REPORT

issued by an Accredited Testing Laboratory

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Date	Reference	Page
2019-06-11	8P07436-F3	1 (85)

FCC ID: 2ADEFAT-DG2, ISED ID: 12460A-ATDG2

Airtame ApS
Att: Kendra Bannister
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1434 Copenhagen K
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Equipment Authorization measurements on U-NII-3 RLAN

FCC ID: 2ADEFAT-DG2
ISED ID: 12460A-ATDG2

Test object

Product name: Airtame 2
Product model of Airtame 2: AT-DG2
HW Revision: Airtame_DG2_V7_RB
FVIN: cyw89342-dfs_IIIg.clm_blob

RISE Research Institutes of Sweden AB
Electronics - EMC

Performed by

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Testing
ISO/IEC 17025

Table of Content

Summary

Standard	Compliant	Remarks
FCC 47 CFR Part 15 E 15.407 Operation within the bands 5725-5850 MHz KDB 789033, D02 General U-NII Test Procedures New Rules v02r01, December 14, 2017	**Yes**	
ISED RSS-247 Issue 2, February 2017 / ISED RSS-Gen Issue 5 April 2018 Licence-Exempt Local Area Network (LE-LAN), RSS-247 Operation within the bands 5725-5850 MHz	**Yes**	
15.407 (a) (3), Maximum conducted output power / RSS-247 6.2.4.1 Maximum conducted output power	Yes	
15.407 (a) (3), Maximum power spectral density / RSS-247 6.2.4.1 Output power spectral density	Yes	
15.407 (b) (4)(i) Maximum emission outside of the frequency bands of operation / RSS-247 6.2.4.2, Unwanted emission	Yes	Note 1
15.407 (b) (6) Unwanted emission below 1 GHz; according 15.209 / RSS-Gen 8.9 Transmitter emission	Yes	
15.407 (b) (7) Unwanted emission in the restricted bands / RSS-Gen 8.10 Restricted emission bands	Yes	
15.407 (b) (6) Conducted emission AC; according 15.207 / RSS-Gen 8.8 AC Power-line conducted emission	Yes	
15.407 (c) Automatic discontinue transmission/ RSS-247 6.4 (a) Automatic discontinue transmission	-	Note 2
15.407 (f) Radiation exposure; §1.1307 (b), §2.1091, §2.1093 / RSS-102 Radiofrequency (RF) exposure	Yes	Note 3
15.407 (g) Frequency stability / RSS-Gen 8.11 Frequency stability	Yes	
15.407 (h) Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS) / RSS-247 6.3 Dynamic frequency selection	N/A	Note 4
15.407 (i) Security features/ RSS-247 6.4 (b) Security features	-	Note 2
Duty cycle measurements	N/A	Note 5
Band edge: f low= 5725 MHz f high = 5850 MHz	Yes	Note 6
15.407 (e) 6 dB Bandwidth	Yes	
26 dB Bandwidth	N/A	Note 7
99% Occupied bandwidth	N/A	Note 8

Note 1: This test was done with two devices. The device S/N 1182685-000018 which we used for all tests had harmonic with level over the limit in the band 8.2-12.75 GHz in spurious emission test. When we repeated emission test in this band with device S/N 1261093-000724, the device complied requirements. The both devices are from the same production line and hardware revision - without differences in the hardware. The reason why the first DUT was not compliant in this test is that the shielding over

EMMC on this DUT was a prototype with larger tolerances then shielding from mass production with tighter tolerances.

Note 2: See in separate document provided by client.

Note 3: See in the report annex, ”8P07436-F3 RF exposure”

Note 4: According 15.407 (h) (1) and RSS-247 6.2.4.1 TPC mechanism is not required for devices operating in the band 5725-5850 MHz.

According 15.407 (h) (2) and RSS-247 6.3 Dynamic frequency selection is not required for devices operating in the band 5725-5850 MHz.

Note 5: There is not particular requirement, but information is needed for choosing applicable RF output power test method and for correction of data.

Note 6: This is part of the requirement for maximum emission outside of the frequency bands of operation.

Note 7: There is not particular requirement, but information is needed for configuration of instruments and for assessment if operating channel is inside allowed frequency band.

Note 8: There is not particular requirement, but information is needed for configuration of instruments and as alternative for assessment if operating channel is inside allowed frequency band.

Commission

The tests were performed to verify that the electromagnetic emission from the test object meets the requirements of FCC Part 15E and RSS-247 chapter 6.

Manufacturer representative

Airtame ApS
Kendra Bannister
Kuglegårdsvej 17
1434 Copenhagen K
Denmark

Test object

The AT-DG2, 5 GHz RLAN provides wireless connection and transfer of huge amount of data including high definition video stream.
The device will be used as indoor client.
The test object could be configured in different ways. For these measurements devices were configured for test mode with duty cycle as high as possible. Duty cycle varied from 94.9% to 98.7% depending of mode, configuration, modulation and bandwidth.
Samples used during tests:

- S/N 1182685-000018 (for the most of the tests)
- S/N 1261093-000724 (for spurious emission test between 8.2-12.75 GHz)

We had to use another DUT to finish spurious emission test in the band 8.2 to 12.75 GHz because level of the first harmonic from the first DUT was over the limit. See explanation bellow and on page 4, note 1.

The client completed an investigation of the S/N 1182685-000018 after the spurious emission test in the band 8.2 -12.75 GHz detected a first harmonic over the specified limits. The production batch of this DUT was from the early phases of production, where *prototype* shielding over the EMMC was used. The second DUT (S/N 1261093-000724) is from a mass production batch produced later on. There are no hardware differences between the two batches. The only difference is the shielding over the EMMC on the second DUT is no longer a prototype shield, it is produced in a stamping and bending process with tighter tolerance control.

The client then validated this theory by comparing the performance of this S/N 1182685-000018 - with the corners of the EMMC shield soldered shut to represent our improved tolerances - to other devices produced in mass production (for example S/N 1261093-000724). The device performed similarly to other units from mass production, which show a spurious level of approx. -51 dBm, which is within the limits for FCC regulations.

A special test software ‘mfg’-manufacturing cypress-chip firmware and a tool from cypress called ‘wl’ was used in the test objects to achieve test mode and high duty cycle transmission.
Device under test was configured by the python script on the separate PC.

Transceiver:	CYW89342CRFB4G
Antennas:	PCB printed antennas
Antenna gain	
Chain 1	2.5 dBi
Chain 2	6 dBi
Frequencies used during test:	5745 MHz 5755 MHz 5775 MHz 5785 MHz 5795 MHz 5825 MHz
Output power, max, setting	17 dBm/p17, but maximum accepted setting can be seen in each subtest.
Frequency bandwidth:	20 MHz 40 MHz 80 MHz
Modulations:	Standards 802.11a, 802.11n and 802.11ac with modulations BPSK, QPSK, 16-QAM, 64-QAM and 256-QAM; MSC0 to MSC8
Max declared duty cycle in normal operation:	< 95%
Duty cycle during test:	See in the respective sub-tests
Supply voltage to AT-DG2:	5 V±2%, feeding from PSU (normal use) feeding from PoE adapter (test) Extreme voltage: ±15% of nominal voltage

During the test, the test object was powered by 5 V DC from PoE adapter. Power adapter was powered by 48 V DC from PoE injector which was powered by 120 V AC/60 Hz supply.
PoE injector and power adapter were used instead to power supply, PSU, to be able to control device under test to different modes, channels, power, BW and modulations.

Radiated tests:
During radiated tests only AT-DG2, PoE adapter and monitor were placed in the anechoic chamber. PoE injector, router and PC were outside the chamber.

Conducted tests:
Conducted emission was done by powering test device from PoE injector via PoE adapter.
PoE adapter was powered to the 120 V AC supply.
Environmental test with voltage variation was done with variation of 120 V AC for ±15%, instead for variation of 5 V DC due to practical reasons.

The test items were delivered to RISE 2018-09-03, 2018-09-17, 2018-11-05 and 2019-03-05.

Testing was carried by Ermin Pasalic and Markel Bertilsson at 2019-01-29 to 2019-04-30.

Operational test mode

The following were set in the EUT, if not otherwise stated.
Initial conducted power measurement and radiated spurious measurement were performed with maximum output power (setting 17 dBm/p17). During edge test it was needed to tune down output power to meet edge requirements. Se maximum acceptable power classes for different bandwidths to comply with edge requirement which consider also variation due to temperature.

In the table below you can find maximum acceptable power class to comply with all requirements:

	Max overall acceptable power class – FCC/ISED
Ch 149	13 dBm/p13
Ch 151	12 dBm/p12
Ch 153	13 dBm/p13
Ch 155	13 dBm/p13
Ch 157	13 dBm/p13
Ch 159	13 dBm/p13
Ch 161	13 dBm/p13
Ch 165	13 dBm/p13

Tx power dBm: 18.5 dBm total in MIMO mode and 15.9 dBm per chain in SISO mode
Channel BW: 20 MHz / 40 MHz / 80 MHz

For duty cycle measurements results see: Duty cycle measurements.

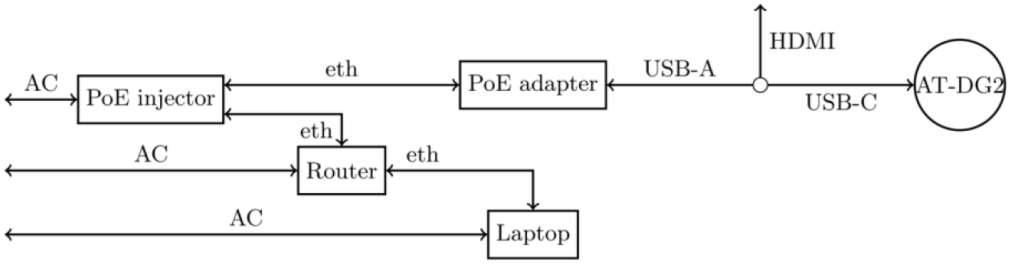
Justification measurements were performed of the different WiFi standards, different modulation and coding index – MCS and different antenna configuration. Justification were also performed of different placements of DUT and the worst case channel through different frequency bands. The presented results in the reports were judged to represent a worst case scenario based on the justification measurement.
The worst case according justification tests was 802.11ac, MCS0 and 20 MHz BW in MIMO mode.
Regarding placement of DUT, laying placement was the worst case.
The channel 165 showed highest emission levels in U-NII-3 band.

Connected equipment during the test

According to ANSI C63.10.2013, clause 5.10.7

PoE injector, AXIS T8120 15W MDSPN 1P, model: 5026-001-01	Client equipment
PoE adapter, model: AT-PoE, FCC ID: 2ADEFTAT-PoE	Client equipment
Router, NetgearAC1900 Smart WiFi Router Model: R7000	Client equipment
HP Laptop Model: 14-bp092no, ProdID 2GG01EA#UUW	Client equipment
Lenovo ThinkVision LCD monitor, Type/Model A16270QP0	RISE equipment

Test setup - DUT with auxiliary equipment



DUT consists of AT-DG2 and PoE adapter.

Cabling during tests:

AT-DG2 port	Cable type	Termination / use
USB C	Aircord 0.2 m; branch USB C	Cable splitter (to PoE adapter via one branch with USB A connector and to the Monitor via second branch with HDMI connector)

PoE adapter	Cable type	Termination / use
USB-A	Aircord 0.85 m; branch USB A	Cable splitter (to AT-DG2 via one branch with USB C connector and to the Monitor via second branch with HDMI connector)
LAN	Cat 5, 1.0 m (conductive tests) Cat 5, 3.0 m (radiated tests)	PoE injector

Measurement equipment

Measurement equipment	RISE number	Calibration Due
Semi anechoic chamber, Edison	504114	2021-08
Test site Galvani	15:117	-
Computer Lenovo ThinkCentre	-	-
Software R&S EMC32, ver.9.15.00	503889	-
EMI test receiver R&S ESU 26	902210	2019-07
Signal Analyser R&S FSQ26	BX50694	2019-07
Signal Analyser R&S ESI40	503125	2019-07
Antenna Schaffner CBL 6143	504079	2021-08
Low Noise Amplifier Miteq	504160	2020-01
Step attenuator Narda743-60	BX41644	2019-11
Coaxial cable	BX50672	2019-10
Coaxial cable	504102	2020-03
Coaxial cable	504103	2020-03
Coaxial cable	504104	2020-03
Coaxial cable	900678	2020-05
Coaxial cable	504162	2020-01
120 V AC/60 Hz AC Power source HP 6813B	503091	2019-09
DC power supply TTI	502786	-
DC power supply HP E3632A	503170	-
Multimeter Fluke 83	501522	2019-06
Multimeter Fluke 85III	503418	2019-06
Temperature and humidity meter Testo 625	503498	2019-06
Test site Marconi	15:121	-
Software R&S WMS32, ver.10.40.10	-	-
Switching box with RF power meters R&S OSP120 with OSP-B157W8	BX60313	2020-07
Coaxial cable	BX81424	2020-05
Coaxial cable	BX81436	2020-05
Coaxial cable	BX50685	2020-05
EMI test receiver R&S ESU 40	901385	2019-07
Antenna ETS-Lindgren 3115 Tesla	902175	2021-07
Standard gain horn, 18-26 GHz, 20240-20	503674	2021-01
Standard gain horn, 26-40 GHz, 22240-20	503674	2021-01
Low Noise Amplifier Miteq, 18-26.5 GHz	503285	2020-01
Low Noise Amplifier Miteq 18-40 GHz	503278	2020-01
Semi anechoic chamber, Tesla	503881	2019-12
Software R&S EMC32, ver.9.15.00	BX62351	-
Standard gain horn, 8-12.75 GHz	503939	-
Standard gain horn, 12.75-18 GHz	503900	-
Low Noise Amplifier Miteq	901545	2020-01

Huber Suhner antenna cable N-N	BX62218	2019-09
Coaxial cable	503697	2020-01
6 dB Dämpare	BX61530	2019-07
Coaxial cable	503508	2019-09
Coaxial cable	503509	2019-09
Coaxial cable	504206	2019-07
Temperature and humidity meter Testo 625	504188	2019-06
LISN Schwarzbeck NNLA 8120	BX70761	2020-04
LISN Schwarzbeck NNBL 8226-2	902060	2020-02
Limiter, EM-7600	BX42883	2019-09
Temperature scope	503360	2021-02
Temperature and humidity meter Testo 625	504203	2020-05
Temperature and humidity meter Testo 625, with wire sensor 2A	504117	2019-06
Coaxial cable	900226	2019-09
Coaxial cable	504035	2020-01
Coaxial cable	503274	2020-01

Test facility

The used semi-anechoic chambers are compliant with ANSI C63.4. RISE is an ISO 17025 accredited test facility for Electromagnetic Compatibility (EMC) and Radio testing. RISE is Recognized Lab under FCC and ISED (registration No. 3482A) rules.

References

Measurements were done according to relevant parts of the following standards:

ANSI 63.10-2013
eCFR 47, part 15 C
eCFR 47, part 15 E
KDB 447498 D01 General RF Exposure Guidance v06
KDB 789033 D02 General U-NII Test Procedures New Rules v02r01; Dec. 14, 2017
RSS-Gen, Issue 5, Apr. 2018
RSS-Gen, Issue 5, March 2019, Amendment 1
RSS-247, Issue 2, Feb. 2017
KDB 662911 D01 Multiple Transmitter Output v02r01, Oct. 2013
KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02, Apr. 2016
KDB 905462 D03 Client Without DFS New Rules v01r02, Aug. 2016

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence). The measurement uncertainties can be found in the table below:

Method	**Uncertainty**
Duty cycle	1.3 %
Maximum peak conducted power	1 dB
Restricted bands of operation:	
Radiated emission, 30 – 1000 MHz	4.8/5.6 dB (V/H-pol)
Radiated emission, 1 – 40 GHz	2.6 dB
Conducted 26 dBc	2 %
Power spectral density	1.3 dB
RF Safety	1 dB
99 % Occupied bandwidth	2.0 %
Band edge, restricted bands, radiated	4.8/5.6 dB (V/H-pol)
Band edge, 99 % OBW	2.0 %

Compliancy evaluation is based on a shared risk principle with respect to the measurement uncertainty.

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in the report.

Test participants
The customer not present during the tests.

Test results

Duty cycle measurements

Date	Temperature	Humidity
2019-02-12	19 °C ± 3 °C	16 % ± 5 %
2019-02-13	23 °C ± 3 °C	19 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10 clause 12.2 and the KDB 789033 D02 Dec. 14, 2017 II.B.2.b).

Conducted measurements were performed on units with the temporary antenna connectors, with transmission of duty cycle between 95% and 99% and with normal modulation.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Test site Marconi	15:121
Software R&S WMS32, ver.10.40.10	-
Signal Analyser R&S FSQ26	BX50694
Switching box with RF power meters R&S OSP120 with OSP-B157W8	BX60313
Coaxial cable	BX81424
Coaxial cable	BX81436
Coaxial cable	BX50685
120 V AC/60 Hz AC Power source HP 6813B	503 091
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

SISO 2, (chain 2 – 6 dBi antenna gain)		802.11.ac/ MCS0			
T_{nom} 20°C V_{nom} 120 V AC					
f [MHz]	BW [MHz]	Pulse period [ms]	Pulse width [ms]	Duty Cycle [%]	Correction [dB]
5745	20	1.36	1.34	98.7	0.06
5755	40	0.69	0.67	97.0	0.13
5775	80	0.35	0.33	94.9	0.23
5785	20	1.36	1.34	98.7	0.06
5795	40	0.68	0.66	97.4	0.11
5825	20	1.36	1.34	98.6	0.07

Results

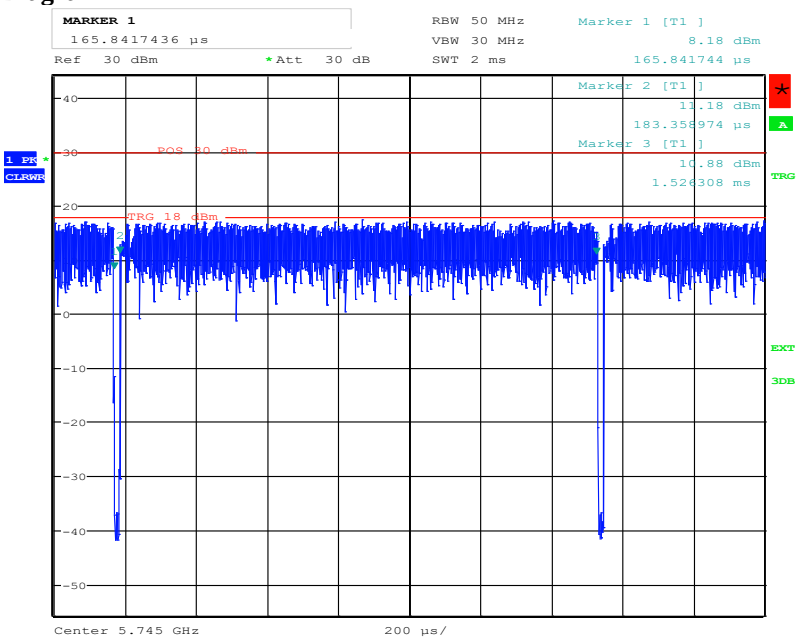
The duty cycle measurements can be found in the diagrams below:

Diagram 1:	5745 MHz, 20 MHz BW, SISO 2
Diagram 2:	5755 MHz, 40 MHz BW, SISO 2
Diagram 3:	5775 MHz, 80 MHz BW, SISO 2
Diagram 4:	5785 MHz, 20 MHz BW, SISO 2
Diagram 5:	5795 MHz, 40 MHz BW, SISO 2
Diagram 6:	5825 MHz, 20 MHz BW, SISO 2

Test engineer: Markel Bertilsson and Ermin Pasalic

Complies?	N/A

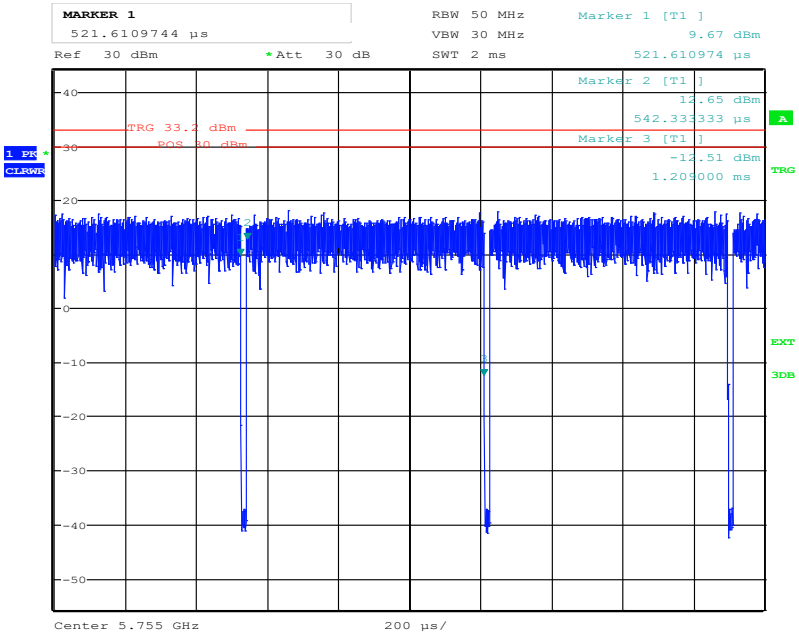
Diagram 1



Date: 4.MAR.2019 16:12:23

DUT operating at 5745 MHz and 20 MHz BW, SISO 2; Duty cycle

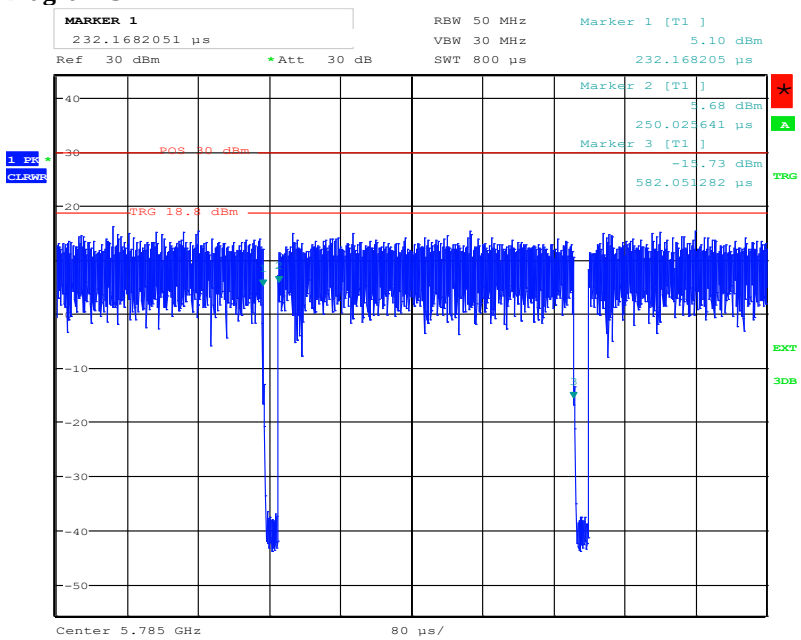
Diagram 2



Date: 4.MAR.2019 16:10:13

DUT operating at 5755 MHz and 40 MHz BW, SISO 2; Duty cycle

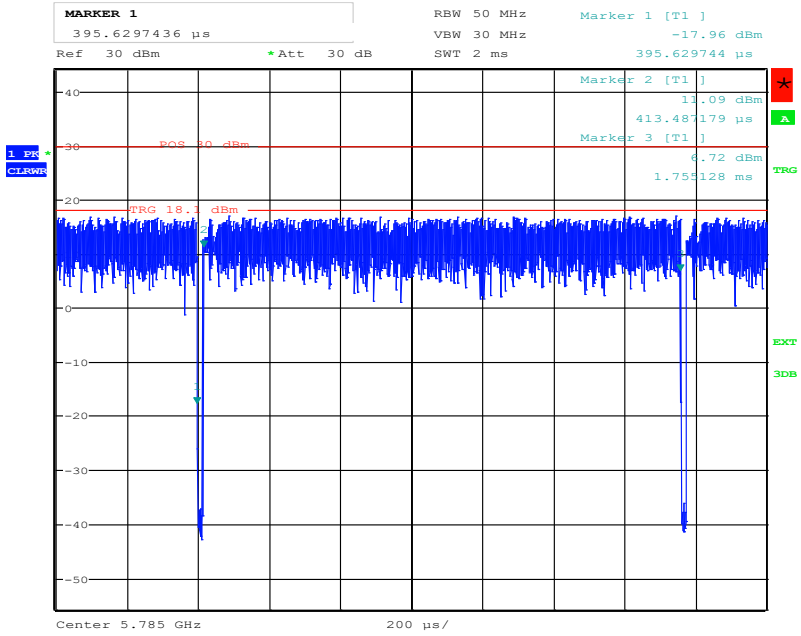
Diagram 3



Date: 4.MAR.2019 16:18:07

DUT operating at 5775 MHz and 80 MHz BW, SISO 2; Duty cycle

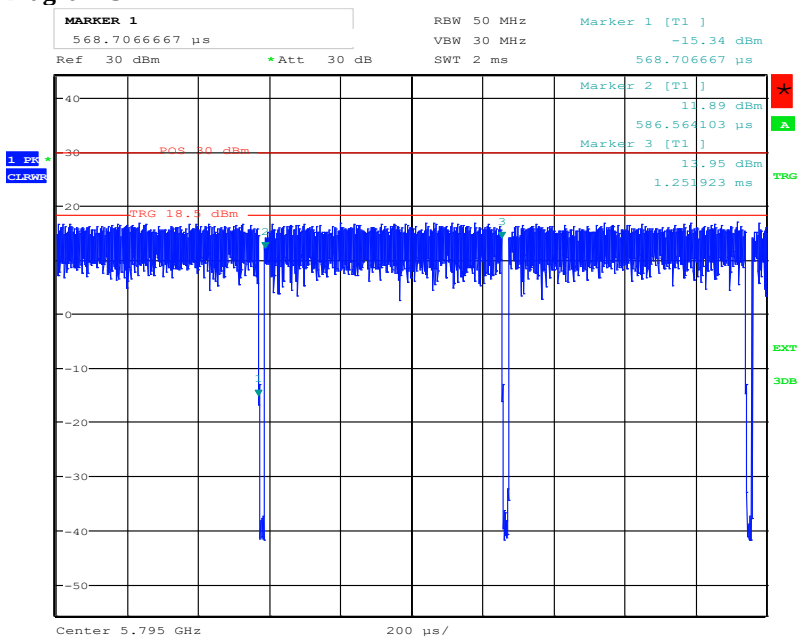
Diagram 4



Date: 4.MAR.2019 16:21:24

DUT operating at 5785 MHz and 20 MHz BW, SISO 2; Duty cycle

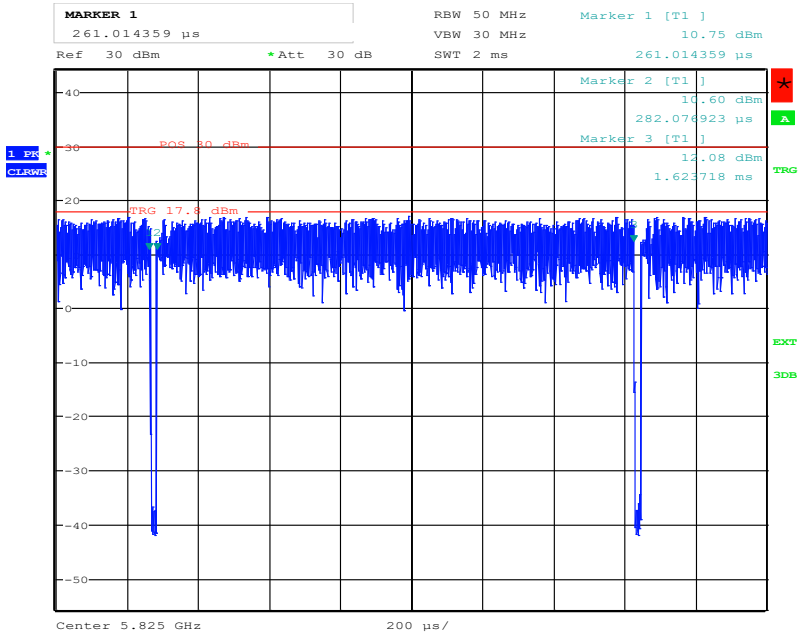
Diagram 5



Date: 4.MAR.2019 16:23:24

DUT operating at 5795 MHz and 40 MHz BW, SISO 2; Duty cycle

Diagram 6



Date: 4.MAR.2019 16:25:19

DUT operating at 5825 MHz and 20 MHz BW, SISO 2; Duty cycle

Maximum conducted output power/e.i.r.p. measurements according to FCC 47 CFR part 15.407 (a) (3) /RSS-247 6.2.4.1

Date	Temperature	Humidity
2019-02-12	19 °C ± 3 °C	16 % ± 5 %
2019-02-13	23 °C ± 3 °C	19 % ± 5 %
2019-04-30	22 °C ± 3 °C	28 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10 clause 12.3 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.E.3.b). Additionally, test in MIMO operating mode was done according KDB 662911 D01 Multiple Transmitter Output v02r01.E.1.

Conducted measurements were performed on units with the temporary antenna connectors, with transmission of duty cycle between 95% and 99% and with normal modulation.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Test site Marconi	15:121
Computer Lenovo ThinkCentre	-
Software R&S WMS32, ver.10.40.10	-
Switching box with RF power meters R&S OSP120 with OSP-B157W8	BX60313
Coaxial cable	BX81424
Coaxial cable	BX81436
Coaxial cable	BX50685
Temperature and humidity meter Testo 625	504 117
120 V AC/60 Hz AC Power source HP 6813B	503 091
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

Conducted output power as function of voltage variation

MIMO			802.11ac			
T_{nom} 20°C MSC0	Max conducted output power and e.i.r.p. (RMS detector – gated power meter)					
	f = 5745 MHz BW = 20 MHz 17 dBm/p17		f = 5785 MHz BW = 20 MHz 17 dBm/p17		f = 5825 MHz BW = 20 MHz 17 dBm/p17	
	Power	e.i.r.p.	Power	e.i.r.p.	Power	e.i.r.p.
$V_{85\% nom}$ 102 V AC	19.5	23.7	20.5	24.6	19.3	23.6
V_{nom} 120 V AC	19.9	24.1	20.7	24.8	19.4	23.7
$V_{115\% nom}$ 138 V AC	20.0	24.3	20.9	25.0	19.5	23.8

MIMO			802.11ac			
T_{nom} 20°C MSC0	Max conducted output power and e.i.r.p. (RMS detector – gated power meter)					
	f = 5755 MHz BW = 40 MHz 17 dBm/p17		f = 5795 MHz BW = 40 MHz 17 dBm/p17		f = 5775 MHz BW = 80 MHz 17 dBm/p17	
	Power	e.i.r.p.	Power	e.i.r.p.	Power	e.i.r.p.
$V_{85\% nom}$ 102 V AC	20.0	24.2	19.5	23.5	19.8	24.1
V_{nom} 120 V AC	20.2	24.4	19.6	23.6	19.8	24.1
$V_{115\% nom}$ 138 V AC	20.2	24.4	19.6	23.7	19.8	24.1

SISO 2, (chain 2 – 6 dBi antenna gain)			802.11ac			
T_{nom} 20°C MSC0	Max conducted output power and e.i.r.p. (RMS detector – gated power meter)					
	f = 5745 MHz BW = 20 MHz 17 dBm/p17		f = 5785 MHz BW = 20 MHz 17 dBm/p17		f = 5825 MHz BW = 20 MHz 17 dBm/p17	
	Power	e.i.r.p.	Power	e.i.r.p.	Power	e.i.r.p.
$V_{85\% nom}$ 102 V AC	18.9	24.9	17.8	23.8	17.2	23.2
V_{nom} 120 V AC	19.0	25.0	17.8	23.8	17.2	23.2
$V_{115\% nom}$ 138 V AC	19.0	25.0	17.7	23.7	17.1	23.1

SISO 2, (chain 2 – 6 dBi antenna gain)	802.11ac					
T_{nom} 20°C MSC0	Max conducted output power and e.i.r.p. (RMS detector – gated power meter)					
	f = 5755 MHz BW = 40 MHz 17 dBm/p17		f = 5795 MHz BW = 40 MHz 17 dBm/p17		f = 5775 MHz BW = 80 MHz 17 dBm/p17	
	Power	e.i.r.p.	Power	e.i.r.p.	Power	e.i.r.p.
$V_{85\%\ nom}$ 102 V AC	17.6	23.6	16.7	22.7	17.0	23.0
V_{nom} 120 V AC	17.7	23.7	16.7	22.7	17.1	23.1
$V_{115\%\ nom}$ 138 V AC	17.5	23.5	16.6	22.6	17.0	23.0

Note : According 47CFR 15.31(e), for intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

802.11ac V_{nom} 120 V AC T_{nom} 20°C MSC0	Max conducted output power and e.i.r.p. (RMS detector – gated power meter)					
	f = 5745 MHz BW = 20 MHz 13 dBm/p13		f = 5785 MHz BW = 20 MHz 13 dBm/p13		f = 5825 MHz BW = 20 MHz 13 dBm/p13	
	Power	e.i.r.p.	Power	e.i.r.p.	Power	e.i.r.p.
MIMO	18.5	23.4	18.0	22.6	17.6	22.4
SISO 2	15.9	21.9	15.1	21.1	15.4	21.4

802.11ac V_{nom} 120 V AC T_{nom} 20°C MSC0	Max conducted output power and e.i.r.p. (RMS detector – gated power meter)					
	f = 5755 MHz BW = 40 MHz 13 dBm/p13		f = 5795 MHz BW = 40 MHz 13 dBm/p13		f = 5775 MHz BW = 80 MHz 13 dBm/p13	
	Power	e.i.r.p.	Power	e.i.r.p.	Power	e.i.r.p.
MIMO	18.2	23.0	17.8	22.5	17.3	22.0
SISO 2	15.8	21.8	15.2	21.2	14.7	20.7

Note: Output power was initially measured at highest declared power class, 17 dBm/p17. During the measurement of different radio parameters, power class had to be reduced to get device compliant. The two upper tables present complementary measurement results of the power with power setting of 13 dBm/p13.

Limits

According to 47CFR 15.407(a)(3) and RSS-247 6.2.4.1, for devices operating in the band 5.725-5.85 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. If antenna gain is higher than 6 dBi, maximum conducted output power shall be reduced by the amount in dB antenna gain exceeds 6 dBi.

Test engineer: Markel Bertilsson and Ermin Pasalic

Complies?	Yes

Maximum power spectral density measurements according to FCC 47 CFR part 15.407 (a) (3) / RSS-247 6.2.4.1

Date	Temperature	Humidity
2019-02-12	19 °C ± 3 °C	16 % ± 5 %
2019-02-13	23 °C ± 3 °C	19 % ± 5 %
2019-04-30	22 °C ± 3 °C	28 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10 clause 12.5 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.F.1 (II.E.2.f; SA-3).
Additionally, test in MIMO operating mode was done according KDB 662911 D01 Multiple Transmitter Output v02r01.E.2.a.

The conducted measurements were performed on units with the temporal antenna connectors, with transmission of duty cycle between 95% and 99% and with normal modulation.
The test was performed with RMS detector. Total power in the burst was measured with triggered power meter.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Test site Marconi	15:121
Computer Lenovo ThinkCentre	-
Software R&S WMS32, ver.10.40.10	-
Spectrum analyser R&S FSQ 26	BX50694
Switching box with RF power meters R&S OSP120 with OSP-B157W8	BX60313
Coaxial cable	BX81424
Coaxial cable	BX81436
Coaxial cable	BX50685
Temperature and humidity meter Testo 625	504 117
120 V AC/60 Hz AC Power source HP 6813B	503 091
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

Power spectral density as function of voltage variation

MIMO			802.11ac			
T_{nom} 20°C MSC0	Max power spectral density, PSD and Max e.i.r.p power spectral density, (SA-3)					
	f = 5745 MHz BW = 20 MHz 17 dBm/p17		f = 5785 MHz BW = 20 MHz 17 dBm/p17		f = 5825 MHz BW = 20 MHz 17 dBm/p17	
	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD
$V_{85\% nom}$ 102 V AC	6.7	10.9	6.0	10.1	5.1	9.4
V_{nom} 120 V AC	6.7	10.9	6.3	10.4	5.2	9.5
$V_{115\% nom}$ 138 V AC	7.1	11.4	6.4	10.5	5.3	9.6

MIMO			802.11ac			
T_{nom} 20°C MSC0	Max power spectral density, PSD and Max e.i.r.p power spectral density, (SA-3)					
	f = 5755 MHz BW = 40 MHz 17 dBm/p17		f = 5795 MHz BW = 40 MHz 17 dBm/p17		f = 5775 MHz BW = 80 MHz 17 dBm/p17	
	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD
$V_{85\% nom}$ 102 V AC	2.6	6.8	2.2	6.2	-0.2	4.1
V_{nom} 120 V AC	2.7	6.9	2.2	6.2	-0.3	4.0
$V_{115\% nom}$ 138 V AC	2.8	7.0	2.4	6.5	-0.1	4.2

SISO 2, (chain 2 – 6 dBi antenna gain)			802.11ac			
T_{nom} 20°C MSC0	Max power spectral density, PSD and Max e.i.r.p power spectral density, (SA-3)					
	f = 5745 MHz BW = 20 MHz 17 dBm/p17		f = 5785 MHz BW = 20 MHz 17 dBm/p17		f = 5825 MHz BW = 20 MHz 17 dBm/p17	
	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD
$V_{85\% nom}$ 102 V AC	4.2	10.2	3.4	9.4	3.1	9.1
V_{nom} 120 V AC	4.4	10.4	3.4	9.4	3.2	9.2
$V_{115\% nom}$ 138 V AC	4.3	10.3	3.3	9.3	3.0	9.0

SISO 2, (chain 2 – 6 dBi antenna gain)	802.11ac					
T_{nom} 20°C MSC0	Max power spectral density, PSD and Max e.i.r.p power spectral density, (SA-3)					
	f = 5755 MHz BW = 40 MHz 17 dBm/p17		f = 5795 MHz BW = 40 MHz 17 dBm/p17		f = 5775 MHz BW = 80 MHz 17 dBm/p17	
	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD
$V_{85\% nom}$ 102 V AC	0.3	6.3	-0.6	5.4	-3.3	2.7
V_{nom} 120 V AC	0.4	6.4	-0.5	5.5	-3.2	2.8
$V_{115\% nom}$ 138 V AC	0.2	6.2	-0.6	5.4	-3.2	2.8

Note: No corrections of power spectral density, PSD, for duty cycle were done in upper tables because PSD measured by spectrum analyser is normalized to the power measured in the burst by OSP-B157W8 which is not impacted by duty cycle.

802.11ac V_{nom} 120 V AC T_{nom} 20°C MSC0	Max power spectral density, PSD and Max e.i.r.p power spectral density, (SA-3)					
	f = 5745 MHz BW = 20 MHz 13 dBm/p13		f = 5785 MHz BW = 20 MHz 13 dBm/p13		f = 5825 MHz BW = 20 MHz 13 dBm/p13	
	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD
MIMO	3.7	8.5	3.5	8.3	3.5	8.3
SISO 2	1.4	7.4	0.8	6.8	1.3	7.3

802.11ac V_{nom} 120 V AC T_{nom} 20°C MSC0	Max power spectral density, PSD and Max e.i.r.p power spectral density, (SA-3)					
	f = 5755 MHz BW = 40 MHz 13 dBm/p13		f = 5795 MHz BW = 40 MHz 13 dBm/p13		f = 5775 MHz BW = 80 MHz 13 dBm/p13	
	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD	PSD	e.i.r.p. PSD
MIMO	1.0	5.8	0.5	5.3	-2.6	2.2
SISO 2	-1.4	4.6	-1.9	4.1	-5.7	0.3

Note: Power spectral density was initially measured at highest declared power class, 17 dBm/p17. During the measurement of different radio parameters, power class had to be reduced to get device compliant. The two upper tables present complementary measurement results of the power spectral density with power setting of 13 dBm/p13.

The measurements with RMS detector can be found in the diagrams below:

Diagram 1:	Power spectral density; DUT operating at 5745 MHz 20 MHz BW MIMO MSC0
Diagram 2:	Power spectral density; DUT operating at 5785 MHz 20 MHz BW MIMO MSC0
Diagram 3:	Power spectral density; DUT operating at 5825 MHz 20 MHz BW MIMO MSC0
Diagram 4:	Power spectral density; DUT operating at 5755 MHz 40 MHz BW MIMO MSC0
Diagram 5:	Power spectral density; DUT operating at 5795 MHz 40 MHz BW MIMO MSC0
Diagram 6:	Power spectral density; DUT operating at 5775 MHz 80 MHz BW MIMO MSC0
Diagram 7:	Power spectral density; DUT operating at 5745 MHz 20 MHz BW SISO 2 MSC0
Diagram 8:	Power spectral density, DUT operating at 5785 MHz 20 MHz BW SISO 2, MSC0
Diagram 9:	Power spectral density, DUT operating at 5825 MHz 20 MHz BW SISO 2, MSC0
Diagram 10:	Power spectral density, DUT operating at 5755 MHz 40 MHz BW SISO 2, MSC0
Diagram 11:	Power spectral density, DUT operating at 5795 MHz 40 MHz BW SISO 2, MSC0
Diagram 12:	Power spectral density, DUT operating at 5775 MHz 80 MHz BW SISO 2, MSC0

Note: the results in the diagrams are not corrected for duty cycle.

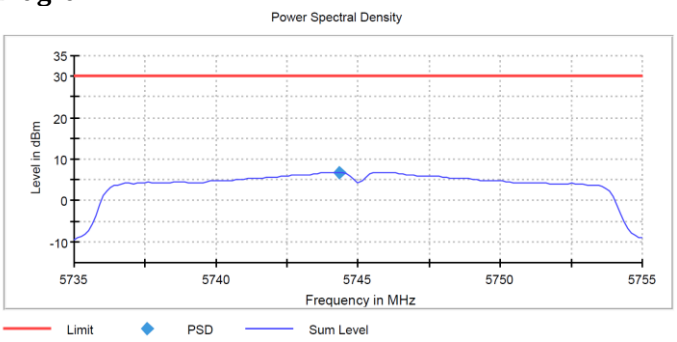
Limits

According to 47CFR 15.407(a)(3) and RSS-247 6.2.4.1, for devices operating in the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band, provided that max antenna gain is 6 dBi.
If antenna gain is higher than 6 dBi, maximum power spectral density shall be reduced by the amount in dB antenna gain exceeds 6 dBi.

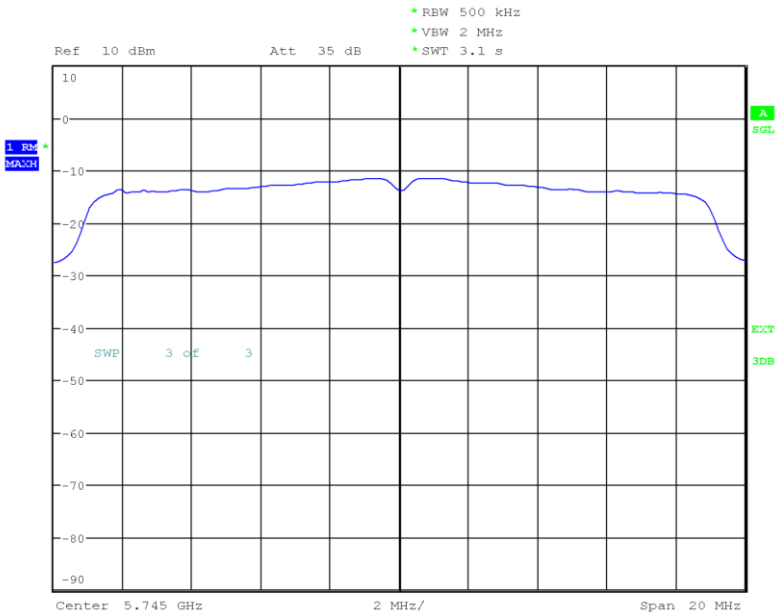
Test engineer: Markel Bertilsson and Ermin Pasalic

Complies?	Yes

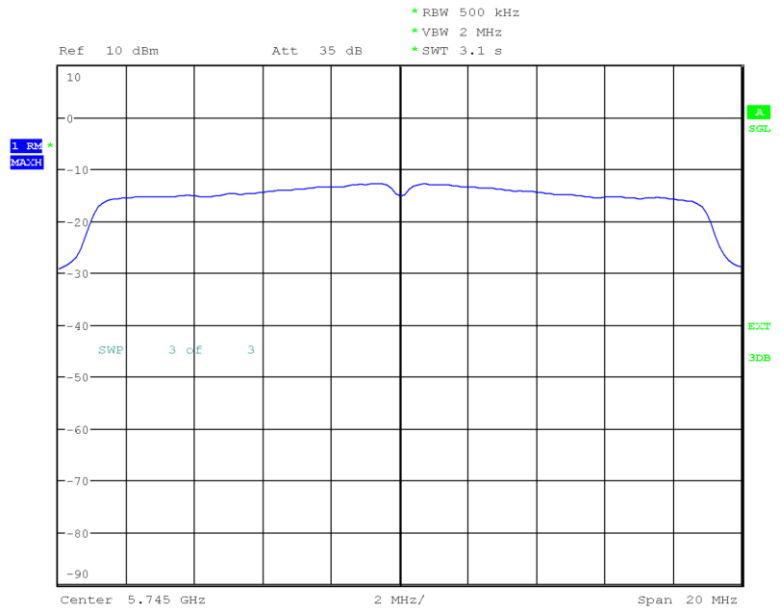
Diagram 1



PSD – total

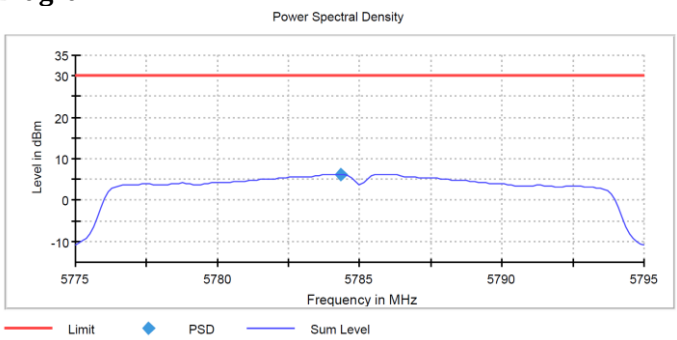


PSD – chain 1, 2.5 dBi antenna gain

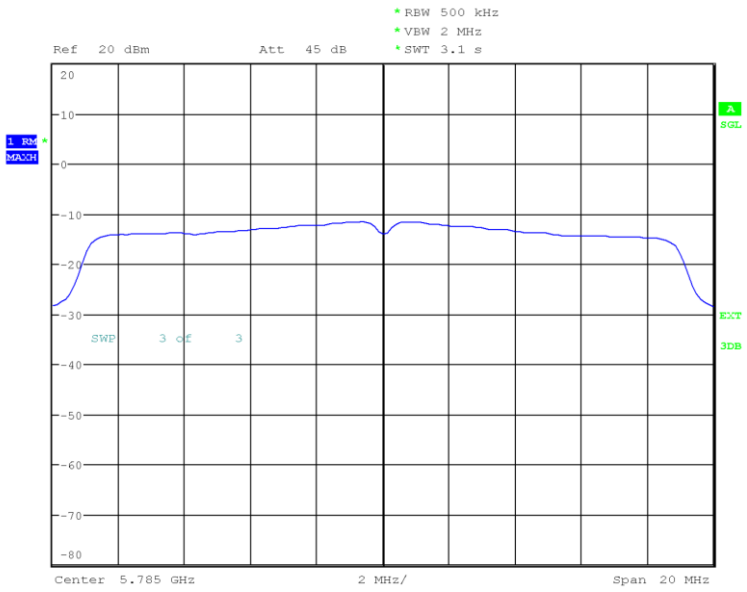


PSD – chain 2, 6 dBi antenna gain
Power spectral density; DUT operating at 5745 MHz 20 MHz BW MIMO MSC0

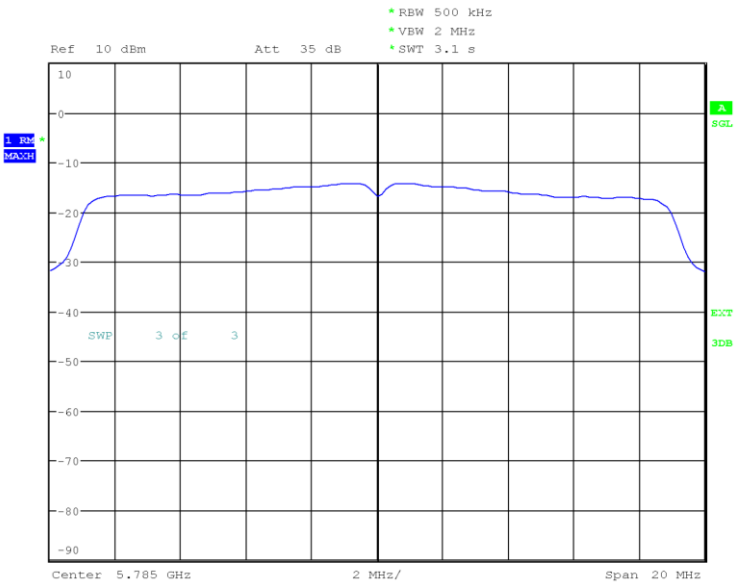
Diagram 2



PSD – total

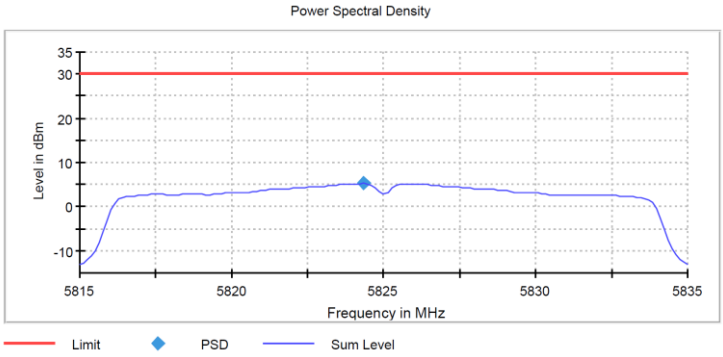


PSD – chain 1, 2.5 dBi antenna gain

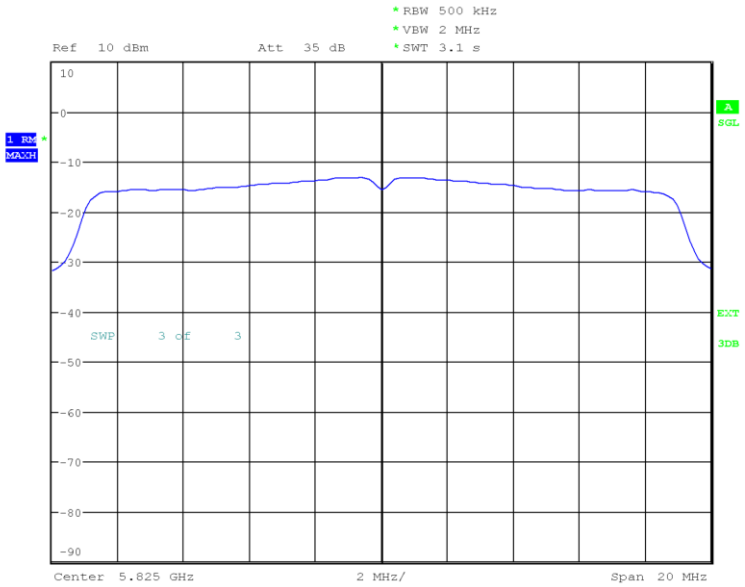


PSD; chain 2, 6 dBi antenna gain
Power spectral density; DUT operating at 5785 MHz 20 MHz BW MIMO MSC0

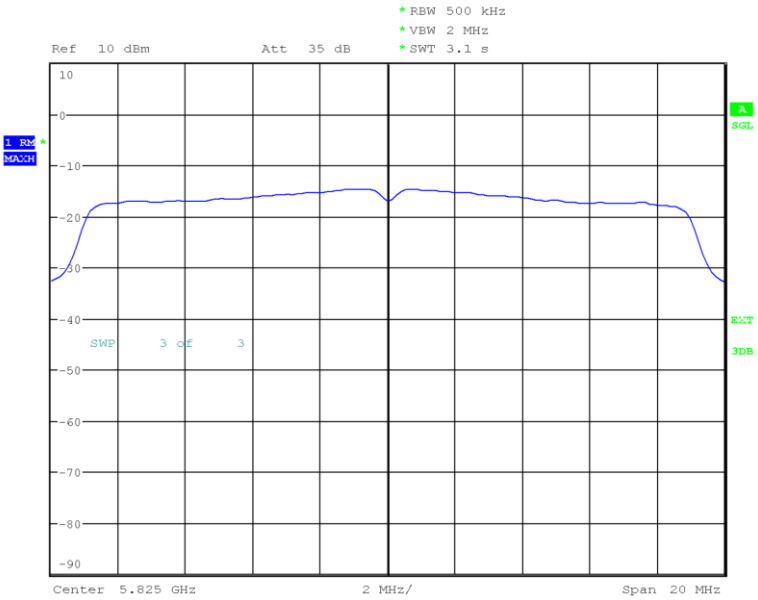
Diagram 3



PSD – total

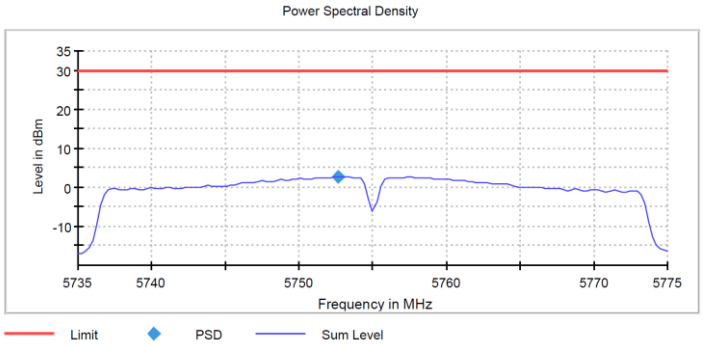


PSD – chain 1, 2.5 dBi antenna gain

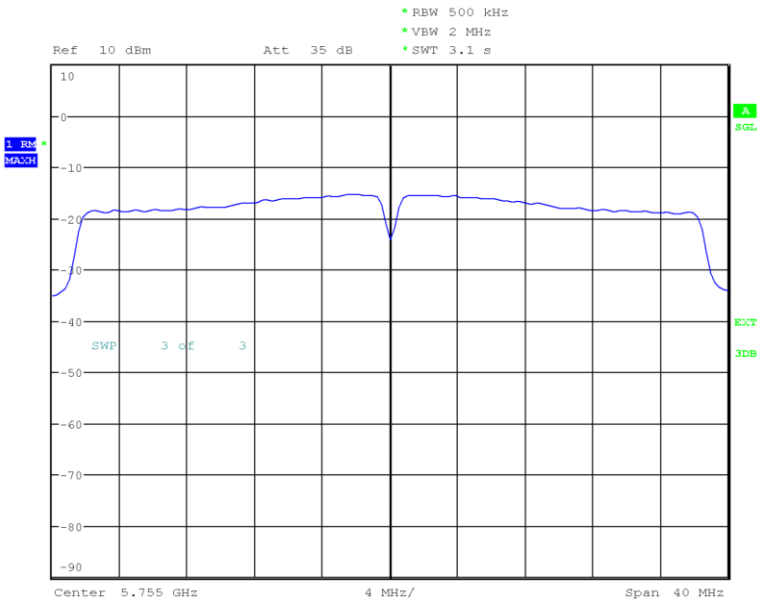


PSD – chain 2, 6 dBi antenna gain
Power spectral density; DUT operating at 5825 MHz 20 MHz BW MIMO MSC0

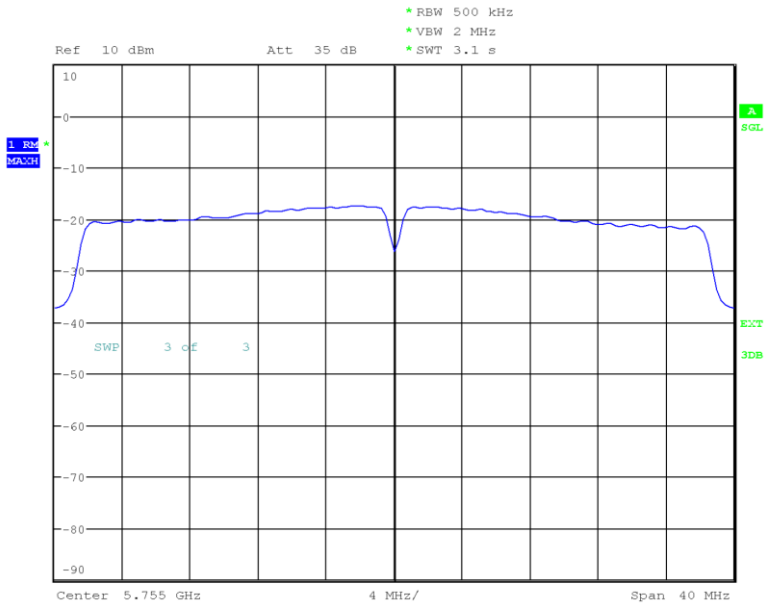
Diagram 4



PSD – total

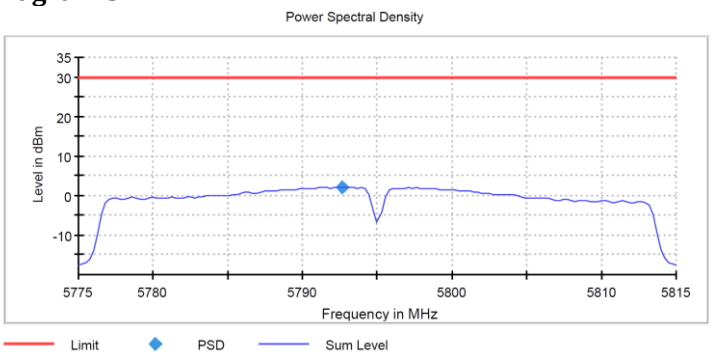


PSD – chain 1, 2.5 dBi antenna gain

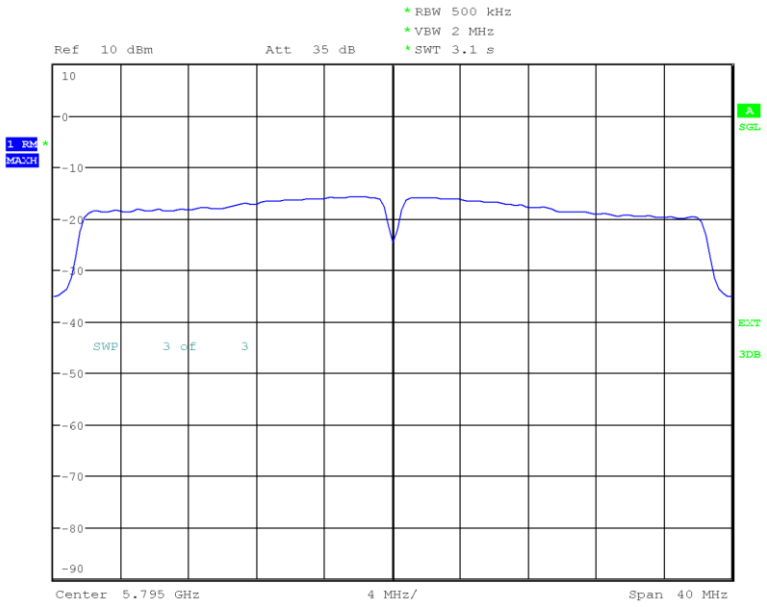


PSD – chain 2, 6 dBi antenna gain
Power spectral density; DUT operating at 5755 MHz 40 MHz BW MIMO MSC0

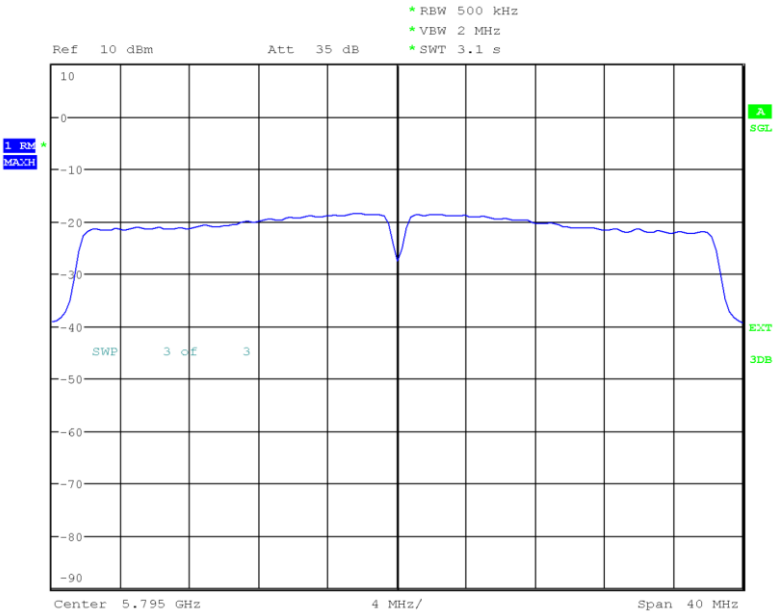
Diagram 5



PSD – total

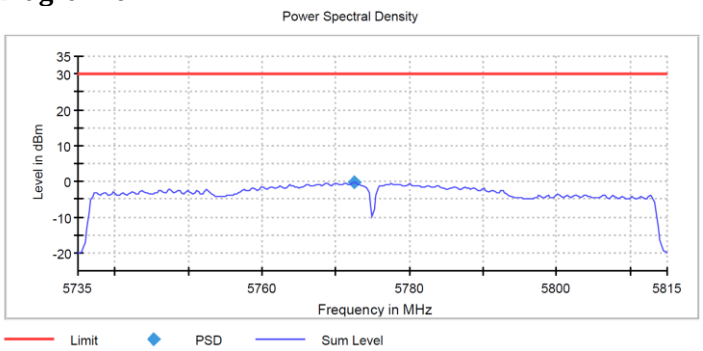


PSD – chain 1, 2.5 dBi antenna gain

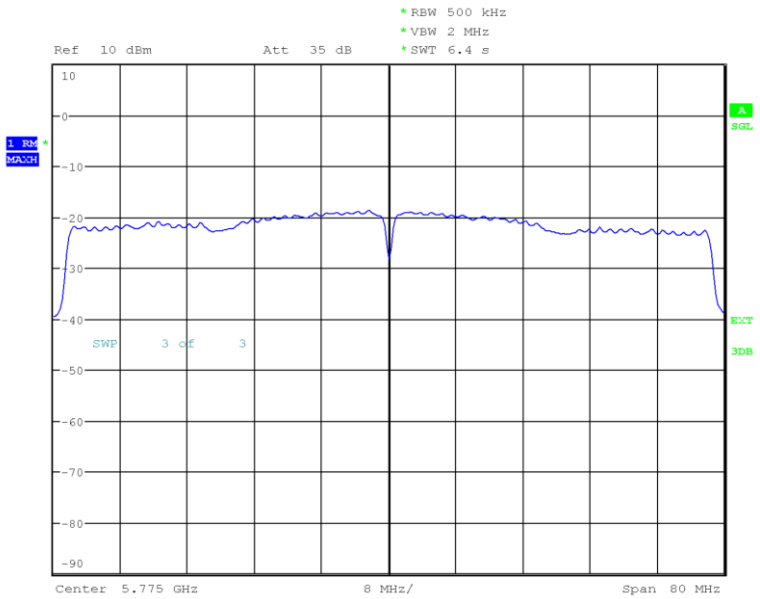


PSD – chain 2, 6 dBi antenna gain
Power spectral density; DUT operating at 5795 MHz 40 MHz BW MIMO MSC0

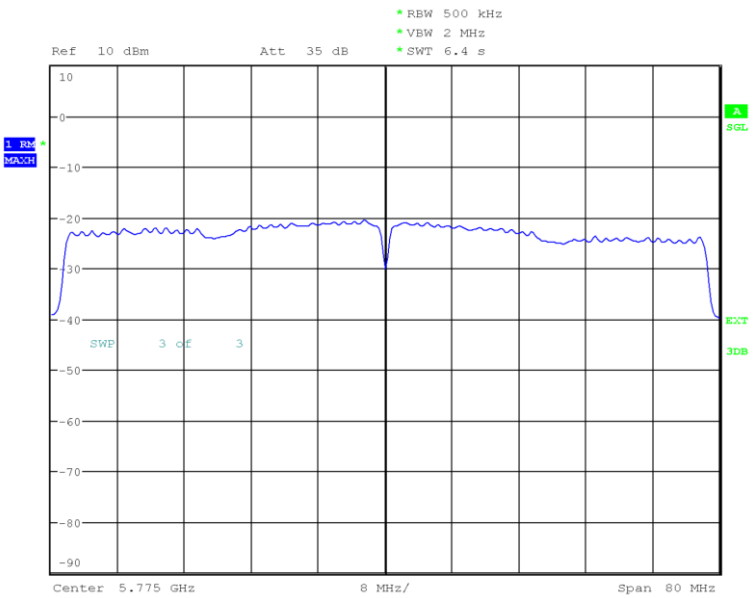
Diagram 6



PSD – total



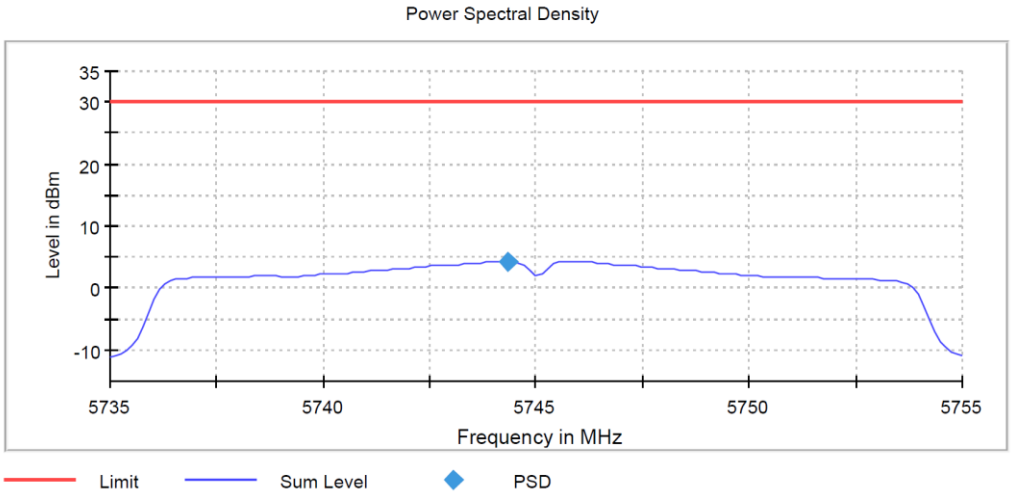
PSD – chain 1, 2.5 dBi antenna gain

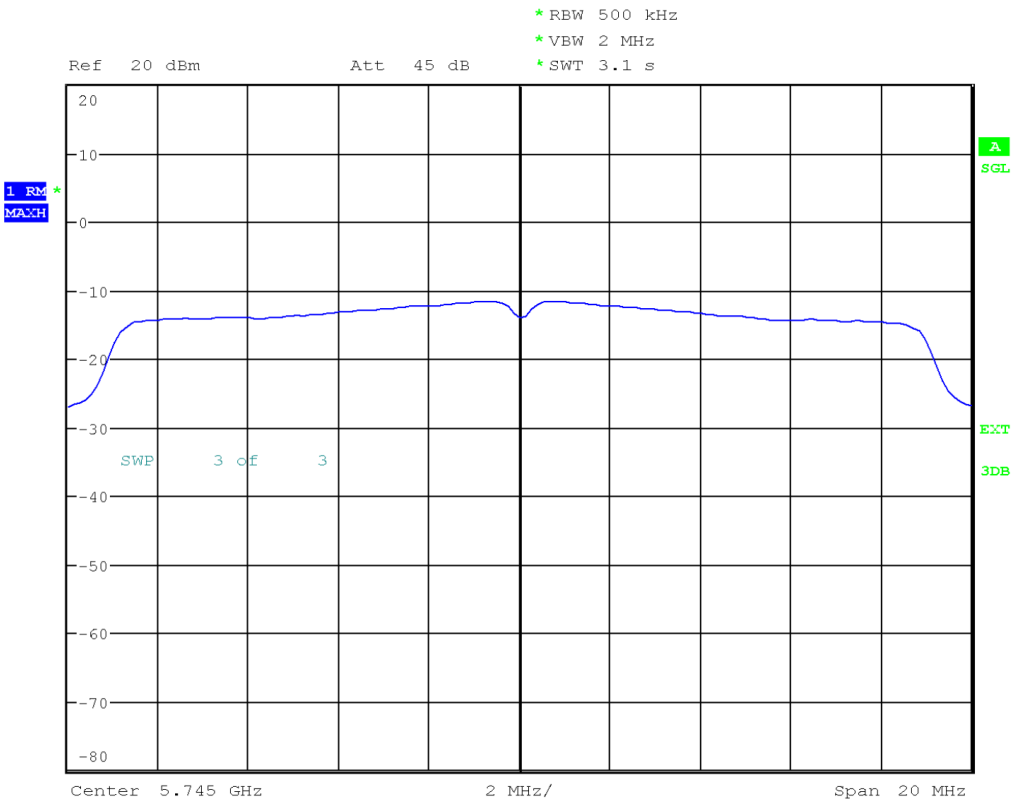


PSD – chain 2, 6 dBi antenna gain

Power spectral density; DUT operating at 5775 MHz 80 MHz BW MIMO MSC0

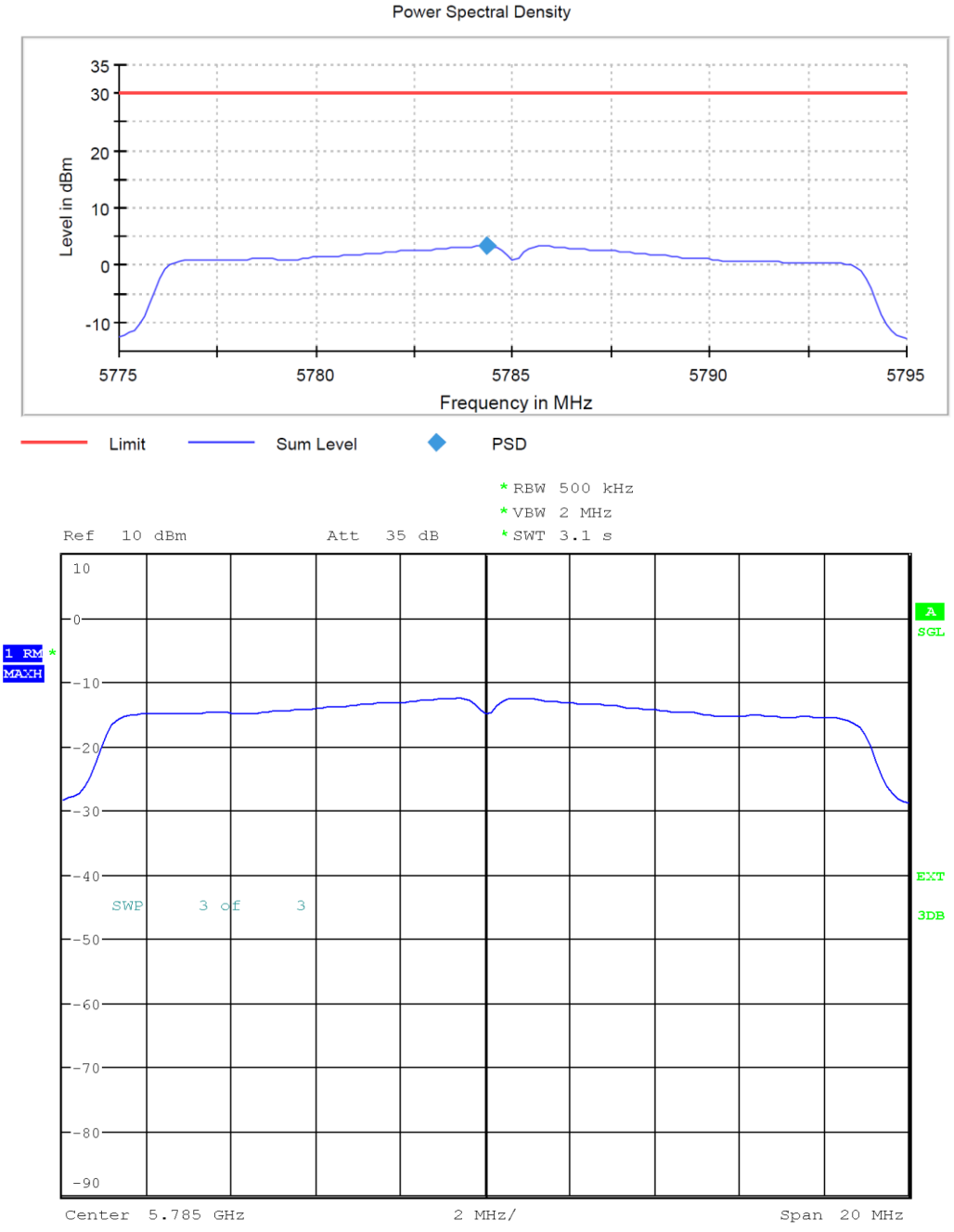
Diagram 7





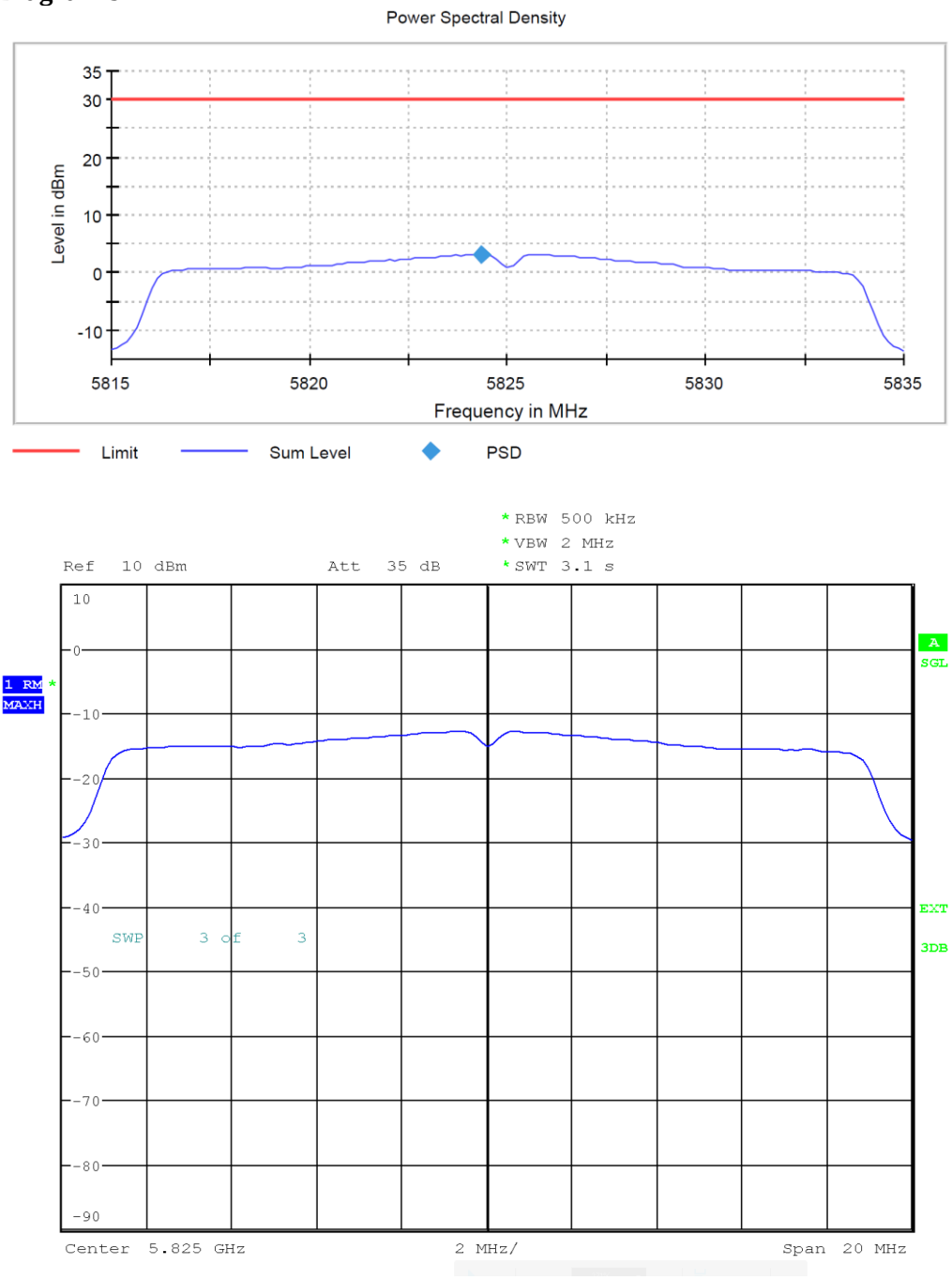
Power spectral density; DUT operating at 5745 MHz 20 MHz BW SISO 2, MSC0 6 dBi antenna gain

Diagram 8



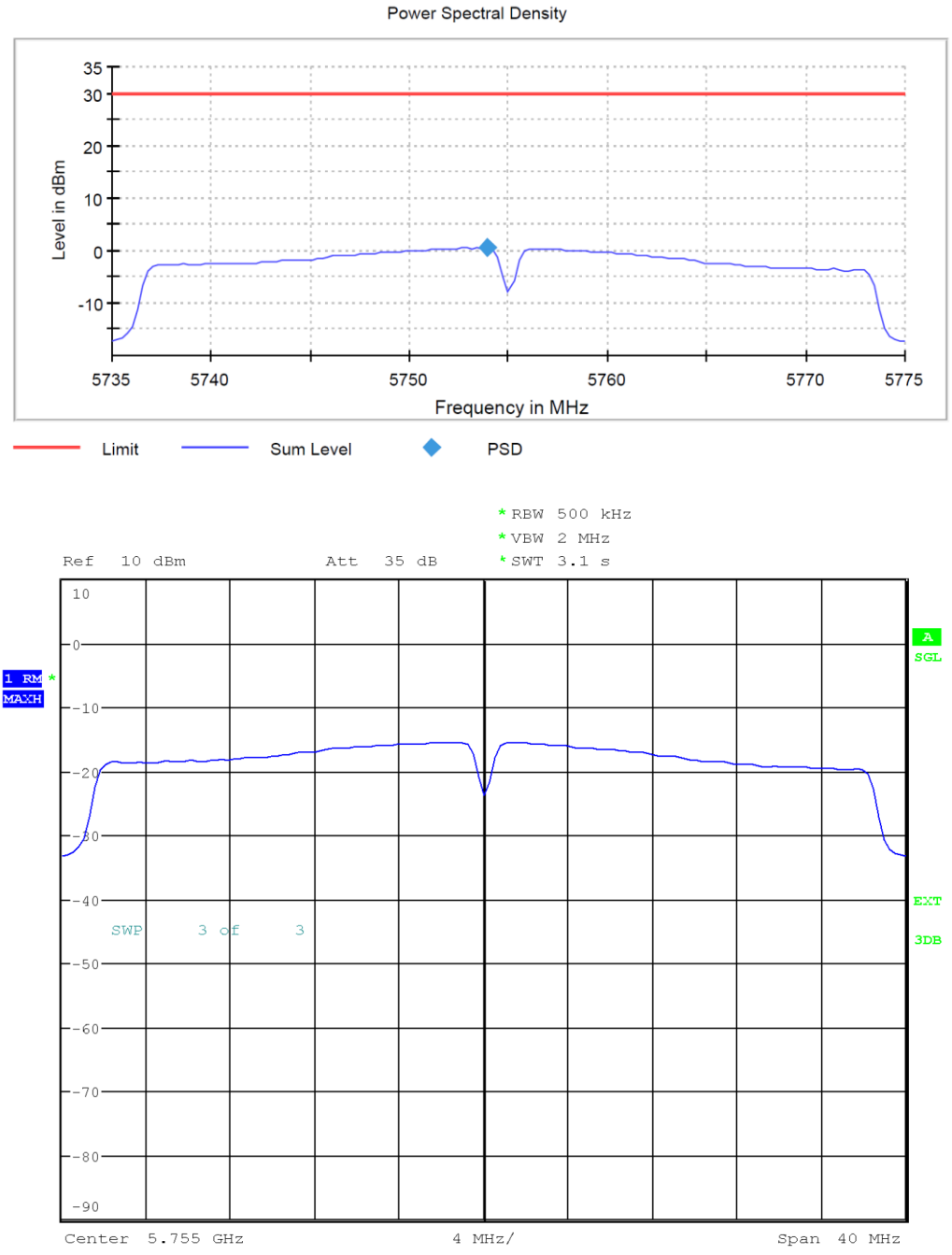
Power spectral density, DUT operating at 5785 MHz 20 MHz BW SISO 2, MSC0
6 dBi antenna gain

Diagram 9



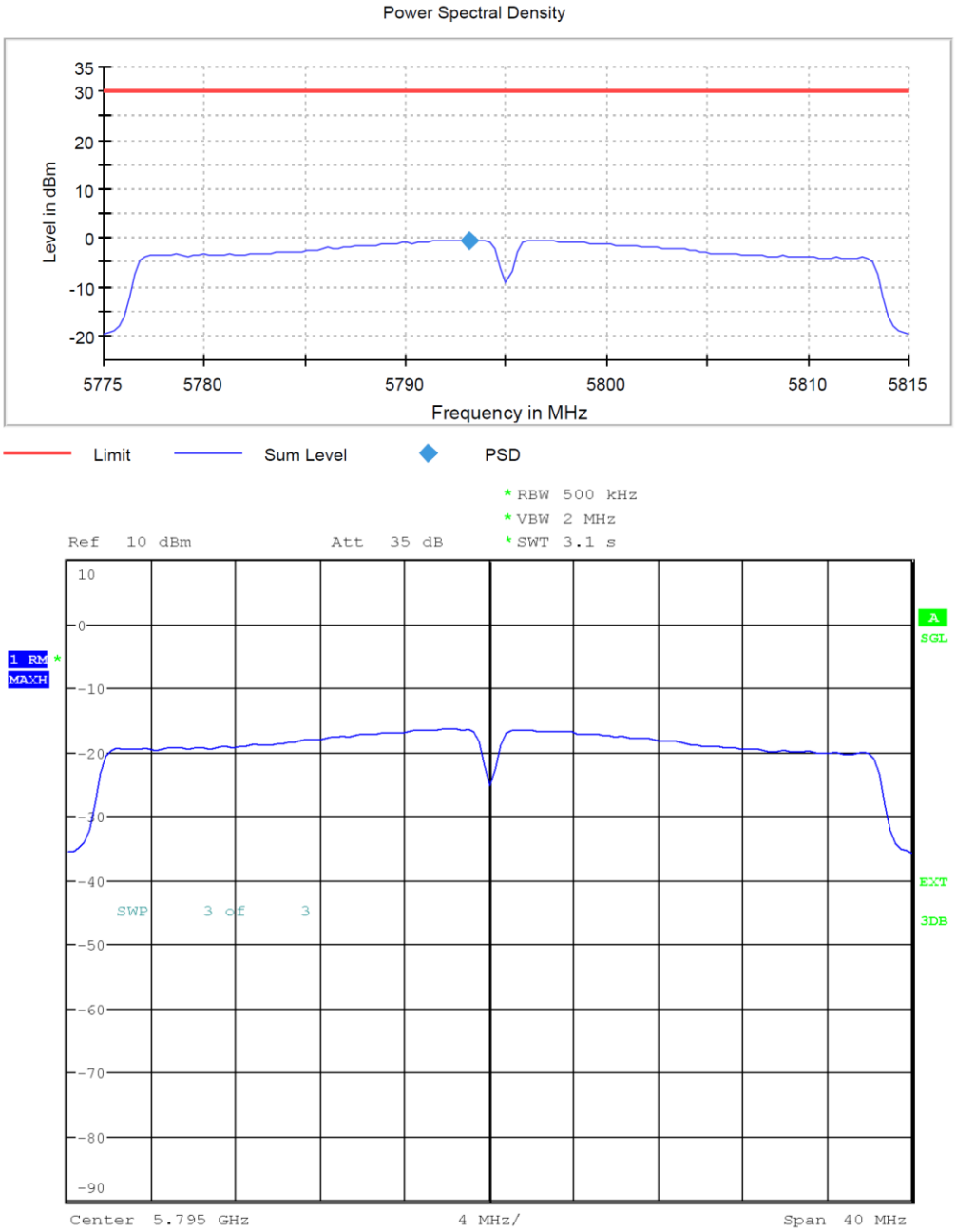
Power spectral density, DUT operating at 5825 MHz 20 MHz BW SISO 2, MSC0
6 dBi antenna gain

Diagram 10



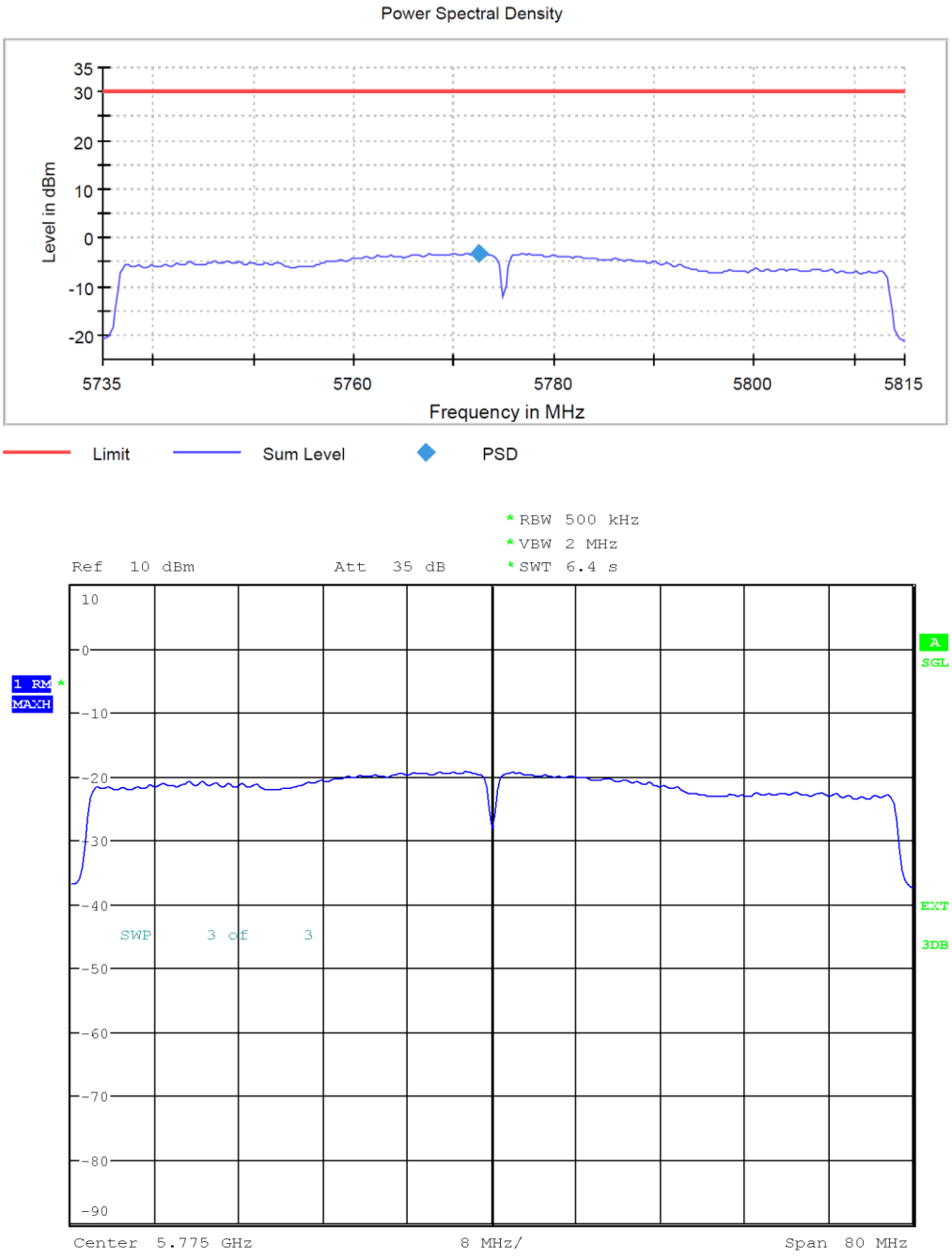
Power spectral density, DUT operating at 5755 MHz 40 MHz BW SISO 2, MSC0
6 dBi antenna gain

Diagram 11



Power spectral density, DUT operating at 5795 MHz 40 MHz BW SISO 2, MSC0
6 dBi antenna gain

Diagram 12



Power spectral density, DUT operating at 5775 MHz 80 MHz BW SISO 2, MSC0
6 dBi antenna gain

Maximum emission outside of the frequency bands of operation according to FCC 47 CFR part 15.407 (b) (4) and (b)(6) and Unwanted emission in the restricted bands according to FCC 47 CFR part 15.407 (b) (7) / RSS-247 6.2.4.2, RSS-Gen 8.9 and 8.10

Date	Temperature	Humidity
2019-02-07	22°C ± 3 °C	28 % ± 5 %
2019-02-08	23°C ± 3 °C	30 % ± 5 %
2019-02-22	21°C ± 3 °C	42 % ± 5 %
2019-02-24	22°C ± 3 °C	35 % ± 5 %
2019-04-26	22°C ± 3 °C	32 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10 clause 12.7 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.G.1-6.

The measurements were performed on units with the integral antennas, with transmission over 98.6% of duty cycle and with normal modulation.
During test a LCD monitor was connected to DUT and data stream was transferred from DUT to the terminal.

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance during the measurements in frequency range 30 MHz to 18 GHz was 3.0 m. The antenna distance during the measurements in frequency range 18 GHz to 40 GHz was 1.0 m.
The EUT height above the reference ground plane was 0.8 m in the frequency range 30-1000 MHz and 1.5 m in the frequency range 1-40 GHz.

The measurement procedure is as follows:

1. A pre-measurement is performed with peak detector. In addition in the frequency range 1 to 8.2 GHz, premeasurement was done with RMS detector, too, due to insufficient dynamic. For measurement < 1 GHz the test object is measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0. For measurement between 1 GHz – 40 GHz the test object is measured in seventeen directions with the antenna at one height, 1.5 m.

2. For measurements in the frequency range 1 – 18 GHz, RF absorbers were covering an floor area to comply with site validation requirements according to CISPR 16-1-4:2010.

3. If the emission is close or above the limit during the pre-measurement, the test object is scanned 360 degrees and the antenna height scanned from 1 to 4 m for maximum response. Then the emission is measured with the quasi-peak detector on frequencies below 1 GHz and with the average/peak detector above 1 GHz.

The following RBW were used:
30 MHz-1 GHz: RBW=120 kHz
1-40 GHz: RBW=1 MHz
Number of sweep points and sweep time was set to fulfil need for trace stability and measured point per pixel.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Semi anechoic chamber, Edison	504114
Computer Lenovo ThinkCentre	-
Software R&S EMC32, ver.9.15.00	503889
EMI test receiver R&S ESU 26	902210
EMI test receiver R&S ESU 40	901385
EMI test receiver R&S ESI 40	503125
Antenna Schaffner CBL 6143	504079
Antenna ETS-Lindgren 3115	902175
Standard gain horn, 18-26 GHz, 20240-20	503674
Standard gain horn, 26-40 GHz, 22240-20	503674
Low Noise Amplifier Miteq, 0.1-18 GHz	504160
Low Noise Amplifier Miteq, 18-26.5 GHz	503285
Low Noise Amplifier Miteq 18-40 GHz	503278
Step attenuator Narda743-60	BX41644
Coaxial cable	BX50672
Coaxial cable	504102
Coaxial cable	504103
Coaxial cable	504104
Coaxial cable	504162
Multimeter Fluke 83	501522
Temperature and humidity meter Testo 625	504117
Semi anechoic chamber, Tesla	503881
Software R&S EMC32, ver.9.15.00	BX62351
Standard gain horn, 8-12.75 GHz	503939
Standard gain horn, 12.75-18 GHz	503900
Low Noise Amplifier Miteq	901545
Huber Suhner antenna cable N-N	BX62218
Coaxial cable	503697
Coaxial cable	BX61530
Coaxial cable	503508
Coaxial cable	503509
Coaxial cable	504206
Coaxial cable	900226
Coaxial cable	504035
Coaxial cable	503274
Temperature and humidity meter Testo 625	504188

Results

The pre-measurement emission spectra for the worst case configuration can be found in the diagrams below:

Diagram 1:	Ambient, 30-1000 MHz, vertical and horizontal polarization
Diagram 2:	30-1000 MHz, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization
Diagram 3:	Ambient, 1-8.2 GHz, vertical and horizontal polarization
Diagram 4:	1-8.2 GHz, MIMO 5785 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization
Diagram 5:	Ambient, 8.2-12.75 GHz, vertical and horizontal polarization
Diagram 6:	8.2-12.75 GHz, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization
Diagram 7:	Ambient, 12.75-18 GHz, vertical and horizontal polarization
Diagram 8:	12.75 GHz-18 GHz, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization
Diagram 9:	Ambient, 18-26.5 GHz, vertical and horizontal polarization
Diagram 10:	18 GHz-26.5, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization
Diagram 11:	Ambient, 26.5-40 GHz, vertical and horizontal polarization
Diagram 12:	26.5-40, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization

Note 1: Worst-case plots are attached.
Note 2: The results in the diagrams are not corrected for duty cycle.

Final measurements

Frequency (MHz)	QP level (dBµV/m)	Corr (dB)	Limit (dBµV/m)	Height (m)	Azimuth (deg)	Polarization
59.99	34.4	17.2	40.0	1.02	290	Vertical
60.25	34.6	17.2	40.0	1.00	285	Vertical
172.93	33.4	18.0	43.5	1.39	184	Horizontal
377.98	38.8	23.5	46.0	1.02	97	Horizontal
383.55	39.2	23.7	46.0	1.00	100	Horizontal
518.77	42.0	26.3	46.0	1.27	220	Horizontal
614.82	41.4	28.0	46.0	1.69	8	Vertical
864.62	37.6	30.5	46.0	1.55	210	Horizontal

Below 1 GHz, quasi peak is applied.

Note: No correction of QP level values in the upper table is applied for duty cycle off 98.5%, (0.07dB), for channel 165, (5825 MHz), 20 MHz bandwidth and MCS0.

Frequency (MHz)	CAV level (dBm)	Peak level (dBm)	Corr (dB)	Limit (dBm)	Height (m)	Azimuth (deg)	Polarization
2766.80	-58.3	-40.7	-61.0	-41.2 (CAV)	1.50	242	Horizontal
5384.98	-56.1	-43.1	-54.8	-41.2 (CAV)	1.50	110	Horizontal
7139.90	-51.2	-38.2	-49.5	-41.2 (CAV)	1.50	220	Vertical
8135.26	-51.1	-38.0	-49.4	-41.2 (CAV)	1.50	220	Vertical
11650.14	-43.7	-39.7	-102.3	-41.2 (CAV)	2.2	306	Vertical
40000.0	-54.0	-41.2	-19.1	-41.2 (CAV)	1.44	18	Horizontal

Average power, CAV, is used for compliance above 1 GHz in the restricted bands, (corresponding class B). In the restricted bands is peak limit 20 dB higher than CAV limit. Outside restricted bands, peak limit of -27 dBm is applied.

Note: No correction of CAV level and peak values in the upper table is applied for duty cycle of 98.5%, (0.07dB), for channel 165, (5825 MHz) and 20 MHz bandwidth. Conversion from the field to eirp and vice versa was done according ANSI C63.10 Annex G and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 II.G.1, respectively.

Remark

Justification measurements were performed of the different antenna configurations, frequency bandwidth, MCS index, channel and placement. The presented results in the reports was judged to represent a worst case scenario.

Limits

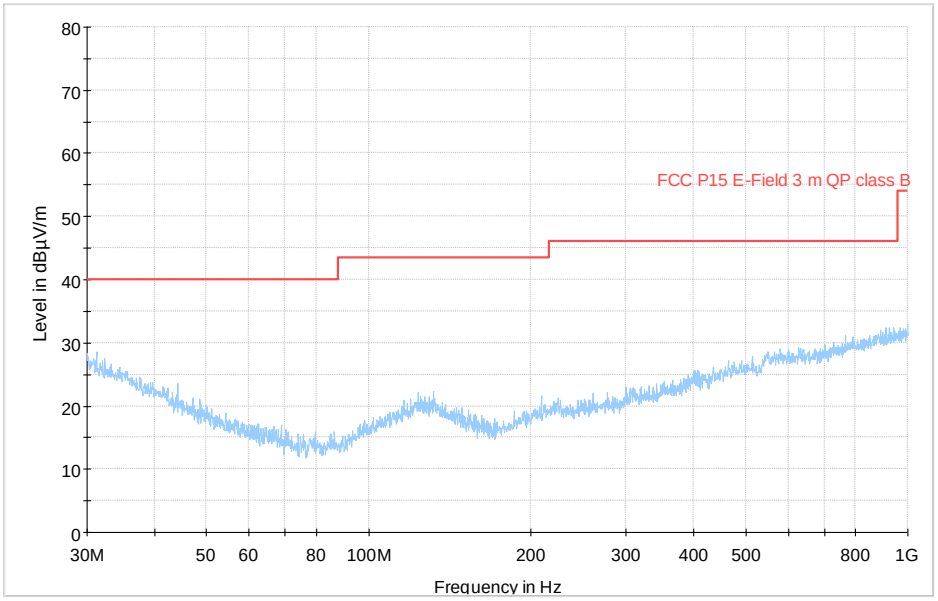
According to 47CFR 15.407(b)(i) and RSS-247 6.2.4.2, e.i.r.p. of the emission produced by the intentional radiator shall comply with the following:
All emission shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below band edge and from 25 MHz above or below the band edge increasing linearly to the level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
According to 47CFR 15.407(b)(7), radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits based on the field strength, specified in Section 15.209(a).

Below 1 GHz applies general field strength limits set in §15.209.
Radiated emissions that fall in the restricted bands specified in RSS-Gen 8.10 shall comply with field strength limits shown in table 5 in RSS-Gen 8.9.

Test engineer: Ermin Pasalic

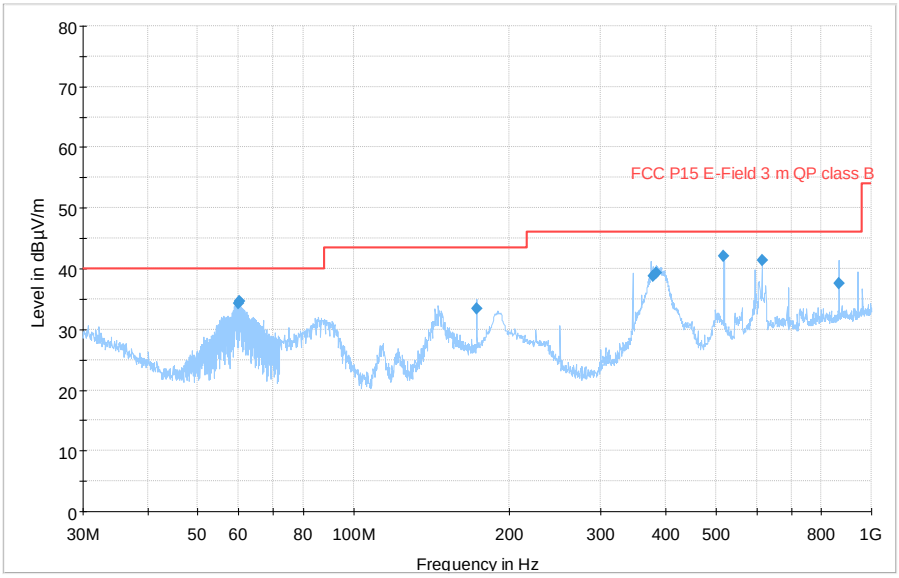
Complies?	Yes

Diagram 1



Ambient, 30-1000 MHz, vertical and horizontal polarization

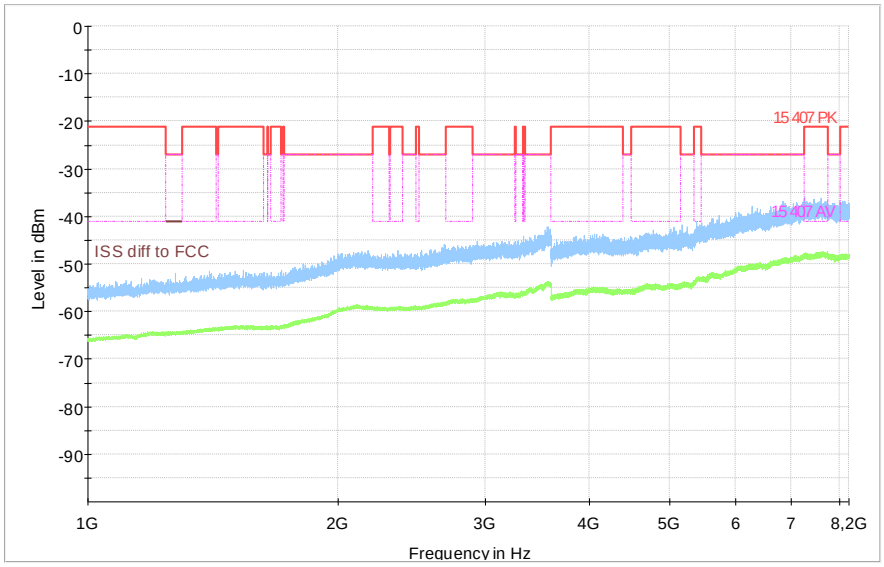
Diagram 2



30-1000 MHz, MIMO 5725 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization

Note: blue dots present E-field level measured by quasi peak detector. They compares to the limit for compliance.
The blue trace is measured E-field by peak detector in the pre-test.

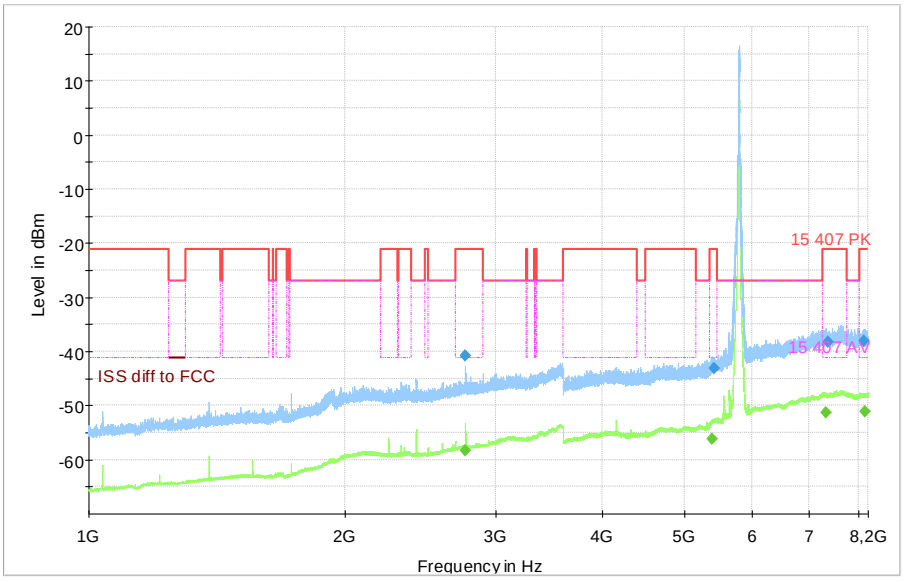
Diagram 3



Ambient, 1-8.2 GHz, vertical and horizontal polarization

Note: blue trace is emission measured by peak detector, green trace is emission measured by RMS detector.
In addition to the peak detector, RMS detector was used in pre-test to improve dynamic.
Limit lines are according 47CFR 15.205(a) and 15.209 (a) and cover requirements in the restricted and no-restricted frequency bands. Restricted frequency band 1240-1427 MHz according RSS-Gen 8.10 is presented by dark brown line and labelled with 'ISS diff to FCC'.

Diagram 4

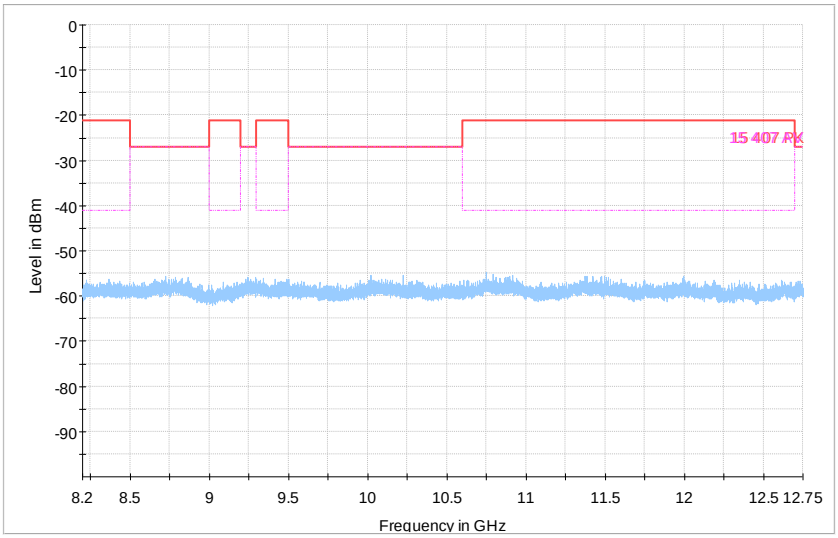


1-8.2 GHz, MIMO 5785 MHz, BW 20 MHz, MCS0, p17 vert. and horiz. polarization

Note 1: levels over limits are in the operating band 5725 MHz to 5850 MHz. Levels at the edge will be presented in the particular chapter; 'Band edge measurements according to 47CFR 2.1049', on pages 91-99.

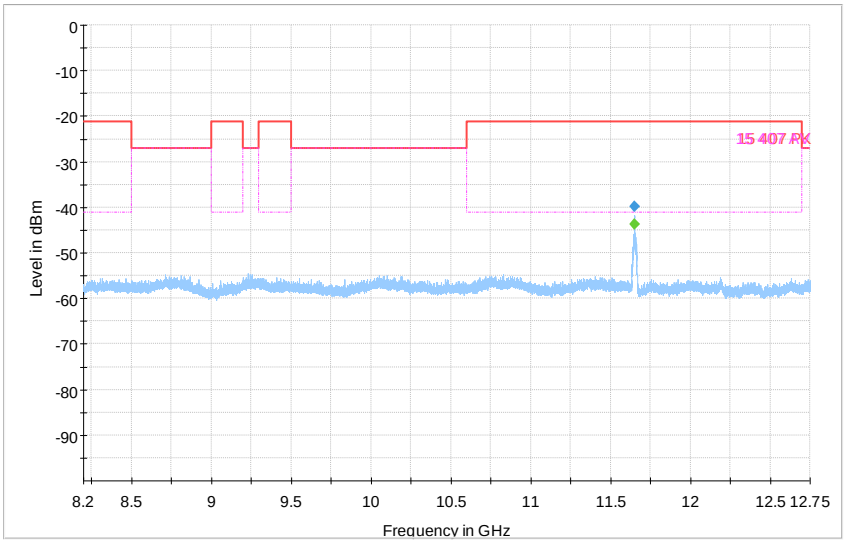
Note 2: blue dots present field level measured by peak detector. They compares to the peak limit, (red line) for compliance. The green dots present field measured by average detector. They compares to the average limit, (pink line) for compliance.
Note 2 applies to diagrams 4 to 8 in this chapter.

Diagram 5



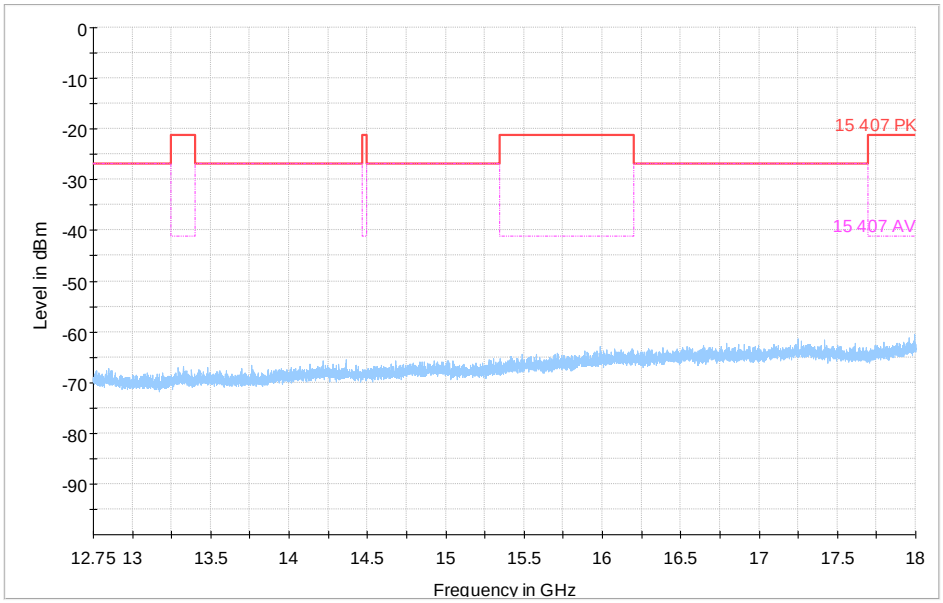
Ambient, 8.2-12.75 GHz, vertical and horizontal polarization

Diagram 6



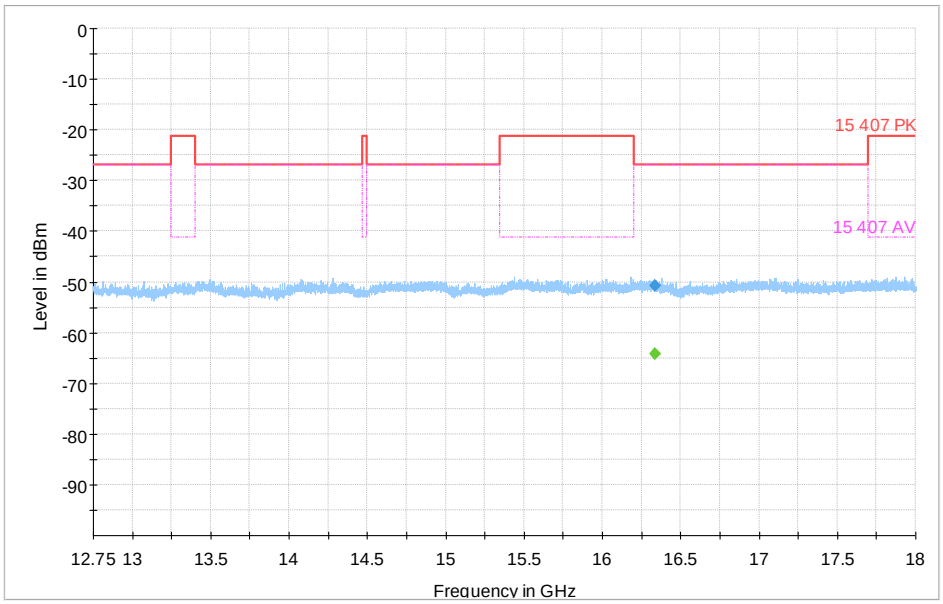
8.2-12.75 GHz, MIMO 5825 MHz, BW 20 MHz, MCS0, p15 vertical and horizontal polarization.

Diagram 7



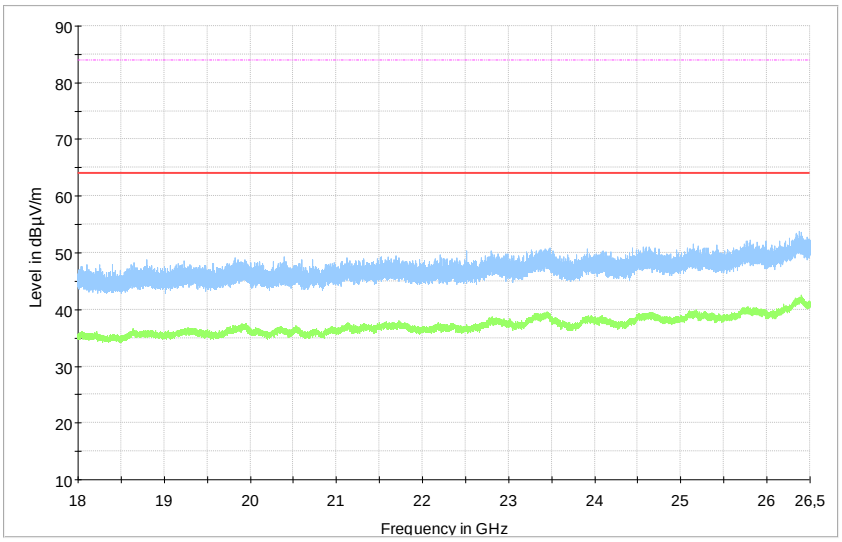
Ambient, 12,75-18 GHz, vertical and horizontal polarization

Diagram 8



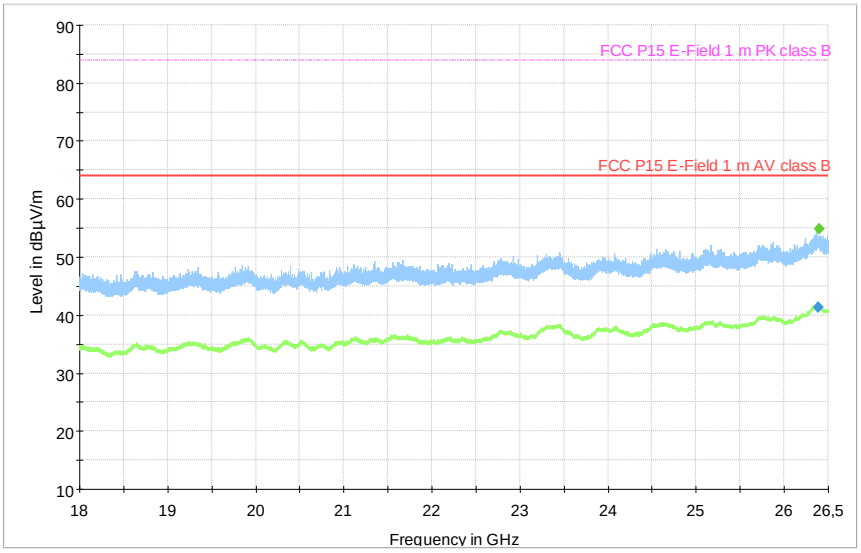
12.75-18 GHz, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 vertical and horizontal polarization

Diagram 9



Ambient, 18-26,5 GHz, vertical and horizontal polarization

Diagram 10



18 - 26.5 GHz, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 horizontal and vertical polarization

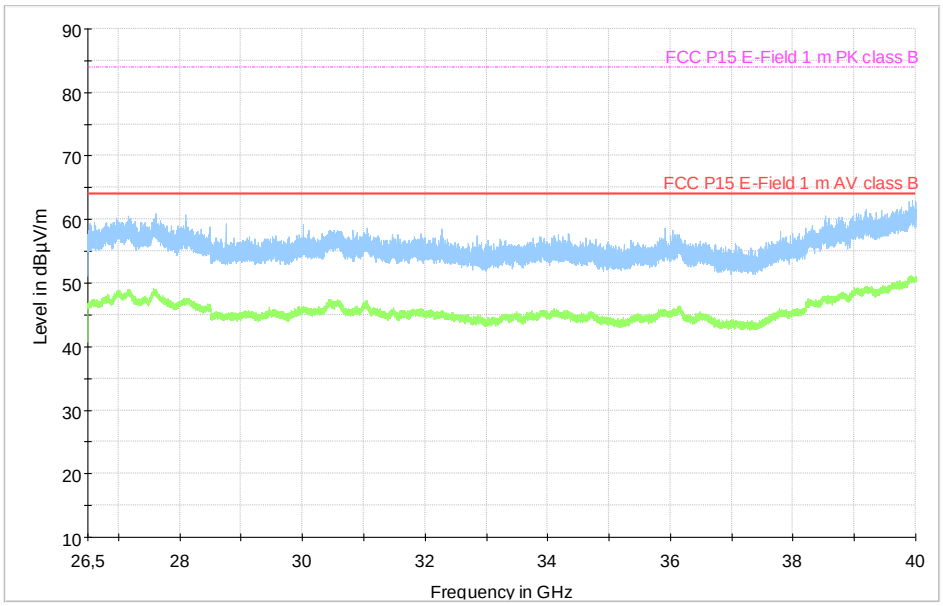
Note: in the range 18-26.5 GHz spurious emission is tested by measurement of E-field at 1 m.

E.I.R.P. limit of -27 dBm/MHz is converted to the field measured at 1 m and presented in the diagrams as FCC P15 E-field 1m AV class B, (red line). FCC P15 E-field 1m PK class B, (magenta line), is informative.

Blue trace is E-field measured at 1 m distance by peak detector. Green trace is E-field measured at 1 m distance by AV detector.

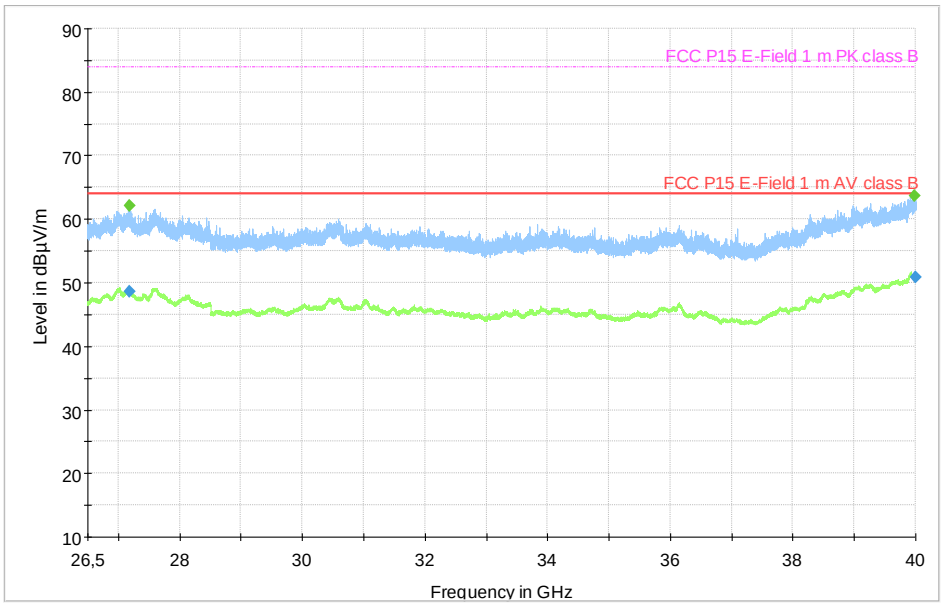
Green dots present field level measured by peak detector. They compares to the peak limit, (pink line) for compliance. The blue dots present field measured by average detector. They compares to the average limit, (red line) for compliance.

Diagram 11



Ambient, 26,5-40 GHz, vertical and horizontal polarization

Diagram 12



26.5-40 GHz, MIMO 5825 MHz, BW 20 MHz, MCS0, p17 horizontal and vertical polarization

Note: in the range 26.5-40 GHz spurious emission is tested by measurement of E-field at 1 m.

E.I.R.P. limit of -27 dBm/MHz is converted to the field measured at 1 m and presented in the diagrams as FCC P15 E-field 1m AV class B, (red line). FCC P15 E-field 1m PK class B, (magenta line), is informative.

Blue trace is E-field measured at 1 m distance by peak detector.
Green trace is E-field measured at 1 m distance by AV detector and is checked for compliance.

Green dots present field level measured by peak detector. They compares to the peak limit, (pink line) for compliance. The blue dots present field measured by average detector. They compares to the average limit, (red line) for compliance.

Conducted emission according to FCC 47 CFR part 15.407 (b) (6) and FCC 47 CFR part 15.207 / RSS-Gen 8.8

Date	Temperature	Humidity
2019-02-22	21°C ± 3 °C	42 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10 clause 6.

The measurements were performed on units with the integral antennas and with transmission between 95% and 98.7% of duty cycle and with normal modulation. Measurements were performed on the AC side of PoE injector. PoE injector is auxiliary equipment providing the PoE to USB adapter with 48 V DC, which subsequently powers the DUT with 5 V DC. Output power was set to the 17 dBm/p17 power class.
During test a LCD monitor was connected to DUT and data stream was transferred from DUT to the terminal.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Semi anechoic chamber, Edison	504114
Computer Lenovo ThinkCentre	-
Software R&S EMC32, ver.9.15.00	503889
EMI test receiver R&S ESU 26	902210
LISN Schwarzbeck NNLA 8120	BX70761
LISN Schwarzbeck NNBL 8226-2	902060
Limiter, EM-7600	BX42883
Coaxial cable	BX50672
Coaxial cable	504102
Coaxial cable	504103
Coaxial cable	504104
Multimeter Fluke 83	501522
Temperature and humidity meter Testo 625	504117

Results

The conducted emission spectra can be found in the diagrams below:

Diagram 1:	120 V AC, Ambient, neutral terminal, PoE active
Diagram 2:	120 V AC, Ambient, phase terminal, PoE active
Diagram 3:	120 V AC, 5745 MHz, neutral terminal
Diagram 4:	120 V AC, 5745 MHz, phase terminal
Diagram 5:	120 V AC, 5775 MHz, neutral terminal
Diagram 6:	120 V AC, 5775 MHz, phase terminal
Diagram 7:	120 V AC, 5785 MHz, neutral terminal
Diagram 8:	120 V AC, 5785 MHz, phase terminal
Diagram 9:	120 V AC, 5825 MHz, neutral terminal
Diagram 10:	120 V AC, 5825 MHz, phase terminal

Limits

According to 47CFR 15.207 and RSS-Gen 8.8,

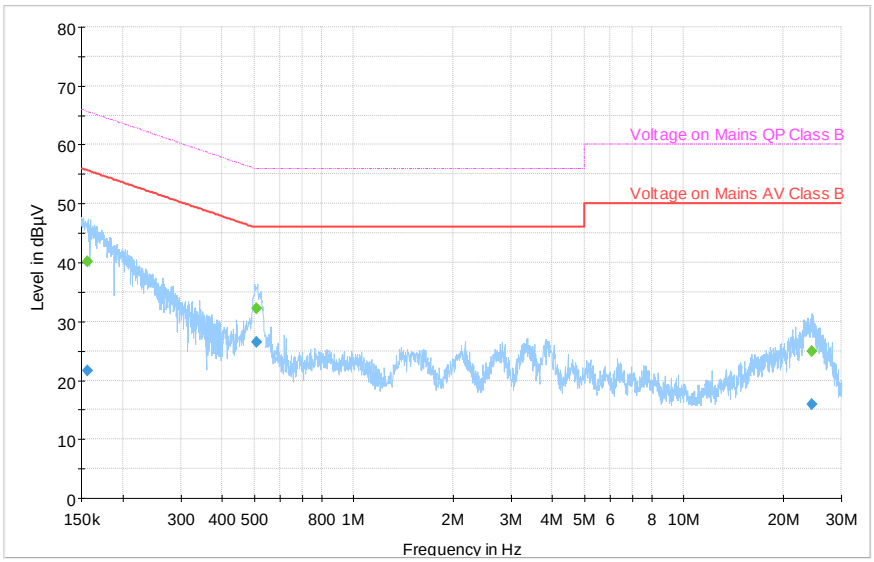
Frequency (MHz)	**Quasi-peak value (dBµV)**	**Average value (dBµV/m)**
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

*=Decreases with the logarithm of the frequency

Test engineer: Markel Bertilsson and Ermin Pasalic

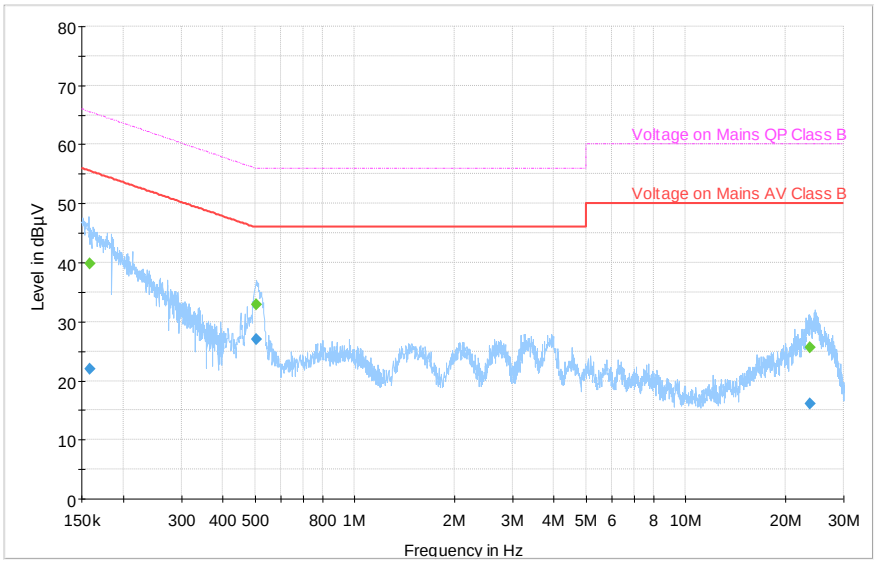
Complies?	Yes

Diagram 1:



120 V AC, Ambient, neutral terminal, PoE active

Diagram 2:

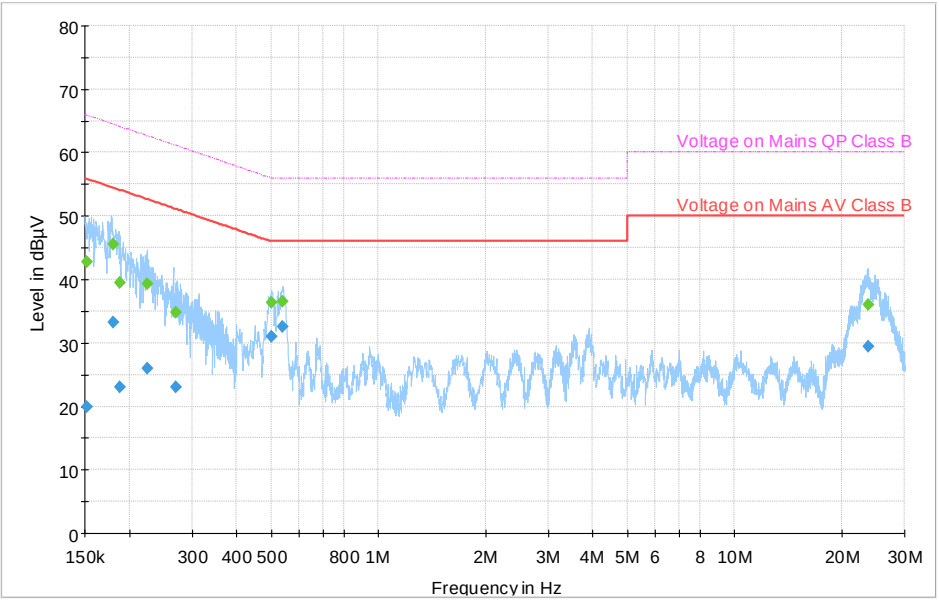


120 V AC, Ambient, phase terminal, PoE active

Note: Blue trace is emission measured with peak detector in the pre-test.
Blue dots are emission levels measured by average detector in final test. Blue dots shall be compared to red limit line, Voltage on Mains AV Class B.
Green dots are emission levels measured by quasi peak detector in final test. Green dots shall be compared to the pink limit line, Voltage on Mains QP Class B.

The blue dots together with the red limit line and green dots together with the pink limit line shall be used for compliance assessment.
This note is applicable on all diagrams in this chapter.

Diagram 3:

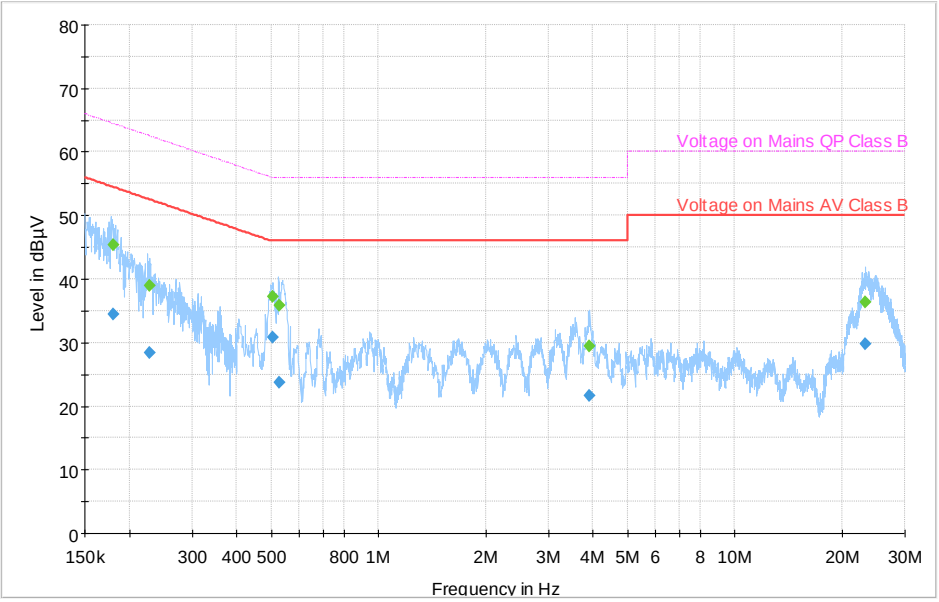


Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.152051	19.88	---	55.89	36.00	15000.0	9.000	9.9
0.152051	---	42.78	65.89	23.11	15000.0	9.000	9.9
0.180177	33.22	---	54.48	21.26	15000.0	9.000	9.9
0.180177	---	45.59	64.48	18.89	15000.0	9.000	9.9
0.188237	23.07	---	54.11	31.05	15000.0	9.000	9.9
0.188237	---	39.55	64.11	24.56	15000.0	9.000	9.9
0.225209	26.06	---	52.63	26.56	15000.0	9.000	9.9
0.225209	---	39.38	62.63	23.24	15000.0	9.000	9.9
0.270625	22.98	---	51.10	28.12	15000.0	9.000	9.9
0.270625	---	34.83	61.10	26.27	15000.0	9.000	9.9
0.503061	30.91	---	46.00	15.09	15000.0	9.000	9.9
0.503061	---	36.33	56.00	19.67	15000.0	9.000	9.9
0.540257	32.54	---	46.00	13.46	15000.0	9.000	9.9
0.540257	---	36.58	56.00	19.42	15000.0	9.000	9.9
23.765705	29.38	---	50.00	20.62	15000.0	9.000	10.9
23.765705	---	36.02	60.00	23.98	15000.0	9.000	10.9

120 V AC, 5745 MHz, neutral terminal

Diagram 4:

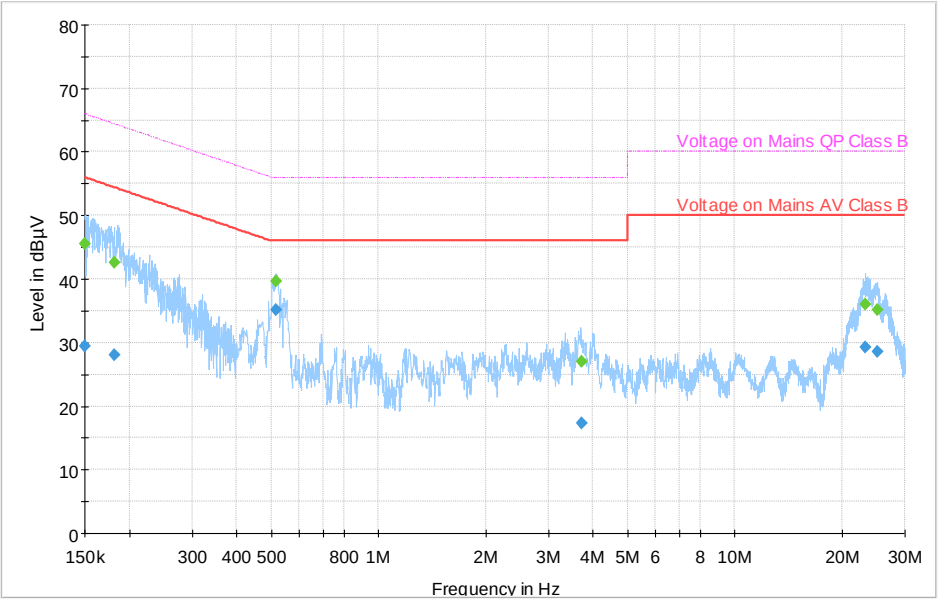


Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.180898	---	45.35	64.44	19.09	15000.0	9.000	9.9
0.180898	34.45	---	54.44	20.00	15000.0	9.000	9.9
0.227869	---	39.03	62.53	23.49	15000.0	9.000	9.9
0.227869	28.44	---	52.53	24.09	15000.0	9.000	9.9
0.505673	---	37.30	56.00	18.70	15000.0	9.000	9.9
0.505673	30.87	---	46.00	15.13	15000.0	9.000	9.9
0.527612	---	35.82	56.00	20.18	15000.0	9.000	9.9
0.527612	23.70	---	46.00	22.30	15000.0	9.000	9.9
3.902067	---	29.42	56.00	26.58	15000.0	9.000	10.1
3.902067	21.60	---	46.00	24.40	15000.0	9.000	10.1
23.171555	---	36.35	60.00	23.65	15000.0	9.000	10.9
23.171555	29.72	---	50.00	20.28	15000.0	9.000	10.9

120 V AC, 5745 MHz, phase terminal

Diagram 5:

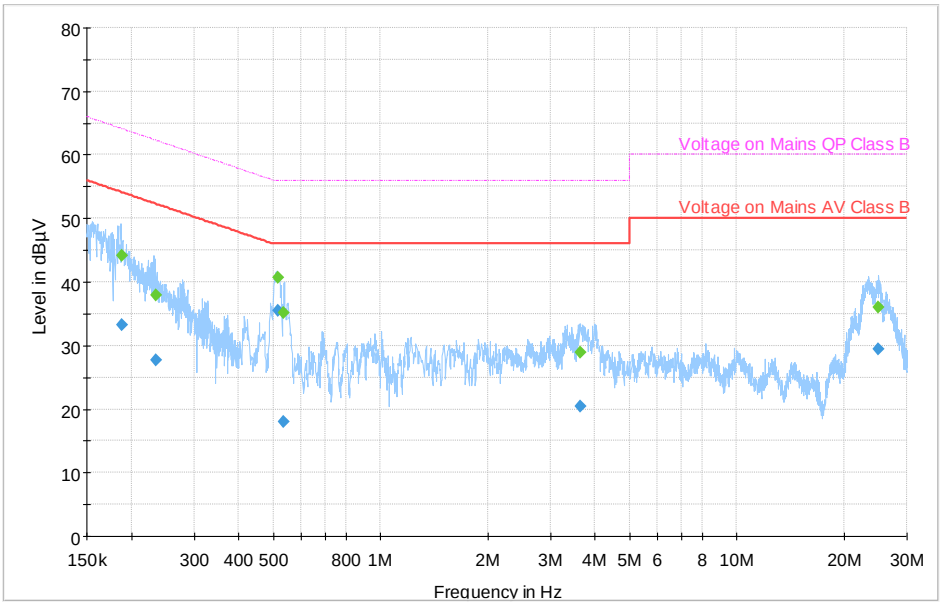


Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.150260	---	45.61	65.99	20.37	15000.0	9.000	9.9
0.150260	29.49	---	55.99	26.50	15000.0	9.000	9.9
0.182067	---	42.52	64.39	21.87	15000.0	9.000	9.9
0.182067	28.09	---	54.39	26.30	15000.0	9.000	9.9
0.516138	---	39.71	56.00	16.29	15000.0	9.000	9.9
0.516138	35.19	---	46.00	10.81	15000.0	9.000	9.9
3.707324	---	27.05	56.00	28.95	15000.0	9.000	10.1
3.707324	17.38	---	46.00	28.62	15000.0	9.000	10.1
23.225000	---	35.95	60.00	24.05	15000.0	9.000	10.9
23.225000	29.34	---	50.00	20.66	15000.0	9.000	10.9
25.161827	---	35.21	60.00	24.79	15000.0	9.000	10.9
25.161827	28.64	---	50.00	21.36	15000.0	9.000	10.9

120 V AC, 5775 MHz, neutral terminal

Diagram 6:

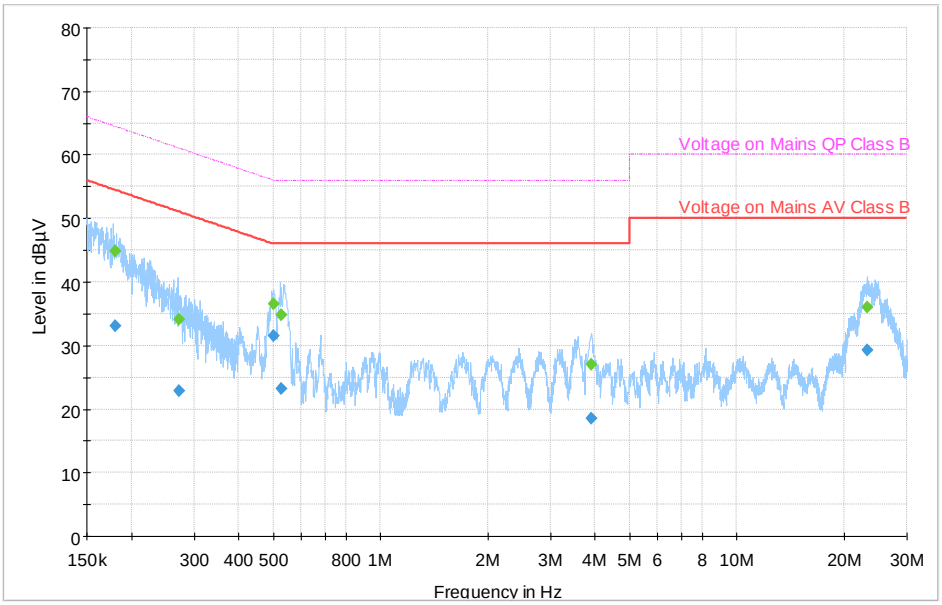


Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.187708	---	44.11	64.14	20.03	15000.0	9.000	9.9
0.187708	33.23	---	54.14	20.91	15000.0	9.000	9.9
0.234920	---	37.96	62.27	24.31	15000.0	9.000	9.9
0.234920	27.64	---	52.27	24.63	15000.0	9.000	9.9
0.517068	---	40.63	56.00	15.37	15000.0	9.000	9.9
0.517068	35.56	---	46.00	10.44	15000.0	9.000	9.9
0.535577	---	35.19	56.00	20.81	15000.0	9.000	9.9
0.535577	17.96	---	46.00	28.04	15000.0	9.000	9.9
3.642516	---	28.91	56.00	27.09	15000.0	9.000	10.1
3.642516	20.42	---	46.00	25.58	15000.0	9.000	10.1
25.019279	---	35.98	60.00	24.02	15000.0	9.000	10.9
25.019279	29.44	---	50.00	20.56	15000.0	9.000	10.9

120 V AC, 5775 MHz, phase terminal

Diagram 7:

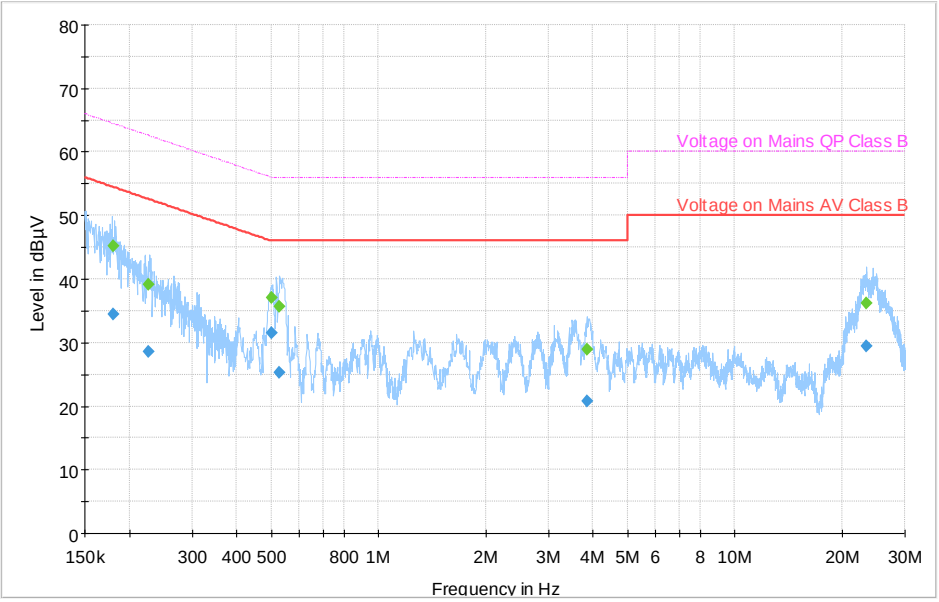


Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.180882	---	44.85	64.45	19.59	15000.0	9.000	9.9
0.180882	33.05	---	54.45	21.40	15000.0	9.000	9.9
0.271426	---	34.15	61.07	26.92	15000.0	9.000	9.9
0.271426	22.83	---	51.07	28.24	15000.0	9.000	9.9
0.501891	---	36.58	56.00	19.42	15000.0	9.000	9.9
0.501891	31.52	---	46.00	14.48	15000.0	9.000	9.9
0.527596	---	34.79	56.00	21.21	15000.0	9.000	9.9
0.527596	23.12	---	46.00	22.88	15000.0	9.000	9.9
3.905128	---	27.10	56.00	28.90	15000.0	9.000	10.1
3.905128	18.53	---	46.00	27.47	15000.0	9.000	10.1
23.161698	---	35.94	60.00	24.06	15000.0	9.000	10.8
23.161698	29.33	---	50.00	20.67	15000.0	9.000	10.8

120 V AC, 5785 MHz, neutral terminal

Diagram 8:

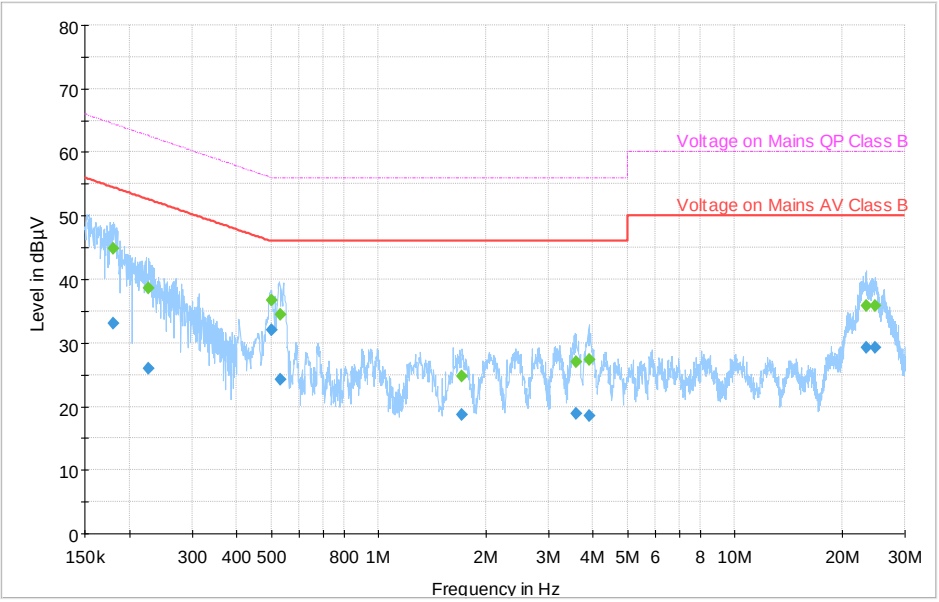


Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.179936	---	45.19	64.49	19.30	15000.0	9.000	9.9
0.179936	34.39	---	54.49	20.10	15000.0	9.000	9.9
0.226330	---	39.10	62.58	23.49	15000.0	9.000	9.9
0.226330	28.60	---	52.58	23.98	15000.0	9.000	9.9
0.502035	---	37.09	56.00	18.91	15000.0	9.000	9.9
0.502035	31.57	---	46.00	14.43	15000.0	9.000	9.9
0.527965	---	35.75	56.00	20.25	15000.0	9.000	9.9
0.527965	25.24	---	46.00	20.76	15000.0	9.000	9.9
3.846346	---	28.96	56.00	27.04	15000.0	9.000	10.1
3.846346	20.79	---	46.00	25.22	15000.0	9.000	10.1
23.416747	---	36.14	60.00	23.86	15000.0	9.000	10.9
23.416747	29.48	---	50.00	20.52	15000.0	9.000	10.9

120 V AC, 5785 MHz, phase terminal

Diagram 9:

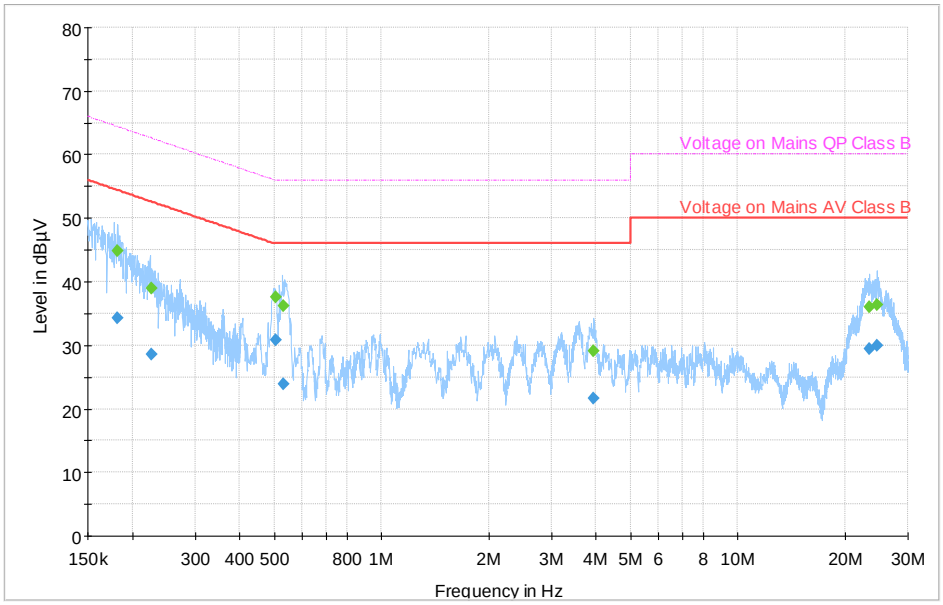


Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.181026	---	44.78	64.44	19.66	15000.0	9.000	9.9
0.181026	33.02	---	54.44	21.42	15000.0	9.000	9.9
0.225978	---	38.61	62.60	23.99	15000.0	9.000	9.9
0.225978	25.98	---	52.60	26.62	15000.0	9.000	9.9
0.501907	---	36.73	56.00	19.27	15000.0	9.000	9.9
0.501907	31.96	---	46.00	14.04	15000.0	9.000	9.9
0.530353	---	34.40	56.00	21.60	15000.0	9.000	9.9
0.530353	24.25	---	46.00	21.75	15000.0	9.000	9.9
1.716731	---	24.75	56.00	31.25	15000.0	9.000	10.0
1.716731	18.78	---	46.00	27.22	15000.0	9.000	10.0
3.581346	---	26.98	56.00	29.02	15000.0	9.000	10.1
3.581346	18.85	---	46.00	27.15	15000.0	9.000	10.1
3.898253	---	27.30	56.00	28.70	15000.0	9.000	10.1
3.898253	18.46	---	46.00	27.54	15000.0	9.000	10.1
23.316234	---	35.83	60.00	24.17	15000.0	9.000	10.9
23.316234	29.18	---	50.00	20.82	15000.0	9.000	10.9
24.726779	---	35.88	60.00	24.12	15000.0	9.000	10.9
24.726779	29.35	---	50.00	20.65	15000.0	9.000	10.9

120 V AC, 5825 MHz, neutral terminal

Diagram 10:



Final_Result

Frequency (MHz)	CAverage (dBµV)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.181715	---	44.88	64.41	19.53	15000.0	9.000	9.9
0.181715	34.26	---	54.41	20.14	15000.0	9.000	9.9
0.225786	---	38.93	62.60	23.67	15000.0	9.000	9.9
0.225786	28.62	---	52.60	23.98	15000.0	9.000	9.9
0.504936	---	37.50	56.00	18.50	15000.0	9.000	9.9
0.504936	30.74	---	46.00	15.26	15000.0	9.000	9.9
0.529503	---	36.13	56.00	19.87	15000.0	9.000	9.9
0.529503	23.85	---	46.00	22.15	15000.0	9.000	9.9
3.931378	---	29.12	56.00	26.88	15000.0	9.000	10.1
3.931378	21.67	---	46.00	24.33	15000.0	9.000	10.1
23.329855	---	36.07	60.00	23.93	15000.0	9.000	10.9
23.329855	29.42	---	50.00	20.58	15000.0	9.000	10.9
24.567965	---	36.41	60.00	23.59	15000.0	9.000	10.9
24.567965	29.87	---	50.00	20.13	15000.0	9.000	10.9

120 V AC, 5825 MHz, phase terminal

Frequency stability according to FCC 47 CFR part 15.407 (g) / RSS-Gen 8.11

Date	Temperature	Humidity
2019-02-19	22 °C ± 3 °C	29 % ± 5 %
2019-02-21	21 °C ± 3 °C	32 % ± 5 %

Procedure

According §15.407(g) it shall be ensured that frequency stability of device is such that an emission is maintained within the band of operation under all conditions of normal operation.
In the KDB 789033 D02 General UNII Test Procedures New Rules v02r01 it is not suggested particular test procedure to verify frequency stability.
Test is based on the measurement of 99% OBW at different temperatures in conductive mode. This test was performed on unit with the temporary antenna connectors, with transmission between 94.9% and 98.7% of duty cycle and with normal modulation. It was checked if 99% of the emission fall inside the operating band. From the higher and lower OBW frequencies it was calculated centre frequency and checked if it falls in the 80 % of the operating band.

The manufacturer declared temperature range between 5 °C and 30 °C.
Test was done at temperatures 50 °C, 30 °C, 20 °C, 10 °C, 0 °C and -20 °C.

Test was done with bandwidth 20 MHz, 40 MHz and 80 MHz and with maximum power classes which provide compliance with other requirements. Power classes used during the frequency stability test are noted in the respective tables.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Multimeter Fluke 83	501522
Temperature and humidity meter Testo 625, with wire sensor 2A	504117
Temperature chamber	503360
Test site Marconi	15:121
Spectrum analyser R&S FSQ 26	BX50694
Coaxial cable	BX81424
Coaxial cable	BX81436
Coaxial cable	BX50685
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	504117

Results

OBW (MHz)

	#149 5745 MHz 17 dBm/p17	#151 5755 MHz 12 dBm/p12	#155 5775 MHz 13 dBm/p13	#159 5795 MHz 17 dBm/p17	#165 5825 MHz 17 dBm/p17
50°C	30.6	38	77	48	27.8
30°C	29	37.6	76.6	49.4	29.8
20°C	30	37.6	76.4	51	31.4
10°C	29	37.6	76.4	48.8	31.4
0°C	27.6	37.4	76.4	46.6	30.4
-20°C	30	37.8	76.6	45.4	28.8

Low and High OBW frequencies (MHz)

	#149 5745 MHz 17 dBm/p17		#151 5755 MHz 12 dBm/p12		#155 5775 MHz 13 dBm/p13		#159 5795 MHz 17 dBm/p17		#165 5825 MHz 17 dBm/p17	
	Low	High	Low	High	Low	High	Low	High	Low	High
50°C	5729.8	5760.4	5736	5774	5736.4	5813.4	5770.2	5818.2	5810.8	5838.6
30°C	5730.2	5759.2	5736.2	5773.8	5736.6	5813.2	5769.6	5819	5809.6	5839.4
20°C	5729.8	5759.8	5736.2	5773.8	5736.8	5813.2	5769	5820	5808.6	5840
10°C	5730.4	5759.4	5736.2	5773.8	5736.8	5813.2	5770.4	5819.2	5808.8	5840.2
0°C	5731.2	5758.8	5736.4	5773.8	5736.8	5813.2	5771.8	5818.4	5809.2	5839.6
-20°C	5730.4	5760.4	5736.2	5774	5736.8	5813.4	5772.6	5818	5810.4	5839.2

Margin to the edges (MHz)

	#149 5745 MHz 17 dBm/p17		#151 5755 MHz 12 dBm/p12		#155 5775 MHz 13 dBm/p13		#159 5795 MHz 17 dBm/p17		#165 5825 MHz 17 dBm/p17	
	Low	High	Low	High	Low	High	Low	High	Low	High
50°C	4.8	89.6	11.0	76.0	11.4	36.6	45.2	31.8	85.8	11.4
30°C	5.2	90.8	11.2	76.2	11.6	36.8	44.6	31.0	84.6	10.6
20°C	4.8	90.2	11.2	76.2	11.8	36.8	44.0	30.0	83.6	10.0
10°C	5.4	90.6	11.2	76.2	11.8	36.8	45.4	30.8	83.8	9.8
0°C	6.2	91.2	11.4	76.2	11.8	36.8	46.8	31.6	84.2	10.4
-20°C	5.4	89.6	11.2	76.0	11.8	36.6	47.6	32.0	85.4	10.8

From the table Low and High OBW frequencies and from the table Margin to the edges we can see that 99 % of the emission remain in the operating band 5725 MHz to 5850 MHz for temperature range -20°C to +50°C.

Centre frequency

	#149 5745 MHz 17 dBm/p17	#151 5755 MHz 12 dBm/p12	#155 5775 MHz 13 dBm/p13	#159 5795 MHz 17 dBm/p17	#165 5825 MHz 17 dBm/p17
50°C	5745.1	5755	5774.9	5794.2	5824.7
30°C	5744.7	5755	5774.9	5794.3	5824.5
20°C	5744.8	5755	5775	5794.5	5824.3
10°C	5744.9	5755	5775	5794.8	5824.5
0°C	5745	5755.1	5775	5795.1	5824.4
-20°C	5745.4	5755.1	5775.1	5795.3	5824.8

Operating band: 5725 MHz – 5850 MHz (125 MHz)
80% of operating band: 5737.5 MHz – 5837.5 MHz

From the table Centre frequency we can see that centre frequency falls in the 80 % of the operating band for the temperature range -20°C to +50°C.
Note: centre frequency is calculated as mean value between higher and lower OBW frequency.

Remark

There is not requirement in the FCC standard for maximum frequency variation so we measured OBW and checked if OBW was maintained within the band of operation. If OBW was maintained inside the band of operation, we considered device as compliant.

According to RSS-Gen 6.11 test should be done with unmodulated signal and according to RSS-Gen 8.11 it should be verified that fundamental emission of the radio apparatus is kept inside at least the central 80% of its permitted operating frequency band. In addition, its occupied bandwidth shall be entirely outside of the restricted bands.
There are not additional requirements on the frequency stability in RSS-247.

Limits

According to 47CFR 15.407 (g) the device shall achieve such frequency stability that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user manual.

According to RSS-Gen 8.11 fundamental emission of the radio apparatus should be kept inside at least the central 80% of its permitted operating frequency band. In addition, its occupied bandwidth shall be entirely outside of the restricted bands.

Test engineer: Ermin Pasalic

Complies?	Yes

6 dB bandwidth measurements according to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.C.2. / RSS-Gen 6.7

Date	Temperature	Humidity
2019-02-14	22 °C ± 3 °C	19 % ± 5 %

Test setup and procedure

The measurements were performed according to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.C.2.
Conducted measurements were performed on units with the temporary antenna connectors, with transmission between 94.9% and 98.7% of duty cycle and with normal modulation.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Test site Marconi	15:121
Spectrum analyser R&S FSQ 26	BX50694
Coaxial cable	BX81424
Coaxial cable	BX81436
Coaxial cable	BX50685
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

SISO 2 (chain 2 – 6 dBi antenna gain)		802.11ac				
T_{nom} 20°C, V_{nom} 120 V AC						
f [MHz]	BW [MHz]	6dB-BW left [MHz]	6dB-BW right [MHz]	6dB-BW [MHz]	Limit [MHz]	RBW [MHz]
5745	20	5736.1	5753.9	17.8	≥ 0.5	0.1
5785	20	5776.1	5793.9	17.8	≥ 0.5	0.1
5825	20	5816.1	5833.9	17.8	≥ 0.5	0.1
5755	40	5736.7	5772.9	36.2	≥ 0.5	0.1
5795	40	5776.7	5813.3	36.6	≥ 0.5	0.1
5775	80	5737.0	5812.7	75.7	≥ 0.5	0.1

The 26 dB BW measurements can be found in the diagrams below:

Diagram 1:	5745 MHz 20 MHz BW, 6 dB BW
Diagram 2:	5785 MHz 20 MHz BW, 6 dB BW
Diagram 3:	5825 MHz 20 MHz BW, 6 dB BW
Diagram 4:	5755 MHz 40 MHz BW, 6 dB BW
Diagram 5:	5795 MHz 40 MHz BW, 6 dB BW
Diagram 6:	5775 MHz 80 MHz BW, 6 dB BW

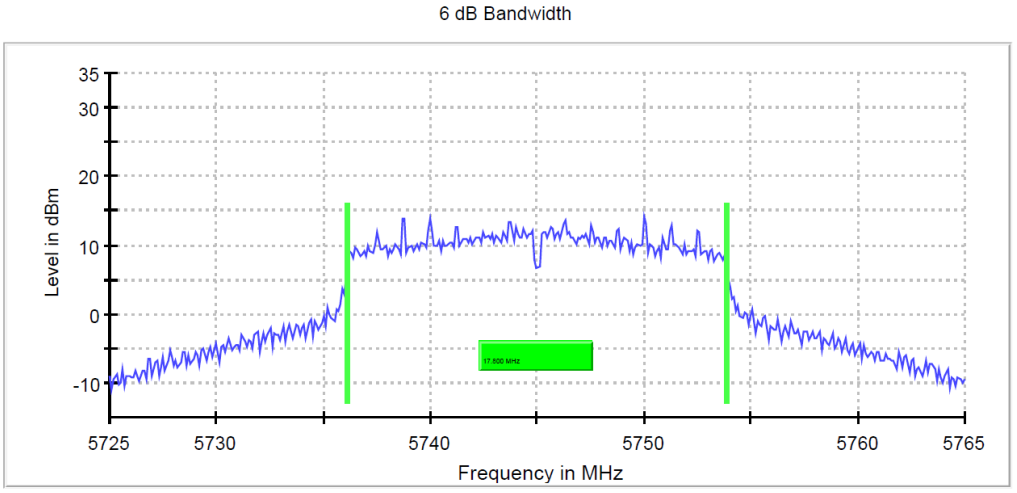
Limits

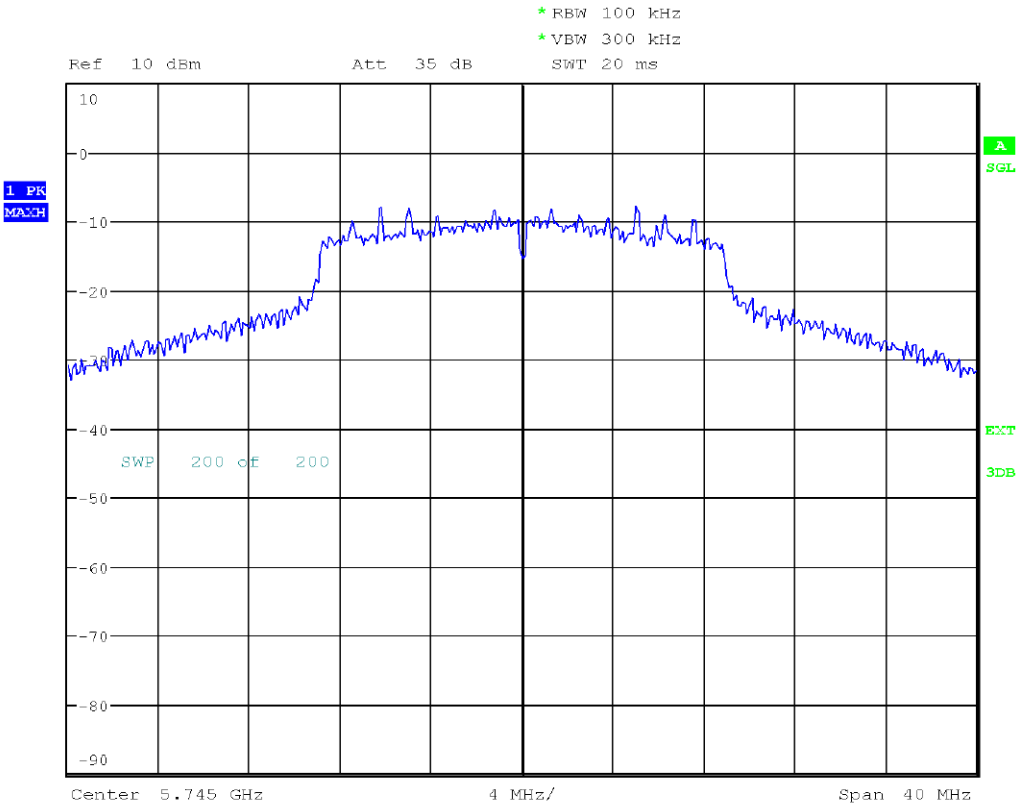
According to 47CFR 15.407(e) and RSS-247 6.2.4.1, for devices operating in the band 5.725-5.85 GHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

Test engineer: Markel Bertilsson and Ermin Pasalic

Complies?	Yes

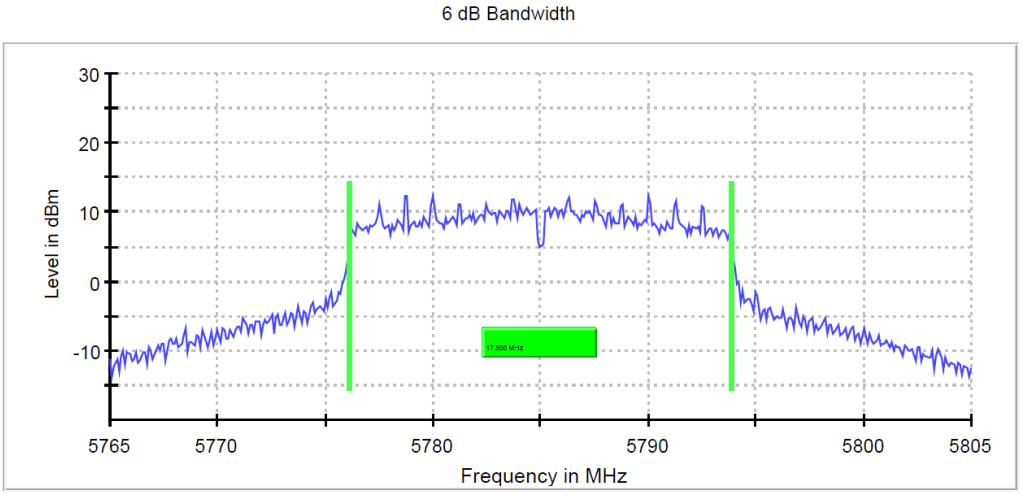
Diagram 1

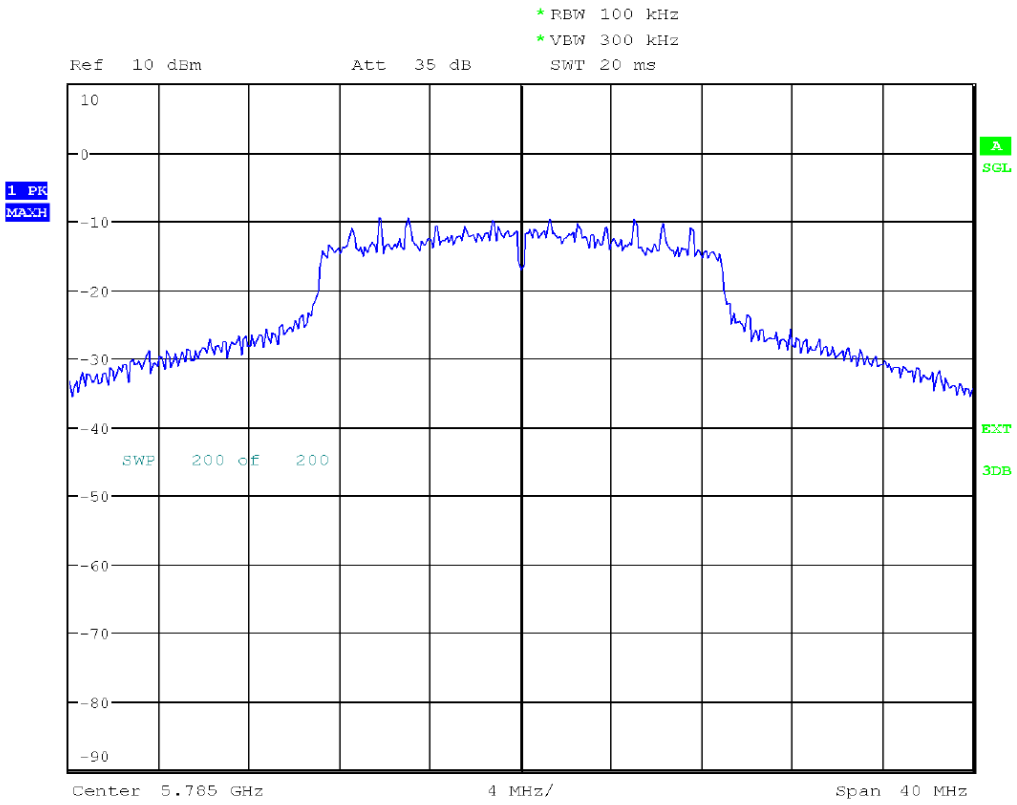




DUT operating at 5745 MHz and 20 MHz BW; 6 dB BW

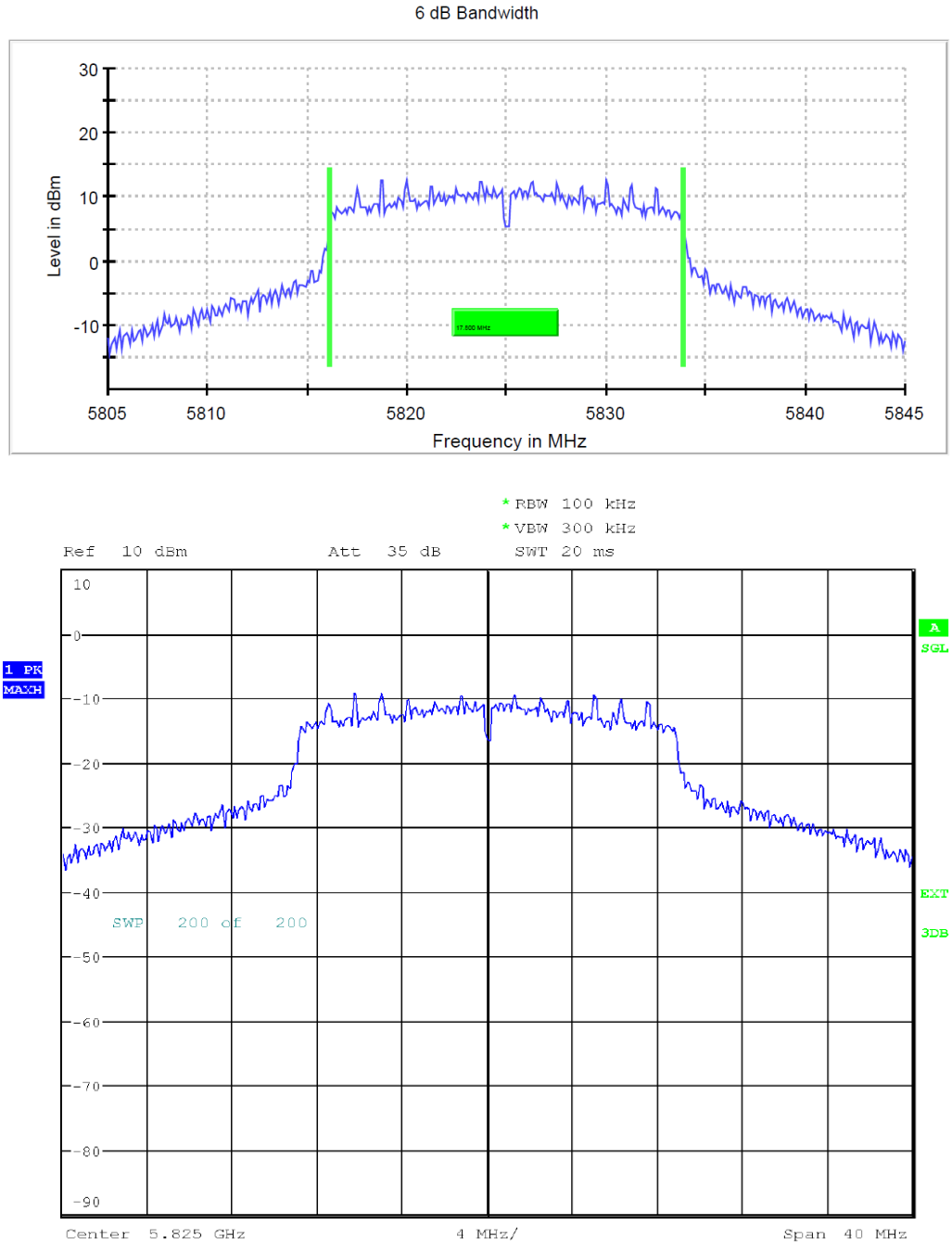
Diagram 2





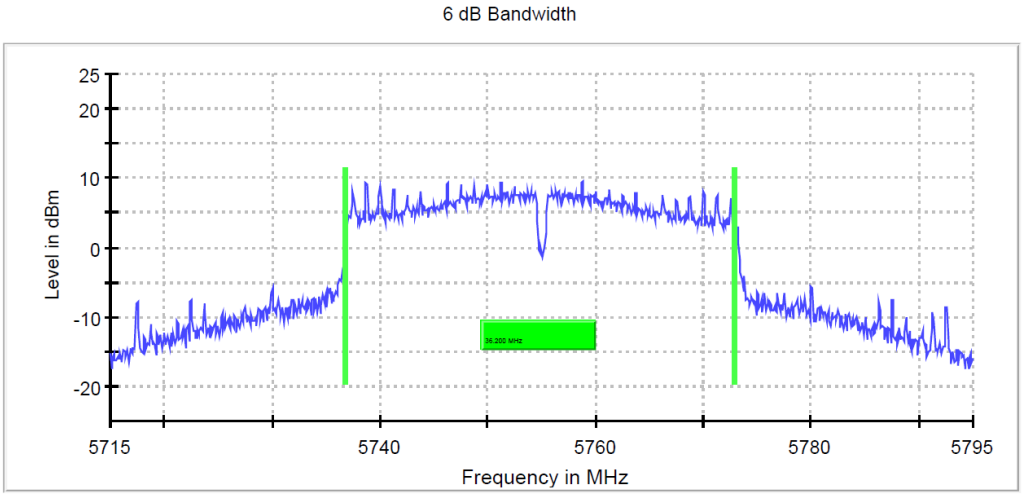
DUT operating at 5785 MHz and 20 MHz BW; 6 dB BW

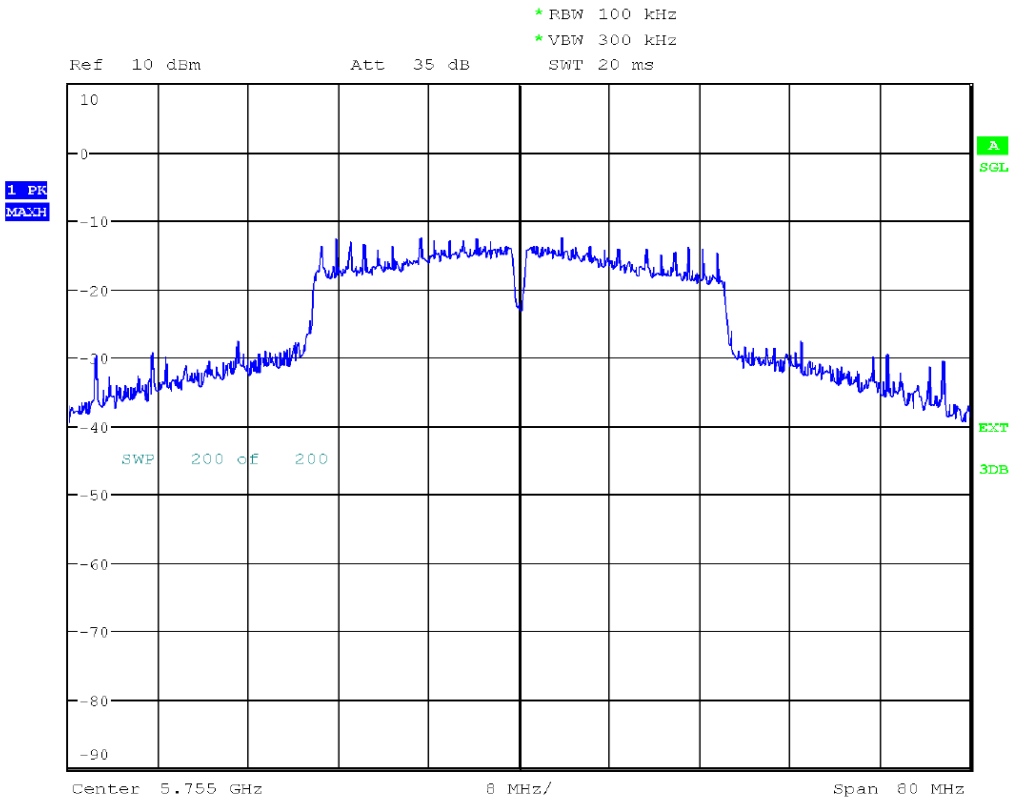
Diagram 3



DUT operating at 5825 MHz and 20 MHz BW; 6 dB BW

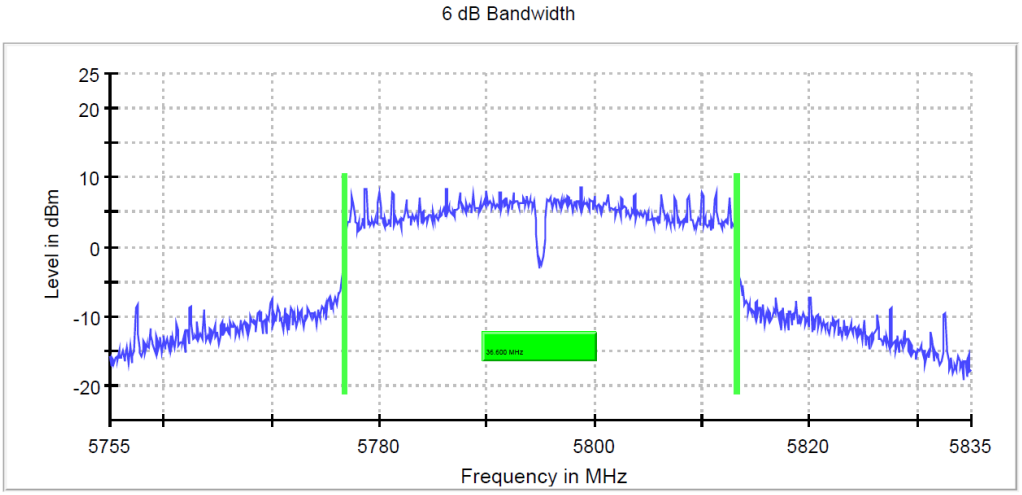
Diagram 4

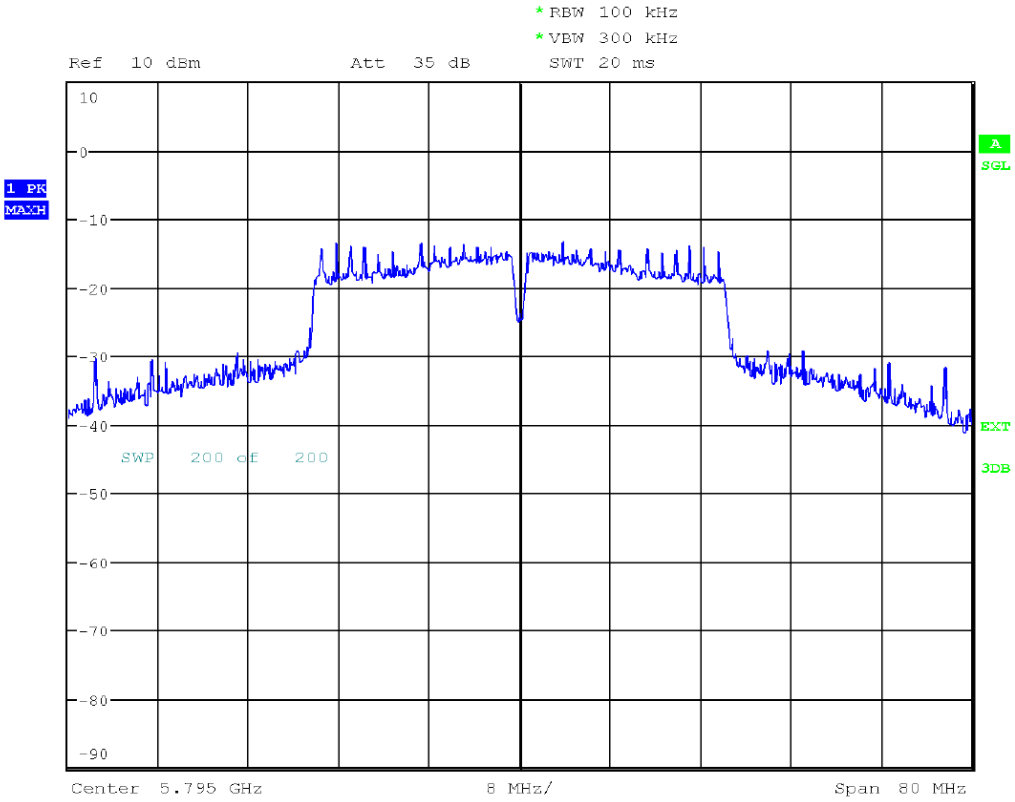




DUT operating at 5755 MHz and 40 MHz BW; 6 dB BW

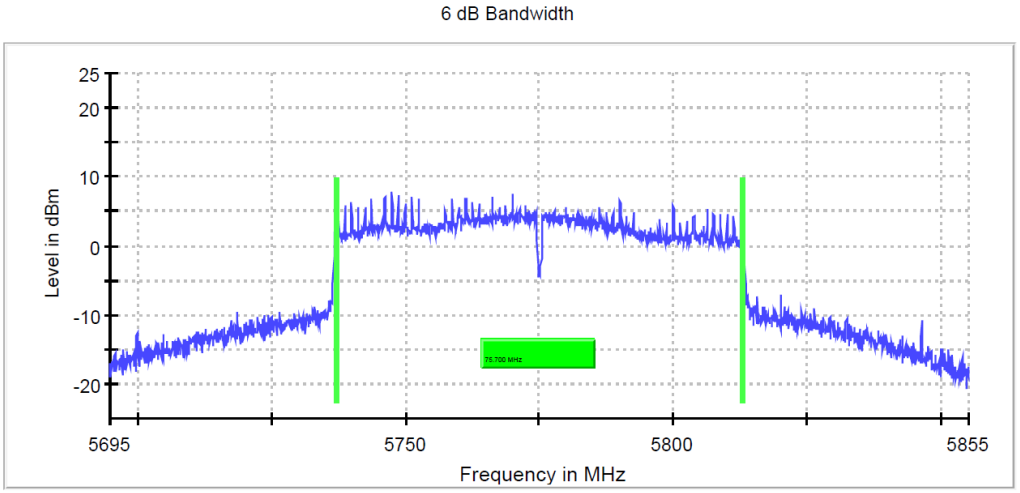
Diagram 5

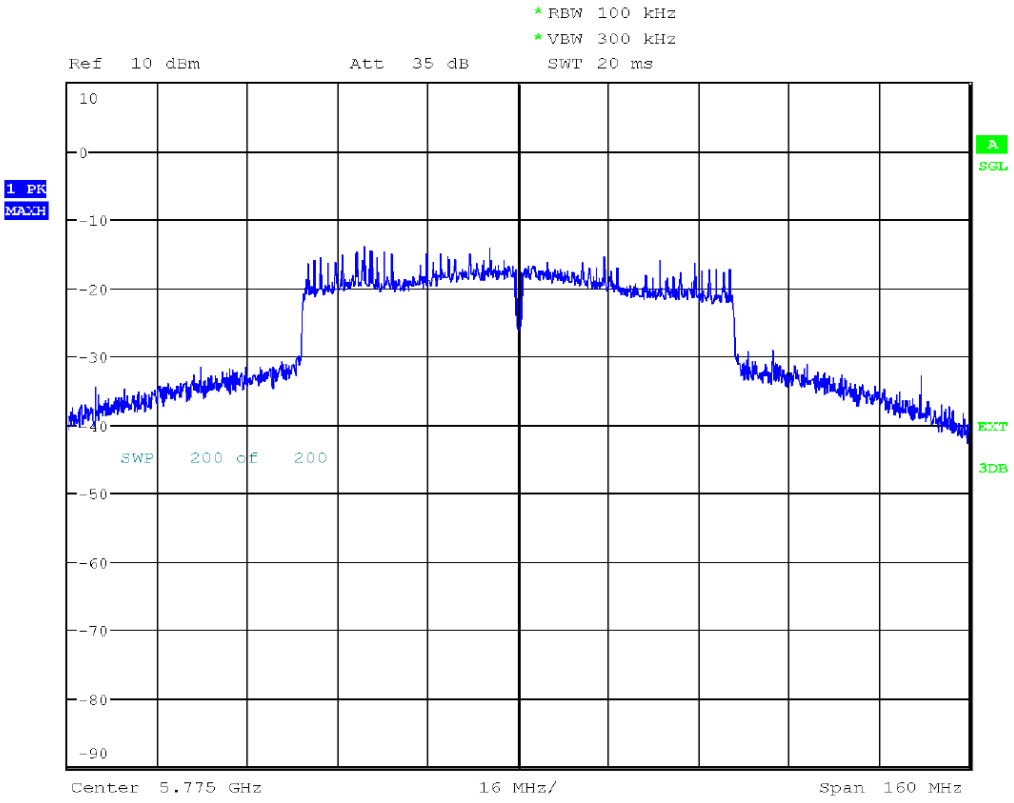




DUT operating at 5795 MHz and 40 MHz BW; 6 dB BW

Diagram 6





DUT operating at 5775 MHz and 80 MHz BW; 6 dB BW

26 dB bandwidth measurements according to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.C.1. / RSS-Gen 6.7

Date	Temperature	Humidity
2019-03-05	23 °C ± 3 °C	11 % ± 5 %
2019-03-06	23 °C ± 3 °C	16 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10 cl. 12.4.1/6.9.2 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.C.1.
Conducted measurements were performed on units with the temporary antenna connectors, with transmission between 94.9% and 98.7% of duty cycle and with normal modulation.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Test site Marconi	15:121
Spectrum analyser R&S FSQ 26	BX50694
Coaxial cable	BX81424
Coaxial cable	BX81436
Coaxial cable	BX50685
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

SISO 2 (chain 2 – 6 dBi antenna gain)		802.11ac			
T_{nom} 20°C, V_{nom} 120 V AC					
f [MHz]	BW [MHz]	EBW left [MHz]	EBW right [MHz]	EBW [MHz]	RBW [MHz]
5745	20	5728.6	5762.3	33.7	0.3
5785	20	5765.2	5802.8	37.6	0.3
5825	20	5807.1	5842.8	35.7	0.3
5755	40	5716.5	5791.2	74.7	0.5
5795	40	5753.4	5834.5	81.1	0.5
5775	80	5704.9	5845.6	140.7	1

The 26 dB BW measurements can be found in the diagrams below:

Diagram 1:	5745 MHz 20 MHz BW, 26 dB EBW
Diagram 2:	5785 MHz 20 MHz BW, 26 dB EBW
Diagram 3:	5825 MHz 20 MHz BW, 26 dB EBW
Diagram 4:	5755 MHz 40 MHz BW, 26 dB EBW
Diagram 5:	5795 MHz 40 MHz BW, 26 dB EBW
Diagram 6:	5825 MHz 80 MHz BW, 26 dB EBW

Limits

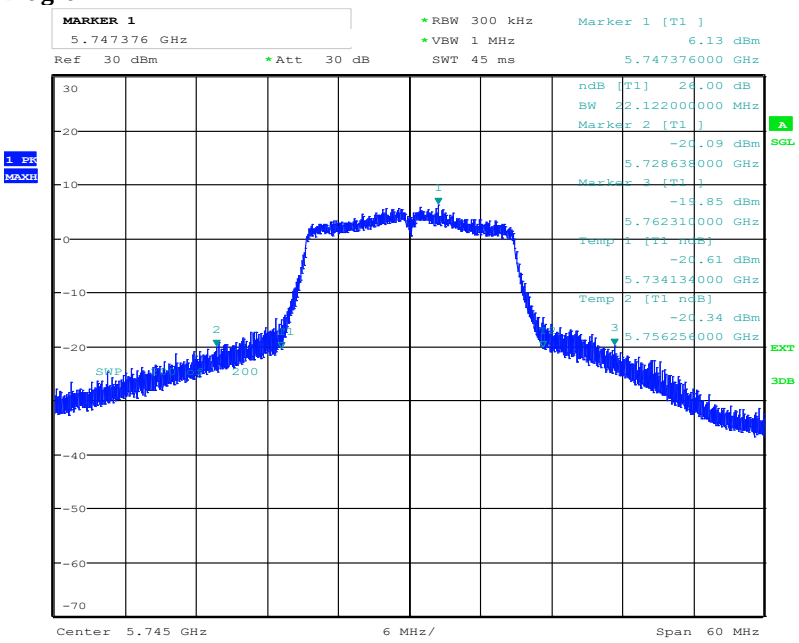
No limits specified in the §15.407 or RSS-247.

Note: There is not particular requirement, but information is needed for configuration of instruments and for assessment if operating channel is inside allowed frequency band.

Test engineer: Ermin Pasalic

Complies?	N/A

Diagram 1

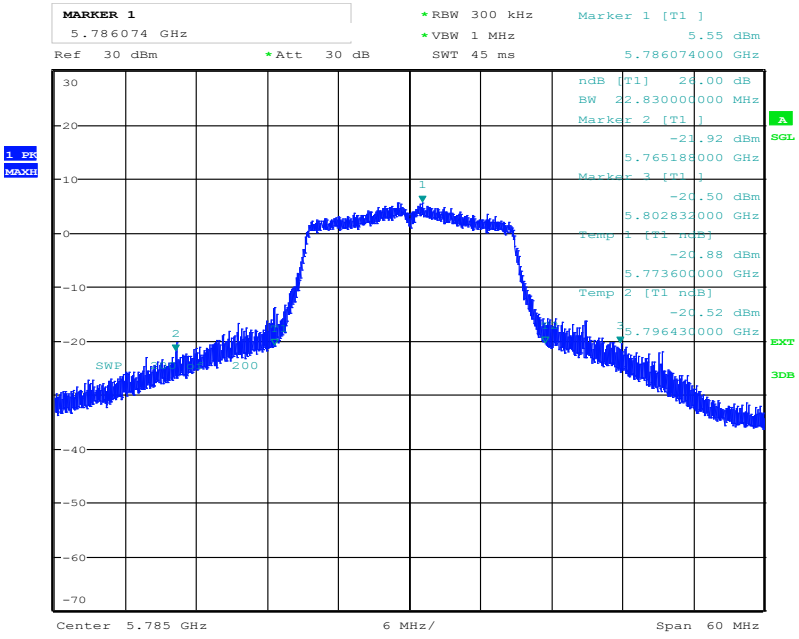


Date: 6.MAR.2019 13:08:23

DUT operating at 5745 MHz and 20 MHz BW; 26 dB EBW, p13 dBm

Note: 26 dB BW is between marker 2 and marker 3.
This note is applicable on all diagrams in this chapter.

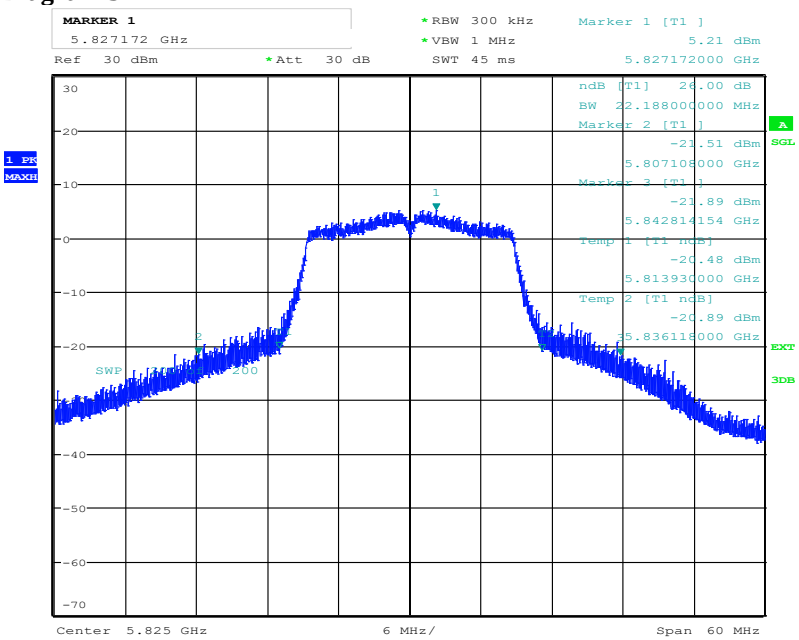
Diagram 2



Date: 6.MAR.2019 13:14:05

DUT operating at 5785 MHz and 20 MHz BW; 26 dB EBW, p13dBm

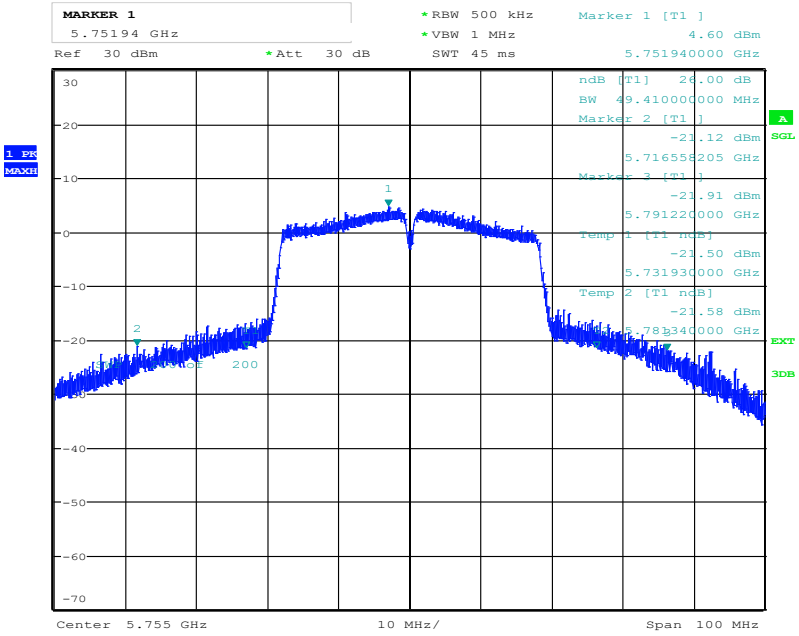
Diagram 3



Date: 6.MAR.2019 11:17:10

DUT operating at 5825 MHz and 20 MHz BW; 26 dB EBW, p13dBm

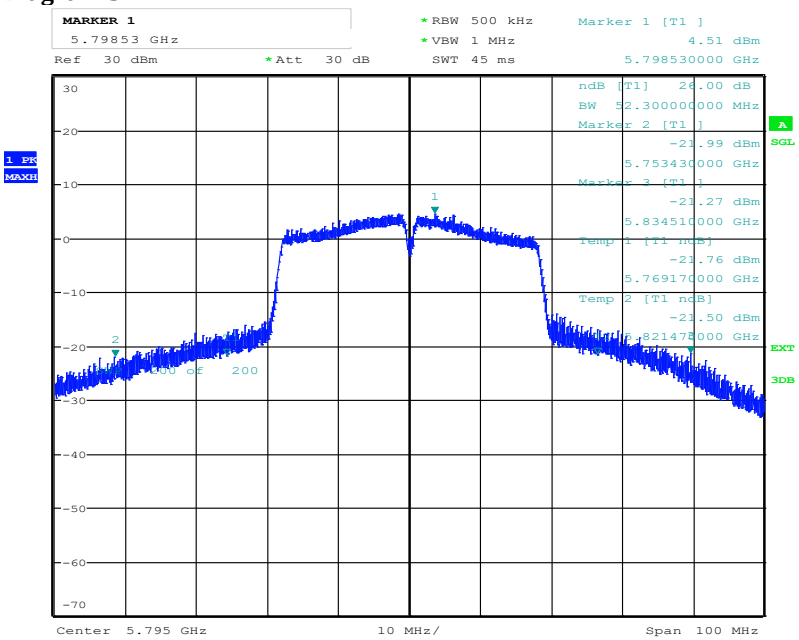
Diagram 4



Date: 6.MAR.2019 11:24:13

DUT operating at 5755 MHz and 40 MHz BW; 26 dB EBW, p13dBm

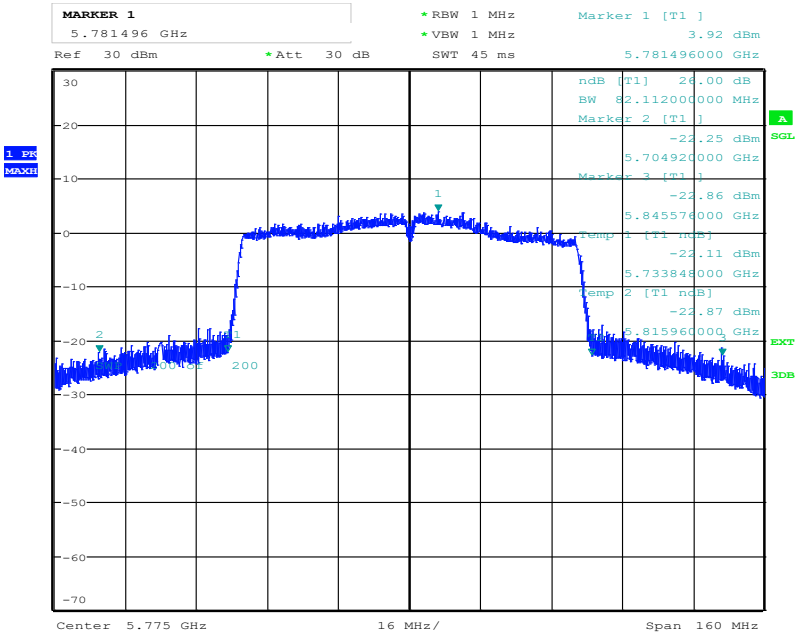
Diagram 5



Date: 6.MAR.2019 12:32:10

DUT operating at 5795 MHz and 40 MHz BW; 26 dB EBW, p13dBm

Diagram 6



Date: 6.MAR.2019 12:38:12

DUT operating at 5775 MHz and 80 MHz BW; 26 dB EBW, p13dBm

99% occupied bandwidth - OBW measurements according to 47CFR2.1049 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.D/RSS-Gen 6.7

Date	Temperature	Humidity
2019-03-05	23 °C ± 3 °C	11 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10, clause 12.4.2/6.9.3 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.D

Conducted measurements were performed on units with the temporary antenna connectors, with transmission between 94.9% and 98.7% of duty cycle and with normal modulation.

The test was performed with max peak detector.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Test site Marconi	15:121
Spectrum analyser R&S FSQ 26	BX50694
Coaxial cable	BX81424
Coaxial cable	BX81436
Coaxial cable	BX50685
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

SISO 2 (chain 2 – 6 dBi antenna gain)		802.11ac			
T_{nom} 20°C, V_{nom} 120 V AC					
f [MHz]	BW [MHz]	OBW left [MHz]	OBW right [MHz]	OBW [MHz]	RBW [MHz]
5745	20	5735.7	5754.3	18.56	0.2
5785	20	5775.8	5794.2	18.37	0.2
5825	20	5815.7	5834.2	18.58	0.2
5755	40	5736.5	5773.6	37.16	0.5
5795	40	5776.5	5813.6	37.13	0.5
5775	80	5736.8	5813.0	76.24	1

The 99% OBW measurements can be found in the diagrams below:

Diagram 1:	5745 MHz 20 MHz BW, 99% OBW
Diagram 2:	5785 MHz 20 MHz BW, 99% OBW
Diagram 3:	5825 MHz 20 MHz BW, 99% OBW
Diagram 4:	5755 MHz 40 MHz BW, 99% OBW
Diagram 5:	5795 MHz 40 MHz BW, 99% OBW
Diagram 6:	5825 MHz 80 MHz BW, 99% OBW

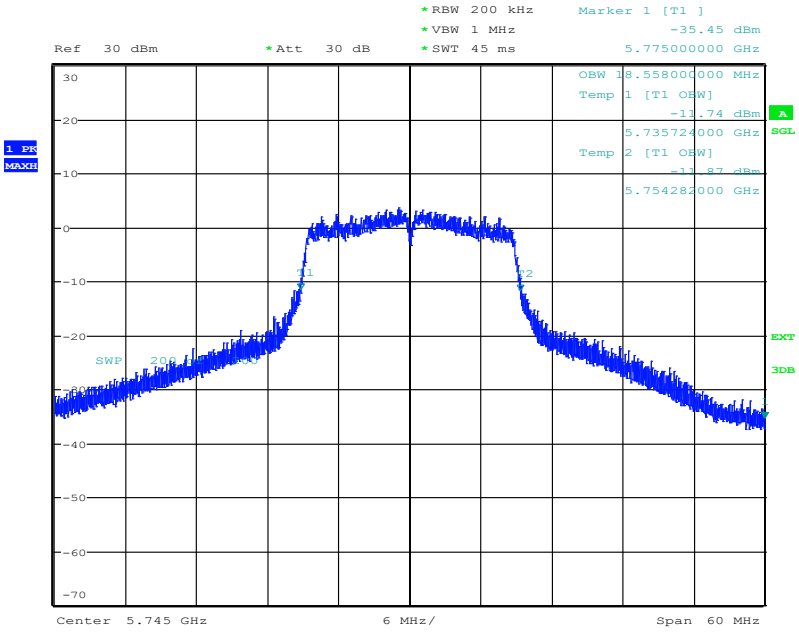
Limits

No limits specified in the §15.407 or RSS-247.

Test engineer: Markel Bertilsson and Ermin Pasalic

Complies?	N/A

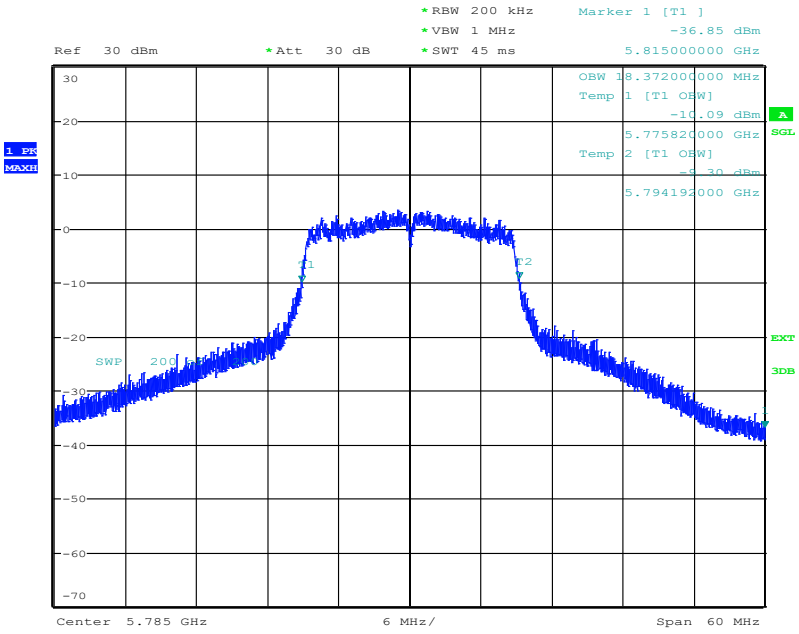
Diagram 1



Date: 5.MAR.2019 12:59:02

DUT operating at 5745 MHz and 20 MHz BW; 99% OBW, p13dBm

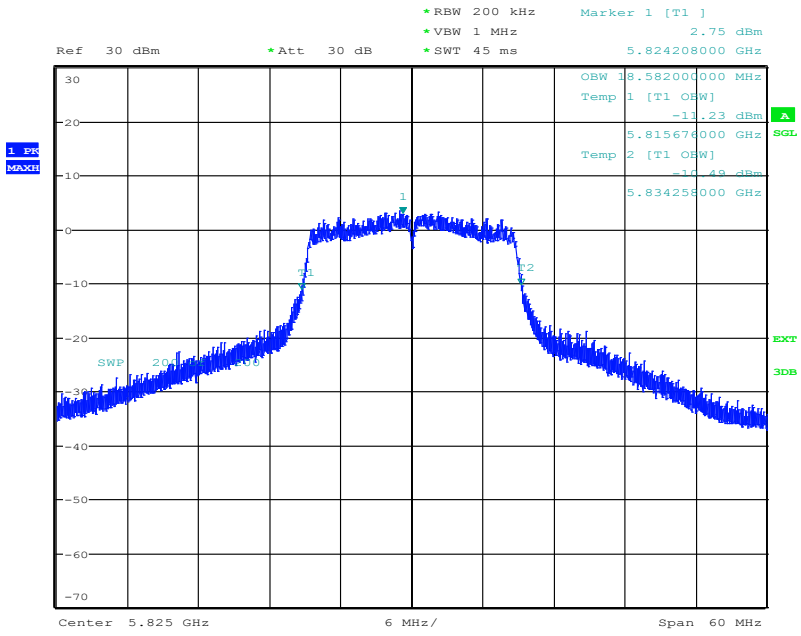
Diagram 2



Date: 5.MAR.2019 12:55:33

DUT operating at 5785 MHz and 20 MHz BW; 99% OBW, p13dBm

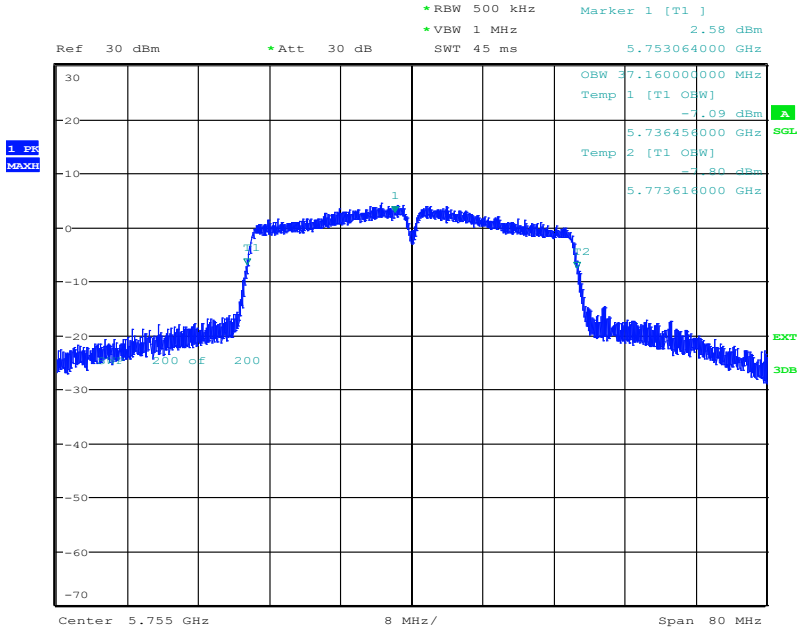
Diagram 3



Date: 5.MAR.2019 12:40:41

DUT operating at 5825 MHz and 20 MHz BW; 99% OBW, p13dBm

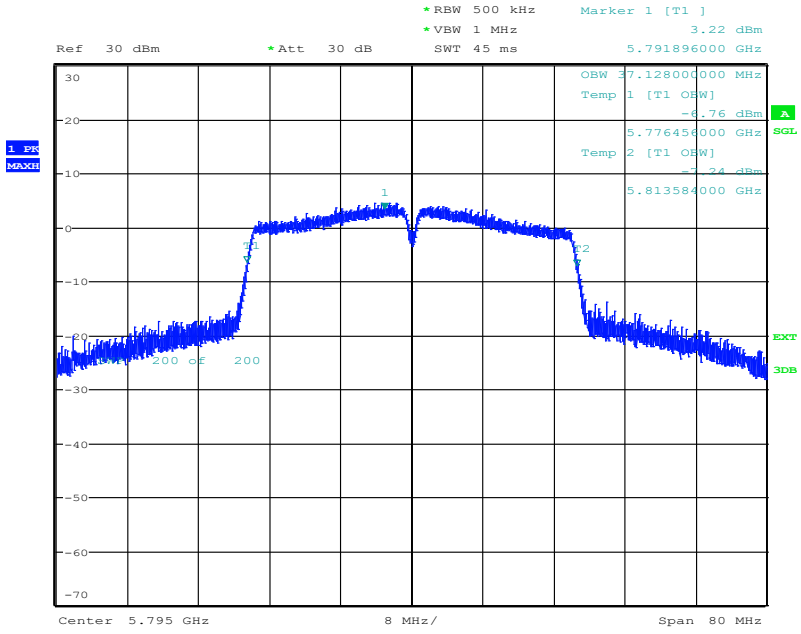
Diagram 4



Date: 5.MAR.2019 14:24:44

DUT operating at 5755 MHz and 40 MHz BW; 99% OBW, p13dBm

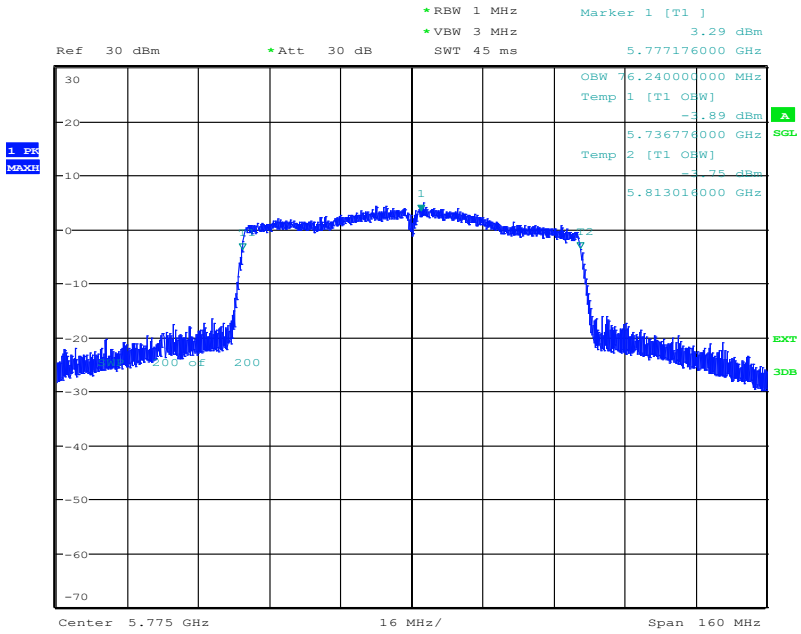
Diagram 5



Date: 5.MAR.2019 14:19:57

DUT operating at 5795 MHz and 40 MHz BW; 99% OBW, p13dBm

Diagram 6



Date: 5.MAR.2019 14:37:37

DUT operating at 5775 MHz and 80 MHz BW; 99% OBW, p13dBm

Band edge measurements according to FCC 47 CFR part 15.407 (b) (4)(i) / RSS-247 6.2.4.2

Date	Temperature	Humidity
2019-02-08	24 °C ± 3 °C	26 % ± 5 %

Test setup and procedure

The measurements were performed according to ANSI C63.10-2013, clause 12.7.4.4. and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Dec. 14, 2017 II.G.3.d.(ii) and II.G.5.

Radiated measurements were performed on units with the integrated antennas with transmission between 94.9% and 98.7% of duty cycle and with normal modulation. The results in the diagrams are not corrected for duty cycle.

Test set-up photos during the tests can be found in the report annex, "8P07436 - F3 photos"

Measurement equipment	RISE number
Semi anechoic chamber, Edison	504114
Computer Lenovo ThinkCentre	-
Software R&S EMC32, ver.9.15.00	503889
EMI test receiver R&S ESU 26	902210
Antenna ETS-Lindgren 3115	902175
Step attenuator Narda743-60	BX41644
Coaxial cable	BX50672
Coaxial cable	504102
Coaxial cable	504103
Coaxial cable	504104
Multimeter Fluke 83	501522
Temperature and humidity meter Testo 625	504117

Results

The band edge measurements can be found in the diagrams below:

Diagram 1:	Ch 149, 5745 MHz 20 MHz BW, 17 dBm/p17 dBm, MHz-Band edge
Diagram 2:	Ch 151, 5755 MHz 40 MHz BW, 12 dBm/p12 dBm, MHz-Band edge
Diagram 3:	Ch 155, 5775 MHz 80 MHz BW, 13 dBm/p13 dBm, MHz-Band edge
Diagram 4:	Ch 159, 5795 MHz 40 MHz BW, 17 dBm/p17 dBm, MHz-Band edge
Diagram 5:	Ch 165 5825 MHz 20 MHz BW, 17 dBm/p17 dBm, MHz-Band edge

Note: The results in the diagrams are not corrected for duty cycle.

Operating frequency, f and bandwidth, BW	Duty cycle [%]	Correction [dB]
5745 MHz, 20 MHz	98.7	0.06
5755 MHz, 40 MHz	97.0	0.13
5775 MHz, 80 MHz	94.9	0.23
5795 MHz, 40 MHz	97.4	0.11
5825 MHz, 20 MHz	98.6	0.07

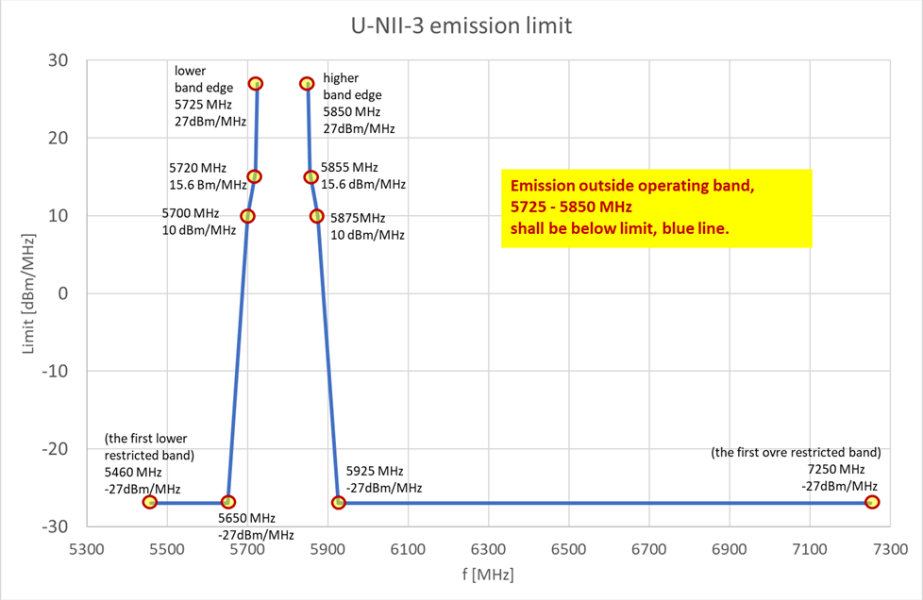
The closest restricted bands:
5350 – 5460 MHz
7250 – 7750 MHz
are far from the operation band 5725-5850 MHz.

The results of the emission in the restricted band are not covered by this chapter and can be seen in the Maximum emission outside of the frequency bands of operation according to FCC 47 CFR part 15.407 (b) (4) and (b)(6) and Unwanted emission in the restricted bands according to FCC 47 CFR part 15.407 (b) (7) / RSS-247 6.2.4.2, RSS-Gen 8.9 and 8.10

Limits

According to 47CFR 15.407(b)(4)(i) and RSS-247 6.2.4.2, all emission outside of 5725-5850 MHz shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edges.

Emission limit is presented in the picture below; emission mask:



Emission mask

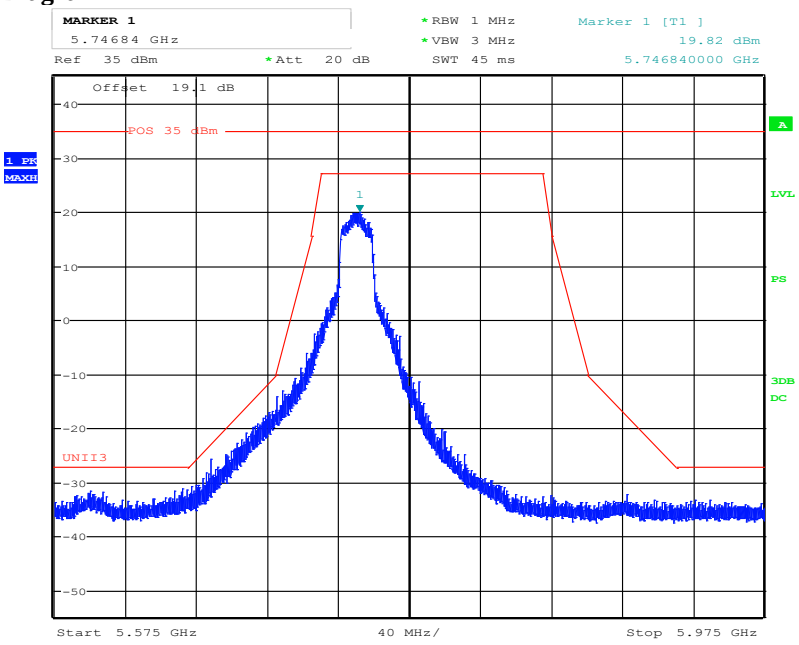
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits based on the field strength, specified in Section 15.209(a).

Radiated emissions that fall in the restricted bands specified in RSS-Gen 8.10 shall comply with field strength limits shown in table 5 in RSS-Gen 8.9.

Test engineer: Ermin Pasalic

Complies?	Yes

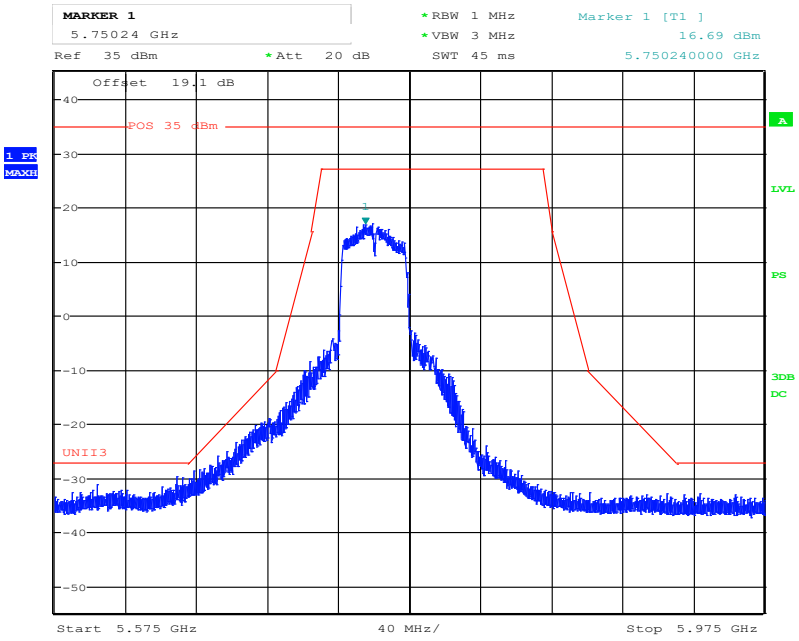
Diagram 1



Date: 8.FEB.2019 14:04:34

Ch 149, 5745 MHz 20 MHz BW, 17 dBm/p17 dBm, MHz-Band edge

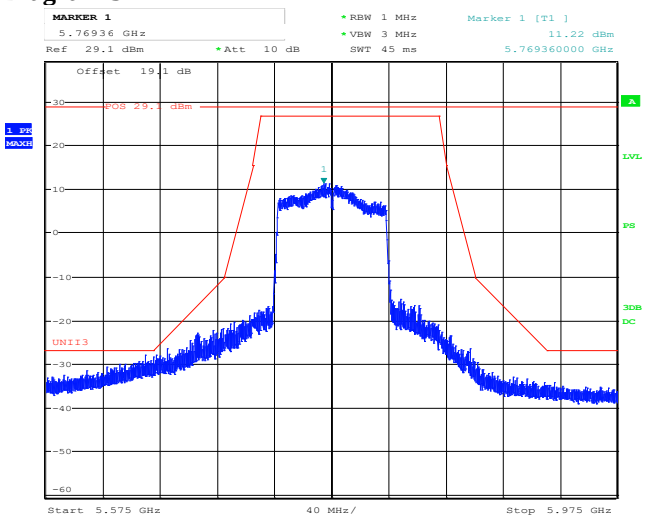
Diagram 2



Date: 8.FEB.2019 14:12:20

Ch 151, 5755 MHz 40 MHz BW, 12 dBm/p12 dBm, MHz-Band edge

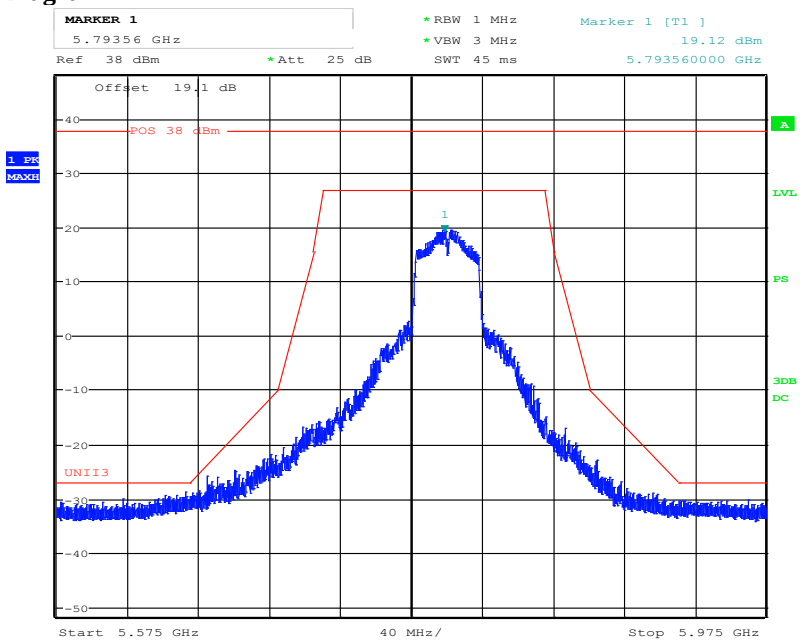
Diagram 3



Date: 8.FEB.2019 13:39:10

Ch 155, 5775 MHz 80 MHz BW, 13 dBm/p13 dBm, MHz-Band edge

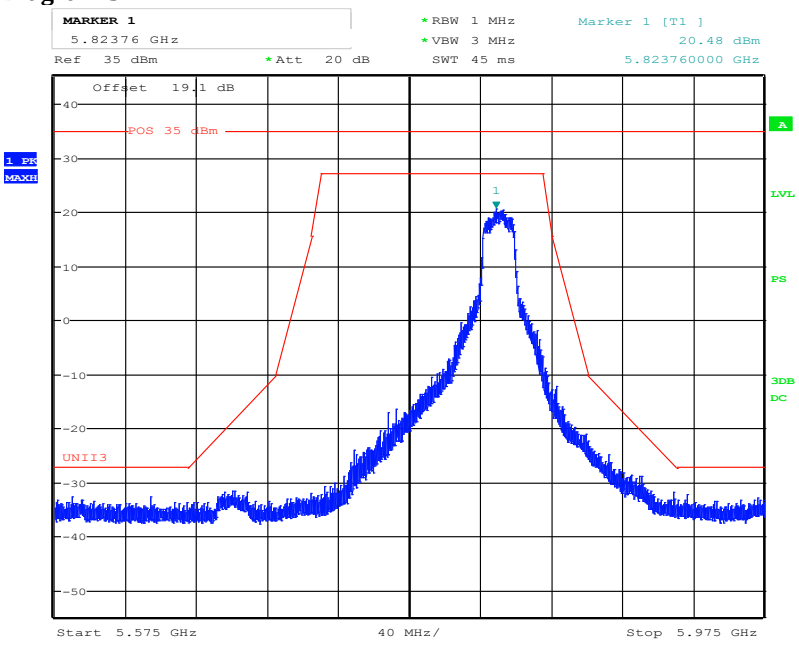
Diagram 4



Date: 8.FEB.2019 13:11:23

Ch 159, 5795 MHz 40 MHz BW, 17 dBm/p17 dBm, MHz-Band edge

Diagram 5



Date: 8.FEB.2019 14:01:09

Ch 165 5825 MHz 20 MHz BW, 17 dBm/p17 dBm, MHz-Band edge