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Test report

FCC 90-Y ESTeem 216AP Test Report

Date of issue: March 10, 2017

Applicant: Electronic Systems Technology, Inc.

Product: Wireless Modem (4.96-4.98GHz)

Model: 216AP

FCC ID: ENPHZN216AP

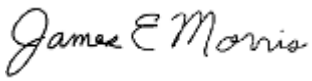
Specifications:

- FCC Part 90, Subpart Y

  Private Land Mobile Radio Services; Regulations governing licensing and use of frequencies in the 4940–4990 MHz band

Test location

Company name	Nemko USA, Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
Province	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
Site number	FCC: US5058; IC: 2040B

Tested by:	Feng You, Sr. Wireless Engineer
Reviewed by:	James Morris
Date:	March 15, 2017
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 USA's ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name:	Electronic Systems Technology, Inc.
Address:	415 N. Quay Street, Bldg. B-1
City:	Kennewick
Province/State:	WA
Postal/Zip code:	99336
Country:	U.S.A.

1.2 Test specifications

FCC Part 90, Subpart Y	Private Land Mobile Radio Services; Regulations governing licensing and use of frequencies in the 4940–4990 MHz band

1.3 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.

1.4 Exclusions

None

1.5 Test report revision history

Revision #	Details of changes made to test report
1	Original report issued
2	Report updated based on review comment.

Section 2. Summary of test results

2.1 FCC Part 90, tests results

Clause	Test description	Verdict
90.1215(d)	Occupied bandwidth	Pass
90.1215(a)	Peak output power	Pass
90.1215(b)	Peak power spectral density	Pass
90.1215(e)	Peak Excursion	Pass
90.210(m)	Spurious emissions at the antenna terminals	Pass
90.210(m)	Radiated spurious emissions	Pass
90.213(a)	Frequency stability	Pass

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	December 28, 2016
Nemko sample ID number	321903#1

3.2 EUT information

Product name	Horizon 4.9
Model	216AP
Serial number	Z-24013

3.3 Technical information

Operating band	4940–4990 MHz
Operating frequency	4960 / 4980 MHz
Modulation type	OFDM
Occupied bandwidth (99 %)	19.04MHz
Emission designator	W7D
Power requirements	100-240V AC, 50-60Hz
Antenna information	R-TNC connectors. See antenna list below. The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

Antenna Type	Model	Gain (dBi)	Minimum Antenna-Person Separation Distance (cm)
Omni-Directional	AA20Ep	10	20
Omni-Directional	AA191Ep	5.5	20
Directional, Linear Polarized Panel	AA204Ep	22	60

3.4 Product description and theory of operation

EUT is 4.96/4.98GHz wireless modem.

3.5 EUT exercise details

A test software was used that allows the change of different RF modes/channels. EUT is set to fixed channel test mode with modulation.

TX Power High, Power Offset 0

3.6 EUT setup diagram

Please refer to photo exhibit

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
EUT	ESTeem	Horizon 4.9 / 216AP	Z-24013
AC Supply	SL Power Electronics	CENB1060A1265F02	N/A

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 ±5 %, for which the equipment was designed.

120V AC 60Hz

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. 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*

Asset Tag	Description	Manufacturer	Model	Serial #	Next Cal
529	Antenna, DRWG	EMCO	3115	2505	01-Feb-2017
815	Multimeter	Fluke	111	78130066	02-Feb-2017
E1013	DRG Horn (Small)	EMCO	3116	00119488	18-Nov-2017
E1035	Variac (Variable Transformer) 3KVA	Shanghai China	TDGC	N/A	VOU
1480	Antenna, Bilog	Schaffner-Chase	CBL6111C	2572	21-Jul-2017
S1179	Environmental Chamber	Cincinnati Sub-Zero	ZPH-32-2-2-H/AC	ZP1615026	21-Apr-2017
E1120	Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	101395	25-May-2017
E1121	EMI Test Receiver	Rohde & Schwarz	ESU 40	100064	28-Apr-2017

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

Section 8. Testing data

8.1 FCC 90.1215(d) and RSS-Gen 4.6.1 Occupied bandwidth

8.1.1 Definitions and limits

FCC
d) The peak power spectral density is measured as conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of one MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

IC:
When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 percent emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

8.1.2 Test summary

Test date:	December 29, 2016	Temperature:	21 °C
Test engineer:	Feng You	Air pressure:	1009 mbar
Verdict:	Pass	Relative humidity:	32 %

8.1.3 Observations/special notes

Spectrum analyser settings:

Resolution bandwidth:	≥ 1 % of span
Video bandwidth:	≥3 × RBW
Frequency span:	10 MHz *for 5 MHz channel* 20 MHz *for 10 MHz channel* 30 MHz *for 20 MHz channel*
Detector mode:	Peak
Trace mode:	Max Hold

8.1.4 Test data

Table 8.1-1: *99 % bandwidth results for 20 MHz channel*

Modulation	Data Rate	Frequency, MHz	99 % bandwidth, MHz
OFDM	48Mbps	4960	17.27
		4980	18.24
	MCS4	4960	18.28
		4980	19.04

Table 8.1-2: *26 dB bandwidth results for 20 MHz channel*

Modulation	Chain	Frequency, MHz	26 dB bandwidth, MHz
OFDM	48Mbps	4960	20.22
		4980	19.88
	MCS4	4960	21.16
		4980	21.29

8.1.4 Test data, continued

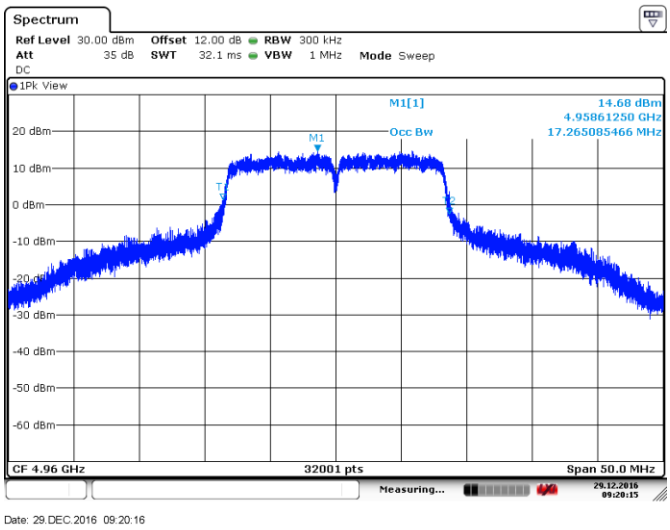


Figure 8.1-1: *99 % bandwidth for 20MHz channel BW, 4960MHz 48Mbps*

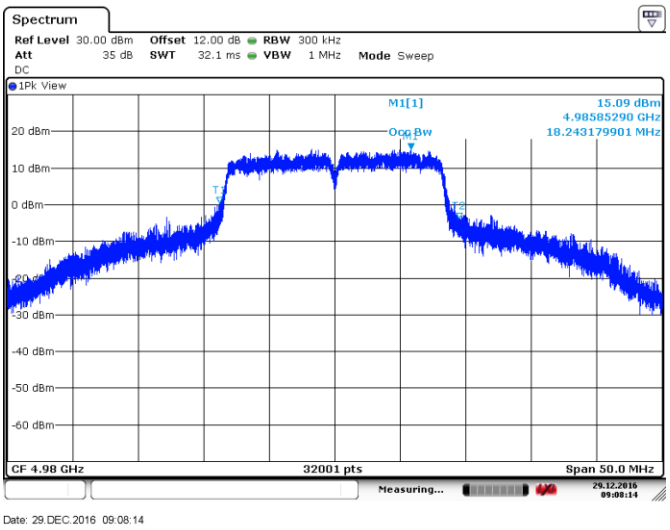


Figure 8.1-2: *99 % bandwidth for 20 MHz channel BW, 4980MHz 48Mbps*

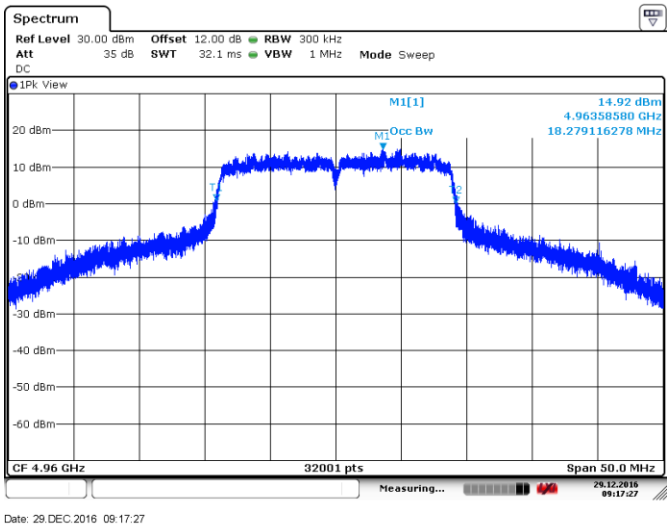


Figure 8.1-3: *99 % bandwidth for 20MHz channel BW, 4960MHz MCS4*

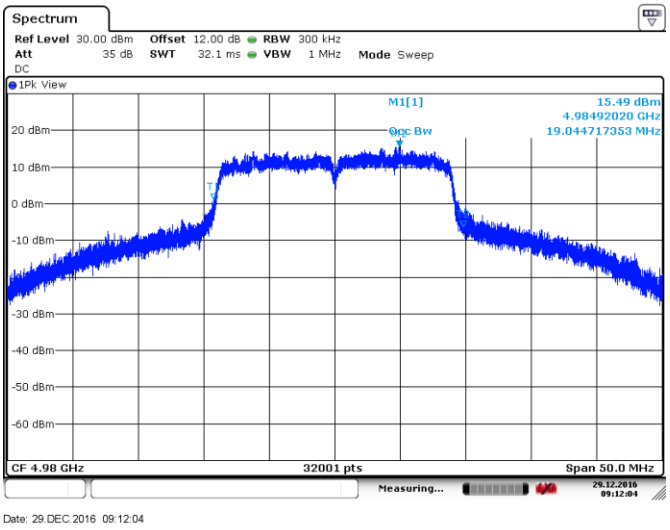


Figure 8.1-4: *99 % bandwidth for 20 MHz channel BW, 4980MHz MCS4*

8.1.4 Test data, continued

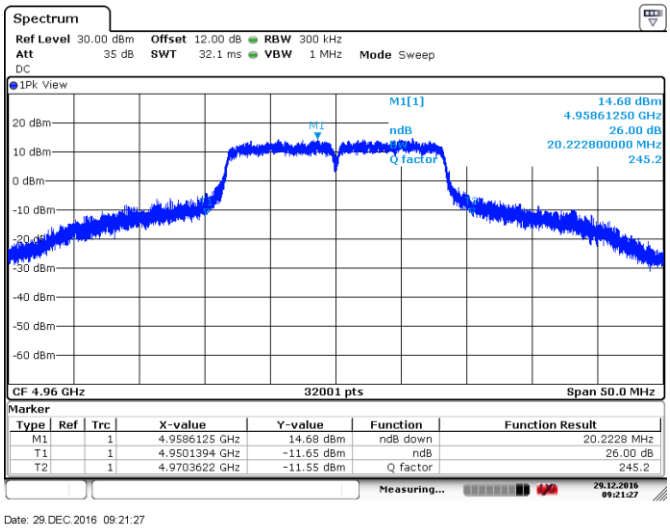


Figure 8.1-5: *26dB bandwidth for 20MHz channel BW, 4960MHz 48Mbps*

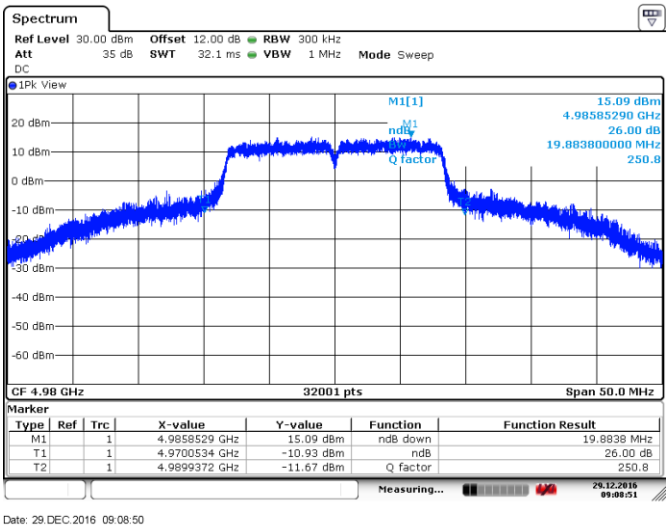


Figure 8.1-6: *26dB bandwidth for 20 MHz channel BW, 4980MHz 48Mbps*

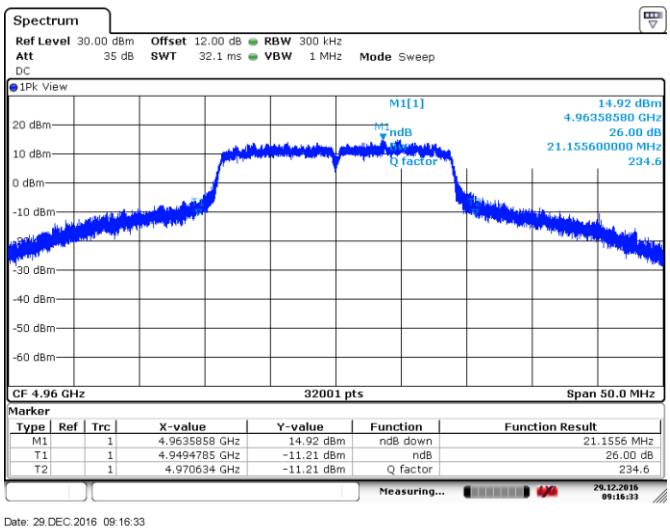


Figure 8.1-7: *26dB bandwidth for 20MHz channel BW, 4960MHz MCS4*

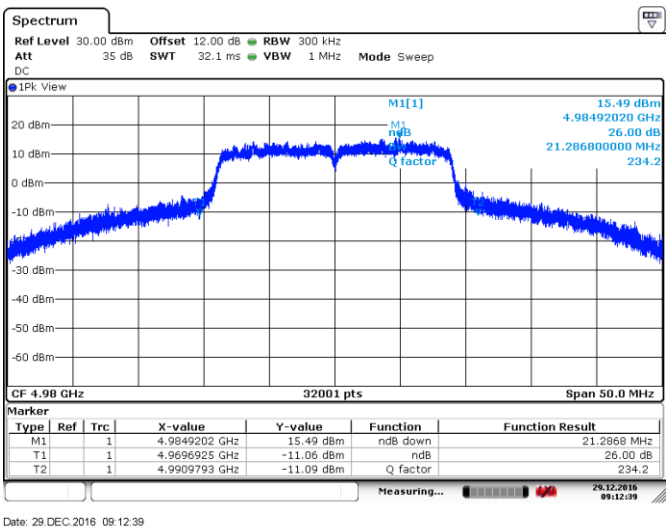


Figure 8.1-8: *26dB bandwidth for 20 MHz channel BW, 4980MHz MCS4*

8.2 FCC 90.213(a) and RSS-111 Clause 5.2 Transmitter frequency stability

8.2.1 Definitions and limits

FCC:
(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table:

Table 8.2-1: *Minimum frequency stability*

Frequency range (MHz)	Fixed and base stations (±ppm)	Mobile stations (±ppm)	
		Over 2 watts output power	2 watts or less output power
Below 25	100	100	200
25–50	20	20	50
72–76	5		50
150–174	5	5	50
216–220	1.0		1.0
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1.0	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
929–930	1.5		
935–940	0.1	1.5	1.5
1427–1435	300	300	300
Above 2450			

IC:
The applicant shall ensure frequency stability by showing that the occupied bandwidth is maintained within the band of operation when tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen. A reference point at the 99 % OBW emission level of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as f_L and f_H respectively.

The applicant shall ensure frequency stability by showing that f_L minus the frequency offset and f_H plus the frequency offset shall be within the dedicated frequency band.

8.2.2 Test summary

Test date:	January 12, 2017	Temperature:	20 °C
Test engineer:	Feng You	Air pressure:	1002 mbar
Verdict:	Pass	Relative humidity:	59 %

8.2.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	3 kHz
Video bandwidth:	30 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.2.4 Test data

Table 8.2-2: *Frequency drift measurement – 4960MHz MCS4*

Test conditions	Frequency, MHz	Drift, ppm
+60 °C, Nominal	4960.06	28.2
+50 °C, Nominal	4960.08	32.3
+40 °C, Nominal	4960.11	38.3
+30 °C, Nominal	4959.91	-2
+20 °C, +15 % (276V)	4959.99	14.1
+20 °C, Nominal (120V)	4959.92	*Reference*
+20 °C, −15 % (85V)	4959.92	0
+10 °C, Nominal	4960.08	32.3
0 °C, Nominal	4960.015	19.2
−10 °C, Nominal	4959.925	1
−20 °C, Nominal	4960.11	38.3
−30 °C, Nominal	4960.11	38.3

Table 8.2-3: *Frequency drift measurement – 4980MHz 48Mbps*

Test conditions	Frequency, MHz	Drift, ppm
+60 °C, Nominal	4980.07	6
+50 °C, Nominal	4980.07	6
+40 °C, Nominal	4980.05	2
+30 °C, Nominal	4980.04	0
+20 °C, +15 % (276V)	4980.04	0
+20 °C, Nominal (120V)	4980.04	*Reference*
+20 °C, −15 % (85V)	4980.04	0
+10 °C, Nominal	4980.04	0
0 °C, Nominal	4980.05	2
−10 °C, Nominal	4980.065	5
−20 °C, Nominal	4980.055	3
−30 °C, Nominal	4980.07	6

8.3 FCC 90.1215(a) and RSS-111 Clause 5.3 Transmit output power and PSD

8.3.1 Definitions and limits

FCC:
(a) The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits given in Table 8.3-1 below
High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

(b) Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz. Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

IC:
Equipment is classified as either a low-power or high-power device according to its maximum transmitted power and its channel bandwidth as described in the section below. The equipment's occupied bandwidth shall not exceed its channel bandwidth. The transmitted power of low-power and high-power devices shall not exceed the maximum limits corresponding to the equipment type given in Table 8.3-1 below.

Table 8.3-1: *Channel bandwidth and power limits*

Channel bandwidth, MHz	Output power (P) for low-power device, dBm	Output power (P) for high-power device, dBm
1	P ≤ 7	7 < P ≤ 20
5	P ≤ 14	14 < P ≤ 27
10	P ≤ 17	17 < P ≤ 30
15	P ≤ 18.8	18.8 < P ≤ 31.8
20	P ≤ 20	20 < P ≤ 33

High- and low-power devices are also limited to a maximum power spectral density of 21 dBm/MHz and 8 dBm/MHz respectively. Devices using channel bandwidths other than those listed in Table 1 are permitted; however, the channel bandwidth shall not exceed 20 MHz and the devices shall comply with the maximum power spectral density limits of 21 dBm/MHz for high-power transmitters and 8 dBm/MHz for low-power transmitters.

5.3.1 Equipment with multiple transmitters

For equipment with an antenna system that works with multiple transmitters, with different information transmitted by each transmitter to each receiver, the total power of the device shall be calculated as the sum of the powers from all the transmitters and it shall not be higher than the power limit specified in Table 1 for high-power devices according to the equipment's channel bandwidth.

8.3.2 Test summary

Test date:	December 28, 2016	Temperature:	21 °C
Test engineer:	Feng You	Air pressure:	1007 mbar
Verdict:	Pass	Relative humidity:	39 %

8.3.3 Observations settings and special notes

The transmit power was measured in conducted mode, using a peak detector (IC) and RMS detector (FCC), over a period of continuous transmission of sufficient duration such that the acquired trace is maximized. Video averaging was not allowed. Spectrum analyser settings:

Resolution bandwidth:	Wider than 99 % OBW
Video bandwidth:	≥ 3 times the RBW
Detector mode:	Peak (IC); RMS (FCC)
Trace mode:	Max Hold

The transmitter power spectral density (PSD) was measured over a bandwidth of 1 MHz or 99 % of the emission bandwidth (for IC) or 26 dB bandwidth (for FCC), whichever is less, with the power measured as per above. A resolution bandwidth less than the measurement bandwidth can be used provided that the measured power is integrated to show total power over the measurement bandwidth. Spectrum analyser settings:

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

8.3.4 Test data

Table 8.3-2: *Output power FCC measurements results for 20MHz Channel bandwidth*

Data Rate	Frequency, MHz	Conducted peak output power, dBm		Margin, dB
		Measured	Limit	
6Mbps	4960	23.2	33	9.8
	4980	23.8	33	9.2
9Mbps	4960	23.12	33	9.88
	4980	23.76	33	9.24
12Mbps	4960	23.08	33	9.92
	4980	23.72	33	9.28
18Mbps	4960	23.18	33	9.82
	4980	23.86	33	9.14
24Mbps	4960	23.06	33	9.94
	4980	23.72	33	9.28
36Mbps	4960	23.14	33	9.86
	4980	23.83	33	9.17
48Mbps	4960	23.26	33	9.74
	4980	23.89	33	9.11
54Mbps	4960	23.22	33	9.78
	4980	23.88	33	9.12
MCS0	4960	23.26	33	9.74
	4980	23.68	33	9.32
MCS1	4960	23.18	33	9.82
	4980	23.46	33	9.54
MCS2	4960	23.36	33	9.64
	4980	23.72	33	9.28
MCS3	4960	23.43	33	9.57
	4980	23.75	33	9.25
MCS4	4960	23.46	33	9.54
	4980	23.78	33	9.22
MCS5	4960	22.63	33	10.37
	4980	23.12	33	9.88
MCS6	4960	21.81	33	11.19
	4980	21.65	33	11.35
MCS7	4960	20.13	33	12.87
	4980	20.74	33	12.26

8.3.4 Test data, continued

Table 8.3-3: *PSD measurements results for 20MHz Channel bandwidth*

Data Rate	Frequency, MHz	Measured Power Spectral Density (PSD), dBm/MHz		Margin, dB
		Measured	Limit	
48Mbps	4960	16.74	21	4.26
	4980	17.25	21	3.75
MCS4	4960	17.49	21	3.51
	4980	18.53	21	2.47

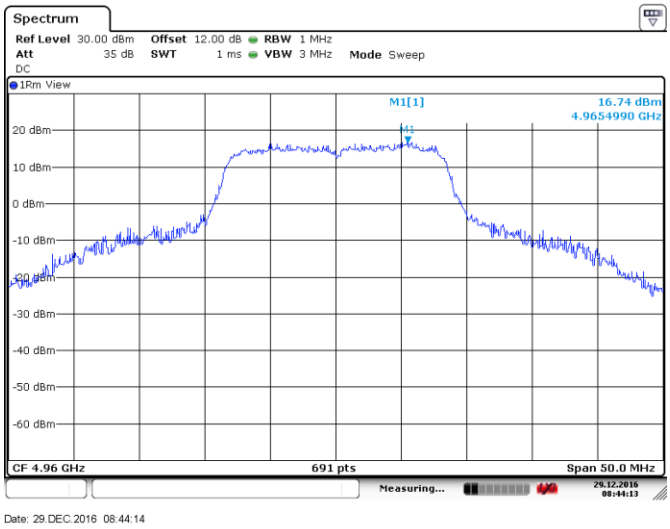


Figure 8.3-1: *PSD for 20MHz channel BW, 4960MHz 48Mbps*

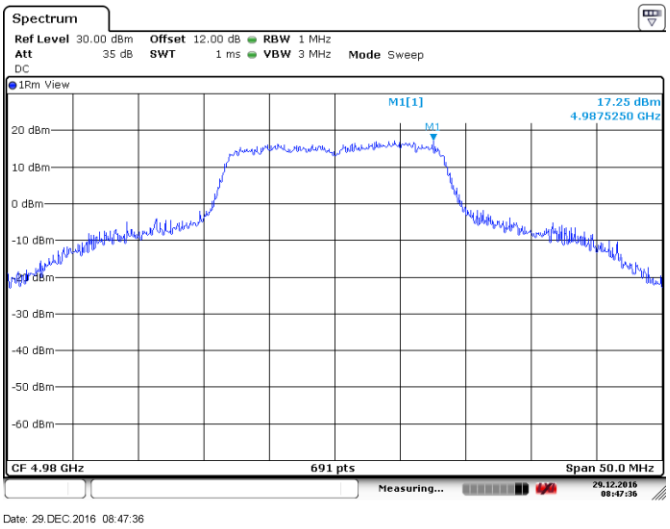


Figure 8.3-2: *PSD for 20 MHz channel BW, 4980MHz 48Mbps*

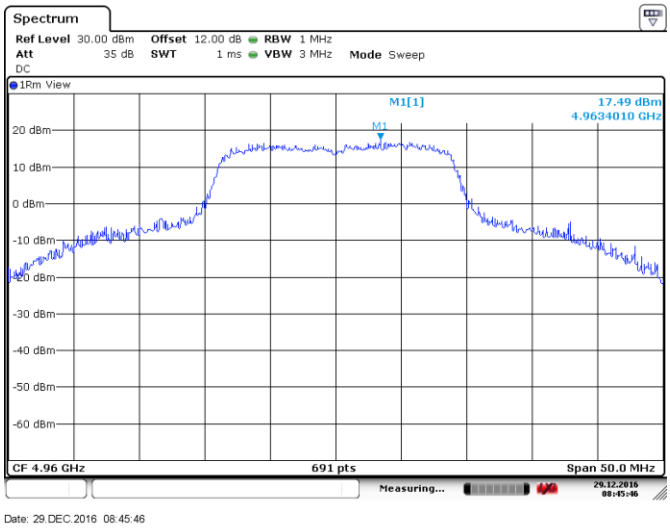


Figure 8.3-3: *PSD for 20MHz channel BW, 4960MHz MCS4*

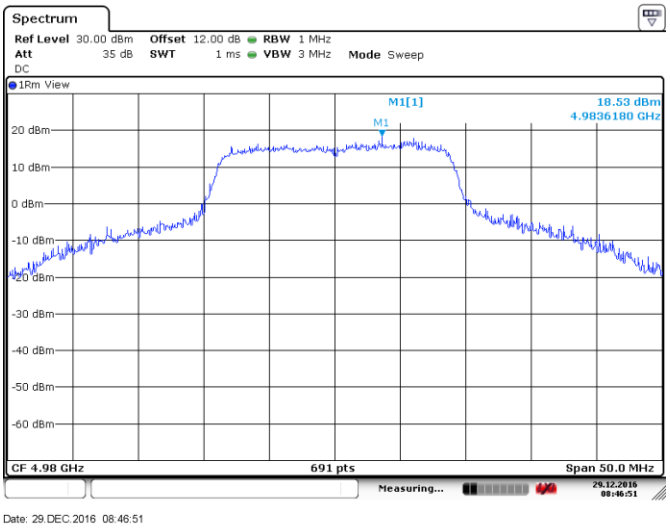


Figure 8.3-4: *PSD for 20 MHz channel BW, 4980MHz MCS4*

8.4 FCC 90.210(m) and RSS-111 Clause 5.4 Transmitter unwanted emissions

8.4.1 Definitions and limits

FCC:
Emission Mask M. For high power transmitters (greater than 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as shown in the Table 8.4-1 *Minimum attenuation high-power transmitter*

IC:
On any frequency f, offset from the channel centre frequency f_c by a separation f_d (expressed as a percentage of the channel bandwidth), the power spectral density of the unwanted emissions for low- and high-power transmitters shall comply with the limits specified in Table 8.4-1. Figure 8.5–1 shows the emission mask for low- and high-power transmitters. For equipment with multiple transmitters, the unwanted emissions of each transmitter shall comply with the emission limits based on the output power of the transmitter regardless of the total output power of the equipment (i.e. total output power from all the transmitters).

Table 8.4-1: *Emission mask for low- and high-power transmitters*

Offset Frequency f_d (% of the equipment's channel bandwidth)	Minimum attenuation low-power transmitter, dB	Minimum attenuation high-power transmitter, dB
$0 < f_d \le 45$	0	0
$45 < f_d \le 50$	$219 \times \log_{10}(f_d / 45)$	$568 \times \log_{10}(f_d / 45)$
$50 < f_d \le 55$	$10 + 242 \times \log_{10}(f_d / 50)$	$26 + 145 \times \log_{10}(f_d / 50)$
$55 < f_d \le 100$	$20 + 31 \times \log_{10}(f_d / 55)$	$32 + 31 \times \log_{10}(f_d / 55)$
$100 < f_d \le 150$	$28 + 68 \times \log_{10}(f_d / 100)$	$40 + 57 \times \log_{10}(f_d / 100)$
$f_d > 150$	40	whichever is less stringent: 50 dBc or −25 dBm

Notes: * - Where: f_d (%) = ((f − f_c) / channel bandwidth) × 100

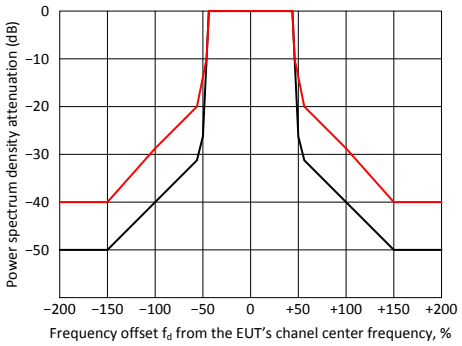


Figure 8.4-1: *Unwanted emission mask for low- and high-power transmitters*

8.4.2 Test summary

Test date:	January 19, 2017	Temperature:	21 °C
Test engineer:	Feng You	Air pressure:	1004 mbar
Verdict:	Pass	Relative humidity:	55 %

8.4.3 Observations settings and special notes

The 0 dB reference level in the unwanted emission mask is the maximum in-band power spectral density measured in terms of average power in the equipment's channel bandwidth, using a resolution bandwidth of as close as possible to, without being less than 1 % of the occupied bandwidth, and a video bandwidth of 30 kHz. The unwanted power spectral density emissions are also measured using the same resolution and video bandwidths used in measuring the reference in-band power spectral density.
Radiated measurements were performed at a distance of 3 m. Radiated emissions were performed while TX antenna connector was terminated with 50 Ω load. No spurious emissions were detected above test instrument's noise floor.

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

Resolution bandwidth:	> 1 % of occupied bandwidth
Video bandwidth:	30 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.4.4 Test data

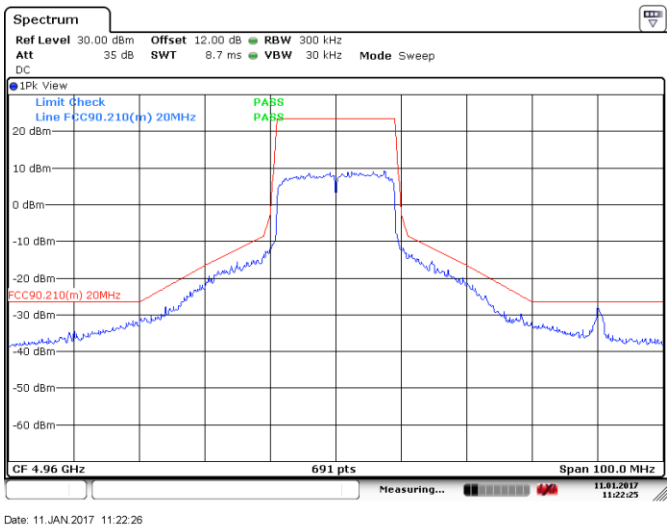


Figure 8.4-2: *Emission mask at 4960MHz, MCS4*

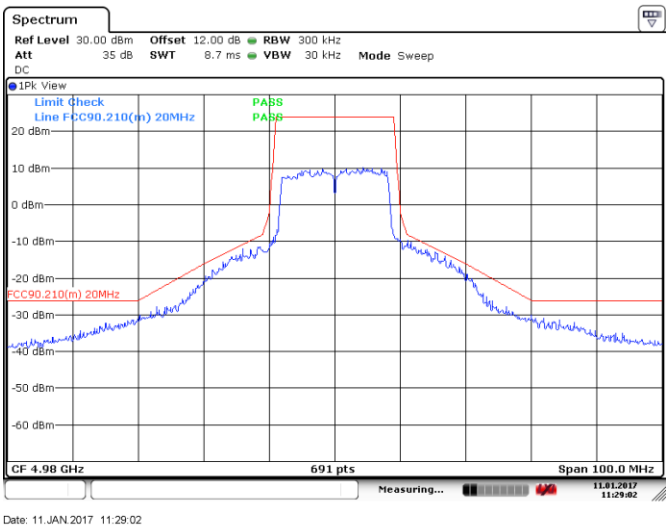


Figure 8.4-3: *Emission mask at 4980MHz, 48Mbps*

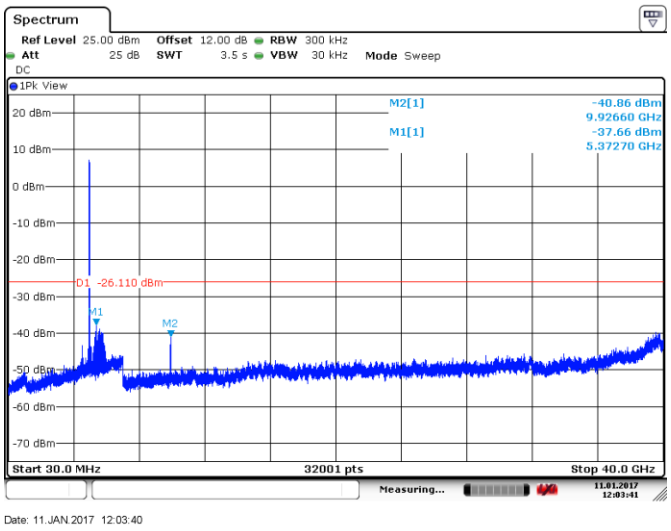


Figure 8.4-4: *Spurious emission at 4960MHz, MCS4*

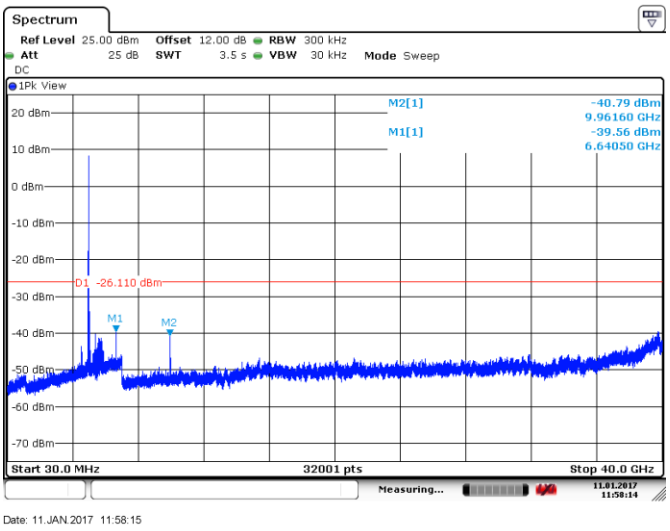
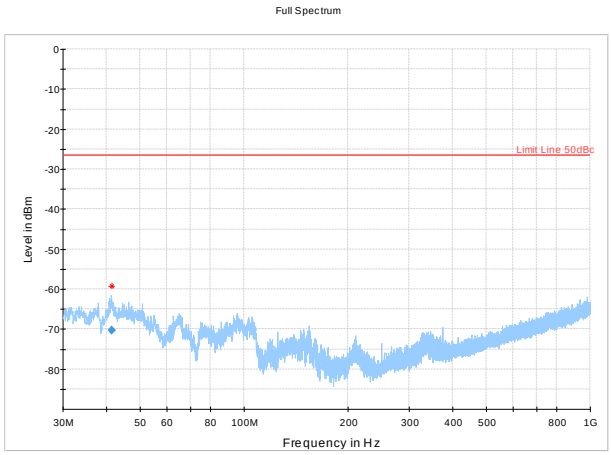
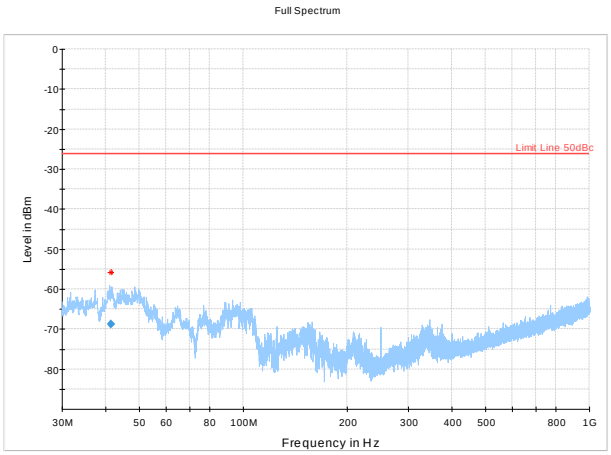


Figure 8.4-5: *Spurious emission at 4980MHz, 48Mbps*

8.4.4 Test data, continued





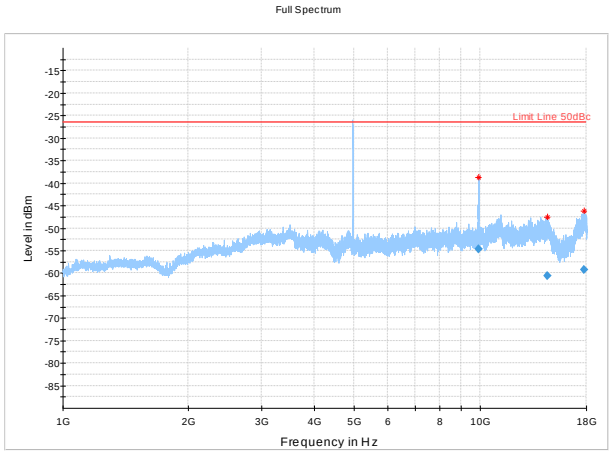


Figure 8.4-6: *Radiated Spurious emission at 4960MHz, MCS4*

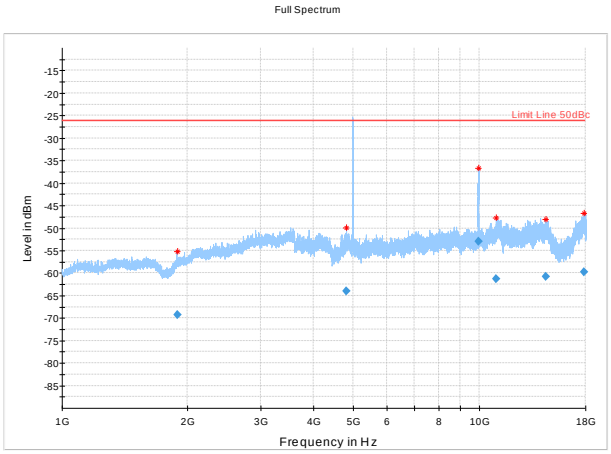


Figure 8.4-7: *Radiated Spurious emission at 4980MHz, 48Mbps*

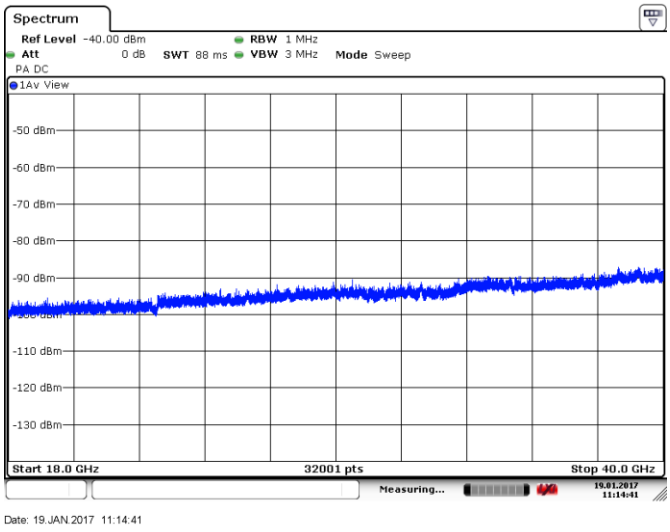


Figure 8.4-8: *Radiated Spurious emission above 18GHz at 4960MHz, MCS4, Horizontal*

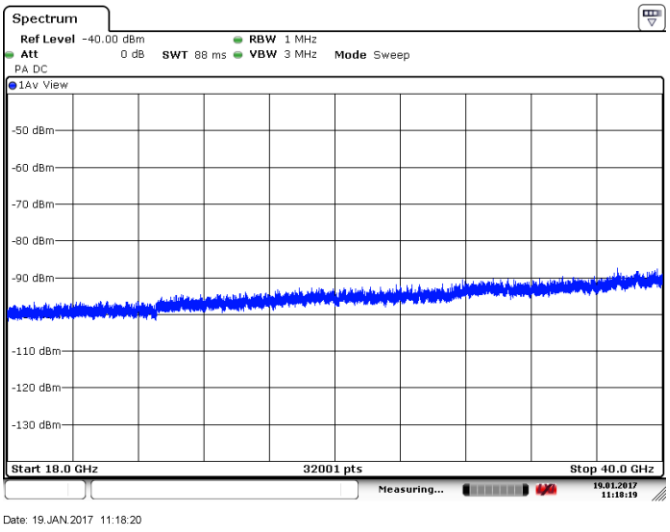


Figure 8.4-9: *Radiated Spurious emission above 18GHz at 4960MHz, MCS4, Vertical*

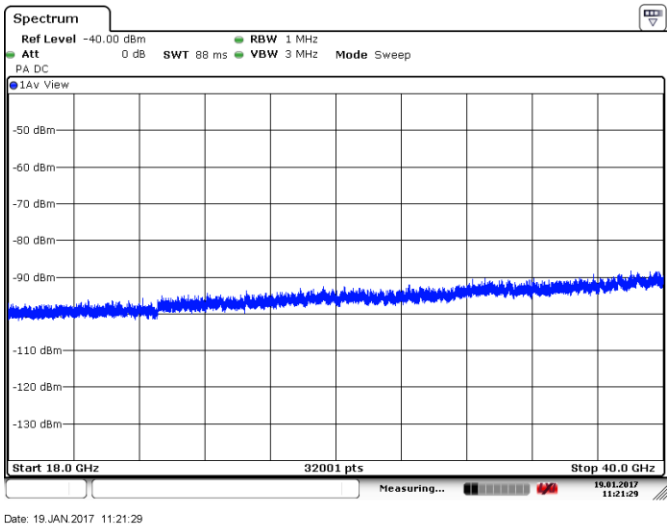


Figure 8.4-10: *Radiated Spurious emission above 18GHz at 4980MHz, 48Mbps, Horizontal*

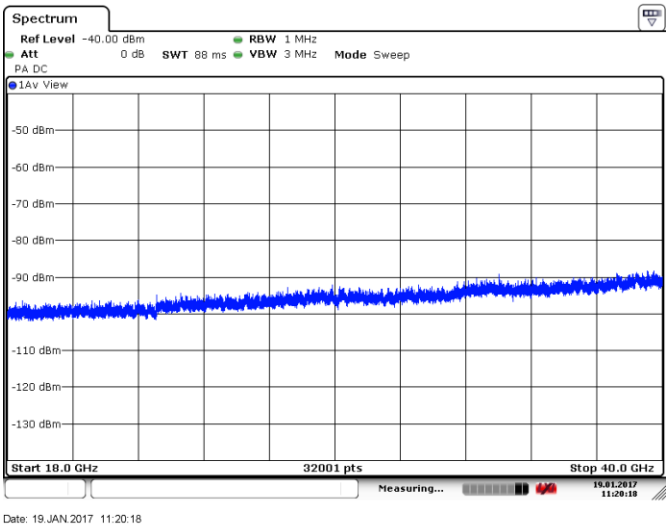


Figure 8.4-11: *Radiated Spurious emission above 18GHz at 4980MHz, 48Mbps, Vertical*

No spurious detected above noise floor 18-40GHz.

Table 8.4-2: *Radiated power measurement results for 4960MHz, MCS4*

Frequency (MHz)	Average (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
41.617500	-70.32	-25	45.32	1000.0	100.000	101.7	V	247.0
9923.400000	-54.72	-25	29.72	5000.0	1000.000	238.9	V	167.0
14495.33333	-60.68	-25	35.68	5000.0	1000.000	166.3	H	189.0
17783.13333	-59.24	-25	34.24	5000.0	1000.000	146.3	H	93.0

Table 8.4-3: *Radiated power measurement results for 4980MHz, 48Mbps*

Frequency (MHz)	Average (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
41.571500	-68.74	-25	43.74	1000.0	100.000	113.2	V	219.0
1889.166667	-69.22	-25	44.22	5000.0	1000.000	283.6	H	322.0
4809.733333	-63.95	-25	38.95	5000.0	1000.000	101.7	V	141.0
9966.166667	-52.93	-25	27.93	5000.0	1000.000	255.3	V	169.0
10990.43333	-61.23	-25	36.23	5000.0	1000.000	189.0	V	0.0
14426.20000	-60.81	-25	35.81	5000.0	1000.000	168.3	H	76.0
17820.26666	-59.69	-25	34.69	5000.0	1000.000	290.3	H	352.0

8.5 FCC 90.1215(e) and RSS-111 5.4 Peak Excursion

8.5.1 Definitions and limits

FCC
(e) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

IC:
5.4 Transmitter Peak to Average Power Ratio (PAPR)
The 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.

8.5.2 Test summary

Test date:	December 28, 2016	Temperature:	21 °C
Test engineer:	Feng You	Air pressure:	1007 mbar
Verdict:	Pass	Relative humidity:	39 %

8.5.3 Observations/special notes

Spectrum analyser settings:

Resolution bandwidth:	1MHz
Video bandwidth:	≥3 × RBW
Frequency span:	50 MHz *for 20 MHz channel*
Detector mode:	Peak / AVG
Trace mode:	Max Hold

8.5.4 Test data

Table 8.5-1: *Peak Excursion*

Data Rate	Frequency, MHz	Peak Excursion, dB		Margin, dB
		Measured	Limit	
6Mbps	4960	3.31	13	9.69
	4980	2.3	13	10.7
9Mbps	4960	1.87	13	11.13
	4980	1.94	13	11.06
12Mbps	4960	1.81	13	11.19
	4980	1.51	13	11.49
18Mbps	4960	1.58	13	11.42
	4980	1.67	13	11.33
24Mbps	4960	1.78	13	11.22
	4980	1.9	13	11.1
36Mbps	4960	2.02	13	10.98
	4980	1.94	13	11.06
48Mbps	4960	2.09	13	10.91
	4980	2.48	13	10.52
54Mbps	4960	1.56	13	11.44
	4980	1.92	13	11.08
MCS0	4960	2.43	13	10.57
	4980	2.66	13	10.34
MCS1	4960	2.23	13	10.77
	4980	2.7	13	10.3
MCS2	4960	1.86	13	11.14
	4980	1.38	13	11.62
MCS3	4960	2.43	13	10.57
	4980	2.21	13	10.79
MCS4	4960	2	13	11
	4980	2.36	13	10.64
MCS5	4960	2.27	13	10.73
	4980	2.56	13	10.44
MCS6	4960	2.12	13	10.88
	4980	2.81	13	10.19
MCS7	4960	1.5	13	11.5
	4980	1.64	13	11.36

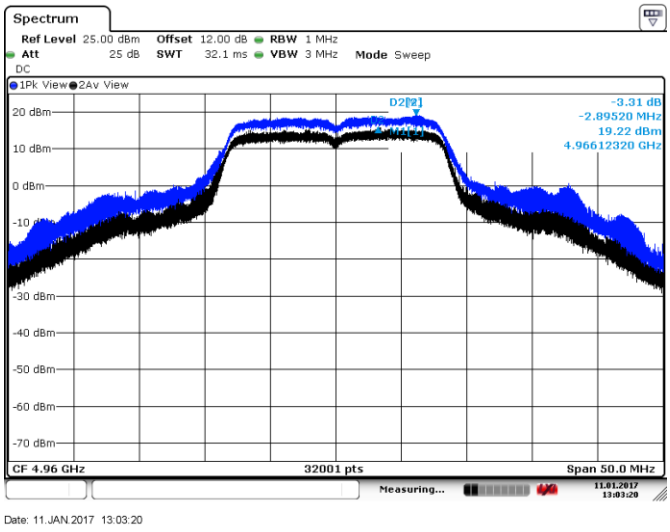


Figure 8.5-1: *Peak Excursion, 4960MHz 6Mbps*

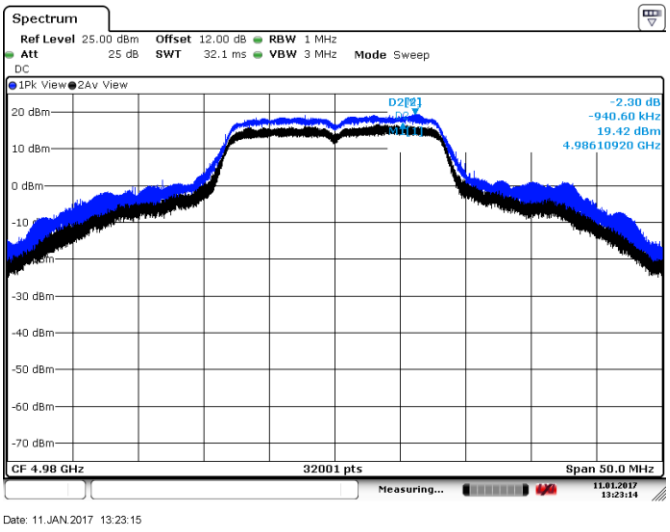


Figure 8.5-2: *Peak Excursion, 4980MHz 6Mbps*

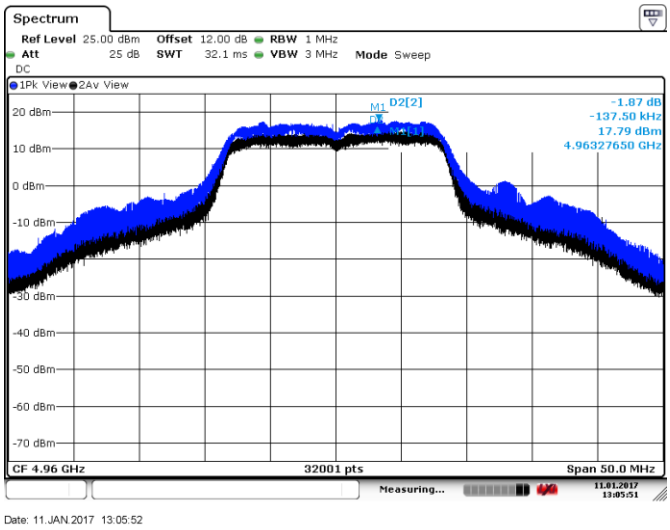


Figure 8.5-3: *Peak Excursion, 4960MHz 9Mbps*

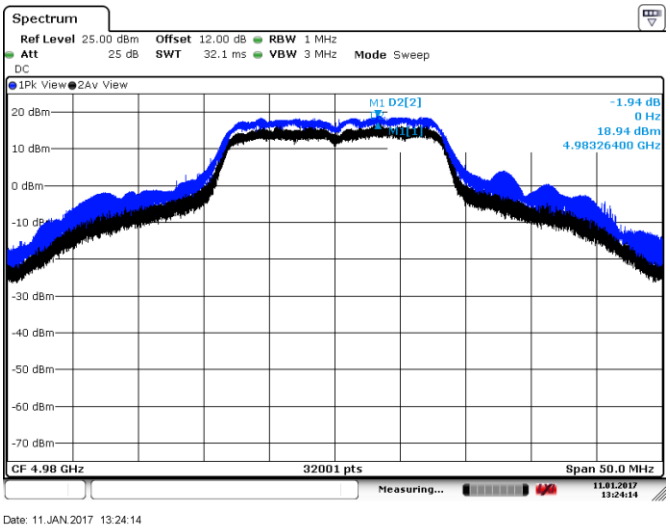


Figure 8.5-4: *Peak Excursion, 4980MHz 9Mbps*

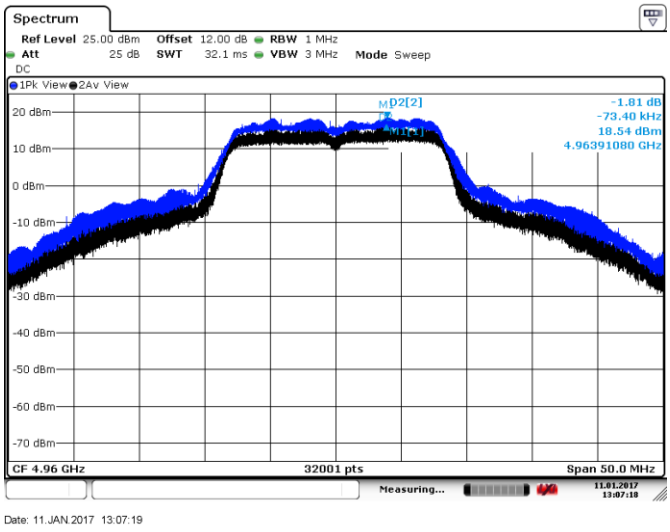


Figure 8.5-5: *Peak Excursion, 4960MHz 12Mbps*

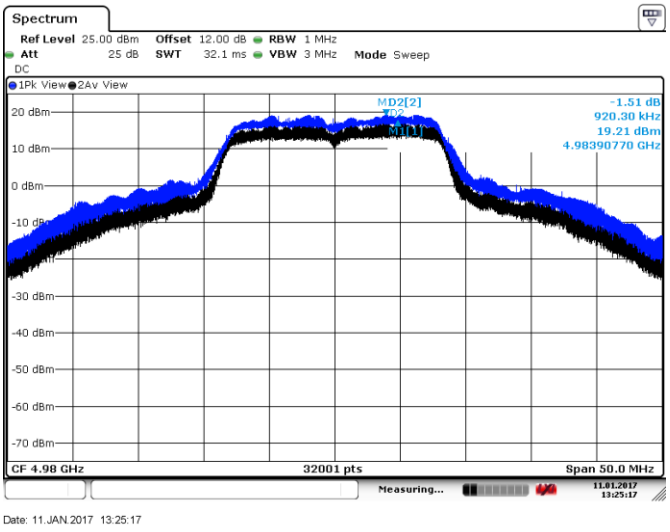


Figure 8.5-6: *Peak Excursion, 4980MHz 12Mbps*

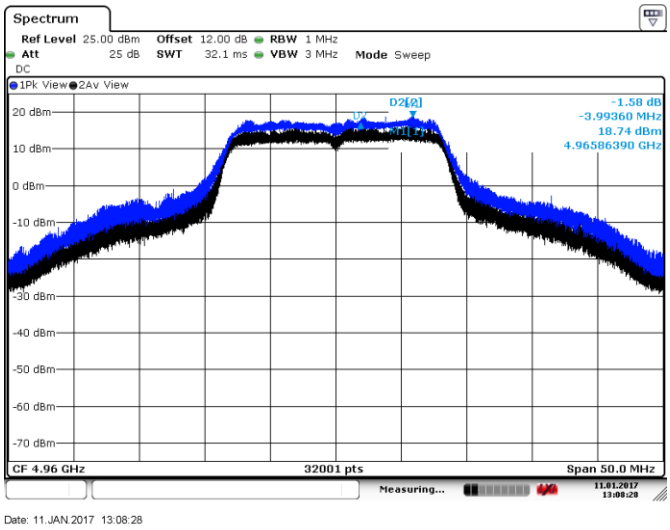


Figure 8.5-7: *Peak Excursion, 4960MHz 18Mbps*

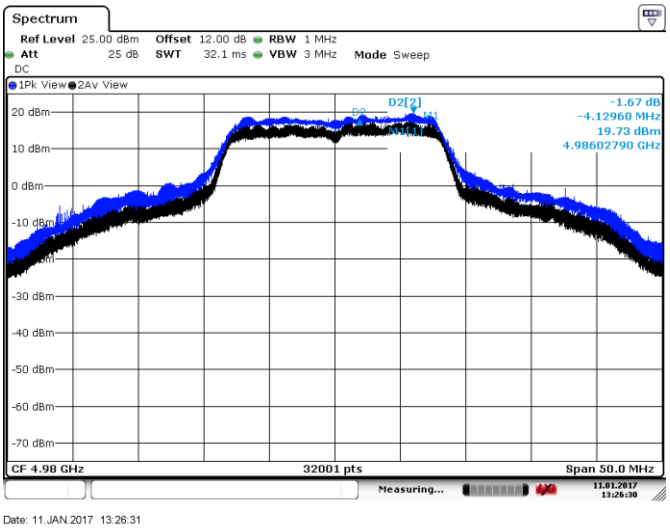


Figure 8.5-8: *Peak Excursion, 4980MHz 18Mbps*

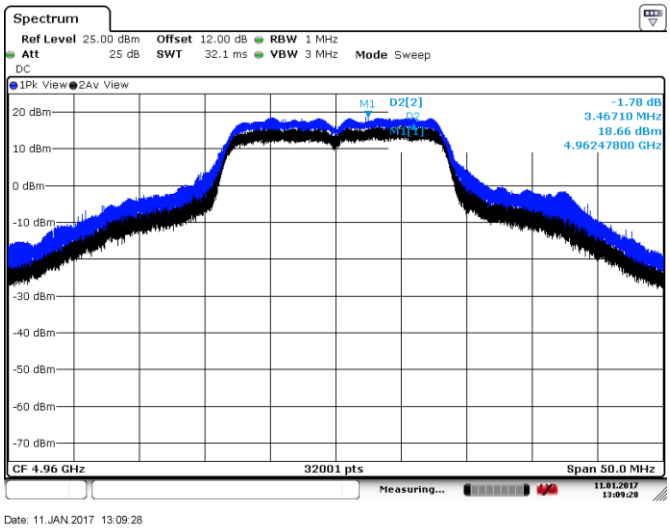


Figure 8.5-9: *Peak Excursion, 4960MHz 24Mbps*

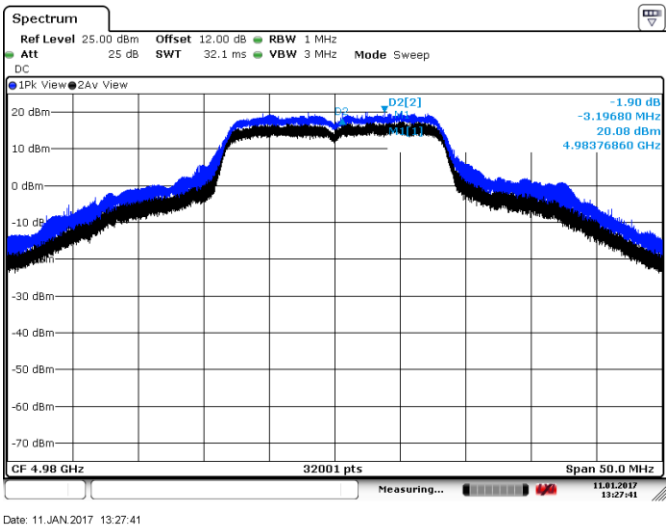


Figure 8.5-10: *Peak Excursion, 4980MHz 24Mbps*

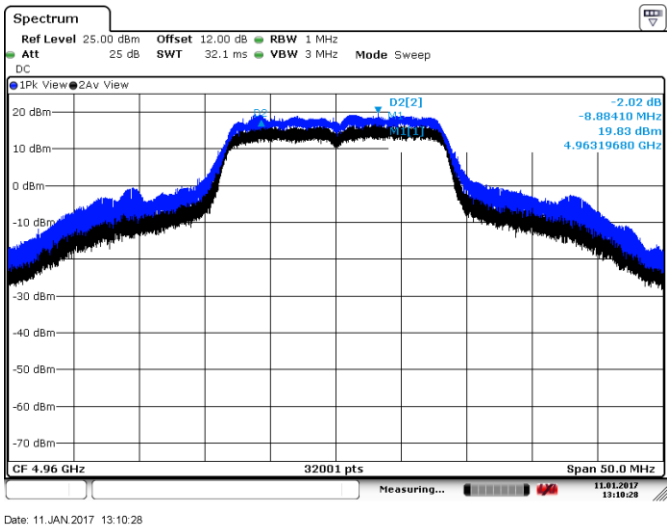


Figure 8.5-11: *Peak Excursion, 4960MHz 36Mbps*

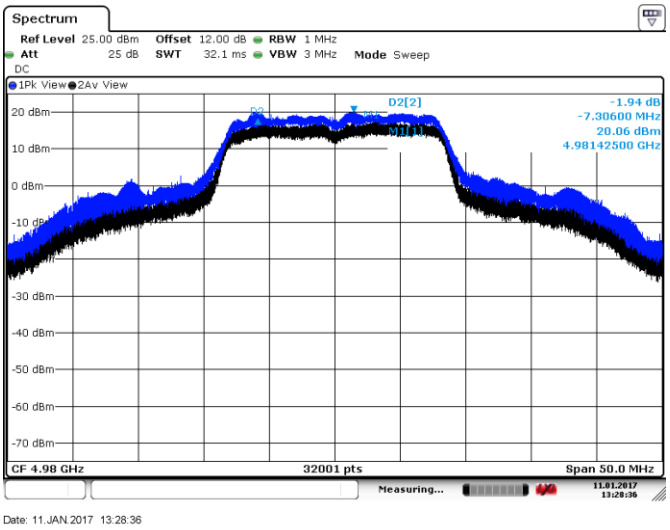
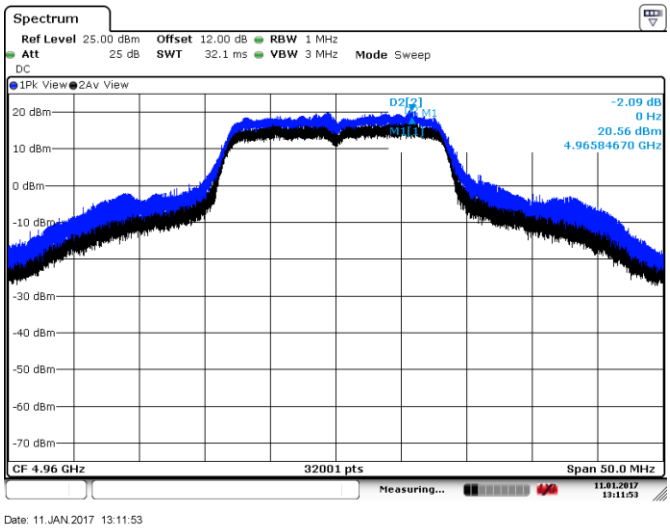
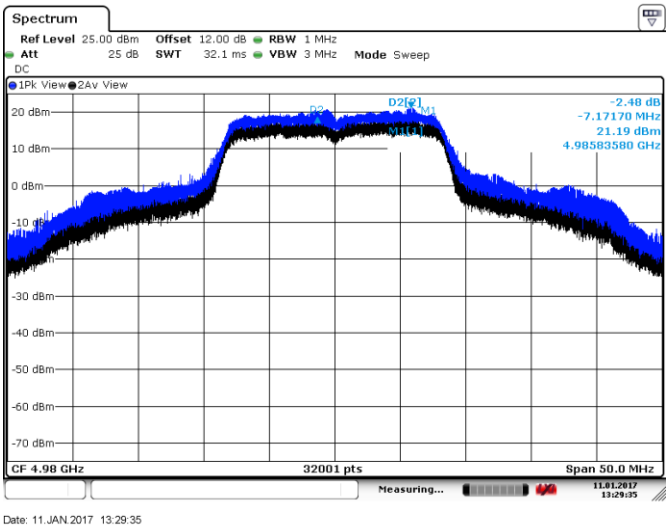


Figure 8.5-12: *Peak Excursion, 4980MHz 36Mbps*



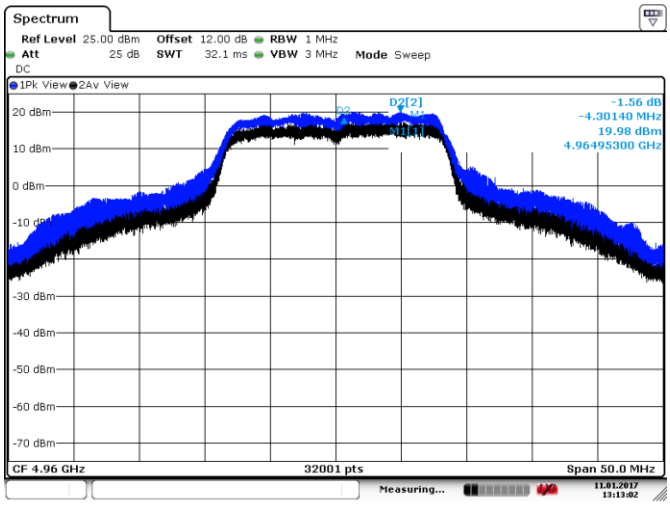
Date: 11.JAN.2017 13:11:53

Figure 8.5-13: *Peak Excursion, 4960MHz 48Mbps*



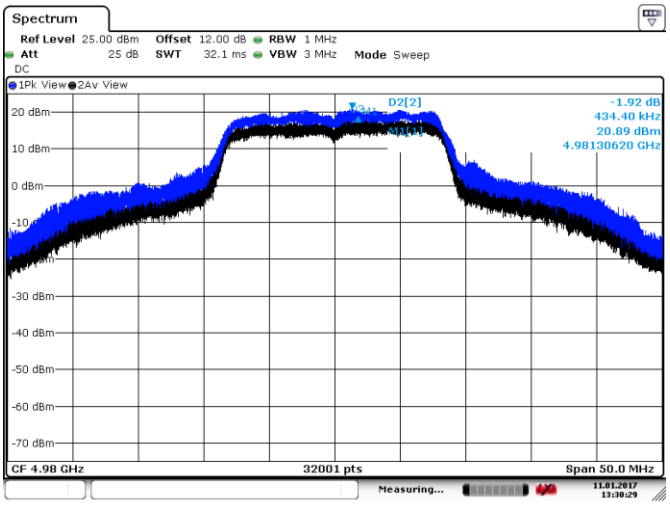
Date: 11.JAN.2017 13:29:35

Figure 8.5-14: *Peak Excursion, 4980MHz 48Mbps*



Date: 11.JAN.2017 13:13:02

Figure 8.5-15: *Peak Excursion, 4960MHz 54Mbps*



Date: 11.JAN.2017 13:30:30

Figure 8.5-16: *Peak Excursion, 4980MHz 54Mbps*

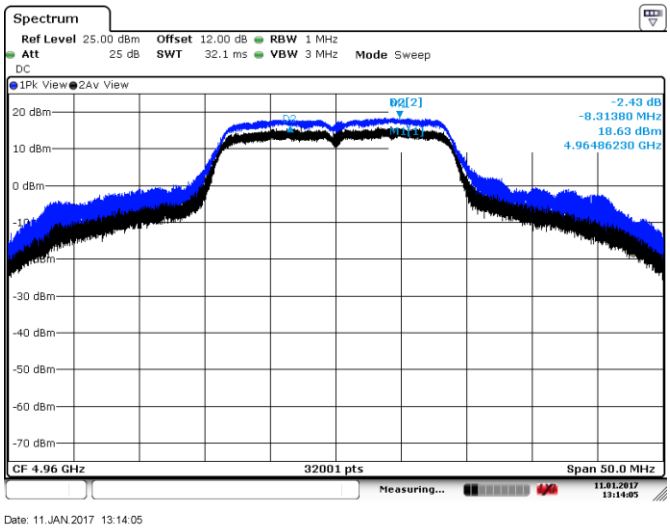


Figure 8.5-17: *Peak Excursion, 4960MHz MCS0*

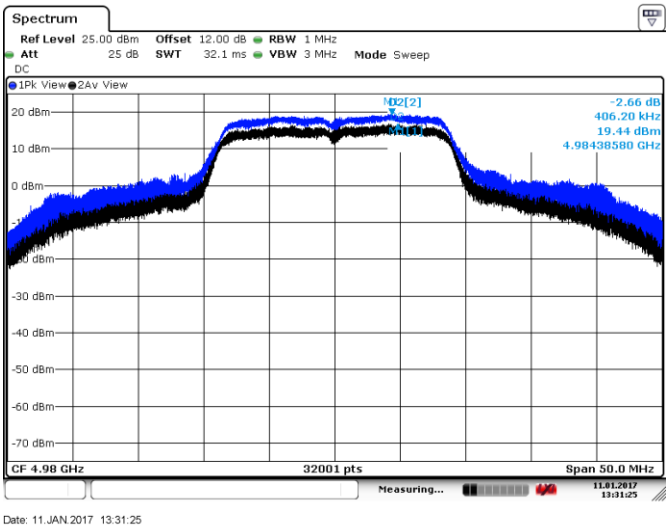


Figure 8.5-18: *Peak Excursion, 4980MHz MCS0*

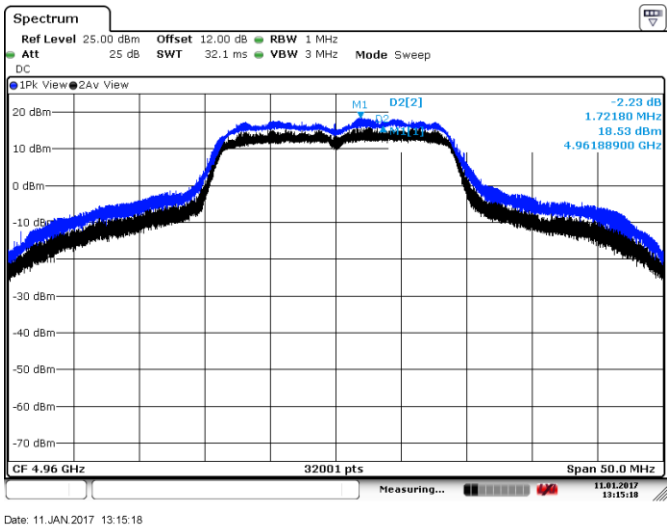


Figure 8.5-19: *Peak Excursion, 4960MHz MCS1*

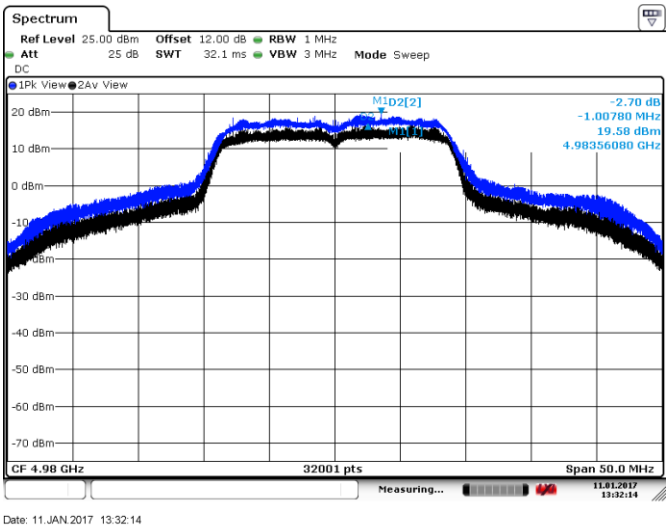
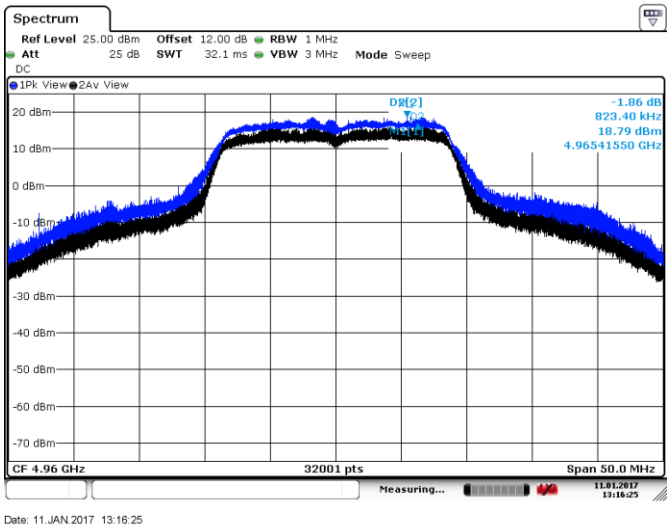
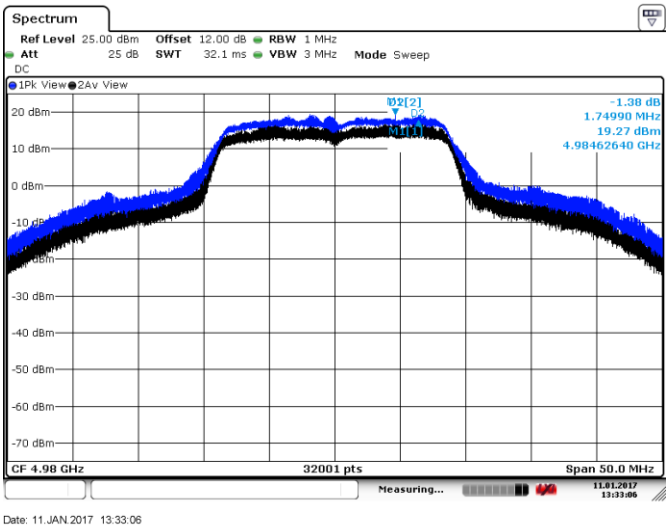


Figure 8.5-20: *Peak Excursion, 4980MHz MCS1*



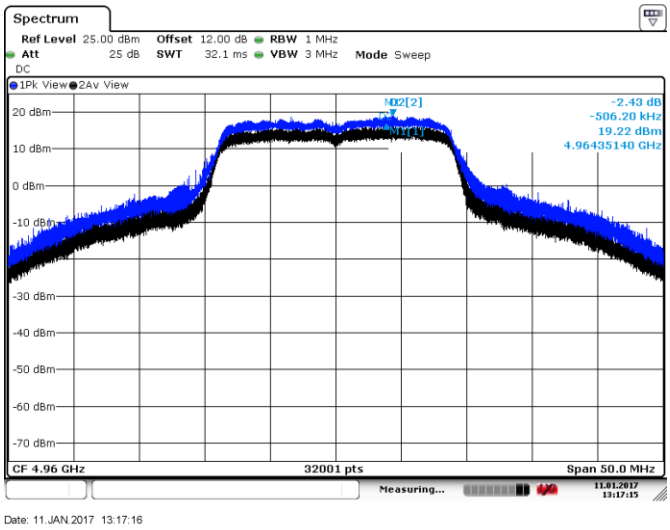
Date: 11.JAN.2017 13:16:25

Figure 8.5-21: *Peak Excursion, 4960MHz MCS2*



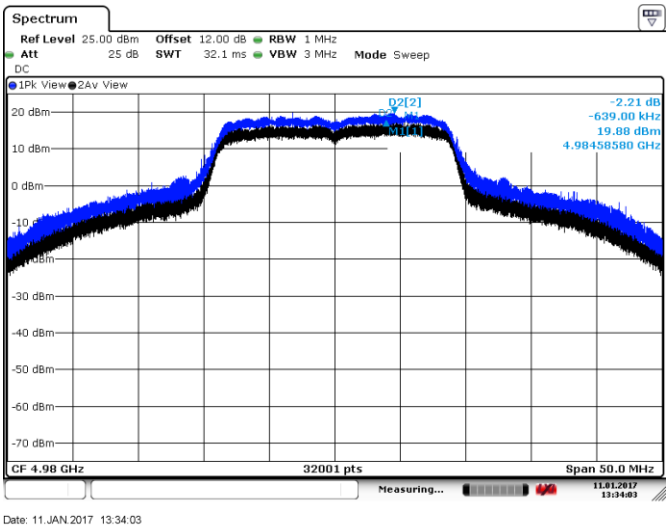
Date: 11.JAN.2017 13:33:06

Figure 8.5-22: *Peak Excursion, 4980MHz MCS2*



Date: 11.JAN.2017 13:17:16

Figure 8.5-23: *Peak Excursion, 4960MHz MCS3*



Date: 11.JAN.2017 13:34:03

Figure 8.5-24: *Peak Excursion, 4980MHz MCS3*

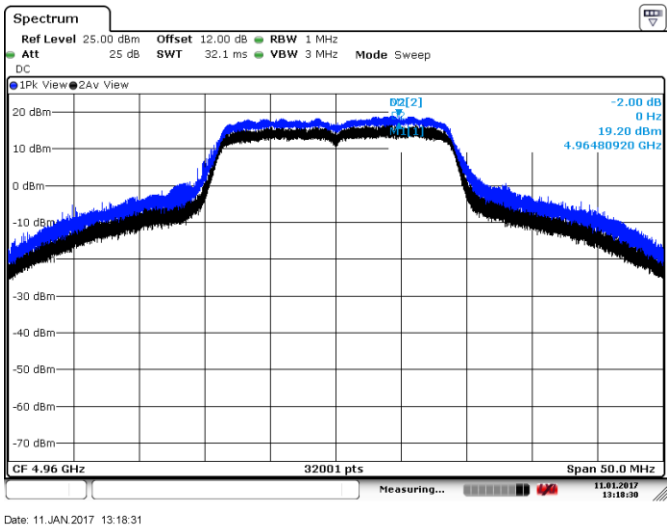


Figure 8.5-25: *Peak Excursion, 4960MHz MCS4*

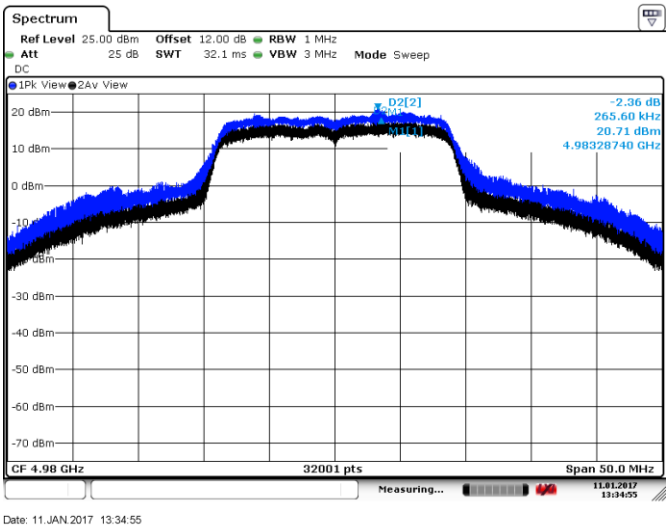


Figure 8.5-26: *Peak Excursion, 4980MHz MCS4*

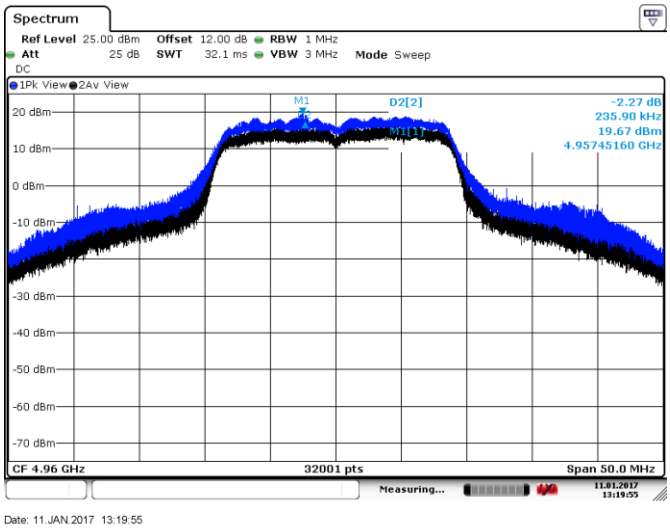


Figure 8.5-27: *Peak Excursion, 4960MHz MCS5*

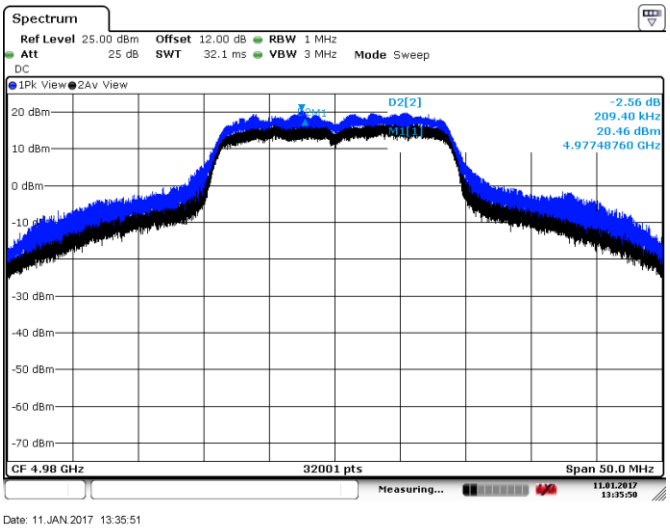


Figure 8.5-28: *Peak Excursion, 4980MHz MCS5*

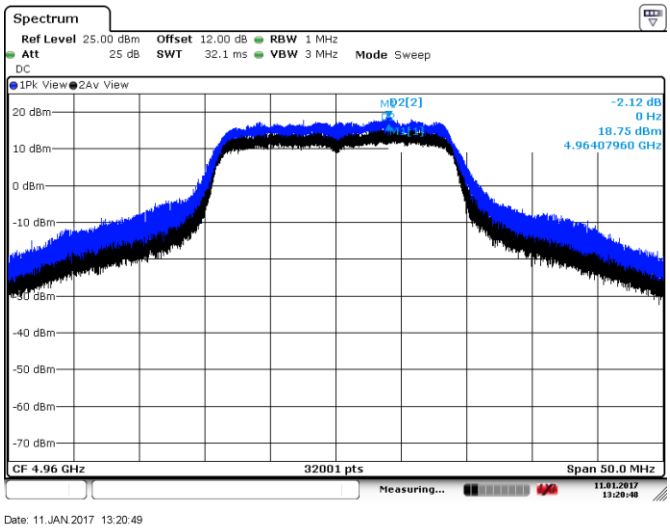


Figure 8.5-29: *Peak Excursion, 4960MHz MCS6*

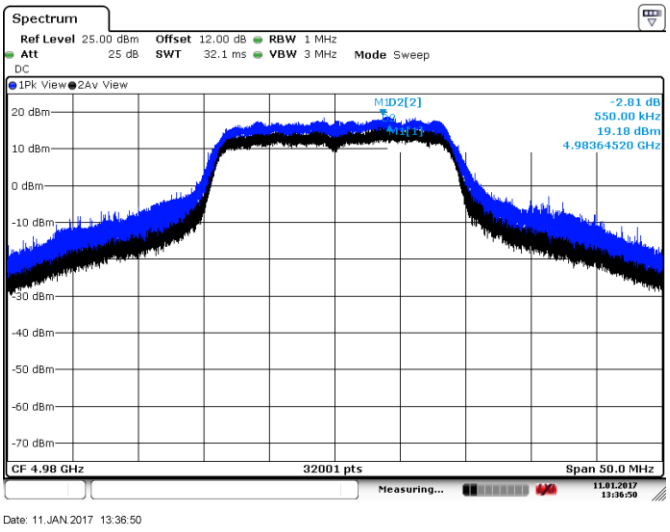


Figure 8.5-30: *Peak Excursion, 4980MHz MCS6*

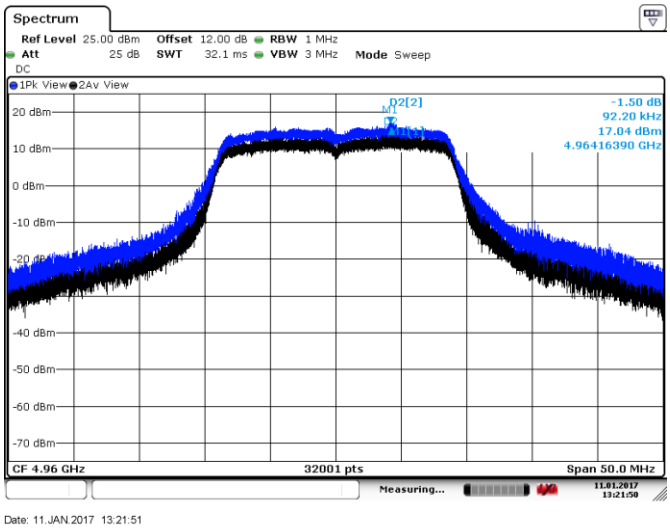


Figure 8.5-31: *Peak Excursion, 4960MHz MCS7*

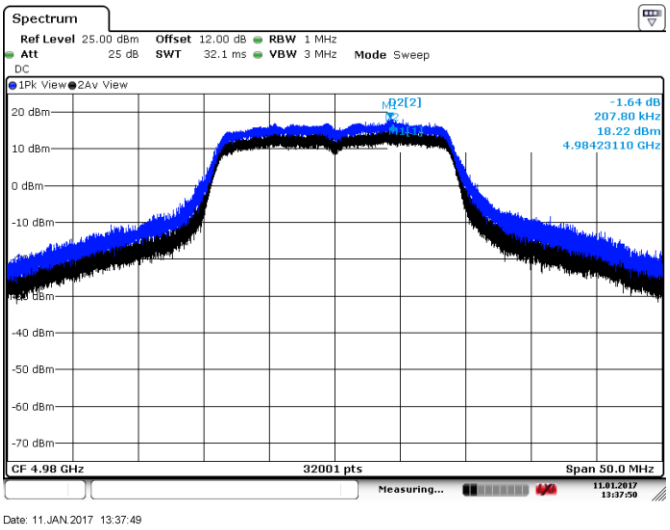
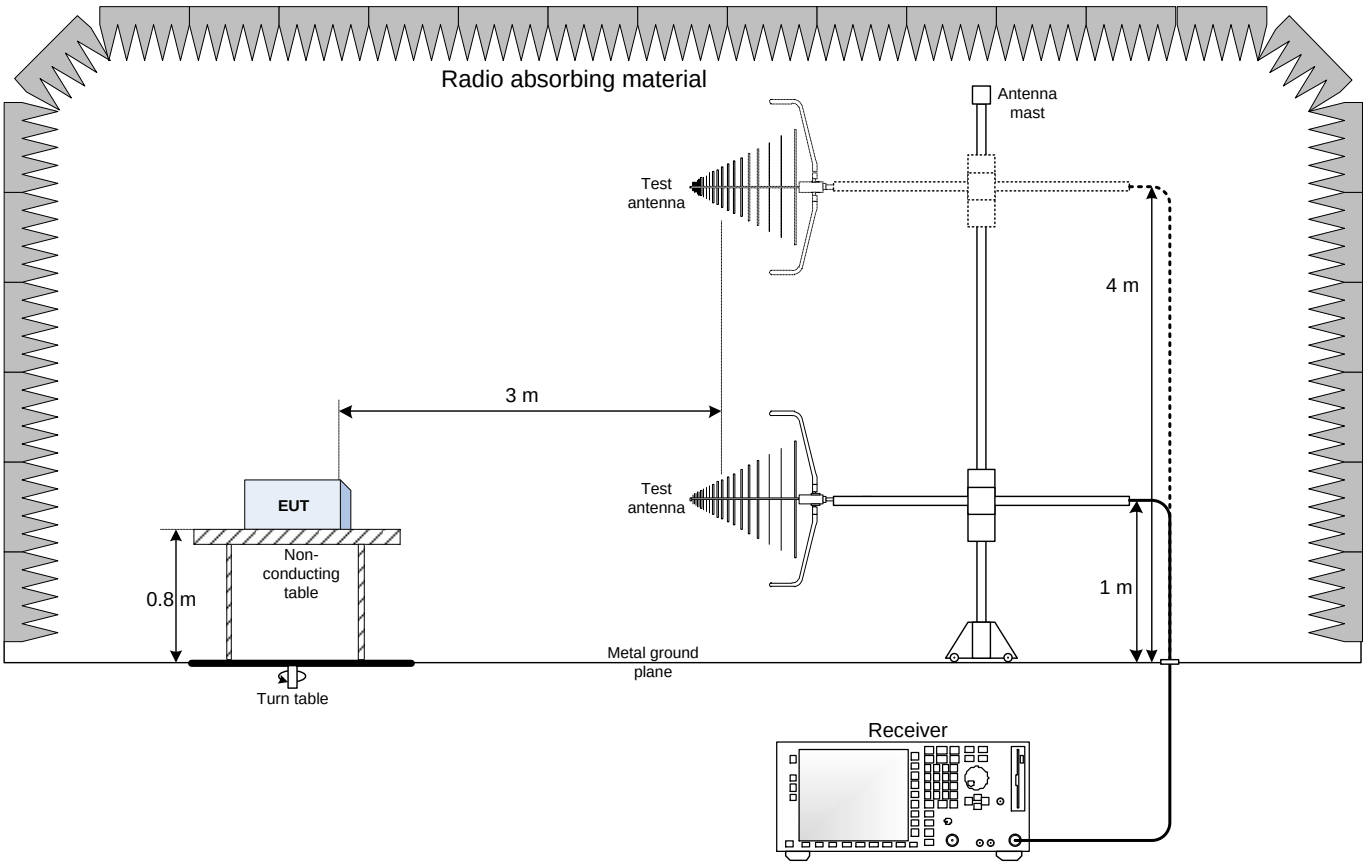


Figure 8.5-32: *Peak Excursion, 4980MHz MCS7*

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up – Below 1GHz



9.2 Radiated emissions set-up – Above 1GHz