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## Report On

Application for Grant of Equipment Authorization of the  
Novatel Wireless Inc.

MIFI6630 Wireless Hotspot Modem

FCC CFR 47 Part 2, Part 22

IC RSS-Gen and RSS-132

RSS-133

**Report No. SD72101251B**

**March 2015**



**REPORT ON** Radio Testing of the  
Novatel Wireless Inc.  
MIFI6630 Wireless Hotspot Modem

**TEST REPORT NUMBER** SD72101251B

**PREPARED FOR** Novatel Wireless Inc.  
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**DATED** March 30, 2015



**Revision History**

SD72101251B Novatel Wireless Inc. MIFI6630 Wireless Hotspot Modem					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
03/30/2015	Initial Release				Ferdinand Custodio



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## **SECTION 1**

### **REPORT SUMMARY**

Radio Testing of the  
Novatel Wireless Inc.  
MIFI6630 Wireless Hotspot Modem



## 1.1 INTRODUCTION

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

- FCC CFR 47 Part 2, Part 22
- IC 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 Inc.
Model Number(s)	MIFI6630
FCC ID Number	PKRNVWMIFI6630
IC Number	3229A-MIFI6630
Serial Number(s)	FID: SH181114900011
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none"><li>• FCC CFR 47 Part 2, Part 22 (October 01, 2014).</li><li>• RSS-132 – Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz (Issue 3, January 2013).</li><li>• RSS-133 – 2GHZ Personal Communications Services (Issue 6, January 2013).</li><li>• RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014).</li></ul>
Start of Test	January 06, 2015
Finish of Test	January 21, 2015
Name of Engineer(s)	Alex Chang Ivan Retana
Related Document(s)	<ul style="list-style-type: none"><li>• RF Exposure Lab Certificate of Compliance SAR Evaluation Test Report Number: SAR.20141207 Revision B</li><li>• Supporting documents for EUT certification are separate exhibits.</li></ul>



## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2, Part 22 with cross-reference to the corresponding IC RSS standard is shown below.

Section	FCC Part Sections(s)	RSS Section(s)	Test Description	Result
2.1	2.1046	RSS-132(5.4)	Transmitter Conducted Output Power	Compliant (RF Exposure Test Report)
2.2	22.913(a)(2), 2.1046	RSS-132(5.4)	Effective Radiated Power	Compliant
—	24.232(c),2.1046	RSS-133(6.4),SRSP-510(5.1.2)	Equivalent Isotropic Radiated Power	Compliant
2.3	2.1049,22.917(b)	RSS-Gen(6.6)	Occupied Bandwidth	Compliant
—	24.232(d)	RRSS-133(6.4)	Peak-Average Ratio	Compliant
2.4	2.1051,22.917(a)	RSS-132(5.5)	Band Edge/Conducted Spurious Emissions	Compliant
2.5	2.1053,22.917(a)	RSS-132(5.5)	Field Strength Of Spurious Radiation	Compliant
2.6	2.1055,22.355	RSS-132(5.3)	Frequency Stability	Compliant
2.7	—	RSS-132(4.6) and RSS-Gen (7.1.2)	Receiver Spurious Emissions	Compliant
2.8	—	RSS-Gen 8.8	Power Line Conducted Emission	Compliant



### 1.3 PRODUCT INFORMATION

#### 1.3.1 EUT General Description

The Equipment Under Test (EUT) was a Novatel Wireless Inc. MIFI6630 Wireless Hotspot Modem. The EUT creates a personal Wi-Fi cloud, capable of sharing high speed 4G LTE and 3G Mobile Broadband Internet connectivity with up to 15 Wi-Fi enabled devices simultaneously.

#### 1.3.2 EUT General Description

EUT Description	Wireless Hotspot Modem
Model Number(s)	MIFI6630
Rated Voltage	Nominal 3.8VDC Li-Ion Battery AC Power Adaptor Input: 100-240VAC/0.3A/50-60Hz Output: 5.0VDC/2.0A
Mode Verified	LTE Band 5
Capability	GSM850/1900, WCDMA850/1900, LTE Band 2/3/4/5/7/12/17/29, WLAN 802.11 a/b/g/n
Antenna Type	Monopole
Manufacturer	NVTL
Part Number	NVTL DA-01020345
Antenna Gain	LTE Band 3: 0.51dBi LTE Band 4: 0.83dBi LTE Band 2: -1.64dBi LTE Band 7: 0.25dBi WCDMA Band 5: -2dBi WCDMA Band 8: -3.3dBi WCDMA Band 2: -1.64dBi WCDMA Band 1: -1dBi GSM850: -2dBi GMS900: -3.3dBi GSM1800: 0.51dBi GSM1900: -1.64dBi CDMA BC0: -3.46dBi CDMA BC1: -0.97dBi





**1.3.3 Transmit Frequency Table**

LTE Band 5					
Bandwidth	Modulation	Tx Frequency (MHz)	Emission Designator	ERP	
				Max. Power (dBm)	Max. Power (W)
5.0 MHz	QPSK	824-849	4M52G7D	23.24	0.211
5.0 MHz	16QAM	824-849	4M49W7D	22.33	0.171
10.0 MHz	QPSK	824-849	8M94G7D	23.09	0.204
10.0 MHz	16QAM	824-849	8M97W7D	22.15	0.164

Technology / Mode	Tx Frequency (MHz)	Emission Designator	ERP (Part 22) / EIRP (Part 24)	
			Max. Power (dBm)	Max. Power (W)
GSM850 (GPRS) Cell Band (BC0)	824-849	248KGXW	28.35	0.6839
GSM1900 (GPRS) PCS Band (BC1)	1850-1910	245KGXW	27.86	0.6109
GSM850 (EGPRS) Cell Band (BC0)	824-849	246KG7W	22.53	0.1791
GSM1900 (EGPRS) PCS Band (BC1)	1850-1910	245KG7W	23.98	0.2500
WCDMA (3GPP Release Version 99) Cell Band 5	824-849	4M17F9W	19.84	0.0964
WCDMA (3GPP Release Version 99) Cell Band 2	1850-1910	4M18F9W	22.31	0.1702



Technology / Mode	Modulation	Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	EIRP (Part 24)	
					Max. Power (dBm)	Max. Power (W)
LTE Band 2	QPSK	1.4	1850-1910	1M10G7D	22.36	0.1722
		3	1850-1910	2M70G7D	22.36	0.1722
		5	1850-1910	4M52G7D	22.34	0.1714
		10	1850-1910	9M00G7D	22.36	0.1722
		15	1850-1910	13M42G7D	22.36	0.1722
		20	1850-1910	17M84G7D	21.86	0.1535
	16QAM	1.4	1850-1910	1M11W7D	20.50	0.1122
		3	1850-1910	2M70W7D	21.28	0.1343
		5	1850-1910	4M51W7D	21.15	0.1303
		10	1850-1910	9M03W7D	21.32	0.1355
		15	1850-1910	13M42W7D	21.15	0.1303
		20	1850-1910	17M88W7D	21.04	0.1271



**1.4 EUT TEST CONFIGURATION**

**1.4.1 Test Configuration Description**

Test Configuration	Description
A	Conducted antenna port measurement. EUT Tx at a max power and connected to the CMW500 for communication.
B	Radiated test measurement. EUT Tx through integral antenna and connected to the CMW500 for communication.
C	Conducted emission test measurement. EUT powered ON and states in idle mode for unintentional conducted emission evaluation.

**1.4.2 EUT Exercise Software**

EUT is controlled by a CMW500 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
Novatel Wireless	USB Cable	Micro USB Type B to Standard USB Type B

**1.4.4 Worst Case Configuration**

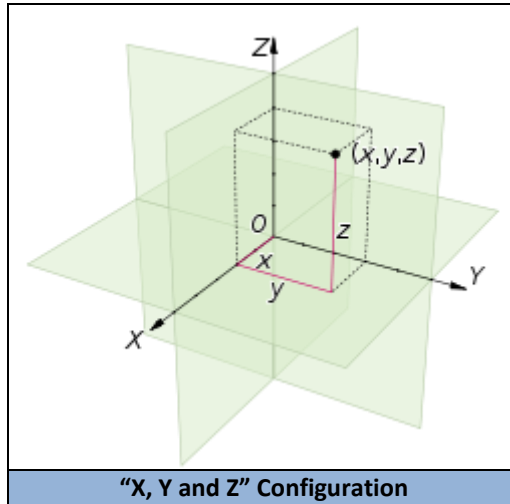
Worst-case configuration used in this test report as per output power measurements:

Band	Channel BW	Modulation	RB Size/Offset
LTE Band 5	5.0 MHz	QPSK	1/24

Technology	Band	Channel	Freq (MHz)
GSM850 / GSM1900 (GPRS)	PCS (BC1)	600	1880.0
	Cell	128	824.2
GSM850 / GSM1900 (EGPRS)	PCS	810	1909.8
	Cell	251	848.8
WCDMA (3GPP Release Version 99)	PCS	512	1850.2
	Cell (Band 5)	4233	846.6
	PCS (Band 2)	9538	1907.6

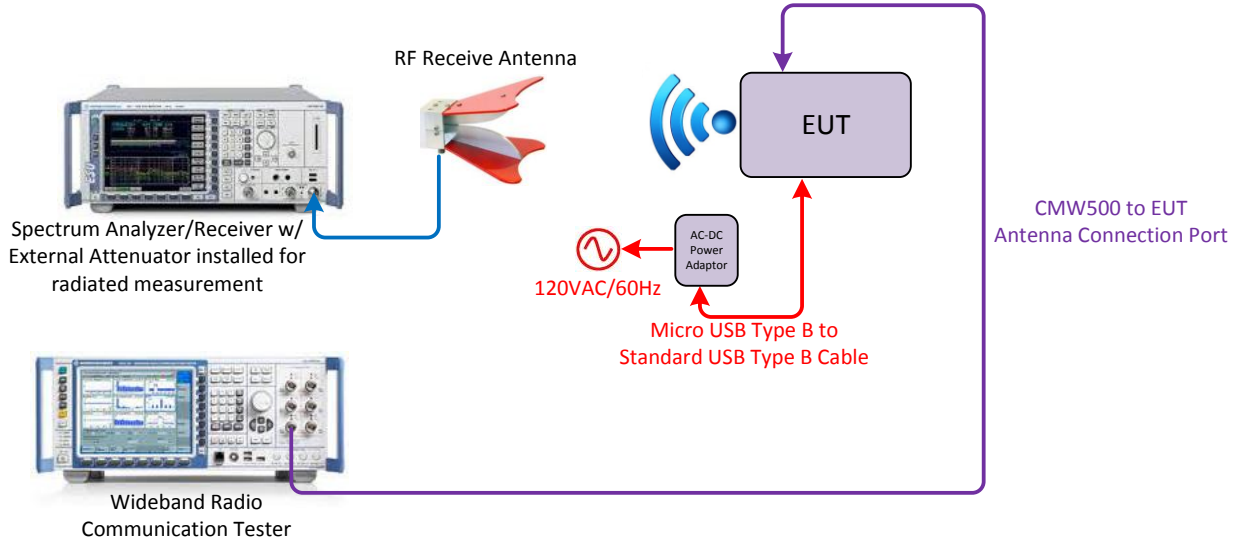
Band	Channel Bandwidth	Modulation	Channel	Freq (MHz)
LTE Band 2	1.4 MHz	QPSK	18900	1880.0

For radiated measurements X, Y, and Z orientations were verified. The verification was determined “X” as worst case configuration.

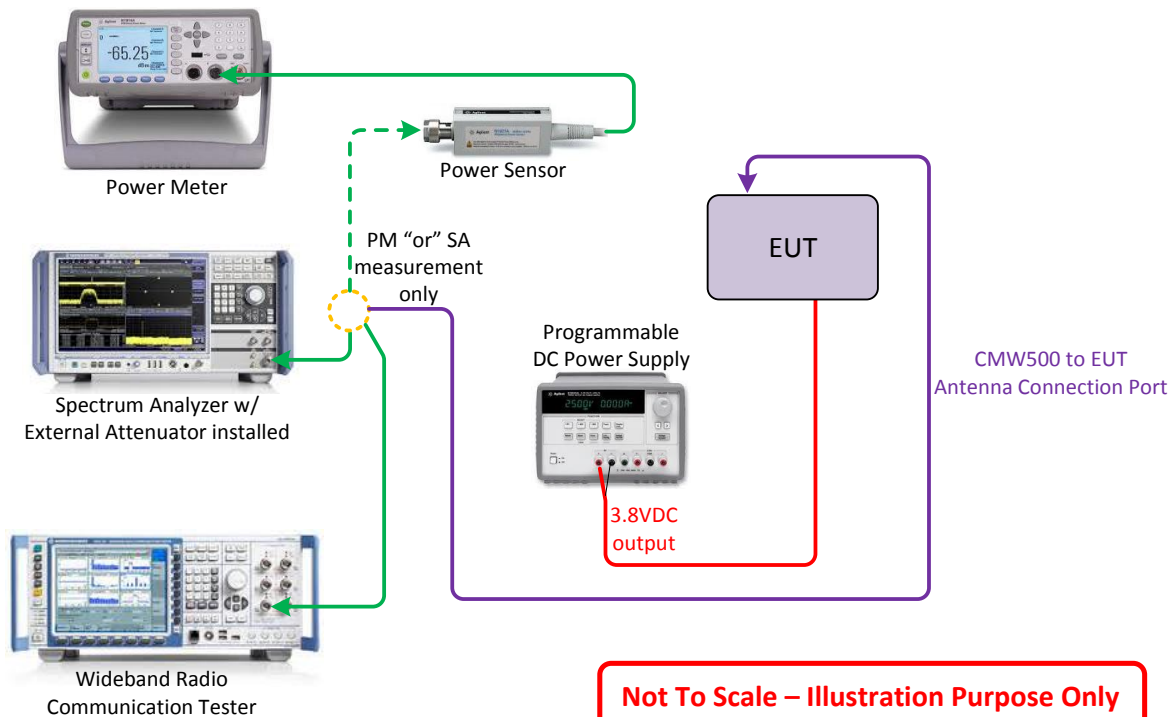


1.4.5 Simplified Test Configuration Diagram

**Radiated/Conducted Emission Test Configuration via Conducted Port**



**Conducted (Antenna Port) Test Configuration**



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



**1.5 DEVIATIONS FROM THE STANDARD**

No deviations from the applicable test standards or test plan were made during testing.

**1.6 MODIFICATION RECORD**

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: FID: SH181114900011		
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 C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements by Substitution method were conducted according to ANSI/TIA/EIA-603-C-2004, August 17,2004. Land Mobile FM or PM -Communications Equipment -Measurement and Performance Standards.

For conducted 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 C63.4-2009. 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)**

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



**1.9 TEST FACILITY REGISTRATION**

**1.9.1 FCC – Registration No.: US1146**

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

**1.9.2 Industry 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 Industry Canada for radio equipment testing with Registration No. 3067A.



**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= Two or more channels containing quantized or digital information  
 D = Data transmission, telemetry, telecommand

**1.10.5 LTE Emission Designator (16QAM)**

Emission Designator = 4M52W7D  
 W = Frequency modulation  
 7= Two or more channels containing quantized or digital information  
 D = Data transmission, telemetry, telecommand

**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			<b>11.8</b>

**1.10.7 Spurious Radiated Emission – Substitution Method**

Example = 84dBµV/m @ 1413 MHz (numerical sample only)





The field strength reading of  $84\text{dB}\mu\text{V}/\text{m}$  @ 1413 MHz ( $2^{\text{nd}}$  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  $84\text{dB}\mu\text{V}/\text{m}$  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 Inc.  
MIFI6630 Wireless Hotspot Modem



## **2.1 TRANSMITTER CONDUCTED POWER MEASUREMENTS**

### **2.1.1 Specification Reference**

Part 2.1046 and RSS-132 (5.4)

### **2.1.2 Standard Applicable**

The conducted power measurements were made in accordance to FCC Part 2.1046, RSS-132.

### **2.1.3 Equipment Under Test and Modification State**

Serial No: FID: SH181114900011 / Test Configuration A

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

January 08, 2015 / AC

The tables presented on this test report are from SAR Evaluation Test Report Number: SAR.20141207 Revision B; TÜV performed verification on random channels and worst case conditions and did not find any significant differences.

### **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 Additional Observations**

- The following data was taken directly from the SAR report.

### **2.1.7 Test Results**

- These are the Conducted port measurement provided by the RF exposure SAR laboratory. The data was used and help in determining worst case testing conditions for the remainder of the report.
- This is a conducted test using a peak/average power meter.
- The 28.0dB LTE Band 5 offset on the power meter was used for the power splitter, external attenuator and cable used.
- The 27.38dB Cell Band (CDMA/EV-DO/GSM850) and WCDMA Band 5; 27.93dB PCS Band (CDMA/EV-DO/GSM1900) and WCDMA Band 2; 27.75dB (LTE Band 2) offset on the power meter was used for the power splitter, external attenuator and cable used.
- TÜV performed verification checks and compared the measurements to the data provided by RF Exposure Labs (SAR.20141207 Revision B and SAR.20140601 Revision D) and the results were found to be similar and are used to show compliance in this test report.
- Only worst case of SO/RC, RTAP, RETAP, RB size and RB offset presented and recorded in this test report.
- The worst case for each mode (marked bold and italic) will be verified for each test throughout this test report.



**2.1.8 Test Results**

See attached table.



LTE Band 5							
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	
QPSK	5 MHz	25	0	20425	826.5	22.01	
		12	6			22.76	
		1	0			22.91	
		1	24			22.89	
		25	0	20525	836.5	22.06	
		12	6			22.85	
		1	0			22.97	
		1	24			23.11	
		25	0	20625	846.5	22.18	
		12	6			22.97	
		1	0			23.09	
		1	24			23.24	
	10 MHz	50	0	20450	829.0	22.01	
			25			12	22.87
			1			0	22.96
			1			24	22.89
		25	0	20525	836.5	22.05	
			12			22.91	
			1			0	22.97
			1			24	22.94
50	0	20600	844.0	22.11			
	25			12	22.93		
	1			0	23.06		
	1			24	23.09		



LTE Band 5								
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)		
16QAM	5 MHz	25	0	20425	826.5	20.12		
		12	6			21.89		
		1	0			21.96		
		1	24			21.92		
		25	0	20525	836.5	20.08		
		12	6			21.92		
		1	0			21.98		
		1	24			22.16		
		25	0	20625	846.5	20.16		
		12	6			21.99		
		1	0			22.13		
		1	24			22.33		
	10 MHz	5 MHz	50	0	20450	829.0	20.08	
			25	12			21.92	
			1	0			21.98	
			1	24			21.93	
		10 MHz	5 MHz	50	0	20525	836.5	20.10
				25	12			21.97
				1	0			21.99
				1	24			21.97
10 MHz	5 MHz	50	0	20600	844.0	20.16		
		25	12			21.96		
		1	0			22.11		
		1	24			22.15		



GSM850 / GSM1900 (GPRS)			
Band	Channel	Frequency (MHz)	Max Power Average (dBm)
Cell	<b>128</b>	<b>824.2</b>	<b>32.50</b>
	190	836.6	32.45
	251	848.8	32.44
PCS	512	1850.2	29.45
	661	1880.0	29.20
	<b>810</b>	<b>1909.8</b>	<b>29.50</b>

GSM850 / GSM1900 (EGPRS)			
Band	Channel	Frequency (MHz)	Max Power Average (dBm)
Cell	128	824.2	26.59
	190	836.6	26.53
	<b>251</b>	<b>848.8</b>	<b>26.68</b>
PCS	<b>512</b>	<b>1850.2</b>	<b>25.62</b>
	661	1880.0	25.46
	810	1909.8	25.55

WCDMA (3GPP Release Version 99)			
Band	Channel	Frequency (MHz)	Max Power Average (dBm)
Cell Band 5	4132	826.4	23.99
	4183	836.6	23.98
	<b>4233</b>	<b>846.6</b>	<b>23.99</b>
PCS Band 2	9262	1852.4	23.88
	9400	1880.0	23.90
	<b>9538</b>	<b>1907.6</b>	<b>23.95</b>



LTE Band 2							
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)
QPSK	1.4 MHz	6	0	18607	1850.7	22.95	27.77
		<b>3</b>	<b>1</b>			<b>24.00</b>	<b>27.97</b>
		1	0			24.00	27.94
		1	5	18900	1880.0	23.99	27.89
		6	0			23.20	28.31
		<b>3</b>	<b>1</b>			<b>24.00</b>	<b>28.47</b>
		1	0	19193	1909.3	23.61	28.43
		1	5			24.00	28.39
		6	0			22.19	27.61
		3	1	18615	1851.5	23.70	27.21
		1	0			23.85	27.19
		<b>1</b>	<b>5</b>			<b>23.99</b>	<b>27.10</b>
	15	0	18900	1880.0	23.01	27.88	
	8	3			22.95	27.80	
	<b>1</b>	<b>0</b>			<b>24.00</b>	<b>27.91</b>	
	1	14	19185	1908.5	23.99	27.89	
	15	0			23.11	28.28	
	8	3			23.05	28.20	
	<b>1</b>	<b>0</b>	18625	1852.5	<b>23.74</b>	<b>28.32</b>	
	1	14			23.73	28.28	
	15	0			22.91	27.16	
	8	3	18900	1880.0	22.81	27.15	
	1	0			23.99	27.38	
	<b>1</b>	<b>14</b>			<b>24.00</b>	<b>27.12</b>	
	25	0	19175	1907.5	22.93	27.70	
	12	6			22.83	27.67	
	<b>1</b>	<b>0</b>			<b>23.95</b>	<b>27.91</b>	
	1	24	18625	1852.5	23.45	27.85	
	25	0			22.98	28.08	
	12	6			23.13	28.23	
	<b>1</b>	<b>0</b>	18900	1880.0	<b>23.56</b>	<b>28.34</b>	
	1	24			23.36	28.30	
	25	0			22.92	27.28	
12	6	19175	1907.5	22.88	27.21		
1	0			23.32	27.66		
<b>1</b>	<b>24</b>			<b>23.98</b>	<b>27.19</b>		





LTE Band 2								
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)	
QPSK	10 MHz	50	0	18650	1855.0	22.52	27.67	
		25	12			22.30	27.51	
		<b>1</b>	<b>0</b>			<b>23.95</b>	<b>27.97</b>	
		1	24			23.46	27.83	
		50	0	18900	1880.0	22.55	28.01	
		25	12			22.95	28.10	
		1	0			23.30	28.30	
		<b>1</b>	<b>24</b>			<b>24.00</b>	<b>28.46</b>	
		50	0	19150	1905.0	22.57	27.70	
		25	12			22.42	27.45	
		1	0			23.23	28.10	
		<b>1</b>	<b>24</b>			<b>23.35</b>	<b>27.69</b>	
	15 MHz	75	0	18675	1857.5	22.38	27.64	
			36			19	22.16	27.56
			<b>1</b>			<b>0</b>	<b>23.89</b>	<b>27.83</b>
			1			74	23.48	28.18
		75	0	18900	1880.0	22.51	27.77	
			36			19	22.86	27.99
			<b>1</b>			<b>0</b>	<b>23.38</b>	<b>28.20</b>
			1			74	23.31	28.10
		75	0	19125	1902.5	22.46	27.86	
			36			19	22.31	27.58
			1			0	23.42	28.11
			<b>1</b>			<b>74</b>	<b>24.00</b>	<b>27.18</b>
20 MHz	100	0	18700	1860.0	22.50	27.81		
		50			25	22.39	27.68	
		<b>1</b>			<b>0</b>	<b>23.48</b>	<b>27.79</b>	
		1			99	23.33	28.21	
	100	0	18900	1880.0	22.52	27.73		
		50			25	22.61	27.96	
		<b>1</b>			<b>0</b>	<b>23.50</b>	<b>28.24</b>	
		1			99	23.35	28.12	
	100	0	19100	1900.0	22.40	27.99		
		50			25	22.22	27.80	
		1			0	23.34	28.12	
		<b>1</b>			<b>99</b>	<b>23.43</b>	<b>27.14</b>	



LTE Band 2							
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)
16QAM	1.4 MHz	6	0	18607	1850.7	21.96	27.90
		3	1			21.95	27.87
		1	0			21.94	27.82
		1	5			21.91	27.81
		6	0	18900	1880.0	22.11	28.29
		3	1			22.14	28.25
		1	0			22.12	28.20
		1	5			22.10	28.18
		6	0	19193	1909.3	21.92	27.12
		3	1			21.88	27.13
		1	0			21.91	27.10
		1	5			21.93	27.09
	3 MHz	18615	1851.5	15	0	21.98	27.73
				8	3	21.76	27.60
				1	0	22.92	27.98
				1	14	22.69	27.91
		18900	1880.0	15	0	22.14	28.19
				8	3	22.10	28.10
				1	0	22.63	28.45
				1	14	22.39	28.43
		19185	1908.5	15	0	21.92	27.10
				8	3	21.82	27.05
				1	0	22.75	27.46
				1	14	22.74	27.17
	5 MHz	18625	1852.5	25	0	22.01	27.69
				12	6	21.84	27.70
				1	0	22.79	27.99
				1	24	22.21	27.89
		18900	1880.0	25	0	21.96	28.15
				12	6	22.21	28.30
				1	0	22.44	28.42
				1	24	22.07	28.33
		19175	1907.5	25	0	22.01	27.27
12				6	21.88	27.28	
1				0	22.37	28.42	
1				24	22.75	27.26	



LTE Band 2							
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)
16QAM	10 MHz	50	0	18650	1855.0	21.30	27.52
		25	12			21.17	27.40
		<b>1</b>	<b>0</b>			<b>22.77</b>	<b>27.98</b>
		1	24			22.24	27.86
		50	0	18900	1880.0	21.62	28.00
		25	12			21.81	28.05
		1	0			22.19	28.31
		<b>1</b>	<b>24</b>			<b>22.96</b>	<b>28.45</b>
		50	0	19150	1905.0	21.53	27.97
		25	12			21.42	27.39
		1	0			22.07	28.11
		<b>1</b>	<b>24</b>			<b>22.25</b>	<b>27.75</b>
	15 MHz	18675	1857.5	75	0	21.35	27.66
				36	19	21.17	27.65
				<b>1</b>	<b>0</b>	<b>22.79</b>	<b>27.95</b>
				1	74	22.13	28.25
		18900	1880.0	75	0	21.25	27.74
				36	19	21.64	28.03
				<b>1</b>	<b>0</b>	<b>22.07</b>	<b>28.30</b>
				1	74	21.96	28.20
		19125	1902.5	75	0	21.46	27.89
				36	19	21.23	27.59
				1	0	22.21	28.24
				<b>1</b>	<b>74</b>	<b>22.76</b>	<b>27.24</b>
	20 MHz	18700	1860.0	100	0	21.54	27.82
				50	25	21.39	27.66
				<b>1</b>	<b>0</b>	<b>22.68</b>	<b>27.92</b>
				1	99	22.01	28.39
		18900	1880.0	100	0	21.50	27.71
				50	25	21.54	27.89
<b>1</b>				<b>0</b>	<b>22.38</b>	<b>28.44</b>	
1				99	21.71	28.29	
19100		1900.0	100	0	21.32	27.99	
			50	25	21.16	27.72	
			1	0	21.74	28.29	
			<b>1</b>	<b>99</b>	<b>22.68</b>	<b>27.34</b>	



## **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: FID: SH181114900011 / Test Configuration (N/A, calculation only)

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

January 21, 2015 / AC

### **2.2.5 Test Equipment Used**

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

### **2.2.6 Additional Observations**

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

$$ERP = P_T + G_T - L_c$$

Where:

$P_T$  = transmitter conducted output power dBm (Section 2.1 of this test report)

$G_T$  = gain of the transmitting antenna, in dBi.

$L_c$  = signal attenuation in the connecting cable between the transmitter and antenna, in dB (EUT configuration during verification is mounted on an interface board with short direct connection to the antenna port. The loss between the EUT and the antenna port is considered negligible).

### **2.2.7 Test Results**

See attached table.



LTE BAND 5						
Frequency (MHz)	Channel BW (MHz)	Modulation	RB Size/Offset	ERP (dBm)	ERP (Watt)	Limit (Watt)
826.5	5	QPSK	1/0	20.91	0.123	7
836.5	5	QPSK	1/24	21.11	0.129	7
846.5	5	QPSK	1/24	21.24	0.133	7
826.5	5	16-QAM	1/0	19.96	0.099	7
836.5	5	16-QAM	1/24	20.16	0.104	7
846.5	5	16-QAM	1/24	20.33	0.108	7
829.0	10	QPSK	1/0	20.96	0.125	7
836.5	10	QPSK	1/0	20.97	0.125	7
844.0	10	QPSK	1/24	21.09	0.129	7
829.0	10	16-QAM	1/0	19.98	0.100	7
836.5	10	16-QAM	1/0	19.99	0.100	7
844.0	10	16-QAM	1/24	20.15	0.104	7

GSM850 / GSM1900 (GPRS) Cell Band						
Frequency (MHz)	Max Power Average (dBm)	Antenna Gain-2.15 (-2.0-2.15=-4.15) (dBi)	ERP			
			(dBm)	(W)	Limit (dBm)	Margin (dB)
824.2	32.50	-4.15	28.35	0.6839	38.45	10.10
836.6	32.45	-4.15	28.30	0.6761	38.45	10.15
848.8	32.44	-4.15	28.29	0.6745	38.45	10.16

GSM850 / GSM1900 (EGPRS) Cell Band						
Frequency (MHz)	Max Power Average (dBm)	Antenna Gain-2.15 (-2.0-2.15=-4.15) (dBi)	ERP			
			(dBm)	(W)	Limit (dBm)	Margin (dB)
824.2	26.59	-4.15	22.44	0.1754	38.45	16.01
836.6	26.53	-4.15	22.38	0.1729	38.45	16.07
848.8	26.68	-4.15	22.53	0.1791	38.45	15.92

WCDMA (3GPP Release Version 99) Cell Band 5						
Frequency (MHz)	Max Power Average (dBm)	Antenna Gain-2.15 (-2.0-2.15=-4.15) (dBi)	ERP			
			(dBm)	(W)	Limit (dBm)	Margin (dB)
826.4	23.99	-4.15	19.84	0.0964	38.45	18.61
836.6	23.98	-4.15	19.83	0.0962	38.45	18.62
846.6	23.99	-4.15	19.84	0.0964	38.45	18.61



## **2.3 EQUIVALENT ISOTROPIC RADIATED POWER**

### **2.3.1 Specification Reference**

Part 24 Subpart E §24.234(c)

### **2.3.2 Standard Applicable**

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.

### **2.3.3 Equipment Under Test and Modification State**

Serial No: FID: SH181114900011 / Test Configuration (N/A, calculation only)

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

July 08, 2014 / AC

### **2.3.5 Test Equipment Used**

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

### **2.3.6 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 (EUT poses an internal Antenna. The loss between the EUT and the antenna port is considered negligible).

### **2.3.7 Test Results**

See attached table.



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GSM850 / GSM1900 (GPRS) PCS Band						
Frequency (MHz)	Max Power Average (dBm)	Antenna Gain (dBi)	EIRP			
			(dBm)	(W)	Limit (W)	Margin (W)
1850.2	29.45	-1.64	27.81	0.6039	2	1.40
1880.0	29.20	-1.64	27.56	0.5702	2	1.43
1909.8	29.50	-1.64	27.86	0.6109	2	1.39

GSM850 / GSM1900 (EGPRS) PCS Band						
Frequency (MHz)	Max Power Average (dBm)	Antenna Gain (dBi)	EIRP			
			(dBm)	(W)	Limit (W)	Margin (W)
1850.2	25.62	-1.64	23.98	0.2500	2	1.75
1880.0	25.46	-1.64	23.82	0.2410	2	1.76
1909.8	25.55	-1.64	23.91	0.2460	2	1.75

WCDMA (3GPP Release Version 99) PCS Band 2						
Frequency (MHz)	Max Power Average (dBm)	Antenna Gain (dBi)	EIRP			
			(dBm)	(W)	Limit (W)	Margin (W)
1852.4	23.88	-1.64	22.24	0.1675	2	1.83
1880.0	23.90	-1.64	22.26	0.1683	2	1.83
1907.6	23.95	-1.64	22.31	0.1702	2	1.83



LTE Band 2									
Modulation	Bandwidth (MHz)	RB Size/Offset	Channels	Frequency (MHz)	Tx Average Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
QPSK	1.4	3 / 1	18607	1850.7	24.00	-1.64	22.36	30.00	7.64
		3 / 1	18900	1880.0	24.00	-1.64	22.36	30.00	7.64
		1 / 5	19193	1909.3	23.99	-1.64	22.35	30.00	7.65
	3	1 / 0	18615	1851.5	24.00	-1.64	22.36	30.00	7.64
		1 / 0	18900	1880.0	23.74	-1.64	22.10	30.00	7.9
		1 / 14	19185	1908.5	24.00	-1.64	22.36	30.00	7.64
	5	1 / 0	18625	1852.5	23.95	-1.64	22.31	30.00	7.69
		1 / 0	18900	1880.0	23.56	-1.64	21.92	30.00	8.08
		1 / 24	19175	1907.5	23.98	-1.64	22.34	30.00	7.66
	10	1 / 0	18650	1855.0	23.95	-1.64	22.31	30.00	7.69
		1 / 24	18900	1880.0	24.00	-1.64	22.36	30.00	7.64
		1 / 24	19150	1905.0	23.35	-1.64	21.71	30.00	8.29
	15	1 / 0	18675	1857.5	23.89	-1.64	22.25	30.00	7.75
		1 / 0	18900	1880.0	23.38	-1.64	21.74	30.00	8.26
		1 / 74	19125	1902.5	24.00	-1.64	22.36	30.00	7.64
	20	1 / 0	18700	1860.0	23.48	-1.64	21.84	30.00	8.16
		1 / 0	18900	1880.0	23.50	-1.64	21.86	30.00	8.14
		1 / 99	19100	1900.0	23.43	-1.64	21.79	30.00	8.21





LTE Band 2									
Modulation	Bandwidth (MHz)	RB Size/Offset	Channels	Frequency (MHz)	Tx Average Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
16QAM	1.4	6 / 0	18607	1850.7	21.96	-1.64	20.32	30.00	9.68
		3 / 1	18900	1880.0	22.14	-1.64	20.50	30.00	9.5
		1 / 5	19193	1909.3	21.93	-1.64	20.29	30.00	9.71
	3	1 / 0	18615	1851.5	22.92	-1.64	21.28	30.00	8.72
		1 / 0	18900	1880.0	22.63	-1.64	20.99	30.00	9.01
		1 / 0	19185	1908.5	22.75	-1.64	21.11	30.00	8.89
	5	1 / 0	18625	1852.5	22.79	-1.64	21.15	30.00	8.85
		1 / 0	18900	1880.0	22.44	-1.64	20.80	30.00	9.2
		1 / 24	19175	1907.5	22.75	-1.64	21.11	30.00	8.89
	10	1 / 0	18650	1855.0	22.77	-1.64	21.13	30.00	8.87
		1 / 24	18900	1880.0	22.96	-1.64	21.32	30.00	8.68
		1 / 24	19150	1905.0	22.25	-1.64	20.61	30.00	9.39
	15	1 / 0	18675	1857.5	22.79	-1.64	21.15	30.00	8.85
		1 / 0	18900	1880.0	22.07	-1.64	20.43	30.00	9.57
		1 / 74	19125	1902.5	22.76	-1.64	21.12	30.00	8.88
	20	1 / 0	18700	1860.0	22.68	-1.64	21.04	30.00	8.96
		1 / 0	18900	1880.0	22.38	-1.64	20.74	30.00	9.26
		1 / 99	19100	1900.0	22.68	-1.64	21.04	30.00	8.96



## **2.4 OCCUPIED BANDWIDTH**

### **2.4.1 Specification Reference**

Part 22 Subpart H §22.917(b) and RSS-Gen (6.6)

### **2.4.2 Standard Applicable**

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

### **2.4.3 Equipment Under Test and Modification State**

Serial No: FID: SH181114900011 / Test Configuration A

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

January 08, 2015 / AC

### **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 Location**

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.3°C
Relative Humidity	31.0%
ATM Pressure	99.2 kPa

### **2.4.7 Additional Observations**

- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- The 28.0dB LTE Band 5 offset on the power meter was used for the power splitter, external attenuator and cable used.
- The 27.38dB Cell Band (CDMA/EV-DO/GSM850) and WCDMA Band 5; 27.93dB PCS Band (CDMA/EV-DO/GSM1900) and WCDMA Band 2; 27.75dB (LTE Band 2) offset on the power meter was used for the power splitter, external attenuator and cable used.
- For 26 dB bandwidth, the span was set to encompass the whole emission.
- The RBW is set to 1% of the span while the VBW is 3X RBW.
- The highest level is recorded and 26dBc is drawn from this level.
- The bandwidth where the fundamental emission intersected this line is the 26dB bandwidth.
- For 99% BW, the SA built-in emission bandwidth measurement feature is utilized. The power level setting is set to 99%.



**2.4.8 Test Results**

See attached plots.

LTE Band 5							
Modulation	BW	RB Size	RB Offset	Channel	Frequency	99% OBW (MHz)	26dB BW (MHz)
QPSK	5 MHz	25	0	20625	846.5	4.52	5.05
	10 MHz	50	0	20600	844.0	8.94	9.58

LTE Band 5							
Modulation	BW	RB Size	RB Offset	Channel	Frequency	99% OBW (MHz)	26dB BW (MHz)
16QAM	5 MHz	25	0	20625	846.5	4.49	5.04
	10 MHz	50	0	20600	844.0	8.97	9.52

GSM850 / GSM1900 (GPRS)				
Band	Channel	Frequency	99% OBW (kHz)	26dB BW (kHz)
Cell	128	824.2	247.47	324.20
PCS	810	1909.8	244.57	325.60

GSM850 / GSM1900 (EGPRS)				
Band	Channel	Frequency	99% OBW (kHz)	26dB BW (kHz)
Cell	251	848.8	246.02	324.20
PCS	512	1850.2	244.57	324.20

WCDMA (3GPP Release Version 99)				
Band	Channel	Frequency	99% OBW (MHz)	26dB BW (MHz)
Cell Band 5	4233	846.6	4.17	4.69
PCS Band 2	9538	1907.6	4.18	4.69

LTE Band 2							
Modulation	BW	RB Size	RB Offset	Channel	Frequency	99% OBW (MHz)	26dB BW (MHz)
QPSK	1.4 MHz	3	1	18900	1880.0	1.10	1.30
	3 MHz	1	0	18615	1851.5	2.70	3.00
	5 MHz	1	24	19175	1907.5	4.52	5.05
	10 MHz	1	24	18900	1880.0	9.00	10.01
	15 MHz	1	74	19125	1902.5	13.42	14.70
	20 MHz	1	0	18900	1880.0	17.84	19.23

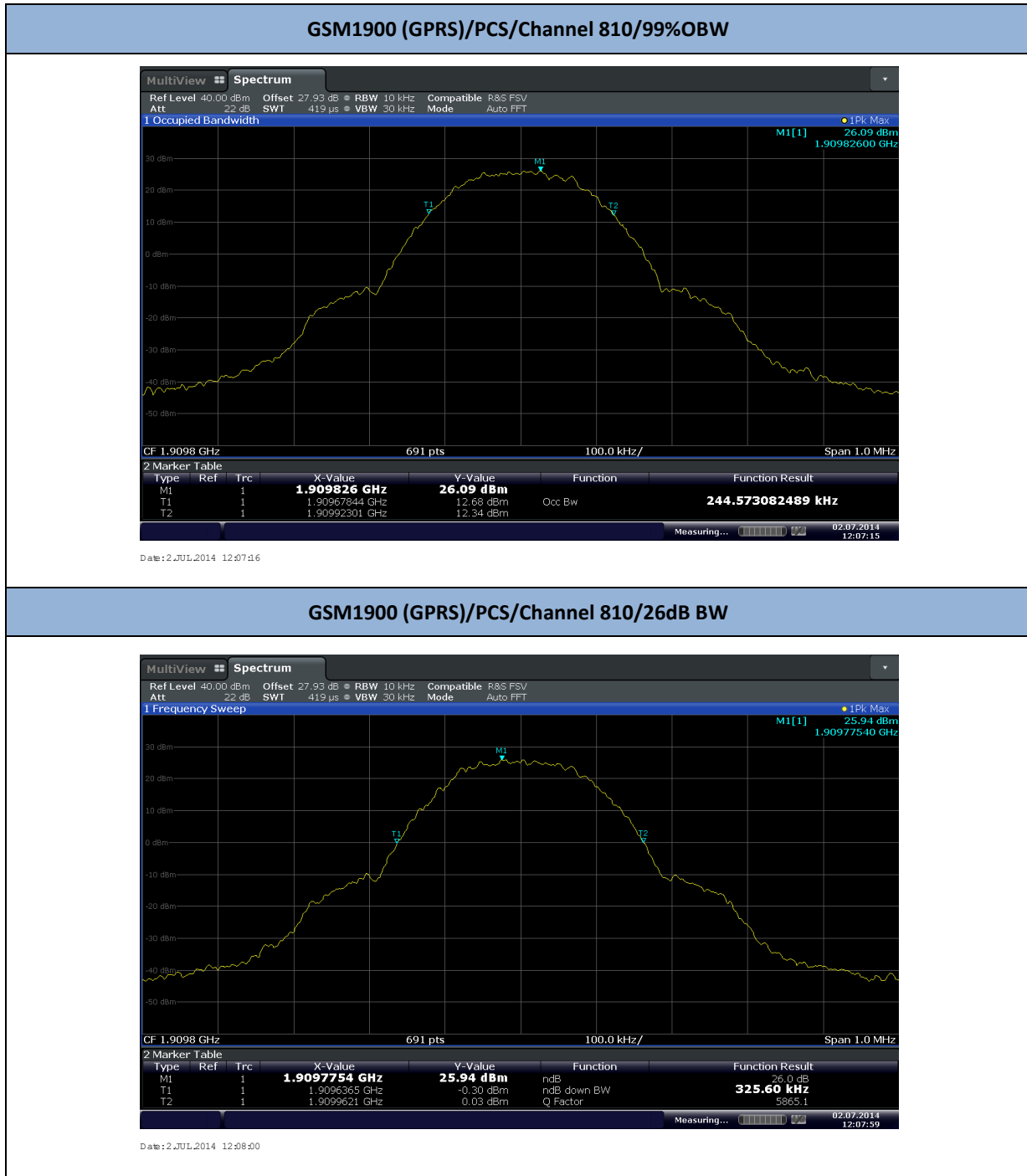


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LTE Band 2							
Modulation	BW	RB Size	RB Offset	Channel	Frequency	99% OBW (MHz)	26dB BW (MHz)
16QAM	1.4 MHz	3	1	18900	1880.0	1.11	1.33
	3 MHz	1	0	18615	1851.5	2.70	3.00
	5 MHz	1	0	18625	1852.5	4.51	5.07
	10 MHz	1	24	18900	1880.0	9.03	9.93
	15 MHz	1	0	18675	1857.5	13.42	14.59
	20 MHz	1	0	18700	1860.0	17.88	19.36



2.4.9 Sample Test Plots





## **2.5 PEAK-AVERAGE RATIO**

### **2.5.1 Specification Reference**

Part 24 Subpart E §24.232(d)

### **2.5.2 Standard Applicable**

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.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

### **2.5.3 Equipment Under Test and Modification State**

Serial No: FID: SH181114900011 / Test Configuration A

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

July 06, 2014 / AC

### **2.5.5 Test Equipment Used**

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

### **2.5.6 Environmental Conditions/ Test Location**

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.4°C
Relative Humidity	51.7%
ATM Pressure	98.7 kPa

### **2.5.7 Additional Observations**

- This is a conducted test. Test procedure is per Section 3.0 of KDB971168 (D01 Power Meas License Digital Systems v01).
- 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



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spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth.

- All channels based from worst case configuration were verified. Only the worst channel and configuration presented.
- The 27.38dB Cell Band (CDMA/EV-DO/GSM850) and WCDMA Band 5; 27.93dB PCS Band (CDMA/EV-DO/GSM1900) and WCDMA Band 2; 27.75dB (LTE Band 2) offset on the power meter was used for the power splitter, external attenuator and cable used.
- There are no measured PAPR levels greater than 13dB. EUT complies.

### 2.5.8 Test Results

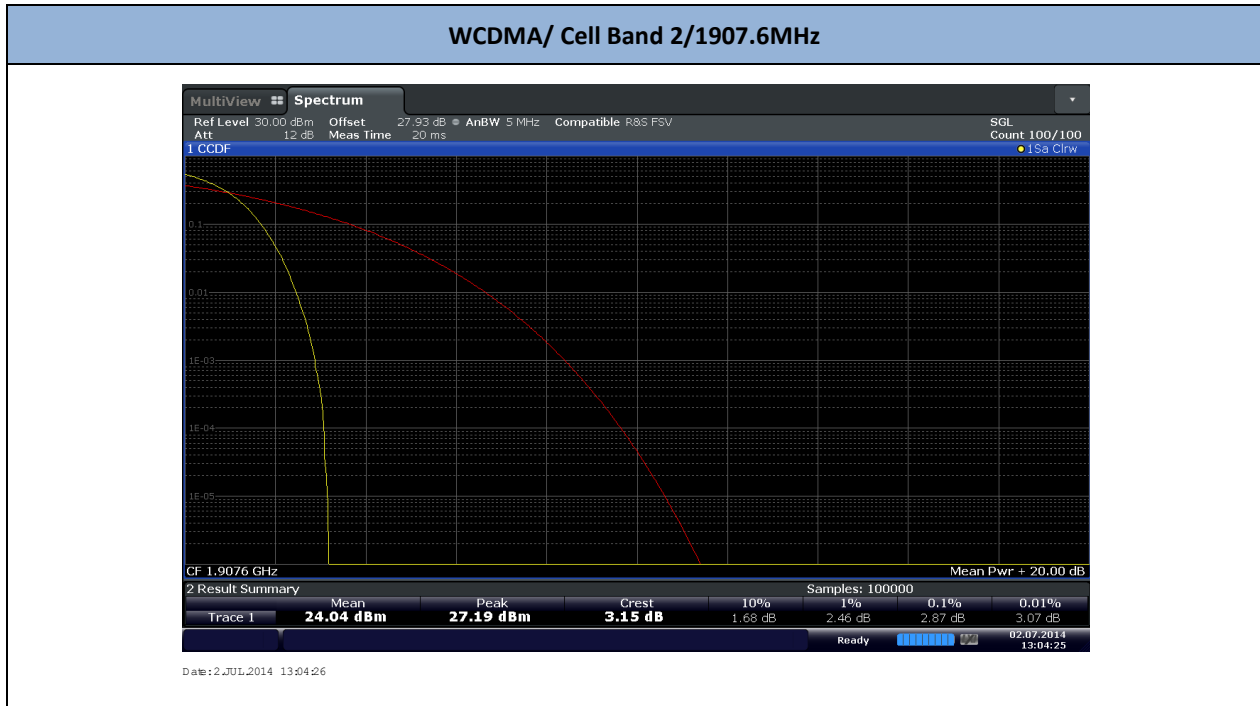
The worst-case measured PARP level was preformed each band (Cell and PCS).

See attached plots.

Band / Frequency	Mean (dBm)	Peak (dBm)	0.1 % (dB)	Limit for 0.1% (dB)
GSM1900/GPRS (PCS BC1) /1909.8 MHz	PAR of -0.99 using trace max hold method			13
GSM1900/EGPRS (PCS BC1) /1909.8 MHz	PAR of 1.16 using trace max hold method			13
WCDMA/Cell Band 5/846.6 MHz	23.87	27.26	3.04	13
WCDMA/Cell Band 2/1907.6MHz	24.04	27.19	2.87	13
LTE Band 2 (1.4MHz BW)/ 1880MHz/QPSK	23.38	29.78	5.45	13
LTE Band 2 (3MHz BW)/ 1851.5MHz/QPSK	23.32	29.93	5.42	13
LTE Band 2 (5MHz BW)/ 1907.5MHz/QPSK	23.44	29.82	5.28	13
LTE Band 2 (10MHz BW)/ 1880MHz/QPSK	23.05	29.64	5.45	13
LTE Band 2 (15MHz BW)/ 1902.5MHz/QPSK	23.20	29.60	5.51	13
LTE Band 2 (20MHz BW)/ 1880MHz/QPSK	23.26	29.75	5.42	13
LTE Band 2 (1.4MHz BW)/ 1880MHz/16QAM	22.34	29.74	6.12	13
LTE Band 2 (3MHz BW)/ 1851.5MHz/16QAM	22.24	30.00	6.26	13
LTE Band 2 (5MHz BW)/ 1852.5MHz/16QAM	22.24	29.86	6.26	13
LTE Band 2 (10MHz BW)/ 1880MHz/16QAM	22.25	29.84	6.12	13
LTE Band 2 (15MHz BW)/ 1857.5MHz/16QAM	21.02	28.39	6.14	13
LTE Band 2 (20MHz BW)/ 1860MHz/16QAM	22.36	29.70	6.20	13



2.5.9 Sample Test Plot







## **2.6 BAND EDGE/CONDUCTED SPURIOUS EMISSIONS**

### **2.6.1 Specification Reference**

Part 22 Subpart H §22.917(a) and RSS-132 (5.5)

### **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.

### **2.6.3 Equipment Under Test and Modification State**

Serial No: FID: SH181114900011 / Test Configuration A

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

January 08, 2015 / AC

### **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 Location**

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.3°C
Relative Humidity	31.0%
ATM Pressure	99.2 kPa

### **2.6.7 Additional Observations**

- This is a conducted test.
- The 28.0dB LTE Band 5 offset on the power meter was used for the power splitter, external attenuator and cable used.
- The 27.38dB Cell Band (CDMA/EV-DO/GSM850) and WCDMA Band 5; 27.93dB PCS Band (CDMA/EV-DO/GSM1900) and WCDMA Band 2; 27.75dB (LTE Band 2) offset on the power meter was used for the power splitter, external attenuator and cable used.
- For band edge measurements, set RBW to 1% of the span.
- For both band edge and out of band emissions, set the limit to -13dBm.
- All RB size available verified and the worst case size for band edge verification presented in this test report.
- For PCS band edge measurements, set RBW to 1% of the span or greater.
- Both power was integrated over 1% of EBW for cellular band edge measurements.
- The conducted spurious emission performed with the spectrum was searched from 30MHz to 10GHz.



**2.6.8 Test Results**

See attached plots.

Band / Mode / Frequency	Measured (dBm)	Limit (dBm)
GSM850/GPRS/Low Channel (128)/Cell BC0 Band Edge @ 824MHz	-19.83	-13
GSM850/GPRS/High Channel (251)/Cell BC0 Band Edge @ 849MHz	-19.25	-13
GSM1900/GPRS/Low Channel (512)/PCS BC1 Band Edge @ 1850MHz	-22.41	-13
GSM1900/GPRS/High Channel (810)/PCS BC1 Band Edge @ 1910MHz	-20.58	-13
GMS850/EGPRS/Low Channel (128)/Cell BC0 Band Edge @ 824MHz	-15.01	-13
GSM850/EGPRS/High Channel (251)/Cell BC0 Band Edge @ 849MHz	-19.23	-13
GSM1900/EGPRS/Low Channel (512)/PCS BC1 Band Edge @ 1850MHz	-14.65	-13
GSM1900/EGPRS/High Channel (810)/PCS BC1 Band Edge @ 1910MHz	-13.54	-13
WCDMA/Low Channel (4132)/Cell Band 5 Band Edge @ 824MHz	-25.03	-13
WCDMA/High Channel (4233)/Cell Band 5 Band Edge @ 849MHz	-26.72	-13



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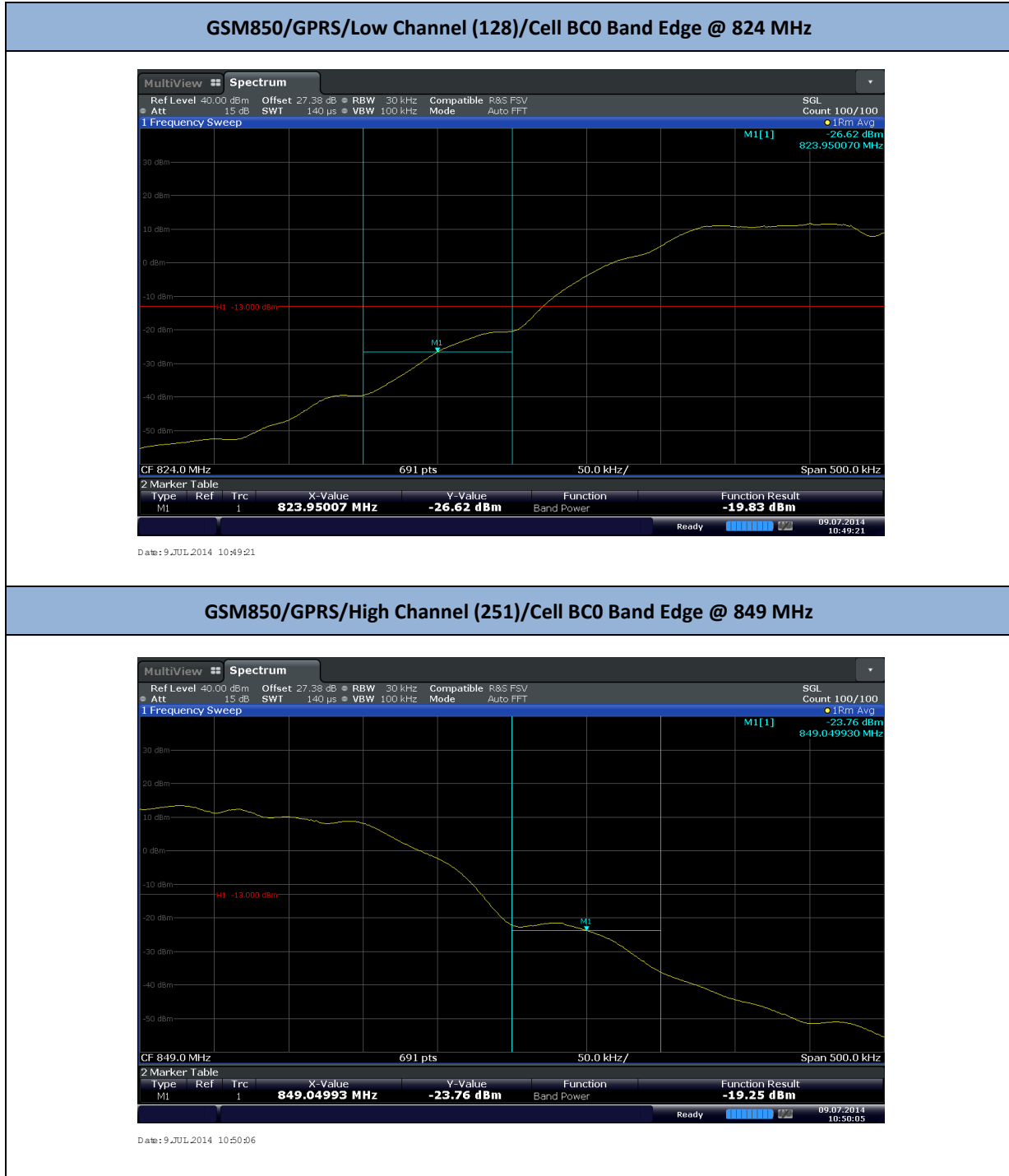
Band / Mode / Frequency	Measured (dBm)	Limit (dBm)
WCDMA/Low Channel (9262)/PCS Band 2 Band Edge @ 18250MHz	-28.83	-13
WCDMA/High Channel (9538)/PCS Band 2 Band Edge @ 1910MHz	-26.23	-13
LTE Band 2 (1.4MHz BW)/Low Channel (18607) Band Edge @ 1850MHz	-22.25	-13
LTE Band 2 (1.4MHz BW)/High Channel (19193) Band Edge @ 1910MHz	-18.53	-13
LTE Band 2 (3MHz BW)/Low Channel (18615) Band Edge @ 1850MHz	-21.63	-13
LTE Band 2 (3MHz BW)/High Channel (19185) Band Edge @ 1910MHz	-18.15	-13
LTE Band 2 (5MHz BW)/Low Channel (18625) Band Edge @ 1850MHz	-22.55	-13
LTE Band 2 (5MHz BW)/High Channel (19175) Band Edge @ 1910MHz	-20.78	-13
LTE Band 2 (10MHz BW)/Low Channel (18650) Band Edge @ 1850MHz	-35.00	-13
LTE Band 2 (10MHz BW)/High Channel (19150) Band Edge @ 1910MHz	-35.7	-13
LTE Band 2 (15MHz BW)/Low Channel (18675) Band Edge @ 1850MHz	-40.37	-13
LTE Band 2 (15MHz BW)/High Channel (19125) Band Edge @ 1910MHz	-36.95	-13
LTE Band 2 (20MHz BW)/Low Channel (18700) Band Edge @ 1850MHz	-41.56	-13
LTE Band 2 (20MHz BW)/High Channel (19100) Band Edge @ 1910MHz	-41.10	-13
LTE Band 5 (5MHz BW)/Low Channel (QPSK) Band Edge @ 824MHz	-36.64	-13
LTE Band 5 (5MHz BW)/High Channel (QPSK) Band Edge @ 849MHz	-35.33	-13
LTE Band 5 (5MHz BW)/Low Channel (16QAM) Band Edge @ 824MHz	-37.87	-13
LTE Band 5 (5MHz BW)/High Channel (16QAM) Band Edge @ 849MHz	-37.83	-13
LTE Band 5 (10MHz BW)/Low Channel (QPSK) Band Edge @ 824MHz	-42.01	-13
LTE Band 5 (10MHz BW)/High Channel (QPSK) Band Edge @ 849MHz	-37.98	-13
LTE Band 5 (10MHz BW)/Low Channel (16QAM) Band Edge @ 824MHz	-41.10	-13
LTE Band 5 (10MHz BW)/High Channel (16QAM) Band Edge @ 849MHz	-39.63	-13



Conducted Spurious Emission from 30MHz to 20GHz			
Band / Mode / Frequency	Highest Emission Measured (dBm)	Limit (dBm)	Verdict
GSM850/GPRS/Cell/Low Channel (128)	-29.99	-13	Complies
GSM850/GPRS/Cell/Mid Channel (190)	-30.62	-13	Complies
GSM850/GPRS/Cell/High Channel (251)	-29.75	-13	Complies
GSM1900/GPRS/PCS/Low Channel (512)	-29.57	-13	Complies
GSM1900/GPRS/PCS/Mid Channel (661)	-33.53	-13	Complies
GSM1900/GPRS/PCS/High Channel (810)	-29.54	-13	Complies
GSM850/EGPRS/Cell/Low Channel (128)	-40.79	-13	Complies
GSM850/EGPRS/Cell/Mid Channel (190)	-40.51	-13	Complies
GSM850/EGPRS/Cell/High Channel (251)	-40.15	-13	Complies
GSM1900/EGPRS/PCS/Low Channel (512)	-40.28	-13	Complies
GSM1900/EGPRS/PCS/Mid Channel (661)	-41.04	-13	Complies
GSM1900/EGPRS/PCS/High Channel (810)	-39.74	-13	Complies
WCDMA/Cell Band 5/Low Channel (4132)	-39.48	-13	Complies
WCDMA/Cell Band 5/Mid Channel (4183)	-40.06	-13	Complies
WCDMA/Cell Band 5/High Channel (4233)	-40.89	-13	Complies
WCDMA/PCS Band 2/Low Channel (9262)	-37.54	-13	Complies
WCDMA/PCS Band 2/Mid Channel (9400)	-40.14	-13	Complies
WCDMA/PCS Band 2/High Channel (9538)	-39.66	-13	Complies
LTE Band 2 (1.4MHz BW)/Low Channel (18607)	-35.77	-13	Complies
LTE Band 2 (1.4MHz BW)/Mid Channel (18900)	-36.39	-13	Complies
LTE Band 2 (1.4MHz BW)/High Channel (19193)	-29.49	-13	Complies
LTE Band 2 (3MHz BW)/Low Channel (18615)	-35.84	-13	Complies
LTE Band 2 (3MHz BW)/Mid Channel (18900)	-32.03	-13	Complies
LTE Band 2 (3MHz BW)/High Channel (19185)	-32.39	-13	Complies
LTE Band 2 (5MHz BW)/Low Channel (18625)	-35.56	-13	Complies
LTE Band 2 (5MHz BW)/Mid Channel (18900)	-36.88	-13	Complies
LTE Band 2 (5MHz BW)/High Channel (19175)	-36.33	-13	Complies
LTE Band 2 (10MHz BW)/Low Channel (18650)	-31.69	-13	Complies
LTE Band 2 (10MHz BW)/Mid Channel (18900)	-35.71	-13	Complies
LTE Band 2 (10MHz BW)/High Channel (19150)	-35.77	-13	Complies
LTE Band 2 (15MHz BW)/Low Channel (18675)	-32.13	-13	Complies
LTE Band 2 (15MHz BW)/Mid Channel (18900)	-36.23	-13	Complies
LTE Band 2 (15MHz BW)/High Channel (19125)	-31.60	-13	Complies
LTE Band 2 (20MHz BW)/Low Channel (18700)	-32.41	-13	Complies
LTE Band 2 (20MHz BW)/Mid Channel (18900)	-32.75	-13	Complies
LTE Band 2 (20MHz BW)/High Channel (19100)	-35.56	-13	Complies
LTE Band 5 (5MHz BW)/Low Channel (20425)	-37.80	-13	Complies
LTE Band 5 (5MHz BW)/Mid Channel (20525)	-38.07	-13	Complies
LTE Band 5 (5MHz BW)/High Channel (20675)	-35.96	-13	Complies
LTE Band 5 (10MHz BW)/Low Channel (20450)	-39.57	-13	Complies
LTE Band 5 (10MHz BW)/Mid Channel (20525)	-39.10	-13	Complies
LTE Band 5 (10MHz BW)/High Channel (20600)	-39.25	-13	Complies

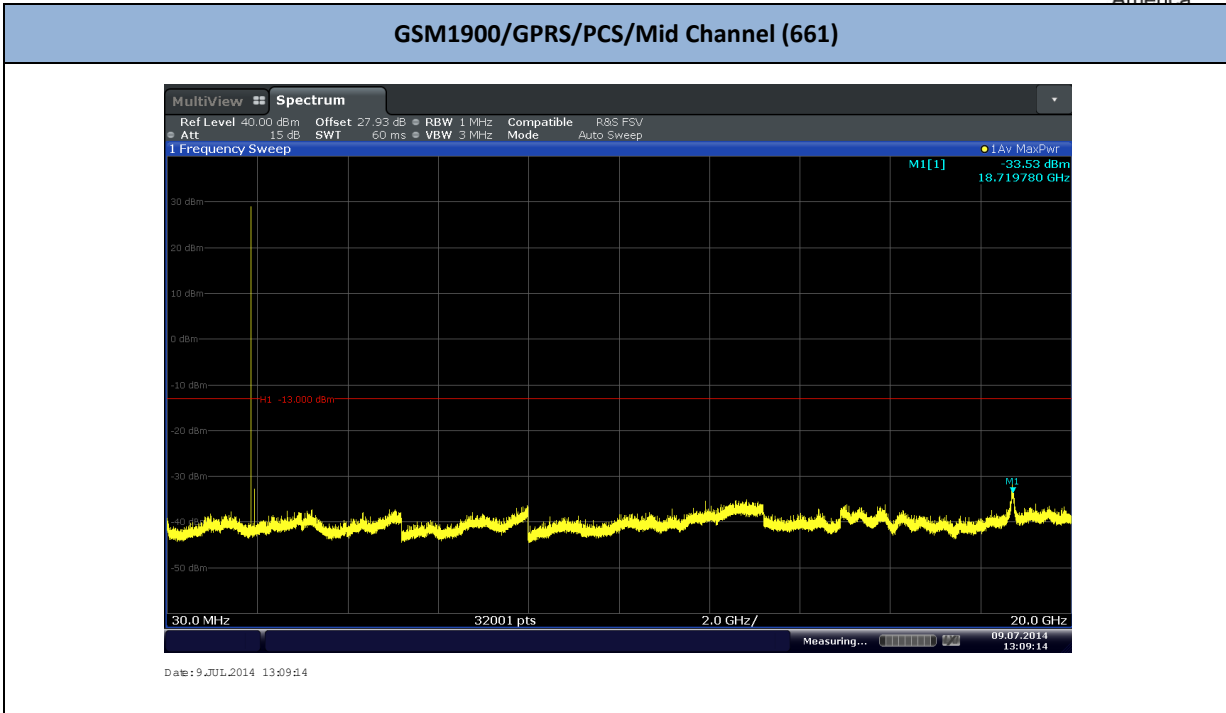


2.6.9 Sample Test Plots





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## **2.7 FIELD STRENGTH OF SPURIOUS RADIATION**

### **2.7.1 Specification Reference**

Part 22 Subpart H §22.917(a) and RSS-132 (5.5)

### **2.7.2 Standard Applicable**

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

### **2.7.3 Equipment Under Test and Modification State**

Serial No: FID: SH181114900011 / Test Configuration B

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

January 09 and 15, 2015 / AC

### **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 Location**

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.4°C
Relative Humidity	37.8%
ATM Pressure	99.1 kPa

### **2.7.7 Additional Observations**

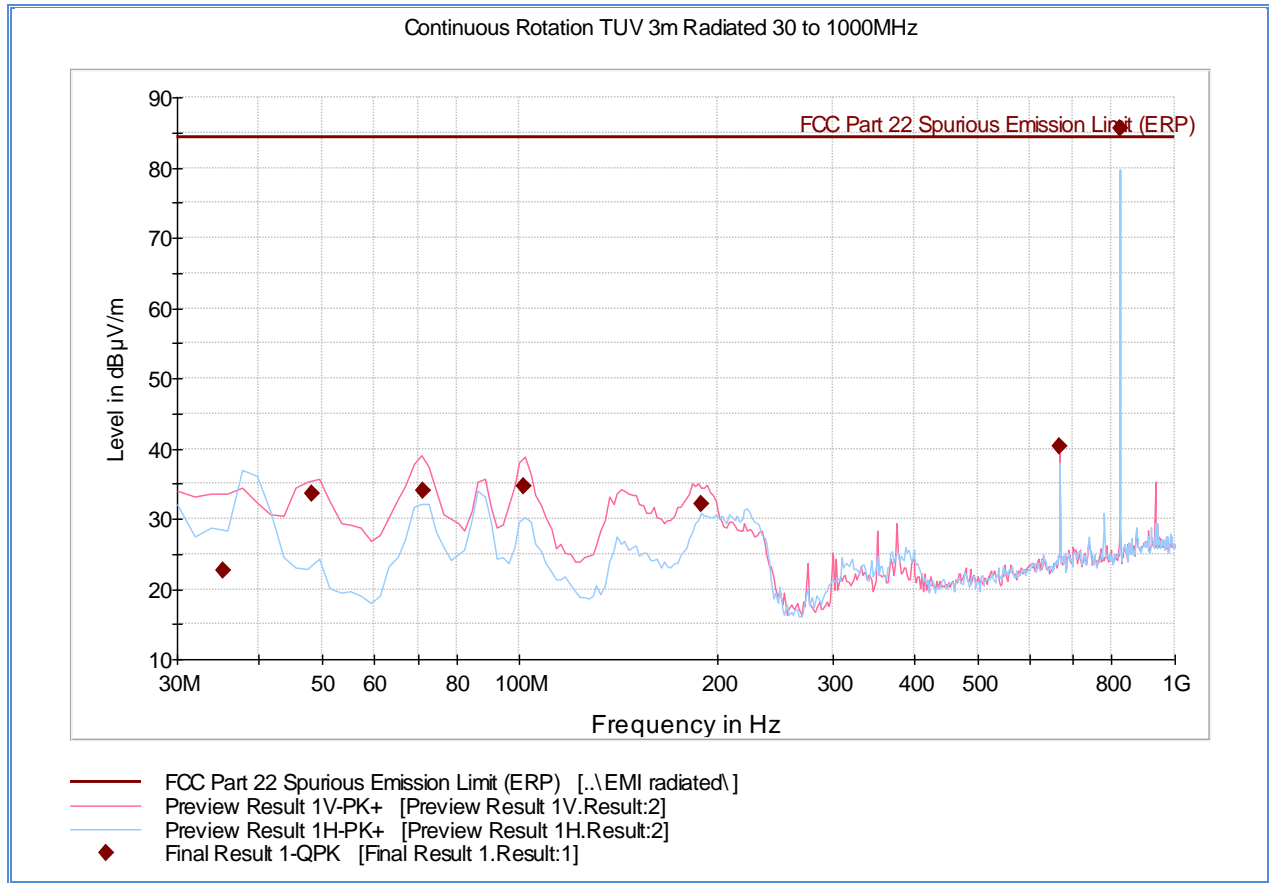
- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- Only the worst case configuration presented in this test report.
- The spectrum was searched from 30 MHz to 18 GHz (requirement is up to the 10<sup>th</sup> harmonic 9GHz required).
- There are no emissions found that doesn't comply with -13dBW limit in the 824-849 MHz frequency range. This limit corresponds to 84.4 dBµV/m @ 3 meters.
- Measurement was done using EMC32 V8.52 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

### **2.7.8 Test Results**

See attached plots.



**2.7.9 Test Results Below 1GHz\_Worst Case Configuration  
 GSM850 (GPRS)\_Cell\_Low Channel (128)**



**Quasi Peak Data**

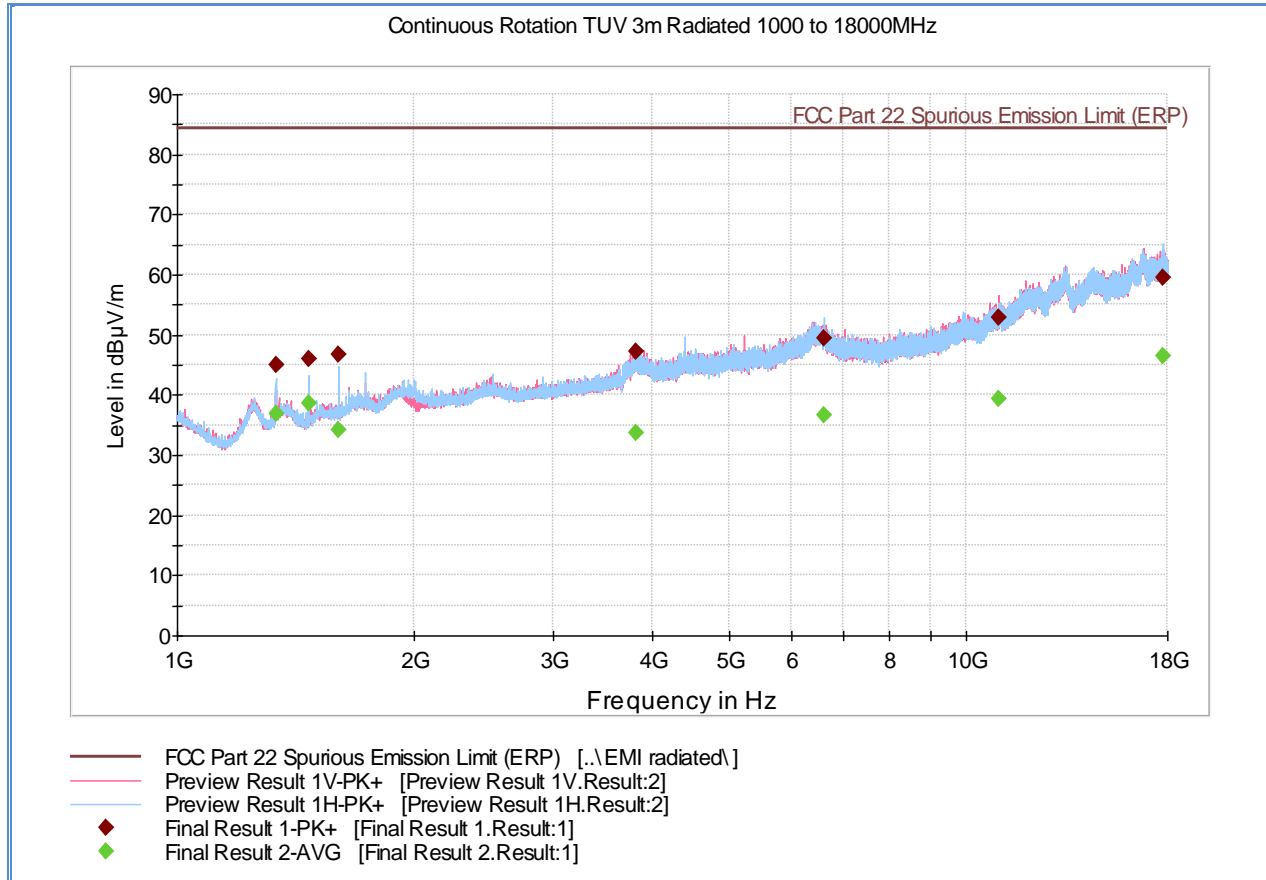
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.215551	22.6	1000.0	120.000	400.0	H	15.0	-13.4	61.8	84.4
48.238878	33.6	1000.0	120.000	100.0	V	62.0	-18.3	50.8	84.4
71.021643	34.0	1000.0	120.000	109.0	V	252.0	-21.5	50.4	84.4
101.603848	34.7	1000.0	120.000	100.0	V	282.0	-18.8	49.7	84.4
189.422685	32.0	1000.0	120.000	100.0	V	229.0	-15.3	52.3	84.4
666.675190	40.4	1000.0	120.000	100.0	V	193.0	-2.0	44.0	84.4
824.130100	85.6	1000.0	120.000	196.0	H	74.0		Fundamental	

**Test Notes:** Only worst case channel presented for spurious emissions below 1GHz.





**2.7.10 Test Results Above 1GHz\_GSM850 (GPRS)\_Cell\_Low Channel (128)**



**Peak/Average Data**

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1333.400000	45.0	36.9	1000.0	1000.000	151.7	H	318.0	-5.0	39.3	47.5	84.4
1466.566667	46.1	38.7	1000.0	1000.000	128.7	H	325.0	-5.2	38.3	45.7	84.4
1599.733333	46.8	34.2	1000.0	1000.000	151.7	H	346.0	-4.9	37.6	50.2	84.4
3811.100000	47.2	33.8	1000.0	1000.000	403.6	V	4.0	6.0	37.2	50.6	84.4
6603.000000	49.5	36.7	1000.0	1000.000	351.2	H	41.0	12.8	34.9	47.7	84.4
10998.83333	52.8	39.4	1000.0	1000.000	403.6	V	33.0	17.1	31.6	45.0	84.4
17781.26666	59.6	46.5	1000.0	1000.000	177.6	H	94.0	25.8	24.8	37.8	84.4

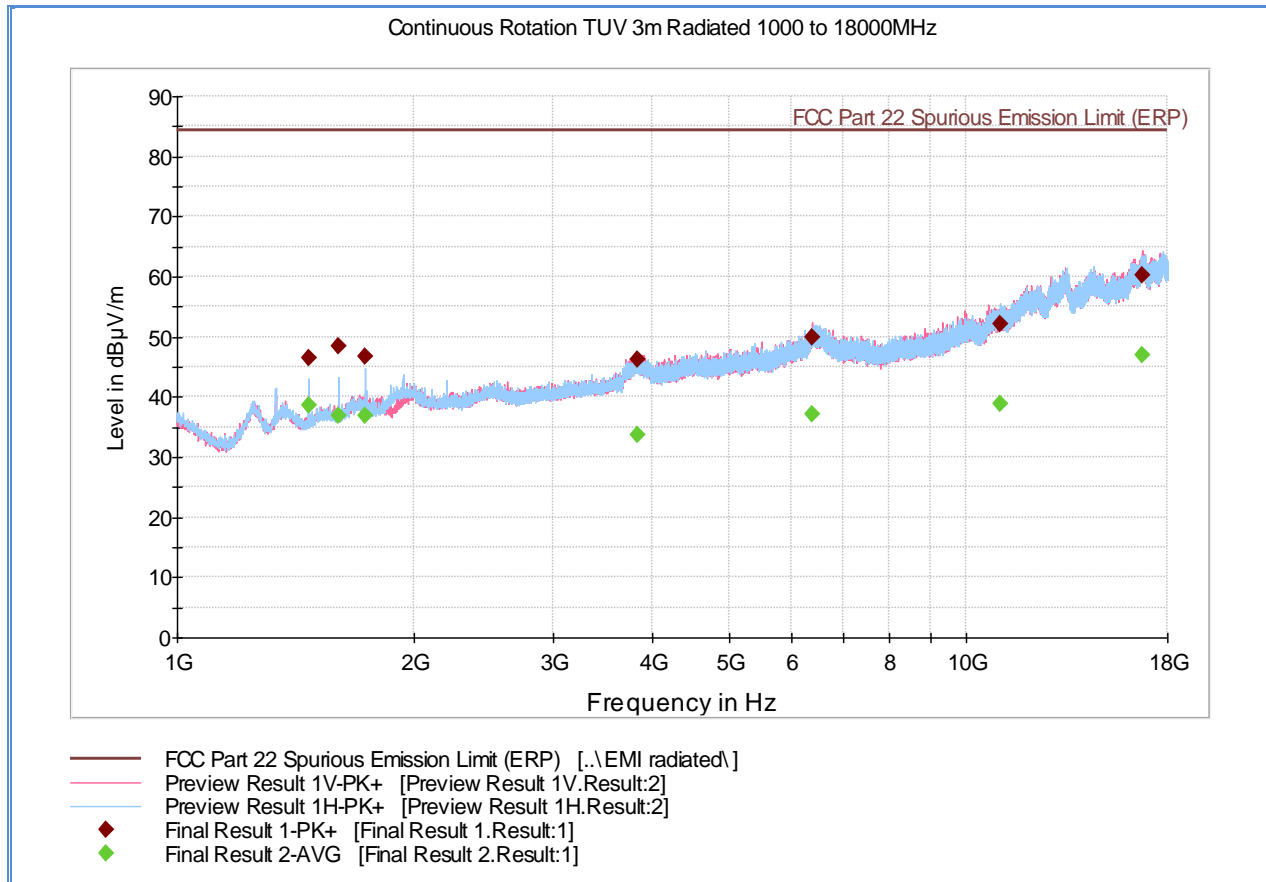
**Substitution Data**

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 modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 800MHz to 1GHz notch filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.7.11 Test Results Above 1GHz\_GSM850 (GPRS)\_Cell\_Mid Channel (190)



Peak/Average Data

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1466.566667	46.4	38.7	1000.0	1000.000	120.7	H	322.0	-5.2	38.0	45.7	84.4
1599.933333	48.4	36.9	1000.0	1000.000	128.7	H	358.0	-4.9	35.9	47.5	84.4
1733.066667	46.7	37.0	1000.0	1000.000	112.7	H	-4.0	-3.4	37.7	47.4	84.4
3825.633333	46.3	33.8	1000.0	1000.000	403.6	H	304.0	6.0	38.1	50.6	84.4
6378.600000	49.9	37.1	1000.0	1000.000	202.3	V	-2.0	12.6	34.5	47.3	84.4
11038.466666	52.2	38.9	1000.0	1000.000	403.6	H	250.0	16.9	32.2	45.4	84.4
16752.000000	60.3	47.0	1000.0	1000.000	403.6	V	96.0	25.9	24.1	37.4	84.4

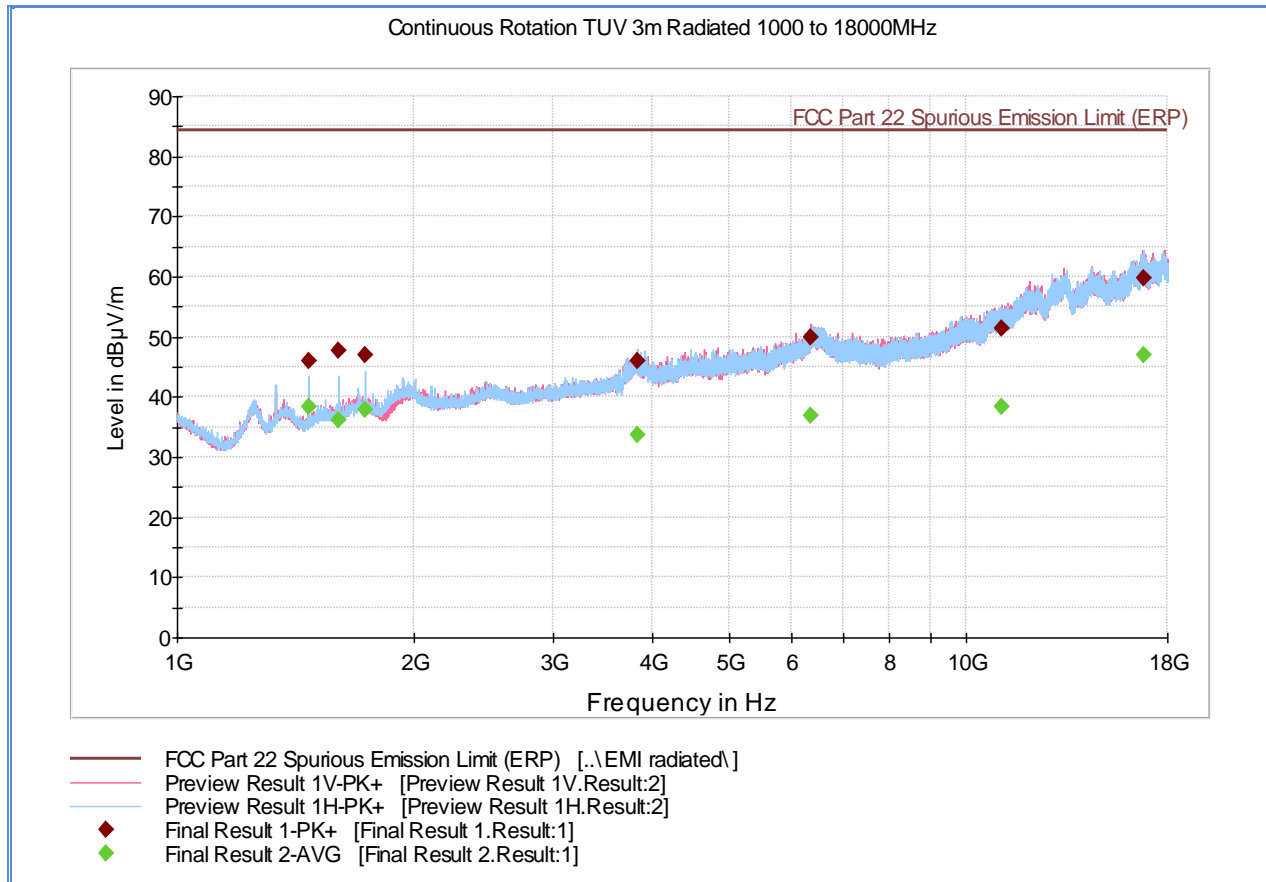
Substitution Data

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 modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 800MHz to 1GHz notch filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.7.12 Test Results Above 1GHz\_GSM850 (GPRS)\_Cell\_High Channel (251)



Peak/Average Data

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1466.566667	45.9	38.4	1000.0	1000.000	121.7	H	329.0	-5.2	38.5	45.9	84.4
1599.900000	47.6	36.2	1000.0	1000.000	145.7	H	0.0	-4.9	36.8	48.2	84.4
1733.466667	47.0	37.8	1000.0	1000.000	102.7	H	-3.0	-3.4	37.4	46.6	84.4
3837.300000	45.9	33.6	1000.0	1000.000	146.7	H	323.0	6.1	38.4	50.8	84.4
6353.166667	49.9	36.9	1000.0	1000.000	102.7	V	143.0	12.5	34.4	47.5	84.4
11085.366666	51.3	38.3	1000.0	1000.000	199.5	V	290.0	16.6	33.1	46.0	84.4
16767.133333	59.7	47.1	1000.0	1000.000	403.6	H	230.0	25.9	24.7	37.3	84.4

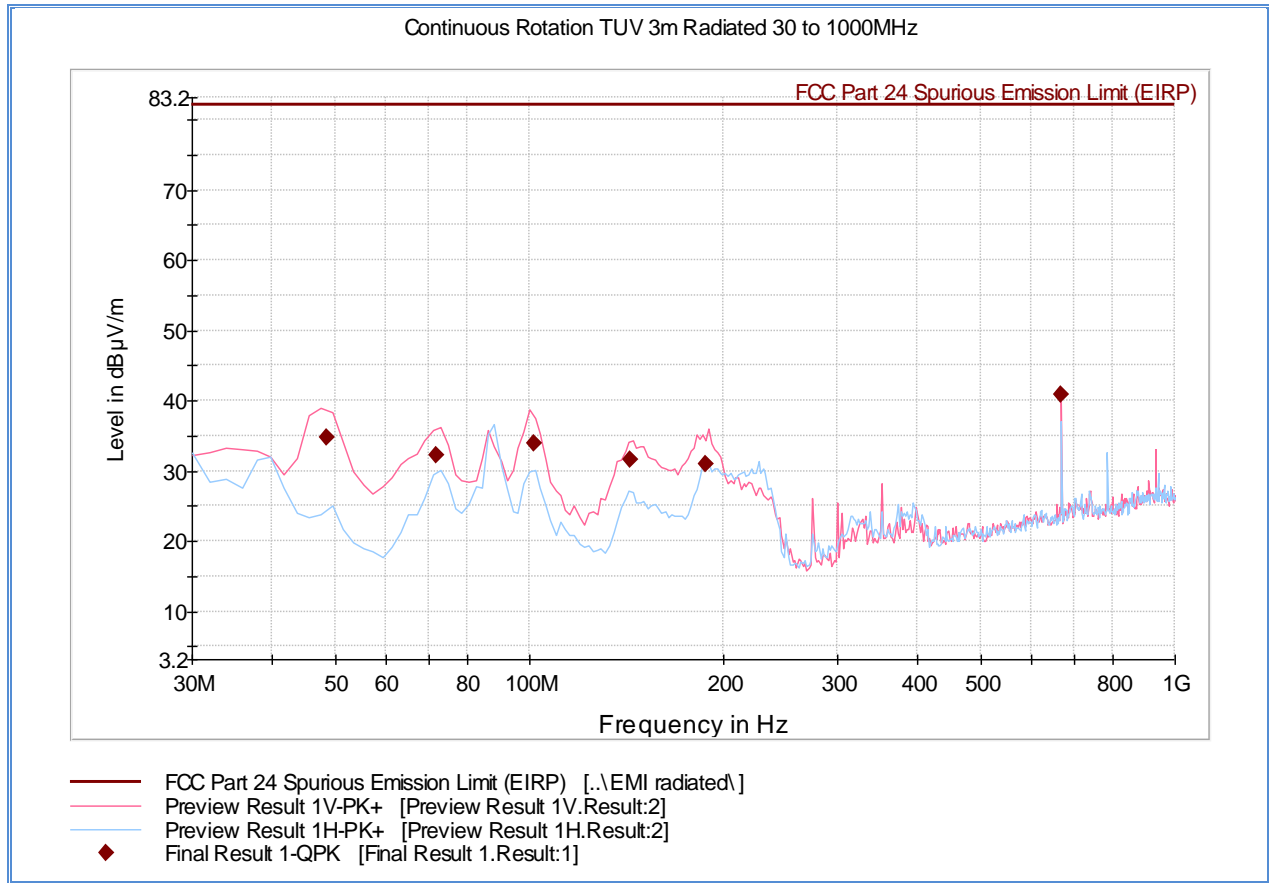
Substitution Data

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 modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 800MHz to 1GHz notch filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



**2.7.13 Test Results Below 1GHz\_Worst Case Configuration  
 GSM1900 (GPRS)\_PCS\_High Channel (810)**



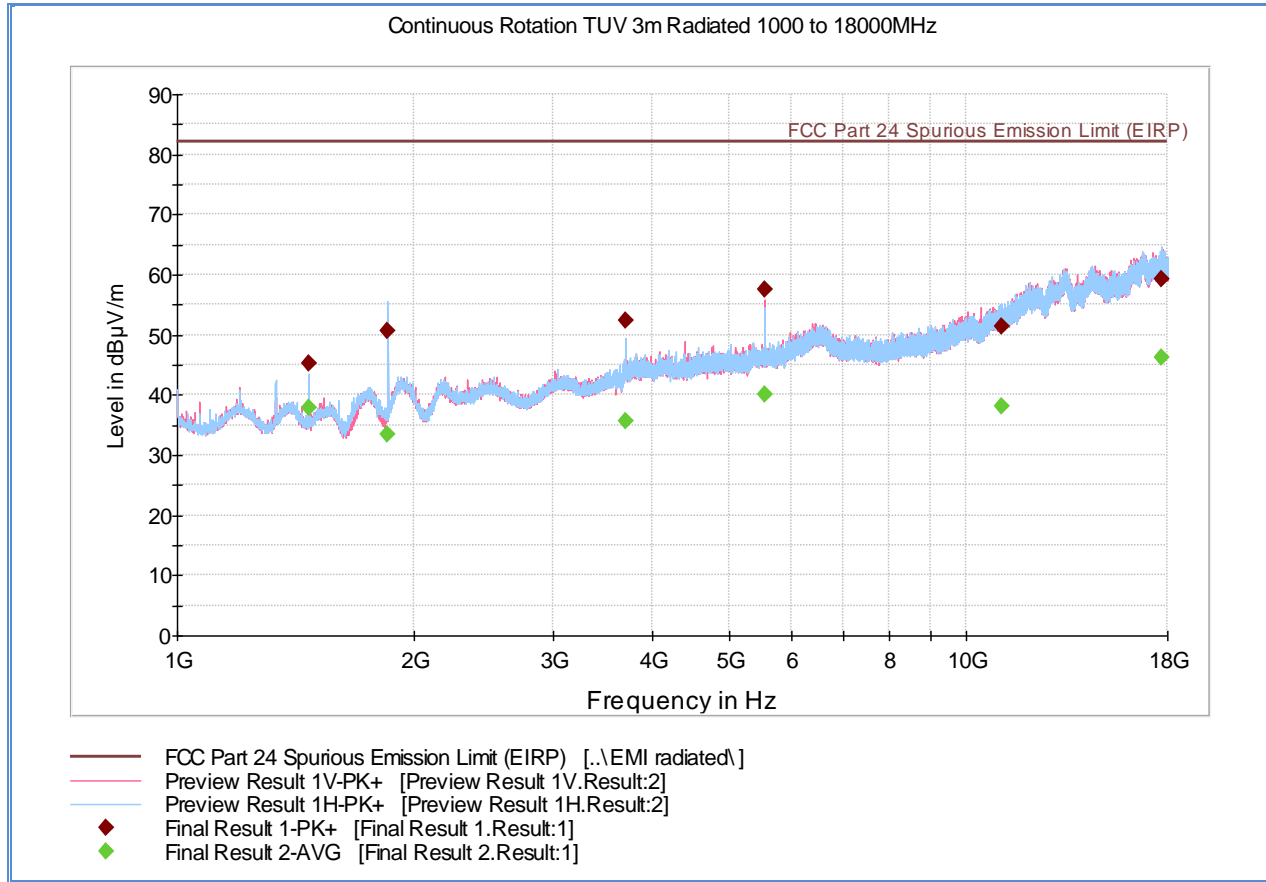
**Quasi Peak Data**

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)
48.614990	34.8	1000.0	120.000	100.0	V	206.0	-18.5	47.4	82.2
71.805531	32.3	1000.0	120.000	100.0	V	294.0	-21.4	50.0	82.2
101.539960	33.9	1000.0	120.000	100.0	V	262.0	-18.8	48.4	82.2
143.289379	31.7	1000.0	120.000	100.0	V	134.0	-18.6	50.6	82.2
187.798798	30.9	1000.0	120.000	100.0	V	264.0	-15.4	51.3	82.2
666.675190	40.9	1000.0	120.000	100.0	V	325.0	-2.0	41.4	82.2

**Test Notes:** Only worst case channel presented for spurious emissions below 1GHz.



**2.7.14 Test Results Above 1GHz\_GSM1900 (GPRS)\_PCS\_Low Channel (512)**



**Peak/Average Data**

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1466.566667	45.2	37.9	1000.0	1000.000	130.7	H	329.0	-5.2	37.1	44.3	82.2
1850.200000	50.8	33.3	1000.0	1000.000	99.7	H	324.0	-2.2	31.5	48.9	82.2
3700.566667	52.3	35.8	1000.0	1000.000	102.7	H	171.0	4.7	29.9	46.5	82.2
5550.733333	57.5	40.0	1000.0	1000.000	137.7	V	306.0	8.9	24.7	42.2	82.2
11097.633333	51.5	38.2	1000.0	1000.000	101.7	H	16.0	16.5	30.7	44.1	82.2
17727.633333	59.1	46.2	1000.0	1000.000	99.7	H	270.0	25.7	23.1	36.1	82.2

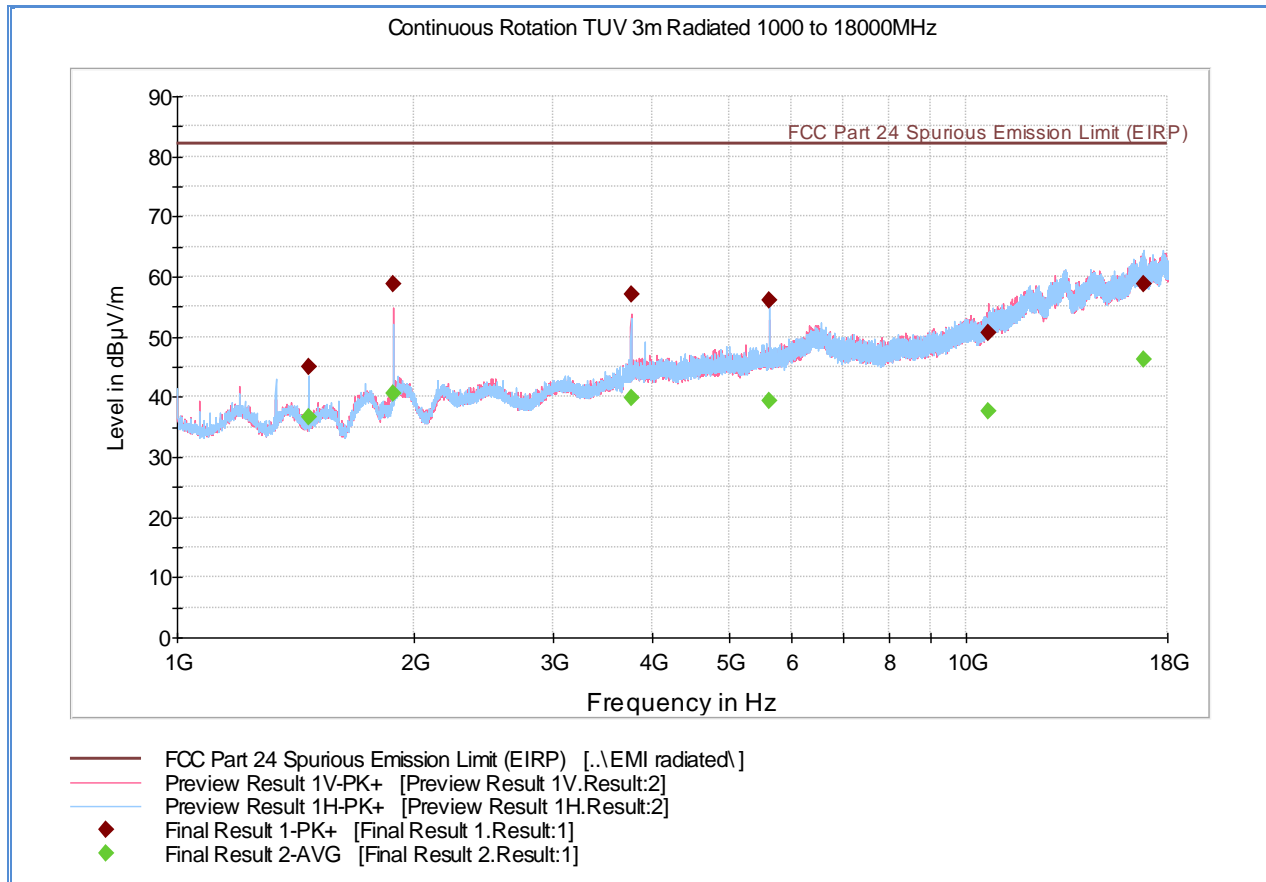
**Substitution Data**

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 modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 1800MHz to 2000MHz notch filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



**2.7.15 Test Results Above 1GHz\_GSM1900 (GPRS)\_PCS\_Mid Channel (661)**



**Peak/Average Data**

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1466.366667	44.9	36.7	1000.0	1000.000	128.7	H	328.0	-5.2	37.3	45.6	82.2
1879.833333	58.7	40.5	1000.0	1000.000	145.7	V	76.0	-1.8	23.5	41.7	82.2
3760.066667	57.1	39.9	1000.0	1000.000	180.6	V	334.0	5.3	25.1	42.3	82.2
5640.066667	56.1	39.2	1000.0	1000.000	200.5	H	143.0	9.2	26.1	43.0	82.2
10690.966666	50.7	37.6	1000.0	1000.000	169.6	V	30.0	15.9	31.6	44.6	82.2
16818.90000	58.7	46.3	1000.0	1000.000	367.1	H	207.0	25.6	23.5	35.9	82.2

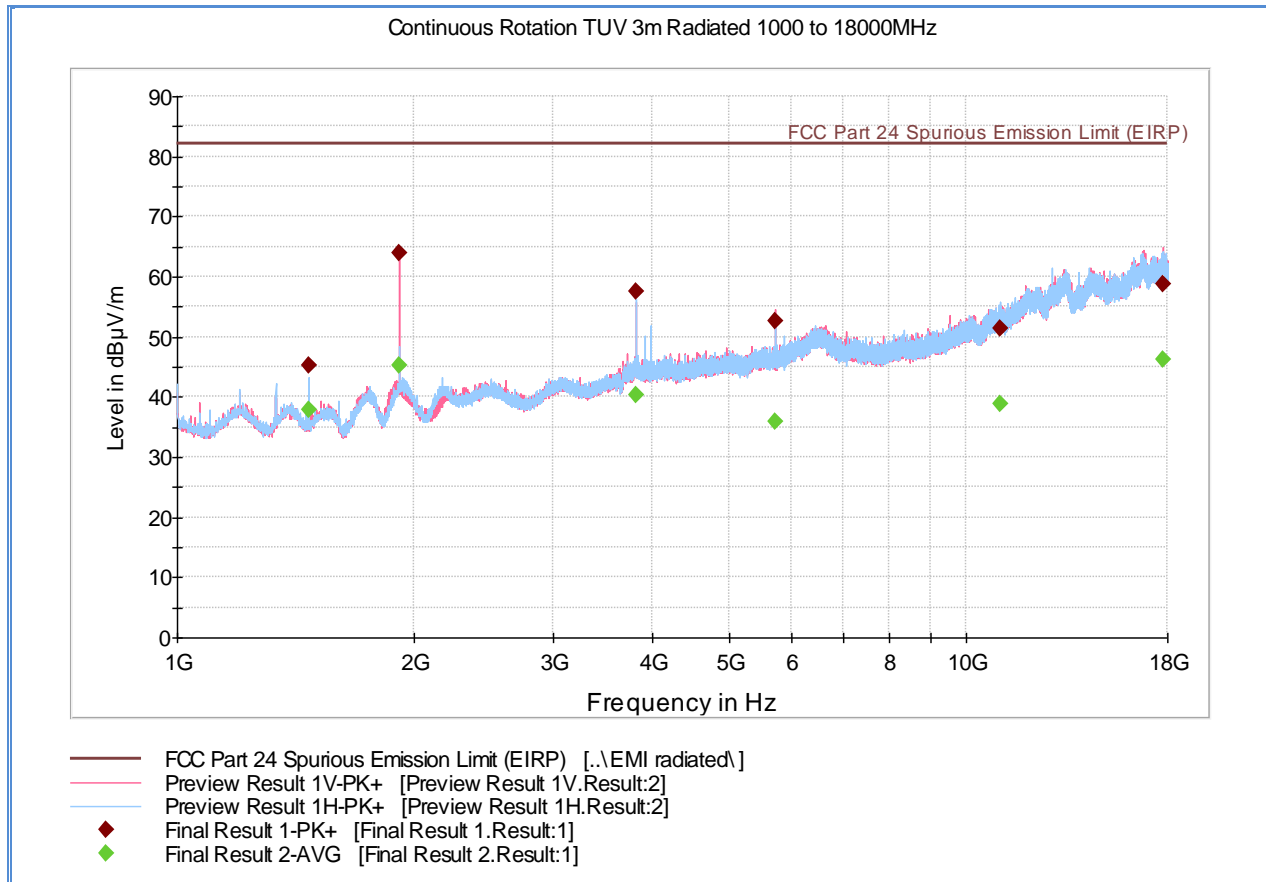
**Substitution Data**

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 modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 1800MHz to 2000MHz notch filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



**2.7.16 Test Results Above 1GHz\_GSM1900 (GPRS)\_PCS\_High Channel (810)**



**Peak/Average Data**

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1466.566667	45.4	38.0	1000.0	1000.000	128.7	H	330.0	-5.2	36.9	44.2	82.2
1909.700000	64.0	45.4	1000.0	1000.000	112.7	V	244.0	-1.5	18.2	36.9	82.2
3819.566667	57.6	40.3	1000.0	1000.000	258.3	H	30.0	6.0	24.7	42.0	82.2
5729.800000	52.6	35.8	1000.0	1000.000	205.5	V	170.0	9.6	29.6	46.4	82.2
11039.833333	51.4	38.9	1000.0	1000.000	391.1	H	130.0	16.9	30.9	43.4	82.2
17740.266666	58.9	46.3	1000.0	1000.000	207.5	V	243.0	25.8	23.3	35.9	82.2

**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
1909.700000	64.0	-3.3	8.2	-36.2	-31.22	-13	Complies

**Test Notes:** Only worst case modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 1800MHz to 2000MHz notch filter. Substitution data required when margin is <20dB compared to the -13dBm limit (converted to field strength @ 3 meters).