EMI – TEST REPORT

- FCC Part 15.407, 5150-5250 MHz, indoor, RSS247 -

Type / Model Name	:	SCALANCE W700 / MSN
Product Description	:	Industrial WLAN access point
Applicant	:	Siemens AG, Industrial Automation Division
Address	:	Gleiwitzer Strasse 555
		90475 NUERNBERG, GERMANY
Manufacturer	:	Siemens AG, Sensors & Communication
Address	:	Oestliche Rheinbrueckenstrasse 50
		76187 KARLSRUHE, GERMANY
Licence holder	:	Siemens AG, Industrial Automation Division
Address	:	Gleiwitzer Strasse 555
		90475 NUERNBERG, GERMANY

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

Test Report No. : T40580-02-01HS	18. May 2016 Date of issue

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

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ATTACHMENT A as separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September 2015)

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 C - Intentional Radiators (September 2015)

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 15.212	Modular transmitters

FCC Rules and Regulations Part 15, Subpart E – Unlicensed National Information Infrastructure Devices (December 2015)

Part 15, Subpart E, Section 15.407	Operation within the bands 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, 5.47 - 5.725 GHz and 5.725 - 5.85 GHz

ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
ETSI TR 100 028 V1.3.1: 2001-03	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2
KDB 789033 D02 v01r02	Guidance for compliance Testing of U-NII devices, April 8, 2016.
KDB 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band, October 31, 2013

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

2.2 General remarks:

The EUT is fully tested and approved according the "old Rules". This test report shall show the further compliance to the "new Rules" under the premise that no operating parameter of the EUT are changed. Therefore the output power and the PSD are re-measured under the "new rules". Spurious emissions stay the same as under the "old Rules" and are already documented with the test report T36325-00-13HS by mikes testing partners.

2.3 Equipment category

WLAN - AP

2.4 Short description of the equipment under test (EUT)

The EUT is a 2-Port WLAN-access point. The firmware does not support ad-hoc modes. The possibility to choose the channel for data transmission or power setting in relation to the used antenna with antenna cable makes a professional installation necessary. The AP is compatible with 802.11a, 802.11n Standard. It supports the 2.4 GHz and 5 GHz frequency band and supports no beam forming.

Number of tested samples: 1
Serial number: VPF8196398
Firmware version: V05.01.01

EUT configuration:
(The CDF filled by the applicant can be viewed at the test laboratory.)

2.5 Variants of the EUT

Variant	Device-Name	WLAN-Interfaces	LAN connector	Antenna Ports	Order numbers
V01	MSN-W1-RJ-E2	1	RJ45	2	6GK5734-1FX00-xxxx
V02	MSN-W1-M12-E2	1	M12	2	6GK5774-1FY00-xxxx

2.6 Operation frequency and channel plan

The operating frequency is 5150 MHz to 5250 MHz.

Channel plan:
Channel plan WLAN Standard 802.11a/n, HT20:

Channel	Frequency (MHz)
36	5180
40	5200
44	5220
48	5240

HT40 mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36up	5190	40down	5190
44up	5230	48down	5230

Note: The marked frequencies are determined for final testing.

2.7 Transmit operating modes

The module use OFDM modulation and is capable to provide following data rates:
- 802.11a 54, 48, 36, 24, 18, 12, 9, 6 Mbps
- 802.11n HT20, MCS 0 - 15
- 802.11n HT40, MCS 0 - 15

HT20

MCS parameters for mandatory 20 MHz, NSS = 1, NES = 1

MCS Index	Modulation	*R*	$N_{BPSCS(iSS)}$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI (see NOTE)
0	BPSK	1/2	1	52	4	52	26	6.5	7.2
1	QPSK	1/2	2	52	4	104	52	13.0	14.4
2	QPSK	3/4	2	52	4	104	78	19.5	21.7
3	16-QAM	1/2	4	52	4	208	104	26.0	28.9
4	16-QAM	3/4	4	52	4	208	156	39.0	43.3
5	64-QAM	2/3	6	52	4	312	208	52.0	57.8
6	64-QAM	3/4	6	52	4	312	234	58.5	65.0
7	64-QAM	5/6	6	52	4	312	260	65.0	72.2

NOTE—Support of 400 ns GI is optional on transmit and receive.

MCS parameters for optional 20 MHz, *NSS* = 2, *NES* = 1, EQM

MCS Index	Modulation	*R*	$N_{BPSCS(iSS)}$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI (see NOTE)
8	BPSK	1/2	1	52	4	104	52	13.0	14.4
9	QPSK	1/2	2	52	4	208	104	26.0	28.9
10	QPSK	3/4	2	52	4	208	156	39.0	43.3
11	16-QAM	1/2	4	52	4	416	208	52.0	57.8
12	16-QAM	3/4	4	52	4	416	312	78.0	86.7
13	64-QAM	2/3	6	52	4	624	416	104.0	115.6
14	64-QAM	3/4	6	52	4	624	468	117.0	130.0
15	64-QAM	5/6	6	52	4	624	520	130.0	144.4

NOTE—The 400 ns GI rate values are rounded to 1 decimal place.

HT40

MCS parameters for optional 40 MHz, NSS = 1, NES = 1

MCS Index	Modulation	R	$N_{BPSCS}(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI
0	BPSK	1/2	1	108	6	108	54	13.5	15.0
1	QPSK	1/2	2	108	6	216	108	27.0	30.0
2	QPSK	3/4	2	108	6	216	162	40.5	45.0
3	16-QAM	1/2	4	108	6	432	216	54.0	60.0
4	16-QAM	3/4	4	108	6	432	324	81.0	90.0
5	64-QAM	2/3	6	108	6	648	432	108.0	120.0
6	64-QAM	3/4	6	108	6	648	486	121.5	135.0
7	64-QAM	5/6	6	108	6	648	540	135.0	150.0

MCS parameters for optional 40 MHz, NSS = 2, NES = 1, EQM

MCS Index	Modulation	R	$N_{BPSCS}(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI
8	BPSK	1/2	1	108	6	216	108	27.0	30.0
9	QPSK	1/2	2	108	6	432	216	54.0	60.0
10	QPSK	3/4	2	108	6	432	324	81.0	90.0
11	16-QAM	1/2	4	108	6	864	432	108.0	120.0
12	16-QAM	3/4	4	108	6	864	648	162.0	180.0
13	64-QAM	2/3	6	108	6	1296	864	216.0	240.0
14	64-QAM	3/4	6	108	6	1296	972	243.0	270.0
15	64-QAM	5/6	6	108	6	1296	1080	270.0	300.0

Symbol	Explanation
N_{SS}	Number of spatial streams
R	Coding rate
N_{BPSC}	Number of coded bits per single carrier (total across spatial streams)
$N_{BPSCS}(i_{SS})$	Number of coded bits per single carrier for each spatial stream, $i_{SS} = 1,...,N_{SS}$
N_{SD}	Number of complex data numbers per spatial stream per OFDM symbol
N_{SP}	Number of pilot values per OFDM symbol
N_{CBPS}	Number of coded bits per OFDM symbol
N_{DBPS}	Number of data bits per OFDM symbol
N_{ES}	Number of BCC encoders for the DATA field
N_{TBPS}	Total bits per subcarrier

2.8 Antenna

Antennas intended for use are classified into 3 gain groups:

- Antenna gain group 1: Antennas 0 to 6 dBi
- Antenna gain group 2: Antennas 6 to 9 dBi
- Antenna gain group 3: Antennas 9 to 14 dBi

Number	Manufacturer Number	Characteristic	Model number	Connector	Frequency (GHz)	Gain 5GHz	Cable loss (dB)	effective Gain 5 GHz (dBi)	Group
1	6GK5793-8DK00-0AA0	Directed	**ANT 793-8DK**	2x N-female	5 GHz	23	8.8	14.2	9-14
2	6GK5793-8DJ00-0AA0	Directed	**ANT 793-8DJ**	2x N-female	5 GHz	18	4.4	13.6	9-14
3	6GK5793-8DL00-0AA0	Directed	**ANT793-8DL**	2x N-female	2.4 + 5	14	0	14	9-14
4	6GK5793-8DP00-0AA0	Directed	**ANT793-8DP**	N-female	5 GHz	13.5	0	13.5	9-14
5	6GK5795-6DC00-0AA0	Wide angle	**ANT 795-6DC**	N-female	2.4 + 5 GHz	9	0	9	6-9 dBi
6	6GK5793-6DG00-0AA0	Wide angle	**ANT793-6DG**	2x N-female	5 GHz	9	0	9	6-9 dBi
7	6GK5795-6MN10-0AA6	Omni	**ANT 795-6MN**	N-female	2.4 + 5 GHz	8	0	8	6-9 dBi
8	6GK5795-6MP00-0AA0	Omni	**ANT795-6MP**	N-female	2.4 + 5 GHz	7	0	7	6-9 dBi
9	6GK5896-6MM00-0AA0	Omni	**ANT896-6MM**	QMA-female	2.4 + 5 GHz	7	0	7	6-9 dBi
10	6GK5 793-4MN00-0AA6	Omni	**ANT 793-4MN**	N-female	5 GHz	6	0	6	0-6 dBi
11	6GK5795-4MD00-0AA3	Omni	**ANT795-4MD**	N-male	2.4 + 5 GHz	5	0	5	0-6 dBi
12	6GK5795-4MC00-0AA3	Omni	**ANT795-4MC**	N-male	2.4 + 5 GHz	5	0	5	0-6 dBi
13	6GK5795-4MA00-0AA3	Omni	**ANT 795-4MA**	R-SMA male	2.4 + 5 GHz	5	0	5	0-6 dBi
14	6GK5793-6MN00-0AA6	Omni	**ANT 793-6MN**	N-female	5 GHz	5	0	5	0-6 dBi
15	6GK5795-4MX00-0AA0	Omni	**ANT795-4MX**	N-male	2.4 + 5 GHz	2	0	2	0-6 dBi
16	6XV1875-2D	Omni	**IWLAN Rcoax 1/2"**	N-female	5 GHz	0	0	0	0-6 dBi

Note: The directed antenna number 2 may be used only with minimum 5 m antenna cable,
Type 6XV 1875-5CH50 with cable loss 4.4 dB at 5.7 GHz.
The directed antenna number 1 may be used only with minimum 10 m antenna cable,
Type 6XV 1875-5CN10 with cable loss 8.8 dB at 5.7 GHz.

2.9 Power supply system utilised

Power supply voltage, V_{nom} : 100 - 120 VAC

2.10 Peripheral devices and interface cables

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

- LAN cable, 3m Model : CAT5
- Power supply cable, 1m Model : Self-made
- C-Plug-Adaptor for test mode control Model : Self-made

2.11 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting of the EUT produce the maximum of the emissions.
The tests are carried out in the following frequency band:

5150 - 5250 MHz

Preliminary tests are performed to find the worst-case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate. The EUT is controlled for several tests with special test software used for testing only where continuous signals are needed. For the tests a max possible duty cycle (x) is set.

Following channels and test modes are selected for the final test as listed below:

WLAN	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.11a	36 to 48	36, 44, 48	P14, P12, P9	OFDM	BPSK	6 Mbps
802.11n; HT20	36 to 48	36, 44, 48	P14, P12, P9	OFDM	BPSK	MCS0 (BW=20 MHz)
802.11n; HT40	36up to 44up	36up, 44up	P14, P12, P9	OFDM	BPSK	MCS8 (BW=40 MHz)

- TX continuous mode, 802.11a
  One port mode, 2 port mode,
- TX continuous mode, 802.11n
  One port mode, 2 port mode,

2.11.1 Test jig

No test jig is used.

2.11.2 Test software

Test software is used to set TX continuous in device service mode. Power, channel and modulation (data rate) setting is done via network interface which is available for professional settings.

3 TEST RESULT SUMMARY

UNII device using the operating band 5150 MHz - 5250 MHz:

FCC Rule Part (new rules)	FCC Rule Part (old rules)	Description	Result
15.407(b)(6)	15.207(a)	AC power line conducted emissions	Not tested
15.407(a)(5)	15.407(a)	EBW 26 dB	passed
15.407(a)(1)	15.407(a)	Maximum conducted output power	passed
15.407(a)(1)	15.407(a)	Maximum conducted PSD	passed
15.407(b)(1)	15.407(b)	Undesirable emissions	Not tested
15.407(b)(7)	15.205(a)	Emissions in restricted bands	Not tested
15.407(a)	15.407(a)	Antenna requirement	passed
15.407(g)	15.407(g)	Frequency stability	Not tested

RSS Rule Part (new rules)	RSS Rule Part (old rules)	Description	Result
RSS-Gen, 8.8	RSS Gen, 7.2.4.	AC power line conducted emissions	Not tested
RSS247, 6.2.1(1)	RSS210, A9.2	Maximum conducted output power	passed
RSS247, 6.2.1(2)	RSS210, A9.2	Unwanted emission, radiated	Not tested
RSS-Gen, 8.9	RSS-Gen, 7.2.2	Unwanted emissions in restricted bands	Not tested
RSS247, 6.2.1(1)	RSS210, A9.2	Maximum power spectral density	passed
RSS-Gen, 6.10	RSS-Gen, 4.5	Pulsed operation	Not tested
RSS-Gen, 6.6	RSS-Gen, 7.1.2	Antenna requirement	passed
RSS-Gen, 6.11	RSS-Gen, 7.2.6	Transmitter frequency stability	Not tested
RSS-Gen, 6.6	RSS210, A9.2	99 % Bandwidth	passed
RSS 102, 2.5.2	RSS 102, 2.5.2	MPE	Not tested

The mentioned new RSS Rule Parts in the above table are related to:
RSS Gen, Issue 4, November 2014
RSS 247, Issue 1, May 2015
RSS 102, Issue 4, March 2015

The mentioned old RSS Rule Parts in the above table are related to:
RSS Gen, Issue 3, December 2010
RSS 210, Issue 8, December 2010
RSS 102, Issue 4, March 2010

3.1 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	:	25 April 2016
Testing concluded on	:	03 May 2016

Checked by:

Klaus Gegenfurtner
I confirm the correctness and Integrity of this document
2016.05.18 11:36:00 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Hermann Smetana
I am the author of this document
2016.05.18 11:10:51 +02'00'

Hermann Smetana
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 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

4.3 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.

Measurement uncertainty table	
Measurement output power, conducted	±1.5 dB
Measurement PSD, conducted	±1.5 dB
Measurement spurious emissions, conducted	±3.0 dB
Measurement spurious emissions, radiated	±6.0 dB
Measurement frequency	±1 x 10^{-6}

4.1 Measurement protocol for FCC and ISED

4.1.1 General information

4.1.1.1 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 open area test site is a listed under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 247 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the CISPR 22 limits.

4.1.1.2 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 without termination. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.1.1.3 Details of test procedures

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 - "American national standard of procedures for compliance testing of 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 C63.10 and applying the CISPR 22 limits.

5 TEST CONDITIONS AND RESULTS

5.1 AC power line conducted emissions

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

5.1.1 Description of the test location

Test location: NONE

Remarks: This measurement is already documented in the test report T36325-00-13HS.

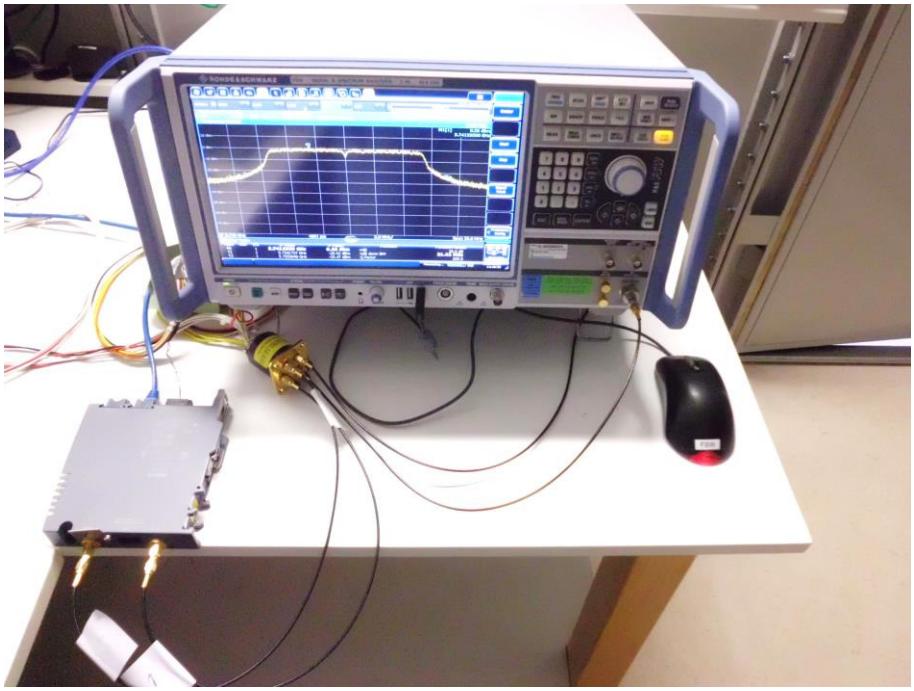
5.2 EBW and OBW

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

5.2.1 Description of the test location

Test location: AREA 4

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(5):
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less.

5.2.4 Description of Measurement

The bandwidth is measured conducted using a spectrum analyser and following the procedures according the OET 789033, item C. The spectrum analyser function “n-dB-down” is used to determine the bandwidth. For the OBW the analyser function “OBW” is used to determine the bandwidth. The procedures according the OET 789033, item D are followed in this case.

Spectrum analyser settings occupied bandwidth:
For 20 MHz channels:

RBW: 300 kHz,	VBW: 1 MHz,	Detector: Peak,	Trace mode: max hold;

For 40 MHz channels:

RBW: 500 kHz,	VBW: 2 MHz,	Detector: Peak,	Trace mode: max hold;

5.2.5 Test result

802.11a mode, Port1:

Channel	Centre frequency	26 dB bandwidth	99% OBW
	(MHz)	(MHz)	(MHz)
CH36	5180	22.040	16.964
CH40	5200	21.400	17.069
CH48	5240	22.510	17.239

802.11n mode, HT 20, Port1:

Channel	Centre frequency	26 dB bandwidth	99% OBW
	(MHz)	(MHz)	(MHz)
CH36	5180	22.220	17.979
CH40	5200	22.110	18.021
CH48	5240	22.790	18.103

802.11n mode, HT 40, Port1:

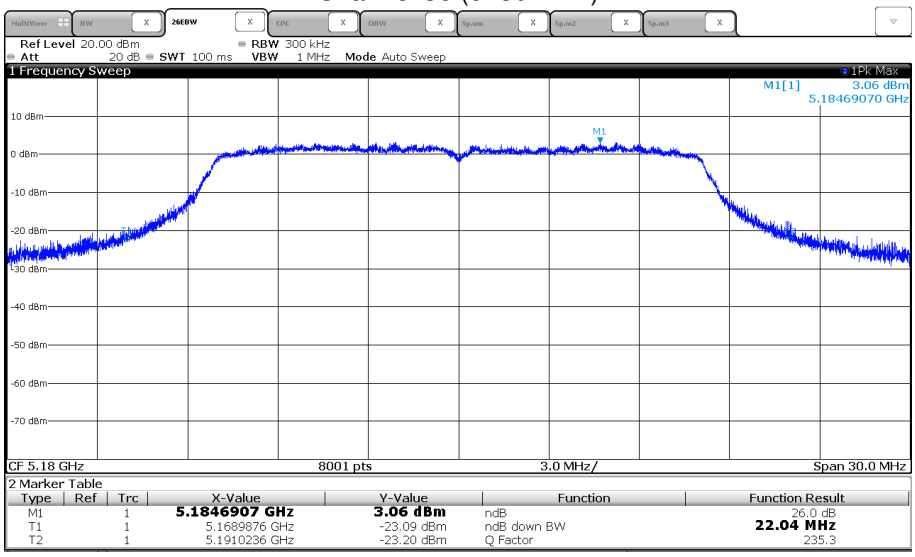
Channel	Centre frequency	26 dB bandwidth	99% OBW
	(MHz)	(MHz)	(MHz)
CH36up	5190	42.930	36.317
CH44up	5230	44.350	36.412

Remarks: For detailed test results please see the following test protocols. No limit is defined for EBW and OBW.

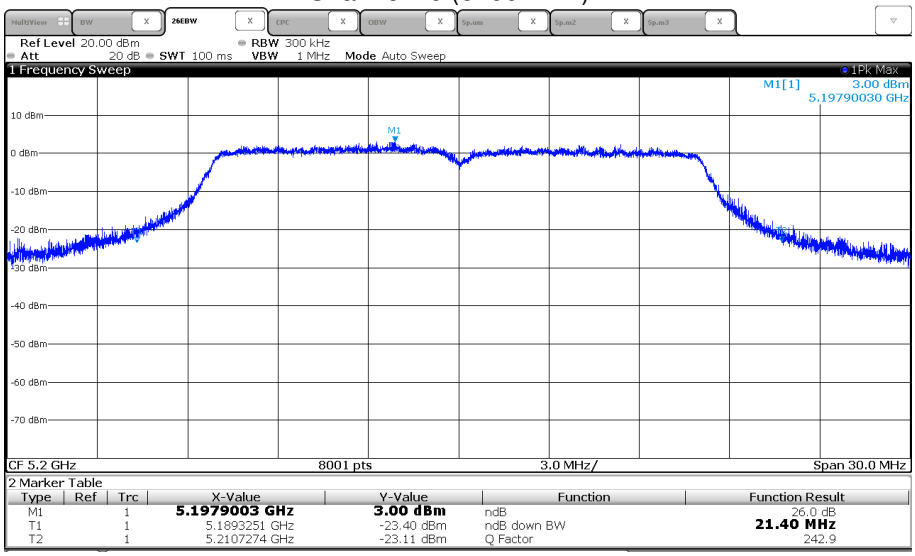
5.2.6 Test protocol EBW 26dB

801.11a:

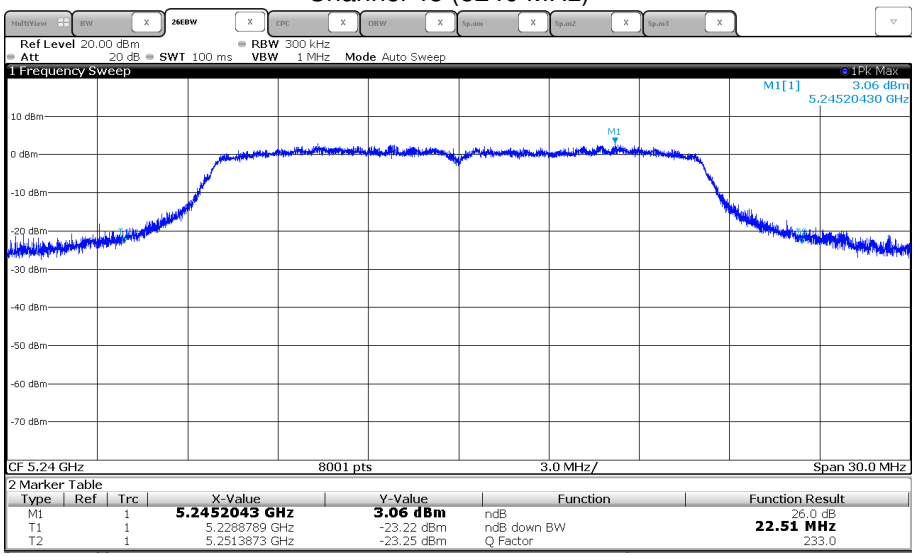
Channel 36 (5180 MHz)



Channel 40 (5200 MHz)

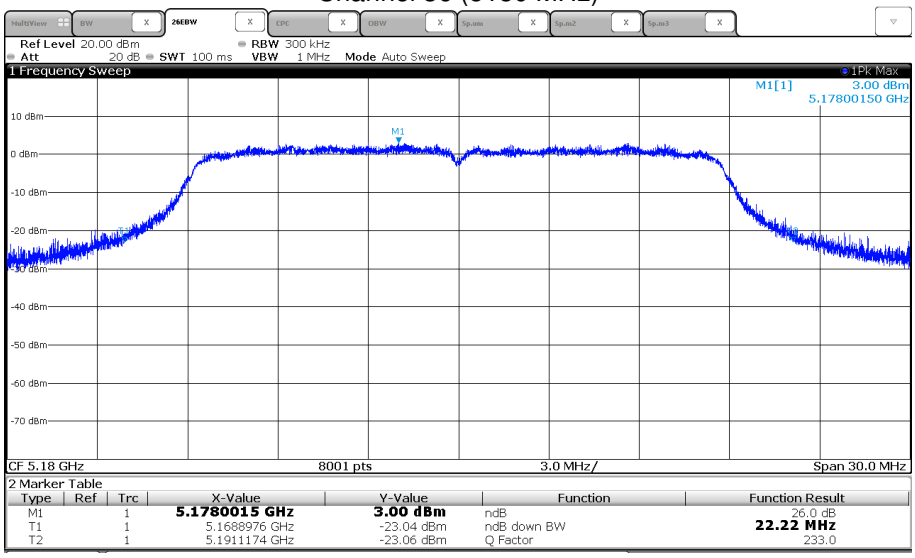


Channel 48 (5240 MHz)

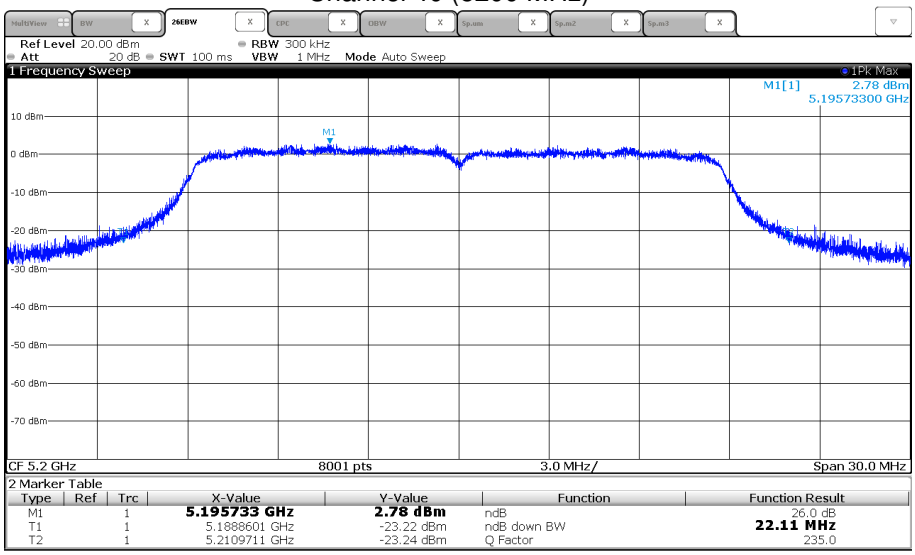


HT20:

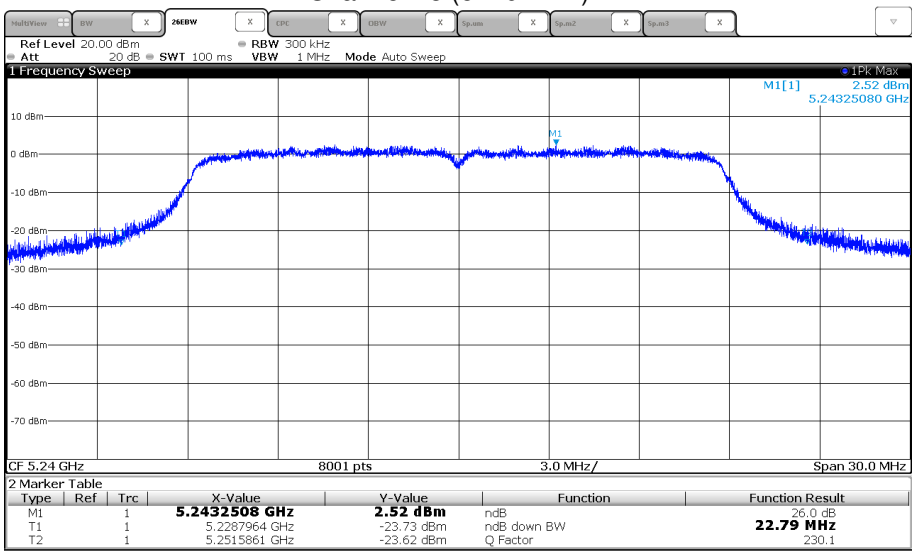
Channel 36 (5180 MHz)



Channel 40 (5200 MHz)

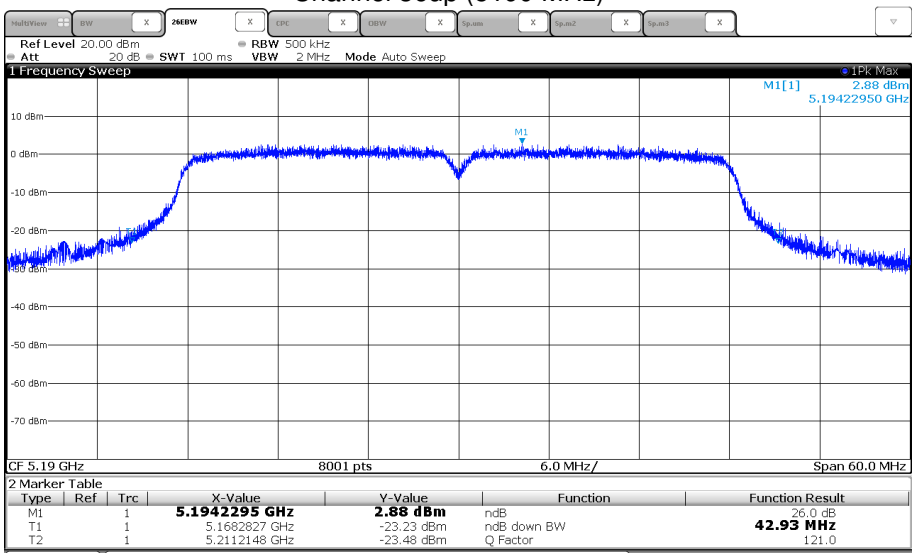


Channel 48 (5240 MHz)

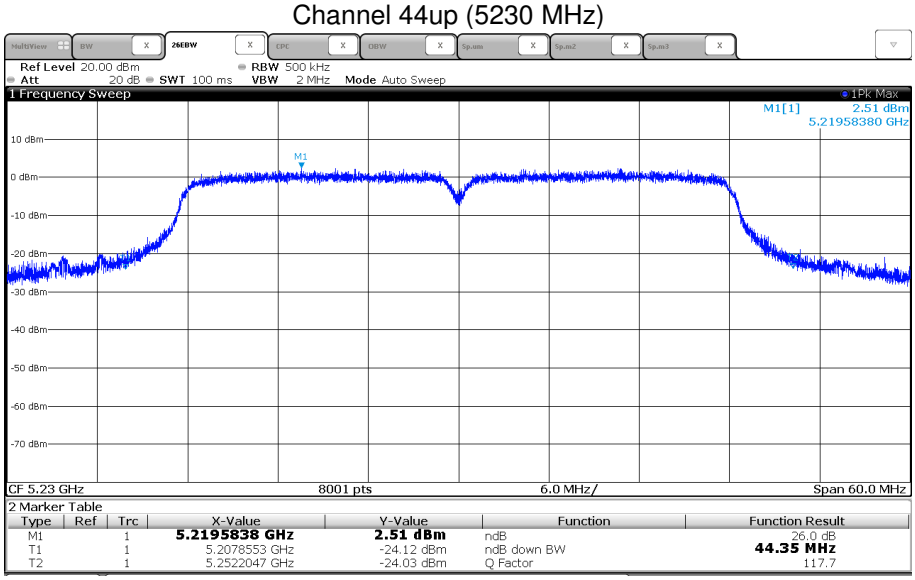


HT40:

Channel 36up (5190 MHz)



Channel 44up (5230 MHz)



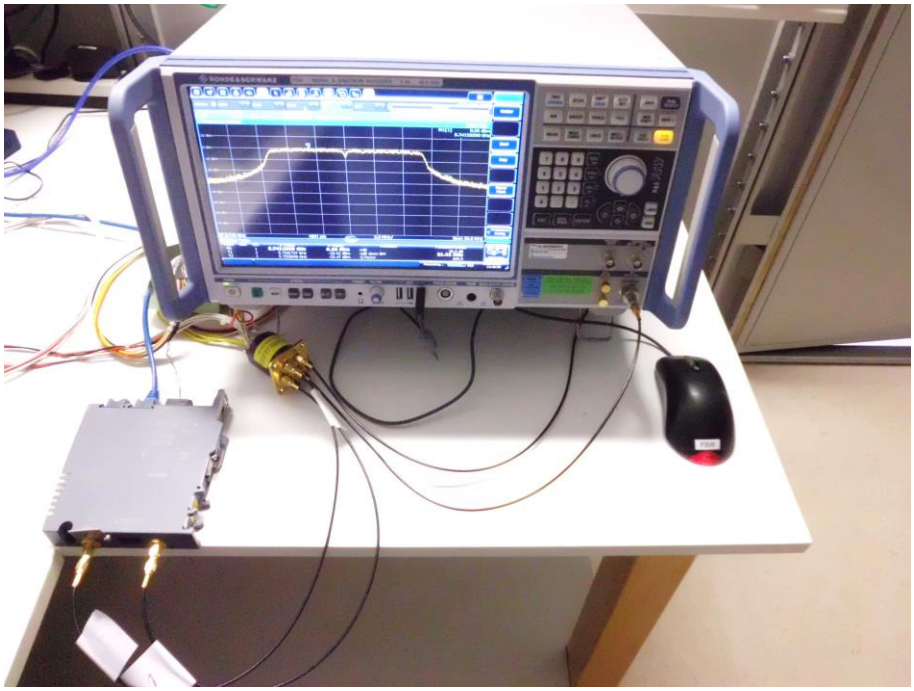
5.3 Maximum conducted output power

For test instruments and accessories used see section 6 Part **CPC 3**.

5.3.1 Description of the test location

Test location: AREA 4

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15E, Section 15.407(a):
For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

5.3.4 Description of Measurement

The maximum conducted output power is measured using a spectrum analyser with the function “integrated band power measurement” following the procedure set out in KDB 789033 D02, item C f) Method SA-3. The EUT is set in TX continuous mode while measuring. The EUT is measured following the procedure set out in KDB 662911 for MIMO devices. The output power is measured separate at chain 1, and 2. The measurement values are converted into linear values, summed and converted back into log values. The resulting values are listed in the following tables. The insertion loss of cable and switch is taken into account with 3.9 dB at 5.2 GHz.
Spectrum analyser settings:
RBW: 1 MHz, VBW: 3 MHz, Detector: RMS (power averaging), Trace mode: max hold;
Number of points: 6401, Sweep time: see table, Band power function;

Modulation	Burst time T	Sweep points	Max sweep time analyser
	(ms)		(s)
802.11a	2.069	6401	13.2
802.11n, HT20	0.893	6401	5.7
802.11n, HT40	0.321	6401	2.1

5.3.5 Test result

1 Port mode (only one port is active and port 2 is internally terminated):
Raw data as representative for all one Port measurements, used for 802.11a:

	A1 [P9] (dBm)	A1 [P12] (dBm)	A1 [P14] (dBm)
CH36	3.63	5.63	7.13
CH40	3.27	6.23	7.73
CH48	3.41	6.64	8.14

Calculation of the total output power:

802.11a, 6 Mbps, 1TX		Test results conducted				
Port 1		A [P9] (dBm)	A [P12] (dBm)	A [P14] (dBm)	Limit (dBm)	Min Margin (dB)
Lowest frequency:	CH36					
T_{nom}	V_{nom}	7.5	9.5	11.0	30.0	-19.0
Middle frequency:	CH40					
T_{nom}	V_{nom}	7.2	10.1	11.6	30.0	-18.4
Highest frequency:	CH48					
T_{nom}	V_{nom}	7.3	10.5	12.0	30.0	-18.0

Note. An insertion loss of 3.9 dB at 5200 MHz for measurement cable and switch is taken into account.

HT20, MCS0, 1TX		Test results conducted				
Port 1		A [P9] (dBm)	A [P12] (dBm)	A [P14] (dBm)	Limit (dBm)	Min Margin (dB)
Lowest frequency:	CH36					
T_{nom}	V_{nom}	6.7	8.8	10.3	30.0	-19.7
Middle frequency:	CH40					
T_{nom}	V_{nom}	6.4	8.6	10.1	30.0	-19.9
Highest frequency:	CH48					
T_{nom}	V_{nom}	6.7	10.0	11.5	30.0	-18.5

HT40, MCS8, 1TX		Test results conducted				
Port 1		A [P9] (dBm)	A [P12] (dBm)	A [P14] (dBm)	Limit (dBm)	Min Margin (dB)
Lowest frequency:	CH36up					
T_{nom}	V_{nom}	5.1	7.1	8.6	30.0	-21.4
Highest frequency:	CH44up					
T_{nom}	V_{nom}	5.4	7.6	9.1	30.0	-20.9

2 Port mode (all two ports are active):
Raw data as representative for all 2 Port measurements, used for 802.11a:

	A1 [P9] (dBm)	A2 [P9] (dBm)	A1 [P12] (dBm)	A2 [P12] (dBm)	A1 [P14] (dBm)	A2 [P14] (dBm)
CH36	0.44	-0.14	5.33	6.61	7.83	9.11
CH40	0.40	0.16	5.34	6.74	7.84	9.24
CH48	0.75	0.89	5.79	6.68	8.29	9.68

Calculation of the total output power:

802.11a, 6 Mbps, 2TX		Test results conducted				
Port 1+2		A [P9] (dBm)	A [P12] (dBm)	A [P14] (dBm)	Limit (dBm)	Min Margin (dB)
Lowest frequency:	CH36					
T_{nom}	V_{nom}	7.1	12.9	15.4	30.0	-14.6
Middle frequency:	CH40					
T_{nom}	V_{nom}	7.2	13.0	15.5	30.0	-14.5
Highest frequency:	CH48					
T_{nom}	V_{nom}	7.7	13.2	16.0	30.0	-14.0

Note. An insertion loss of 3.9 dB at 5200 MHz for measurement cable and switch is taken into account.

HT20, MCS8, 2TX		Test results conducted				
Port 1+2		A [P9] (dBm)	A [P12] (dBm)	A [P14] (dBm)	Limit (dBm)	Min Margin (dB)
Lowest frequency:	CH36					
T_{nom}	V_{nom}	6.5	12.7	14.2	30.0	-15.8
Middle frequency:	CH40					
T_{nom}	V_{nom}	6.6	13.2	14.7	30.0	-15.3
Highest frequency:	CH48					
T_{nom}	V_{nom}	6.9	13.3	15.0	30.0	-15.0

HT40, MCS16, 2TX		Test results conducted				
Port 1+2		A [P9] (dBm)	A [P12] (dBm)	A [P14] (dBm)	Limit (dBm)	Min Margin (dB)
Lowest frequency:	CH36up					
T_{nom}	V_{nom}	5.3	11.9	12.9	30.0	-17.1
Highest frequency:	CH44up					
T_{nom}	V_{nom}	5.4	12.5	13.5	30.0	-16.5

Peak power limit according to FCC Part 15E, Section 15.407(a)(ii):

Frequency (MHz)	Maximum conducted power limit	
	(dBm)	(Watt)
5150 - 5250	30	1.0

5.3.6 Calculation of the maximum EIRP

1 Port mode

Calculation of maximum EIRP						
Port 1	P set	Ant gain	Amax	EIRPmax	Limit	Margin
802.11a		(dBi)	(dBm)	(dBm)	(dBm)	(dB)
Antenna group 1	P14	6	12.0	18.0	22.3	-4.3
Antenna group 2	P12	9	10.5	19.5	22.3	-2.8
Antenna group 3	P9	14.2	7.5	21.7	22.3	-0.6

Calculation of maximum EIRP						
Port 1	P set	Ant gain	Amax	EIRPmax	Limit	Margin
802.11n, HT20		(dBi)	(dBm)	(dBm)	(dBm)	(dB)
Antenna group 1	P14	6	12.0	16.7	22.5	-5.8
Antenna group 2	P12	9	10.5	18.2	22.5	-4.3
Antenna group 3	P9	14.2	7.5	21.7	22.5	-0.8

Calculation of maximum EIRP						
Port 1	P set	Ant gain	Amax	EIRPmax	Limit	Margin
802.11n, HT40		(dBi)	(dBm)	(dBm)	(dBm)	(dB)
Antenna group 1	P14	6	12.0	16.7	23.0	-6.3
Antenna group 2	P12	9	10.5	18.2	23.0	-4.8
Antenna group 3	P9	14.2	7.5	21.7	23.0	-1.3

2 Port mode

Calculation of maximum EIRP						
Port 1+2	P set	Ant gain	Amax	EIRPmax	Limit	Margin
802.11a		(dBi)	(dBm)	(dBm)	(dBm)	(dB)
Antenna group 1	P14	6	16.0	22.0	22.3	-0.3
Antenna group 2	P12	9	13.2	22.2	22.3	-0.1
Antenna group 3	P9	14.2	7.7	21.9	22.3	-0.4

Calculation of maximum EIRP						
Port 1+2	P set	Ant gain	Amax	EIRPmax	Limit	Margin
802.11n, HT20		(dBi)	(dBm)	(dBm)	(dBm)	(dB)
Antenna group 1	P14	6	15.0	21.0	22.5	-1.5
Antenna group 2	P12	9	13.3	22.3	22.5	-0.2
Antenna group 3	P9	14.2	6.9	21.1	22.5	-1.4

Calculation of maximum EIRP						
Port 1+2	P set	Ant gain	Amax	EIRPmax	Limit	Margin
802.11n, HT40		(dBi)	(dBm)	(dBm)	(dBm)	(dB)
Antenna group 1	P14	6	13.5	19.5	23.0	-3.5
Antenna group 2	P12	9	12.5	21.5	23.0	-1.5
Antenna group 3	P9	14.2	5.4	19.6	23.0	-3.4

Maximum EIRP power limit according to RSS247, 6.2.1(1):
The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz.

Frequency	EIRP limit		
(MHz)		(dBm)	(dBm)
5150-5250	Legacy, 10 + 10log(B)	22.3	23.0
	HT20, 10 + 10log(B)	22.5	23.0
	HT40, 10 + 10log(B)	25.6	23.0

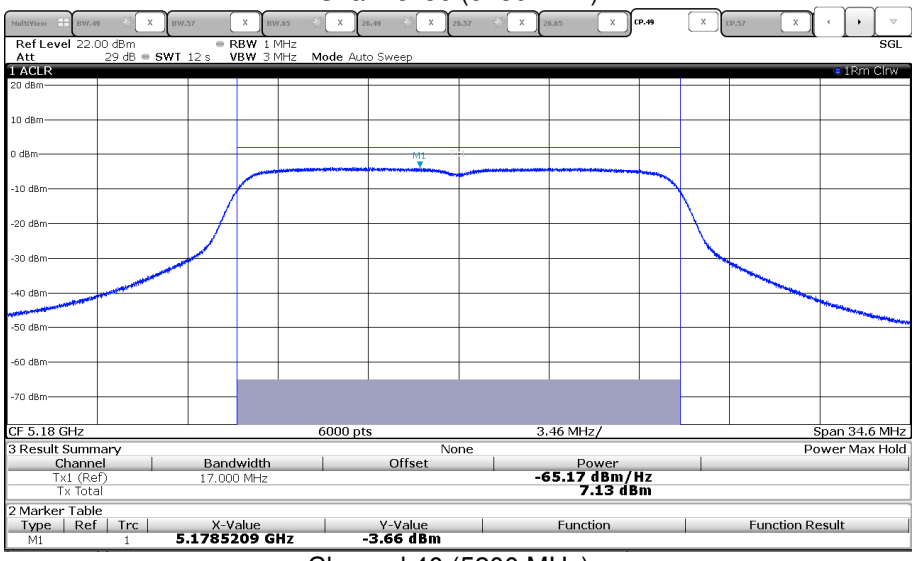
The requirements are **FULFILLED.**

Remarks: For detailed test results please see the following test protocols.

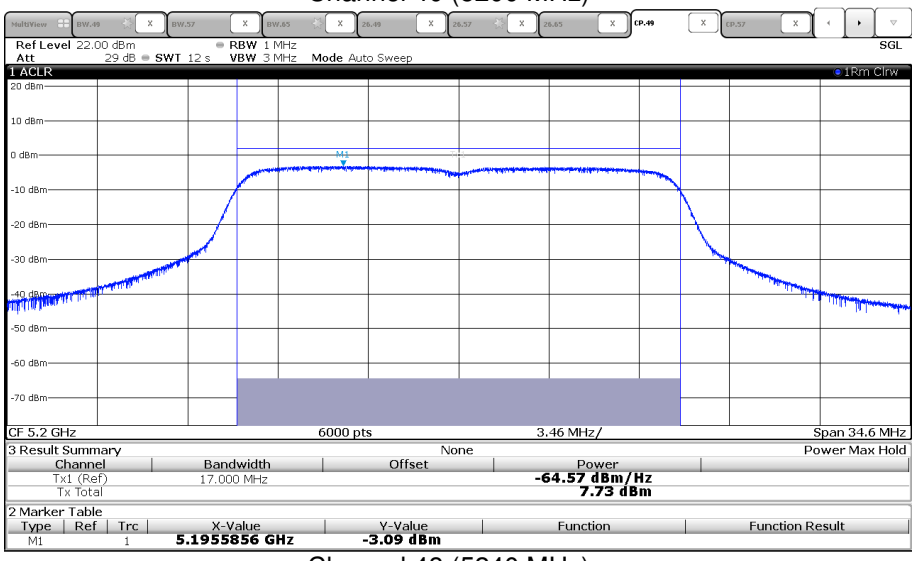
5.3.7 Test protocol maximum conducted output power

1 Port mode (only one port is active, port 2 is internally terminated):
801.11a, P14:

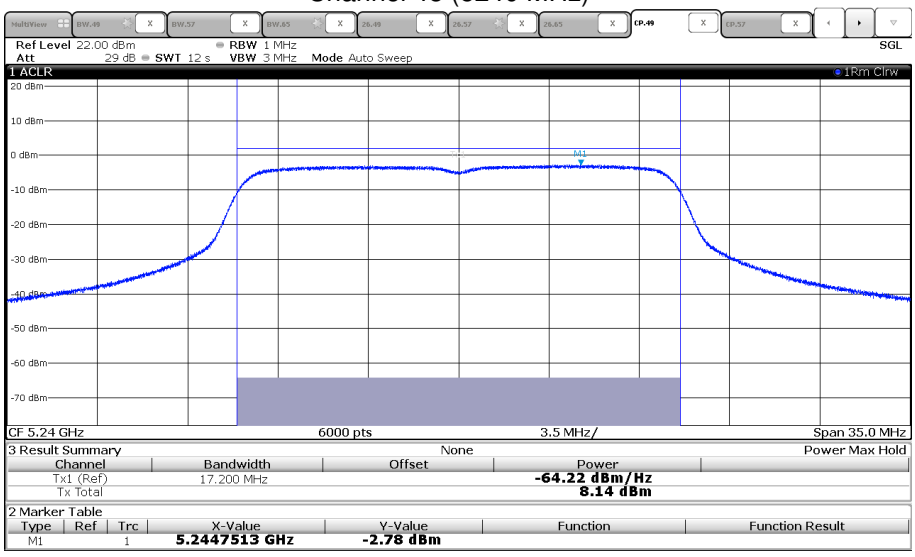
Channel 36 (5180 MHz)



Channel 40 (5200 MHz)

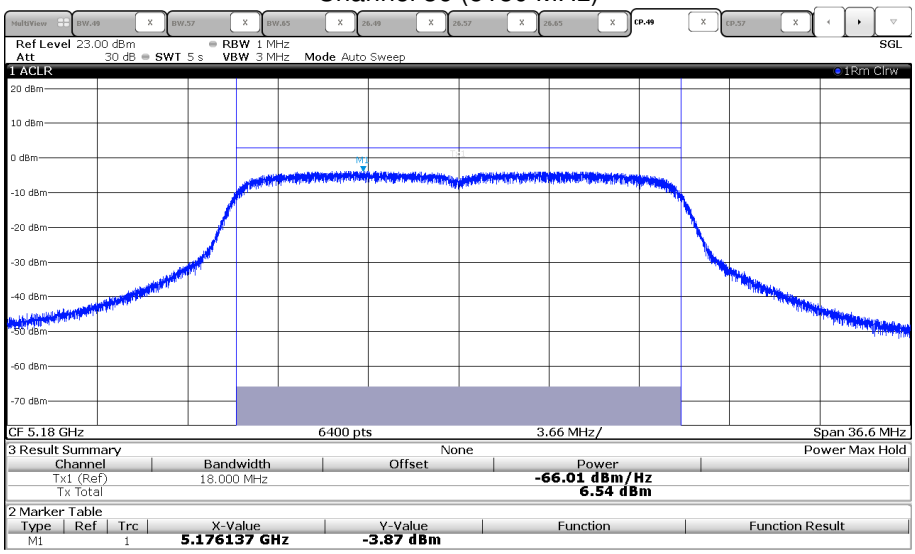


Channel 48 (5240 MHz)

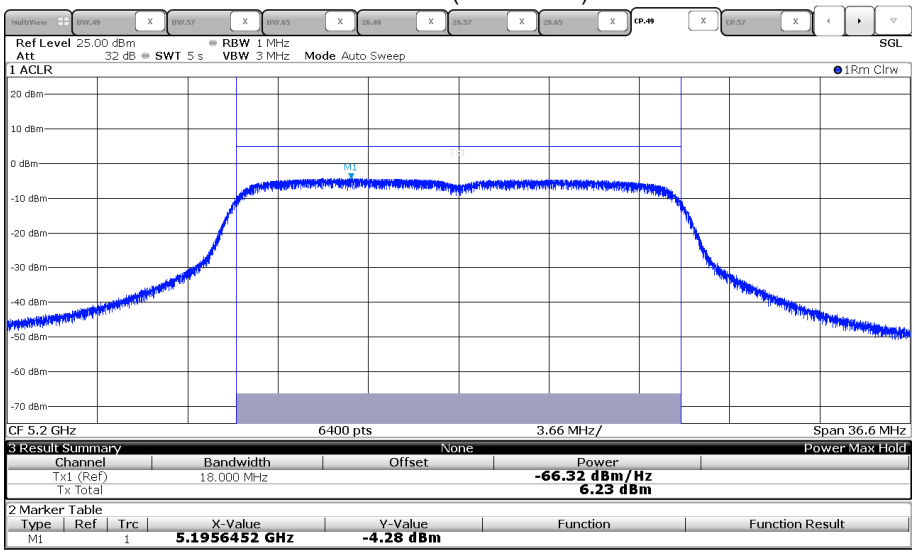


HT20, P14:

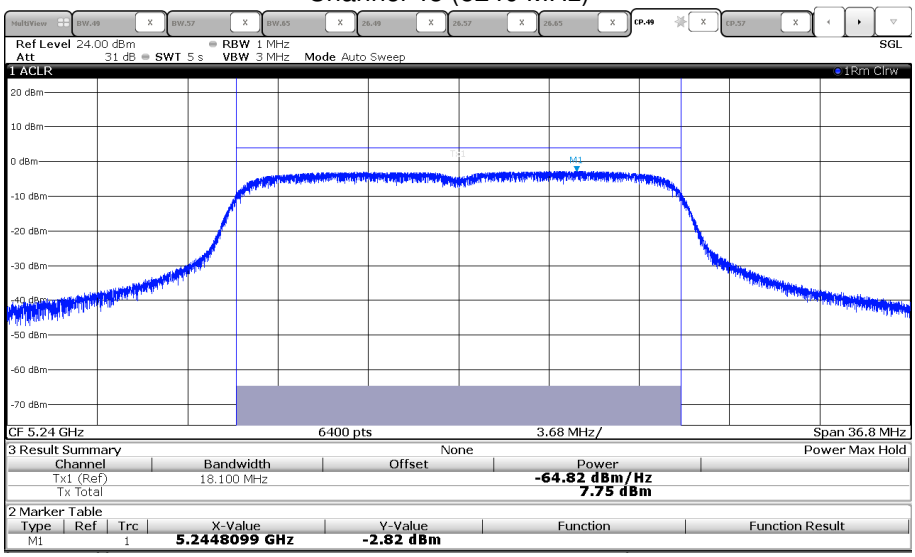
Channel 36 (5180 MHz)



Channel 40 (5200 MHz)

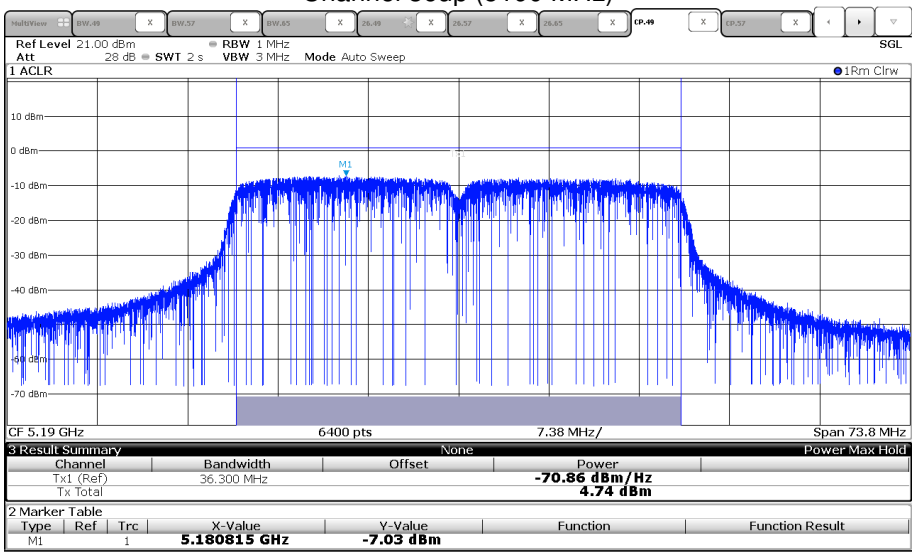


Channel 48 (5240 MHz)

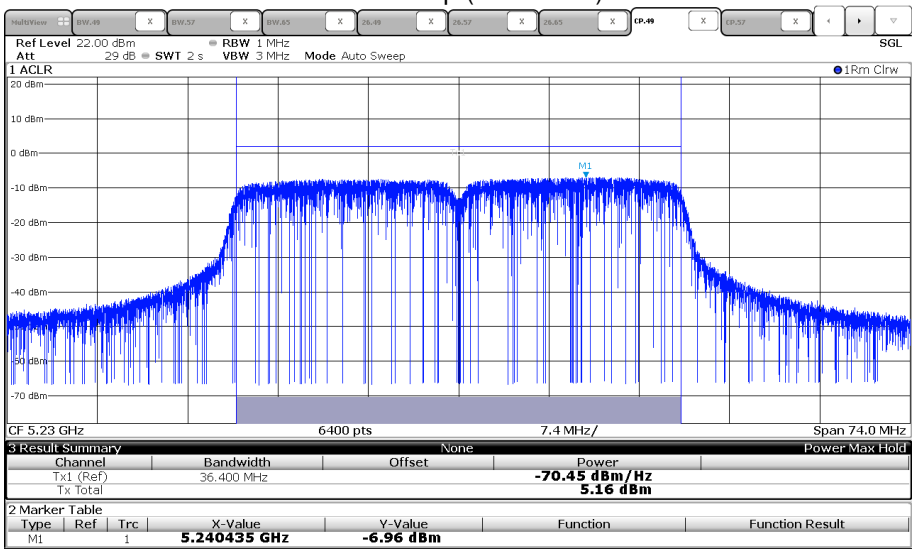


HT40, P14:

Channel 36up (5190 MHz)

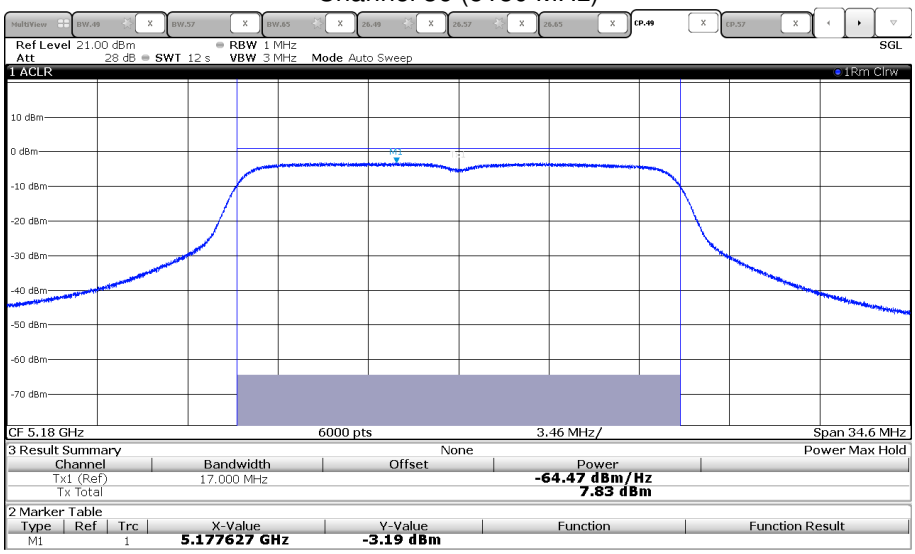


Channel 44up (5210 MHz)



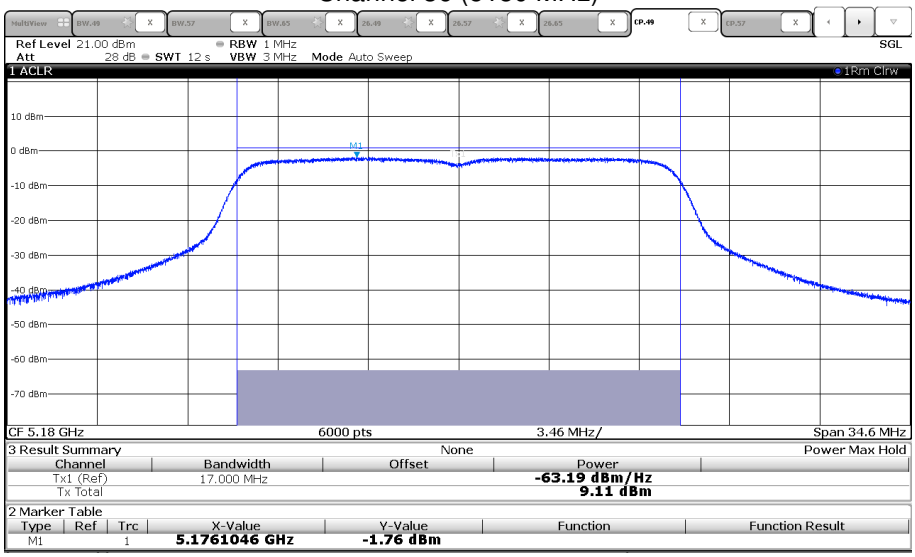
2 Port mode (two ports are active, port 3 is internally terminated):
801.11a, P14:

Channel 36 (5180 MHz)

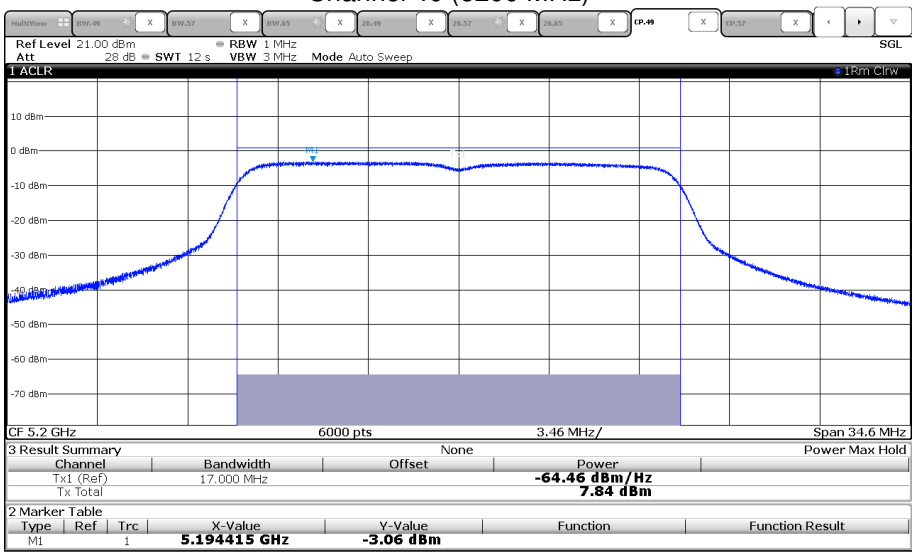


Port 2:

Channel 36 (5180 MHz)

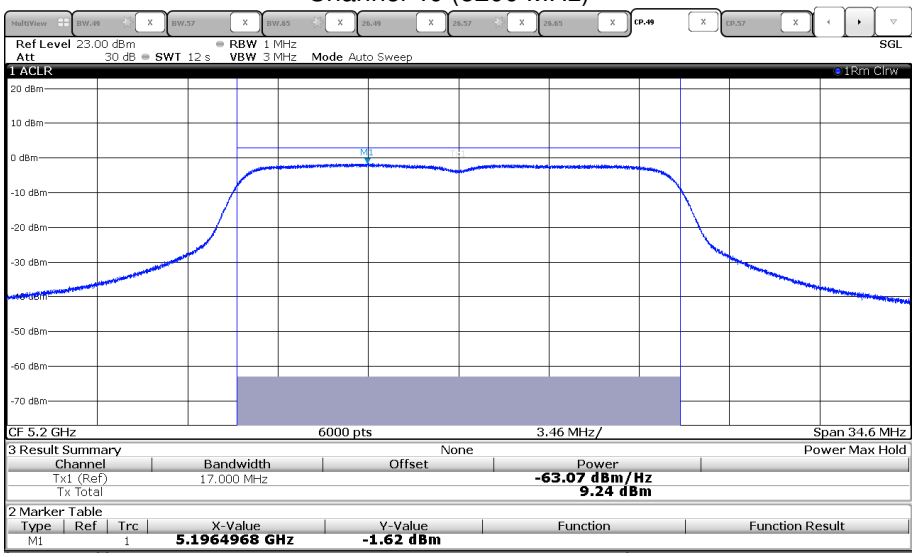


Channel 40 (5200 MHz)

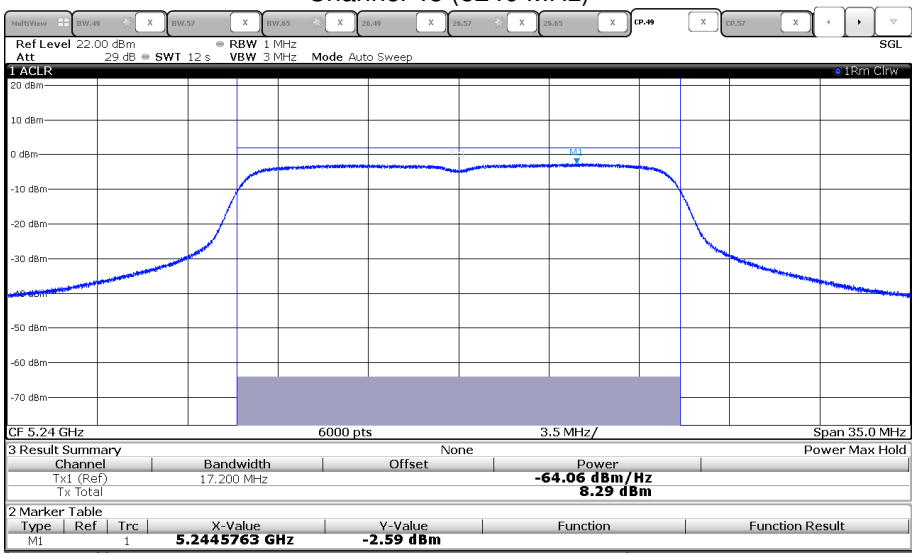


Port 2:

Channel 40 (5200 MHz)

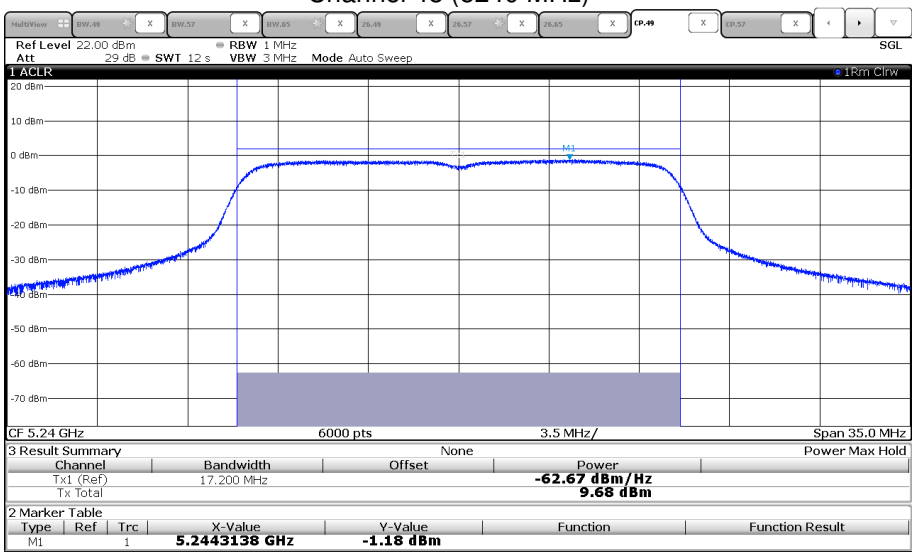


Channel 48 (5240 MHz)



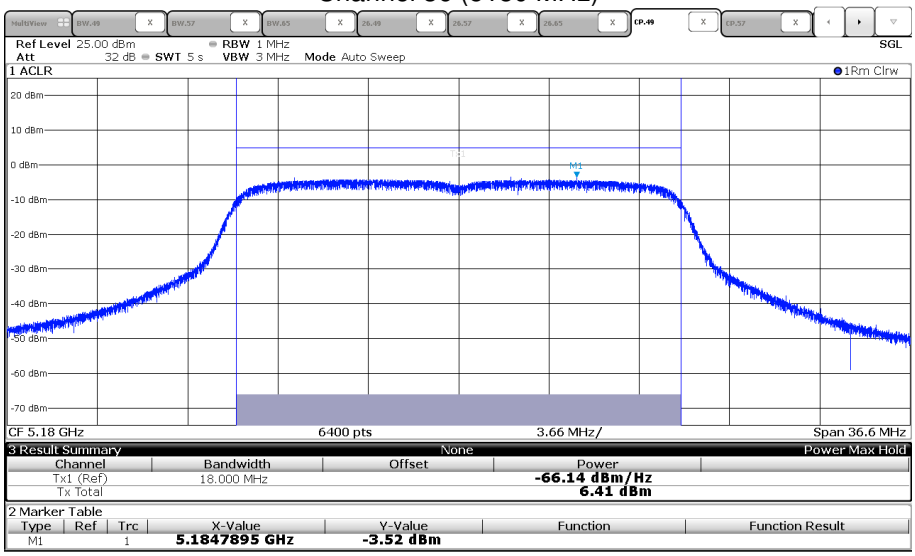
Port 2:

Channel 48 (5240 MHz)



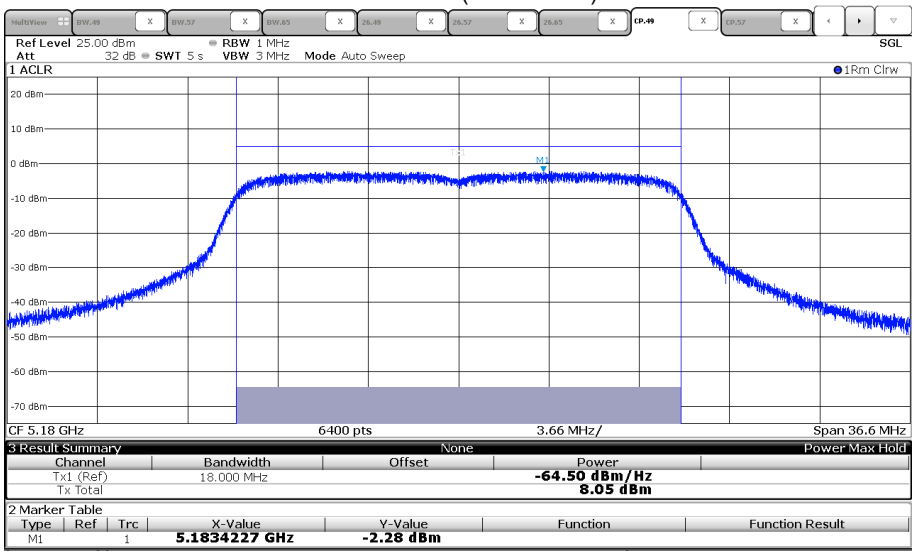
HT20, P14:

Channel 36 (5180 MHz)

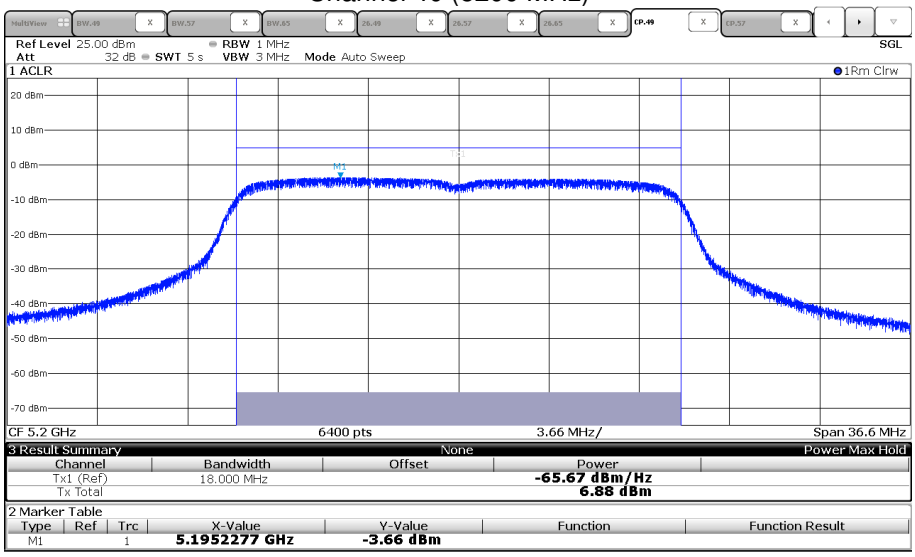


Port 2:

Channel 36 (5180 MHz)

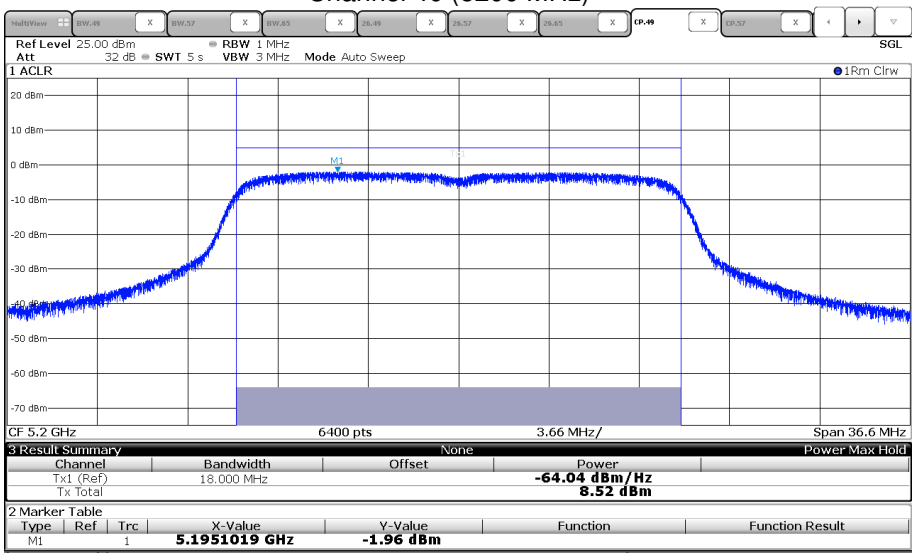


Channel 40 (5200 MHz)

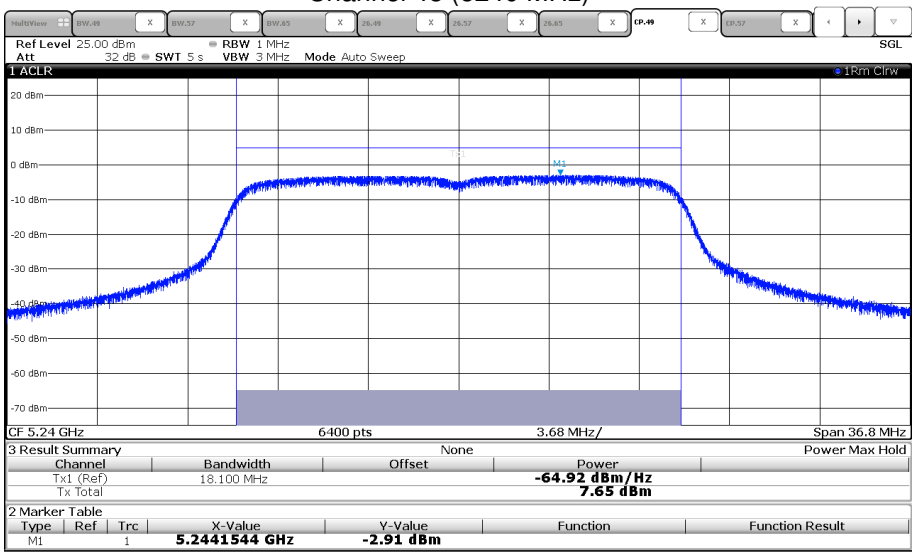


Port 2:

Channel 40 (5200 MHz)

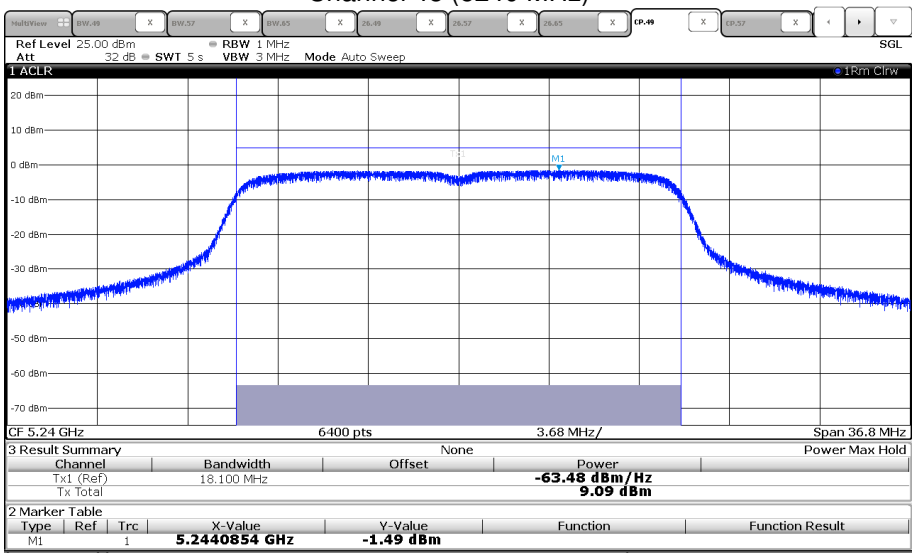


Channel 48 (5240 MHz)



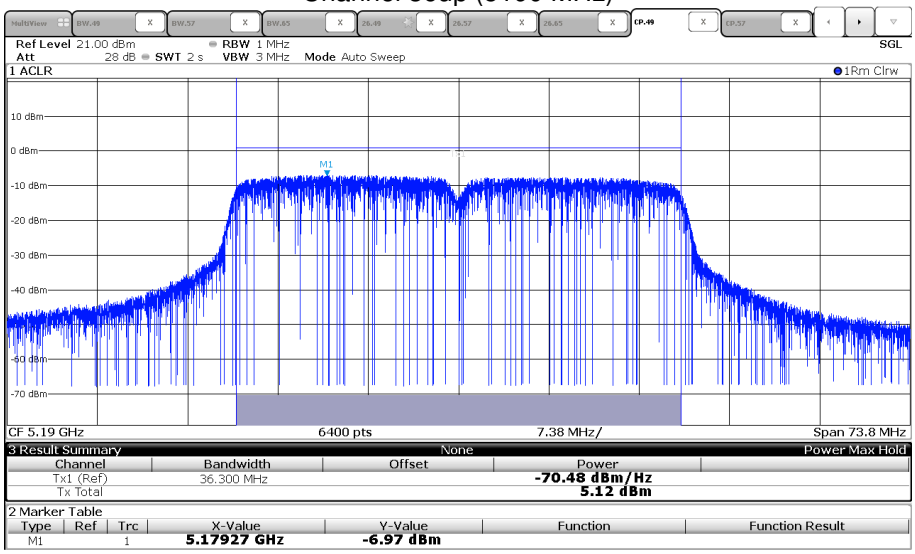
Port 2:

Channel 48 (5240 MHz)



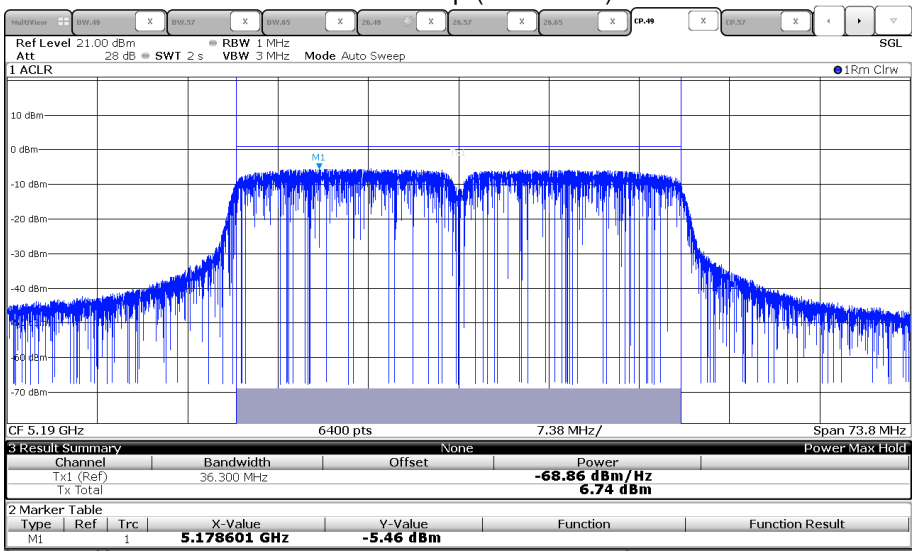
HT40:

Channel 36up (5190 MHz)

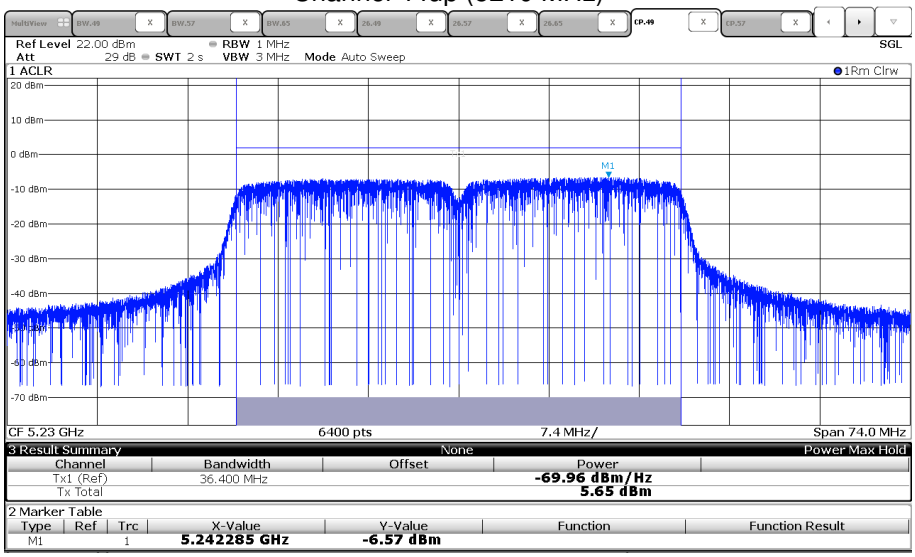


Port 2:

Channel 36up (5190 MHz)

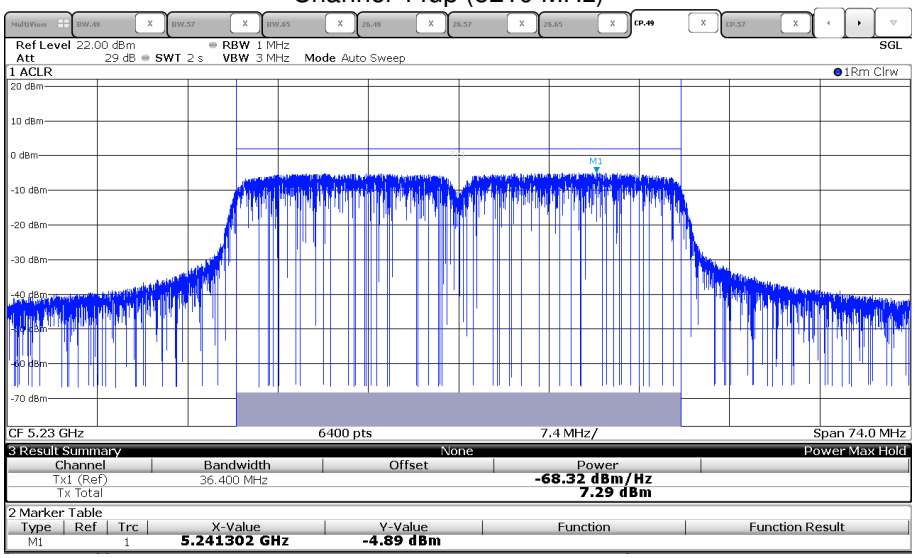


Channel 44up (5210 MHz)



Port 2:

Channel 44up (5210 MHz)



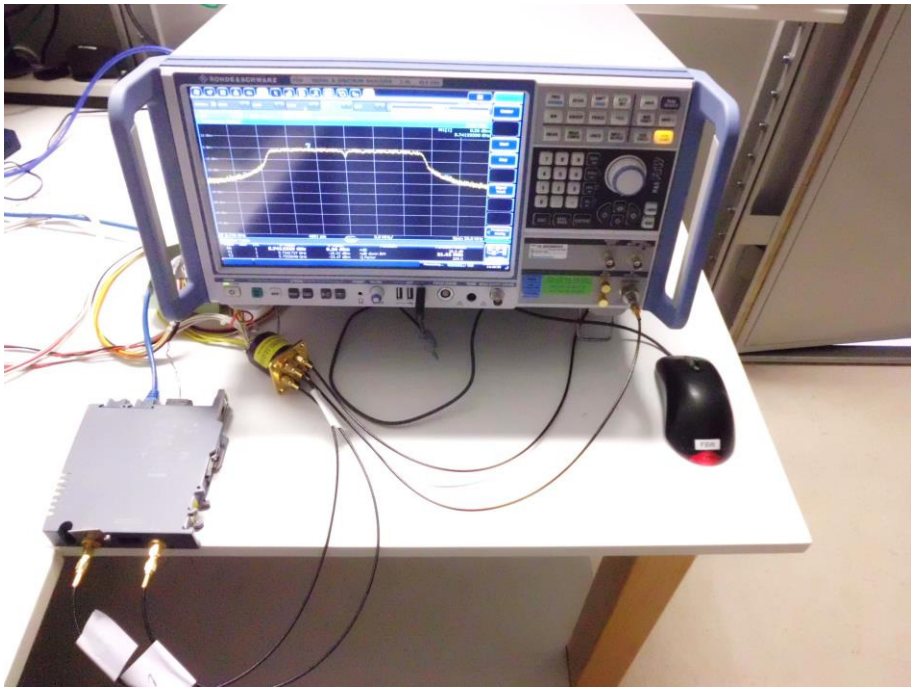
5.4 Maximum power spectral density

For test instruments and accessories used see section 6 Part **CPC 3**.

5.4.1 Description of the test location

Test location: AREA 4

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(1i):
In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.4.4 Description of Measurement

The maximum power spectral density is measured using a spectrum analyser with the function “integrated band power measurement” following the procedure set out in KDB 789033 D02, item F. Therefore the PSD is measured the same way. The “integrated band power measurement” is related to PSD (dBm/Hz). The EUT is set in TX continuous mode while measuring. The EUT is measured separate at chain 1 and chain 2. The measurement values are converted into linear values. The chain 1 and chain 2 are summed and converted back into log values and corrected with the conversion factor Hz to 1 MHz, 60.0 dB. The resulting values are listed in the following tables. The insertion loss of cable and switch is taken into account with 3.9 dB at 5.2 GHz.

Spectrum analyser settings:
Channel power measurement function, TX channel bandwidth equal to EBW;
RBW: 1 MHz, VBW: 1 kHz, Sweep time: auto, Detector: PK, Trace: max hold;
Number of points: 6401, Sweep time: see table, Band power function;

Modulation	Burst time T	Sweep points	Max sweep time analyser
	(ms)		(s)
802.11a	2.069	6401	13.2
802.11n, HT20	0.893	6401	5.7
802.11n, HT40	0.321	6401	2.1

5.4.5 Test result

Note: In case of HT20 and HT40 is falling back into CDD-Modes the firmware will compensate automatically the array gain for this kind of correlating signals depending of used ports.

1 Port mode (only one port is active and port 2 is internally terminated):
Raw data as representative for all one Port measurements, used for 802.11a:

	PD1 [P9] (dBm/Hz)	PD1 [P12] (dBm/Hz)	PD1 [P14] (dBm/Hz)
CH36	-68.67	-66.77	-65.17
CH40	-69.06	-66.17	-64.57
CH48	-68.94	-65.82	-64.22

Calculation of the total PSD:

802.11a, 6 Mbps, 1TX		Test results conducted				
Port 1		PD [P9] (dBm/MHz)	PD [P12] (dBm/MHz)	PD [P14] (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Lowest frequency: CH36						
T_{nom}	V_{nom}	-4.8	-2.9	-1.3	17.0	-18.3
Middle frequency: CH40						
T_{nom}	V_{nom}	-5.2	-2.3	-0.7	17.0	-17.7
Highest frequency: CH48						
T_{nom}	V_{nom}	-5.0	-1.9	-0.3	17.0	-17.3

Note. An insertion loss of 3.9 dB at 5200 MHz for measurement cable and switch is taken into account.

HT20, MCS0, 1TX		Test results conducted				
Port 1		PD [P9] (dBm/MHz)	PD [P12] (dBm/MHz)	PD [P14] (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Lowest frequency: CH36						
T_{nom}	V_{nom}	-5.8	-3.7	-2.1	17.0	-19.1
Middle frequency: CH40						
T_{nom}	V_{nom}	-6.2	-4.0	-2.4	17.0	-19.4
Highest frequency: CH48						
T_{nom}	V_{nom}	-5.9	-2.7	-1.1	17.0	-18.1

HT40, MCS8, 1TX		Test results conducted				
Port 1		PD [P9] (dBm/MHz)	PD [P12] (dBm/MHz)	PD [P14] (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Lowest frequency: CH36up						
T_{nom}	V_{nom}	-10.5	-8.6	-7.0	17.0	-24.0
Middle frequency: CH44up						
T_{nom}	V_{nom}	-10.2	-8.2	-6.6	17.0	-23.6

2 Port mode (all two ports are active):
Raw data as representative for all 2 Port measurements, used for 802.11a:

	PD1 [P9] (dBm/Hz)	PD2 [P9] (dBm/Hz)	PD1 [P12] (dBm/Hz)	PD2 [P12] (dBm/Hz)	PD1 [P14] (dBm/Hz)	PD2 [P14] (dBm/Hz)
CH36	-71.87	-72.45	-66.97	-65.69	-64.47	-63.19
CH40	-71.93	-72.17	-66.99	-65.57	-64.49	-63.07
CH48	-71.61	-71.47	-66.56	-65.67	-64.06	-62.67

Calculation of the total PSD:

802.11a, 6 Mbps, 2TX		Test results conducted				
Port 1+2		PD [P9] (dBm/MHz)	PD [P12] (dBm/MHz)	PD [P14] (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Lowest frequency: CH36						
T_{nom}	V_{nom}	-5.2	0.6	3.1	17.0	-13.9
Middle frequency: CH40						
T_{nom}	V_{nom}	-5.1	0.7	3.2	17.0	-13.8
Highest frequency: CH48						
T_{nom}	V_{nom}	-4.6	0.8	3.6	17.0	-13.4

Note. An insertion loss of 3.9 dB at 5200 MHz for measurement cable and switch is taken into account.

HT20, MCS8, 2TX		Test results conducted				
Port 1+2		PD [P9] (dBm/MHz)	PD [P12] (dBm/MHz)	PD [P14] (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Lowest frequency: CH36						
T_{nom}	V_{nom}	-6.1	0.2	1.7	17.0	-15.3
Middle frequency: CH40						
T_{nom}	V_{nom}	-6.0	0.6	2.1	17.0	-14.9
Highest frequency: CH48						
T_{nom}	V_{nom}	-5.6	0.8	2.5	17.0	-14.5

HT40, MCS16, 2TX		Test results conducted				
Port 1+2		PD [P9] (dBm/MHz)	PD [P12] (dBm/MHz)	PD [P14] (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Lowest frequency: CH36up						
T_{nom}	V_{nom}	-10.3	-3.7	-2.7	17.0	-19.7
Middle frequency: CH44up						
T_{nom}	V_{nom}	-10.2	-3.2	-2.2	17.0	-19.2

Maximum power spectral density limit according to FCC Part 15E, Section 15.407(a)(1i):

Frequency	Maximum power spectral density limit
(MHz)	(dBm/MHz)
5150 - 5250	17.0

Maximum power spectral density limit according to RSS247, 6.2.1(1):
The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

Frequency	Maximum power spectral density limit
(MHz)	(dBm/MHz)
5150 - 5250	10.0

The requirements are **FULFILLED.**

Remarks: For detailed test results, please see to test protocols under 5.3.7.

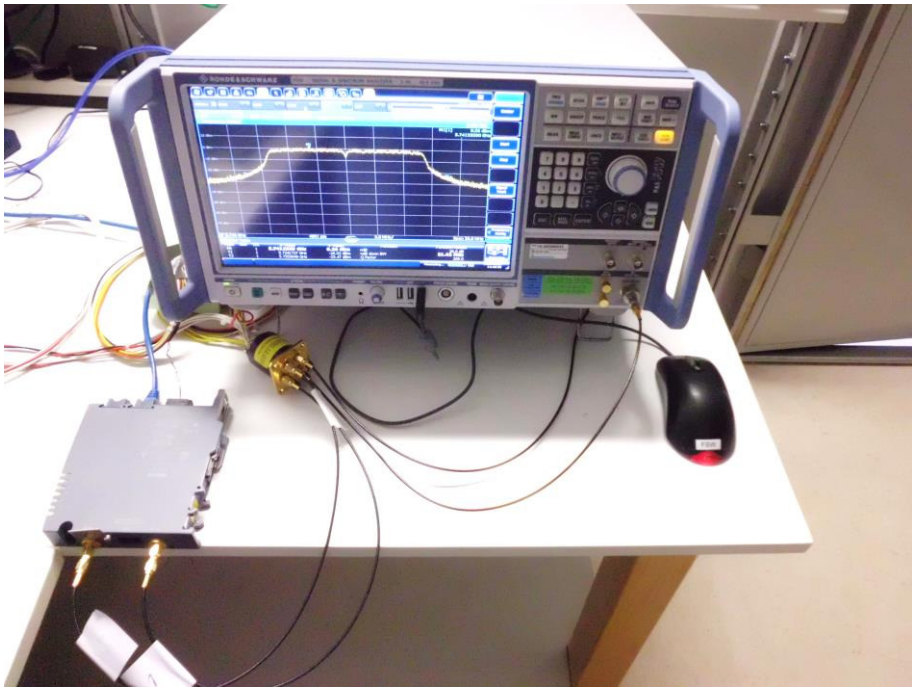
5.5 Defacto limit

For test instruments and accessories used see section 6 Part **CPC 3**.

5.5.1 Description of the test location

Test location: AREA 4

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

According to FCC Part 15, Section 15.407(a)(3):
If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.5.4 Test result

1 Port mode (only one port is active and port 2 is internally terminated):
Output power:

Antenna	Gx	Cond. limit	G	Amax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)	5 GHz
ANT 793-8DK	14.2	30.0	6.0	7.7	21.8	0.0	P9
ANT 793-8DJ	13.6	30.0	6.0	7.7	22.4	0.0	P9
ANT793-8DL	14.0	30.0	6.0	7.7	22.0	0.0	P9
ANT793-8DP	13.5	30.0	6.0	7.7	22.5	0.0	P9

Antenna	Gx	Cond. limit	G	Amax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)	5 GHz
ANT 795-6DC	9.0	30.0	6.0	13.3	27.0	0.0	P12
ANT793-6DG	9.0	30.0	6.0	13.3	27.0	0.0	P12
ANT 795-6MN	8.0	30.0	6.0	13.3	28.0	0.0	P12
ANT795-6MP	7.0	30.0	6.0	13.3	29.0	0.0	P12
ANT896-6MM	7.0	30.0	6.0	13.3	29.0	0.0	P12

PSD:

Antenna	Gx	Cond. limit	G	PSDmax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm/MHz)	(dBi)	(dBm/MHz)	(dBm/MHz)	(dB)	5 GHz
ANT 793-8DK	14.2	17.0	6.0	-4.6	8.8	0.0	P9
ANT 793-8DJ	13.6	17.0	6.0	-4.6	9.4	0.0	P9
ANT793-8DL	14.0	17.0	6.0	-4.6	9.0	0.0	P9
ANT793-8DP	13.5	17.0	6.0	-4.6	9.5	0.0	P9

Antenna	Gx	Cond. limit	G	PSDmax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm/MHz)	(dBi)	(dBm/MHz)	(dBm/MHz)	(dB)	5 GHz
ANT 795-6DC	9.0	17.0	6.0	0.8	14.0	0.0	P12
ANT793-6DG	9.0	17.0	6.0	0.8	14.0	0.0	P12
ANT 795-6MN	8.0	17.0	6.0	0.8	15.0	0.0	P12
ANT795-6MP	7.0	17.0	6.0	0.8	16.0	0.0	P12
ANT896-6MM	7.0	17.0	6.0	0.8	16.0	0.0	P12

2 Port mode (all two ports are active):
Output power:

Antenna	Gx	Cond. limit	G	Amax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)	5 GHz
ANT 793-8DK	14.2	30.0	6.0	7.7	21.8	0.0	P9
ANT 793-8DJ	13.6	30.0	6.0	7.7	22.4	0.0	P9
ANT793-8DL	14.0	30.0	6.0	7.7	22.0	0.0	P9
ANT793-8DP	13.5	30.0	6.0	7.7	22.5	0.0	P9

Antenna	Gx	Cond. limit	G	Amax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)	5 GHz
ANT 795-6DC	9.0	30.0	6.0	13.3	27.0	0.0	P12
ANT793-6DG	9.0	30.0	6.0	13.3	27.0	0.0	P12
ANT 795-6MN	8.0	30.0	6.0	13.3	28.0	0.0	P12
ANT795-6MP	7.0	30.0	6.0	13.3	29.0	0.0	P12
ANT896-6MM	7.0	30.0	6.0	13.3	29.0	0.0	P12

PSD:

Antenna	Gx	Cond. limit	G	PSDmax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm/MHz)	(dBi)	(dBm/MHz)	(dBm/MHz)	(dB)	5 GHz
ANT 793-8DK	14.2	17.0	6.0	-4.6	8.8	0.0	P9
ANT 793-8DJ	13.6	17.0	6.0	-4.6	9.4	0.0	P9
ANT793-8DL	14.0	17.0	6.0	-4.6	9.0	0.0	P9
ANT793-8DP	13.5	17.0	6.0	-4.6	9.5	0.0	P9

Antenna	Gx	Cond. limit	G	PSDmax	Limit P_{out}	Reduction	P set
	(dBi)	(dBm/MHz)	(dBi)	(dBm/MHz)	(dBm/MHz)	(dB)	5 GHz
ANT 795-6DC	9.0	17.0	6.0	0.8	14.0	0.0	P12
ANT793-6DG	9.0	17.0	6.0	0.8	14.0	0.0	P12
ANT 795-6MN	8.0	17.0	6.0	0.8	15.0	0.0	P12
ANT795-6MP	7.0	17.0	6.0	0.8	16.0	0.0	P12
ANT896-6MM	7.0	17.0	6.0	0.8	16.0	0.0	P12

Defacto limit according to FCC Part 15, Section 15.407(a)(3):
If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Frequency (MHz)	Defacto EIRP limit	
	(dBm)	(Watt)
5150 - 5250	36	4.0

Frequency (MHz)	Defacto radiated PSD limit	
	(dBm)	(mW)
5150 - 5250	17.0	50.0

The requirements are **FULFILLED.**

Remarks: No power reduction results using the listed antennas in combination with the mentioned power setting.

5.6 Unwanted emissions in restricted bands, conducted

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

5.6.1 Description of the test location

Test location: NONE

Remarks: This measurement is already documented in the test report T36325-00-13HS.

5.7 Frequency stability

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

5.7.1 Description of the test location

Test location: NONE

Remarks: This measurement is already documented in the test report T36325-00-13HS.

5.8 Antenna application

5.8.1 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 use the listed antennas for MIMO technique. The equipment connector is SMA-R.

Remarks:

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.
CPC 3	FSW43 DC-40 GHz - D/C9914	02-02/11-15-001 02-02/50-12-010	05/08/2016	05/08/2015		
MB	FSW43 DC-40 GHz - D/C9914	02-02/11-15-001 02-02/50-12-010	05/08/2016	05/08/2015		