Choose certainty.
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Report On

Application for Grant of Equipment Authorization of the
Inseego Corp.
M1000 Wireless Hotspot Modem

FCC CFR 47 Part 2, 90 and 96
RSS-192 Issue 3 January 2008
RSS-197 Issue 1 February 2010

Report No. 72146272F **May 2019**

REPORT ON	Radio Testing of the Inseego Corp. M1000 Wireless Hotspot Modem
TEST REPORT NUMBER	72146272F
PREPARED FOR	Inseego Corp. 9605 Scranton Road, Suite 300 San Diego, CA 92121 USA
CONTACT PERSON	Roman Olmos Senior Regulatory Engineer (858) 812-0606 roman.olmos@inseego.com
PREPARED BY	Xiaoying Zhang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: Senior EMC Test Engineer/Wireless Team Lead
DATED	May 30, 2019

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

Revision History

72146272F Inseego Corp. M1000 Wireless Hotspot Modem					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
05/30/2019	-	Initial Release			Ferdinand S. Custodio

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Inseego Corp.
M1000 Wireless Hotspot Modem

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Inseego Corp. M1000 Wireless Hotspot Modem to the requirements of the following:

- FCC CFR 47 Part 2, 90 and 96
- RSS-192 Issue 3 January 2008
- RSS-197 Issue 1 February 2010

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Inseego Corp.
Product Marketing Name	5G MiFi 1000
Model Number(s)	M1000
FCC ID Number	PKRISGM1000
IC Number	3229A-M1000
Serial Number(s)	990013090027496, 990013090023966 (IMEI)
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC CFR 47 Part 2, 90 and 96 (October 1, 2018) • KDB412172 D01 Determining ERP and EIRP v01r01 August 07, 2015: Guidelines for determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of an RF transmitting system • KDB971168 D01 Power Meas License Digital Systems v03r01: April 9 2018: Measurement guidance for certification of licensed digital transmitters • RSS-192 Issue 3 January 2008 - Fixed Wireless Access Equipment Operating in the Band 3450-3650 MHz • RSS-197 Issue 1 February 2010 – Wireless Broadband Access Equipment Operating in the Band 3650-3700 MHz • RSS-Gen Issue 5 Amendment 1: March 2019 - General Requirements for Compliance of Radio Apparatus • ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
Start of Test	April 26, 2019
Finish of Test	May 24, 2019
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	Supporting documents for EUT certification are separate exhibits.

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1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2, 90 and 96 with cross-reference to the corresponding ISED RSS standard is shown below.

Section	FCC Part Sections(s)	RSS Section(s)	Test Description	Result
2.1	2.1046	RSS-192: 5.4	Transmitter Conducted Output Power	Compliant
2.2	2.1046 96.41(b) 90.1321(c)	RSS-192: 5.4 RSS-197: 5.6	Effective Isotropic Radiated Power and Power Spectral Density	Compliant
-	96.41(g)	-	Peak-Average Ratio	N/A*
2.3	2.1049 96.41(e)(3) 90.1323(a)	RSS-Gen: 6.7 RSS-192: 5.5 RSS-197: 5.7	Occupied Bandwidth	Compliant
2.4	2.1051 96.41(e)(1)(3) 90.1323(a)	RSS-192: 5.5 RSS-197: 5.7	Band Edge and Emission Mask	Compliant
2.5	2.1051 96.41(e)(1)(2)(3) 90.1323(a)	RSS-192: 5.5 RSS-197: 5.7	Conducted Spurious Emissions	Compliant
2.6	2.1053 96.41(e) 90.1323(a)	RSS-192: 5.5 RSS-197: 5.7	Field Strength of Spurious Radiation	Compliant
2.7	2.1055 90.213	RSS-192: 5.3 RSS-197: 5.3	Frequency Stability	Compliant
-	-	RSS-192 (5.6) RSS-197 (5.8) RSS-Gen 7.4	Receiver Spurious Emissions	N/A**
2.8	-	RSS-GEN 8.8	Power Line Conducted Emissions	Compliant

N/A* Not applicable. For CBSD only.
N/A** Not applicable. No stand-alone receiver.

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1.3 PRODUCT INFORMATION

1.3.1 EUT General Description

The Equipment Under Test (EUT) was an Inseego Corp. M1000 Wireless Hotspot Modem. The EUT is a Wireless Hotspot Modem supporting 3G/4G/5G/WLAN Technologies. The EUT is also equipped with a USB Port and AC Wall Power Adaptor.

1.3.2 Technical Description

EUT Description	Wireless Hotspot Modem
Product Marketing Name	5G MiFi 1000
Model Number(s)	M1000
Rated Voltage	3.8V, 4400mAh (Rechargeable Li-Ion battery pack) Input 100-240VAC, Output 5V (External AC-DC Power Adapter)
Mode Verified	LTE Band 48: 3550-3700 MHz
Capability	WCDMA Band 2, 4, 5, LTE Band 2, 4, 5, 13, 66, 5G Band n261, and 802.11 a/b/g/n/ac
Primary Unit (EUT)	☐ Production ☒ Pre-Production ☐ Engineering
Manufacturer Declared Rated Power	22 dBm
Manufacturer Declared Voltage Range	3.3 V – 4.2 VDC

(Client declaration, max. antenna gain covered under this test report)

LTE Bands	Frequency(ies)	Antenna Gains
Band 48	3550-3700 MHz	3.6 dBi

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1.3.3 Transmit Frequency Table

LTE Band 48					
Modulation	Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	EIRP / 10 MHz	
				Max Power (dBm)	Max Power (Watts)
QPSK	5	3550 - 3650	4M47G7D	22.06	0.16
	10		8M94G7D	21.88	0.15
	15		13M4G7D	22.90	0.19
	20		17M9G7D	22.87	0.19
16QAM	5		4M48W7D	21.33	0.14
	10		8M94W7D	20.92	0.12
	15		13M4W7D	22.04	0.16
	20		17M9W7D	22.18	0.17

LTE Band 48					
Modulation	Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	EIRP / 25 MHz	
				Max Power (dBm)	Max Power (Watts)
QPSK	5	3650 - 3700	4M47G7D	22.22	0.17
	10		8M95G7D	22.09	0.16
	15		13M4G7D	22.55	0.18
	20		17M9G7D	22.44	0.18
16QAM	5		4M49W7D	21.48	0.14
	10		8M94W7D	21.21	0.13
	15		13M4W7D	21.58	0.14
	20		17M9W7D	21.63	0.15

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1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement. EUT Transmits at maximum power and is powered by the internal battery and/or USB via AC Adapter.
B	Radiated test setup / case spurious emissions. The EUT is connected to the call box in radiated way or connect to the call box with antenna port terminated by the call box.

1.4.2 EUT Exercise Software

EUT is controlled by a CMW 500 Wideband Radio Communication Tester. There are no other test software used during verification.

1.4.3 Support Equipment and I/O cables

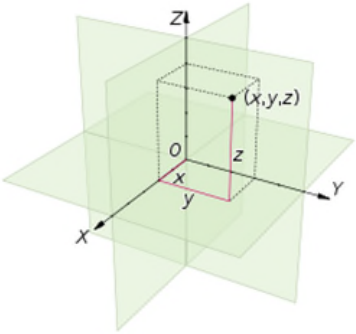
Manufacturer	Equipment/Cable	Description
Inseego Corp.	USB Cable	Type A to Type C USB Cable. M/N: NOV7000USB
Inseego Corp.	External AC-DC Power Adapter	Model: SSW-2783, PN: 40123126.01 Input: 100-240VAC, 50/60Hz, 0.5A Output: 5VDC, max. 2A

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per output power measurements:

Band	Channel BW	Modulation	RB Size/Offset
Band 48 (3450 – 3650 MHz)	5 MHz	QPSK	1/12
Band 48 (3650 – 3700 MHz)	15 MHz	QPSK	1/37

For radiated measurements X, Y, and Z orientations were verified. The verification was determined “Y” as worst case configuration.



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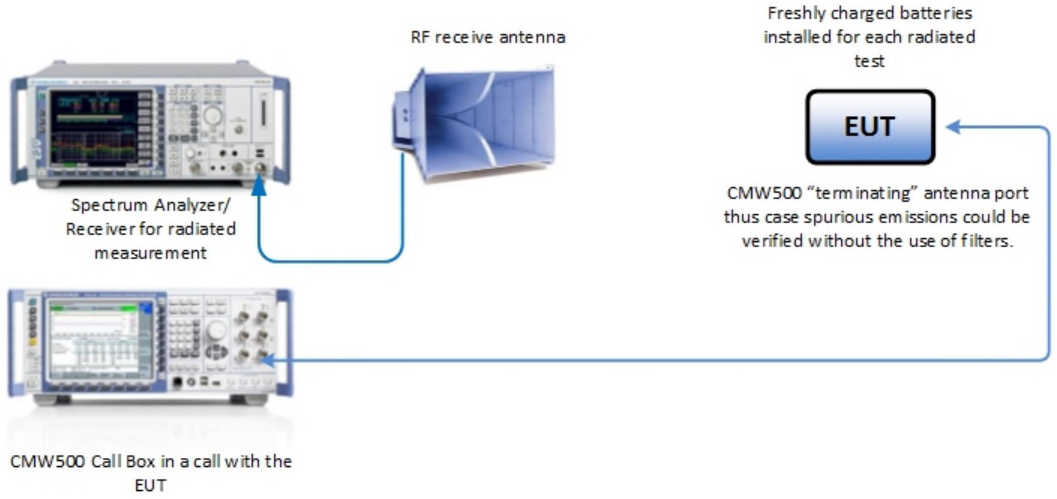
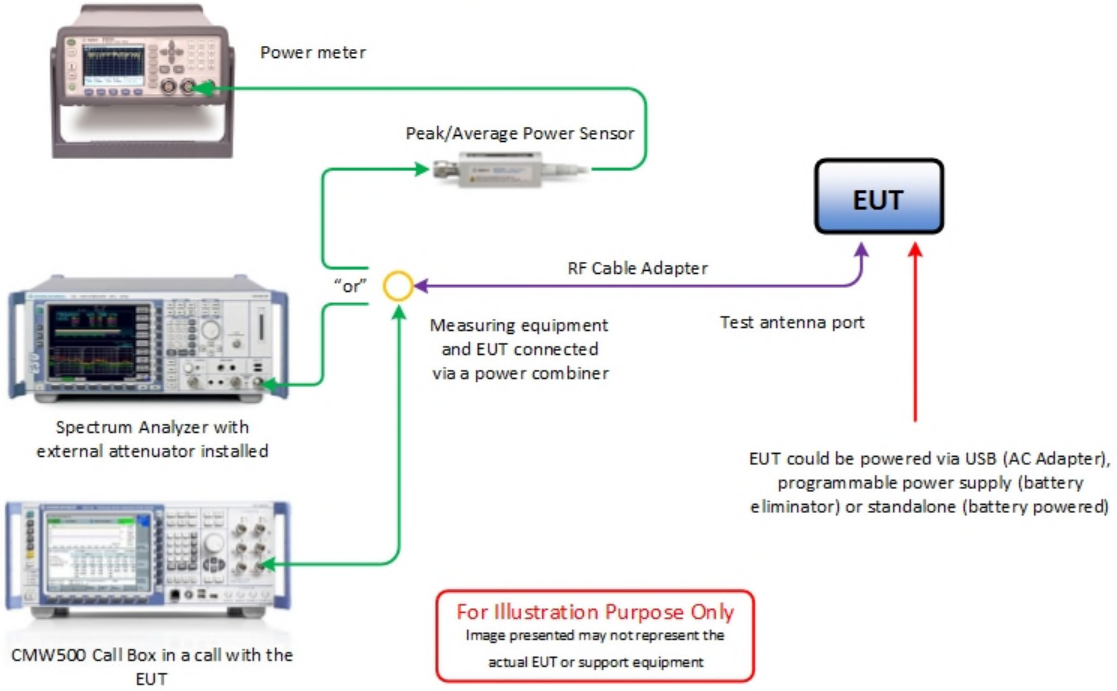
1.4.5 Simplified Test Configuration Diagram

Radiated Test Configuration



Conducted (Antenna Port) Test Configuration



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1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: 990013090027496 and 990013090023966 (IMEI)		
None	—	—

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: (858) 678-1400 Fax: (858) 546-0364.

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: (858) 678-1400 Fax: (858) 546-0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Designation is US1146.

1.9.2 Innovation, Science and Economic Development Canada (IC) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 NCC (National Communications Commission - US0102)

TUV SUD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP002 for Low-Power RF Device type of testing.

1.9.5 VCCI – Registration No. A-0280 and A-0281

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

1.9.6 RRA – Identification No. US0102

TUV SUD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

1.9.7 OFCA – U.S. Identification No. US0102

TUV SUD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.

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1.10 SAMPLE CALCULATIONS

1.10.1 LTE Emission Designator (QPSK)

Emission Designator = 4M51G7D
G = Phase Modulation
7= Quantized/Digital Info
D = Data Transmission, telemetry, telecommand

1.10.2 LTE Emission Designator (16QAM)

Emission Designator = 4M50W7D
W = Frequency Modulation
7= Quantized/Digital Info
D = Data Transmission, telemetry, telecommand

1.10.3 Spurious Radiated Emission (below 1GHz)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**11.8**

1.10.4 Spurious Radiated Emission – Substitution Method

Example = 84dBµV/m @ 1413 MHz (numerical sample only)

The field strength reading of 84dBµV/m @ 1413 MHz (2nd Harmonic of 706.5 MHz) is the maximized measurement when the EUT is on the turntable measured at 3 meters. The gain of the substituted antenna is 7.8dBi while the transmit cable loss is 1.0 dB (cable between signal generator and the substituted antenna). The signal generator level is adjusted until the 84dBµV/m level at the receiving end is replicated (identical test setup, i.e. same antenna, cable/s and preamp). If the adjusted signal generator level is -18dBm, then we have the following for both EIRP and ERP as required:

P_{EIRP} = -18 dBm + 7.8 dBi – 1dB
= 11.2 dBm
P_{ERP} = P_{EIRP} – 2.15 dB
= 11.2 dBm – 2.15 dB
= 9.05 dBm

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SECTION 2

TEST DETAILS

Radio Testing of the
Inseego Corp.
M1000 Wireless Hotspot Modem

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2.1 TRANSMITTER CONDUCTED POWER MEASUREMENTS

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046
RSS-192, Clause 5.4

2.1.2 Standard Applicable

The conducted power mesurements were made in accordance to FCC Part 2 Clasue 2.1046 and RSS-192 Clause 5.4.

RSS-192, Clause 5.4:
The average output power, P_{mean}, shall be within ±2.0 dB of the manufacturer's rated power. The e.i.r.p shall comply with the limits sepcified in SRSP-303.4.

2.1.3 Equipment Under Test and Modification State

Serial No: 990013090027496 and 990013090023966 (IMEI) / Test Configuration A

2.1.4 Date of Test/Initial of test personnel who performed the test

May 21, 2019 / XYZ

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.5 °C
Relative Humidity	44.1 %
ATM Pressure	98.9 kPa

2.1.7 Additional Observations

- This is a conducted test using Power Meter.
- The path loss were measured and entered as a level offset.
- Low, Middle and High channels for all bandwidths with different RB size and RB offset and modulations were verified and reported.

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2.1.8 Test Results

LTE Band 48 (3550-3650 MHz) according to FCC Part 96 / RSS-192							
Bandwidth (MHz)	Channel	Frequency (MHz)	Modulation	No. RB	RB Start	Average Power (dBm)	Peak Power (dBm)
5	55265	3552.5	QPSK	1	12	18.07	25.49
	55740	3600		1	12	18.16	25.70
	56215	3647.5		1	12	18.46	25.84
	55265	3552.5	16QAM	1	12	17.44	25.39
	55740	3600		1	12	17.38	25.52
	56215	3647.5		1	12	17.73	25.66
10	55290	3555	QPSK	1	25	18.06	25.68
	55740	3600		1	25	18.19	25.79
	56190	3645		1	25	18.28	25.96
	55290	3555	16QAM	1	25	17.24	25.42
	55740	3600		1	25	17.23	25.65
	56190	3645		1	25	17.32	25.83
15	55315	3557.5	QPSK	1	37	18.02	25.74
	55740	3600		1	37	18.25	25.74
	56165	3642.5		1	37	18.31	25.98
	55315	3557.5	16QAM	1	37	17.20	25.62
	55740	3600		1	37	17.42	25.72
	56165	3642.5		1	37	17.36	25.78
20	55340	3560	QPSK	1	99	18.11	25.67
	55740	3600		1	99	18.45	25.86
	56140	3640		1	99	18.37	25.90
	55340	3560	16QAM	1	99	17.25	25.56
	55740	3600		1	99	17.63	25.70
	56140	3640		1	99	17.39	25.76

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LTE Band 48 (3650-3700 MHz) according to FCC Part 90 / RSS-197							
Bandwidth (MHz)	Channel	Frequency (MHz)	Modulation	No. RB	RB Start	Average Power (dBm)	Peak Power (dBm)
5	56265	3652.5	QPSK	1	12	18.62	26.21
	56490	3675		1	12	18.43	26.71
	56715	3697.5		1	12	18.03	26.72
	56265	3652.5	16QAM	1	12	17.88	26.04
	56490	3675		1	12	17.52	26.15
	56715	3697.5		1	12	17.15	26.39
10	56290	3655	QPSK	1	25	18.49	26.21
	56490	3675		1	25	18.30	26.27
	56690	3695		1	25	18.10	27.35
	56290	3655	16QAM	1	25	17.61	26.12
	56490	3675		1	25	17.33	26.00
	56690	3695		1	25	17.42	26.89
15	56315	3657.5	QPSK	1	37	18.80	26.39
	56490	3675		1	37	18.95	26.77
	56665	3692.5		1	37	18.36	28.50
	56315	3657.5	16QAM	1	37	17.98	26.24
	56490	3675		1	37	17.76	26.23
	56665	3692.5		1	37	17.43	28.21
20	56340	3660	QPSK	1	50	18.84	26.35
	56490	3675		1	50	18.51	26.42
	56640	3690		1	50	18.13	25.97
	56340	3660	16QAM	1	50	18.03	26.15
	56490	3675		1	50	17.86	26.18
	56640	3690		1	50	17.66	26.20

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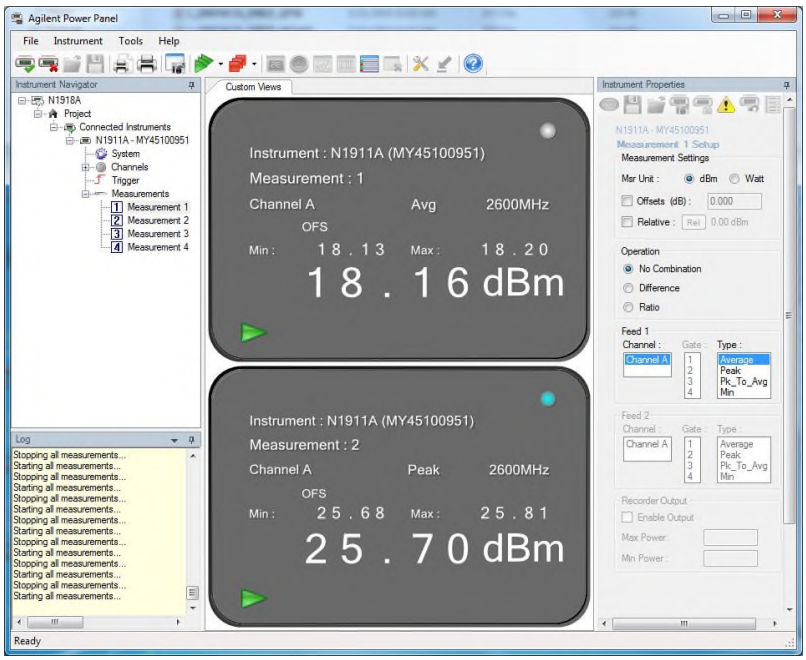
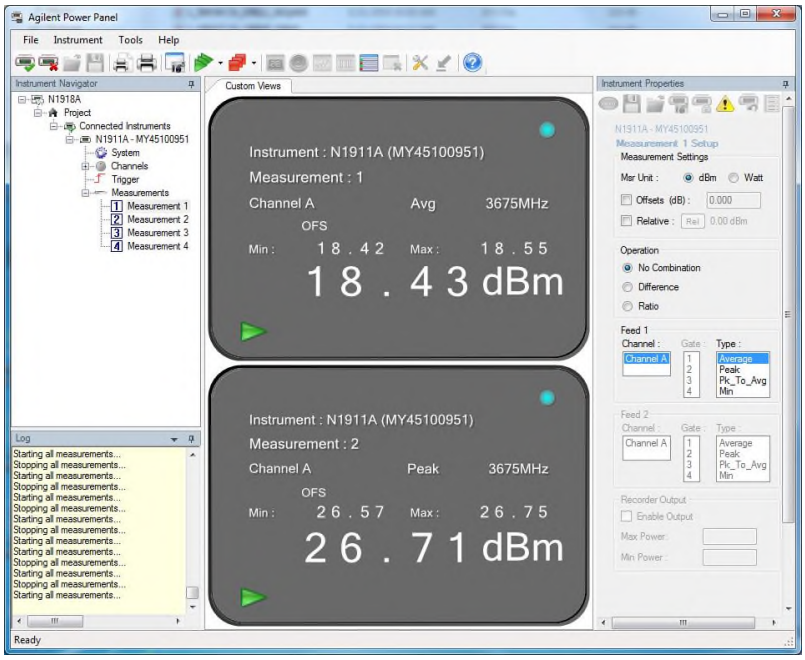
2.1.9 Sample Test Measurement Screen



LTE Band 48 (3550 – 3650 MHz)_5M Bandwidth Middle Chanel QPSK 1 RB 12 offset



LTE Band 48 (3650 – 3700 MHz)_5 MHz Bandwidth_Middle Chanel QPSK 1 RB 12 offset

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2.2 EFFECTIVE ISOTROPIC RADIATED POWER AND POWER SPECTRAL DENSITY

2.2.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046
FCC 47 CFR Part 96, Clause 96.41(b)
FCC 47 CFR Part 90, Clause 90.1321(c)
RSS-192, Clause 5.4
RSS-197, Clause 5.6

2.2.2 Standard Applicable

FCC 47 CFR Part 96, Clause 96.41:
(b) Unless othewise specified in this sectin, the maximum effective isotropic radiated power (EIRP) and maximum Power Sepctral Density (PSD) of any CBSD and End User Device must comply with the limits show in the table below:

Device	Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
End User Device	23	N/A
Category A CBSD	30	20
Category B CBSD	47	37

RSS-192, Clause 5.4:
The average output power, P_{mean}, shall be within 2.0 dB of the manufacturer's rated power. The e.i.r.p shall comply with the limits sepcified in SRSP-303.4.

FCC 47 CFR Part 90, Clause 90.1321:
(c) Mobile and portable stations are limited to 1 watt/25 MHz EIRP. In any event, the peak EIRP density shall not exceed 40 milliwatts in any one-mega-hertz slice of specturem.

RSS-197, Clause 5.6;
The maximum e.i.r.p density of mobile equipment shall not exceed 40 mW in any 1 MHz bandwidth.

2.2.3 Equipment Under Test and Modification State

Serial No: 990013090027496 and 990013090023966 (IMEI) / Test Configuration A

2.2.4 Date of Test/Initial of test personnel who performed the test

May 21, 2019 / XYZ

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

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2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.5 °C
Relative Humidity	44.1 %
ATM Pressure	98.9 kPa

2.2.7 Additional Observations

- EIRP was calculated as per Section 1.2 and 1.3 of KDB412172 D01 (Determining ERP and EIRP v01r01).
- Calculation formula in logarithmic terms:

  $EIRP = P_T + G_T - L_C$

  Where:

  P_T = transmitter conducted output power dBm (Section 2.1 of this test report)

  G_T = gain of the transmitting antenna, in dBi (EIRP);

  L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB (EUT posees an internal Antenna. The loss between the EUT and the antenna port is considered negligible).

- Conducted EIRP Density is tested in any 1 MHz
- The path loss were measured and entered as a level offset.
- Low, Middle and High channels for all modulations were verified and reported.

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2.2.8 Test Results

LTE Band 48 (3550 – 3650 MHz) EIRP according to FCC Part 96 / RSS-192									
Modulation	**Bandwidth (MHz)**	**RB Size/Offset**	**Channels**	**Frequency (MHz)**	**Average Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**Limit (dBm)**	**Compliance**
QPSK	5	1 / 12	55265	3552.5	18.07	3.6	21.67	22 ± 2	Yes
		1 / 12	55740	3600	18.16	3.6	21.76	22 ± 2	Yes
		1 / 12	56215	3647.5	18.46	3.6	22.06	22 ± 2	Yes
	10	1 / 25	55290	3555	18.06	3.6	21.66	22 ± 2	Yes
		1 / 25	55740	3600	18.19	3.6	21.79	22 ± 2	Yes
		1 / 25	56190	3645	18.28	3.6	21.88	22 ± 2	Yes
	15	1 / 37	55315	3557.5	18.02	3.6	21.62	22 ± 2	Yes
		1 / 37	55740	3600	18.25	3.6	21.85	22 ± 2	Yes
		1 / 37	56165	3642.5	18.31	3.6	21.91	22 ± 2	Yes
	20	1 / 99	55340	3560	18.11	3.6	21.71	22 ± 2	Yes
		1 / 99	55740	3600	18.45	3.6	22.05	22 ± 2	Yes
		1 / 99	56140	3640	18.37	3.6	21.97	22 ± 2	Yes
16QAM	5	1 / 12	55265	3552.5	17.44	3.6	21.04	22 ± 2	Yes
		1 / 12	55740	3600	17.38	3.6	20.98	22 ± 2	Yes
		1 / 12	56215	3647.5	17.73	3.6	21.33	22 ± 2	Yes
	10	1 / 25	55290	3555	17.24	3.6	20.84	22 ± 2	Yes
		1 / 25	55740	3600	17.23	3.6	20.83	22 ± 2	Yes
		1 / 25	56190	3645	17.32	3.6	20.92	22 ± 2	Yes
	15	1 / 37	55315	3557.5	17.20	3.6	20.80	22 ± 2	Yes
		1 / 37	55740	3600	17.42	3.6	21.02	22 ± 2	Yes
		1 / 37	56165	3642.5	17.36	3.6	20.96	22 ± 2	Yes
	20	1 / 99	55340	3560	17.25	3.6	20.85	22 ± 2	Yes
		1 / 99	55740	3600	17.63	3.6	21.23	22 ± 2	Yes
		1 / 99	56140	3640	17.39	3.6	20.99	22 ± 2	Yes

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LTE Band 48 (3550 – 3650 MHz) EIRP/10 MHz according to FCC Part 96 / RSS-192								
Modulation	**Bandwidth (MHz)**	**Channels**	**Frequency (MHz)**	**Peak Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm/10 MHz)**	**Limit (dBm/10 MHz)**	**Margin (dBm)**
QPSK	5	55265	3552.5	18.07	3.6	21.67	23	1.33
		55740	3600	18.16	3.6	21.76	23	1.24
		56215	**3647.5**	**18.46**	**3.6**	**22.06**	**23**	**0.94**
	10	55290	3555	18.06	3.6	21.66	23	1.34
		55740	3600	18.19	3.6	21.79	23	1.21
		56190	**3645**	**18.28**	**3.6**	**21.88**	**23**	**1.12**
	15	55315	3557.5	19.06	3.6	22.66	23	0.34
		55740	**3600**	**19.30**	**3.6**	**22.90**	**23**	**0.1**
		56165	3642.5	19.17	3.6	22.77	23	0.23
	20	55340	3560	19.08	3.6	22.68	23	0.32
		55740	**3600**	**19.27**	**3.6**	**22.87**	**23**	**0.13**
		56140	3640	19.19	3.6	22.79	23	0.21
16QAM	5	55265	3552.5	17.44	3.6	21.04	23	1.96
		55740	3600	17.38	3.6	20.98	23	2.02
		56215	**3647.5**	**17.73**	**3.6**	**21.33**	**23**	**1.67**
	10	55290	3555	17.24	3.6	20.84	23	2.16
		55740	3600	17.23	3.6	20.83	23	2.17
		56190	**3645**	**17.32**	**3.6**	**20.92**	**23**	**2.08**
	15	55315	3557.5	18.14	3.6	21.74	23	1.26
		55740	3600	18.11	3.6	21.71	23	1.29
		56165	**3642.5**	**18.44**	**3.6**	**22.04**	**23**	**0.96**
	20	55340	3560	18.14	3.6	21.74	23	1.26
		55740	**3600**	**19.02**	**3.6**	**22.62**	**23**	**0.38**
		56140	3640	18.58	3.6	22.18	23	0.82

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LTE Band 48 (3650 – 3700 MHz) EIRP/25 MHz according to FCC Part 90 / RSS-197									
Modulation	Bandwidth (MHz)	RB Size/Offset	Channels	Frequency (MHz)	Tx Average Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
QPSK	5	**1 / 12**	**56265**	**3652.5**	**18.62**	**3.6**	**22.22**	**30**	**7.78**
		1 / 12	56490	3675	18.43	3.6	22.03	30	7.97
		1 / 12	56715	3697.5	18.03	3.6	21.63	30	8.37
	10	**1 / 25**	**56290**	**3655**	**18.49**	**3.6**	**22.09**	**30**	**7.91**
		1 / 25	56490	3675	18.30	3.6	21.90	30	8.1
		1 / 25	56690	3695	18.10	3.6	21.70	30	8.3
	15	1 / 37	56315	3675.5	18.80	3.6	22.40	30	7.6
		1 / 37	**56490**	**3675**	**18.95**	**3.6**	**22.55**	**30**	**7.45**
		1 / 37	56665	3692.5	18.36	3.6	21.96	30	8.04
	20	**1 / 50**	**56340**	**3660**	**18.84**	**3.6**	**22.44**	**30**	**7.56**
		1 / 50	56490	3675	18.51	3.6	22.11	30	7.89
		1 / 50	56640	3690	18.13	3.6	21.73	30	8.27
16QAM	5	**1 / 12**	**56265**	**3652.5**	**17.88**	**3.6**	**21.48**	**30**	**8.52**
		1 / 12	56490	3675	17.52	3.6	21.12	30	8.88
		1 / 12	56715	3697.5	17.15	3.6	20.75	30	9.25
	10	**1 / 25**	**56290**	**3655**	**17.61**	**3.6**	**21.21**	**30**	**8.79**
		1 / 25	56490	3675	17.33	3.6	20.93	30	9.07
		1 / 25	56690	3695	17.42	3.6	21.02	30	8.98
	15	**1 / 37**	**56315**	**3675.5**	**17.98**	**3.6**	**21.58**	**30**	**8.42**
		1 / 37	56490	3675	17.76	3.6	21.36	30	8.64
		1 / 37	56665	3692.5	17.43	3.6	21.03	30	8.97
	20	**1 / 50**	**56340**	**3660**	**18.03**	**3.6**	**21.63**	**30**	**8.37**
		1 / 50	56490	3675	17.86	3.6	21.46	30	8.54
		1 / 50	56640	3690	17.66	3.6	21.26	30	8.74

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LTE Band 48 (3650 – 3700 MHz) EIRP Density according to FCC Part 90 / RSS-197								
Modulation	**Bandwidth (MHz)**	**Channels**	**Frequency (MHz)**	**Peak Power Density (dBm / 1 MHz)**	**Antenna Gain (dBi)**	**EIRP Density (dBm / 1 MHz)**	**Limit (dBm)**	**Margin (dBm)**
QPSK	5	56265	3652.5	10.93	3.6	14.53	16.02	1.49
		56490	3675	11.11	3.6	14.71	16.02	1.31
		56715	3697.5	11.58	3.6	15.18	16.02	0.84
	10	56290	3655	8.35	3.6	11.95	16.02	4.07
		56490	3675	9.06	3.6	12.66	16.02	3.36
		56690	3695	8.05	3.6	11.65	16.02	4.37
	15	56315	3657.5	8.63	3.6	12.23	16.02	3.79
		56490	3675	8.38	3.6	11.98	16.02	4.04
		56665	3692.5	8.79	3.6	12.39	16.02	3.63
	20	56340	3660	7.11	3.6	10.71	16.02	5.31
		56490	3675	6.33	3.6	9.93	16.02	6.09
		56640	3690	7.70	3.6	11.3	16.02	4.72
16QAM	5	56265	3652.5	9.58	3.6	13.18	16.02	2.84
		56490	3675	9.63	3.6	13.23	16.02	2.79
		56715	3697.5	10.43	3.6	14.03	16.02	1.99
	10	56290	3655	7.42	3.6	11.02	16.02	5.0
		56490	3675	7.02	3.6	10.62	16.02	5.40
		56690	3695	7.25	3.6	10.85	16.02	5.17
	15	56315	3657.5	7.34	3.6	10.94	16.02	5.08
		56490	3675	7.85	3.6	11.45	16.02	4.57
		56665	3692.5	6.88	3.6	10.48	16.02	5.54
	20	56340	3660	6.14	3.6	9.74	16.02	6.28
		56490	3675	5.32	3.6	8.92	16.02	7.10
		56640	3690	6.09	3.6	9.69	16.02	6.33

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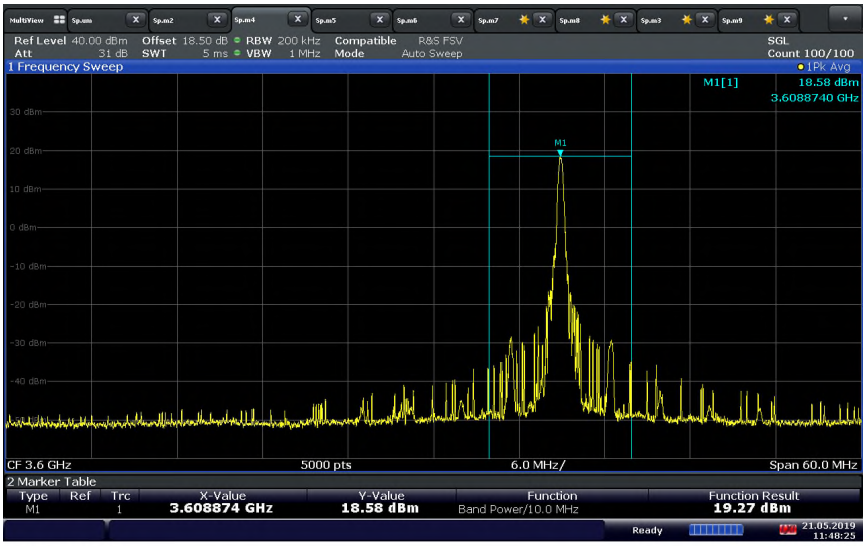
2.2.9 Sample Test Measurement Screen



11:48:26 21.05.2019

LTE Band 48 (3550 – 3650 MHz) 20 MHz Bandwidth Middle Channel 3600 MHz 1RB 99 offset QPSK EIRP/10 MHz

12:37:43 21.05.2019

LTE Band 48 (3650 – 3700 MHz) 5 MHz Bandwidth Middle Channel 3675 MHz QPSK Power Spectral Density

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2.3 OCCUPIED BANDWIDTH

2.3.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1049
FCC 47 CFR Part 96, Clause 96.41 (e)(3)
FCC 47 CFR Part 90, Clause 90.1323 (a)
RSS-192, Clause 5.5
RSS-197, Clause 5.7
RSS-GEN, Clause 6.7

2.3.2 Standard Applicable

The transmitted signal bandwidth shall be reported as the 99% emission bandwidth, that is the frequency bandwidth suuch that, below its lower and above its upper frequency limits, the mean powers radiated are eqch equal to 0.5 percent of the total mean power radiated by a give emission.

26dB 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 by at least 26 dB below the transmitter power.

Using the occupied bandwidth meansurement function in the spectrum analyzer, the 99% occupied bandwith was measured.

In addition, the 26dB bandwidth was measured in accorance with FCC KDB 971168 D01 v03r01 Clause 4.1 using the ndB measurement function in the spectrum analyzer.

2.3.3 Equipment Under Test and Modification State

Serial No: 990013090027496 (IMEI) / Test Configuration A

2.3.4 Date of Test/Initial of test personnel who performed the test

March 17 and 18, 2019 / XYZ

2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.1 - 25.6 °C
Relative Humidity	41.3 - 44.8 %
ATM Pressure	98.8 - 99.1 kPa

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2.3.7 Additional Observations

- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- Using the occupied bandwidth meansurement function in the spectrum analyzer, the 99% occupied bandwith was measured.
- The 26dB bandwidth was measured in accorance with ANSI C63.26 clause 5.4.3 using the ndB measurement function in the spectrum analyzer.
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

2.3.8 Test Results

LTE Band 48 (3550 – 3650 MHz)					
Modulation	***Bandwidth (MHz)***	***Channel***	***Frequency (MHz)***	***99% OBW (MHz)***	***26dB BW (MHz)***
QPSK	5	55740	3600	4.47	4.84
	10			8.94	9.61
	15			13.44	14.49
	20			17.88	19.04
16QAM	5	55740	3600	4.48	4.84
	10			8.94	9.69
	15			13.44	14.66
	20			17.86	19.13

LTE Band 48 (3650 – 3700 MHz)					
Modulation	***Bandwidth (MHz)***	***Channel***	***Frequency (MHz)***	***99% OBW (MHz)***	***26dB BW (MHz)***
QPSK	5	56490	3675	4.47	4.85
	10			8.95	9.67
	15			13.43	14.44
	20			17.86	19.12
16QAM	5	56490	3675	4.49	4.87
	10			8.94	9.62
	15			13.44	14.42
	20			17.87	19.16

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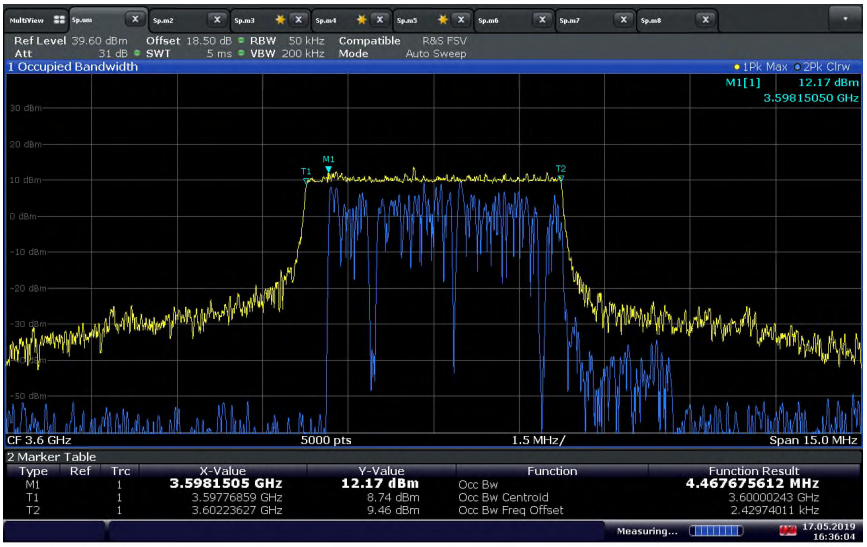
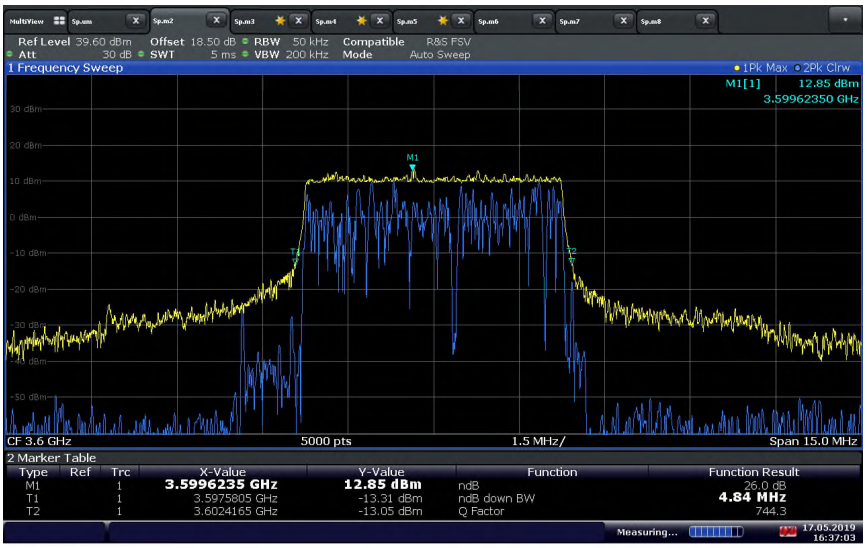
2.3.9 Example Test Plots

LTE Band 48 (3550 – 3650 MHz)_5 MHz BW / Middle Channel 3600 MHz / QPSK / 99%OBW



16:36:05 17.05.2019

LTE Band 48 (3550 – 3650 MHz)_5 MHz BW / Middle Channel 3600 MHz / QPSK / 26dB BW



16:37:03 17.05.2019

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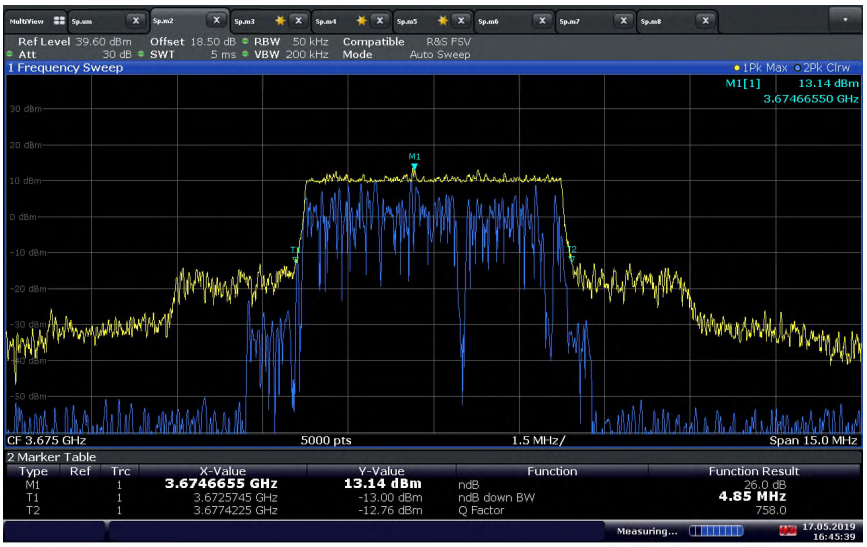
LTE Band 48 (3650 – 3700 MHz)_5 MHz BW / Middle Channel 3675 MHz / QPSK / 99%OBW

16:46:19 17.05.2019

LTE Band 48 (3650 – 3700 MHz)_5 MHz BW / Middle Channel 3675 MHz / QPSK / 26dB BW



16:45:39 17.05.2019

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2.4 SPURIOUS EMISSION AT BAND EDGE

2.4.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 96, Clause 96.41(e)(1)(3)
FCC 47 CFR Part 90, Clause 90.1323(a)
RSS-192, Clause 5.5
RSS-197, Clause 5.7

2.4.2 Standard Applicable

FCC 47 CFR Part 96.41:
(e) 3.5 GHz Emissions and Interference Limits - (1) General protection levels. Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the uper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed -25 dBm/MHz. The upper and lower SAS assigned channel edges are the upper and lower limits of any channel assigned to a CBSD by an SAS, or in the case of multiple contiguous channels, the upper and lower limits of the combined contiguous channels.

RSS-192, Clause 5.5:
The unwanted emissions shall comply with the following limits:
(i) In any 30 kHz bandwidth, the unwanted emission spectral density that is relative to the inband spectral density shall be attenuated at least to the limits shown in Table 1 according to the equipment modulation. The attenuation shall be linearly interpolated between the turning point attenuation limits.

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Table 1: Attenuation of Unwanted Emission Limits for Various Access Schemes

Orthogonal Frequency Division Multiple Access (OFDMA)

Turning Point (F/ChS)	0	0.21	0.56	1.5	2
EMO = 2	8 dB	25 dB	27 dB	50 dB	50 dB
EMO = 4	8 dB	27 dB	32 dB	50 dB	50 dB
EMO = 6	8 dB	32 dB	38 dB	50 dB	50 dB

Code Division Multiple Access (CDMA)

Turning Point (F/ChS)	0	0.3	0.5	1	2
EMO Not applicable	0 dB	25 dB	25 dB	45 dB	45 dB

Frequency Division Multiple Access (FDMA)

Turning Point (F/ChS)	0	0.1	0.35	1	2
EMO = 2	23 dB	25 dB	25 dB	45 dB	45 dB
EMO = 3	27 dB	29 dB	29 dB	45 dB	45 dB
EMO = 4 or 6	31 dB	33 dB	33 dB	45 dB	45 dB

Time Division Multiple Access (TDMA)

Turning Point (F/ChS)	0	0.3	0.56	1.5	2
EMO = 2	Not applicable	25 dB	25 dB	45 dB	45 dB
EMO = 4	Not applicable	32 dB	37 dB	45 dB	45 dB
EMO = 6	13 dB	34 dB	42 dB	45 dB	45 dB

The offset frequency from the block edge, F, at each turning point can be determined as follows:
F = ChS * (Turning Point); where ChS is defined as the frequency spacing between the centre frequencies of two adjacent channels.

EMO is the equivalent modulation order of the transmitter, defined as log2(number of discrete states which may be assigned to each symbol). For example, for quadrature amplitude modulation (QAM):

2 = 4 QAM
4 = 16 QAM
6 = 64 QAM

(ii) In any 1.0 MHz band that is removed from the assigned centre frequency by more than ±250% of the necessary bandwidth, the power of any emission must be attenuated below P_{mean} by at least 43 + 10 log10(P_{mean}) dB, or 70 dB, whichever is less stringent. Pmean is the mean output power of the transmitter in watts.

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FCC 47 CFR Part 90.1323:
(a) The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or less, but at least one percent of the emission bandwidth of the fundamental emission of the transmitter, provided the measured energy is integrated over a 1 MHz bandwidth.

RSS-197, Clause 5.7:
The unwanted emissions shall be measured at the frequencies of the highest and lowest channel of all bandwidths and types of modulation that the equipment can operate with a resolution bandwidth of 1 MHz or less, but at least 1% of the occupied bandwidth of the transmitter, provided that the measured power is integrated over a 1 MHz bandwidth.

The power of any emissions outside the frequency band 3650-3700 MHz shall be attenuated below the channel transmitter power P (dBW) by 43 + 10 Log (p), where p is measured in watts.

2.4.3 Equipment Under Test and Modification State

Serial No: 990013090027496 and 990013090023966 (IMEI) / Test Configuration A

2.4.4 Date of Test/Initial of test personnel who performed the test

May 21, 2019 / XYZ

2.4.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.5 °C
Relative Humidity	44.1 %
ATM Pressure	98.9 kPa

2.4.7 Additional Observations

- This is a conducted test.
- The path loss were measured and entered as a level offset.
- All channel bandwidth, RB Size and offset and modulation are verified. Only the worst case modulation (QPSK) for band edge verification presented in this test report.

2.4.8 Test Results

See attached test plots.

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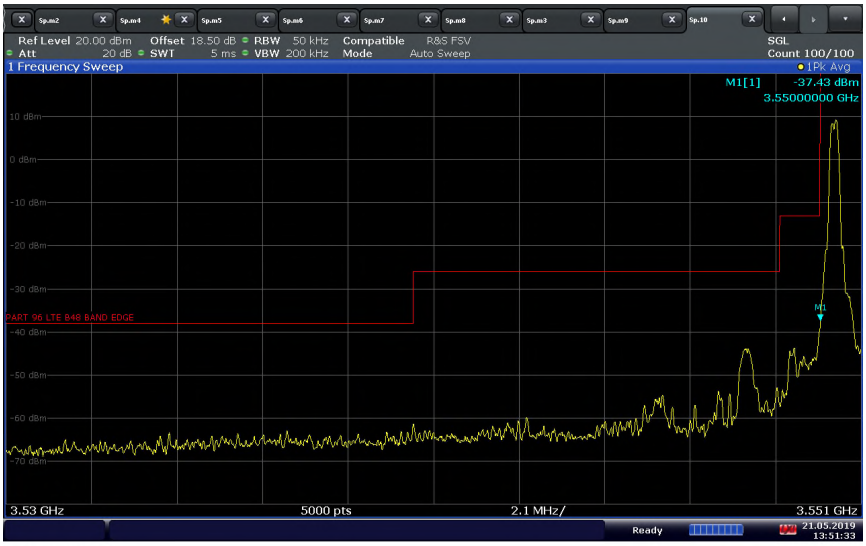
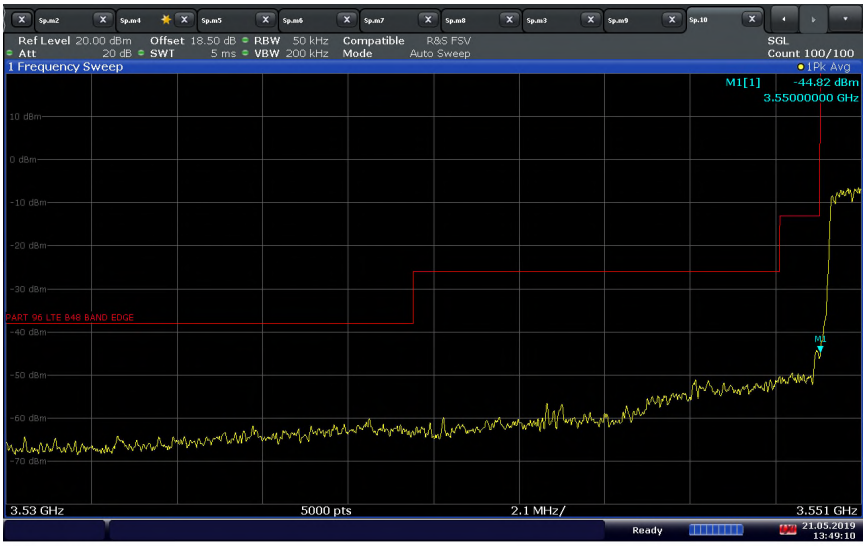
LTE Band 48 (3550 – 3650 MHz)_5 MHz BW / QPSK / Low Channel 3552.5 MHz 1 RB 0 offset
Low Band Edge



13:51:33 21.05.2019

LTE Band 48 (3550 – 3650 MHz)_5 MHz BW / QPSK / Low Channel 3552.5 MHz Full RB
Low Band Edge



13:49:11 21.05.2019

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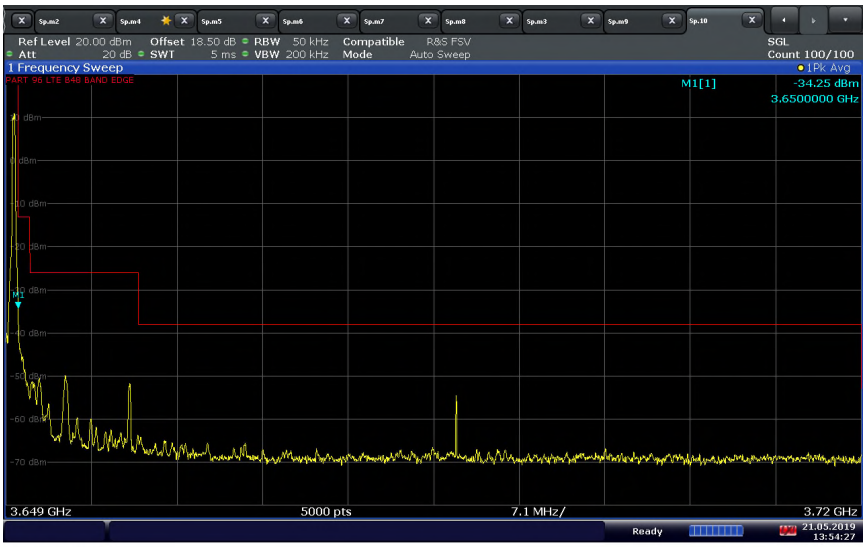
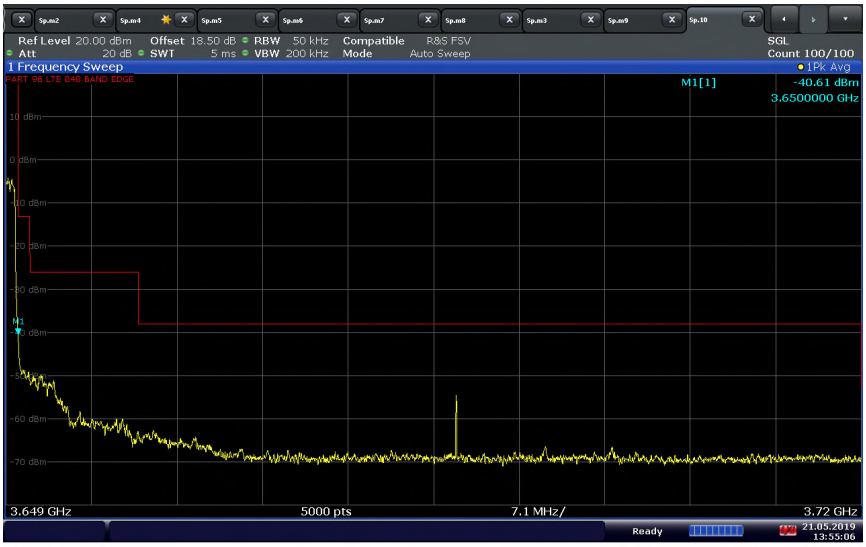
LTE Band 48 (3550 – 3650 MHz)_5 MHz BW / QPSK / High Channel 3647.5 MHz 1 RB 24 offset
High Band Edge



13:54:27 21.05.2019

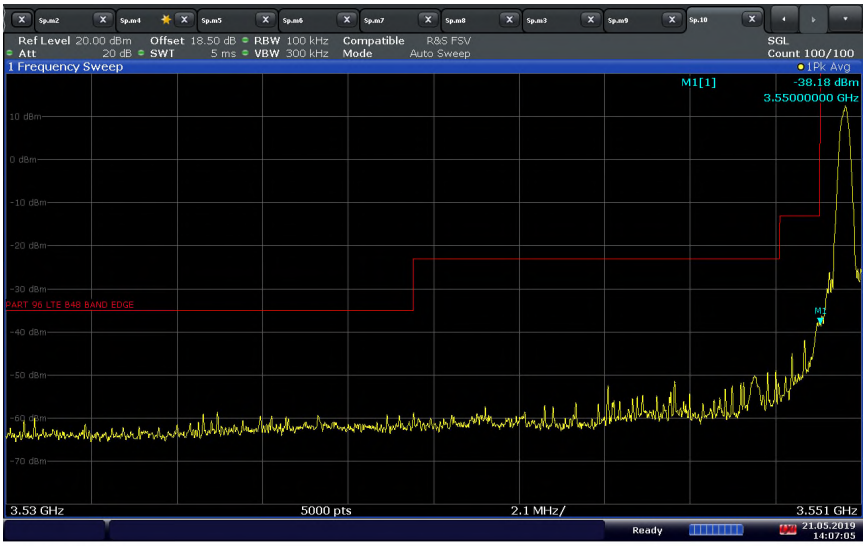
LTE Band 48 (3550 – 3650 MHz)_5 MHz BW / QPSK / High Channel 3647.5 MHz Full RB
High Band Edge



13:55:06 21.05.2019

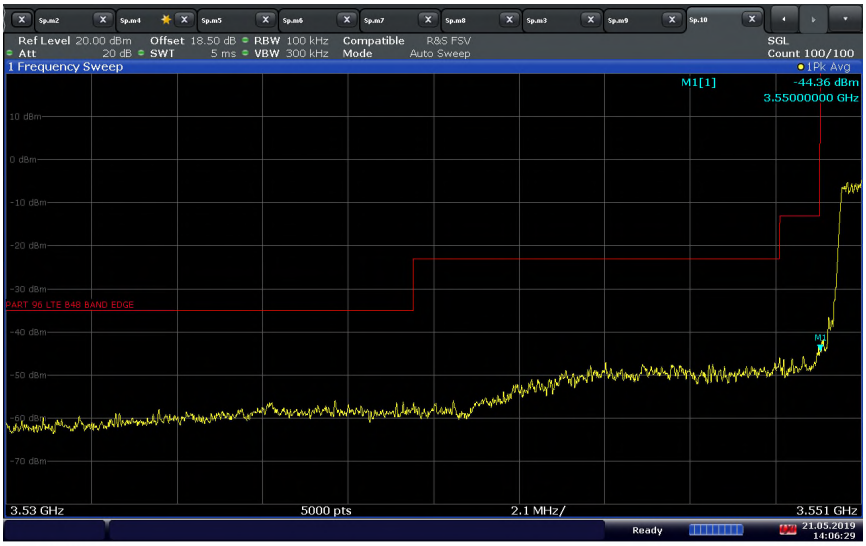
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3550 – 3650 MHz)_10 MHz BW / QPSK / Low Channel 3555 MHz 1 RB 0 offset
Low Band Edge



14:07:06 21.05.2019

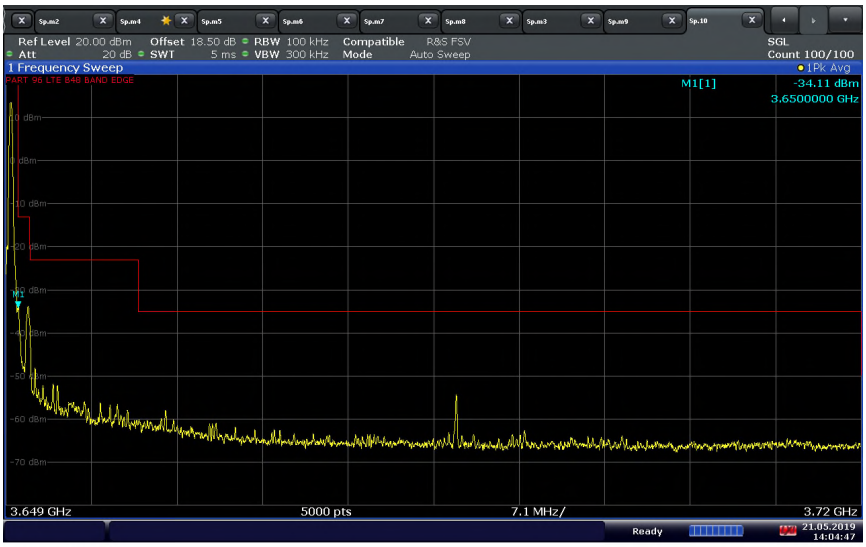
LTE Band 48 (3550 – 3650 MHz)_10 MHz BW / QPSK / Low Channel 3555 MHz Full RB
Low Band Edge



14:06:29 21.05.2019

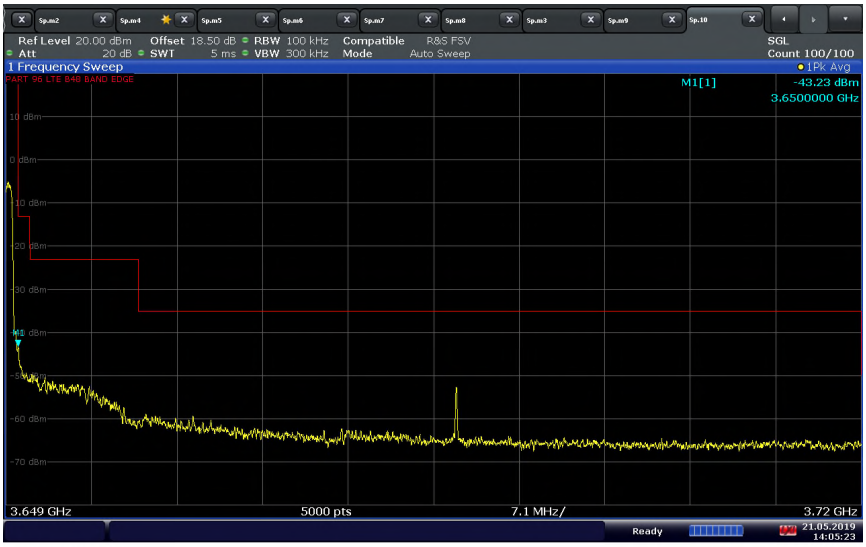
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3550 – 3650 MHz)_10 MHz BW / QPSK / High Channel 3645 MHz 1 RB 49 offset
High Band Edge



14:04:47 21.05.2019

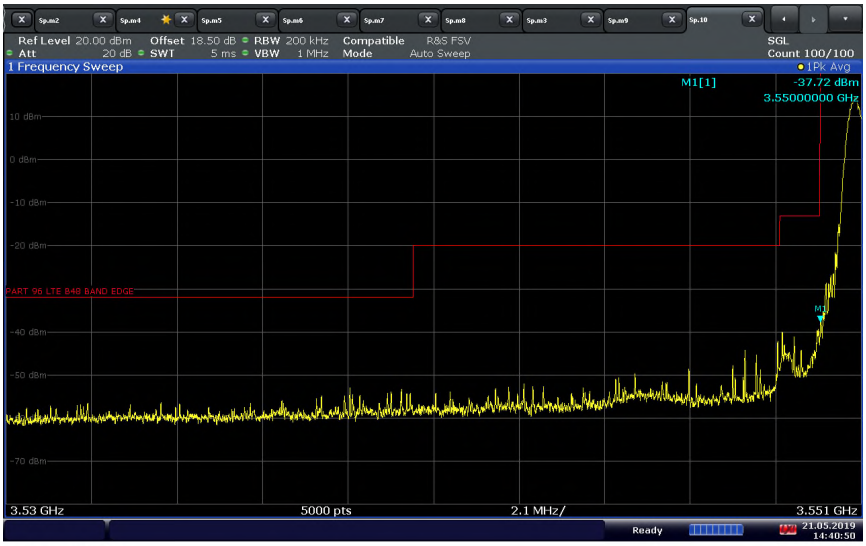
LTE Band 48 (3550 – 3650 MHz)_10 MHz BW / QPSK / High Channel 3645 MHz Full RB
High Band Edge



14:05:24 21.05.2019

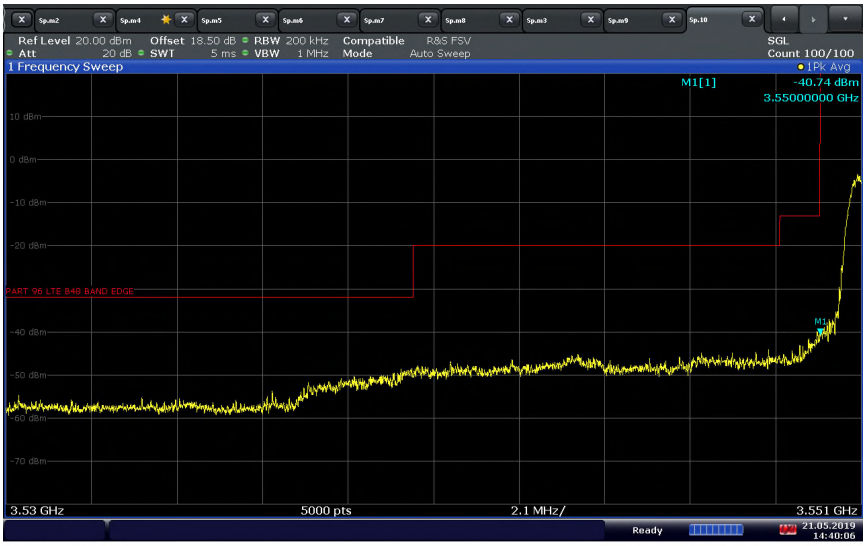
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3550 – 3650 MHz)_15 MHz BW / QPSK / Low Channel 3557.5 MHz 1 RB 0 offset
Low Band Edge



14:40:51 21.05.2019

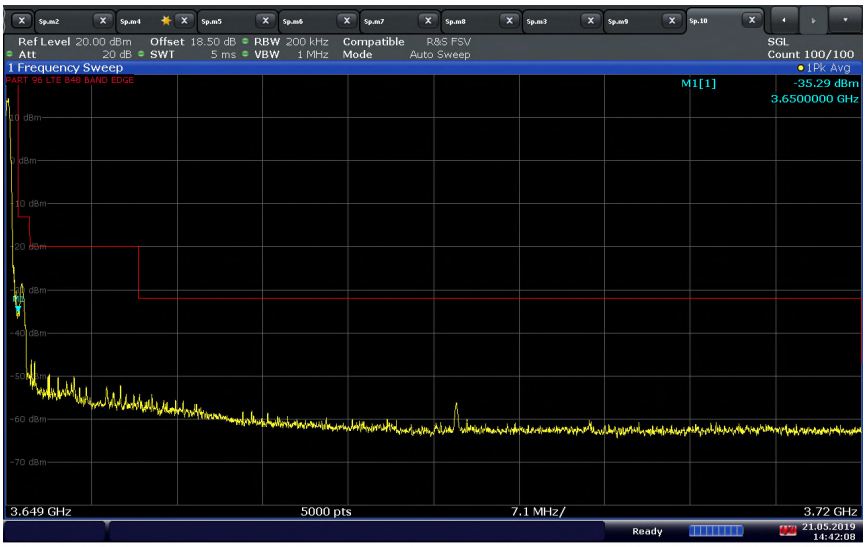
LTE Band 48 (3550 – 3650 MHz)_15 MHz BW / QPSK / Low Channel 3557.5 MHz Full RB
Low Band Edge



14:40:07 21.05.2019

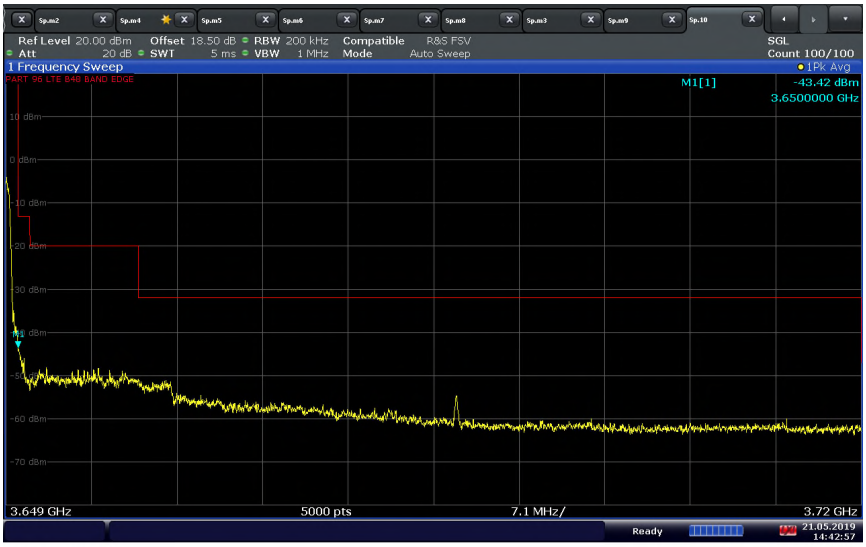
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3550 – 3650 MHz)_15 MHz BW / QPSK / High Channel 3642.5 MHz 1 RB 74 offset
High Band Edge



14:42:08 21.05.2019

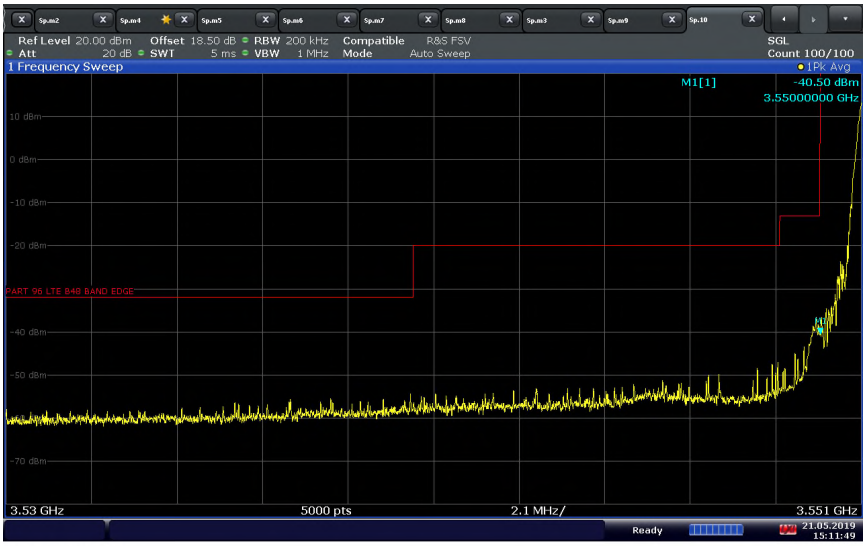
LTE Band 48 (3550 – 3650 MHz)_15 MHz BW / QPSK / High Channel 3642.5 MHz Full RB
High Band Edge



14:42:57 21.05.2019

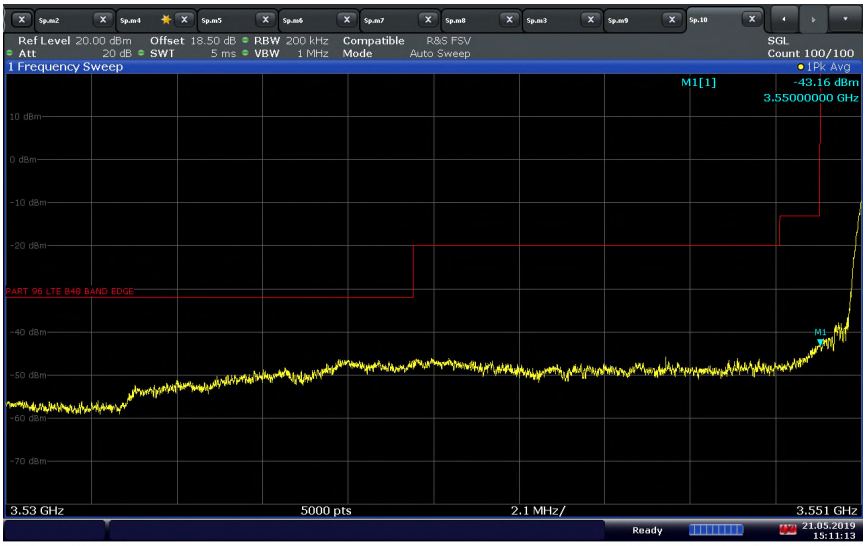
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3550 – 3650 MHz)_20 MHz BW / QPSK / Low Channel 3560 MHz 1 RB 0 offset
Low Band Edge



15:11:50 21.05.2019

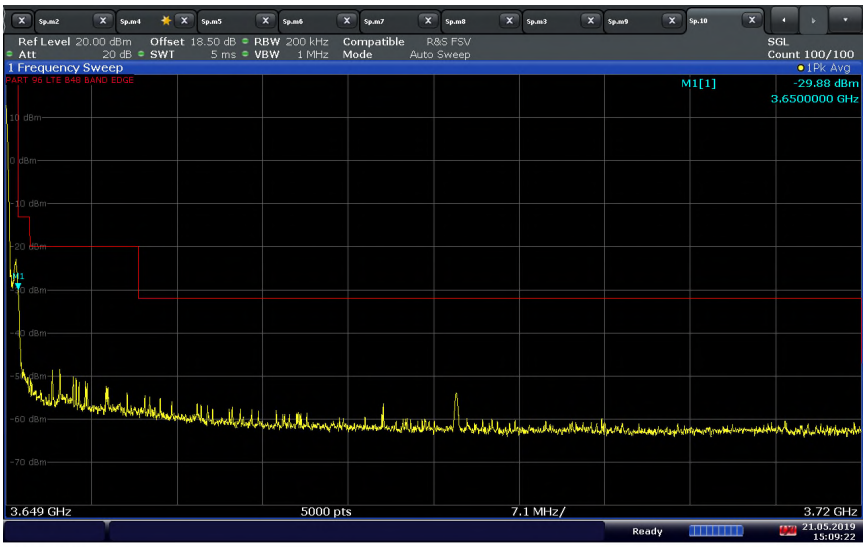
LTE Band 48 (3550 – 3650 MHz)_20 MHz BW / QPSK / Low Channel 3560 MHz Full RB
Low Band Edge



15:11:13 21.05.2019

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3550 – 3650 MHz)_20 MHz BW / QPSK / High Channel 3640 MHz 1 RB 99 offset
High Band Edge



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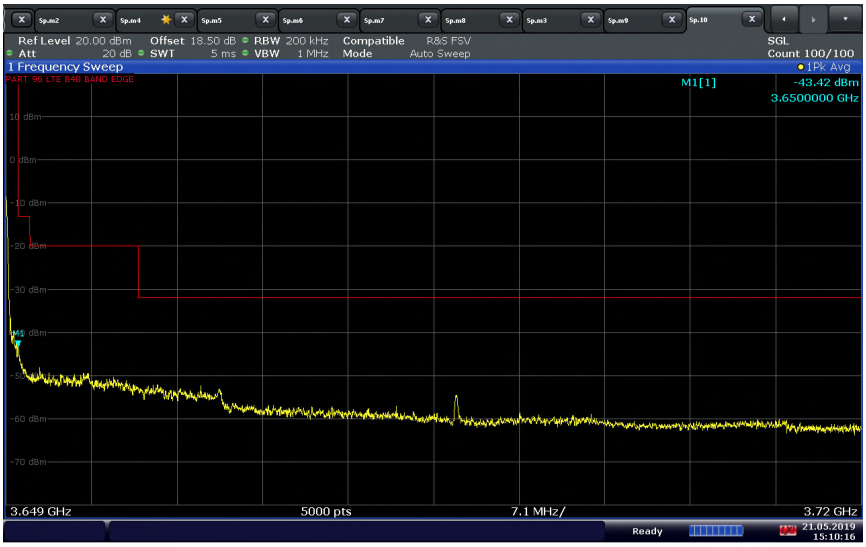
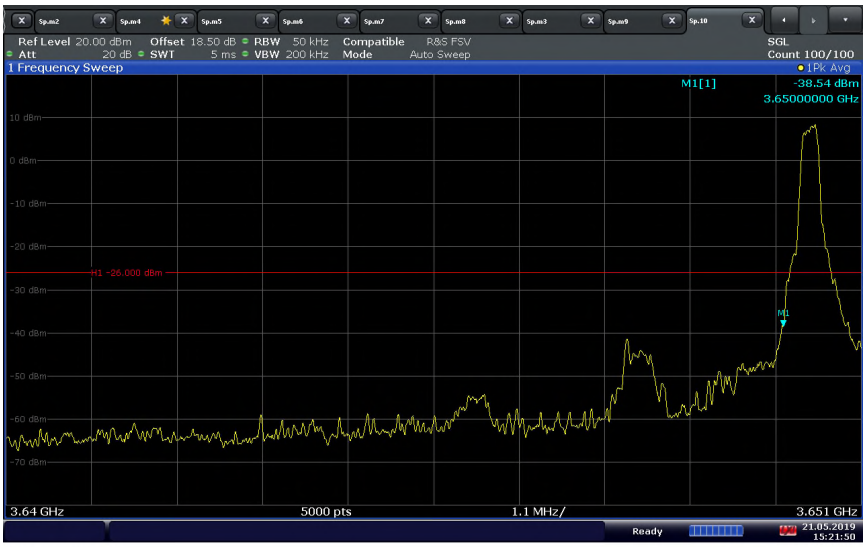
LTE Band 48 (3550 – 3650 MHz)_20 MHz BW / QPSK / High Channel 3640 MHz Full RB
High Band Edge



15:10:16 21.05.2019

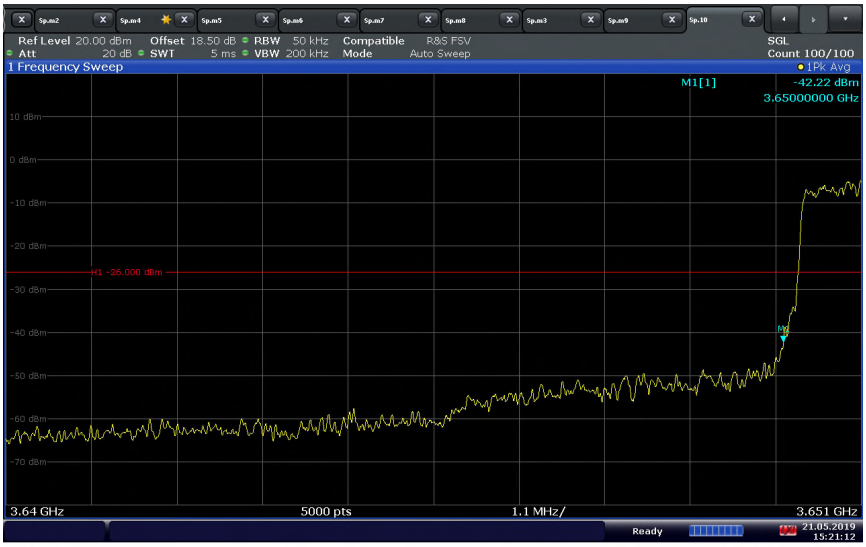
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_5 MHz BW / QPSK / Low Channel 3652.5 MHz 1 RB 0 offset
Low Band Edge



15:21:50 21.05.2019

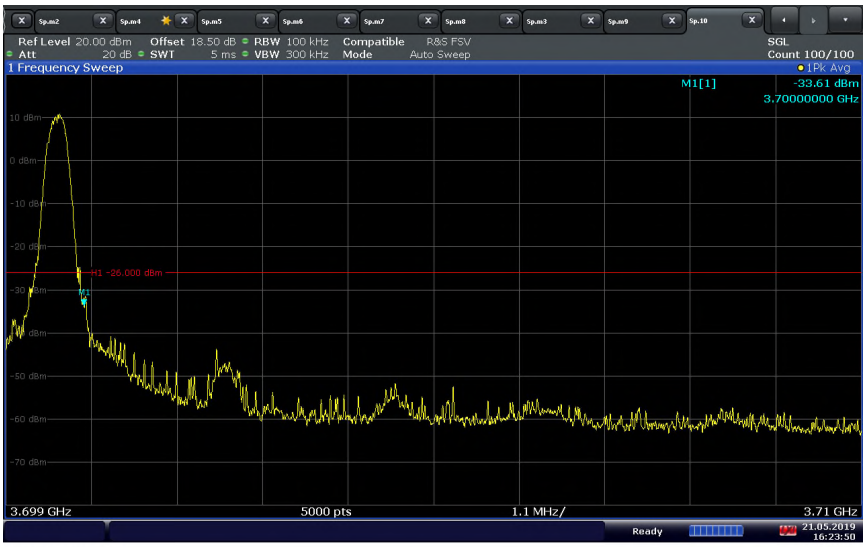
LTE Band 48 (3650 – 3700 MHz)_5 MHz BW / QPSK / Low Channel 3652.5 MHz Full RB
Low Band Edge



15:21:12 21.05.2019

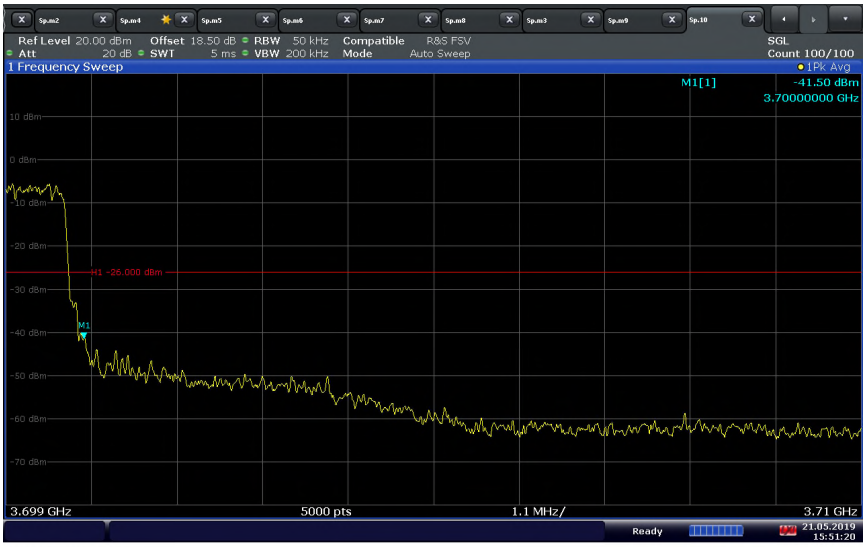
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_5 MHz BW / QPSK / High Channel 3697.5 MHz 1 RB 24 offset
High Band Edge



16:23:50 21.05.2019

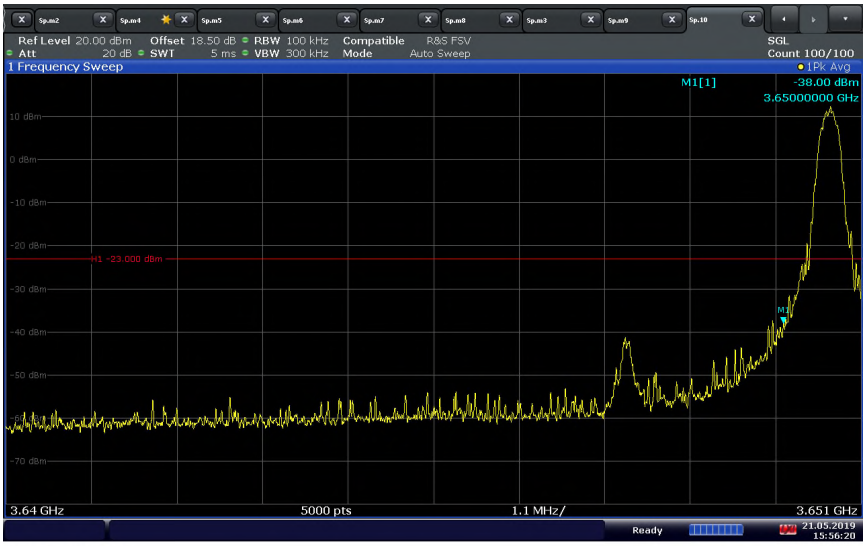
LTE Band 48 (3650 – 3700 MHz)_5 MHz BW / QPSK / High Channel 3697.5 MHz Full RB
High Band Edge



15:51:21 21.05.2019

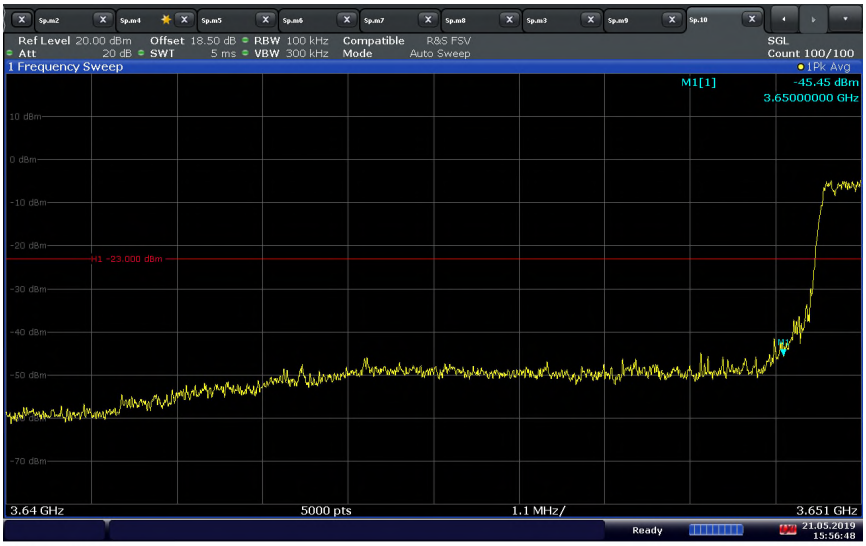
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_10 MHz BW / QPSK / Low Channel 3655 MHz 1 RB 0 offset
Low Band Edge



15:56:21 21.05.2019

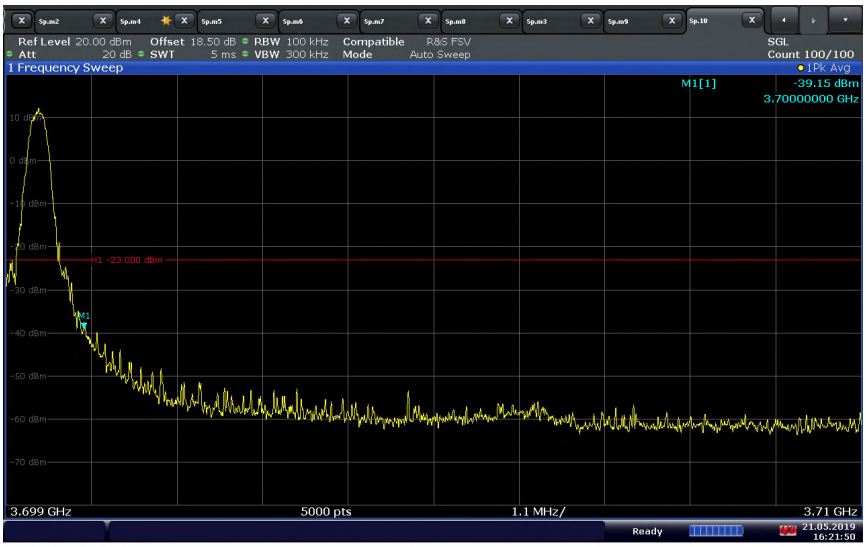
LTE Band 48 (3650 – 3700 MHz)_10 MHz BW / QPSK / Low Channel 3655 MHz Full RB
Low Band Edge



15:56:48 21.05.2019

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_10 MHz BW / QPSK / High Channel 3695 MHz 1 RB 49 offset
High Band Edge



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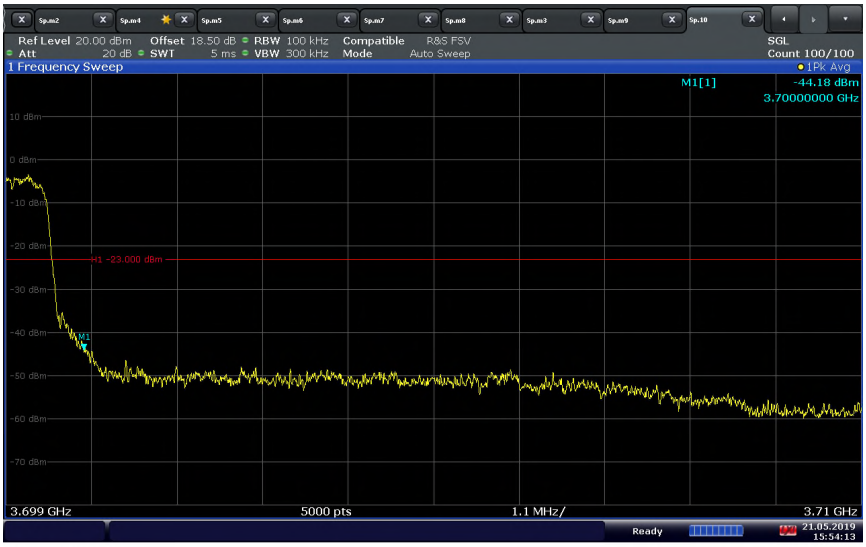
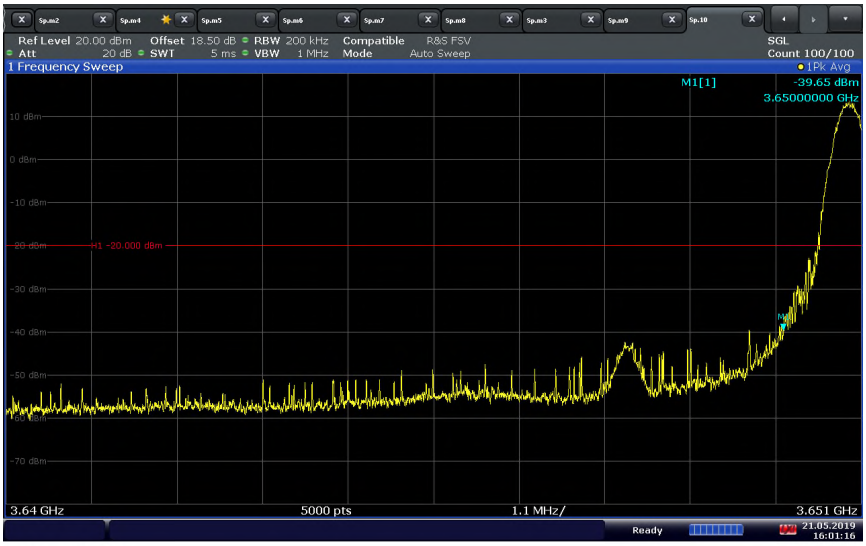
LTE Band 48 (3650 – 3700 MHz)_10 MHz BW / QPSK / High Channel 3695 MHz Full RB
High Band Edge



15:54:14 21.05.2019

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_15 MHz BW / QPSK / Low Channel 3657.5 MHz 1 RB 0 offset
Low Band Edge



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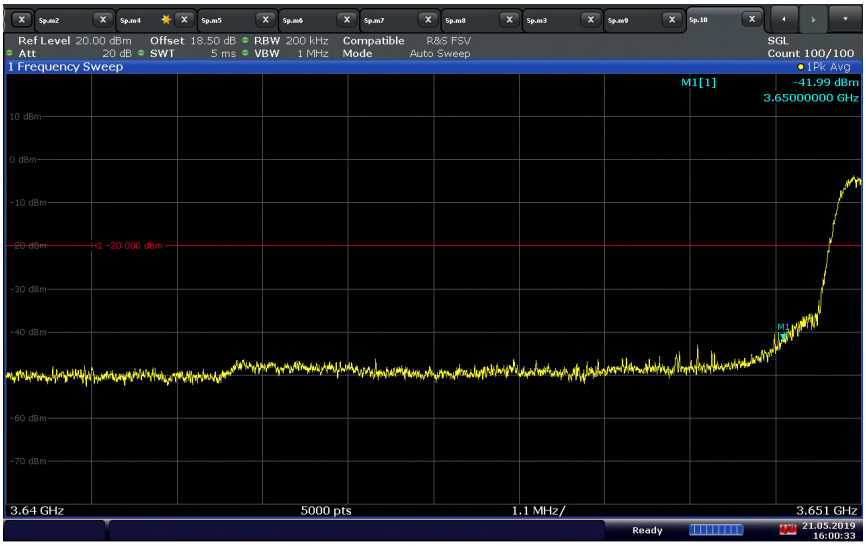
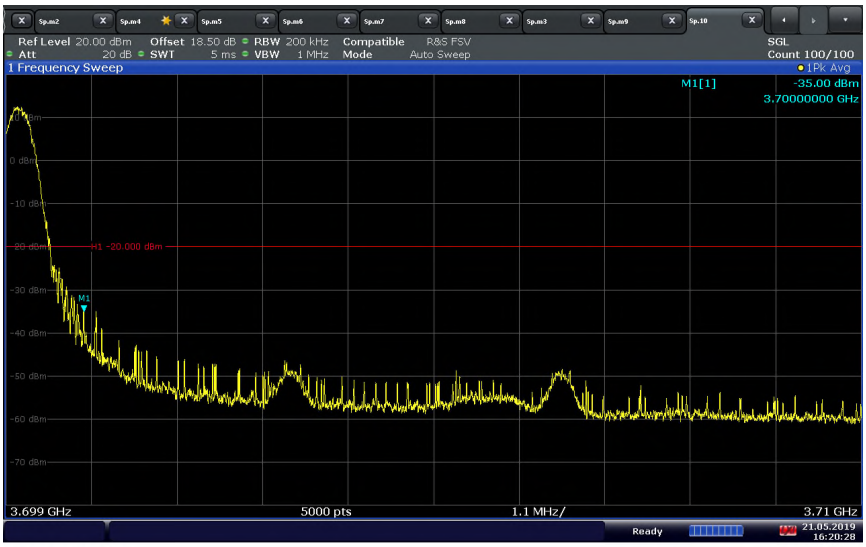
LTE Band 48 (3650 – 3700 MHz)_15 MHz BW / QPSK / Low Channel 3657.5 MHz Full RB
Low Band Edge



16:00:33 21.05.2019

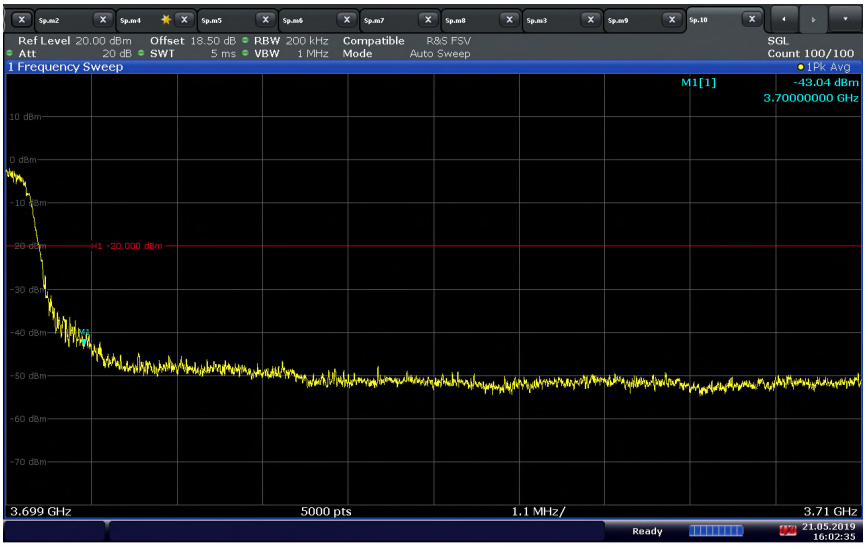
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_15 MHz BW / QPSK / High Channel 3692.5 MHz 1 RB 74 offset
High Band Edge



16:20:28 21.05.2019

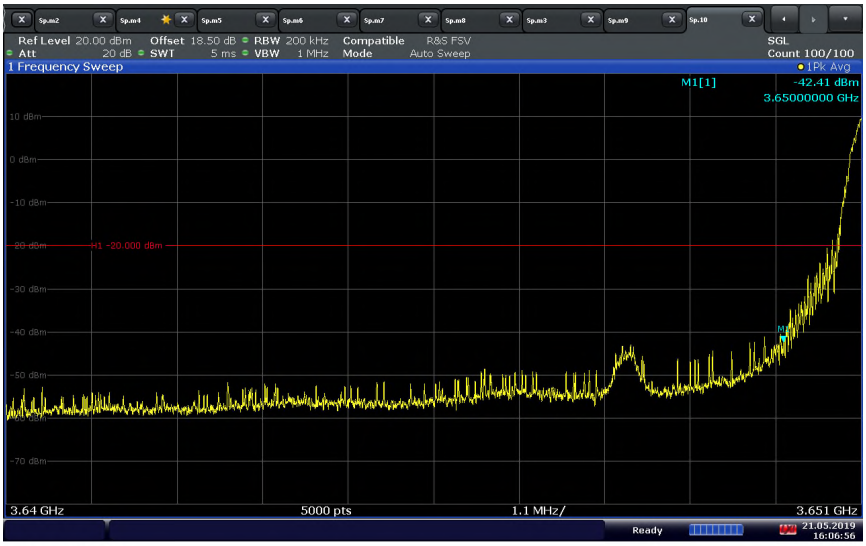
LTE Band 48 (3650 – 3700 MHz)_15 MHz BW / QPSK / High Channel 3692.5 MHz Full RB
High Band Edge



16:02:36 21.05.2019

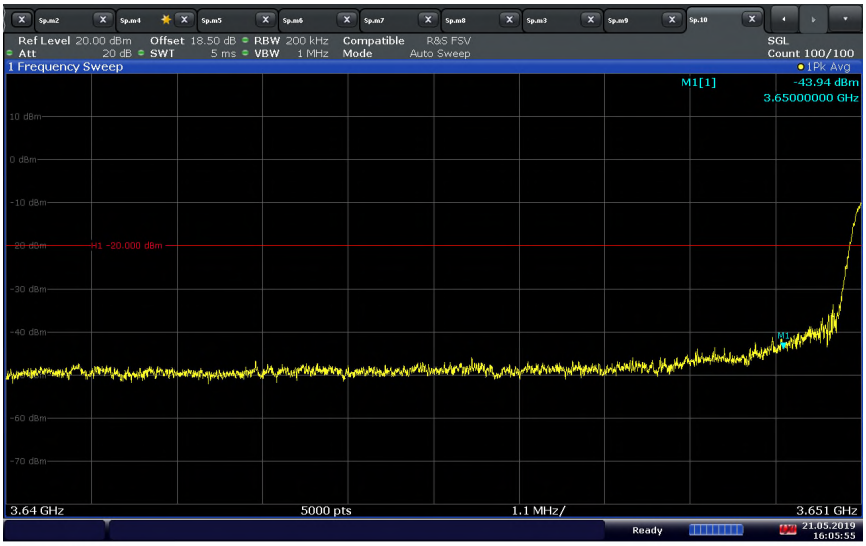
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_20 MHz BW / QPSK / Low Channel 3660 MHz 1 RB 0 offset
Low Band Edge



16:06:57 21.05.2019

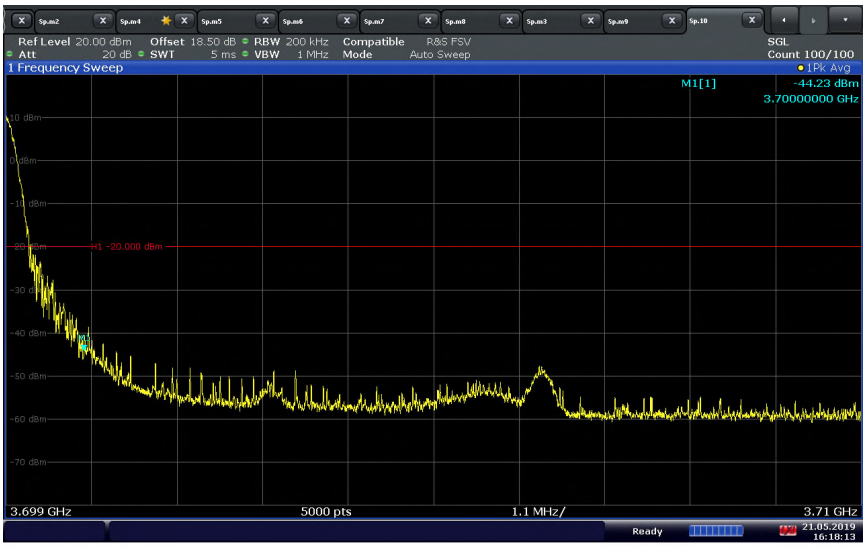
LTE Band 48 (3650 – 3700 MHz)_20 MHz BW / QPSK / Low Channel 3660 MHz Full RB
Low Band Edge



16:05:55 21.05.2019

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 48 (3650 – 3700 MHz)_20 MHz BW / QPSK / High Channel 3690 MHz 1 RB 99 offset
High Band Edge



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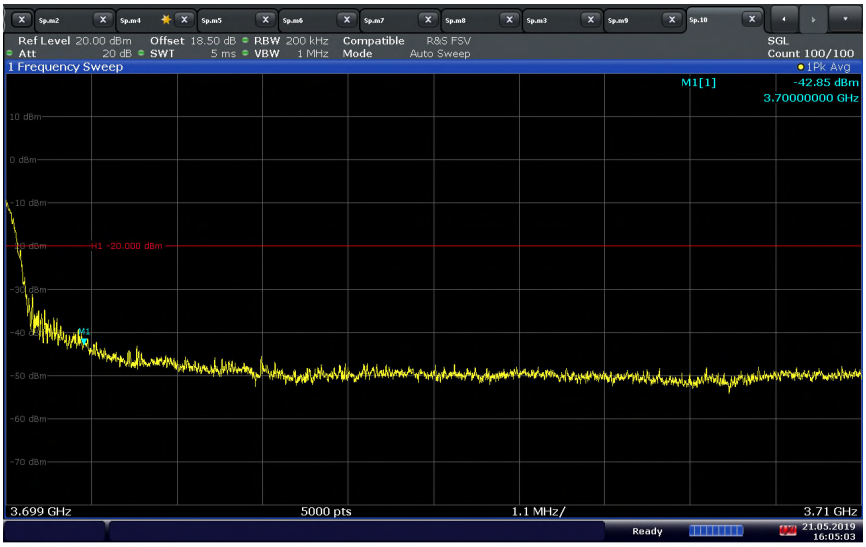
LTE Band 48 (3650 – 3700 MHz)_20 MHz BW / QPSK / High Channel 3690 MHz Full RB
High Band Edge



16:05:04 21.05.2019

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364