

EMC Test Report

Project Number: 4323476

Report Number: 4323476EMC03 **Revision Level:** 0

Client: Continental Automotive Systems, Inc.

Equipment Under Test: Wireless Modem Module

Model: BL28NA-003

FCC ID: LHJ-BL28NA003

IC ID: 2807E-BL28NA003

FCC Rule Parts: Part 2, Part 22(H), Part 24(E)

Industry Canada: RSS-GEN, Issue 5

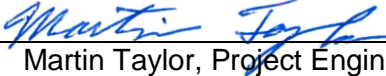
RSS-132, Issue 3

RSS-133 Issue 6

Report issued on: 04 September 2018

Test Result: Compliant

Tested by:



Martin Taylor, Project Engineer

Reviewed by:



David Schramm, Operations Manager

Remarks: This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Reference Sections		Test Description	Test Condition	Test Result
FCC	IC			
2.1046	RSS-GEN (6.12)	Conducted Output Power	Conducted	Reported
24.232(d)	RSS-132 (5.4) RSS-133 (6.4)	Peak-to-Average Ratio		Pass
2.1049 22.917(b) 24.238(b)	RSS-GEN (6.7) RSS-133 (2.3)	Occupied Bandwidth		Reported
2.1051 22.917(a) 24.238(a)	RSS-132 (5.5) RSS-133 (6.5.1)	Band Edge / Conducted Spurious Emissions		Pass
22.913(a)(5)	--	Effective Radiated Power	Radiated	Pass
24.232(c)	RSS-132 (5.4) RSS-133 (6.4)	Effective Isotropic Radiated Power		Pass
2.1053 22.917(a) 24.238(a)	RSS-GEN (6.13) RSS-132 (5.5) RSS-133 (6.5.1)	Radiated Spurious Emissions		Pass
2.1055 24.235	RSS-GEN (6.11) RSS-132 (5.3) RSS-133 (6.3)	Frequency Stability	Conducted	Pass

1.1 Modifications Required to Compliance

None

2 General Information

2.1 Client Information

Name: Continental Automotive Systems, Inc.
Address: 21440 West Lake Cook Road
City, State, Zip, Country: Deer Park, IL 60010, USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

2.3 General Information of EUT

Type of Product: Wireless Modem Module
Model Number: BL28NA-003
Serial Number: ADN180505317640
FCC ID: LHJ-BL28NA003
IC ID: 2807E-BL28NA003

IMEI Number: 004401810317640

Rated Voltage: 10.2 – 13.8 Vdc
Test Voltage: 12 Vdc, 10.2 Vdc, 13.8 Vdc

Tx Frequency Range: 824.2 – 848.8 MHz (GSM850)
1850.2 – 1909.8 MHz (GSM1900)

FCC Classification: PCS Licensed Transmitter PCB
Type: Pre-Production

Sample Received Date: 13 June 2018
Dates of testing: 16 July – 14 August 2018

2.4 Operating Modes and Conditions

The EUT was exercised by connecting a CMW 500 Radio Communication Tester to the device. The CMW was used to control signaling and channel during testing.

3 RF Output Power

3.1 Test Result

Test Description	Basic Standards	Test Result
RF Output Power	FCC 2.1046 RSS-GEN (6.12)	Reported

3.2 Test Method

The EUT was directly connected to a Radio Communication Tester (CMW 500) and a radio link was established. The output power of the EUT was set to maximum value by using the maximum power setting on the CMW. The output power was measured using the CMW internal measurement functions.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.3 °C

Relative Humidity: 53.8 %

Atmospheric Pressure: 97.6 kPa

3.4 Test Equipment

Test End Date: 24-Jul-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE	141	HUBER & SUHNER	B095588	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the CMW 500 is on a 2-year calibration cycle.

3.5 Test Data

Band	Uplink Channel	UL Frequency (MHz)	Mode	Modulation	Slots	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
850	128	824.2	GPRS	GMSK	1	32.74	0.35	33.09
850	128	824.2	GPRS	GMSK	2	32.58	0.35	32.93
850	128	824.2	GPRS	GMSK	3	32.39	0.35	32.74
850	128	824.2	GPRS	GMSK	4	32.16	0.35	32.51
850	189	836.4	GPRS	GMSK	1	32.75	0.35	33.10
850	189	836.4	GPRS	GMSK	2	32.57	0.35	32.92
850	189	836.4	GPRS	GMSK	3	32.37	0.35	32.72
850	189	836.4	GPRS	GMSK	4	32.12	0.35	32.47
850	251	848.8	GPRS	GMSK	1	32.17	0.35	32.52
850	251	848.8	GPRS	GMSK	2	31.95	0.35	32.30
850	251	848.8	GPRS	GMSK	3	31.70	0.35	32.05
850	251	848.8	GPRS	GMSK	4	31.40	0.35	31.75
850	128	824.2	EGPRS	8-PSK	1	26.73	0.35	27.08
850	128	824.2	EGPRS	8-PSK	2	26.47	0.35	26.82
850	128	824.2	EGPRS	8-PSK	3	26.09	0.35	26.44
850	128	824.2	EGPRS	8-PSK	4	25.54	0.35	25.89
850	189	836.4	EGPRS	8-PSK	1	26.67	0.35	27.02
850	189	836.4	EGPRS	8-PSK	2	26.10	0.35	26.45
850	189	836.4	EGPRS	8-PSK	3	26.00	0.35	26.35
850	189	836.4	EGPRS	8-PSK	4	25.41	0.35	25.76
850	251	848.8	EGPRS	8-PSK	1	25.91	0.35	26.26
850	251	848.8	EGPRS	8-PSK	2	25.63	0.35	25.98
850	251	848.8	EGPRS	8-PSK	3	25.50	0.35	25.85
850	251	848.8	EGPRS	8-PSK	4	25.06	0.35	25.41
1900	512	1850.2	GPRS	GMSK	1	28.36	0.53	28.89
1900	512	1850.2	GPRS	GMSK	2	28.34	0.53	28.87
1900	512	1850.2	GPRS	GMSK	3	28.21	0.53	28.74
1900	512	1850.2	GPRS	GMSK	4	28.07	0.53	28.60
1900	661	1880	GPRS	GMSK	1	28.41	0.54	28.95
1900	661	1880	GPRS	GMSK	2	28.37	0.54	28.91
1900	661	1880	GPRS	GMSK	3	28.23	0.54	28.77
1900	661	1880	GPRS	GMSK	4	28.08	0.54	28.62
1900	810	1909.8	GPRS	GMSK	1	28.67	0.54	29.21
1900	810	1909.8	GPRS	GMSK	2	28.64	0.54	29.18
1900	810	1909.8	GPRS	GMSK	3	28.50	0.54	29.04
1900	810	1909.8	GPRS	GMSK	4	28.38	0.54	28.92
1900	512	1850.2	EGPRS	8-PSK	1	24.17	0.53	24.70
1900	512	1850.2	EGPRS	8-PSK	2	24.13	0.53	24.66
1900	512	1850.2	EGPRS	8-PSK	3	23.80	0.53	24.33
1900	512	1850.2	EGPRS	8-PSK	4	23.73	0.53	24.26
1900	661	1880	EGPRS	8-PSK	1	24.07	0.54	24.61
1900	661	1880	EGPRS	8-PSK	2	24.05	0.54	24.59
1900	661	1880	EGPRS	8-PSK	3	23.77	0.54	24.31
1900	661	1880	EGPRS	8-PSK	4	23.67	0.54	24.21
1900	810	1909.8	EGPRS	8-PSK	1	24.19	0.54	24.73
1900	810	1909.8	EGPRS	8-PSK	2	24.04	0.54	24.58
1900	810	1909.8	EGPRS	8-PSK	3	23.89	0.54	24.43
1900	810	1909.8	EGPRS	8-PSK	4	23.76	0.54	24.30

GSM850 Max: 33.10dBm (2.042W)

GSM1900 Max: 29.21dBm (0.834W)

4 Peak to Average Ratio

4.1 Test Result

Test Description	Basic Standards	Test Result
Peak to Average Ratio	FCC 24.232(d) RSS-132 (5.4) RSS-133 (6.4)	Pass

4.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v03r01 was used to determine the peak-to-average power ratio. Clause 5.7.2 references ANSI C63.26-2015 Subclause 5.2.3.4 which defines the measurement method using the CCDF function of the spectrum analyzer. Measurements were recorded at the middle channel of each band at the highest power.

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.3 °C
 Relative Humidity: 54.6 %
 Atmospheric Pressure: 97.7 kPa

4.4 Test Equipment

Test End Date: 16-Jul-2018

Tester: MT

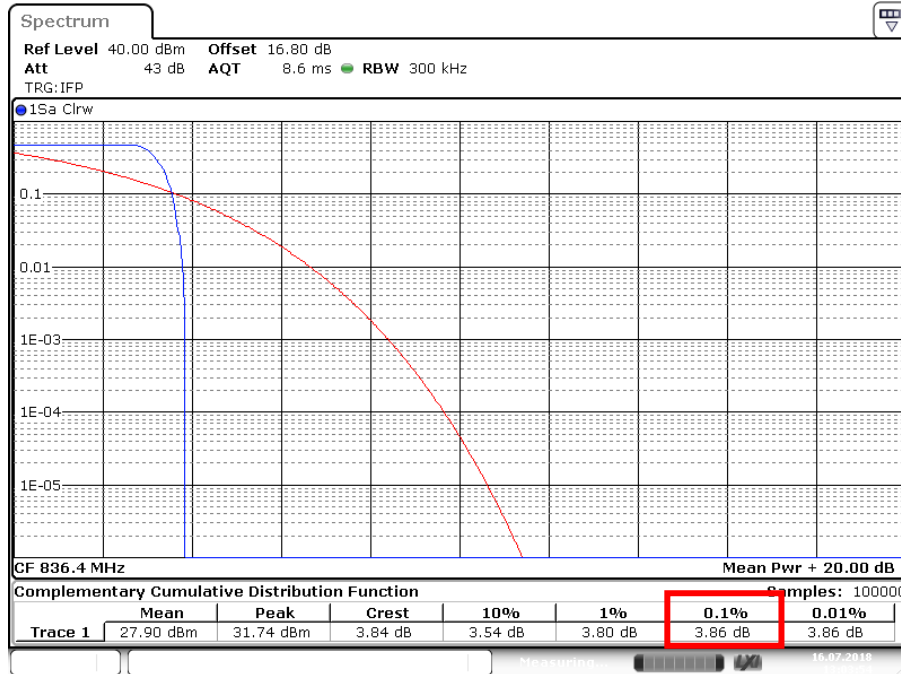
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	1608522I	24-Jul-2018
RF CABLE	1134	GORE	B094785	25-Jul-2019
RF CABLE	141	HUBER & SUHNER	B095588	25-Jul-2019
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15032	CNR
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the CMW 500 is on a 2-year calibration cycle.

4.5 Test Data

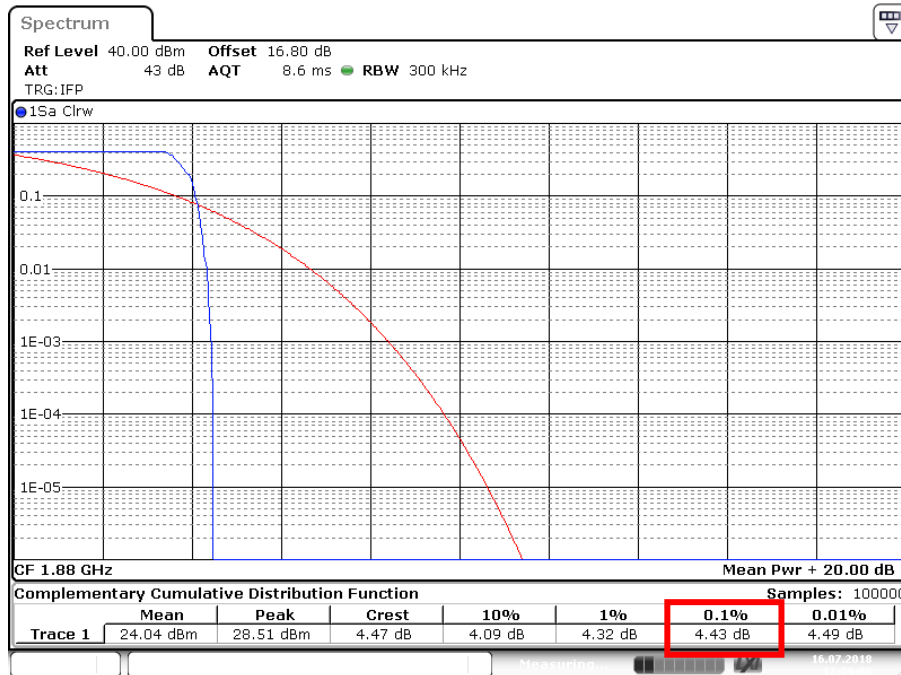
The requirement is that the peak-to-average ratio shall not exceed 13 dB for more than 0.1% of the time.

GSM850 CH 189



Date: 16 JUL 2018 13:03:55

GSM1900 CH 661



Date: 16 JUL 2018 12:59:08

5 Occupied Bandwidth

5.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth	FCC 2.1049 FCC 22.917(b) FCC 24.238(b) RSS-GEN (6.7) RSS-133 (2.3)	Reported

5.2 Test Method

The occupied bandwidth is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of a given emission.

The span of the analyzer was set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth was set to between 1% and 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. Video averaging is not permitted. The 99% occupied bandwidth was measured using the spectrum analyzer's occupied bandwidth measurement function.

A radio link was established between the EUT and the Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. The occupied bandwidth measurement was conducted at the middle channel of each band.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.3 °C
 Relative Humidity: 54.6 %
 Atmospheric Pressure: 97.7 kPa

5.4 Test Equipment

Test End Date: 16-Jul-2018

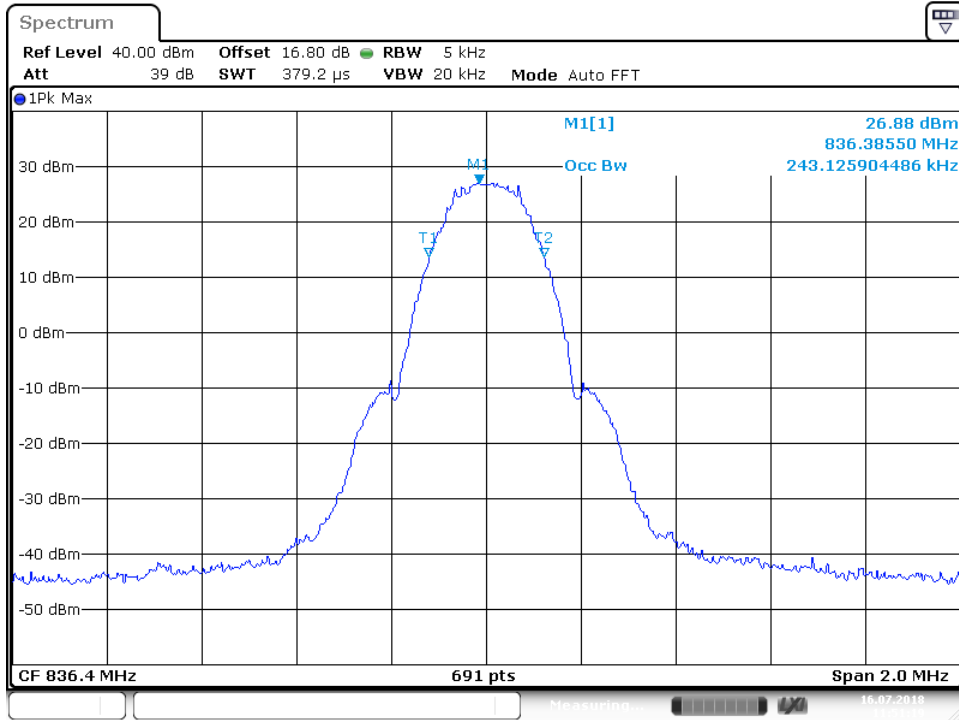
Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	1608522I	24-Jul-2018
RF CABLE	1134	GORE	B094785	25-Jul-2019
RF CABLE	141	HUBER & SUHNER	B095588	25-Jul-2019
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15032	CNR
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

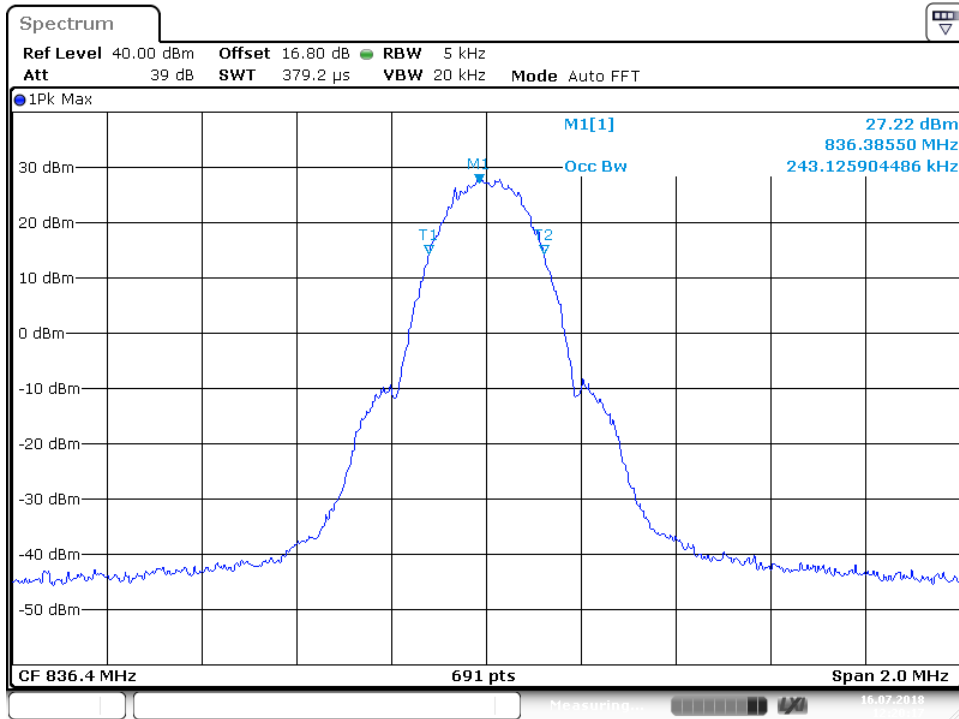
- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the CMW 500 is on a 2-year calibration cycle.

5.5 Test Data

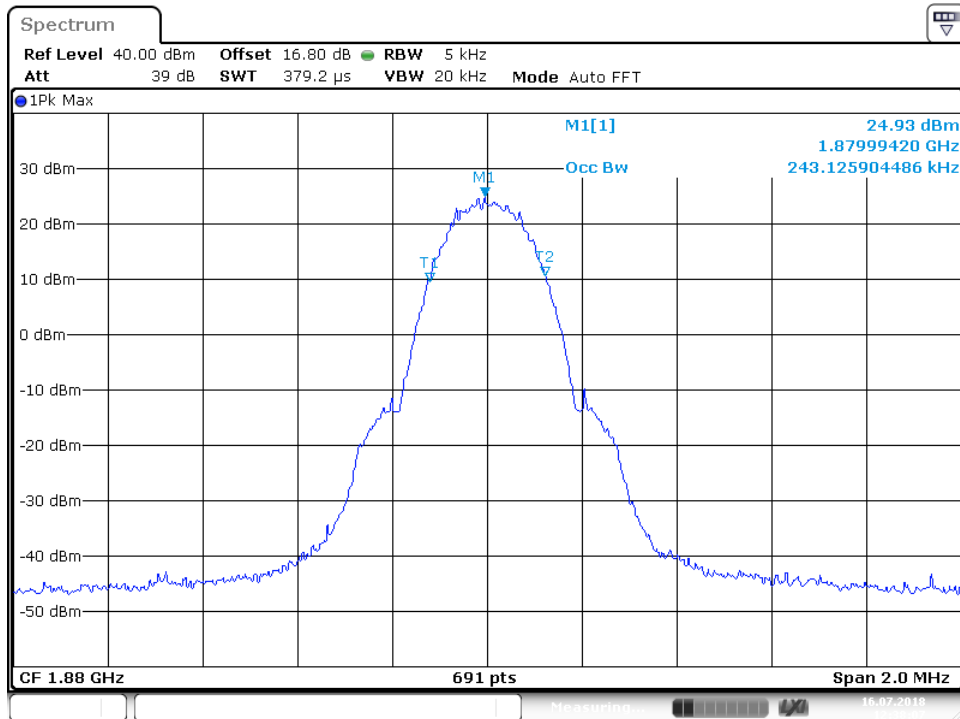
GSM850 Channel 189 - 99% Occupied Bandwidth GPRS



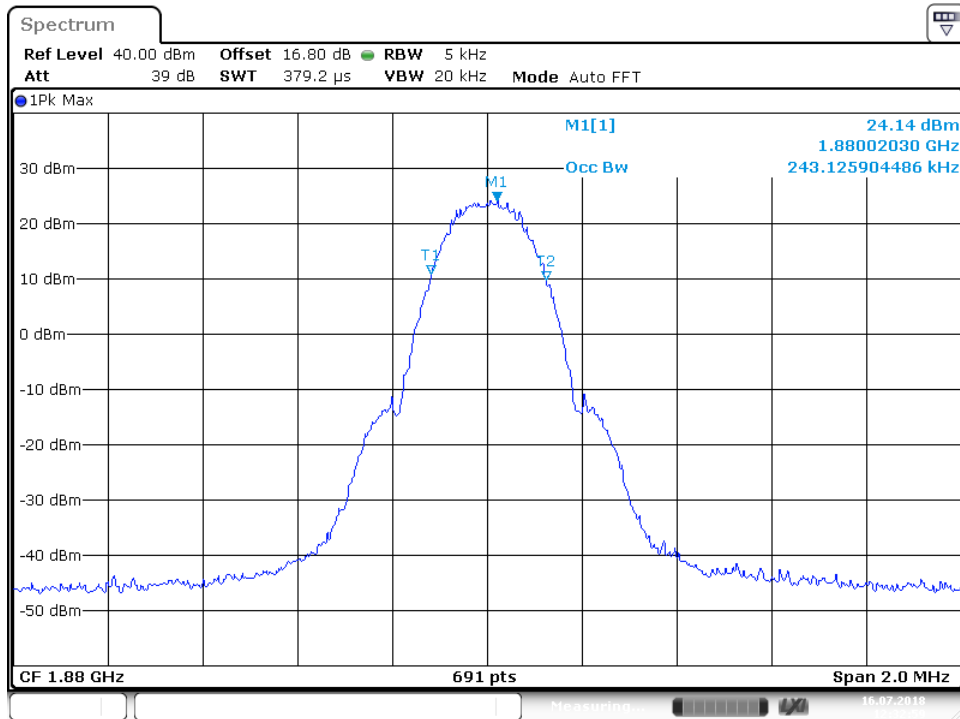
EGPRS



GSM1900 Channel 661 - 99% Occupied Bandwidth GPRS



EGPRS



6 Band Edge and Conducted Spurious Emissions

6.1 Test Result

Test Description	Basic Standards	Test Result
Conducted Spurious Emissions and Band Edge	FCC 2.1051 FCC 22.917(a) FCC 24.238(a) RSS-132 (5.5) RSS-133 (6.5.1)	Pass

6.2 Test Method

The conducted power at the EUT antenna port of the band edge (out-of-band) and spurious band emissions are measured by means of a calibrated spectrum analyzer. The spectrum is investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. The power of any emissions outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) measured in watts by at least $43 + 10 \log (P)$ dB.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.2 – 23.6 °C
 Relative Humidity: 52.5 – 52.8 %
 Atmospheric Pressure: 97.4 – 97.8 kPa

6.4 Test Equipment

Test End Date: 23-Jul-2018

Tester: MT

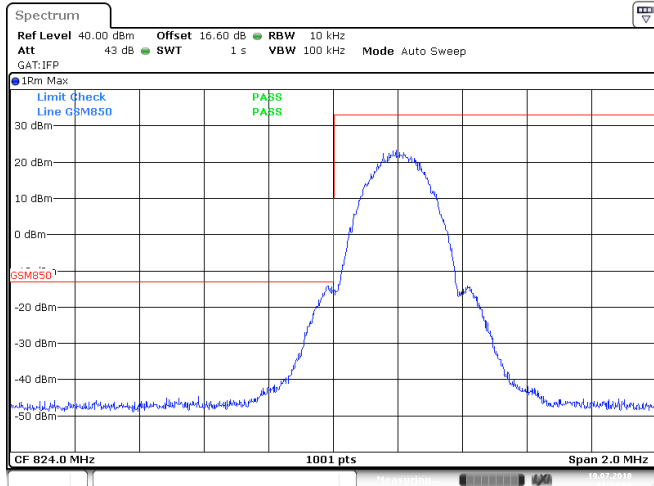
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	1608522I	24-Jul-2018
RF CABLE	1134	GORE	B094785	25-Jul-2019
RF CABLE	141	HUBER & SUHNER	B095588	25-Jul-2019
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15032	CNR
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the CMW 500 is on a 2-year calibration cycle.

6.5 Test Data – Band Edge

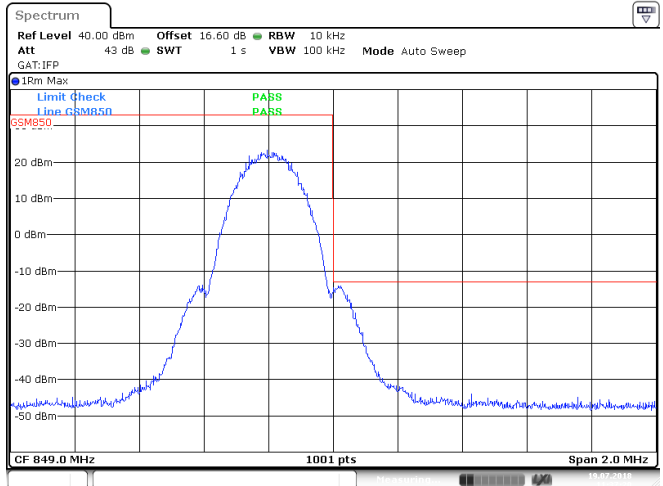
GSM850

Lower Band Edge (Channel 128, 824.2 MHz)



Date: 19 JUL 2018 11:24:10

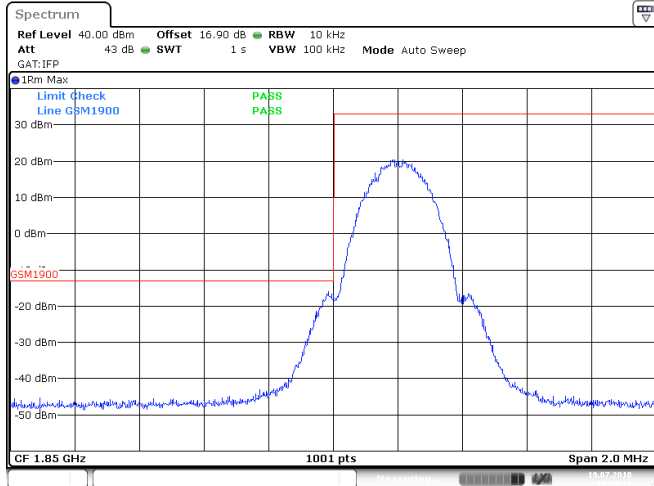
Upper Band Edge (Channel 251, 848.8 MHz)



Date: 19 JUL 2018 11:27:20

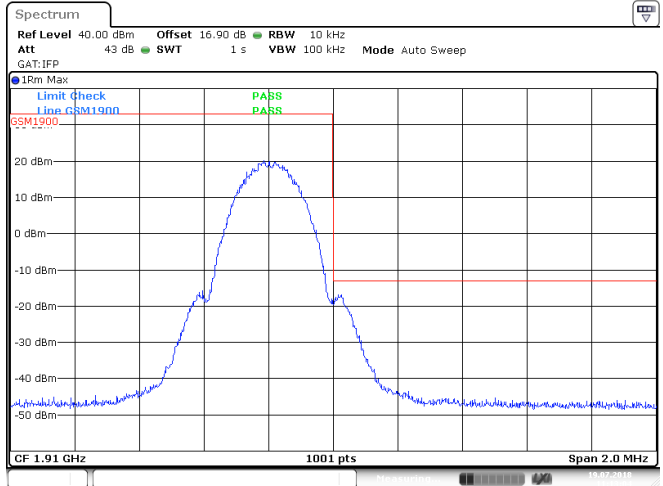
GSM1900

Lower Band Edge (Channel 512, 1850.2 MHz)



Date: 19 JUL 2018 11:19:17

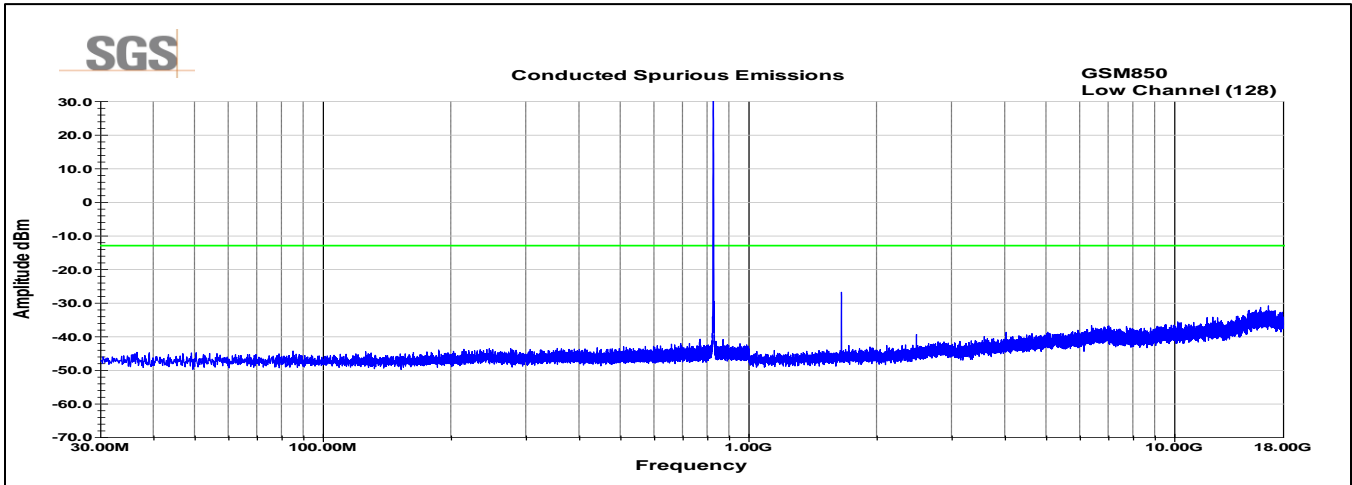
Upper Band Edge (Channel 810, 1909.8 MHz)



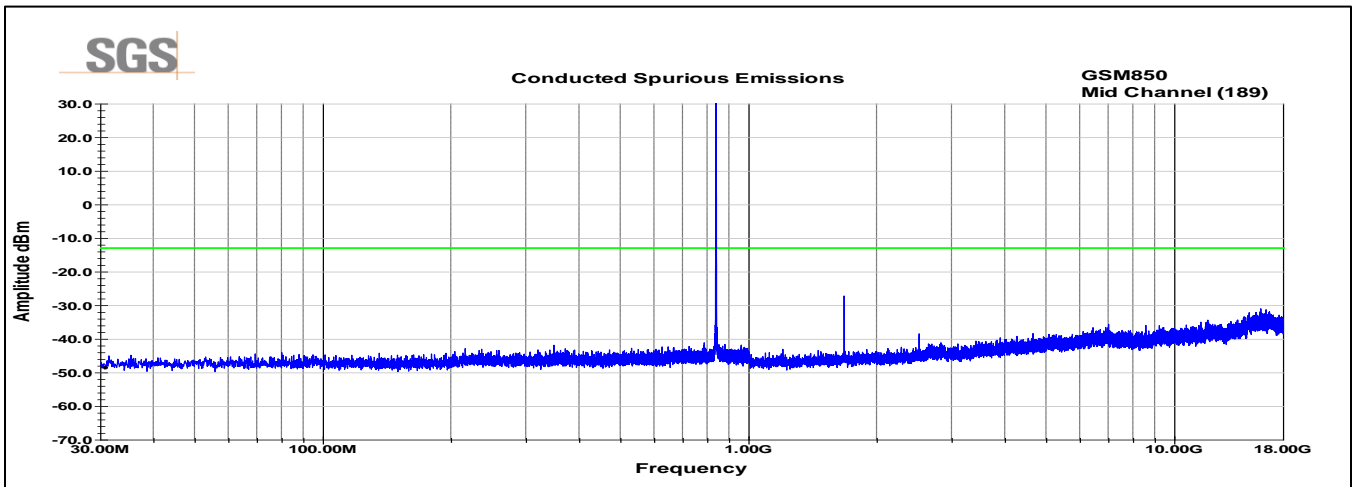
Date: 19 JUL 2018 11:13:04

6.6 Test Data – Conducted Spurious Emissions

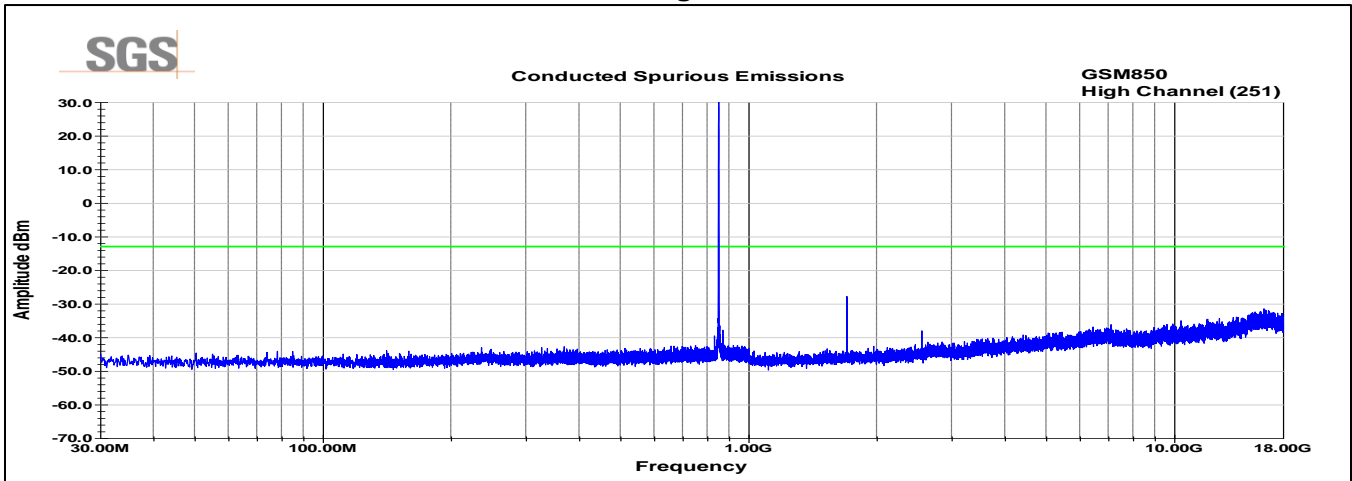
GSM850 Low Channel



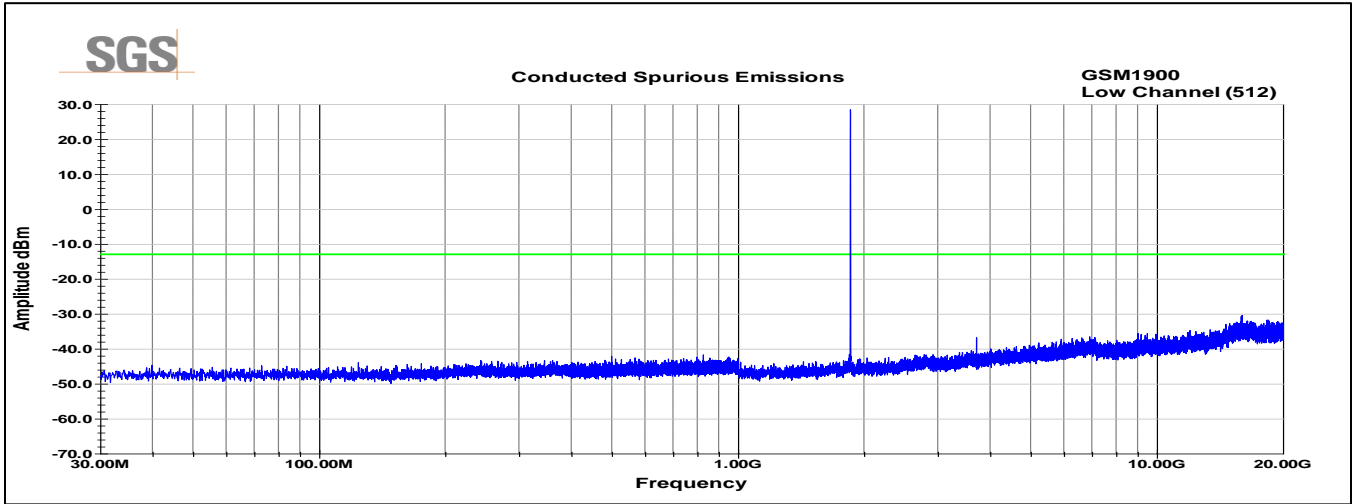
GSM850 Mid Channel



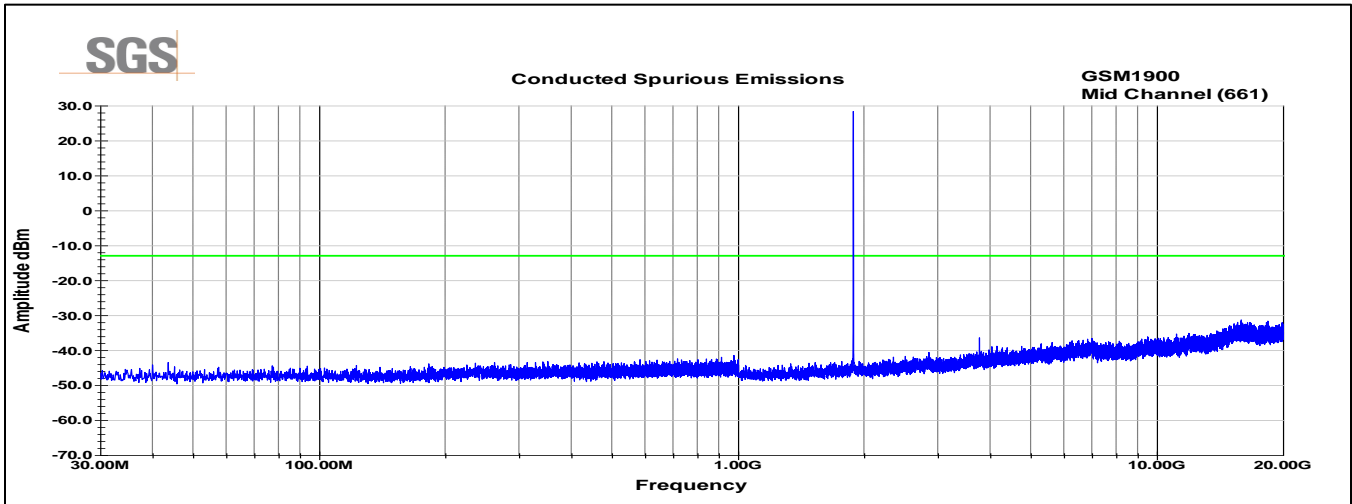
GSM850 High Channel



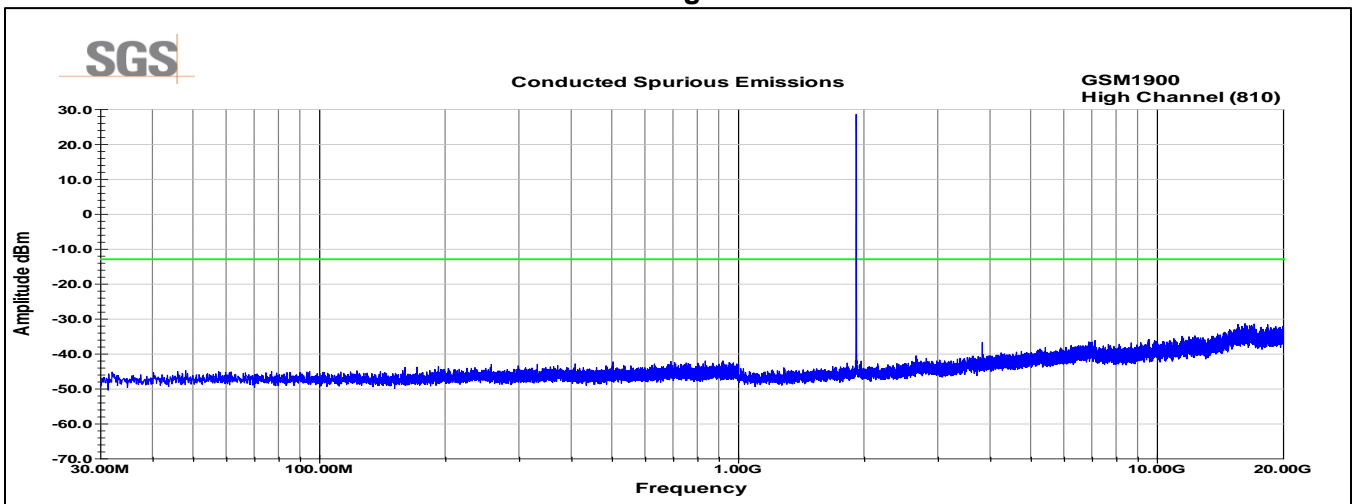
GSM1900 Low Channel



GSM1900 Mid Channel



GSM1900 High Channel



7 Effective Radiated Power

7.1 Test Result

Test Description	Basic Standards	Test Result
Effective Radiated Power	FCC 22.913(a)(5)	Pass
Effective Isotropic Radiated Power	FCC 24.232(c) RSS-132 (5.4) RSS-133 (6.4)	Pass

7.2 Test Method

Because the device is provided with a coaxial port but no antenna, ERP/EIRP measurements were taken by measuring the conducted output power and defining the maximum gain antenna that may be used while maintaining compliance with the applicable limits.

7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

7.4 Test Equipment

None

7.5 Test Data

Band of Operation		Conducted Power (1) w/tolerance dBm	Antenna Gain (2)	Cable Loss	Average EIRP		FCC EIRP Limit W	% of Limit	Verdict
Type	MHz				dBm	W			
GSM 850	824-849	30.0	1.0	0.0	31.0	1.259	7.0	18%	Pass
GSM 1900	1850-1910	27.0	5.0	0.0	32.0	1.585	2.0	79%	Pass

Band of Operation		Conducted Power (1) w/tolerance dBm	Antenna Gain (2)	Cable Loss	Average EIRP		ISED EIRP Limit W	% of Limit	Verdict
Type	MHz				dBm	mW			
GSM 850	824-849	30.0	1.0	0.0	31.0	1.259	11.5	11%	Pass
GSM 1900	1850-1910	27.0	5.0	0.0	32.0	1.585	2.0	79%	Pass

Note (1): The maximum conducted power with tune-up tolerance is 35dBm for GSM 850 and 32dBm for GSM 1900. However, the maximum transmitter on-time is 4 out of 8 Tx time slots, which reduces the time-averaged power by 3dB. In addition, in compliance with the 3GPP specifications, the device implements a 2dB Tx power back-off for 3 and 4 Tx slot operation. Even with this power back-off, 4 Tx slot operation is still the worst-case configuration, so the maximum power is reduced by a total of 5dB.

Note (2): Antenna gain was determined from maximum gain while still meeting the RF exposure requirements at 20cm.

8 Radiated Spurious Emissions

8.1 Test Result

Test Description	Basic Standards		Test Result
Radiated Spurious Emissions	FCC 2.1053 FCC 22.917(a) FCC 24.238(a) ANSI/TIA-603-C-2004	RSS-GEN (6.13) RSS-132 (5.5) RSS-133 (6.5.1)	Pass

8.2 Test Method

The radiated power emanating from the EUT of the band edge (out-of-band) and spurious band emissions are measured by means of a calibrated spectrum analyzer. The spectrum is investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. The power of any emissions outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) measured in watts by at least $43 + 10 \log (P)$ dB.

The EUT was manipulated through each of its three orthogonal axes with the measurement oriented in both vertical and horizontal polarizations.

A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester.

The measurements were performed at the low, middle and high channels.

8.3 Test Site

SGS Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions	30-1000MHz	1-18GHz	18-20GHz
Enclosure:	3m Chamber	10m Chamber	3m Chamber
Temperature:	24.2 °C	23.9 °C	23.8 °C
Relative Humidity:	52.6 %	50.9 %	50.9 %
Atmospheric Pressure:	98.1 kPa	97.8 kPa	98.1 kPa

8.4 Test Equipment

30-1000MHz

Test End Date: 6-Aug-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079689	16-Oct-2018
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	23-Jul-2019
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	24-Jul-2019
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17016	23-Jul-2019
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	27-Jul-2019
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	1206247	28-Feb-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

1-18GHz

Test End Date: 27-Jul-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	2-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079716	23-Jul-2019
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	6-Mar-2019
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

18-20GHz

Test End Date: 6-Aug-2018

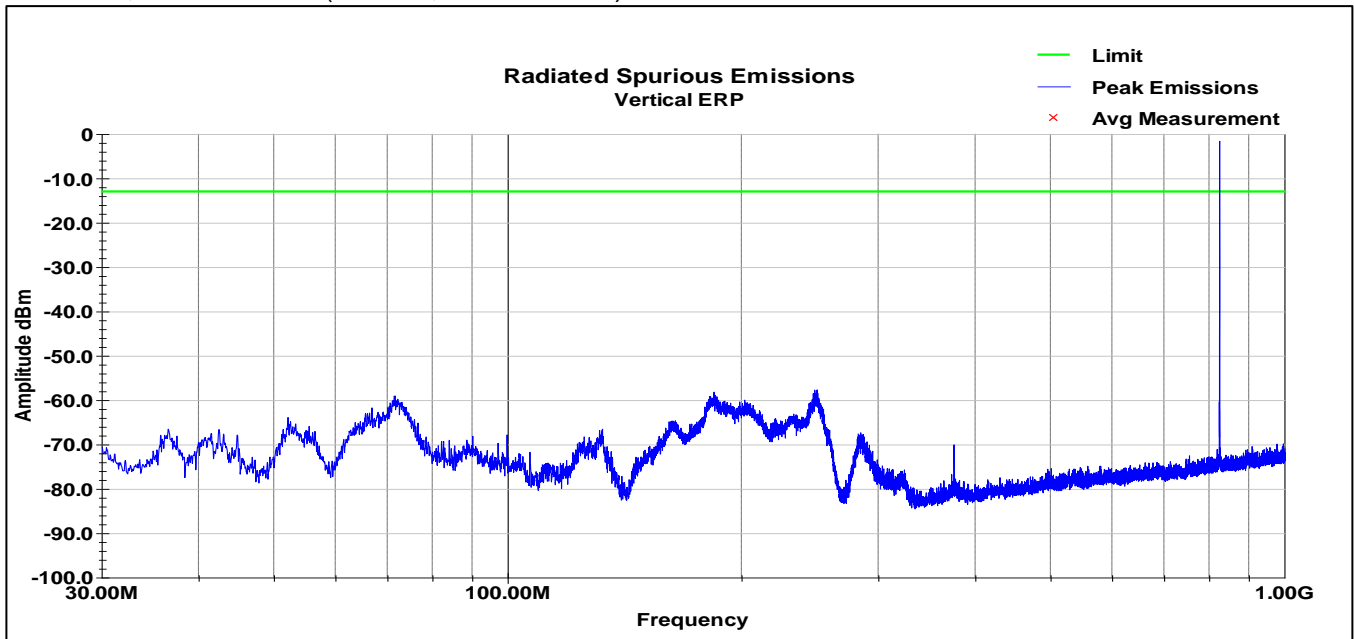
Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, HORN (SMALL)	LB-180400-20-C-KF	A-INFO	15007	30-Mar-2019
RF CABLE	SF102	HUBER & SUHNER	B079822	25-Jul-2019
RF CABLE	SF102	HUBER & SUHNER	B079823	25-Jul-2019
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	27-Jul-2019
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	1206247	28-Feb-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

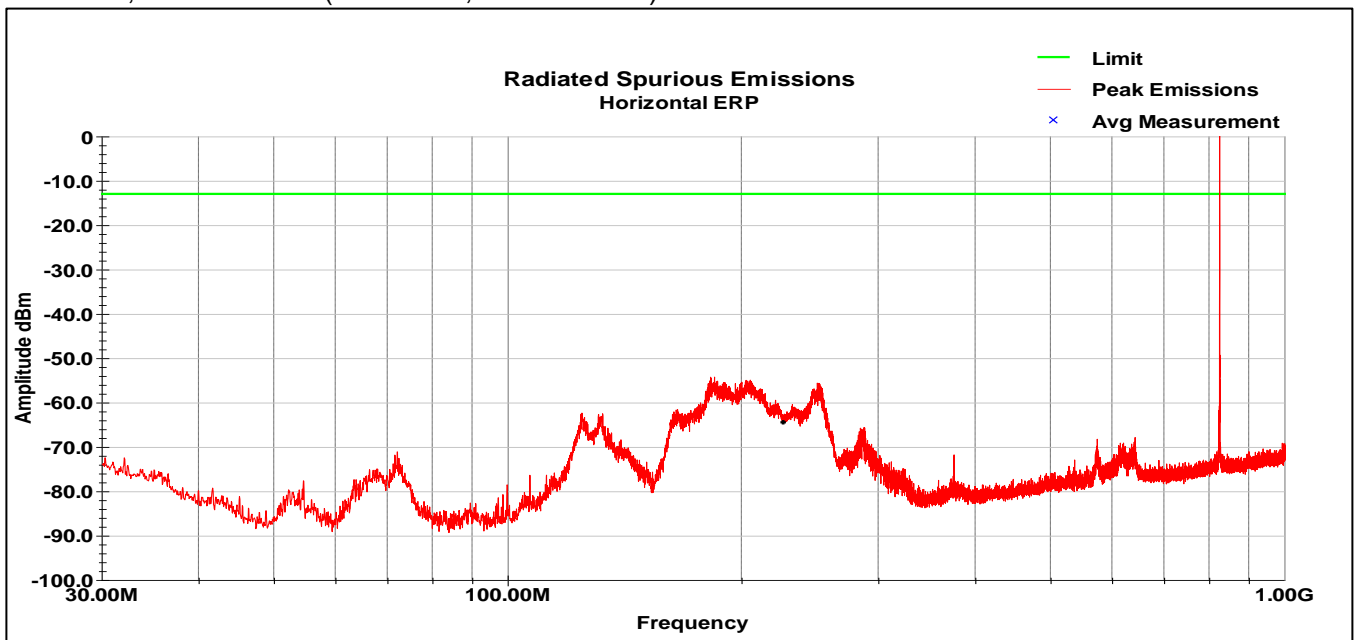
- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the CMW 500 is on a 2-year calibration cycle.

8.5 Test Data

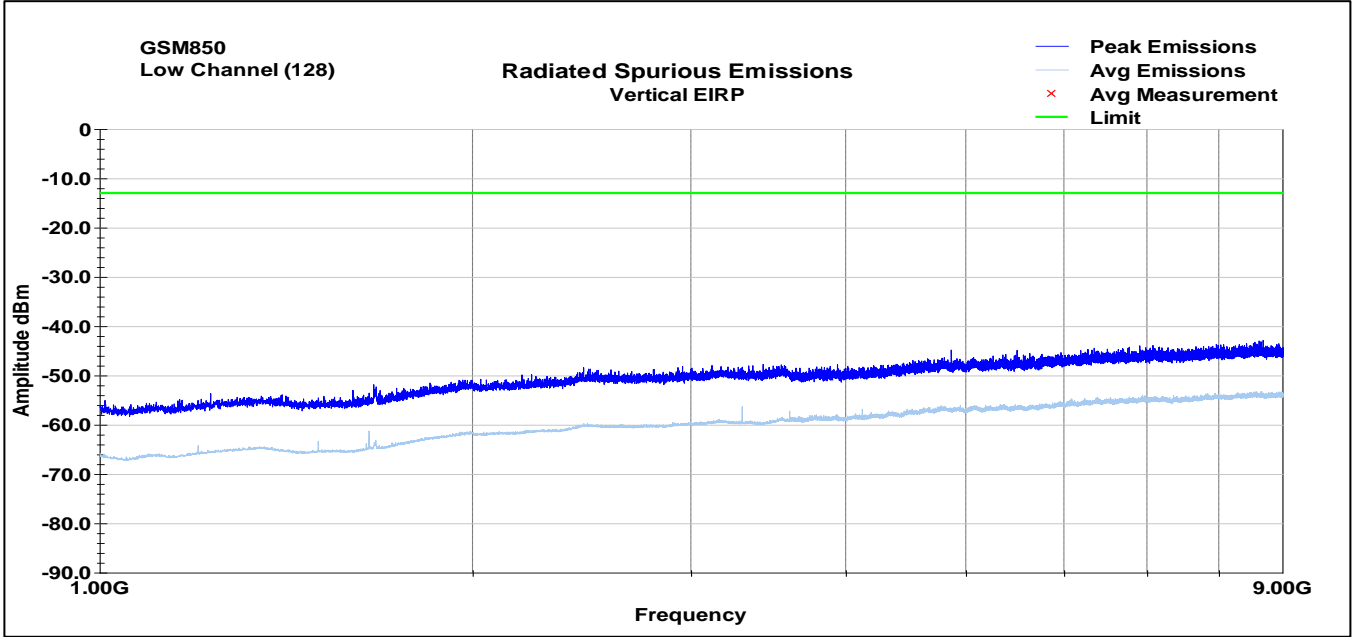
GSM 850, Low Channel (Vertical, 30-1000MHz)



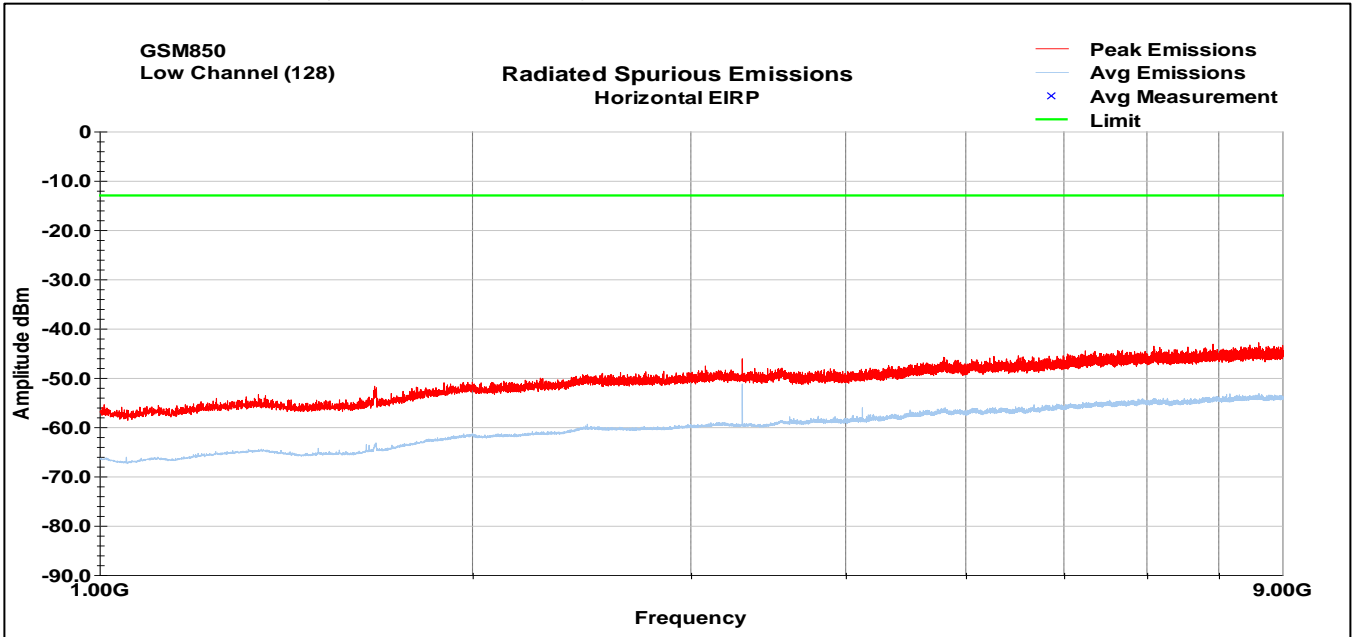
GSM 850, Low Channel (Horizontal, 30-1000MHz)



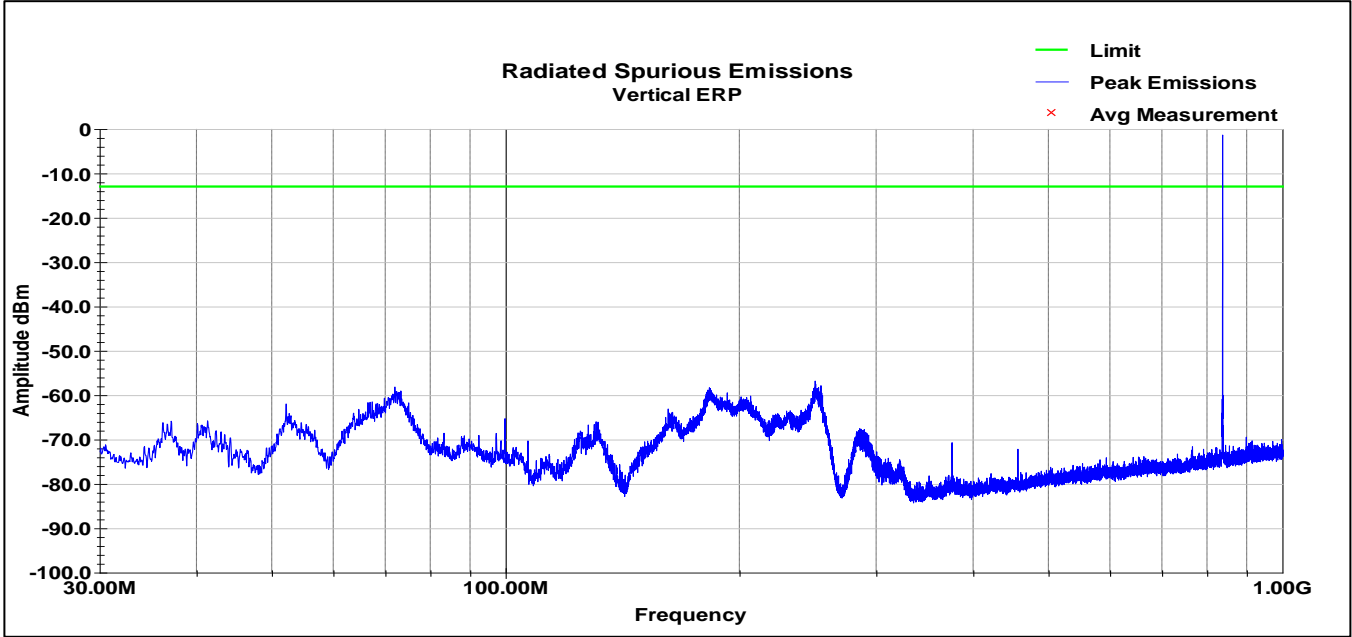
GSM 850, Low Channel (Vertical, 1-9GHz)



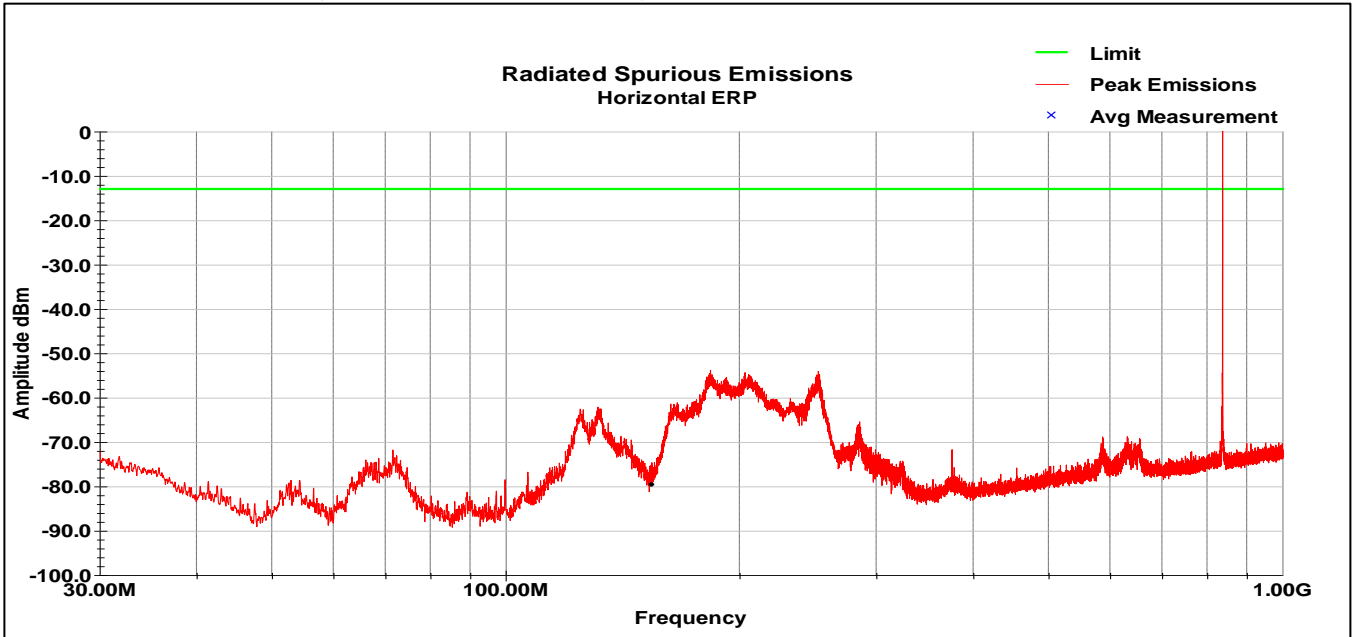
GSM 850, Low Channel (Horizontal, 1-9GHz)



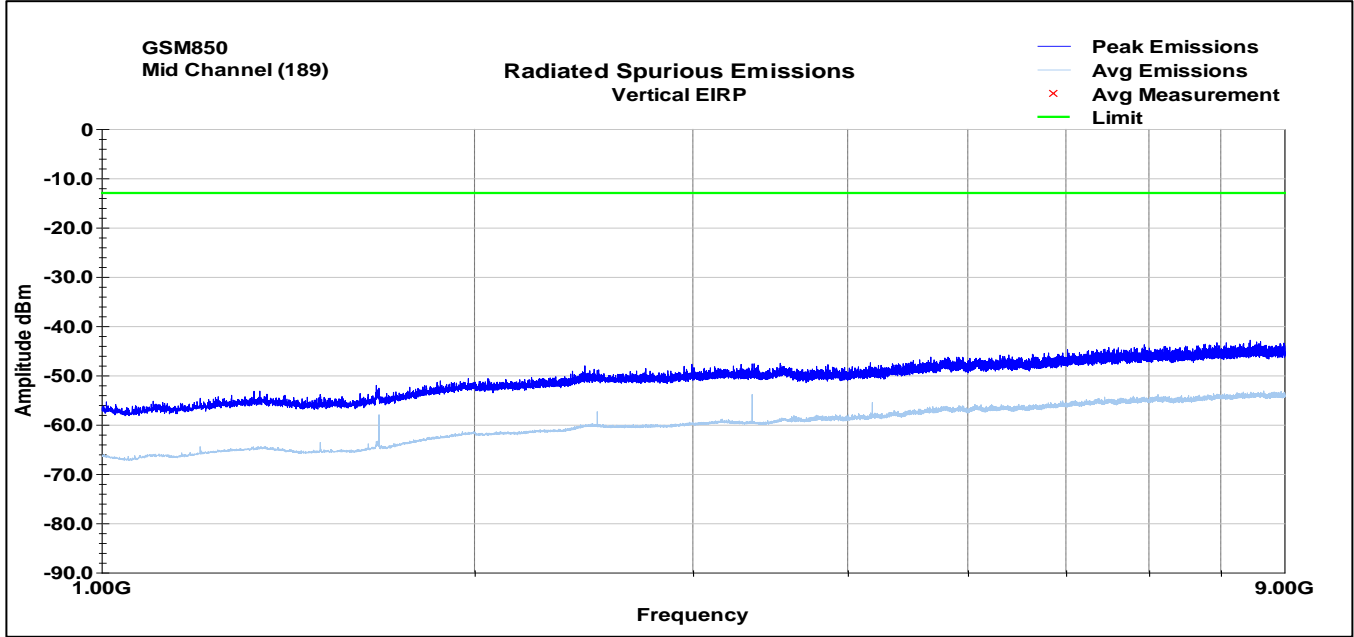
GSM 850, Mid Channel (Vertical, 30-1000MHz)



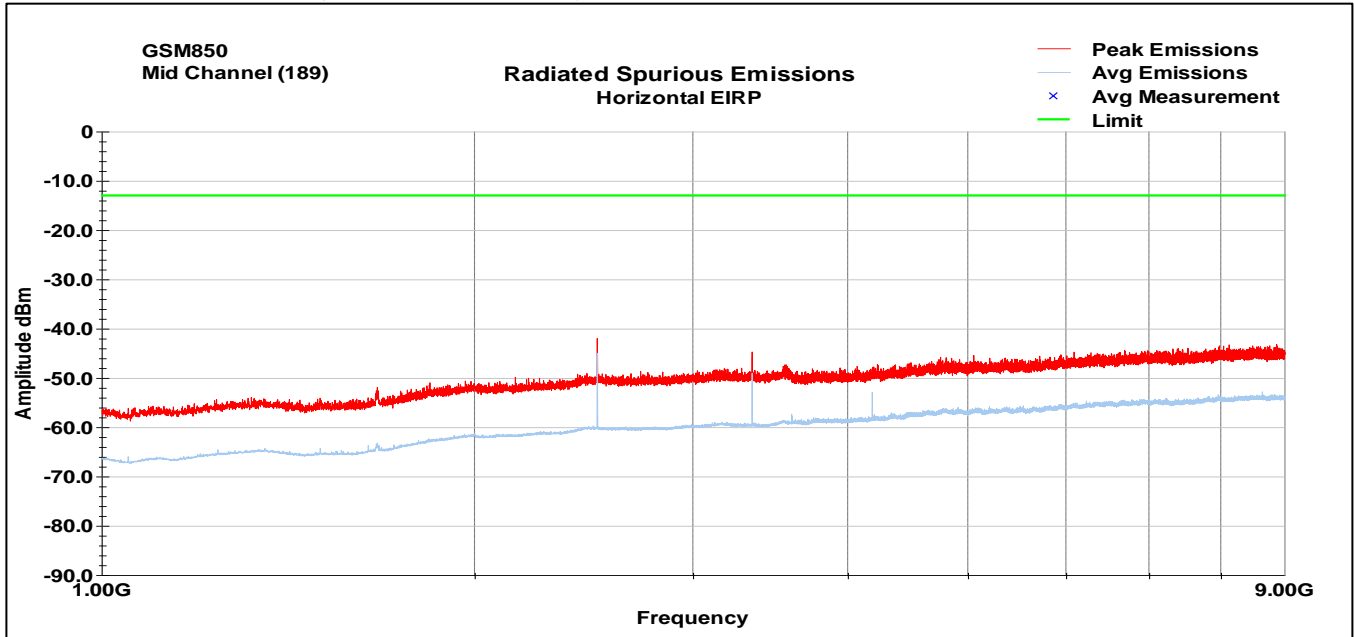
GSM 850, Mid Channel (Horizontal, 30-1000MHz)



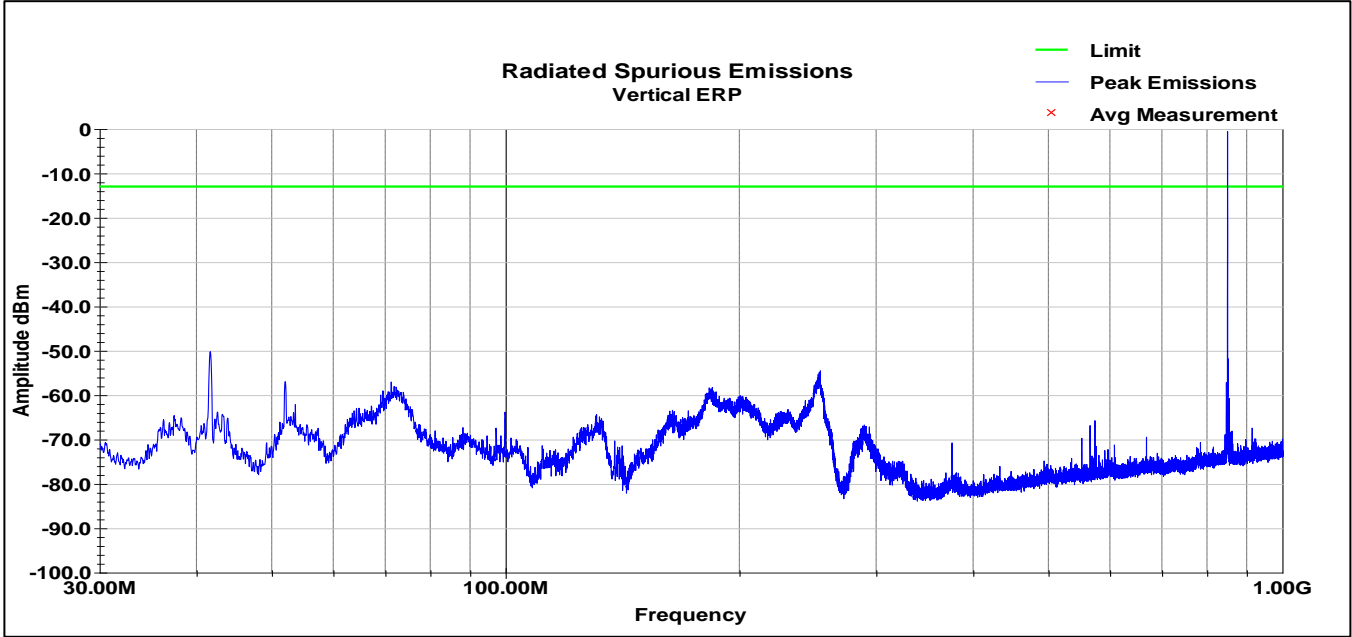
GSM 850, Mid Channel (Vertical, 1-9GHz)



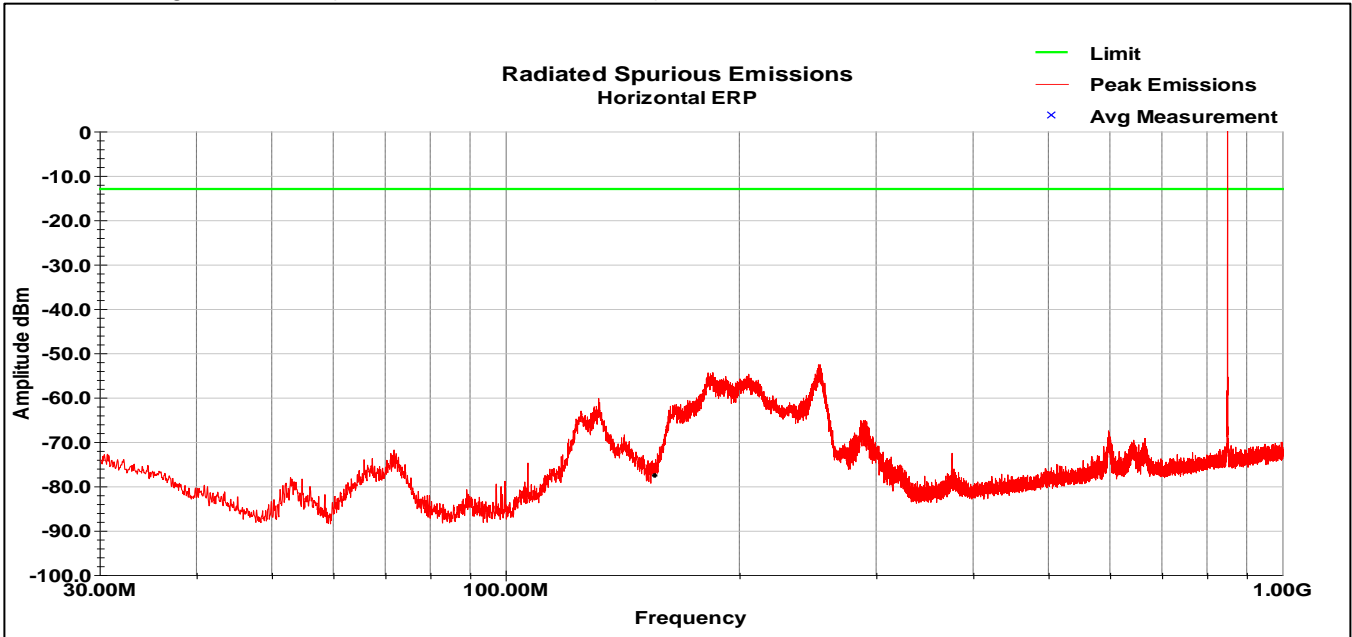
GSM 850, Mid Channel (Horizontal, 1-9GHz)



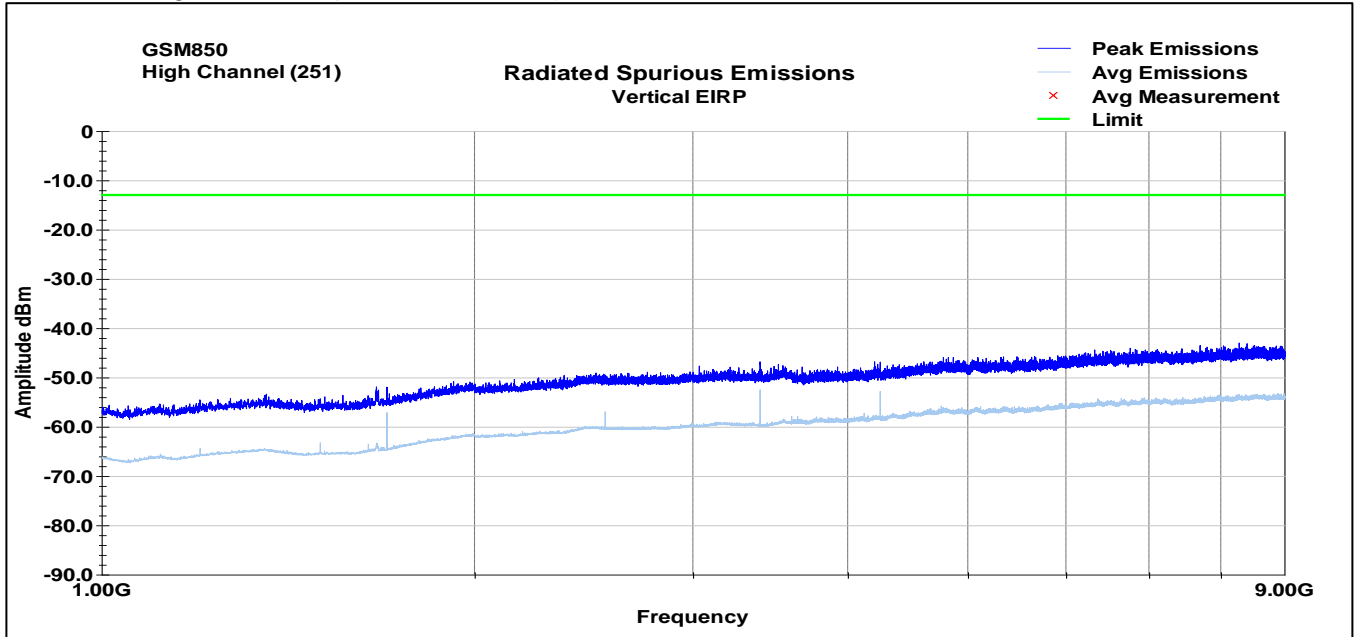
GSM 850, High Channel (Vertical, 30-1000MHz)



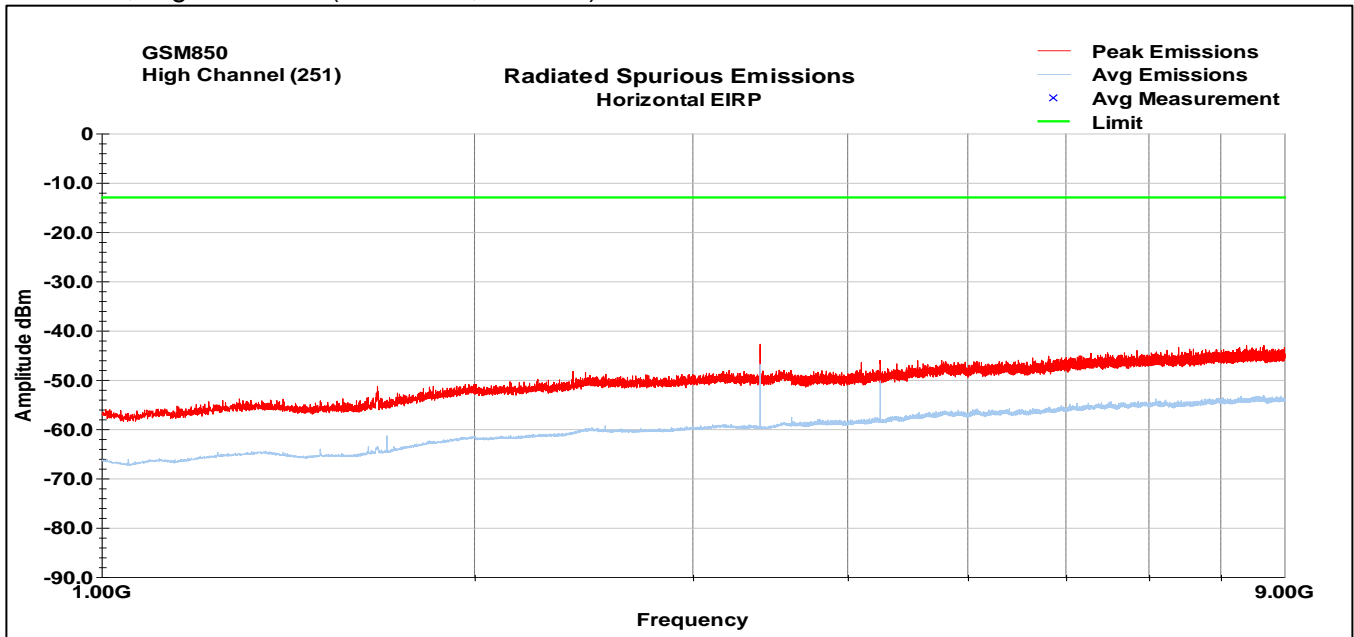
GSM 850, High Channel (Horizontal, 30-1000MHz)



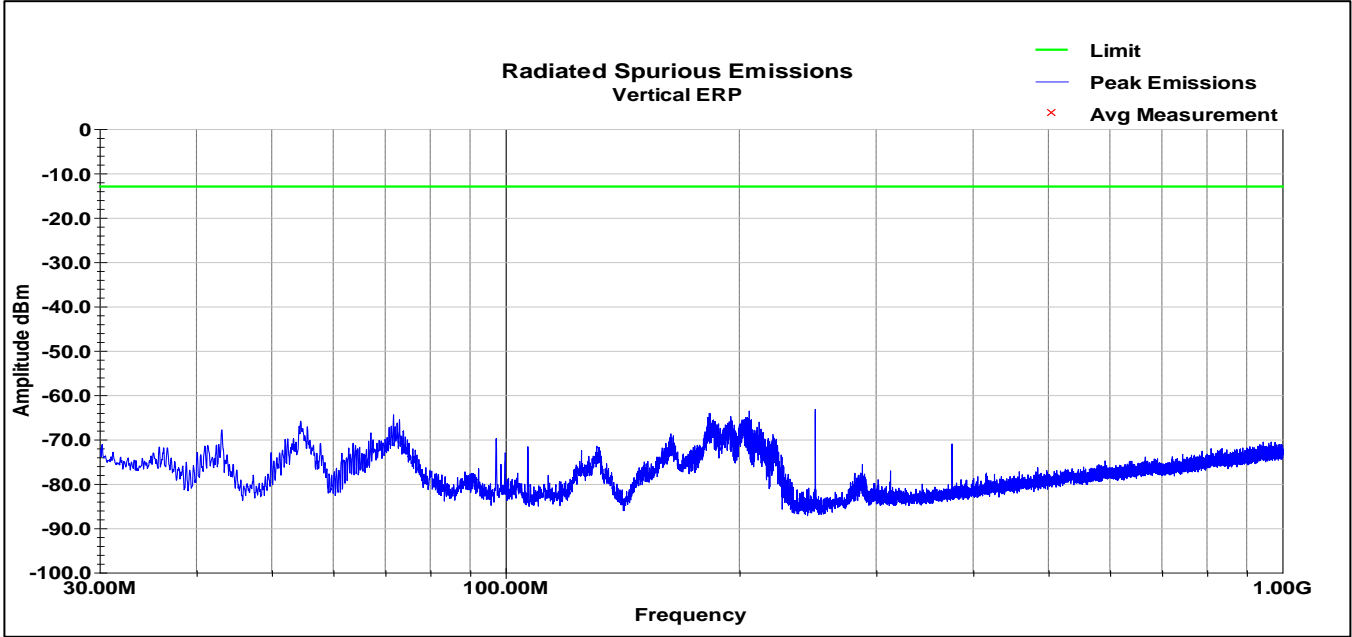
GSM 850, High Channel (Vertical, 1-9GHz)



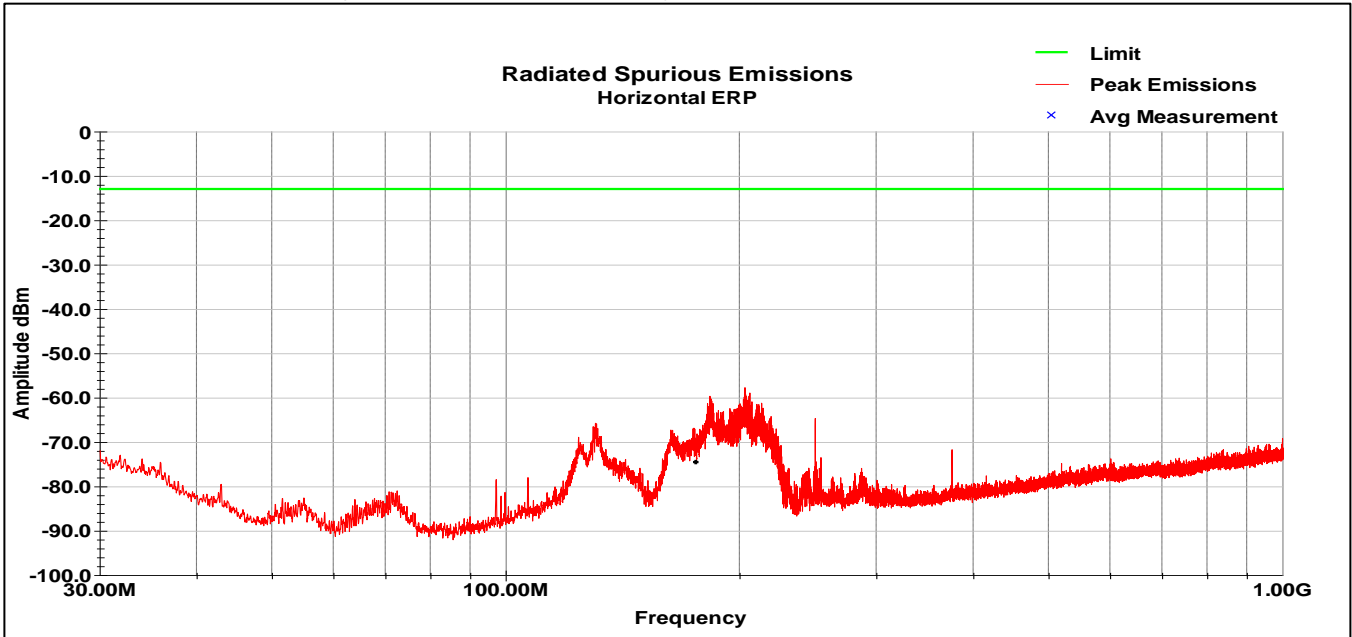
GSM 850, High Channel (Horizontal, 1-9GHz)



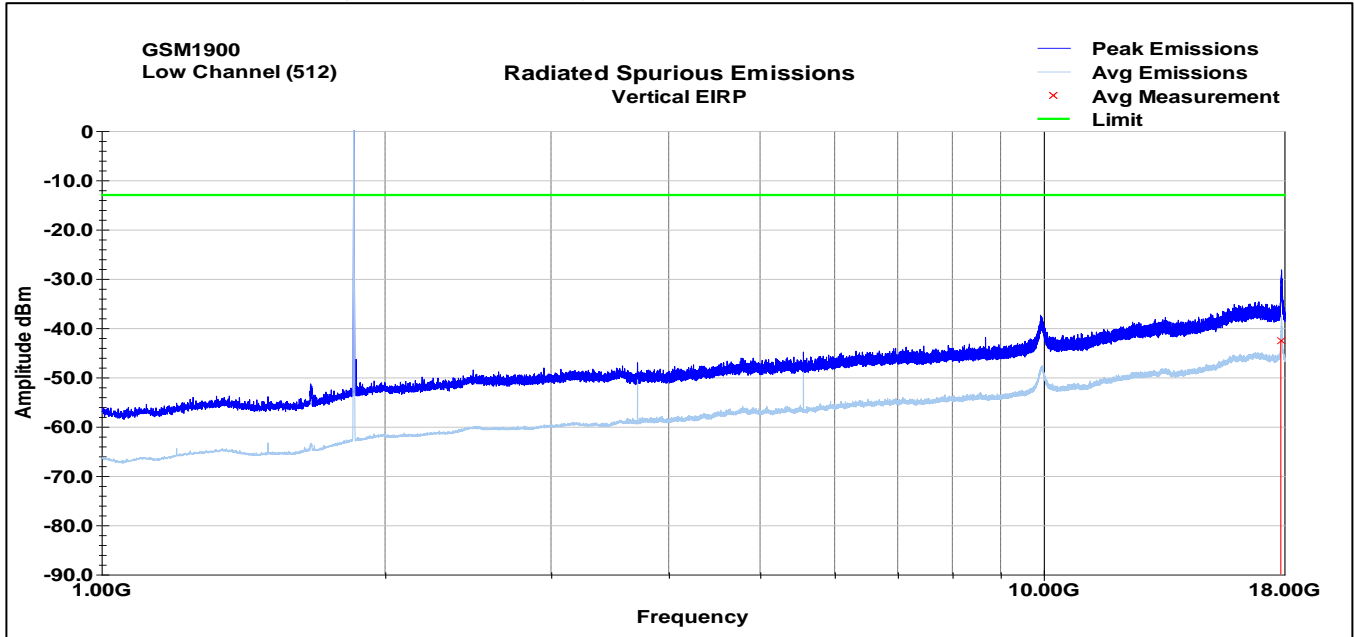
GSM 1900, Low Channel (Vertical, 30-1000MHz)



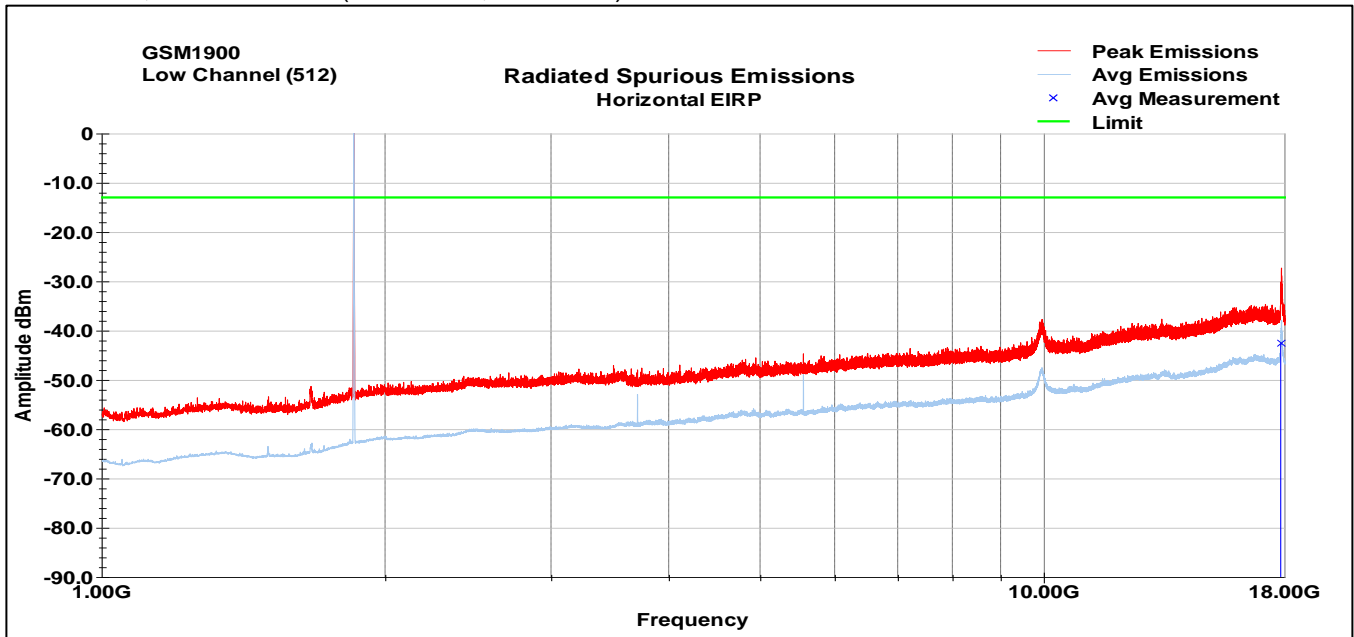
GSM 1900, Low Channel (Horizontal, 30-1000MHz)



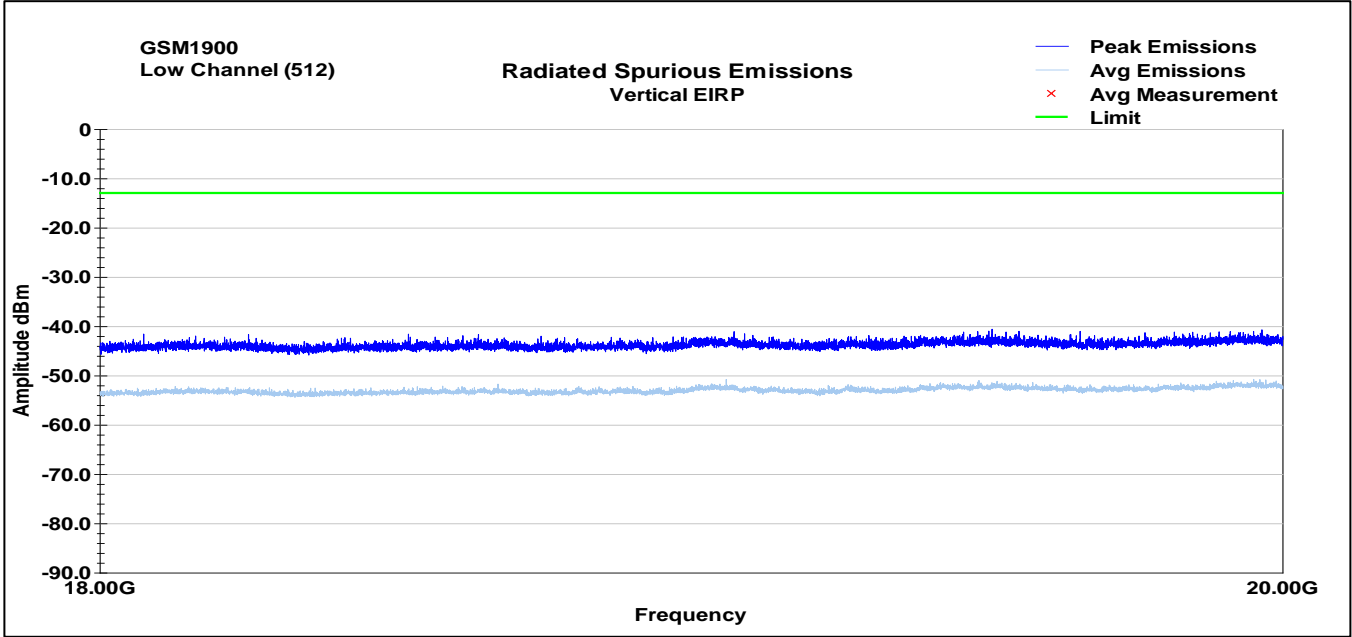
GSM 1900, Low Channel (Vertical, 1-18GHz)



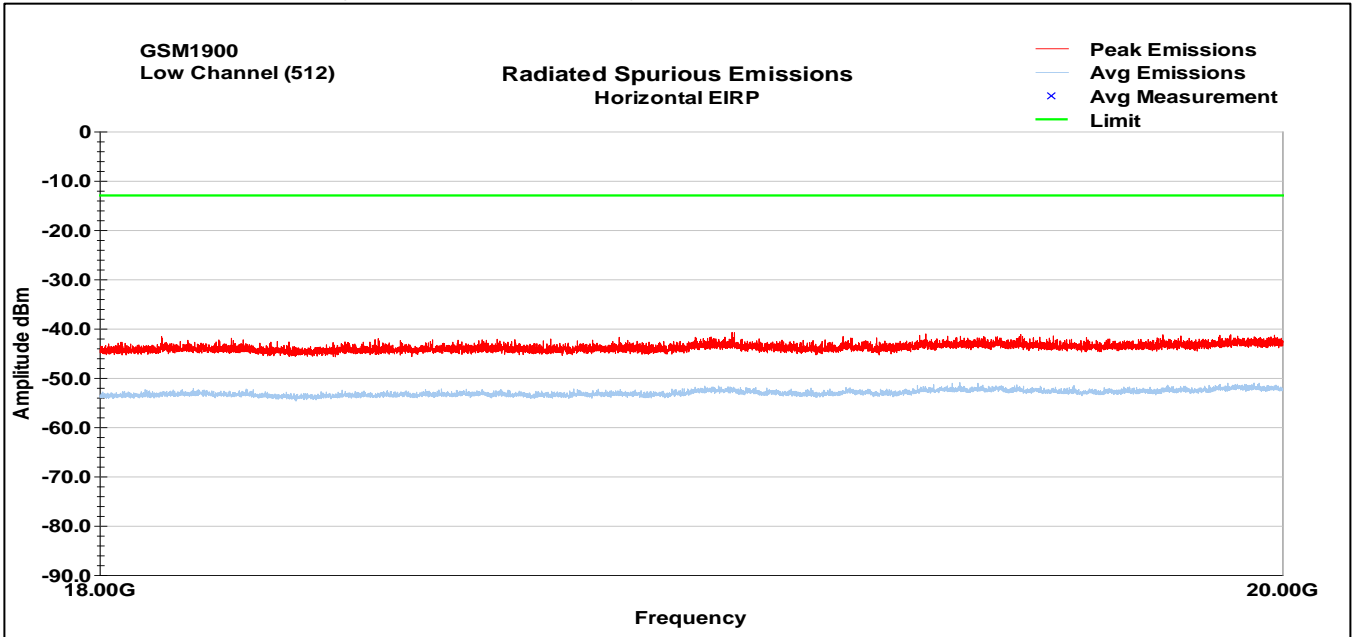
GSM 1900, Low Channel (Horizontal, 1-18GHz)



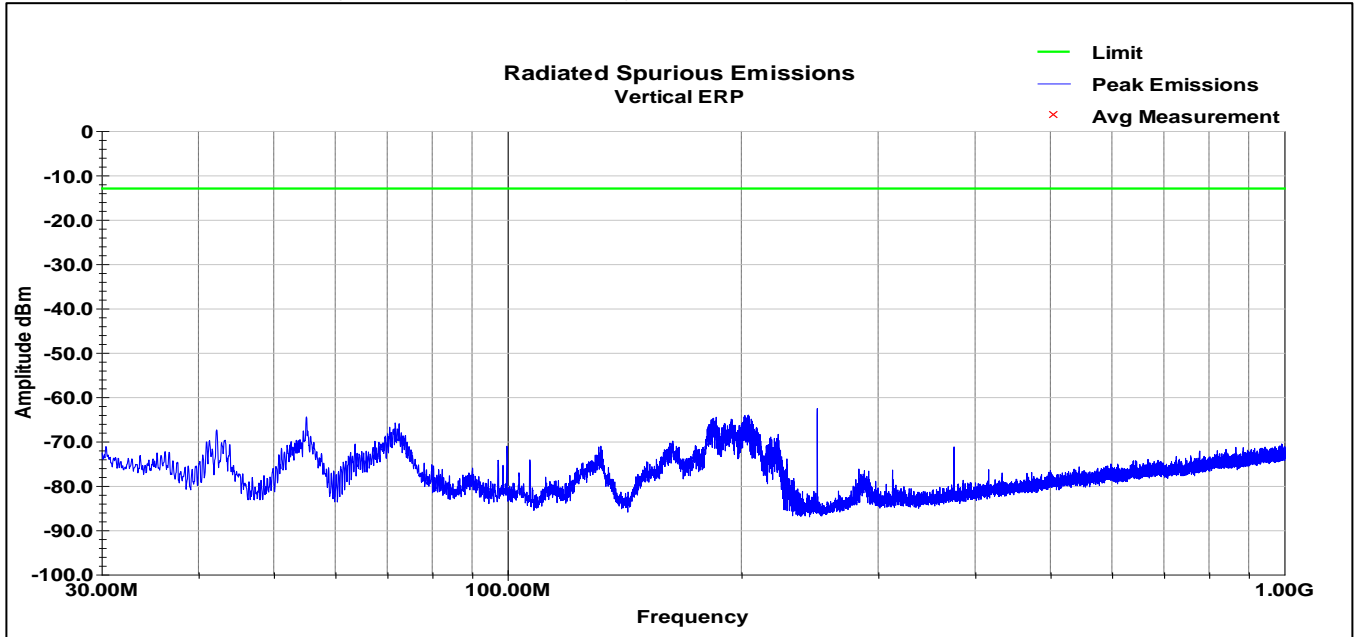
GSM 1900, Low Channel (Vertical, 18-20GHz)



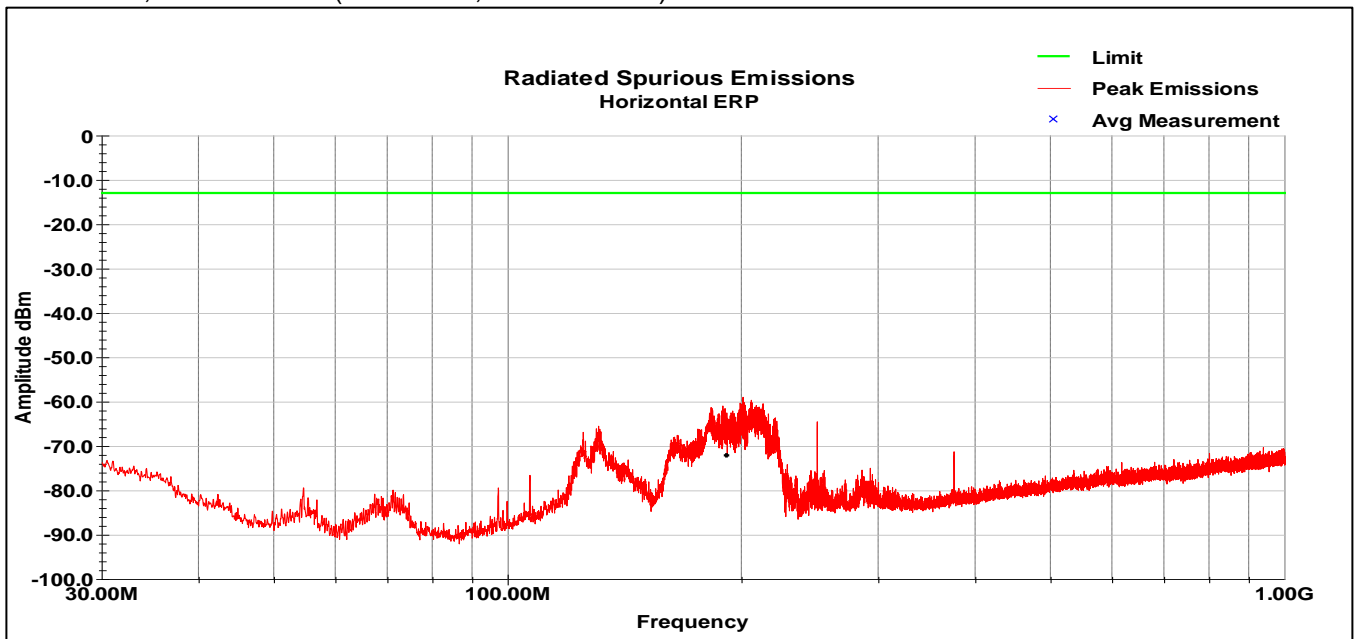
GSM 1900, Low Channel (Horizontal, 18-20GHz)



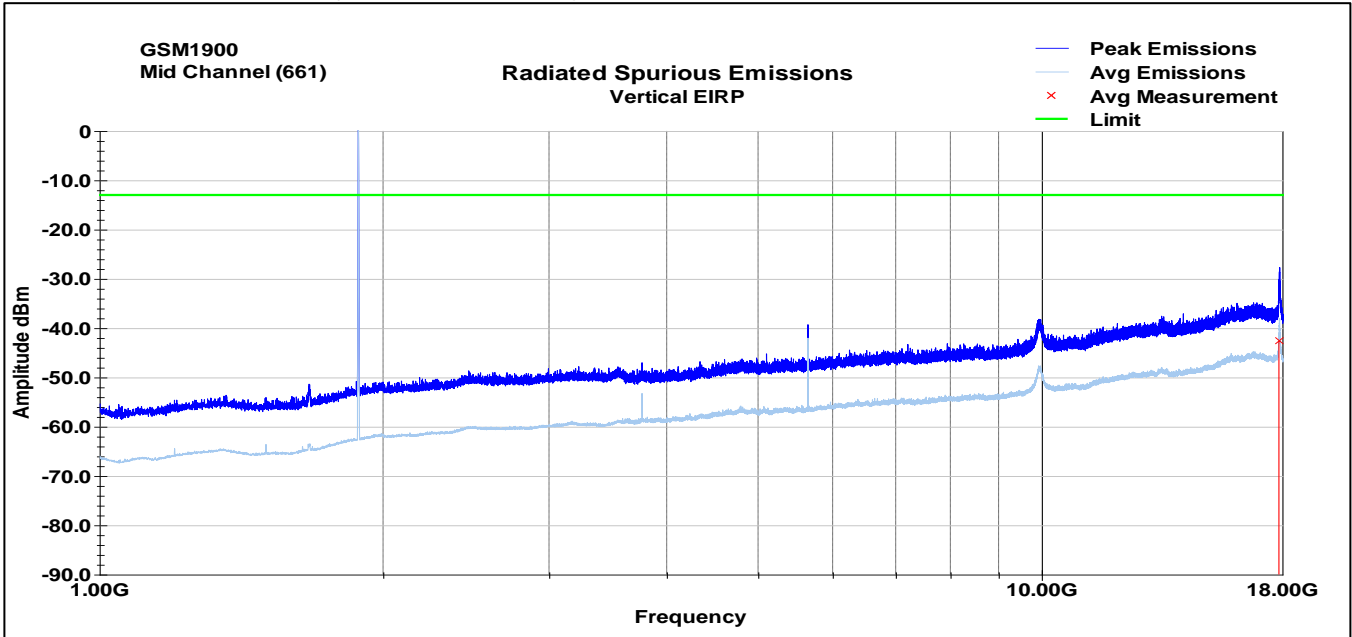
GSM 1900, Mid Channel (Vertical, 30-1000MHz)



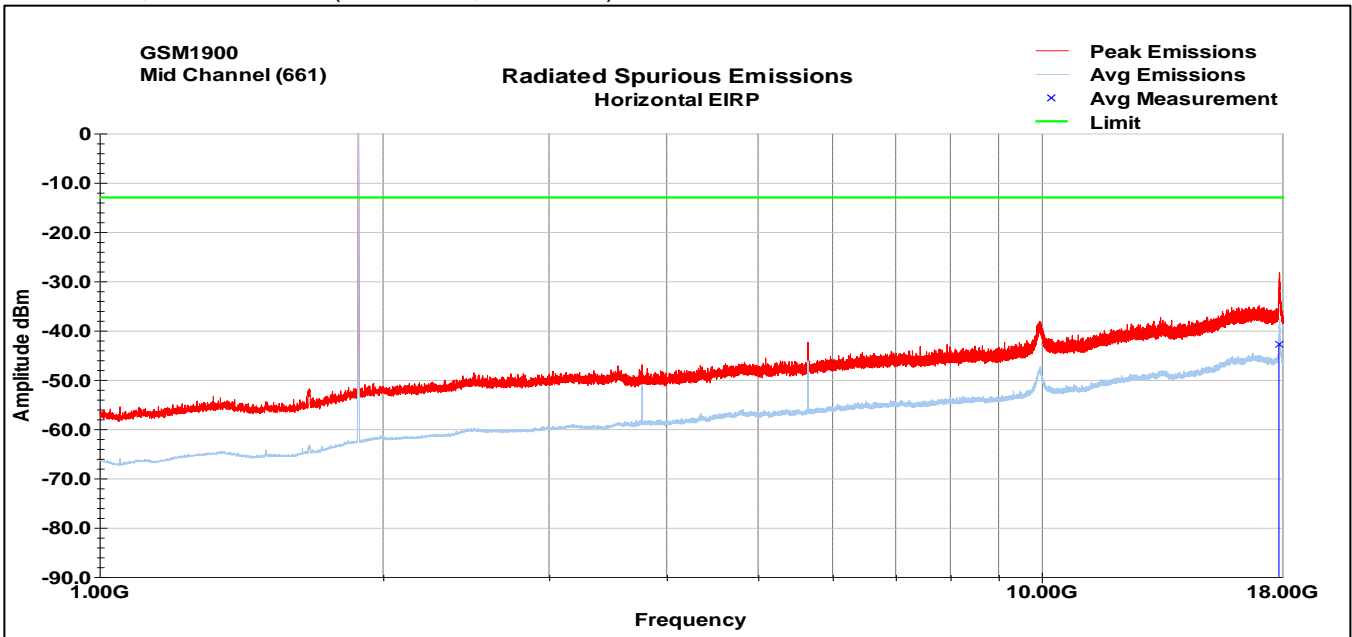
GSM 1900, Mid Channel (Horizontal, 30-1000MHz)



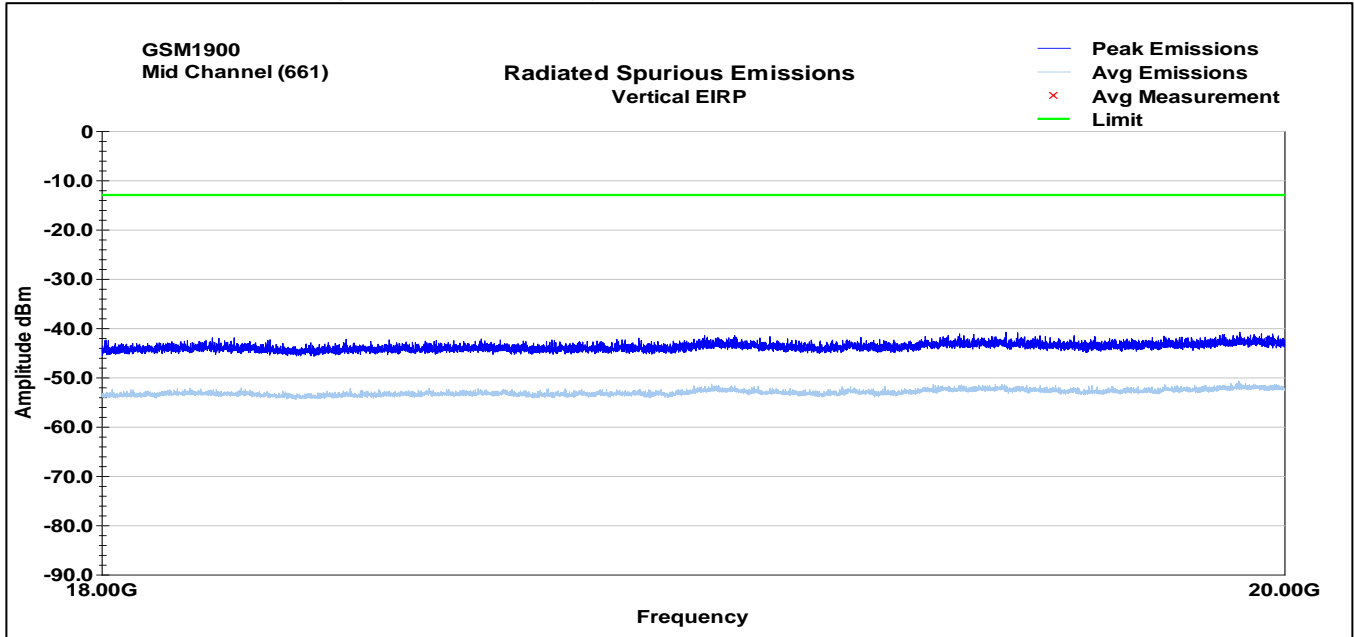
GSM 1900, Mid Channel (Vertical, 1-18GHz)



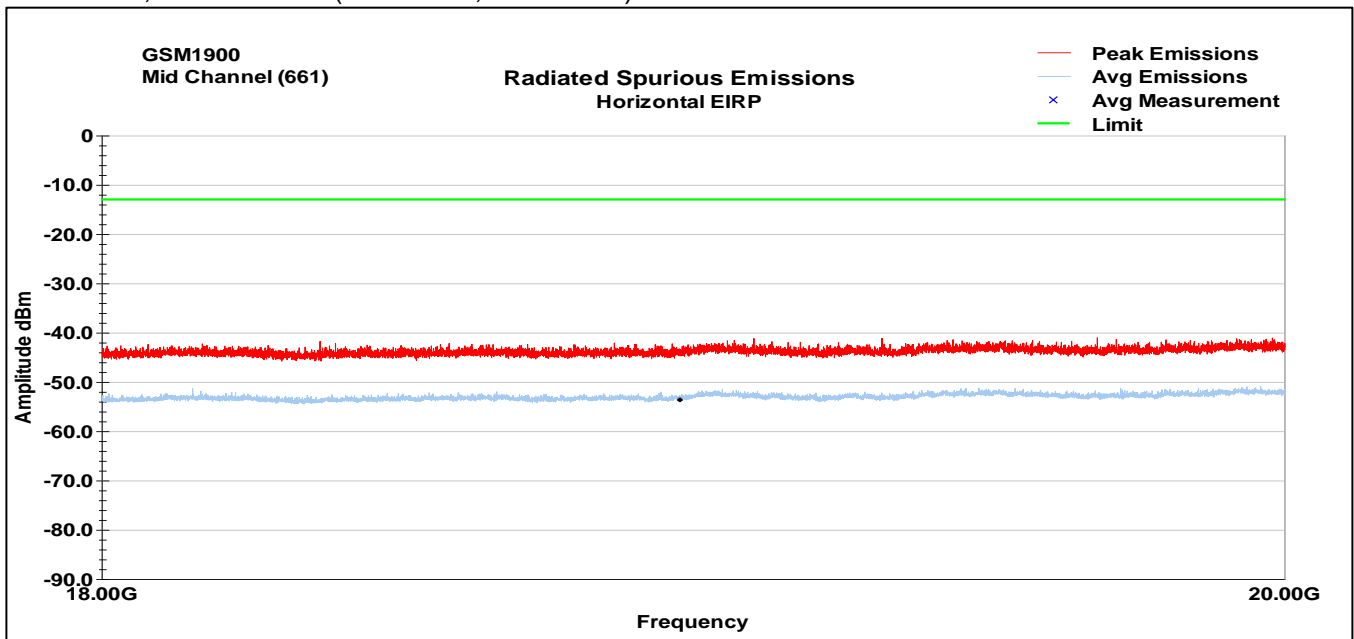
GSM 1900, Mid Channel (Horizontal, 1-18GHz)



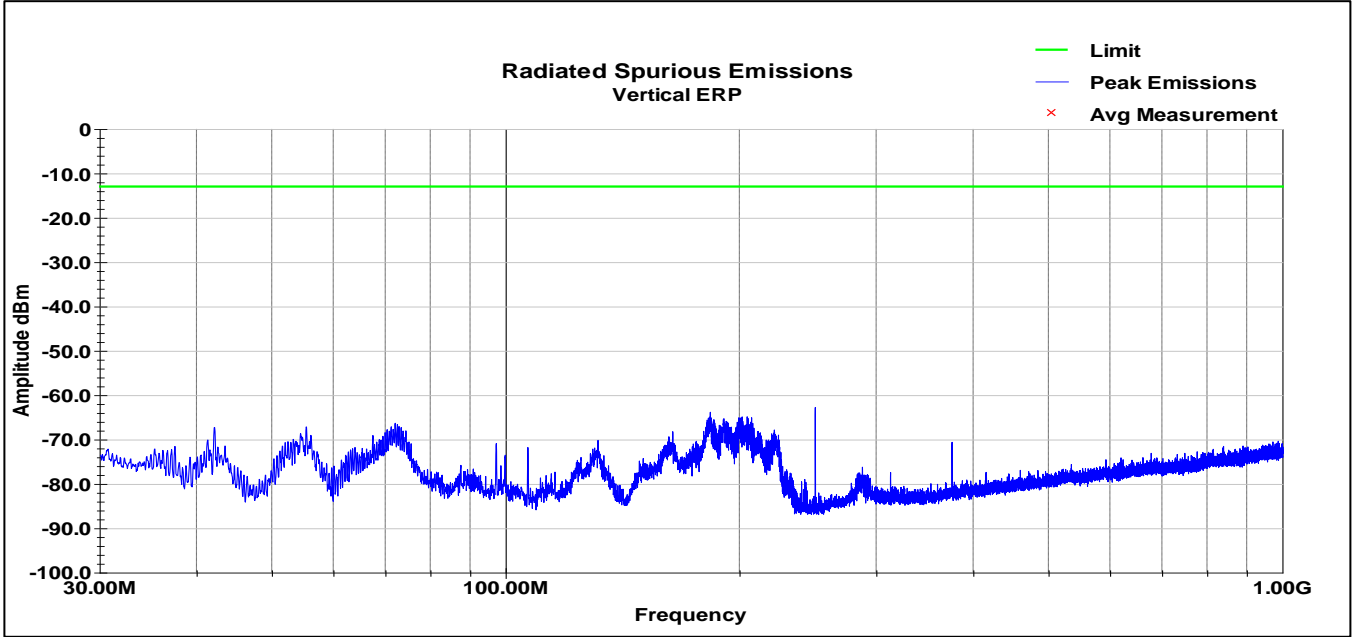
GSM 1900, Mid Channel (Vertical, 18-20GHz)



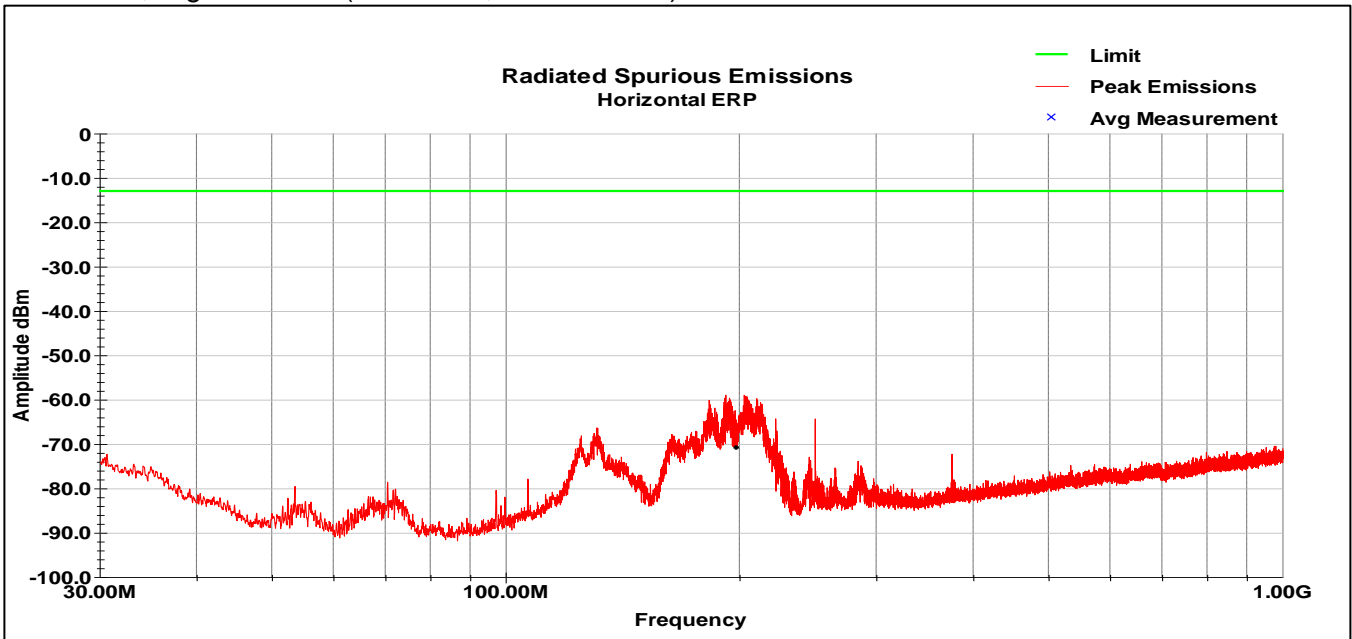
GSM 1900, Mid Channel (Horizontal, 18-20GHz)



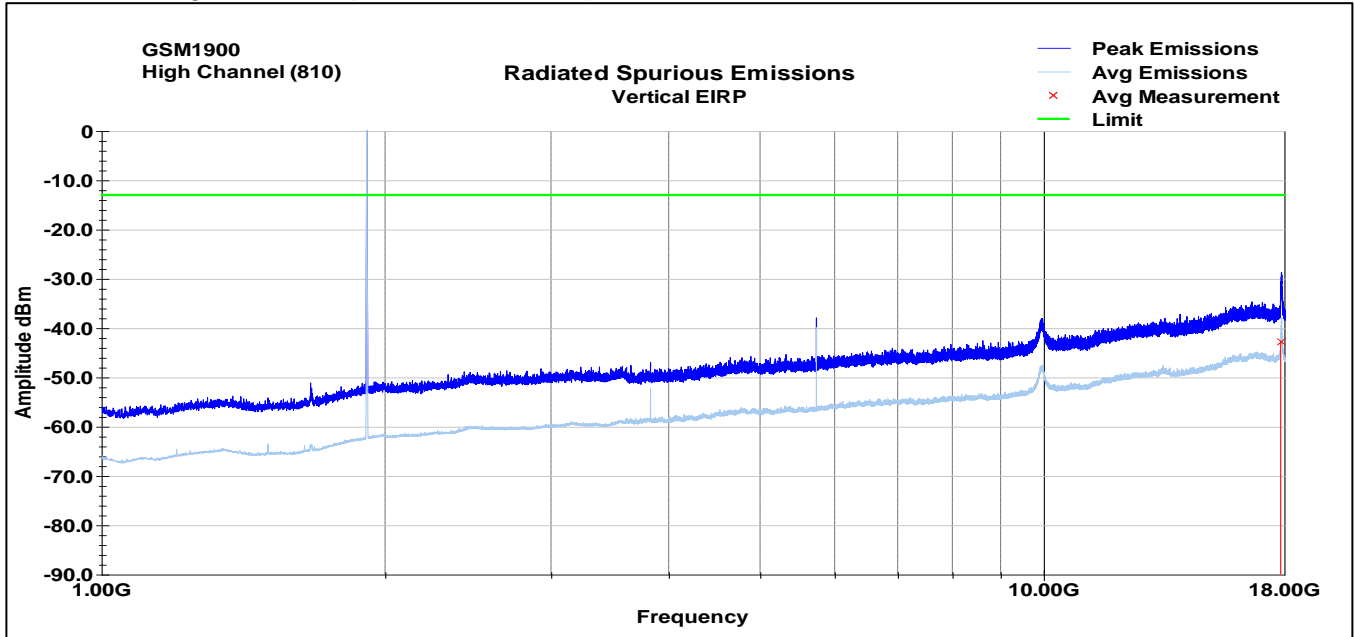
GSM 1900, High Channel (Vertical, 30-1000MHz)



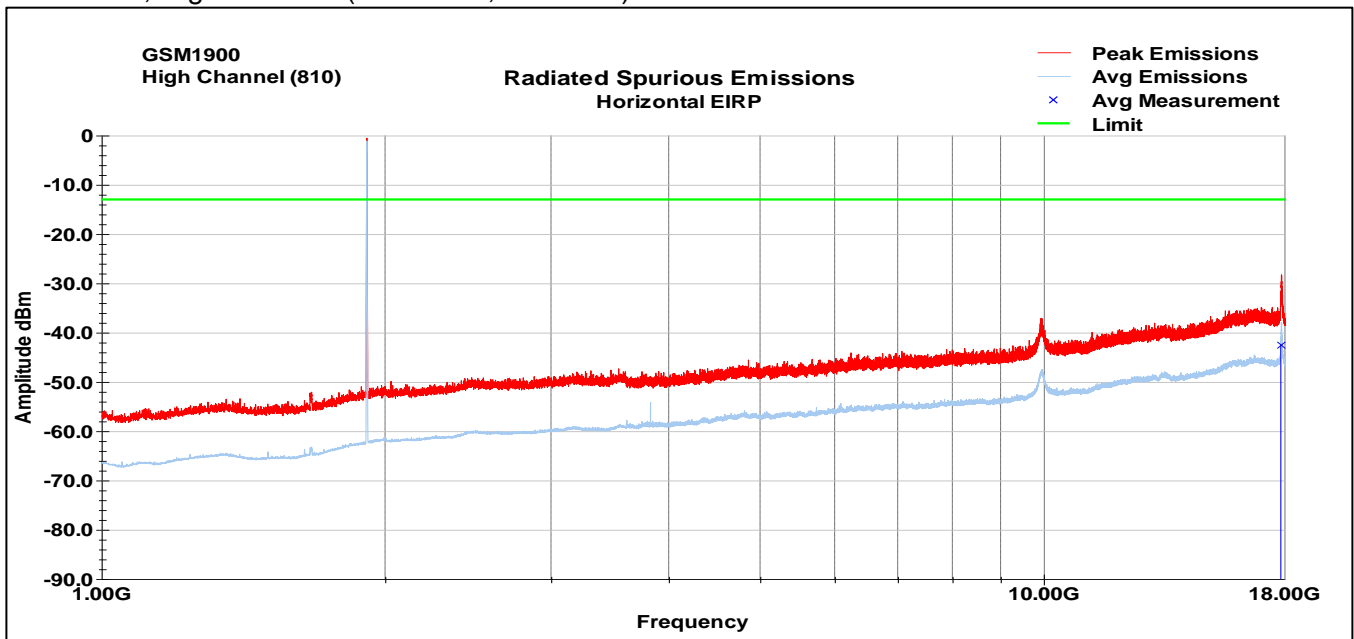
GSM 1900, High Channel (Horizontal, 30-1000MHz)



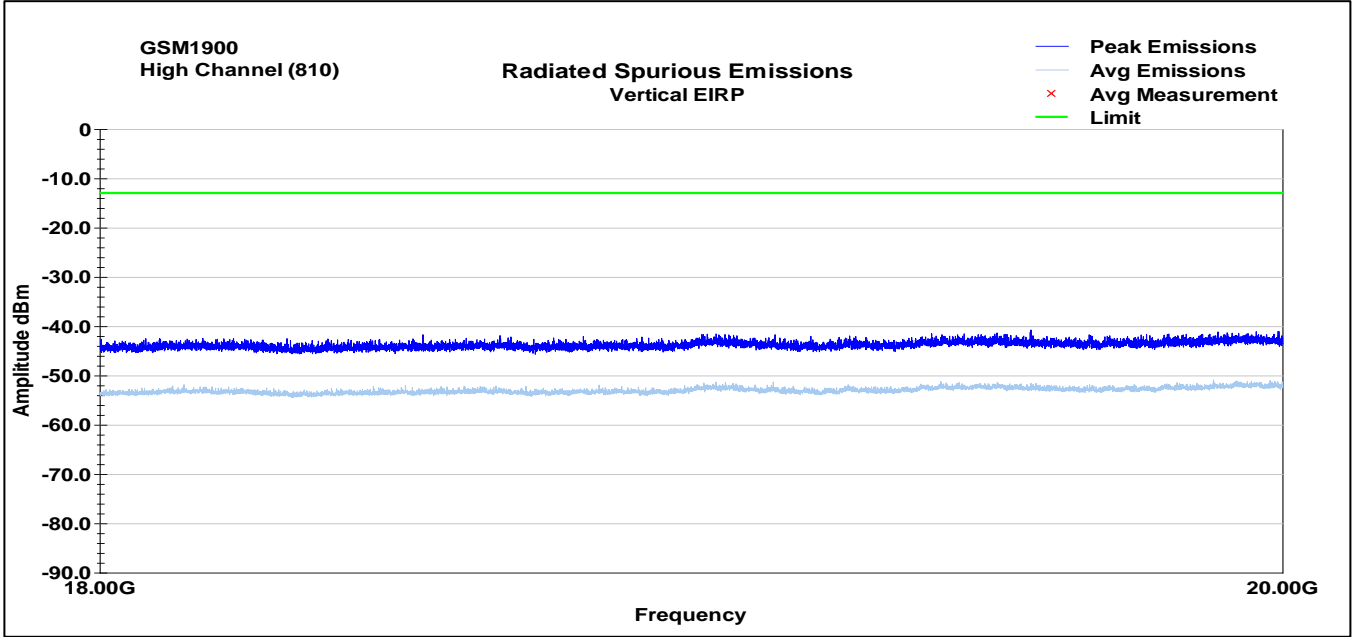
GSM 1900, High Channel (Vertical, 1-18GHz)



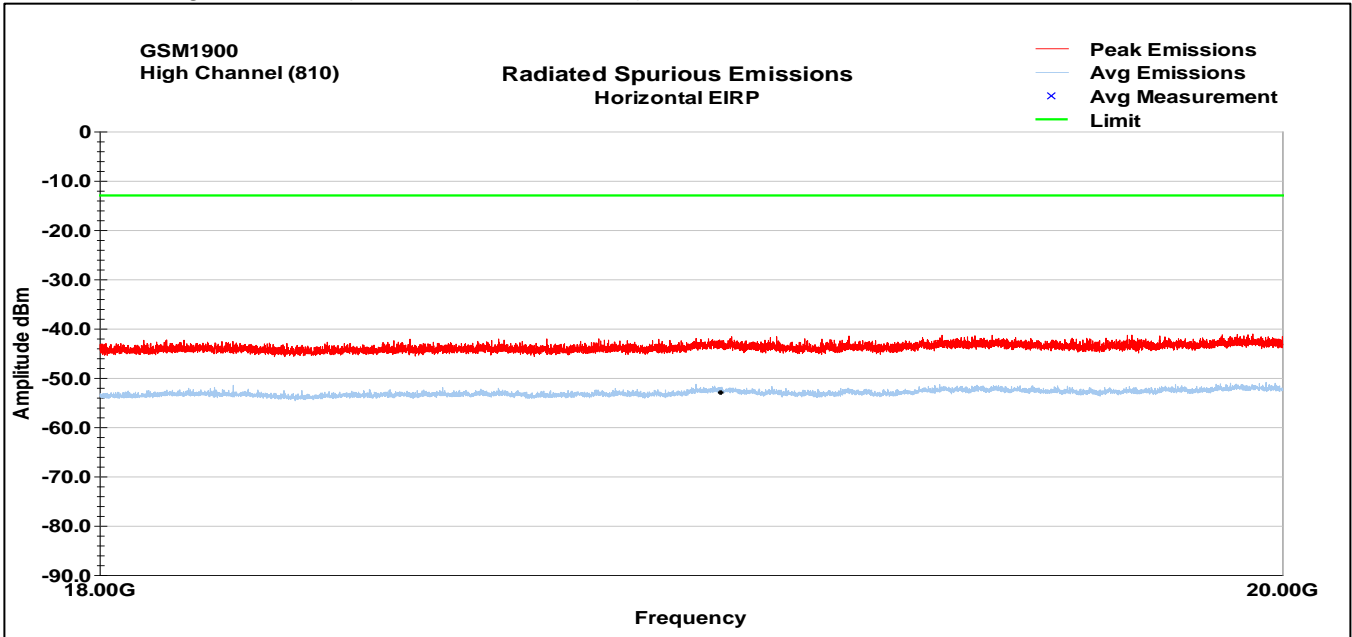
GSM 1900, High Channel (Horizontal, 1-18GHz)



GSM 1900, High Channel (Vertical, 18-20GHz)



GSM 1900, High Channel (Horizontal, 18-20GHz)



9 Frequency Stability

9.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	FCC 2.1055 FCC 24.235 RSS-GEN (6.11) RSS-132 (5.3) RSS-133 (6.3)	Pass

9.2 Test Method

The EUT was placed inside the Environmental Chamber and was allowed to stabilize to set temperature for a minimum of thirty minutes before any measurements were made. The EUT antenna port was connected to the CMW 500 and the frequency was measured using the CMW internal measurement functions. The EUT was tested at the middle channel of each band.

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

9.4 Test Equipment

Test End Date: 14-Aug-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020
ENVIRONMENTAL TEST CHAMBER	T2RC	TENNEY ENVIRONMENTAL	B094877	CNR
MULTIMETER	87V	FLUKE	B079677	27-Jul-2019

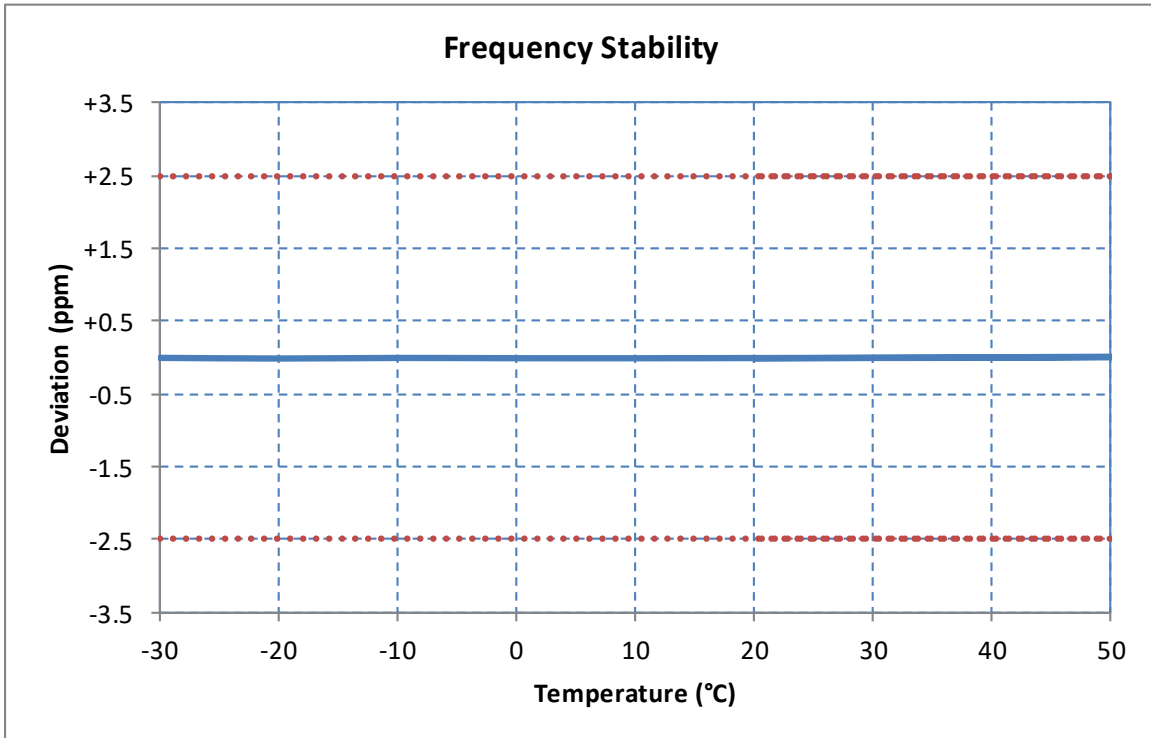
- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the CMW 500 is on a 2-year calibration cycle.

9.5 Test Data

The carrier frequency shall not depart from the reference frequency by more than ± 2.5 ppm.

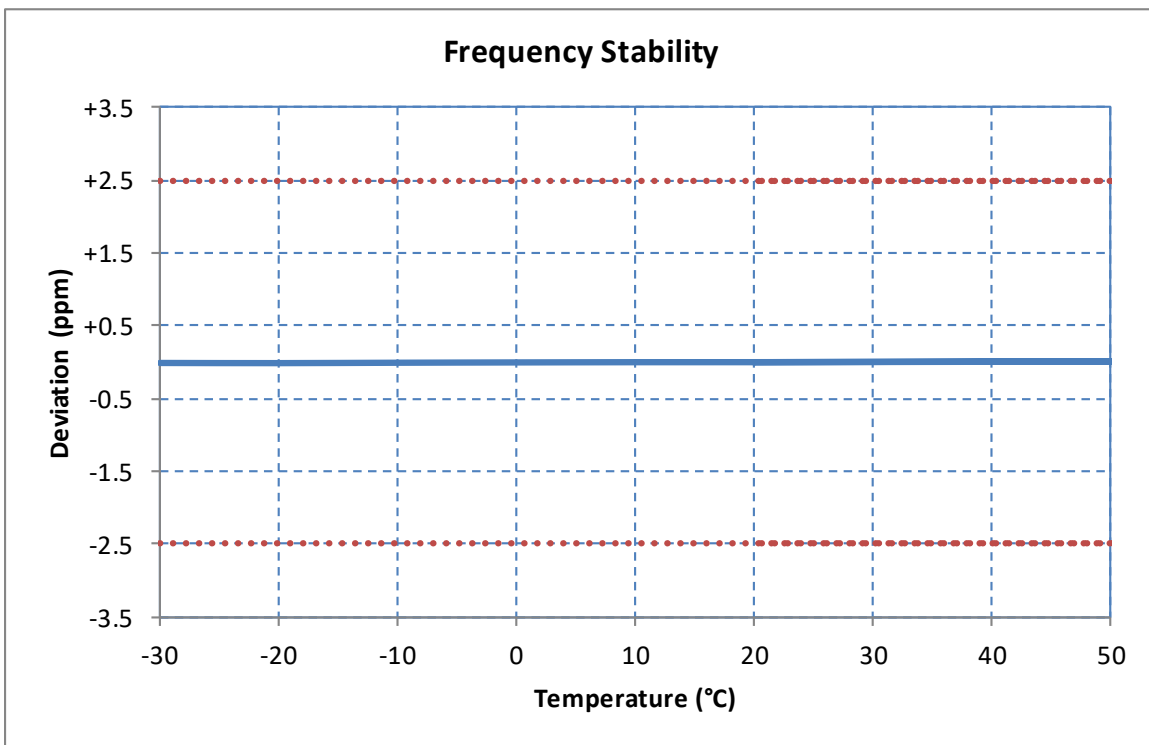
GSM 850, Channel 189 (836.4MHz)

Voltage %	Power V_{DC}	Temp $^{\circ}C$	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	12.00	+20 (Ref)	836,400,011	+11	+0.01	+0.000001
100%	12.00	-30	836,400,013	+13	+0.02	+0.000002
100%	12.00	-20	836,400,008	+8	+0.01	+0.000001
100%	12.00	-10	836,400,012	+12	+0.01	+0.000001
100%	12.00	0	836,400,010	+10	+0.01	+0.000001
100%	12.00	+10	836,400,010	+10	+0.01	+0.000001
100%	12.00	+20	836,400,011	+11	+0.01	+0.000001
100%	12.00	+30	836,400,012	+12	+0.01	+0.000001
100%	12.00	+40	836,400,013	+13	+0.02	+0.000002
100%	12.00	+50	836,400,017	+17	+0.02	+0.000002
100%	12.00	+55	836,400,022	+22	+0.03	+0.000003
115%	13.80	+20	836,400,009	+9	+0.01	+0.000001
85%	10.20	+20	836,400,010	+10	+0.01	+0.000001



GSM 1900, Channel 661 (1880MHz)

Voltage %	Power V _{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	12.00	+20 (Ref)	1,880,000,010	+10	+0.01	+0.000001
100%	12.00	-30	1,880,000,003	+3	+0.00	+0.000000
100%	12.00	-20	1,880,000,001	+1	+0.00	+0.000000
100%	12.00	-10	1,880,000,005	+5	+0.00	+0.000000
100%	12.00	0	1,880,000,008	+8	+0.00	+0.000000
100%	12.00	+10	1,880,000,010	+10	+0.01	+0.000001
100%	12.00	+20	1,880,000,010	+10	+0.01	+0.000001
100%	12.00	+30	1,880,000,012	+12	+0.01	+0.000001
100%	12.00	+40	1,880,000,014	+14	+0.01	+0.000001
100%	12.00	+50	1,880,000,014	+14	+0.01	+0.000001
100%	12.00	+55	1,880,000,021	+21	+0.01	+0.000001
115%	13.80	+20	1,880,000,010	+10	+0.01	+0.000001
85%	10.20	+20	1,880,000,009	+9	+0.00	+0.000000



10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	04 September 2018