

Test report

316884-1TRFWL

Date of issue: November 10, 2016

Applicant:

Redline Communications

Product:

Broad-band wireless infrastructure product

Model:

RDL-3000-RMG

FCC ID:

QC8-RDL3000RMG

IC Registration number:

4310A-RDL3000RMG

Specifications:

◆ **FCC 47 CFR Part 15 Subpart E, §15.407**


Unlicensed National Information Infrastructure Devices

◆ **RSS-247, Issue 1, Section 6, May 2015**

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs)
and Licence-Exempt Local Area Network (LE-LAN) Devices

Test location

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Website	www.nemko.com
Site number	FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	Andrey Adelberg, Senior Wireless/EMC Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Review date	November 10, 2016
Reviewer signature	

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 contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Table of contents

Table of contents	3
Section 1. Report summary	4
1.1 Applicant and manufacturer	4
1.2 Test specifications	4
1.3 Test methods	4
1.4 Statement of compliance	4
1.5 Exclusions	4
1.6 Test report revision history	4
Section 2. Summary of test results	5
2.1 FCC Part 15 Subpart C, general requirements test results	5
2.2 FCC Part 15 Subpart E, test results	5
2.3 RSS-Gen, Issue 4, test results	5
2.4 IC RSS-247, Issue 1, test results	6
Section 3. Equipment under test (EUT) details	7
3.1 Sample information	7
3.2 EUT information	7
3.3 Technical information	7
3.4 Product description and theory of operation	7
3.5 EUT exercise details	7
3.6 EUT setup diagram	8
3.7 EUT sub assemblies	8
Section 4. Engineering considerations	9
4.1 Modifications incorporated in the EUT	9
4.2 Technical judgment	9
4.3 Deviations from laboratory tests procedures	9
Section 5. Test conditions	10
5.1 Atmospheric conditions	10
5.2 Power supply range	10
Section 6. Measurement uncertainty	11
6.1 Uncertainty of measurement	11
Section 7. Test equipment	12
7.1 Test equipment list	12
Section 8. Testing data	13
8.1 FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits	13
8.2 FCC 15.407(b) and RSS-247 6.2.4 (2) Spurious (out-of-band) emissions	23
Section 9. Block diagrams of test set-ups	39
9.1 Radiated emissions set-up for frequencies below 1 GHz	39
9.2 Radiated emissions set-up for frequencies above 1 GHz	40

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Redline Communications
Address	302 Town Center Blvd., Markham, ON, Canada, L3R 0E8

1.2 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407	Unlicensed National Information Infrastructure Devices
RSS-247, Issue 1	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

789033 D02 General UNII Test Procedures New Rules v01r03 (August 22, 2016)	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
FCC 16-24 (March 2, 2016)	Memorandum opinion and order for U-NII-3 (5.725–5.85 GHz) band
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

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. 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 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.31(e)	Variation of power source	Pass ¹
§15.203	Antenna requirement	Pass ²

Notes: ¹ Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

² The EUT is a professionally installed equipment.

2.2 FCC Part 15 Subpart E, test results

Part	Test description	Verdict
§15.403(i)	Emission bandwidth	Pass
§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	Pass
§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	Pass
§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

2.3 RSS-Gen, Issue 4, test results

Part	Test description	Verdict
6.6	Occupied Bandwidth	Pass
7.1.2 ¹	Receiver radiated emission limits	Not applicable
7.1.3 ¹	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Pass
8.11 ²	Frequency stability	Pass

Notes: ¹ According to sections 5.2 and 5.3 of RSS-Gen, Issue 4: if EUT does not have a stand-alone receiver neither scanner receiver, then it exempt from receiver requirements.

² According to section 8.11 of RSS-Gen, Issue 4: if the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required

2.4 IC RSS-247, Issue 1, test results

Section	Test description	Verdict
6.1 (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
6.2.3 (1)	Power limits 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	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 (2)	TPC requirements for devices with a maximum e.i.r.p. greater than 500 mW	Not applicable
6.2.2 (3)	e.i.r.p. at different elevations restrictions for 5250–5350 MHz band	Not applicable
6.2.3 (2)	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: 802.11a, 802.11n HT20 and 802.11n HT40

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	June 27, 2016
Nemko sample ID number	133-002686

3.2 EUT information

Product name	Broad-band wireless infrastructure product
Model	RDL-3000-RMG
Serial number	149PC12480006

3.3 Technical information

Applicant IC company number	4310A
IC UPN number	RDL3000RMG
All used IC test site(s) Reg. number	2040A-4
RSS number and Issue number	RSS-247 Issue 1, Section 6, May 2015
Frequency band	5725–5850 MHz
Frequency Min (MHz)	5727.5 (5 MHz channel), 5730 (10 MHz channel), 5735 (20 MHz channel)
Frequency Max (MHz)	5847.5 (5 MHz channel), 5845 (10 MHz channel), 5840 (20 MHz channel)
RF power Max (W), Conducted	0.242 (23.84 dBm for 5 MHz channel), 0.244 (23.87 dBm for 10 MHz channel), 0.284 (24.53 dBm for 20 MHz channel),
Field strength, Units @ distance	N/A
Measured BW (kHz) (26 dB)	4690 (5 MHz channel), 9290 (10 MHz channel), 18750 (20 MHz channel)
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	BPSK, QPSK, 16-QAM, 64-QAM, 128-QAM, 256-QAM
Emission classification (F1D, G1D, D1D)	W7D
Transmitter spurious, Units @ distance	45.08 dB μ V/m (average) at 11.695 GHz @ 3 m
Power requirements	48 V _{DC} PoE via 120 V _{AC} , 60 Hz
Antenna information	19 dBi Dual Polarization/ Dual Slant Subscriber Antenna 4.9–6.1 GHz, Redline 30-00328-50 10 dBi L-COM HG5158DP-10U, L-COM 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 The EUT is professionally installed.

3.4 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 5725–5850 MHz band.

3.5 EUT exercise details

The EUT was controlled to transmit at desired frequency and modulation from laptop using web interface at IP address: 192.168.25.2

3.6 EUT setup diagram

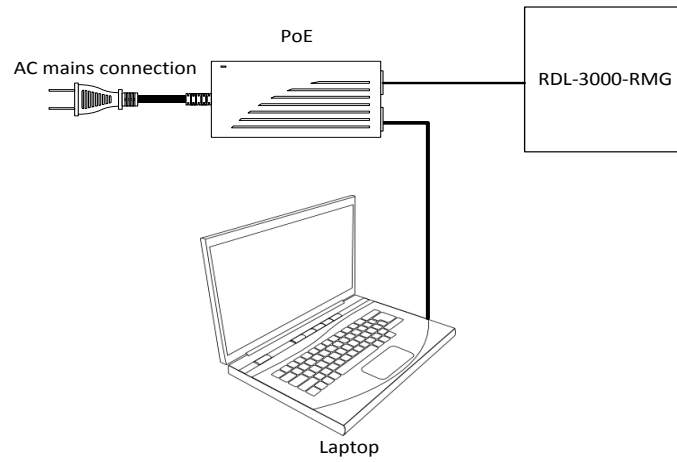


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
PoE	Cincon Electronics Co.	TRG60A-POE-L	1127

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 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.

5.2 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 $\pm 5\%$, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

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

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

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	Dec. 01/16
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
AC Power source	Chenwa	2700M-10k	FA002716	—	VOU
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/17
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Apr. 15/17
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 28/17
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 26/17
Horn antenna 18–40 GHz	EMCO	3116	FA001847	1 year	Apr.15/17
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	April 26/17
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Pre-amplifier (26–40 GHz)	Narda	DBL-2640N610	FA001556	—	VOU
LISN	Rohde & Schwarz	ENV216	FA002023	1 year	Mar. 08/17
Temperature chamber	Espec	EPX-4H	FA002735	1 year	Jan 26/17

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

Section 8. Testing data

8.1 FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits

8.1.1 Definitions and limits

FCC:

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.

IC:

The maximum conducted output power shall not exceed 1 W. The 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 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.

8.1.2 Test summary

Test date:	June 28, 2016	Temperature:	21 °C
Test engineer:	Andrey Adelberg	Air pressure:	1010 mbar
Verdict:	Pass	Relative humidity:	31 %

8.1.3 Observations, settings and special notes

The test was performed according to guidelines section E.2.b Method SA-1: power averaging (rms) detection with slow sweep and EUT transmitting continuously at full power.

EBW (26 dB BW) for 5 MHz channel is 4.78 MHz, for 10 MHz channel is 9.39 MHz and for 20 MHz channel is 18.59 MHz.

For the channel power measurements, span was set to 150 % of EBW: for 5 MHz channel the span was 7.2 MHz, for 10 MHz channel the span was 14 MHz and for 20 MHz channel the span was set to 28 MHz.

Output power calculation for 10 dBi antenna: 30 dBm – (10 dBi – 6 dBi) = 26 dBm; for 19 dBi antenna: 30 dBm – (19 dBi – 6 dBi) = 17 dBm and for 32 dBi antenna: 30 dBm – (32 dBi – 6 dBi) = 4 dBm.

Combined average output power was calculated as follows:

$$P_{combined} = 10 \times \log_{10} \left((10^{P_{cho}/10}) + (10^{P_{ch1}/10}) \right)$$

EIRP was calculated as follows:

$$EIRP = P_{combined} + \text{antenna gain}$$

For antennas with the directional gain greater than 6 dBi, the maximum power spectral density limit was calculated as follows:

For 10 dBi antenna: 30 dBm/500 kHz – (10 dBi – 6 dBi) = 26 dBm/500 kHz; for 19 dBi antenna: 30 dBm/500 kHz – (19 dBi – 6 dBi) = 17 dBm/500 kHz and for 32 dBi antenna: 30 dBm/500 kHz – (32 dBi – 6 dBi) = 4 dBm/500 kHz.



8.1.4 Test data

Table 8.1-1: Output power measurements and EIRP calculations results for 5 MHz channel and PMP 10 dBi (and PTP 19 and 24 dBi) antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5727.5	17.63	17.39	20.52	26.00	5.48	10.00	30.52	36.00	5.48
	5790.0	20.72	20.84	23.79	26.00	2.21	10.00	33.79	36.00	2.21
	5847.5	18.77	19.31	22.06	26.00	3.94	10.00	32.06	36.00	3.94
256-QAM	5727.5	17.64	17.14	20.41	26.00	5.59	10.00	30.41	36.00	5.59
	5790.0	20.77	20.89	23.84	26.00	2.16	10.00	33.84	36.00	2.16
	5847.5	18.82	18.99	21.92	26.00	4.08	10.00	31.92	36.00	4.08

Table 8.1-2: Output power measurements and EIRP calculations results for 5 MHz channel and PMP 19 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5727.5	12.67	12.45	15.57	17.00	1.43	19.00	34.57	36.00	1.43
	5790.0	12.42	12.07	15.26	17.00	1.74	19.00	34.26	36.00	1.74
	5847.5	12.08	13.47	15.84	17.00	1.16	19.00	34.84	36.00	1.16
256-QAM	5727.5	12.84	12.13	15.51	17.00	1.49	19.00	34.51	36.00	1.49
	5790.0	12.41	12.22	15.33	17.00	1.67	19.00	34.33	36.00	1.67
	5847.5	12.19	13.00	15.62	17.00	1.38	19.00	34.62	36.00	1.38

Table 8.1-3: Output power measurements and EIRP calculations results for 5 MHz channel and PMP 32 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5727.5	0.04	0.21	3.14	4.00	0.86	32.00	35.14	36.00	0.86
	5790.0	-0.71	0.06	2.70	4.00	1.30	32.00	34.70	36.00	1.30
	5847.5	-0.78	0.38	2.85	4.00	1.15	32.00	34.85	36.00	1.15
256-QAM	5727.5	-0.25	0.47	3.14	4.00	0.86	32.00	35.14	36.00	0.86
	5790.0	-0.64	-0.16	2.62	4.00	1.38	32.00	34.62	36.00	1.38
	5847.5	-0.61	-0.18	2.62	4.00	1.38	32.00	34.62	36.00	1.38

Section 8

Testing data

Test name

FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits

Specification

FCC Part 15 Subpart E and RSS-247 Issue 1



Table 8.1-4: Output power measurements and EIRP calculations results for 10 MHz channel and PMP 10 dBi (and PTP 19 and 24 dBi) antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5730.0	19.49	19.40	22.46	26.00	3.54	10.00	32.46	36.00	3.54
	5790.0	20.82	20.83	23.84	26.00	2.16	10.00	33.84	36.00	2.16
	5845.0	18.85	19.98	22.46	26.00	3.54	10.00	32.46	36.00	3.54
256-QAM	5730.0	19.31	19.34	22.34	26.00	3.66	10.00	32.34	36.00	3.66
	5790.0	20.71	20.84	23.79	26.00	2.21	10.00	33.79	36.00	2.21
	5845.0	18.94	18.84	21.90	26.00	4.10	10.00	31.90	36.00	4.10

Table 8.1-5: Output power measurements and EIRP calculations results for 10 MHz channel and PMP 19 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5730.0	12.63	12.33	15.49	17.00	1.51	19.00	34.49	36.00	1.51
	5790.0	12.45	12.09	15.28	17.00	1.72	19.00	34.28	36.00	1.72
	5845.0	12.10	12.49	15.31	17.00	1.69	19.00	34.31	36.00	1.69
256-QAM	5730.0	12.69	12.30	15.51	17.00	1.49	19.00	34.51	36.00	1.49
	5790.0	12.56	11.91	15.26	17.00	1.74	19.00	34.26	36.00	1.74
	5845.0	12.30	12.04	15.18	17.00	1.82	19.00	34.18	36.00	1.82

Table 8.1-6: Output power measurements and EIRP calculations results for 10 MHz channel and PMP 32 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5730.0	-0.52	-0.81	2.35	4.00	1.65	32.00	34.35	36.00	1.65
	5790.0	-0.45	0.35	2.98	4.00	1.02	32.00	34.98	36.00	1.02
	5845.0	-0.69	0.06	2.71	4.00	1.29	32.00	34.71	36.00	1.29
256-QAM	5730.0	-0.56	-0.51	2.48	4.00	1.52	32.00	34.48	36.00	1.52
	5790.0	-0.63	-0.04	2.69	4.00	1.31	32.00	34.69	36.00	1.31
	5845.0	-0.63	-0.06	2.67	4.00	1.33	32.00	34.67	36.00	1.33

Section 8

Testing data

Test name

FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits

Specification

FCC Part 15 Subpart E and RSS-247 Issue 1



Table 8.1-7: Output power measurements and EIRP calculations results for 20 MHz channel and PMP 10 dBi (and PTP 19 and 24 dBi) antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5735.0	20.80	21.69	24.28	26.00	1.72	10.00	34.28	36.00	1.72
	5790.0	21.47	21.56	24.53	26.00	1.47	10.00	34.53	36.00	1.47
	5840.0	20.30	20.73	23.53	26.00	2.47	10.00	33.53	36.00	2.47
256-QAM	5735.0	21.03	21.80	24.44	26.00	1.56	10.00	34.44	36.00	1.56
	5790.0	21.44	21.49	24.48	26.00	1.52	10.00	34.48	36.00	1.52
	5840.0	20.54	20.77	23.67	26.00	2.33	10.00	33.67	36.00	2.33

Table 8.1-8: Output power measurements and EIRP calculations results for 20 MHz channel and PMP 19 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5735.0	12.05	12.90	15.51	17.00	1.49	19.00	34.51	36.00	1.49
	5790.0	13.11	12.73	15.93	17.00	1.07	19.00	34.93	36.00	1.07
	5840.0	12.93	12.77	15.86	17.00	1.14	19.00	34.86	36.00	1.14
256-QAM	5735.0	12.26	12.95	15.63	17.00	1.37	19.00	34.63	36.00	1.37
	5790.0	13.00	12.71	15.87	17.00	1.13	19.00	34.87	36.00	1.13
	5840.0	12.90	12.74	15.83	17.00	1.17	19.00	34.83	36.00	1.17

Table 8.1-9: Output power measurements and EIRP calculations results for 20 MHz channel and PMP 32 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5735.0	-0.03	-0.29	2.85	4.00	1.15	32.00	34.85	36.00	1.15
	5790.0	0.16	-0.54	2.83	4.00	1.17	32.00	34.83	36.00	1.17
	5840.0	0.00	-0.50	2.77	4.00	1.23	32.00	34.77	36.00	1.23
256-QAM	5735.0	-0.03	-0.24	2.88	4.00	1.12	32.00	34.88	36.00	1.12
	5790.0	-0.07	-0.42	2.77	4.00	1.23	32.00	34.77	36.00	1.23
	5840.0	-0.01	-0.51	2.76	4.00	1.24	32.00	34.76	36.00	1.24

Section 8

Testing data

Test name

FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits

Specification

FCC Part 15 Subpart E and RSS-247 Issue 1



Table 8.1-10: Output power measurements for 5 MHz channel and PTP 32 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5727.5	17.63	17.39	20.52	30.00	9.48
	5790.0	18.72	18.84	21.79	30.00	8.21
	5847.5	18.77	19.31	22.06	30.00	7.94
256-QAM	5727.5	17.64	17.14	20.41	30.00	9.59
	5790.0	18.77	18.89	21.84	30.00	8.16
	5847.5	18.82	18.99	21.92	30.00	8.08

Table 8.1-11: Output power measurements for 10 MHz channel and PTP 32 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5730.0	19.49	19.40	22.46	30.00	7.54
	5790.0	18.82	18.83	21.84	30.00	8.16
	5845.0	18.85	19.98	22.46	30.00	7.54
256-QAM	5730.0	19.31	19.34	22.34	30.00	7.66
	5790.0	18.71	18.84	21.79	30.00	8.21
	5845.0	18.94	18.84	21.90	30.00	8.10

Table 8.1-12: Output power measurements for 20 MHz channel and PTP 32 dBi antenna gain

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5735.0	20.80	21.69	24.28	30.00	5.72
	5790.0	19.47	19.56	22.53	30.00	7.47
	5840.0	20.30	20.73	23.53	30.00	6.47
256-QAM	5735.0	21.03	21.80	24.44	30.00	5.56
	5790.0	19.44	19.49	22.48	30.00	7.52
	5840.0	20.54	20.77	23.67	30.00	6.33

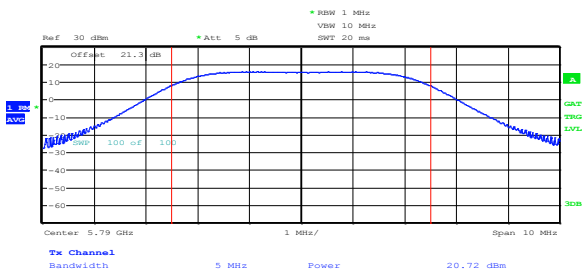


Figure 8.1-1: Sample plot for Power on 5 MHz

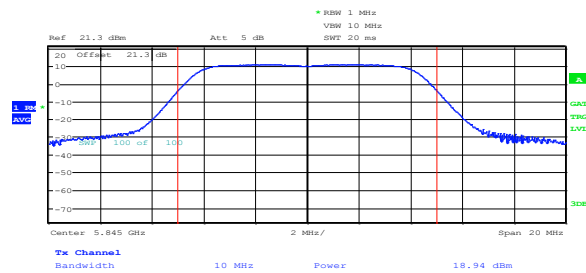
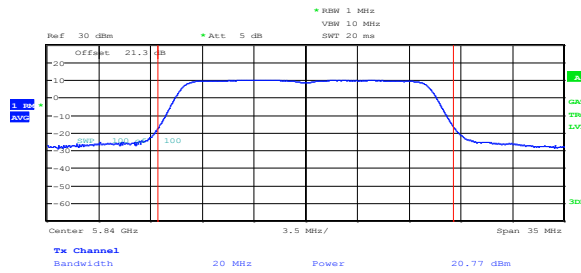


Figure 8.1-2: Sample plot for Power on 10 MHz



Section 8

Testing data

Test name

FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits

Specification

FCC Part 15 Subpart E and RSS-247 Issue 1



Figure 8.1-3: Sample plot for Power on 20 MHz



Table 8.1-13: PSD measurements results for 5 MHz channel and PMP 10 dBi (and PTP 10, 19 and 24 dBi) antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5727.5	9.82	12.04	14.08	26.00	11.92
	5790.0	13.12	13.07	16.11	26.00	9.89
	5847.5	10.79	11.01	13.91	26.00	12.09
256-QAM	5727.5	10.12	9.86	13.00	26.00	13.00
	5790.0	13.23	13.05	16.15	26.00	9.85
	5847.5	10.85	11.09	13.98	26.00	12.02

Table 8.1-14: PSD measurements results for 5 MHz channel and PMP 19 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5727.5	5.06	4.86	7.97	17.00	9.03
	5790.0	4.69	4.18	7.45	17.00	9.55
	5847.5	4.06	5.06	7.60	17.00	9.40
256-QAM	5727.5	5.12	4.82	7.98	17.00	9.02
	5790.0	4.74	4.10	7.44	17.00	9.56
	5847.5	4.12	5.16	7.68	17.00	9.32

Table 8.1-15: PSD measurements results for 5 MHz channel and PMP 24 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5727.5	-8.02	-7.41	-4.69	12.00	16.69
	5790.0	-8.35	-7.87	-5.09	12.00	17.09
	5847.5	-8.72	-8.13	-5.40	12.00	17.40
256-QAM	5727.5	-8.08	-7.44	-4.74	12.00	16.74
	5790.0	-8.25	-8.06	-5.14	12.00	17.14
	5847.5	-8.72	-7.93	-5.30	12.00	17.30

Table 8.1-16: PSD measurements results for 5 MHz channel and PMP 32 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5727.5	-8.02	-7.41	-4.69	4.00	8.69
	5790.0	-8.35	-7.87	-5.09	4.00	9.09
	5847.5	-8.72	-8.13	-5.40	4.00	9.40
256-QAM	5727.5	-8.08	-7.44	-4.74	4.00	8.74
	5790.0	-8.25	-8.06	-5.14	4.00	9.14
	5847.5	-8.72	-7.93	-5.30	4.00	9.30

Table 8.1-17: PSD measurements results for 10 MHz channel and PMP 10 dBi (and PTP 10, 19 and 24 dBi) antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5730.0	8.61	8.87	11.75	26.00	14.25
	5790.0	10.08	10.15	13.13	26.00	12.87
	5845.0	8.14	8.50	11.33	26.00	14.67
256-QAM	5730.0	8.73	8.36	11.56	26.00	14.44
	5790.0	10.12	10.11	13.13	26.00	12.87
	5845.0	8.17	8.28	11.24	26.00	14.76

Section 8

Testing data

Test name

FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits

Specification

FCC Part 15 Subpart E and RSS-247 Issue 1



Table 8.1-18: PSD measurements results for 10 MHz channel and PMP 19 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5730.0	1.96	1.60	4.79	17.00	12.21
	5790.0	1.70	1.25	4.49	17.00	12.51
	5845.0	1.45	1.33	4.40	17.00	12.60
256-QAM	5730.0	1.95	1.40	4.69	17.00	12.31
	5790.0	1.68	1.18	4.45	17.00	12.55
	5845.0	1.45	1.31	4.39	17.00	12.61

Table 8.1-19: PSD measurements results for 10 MHz channel and PMP 24 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5730.0	-11.05	-11.59	-8.30	12.00	20.30
	5790.0	-11.38	-10.90	-8.12	12.00	20.12
	5845.0	-11.38	-10.88	-8.11	12.00	20.11
256-QAM	5730.0	-11.20	-11.51	-8.34	12.00	20.34
	5790.0	-11.54	-11.16	-8.34	12.00	20.34
	5845.0	-11.39	-10.82	-8.09	12.00	20.09

Table 8.1-20: PSD measurements results for 10 MHz channel and PMP 32 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5730.0	-11.05	-11.59	-8.30	4.00	12.30
	5790.0	-11.38	-10.90	-8.12	4.00	12.12
	5845.0	-11.38	-10.88	-8.11	4.00	12.11
256-QAM	5730.0	-11.20	-11.51	-8.34	4.00	12.34
	5790.0	-11.54	-11.16	-8.34	4.00	12.34
	5845.0	-11.39	-10.82	-8.09	4.00	12.09

Table 8.1-21: PSD measurements results for 20 MHz channel and PMP 10 dBi (and PTP 10, 19 and 24 dBi) antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5735.0	7.32	7.92	10.64	26.00	15.36
	5790.0	7.68	7.73	10.72	26.00	15.28
	5840.0	6.78	6.83	9.82	26.00	16.18
256-QAM	5735.0	7.35	7.84	10.61	26.00	15.39
	5790.0	7.79	7.62	10.72	26.00	15.28
	5840.0	6.67	6.94	9.82	26.00	16.18

Table 8.1-22: PSD measurements results for 20 MHz channel and PMP 19 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5735.0	-1.58	-1.00	1.73	17.00	15.27
	5790.0	-0.66	-1.12	2.13	17.00	14.87
	5840.0	-1.03	-1.17	1.91	17.00	15.09
256-QAM	5735.0	-1.42	-1.03	1.79	17.00	15.21
	5790.0	-0.75	-1.16	2.06	17.00	14.94
	5840.0	-0.98	-1.10	1.97	17.00	15.03

Section 8

Testing data

Test name

FCC 15.407(a)(3) and RSS-247 6.2.4 (1) 5.725–5.85 GHz band output power and spectral density limits

Specification

FCC Part 15 Subpart E and RSS-247 Issue 1



Table 8.1-23: PSD measurements results for 20 MHz channel and PMP 24 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5735.0	-13.65	-14.12	-10.87	12.00	22.87
	5790.0	-13.67	-14.40	-11.01	12.00	23.01
	5840.0	-13.95	-14.39	-11.15	12.00	23.15
256-QAM	5735.0	-13.47	-14.28	-10.85	12.00	22.85
	5790.0	-13.89	-14.34	-11.10	12.00	23.10
	5840.0	-13.98	-14.42	-11.18	12.00	23.18

Table 8.1-24: PSD measurements results for 20 MHz channel and PMP 32 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5735.0	-13.65	-14.12	-10.87	4.00	14.87
	5790.0	-13.67	-14.40	-11.01	4.00	15.01
	5840.0	-13.95	-14.39	-11.15	4.00	15.15
256-QAM	5735.0	-13.47	-14.28	-10.85	4.00	14.85
	5790.0	-13.89	-14.34	-11.10	4.00	15.10
	5840.0	-13.98	-14.42	-11.18	4.00	15.18

Table 8.1-25: PSD measurements results for 5 MHz channel and PTP 32 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5727.5	9.82	12.04	14.08	30.00	15.92
	5790.0	11.12	11.07	14.11	30.00	15.89
	5847.5	10.79	11.01	13.91	30.00	16.09
256-QAM	5727.5	10.12	9.86	13.00	30.00	17.00
	5790.0	11.23	11.05	14.15	30.00	15.85
	5847.5	10.85	11.09	13.98	30.00	16.02

Table 8.1-26: PSD measurements results for 10 MHz channel and PTP 32 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5730.0	8.61	8.87	11.75	30.00	18.25
	5790.0	8.08	8.15	11.13	30.00	18.87
	5845.0	8.14	8.50	11.33	30.00	18.67
256-QAM	5730.0	8.73	8.36	11.56	30.00	18.44
	5790.0	8.12	8.11	11.13	30.00	18.87
	5845.0	8.17	8.28	11.24	30.00	18.76

Table 8.1-27: PSD measurements results for 20 MHz channel and PTP 32 dBi antenna gain

Modulation	Frequency, MHz	PSD on ch0, dBm/0.5 MHz	PSD on ch1, dBm/0.5 MHz	Combined PSD, dBm/0.5 MHz	PSD limit, dBm/0.5 MHz	Margin, dB
BPSK	5735.0	7.32	7.92	10.64	30.00	19.36
	5790.0	5.68	5.73	8.72	30.00	21.28
	5840.0	6.78	6.83	9.82	30.00	20.18
256-QAM	5735.0	7.35	7.84	10.61	30.00	19.39
	5790.0	5.79	5.72	8.77	30.00	21.23
	5840.0	6.67	6.94	9.82	30.00	20.18

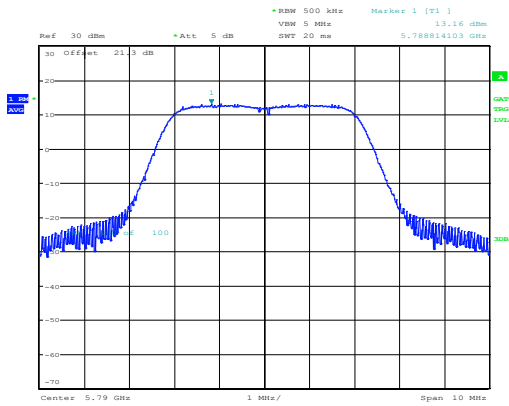


Figure 8.1-4: Sample plot for PSD on 5 MHz

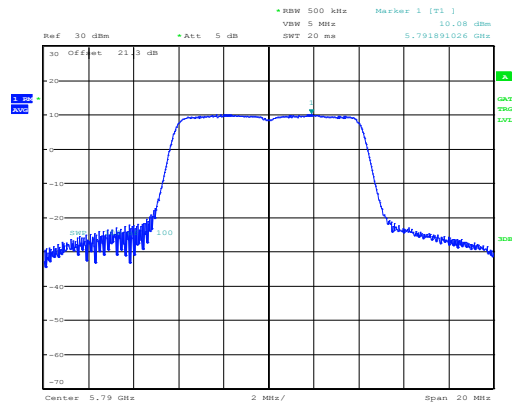


Figure 8.1-5: Sample plot for PSD on 10 MHz

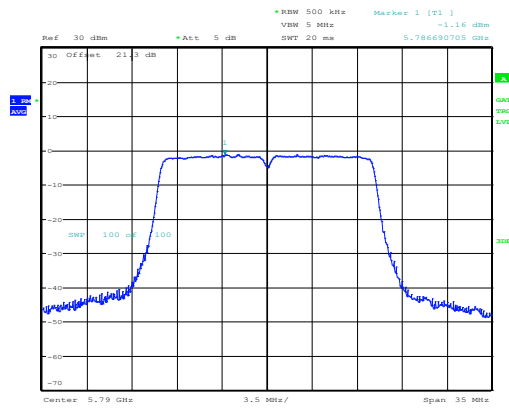


Figure 8.1-6: Sample plot for PSD on 20 MHz

8.2 FCC 15.407(b) and RSS-247 6.2.4 (2) Spurious (out-of-band) emissions

8.2.1 Definitions and limits

FCC:

(4) For transmitters operating in the 5.725–5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of –27 dBm/MHz.

(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.

(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 block edges as the design of the equipment permits.

IC:

For the band 5725–5850 MHz, emissions at frequencies from the band edges to 10 MHz above or below the band edges shall not exceed –17 dBm/MHz e.i.r.p.

For emissions at frequencies more than 10 MHz above or below the band edges, the emissions power shall not exceed –27 dBm/MHz.

RSS-Gen 8.10 Emissions falling within restricted frequency bands

Restricted bands, identified in Table 8.2-2, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:

- (a) fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of below;
- (b) unwanted emissions falling into restricted bands of below shall comply with the limits specified in RSS-Gen;
- (c) unwanted emissions not falling within restricted frequency bands shall either comply with the limits specified in the applicable RSS, or with those specified in RSS-Gen.

FCC 16-24, Memorandum opinion and order, March 2, 2016

(i) All emissions shall be limited to a level of –27 dBm/MHz EIRP at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz EIRP 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 EIRP 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 EIRP at the band edge.

Table 8.2-1: FCC §15.209 and RSS-Gen – Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F (<i>F</i> in kHz)	67.6 – 20 × log ₁₀ (F) (<i>F</i> in kHz)	300
0.490–1.705	24000/F (<i>F</i> in kHz)	87.6 – 20 × log ₁₀ (F) (<i>F</i> in kHz)	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

Table 8.2-2: IC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677–5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

Note: Certain frequency bands listed in Table 8.2-2 and above 38.6 GHz are designated for low-power license-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.2-3: 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			

8.2.2 Test summary

Test date:	June 29, 2016	Temperature:	22 °C
Test engineer:	Andrey Adelberg	Air pressure:	1007 mbar
Verdict:	Pass	Relative humidity:	31 %

8.2.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 40 GHz.

Radiated measurements were performed at a distance of 3 m, the EUT was transmitting on both MIMO chains simultaneously. Cabinet radiation was performed while both antenna connectors were terminated with 50 Ω load.

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

Conducted emissions measurements outside restricted bands were performed on each individual MIMO chain. The reference level offset was adjusted to include antenna directional gain and a compensation of two antenna ports (3 dB):

For 10 dBi antenna reference level was offset by 13 dB, for 19 dBi antenna reference level was offset by 22 dB and for 32 dBi antenna reference level was offset by 35 dB, for 24 dBi antenna reference level was offset by 27 dB

8.2.4 Test data

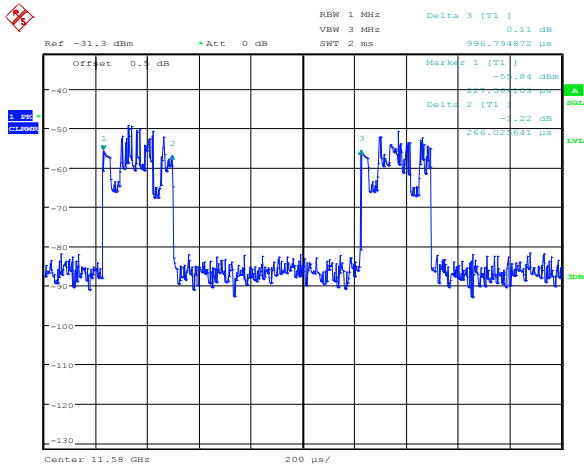


Diagram 8.2-1: Duty cycle for 5 MHz channel

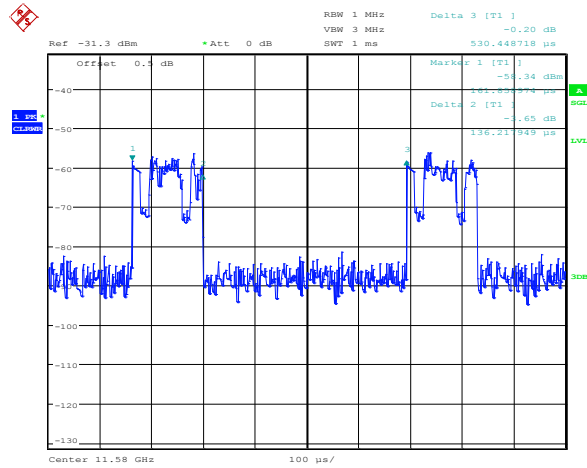


Diagram 8.2-2: Duty cycle for 10 MHz channel

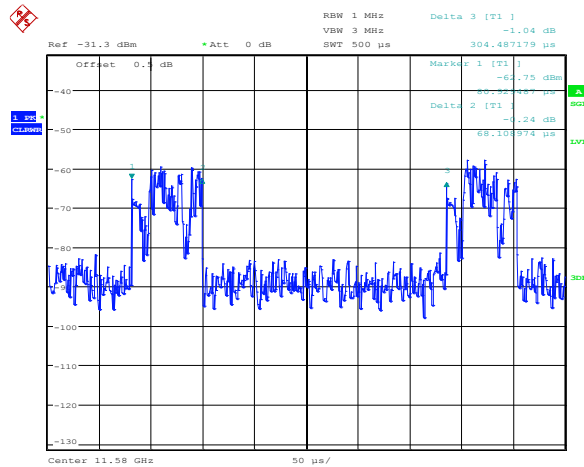


Diagram 8.2-3: Duty cycle for 20 MHz channel

Duty cycle correction factor calculations:

For 5 MHz channel

T_{XON} is 266.03 µs; $T_{XPERIOD}$ is 996.80 µs; Duty cycle = 27%; Correction Factor = $20 \times \log_{10}(0.27) = -11.47$ dB

For 10 MHz channel

T_{XON} is 136.20 µs; $T_{XPERIOD}$ is 530.45 µs; Duty cycle = 26%; Correction Factor = $20 \times \log_{10}(0.26) = -11.81$ dB

For 20 MHz channel

T_{XON} is 68.11 µs; $T_{XPERIOD}$ is 304.49 µs; Duty cycle = 22%; Correction Factor = $20 \times \log_{10}(0.22) = -13.01$ dB

Table 8.2-4: Conducted spurious emissions measurements within restricted bands, 24 dBi PTP antenna results

Channel bandwidth, MHz	Channel	Frequency, MHz	Peak level, dBm	Peak limit, dBm	Peak margin, dB	RMS level, dBm	Duty cycle CF, dB	Corrected RMS, dBm	Average limit, dBm	Average margin, dB
5	Mid	11.580	-32.40	-21.23	11.17	-48.14	5.68	-42.46	-41.23	1.23
10	Mid	11.580	-30.83	-21.23	9.60	-49.38	5.85	-43.53	-41.23	2.30
20	Mid	11.580	-32.79	-21.23	11.56	-50.54	6.57	-43.97	-41.23	2.74

Note: Peak and RMS levels are based on sum of power level, multiple antenna ports factor (3 dB) and antenna gain of 24 dBi.

Duty cycle RMS correction factor for 5 MHz channel = $10 \times \text{Log}_{10}(1/0.27) = 5.68$ dB

Duty cycle RMS correction factor for 10 MHz channel = $10 \times \text{Log}_{10}(1/0.26) = 5.85$ dB

Duty cycle RMS correction factor for 20 MHz channel = $10 \times \text{Log}_{10}(1/0.22) = 6.57$ dB

Same power settings that were used for 24 dBi PTP antenna apply also to the 19 dBi PTP antenna, hence compliance with restricted bands conducted-to-radiated emissions was achieved as well.

Table 8.2-5: Conducted spurious emissions measurements outside restricted bands, 32 dBi PTP antenna results for cho

Channel bandwidth, MHz	Channel	Frequency, MHz	EIRP level, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
5	Low	5537	-28.42	-27.00	1.42
10	Low	5331	-27.31	-27.00	0.31
20	Low	5512	-27.12	-27.00	0.12
5	High	5533	-27.63	-27.00	0.63

Note: EIRP level measurement result includes correction factor for multiple antenna ports (3 dB) and antenna gain of 32 dBi.

Table 8.2-6: Conducted spurious emissions measurements outside restricted bands, 32 dBi PTP antenna results for ch1

Channel bandwidth, MHz	Channel	Frequency, MHz	EIRP level, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
5	Low	5232	-27.64	-27.00	0.64
10	Low	5204	-27.14	-27.00	0.14
20	Low	5259	-27.27	-27.00	0.27

Note: EIRP level measurement result includes correction factor for multiple antenna ports (3 dB) and antenna gain of 32 dBi.

Table 8.2-7: Conducted spurious emissions measurements within restricted bands, 32 dBi PTP antenna results for cho

Channel bandwidth, MHz	Channel	Frequency, MHz	Peak level, dBm	Peak limit, dBm	Peak margin, dB	RMS level, dBm	Duty cycle CF, dB	Corrected RMS, dBm	Average limit, dBm	Average margin, dB
10	High	5448	-32.81	-21.23	11.58	-54.16	5.85	-48.31	-41.23	7.08
20	High	5385	-27.25	-21.23	6.02	-49.57	6.57	-43.00	-41.23	1.77

Table 8.2-8: Conducted spurious emissions measurements within restricted bands, 32 dBi PTP antenna results for ch1

Channel bandwidth, MHz	Channel	Frequency, MHz	Peak level, dBm	Peak limit, dBm	Peak margin, dB	RMS level, dBm	Duty cycle CF, dB	Corrected RMS, dBm	Average limit, dBm	Average margin, dB
5	High	5427	-28.01	-21.23	6.78	-49.18	5.85	-43.33	-41.23	2.10
10	High	5451	-28.12	-21.23	6.89	-48.81	5.85	-42.96	-41.23	1.73
20	High	5366	-27.34	-21.23	6.11	-49.29	6.57	-42.72	-41.23	1.49

Section 8
Test name
Specification

Testing data
 FCC 15.407(b) and RSS-247 6.2.4 (2) Spurious (out-of-band) emissions
 FCC Part 15 Subpart E and RSS-247 Issue 1

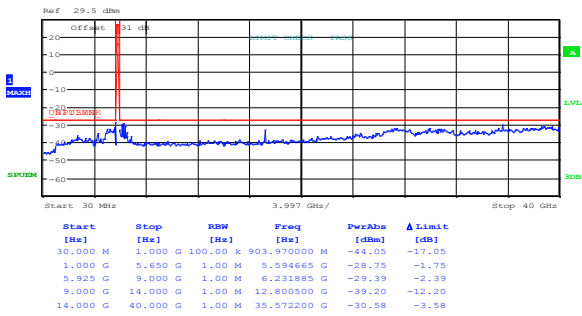


Figure 8.2-4: Conducted spurious emissions outside restricted bands, 5 MHz low channel, for 24 dBi antenna, cho, PTP application

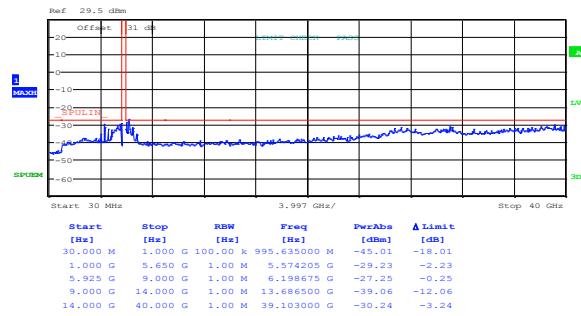


Figure 8.2-5: Conducted spurious emissions outside restricted bands, 5 MHz high channel, for 24 dBi antenna, cho, PTP application

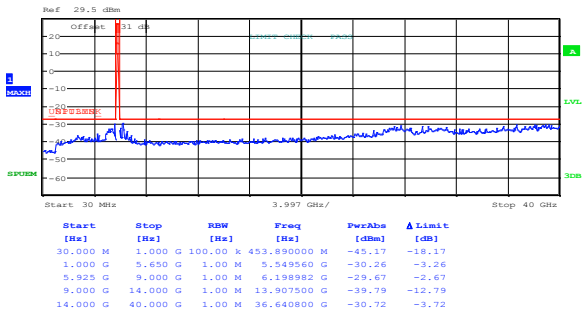


Figure 8.2-6: Conducted spurious emissions outside restricted bands, 5 MHz low channel, for 24 dBi antenna, ch1, PTP application

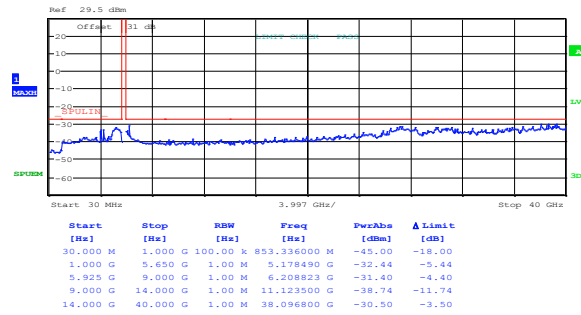


Figure 8.2-7: Conducted spurious emissions outside restricted bands, 5 MHz high channel, for 24 dBi antenna, ch1, PTP application

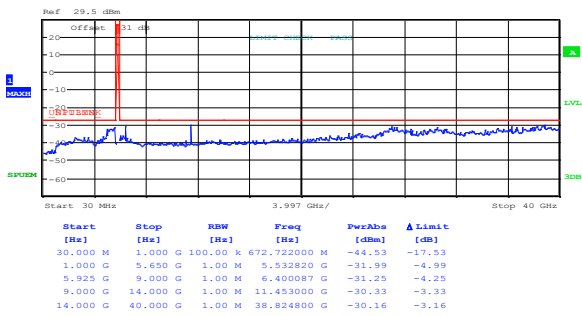


Figure 8.2-8: Conducted spurious emissions outside restricted bands, 10 MHz low channel, for 24 dBi antenna, cho, PTP application

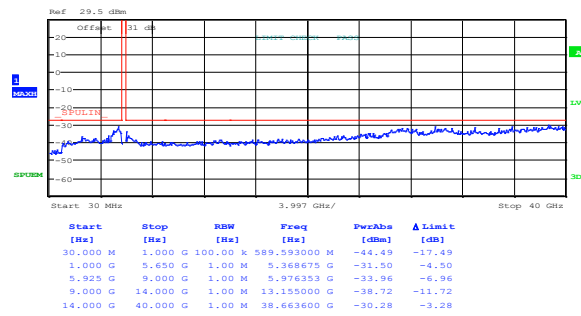


Figure 8.2-9: Conducted spurious emissions outside restricted bands, 10 MHz high channel, for 24 dBi antenna, cho, PTP application

Section 8
Test name
Specification

Testing data
 FCC 15.407(b) and RSS-247 6.2.4 (2) Spurious (out-of-band) emissions
 FCC Part 15 Subpart E and RSS-247 Issue 1

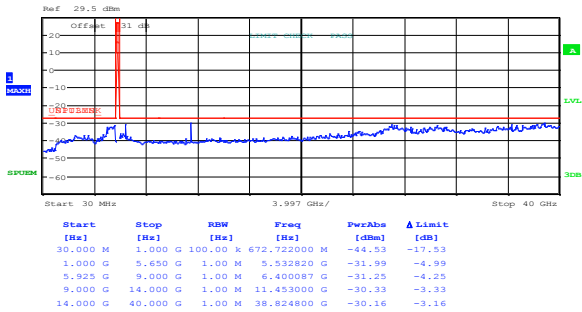


Figure 8.2-10: Conducted spurious emissions outside restricted bands, 10 MHz low channel, for 24 dBi antenna, ch1, PTP application

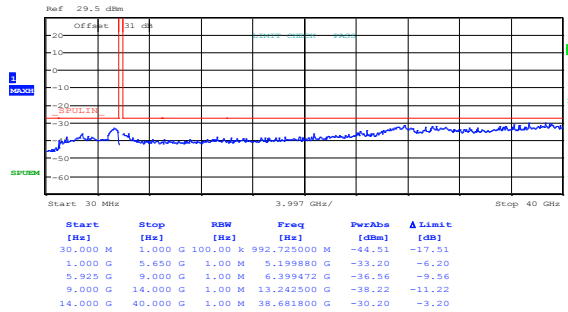


Figure 8.2-11: Conducted spurious emissions outside restricted bands, 10 MHz high channel, for 24 dBi antenna, ch1, PTP application

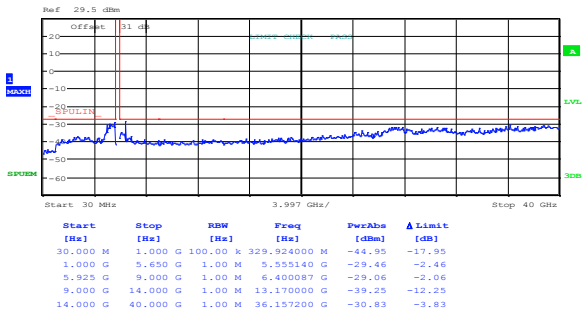


Figure 8.2-12: Conducted spurious emissions outside restricted bands, 20 MHz low channel, for 24 dBi antenna, cho, PTP application

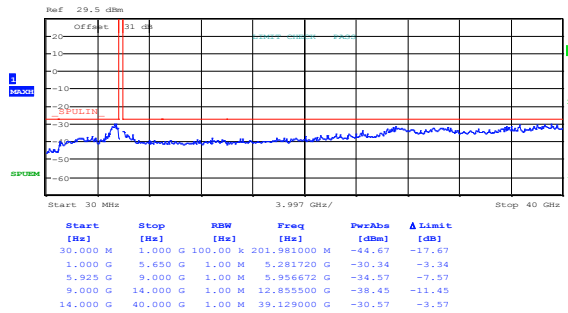


Figure 8.2-13: Conducted spurious emissions outside restricted bands, 20 MHz high channel, for 24 dBi antenna, cho, PTP application

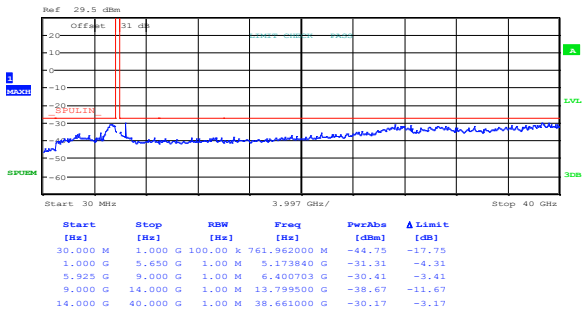


Figure 8.2-14: Conducted spurious emissions outside restricted bands, 20 MHz low channel, for 24 dBi antenna, ch1, PTP application

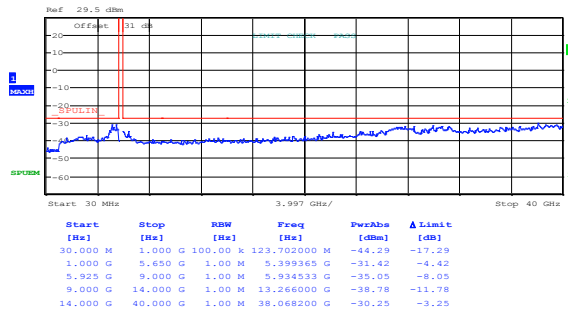


Figure 8.2-15: Conducted spurious emissions outside restricted bands, 20 MHz high channel, for 24 dBi antenna, ch1, PTP application

Section 8
Test name
Specification

Testing data
 FCC 15.407(b) and RSS-247 6.2.4 (2) Spurious (out-of-band) emissions
 FCC Part 15 Subpart E and RSS-247 Issue 1

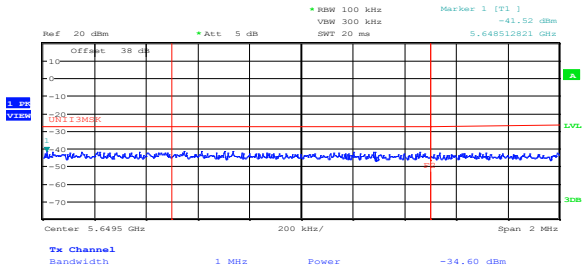


Figure 8.2-16: Conducted spurious emissions at the lower band edge at 5650 MHz, 5 MHz low channel, for 24 dBi antenna, cho, PTP application

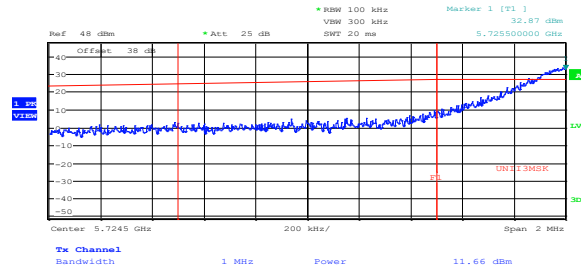


Figure 8.2-17: Conducted spurious emissions at the lower band edge at 5725 MHz, 5 MHz low channel, for 24 dBi antenna, cho, PTP application

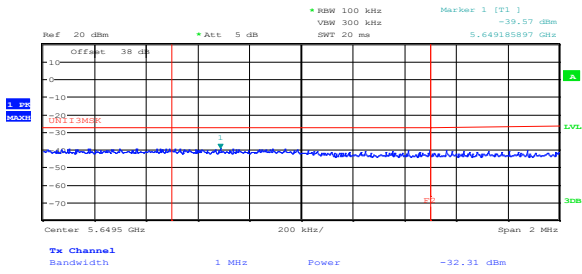


Figure 8.2-18: Conducted spurious emissions at the lower band edge at 5650 MHz, 5 MHz low channel, for 24 dBi antenna, ch1, PTP application

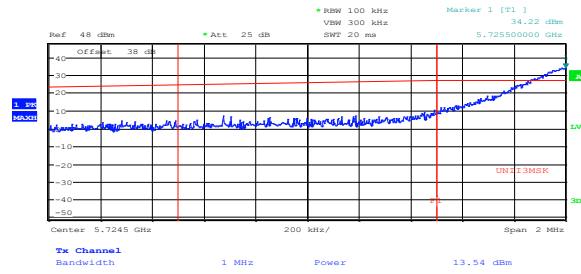


Figure 8.2-19: Conducted spurious emissions at the lower band edge at 5725 MHz, 5 MHz low channel, for 24 dBi antenna, ch1, PTP application

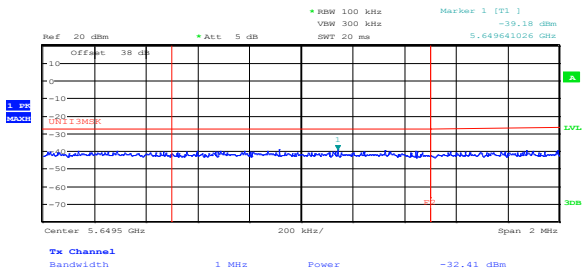


Figure 8.2-20: Conducted spurious emissions at the lower band edge at 5650 MHz, 10 MHz low channel, for 24 dBi antenna, cho, PTP application

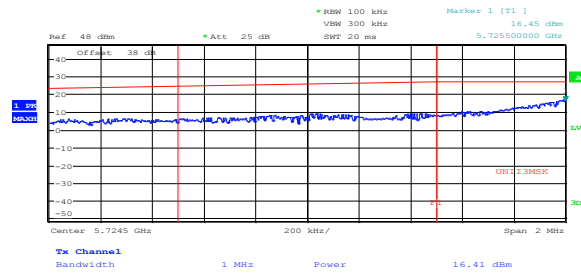


Figure 8.2-21: Conducted spurious emissions at the lower band edge at 5725 MHz, 10 MHz low channel, for 24 dBi antenna, cho, PTP application

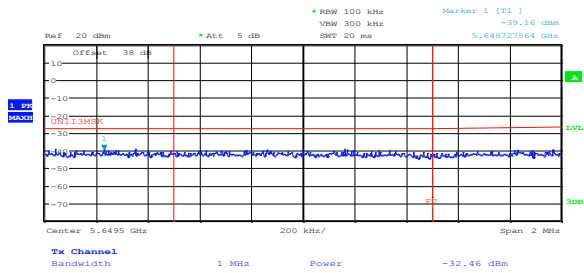


Figure 8.2-22: Conducted spurious emissions at the lower band edge at 5650 MHz, 10 MHz low channel, for 24 dBi antenna, ch1, PTP application

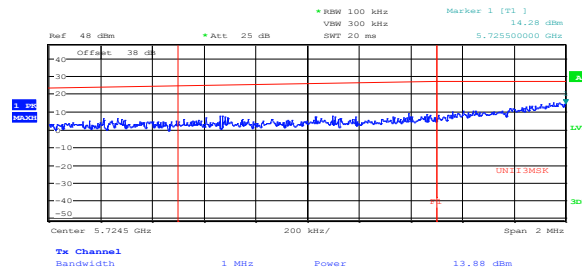


Figure 8.2-23: Conducted spurious emissions at the lower band edge at 5725 MHz, 10 MHz low channel, for 24 dBi antenna, ch1, PTP application

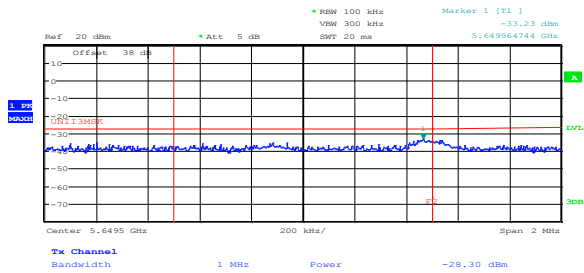


Figure 8.2-24: Conducted spurious emissions at the lower band edge at 5650 MHz, 20 MHz low channel, for 24 dBi antenna, cho, PTP application

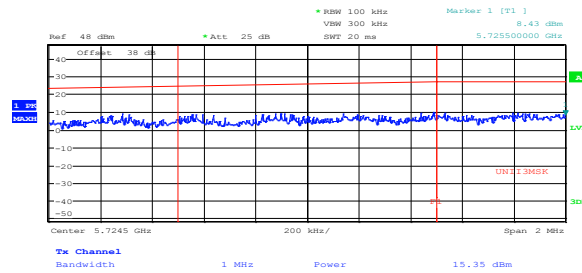


Figure 8.2-25: Conducted spurious emissions at the lower band edge at 5725 MHz, 20 MHz low channel, for 24 dBi antenna, cho, PTP application

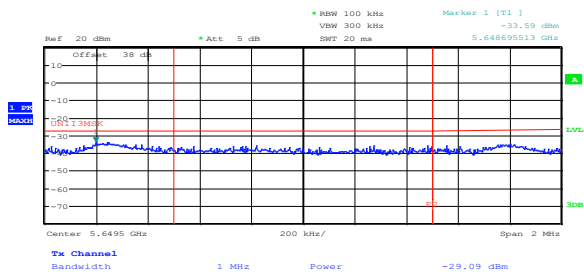


Figure 8.2-26: Conducted spurious emissions at the lower band edge at 5650 MHz, 20 MHz low channel, for 24 dBi antenna, ch1, PTP application

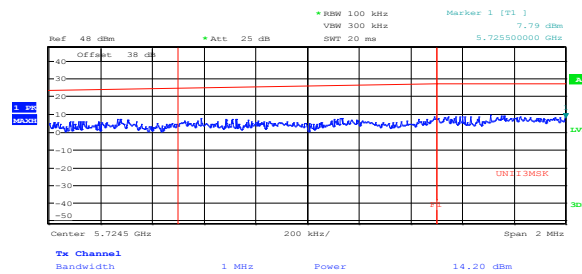


Figure 8.2-27: Conducted spurious emissions at the lower band edge at 5725 MHz, 20 MHz low channel, for 24 dBi antenna, ch1, PTP application

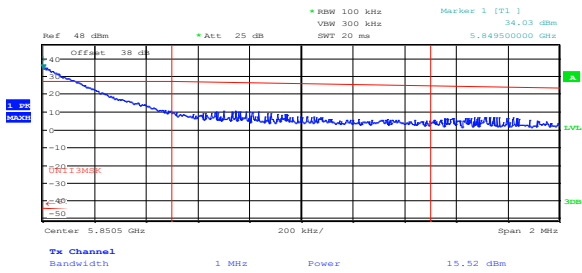


Figure 8.2-28: Conducted spurious emissions at the upper band edge at 5850 MHz, 5 MHz high channel, for 24 dBi antenna, cho, PTP application

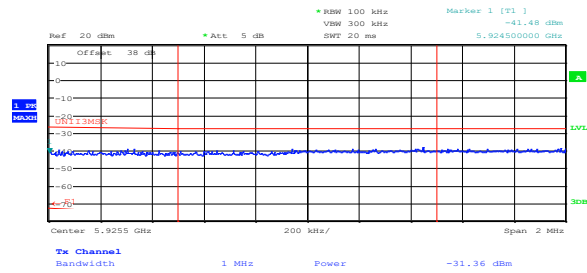


Figure 8.2-29: Conducted spurious emissions at the upper band edge at 5925 MHz, 5 MHz high channel, for 24 dBi antenna, cho, PTP application

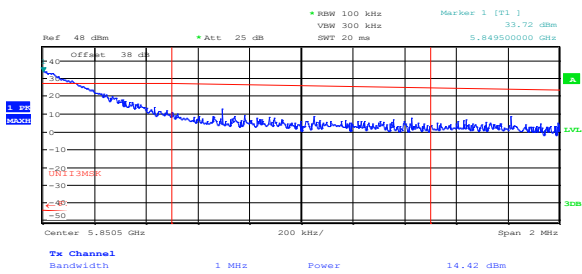


Figure 8.2-30: Conducted spurious emissions at the upper band edge at 5850 MHz, 5 MHz high channel, for 24 dBi antenna, ch1, PTP application

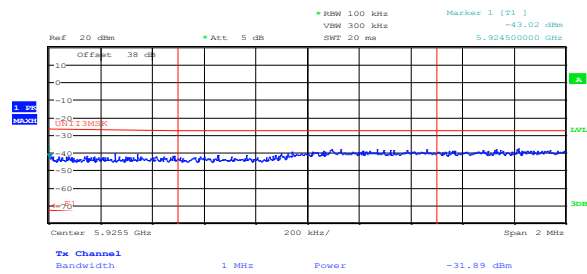


Figure 8.2-31: Conducted spurious emissions at the upper band edge at 5925 MHz, 5 MHz high channel, for 24 dBi antenna, ch1, PTP application

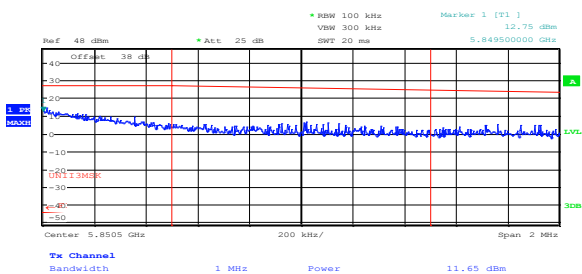


Figure 8.2-32: Conducted spurious emissions at the upper band edge at 5850 MHz, 10 MHz high channel, for 24 dBi antenna, cho, PTP application

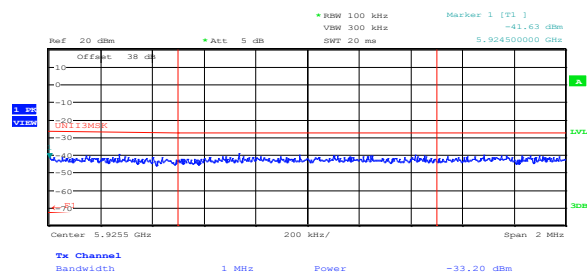


Figure 8.2-33: Conducted spurious emissions at the upper band edge at 5925 MHz, 10 MHz high channel, for 24 dBi antenna, cho, PTP application

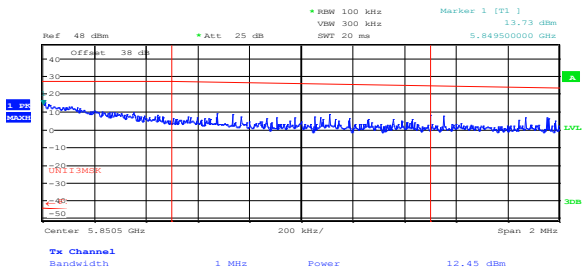


Figure 8.2-34: Conducted spurious emissions at the upper band edge at 5850 MHz, 10 MHz high channel, for 24 dBi antenna, ch1, PTP application

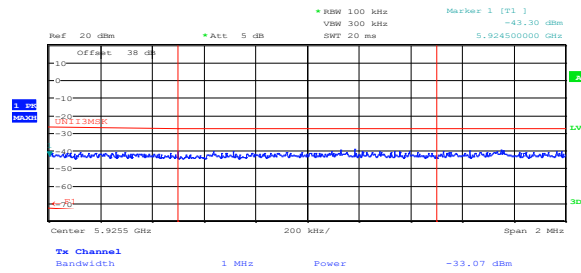


Figure 8.2-35: Conducted spurious emissions at the upper band edge at 5925 MHz, 10 MHz high channel, for 24 dBi antenna, ch1, PTP application

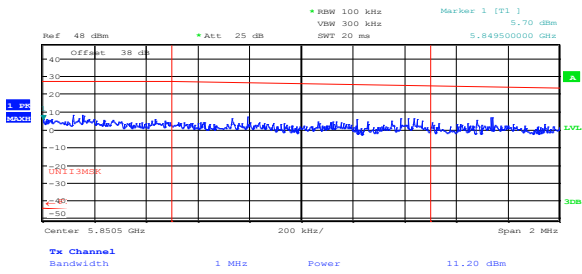


Figure 8.2-36: Conducted spurious emissions at the upper band edge at 5850 MHz, 20 MHz high channel, for 24 dBi antenna, ch0, PTP application

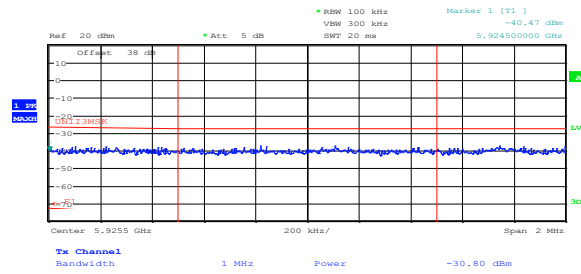


Figure 8.2-37: Conducted spurious emissions at the upper band edge at 5925 MHz, 20 MHz high channel, for 24 dBi antenna, ch0, PTP application

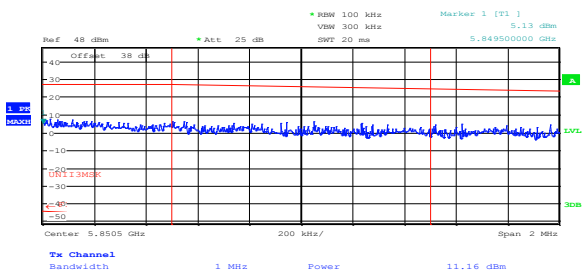


Figure 8.2-38: Conducted spurious emissions at the upper band edge at 5850 MHz, 20 MHz high channel, for 24 dBi antenna, ch1, PTP application

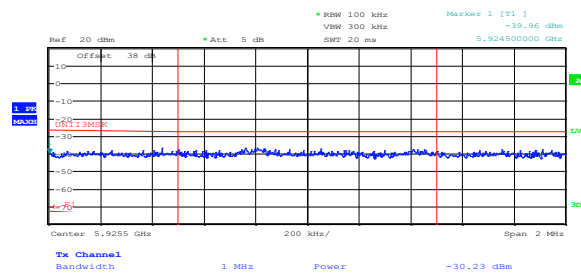


Figure 8.2-39: Conducted spurious emissions at the upper band edge at 5925 MHz, 20 MHz high channel, for 24 dBi antenna, ch1, PTP application

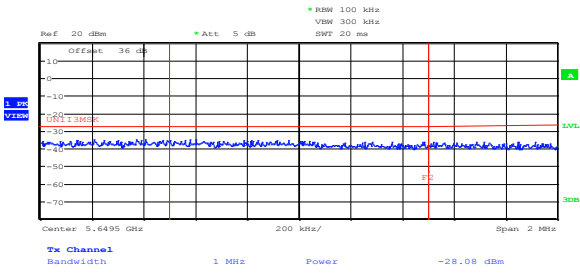


Figure 8.2-40: Conducted spurious emissions at the lower band edge at 5650 MHz, 5 MHz low channel, for 32 dBi antenna, cho, PTP application

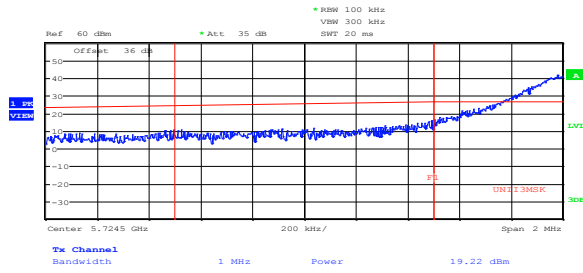


Figure 8.2-41: Conducted spurious emissions at the lower band edge at 5725 MHz, 5 MHz low channel, for 32 dBi antenna, cho, PTP application

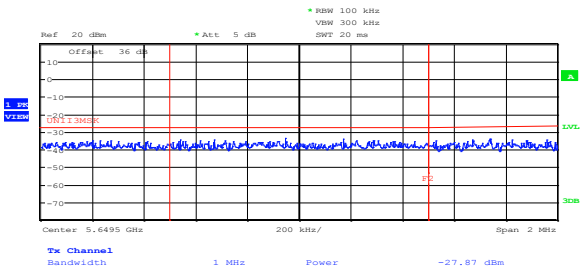


Figure 8.2-42: Conducted spurious emissions at the lower band edge at 5650 MHz, 10 MHz low channel, for 32 dBi antenna, cho, PTP application

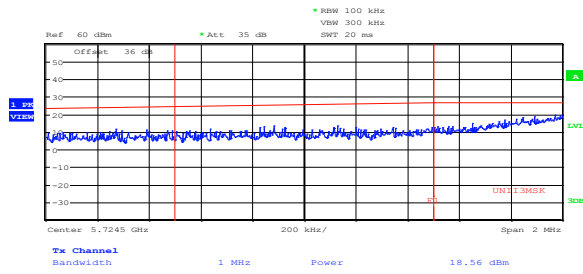


Figure 8.2-43: Conducted spurious emissions at the lower band edge at 5725 MHz, 10 MHz low channel, for 32 dBi antenna, cho, PTP application

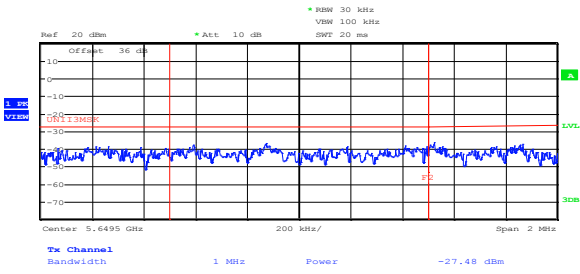


Figure 8.2-44: Conducted spurious emissions at the lower band edge at 5650 MHz, 20 MHz low channel, for 32 dBi antenna, cho, PTP application

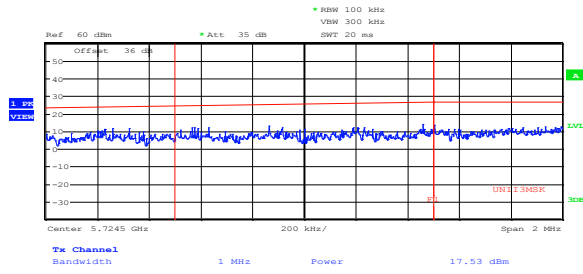


Figure 8.2-45: Conducted spurious emissions at the lower band edge at 5725 MHz, 20 MHz low channel, for 32 dBi antenna, cho, PTP application

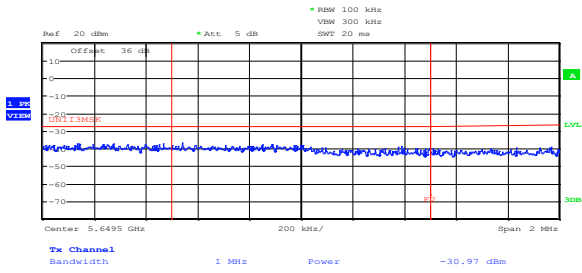


Figure 8.2-46: Conducted spurious emissions at the lower band edge at 5650 MHz, 5 MHz low channel, for 32 dBi antenna, ch1, PTP application

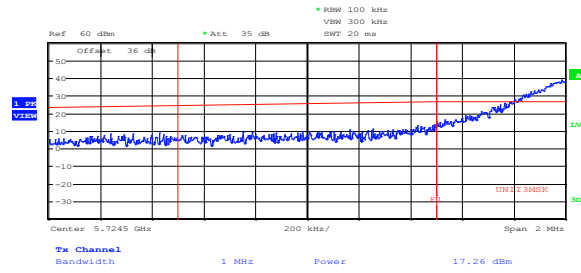


Figure 8.2-47: Conducted spurious emissions at the lower band edge at 5725 MHz, 5 MHz low channel, for 32 dBi antenna, ch1, PTP application

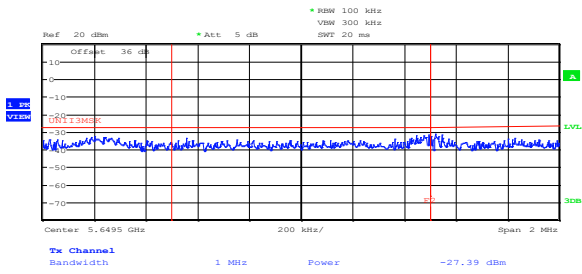


Figure 8.2-48: Conducted spurious emissions at the lower band edge at 5650 MHz, 10 MHz low channel, for 32 dBi antenna, ch1, PTP application

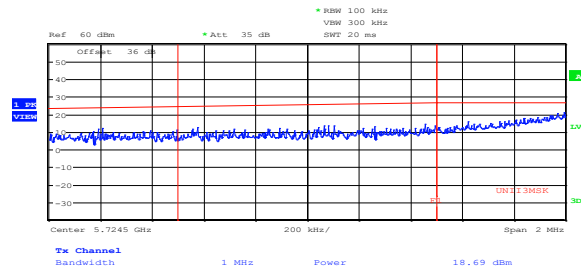


Figure 8.2-49: Conducted spurious emissions at the lower band edge at 5725 MHz, 10 MHz low channel, for 32 dBi antenna, ch1, PTP application

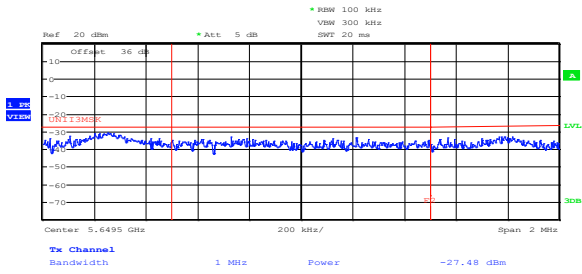


Figure 8.2-50: Conducted spurious emissions at the lower band edge at 5650 MHz, 20 MHz low channel, for 32 dBi antenna, ch1, PTP application

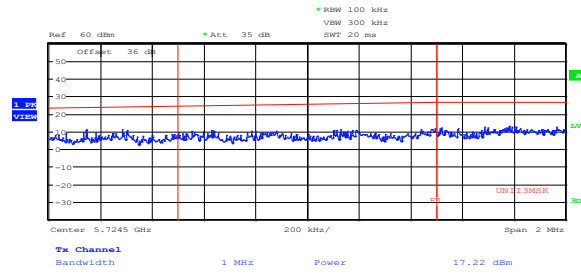


Figure 8.2-51: Conducted spurious emissions at the lower band edge at 5725 MHz, 20 MHz low channel, for 32 dBi antenna, ch1, PTP application

Section 8
Test name
Specification

Testing data
 FCC 15.407(b) and RSS-247 6.2.4 (2) Spurious (out-of-band) emissions
 FCC Part 15 Subpart E and RSS-247 Issue 1

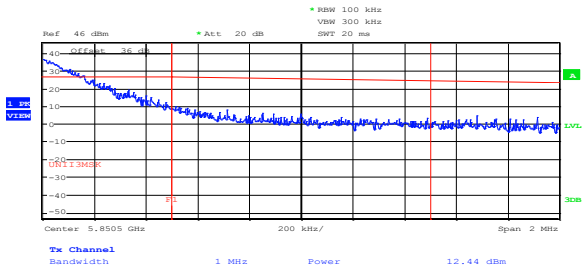


Figure 8.2-52: Conducted spurious emissions at the upper band edge at 5850 MHz, 5 MHz high channel, for 32 dBi antenna, cho, PTP application

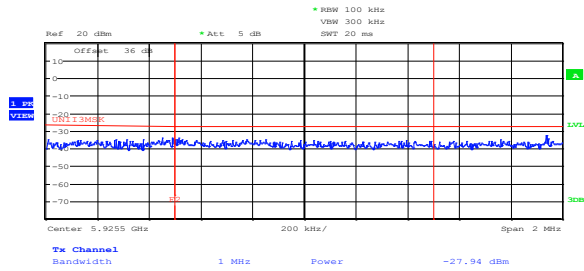


Figure 8.2-53: Conducted spurious emissions at the upper band edge at 5925 MHz, 5 MHz high channel, for 32 dBi antenna, cho, PTP application

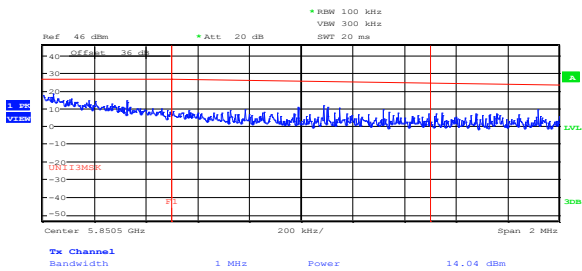


Figure 8.2-54: Conducted spurious emissions at the upper band edge at 5850 MHz, 10 MHz high channel, for 32 dBi antenna, cho, PTP application

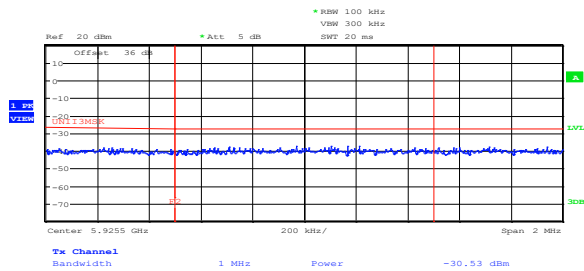


Figure 8.2-55: Conducted spurious emissions at the upper band edge at 5925 MHz, 10 MHz high channel, for 32 dBi antenna, cho, PTP application

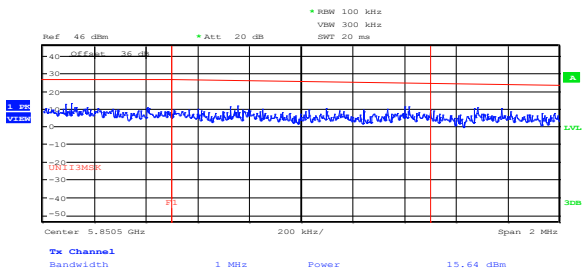


Figure 8.2-56: Conducted spurious emissions at the upper band edge at 5850 MHz, 20 MHz high channel, for 32 dBi antenna, cho, PTP application

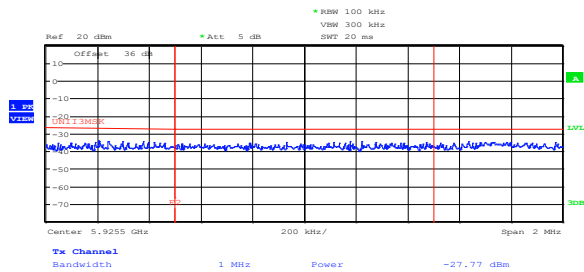


Figure 8.2-57: Conducted spurious emissions at the upper band edge at 5925 MHz, 20 MHz high channel, for 32 dBi antenna, cho, PTP application

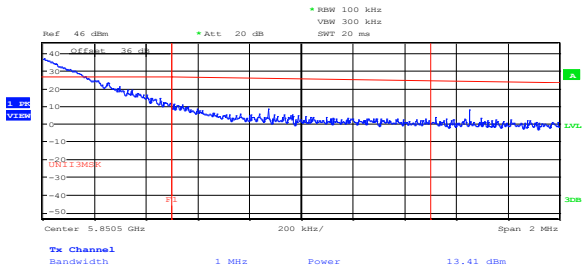


Figure 8.2-58: Conducted spurious emissions at the upper band edge at 5850 MHz, 5 MHz high channel, for 32 dBi antenna, ch1, PTP application

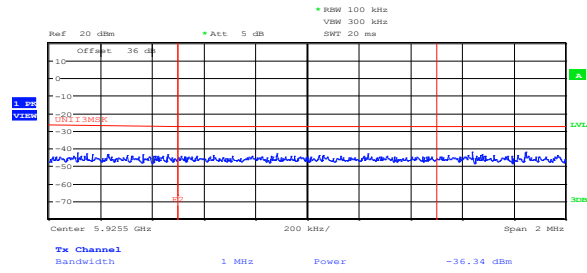


Figure 8.2-59: Conducted spurious emissions at the upper band edge at 5925 MHz, 5 MHz high channel, for 32 dBi antenna, ch1, PTP application

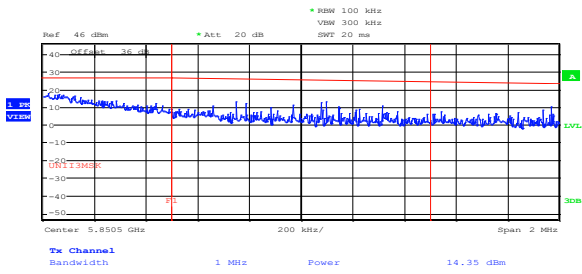


Figure 8.2-60: Conducted spurious emissions at the upper band edge at 5850 MHz, 10 MHz high channel, for 32 dBi antenna, ch1, PTP application

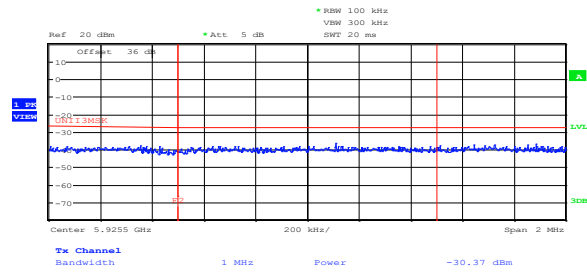


Figure 8.2-61: Conducted spurious emissions at the upper band edge at 5925 MHz, 10 MHz high channel, for 32 dBi antenna, ch1, PTP application

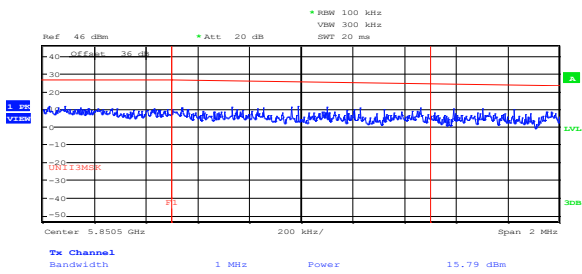


Figure 8.2-62: Conducted spurious emissions at the upper band edge at 5850 MHz, 20 MHz high channel, for 32 dBi antenna, ch1, PTP application

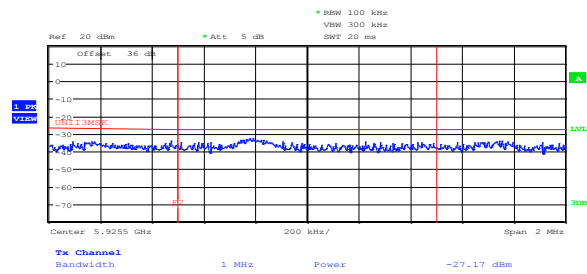


Figure 8.2-63: Conducted spurious emissions at the upper band edge at 5925 MHz, 20 MHz high channel, for 32 dBi antenna, ch1, PTP application



Radiated spurious emissions with attached 32 dBi antenna (for PTP application) were performed at the frequencies that exceeded limits for conducted spurious emissions at the antenna port.

Table 8.2-9: Radiated field strength measurement results within restricted bands for PTP 32 dBi antenna

Channel bandwidth	Frequency, GHz	Peak Field strength, dB μ V/m	Peak limit, dB μ V/m	Peak margin, dB	Average Field strength, dB μ V/m	Average limit, dB μ V/m	Average margin, dB
5 MHz	11.580	71.77	74.00	2.23	53.95	54.00	0.05
10 MHz	11.580	72.04	74.00	1.96	53.70	54.00	0.30
20 MHz	11.580	73.60	74.00	0.40	53.64	54.00	0.36

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable. Average field strength result in the table above is already corrected to compensate the duty cycle.

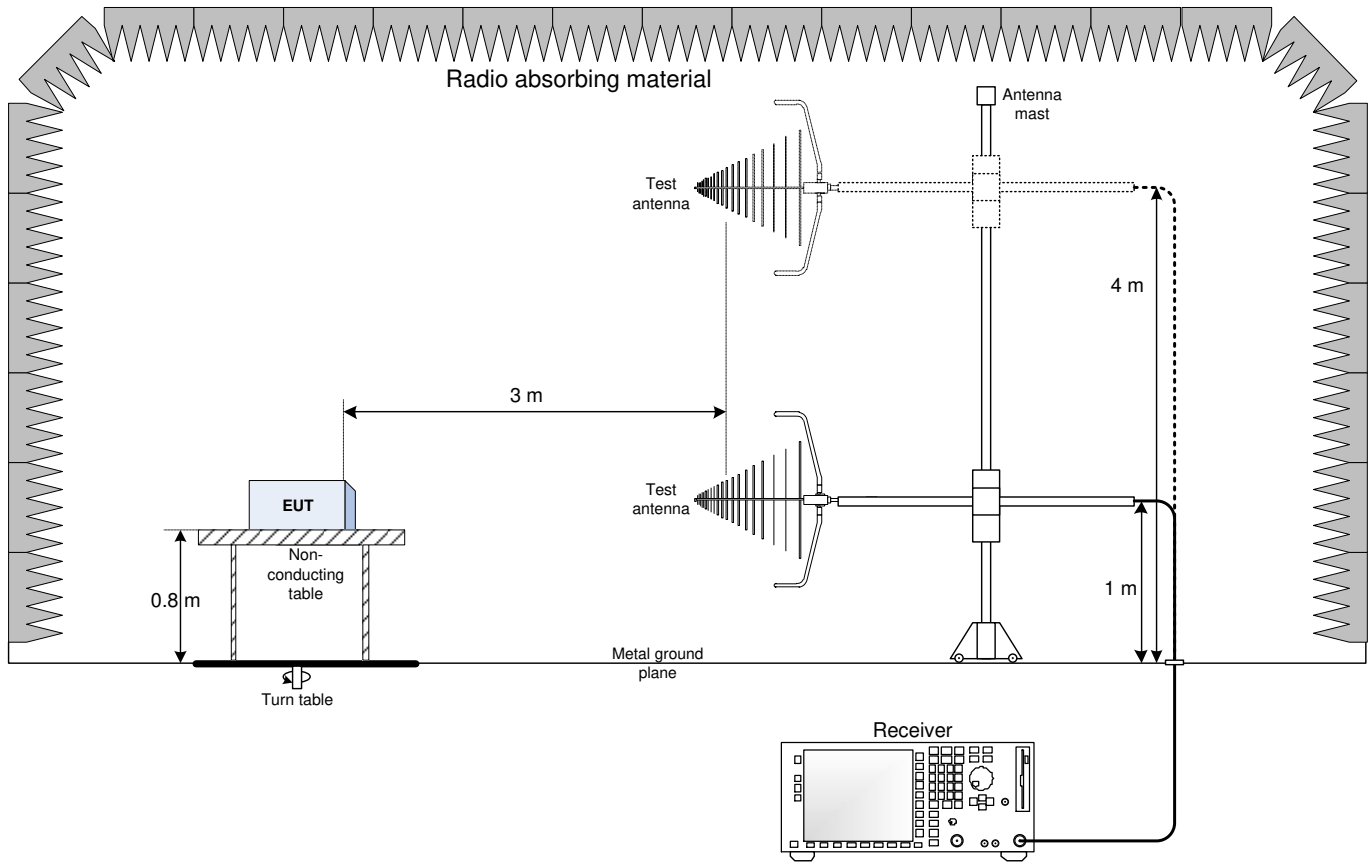
Table 8.2-10: Radiated field strength measurement results outside restricted bands for PTP 32 dBi antenna

Channel bandwidth	Frequency, MHz	Field strength, dB μ V/m/MHz	Limit, dB μ V/m/MHz	Margin, dB
5 MHz, low channel	6400	61.28	68.23	6.95
5 MHz, high channel	6400	62.32	68.23	5.91
10 MHz, low channel	6400	61.84	68.23	6.39
10 MHz, high channel	6400	62.93	68.23	5.30
20 MHz, low channel	6400	62.54	68.23	5.69
20 MHz, high channel	6400	63.89	68.23	4.34

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz

