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RADIO TEST REPORT – 400316-3R1TRFWL

Type of assessment:

Class II Permissive Change

Applicant:

Redline Communications

Product:

Broad-band wireless infrastructure product

Model:

RDL-3100-RMA

FCC ID:

QC8-RDL3100RMA

IC Registration number:

4310A-RDL3100RMA

Specifications:

- FCC 47 CFR Part 15 Subpart E, §15.407
- RSS-247, Issue 2, Feb 2017, Section 6

Date of issue: July 29, 2020

Andrey Adelberg, Senior EMC/RF Specialist
Tested by


Signature

David Duchesne, EMC/RF Lab Manager
Reviewed by


Signature

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	FCC:	CA2040	CA2041	CA0101
	ISED:	2040A-4	2040G-5	24676
Website	www.nemko.com			

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407	Unlicensed National Information Infrastructure Devises
RSS-247, Issue 2, Feb 2017, Section 6	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices. Technical requirements for licence-exempt local area network devices and digital transmission systems operating in the 5 GHz band

1.2 Test methods

789033 D02 General U-NII Test Procedures New Rules v02r01 (December 14, 2017)	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
662911 D01 Multiple Transmitter Output v02r01 (October 31, 2013)	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
662911 D02 MIMO with Cross Polarized Antenna v01 (October 25, 2011)	Emissions testing of transmitters with multiple outputs in the same band (MIMO) with Cross Polarized Antenna
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.3 Exclusions

Due to C2PC only limited subset of testing was perform in order to make sure continued compliance with added 3 channel bandwidths: 0.875 MHz, 5 MHz and 45 MHz.

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.3 above. Results obtained indicate that the product under test complies In full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	July 9, 2020	Original report issued
R1TRF	July 29, 2020	EUT internal photographs were removed

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

It was decided to perform the following:

1. RF power output: on one channel for each modulation/additional bandwidth.
2. Power Spectral Density: on one channel for each modulation/additional bandwidth.
3. Occupied bandwidth: at additional bandwidths 0.875 MHz, 5 MHz, and 45 MHz.
4. Band edge spurious emissions: upper and lower band edge with both additional bandwidths
5. Out-of-band spurious emissions: spurious emissions up to 10x fundamental TX frequency on one frequency for one of the additional bandwidths.

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

3.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 4 Measurement uncertainty

4.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Table 4.1-1: *Measurement uncertainty calculations*

Test name	Measurement uncertainty, ±dB
All antenna port measurements	0.55
Occupied bandwidth	4.45
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78

Section 5 Information provided by the applicant

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacture

Applicant name	Redline Communications
Applicant address	302 Town Center Blvd., Markham, Ontario L3R 0E8, Canada
Manufacture name	Same as applicant
Manufacture address	Same as applicant

5.3 EUT information

Product name	Broad-band wireless infrastructure product
Model	RDL-3100-RMA
Serial number	318SC16300082
Power supply requirements	48 V_{DC} PoE via 120 V_{AC}, 60 Hz
Product description and theory of operation	The EUT is a 2×2 MIMO point-to-multipoint (PMP) and point-to-point (PTP) carrier grade broadband wireless infrastructure product, designed to operate in the U-NII-3 WLAN band.

5.4 Radio technical information

Device type	☒	Outdoor access point
	☐	Indoor access point
	☐	Fixed point-to-point access point
	☐	Client device
	☐	Device installed in vehicles
Frequency band	5725–5850 MHz (U-NII-3)	
Channel sizes (MHz)	0.875, 5, 45	
Type of modulation	OFDM using 256-QAM, 128-QAM, 64-QAM, 16-QAM, QPSK and BPSK modulation for sub-carriers	
Antenna information	10 dBi Redline AOD-DB-0512-02 omnidirectional antenna 10 dBi L-Com, HG5158DP-10U, omnidirectional antenna 24 dBi Dual Polarization Antenna 4.9–6.1 GHz, Redline 30-00362-00 32 dBi Redline A3FT3204LTPD Parabolic Antenna, 4.9–5.8 GHz, 4 degree, dual polarity	

Channel sizes:	0.875 MHz	5 MHz	45 MHz
Frequency Min (MHz)	5725.5	5727.5	5747.5
Frequency Max (MHz)	5849.5	5847.5	5827.5
RF power Max (W), Conducted	0.296 (24.72 dBm)	0.291 (24.61 dBm)	0.291 (24.61 dBm)
Measured BW (kHz), 99% OBW	725	4126	41001
Emission classification	725KW7D	4M13W7D	41M0W7D
Transmitter spurious, dBµV/m @ 3 m	53.69 at 5150 MHz	53.98 at 5150 MHz	53.96 at 1550 MHz

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions	Software version used: 3.12.6
Transmitter state	The EUT was controlled to transmit at desired frequency and modulation from laptop using web interface at IP address: 192.168.25.2. In addition, Telnet session was used to force 95% duty cycle with the following command: *dbg txloop 1 0 95*

EUT setup configuration, continued

Table 5.5-1: *Support equipment*

Description	Brand name	Model, Part number, Serial number, Revision level
Power over Ethernet adapter	Microsemi	PN: PD-9001GR/AT/AC

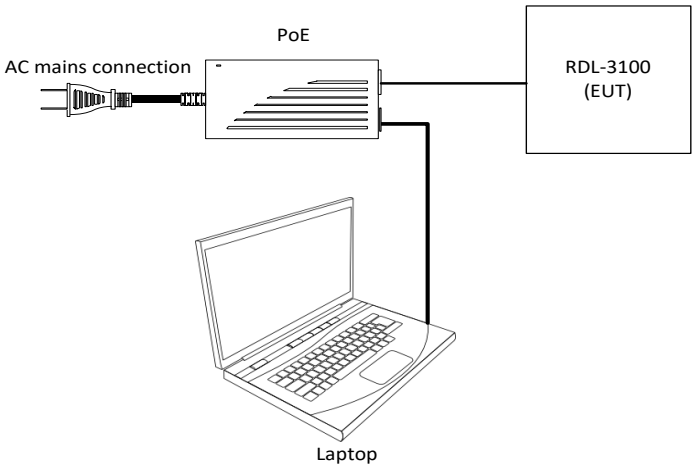

Figure 5.5-1: *Setup block diagram*

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Ottawa

6.2 Testing period

Test start date	June 15, 2020	Test end date	June 30, 2020

6.3 Sample information

Receipt date	June 12, 2020	Nemko sample ID number(s)	1

6.4 FCC Part 15 Subpart A and C, general requirements test results

Table 6.4-1: *FCC general requirements results*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not tested
§15.31I	Variation of power source	Pass
§15.31(m)	Number of tested frequencies	Pass
§15.203	Antenna requirement	Pass

Notes: Only limited subset of testing was performed

6.5 FCC Part §15.407 test results

Table 6.5-1: *FCC §15.407 requirements results*

Part	Test description	Verdict
§15.403(i)	Emission bandwidth	Not applicable
§15.407(a)(1)	Power and density limits within 5.15–5.25 GHz band	Not applicable
§15.407(a)(2)	Power and density limits within 5.25–5.35 GHz and 5.47–5.725 GHz bands	Not applicable
§15.407(a)(3)	Power and density limits within 5.725–5.85 GHz band	Pass
§15.407(b)(1)	Undesirable emission limits for 5.15–5.25 GHz band	Not applicable
§15.407(b)(2)	Undesirable emission limits for 5.25–5.35 GHz band	Not applicable
§15.407(b)(3)	Undesirable emission limits for 5.47–5.725 GHz bands	Not applicable
§15.407(b)(4)	Undesirable emission limits for 5.725–5.85 GHz band	Pass
§15.407(b)(6)	Conducted limits for U-NII devices using an AC power line	Not tested
§15.407(e)	Minimum 6 dB bandwidth of U-NII devices within the 5.725-5.85 GHz band	Pass
§15.407(g)	Frequency stability	Not tested
§15.407(h)(1)[1]	Transmit power control (TPC)	Not applicable
§15.407(h)(2)[1]	Dynamic Frequency Selection (DFS)	Not applicable

Notes [1]DFS and TPC requirements are only applicable to 5.25–5.35 GHz and 5.47–5.725 GHz bands
Only limited subset of testing was performed

6.6 ISED RSS-Gen, Issue 5, test results

Table 6.6-1: *RSS-Gen requirements results*

Clause	Test description	Verdict
7.3	Receiver radiated emission limits	Not applicable
7.4	Receiver conducted emission limits	Not applicable
6.9	Operating bands and selection of test frequencies	Pass
8.8	AC power-line conducted emissions limits	Not tested

Notes: [1]According to sections 5.2 and 5.3 of RSS-Gen, Issue 5 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.
Only limited subset of testing was performed

6.7 ISED RSS-247, Issue 2, test results

Table 6.7-1: *ISED RSS-247 requirements results*

Section	Test description	Verdict
6.1[1]	Types of Modulation	Pass
6.2.1.1	Power limits for 5150–5250 MHz band	Not applicable
6.2.2.1	Power limits for 5250–5350 MHz band	Not applicable
6.2.2.1(b)	TPC requirements for 5250–5350 MHz band	Not applicable
6.2.3.1	Power limits for 5470–5600 MHz and 5650–5725 MHz bands	Not applicable
6.2.3.1(b)	TPC requirements for 5470–5600 MHz and 5650–5725 MHz bands	Not applicable
6.2.4.1	Power limits for 5725–5850 MHz band	Pass
6.2.4.1	Minimum 6 dB bandwidth for 5725–5850 MHz band	Pass
6.2.1.2	Unwanted emission limits for 5150–5250 MHz band	Not applicable
6.2.2.2	Unwanted emission limits for 5250–5350 MHz band	Not applicable
6.2.2.3	Additional requirements for 5250–5350 MHz band	Not applicable
6.2.3.	Unwanted emission limits for 5470–5600 MHz and 5650–5725 MHz bands	Not applicable
6.2.4.2	Unwanted emission limits for 5725–5850 MHz band	Pass
6.3	Dynamic Frequency Selection (DFS) for devices operating in the bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz	Not applicable

Notes: [1] The EUT employs digital modulations, such as: BPSK up to 256-QAM
Only limited subset of testing was performed

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	January 24, 2021
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	November 8, 2020
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	October 31, 2020
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	October 31, 2020
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002873	1 year	November 4, 2020
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	November 7, 2020
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU

Notes: NCR - no calibration required, VOU - verify on use

Section 8 Testing data

8.1 Variation of power source

8.1.1 References, definitions and limits

FCC §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. For battery operated equipment, the equipment tests shall be performed using a new battery.

8.1.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	June 15, 2020

8.1.3 Observations, settings and special notes

The testing was performed as per ANSI C63.10 Section 5.13.

a) Where the device is intended to be powered from an external power adapter, the voltage variations shall be applied to the input of the adapter provided with the device at the time of sale. If the device is not marketed or sold with a specific adapter, then a typical power adapter shall be used.
b) For devices, where operating at a supply voltage deviating ±15% from the nominal rated value may cause damages or loss of intended function, test to minimum and maximum allowable voltage per manufacturer's specification and document in the report.
c) For devices with wide range of rated supply voltage, test at 15% below the lowest and 15% above the highest declared nominal rated supply voltage.
d) For devices obtaining power from an input/output (I/O) port (USB, firewire, etc.), a test jig is necessary to apply voltage variation to the device from a support power supply, while maintaining the functionalities of the device.

For battery-operated equipment, the equipment tests shall be performed using a variable power supply.

8.1.4 Test data

EUT Power requirements:	☒ AC	☐ DC	☐ Battery
If EUT is an AC or a DC powered, was the noticeable output power variation observed?	☐ YES	☒ NO	☐ N/A
If EUT is battery operated, was the testing performed using fresh batteries?	☐ YES	☐ NO	☒ N/A
If EUT is rechargeable battery operated, was the testing performed using fully charged batteries?	☐ YES	☐ NO	☒ N/A

8.2 Number of frequencies

8.2.1 References, definitions and limits

FCC §15.31:

(m) Measurements on intentional radiators or receivers shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table.

RSS-Gen, Clause 6.9:

Except where otherwise specified, measurements shall be performed for each frequency band of operation for which the radio apparatus is to be certified, with the device operating at the frequencies in each band of operation shown in table below. The frequencies selected for measurements shall be reported in the test report.

Table 8.2-1: *Frequency Range of Operation*

Frequency range over which the device operates (in each band)	Number of test frequencies required	Location of measurement frequency inside the operating frequency range
1 MHz or less	1	Center (middle of the band)
1–10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near center and 1 near low end

Notes: "near" means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

8.2.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	June 15, 2020

8.2.3 Observations, settings and special notes

ANSI C63.10, Clause 5.6.2.1:

The number of channels tested can be reduced by measuring the center channel bandwidth first and then applying the following relaxations as appropriate:

a) For each operating mode, if the measured channel bandwidth on the middle channel is at least 150% of the minimum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

b) For multiple-input multiple-output (MIMO) systems, if the measured channel bandwidth on testing the middle channel exceeds the minimum permitted bandwidth by more than 50% on one transmit chain, then it is not necessary to repeat testing on the other chains.

c) If the measured channel bandwidth on the middle channel is less than 50% of the maximum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

ANSI C63.10, Clause 5.6.2.2:

For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

a) Band edge requirements—Measurements on the mode with the widest bandwidth can be used to cover the same channel (center frequency) on modes with narrower bandwidth that have the same or lower output power for each modulation family (e.g., OFDM and direct sequence spread spectrum).

b) Spurious emissions—Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).

c) In-band PSD—Measurements on the mode with the narrowest bandwidth can be used to cover all modes within the same modulation family of an equal or lower output power provided the result is less than 50% of the limit.

8.2.4 Test data

Table 8.2-2: *Test channels selection*

Channel bandwidth, MHz	Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
0.875	5725	5850	125	5725.5	5790.0	5849.5
5	5725	5850	125	5727.5	5790.0	5847.5
45	5725	5850	125	5747.5	5790.0	5827.5

8.3 Antenna requirement

8.3.1 References, definitions and limits

FCC §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 so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen, Clause 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report.

8.3.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	June 15, 2020

8.3.3 Observations, settings and special notes

None

8.3.4 Test data

Must the EUT be professionally installed?	☒ YES	☐ NO	
Does the EUT have detachable antenna(s)?	☒ YES	☐ NO	
If detachable, is the antenna connector(s) non-standard?	☐ YES	☐ NO	☒ N/A

Table 8.3-1: *Antenna information*

Antenna type	Manufacturer	Model number	Maximum gain	Connector type
Omnidirectional	Redline	AOD-DB-0512-02	10 dBi	N-type
Omnidirectional	L-Com	HG5158DP-10U	10 dBi	N-type
Dual Polarization	Redline	30-00362-00	24 dBi	MCX
Parabolic	Redline	A3FT3204LTPD	32 dBi	N-type

8.4 Emission bandwidth and 6 dB BW

8.4.1 References, definitions and limits

FCC §15.403:

(i) For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

FCC §15.407:

(e) Within the 5.725–5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

RSS-247, Clause 2.6.4:

Frequency band 5725-5850 MHz:

6.2.4.1 Power limits

For equipment operating in the band 5725–5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

8.4.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	June 24, 2020

8.4.3 Observations, settings and special notes

The emission bandwidth was tested per ANSI C63.10, Clause 12.4 and KDB 789033 D02, Clause II(C)(1). Spectrum analyser settings:

Resolution bandwidth	approximately 1% of the emission bandwidth
Video bandwidth	> RBW
Detector mode	Peak
Trace mode	Max Hold

The 6 dB bandwidth was tested per ANSI C63.10, Clause 11.8 and KDB 789033 D02, Clause II(C)(2). Spectrum analyser settings:

Resolution bandwidth	100 kHz
Video bandwidth	≥3 × RBW
Detector mode	Peak
Trace mode	Max Hold

8.4.4 Test data

Table 8.4-1: *26 dB bandwidth results*

Channel bandwidth, MHz	Modulation	Frequency, MHz	26 dB bandwidth at ch0, MHz	26 dB bandwidth at ch1, MHz
0.875	BPSK	5790	0.884	0.824
0.875	256QAM	5790	0.839	0.839
5	BPSK	5790	4.830	4670
5	256QAM	5790	4.750	4740
45	BPSK	5790	43.860	44.460
45	256QAM	5790	43.960	44.460

Table 8.4-2: *6 dB bandwidth results*

Channel bandwidth, MHz	Modulation	Frequency, MHz	6 dB bandwidth at ch0, MHz	6 dB bandwidth at ch1, MHz	Minimum limit, MHz	Minimum margin, MHz
0.875	BPSK	5790	0.749	0.749	0.500	0.249
0.875	256QAM	5790	0.744	0.764	0.500	0.244
5	BPSK	5790	4.100	4.100	0.500	3.600
5	256QAM	5790	4.200	4.200	0.500	3.700
45	BPSK	5790	41.360	41.260	0.500	40.760
45	256QAM	5790	41.360	41.360	0.500	40.860

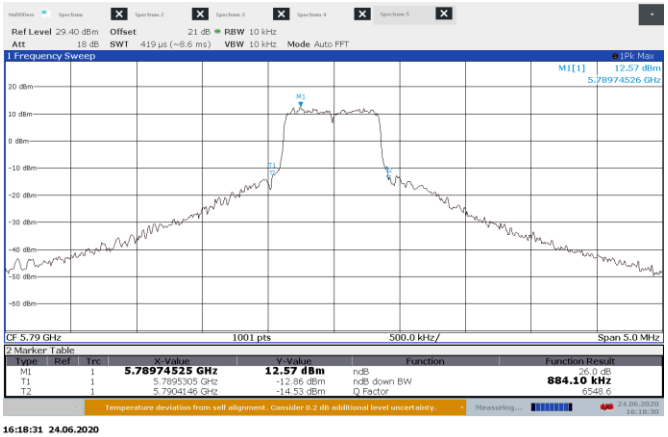

Figure 8.4-1: *26 dB bandwidth on 0.875 MHz channel, sample plot*

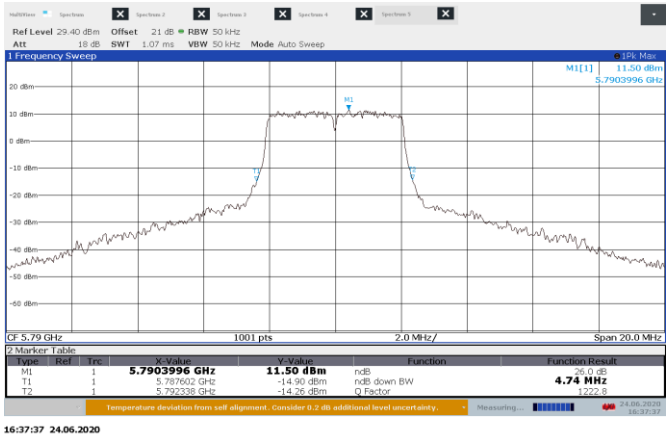

Figure 8.4-2: *26 dB bandwidth on 5 MHz channel, sample plot*

Test data, continued

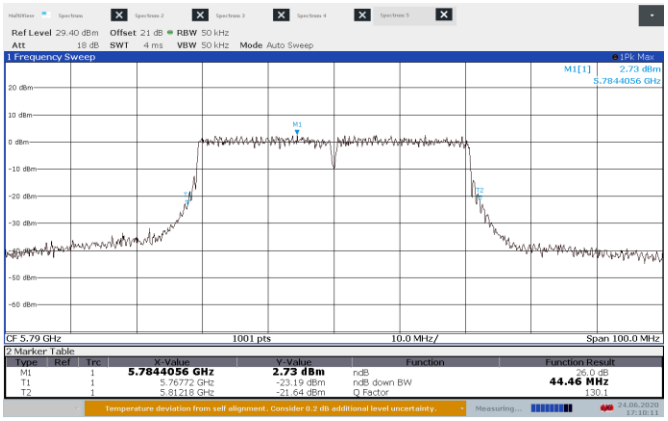

Figure 8.4-3: *26 dB bandwidth on 45 MHz channel, sample plot*

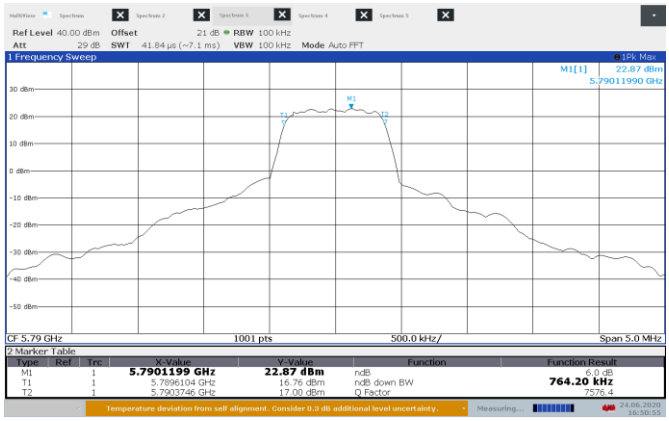

Figure 8.4-4: *6 dB bandwidth on 0.875 MHz channel, sample plot*

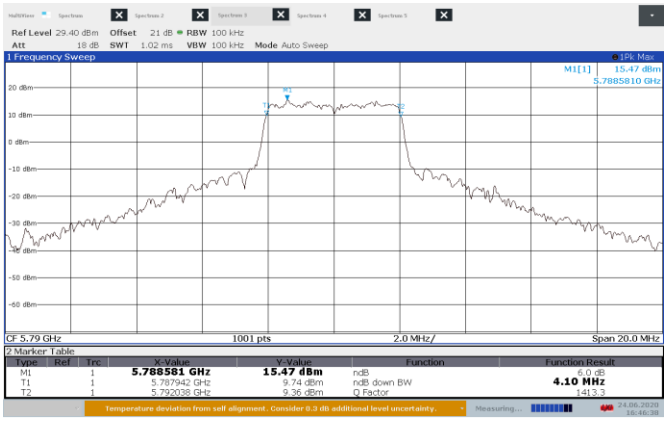

Figure 8.4-5: *6 dB bandwidth on 5 MHz channel, sample plot*

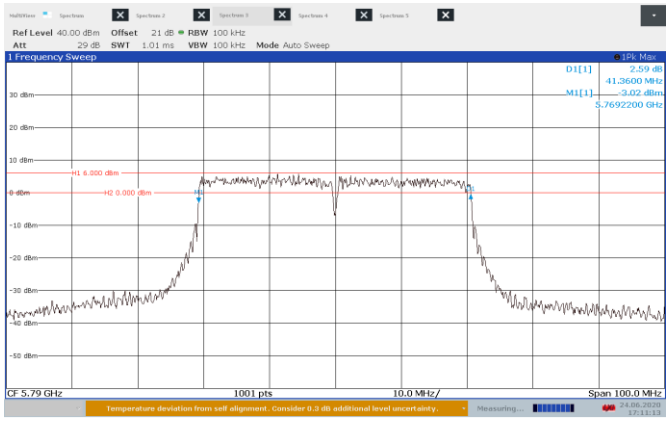

Figure 8.4-6: *6 dB bandwidth on 45 MHz channel, sample plot*

8.5 Occupied bandwidth

8.5.1 References, definitions and limits

ANSI C63.10-2013, Clause 6.9.3:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

RSS-Gen, Clause 6.7:

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

8.5.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	June 26, 2020

8.5.3 Observations, settings and special notes

The emission bandwidth was tested per ANSI C63.10, Clause 6.9.3 and KDB 789033 D02, Clause II(D). Spectrum analyser settings:

Resolution bandwidth:	≥ 1 % of span
Video bandwidth:	≥3 × RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.5.4 Test data

Table 8.5-1: *99% bandwidth results*

Channel bandwidth, MHz	Modulation	Frequency, MHz	99% bandwidth at ch0, MHz	99% bandwidth at ch1, MHz
0.875	BPSK	5790	0.725	0.720
0.875	256QAM	5790	0.723	0.722
5	BPSK	5790	4.126	4.109
5	256QAM	5790	4.125	4.122
45	BPSK	5790	41.001	40.985
45	256QAM	5790	40.975	40.942

Test data, continued

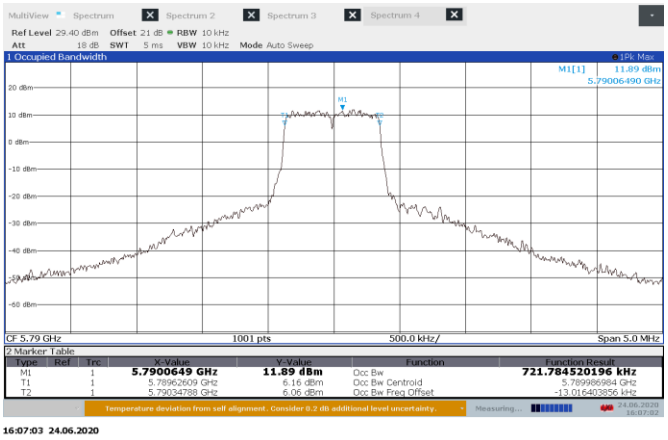

Figure 8.5-1: *99% bandwidth on 0.875 MHz channel, sample plot*

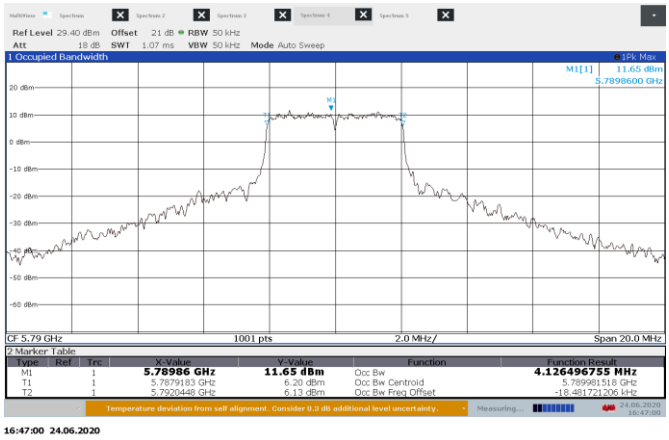

Figure 8.5-2: *99% bandwidth on 5 MHz channel, sample plot*

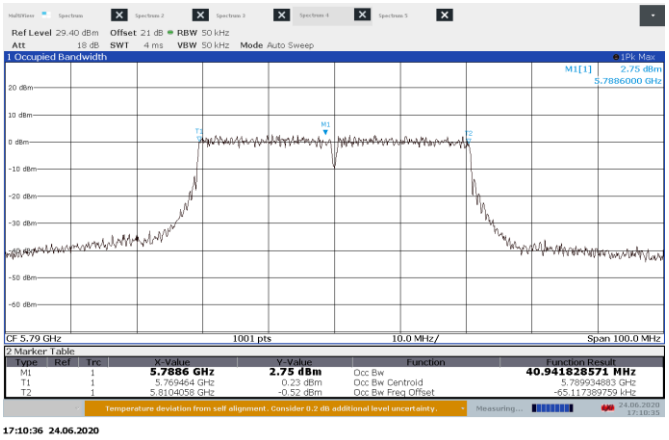

Figure 8.5-3: *99% bandwidth on 45 MHz channel, sample plot*

8.6 Transmitter output power and e.i.r.p. requirements for 5470–5725 MHz band

8.6.1 References, definitions and limits

FCC §15.407:

(a) Power limits:

(3) For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

(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. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725–5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

RSS-247, Clause 6.2:

Power and unwanted emissions limits

The output power and e.i.r.p. of the equipment wanted emission shall be measured in terms of average value.

6.2.4 Frequency band 5725–5850 MHz

6.2.4.1 Power limits

The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

8.6.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	June 24, 2020

8.6.3 Observations, settings and special notes

Combined average output power was calculated as follows: $P_{combined} = 10 \times log_{10}\left(\left(10^{P_{ch0}/10}\right) + \left(10^{P_{ch1}/10}\right)\right)$

EIRP was calculated as follows: $EIRP = P_{combined} + antenna\ gain$

Combined PPSD was calculated as follows: $PPSD_{combined} = 10 \times log_{10}\left(\left(10^{PSD_{ch0}/10}\right) + \left(10^{PSD_{ch1}/10}\right)\right)$

No summation of directional gain is needed for cross-polarized antennas as per manufacturer's definition of the cross-polarized MIMO type.

The EUT is also a fixed point-to-point device; therefore it may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

For point-to-multi point operations antennas with the directional gain greater than 6 dBi, the maximum output power limit was calculated as follows:
30 dBm – (Maximum antenna gain – 6 dBi)
For 10 dBi antenna with 0.7 dB cable loss: Limit = 30 dBm – (9.3 dBi – 6 dBi) = 26.7 dBm
For 24 dBi antenna with 0.7 dB cable loss: Limit = 30 dBm – (23.3 dBi – 6 dBi) = 12.7 dBm
For 32 dBi antenna with 0.7 dB cable loss: Limit = 30 dBm – (31.3 dBi – 6 dBi) = 4.7 dBm

For antennas with the directional gain greater than 6 dBi, the maximum power spectral density limit was calculated as follows:
30 dBm/500 kHz – (Maximum antenna gain – 6 dBi)
For 10 dBi antenna with 0.7 dB cable loss: Limit = 30 dBm/500 kHz – (9.3 dBi – 6 dBi) = 26.7 dBm/500 kHz
For 24 dBi antenna with 0.7 dB cable loss: Limit = 30 dBm/500 kHz – (23.3 dBi – 6 dBi) = 12.7 dBm/500 kHz
For 32 dBi antenna with 0.7 dB cable loss: Limit = 30 dBm/500 kHz – (31.3 dBi – 6 dBi) = 4.7 dBm/500 kHz

Power spectral density was tested per ANSI C63.10, Clause 12.5 and 789033 D02, Clause II(F).
Conducted output power was tested per ANSI C63.10, Clause 12.3 and 789033 D02, Clause II(E) using method SA-1 or SA-1 Alternative (averaging with the EUT transmitting at full power throughout each sweep).
Spectrum analyser settings:

Resolution bandwidth	10 kHz to 1 MHz
Video bandwidth	≥ 3 MHz
Frequency span	Enough to encompass the entire 26 dB EBW or 99% OBW of the signal
Detector mode	RMS
Trace mode	Max Hold
Power aggregation	Over 26 dB EBW or 99% OBW

8.6.1 Test data

Table 8.6-1: *Output power measurements results for 0.875 MHz channel with 10 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	21.81	21.40	24.62	26.70	2.08	9.30	33.92	36.00	2.08
256QAM	5790	21.92	21.48	24.72	26.70	1.98	9.30	34.02	36.00	1.98

Table 8.6-2: *PPSD measurements results for 0.875 MHz channel with 10 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	16.68	16.15	19.43	26.70	7.27
256QAM	5790	16.67	16.87	19.78	26.70	6.92

Table 8.6-3: *Output power measurements results for 0.875 MHz channel with 24 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	9.68	9.17	12.44	12.70	0.26	23.30	35.74	36.00	0.26
256QAM	5790	9.83	9.28	12.57	12.70	0.13	23.30	35.87	36.00	0.13

Table 8.6-4: *PPSD measurements results for 0.875 MHz channel with 24 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	4.59	4.09	7.36	12.70	5.34
256QAM	5790	4.55	4.24	7.41	12.70	5.29

Table 8.6-5: *Output power measurements results for 0.875 MHz channel with 32 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	0.65	1.12	3.90	4.70	0.80	32.00	35.90	36.00	0.80
256QAM	5790	0.61	1.19	3.92	4.70	0.78	32.00	35.92	36.00	0.78

Table 8.6-6: *PPSD measurements results for 0.875 MHz channel with 32 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	-4.03	-3.60	-0.80	4.70	5.50
256QAM	5790	-4.12	-4.07	-1.08	4.70	5.78

Test data, continued

Table 8.6-7: *Output power measurements results for 5 MHz channel with 10 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	21.73	21.37	24.56	26.70	2.14	9.30	33.86	36.00	2.14
256QAM	5790	21.97	21.27	24.64	26.70	2.06	9.30	33.94	36.00	2.06

Table 8.6-8: *PPSD measurements results for 5 MHz channel with 10 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	13.76	13.21	16.50	26.70	10.20
256QAM	5790	13.73	13.13	16.45	26.70	10.25

Table 8.6-9: *Output power measurements results for 5 MHz channel with 24 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	9.69	9.15	12.44	12.70	0.26	23.30	35.74	36.00	0.26
256QAM	5790	9.73	9.01	12.40	12.70	0.30	23.30	35.70	36.00	0.30

Table 8.6-10: *PPSD measurements results for 5 MHz channel with 24 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	1.57	0.80	4.21	12.70	8.49
256QAM	5790	1.66	0.89	4.30	12.70	8.40

Table 8.6-11: *Output power measurements results for 5 MHz channel with 32 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	0.75	0.95	3.86	4.70	0.84	32.00	35.86	36.00	0.84
256QAM	5790	0.76	1.03	3.91	4.70	0.79	32.00	35.91	36.00	0.79

Table 8.6-12: *PPSD measurements results for 5 MHz channel with 32 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	-6.71	-6.99	-3.84	4.70	8.54
256QAM	5790	-7.60	-7.13	-4.35	4.70	9.05

Test data, continued

Table 8.6-13: *Output power measurements results for 45 MHz channel with 10 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	21.73	21.53	24.64	26.70	2.06	9.30	33.94	36.00	2.06
256QAM	5790	21.94	21.17	24.58	26.70	2.12	9.30	33.88	36.00	2.12

Table 8.6-14: *PPSD measurements results for 45 MHz channel with 10 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	3.83	3.35	6.61	26.70	20.09
256QAM	5790	3.94	3.67	6.82	26.70	19.88

Table 8.6-15: *Output power measurements results for 45 MHz channel with 24 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	9.59	8.91	12.27	12.70	0.43	23.30	35.57	36.00	0.43
256QAM	5790	9.18	9.16	12.18	12.70	0.52	23.30	35.48	36.00	0.52

Table 8.6-16: *PPSD measurements results for 45 MHz channel with 24 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	-8.45	-8.84	-5.63	12.70	18.33
256QAM	5790	-8.37	-8.69	-5.52	12.70	18.22

Table 8.6-17: *Output power measurements results for 45 MHz channel with 32 dBi antenna for PMP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB	Total antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dBm
BPSK	5790	0.52	0.99	3.77	4.70	0.93	32.00	35.77	36.00	0.93
256QAM	5790	0.45	0.93	3.71	4.70	0.99	32.00	35.71	36.00	0.99

Table 8.6-18: *PPSD measurements results for 45 MHz channel with 32 dBi antenna for PMP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	-17.46	-16.77	-14.09	4.70	18.79
256QAM	5790	-17.53	-16.87	-14.18	4.70	18.88

Test data, continued

Table 8.6-19: *Output power measurements results for 0.875 MHz channel for PTP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB
BPSK	5790	21.81	21.40	24.62	26.70	2.08
256QAM	5790	21.92	21.48	24.72	26.70	1.98

Table 8.6-20: *PPSD measurements results for 0.875 MHz channel for PTP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	16.68	16.15	19.43	26.70	7.27
256QAM	5790	16.67	16.87	19.78	26.70	6.92

Table 8.6-21: *Output power measurements results for 5 MHz channel for PTP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB
BPSK	5790	21.73	21.37	24.56	26.70	2.14
256QAM	5790	21.97	21.27	24.64	26.70	2.06

Table 8.6-22: *PPSD measurements results for 5 MHz channel for PTP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	13.76	13.21	16.50	26.70	10.20
256QAM	5790	13.73	13.13	16.45	26.70	10.25

Table 8.6-23: *Output power measurements results for 45 MHz channel for PTP application*

Modulation	Frequency, MHz	Conducted output power at ch0, dBm	Conducted output power at ch1, dBm	Combined output power, dBm	Power limit, dBm	Power margin, dB
BPSK	5790	21.73	21.53	24.64	26.70	2.06
256QAM	5790	21.94	21.17	24.58	26.70	2.12

Table 8.6-24: *PPSD measurements results for 45 MHz channel for PTP application*

Modulation	Frequency, MHz	PPSD at ch0, dBm/0.5 MHz	PPSD at ch1, dBm/0.5 MHz	Combined PPSD, dBm/0.5 MHz	PPSD limit, dBm/0.5 MHz	PPSD margin, dB
BPSK	5790	3.83	3.35	6.61	26.70	20.09
256QAM	5790	3.94	3.67	6.82	26.70	19.88

Test data, continued

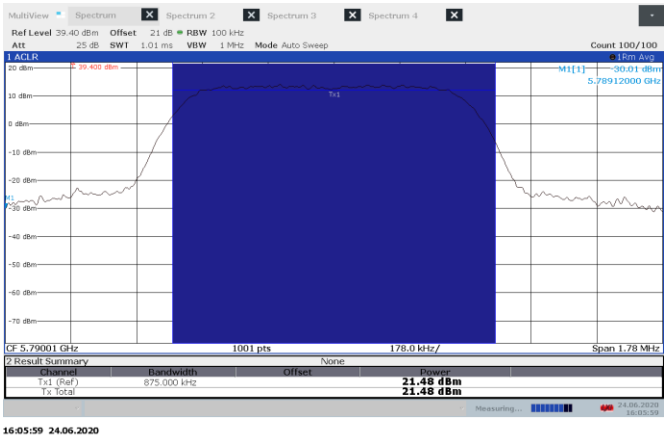

Figure 8.6-1: *Sample plot for output power on 0.875 MHz channel*

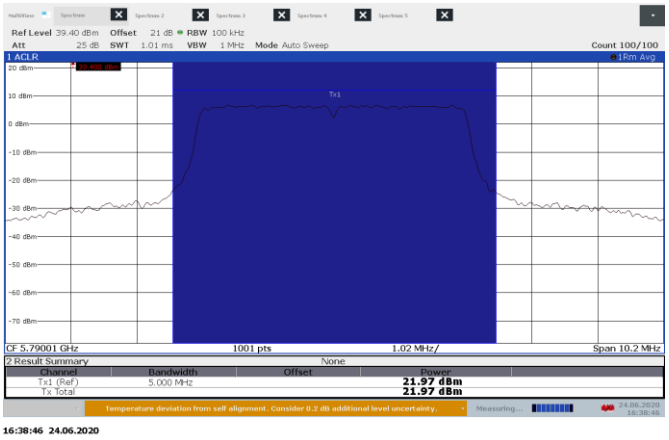

Figure 8.6-2: *Sample plot for output power on 5 MHz channel*

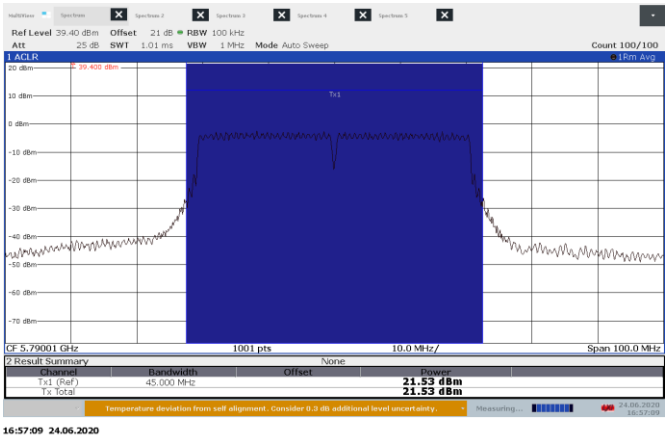

Figure 8.6-3: *Sample plot for output power on 45 MHz channel*

Test data, continued

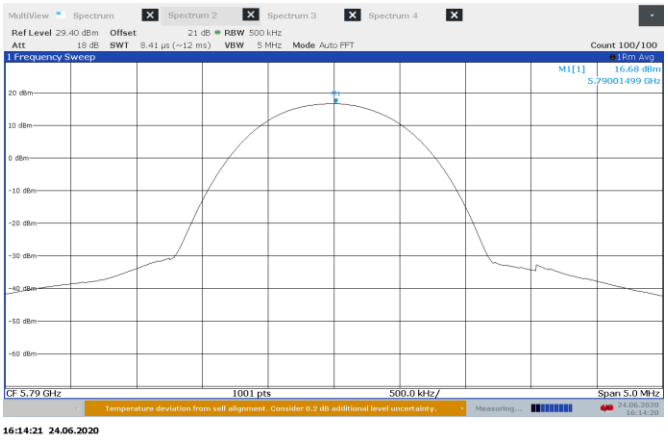

Figure 8.6-4: *Sample plot for PPSD on 0.875 MHz channel*

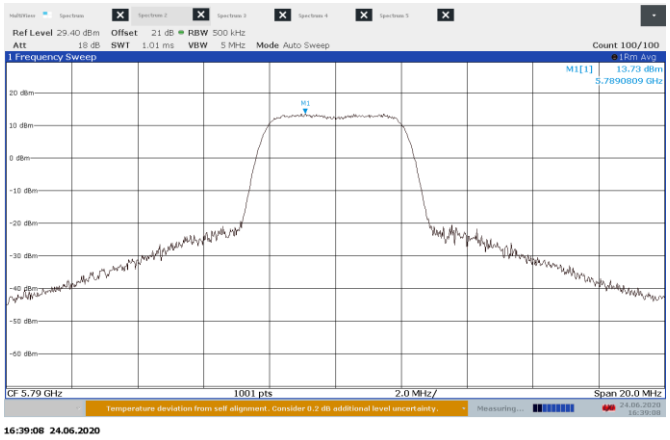

Figure 8.6-5: *Sample plot for PPSD on 5 MHz channel*

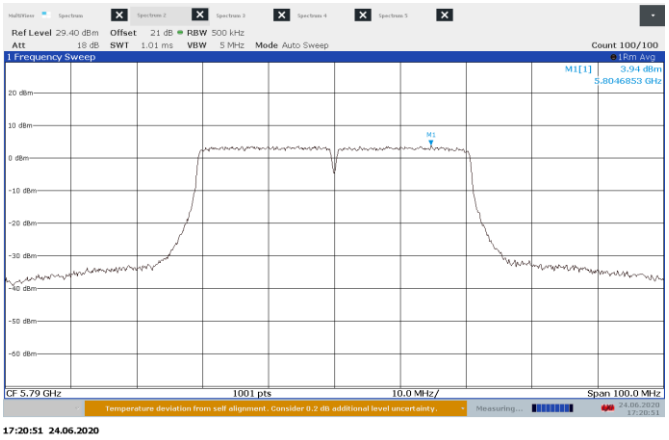

Figure 8.6-6: *Sample plot for PPSD on 45 MHz channel*

8.7 Spurious unwanted (undesirable) emissions

8.7.1 References, definitions and limits

FCC §15.407:

(b) Undesirable emission limits.
Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(4) For transmitters operating in the 5.725–5.85 GHz band:

(i) All emissions 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 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 the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

RSS-247, Clause 6.2:

Power and unwanted emissions limits
The power and e.i.r.p. of the equipment unwanted emission shall be measured in peak value. However, the equipment is required to comply with the provisions in RSS-Gen with respect to emissions falling within restricted frequency bands which are listed in the same standard.
If the transmission is in bursts, the provisions of RSS-Gen for pulsed operation shall apply.
The outermost carrier frequencies or channels shall be used when measuring unwanted emissions. Such carrier or channel centre frequencies are to be indicated in the test report.

6.2.4 Frequency band 5725–5850 MHz

6.2.4.2 Unwanted emission limits
Devices operating in the band 5725–5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

a. 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
b. 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
c. 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to −27 dBm/MHz at 75 MHz above or below the band edges; and
d. −27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

Table 8.7-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

	Field strength of emissions		
Frequency, MHz	**µV/m**	**dBµV/m**	**Measurement distance, m**
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

References, definitions and limits, continued

Table 8.7-2: *ISED restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	12.57675–12.57725	399.9–410	7.25–7.75
0.495–0.505	13.36–13.41	608–614	8.025–8.5
2.1735–2.1905	16.42–16.423	960–1427	9.0–9.2
3.020–3.026	16.69475–16.69525	1435–1626.5	9.3–9.5
4.125–4.128	16.80425–16.80475	1645.5–1646.5	10.6–12.7
4.17725–4.17775	25.5–25.67	1660–1710	13.25–13.4
4.20725–4.20775	37.5–38.25	1718.8–1722.2	14.47–14.5
5.677–5.683	73–74.6	2200–2300	15.35–16.2
6.215–6.218	74.8–75.2	2310–2390	17.7–21.4
6.26775–6.26825	108–138	2483.5–2500	22.01–23.12
6.31175–6.31225	149.9–150.05	2655–2900	23.6–24.0
8.291–8.294	156.52475–156.52525	3260–3267	31.2–31.8
8.362–8.366	156.7–156.9	3332–3339	36.43–36.5
8.37625–8.38675	162.0125–167.17	3345.8–3358	
8.41425–8.41475	167.72–173.2	3500–4400	Above 38.6
12.29–12.293	240–285	4500–5150	
12.51975–12.52025	322–335.4	5350–5460	

Note: Certain frequency bands listed in Table 8.7-2 and above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

Table 8.7-3: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.7.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	June 16, 2020

8.7.3 Observations, settings and special notes

- As part of the current assessment, the test range of 9 kHz to 40 GHz has been fully considered and compared to the actual frequencies utilized within the EUT. Since the EUT contains a transmitter in the GHz range, the EUT has been deemed compliant without formal testing in the 9 kHz to 30 MHz test range, therefore formal test results (tabular data and/or plots) are not provided within this test report.
- EUT was set to transmit with 95 % duty cycle. The EUT was transmitting on both MIMO chains simultaneously
- Radiated measurements were performed at a distance of 3 m up to 18 GHz, at 1 m above 18 GHz (with added distance correction factor).
- The spurious emission was tested per ANSI C63.10, Clause 12.7 and 789033 D02, Clause II(G).

Spectrum analyser for peak conducted measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser for peak conducted measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser for average conducted measurements within restricted bands above 1 GHz for frequencies where peak results were above the average limit:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 MHz
Detector mode:	RMS
Trace mode:	Power average
Number of averaging traces:	100

Spectrum analyser for peak conducted measurements outside restricted bands:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.7.4 Test data

Table 8.7-4: *Radiated field strength at mask band edges measurement results for Point-to-Multipoint operation*

Channel width, MHz	Antenna gain, dBi	Channel	Emission frequency, MHz	Peak Field strength, dBµV/m	EIRPSD, dBm/MHz	EIRPSD limit, dBm/MHz	Margin, dB
0.875	10	Low	5650	44.37	-50.86	-27.00	23.86
0.875	10	High	5925	42.88	-52.35	-27.00	25.35
0.875	24	Low	5650	43.33	-51.90	-27.00	24.90
0.875	24	High	5925	42.24	-52.99	-27.00	25.99
0.875	32	Low	5650	42.03	-53.20	-27.00	26.20
0.875	32	High	5925	41.22	-54.01	-27.00	27.01
5	10	Low	5650	43.44	-51.79	-27.00	24.79
5	10	High	5925	43.10	-52.13	-27.00	25.13
5	24	Low	5650	41.69	-53.54	-27.00	26.54
5	24	High	5925	42.73	-52.50	-27.00	25.50
5	32	Low	5650	40.88	-54.35	-27.00	27.35
5	32	High	5925	41.21	-54.02	-27.00	27.02
45	10	Low	5650	50.30	-44.93	-27.00	17.93
45	10	High	5925	52.40	-42.83	-27.00	15.83
45	24	Low	5650	41.98	-53.25	-27.00	26.25
45	24	High	5925	50.17	-45.06	-27.00	18.06
45	32	Low	5650	41.35	-53.88	-27.00	26.88
45	32	High	5925	41.99	-53.24	-27.00	26.24

Notes: EIRPSD (EIRP Peak power density) was calculated from peak Field strength (FS) measured with 1 MHz RBW at 3 m distance as follows:
EIRPSD [dBm/MHz] = FS [dBµV/m] – 95.23 [dB]

The rest of the radiated spurious emissions were more than 15 dB below the limits.

Table 8.7-5: *Radiated field strength at mask band edges measurement results for Point-to-Point operation*

Channel width, MHz	Antenna gain, dBi	Channel	Emission frequency, MHz	Peak Field strength, dBµV/m	EIRPSD, dBm/MHz	EIRPSD limit, dBm/MHz	Margin, dB
0.875	10	Low	5650	44.37	-50.86	-27.00	23.86
0.875	10	High	5925	42.88	-52.35	-27.00	25.35
0.875	24	Low	5650	54.75	-40.48	-27.00	13.48
0.875	24	High	5925	52.86	-42.37	-27.00	15.37
0.875	32	Low	5650	57.57	-37.66	-27.00	10.66
0.875	32	High	5925	58.08	-37.15	-27.00	10.15
5	10	Low	5650	43.44	-51.79	-27.00	24.79
5	10	High	5925	43.10	-52.13	-27.00	25.13
5	24	Low	5650	53.84	-41.39	-27.00	14.39
5	24	High	5925	53.67	-41.56	-27.00	14.56
5	32	Low	5650	56.52	-38.71	-27.00	11.71
5	32	High	5925	58.52	-36.71	-27.00	9.71
45	10	Low	5650	50.30	-44.93	-27.00	17.93
45	10	High	5925	52.40	-42.83	-27.00	15.83
45	24	Low	5650	60.71	-34.52	-27.00	7.52
45	24	High	5925	61.90	-33.33	-27.00	6.33
45	32	Low	5650	60.56	-34.67	-27.00	7.67
45	32	High	5925	61.56	-33.67	-27.00	6.67

Test data, continued

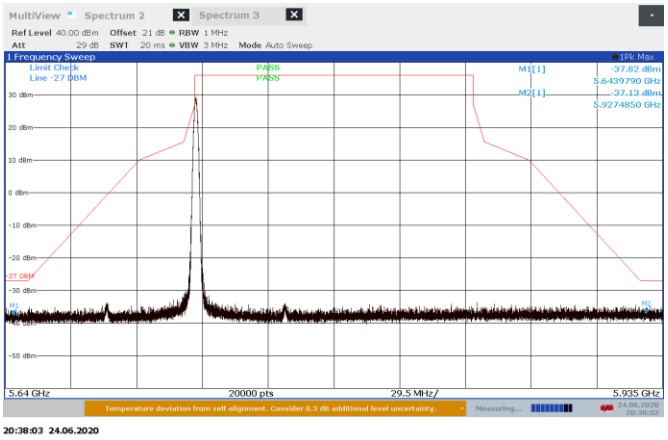

Figure 8.7-1: *Conducted spurious emissions mask, 0.875 MHz low channel at ch0*

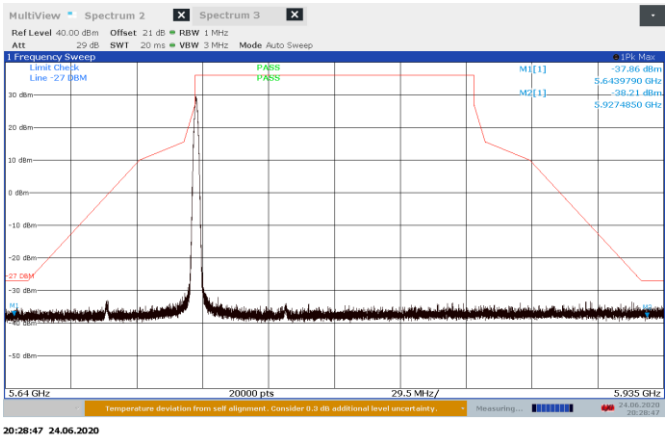

Figure 8.7-2: *Conducted spurious emissions mask, 0.875 MHz low channel at ch1*

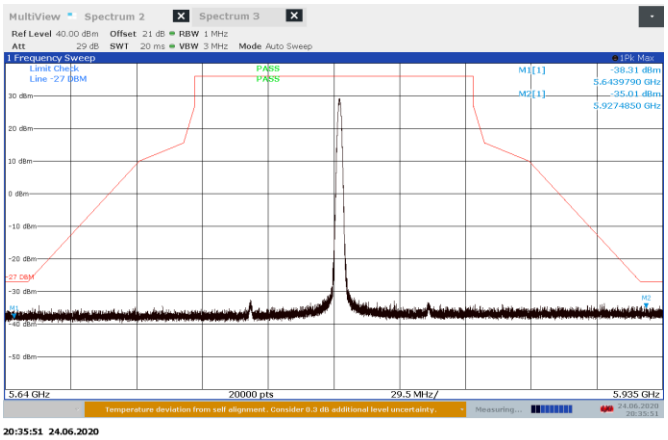

Figure 8.7-3: *Conducted spurious emissions mask, 0.875 MHz mid channel at ch0*

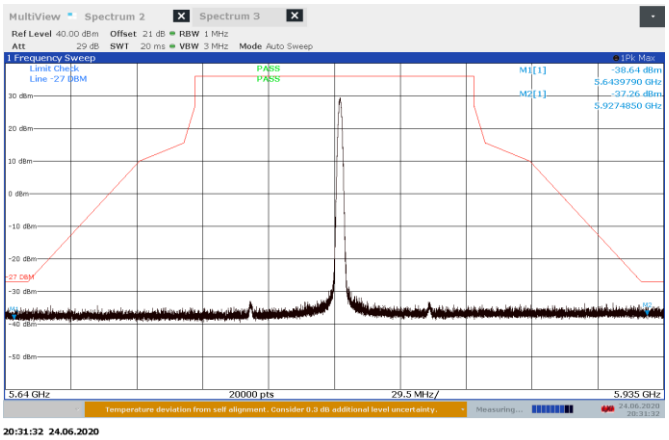

Figure 8.7-4: *Conducted spurious emissions mask, 0.875 MHz mid channel at ch1*

Test data, continued

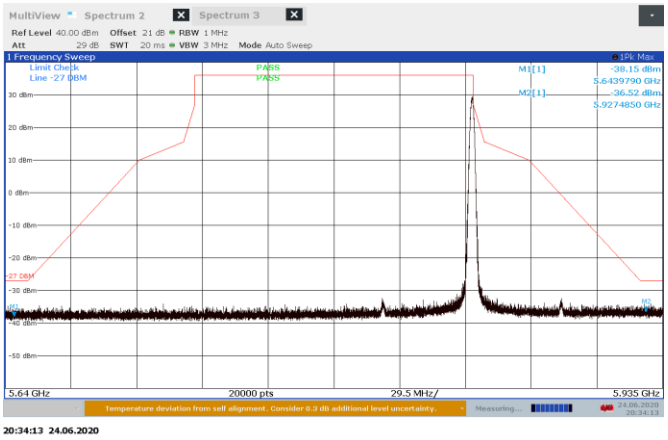

Figure 8.7-5: *Conducted spurious emissions mask, 0.875 MHz high channel at ch0*

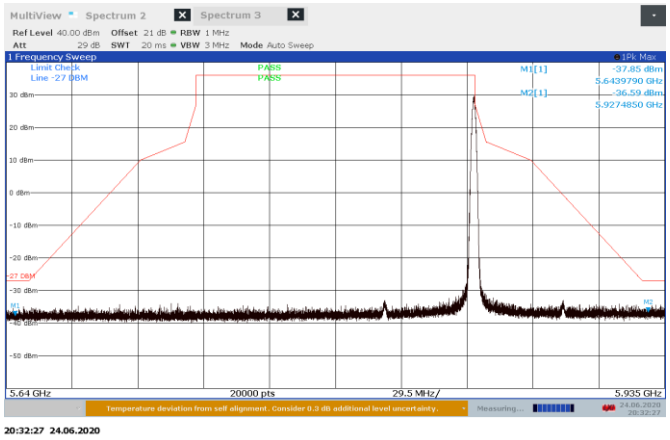

Figure 8.7-6: *Conducted spurious emissions mask, 0.875 MHz high channel at ch1*

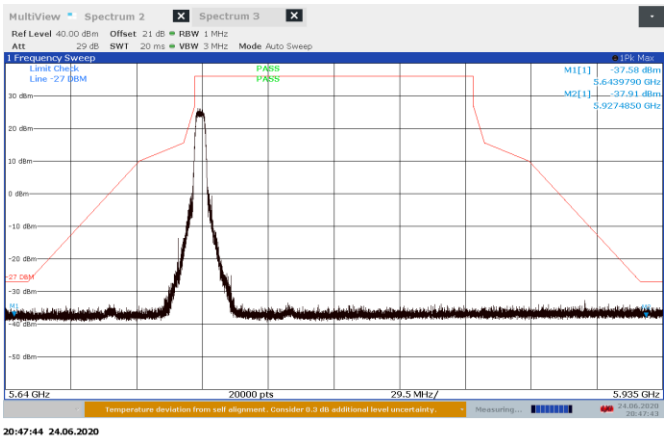

Figure 8.7-7: *Conducted spurious emissions mask, 5 MHz low channel at ch0*

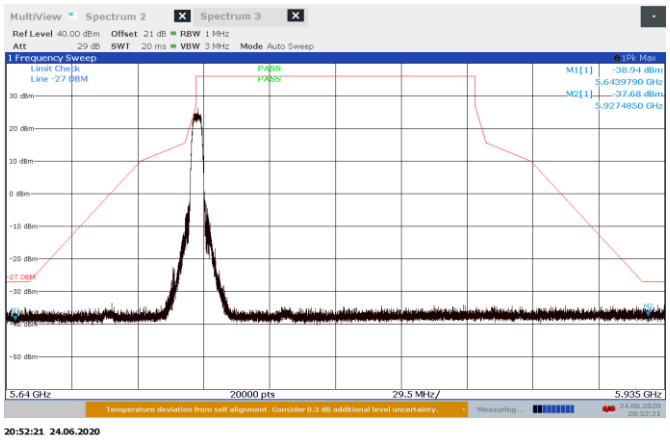

Figure 8.7-8: *Conducted spurious emissions mask, 5 MHz low channel at ch1*

Test data, continued

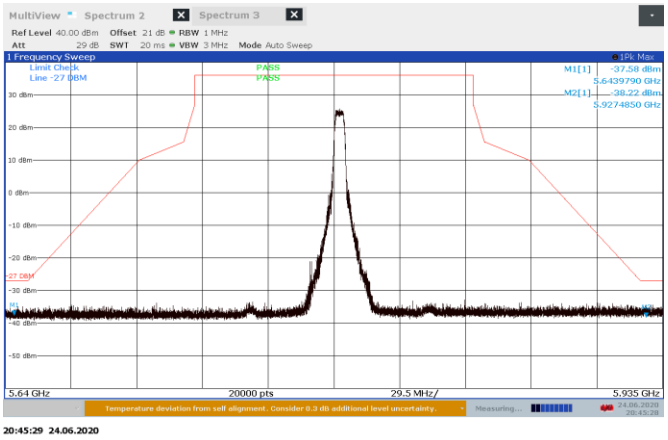

Figure 8.7-9: *Conducted spurious emissions mask, 5 MHz mid channel at ch0*

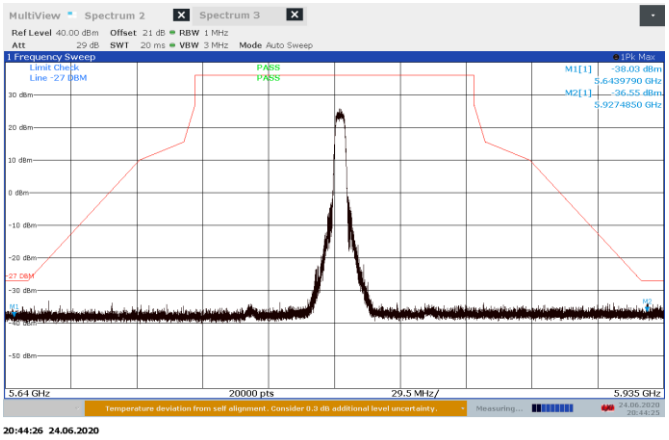

Figure 8.7-10: *Conducted spurious emissions mask, 5 MHz mid channel at ch1*

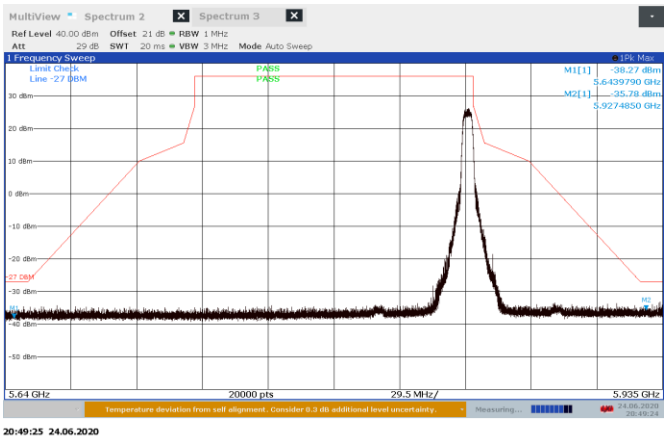

Figure 8.7-11: *Conducted spurious emissions mask, 5 MHz high channel at ch0*

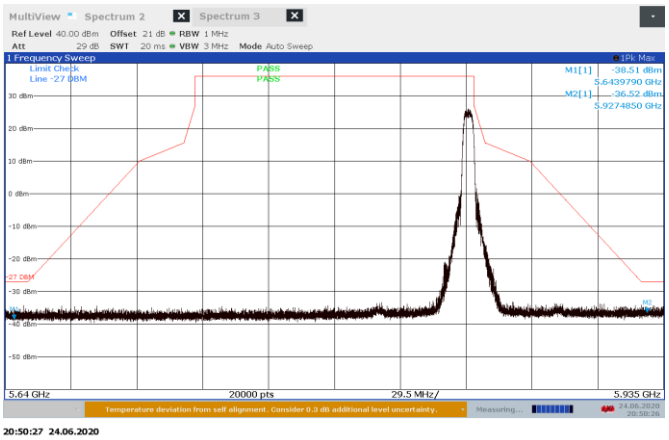

Figure 8.7-12: *Conducted spurious emissions mask, 5 MHz high channel at ch1*

Test data, continued

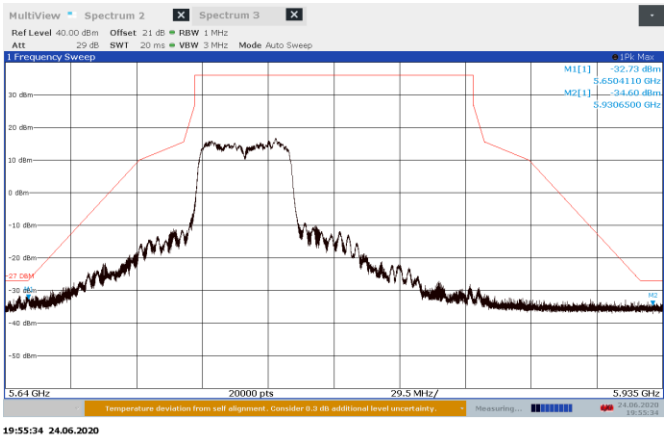

Figure 8.7-13: *Conducted spurious emissions mask, 45 MHz low channel at ch0*

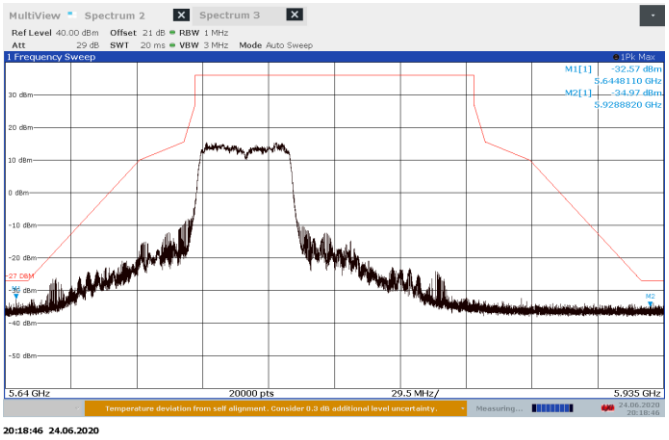

Figure 8.7-14: *Conducted spurious emissions mask, 45 MHz low channel at ch1*

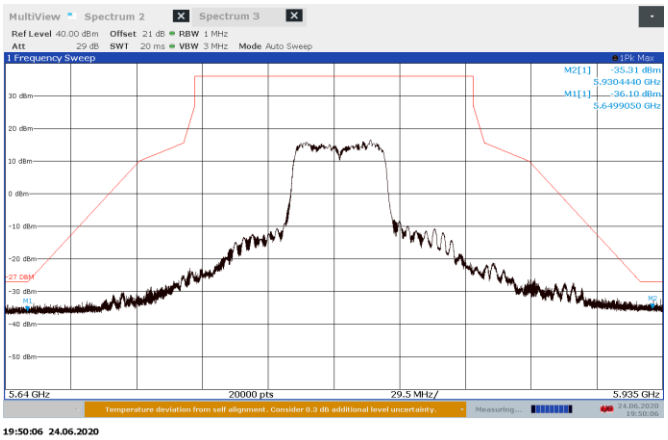

Figure 8.7-15: *Conducted spurious emissions mask, 45 MHz mid channel at ch0*

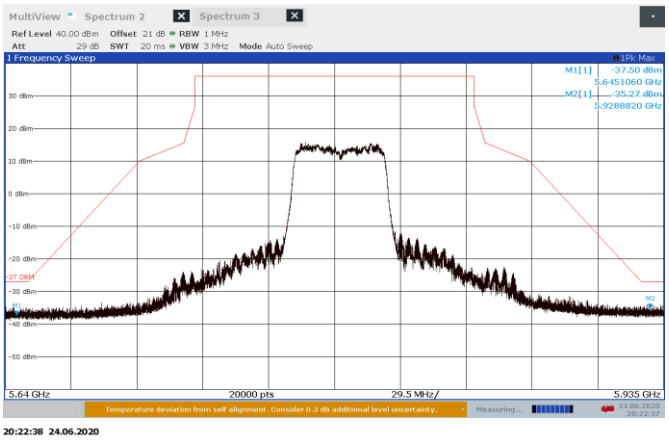

Figure 8.7-16: *Conducted spurious emissions mask, 45 MHz mid channel at ch1*

Test data, continued

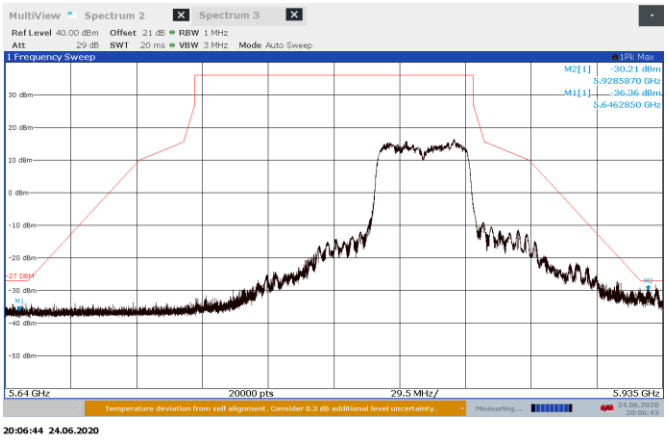

Figure 8.7-17: *Conducted spurious emissions mask, 45 MHz high channel at ch0*

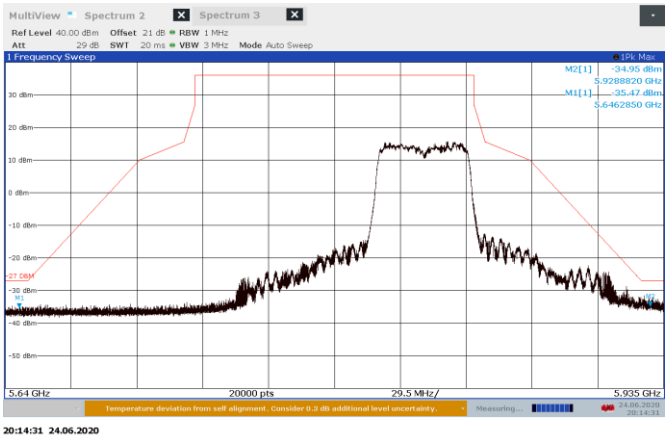

Figure 8.7-18: *Conducted spurious emissions mask, 45 MHz high channel at ch1*

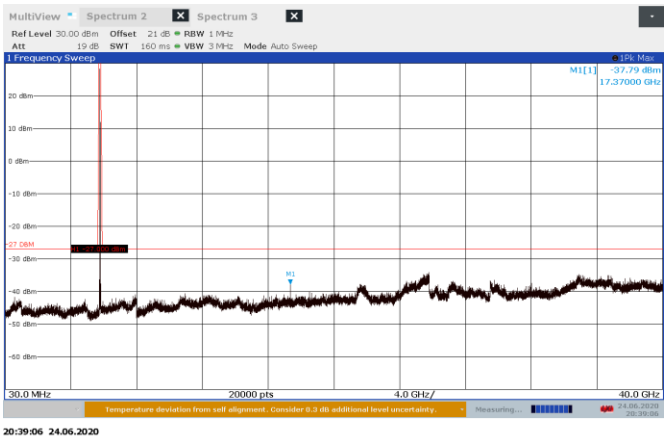

Figure 8.7-19: *Conducted spurious emissions up to 40 GHz, 0.875 MHz channel at ch0*

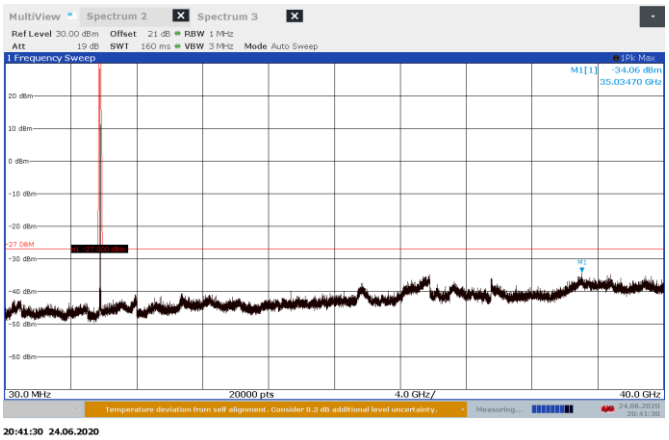

Figure 8.7-20: *Conducted spurious emissions up to 40 GHz, 0.875 MHz channel at ch1*

Test data, continued

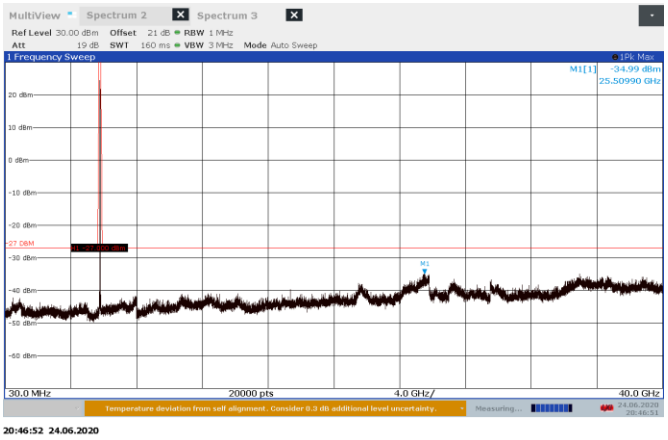

Figure 8.7-21: *Conducted spurious emissions up to 40 GHz, 5 MHz channel at ch0*

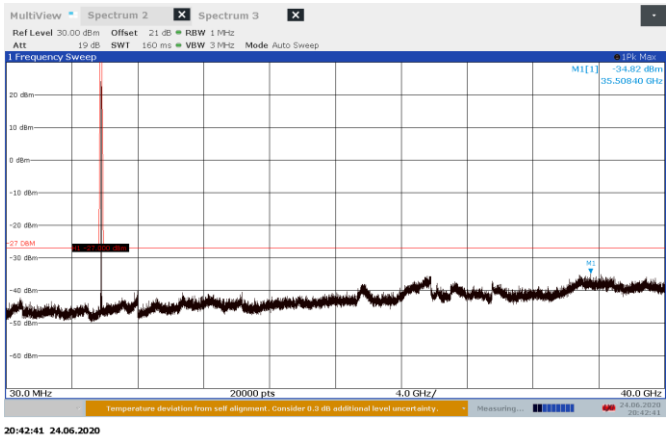

Figure 8.7-22: *Conducted spurious emissions up to 40 GHz, 5 MHz channel at ch1*

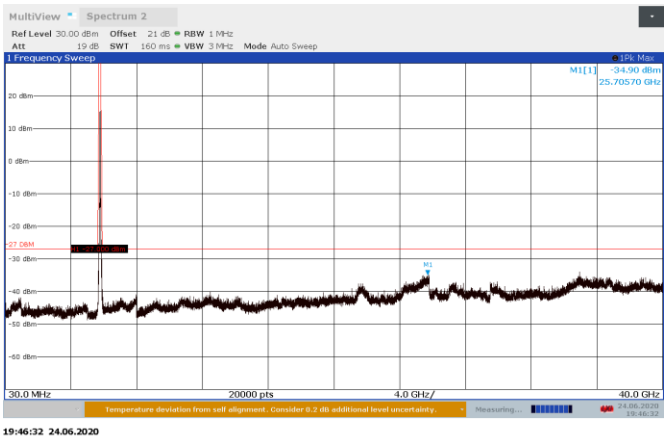

Figure 8.7-23: *Conducted spurious emissions up to 40 GHz, 45 MHz channel at ch0*

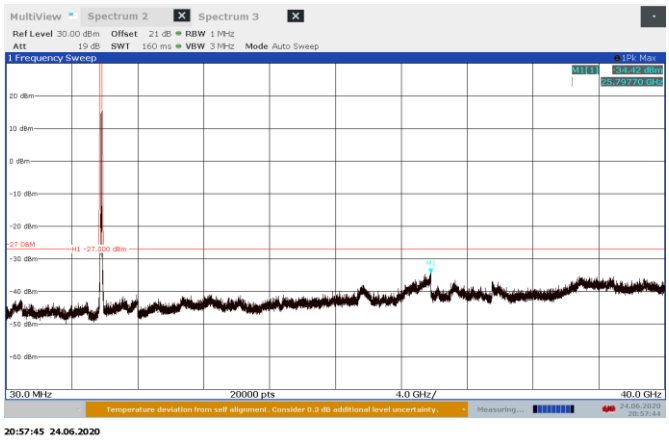

Figure 8.7-24: *Conducted spurious emissions up to 40 GHz, 45 MHz channel at ch1*

End of the test report