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Report On

Application for Grant of Equipment Authorization of the
Nextivity Inc.

Cel-Fi GO Cellphone Signal Repeater

FCC CFR 47 Part 2 and 27

IC RSS-Gen and RSS-130

Report No. SD72121023-1016E Rev 1.0

March 2017



REPORT ON	EMC Evaluation of the Nextivity Inc. Cel-Fi GO Cellphone Signal Repeater
TEST REPORT NUMBER	SD72121023-1016E Rev 1.0
TEST REPORT DATE	March 2017
PREPARED FOR	Nextivity Inc. 16550 West Bernardo Drive, Bldg 5, Suite 550, San Diego, CA 92127, USA
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DATED	March 30, 2017



Revision History

SD72121023-1016E Rev 1.0 Nextivity Inc. Cel-Fi GO Cellphone Signal Repeater					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
03/15/17	Initial Release				Juan M Gonzalez
03/30/17	Initial Release	Rev 1.0	Added Antenna Information	Page 9, 10, 23	Juan M Gonzalez



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
Cel-Fi GO 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 FCC CFR 47 Part 2 and 27 and IC 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 GO
Model Number(s)	G32-2/4/5/12/13
FCC ID	YETG32-2451213
IC Number	9298A-G322451213
Serial Number(s)	332633000356 (Fix Unit) and 332633000417 (Mobile Unit)
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	December 07, 2016
Finish of Test	December 21, 2016
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	• ANSI/TIA-603-D-2010 – 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 v0101 (Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System. • Antenna Kitting_v1.pdf • 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		
3.1	2.1046	27.50 (c)(9)	4.4	Transmitter Conducted Output Power	Compliant
3.2	-	-	4.4	Equivalent Isotropic Radiated Power	Compliant
	2.1046	27.50 (c)(9)	-	Equivalent Radiated Power	Compliant
3.3	2.1049	27.53 (h)(3)	RSS-Gen 6.6	Occupied Bandwidth	Compliant
3.4	-	27.50 (d)(5)	4.4	Peak-Average Ratio	Compliant
3.5	2.1051	27.53 (g)	4.6.1	Band Edge	Compliant
3.6	2.1051	27.53 (g)	4.6.1	Conducted Spurious Emissions	Compliant
3.7	2.1053	27.53 (g)	4.6	Field Strength Of Spurious Radiation	Compliant
3.8	2.1055	27.54	4.3	Frequency Stability	Compliant
-	-	-	RSS-Gen 7.1	Receiver Spurious Emissions	N/A
3.9	-	-	RSS-Gen 8.8	Power Line Conducted Emission	Compliant

N/A Not required as per RSS-Gen 5.3. The EUT however already shows compliance to FCC Subpart B/ICES-003.



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Nextivity Inc. Cel-Fi GO Cellphone Signal Repeater. The EUT is a WCDMA/LTE Signal Booster to improve voice and data cellular performance in a variety of mobile (e.g. Vehicle and Marine), Fix (e.g. Home/office and Nomadic), Indoor and Outdoor environments. Both Fix and Mobile Versions are identical except the allowed maximum system gains which are set by firmware during production. The model tested in this report was the Fix sample as the representative unit unless otherwise stated. The unit includes Bluetooth LE connectivity. With the use of Nextivity smartphone application, it allows user to register the product, update software, capture / display details metrics of the system. The LTE Band 12 function of the EUT were verified in this test report.



1.3.2 EUT General Description

EUT Description	Cellphone Signal Repeater																				
Model Name	Cel-Fi GO																				
Model Number(s)	G32-2/4/5/12/13																				
Rated Voltage	15V DC via external AC/DC adapter (Fix Unit) 12V DC via CLA (Cigarette Lighter Adaptor) (Mobile Unit)																				
Mode Verified	LTE Band 12																				
Frequency Range	Downlink: 729 - 746MHz Uplink: 699 - 716MHz																				
Channel Bandwidth	5MHz, 10MHz																				
Rated Power	<table><tr><th rowspan="2">Bandwidth (MHz)</th><th colspan="2">Band 12</th></tr><tr><th>DL (dB)</th><th>UL (dB)</th></tr><tr><td>5</td><td>10.0</td><td rowspan="2">20</td></tr><tr><td>10</td><td>13.0</td></tr></table>			Bandwidth (MHz)	Band 12		DL (dB)	UL (dB)	5	10.0	20	10	13.0								
Bandwidth (MHz)	Band 12																				
	DL (dB)	UL (dB)																			
5	10.0	20																			
10	13.0																				
Capability	WCDMA (Band 2 and 5), LTE (Band 2, 4, 5, 12 and 13) and BT LE																				
Primary Unit (EUT)	☐ Production ☐ Pre-Production ☒ Engineering																				
Manufacturer Declared Temperature Range	0°C to 65°C																				
Antenna Type	External Antenna																				
Manufacturer	Refer to the Antenna Kitting information supplied by the manufacture																				
Antenna Model	Refer to the Antenna Kitting information supplied by the manufacture																				
Maximum Antenna Gain	<table><tr><th>Radio</th><th>Uplink (Donor)</th><th>Downlink (Server)</th></tr><tr><td>HSPA/LTE Band 2</td><td>6.0 dBi</td><td>-1.0 dBi</td></tr><tr><td>LTE Band 4</td><td>6.0 dBi</td><td>-1.0 dBi</td></tr><tr><td>HSPA/LTE Band 5</td><td>8.0 dBi</td><td>-1.0 dBi</td></tr><tr><td>LTE Band 12</td><td>8.0 dBi</td><td>-1.0 dBi</td></tr><tr><td>LTE Band 13</td><td>8.0 dBi</td><td>-1.0 dBi</td></tr></table>			Radio	Uplink (Donor)	Downlink (Server)	HSPA/LTE Band 2	6.0 dBi	-1.0 dBi	LTE Band 4	6.0 dBi	-1.0 dBi	HSPA/LTE Band 5	8.0 dBi	-1.0 dBi	LTE Band 12	8.0 dBi	-1.0 dBi	LTE Band 13	8.0 dBi	-1.0 dBi
Radio	Uplink (Donor)	Downlink (Server)																			
HSPA/LTE Band 2	6.0 dBi	-1.0 dBi																			
LTE Band 4	6.0 dBi	-1.0 dBi																			
HSPA/LTE Band 5	8.0 dBi	-1.0 dBi																			
LTE Band 12	8.0 dBi	-1.0 dBi																			
LTE Band 13	8.0 dBi	-1.0 dBi																			



1.3.3 Transmit Frequency Table

Mode	Channel Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	ERP(Part 27)		EIRP (RSS-130)	
				Max. Power (dBm)	Max. Power (W)	Max. Power (dBm)	Max. Power (W)
LTE Band 12 Downlink	5	731.5 - 743.5	4M28F9W	7.37	0.005	9.52	0.009
	10	734.0 - 741.0	8M77F9W	10.54	0.011	12.69	0.019
LTE Band 12 Uplink	5	701.5 - 713.5	4M30F9W	28.47	0.703	30.62	1.153
	10	704.0 - 711.0	8M85F9W	28.29	0.675	30.44	1.107



1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

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

1.4.2 EUT Exercise Software

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

1.4.3 Support Equipment and I/O cables

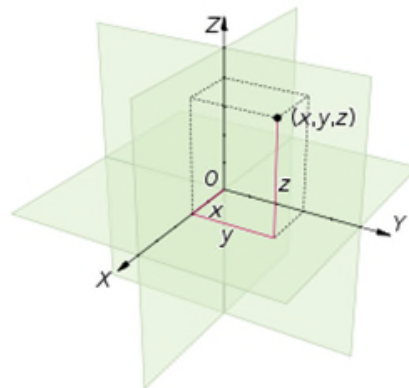
Manufacturer	Equipment/Cable	Description
HON-KWANG	I.T.E Power Supply	Model: HK-AY-150A160-US S/N: GB0000007 Input: 100-240V, 50/60Hz, 0.8A; Output: 15 VDC 1.6A
-	Cigarette Lighter Adaptor (CLA)	Model: 290N035-001 Input: 12.6 – 14.7VDC; Output: 12VDC
Nextivity	Support USB cable	Custom 1.0 meter shielded USB Type A to Type A cable
Nextivity	USB / Interface Box	Unshielded with “Tag-Connect” interface
API Technologies Corp.	DC Block	M/N: 8037
Lenovo	Support Laptop	M/N: 2912-3VU, S/N: R9-92MH0 10/11
Lenovo	Support Laptop AC Adapter	M/N: 42T4430 S/N: 11S42T4430Z1ZGWE27AA9X

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):

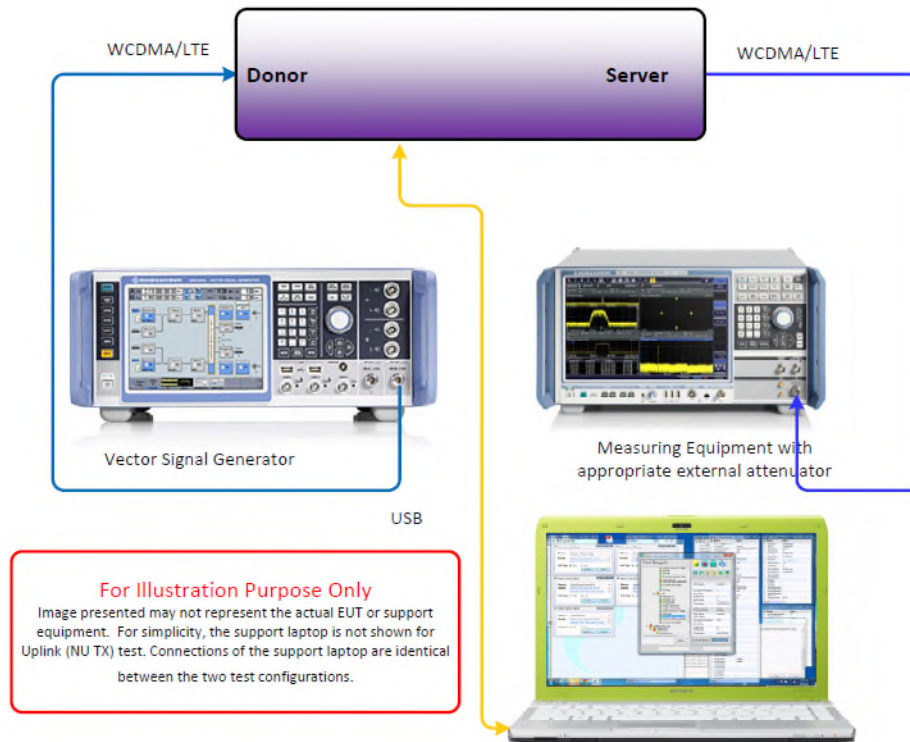
Mode	Bandwidth	Cellular	Frequency
LTE Band 12 Downlink	10MHz	Channel 5060	734 MHz
LTE Band 12 Uplink	5MHz	Channel 23155	713.5 MHz

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.

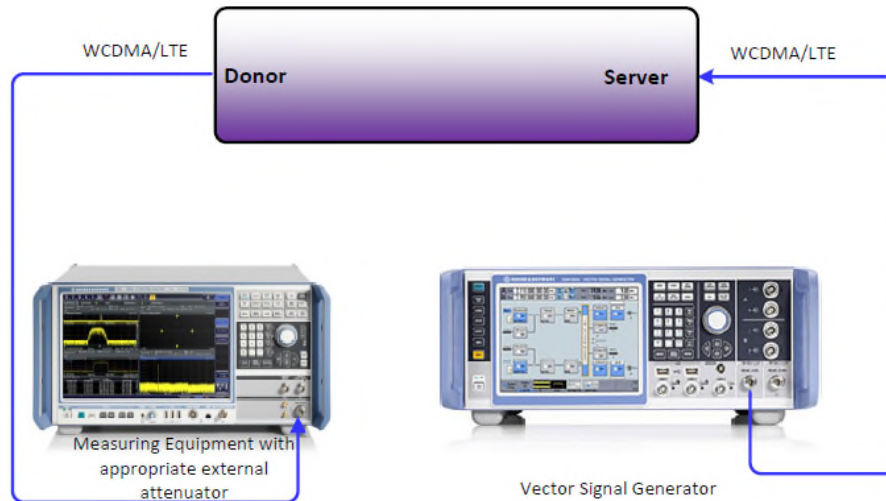


1.4.5 Simplified Test Configuration Diagram

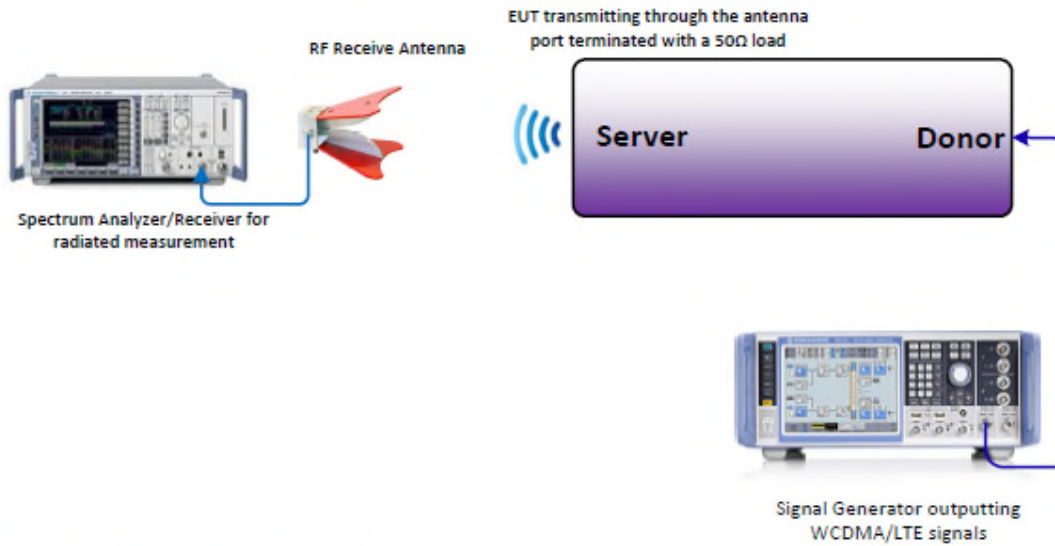
Downlink (Server Port) Conducted Test



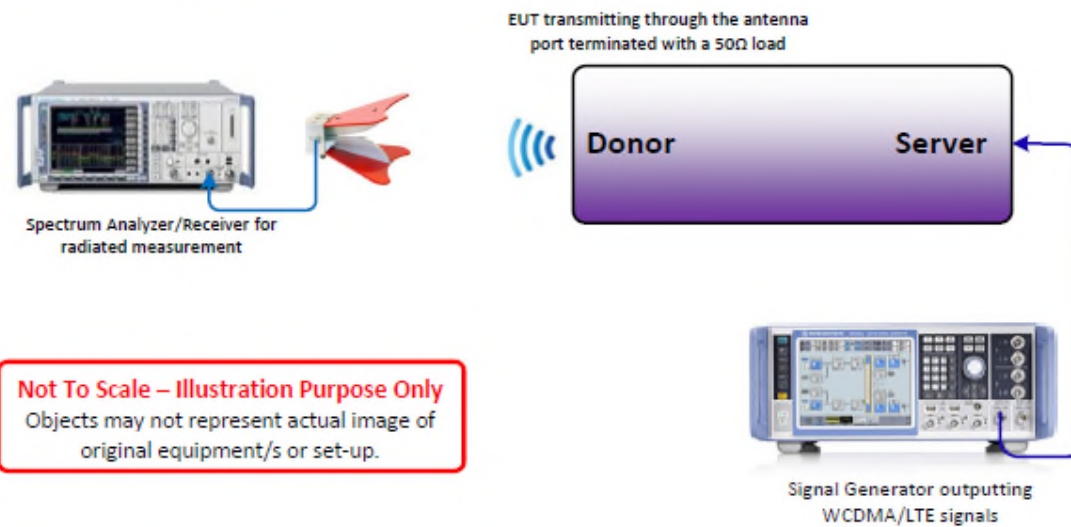
Uplink (Donor Port) Conducted Test



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 332633000356 (Fix Unit) and 332633000417 (Mobile Unit)		
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 – 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.



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

The 10m Semi-anechoic chamber of TUV SUD 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 = 4M29F9W

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:

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



SECTION 2

TEST DETAILS

Radio Testing of the
Nextivity Inc.
Cel-Fi GO 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 (c)(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 (c)(9):

(9) Control and mobile stations in the 698-746 MHz band 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: 332633000356 (Fix Unit) / Test Configuration A and B

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

December 07, 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	22.3°C
Relative Humidity	48.6%
ATM Pressure	99.3kPa



2.1.7 Additional Observations

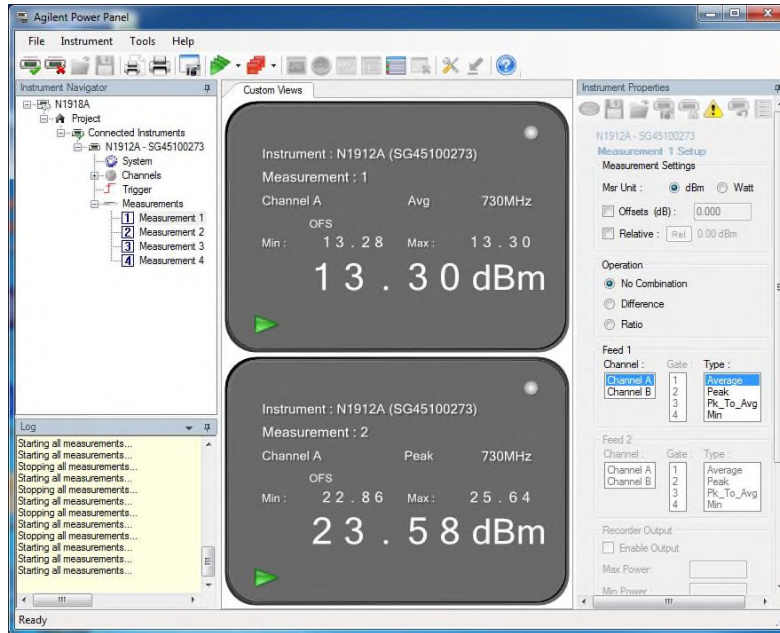
- This is a conducted test using an average power meter.
- The path loss was measured and entered as a level offset (20.5dB).
- Both Peak and Average measurements presented.

2.1.8 Test Results

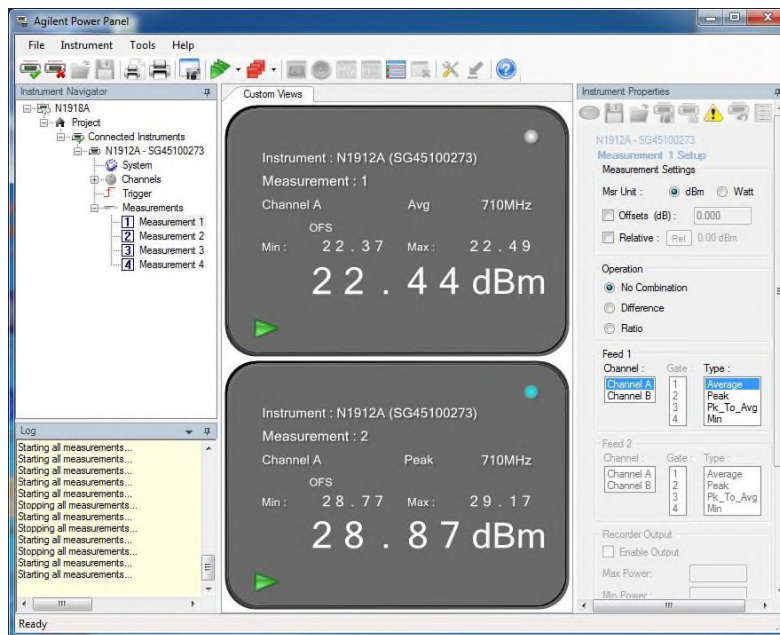
<i>Downlink (CU B12 Output)</i>					
Band	Bandwidth	Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)
LTE Band 12	5MHz	5035	731.50	10.52	21.02
		5095	737.50	10.47	20.82
		5155	743.50	10.27	20.58
	10MHz	5060	734.00	13.69	23.29
		5095	737.50	13.30	23.58
		5130	741.00	13.53	24.90

<i>Uplink (NU B12 Output)</i>					
Band	Bandwidth	Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)
LTE Band 12	5MHz	23035	701.50	22.42	28.74
		23095	707.50	22.37	28.78
		23155	713.50	22.62	29.17
	10MHz	23060	704.00	22.33	28.49
		23095	707.50	22.44	28.87
		23130	711.00	22.36	29.33

2.1.9 Sample Test Plot



LTE Band 12 DL 10MHz Bandwidth Middle Channel



LTE Band 12 UL 10MHz Bandwidth Middle 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 (c)(9)
RSS-130, Clause 4.4

2.2.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.50 (c)(9):
(9) Control and mobile stations in the 698-746 MHz band 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: 332633000356 (Fix Unit)

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

December 07, 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:

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

Where:

P_T = transmitter conducted output power dBm (Section 3.1 of this test report)
 G_T = gain of the transmitting antenna, in dBi (EIRP: the -2.15 in the formula is to convert EIRP to ERP);
 L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

2.2.6 Sample Computation

ERP = $P_T + G_T - L_C - 2.15\text{dB}$
= 13.80 (Conducted Power) + 0 dBi (max. gain) – 0 (cable loss negligible @ 734MHz) -2.15
= 11.65 dBm



2.2.7 Test Results

Band 12 Downlink							
Bandwidth	Channel	Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	EIRP (dBm)	Limit (dBm)
5.0MHz	5035	731.50	10.52	-1.0	7.37	9.52	44.78
	5095	737.50	10.47	-1.0	7.32	9.47	44.78
	5155	743.50	10.27	-1.0	7.12	9.27	44.78
10MHz	5060	734.00	13.69	-1.0	10.54	12.69	44.78
	5095	737.50	13.30	-1.0	10.15	12.30	44.78
	5130	741.00	13.53	-1.0	10.38	12.53	44.78

Band 12 Uplink							
Bandwidth	Channel	Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	EIRP (dBm)	Limit (dBm)
5.0MHz	23035	701.50	22.42	8.0	28.27	30.42	44.78
	23095	707.50	22.37	8.0	28.22	30.37	44.78
	23155	713.50	22.62	8.0	28.47	30.62	44.78
10MHz	23060	704.00	22.33	8.0	28.18	30.33	44.78
	23095	707.50	22.44	8.0	28.29	30.44	44.78
	23130	711.00	22.36	8.0	28.21	30.36	44.78



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)(3)
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: 332633000356 (Fix Unit) / Test Configuration A and B

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

December 07, 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	22.3°C
Relative Humidity	48.6%
ATM Pressure	99.3kPa

2.3.7 Additional Observations

- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- All channels for emission bandwidth 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.
- 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% for OBW measurements while “n dB down” was set to -26 for 26dB BW measurements.

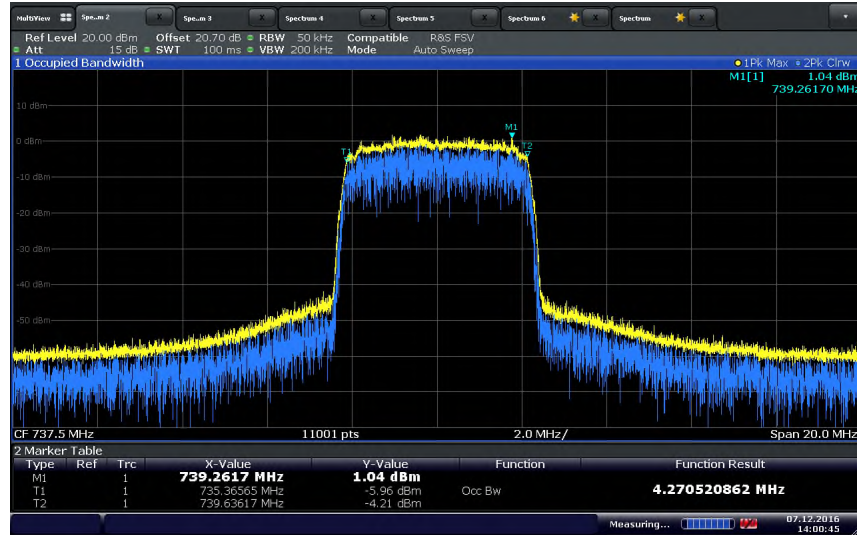


2.3.8 Test Results

<i>Downlink</i>					
Band	Bandwidth	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
LTE Band 12	5MHz	5035	731.50	4.28	4.68
		5095	737.50	4.27	4.69
		5155	743.50	4.27	4.68
	10MHz	5060	734.00	8.77	9.31
		5095	737.50	8.77	9.30
		5130	741.00	8.77	9.32

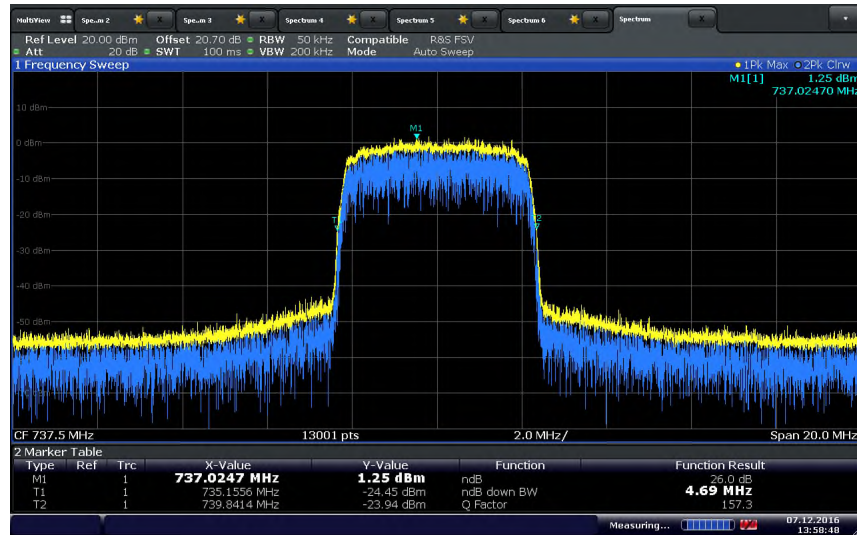
<i>Uplink</i>					
Band	Bandwidth	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
LTE Band 12	5MHz	23035	701.50	4.30	4.72
		23095	707.50	4.29	4.72
		23155	713.50	4.30	4.71
	10MHz	23060	704.00	8.85	9.31
		23095	707.50	8.81	9.30
		23130	711.00	8.81	9.27

LTE Band 12 Downlink 5MHz Bandwidth Mid Channel 99% OBW



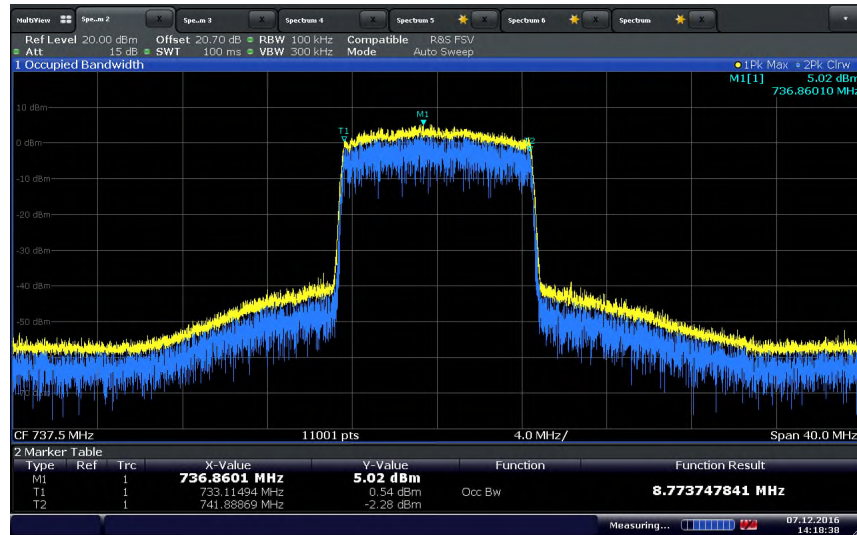
Date: 7 DEC. 2016 14:00:45

LTE Band 12 Downlink 5MHz Bandwidth Mid Channel -26dB BW



Date: 7 DEC. 2016 13:50:48

LTE Band 12 Downlink 10MHz Bandwidth Mid Channel 99% OBW



Date: 7 DEC. 2016 14:18:38

LTE Band 12 Downlink 10MHz Bandwidth Mid Channel -26dB BW



Date: 7 DEC. 2016 14:21:22

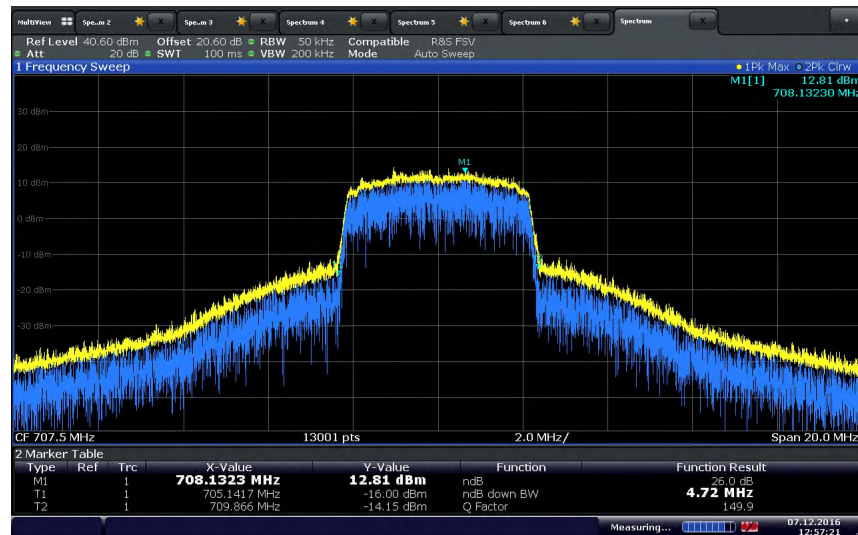


LTE Band 12 Uplink 5MHz Bandwidth Mid Channel 99% OBW



Date: 7 DEC. 2016 12:57:51

LTE Band 12 Uplink 5MHz Bandwidth Mid Channel -26dB BW



Date: 7 DEC. 2016 12:57:21

LTE Band 12 Uplink 10MHz Bandwidth Mid Channel 99% OBW



Date: 7 DEC 2016 14:36:18

LTE Band 12 Uplink 10MHz Bandwidth Mid Channel -26dB BW



Date: 7 DEC 2016 14:36:53



2.4 PEAK-AVERAGE RATIO

2.4.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.50(d)(5)
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: 332633000356 (Fix Unit) / Test Configuration A and B

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

December 07, 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	22.3°C
Relative Humidity	48.6%
ATM Pressure	99.3kPa

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 losses) 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 were 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 12	5MHz	5035	731.50	12.43
		5095	737.50	12.42
		5155	743.50	12.43
	10MHz	5060	734.00	11.60
		5095	737.50	11.80
		5130	741.00	11.61

<i>Uplink</i>				
Band	Bandwidth	Channel	Frequency (MHz)	PAR (dB)
LTE Band 12	5MHz	23035	701.50	6.60
		23095	707.50	6.65
		23155	713.50	6.83
	10MHz	23060	704.00	6.82
		23095	707.50	6.66
		23130	711.00	7.48

2.4.9 Sample Test Plot

LTE Band 12 Downlink 5MHz Bandwidth Mid Channel -PAR



Date: 7 DEC. 2016 14:00:21

LTE Band 12 Downlink 10MHz Bandwidth Mid Channel -PAR



Date: 7 DEC. 2016 14:19:18

LTE Band 12 Uplink 5MHz Bandwidth Mid Channel -PAR



Date: 7 DEC. 2016 12:58:16

LTE Band 12 Uplink 10MHz Bandwidth Mid Channel -PAR



Date: 7 DEC. 2016 14:37:14



2.5 BAND EDGE

2.5.1 Specification Reference

FCC 47 CFR Part 27, Clause 27.53(g)
RSS-130, Clause 4.6

2.5.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.53:

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (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 4.6.1:

The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (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: 332633000356 (Fix Unit) / Test Configuration A and B

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

December 07, 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

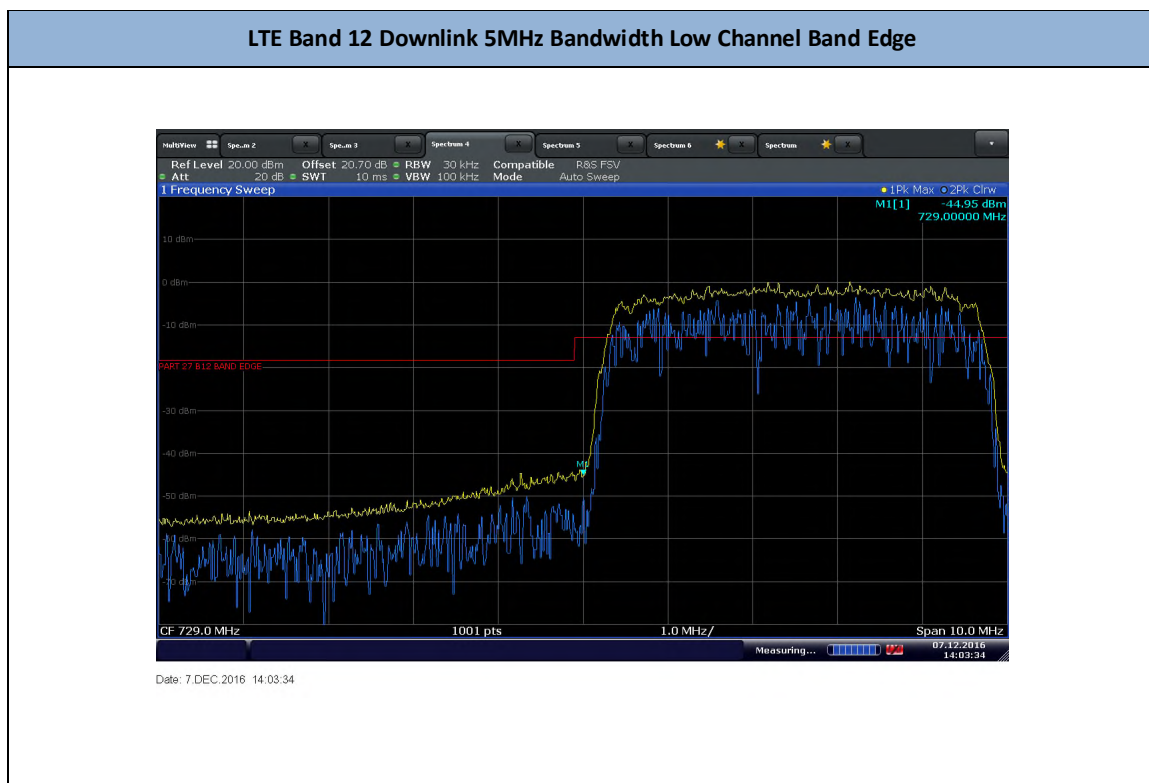
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	22.3°C
Relative Humidity	48.6%
ATM Pressure	99.3kPa

2.5.7 Additional Observations

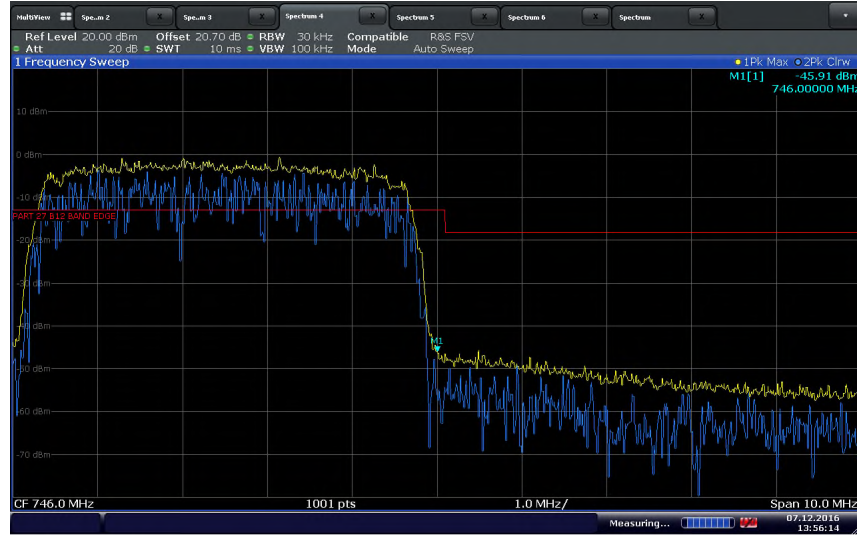
- This is a conducted test. Test guidance is per Section 6.0 of KDB971168 (D01 Power Meas License Digital Systems v02r02).
- The path loss was measured and entered as a level offset.
- The center frequency of the spectrum is the band edge frequency (729-746 MHz and 698-716 MHz).
- Using a span of 10MHz, RBW is set to 30 kHz (minimum of 30kHz limited to 1% of EBW) 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.

2.5.8 Test Results



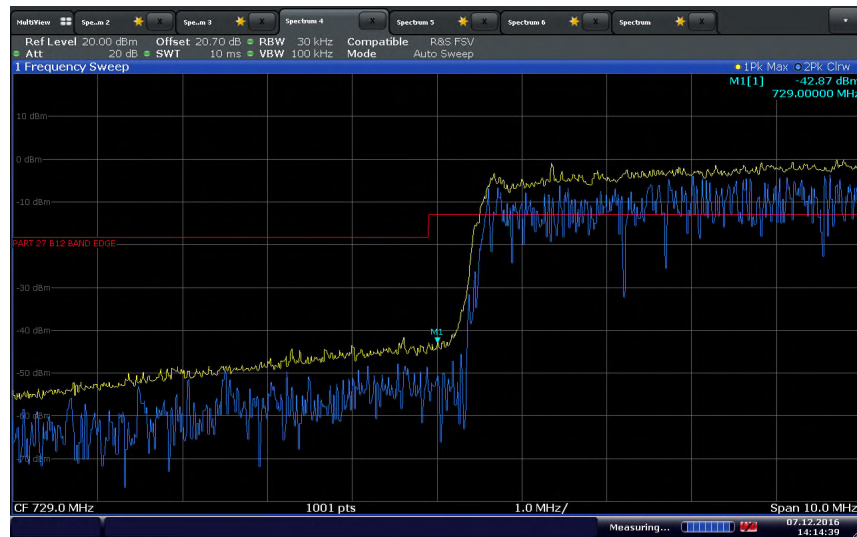


LTE Band 12 Downlink 5MHz Bandwidth High Channel Band Edge



Date: 7 DEC. 2016 13:56:13

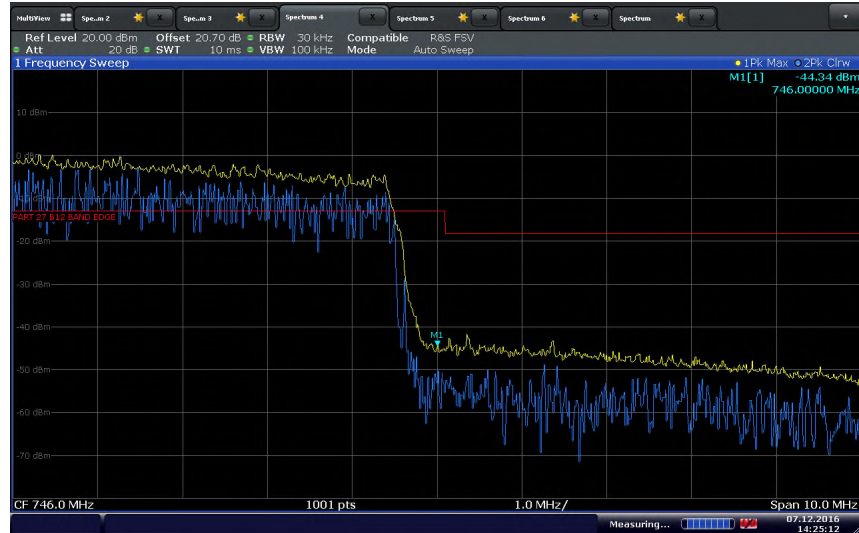
LTE Band 12 Downlink 10MHz Bandwidth Low Channel Band Edge



Date: 7 DEC. 2016 14:14:39



LTE Band 12 Downlink 10MHz Bandwidth High Channel Band Edge



LTE Band 12 Uplink 5MHz Bandwidth Low Channel Band Edge



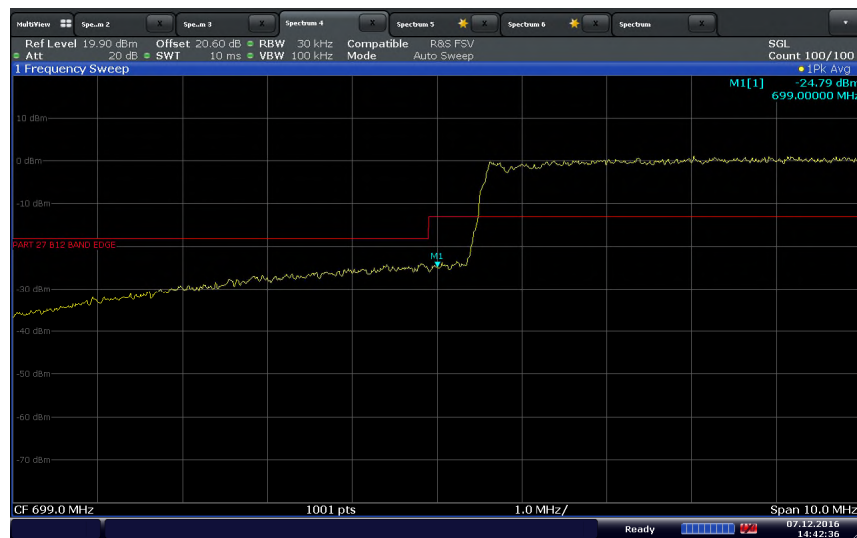


LTE Band 12 Uplink 5MHz Bandwidth High Channel Band Edge



Date: 7 DEC 2016 14:47:07

LTE Band 12 Uplink 10MHz Bandwidth Low Channel Band Edge



Date: 7 DEC 2016 14:42:36

LTE Band 12 Uplink 10MHz Bandwidth High Channel Band Edge



Date: 7 DEC 2016 14:31:52



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(g)
RSS-130, Clause 4.6.1

2.6.2 Standard Applicable

FCC 47 CFR Part 27, Clause 27.53:

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's 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 the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (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.

2.6.3 Equipment Under Test and Modification State

Serial No: 332633000356 (Fix Unit) / Test Configuration A and B

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

December 07, 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.

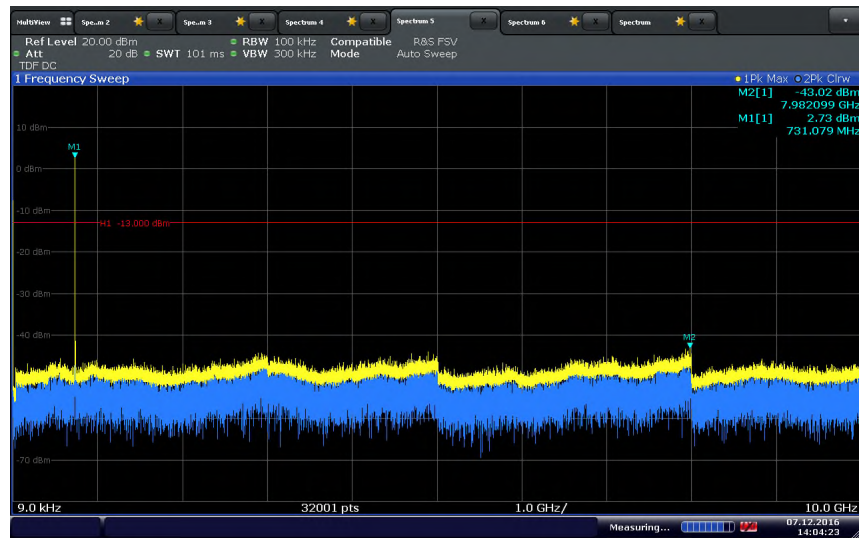
Ambient Temperature	22.3°C
Relative Humidity	48.6%
ATM Pressure	99.3kPa

2.6.7 Additional Observations

- This is a conducted test.
- The transducer factor (TDF) used is from the external attenuators and cables used.
- Sweep points set to maximum the SA can support.
- Sweep time set to auto.
- The spectrum was searched from 9 kHz to 10GHz (requirement is up to the 10th harmonic ($\leq 8\text{GHz}$)).

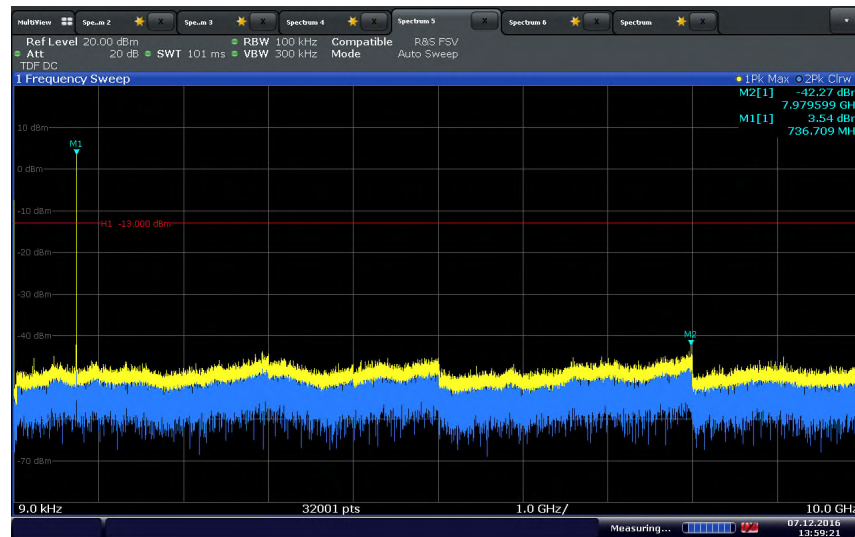
2.6.8 Test Results

LTE Band 12 Downlink 5MHz Bandwidth Low Channel Conducted Spurious Emissions



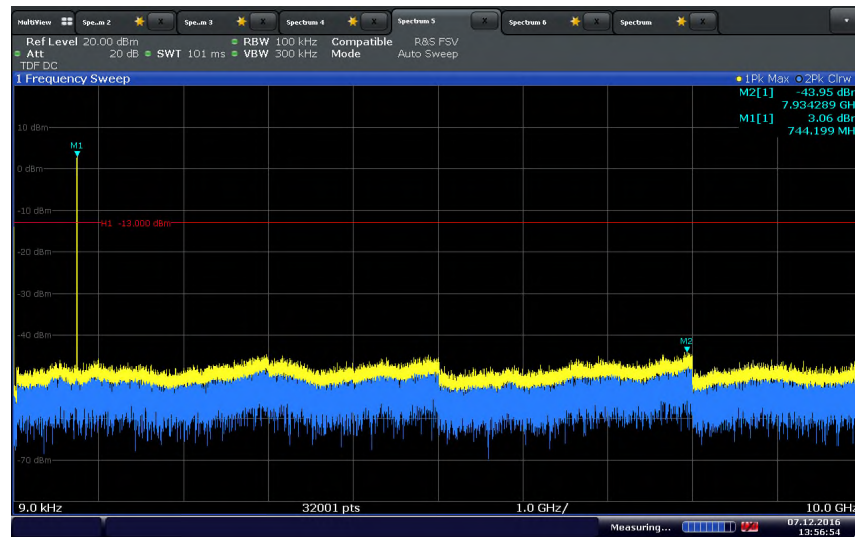
Date: 7 DEC. 2016 14:04:24

LTE Band 12 Downlink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions



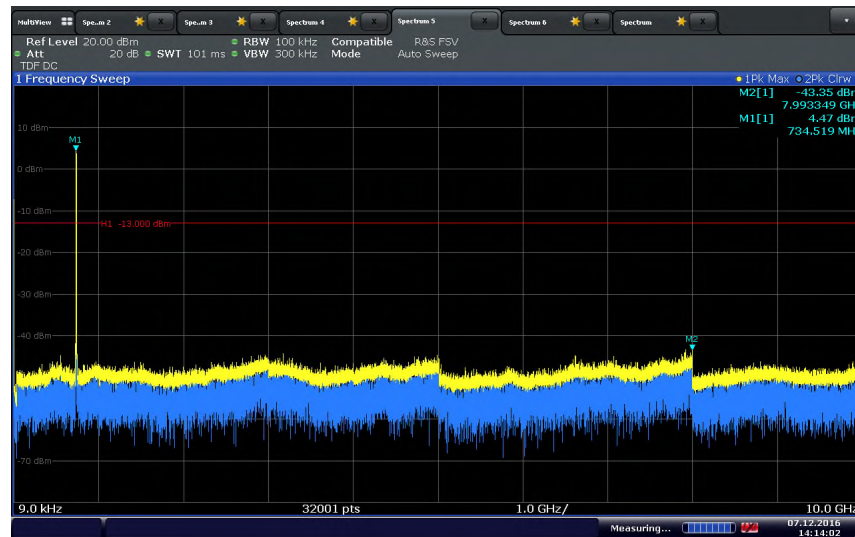
Date: 7 DEC. 2016 13:59:21

LTE Band 12 Downlink 5MHz Bandwidth High Channel Conducted Spurious Emissions



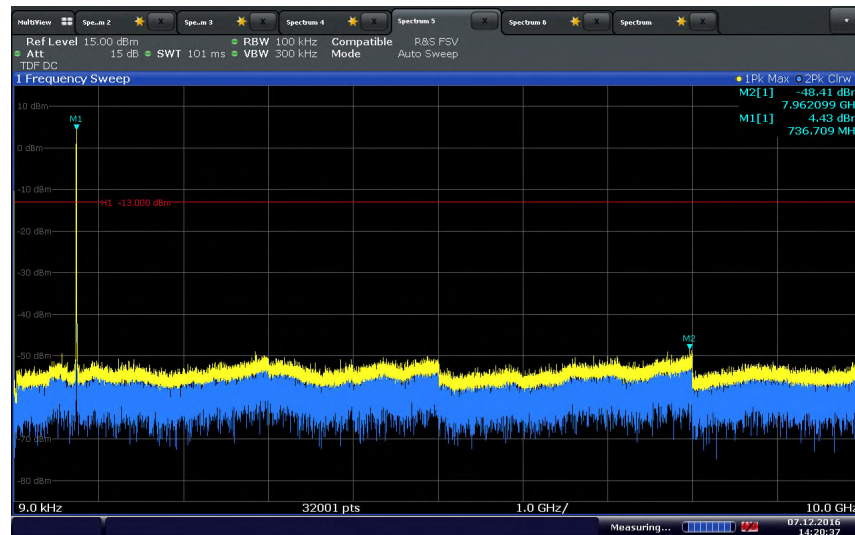
Date: 7 DEC. 2016 13:56:54

LTE Band 12 Downlink 10MHz Bandwidth Low Channel Conducted Spurious Emissions



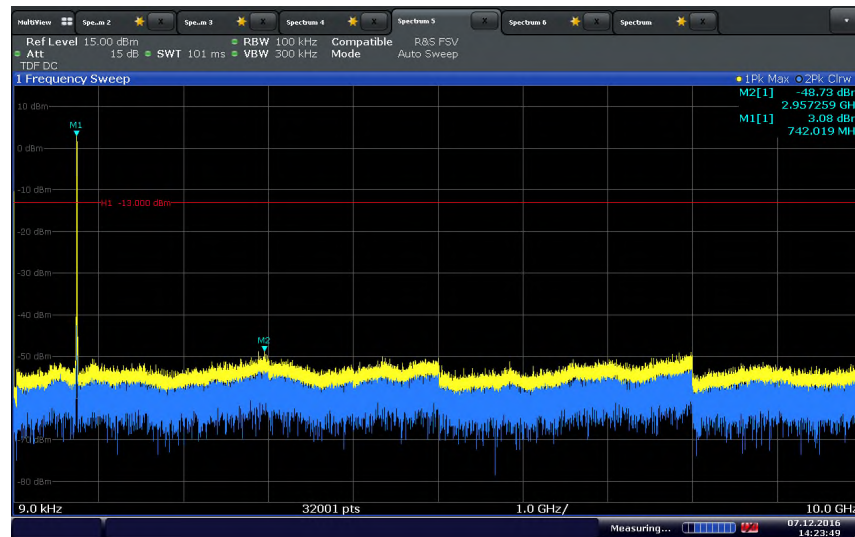
Date: 7 DEC. 2016 14:14:02

LTE Band 12 Downlink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions

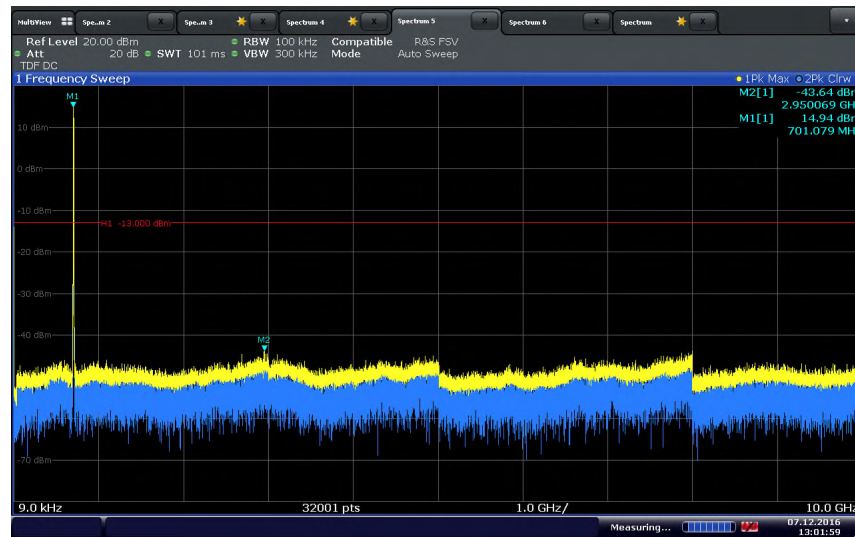


Date: 7 DEC. 2016 14:20:37

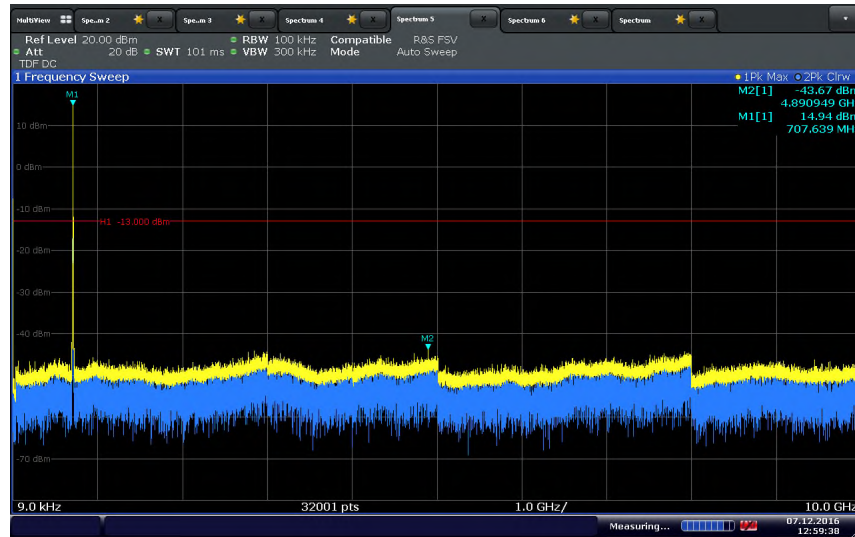
LTE Band 12 Downlink 10MHz Bandwidth High Channel Conducted Spurious Emissions



LTE Band 12 Uplink 5MHz Bandwidth Low Channel Conducted Spurious Emissions

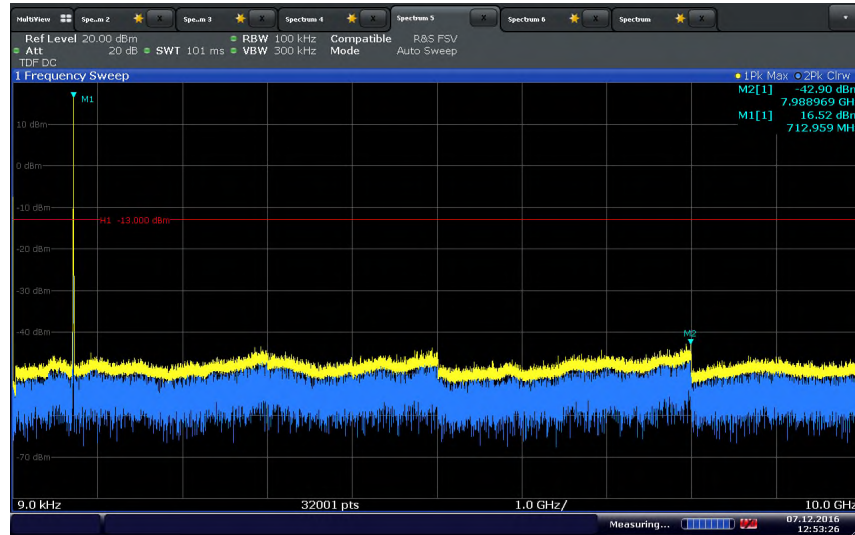


LTE Band 12 Uplink 5MHz Bandwidth Mid Channel Conducted Spurious Emissions



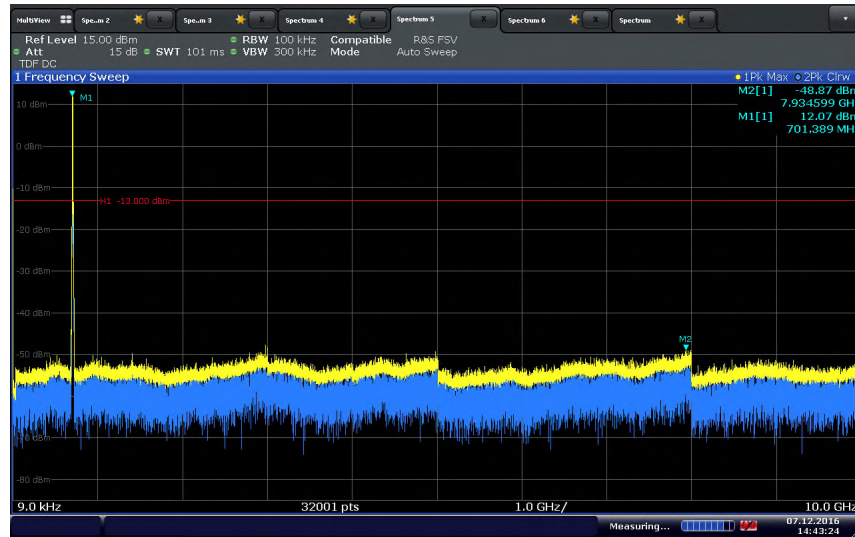
Date: 7 DEC. 2016 12:59:38

LTE Band 12 Uplink 5MHz Bandwidth High Channel Conducted Spurious Emissions



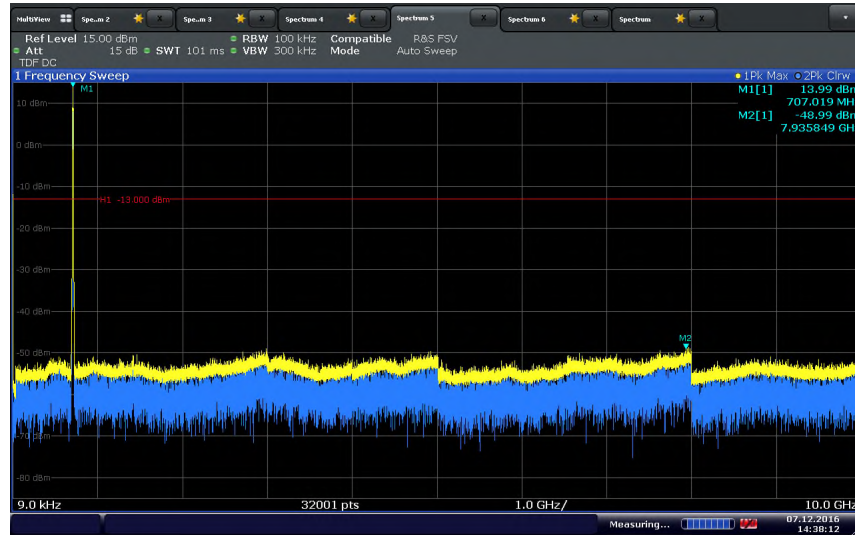
Date: 7 DEC. 2016 12:53:26

LTE Band 12 Uplink 10MHz Bandwidth Low Channel Conducted Spurious Emissions



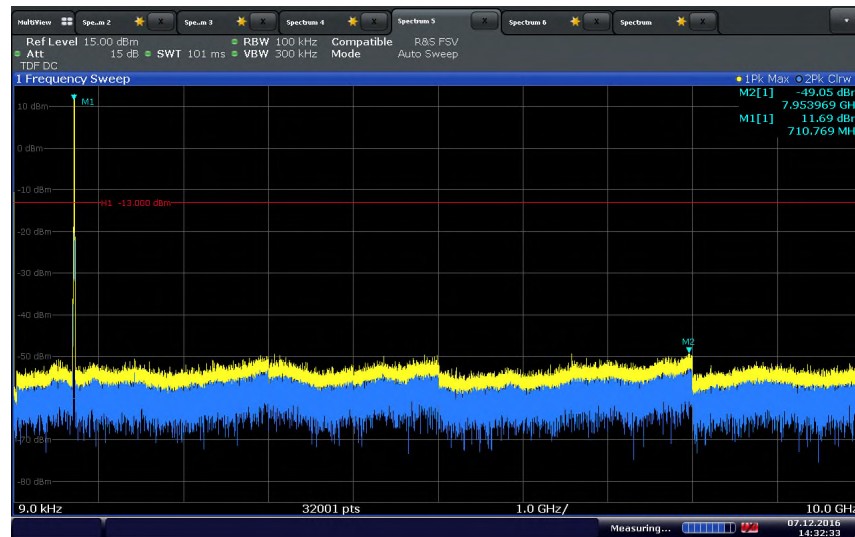
Date: 7 DEC. 2016 14:43:24

LTE Band 12 Uplink 10MHz Bandwidth Mid Channel Conducted Spurious Emissions



Date: 7 DEC. 2016 14:38:13

LTE Band 12 Uplink 10MHz Bandwidth High Channel Conducted Spurious Emissions



Date: 7 DEC 2016 14:32:32



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(g)
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: 332633000356 (Fix Unit) / Test Configuration C and D

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

December 10, 18 and 19, 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	22.5 - 23.1°C
Relative Humidity	37.6 - 56.8%
ATM Pressure	99.2 - 99.3kPa

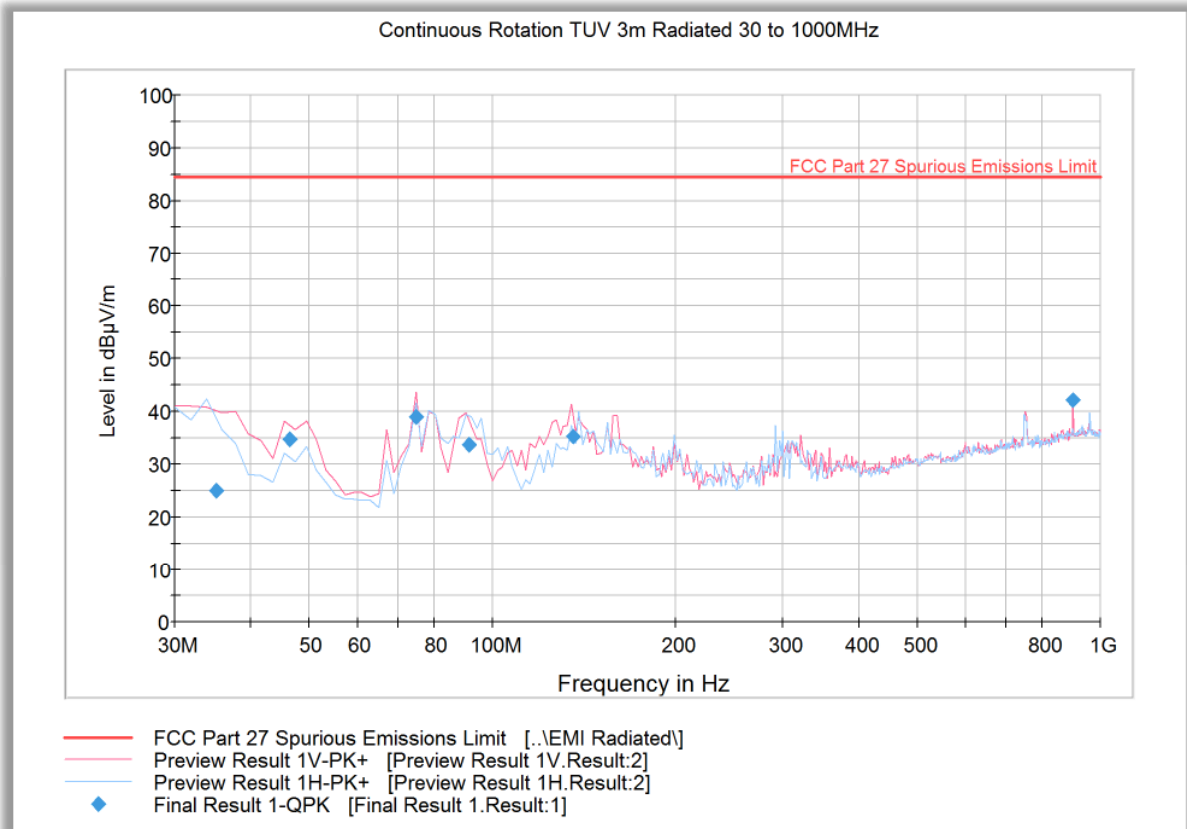
2.7.7 Additional Observations

- 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

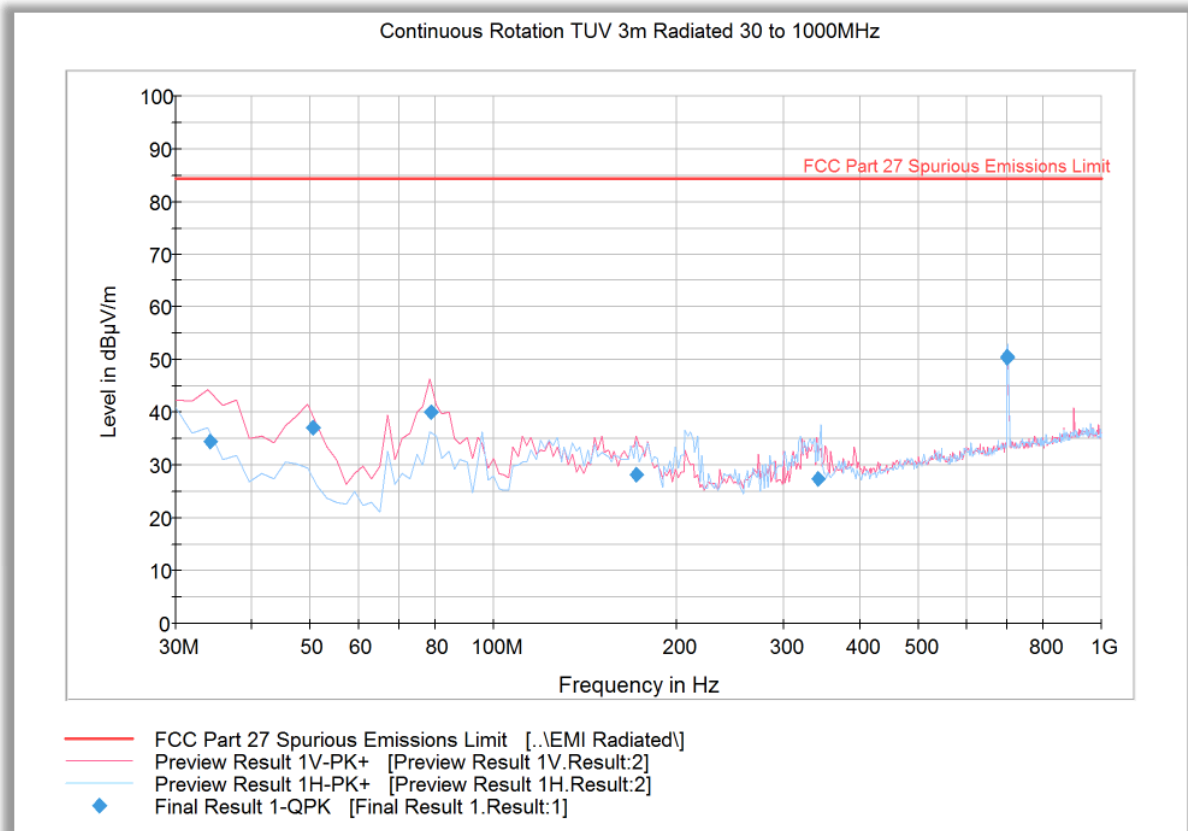


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.047776	25.1	1000.0	120.000	158.0	H	192.0	-8.5	59.3	84.4
46.431102	34.9	1000.0	120.000	100.0	V	336.0	-12.6	49.5	84.4
74.789419	39.1	1000.0	120.000	100.0	V	87.0	-15.5	45.3	84.4
91.380521	33.7	1000.0	120.000	150.0	V	63.0	-14.2	50.7	84.4
135.569940	35.3	1000.0	120.000	105.0	V	160.0	-13.8	49.1	84.4
899.981723	42.1	1000.0	120.000	100.0	V	128.0	8.3	42.3	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) - 5MHz Bandwidth Low Channel

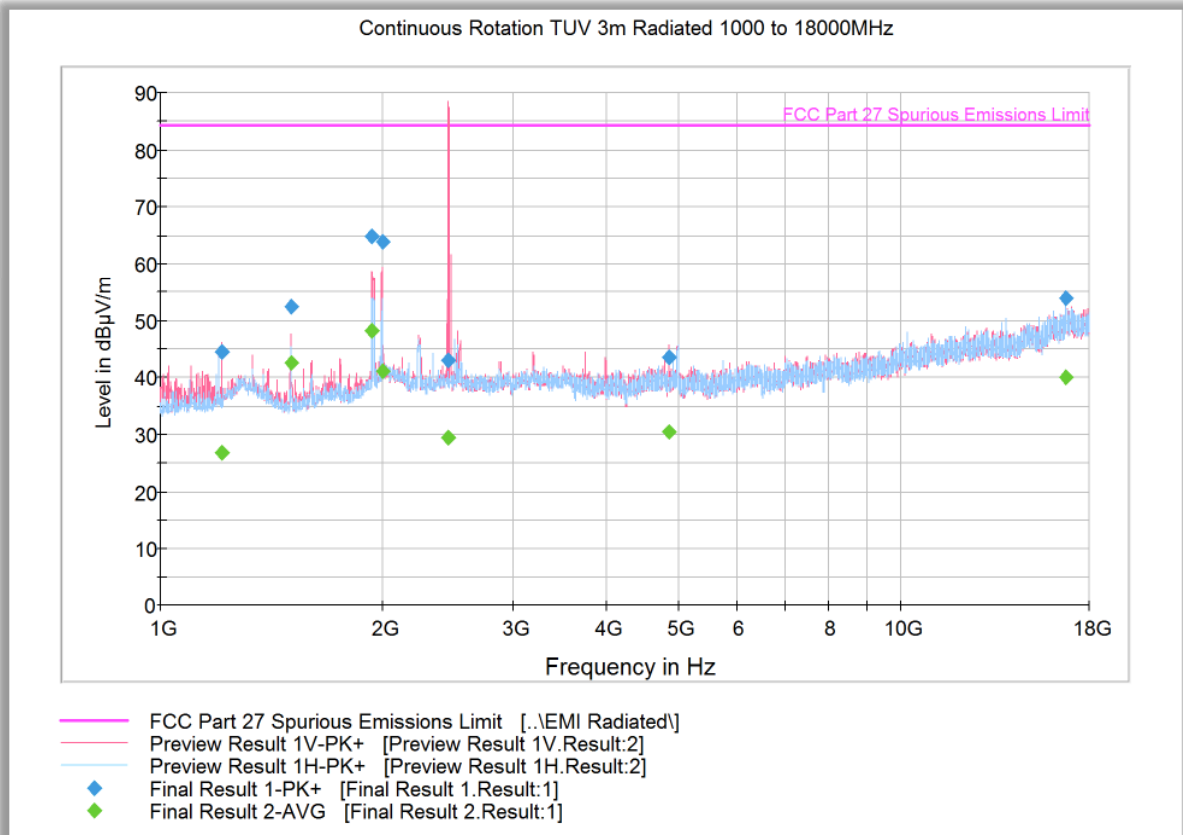


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
34.207776	34.5	1000.0	120.000	100.0	V	293.0	-7.9	49.9	84.4
50.398878	37.0	1000.0	120.000	100.0	V	176.0	-13.1	47.4	84.4
78.797194	40.0	1000.0	120.000	100.0	V	23.0	-15.6	44.4	84.4
172.183808	28.1	1000.0	120.000	166.0	H	108.0	-10.7	56.4	84.4
342.069820	27.4	1000.0	120.000	400.0	H	130.0	-4.6	57.0	84.4
700.465170	50.2	1000.0	120.000	196.0	H	137.0	4.7	34.2	84.4
701.129058	50.6	1000.0	120.000	200.0	H	257.0	4.7	33.8	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 10MHz Low Channel



Peak Data

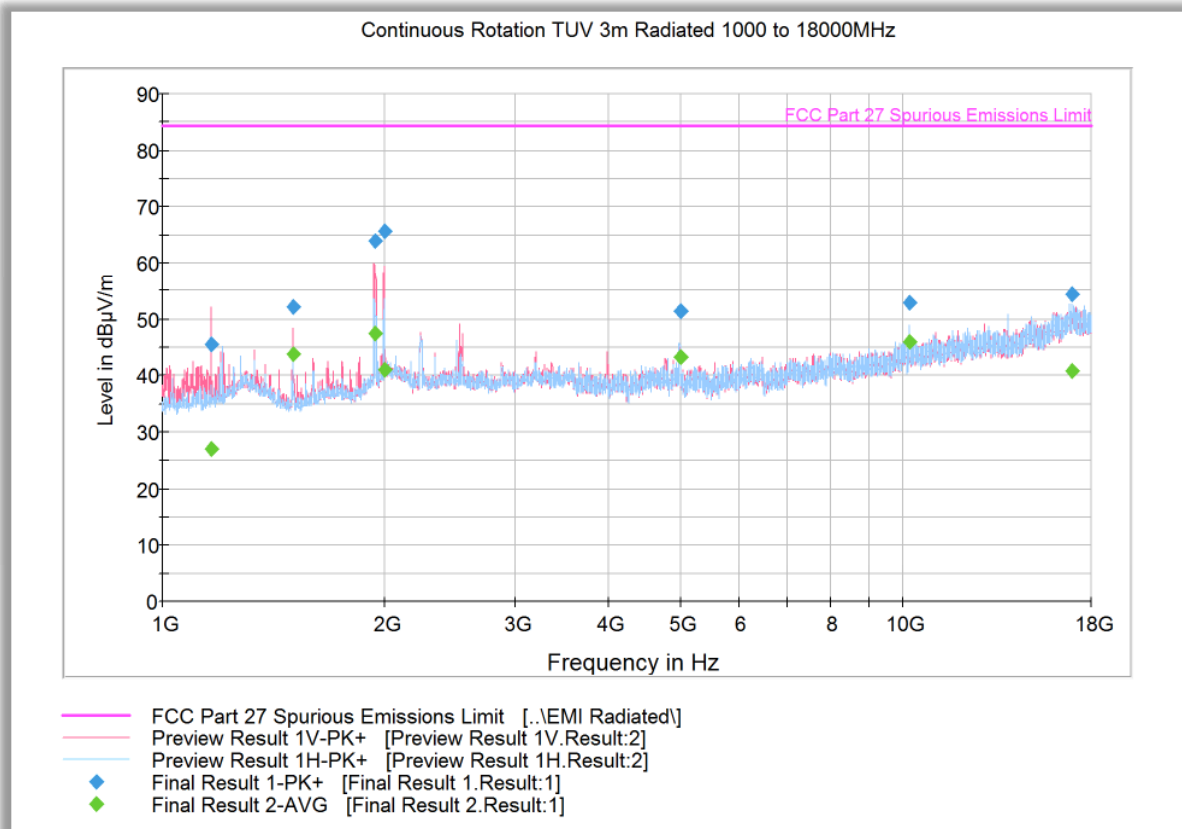
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1209.333333	44.4	1000.0	1000.000	270.3	V	57.0	-6.5	40.0	84.4
1500.000000	52.5	1000.0	1000.000	116.7	V	201.0	-6.2	31.9	84.4
1932.566667	64.9	1000.0	1000.000	135.7	V	256.0	-0.7	19.5	84.4
1993.000000	63.9	1000.0	1000.000	296.2	V	96.0	-0.2	20.5	84.4
2448.766667	42.9	1000.0	1000.000	245.4	V	-1.0	-1.0	BLE Carrier	
4853.333333	43.6	1000.0	1000.000	231.4	V	16.0	3.4	40.8	84.4
16725.966667	53.8	1000.0	1000.000	151.2	H	219.0	19.8	30.6	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)
1209.333333	26.8	1000.0	1000.000	270.3	V	57.0	-6.5	57.6	84.4
1500.000000	42.6	1000.0	1000.000	116.7	V	201.0	-6.2	41.8	84.4
1932.566667	48.3	1000.0	1000.000	135.7	V	256.0	-0.7	36.1	84.4
1993.000000	41.0	1000.0	1000.000	296.2	V	96.0	-0.2	43.4	84.4
2448.766667	29.4	1000.0	1000.000	245.4	V	-1.0	-1.0	BLE Carrier	
4853.333333	30.5	1000.0	1000.000	231.4	V	16.0	3.4	53.9	84.4
16725.966667	40.1	1000.0	1000.000	151.2	H	219.0	19.8	44.3	84.4

Test Notes: Emissions within the 2.4GHz band (Bluetooth LE) will be ignored. 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 10MHz Mid Channel



Peak Data

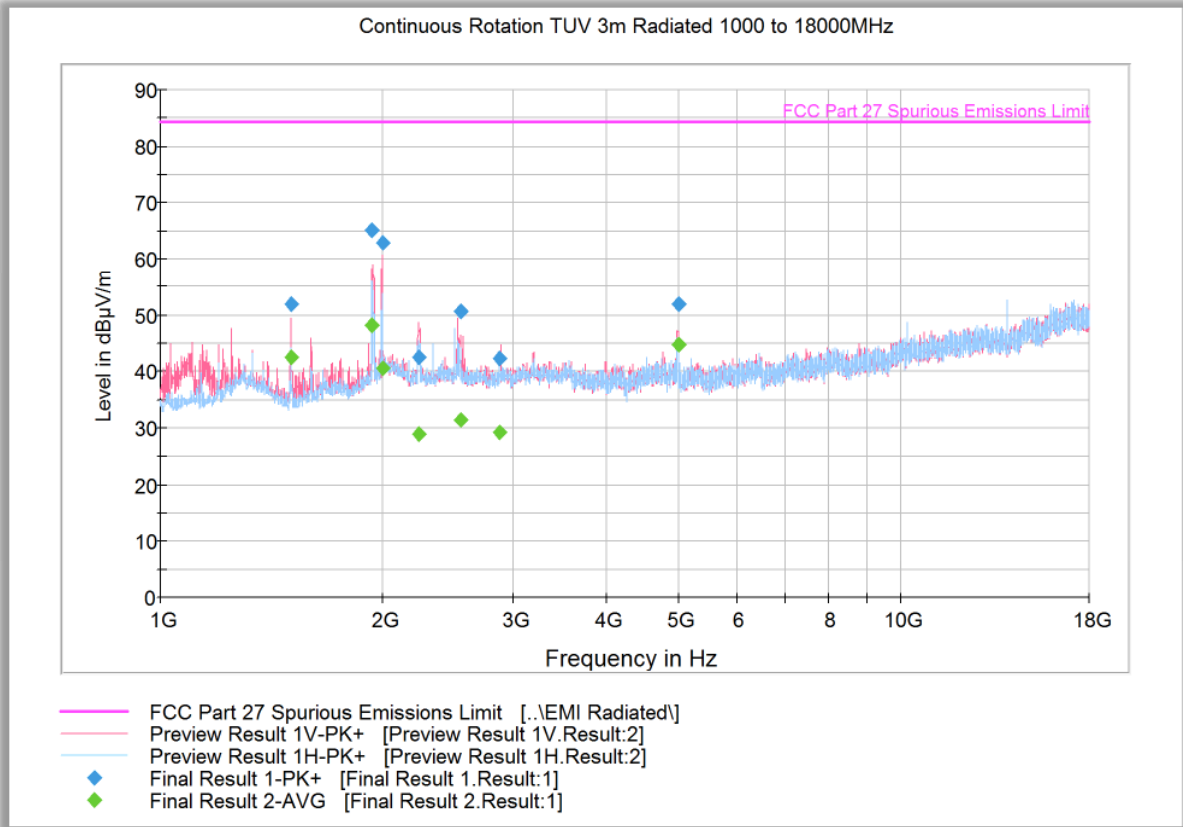
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1165.700000	45.5	1000.0	1000.000	311.2	V	65.0	-7.3	38.9	84.4
1500.033333	52.2	1000.0	1000.000	108.7	V	191.0	-6.2	32.2	84.4
1932.966667	63.8	1000.0	1000.000	103.7	V	159.0	-0.7	20.6	84.4
1993.000000	65.5	1000.0	1000.000	290.2	V	87.0	-0.2	18.9	84.4
5000.133333	51.4	1000.0	1000.000	102.8	H	172.0	3.4	33.0	84.4
10200.200000	52.9	1000.0	1000.000	115.8	H	52.0	11.3	31.5	84.4
16932.233333	54.4	1000.0	1000.000	103.7	H	226.0	20.0	30.0	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)
1165.700000	27.0	1000.0	1000.000	311.2	V	65.0	-7.3	57.4	84.4
1500.033333	43.7	1000.0	1000.000	108.7	V	191.0	-6.2	40.7	84.4
1932.966667	47.4	1000.0	1000.000	103.7	V	159.0	-0.7	37.0	84.4
1993.000000	41.0	1000.0	1000.000	290.2	V	87.0	-0.2	43.4	84.4
5000.133333	43.2	1000.0	1000.000	102.8	H	172.0	3.4	41.2	84.4
10200.200000	45.9	1000.0	1000.000	115.8	H	52.0	11.3	38.5	84.4
16932.233333	40.9	1000.0	1000.000	103.7	H	226.0	20.0	43.5	84.4

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 10MHz High Channel



Peak Data

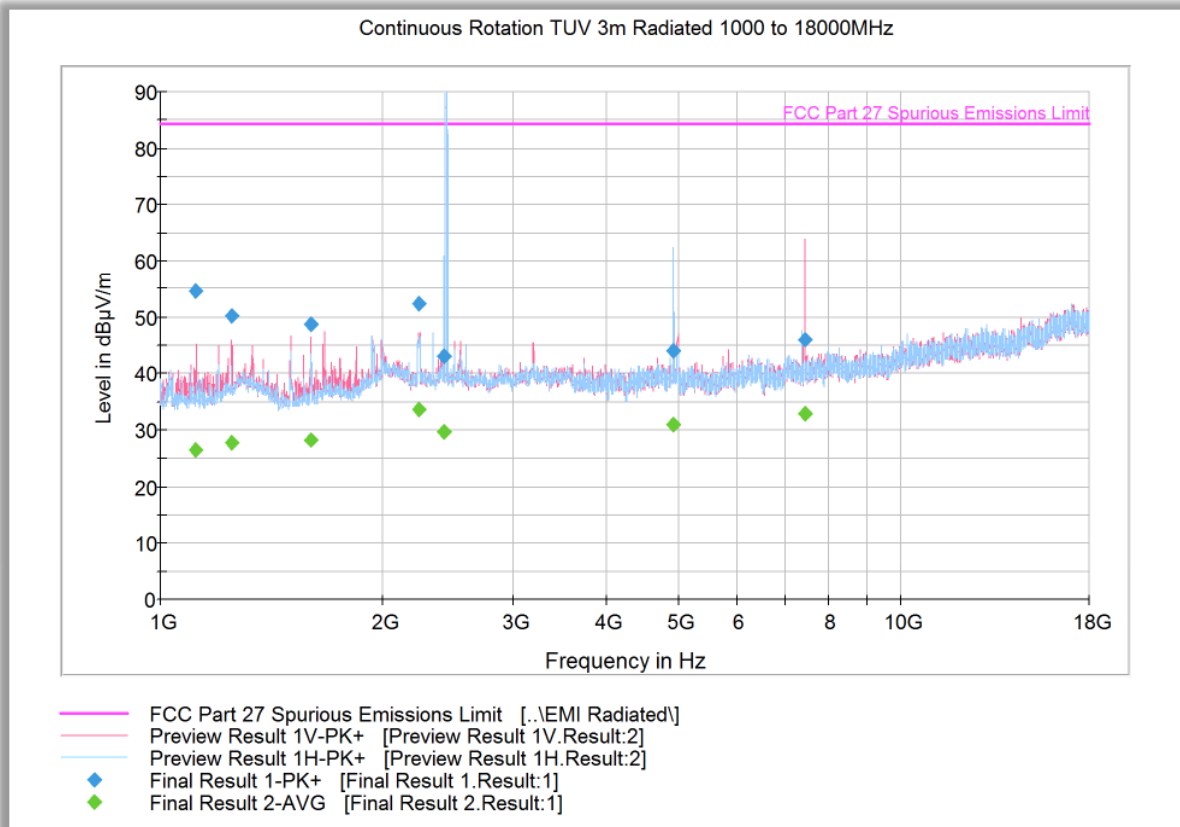
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.000000	51.9	1000.0	1000.000	112.7	V	195.0	-6.2	32.5	84.4
1932.533333	65.2	1000.0	1000.000	135.7	V	108.0	-0.7	19.2	84.4
1992.600000	62.9	1000.0	1000.000	291.2	V	4.0	-0.2	21.5	84.4
2231.166667	42.5	1000.0	1000.000	182.6	V	134.0	-1.8	41.9	84.4
2538.133333	50.6	1000.0	1000.000	310.2	V	146.0	-0.8	33.8	84.4
2872.066667	42.4	1000.0	1000.000	178.6	V	27.0	-0.3	42.0	84.4
4999.933333	51.8	1000.0	1000.000	103.7	V	124.0	3.4	32.6	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	42.6	1000.0	1000.000	112.7	V	195.0	-6.2	41.8	84.4
1932.533333	48.3	1000.0	1000.000	135.7	V	108.0	-0.7	36.1	84.4
1992.600000	40.5	1000.0	1000.000	291.2	V	4.0	-0.2	43.9	84.4
2231.166667	29.1	1000.0	1000.000	182.6	V	134.0	-1.8	55.3	84.4
2538.133333	31.5	1000.0	1000.000	310.2	V	146.0	-0.8	52.9	84.4
2872.066667	29.3	1000.0	1000.000	178.6	V	27.0	-0.3	55.2	84.4
4999.933333	44.7	1000.0	1000.000	103.7	V	124.0	3.4	39.7	84.4

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 Low Channel



Peak Data

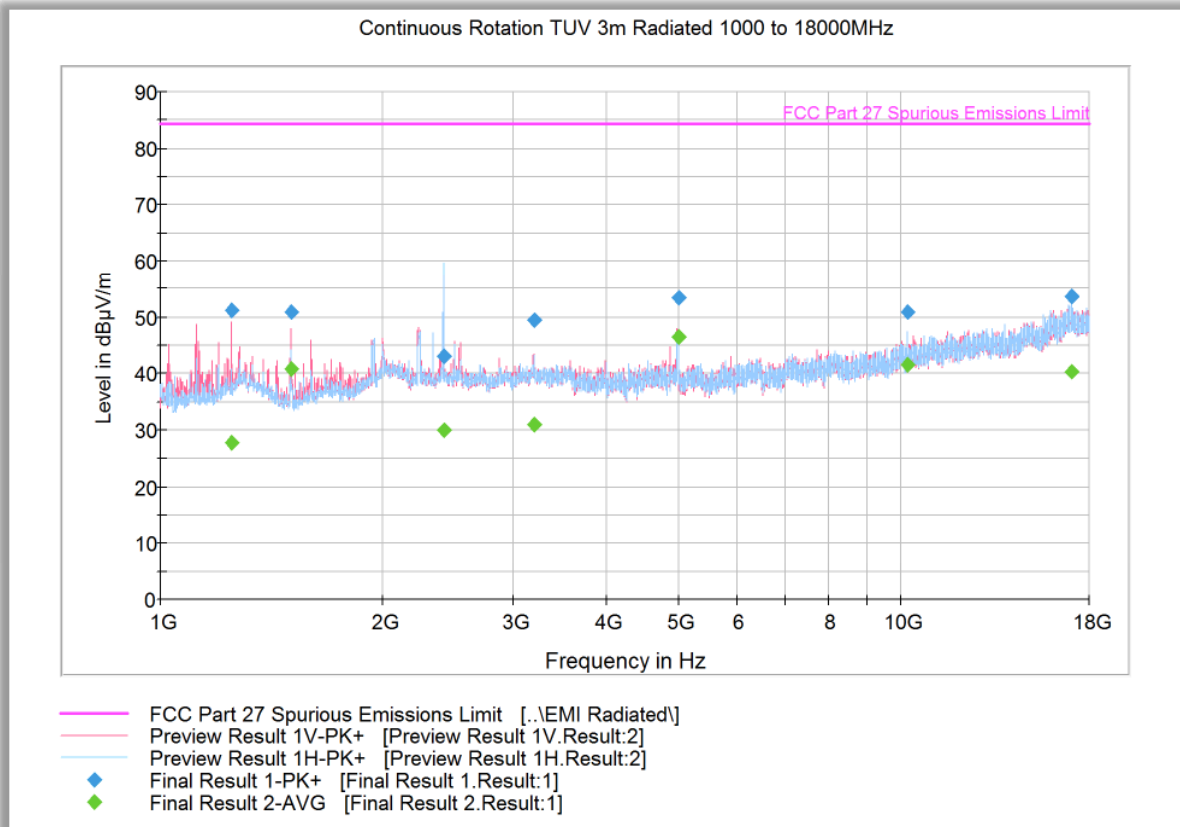
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1114.666667	54.5	1000.0	1000.000	243.4	V	20.0	-7.2	29.9	84.4
1247.433333	50.2	1000.0	1000.000	215.5	V	80.0	-5.7	34.2	84.4
1593.166667	48.6	1000.0	1000.000	153.7	V	70.0	-5.9	35.8	84.4
2232.700000	52.5	1000.0	1000.000	317.2	H	168.0	-1.8	31.9	84.4
2416.466667	43.0	1000.0	1000.000	146.7	H	-7.0	-1.1	BLE Carrier	
4934.000000	44.1	1000.0	1000.000	252.5	H	323.0	3.6	40.3	84.4
7415.466667	46.0	1000.0	1000.000	153.7	V	16.0	7.3	38.4	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)
1114.666667	26.7	1000.0	1000.000	243.4	V	20.0	-7.2	57.7	84.4
1247.433333	27.8	1000.0	1000.000	215.5	V	80.0	-5.7	56.6	84.4
1593.166667	28.3	1000.0	1000.000	153.7	V	70.0	-5.9	56.1	84.4
2232.700000	33.6	1000.0	1000.000	317.2	H	168.0	-1.8	50.8	84.4
2416.466667	29.8	1000.0	1000.000	146.7	H	-7.0	-1.1	BLE Carrier	
4934.000000	31.0	1000.0	1000.000	252.5	H	323.0	3.6	53.4	84.4
7415.466667	32.9	1000.0	1000.000	153.7	V	16.0	7.3	51.5	84.4

Test Notes: Emissions within 2.4GHz band (Bluetooth LE) will be ignored. 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 5MHz Mid Channel



Peak Data

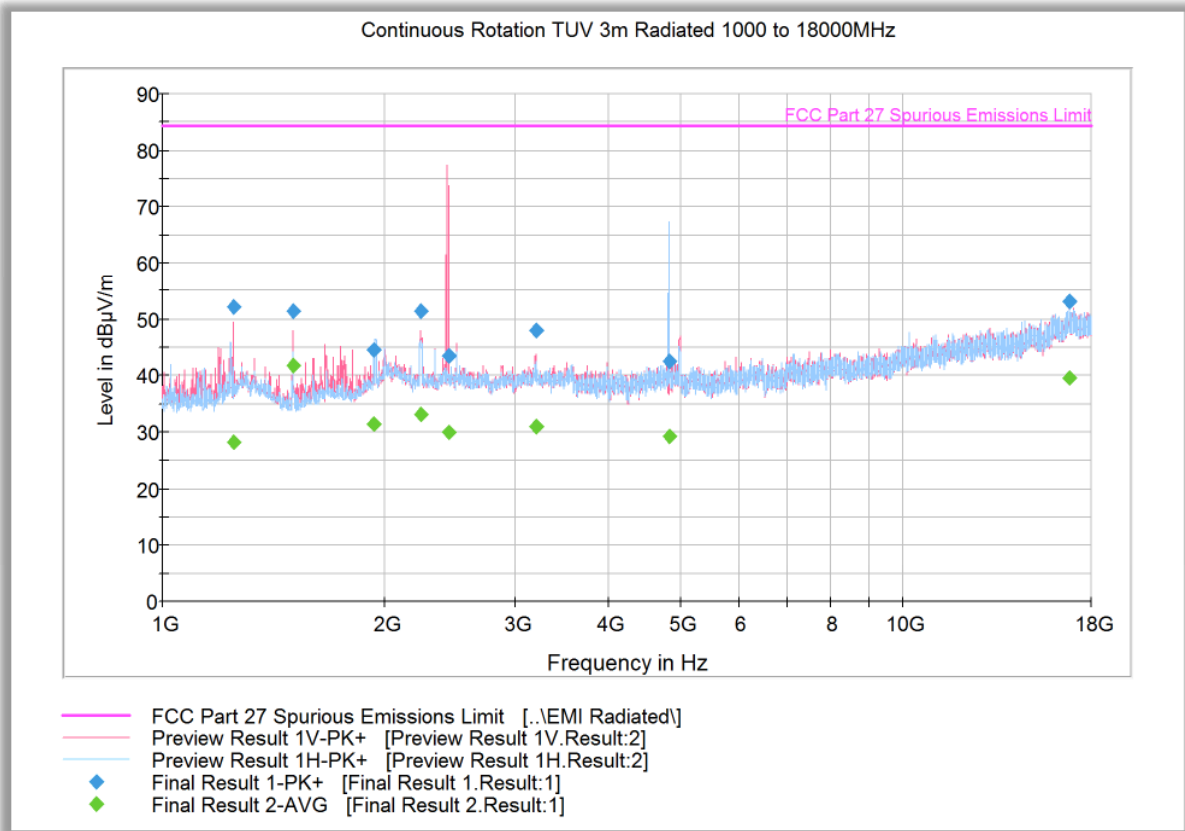
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1247.433333	51.1	1000.0	1000.000	212.5	V	83.0	-5.7	33.3	84.4
1500.000000	51.0	1000.0	1000.000	147.7	V	163.0	-6.2	33.4	84.4
2410.100000	42.9	1000.0	1000.000	265.3	H	265.0	-1.1	41.5	84.4
3193.000000	49.5	1000.0	1000.000	352.7	V	308.0	1.1	34.9	84.4
4999.933333	53.3	1000.0	1000.000	116.7	V	144.0	3.4	31.1	84.4
10199.800000	50.8	1000.0	1000.000	103.7	H	315.0	11.3	33.6	84.4
17026.466667	53.7	1000.0	1000.000	252.4	H	143.0	19.9	30.7	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)
1247.433333	27.9	1000.0	1000.000	212.5	V	83.0	-5.7	56.5	84.4
1500.000000	40.9	1000.0	1000.000	147.7	V	163.0	-6.2	43.5	84.4
2410.100000	29.9	1000.0	1000.000	265.3	H	265.0	-1.1	54.5	84.4
3193.000000	31.1	1000.0	1000.000	352.7	V	308.0	1.1	53.3	84.4
4999.933333	46.4	1000.0	1000.000	116.7	V	144.0	3.4	38.0	84.4
10199.800000	41.6	1000.0	1000.000	103.7	H	315.0	11.3	42.8	84.4
17026.466667	40.2	1000.0	1000.000	252.4	H	143.0	19.9	44.2	84.4

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 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)
1246.700000	52.2	1000.0	1000.000	199.5	V	78.0	-5.7	32.2	84.4
1500.000000	51.5	1000.0	1000.000	147.7	V	161.0	-6.2	32.9	84.4
1931.600000	44.4	1000.0	1000.000	301.2	H	-19.0	-0.7	40.0	84.4
2230.466667	51.4	1000.0	1000.000	190.5	V	106.0	-1.8	33.0	84.4
2431.233333	43.5	1000.0	1000.000	265.3	V	157.0	-1.0	BLE Carrier	
3194.733333	48.0	1000.0	1000.000	221.4	V	124.0	1.1	36.4	84.4
4834.466667	42.4	1000.0	1000.000	291.2	H	104.0	3.3	42.0	84.4
16772.566667	53.1	1000.0	1000.000	128.7	V	120.0	19.9	31.3	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)
1246.700000	28.2	1000.0	1000.000	199.5	V	78.0	-5.7	56.2	84.4
1500.000000	41.9	1000.0	1000.000	147.7	V	161.0	-6.2	42.5	84.4
1931.600000	31.4	1000.0	1000.000	301.2	H	-19.0	-0.7	53.0	84.4
2230.466667	33.1	1000.0	1000.000	190.5	V	106.0	-1.8	51.3	84.4
2431.233333	29.9	1000.0	1000.000	265.3	V	157.0	-1.0	BLE Carrier	
3194.733333	31.1	1000.0	1000.000	221.4	V	124.0	1.1	53.3	84.4
4834.466667	29.3	1000.0	1000.000	291.2	H	104.0	3.3	55.1	84.4
16772.566667	39.7	1000.0	1000.000	128.7	V	120.0	19.9	44.7	84.4

Test Notes: Emissions within 2.4GHz band (CU Bluetooth LE) will be ignored. 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, Clause 4.3:

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 $43 + 10 \log_{10} p$ (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: 332633000356 (Fix Unit) and 332633000417 (Mobile Unit) / Test Configuration A and B

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

December 20 and 21, 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	21.7 – 22.1°C
Relative Humidity	23.2 - 58.1%
ATM Pressure	99.0 - 99.5kPa



2.8.7 Additional Observations

- This is a conducted test.
- The Fix Unit was operated at 120.0VAC nominal voltage and was placed in the temperature chamber for the series of temperature variation 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 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 on both Fix and Mobile Units.
- 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.
- Test Procedure as per RSS-130 was also performed and 5MHz BW for Downlink and Uplink was used.

2.8.8 Test Results Summary

LTE B12 Downlink (Fix Unit)					
Voltage (VAC)	Temperature (°C)	Frequency Deviation (Hz/ppm)	f_L (MHz)	f_H (MHz)	Compliance
120	-30	0/0	729.27094	745.73521	Within the frequency range of 729 – 746 MHz band EUT Complies.
	-20	0/0	729.26479	745.73598	
	-10	0/0	729.27094	745.73521	
	0	0/0	729.26017	745.72444	
	+10	0/0	729.26402	745.72291	
	+20	0/0	729.25863	745.72598	
	+30	0/0	729.26171	745.72675	
	+40	0/0	729.2594	745.72983	
	+50	0/0	729.26786	745.72752	

LTE B12 Downlink (Fix Unit)					
Temperature (°C)	Voltage (VAC)	Frequency Deviation (Hz/ppm)	f_L (MHz)	f_H (MHz)	Compliance
20	102	0/0	729.26556	745.72906	Within the frequency range of 729 – 746 MHz band EUT Complies.
	138	0/0	729.26786	745.72675	



LTE B12 Downlink (Mobile Unit)					
<i>Temperature (°C)</i>	<i>Voltage (VAC)</i>	<i>Frequency Deviation (ppm)</i>	<i>f_L (MHz)</i>	<i>f_H (MHz)</i>	<i>Compliance</i>
20	10.2	0/0	729.26479	745.7306	Within the frequency range of 729 – 746 MHz band EUT Complies.
	12.0	0/0	729.25863	745.73444	
	13.8	0/0	729.26171	745.73444	



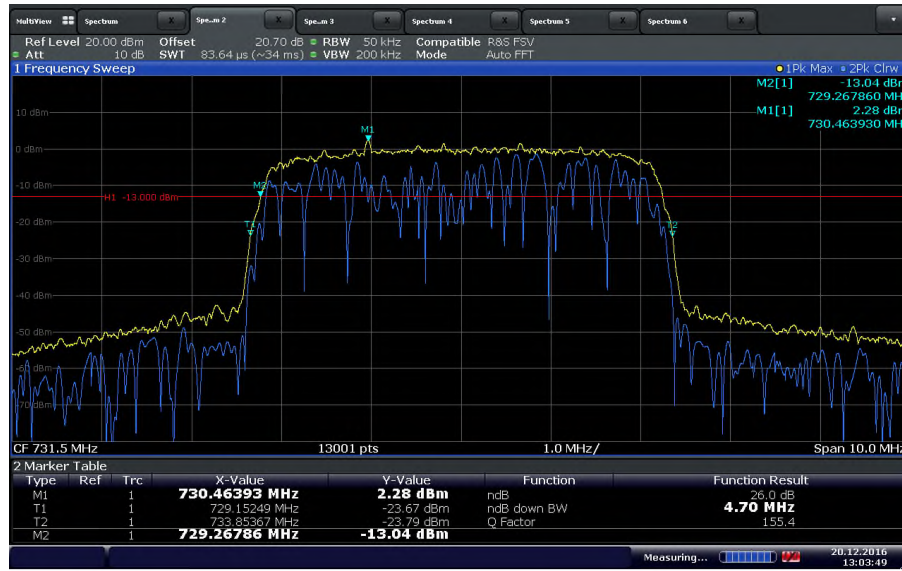
LTE B12 Uplink (Fix Unit)					
Voltage (VAC)	Temperature (°C)	Frequency Deviation (Hz/ppm)	f_L (MHz)	f_H (MHz)	Compliance
120	-30	0/0	699.14249	715.85443	Within the frequency range of 699 – 716 MHz band EUT Complies.
	-20	0/0	699.14557	715.90135	
	-10	0/0	699.14403	715.86905	
	0	0/0	699.13403	715.89905	
	+10	0/0	699.14095	715.8705	
	+20	0/0	699.12941	715.87674	
	+30	0/0	699.13403	715.8229	
	+40	0/0	699.14018	715.91904	
	+50	0/0	699.13249	715.85059	

LTE B12 Uplink (Fix Unit)					
Temperature (°C)	Voltage (VAC)	Frequency Deviation (Hz/ppm)	f_L (MHz)	f_H (MHz)	Compliance
20	102	0/0	699.14095	715.86136	Within the frequency range of 699 – 716 MHz band EUT Complies.
	138	0/0	699.15095	715.83444	

LTE B12 Uplink (Mobile Unit)					
Temperature (°C)	Voltage (VAC)	Frequency Deviation (Hz/ppm)	f_L (MHz)	f_H (MHz)	Compliance
20	10.2	0/0	699.15556	715.84982	Within the frequency range of 699 – 716 MHz band EUT Complies..
	12.0	0/0	699.1448	715.89212	
	13.8	0/0	699.13403	715.8652	



2.8.9 Sample Test Plot for Downlink



Date: 20 DEC 2016 13:03:49

LTE B12 Downlink f_L Testing - 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: 332633000356 (Fix Unit) / Test Configuration B

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

December 16, 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	22.2 °C
Relative Humidity	56.1. %
ATM Pressure	98.7 kPa



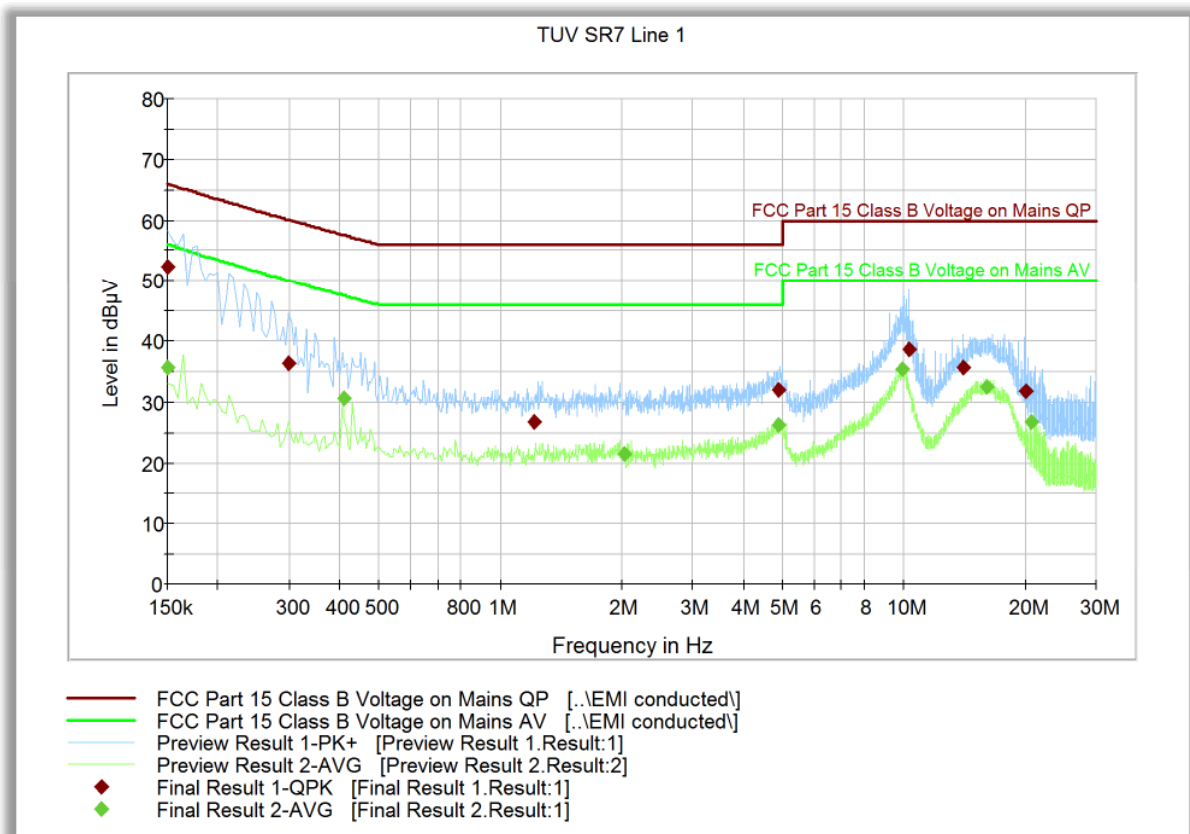
2.9.7 Additional Observations

- The EUT was verified using AC adapter supplied by the manufacturer.
- EUT verified using input voltage of 120VAC 60Hz.
- 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 (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 (db μ V) @ 150kHz			26.2

2.9.9 Test Results - Conducted Emissions Line 1 – Hot



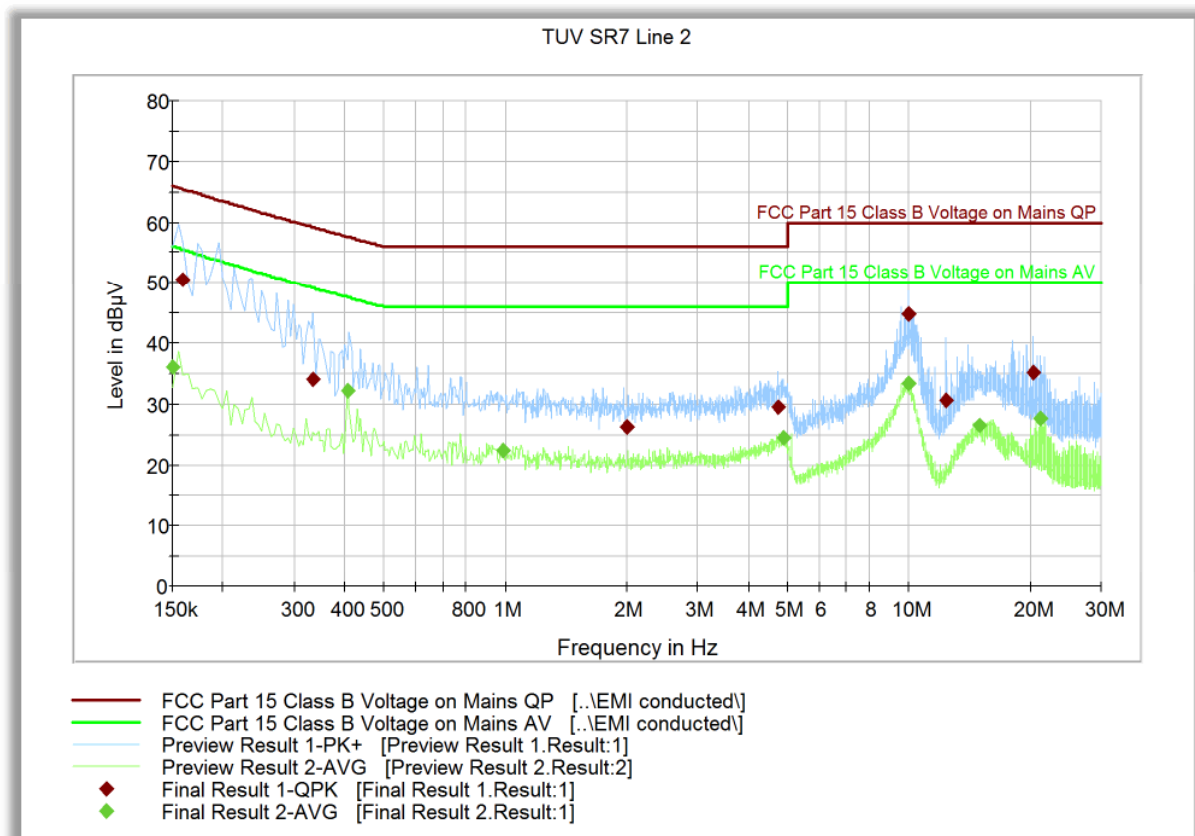
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	52.4	1000.0	9.000	Off	L1	20.2	13.6	66.0
0.298500	36.3	1000.0	9.000	Off	L1	20.0	23.8	60.1
1.212000	26.8	1000.0	9.000	Off	L1	20.0	29.2	56.0
4.893000	31.9	1000.0	9.000	Off	L1	20.1	24.1	56.0
10.266000	38.6	1000.0	9.000	Off	L1	20.2	21.4	60.0
14.001000	35.7	1000.0	9.000	Off	L1	20.2	24.3	60.0
19.995000	31.7	1000.0	9.000	Off	L1	20.4	28.3	60.0
0.150000	52.4	1000.0	9.000	Off	L1	20.2	13.6	66.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.150000	35.6	1000.0	9.000	Off	L1	20.2	20.4	56.0
0.411000	30.7	1000.0	9.000	Off	L1	20.0	16.8	47.5
2.035500	21.6	1000.0	9.000	Off	L1	20.0	24.4	46.0
4.893000	26.4	1000.0	9.000	Off	L1	20.1	19.6	46.0
9.924000	35.3	1000.0	9.000	Off	L1	20.2	14.7	50.0
15.999000	32.6	1000.0	9.000	Off	L1	20.3	17.4	50.0
20.737500	26.6	1000.0	9.000	Off	L1	20.4	23.4	50.0
0.150000	35.6	1000.0	9.000	Off	L1	20.2	20.4	56.0

2.9.10 Test Results - Conducted Emissions Line 2 –Neutral



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.159000	50.6	1000.0	9.000	Off	N	20.2	14.9	65.5
0.334500	34.1	1000.0	9.000	Off	N	20.0	25.0	59.2
1.999500	26.3	1000.0	9.000	Off	N	20.0	29.7	56.0
4.749000	29.6	1000.0	9.000	Off	N	20.1	26.4	56.0
10.000500	44.9	1000.0	9.000	Off	N	20.2	15.1	60.0
12.399000	30.6	1000.0	9.000	Off	N	20.2	29.4	60.0
20.400000	35.1	1000.0	9.000	Off	N	20.4	24.9	60.0
0.159000	50.6	1000.0	9.000	Off	N	20.2	14.9	65.5

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.150000	36.1	1000.0	9.000	Off	N	20.2	19.9	56.0
0.406500	32.3	1000.0	9.000	Off	N	20.0	15.3	47.6
0.987000	22.4	1000.0	9.000	Off	N	20.0	23.6	46.0
4.902000	24.4	1000.0	9.000	Off	N	20.1	21.6	46.0
10.000500	33.3	1000.0	9.000	Off	N	20.2	16.7	50.0
14.982000	26.4	1000.0	9.000	Off	N	20.3	23.6	50.0
21.228000	27.6	1000.0	9.000	Off	N	20.4	22.4	50.0
0.150000	36.1	1000.0	9.000	Off	N	20.2	19.9	56.0



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
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/26/16	10/26/17
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 signalling	
8871	20dB Attenuator	18N10W-20dB	-	INMET	Verified by 7582 and 7608	
Radiated Emissions						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/26/16	10/26/17
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
1016	Pre-amplifier	PAM-0202	187	PAM	10/17/16	10/17/17
1040	EMI Test Receiver	ESU	100133	Rhode & Schwarz	10/07/16	10/07/17
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	Verified by 7582 and 7608	
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7582 and 7608	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7582 and 7608	
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
	AC Power Supply	EW801-2-115	972430001	ELGAR	Verified by 6792	
	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	Preamplifier	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	Preamplifier	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

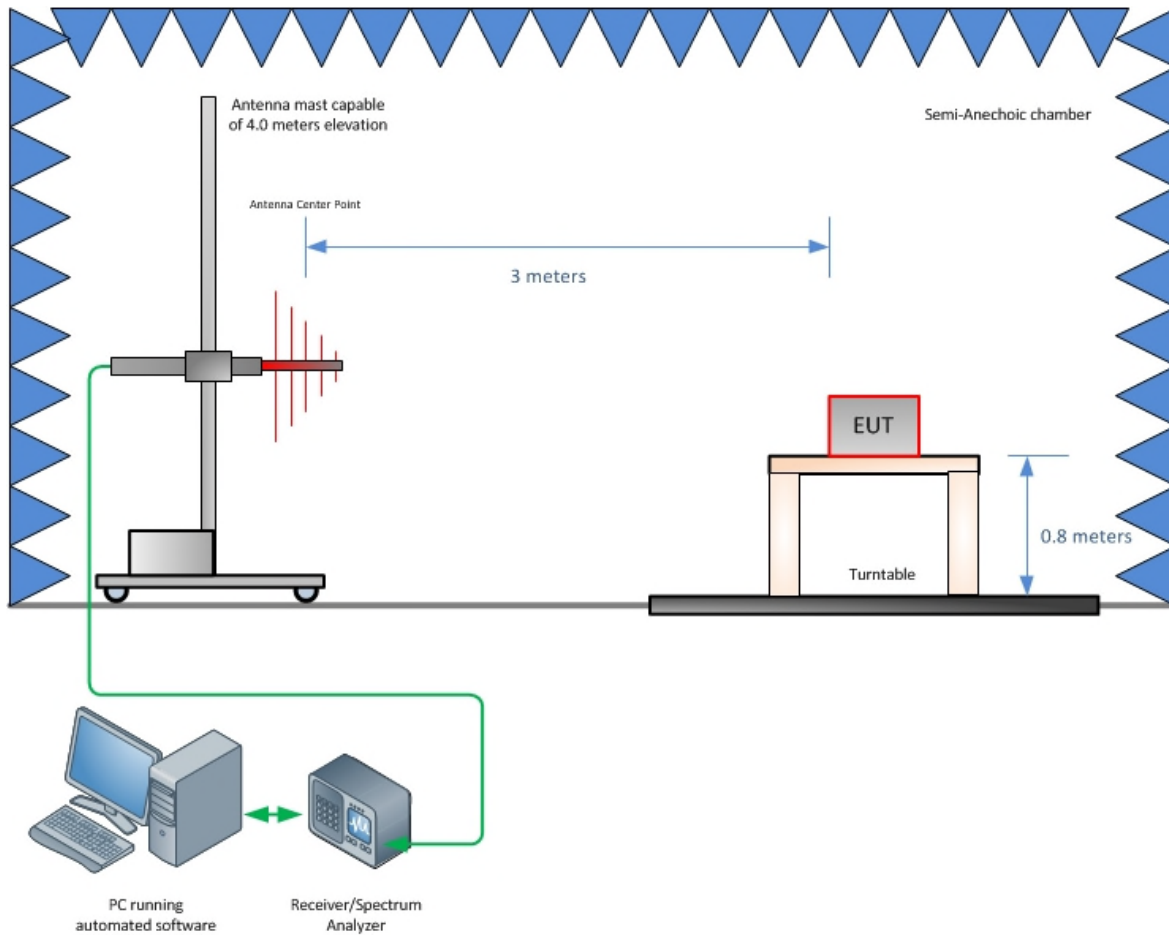
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.72
Coverage Factor (k):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



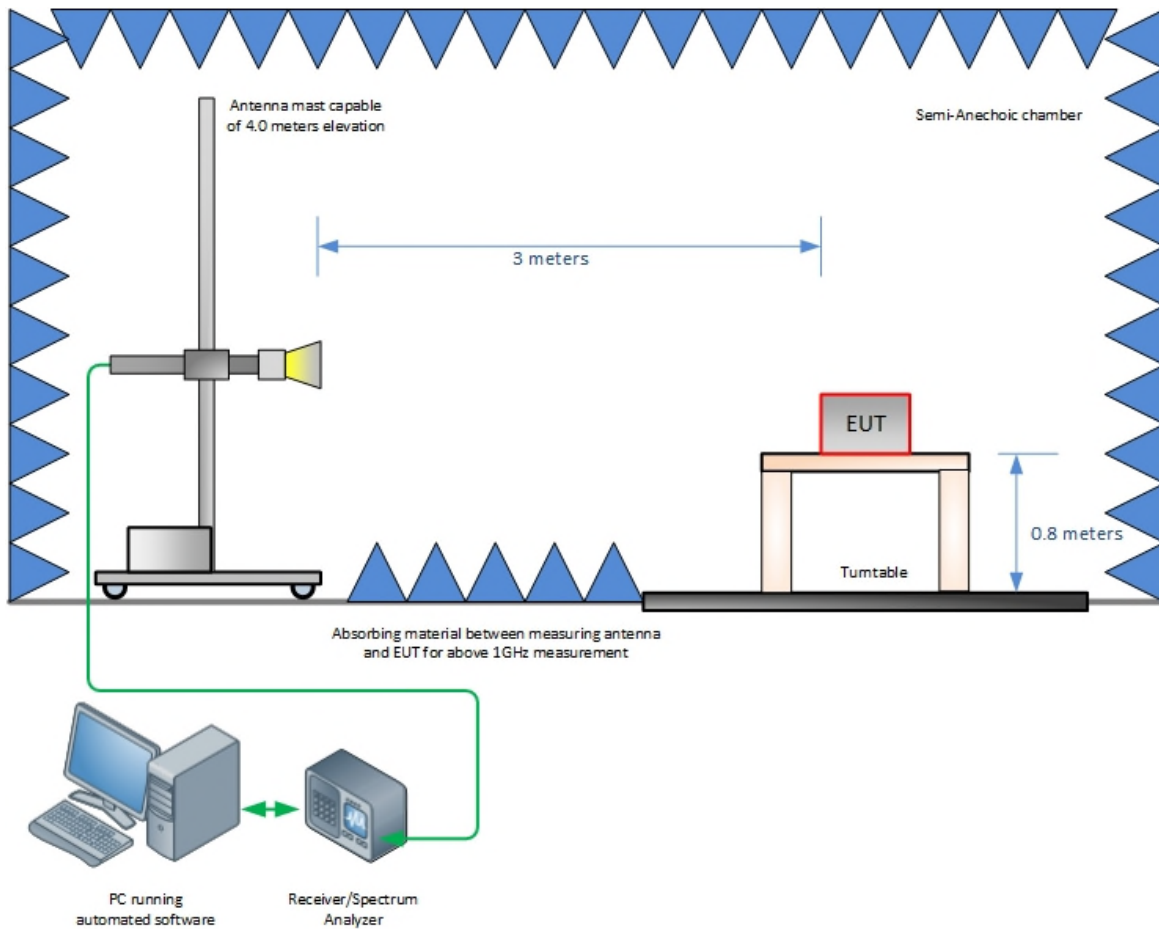
SECTION 4

DIAGRAM OF TEST SETUP

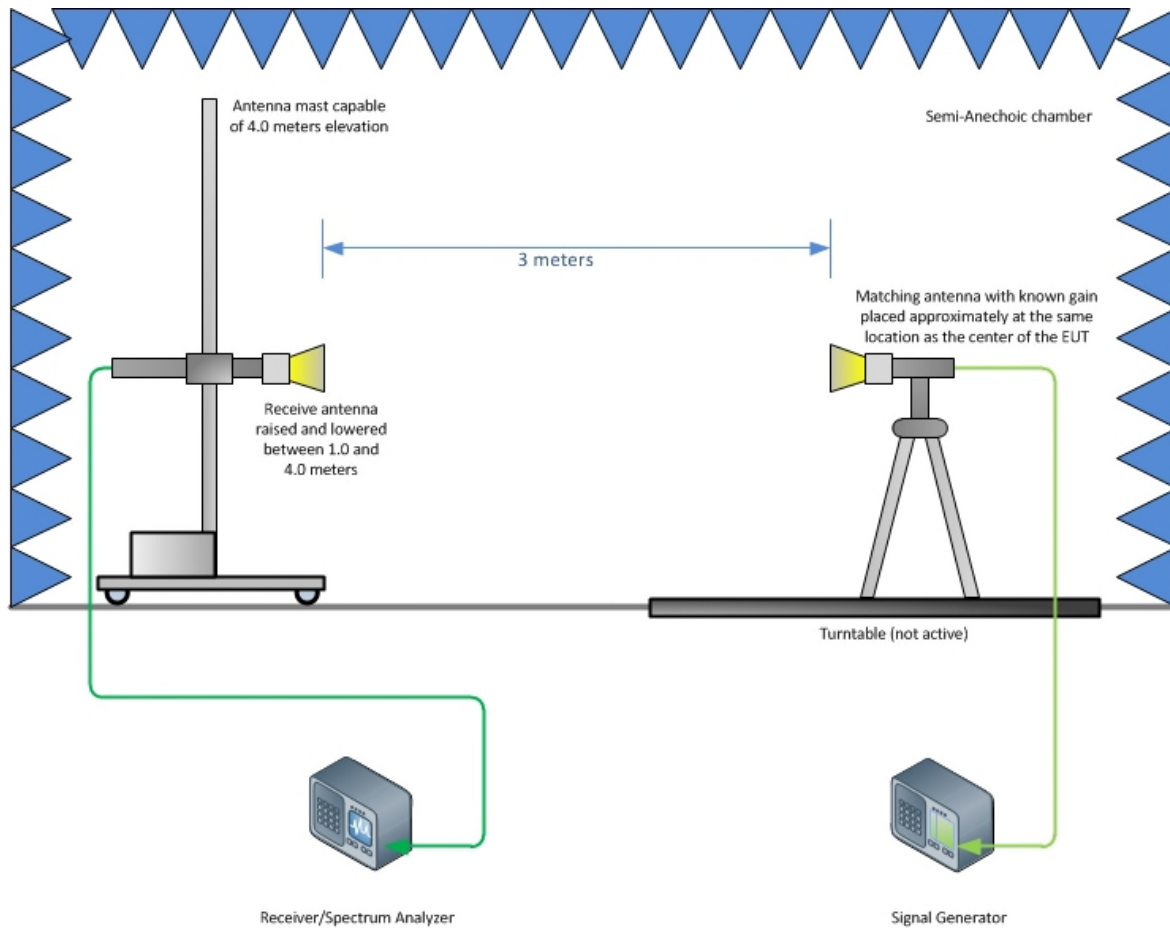
4.1 TEST SETUP DIAGRAM



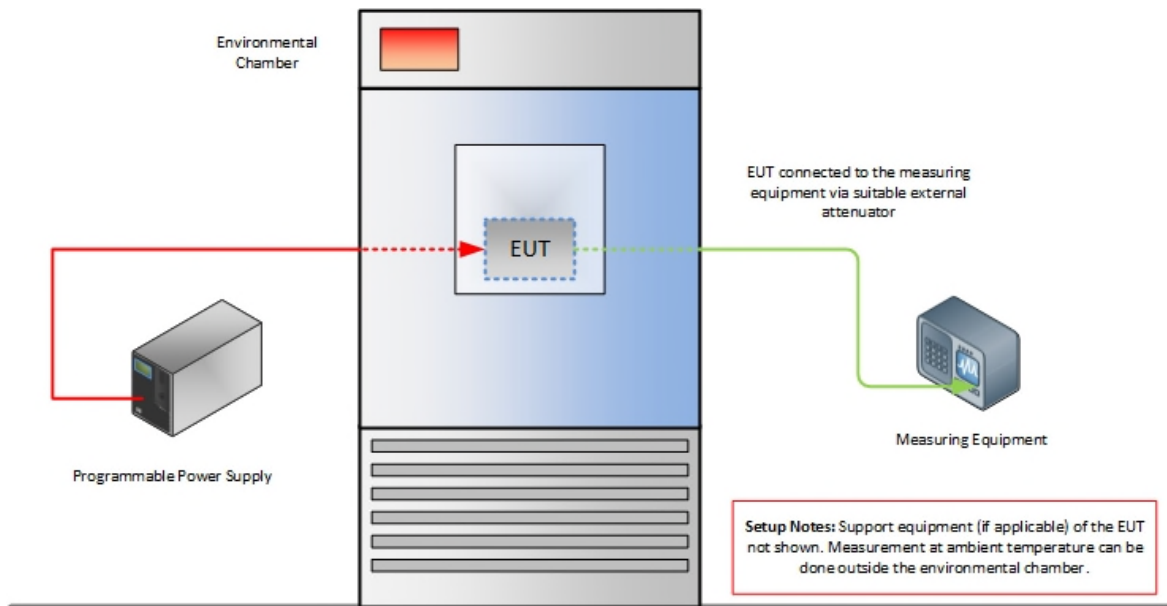
Radiated Emission Test Setup (Below 1GHz)



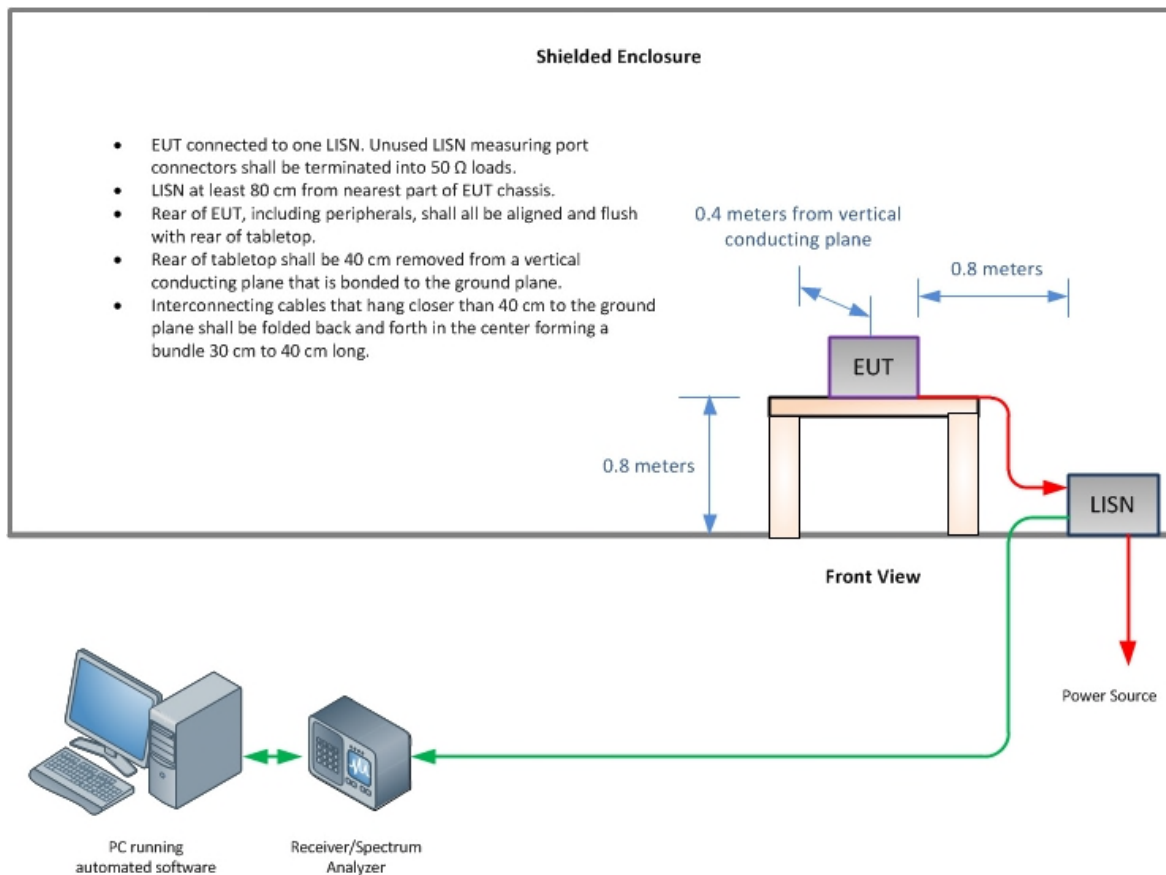
Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz, if applicable)



Frequency Stability Test Configuration



Conducted Emissions Test Configuration (if applicable)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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