

FCC ID: NXW-RF600R2

EMI - TEST REPORT

- FCC Part 15.247 -

Test Report No. :

T37751-00-00HU

28. July 2014

Date of issue

Type / Model Name : RF650R, RF680R, RF685R

Product Description : RFID UHF Reader

Applicant : Siemens AG

Address : Siemensstr. 2-4
D-90766 Fuerth

Manufacturer : Siemens AG

Address : Oestliche Rheinbrueckenstr. 50
D-76187 Karlsruhe

Licence holder : Siemens AG

Address : Siemensstr. 2-4
D-90766 Fuerth

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

POSITIVE



Deutsche
Akkreditierungsstelle
D-PL-12030-01-00

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, 2013)

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, 2013)

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, 2013)

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

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C63.10: 2009	Testing Unlicensed Wireless Devices
ANSI C95.1:1992	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
CISPR 22: 2005 EN 55022: 2006	Information technology equipment

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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 50 channels in the frequency band from 902 to 928 MHz.

The reader family RF600R consist of following models:

- RF650R
- RF680R
- RF685R

The manufacturer declared that the models are technical identical expect the following items:

- RF650R:
 - 4x ext. antenna connector
 - 1x Ethernet connector RJ45
 - 1x M12 12-pole connector for digital Inputs and Outputs
 - max. connected output power 30.0 dBm
- RF680R:
 - 4x ext. antenna connectors
 - 2x Ethernet ports with M12 4-pole connectors
 - 1x M12 12-pole connector for digital Inputs and Outputs
 - max. connected output power 30.0 dBm
- RF685R:
 - 1x ext. antenna connector
 - 1x int. antenna (5.0 dBi)
 - 2x Ethernet ports with M12 4-pole connectors
 - 1x M12 12-pole connector for digital Inputs and Outputs
 - max. connected output power 30.0 dBm

Following antennas are provided with the RF650R, RF680R, RF685R:

- RF660A antenna: Type 60° - 75° CP (6.0 dBi)
- RF620A antenna: Horizontal plane: 130° and Vertical plane: 105° (-10 - -5 dBi)
- RF640A antenna: Horizontal plane: 75° and Vertical plane: 85° (4.0 dBi)
- RF642A antenna: Horizontal plane: 80° and Vertical plane: 70° (7.0 dBi)

For detailed information about the different models and the antennas please refer to the user manual.

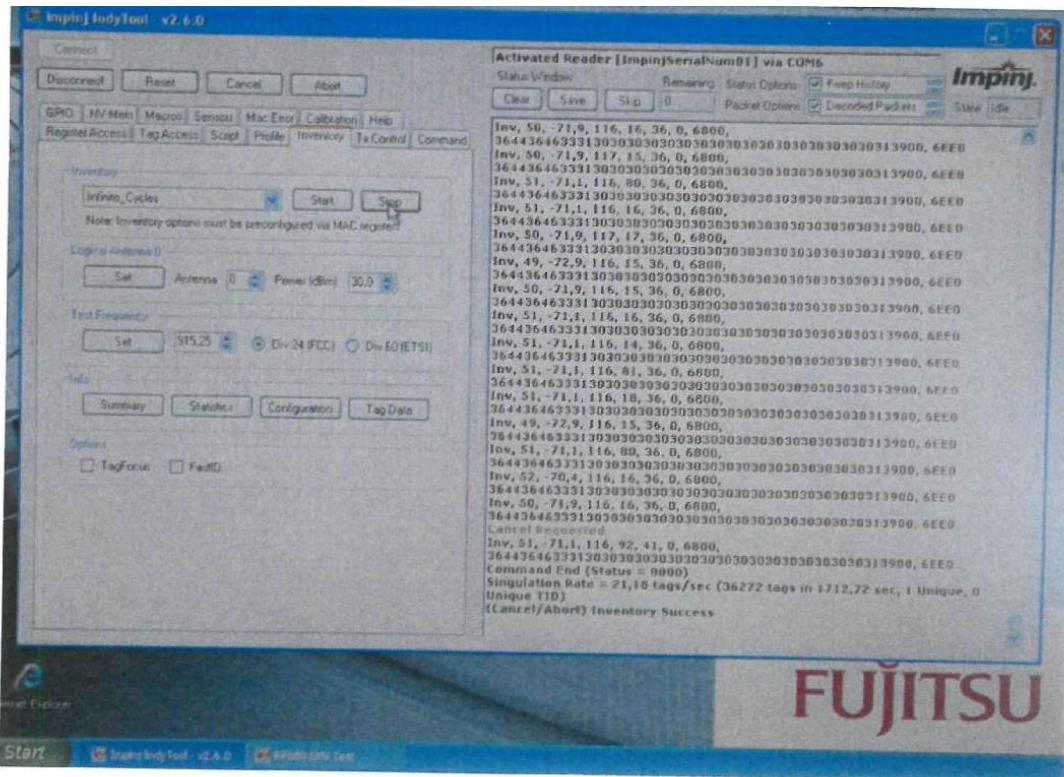
The EuT is declared as Class B digital device.

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

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Screenshot of the supportet test software:

Tag reading 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 : 14. May 2014

Testing concluded on : 19. May 2014

Checked by: **Test**

Checked by: _____ Tested by: _____

Thomas Weise
Laboratory Manager

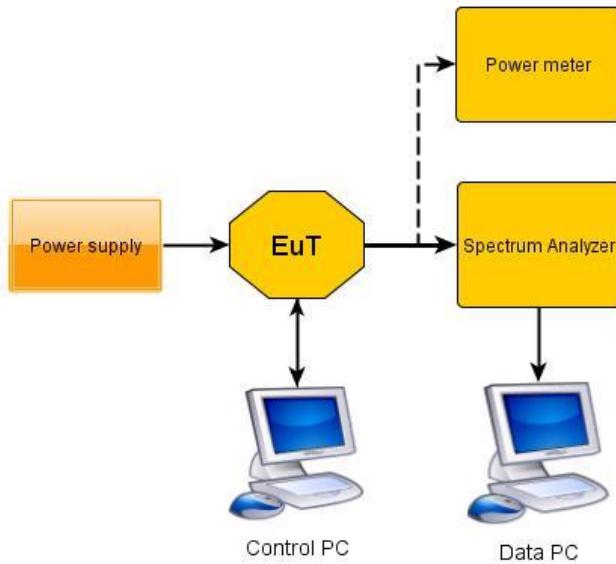
Markus Huber

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3 EQUIPMENT UNDER TEST

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

3.2 Test setup



3.3 Power supply system utilised

Power supply voltage: : 100-240 V / 50-60 Hz / 1φ, 24 V DC

3.4 Short description of the EUT

The EuT's are UHF RFID reader systems. They can read active and passive Tags in the frequency range from 902 to 928 MHz.

Number of tested samples: 1
Serial number: Prototype

EUT operation mode:

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

- TAG reading mode supplying 30.0 dBm (902.75 MHz to 927.25 MHz)

- Standby mode

-

-

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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 : RF660A
 - Antenna Model : RF620A
 - Antenna Model : RF640A
 - Antenna Model : RF642A
 - Power supply Model : 6GT2898-0AC81, ES 001
 - Model :
- customer specific cables

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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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4.5 Measurement Protocol for FCC, VCCI and AUSTEL

4.5.1 GENERAL INFORMATION

4.5.1.1 Test Methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.10: 2009, Testing Unlicensed Wireless Devices."

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.5.1.2 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.

4.6 Determination of worst case measurement conditions

Pre measurements shows that the RF680R is the worst case model. So the complete testing were performed with this model and with max. Tx power setting 30 dBm.

Following measurements have been made with following samples, settings and antennas:

- RF650R – Partly testing:
 - o 20 dB bandwidth, power setting 30.0 dBm
 - o Maximum peak conducted output power, power setting 30.0 dBm
 - o Channel separation, power setting 30.0 dBm
- RF680R – Complete testing:
 - o Conducted emissions, power setting 30.0 dBm (antenna RF660A)
 - o 20 dB bandwidth, power setting 30.0 dBm
 - o Maximum peak conducted output power, power setting 30.0 dBm
 - o Maximum peak conducted output power, power setting 29.0 dBm
 - o Spurious RF conducted emissions, power setting 30.0 dBm
 - o Spurious radiated emissions in the restricted bands, power setting 30.0 dBm (antenna RF660A)
 - o Hopping sequence, power setting 30.0 dBm
 - o Dwell time, power setting 30.0 dBm
 - o Channel separation, power setting 30.0 dBm
 - o Quantity of hopping channels, power setting 30.0 dBm
 - o Maximum permissible exposure (MPE), power setting 30.0 dBm (antenna RF660A) and 29.0 dBm (antenna RF642A)
- RF685R – Partly testing:
 - o Maximum peak conducted output power, power setting 30.0 dBm

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5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

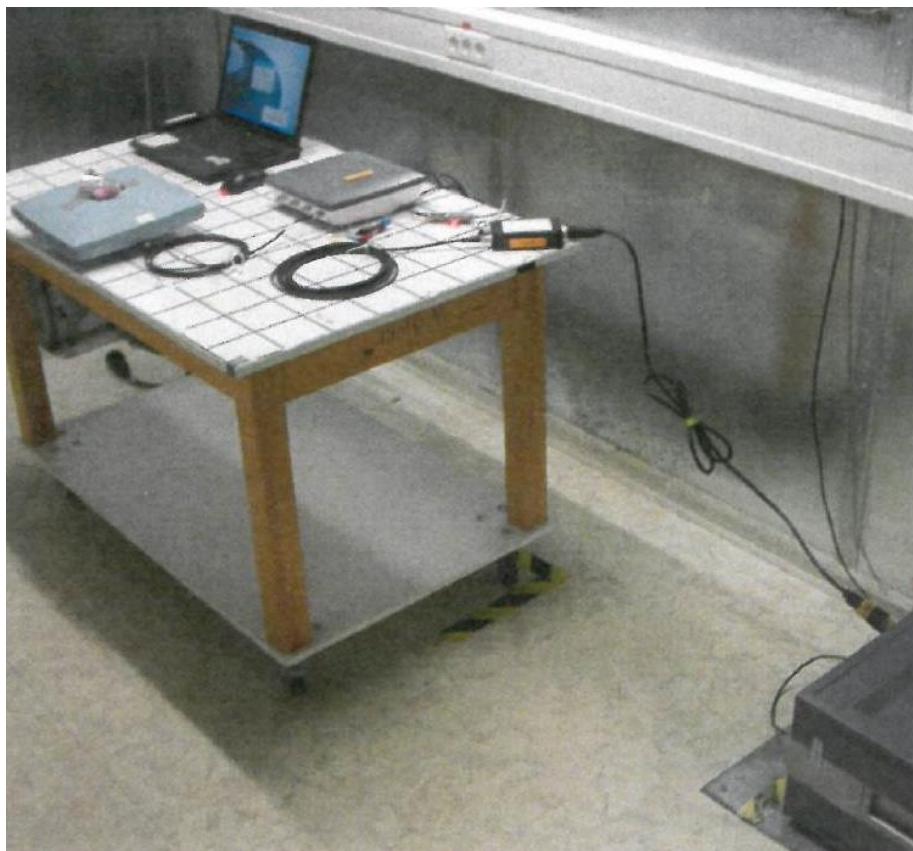
For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up

RF680R:



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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 (dB μ V)	
	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 $50\ \Omega/50\ \mu\text{H}$ (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 dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20 \log \mu\text{V}$$

$$\mu\text{V} = 10^{(\text{dB}\mu\text{V}/20)}$$

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz
 Min. limit margin 2.9 dB at 0.417 MHz

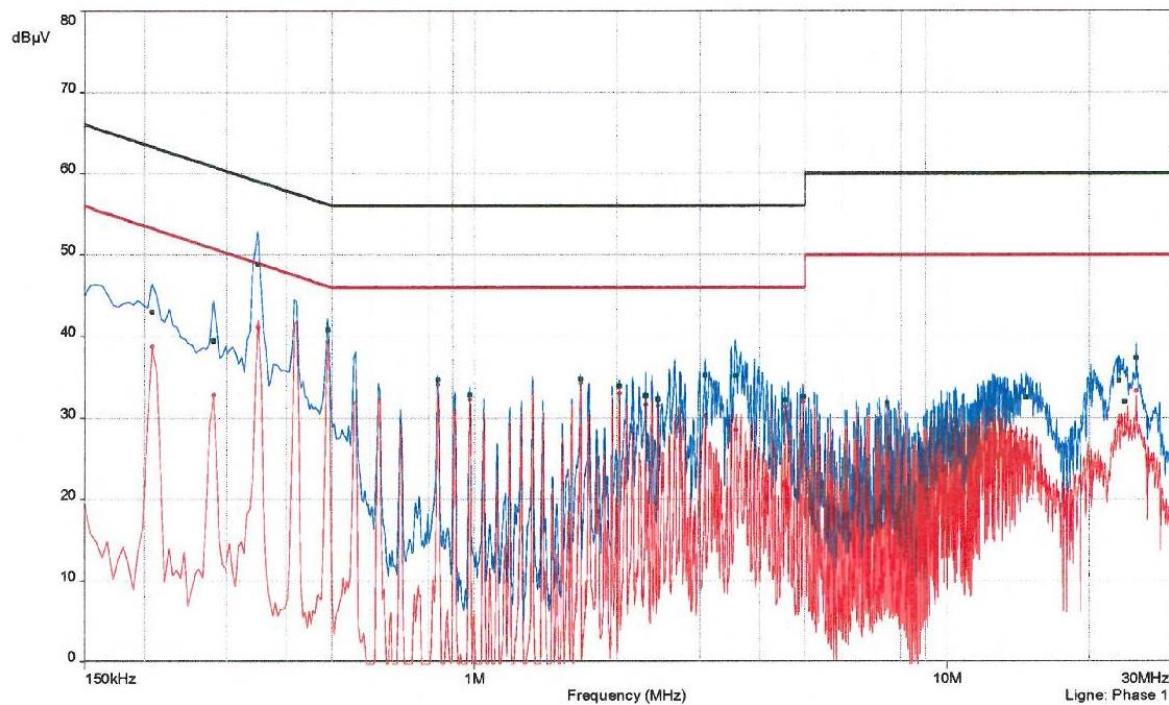
The requirements are **FULFILLED**.

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

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5.1.6 Test protocol

Test point: L1
 Operation mode: Tag reading mode supplying 30.0 dBm
 Remarks: RF680R

Result: Passed



freq	SR	QP	margin	limit	AV	margin	limit	line
MHz		dB(μ V)	dB	dB	dB(μ V)	dB	dB	
0.2085	1	42.96	20.31	63.26	38.87	14.4	53.26	Phase 1
0.2805	1	39.44	21.36	60.8	32.91	17.9	50.8	Phase 1
0.3495	2	48.91	10.07	58.97	41.16	7.82	48.97	Phase 1
0.489	2	40.82	15.37	56.18	39.37	6.81	46.18	Phase 1
0.8385	3	34.73	21.27	56	34.14	11.86	46	Phase 1
0.978	3	32.8	23.2	56	32.35	13.65	46	Phase 1
1.677	4	34.8	21.2	56	34.39	11.61	46	Phase 1
2.028	4	33.9	22.1	56	33.16	12.84	46	Phase 1
2.307	4	32.78	23.22	56	31.76	14.24	46	Phase 1
2.445	5	32.28	23.72	56	31.59	14.41	46	Phase 1
3.075	5	35.26	20.74	56	30.37	15.63	46	Phase 1
3.5655	5	35.13	20.87	56	28.63	17.37	46	Phase 1
4.542	5	32.18	23.82	56	31.38	14.62	46	Phase 1
4.962	6	32.61	23.39	56	32.07	13.93	46	Phase 1
7.4775	6	31.84	28.16	60	31.48	18.52	50	Phase 1
12.507	7	32.61	27.39	60	29.73	20.27	50	Phase 1
13.2765	7	32.37	27.63	60	31.23	18.77	50	Phase 1
13.6275	7	30.92	29.08	60	28.39	21.61	50	Phase 1
14.6715	7	32.51	27.49	60	27.79	22.21	50	Phase 1
23.0565	8	34.56	25.44	60	29.55	20.45	50	Phase 1
23.6865	8	31.98	28.02	60	28.1	21.9	50	Phase 1
25.0815	8	37.33	22.67	60	33.33	16.67	50	Phase 1

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Test point

N

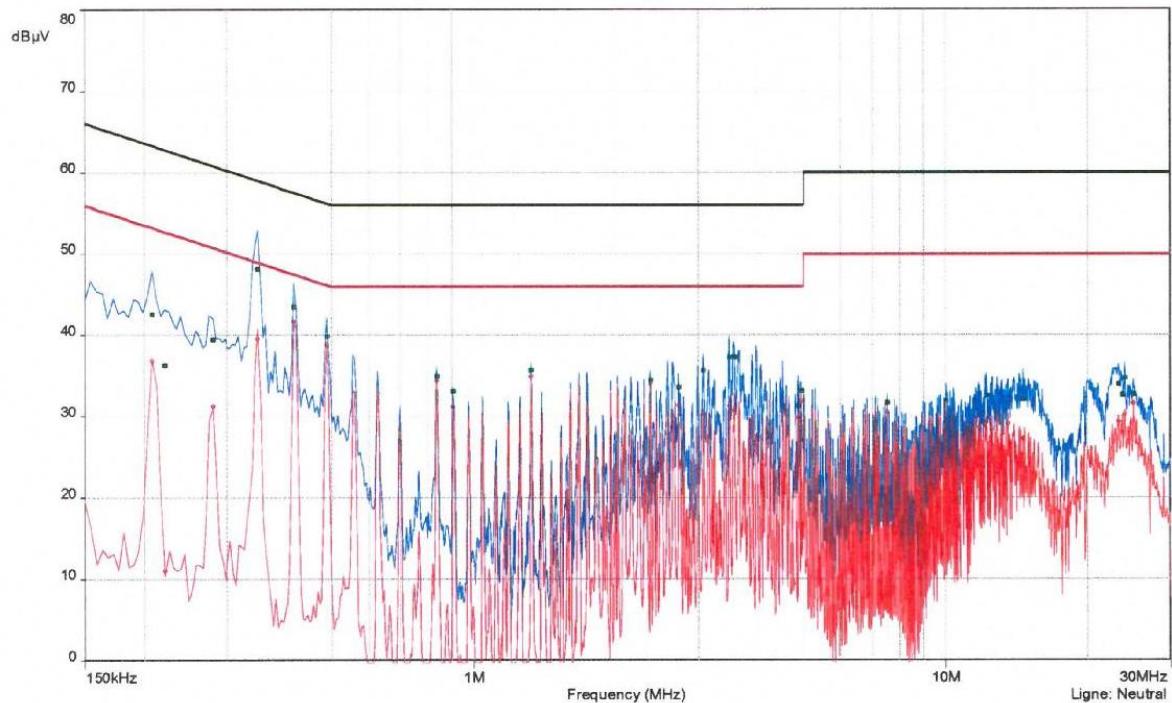
Operation mode:

Tag reading mode supplying 30.0 dBm

Remarks:

RF680R

Result: Passed



freq MHz	SR	QP dB(μ V)	margin dB	limit dB	AV dB(μ V)	margin dB	limit dB	line
0.2085	9	42.48	20.78	63.26	36.91	16.35	53.26	Neutral
0.222	9	36.23	26.52	62.74	11.07	41.67	52.74	Neutral
0.2805	9	39.48	21.32	60.8	31.34	19.46	50.8	Neutral
0.3495	10	48.16	10.81	58.97	39.61	9.36	48.97	Neutral
0.417	10	43.42	14.09	57.51	41.76	5.74	47.51	Neutral
0.489	10	39.83	16.35	56.18	38.88	7.31	46.18	Neutral
0.8385	11	34.9	21.1	56	34.44	11.56	46	Neutral
0.906	11	33.08	22.92	56	31.24	14.76	46	Neutral
1.326	12	35.6	20.4	56	35.03	10.97	46	Neutral
2.3745	12	34.36	21.64	56	34.04	11.96	46	Neutral
2.724	13	33.54	22.46	56	31.39	14.61	46	Neutral
3.075	13	35.53	20.47	56	30.34	15.66	46	Neutral
3.489	13	37.21	18.79	56	31.35	14.65	46	Neutral
3.579	13	37.23	18.77	56	30.82	15.18	46	Neutral
4.89	14	31.28	24.72	56	29.84	16.16	46	Neutral
4.9575	14	33.04	22.96	56	31.91	14.09	46	Neutral
7.5405	14	31.67	28.33	60	30.53	19.47	50	Neutral

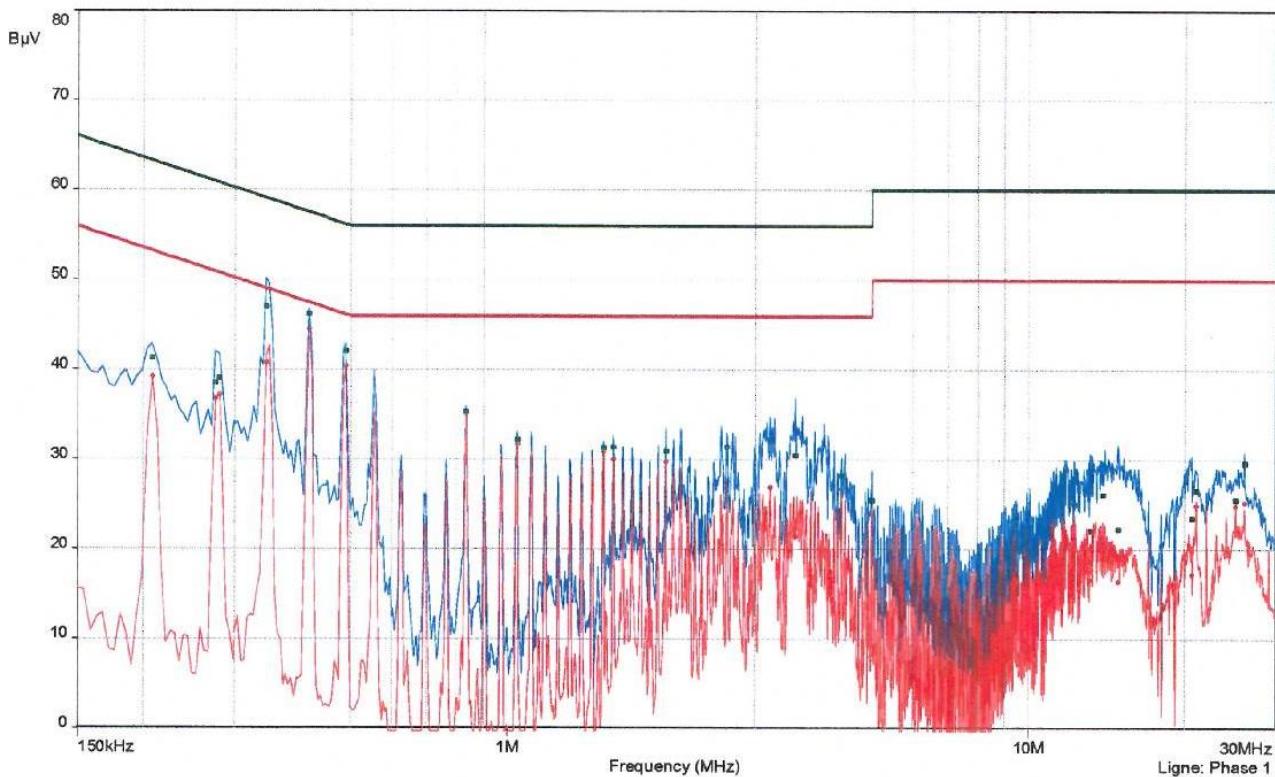
FCC ID: NXW-RF600R2

freq MHz	SR	QP dB(µV)	margin dB	limit dB	AV dB(µV)	margin dB	limit dB	line
10.0545	15	31.77	28.23	60	30.5	19.5	50	Neutral
12.219	15	32.5	27.5	60	29.33	20.67	50	Neutral
13.614	15	31.22	28.78	60	29.17	20.83	50	Neutral
14.6625	15	32.02	27.98	60	27.28	22.72	50	Neutral
23.3175	16	33.87	26.13	60	29.38	20.62	50	Neutral
23.736	16	32.58	27.42	60	28.12	21.88	50	Neutral
24.087	16	34.68	25.32	60	30.35	19.65	50	Neutral
25.095	16	32.63	27.37	60	31.65	18.35	50	Neutral

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Test point: L1
 Operation mode: Standby mode
 Remarks: RF680R

Result: Passed



freq MHz	SR	QP dB(µV)	margin dB	limit dB	AV dB(µV)	margin dB	limit dB	line
0.2085	1	41.28	21.99	63.26	39.34	13.93	53.26	Phase 1
0.276	1	38.54	22.39	60.94	36.92	14.02	50.94	Phase 1
0.2805	1	39.04	21.76	60.8	37.37	13.43	50.8	Phase 1
0.345	2	46.96	12.12	59.08	40.87	8.21	49.08	Phase 1
0.417	2	46.16	11.35	57.51	44.53	2.98	47.51	Phase 1
0.489	2	42.04	14.14	56.18	40.47	5.72	46.18	Phase 1
0.834	3	35.34	20.66	56	35.14	10.86	46	Phase 1
1.0455	3	32.2	23.8	56	31.77	14.23	46	Phase 1
1.533	4	31.31	24.69	56	31.05	14.95	46	Phase 1
1.6005	4	31.38	24.62	56	30.19	15.81	46	Phase 1
2.019	4	30.92	25.08	56	29.84	16.16	46	Phase 1
2.6475	5	31.38	24.62	56	27.55	18.45	46	Phase 1
3.2055	5	32.16	23.84	56	27.05	18.95	46	Phase 1
3.5745	5	30.45	25.55	56	21.46	24.54	46	Phase 1
4.389	5	28.24	27.76	56	26.81	19.19	46	Phase 1
5.016	6	25.46	34.54	60	24.06	25.94	50	Phase 1
9.4755	6	23.55	36.45	60	20.49	29.51	50	Phase 1

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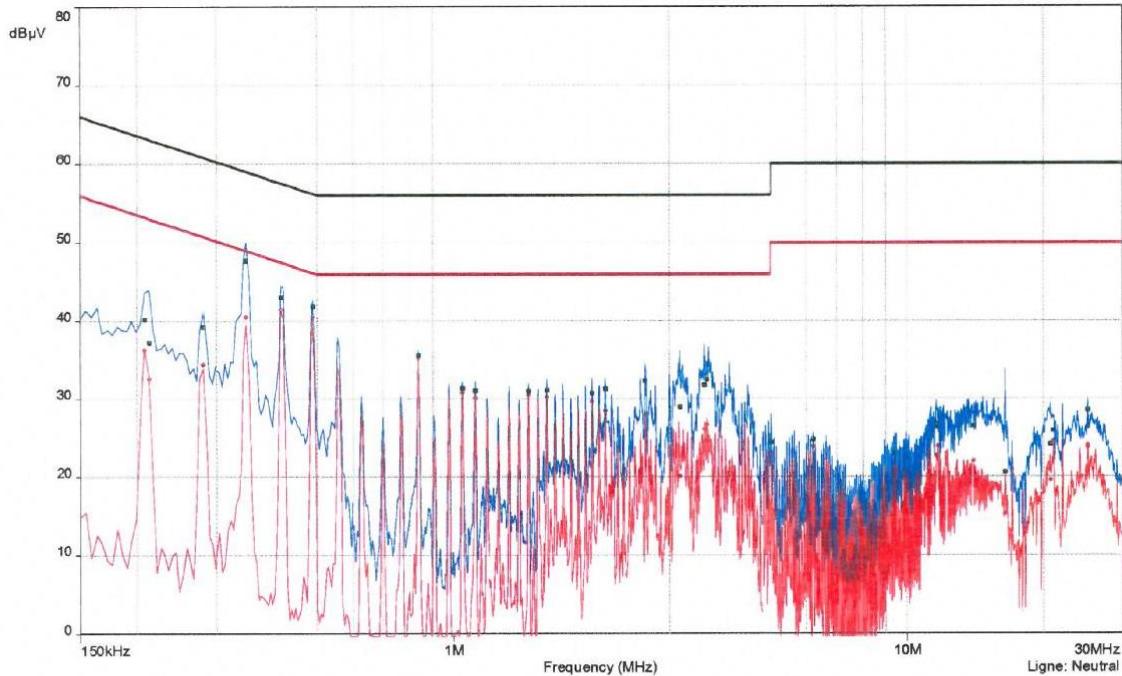
freq MHz	SR	QP dB(µV)	margin dB	limit dB	AV dB(µV)	margin dB	limit dB	line
12.264	7	25.04	34.96	60	21.32	28.68	50	Phase 1
13.1685	7	22.13	37.87	60	16.64	33.36	50	Phase 1
13.938	7	26.07	33.93	60	21.42	28.58	50	Phase 1
14.91	7	22.26	37.74	60	16.46	33.54	50	Phase 1
20.703	8	23.49	36.51	60	17.25	32.75	50	Phase 1
21.063	8	26.6	33.4	60	25.03	24.97	50	Phase 1
25.0725	8	25.54	34.46	60	24.92	25.08	50	Phase 1
26.076	8	29.65	30.35	60	25.35	24.65	50	Phase 1

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Test point
Operation mode:
Remarks:

N
Standby mode
RF680R

Result: Passed



freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
0.2085	9	40.19	23.07	63.26	36.31	16.96	53.26	Neutral
0.213	9	37.16	25.93	63.09	32.63	20.46	53.09	Neutral
0.2805	9	39.2	21.6	60.8	34.42	16.38	50.8	Neutral
0.3495	10	47.7	11.28	58.97	40.57	8.4	48.97	Neutral
0.417	10	43	14.51	57.51	41.52	5.99	47.51	Neutral
0.489	10	41.83	14.36	56.18	40.55	5.63	46.18	Neutral
0.8385	11	35.59	20.41	56	35.34	10.66	46	Neutral
1.0455	11	31.31	24.69	56	30.88	15.12	46	Neutral
1.1175	11	31.03	24.97	56	30.15	15.85	46	Neutral
1.4655	12	30.91	25.09	56	30.57	15.43	46	Neutral
1.605	12	31.1	24.9	56	30.35	15.65	46	Neutral
2.0235	12	30.7	25.3	56	29.71	16.29	46	Neutral
2.163	12	31.26	24.74	56	28.53	17.47	46	Neutral
2.652	13	32.27	23.73	56	28.07	17.93	46	Neutral
3.1605	13	28.87	27.13	56	20.08	25.92	46	Neutral
3.5835	13	31.76	24.24	56	26.19	19.81	46	Neutral
3.6285	13	32.39	23.61	56	26.75	19.25	46	Neutral
5.025	14	24.42	35.58	60	23.18	26.82	50	Neutral
6.213	14	24.8	35.2	60	23.89	26.11	50	Neutral
9.354	14	23.06	36.94	60	21.2	28.8	50	Neutral
9.426	14	23.31	36.69	60	21.79	28.21	50	Neutral

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freq MHz	SR	QP dB(µV)	margin dB	limit dB	AV dB(µV)	margin dB	limit dB	line
11.589	15	26.3	33.7	60	22.72	27.28	50	Neutral
11.7285	15	26.69	33.31	60	24.02	25.98	50	Neutral
14.0325	15	26.48	33.52	60	22.08	27.92	50	Neutral
16.4805	15	20.53	39.47	60	15.29	34.71	50	Neutral
20.7345	16	24.12	35.88	60	19.59	30.41	50	Neutral
21.0585	16	25.9	34.1	60	24.68	25.32	50	Neutral
25.068	16	28.49	31.51	60	23.85	26.15	50	Neutral
25.0725	16	26.32	33.68	60	24.1	25.9	50	Neutral

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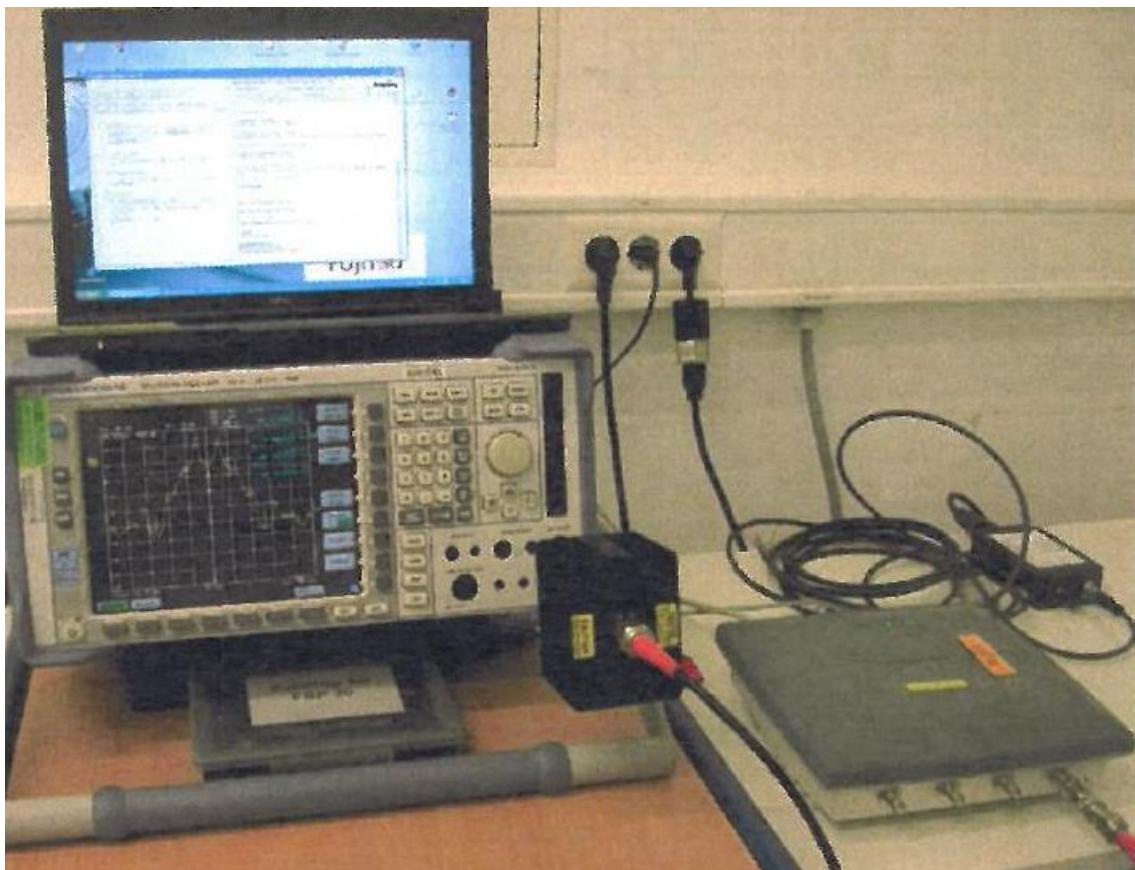
5.2 20 dB bandwidth

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

5.2.1 Description of the test location

Test location: Shielded room S5

5.2.2 Photo documentation of the test set-up



5.2.1 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.

5.2.2 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.

FCC ID: NXW-RF600R2
5.2.3 Test result

RF650R - Power setting 30.0 dBm:

Channel No.	-20 dB Bandwidth below peak (kHz)
CH 1 (902.75 MHz)	79.8
CH 25 (914.75 MHz)	80.4
CH 50 (927.25 MHz)	81.6

RF680R - Power setting 30.0 dBm:

Channel No.	-20 dB Bandwidth below peak (kHz)
CH 1 (902.75 MHz)	70.2
CH 25 (914.75 MHz)	73.8
CH 50 (927.25 MHz)	69.0

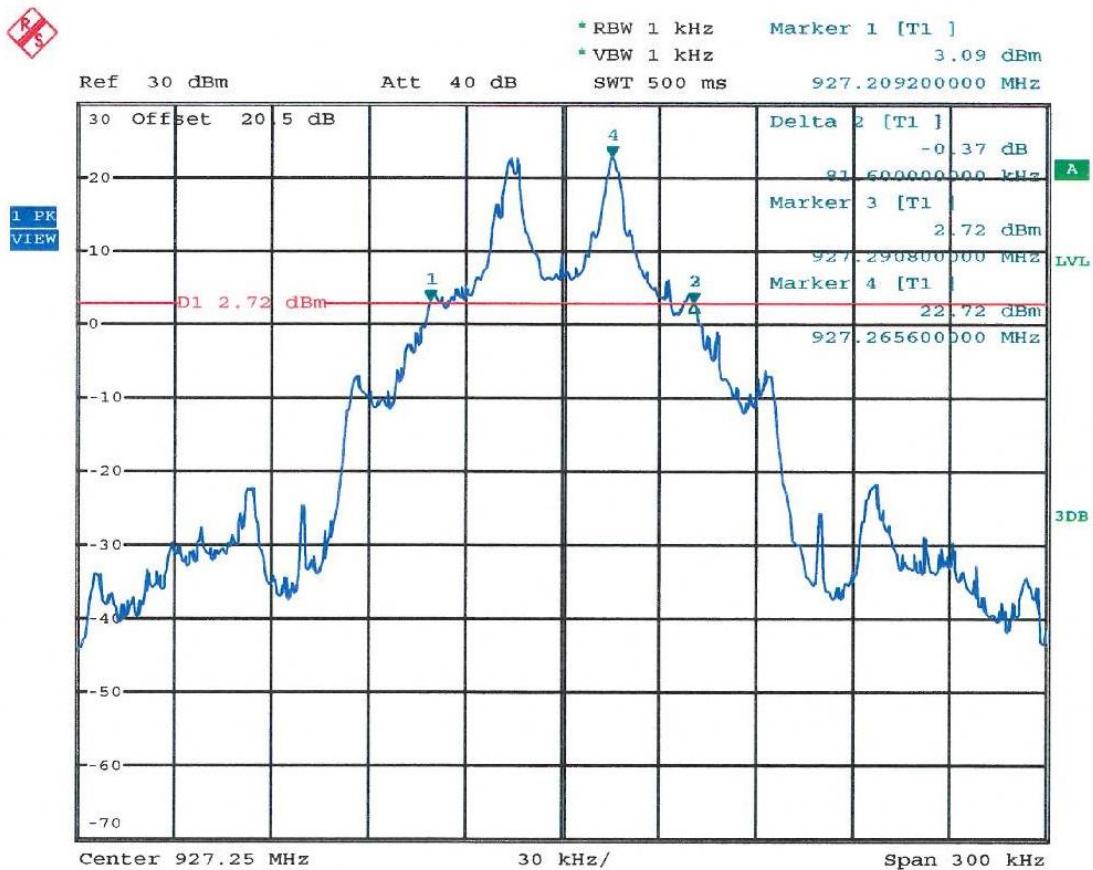
Note: For example about the settings from the measurement one plot from each device is attached.

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

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

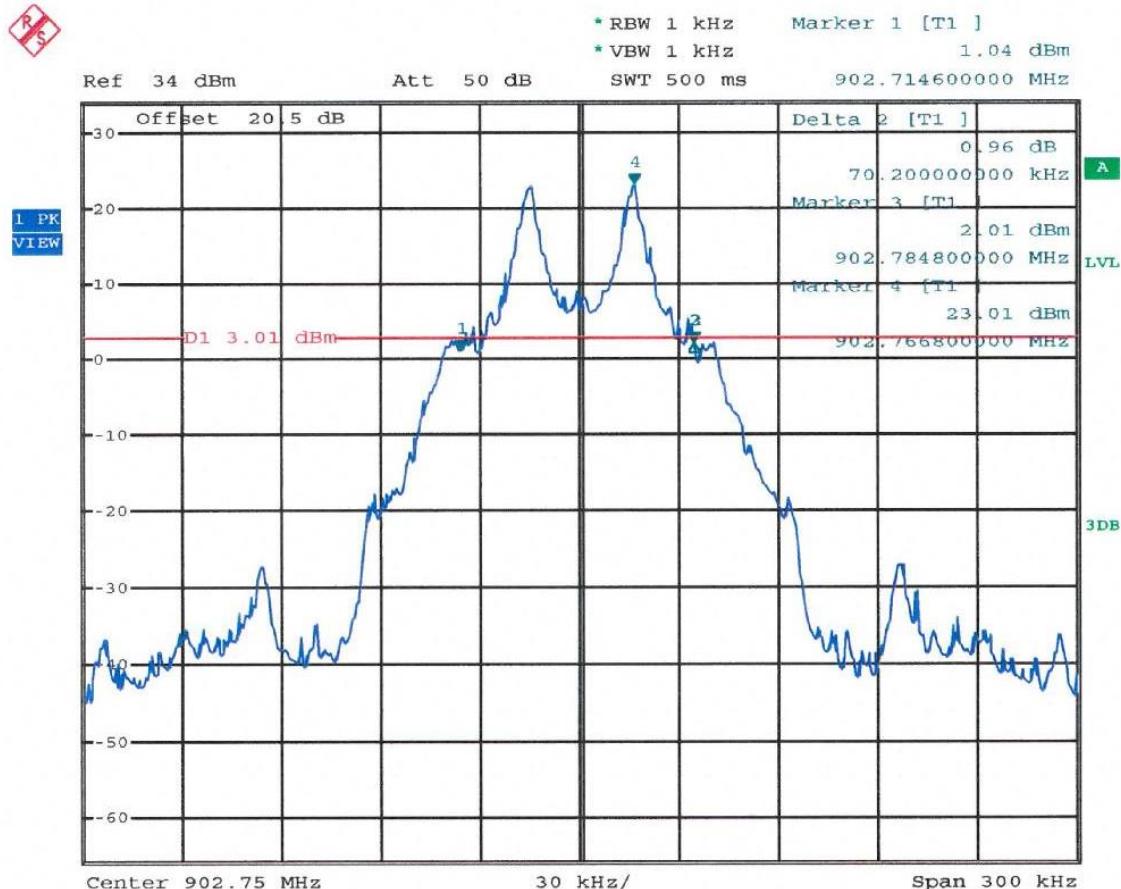
The requirements are **FULFILLED**.

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

FCC ID: NXW-RF600R2
5.2.4 Test protocol
**RF650R
Channel 50
927.25 MHz**


FCC ID: NXW-RF600R2

RF680R
Channel 01
902.75 MHz

FCC ID: NXW-RF600R2

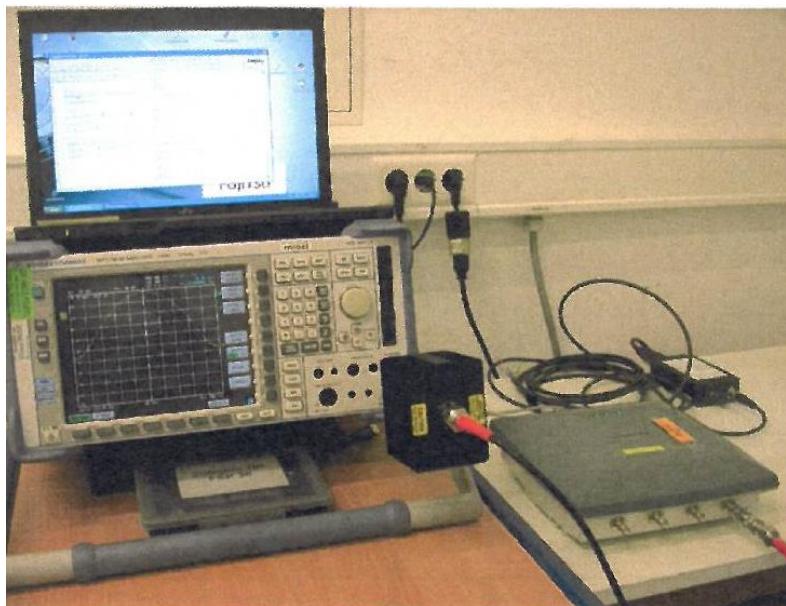
5.3 Maximum peak conducted output power

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

5.3.1 Description of the test location

Test location: Shielded room S5

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	100 kHz	Sweep time	5 ms (Auto)
VBW	300 kHz	Power Mode	Max. hold
Detector	Peak	Span	500 kHz

FCC ID: NXW-RF600R2
5.3.5 Test result

a.) RF650R, power setting 30.0 dBm
 =>RF660A, antenna gain: 6.0 dBi

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
1	902.75	28.60	30.0	-1.40
25	914.75	28.48	30.0	-1.52
50	927.25	28.27	30.0	-1.73

b.) RF680R, power setting 29.0 dBm
 =>RF642A, antenna gain: 7.0 dBi

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
1	902.75	27.92	30.0	-2.08
25	914.75	28.10	30.0	-1.90
50	927.25	27.87	30.0	-2.13

c.) RF680R, power setting 30.0 dBm
 =>RF660A, antenna gain: 6.0 dBi

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
1	902.75	29.13	30.0	-0.87
25	914.75	28.63	30.0	-1.37
50	927.25	28.29	30.0	-1.71

d.) RF685R, power setting 30.0 dBm
 =>RF660A, antenna gain: 6.0 dBi

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
1	902.75	29.00	30.0	-1.0
25	914.75	29.31	30.0	-0.69
50	927.25	28.72	30.0	-1.18

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 (MHz)	Hopping channels	Hop. CH carrier frequ. separation	Peak Power Limit	
			(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 (7.0 dBi) exceeds 6 dBi. Refer to 5.3.5 b.) above.

FCC ID: NXW-RF600R2

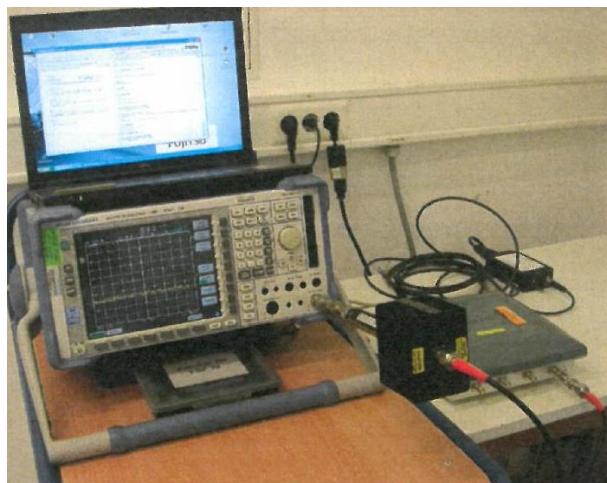
5.4 Spurious RF conducted emissions

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 S5

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

FCC ID: NXW-RF600R2**5.4.5 Test result**

Power setting 30.0 dBm

Hopping frequency from 902.75 to 927.25 MHz, max. level 29.46 dBm			
Frequency (MHz)	Peak power * (dBm)	Limit (-20 dB) (dBm)	Delta (dB)
2764.0	-27.10	9.46	-36.3
3988.0	-56.83	9.46	-66.3
7768.0	-55.82	9.46	-65.3

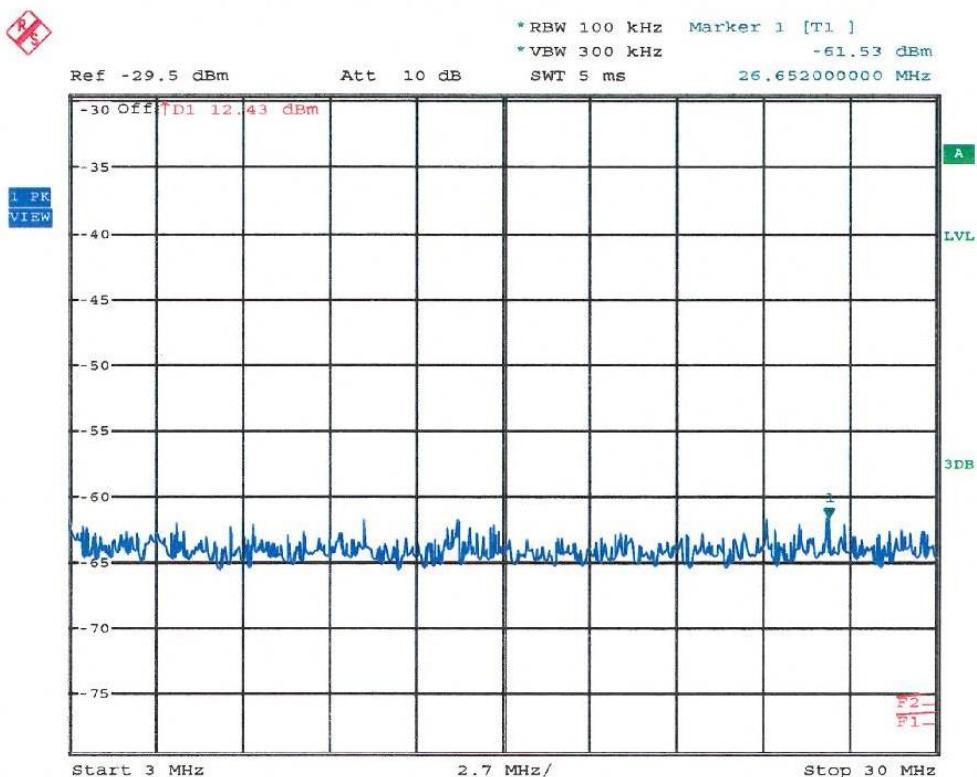
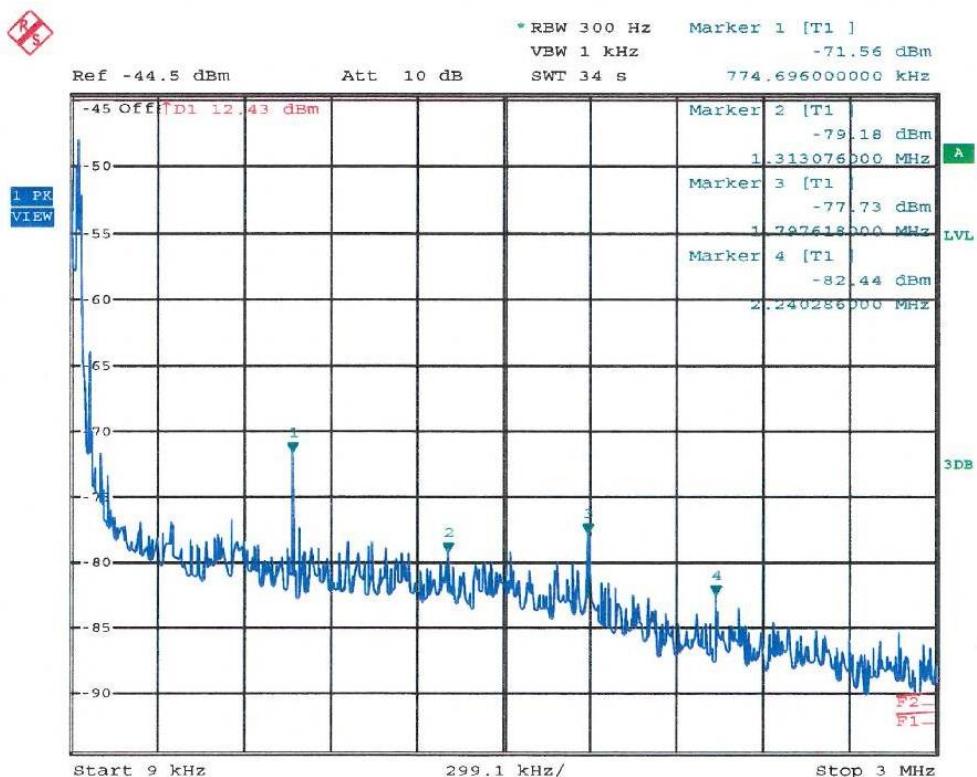
* Fixed attenuation of 20 dB is included in the Peak power.

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 902.75 to 927.25 MHz.
 - This mode represents the worst case mode of the EuT.

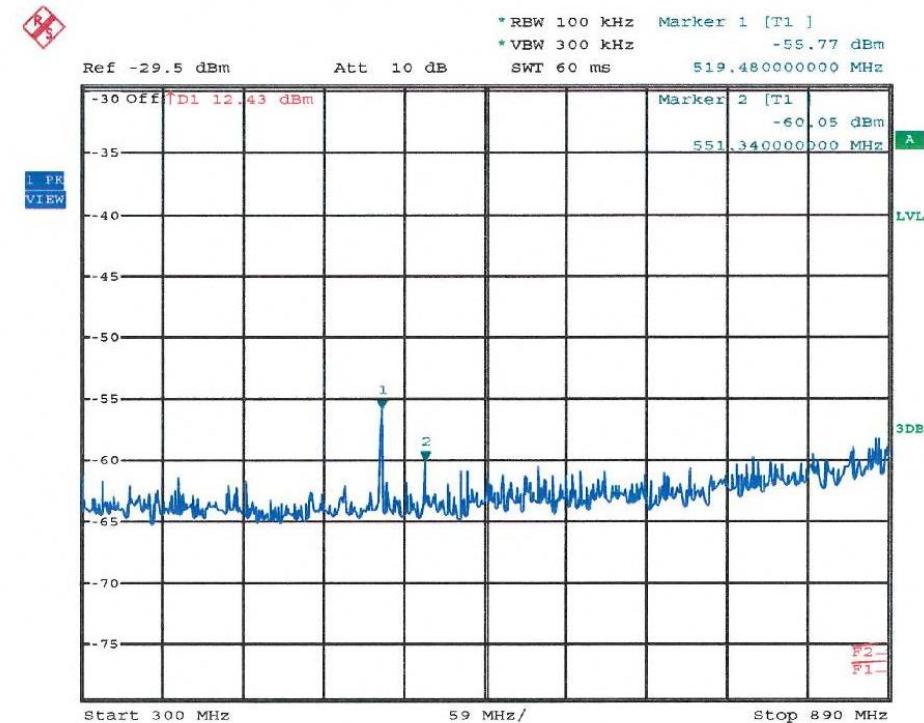
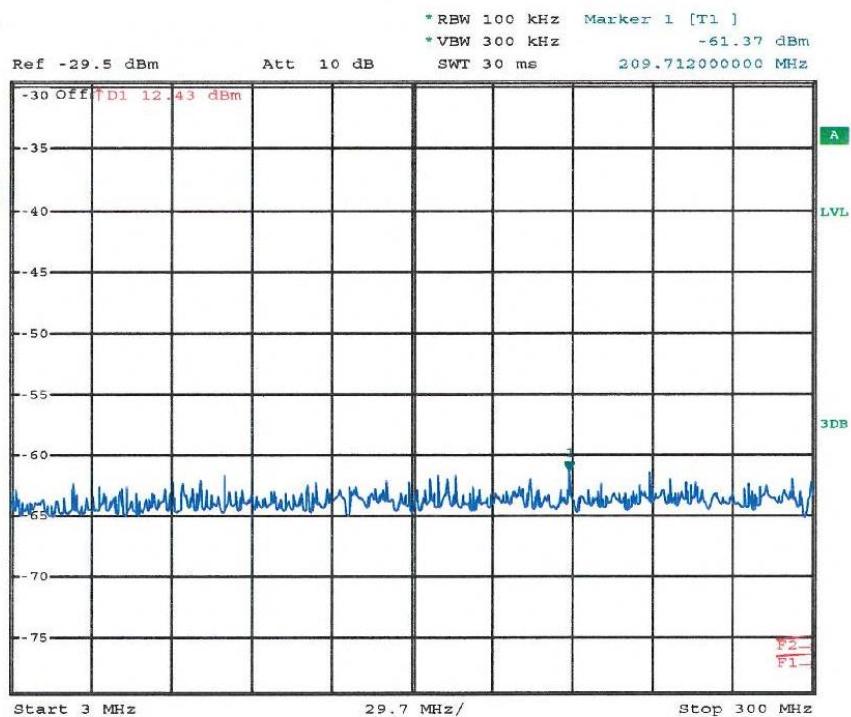
FCC ID: NXW-RF600R2

Conducted RF emission from 9 kHz to 30 MHz

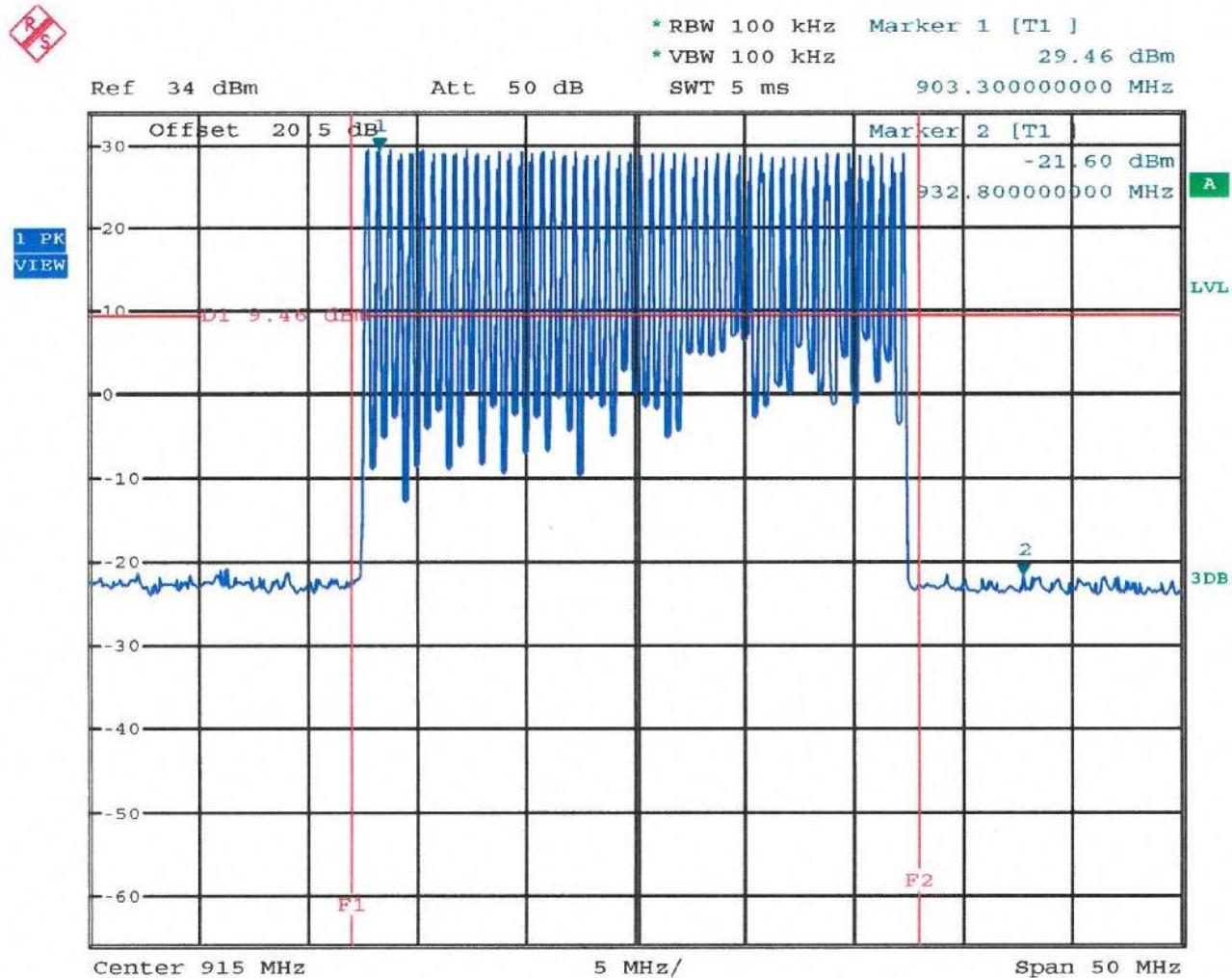


FCC ID: NXW-RF600R2

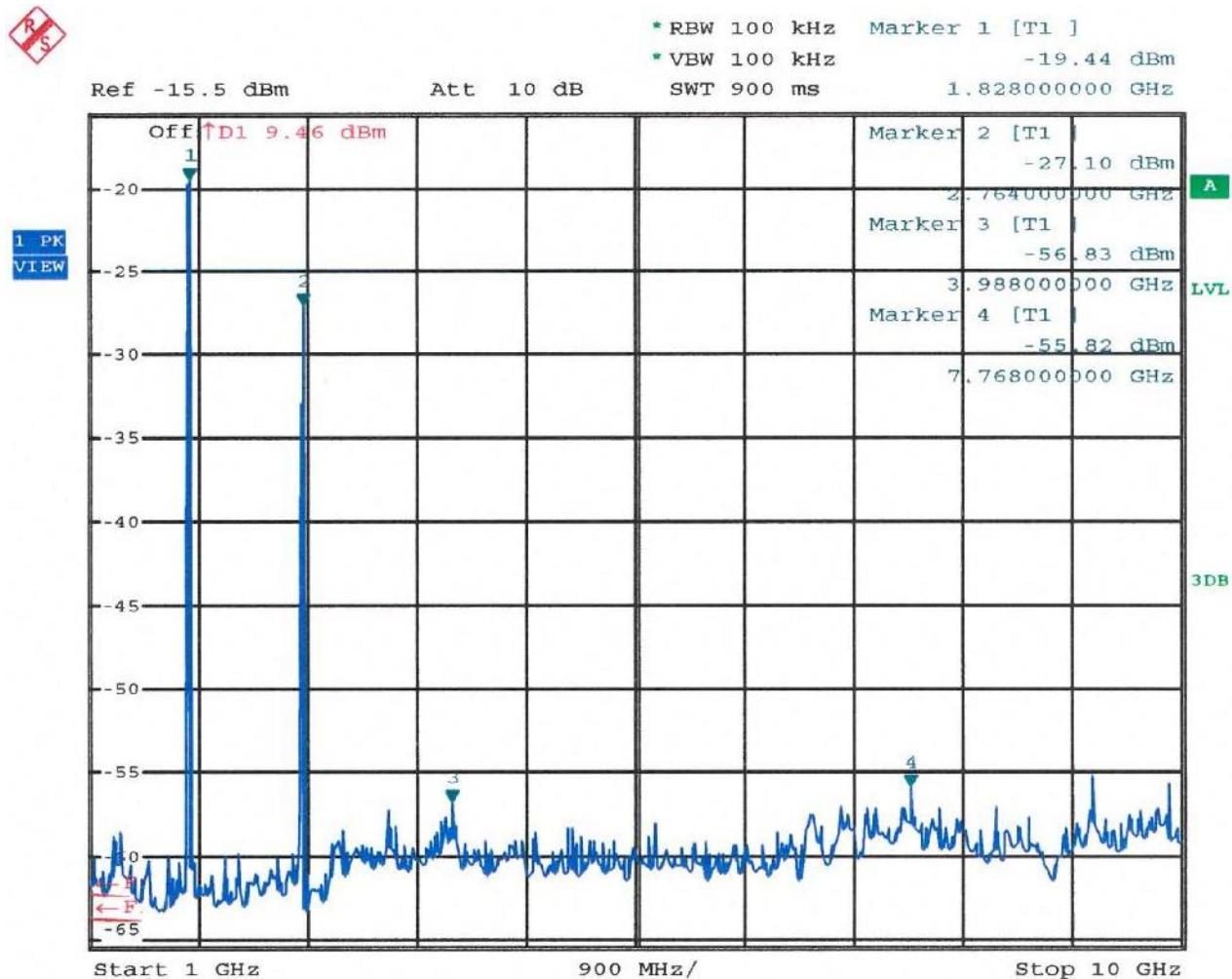
Conducted RF emission from 30 to 1000 MHz



FCC ID: NXW-RF600R2
 Conducted RF emission from 30 to 1000 MHz
 (Band edge)



FCC ID: NXW-RF600R2
Conducted RF emission from 1 to 10 GHz



level no. 2, no.3 and no.4 are located in restricted band.

FCC ID: NXW-RF600R2

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



FCC ID: NXW-RF600R2



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.

FCC ID: NXW-RF600R2
5.5.5 Test result
5.5.5.1 Radiated emission test f < 1 GHz

Frequency [kHz]	L: QP [dB μ V]	L: AV [dB μ V]	Bandwidth [kHz]	Correct. [dB]	L: QP [dB μ V/m]	L: AV [dB μ V/m]	Limit [dB μ V/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

Frequency [MHz]	L: QP [dB μ V]	Correct. [dB]	L: QP [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
33.78	3.7	13.4	17.1	40.0	-22.9
118.54	9.3	12.9	22.2	43.5	-21.3
517.43	4.8	21.9	26.7	46.0	-19.3

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

5.5.5.2 Radiated emission test f > 1GHz

RF680R, power setting 30.0 dBm
=>RF660A, antenna gain: 6.0 dBi

Frequency (GHz)	L: PK (dB μ V)	L: AV (dB μ V)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(μ V/m)	L: AV dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
2.764	49.75	38.64	1000	-9.2	40.6	29.4	54.0	-24.6

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

RBW: 1 MHz

VBW: 10 Hz

Sweep: Auto

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

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μ V/m)	dB(μ V/m)	
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

FCC ID: NXW-RF600R2
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.

FCC ID: NXW-RF600R2

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.

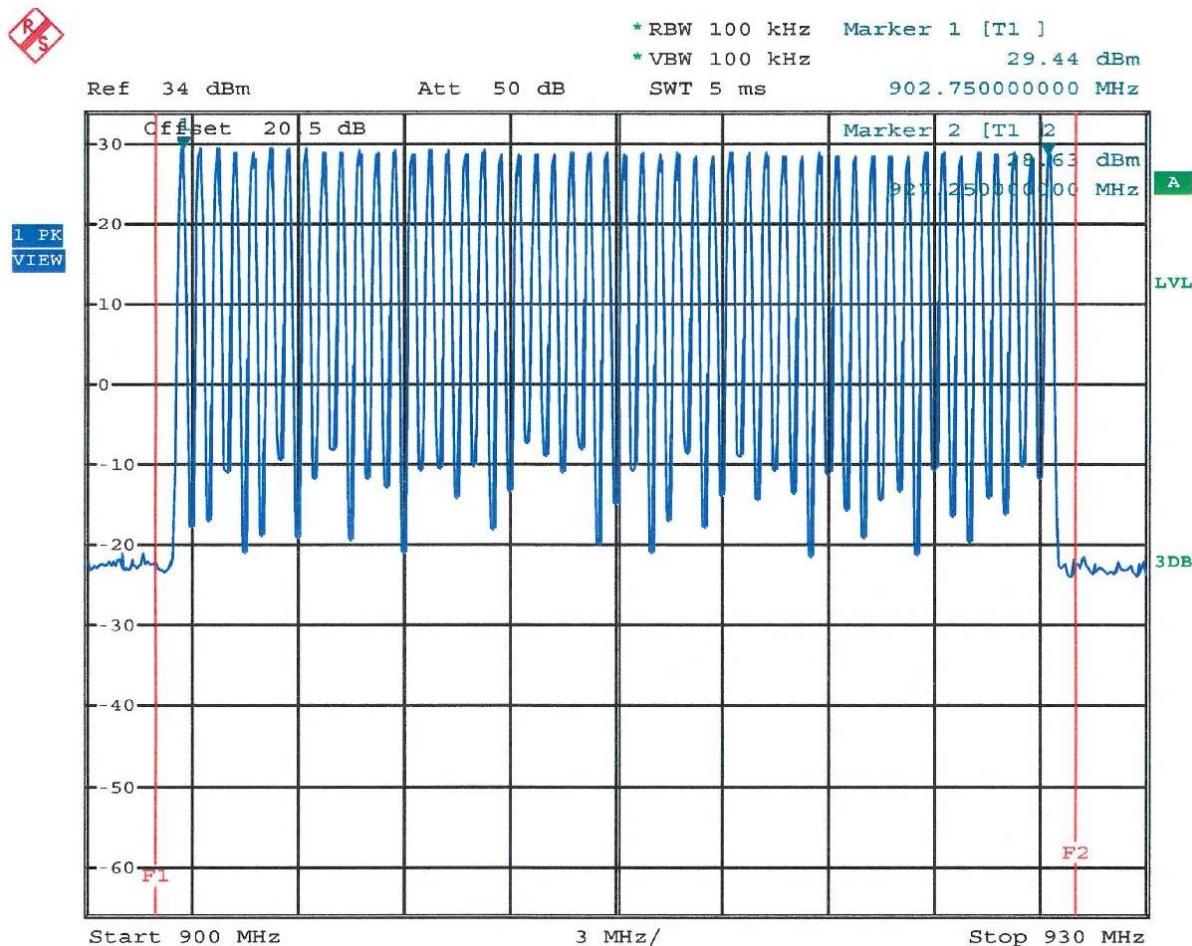
Remarks: The channel is represented by a pseudo-random hopping sequence hopping through the 50

RF-channels.

For detailed information about the hopping sequence, please refer to

“Theory of Operation Manual”.

5.6.1 Test protocol



FCC ID: NXW-RF600R2

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
“Theory of Operation 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 50 hopping channel mode.
(Declared by the manufacturer.)
For detailed information about the hopping sequence, please refer to
“Theory of Operation Manual”.

FCC ID: NXW-RF600R2

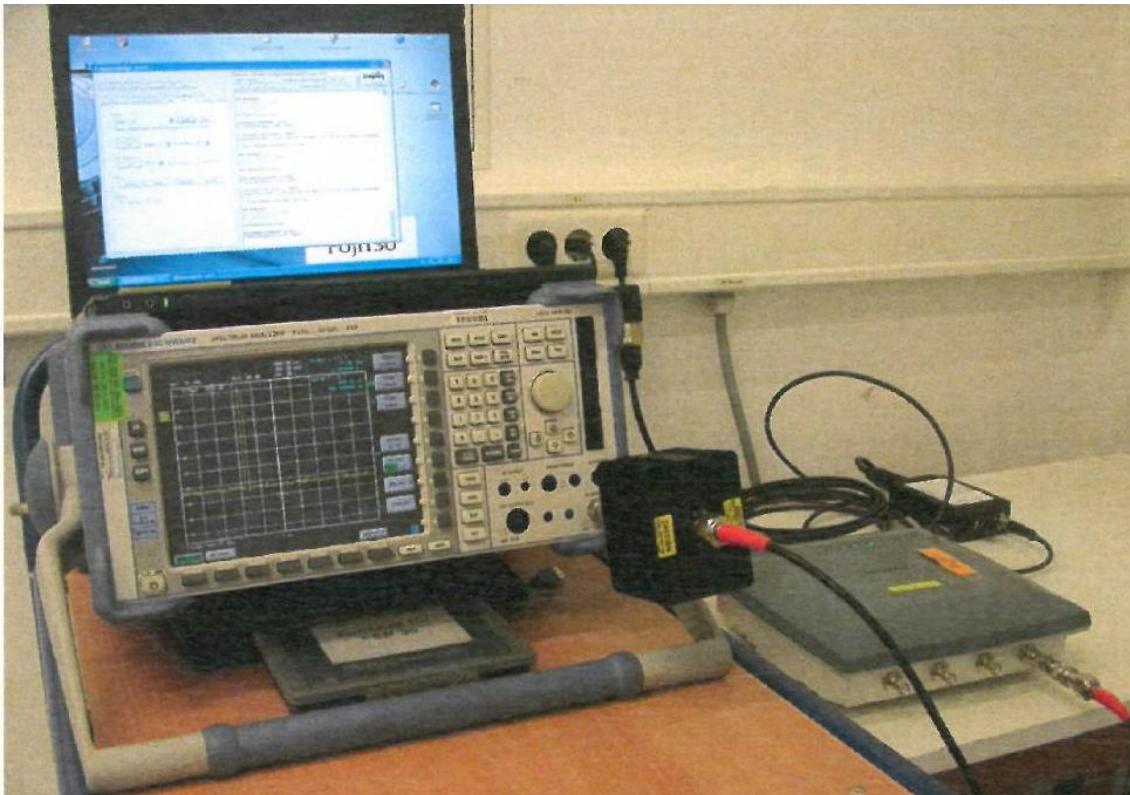
5.9 Dwell time

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

5.9.1 Description of the test location

Test location: Shielded room S5

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 and added up the appropriate time intervals the hopping system has applied this channel.

FCC ID: NXW-RF600R2**5.9.5 Test result**

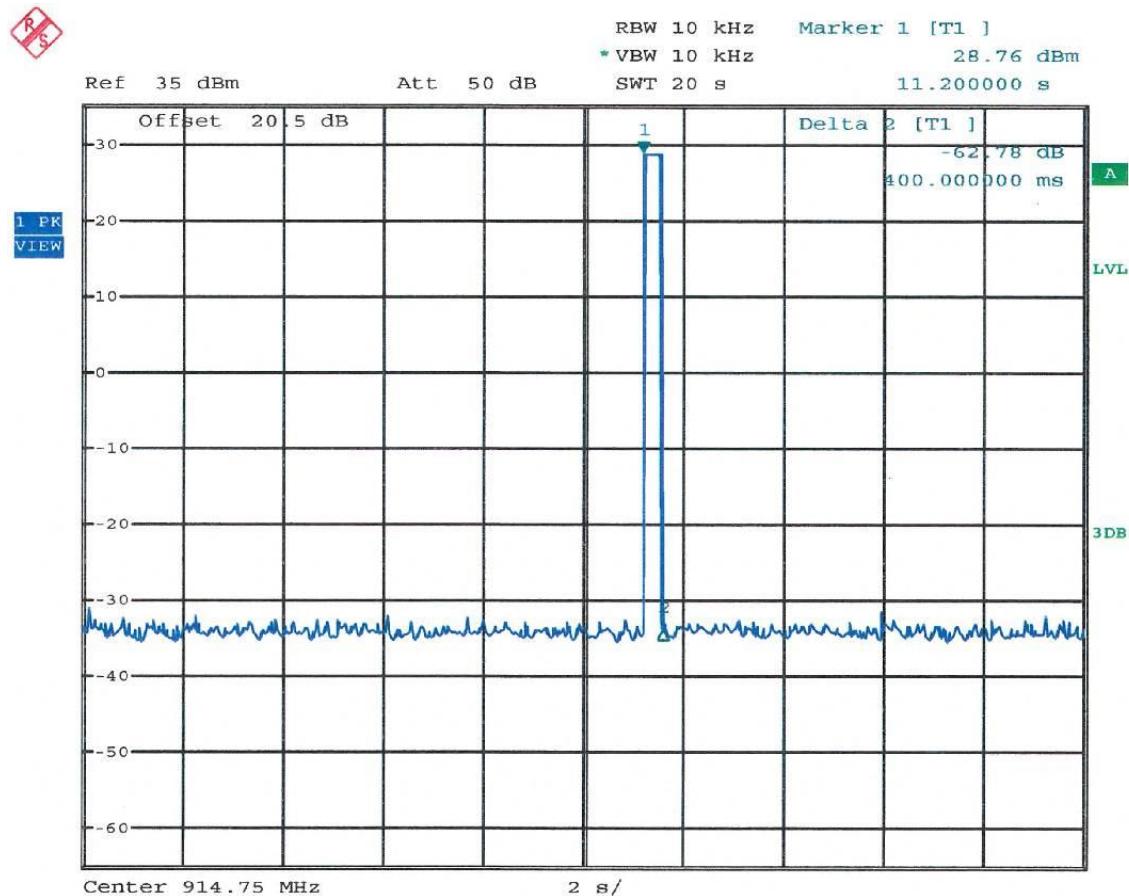
Channel frequency (MHz)	Pulse Time (ms)	Number of Bursts (in 1 time period)	Dwell time (ms)
914.75	400	1	400

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

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

The requirements are **FULFILLED**.

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

FCC ID: NXW-RF600R2
5.9.6 Test protocol
Time of occupancy (Dwell time)


FCC ID: NXW-RF600R2

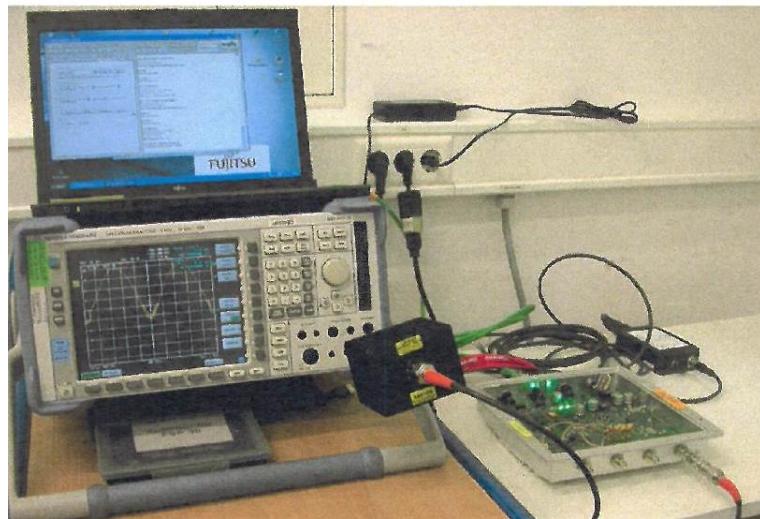
5.10 Channel separation

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

5.10.1 Description of the test location

Test location: Shielded room S5

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

- RF650R:

Channel 1 (MHz)	Channel 2 (MHz)	Channel separation (kHz)
902.75	903.25	500

- RF680R:

Channel 1 (MHz)	Channel 2 (MHz)	Channel separation (kHz)
902.75	903.25	500

FCC ID: NXW-RF600R2

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

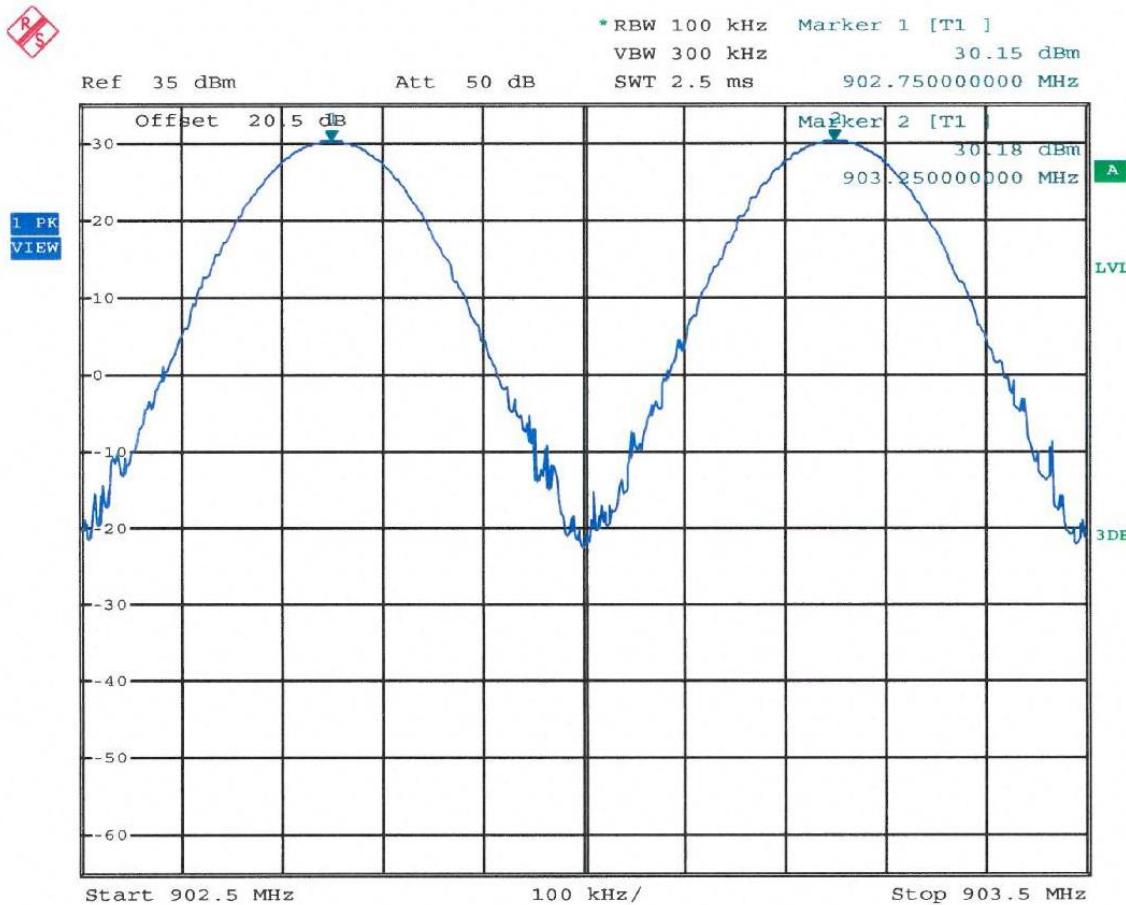
Frequency (MHz)	Hopping channels	Limit channel separation (kHz)
All systems		> 25 kHz or 20 dB bandwidth, which ever is greater
2400-2483.5	≥ 15	

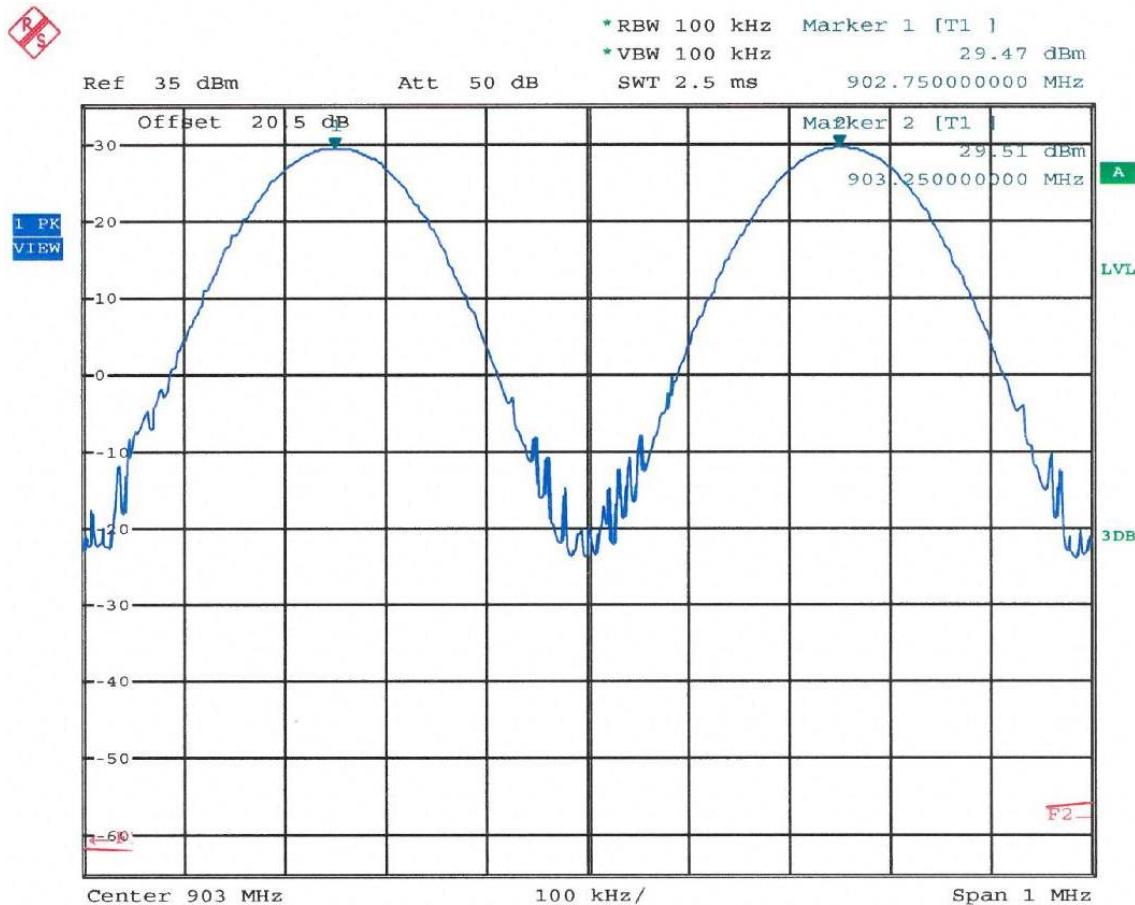
The requirements are **FULFILLED**.

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

5.10.6 Test protocol

RF650R Channel separation



FCC ID: NXW-RF600R2
**RF680R
Channel separation**


FCC ID: NXW-RF600R2

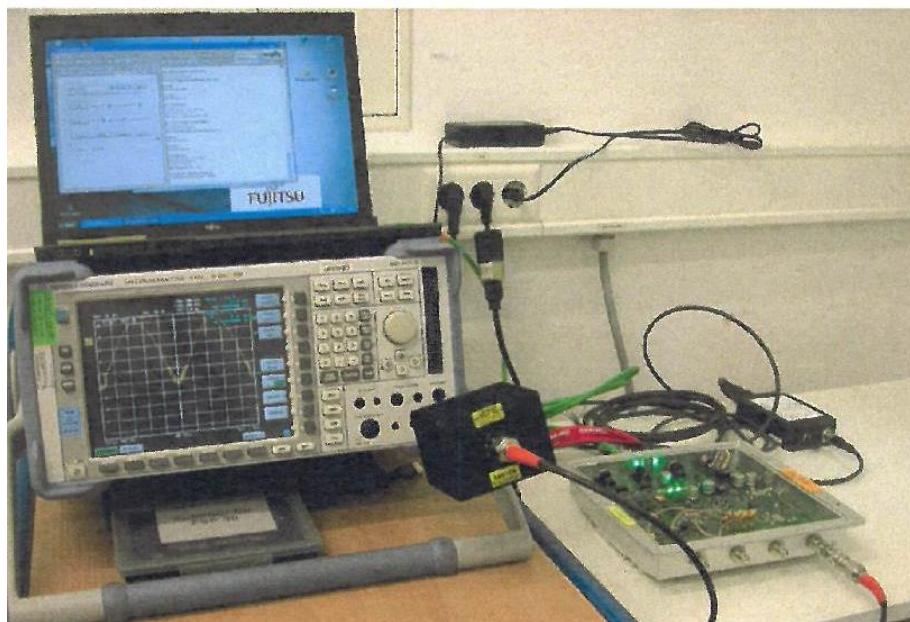
5.11 Quantity of hopping channels

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

5.11.1 Description of the test location

Test location: Shielded room S5

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	50	50

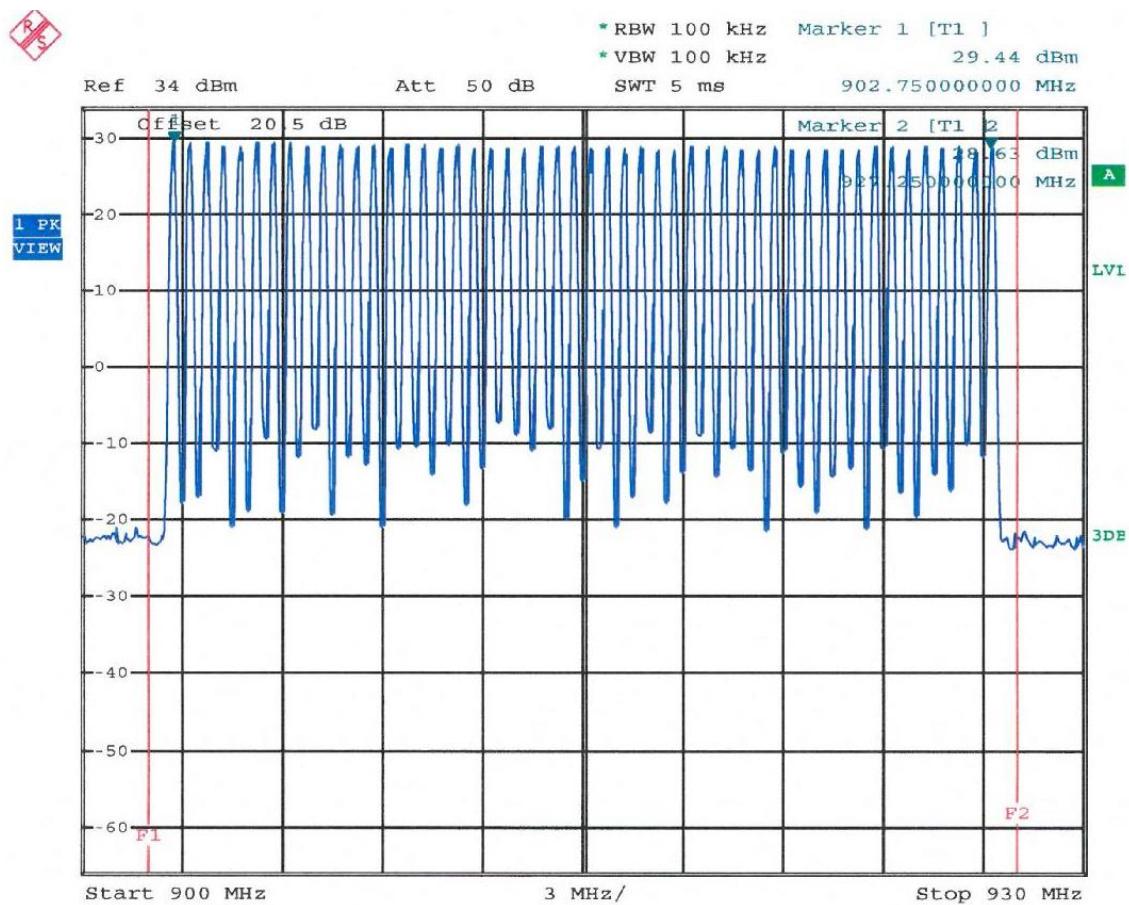
FCC ID: NXW-RF600R2

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.

FCC ID: NXW-RF600R2
5.11.6 Test protocol
Quantity of hopping channel


FCC ID: NXW-RF600R2**5.12 Antenna application - Detailed photos see Attachment A****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 reverse TNC plugs to connect the defined antennas supplied by the manufacturer.

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

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.

FCC ID: NXW-RF600R2

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.

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

where

P_d = power density (mW/cm²)

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.

FCC ID: NXW-RF600R2

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	ESHS 30	02-02/03-05-002	16/07/2014	16/07/2013		
	ESH 2 - Z 5	02-02/20-05-004	18/10/2015	18/10/2013	28/08/2014	28/02/2014
	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			10/10/2014	10/04/2014
	SP 103 /3.5-60	02-02/50-05-182				
CPC 2	FSP 30	02-02/11-05-001	24/10/2014	24/10/2013		
	Inmet 18N50W-20 dB	02-02/50-10-001				
DC	FSP 30	02-02/11-05-001	24/10/2014	24/10/2013		
	Inmet 18N50W-20 dB	02-02/50-10-001				
MB	FSP 30	02-02/11-05-001	24/10/2014	24/10/2013		
	Inmet 18N50W-20 dB	02-02/50-10-001				
SEC 1-3	FSP 30	02-02/11-05-001	24/10/2014	24/10/2013		
	WHJS 1000-10EE	02-02/50-05-070				
	Inmet 18N50W-20 dB	02-02/50-10-001				
SER 1	FMZB 1516	01-02/24-01-018			13/02/2015	13/02/2014
	ESR 7	02-02/03-13-001	21/05/2014	21/05/2013		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	28/06/2014	28/06/2013		
	VULB 9168	02-02/24-05-005	08/04/2015	08/04/2014	08/10/2014	08/04/2014
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 3	FSP 30	02-02/11-05-001	24/10/2014	24/10/2013		
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				