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Report On

Application for Grant of Equipment Authorization of the
Nextivity Inc.

QUATRA 4000 Industrial Signal Booster

FCC CFR 47 Part 2 and 27

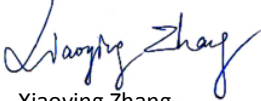
RSS-Gen, RSS-139, RSS-130 and RSS-195

Report No. 72154394B

December 2019

FCC ID: NU: YETI44-1234CNU
CU: YETI41-5ECU
IC: NU: 9298A-I441234CNU
CU: 9298A-I415ECU
Report No. 72154394B



REPORT ON	Radio Testing of the Nextivity Inc. QUATRA 4000 Industrial Signal Booster
TEST REPORT NUMBER	72154394B
PREPARED FOR	Nextivity Inc. 16550 West Bernardo Drive, Bldg 5, Suite 550, San Diego, CA 92127, USA
CONTACT PERSON	CK Li Sr. Principal Engineer, Regulatory CLi@NextivityInc.com (858) 485-9442
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	December 19, 2019

FCC ID: NU: YETI44-1234CNU
CU: YETI41-5ECU
IC: NU: 9298A-I441234CNU
CU: 9298A-I415ECU
Report No. 72154394B



Revision History

72154394B Nextivity Inc. QUATRA 4000 Industrial Signal Booster					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
12/19/19	-	Initial Release			Ferdinand S. Custodio



CONTENTS

Section	Page No
1	REPORT SUMMARY 5
1.1	Introduction 6
1.2	Brief Summary of Results 8
1.3	Product Information 9
1.4	EUT Test configuration 13
1.5	Deviations from the Standard 18
1.6	Modification Record 18
1.7	Test Methodology 18
1.8	Test Facility Location 18
1.9	Test Facility Registration 18
1.10	Sample Calculations 20
2	TEST DETAILS 21
2.1	Transmitter Conducted Output Power 22
2.2	Effective Isotropic Radiated Power 36
2.3	Effective Radiated Power 40
2.4	Occupied Bandwidth 45
2.5	Peak-Average Ratio 80
2.6	Band Edge 92
2.7	Conducted Spurious Emissions 122
2.8	Field Strength of Spurious Radiation 168
2.9	Frequency Stability 205
2.10	Power Line Conducted Emissions 226
3	TEST EQUIPMENT USED 230
3.1	Test Equipment Used 231
3.2	Measurement Uncertainty 232
4	DIAGRAM OF TEST SETUP 234
4.1	Test Setup Diagram 235
5	ACCREDITATION, DISCLAIMERS AND COPYRIGHT 239
5.1	Accreditation, Disclaimers and Copyright 240

FCC ID: NU: YETI44-1234CNU
CU: YETI41-5ECU
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CU: 9298A-I415ECU
Report No. 72154394B



SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
QUATRA 4000 Industrial Signal Booster



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Nextivity Inc. QUATRA 4000 Industrial Signal Booster to the requirements of the following:

- FCC CFR 47 Part 2 and 27
- RSS-Gen, RSS-139, RSS-130 and RSS-195

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	Nextivity Inc.
Trade Name	Cel-Fi™
Model Name	QUATRA 4000
Model Number(s)	NU: I44-1234CNU CU: I41-5ECU
FCC ID	NU: YETI44-1234CNU CU: YETI41-5ECU
IC Number	NU: 9298A-I441234CNU CU: 9298A-I415ECU
Serial Number(s)	370920000139 (NU) and 371929000156 (CU)
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC CFR 47 Part 2 and 27 (October 1, 2018). • RSS-139 - Advanced Wireless Services (AWS) Equipment Operating in the bands 1710-1780 MHz and 2110-2180 MHz (Issue 3, July 2015). • SRSP-513 - Technical Requirements for Advanced Wireless Services (AWS) in the Bands 1710-1780 MHz and 2110-2180 MHz (Issue 3, July 2015). • RSS-130 - Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz (Issue 2, February 2019). • SRSP-518 - Technical Requirements in the Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz (Issue 2, February 2019). • RSS-195 - Wireless Communication Service (WCS) Equipment Operating in the Bands 2305-2320 MHz and 2345-2360 MHz (Issue 2, April 2014). • SRSP-516 - Technical Requirements for Wireless Communication Service (WCS) Operating in the Bands 2305-2320 MHz and 2345-2360 MHz (Issue 1, April 2014). • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 5, November 2019 Amendment 1). • ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

FCC ID: NU: YETI44-1234CNU
CU: YETI41-5ECU
IC: NU: 9298A-I441234CNU
CU: 9298A-I415ECU
Report No. 72154394B



Start of Test	August 02, 2019
Finish of Test	September 07, 2019
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	• KDB971168 D01 Power Meas License Digital Systems v03r01 (Measurement Guidance For Certification of Licensed Digital Transmitters) • KDB412172 D01 Determining ERP and EIRP v01r01 (Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System) • Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2 and 27 and 20.21(c) with cross-reference to the corresponding ISSED RSS standards is shown below.

Section	Spec Clause					Test Description	Result
	FCC Part 2	FCC Part 27	RSS-139	RSS-130	RSS-195		
2.1	2.1046	-	-	-	-	Transmitter Conducted Output Power	Compliant
2.2	-	27.50 (h)(1) 27.50 (a)(1)	6.5	-	5.5	Equivalent Isotropic Radiated Power	Compliant
2.3	-	27.50 (c)(3) 27.50 (b)(4)	-	4.6.3	-	Equivalent Radiated Power	Compliant
2.4	2.1049	-	RSS-Gen 6.7			Occupied Bandwidth	Compliant
2.5	-	27.50 (d)(5)	6.5	4.6.1	5.5.1	Peak-Average Ratio	Compliant
2.6	2.1051	27.53 (h)(1),(3) 27.53 (g) 27.53 (c)(1),(2),(5)	6.6	4.7	5.6.1	Band Edge	Compliant
2.7	2.1051	27.53 (h)(1),(3) 27.53 (g) 27.53 (c)(1),(2),(3), (4),(5) (6) and (f)	6.6	4.7	5.6.1	Conducted Spurious Emissions	Compliant
2.8	2.1053	27.53 (h)(1) 27.53 (g) 27.53 (c)(1),(2), (5)	6.6	4.7	5.6.1	Field Strength of Spurious Radiation	Compliant
2.9	2.1055	27.54	6.4	4.5	5.4	Frequency Stability	Compliant
-	-	-	RSS-Gen 7.1			Receiver Spurious Emissions	N/A
2.10	15.207 (a)	-	RSS-Gen 8.8			Power Line Conducted Emission	Compliant

N/A: Not required as per RSS-GEN 5.3. EUT is not a Stand-Alone receiver.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Nextivity Inc. QUATRA 4000 Industrial Signal Booster. The EUT is a WCDMA/LTE Signal Booster to improve voice and data cellular performance in large enterprise environments. Quatra 4000 is capable to support up to four carriers (via separate donor antenna ports). Quatra 4000 consists of two separate units: the Network Unit (NU), and the Coverage Unit (CU). The NU comprises a transmitter and receiver which communicate with the cell tower and the CU. CU comprises a transmitter and receiver which communicate with the User Equipment (e.g. Cell Phone) and the NU.

Users place the NU in an area with the strongest signal from the carrier networks. The CUs are then either placed in the center of the home or office, or in the area where the best signal quality is most needed. The NU and CU are placed at varying distance apart and are communicated via Ethernet cables.

One NU can connect up to six CUs via Ethernet Cat 5 cables. The NU transmits and receives Cellular signals from the base station and operates similar to a cellular handset. The CU transmits and receives signals with the cellular handset and operates on frequencies similar to the cellular base station.

One NU can connect up to six CUs via Ethernet Cat 5 cables. The NU transmits and receives Cellular signals from the base station and operates similar to a cellular handset. The CU transmits and receives signals with the cellular handset and operates on frequencies similar to the cellular base station.

NU has four antenna ports. Each antenna port is assigned to support one operator, separated donor antennas. Up to two bands can be transmitted simultaneously at each antenna port from yellow group to another colored group (eg. Carrier B: LTE Band 71 + Band 4, Band 71 + Band 25, Band 12 + Band 4, Band 12 + Band 25).

Up to two bands on each antenna port															
Ant Port	1					2				3			4		
Operator #	A					B				C			D		
Max Support BW	30 MHz					40 MHz				30 MHz			40 MHz		
Band	LB12	LB30	W5	L25	L4	L71	L12	L4	L25	L13	L25	L4	L41	L26	L25
Band Combination	√		√			√		√		√	√		√	√	
	√			√		√			√	√		√	√		√
	√				√		√	√		-	-	-		√	√
		√	√				√		√	-	-	-	-	-	-
		√		√				√	√	-	-	-	-	-	-
		√			√	-	-	-	-	-	-	-	-	-	-

The LTE Band 4, Band 12, Band 13, Band 30 and Band 71 function of the EUT was verified in this test report.

1.3.2 EUT General Description

EUT Description	Industrial Signal Booster
Trade Name	Cel-Fi™
Model Name	QUATRA 4000
Model Number(s)	NU: I44-1234CNU CU: I41-5ECU
Rated Voltage	NU: 120 VAC 60Hz CU: 54V DC (powered from NU via Ethernet cables)
Mode Verified	LTE Band 4, 12, 13, 30 and 71
Frequency Bands	LTE Band 4: Uplink: 1710 - 1755 MHz Downlink: 2110 - 2155 MHz LTE Band 12: Uplink: 699 - 716 MHz Downlink: 729 - 746 MHz LTE Band 13: Uplink: 777 - 787 MHz Downlink: 746 - 756 MHz LTE Band 30: Uplink: 2305 - 2315 MHz Downlink: 2350 - 2360 MHz LTE Band 71: Uplink: 663 - 698 MHz Downlink: 617 - 652 MHz

Product Specifications

Signal Bandwidth (MHz)	Band 4, 71		Band 12, 13, 30	
	DL (dB)	UL (dB)	DL (dB)	UL (dB)
5	Max. 16	Max. 22	Max. 16	Max. 22 (Band 12, 13)
10				Max. 19 (Band 30)
15			N/A	
20			N/A	

Capability	WCDMA (Band 5), LTE (Band 4, 12, 13, 25, 26, 30, 41 and 71)
Primary Unit (EUT)	☐ Production ☒ Pre-Production ☐ Engineering
Environment	Fixed, Indoor
Manufacturer Declared Temperature Range	0°C to 40°C

FCC ID: NU: YETI44-1234CNU
CU: YETI41-5ECU
IC: NU: 9298A-I441234CNU
CU: 9298A-I415ECU
Report No. 72154394B



Antenna Type

External Antenna

Manufacturer

Refer to the Antenna information supplied by the manufacture

Antenna Model

Refer to the Antenna information supplied by the manufacture

Maximum Antenna System
(Antenna + Cable) Gain

Radio	Uplink (Donor)	Downlink (Server)
LTE Band 4	5.72 dBi	2.6 dBi
LTE Band 12	6.77 dBi	0.4 dBi
LTE Band 13	6.48 dBi	0.4 dBi
LTE Band 30	4.33 dBi	2.3 dBi
LTE Band 71	6.91 dBi	0.4 dBi

1.3.3 Transmit Frequency Table

Mode	Channel Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	EIRP		ERP	
				Max. Power Avg (dBm)	Max. Power Avg (W)	Max. Power Avg (dBm)	Max. Power Avg (W)
LTE Band 4 Downlink	5	2110 - 2155	4M50F9W	13.25	0.02	-	-
	10	2110 - 2155	8M99F9W	15.82	0.04	-	-
	15	2110 - 2155	13M5F9W	16.96	0.05	-	-
	20	2110 - 2155	17M9F9W	18.95	0.08	-	-
LTE Band 4 Uplink	5	1710 - 1755	4M44F9W	28.94	0.78	-	-
	10	1710 - 1755	8M91F9W	28.91	0.78	-	-
	15	1710 - 1755	13M7F9W	29.13	0.82	-	-
	20	1710 - 1755	17M8F9W	28.98	0.79	-	-
LTE Band 12 Downlink	5	729 - 746	4M47F9W	-	-	9.10	0.01
	10	729 - 746	8M88F9W	-	-	12.52	0.02
LTE Band 12 Uplink	5	699 - 716	4M44F9W	-	-	28.19	0.66
	10	699 - 716	8M87F9W	-	-	28.41	0.69
LTE Band 13 Downlink	5	746 - 756	4M58F9W	-	-	8.90	0.01
	10	746 - 756	8M98F9W	-	-	11.63	0.01
LTE Band 13 Uplink	5	777 - 787	4M64F9W	-	-	27.68	0.59
	10	777 - 787	8M52F9W	-	-	27.71	0.59
LTE Band 30 Downlink	5	2350 - 2360	4M43F9W	13.52	0.02	-	-
	10	2350 - 2360	8M83F9W	16.18	0.04	-	-
LTE Band 30 Uplink	5	2305 - 2315	4M45F9W	26.57	0.45	-	-
	10	2305 - 2315	8M87F9W	26.85	0.48	-	-
LTE Band 71 Downlink	5	617 - 652	4M45F9W	-	-	8.82	0.01
	10	617 - 652	8M91F9W	-	-	11.98	0.02
	15	617 - 652	13M3F9W	-	-	13.72	0.02
	20	617 - 652	17M8F9W	-	-	14.89	0.03
LTE Band 71 Uplink	5	663 - 698	4M44F9W	-	-	27.70	0.59
	10	663 - 698	8M88F9W	-	-	27.80	0.60
	15	663 - 698	13M3F9W	-	-	27.73	0.59
	20	663 - 698	17M8F9W	-	-	27.65	0.58

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Downlink. Input signal is applied to the antenna port of Donor (NU). Output is monitored from the antenna port of Server (CU).
B	Uplink. Input signal is applied to the antenna port of Server (CU). Output is monitored from the antenna port of Donor (NU).
C	Radiated test setup. Downlink. Input signal is applied to the antenna port of Donor (NU). The antenna port of Server (CU) is terminated with a 50Ω load or Signal Generator.
D	Radiated test setup. Uplink. Input signal is applied to the antenna port of Server (CU). The antenna port of Donor (NU) is terminated with a 50Ω load or Signal Generator.

1.4.2 EUT Exercise Software

Manufacturer provided Nextivity Chart Interface v2.0.0.16 running from a support laptop where both NU and CU are connected via USB.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	M/N: Latitude D630 PP18L, S/N 5SBJBG1
Dell	Support Laptop AC Adapter	M/N: PA-1900-02D S/N 5SBJBG1
Nextivity	Support USB cable x 2	Custom 1.0 meter shielded USB Type A to Type A cable
Nextivity	Support USB cable x 2	Custom 1.0 meter shielded USB Type A to Micro B cable
Nextivity	USB / Interface Box x 2	Unshielded with "Tag-Connect" interface
Agilent	ESG Vector Signal Generator	M/N: E4438C, S/N MY49071335
Agilent	ESG Vector Signal Generator	M/N: E4438C, S/N: MY47271206
Agilent	ESG Vector Signal Generator	M/N: E4438C, S/N: MY45093445
Agilent	ESG Vector Signal Generator	M/N: E4438C, S/N: MY47271033
Agilent	ESG Vector Signal Generator	M/N: E4438C, S/N: MY42080338
Rhode & Schwarz	Wideband Radio Communication Tester	M/N: CMW 500, S/N: 145913
Rhode & Schwarz	Universal Radio Communication Tester	M/N: CMU 200, S/N: 114536
INSTOCK Wireless Componentr	DIVIDER/COMBINER	M/N: PD2160

FCC ID: NU: YETI44-1234CNU
CU: YETI41-5ECU
IC: NU: 9298A-I441234CNU
CU: 9298A-I415ECU
Report No. 72154394B



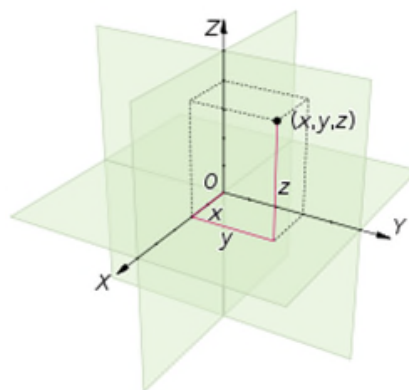
Mini Circuits	Power Splitter	M/N: ZN2PD2-50-S+ S/N: S UU27701207
Mini Circuits	Power Splitter	M/N: ZN2PD-63-S+ S/N: S UU74001429
Weinschel	Power Splitter	M/N: 1506A, S/N: RR002
RF Precision Cables, Inc.	2-Way Pwr Dvdr	M/N: PDX2130
Ramsey	Support Shielded Test Enclosure	With custom USB cable

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report per Transmitter Conducted Output Power (Section 2.1 of this test report). This is for single channel verification, otherwise all three channels (Low, Mid and High) are verified:

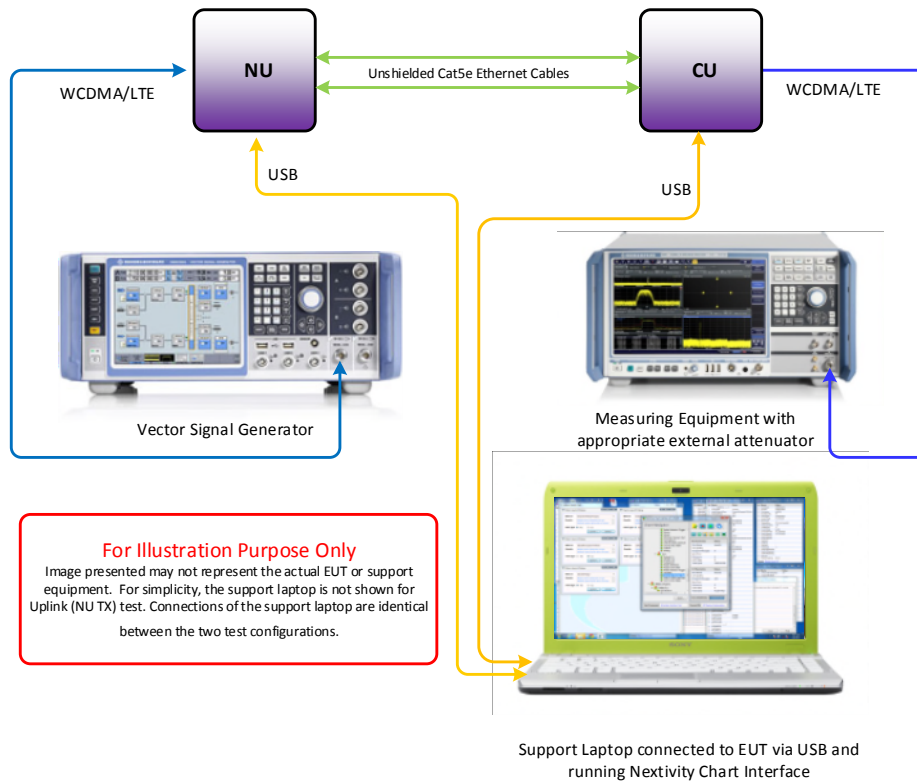
Mode	Bandwidth	Channel No.	Frequency
LTE Band 4 Downlink	20MHz	High Channel 2300	2145.0MHz
LTE Band 4 Uplink	15MHz	Low Channel 20025	1717.5MHz
LTE Band 12 Downlink	10MHz	High Channel 5130	741.0MHz
LTE Band 12 Uplink	10MHz	Low Channel 23060	704.0MHz
LTE Band 13 Downlink	10MHz	Middle Channel 5230	751.0MHz
LTE Band 13 Uplink	10MHz	Middle Channel 23230	782.0MHz
LTE Band 30 Downlink	10MHz	Middle Channel 9820	2355.0MHz
LTE Band 30 Uplink	5MHz	High Channel 27735	2312.5MHz
LTE Band 71 Downlink	20MHz	Low Channel 68686	627.0MHz
LTE Band 71 Uplink	10MHz	Middle Channel 133297	680.5MHz

Final installation position is unknown at the time of verification. For radiated measurements X and Z orientations were verified since the EUT won't work on Y orientation. No major variation in emissions observed between the three (3) orientations. Verifications performed using "X" configuration.



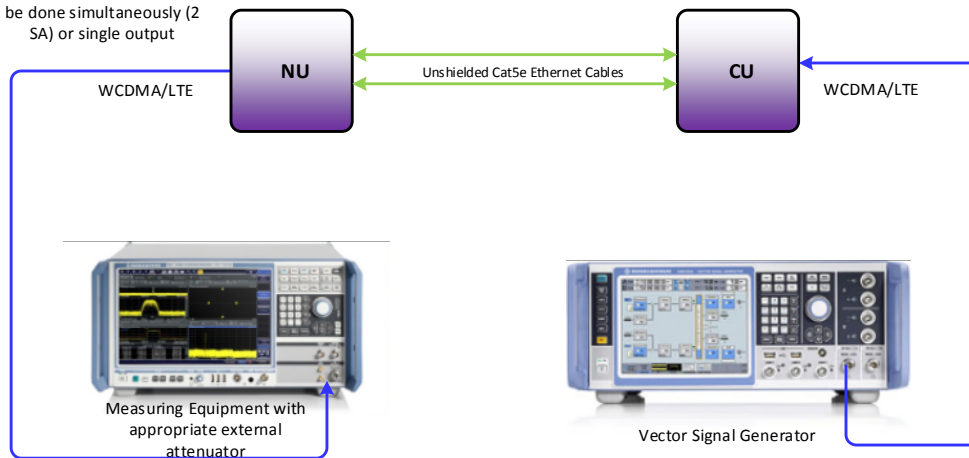
1.4.5 Simplified Test Configuration Diagram

Downlink (CU Tx) Conducted Test

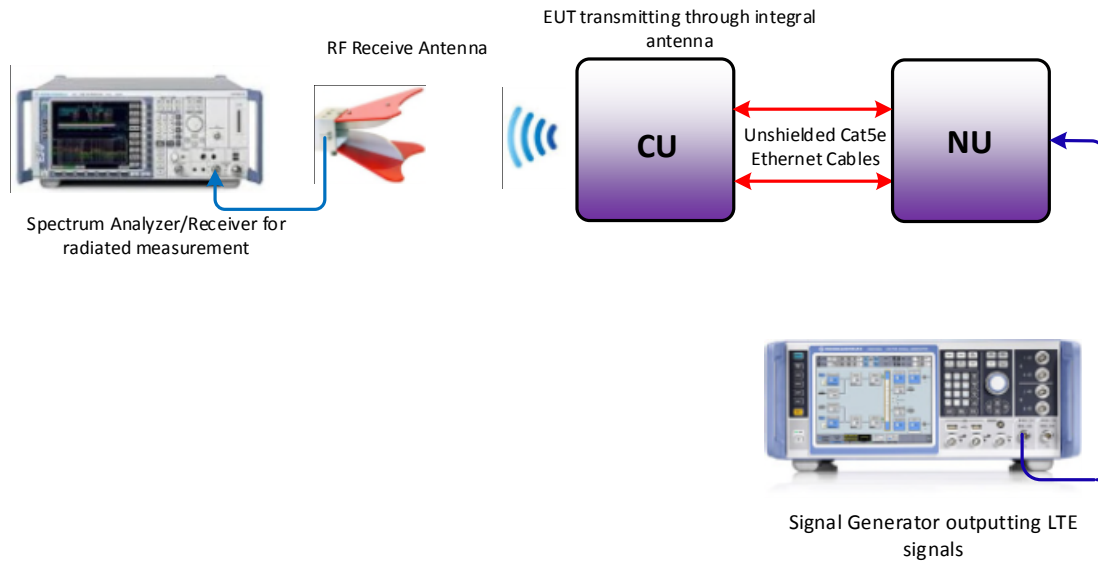


Uplink (NU Tx) Conducted Test

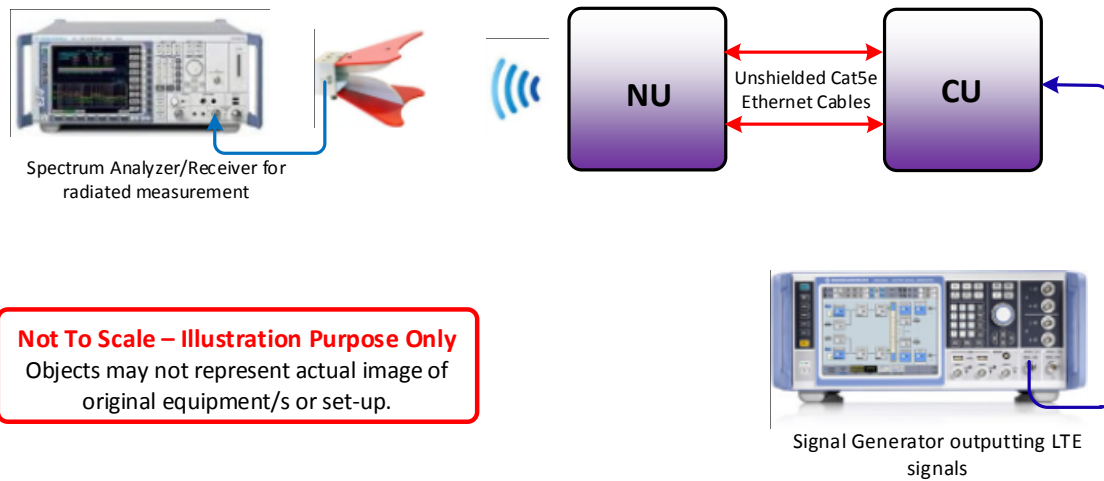
Monitoring the output can be done simultaneously (2 SA) or single output



Radiated Testing (Downlink)



Radiated Testing (Uplink)



Not To Scale – Illustration Purpose Only
 Objects may not represent actual image of
 original equipment/s or set-up.

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: 370920000139 (NU) and 371929000156 (CU)		
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 (if applicable) and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.26-2015. 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 (ISED) 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.

1.10 SAMPLE CALCULATIONS

1.10.1 LTE Emission Designator

Emission Designator = 1M30F9W
 F = Frequency Modulation
 9= Composite Digital Info
 W = Combination (Audio/Data)

1.10.2 Spurious Radiated Emission (below 1GHz)

Measuring equipment raw measurement (dBμV/m) @ 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

FCC ID: NU: YETI44-1234CNU
CU: YETI41-5ECU
IC: NU: 9298A-I441234CNU
CU: 9298A-I415ECU
Report No. 72154394B



SECTION 2

TEST DETAILS

Radio Testing of the
Nextivity Inc.
QUATRA 4000 Industrial Signal Booster

2.1 TRANSMITTER CONDUCTED OUTPUT POWER

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046

2.1.2 Standard Applicable

The conducted power measurements were made in accordance to FCC Part 2 Clause 2.1046:

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

2.1.3 Equipment Under Test and Modification State

Serial No: 370920000139 (NU) and 371929000156 (CU) / Test Configuration A and B

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

August 08, 09, 15, November 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	23.9 - 26.0°C
Relative Humidity	45.7 - 52.3%
ATM Pressure	98.7 - 98.9kPa

2.1.7 Additional Observations

- This is a conducted test using power meter.
- The path loss was measured and entered as a level offset.
- Both Peak and Average measurements presented.
- Low, Middle and High channels for all bandwidths were verified and reported.

2.1.8 Test Results

LTE Band 4 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	1975	2112.5	9.79	18.22
	2175	2132.5	9.78	19.54
	2375	2152.5	10.65	19.90
10	2000	2115.0	12.33	22.29
	2175	2132.5	13.06	23.36
	2350	2150.0	13.22	22.92
15	2025	2117.5	14.25	25.19
	2175	2132.5	14.26	25.41
	2325	2147.5	14.36	25.70
20	2050	2120.0	16.04	25.01
	2175	2132.5	16.03	25.98
	2300	2145.0	16.35	26.81

LTE Band 4 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	19975	1712.5	23.22	31.08
	20175	1732.5	22.67	31.47
	20375	1752.5	22.80	31.01
10	20000	1715.0	23.19	31.02
	20175	1732.5	22.54	31.61
	20350	1750.0	22.81	31.33
15	20025	1717.5	23.41	31.77
	20175	1732.5	22.57	31.69
	20325	1747.5	22.91	31.62
20	20050	1720.0	23.26	30.25
	20175	1732.5	22.65	30.28
	20300	1745.0	22.94	30.09

LTE Band 12 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	5035	731.5	10.85	18.24
	5095	737.5	10.79	18.44
	5155	743.5	10.83	18.03
10	5060	734.0	14.09	21.81
	5095	737.5	13.58	22.03
	5130	741.0	14.27	22.33

LTE Band 12 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	23035	701.5	22.91	32.54
	23095	707.5	23.57	32.68
	23155	713.5	23.43	33.17
10	23060	704.0	23.79	33.03
	23095	707.5	23.59	32.92
	23130	711.0	23.36	33.07

LTE Band 13 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	5205	748.5	10.32	19.62
	5230	751.0	10.65	19.76
	5255	753.5	10.44	18.95
10	-	-	-	-
	5230	751.0	13.38	22.15
	-	-	-	-

LTE Band 13 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	23205	779.5	23.19	33.92
	23230	782.0	23.35	32.98
	23255	784.5	23.17	33.37
10	-	-	-	-
	23230	782.0	23.38	33.38
	-	-	-	-

LTE Band 30 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	9795	2352.5	11.22	18.79
	9820	2355.0	11.07	18.57
	9845	2357.5	10.82	18.56
10	-	-	-	-
	9820	2355.0	13.88	21.88
	-	-	-	-

LTE Band 30 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	27685	2307.5	18.46	28.48
	27710	2310.0	18.31	28.10
	27735	2312.5	18.52	28.32
10	-	-	-	-
	27710	2310.0	18.40	29.38
	-	-	-	-

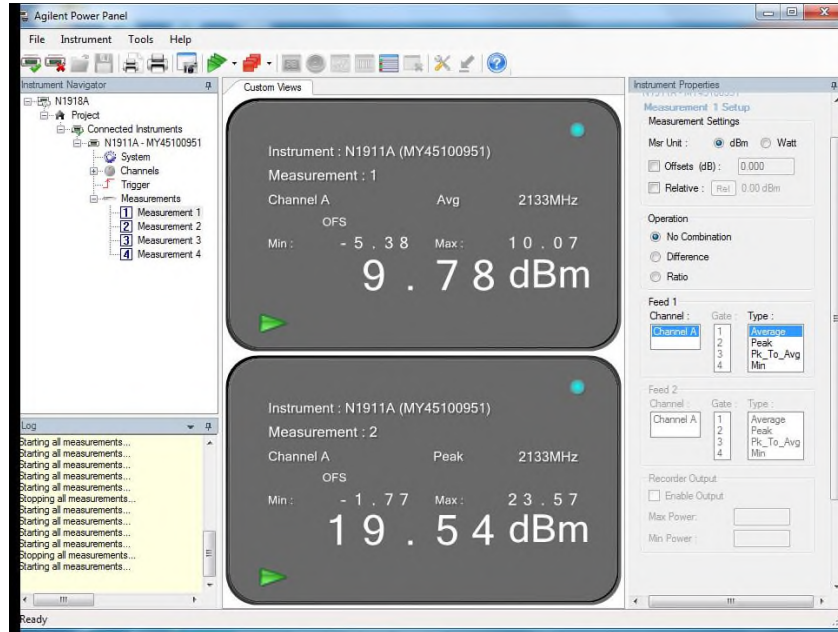
LTE Band 71 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	68611	619.5	10.49	20.25
	68761	634.5	10.54	20.65
	68911	649.5	10.57	20.38
10	68636	622.0	13.72	24.16
	68761	634.5	13.47	23.29
	68886	647.0	13.73	24.11
15	68661	624.5	15.47	26.17
	68761	634.5	15.05	25.54
	68861	644.5	15.27	25.64
20	68686	627.0	16.64	27.55
	68761	634.5	16.16	26.63
	68836	642.0	16.43	28.08

LTE Band 71 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
5	133147	665.5	21.73	33.35
	133297	680.5	22.94	33.87
	133447	695.5	21.37	31.01
10	133172	668.0	21.70	32.19
	133297	680.5	23.04	33.02
	133422	693.0	21.81	32.71
15	133197	670.5	22.35	32.45
	133297	680.5	22.97	32.44
	133397	690.5	22.36	32.70
20	133222	673.0	22.89	33.11
	133297	680.5	21.48	31.15
	133372	688.0	22.87	32.86

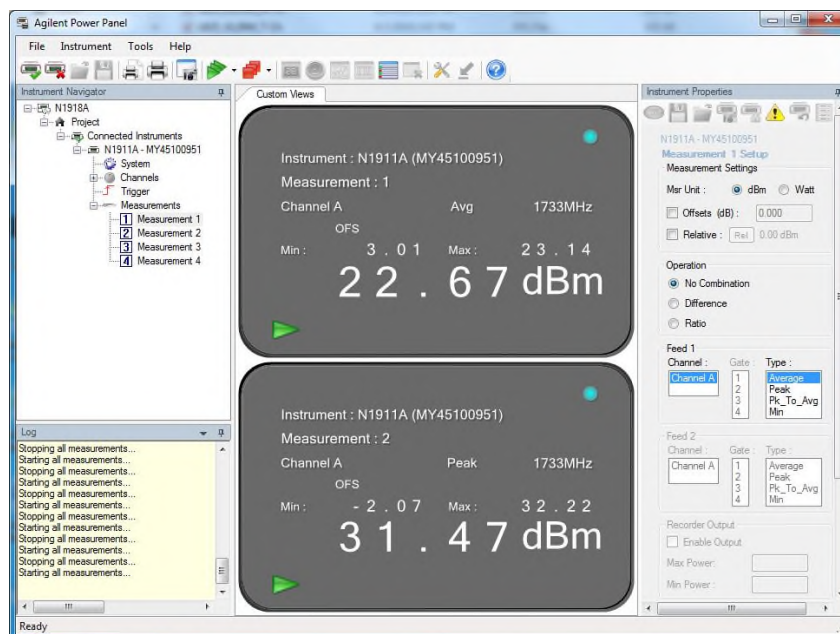
2 Bands/port worst case configuration Downlink				
CU with Ant Port	Band & Bandwidth & Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
A	LTE Band 4 20MHz BW High Ch & LTE Band 12 10MHz BW High Ch	2145.0 MHz + 741.0 MHz	18.70	27.71
	LTE Band 4 20MHz BW High Ch & LTE Band 30 10MHz BW Mid Ch	2145.0 MHz + 2355.0 MHz	18.35	26.76
	LTE Band 25 20MHz BW Mid Ch & LTE Band 12 10MHz BW High Ch	1962.5 MHz + 741.0 MHz	18.93	27.71
	LTE Band 25 20MHz BW Mid Ch & LTE Band 30 10MHz BW Mid Ch	1962.5 MHz + 2355.0 MHz	18.64	29.92
	WCDMA Band 5 15MHz BW Low Ch & LTE Band 12 10MHz BW High Ch	871.4MHz & 876.4MHz & 881.4MHz + 741.0 MHz	17.65	27.58
	WCDMA Band 5 15MHz BW Low Ch & LTE Band 30 10MHz BW Mid Ch	871.4MHz & 876.4MHz & 881.4MHz + 2355.0 MHz	17.84	26.24
B	LTE Band 4 20MHz BW High Ch & LTE Band 71 20MHz BW Low Ch	2145.0 MHz + 627.0.0 MHz	19.61	29.21
	LTE Band 25 20MHz BW Mid Ch & LTE Band 71 20MHz BW Low Ch	1962.5 MHz + 627.0 MHz	20.11	28.60
	LTE Band 4 20MHz BW High Ch & LTE Band 25 20MHz BW Mid Ch	2145.0 MHz + 1962.5 MHz	18.40	27.37
C	LTE Band 4 20MHz BW High Ch & LTE Band 13 10MHz BW Mid Ch	2145.0 MHz + 751.0 MHz	18.67	27.28
	LTE Band 25 20MHz BW Mid Ch & LTE Band 13 10MHz BW Mid Ch	1962.5 MHz + 751.0 MHz	18.91	27.27

2 Bands/port worst case configuration Uplink				
Ant Port	Band & Bandwidth & Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)
A	LTE Band 4 15MHz BW Low Ch & LTE Band 12 10MHz BW Low Ch	1717.5 MHz + 704.0 MHz	24.20	32.24
	LTE Band 4 15MHz BW Low Ch & LTE Band 30 5MHz BW High Ch	1717.5 MHz + 2312.5 MHz	24.16	31.40
	LTE Band 25 20MHz BW High Ch & LTE Band 12 10MHz BW Low Ch	1905.0 MHz + 704 MHz	23.88	31.86
	LTE Band 25 20MHz BW High Ch & LTE Band 30 5MHz BW High Ch	1905.0 MHz + 2312.5 MHz	24.29	32.38
	WCDMA Band 5 5MHz BW Mid Ch & LTE Band 12 10MHz BW Low Ch	836.6 MHz + 704 MHz	23.63	31.40
	WCDMA Band 5 5MHz BW Mid Ch & LTE Band 30 5MHz BW High Ch	836.6 MHz + 2312.5 MHz	23.19	31.21
B	LTE Band 4 15MHz BW Low Ch & LTE Band 71 10MHz BW Mid Ch	1717.5 MHz + 680.5 MHz	25.83	33.0
	LTE Band 25 20MHz BW High Ch & LTE Band 71 10MHz BW Mid Ch	1905.0 MHz + 680.5 MHz	26.11	34.08
	LTE Band 4 15MHz BW Low Ch & LTE Band 25 20MHz BW High Ch	1717.5 MHz + 1905.0 MHz	25.24	32.02
C	LTE Band 4 15MHz BW Low Ch & LTE Band 13 10MHz BW Mid Ch	1717.5 MHz + 782.0 MHz	25.32	34.42
	LTE Band 25 20MHz BW High Ch & LTE Band 13 10MHz BW Mid Ch	1905.0 MHz + 782.0 MHz	25.88	34.98
D	LTE Band 26 15MHz BW Low Ch & LTE Band 25 20MHz BW High Ch	831.5 MHz + 1905.0 MHz	23.75	32.39

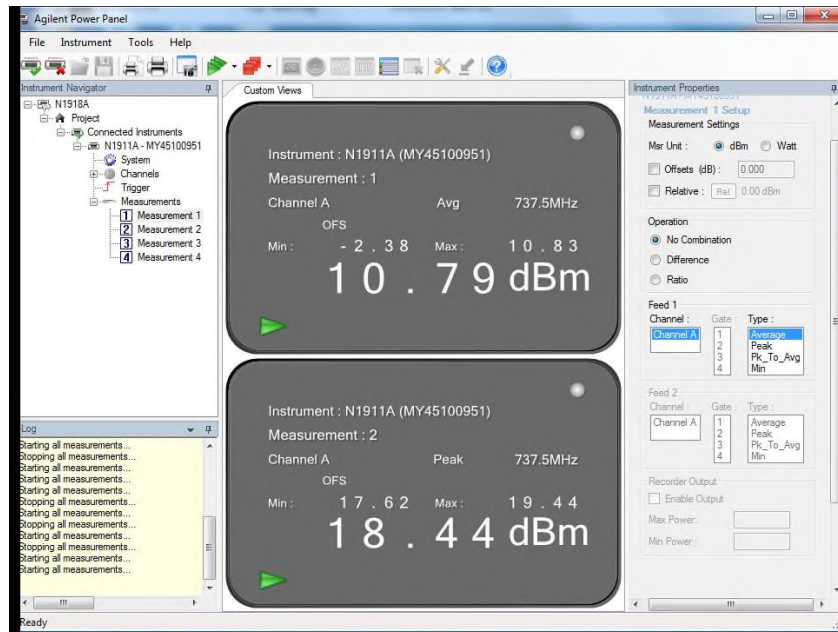
2.1.9 Sample Test Plot



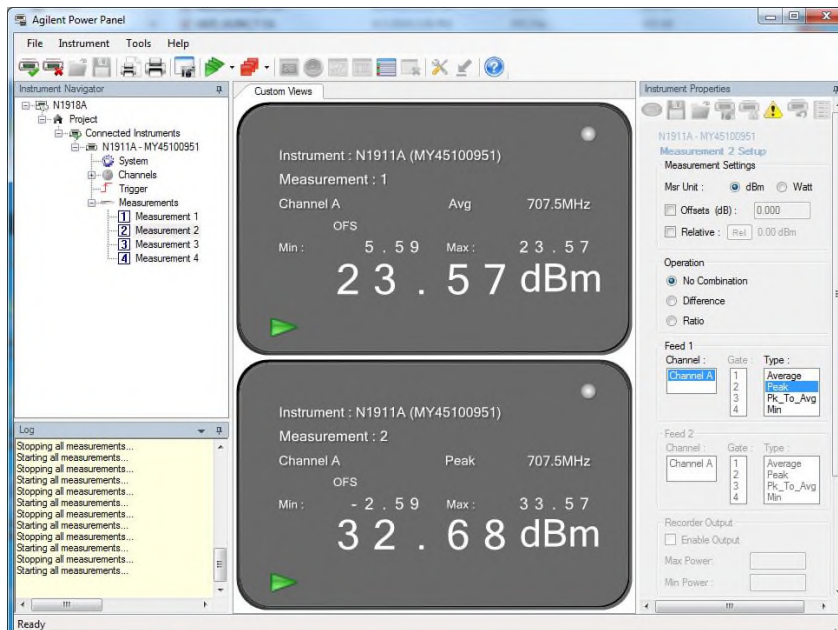
LTE Band 4 DL 5 MHz Bandwidth Middle Channel



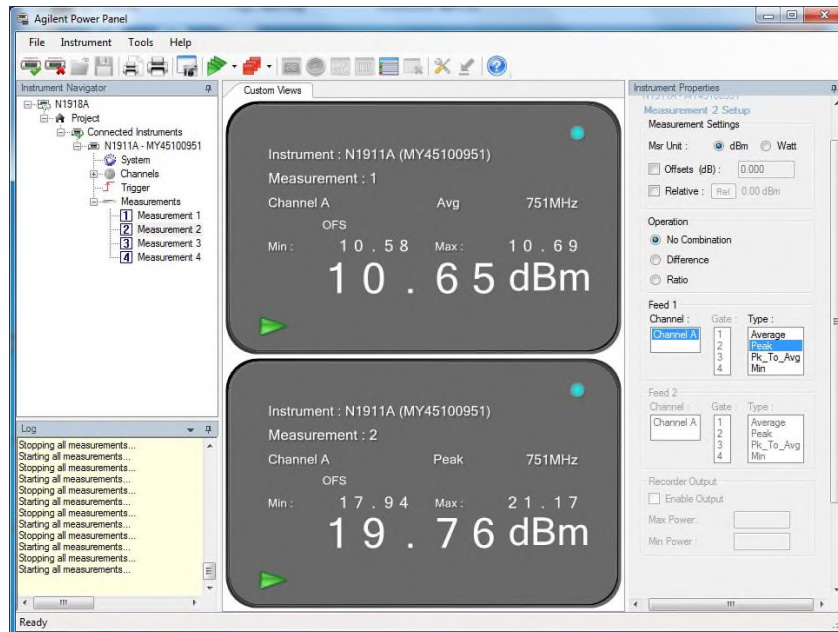
LTE Band 4 UL 5 MHz Bandwidth Middle Channel



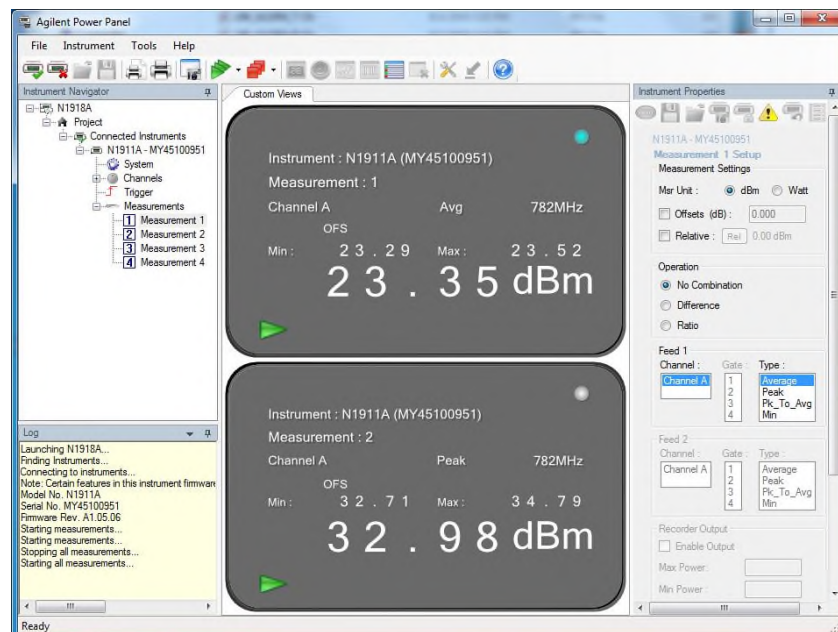
LTE Band 12 DL 5 MHz Bandwidth Middle Channel



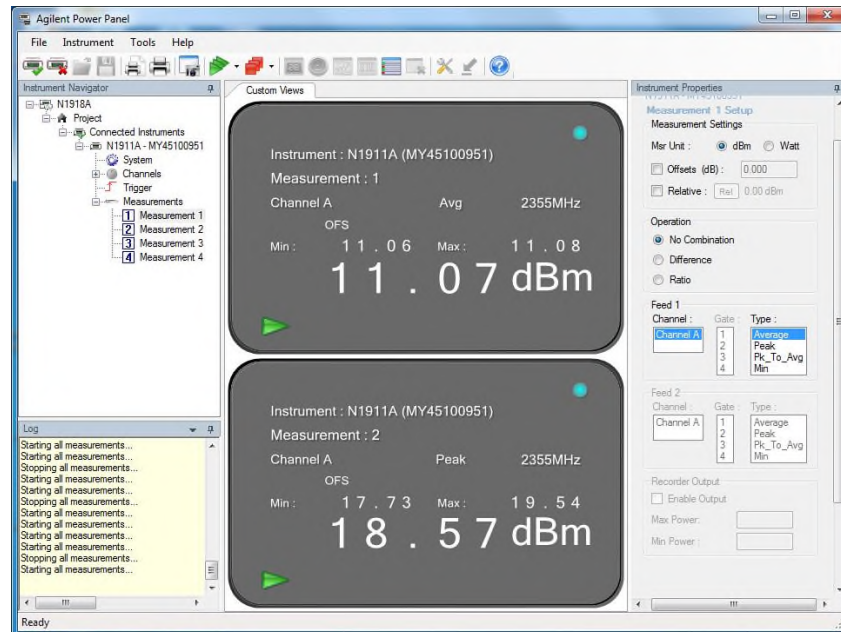
LTE Band 12 UL 5 MHz Bandwidth Middle Channel



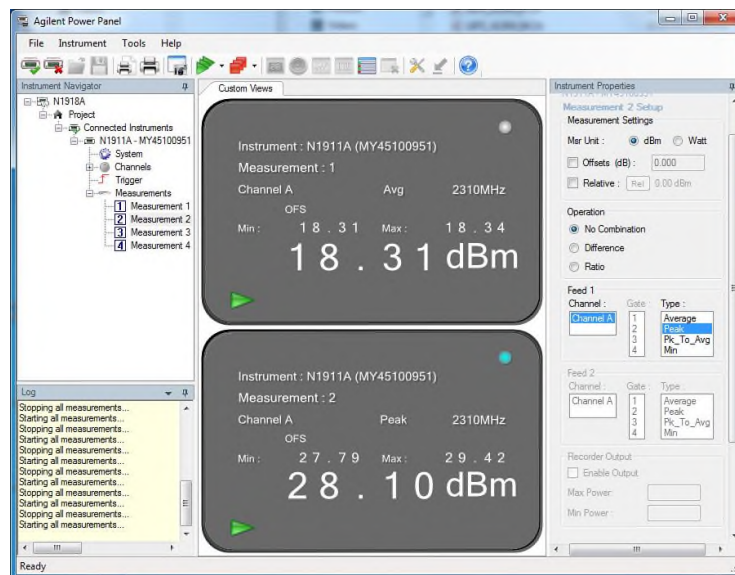
LTE Band 13 DL 5 MHz Bandwidth Middle Channel



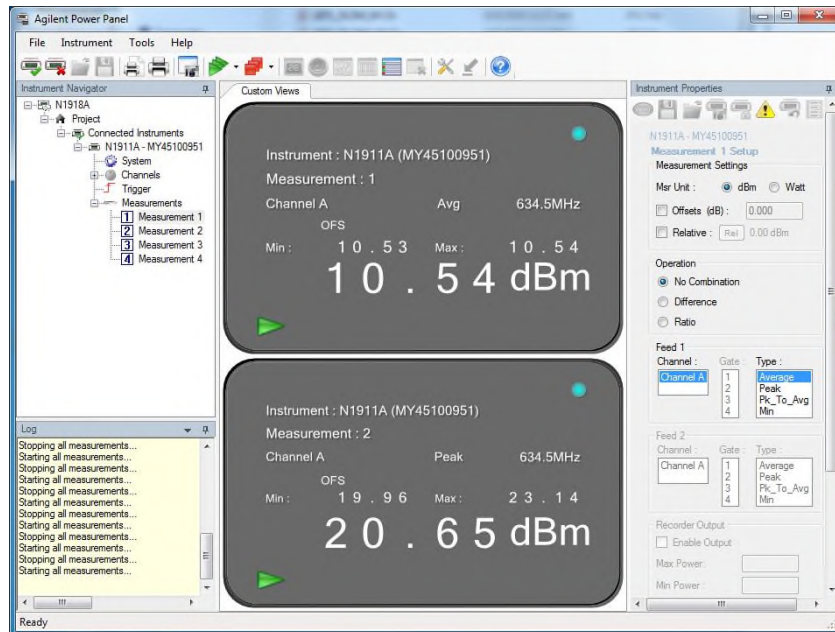
LTE Band 13 UL 5 MHz Bandwidth Middle Channel



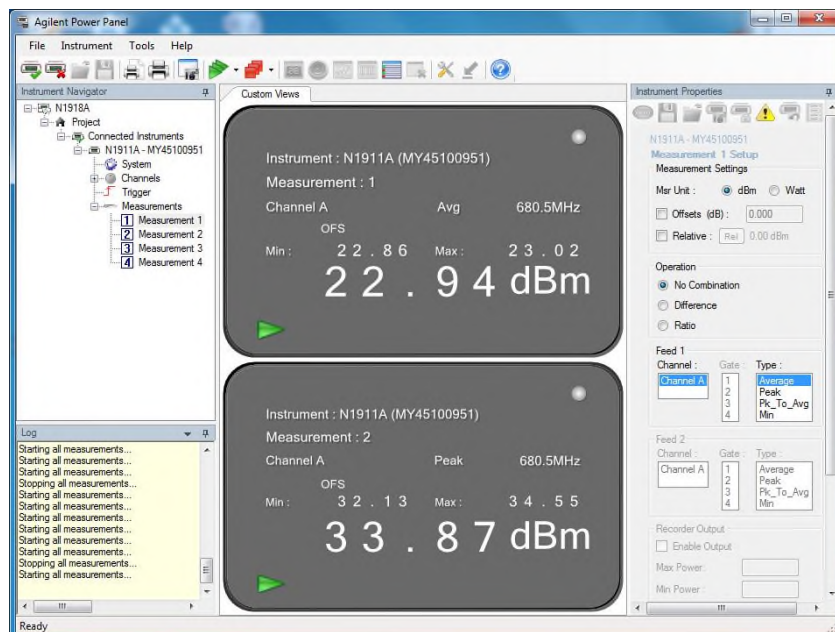
LTE Band 30 DL 5 MHz Bandwidth Middle Channel



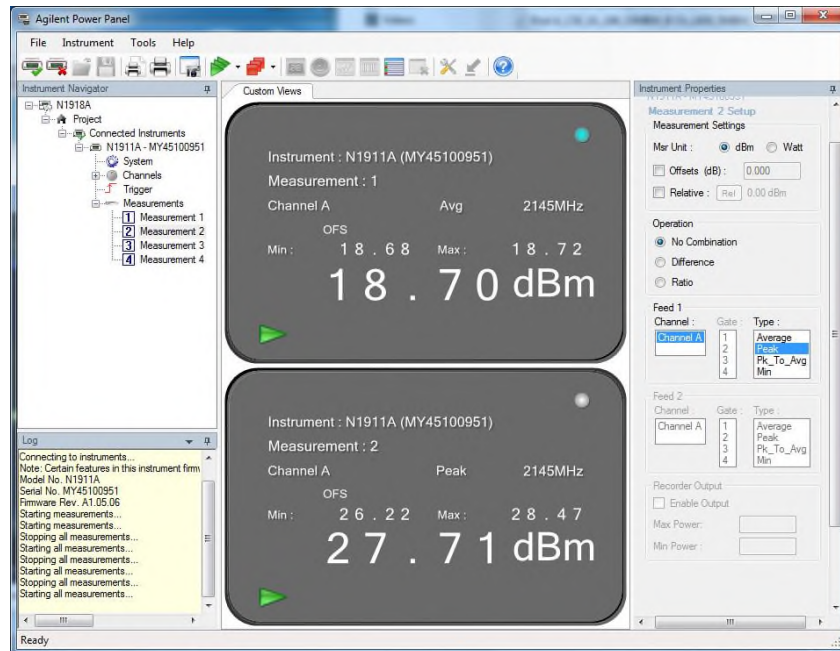
LTE Band 30 UL 5 MHz Bandwidth Middle Channel



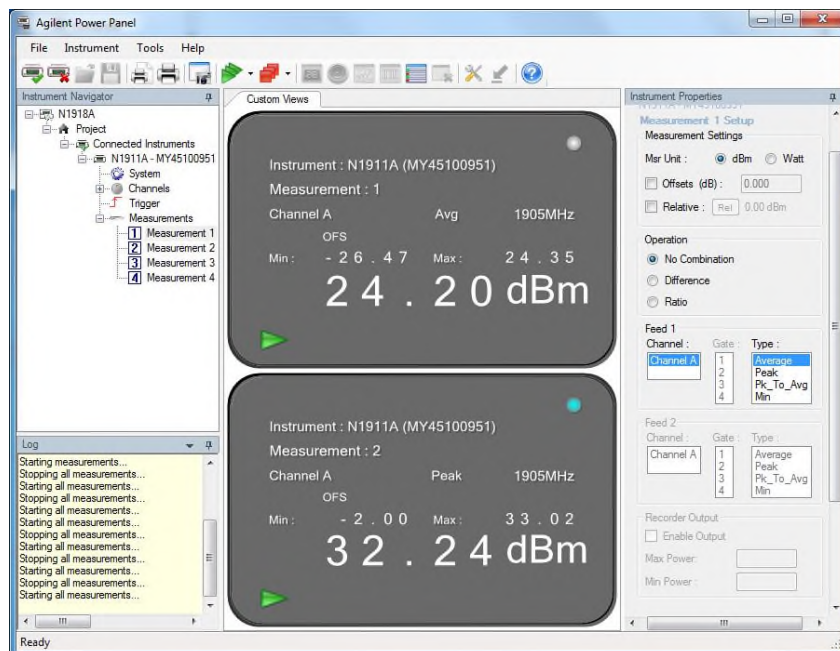
LTE Band 71 DL 5 MHz Bandwidth Middle Channel



LTE Band 71 UL 5 MHz Bandwidth Middle Channel



Downlink: LTE Band 4 20MHz BW High Ch & LTE Band 12 10MHz BW High Ch



Uplink: LTE Band 4 15MHz BW Low Ch & LTE Band 12 10MHz BW Low Ch

2.2 EFFECTIVE ISOTROPIC RADIATED POWER

2.2.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.50 (h)(1)
FCC 47 CFR Part 27, Clause 27.50 (a)(1)
RSS-139, Clause 6.5
RSS-195, Clause 5.5

2.2.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.50 (h):

(1) Main, booster and base stations. (i) The maximum EIRP of a main, booster or base station shall not exceed $33 \text{ dBW} + 10 \log(X/Y) \text{ dBW}$, 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.

(ii) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in dBW in a given direction shall be determined by the following formula: $\text{EIRP} = 33 \text{ dBW} + 10 \log(X/Y) \text{ dBW} + 10 \log(360/\text{beamwidth}) \text{ dBW}$, where X is the actual channel width in MHz, Y is either (i) 6 MHz if prior to transition or the station is in the MBS following transition or (ii) 5.5 MHz if the station is in the LBS and UBS following transition, and beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points.

RSS-139, Clause 6.5:

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710 - 1780 MHz shall not exceed one watt.

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

FCC 47 CFR Part 27, Clause 27.50 (a):

The following power limits and related requirements apply to stations transmitting in the 2305–2320 MHz band or the 2345–2360 MHz band.

(1) Base and fixed stations. (i) For base and fixed stations transmitting in the 2305–2315 MHz band or the 2350–2360MHz band:

(A) The average equivalent isotropically radiated power (EIRP) must not exceed 2,000 watts within any 5megahertz of authorized bandwidth and must not exceed 400 watts within any 1 megahertz of authorized bandwidth.

RSS-195, Clause 5.5:

The equivalent isotropically radiated power (e.i.r.p.) for base and fixed station equipment shall comply with the e.i.r.p. limit in SRSP-516.

The e.i.r.p of fixed subscriber equipment shall not exceed 20 W/5MHz.

2.2.3 Equipment Under Test and Modification State

Serial No: 370920000139 (NU) and 371929000156 (CU) (Calculation only)

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

August 08, 09 and 15, 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.

2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.8 - 26.0°C
Relative Humidity	51.1 - 52.3%
ATM Pressure	98.8 - 98.9kPa

2.2.7 Additional Observations

- EIRP was calculated as per Section 1.3.2 of KDB412172 D01 (Determining ERP and EIRP v01).
- 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.

2.2.8 Sample Computation

$$\begin{aligned} EIRP &= P_T + G_T - L_c \\ &= 29.87 \text{ (Peak)} + 0.13 \text{ (max. gain)} - 3.84 \text{ (cable loss)} \\ &= 26.16 \text{ dBm} \end{aligned}$$

2.2.9 Test Results

LTE Band 4 Downlink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	EIRP (dBm)	Limit (dBm)
5	2112.5	9.79	2.6	12.39	62.2
	2132.5	9.78	2.6	12.38	62.2
	2152.5	10.65	2.6	13.25	62.2
10	2115.0	12.33	2.6	14.93	65.2
	2132.5	13.06	2.6	15.66	65.2
	2150.0	13.22	2.6	15.82	65.2
15	2117.5	14.25	2.6	16.85	66.9
	2132.5	14.26	2.6	16.86	66.9
	2147.5	14.36	2.6	16.96	66.9
20	2120.0	16.04	2.6	18.64	68.2
	2132.5	16.03	2.6	18.63	68.2
	2145.0	16.35	2.6	18.95	68.2

LTE Band 4 Uplink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	EIRP (dBm)	Limit (dBm)
5	1712.5	23.22	5.72	28.94	30
	1732.5	22.67	5.72	28.39	30
	1752.5	22.80	5.72	28.52	30
10	1715.0	23.19	5.72	28.91	30
	1732.5	22.54	5.72	28.26	30
	1750.0	22.81	5.72	28.53	30
15	1717.5	23.41	5.72	29.13	30
	1732.5	22.57	5.72	28.29	30
	1747.5	22.91	5.72	28.63	30
20	1720.0	23.26	5.72	28.98	30
	1732.5	22.65	5.72	28.37	30
	1745.0	22.94	5.72	28.66	30

LTE Band 30 Downlink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	EIRP (dBm)	Limit (dBm/MHz)
5	2352.5	11.22	2.3	13.52	56.0
	2355.0	11.07	2.3	13.37	56.0
	2357.5	10.82	2.3	13.12	56.0
10	-	-	-	-	-
	2355.0	13.88	2.3	16.18	56.0
	-	-	-	-	-

LTE Band 30 Uplink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	EIRP (dBm)	Limit (dBm)
5	2307.5	22.06	4.33	26.39	56.0
	2310.0	22.24	4.33	26.57	56.0
	2312.5	22.52	4.33	26.85	56.0
10	-	-	-	-	-
	2310.0	22.11	4.33	26.44	56.0
	-	-	-	-	-

2.3 EFFECTIVE RADIATED POWER

2.3.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.50 (c)(3)
 FCC 47 CFR Part 27, Clause 27.50 (b)(4)
 RSS-130, Clause 4.6.2, and 4.6.3

2.3.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.50 (c):

(3) Fixed and base stations transmitting a signal within an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna height greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

TABLE 3 TO § 27.50—PERMISSIBLE POWER AND ANTENNA HEIGHTS FOR BASE AND FIXED STATIONS IN THE 600 MHz, 698–757 MHz, 758–763 MHz, 776–787 MHz AND 788–793 MHz BANDS TRANSMITTING A SIGNAL WITH AN EMISSION BANDWIDTH GREATER THAN 1 MHz

Antenna height (AAT) in meters (feet)	Effective radi- ated power (ERP) per MHz (watts/MHz)
Above 1372 (4500)	65
Above 1220 (4000) To 1372 (4500)	70
Above 1067 (3500) To 1220 (4000)	75
Above 915 (3000) To 1067 (3500)	100
Above 763 (2500) To 915 (3000)	140
Above 610 (2000) To 763 (2500)	200
Above 458 (1500) To 610 (2000)	350
Above 305 (1000) To 458 (1500)	600
Up to 305 (1000)	1000

FCC 47 CFR Part 27, Clause 27.50 (b):

(4) Fixed and base stations transmitting a signal in the 746–757 MHz and 776–787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

RSS-130 Clause 4.6.2 Frequency bands 617-652 MHz and 663-698 MHz

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

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.



Clause 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.

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.

2.3.3 Equipment Under Test and Modification State

Serial No: 370920000139 (NU) and 371929000156 (CU) (Calculation only)

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

August 08, 09 and 15, 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	24.8 - 26.0°C
Relative Humidity	51.1 - 52.3%
ATM Pressure	98.8 - 98.9kPa

2.3.7 Additional Observations

- ERP and EIRP were calculated as per Section 1.2 and 1.3 of KDB412172 D01 (Determining ERP and EIRP v01).
- Calculation formula in logarithmic terms:

$$\text{ERP or EIRP} = P_T + G_T - L_c$$

Where:

P_T = transmitter output power, expressed in dBm (Section 2.1 of this test report)

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

$$G_T(\text{dBd}) = G_T(\text{dBi}) - 2.15 \text{ dB}$$

L_c = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

2.3.8 Sample Computation

$$\begin{aligned} \text{ERP} &= P_T + G_T - L_C - 2.15\text{dB} \\ &= 29.87 \text{ (Peak)} + 0.13 \text{ (max. gain)} - 3.84 \text{ (cable loss)} - 2.15 \\ &= 24.01 \text{ dBm} \end{aligned}$$

2.3.9 Test Results

LTE Band 12 Downlink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	ERP (dBm)	Limit (dBm)
5	731.5	10.85	0.4	9.10	44.77
	737.5	10.79	0.4	9.04	44.77
	743.5	10.83	0.4	9.08	44.77
10	734.0	14.09	0.4	12.34	44.77
	737.5	13.58	0.4	11.83	44.77
	741.0	14.27	0.4	12.52	44.77

LTE Band 12 Uplink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	ERP (dBm)	Limit (dBm)
5	701.5	22.91	6.77	27.53	44.77
	707.5	23.57	6.77	28.19	44.77
	713.5	23.43	6.77	28.05	44.77
10	704.0	23.79	6.77	28.41	44.77
	707.5	23.59	6.77	28.21	44.77
	711.0	23.36	6.77	27.98	44.77

LTE Band 13 Downlink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	ERP (dBm)	Limit (dBm)
5	748.5	10.32	0.4	8.57	44.77
	751.0	10.65	0.4	8.90	44.77
	753.5	10.44	0.4	8.69	44.77
10	-	-	-	-	-
	751.0	13.38	0.4	11.63	44.77
	-	-	-	-	-

LTE Band 13 Uplink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	ERP (dBm)	Limit (dBm)
5	779.5	23.19	6.48	27.52	44.77
	782.0	23.35	6.48	27.68	44.77
	784.5	23.17	6.48	27.50	44.77
10	-	-	-	-	-
	782.0	23.38	6.48	27.71	44.77
	-	-	-	-	-

LTE Band 71 Downlink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	ERP (dBm)	Limit (dBm)
5	619.5	10.49	0.4	8.74	34.77
	634.5	10.54	0.4	8.79	34.77
	649.5	10.57	0.4	8.82	34.77
10	622.0	13.72	0.4	11.97	34.77
	634.5	13.47	0.4	11.72	34.77
	647.5	13.73	0.4	11.98	34.77
15	624.5	15.47	0.4	13.72	34.77
	634.5	15.05	0.4	13.30	34.77
	644.5	15.27	0.4	13.52	34.77
20	627.0	16.64	0.4	14.89	34.77
	634.5	16.16	0.4	14.41	34.77
	642.0	16.43	0.4	14.68	34.77

LTE Band 71 Uplink					
Bandwidth (MHz)	Frequency (MHz)	Max Power Average (dBm)	Antenna System Gain (dBi)	ERP (dBm)	Limit (dBm)
5	665.5	21.73	6.91	26.49	34.77
	680.5	22.94	6.91	27.70	34.77
	695.5	21.37	6.91	26.13	34.77
10	668.0	21.70	6.91	26.46	34.77
	680.5	23.04	6.91	27.80	34.77
	693.5	21.81	6.91	26.57	34.77
15	670.5	22.35	6.91	27.11	34.77
	680.5	22.97	6.91	27.73	34.77
	690.5	22.36	6.91	27.12	34.77
20	673.0	22.89	6.91	27.65	34.77
	680.5	21.48	6.91	26.24	34.77
	688.0	22.87	6.91	27.63	34.77

2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

FCC 47 CFR Part 2. Clause 2.1049
RSS-GEN Issue 5, Clause 6.7

2.4.2 Standard Applicable

The transmitted signal bandwidth shall be reported as the 99% emission bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given 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 measurement function in the spectrum analyzer, the 99% occupied bandwidth was measured.

In addition, the 26dB bandwidth was measured in accordance with FCC KDB 971168 D01 V0202 Clause 4.1 using the ndB measurement function in the spectrum analyzer.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be at least 3x RBW.

2.4.3 Equipment Under Test and Modification State

Serial No: 370920000139 (NU) and 371929000156 (CU) / Test Configuration A and B

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

August 09 to 16, 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 performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	25.2 - 26.3°C
Relative Humidity	46.4 - 53.3%
ATM Pressure	98.8 - 99.0kPa

2.4.7 Additional Observations

- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- Using the occupied bandwidth measurement function in the spectrum analyzer, the 99% occupied bandwidth was measured.
- The 26dB bandwidth was measured in accordance 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.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The RBW is set to 1% of the OBW while the VBW is $\geq 3X$ RBW.
- The detector is peak and the trace mode is max hold.
- All low, middle and high channels were verified. Only test plots for middle channel presented in this test report as the representative configuration.

2.4.8 Test Results and Sample Test Plot

LTE Band 4 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	1975	2112.5	4.50	4.82
	2175	2132.5	4.45	4.77
	2375	2152.5	4.50	4.84
10	2000	2115.0	8.94	9.66
	2175	2132.5	8.99	9.66
	2350	2150.0	8.93	9.60
15	2025	2117.5	13.24	14.11
	2175	2132.5	13.47	14.47
	2325	2147.5	13.31	14.11
20	2050	2120.0	17.89	18.81
	2175	2132.5	17.76	19.26
	2300	2145.0	17.86	19.26

LTE Band 4 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	19975	1712.5	4.44	4.75
	20175	1732.5	4.44	4.76
	20375	1752.5	4.44	4.75
10	20000	1715.0	8.91	9.55
	20175	1732.5	8.88	9.49
	20350	1750.0	8.87	9.54
15	20025	1717.5	13.66	14.74
	20175	1732.5	13.62	14.46
	20325	1747.5	13.64	14.76
20	20050	1720.0	17.77	18.99
	20175	1732.5	17.73	18.96
	20300	1745.0	17.77	19.11

LTE Band 12 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	5035	731.5	4.42	4.74
	5095	737.5	4.47	4.84
	5155	743.5	4.43	4.75
10	5060	734.0	8.88	9.55
	5095	737.5	8.84	9.54
	5130	741.0	8.88	9.57

LTE Band 12 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	23035	701.5	4.43	4.75
	23095	707.5	4.44	4.76
	23155	713.5	4.43	4.75
10	23060	704.0	8.85	9.48
	23095	707.5	8.87	9.60
	23130	711.0	8.87	9.51

LTE Band 13 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	5205	748.5	4.45	4.77
	5230	751.0	4.58	4.92
	5255	753.5	4.45	4.85
10	-	-	-	-
	5230	751.0	8.98	9.44
	-	-	-	-

LTE Band 13 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	23205	779.5	4.64	4.95
	23230	782.0	4.63	4.94
	23255	784.5	4.63	4.95
10	-	-	-	-
	23230	782.0	8.52	9.42
	-	-	-	-

LTE Band 30 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	9795	2352.5	4.41	4.75
	9820	2355.0	4.43	4.77
	9845	2357.5	4.42	4.75
10	-	-	-	-
	9820	2355.0	8.83	9.42
	-	-	-	-

LTE Band 30 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	27685	2307.5	4.44	4.76
	27710	2310.0	4.43	4.76
	27735	2312.5	4.45	4.75
10	-	-	-	-
	27710	2310.0	8.87	9.53
	-	-	-	-

LTE Band 71 Downlink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	68611	619.5	4.44	4.78
	68761	634.5	4.45	4.76
	68911	649.5	4.44	4.77
10	68636	622.0	8.88	9.59
	68761	634.5	8.91	9.59
	68886	647.0	8.90	9.55
15	68661	624.5	13.28	14.24
	68761	634.5	13.32	14.29
	68861	644.5	13.24	14.27
20	68686	627.0	17.71	19.20
	68761	634.5	17.78	19.17
	68836	642.0	17.64	19.02

LTE Band 71 Uplink				
Bandwidth (MHz)	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
5	133147	665.5	4.41	4.73
	133297	680.5	4.44	4.77
	133447	695.5	4.43	4.75
10	133172	668.0	8.83	9.49
	133297	680.5	8.88	9.57
	133422	693.0	8.88	9.49
15	133197	670.5	13.25	14.20
	133297	680.5	13.29	14.18
	133397	690.5	13.29	14.20
20	133222	673.0	17.65	18.96
	133297	680.5	17.79	18.93
	133372	688.0	17.76	19.02

LTE Band 4 Downlink (5 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 99%OBW



LTE Band 4 Downlink (5 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 26dB BW



LTE Band 4 Downlink (10 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 99%OBW



12:24:14 12.08.2019

LTE Band 4 Downlink (10 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 26dB BW



12:24:58 12.08.2019

LTE Band 4 Downlink (15 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 99%OBW



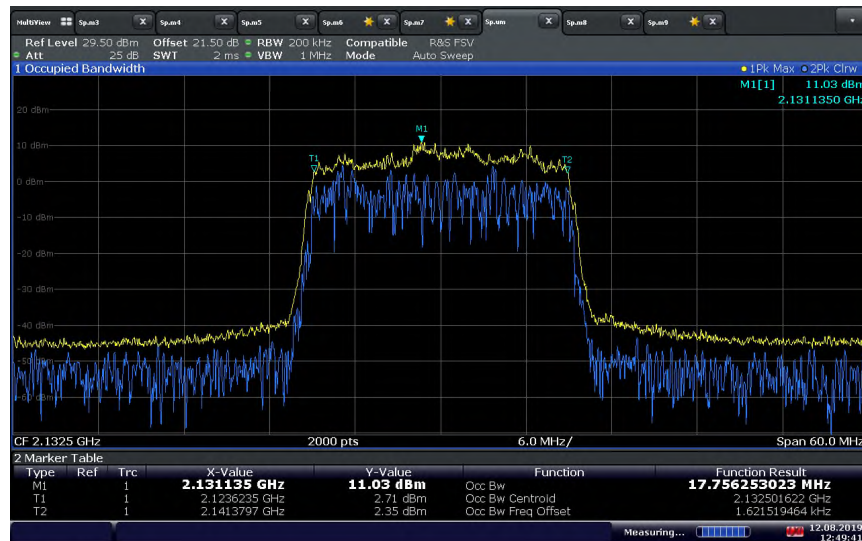
12:40:39 12.08.2019

LTE Band 4 Downlink (15 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 26dB BW



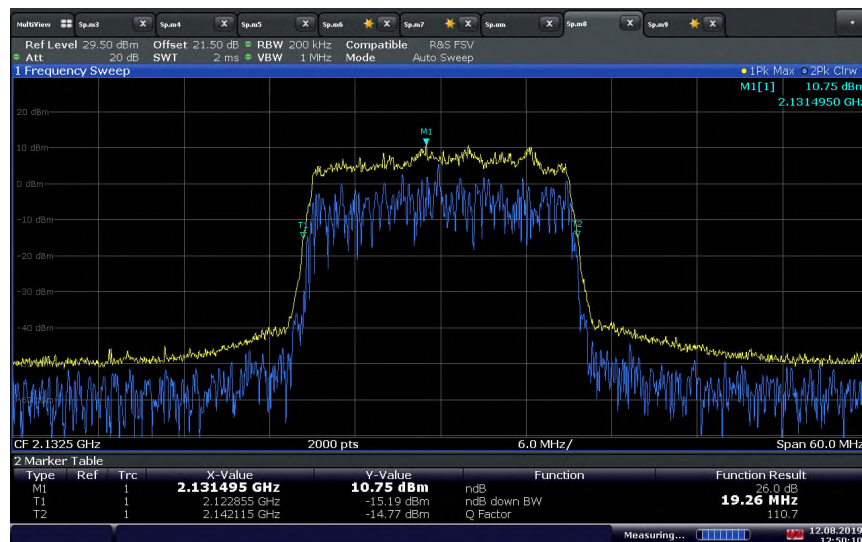
12:39:57 12.08.2019

LTE Band 4 Downlink (20 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 99%OBW



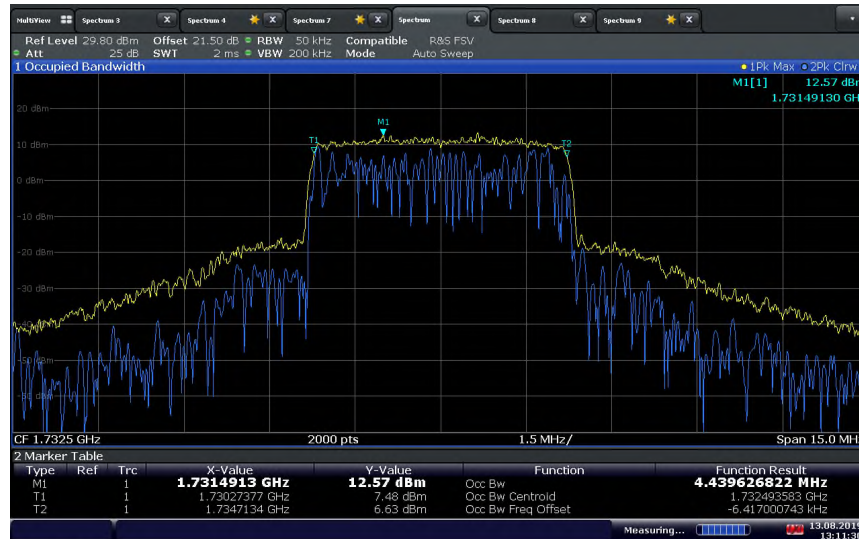
12:49:41 12.08.2019

LTE Band 4 Downlink (20 MHz BW) / Middle Channel Middle Channel 2132.5 MHz / 26dB BW



12:50:11 12.08.2019

LTE Band 4 Uplink (5 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 99%OBW



13:11:32 13.08.2019

LTE Band 4 Uplink (5 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 26dB BW



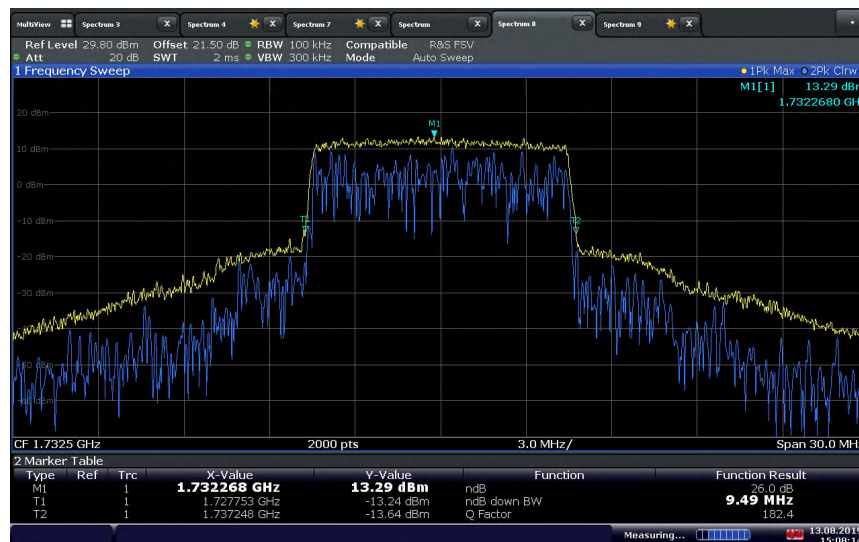
13:10:51 13.08.2019

LTE Band 4 Uplink (10 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 99%OBW



15:07:42 13.08.2019

LTE Band 4 Uplink (10 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 26dB BW



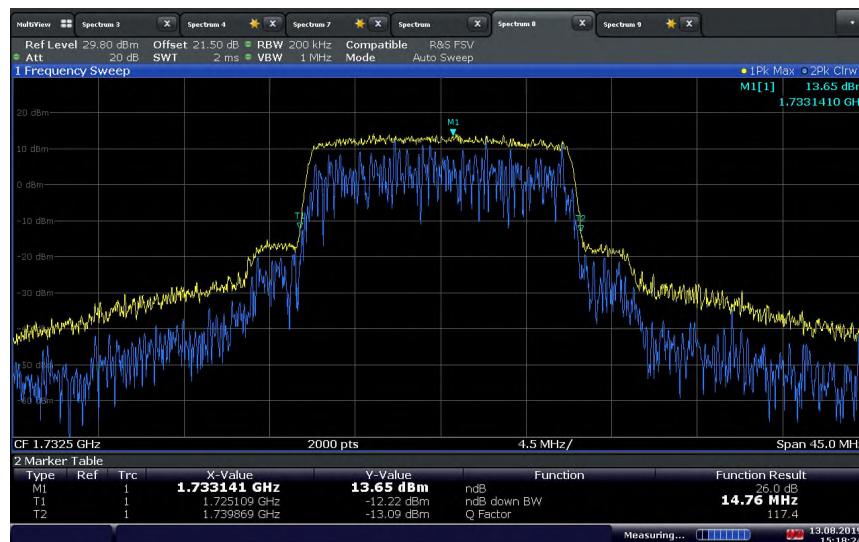
15:08:15 13.08.2019

LTE Band 4 Uplink (15 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 99%OBW



15:17:49 13.08.2019

LTE Band 4 Uplink (15 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 26dB BW



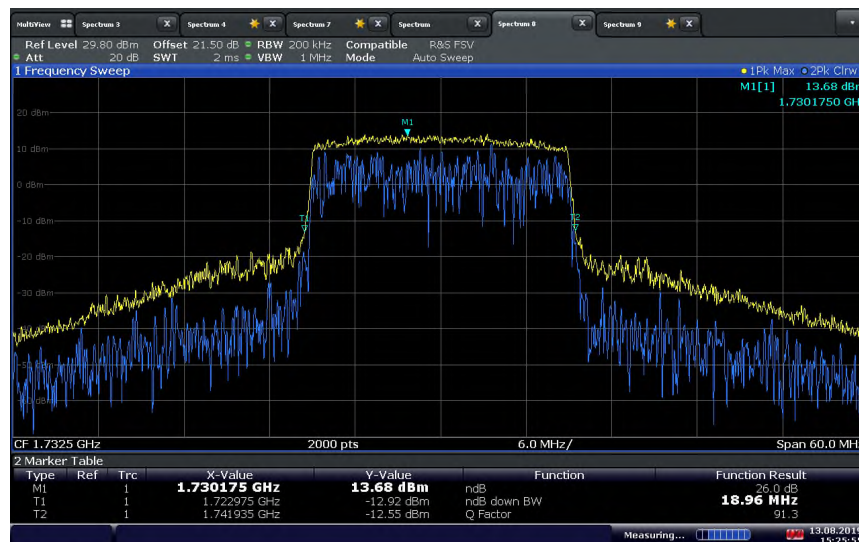
15:18:24 13.08.2019

LTE Band 4 Uplink (20 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 99%OBW



15:26:35 13.08.2019

LTE Band 4 Uplink (20 MHz BW) / Middle Channel Middle Channel 1732.5 MHz / 26dB BW



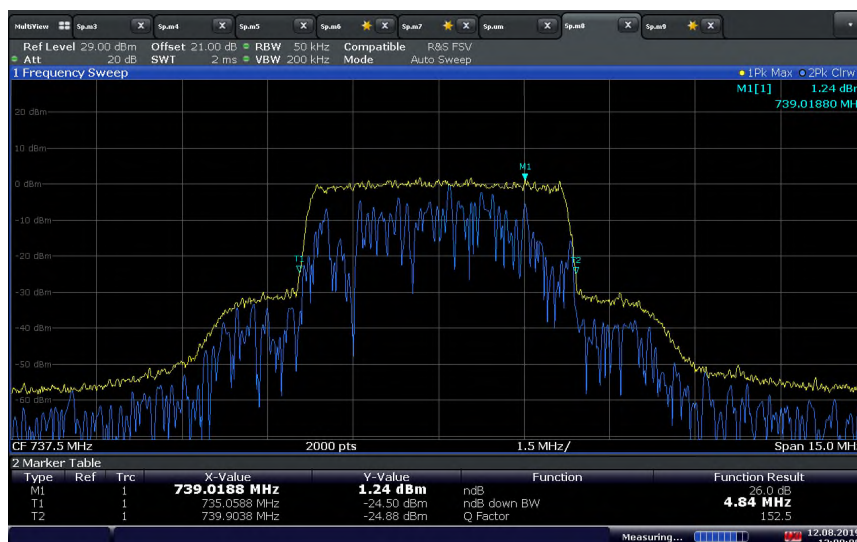
15:25:55 13.08.2019

LTE Band 12 Downlink (5 MHz BW) / Middle Channel Middle Channel 737.5 MHz / 99%OBW



13:08:17 12.08.2019

LTE Band 12 Downlink (5 MHz BW) / Middle Channel Middle Channel 737.5 MHz / 26dB BW



13:09:08 12.08.2019

LTE Band 12 Downlink (10 MHz BW) / Middle Channel Middle Channel 737.5 MHz / 99%OBW



13:19:24 12.08.2019

LTE Band 12 Downlink (10 MHz BW) / Middle Channel Middle Channel 737.5 MHz / 26dB BW



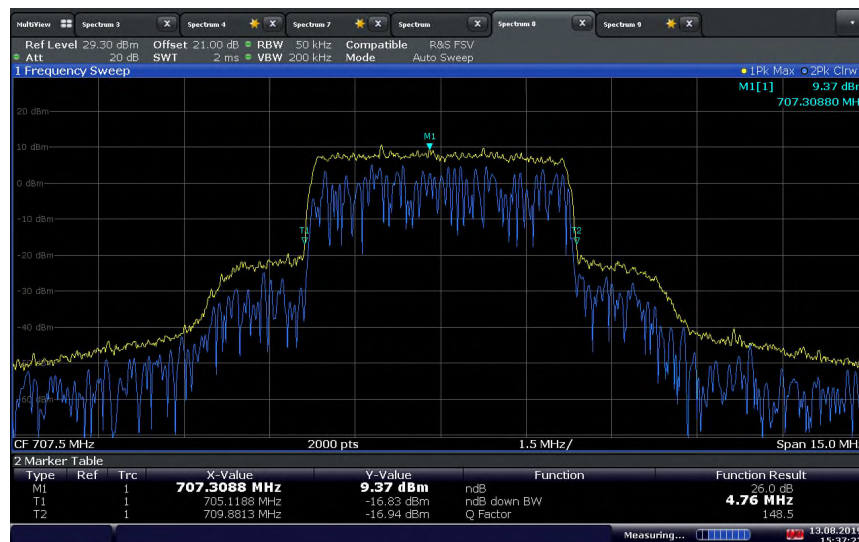
13:18:45 12.08.2019

LTE Band 12 Uplink (5 MHz BW) / Middle Channel Middle Channel 707.5 MHz / 99%OBW



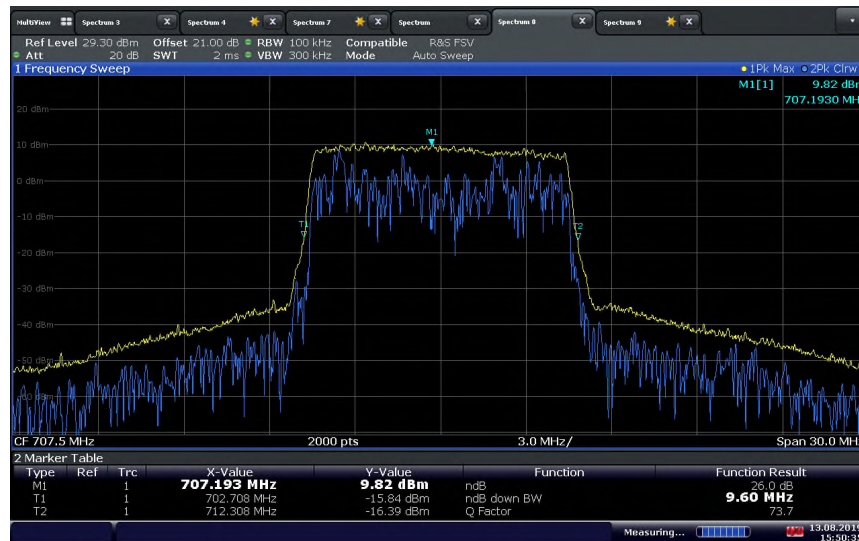
15:36:44 13.08.2019

LTE Band 12 Uplink (5 MHz BW) / Middle Channel Middle Channel 707.5 MHz / 26dB BW



15:37:23 13.08.2019

LTE Band 12 Uplink (10 MHz BW) / Middle Channel Middle Channel 707.5 MHz / 99%OBW



15:50:36 13.08.2019

LTE Band 12 Uplink (10 MHz BW) / Middle Channel Middle Channel 707.5 MHz / 26dB BW



15:52:34 13.08.2019

LTE Band 13 Downlink (5 MHz BW) / Middle Channel Middle Channel 751.0 MHz / 99%OBW



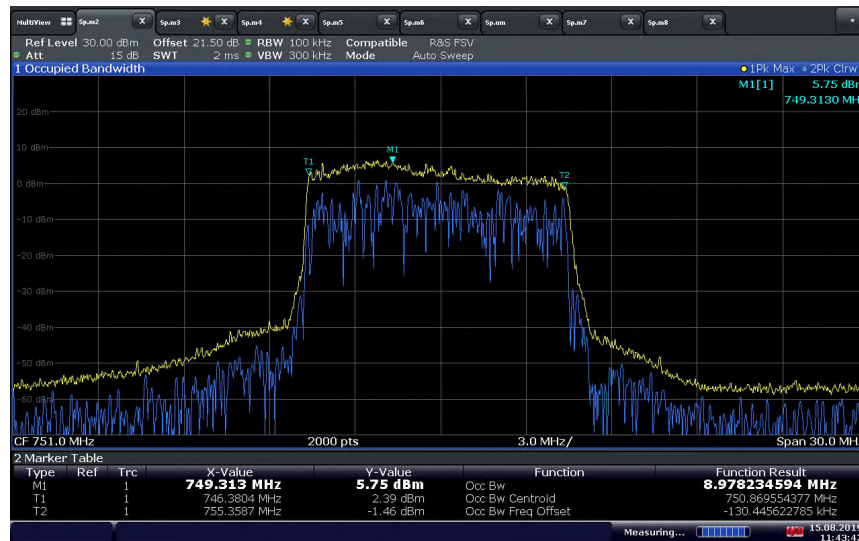
11:14:06 15.08.2019

LTE Band 13 Downlink (5 MHz BW) / Middle Channel Middle Channel 751.0 MHz / 26dB BW



11:14:52 15.08.2019

LTE Band 13 Downlink (10 MHz BW) / Middle Channel Middle Channel 751.0 MHz / 99%OBW



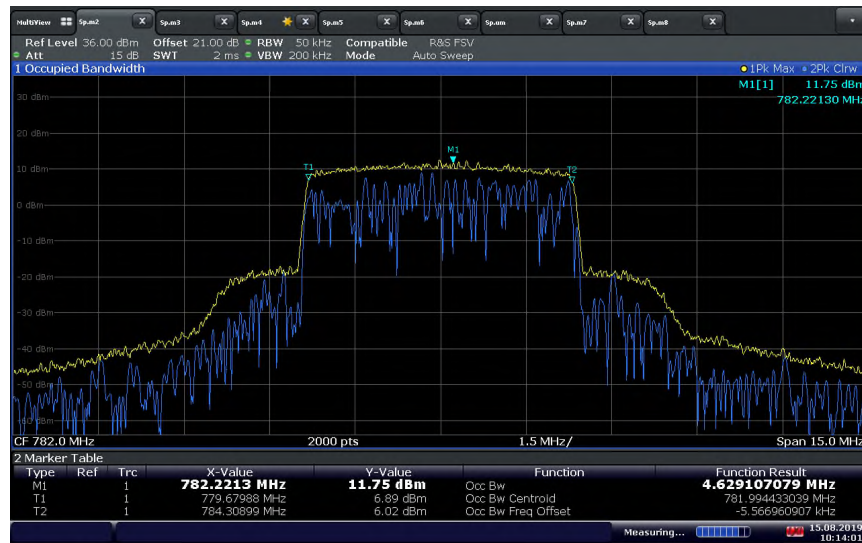
11:43:42 15.08.2019

LTE Band 13 Downlink (10 MHz BW) / Middle Channel Middle Channel 751.0 MHz / 26dB BW



11:44:42 15.08.2019

LTE Band 13 Uplink (5 MHz BW) / Middle Channel Middle Channel 782.0 MHz / 99%OBW



10:14:01 15.08.2019

LTE Band 13 Uplink (5 MHz BW) / Middle Channel Middle Channel 782.0 MHz / 26dB BW



10:14:01 15.08.2019

LTE Band 13 Uplink (10 MHz BW) / Middle Channel Middle Channel 782.0 MHz / 99%OBW



09:58:56 15.08.2019

LTE Band 13 Uplink (10 MHz BW) / Middle Channel Middle Channel 782.0 MHz / 26dB BW



09:59:33 15.08.2019

LTE Band 30 Downlink (5 MHz BW) / Middle Channel Middle Channel 2355.0 MHz / 99%OBW



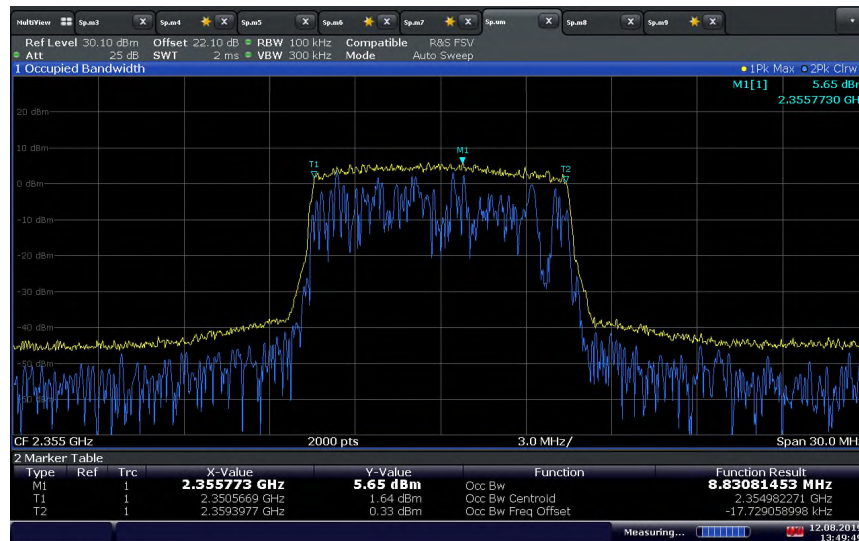
13:40:29 12.08.2019

LTE Band 30 Downlink (5 MHz BW) / Middle Channel Middle Channel 2355.0 MHz / 26dB BW



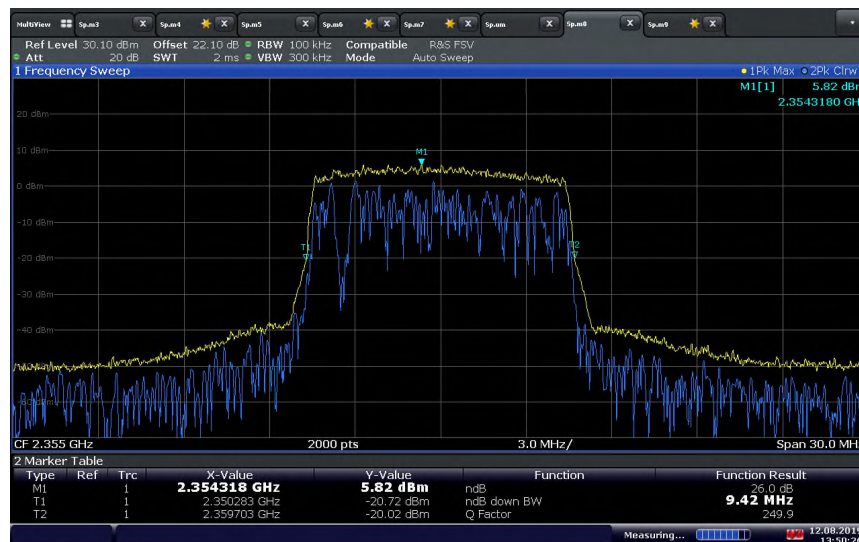
13:39:33 12.08.2019

LTE Band 30 Downlink (10 MHz BW) / Middle Channel Middle Channel 2355.0 MHz / 99%OBW



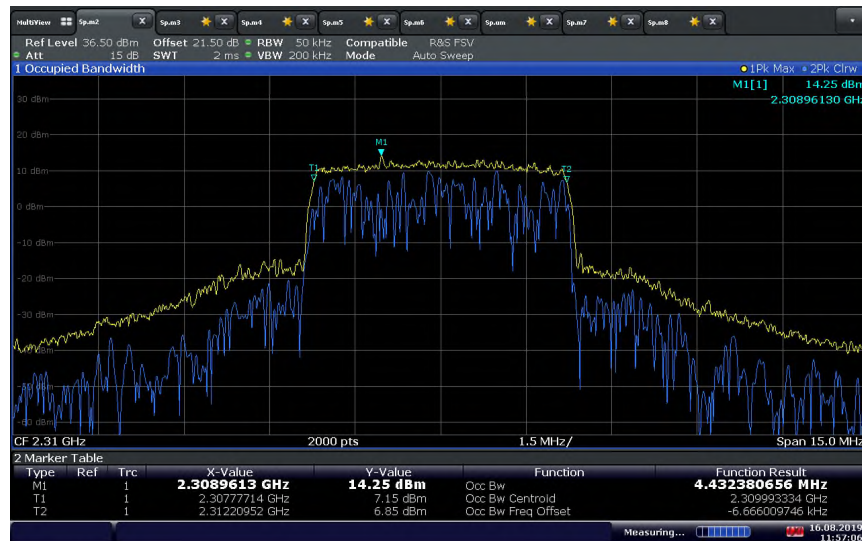
13:49:49 12.08.2019

LTE Band 30 Downlink (10 MHz BW) / Middle Channel Middle Channel 2355.0 MHz / 26dB BW



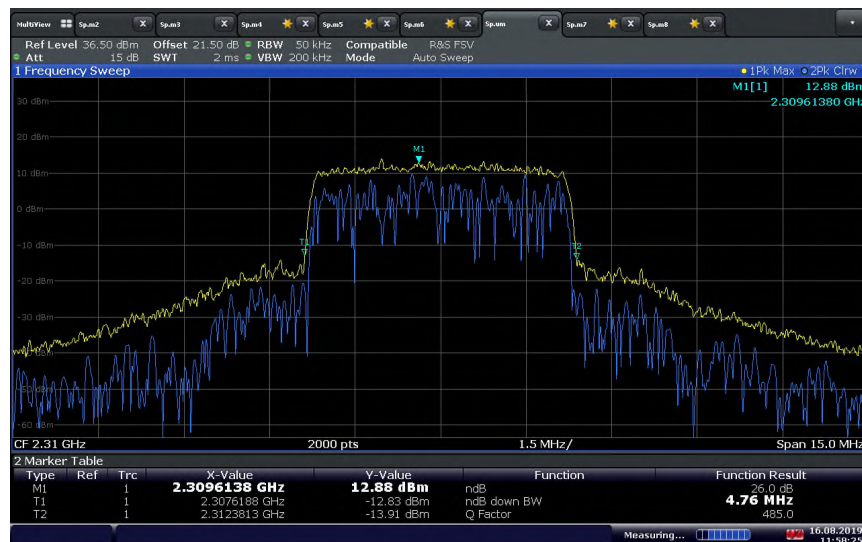
13:50:27 12.08.2019

LTE Band 30 Uplink (5 MHz BW) / Middle Channel Middle Channel 2310.0 MHz / 99%OBW



11:57:07 16.08.2019

LTE Band 30 Uplink (5 MHz BW) / Middle Channel Middle Channel 2310.0 MHz / 26dB BW



11:58:26 16.08.2019

LTE Band 30 Uplink (10 MHz BW) / Middle Channel Middle Channel 2310.0 MHz / 99%OBW



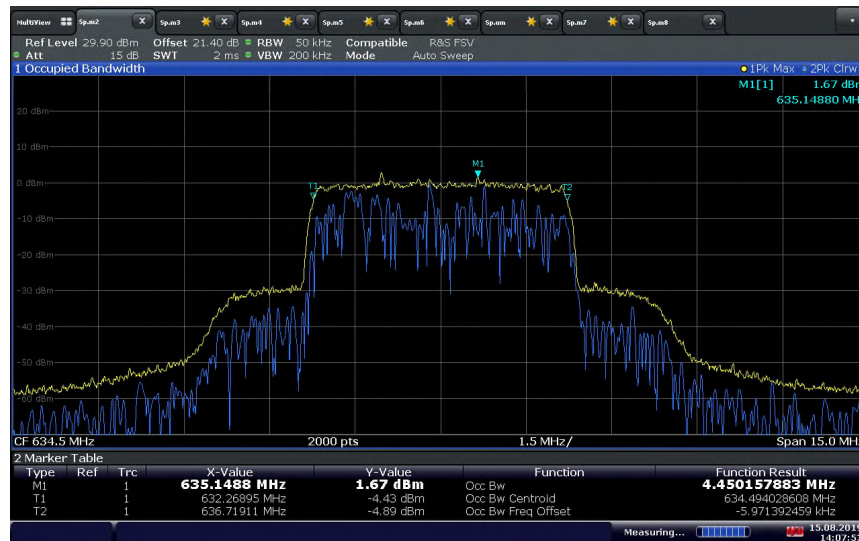
11:53:16 16.08.2019

LTE Band 30 Uplink (10 MHz BW) / Middle Channel Middle Channel 2310.0 MHz / 26dB BW



11:52:05 16.08.2019

LTE Band 71 Downlink (5 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 99%OBW



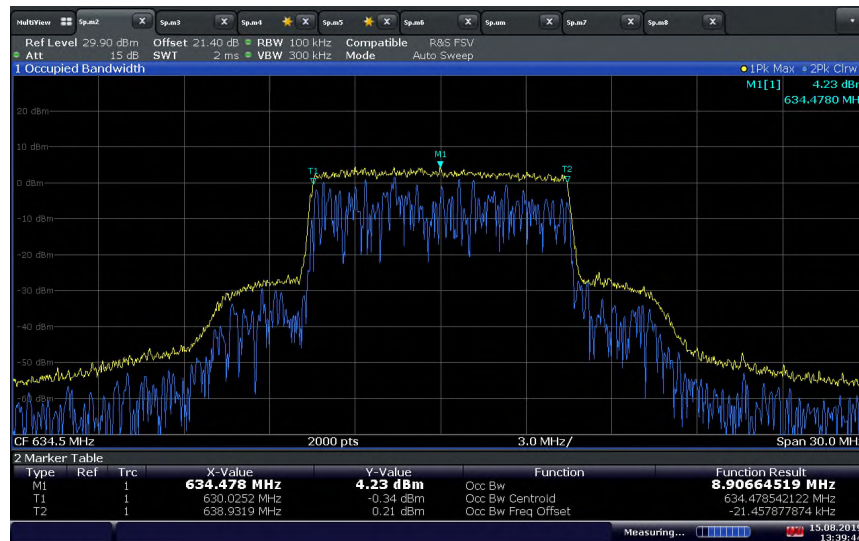
14:07:54 15.08.2019

LTE Band 71 Downlink (5 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 26dB BW



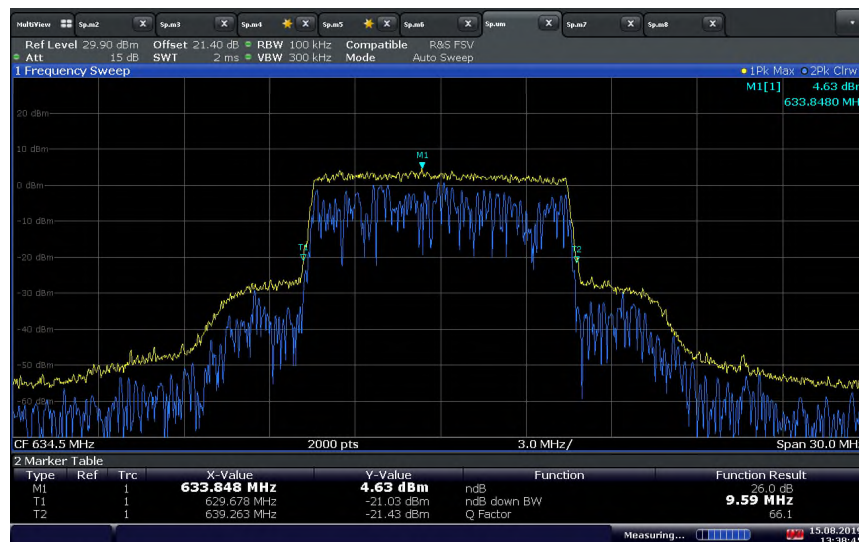
14:09:27 15.08.2019

LTE Band 71 Downlink (10 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 99%OBW



13:39:45 15.08.2019

LTE Band 71 Downlink (10 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 26dB BW



13:38:46 15.08.2019

LTE Band 71 Downlink (15 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 99%OBW



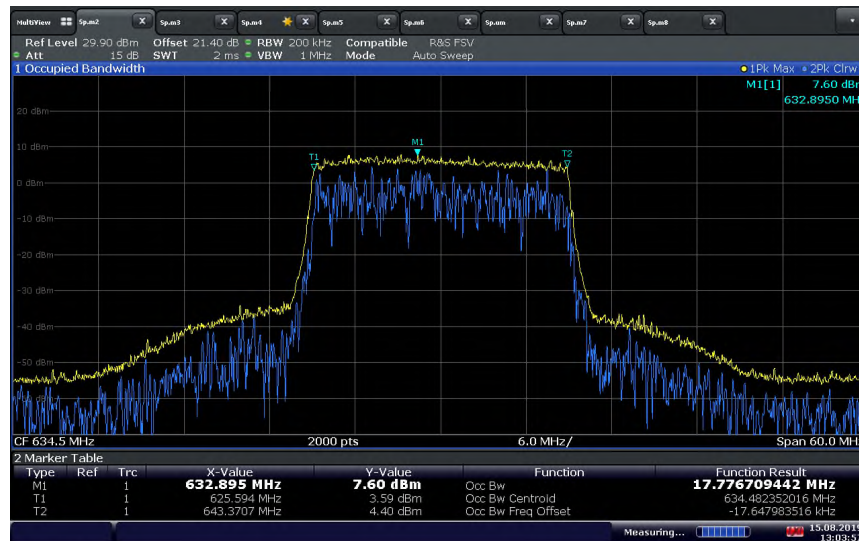
13:27:16 15.08.2019

LTE Band 71 Downlink (15 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 26dB BW



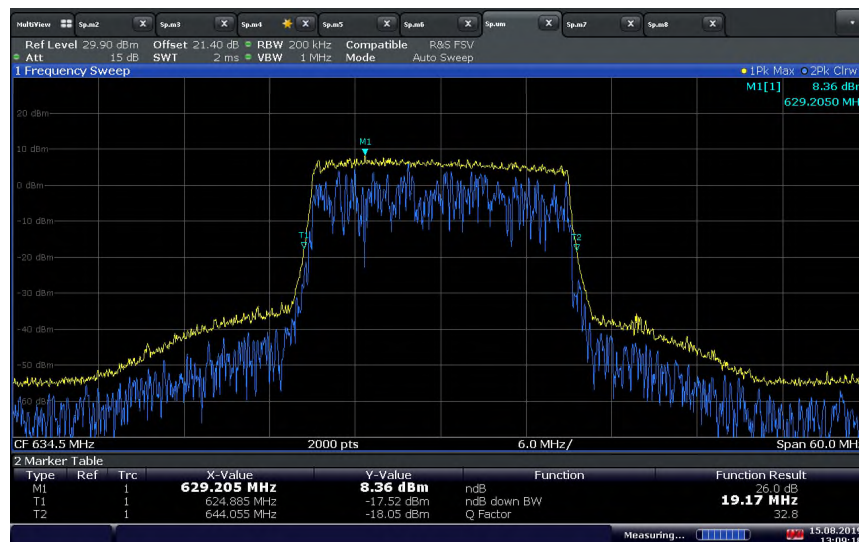
13:28:16 15.08.2019

LTE Band 71 Downlink (20 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 99%OBW



13:03:58 15.08.2019

LTE Band 71 Downlink (20 MHz BW) / Middle Channel Middle Channel 634.5 MHz / 26dB BW



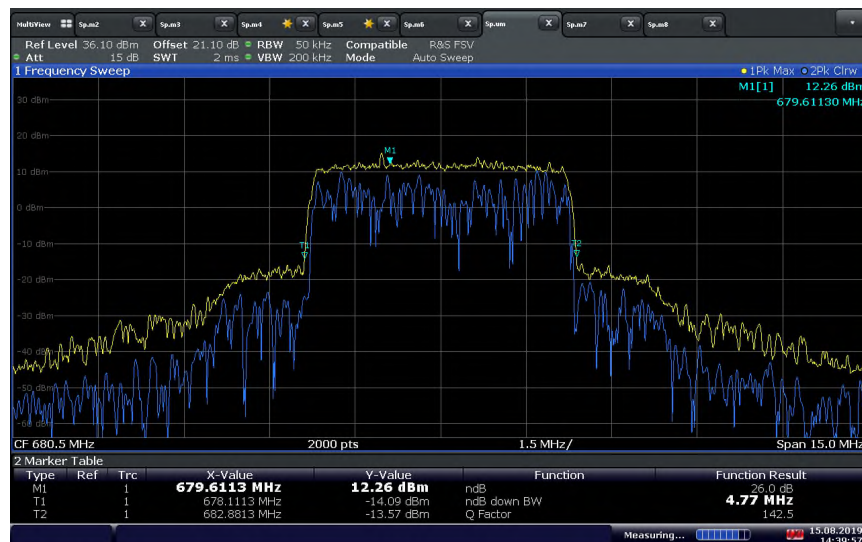
13:09:18 15.08.2019

LTE Band 71 Uplink (5 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 99%OBW



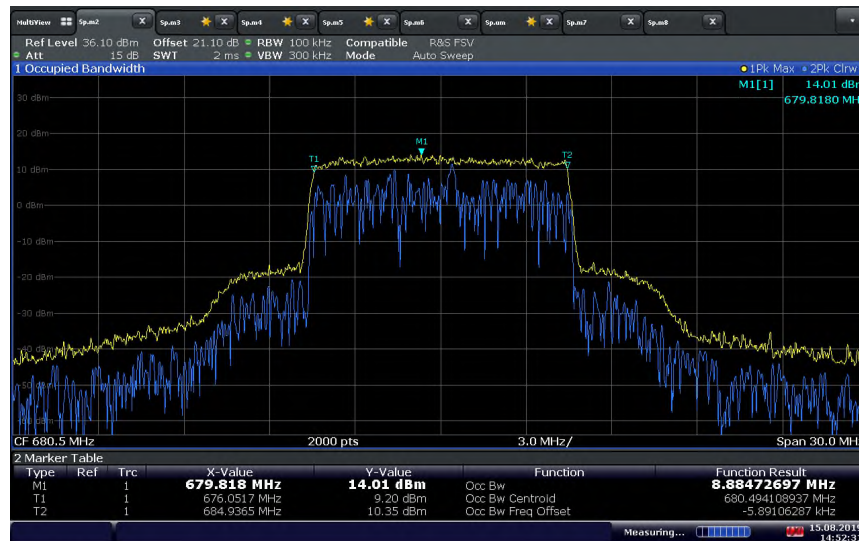
14:38:04 15.08.2019

LTE Band 71 Uplink (5 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 26dB BW



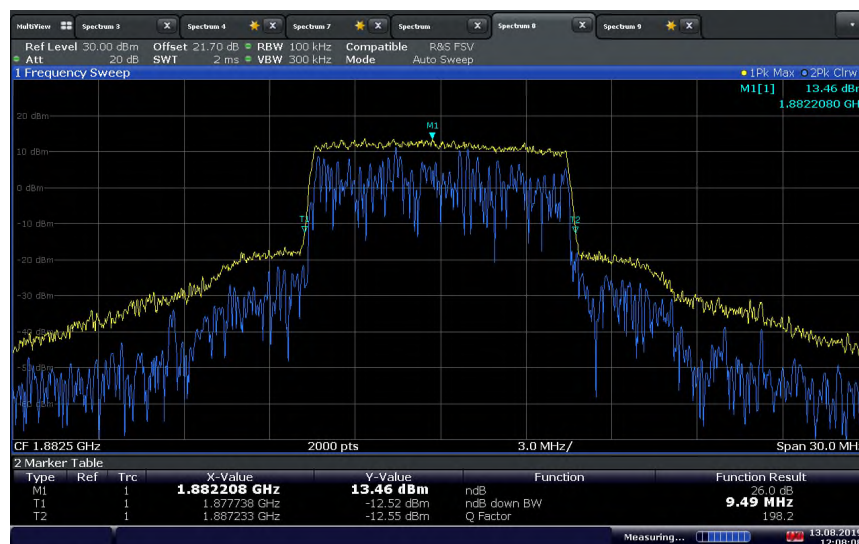
14:39:57 15.08.2019

LTE Band 71 Uplink (10 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 99%OBW



14:52:32 15.08.2019

LTE Band 71 Uplink (10 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 26dB BW



12:08:09 13.08.2019

LTE Band 71 Uplink (15 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 99%OBW



LTE Band 71 Uplink (15 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 26dB BW



LTE Band 71 Uplink (20 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 99%OBW



LTE Band 71 Uplink (20 MHz BW) / Middle Channel Middle Channel 680.5 MHz / 26dB BW



2.5 PEAK-AVERAGE RATIO

2.5.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.50 (d)(5)
RSS-139, Clause 6.5
RSS-130, Clause 4.6.1
RSS-195, Clause 5.5.1

2.5.2 Standard Applicable

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.

2.5.3 Equipment Under Test and Modification State

Serial No: 370920000139 (NU) and 371929000156 (CU) / Test Configuration A and B

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

August 09 to 15, 2019/XYZ

2.5.5 Test Equipment Used

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

2.5.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	25.9 - 26.3°C
Relative Humidity	49.5 - 52.3%
ATM Pressure	98.8 - 99.0kPa

2.5.7 Additional Observations

- This is a conducted test.
- Test procedure is per FCC KDB 971168 D01 v03r01 clause 5.7, the PAPR was measured in accordance with ANSI C63.26 clause 5.2.3.4.
- Measurement was done using the Spectrum Analyzer's Complementary Cumulative Distribution Function (CCDF) measurement profile. The built-in function is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth (crest factor or peak-to-average ratio) A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth.
- RBW was set to maximum the SA can support.
- There are no measured PAR levels greater than 13dB.
- Low, Middle and High channels for all bandwidths were verified.
- Only test plots for middle channel were presented as the representative configuration.

2.5.8 Test Results

LTE Band 4 Downlink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	1975	2112.5	10.54
	2175	2132.5	10.52
	2375	2152.5	9.91
10 MHz	2000	2115.0	9.49
	2175	2132.5	9.63
	2350	2150.0	9.02
15 MHz	2025	2117.5	11.30
	2175	2132.5	10.35
	2325	2147.5	11.25
20 MHz	2050	2120.0	10.44
	2175	2132.5	10.28
	2300	2145.0	9.37

LTE Band 4 Uplink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	19975	1712.5	8.0
	20175	1732.5	8.99
	20375	1752.5	9.27
10 MHz	20000	1715.0	8.10
	20175	1732.5	8.88
	20350	1750.0	8.62
15 MHz	20025	1717.5	8.72
	20175	1732.5	9.53
	20325	1747.5	9.15
20 MHz	20050	1720.0	8.53
	20175	1732.5	9.24
	20300	1745.0	8.89

LTE Band 12 Downlink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	5035	731.5	7.14
	5095	737.5	7.43
	5155	743.5	7.92
10 MHz	5060	734.0	8.90
	5095	737.5	8.84
	5130	741.0	9.47

LTE Band 12 Uplink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	23035	701.5	11.24
	23095	707.5	10.27
	23155	713.5	10.58
10 MHz	23060	704.0	10.34
	23095	707.5	10.35
	23130	711.0	10.91

LTE Band 13 Downlink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	5205	748.5	11.54
	5230	751.0	11.33
	5255	753.5	11.38
10 MHz	-	-	-
	5230	751.0	11.23
	-	-	-

LTE Band 13 Uplink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	23205	779.5	11.17
	23230	782.0	10.88
	23255	784.5	11.05
10 MHz	-	-	-
	23230	782.0	10.99
	-	-	-

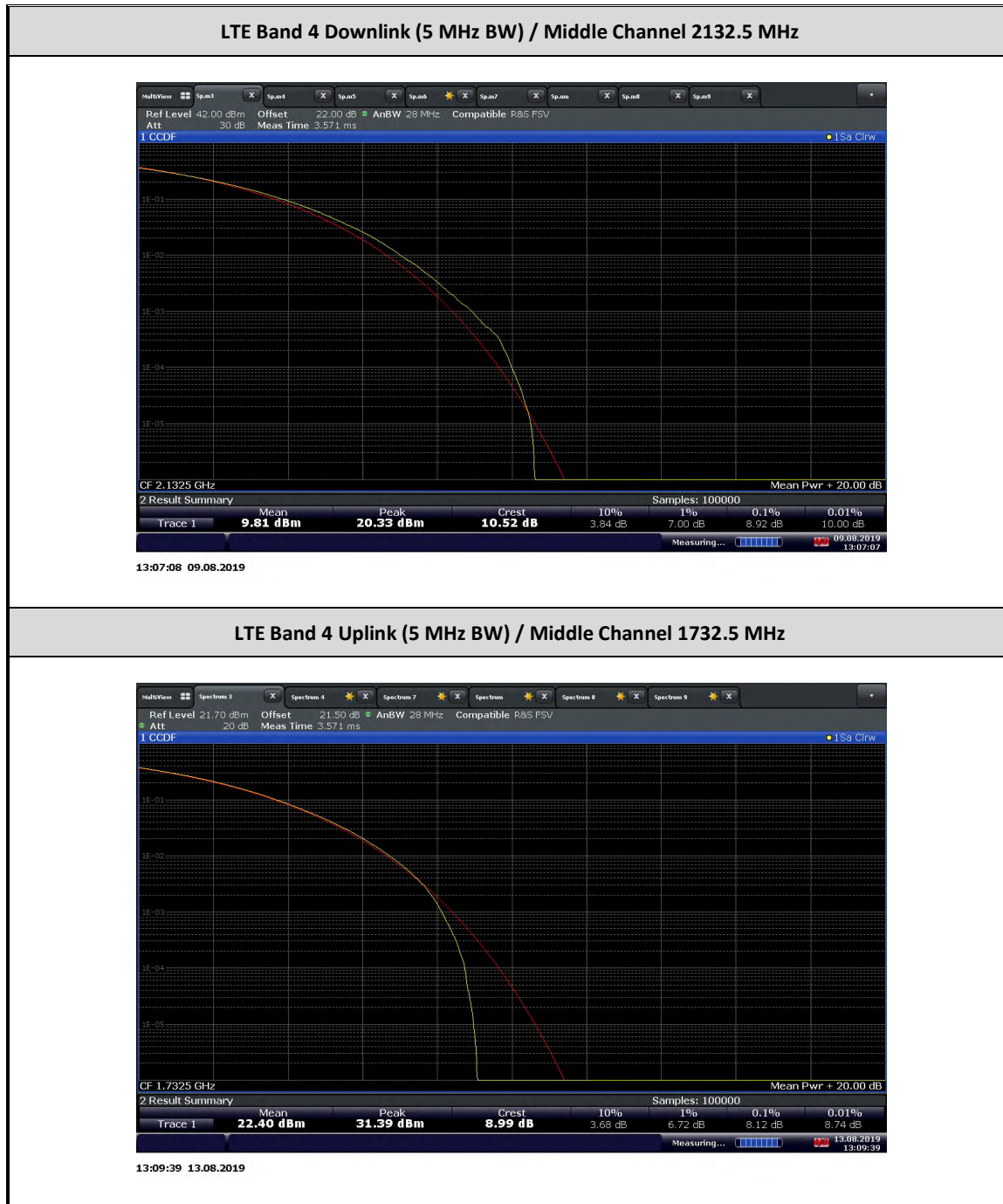
LTE Band 30 Downlink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	9795	2352.5	7.87
	9820	2355.0	7.19
	9845	2357.5	7.93
10 MHz	-	-	-
	9820	2355.0	7.91
	-	-	-

LTE Band 30 Uplink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	27685	2307.5	8.63
	27710	2310.0	8.81
	27735	2312.5	8.52
10 MHz	-	-	-
	27710	2310.0	8.80
	-	-	-

LTE Band 71 Downlink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	68611	619.5	12.53
	68761	634.5	12.06
	68911	649.5	12.57
10 MHz	68636	622.0	11.55
	68761	634.5	11.87
	68886	647.0	12.22
15 MHz	68661	624.5	11.76
	68761	634.5	12.07
	68861	644.5	11.57
20 MHz	68686	627.0	11.86
	68761	634.5	12.12
	68836	642.0	12.26

LTE Band 71 Uplink			
Bandwidth (MHz)	Channels	Frequency (MHz)	PAR (dB)
5 MHz	133147	665.5	11.64
	133297	680.5	11.36
	133447	695.5	12.17
10 MHz	133172	668.0	10.93
	133297	680.5	10.91
	133422	693.0	11.43
15 MHz	133197	670.5	11.16
	133297	680.5	11.21
	133397	690.5	11.27
20 MHz	133222	673.0	10.69
	133297	680.5	11.19
	133372	688.0	11.34

2.5.9 Sample Test Plot



LTE Band 12 Downlink (5 MHz BW) / Middle Channel 737.5 MHz



LTE Band 12 Uplink (5 MHz BW) / Middle Channel 707.5 MHz



LTE Band 13 Downlink (5 MHz BW) / Middle Channel 751 MHz



LTE Band 13 Uplink (5 MHz BW) / Middle Channel 782 MHz

