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Radio Test report – 359870-1TRFWL

Applicant:

Redline Communications

Product:

LTE Base Station – Band 4

Model:

Ellipse 4G HP Band 4

FCC ID:	ISED Reg. Number	HVIN:
QC8-B4	4310A-B4	Ellipse 4G HP Band 4

Requirements/Summary:

Standard	Environmental phenomenon	Compliance
FCC 47 CFR Part 27	Miscellaneous wireless communications services	Yes
RSS-139 Issue 3, July 16, 2015	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710–1780 MHz and 2110–2180 MHz	Yes

Tested by:	Andrey Adelberg, Senior EMC/Wireless Specialist
Reviewed by:	Kevin Rose, Wireless/EMC Specialist
Date of issue:	November 13, 2018
Reviewer signature	

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC test site registration number: CA2040, IC: 2040A-4 (3 m semi anechoic chamber)

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 reAnt Are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Redline Communications
Address	302 Town Center Blvd.
City	Markham
Province/State	Ontario
Postal/Zip code	L3R 0E8
Country	Canada

1.2 Test specifications

FCC 47 CFR Part 27	Miscellaneous wireless communications services
FCC 47 CFR Part 2	Frequency Allocations and Radio Treaty Maters; General Rules and Regulations
RSS-139 Issue 3, July 16, 2015	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710–1780 MHz and 2110–2180 MHz
RSS-Gen, Issue 5, April 2018	General Requirements for Compliance of Radio Apparatus
SRSP-513, Issue 3, July 2015	Technical Requirements for Advanced Wireless Services (AWS) in the Bands 1710–1780 MHz and 2110–2180 MHz

1.3 Test methods

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services Accredited Standards Committee C63®—Electromagnetic Compatibility

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 1.5 below. 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 27 test results

Part	Test description	Verdict
§27.50(b)	Maximum output power at RF antenna connector	Pass
§27.53	Spurious emissions at RF antenna connector	Pass
§27.53	Radiated spurious emissions	Pass
§27.54	Frequency stability	Pass
§2.1049	Occupied bandwidth	Pass

Notes: None

2.2 RSS-139 test results

Part	Test description	Verdict
4.1	Transmitter output power and Equivalent Isotropic Radiated Power (e.i.r.p.)	Pass
4.2	Spurious emissions at RF antenna connector	Pass
4.2	Radiated spurious emissions	Pass
6.4	Transmitter frequency stability	Pass
RSS-Gen, 6.7	Occupied bandwidth	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	September 3, 2018
Nemko sample ID number	2/4

3.2 EUT information

Product name	LTE Base Station – Band 4
Model	Ellipse 4G HP Band 4
Serial number	387RM18320003
Antenna ports	2 TX/RX Ports
Frequency	LTE TX (DL): 2110–2155 MHz LTE RX (UL): 1710–1755 MHz
Accuracy (nominal)	±0.1 ppm
Nominal voltage	48 V_{DC} @ 2.2 A
Modulation	LTE: QPSK, 16QAM, 64QAM
Channel bandwidth	LTE: 5, 10, 20 MHz
Regulatory requirements	Radio: FCC Part 2, 27, RSS-Gen, RSS-139
Emission Designator:	LTE: 5M00W7D, 10M0W7D, 20M0W7D
Single carrier	Single Antenna, TX Diversity, MIMO
Operating temperature	–40 °C to +65 °C
Nominal voltage	48 V_{DC} via 120 V_{AC}/ 60 Hz power supply

3.3 Product description and theory of operation

Ellipse 4G HP B04 is an all outdoor LTE eNodeB (E-UTRAN Node B) single band base station operating in LTE Band 4 (2110–2155 MHz)

3.4 EUT setup diagram

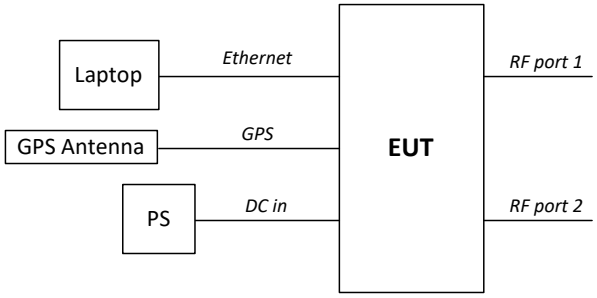


Figure 3.4-1: *Setup diagram – Radio Compliance*

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

The testing was performed in accordance with the customer approved test plan, which suggested to measure output power on all 3 modulations, and the rest of the testing on QPSK and 64QAM.

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 ±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. 9/18
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	March 26/19
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Oct 26/18
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Oct. 1/18
Horn antenna (1–18 GHz)	EMCO	3115	FA000649	1 year	Oct. 27/18
Preamp (1–18 GHz)	ETS-Lindgren	124334	FA002873	1 year	Nov. 3/18
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	Oct. 1/18
Power meter	Agilent	E4418B	FA001678	1 year	June 5/19
Power sensor	HP	8482A	FA001944	1 year	May 30/19
Temperature chamber	Espec	EPX-4H	FA002735	1 year	Sept. 12/19

Note: NCR - no calibration required

Table 7.1-2: *Test software*

Test description	Manufacturer of Software	Details
Radiated emissions – Ottawa	Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 9.26.01

Section 8. Testing data

8.1 FCC 27.50(d) and RSS-139, 4.1 Maximum output power at RF antenna connector

8.1.1 Definitions and limits

§ 27.50(d) Operation within the bands: 2110–2155 MHz and 2155–2180 MHz.

(1) The power of each fixed or base station transmitting in the 1995–2000 MHz, 2110–2155 MHz, 2155–2180 MHz or 2180–2200 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to:

(i) An equivalent isotropically radiated power (EIRP) of 3280 watts when transmitting with an emission bandwidth of 1 MHz or less;

(ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(2) The power of each fixed or base station transmitting in the 1995–2000 MHz, the 2110–2155 MHz 2155–2180 MHz band, or 2180–2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:

(i) An equivalent isotropically radiated power (EIRP) of 1640 watts when transmitting with an emission bandwidth of 1 MHz or less;

(ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(3) A licensee operating a base or fixed station in the 2110–2155 MHz band utilizing a power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must coordinate such operations in advance with all Government and non-Government satellite entities in the 2025–2110 MHz band. A licensee operating a base or fixed station in the 2110–2180 MHz band utilizing power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must be coordinated in advance with the following licensees authorized to operate within 120 kilometers (75 miles) of the base or fixed station operating in this band: All Broadband Radio Service (BRS) licensees authorized under this part in the 2155–2160 MHz band and all advanced wireless services (AWS) licensees authorized to operate on adjacent frequency blocks in the 2110–2180 MHz band.

(5) Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

(6) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

RSS-139, Section 4.1

The transmitter power shall be measured in terms of a root-mean-square (RMS) average value.

RSS-139, Section 6.5

Consult SRSP-513 for e.i.r.p. limits on fixed and base stations operating in the band 2110–2180 MHz.

In addition, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

SRSP-513, Section 5.1

5.1.1 Fixed and base stations

5.1.1.1 For fixed and base stations operating within the frequency range 2110–2180 MHz with a channel bandwidth equal to or less than 1 MHz, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts with an antenna height above average terrain (HAAT) up to 300 metres.

5.1.1.2 For fixed and base stations operating within the frequency range 2110–2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 1640 watts/MHz e.i.r.p. (i.e. no more than 1640 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres.

5.1.1.3 Fixed and base stations located in geographic areas at a distance greater than 26 km from large or medium population centres, and transmitting within the frequency range 2110–2180 MHz, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 300 metres.

Within 26 km of any large or medium population centre, fixed and base stations may operate at increased e.i.r.p. if more than 50% of the population within a particular sector's coverage is located outside these large and medium population centres.

Fixed and base stations with increased e.i.r.p. must not be used to provide coverage to large and medium population centres. However, some incidental coverage of these large and medium population centres by stations with increased e.i.r.p. is permitted.

This provision also applies for fixed and base stations with a channel bandwidth equal to or less than 1 MHz (i.e. the e.i.r.p. may be increased up to a maximum of 3280 watts).

5.1.1.4 Fixed and base station antenna heights above average terrain may exceed 300 metres with a reduction in e.i.r.p. The maximum permissible e.i.r.p. for installations with antenna HAAT in excess of 300 metres is given in the following table:

Table 8.1-1: *Reduction to Maximum Allowable E.I.R.P. for HAAT > 300 m*

HAAT (m)	Maximum EIRP, W/MHz
HAAT ≤ 300	1640 (or 3280[1])
300 < HAAT ≤ 500	1070
500 < HAAT ≤ 1000	490
1000 < HAAT ≤ 1500	270
1500 < HAAT ≤ 2000	160

Note: [1]for fixed and base stations with a channel bandwidth equal to or less than 1 MHz

8.1.2 Test summary

Test date	September 18, 2018
Test engineer	Andrey Adelberg

8.1.3 Observations, settings and special notes

Note: ERP limit is 1000 W/MHz (60 dBm/MHz), EIRP limit is 1640 W/MHz (62.1484 dBm/MHz)
Based on the RF margins noted in this report, considerations pertaining to the maximum allowed EIRP and antenna type should be considered for each installation.
Output power was measured with RMS power meter.
Test receiver settings for PSD measurements:

Detector mode	RMS
Resolution bandwidth	1 MHz
Video bandwidth	>RBW
Measurement mode	Power over emission bandwidth
Trace mode	Averaging
Measurement time	Auto

8.1.4 Test data

Table 8.1-2: *Output power measurement results for SISO operation at Port* ***1***

Remarks	Frequency, MHz	RF output power, W	RF output power, dBm	RF power density, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 5 MHz, Low channel	2112.5	9.40	39.73	34.40	62.15	27.75
16QAM, 5 MHz, Low channel	2112.5	7.67	38.85	34.36	62.15	27.79
64QAM, 5 MHz, Low channel	2112.5	9.71	39.87	34.81	62.15	27.34
QPSK, 5 MHz, Mid channel	2132.5	9.48	39.77	34.42	62.15	27.73
16QAM, 5 MHz, Mid channel	2132.5	7.93	38.99	34.41	62.15	27.74
64QAM, 5 MHz, Mid channel	2132.5	9.33	39.70	34.34	62.15	27.81
QPSK, 5 MHz, High channel	2152.5	9.66	39.85	34.46	62.15	27.69
16QAM, 5 MHz, High channel	2152.5	7.62	38.82	34.02	62.15	28.13
64QAM, 5 MHz, High channel	2152.5	9.35	39.71	34.36	62.15	27.79
QPSK, 10 MHz, Low channel	2115.0	8.97	39.53	31.10	62.15	31.05
16QAM, 10 MHz, Low channel	2115.0	8.43	39.26	31.12	62.15	31.03
64QAM, 10 MHz, Low channel	2115.0	9.95	39.98	30.70	62.15	31.45
QPSK, 10 MHz, Mid channel	2132.5	9.10	39.59	31.24	62.15	30.91
16QAM, 10 MHz, Mid channel	2132.5	8.17	39.12	31.36	62.15	30.79
64QAM, 10 MHz, Mid channel	2132.5	8.53	39.31	31.11	62.15	31.04
QPSK, 10 MHz, High channel	2150.0	8.89	39.49	31.03	62.15	31.12
16QAM, 10 MHz, High channel	2150.0	8.22	39.15	31.43	62.15	30.72
64QAM, 10 MHz, High channel	2150.0	9.25	39.66	31.33	62.15	30.82
QPSK, 20 MHz, Low channel	2120.0	8.47	39.28	27.76	62.15	34.39
16QAM, 20 MHz, Low channel	2120.0	7.89	38.97	28.02	62.15	34.13
64QAM, 20 MHz, Low channel	2120.0	8.93	39.51	27.93	62.15	34.22
QPSK, 20 MHz, Mid channel	2132.5	9.04	39.56	27.91	62.15	34.24
16QAM, 20 MHz, Mid channel	2132.5	7.91	38.98	28.27	62.15	33.88
64QAM, 20 MHz, Mid channel	2132.5	8.55	39.32	27.81	62.15	34.34
QPSK, 20 MHz, High channel	2145.0	9.10	39.59	28.00	62.15	34.15
16QAM, 20 MHz, High channel	2145.0	7.94	39.00	28.03	62.15	34.12
64QAM, 20 MHz, High channel	2145.0	8.77	39.43	27.28	62.15	34.87

Table 8.1-3: *Output power measurement results for SISO operation at Port* ***2***

Remarks	Frequency, MHz	RF output power, W	RF output power, dBm	RF power density, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 5 MHz, Low channel	2112.5	9.10	39.59	34.06	62.15	28.09
16QAM, 5 MHz, Low channel	2112.5	10.16	40.07	34.28	62.15	27.87
64QAM, 5 MHz, Low channel	2112.5	6.38	38.05	33.94	62.15	28.21
QPSK, 5 MHz, Mid channel	2132.5	9.14	39.61	34.14	62.15	28.01
16QAM, 5 MHz, Mid channel	2132.5	8.02	39.04	34.28	62.15	27.87
64QAM, 5 MHz, Mid channel	2132.5	8.81	39.45	34.08	62.15	28.07
QPSK, 5 MHz, High channel	2152.5	9.20	39.64	34.05	62.15	28.10
16QAM, 5 MHz, High channel	2152.5	8.22	39.15	34.41	62.15	27.74
64QAM, 5 MHz, High channel	2152.5	8.93	39.51	34.20	62.15	27.95
QPSK, 10 MHz, Low channel	2115.0	8.55	39.32	30.95	62.15	31.20
16QAM, 10 MHz, Low channel	2115.0	7.83	38.94	31.07	62.15	31.08
64QAM, 10 MHz, Low channel	2115.0	8.79	39.44	31.00	62.15	31.15
QPSK, 10 MHz, Mid channel	2132.5	8.83	39.46	31.04	62.15	31.11
16QAM, 10 MHz, Mid channel	2132.5	7.74	38.89	31.26	62.15	30.89
64QAM, 10 MHz, Mid channel	2132.5	8.59	39.34	31.00	62.15	31.15
QPSK, 10 MHz, High channel	2150.0	8.83	39.46	31.16	62.15	30.99
16QAM, 10 MHz, High channel	2150.0	8.00	39.03	31.42	62.15	30.73
64QAM, 10 MHz, High channel	2150.0	8.79	39.44	31.27	62.15	30.88
QPSK, 20 MHz, Low channel	2120.0	9.08	39.58	27.96	62.15	34.19
16QAM, 20 MHz, Low channel	2120.0	7.93	38.99	28.17	62.15	33.98
64QAM, 20 MHz, Low channel	2120.0	8.79	39.44	27.87	62.15	34.28
QPSK, 20 MHz, Mid channel	2132.5	9.31	39.69	28.17	62.15	33.98
16QAM, 20 MHz, Mid channel	2132.5	8.38	39.23	28.24	62.15	33.91
64QAM, 20 MHz, Mid channel	2132.5	9.08	39.58	28.31	62.15	33.84
QPSK, 20 MHz, High channel	2145.0	9.25	39.66	28.01	62.15	34.14
16QAM, 20 MHz, High channel	2145.0	8.41	39.25	28.48	62.15	33.67
64QAM, 20 MHz, High channel	2145.0	9.04	39.56	27.97	62.15	34.18

Table 8.1-4: *Output power measurement results for MIMO operation*

Remarks	Frequency, MHz	RF power spectral density at port 1, dBm/MHz	RF power spectral density at port 2, dBm/MHz	Total RF power spectral density, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 5 MHz, Low channel	2112.5	34.40	34.06	37.24	62.15	24.91
16QAM, 5 MHz, Low channel	2112.5	34.36	34.28	37.33	62.15	24.82
64QAM, 5 MHz, Low channel	2112.5	34.81	33.94	37.41	62.15	24.74
QPSK, 5 MHz, Mid channel	2132.5	34.42	34.14	37.29	62.15	24.86
16QAM, 5 MHz, Mid channel	2132.5	34.41	34.28	37.36	62.15	24.79
64QAM, 5 MHz, Mid channel	2132.5	34.34	34.08	37.22	62.15	24.93
QPSK, 5 MHz, High channel	2152.5	34.46	34.05	37.27	62.15	24.88
16QAM, 5 MHz, High channel	2152.5	34.02	34.41	37.23	62.15	24.92
64QAM, 5 MHz, High channel	2152.5	34.36	34.20	37.29	62.15	24.86
QPSK, 10 MHz, Low channel	2115.0	31.10	30.95	34.04	62.15	28.11
16QAM, 10 MHz, Low channel	2115.0	31.12	31.07	34.11	62.15	28.04
64QAM, 10 MHz, Low channel	2115.0	30.70	31.00	33.86	62.15	28.29
QPSK, 10 MHz, Mid channel	2132.5	31.24	31.04	34.15	62.15	28.00
16QAM, 10 MHz, Mid channel	2132.5	31.36	31.26	34.32	62.15	27.83
64QAM, 10 MHz, Mid channel	2132.5	31.11	31.00	34.07	62.15	28.08
QPSK, 10 MHz, High channel	2150.0	31.03	31.16	34.11	62.15	28.04
16QAM, 10 MHz, High channel	2150.0	31.43	31.42	34.44	62.15	27.71
64QAM, 10 MHz, High channel	2150.0	31.33	31.27	34.31	62.15	27.84
QPSK, 20 MHz, Low channel	2120.0	27.76	27.96	30.87	62.15	31.28
16QAM, 20 MHz, Low channel	2120.0	28.02	28.17	31.11	62.15	31.04
64QAM, 20 MHz, Low channel	2120.0	27.93	27.87	30.91	62.15	31.24
QPSK, 20 MHz, Mid channel	2132.5	27.91	28.17	31.05	62.15	31.10
16QAM, 20 MHz, Mid channel	2132.5	28.27	28.24	31.27	62.15	30.88
64QAM, 20 MHz, Mid channel	2132.5	27.81	28.31	31.08	62.15	31.07
QPSK, 20 MHz, High channel	2145.0	28.00	28.01	31.02	62.15	31.13
16QAM, 20 MHz, High channel	2145.0	28.03	28.48	31.27	62.15	30.88
64QAM, 20 MHz, High channel	2145.0	27.28	27.97	30.65	62.15	31.50

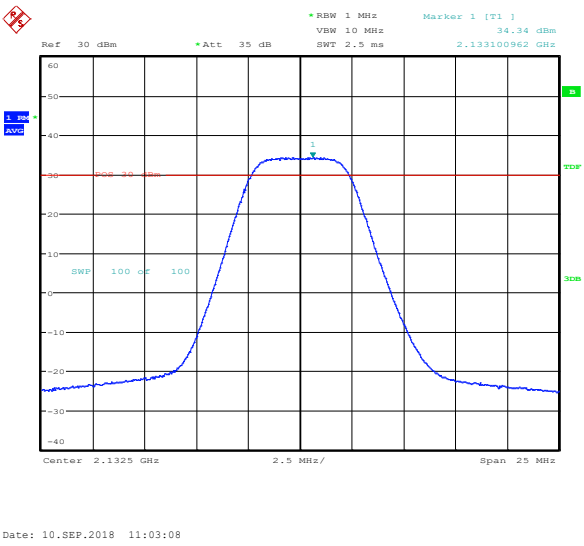


Figure 8.1-1: *PSD sample plot, 5 MHz bandwidth*

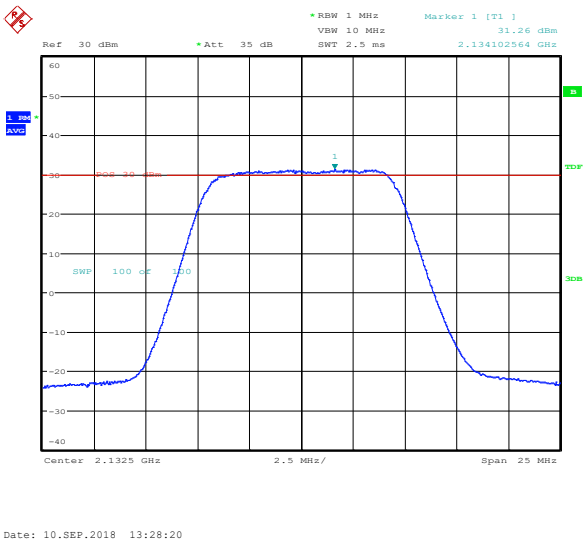


Figure 8.1-2: *PSD sample plot, 10 MHz bandwidth*

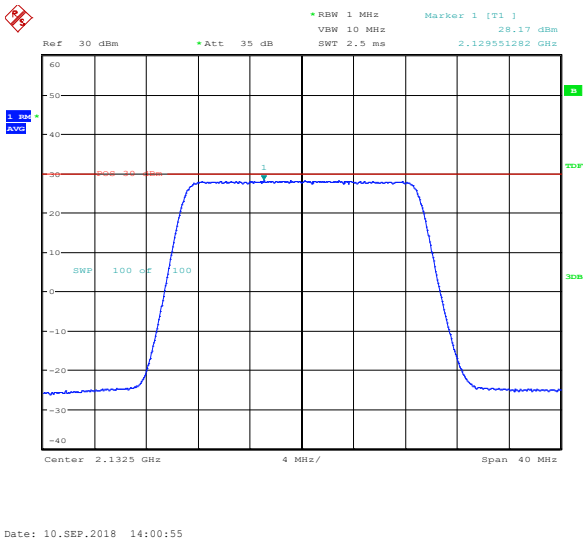


Figure 8.1-3: *PSD sample plot, 20 MHz bandwidth*

Table 8.1-5: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for Port* ***1***

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
QPSK, 5 MHz, Low channel	2112.5	7.63	13.00	5.37
64QAM, 5 MHz, Low channel	2112.5	7.40	13.00	5.60
QPSK, 5 MHz, Mid channel	2132.5	7.85	13.00	5.15
64QAM, 5 MHz, Mid channel	2132.5	7.63	13.00	5.37
QPSK, 5 MHz, High channel	2152.5	7.63	13.00	5.37
64QAM, 5 MHz, High channel	2152.5	7.72	13.00	5.28
QPSK, 10 MHz, Low channel	2115.0	7.76	13.00	5.24
64QAM, 10 MHz, Low channel	2115.0	7.44	13.00	5.56
QPSK, 10 MHz, Mid channel	2132.5	7.85	13.00	5.15
64QAM, 10 MHz, Mid channel	2132.5	7.88	13.00	5.12
QPSK, 10 MHz, High channel	2150.0	7.92	13.00	5.08
64QAM, 10 MHz, High channel	2150.0	7.69	13.00	5.31
QPSK, 20 MHz, Low channel	2120.0	8.21	13.00	4.79
64QAM, 20 MHz, Low channel	2120.0	8.14	13.00	4.86
QPSK, 20 MHz, Mid channel	2132.5	8.30	13.00	4.70
64QAM, 20 MHz, Mid channel	2132.5	8.24	13.00	4.76
QPSK, 20 MHz, High channel	2145.0	8.33	13.00	4.67
64QAM, 20 MHz, High channel	2145.0	8.37	13.00	4.63

Table 8.1-6: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for Port* ***2***

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
QPSK, 5 MHz, Low channel	2112.5	7.63	13.00	5.37
64QAM, 5 MHz, Low channel	2112.5	7.53	13.00	5.47
QPSK, 5 MHz, Mid channel	2132.5	7.63	13.00	5.37
64QAM, 5 MHz, Mid channel	2132.5	7.63	13.00	5.37
QPSK, 5 MHz, High channel	2152.5	7.66	13.00	5.34
64QAM, 5 MHz, High channel	2152.5	7.56	13.00	5.44
QPSK, 10 MHz, Low channel	2115.0	7.92	13.00	5.08
64QAM, 10 MHz, Low channel	2115.0	7.15	13.00	5.85
QPSK, 10 MHz, Mid channel	2132.5	7.98	13.00	5.02
64QAM, 10 MHz, Mid channel	2132.5	7.79	13.00	5.21
QPSK, 10 MHz, High channel	2150.0	7.82	13.00	5.18
64QAM, 10 MHz, High channel	2150.0	7.72	13.00	5.28
QPSK, 20 MHz, Low channel	2120.0	8.01	13.00	4.99
64QAM, 20 MHz, Low channel	2120.0	7.95	13.00	5.05
QPSK, 20 MHz, Mid channel	2132.5	8.27	13.00	4.73
64QAM, 20 MHz, Mid channel	2132.5	8.30	13.00	4.70
QPSK, 20 MHz, High channel	2145.0	8.40	13.00	4.60
16QAM, 20 MHz, High channel	2145.0	8.37	13.00	4.63

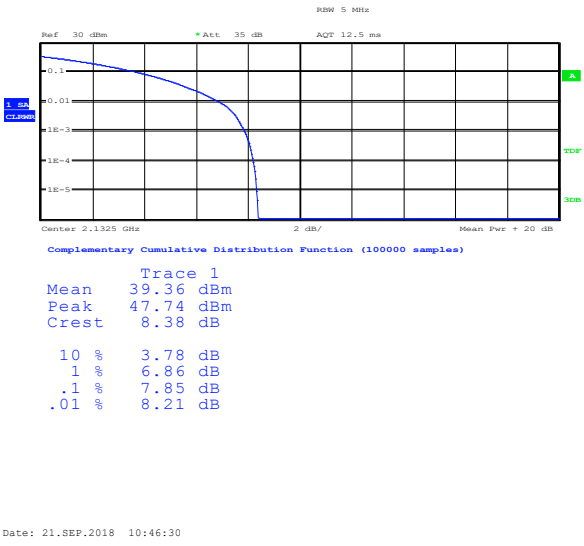


Figure 8.1-4: *CCDF sample plot, 5 MHz channel*

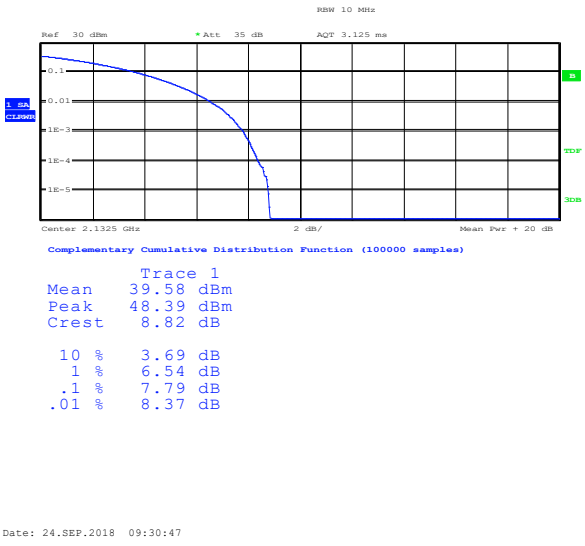


Figure 8.1-5: *CCDF sample plot, 10 MHz channel*

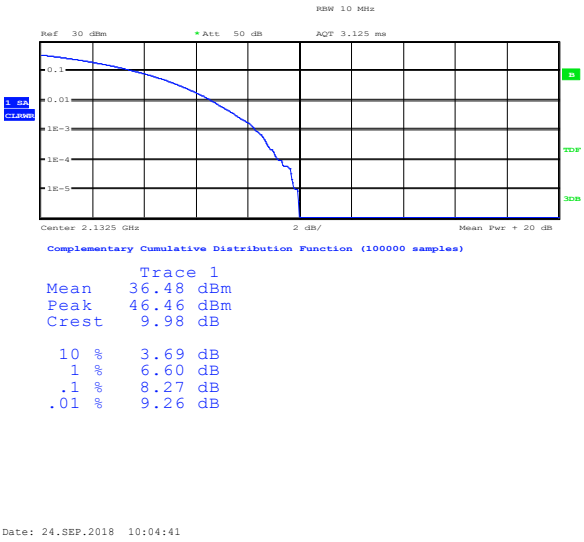


Figure 8.1-6: *CCDF sample plot, 20 MHz channel*

8.2 FCC 27.53 and RSS-139, 4.2 Spurious emissions at RF antenna connector

8.2.1 Definitions and limits

FCC:
(h) AWS emission limits
(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}$ (P) dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

RSS-139, Section 6.6:
i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10}$ p (watts) dB.
ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10}$ p (watts) dB.

8.2.2 Test summary

Test date	September 20, 2018
Test engineer	Andrey Adelberg

8.2.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
All measurements were performed using an average (RMS) detector.
Limit line was adjusted for MIMO operation by 3 dB (for *2* ports: $10 \times \text{Log}_{10}(2)$): −13 dBm – 3 dB = −16 dBm
RBW 1 MHz, VBW was wider than RBW.

8.2.4 Test data

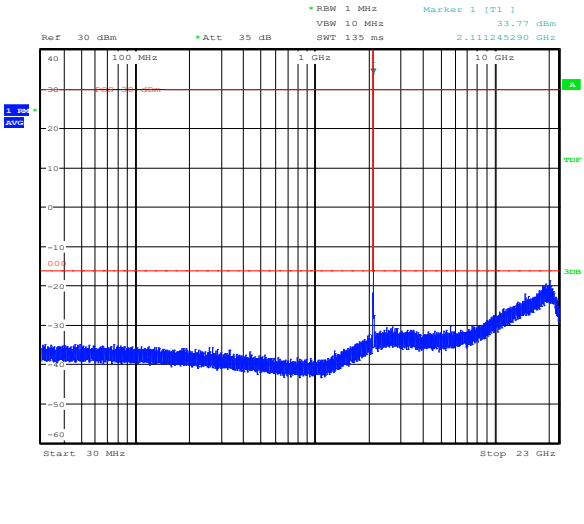


Figure 8.2-1: *Conducted spurious emissions at Antenna 1 QPSK, 5 MHz, low channel*

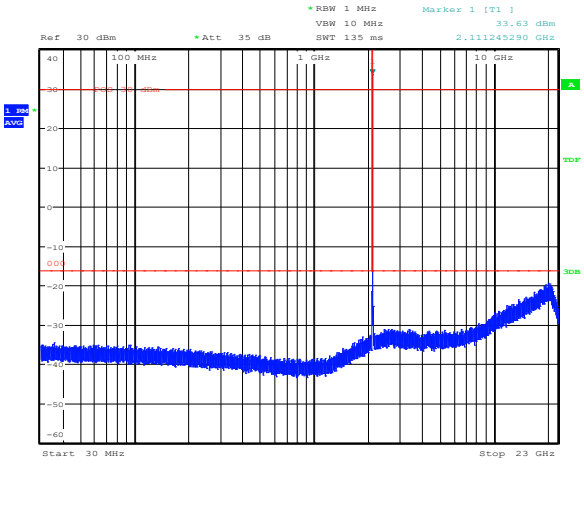


Figure 8.2-2: *Conducted spurious emissions at Antenna 1, 64QAM, 5 MHz, low channel*

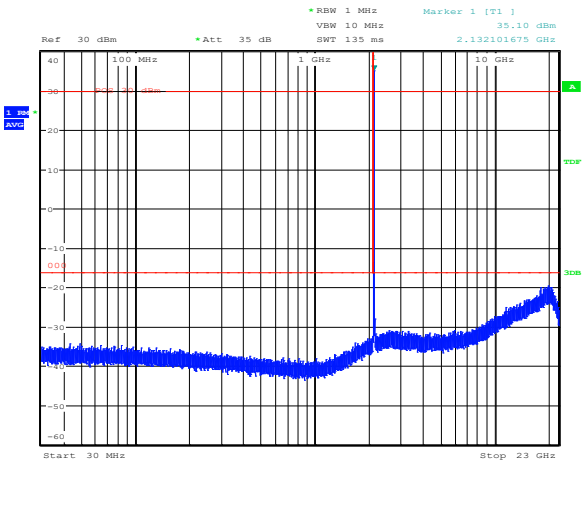


Figure 8.2-3: *Conducted spurious emissions at Antenna 1 QPSK, 5 MHz, mid channel*

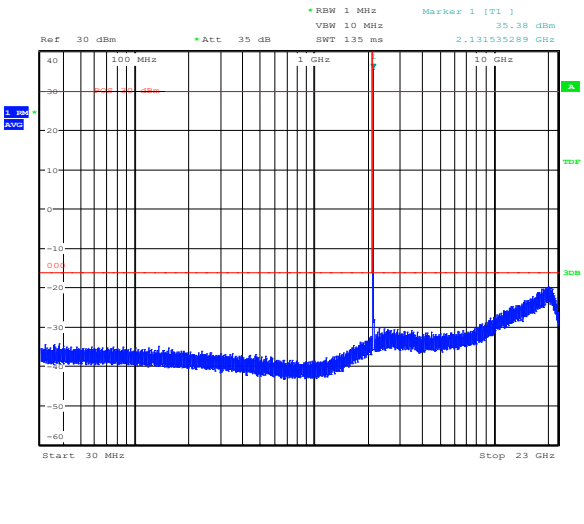


Figure 8.2-4: *Conducted spurious emissions at Antenna 1, 64QAM, 5 MHz, mid channel*

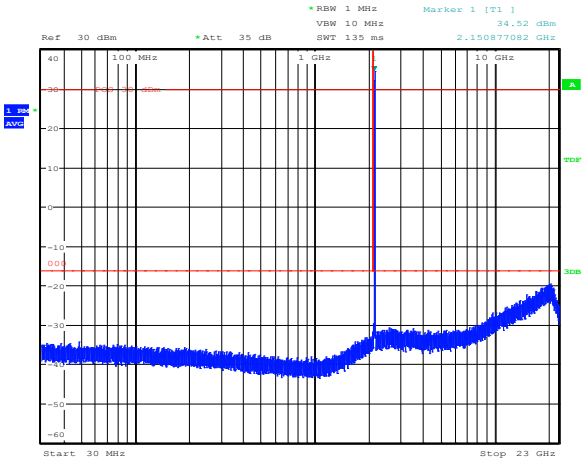


Figure 8.2-5: *Conducted spurious emissions at Antenna 1 QPSK, 5 MHz, high channel*

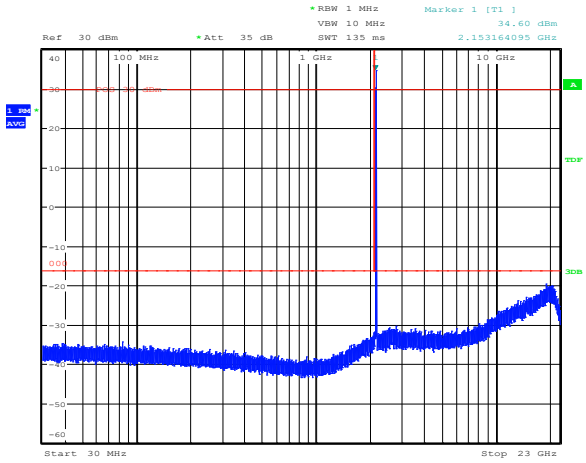


Figure 8.2-6: *Conducted spurious emissions at Antenna 1, 64QAM, 5 MHz, high channel*

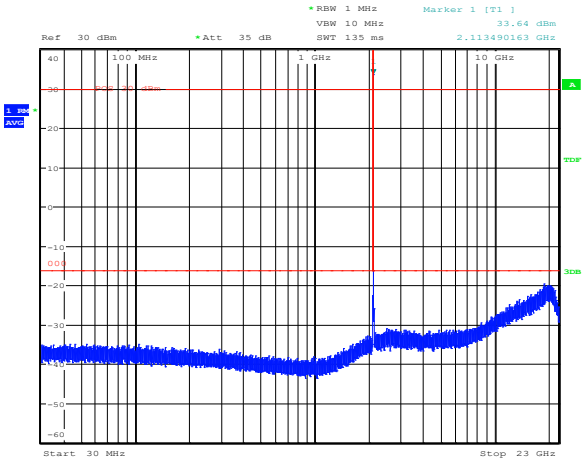


Figure 8.2-7: *Conducted spurious emissions at Antenna 2 QPSK, 5 MHz, low channel*

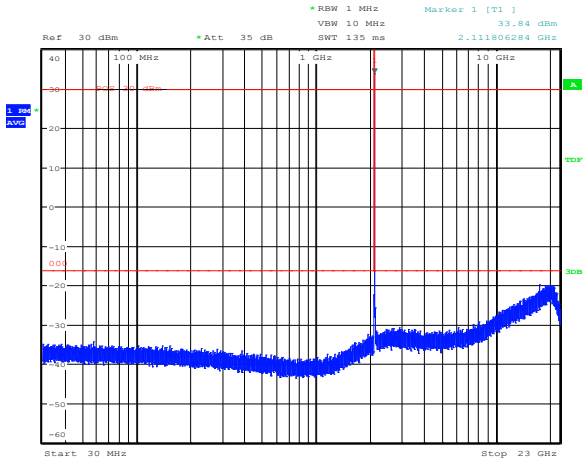


Figure 8.2-8: *Conducted spurious emissions at Antenna 2, 64QAM, 5 MHz, low channel*

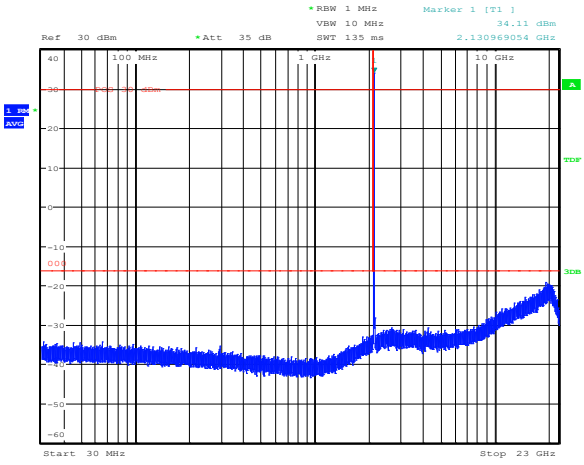


Figure 8.2-9: *Conducted spurious emissions at Antenna 2 QPSK, 5 MHz, mid channel*

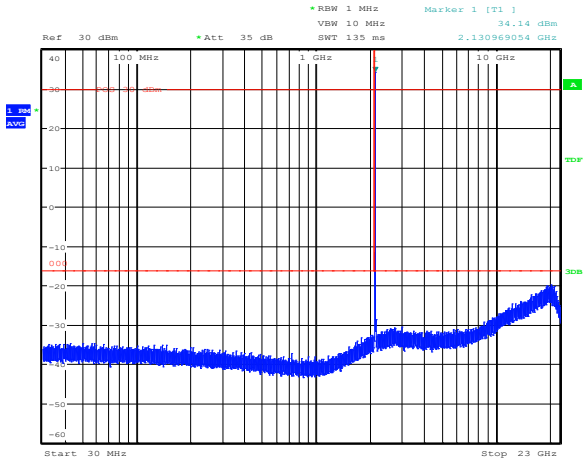


Figure 8.2-10: *Conducted spurious emissions at Antenna 2, 64QAM, 5 MHz, mid channel*

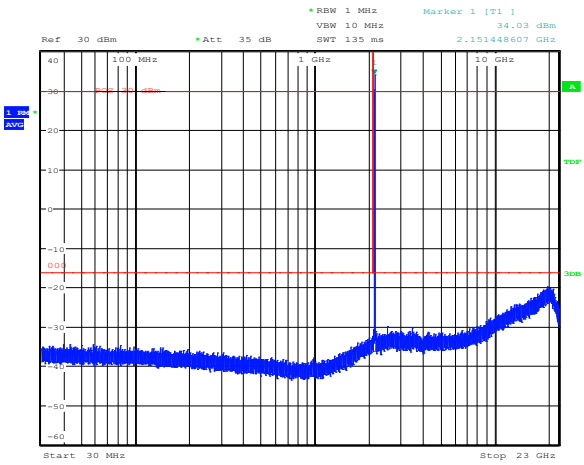


Figure 8.2-11: *Conducted spurious emissions at Antenna 2 QPSK, 5 MHz, high channel*

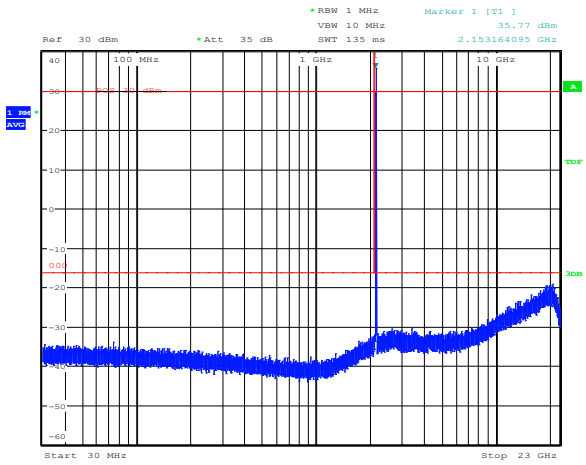


Figure 8.2-12: *Conducted spurious emissions at Antenna 2, 64QAM, 5 MHz, high channel*

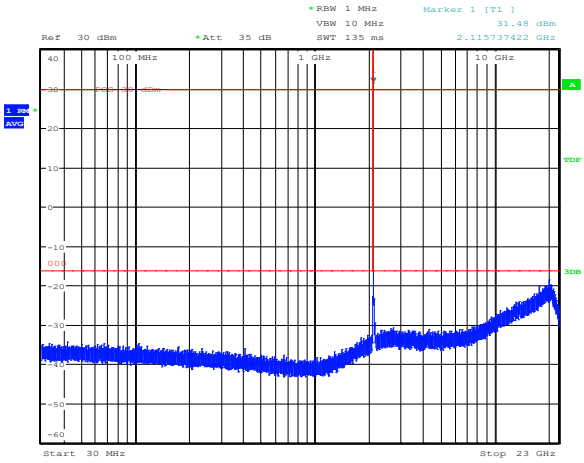


Figure 8.2-13: *Conducted spurious emissions at Antenna 1 QPSK, 10 MHz, low channel*

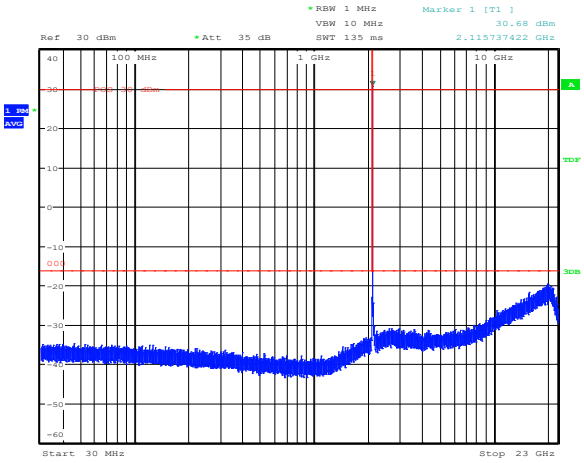


Figure 8.2-14: *Conducted spurious emissions at Antenna 1, 64QAM, 10 MHz, low channel*

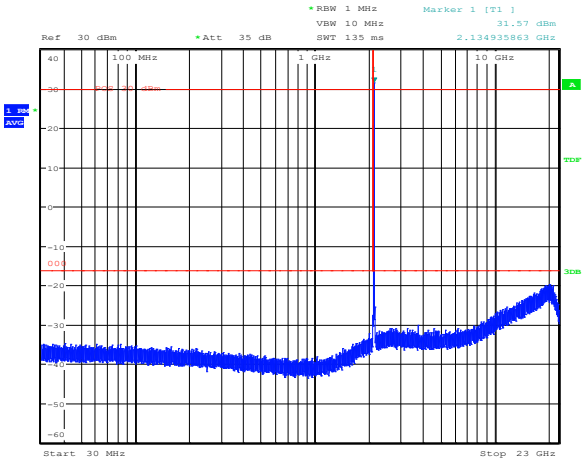


Figure 8.2-15: *Conducted spurious emissions at Antenna 1 QPSK, 10 MHz, mid channel*

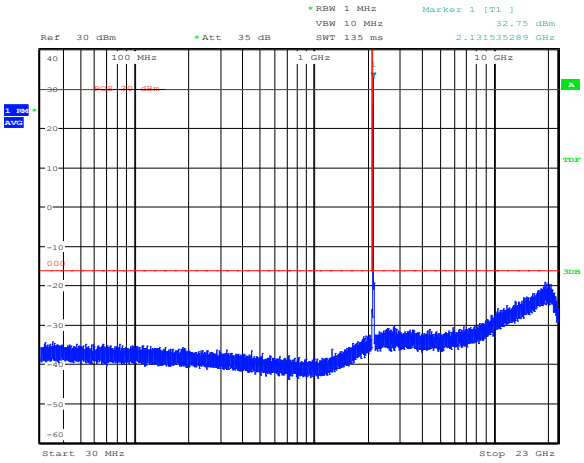


Figure 8.2-16: *Conducted spurious emissions at Antenna 1, 64QAM, 10 MHz, mid channel*

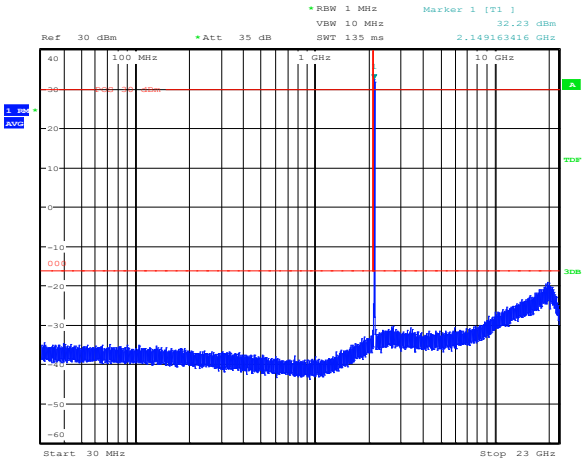


Figure 8.2-17: *Conducted spurious emissions at Antenna 1 QPSK, 10 MHz, high channel*

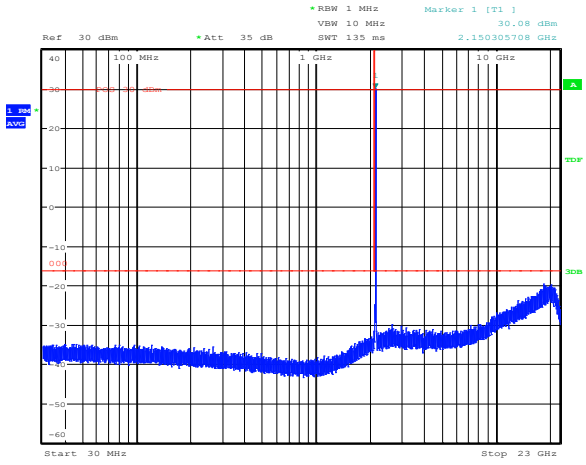


Figure 8.2-18: *Conducted spurious emissions at Antenna 1, 64QAM, 10 MHz, high channel*

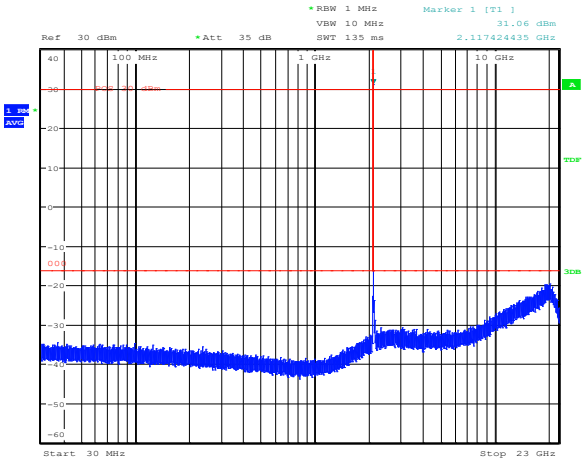


Figure 8.2-19: *Conducted spurious emissions at Antenna 2 QPSK, 10 MHz, low channel*

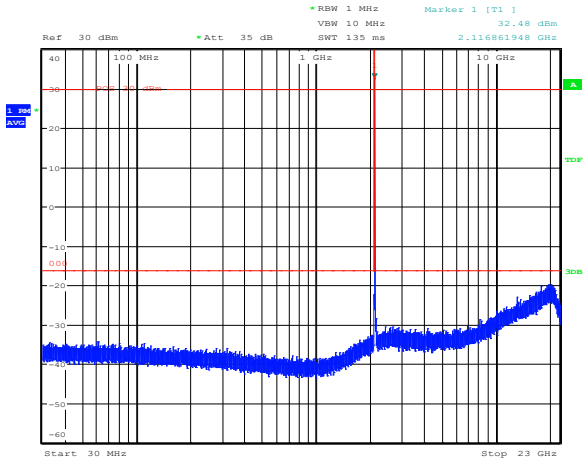


Figure 8.2-20: *Conducted spurious emissions at Antenna 2, 64QAM, 10 MHz, low channel*

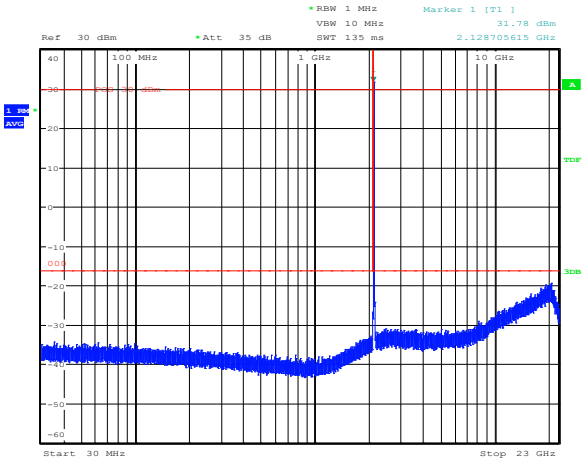


Figure 8.2-21: *Conducted spurious emissions at Antenna 2 QPSK, 10 MHz, mid channel*

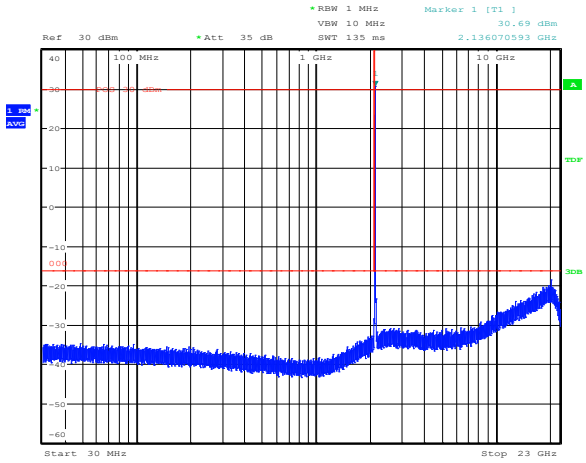


Figure 8.2-22: *Conducted spurious emissions at Antenna 2, 64QAM, 10 MHz, mid channel*

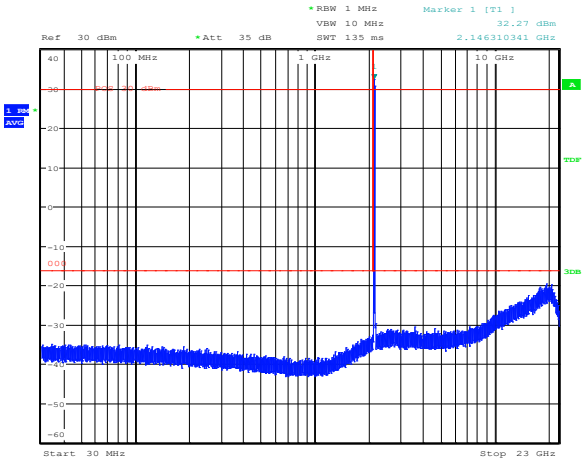


Figure 8.2-23: *Conducted spurious emissions at Antenna 2 QPSK, 10 MHz, high channel*

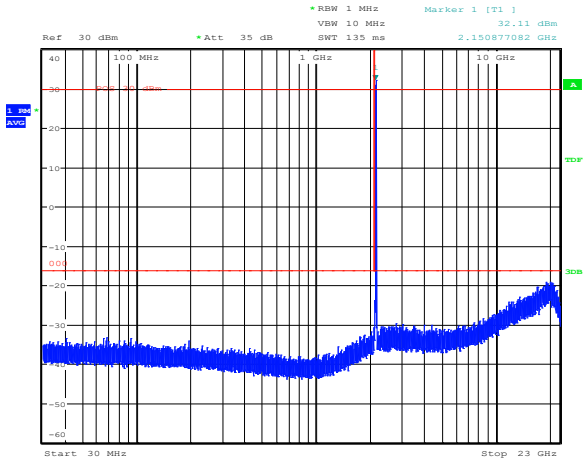


Figure 8.2-24: *Conducted spurious emissions at Antenna 2, 64QAM, 10 MHz, high channel*

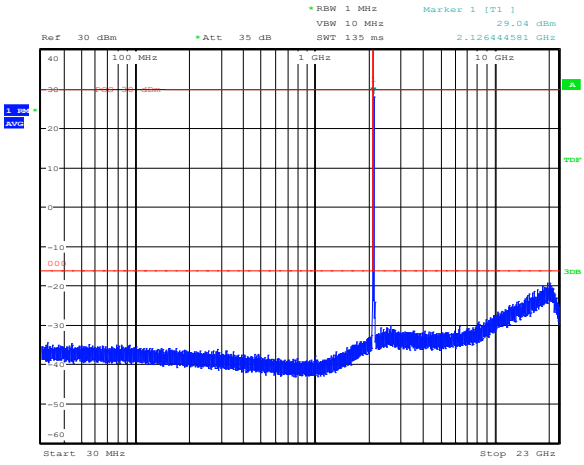


Figure 8.2-25: *Conducted spurious emissions at Antenna 1 QPSK, 20 MHz, low channel*

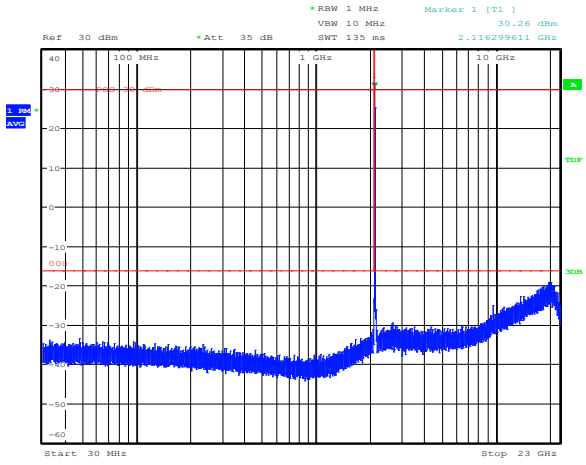


Figure 8.2-26: *Conducted spurious emissions at Antenna 1, 64QAM, 20 MHz, low channel*

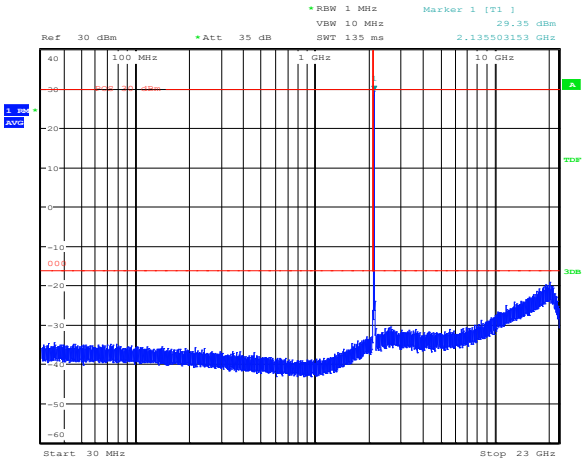


Figure 8.2-27: *Conducted spurious emissions at Antenna 1 QPSK, 20 MHz, mid channel*

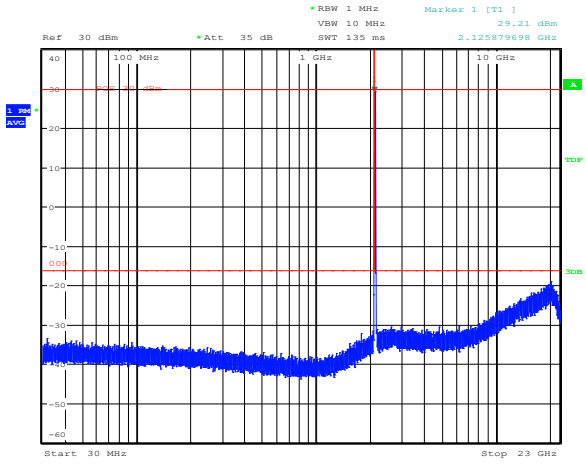


Figure 8.2-28: *Conducted spurious emissions at Antenna 1, 64QAM, 20 MHz, mid channel*

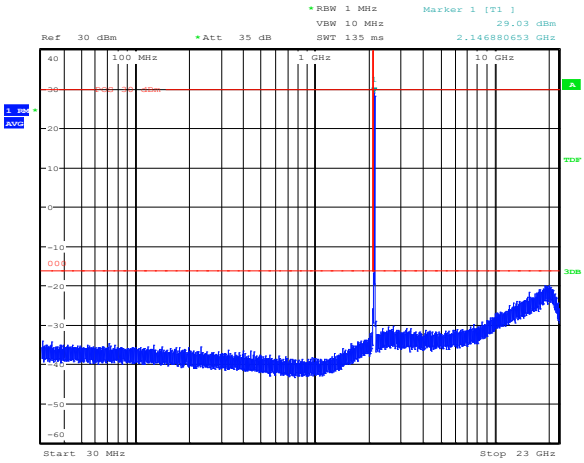


Figure 8.2-29: *Conducted spurious emissions at Antenna 1 QPSK, 20 MHz, high channel*

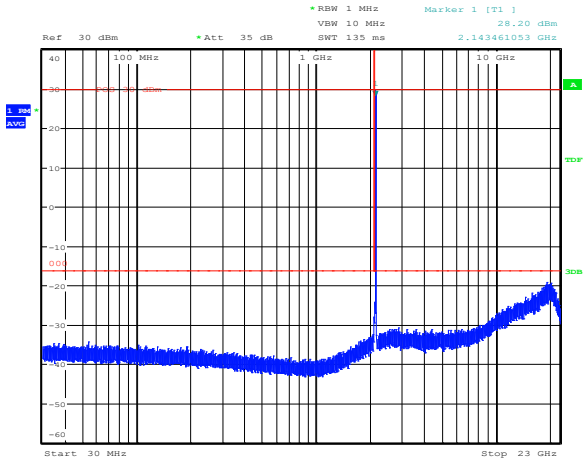


Figure 8.2-30: *Conducted spurious emissions at Antenna 1, 64QAM, 20 MHz, high channel*

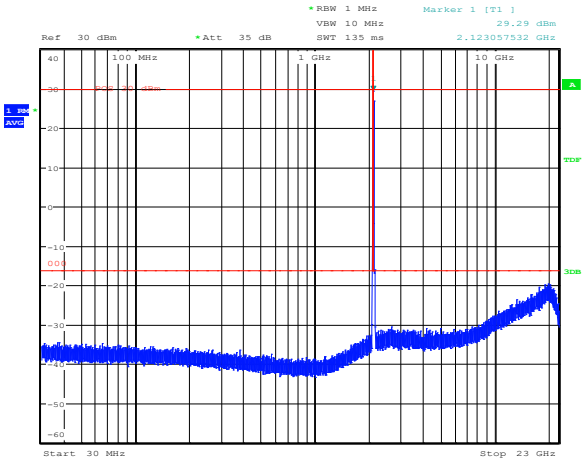


Figure 8.2-31: *Conducted spurious emissions at Antenna 2 QPSK, 20 MHz, low channel*

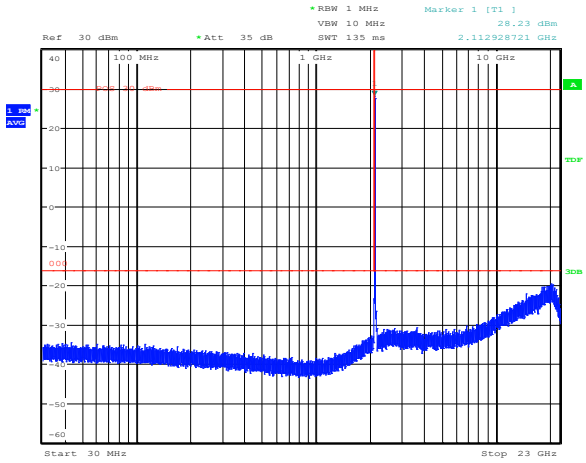


Figure 8.2-32: *Conducted spurious emissions at Antenna 2, 64QAM, 20 MHz, low channel*

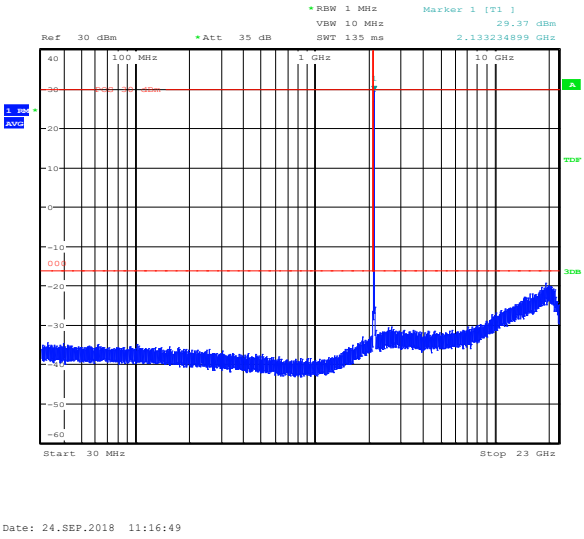


Figure 8.2-33: *Conducted spurious emissions at Antenna 2 QPSK, 20 MHz, mid channel*

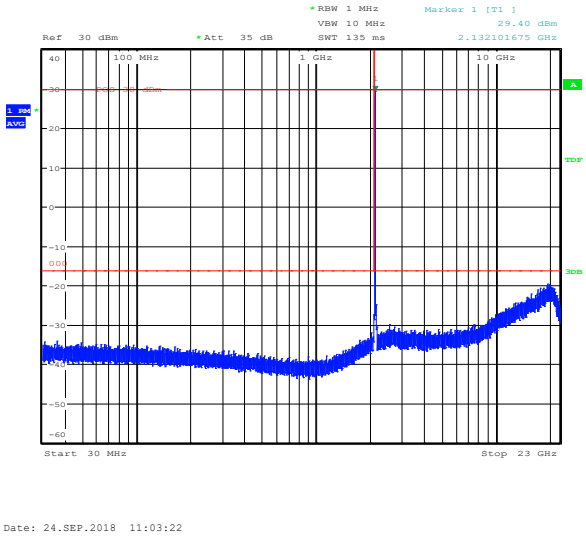


Figure 8.2-34: *Conducted spurious emissions at Antenna 2, 64QAM, 20 MHz, mid channel*

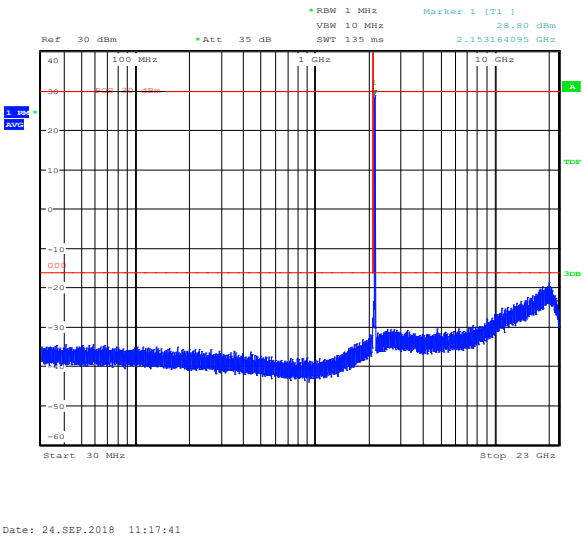


Figure 8.2-35: *Conducted spurious emissions at Antenna 2 QPSK, 20 MHz, high channel*

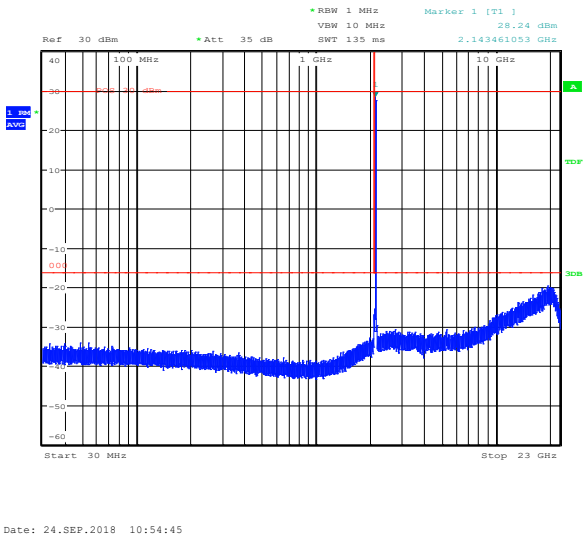


Figure 8.2-36: *Conducted spurious emissions at Antenna 2, 64QAM, 20 MHz, high channel*

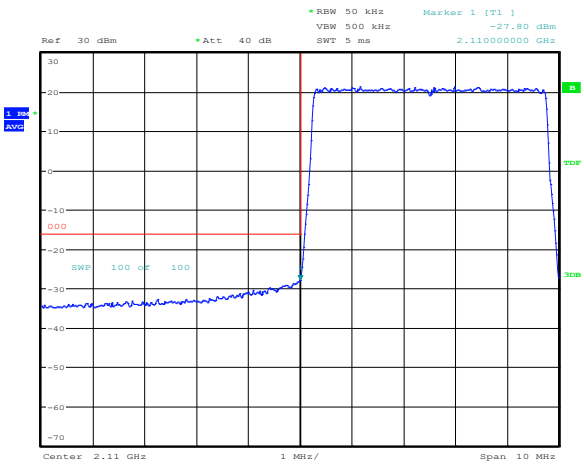


Figure 8.2-37: *Conducted band edge emission at Antenna 1 at 2110 MHz, 5 MHz, QPSK (RBW = 1% of EBW)*

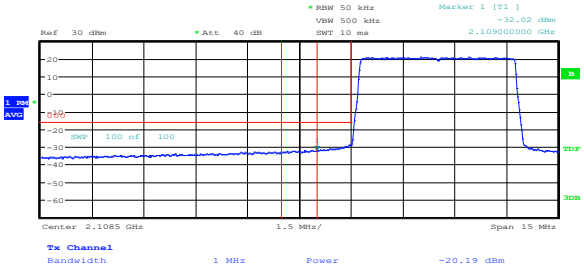


Figure 8.2-38: *Conducted band edge emission at Antenna 1 at 2109 MHz, 5 MHz, QPSK (RBW = 1 MHz)*

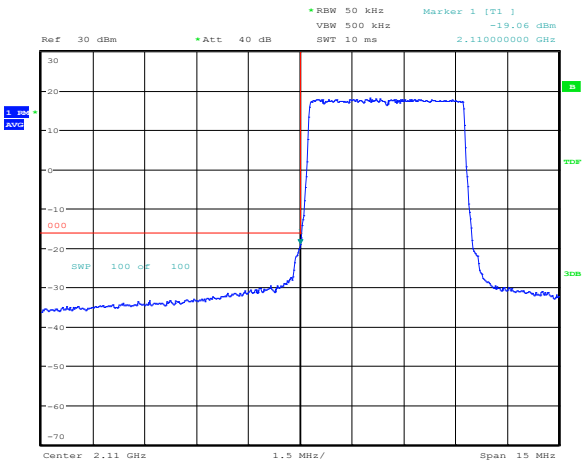


Figure 8.2-39: *Conducted band edge emission at Antenna 2 at 2110 MHz, 5 MHz, QPSK (RBW = 1% of EBW)*

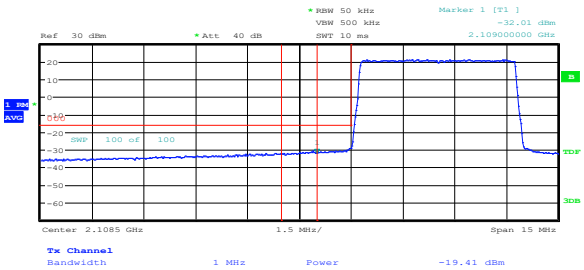
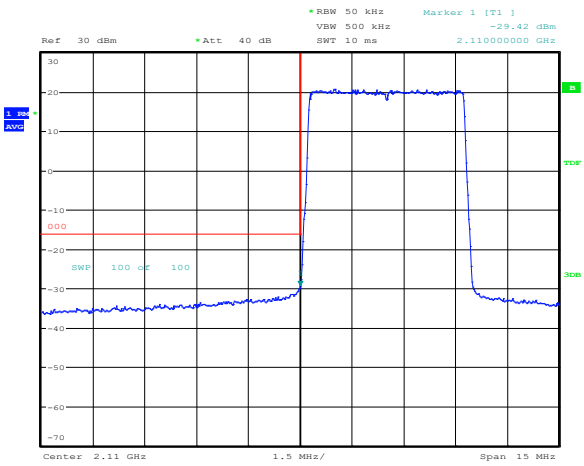
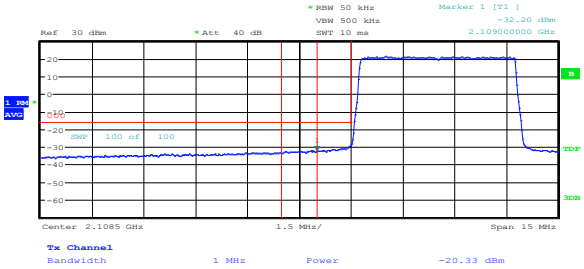


Figure 8.2-40: *Conducted band edge emission at Antenna 2 at 2109 MHz, 5 MHz, QPSK (RBW = 1 MHz)*



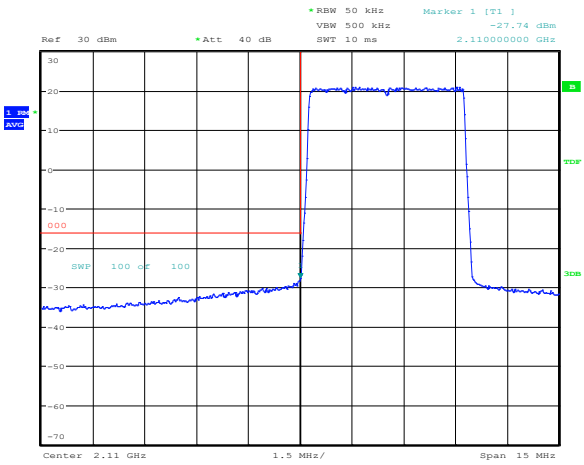
Date: 24.SEP.2018 15:40:19

Figure 8.2-41: *Conducted band edge emission at Antenna 1 at 2110 MHz, 5 MHz, 64QAM (RBW = 1% of EBW)*



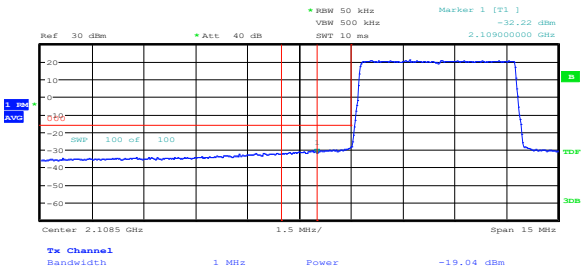
Date: 24.SEP.2018 15:40:48

Figure 8.2-42: *Conducted band edge emission at Antenna 1 at 2109 MHz, 5 MHz, 64QAM (RBW = 1 MHz)*



Date: 24.SEP.2018 15:39:50

Figure 8.2-43: *Conducted band edge emission at Antenna 2 at 2110 MHz, 5 MHz, 64QAM (RBW = 1% of EBW)*



Date: 24.SEP.2018 15:41:13

Figure 8.2-44: *Conducted band edge emission at Antenna 2 at 2109 MHz, 5 MHz, 64QAM (RBW = 1 MHz)*

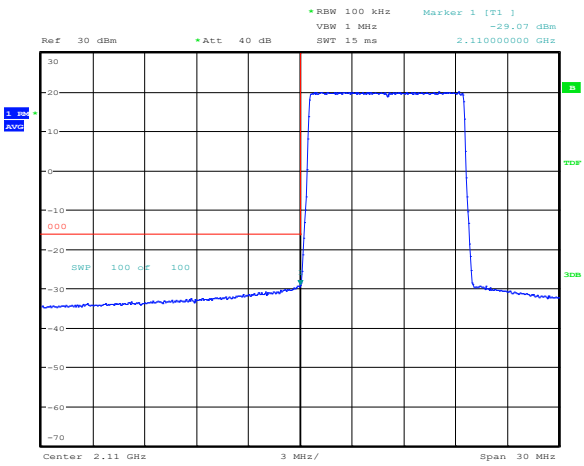


Figure 8.2-45: *Conducted band edge emission at Antenna 1 at 2110 MHz, 10 MHz, QPSK (RBW = 1% of EBW)*

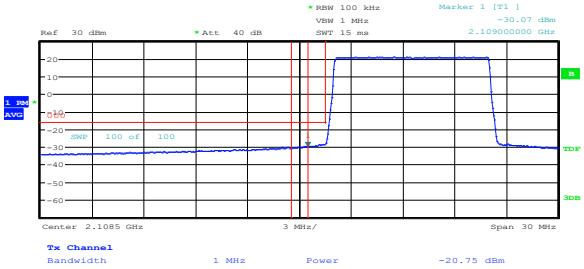


Figure 8.2-46: *Conducted band edge emission at Antenna 1 at 2109 MHz, 10 MHz, QPSK (RBW = 1 MHz)*

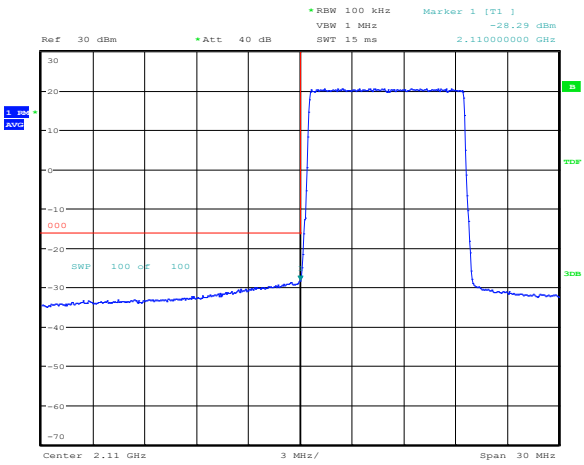


Figure 8.2-47: *Conducted band edge emission at Antenna 2 at 2110 MHz, 10 MHz, QPSK (RBW = 1% of EBW)*

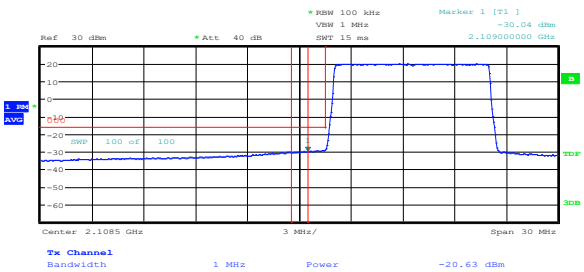


Figure 8.2-48: *Conducted band edge emission at Antenna 2 at 2109 MHz, 10 MHz, QPSK (RBW = 1 MHz)*

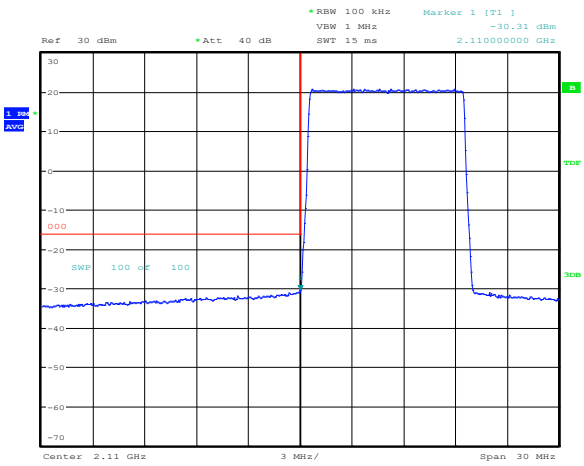


Figure 8.2-49: *Conducted band edge emission at Antenna 1 at 2110 MHz, 10 MHz, 64QAM (RBW = 1% of EBW)*

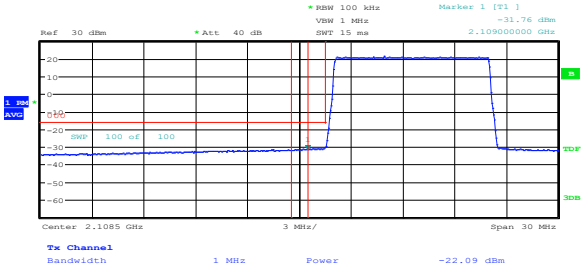


Figure 8.2-50: *Conducted band edge emission at Antenna 1 at 2109 MHz, 10 MHz, 64QAM (RBW = 1 MHz)*

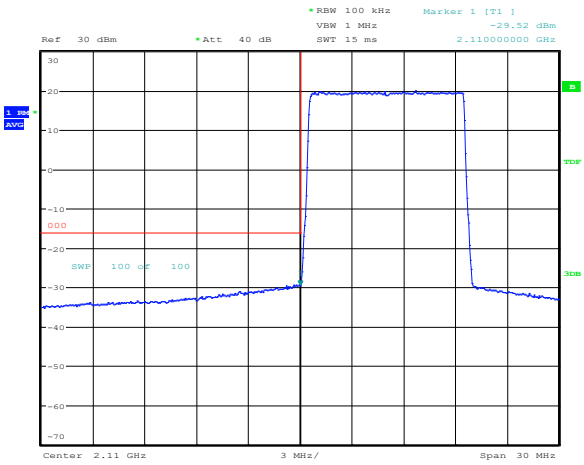


Figure 8.2-51: *Conducted band edge emission at Antenna 2 at 2110 MHz, 10 MHz, 64QAM (RBW = 1% of EBW)*

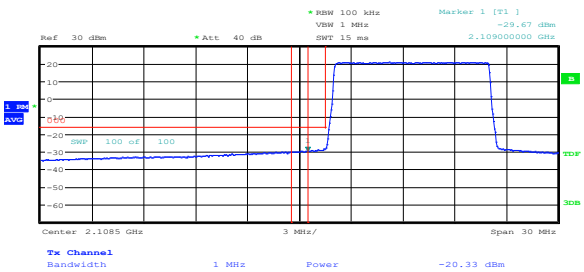


Figure 8.2-52: *Conducted band edge emission at Antenna 2 at 2109 MHz, 10 MHz, 64QAM (RBW = 1 MHz)*

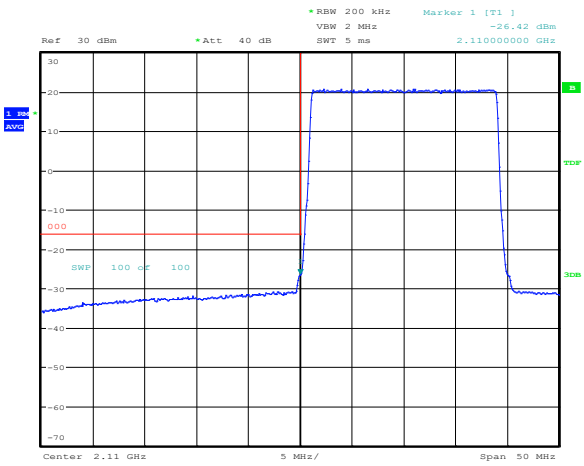


Figure 8.2-53: *Conducted band edge emission at Antenna 1 at 2110 MHz, 20 MHz, QPSK (RBW = 1% of EBW)*

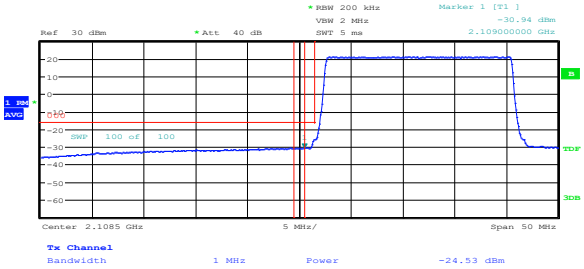


Figure 8.2-54: *Conducted band edge emission at Antenna 1 at 2109 MHz, 20 MHz, QPSK (RBW = 1 MHz)*

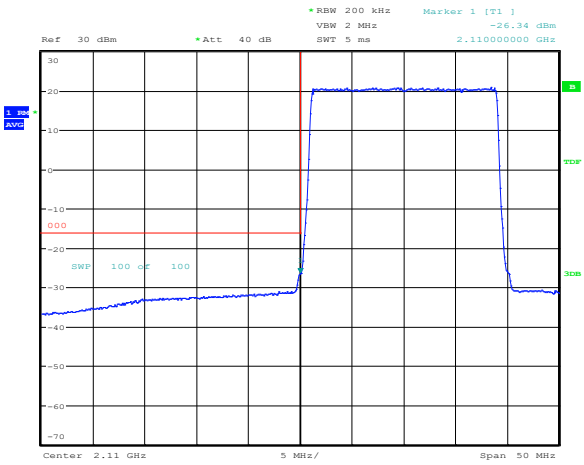


Figure 8.2-55: *Conducted band edge emission at Antenna 2 at 2110 MHz, 20 MHz, QPSK (RBW = 1% of EBW)*

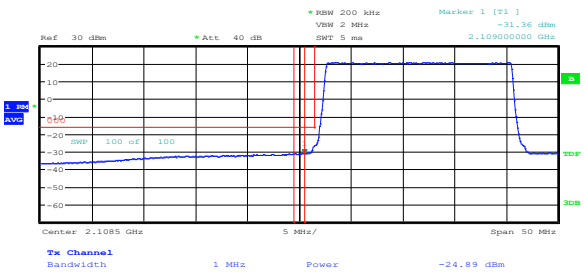


Figure 8.2-56: *Conducted band edge emission at Antenna 2 at 2109 MHz, 20 MHz, QPSK (RBW = 1 MHz)*

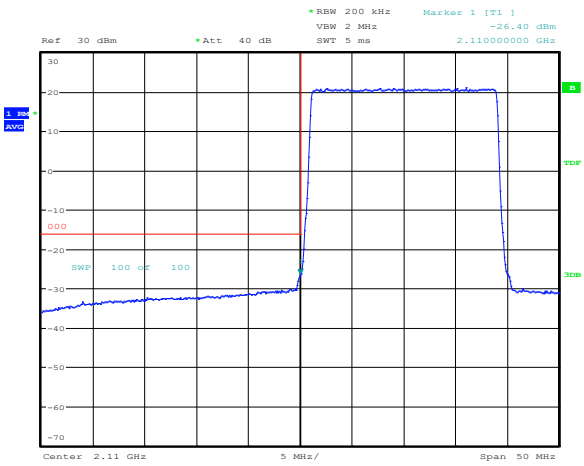


Figure 8.2-57: *Conducted band edge emission at Antenna 1 at 2110 MHz, 20 MHz, 64QAM (RBW = 1% of EBW)*

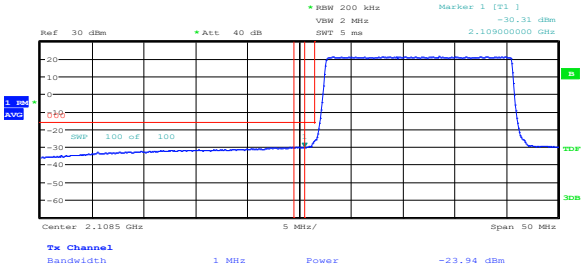


Figure 8.2-58: *Conducted band edge emission at Antenna 1 at 2109 MHz, 20 MHz, 64QAM (RBW = 1 MHz)*

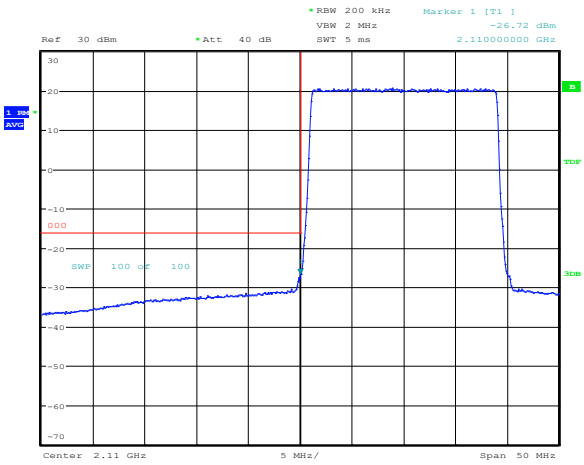


Figure 8.2-59: *Conducted band edge emission at Antenna 2 at 2110 MHz, 20 MHz, 64QAM (RBW = 1% of EBW)*

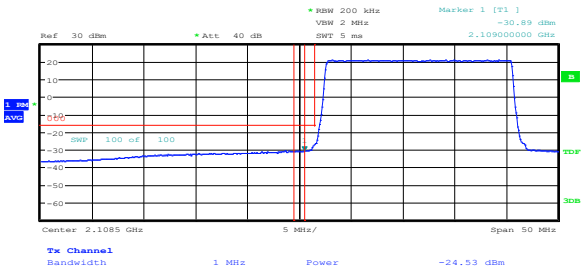


Figure 8.2-60: *Conducted band edge emission at Antenna 2 at 2109 MHz, 20 MHz, 64QAM (RBW = 1 MHz)*

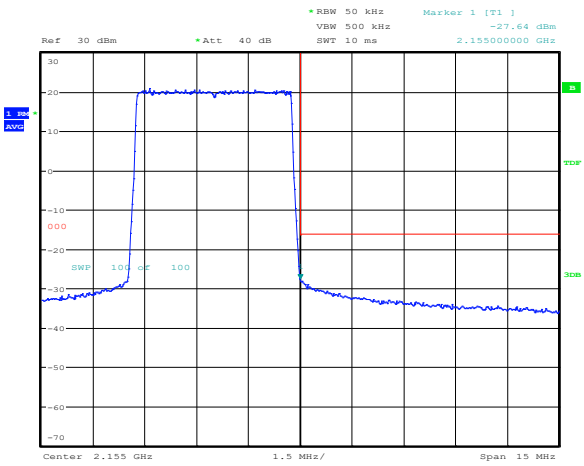


Figure 8.2-61: *Conducted band edge emission at Antenna 1 at 2155 MHz, 5 MHz, QPSK (RBW = 1% of EBW)*

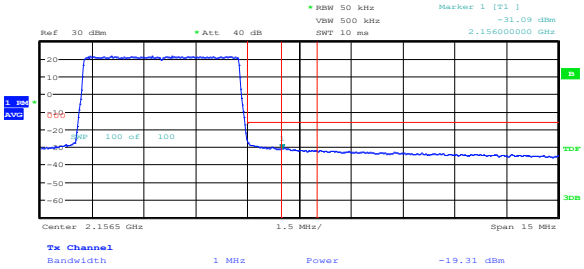


Figure 8.2-62: *Conducted band edge emission at Antenna 1 at 2156 MHz, 5 MHz, QPSK (RBW = 1 MHz)*

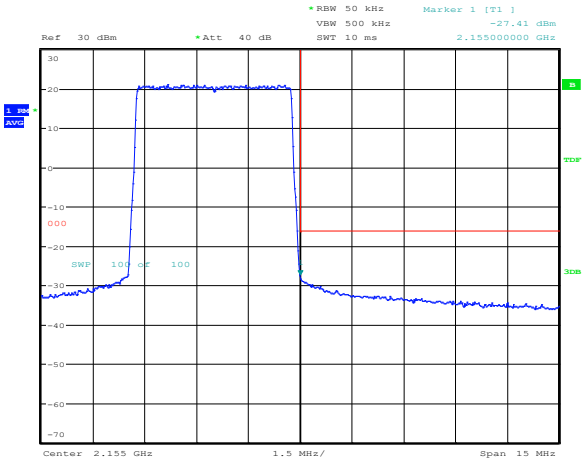


Figure 8.2-63: *Conducted band edge emission at Antenna 2 at 2155 MHz, 5 MHz, QPSK (RBW = 1% of EBW)*

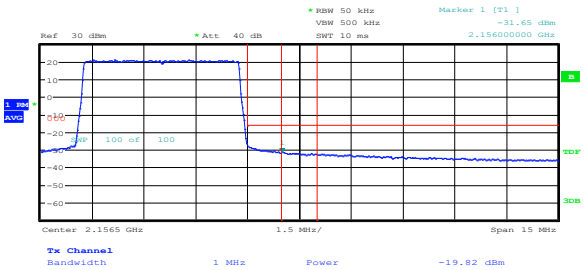


Figure 8.2-64: *Conducted band edge emission at Antenna 2 at 2156 MHz, 5 MHz, QPSK (RBW = 1 MHz)*

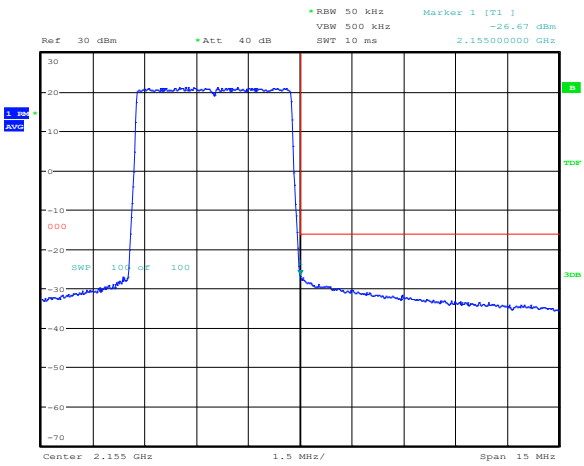


Figure 8.2-65: *Conducted band edge emission at Antenna 1 at 2155 MHz, 5 MHz, 64QAM (RBW = 1% of EBW)*

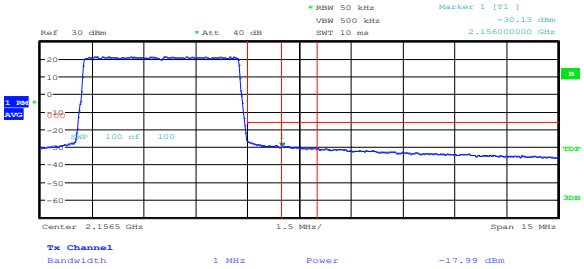


Figure 8.2-66: *Conducted band edge emission at Antenna 1 at 2156 MHz, 5 MHz, 64QAM (RBW = 1 MHz)*

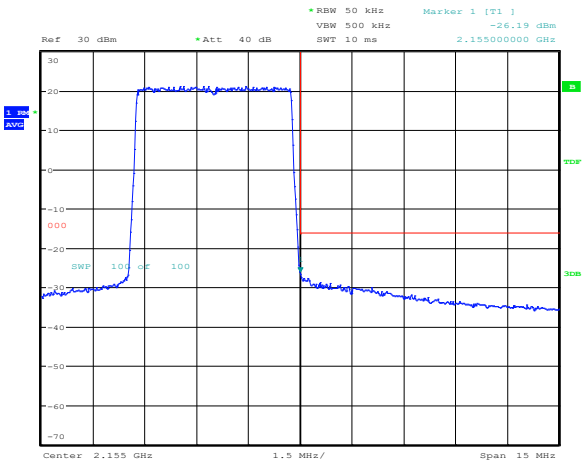


Figure 8.2-67: *Conducted band edge emission at Antenna 2 at 2155 MHz, 5 MHz, 64QAM (RBW = 1% of EBW)*

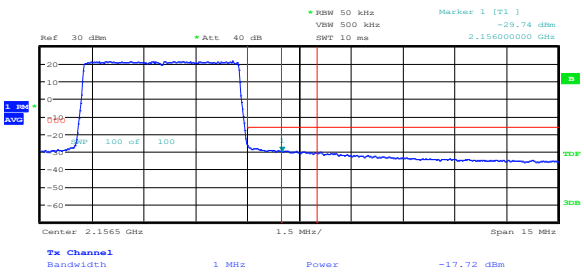


Figure 8.2-68: *Conducted band edge emission at Antenna 2 at 2156 MHz, 5 MHz, 64QAM (RBW = 1 MHz)*

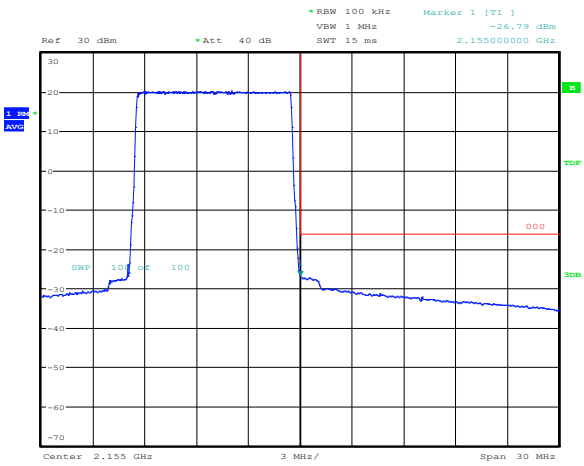


Figure 8.2-69: *Conducted band edge emission at Antenna 1 at 2155 MHz, 10 MHz, QPSK (RBW = 1% of EBW)*

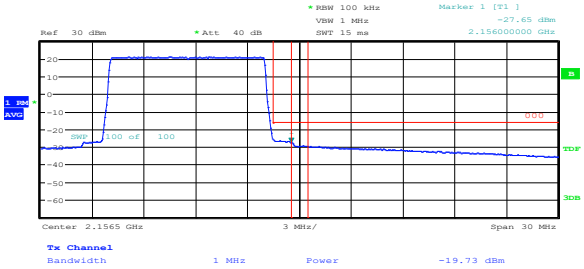


Figure 8.2-70: *Conducted band edge emission at Antenna 1 at 2156 MHz, 10 MHz, QPSK (RBW = 1 MHz)*

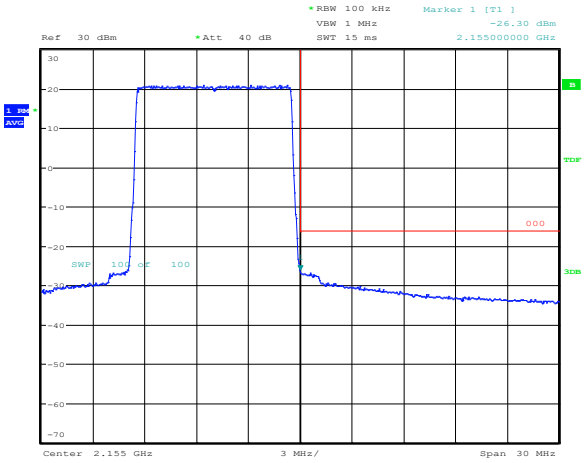


Figure 8.2-71: *Conducted band edge emission at Antenna 2 at 2155 MHz, 10 MHz, QPSK (RBW = 1% of EBW)*

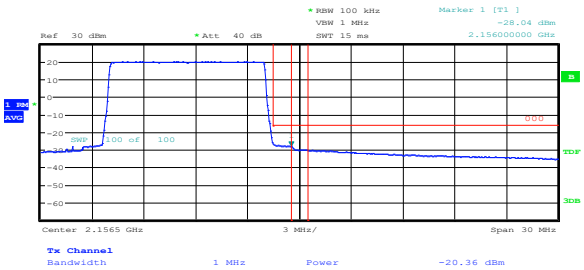


Figure 8.2-72: *Conducted band edge emission at Antenna 2 at 2156 MHz, 10 MHz, QPSK (RBW = 1 MHz)*

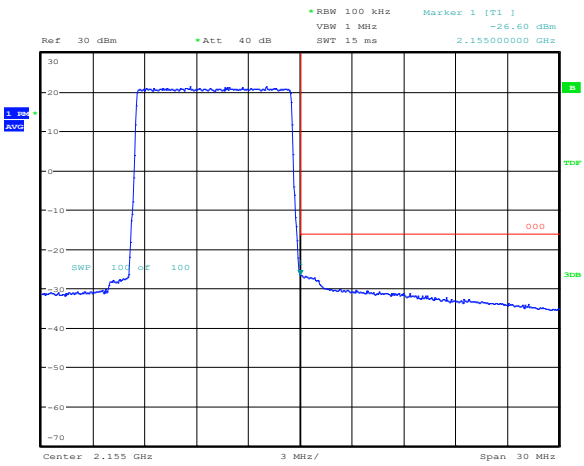


Figure 8.2-73: *Conducted band edge emission at Antenna 1 at 2155 MHz, 10 MHz, 64QAM (RBW = 1% of EBW)*

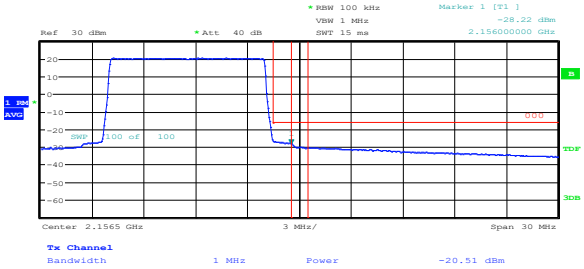


Figure 8.2-74: *Conducted band edge emission at Antenna 1 at 2156 MHz, 10 MHz, 64QAM (RBW = 1 MHz)*

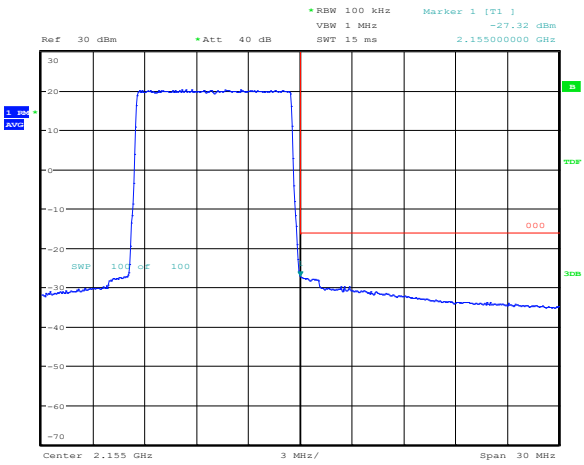


Figure 8.2-75: *Conducted band edge emission at Antenna 2 at 2155 MHz, 10 MHz, 64QAM (RBW = 1% of EBW)*

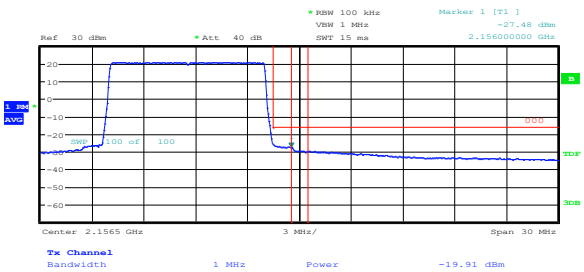


Figure 8.2-76: *Conducted band edge emission at Antenna 2 at 2156 MHz, 10 MHz, 64QAM (RBW = 1 MHz)*

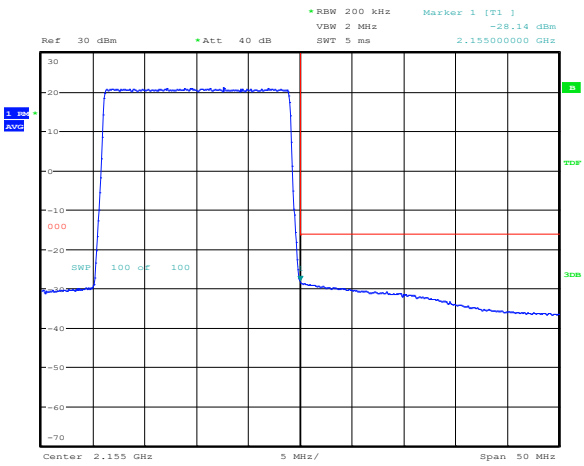


Figure 8.2-77: *Conducted band edge emission at Antenna 1 at 2155 MHz, 20 MHz, QPSK (RBW = 1% of EBW)*

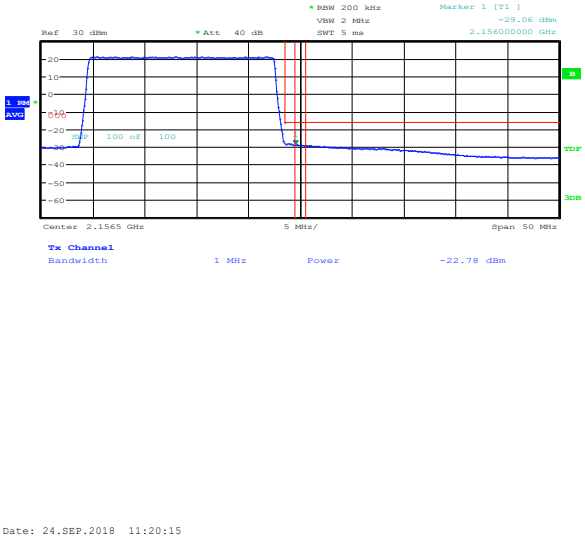


Figure 8.2-78: *Conducted band edge emission at Antenna 1 at 2156 MHz, 20 MHz, QPSK (RBW = 1 MHz)*

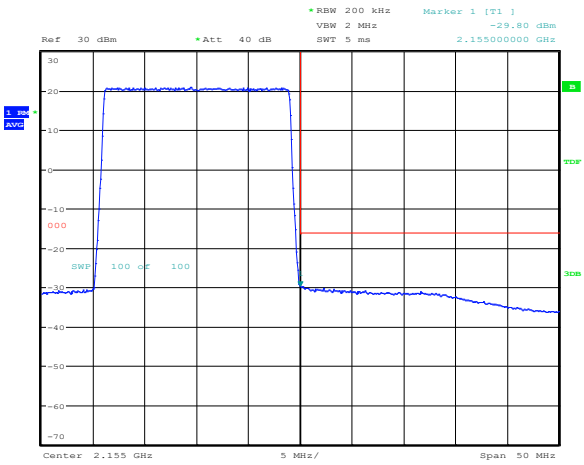


Figure 8.2-79: *Conducted band edge emission at Antenna 2 at 2155 MHz, 20 MHz, QPSK (RBW = 1% of EBW)*

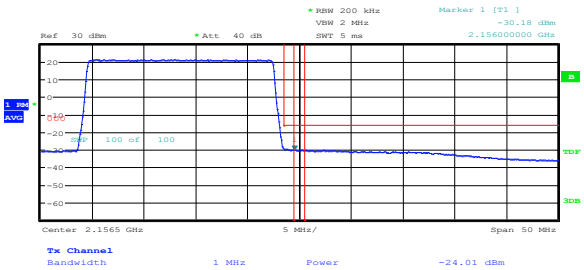


Figure 8.2-80: *Conducted band edge emission at Antenna 2 at 2156 MHz, 20 MHz, QPSK (RBW = 1 MHz)*

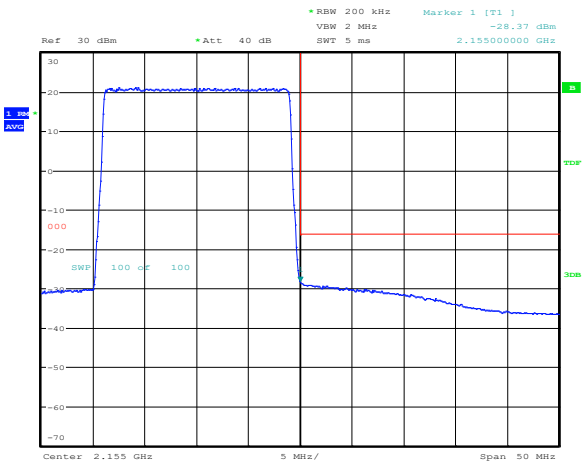


Figure 8.2-81: *Conducted band edge emission at Antenna 1 at 2155 MHz, 20 MHz, 64QAM (RBW = 1% of EBW)*

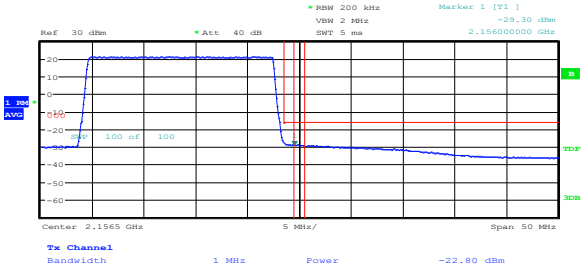


Figure 8.2-82: *Conducted band edge emission at Antenna 1 at 2156 MHz, 20 MHz, 64QAM (RBW = 1 MHz)*

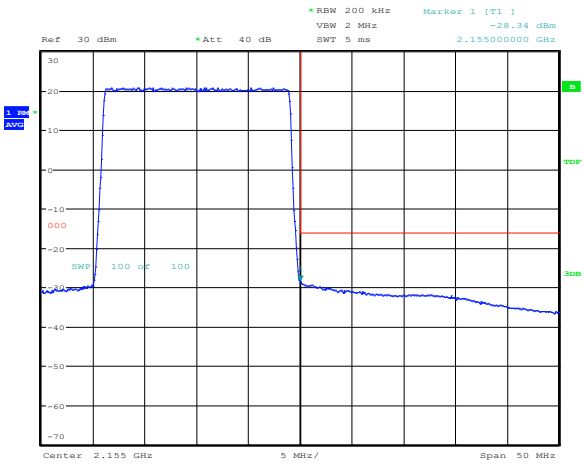


Figure 8.2-83: *Conducted band edge emission at Antenna 2 at 2155 MHz, 20 MHz, 64QAM (RBW = 1% of EBW)*

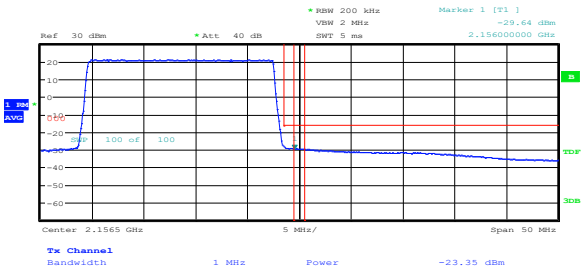


Figure 8.2-84: *Conducted band edge emission at Antenna 2 at 2156 MHz, 20 MHz, 64QAM (RBW = 1 MHz)*

8.3 FCC 27.53 and RSS-139, 4.2 Radiated spurious emissions

8.3.1 Definitions and limits

FCC:
(h) AWS emission limits
(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}$ (P) dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

RSS-139, Section 6.6:
i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10}$ p (watts) dB.
ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10}$ p (watts) dB.

8.3.2 Test summary

Test date	September 21, 2018
Test engineer	Andrey Adelberg

8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
All measurements were performed using a peak detector.
RBW within 30–1000 MHz was 100 kHz and 1 MHz above 1 GHz. VBW was wider than RBW.
Testing was performed with both RF ports terminated with 50 Ohm load and with 10 dB attenuators installed at the output.

8.3.4 Test data

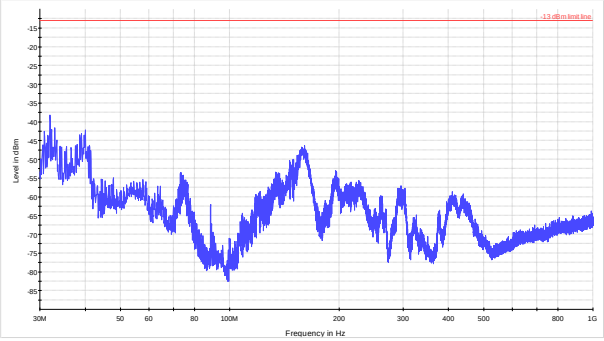


Figure 8.3-1: *Radiated spurious emission below 1 GHz for 5 MHz low channel*

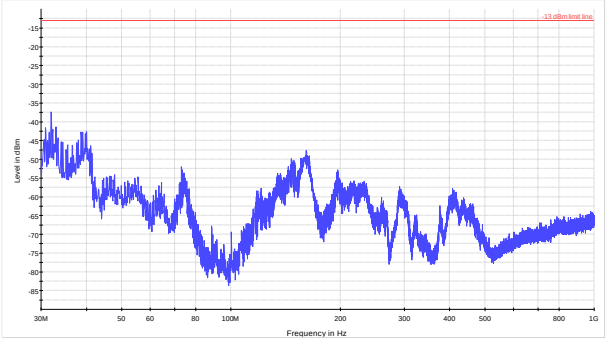


Figure 8.3-2: *Radiated spurious emission below 1 GHz for 5 MHz mid channel*

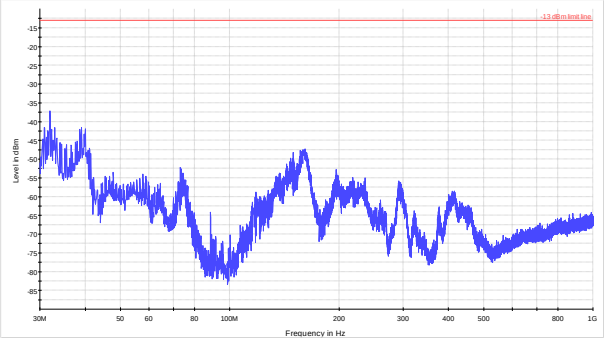


Figure 8.3-3: *Radiated spurious emission below 1 GHz for 5 MHz high channel*

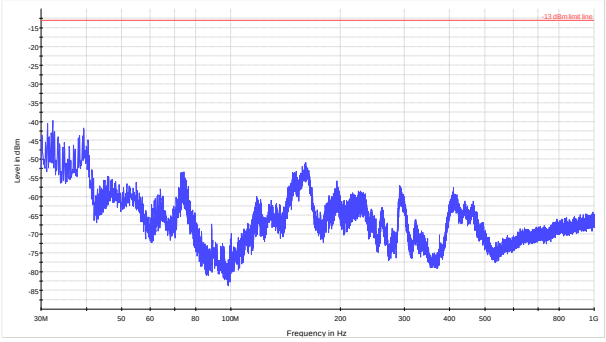


Figure 8.3-4: *Radiated spurious emission below 1 GHz for 10 MHz low channel*

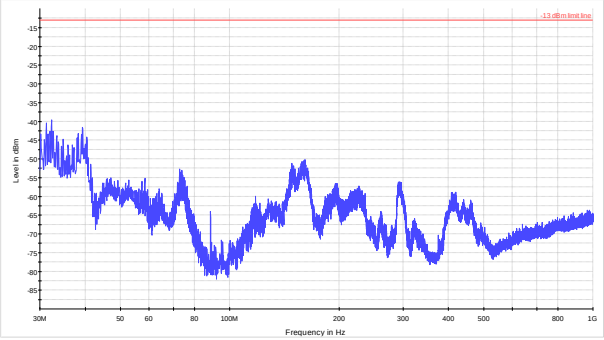


Figure 8.3-5: *Radiated spurious emission below 1 GHz for 10 MHz mid channel*

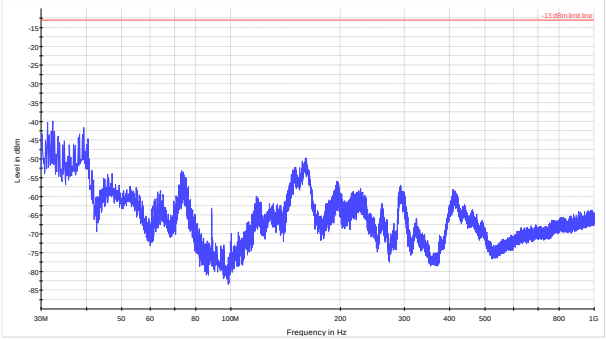


Figure 8.3-6: *Radiated spurious emission below 1 GHz for 10 MHz high channel*

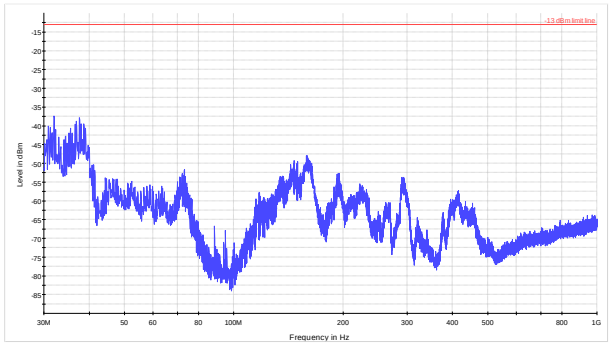


Figure 8.3-7: *Radiated spurious emission below 1 GHz for 20 MHz low channel*

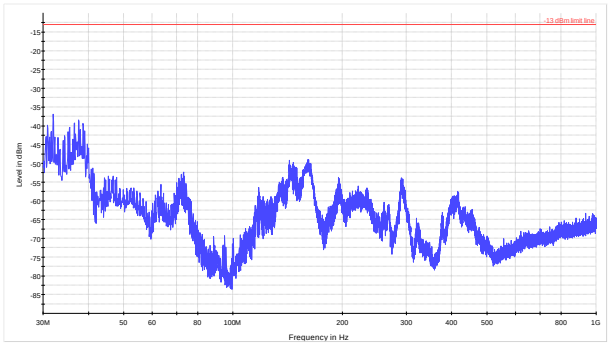


Figure 8.3-8: *Radiated spurious emission below 1 GHz for 20 MHz mid channel*

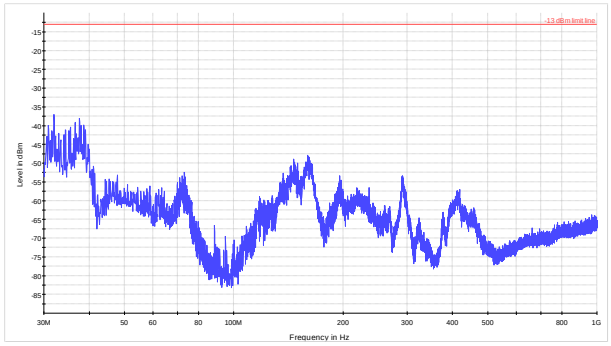


Figure 8.3-9: *Radiated spurious emission below 1 GHz for 20 MHz high channel*

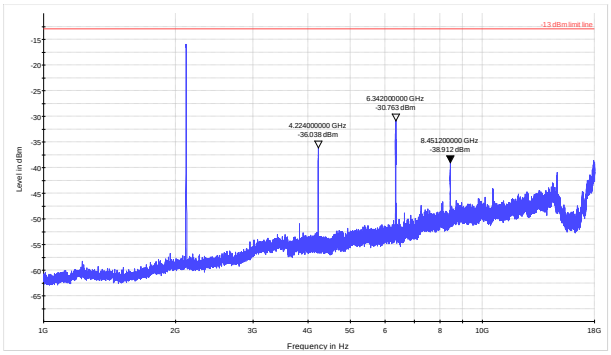


Figure 8.3-10: *Radiated spurious emission within 1–18 GHz for 5 MHz low channel*

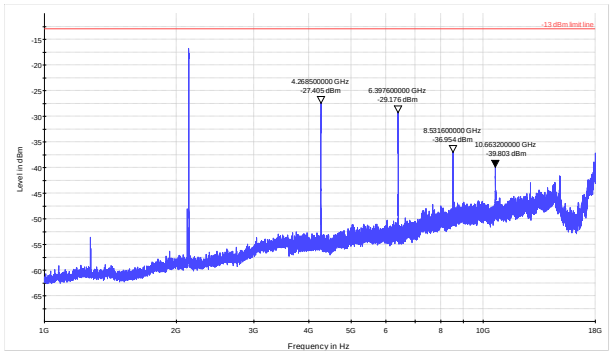


Figure 8.3-11: *Radiated spurious emission within 1–18 GHz for 5 MHz mid channel*

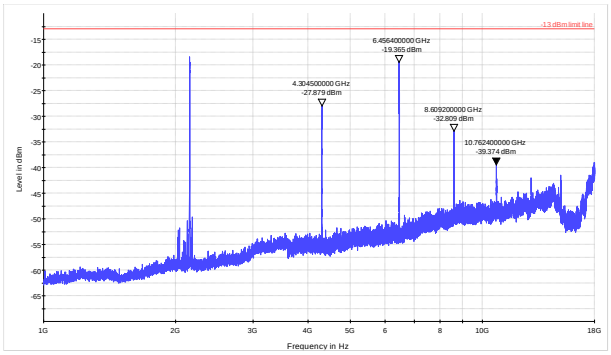


Figure 8.3-12: *Radiated spurious emission within 1–18 GHz for 5 MHz high channel*

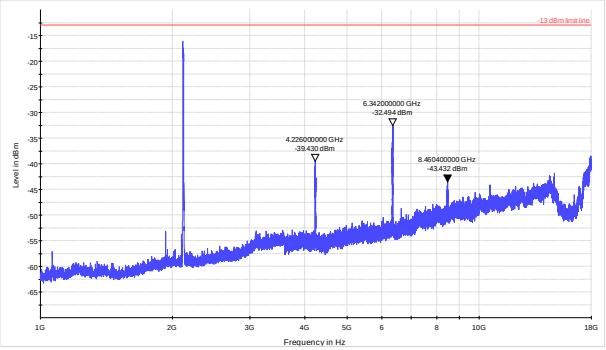


Figure 8.3-13: *Radiated spurious emission within 1–18 GHz for 10 MHz low channel*

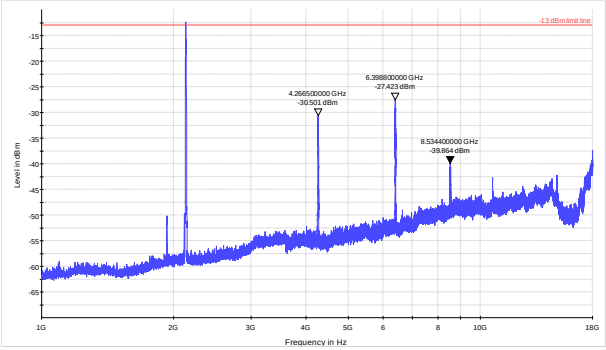


Figure 8.3-14: *Radiated spurious emission within 1–18 GHz for 10 MHz mid channel*

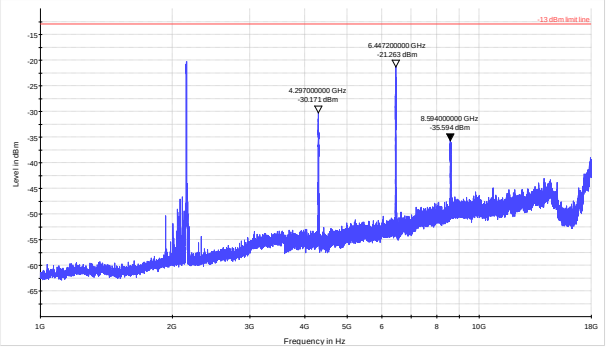


Figure 8.3-15: *Radiated spurious emission within 1–18 GHz for 10 MHz high channel*

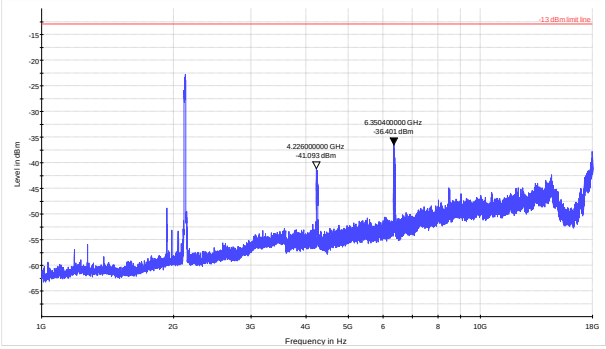


Figure 8.3-16: *Radiated spurious emission within 1–18 GHz for 20 MHz low channel*

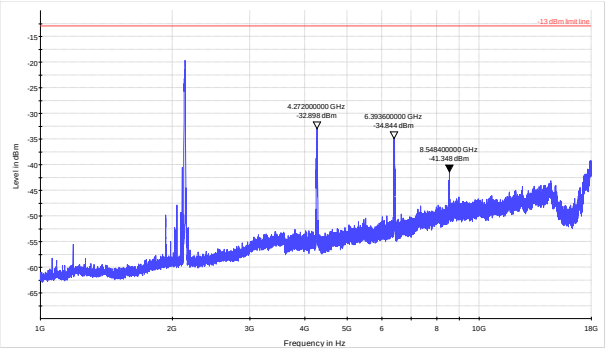


Figure 8.3-17: *Radiated spurious emission within 1–18 GHz for 20 MHz mid channel*

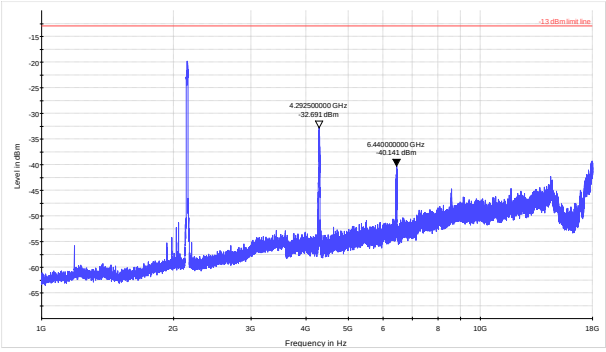


Figure 8.3-18: *Radiated spurious emission within 1–18 GHz for 20 MHz high channel*

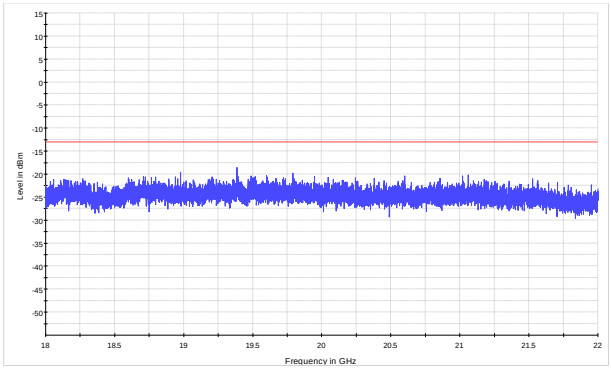


Figure 8.3-19: *Radiated spurious emission above 18 GHz for 5 MHz low channel*

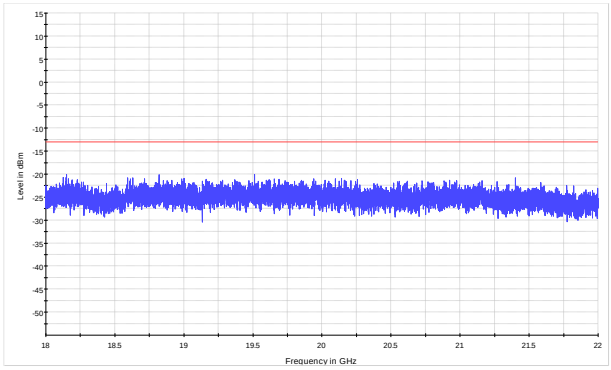


Figure 8.3-20: *Radiated spurious emission above 18 GHz for 5 MHz mid channel*

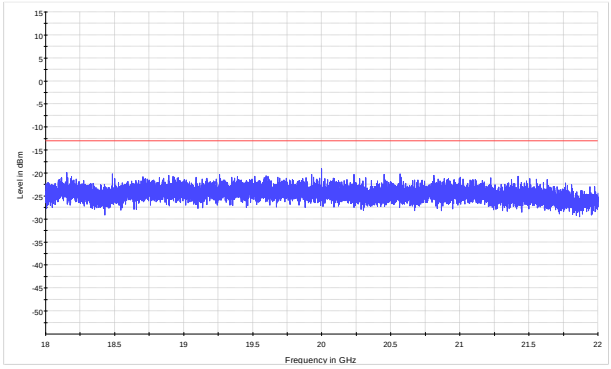


Figure 8.3-21: *Radiated spurious emission above 18 GHz for 5 MHz high channel*

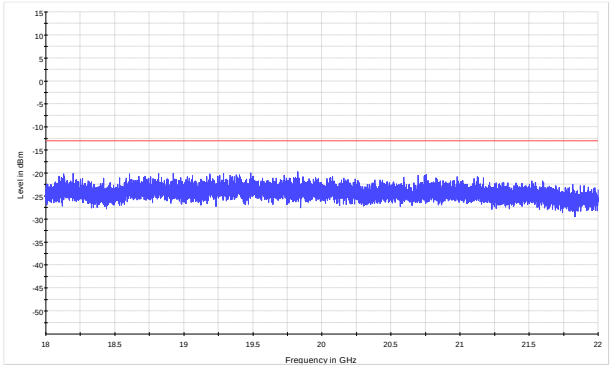


Figure 8.3-22: *Radiated spurious emission above 18 GHz for 10 MHz low channel*

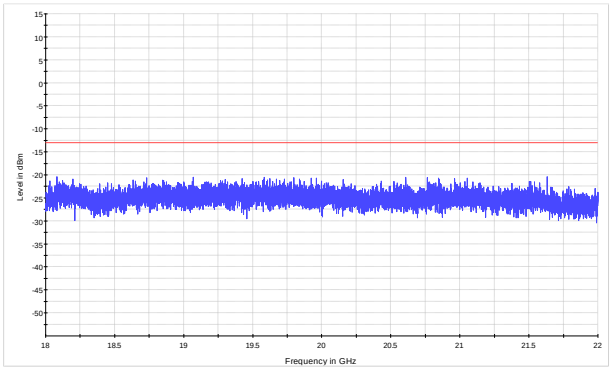


Figure 8.3-23: *Radiated spurious emission above 18 GHz for 10 MHz mid channel*

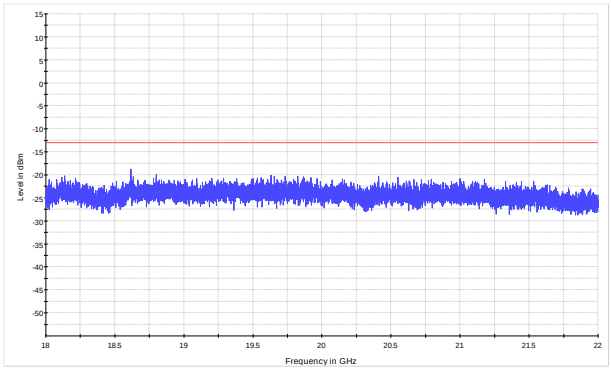


Figure 8.3-24: *Radiated spurious emission above 18 GHz for 10 MHz high channel*

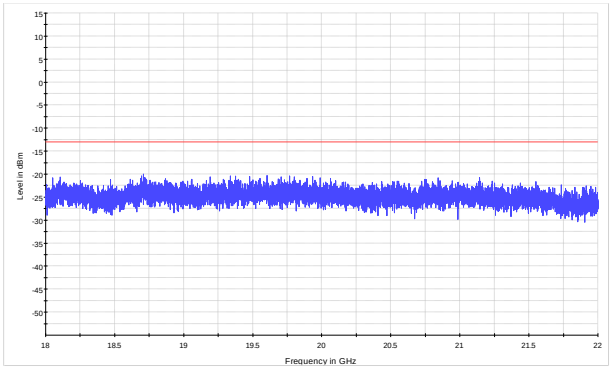


Figure 8.3-25: *Radiated spurious emission above 18 GHz for 20 MHz low channel*

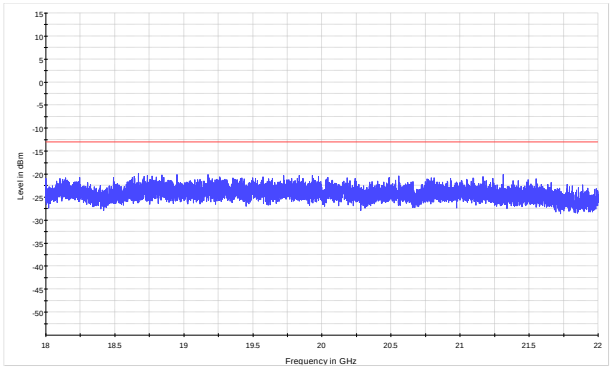


Figure 8.3-26: *Radiated spurious emission above 18 GHz for 20 MHz mid channel*

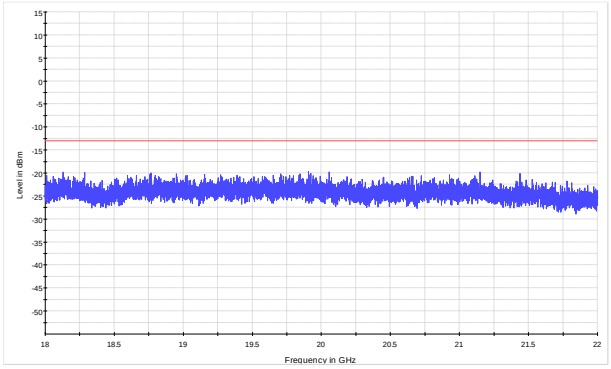


Figure 8.3-27: *Radiated spurious emission above 18 GHz for 20 MHz high channel*

8.4 FCC 27.54 and RSS-139, Section 6.4 Frequency stability

8.4.1 Definitions and limits

FCC:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

RSS-139, Section 6.4:
The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

8.4.2 Test summary

Test date	September 25, 2018
Test engineer	Andrey Adelberg

8.4.3 Observations, settings and special notes

26 dBc points including frequency tolerance were assessed to remain within assigned band.

8.4.4 Test data

Table 8.4-1: *Frequency error results*

Temperature, °C	Voltage, V_{AC}	Frequency, Hz	Nominal frequency, Hz	Frequency error, Hz
+50	120	2132499998	2132500000	-2
+40	120	2132499997	2132500000	-3
+30	120	2132499996	2132500000	-4
+20	102	2132499996	2132500000	-4
+20	120	2132499996	2132500000	-4
+20	138	2132499997	2132500000	-3
+10	120	2132499997	2132500000	-3
0	120	2132499998	2132500000	-2
−10	120	2132499998	2132500000	-2
−20	120	2132499997	2132500000	-3
−30	120	2132500001	2132500000	1
−40	120	2132500007	2132500000	7

Max negative drift: −4 Hz, Max positive drift: +7 Hz.
26 dB is located no closer than 144 kHz from the band edges.

8.5 FCC Part 2.1049 and RSS-Gen, 6.7 Occupied bandwidth

8.5.1 Definitions and limits

FCC:
The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

RSS-Gen, 6.7
The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

8.5.2 Test summary

Test date	September 21, 2018
Test engineer	Andrey Adelberg

8.5.3 Observations, settings and special notes

Spectrum analyzer settings:

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

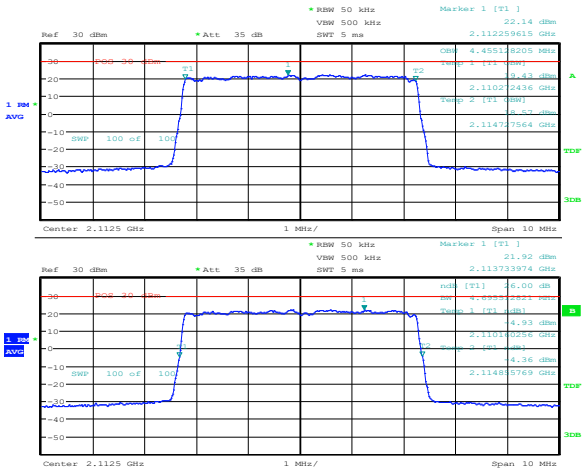
8.5.4 Test data

Table 8.5-1: *Occupied bandwidth results at Antenna* ***1***

Remarks	Frequency, MHz	99% OBW, MHz	26 dB BW, MHz
QPSK, 5 MHz, Low channel	2112.5	4.47	4.73
64QAM, 5 MHz, Low channel	2112.5	4.47	4.71
QPSK, 5 MHz, Mid channel	2132.5	4.49	4.71
64QAM, 5 MHz, Mid channel	2132.5	4.49	4.73
QPSK, 5 MHz, High channel	2152.5	4.49	4.71
64QAM, 5 MHz, High channel	2152.5	4.49	4.70
QPSK, 10 MHz, Low channel	2115.0	8.94	9.29
64QAM, 10 MHz, Low channel	2115.0	8.81	9.29
QPSK, 10 MHz, Mid channel	2132.5	8.94	9.29
64QAM, 10 MHz, Mid channel	2132.5	8.94	9.29
QPSK, 10 MHz, High channel	2150.0	8.81	9.29
64QAM, 10 MHz, High channel	2150.0	8.94	9.29
QPSK, 20 MHz, Low channel	2120.0	17.82	18.33
64QAM, 20 MHz, Low channel	2120.0	17.82	18.33
QPSK, 20 MHz, Mid channel	2132.5	17.82	18.33
64QAM, 20 MHz, Mid channel	2132.5	17.82	18.46
QPSK, 20 MHz, High channel	2145.0	17.82	18.33
64QAM, 20 MHz, High channel	2145.0	17.82	18.33

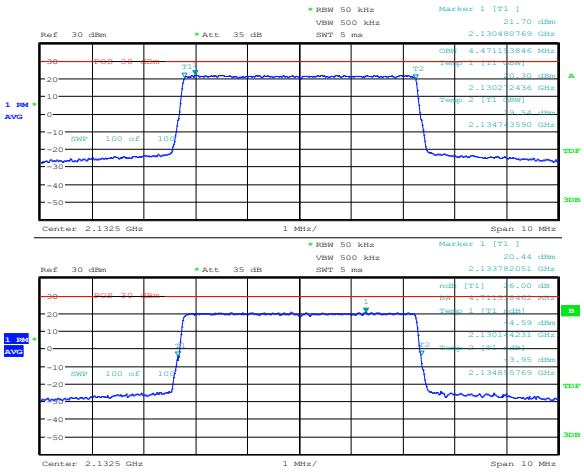
Table 8.5-2: *Occupied bandwidth results at Antenna* ***2***

Remarks	Frequency, MHz	99% OBW, MHz	26 dB BW, MHz
QPSK, 5 MHz, Low channel	2112.5	4.49	4.71
64QAM, 5 MHz, Low channel	2112.5	4.47	4.73
QPSK, 5 MHz, Mid channel	2132.5	4.49	4.71
64QAM, 5 MHz, Mid channel	2132.5	4.47	4.71
QPSK, 5 MHz, High channel	2152.5	4.49	4.71
64QAM, 5 MHz, High channel	2152.5	4.49	4.70
QPSK, 10 MHz, Low channel	2115.0	8.94	9.29
64QAM, 10 MHz, Low channel	2115.0	8.94	9.29
QPSK, 10 MHz, Mid channel	2132.5	8.94	9.29
64QAM, 10 MHz, Mid channel	2132.5	8.91	9.29
QPSK, 10 MHz, High channel	2150.0	8.94	9.29
64QAM, 10 MHz, High channel	2150.0	8.94	9.29
QPSK, 20 MHz, Low channel	2120.0	17.82	18.33
64QAM, 20 MHz, Low channel	2120.0	17.88	18.40
QPSK, 20 MHz, Mid channel	2132.5	17.82	18.33
64QAM, 20 MHz, Mid channel	2132.5	17.82	18.46
QPSK, 20 MHz, High channel	2145.0	17.82	18.33
64QAM, 20 MHz, High channel	2145.0	17.82	18.33



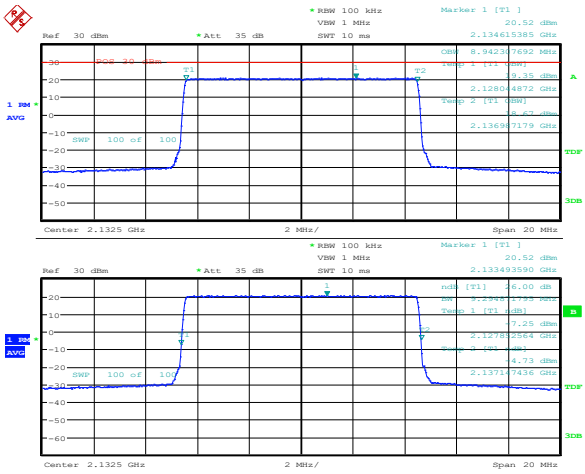
Date: 21.SEP.2018 10:00:53

Figure 8.5-1: *Occupied bandwidth, QPSK, 5 MHz, sample plot*



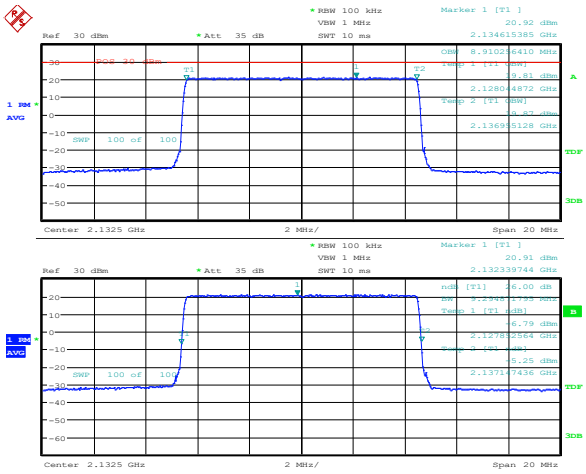
Date: 21.SEP.2018 10:20:01

Figure 8.5-2: *Occupied bandwidth, 64QAM, 5 MHz, sample plot*



Date: 10.SEP.2018 16:18:49

Figure 8.5-3: *Occupied bandwidth, QPSK, 10 MHz, sample plot*



Date: 10.SEP.2018 16:33:11

Figure 8.5-4: *Occupied bandwidth, 64QAM, 10 MHz, sample plot*

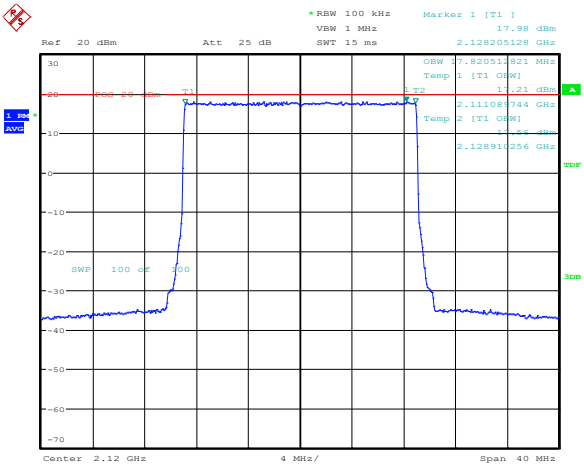


Figure 8.5-5: *Occupied 99% bandwidth, QPSK, 20 MHz, sample plot*

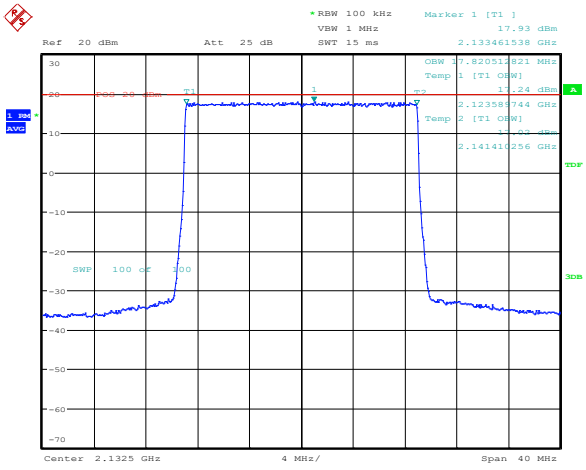


Figure 8.5-6: *Occupied 99% bandwidth, 64QAM, 20 MHz, sample plot*

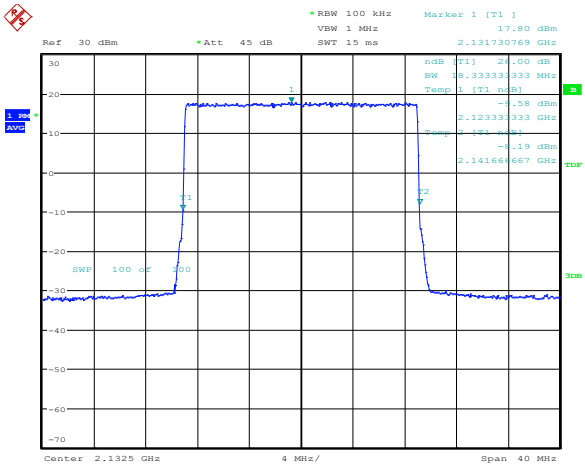


Figure 8.5-7: *Emission 26 dB bandwidth, QPSK, 20 MHz, sample plot*

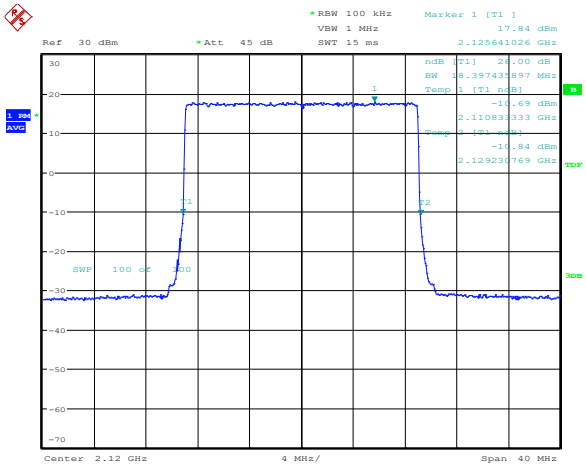
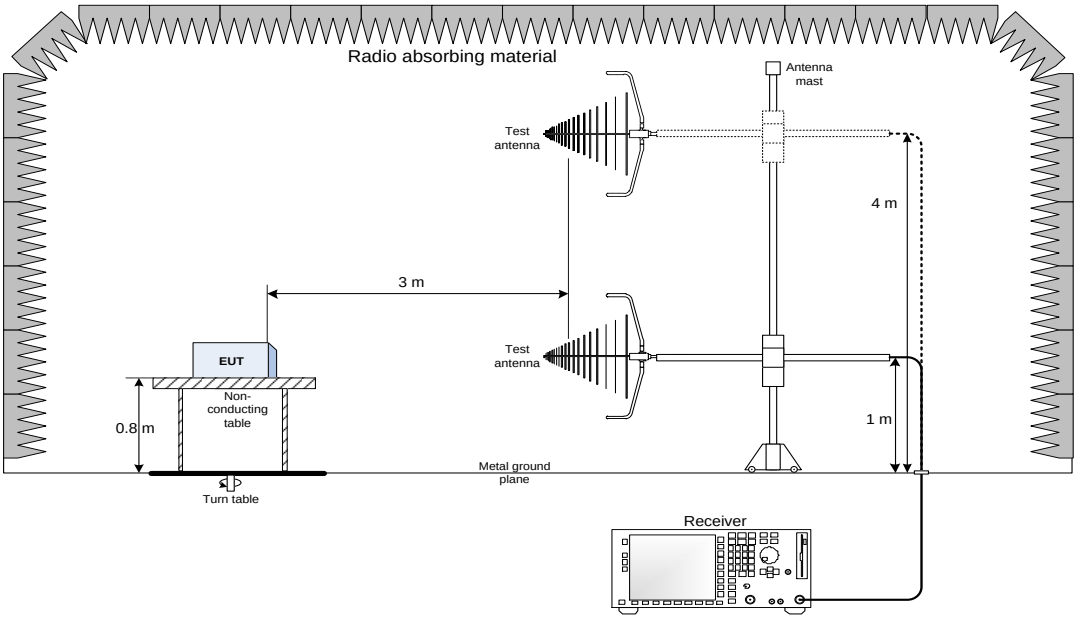


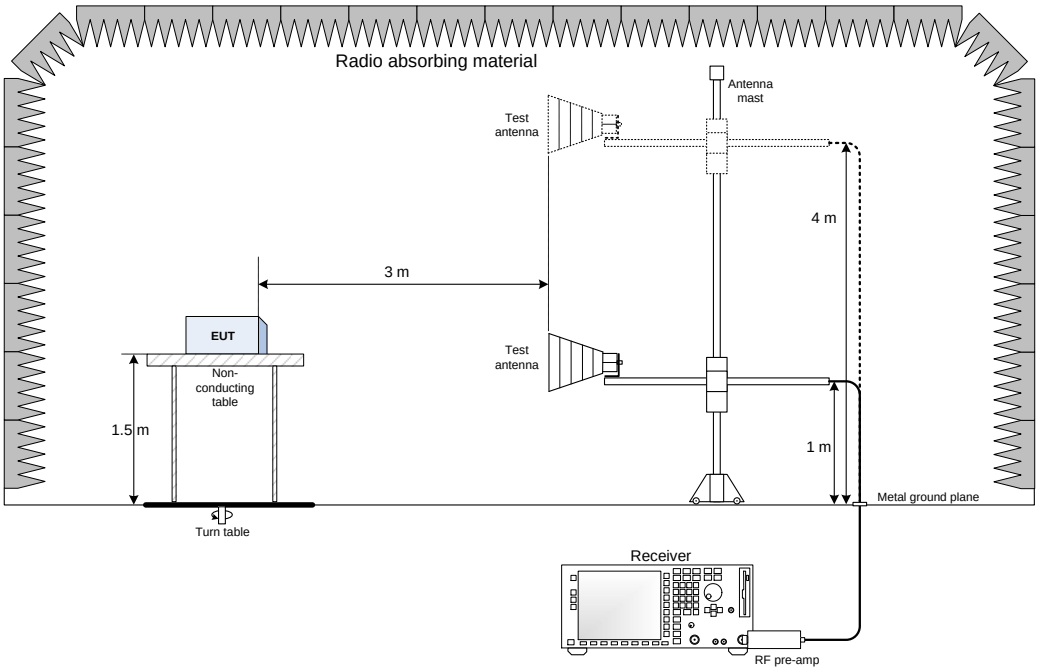
Figure 8.5-8: *Emission 26 dB bandwidth, 64QAM, 20 MHz, sample plot*

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



9.3 Conducted emissions set-up