

Radio Test report

371551 - 1TRFWLR1

Applicant:

Casa Systems

Product:

Apex™ Lifestyle Small Cell

Model:

Triangle LTE Band 4 & Band 13

Part number:

N/A

Specifications:

- ◆ FCC CFR 47 Part 27
Experimental Radio, Auxiliary, Special Broadcast and Other Program Distributional Services
- ◆ RSS 130 Issue 2
Equipment Operating in the Freq. Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz
- ◆ RSS 139 Issue 3
Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780MHz and 2110-2180MHz

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:	Andres Martinez, Test Engineer.
Reviewed by:	Chip Fleury, Wireless and Certification Supervisor
Date:	May 7, 2019
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

Nemko USA Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko USA Inc. accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on this report.

© Nemko USA Inc.

Table of contents

Table of contents	3
Section 1. Report summary	4
1.1 Applicant and manufacturer	4
1.2 Test specifications	4
1.3 Test method	4
1.4 Statement of compliance	4
1.5 Exclusions	4
1.6 Test report revision history	4
Section 2. Summary of test results	5
2.1 FCC Part 2 and 27 test results	5
2.2 RSS Gen Issue 5	5
Section 3. Equipment under test (EUT) details	6
3.1 Sample information	6
3.2 EUT information	6
3.3 Product description and theory of operation	7
3.4 EUT test details	8
3.5 EUT setup diagram (ask customer for setup diag.)	10
Section 4. Engineering considerations	11
4.1 Modifications incorporated in the EUT	11
4.2 Technical judgment	11
4.3 Deviations from laboratory tests procedures	11
Section 5. Test conditions	12
5.1 Atmospheric conditions	12
5.2 Power supply range	12
Section 6. Measurement uncertainty	13
6.1 Uncertainty of measurement	13
Section 7. Test equipment	14
7.1 Test equipment list	14
Section 8. Testing data	15
8.1 Maximum output power at RF antenna connector (EIRP)	15
8.2 Spurious emissions at RF antenna connector (Band 4)	20
8.3 Spurious emissions at RF antenna connector (Band 13)	27
8.4 Radiated spurious emissions	41
8.5 Frequency stability (Band 4, Band 13)	45
8.6 Occupied bandwidth (Band 4, Band 13)	52
8.7 Peak-to-average power ratio (Band 4, Band 13)	55
Section 9. Block diagrams of test set-ups	58
9.1 Radiated emissions set-up for frequencies below 1 GHz	58
9.2 Radiated emissions set-up for frequencies above 1 GHz	58

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
RSS 130 Issue 2	Equipment Operating in the Freq. Bands 617-652MHz, 663-698 MHz, 698-756MHz and 777-787MHz
RSS 139 Issue 3	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780MHz and 2110-2180MHz

1.3 Test method

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
RSS-GEN ISSUE 5	General Requirements for Compliance of Radio Apparatus

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 Triangle LTE B4 & 13.

See "Summary of test results" for full details.

1.5 Exclusions

None.

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
R1	Add 1.3 RSS-GEN, Add ERP for frequencies below 1GHz

Section 2. Summary of test results

2.1 FCC Part 2 and 27 test results (LTE Bands 4 and 13)

Part	Test description	Verdict
§2.1046 & 27.50(d)(4), 27.50(d)(6), 27.50(b)(9)	Maximum output power at RF antenna connector (EIRP) and PAR	Pass
§2.1051 & 27.53(h), 27.53(c)	Spurious emissions at RF antenna connector	Pass
§27.53(c)(1), §27.53(c)(5)	Radiated spurious emissions	Pass
§2,1055 & 27.54	Frequency stability	Pass
§2.1049	Occupied bandwidth	Pass

Notes: None

2.2 RSS Gen Issue 5

Part	Test description	Verdict
§6.12	Transmitter output power	Pass
§6.13	Transmitter unwanted emissions	Pass
§6.11	Transmitter frequency stability	Pass
§6.7	Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth	Pass

Notes: None

2.3 RSS-130 Issue 2 (LTE Band 13)

Part	Test description	Verdict
§4.3	Frequency block (SRSP-518)	Pass
§4.6, 4.6.1, 4.6.3	Transmitter output power (e.r.p.) and PAPR	Pass
§4.7, 4.7.1, 4.7.2	Transmitter unwanted emissions	Pass
§4.5	Transmitter frequency stability	Pass

Notes: None

2.4 RSS-139 Issue 3 (LTE Band 4)

Part	Test description	Verdict
§6.5	Transmitter output power	Pass
§6.6	Transmitter unwanted emissions	Pass
§6.4	Transmitter frequency stability	Pass
§6.7	Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	March 15, 2019
--------------	----------------

3.2 EUT information.

Product name	Apex™ Lifestyle Small Cell
Model	Triangle LTEB4 & 13
Part number	N/A
Revision	N/A
Serial number	N/A
Antenna ports	2 TX Ports, 2X2 MIMO
Conducted Ports	Ports 1 and 2 are correlated
Channel Bandwidth	LTE Band 4: 5MHz, 10MHz, 15MHz and 20MHz. LTE Band 13: 5MHz and 10MHz
B4 Frequency bands	TX (DL)/RX (UL): 2110 – 2155MHz
B13 Frequency bands	TX (DL)/RX (UL): 746 – 756MHz
Maximum Output Power	24.17dBm for antenna Port 1 and Port 2.
Accuracy (nominal)	±0.1 ppm
Nominal voltage	–40 to –90 V _{AC} , 45Watts
Modulation	LTE: QPSK, 16 QAM, 64 QAM
Regulatory requirements	Radio: FCC Part 2, 27 RSS-130 Issue 2, RSS-139 Issue 3
Emission Designator:	G7D – 16 and 64 QAM, and W7D for QPSK
Operating temperature	–30 °C to +50 °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 Lifestyle Small Cell is a low-power RF emitting eNodeB for LTE RAN. Each Unit supports one LTE radio sector with two radio streams @ 17 dBm, 100 mW. (4G) that is responsible for radio transmission and reception from UEs in a LTE Network. The Apex Lifestyle Small Cell provides radio coverage for LTE enabled devices and or handsets within a residential or enterprise coverage area. The Apex Lifestyle Small Cell incorporates all the capabilities and functions of a standard eNode B. This version can be configured for B4 and B13 operation.	
Physical	Dimensions	205mm x 88mm x 160mm
	Weight	450 Grams
	Operating Temperature	< 7.5W at full capacity
	Mounting	12 VDC@1.5A, power supply @ 220 VAC
Software details	qdart_smallcell.win.1.0_installer_30601.1	

3.4 EUT test details

EUT setup/configuration rationale:

Down link/Up link

RAT	Modulation	Performance Requirement
LTE	QPSK/16QAM/64QAM	N/A

Carrier Configurations:

Band 4

Channel BW	20 Mhz					
	Channel (edges vary)					
	TX 1			TX 2		
EARFCN	2050	2175	2300	2050	2175	2300
MHZ	2120	2132.5	2145	2120	2132.5	2145
ETM 3.1 64QAM	OK	OK	OK	OK	OK	OK
ETM 3.2 16QAM	OK	OK	OK	OK	OK	OK
ETM1.1 QPSK	OK	OK	OK	OK	OK	OK
Channel BW	15 Mhz					
	Channel (edges vary)					
	TX 1			TX 2		
EARFCN	2025	2175	2325	2025	2175	2325
MHZ	2117.5	2132.5	2147.5	2117.5	2132.5	2147.5
ETM 3.1 64QAM	OK	OK	OK	OK	OK	OK
ETM 3.2 16QAM	OK	OK	OK	OK	OK	OK
ETM1.1 QPSK	OK	OK	OK	OK	OK	OK
Channel BW	10 Mhz					
	Channel (edges vary)					
	TX 1			TX 2		
EARFCN	2000	2175	2350	2000	2175	2350
MHZ	2115	2132.5	2150	2115	2132.5	2150
ETM 3.1 64QAM	OK	OK	OK	OK	OK	OK
ETM 3.2 16QAM	OK	OK	OK	OK	OK	OK
ETM1.1 QPSK	OK	OK	OK	OK	OK	OK
Channel BW	5Mhz					
	Channel (edges vary)					
	TX 1			TX 2		
EARFCN	1975	2175	2375	1975	2175	2375
MHZ	2112.5	2132.5	2152.5	2112.5	2132.5	2152.5
ETM 3.1 64QAM	OK	OK	OK	OK	OK	OK
ETM 3.2 16QAM	OK	OK	OK	OK	OK	OK
ETM1.1 QPSK	OK	OK	OK	OK	OK	OK

Carrier configuration for LTE Band 4.

Band 13

Channel BW	10 Mhz					
	Channel (edges vary)					
	TX 1			TX 2		
EARFCN		5230			5230	
MHZ		751			751	
ETM 3.1 64QAM		OK			OK	
ETM 3.2 16QAM		OK			OK	
ETM1.1 QPSK		OK			OK	
Channel BW	5Mhz					
	Channel (edges vary)					
	TX 1			TX 2		
EARFCN	5205	5230	5255	5205	5230	5255
MHZ	748.5	751	753.5	748.5	751	753.5
ETM 3.1 64QAM	OK	OK	OK	OK	OK	OK
ETM 3.2 16QAM	OK	OK	OK	OK	OK	OK
ETM1.1 QPSK	OK	OK	OK	OK	OK	OK

Carrier configuration for LTE Band 13

3.5 EUT setup diagram

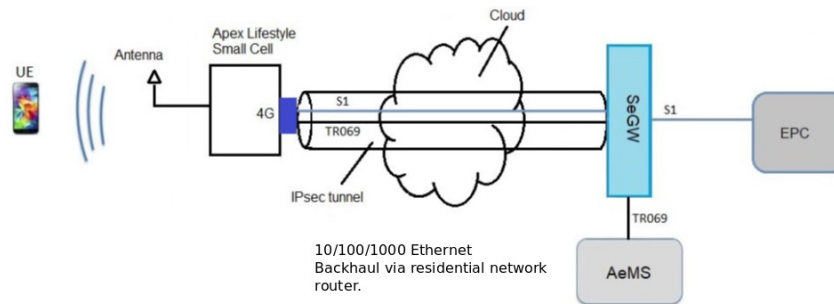


Figure 3.5-1: Typical Setup diagram

- Test environment block

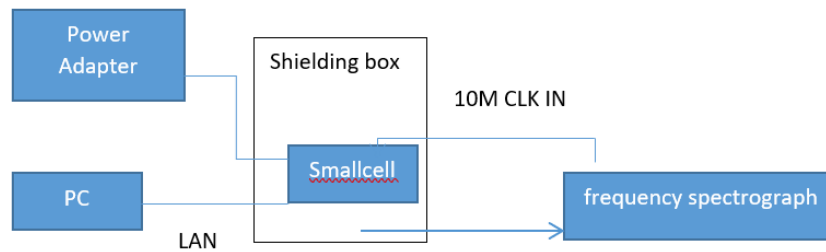


Figure 3.5-2: Radio Control Setup diagram

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

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

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

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

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list
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	11/28/2019
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	EXXXX	NCR	NCR
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 20dB	Centric RF	C407-20	E1201	NCR	VOU
Variac	Shanghai China	TDGC	S1043	NCR	NCR
Multimeter	Fluke	111	814	1 yr	12 Jun 2019

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 Maximum output power at RF antenna connector (EIRP)

8.1.1 Definitions and limits

FCC (Band 4):

(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

- (4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1-watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

FCC (Band 13):

(b) The following power and antenna height limits apply to transmitters operating in the 746-758 MHz, 775-788 MHz and 805-806 MHz bands:

- (9) Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands and fixed stations transmitting in the 787-788 MHz and 805-806 MHz bands are limited to 30 watts ERP.

RSS-130 Issue 2

4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

RSS-139 Issus 3

6.5 Transmitter Output Power

The equivalent isotopically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt.

(See section 8.7 for PAPR) In addition, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

RSS Gen Issue 5:

(See section 8.7 for PAPR) The transmitter output power shall be measured in terms of average power. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

8.1.2 Test summary

Test date	April 1, 2019
-----------	---------------

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 Do1 and Do2, Ports 1 and 2 are co-related respectively therefore 10 Log (2) (I.E. 3dB) added to the EIPR (or ERP) measurement.

Measurement was performed using RMS power meter.

8.1.4 Test data

Table 8.1-2: Measured Output power of EUT – LTE Band 4 - 5M Bandwidth

Frequency	Port 1	Port 2	10 Log* (2)	Total RF Power	Total EIRP	Limit dBm	Margin to Limit	PSD Port 2 (1MHz)
QPSK -5M								
2112.5	16.65	16.78	3	19.73	22.73	30	7.27	11.18
2132.5	16.61	16.42	3	19.53	22.53	30	7.47	11.79
2152.5	16.80	16.33	3	19.58	22.58	30	7.42	11.55
16QAM -5M								
2112.5	16.26	16.01	3	19.15	22.15	30	7.85	11.04
2132.5	16.28	15.97	3	19.14	22.14	30	7.86	11.31
2152.5	16.49	16.07	3	19.30	22.30	30	7.70	11.25
64QAM -5M								
2112.5	16.68	16.24	3	19.48	22.48	30	7.52	10.85
2132.5	16.66	16.42	3	19.55	22.55	30	7.45	11.27
2152.5	16.86	16.42	3	19.66	22.66	30	7.34	11.27

Note: The port measurement includes: 20db attenuator, 0.41dB cable loss and 2.15dBi antenna gain.

Table 8.1-3: Measured Output power of EUT – LTE Band 4 - 10M Bandwidth

Frequency	Port 1	Port 2	10 Log* (2)	Total RF Power	Total EIRP	Limit dBm	Margin to Limit	PSD Port 2 (1MHz)
QPSK -10M								
2115	16.48	16.03	3	19.27	22.27	30	7.73	7.47
2132.5	16.39	16.21	3	19.31	22.31	30	7.69	7.40
2150	16.49	16.21	3	19.36	22.36	30	7.64	7.77
16QAM -10M								
2115	16.30	15.94	3	19.13	22.13	30	7.87	7.86
2132.5	16.28	16.08	3	19.19	22.19	30	7.81	8.15
2150	16.31	15.98	3	19.16	22.16	30	7.84	8.28
64QAM -10M								
2115	16.44	16.09	3	19.28	22.28	30	7.72	7.57
2132.5	16.46	16.27	3	19.38	22.38	30	7.62	7.91
2150	16.42	16.21	3	19.33	22.33	30	7.67	7.74

Note: The port measurement includes: 20db attenuator, 0.41dB cable loss and 2.15dBi antenna gain.

Table 8.1-4: Measured Output power of EUT – LTE Band 4 - 15M Bandwidth

Frequency	Port 1 (dBm)	Port 2 (dBm)	10 Log [*] (2)	Total RF Power (dBm)	Total e.i.r.p. (dBm)	Limit (dBm)	Margin to Limit	PSD Port 2 (1MHz)
QPSK -15M								
2117.5	16.93	16.37	3	19.67	22.67	30	7.33	6.16
2132.5	16.77	16.53	3	19.66	22.66	30	7.34	6.29
2147.5	16.54	16.56	3	19.56	22.56	30	7.44	6.53
16QAM -15M								
2117.5	16.11	15.88	3	19.01	22.01	30	7.99	5.99
2132.5	16.10	15.96	3	19.04	22.04	30	7.96	6.25
2147.5	16.02	16.01	3	19.03	22.03	30	7.97	6.13
64QAM -15M								
2117.5	16.51	16.33	3	19.43	22.43	30	7.57	5.83
2132.5	16.48	16.37	3	19.44	22.44	30	7.56	6.14
2147.5	16.31	16.5	3	19.42	22.42	30	7.58	6.38

Note: The port measurement includes: 20db attenuator, 0.41dB cable loss and 2.15dBi antenna gain.

Table 8.1-5: Measured Output power of EUT – LTE Band 4 - 20M Bandwidth

Frequency	Port 1 (dBm)	Port 2 (dBm)	10 Log [*] (2)	Total RF Power (dBm)	Total e.i.r.p. (dBm)	Limit (dBm)	Margin to Limit (dBm)	PSD Port 2 (1MHz)
QPSK -20M								
2120	17.29	17.08	3	20.20	23.20	30	6.80	4.89
2132.5	17.14	17.14	3	20.15	23.15	30	6.85	4.77
2145	17.13	17.1	3	20.13	23.13	30	6.87	4.59
16QAM -20M								
2120	17.22	17.04	3	20.14	23.14	30	6.86	5.29
2132.5	17.11	17.21	3	20.17	23.17	30	6.83	5.21
2145	17.04	17.03	3	20.05	23.05	30	6.95	5.38
64QAM -20M								
2120	17.15	17.17	3	20.17	23.17	30	6.83	4.90
2132.5	17.18	17.24	3	20.22	23.22	30	6.78	4.67
2145	17.07	17.29	3	20.19	23.19	30	6.81	5.19

Note: The port measurement includes: 20db attenuator, 0.41dB cable loss and 2.15dBi antenna gain.

Table 8.1-6: Measured Output power of EUT – LTE Band 13 - 5M Bandwidth

Frequency	Port 1 (dBm)	Port 2 (dBm)	10 Log ² (2)	Total RF Power (dBm)	Total e.r.p (dBm)	Limit (dBm)	Margin to Limit (dBm)	PSD Port 2 (1MHz)
QPSK -5M								
748.5	18.04	18.21	3	21.14	24.14	45	20.56	13.82
751	17.58	17.65	3	20.63	23.63	45	21.07	12.76
753.5	17.75	17.91	3	20.84	23.84	45	20.86	12.95
16QAM -5M								
748.5	18.02	17.9	3	20.97	23.97	45	20.73	13.24
751	17.30	17.26	3	20.29	23.29	45	21.41	12.75
753.5	17.42	17.56	3	20.50	23.50	45	21.20	13.49
64QAM -5M								
748.5	18.11	18.2	3	21.17	24.17	45	20.53	13.59
751	17.54	17.57	3	20.57	23.57	45	21.13	12.27
753.5	17.66	17.83	3	20.76	23.76	45	20.94	13.61

Note: The port measurement includes: 20db attenuator, 0.41dB cable loss and 2.15dBi antenna gain.

Table 8.1-7: Measured Output power of EUT – LTE Band 13 - 10M Bandwidth

Frequency	Port 1 (dBm)	Port 2 (dBm)	10 Log ² (2)	Total RF Power (dBm)	Total e.r.p (dBm)	Limit (dBm)	Margin to Limit (dBm)	PSD Port 2 (1MHz)
QPSK -10M								
751	17.56	17.61	3	20.60	23.60	45	21.10	9.22
16QAM -10M								
751	17.40	17.44	3	20.43	23.43	45	21.27	9.71
64QAM -10M								
751	17.46	17.54	3	20.51	23.51	45	21.19	9.55

Note: The port measurement includes: 20db attenuator, 0.41dB cable loss and 2.15dBi antenna gain.

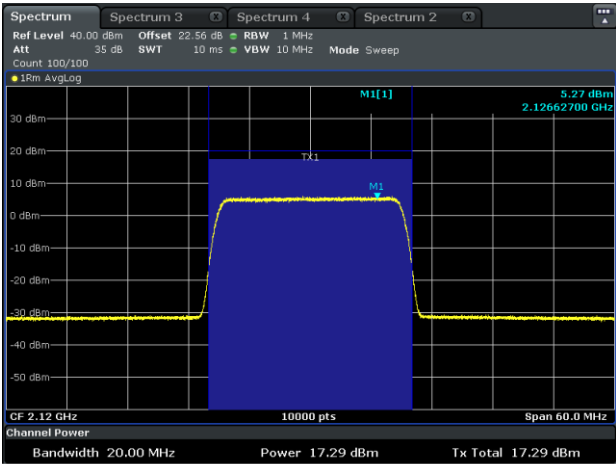


Figure 8.1-1: Output power measurement on Port 1, Band 4, 2120MHz, QPSK, 20MHz BW.

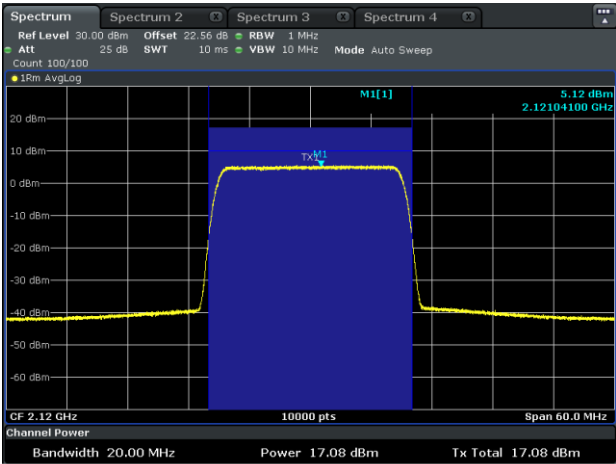


Figure 8.1-2: Output power measurement on Port 2, Band 4, 2120MHz, QPSK, 20MHz BW.

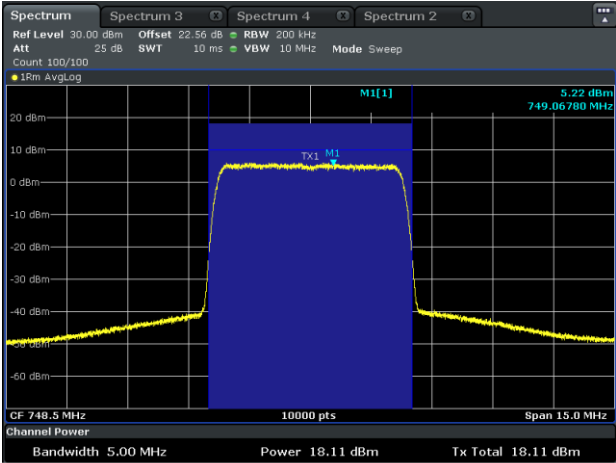


Figure 8.1-3: Output power measurement on Port 1, Band 13, 748.5MHz, 64QAM, 5MHz BW.

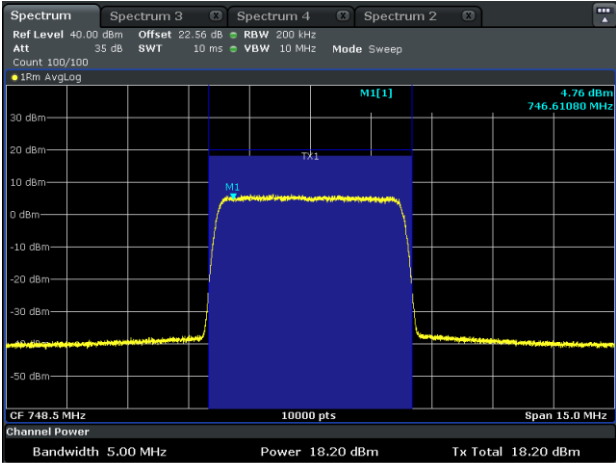


Figure 8.1-4: Output power measurement on Port 2, Band 13, 748.5MHz, 64QAM, 5MHz BW.

8.2 Spurious emissions at RF antenna connector (Band 4)

8.2.1 Definitions and limits

FCC 27.53 (Band 4):

(h) AWS emission limits.

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

RSS-139 Issue 3

6.6 Transmitter Unwanted Emissions

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block,² which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

8.2.2 Test summary

Test date	April 4, 2019
-----------	---------------

8.2.3 Observations, settings and special notes

The spectrum was searched from 9kHz to the 26GHz.

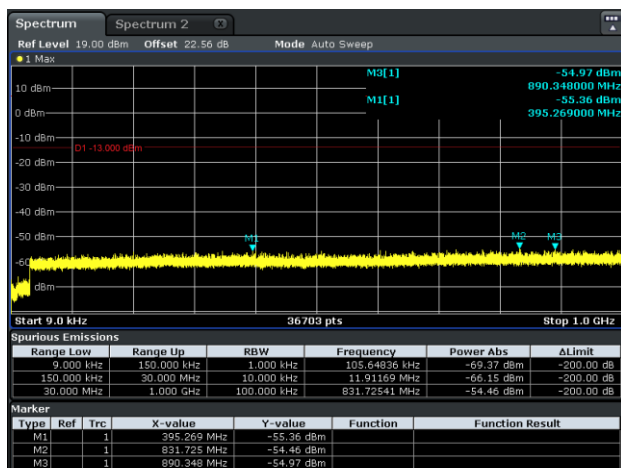
All measurements were performed using RMS detector at Max Hold.

Port 2 – LTE Band 4, 16QAM, 5Mhz, 10MHz, 15MHz and 20MHz Bandwidth - Spurious Emissions

Not shown – Plots for Port 1 were essentially the same.

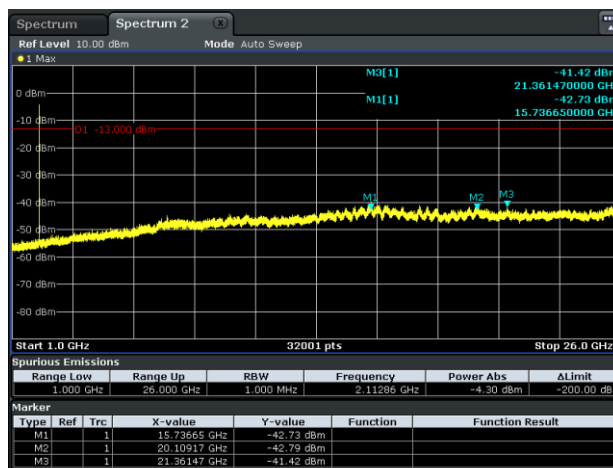
Offset: 20db attenuator + 0.41dB cable loss + 2.15dBi (>1GHz) antenna gain = 22.56dB

8.2.4 Test data



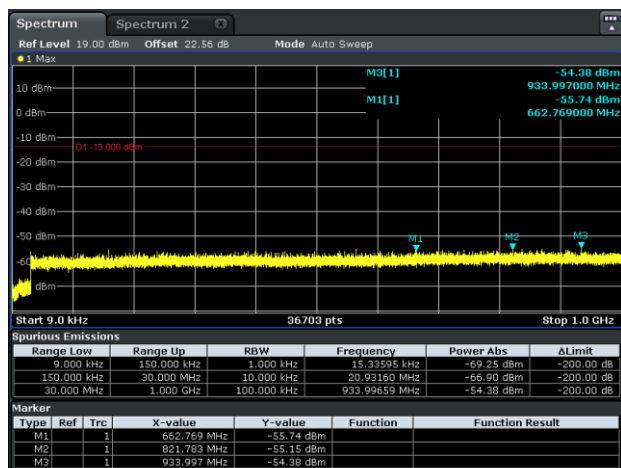
Date: 4 APR 2019 12:46:15

Figure 8.2-1: Conducted spurious emissions 9KHz to 1GHz, 2112.5MHz, 16QAM, 5MHz BW.



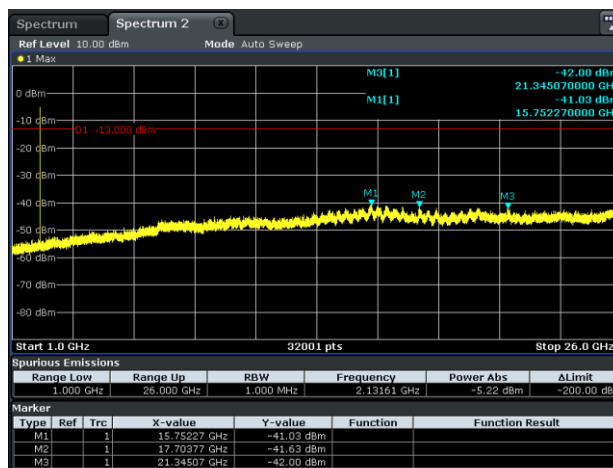
Date: 4 APR 2019 12:47:38

Figure 8.2-2: Conducted spurious emissions 1GHz to 26GHz, 2112.5MHz, 16QAM, 5MHz BW.



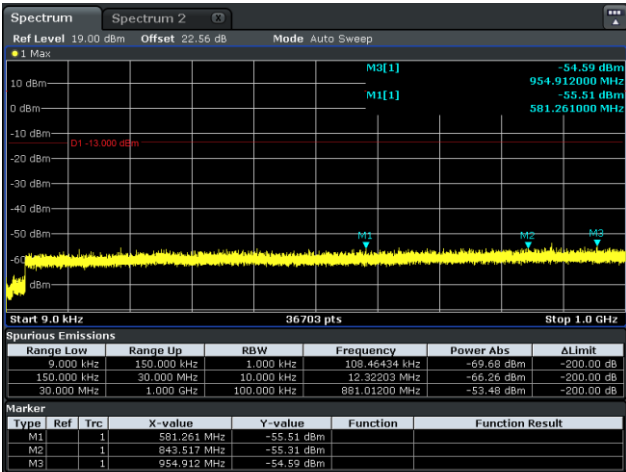
Date: 4 APR 2019 12:50:07

Figure 8.2-3: Conducted spurious emissions 9KHz to 1GHz, 2132.5MHz, 16QAM, 5MHz BW.



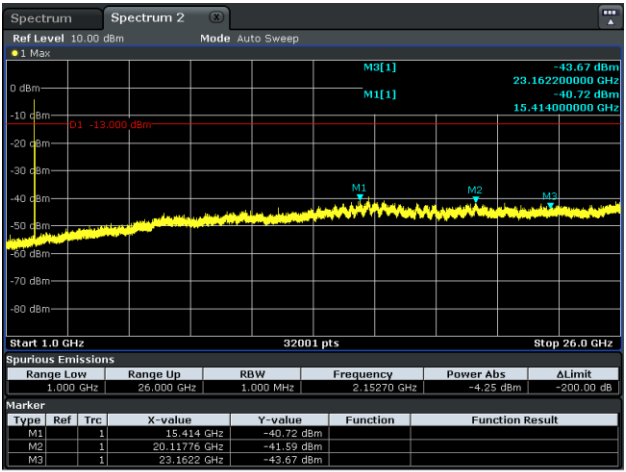
Date: 4 APR 2019 12:50:45

Figure 8.2-4: Conducted spurious emissions 1GHz to 26GHz, 2132.5MHz, 16QAM, 5MHz BW.



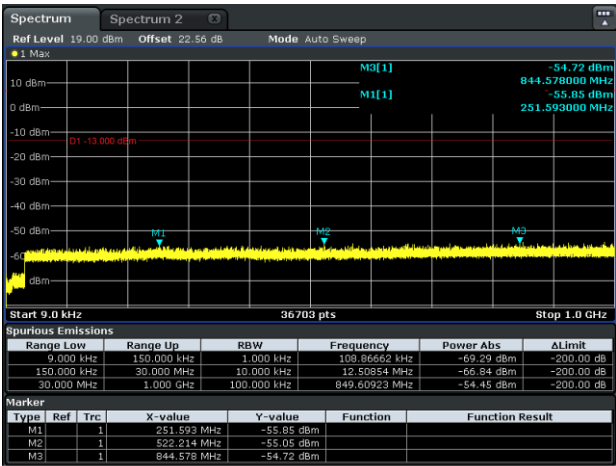
Date: 4 APR 2019 12:53:40

Figure 8.2-5: Conducted spurious emissions 9kHz to 1GHz, 215.5MHz, 16QAM, 5MHz BW.



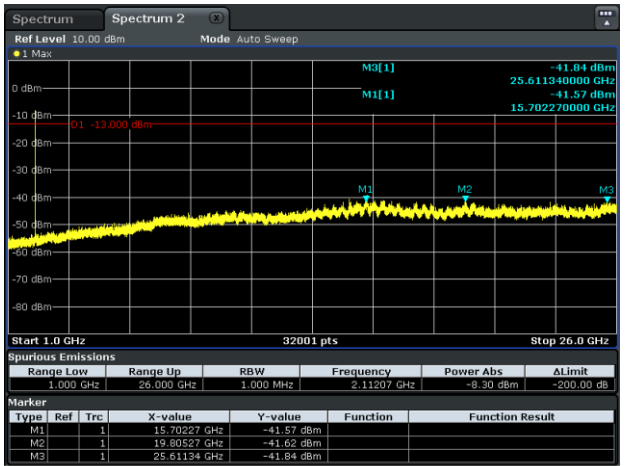
Date: 4 APR 2019 12:54:26

Figure 8.2-6: Conducted spurious emissions 1GHz to 26GHz, 215.5MHz, 16QAM, 5MHz BW.



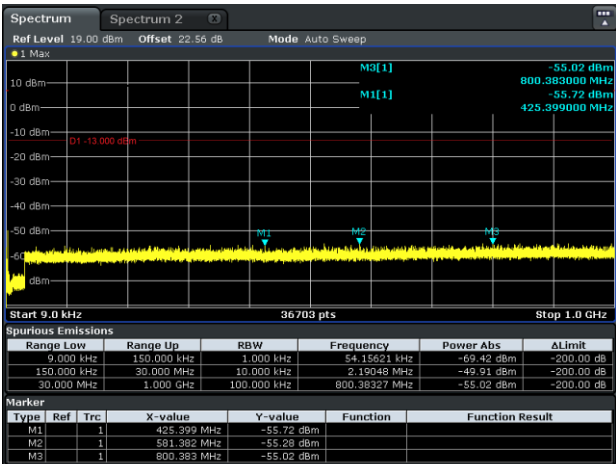
Date: 4 APR 2019 12:36:12

Figure 8.2-7: Conducted spurious emissions 9kHz to 1GHz, 2115MHz, 16QAM, 10MHz BW.



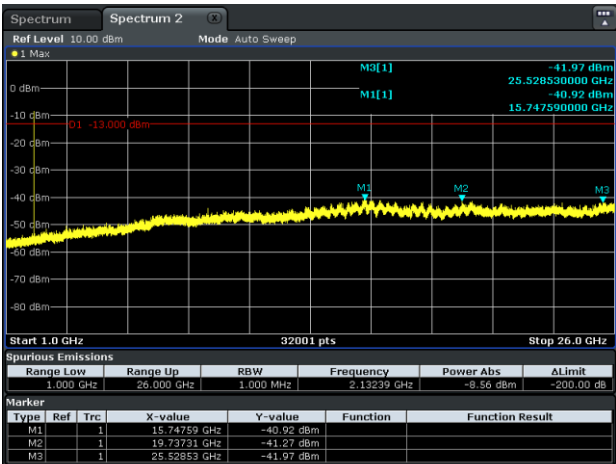
Date: 4 APR 2019 12:36:48

Figure 8.2-8: Conducted spurious emissions 1GHz to 26GHz, 2115MHz, 16QAM, 10MHz BW.



Date: 4 APR 2019 12:38:56

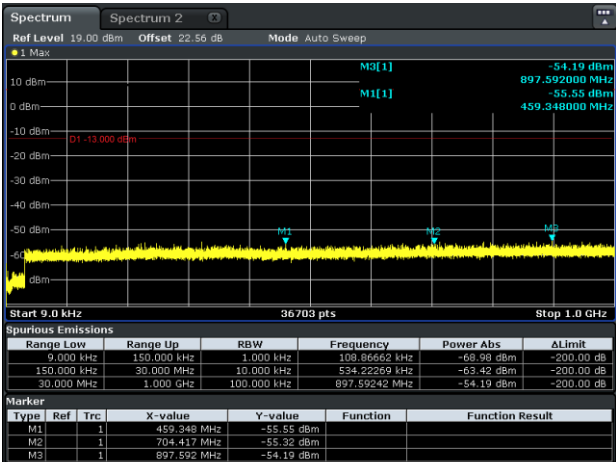
Figure 8.2-9: Conducted spurious emissions 9kHz to 1GHz, 2132.5MHz, 16QAM, 10MHz BW.



Date: 4 APR 2019 12:39:51

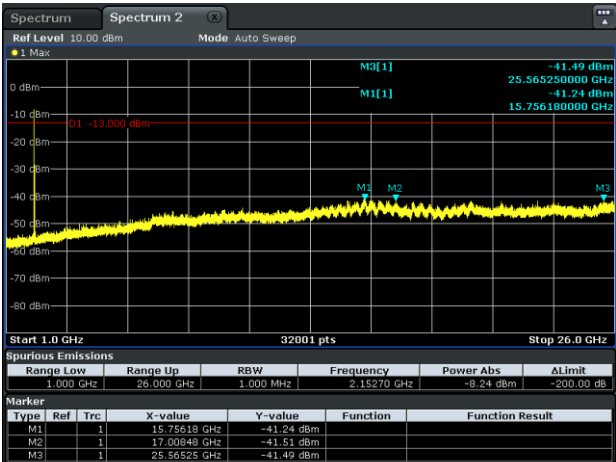
Figure 8.2-10: Conducted spurious emission for GPS L1 at 1.5754 GHz, 16QAM, 10MHz BW.

Figure 8.2-10



Date: 4 APR 2019 12:42:14

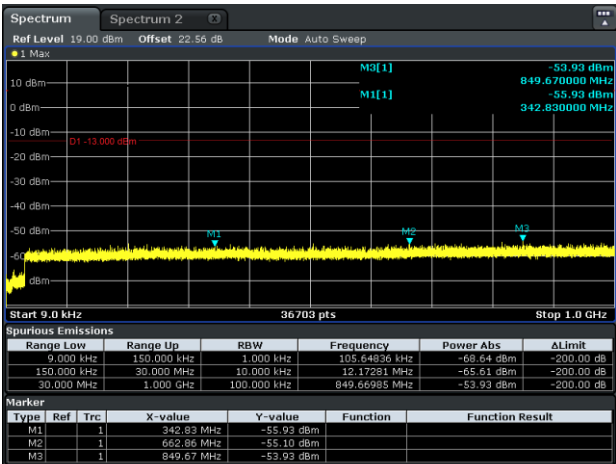
Figure 8.2-11: Conducted spurious emissions 9kHz to 1GHz, 2150MHz, 16QAM, 10MHz BW.



Date: 4 APR 2019 12:43:25

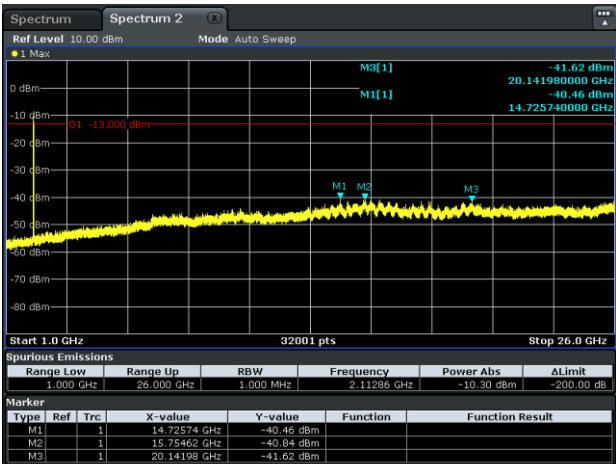
Figure 8.2-12: Conducted spurious emissions for GPS L1 at 1.5754 GHz, 16QAM, 10MHz BW.

Figure 8.2-12



Date: 4 APR 2019 12:25:55

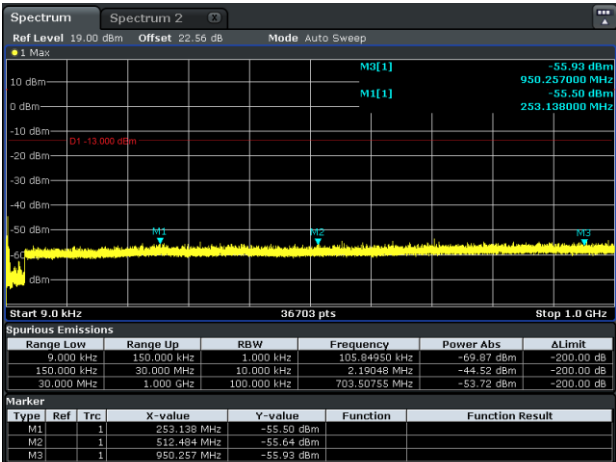
Figure 8.2-13: Conducted spurious emissions 9KHz to 1GHz, 2117.5MHz, 16QAM, 15MHz BW.



Date: 4 APR 2019 12:26:12

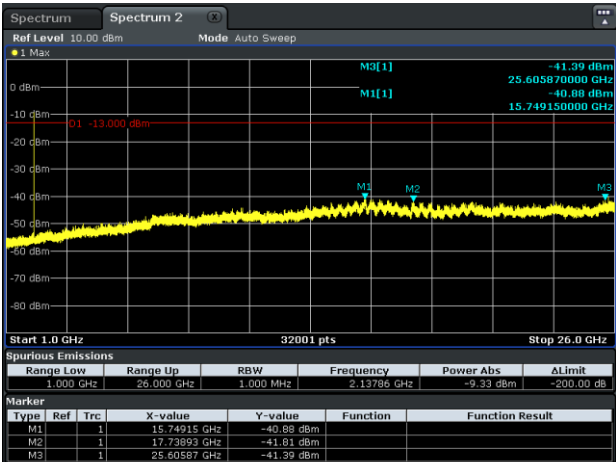
Figure 8.2-14: Conducted spurious emissions 1GHz to 26GHz, 2117.5MHz, 16QAM, 15MHz BW.

Figure 8.2-14



Date: 4 APR 2019 12:29:55

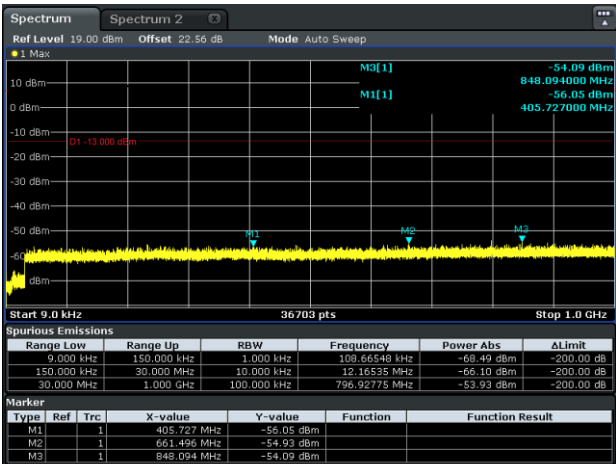
Figure 8.2-15: Conducted spurious emissions 9KHz to 1GHz, 2132.5MHz, 16QAM, 15MHz BW.



Date: 4 APR 2019 12:30:29

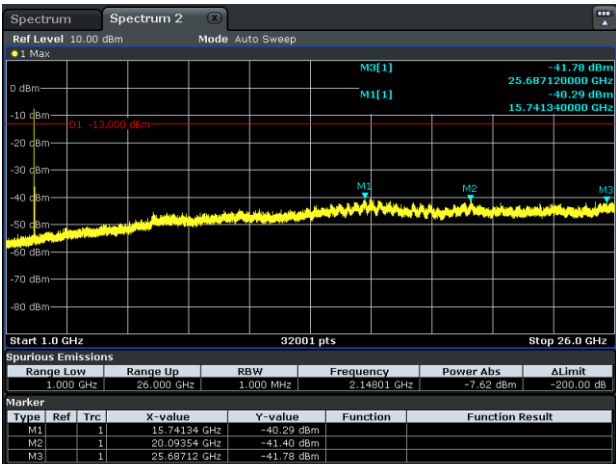
Figure 8.2-16: Conducted spurious emissions 1GHz to 26GHz, 2132.5MHz, 16QAM, 15MHz BW.

Figure 8.2-16



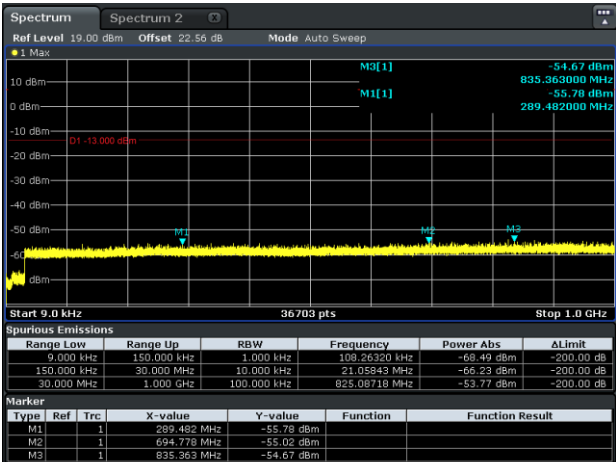
Date: 4 APR 2019 12:33:05

Figure 8.2-17: Conducted spurious emissions 9KHz to 1GHz, 2147.5MHz, 16QAM, 15MHz BW.



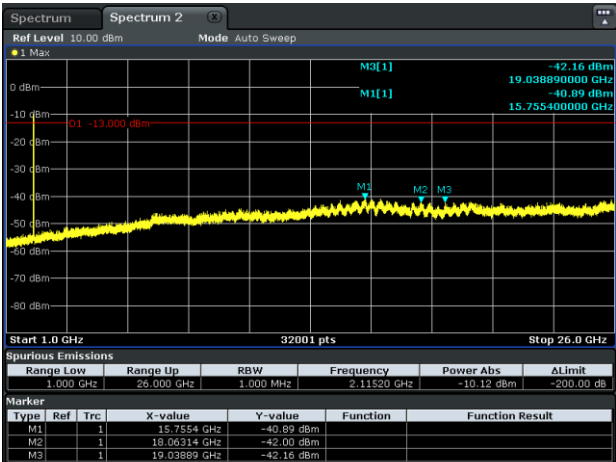
Date: 4 APR 2019 12:33:51

Figure 8.2-18: Conducted spurious emissions 1GHz to 26GHz, 2147.5MHz, 16QAM, 15MHz BW.



Date: 4 APR 2019 12:14:09

Figure 8.2-199: Conducted spurious emissions 9KHz to 1GHz, 2120MHz, 16QAM, 20MHz BW.



Date: 4 APR 2019 12:14:57

Figure 8.2-200: Conducted spurious emissions 1GHz to 26GHz, 2120MHz, 16QAM, 20MHz BW.