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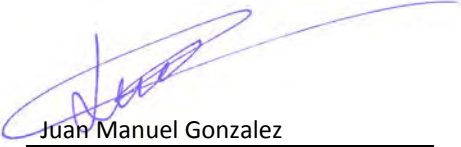
Application for Grant of Equipment Authorization of the
Novatel Wireless
MC730 USB Modem

FCC CFR 47 Part 2, Part 22 and 24
ISED RSS-Gen and RSS-132 and RSS-133

Report No. SD72123529-0117A

April 2017



REPORT ON	Radio Testing of the Novatel Wireless USB Modem
TEST REPORT NUMBER	SD72123529-0117A
PREPARED FOR	Novatel Wireless 9605 Scranton Rd., Suite 300 San Diego, CA 92121
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PREPARED BY	 Ferdinand S. Custodio Name Authorized Signatory Title: EMC/Senior Wireless Test Engineer
APPROVED BY	 Juan Manuel Gonzalez Name Authorized Signatory Title: EMC SL Manager West Region
DATED	<u>April 10, 2017</u>



Revision History

SD72123529-0117A Novatel Wireless MC730 USB Modem					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
04/10/17	Initial Release				Juan M Gonzalez



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Novatel Wireless
MC730 USB Modem



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Novatel Wireless USB Modem to the requirements of the following:

- FCC CFR 47 Part 2, Part 22 and 24
- ISED RSS-Gen and RSS-132 and RSS-133.

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	Novatel Wireless
Product Marketing Name	USB730L
Model Number(s)	MC730
FCC ID Number	3229A-MC730
IC Number	PKRNVWMC730
Serial Number(s)	1073-0319 and 1073-0286
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC CFR 47 Part 2, Part 22 and 24 (October 1, 2016). • RSS-132 - Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz (Issue 3, January 2013). • RSS-133 – 2 GHz Personal Communications Services (Issue 6, January 2013). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 4, November 2014).
Start of Test	February 15, 2017
Finish of Test	March 14, 2017
Name of Engineer(s)	Ferdinand S. Custodio
Related Document(s)	• 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. • SRSP-510 Issue 5 February 2009 Technical Requirements for Personal Communications Services (PCS) in the Bands 1850-1915 MHz and 1930-1995 MHz



- MC730_Tune Up Procedure_NA_Rev1.0.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, Part 22 and 24 with cross-reference to the corresponding ISSED RSS standard is shown below.

Section	FCC Part Sections(s)	RSS Section(s)	Test Description	Result
2.1	2.1046	RSS-132(5.4),RSS-133(6.4)	Transmitter Conducted Output Power	Compliant
2.2	22.913(a)(2), 2.1046	RSS-132(5.4),SRSP-503(5.1.3)	Effective Radiated Power	Compliant
2.3	24.232(c),2.1046	RSS-133(6.4),SRSP-510(5.1.2)	Equivalent Isotropic Radiated Power	Compliant
2.4	2.1049,22.917(b), 24.238(b)	RSS-Gen 6.6	Occupied Bandwidth	Compliant
2.5	24.232(d)	RSS-133(6.4)	Peak-Average Ratio	Compliant
2.6	2.1051,22.917(a), 24.238(a)	RSS-132(5.5),RSS-133(6.5)	Band Edge/Conducted Spurious Emissions	Compliant
2.7	Clause 7 of KDB971168 D01 v02r02		Field Strength Of Spurious Radiation	Compliant
2.8	2.1055,22.355,24.235	RSS-132(5.3),RSS-133(6.3)	Frequency Stability	Compliant
2.9		RSS-132(5.6),RSS-133(6.6)	Receiver Spurious Emissions	N/A*
2.10		RSS-Gen 8.8	Power Line Conducted Emission	Compliant

N/A - Not applicable. EUT does not fall to any category defined as Receiver under Section 5 of RSS-Gen Issue 4.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Novatel Wireless MC730 USB730L USB Modem as shown in the photograph below. The EUT supports 2G, 3G and 4G technologies.



Equipment Under Test



1.3.2 EUT General Description

EUT Description USB Modem

Model Number(s) MC730

Rated Voltage 5 ±0.25 VDC (USB)

Mode Verified See Capability table below **except** LTE Band 4 and 13

Capability	
LTE	Band 2, 4, 5 and 13
CDMA 1xRTT	BC0 and BC1
1xEVDO	BC0 and BC1
GPRS	850 and 1900
EGPRS	850 and 1900
WCDMA/HSPA	Band 2 and 5

Primary Unit (EUT) ☐ Production
☒ Pre-Production

Antenna Type Monopole

Manufacturer NVTL

Part Number 12023208

Antenna Gain	Band Class	Frequency Band	Reference Frequency	Antenna Gain
	LTE B2	1900MHz	1880MHz	1.23dBi
	LTE B5	800Mhz	820MHz	1.07dBi
	WCDMA B5	850MHz	840MHz	1.36dBi
	WCDMA B2	1900MHz	1880MHz	1.23dBi
	GSM850	850MHz	840Mhz	1.36dBi
	GSM1900	1900MHz	1860MHz	1.04dBi
	CDMA BC0	850MHz	840MHz	1.36dBi
	CDMA BC1	1900MHz	1910MHz	1.15dBi

1.3.3 Transmit Frequency Table

Mode	Tx Frequency (MHz)	Emission Designator	Max. Conducted Power (dBm)	Calculated Power (dBm)
CDMA2000 BC0	824-849	1M41F9W	24.5	23.71 ERP
1xEV-DO BC0 Rel 0	824-849	1M42F9W	24.5	23.71 ERP
1xEV-DO BC0 Rel A	824-849	1M42F9W	24.5	23.71 ERP
CDMA2000 BC1	1850-1910	1M42F9W	24.0	25.15 EIRP
1xEV-DO BC1 Rel 0	1850-1910	1M42F9W	24.0	25.15 EIRP
1xEV-DO BC1 Rel A	1850-1910	1M42F9W	24.0	25.15 EIRP
GSM850 (GPRS)	824-849	307KGXW	33.0	32.31 ERP
GSM1900 (GPRS)	1850-1910	314KGXW	28.0	31.04 EIRP
GSM850 (EGPRS)	824-849	307KG7W	31.0	26.21 ERP
GSM1900 (EGPRS)	1850-1910	314KG7W	27.0	27.04 EIRP
WCDMA/HSPA Band 5	824-849	4M70F9W	24.0	23.21 ERP
WCDMA/HSPA Band 2	1850-1910	4M72F9W	23.0	24.23 EIRP

Technology / Mode	Modulation	Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	Max. Conducted Power (dBm)	Calculated Power (dBm)
LTE Band 2	QPSK	1.4	Bandwidth not supported by the carrier			
		3				
		5	1850-1910	4M91G7D	24.0	25.23 EIRP
		10	1850-1910	9M86G7D	24.0	25.23 EIRP
		15	1850-1910	14M4G7D	24.0	25.23 EIRP
		20	1850-1910	18M9G7D	24.0	25.23 EIRP



LTE Band 2	16QAM	1.4	Bandwidth not supported by the carrier			
		3				
		5	1850-1910	4M91W7D	24.0	25.23 EIRP
		10	1850-1910	9M86W7D	24.0	25.23 EIRP
		15	1850-1910	14M4G7D	24.0	25.23 EIRP
		20	1850-1910	18M9G7D	24.0	25.23 EIRP
LTE Band 5	QPSK	1.4	Bandwidth not supported by the carrier			
		3				
		5	824-849	4M96G7D	24.0	22.92 ERP
		10	824-849	9M80G7D	24.0	22.92 ERP
	16QAM	1.4	Bandwidth not supported by the carrier			
		3				
		5	824-849	4M96W7D	24.0	22.92 ERP
		10	824-849	9M80W7D	24.0	22.92 ERP

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement. The EUT has an optional external antenna port, this port was used for all antenna conducted port measurements.
B	Radiated test setup. Since the EUT is a computer peripheral, the test was performed with the integral antenna. This configuration also ensures connectivity with the call box.

1.4.2 EUT Exercise Software

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

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
DLink	USB Dock Stand	1.0 meter USB 2.0 extension dock stand cradle cable USB A to A male to female
htc	AC Adapter	Model TC U50 P/N79H00098-01M Output: 5VDC @1A (USB)
Rhode & Schwarz	Support Wideband Radio Communication Tester	M/N CMW500 S/N 1201.0002k50/103829
Lenovo	Support Laptop (T410S)	P/N 0A31972 S/N R9-92MH0 10/11 (used for AC Conducted Emissions test)
LiteOn Technology Corporation	AC Adapter for Support Laptop	Model 42T4430 S/N 11S42T4430Z1ZGWE27AA9X REV G (used for AC Conducted Emissions test)

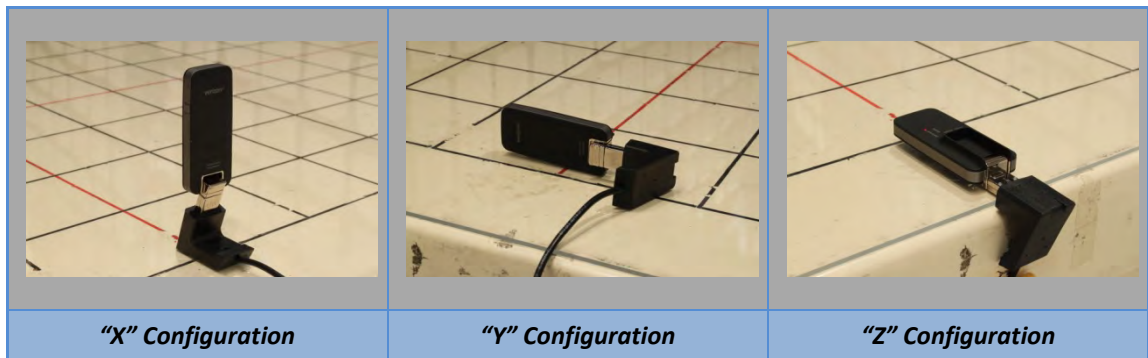
1.4.4 EUT Worst Case Configuration

There was no specific worst-case configuration used in this test report. Since there are several variables per technology, worst case configuration was established per individual test cases. Please refer to each individual test case for details. The table below however represents the established worst case settings for the call box (CMW500) used for establishing connection with the EUT:

Mode	Configuration
CDMA 1xRTT	1 st Service Option was SO 55 (Loopback) with Radio Configuration of 3/3 H-PSK. Expected power mode at Max Power

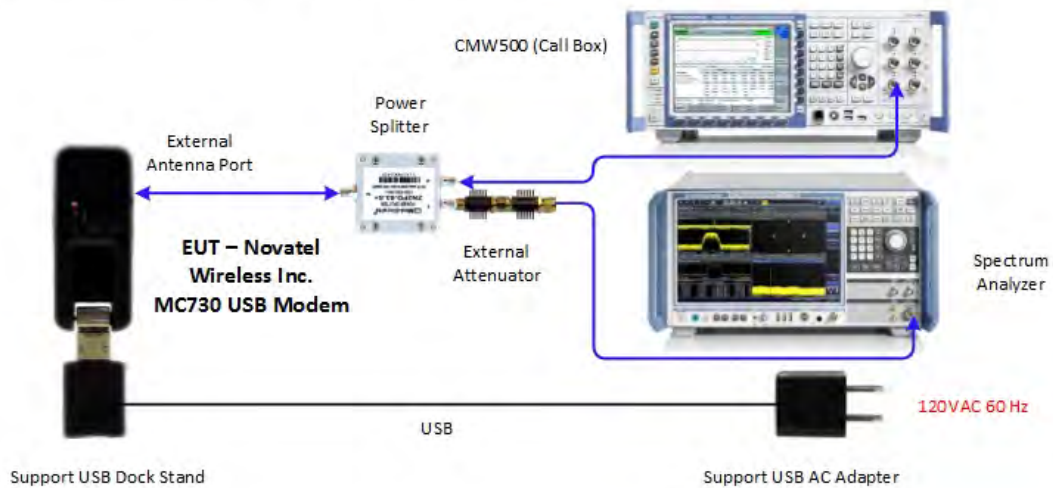
1xEV-DO	Application is Forward Test with expected power mode at Max Power
GPRS	Test Mode A / e2e:max UL, Auto Slot configuration
EGPRS	Test Mode A / e2e:max UL, Auto Slot configuration
WCDMA/HSPA	Active TPC are All 1. Connection Setup was Test Mode/RMC
LTE Band 5	Active TPC Setup is Max Power, scheduling is RMC
LTE Band 2	Active TPC Setup is Max Power, scheduling is RMC

EUT is a computer peripheral. For radiated measurements X, Y and Z orientations were verified. Worst case transmit pattern was observed when EUT is in "Z" configuration. Verifications performed using "Z" configuration.

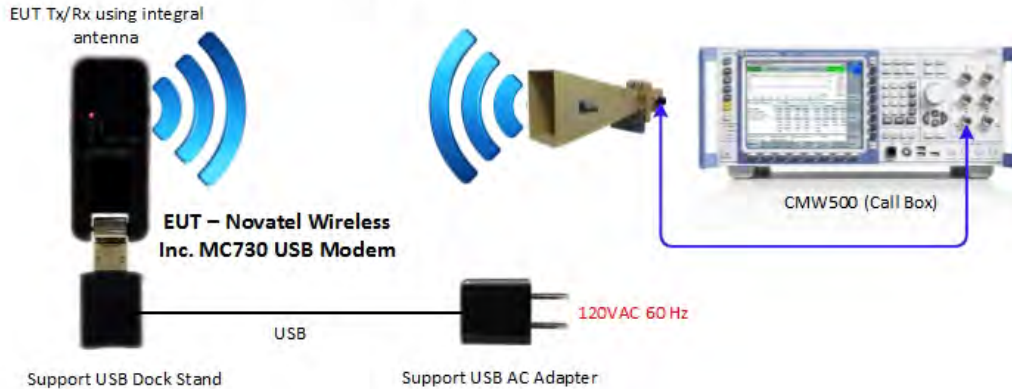


1.4.5 Simplified Test Configuration Diagram

Antenna Conducted Port Test Configuration



Radiated Emissions Test Configuration



For Illustration Purpose Only
 Not to scale and images presented may not
 represent the actual EUT or support equipment



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 1073-0286 and 1073-0319		
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 and ANSI/TIA-603-C-2004 – Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards.

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 (IC) 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.

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

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

1.9.4 NCC (National Communications Commission - US0102)

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

1.9.5 VCCI – Registration No. A-0230

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

1.10 SAMPLE CALCULATIONS

1.10.1 GSM Emission Designator

Emission Designator = 250KGXW
 GSM BW = 250 kHz
 G = Phase Modulation
 X = Cases not otherwise covered
 W = Combination (Audio/Data)

1.10.2 WCDMA Emission Designator

Emission Designator = 4M15F9W
 WCDMA BW = 4.15 MHz
 F = Frequency Modulation
 9= Composite Digital Info
 W = Combination (Audio/Data)

1.10.3 CDMA Emission Designator

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

1.10.4 LTE Emission Designator (QPSK)

Emission Designator = 4M51G7D
 G = Phase Modulation
 7= Quantized/Digital Info
 D = Combination (Audio/Data)

1.10.5 LTE Emission Designator (16QAM)

Emission Designator = 4M52W7D
 W = Frequency Modulation
 7= Quantized/Digital Info
 D = Combination (Audio/Data)

1.10.6 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



1.10.7 Spurious Radiated Emission – Substitution Method

Example = 84dB μ V/m @ 1413 MHz (numerical sample only)

The field strength reading of 84dB μ V/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 84dB μ V/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
Novatel Wireless
MC730 USB Modem



2.1 TRANSMITTER CONDUCTED OUTPUT POWER

2.1.1 Specification Reference

Part 2.1046 (a) and (c)

2.1.2 Standard Applicable

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

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

2.1.3 Equipment Under Test and Modification State

Serial No: 1073-0286 and 1073-0319 / Test Configuration A

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

February 15 to 17, 2017/FSC

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	24.7 - 25.3 °C
Relative Humidity	41.2 – 44.5 %
ATM Pressure	99.1 – 99.9 kPa

2.1.7 Additional Observations

- This is a conducted test using an average power meter.
- Please refer to Section 1.4.4 for details regarding call box connection configuration.
- The following correction factors were used as a power meter offset for the power splitter, external attenuator, RF Cable Assembly Path Loss (provided by the manufacturer) and cable used:

Frequency	Correction Factor
830 MHz	26.6 dB
1880 MHz	27.5 dB

- Measurements were verified within the manufacturer declared Tune-Up procedure.

2.1.8 Test Results

CDMA 1xRTT				
Band	Channel	Frequency (MHz)	Max Power Average (dBm)	Mobile Station Control (SO) / (RC)
Cell (BC0)	1013	824.70	24.3	55 / (3/3)
	384	836.52	24.3	55 / (3/3)
	777	848.31	24.4	55 / (3/3)
PCS (BC1)	25	1851.25	23.1	55 / (3/3)
	600	1880.00	23.9	55 / (3/3)
	1175	1908.75	23.0	55 / (3/3)

CDMA – 1xEvDO Release 0				
Band	Channel	Frequency (MHz)	Max Power Average (dBm)	Access Terminal Control
Cell (BC0)	1013	824.70	23.7	Forward
	384	836.52	23.7	Forward
	777	848.31	23.9	Forward
PCS (BC1)	25	1851.25	23.0	Forward
	600	1880.00	23.1	Forward
	1175	1908.75	23.0	Forward



CDMA – 1xEVDO Release A				
Band	Channel	Frequency (MHz)	Max Power Average (dBm)	Access Terminal Control
Cell (BC0)	1013	824.70	23.7	Forward
	384	836.52	23.8	Forward
	777	848.31	23.6	Forward
PCS (BC1)	25	1851.25	23.0	Forward
	600	1880.00	23.1	Forward
	1175	1908.75	23.0	Forward

GPRS (CS SMS)			
Band	Channel	Frequency (MHz)	Max Power Average (dBm)
GPRS850	128	824.2	31.9
	190	836.6	31.9
	251	848.8	32.1
GPRS1900	512	1850.2	28.8
	661	1880.0	29.4
	810	1909.8	29.4

EGPRS (PS Connect)			
Band	Channel	Frequency (MHz)	Max Power Average (dBm)
EGPRS850	128	824.2	25.0
	190	836.6	25.2
	251	848.8	25.3
EGPRS1900	512	1850.2	24.4
	661	1880.0	24.5
	810	1909.8	24.2



WCDMA/HSPA			
Band	Channel	Frequency (MHz)	Max Power Average (dBm)
Band 5	4132	826.4	22.7
	4183	836.6	23.6
	4233	846.6	23.4
Band 2	9262	1852.4	22.4
	9400	1880.0	22.9
	9538	1907.6	22.0

LTE Band 5						
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)
QPSK	1.4 MHz	1	0	20407	824.7	22.4
		1	0	20525	836.5	22.6
		1	0	20643	848.3	22.7
	3 MHz	1	0	20415	825.5	22.2
		1	0	20525	836.5	22.5
		1	0	20635	847.5	22.7
	5 MHz	1	0	20425	826.5	21.9
		1	0	20525	836.5	22.9
		1	0	20625	846.5	22.7
	10 MHz	1	0	20450	829.0	23.0
		1	0	20525	836.5	22.3
		1	0	20600	844.0	22.3
LTE Band 5						
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)
16QAM	1.4 MHz	1	0	20407	824.7	21.6
		1	0	20525	836.5	21.7
		1	0	20643	848.3	21.7



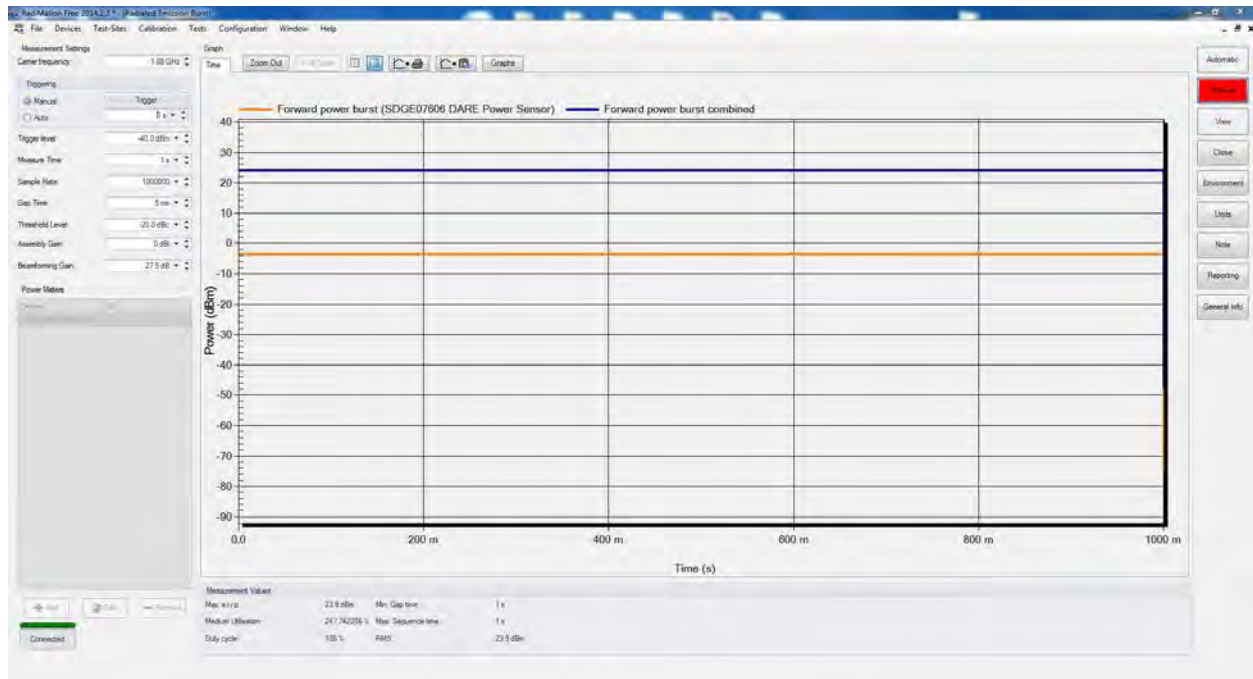
	3 MHz	1	0	20415	825.5	21.5
		1	0	20525	836.5	21.7
		1	0	20635	847.5	21.9
	5 MHz	1	0	20425	826.5	21.1
		1	0	20525	836.5	21.6
		1	0	20625	846.5	21.8
	10 MHz	1	0	20450	829.0	21.9
		1	0	20525	836.5	21.5
		1	0	20600	844.0	21.4

LTE Band 2						
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)
QPSK	1.4 MHz	1	0	18607	1850.7	22.4
		1	0	18900	1880.0	22.8
		1	0	19193	1909.3	22.4
	3 MHz	1	0	18615	1851.5	22.5
		1	0	18900	1880.0	22.8
		1	0	19185	1908.5	22.5
	5 MHz	1	0	18625	1852.5	22.6
		1	0	18900	1880.0	23.0
		1	0	19175	1907.5	22.6
	10 MHz	1	0	18650	1855.0	22.8
		1	0	18900	1880.0	23.3
		1	0	19150	1905.0	23.0
	15 MHz	1	0	18675	1857.5	22.7
		1	0	18900	1880.0	22.8
		1	0	19125	1902.5	22.7
	20 MHz	1	0	18700	1860.0	22.8
		1	0	18900	1880.0	23.0
		1	0	19100	1900.0	22.6

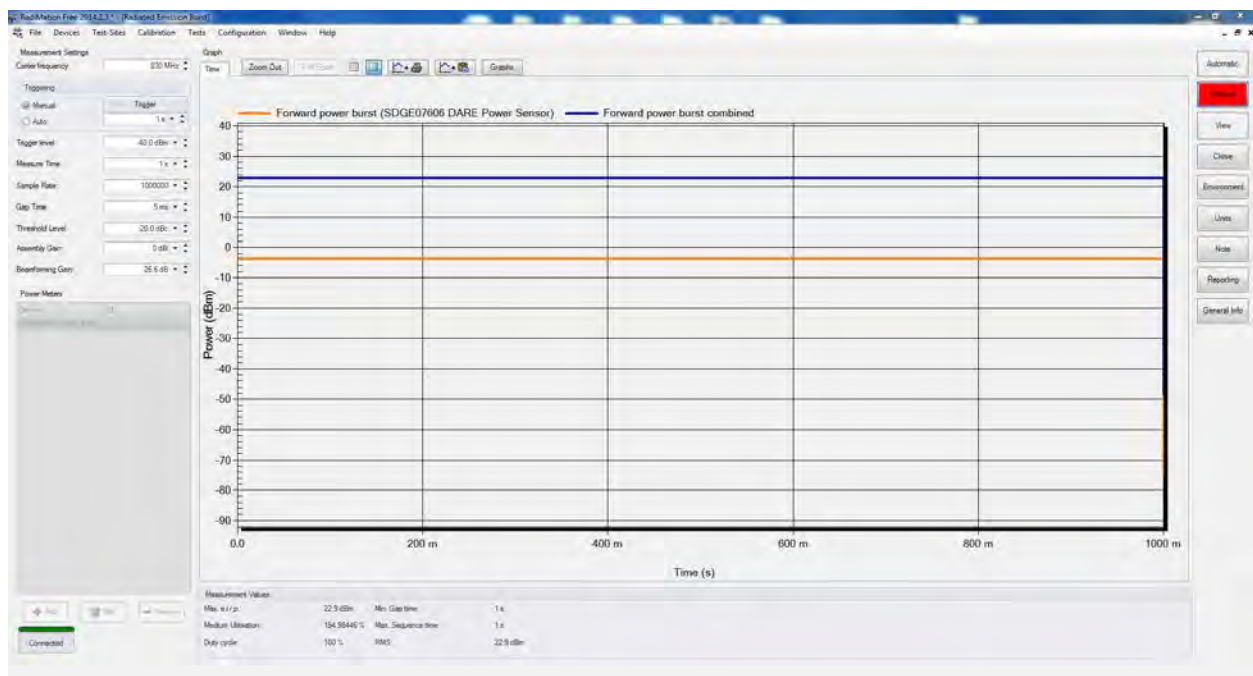


LTE Band 2						
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)
16QAM	1.4 MHz	1	0	18607	1850.7	21.5
		1	0	18900	1880.0	21.8
		1	0	19193	1909.3	21.5
	3 MHz	1	0	18615	1851.5	21.6
		1	0	18900	1880.0	22.0
		1	0	19185	1908.5	21.5
	5 MHz	1	0	18625	1852.5	21.9
		1	0	18900	1880.0	22.1
		1	0	19175	1907.5	21.8
	10 MHz	1	0	18650	1855.0	21.8
		1	0	18900	1880.0	22.4
		1	0	19150	1905.0	22.0
	15 MHz	1	0	18675	1857.5	21.9
		1	0	18900	1880.0	22.0
		1	0	19125	1902.5	21.6
	20 MHz	1	0	18700	1860.0	21.8
		1	0	18900	1880.0	22.1
		1	0	19100	1900.0	21.6

2.1.9 Sample Test Plot



Mid Channel CDMA PCS Band



Mid Channel LTE Band 5



2.2 EFFECTIVE RADIATED POWER

2.2.1 Specification Reference

Part 22 Subpart H §22.913(a)(2)

2.2.2 Standard Applicable

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

2.2.3 Equipment Under Test and Modification State

Serial No: 1073-0286 and 1073-0319/ Test Configuration A

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

March 15, 2017/FSC

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:

$$ERP = P_T + G_T - L_C - 2.15dB$$

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: 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 = $P_T + G_T - L_C - 2.15dB$
= 24.0 dBm (conducted output power) + 1.07 dBi (antenna gain) – 0 (cable loss was programmed as an offset in the power meter) -2.15
= 22.92 dBm

2.2.7 Test Results

Compliant. See attached table.



Technology	Conducted Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	ERP Limit (dBm)
LTE Band 2	24.0	1.23		
LTE Band 4	23.0	1.21		
LTE Band 13	24.0	0.83		
LTE Band 5	24.0	1.07	22.92	38.45
CDMA BC0	24.5	1.36	23.71	38.45
CDMA BC1	24.0	1.15		
WCDMA/HSPA B2	23.0	1.23		
WCDMA/HSPA B5	24.0	1.36	23.21	38.45
GPRS 850	33.0	1.36	32.21	38.45
EDGE 850	27.0	1.36	26.21	38.45
GPRS 1900	30.0	1.04		
EDGE 1900	26.0	1.04		



2.3 EQUIVALENT ISOTROPIC RADIATED POWER

2.3.1 Specification Reference

Part 24 Subpart E §24.234(c)

2.3.2 Standard Applicable

Part 24 Subpart E §24.234(c)

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

RSS 132 5.2

The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts. Refer to SRSP-503 for base station e.i.r.p. limits.

SRSP-510 5.1.2

Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p. The equipment shall employ means to limit the power to the minimum necessary for successful communication.

2.3.3 Equipment Under Test and Modification State

Serial No: 1073-0286 and 1073-0319/Test Configuration A

2.3.4 Date of Calculation/Initial of test personnel who performed the calculation

March 15, 2017/FSC

2.3.5 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.

2.3.6 Sample Computation

$$\begin{aligned}\text{EIRP} &= P_T + G_T - L_C \\ &= 24.0 \text{ (conducted output power)} + 1.23 \text{ (antenna gain)} - 0 \text{ (cable loss was programmed as an offset in the power meter)} \\ &= 22.92 \text{ dBm}\end{aligned}$$



2.3.7 Test Results

Compliant. See attached table.

Technology	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)
LTE Band 2	24.0	1.23	25.23	33.0
LTE Band 4	23.0	1.21		
LTE Band 13	24.0	0.83		
LTE Band 5	24.0	1.07		
CDMA BC0	24.5	1.36		
CDMA BC1	24.0	1.15	25.15	33.0
WCDMA/HSPA B2	23.0	1.23	24.23	33.0
WCDMA/HSPA B5	24.0	1.36		
GPRS 850	33.0	1.36		
EDGE 850	27.0	1.36		
GPRS 1900	30.0	1.04	31.04	33.0
EDGE 1900	26.0	1.04	27.04	33.0



2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1049
FCC 47 CFR Part 22, Clause 22.917(b)
FCC 47 CFR Part 24, Clause 24.238(b)
RSS-GEN 4.6.1

2.4.2 Standard Applicable

The transmitted signal bandwidth shall be reported as the 99% emission bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. 26dB Bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated by at least 26 dB below the transmitter power.

2.4.3 Equipment Under Test and Modification State

Serial No: 1073-0286 / Test Configuration A

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

March 07, 2017/FSC

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	23.5 °C
Relative Humidity	31.8 %
ATM Pressure	99.7 kPa

2.4.7 Additional Observations

- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- The RBW was set between 1% to 5% of the anticipated OBW while the VBW was 3X RBW.
- For 1xEV-DO only the worst case bandwidth between Release 0 and Release A presented.
- For GSM, only the worst case bandwidth between GPRS and EGPRS presented.
- For LTE, only the worst case bandwidth between 16QAM and QPSK presented.
- The SA built-in emission bandwidth measurement feature is utilized. The power level setting was set to 99% while "x dB" was set to -26.

2.4.8 Test Results

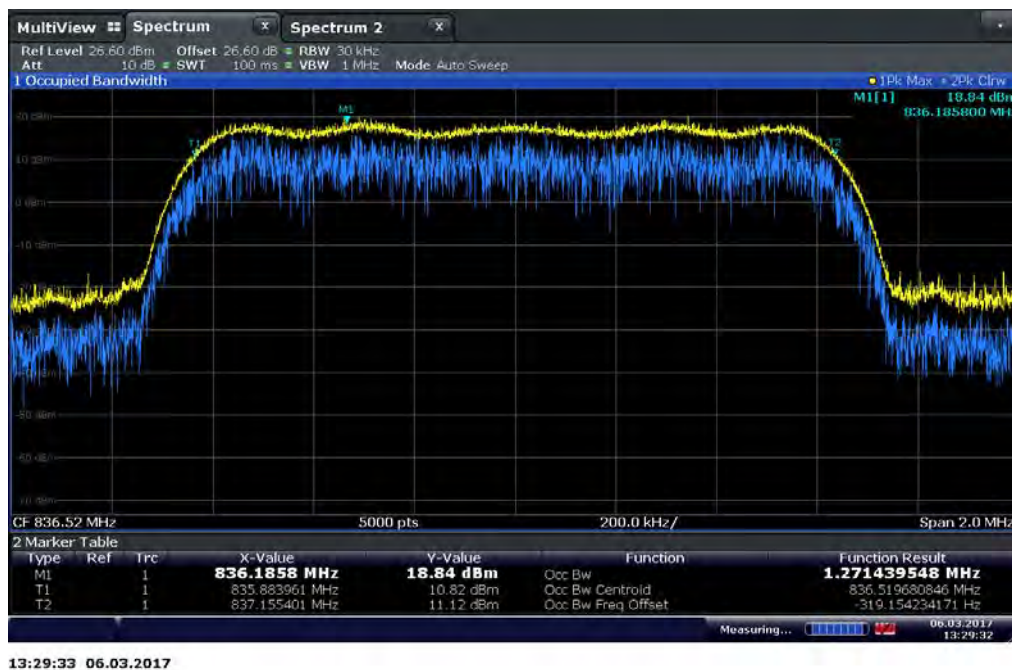
Mode	Band	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
CDMA2000	BC 0	1013	824.70	1.27	1.41
		384	836.52	1.27	1.41
		777	848.31	1.27	1.41
	BC 1	25	1851.25	1.27	1.41
		600	1880.00	1.27	1.42
		1175	1908.75	1.27	1.42
1xEV-DO (Release 0 / Release A)	BC 0	1013	824.70	1.27	1.41
		384	836.52	1.27	1.42
		777	848.31	1.27	1.41
	BC 1	25	1851.25	1.27	1.42
		600	1880.00	1.27	1.42
		1175	1908.75	1.27	1.42
GPRS/EGPRS	850 MHz	128	824.2	0.243	0.307
		190	836.6	0.244	0.299
		251	848.8	0.244	0.288
	1900 MHz	512	1850.2	0.244	0.314
		661	1880.0	0.243	0.302
		810	1909.8	0.245	0.301
WCDMA/HSPA	Band 5	4132	826.4	4.141	4.67
		4183	836.6	4.131	4.66
		4233	846.6	4.141	4.70
	Band 2	9262	1852.4	4.145	4.70
		9400	1880.0	4.145	4.72
		9538	1907.6	4.144	4.70



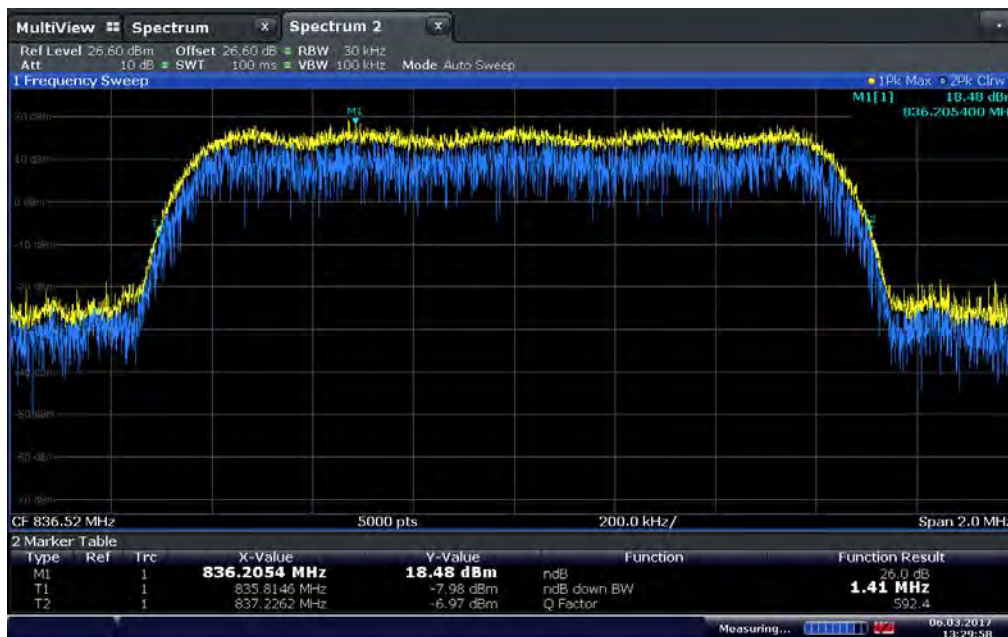
Mode	Bandwidth	Channel	Frequency (MHz)	OBW (MHz)	-26dB BW (MHz)
LTE Band 5	1.4 MHz	20407	824.7	Not supported by the Carrier	
		20525	836.5		
		20643	848.3		
	3 MHz	20415	825.5		
		20525	836.5		
		20635	847.5		
	5 MHz	20425	826.5	4.501	4.96
		20525	836.5	4.503	4.88
		20625	846.5	4.496	4.93
	10 MHz	20450	829.0	8.975	9.67
		20525	836.5	8.967	9.68
		20600	844.0	8.986	9.80
LTE Band 2	1.4 MHz	18607	1850.7	Not supported by the Carrier	
		18900	1880.0		
		19193	1909.3		
	3 MHz	18615	1851.5		
		18900	1880.0		
		19185	1908.5		
	5 MHz	18625	1852.5	4.49	4.89
		18900	1880.0	4.49	4.85
		19175	1907.5	4.49	4.91
	10 MHz	18650	1855.0	8.96	9.86
		18900	1880.0	8.97	9.58
		19150	1905.0	8.95	9.78
	15 MHz	18675	1857.5	13.37	14.15
		18900	1880.0	13.43	14.40

	20 MHz	19125	1902.5	13.38	14.26
		18700	1860.0	17.82	18.92
		18900	1880.0	17.84	18.91
		19100	1900.0	17.83	18.72

2.4.9 Sample Test Plots

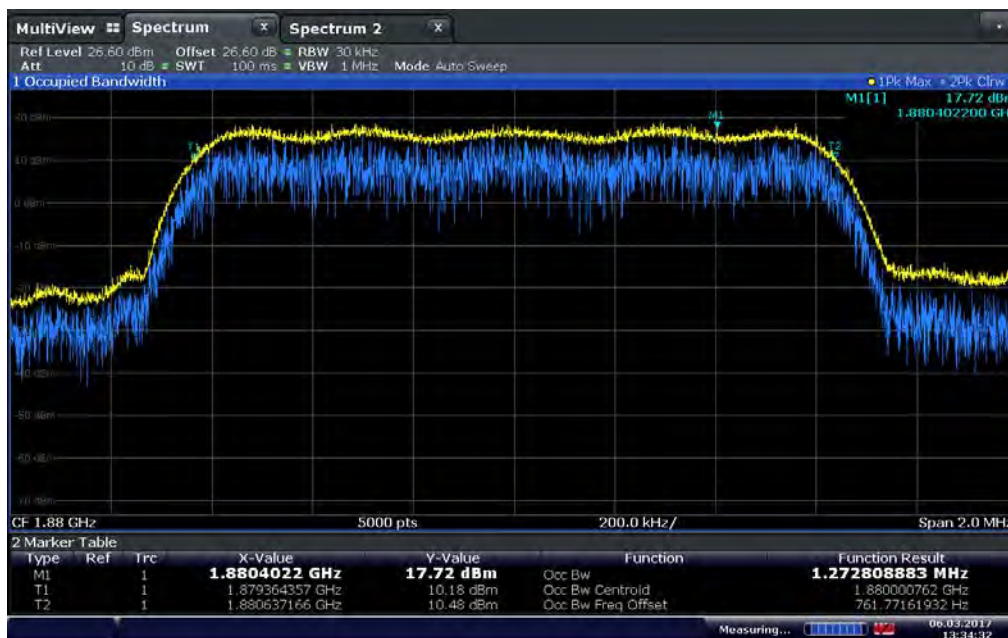


CDMA BC0 99% Power Bandwidth



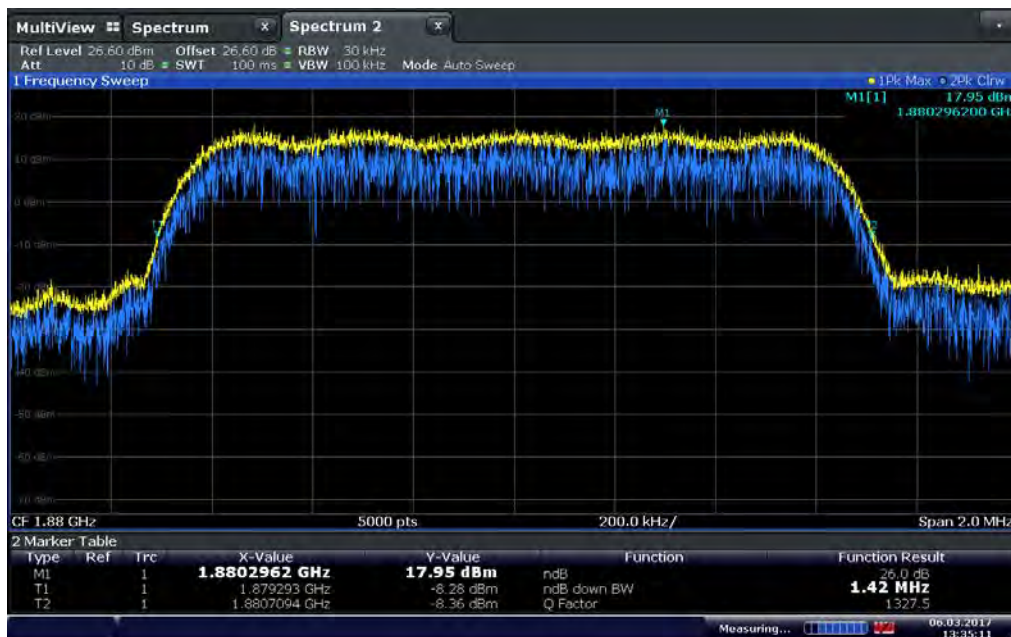
13:29:58 06.03.2017

CDMA BC0 OBW (-26 dB)



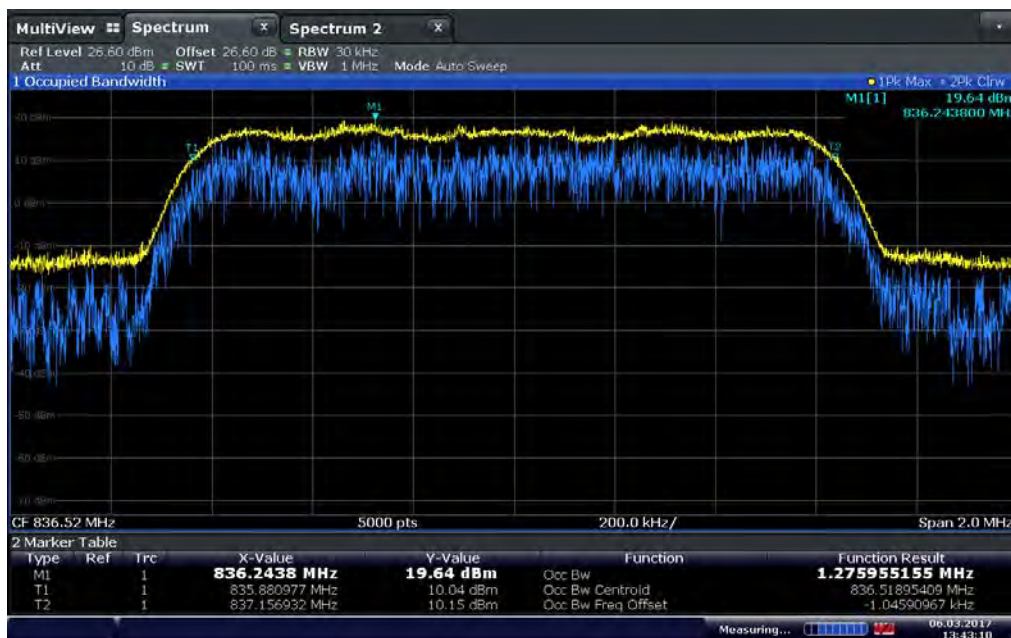
13:34:33 06.03.2017

CDMA BC1 99% Power Bandwidth



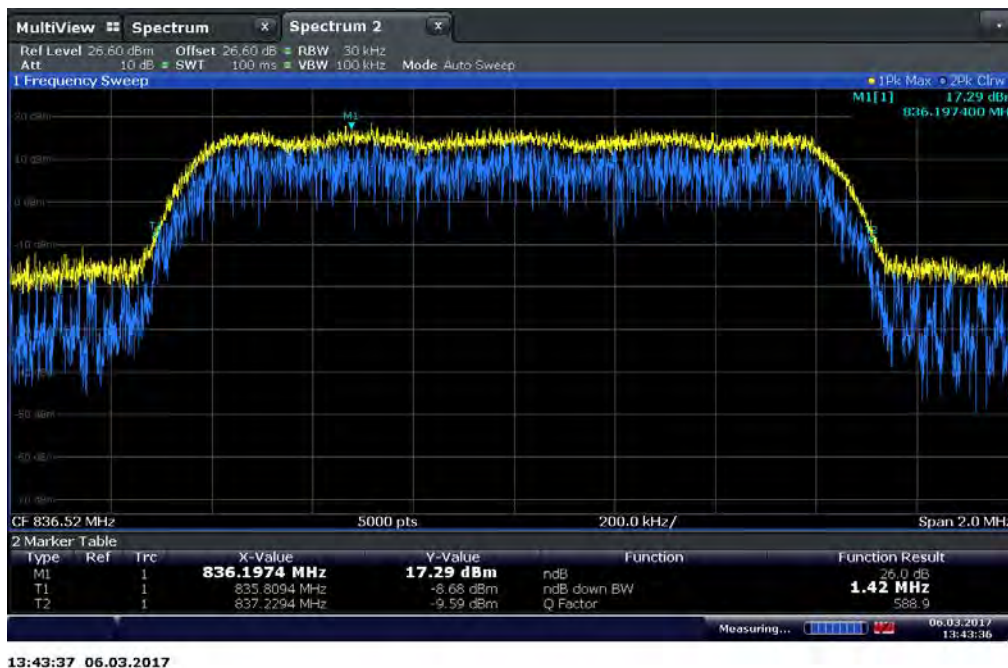
13:35:12 06.03.2017

CDMA BC1 OBW (-26 dB)

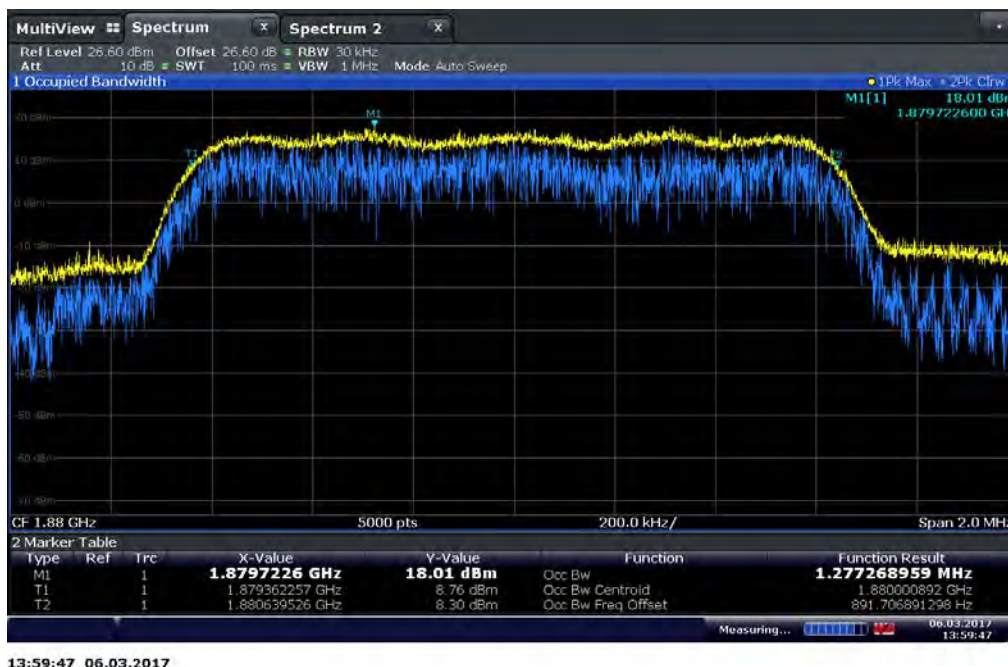


13:43:10 06.03.2017

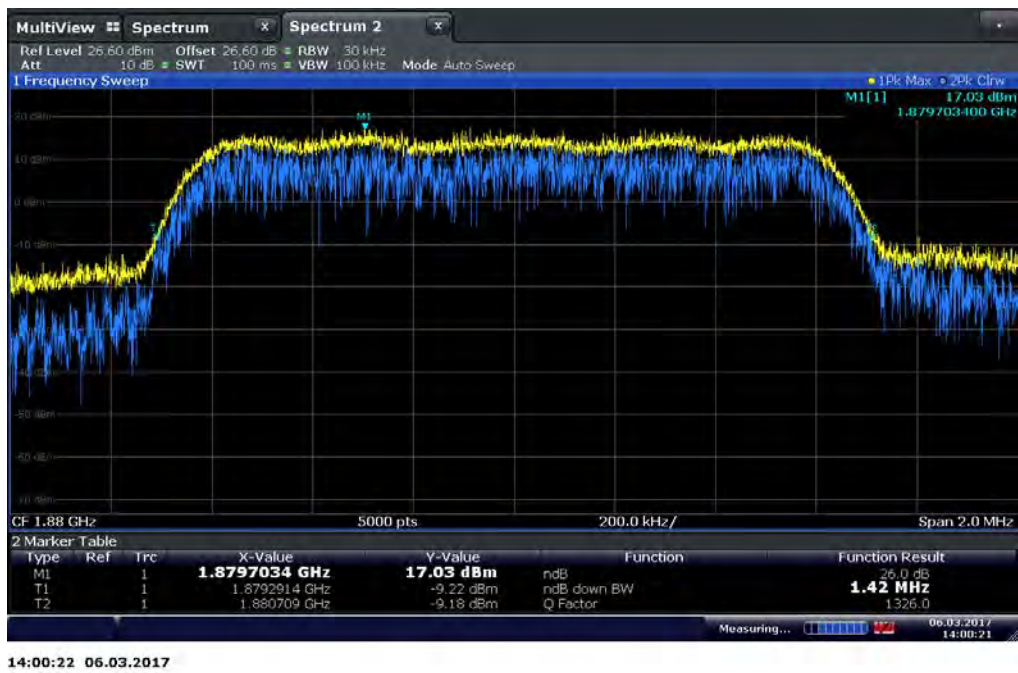
1xEV-DO BC0 99% Power Bandwidth



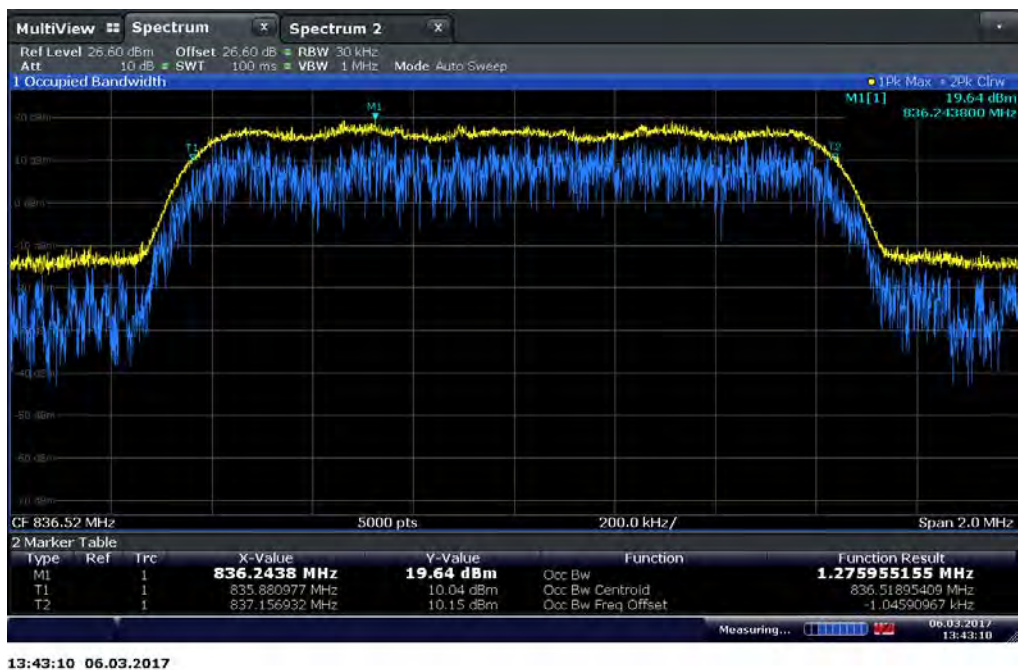
1xEV-DO BC0 OBW (-26 dB)



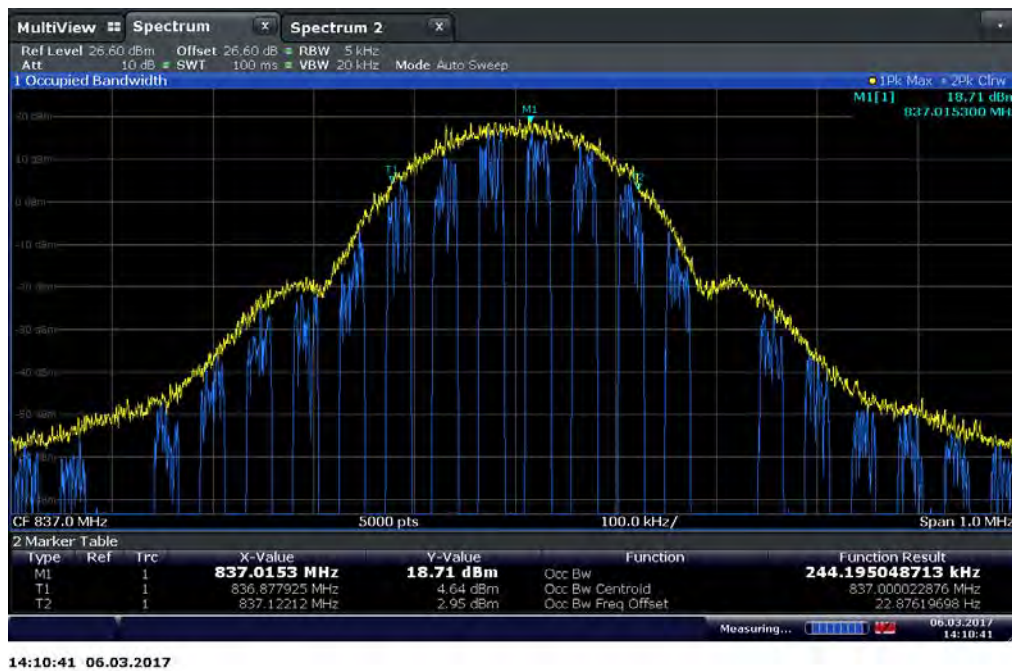
1xEV-DO BC1 99% Power Bandwidth



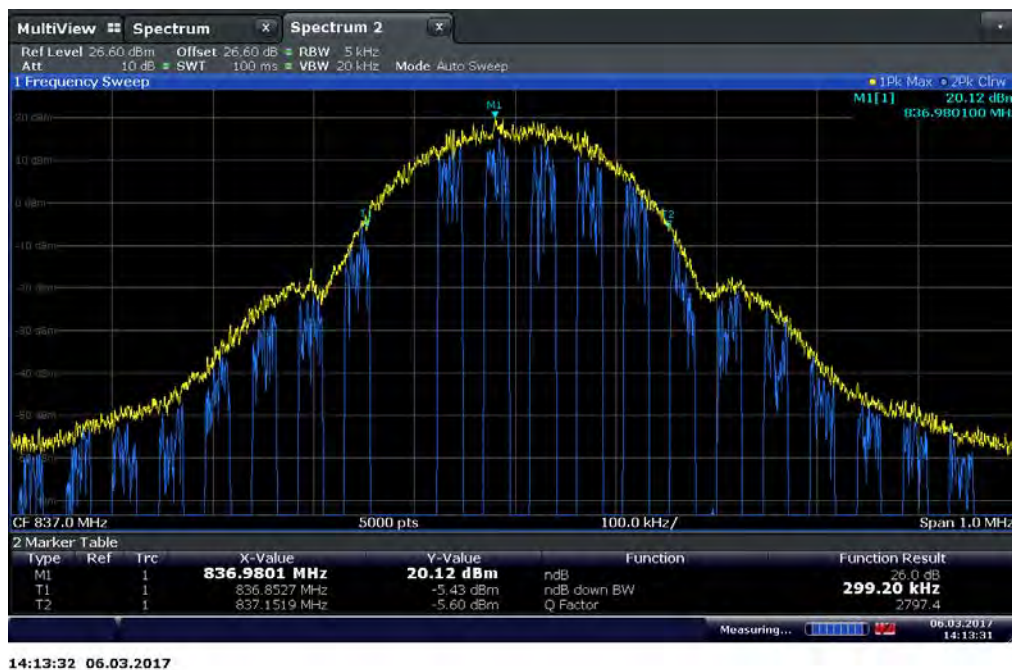
1xEV-DO BC1 OBW (-26 dB)



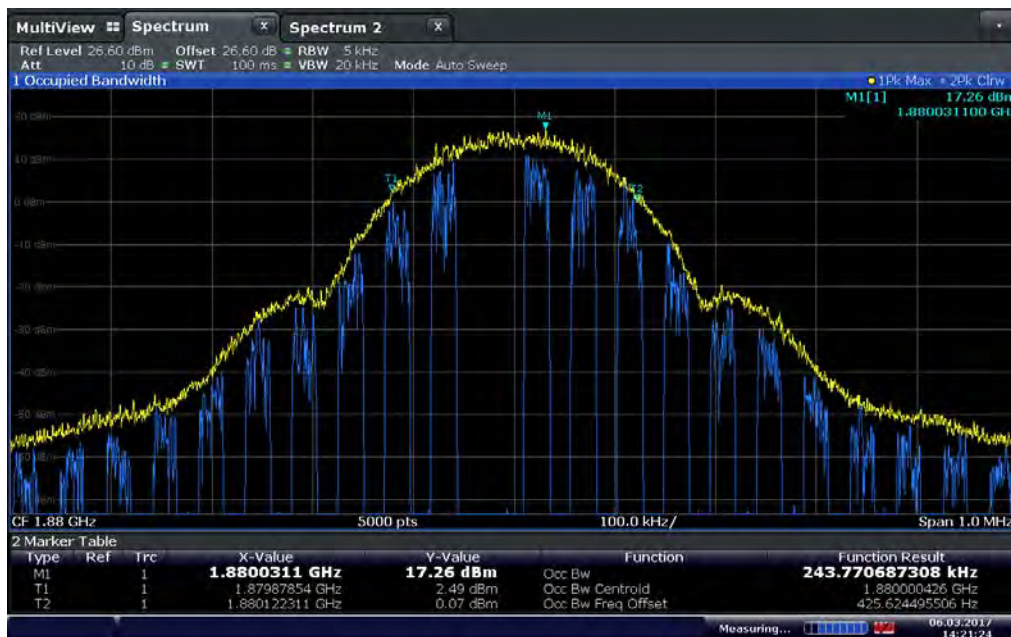
1xEV-DO BC0 99% Power Bandwidth



GPRS/EGPRS850 OBW (-26 dB)

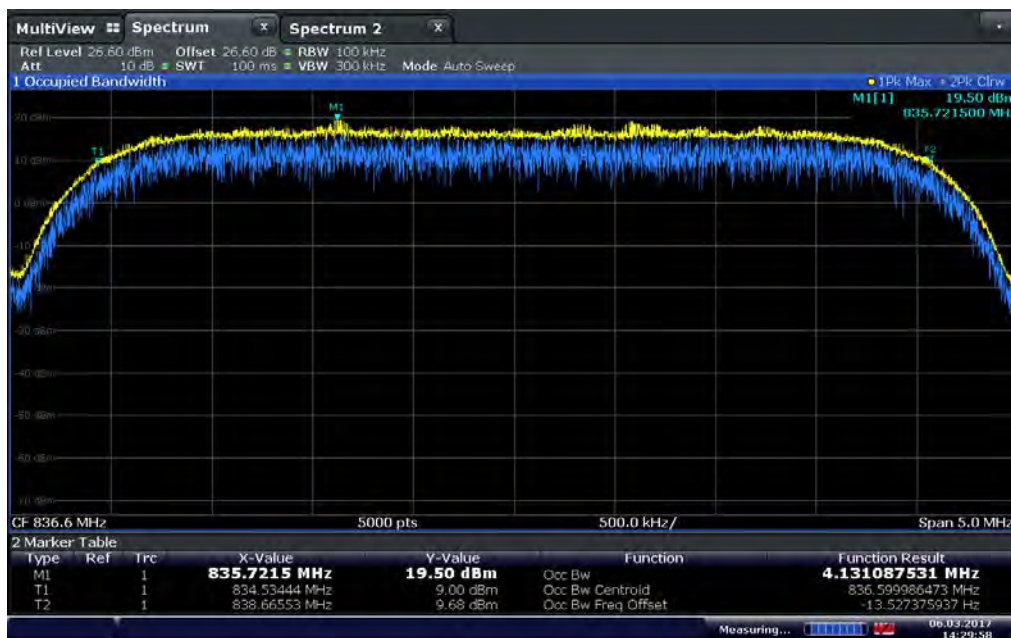


GPRS/EGPRS850 99% Power Bandwidth



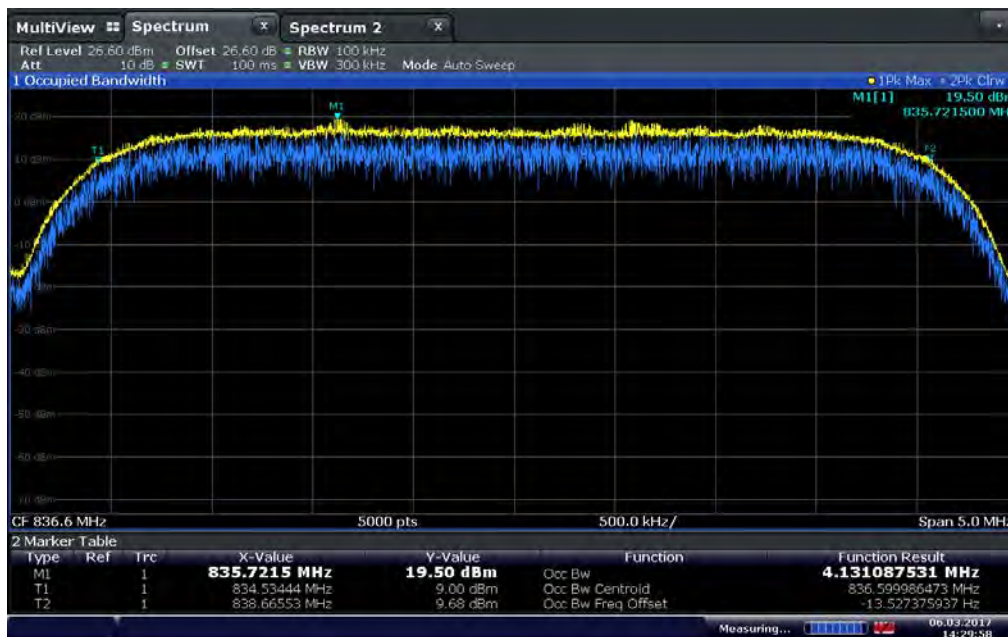
14:21:24 06.03.2017

GPRS/EGPRS1900 OBW (-26 dB)



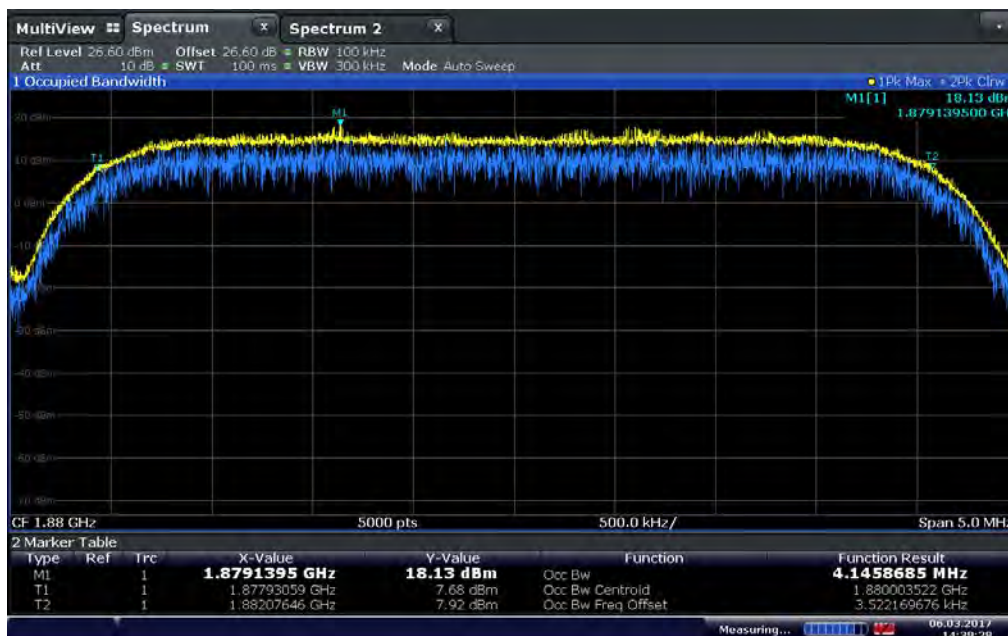
14:29:58 06.03.2017

WCDMA/HSPA B5 99% Power Bandwidth



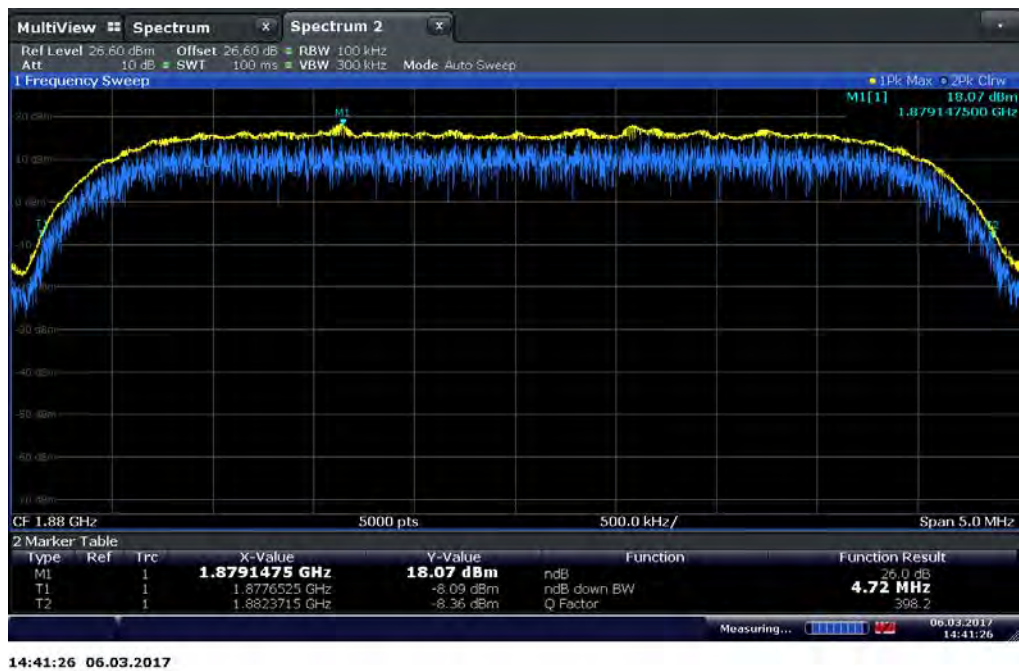
14:29:58 06.03.2017

WCDMA/HSPA B5 OBW (-26 dB)

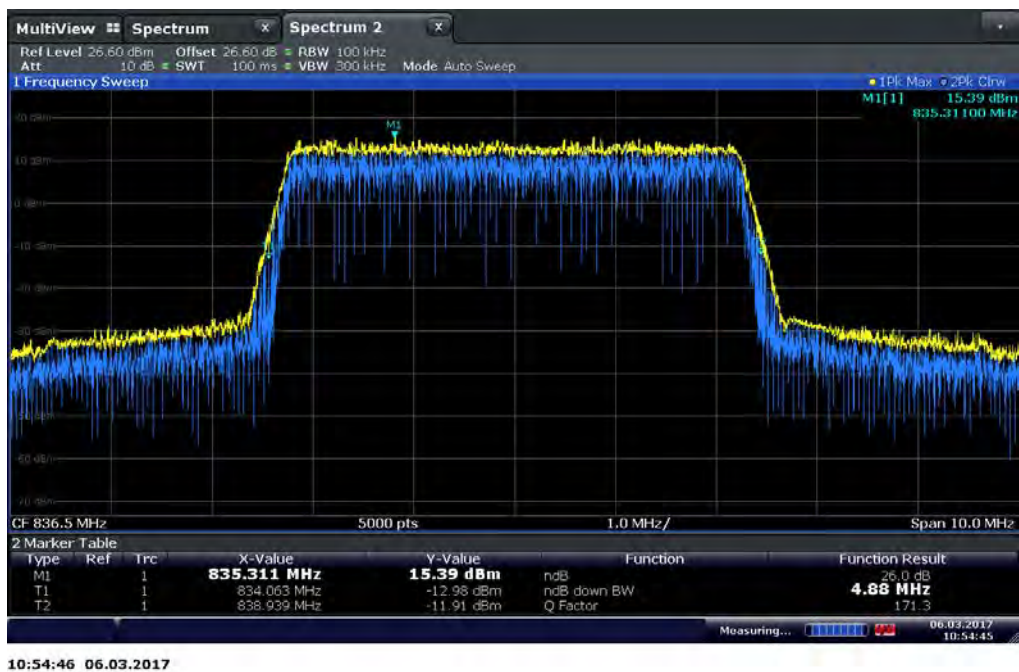


14:39:29 06.03.2017

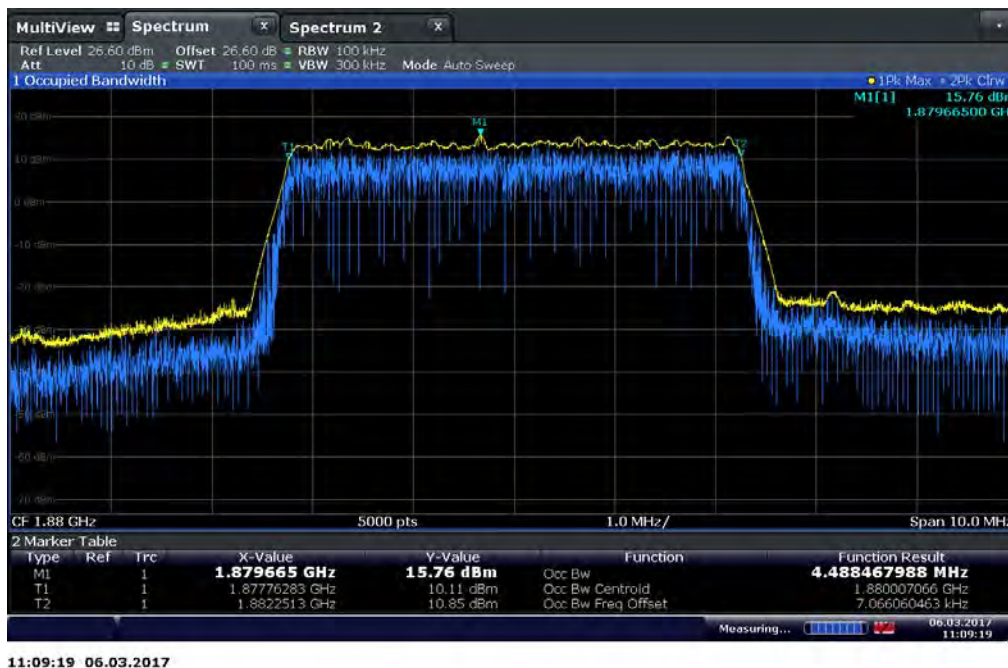
WCDMA/HSPA B2 99% Power Bandwidth



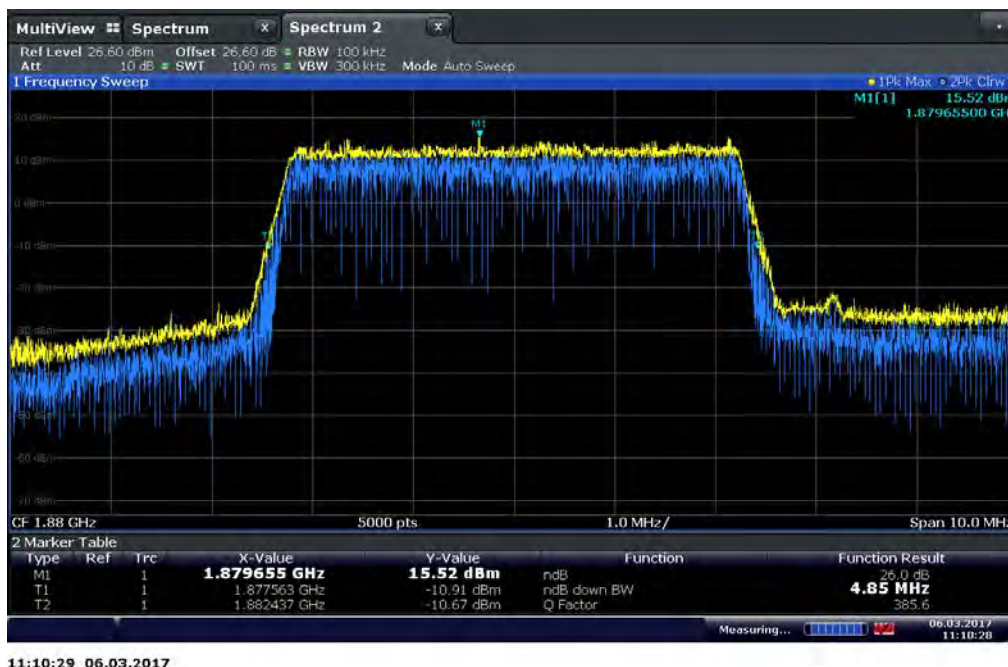
WCDMA/HSPA B2 OBW (-26 dB)



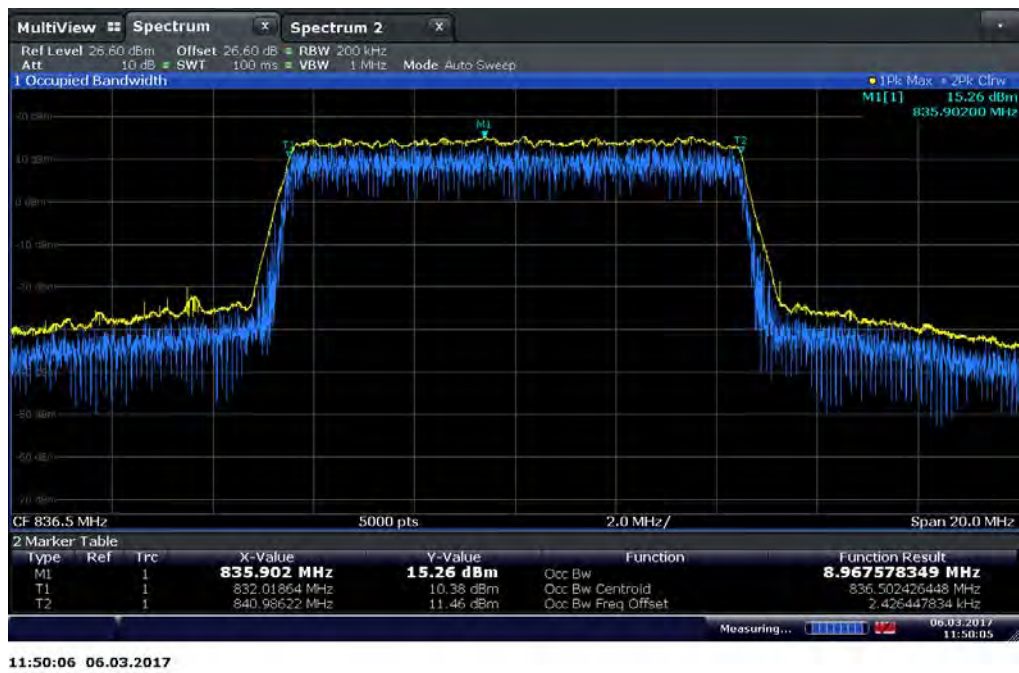
LTE Band 5 5MHz OBW (-26 dB)



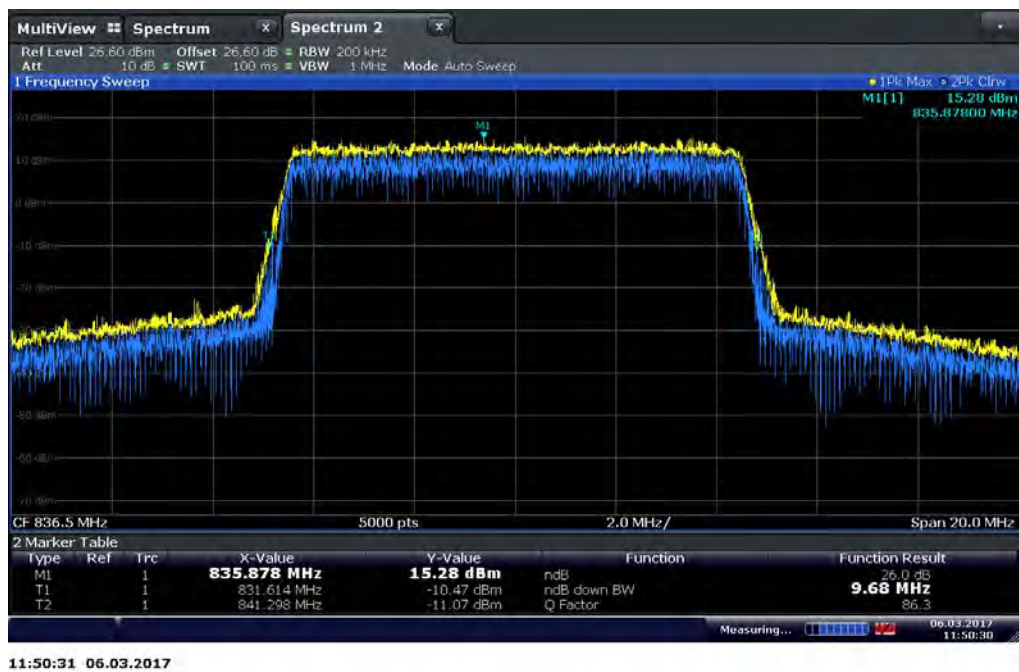
LTE Band 2 5MHz 99% Power Bandwidth



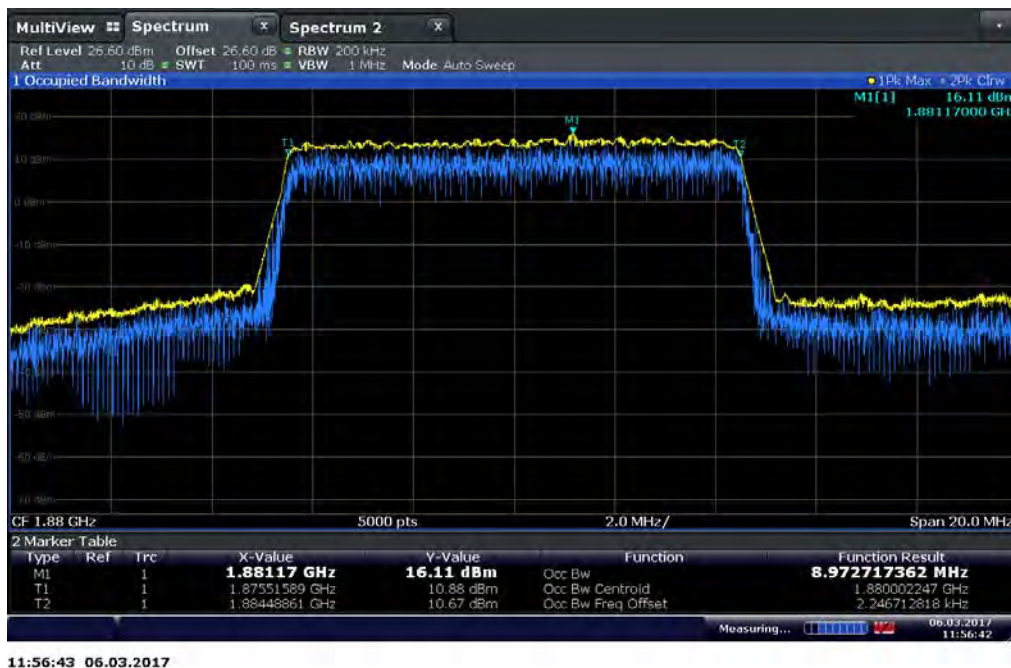
LTE Band 2 5MHz OBW (-26 dB)



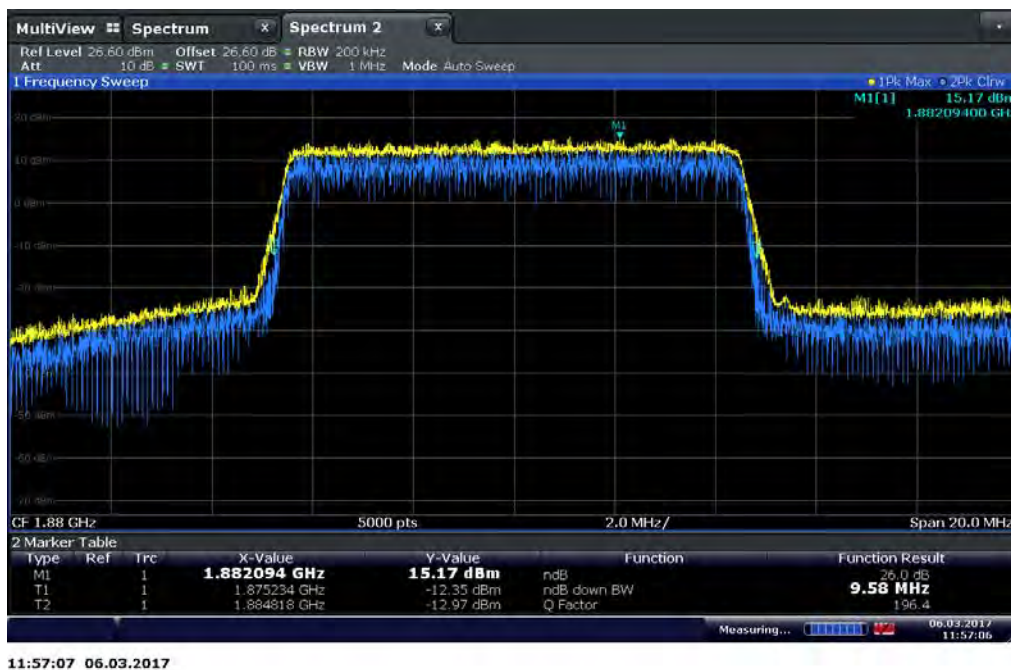
LTE Band 5 10MHz 99% Power Bandwidth



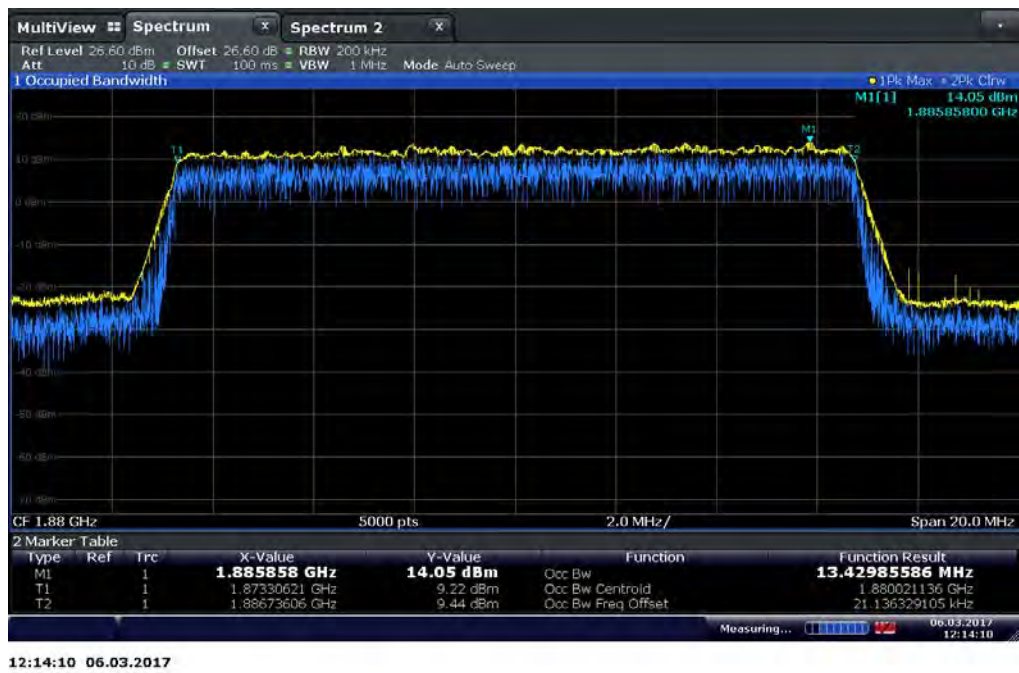
LTE Band 5 10MHz OBW (-26 dB)



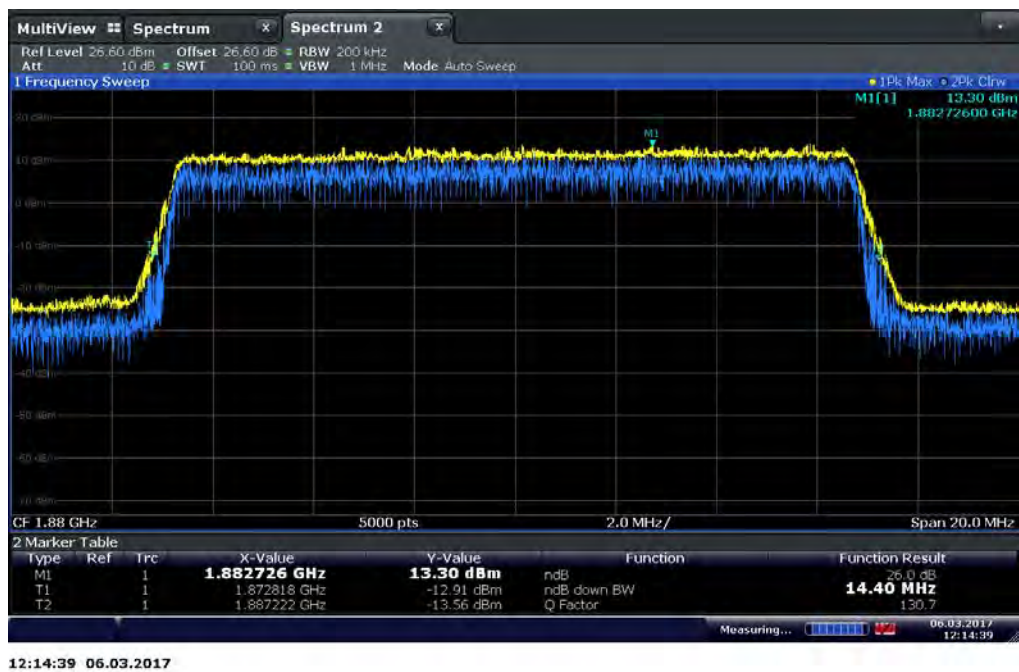
LTE Band 2 10MHz 99% Power Bandwidth



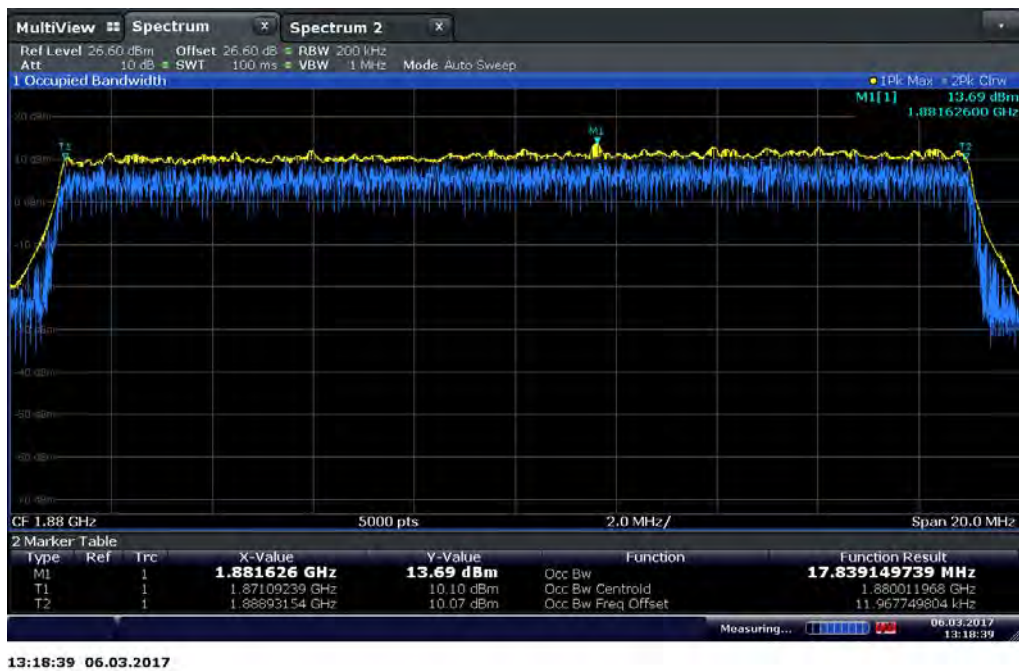
LTE Band 2 10MHz OBW (-26 dB)



LTE Band 2 15MHz 99% Power Bandwidth



LTE Band 2 15MHz OBW (-26 dB)



LTE Band 2 20MHz 99% Power Bandwidth



LTE Band 2 20MHz OBW (-26 dB)



2.5 PEAK-AVERAGE RATIO

2.5.1 Specification Reference

Part 24 Subpart E §24.232(d)
RSS-133(5.4)
RSS-133(6.4)

2.5.2 Standard Applicable

Part 24 Subpart E §24.232(d)

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 (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. 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

RSS-133(5.4) and RSS-133(6.4)

In addition, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

2.5.3 Equipment Under Test and Modification State

Serial No: 1073-0286 / Test Configuration A

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

March 13, 2017/FSC

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	23.7 °C
Relative Humidity	45.5 %
ATM Pressure	99.0 kPa

2.5.7 Additional Observations

- This is a conducted test. Guidance is per Section 5.7 of KDB971168 (D01 Power Meas License Digital Systems v02r02).
- Procedure is per Section 5.7.1 of KDB971168.

- RBW was set to maximum the SA can support (28MHz, minimum requirement is $\geq$ signal's occupied bandwidth)
- Number of samples was adjusted until the CCDF curve was stabilized (≥ 4500000 samples).
- 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.
- The maximum PAPR level associated with a probability of 0.1% was recorded.
- Only the worst case PAPR recorded associated with a particular bandwidth are presented for LTE bands.
- Only the worst case Release presented for CDMA – 1xEVDO.
- There are no measured PAPR levels greater than 13dB. EUT complies.

2.5.8 Test Results

Technology	Band	Channel	Frequency (MHz)	PAR (dB)
CDMA 1xRTT	Cell (BC0)	1013	824.70	4.08
		384	836.52	4.16
		777	848.31	4.00
	PCS (BC1)	25	1851.25	3.34
		600	1880.00	3.48
		1175	1908.75	3.28
CDMA – 1xEVDO Release 0/A	Cell (BC0)	1013	824.70	5.14
		384	836.52	5.78
		777	848.31	5.14
	PCS (BC1)	25	1851.25	4.50
		600	1880.00	4.48
		1175	1908.75	4.14
GPRS	GPRS850	128	824.2	3.72
		190	836.6	3.72
		251	848.8	3.72
	GPRS1900	512	1850.2	3.86

		661	1880.0	3.86
		810	1909.8	3.88
EGPRS	EGPRS850	128	824.2	3.72
		190	836.6	3.70
		251	848.8	3.76
	EGPRS1900	512	1850.2	3.86
		661	1880.0	3.88
		810	1909.8	3.86
WCDMA/HSPA	Band 5	4132	826.4	3.00
		4183	836.6	2.82
		4233	846.6	2.78
	Band 2	9262	1852.4	2.66
		9400	1880.0	2.54
		9538	1907.6	2.64

LTE Band	Modulation	Channel	Frequency (MHz)	PAR (dB)
LTE Band 5 (5 MHz BW)	QPSK	20425	826.5	5.34
		20525	836.5	5.50
		20625	846.5	5.44
	16-QAM	20425	826.5	6.20
		20525	836.5	6.32
		20625	846.5	6.12
LTE Band 2 (10 MHz BW)	QPSK	18650	1855.0	5.30
		18900	1880.0	5.36
		19150	1905.0	5.50
	16-QAM	18650	1855.0	6.24
		18900	1880.0	6.12
		19150	1905.0	6.30

2.5.9 Sample Test Plots



Date: 13.MAR.2017 05:29:27

CDMA 1xRTT Mid Channel BC0



Date: 13.MAR.2017 05:36:04

CDMA 1xRTT Mid Channel BC1



CDMA – 1xEvDO Release A Mid Channel BC0



CDMA – 1xEvDO Release 0 Mid Channel BC1



Date: 13.MAR.2017 06:07:31

GPRS Mid Channel GPRS850



Date: 13.MAR.2017 06:21:29

GPRS Mid Channel GPRS1900



Date: 13.MAR.2017 06:33:28

EGPRS Mid Channel EGPRS850



Date: 13.MAR.2017 06:29:21

EGPRS Mid Channel EGPRS1900



WCDMA/HSPA Mid Channel Band 5



WCDMA/HSPA Mid Channel Band 2



Date: 13.MAR.2017 07:14:41

LTE Band 5 5MHz OBW Mid Channel QPSK PAPR



Date: 13.MAR.2017 07:16:06

LTE Band 5 5MHz OBW Mid Channel 16-QAM PAPR



LTE Band 2 10MHz OBW Mid Channel QPSK PAPR



LTE Band 2 10MHz OBW Mid Channel 16-QAM PAPR



2.6 BAND EDGE/CONDUCTED SPURIOUS EMISSIONS

2.6.1 Specification Reference

Part 22 Subpart H §22.917(a) and Part 24 Subpart E §24.238(a)
RSS-132, Clause 5.5
RSS-133, Clause 6.5.1

2.6.2 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.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

- (i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).
- (ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

- (i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).
- (ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

2.6.3 Equipment Under Test and Modification State

Serial No: 1073-0286 / Test Configuration A

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

March 13 and 14, 2017/FSC

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	23.7 °C
Relative Humidity	45.5 %
ATM Pressure	99.0 kPa

2.6.7 Additional Observations

- This is a conducted test. Test guidance is per Section 6.0 of KDB971168 (D01 Power Meas License Digital Systems v02r02).
- Corresponding offset was used for the external attenuator, power splitter and cable used when verifying Band edges while TDF (Transducer Factor) was used for Spurious Emissions tests covering the whole frequency band (up to 10th harmonic).
- For Band edge measurements, RBW were set to minimum 1% of OBW otherwise power integration was used over 100 kHz for cell and 1 MHz for PCS.
- Resulting band edge measurements were verified against the manufacturer tune-up procedure with positive results.
- Only the worst case Release (0 or A) presented for 1xEV-DO.
- Only worst case bandwidth and modulation presented for LTE bands.

2.6.8 Test Results

See attached plots.



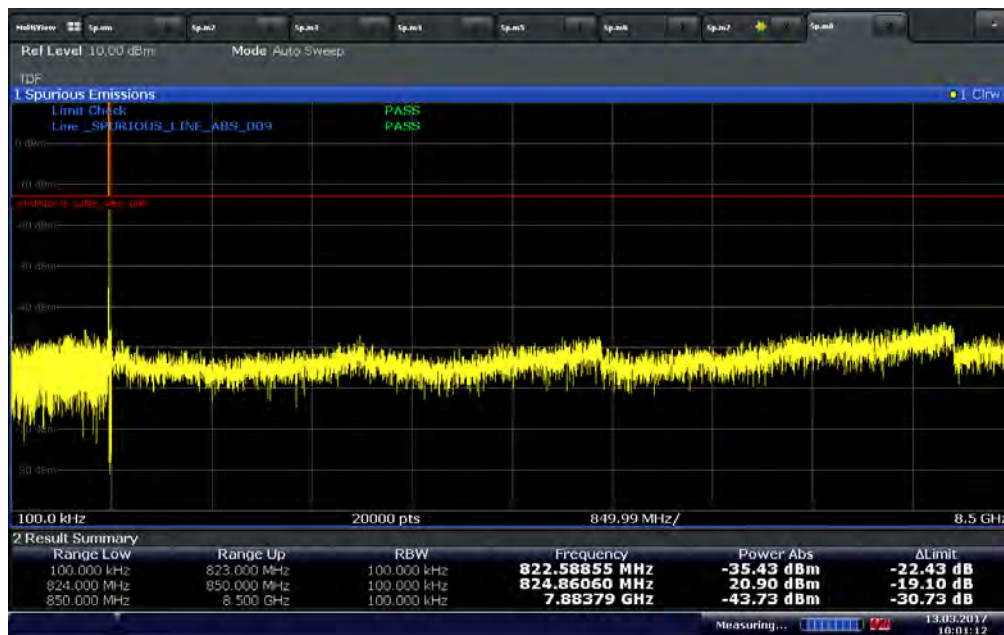
Date: 13.MAR.2017 08:52:33

CDMA2000 (BC0) Band Edge @ 824MHz



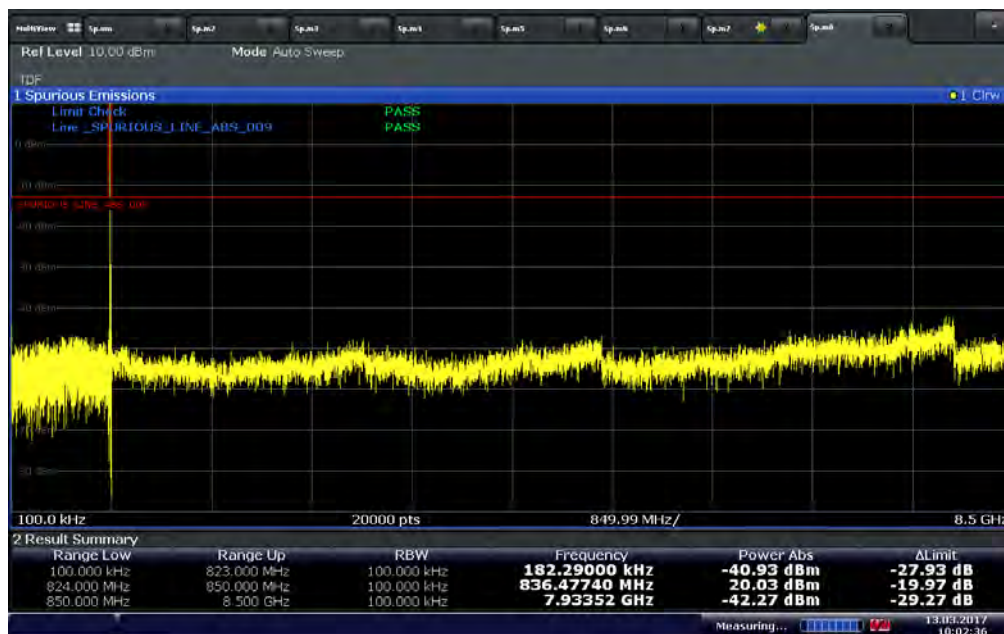
Date: 13.MAR.2017 09:21:32

CDMA2000 (BC0) Band Edge @ 849MHz (band power integrated to 100 kHz)



Date: 13.MAR.2017 10:01:12

CDMA2000 (BC0) Low Channel



Date: 13.MAR.2017 10:02:36

CDMA2000 (BC0) Mid Channel



Date: 13.MAR.2017 10:05:47

CDMA2000 (BC0) High Channel



Date: 14.MAR.2017 06:55:47

1xEV-DO (BC0) Band Edge @ 824MHz



Date: 14 MAR 2017 06:57:19

1xEV-DO (BC0) Band Edge @ 849MHz (band power integrated to 100 kHz)



Date: 14 MAR 2017 06:52:15

1xEV-DO (BC0) Low Channel



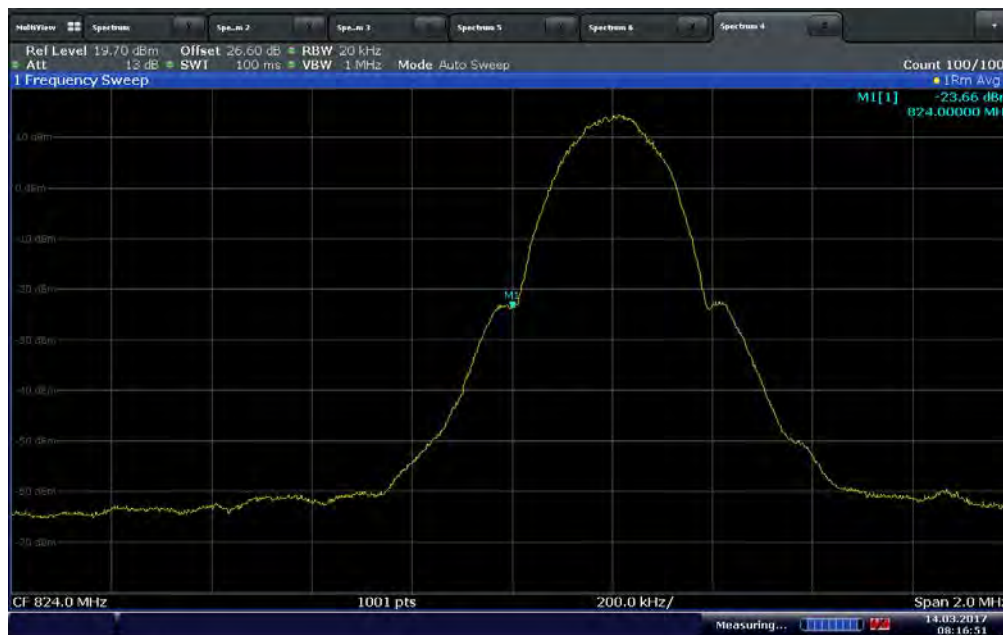
Date: 14 MAR 2017 06:49:08

1xEV-DO (BC0) Mid Channel



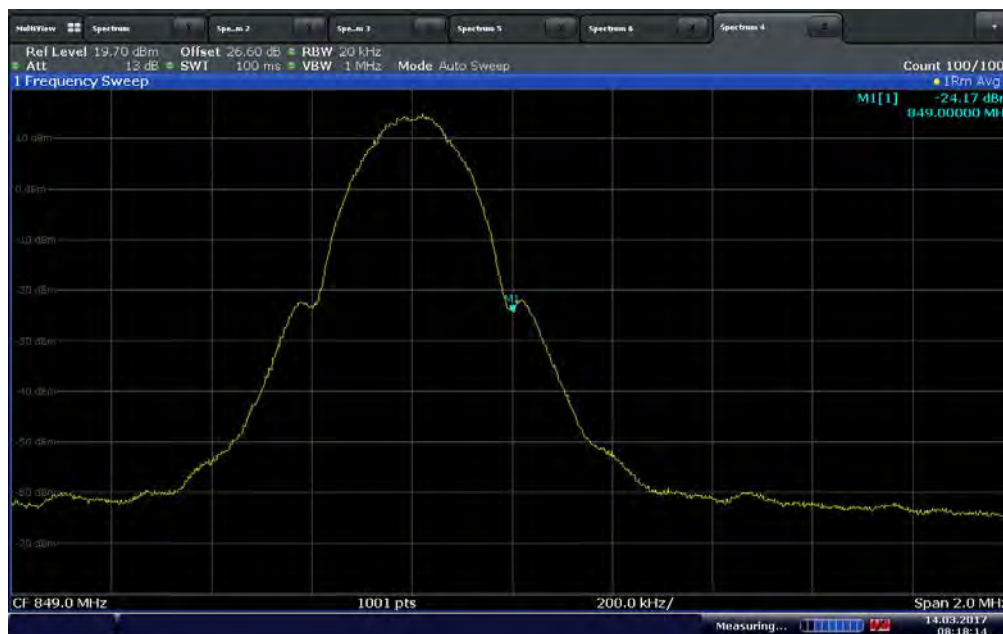
Date: 14 MAR 2017 06:58:26

1xEV-DO (BC0) High Channel



Date: 14.MAR.2017 08:16:50

GPRS850 Band Edge @ 824MHz



Date: 14.MAR.2017 08:18:14

GPRS850 Band Edge @ 849MHz



Date: 14 MAR 2017 08:15:41

GPRS850 Low Channel



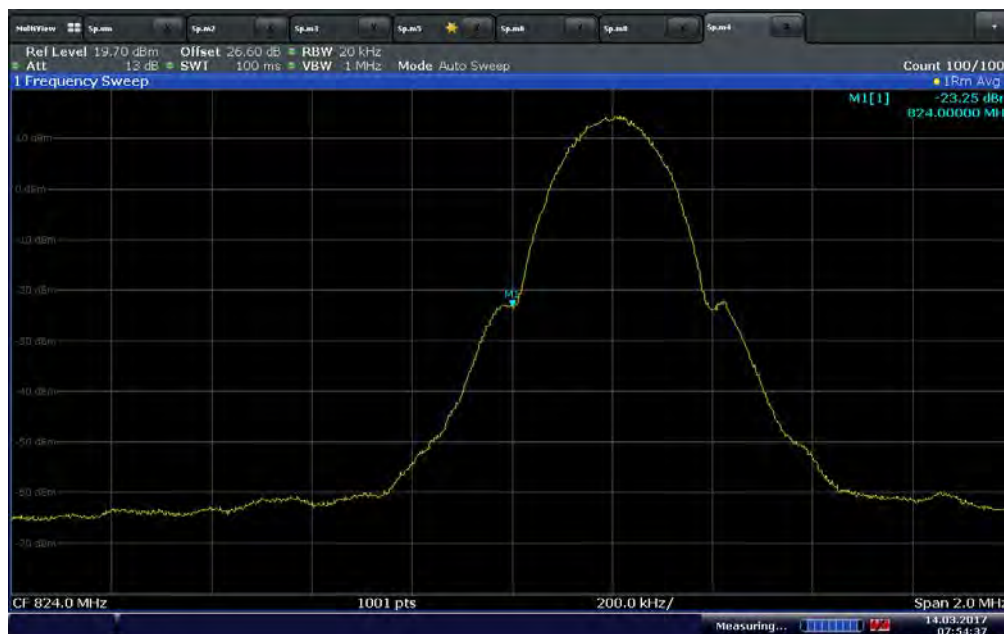
Date: 14 MAR 2017 08:12:36

GPRS850 Mid Channel



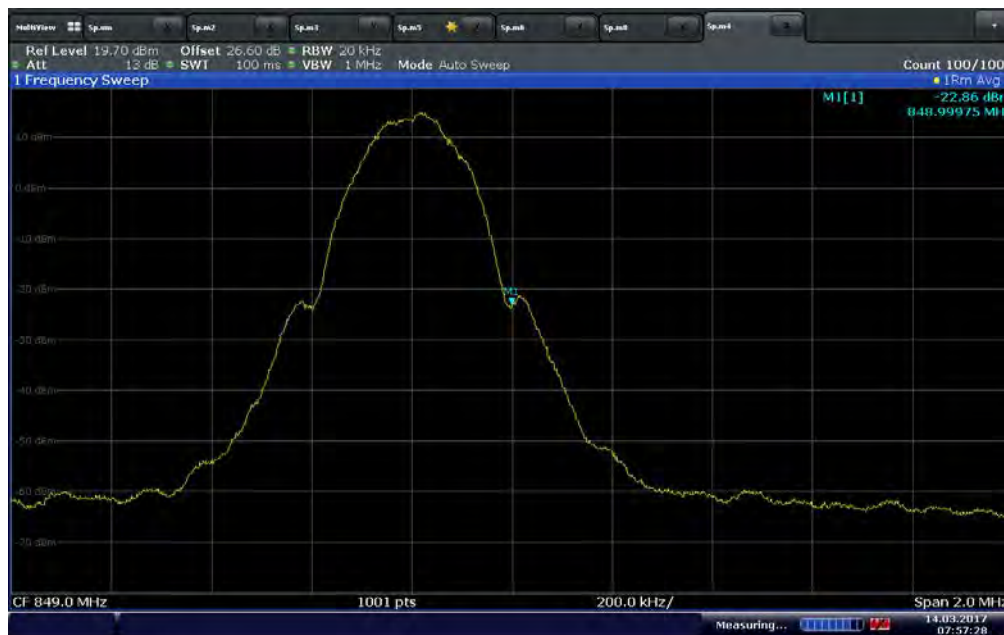
Date: 14 MAR 2017 08:25:17

GPRS850 High Channel



Date: 14 MAR 2017 07:54:38

EGPRS850 Band Edge @ 824MHz



Date: 14 MAR 2017 07:57:28

EGPRS850 Band Edge @ 849MHz



Date: 14 MAR 2017 07:49:23

EGPRS850 Low Channel



Date: 14 MAR 2017 07:44:45

EGPRS850 Mid Channel



Date: 14 MAR 2017 07:58:08

EGPRS850 High Channel



Date: 14.MAR.2017 08:37:51

WCDMA/HSPA Band 5 Band Edge @ 824MHz



Date: 14.MAR.2017 08:39:22

WCDMA/HSPA Band 5 Band Edge @ 849MHz



Date: 14 MAR 2017 08:35:56

WCDMA/HSPA Band 5 Low Channel



Date: 14 MAR 2017 08:34:51

WCDMA/HSPA Band 5 Mid Channel



Date: 14 MAR 2017 08:40:41

WCDMA/HSPA Band 5 High Channel



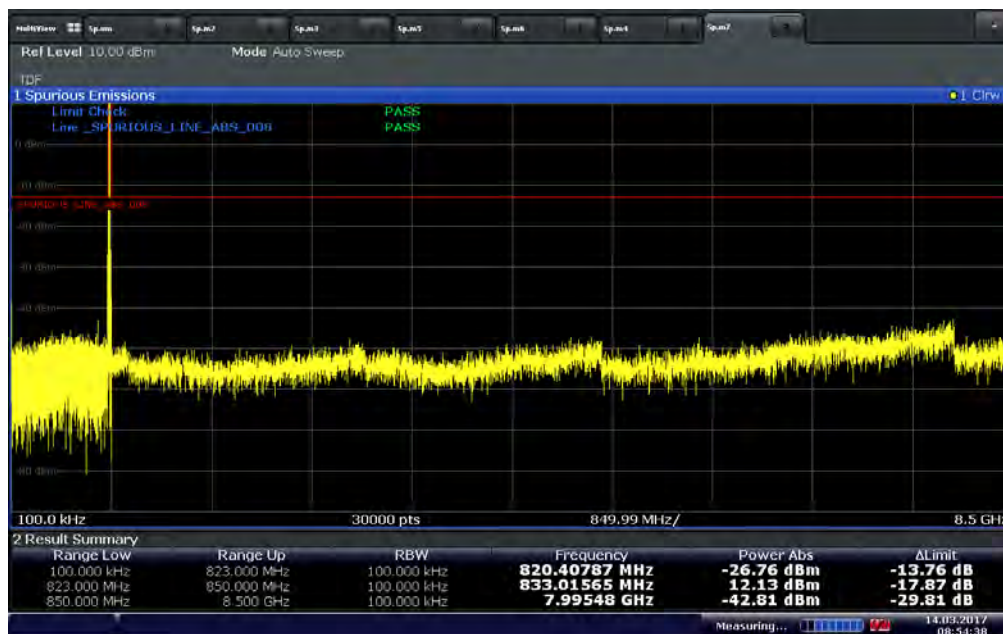
Date: 14 MAR 2017 08:56:10

LTE Band 5 Band Edge @ 824MHz



Date: 14 MAR 2017 08:57:57

LTE Band 5 Band Edge @ 849MHz



Date: 14 MAR 2017 08:54:38

LTE Band 5 Low Channel



Date: 14 MAR 2017 08:51:10

LTE Band 5 Mid Channel



Date: 14 MAR 2017 08:58:55

LTE Band 5 High Channel



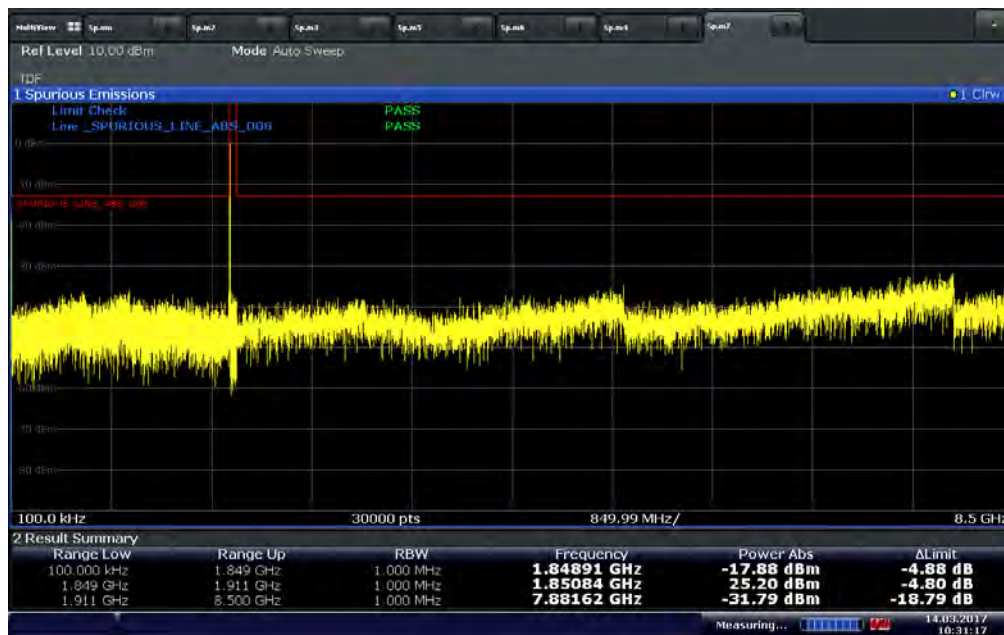
Date: 14 MAR 2017 10:33:14

CDMA2000 (BC1) Band Edge @ 1850 MHz



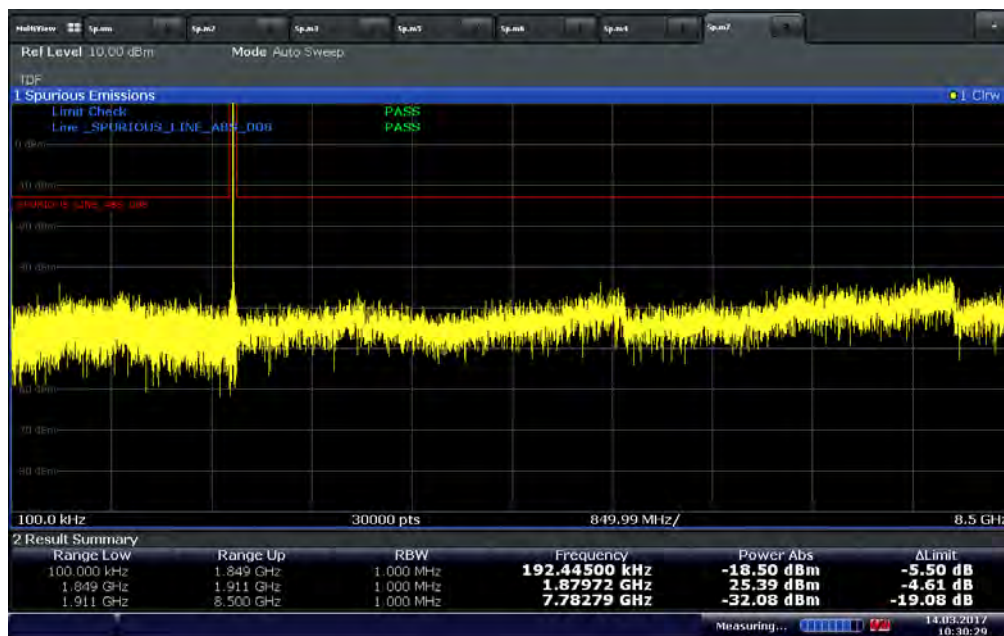
Date: 14 MAR 2017 10:36:05

CDMA2000 (BC1) Band Edge @ 1910 MHz



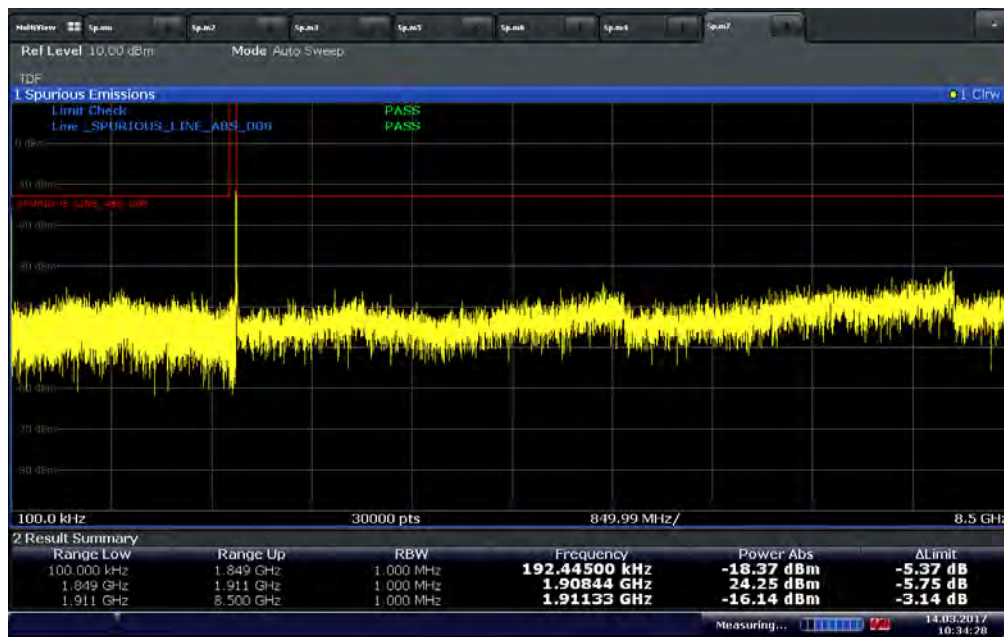
Date: 14 MAR 2017 10:31:17

CDMA2000 (BC1) Low Channel



Date: 14 MAR 2017 10:30:29

CDMA2000 (BC1) Mid Channel



Date: 14 MAR 2017 10:34:28

CDMA2000 (BC1) High Channel

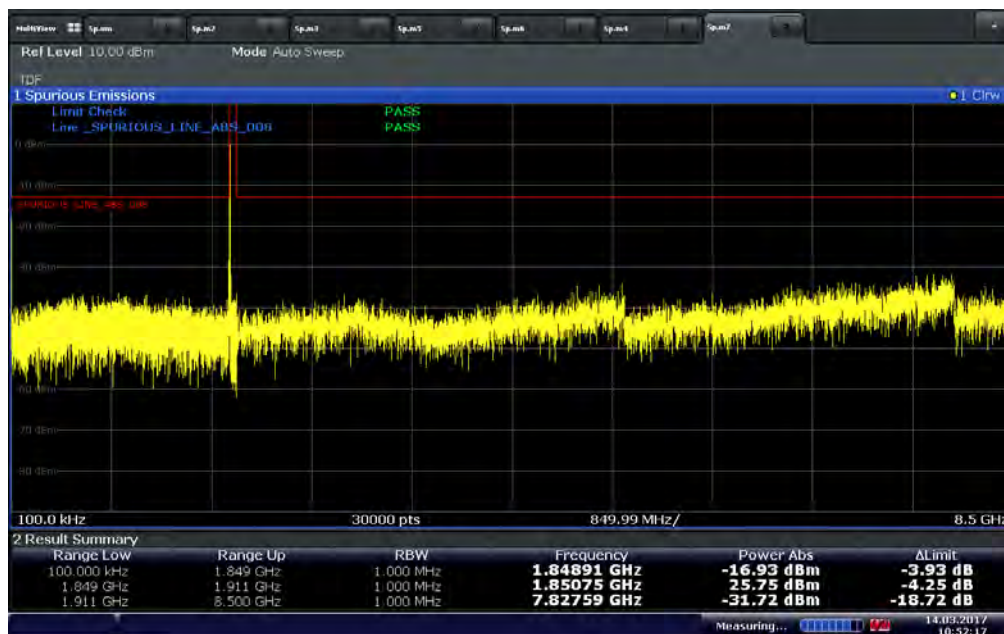


Date: 14 MAR 2017 10:53:16

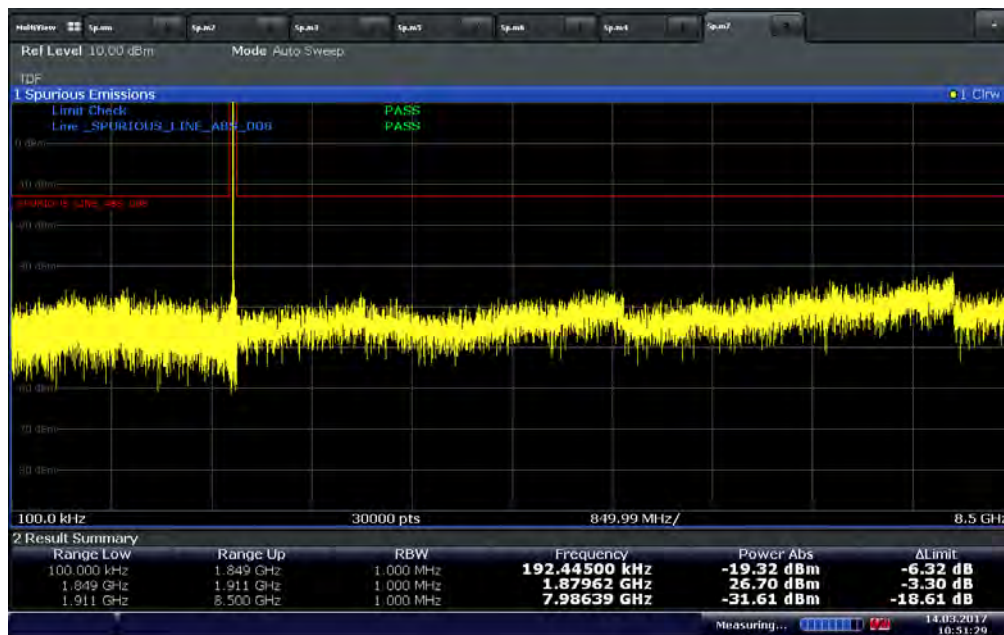
1xEV-DO (BC1) Band Edge @ 1850 MHz



1xEV-DO (BC1) Band Edge @ 1910 MHz

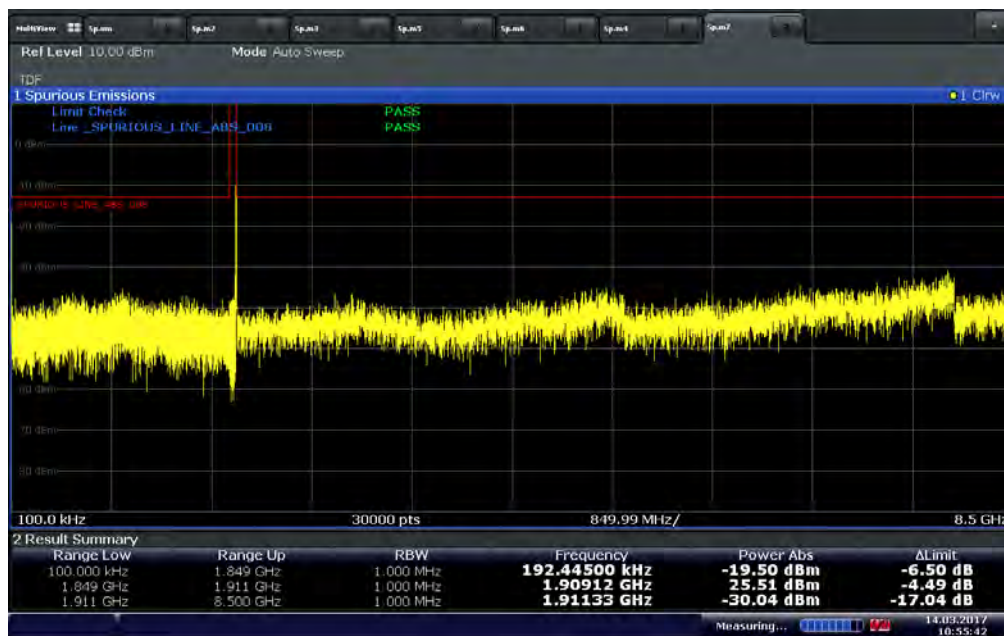


1xEV-DO (BC1) Low Channel



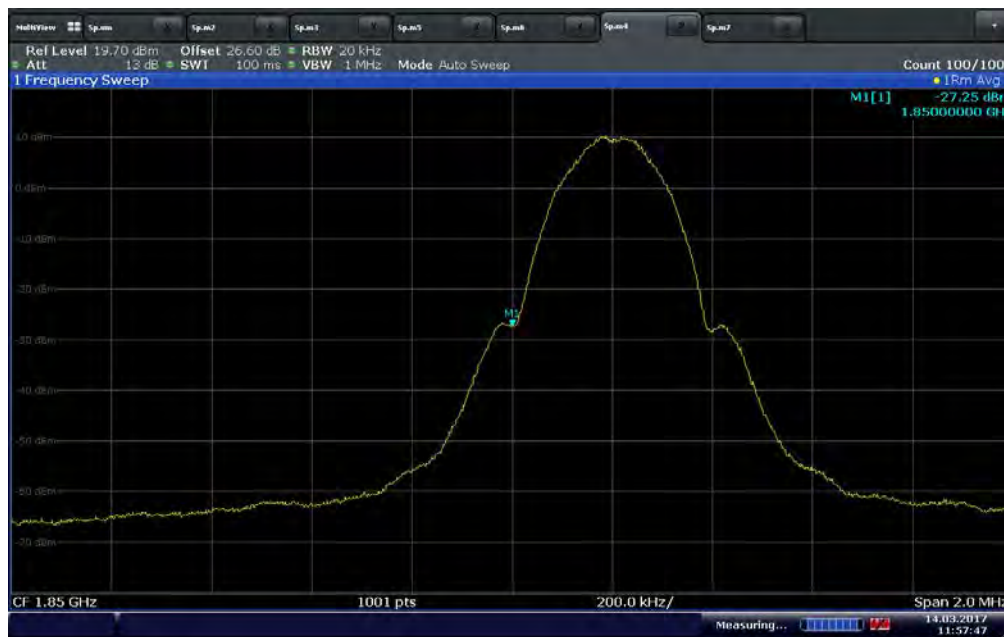
Date: 14 MAR 2017 10:51:28

1xEV-DO (BC1) Mid Channel



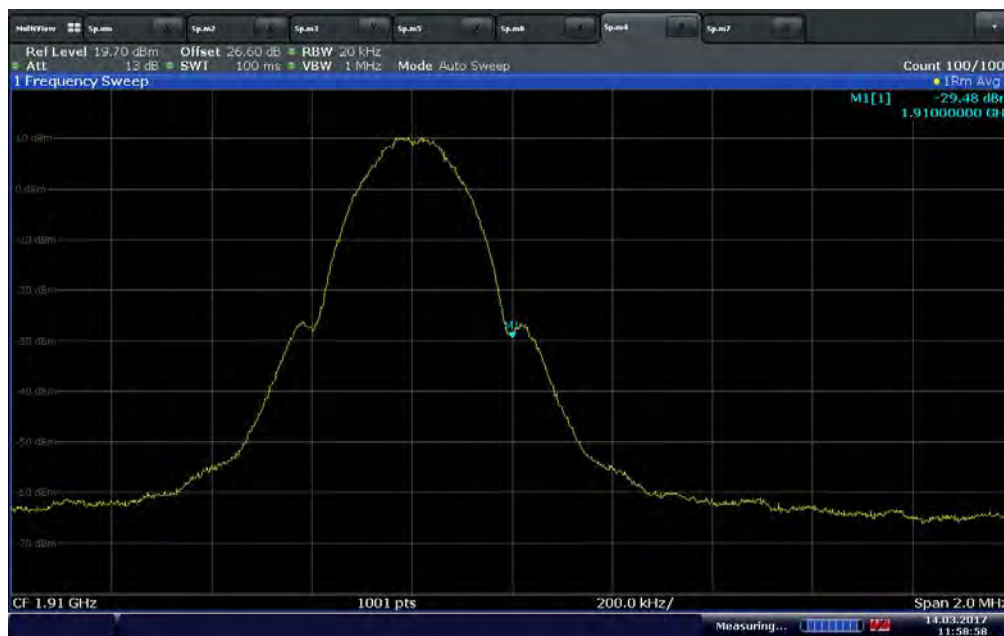
Date: 14 MAR 2017 10:55:42

1xEV-DO (BC1) High Channel



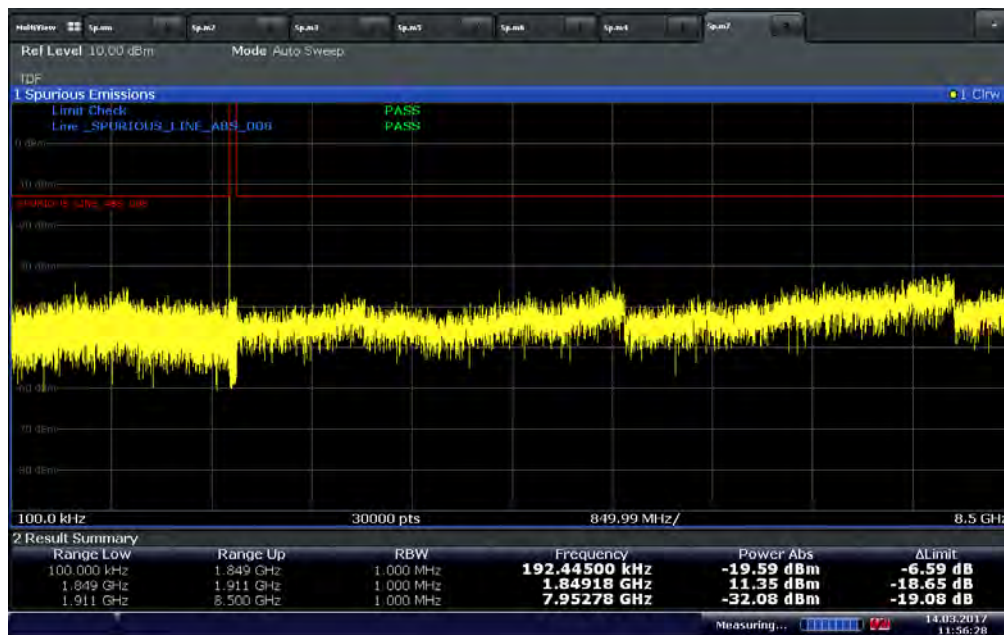
Date: 14 MAR 2017 11:57:47

GPRS1900 Band Edge @ 1850 MHz



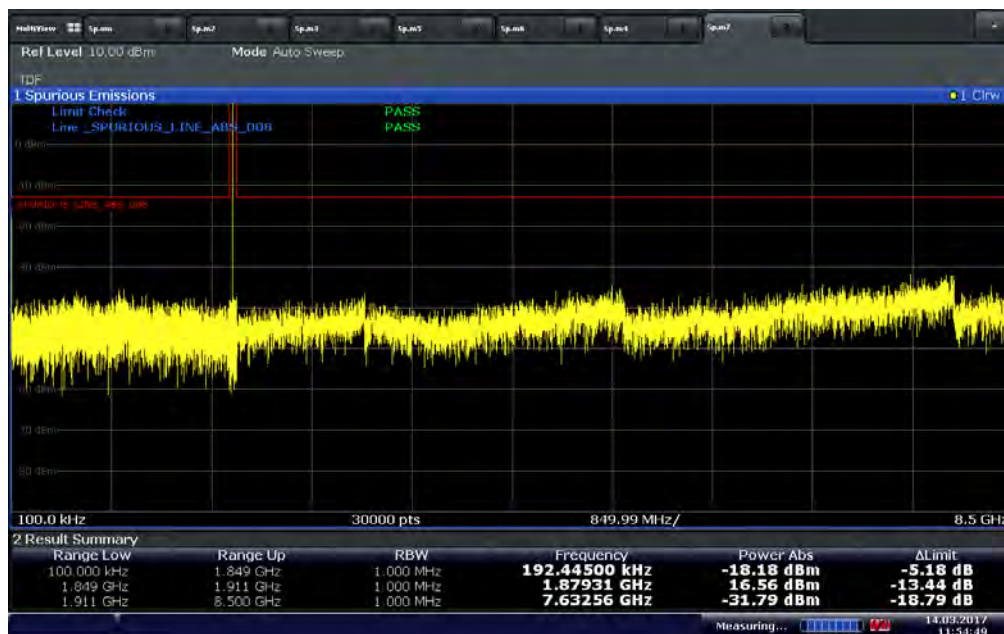
Date: 14 MAR 2017 11:58:57

GPRS1900 Band Edge @ 1910 MHz



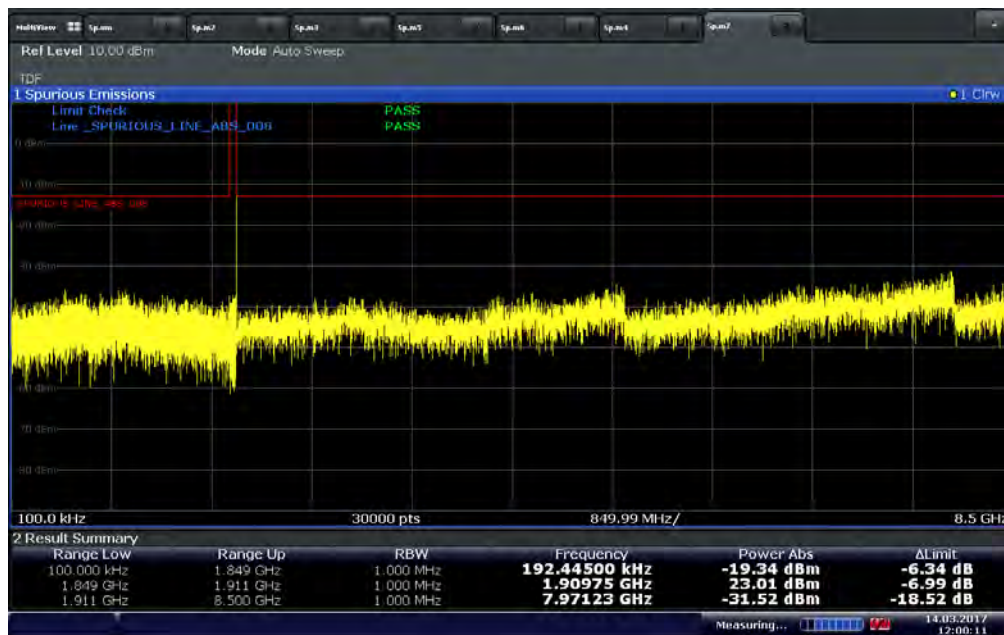
Date: 14 MAR 2017 11:56:28

GPRS1900 Low Channel



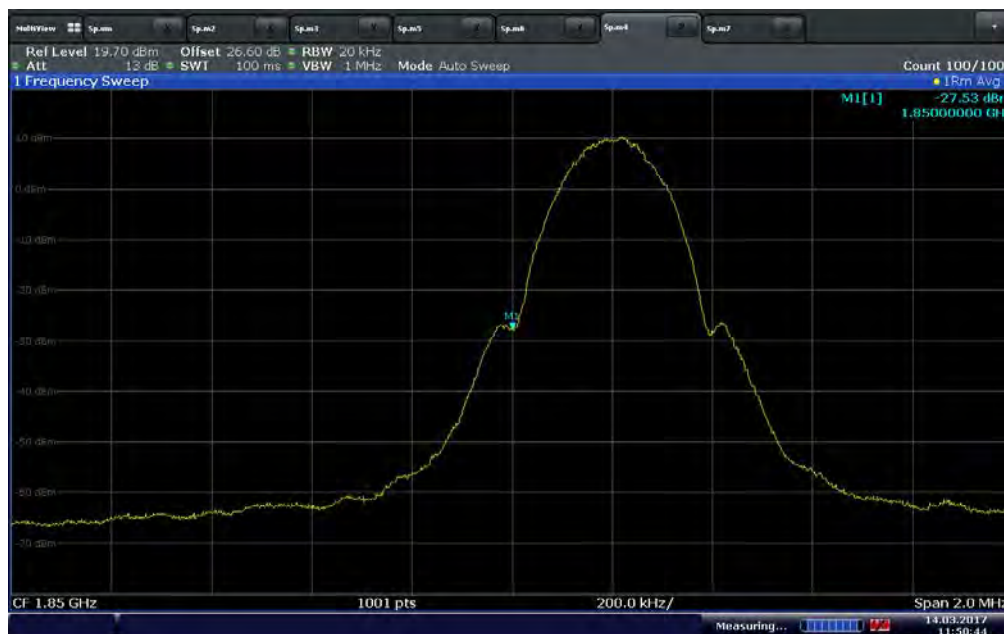
Date: 14 MAR 2017 11:54:50

GPRS1900 Mid Channel



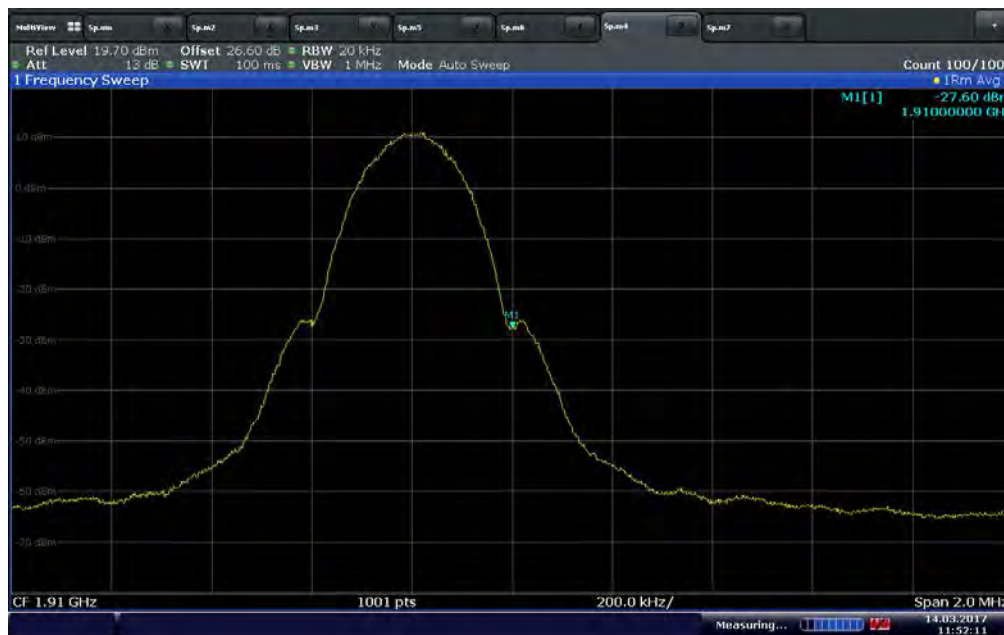
Date: 14 MAR 2017 12:00:11

GPRS1900 High Channel



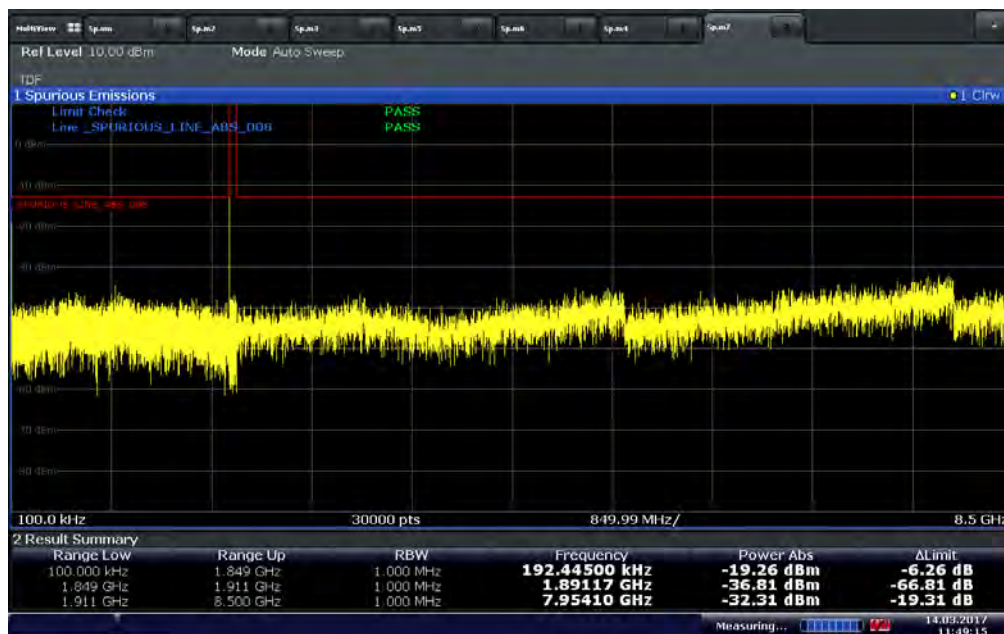
Date: 14 MAR 2017 11:50:44

EGPRS1900 Band Edge @ 1850 MHz



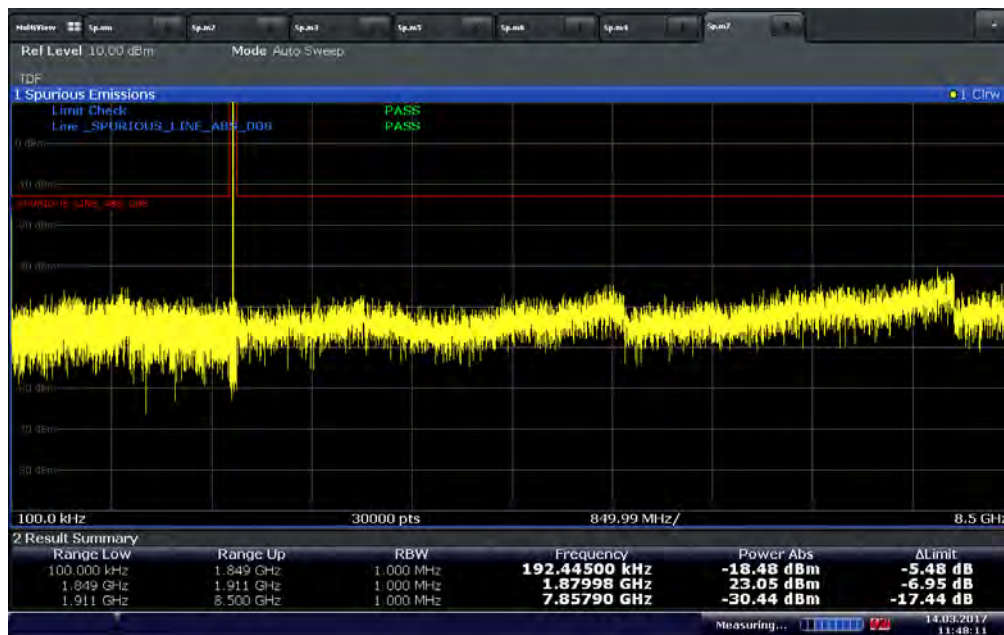
Date: 14 MAR 2017 11:52:11

EGPRS1900 Band Edge @ 1910 MHz



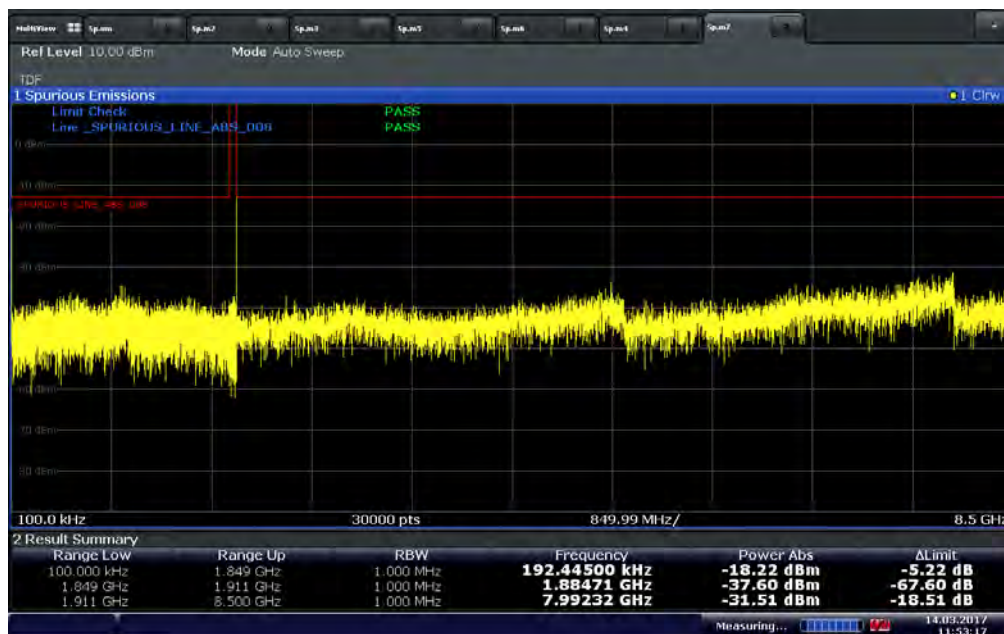
Date: 14 MAR 2017 11:49:15

EGPRS1900 Low Channel



Date: 14 MAR 2017 11:48:10

EGPRS1900 Mid Channel



Date: 14 MAR 2017 11:53:17

EGPRS1900 High Channel



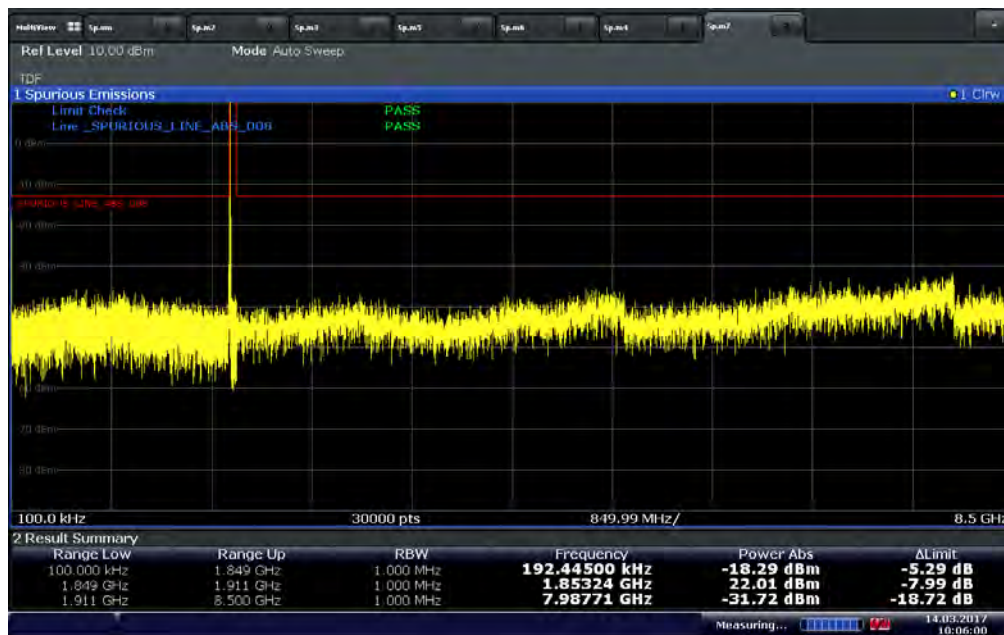
Date: 14 MAR 2017 10:07:32

WCDMA/HSPA Band 2 Band Edge @ 1850 MHz



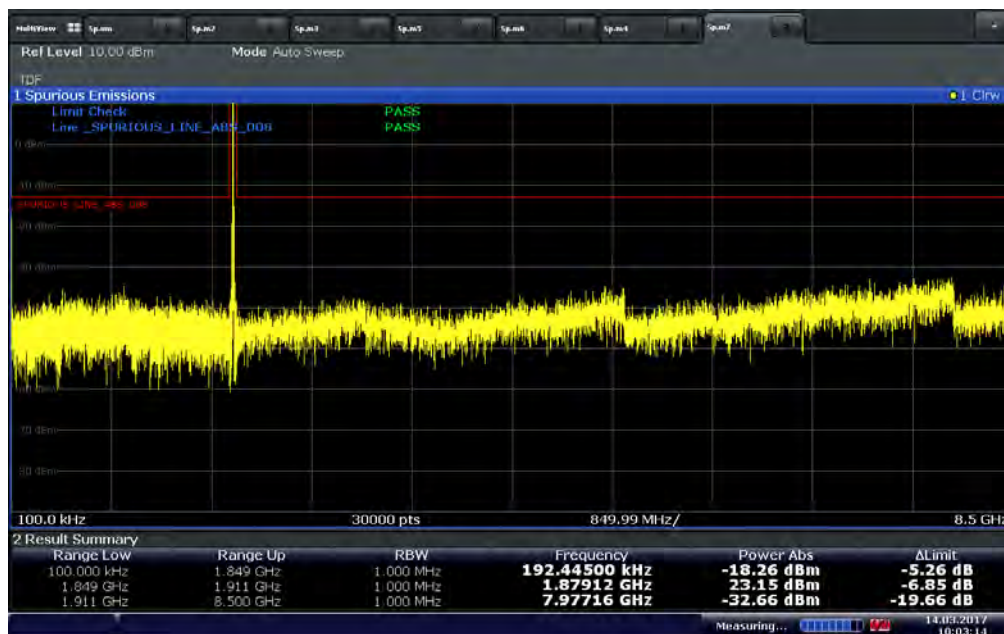
Date: 14 MAR 2017 10:09:03

WCDMA/HSPA Band 2 Band Edge @ 1910 MHz



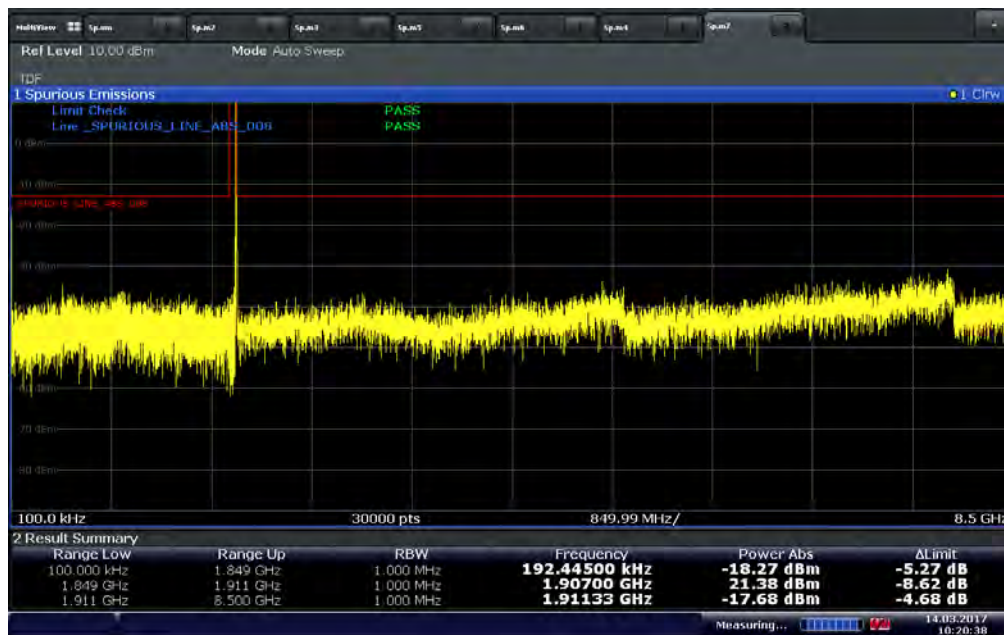
Date: 14 MAR 2017 10:06:00

WCDMA/HSPA Band 2 Low Channel



Date: 14 MAR 2017 10:03:14

WCDMA/HSPA Band 2 Mid Channel



Date: 14 MAR 2017 10:20:38

WCDMA/HSPA Band 2 High Channel



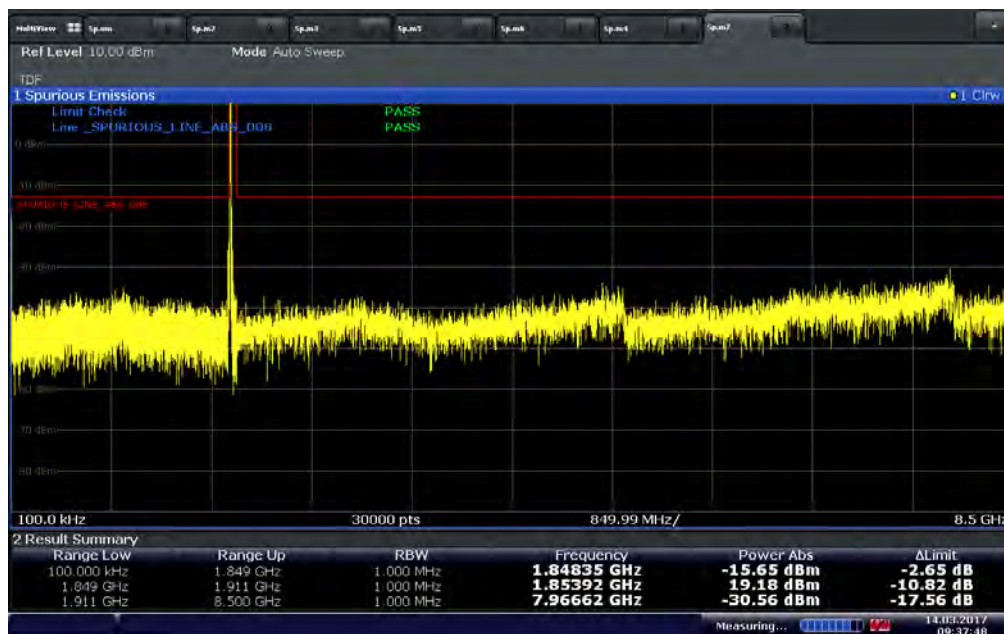
Date: 14 MAR 2017 09:42:52

LTE Band 2 Band Edge @ 1850 MHz



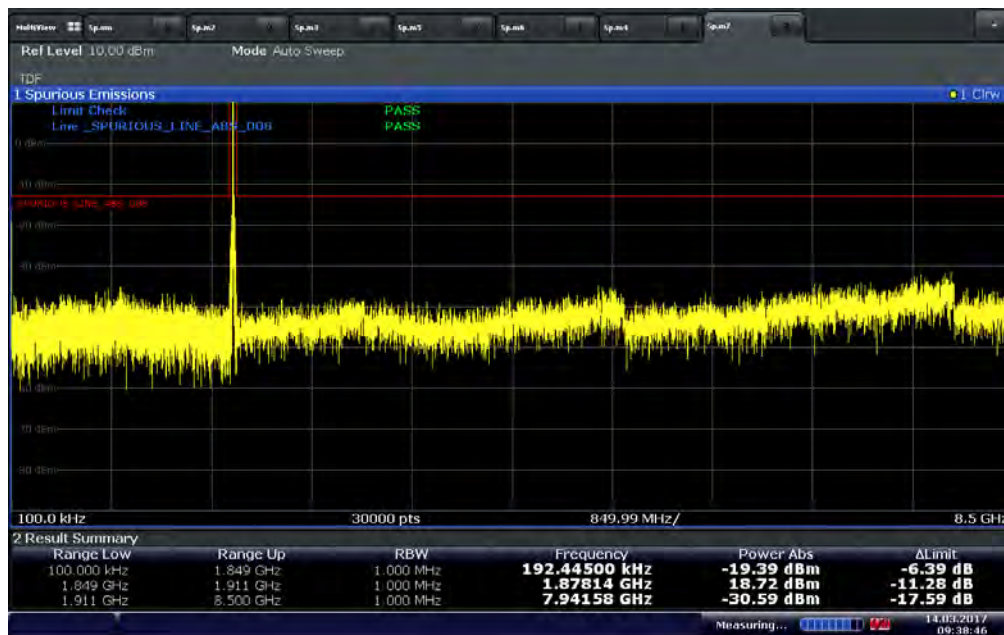
Date: 14 MAR 2017 09:44:37

LTE Band 2 Band Edge @ 1910 MHz



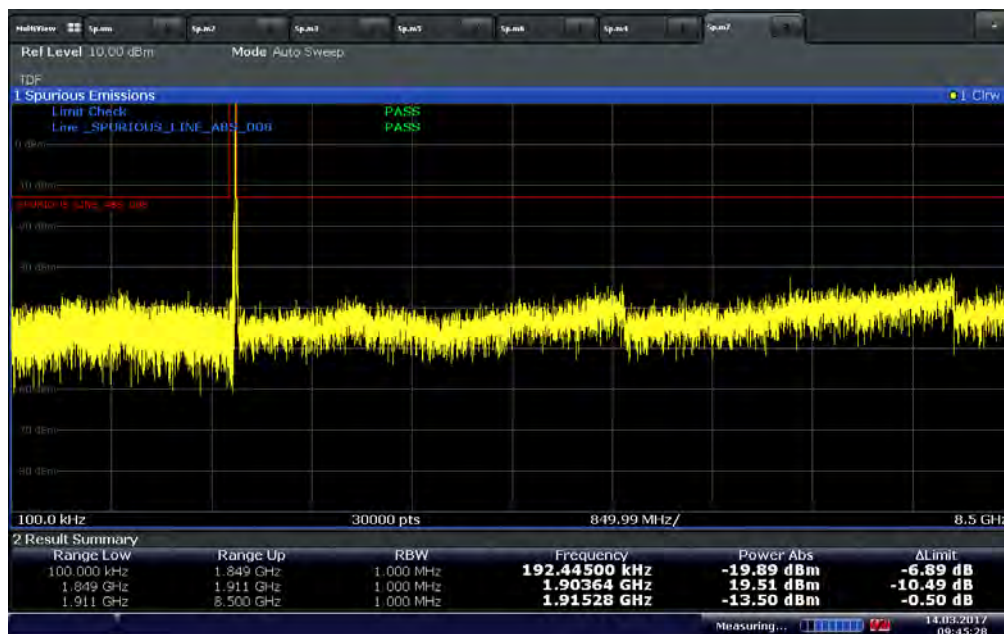
Date: 14 MAR 2017 09:37:48

LTE Band 2 Low Channel



Date: 14 MAR 2017 09:38:47

LTE Band 2 Mid Channel



Date: 14 MAR 2017 09:45:28

LTE Band 2 High Channel



2.7 FIELD STRENGTH OF SPURIOUS RADIATION

2.7.1 Specification Reference

Clause 7 of KDB971168 D01 v02r02

2.7.2 Standard Applicable

When antenna-port conducted measurements are performed to demonstrate compliance to the applicable unwanted emission limits, a separate radiated measurement is required to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Note that when radiated measurements are performed to demonstrate compliance to the unwanted emission limits (e.g., an EUT with integral transmit antenna), this measurement is not required.

These measurements may be performed with the transmit antenna port(s) terminated. Unless otherwise specified in the applicable rule section, the same limits applicable to spurious (unwanted) emissions at the antenna terminals also apply to radiated spurious emissions.

2.7.3 Equipment Under Test and Modification State

Serial No: 1073-0319 / Test Configuration B

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

February 22 to 24, 2017/FSC

2.7.5 Test Equipment Used

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

2.7.6 Environmental Conditions

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

Ambient Temperature	26.7 °C
Relative Humidity	40.7%
ATM Pressure	99.4 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.
- To reduce report size, only the deemed worst case configuration and channel presented in this test report.
- The test was performed using the EUT integral antenna.



- 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.

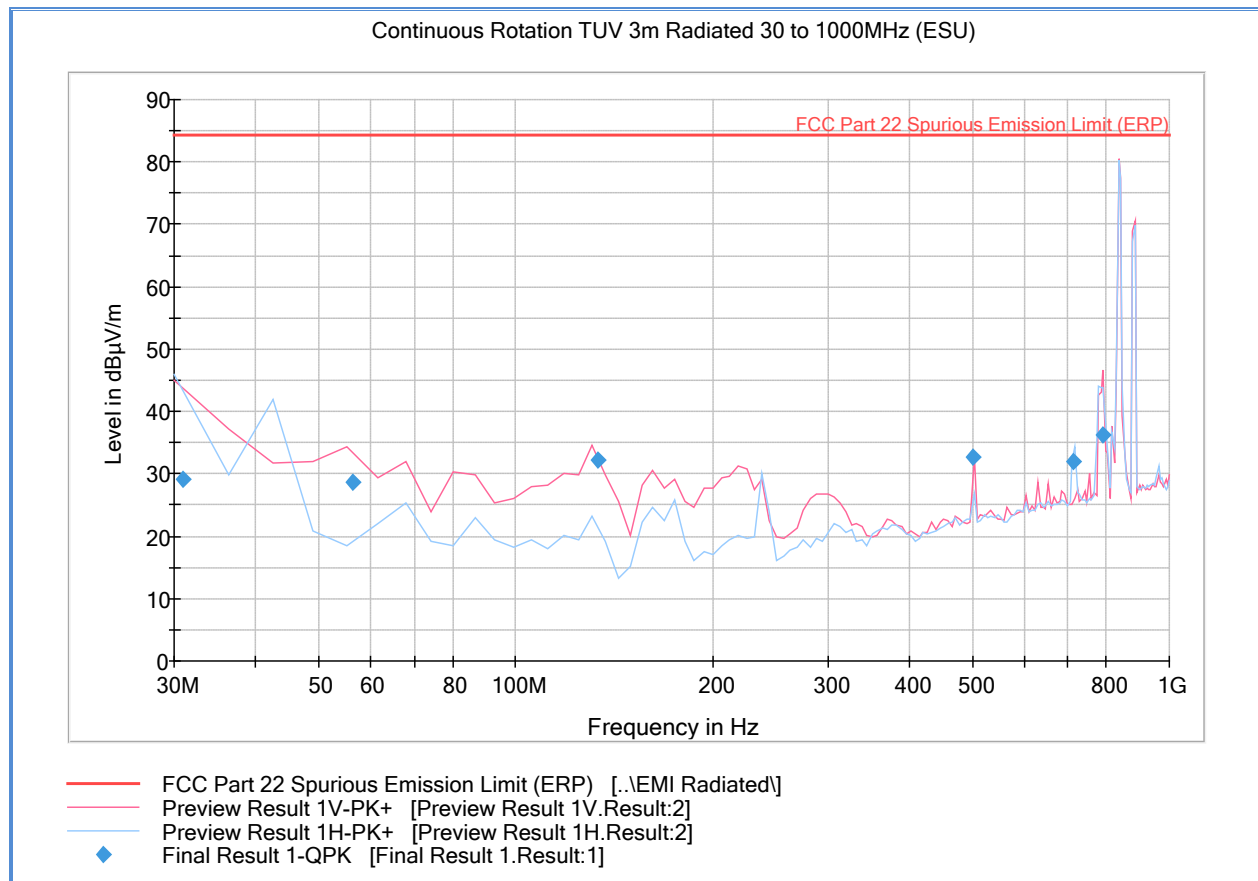
2.7.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ V) @ 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# 1033 (antenna)	17.2	
Reported QuasiPeak Final Measurement (db μ V/m) @ 30MHz			11.8

2.7.9 Test Results

Complies. See attached plots.

2.7.10 Test Results Below 1GHz (CDMA2000 BC0 Worst Case Configuration)

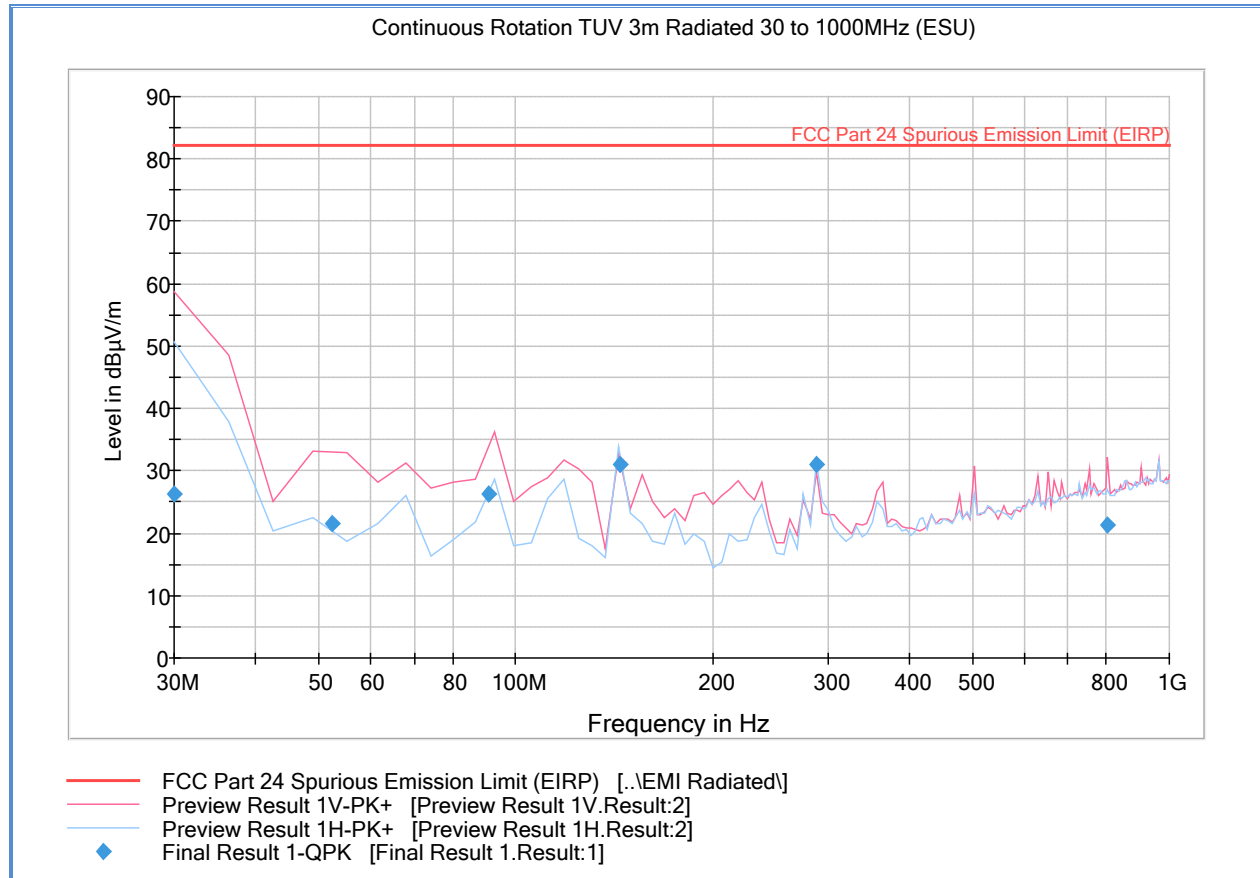


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
31.000000	29.1	1000.0	120.000	300.0	H	173.0	-7.6	55.3	84.4
56.274805	28.8	1000.0	120.000	100.0	V	116.0	-16.7	55.6	84.4
133.219221	32.3	1000.0	120.000	100.0	V	150.0	-16.3	52.1	84.4
500.002597	32.7	1000.0	120.000	105.0	V	35.0	-2.0	51.7	84.4
713.158442	32.0	1000.0	120.000	100.0	H	276.0	2.7	52.4	84.4
792.062857	36.3	1000.0	120.000	192.0	V	184.0	3.5	48.1	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 Below 1GHz (CDMA2000 BC1 Worst Case Configuration)

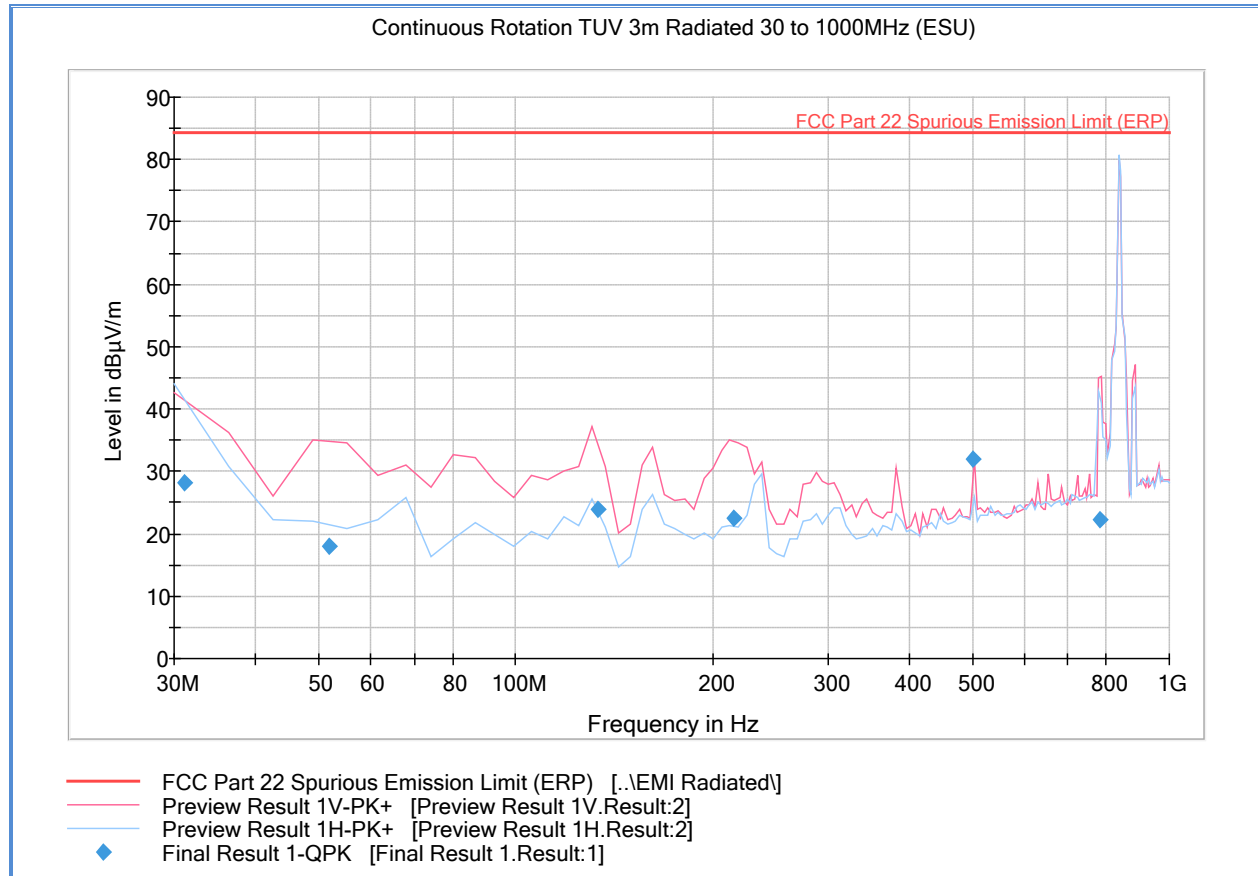


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.000000	26.2	1000.0	120.000	100.0	V	258.0	-6.8	58.2	84.4
52.216104	21.5	1000.0	120.000	100.0	V	39.0	-15.7	62.8	84.4
90.747013	26.3	1000.0	120.000	100.0	V	253.0	-16.6	58.1	84.4
144.576623	31.1	1000.0	120.000	250.0	H	21.0	-15.4	53.3	84.4
288.446753	30.9	1000.0	120.000	183.0	H	-2.0	-9.5	53.5	84.4
805.260260	21.3	1000.0	120.000	150.0	V	85.0	3.4	63.1	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.

2.7.12 Test Results Below 1GHz (1xEV-DO BC0 Worst Case Configuration)

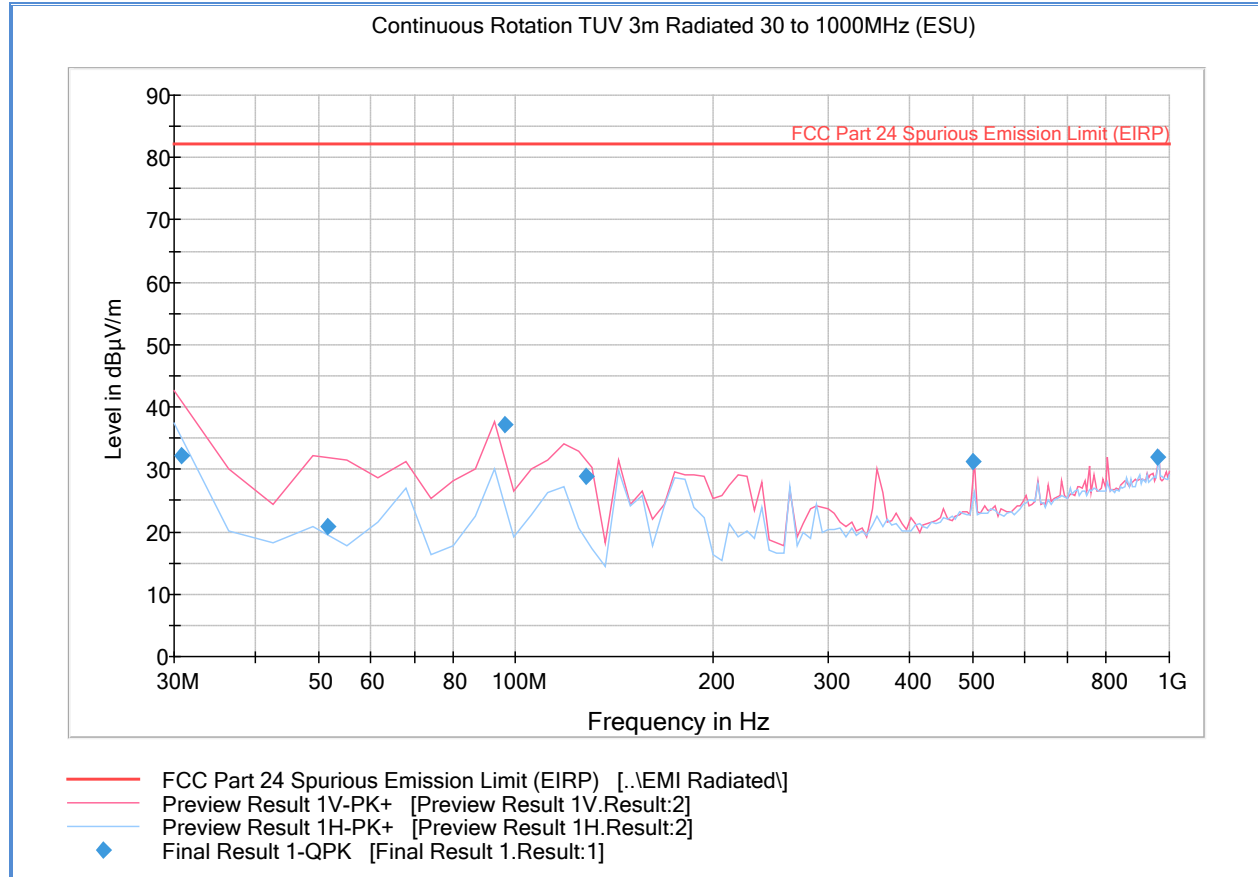


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
31.120000	28.1	1000.0	120.000	400.0	H	4.0	-7.7	56.3	84.4
51.896104	18.1	1000.0	120.000	100.0	V	227.0	-15.6	66.3	84.4
133.819221	23.9	1000.0	120.000	100.0	V	151.0	-16.2	60.5	84.4
215.462338	22.6	1000.0	120.000	100.0	V	315.0	-11.7	61.8	84.4
500.042597	32.0	1000.0	120.000	100.0	V	39.0	-2.0	52.4	84.4
783.324156	22.2	1000.0	120.000	150.0	V	198.0	3.6	62.2	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.

2.7.13 Test Results Below 1GHz (1xEV-DO BC1 Worst Case Configuration)

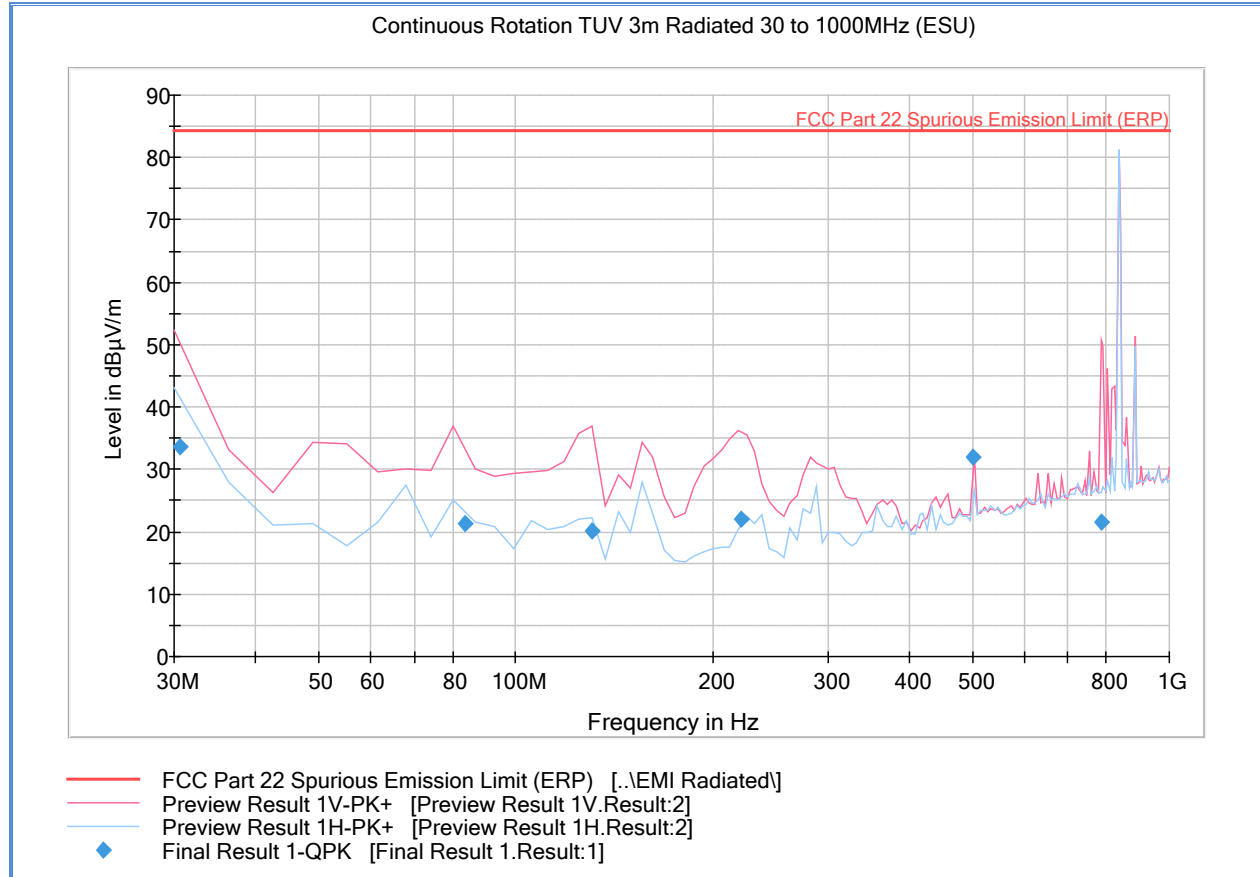


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.760000	32.3	1000.0	120.000	105.0	V	253.0	-7.4	52.1	84.4
51.616104	20.9	1000.0	120.000	105.0	V	188.0	-15.6	63.5	84.4
96.427013	37.1	1000.0	120.000	105.0	V	263.0	-15.7	47.3	84.4
127.840519	29.0	1000.0	120.000	100.0	V	128.0	-16.7	55.4	84.4
500.042597	31.3	1000.0	120.000	121.0	V	22.0	-2.0	53.1	84.4
960.087792	32.0	1000.0	120.000	114.0	V	154.0	6.2	52.4	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.

2.7.14 Test Results Below 1GHz (GPRS/EGPRS 850 Worst Case Configuration)

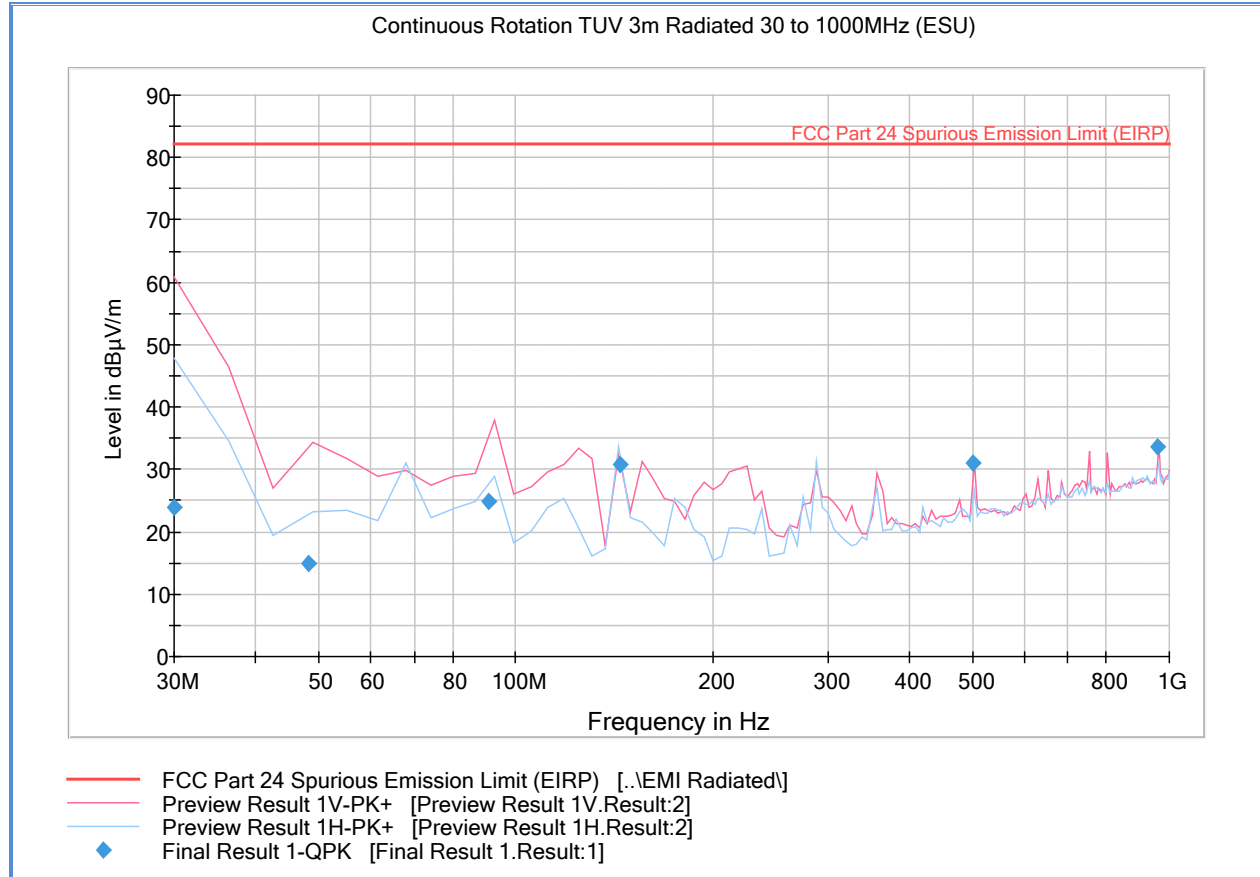


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.680000	33.7	1000.0	120.000	100.0	V	285.0	-7.4	50.7	84.4
83.469610	21.4	1000.0	120.000	115.0	V	158.0	-17.7	63.0	84.4
130.539221	20.2	1000.0	120.000	109.0	V	132.0	-16.6	64.2	84.4
221.521039	22.0	1000.0	120.000	105.0	V	-14.0	-11.1	62.4	84.4
500.042597	31.9	1000.0	120.000	100.0	V	59.0	-2.0	52.5	84.4
788.124156	21.5	1000.0	120.000	109.0	V	302.0	3.5	62.9	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.

2.7.15 Test Results Below 1GHz (GPRS/EGPRS 1900 Worst Case Configuration)

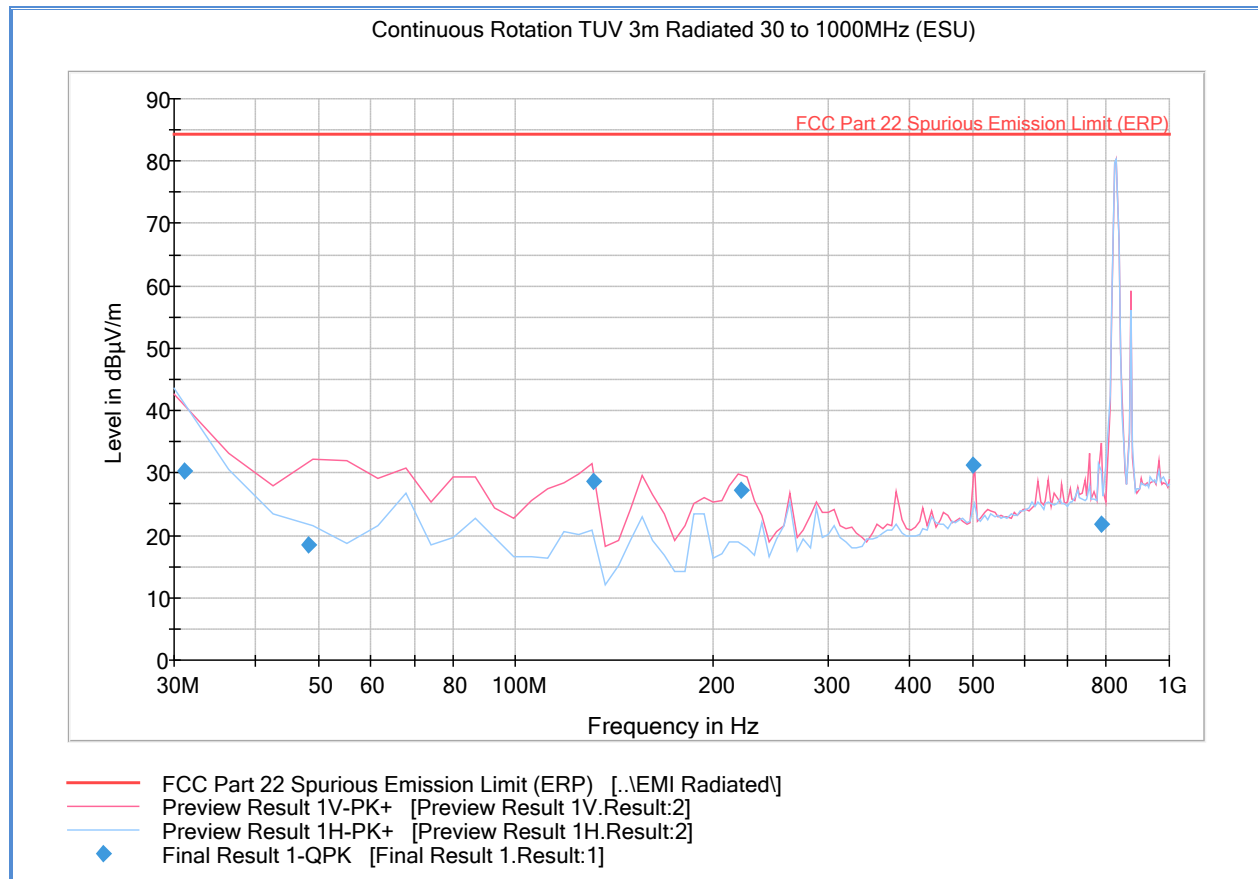


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.040000	24.0	1000.0	120.000	100.0	V	295.0	-6.9	60.4	84.4
48.216104	14.9	1000.0	120.000	110.0	V	217.0	-14.9	69.5	84.4
91.067013	24.9	1000.0	120.000	100.0	V	91.0	-16.5	59.4	84.4
144.496623	30.8	1000.0	120.000	250.0	H	185.0	-15.4	53.6	84.4
500.002597	31.0	1000.0	120.000	100.0	V	55.0	-2.0	53.4	84.4
960.087792	33.7	1000.0	120.000	141.0	V	73.0	6.2	50.7	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.

2.7.16 Test Results Below 1GHz (WCDMA/HSPA B5 Worst Case Configuration)

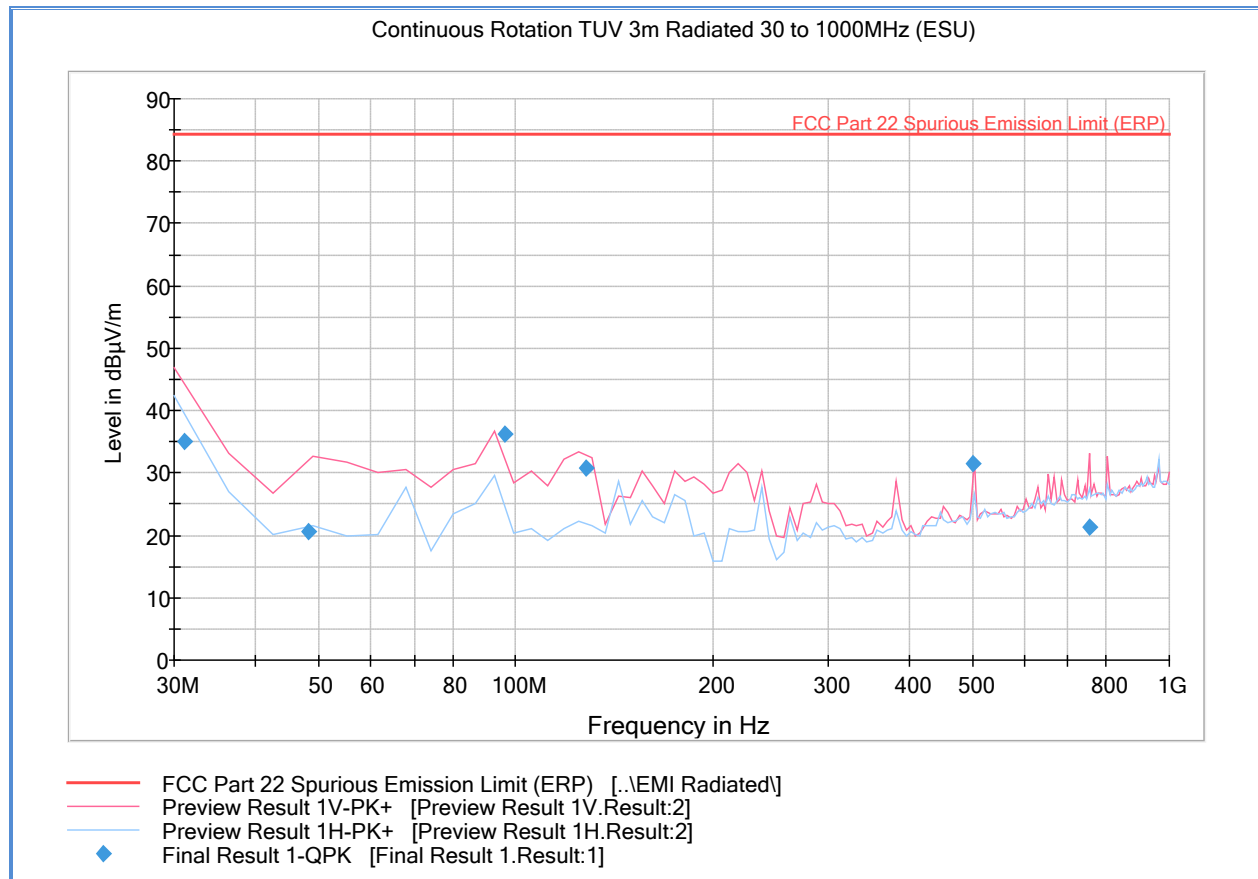


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.120000	30.3	1000.0	120.000	350.0	H	155.0	-7.7	54.1	84.4
48.176104	18.5	1000.0	120.000	105.0	V	204.0	-14.9	65.9	84.4
131.299221	28.7	1000.0	120.000	100.0	V	126.0	-16.5	55.7	84.4
221.041039	27.2	1000.0	120.000	100.0	V	328.0	-11.1	57.2	84.4
500.042597	31.4	1000.0	120.000	150.0	V	35.0	-2.0	53.0	84.4
785.484156	21.8	1000.0	120.000	177.0	V	173.0	3.6	62.6	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.

2.7.17 Test Results Below 1GHz (WCDMA/HSPA B2 Worst Case Configuration)

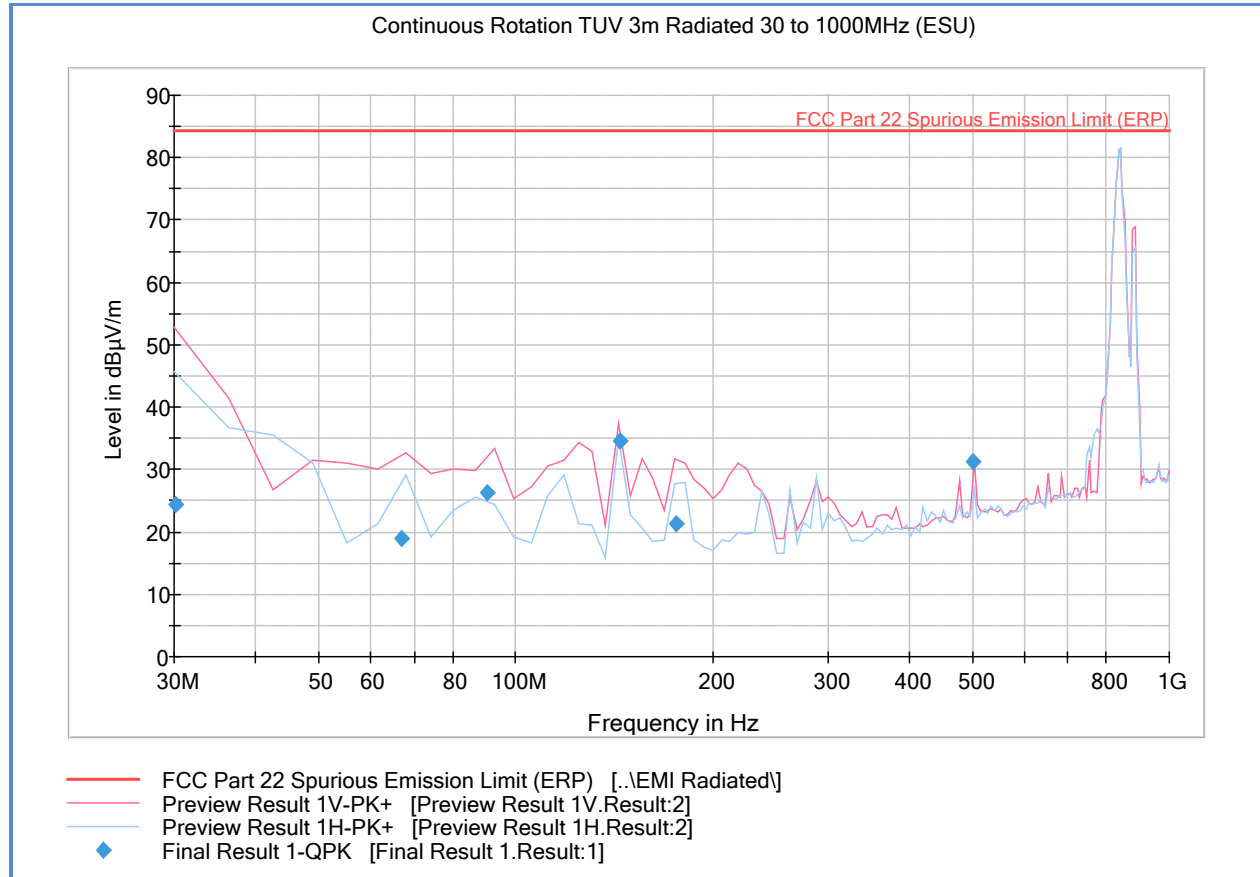


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.040000	35.0	1000.0	120.000	150.0	V	52.0	-7.7	49.3	84.4
48.216104	20.5	1000.0	120.000	100.0	V	198.0	-14.9	63.9	84.4
96.387013	36.2	1000.0	120.000	128.0	V	243.0	-15.7	48.2	84.4
127.960519	30.8	1000.0	120.000	100.0	V	136.0	-16.7	53.6	84.4
500.042597	31.4	1000.0	120.000	105.0	V	24.0	-2.0	52.9	84.4
753.270649	21.3	1000.0	120.000	115.0	V	67.0	3.2	63.1	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.

2.7.18 Test Results Below 1GHz (LTE Band 5 Worst Case Configuration)

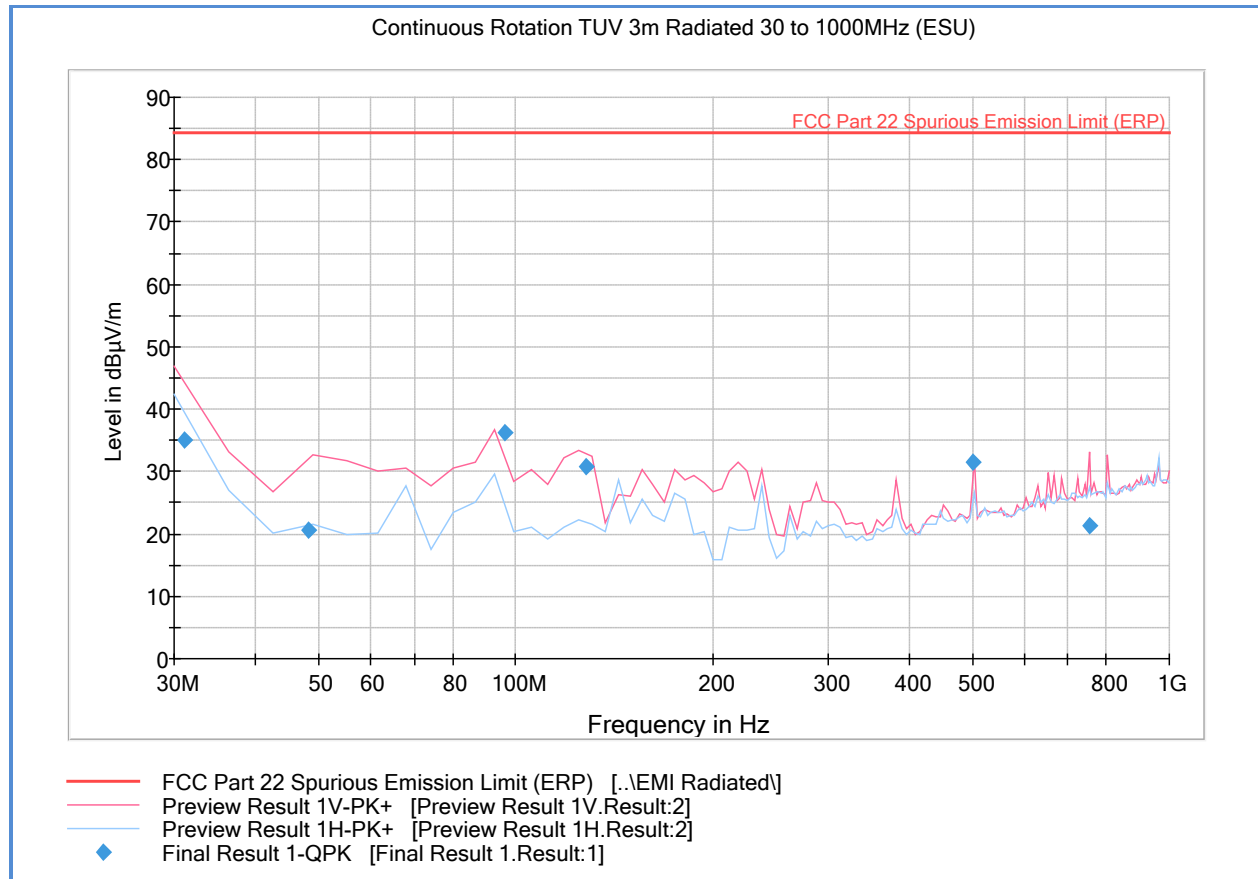


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.080000	24.4	1000.0	120.000	150.0	V	78.0	-6.9	60.0	84.4
66.712208	18.9	1000.0	120.000	277.0	V	3.0	-17.9	65.5	84.4
90.387013	26.3	1000.0	120.000	139.0	V	251.0	-16.7	58.1	84.4
144.296623	34.6	1000.0	120.000	106.0	V	33.0	-15.4	49.8	84.4
176.230130	21.4	1000.0	120.000	100.0	V	94.0	-13.0	63.0	84.4
500.042597	31.3	1000.0	120.000	109.0	V	40.0	-2.0	53.1	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.

2.7.19 Test Results Below 1GHz (LTE Band 2 Worst Case Configuration)

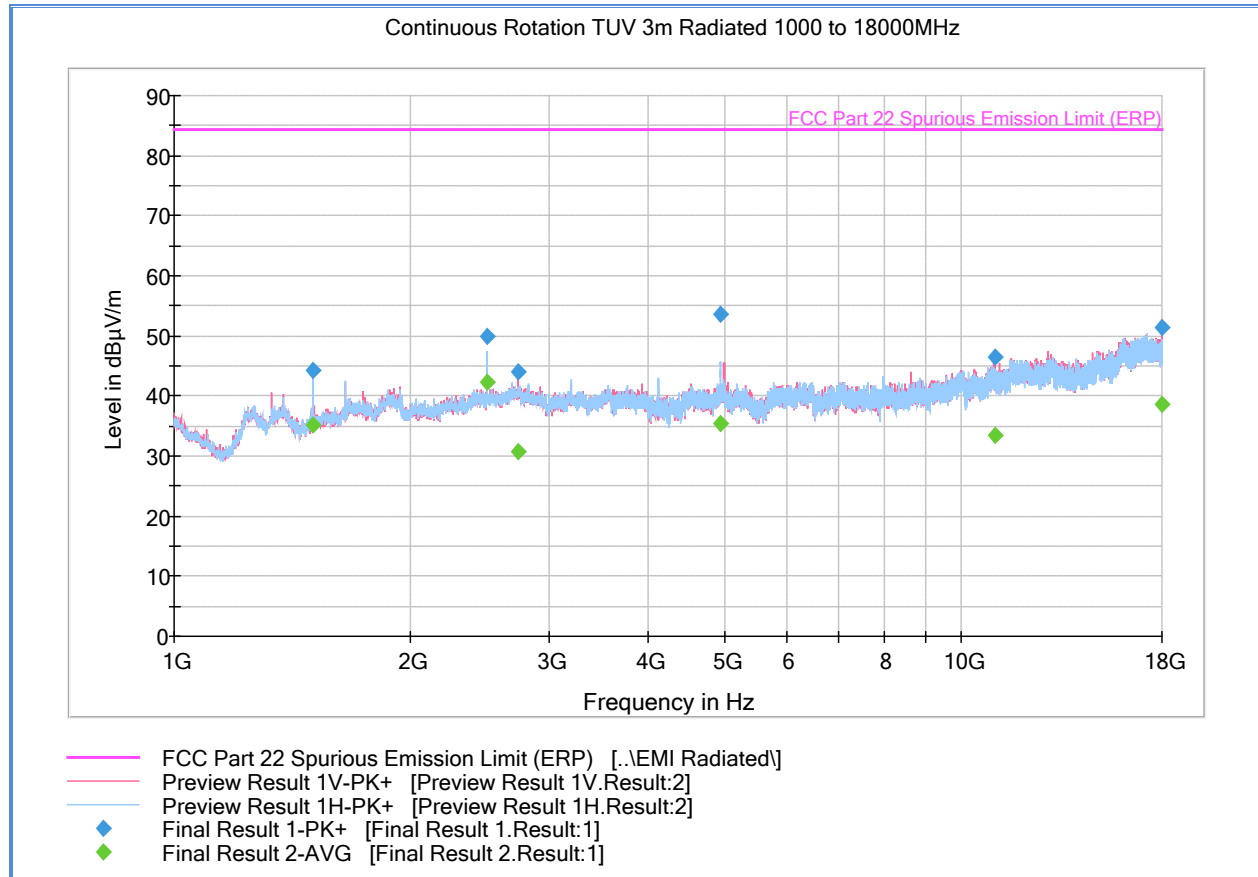


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
31.040000	35.0	1000.0	120.000	150.0	V	52.0	-7.7	49.3	84.4
48.216104	20.5	1000.0	120.000	100.0	V	198.0	-14.9	63.9	84.4
96.387013	36.2	1000.0	120.000	128.0	V	243.0	-15.7	48.2	84.4
127.960519	30.8	1000.0	120.000	100.0	V	136.0	-16.7	53.6	84.4
500.042597	31.4	1000.0	120.000	105.0	V	24.0	-2.0	52.9	84.4
753.270649	21.3	1000.0	120.000	115.0	V	67.0	3.2	63.1	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.

2.7.20 Test Results Above 1GHz (CDMA2000 BC0 Low Channel)



Peak Data

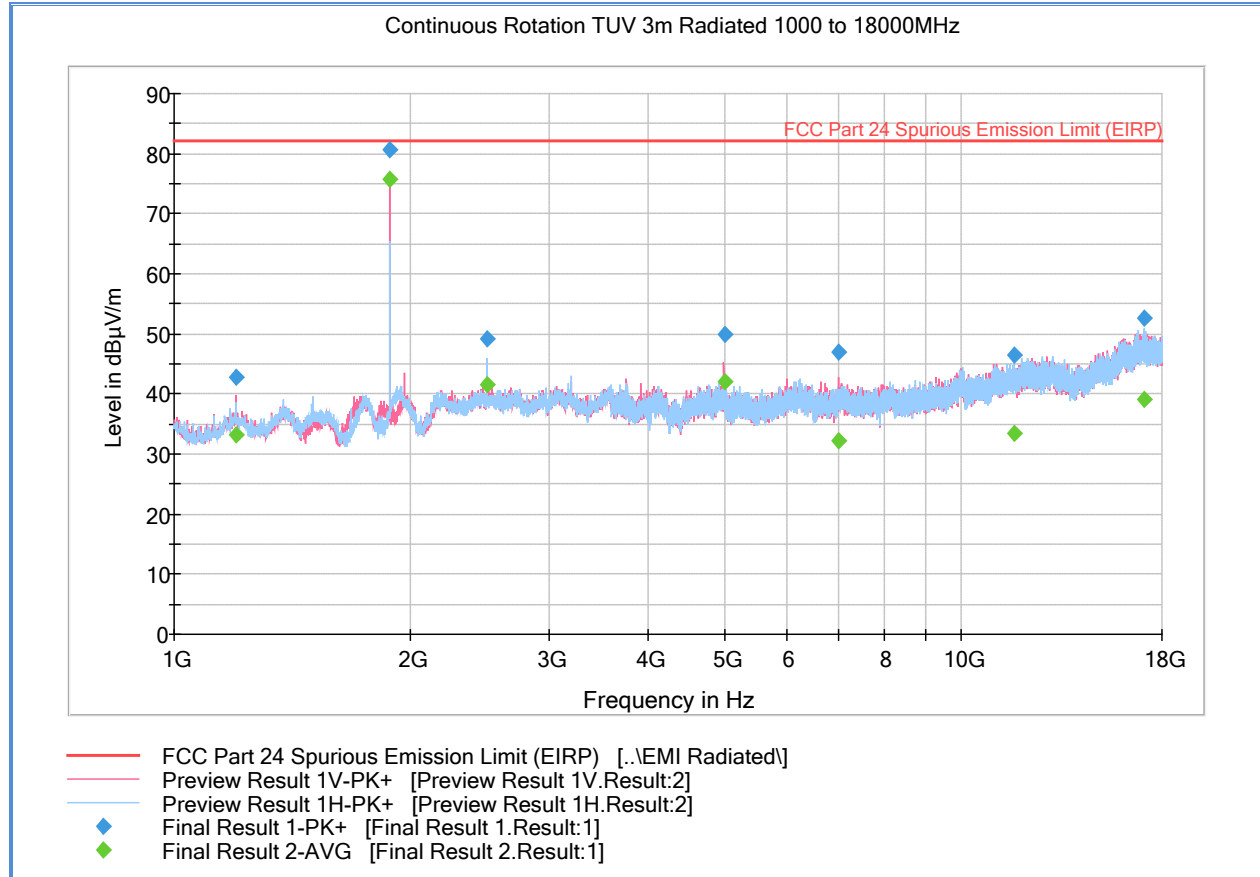
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.000000	44.2	1000.0	1000.000	368.1	H	112.0	-6.2	40.2	84.4
2499.766667	50.0	1000.0	1000.000	103.7	H	142.0	-0.5	34.4	84.4
2736.100000	44.0	1000.0	1000.000	202.3	V	206.0	-0.1	40.4	84.4
4948.500000	53.5	1000.0	1000.000	205.4	H	-2.0	3.9	30.9	84.4
11027.133333	46.5	1000.0	1000.000	150.6	V	43.0	12.2	37.9	84.4
17980.733333	51.5	1000.0	1000.000	395.0	V	206.0	19.8	32.9	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.21 Test Results Above 1GHz (CDMA2000 BC1 Middle Channel)



Peak Data

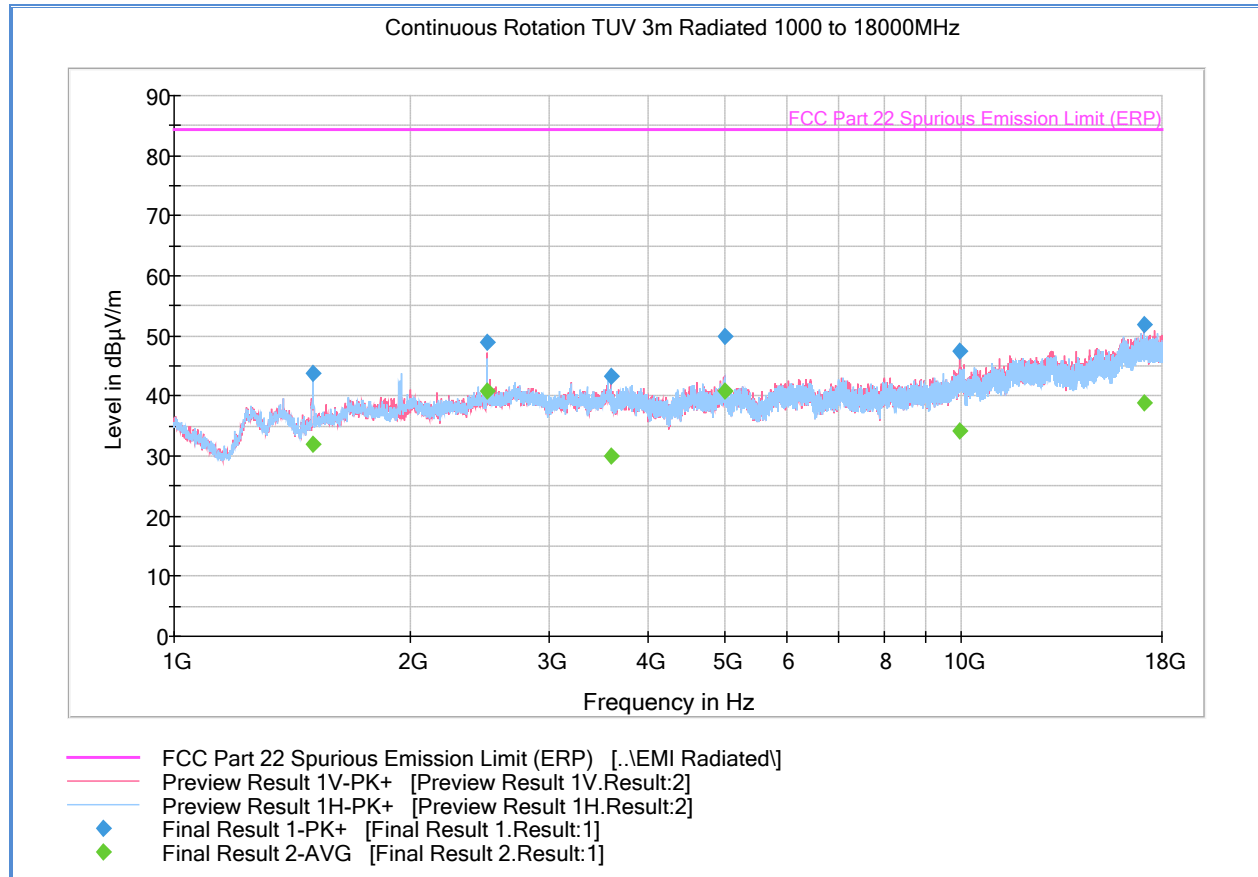
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1199.833333	42.8	1000.0	1000.000	181.5	V	10.0	-6.7	41.6	84.4
1879.666667	80.8	1000.0	1000.000	229.4	V	188.0	-2.9	3.6	84.4
2499.800000	49.3	1000.0	1000.000	136.6	H	200.0	-0.5	35.1	84.4
5000.333333	49.8	1000.0	1000.000	143.6	V	132.0	3.8	34.6	84.4
6999.666667	47.0	1000.0	1000.000	250.5	V	258.0	6.5	37.4	84.4
11709.266667	46.4	1000.0	1000.000	250.5	H	49.0	13.2	38.0	84.4
17075.400000	52.6	1000.0	1000.000	132.7	H	62.0	19.6	31.8	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters). Notched carrier is ignored.

2.7.22 Test Results Above 1GHz (1xEV-DO BC0 Mid Channel)



Peak Data

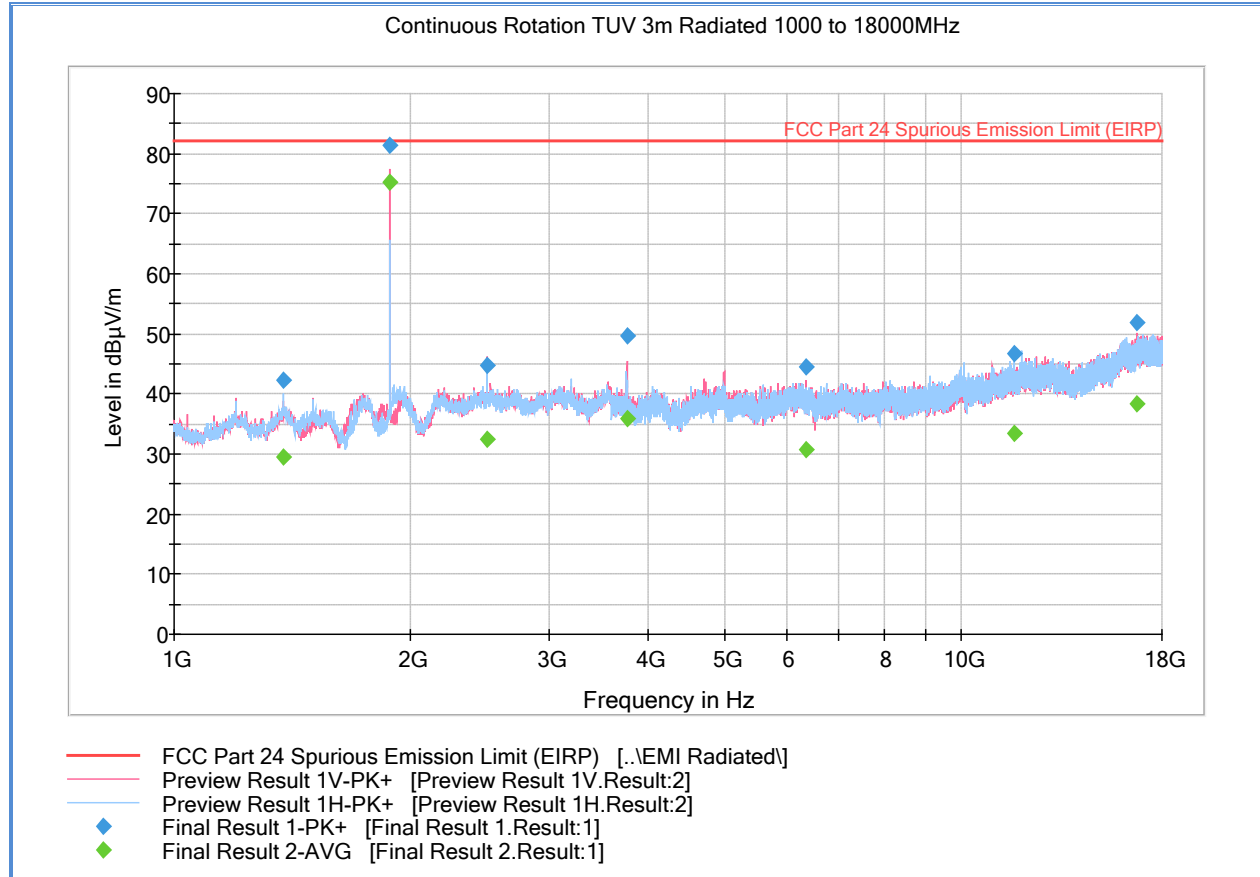
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1499.600000	43.7	1000.0	1000.000	251.5	H	117.0	-6.2	40.7	84.4
2500.166667	49.0	1000.0	1000.000	150.7	V	222.0	-0.5	35.4	84.4
3590.033333	43.2	1000.0	1000.000	175.6	V	-1.0	1.5	41.2	84.4
5000.300000	49.9	1000.0	1000.000	301.2	V	52.0	3.8	34.5	84.4
9961.300000	47.4	1000.0	1000.000	155.6	V	244.0	10.0	37.0	84.4
17099.366667	51.8	1000.0	1000.000	218.4	V	206.0	19.6	32.5	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.23 Test Results Above 1GHz (1xEV-DO BC1 Middle Channel)



Peak Data

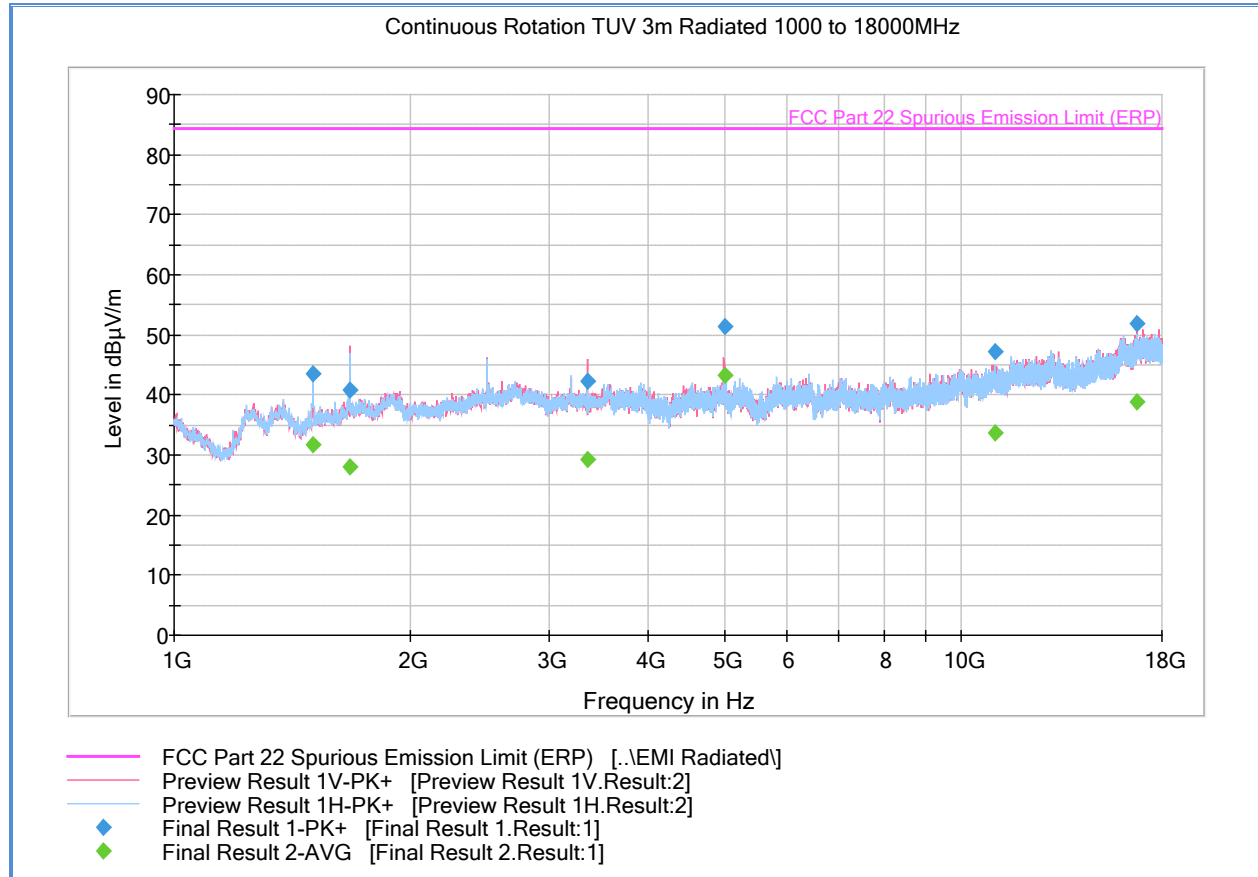
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1374.766667	42.3	1000.0	1000.000	194.5	H	239.0	-5.5	42.1	84.4
1880.233333	81.4	1000.0	1000.000	231.3	V	185.0	-2.9	2.9	84.4
2500.200000	44.7	1000.0	1000.000	177.5	V	248.0	-0.5	39.7	84.4
3759.466667	49.6	1000.0	1000.000	124.7	V	216.0	1.9	34.7	84.4
6345.733333	44.6	1000.0	1000.000	212.4	V	268.0	6.1	39.8	84.4
11688.900000	46.7	1000.0	1000.000	99.7	H	172.0	13.2	37.7	84.4
16700.466667	51.9	1000.0	1000.000	132.7	V	306.0	19.6	32.5	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters). Notched carrier is ignored.

2.7.24 Test Results Above 1GHz (GPRS/EGPRS 850 High Channel)



Peak Data

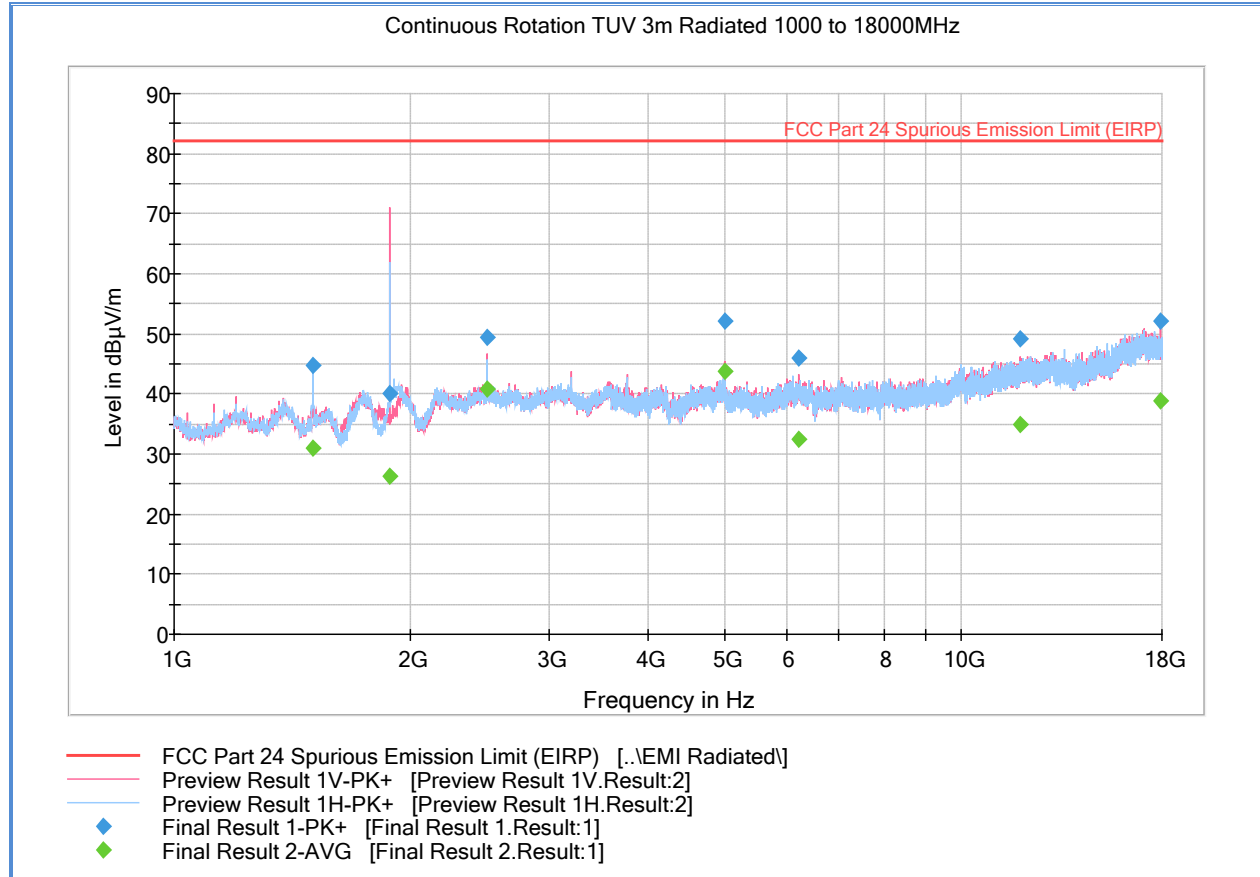
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.200000	43.5	1000.0	1000.000	236.4	H	52.0	-6.2	40.8	84.4
1673.800000	40.8	1000.0	1000.000	286.2	V	204.0	-4.8	43.5	84.4
3346.766667	42.3	1000.0	1000.000	401.1	V	158.0	1.0	42.1	84.4
4999.933333	51.5	1000.0	1000.000	218.4	V	333.0	3.8	32.9	84.4
11025.266667	47.3	1000.0	1000.000	116.7	H	227.0	12.2	37.0	84.4
16760.900000	51.9	1000.0	1000.000	323.1	V	192.0	19.7	32.4	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.25 Test Results Above 1GHz (GPRS/EGPRS 1900 Low Channel)



Peak Data

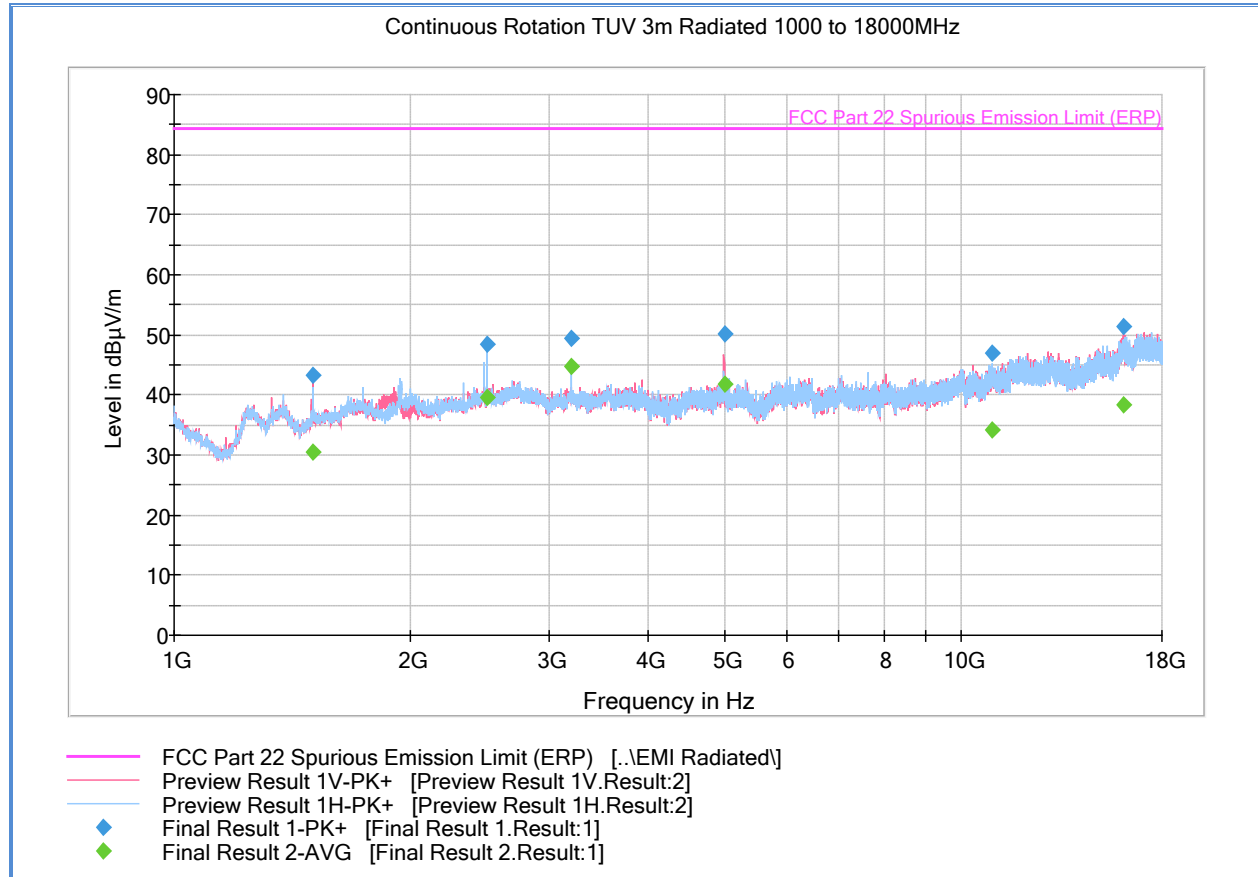
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.200000	44.8	1000.0	1000.000	176.6	H	102.0	-6.2	39.6	84.4
1880.033333	40.1	1000.0	1000.000	322.2	V	173.0	-2.9	44.2	84.4
2499.800000	49.4	1000.0	1000.000	159.6	V	319.0	-0.5	35.0	84.4
5000.300000	52.1	1000.0	1000.000	227.4	V	331.0	3.8	32.3	84.4
6230.900000	46.0	1000.0	1000.000	120.7	V	196.0	6.0	38.4	84.4
11867.733333	49.1	1000.0	1000.000	384.0	V	297.0	13.6	35.3	84.4
17898.366667	52.1	1000.0	1000.000	406.7	V	274.0	19.8	32.3	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters). Notched carrier is ignored.

2.7.26 Test Results Above 1GHz (WCDMA/HSPA B5 Low Channel)



Peak Data

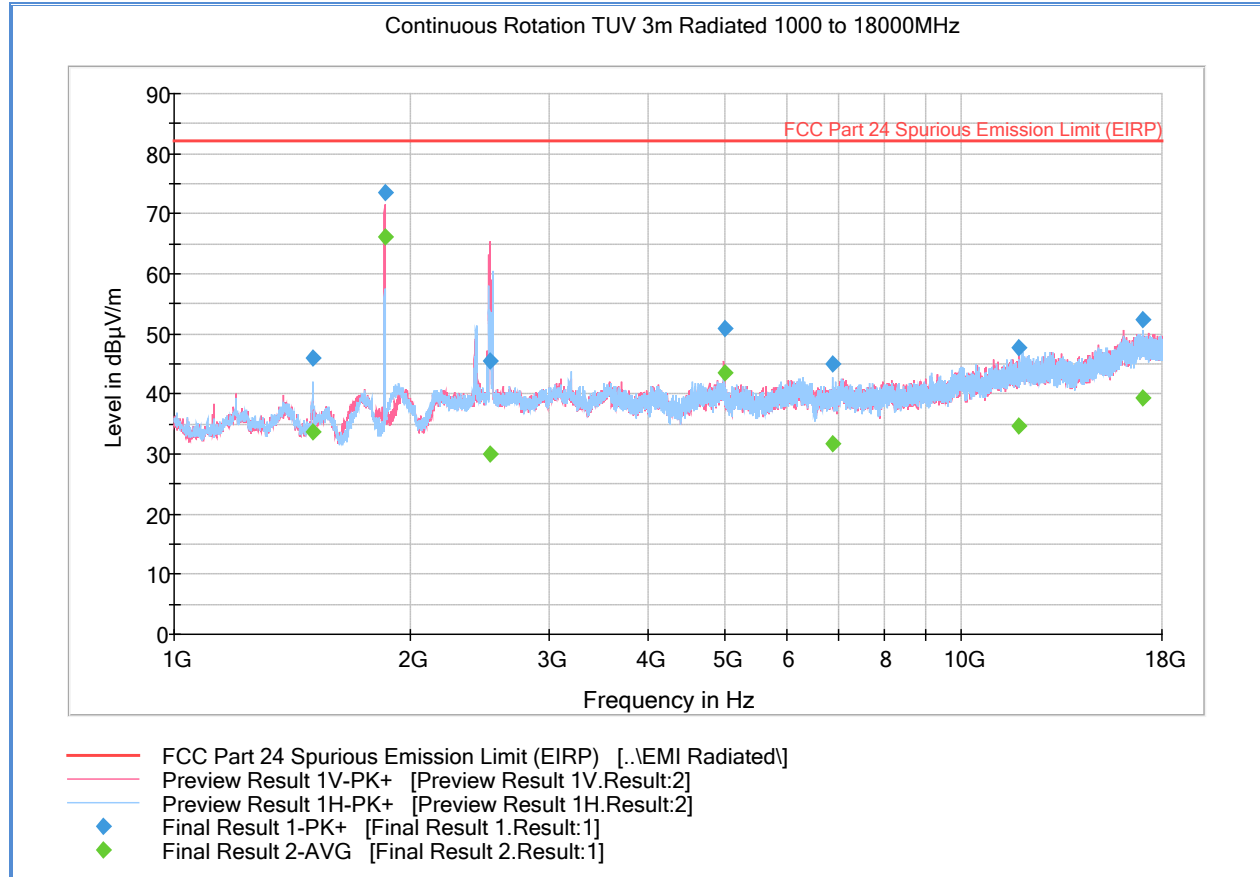
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.000000	43.3	1000.0	1000.000	115.8	V	10.0	-6.2	41.1	84.4
2499.766667	48.6	1000.0	1000.000	142.7	H	136.0	-0.5	35.8	84.4
3200.000000	49.5	1000.0	1000.000	115.8	H	90.0	1.2	34.9	84.4
4999.933333	50.1	1000.0	1000.000	287.2	V	89.0	3.8	34.3	84.4
10957.300000	47.0	1000.0	1000.000	288.3	H	342.0	12.0	37.4	84.4
16078.300000	51.4	1000.0	1000.000	247.3	V	327.0	18.6	33.0	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.27 Test Results Above 1GHz (WCDMA/HSPA B2 Low Channel)



Peak Data

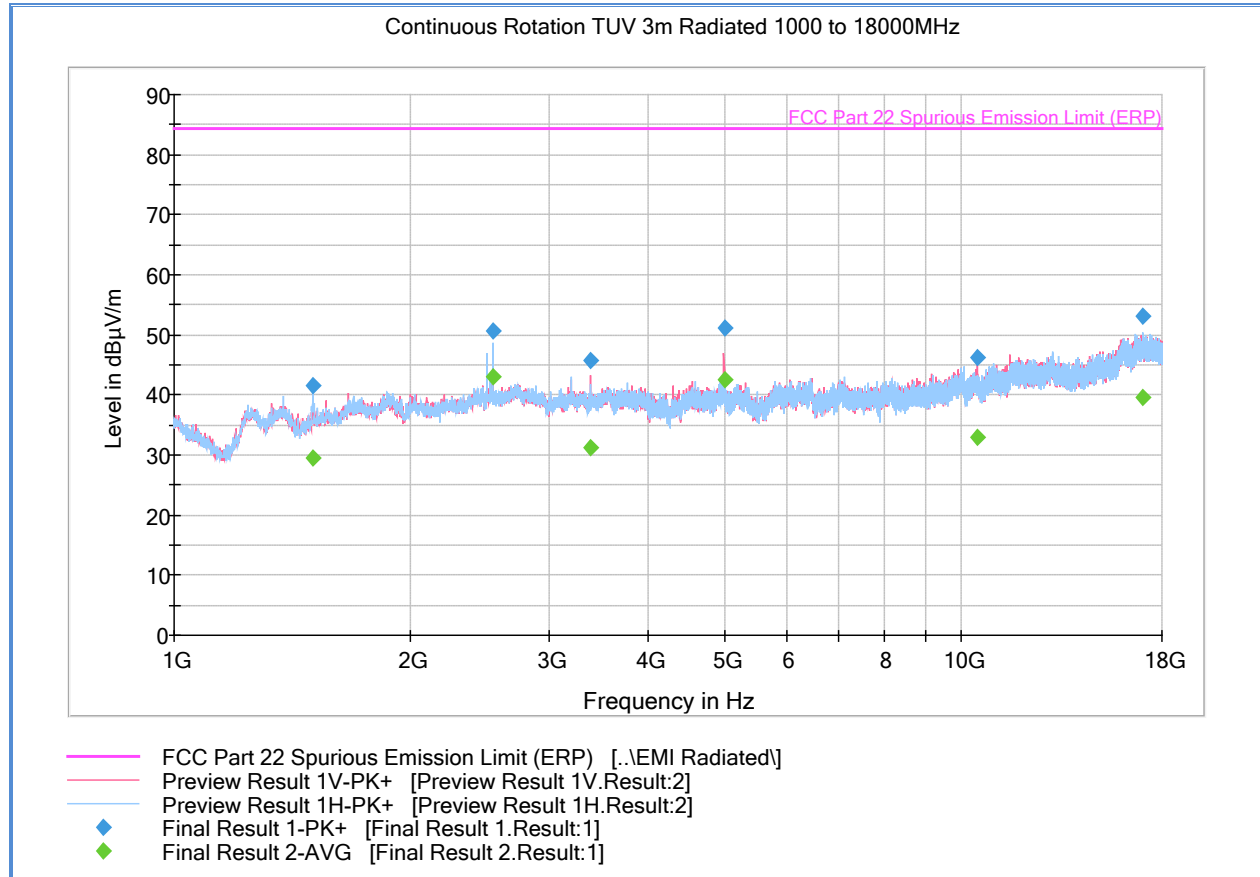
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.200000	45.9	1000.0	1000.000	164.6	H	188.0	-6.2	38.5	84.4
1851.333333	73.6	1000.0	1000.000	288.2	V	192.0	-3.3	10.8	84.4
2521.700000	45.4	1000.0	1000.000	270.3	V	24.0	-0.6	39.0	84.4
5000.133333	50.9	1000.0	1000.000	143.6	V	134.0	3.8	33.5	84.4
6876.000000	45.0	1000.0	1000.000	334.1	H	182.0	6.0	39.4	84.4
11861.266667	47.7	1000.0	1000.000	203.5	V	10.0	13.6	36.7	84.4
16986.433333	52.5	1000.0	1000.000	402.0	H	16.0	19.6	31.9	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters). Notched carrier is ignored.

2.7.28 Test Results Above 1GHz (LTE Band 5 High Channel)



Peak Data

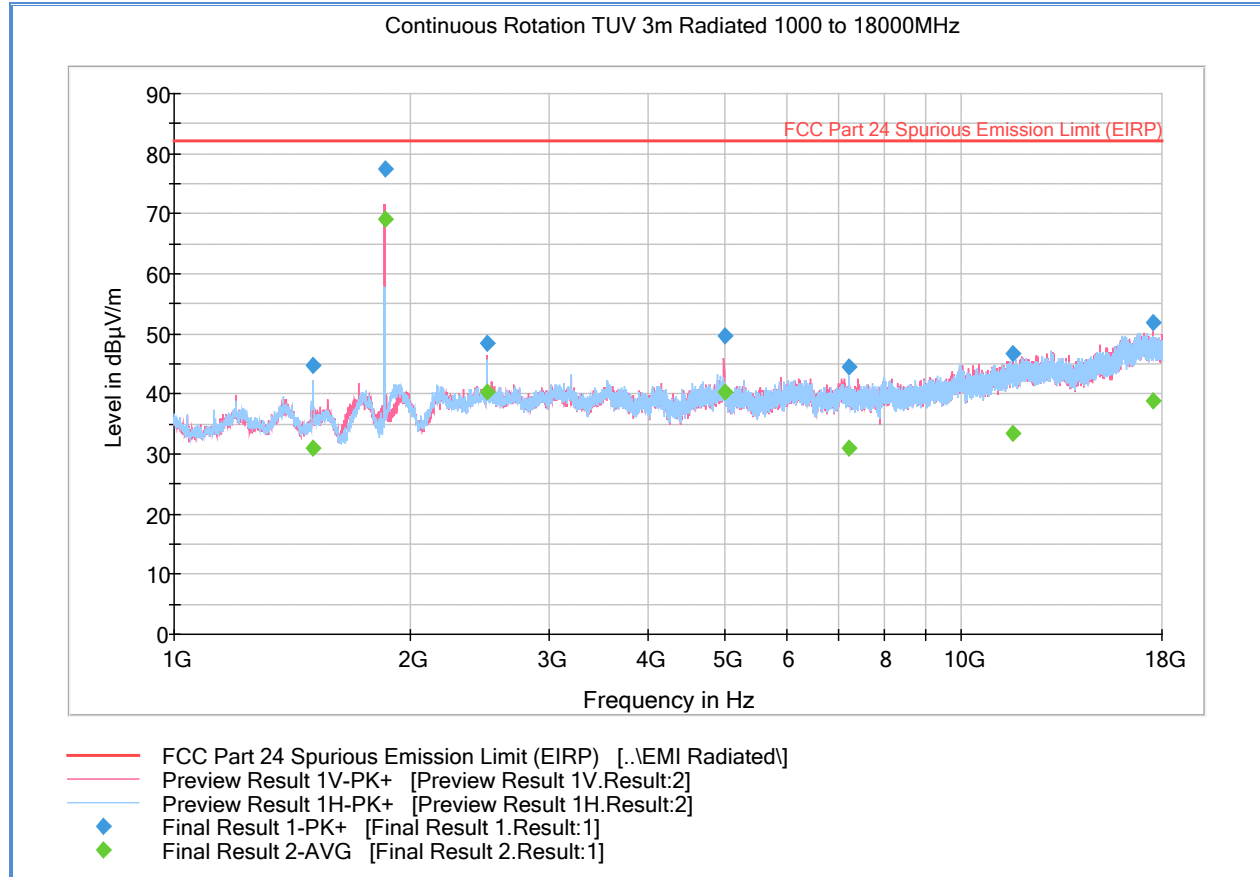
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.600000	41.7	1000.0	1000.000	132.7	V	5.0	-6.2	42.7	84.4
2538.133333	50.7	1000.0	1000.000	283.2	H	146.0	-0.7	33.6	84.4
3384.166667	45.7	1000.0	1000.000	291.2	V	68.0	0.9	38.7	84.4
4999.933333	51.2	1000.0	1000.000	247.3	V	331.0	3.8	33.1	84.4
10468.300000	46.3	1000.0	1000.000	350.7	V	217.0	10.9	38.1	84.4
16996.833333	53.0	1000.0	1000.000	410.8	H	325.0	19.6	31.4	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.7.29 Test Results Above 1GHz (LTE Band 2 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)
1500.233333	44.7	1000.0	1000.000	181.5	H	189.0	-6.2	39.7	84.4
1851.000000	77.4	1000.0	1000.000	329.1	V	183.0	-3.3	7.0	84.4
2500.200000	48.5	1000.0	1000.000	152.6	V	249.0	-0.5	35.9	84.4
5000.333333	49.8	1000.0	1000.000	164.6	V	259.0	3.8	34.6	84.4
7193.133333	44.4	1000.0	1000.000	251.5	H	68.0	6.6	40.0	84.4
11657.833333	46.8	1000.0	1000.000	345.1	V	219.0	13.2	37.6	84.4
17514.766667	51.8	1000.0	1000.000	368.1	V	111.0	19.7	32.5	84.4

Substitution Data

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

Test Notes: Only worst case channel presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters). Notched carrier is ignored.



2.8 FREQUENCY STABILITY

2.8.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055
FCC 47 CFR Part 22, Clause 22.355
FCC 47 CFR Part 24, Clause 24.235
RSS-132, Clause 5.3
RSS-133, Clause 6.3

2.8.2 Standard Applicable

FCC:

Part 22 Clause 22.355: Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1—Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Mobile ≤ 3 watts (ppm)
821 to 896	2.5

Part 24, Clause 24.235: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

ISED:

RSS-132 Clause 5.3: The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

RSS-133 Clause 6.3: The carrier frequency shall not depart from the reference frequency, in excess of ± 2.5 ppm for mobile stations.

2.8.3 Equipment Under Test and Modification State

Serial No: 1073-0286 and 1073-0319 / Test Configuration A

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

February 27 and 28, 2017/FSC

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	23.5 – 23.7 °C
Relative Humidity	40.9 -47.1 %
ATM Pressure	98.7 – 99.2 kPa

2.8.7 Additional Observations

- This is a conducted test. The EUT was operated at 5.0VDC nominal USB voltage and was placed in the temperature chamber for the series of evaluations performed.
- Test methodology is per Section 5.6 of ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.
- Voltage variations @ 20°C was performed at the manufacturer declared rated voltage of 5 ±0.25 VDC.
- Reference measurements were performed on mid channels only.
- For PCS devices, the maximum frequency deviation was used as frequency offset to verify that the fundamental emission stay within the authorized bands of operation.
- For Cellular devices, the maximum frequency deviation in percent was used to calculate maximum frequency deviation in parts per million (ppm).

2.8.8 Sample Calculations for PCS Devices

CDMA2000 BC1 (1850 MHz to 1910 MHz)

$$\text{Reference Center Frequency @ 20°C:} = \frac{T_1 + T_2}{2}$$

T₂ and T₁ are Marker Points on the plot based on 99% OBW)

$$= \frac{1878.5386 \text{ MHz} + 1881.4794 \text{ MHz}}{2}$$
$$= 1880.009 \text{ MHz}$$

$$\text{Reference Center Frequency @ 30°C:} = \frac{1878.5268 \text{ MHz} + 1881.5003 \text{ MHz}}{2}$$
$$= 1880.01355 \text{ MHz}$$

$$\text{Therefore Frequency Deviation:} = 1880.01355 \text{ MHz} - 1880.009 \text{ MHz}$$
$$= 0.00455 \text{ MHz}$$

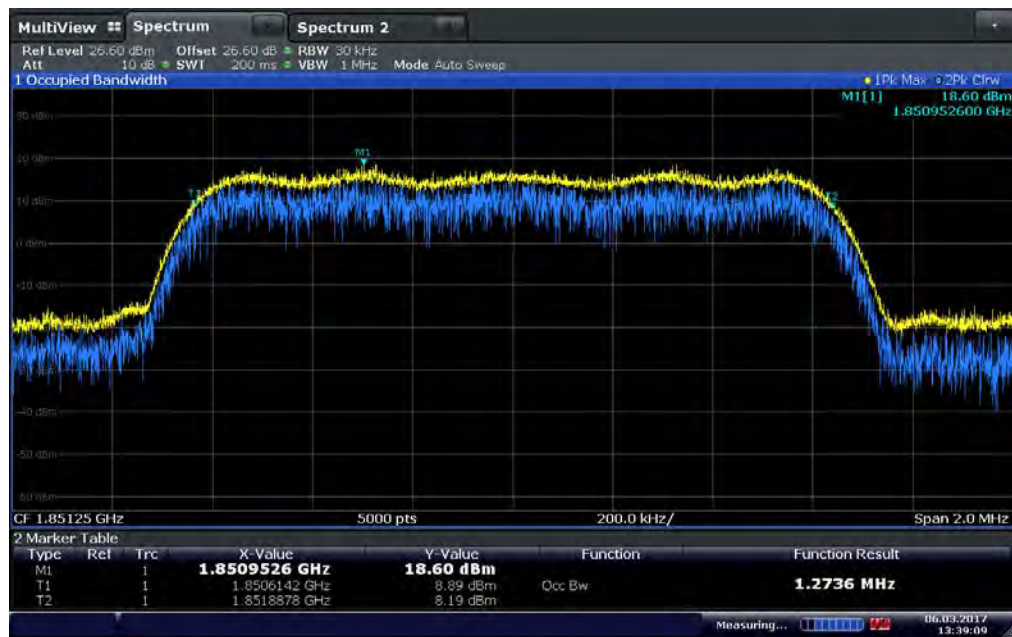
Reference F_L @ 20°C: 1850.6142 MHz (based from Low Channel lower edge 99% OBW)

Reference F_H @ 20°C: 1909.3870 MHz (based from High Channel upper edge 99% OBW)

Using Frequency Deviation as the offset for both F_L and F_H, we get the following:

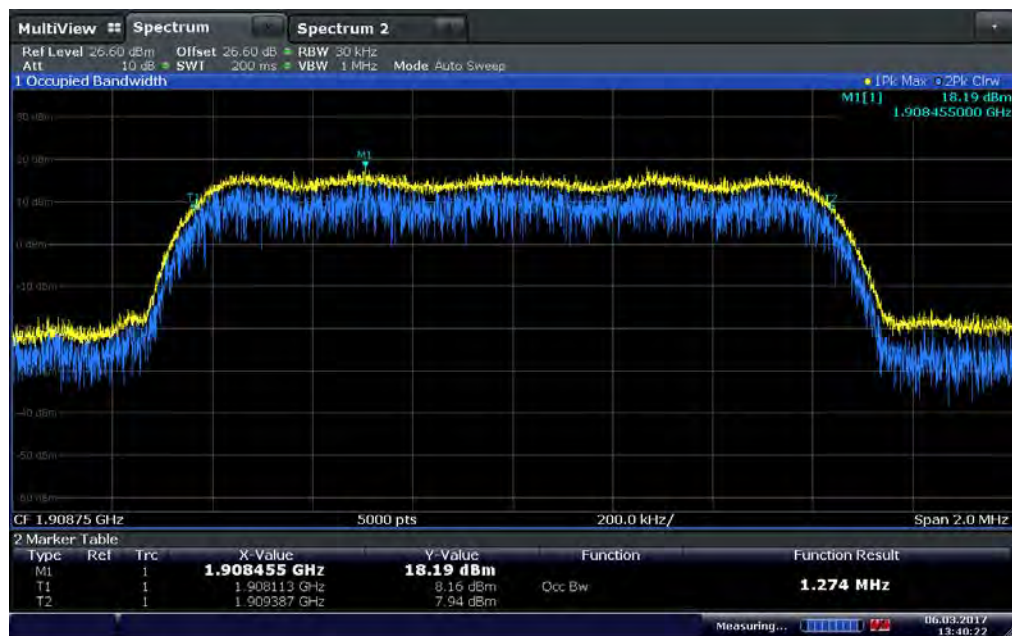
$$F_L = 1850.6142 \text{ MHz} - 0.00455 \text{ MHz}$$
$$= 1850.60965 \text{ MHz (within the 1850 MHz to 1910 MHz Band, complies)}$$

$$F_H = 1909.3870 \text{ MHz} + 0.00455 \text{ MHz}$$
$$= 1909.3916 \text{ MHz (within the 1850 MHz to 1910 MHz Band, complies)}$$



Date: 6.MAR.2017 13:39:09

CDMA2000 BC1 Low Channel 99% OBW showing $T_1 (F_L)$



Date: 6.MAR.2017 13:40:22

CDMA2000 BC1 High Channel 99% OBW showing $T_2 (F_H)$

2.8.9 Test Results Summary

Mode	Frequency (MHz)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Compliance
CDMA2000 BC0	836.52	0.000178	1.78	2.5	Complies
CDMA2000 BC1	1880.0	-0.000241	-2.41	See Note	Complies
1xEV-DO BC0	836.52	0.000196	1.96	2.5	Complies
1xEV-DO BC1	1880.0	0.000180	1.80	See Note	Complies
WCDMA/HSPA B5	836.60	0.000246	2.46	2.5	Complies
WCDMA/HSPA B2	1880.0	-0.000248	-2.48	See Note	Complies
GPRS850	836.60	0.000007	0.07	2.5	Complies
GPRS1900	1888.0	0.000018	0.18	See Note	Complies
EDGE850	836.60	-0.000008	-0.08	2.5	Complies
EDGE1900	1888.0	-0.000100	-1.00	See Note	Complies
LTE Band 5	836.50	0.000136	1.36	2.5	Complies
LTE Band 2	1880.0	-0.000241	-2.41	See Note	Complies

Note: Limit for PCS devices is that the fundamental emissions stay within the authorized bands of operation.

2.8.10 Test Results Table

CDMA2000 BC0					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	835.862903	837.177500	836.52	-0.000077	-0.77
40°C	835.862784	837.175560	836.52	0.000046	0.46
30°C	835.862342	837.176832	836.52	-0.000004	-0.04
20°C (+15% NV)	835.862145	837.176986	836.52	0.000145	1.45
20°C (NV)	835.862145	837.176962	836.52	0.000000	0.00
20°C (-15% NV)	835.862132	837.176958	836.52	0.000001	0.01
10°C	835.865420	837.174367	836.52	-0.000041	-0.41
0°C	835.866550	837.175000	836.52	-0.000146	-1.46
-10°C	835.865421	837.176642	836.52	-0.000177	-1.77
-20°C	835.860345	837.175789	836.52	0.000178	1.78
-30°C	835.861412	837.176943	836.52	0.000045	0.45

CDMA2000 BC1					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	1878.5092	1881.5045	1880.01	0.000116	1.16
40°C	1878.5135	1881.5018	1880.01	0.000074	0.74
30°C	1878.5268	1881.5003	1880.01	-0.000241	-2.41
20°C (+15% NV)	1878.5384	1881.4794	1880.01	0.000006	0.06
20°C (NV)	1878.5386	1881.4794	1880.01	0.000000	0.00
20°C (-15% NV)	1878.538	1881.4806	1880.01	-0.000014	-0.14
10°C	1878.5255	1881.4989	1880.01	-0.000171	-1.71
0°C	1878.5325	1881.4881	1880.01	-0.000066	-0.66
-10°C	1878.5336	1881.4785	1880.01	0.000159	1.59
-20°C	1878.5228	1881.4881	1880.01	0.000193	1.93
-30°C	1878.5229	1881.4986	1880.01	-0.000094	-0.94

1xEV-DO BC0					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	835.86274	837.17614	836.52	-0.000108	-1.08
40°C	835.85951	837.17783	836.52	-0.000016	-0.16
30°C	835.86215	837.17631	836.52	-0.000083	-0.83
20°C (+15% NV)	835.85890	837.17769	836.52	0.000028	0.28
20°C (NV)	835.85999	837.17707	836.52	0.000000	0.00
20°C (-15% NV)	835.86250	837.17754	836.52	-0.000178	-1.78
10°C	835.85830	837.17549	836.52	0.000196	1.96
0°C	835.86005	837.17548	836.52	0.000092	0.92
-10°C	835.86255	837.17524	836.52	-0.000044	-0.44
-20°C	835.86465	837.17539	836.52	-0.000178	-1.78
-30°C	835.86208	837.17569	836.52	-0.000043	-0.43

1xEV-DO BC1					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	1878.507	1881.5368	1880.02	0.000109	1.09
40°C	1878.5256	1881.5245	1880.03	-0.000058	-0.58
30°C	1878.5352	1881.5158	1880.03	-0.000082	-0.82
20°C (+15% NV)	1878.5372	1881.5106	1880.02	0.000003	0.03
20°C (NV)	1878.5374	1881.5106	1880.02	0.000000	0.00
20°C (-15% NV)	1878.5373	1881.5105	1880.02	0.000005	0.05
10°C	1878.5357	1881.5125	1880.02	-0.000005	-0.05
0°C	1878.5322	1881.5124	1880.02	0.000091	0.91
-10°C	1878.5225	1881.5203	1880.02	0.000137	1.37
-20°C	1878.5227	1881.5185	1880.02	0.000180	1.80
-30°C	1878.5232	1881.5198	1880.02	0.000130	1.30

WCDMA/HSPA B5					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	834.5303	838.66572	836.60	0.000236	2.36
40°C	834.53134	838.66451	836.60	0.000246	2.46
30°C	834.53251	838.66473	836.60	0.000163	1.63
20°C (+15% NV)	834.53552	838.66442	836.60	0.000002	0.02
20°C (NV)	834.53562	838.66435	836.60	0.000000	0.00
20°C (-15% NV)	834.53563	838.66412	836.60	0.000013	0.13
10°C	834.53253	838.6645	836.60	0.000176	1.76
0°C	834.53243	838.66432	836.60	0.000192	1.92
-10°C	834.53332	838.6643	836.60	0.000140	1.40
-20°C	834.53471	838.66754	836.60	-0.000136	-1.36
-30°C	834.53202	838.66848	836.60	-0.000032	-0.32

WCDMA/HSPA B2					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	1877.1426	1882.8932	1880.02	-0.000248	-2.48
40°C	1877.2359	1882.7823	1880.01	0.000221	2.21
30°C	1877.1432	1882.8832	1880.01	0.000002	0.02
20°C (+15% NV)	1877.4014	1882.6254	1880.01	-0.000007	-0.07
20°C (NV)	1877.4014	1882.6252	1880.01	0.000000	0.00
20°C (-15% NV)	1877.4025	1882.6235	1880.01	0.000014	0.14
10°C	1877.4056	1882.6147	1880.01	0.000167	1.67
0°C	1877.4085	1882.6098	1880.01	0.000219	2.19
-10°C	1877.4088	1882.6088	1880.01	0.000237	2.37
-20°C	1877.4107	1882.6095	1880.01	0.000167	1.67
-30°C	1877.4167	1882.6071	1880.01	0.000073	0.73

GPRS850					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	836.42835	836.77156	836.60	-0.000002	-0.02
40°C	836.42825	836.77154	836.60	0.000004	0.04
30°C	836.42832	836.77151	836.60	0.000002	0.02
20°C (+15% NV)	836.42837	836.77148	836.60	0.000001	0.01
20°C (NV)	836.42837	836.7715	836.60	0.000000	0.00
20°C (-15% NV)	836.42826	836.7715	836.60	0.000006	0.06
10°C	836.42833	836.77149	836.60	0.000003	0.03
0°C	836.42833	836.77154	836.60	-0.000001	-0.01
-10°C	836.42834	836.77147	836.60	0.000003	0.03
-20°C	836.4284	836.77143	836.60	0.000002	0.02
-30°C	836.42833	836.77142	836.60	0.000007	0.07

GPRS1900					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	1878.86012	1881.14137	1880.00	0.000005	0.05
40°C	1878.86032	1881.14125	1880.00	0.000003	0.03
30°C	1878.86038	1881.14120	1880.00	0.000003	0.03
20°C (+15% NV)	1878.86055	1881.14115	1880.00	-0.000001	-0.01
20°C (NV)	1878.86043	1881.14125	1880.00	0.000000	0.00
20°C (-15% NV)	1878.86100	1881.14100	1880.00	-0.000009	-0.09
10°C	1878.86092	1881.14088	1880.00	-0.000003	-0.03
0°C	1878.86012	1881.14105	1880.00	0.000014	0.14
-10°C	1878.85995	1881.14122	1880.00	0.000014	0.14
-20°C	1878.85975	1881.14154	1880.00	0.000010	0.10
-30°C	1878.85987	1881.14114	1880.00	0.000018	0.18

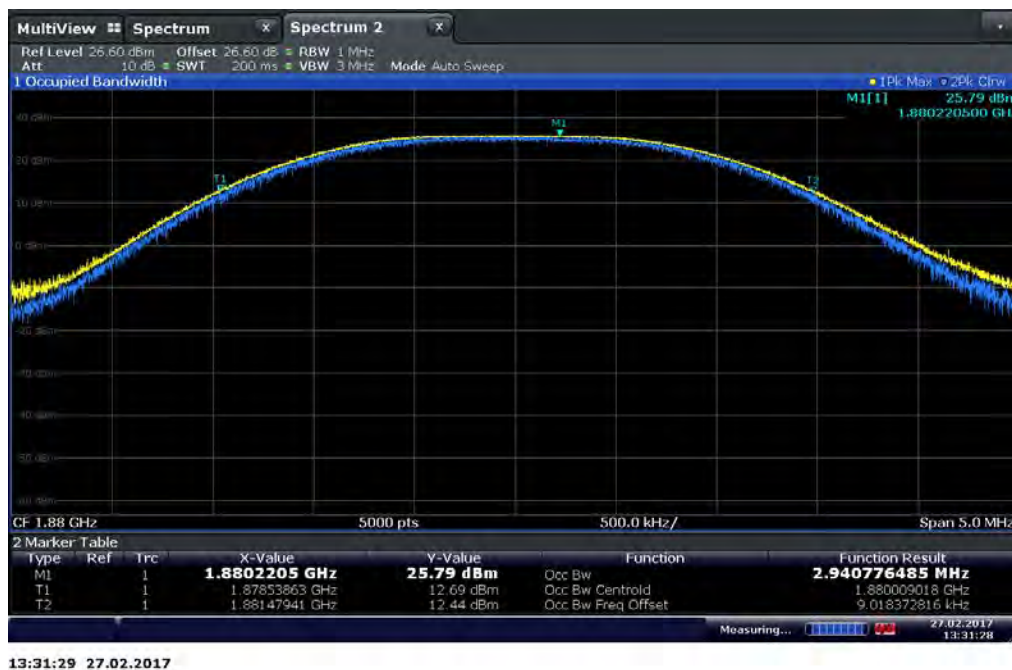
EDGE850					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	836.42833	836.77158	836.60	-0.000004	-0.04
40°C	836.42839	836.77158	836.60	-0.000008	-0.08
30°C	836.42838	836.77158	836.60	-0.000007	-0.07
20°C (+15% NV)	836.42835	836.77151	836.60	-0.000001	-0.01
20°C (NV)	836.42833	836.77151	836.60	0.000000	0.00
20°C (-15% NV)	836.42832	836.77154	836.60	-0.000001	-0.01
10°C	836.42836	836.77146	836.60	0.000001	0.01
0°C	836.42833	836.7715	836.60	0.000000	0.00
-10°C	836.42834	836.7715	836.60	0.000000	0.00
-20°C	836.42838	836.77148	836.60	-0.000001	-0.01
-30°C	836.42833	836.77141	836.60	0.000006	0.06

EDGE1900					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	1878.86102	1881.1404	1880.00	-0.000016	-0.16
40°C	1878.86005	1881.1423	1880.00	-0.000041	-0.41
30°C	1878.86202	1881.1412	1880.00	-0.000065	-0.65
20°C (+15% NV)	1878.86345	1881.1411	1880.00	-0.000100	-1.00
20°C (NV)	1878.85979	1881.1410	1880.00	0.000000	0.00
20°C (-15% NV)	1878.85988	1881.1411	1880.00	-0.000005	-0.05
10°C	1878.85955	1881.1425	1880.00	-0.000034	-0.34
0°C	1878.85967	1881.1413	1880.00	-0.000005	-0.05
-10°C	1878.86001	1881.1406	1880.00	0.000005	0.05
-20°C	1878.85988	1881.1407	1880.00	0.000007	0.07
-30°C	1878.85987	1881.1410	1880.00	-0.000001	-0.01

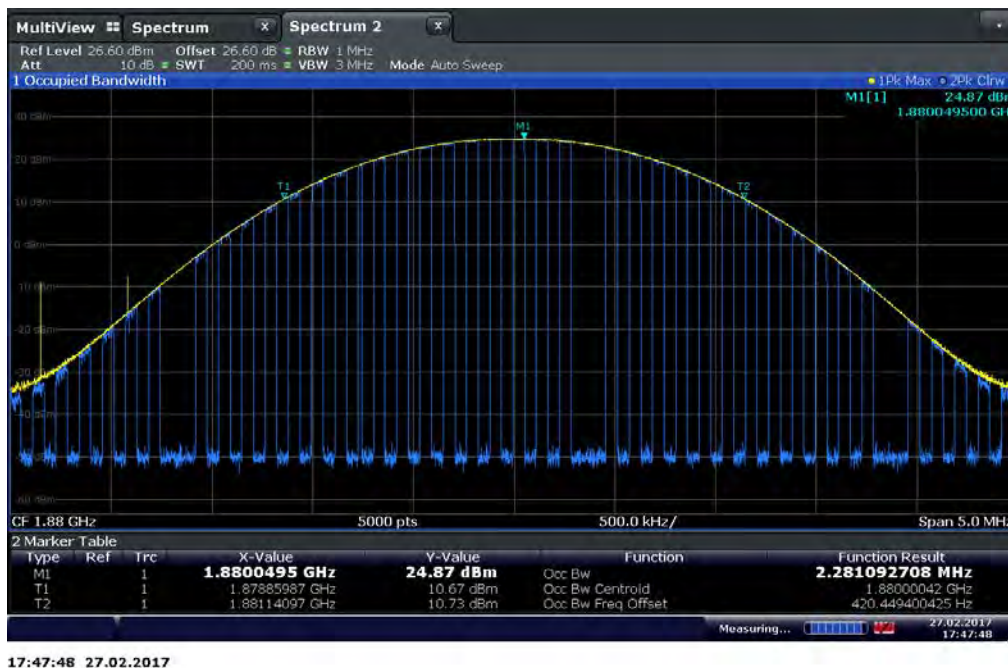
LTE Band 5					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	834.24408	838.75513	836.50	0.000105	1.05
40°C	834.24666	838.75345	836.50	0.000051	0.51
30°C	834.24378	838.75823	836.50	-0.000063	-0.63
20°C (+15% NV)	834.25462	838.74645	836.50	-0.000007	-0.07
20°C (NV)	834.25475	838.74621	836.50	0.000000	0.00
20°C (-15% NV)	834.25488	838.74615	836.50	-0.000004	-0.04
10°C	834.25268	838.74834	836.50	-0.000004	-0.04
0°C	834.25128	838.74989	836.50	-0.000013	-0.13
-10°C	834.24936	838.74934	836.50	0.000135	1.35
-20°C	834.25246	838.74623	836.50	0.000136	1.36
-30°C	834.24432	838.75795	836.50	-0.000078	-0.78

LTE Band 2					
Temperature	F_L/T_1 (MHz)	F_H/T_2 (MHz)	Center Frequency (MHz)	Frequency Deviation (%)	ppm
50°C	1877.14868	1882.8793	1880.01	-0.000241	-2.41
40°C	1877.14678	1882.878	1880.01	-0.000155	-1.55
30°C	1877.14423	1882.8749	1880.01	-0.000005	-0.05
20°C (+15% NV)	1877.14545	1882.8733	1880.01	0.000006	0.06
20°C (NV)	1877.14529	1882.8737	1880.01	0.000000	0.00
20°C (-15% NV)	1877.14565	1882.873	1880.01	0.000008	0.08
10°C	1877.1444	1882.8729	1880.01	0.000044	0.44
0°C	1877.1451	1882.8732	1880.01	0.000017	0.17
-10°C	1877.14327	1882.8731	1880.01	0.000069	0.69
-20°C	1877.14237	1882.8736	1880.01	0.000080	0.80
-30°C	1877.14029	1882.8777	1880.01	0.000026	0.26

2.8.11 Sample Test Plots



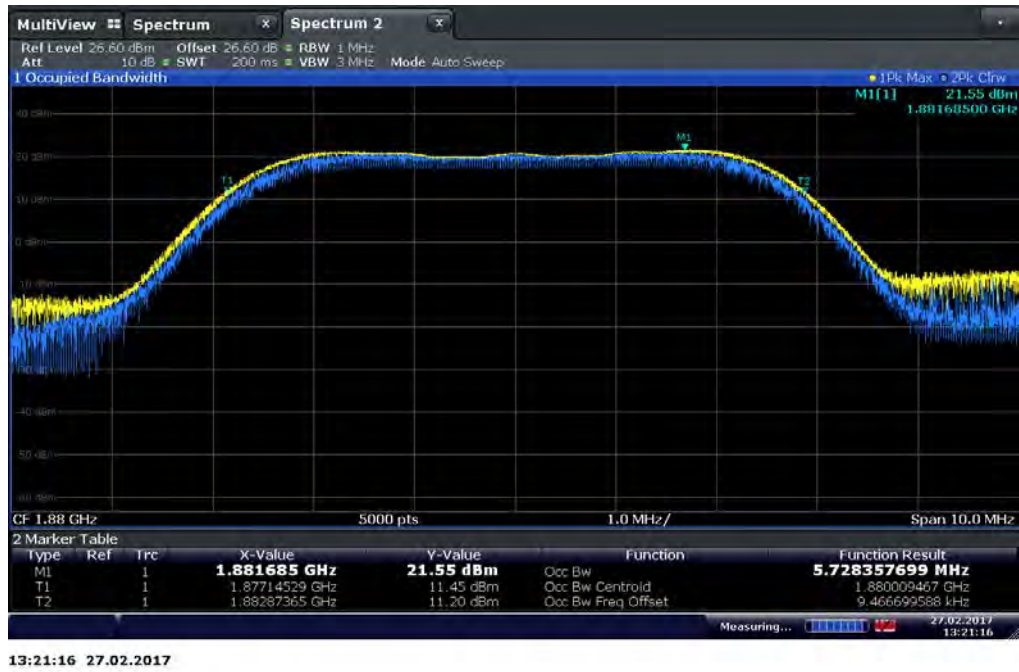
CDMA2000 PCS (Nominal Voltage @20°C)



EGPRS 1900 @ -30°C



WCDMA B2 @ -30°C



LTE B2 @ 20°C



2.9 RECEIVER SPURIOUS EMISSIONS

2.9.1 Specification Reference

RSS-132(4.6) and RSS-133(6.6)

2.9.2 Standard Applicable

Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

2.9.3 Equipment Under Test and Modification State

Not performed. EUT does not fall to any category defined as Receiver under Section 5 of RSS-Gen Issue 4

2.10 POWER LINE CONDUCTED EMISSIONS

2.10.1 Specification Reference

RSS-Gen 8.8

2.10.2 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.*

2.10.3 Equipment Under Test and Modification State

Serial No: 1073-0286/ Test Configuration B

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

March 06, 2017/FSC

2.10.5 Test Equipment Used

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

2.10.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.5 °C
Relative Humidity	34.4 %
ATM Pressure	99.7 kPa



2.10.7 Additional Observations

- Verification performed on the host support laptop.
- 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. See Section 2.10.8 for sample computation

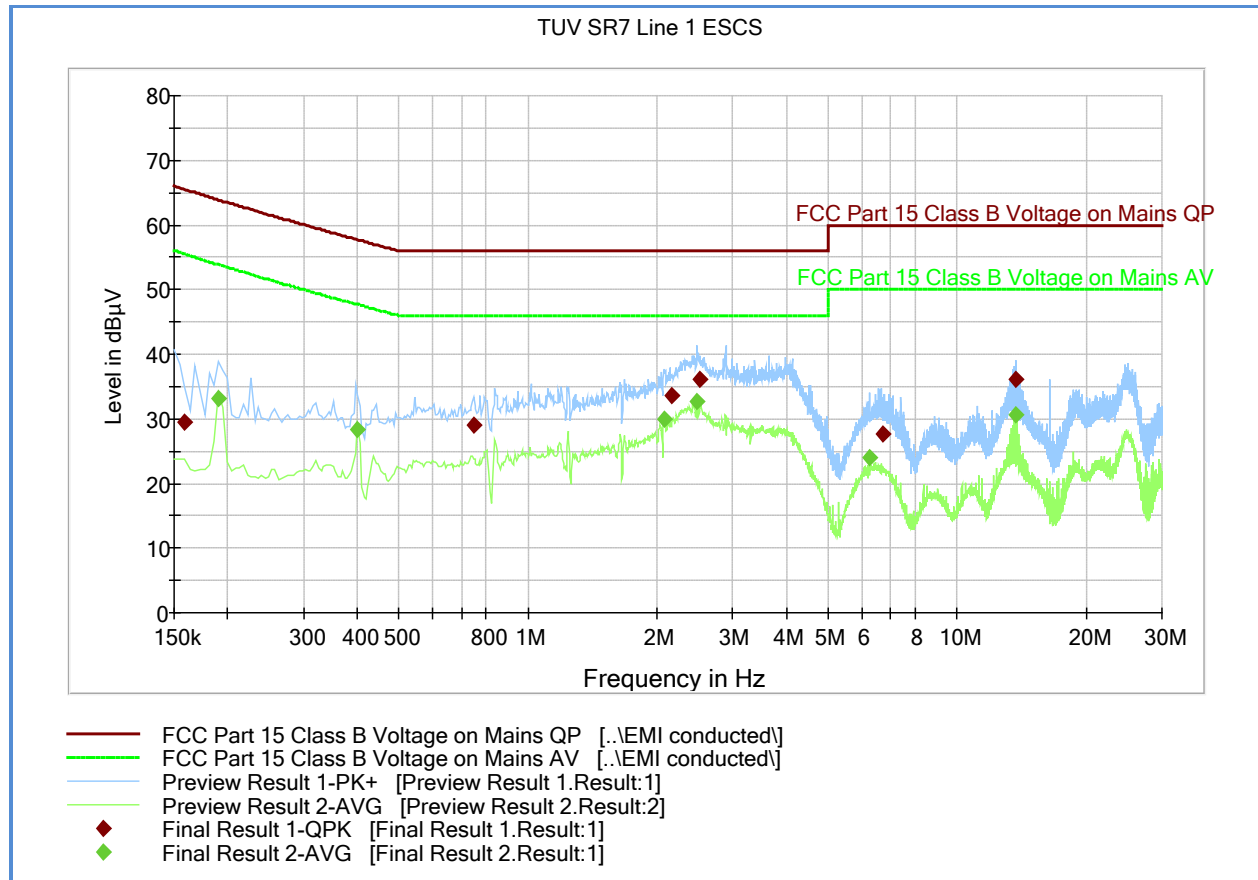
2.10.8 Sample Computation (Conducted Emission – Quasi Peak)

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# 7568 (LISN)	0.30	
Reported QuasiPeak Final Measurement (db μ V) @ 150kHz			26.2

2.10.9 Test Results

Compliant. See attached plots and tables.

2.10.10 120VAC 60Hz (Line 1)



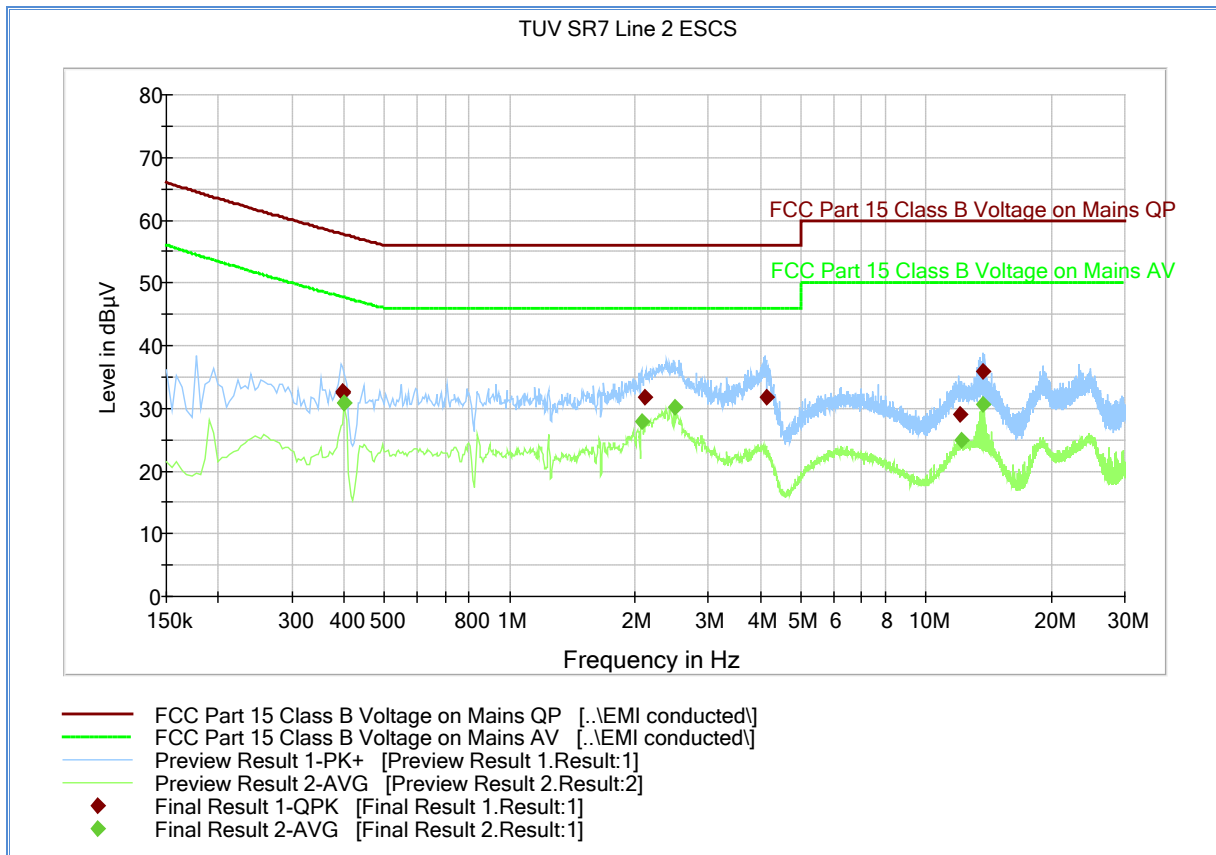
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.159000	29.5	1000.0	9.000	Off	L1	20.2	36.0	65.5
0.748500	29.1	1000.0	9.000	Off	L1	20.0	26.9	56.0
2.166000	33.6	1000.0	9.000	Off	L1	20.0	22.4	56.0
2.512500	36.2	1000.0	9.000	Off	L1	20.1	19.8	56.0
6.706500	27.7	1000.0	9.000	Off	L1	20.1	32.3	60.0
13.659000	36.0	1000.0	9.000	Off	L1	20.2	24.0	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.190500	33.1	1000.0	9.000	Off	L1	20.1	20.7	53.9
0.402000	28.3	1000.0	9.000	Off	L1	20.0	19.4	47.7
2.080500	30.0	1000.0	9.000	Off	L1	20.0	16.0	46.0
2.481000	32.8	1000.0	9.000	Off	L1	20.1	13.2	46.0
6.265500	24.0	1000.0	9.000	Off	L1	20.1	26.0	50.0
13.659000	30.7	1000.0	9.000	Off	L1	20.2	19.3	50.0

2.10.11 120VAC 60Hz (Line 2)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.397500	32.7	1000.0	9.000	Off	N	20.0	25.0	57.8
0.397500	32.6	1000.0	9.000	Off	N	20.0	25.2	57.8
2.121000	31.8	1000.0	9.000	Off	N	20.0	24.2	56.0
4.155000	31.7	1000.0	9.000	Off	N	20.1	24.3	56.0
12.066000	29.1	1000.0	9.000	Off	N	20.2	30.9	60.0
13.659000	35.9	1000.0	9.000	Off	N	20.2	24.1	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.402000	30.9	1000.0	9.000	Off	N	20.0	16.8	47.7
0.402000	30.9	1000.0	9.000	Off	N	20.0	16.8	47.7
2.080500	27.9	1000.0	9.000	Off	N	20.0	18.1	46.0
2.485500	30.2	1000.0	9.000	Off	N	20.1	15.8	46.0
12.165000	24.9	1000.0	9.000	Off	N	20.2	25.1	50.0
13.659000	30.5	1000.0	9.000	Off	N	20.2	19.5	50.0



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7606	USB RF Power Sensor	RadiPower RPR3006W	14I00048SNO 048	DARE!! Instruments	11/30/16	11/30/17
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	NCR. For signalling purposes only	
8800	Broadband Resistive Power Divider	1506A	RR002	Weinschel Corp.	Verified by 7582 and 7608	
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7582 and 7608	
8832	20dB Attenuator	34-20-34	BP4150	MCE/Weinschel	Verified by 7582 and 7608	
Radiated Emissions						
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/07/16	10/07/17
1016	Pre-amplifier	PAM-0202	187	PAM	02/09/17	02/09/18
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	03/21/16	03/21/17
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/16	03/17/17
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/09/17	02/09/18
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	05/16/16	05/16/17
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	06/29/16	06/29/17
8817	800 MHz to 1GHz Notch Filter	BRM50706	019	Micro-Tronics	Verified by 1003 and 7582	
8806	1.8GHz to 2.0GHz Notch Filter	BRM50707	005	Micro-Tronics	Verified by 1003 and 7582	
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 1003 and 7582	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 1003 and 7582	
AC Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	09/07/16	09/07/17
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	11/05/16	11/05/17
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	11/05/16	11/05/17
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7582 and 7608	
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7582 and 7608	



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

3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Conducted 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	Combiners	Rectangular	1.20	0.69	0.48
4	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.77
Coverage Factor (k):					1.96
Expanded Uncertainty:					1.51

3.2.2 AC Conducted Emissions

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

3.2.3 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

3.2.4 Radiated Measurements (Above 1GHz)

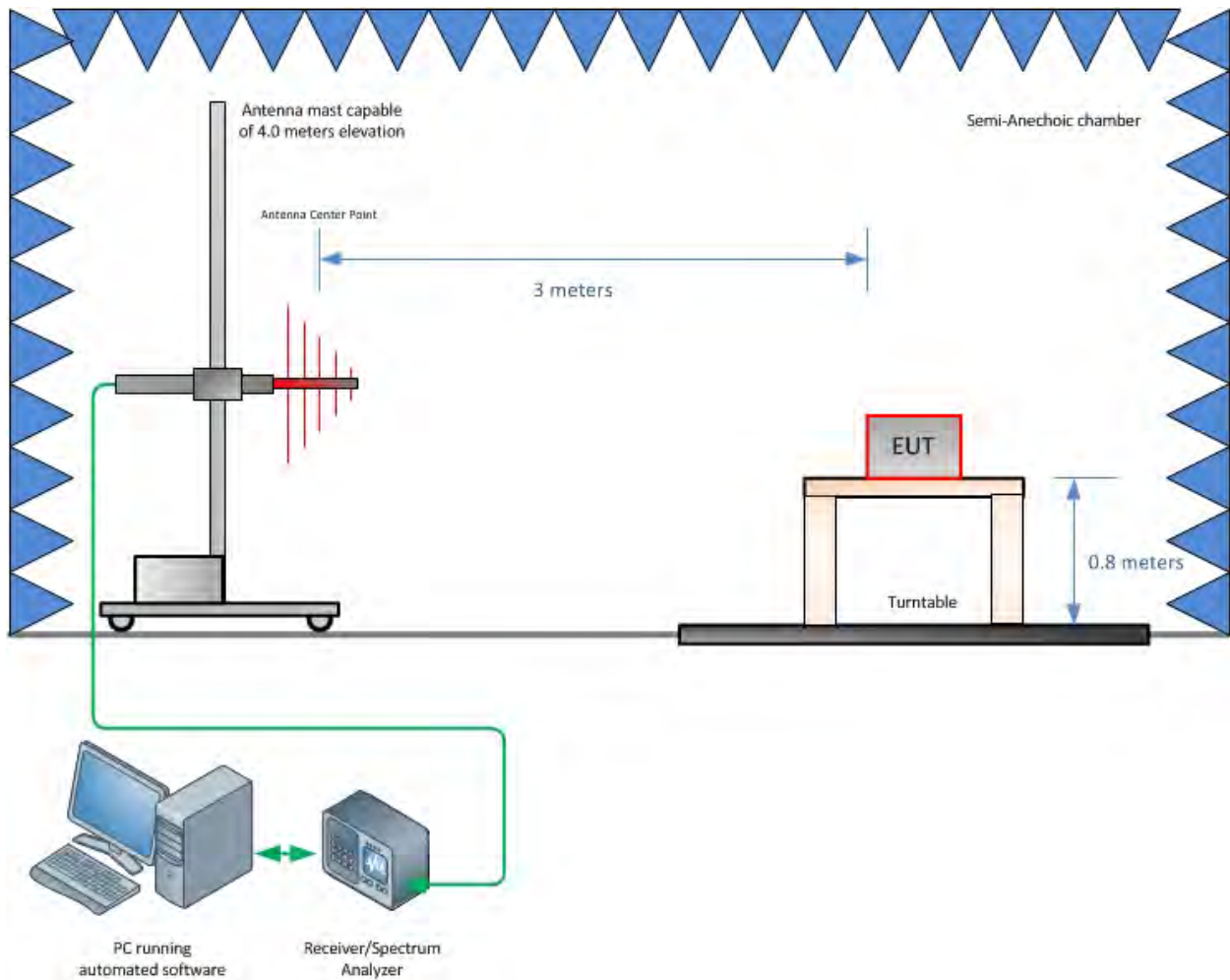
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	2.70	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:					3.57



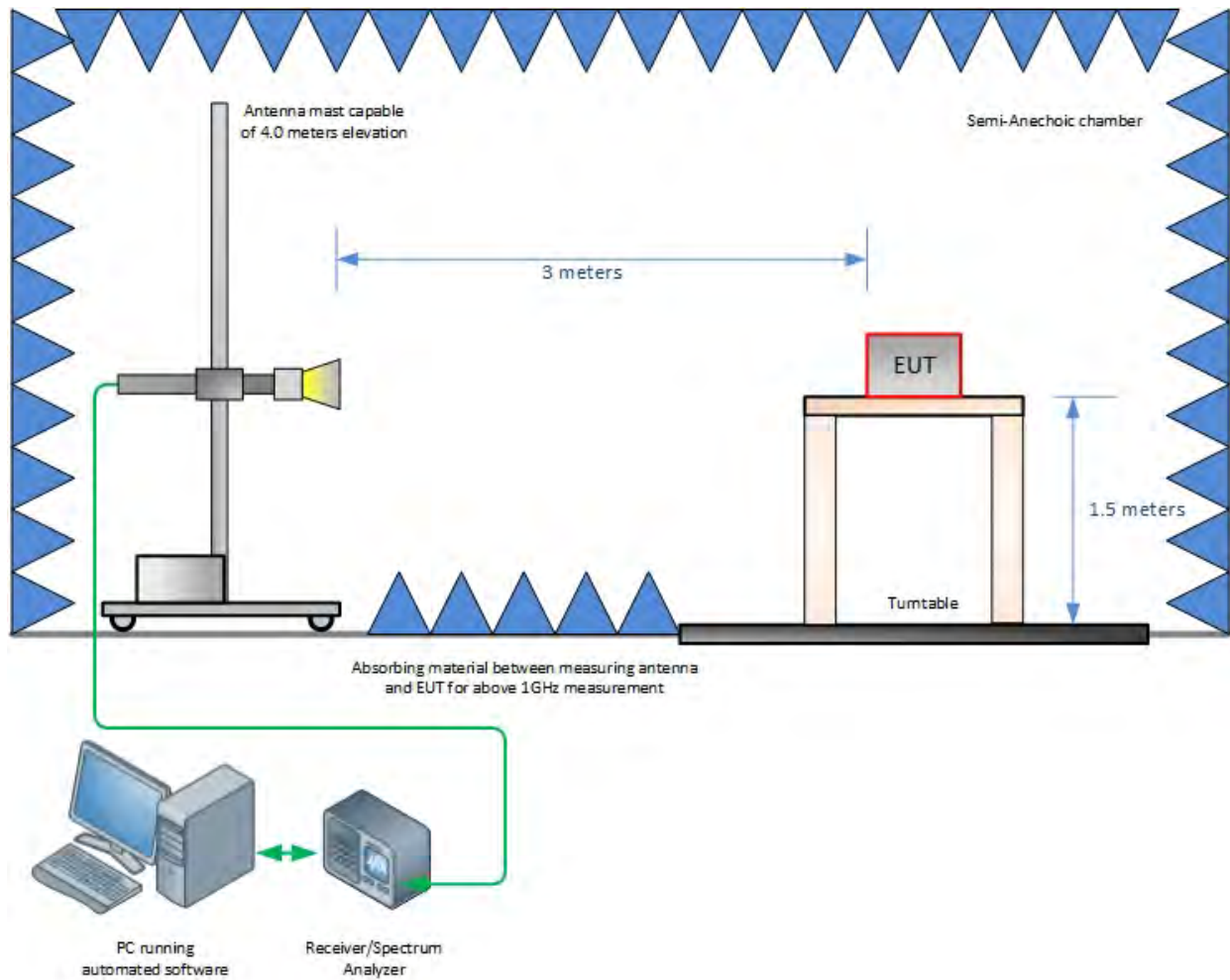
SECTION 4

DIAGRAM OF TEST SETUP

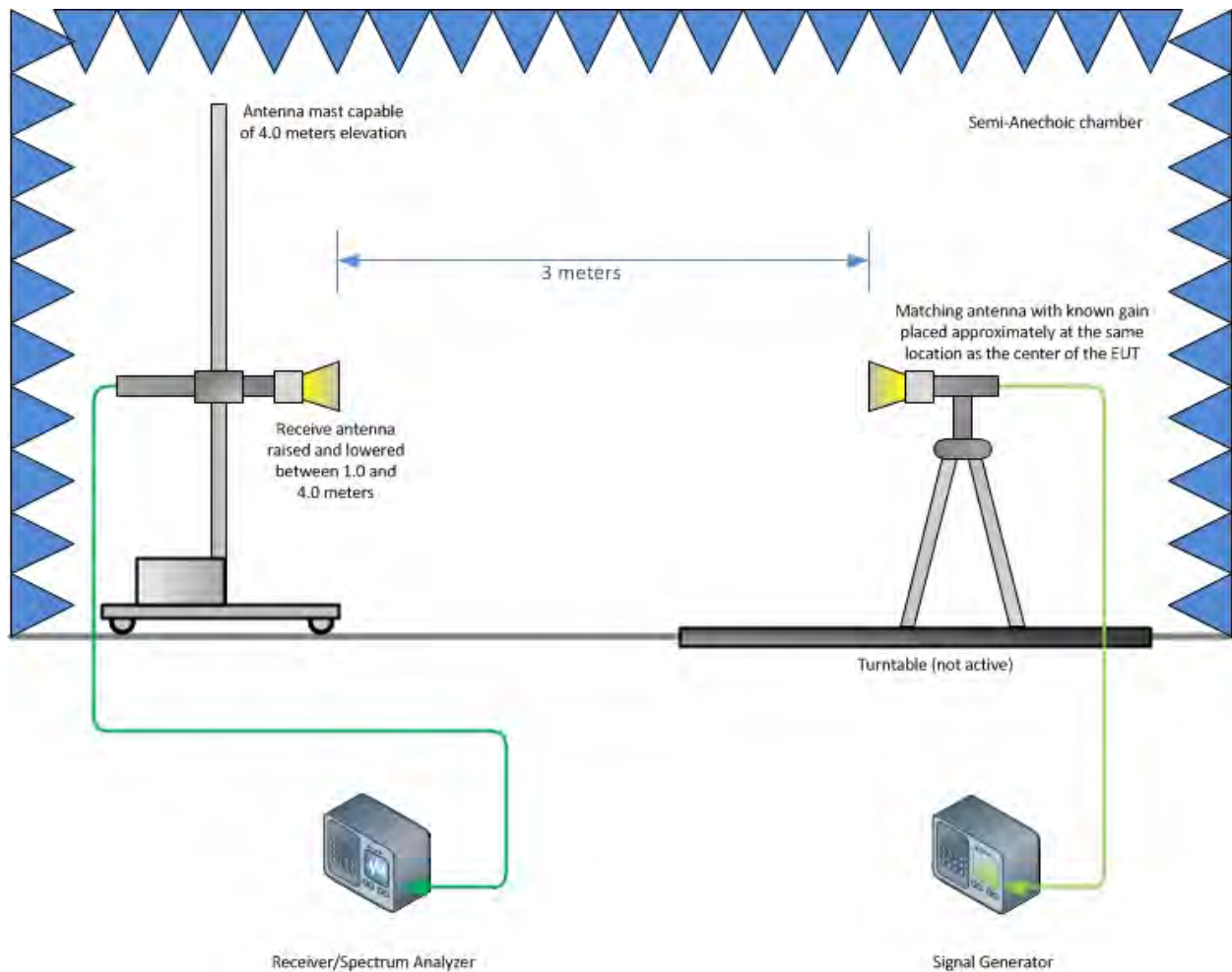
4.1 TEST SETUP DIAGRAM



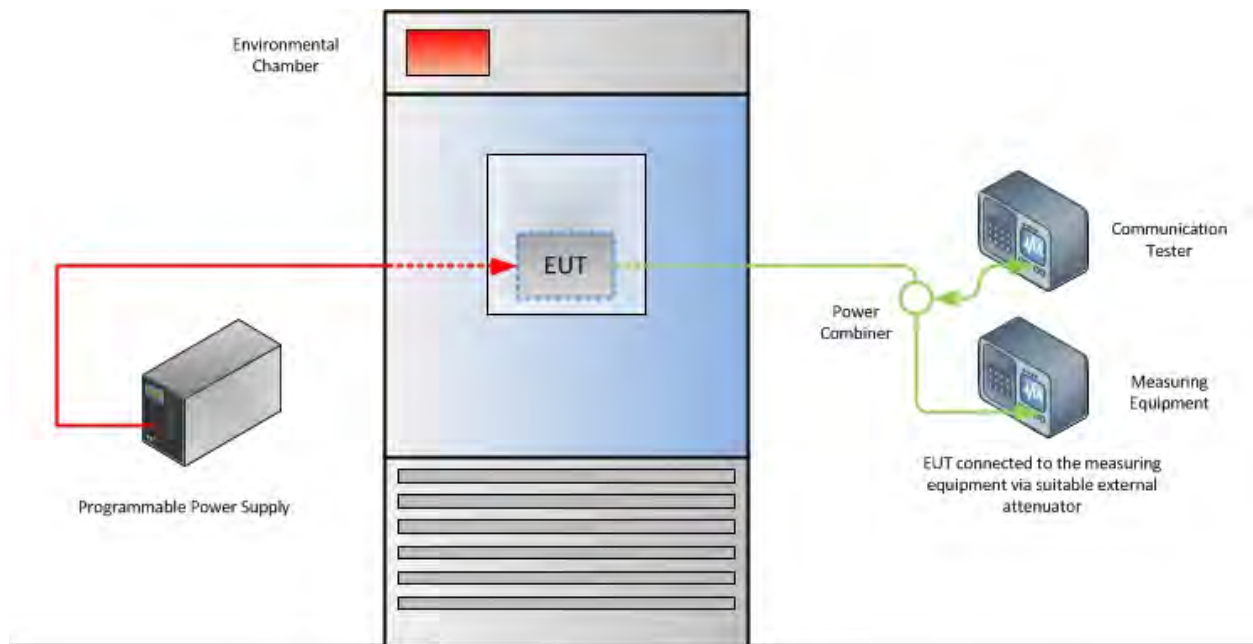
Radiated Emission Test Setup (Below 1GHz)



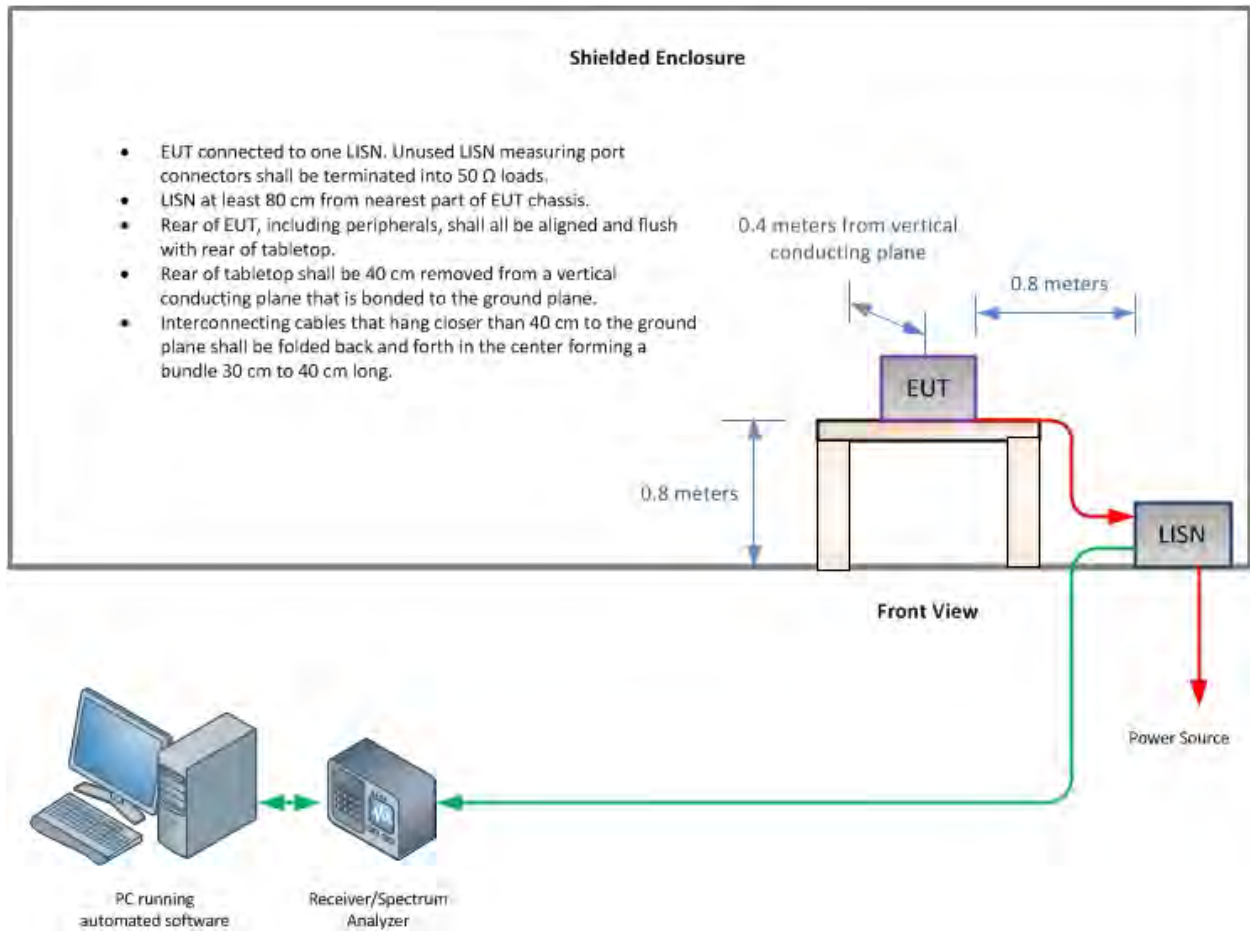
Radiated Emission Test Setup (Above 1GHz)



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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