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Report On

Application for Grant of Equipment Authorization of the
Nextivity Inc.

Cel-Fi DUO Smart Cellular Signal Booster

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

Report No. SD72112724-0116D

April 2016

FCC ID: NU: YETD32-21366NU
CU: YETD32-21366CU
IC: N/A
Report No. SD72112724-0116D



REPORT ON Radio Testing of the
Nextivity Inc.
Smart Cellular Signal Booster

TEST REPORT NUMBER SD72112724-0116D

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SD72112724-0116D Nextivity Inc. M/N D32-2/13/66 Cel-Fi DUO Smart Cellular Signal Booster					
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04/22/16	Initial Release				Juan M Gonzalez



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
Cel-Fi DUO Smart Cellular Signal Booster



1.1 INTRODUCTION

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

- FCC CFR 47 Part 2, Part 27
- IC RSS-Gen and RSS-139.

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 DUO
Model Number(s)	D32-2/13/66
FCC ID	NU: YETD32-21366NU CU: YETD32-21366CU
IC Number	N/A
Serial Number(s)	951550000015 (NU and CU)
Number of Samples Tested	2
Test Specification/Issue/Date	<ul style="list-style-type: none">• FCC CFR 47 Part 2, Part 27 (October 1, 2015).• RSS-139 - Advanced Wireless Services (AWS) Equipment Operating in the bands 1710-1780 MHz and 2110-2180 MHz (Issue 3, July 2015).• RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 4, November 2014).
Start of Test	January 11, 2016
Finish of Test	February 21, 2016
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	<ul style="list-style-type: none">• ANSI/TIA-603-C-2004 – Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards.• KDB971168 (D01 Power Meas License Digital Systems v02r02) 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, Part 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-139		
2.1	2.1046	27.50 (h)(1)	6.5	Transmitter Conducted Output Power	Compliant
2.2	-	27.50 (h)(1)	6.5	Equivalent Isotropic Radiated Power	Compliant
2.3	2.1049	27.53 (h)	RSS-Gen 6.6	Occupied Bandwidth	Compliant
2.4	-	27.50 (d)(5)	6.5	Peak-Average Ratio	Compliant
2.5	2.1051	27.53 (h)(1),(3)	6.6	Band Edge	Compliant
2.6	2.1051	27.53 (h)(1),(3)	6.6	Conducted Spurious Emissions	Compliant
2.7	2.1053	27.53 (h)(1)	6.6	Field Strength of Spurious Radiation	Compliant
2.8	2.1055	27.54	6.4	Frequency Stability	Compliant
-	-	-	RSS-Gen 7	Receiver Spurious Emissions	N/A*
2.9	-		RSS-Gen 8.8	Power Line Conducted Emission	Compliant

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 DUO Smart Cellular Signal Booster. The EUT is a signal booster for indoor residential, small business and small enterprise use. It consists of two units: the Network Unit (NU), and the Coverage Unit (CU). NU and CU are shipped and sold as one unit. 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. The NU and CU are connected wirelessly over a full-duplex wireless link in the UNII band using a mixed OFDM and muxed cellular signal over a 30 or 40 MHz channel in each direction. The CU also includes Bluetooth LE connectivity. With the use of smart phone application, it allows user to register the product, update software, capture/display details metrics of the system. NU does not support Bluetooth LE. The LTE Band 66 function of the EUT were verified in this test report.



1.3.2 EUT General Description

EUT Description Smart Cellular Signal Booster

Model Name Cel-Fi DUO

Model Number(s) D32-2/13/66

Rated Voltage 12V DC via external AC/DC adapter.

Mode Verified LTE Band 66

Frequency Bands NU: 1710 - 1780MHz
 CU: 2110 - 2180MHz

Channel Bandwidth 5MHz, 10MHz, 15MHz and 20MHz

Capability LTE Band 2, 13, 66/UNII 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

Antenna Gain	NU	CU
	2 dBi	2 dBi



1.3.3 Transmit Frequency Table

Mode	Channel Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	EIRP(Part 27)	
				Max. Power (dBm)	Max. Power (W)
LTE Band 66 Downlink	5	2112.5 - 2177.5	4M23F9W	11.93	0.016
	10	2115 - 2175	8M80F9W	14.35	0.027
	15	2117.5 - 2172.5	13M3F9W	15.62	0.036
	20	2120 - 2170	17M8F9W	17.39	0.055
LTE Band 66 Uplink	5	1712.5 - 1777.5	4M28F9W	23.72	0.236
	10	1715 - 1775	8M80F9W	23.59	0.229
	15	1717.5 - 1772.5	13M4F9W	23.36	0.217
	20	1720 - 1770	17M8F9W	23.79	0.239



1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Downlink (CU TX). Input signal is applied to B66 antenna port of NU. Output is monitored from B66 Top antenna port of CU.
B	Uplink (NU TX). Input signal is applied to B66 antenna port of CU. Output is monitored from B66 Top antenna port of NU.
C	Radiated test setup. Downlink (CU TX). Input signal is applied to B66 antenna port of NU. B66 Top antenna port of CU is terminated with a 50Ω load.
D	Radiated test setup. Uplink (NU TX). Input signal is applied to B66 antenna port of CU. B66 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

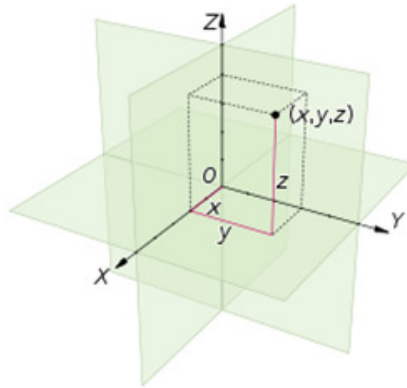
Manufacturer	Equipment/Cable	Description
Hon-Kwang	AC/DC Adapter (EUT)	M/N HK-AB-120A250-US P/N 290N025-001, 12VDC 2.5A
-	Support USB cable	1.75 meters, shielded Type A to Micro B connector
Nextivity	Support USB cable	Custom 1.0 meter shielded USB Type A to DB9 for the Shielded Test Enclosure
Sony	Support Laptop	M/N PCG-31311L S/N 27545534 3006488
Sony	Support Laptop AC Adapter	M/N PCGA-AC19V9 S/N 147839091 0023259
Rhode & Schwarz	Support Wideband Radio Communication Tester	M/N CMW500 S/N 1201.0002k50/103829
Mini-Circuits	Support Coaxial SMA Fixed Attenuator (x4)	M/N VAT-30W2 30dB DC-6GHz
Ramsey	Support Shielded Test Enclosure	M/N STE3300 S/N 3042 with custom USB cable and AC/DC Adapter

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:

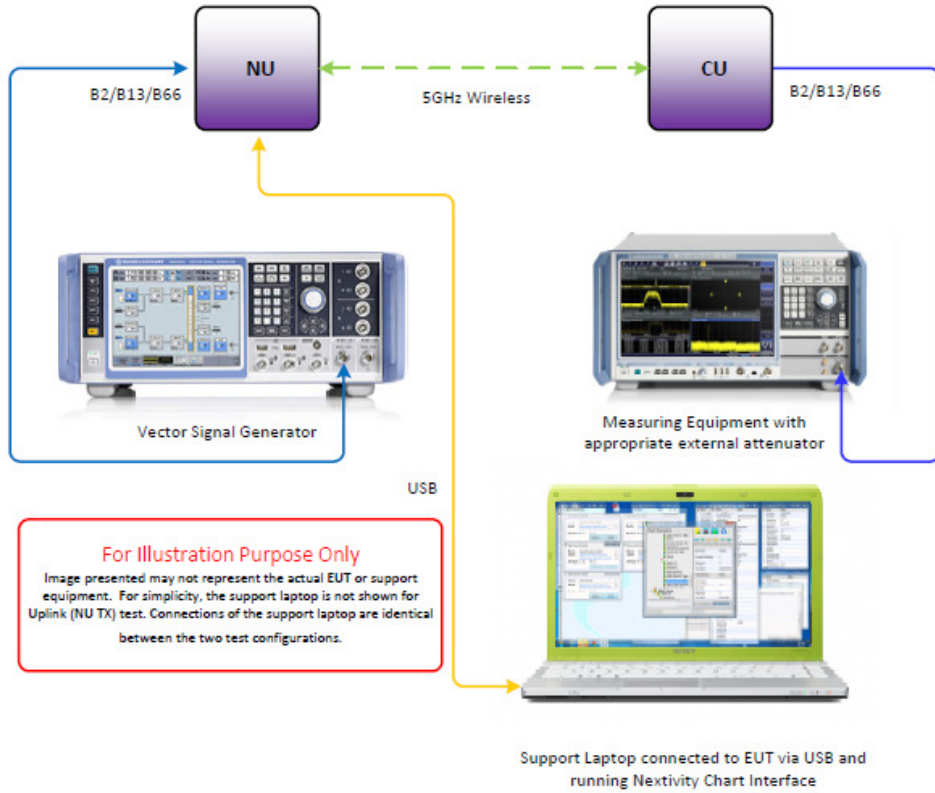
Mode	Bandwidth	Channel No.	Frequency
LTE Band 66 Downlink	20MHz	Middle Channel 66786	2145MHz
LTE Band 66 Uplink	20MHz	Middle Channel 132322	1745MHz

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 "Z" configuration.

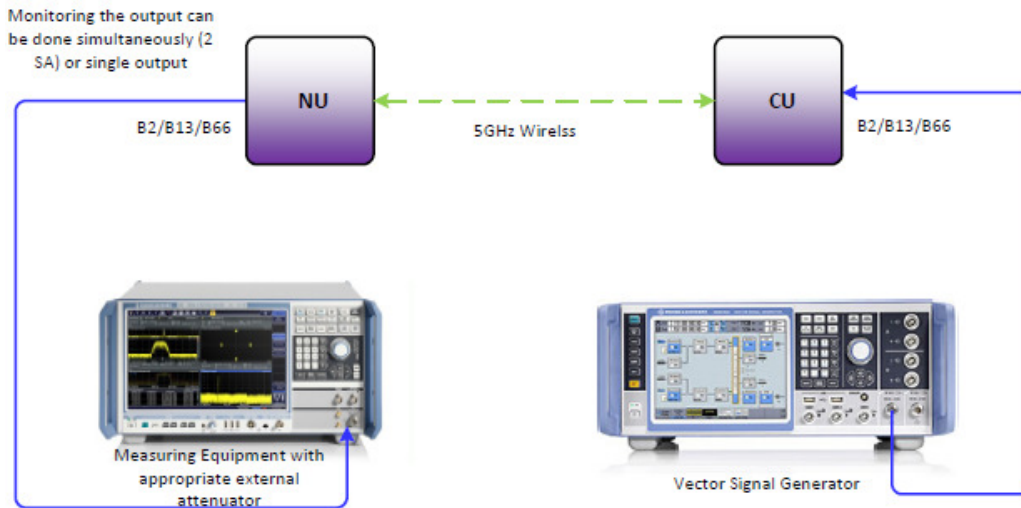


1.4.5 Simplified Test Configuration Diagram

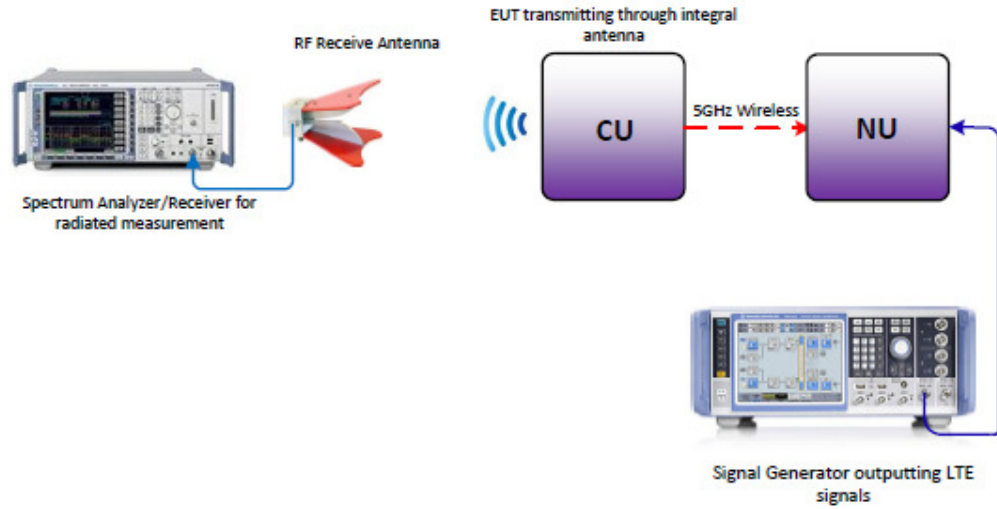
Downlink (CU Tx) Conducted Test



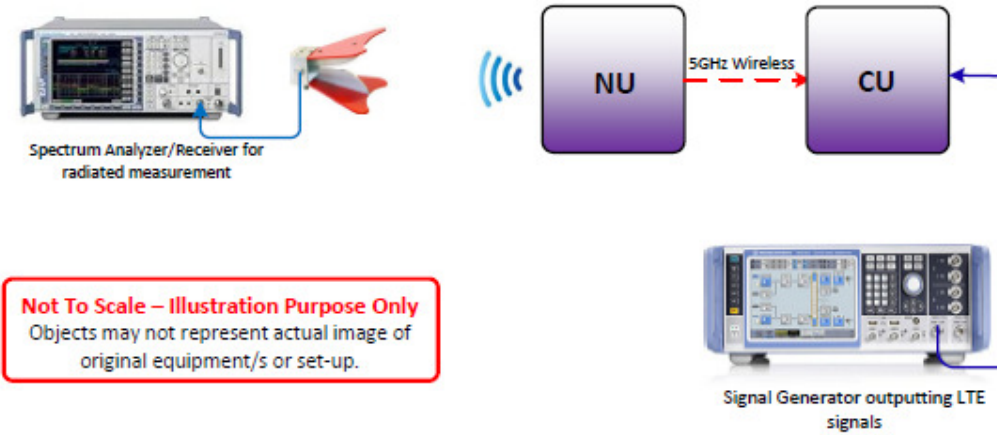
Uplink (NU Tx) Conducted Test



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 95155000015 (NU and 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)

Building #8, 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration 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.

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1.9.2 Innovation, Science and Economic Development Canada Registration No.: 3067A

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



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
	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:

$$\begin{aligned}
 P_{EIRP} &= -18 \text{ dBm} + 7.8 \text{ dBi} - 1\text{dB} \\
 &= 11.2 \text{ dBm} \\
 P_{ERP} &= P_{EIRP} - 2.15 \text{ dB} \\
 &= 11.2 \text{ dBm} - 2.15 \text{ dB} \\
 &= 9.05 \text{ dBm}
 \end{aligned}$$

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CU: YETD32-21366CU
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SECTION 2

TEST DETAILS

Radio Testing of the
Nextivity Inc.
Cel-Fi DUO Smart Cellular Signal Booster



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 (d)(2)
FCC 47 CFR Part 27, Clause 27.50 (d)(4)
RSS-139, Clause 6.5

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(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.

2.1.3 Equipment Under Test and Modification State

Serial No: 951550000015 (NU and CU) / Test Configuration A and B

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

January 13 and February 15, 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 23.0 - 26.8°C
 Relative Humidity 25.2 – 33.6%
 ATM Pressure 99.1 – 99.5kPa

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.

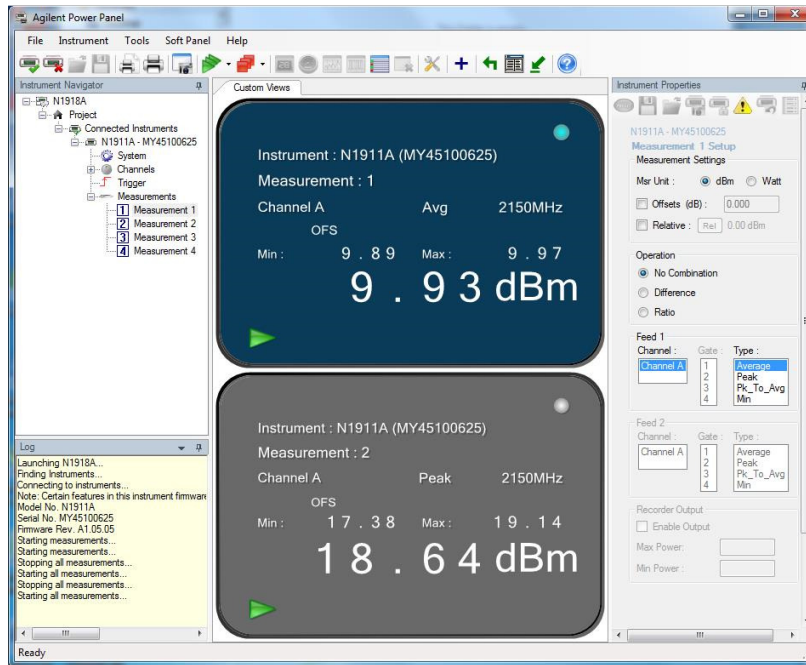
2.1.8 Test Results

<i>Downlink</i>					
Band	Bandwidth	Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)
LTE Band 66	5MHz	66461	2112.5	9.25	16.50
		66786	2145	9.93	18.64
		67111	2177.5	9.83	20.45
	10MHz	66786	2115	11.80	19.99
		66786	2145	12.35	20.55
		67086	2175	12.34	21.63
	15MHz	66511	2117.5	13.13	21.30
		66786	2145	13.62	21.95
		67061	2172.5	13.30	22.98
	20MHz	66536	2120	14.96	22.49
		66786	2145	15.39	23.69
		67036	2170	15.09	23.56

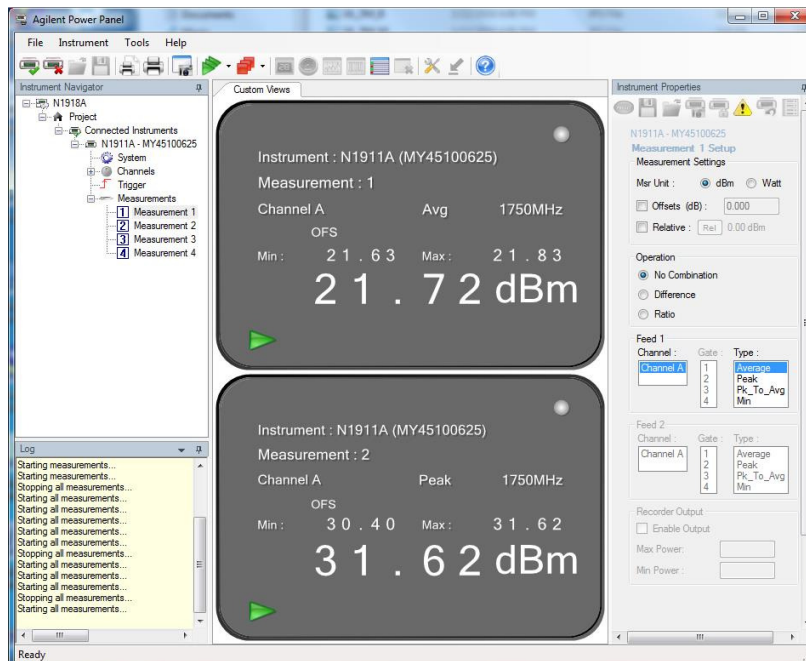


<i>Uplink</i>					
Band	Bandwidth	Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)
LTE Band 66	5MHz	131997	1712.5	21.61	30.35
		132322	1745	21.72	31.62
		132647	1777.5	20.53	29.94
	10MHz	132322	1715	21.59	30.65
		132322	1745	21.55	31.05
		132622	1775	20.62	29.74
	15MHz	132047	1717.5	21.14	31.88
		132322	1745	21.36	31.76
		132597	1772.5	20.08	29.80
	20MHz	132072	1720	21.73	31.41
		132322	1745	21.79	31.01
		132572	1770	20.99	30.70

2.1.9 Sample Test Plot



LTE Band 66 DL 5MHz Bandwidth Mid Channel



LTE Band 66 UL 5MHz Bandwidth Mid Channel



2.2 EQUIVALENT ISOTROPIC RADIATED POWER

2.2.1 Specification Reference

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

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.

2.2.3 Equipment Under Test and Modification State

Serial No: 951550000015 (NU and CU)

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

January 07 and February 15, 2016/XYZ

2.2.5 Additional Observations

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

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

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.

2.2.6 Sample Computation

$$\begin{aligned} \text{ERP} &= P_T + G_T - L_c \\ &= 23.19 \text{ (Average)} + 0.13 \text{ (max. gain)} - 5.28 \text{ (cable loss)} \\ &= 18.04 \text{ dBm} \end{aligned}$$



2.2.7 Test Results

Band 66 Downlink						
Bandwidth	Channel	Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)
5.0MHz	66461	2112.5	9.25	2	11.25	33
	66786	2145	9.93	2	11.93	33
	67111	2177.5	9.83	2	11.83	33
10MHz	66786	2115	11.80	2	13.80	33
	66786	2145	12.35	2	14.35	33
	67086	2175	12.34	2	14.34	33
15MHz	66511	2117.5	13.13	2	15.13	33
	66786	2145	13.62	2	15.62	33
	67061	2172.5	13.30	2	15.30	33
20.0MHz	66536	2120	14.96	2	16.96	33
	66786	2145	15.39	2	17.39	33
	67036	2170	15.09	2	17.09	33



Band 66 Uplink						
Bandwidth	Channel	Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)
5.0MHz	131997	1712.5	21.61	2	23.61	33
	132322	1745	21.72	2	23.72	33
	132647	1777.5	20.53	2	22.53	33
10MHz	132322	1715	21.59	2	23.59	33
	132322	1745	21.55	2	23.55	33
	132622	1775	20.62	2	22.62	33
15MHz	132047	1717.5	21.14	2	23.14	33
	132322	1745	21.36	2	23.36	33
	132597	1772.5	20.08	2	22.08	33
20.0MHz	132072	1720	21.73	2	23.73	33
	132322	1745	21.79	2	23.79	33
	132572	1770	20.99	2	22.99	33



2.3 OCCUPIED BANDWIDTH

2.3.1 Specification Reference

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

2.3.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.53(h)(3)
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: 951550000015 (NU and CU) / Test Configuration A and B

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

January 12, 13, February 12 and 15, 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	21.5 - 26.8°C
Relative Humidity	21.4 - 34.4%
ATM Pressure	99.1 - 100.0kPa

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 $\geq 3X$ RBW.
- The detector is peak and the trace mode is max hold.
- Only test plots for middle channel were presented 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

<i>Downlink</i>					
Band	Bandwidth	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
LTE Band 66	5MHz	66461	2112.5	4.23	4.69
		66786	2145	4.23	4.66
		67111	2177.5	4.23	4.69
	10MHz	66786	2115	8.80	9.32
		66786	2145	8.74	9.32
		67086	2175	8.80	9.49
	15MHz	66511	2117.5	13.29	14.24
		66786	2145	13.29	14.24
		67061	2172.5	13.29	14.24
	20MHz	66536	2120	17.83	18.64
		66786	2145	17.83	18.64
		67036	2170	17.83	19.57



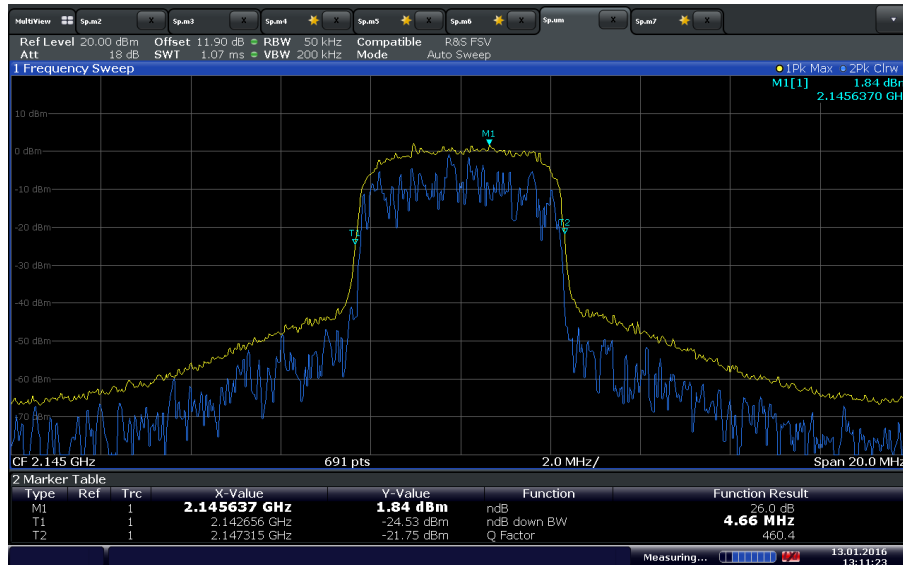
<i>Uplink</i>					
Band	Bandwidth	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
LTE Band 66	5MHz	131997	1712.5	4.23	4.69
		132322	1745	4.23	4.63
		132647	1777.5	4.28	4.80
	10MHz	132322	1715	8.80	9.32
		132322	1745	8.80	9.38
		132622	1775	8.80	9.44
	15MHz	132047	1717.5	13.29	14.15
		132322	1745	13.37	14.07
		132597	1772.5	13.29	14.15
	20MHz	132072	1720	17.83	18.52
		132322	1745	17.83	18.64
		132572	1770	17.83	19.10

LTE Band 66 Downlink 5MHz Bandwidth Mid Channel 99% OBW



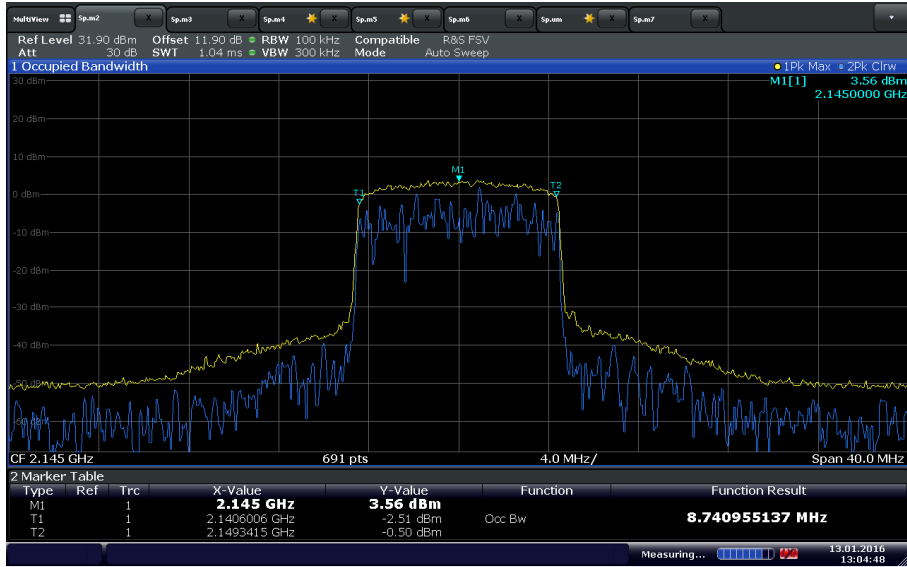
Date: 12. JAN. 2016 15:41:21

LTE Band 66 Downlink 5MHz Bandwidth Mid Channel -26dB BW



Date: 13. JAN. 2016 13:11:23

LTE Band 66 Downlink 10MHz Bandwidth Mid Channel 99% OBW



Date: 13. JAN.2016 13:04:48

LTE Band 66 Downlink 10MHz Bandwidth Mid Channel -26dB BW



Date: 13. JAN.2016 13:05:43



LTE Band 66 Downlink 15MHz Bandwidth Mid Channel 99% OBW



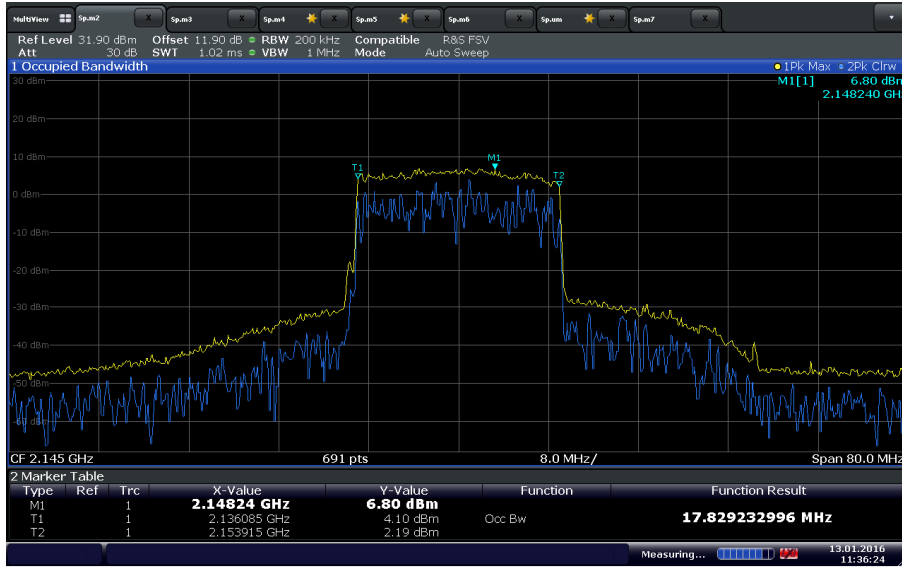
Date: 13. JAN. 2016 11:45:41

LTE Band 66 Downlink 15MHz Bandwidth Mid Channel -26dB BW



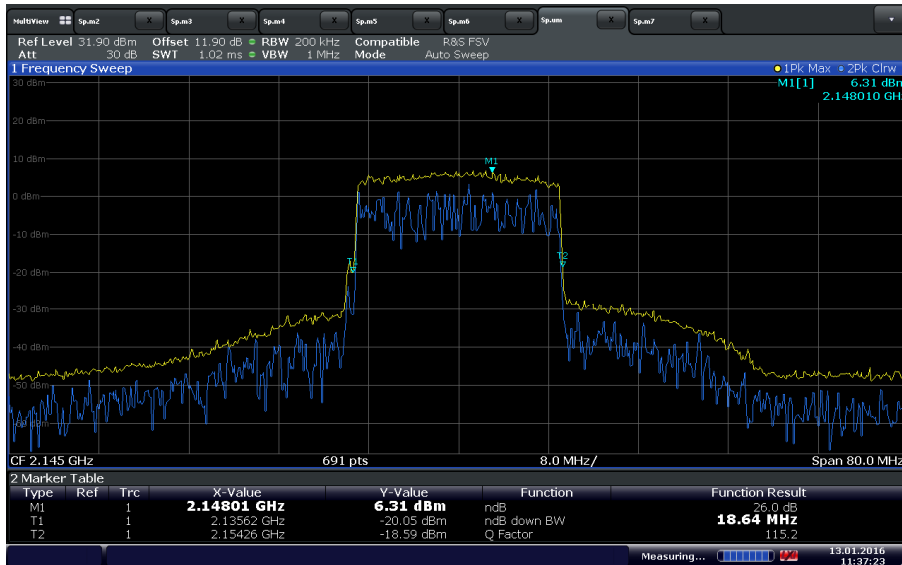
Date: 13. JAN. 2016 11:49:09

LTE Band 66 Downlink 20MHz Bandwidth Mid Channel 99% OBW



Date: 13. JAN.2016 11:36:24

LTE Band 66 Downlink 20MHz Bandwidth Mid Channel -26dB BW



Date: 13. JAN.2016 11:37:23

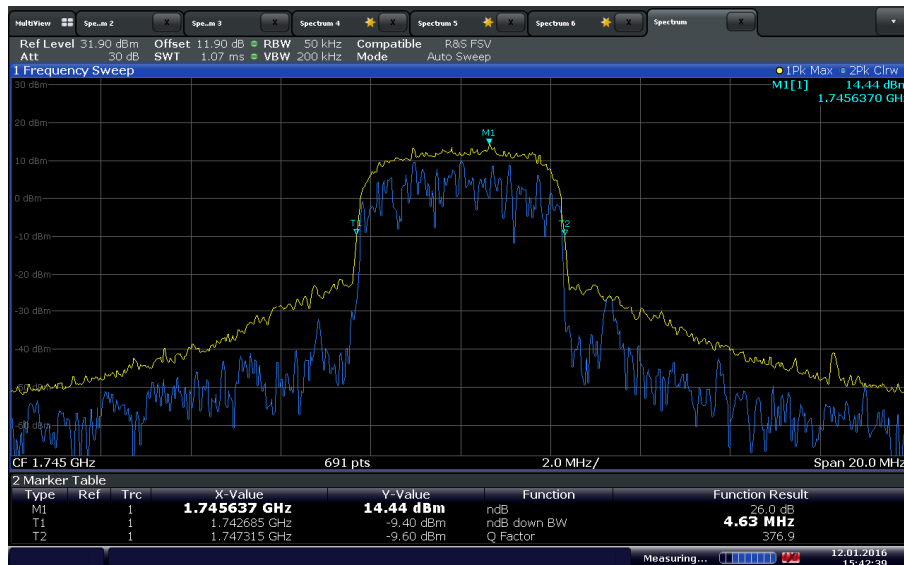


LTE Band 66 Uplink 5MHz Bandwidth Mid Channel 99% OBW



Date: 12 JAN 2016 15:41:21

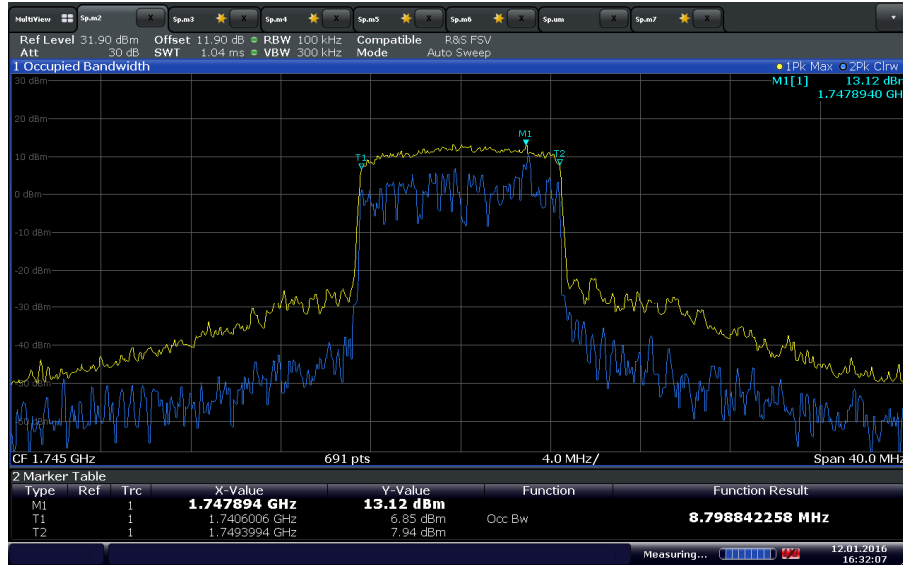
LTE Band 66 Uplink 5MHz Bandwidth Mid Channel -26dB BW



Date: 12 JAN 2016 15:42:39



LTE Band 66 Uplink 10MHz Bandwidth Mid Channel 99% OBW



Date: 12 JAN 2016 16:32:06

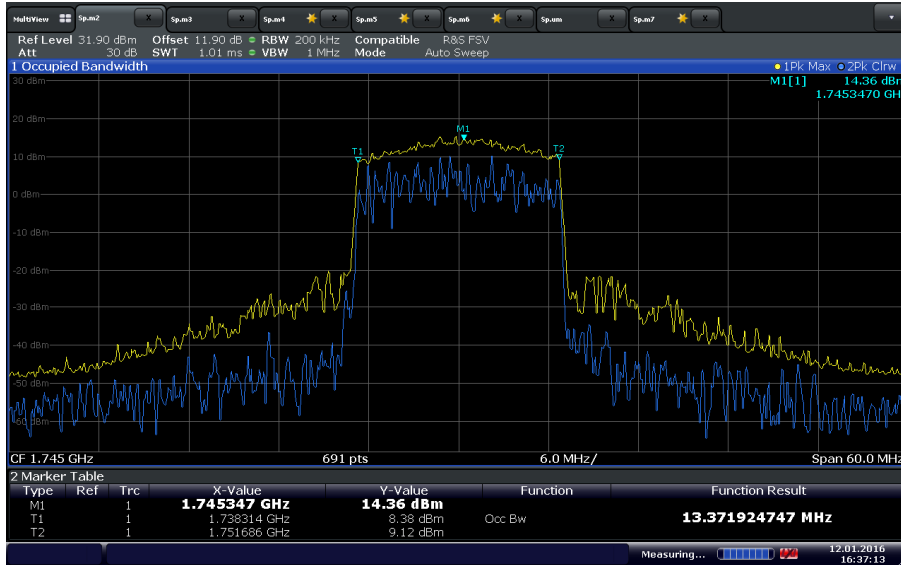
LTE Band 66 Uplink 10MHz Bandwidth Mid Channel -26dB BW



Date: 12 JAN 2016 16:31:21

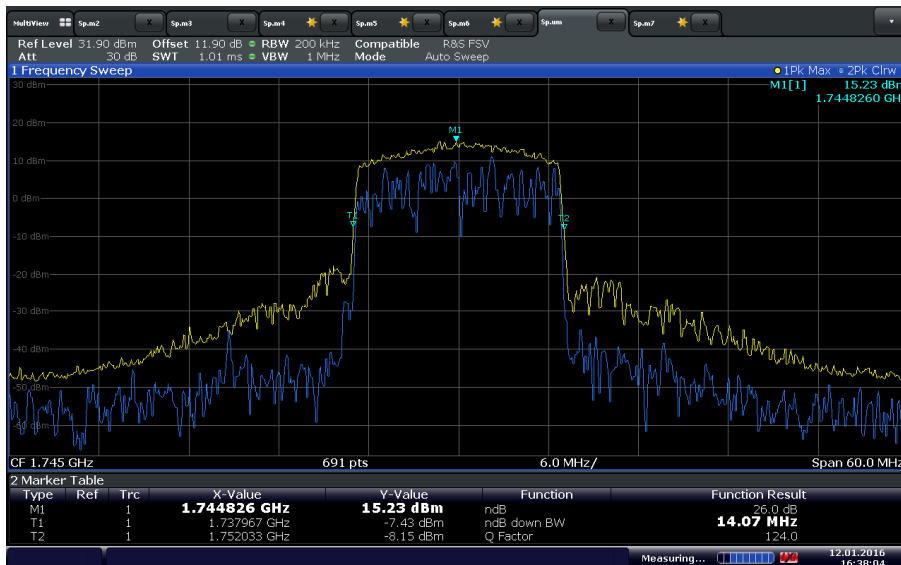


LTE Band 66 Uplink 15MHz Bandwidth Mid Channel 99% OBW



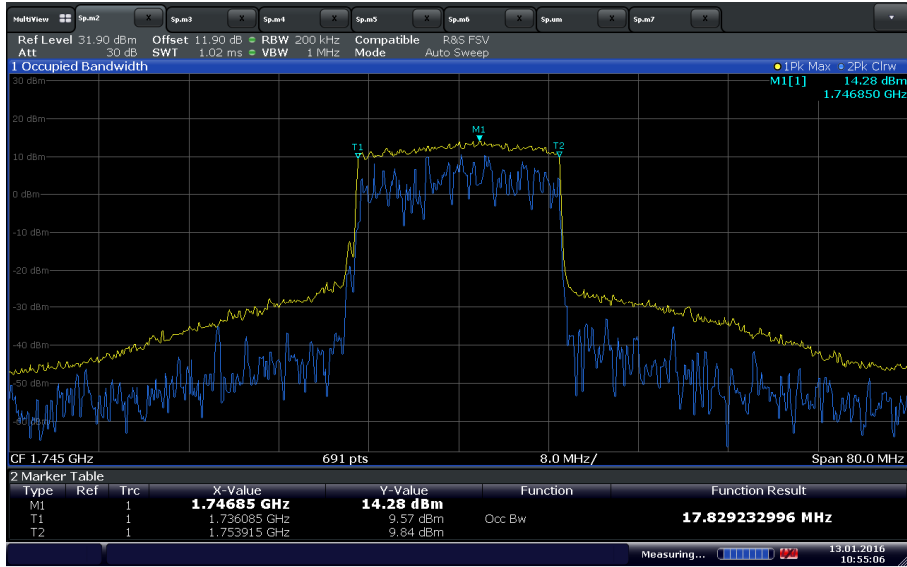
Date: 12 JAN 2016 16:37:13

LTE Band 66 Uplink 15MHz Bandwidth Mid Channel -26dB BW



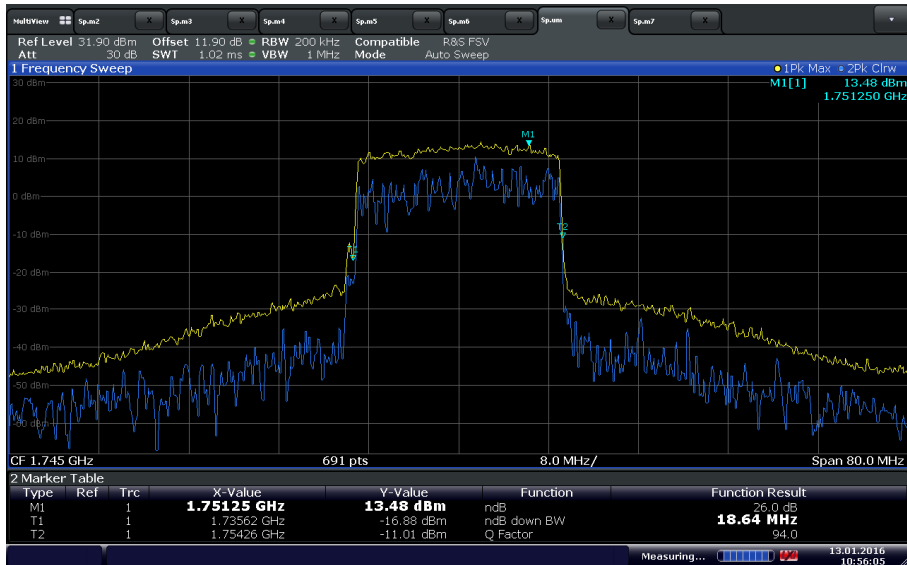
Date: 12 JAN 2016 16:38:04

LTE Band 66 Uplink 20MHz Bandwidth Mid Channel 99% OBW



Date: 13.JAN.2016 10:55:06

LTE Band 66 Uplink 20MHz Bandwidth Mid Channel -26dB BW



Date: 13.JAN.2016 10:56:04



2.4 PEAK-AVERAGE RATIO

2.4.1 Specification Reference

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

2.4.2 Standard Applicable

(5) Equipment employed must be authorized in accordance with the provisions of § 24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

2.4.3 Equipment Under Test and Modification State

Serial No: 95155000015 (NU and CU) / Test Configuration A and B

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

January 08, February 12 and 15, 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	21.9 - 26.8°C
Relative Humidity	21.4 - 43.3%
ATM Pressure	99.1 - 99.5kPa

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).
- The path loss was measured and entered as a level offset.
- 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.



- RBW was set to maximum the SA can support.
- The maximum PAPR level associated with a probability of 0.1% was recorded.
- There are no measured PAR levels greater than 13dB. EUT complies.

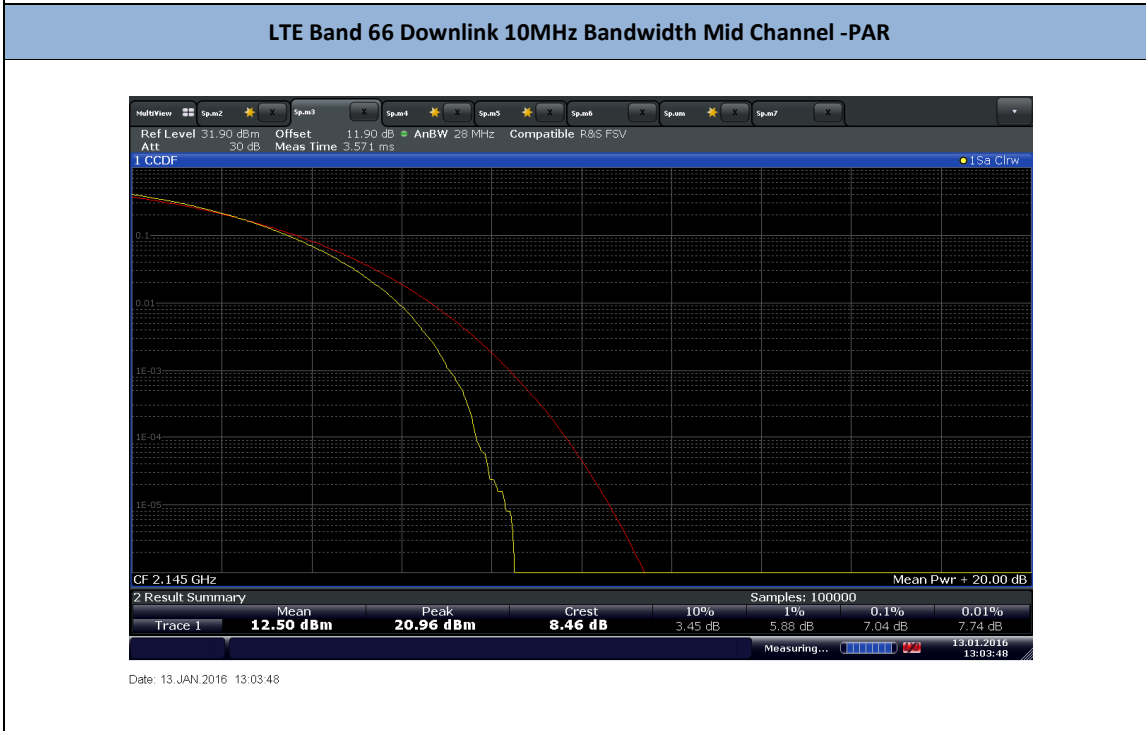
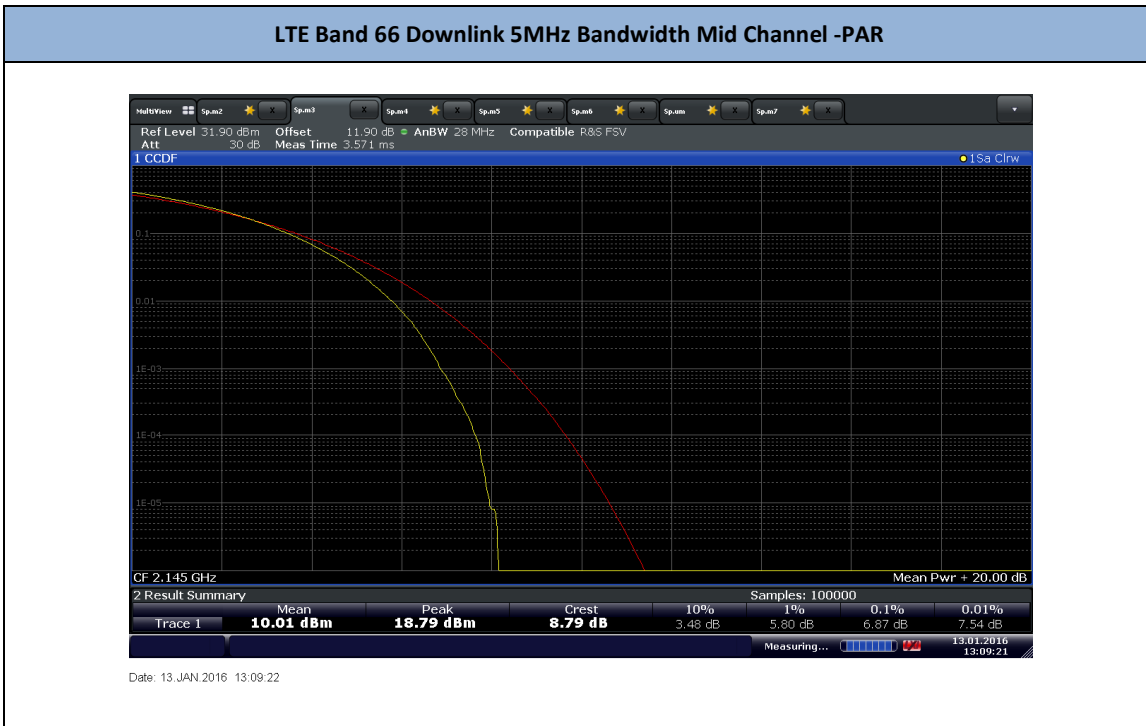
2.4.8 Test Results

<i>Downlink</i>				
Band	Bandwidth	Channel	Frequency (MHz)	PAR (dB)
LTE Band 66	5MHz	66461	2112.5	7.61
		66786	2145	8.79
		67111	2177.5	10.60
	10MHz	66786	2115	7.65
		66786	2145	8.46
		67086	2175	9.98
	15MHz	66511	2117.5	8.35
		66786	2145	8.73
		67061	2172.5	9.47
	20MHz	66536	2120	7.81
		66786	2145	8.10
		67036	2170	9.21



<i>Uplink</i>				
Band	Bandwidth	Channel	Frequency (MHz)	PAR (dB)
LTE Band 66	5MHz	131997	1712.5	8.76
		132322	1745	9.50
		132647	1777.5	10.79
	10MHz	132322	1715	9.76
		132322	1745	9.54
		132622	1775	9.89
	15MHz	132047	1717.5	10.59
		132322	1745	9.93
		132597	1772.5	10.26
	20MHz	132072	1720	9.55
		132322	1745	9.56
		132572	1770	10.33

2.4.9 Sample Test Plot



LTE Band 66 Downlink 15MHz Bandwidth Mid Channel -PAR



Date: 13. JAN.2016 11:44:42

LTE Band 66 Downlink 20MHz Bandwidth Mid Channel -PAR



Date: 13. JAN.2016 11:34:38

LTE Band 66 Uplink 5MHz Bandwidth Mid Channel -PAR



Date: 12.JAN.2016 15:39:58

LTE Band 66 Uplink 10MHz Bandwidth Mid Channel -PAR



Date: 12.JAN.2016 16:33:06

LTE Band 66 Uplink 15MHz Bandwidth Mid Channel -PAR



Date: 12, JAN, 2016 16:35:36

LTE Band 66 Uplink 20MHz Bandwidth Mid Channel -PAR



Date: 13, JAN, 2016 10:53:30



2.5 BAND EDGE

2.5.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.53 (h)(1),(3)
RSS-139, Clause 6.6

2.5.2 Standard Applicable

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee’s frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

2.5.3 Equipment Under Test and Modification State

Serial No: 951550000015 (NU and CU) / Test Configuration A and B

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

January 12, 13 and February 15, 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

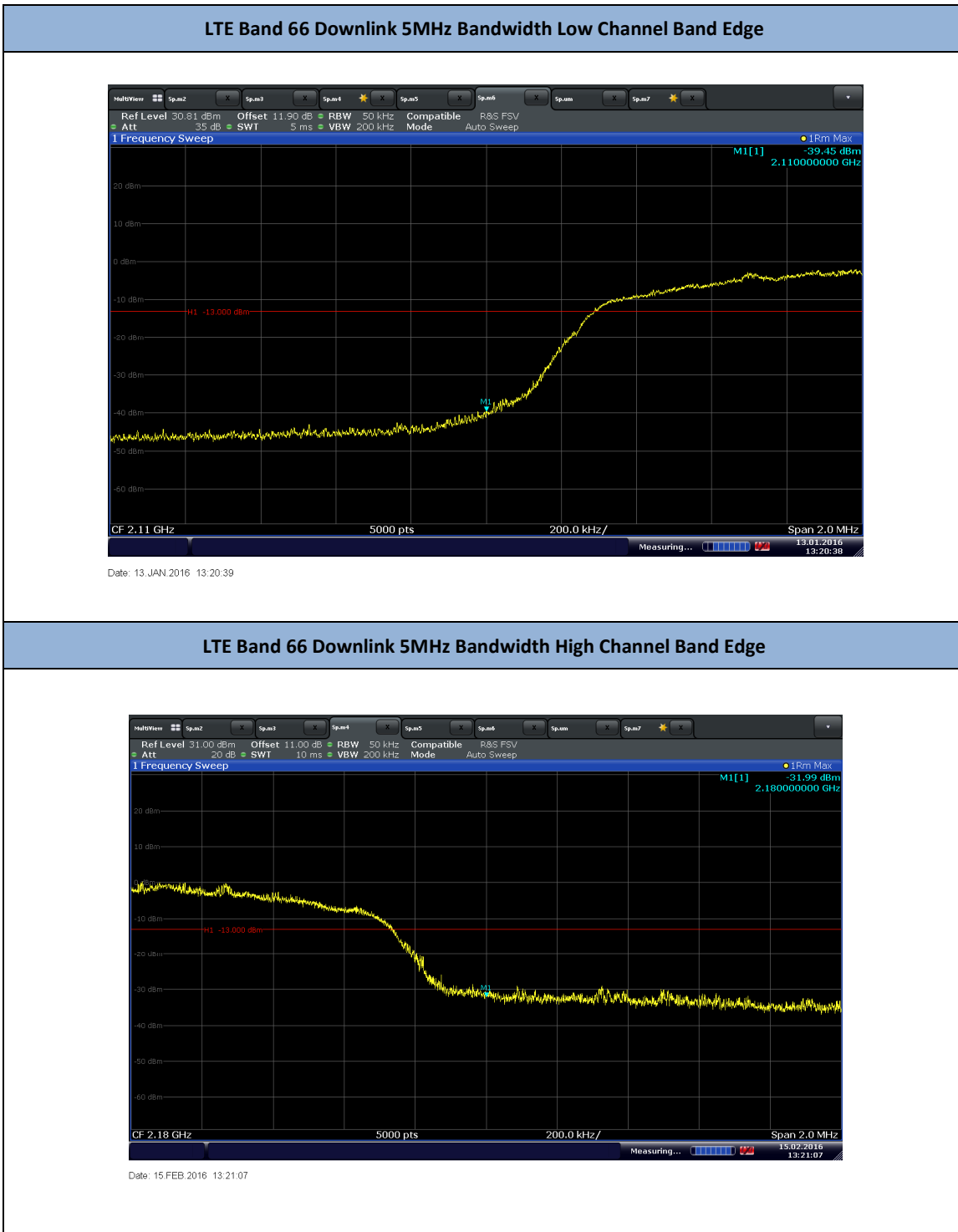
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	21.5 - 26.8°C
Relative Humidity	21.4 - 34.4%
ATM Pressure	99.1 - 100.0kPa

2.5.7 Additional Observations

- This is a conducted test.
- Test guidance is per Section 6 of KDB971168 (D01 Power Meas License Digital Systems v02r02).
- The path loss was measured and entered as a level offset.
- For band edge measurements, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter was employed.
- The limit is set to -13dBm.

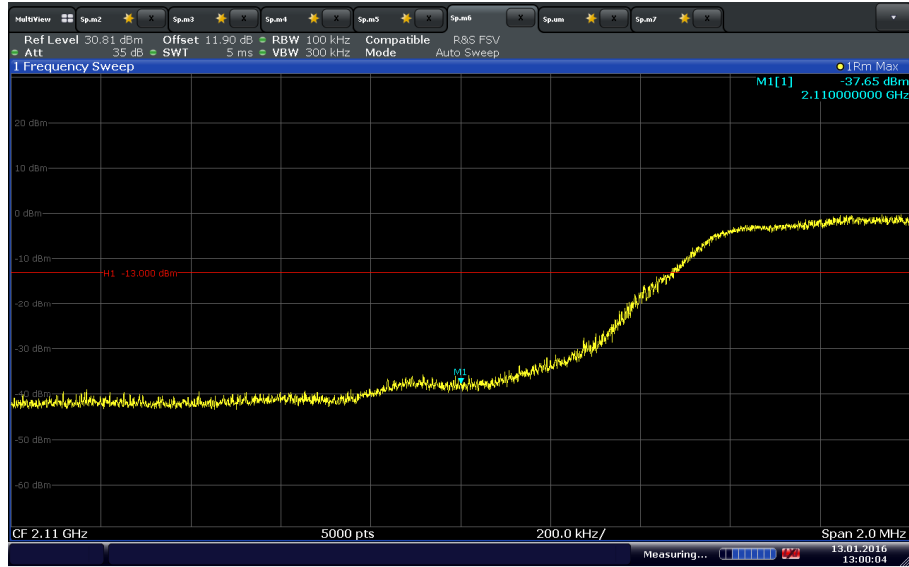
2.5.8 Test Results





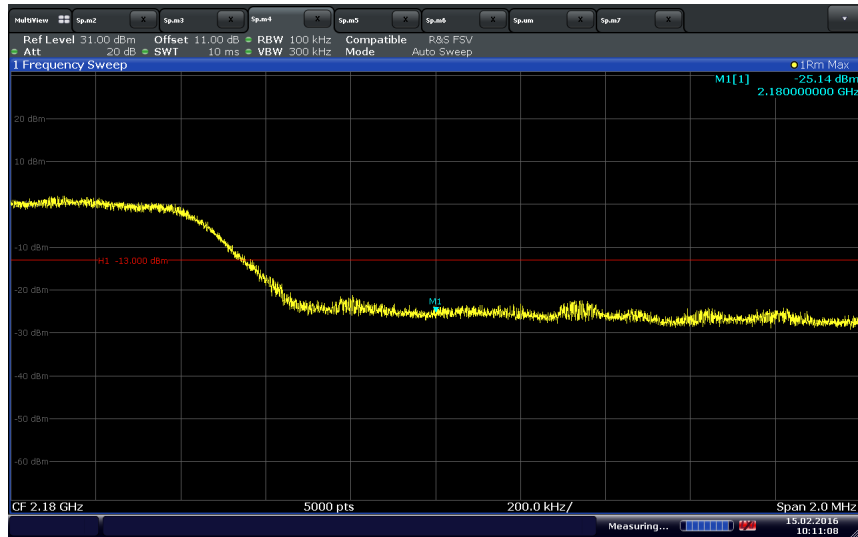
America

LTE Band 66 Downlink 10MHz Bandwidth Low Channel Band Edge



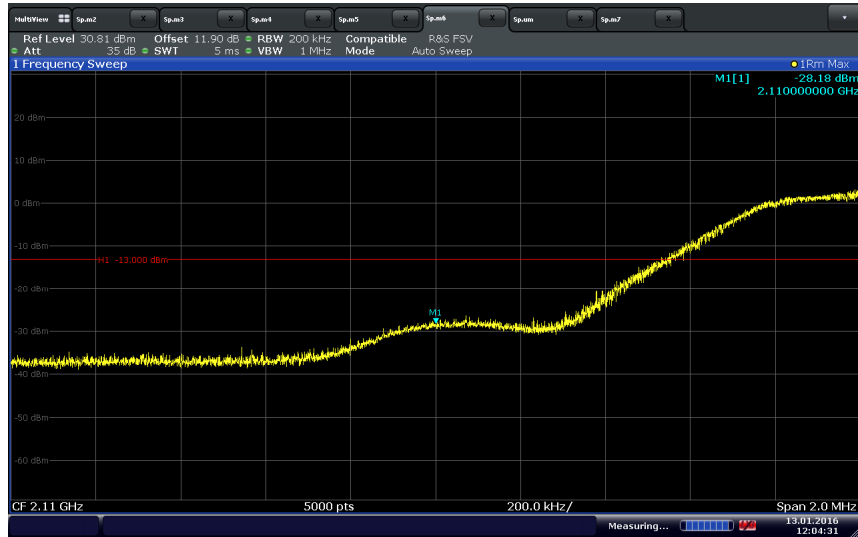
Date: 13 JAN 2016 13:00:04

LTE Band 66 Downlink 10MHz Bandwidth High Channel Band Edge

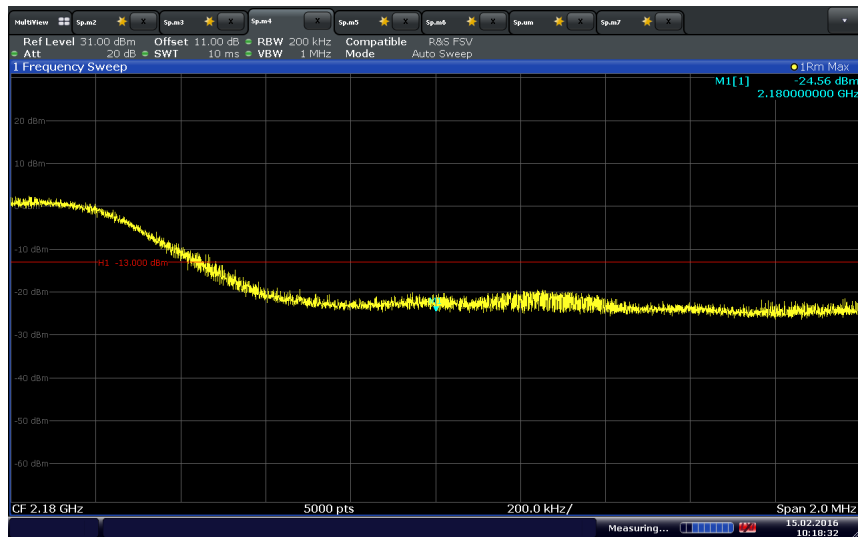


Date: 15 FEB 2016 10:11:09

LTE Band 66 Downlink 15MHz Bandwidth Low Channel Band Edge

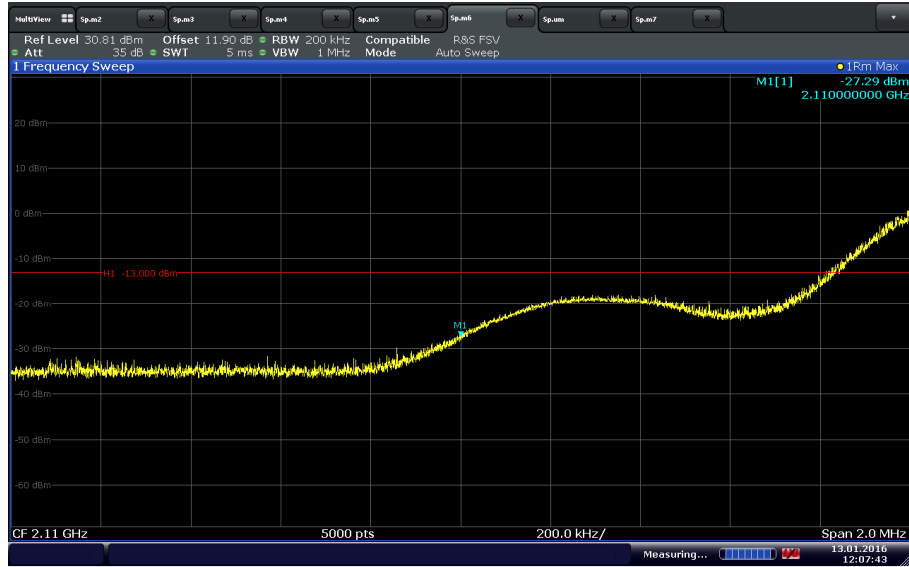


LTE Band 66 Downlink 15MHz Bandwidth High Channel Band Edge



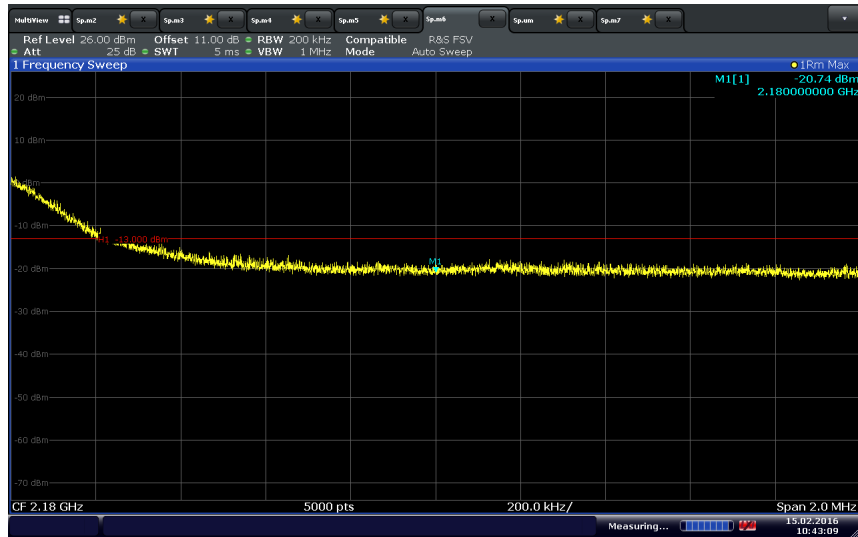


LTE Band 66 Downlink 20MHz Bandwidth Low Channel Band Edge



Date: 13 JAN 2016 12:07:43

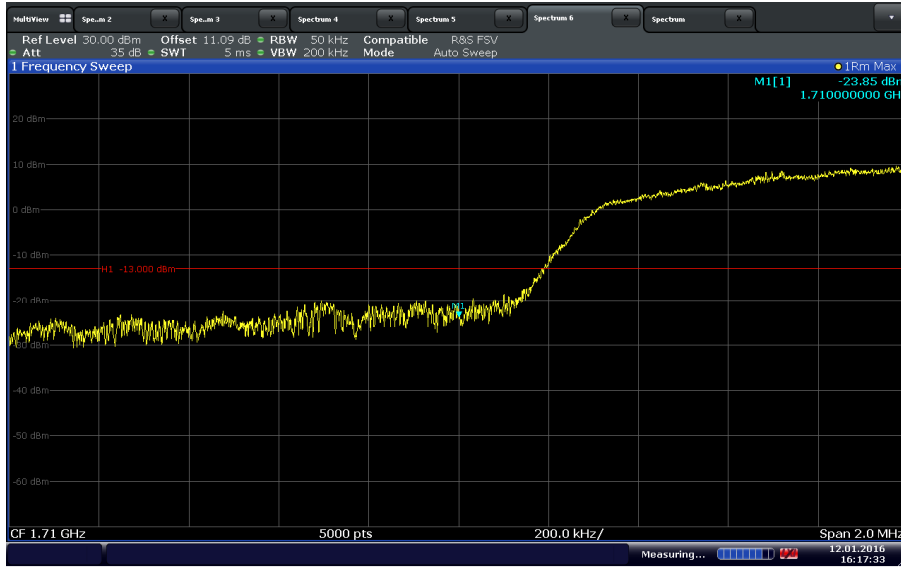
LTE Band 66 Downlink 20MHz Bandwidth High Channel Band Edge



Date: 15 FEB 2016 10:43:09

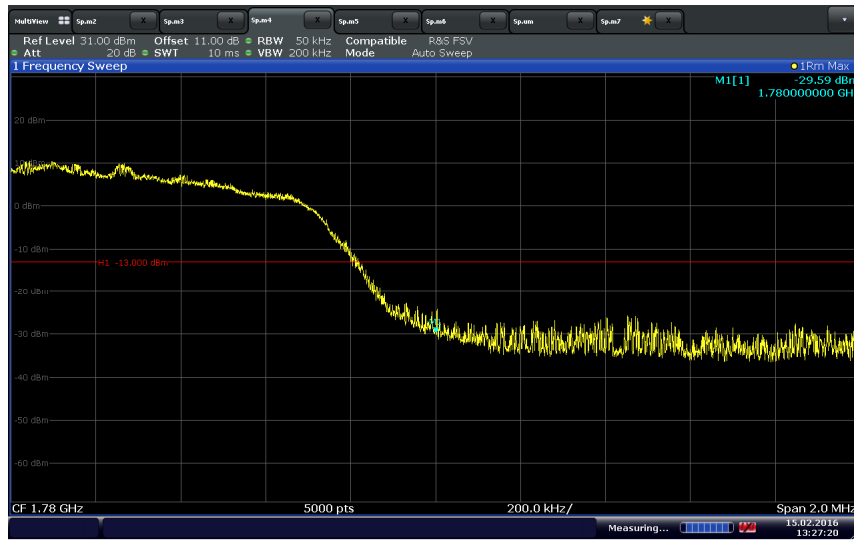


LTE Band 66 Uplink 5MHz Bandwidth Low Channel Band Edge



Date: 12.JAN.2016 16:17:33

LTE Band 66 Uplink 5MHz Bandwidth High Channel Band Edge

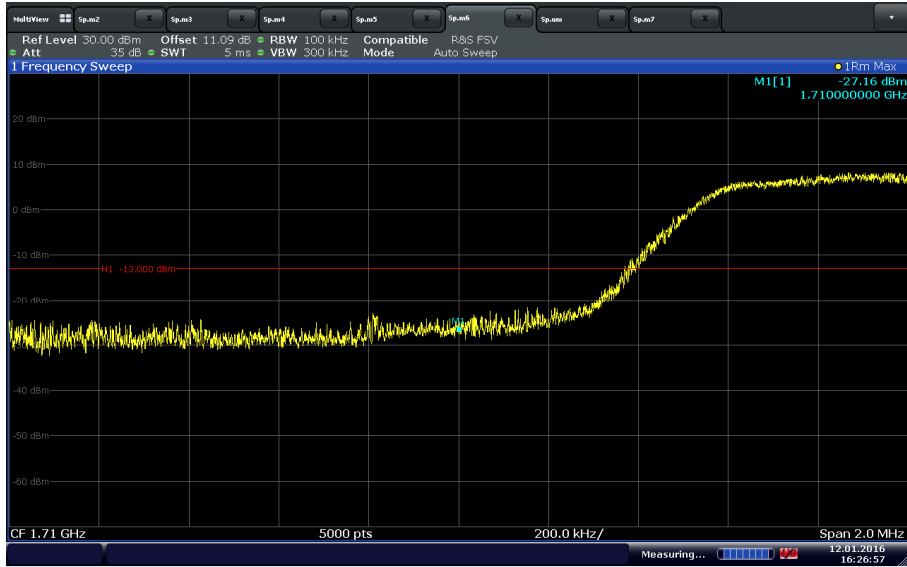


Date: 15.FEB.2016 13:27:20



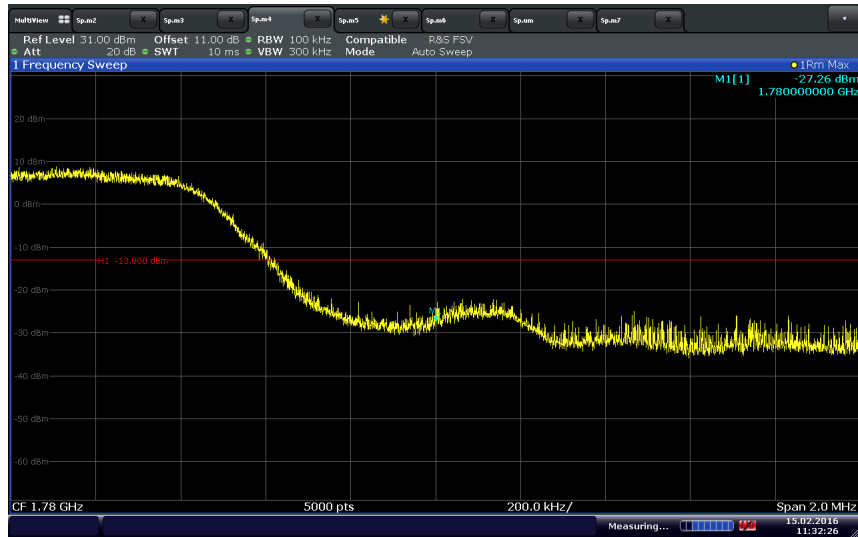
America

LTE Band 66 Uplink 10MHz Bandwidth Low Channel Band Edge



Date: 12 JAN 2016 16:26:58

LTE Band 66 Uplink 10MHz Bandwidth High Channel Band Edge

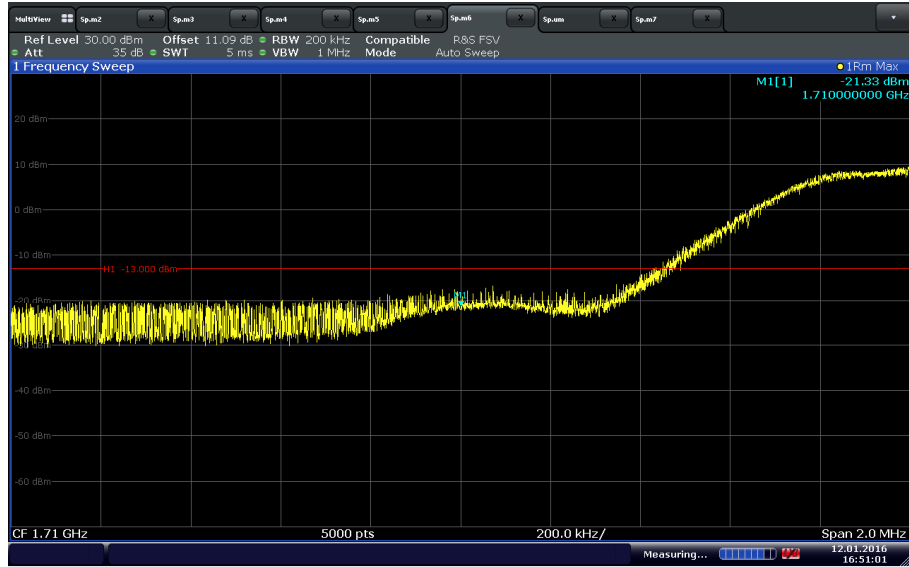


Date: 15 FEB 2016 11:32:26



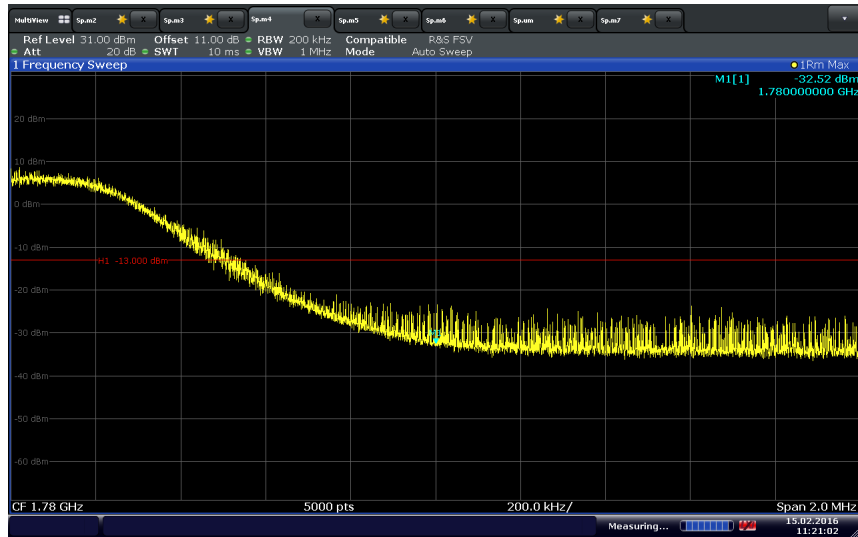
America

LTE Band 66 Uplink 15MHz Bandwidth Low Channel Band Edge



Date: 12 JAN 2016 16:51:01

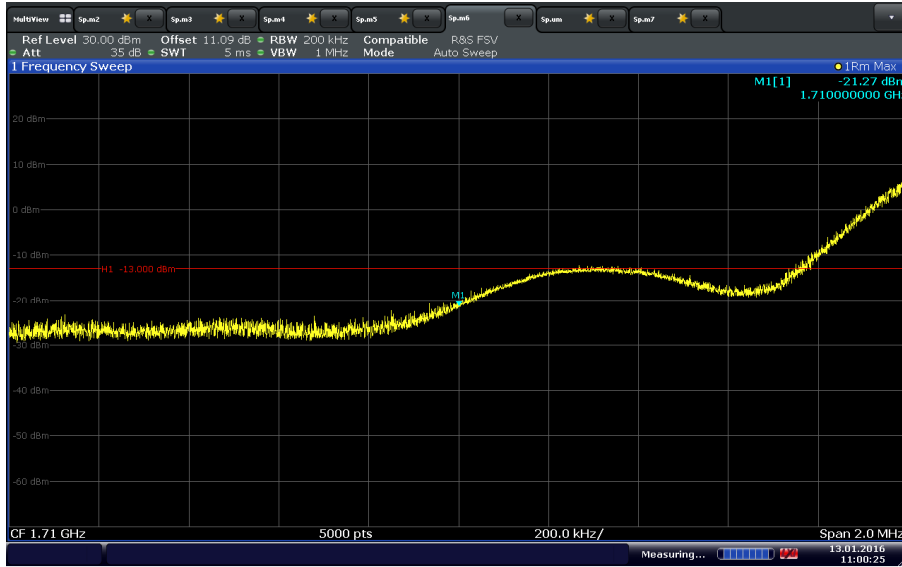
LTE Band 66 Uplink 15MHz Bandwidth High Channel Band Edge



Date: 15 FEB 2016 11:21:02

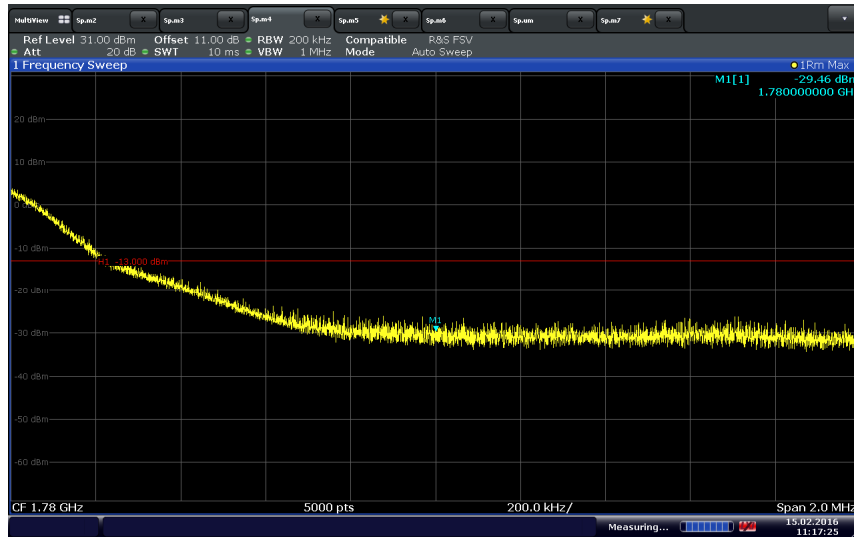


LTE Band 66 Uplink 20MHz Bandwidth Low Channel Band Edge



Date: 13. JAN. 2016 11:00:25

LTE Band 66 Uplink 20MHz Bandwidth High Channel Band Edge



Date: 15 FEB. 2016 11:17:25



2.6 CONDUCTED SPURIOUS EMISSIONS

2.6.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.53 (h)(1),(3)
RSS-139, Clause 6.6

2.6.2 Standard Applicable

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee’s frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

2.6.3 Equipment Under Test and Modification State

Serial No: 951550000015 (NU and CU) / Test Configuration A and B

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

January 12, 13, February 12 and 15, 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

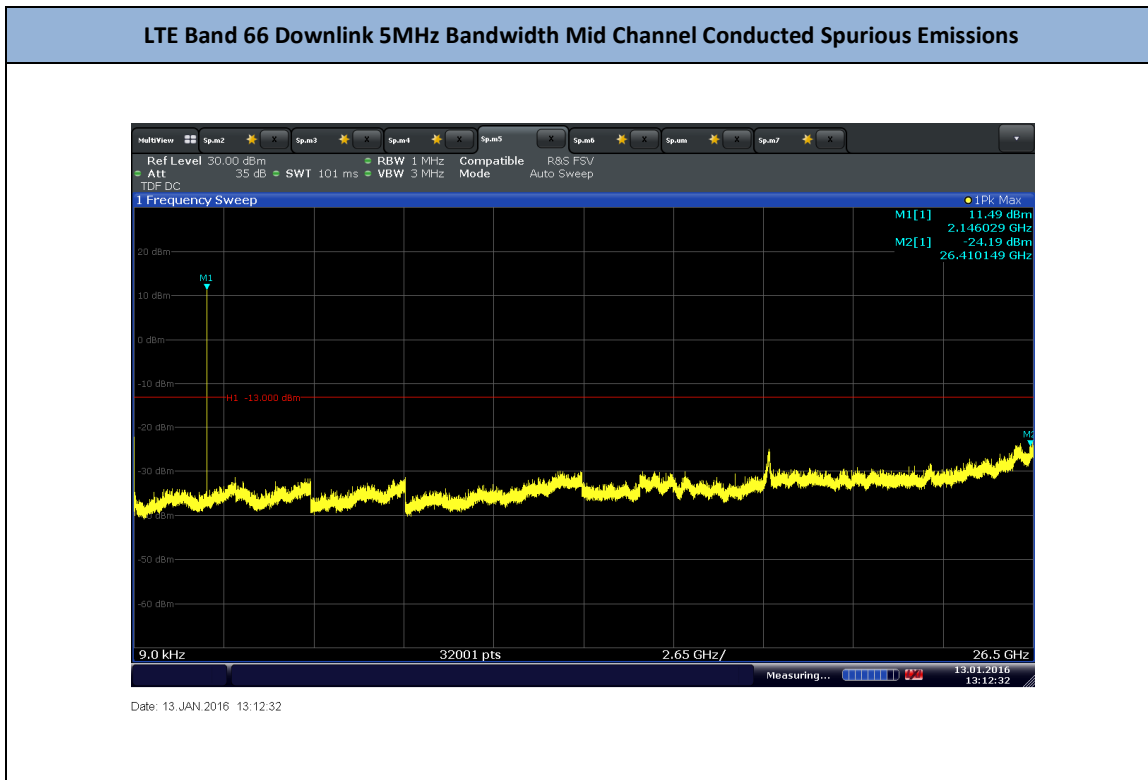
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	21.5 - 26.8°C
Relative Humidity	21.4 - 34.4%
ATM Pressure	99.1 - 100.0kPa

2.6.7 Additional Observations

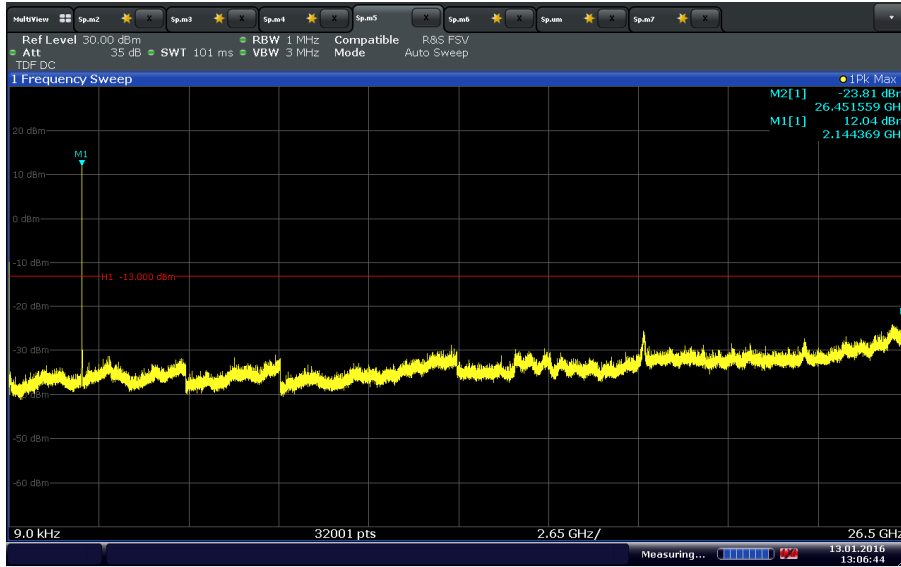
- This is a conducted test.
- The transducer factor (TDF) used is from the external attenuators and cables used.
- The spectrum was searched from 9 kHz to 26.5GHz (requirement is up to the 10th harmonic).
- Low, Middle and High Channels were verified. Only Middle Channel presented in this test report as the representative configuration.

2.6.8 Test Results



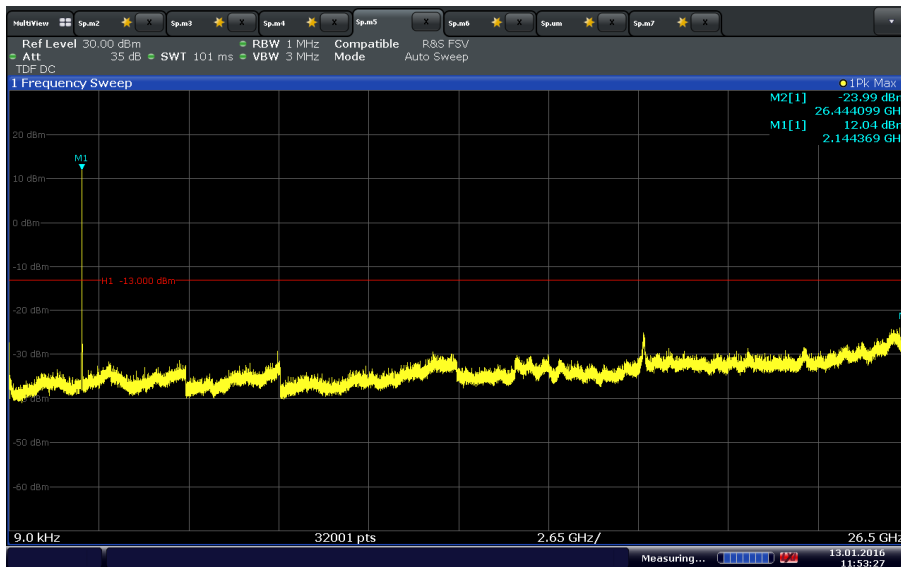


LTE Band 66 Downlink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions



Date: 13 JAN 2016 13:06:44

LTE Band 66 Downlink 15MHz Bandwidth Mid Channel Conducted Spurious Emissions



Date: 13 JAN 2016 11:53:27

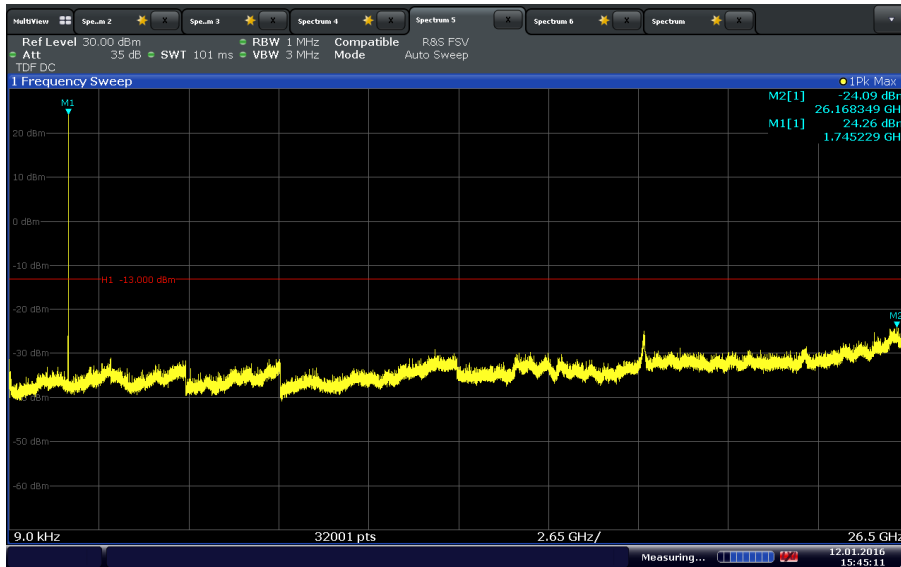


LTE Band 66 Downlink 20MHz Bandwidth Mid Channel Conducted Spurious Emissions



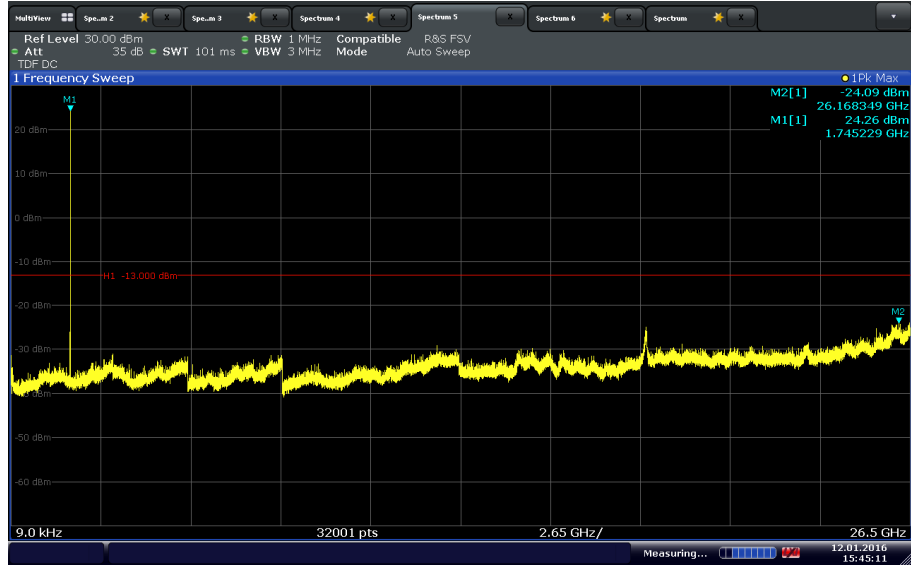
Date: 13, JAN, 2016 11:38:41

LTE Band 66 Uplink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions



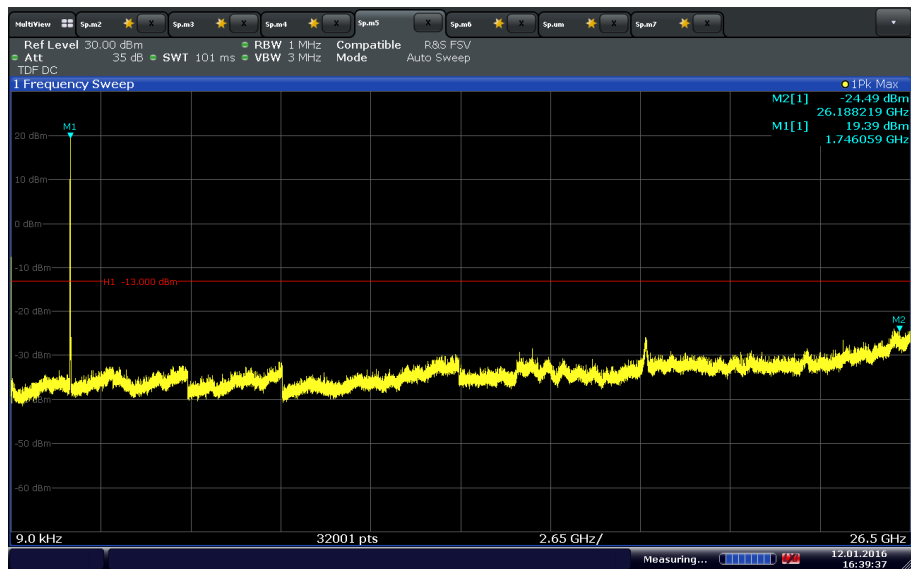
Date: 12, JAN, 2016 15:45:11

LTE Band 66 Uplink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions



Date: 12. JAN.2016 15:45:11

LTE Band 66 Uplink 15MHz Bandwidth Mid Channel Conducted Spurious Emissions



Date: 12. JAN.2016 16:39:37



LTE Band 66 Uplink 20MHz Bandwidth Mid Channel Conducted Spurious Emissions



Date: 13. JAN.2016 10:57:29



2.7 FIELD STRENGTH OF SPURIOUS RADIATION

2.7.1 Specification Reference

FCC 47 CRF Part 22, Clause 24.238(a)
RSS-139, Clause 6.6

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: 95155000015 (NU and CU) / Test Configuration C and D

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

January 22, February 19 and 21, 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	22.3 - 24.6 °C
Relative Humidity	32.5 - 33.7 %
ATM Pressure	98.7 - 99.6 kPa

2.7.7 Additional Observations

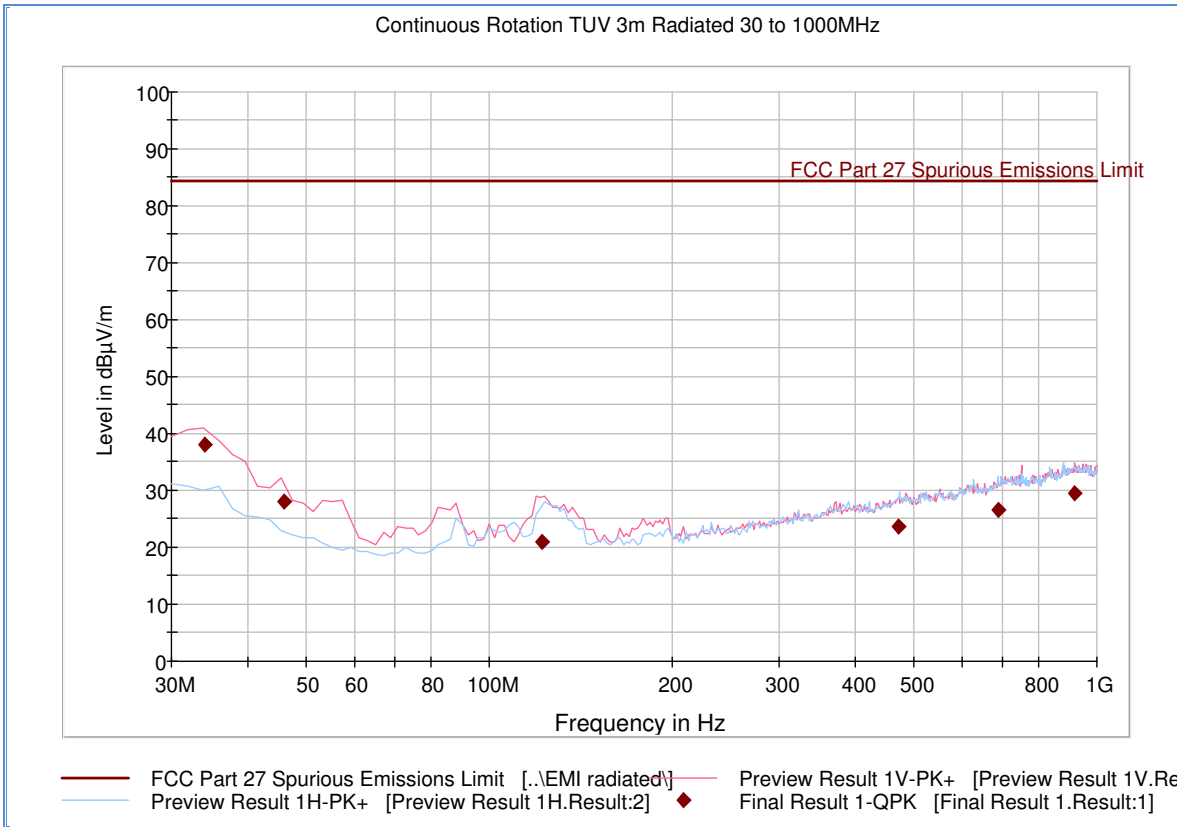
- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- Only the worst case configuration presented in this test report.
- Measurement was done using EMC32 V8.53 automated software. Reported 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) - 20MHz Bandwidth Middle Channel



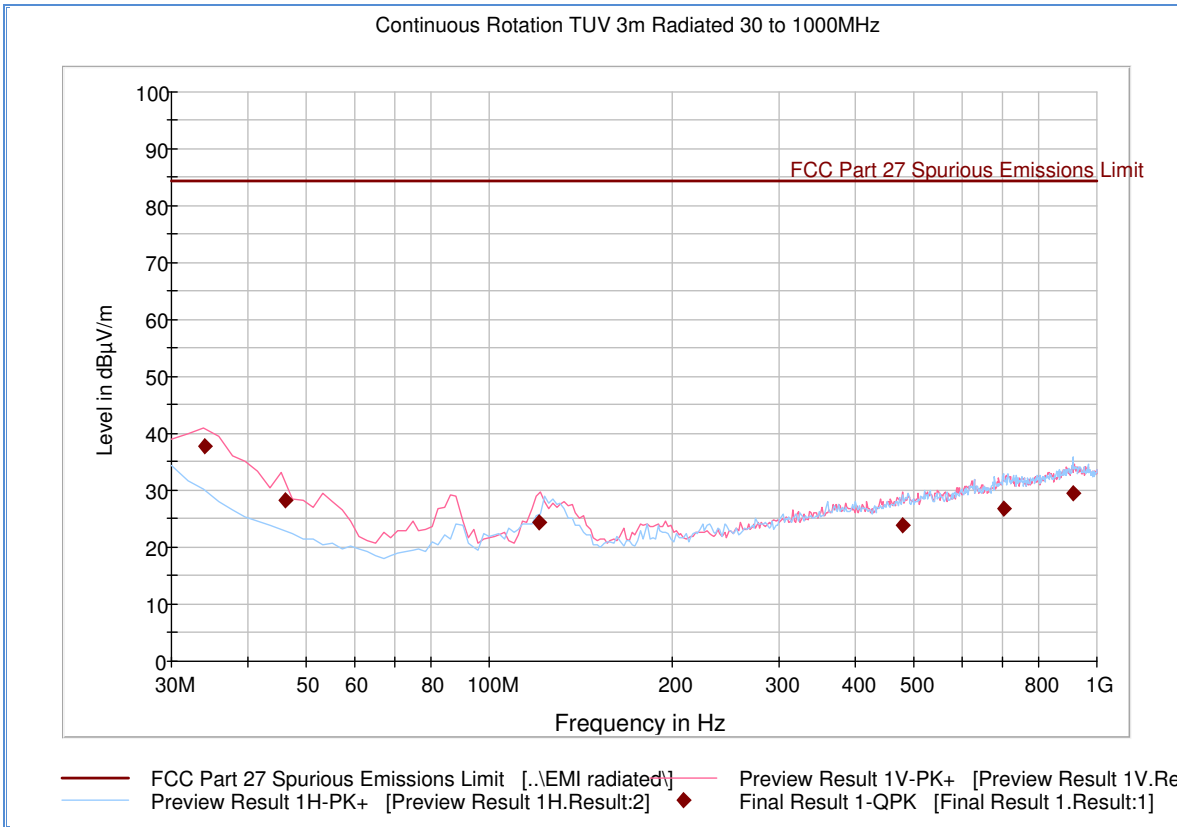
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
34.087776	38.1	1000.0	120.000	100.0	V	38.0	-7.9	46.3	84.4
45.951102	28.1	1000.0	120.000	100.0	V	211.0	-13.0	56.3	84.4
121.986613	21.0	1000.0	120.000	109.0	V	66.0	-15.2	63.4	84.4
471.446413	23.7	1000.0	120.000	100.0	H	180.0	-1.8	60.7	84.4
688.194068	26.7	1000.0	120.000	350.0	H	157.0	2.7	57.7	84.4
917.260601	29.5	1000.0	120.000	350.0	V	35.0	6.6	54.9	84.4

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) - 20MHz Bandwidth Middle Channel



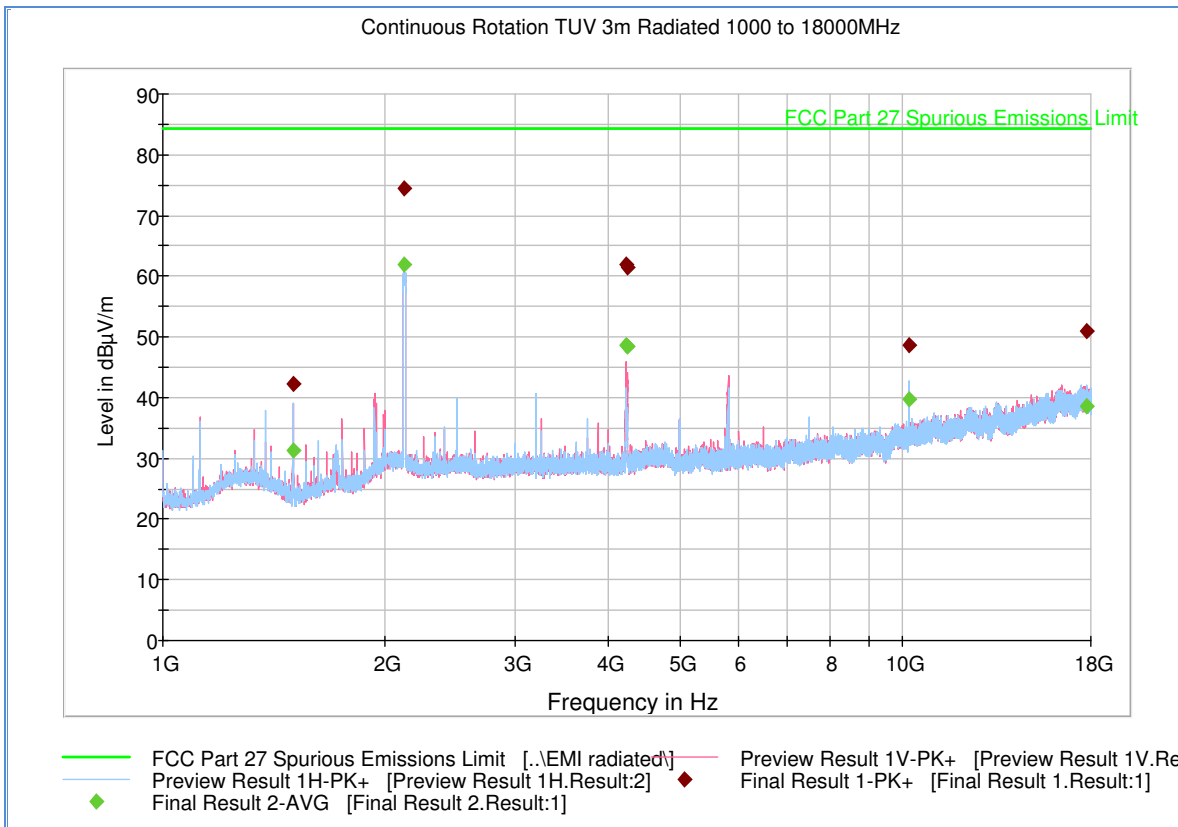
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
34.007776	37.8	1000.0	120.000	100.0	V	54.0	-7.8	46.6	84.4
46.071102	28.2	1000.0	120.000	100.0	V	229.0	-13.0	56.2	84.4
120.762725	24.5	1000.0	120.000	100.0	V	229.0	-15.1	59.9	84.4
479.238076	24.0	1000.0	120.000	250.0	V	225.0	-1.4	60.4	84.4
701.985170	26.8	1000.0	120.000	350.0	H	227.0	3.1	57.6	84.4
912.348938	29.4	1000.0	120.000	237.0	H	12.0	6.5	55.0	84.4

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 20MHz 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)
1500.000000	42.2	1000.0	1000.000	191.5	H	194.0	-6.3	42.2	84.4
2119.133333	74.5	1000.0	1000.000	171.6	V	1.0	-1.2	DL Fundamental	
4237.166667	61.9	1000.0	1000.000	132.7	V	9.0	2.0	22.5	84.4
4243.166667	61.5	1000.0	1000.000	132.7	V	20.0	2.0	22.9	84.4
10200.233333	48.6	1000.0	1000.000	200.5	H	35.0	9.9	35.8	84.4
17761.233333	50.9	1000.0	1000.000	290.2	H	10.0	18.1	33.5	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	31.4	1000.0	1000.000	191.5	H	194.0	-6.3	53.0	84.4
2119.133333	61.9	1000.0	1000.000	171.6	V	1.0	-1.2	DL Fundamental	
4237.166667	48.7	1000.0	1000.000	132.7	V	9.0	2.0	35.7	84.4
4243.166667	48.5	1000.0	1000.000	132.7	V	20.0	2.0	35.9	84.4
10200.233333	39.8	1000.0	1000.000	200.5	H	35.0	9.9	44.6	84.4
17761.233333	38.5	1000.0	1000.000	290.2	H	10.0	18.1	45.9	84.4



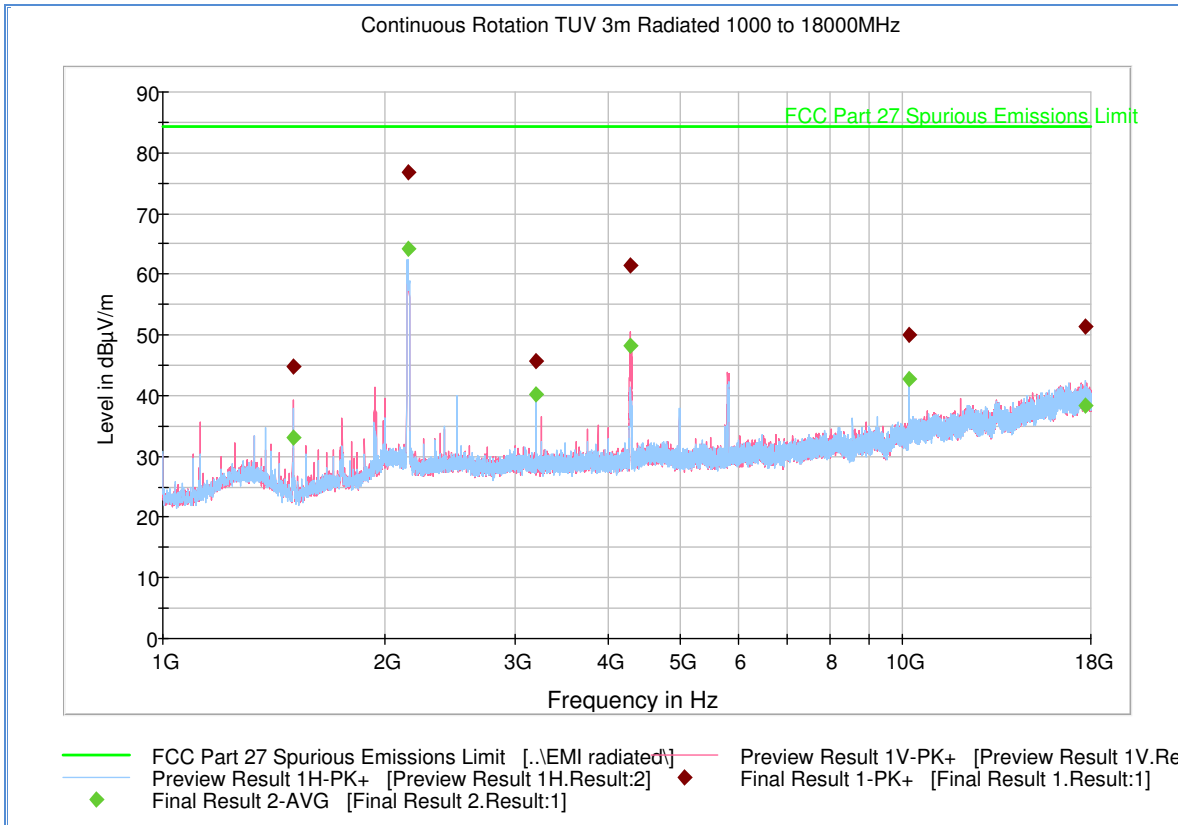
Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (db μ V/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 - Downlink 20MHz Bandwidth Mid 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	44.8	1000.0	1000.000	131.7	V	337.0	-6.3	39.6	84.4
2144.066667	76.8	1000.0	1000.000	198.5	H	327.0	-1.4	DL Fundamental	
3200.000000	45.7	1000.0	1000.000	103.7	H	251.0	0.2	38.7	84.4
4295.133333	61.5	1000.0	1000.000	303.2	V	58.0	1.9	22.9	84.4
10200.033333	50.0	1000.0	1000.000	226.4	H	251.0	9.9	34.4	84.4
17720.633333	51.4	1000.0	1000.000	227.4	H	317.0	18.1	33.0	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	33.2	1000.0	1000.000	131.7	V	337.0	-6.3	51.2	84.4
2144.066667	64.2	1000.0	1000.000	198.5	H	327.0	-1.4	DL Fundamental	
3200.000000	40.3	1000.0	1000.000	103.7	H	251.0	0.2	44.1	84.4
4295.133333	48.3	1000.0	1000.000	303.2	V	58.0	1.9	36.1	84.4
10200.033333	42.6	1000.0	1000.000	226.4	H	251.0	9.9	41.8	84.4
17720.633333	38.4	1000.0	1000.000	227.4	H	317.0	18.1	46.0	84.4



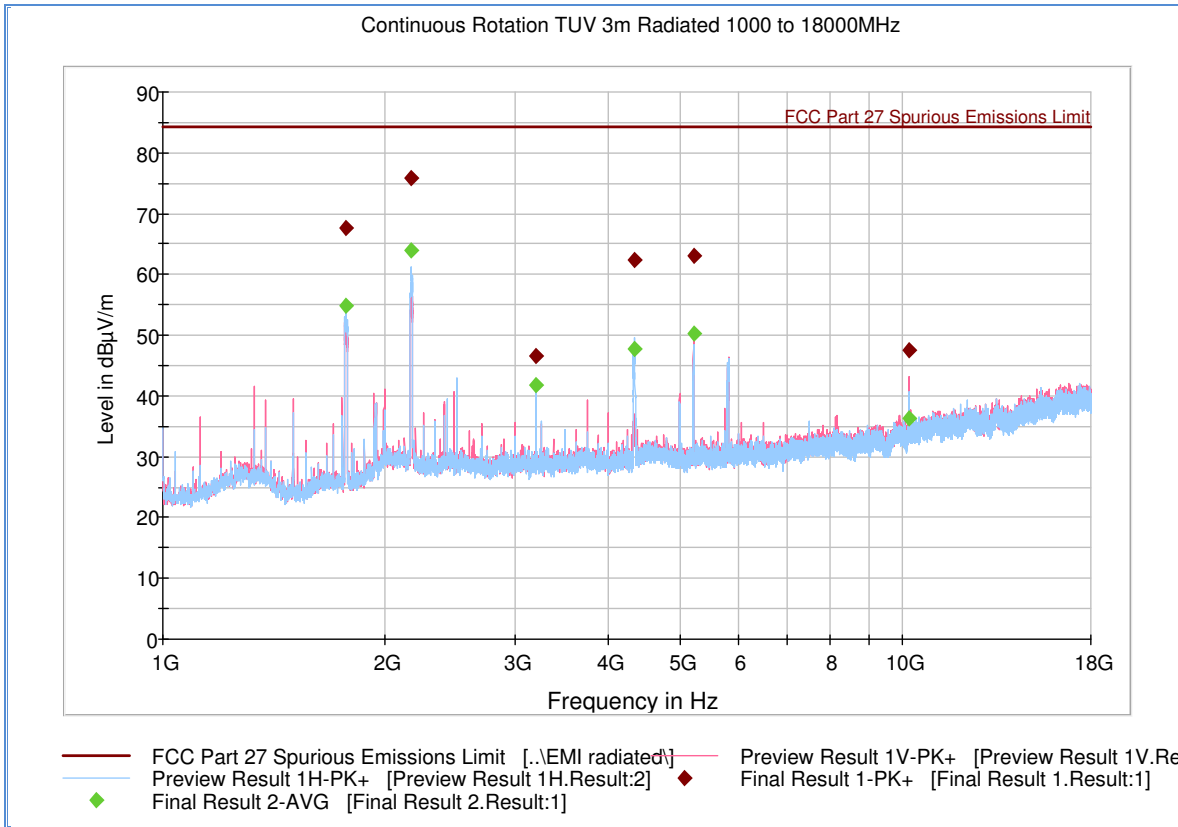
Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (db μ V/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 - Downlink 20MHz Bandwidth 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)
1767.300000	67.7	1000.0	1000.000	216.4	H	306.0	-4.0	UL Fundamental	
2169.400000	75.8	1000.0	1000.000	180.6	H	337.0	-1.5	DL Fundamental	
3200.000000	46.5	1000.0	1000.000	101.7	H	3.0	0.2	37.9	84.4
4341.433333	62.4	1000.0	1000.000	267.3	H	358.0	2.1	22.0	84.4
5230.866667	63.1	1000.0	1000.000	201.3	V	279.0	3.4	21.3	84.4
10200.033333	47.4	1000.0	1000.000	180.6	V	190.0	9.9	37.0	84.4
1767.300000	67.7	1000.0	1000.000	216.4	H	306.0	-4.0	37.9	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)
1767.300000	54.9	1000.0	1000.000	216.4	H	306.0	-4.0	UL Fundamental	
2169.400000	63.9	1000.0	1000.000	180.6	H	337.0	-1.5	DL Fundamental	
3200.000000	41.8	1000.0	1000.000	101.7	H	3.0	0.2	42.6	84.4
4341.433333	47.8	1000.0	1000.000	267.3	H	358.0	2.1	36.6	84.4
5230.866667	50.2	1000.0	1000.000	201.3	V	279.0	3.4	34.2	84.4
10200.033333	36.3	1000.0	1000.000	180.6	V	190.0	9.9	48.1	84.4
1767.300000	54.9	1000.0	1000.000	216.4	H	306.0	-4.0	42.6	84.4

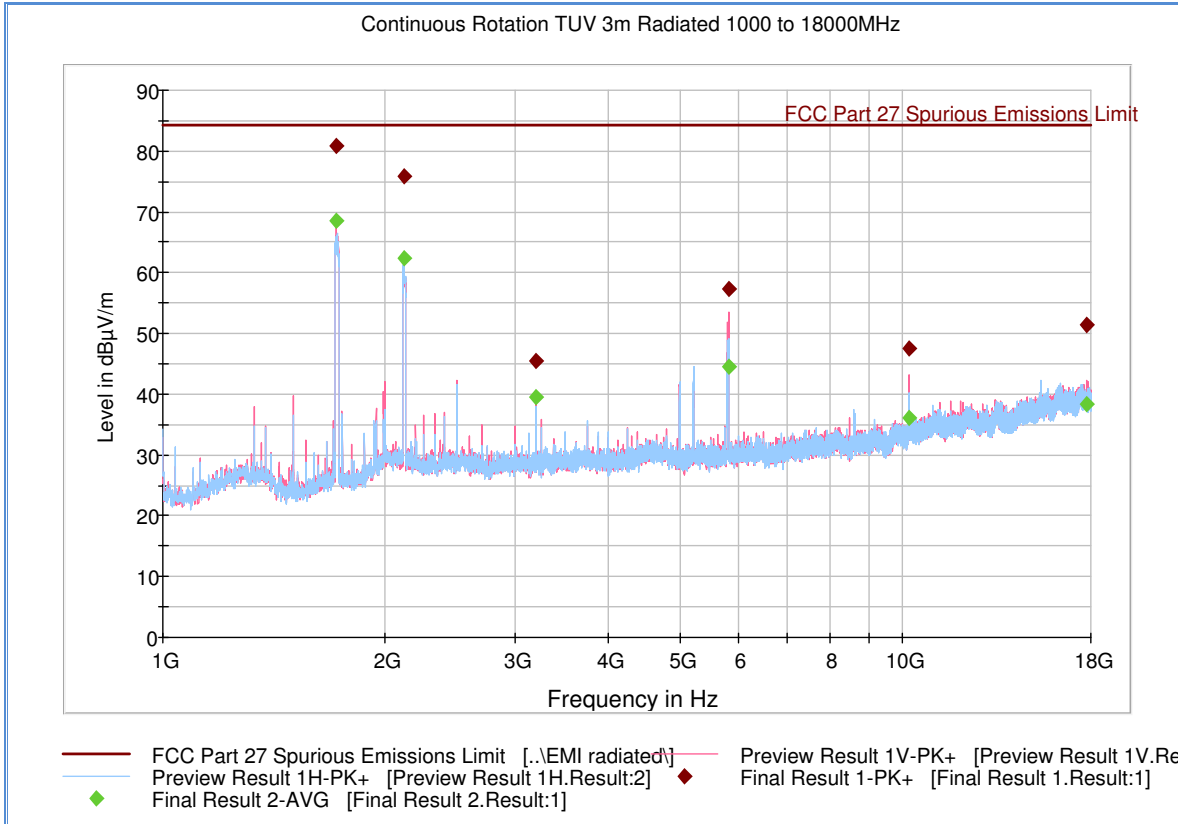


Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (db μ V/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 20MHz 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)
1718.500000	80.8	1000.0	1000.000	303.2	V	198.0	-4.5	UL Fundamental	
2122.700000	75.8	1000.0	1000.000	102.7	H	204.0	-1.3	DL Fundamental	
3200.000000	45.4	1000.0	1000.000	103.7	V	19.0	0.2	39.0	84.4
5825.966667	57.2	1000.0	1000.000	225.4	V	206.0	4.3	27.2	84.4
10199.833333	47.4	1000.0	1000.000	189.5	V	330.0	9.9	37.0	84.4
17745.800000	51.4	1000.0	1000.000	176.6	V	86.0	18.1	33.0	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)
1718.500000	68.4	1000.0	1000.000	303.2	V	198.0	-4.5	UL Fundamental	
2122.700000	62.4	1000.0	1000.000	102.7	H	204.0	-1.3	DL Fundamental	
3200.000000	39.6	1000.0	1000.000	103.7	V	19.0	0.2	44.8	84.4
5825.966667	44.5	1000.0	1000.000	225.4	V	206.0	4.3	39.9	84.4
10199.833333	36.2	1000.0	1000.000	189.5	V	330.0	9.9	48.2	84.4
17745.800000	38.3	1000.0	1000.000	176.6	V	86.0	18.1	46.1	84.4

FCC ID: NU: YETD32-21366NU
 CU: YETD32-21366CU
 IC: N/A
 Report No. SD72112724-0116D



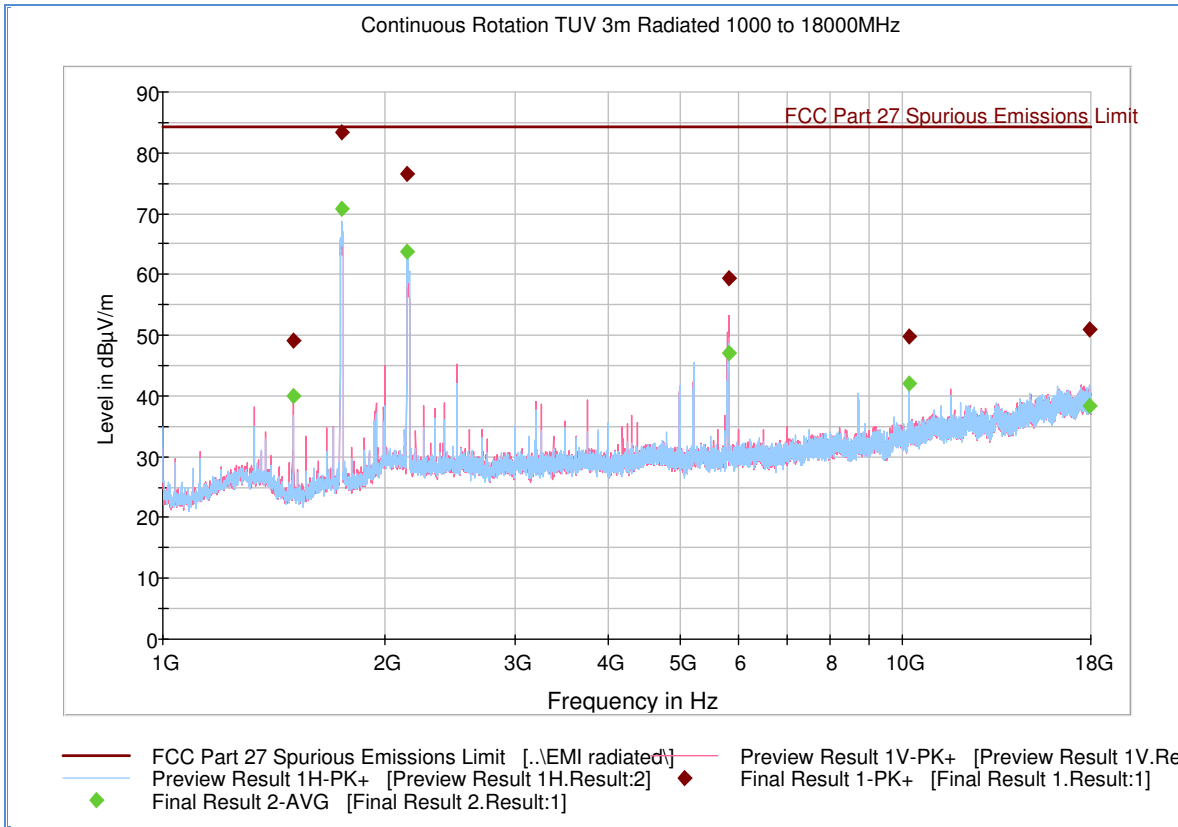
Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (db μ V/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).



2.7.15 Test Results Above 1GHz - Uplink 20MHz Bandwidth Mid 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	49.2	1000.0	1000.000	311.2	V	-3.0	-6.3	35.2	84.4
1746.666667	83.3	1000.0	1000.000	179.5	H	324.0	-4.2	UL Fundamental	
2141.833333	76.6	1000.0	1000.000	405.4	H	262.0	-1.4	DL Fundamental	
5826.166667	59.4	1000.0	1000.000	226.4	V	206.0	4.3	25.0	84.4
10200.033333	49.7	1000.0	1000.000	198.5	H	151.0	9.9	34.7	84.4
17901.800000	51.0	1000.0	1000.000	200.5	H	0.0	18.4	33.4	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	40.0	1000.0	1000.000	311.2	V	-3.0	-6.3	44.4	84.4
1746.666667	70.8	1000.0	1000.000	179.5	H	324.0	-4.2	UL Fundamental	
2141.833333	63.7	1000.0	1000.000	405.4	H	262.0	-1.4	DL Fundamental	
5826.166667	47.0	1000.0	1000.000	226.4	V	206.0	4.3	38.6	84.4
10200.033333	42.0	1000.0	1000.000	198.5	H	151.0	9.9	37.5	84.4
17901.800000	38.5	1000.0	1000.000	200.5	H	0.0	18.4	43.5	84.4



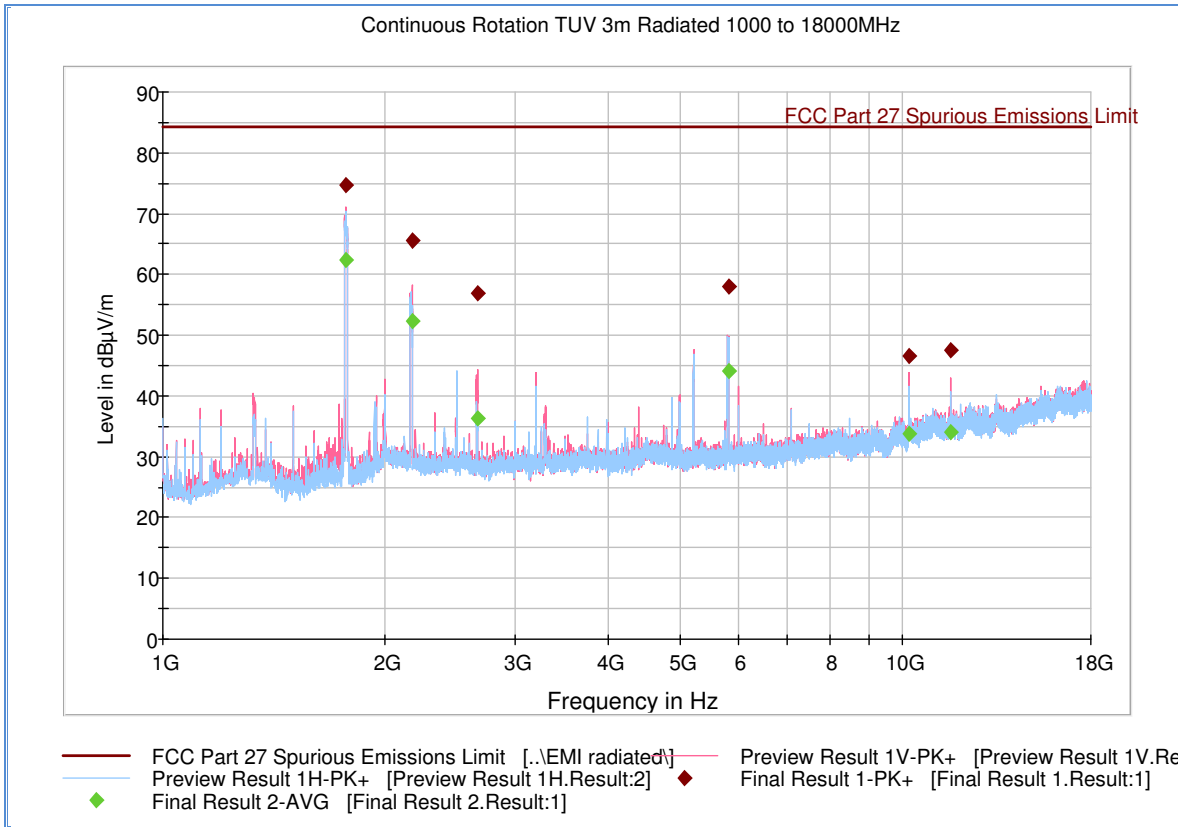
Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (db μ V/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).



2.7.16 Test Results Above 1GHz - Uplink 20MHz Bandwidth 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)
1771.466667	74.8	1000.0	1000.000	189.5	V	226.0	-3.9	UL Fundamental	
2172.266667	65.5	1000.0	1000.000	165.6	V	216.0	-1.5	DL Fundamental	
2666.200000	56.9	1000.0	1000.000	216.5	V	203.0	-0.9	27.5	84.4
5816.533333	57.9	1000.0	1000.000	156.7	V	206.0	4.3	26.5	84.4
10200.633333	46.6	1000.0	1000.000	280.3	V	107.0	9.9	37.8	84.4
11630.300000	47.5	1000.0	1000.000	202.3	V	304.0	12.0	36.9	84.4
1771.466667	74.8	1000.0	1000.000	189.5	V	226.0	-3.9	27.5	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)
1771.466667	62.4	1000.0	1000.000	189.5	V	226.0	-3.9	UL Fundamental	
2172.266667	52.3	1000.0	1000.000	165.6	V	216.0	-1.5	DL Fundamental	
2666.200000	36.4	1000.0	1000.000	216.5	V	203.0	-0.9	48.0	84.4
5816.533333	44.1	1000.0	1000.000	156.7	V	206.0	4.3	40.3	84.4
10200.633333	33.7	1000.0	1000.000	280.3	V	107.0	9.9	50.7	84.4
11630.300000	34.1	1000.0	1000.000	202.3	V	304.0	12.0	50.3	84.4
1771.466667	62.4	1000.0	1000.000	189.5	V	226.0	-3.9	22.0	84.4



Substitution Data

Frequency (MHz)	Field Strength @ 3 meters (db μ V/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-139, Clause 6.4

2.8.2 Standard Applicable

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

2.8.3 Equipment Under Test and Modification State

Serial No: 951550000015 (NU and CU) / Test Configuration A and B

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

February 01 and 02, 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	21.3 - 22.8°C
Relative Humidity	26.6 - 29.0%
ATM Pressure	99.2 – 99.7kPa

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.
- Input Type "Tones" was selected and the EUT was injected a CW signal from a Signal Generator and maximum frequency error was monitored using the spectrum analyzer.



- 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 then 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.
- Middle Channel was tested as the representative configuration.

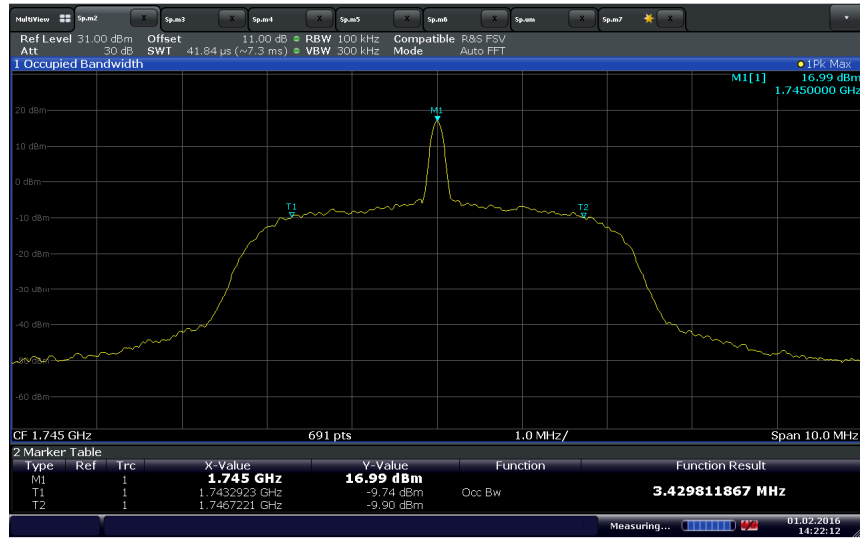
2.8.8 Test Results Summary

LTE B66 Downlink		
Voltage (VAC)	Temperature (°C)	Frequency Deviation (Hz/ppm)
120	-30	0 / 0
	-20	0 / 0
	-10	0 / 0
	0	0 / 0
	+10	0 / 0
	+20	0 / 0
	+30	0 / 0
	+40	0 / 0
	+50	0 / 0

LTE B66 Downlink		
Temperature (°C)	Voltage (VAC)	Frequency Deviation (Hz/ppm)
20	102	0 / 0
	138	0 / 0



2.8.9 Sample Test Plots



Date: 1 FEB 2016 14:22:12

LTE B66 Uplink (Middle Channel 1013) 120VDC @ 20°C



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 (dB μ V)	
	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: **Error! Reference source not found.** / Default Test Configuration

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

January 18, 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 22.5 °C
Relative Humidity 52.6.%
ATM Pressure 99.9 kPa



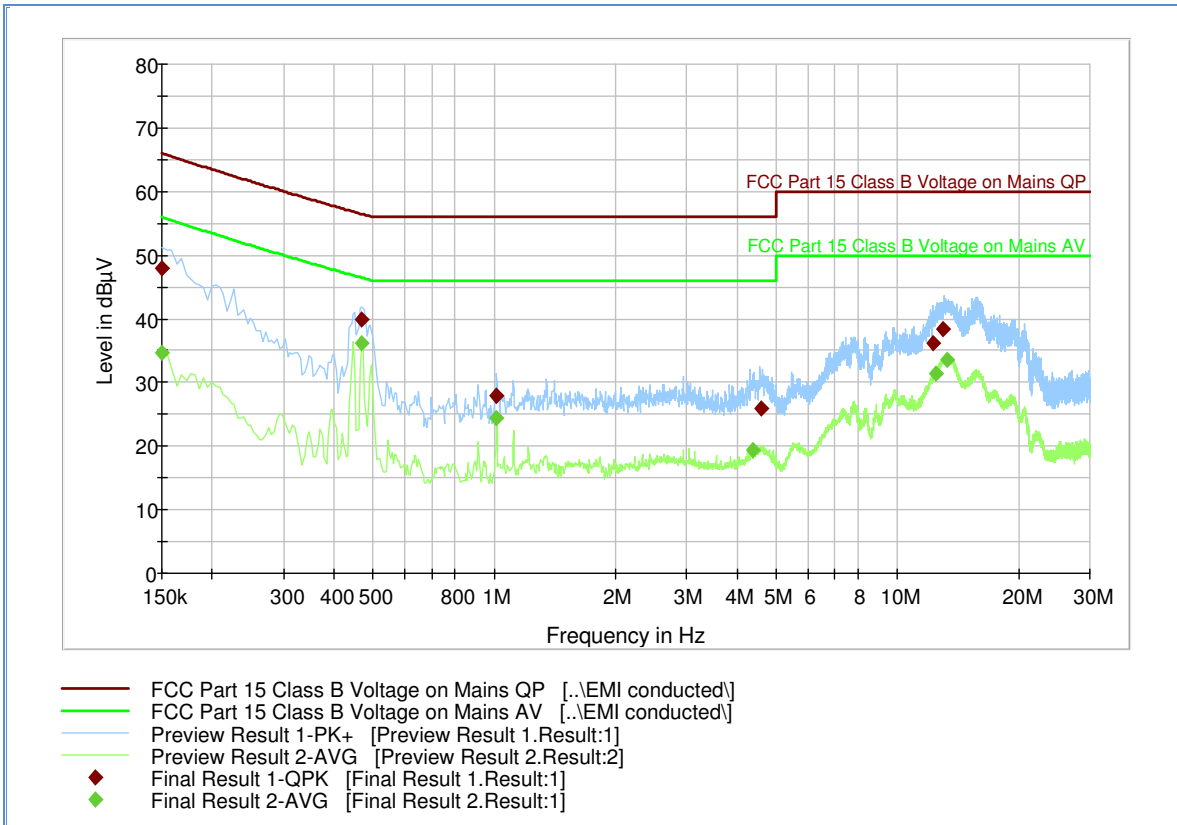
2.9.7 Additional Observations

- The EUT was verified using AC adapter supplied by the manufacturer..
- EUT 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 2.2.8 for sample computation.

2.9.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (db μ V) @ 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)



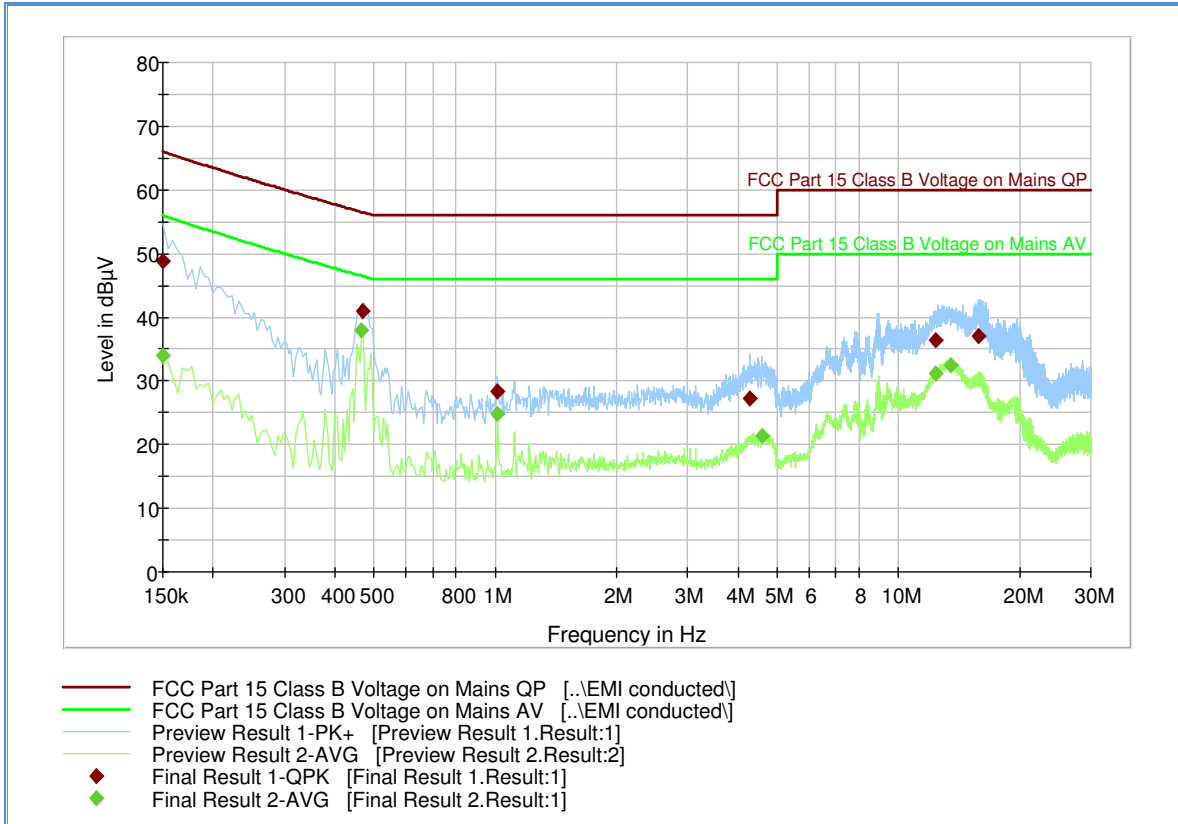
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	47.9	1000.0	9.000	Off	L1	20.1	18.1	66.0
0.469500	40.0	1000.0	9.000	Off	L1	20.1	16.5	56.5
1.014000	28.0	1000.0	9.000	Off	L1	20.2	28.0	56.0
4.609500	25.9	1000.0	9.000	Off	L1	20.5	30.1	56.0
12.246000	36.2	1000.0	9.000	Off	L1	20.6	23.8	60.0
12.997500	38.4	1000.0	9.000	Off	L1	20.6	21.6	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.150000	34.6	1000.0	9.000	Off	L1	20.1	21.4	56.0
0.469500	36.3	1000.0	9.000	Off	L1	20.1	10.2	46.5
1.014000	24.4	1000.0	9.000	Off	L1	20.2	21.6	46.0
4.366500	19.5	1000.0	9.000	Off	L1	20.4	26.5	46.0
12.408000	31.4	1000.0	9.000	Off	L1	20.6	18.6	50.0
13.263000	33.7	1000.0	9.000	Off	L1	20.6	16.3	50.0

2.9.10 Test Results - Conducted Emissions Line 1 – Hot (CU)



Quasi Peak

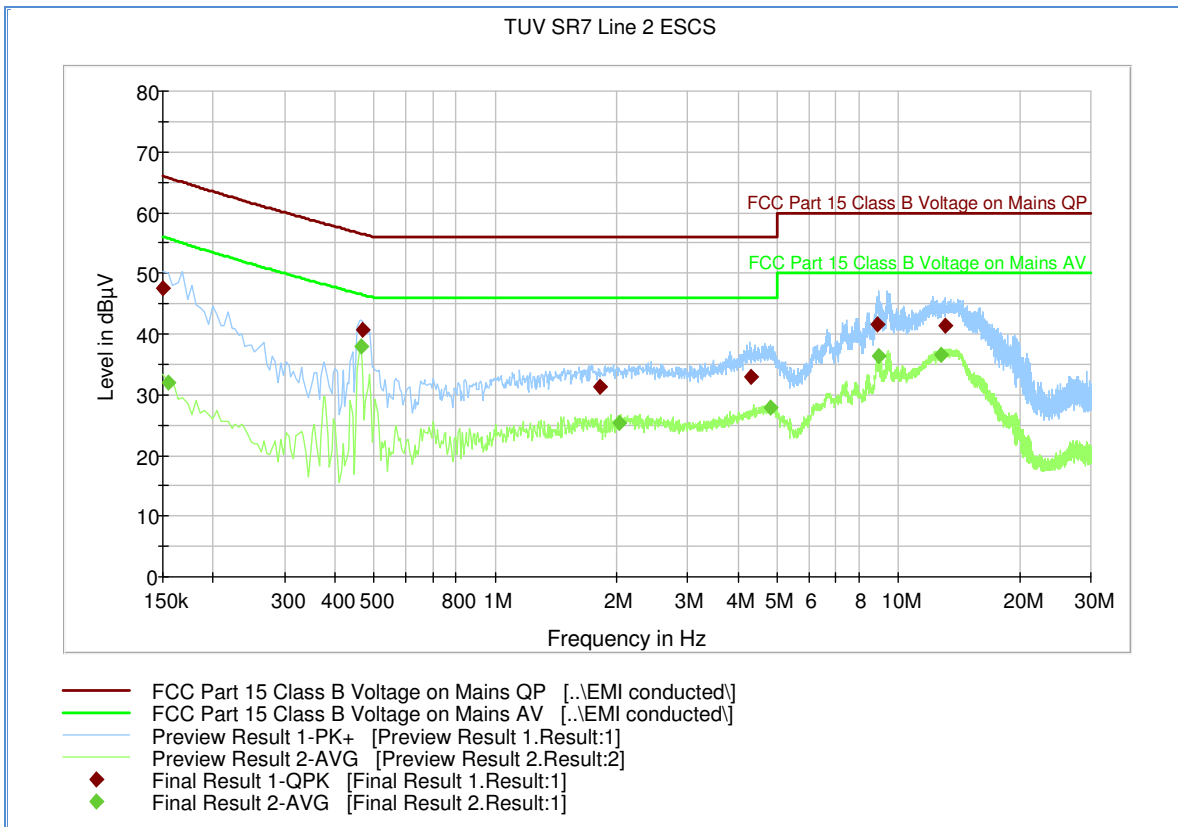
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	48.9	1000.0	9.000	Off	L1	20.1	17.1	66.0
0.469500	40.9	1000.0	9.000	Off	L1	20.1	15.6	56.5
1.014000	28.3	1000.0	9.000	Off	L1	20.2	27.7	56.0
4.285500	27.2	1000.0	9.000	Off	L1	20.4	28.8	56.0
12.363000	36.4	1000.0	9.000	Off	L1	20.6	23.6	60.0
15.841500	37.1	1000.0	9.000	Off	L1	20.6	22.9	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.150000	33.9	1000.0	9.000	Off	L1	20.1	22.1	56.0
0.465000	37.8	1000.0	9.000	Off	L1	20.1	8.7	46.5
1.014000	24.9	1000.0	9.000	Off	L1	20.2	21.1	46.0
4.582500	21.3	1000.0	9.000	Off	L1	20.4	24.7	46.0
12.403500	31.3	1000.0	9.000	Off	L1	20.6	18.7	50.0
13.452000	32.4	1000.0	9.000	Off	L1	20.6	17.6	50.0



2.9.11 FCC Conducted Emissions Line 2 – Neutral (CU)



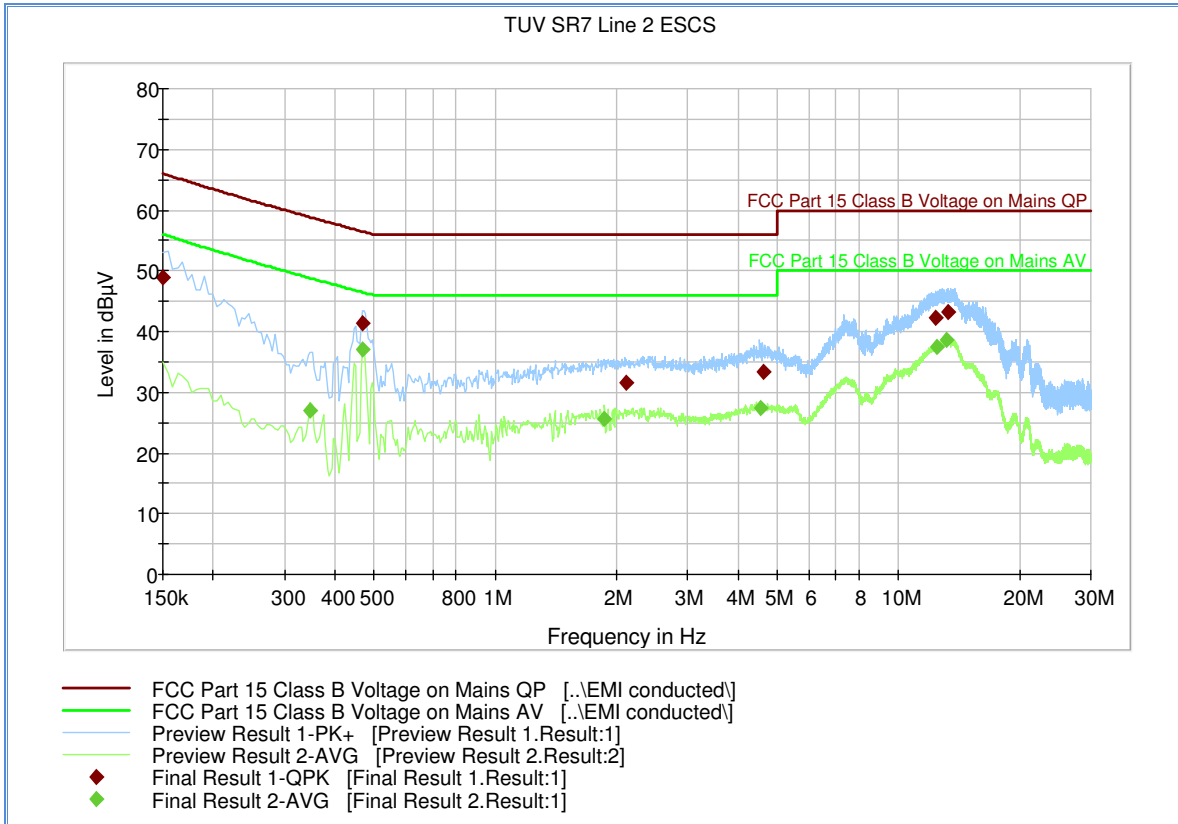
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	47.4	1000.0	9.000	Off	N	20.1	18.6	66.0
0.469500	40.8	1000.0	9.000	Off	N	20.1	15.7	56.5
1.819500	31.2	1000.0	9.000	Off	N	20.2	24.8	56.0
4.312500	32.9	1000.0	9.000	Off	N	20.4	23.1	56.0
8.875500	41.6	1000.0	9.000	Off	N	20.5	18.4	60.0
13.101000	41.4	1000.0	9.000	Off	N	20.6	18.6	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.154500	32.0	1000.0	9.000	Off	N	20.0	23.7	55.7
0.465000	37.8	1000.0	9.000	Off	N	20.1	8.7	46.5
2.031000	25.4	1000.0	9.000	Off	N	20.1	20.6	46.0
4.803000	27.8	1000.0	9.000	Off	N	20.5	18.2	46.0
8.938500	36.2	1000.0	9.000	Off	N	20.5	13.8	50.0
12.741000	36.6	1000.0	9.000	Off	N	20.7	13.4	50.0

2.9.12 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)
0.150000	49.0	1000.0	9.000	Off	N	20.1	17.0	66.0
0.469500	41.5	1000.0	9.000	Off	N	20.1	15.0	56.5
2.107500	31.5	1000.0	9.000	Off	N	20.3	24.5	56.0
4.623000	33.4	1000.0	9.000	Off	N	20.4	22.6	56.0
12.358500	42.4	1000.0	9.000	Off	N	20.7	17.6	60.0
13.281000	43.2	1000.0	9.000	Off	N	20.6	16.8	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.348000	26.9	1000.0	9.000	Off	N	20.2	21.9	48.8
0.469500	37.1	1000.0	9.000	Off	N	20.1	9.4	46.5
1.860000	25.7	1000.0	9.000	Off	N	20.2	20.3	46.0
4.537500	27.5	1000.0	9.000	Off	N	20.4	18.5	46.0
12.435000	37.5	1000.0	9.000	Off	N	20.7	12.5	50.0
13.177500	38.5	1000.0	9.000	Off	N	20.6	11.5	50.0

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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	05/27/15	05/27/16
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	04/10/15	04/10/16
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/05/15	10/05/16
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	07/29/15	07/29/16
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50 /103829	Rhode & Schwarz	For signalling	
8772	10dB Attenuator	606-10-1F4/DR	-	MECA	Verified by 7582 and 7608	
Radiated Emissions						
1033	Bilog Antenna	3142C	00044556	EMCO	09/25/15	09/25/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/27/15	04/27/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/15/15	12/15/16
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	04/03/15	04/03/16
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/03/15	09/03/16
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	05/03/15	05/03/16
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	04/10/15	04/10/16
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	07/14/15	07/14/16
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	10/28/15	10/28/16
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/20/15	02/20/16
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/20/15	02/20/16
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50 /103829	Rhode & Schwarz	For signalling	

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Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/14/15	08/14/16
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	04/09/15	04/09/16
	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

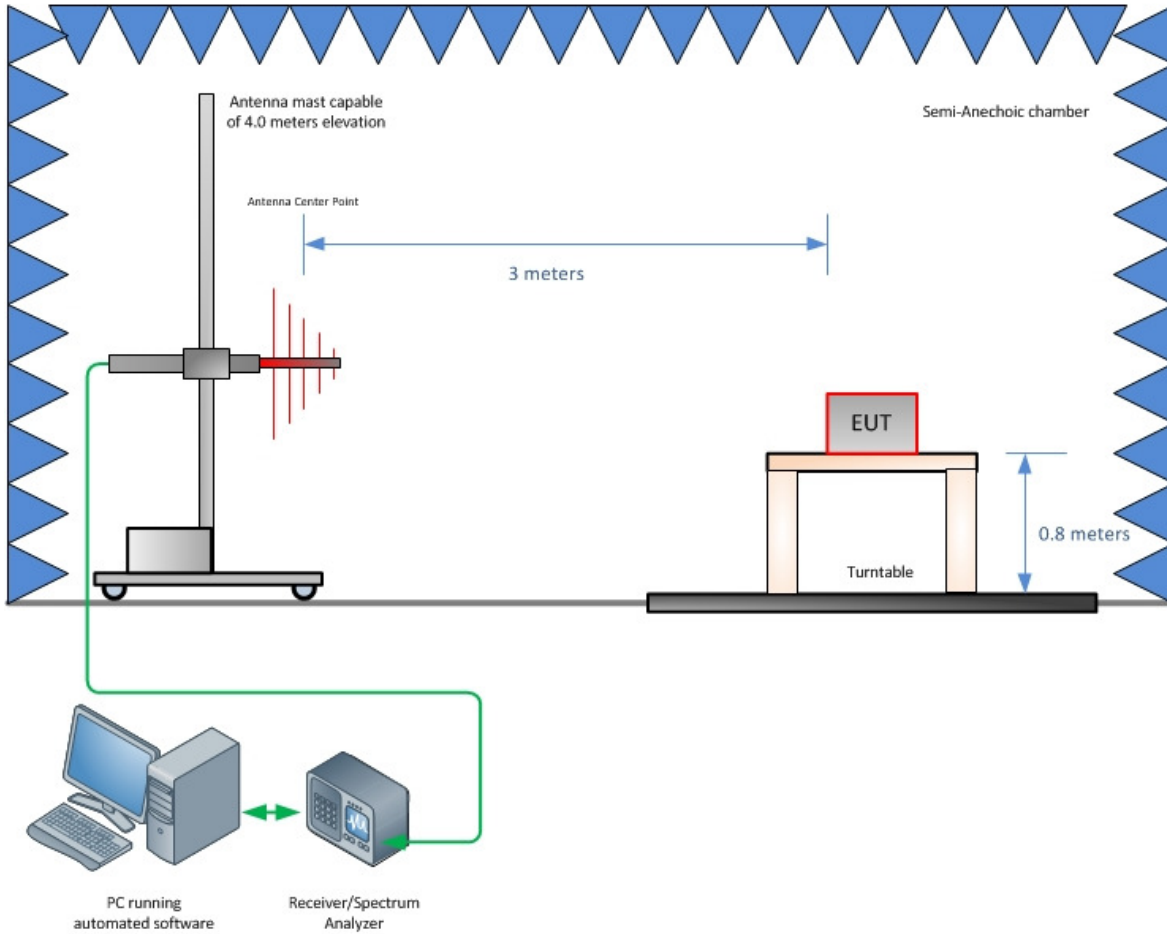
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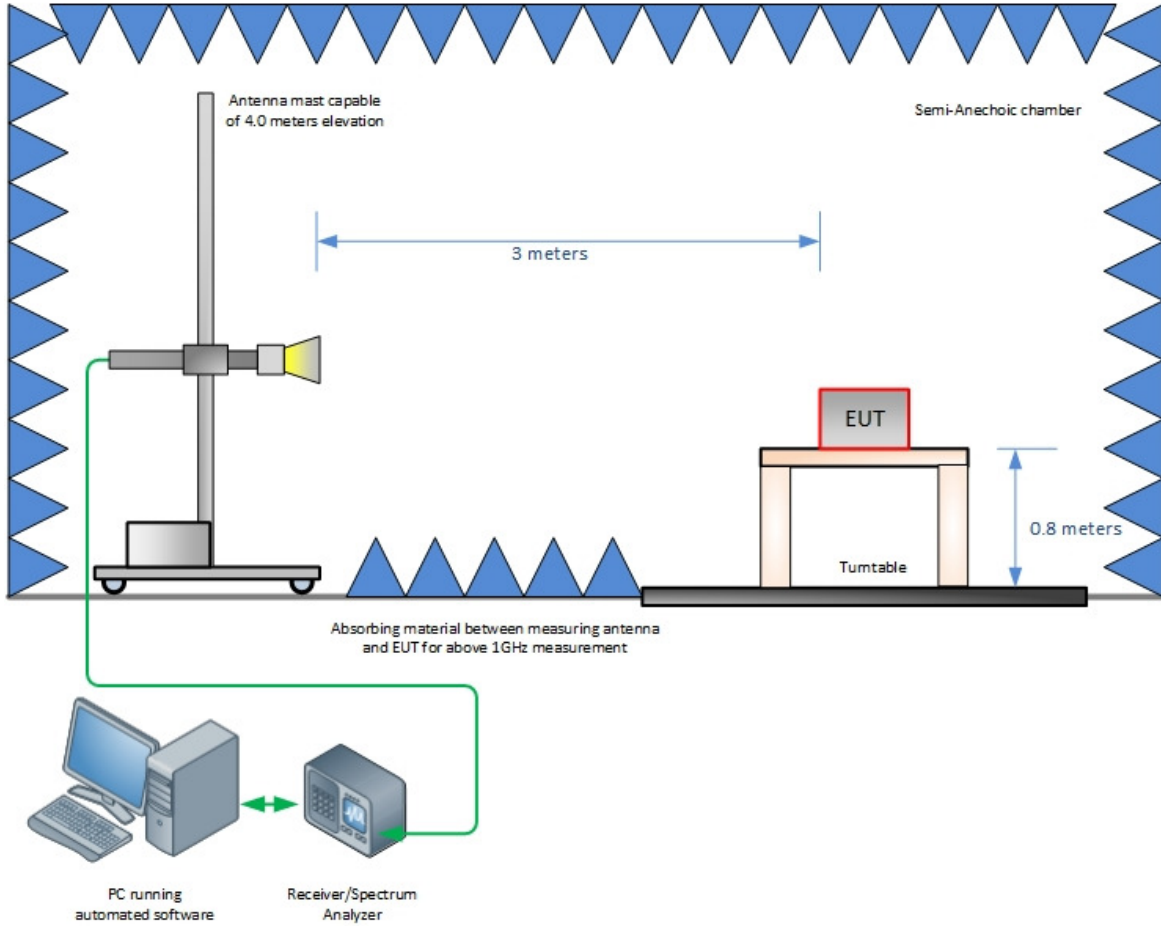
SECTION 4

DIAGRAM OF TEST SETUP

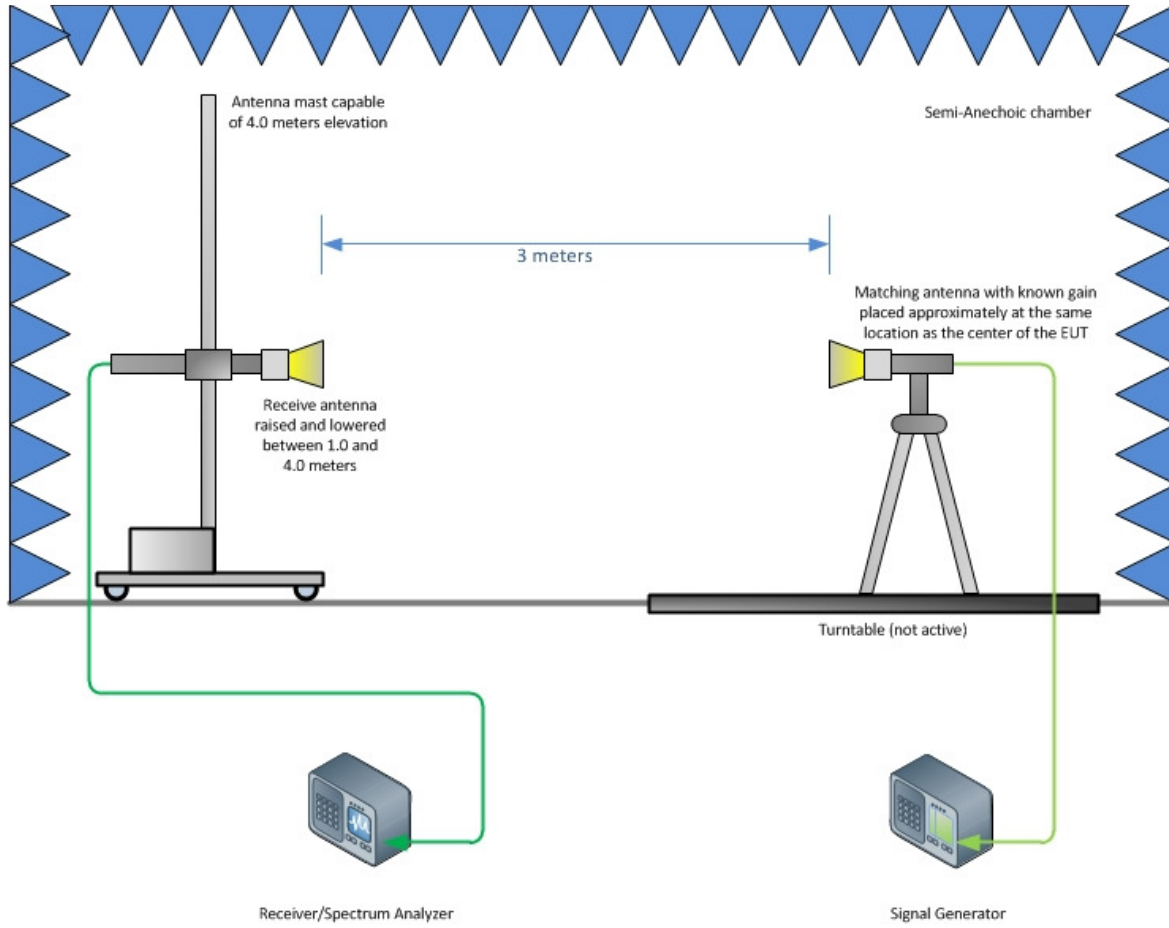
4.1 TEST SETUP DIAGRAM



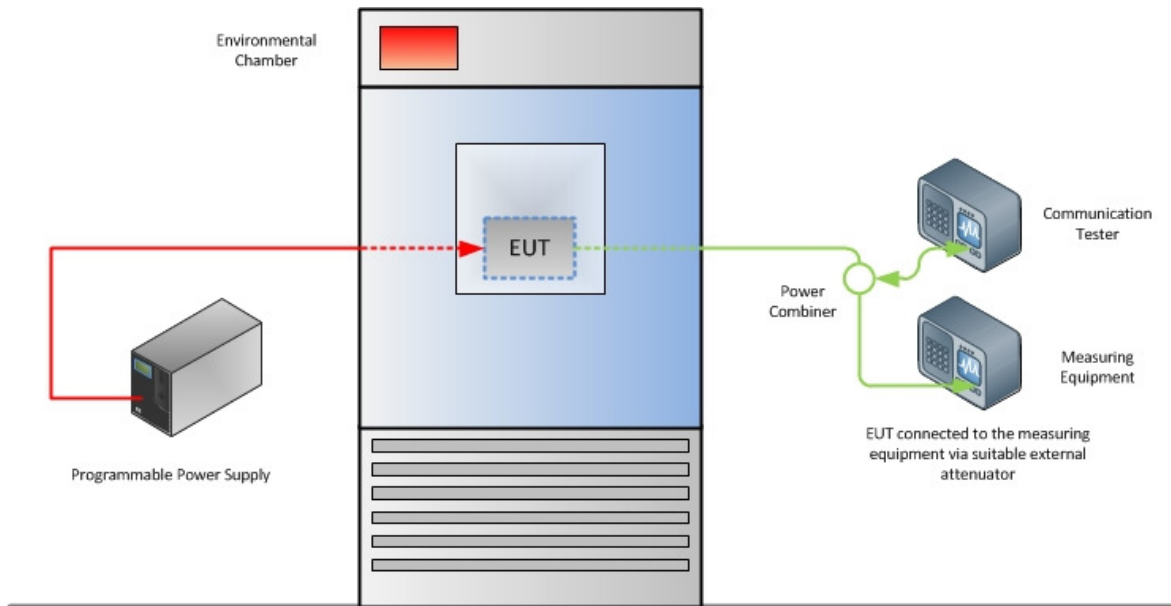
Radiated Emission Test Setup (Below 1GHz)



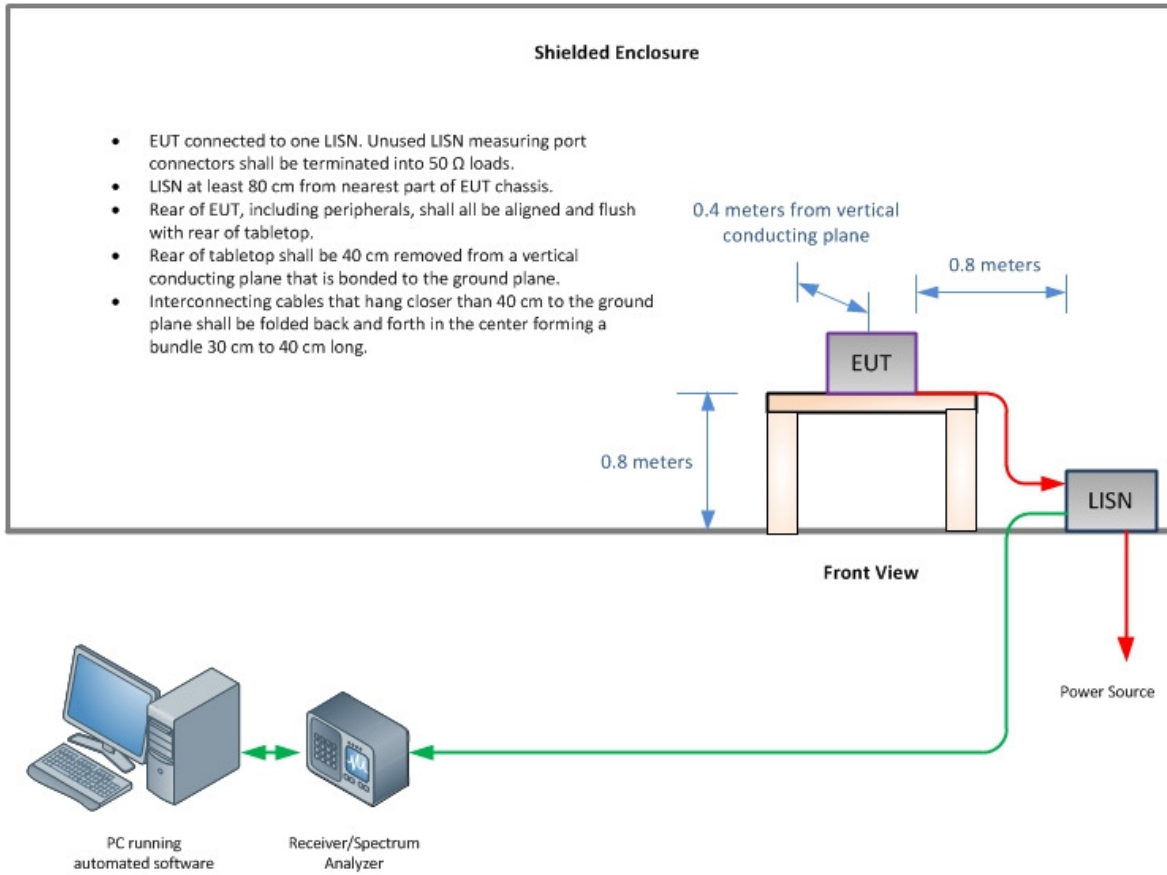
Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz, if applicable)



Frequency Stability Test Configuration



Conducted Emissions Test Configuration (if applicable)

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SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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