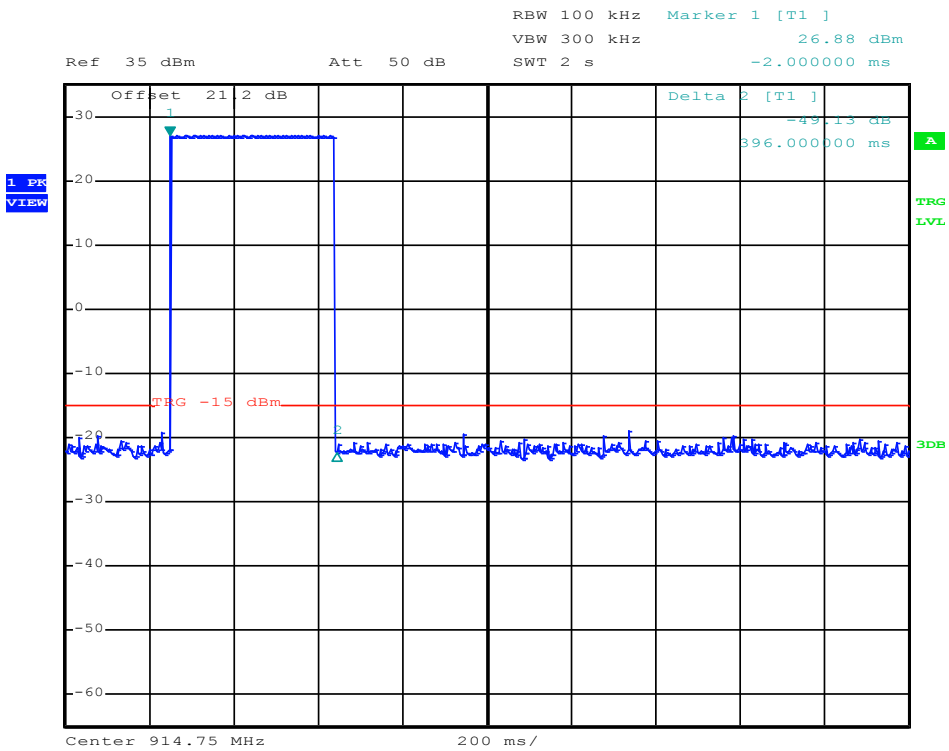
The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

5.9.6 Test protocol

Time of occupancy (Dwell time)





5.10 Channel separation

For test instruments and accessories used see section 6 Part **MB**.

5.10.1 Description of the test location

Test location: Shielded room S4

5.10.2 Photo documentation of the test set-up

5.10.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(1):
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.

5.10.4 Description of Measurement

This measurement was done by using a spectrum analyser. The Span of the analyzer was set wide enough to capture 2 frequencies. The result of the channel separation was compared with the 20 dB bandwidth and recorded.

5.10.5 Test result

Channel 1 (MHz)	Channel 2 (MHz)	Channel separation (kHz)
902.25	902.75	500

FCC ID: WJ9-ARU2400

Limit according to FCC Part 15C, Section 15.247(a):

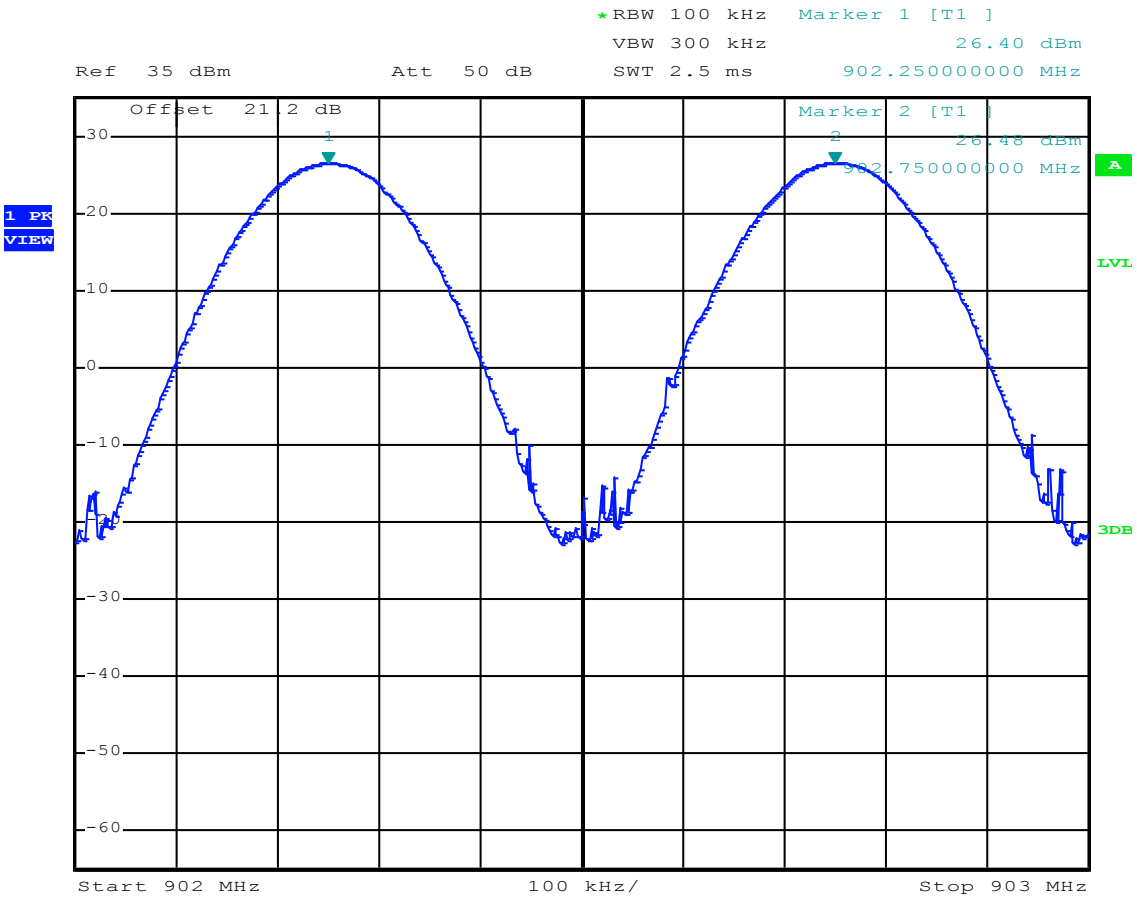
Frequency	Hopping channels	Limit channel separation
(MHz)		(kHz)
All systems		> 25 kHz or 20 dB bandwidth, which ever is greater
2400-2483.5	≥ 15	

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

5.10.6 Test protocol

Channel separation



5.11 Quantity of hopping channels

For test instruments and accessories used see section 6 Part **MB**.

5.11.1 Description of the test location

Test location: Shielded room S4

5.11.2 Photo documentation of the test set-up

5.11.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(1)(i):
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 system shall use at least 50 hopping frequencies.

5.11.4 Description of Measurement

This measurement was done by using a spectrum analyser. The EuT was transmitting at its maximum data rate. The Span of the analyzer was set wide enough to capture the frequency band from 902-928 MHz.

5.11.5 Test result

Hopping channel frequency range	Quantity of hopping channels value	Quantity of hopping channels minimum limit
902-928 MHz	52	50

Limit according to FCC Part 15C, Section 15.247(1):

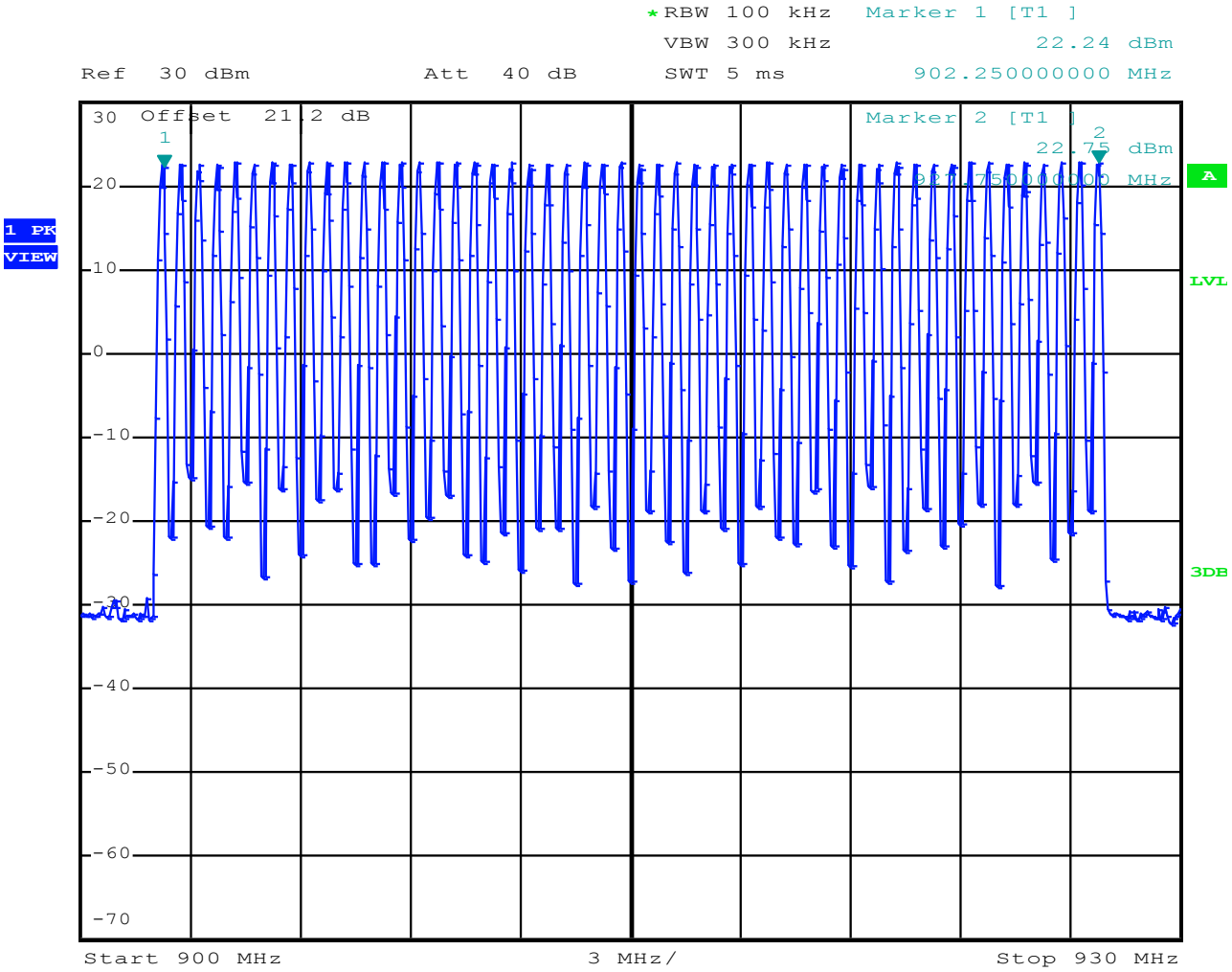
Frequency range (MHz)	LIMIT (Quantity of Hopping Channels)			
	20dB Bandwidth < 250kHz	20dB Bandwidth > 250kHz	20dB Bandwidth < 1 MHz	20dB Bandwidth > 1MHz
902 - 928	**50**	25	---	---

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

5.11.6 Test protocol

Quantity of hopping channel



5.12 Antenna application

5.12.1 Applicable standard

According to FCC Part 15C, Section 15.203:
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 shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has FAKRA connectors to connect the defined antennas supplied by the manufacturer.

All supplied antennas meet the requirements of part 15.203 and 15.204.

The device will be professionally installed. So it is secured that the proper antenna is employed so that the limits accd. FCC Part 15.247 are not exceeded.

5.12.2 Antenna requirements

According to FCC Part 15C, Section 15.247 (b)(4):
The conducted output power limit specified in paragraph (b) of 15.247 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 intentional radiator shall be reduced below the stated values in paragraph (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.

The necessary output power reduction depends on the used antenna type. The value of output power have to be reduced is controlled by firmware of the EUT and will be automatically set by selecting the antenna.

Remarks: For detailed information about the used the antennas please refer to the user manual or technical documentation from the manufacturer.

5.13 Maximum permissible exposure (MPE) – See Attachment B

For test instruments and accessories used see section 6 Part **CPC 2**.

5.13.1 Description of the test location

Test location: None

5.13.2 Applicable standard

According to FCC Part 15, Section 15.247(i):
Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.
The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".
This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

5.13.3 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, the MPE can be calculated in a defined distance away from the product.

Friis transmission formula: $P_d = \frac{P_{out} * G}{4 * \Pi * r^2}$

where

P_d =power density (mW/cm^2)
P_{out} = output power to antenna (mW)
G = gain of antenna (linear scale)
r = distance between antenna and observation point (cm)

Remarks: For detailed test result please refer Attachment B.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	BAT-EMC 3.18.0.26	01-02/68-13-001				
	ESCI	02-02/03-15-001	11/06/2019	11/06/2018		
	ESH 2 - Z 5	02-02/20-05-004	25/10/2019	25/10/2017	30/04/2019	31/10/2018
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	18/11/2019	18/11/2016	06/05/2019	06/11/2018
	SP 103 /3.5-60	02-02/50-05-182				
CPC 2	FSP 30	02-02/11-05-001	09/10/2019	09/10/2018		
	18N50W-20dB	02-02/50-16-031				
DC	FSP 30	02-02/11-05-001	09/10/2019	09/10/2018		
	18N50W-20dB	02-02/50-16-031				
MB	FSP 30	02-02/11-05-001	09/10/2019	09/10/2018		
	18N50W-20dB	02-02/50-16-031				
SEC 1-3	FSP 30	02-02/11-05-001	09/10/2019	09/10/2018		
	WHJS 1000-10EE	02-02/50-05-070				
	18N50W-20dB	02-02/50-16-031				
SER 1	ESCI	02-02/03-05-005	11/12/2019	11/12/2018		
	HFH 2 - Z 2	02-02/24-15-001	22/03/2019	22/03/2018		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 2	ESVS 30	02-02/03-05-006	06/06/2019	06/06/2018		
	VULB 9168	02-02/24-05-005	18/04/2019	18/04/2018		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	FSP 40	02-02/11-11-001	17/10/2019	17/10/2018		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	08/05/2019	08/05/2018		
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				