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Report On

Application for Grant of Equipment Authorization of the
Nextivity Inc.
Cel-Fi Quatra Cellphone Signal Repeater

FCC CFR 47 Part 2 and 27
RSS-Gen and RSS-130

Report No. SD72132066-1017G **November 2017**

REPORT ON	Radio Testing of the Nextivity Inc. Cellphone Signal Repeater
TEST REPORT NUMBER	SD72132066-1017G
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 (858) 485-9442 CKLi@NextivityInc.com
PREPARED BY	Xiaoying Zhang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: EMC/Senior Wireless Test Engineer
DATED	November 13, 2017

Revision History

SD72132066-1017G Nextivity Inc. Cel-Fi Quatra Cellphone Signal Repeater					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
11/13/17	Initial Release				Ferdinand S. Custodio

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
Cel-Fi Quatra Cellphone Signal Repeater

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Nextivity Inc. Cellphone Signal Repeater to the requirements of the following:

- FCC CFR 47 Part 2 and 27
- RSS-Gen and RSS-130.

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.
Model Name	Cel-Fi Quatra
Model Number(s)	NU: Q34-4/5/12/13/25NU_EXA CU: Q34-4/5/12/13/25CU_EXA
FCC ID	NU: YETQ34-45121325NU CU: YETQ34-45121325CU
IC Number	NU: 9298A-Q45121325NU CU: 9298A-Q45121325CU
Serial Number(s)	930629000238 (NU) and 920629000031 (CU) (Note: Verified with a variant of the EUT under Model Number Q34-2/5/13/66NU and Q34-2/5/13/66CU which is declared identical with this model with the exception of different cell bands support)
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC CFR 47 Part 2 and 27 (October 1, 2016). • RSS-130 – Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz (Issue 1, October 2013). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 4, November 2014).
Start of Test	October 19, 2016
Finish of Test	November 09, 2016
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	• 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 with cross-reference to the corresponding IC RSS standard is shown below.

Section	Spec Clause			Test Description	Result
	FCC Part 2	FCC Part 27	RSS-130		
2.1	2.1046	27.50 (b)(9)	4.4	Transmitter Conducted Output Power	Compliant*
2.2	2.1046	27.50 (b)(9)	-	Equivalent Isotropic Radiated Power	Compliant*
	-	-	4.4	Equivalent Radiated Power	Compliant*
2.3	2.1049	27.53 (h)	RSS-Gen 6.6	Occupied Bandwidth	Compliant*
2.4	-	27.50 (d)(5)	4.4	Peak-Average Ratio	Compliant*
2.5	2.1051	27.53 (c)(1),(2),(5)	4.6.1	Band Edge	Compliant*
2.6	2.1051	27.53 (c)(1),(2),(4),(5),(6) and (f)	4.6	Conducted Spurious Emissions	Compliant*
2.7	2.1053	27.53 (c)(1),(2),(4),(5),(6) and (f)	4.6	Field Strength Of Spurious Radiation	Compliant*
2.8	2.1055	27.54	4.3	Frequency Stability	Compliant*
-	-	-	RSS-Gen 6.0	Receiver Spurious Emissions	N/A
2.9	-	-	RSS-Gen 8.8	Power Line Conducted Emission	Compliant*

*Compliant** - *A variant of the EUT was previously approved under FCC IDs NU: YETQ34-251366NU and YETQ34-251366CU under Model Number* Q34-2/5/13/66NU *and Q34-2/5/13/66CU. The EUT is identical with this model with the exception of different bands support. All measurement for LTE Band 13 were from this variant and covered under test report SD72121022-1016A Nextivity FCC IC Part 27 B13 Test Report.pdf.*

Results from previous testing of the EUT using Version 2015 of FCC CFR Part 27 applies. There are no differences between version 2015 and 2016, so the EUT is deemed to comply with FCC CFR Part 27 version 2016.

N/A - *Not applicable. EUT has no Stand-Alone receiver port*

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Nextivity Inc. Cel-Fi Quatra Cellphone Signal Repeater. The EUT is a WCDMA/LTE Signal Booster to improve voice and data cellular performance in large enterprise environments. The EUT 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. Users place the NU in an area with the strongest signal from the carrier network. The CU is then placed in the centre of the home or office, or in the area where the best signal quality is best needed. The NU and CU are placed at varying distances apart and are communicated via Ethernet cables. Both NU and CU also includes Bluetooth LE connectivity. They are using the same Bluetooth module and antenna. LTE Band 13 function of the EUT was verified in this test report.

1.3.2 EUT General Description

EUT Description	Cellphone Signal Repeater
Model Name	Cel-Fi Quatra
Model Number(s)	NU: Q34-4/5/12/13/25NU_EXA CU: Q34-4/5/12/13/25CU_EXA
Rated Voltage	NU: 54V DC via external AC/DC adapter CU: 54V DC via POE
Mode Verified	LTE Band 13
Frequency Range	NU: 777 MHz – 787 MHz CU: 746 MHz – 756 MHz
Channel Bandwidth	5MHz, 10MHz

Rated Power

Bandwidth (MHz)	Band 13	
	DL (dB)	UL (dB)
5	10.0	20
10	13.0	

Capability	WCDMA (Band 5), LTE (Band 25, 12, 13 and 4) and BT LE
Primary Unit (EUT)	☒ Production ☐ Pre-Production ☐ Engineering
Manufacturer Declared Temperature Range	0°C to 40°C
Antenna Type	PCB PIFA
Manufacturer	Nextivity Inc.
Antenna Model	N/A

Maximum Antenna Gain

NU	CU
0 dBi	0 dBi

1.3.3 Transmit Frequency Table

Mode	Channel Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	ERP(Part 27)	
				Max. Power (dBm)	Max. Power (W)
LTE Band 13 Downlink	5	748.5 - 753.5	4M44F9W	11.20	0.013
	10	**751**	**8M79F9W**	**14.28**	**0.027**
LTE Band 13 Uplink	**5**	**779.5 - 784.5**	**4M43F9W**	**22.01**	**0.16**
	10	782	8M82F9W	21.41	0.14

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Downlink (CU TX). Input signal is applied to B13 antenna port of NU. Output is monitored from B13 Top antenna port of CU.
B	Uplink (NU TX). Input signal is applied to B13 antenna port of CU. Output is monitored from B13 Top antenna port of NU.
C	Radiated test setup. Downlink (CU TX). Input signal is applied to B13 antenna port of NU. B13 Top antenna port of CU is terminated with a 50Ω load.
D	Radiated test setup. Uplink (NU TX). Input signal is applied to B13 antenna port of CU. B13 Top antenna port of NU is terminated with a 50Ω load.

1.4.2 EUT Exercise Software

Manufacturer provided a configuration software (ConformanceTest.exe) running from a support laptop where both EUT are connected via USB.

1.4.3 Support Equipment and I/O cables

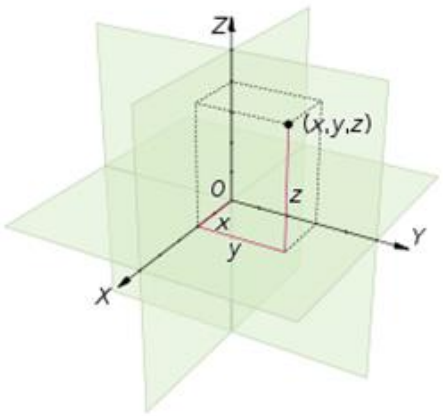
Manufacturer	Equipment/Cable	Description
Nextivity	AC/DC Adapter (EUT)	M/N 290N029-001 S/N 161200002A0, 54VDC 2.22A
Netgear	Network patch Cable (1x NU to CU)	4.0m, unshielded, Cat5e 24AWG UTP
-	Support USB cable	1.75 meters, shielded Type A to Micro B connector
-	Support USB cable	Custom 1.0 meter shielded USB Type A to Type B for the Shielded Test Enclosure
Lenovo	Support Laptop	M/N: 2912-3VU, S/N: R9-92MH0 10/11
Lenovo	Support Laptop AC Adapter	M/N: 42T4430 S/N: 11S42T4430Z1ZGWE27AA9X
Rhode & Schwarz	Support Wideband Radio Communication Tester	M/N CMW500 S/N 1201.0002K50/103829
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:

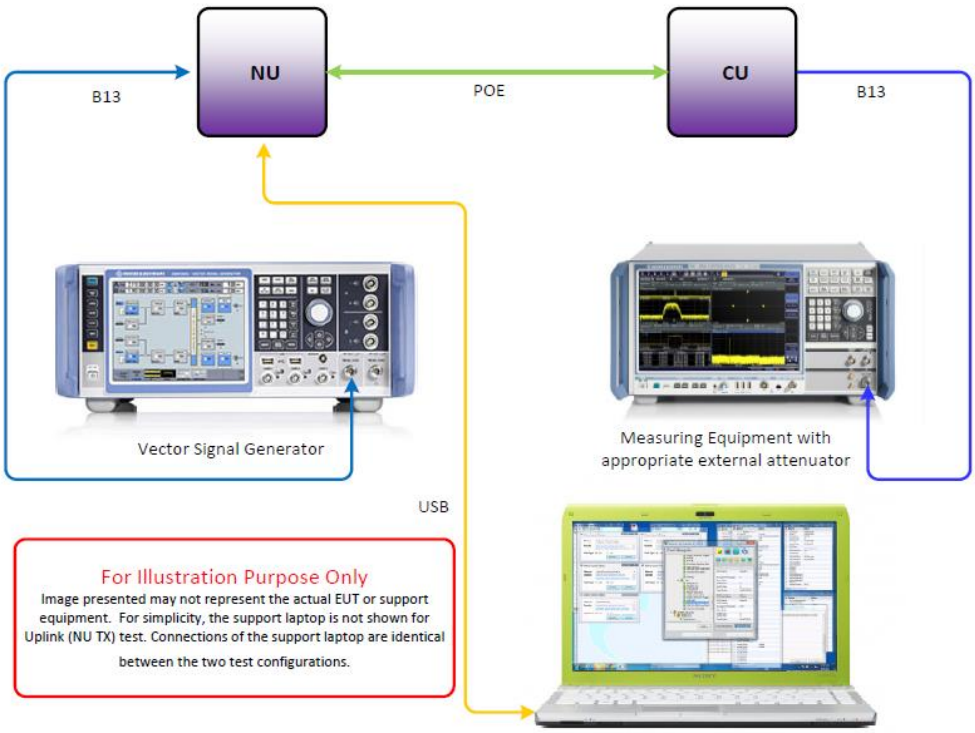
Mode	Bandwidth	Cellular	Frequency
LTE Band 13 Downlink	10MHz	Channel 5230	751 MHz
LTE Band 13 Uplink	5MHz	Channel 23230	782 MHz

EUT is a mobile device. Final installation position is unknown at the time of verification. For radiated measurements X, Y and Z orientations were verified. No major variation in emissions observed between the three (3) orientations. Verifications performed using "Y" configuration.

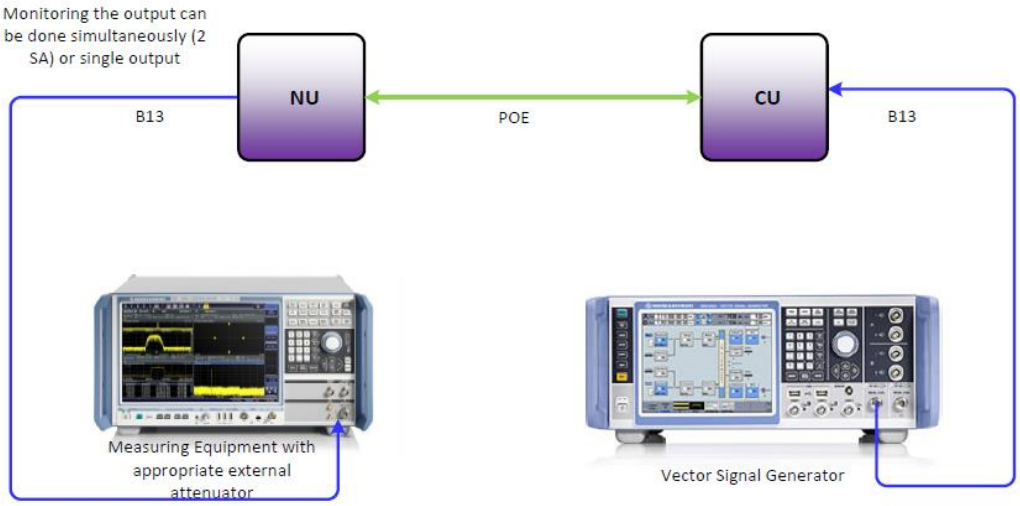


1.4.5 Simplified Test Configuration Diagram

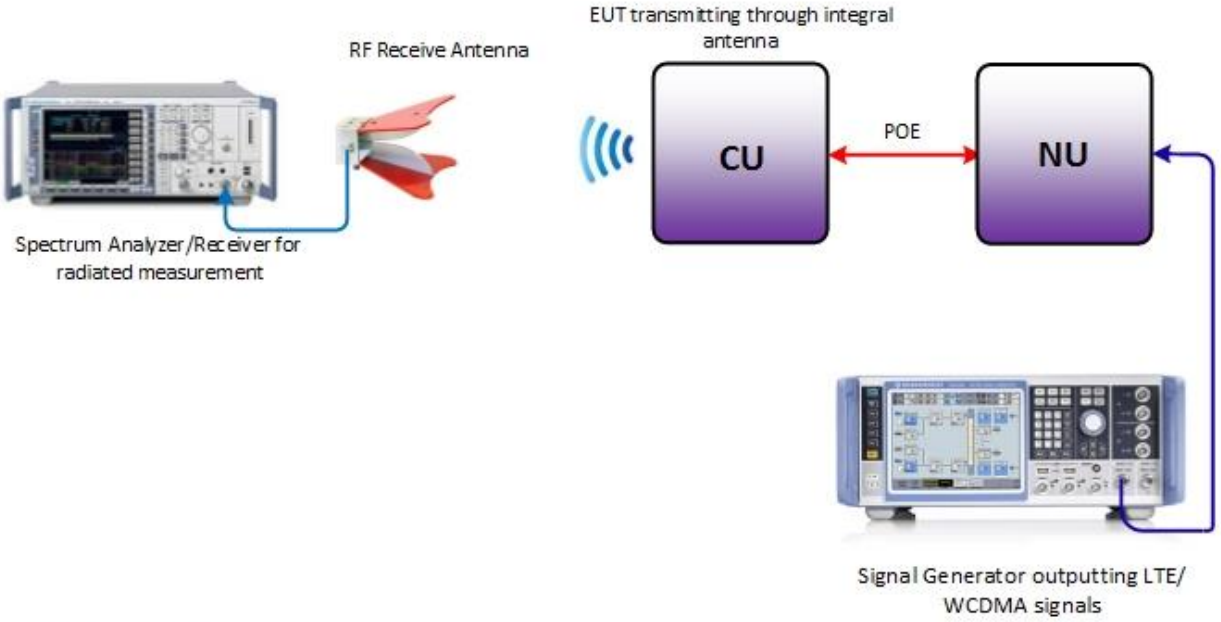
Downlink (CU Tx) Conducted Test



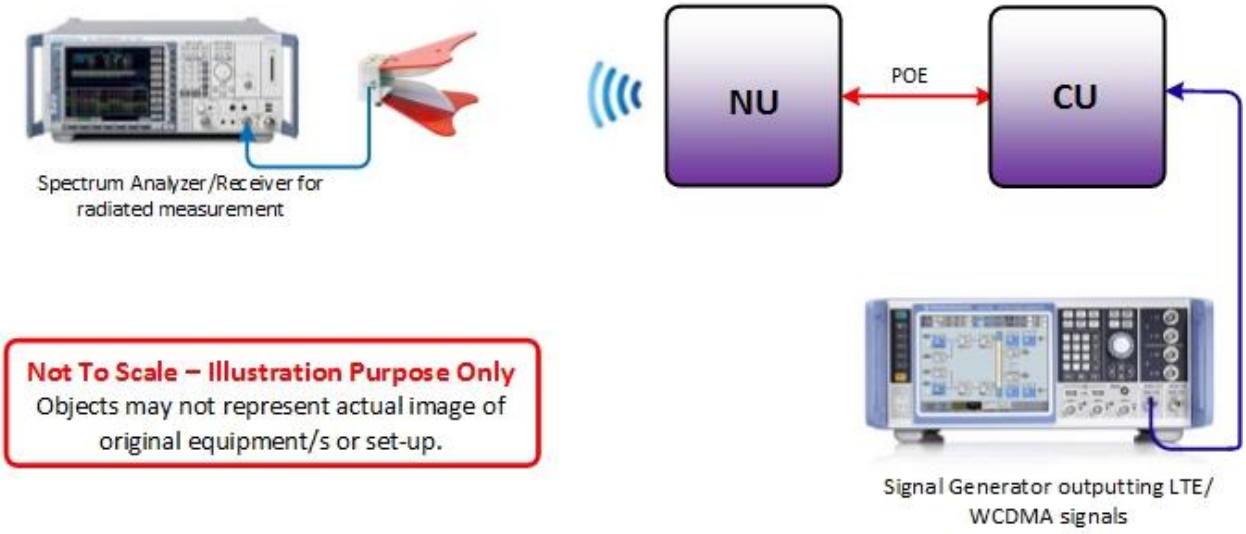
Uplink (NU Tx) Conducted Test



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 930629000238 (NU) and 920629000031 (CU)		
N/A	-	-

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 Registration is US1146.

1.9.2 Innovation, Science and Economic Development Canada 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.

1.10 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**

1.10.3 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

SECTION 2

TEST DETAILS

Radio Testing of the
Nextivity Inc.
Cel-Fi Quatra Cellphone Signal Repeater

2.1 TRANSMITTER CONDUCTED OUTPUT POWER

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046 (a) and (c)
FCC 47 CFR Part 27, Clause 27.50 (b)(9)
RSS-130, Clause 4.4

2.1.2 Standard Applicable

FCC 47 CFR 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.

FCC 47 CFR Part 27, Clause 27.50 (b)(9):
Control stations and mobile stations transmitting in the 746–757 MHz, 776–788 MHz, and 805–806 MHz bands and fixed stations transmitting in the 787–788 MHz and 805–806 MHz bands are limited to 30 watts ERP.

RSS-130, Clause 4.4:
The e.i.r.p. shall not exceed 50 watts for mobile equipment or for outdoor fixed subscriber equipment, nor shall it exceed 5 watts for portable equipment or for indoor fixed subscriber equipment.

2.1.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration A and B

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

October 19, 2016/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 performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	26.6°C
Relative Humidity	45.1%
ATM Pressure	98.8kPa

2.1.7 Additional Observations

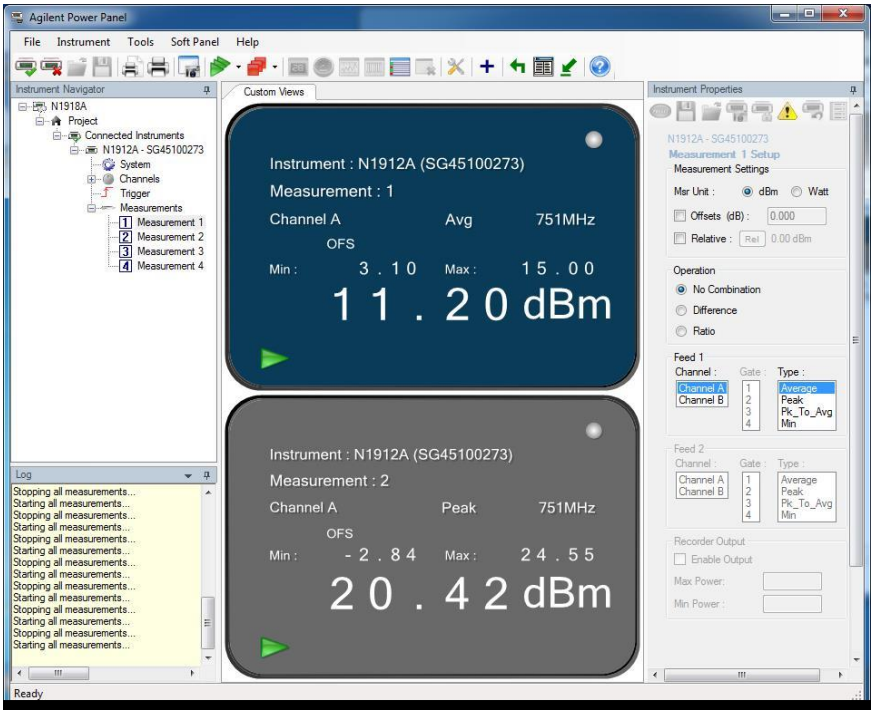
- This is a conducted test using an average power meter.
- The path loss was measured and entered as a level offset.
- Both Peak and Average measurements presented.
- Since LTE B13 supports MIMO mode, using the Measure-and-Sum approach, the output power of both Top Antenna Port and Side Antenna Port were measured, and the total output power were then summed mathematically in linear power units according to FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

2.1.8 Test Results

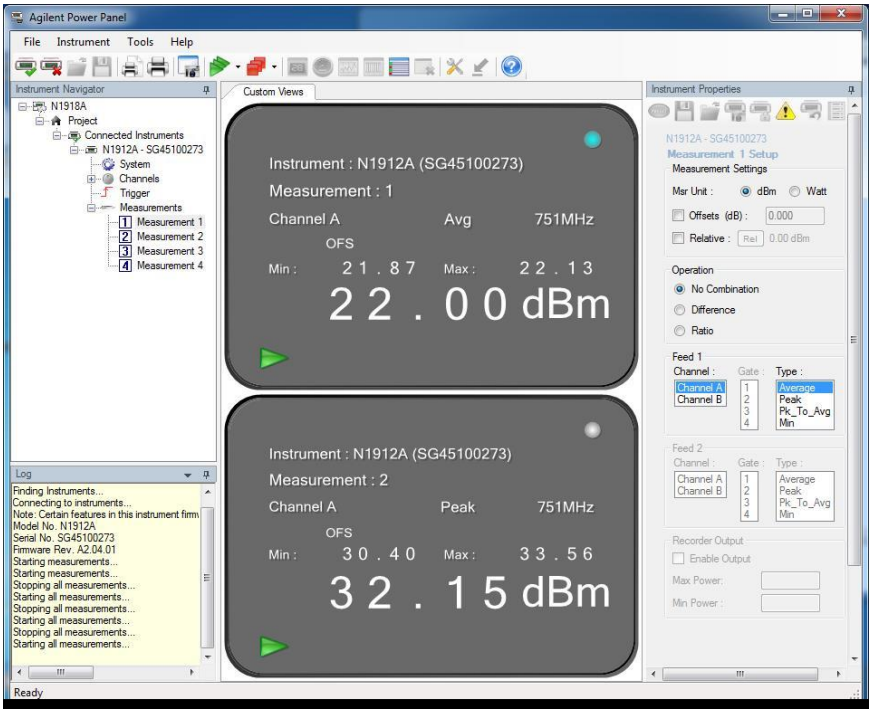
LTE B13 Downlink								
Bandwidth (MHz)	Channel	Frequency (MHz)	Top Antenna		Side Antenna		Sum	
			Avg Power (dBm)	PK Power (dBm)	Avg Power (dBm)	PK Power (dBm)	Avg Power (dBm)	PK Power (dBm)
5	5205	748.5	10.46	22.64	10.86	22.53	13.67	25.60
	5230	751	11.20	20.42	10.78	21.04	14.00	23.75
	5255	753.5	11.01	21.42	10.44	20.44	13.74	23.97
10	-	-	-	-	-	-	-	-
	5230	751	14.28	23.29	13.85	22.2	17.08	25.79
	-	-	-	-	-	-	-	-

LTE B13 Uplink								
Bandwidth (MHz)	Channel	Frequency (MHz)	Top Antenna		Side Antenna		Sum	
			Avg Power (dBm)	PK Power (dBm)	Avg Power (dBm)	PK Power (dBm)	Avg Power (dBm)	PK Power (dBm)
5	23205	779.5	22.01	31.45	20.43	31.68	24.30	34.58
	23230	782	22.00	32.15	21.60	31.54	24.81	34.87
	23255	784.5	21.94	32.91	20.91	31.05	24.46	35.09
10	-	-	-	-	-	-	-	-
	23230	782	21.41	31.55	21.19	31.14	24.31	34.36
	-	-	-	-	-	-	-	-

2.1.9 Sample Test Plot



LTE Band 13 DL 5MHz Bandwidth Mid Channel



LTE Band 13 UL 5MHz Bandwidth Mid Channel

2.2 EFFECTIVE RADIATED POWER

2.2.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046 (a) and (c)
FCC 47 CFR Part 27, Clause 27.50 (b)(9)
RSS-130, Clause 4.4

2.2.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.50 (b)(9):
Control stations and mobile stations transmitting in the 746–757 MHz, 776–788 MHz, and 805–806 MHz bands and fixed stations transmitting in the 787–788 MHz and 805–806 MHz bands are limited to 30 watts ERP.

RSS-130, Clause 4.4:
The e.i.r.p. shall not exceed 50 watts for mobile equipment or for outdoor fixed subscriber equipment, nor shall it exceed 5 watts for portable equipment or for indoor fixed subscriber equipment.

2.2.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU)

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

October 19, 2016/XYZ

2.2.5 Additional Observations

- ERP was calculated as per Section 1.3.2 of KDB412172 D01 (Determining ERP and EIRP v01).
- Calculation formula in logarithmic terms:

$$\mathbf{ERP = P_T + G_T - L_C - 2.15dB}$$

Where:

$\mathbf{P_T}$ = transmitter conducted output power dBm (Section 2.1 of this test report)
$\mathbf{G_T}$ = gain of the transmitting antenna, in dBi (EIRP: the -2.15 in the formula is to convert EIRP to ERP);
$\mathbf{L_C}$ = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

2.2.6 Sample Computation

ERP = $P_T + G_T - L_C$ - 2.15dB
= 29.87 (Peak) + 0.13 (max. gain) – 3.84 (cable loss) -2.15
= 24.01 dBm

2.2.7 Test Results

LTE B13 Downlink							
Bandwidth (MHz)	Frequency (MHz)	Avg Power (dBm)		Antenna Gain (dBi)	Sum		Limit (dBm)
		Top Antenna	Side Antenna		ERP (dBm)	EIRP (dBm)	
5	748.5	10.46	10.86	0	11.52	13.67	44.77
	751	11.20	10.78	0	11.85	14.00	44.77
	753.5	11.01	10.44	0	11.59	13.74	44.77
10	-	-	-	-	-	-	44.77
	751	**14.28**	**13.85**	0	14.93	**17.08**	44.77
	-	-	-	-	-	-	44.77

LTE B13 Uplink							
Bandwidth (MHz)	Frequency (MHz)	Avg Power (dBm)		Antenna Gain (dBi)	Sum		Limit (dBm)
		Top Antenna	Side Antenna		ERP (dBm)	EIRP (dBm)	
5	**779.5**	**22.01**	**20.43**	**0**	**22.15**	**24.30**	**44.77**
	782	22.00	21.60	0	22.66	24.81	44.77
	784.5	21.94	20.91	0	22.31	24.46	44.77
10	-	-	-	-	-	-	44.77
	782	21.41	21.19	0	22.16	24.31	44.77
	-	-	-	-	-	-	44.77

2.3 OCCUPIED BANDWIDTH

2.3.1 Specification Reference

FCC 47 CFR Part 2. Clause 2.1049
FCC 47 CFR Part 27, Clause 27.53(h)
RSS-GEN Issue 4, Clause 6.6

2.3.2 Standard Applicable

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

2.3.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration A and B

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

October 20, 2016/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 performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	26.4°C
Relative Humidity	33.8%
ATM Pressure	99.0kPa

2.3.7 Additional Observations

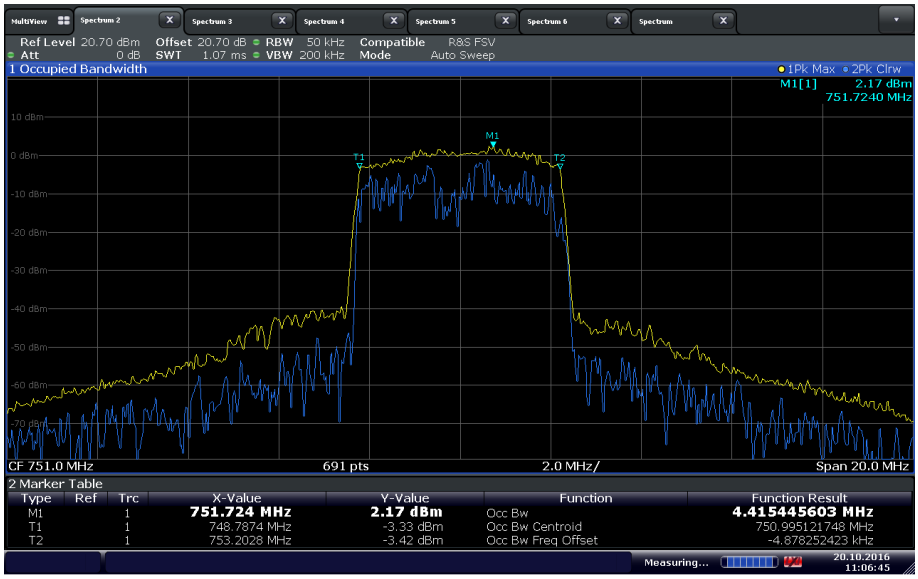
- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- All channels for emission bandwidth verification verified.
- The span is between two and five times the anticipated OBW.
- The RBW is set to 1% of the OBW while the VBW is ≥3X RBW.
- The detector is peak and the trace mode 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.
- The SA built-in emission bandwidth measurement feature is utilized. The power level setting is set to 99% while “x dB” is set to -26.

2.3.8 Test Results

Downlink					
Band	**Bandwidth**	**Channel**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
LTE Band 13	5MHz	5205	748.5	4.44	4.78
		5230	751	4.42	4.78
		5255	753.5	4.42	4.78
	10MHz	-	-	-	-
		5230	751	8.79	9.32
		-	-	-	-

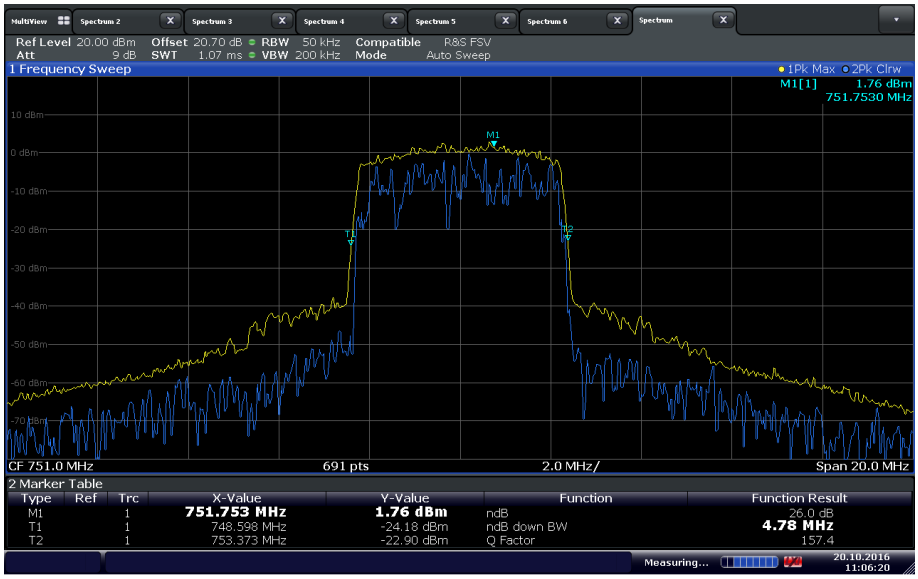
Uplink					
Band	**Bandwidth**	**Channel**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
LTE Band 13	5MHz	23205	748.5	4.42	4.78
		23230	751	4.43	4.78
		23255	753.5	4.43	4.78
	10MHz	-	-	-	-
		23230	751	8.82	9.38
		-	-	-	-

LTE Band 13 Downlink 5MHz Bandwidth Mid Channel 99% OBW



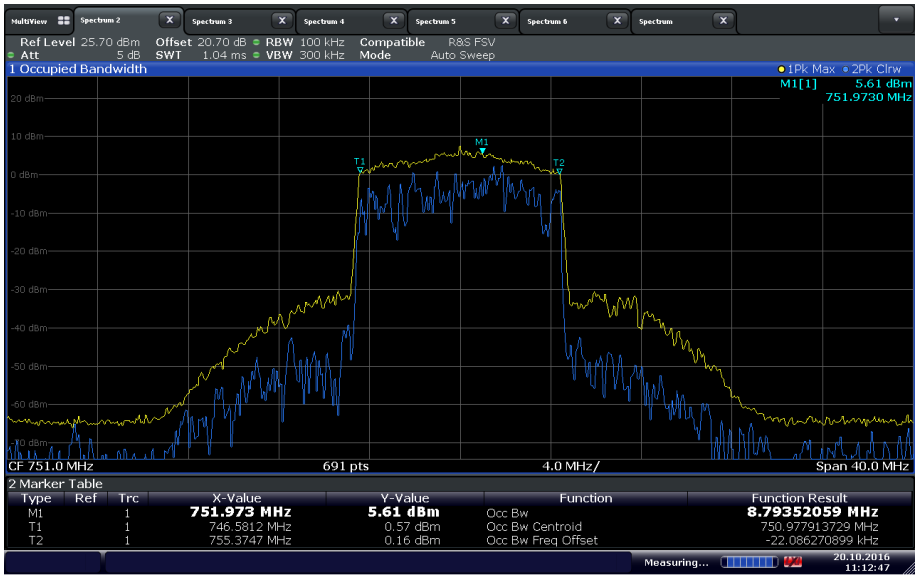
11:06:46 20.10.2016

LTE Band 13 Downlink 5MHz Bandwidth Mid Channel -26dB BW



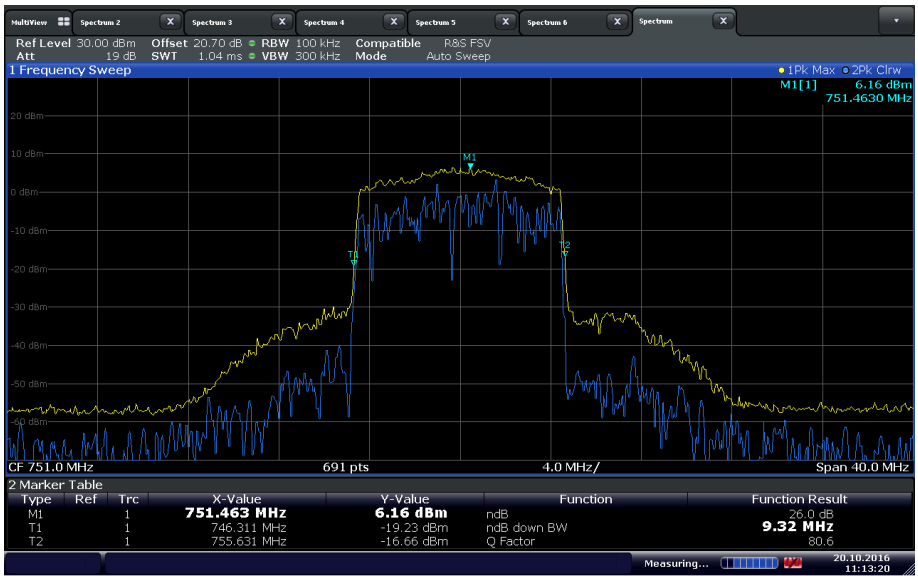
11:06:20 20.10.2016

LTE Band 13 Downlink 10MHz Bandwidth Mid Channel 99% OBW



11:12:47 20.10.2016

LTE Band 13 Downlink 10MHz Bandwidth Mid Channel -26dB BW

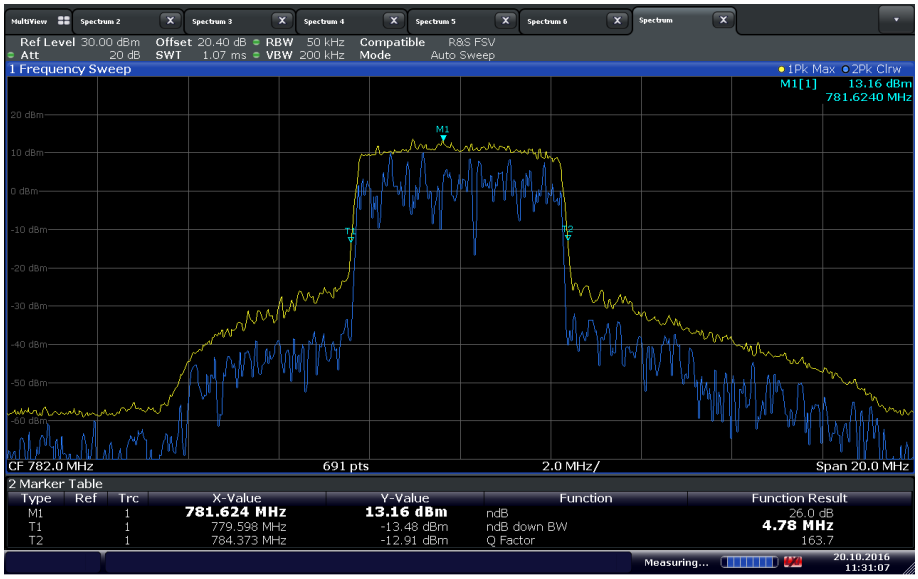


11:13:20 20.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Mid Channel 99% OBW

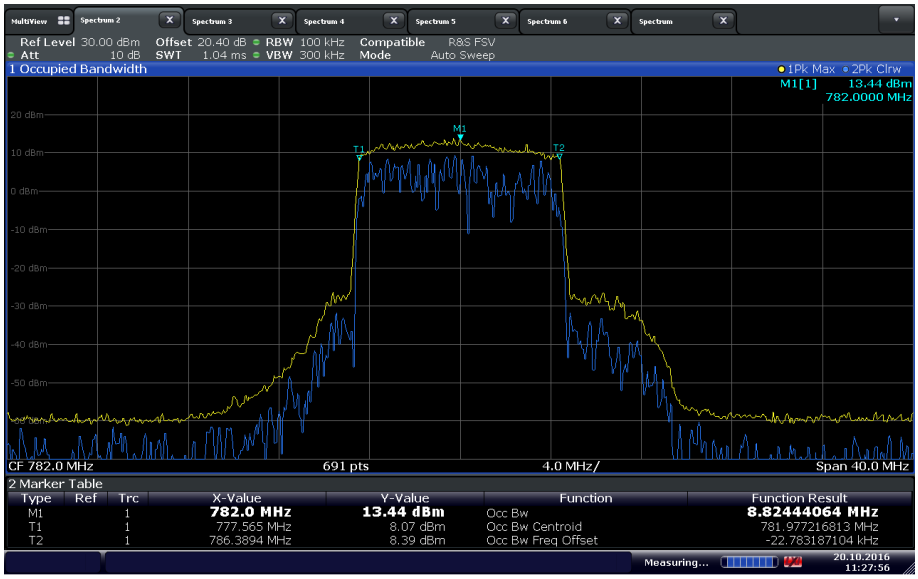
11:31:44 20.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Mid Channel -26dB BW



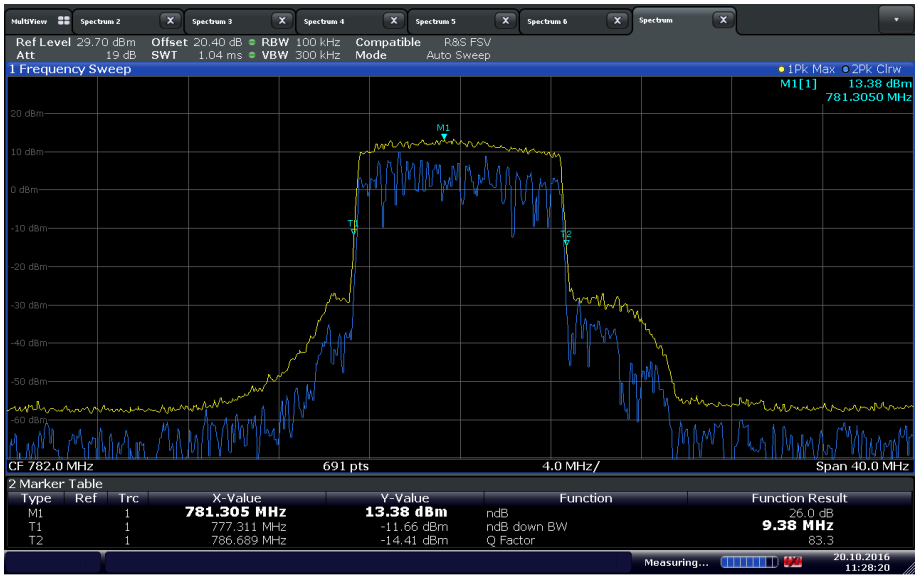
11:31:08 20.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Mid Channel 99% OBW



11:27:56 20.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Mid Channel -26dB BW



11:28:20 20.10.2016

2.4 PEAK-AVERAGE RATIO

2.4.1 Specification Reference

RSS-130, Clause 4.4

2.4.2 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.

2.4.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration A and B

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

October 20, 2016/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	26.4°C
Relative Humidity	33.8%
ATM Pressure	99.0kPa

2.4.7 Additional Observations

- This is a conducted test. Test procedure is per Section 5.7 of KDB971168 (D01 Power Meas License Digital Systems v02r02). Appropriate offset (line loses) applied.
- 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) The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signals spends at or above the level defines the probability for that particular power level.
- Procedure is per Section 5.7.1 of KDB971168.
- RBW was set to maximum the SA can support.

- The maximum PAPR level associated with a probability of 0.1% was recorded.
- All low, middle and high channels were verified. Only test plots for middle channel presented in this test report as the representative configuration.
- There are no measured PAR levels greater than 13dB. EUT complies.

2.4.8 Test Results

Downlink				
Band	**Bandwidth**	**Channel**	***Frequency (MHz)***	**PAR (dB)**
LTE Band 13	5MHz	5205	748.5	11.74
		5230	751	11.54
		5255	753.5	11.92
	10MHz	-	-	-
		5230	751	10.44
		-	-	-

Uplink				
Band	**Bandwidth**	**Channel**	***Frequency (MHz)***	**PAR (dB)**
LTE Band 13	5MHz	23205	779.5	11.23
		23230	782	11.25
		23255	784.5	11.21
	10MHz	-	-	-
		23230	782	10.83
		-	-	-

2.4.9 Sample Test Plot

LTE Band 13 Downlink 5MHz Bandwidth Mid Channel -PAR

11:07:15 20.10.2016

LTE Band 13 Downlink 10MHz Bandwidth Mid Channel -PAR

11:11:37 20.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Mid Channel -PAR

11:30:32 20.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Mid Channel -PAR

11:27:22 20.10.2016

2.5 BAND EDGE

2.5.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.53(c)(1),(2) and (5)
RSS-130, Clause 4.6.

2.5.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.53:
(c)(1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(c)(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(c)(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130, Clause 4.6.1:
The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside thefrequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

2.5.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration A and B

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

October 20, 2016/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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.4°C
Relative Humidity	33.8%
ATM Pressure	99.0kPa

2.5.7 Additional Observations

- This is a conducted test. Test guidance is per Section 6.0 of KDB971168 (D01 Power Meas License Digital Systems v02r01).
- The path loss was measured and entered as a level offset.
- The center frequency of the spectrum is the band edge frequency (worst case 746 MHz – 756MHz and 777 MHz -787 MHz per IC requirement).
- Using a span of 2MHz, RBW is set to 30 kHz and VBW is set to 3X RBW.
- The limit was set to -13dBm in the 100 kHz bands immediately outside and adjacent to the frequency block, and -18.23dBm for 100 kHz outside of the frequency block to compensate RBW from 100 kHz to 30 kHz.
- The limit was adjusted with a correction of -3dB [10LOG(2)] by using the Measure and Add 10Log(N) dB technique according to FCC KDB 662911 D01 Multiple Transmitter Output v02r01 accounting for simultaneous transmission from both main antenna and side antenna.

2.5.8 Test Results

LTE Band 13 Downlink 5MHz Bandwidth Low Channel Band Edge

15:34:21 20.10.2016

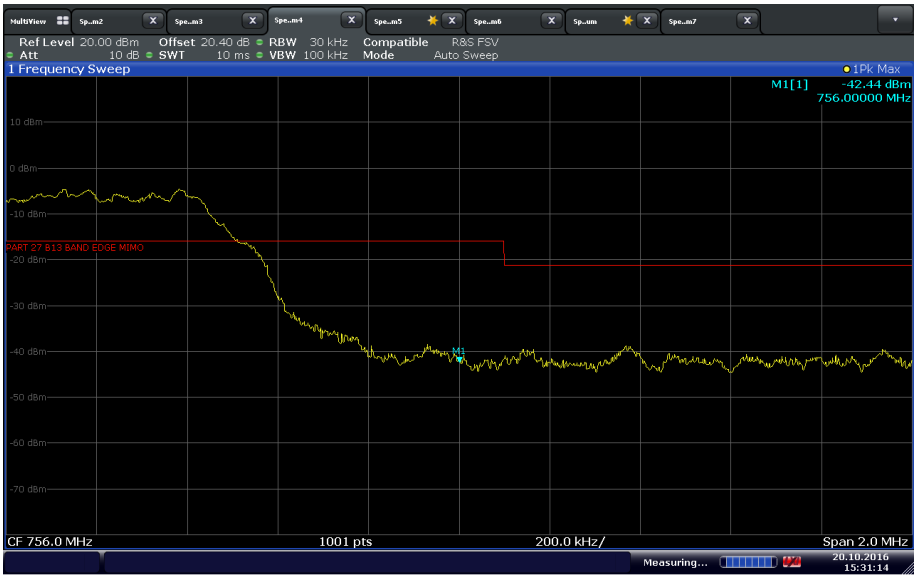
LTE Band 13 Downlink 5MHz Bandwidth High Channel Band Edge

15:32:43 20.10.2016

LTE Band 13 Downlink 10MHz Bandwidth Low Channel Band Edge

15:30:03 20.10.2016

LTE Band 13 Downlink 10MHz Bandwidth High Channel Band Edge

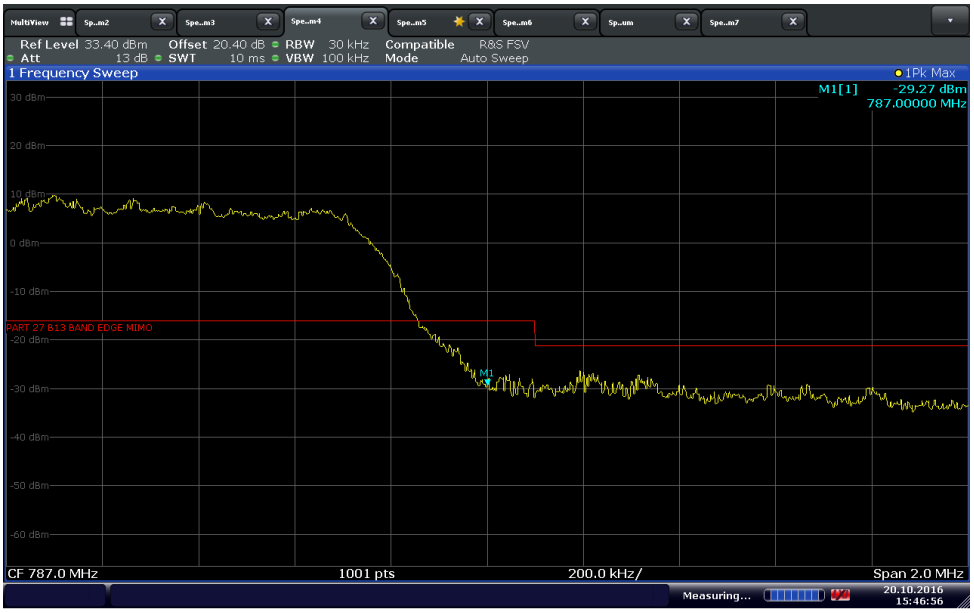


15:31:14 20.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Low Channel Band Edge

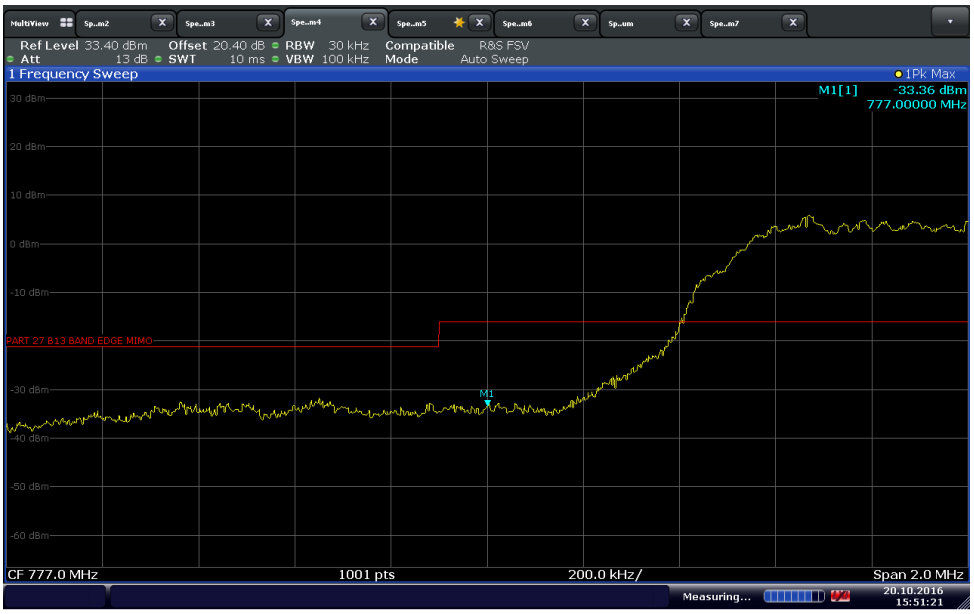
15:45:06 20.10.2016

LTE Band 13 Uplink 5MHz Bandwidth High Channel Band Edge



15:46:57 20.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Low Channel Band Edge



15:51:21 20.10.2016

LTE Band 13 Uplink 10MHz Bandwidth High Channel Band Edge

15:50:15 20.10.2016

2.6 CONDUCTED SPURIOUS EMISSIONS

2.6.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 27, Clause 27.53(c)
RSS-130, Clause 4.6.2

2.6.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.53:
(c)(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(c)(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130, Clause 4.6.1:
The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside thefrequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

RSS-130, Clause 4.6.2:
In addition to the limit outlined in Section 4.6.1 (RSS-Gen and RSS-130), equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:
(a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:
(i) 76 + 10 log10 p(watts), dB, for base and fixed equipment, and
(ii) 65 + 10 log10 p(watts), dB, for mobile and portable equipment.
(b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

2.6.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration A and B

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

October 20 and 21, 2016/XYZ

2.6.5 Test Equipment Used

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

2.6.6 Environmental Conditions

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

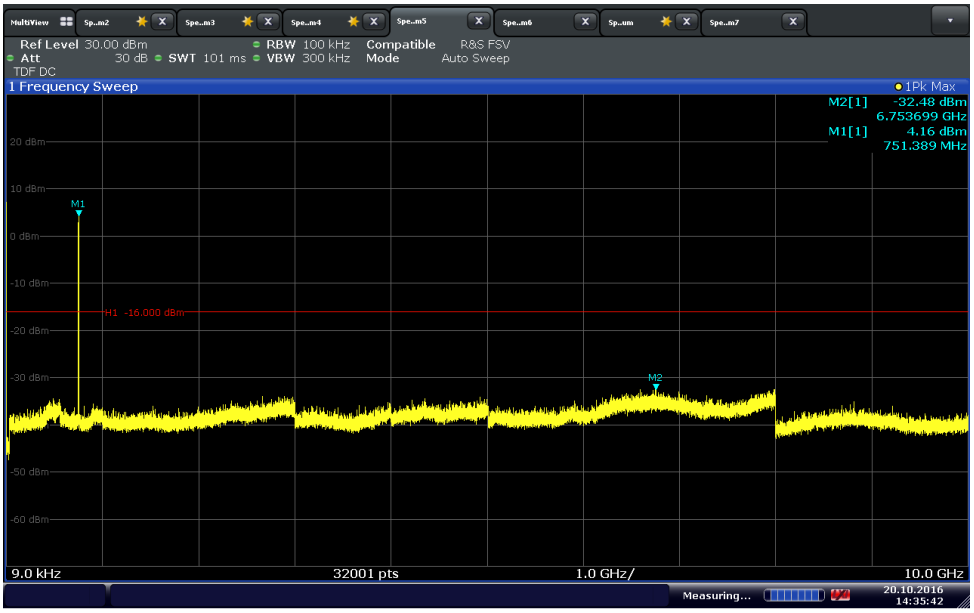
Ambient Temperature	26.4 - 27.3°C
Relative Humidity	24.5 - 33.8%
ATM Pressure	98.8 - 99.0kPa

2.6.7 Additional Observations

- This is a conducted test.
- The transducer factor (TDF) used is from the external attenuators and cables used.
- The spectrum was searched from 9 kHz to 10 GHz (requirement is up to the 10th harmonic (≤8GHz)) using 100 kHz RBW.
- For 763-775 MHz and 793-806 MHz verification, the next available RBW was used (6.25 kHz required, 10kHz RBW utilized).
- For 1559 – 1610 MHz verifiation, 1 MHz RBW was used. Additional correction factor of 0dB was added for the antenna gain of the EUT.
- The limit was adjusted with a correction of -3dB [10LOG(2)] by using the Measure and Add 10Log(N) dB technique according to FCC KDB 662911 D01 Multiple Transmitter Output v02r01 accounting for simultaneous transmission from both main antenna and side antenna.
- All low, middle and high channels were verified. Only test plots for middle channel presented in this test report as the representative configuration.

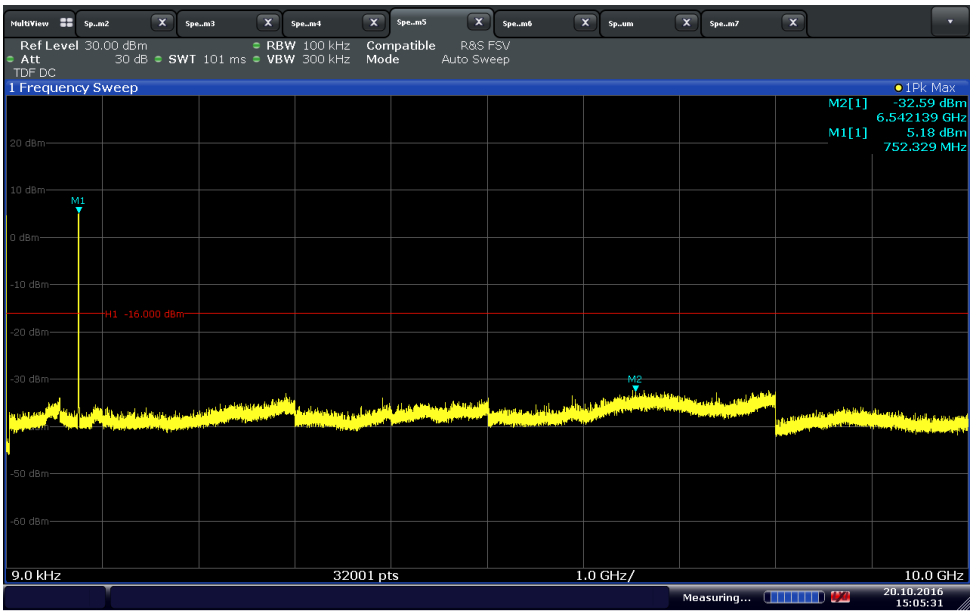
2.6.8 Test Results

LTE Band 13 Downlink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions



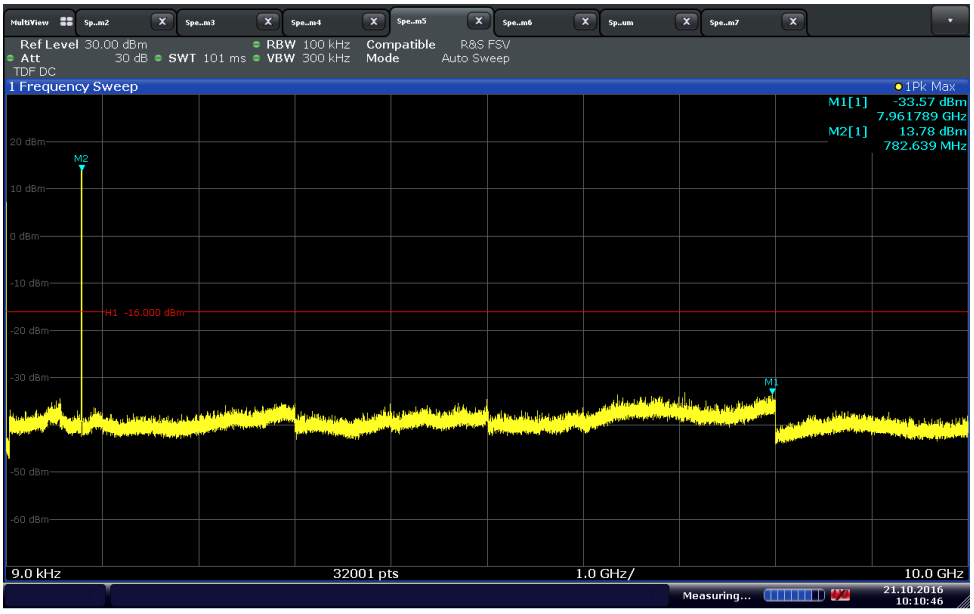
14:35:43 20.10.2016

LTE Band 13 Downlink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions



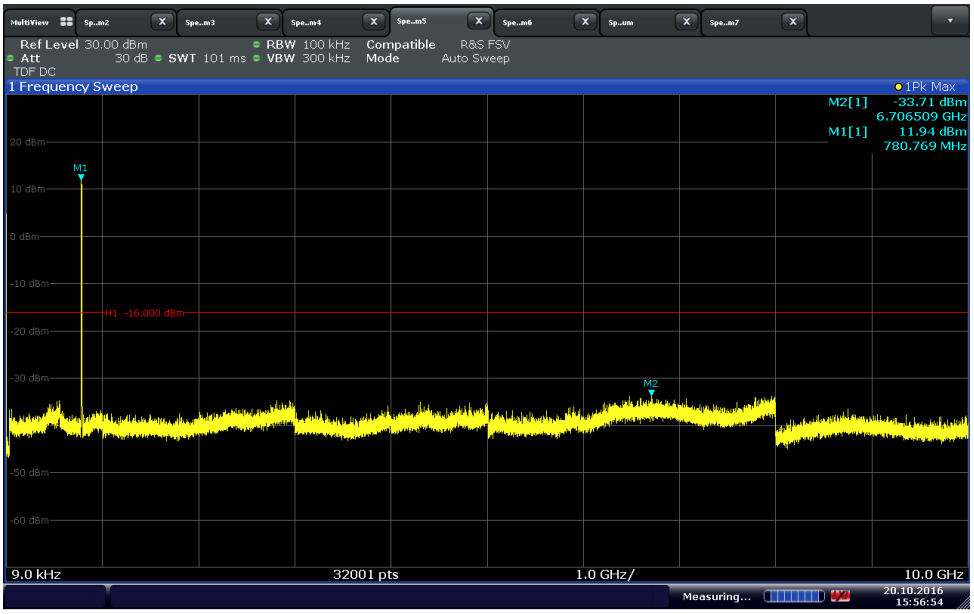
15:05:32 20.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions



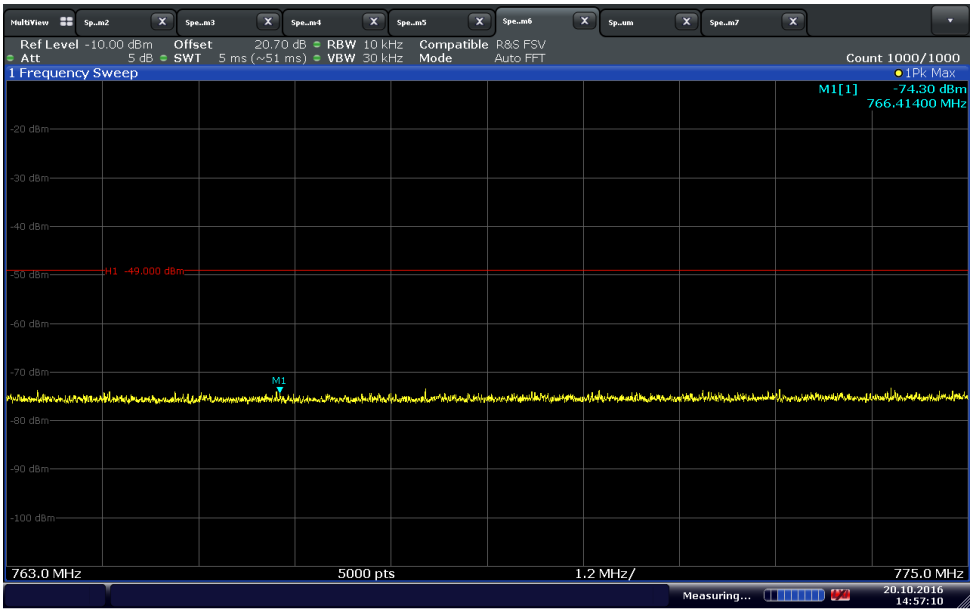
10:10:46 21.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions



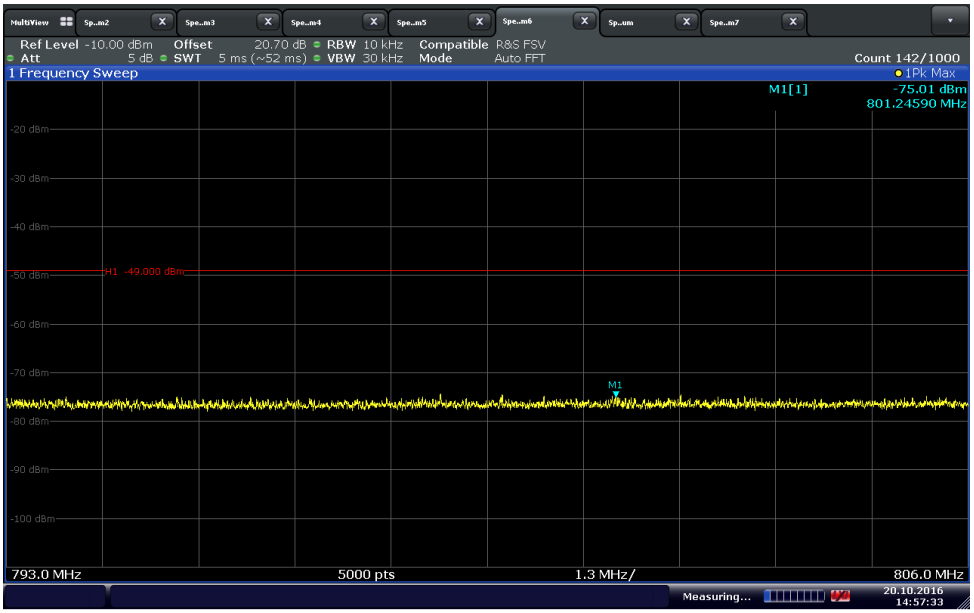
15:56:54 20.10.2016

LTE Band 13 Downlink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions (763-775 MHz)



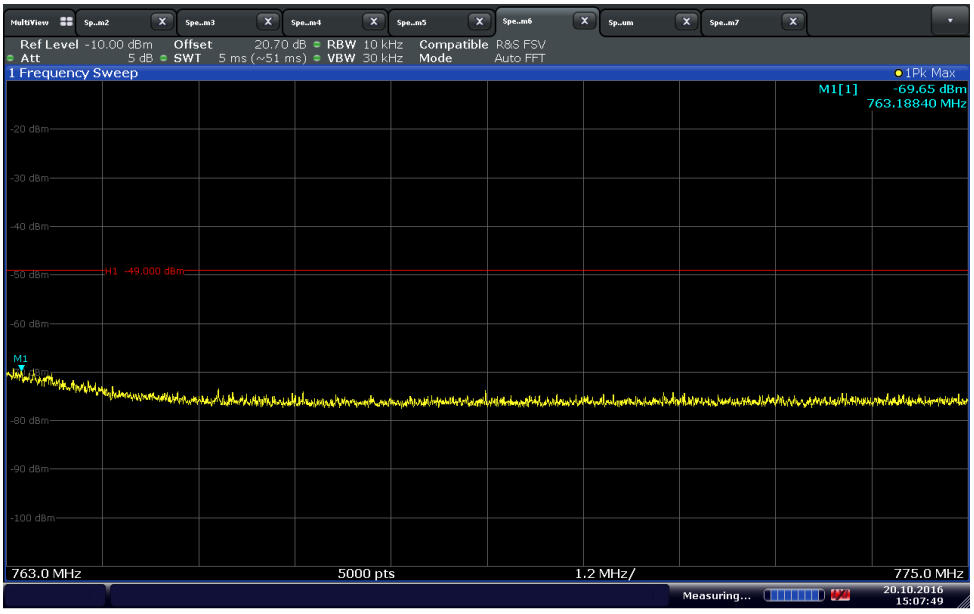
14:57:11 20.10.2016

LTE Band 13 Downlink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions (793-806 MHz)



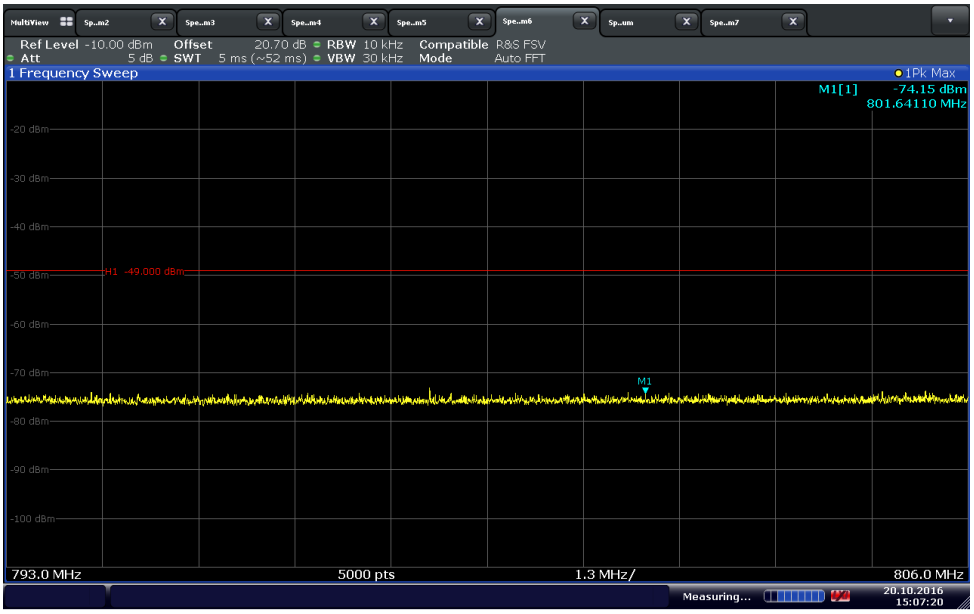
14:57:34 20.10.2016

LTE Band 13 Downlink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions (763-775 MHz)



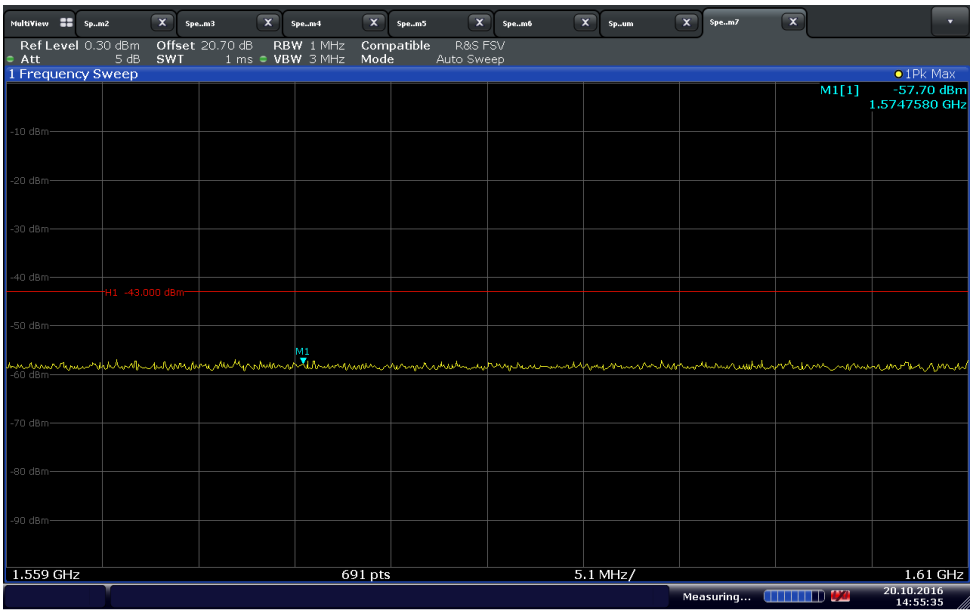
15:07:50 20.10.2016

TE Band 13 Downlink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions (793-806 MHz)



15:07:20 20.10.2016

LTE Band 13 Downlink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions (1559-1610 MHz)



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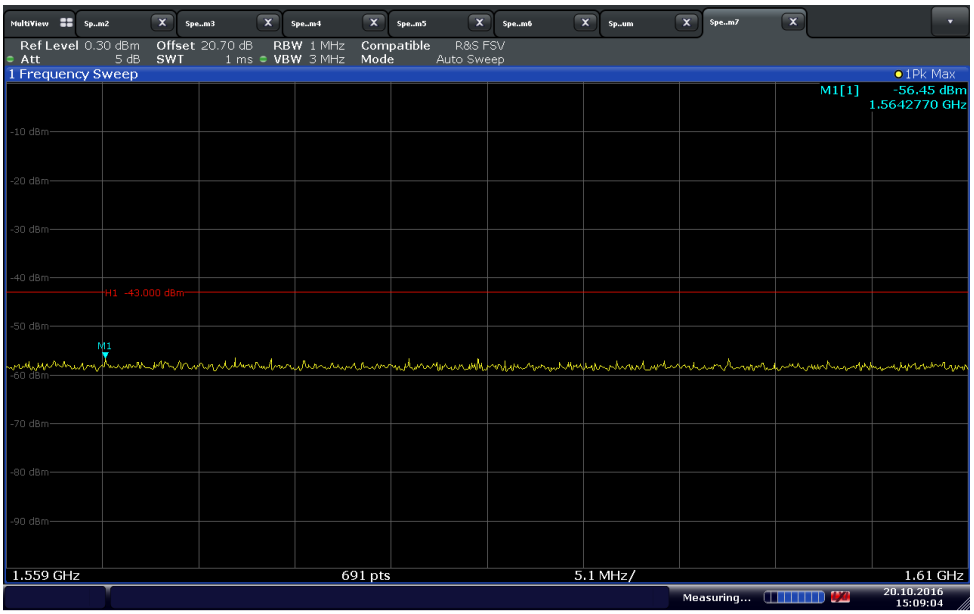
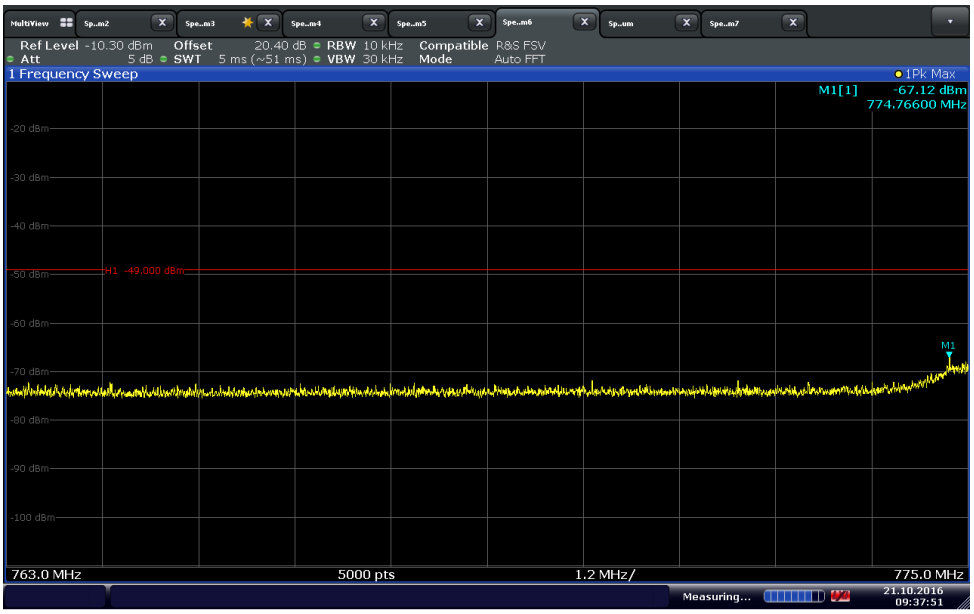
LTE Band 13 Downlink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions (1559-1610 MHz)



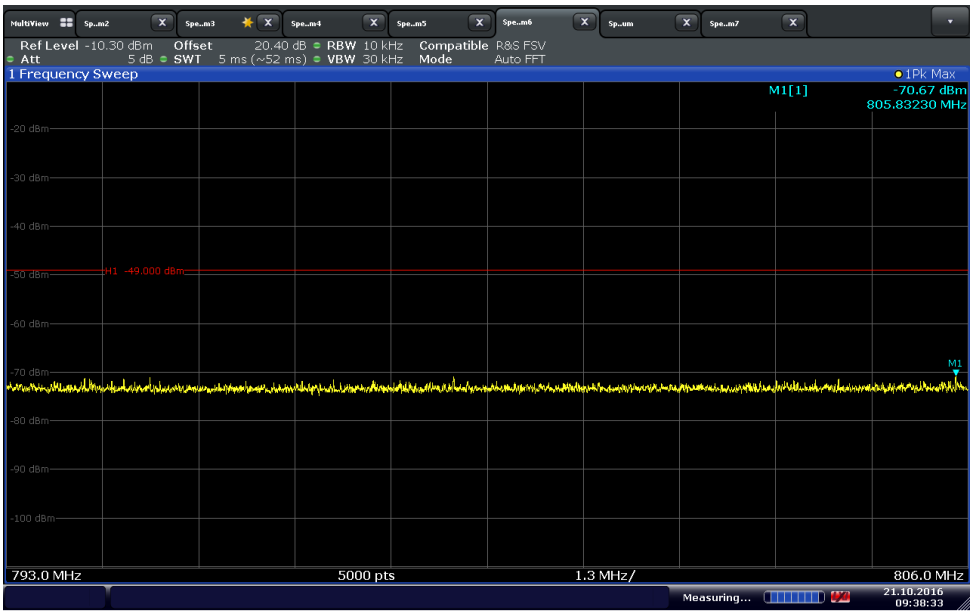
15:09:05 20.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions (763 - 775MHz)



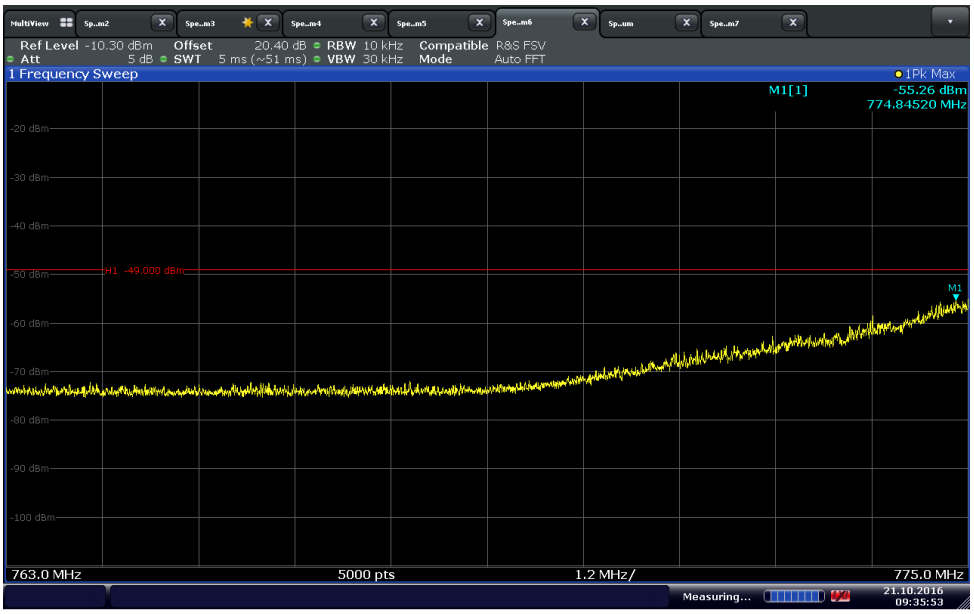
09:37:52 21.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions (793-806 MHz)



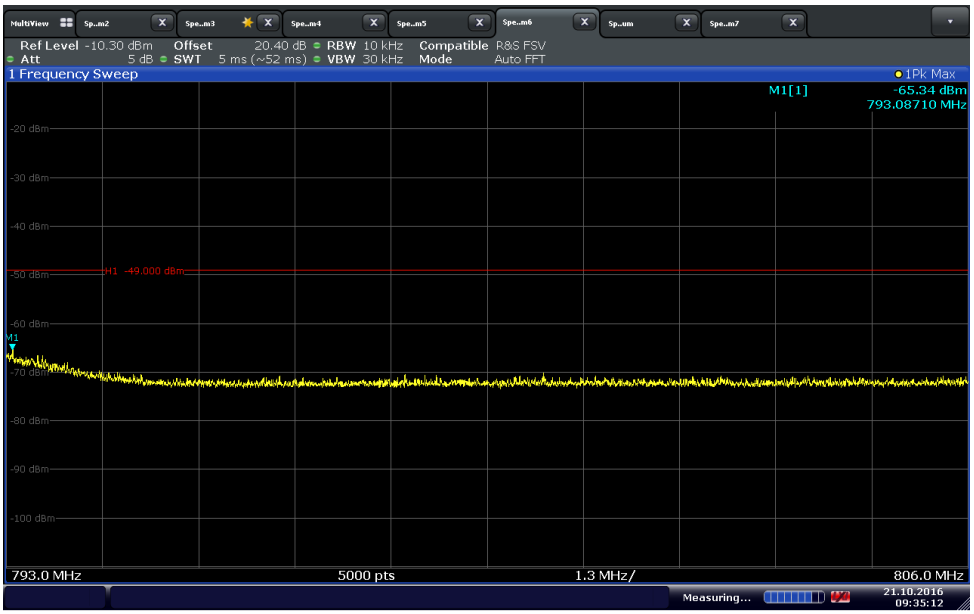
09:38:34 21.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions (763 - 775MHz)



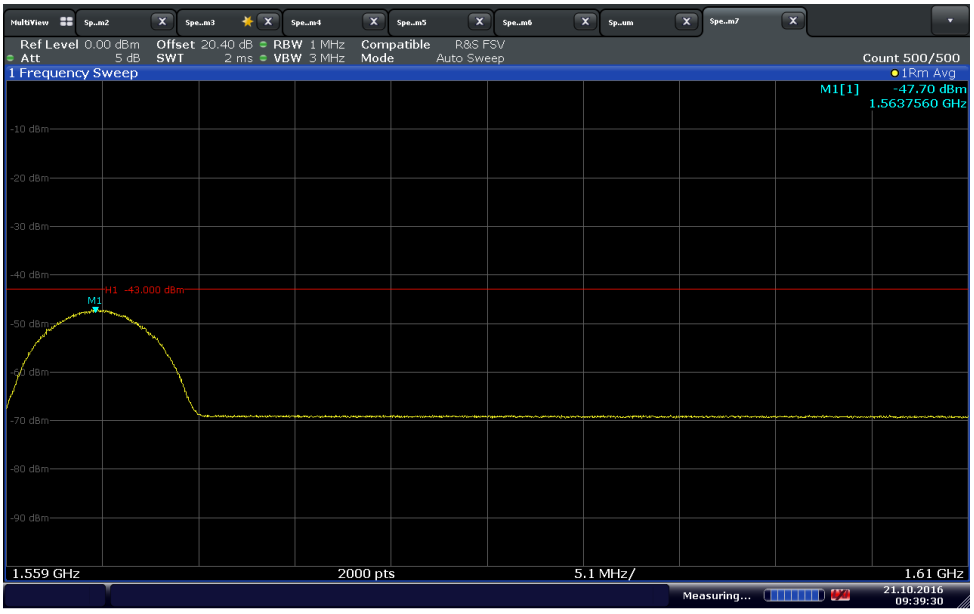
09:35:54 21.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions (793-806 MHz)



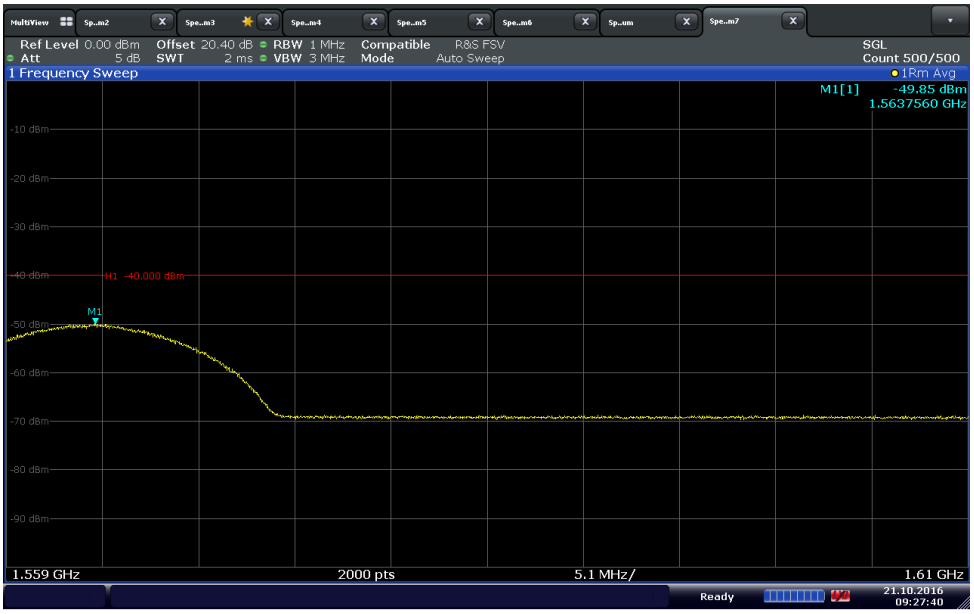
09:35:12 21.10.2016

LTE Band 13 Uplink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions (1559 – 1610MHz)



09:39:30 21.10.2016

LTE Band 13 Uplink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions (1559 – 1610MHz)



09:27:41 21.10.2016

2.7 FIELD STRENGTH OF SPURIOUS RADIATION

2.7.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 27, Clause 27.53(c)
RSS-130, Clause 4.6

2.7.2 Standard Applicable

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

2.7.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration C and D

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

October 21 and 24, 2016/XYZ

2.7.5 Test Equipment Used

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

2.7.6 Environmental Conditions

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

Ambient Temperature	26.2 - 27.3°C
Relative Humidity	24.5 - 42.6%
ATM Pressure	98.8 - 99.3kPa

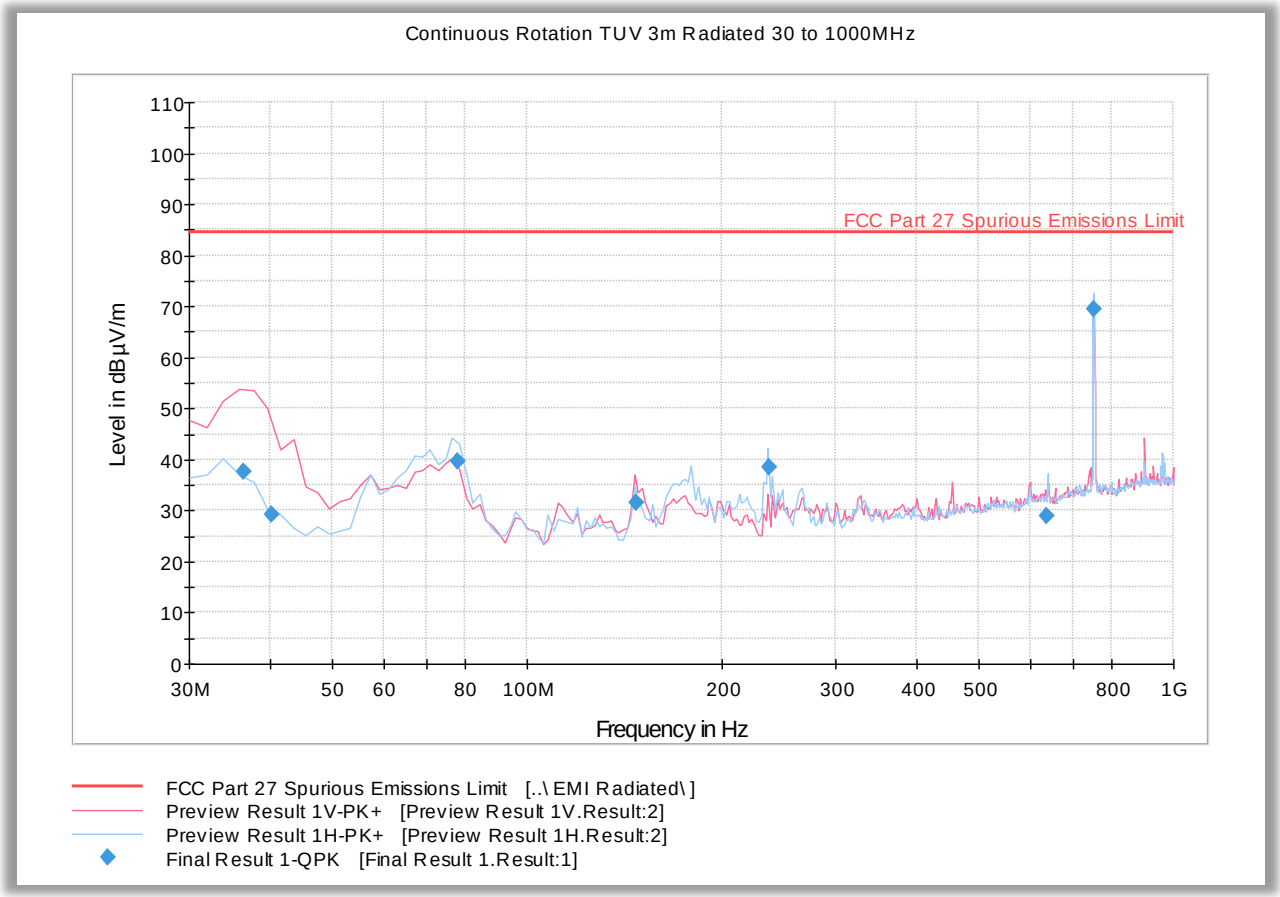
2.7.7 Additional Observations

- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-D 2010, June 24, 2010.
- Only the worst case configuration presented in this test report.
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.7.8 Test Results

See attached plots.

2.7.9 Test Results Below 1GHz (Downlink Worst Case Configuration) - 10MHz Bandwidth Middle Channel

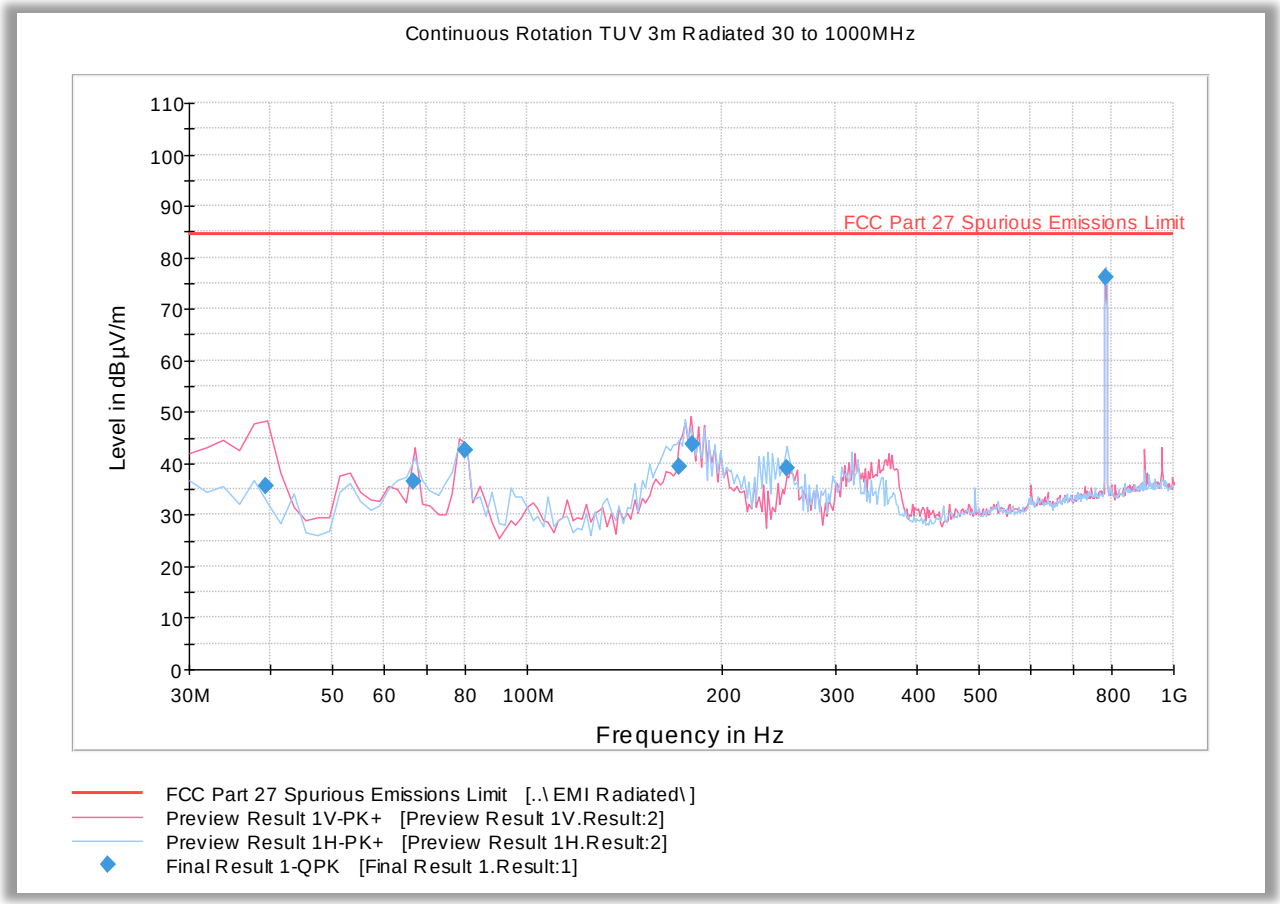


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
36.471663	37.7	1000.0	120.000	100.0	V	60.0	-9.3	46.7	84.4
40.367214	29.3	1000.0	120.000	100.0	V	245.0	-11.2	55.1	84.4
77.933307	39.6	1000.0	120.000	250.0	H	167.0	-15.6	44.8	84.4
147.593267	31.6	1000.0	120.000	100.0	V	101.0	-12.6	52.8	84.4
236.372104	38.4	1000.0	120.000	122.0	H	202.0	-8.2	46.0	84.4
637.436874	28.9	1000.0	120.000	100.0	H	23.0	3.6	55.5	84.4
751.886253	69.5	1000.0	120.000	100.0	H	330.0	5.6	Fundamental	

Test Notes: Only worst case channel presented for spurious emissions below 1GHz. Only case spurious emissions within 20dB of the calculated limit will be proven by substitution method.

2.7.10 Test Results Below 1GHz (Uplink Worst Case Configuration) - 5MHz Bandwidth High Channel

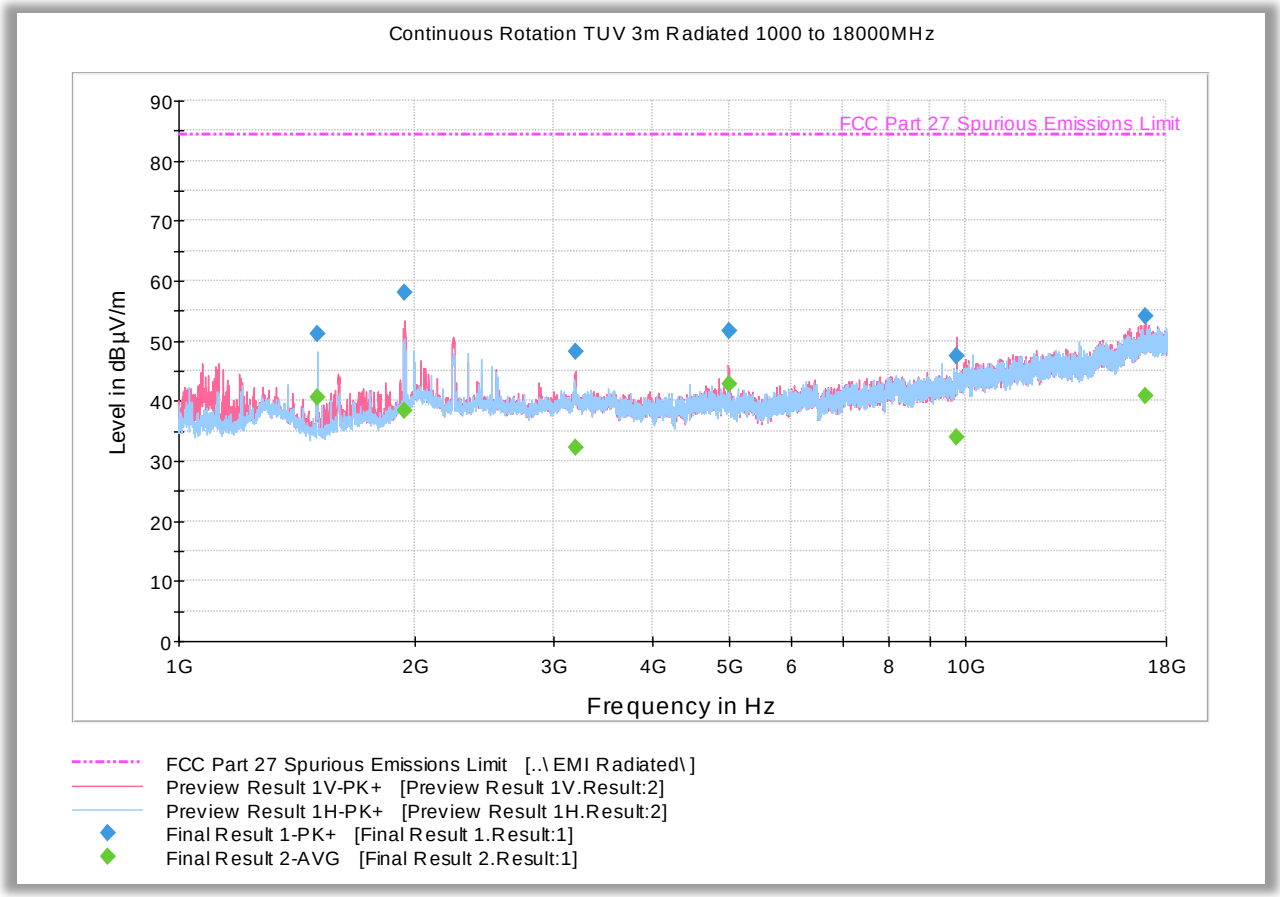


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
39.359439	35.6	1000.0	120.000	109.0	V	46.0	-10.8	48.8	84.4
66.533868	36.5	1000.0	120.000	255.0	H	329.0	-15.7	47.9	84.4
79.997194	42.7	1000.0	120.000	105.0	V	275.0	-15.7	41.7	84.4
171.783808	39.5	1000.0	120.000	100.0	H	1.0	-10.7	44.9	84.4
179.799359	43.6	1000.0	120.000	203.0	V	323.0	-10.7	40.8	84.4
252.603206	39.1	1000.0	120.000	100.0	H	164.0	-7.7	45.3	84.4
785.172345	76.1	1000.0	120.000	150.0	H	30.0	6.1	Fundamental	

Test Notes: Only worst case channel presented for spurious emissions below 1GHz. Only case spurious emissions within 20dB of the calculated limit will be proven by substitution method.

2.7.11 Test Results Above 1GHz - Downlink 10MHz Middle Channel



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	51.2	1000.0	1000.000	138.7	H	59.0	-6.2	33.2	84.4
1936.166667	58.0	1000.0	1000.000	252.3	V	297.0	-0.7	26.4	84.4
3192.633333	48.3	1000.0	1000.000	170.6	V	125.0	1.1	36.2	84.4
4999.933333	51.5	1000.0	1000.000	135.7	V	192.0	3.4	32.9	84.4
9728.000000	47.6	1000.0	1000.000	207.5	V	353.0	10.2	36.8	84.4
16976.800000	54.0	1000.0	1000.000	326.2	V	59.0	20.0	30.4	84.4

Average Data

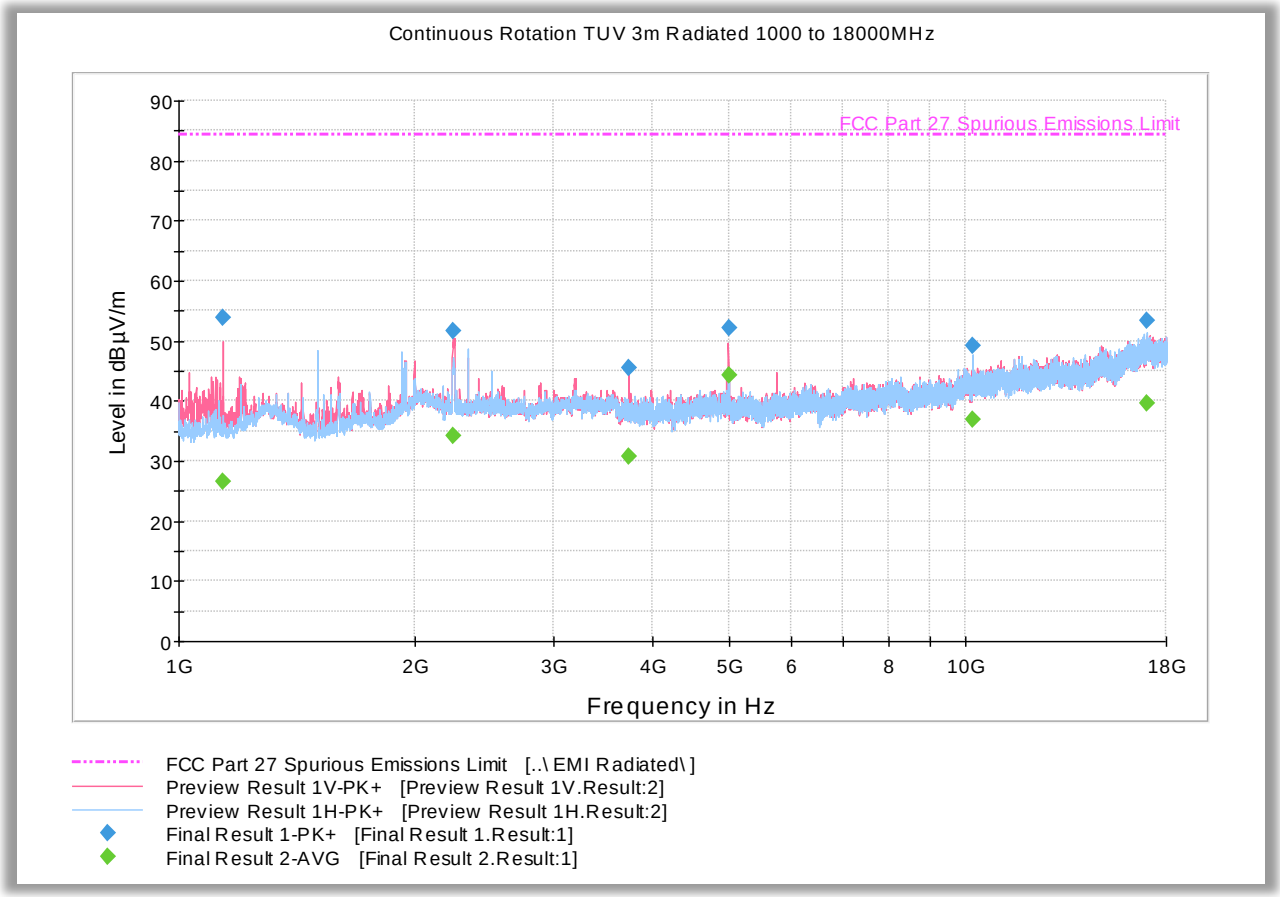
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	40.6	1000.0	1000.000	138.7	H	59.0	-6.2	43.8	84.4
1936.166667	38.5	1000.0	1000.000	252.3	V	297.0	-0.7	45.9	84.4
3192.633333	32.1	1000.0	1000.000	170.6	V	125.0	1.1	52.3	84.4
4999.933333	42.8	1000.0	1000.000	135.7	V	192.0	3.4	41.6	84.4
9728.000000	34.0	1000.0	1000.000	207.5	V	353.0	10.2	50.4	84.4
16976.800000	40.8	1000.0	1000.000	326.2	V	59.0	20.0	43.6	84.4

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dbµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.12 Test Results Above 1GHz - Uplink 5MHz Low Channel



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1138.266667	53.8	1000.0	1000.000	147.7	V	142.0	-7.4	30.6	84.4
2231.933333	51.7	1000.0	1000.000	151.6	V	124.0	-1.8	32.7	84.4
3738.900000	45.4	1000.0	1000.000	250.5	V	59.0	1.5	39.0	84.4
4999.933333	52.1	1000.0	1000.000	103.7	V	139.0	3.4	32.3	84.4
10200.633333	49.3	1000.0	1000.000	244.4	H	323.0	11.3	35.1	84.4
17041.566667	53.3	1000.0	1000.000	151.6	H	183.0	19.9	31.1	84.4

Average Data

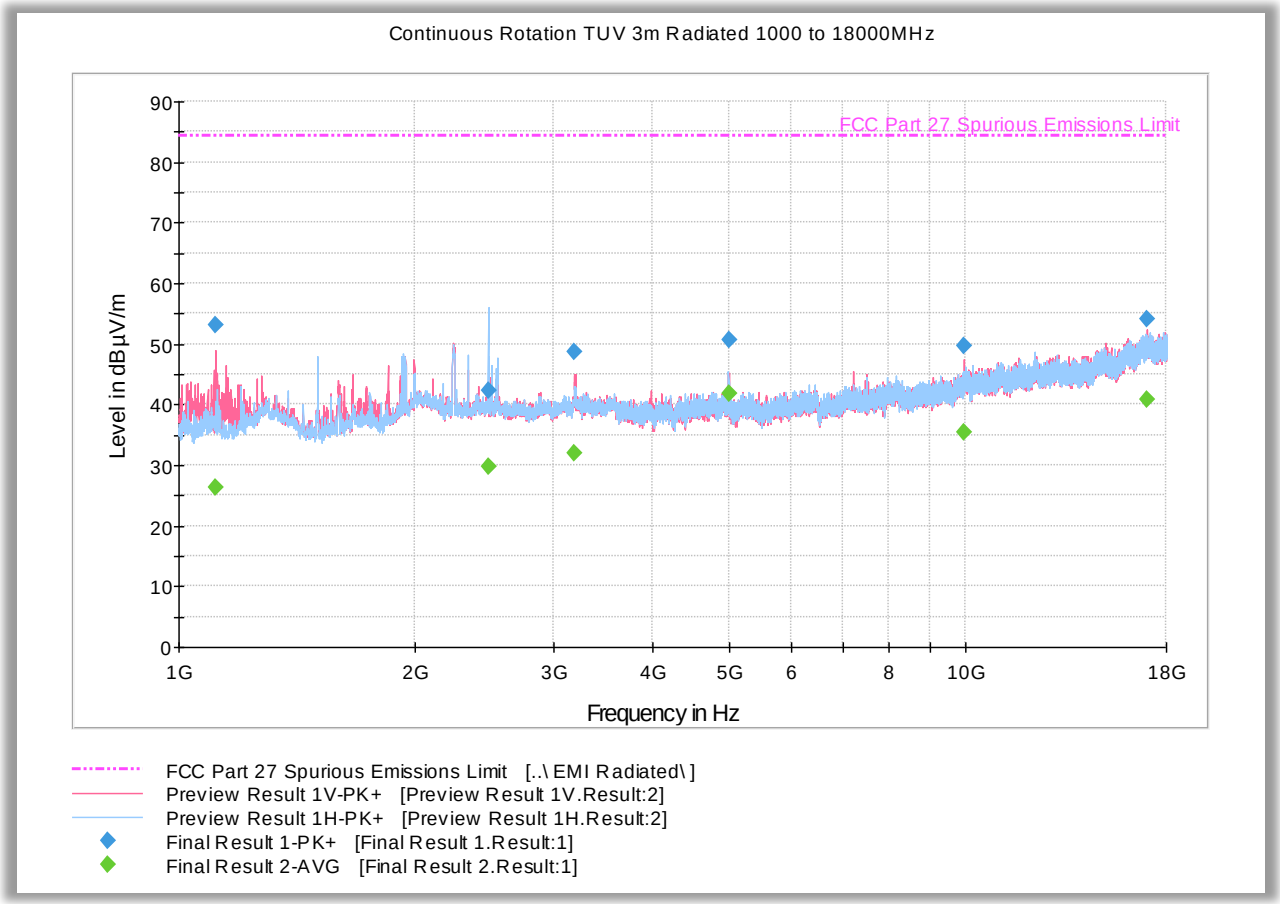
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1138.266667	26.5	1000.0	1000.000	147.7	V	142.0	-7.4	57.9	84.4
2231.933333	34.3	1000.0	1000.000	151.6	V	124.0	-1.8	50.1	84.4
3738.900000	30.6	1000.0	1000.000	250.5	V	59.0	1.5	53.8	84.4
4999.933333	44.4	1000.0	1000.000	103.7	V	139.0	3.4	40.0	84.4
10200.633333	36.9	1000.0	1000.000	244.4	H	323.0	11.3	47.5	84.4
17041.566667	39.7	1000.0	1000.000	151.6	H	183.0	19.9	44.7	84.4

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dbµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.13 Test Results Above 1GHz - Uplink 5MHz Middle Channel



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1115.400000	53.0	1000.0	1000.000	356.1	V	145.0	-7.2	31.4	84.4
2473.166667	42.4	1000.0	1000.000	171.6	H	341.0	-0.8	42.0	84.4
3188.466667	48.6	1000.0	1000.000	150.7	V	116.0	1.1	35.8	84.4
4999.933333	50.7	1000.0	1000.000	223.4	H	119.0	3.4	33.7	84.4
9956.566667	49.7	1000.0	1000.000	242.4	V	76.0	10.7	34.7	84.4
17003.800000	54.1	1000.0	1000.000	321.1	V	283.0	20.0	30.3	84.4

Average Data

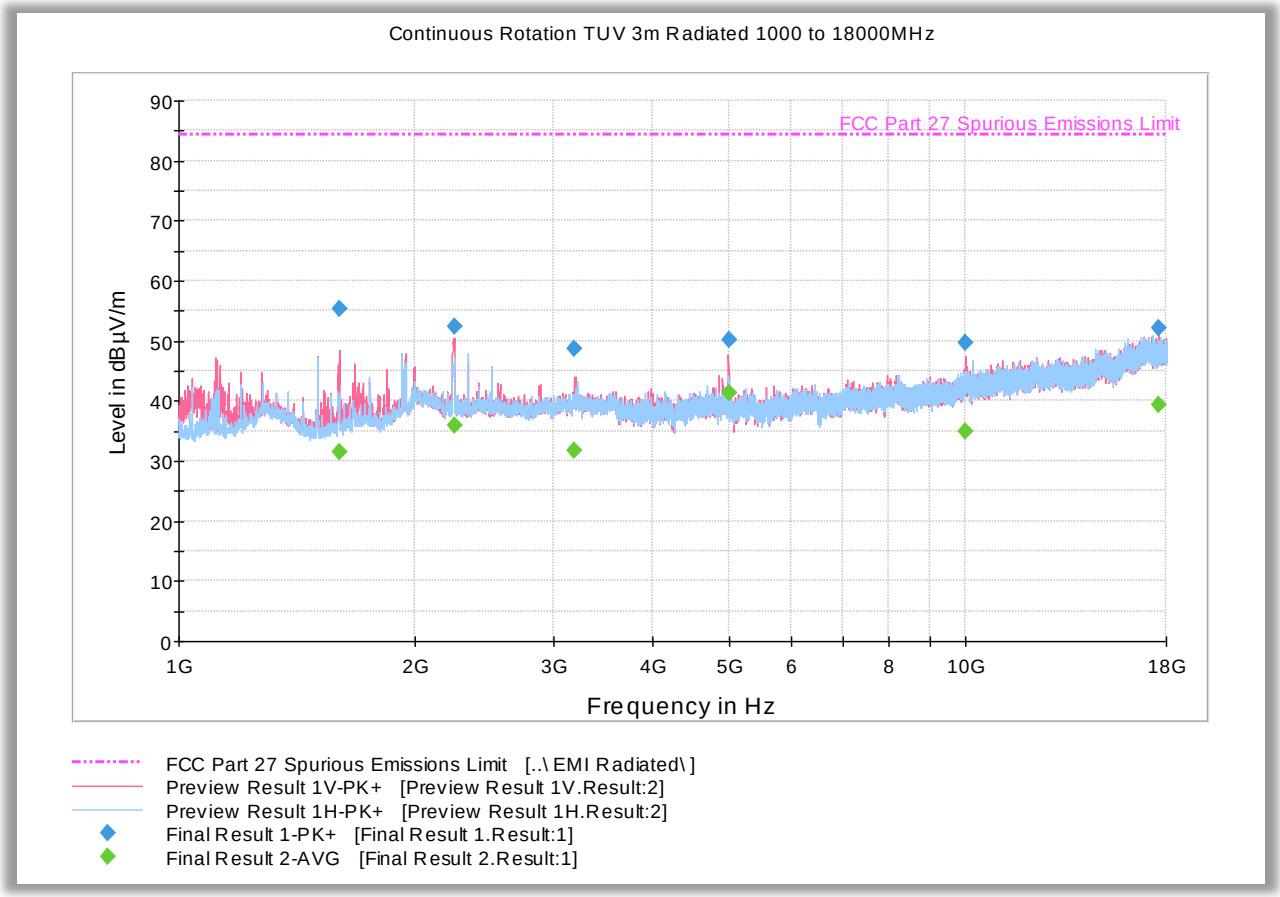
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1115.400000	26.4	1000.0	1000.000	356.1	V	145.0	-7.2	58.0	84.4
2473.166667	29.6	1000.0	1000.000	171.6	H	341.0	-0.8	54.8	84.4
3188.466667	32.0	1000.0	1000.000	150.7	V	116.0	1.1	52.4	84.4
4999.933333	41.9	1000.0	1000.000	223.4	H	119.0	3.4	42.5	84.4
9956.566667	35.4	1000.0	1000.000	242.4	V	76.0	10.7	49.0	84.4
17003.800000	40.7	1000.0	1000.000	321.1	V	283.0	20.0	43.7	84.4

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dbµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.14 Test Results Above 1GHz - Uplink 5MHz High Channel



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1599.533333	55.3	1000.0	1000.000	178.6	V	90.0	-5.9	29.1	84.4
2238.700000	52.4	1000.0	1000.000	151.6	V	128.0	-1.8	32.0	84.4
3184.900000	48.8	1000.0	1000.000	208.5	V	117.0	1.1	35.6	84.4
4999.933333	50.2	1000.0	1000.000	120.7	V	135.0	3.4	34.2	84.4
9996.200000	49.6	1000.0	1000.000	103.7	V	105.0	10.8	34.8	84.4
17648.466667	52.1	1000.0	1000.000	103.7	V	326.0	20.1	32.3	84.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1599.533333	31.4	1000.0	1000.000	178.6	V	90.0	-5.9	53.0	84.4
2238.700000	35.8	1000.0	1000.000	151.6	V	128.0	-1.8	48.6	84.4
3184.900000	31.8	1000.0	1000.000	208.5	V	117.0	1.1	52.6	84.4
4999.933333	41.2	1000.0	1000.000	120.7	V	135.0	3.4	43.2	84.4
9996.200000	34.9	1000.0	1000.000	103.7	V	105.0	10.8	49.5	84.4
17648.466667	39.4	1000.0	1000.000	103.7	V	326.0	20.1	45.0	84.4

Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (dbµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance

Test Notes: Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.8 FREQUENCY STABILITY

2.8.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055
FCC 47 CFR Part 27, Clause 27.54
RSS-130, Clause 4.3

2.8.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.54:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

RSS-130:
The transmitter frequency stability limit shall be determined as follows:
(a) The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;
(b) Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 log10 p (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as fL and fH respectively.

The applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

2.8.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration A and B

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

October 24 and 25, 2016/XYZ

2.8.5 Test Equipment Used

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

2.8.6 Environmental Conditions

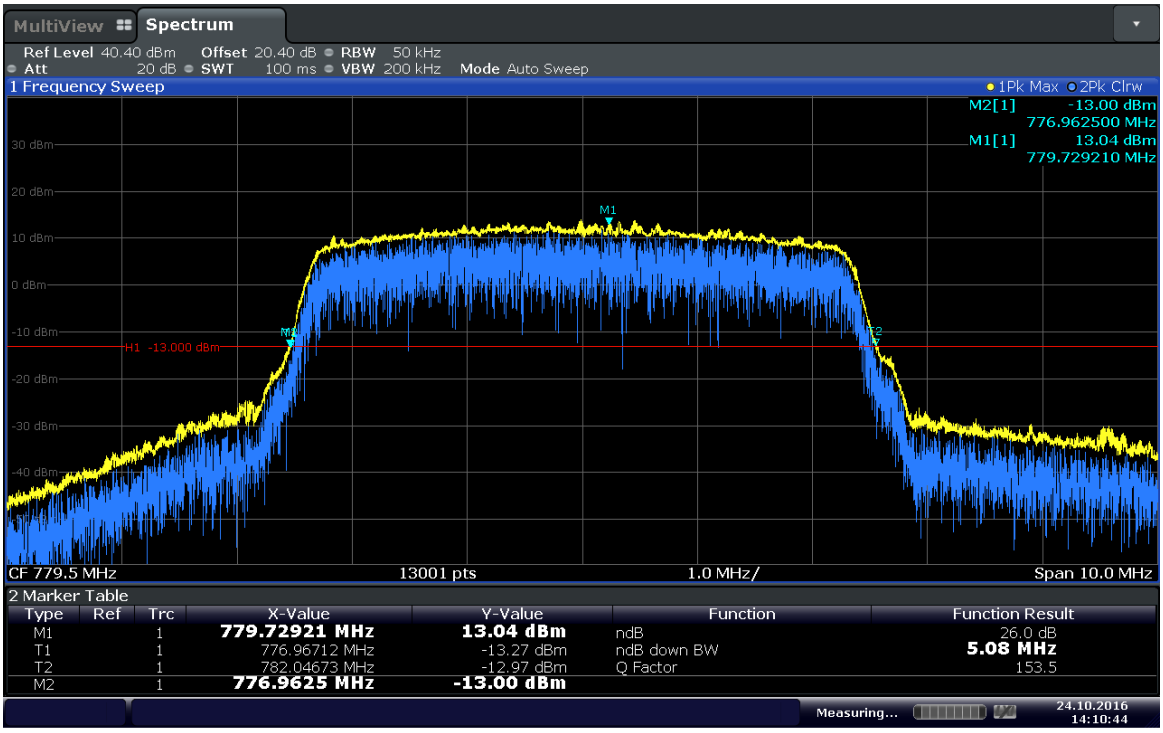
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	25.5 - 26.2°C
Relative Humidity	42.6 - 48.1%
ATM Pressure	99.3 - 99.5kPa

2.8.7 Additional Observations

- This is a conducted test.
- The EUT was operated at 120.0VAC nominal voltage and was placed in the temperature chamber for the series of evaluations performed.
- The Temperature was reduced to -30°C and allowed to sit for 1 hour to allow the equipment and chamber temperature to stabilize. The measurements on both downlink and uplink were then performed. The temperature was them increased by 10°C steps and allowed to settle before taking the next set of measurements.
- Voltage variation was also performed at 85% and 115% of the nominal voltage.
- Test Procedure as per RSS-130 was also performed
- 5MHz BW for both Downlink and Uplink was used.

2.8.8 Sample Comutation and Sample Plots for Uplink

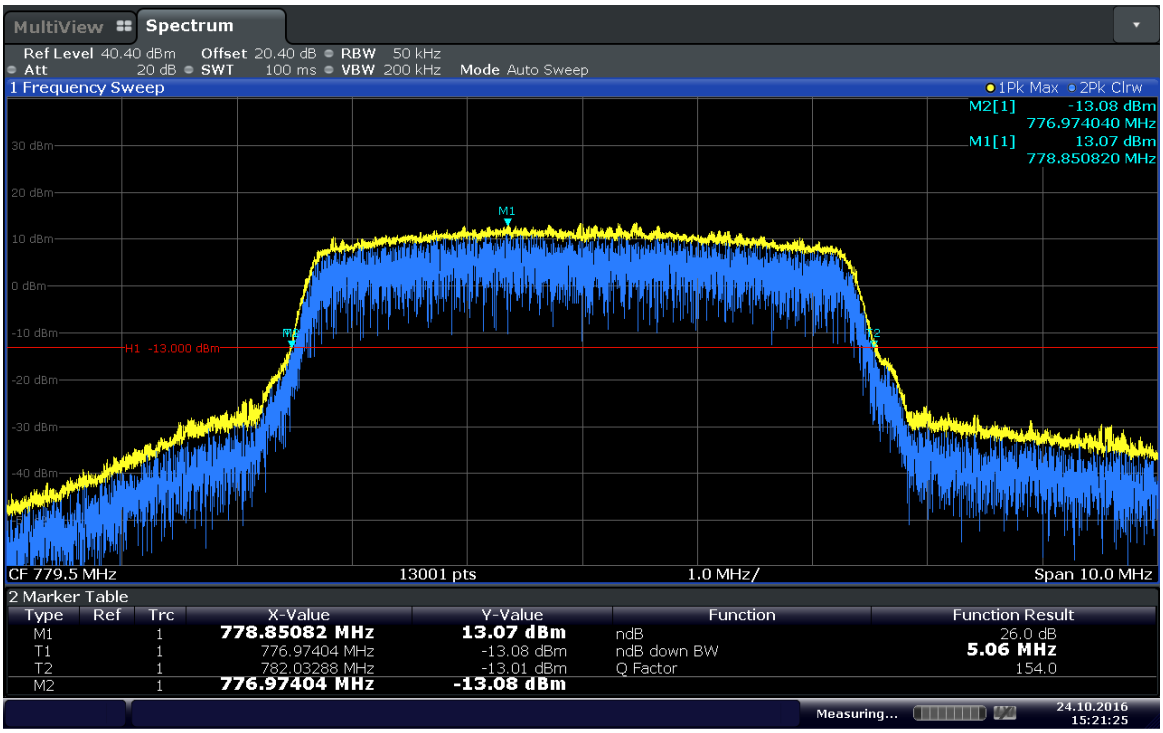


14:10:44 24.10.2016

LTE B13 Uplink Low Channel @ 20°C Nominal Voltage

Computation of Center Frequency (@ 20°C):

Since T1 = 776.96712 MHz and T2 = 782.04673 MHz, therefore (T2-T1)/2 + T1 = Center Frequency (779.506925 MHz)



15:21:26 24.10.2016

LTE B13 Uplink Low Channel @ 50°C Nominal Voltage

Computation of Center Frequency (@ 50°C):

Since T1 = 776.97404 MHz and T2 = 782.3288 MHz, therefore (T2-T1)/2 + T1 = Center Frequency (779.50346 MHz)

Calculation of Frequency Deviation (ppm @50 °C)

Comparing center frequency @ 50 °C to center frequency @ 20 °C, then calculate ppm.
((779.50346 MHz - 779.506925 MHz) / 779.506925 MHz) x 1000000 = 4.45 ppm

2.8.9 Test Results Summary

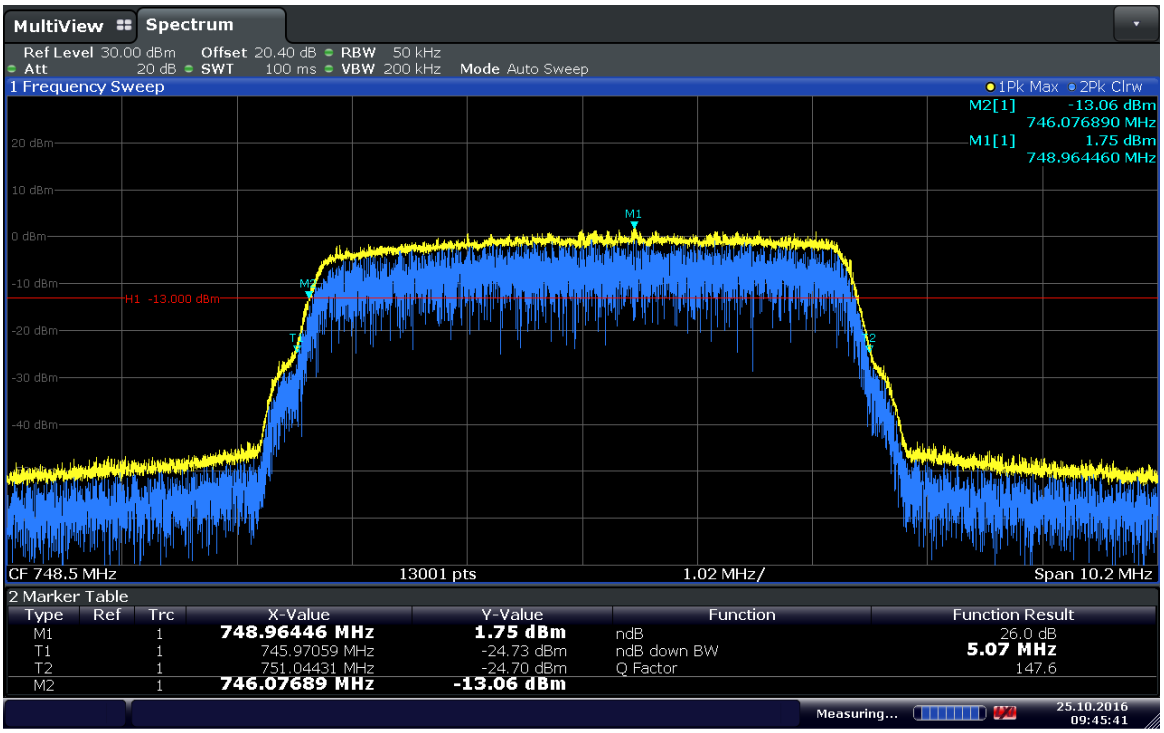
LTE B13 Downlink					
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***fL (MHz)***	***fH (MHz)***	***Compliance***
120	-30	1.57	746.08985	755.90019	Within the frequency range of 746 – 756 MHz band EUT Complies.
	-20	1.57	746.08436	755.89838	
	-10	4.72	746.08671	755.89682	
	0	0	746.08412	755.90231	
	+10	4.19	746.08395	755.90616	
	+20	-	**746.08749**	**755.88426**	
	+30	4.71	746.0718	755.88583	
	+40	15.19	746.07102	755.89682	
	+50	7.33	746.07689	755.89838	

LTE B13 Downlink					
Temperature (°C)	***Voltage (VAC)***	***Frequency Deviation (ppm)***	***fL***	***fH***	***Compliance***
20	102	11.01	746.08725	755.87485	Within the frequency range of 746 – 756 MHz band EUT Complies
	138	7.34	746.082	755.88587	

LTE B13 Uplink					
Voltage (VAC)	***Temperature (°C)***	***Frequency Deviation (ppm)***	***fL***	***fH***	***Compliance***
120	-30	0.5	776.97019	787.05365	Within the frequency range of 777 – 787 MHz band EUT Complies.
	-20	0.49	776.9625	787.0598	
	-10	6.91	776.96866	787.03673	
	0	1.98	776.97019	787.05134	
	+10	5.92	776.96327	787.04903	
	+20	-	**776.9625**	**787.05365**	
	+30	5.43	776.96481	787.0475	
	+40	2.47	776.96558	787.04827	
	+50	4.44	776.97404	787.04827	

LTE B13 Uplink					
Temperature (°C)	***Voltage (VAC)***	***Frequency Deviation (ppm)***	***fL***	***fH***	***Compliance***
20	102	6.91	776.97096	787.06057	Within the frequency range of 777 – 787 MHz band EUT Complies
	138	5.92	776.97019	787.0475	

2.8.10 Sample Test Plots for Downlink



09:45:42 25.10.2016

LTE B13 Downlink Low Channel @ 50°C Nominal Voltage

2.9 POWER LINE CONDUCTED EMISSIONS

2.9.1 Specification Reference

RSS-Gen 8.8

2.9.2 Standard Applicable

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.9.3 Equipment Under Test and Modification State

Serial No: 930629000238 (NU) and 920629000031 (CU) / Test Configuration B

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

November 09, 2016/XYZ

2.9.5 Test Equipment Used

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

2.9.6 Environmental Conditions

Ambient Temperature	23.8°C
Relative Humidity	30.8%
ATM Pressure	98.8kPa

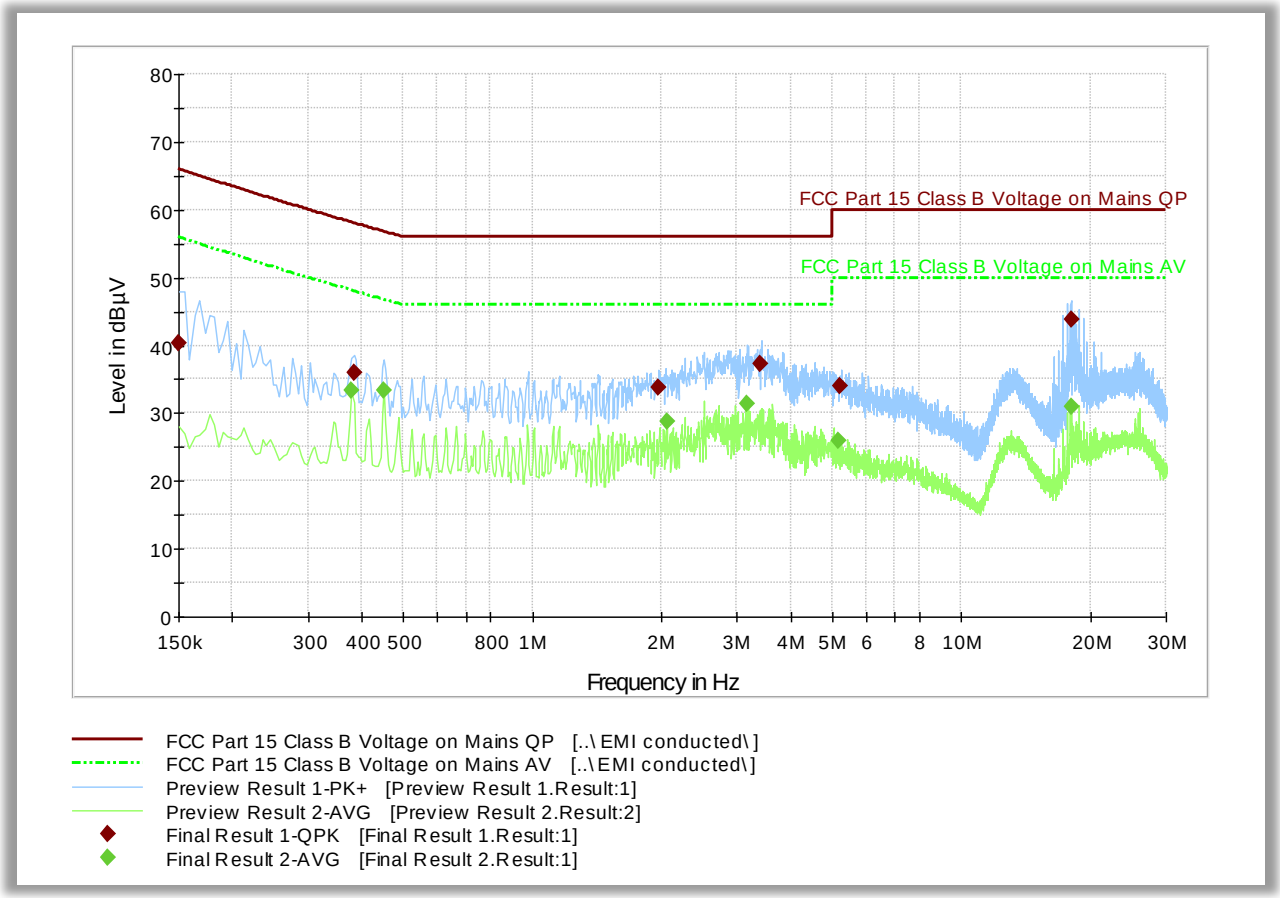
2.9.7 Additional Observations

- The EUT was verified using AC adapter supplied by the manufacturer..
- EUT (NU) verified using input voltage of 120VAC 60Hz.
- There are no significant variations in test results between each operating modes. Only the normal operation mode observed is presented.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.9.8 for sample computation.

2.9.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7567 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.9.9 Test Results - Conducted Emissions Line 1 – Hot (NU)



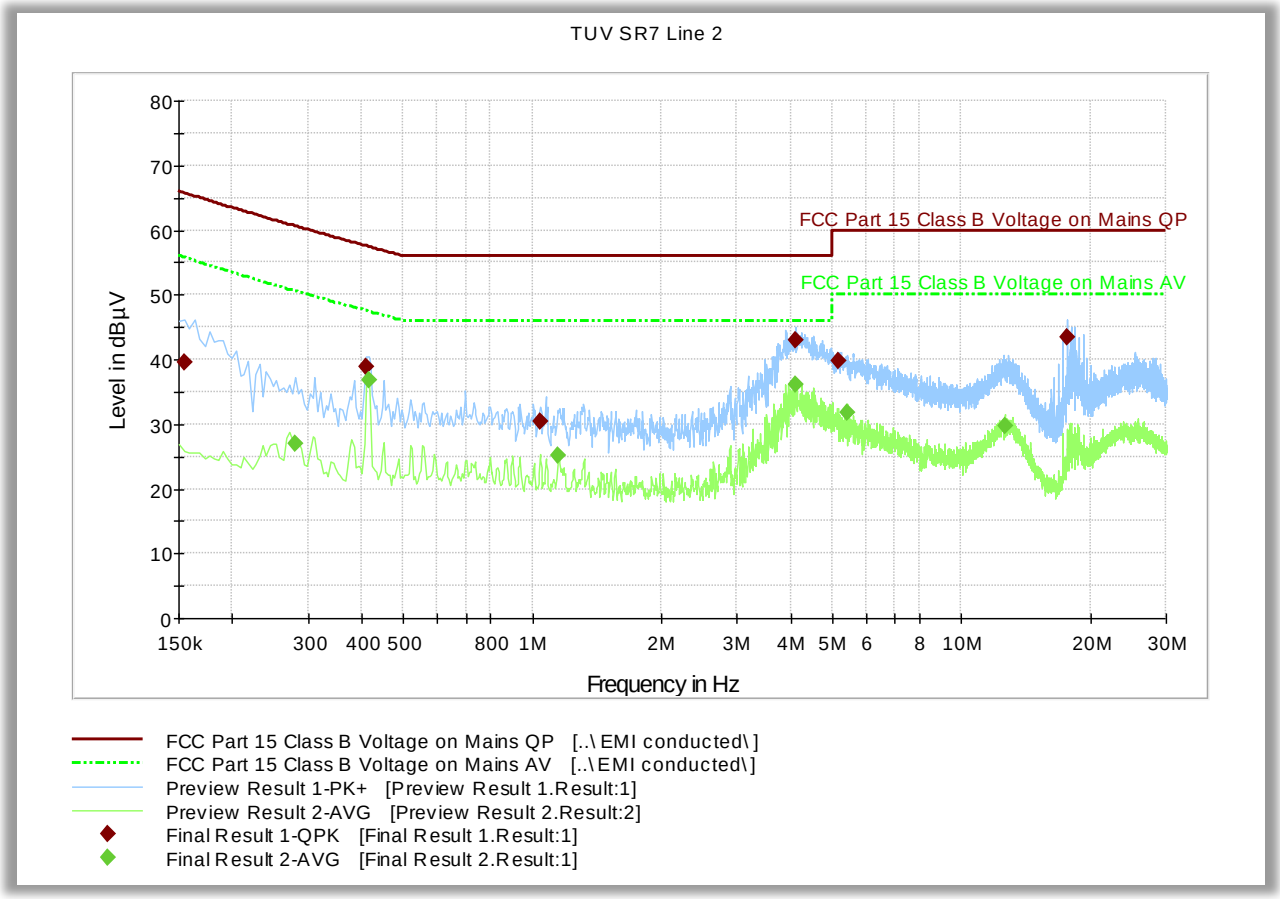
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	40.4	1000.0	9.000	Off	L1	20.2	25.6	66.0
0.384000	36.0	1000.0	9.000	Off	L1	20.0	22.1	58.1
1.963500	33.8	1000.0	9.000	Off	L1	20.0	22.2	56.0
3.408000	37.3	1000.0	9.000	Off	L1	20.1	18.7	56.0
5.199000	34.1	1000.0	9.000	Off	L1	20.1	25.9	60.0
18.001500	43.8	1000.0	9.000	Off	L1	20.4	16.2	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.379500	33.3	1000.0	9.000	Off	L1	20.0	14.8	48.1
0.451500	33.4	1000.0	9.000	Off	L1	20.0	13.3	46.8
2.058000	28.8	1000.0	9.000	Off	L1	20.0	17.2	46.0
3.174000	31.4	1000.0	9.000	Off	L1	20.1	14.6	46.0
5.158500	25.9	1000.0	9.000	Off	L1	20.1	24.1	50.0
18.001500	30.9	1000.0	9.000	Off	L1	20.4	19.1	50.0

2.9.10 FCC Conducted Emissions Line 2 – Neutral (NU)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.154500	39.5	1000.0	9.000	Off	N	20.2	26.2	65.7
0.411000	38.9	1000.0	9.000	Off	N	20.0	18.6	57.5
1.045500	30.3	1000.0	9.000	Off	N	20.0	25.7	56.0
4.110000	42.9	1000.0	9.000	Off	N	20.1	13.1	56.0
5.190000	39.7	1000.0	9.000	Off	N	20.1	20.3	60.0
17.601000	43.5	1000.0	9.000	Off	N	20.4	16.5	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.280500	26.9	1000.0	9.000	Off	N	20.0	23.6	50.6
0.415500	36.9	1000.0	9.000	Off	N	20.0	10.5	47.4
1.149000	25.0	1000.0	9.000	Off	N	20.0	21.0	46.0
4.110000	36.1	1000.0	9.000	Off	N	20.1	9.9	46.0
5.437500	31.8	1000.0	9.000	Off	N	20.1	18.2	50.0
12.691500	29.7	1000.0	9.000	Off	N	20.2	20.3	50.0

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7604	P-Series Power Meter	N1912A	SG45100273	Agilent	07/27/16	07/27/17
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	04/19/16	04/19/17
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	06/29/16	06/29/17
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/02/16	09/02/17
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50 /103829	Rhode & Schwarz	For signaling	
8871	20dB Attenuator	18N10W-20dB	-	INMET	Verified by 7611 and 7608	
Radiated Emissions						
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	02/01/16	02/01/17
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/02/16	09/02/17
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/06/15	11/06/17
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	05/12/16	05/12/17
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	01/11/16	01/11/17
1040	EMI Test Receiver	ESU	100133	Rhode & Schwarz	10/07/16	10/07/17
1016	Pre-amplifier	PAM-0202	187	PAM	10/17/16	10/17/17
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	Verified by 7608 and 7611	
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7608 and 7611	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7608 and 7611	
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50 /103829	Rhode & Schwarz	For signalling	
Conducted Emissions						
7620	EMI Test Receiver	ESU40	100399	Rhode & Schwarz	09/09/16	09/09/17
6837	LISN	FCC-LISN-50-25-2	5025	Fischer Custom Comm.	03/29/16	03/29/17
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/29/16	02/28/17
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/29/16	02/28/17
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50 /103829	Rhode & Schwarz	For signalling	

Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/29/16	08/29/17
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	08/22/16	08/22/17
	DC Power Supply	35010M	D102007S	Protek	Verified by 6792	
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Conducted Measurements

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
4	Attenuator	Rectangular	0.30	0.17	0.03
5	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	0.80
				Coverage Factor (k):	2
				Expanded Uncertainty:	1.59

3.2.2 Radiated Measurements (Below 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.78
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.57

3.2.3 Radiated Emission Measurements (Above 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.78
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.56

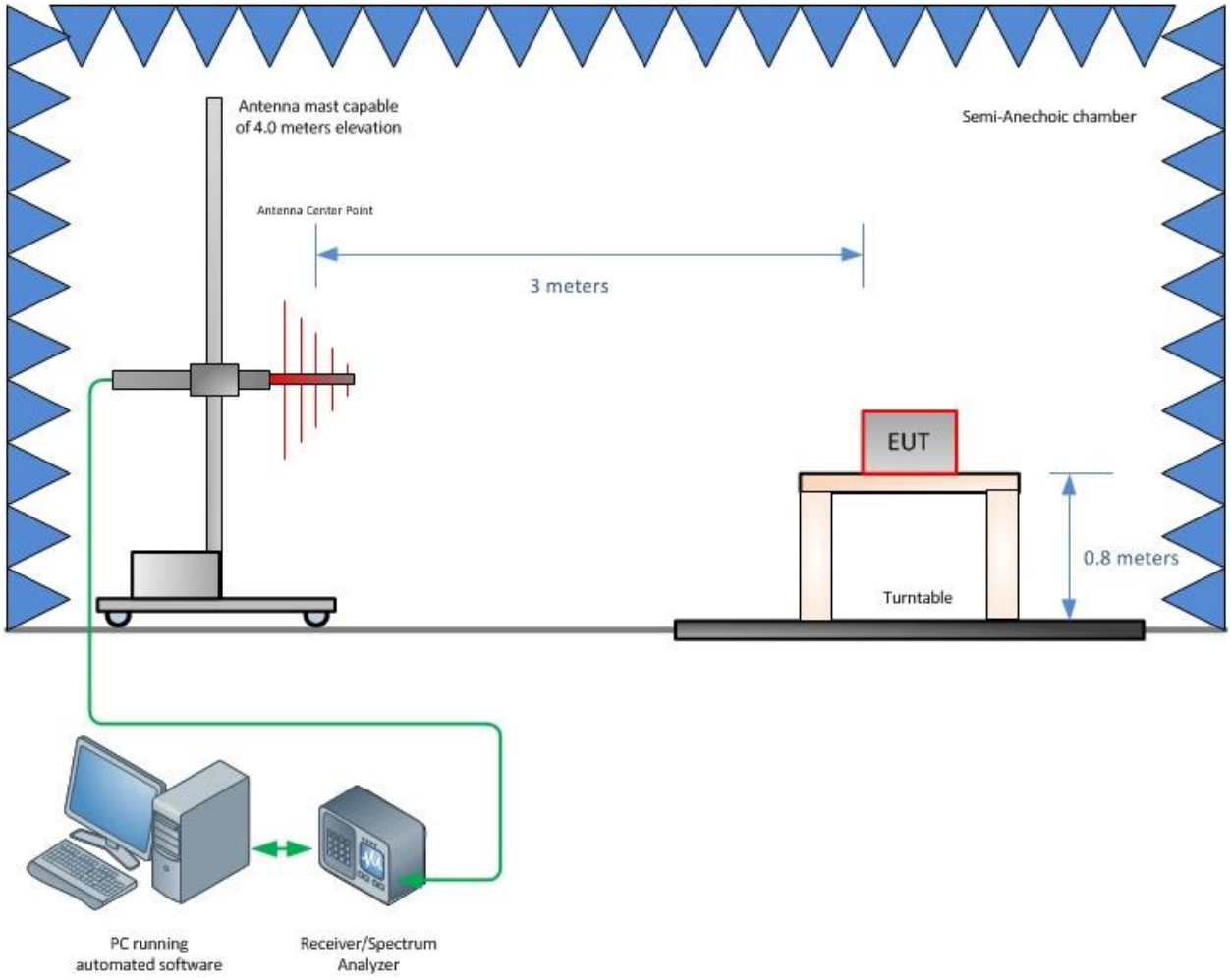
3.2.4 Conducted Antenna Port Measurement

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	0.72
				Coverage Factor (k):	2
				Expanded Uncertainty:	1.45

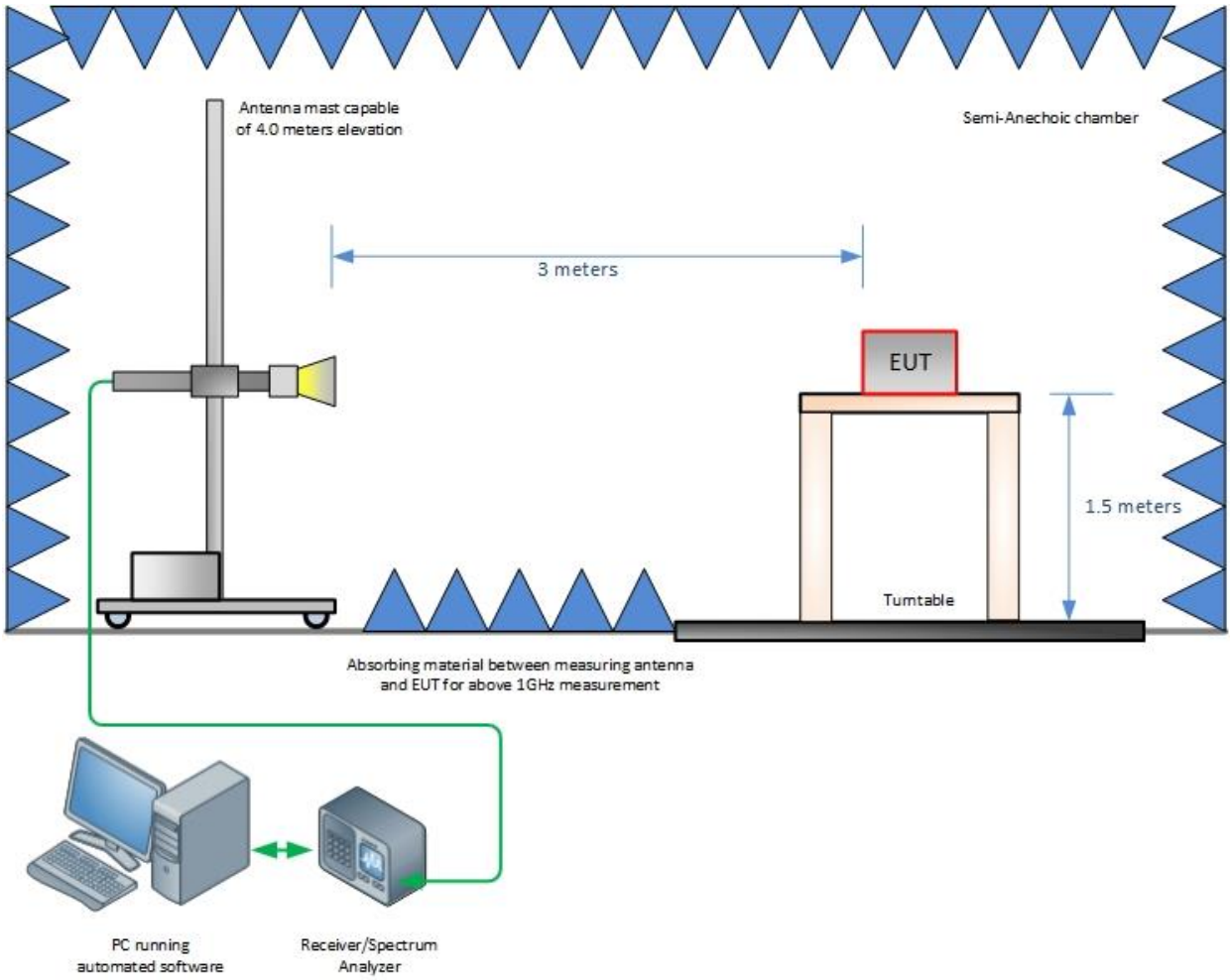
SECTION 4

DIAGRAM OF TEST SETUP

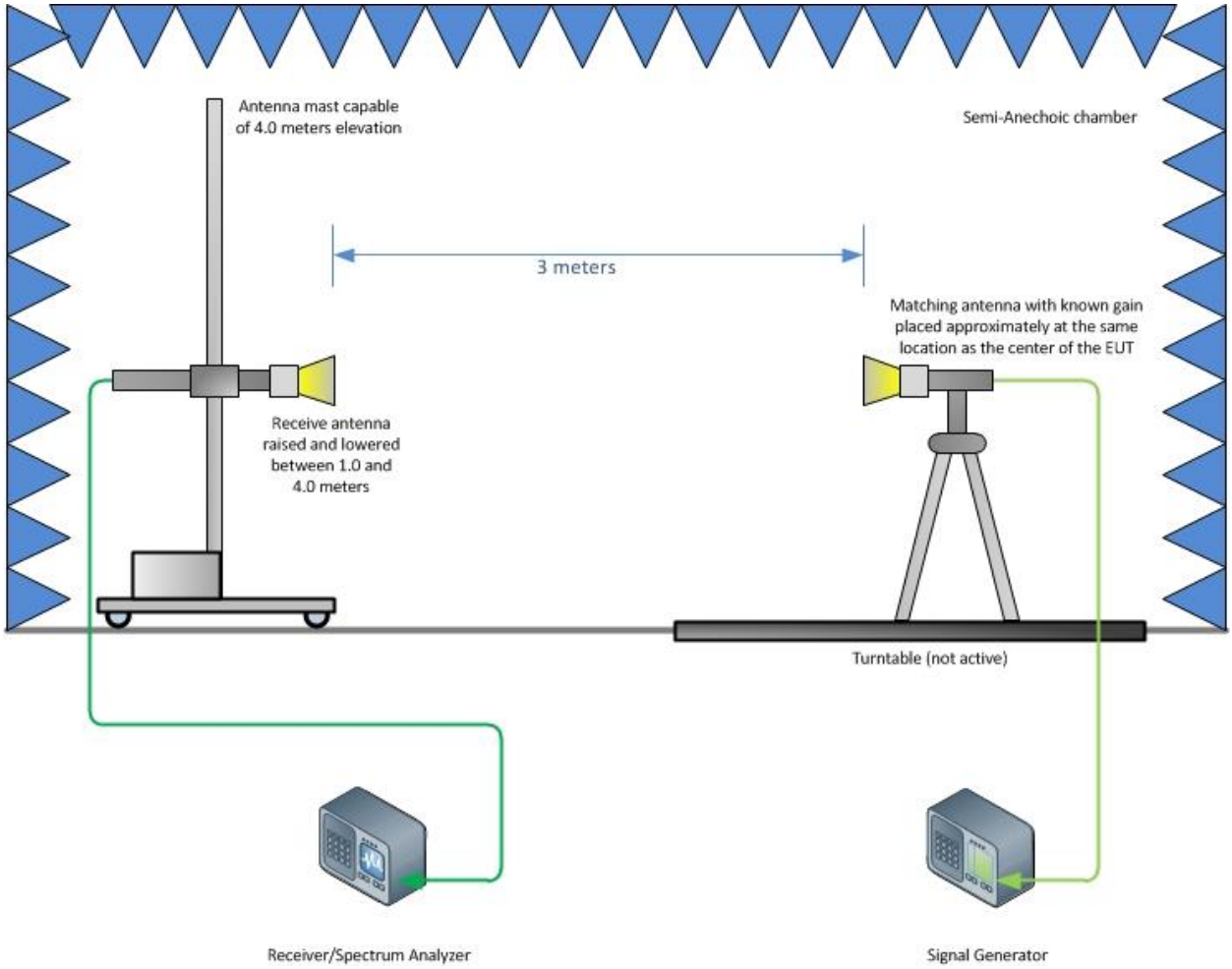
4.1 TEST SETUP DIAGRAM



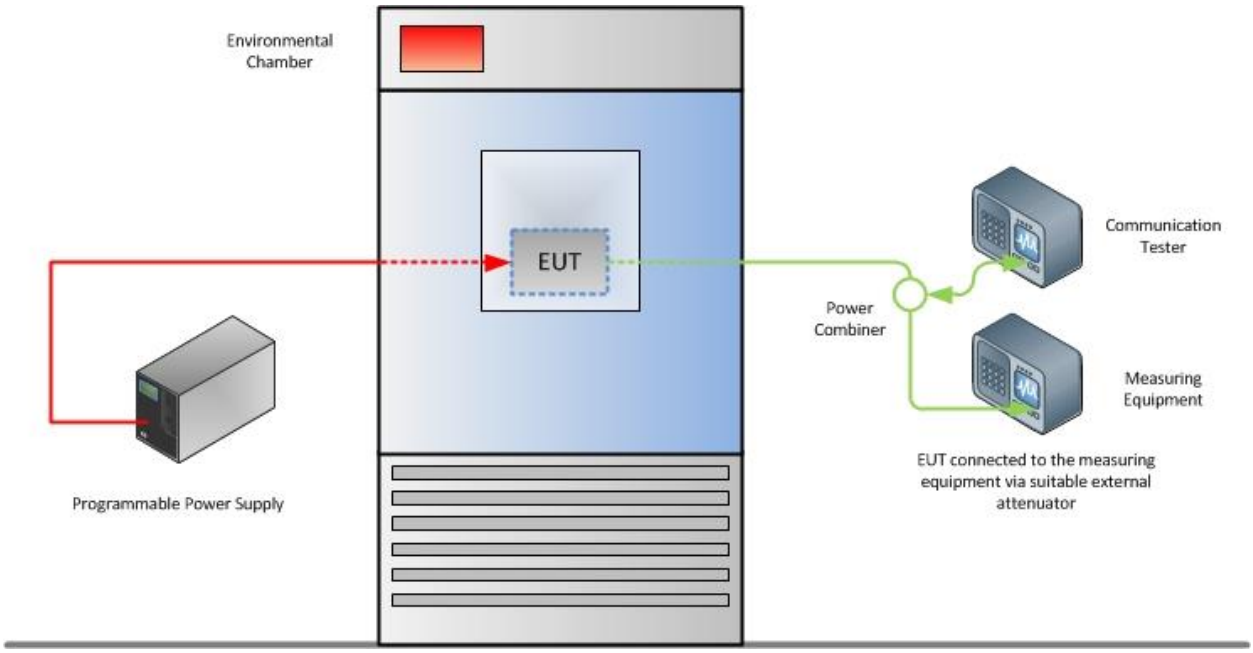
Radiated Emission Test Setup (Below 1GHz)



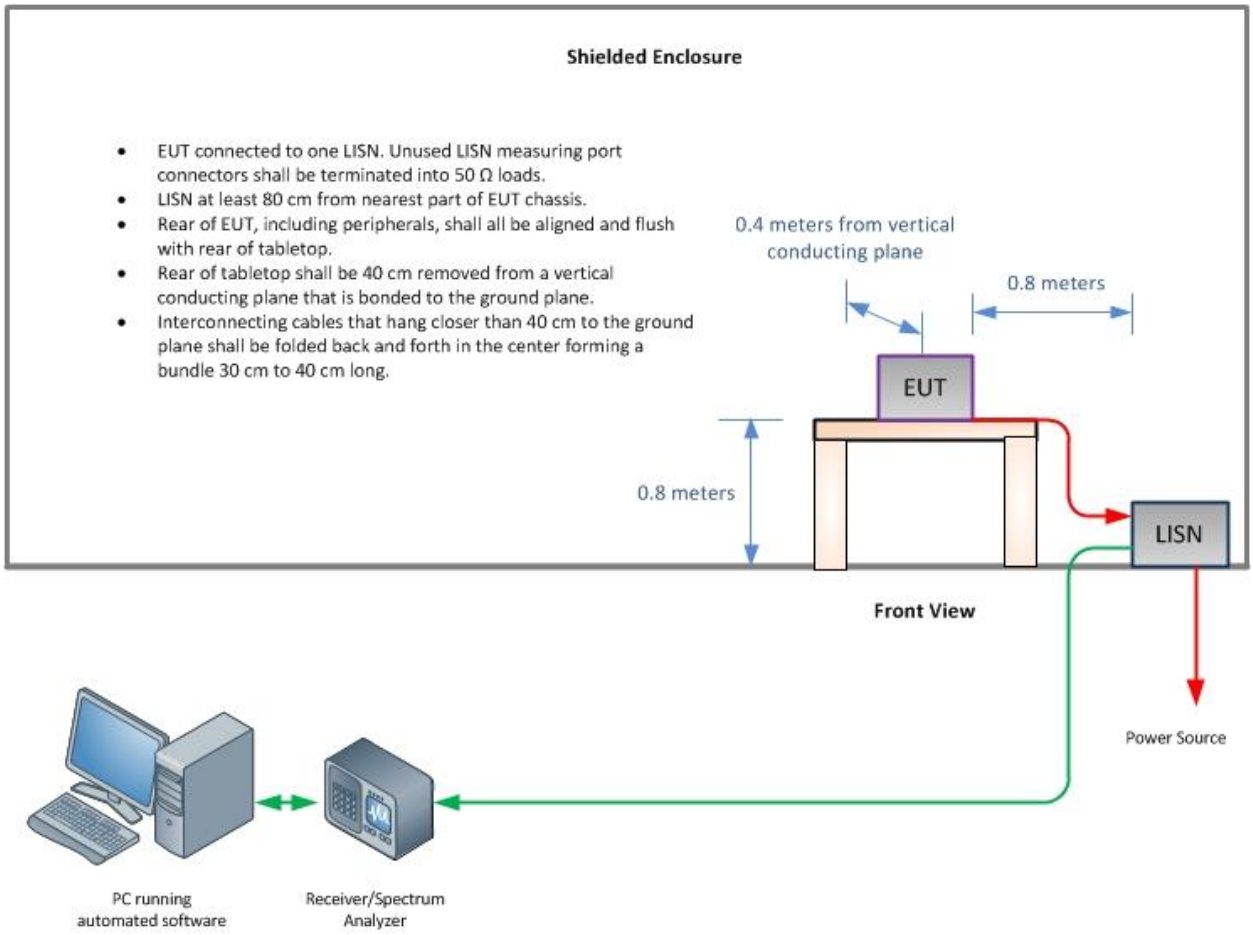
Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz, if applicable)



Frequency Stability Test Comfiguration



Conducted Emissions Test Configuration (if applicable)

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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