



CERTIFICATION TEST REPORT

Report Number. : 11708394-E7V3

Applicant : APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

Model : A1905

FCC ID : BCG-E3172A

IC : 579C-E3172A

EUT Description : SMARTPHONE

Test Standard(s) : FCC CFR47 PART 22H, 24E, 27L, AND 90S
IC RSS-132 ISSUE 3, RSS-133 ISSUE 6 AND RSS-139 ISSUE 3

Date Of Issue:

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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	7/26/2017	Initial Review	--
V2	8/1/2017	Updated report to address TCB's questions	Tina Chu
V3	8/16/2017	Updated Section 6	Tina Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: SMARTPHONE

MODEL: A1905

SERIAL NUMBER: C7CTW008J8W1

DATE TESTED: April 10, 2017 – July 26, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 22H, 24E, 27L, AND 90S	Pass
IC RSS-132 ISSUE 3, RSS-133 ISSUE 6, AND RSS-139 ISSUE 3	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 22, FCC CFR Part 24, FCC Part 27, FCC Part 90 and FCC KDB 971168 D01 v02r02, KDB 971168 D02 v01. RSS-132 Issue 3, RSS-133 Issue 6 and RSS-139 Issue 3 and ANSI C63.26:2015.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A (IC:2324B-1)	☒ Chamber D (IC:22541-1)
☐ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)
	☐ Chamber G (IC:22541-4)
	☐ Chamber H (IC:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Radiated Disturbance, 26000 to 40000 MHz	5.24 dB
Occupied Channel Bandwidth	±0.39 %
Temperature	±0.9 °C
Supply voltages	±0.45 %
Time	±0.02 %

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Equipment Under Test is a mobile phone with GSM, GPRS, EGPRS, UMTS, LTE and TD-SCDMA technologies. It also supports IEEE 802.11a/b/g/n/ac, Bluetooth®, GPS and NFC. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible.

5.2. MAXIMUM OUTPUT POWER

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015

KDB 971168 Section 5.6

$$\text{ERP/EIRP} = \text{PMeas} + \text{GT} - \text{LC}$$

where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);

PMeas = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted and ERP/EIRP output powers as follows:

5.2.1. LAT 1

GSM MODES

<u>RSS 132 850MHz Band IC</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
824- 849	GPRS	33.30	-1.78	31.52	1419.1	40.6	-9.1
	EGPRS	28.00	-1.78	26.22	418.8	40.6	-14.4
<u>Part 22 850MHz Band FCC</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	ERP		Limit (dBm)	Margin (dB)
				dBm	mW		
824-849	GPRS	33.30	-1.78	29.37	865.0	38.5	-9.1
	EGPRS	28.00	-1.78	24.07	255.3	38.5	-14.4
<u>Part 24 / RSS 133 1900MHz Band</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
1850-1910	GPRS	31.30	-1.64	29.66	924.7	33.0	-3.3
	EGPRS	27.00	-1.64	25.36	343.6	33.0	-7.6

UMTS MODE

RSS 132 850MHz Band IC							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
824- 849	REL 99	24.80	-1.78	23.02	200.4	40.6	-17.6
	HSDPA	24.70	-1.78	22.92	195.9	40.6	-17.7
Part 22 850MHz Band FCC							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	ERP		Limit (dBm)	Margin (dB)
				dBm	mW		
824-849	REL 99	24.80	-1.78	20.87	122.2	38.5	-17.6
	HSDPA	24.70	-1.78	20.77	119.4	38.5	-17.7
Part 24 / RSS 133 1900MHz Band							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
1850-1910	REL 99	25.00	-1.64	23.36	216.8	33.0	-9.6
	HSDPA	24.90	-1.64	23.26	211.8	33.0	-9.7
Part 27 / RSS 139 1700MHz Band							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
1710-1755	REL 99	25.30	-3.54	21.76	150.0	30.0	-8.2
	HSDPA	25.20	-3.54	21.66	146.6	30.0	-8.3

5.2.2. UAT 1

GSM MODES

<u>RSS 132 850MHz Band IC</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
824- 849	GPRS	30.80	-2.26	28.54	714.5	40.6	-12.1
	EGPRS	25.50	-2.26	23.24	210.9	40.6	-17.4
<u>Part 22 850MHz Band FCC</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	ERP		Limit (dBm)	Margin (dB)
				dBm	mW		
824-849	GPRS	30.80	-2.26	26.39	435.5	38.5	-12.1
	EGPRS	25.50	-2.26	21.09	128.5	38.5	-17.4
<u>Part 24 / RSS 133 1900MHz Band</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
1850-1910	GPRS	27.00	1.90	28.90	776.2	33.0	-4.1
	EGPRS	23.50	1.90	25.40	346.7	33.0	-7.6

UMTS MODE

<u>RSS 132 850MHz Band IC</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
824- 849	REL 99	23.80	-2.26	21.54	142.6	40.6	-19.1
	HSDPA	23.70	-2.26	21.44	139.3	40.6	-19.2
<u>Part 22 850MHz Band FCC</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	ERP		Limit (dBm)	Margin (dB)
				dBm	mW		
824-849	REL 99	23.80	-2.26	19.39	86.9	38.5	-19.1
	HSDPA	23.70	-2.26	19.29	84.9	38.5	-19.2
<u>Part 24 / RSS 133 1900MHz Band</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
1850-1910	REL 99	19.50	1.90	21.40	138.0	33.0	-11.6
	HSDPA	19.40	1.90	21.30	134.9	33.0	-11.7
<u>Part 27 / RSS 139 1700MHz Band</u>							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
1710-1755	REL 99	19.50	2.37	21.87	153.8	30.0	-8.1
	HSDPA	19.40	2.37	21.77	150.3	30.0	-8.2

5.3. MAXIMUM ANTENNA GAIN

Frequency (MHz)	LAT 1 Antenna Gain (dBi)	UAT 1 Antenna Gain (dBi)
824 - 849	-1.78	-2.26
1850 - 1910	-1.64	1.90
1710 - 1755	-3.54	2.37

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 00.34.02.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case is EUT on the highest power. Based on Average Power measurement investigations, the following modes should be considered as worst-case scenario for all other measurements.

Worst-case modes:

- GSM GPRS
- GSM EGPRS
- UMTS REL 99
- UMTS HSDPA

The EUT was investigated in three orthogonal orientations X/Y/Z on both LAT 1 and UAT 1 antennas. It was determined that X (Flatbed) orientation was the worst-case orientation for all bands on both antennas without AC/DC adapter, headphones, or laptop.

Radiated spurious emissions were investigated below 30MHz, 30MHz-1GHz and above 1GHz. There were no emissions found on below 30MHz and 30MHz-1GHz.

For simultaneous transmission of multiple channels in the 2.4GHz and Cellular bands, tests were conducted for various configurations having the highest power, least separation in frequencies and widest operation bandwidths. No noticeable new emission was found.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop AC Adapter	Apple	MD592LL/A	N/A
Laptop	Apple	A1466	C02PS2H6G08S

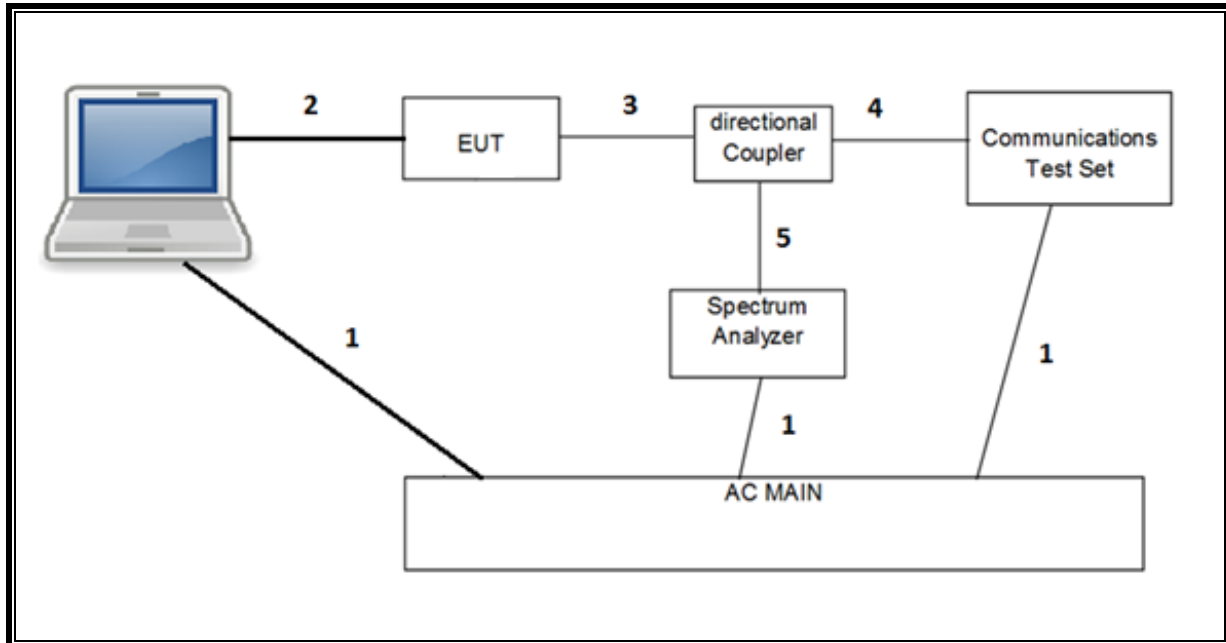
I/O CABLES (RF Conducted Test)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	3	US 115V	Un-shielded	2.0m	N/A
2	USB	1	DC	Un-shielded	1.0m	N/A
3	RF In/Out	1	EUT	Un-shielded	0.6m	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	1.2m	N/A
5	RF In/Out	1	Barrel	N/A	N/A	N/A

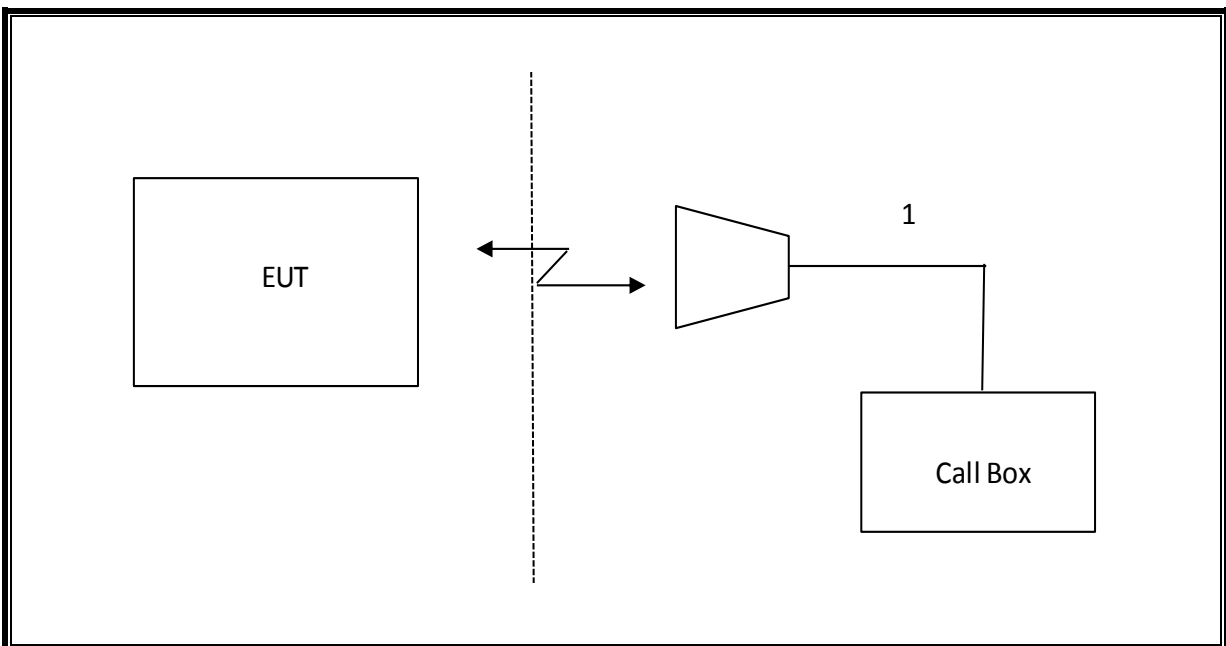
I/O CABLES (RF Radiated Test)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	RF In/Out	1	Antenna	Un-shielded	5m	NA

CONDUCTED SETUP



RADIATED SETUP



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
*Antenna, Horn 1-18GHz	ETS Lindgren	3117	T862	4/18/2017
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T243	10/11/2017
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T286	5/4/2017
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S42	T740	11/29/17
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T340	12/14/2017
Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Keysight	N9030A	T342	2/23/2018
Spectrum Analyzer, PSA 3Hz to 44GHz	Keysight	E4446A	T123	10/20/2017
*Directional Coupler	KRYTAR	152610	T1537	4/11/2017
Directional Coupler	KRYTAR	152610	T1537	4/24/2018
Wireless Communications Test Set, 8960 Series 10	Agilent	E5515C	T213	2/21/2018
Filter, HPF 3.0GHz	MICROTRONICS	HPM17543	T487	1/28/2018
*Filter, HPF 1.2GHz	Micro-Tronics	WHKX1.2/15G-6ST	T1182	5/31/2017
*Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T1210	6/30/2017
*Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T959	7/09/2017
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T971	8/05/2017
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	9/10/2017
Antenna, Horn 1-18GHz	Emco	3115	T59	11/18/2017
Amplifier, 26.5GHz to 40GHz	Miteq	NSP 4000 SP2	T88	4/29/2018
*Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight	8449B	T404	7/5/2017
*Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	6/16/2017
Antenna, Horn 26.5GHz to 40GHz	ARA	MWH-2640	T90	8/19/2017
Spectrum Analyzer	Keysight	8564E	T106	9/7/2017
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T1616	12/12/2017

NOTE: Equipment that calibrated during the testing period was set for test after the calibration.

*Testing is completed before equipment expiration date.

7. RF POWER OUTPUT VERIFICATION

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted output powers as follows:

7.1. GSM

Using CMW500 Communication Test Set

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press **Connection control** to choose the different menus

Press **RESET** > choose all to reset all settings

Connection	Press Signal Off to turn off the signal and change settings Network Support > GSM+GPRS or GSM+EGPRS Main Service > Packet Data Service selection > Test Mode A – Auto Slot Config. off
MS Signal	Press Slot Config bottom on the right twice to select and change the number of time slots and power setting > Slot configuration > Uplink/Gamma > 33 dBm for GPRS 850/900 > 27 dBm for EGPRS 850/900 > 30 dBm for GPRS1800/1900 > 26 dBm for EGPRS1800/1900
BS Signal	Enter the same channel number for TCH channel (test channel) and BCCH channel Frequency Offset > + 0 Hz Mode > BCCH and TCH BCCH Level > -85 dBm (May need to adjust if link is not stable) BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel] Channel Type > Off P0> 4 dB Slot Config > Unchanged (if already set under MS Signal) TCH > choose desired test channel Hopping > Off Main Timeslot > 3 (Default)
Network	Coding Scheme > CS 4 (GPRS) and MCS5-9 (EGPRS) Bit Stream > 2E9-1PSR Bit Pattern
AF/RF	Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input
Connection	Press Signal On to turn on the signal and change settings

Using Agilent 8960A Communication Test Set

System Config: GSM/GPRS Mobile Test
E1968A A.06.31

Call Params: BCH → Cell Band: GSM850/PCS
TCH → Traffic Band: GSM850/PCS
Traffic Channel: 128/192/251 or 512/661/810
MS Tx Level: 0
PDTCH → Traffic Band: GSM850/PCS
Traffic Channel: 128/192/251 512/661/810
MS Tx Level: 0
Coding Scheme: CS-4 (GPRS)
Coding Scheme: MCS-5 to 9 (EGPRS)
MultiSlot Config: 1up, 1 down (Assuming that the highest

conducted power)

Control: Active Cell → GSM/GPRS

RESULT

7.1.1. GPRS/EGPRS

LAT 1

ID:	50820	Date:	4/19/17		
Band	Mode	Ch.	f (MHz)	1 time slot	2 time slots
				Average (dBm)	Average (dBm)
850	GPRS	128	824.2	33.2	32.1
		190	836.6	33.2	32.3
		251	848.8	33.3	32.0
	EGPRS	128	824.2	28.0	28.0
		190	836.6	27.9	27.8
		251	848.8	27.8	27.8
1900	GPRS	512	1850.2	31.3	30.3
		661	1880.0	31.2	30.2
		810	1909.8	31.1	30.1
	EGPRS	512	1850.2	27.0	26.9
		661	1880.0	27.0	26.9
		810	1909.8	27.0	27.0

UAT 1

ID:	50820	Date:	4/21/17		
Band	Mode	Ch.	f (MHz)	1 time slot	2 time slots
				Average (dBm)	Average (dBm)
850	GPRS	128	824.2	30.8	29.8
		190	836.6	30.7	29.8
		251	848.8	30.7	29.7
	EGPRS	128	824.2	25.5	25.5
		190	836.6	25.4	25.3
		251	848.8	25.4	25.3
1900	GPRS	512	1850.2	27.0	24.0
		661	1880.0	26.9	23.9
		810	1909.8	26.8	23.8
	EGPRS	512	1850.2	23.5	23.5
		661	1880.0	23.4	23.3
		810	1909.8	23.4	23.3

7.2. UMTS

TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW $\geq$ RBW $\geq$ 26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

7.2.1. UMTS REL99

The following summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	β_c	Not Applicable
	β_d	Not Applicable
	β_{ec}	Not Applicable
	β_c/β_d	8/15
	β_{hs}	Not Applicable
	β_{ed}	Not Applicable

RESULTS

LAT 1

ID:	29439	Date:	4/18/17	
Band	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
				Average
UMTS Rel. 99 850MHz	4132	4357	826.4	24.8
	4183	4408	836.6	24.8
	4233	4458	846.6	24.8

Band	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
				Average
UMTS Rel. 99 1900MHz	9262	9662	1852.4	24.9
	9400	9800	1880.0	24.9
	9538	9938	1907.6	25.0

Band	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
				Average
UMTS Rel. 99 1700MHz	1312	1537	1712.4	25.2
	1413	1638	1732.6	25.3
	1513	1738	1752.6	25.2

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ID:	39005	Date:	4/18/17	
Band	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
				Average
UMTS Rel. 99 850MHz	4132	4357	826.4	23.8
	4183	4408	836.6	23.7
	4233	4458	846.6	23.7

Band	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
				Average
UMTS Rel. 99 1900MHz	9262	9662	1852.4	19.5
	9400	9800	1880.0	19.5
	9538	9938	1907.6	19.5

Band	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
				Average
UMTS Rel. 99 1700MHz	1312	1537	1712.4	19.4
	1413	1638	1732.6	19.5
	1513	1738	1752.6	19.4

7.2.2. HSDPA REL 5

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121.

Summary of settings are illustrated below:

	Mode	Rel5 HSDPA			
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	11/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	$A_{hs} = \beta_{hs}/\beta_c$	30/15			

RESULT

LAT 1

ID:	29439	Date:	4/18/17		
Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 850MHz	1	4132	4357	826.4	24.7
		4183	4408	836.6	24.7
		4233	4458	846.6	24.7
	2	4132	4357	826.4	24.6
		4183	4408	836.6	24.7
		4233	4458	846.6	24.7
	3	4132	4357	826.4	24.2
		4183	4408	836.6	24.2
		4233	4458	846.6	24.1
	4	4132	4357	826.4	24.1
		4183	4408	836.6	24.1
		4233	4458	846.6	24.2

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1900MHz	1	9262	9662	1852.4	24.8
		9400	9800	1880.0	24.8
		9538	9938	1907.6	24.9
	2	9262	9662	1852.4	24.7
		9400	9800	1880.0	24.7
		9538	9938	1907.6	24.6
	3	9262	9662	1852.4	24.2
		9400	9800	1880.0	24.2
		9538	9938	1907.6	24.3
	4	9262	9662	1852.4	24.1
		9400	9800	1880.0	24.0
		9538	9938	1907.6	24.1

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1700MHz	1	1312	1537	1712.4	25.0
		1413	1638	1732.6	25.2
		1513	1738	1752.6	25.1
	2	1312	1537	1712.4	25.0
		1413	1638	1732.6	25.0
		1513	1738	1752.6	25.1
	3	1312	1537	1712.4	24.5
		1413	1638	1732.6	24.4
		1513	1738	1752.6	24.4
	4	1312	1537	1712.4	24.4
		1413	1638	1732.6	24.5
		1513	1738	1752.6	24.4

UAT 1

ID:	39005	Date:	4/18/17		
Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 850MHz	1	4132	4357	826.4	23.7
		4183	4408	836.6	23.6
		4233	4458	846.6	23.6
	2	4132	4357	826.4	23.5
		4183	4408	836.6	23.4
		4233	4458	846.6	23.5
	3	4132	4357	826.4	23.2
		4183	4408	836.6	23.1
		4233	4458	846.6	23.1
	4	4132	4357	826.4	23.2
		4183	4408	836.6	23.2
		4233	4458	846.6	23.1

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1900MHz	1	9262	9662	1852.4	19.3
		9400	9800	1880.0	19.3
		9538	9938	1907.6	19.4
	2	9262	9662	1852.4	19.2
		9400	9800	1880.0	19.2
		9538	9938	1907.6	19.3
	3	9262	9662	1852.4	18.8
		9400	9800	1880.0	18.6
		9538	9938	1907.6	18.6
	4	9262	9662	1852.4	18.5
		9400	9800	1880.0	18.6
		9538	9938	1907.6	18.4

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1700MHz	1	1312	1537	1712.4	19.3
		1413	1638	1732.6	19.4
		1513	1738	1752.6	19.2
	2	1312	1537	1712.4	19.3
		1413	1638	1732.6	19.3
		1513	1738	1752.6	19.2
	3	1312	1537	1712.4	18.8
		1413	1638	1732.6	18.8
		1513	1738	1752.6	18.7
	4	1312	1537	1712.4	18.7
		1413	1638	1732.6	18.8
		1513	1738	1752.6	18.7

7.2.3. HSPA REL 6 (HSDPA & HSUPA)

TEST PROCEDURE

The following summary of these settings are illustrated below:

	Mode	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	6/15	15/9	2/15	15/1
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	1309/225	94/75	47/15	56/75	47/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	$A_{hs} = \beta_{hs}/\beta_c$	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	12
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	67
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

RESULTS

LAT 1

ID:	29439	Date:	4/18/17		
Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSUPA 850MHz	1	4132	4357	826.4	24.4
		4183	4408	836.6	24.6
		4233	4458	846.6	24.4
	2	4132	4357	826.4	22.4
		4183	4408	836.6	22.3
		4233	4458	846.6	22.4
	3	4132	4357	826.4	23.4
		4183	4408	836.6	23.3
		4233	4458	846.6	23.3
	4	4132	4357	826.4	22.5
		4183	4408	836.6	22.6
		4233	4458	846.6	22.6
	5	4132	4357	826.4	24.4
		4183	4408	836.6	24.4
		4233	4458	846.6	24.5

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSUPA 1900MHz	1	9262	9662	1852.4	24.6
		9400	9800	1880.0	24.8
		9538	9938	1907.6	24.5
	2	9262	9662	1852.4	22.5
		9400	9800	1880.0	22.5
		9538	9938	1907.6	22.6
	3	9262	9662	1852.4	23.4
		9400	9800	1880.0	23.4
		9538	9938	1907.6	23.5
	4	9262	9662	1852.4	22.8
		9400	9800	1880.0	22.5
		9538	9938	1907.6	23.0
	5	9262	9662	1852.4	24.6
		9400	9800	1880.0	24.5
		9538	9938	1907.6	24.5

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSUPA 1700MHz	1	1312	1537	1712.4	24.8
		1413	1638	1732.6	25.1
		1513	1738	1752.6	24.7
	2	1312	1537	1712.4	22.9
		1413	1638	1732.6	23.0
		1513	1738	1752.6	22.9
	3	1312	1537	1712.4	24.0
		1413	1638	1732.6	24.2
		1513	1738	1752.6	24.1
	4	1312	1537	1712.4	23.0
		1413	1638	1732.6	23.2
		1513	1738	1752.6	23.1
	5	1312	1537	1712.4	24.9
		1413	1638	1732.6	25.0
		1513	1738	1752.6	24.9

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ID:	50820	Date:	4/19/17
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Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSUPA 850MHz	1	4132	4357	826.4	23.6
		4183	4408	836.6	23.5
		4233	4458	846.6	23.4
	2	4132	4357	826.4	21.5
		4183	4408	836.6	21.4
		4233	4458	846.6	21.5
	3	4132	4357	826.4	22.5
		4183	4408	836.6	22.5
		4233	4458	846.6	22.4
	4	4132	4357	826.4	21.4
		4183	4408	836.6	21.4
		4233	4458	846.6	21.4
	5	4132	4357	826.4	23.4
		4183	4408	836.6	23.3
		4233	4458	846.6	23.5

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSUPA 1900MHz	1	9262	9662	1852.4	18.9
		9400	9800	1880.0	19.1
		9538	9938	1907.6	19.2
	2	9262	9662	1852.4	17.1
		9400	9800	1880.0	17.1
		9538	9938	1907.6	17.1
	3	9262	9662	1852.4	18.1
		9400	9800	1880.0	18.0
		9538	9938	1907.6	18.0
	4	9262	9662	1852.4	17.0
		9400	9800	1880.0	16.9
		9538	9938	1907.6	16.9
	5	9262	9662	1852.4	19.1
		9400	9800	1880.0	18.9
		9538	9938	1907.6	19.0

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSUPA 1700MHz	1	1312	1537	1712.4	19.0
		1413	1638	1732.6	19.2
		1513	1738	1752.6	19.0
	2	1312	1537	1712.4	17.0
		1413	1638	1732.6	17.0
		1513	1738	1752.6	17.0
	3	1312	1537	1712.4	18.1
		1413	1638	1732.6	18.0
		1513	1738	1752.6	18.0
	4	1312	1537	1712.4	17.1
		1413	1638	1732.6	17.1
		1513	1738	1752.6	16.9
	5	1312	1537	1712.4	19.1
		1413	1638	1732.6	19.0
		1513	1738	1752.6	19.1

7.2.4. DUAL CARRIER HSDPA

DC-HSDPA (Rel 8, CAT 24)

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0.

A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

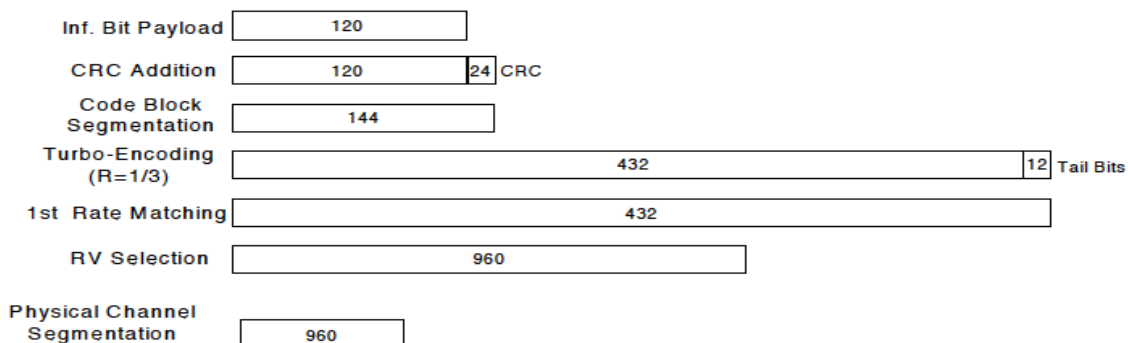


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 8 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	Rel6 HSDPA		Rel6 HSDPA	
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	β_d (SF)	64			
	β_c/β_d	2/15	11/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR	0	0	0.5	0.5
	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	$A_{hs} = \beta_{hs} / \beta_c$	30/15			

RESULT

LAT 1

ID:	50820	Date:	4/19/17		
Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 850MHz	1	4132	4357	826.4	24.4
		4183	4408	836.6	24.4
		4233	4458	846.6	24.5
	2	4132	4357	826.4	24.4
		4183	4408	836.6	24.4
		4233	4458	846.6	24.4
	3	4132	4357	826.4	24.1
		4183	4408	836.6	24.2
		4233	4458	846.6	24.1
	4	4132	4357	826.4	24.0
		4183	4408	836.6	24.1
		4233	4458	846.6	24.0

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1900MHz	1	9262	9662	1852.4	24.7
		9400	9800	1880.0	24.6
		9538	9938	1907.6	24.7
	2	9262	9662	1852.4	24.7
		9400	9800	1880.0	24.5
		9538	9938	1907.6	24.6
	3	9262	9662	1852.4	24.2
		9400	9800	1880.0	24.1
		9538	9938	1907.6	24.1
	4	9262	9662	1852.4	24.1
		9400	9800	1880.0	24.2
		9538	9938	1907.6	24.1

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1700MHz	1	1312	1537	1712.4	24.9
		1413	1638	1732.6	24.9
		1513	1738	1752.6	24.9
	2	1312	1537	1712.4	24.9
		1413	1638	1732.6	24.9
		1513	1738	1752.6	24.9
	3	1312	1537	1712.4	24.5
		1413	1638	1732.6	24.4
		1513	1738	1752.6	24.4
	4	1312	1537	1712.4	24.4
		1413	1638	1732.6	24.5
		1513	1738	1752.6	24.3

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ID:	50820	Date:	4/19/17
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Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 850MHz	1	4132	4357	826.4	23.4
		4183	4408	836.6	23.4
		4233	4458	846.6	23.3
	2	4132	4357	826.4	23.3
		4183	4408	836.6	23.3
		4233	4458	846.6	23.3
	3	4132	4357	826.4	23.0
		4183	4408	836.6	23.1
		4233	4458	846.6	23.1
	4	4132	4357	826.4	23.1
		4183	4408	836.6	23.0
		4233	4458	846.6	23.1

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1900MHz	1	9262	9662	1852.4	19.1
		9400	9800	1880.0	19.2
		9538	9938	1907.6	19.2
	2	9262	9662	1852.4	19.1
		9400	9800	1880.0	19.1
		9538	9938	1907.6	19.1
	3	9262	9662	1852.4	18.7
		9400	9800	1880.0	18.6
		9538	9938	1907.6	18.7
	4	9262	9662	1852.4	18.8
		9400	9800	1880.0	18.6
		9538	9938	1907.6	18.7

Band	Subtest	UL Ch	DL Ch	Frequency (MHz)	Conducted Output Power (dBm)
					Average
UMTS HSDPA 1700MHz	1	1312	1537	1712.4	18.9
		1413	1638	1732.6	19.0
		1513	1738	1752.6	18.9
	2	1312	1537	1712.4	18.9
		1413	1638	1732.6	18.9
		1513	1738	1752.6	18.9
	3	1312	1537	1712.4	18.5
		1413	1638	1732.6	18.4
		1513	1738	1752.6	18.6
	4	1312	1537	1712.4	18.4
		1413	1638	1732.6	18.5
		1513	1738	1752.6	18.4

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

IC: RSS132; RSS133§2.3; RSS139

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

RESULTS

There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested.

GSM GPRS MODE PART 22 AND 24 / RSS 132 AND 133

Band	Mode	Channel	f(MHz)	99% BW (KHz)	-26dB BW (KHz)
CELL	GPRS	190	836.6	242.78	319.5
PCS		661	1880	248.56	315.8

GSM EGPRS MODE PART 22 AND 24 / RSS 132 AND 133

Band	Mode	Channel	f(MHz)	99% BW (KHz)	-26dB BW (KHz)
CELL	EGPRS	190	836.6	247.95	319.0
PCS		661	1880	248.13	318.1

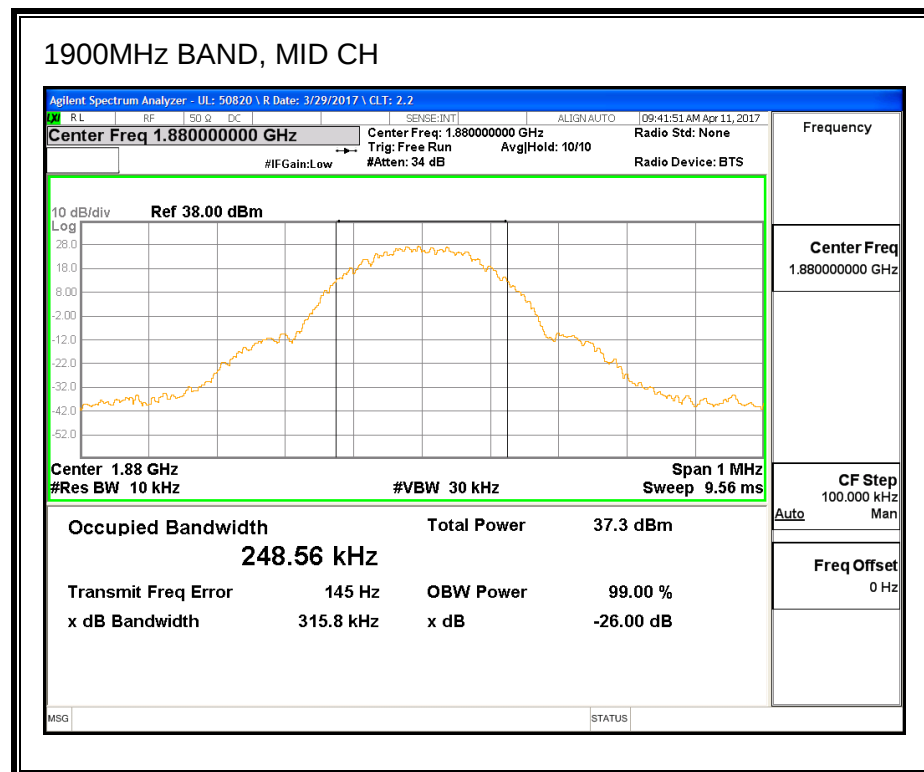
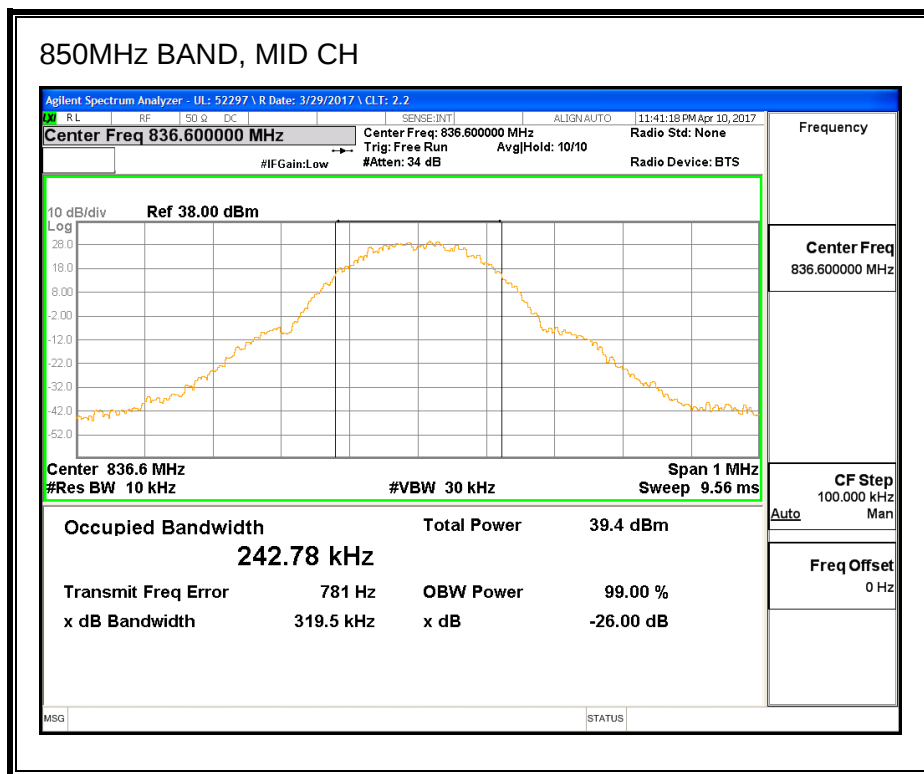
UMTS REL 99 MODE PART 22, 24, AND 27 / RSS 132, 133 AND 139

Band	Mode	DL Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
850MHz	UMTS Rel. 99	4408	836.6	4.0740	4.623
1900MHz		9800	1880	4.0755	4.606
1700MHz		1638	1732.6	4.0718	4.555

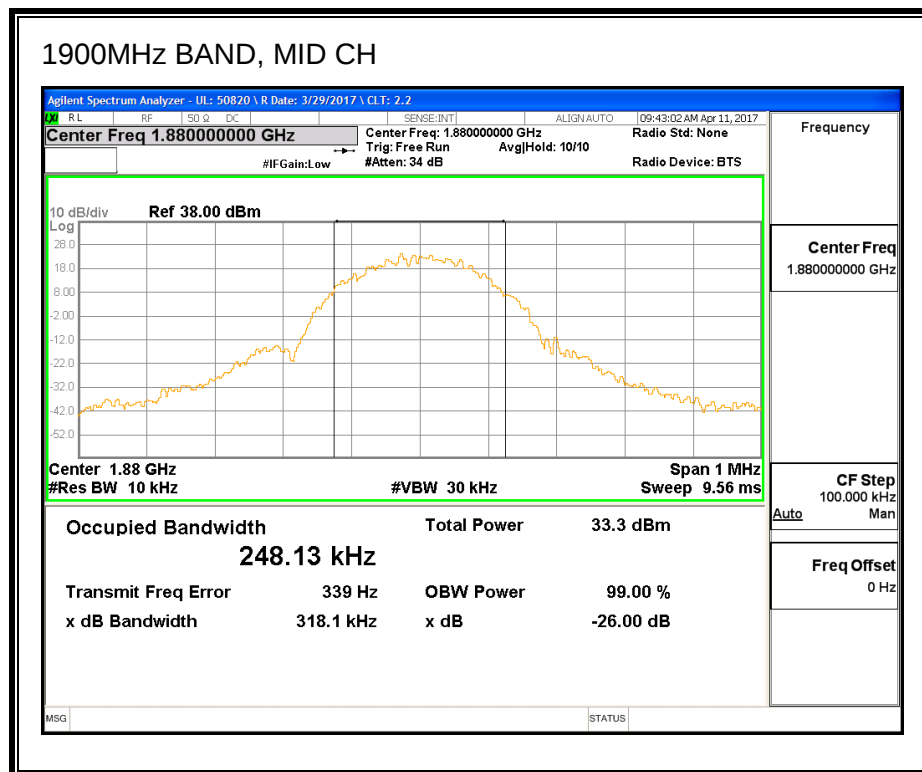
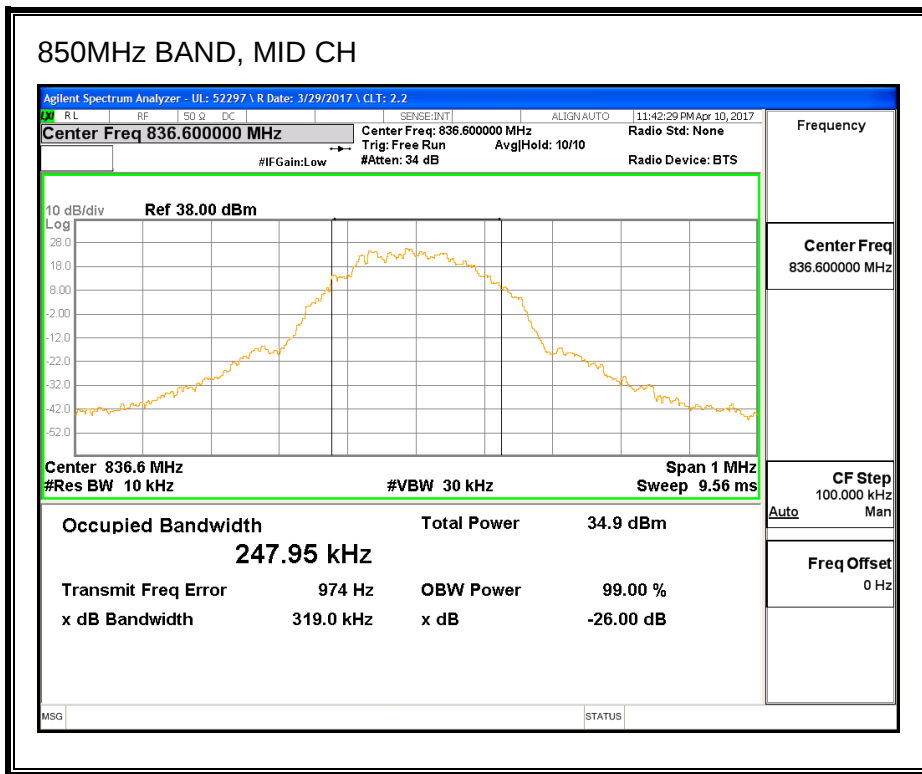
UMTS HSDPA MODE PART 22, 24 AND 27 / RSS 132, 133 AND 139

Band	Mode	DL Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
850MHz	UMTS HSDPA	4408	836.6	4.0673	4.616
1900MHz		9800	1880	4.0651	4.615
1700MHz		1638	1732.6	4.0634	4.578

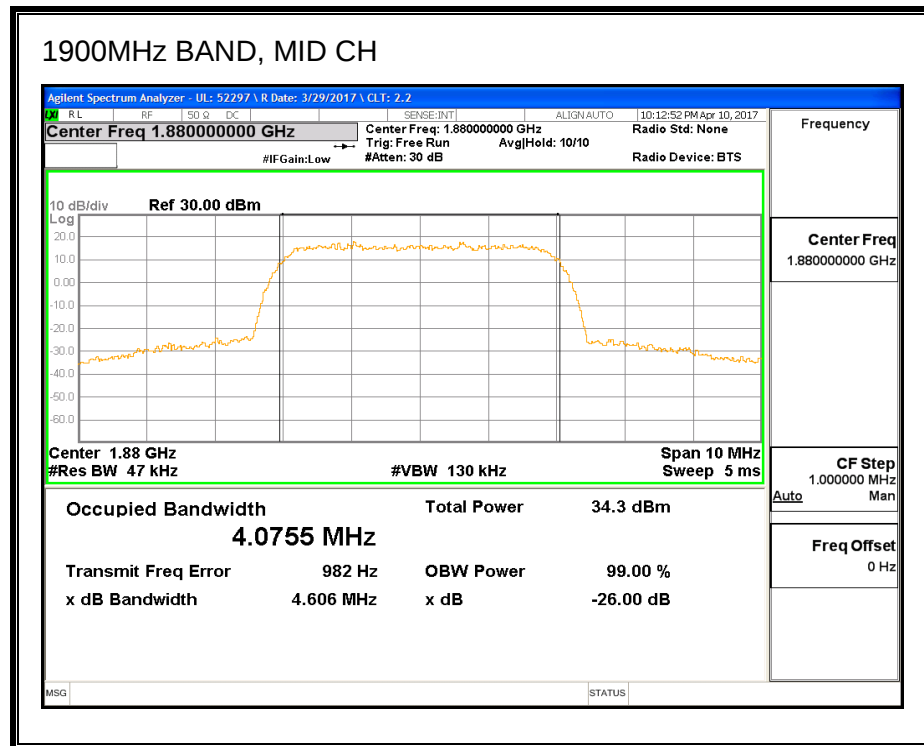
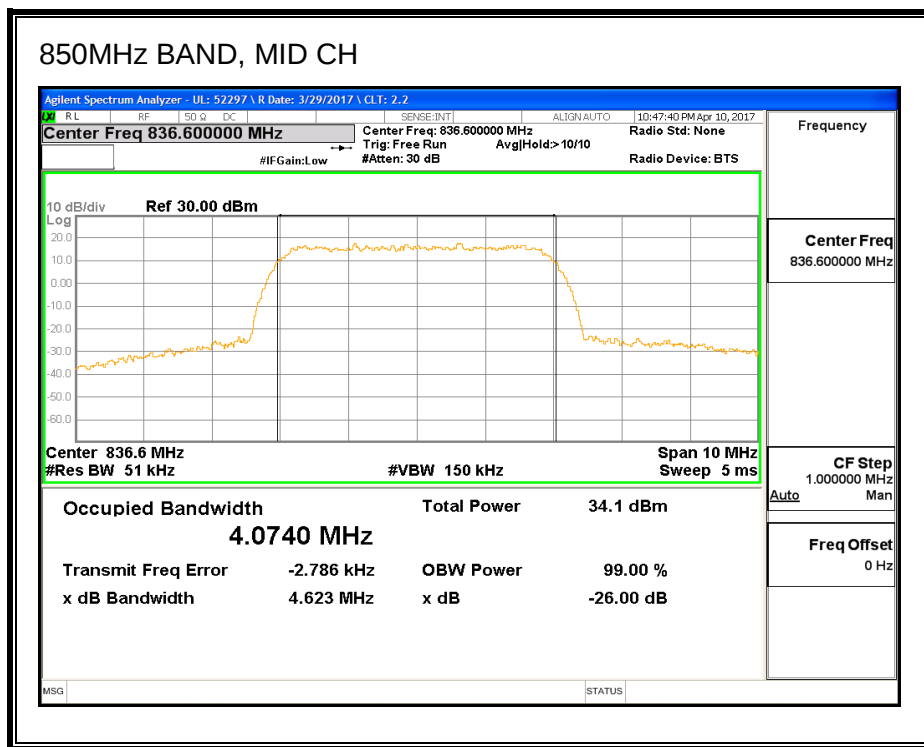
8.1.1. GSM GPRS

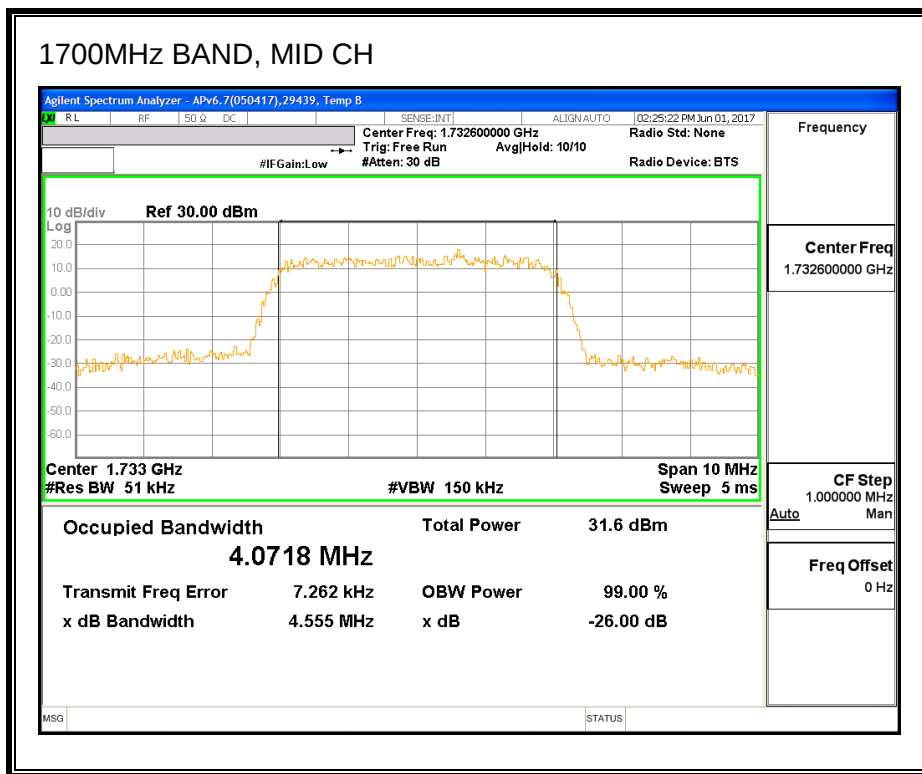


8.1.2. GSM EGPRS

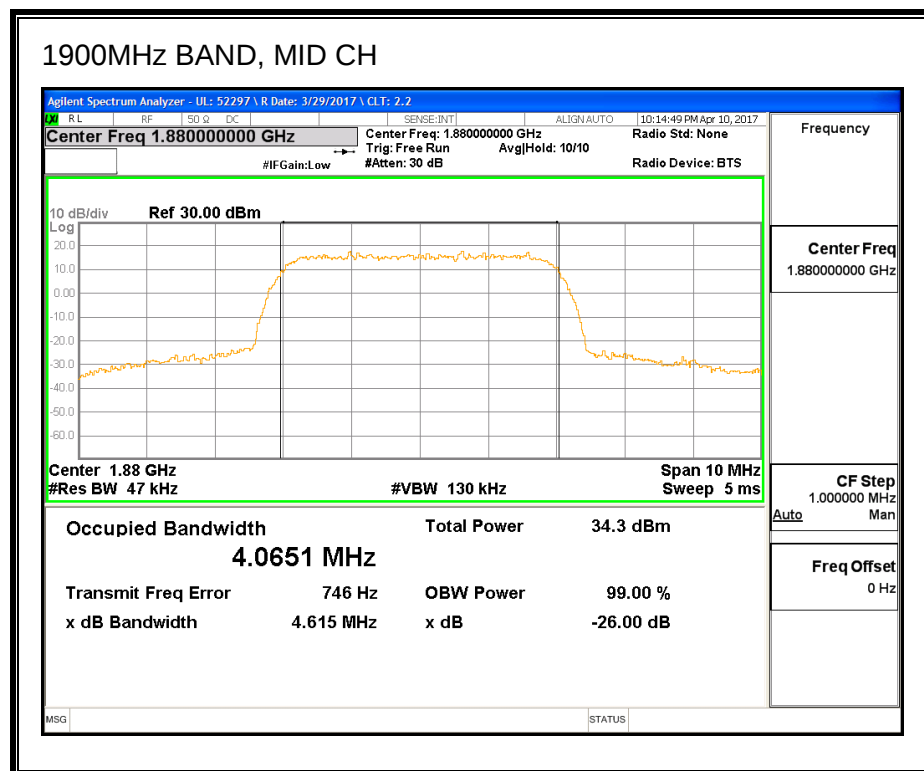
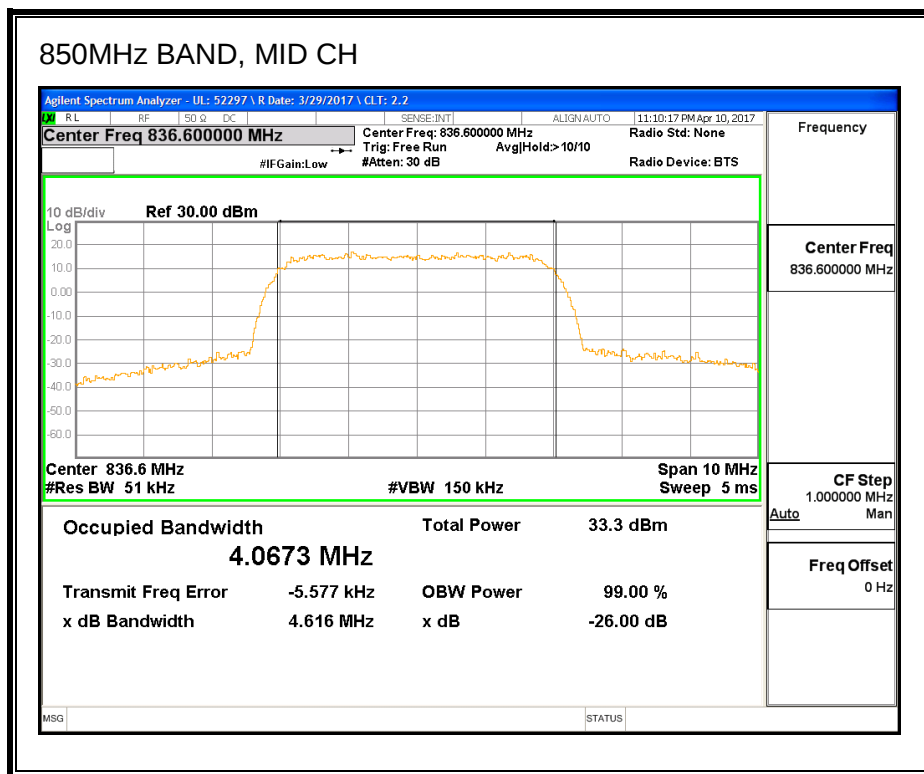


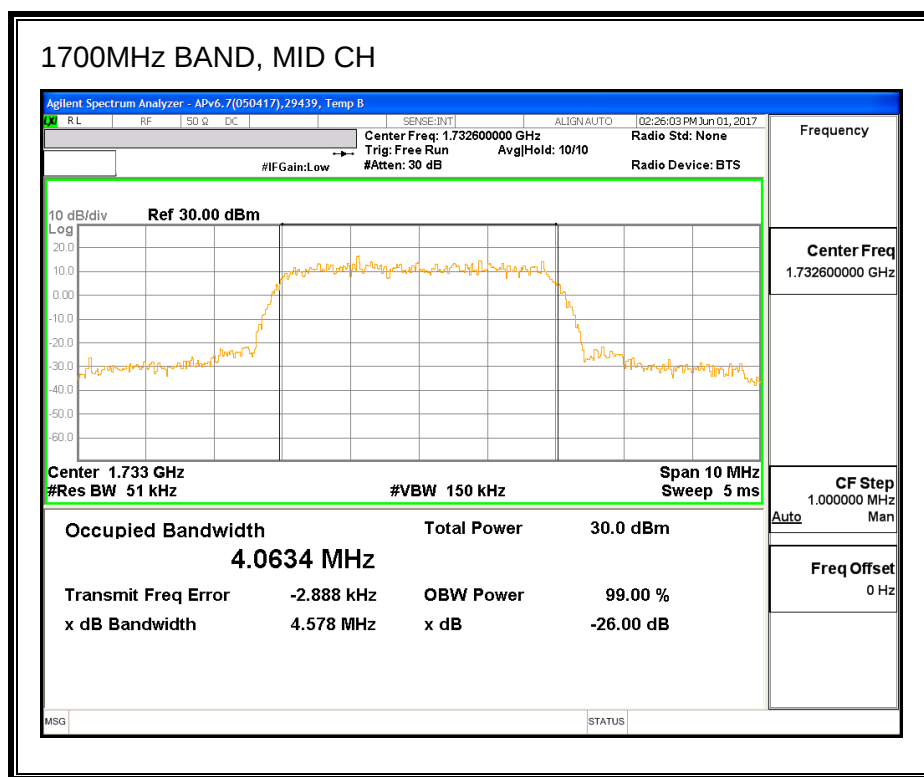
8.1.3. UMTS REL 99





8.1.4. UMTS HSDPA





8.2. BAND EDGE

RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53 and §90.691
IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

LIMITS

FCC: §22.917, §24.238, §27.53

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.

FCC: §90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

RSS132§5.5

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

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).

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.

RSS133§6.5

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.

RSS139§6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, Footnote 2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

TEST PROCEDURE

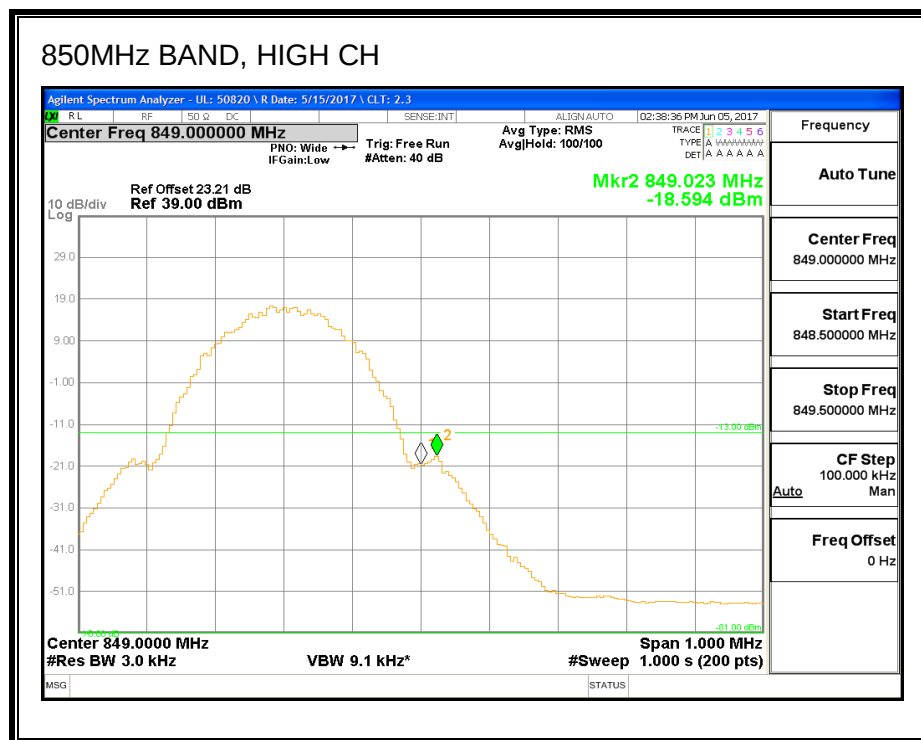
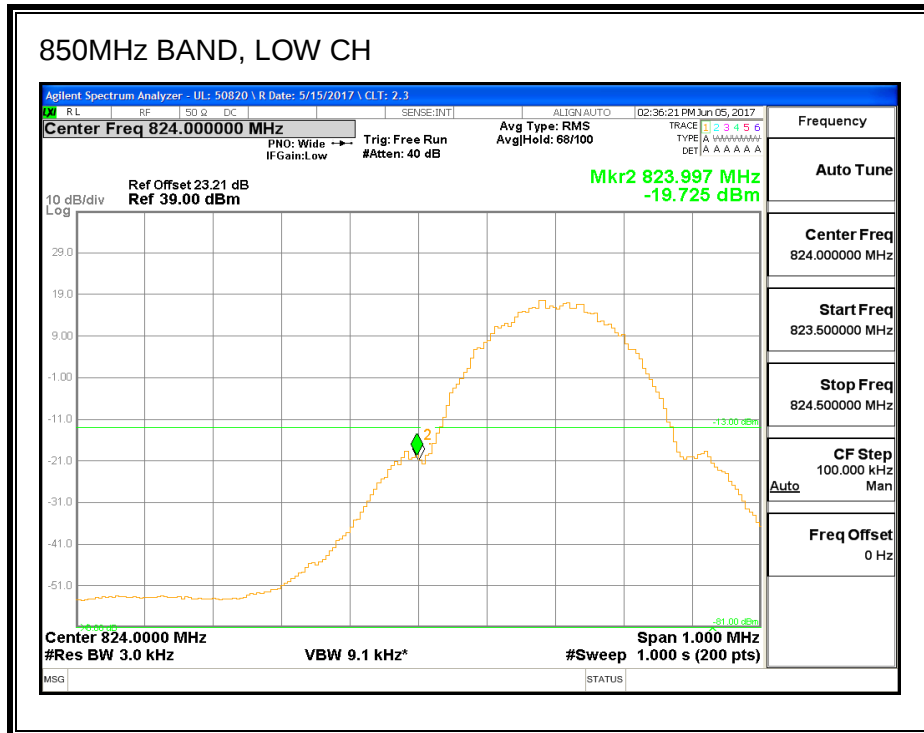
The transmitter output was connected to a Agilent 8960 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

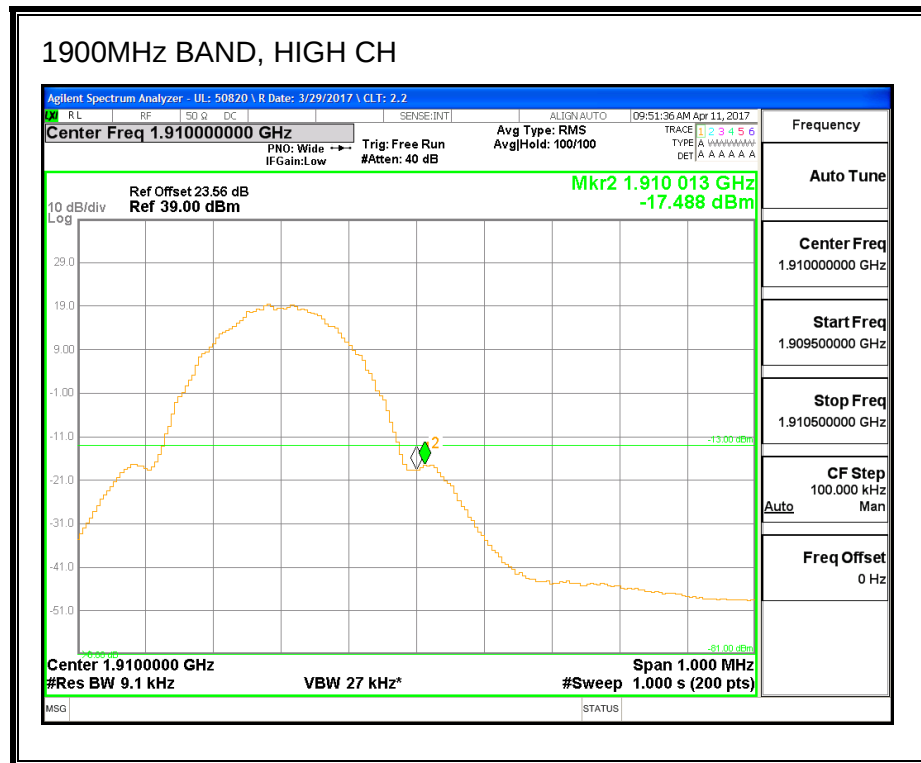
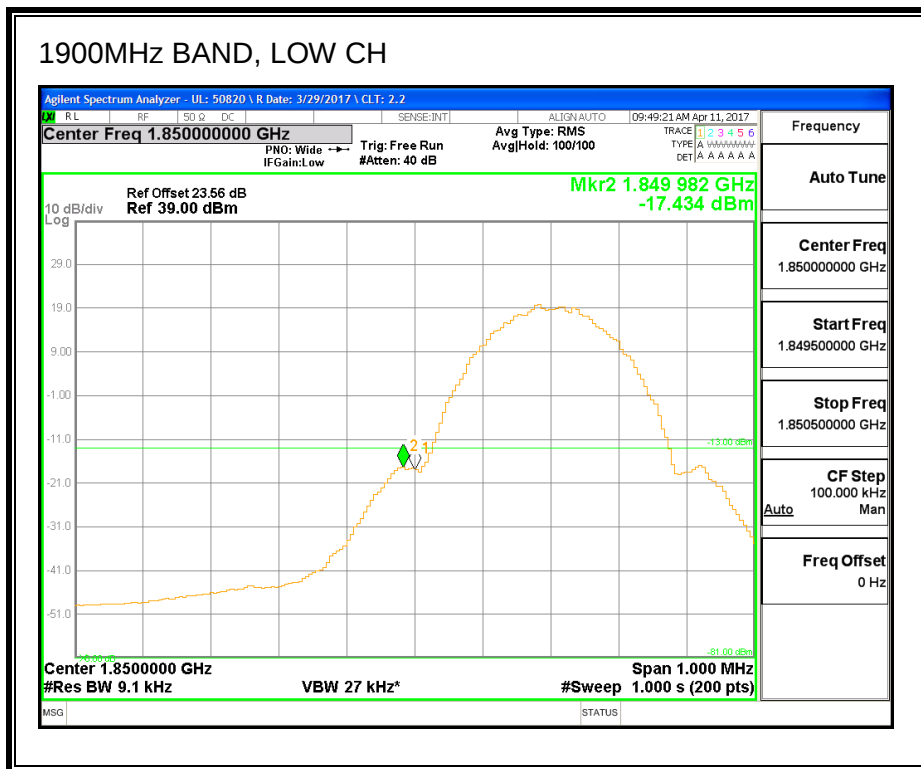
For each band edge measurement:

- Set the spectrum analyzer span to include the block edge frequency.
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

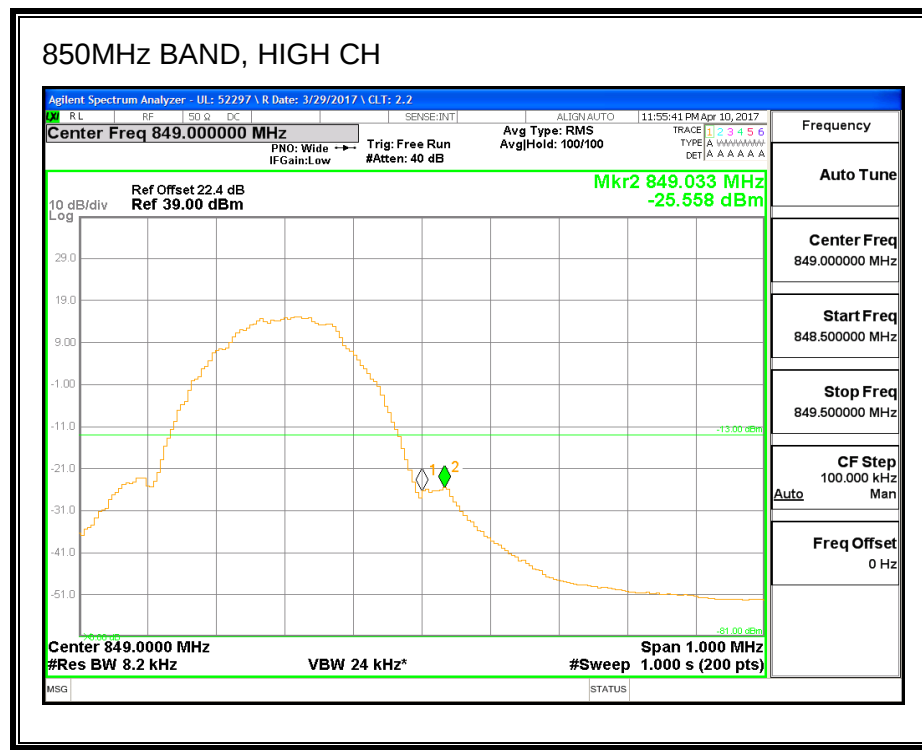
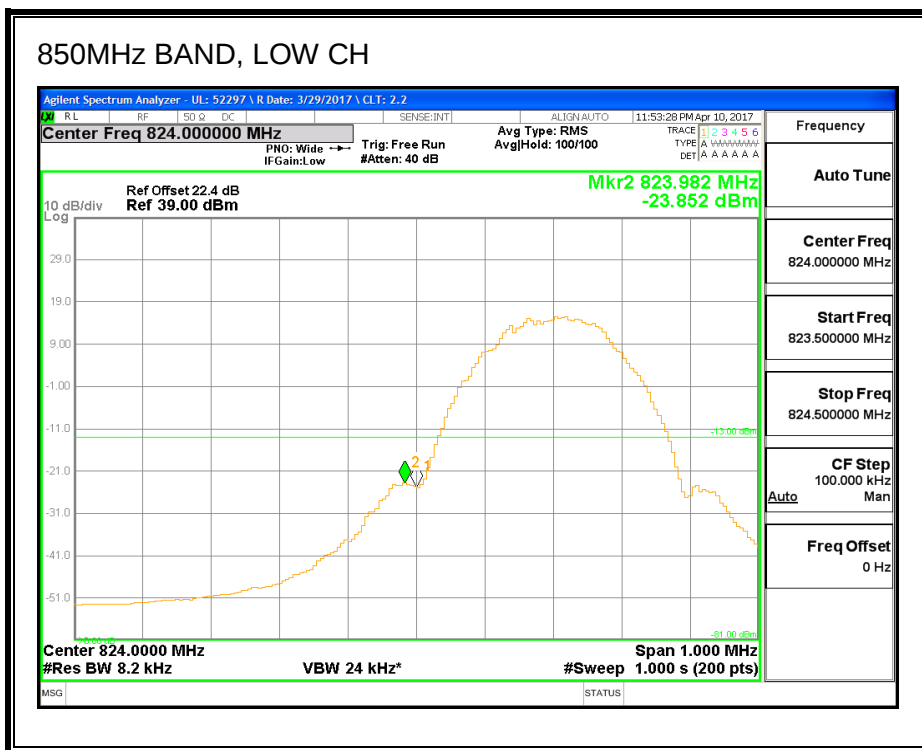
RESULTS

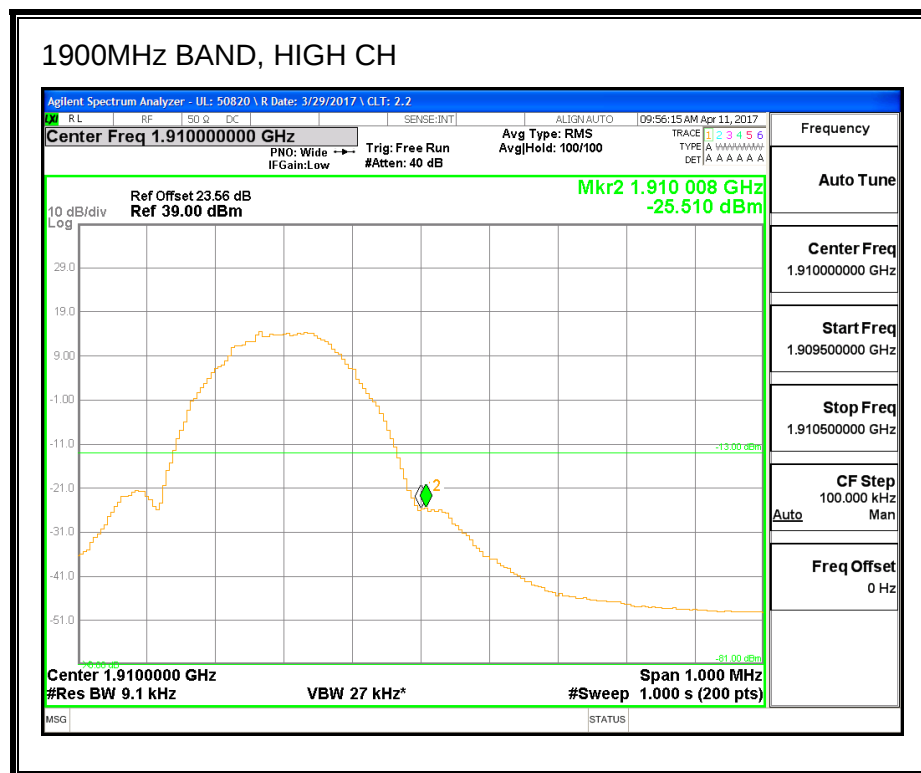
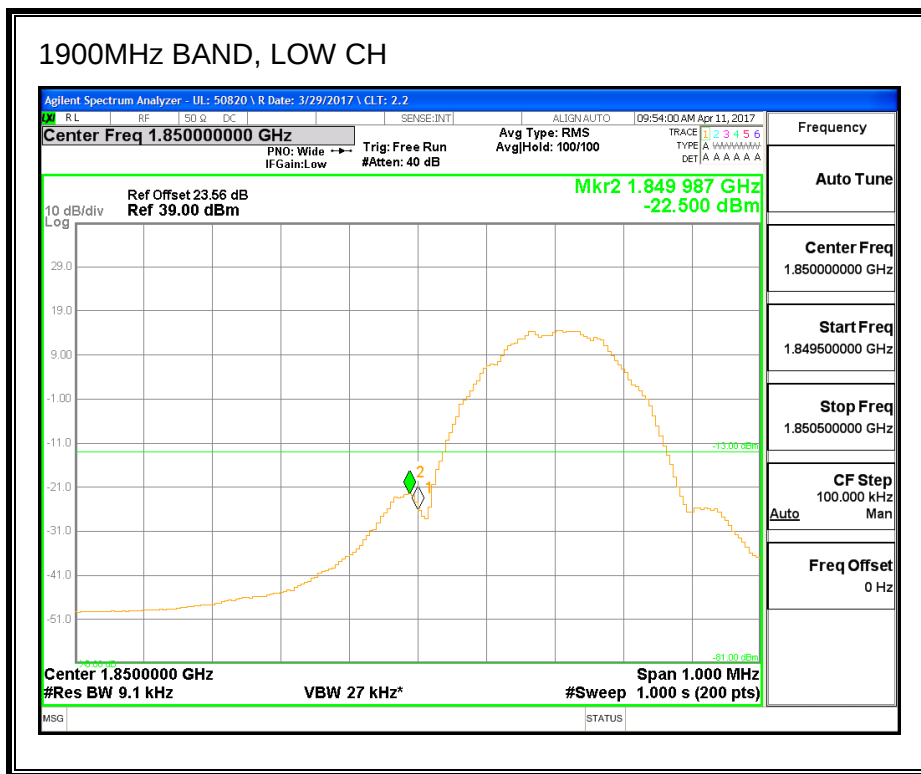
8.2.1. GSM-GPRS



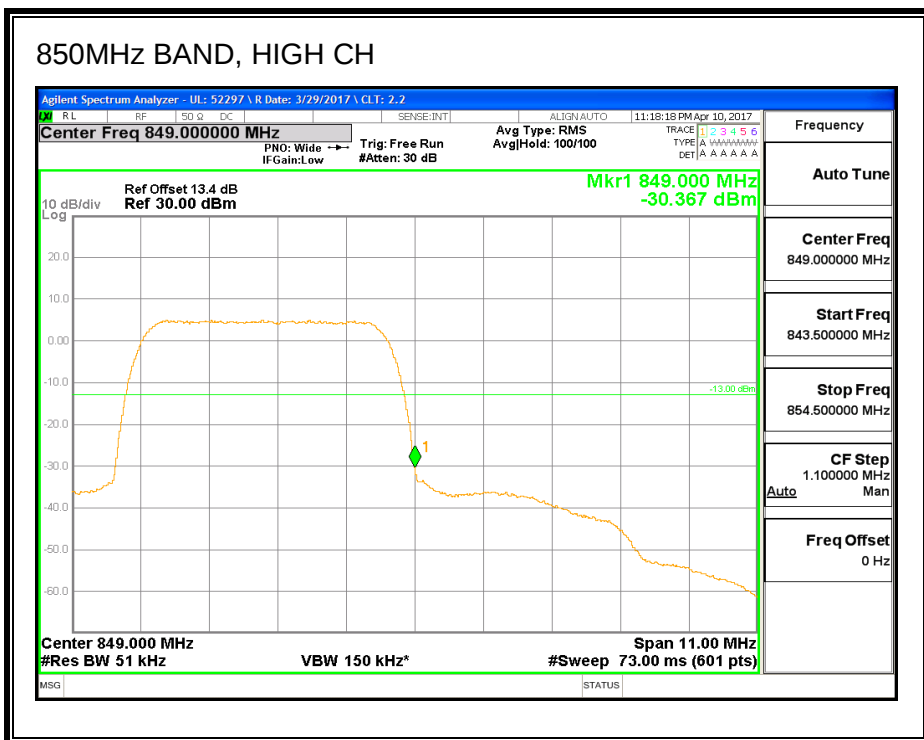
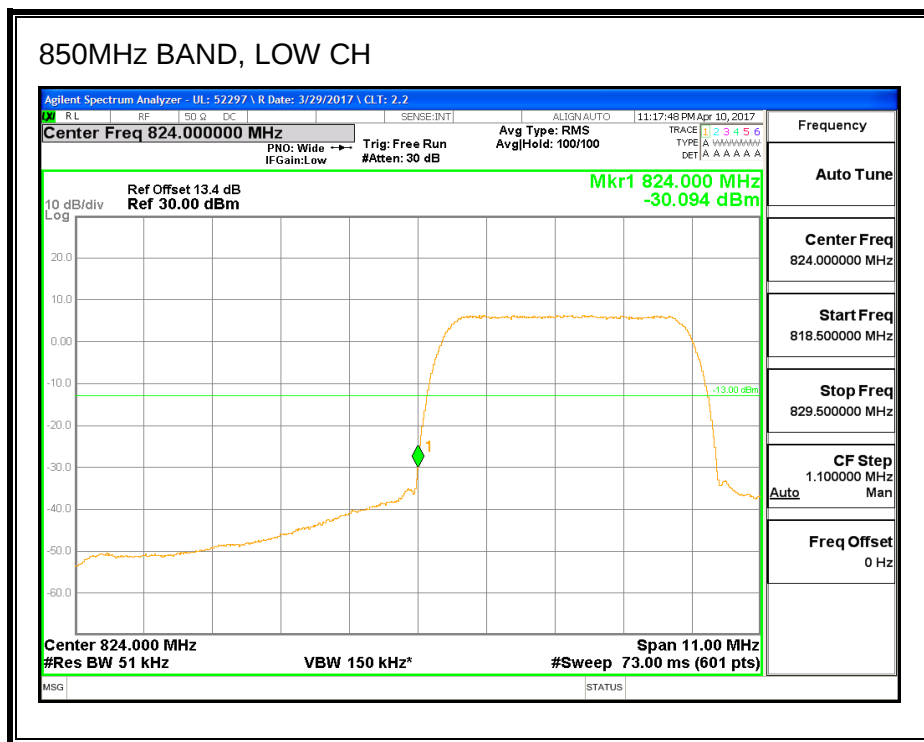


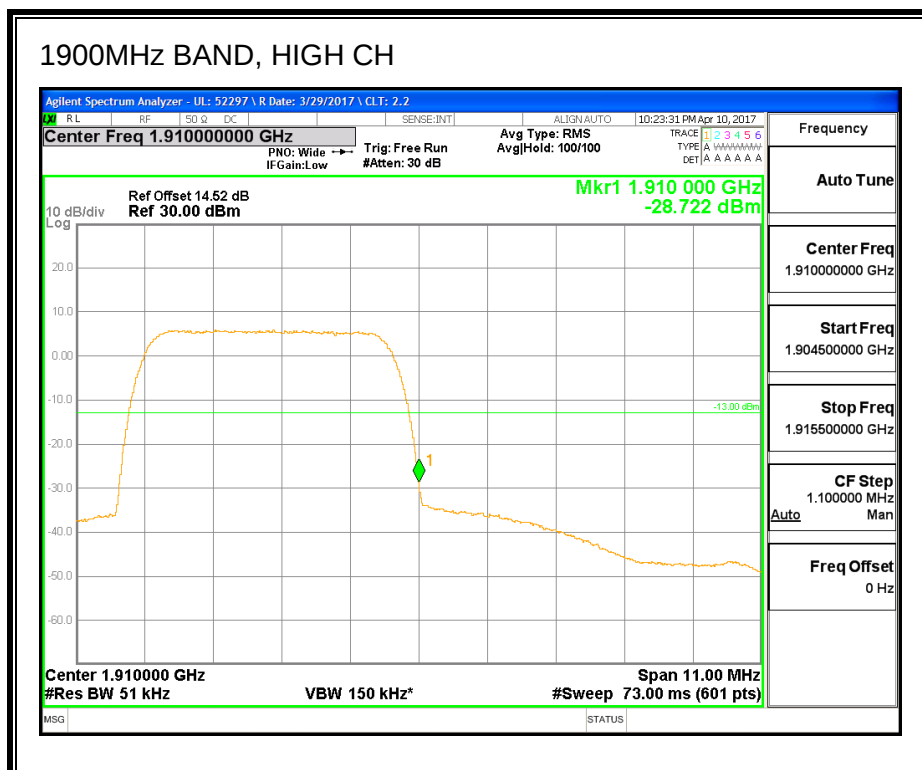
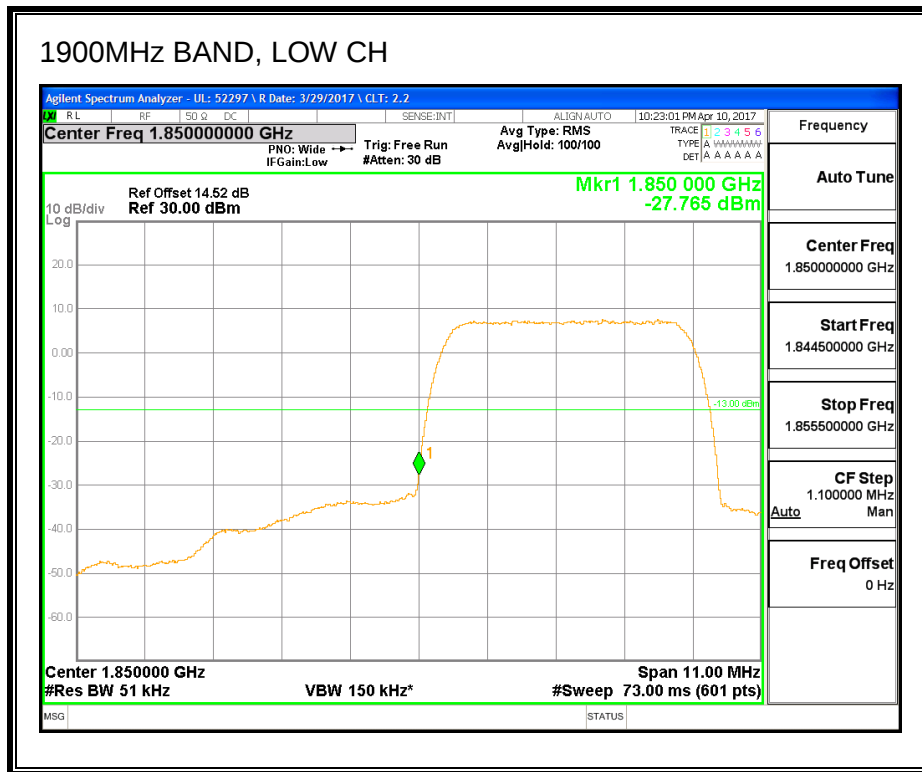
8.2.2. GSM-EGPRS

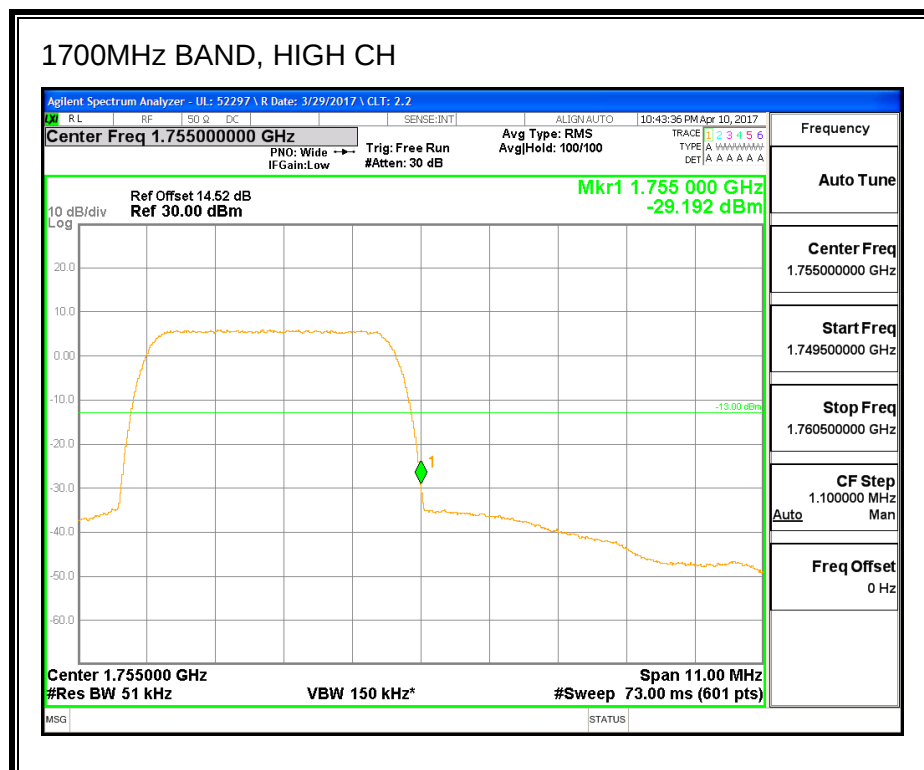
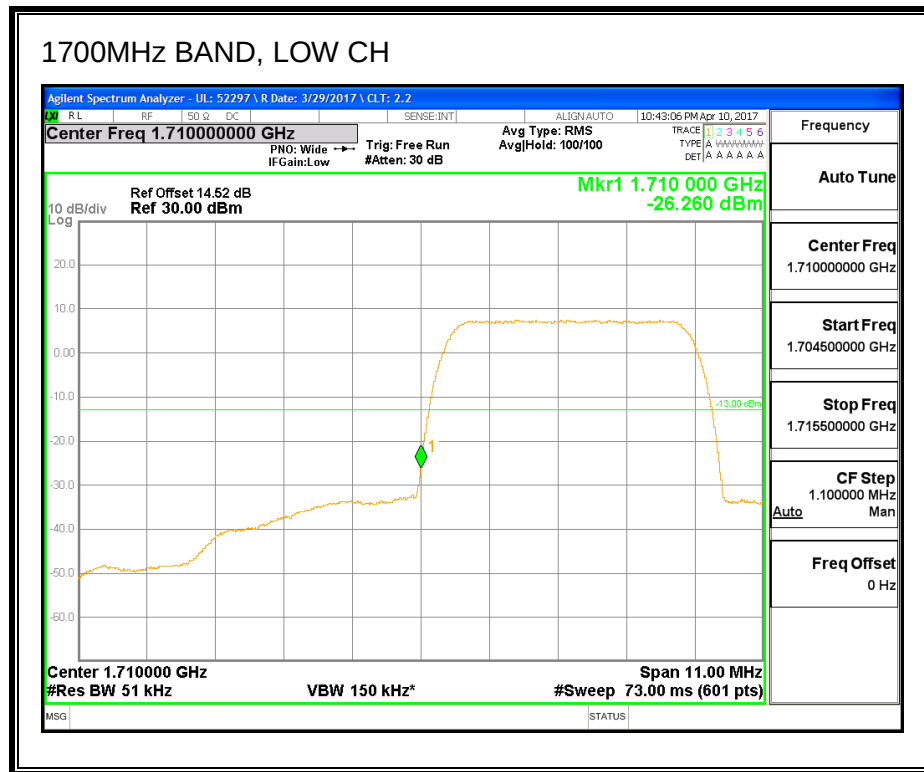




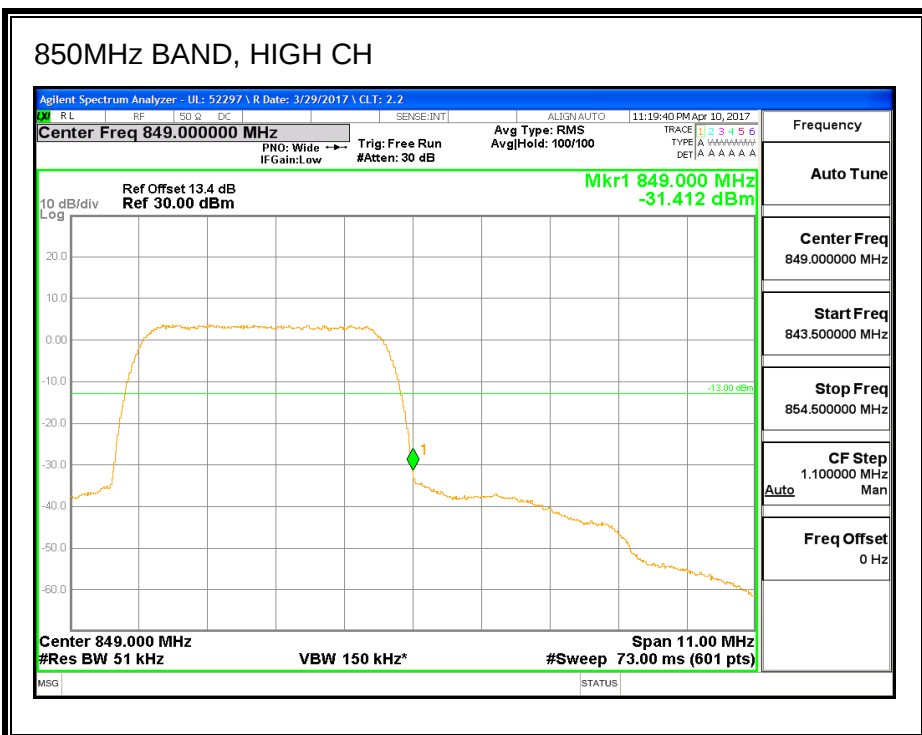
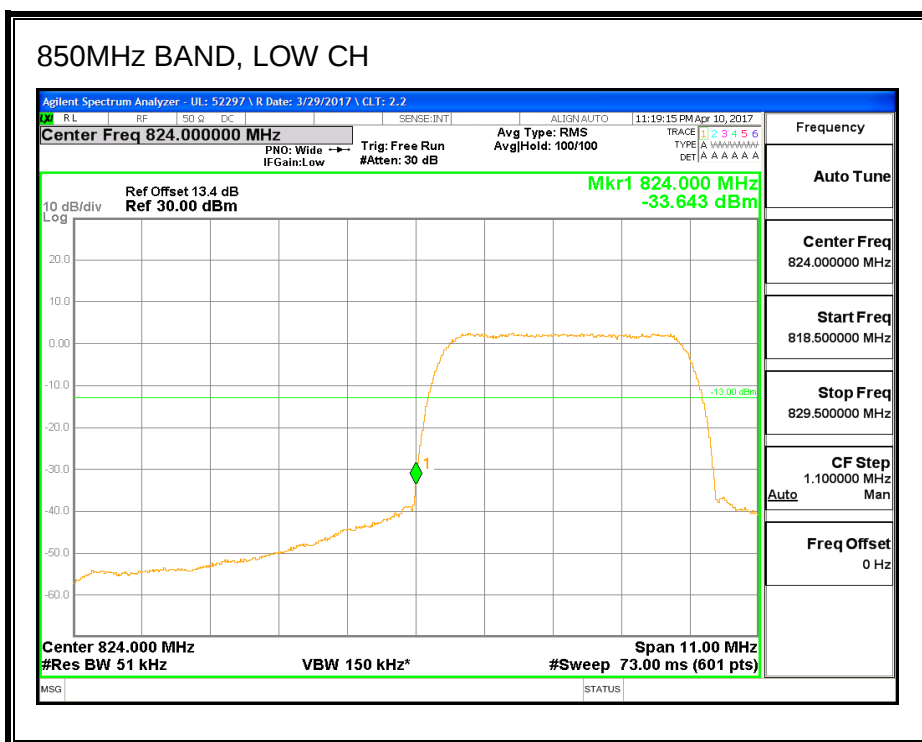
8.2.3. UMTS REL 99

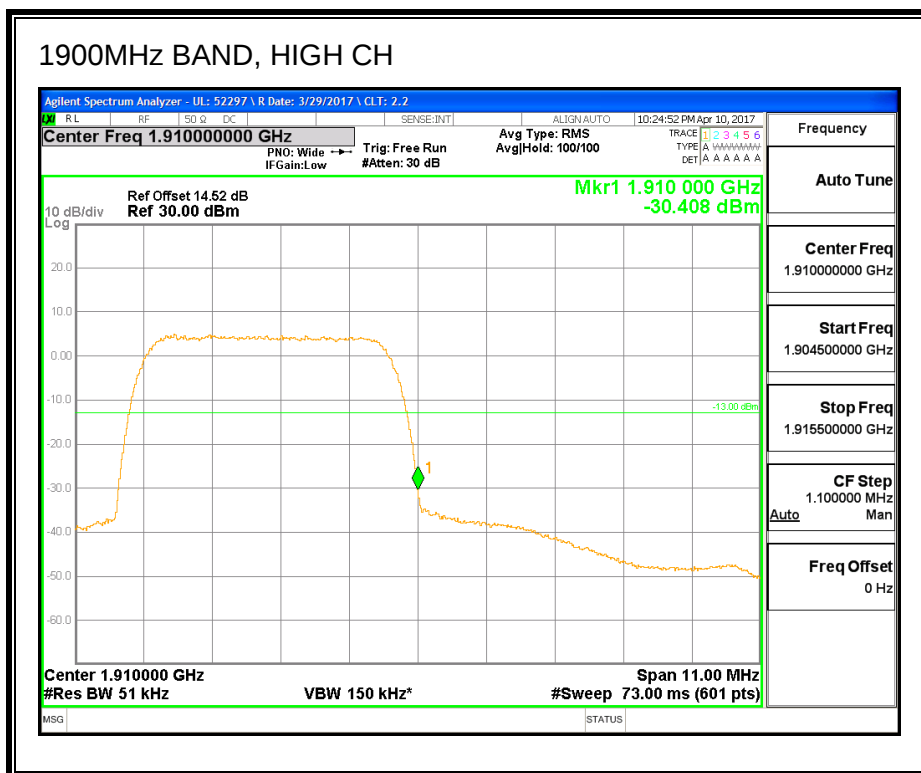
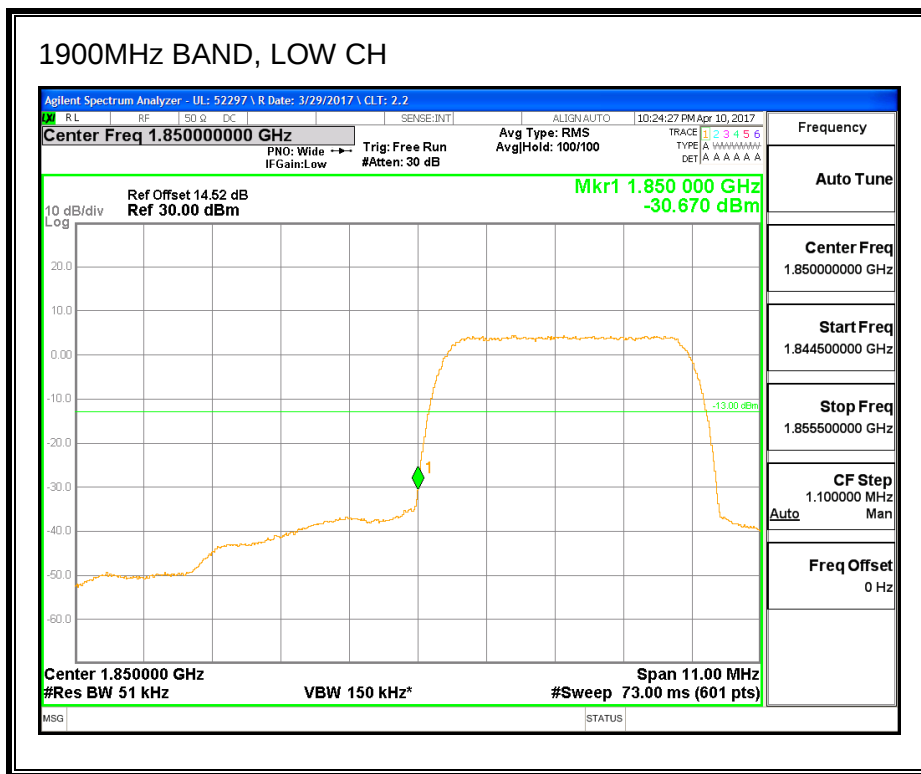


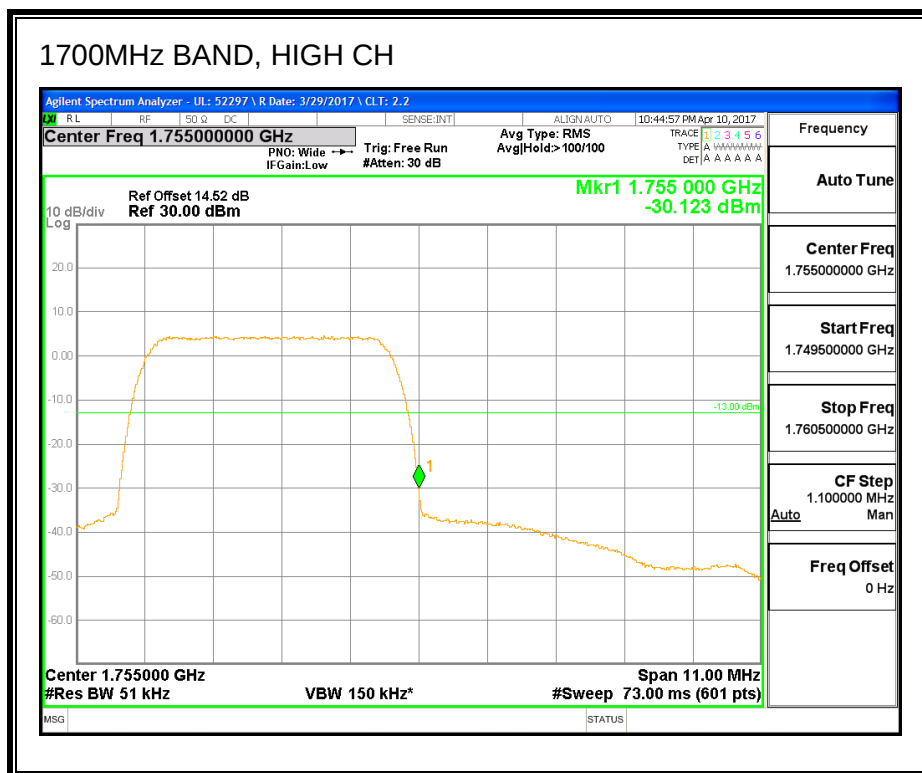
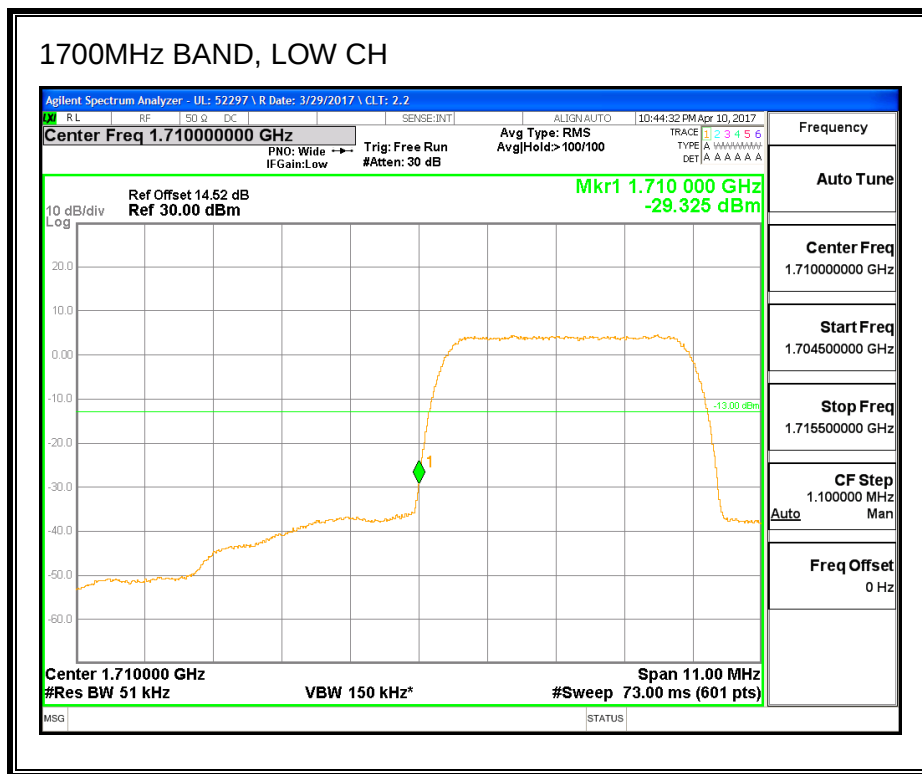




8.2.4. UMTS HSDPA







8.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53 and §90.691
IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

LIMITS

FCC: §22.917, §24.238, §27.53

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.

FCC: §90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

RSS132§5.5

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

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).

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.

RSS133§6.5

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.

RSS139§6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, Footnote 2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

TEST PROCEDURE

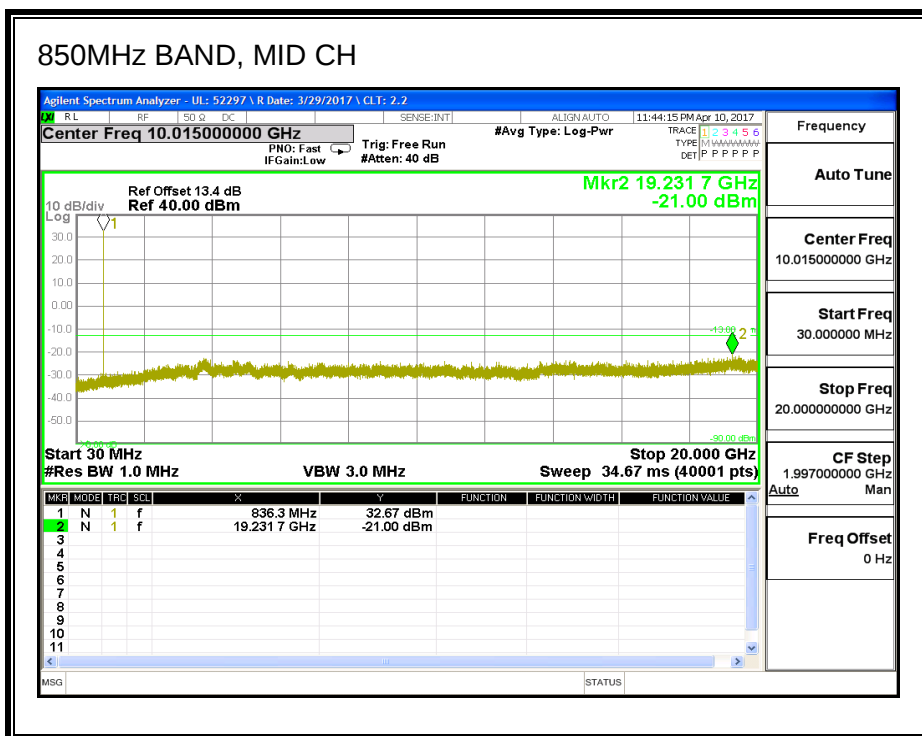
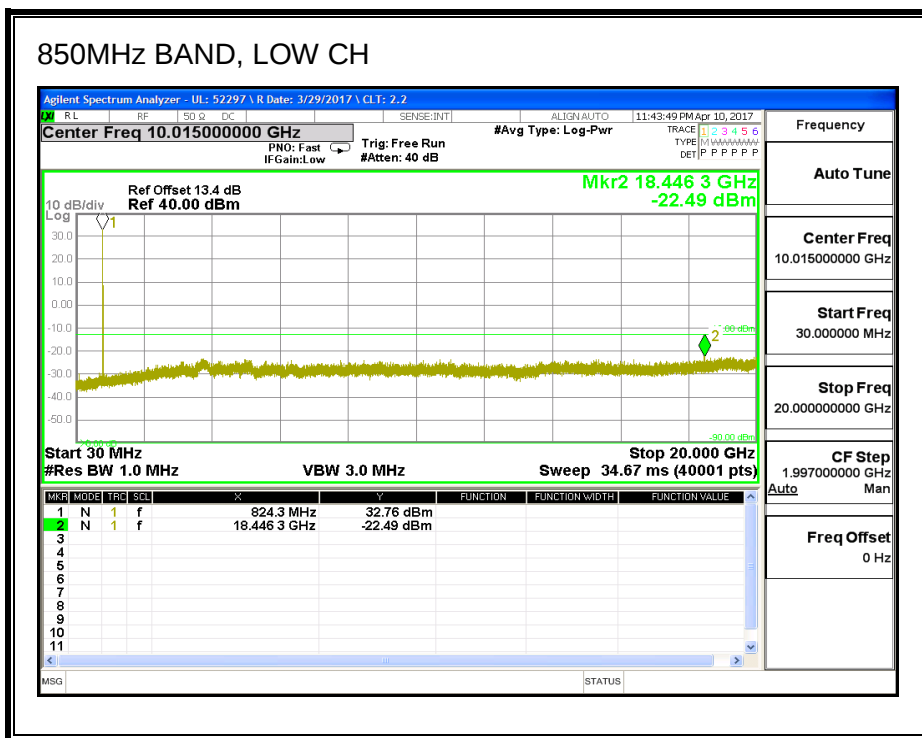
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

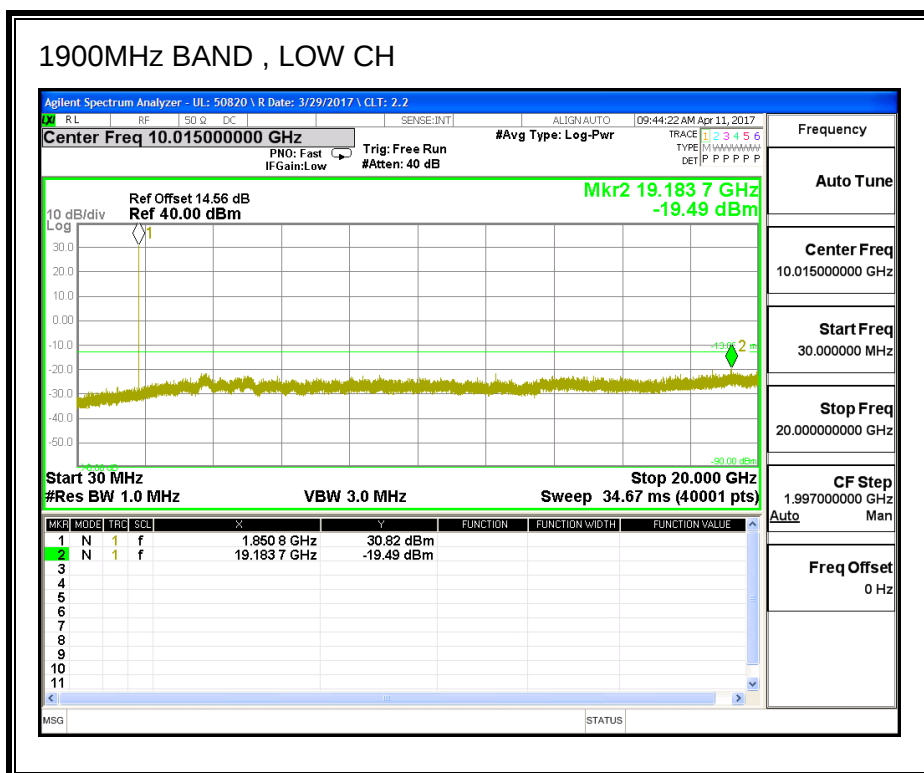
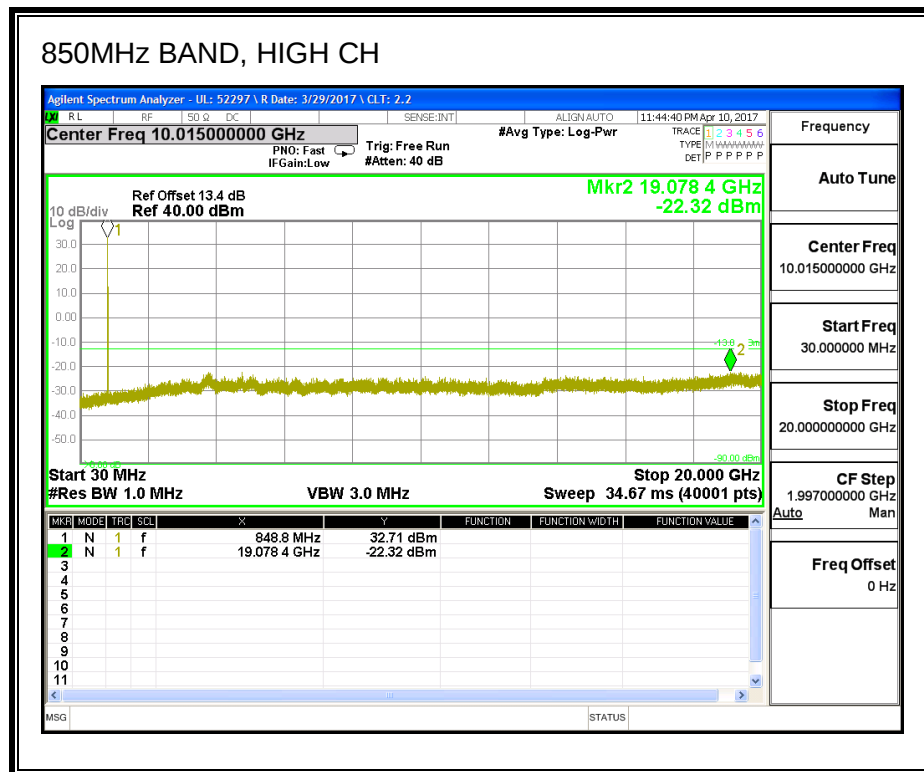
For each out of band emissions measurement:

- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

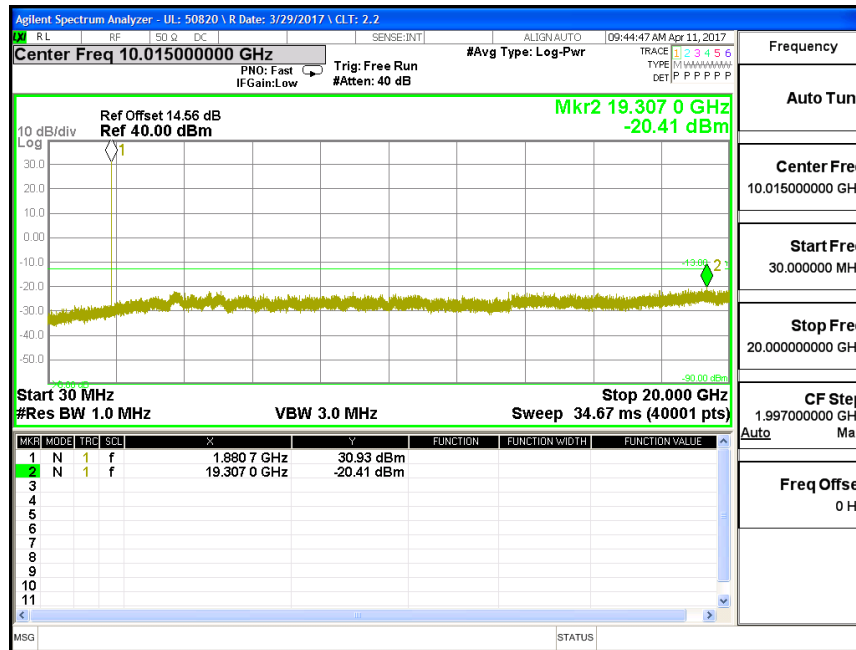
RESULTS

8.3.1. GSM-GPRS

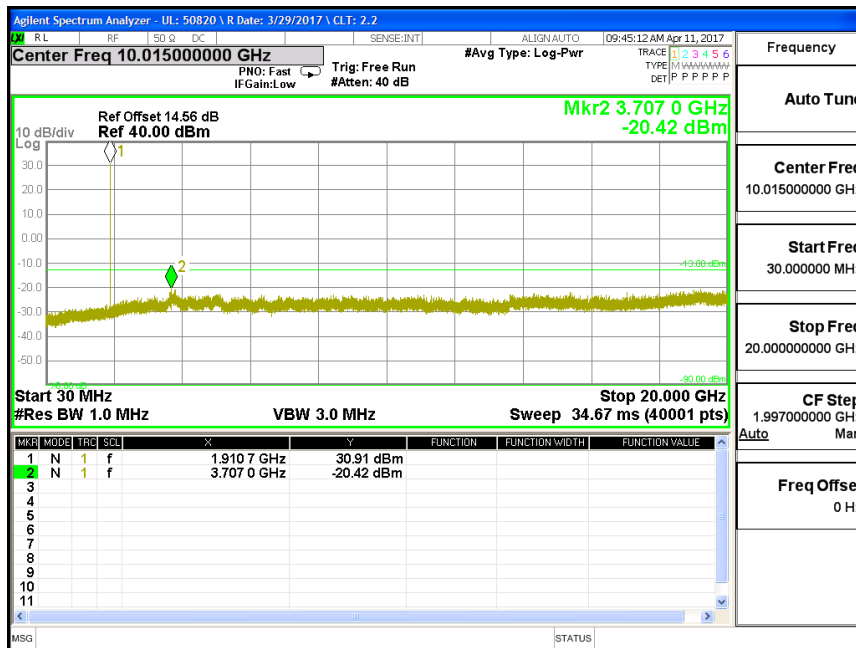




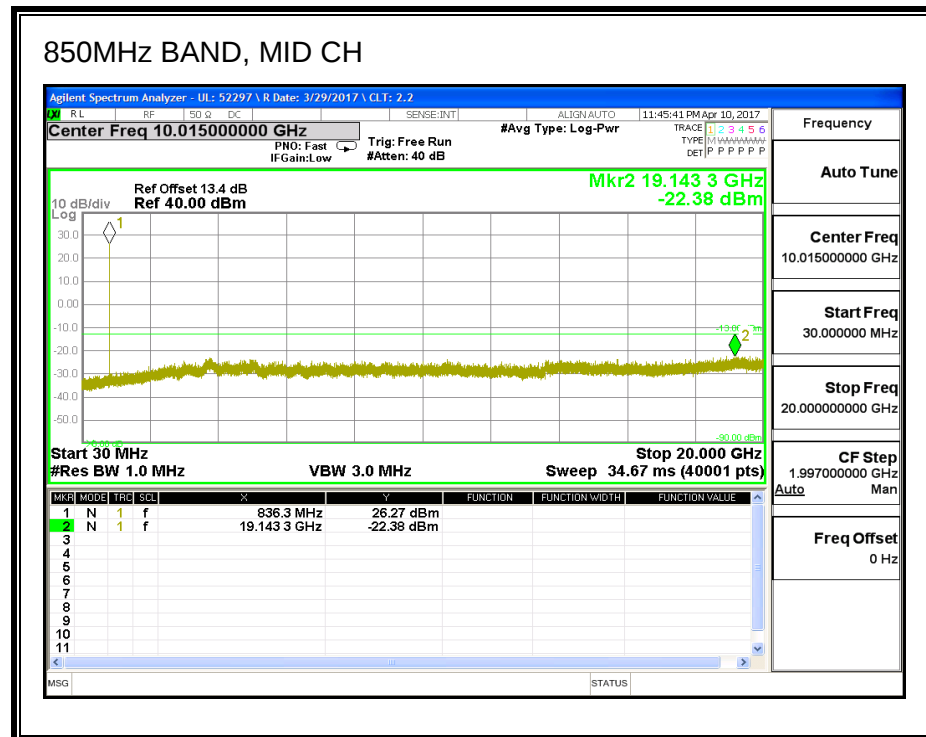
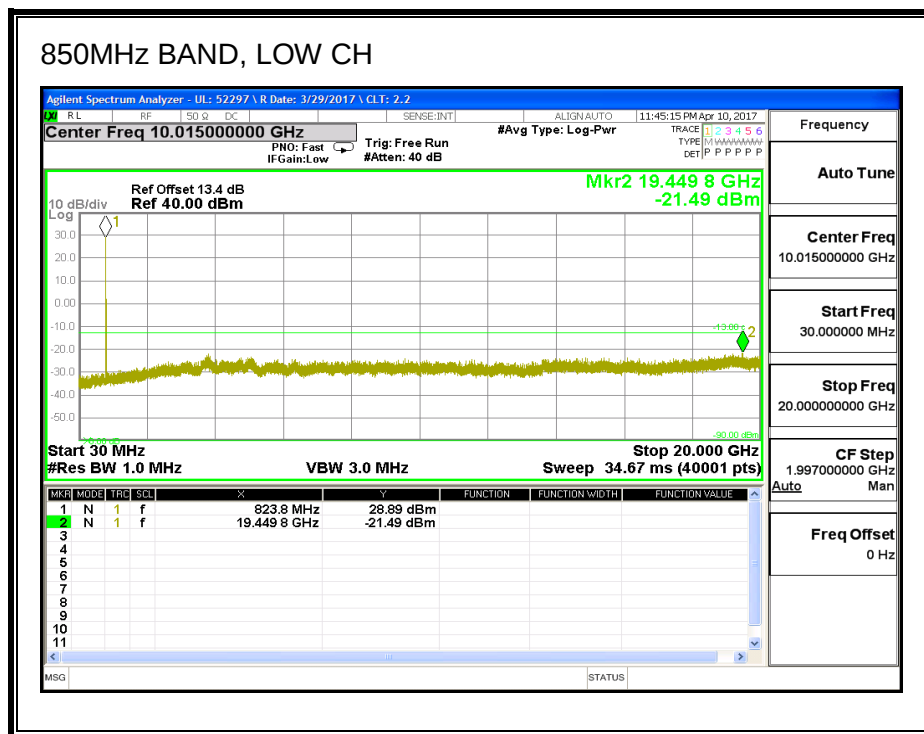
1900MHz BAND , MID CH

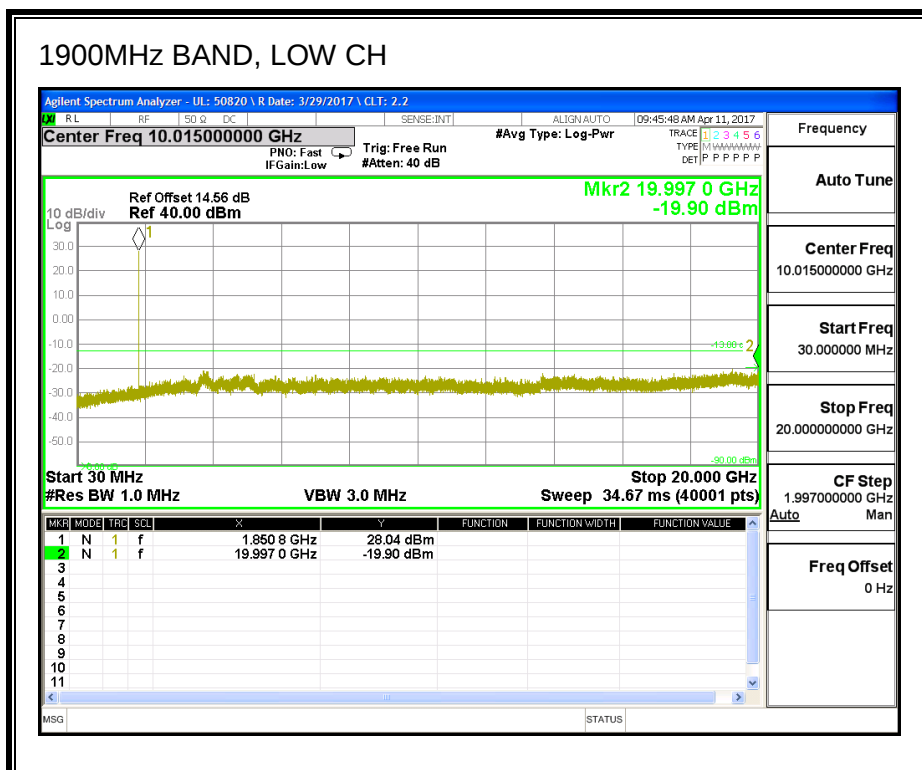
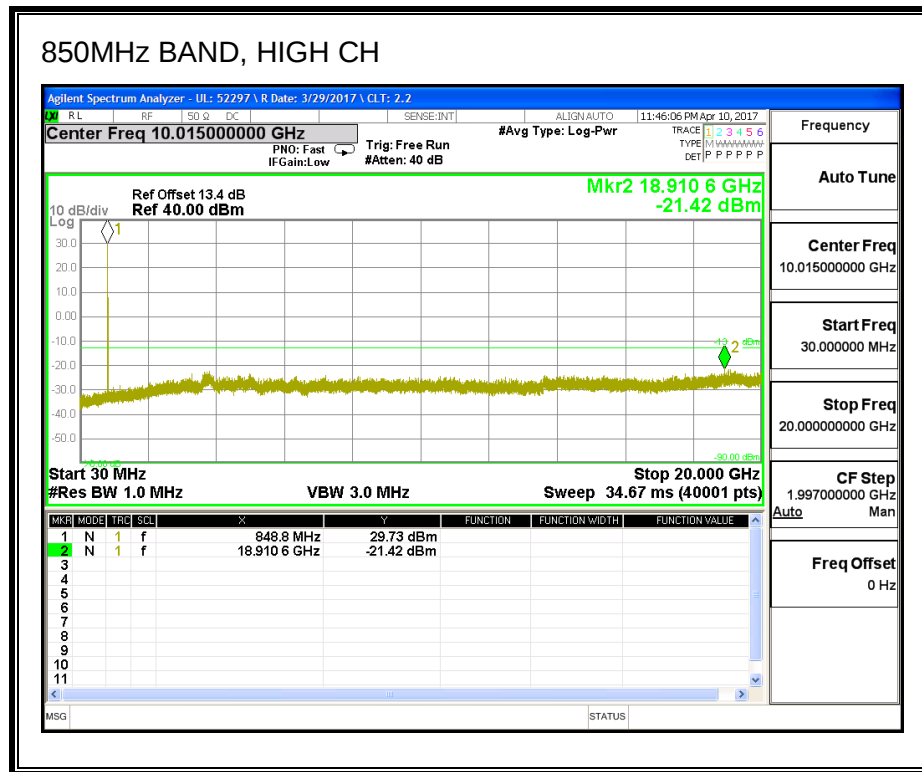


1900MHz BAND , HIGH CH

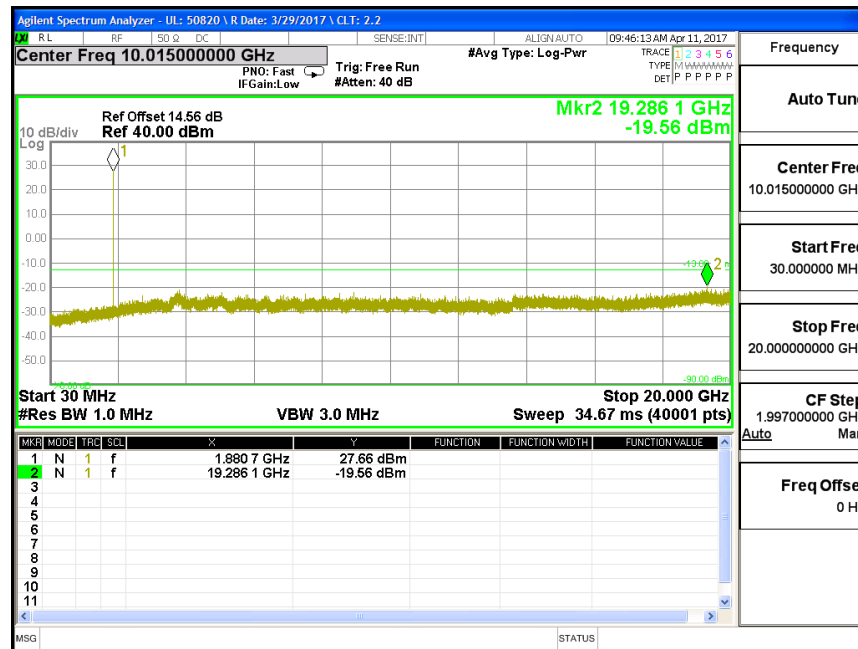


8.3.2. GSM-EGPRS

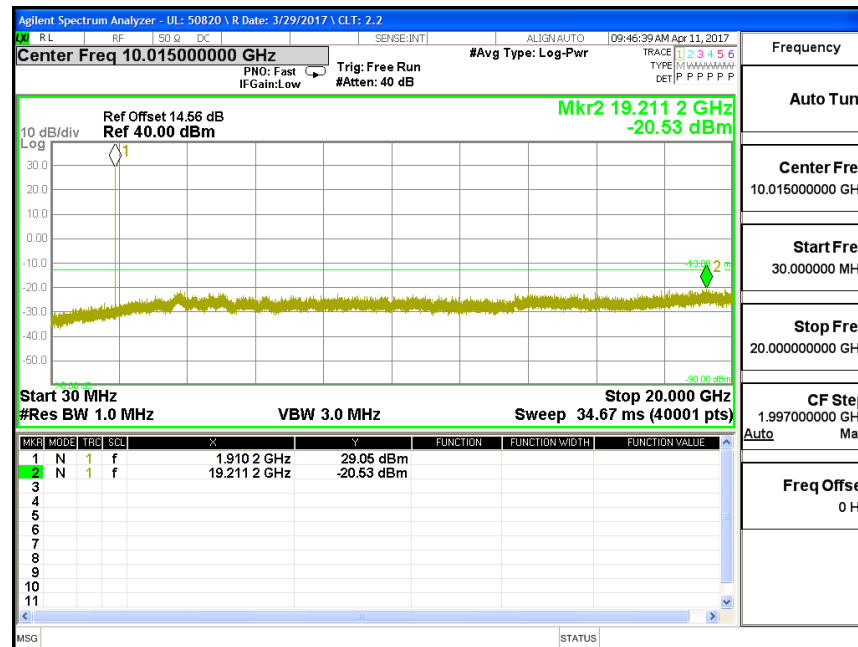




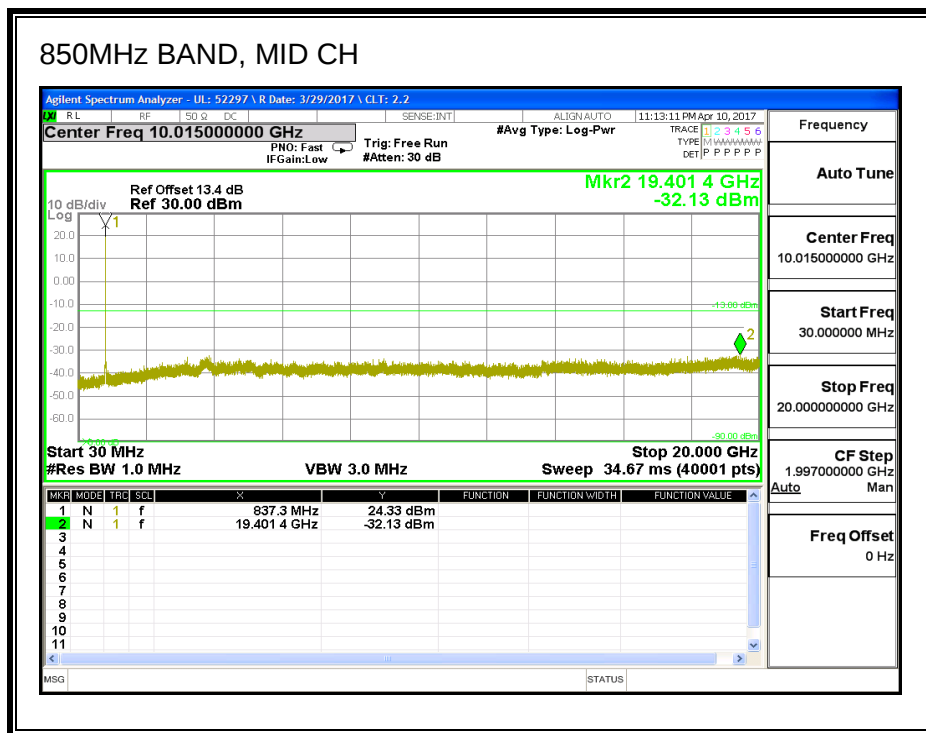
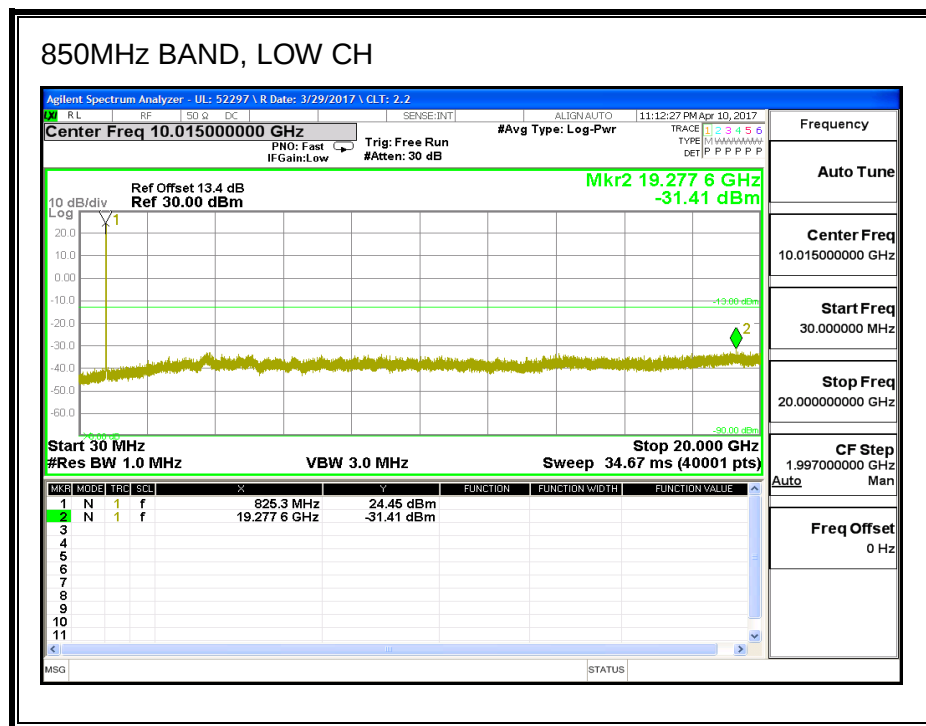
1900MHz BAND, MID CH

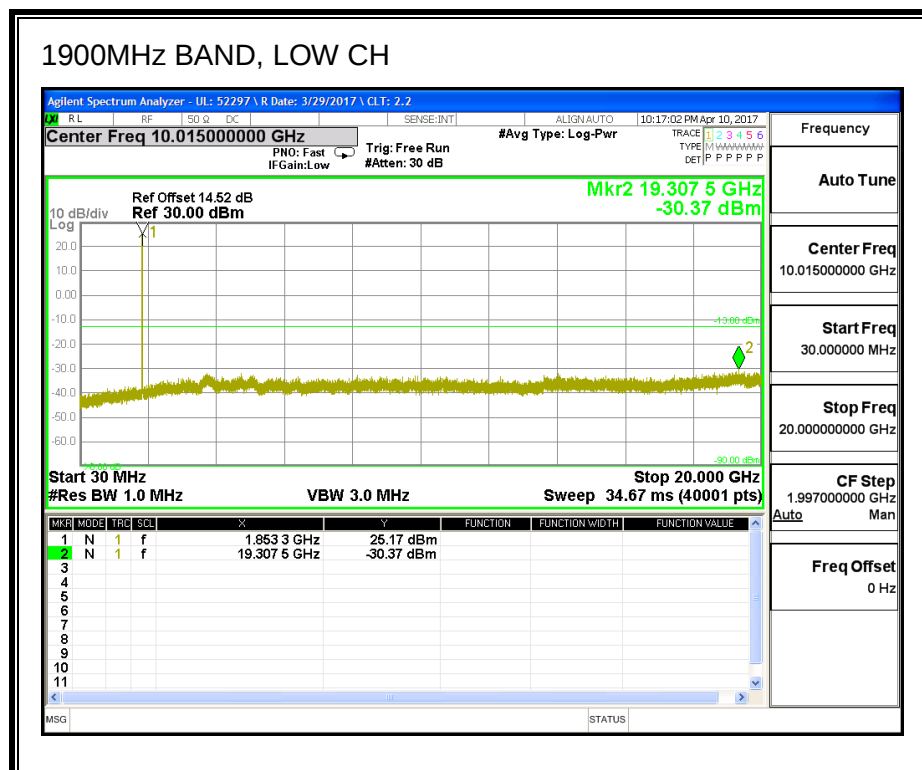
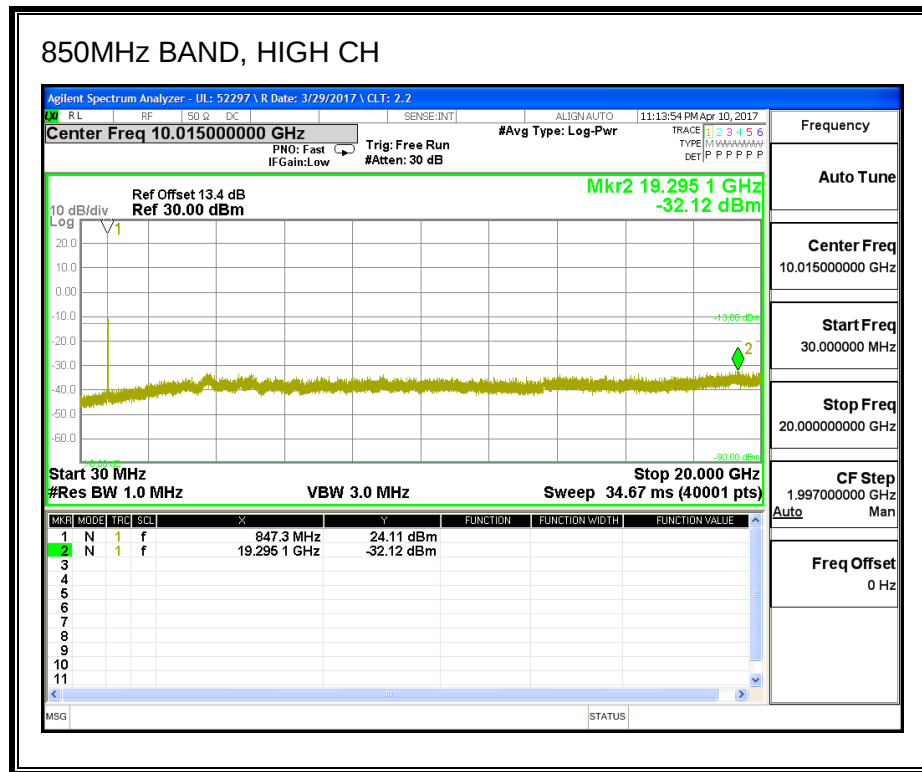


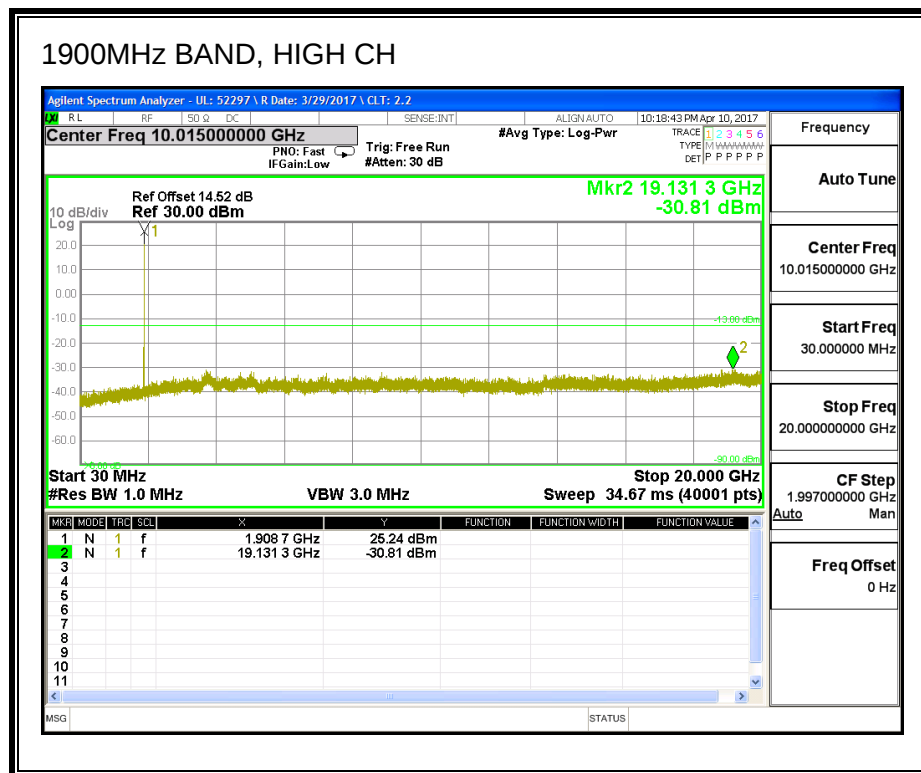
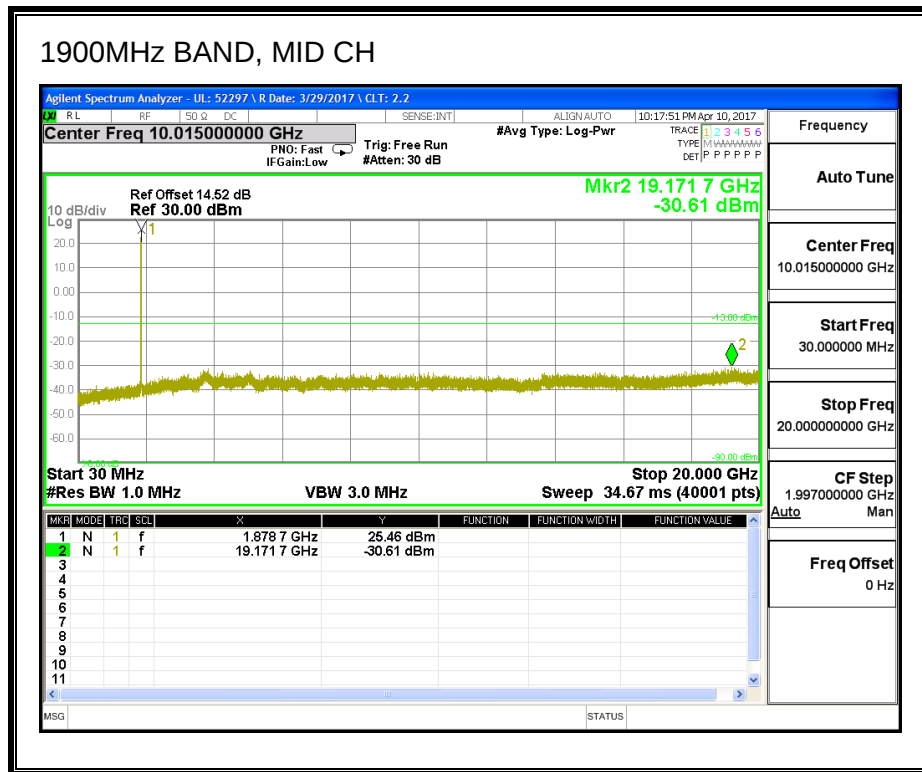
1900MHz BAND, HIGH CH

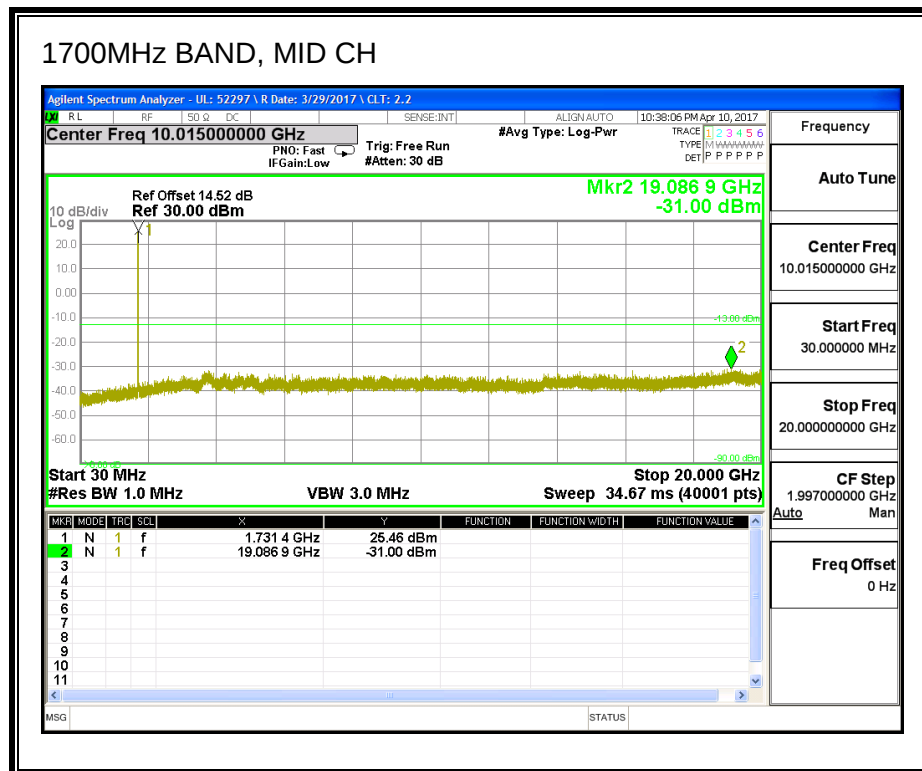


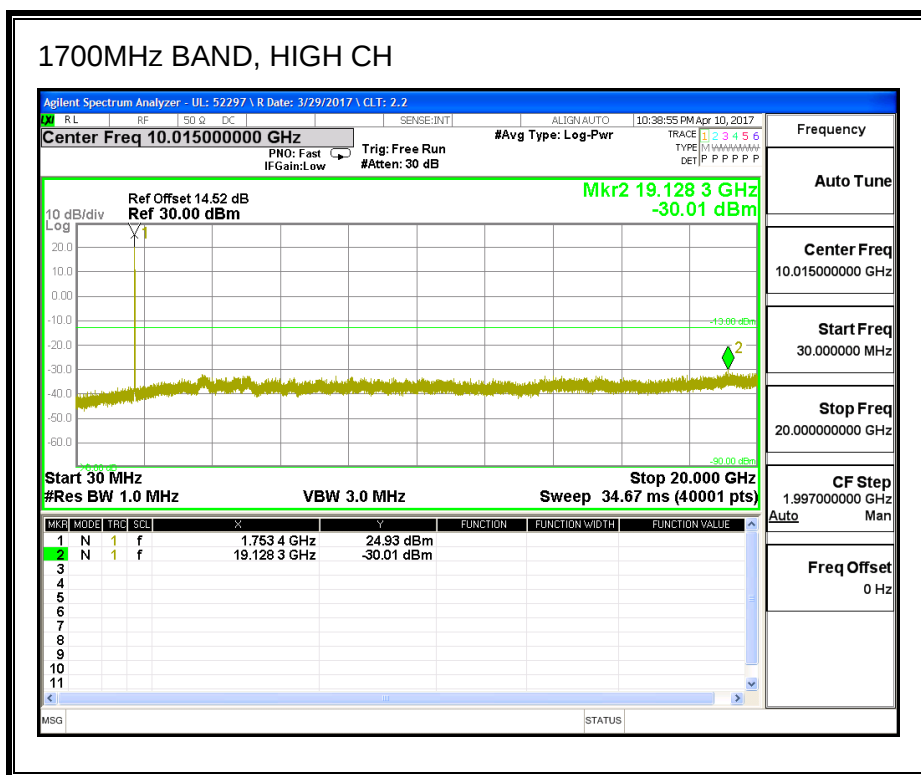
8.3.3. UMTS REL 99



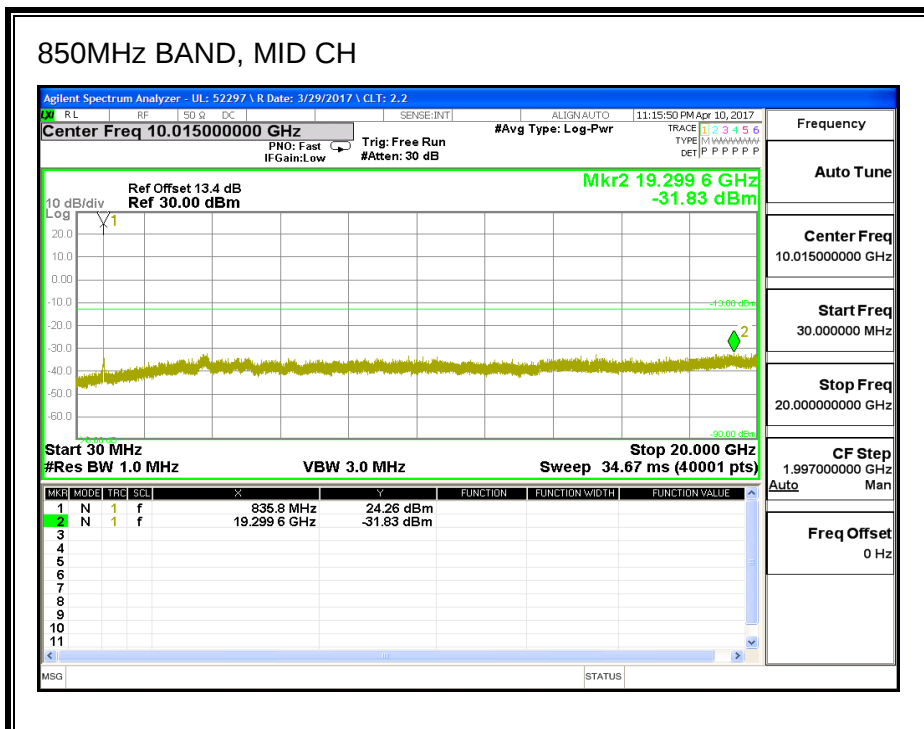
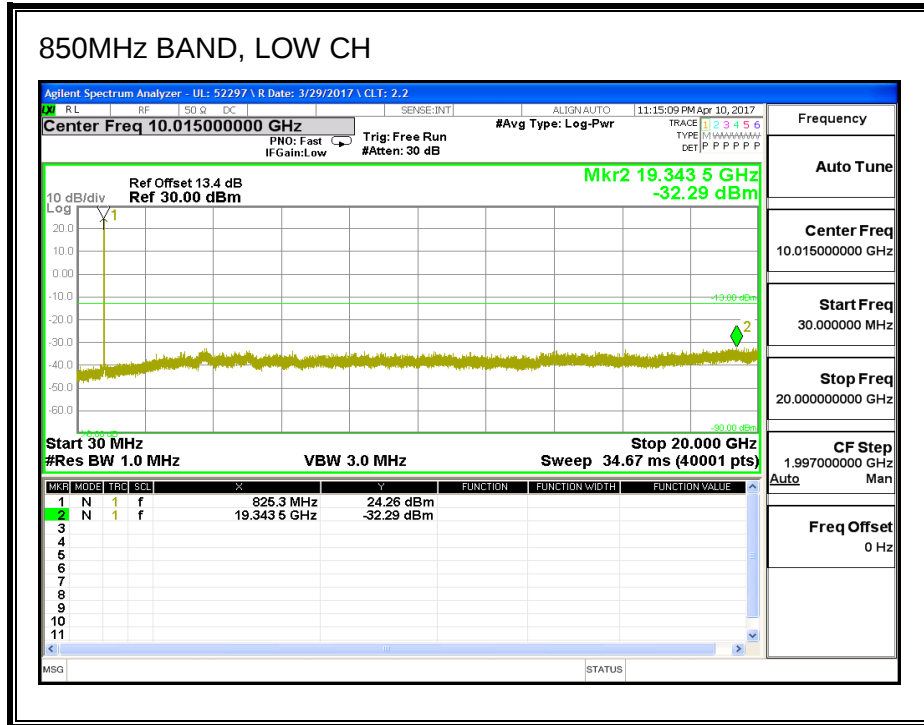


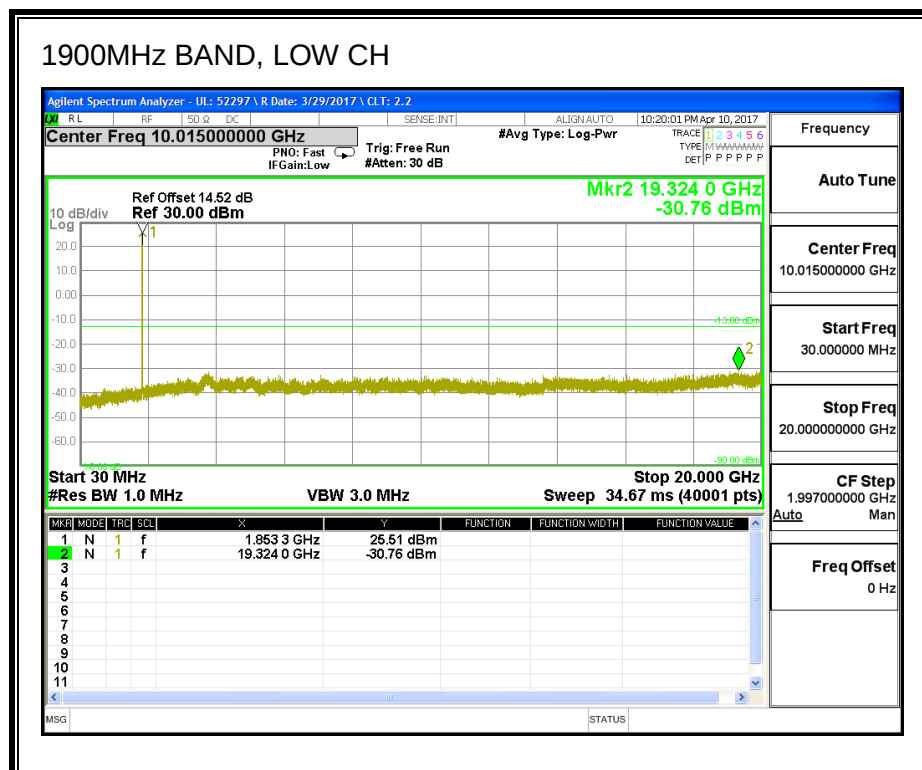
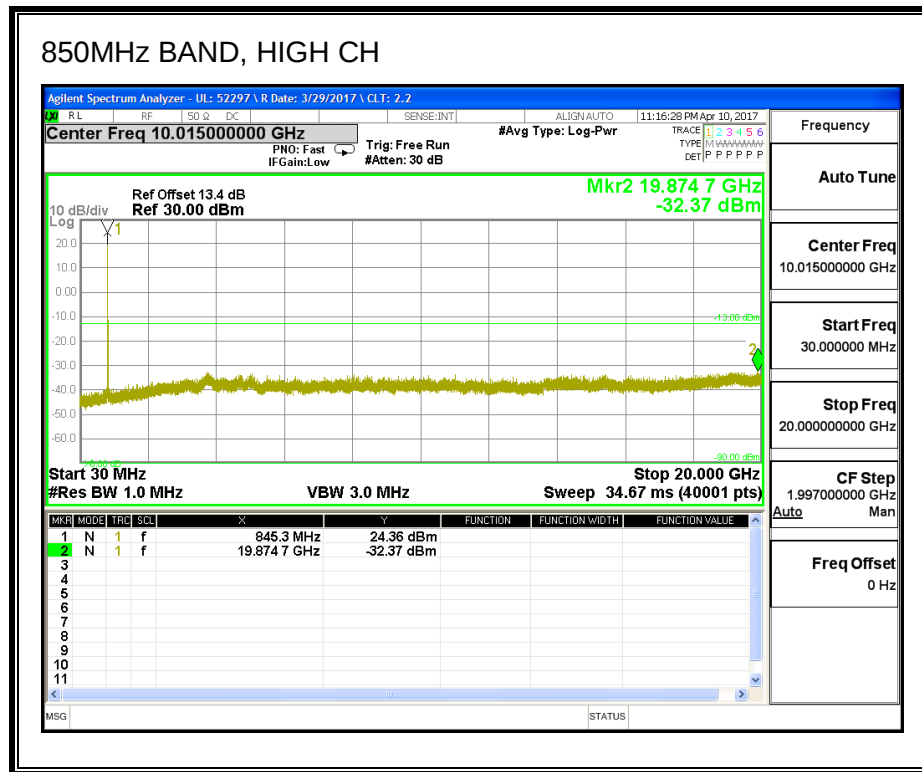


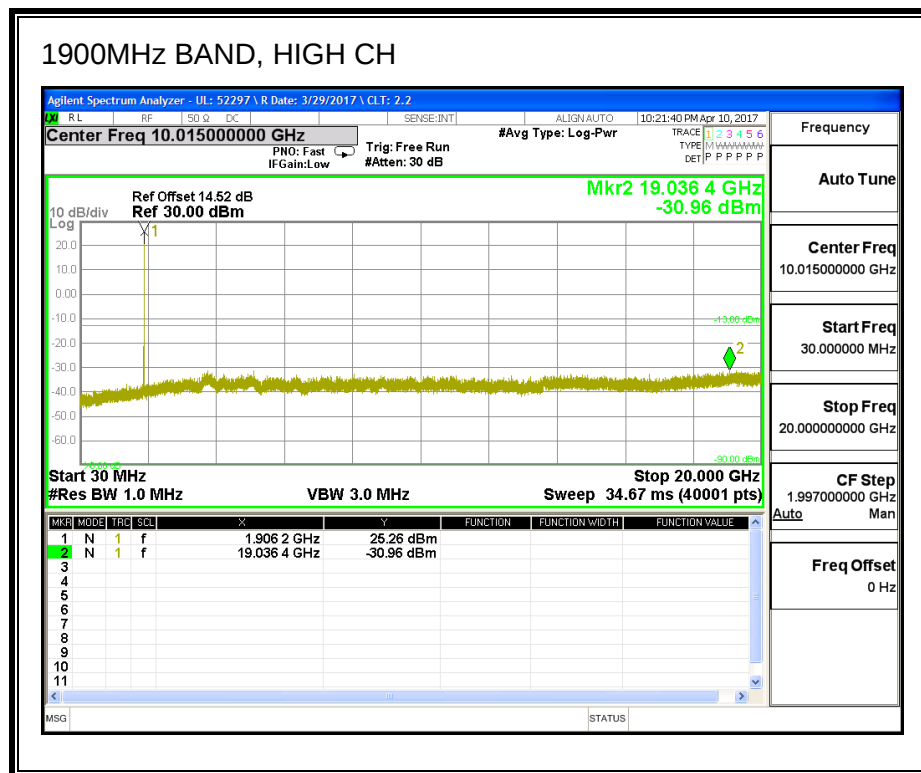
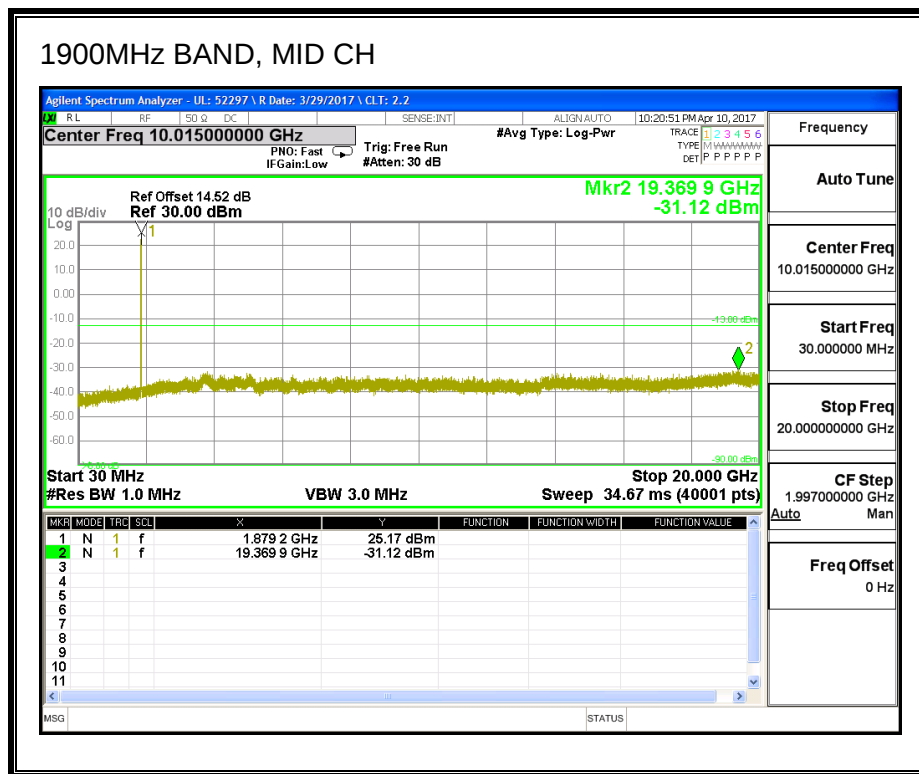


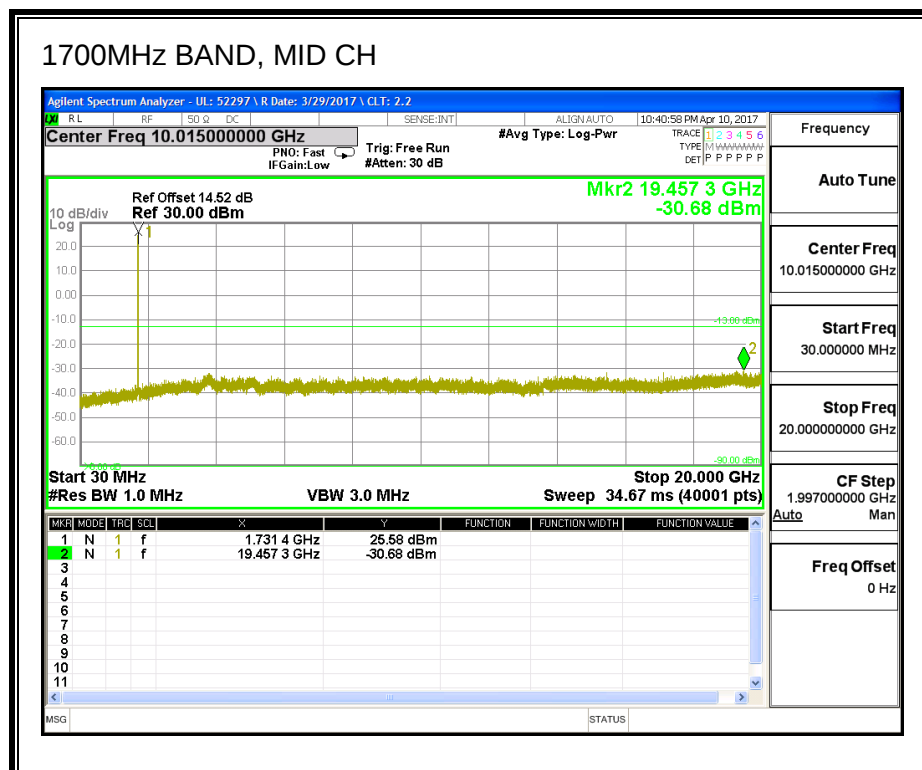
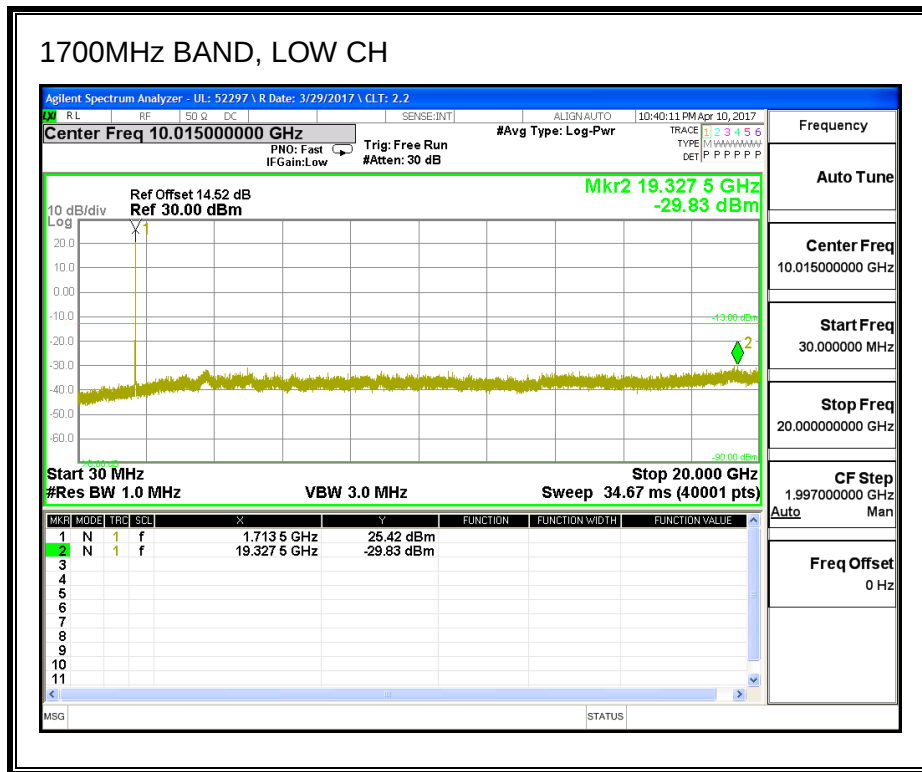


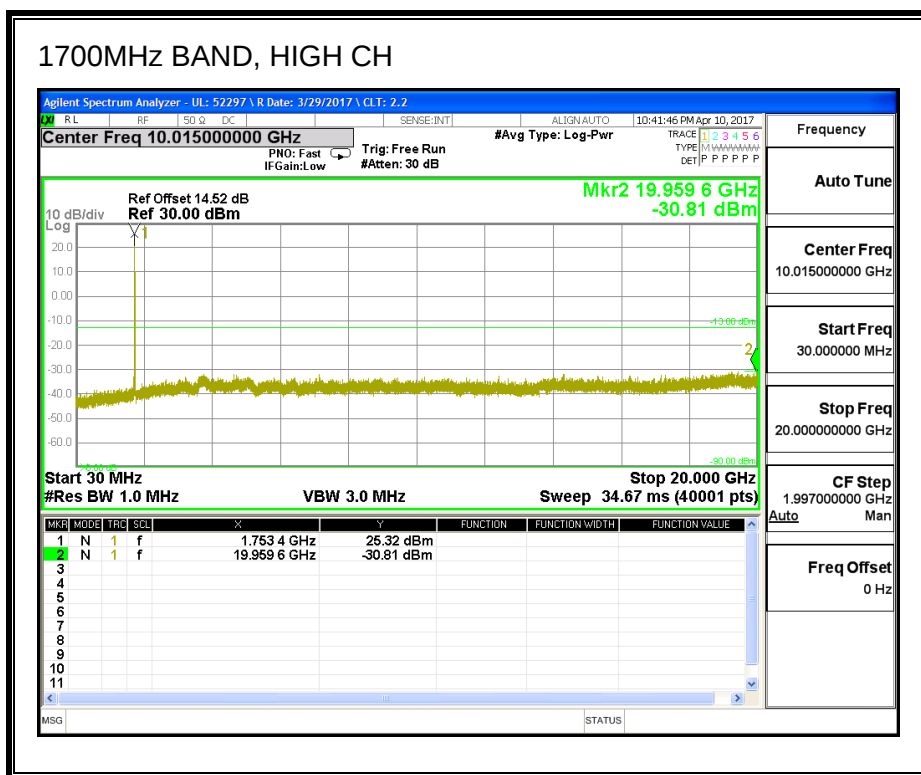
8.3.4. UMTS HSDPA











9. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54 and §90.213

IC: RSS132§5.3; RSS133§6.3 and RSS139§6.4

LIMITS

FCC §22.355

The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

FCC §24.235 & §27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

FCC §90.213

The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations

RSS132§5.3

The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 SRSP for mobile stations and ± 1.5 ppm for base stations.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS133§6.3

The carrier frequency shall not depart from the reference frequency, in excess of ± 2.5 ppm for mobile stations and ± 1.0 ppm for base stations.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS139§6.4

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = -30° to $+50^{\circ}\text{C}$
- Voltage = (85% - 115%)

Low voltage, 3.23VDC, Normal, 3.8VDC and High voltage, 4.37VDC.
End Voltage, 3.2VDC.

Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to 20°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until $+50^{\circ}\text{C}$ is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

RESULTS

See the following pages.

9.1. GSM

ID:	29446	Date:	4/20/17
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GPRS 850MHz

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	824.0195	848.9773		
Extreme (50C)		824.0195	848.9773	-17.8	-0.02
Extreme (40C)		824.0195	848.9773	-17.2	-0.02
Extreme (30C)		824.0195	848.9773	-18.9	-0.02
Extreme (10C)		824.0195	848.9773	-17.0	-0.02
Extreme (0C)		824.0195	848.9773	-20.3	-0.02
Extreme (-10C)		824.0195	848.9773	-19.1	-0.02
Extreme (-20C)		824.0195	848.9773	-17.5	-0.02
Extreme (-30C)		824.0195	848.9773	-17.7	-0.02
20C	15%	824.0195	848.9773	-17.6	-0.02
	-15%	824.0195	848.9773	-18.2	-0.02
	End Point	824.0195	848.9773	-17.3	-0.02

GPRS 1900MHz

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1850.0597	1909.9463		
Extreme (50C)		1850.0596	1909.9462	-29.9	-0.02
Extreme (40C)		1850.0596	1909.9462	-31.1	-0.02
Extreme (30C)		1850.0596	1909.9462	-31.4	-0.02
Extreme (10C)		1850.0596	1909.9462	-28.6	-0.02
Extreme (0C)		1850.0596	1909.9462	-28.7	-0.02
Extreme (-10C)		1850.0596	1909.9462	-28.6	-0.02
Extreme (-20C)		1850.0596	1909.9462	-29.5	-0.02
Extreme (-30C)		1850.0596	1909.9462	-28.4	-0.02
20C	15%	1850.0596	1909.9462	-33.5	-0.02
	-15%	1850.0596	1909.9462	-32.9	-0.02
	End Point	1850.0596	1909.9462	-31.0	-0.02

9.2. UMTS

ID:	29446	Date:	4/20/17
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UMTS REL99 BAND 5

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	824.0875	848.9125		
Extreme (50C)		824.0875	848.9125	4.2	0.01
Extreme (40C)		824.0875	848.9125	4.3	0.01
Extreme (30C)		824.0875	848.9125	5.6	0.01
Extreme (10C)		824.0875	848.9125	4.4	0.01
Extreme (0C)		824.0875	848.9125	5.4	0.01
Extreme (-10C)		824.0875	848.9125	6.4	0.01
Extreme (-20C)		824.0875	848.9125	4.4	0.01
Extreme (-30C)		824.0875	848.9125	5.1	0.01
20C	15%	824.0875	848.9125	5.0	0.01
	-15%	824.0875	848.9125	3.9	0.00
	End Point	824.0875	848.9125	4.1	0.00

UMTS REL99 BAND 2

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1850.0850	1909.9208		
Extreme (50C)		1850.0850	1909.9208	-16.5	-0.01
Extreme (40C)		1850.0850	1909.9208	-15.0	-0.01
Extreme (30C)		1850.0850	1909.9208	-15.2	-0.01
Extreme (10C)		1850.0850	1909.9208	-13.3	-0.01
Extreme (0C)		1850.0850	1909.9208	-15.0	-0.01
Extreme (-10C)		1850.0850	1909.9208	-16.2	-0.01
Extreme (-20C)		1850.0850	1909.9208	-14.0	-0.01
Extreme (-30C)		1850.0850	1909.9208	-15.5	-0.01
20C	15%	1850.0850	1909.9208	-12.5	-0.01
	-15%	1850.0850	1909.9208	-12.3	-0.01
	End Point	1850.0850	1909.9208	-12.0	-0.01

UMTS REL99 BAND 4

Limit		1710	1755	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1710.0825	1754.9225		
Extreme (50C)		1710.0825	1754.9225	-15.8	-0.01
Extreme (40C)		1710.0825	1754.9225	-15.7	-0.01
Extreme (30C)		1710.0825	1754.9225	-19.0	-0.01
Extreme (10C)		1710.0825	1754.9225	-14.3	-0.01
Extreme (0C)		1710.0825	1754.9225	-14.3	-0.01
Extreme (-10C)		1710.0825	1754.9225	-14.8	-0.01
Extreme (-20C)		1710.0825	1754.9225	-14.8	-0.01
Extreme (-30C)		1710.0825	1754.9225	-13.4	-0.01
20C	15%	1710.0825	1754.9225	-16.7	-0.01
	-15%	1710.0825	1754.9225	-15.9	-0.01
	End Point	1710.0825	1754.9225	-14.7	-0.01

10. PEAK-TO-AVERAGE RATIO

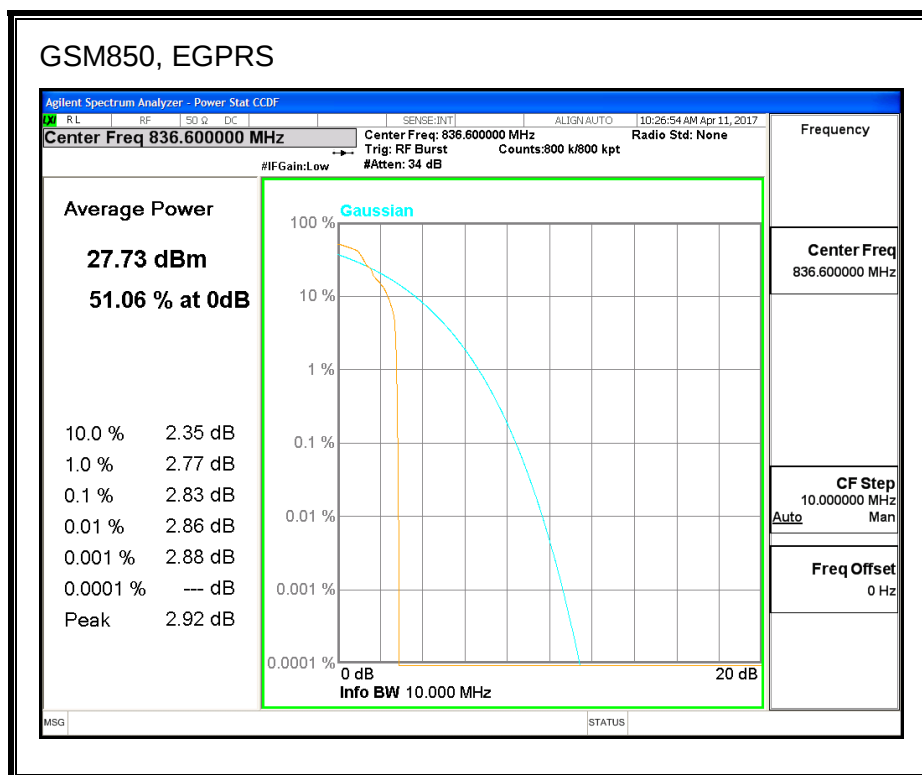
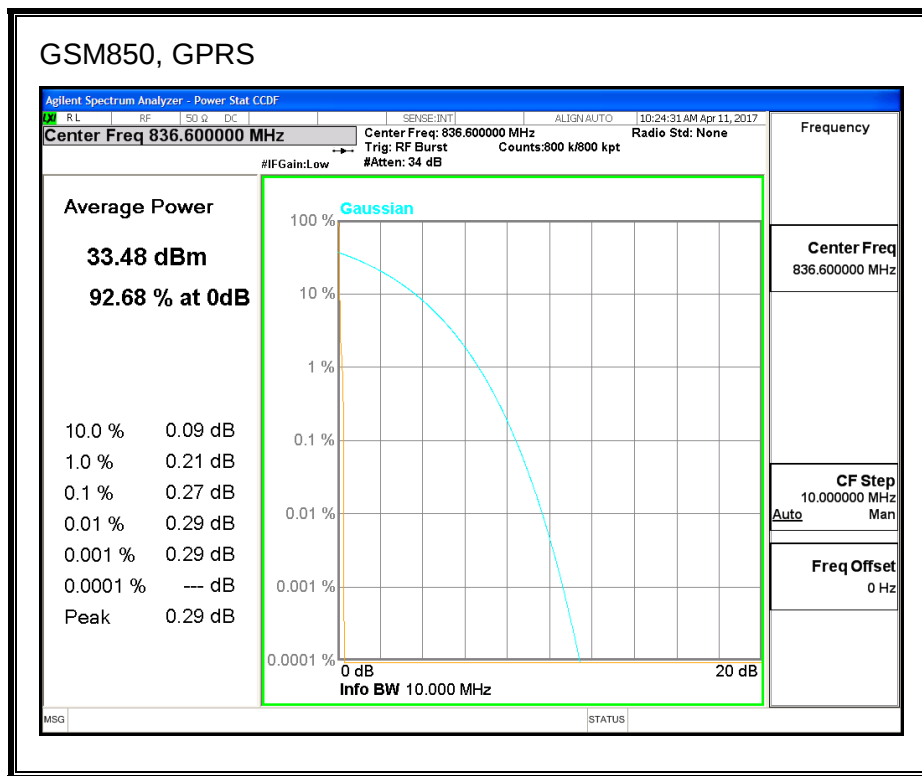
In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

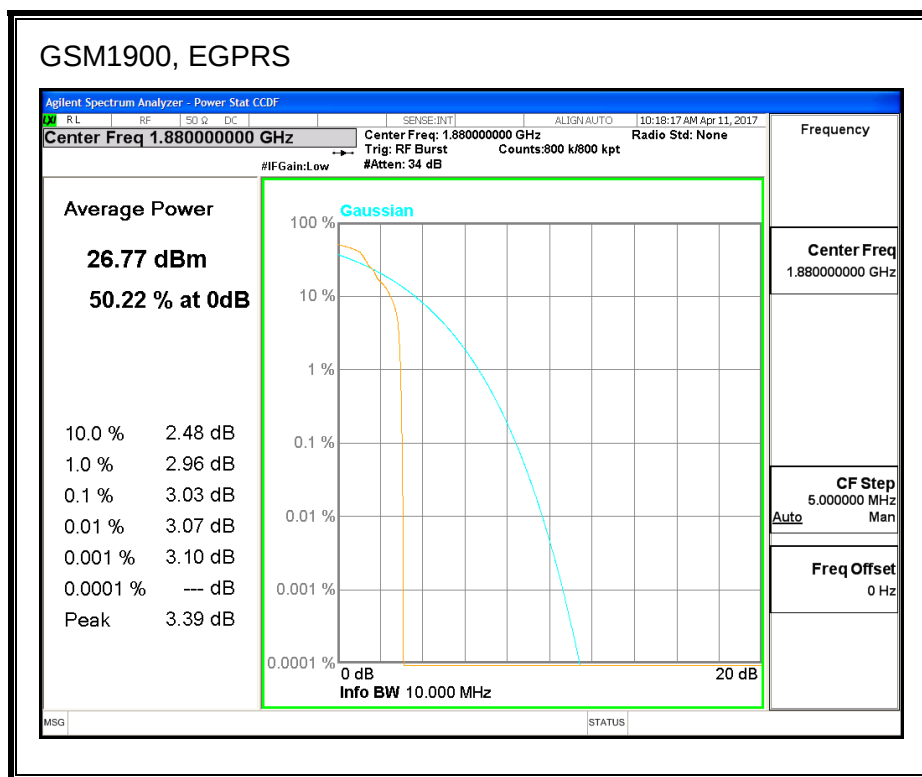
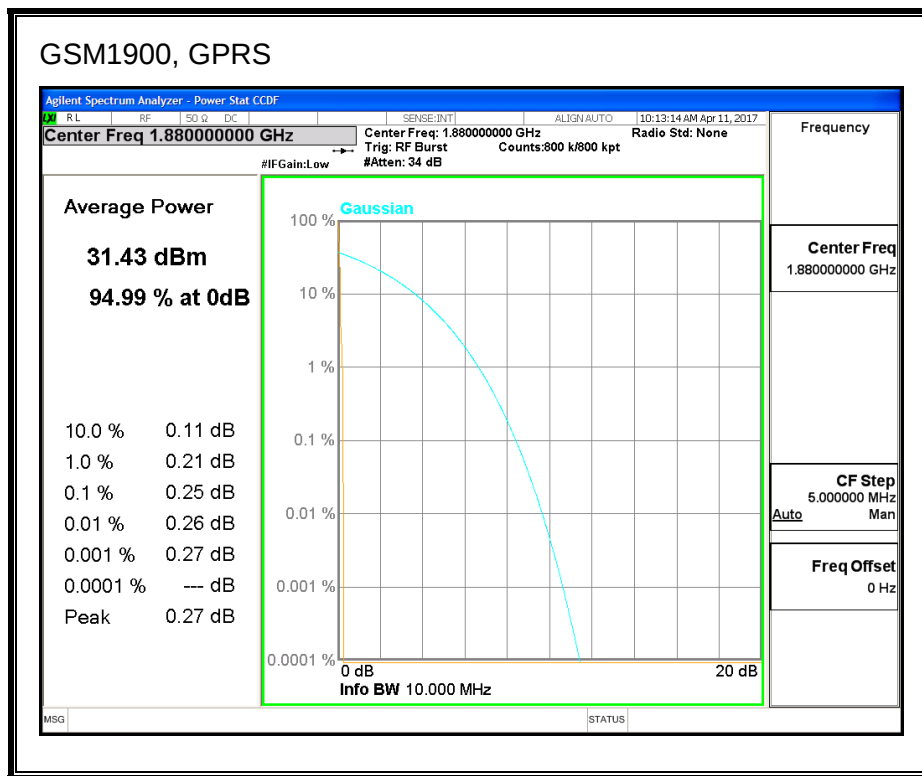
RESULT

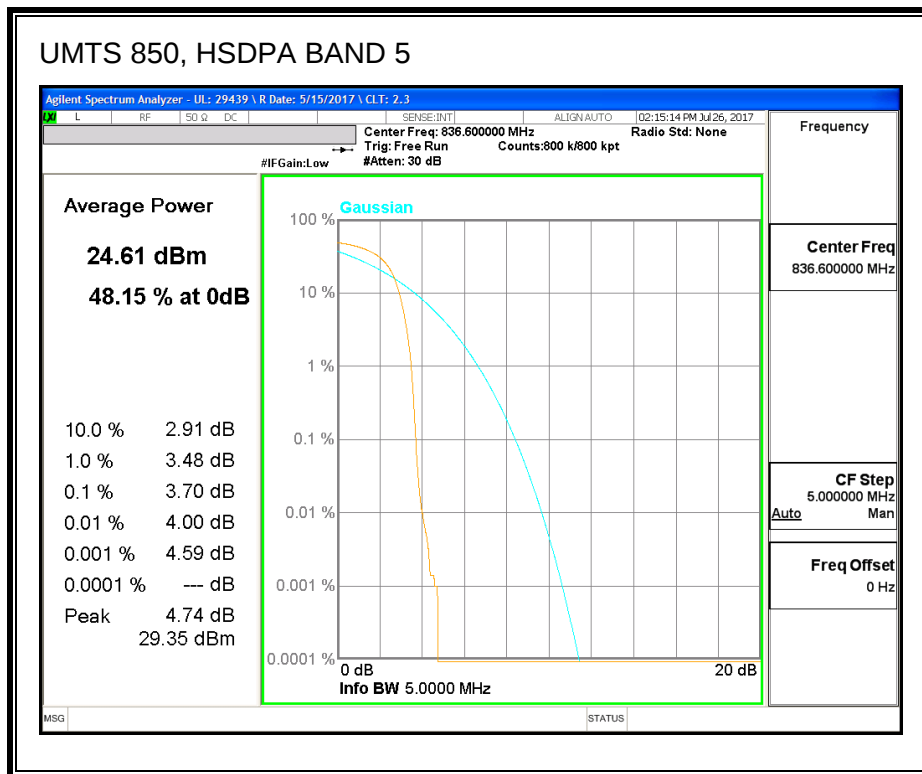
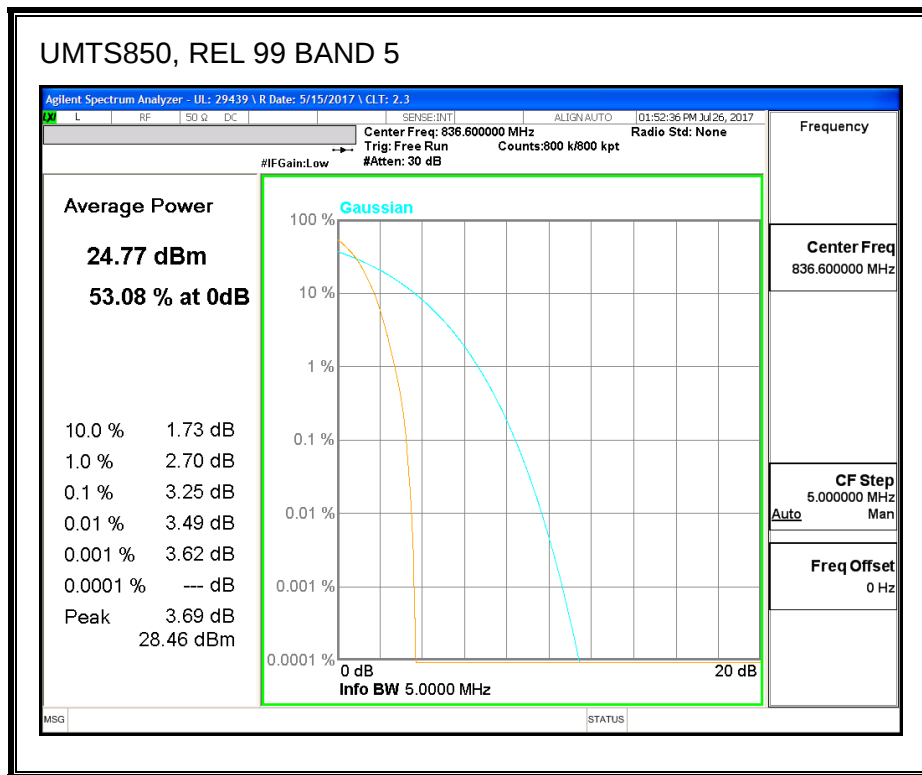
LAT 1 antenna was used to measure as the worst case. The results from all CCDF plots are passed with 13dB peak-to-average ratio criteria.

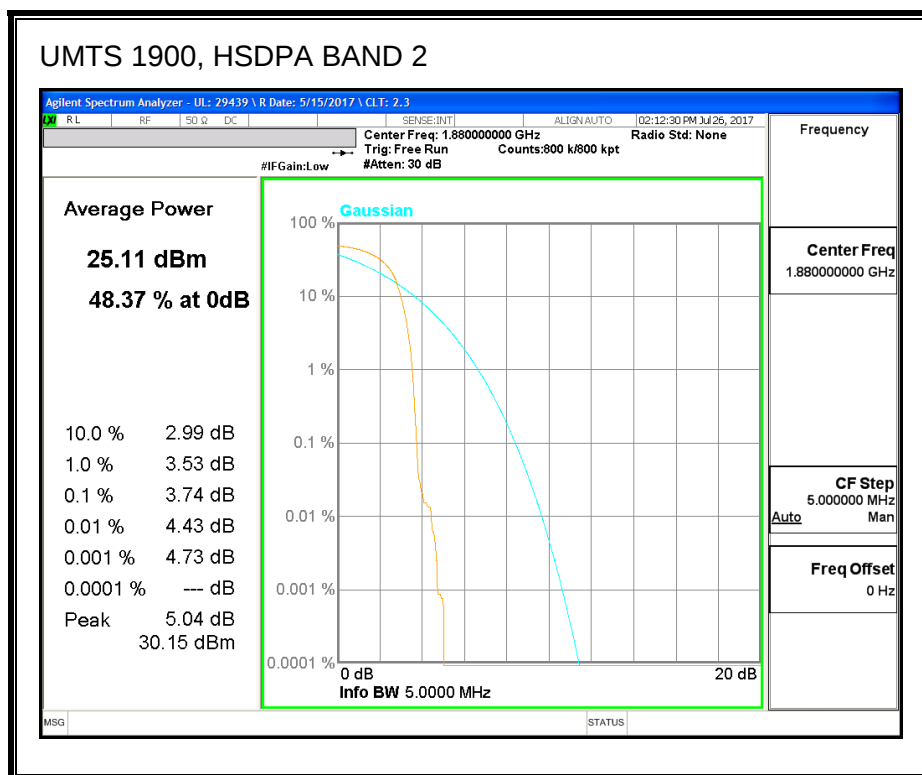
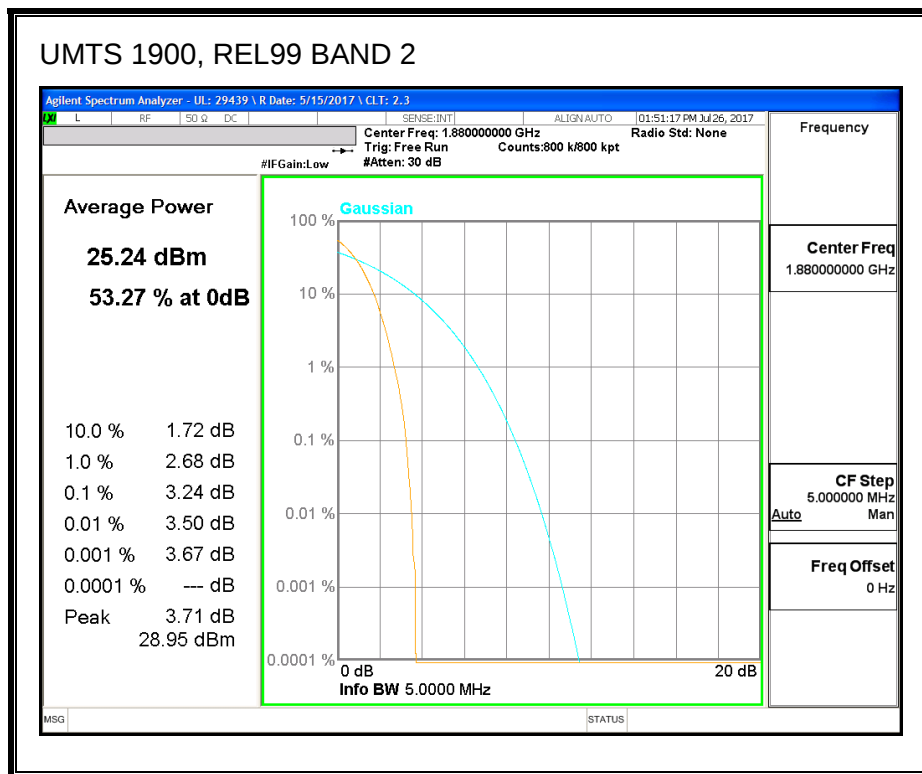
Mode	Modulation	Conducted Power (dBm)		Peak-to-Average Ratio
		*Peak	Average	
GSM850	GPRS	33.75	33.48	0.27
	EGPRS	30.56	27.73	2.83
GSM1900	GPRS	31.68	31.43	0.25
	EGPRS	29.80	26.77	3.03
*Peak Reading = Average Reading + Peak - to - Average Ratio				

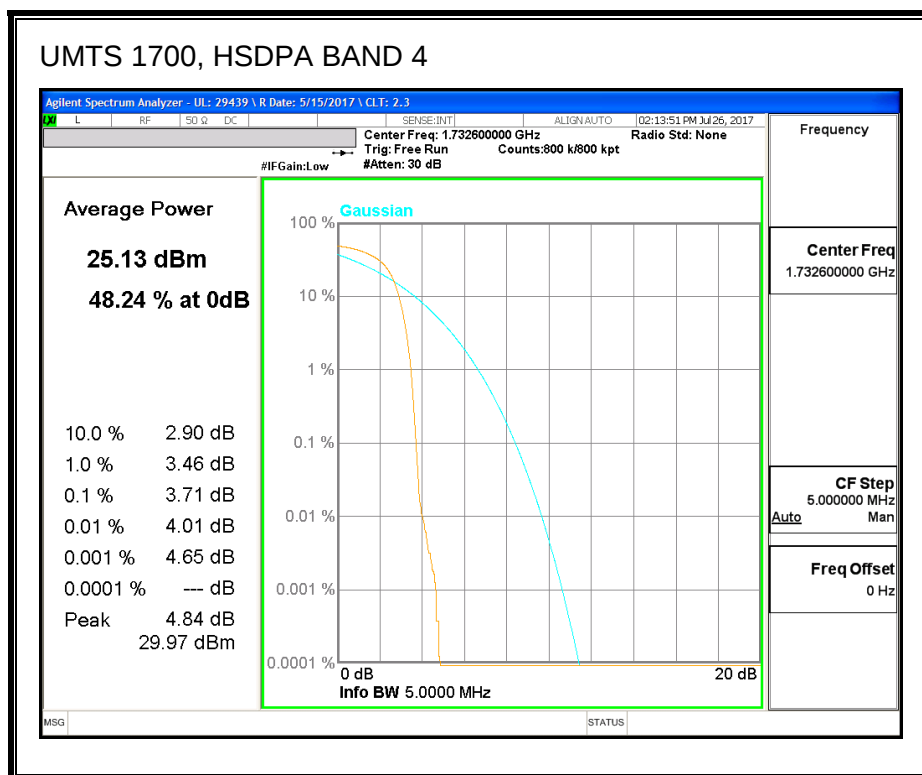
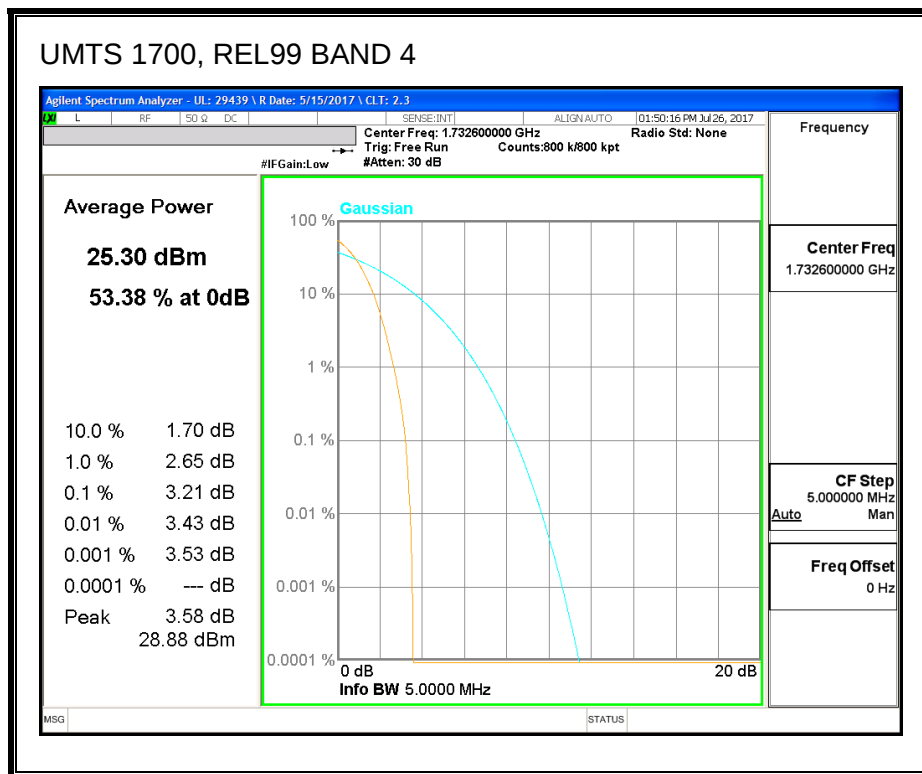
Mode	Modulation	Conducted Power (dBm)		Peak-to-Average Ratio
		*Peak	Average	
UMTS Band 5	REL99	28.02	24.77	3.25
	HSDPA	28.31	24.61	3.70
UMTS Band 2	REL99	28.48	25.24	3.24
	HSDPA	28.85	25.11	3.74
UMTS Band 4	REL99	28.51	25.30	3.21
	HSDPA	28.84	25.13	3.71
*Peak Reading = Average Reading + Peak - to - Average Ratio				











11. RADIATED TEST RESULTS

11.1. FIELD STRENGTH OF SPURIOUS RADIATION, LAT 1

RULE PART(S)

FCC: §2.1053, §22.917, §24.238, §27.53 and §90.691.

IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

LIMIT

FCC: §22.917, §24.238, §27.53

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.

FCC: §90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

RSS132§5.5

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

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).

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.

RSS133§6.5

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.

RSS139§6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, Footnote 2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). 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.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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.

MODES TESTED

- GPRS/EGPRS
- UMTS, REL 99 and HSDPA

RESULTS

11.1.1. GSM

GPRS, 850MHz

High Frequency Substitution Measurement UL Fremont Radiated Chamber											
Company: Project #: Date: 04/07/17 Test Engineer: 44353 Configuration: EUT only Mode: GPRS 850MHz											
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable											
Chamber 3m Chamber D		Pre-amplifier 3m Chamber D		Filter Filter		Limit EIRP					
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes	
Low Channel (824.2MHz)											
1.65	-67.4	H	3.0	-25.6	35.0	1.0	-59.6	-13.0	-46.6		
2.47	-65.0	H	3.0	-20.9	33.9	1.0	-53.8	-13.0	-40.8		
3.30	-66.7	H	3.0	-19.9	33.2	1.0	-52.1	-13.0	-39.1		
1.65	-66.9	V	3.0	-24.9	35.0	1.0	-58.9	-13.0	-45.9		
2.47	-66.0	V	3.0	-21.6	33.9	1.0	-54.6	-13.0	-41.6		
3.30	-65.7	V	3.0	-18.8	33.2	1.0	-51.0	-13.0	-38.0		
Mid Channel (836.6MHz)											
1.67	-66.3	H	3.0	-24.4	35.0	1.0	-58.5	-13.0	-45.5		
2.51	-66.6	H	3.0	-22.3	33.7	1.0	-55.1	-13.0	-42.1		
3.35	-64.7	H	3.0	-17.8	33.3	1.0	-50.1	-13.0	-37.1		
1.67	-64.5	V	3.0	-22.4	35.0	1.0	-56.5	-13.0	-43.5		
2.51	-65.9	V	3.0	-21.4	33.7	1.0	-54.1	-13.0	-41.1		
3.35	-64.2	V	3.0	-17.2	33.3	1.0	-49.5	-13.0	-36.5		
High Channel (848.8MHz)											
1.70	-66.9	H	3.0	-25.0	35.0	1.0	-59.0	-13.0	-46.0		
2.55	-65.9	H	3.0	-21.5	33.7	1.0	-54.2	-13.0	-41.2		
3.40	-65.7	H	3.0	-18.6	33.3	1.0	-50.9	-13.0	-37.9		
1.70	-67.5	V	3.0	-25.4	35.0	1.0	-59.4	-13.0	-46.4		
2.55	-65.3	V	3.0	-20.6	33.7	1.0	-53.3	-13.0	-40.3		
3.40	-63.7	V	3.0	-16.6	33.3	1.0	-48.9	-13.0	-35.9		
Rev. 03.19.15											

EGPRS, 850MHz

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/11/17 Test Engineer: 30606 Configuration: EUT only Mode: EGPRS 850MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (824.2MHz)										
1.65	-68.54	H	3.0	-26.8	35.0	1.0	-60.8	-13.0	-47.8	
2.47	-66.96	H	3.0	-22.9	33.9	1.0	-55.8	-13.0	-42.8	
3.30	-66.88	H	3.0	-20.1	33.2	1.0	-52.3	-13.0	-39.3	
1.65	-68.43	V	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4	
2.47	-67.84	V	3.0	-23.5	33.9	1.0	-56.4	-13.0	-43.4	
3.30	-66.91	V	3.0	-20.0	33.2	1.0	-52.3	-13.0	-39.3	
Mid Channel (836.6MHz)										
1.67	-68.7	H	3.0	-26.8	35.0	1.0	-60.8	-13.0	-47.8	
2.51	-67.0	H	3.0	-22.7	33.7	1.0	-55.4	-13.0	-42.4	
3.35	-67.3	H	3.0	-20.4	33.3	1.0	-52.7	-13.0	-39.7	
1.67	-69.0	V	3.0	-27.0	35.0	1.0	-61.0	-13.0	-48.0	
2.51	-67.7	V	3.0	-23.3	33.7	1.0	-56.0	-13.0	-43.0	
3.35	-66.5	V	3.0	-19.5	33.3	1.0	-51.8	-13.0	-38.8	
High Channel (848.8MHz)										
1.70	-68.8	H	3.0	-26.8	35.0	1.0	-60.9	-13.0	-47.9	
2.55	-66.7	H	3.0	-22.3	33.7	1.0	-55.0	-13.0	-42.0	
3.40	-67.0	H	3.0	-20.0	33.3	1.0	-52.3	-13.0	-39.3	
1.70	-69.2	V	3.0	-27.1	35.0	1.0	-61.1	-13.0	-48.1	
2.55	-67.9	V	3.0	-23.3	33.7	1.0	-55.9	-13.0	-42.9	
3.40	-66.8	V	3.0	-19.7	33.3	1.0	-52.0	-13.0	-39.0	
Rev. 03.19.15										

GPRS, 1900MHz

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/08/17 Test Engineer: 30568 Configuration: EUT only Mode: GPRS 1900MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1850.2MHz)										
3.70	-62.2	H	3.0	-14.3	33.5	1.0	-46.8	-13.0	-33.8	
5.55	-64.3	H	3.0	-13.1	32.5	1.0	-44.5	-13.0	-31.5	
7.40	-65.4	H	3.0	-11.0	30.4	1.0	-40.4	-13.0	-27.4	
3.70	-63.2	V	3.0	-15.3	33.5	1.0	-47.8	-13.0	-34.8	
5.55	-64.3	V	3.0	-13.3	32.5	1.0	-44.8	-13.0	-31.8	
7.40	-65.6	V	3.0	-11.0	30.4	1.0	-40.4	-13.0	-27.4	
Mid Channel (1880.0)										
3.76	-62.5	H	3.0	-14.3	33.5	1.0	-46.9	-13.0	-33.9	
5.64	-65.3	H	3.0	-13.8	32.4	1.0	-45.2	-13.0	-32.2	
7.52	-66.3	H	3.0	-11.8	30.3	1.0	-41.0	-13.0	-28.0	
3.76	-62.5	V	3.0	-14.4	33.5	1.0	-46.9	-13.0	-33.9	
5.64	-65.1	V	3.0	-13.8	32.4	1.0	-45.2	-13.0	-32.2	
7.52	-66.2	V	3.0	-11.6	30.3	1.0	-40.8	-13.0	-27.8	
High Channel (1909.8MHz)										
3.82	-63.4	H	3.0	-15.1	33.6	1.0	-47.7	-13.0	-34.7	
5.73	-65.1	H	3.0	-13.4	32.3	1.0	-44.7	-13.0	-31.7	
7.54	-65.7	H	3.0	-11.2	30.2	1.0	-40.5	-13.0	-27.5	
3.82	-63.3	V	3.0	-15.1	33.6	1.0	-47.6	-13.0	-34.6	
5.73	-65.2	V	3.0	-13.8	32.3	1.0	-45.0	-13.0	-32.0	
7.54	-65.7	V	3.0	-11.0	30.2	1.0	-40.2	-13.0	-27.2	
Rev. 03.19.15										

EGPRS, 1900MHz

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/08/17 Test Engineer: 30568 Configuration: EUT only Mode: EGPRS 1900MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1850.2MHz)										
3.70	-62.5	H	3.0	-14.6	33.5	1.0	-47.1	-13.0	-34.1	
5.55	-64.0	H	3.0	-12.7	32.5	1.0	-44.2	-13.0	-31.2	
7.40	-65.3	H	3.0	-11.0	30.4	1.0	-40.4	-13.0	-27.4	
3.70	-62.6	V	3.0	-14.7	33.5	1.0	-47.2	-13.0	-34.2	
5.55	-63.9	V	3.0	-12.9	32.5	1.0	-44.3	-13.0	-31.3	
7.40	-66.5	V	3.0	-12.0	30.4	1.0	-41.4	-13.0	-28.4	
Mid Channel (1880.0)										
3.76	-61.4	H	3.0	-13.3	33.5	1.0	-45.8	-13.0	-32.8	
5.64	-63.6	H	3.0	-12.1	32.4	1.0	-43.5	-13.0	-30.5	
7.52	-67.0	H	3.0	-12.5	30.3	1.0	-41.8	-13.0	-28.8	
3.76	-61.9	V	3.0	-13.8	33.5	1.0	-46.4	-13.0	-33.4	
5.64	-63.7	V	3.0	-12.4	32.4	1.0	-43.8	-13.0	-30.8	
7.52	-66.0	V	3.0	-11.3	30.3	1.0	-40.6	-13.0	-27.6	
High Channel (1909.8MHz)										
3.82	-62.0	H	3.0	-13.7	33.6	1.0	-46.3	-13.0	-33.3	
5.73	-63.8	H	3.0	-12.2	32.3	1.0	-43.5	-13.0	-30.5	
7.54	-68.0	H	3.0	-13.5	30.2	1.0	-42.7	-13.0	-29.7	
3.82	-61.7	V	3.0	-13.5	33.6	1.0	-46.1	-13.0	-33.1	
5.73	-63.1	V	3.0	-11.7	32.3	1.0	-43.0	-13.0	-30.0	
7.54	-66.7	V	3.0	-12.0	30.2	1.0	-41.3	-13.0	-28.3	
Rev. 03.19.15										

11.1.2. UMTS

UMTS REL 99, 850MHz BAND 5

High Frequency Substitution Measurement UL Fremont Radiated Chamber											
Company: Project #: Date: 04/11/17 Test Engineer: 30606 Configuration: EUT Only Mode: REL 99, 850MHz											
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable											
Chamber		Pre-amplifier		Filter		Limit					
3m Chamber D		3m Chamber D		Filter		EIRP					
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes	
Low Channel (826.4MHz)											
1.65	-68.2	H	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4		
2.48	-67.3	H	3.0	-23.1	33.9	1.0	-56.0	-13.0	-43.0		
3.31	-67.2	H	3.0	-20.4	33.2	1.0	-52.6	-13.0	-39.6		
1.65	-68.4	V	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4		
2.48	-67.1	V	3.0	-22.7	33.9	1.0	-55.6	-13.0	-42.6		
3.31	-67.5	V	3.0	-20.6	33.2	1.0	-52.8	-13.0	-39.8		
Mid Channel (836.6MHz)											
1.67	-68.4	H	3.0	-26.6	35.0	1.0	-60.6	-13.0	-47.6		
2.51	-68.0	H	3.0	-23.7	33.7	1.0	-56.5	-13.0	-43.5		
3.35	-66.7	H	3.0	-19.8	33.3	1.0	-52.0	-13.0	-39.0		
1.67	-68.4	V	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4		
2.51	-66.8	V	3.0	-22.3	33.7	1.0	-55.0	-13.0	-42.0		
3.35	-65.8	V	3.0	-18.8	33.3	1.0	-51.0	-13.0	-38.0		
High Channel (846.6MHz)											
1.69	-68.2	H	3.0	-26.3	35.0	1.0	-60.3	-13.0	-47.3		
2.54	-67.8	H	3.0	-23.4	33.7	1.0	-56.1	-13.0	-43.1		
3.39	-66.5	H	3.0	-19.5	33.3	1.0	-51.8	-13.0	-38.8		
1.69	-67.8	V	3.0	-25.7	35.0	1.0	-59.7	-13.0	-46.7		
2.54	-67.0	V	3.0	-22.4	33.7	1.0	-55.1	-13.0	-42.1		
3.39	-67.2	V	3.0	-20.1	33.3	1.0	-52.4	-13.0	-39.4		
Rev. 03.19.15											

UMTS HSDPA, 850MHz BAND 5

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/12/17 Test Engineer: 30606 Configuration: EUT Only Mode: HSDPA, 850MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (826.4MHz)										
1.65	-69.2	H	3.0	-27.4	35.0	1.0	-61.4	-13.0	-48.4	
2.48	-66.6	H	3.0	-22.4	33.9	1.0	-55.3	-13.0	-42.3	
3.31	-67.5	H	3.0	-20.7	33.2	1.0	-52.9	-13.0	-39.9	
1.65	-68.4	V	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4	
2.48	-67.5	V	3.0	-23.1	33.9	1.0	-56.0	-13.0	-43.0	
3.31	-67.5	V	3.0	-20.6	33.2	1.0	-52.8	-13.0	-39.8	
Mid Channel (836.6MHz)										
1.67	-68.4	H	3.0	-26.6	35.0	1.0	-60.6	-13.0	-47.6	
2.51	-68.0	H	3.0	-23.7	33.7	1.0	-56.5	-13.0	-43.5	
3.35	-66.9	H	3.0	-20.0	33.3	1.0	-52.2	-13.0	-39.2	
1.67	-68.4	V	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4	
2.51	-67.8	V	3.0	-23.3	33.7	1.0	-56.0	-13.0	-43.0	
3.35	-66.8	V	3.0	-19.8	33.3	1.0	-52.0	-13.0	-39.0	
High Channel (846.6MHz)										
1.69	-68.8	H	3.0	-26.9	35.0	1.0	-60.9	-13.0	-47.9	
2.54	-68.8	H	3.0	-24.4	33.7	1.0	-57.1	-13.0	-44.1	
3.39	-67.5	H	3.0	-20.5	33.3	1.0	-52.8	-13.0	-39.8	
1.69	-69.2	V	3.0	-27.1	35.0	1.0	-61.1	-13.0	-48.1	
2.54	-68.0	V	3.0	-23.4	33.7	1.0	-56.1	-13.0	-43.1	
3.39	-67.2	V	3.0	-20.1	33.3	1.0	-52.4	-13.0	-39.4	
Rev. 03.19.15										

UMTS REL 99, 1900MHz BAND 2

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/08/17 Test Engineer: 30568 Configuration: EUT Only Mode: REL 99, 1900MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1852.4MHz)										
3.70	-65.0	H	3.0	-17.0	33.5	1.0	-49.5	-13.0	-36.5	
5.56	-67.6	H	3.0	-16.3	32.5	1.0	-47.8	-13.0	-34.8	
7.41	-68.3	H	3.0	-14.0	30.4	1.0	-43.4	-13.0	-30.4	
3.70	-63.5	V	3.0	-15.5	33.5	1.0	-48.0	-13.0	-35.0	
5.55	-66.2	V	3.0	-15.2	32.5	1.0	-46.6	-13.0	-33.6	
7.42	-67.8	V	3.0	-13.2	30.4	1.0	-42.6	-13.0	-29.6	
Mid Channel (1880MHz)										
3.76	-63.9	H	3.0	-15.8	33.5	1.0	-48.3	-13.0	-35.3	
5.64	-67.7	H	3.0	-16.3	32.4	1.0	-47.6	-13.0	-34.6	
7.52	-67.9	H	3.0	-13.4	30.3	1.0	-42.7	-13.0	-29.7	
3.76	-65.2	V	3.0	-17.1	33.5	1.0	-49.6	-13.0	-36.6	
5.64	-66.3	V	3.0	-15.0	32.4	1.0	-46.4	-13.0	-33.4	
7.52	-67.9	V	3.0	-13.2	30.3	1.0	-42.5	-13.0	-29.5	
High Channel (1907.6MHz)										
3.81	-64.4	H	3.0	-16.1	33.6	1.0	-48.7	-13.0	-35.7	
5.72	-67.3	H	3.0	-15.7	32.3	1.0	-47.0	-13.0	-34.0	
7.66	-67.7	H	3.0	-13.0	30.1	1.0	-42.1	-13.0	-29.1	
3.82	-63.9	V	3.0	-15.6	33.6	1.0	-48.2	-13.0	-35.2	
5.72	-66.6	V	3.0	-15.2	32.3	1.0	-46.5	-13.0	-33.5	
7.63	-67.1	V	3.0	-12.3	30.1	1.0	-41.5	-13.0	-28.5	
Rev. 03.19.15										

UMTS HSDPA, 1900MHz BAND 2

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/08/17 Test Engineer: 30568 Configuration: EUT Only Mode: HSDPA 1900MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1852.4MHz)										
3.70	-62.9	H	3.0	-15.0	33.5	1.0	-47.5	-13.0	-34.5	
5.56	-64.8	H	3.0	-13.5	32.5	1.0	-44.9	-13.0	-31.9	
7.41	-66.0	H	3.0	-11.6	30.4	1.0	-41.0	-13.0	-28.0	
3.70	-62.3	V	3.0	-14.4	33.5	1.0	-46.9	-13.0	-33.9	
5.56	-63.9	V	3.0	-12.9	32.5	1.0	-44.4	-13.0	-31.4	
7.41	-67.3	V	3.0	-12.7	30.4	1.0	-42.1	-13.0	-29.1	
Mid Channel (1880MHz)										
3.76	-63.2	H	3.0	-15.1	33.5	1.0	-47.6	-13.0	-34.6	
5.64	-64.7	H	3.0	-13.3	32.4	1.0	-44.7	-13.0	-31.7	
7.52	-66.3	H	3.0	-11.8	30.3	1.0	-41.1	-13.0	-28.1	
3.76	-62.5	V	3.0	-14.4	33.5	1.0	-47.0	-13.0	-34.0	
5.64	-64.8	V	3.0	-13.5	32.4	1.0	-44.9	-13.0	-31.9	
7.52	-67.0	V	3.0	-12.3	30.3	1.0	-41.6	-13.0	-28.6	
High Channel (1907.6MHz)										
3.82	-63.3	H	3.0	-15.0	33.6	1.0	-47.6	-13.0	-34.6	
5.72	-64.2	H	3.0	-12.6	32.3	1.0	-43.9	-13.0	-30.9	
7.63	-67.2	H	3.0	-12.6	30.1	1.0	-41.7	-13.0	-28.7	
3.82	-62.9	V	3.0	-14.6	33.6	1.0	-47.2	-13.0	-34.2	
5.72	-64.8	V	3.0	-13.4	32.3	1.0	-44.7	-13.0	-31.7	
7.63	-67.5	V	3.0	-12.7	30.1	1.0	-41.9	-13.0	-28.9	
Rev. 03.19.15										

UMTS REL 99, 1700MHz BAND 4

High Frequency Substitution Measurement UL Fremont Radiated Chamber											
Company: Project #: Date: 04/08/17 Test Engineer: 30568 Configuration: EUT Only Mode: REL 99, 1700MHz											
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable											
Chamber		Pre-amplifier		Filter		Limit					
3m Chamber D		3m Chamber D		Filter		EIRP					
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes	
Low Channel (1712.4MHz)											
3.42	-64.5	H	3.0	-17.3	33.3	1.0	-49.6	-13.0	-36.6		
5.14	-63.2	H	3.0	-12.7	32.9	1.0	-44.6	-13.0	-31.6		
6.85	-65.5	H	3.0	-11.9	31.1	1.0	-42.0	-13.0	-29.0		
3.42	-65.2	V	3.0	-18.0	33.3	1.0	-50.3	-13.0	-37.3		
5.14	-64.1	V	3.0	-13.9	32.9	1.0	-45.8	-13.0	-32.8		
6.85	-66.2	V	3.0	-12.4	31.1	1.0	-42.4	-13.0	-29.4		
Mid Channel (1732.6MHz)											
3.47	-65.8	H	3.0	-18.5	33.3	1.0	-50.9	-13.0	-37.9		
5.20	-65.3	H	3.0	-14.6	32.9	1.0	-46.5	-13.0	-33.5		
6.93	-64.8	H	3.0	-11.1	31.0	1.0	-41.1	-13.0	-28.1		
3.47	-64.6	V	3.0	-17.2	33.3	1.0	-49.6	-13.0	-36.6		
5.20	-64.6	V	3.0	-14.4	32.9	1.0	-46.2	-13.0	-33.2		
6.93	-65.5	V	3.0	-11.5	31.0	1.0	-41.4	-13.0	-28.4		
High Channel (1752.6MHz)											
3.51	-64.7	H	3.0	-17.3	33.4	1.0	-49.7	-13.0	-36.7		
5.26	-65.0	H	3.0	-14.2	32.8	1.0	-46.0	-13.0	-33.0		
7.01	-64.9	H	3.0	-11.1	30.9	1.0	-41.0	-13.0	-28.0		
3.51	-64.8	V	3.0	-17.4	33.4	1.0	-49.7	-13.0	-36.7		
5.26	-65.1	V	3.0	-14.7	32.8	1.0	-46.5	-13.0	-33.5		
7.01	-65.3	V	3.0	-11.1	30.9	1.0	-41.0	-13.0	-28.0		
Rev. 03.19.15											

UMTS HSDPA, 1700MHz BAND 4

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/08/17 Test Engineer: 30568 Configuration: EUT Only Mode: HSDPA 1700MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1712.4MHz)										
3.42	-64.5	H	3.0	-17.4	33.3	1.0	-49.7	-13.0	-36.7	
5.14	-63.8	H	3.0	-13.2	32.9	1.0	-45.1	-13.0	-32.1	
6.85	-68.5	H	3.0	-14.9	31.1	1.0	-45.0	-13.0	-32.0	
3.42	-65.2	V	3.0	-18.0	33.3	1.0	-50.3	-13.0	-37.3	
5.14	-67.0	V	3.0	-16.8	32.9	1.0	-48.7	-13.0	-35.7	
6.85	-69.0	V	3.0	-15.2	31.1	1.0	-45.2	-13.0	-32.2	
Mid Channel (1732.6MHz)										
3.47	-65.3	H	3.0	-18.0	33.3	1.0	-50.3	-13.0	-37.3	
5.20	-64.8	H	3.0	-14.1	32.9	1.0	-45.9	-13.0	-32.9	
6.93	-68.8	H	3.0	-15.1	31.0	1.0	-45.0	-13.0	-32.0	
3.47	-64.4	V	3.0	-17.1	33.3	1.0	-49.4	-13.0	-36.4	
5.20	-64.7	V	3.0	-14.4	32.9	1.0	-46.3	-13.0	-33.3	
6.93	-68.6	V	3.0	-14.6	31.0	1.0	-44.5	-13.0	-31.5	
High Channel (1752.6MHz)										
3.51	-65.0	H	3.0	-17.6	33.4	1.0	-49.9	-13.0	-36.9	
5.26	-65.6	H	3.0	-14.9	32.8	1.0	-46.7	-13.0	-33.7	
7.01	-69.0	H	3.0	-15.1	30.9	1.0	-45.0	-13.0	-32.0	
3.51	-64.6	V	3.0	-17.1	33.4	1.0	-49.5	-13.0	-36.5	
5.26	-65.2	V	3.0	-14.8	32.8	1.0	-46.6	-13.0	-33.6	
7.01	-69.0	V	3.0	-14.8	30.9	1.0	-44.7	-13.0	-31.7	
Rev. 03.19.15										

11.2. FIELD STRENGTH OF SPURIOUS RADIATION, UAT 1

11.2.1. GSM

GPRS, 850MHz

High Frequency Substitution Measurement UL Fremont Radiated Chamber											
Company: Project #: Date: 04/11/17 Test Engineer: 30606 Configuration: EUT only Mode: GPRS 850MHz											
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable											
Chamber		Pre-amplifier		Filter		Limit					
3m Chamber D		3m Chamber D		Filter		EIRP					
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes	
Low Channel (824.2MHz)											
1.65	-68.2	H	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4		
2.47	-68.2	H	3.0	-24.1	33.9	1.0	-57.0	-13.0	-44.0		
3.30	-67.6	H	3.0	-20.8	33.2	1.0	-53.1	-13.0	-40.1		
1.65	-68.4	V	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4		
2.47	-67.9	V	3.0	-23.6	33.9	1.0	-56.5	-13.0	-43.5		
3.30	-65.8	V	3.0	-18.9	33.2	1.0	-51.2	-13.0	-38.2		
Mid Channel (836.6MHz)											
1.67	-67.5	H	3.0	-25.6	35.0	1.0	-59.6	-13.0	-46.6		
2.51	-66.3	H	3.0	-22.0	33.7	1.0	-54.7	-13.0	-41.7		
3.35	-65.2	H	3.0	-18.3	33.3	1.0	-50.5	-13.0	-37.5		
1.67	-68.5	V	3.0	-26.5	35.0	1.0	-60.5	-13.0	-47.5		
2.51	-67.9	V	3.0	-23.4	33.7	1.0	-56.1	-13.0	-43.1		
3.35	-66.5	V	3.0	-19.5	33.3	1.0	-51.7	-13.0	-38.7		
High Channel (848.8MHz)											
1.70	-68.3	H	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4		
2.55	-67.3	H	3.0	-22.9	33.7	1.0	-55.5	-13.0	-42.5		
3.40	-66.9	H	3.0	-19.9	33.3	1.0	-52.2	-13.0	-39.2		
1.70	-69.3	V	3.0	-27.2	35.0	1.0	-61.2	-13.0	-48.2		
2.55	-68.0	V	3.0	-23.4	33.7	1.0	-56.0	-13.0	-43.0		
3.40	-67.3	V	3.0	-20.1	33.3	1.0	-52.4	-13.0	-39.4		
Rev. 03.19.15											

EGPRS, 850MHz

High Frequency Substitution Measurement UL Fremont Radiated Chamber										
Company: Project #: Date: 04/11/17 Test Engineer: 30606 Configuration: EUT only Mode: EGPRS 850MHz										
Test Equipment: Substitution: Horn T59 Substitution, and 8ft SMA Cable										
Chamber		Pre-amplifier		Filter		Limit				
3m Chamber D		3m Chamber D		Filter		EIRP				
Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (824.2MHz)										
1.65	-69.0	H	3.0	-27.2	35.0	1.0	-61.2	-13.0	-48.2	
2.47	-67.2	H	3.0	-23.1	33.9	1.0	-56.0	-13.0	-43.0	
3.30	-67.3	H	3.0	-20.5	33.2	1.0	-52.7	-13.0	-39.7	
1.65	-68.9	V	3.0	-26.9	35.0	1.0	-60.9	-13.0	-47.9	
2.47	-68.3	V	3.0	-24.0	33.9	1.0	-56.9	-13.0	-43.9	
3.30	-66.2	V	3.0	-19.3	33.2	1.0	-51.6	-13.0	-38.6	
Mid Channel (836.6MHz)										
1.67	-68.8	H	3.0	-27.0	35.0	1.0	-61.0	-13.0	-48.0	
2.51	-67.1	H	3.0	-22.8	33.7	1.0	-55.5	-13.0	-42.5	
3.35	-65.2	H	3.0	-18.3	33.3	1.0	-50.6	-13.0	-37.6	
1.67	-68.5	V	3.0	-26.5	35.0	1.0	-60.5	-13.0	-47.5	
2.51	-67.3	V	3.0	-22.8	33.7	1.0	-55.6	-13.0	-42.6	
3.35	-66.0	V	3.0	-19.0	33.3	1.0	-51.2	-13.0	-38.2	
High Channel (848.8MHz)										
1.70	-68.6	H	3.0	-26.6	35.0	1.0	-60.7	-13.0	-47.7	
2.55	-68.2	H	3.0	-23.7	33.7	1.0	-56.4	-13.0	-43.4	
3.40	-67.0	H	3.0	-19.9	33.3	1.0	-52.2	-13.0	-39.2	
1.70	-69.1	V	3.0	-27.0	35.0	1.0	-61.0	-13.0	-48.0	
2.55	-67.5	V	3.0	-22.9	33.7	1.0	-55.5	-13.0	-42.5	
3.40	-66.4	V	3.0	-19.3	33.3	1.0	-51.5	-13.0	-38.5	
Rev. 03.19.15										

GPRS, 1900MHz

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:

Project #:

Date: 04/10/17

Test Engineer: 44353

Configuration: EUT only

Mode: GSM 1900

Test Equipment:

Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber
 3m Chamber D

Pre-amplifier
 3m Chamber D

Filter
 Filter

Limit
 EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1850.2MHz)										
3.70	-63.9	H	3.0	-15.9	33.5	1.0	-48.4	-13.0	-35.4	
5.55	-65.9	H	3.0	-14.6	32.5	1.0	-46.0	-13.0	-33.0	
7.40	-65.5	H	3.0	-11.1	30.4	1.0	-40.5	-13.0	-27.5	
3.70	-64.2	V	3.0	-16.3	33.5	1.0	-48.8	-13.0	-35.8	
5.55	-68.0	V	3.0	-17.0	32.5	1.0	-48.5	-13.0	-35.5	
7.40	-67.0	V	3.0	-12.5	30.4	1.0	-41.9	-13.0	-28.9	
Mid Channel (1880.0)										
3.76	-64.4	H	3.0	-16.3	33.5	1.0	-48.8	-13.0	-35.8	
5.64	-66.6	H	3.0	-15.1	32.4	1.0	-46.5	-13.0	-33.5	
7.52	-66.4	H	3.0	-11.9	30.3	1.0	-41.2	-13.0	-28.2	
3.76	-63.6	V	3.0	-15.5	33.5	1.0	-48.1	-13.0	-35.1	
5.64	-66.2	V	3.0	-14.9	32.4	1.0	-46.3	-13.0	-33.3	
7.52	-67.1	V	3.0	-12.4	30.3	1.0	-41.7	-13.0	-28.7	
High Channel (1909.8MHz)										
3.82	-64.3	H	3.0	-16.0	33.6	1.0	-48.6	-13.0	-35.6	
5.73	-65.6	H	3.0	-14.0	32.3	1.0	-45.3	-13.0	-32.3	
7.54	-67.1	H	3.0	-12.6	30.2	1.0	-41.9	-13.0	-28.9	
3.82	-62.8	V	3.0	-14.6	33.6	1.0	-47.2	-13.0	-34.2	
5.73	-66.1	V	3.0	-14.7	32.3	1.0	-45.9	-13.0	-32.9	
7.54	-66.6	V	3.0	-11.9	30.2	1.0	-41.1	-13.0	-28.1	

Rev. 03.19.15

EGPRS, 1900MHz

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/10/17
Test Engineer: 44353
Configuration: EUT only
Mode: EDGE 1900

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber

Pre-amplifier

Filter

Limit

3m Chamber D

3m Chamber D

Filter

EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1850.2MHz)										
3.70	-64.2	H	3.0	-16.3	33.5	1.0	-48.8	-13.0	-35.8	
5.55	-67.2	H	3.0	-15.9	32.5	1.0	-47.4	-13.0	-34.4	
7.40	-66.1	H	3.0	-11.7	30.4	1.0	-41.1	-13.0	-28.1	
3.70	-64.5	V	3.0	-16.6	33.5	1.0	-49.1	-13.0	-36.1	
5.55	-66.5	V	3.0	-15.5	32.5	1.0	-47.0	-13.0	-34.0	
7.40	-67.0	V	3.0	-12.5	30.4	1.0	-41.9	-13.0	-28.9	
Mid Channel (1880.0)										
3.76	-64.3	H	3.0	-16.2	33.5	1.0	-48.8	-13.0	-35.8	
5.64	-65.6	H	3.0	-14.1	32.4	1.0	-45.5	-13.0	-32.5	
7.52	-67.1	H	3.0	-12.6	30.3	1.0	-41.9	-13.0	-28.9	
3.76	-63.3	V	3.0	-15.2	33.5	1.0	-47.7	-13.0	-34.7	
5.64	-65.3	V	3.0	-14.1	32.4	1.0	-45.5	-13.0	-32.5	
7.52	-65.6	V	3.0	-11.0	30.3	1.0	-40.2	-13.0	-27.2	
High Channel (1909.8MHz)										
3.82	-63.6	H	3.0	-15.3	33.6	1.0	-47.9	-13.0	-34.9	
5.73	-66.9	H	3.0	-15.3	32.3	1.0	-46.6	-13.0	-33.6	
7.54	-65.5	H	3.0	-11.0	30.2	1.0	-40.2	-13.0	-27.2	
3.82	-64.5	V	3.0	-16.2	33.6	1.0	-48.8	-13.0	-35.8	
5.73	-66.6	V	3.0	-15.1	32.3	1.0	-46.4	-13.0	-33.4	
7.54	-67.1	V	3.0	-12.4	30.2	1.0	-41.7	-13.0	-28.7	

Rev. 03.19.15

11.2.2. UMTS

UMTS REL 99, 850MHz BAND 5

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/12/17
Test Engineer: 30606
Configuration: EUT Only
Mode: REL 99, 850MHz

Test Equipment:
 Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber
 3m Chamber D

Pre-amplifier
 3m Chamber D

Filter
 Filter

Limit
 EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (826.4MHz)										
1.65	-67.6	H	3.0	-25.8	35.0	1.0	-59.9	-13.0	-46.9	
2.48	-66.9	H	3.0	-22.8	33.9	1.0	-55.6	-13.0	-42.6	
3.31	-66.6	H	3.0	-19.8	33.2	1.0	-52.0	-13.0	-39.0	
1.65	-68.0	V	3.0	-26.0	35.0	1.0	-60.0	-13.0	-47.0	
2.48	-67.7	V	3.0	-23.3	33.9	1.0	-56.2	-13.0	-43.2	
3.31	-66.3	V	3.0	-19.4	33.2	1.0	-51.7	-13.0	-38.7	
Mid Channel (836.6MHz)										
1.67	-68.2	H	3.0	-26.3	35.0	1.0	-60.3	-13.0	-47.3	
2.51	-67.0	H	3.0	-22.7	33.7	1.0	-55.4	-13.0	-42.4	
3.35	-66.8	H	3.0	-19.9	33.3	1.0	-52.2	-13.0	-39.2	
1.67	-67.2	V	3.0	-25.1	35.0	1.0	-59.2	-13.0	-46.2	
2.51	-67.5	V	3.0	-23.0	33.7	1.0	-55.7	-13.0	-42.7	
3.35	-66.1	V	3.0	-19.1	33.3	1.0	-51.4	-13.0	-38.4	
High Channel (846.6MHz)										
1.69	-67.1	H	3.0	-25.2	35.0	1.0	-59.2	-13.0	-46.2	
2.54	-66.8	H	3.0	-22.4	33.7	1.0	-55.1	-13.0	-42.1	
3.39	-66.5	H	3.0	-19.5	33.3	1.0	-51.8	-13.0	-38.8	
1.69	-69.0	V	3.0	-26.9	35.0	1.0	-60.9	-13.0	-47.9	
2.54	-68.1	V	3.0	-23.6	33.7	1.0	-56.2	-13.0	-43.2	
3.39	-66.6	V	3.0	-19.5	33.3	1.0	-51.8	-13.0	-38.8	

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UMTS HSDPA, 850MHz BAND 5

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/12/17
Test Engineer: 30606
Configuration: EUT Only
Mode: HSDPA 850MHz

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber

3m Chamber D

Pre-amplifier

3m Chamber D

Filter

Filter

Limit

EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (826.4MHz)										
1.65	-68.2	H	3.0	-26.4	35.0	1.0	-60.4	-13.0	-47.4	
2.48	-66.6	H	3.0	-22.4	33.9	1.0	-55.3	-13.0	-42.3	
3.31	-66.2	H	3.0	-19.4	33.2	1.0	-51.6	-13.0	-38.6	
1.65	-67.4	V	3.0	-25.4	35.0	1.0	-59.4	-13.0	-46.4	
2.48	-66.6	V	3.0	-22.2	33.9	1.0	-55.1	-13.0	-42.1	
3.31	-64.9	V	3.0	-18.1	33.2	1.0	-50.3	-13.0	-37.3	
Mid Channel (836.6MHz)										
1.67	-68.1	H	3.0	-26.2	35.0	1.0	-60.3	-13.0	-47.3	
2.51	-67.0	H	3.0	-22.7	33.7	1.0	-55.4	-13.0	-42.4	
3.35	-66.7	H	3.0	-19.8	33.3	1.0	-52.1	-13.0	-39.1	
1.67	-67.9	V	3.0	-25.9	35.0	1.0	-59.9	-13.0	-46.9	
2.51	-68.1	V	3.0	-23.6	33.7	1.0	-56.4	-13.0	-43.4	
3.35	-67.0	V	3.0	-20.0	33.3	1.0	-52.2	-13.0	-39.2	
High Channel (846.6MHz)										
1.69	-68.4	H	3.0	-26.5	35.0	1.0	-60.5	-13.0	-47.5	
2.54	-67.7	H	3.0	-23.3	33.7	1.0	-56.0	-13.0	-43.0	
3.39	-66.3	H	3.0	-19.3	33.3	1.0	-51.6	-13.0	-38.6	
1.69	-68.8	V	3.0	-26.7	35.0	1.0	-60.7	-13.0	-47.7	
2.54	-67.6	V	3.0	-23.0	33.7	1.0	-55.7	-13.0	-42.7	
3.39	-67.3	V	3.0	-20.2	33.3	1.0	-52.5	-13.0	-39.5	

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UMTS REL 99, 1900MHz BAND 2

**High Frequency Substitution Measurement
UL Fremont Radiated Chamber**

Company:
Project #:
Date: 04/10/17
Test Engineer: 30606
Configuration: EUT Only
Mode: REL 99, 1900MHz

Test Equipment:

Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifier	Filter	Limit
3m Chamber D	3m Chamber D	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1852.4MHz)										
3.70	-64.2	H	3.0	-16.3	33.5	1.0	-48.8	-13.0	-35.8	
5.55	-65.3	H	3.0	-14.0	32.5	1.0	-45.5	-13.0	-32.5	
7.40	-67.3	H	3.0	-12.9	30.4	1.0	-42.3	-13.0	-29.3	
3.70	-64.1	V	3.0	-16.2	33.5	1.0	-48.7	-13.0	-35.7	
5.55	-67.5	V	3.0	-16.5	32.5	1.0	-48.0	-13.0	-35.0	
7.40	-68.3	V	3.0	-13.7	30.4	1.0	-43.1	-13.0	-30.1	
Mid Channel (1880MHz)										
3.76	-65.4	H	3.0	-17.3	33.5	1.0	-49.8	-13.0	-36.8	
5.64	-68.2	H	3.0	-16.8	32.4	1.0	-48.2	-13.0	-35.2	
7.52	-67.7	H	3.0	-13.2	30.3	1.0	-42.5	-13.0	-29.5	
3.76	-65.4	V	3.0	-17.3	33.5	1.0	-49.9	-13.0	-36.9	
5.64	-67.6	V	3.0	-16.4	32.4	1.0	-47.8	-13.0	-34.8	
7.52	-68.1	V	3.0	-13.4	30.3	1.0	-42.7	-13.0	-29.7	
High Channel (1907.6MHz)										
3.82	-65.9	H	3.0	-17.6	33.6	1.0	-50.2	-13.0	-37.2	
5.73	-68.0	H	3.0	-16.4	32.3	1.0	-47.6	-13.0	-34.6	
7.54	-67.8	H	3.0	-13.3	30.2	1.0	-42.5	-13.0	-29.5	
3.82	-66.6	V	3.0	-18.3	33.6	1.0	-50.9	-13.0	-37.9	
5.73	-67.2	V	3.0	-15.7	32.3	1.0	-47.0	-13.0	-34.0	
7.54	-68.5	V	3.0	-13.8	30.2	1.0	-43.0	-13.0	-30.0	

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UMTS HSDPA, 1900MHz BAND 2

**High Frequency Substitution Measurement
UL Fremont Radiated Chamber**

Company:
Project #:
Date: 04/10/17
Test Engineer: 30606
Configuration: EUT Only
Mode: HSDPA 1900MHz

Test Equipment:

Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifier	Filter	Limit
3m Chamber D	3m Chamber D	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1852.4MHz)										
3.70	-64.9	H	3.0	-17.0	33.5	1.0	-49.5	-13.0	-36.5	
5.55	-66.7	H	3.0	-15.4	32.5	1.0	-46.9	-13.0	-33.9	
7.40	-68.5	H	3.0	-14.2	30.4	1.0	-43.6	-13.0	-30.6	
3.70	-65.0	H	3.0	-17.1	33.5	1.0	-49.6	-13.0	-36.6	
5.55	-67.2	V	3.0	-16.2	32.5	1.0	-47.7	-13.0	-34.7	
7.40	-68.1	V	3.0	-13.5	30.4	1.0	-42.9	-13.0	-29.9	
Mid Channel (1880MHz)										
3.70	-65.7	H	3.0	-17.7	33.5	1.0	-50.2	-13.0	-37.2	
5.55	-67.9	H	3.0	-16.6	32.5	1.0	-48.1	-13.0	-35.1	
7.40	-68.3	H	3.0	-14.0	30.4	1.0	-43.4	-13.0	-30.4	
3.70	-65.1	H	3.0	-17.1	33.5	1.0	-49.6	-13.0	-36.6	
5.55	-67.4	V	3.0	-16.4	32.5	1.0	-47.9	-13.0	-34.9	
7.40	-66.9	V	3.0	-12.4	30.4	1.0	-41.8	-13.0	-28.8	
High Channel (1907.6MHz)										
3.70	-64.3	H	3.0	-16.4	33.5	1.0	-48.9	-13.0	-35.9	
5.55	-65.9	H	3.0	-14.6	32.5	1.0	-46.1	-13.0	-33.1	
7.40	-67.4	H	3.0	-13.1	30.4	1.0	-42.5	-13.0	-29.5	
3.70	-65.1	H	3.0	-17.1	33.5	1.0	-49.6	-13.0	-36.6	
5.55	-66.4	V	3.0	-15.3	32.5	1.0	-46.8	-13.0	-33.8	
7.40	-66.2	V	3.0	-11.6	30.4	1.0	-41.0	-13.0	-28.0	

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UMTS REL 99, 1700MHz BAND 4

**High Frequency Substitution Measurement
UL Fremont Radiated Chamber**

Company:
Project #:
Date: 04/10/17
Test Engineer: 44353
Configuration: EUT Only
Mode: REL 99, 1700MHz

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifier	Filter	Limit
3m Chamber D	3m Chamber D	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1712.4MHz)										
3.42	-64.7	H	3.0	-17.5	33.3	1.0	-49.8	-13.0	-36.8	
5.14	-65.2	H	3.0	-14.6	32.9	1.0	-46.5	-13.0	-33.5	
6.85	-66.3	H	3.0	-12.7	31.1	1.0	-42.8	-13.0	-29.8	
8.56	-66.5	H	3.0	-10.7	29.0	1.0	-38.7	-13.0	-25.7	
3.42	-66.4	V	3.0	-19.2	33.3	1.0	-51.5	-13.0	-38.5	
5.14	-65.8	V	3.0	-15.6	32.9	1.0	-47.5	-13.0	-34.5	
6.85	-66.9	V	3.0	-13.1	31.1	1.0	-43.1	-13.0	-30.1	
8.56	-67.5	V	3.0	-11.9	29.0	1.0	-39.9	-13.0	-26.9	
Mid Channel (1732.6MHz)										
3.47	-65.2	H	3.0	-17.9	33.3	1.0	-50.3	-13.0	-37.3	
5.20	-66.1	H	3.0	-15.4	32.9	1.0	-47.3	-13.0	-34.3	
6.93	-67.2	H	3.0	-13.5	31.0	1.0	-43.4	-13.0	-30.4	
8.66	-67.1	H	3.0	-11.2	28.9	1.0	-39.0	-13.0	-26.0	
3.47	-64.5	V	3.0	-17.2	33.3	1.0	-49.6	-13.0	-36.6	
5.20	-65.1	V	3.0	-14.9	32.9	1.0	-46.7	-13.0	-33.7	
6.93	-67.3	V	3.0	-13.3	31.0	1.0	-43.3	-13.0	-30.3	
8.66	-67.7	V	3.0	-12.0	28.9	1.0	-39.9	-13.0	-26.9	
High Channel (1752.6MHz)										
3.51	-65.3	H	3.0	-17.9	33.4	1.0	-50.2	-13.0	-37.2	
5.26	-66.3	H	3.0	-15.6	32.8	1.0	-47.4	-13.0	-34.4	
7.01	-67.3	H	3.0	-13.4	30.9	1.0	-43.3	-13.0	-30.3	
8.76	-66.9	H	3.0	-10.8	28.7	1.0	-38.6	-13.0	-25.6	
3.51	-64.4	V	3.0	-16.9	33.4	1.0	-49.3	-13.0	-36.3	
5.26	-66.6	V	3.0	-16.2	32.8	1.0	-48.0	-13.0	-35.0	
7.01	-66.4	V	3.0	-12.2	30.9	1.0	-42.1	-13.0	-29.1	
8.76	-66.6	V	3.0	-10.8	28.7	1.0	-38.6	-13.0	-25.6	

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UMTS HSDPA, 1700MHz BAND 4

**High Frequency Substitution Measurement
UL Fremont Radiated Chamber**

Company:
Project #:
Date: 04/10/17
Test Engineer: 44353
Configuration: EUT Only
Mode: HSPA 1700

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifier	Filter	Limit
3m Chamber D	3m Chamber D	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1712.4MHz)										
3.42	-66.6	H	3.0	-19.4	33.3	1.0	-51.7	-13.0	-38.7	
5.14	-65.0	H	3.0	-14.4	32.9	1.0	-46.3	-13.0	-33.3	
6.85	-66.4	H	3.0	-12.8	31.1	1.0	-42.8	-13.0	-29.8	
8.56	-66.1	H	3.0	-10.3	29.0	1.0	-38.3	-13.0	-25.3	
3.42	-66.3	V	3.0	-19.1	33.3	1.0	-51.4	-13.0	-38.4	
5.14	-65.5	V	3.0	-15.3	32.9	1.0	-47.2	-13.0	-34.2	
6.85	-65.9	V	3.0	-12.1	31.1	1.0	-42.1	-13.0	-29.1	
8.56	-65.3	V	3.0	-9.6	29.0	1.0	-37.6	-13.0	-24.6	
Mid Channel (1732.6MHz)										
3.47	-65.1	H	3.0	-17.8	33.3	1.0	-50.1	-13.0	-37.1	
5.20	-65.8	H	3.0	-15.2	32.9	1.0	-47.0	-13.0	-34.0	
6.93	-67.1	H	3.0	-13.4	31.0	1.0	-43.4	-13.0	-30.4	
8.66	-66.9	H	3.0	-10.9	28.9	1.0	-38.8	-13.0	-25.8	
3.47	-66.8	V	3.0	-19.4	33.3	1.0	-51.8	-13.0	-38.8	
5.20	-65.9	V	3.0	-15.7	32.9	1.0	-47.5	-13.0	-34.5	
6.93	-66.4	V	3.0	-12.4	31.0	1.0	-42.3	-13.0	-29.3	
8.66	-67.8	V	3.0	-12.1	28.9	1.0	-39.9	-13.0	-26.9	
High Channel (1752.6MHz)										
3.51	-65.2	H	3.0	-17.8	33.4	1.0	-50.2	-13.0	-37.2	
5.26	-63.8	H	3.0	-13.0	32.8	1.0	-44.8	-13.0	-31.8	
7.01	-66.2	H	3.0	-12.3	30.9	1.0	-42.2	-13.0	-29.2	
8.76	-66.9	H	3.0	-10.8	28.7	1.0	-38.6	-13.0	-25.6	
3.51	-64.3	V	3.0	-16.9	33.4	1.0	-49.2	-13.0	-36.2	
5.26	-65.7	V	3.0	-15.3	32.8	1.0	-47.1	-13.0	-34.1	
7.01	-65.9	V	3.0	-11.7	30.9	1.0	-41.6	-13.0	-28.6	
8.76	-67.2	V	3.0	-11.4	28.7	1.0	-39.1	-13.0	-26.1	

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