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Radio Test report

362154-1TRFWL

Applicant:

Casa Systems

Product:

Apex Strand Small Cell

Model:

LTE4001-41

Part number:

KRC 161 752/1

FCC ID:

2A038-LTE4001-41

Specifications:

- FCC CFR 47 Part 27
  Experimental Radio, Auxiliary, Special Broadcast and Other Program Distributional Services
- FCC CFR 47 Part 2 (October 2017)
  Frequency Allocations and Radio Treaty Matters General Rules and Regulations

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
FCC Site Number	Test Firm Registration Number: 392943 Designation Number: US5058
ISED Test Site	2040B-3

Tested by:	Martha Espinoza, Wireless Engineer
Reviewed by:	Juan Manuel Gonzalez, EMC & Wireless Business Development Manager
Date:	December 14, 2018
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	Casa Systems
Address	100 Old River Road, #100
City	Andover
Province/State	Massachusetts
Postal/Zip code	10810
Country	USA

1.2 Test specifications

FCC 47 CFR Part 27	Miscellaneous wireless communications services
FCC 47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
FCC 47 CFR Part 27	Public mobile services

1.3 Test method

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested.

This report applies to the Apex Stand Small Cell with model numbers LTE4001-41

See “Summary of test results” for full details.

1.5 Exclusions

Band 41, 15 MHz bandwidth not supported.

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 2 and 27 test results

Part	Test description	Verdict
§2.1046 & 27.50(h)(1)	Maximum output power at RF antenna connector (EIRP)	Pass
§2.1051 & 27.53 (m)	Spurious emissions at RF antenna connector	Pass
§27.53	Radiated spurious emissions	Pass
§2.1053 & 27.53(f)	Radiated spurious emissions within 1559–1610 MHz band	Pass
§2,1055 & 27.54	Frequency stability	Pass
§2.1049	Occupied bandwidth	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	September 28, 2018

3.2 EUT information

Product name	Apex Strand Small Cell
Model	LTE4001-41
Part number	N/A
Revision	N/A
Serial number	Eng. Sample
Antenna ports	4 TX/RX Ports, 2X2 MIMO
Conducted Ports	Ports 1 and 2 and Ports 3 and 4 are correlated Ports 1,2 is directionally uncorrelated with respect to Ports 3,4
TDD	B41: 5.10.20 MHz
B41 Frequency bands	TX (DL)/RX (UL) : 2496 – 2690 MHz
Maximum Output Power	2W (33 dBm)
Accuracy (nominal)	±0.1 ppm
Nominal voltage	*–40 to -90 V_{AC}, 45Watts*
Modulation	LTE: QPSK, 16 QAM, 64 QAM
Channel bandwidth	LTE B41: 5 MHz, 10 MHz and 20MHz
Regulatory requirements	Radio: FCC Part 2, 27
	EMC: FCC Part 15
	Safety: IEC/EN 62368-1, UL/CSA 62368-1 IEC/EN 60950-22, IEC/EN 62950, UL 50E/CAN/CSA
Emission Designator:	D7W – 16 and 64 QAM, and G7W for QPSK
Operating temperature	–30 °C to +55 °C

3.3 Product description and theory of operation

EUT description of the methods used to exercise the EUT and all relevant ports:

Description/theory of operation	The Apex Strand Small Cell is a medium-power RF emitting eNodeB for LTE RAN. This node is capable of emitting up to 2W RF power per sector. Each Unit supports two sectors with radio access capabilities (4G) that is responsible for radio transmission (4 antennas) and reception from UEs in a LTE network. The Apex Strand Small Cell provides radio coverage for LTE enabled devices and or handsets within a home residential or enterprise coverage area. The Apex Strand Small Cell incorporates all the capabilities and functions of a standard eNode B. Model LTE4001-41 operates in Band 41. The device includes a pre-certified Wifi radio for management functions only, accessed by service personnel. The Apex Strand Small Cell is mountable from an available aerial strand. The main advantage of the Apex Strand Small Cell include: · Ease of installation: No dedicated LTE Backhaul needed. Can use available Cable, Gigabit Ethernet or Gigabit optical network for EPC backhaul. · Increased subscriber density: The AeMS should manage up to 1M HeNBs.· Easy integration: Uses X.509 digital certificates to authenticate with the service provider's back-end management systems.· Cost effectiveness: Supports Plug-and-Play provisioning, does not require a dedicated installation, and uses existing infrastructure with minimal intervention.
Physical	**Dimensions**: 508 (20”) × 203.2 (8”) × 203.2 (8”) mm (H × W × D) **Weight**: 10 kg/22lb **Operating Temperature**: –30 to +55 °C **Mounting**: Pole, Wall Mount
Hardware Configuration	Apex Strand Small Cell, LTE4001-41

3.4 EUT test details

EUT setup/configuration rationale:

Down link/Up link	

Band	Modulation
LTE 41	QPSK/16QAM/64QAM

Carrier Configurations:

LTE B41

Bandwidth, MHz	Transmit / DL, MHz					
	B	Channel	M	Channel	T	Channel
5	2498.5	39675	2593	40620	2687.5	41565
10	2501	39700	2593	40620	2685	41540
20	2506	39750	2593	40620	2680	41490

EUT Monitoring Method / Equipment:

Support equipment	**See diagrams below**

3.5 EUT setup diagram

Typical Configuration Test Setup

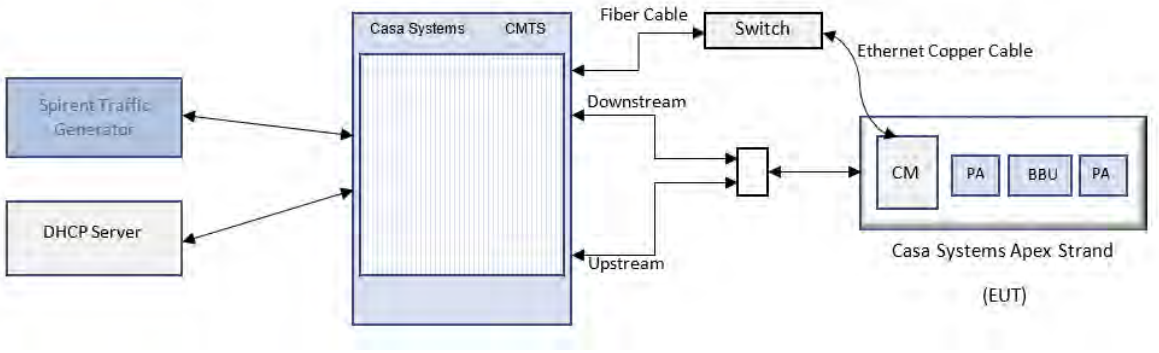
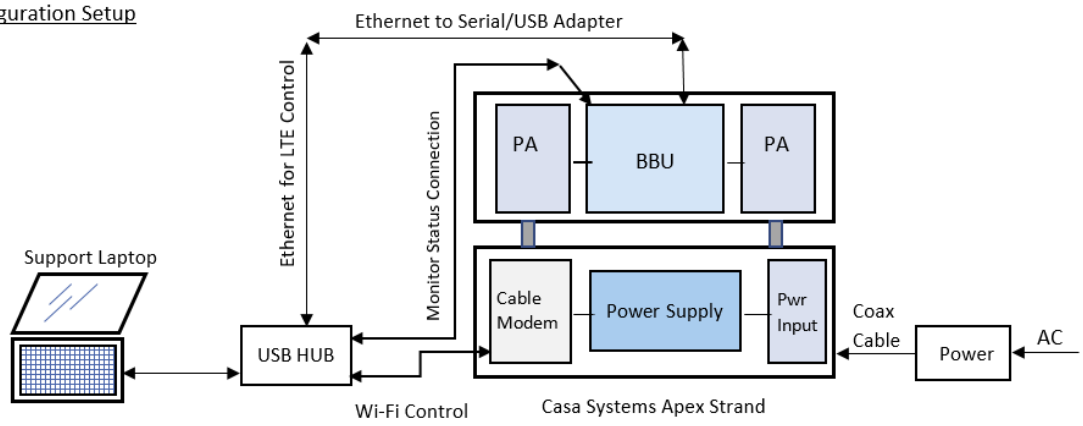


Figure 3.5-1: *Typical Setup diagram*

Radio Control Configuration Setup



Note: *Not created to scale more for clarification of test setups.*

Figure 3.5-2: *Radio Control Setup diagram*

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.

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*

Radiated emissions equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1121	1 Year	04/28/2019
Antenna, Bilog	Schaffner-Chase	CBL6111C	E1763	2 Years	11/28/2018
Antenna, Horn	ETS	3117-PA	E1139	2 Years	01/26/2020
Antenna, Horn	Sage	SAR-2309-42-S2	E1143	2 Years	03/05/2020
Low Noise Amplifier	Sage	SBL-183403430-KFKF-S1	E1174	1 Year	10/16/2019
Band-reject filter	Micro-Tronics	BRM50709	E1142	N/A	VOU

Notes: VOU – Verified on Use

Conducted port equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Spectrum Analyzer	Rohde & Schwarz	FSV40	E1120	1 yr.	08-24-2019
Temp Chamber	CSZ	P-32	S1179	1 yr.	03-21-2019
Power Sensor	ETS	7002-006	E1061	1 yr.	01-18-2019
Attenuator 10dB	Mini-Circuits	BW-K10-2W44+	--	NCR	VOU

Notes: VOU – Verified on Use

Conducted disturbance at mains port equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESCI 7	E1767	1 Year	02/21/2019
Two Line V-Network	Rohde & Schwarz	ENV216	E1019	1 Year	07/24/2019

Radiated/Conducted disturbance test software details

Manufacturer of Software	Details
Rohde-Schwarz	EMC 32 V10.0

Notes: None

Note: NCR - no calibration required

Section 8. Testing data

8.1 FCC 27.50(h)(1) Maximum output power at RF antenna connector (EIRP)

8.1.1 Definitions and limits

(h) The following power limits shall apply in the BRS and EBS:

(1) Main, booster and base stations. (i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW* + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

8.1.2 Test summary

Test date	October 1 to 4, 2018

8.1.3 Observations, settings and special notes

Based on the maximum RF power listed in this report, considerations pertaining to the maximum allowed EIRP (or ERP) and antenna type should be considered for each installation.

Based on KDB 662911 D01 and D02 Ports 1 and 2 and Ports 3 and 4 are co-related respectively therefore 10 Log (2) (I.E. 3dB) added to the EIPR measurement.

However, per KDB 662911 D01 and D02 Ports 1 and 2 are directionally uncorrelated, with Ports 3 and 4, Therefore the sum of ports 1 and 2, and Ports 3 And 4 must individually meet the required Part 27 limits.

Measurement was performed using RMS power meter.

8.1.4 Test data

Table 8.1-1: *Output power Limits based on Actual LTE Bandwidth and post-transition BRS and EBS Channel Bandwidths*

Test Item	Rules Part	Channel BW (X)	Modulation	Test Frequencies	Channel	Channel BW (Y) (BRS + EBS) Modulation (ANY)	Calculated Limit EIRP = 63 dBm + 10 log(X/Y) dBm
EIRP	2.1046 & 27.50(h)(2)	5 MHz	QPSK/16QAM/64QAM	2498.5/2593.0/2687.5	2498.5	6 MHz	62.2
					2593.0	6 MHz	62.2
					2687.5	5.5 MHz	62.6
		10 MHz	QPSK/16QAM/64QAM	2501.0/2593.0/2685.0	2501	6 MHz	65.2
					2593	6 MHz	65.2
					2685	5.5 MHz	65.6
		20 MHz	QPSK/16QAM/64QAM	2506.0/2593.0/2680.0	2506	5.5 MHz	68.2
					2593	6 MHz	68.6
					2680	5.5 MHz	68.2

LIMIT = EIRP = 33 dBW + 10 log(X/Y) dBW

(h) The following power limits shall apply in the BRS and EBS:

(1) Main, booster and base stations. (i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

Table 8.1-2: *Measured Output power of EUT – 5M LTE Bandwidth*

Frequency	Port 1	Port 2	10 Log* (2)	Total RF Power	Ant. Gain	Total EIRP	Limit dBm	Margin to Limit	Port 3	Port 4	10 Log* (2)	Total RF Power	Ant Gain	Total EIRP	Limit dBm	Margin to Limit
QPSK -5M																
2498.5	30.58	29.96	3	36.29	9.5	45.79	62.20	**16.41**	29.55	29.52	3	35.55	9.5	45.05	62.20	**17.15**
2593	30.85	30.05	3	36.48	9.5	45.98	62.20	**16.22**	30.05	29.49	3	35.79	9.5	45.29	62.20	**16.91**
2687.5	30.24	29.54	3	35.91	9.5	45.41	62.60	**17.19**	29.05	29.97	3	35.54	9.5	45.04	62.60	**17.56**
16QAM -5M																
2498.5	30.53	29.77	3	36.18	9.5	45.68	62.20	**16.52**	29.57	29.55	3	35.57	9.5	45.07	62.20	**17.13**
2593	30.81	30.17	3	36.51	9.5	46.01	62.20	**16.19**	30	29.39	3	35.72	9.5	45.22	62.20	**16.98**
2687.5	30.16	29.41	3	35.81	9.5	45.31	62.60	**17.29**	29	29.85	3	35.46	9.5	44.96	62.60	**17.64**
64QAM -5M																
2498.5	30.61	29.79	3	36.23	9.5	45.73	62.20	**16.47**	29.56	29.55	3	35.57	9.5	45.07	62.20	**17.13**
2593	30.85	30.23	3	36.56	9.5	46.06	62.20	**16.14**	29.99	29.37	3	35.70	9.5	45.20	62.20	**17.00**
2687.5	30.24	29.39	3	35.85	9.5	45.35	62.60	**17.25**	28.96	29.88	3	35.45	9.5	44.95	62.60	**17.65**

Table 8.1-3: *Measured Output power of EUT – 10M LTE Bandwidth*

Frequency	Port 1	Port 2	10 Log* (2)	Total RF Power	Ant. Gain	Total EIRP	Limit dBm	Margin to Limit	Port 3	Port 4	10 Log* (2)	Total RF Power	Ant Gain	Total EIRP	Limit dBm	Margin to Limit
QPSK -10M																
2501	30.53	29.23	3	35.94	9.5	45.44	65.20	**19.76**	29.05	29.65	3	35.37	9.5	44.87	65.20	**20.33**
2593	30.74	30.16	3	36.47	9.5	45.97	65.20	**19.23**	29.72	29.67	3	35.71	9.5	45.21	65.20	**19.99**
2685	30.28	29.14	3	35.76	9.5	45.26	65.60	**20.34**	28.85	30.41	3	35.71	9.5	45.21	65.60	**20.39**
16QAM -10M																
2501	30.57	29.25	3	35.97	9.5	45.47	65.20	**19.73**	29.1	29.57	3	35.35	9.5	44.85	65.20	**20.35**
2593	30.76	30.19	3	36.49	9.5	45.99	65.20	**19.21**	29.85	29.58	3	35.73	9.5	45.23	65.20	**19.97**
2685	30.33	29.3	3	35.86	9.5	45.36	65.60	**20.24**	28.81	30.45	3	35.72	9.5	45.22	65.60	**20.38**
64QAM - 10M																
2501	30.54	29.24	3	35.95	9.5	45.45	65.20	**19.75**	29.2	29.51	3	35.37	9.5	44.87	65.20	**20.33**
2593	30.72	30.19	3	36.47	9.5	45.97	65.20	**19.23**	29.79	29.55	3	35.68	9.5	45.18	65.20	**20.02**
2685	30.25	29.3	3	35.81	9.5	45.31	65.60	**20.29**	28.87	30.4	3	35.71	9.5	45.21	65.60	**20.39**

Table 8.1-4: *Measured Output power of EUT – 20M LTE Bandwidth*

Frequency	Port 1	Port 2	10 Log* (2)	Total RF Power	Ant. Gain	Total EIRP	Limit dBm	Margin to Limit	Port 3	Port 4	10 Log * (2)	Total RF Power	Ant Gain	Total EIRP	Limit dBm	Margin to Limit
QPSK -20M																
2506	30.58	29.96	3	36.29	9.5	45.79	68.20	**22.41**	29.55	29.52	3	35.55	9.5	45.05	68.20	**23.15**
2593	30.85	30.05	3	36.48	9.5	45.98	68.60	**22.62**	30.05	29.49	3	35.79	9.5	45.29	68.60	**23.31**
2680	30.24	29.54	3	35.91	9.5	45.41	68.20	**22.79**	29.05	29.97	3	35.54	9.5	45.04	68.20	**23.16**
16QAM -20M																
2501	30.53	29.77	3	36.18	9.5	45.68	68.20	**22.52**	29.57	29.55	3	35.57	9.5	45.07	68.20	**23.13**
2593	30.81	30.17	3	36.51	9.5	46.01	68.60	**22.59**	30	29.39	3	35.72	9.5	45.22	68.60	**23.38**
2685	30.16	29.41	3	35.81	9.5	45.31	68.20	**22.89**	29	29.85	3	35.46	9.5	44.96	68.20	**23.24**
64QAM - 20M																
2506	30.61	29.79	3	36.23	9.5	45.73	68.20	**22.47**	29.56	29.55	3	35.57	9.5	45.07	68.20	**23.13**
2593	30.85	30.23	3	36.56	9.5	46.06	68.60	**22.54**	29.99	29.37	3	35.70	9.5	45.20	68.60	**23.40**
2680	30.24	29.39	3	35.85	9.5	45.35	68.20	**22.85**	28.96	29.88	3	35.45	9.5	44.95	68.20	**23.25**

8.2 FCC 27.53 Spurious emissions at RF antenna connector (B41)

8.2.1 Definitions and limits

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS No. 1 on the same terms and conditions as adjacent channel BRS or EBS licensees. Provided that a documented interference complaint cannot be mutually resolved between the parties prior to the applicable deadline, then the following additional attenuation requirements shall apply:

8.2.2 Test summary

Test date	October 11 and 16, 2018	Temperature	21 °C
Test engineer	Martha Espinoza	Air pressure	1000 mbar
Verdict	Pass	Relative humidity	30 %

8.2.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
All measurements were performed using a peak detector (worst case scenario).
Port 1 – QPSK Spurious Emissions
Port 3 – 16QAM Spurious Emission
Not shown – Various plots of Port 1 and 3 QPSK, 16QAM and 64QAM to verify spurious emissions were essentially the same for all three modes of modulation.

8.2.4 Test data

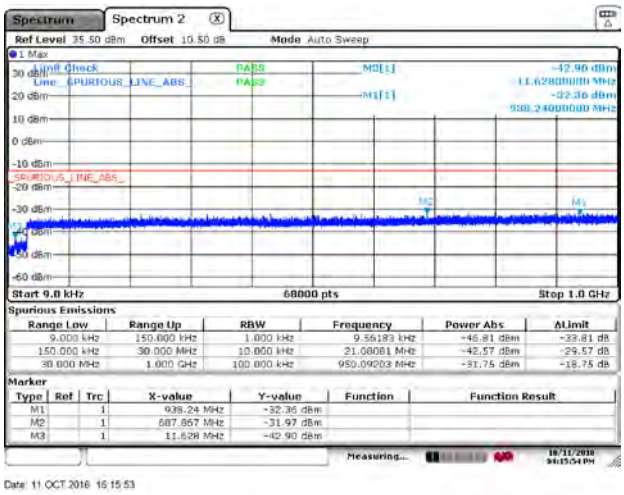


Figure 8.2-1: *Conducted spurious emissions for QPSK 5 MHz low channel at Port 1*

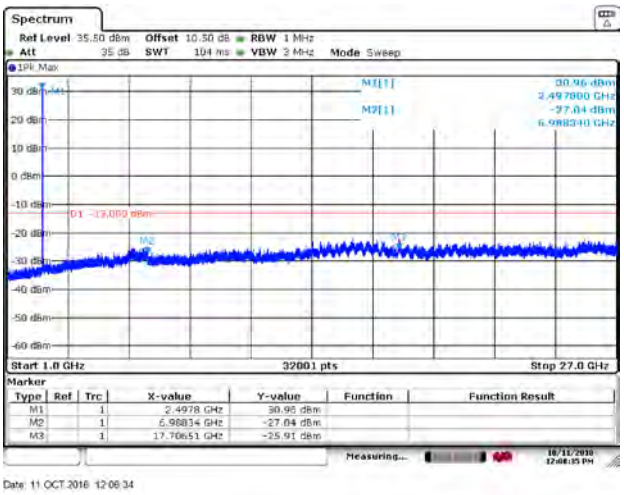


Figure 8.2-2: *Conducted spurious emissions for QPSK 5 MHz low channel at Port 1*

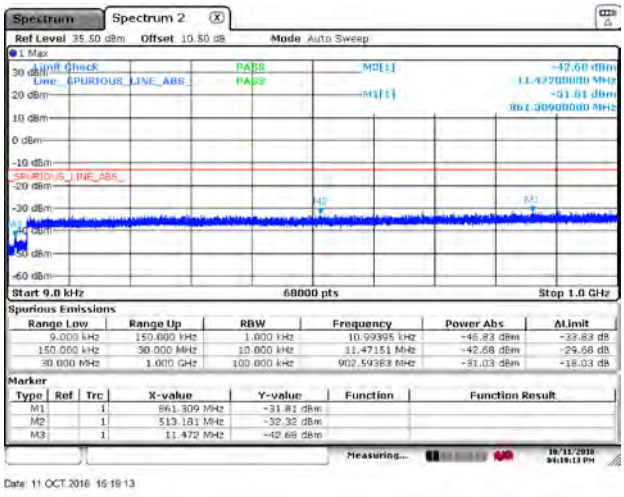


Figure 8.2-3: *Conducted spurious emissions for QPSK 5 MHz Mid channel at Port 1*

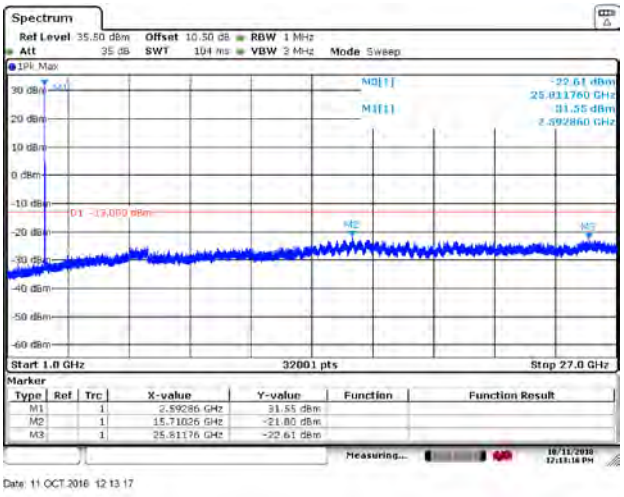


Figure 8.2-4: : *Conducted spurious emissions for QPSK 5 MHz Mid channel at Port 1*

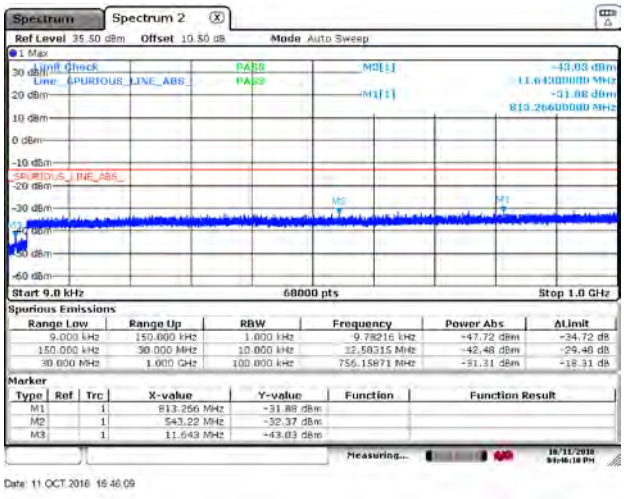


Figure 8.2-5: *Conducted spurious emissions for QPSK 5 MHz high channel at Port 1*

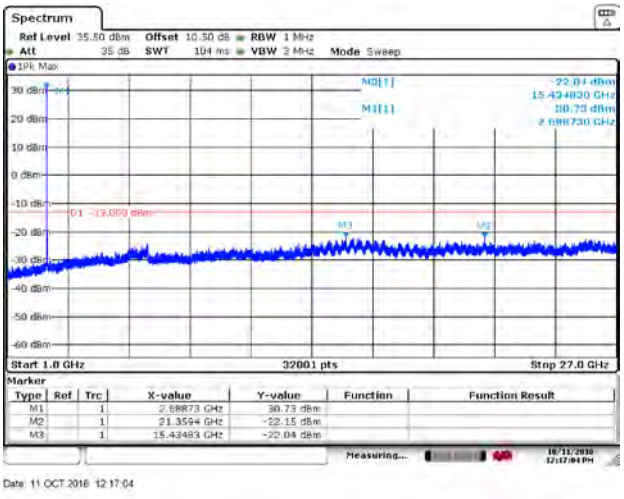


Figure 8.2-6: *Conducted spurious emissions for QPSK 5 MHz high channel at Port 1*

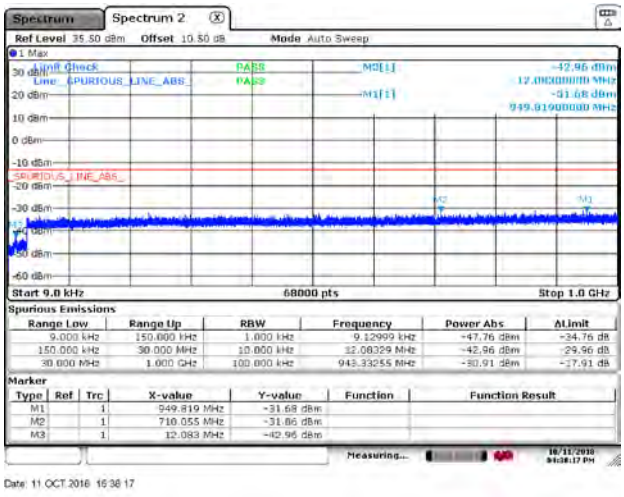


Figure 8.2-7: *Conducted spurious emissions for QPSK 10 MHz low channel at Port 1*

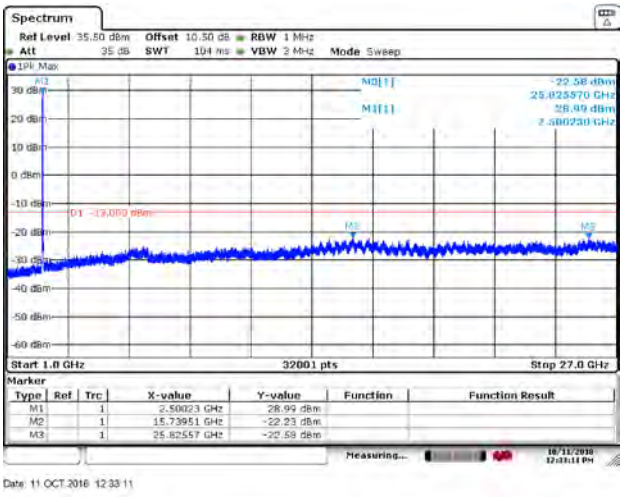


Figure 8.2-8: *Conducted spurious emissions for QPSK 10 MHz low channel at Port 1*

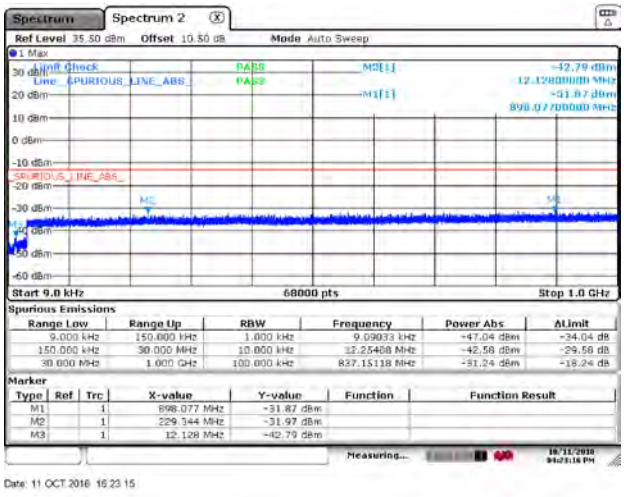


Figure 8.2-9: *Conducted spurious emissions for QPSK 10 MHz Mid channel at Port 1*

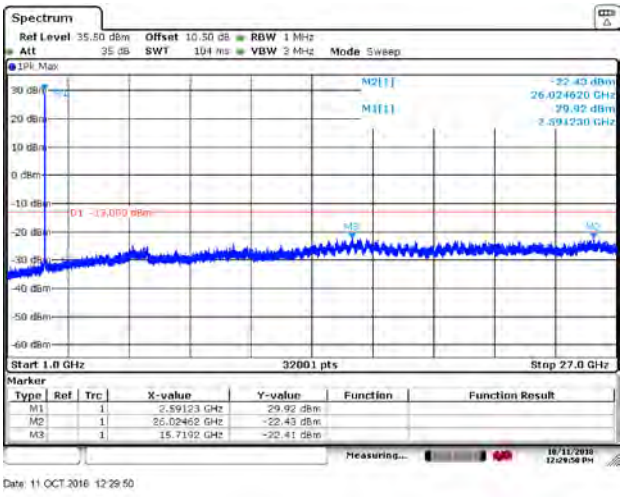


Figure 8.2-10: *Conducted spurious emissions for QPSK 10 MHz Mid channel at Port 1*

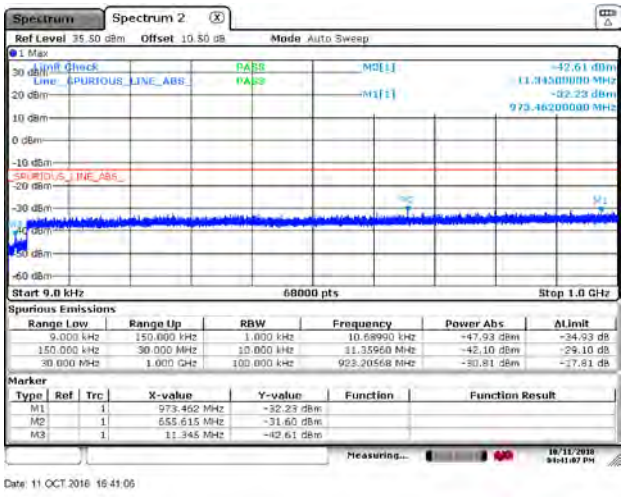


Figure 8.2-11: *Conducted spurious emissions for QPSK 10 MHz High channel at Port 1*

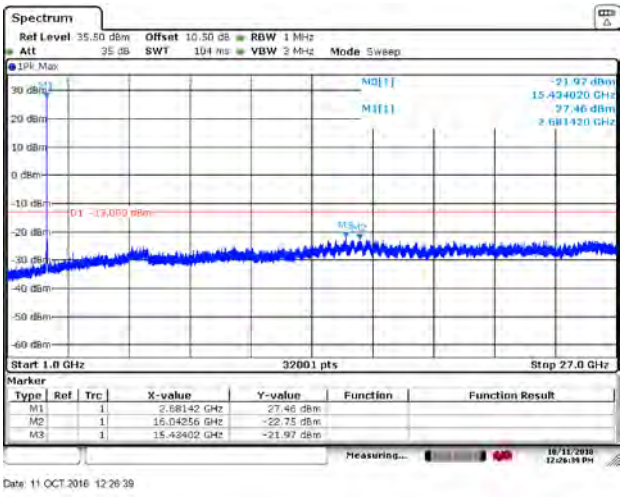


Figure 8.2-12: *Conducted spurious emissions for QPSK 10 MHz High channel at Port 1*

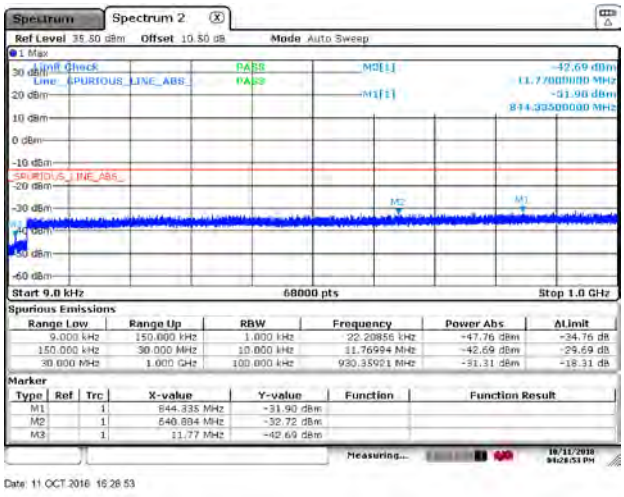


Figure 8.2-13: *Conducted spurious emissions for QPSK 20 MHz Low channel at Port 1*

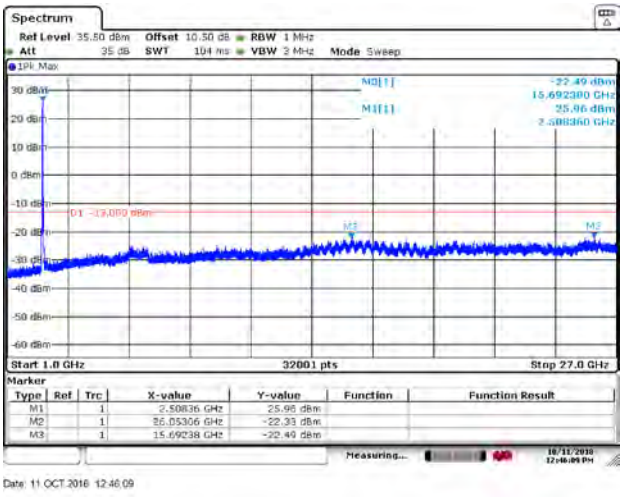


Figure 8.2-14: *Conducted spurious emissions for QPSK 20 MHz Mid channel at Port 1*

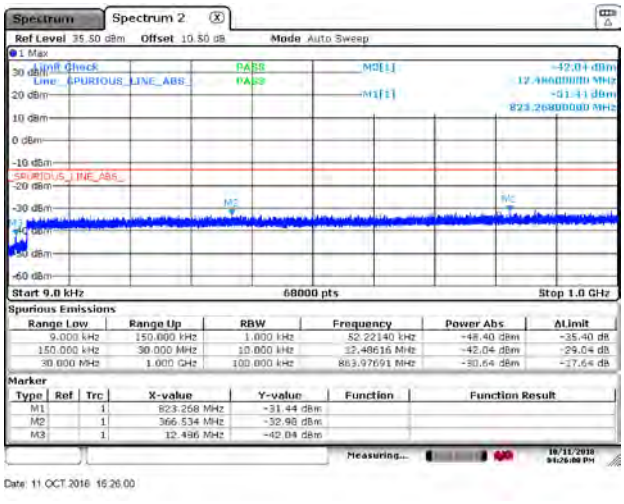


Figure 8.2-15: *Conducted spurious emissions for QPSK 20 MHz Mid channel at Port 1*

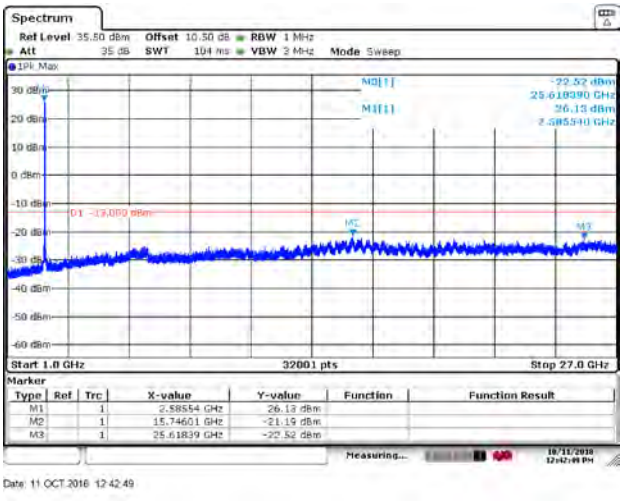


Figure 8.2-16: *Conducted spurious emissions for QPSK 20 MHz Mid channel at Port 1*

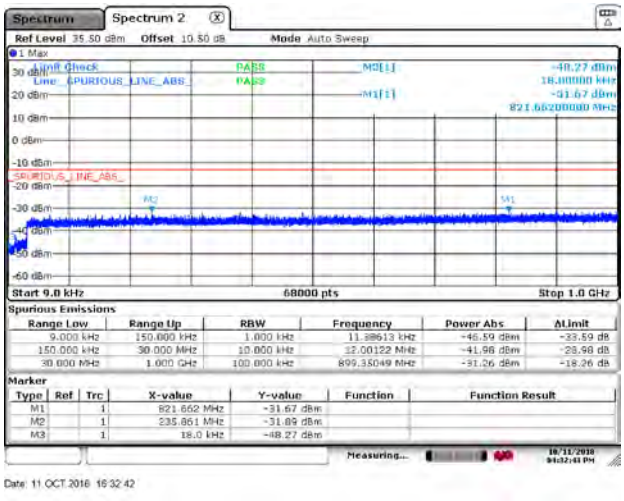


Figure 8.2-17: *Conducted spurious emissions for QPSK 20 MHz High channel at Port 1*

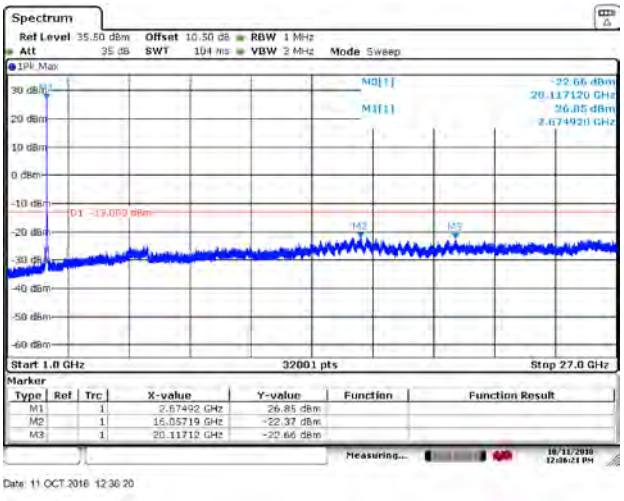


Figure 8.2-18: *Conducted spurious emissions for QPSK 20 MHz High channel at Port 1*

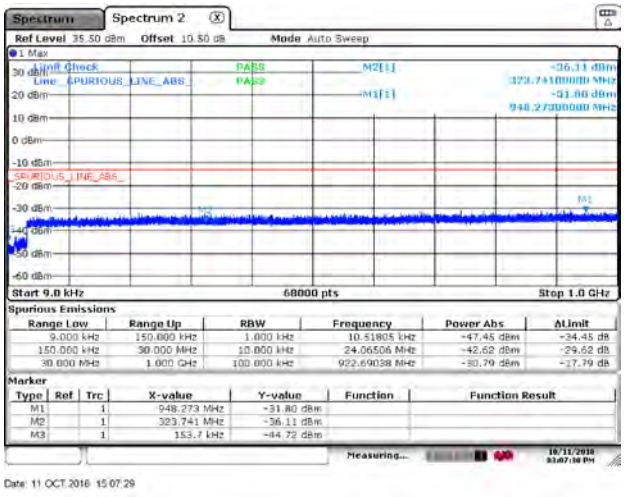


Figure 8.2-19: *Conducted spurious emissions for 16QAM 5 MHz low channel at Port 3*

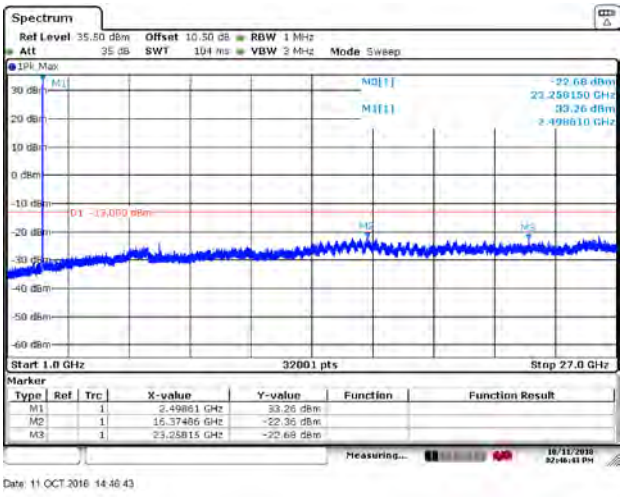


Figure 8.2-20: *Conducted spurious emissions for 16QAM 5 MHz low channel at Port 3*

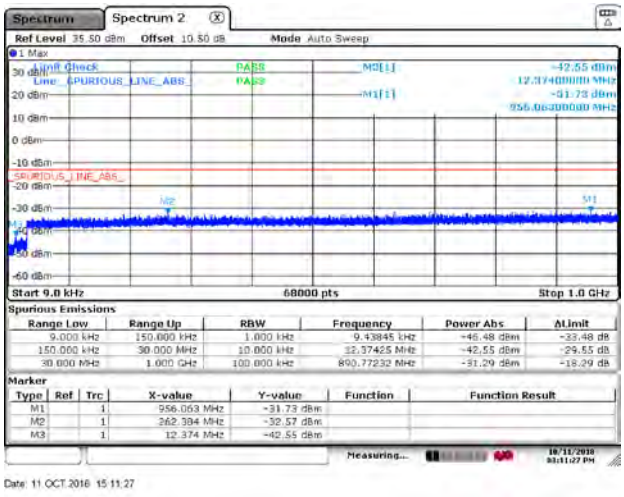


Figure 8.2-21: Conducted spurious emissions for 16QAM 5 MHz Mid channel at Port 3

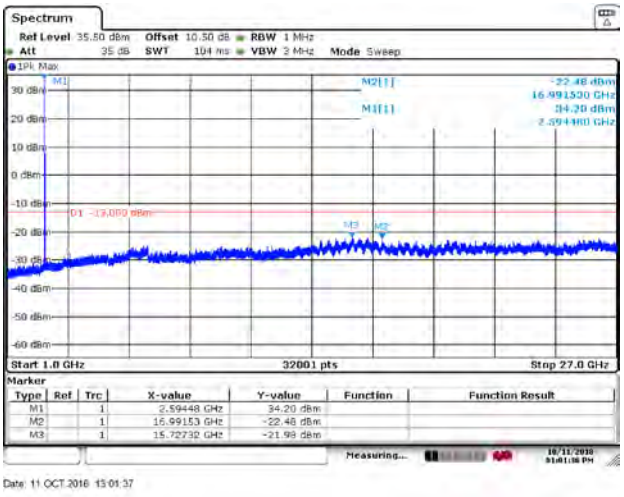


Figure 8.2-22: Conducted spurious emissions for 16QAM 5 MHz Mid channel at Port 3

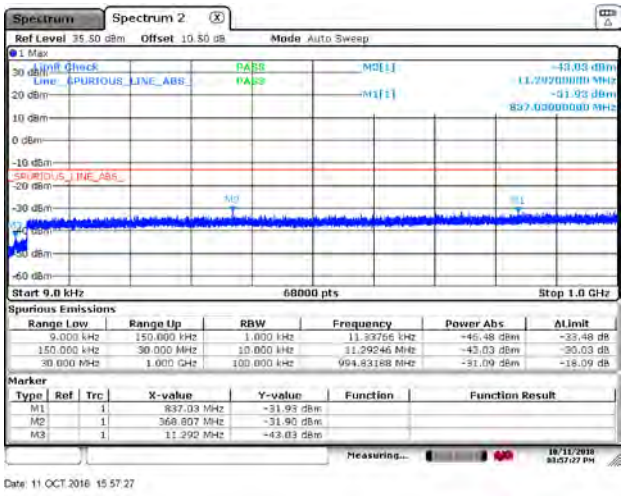


Figure 8.2-23: *Conducted spurious emissions for 16QAM 5 MHz High channel at Port 3*

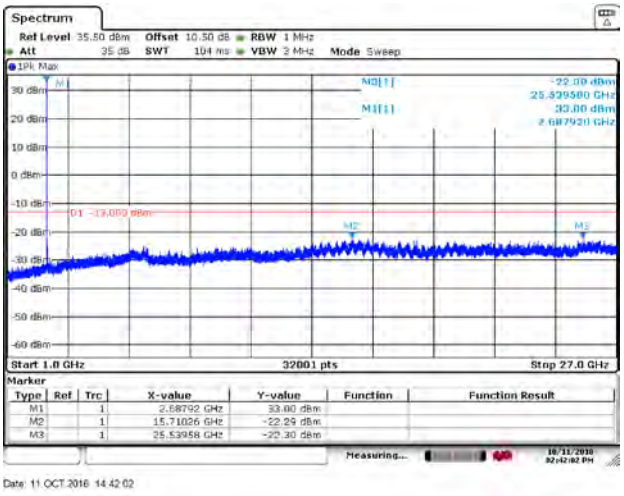


Figure 8.2-24 *Conducted spurious emissions for 16QAM 5 MHz High channel at Port 3*

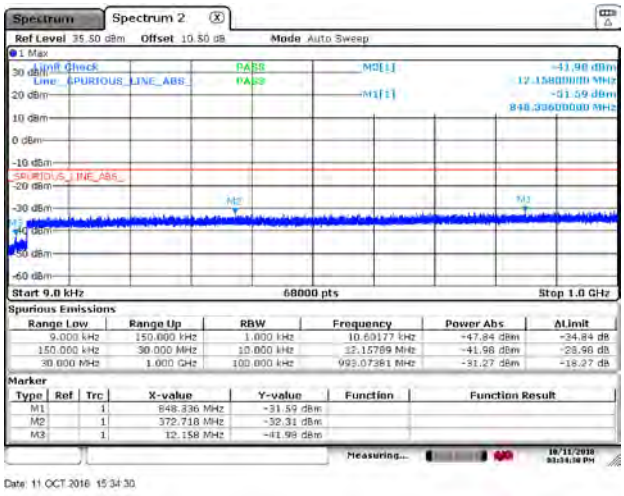


Figure 8.2-25: *Conducted spurious emissions for 16QAM 10 MHz low channel at Port 3*

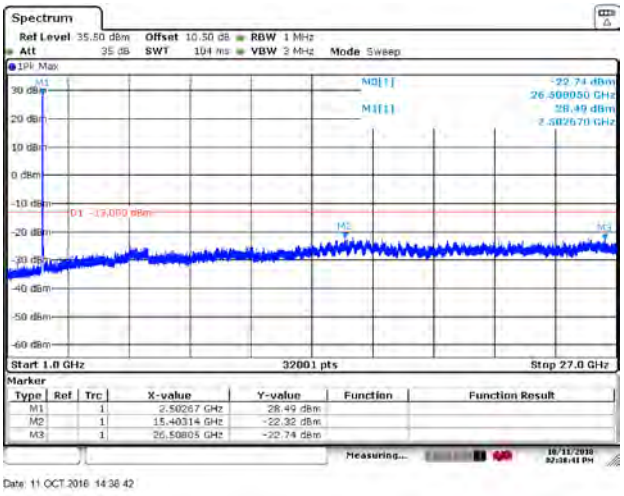


Figure 8.2-26 *Conducted spurious emissions for 16QAM 10 MHz low channel at Port 3*

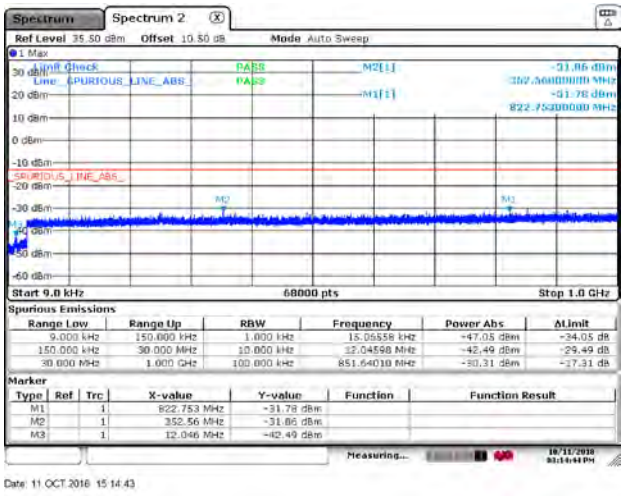


Figure 8.2-27: *Conducted spurious emissions for 16QAM 10 MHz MId channel at Port 3*

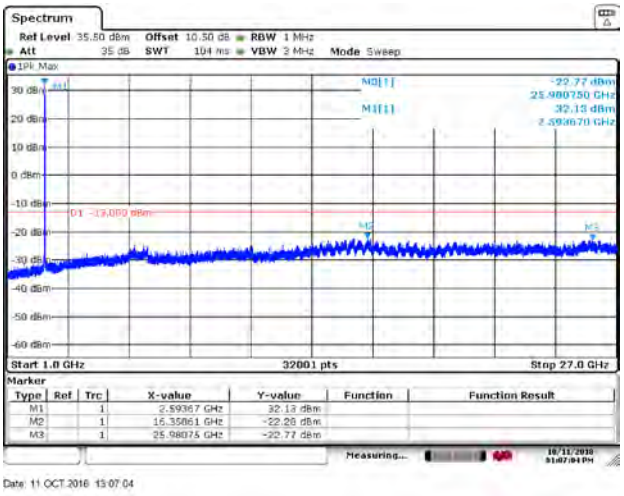


Figure 8.2-28: *Conducted spurious emissions for 16QAM 10 MHz Mid channel at Port 3*

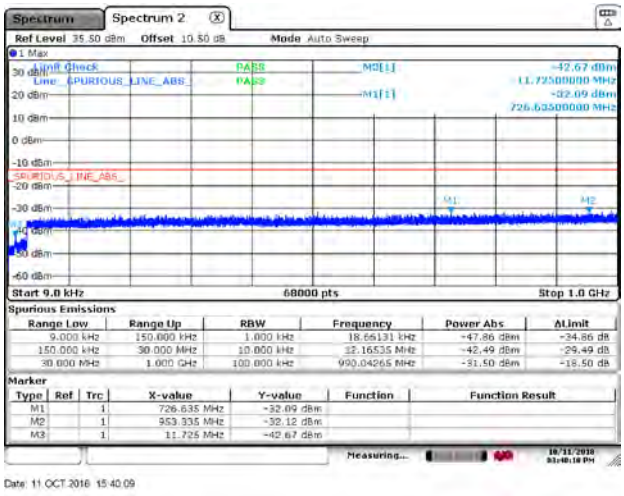


Figure 8.2-29: *Conducted spurious emissions for 16QAM 10 MHz High channel at Port 3*

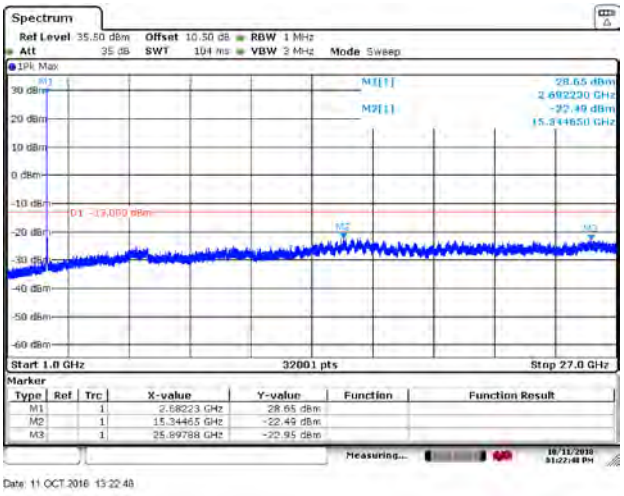


Figure 8.2-30: *Conducted spurious emissions for 16QAM 10 MHz High channel at Port 3*

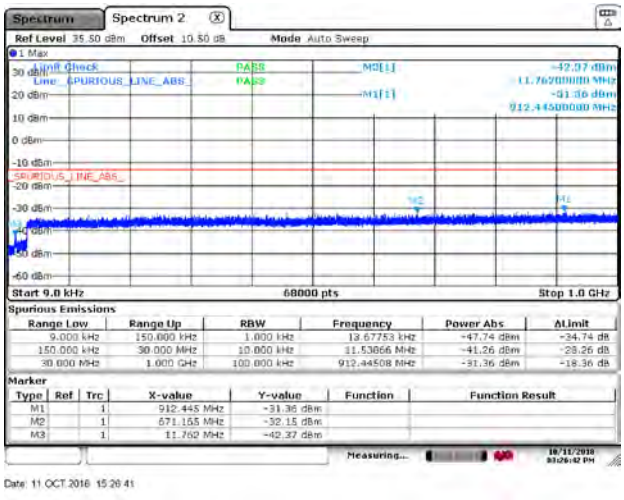


Figure 8.2-31: *Conducted spurious emissions for 16QAM 20 MHz Low channel at Port 3*

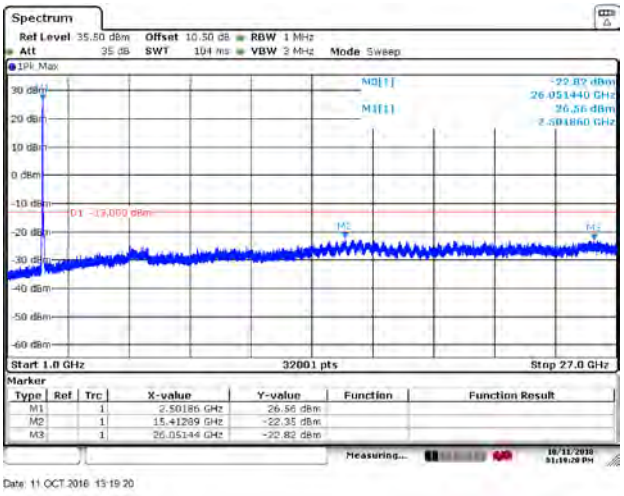


Figure 8.2-32: *Conducted spurious emissions for 16QAM 20 MHz Mid channel at Port 3*

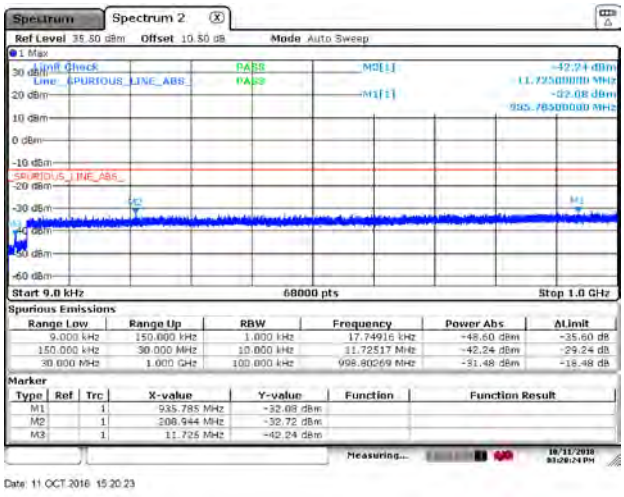


Figure 8.2-33: *Conducted spurious emissions for 16QAM 20 MHz Mid channel at Port 3*

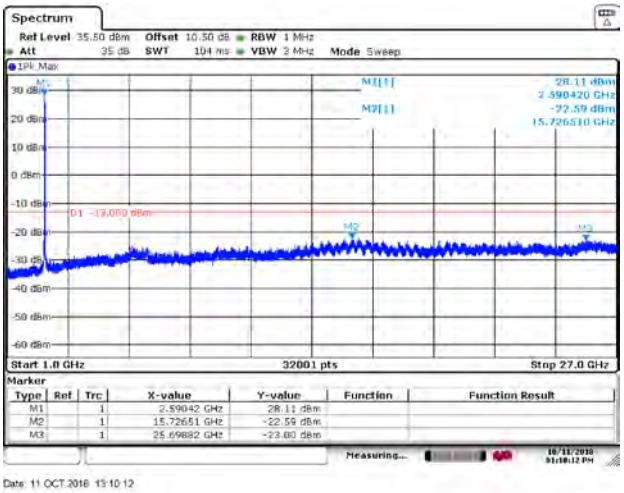


Figure 8.2-34: *Conducted spurious emissions for 16QAM 20 MHz Mid channel at Port 3*

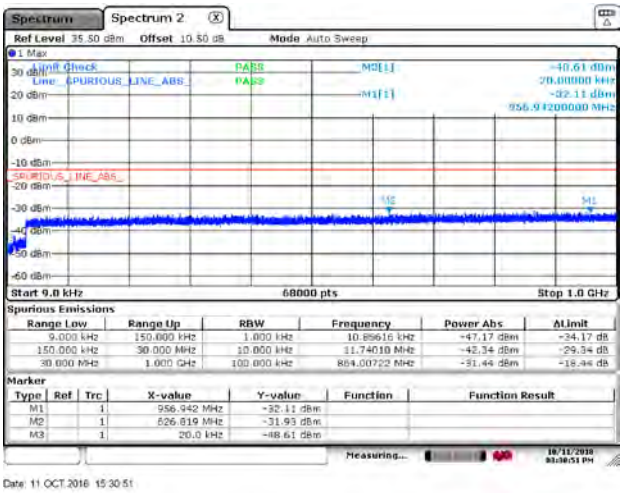


Figure 8.2-35: *Conducted spurious emissions for 16QAM 20 MHz High channel at Port 3*

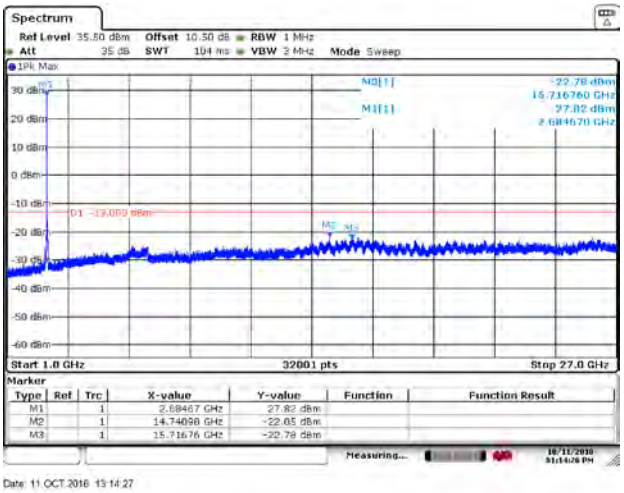


Figure 8.2-36: *Conducted spurious emissions for 16QAM 20 MHz High channel at Port 3*

8.2.5 Spurious Emissions at band edges – 5MHz LTE Bandwidth

Based on the power output readings being nearly identical 3dB was added to the Port 1 spurious emissions readings in calculating total spurious emissions for Ports 1 and Ports 2. This was for 5, 10 and 20MHz bandwidths

Frequency	SA Reading port 1	Band Edge (Ports 1/2)	RBW (kHz)	Limit (dBm)	Result
Low Frequency					
QPSK -5M					
2495	-31.69	-28.69	100	-13.00	P
2496	-25.15	-22.15	100	-13.00	P
2502	-32.18	-29.18	100	-13.00	P
2503	-33.95	-30.95	100	-13.00	P
16QAM -5M					
2495	-33.59	-30.59	100	-13.00	P
2496	-26.21	-23.21	100	-13.00	P
2502	-33.51	-30.51	100	-13.00	P
2503	-34.02	-31.02	100	-13.00	P
64QAM -5M					
2495	-31.22	-28.22	100	-13.00	P
2496	-24.75	-21.75	100	-13.00	P
2501	-25.43	-22.43	100	-13.00	P
2502	-31.6	-28.6	100	-13.00	P
2503	-33.69	-30.69	100	-13.00	P
Mid Frequency					
QPSK -5M					
2589	-34.07	-31.07	100	-13.00	P
2590	-32.41	-29.41	100	-13.00	P
2590.5	-25.88	-22.88	100	-13.00	P
2595.5	-24.89	-21.89	100	-13.00	P
2596	-32.37	-29.37	100	-13.00	P
2597	-33.55	-30.55	100	-13.00	P
16QAM -5M					
2589	-34.86	-31.86	100	-13.00	P
2590	-32.94	-29.94	100	-13.00	P
2590.5	-24.94	-21.94	100	-13.00	P
2595.5	-21.72	-18.72	100	-13.00	P
2596	-30.46	-27.46	100	-13.00	P
2597	-31.6	-28.6	100	-13.00	P
64QAM - 5M					
2589	-35.97	-32.97	100	-13.00	P
2590	-35.42	-32.42	100	-13.00	P
2590.5	-26.25	-23.25	100	-13.00	P
2595.5	-26.18	-23.18	100	-13.00	P
2596	-35.22	-32.22	100	-13.00	P
2597	-35.77	-32.77	100	-13.00	P
High Frequency					
QPSK -5M					
2683.5	-32.53	-29.53	100	-13.00	P
2684.5	-32.57	-29.57	100	-13.00	P
2685	-25.91	-22.91	100	-13.00	P
2690	-25.98	-22.98	100	-13.00	P
2691	-33.33	-30.33	100	-13.00	P
16QAM -5M					
2683.5	-35.03	-32.03	100	-13.00	P
2684.5	-34.71	-31.71	100	-13.00	P
2685	-23.84	-20.84	100	-13.00	P
2690	-26.59	-23.59	100	-13.00	P
2691	-34.57	-31.57	100	-13.00	P
64QAM - 5M					
2683.5	-33.27	-30.27	100	-13.00	P
2684.5	-31.95	-28.95	100	-13.00	P
2685	-26.39	-23.39	100	-13.00	P
2690	-26.68	-23.68	100	-13.00	P
2691	-32.42	-29.42	100	-13.00	P

8.2.6 Spurious Emissions at band edges – 10MHz LTE Bandwidth

Frequency	SA Reading port 1	Band Edge (Ports 1/2)	RBW (kHz)	Limit (dBm)	Result
Low Frequency					
QPSK -10M					
2495	-31.7	-28.7	100	-13	P
2496	-24.86	-21.86	100	-13	P
2506	-24.82	-21.82	100	-13	P
2507.5	-32.86	-29.86	100	-13	P
2508.5	-33.88	-30.88	100	-13	P
16QAM -10M					
2495	-33.96	-30.96	100	-13	P
2496	-25.04	-22.04	100	-13	P
2506	-24.41	-21.41	100	-13	P
2507.5	-34.81	-31.81	100	-13	P
2508.5	-34.45	-31.45	100	-13	P
64QAM -10M					
2495	-32.05	-29.05	100	-13	P
2496	-26.01	-23.01	100	-13	P
2506	-26.72	-23.72	100	-13	P
2507.5	-34.2	-31.2	100	-13	P
2508.5	-34.8	-31.8	100	-13	P
Mid Frequency					
QPSK -10M					
2583	-36.24	-33.24	100	-13	P
2584	-35.59	-32.59	100	-13	P
2588	-27.04	-24.04	100	-13	P
2598	-25.52	-22.52	100	-13	P
2602	-35.83	-32.83	100	-13	P
2603	-36.22	-33.22	100	-13	P
16QAM -10M					
2583	-36.44	-33.44	100	-13	P
2584	-35.8	-32.8	100	-13	P
2588	-24.78	-21.78	100	-13	P
2598	-23.49	-20.49	100	-13	P
2602	-34.7	-31.7	100	-13	P
2603	-35.64	-32.64	100	-13	P
64QAM - 10M					
2583	-35.95	-32.95	100	-13	P
2584	-35.71	-32.71	100	-13	P
2588	-26.44	-23.44	100	-13	P
2598	-26.28	-23.28	100	-13	P
2602	-35.48	-32.48	100	-13	P
2603	-35.74	-32.74	100	-13	P
High Frequency					
QPSK -10M					
2678	-35.2	-32.2	100	-13	P
2679	-35.05	-32.05	100	-13	P
2680	-25.26	-22.26	100	-13	P
2690	-25.6	-22.6	100	-13	P
2691	-35.43	-32.43	100	-13	P
16QAM -10M					
2678	-35.04	-32.04	100	-13	P
2679	-35.03	-32.03	100	-13	P
2680	-26.91	-23.91	100	-13	P
2690	-24.73	-21.73	100	-13	P
2691	-35.03	-32.03	100	-13	P
64QAM - 10M					
2678	-35.5	-32.5	100	-13	P
2679	-35.52	-32.52	100	-13	P
2680	-26.75	-23.75	100	-13	P
2690	-27	-24	100	-13	P
2691	-35.85	-32.85	100	-13	P

8.2.7 Spurious Emissions at band edges – 20MHz LTE Bandwidth

Table 8.3-3: Spurious Emissions at band edges – 20MHz Bandwidth

Frequency	SA Reading port 1	Band Edge (Ports 1/2)	RBW (kHz)	Limit (dBm)	Result
Low Frequency					
QPSK -20M					
2495	-22.27	-19.27	300	-13.00	P
2496	-20.29	-17.29	300	-13.00	P
2516	-22.84	-19.84	300	-13.00	P
2518.5	-26.42	-23.42	300	-13.00	P
2519.5	-27.15	-24.15	300	-13.00	P
16QAM -20M					
2495	-25.23	-22.23	300	-13.00	P
2496	-20.52	-17.52	300	-13.00	P
2516	-23.28	-20.28	300	-13.00	P
2518.5	-29.52	-26.52	300	-13.00	P
2519.5	-30.76	-27.76	300	-13.00	P
64QAM -20M					
2495	-25.87	-22.87	300	-13.00	P
2496	-22.72	-19.72	300	-13.00	P
2516	-24.38	-21.38	300	-13.00	P
2518.5	-30.38	-27.38	300	-13.00	P
2519.5	-31.05	-28.05	300	-13.00	P
Mid Frequency					
QPSK -20M					
2577	-31.25	-28.25	300	-13.00	P
2578	-31.36	-28.36	300	-13.00	P
2583	-23.64	-20.64	300	-13.00	P
2603	-23.89	-20.89	300	-13.00	P
2608	-31.54	-28.54	300	-13.00	P
2609	-31.75	-28.75	300	-13.00	P
16QAM -20M					
2577	-31.77	-28.77	300	-13.00	P
2578	-31.04	-28.04	300	-13.00	P
2583	-21.63	-18.63	300	-13.00	P
2603	-22.77	-19.77	300	-13.00	P
2608	-31.11	-28.11	300	-13.00	P
2609	-31.35	-28.35	300	-13.00	P
64QAM - 20M					
2577	-31.96	-28.96	300	-13.00	P
2578	-32.3	-29.3	300	-13.00	P
2583	-24.3	-21.3	300	-13.00	P
2603	-24.6	-21.6	300	-13.00	P
2608	-32.48	-29.48	300	-13.00	P
2609	-32.14	-29.14	300	-13.00	P
High Frequency					
QPSK -20M					
2667	-31.89	-28.89	300	-13.00	P
2668	-31.02	-28.02	300	-13.00	P
2670	-22.94	-19.94	300	-13.00	P
2690	-22.42	-19.42	300	-13.00	P
2691	-29.61	-26.61	300	-13.00	P
16QAM -20M					
2667	-31.14	-28.14	300	-13.00	P
2668	-31.13	-28.13	300	-13.00	P
2670	-20.29	-17.29	300	-13.00	P
2690	-21.7	-18.7	300	-13.00	P
2691	-30.28	-27.28	300	-13.00	P
64QAM - 20M					
2667	-29.64	-26.64	300	-13.00	P
2668	-29.41	-26.41	300	-13.00	P
2670	-23.61	-20.61	300	-13.00	P
2690	-23.61	-20.61	300	-13.00	P
2691	-27.94	-24.94	300	-13.00	P

Figure 8.2-37: *Conducted band edge emissions for QPSK 2498.5 MHz, 5 MHz channel - Port 1*

Figure 8.2-36: *Conducted band edge emission for 16QAM 2498.5 MHz, 5 MHz channel - Port 1*

Figure 8.2-39: *Conducted band edge emissions for 64QAM 2498.5 MHz, 5 MHz channel - Port 1*

Figure 8.2-40: *Conducted band edge emissions for QPSK 2593 MHz, 5 MHz channel - Port 1*

Figure 8.2-41: *Conducted band edge emissions for 16QAM 2593 MHz, 5 MHz channel - Port 1*

Figure 8.2-42: *Conducted band edge emissions for 64QAM 2593 MHz, 5 MHz channel - Port 1*

Figure 8.2-43: *Conducted band edge emissions for QPSK 2687.5 MHz, 5 MHz channel - Port 1*

Figure 8.2-44: *Conducted band edge emissions for 16QAM 2687.5 MHz, 5 MHz channel - Port 1*

Figure 8.2-45: *Conducted band edge emissions for 64QAM 2687.5 MHz, 5 MHz channel - Port 1*

Figure 8.2-46: *Conducted band edge emissions for QPSK 2501.3 MHz, 10 MHz channel - Port 1*

Figure 8.2-47: *Conducted band edge emissions for 16QAM 2501 MHz, 10 MHz channel - Port 1*

Figure 8.2-48: *Conducted band edge emissions for 64QAM 2501 MHz, 10 MHz channel - Port 1*

Figure 8.2-49: *Conducted band edge emissions for QPSK 2593 MHz, 10 MHz channel - Port 1*

Figure 8.2-50: *Conducted band edge emissions for 64QAM 2593 MHz, 10 MHz channel - Port 1*

Figure 8.2-51: *Conducted band edge emissions for 64QAM 2593 MHz, 10 MHz channel - Port 1*

Figure 8.2-52: *Conducted band edge emissions for QPSK 2685 MHz, 10 MHz channel - Port 1*

Figure 8.2-53: *Conducted band edge emissions for 16QAM 2685 MHz, 10 MHz channel - Port 1*

Figure 8.2-54: *Conducted band edge emissions for 64QAM 2685 MHz, 10 MHz channel - Port 1*

Figure 8.2-55: *Conducted band edge emissions for QPSK 2506 MHz, 20 MHz channel - Port 1*

Figure 8.2-56: *Conducted band edge emissions for 64QAM 2506 MHz, 20 MHz channel - Port 1*

Figure 8.2-57: *Conducted band edge emissions for 64QAM 2506 MHz, 20 MHz channel - Port 1*

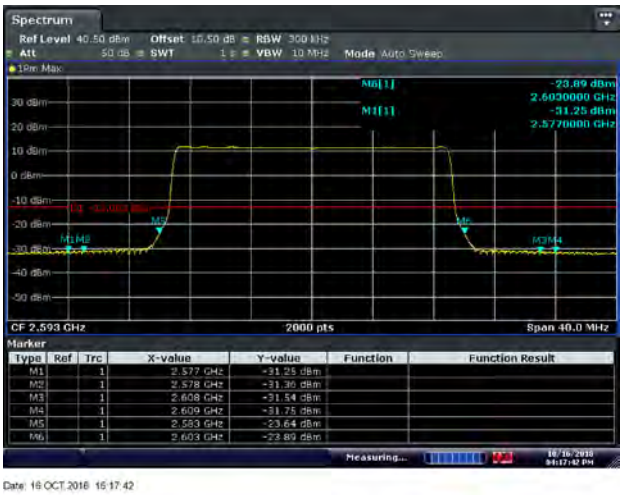


Figure 8.2-58: *Conducted band edge emissions for QPSK 2593 MHz, 20 MHz channel - Port 1*

Figure 8.2-59: *Conducted band edge emissions for 16QAM 2593 MHz, 20 MHz channel - Port 1*

Figure 8.2-60: *Conducted band edge emissions for 64QAM 2593 MHz, 20 MHz channel - Port 1*

Figure 8.2-61: *Conducted band edge emissions for QPSK 2680 MHz, 20 MHz channel - Port 1*

Figure 8.2-62: *Conducted band edge emissions for 16QAM 2680 MHz, 20 MHz channel - Port 1*

Figure 8.2-63: *Conducted band edge emissions for 64QAM 2680 MHz, 20 MHz channel - Port 1*

8.3 FCC 27.53 (m) Radiated spurious emissions

8.3.1 Definitions and limits

Part 27
(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area.

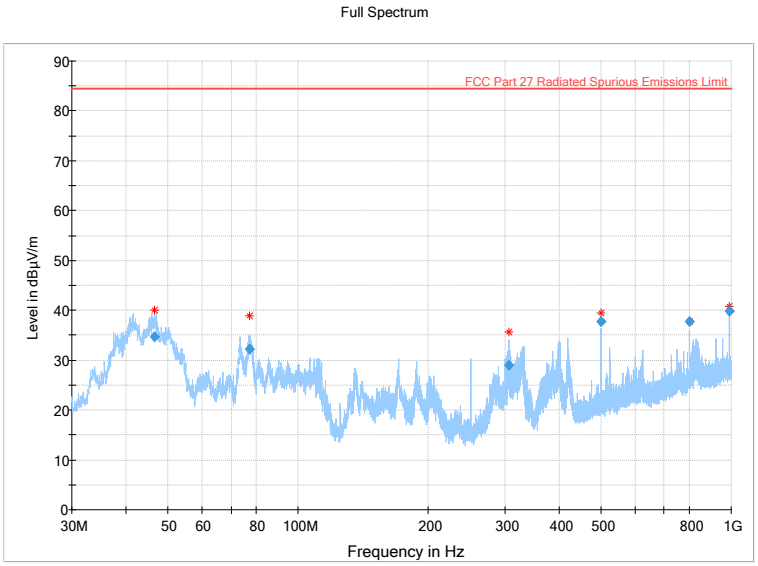
8.3.2 Test summary

Test date	October 23, 2018	Temperature	22 °C
Test engineer	Martha Espinoza	Air pressure	1000 mbar
Verdict	Pass	Relative humidity	30 %

8.3.3 Observations, settings and special notes

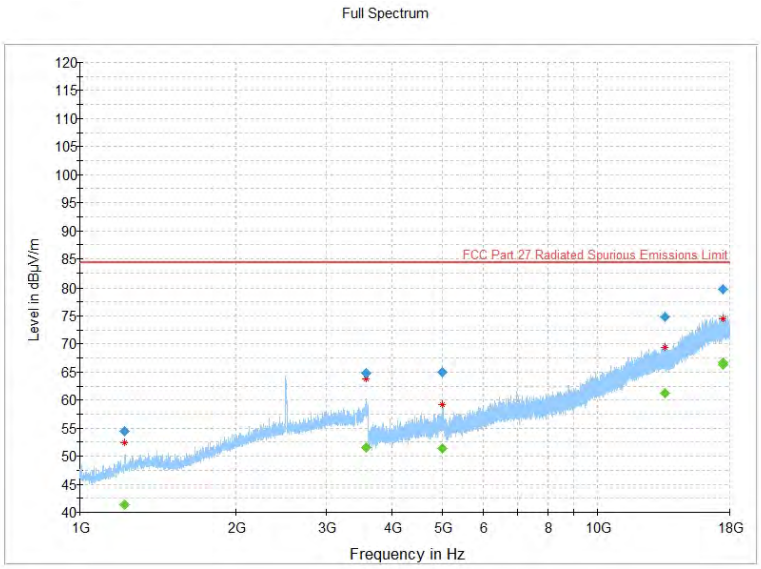
The spectrum was searched from 30 MHz to the 10th harmonic.
RBW within 30–1000 MHz was 100 kHz and 1 MHz above 1 GHz. VBW was wider than RBW.
Testing was performed with all RF ports terminated with 50 Ohm load.
Tested QPSK/20MHz/High/Mid/Low
Filter used 2500 to 2700 MHz
There is no observable difference between 5,10 and 20 MHz Channel results at low, mid or high channels.

8.3.4 Test data (Plots 30MHz -26GHz)



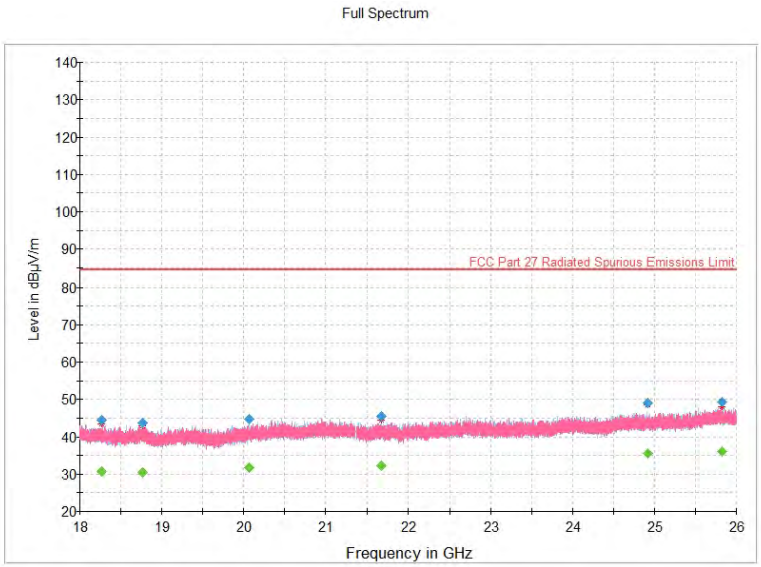
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
46.626500	34.70	84.40	49.70	5000.0	120.000	123.8	V	74.0	11.7
77.359500	32.29	84.40	52.11	5000.0	120.000	172.2	V	352.0	8.8
306.045000	29.05	84.40	55.35	5000.0	120.000	147.4	H	243.0	16.1
499.973500	37.81	84.40	46.59	5000.0	120.000	109.2	V	34.0	21.3
800.034500	37.74	84.40	46.66	5000.0	120.000	212.6	H	230.0	26.0
989.997500	39.80	84.40	44.60	5000.0	120.000	111.1	V	184.0	28.4

Figure/Table 8.3-1: *Radiated spurious emission below 1 GHz, B41 at QPSK/ Low channel/20 MHz*



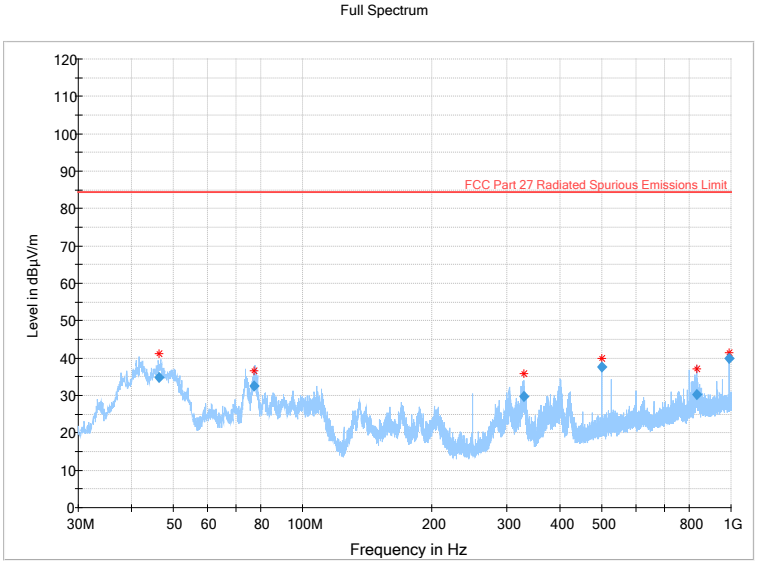
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1221.833333	54.41	---	84.40	29.99	5000.0	1000.000	167.0	H	133.0	32.3
1221.833333	---	41.39	---	---	5000.0	1000.000	167.0	H	133.0	32.3
3571.200000	---	51.50	---	---	5000.0	1000.000	201.0	V	222.0	39.7
3571.200000	64.74	---	84.40	19.66	5000.0	1000.000	201.0	V	222.0	39.7
5013.233333	---	51.46	---	---	5000.0	1000.000	201.0	V	114.0	42.1
5013.233333	64.98	---	84.40	19.42	5000.0	1000.000	201.0	V	114.0	42.1
13472.933333	74.82	---	84.40	9.58	5000.0	1000.000	104.0	H	348.0	52.5
13472.933333	---	61.28	---	---	5000.0	1000.000	104.0	H	348.0	52.5
17443.266667	---	66.65	---	---	5000.0	1000.000	251.0	H	198.0	57.4
17443.266667	79.81	---	84.40	4.59	5000.0	1000.000	251.0	H	198.0	57.4
17450.466667	---	66.38	---	---	5000.0	1000.000	196.0	H	203.0	57.4
17450.466667	79.71	---	84.40	4.69	5000.0	1000.000	196.0	H	203.0	57.4

Figure/Table 8.3-2 *Radiated spurious emission 1-18 GHz, B41 at QPSK/ Low channel/20 MHz*



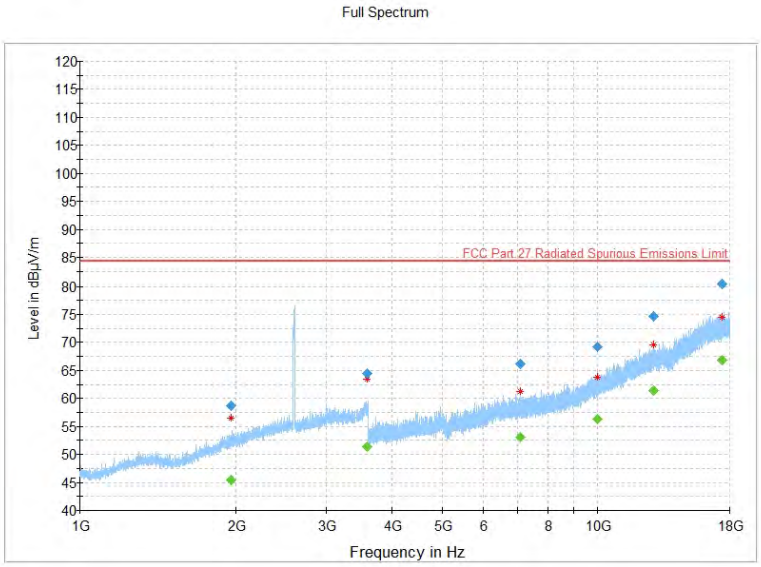
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18270.60	---	30.69	---	---	5000.0	1000.000	107.0	V	289.0	13.1
18270.60	44.57	---	84.40	39.83	5000.0	1000.000	107.0	V	289.0	13.1
18766.46	43.75	---	84.40	40.65	5000.0	1000.000	215.0	V	0.0	13.6
18766.46	---	30.53	---	---	5000.0	1000.000	215.0	V	0.0	13.6
20062.066	44.59	---	84.40	39.81	5000.0	1000.000	156.0	H	340.0	15.1
20062.066	---	31.67	---	---	5000.0	1000.000	156.0	H	340.0	15.1
21667.000	---	32.13	---	---	5000.0	1000.000	128.0	H	151.0	16.0
21667.000	45.44	---	84.40	38.96	5000.0	1000.000	128.0	H	151.0	16.0
24917.266	48.97	---	84.40	35.43	5000.0	1000.000	140.0	H	314.0	19.4
24917.266	---	35.61	---	---	5000.0	1000.000	140.0	H	314.0	19.4
25829.533	49.28	---	84.40	35.12	5000.0	1000.000	104.0	H	285.0	20.7
25829.533	---	35.96	---	---	5000.0	1000.000	104.0	H	285.0	20.7

Figure/Table 8.3-3: *Radiated spurious emission 18-26 GHz, B41 at QPSK/ Low channel/20 MHz*



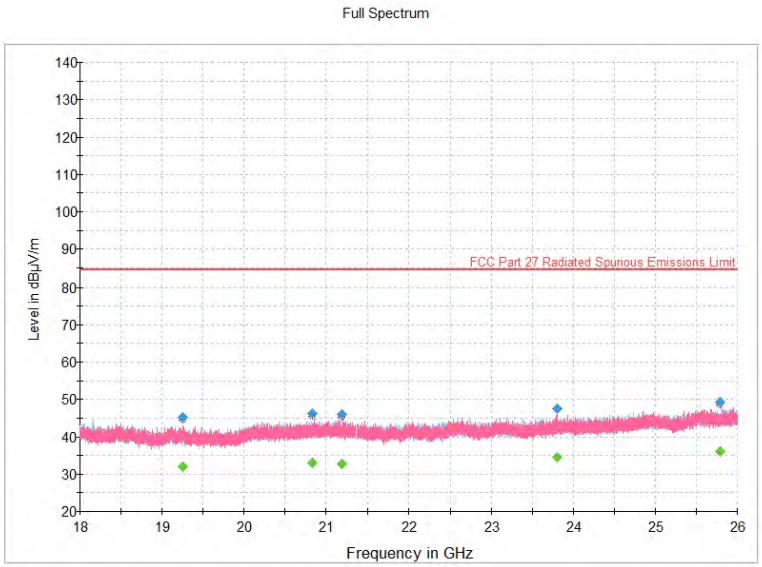
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
46.344000	34.95	84.40	49.45	5000.0	120.000	118.2	V	146.0	11.9
77.224500	32.47	84.40	51.93	5000.0	120.000	136.6	V	0.0	8.8
328.880000	29.71	84.40	54.69	5000.0	120.000	111.4	H	250.0	16.9
499.973500	37.73	84.40	46.67	5000.0	120.000	111.3	V	168.0	21.3
831.310500	30.20	84.40	54.20	5000.0	120.000	209.3	H	213.0	26.4
989.997500	39.93	84.40	44.47	5000.0	120.000	120.8	V	176.0	28.4

Figure/Table 8.3-4: *Radiated spurious emission below 1 GHz, B41 at QPSK/ Mid channel/20 MHz*



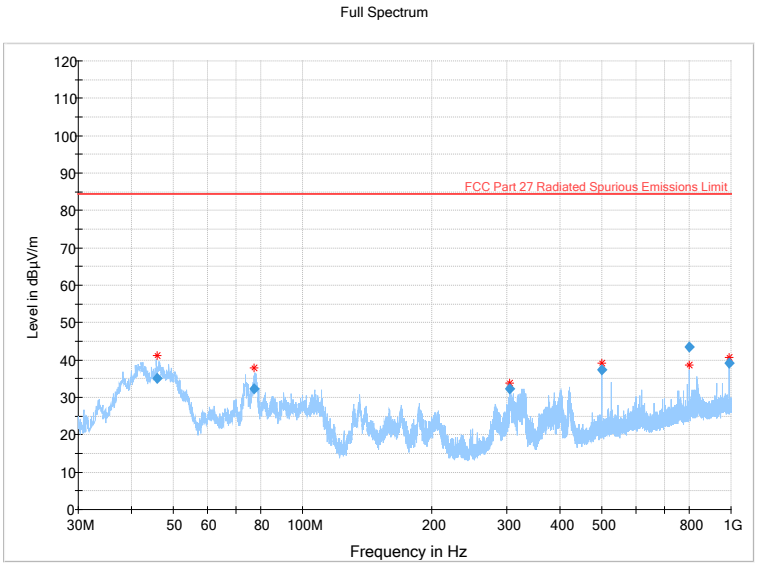
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1965.433333	---	45.39	---	---	5000.0	1000.000	239.0	H	10.0	35.8
1965.433333	58.71	---	84.40	25.69	5000.0	1000.000	239.0	H	10.0	35.8
3581.400000	---	51.42	---	---	5000.0	1000.000	143.0	V	143.0	39.7
3581.400000	64.53	---	84.40	19.87	5000.0	1000.000	143.0	V	143.0	39.7
7094.500000	66.11	---	84.40	18.29	5000.0	1000.000	176.0	H	0.0	45.2
7094.500000	---	53.02	---	---	5000.0	1000.000	176.0	H	0.0	45.2
9982.833333	69.22	---	84.40	15.18	5000.0	1000.000	272.0	V	131.0	48.8
9982.833333	---	56.31	---	---	5000.0	1000.000	272.0	V	131.0	48.8
12846.566667	74.62	---	84.40	9.78	5000.0	1000.000	244.0	V	1.0	52.4
12846.566667	---	61.36	---	---	5000.0	1000.000	244.0	V	1.0	52.4
17409.566667	80.40	---	84.40	4.00	5000.0	1000.000	235.0	V	158.0	57.4
17409.566667	---	66.87	---	---	5000.0	1000.000	235.0	V	158.0	57.4

Figure/Table 8.3-5: *Radiated spurious emission 1-18 GHz, B41 at QPSK/ Mid channel/20 MHz*



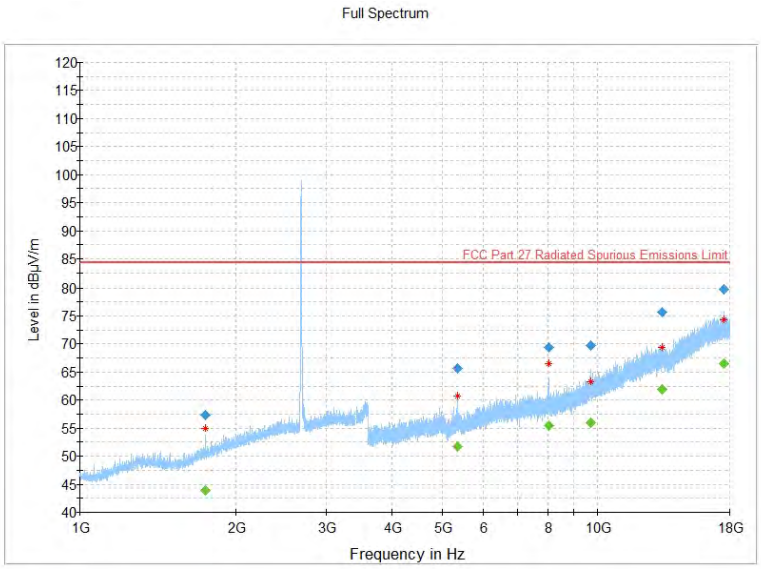
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19252.066667	45.28	---	84.40	39.12	5000.0	1000.000	214.0	V	66.0	14.1
19252.066667	---	31.91	---	---	5000.0	1000.000	214.0	V	66.0	14.1
20838.866667	---	32.87	---	---	5000.0	1000.000	130.0	V	61.0	15.8
20838.866667	46.14	---	84.40	38.26	5000.0	1000.000	130.0	V	61.0	15.8
21193.533333	46.07	---	84.40	38.33	5000.0	1000.000	226.0	V	84.0	16.0
21193.533333	---	32.67	---	---	5000.0	1000.000	226.0	V	84.0	16.0
23800.600000	47.48	---	84.40	36.92	5000.0	1000.000	190.0	V	233.0	17.6
23800.600000	---	34.41	---	---	5000.0	1000.000	190.0	V	233.0	17.6
25791.666667	49.20	---	84.40	35.20	5000.0	1000.000	112.0	H	167.0	20.7
25791.666667	---	36.18	---	---	5000.0	1000.000	112.0	H	167.0	20.7

Figure/Table 8.3-6: *Radiated spurious emission 18-26 GHz, B41 at QPSK/ Mid channel/20 MHz*



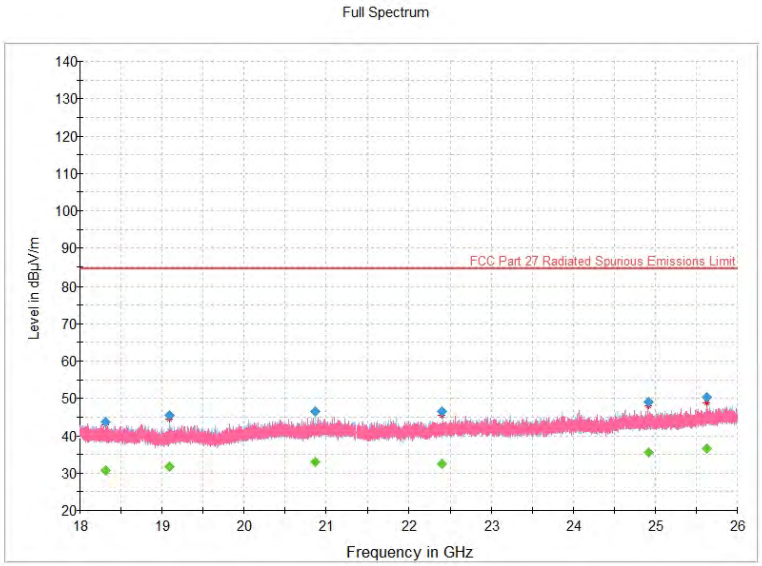
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
45.757000	35.20	84.40	49.20	5000.0	120.000	100.0	V	178.0	12.2
77.264500	32.37	84.40	52.03	5000.0	120.000	124.9	V	0.0	8.8
304.358500	32.22	84.40	52.18	5000.0	120.000	115.5	H	229.0	16.1
499.993500	37.46	84.40	46.94	5000.0	120.000	161.4	V	0.0	21.3
799.994500	43.59	84.40	40.81	5000.0	120.000	151.0	V	124.0	26.0
989.997500	39.14	84.40	45.26	5000.0	120.000	113.6	V	189.0	28.4

Figure/Table 8.3-7: *Radiated spurious emission below 1 GHz, B41 at QPSK/ High channel/20 MHz*



Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1752.800000	57.30	---	84.40	27.10	5000.0	1000.000	285.0	H	10.0	34.2
1752.800000	---	43.86	---	---	5000.0	1000.000	285.0	H	10.0	34.2
5347.600000	65.65	---	84.40	18.75	5000.0	1000.000	239.0	V	111.0	42.7
5347.600000	---	51.78	---	---	5000.0	1000.000	239.0	V	111.0	42.7
8042.833333	69.40	---	84.40	15.00	5000.0	1000.000	149.0	V	116.0	46.2
8042.833333	---	55.40	---	---	5000.0	1000.000	149.0	V	116.0	46.2
9706.800000	---	56.01	---	---	5000.0	1000.000	232.0	H	269.0	48.3
9706.800000	69.74	---	84.40	14.66	5000.0	1000.000	232.0	H	269.0	48.3
13328.000000	---	61.96	---	---	5000.0	1000.000	235.0	V	142.0	52.7
13328.000000	75.72	---	84.40	8.68	5000.0	1000.000	235.0	V	142.0	52.7
17533.900000	79.67	---	84.40	4.73	5000.0	1000.000	293.0	H	20.0	57.4
17533.900000	---	66.46	---	---	5000.0	1000.000	293.0	H	20.0	57.4

Figure/Table 8.3-8: *Radiated spurious emission 1-18 GHz, B41 at QPSK/ High channel/20 MHz*



Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18318.466667	---	30.64	---	---	5000.0	1000.000	200.0	H	10.0	13.0
18318.466667	43.58	---	84.40	40.82	5000.0	1000.000	200.0	H	10.0	13.0
19087.533333	---	31.78	---	---	5000.0	1000.000	125.0	H	323.0	13.6
19087.533333	45.47	---	84.40	38.93	5000.0	1000.000	125.0	H	323.0	13.6
20872.066667	46.43	---	84.40	37.97	5000.0	1000.000	146.0	H	119.0	15.9
20872.066667	---	33.01	---	---	5000.0	1000.000	146.0	H	119.0	15.9
22400.733333	46.42	---	84.40	37.98	5000.0	1000.000	119.0	H	113.0	16.2
22400.733333	---	32.47	---	---	5000.0	1000.000	119.0	H	113.0	16.2
24923.666667	49.11	---	84.40	35.29	5000.0	1000.000	148.0	V	329.0	19.4
24923.666667	---	35.58	---	---	5000.0	1000.000	148.0	V	329.0	19.4
25631.933333	50.30	---	84.40	34.10	5000.0	1000.000	198.0	V	327.0	20.5
25631.933333	---	36.61	---	---	5000.0	1000.000	198.0	V	327.0	20.5

Figure/Table 8.3-9: *Radiated spurious emission 18-26 GHz, B41 at QPSK/ High channel/20 MHz*

8.4 FCC 27.54 and 2.1055 Frequency stability (B41)

8.4.1 Definitions and limits

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.
Voltage Variation at 102Vac (85%), 120Vac (100%) and 138Vac (115%) shows the fundamental frequency stays within the authorized band of operation.

8.4.2 Test summary

Test date	October 19, 2018	Temperature	23 °C
Test engineer	Martha Espinoza	Air pressure	1000 mbar
Verdict	Pass	Relative humidity	30 %

The EUT fundamental emissions stays within the band of operation during testing.

8.4.3 Observations, settings and special notes

Frequency Stability (Bandwidth = 5 MHz, worst case) 120 V 60 HZ
Voltage variation (+/- 15 % of 120 V, 60 HZ)

8.4.4 Test data

Table 8.4-1: *Frequency error results*

Low Channel (MHz)

Temperature	LF (MHZ)	HF (MHZ)	CF (MHZ)	CF Meas (MHZ)	Delta (MHz)	% Variation CF
-30	2496.13882	2500.87024	2498.5	2498.50453	**0.00453**	**0.00018**
-20	2496.13695	2500.89024	2498.5	2498.513595	**0.013595**	**0.00054**
-10	2496.14101	2500.87086	2498.5	2498.505935	**0.005935**	**0.00024**
0	2496.13632	2500.88586	2498.5	2498.51109	**0.01109**	**0.00044**
10	2496.13914	2500.88086	2498.5	2498.51	**0.01**	**0.00040**
20	2496.13476	2500.86743	2498.5	2498.501095	**0.001095**	**0.00004**
30	2496.13664	2500.88211	2498.5	2498.509375	**0.009375**	**0.00038**
40	2496.14195	2500.85961	2498.5	2498.50078	**0.00078**	**0.00003**
50	2496.1382	2500.87493	2498.5	2498.506565	**0.006565**	**0.00026**

Mid Channel (MHz)

Temperature	LF (MHZ)	HF (MHZ)	CF (MHZ)	CF Meas (MHZ)	Delta (MHz)	% Variation CF
-30	2590.61101	2595.39774	2593	2593.004375	**0.004375**	**0.00017**
-20	2590.59976	2595.42055	2593	2593.010155	**0.010155**	**0.00039**
-10	2590.62914	2595.3843	2593	2593.00672	**0.00672**	**0.00026**
0	2590.6332	2595.38461	2593	2593.008905	**0.008905**	**0.00034**
10	2590.6357	2595.37618	2593	2593.00594	**0.00594**	**0.00023**
20	2590.636636	2595.384606	2593	2593.010621	**0.010621**	**0.00041**
30	2590.64289	2595.36399	2593	2593.00344	**0.00344**	**0.00013**
40	2590.64195	2595.37649	2593	2593.00922	**0.00922**	**0.00036**
50	2590.63507	2595.38368	2593	2593.009375	**0.009375**	**0.00036**

High Channel (MHz)

Temperature	LF (MHZ)	HF (MHZ)	CF (MHZ)	CF Meas (MHZ)	Delta (MHz)	% Variation CF
-30	2685.04164	2689.91805	2687.5	2687.479845	**0.020155**	**0.00075**
-20	2685.09726	2689.99867	2687.5	2687.547965	**0.047965**	**0.00178**
-10	2685.14257	2689.86493	2687.5	2687.50375	**0.00375**	**0.00014**
0	2685.13289	2689.8718	2687.5	2687.502345	**0.002345**	**0.00009**
10	2685.13507	2689.87055	2687.5	2687.50281	**0.00281**	**0.00010**
20	2685.13382	2689.88243	2687.5	2687.508125	**0.008125**	**0.00030**
30	2685.14226	2689.87461	2687.5	2687.508435	**0.008435**	**0.00031**
40	2685.13632	2689.88461	2687.5	2687.510465	**0.010465**	**0.00039**
50	2685.13976	2689.86899	2687.5	2687.504375	**0.004375**	**0.00016**

Table 8.4-2: *Voltage Variation*

Voltage power	Room temperature	Channel	CF (MHZ)	LF (MHZ)	HF (MHZ)	CF Meas (MHZ)	Delta (MHZ)	% Variation CF
120 V, 60 Hz	23	Low	2498.5	2496.12695	2500.89274	2498.509845	**0.009845**	**0.000394036**
120 V, 60 Hz	23	Middle	2593	2590.6282	2595.38086	2593.00453	**0.00453**	**0.000174701**
120 V, 60 Hz	23	High	2687.5	2685.1282	2689.88461	2687.506405	**0.006405**	**0.000238326**

Voltage power	Room temperature	Channel	CF (MHZ)	LF (MHZ)	HF (MHZ)	CF Meas (MHZ)	Delta (MHZ)	% Variation CF
102 V, 60 Hz	23	Low	2498.5	2496.12757	2500.88805	2498.50781	**0.00781**	**0.000312588**
102 V, 60 Hz	23	Middle	2593	2590.63101	2595.37899	2593.005	**0.005**	**0.000192827**
102 V, 60 Hz	23	High	2687.5	2685.12632	2689.87743	2687.501875	**0.001875**	**0.000070**

Voltage power	Room temperature	Channel	CF (MHZ)	LF (MHZ)	HF (MHZ)	CF Meas (MHZ)	Delta (MHZ)	% Variation CF
138 V, 60 Hz	23	Low	2498.5	2496.14195	2500.88461	2498.51328	**0.01328**	**0.000531519**
138 V, 60 Hz	23	Middle	2593	2590.64007	2595.36493	2593.0025	**0.0025**	**0.000096**
138 V, 60 Hz	23	High	2687.5	2685.12382	2689.88243	2687.503125	**0.003125**	**0.000116279**

8.5 FCC Part 2.1049 Occupied bandwidth (B41)

8.5.1 Definitions and limits

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.

8.5.2 Test summary

Test date	October 24, 2018	Temperature	23°C
Test engineer	Martha Espinoza	Air pressure	1000 mbar
Verdict	Pass	Relative humidity	30 %

Compliant

8.5.3 Observations, settings and special notes

None

8.5.4 Test data

Declared Bandwidth = 5 MHz

	Bandwidth: 99 %			Bandwidth: 26 db		
CF	**QPSK**	**16QAM**	**64QAM**	**QPSK**	**16QAM**	**64QAM**
2498.5 MHZ	4.435	4.44375	4.44625	4.8487	4.81	4.8187
2593 MHZ	4.435	4.44625	4.44	4.78	4.7912	4.7875
2687.5 MHZ	4.43375	4.44625	4.44125	4.8525	4.7987	4.8425

Declared Bandwidth = 10 MHz

	Bandwidth: 99 %			Bandwidth: 26 db		
CF	**QPSK**	**16QAM**	**64QAM**	**QPSK**	**16QAM**	**64QAM**
2501	8.8975	8.915	8.92	9.615	9.6	9.6325
2593	8.9225	8.9375	8.91	9.5975	9.6	9.6125
2685	8.9125	8.915	8.9175	9.62	9.63	9.75

Declared Bandwidth = 20 MHz

	Bandwidth: 99 %			Bandwidth: 26 db		
CF	**QPSK**	**16QAM**	**64QAM**	**QPSK**	**16QAM**	**64QAM**
2506	17.83	17.86	17.83	19.22	19.04	19.095
2593	17.985	18.025	17.83	19.135	19.01	19.025
2680	17.845	17.845	17.845	19.115	18.93	18.915

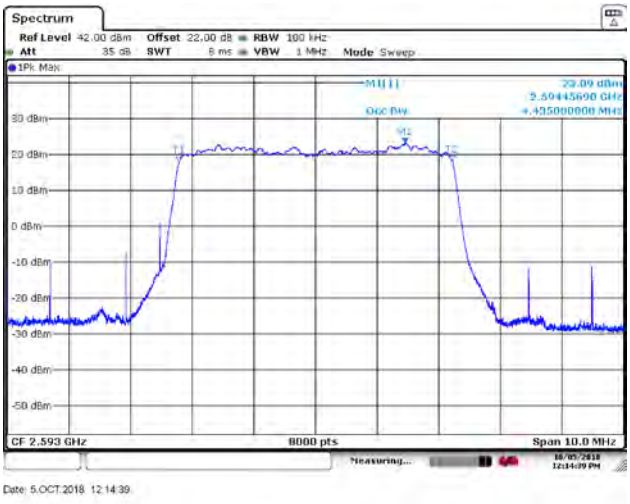


Figure 8.5-1: *99% bandwidth QPSK 5 MHz Mid channel, sample plot*

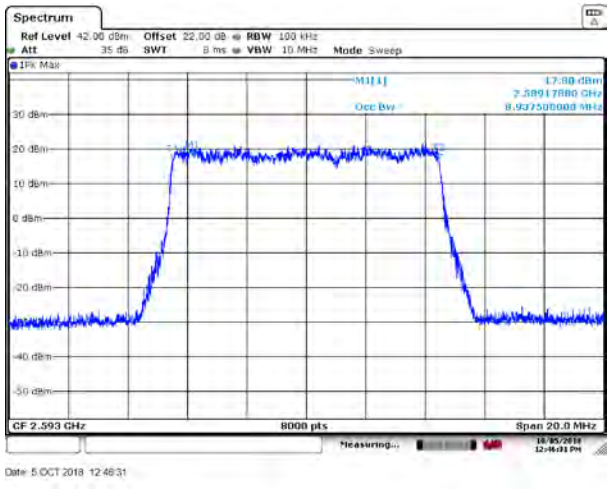


Figure 8.5-2: *99% bandwidth QPSK 10 MHz Mid channel, sample plot*

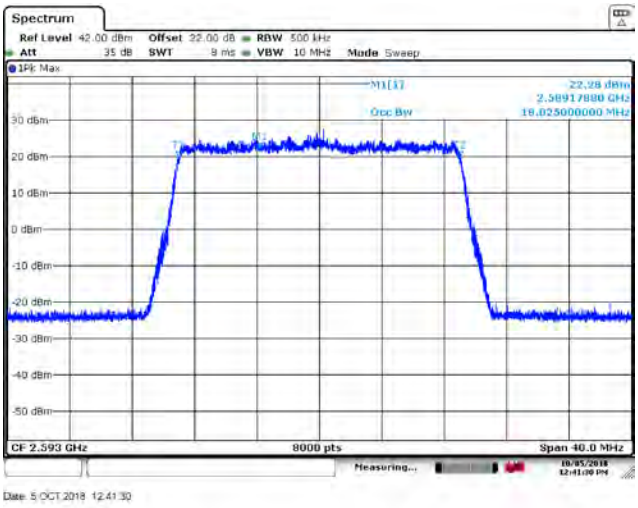


Figure 8.5-3: *99% bandwidth QPSK 20 MHz Mid channel, sample plot*

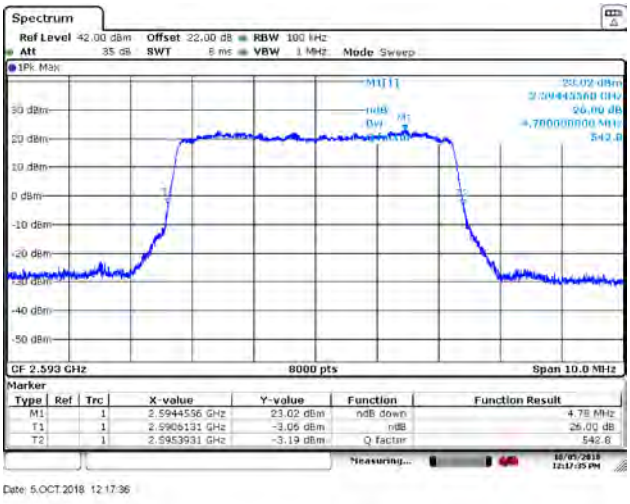


Figure 8.5-4: *26dB bandwidth QPSK 5 MHz Mid channel, sample plot*

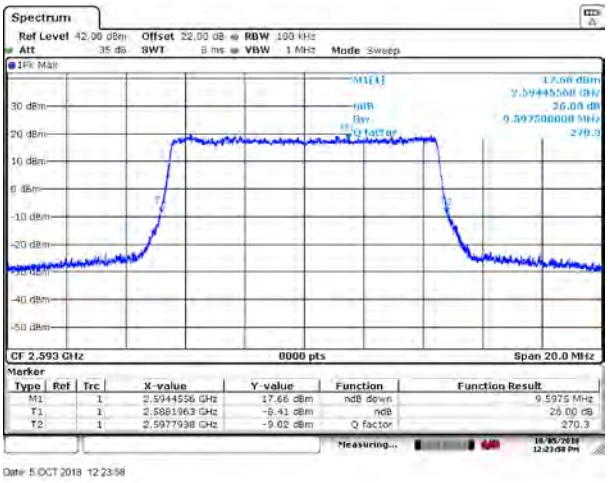


Figure 8.5-5: *26dB bandwidth QPSK 10 MHz Mid channel, sample plot*

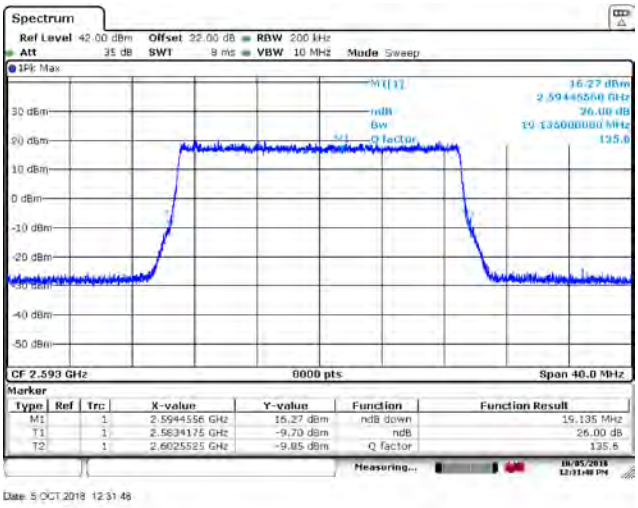
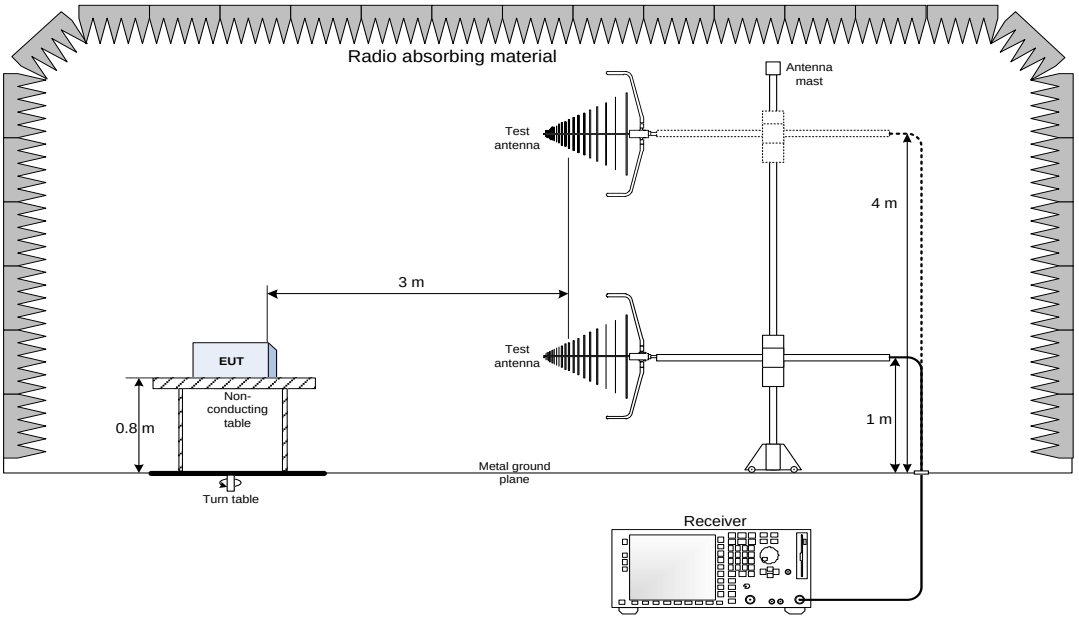


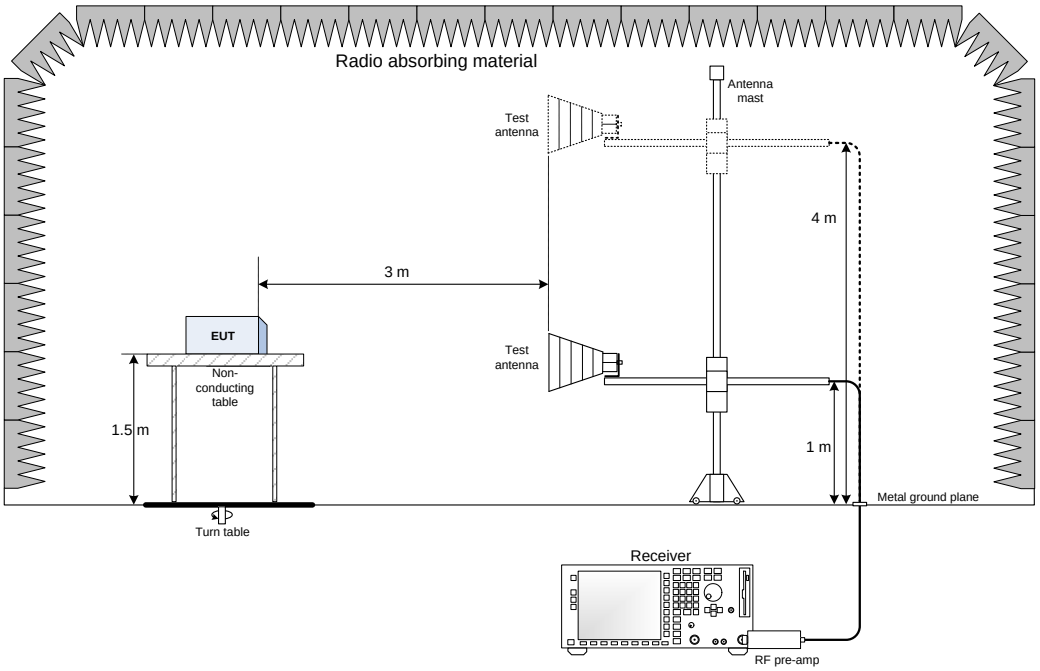
Figure 8.5-6: *26dB bandwidth QPSK 20 MHz Mid channel, sample plot*

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



Thank you for choosing