



**FCC CFR47 PART 27L
CLASS II PERMISSIVE CHANGE
CERTIFICATION TEST REPORT**

FOR

**iPhone With GSM/WCDMA/HSPA+/DC-HSDPA/LTE, 1xRTT/CDMA 1xEVDO Rev. A,
Rev. B/Advanced Bluetooth EDR 2.1, and WiFi 802.11 a/b/g/n**

MODEL NUMBER: A1428

FCC ID: BCG-E2599A

REPORT NUMBER: 12U14759-1

ISSUE DATE: JANUARY 25, 2013

Prepared for

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

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: iPhone With GSM/WCDMA/HSPA+/DC-HSDPA/LTE,
1xRTT/CDMA 1xEVDO Rev. A, Rev.B/Advanced Bluetooth EDR
2.1, and WiFi 802.11 a/b/g/n

MODEL: A1428

SERIAL NUMBER: C39JT00DF9GL

DATE TESTED: JANUARY 5 - 14, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 27L	Pass

UL CCS 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 CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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.

Approved & Released For UL CCS By:

Tested By:



THU CHAN
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WiSE ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR Part 27.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

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:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT, Model A1428 is a mobile phone with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio. The rechargeable battery is not user accessible.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The change filed under this application is adding the UMTS Band 4.

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted and EIRP of peak output powers for UMTS bands as follows:

PORT A (LAT) / PRIMARY

Part 27 Band 4					
Frequency range (MHz)	Modulation	Conducted		EIRP	
		dBm	mW	dBm	mW
1712.4 - 1752.6	Rel 99	26.55	451.9	25.51	355.6
1712.4 - 1752.6	HSUPA	27.30	537.0	25.90	389.0

PORT B (UAT) / SECONDARY

Part 27 Band 4					
Frequency range (MHz)	Modulation	Conducted		EIRP	
		dBm	mW	dBm	mW
1712.4 - 1752.6	Rel 99	25.10	323.6	20.48	111.7
1712.4 - 1752.6	HSUPA	25.80	380.2	20.80	120.2

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a band gap type integral antenna for the 1700MHz bands with a maximum peak gain as follow: Port A(LAT), Port B (UAT)

Frequency (MHz)	Gain (dBi) LAT A1428	Gain (dBi) UAT A1428
UMTS BAND 4, 1712.4 – 1752.6	-0.51	-3.27

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 3.04.06_DEBUG

The EUT software installed during testing was 10B5105C

The EUT is linked with CMU200 and CMW500 Test Set.

5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel for RF radiated emissions above 1GHz and AC conducted emissions are determined as the channel with the AC Power Adapter Source

Based on the investigation results, the highest peak power and enhanced data rate is the worst-case scenario for all measurements.

Worst-case modes below:

- UMTS, REL 99 and HSUPA

The device has two ports of port A (LAT) and Port B (UAT). Port A has a most higher of output power than Port B from the result measurement.

Tests were performed as below,

_Port A: Both conducted and radiated emissions measurements on band 4.

_Port B: Only conducted output power and EIRP radiated emissions measurements on band 4.

The EUT has been investigated on X, Y and Z position, the worst-case was determined on Y-position.

5.7. DESCRIPTION OF TEST SETUP

I/O CABLES (RF CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	US 115V	Un-shielded	2m	N/A
2	RF In/Out	1	EUT	Un-shielded	1m	N/A
3	RF In/Out	1	Spectrum Analyzer	Un-shielded	1m	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	None	N/A

I/O CABLES (RF RADIATED TEST)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	2	US 115V	Un-shielded	2m	NA
2	RF In/Out	1	Horn	Un-shielded	2m	NA

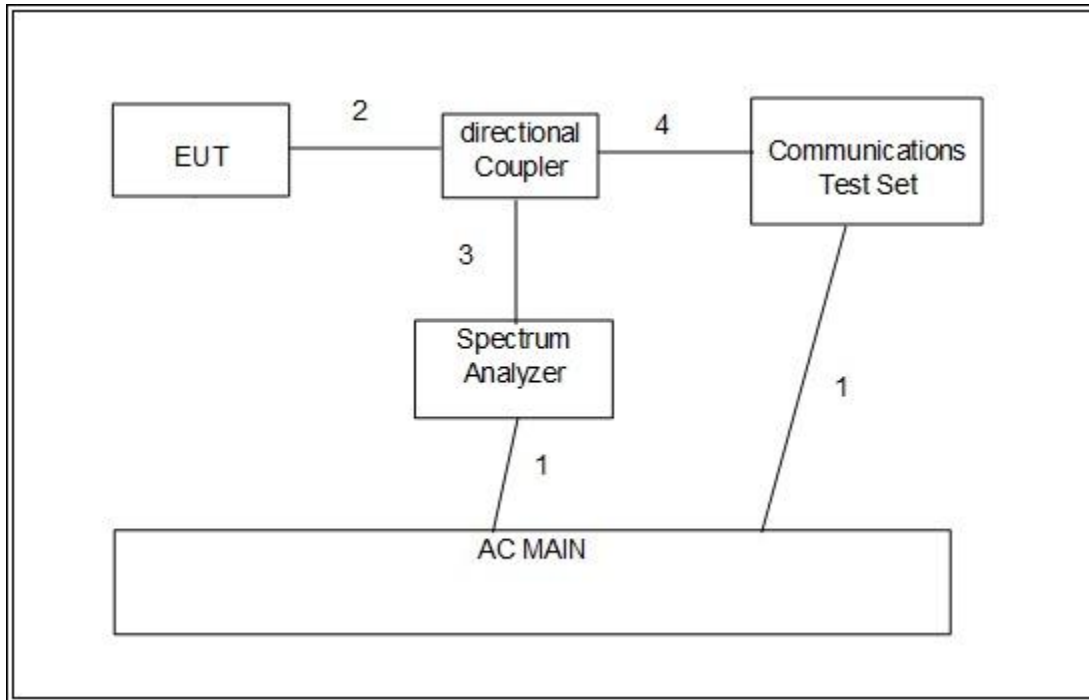
SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Apple	A1385	D292066H2T2DHLHAC	DoC
DC Power Supply	Xantrex	XHR-60-18	27519	NA

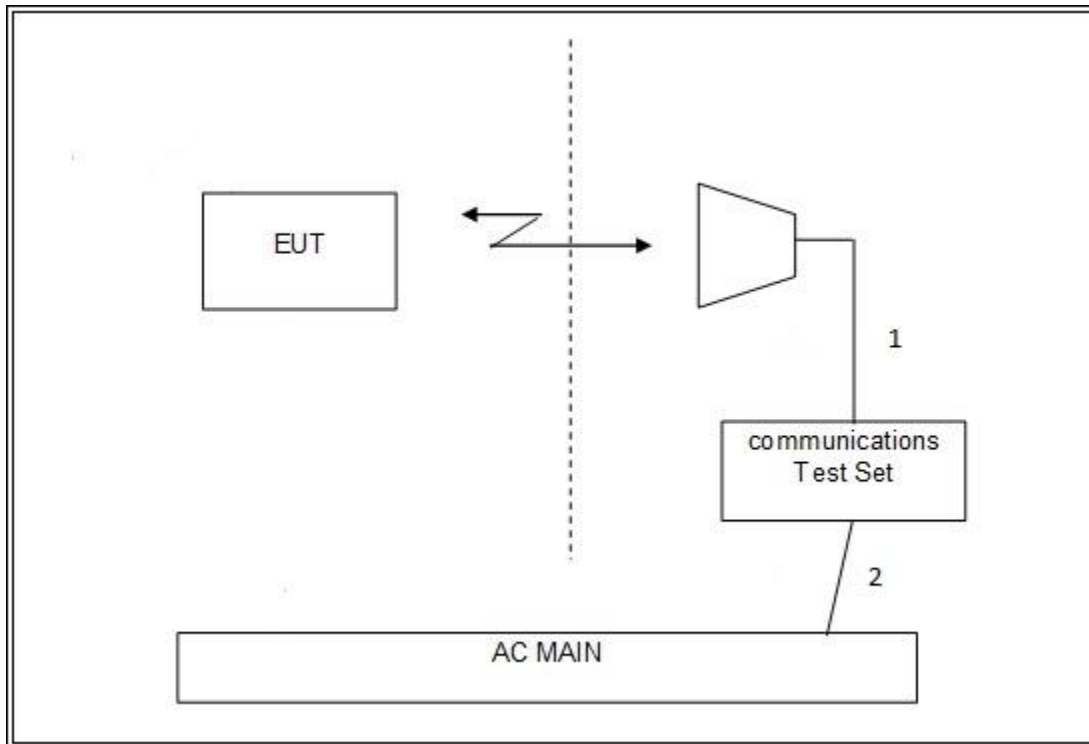
TEST SETUP

The EUT is a stand-alone device. The Communication test set exercised the EUT.

SETUP DIAGRAM FOR RF CONDUCTED TESTS



SETUP DIAGRAM FOR RF RADIATED TESTS



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
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	04/09/13
Antenna, Horn, 18 GHz	EMCO	3115	C00872	09/20/13
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	11/11/13
Communication Test Set	R & S	CMU 200	None	06/06/13
Wideband Communication Test Set	R & S	CMW 500	None	12/16/13
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR
Temperature / Humidity Chamber	WATLOW Controls	SK-3102	None	CNR
Directional Coupler	RF-Lambda	RFDC5M06G15	None	CNR
Vector signal generator, 6 GHz	Agilent / HP	E4438C	None	07/06/13

7. RF POWER OUTPUT VERIFICATION

7.1. UMTS REL99

TEST PROCEDURE

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 V7.5.0 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7) 12.2kps RMC is used for this testing. Power control set to All bits up. A summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	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

PORT A

Band	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
				Average	Peak
UMTS1710 (Band IV)	1312	1537	1712.4	22.95	26.50
	1412	1638	1732.4	22.98	26.53
	1513	1738	1754.0	23.00	26.55

PORT B

Band	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
				Average	Peak
UMTS1710 (Band IV)	1312	1537	1712.4	21.45	25.10
	1412	1638	1732.4	21.50	25.05
	1513	1738	1754.0	21.39	25.00

7.2. UMTS Rel 5 HSDPA

The following Sub-Tests were completed according to the test requirements outlined in section 5.2A of the 3GPP TS34.121-1 V7.5.0 specification. All TX RMS and Peak power requirements for Power Class 3 were met according to table 5.2AA.5 and achieved through the outlined test procedure in section 5.2AA.4.2. A summary of these settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	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			
	HSUPA Test	Not Applicable			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	β_{ec}	-	-	-	-
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
	β_{ed}	Not Applicable			
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			

RESULTS

PORT A, HSDPA

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Average	Peak
UMTS1710 (Band IV)	1	1312	1537	1712.4	22.90	26.34
		1412	1638	1732.4	23.00	26.50
		1513	1738	1752.6	22.92	26.61
	2	1312	1537	1712.4	22.95	26.40
		1412	1638	1732.4	23.00	26.54
		1513	1738	1752.6	22.97	26.58
	3	1312	1537	1712.4	22.50	26.43
		1412	1638	1732.4	22.10	26.40
		1513	1738	1752.6	22.50	26.50
	4	1312	1537	1712.4	22.50	26.60
		1412	1638	1732.4	22.20	26.40
		1513	1738	1752.6	22.50	26.80

PORT B, HSDPA

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Average	Peak
UMTS1710 (Band IV)	1	1312	1537	1712.4	21.45	25.35
		1412	1638	1732.4	21.50	25.40
		1513	1738	1752.6	21.40	25.30
	2	1312	1537	1712.4	21.35	25.32
		1412	1638	1732.4	21.40	25.40
		1513	1738	1752.6	21.38	25.28
	3	1312	1537	1712.4	20.98	25.45
		1412	1638	1732.4	21.00	25.80
		1513	1738	1752.6	20.95	25.60
	4	1312	1537	1712.4	20.90	25.37
		1412	1638	1732.4	20.95	25.40
		1513	1738	1752.6	20.90	25.34

7.1. UMTS DUAL CARRIER HSDPA

RESULT

PORT A (LAT) / PRIMARY

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Average	Peak
UMTS1700 (Band IV)	1	1312	1537	1712.4	22.93	25.60
		1412	1638	1732.4	22.96	25.80
		1513	1738	1752.6	22.98	25.33
	2*	1312	1537	1712.4	22.88	25.80
		1412	1638	1732.4	22.98	26.40
		1513	1738	1752.6	22.96	25.70
	3	1312	1537	1712.4	22.45	26.10
		1412	1638	1732.4	22.50	25.90
		1513	1738	1752.6	22.50	25.60
	4	1312	1537	1712.4	22.44	26.10
		1412	1638	1732.4	22.48	26.30
		1513	1738	1752.6	22.51	25.50

PORT B (UAT) / SECONDARY (WORST CASE ONLY ON SUB TEST 2)

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Average	Peak
UMTS1700 (Band IV)	1	1312	1537	1712.4	21.46	25.30
		1412	1638	1732.4	21.30	25.30
		1513	1738	1752.6	21.47	25.30
	2*	1312	1537	1712.4	21.45	25.75
		1412	1638	1732.4	21.32	25.70
		1513	1738	1752.6	21.48	25.70
	3	1312	1537	1712.4	20.94	25.50
		1412	1638	1732.4	20.87	25.70
		1513	1738	1752.6	20.99	25.65
	4	1312	1537	1712.4	20.99	25.33
		1412	1638	1732.4	20.87	25.70
		1513	1738	1752.6	20.99	25.65

7.2. UMTS - Rel 6 HSPA (HSDPA & HSUPA)

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 V7.5.0 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7) 12.2kps RMC is used for this testing. Power control set to All bits up. A 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	15/15
	β_{ec}	209/225	12/15	30/15	2/15	24/15
	β_c/β_d	11/15	6/15	15/9	2/15	15/15
	β_{hs}	22/15	12/15	30/15	4/15	30/15
β_{ed}	1309/225	94/75	47/15 47/15	56/75	134/15	
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	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	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

PORT A, HSUPA

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Average	Peak
UMTS1700	1	1312	1537	1712.4	23.00	27.30
		1412	1637	1732.4	22.70	27.10
		1513	1738	1752.6	22.80	27.15
	2	1312	1537	1712.4	21.10	27.00
		1412	1637	1732.4	20.64	26.80
		1513	1738	1752.6	20.87	27.05
	3	1312	1537	1712.4	22.05	27.20
		1412	1637	1732.4	21.70	27.05
		1513	1738	1752.6	21.80	27.17
	4	1312	1537	1712.4	21.00	26.80
		1412	1637	1732.4	20.60	26.60
		1513	1738	1752.6	20.75	26.70
	5	1312	1537	1712.4	23.00	26.40
		1412	1637	1732.4	22.60	26.20
		1513	1738	1752.6	22.70	26.40

PORT B, HSUPA

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Average	Peak
UMTS1700	1	1312	1537	1712.4	21.32	25.05
		1412	1637	1732.4	21.47	25.10
		1513	1738	1752.6	21.50	25.09
	2	1312	1537	1712.4	19.55	25.80
		1412	1637	1732.4	19.50	25.70
		1513	1738	1752.6	19.40	25.65
	3	1312	1537	1712.4	20.55	25.20
		1412	1637	1732.4	20.48	25.32
		1513	1738	1752.6	20.45	25.21
	4	1312	1537	1712.4	19.50	25.73
		1412	1637	1732.4	19.46	25.76
		1513	1738	1752.6	19.55	25.72
	5	1312	1537	1712.4	21.50	25.64
		1412	1637	1732.4	21.48	25.59
		1513	1738	1752.6	21.45	25.55

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

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 low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

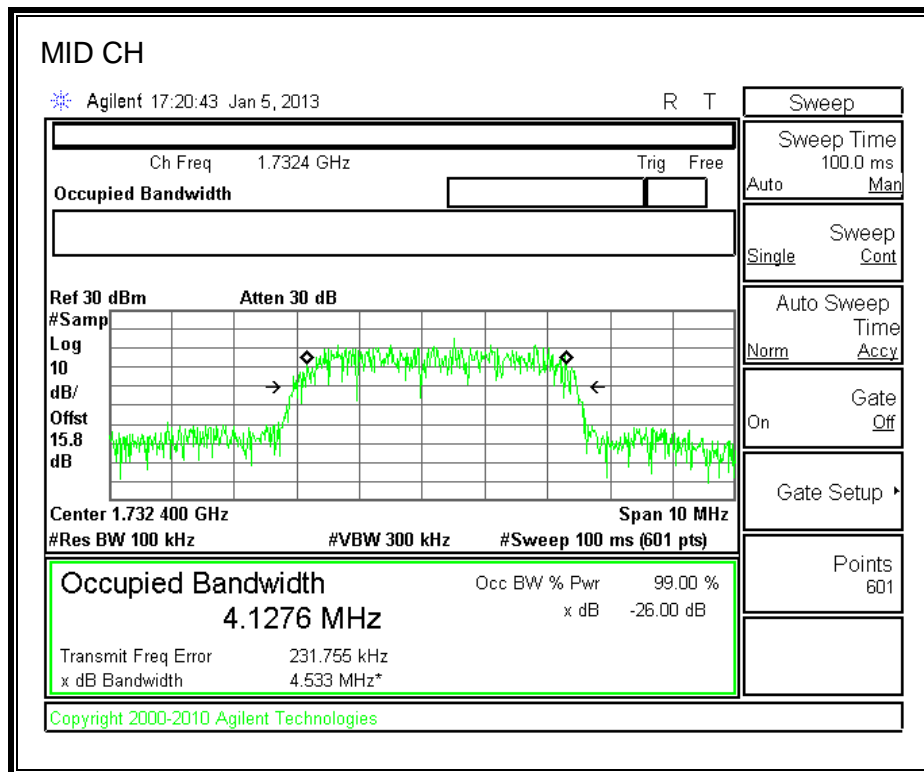
MODES TESTED

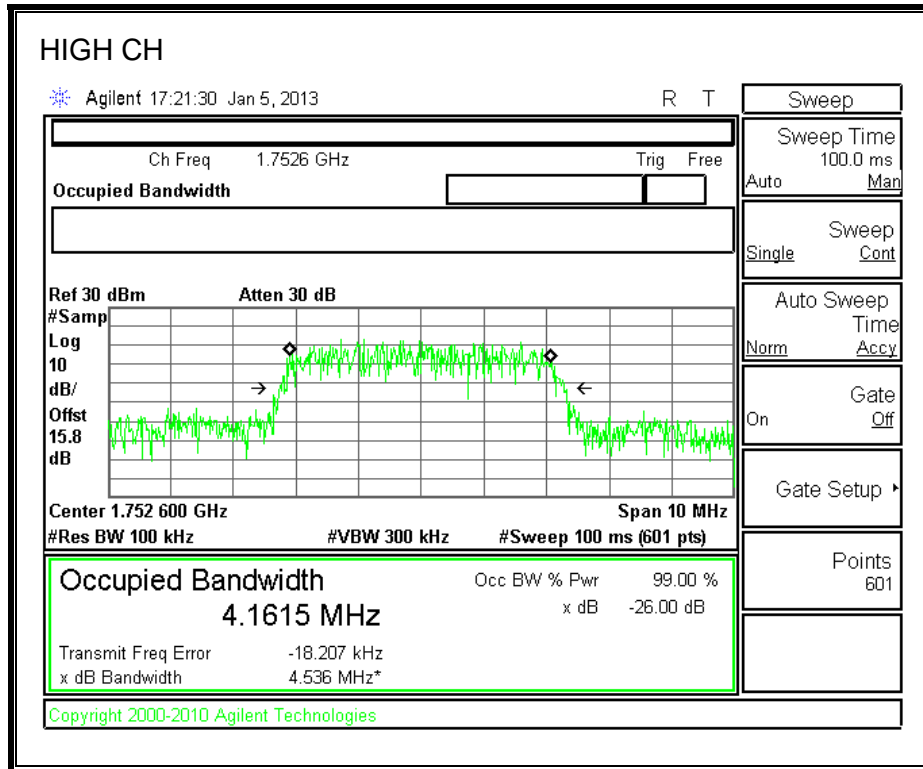
- UMTS, REL 99 and HSUPA

RESULTS

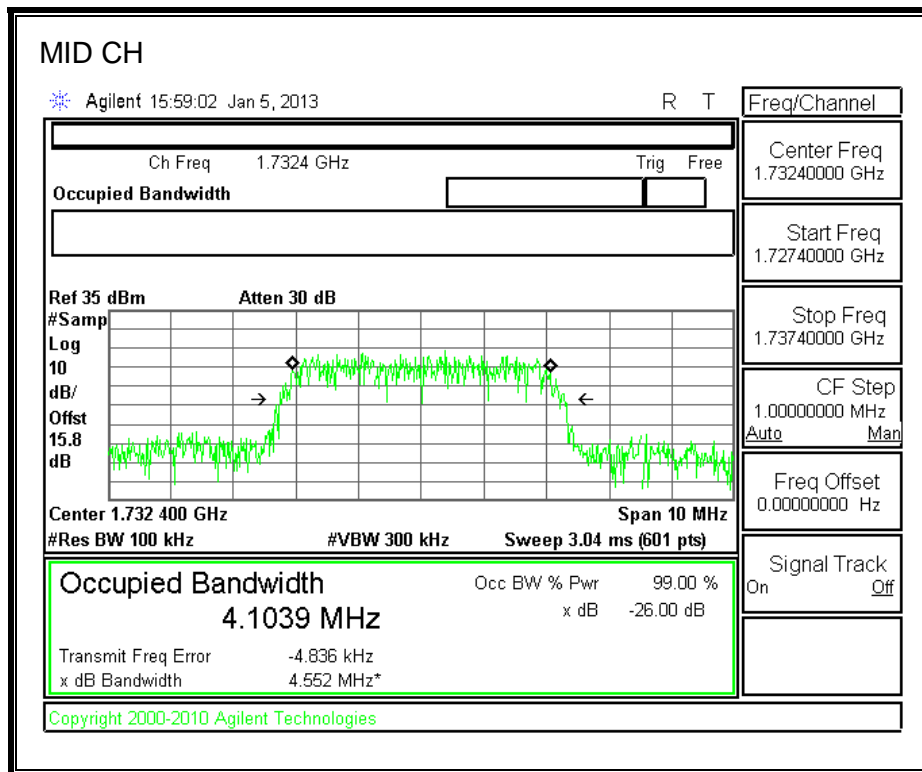
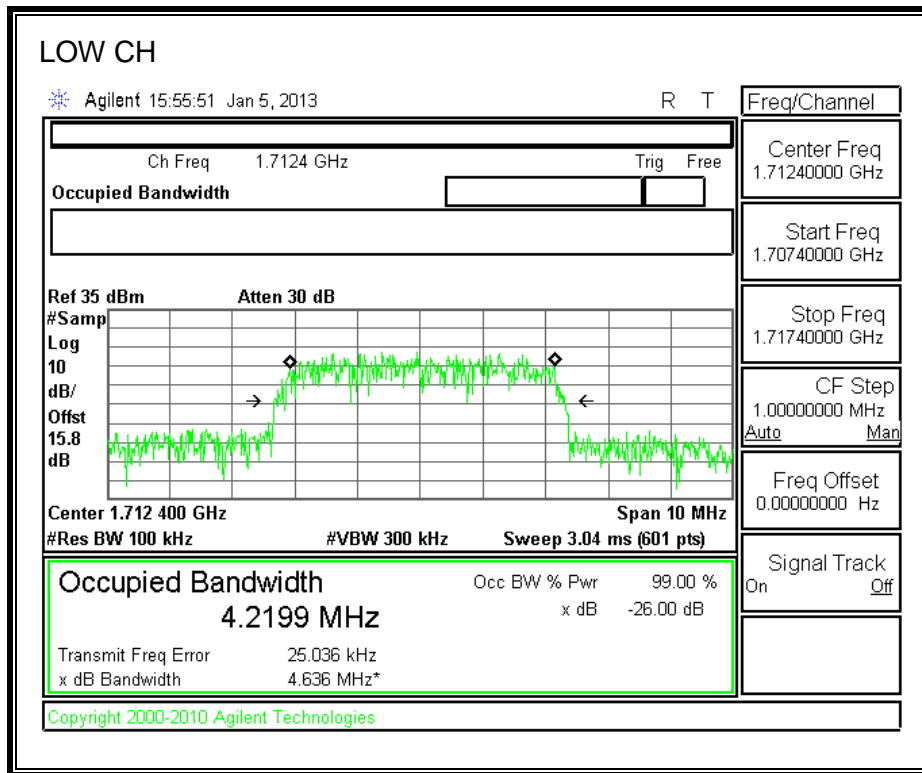
Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
Band 4	UMTS, REL 99	1537	1712.4	4.1983	4.641
		1637	1732.4	4.1276	4.533
		1738	1752.6	4.1615	4.536
	UMTS, HSUPA	1537	1712.4	4.2199	4.636
		1637	1732.4	4.1039	4.552
		1738	1752.6	4.2131	4.527

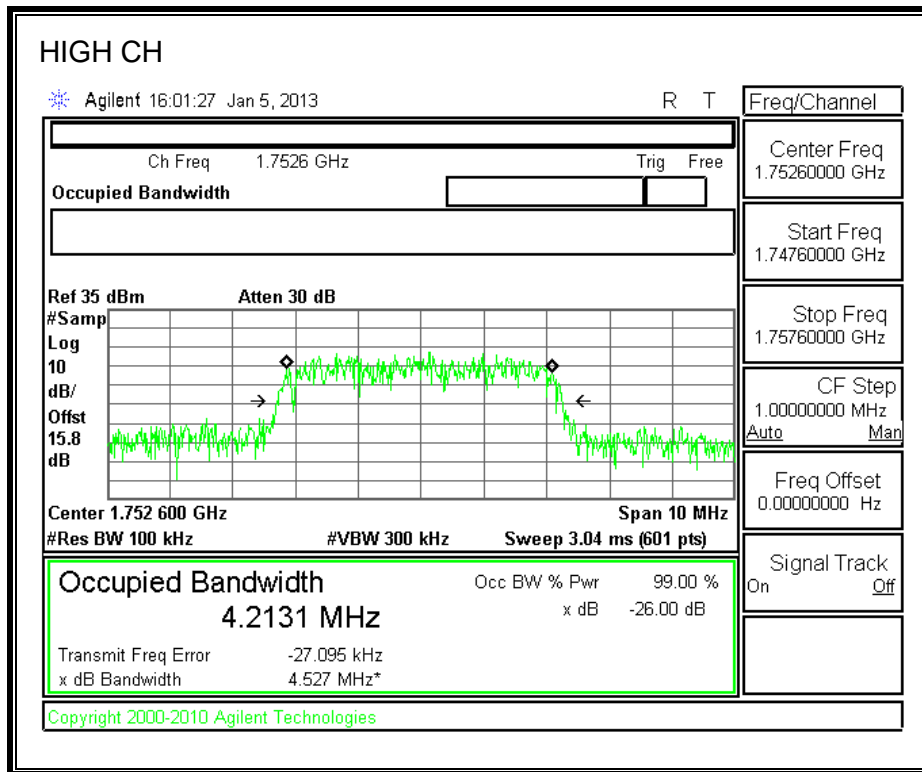
UMTS, Rel 99





UMTS, HSUPA





8.2. BAND EDGE

RULE PART(S)

FCC: §27.53

LIMITS

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.

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 (1710, 1755MHz).
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

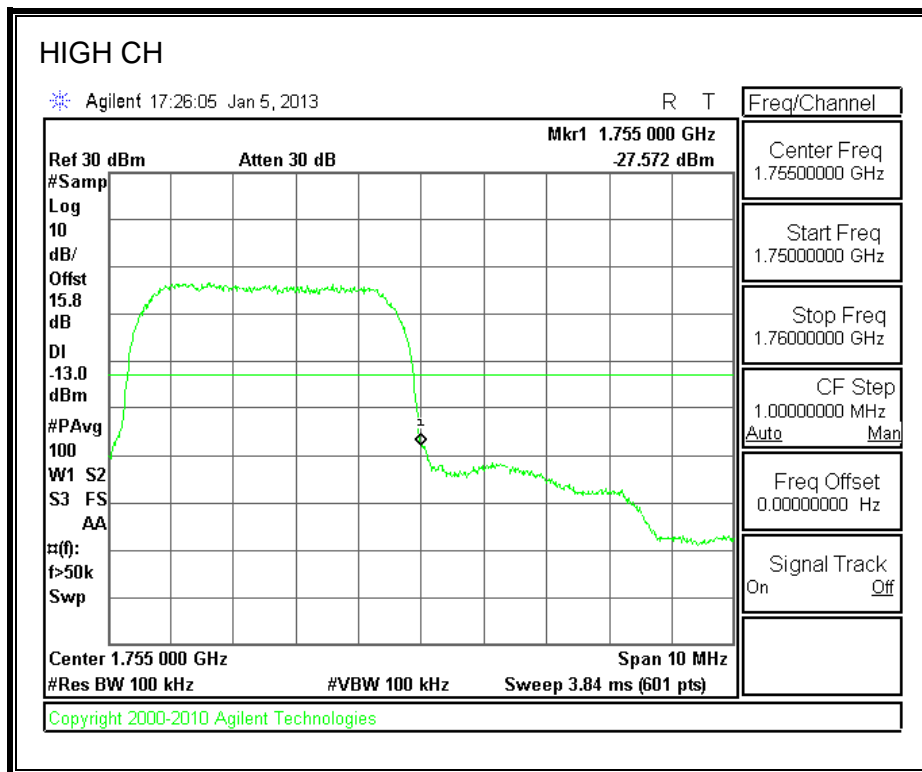
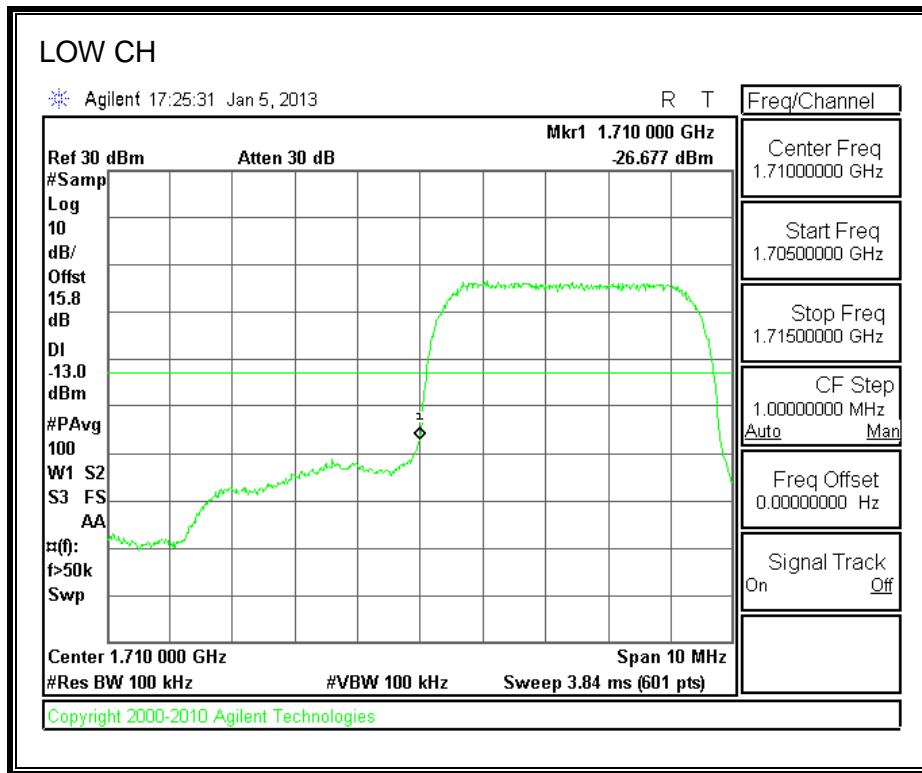
MODES TESTED

- UMTS, REL 99 and HSUPA

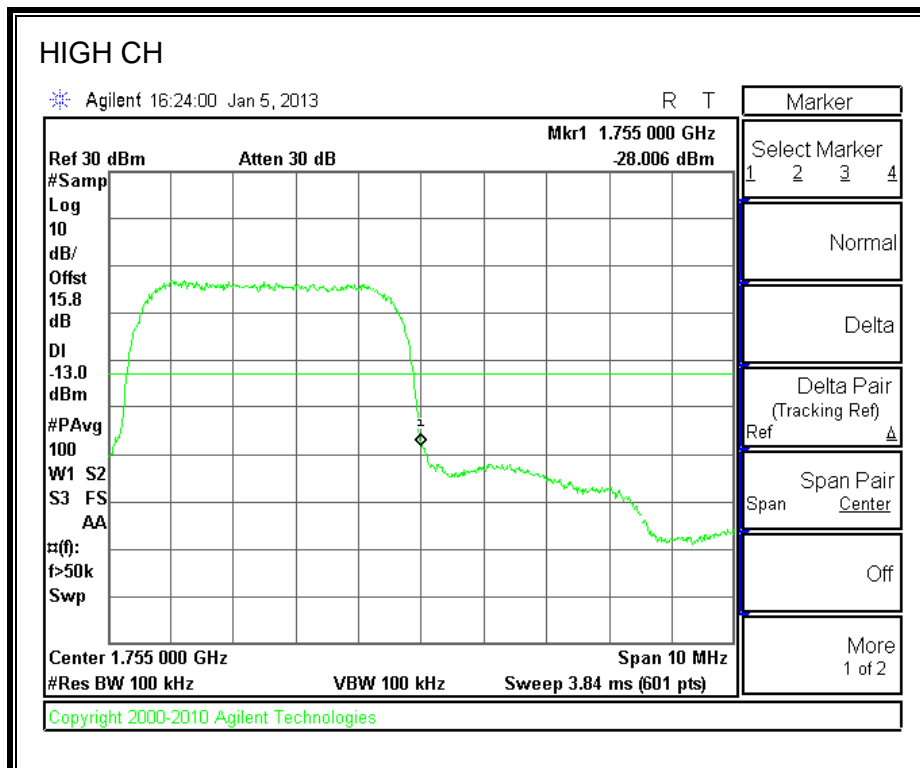
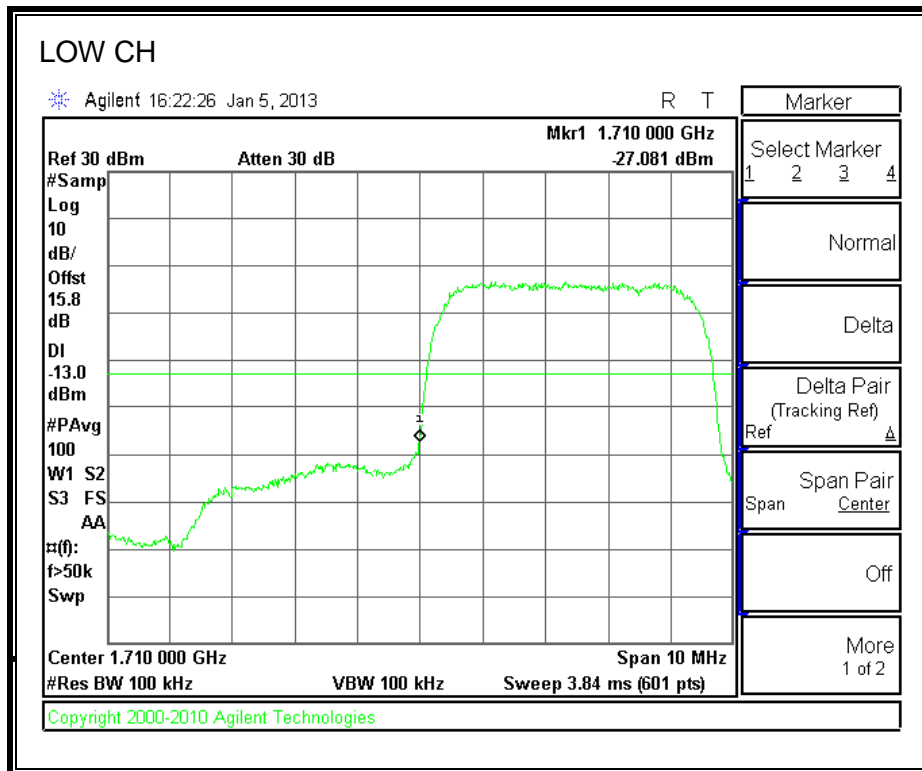
RESULTS

UMTS, REL 99

LAT (PORT A) / PRIMARY



UMTS, HSUPA



8.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §27.53

LIMITS

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.

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:

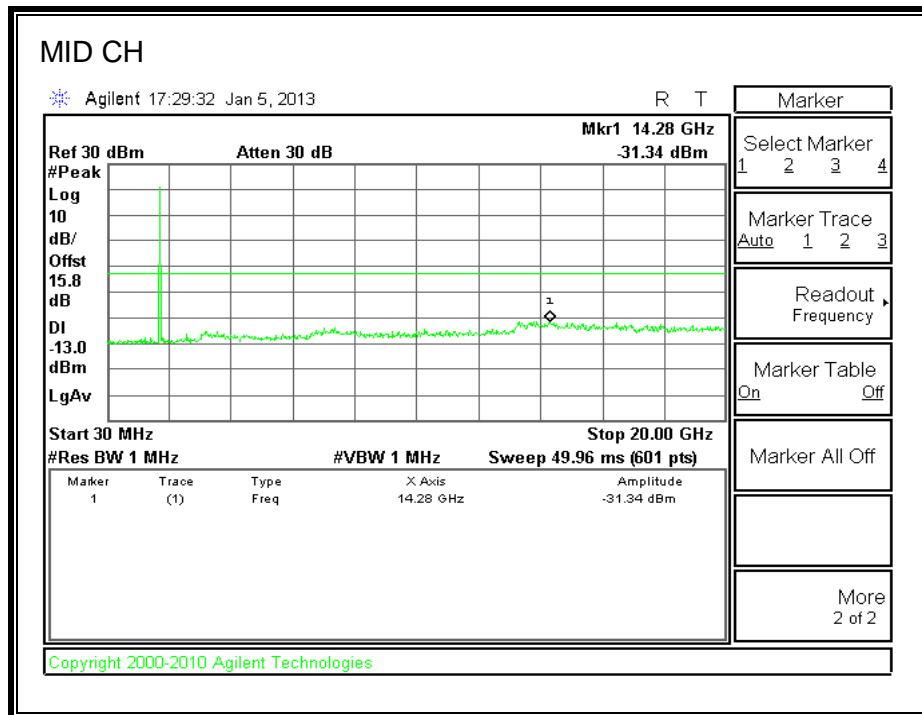
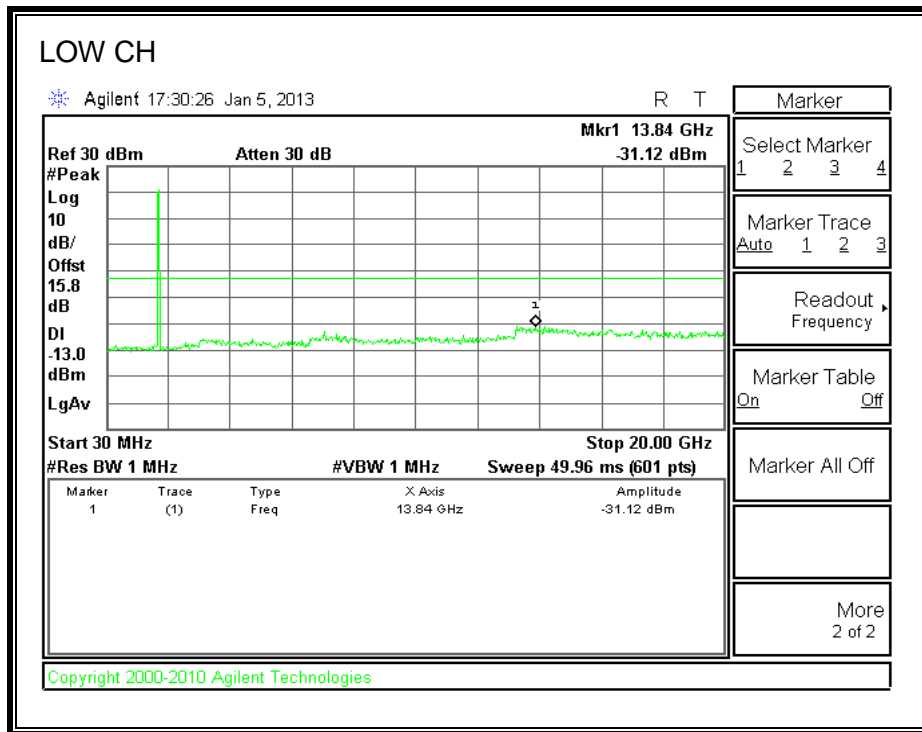
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

MODES TESTED

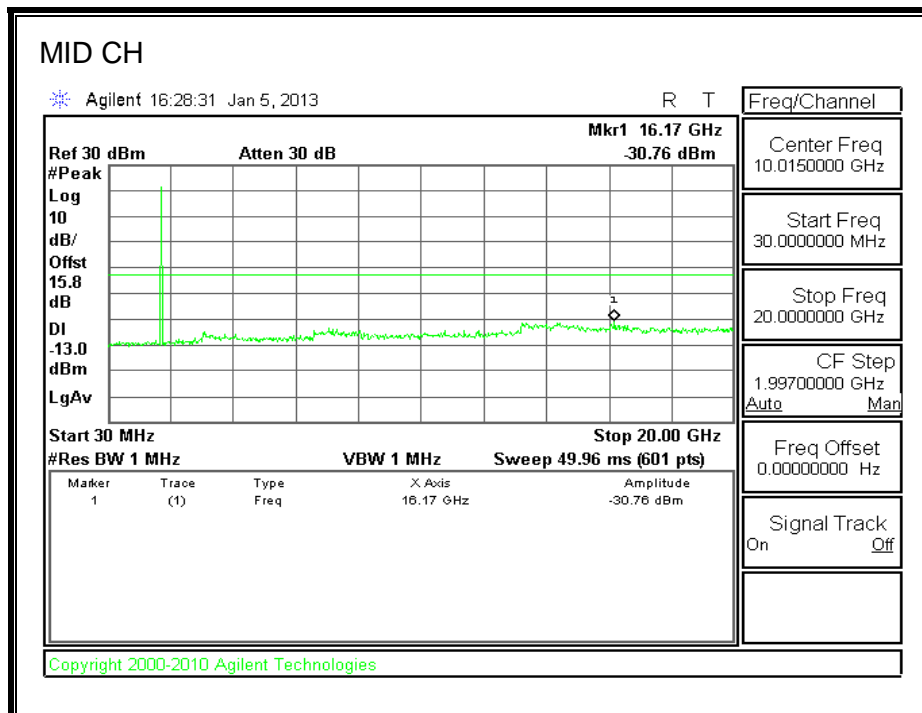
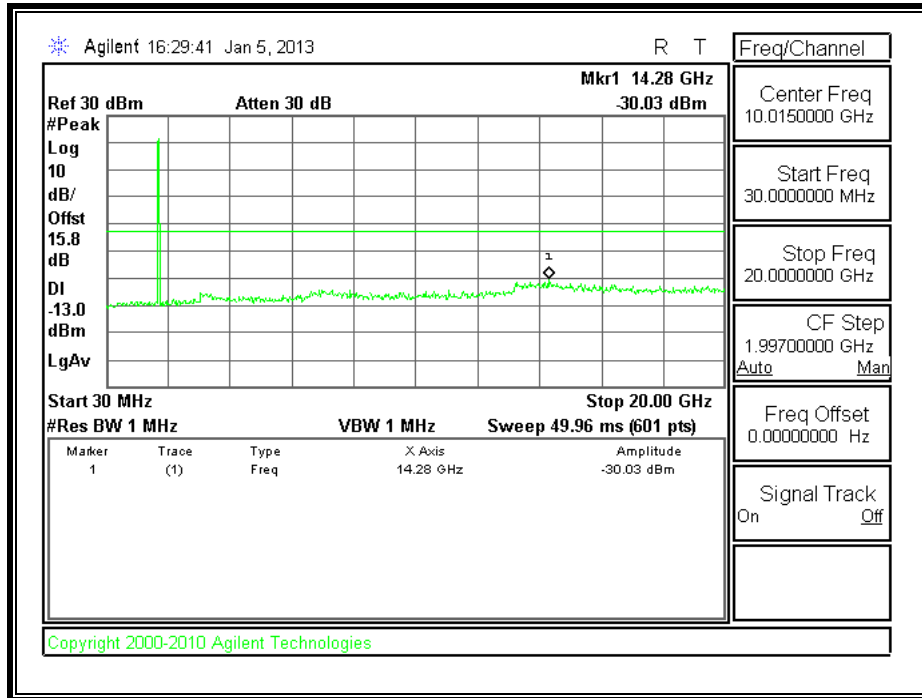
- UMTS, REL 99 and HSUPA

RESULTS

UMTS, REL 99



UMTS, HSUPA



8.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §27.54

LIMITS

- §27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST PROCEDURE

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°C is reached. Reference power supply voltage for these tests is 3.8Vdc.

Use CMU200 with Frequency Error measurement capability.

- Temp. = -30° to +50°C
- Voltage = Low, 3.3VDC, Normal, 3.8VDC and High, 4.2VDC.

Frequency Stability vs Voltage:

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

MODES TESTED

- UMTS, HSUPA

RESULTS

See the following pages.

WCDMA, MID CHANNEL

Reference Frequency: Band 4 UMTS Rel 99 Mid Channel 1732.400003Hz @ 20°C				
Limit: to stay +/- 2.5 ppm = 4331.000 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1732.399999	0.003	2.5
3.80	40	1732.399998	0.003	2.5
3.80	30	1732.400009	-0.003	2.5
3.80	20	1732.400003	0	2.5
3.80	10	1732.400007	-0.002	2.5
3.80	0	1732.400007	-0.002	2.5
3.80	-10	1732.400009	-0.003	2.5
3.80	-20	1732.400007	-0.002	2.5
3.80	-30	1732.400012	-0.005	2.5
Reference Frequency: Band 4 UMTS Rel 99 Mid Channel 1732.400003Hz @ 20°C				
Limit: to stay +/- 2.5 ppm = 4331.000 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	20	1732.400003	0.000	2.5
4.20	20	1732.400005	-0.001	2.5
3.30	20	1732.400004	-0.001	2.5
End Volt (3.1)	20	1732.399999	0.002	2.5

9. RADIATED TEST RESULTS

9.1. RADIATED POWER (EIRP)

RULE PART(S)

FCC: § 27.50

LIMITS

27.50 (d) (2) - Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band are limited to a peak EIRP of 1 watt.

TEST PROCEDURE

ANSI / TIA / EIA 603C Clause 2.2.17

MODES TESTED

- UMTS, REL 99 and HSUPA

PORT A (LAT) / PRIMARY

Mode	Channel	f (MHz)	EIRP	
			dBm	mW
UMTS, REL 99	1537	1712.4	24.29	268.53
	1637	1732.4	25.51	355.63
	1738	1752.6	24.80	302.00
UMTS, HSUPA	1537	1712.4	25.50	354.81
	1637	1732.4	25.90	389.05
	1738	1752.6	25.30	338.84

PORT B (UAT) / SECONDARY

Mode	Channel	f (MHz)	EIRP	
			dBm	mW
UMTS, REL 99	1537	1712.4	19.20	83.18
	1637	1732.4	20.16	103.75
	1738	1752.6	20.48	111.69
UMTS, HSUPA	1537	1712.4	19.90	97.72
	1637	1732.4	20.61	115.08
	1738	1752.6	20.80	120.23

PORT A / PRIMARY

UMTS, REL 99

High Frequency Fundamental Measurement Compliance Certification Services Chamber A								
Company:		Apple						
Project #:		12U14759						
Date:		01/07/13						
Test Engineer:		ROY ZHENG						
Configuration:		EUT standalone						
Mode:		TX, 1700 MHz BAND, WCDMA, Rel 99 MODE Peak						
Test Equipment:								
Receiving: Horn T73, and Camber A SMA Cables								
Substitution: Horn T120 Substitution, 4ft SMA Cable (245182002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1.7124	14.8	V	0.85	8.62	22.52	30.0	-7.5	
1.7124	16.7	H	0.85	8.47	24.29	30.0	-5.7	
Mid Ch								
1.7324	14.7	V	0.85	8.46	22.31	30.0	-7.7	
1.7324	18.0	H	0.85	8.36	25.51	30.0	-4.5	
High Ch								
1.7525	14.9	V	0.85	8.30	22.35	30.0	-7.7	
1.7525	17.4	H	0.85	8.25	24.80	30.0	-5.2	
Rev. 3.17.11								

UMTS HSUPA (Band 4)

High Frequency Fundamental Measurement Compliance Certification Services Chamber A								
Company:		Apple						
Project #:		12U14759						
Date:		01/07/13						
Test Engineer:		ROY ZHENG						
Configuration:		EUT standalone						
Mode:		TX, 1700 MHz BAND, HSUPA MODE						
Test Equipment:								
Receiving: Horn T73, and Camber A SMA Cables								
Substitution: Horn T120 Substitution, 4ft SMA Cable (245182002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1.7124	16.4	V	0.9	8.6	24.2	30.0	-5.8	
1.7124	17.9	H	0.9	8.5	25.5	30.0	-4.5	
Mid Ch								
1.7324	16.8	V	0.9	8.5	24.4	30.0	-5.6	
1.7324	18.4	H	0.9	8.4	25.9	30.0	-4.1	
High Ch								
1.7525	16.8	V	0.9	8.3	24.3	30.0	-5.8	
1.7525	17.9	H	0.9	8.3	25.3	30.0	-4.7	
Rev. 3.17.11								

PORT B / SECONDARY

UMTS, REL 99

High Frequency Fundamental Measurement Compliance Certification Services Chamber A								
Company:		Apple						
Project #:		12U14759						
Date:		01/07/13						
Test Engineer:		ROY ZHENG						
Configuration:		EUT standalone						
Mode:		TX, 1700 MHz BAND, WCDMA Rel 99 MODE Peak						
Test Equipment:								
Receiving: Horn T73, and Chamber A SMA Cables								
Substitution: Horn T120 Substitution, 4ft SMA Cable (245182002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1.7124	11.4	V	0.85	8.62	19.20	30.0	-10.8	
1.7124	11.4	H	0.85	8.47	18.98	30.0	-11.0	
Mid Ch								
1.7324	12.0	V	0.85	8.46	19.61	30.0	-10.4	
1.7324	12.7	H	0.85	8.36	20.16	30.0	-9.8	
High Ch								
1.7525	12.1	V	0.85	8.30	19.50	30.0	-10.5	
1.7525	13.1	H	0.85	8.25	20.48	30.0	-9.5	
Rev. 3.17.11								

UMTS, HSUPA

High Frequency Fundamental Measurement Compliance Certification Services Chamber A								
Company:		Apple						
Project #:		12U14759						
Date:		01/07/13						
Test Engineer:		ROY ZHENG						
Configuration:		EUT standalone						
Mode:		TX, 1700 MHz BAND, WCDMA HSUPA MODE						
Test Equipment:								
Receiving: Horn T73, and Chamber A SMA Cables								
Substitution: Horn T120 Substitution, 4ft SMA Cable (245182002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1.7124	11.6	V	0.85	8.62	19.32	30.0	-10.7	
1.7124	12.3	H	0.85	8.47	19.90	30.0	-10.1	
Mid Ch								
1.7324	12.4	V	0.85	8.46	20.01	30.0	-10.0	
1.7324	13.1	H	0.85	8.36	20.61	30.0	-9.4	
High Ch								
1.7525	12.9	V	0.85	8.30	20.35	30.0	-9.7	
1.7525	13.4	H	0.85	8.25	20.80	30.0	-9.2	
Rev. 3.17.11								

9.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §27.53

LIMIT

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.

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:

PORT A (LAT) and PORT B (UAT PORT)

- UMTS, REL 99 and HSUPA

RESULTS

PORT A, UMTS REL 99

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Apple
Project #: 12U14759
Date: 01/07/12
Test Engineer: ROY ZHENG
Configuration: EUT standalone
Mode: TX, 1700MHz BAND Rel 99

Chamber	Pre-amplifier	Filter	Limit
5m Chamber A	T144 8449B	Filter 1	Part 27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (1712.4MHz)									
3.425	-11.7	V	3.0	37.0	1.0	-47.7	-13.0	-34.7	
5.137	-14.4	V	3.0	36.3	1.0	-49.6	-13.0	-36.6	
3.425	-16.8	H	3.0	37.0	1.0	-52.8	-13.0	-39.8	
5.137	-15.2	H	3.0	36.3	1.0	-50.5	-13.0	-37.5	
Mid Ch, (1732.4MHz)									
3.465	-11.6	V	3.0	37.0	1.0	-47.6	-13.0	-34.6	
5.197	-15.4	V	3.0	36.2	1.0	-50.7	-13.0	-37.7	
3.465	-13.4	H	3.0	37.0	1.0	-49.4	-13.0	-36.4	
5.197	-16.7	H	3.0	36.2	1.0	-51.9	-13.0	-38.9	
High Ch, (1752.6MHz)									
3.505	-10.5	V	3.0	37.0	1.0	-46.5	-13.0	-33.5	
5.258	-15.5	V	3.0	36.3	1.0	-50.8	-13.0	-37.8	
3.505	-14.0	H	3.0	37.0	1.0	-50.0	-13.0	-37.0	
5.258	-15.6	H	3.0	36.3	1.0	-50.8	-13.0	-37.8	

Rev. 03.03.09
 Note: No other emissions were detected above the system noise floor.

PORT A, UMTS HSUPA

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		12U14759							
Date:		01/07/12							
Test Engineer:		ROY ZHENG							
Configuration:		EUT standalone							
Mode:		TX, 1700MHz BAND HSUPA MODE							
Chamber		Pre-amplifier			Filter		Limit		
5m Chamber A		T144 8449B			Filter 1		Part 27		
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (1712.40MHz)									
3.425	-14.4	V	3.0	37.0	1.0	-50.4	-13.0	-37.4	
5.137	-13.4	V	3.0	36.3	1.0	-48.6	-13.0	-35.6	
3.425	-13.8	H	3.0	37.0	1.0	-49.9	-13.0	-36.9	
5.137	-14.8	H	3.0	36.3	1.0	-50.1	-13.0	-37.1	
Mid Ch, (1732.40MHz)									
3.465	-13.8	V	3.0	37.0	1.0	-49.8	-13.0	-36.8	
5.197	-16.2	V	3.0	36.2	1.0	-51.5	-13.0	-38.5	
3.465	-14.4	H	3.0	37.0	1.0	-50.4	-13.0	-37.4	
5.197	-14.7	H	3.0	36.2	1.0	-49.9	-13.0	-36.9	
High Ch, (1752.60MHz)									
3.505	-10.5	V	3.0	37.0	1.0	-46.5	-13.0	-33.5	
5.258	-15.1	V	3.0	36.3	1.0	-50.4	-13.0	-37.4	
3.505	-13.2	H	3.0	37.0	1.0	-49.2	-13.0	-36.2	
5.258	-15.6	H	3.0	36.3	1.0	-50.8	-13.0	-37.8	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

PORT B, UMTS REL 99

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Apple
Project #: 12U14759
Date: 01/07/12
Test Engineer: Roy Zheng
Configuration: EUT Only
Mode: TX, 1700MHz Band Rel 99
 Port B

Chamber

3m Chamber

Pre-amplifier

T34 8449B

Filter

Filter 1

Limit

Part 27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (1712.4MHz)									
3.425	-16.6	V	3.0	35.7	1.0	-51.2	-13.0	-38.2	
5.137	-20.6	V	3.0	34.7	1.0	-54.3	-13.0	-41.3	
3.425	-21.7	H	3.0	35.7	1.0	-56.3	-13.0	-43.3	
5.137	-20.9	H	3.0	34.7	1.0	-54.6	-13.0	-41.6	
Mid Ch, (1732.4MHz)									
3.465	-16.3	V	3.0	35.6	1.0	-51.0	-13.0	-38.0	
5.197	-21.1	V	3.0	34.7	1.0	-54.8	-13.0	-41.8	
3.465	-20.6	H	3.0	35.6	1.0	-55.2	-13.0	-42.2	
5.197	-21.7	H	3.0	34.7	1.0	-55.4	-13.0	-42.4	
High Ch, (1752.6MHz)									
3.505	-14.8	V	3.0	35.6	1.0	-49.4	-13.0	-36.4	
5.258	-21.2	V	3.0	34.7	1.0	-54.9	-13.0	-41.9	
3.505	-17.9	H	3.0	35.6	1.0	-52.5	-13.0	-39.5	
5.258	-22.1	H	3.0	34.7	1.0	-55.8	-13.0	-42.8	

Rev. 03.03.09
 Note: No other emissions were detected above the system noise floor.

PORT B, UMTS HSUPA

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Apple
Project #: 12U14759
Date: 01/07/12
Test Engineer: ROY ZHENG
Configuration: EUT standalone
Mode: TX, 1700MHz BAND HSUPA MODE

Chamber

3m Chamber

Pre-amplifier

T34 8449B

Filter

Filter 1

Limit

Part 27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch. (1712.40MHz)									
3.425	-15.4	V	3.0	35.7	1.0	-50.0	-13.0	-37.0	
5.137	-17.9	V	3.0	34.7	1.0	-51.6	-13.0	-38.6	
3.425	-20.5	H	3.0	35.7	1.0	-55.2	-13.0	-42.2	
5.137	-22.8	H	3.0	34.7	1.0	-56.5	-13.0	-43.5	
Mid Ch. (1732.40MHz)									
3.465	-13.5	V	3.0	35.6	1.0	-48.1	-13.0	-35.1	
5.197	-20.4	V	3.0	34.7	1.0	-54.1	-13.0	-41.1	
3.465	-18.1	H	3.0	35.6	1.0	-52.7	-13.0	-39.7	
5.197	-21.7	H	3.0	34.7	1.0	-55.4	-13.0	-42.4	
High Ch. (1752.50MHz)									
3.505	-11.7	V	3.0	35.6	1.0	-46.3	-13.0	-33.3	
5.258	-20.5	V	3.0	34.7	1.0	-54.2	-13.0	-41.2	
3.505	-16.6	H	3.0	35.6	1.0	-51.2	-13.0	-38.2	
5.258	-20.9	H	3.0	34.7	1.0	-54.6	-13.0	-41.6	

Rev. 03.03.09
 Note: No other emissions were detected above the system noise floor.