QUALCOMM
CDMA Technologies

INGEO (J9CINGEO1)
FCC Part 22 and 24 Test Report

80-VJ402-1

July 14, 2008

Submit technical questions to:
regulatory.support@qualcomm.com

QUALCOMM Incorporated
5775 Morehouse Drive
San Diego, CA 92121-1714
U.S.A.

July 14, 2008
INGEO (J9CINGEO1) FCC Part 22 and 24 Test Report
80-VJ402-1

List of Exhibits

Exhibit	Description	FCC Reference
1	Certification of Test Data	2.911
2	RF Output Power Measured Data - Cellular	2.1046
3	RF Output Power Measured Data - PCS	2.1046, 24.232
4	Occupied Bandwidth and Spurious Emission Measured Data - Cellular	2.1049, 22.917
5	Occupied Bandwidth and Spurious Emission Measured Data - PCS	2.1049, 24.238
6	Conducted Harmonics Emissions Measured Data - Cellular	2.1051, 22.917, 22.901(d)
7	Conducted Harmonics Emissions Measured Data - PCS	2.1051, 24.238
8	Frequency Stability vs. Temperature and Voltage Measured Data - Cellular	2.1055
9	Frequency Stability vs. Temperature and Voltage Measured Data - PCS	2.1055, 24.235
10	Measurement Procedures and Techniques	

Exhibit 1 – Certification of Test Data

The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the measurements of the sample's radio frequency interference emissions characteristics as of the dates and at the times of the test under the conditions herein specified.

Equipment Tested: INGEO, model – Amoi, S/N 00701446156

Dates of Test: 01/21/2008-02/01/2008

Test Performed by:

EMC Engineer, Senior Staff Manager
Robert J Scodellaro

Exhibit 2 – Transmitter RF Power Output - FCC part 2, Paragraph 2.1046

Transmitter RF Power Output - FCC part 2, Paragraph 2.1046

01/21/08

Conducted Power -- INGEO S/N 00701446156
The RF output power was measured using a Gigatronics 8542C Power Meter.

		RF output power (W) - Cellular
		Measured
carrier frequency (MHz)	channel	CDMA Modulation average (mW)
824.7	1013	0.263
836.49	383	0.251
848.31	777	0.257

The cellular band conducted power was measured using the test set up shown in exhibit 10. A Gigatronics power meter and sensor set to modulation average, level offset (for cable and direction coupler losses) and frequency correction (for the cellular band) were used to make the measurement. A call was established between the INGEO device and the Agilent 8960. The INGEO device was set to transmit at maximum conducted power and 100% duty cycle.

Transmitter RF Power Output - FCC part 2, Paragraph 2.1046

Transmitter RF Power Output - FCC part 2, Paragraph 2.1046

01/23/08

Radiated Power -- INGEO S/N 00701446156
The RF output power (**ERP)** was measured in an antenna range anechoic chamber.

		RF output power (W) – Cellular
		Measured
carrier frequency (MHz)	channel	CDMA
824.7	1013	0.224
836.49	383	0.219
848.31	777	0.209

The cellular band RF radiated power (ERP) was measured in an antenna range anechoic chamber as shown in exhibit 10. The INGEO device is mounted to the test fixture, a call is established, the INGEO device is set to maximum output power and 100 % duty cycle. A series of elevation and azimuth measurements are performed on INGEO device using the Orbit Fr595 software that controls the measurement system shown in exhibit 10. The Orbit Fr595 software compiles the measurement results and determines the maximum EIRP. The maximum EIRP level is then converted to an ERP result.

Exhibit 3

Transmitter RF Power Output - FCC part 24, Paragraph 2.1046, 24.232 (b)

Transmitter RF Power Output - FCC part 24, Paragraph 2.1046, 24.232 (b),24.232(d)

01/21/08

Conducted power -- INGEO S/N 00701446156
The RF output power was measured using a Gigatronics 8542C Power Meter.

RF output power (W) - PCS				
carrier frequency (MHz)	Channel	CDMA Modulation average (mW)	Peak to Average ratio (PAR) (dB)	Peak to Average ratio (PAR) Limit (dB)
		measured		
1851.25	25	0.240	3.90	13
1880	600	0.245	3.71	13
1908.75	1175	0.257	3.54	13

The PCS band conducted power was measured using the test set up shown in exhibit 10. A Gigatronics power meter and sensor set to modulation average, level offset (for cable and direction coupler losses) and frequency correction (for the PCS band) was used to make the measurement. A call was established between the INGEO device and the Agilent 8960. The INGEO device was set to transmit at maximum conducted and 100% duty cycle. The Gigatronics power meter was set to peak measurement in order to perform the Peak to Average ratio (PAR) measurement.

Transmitter RF Power Output - FCC part 24, Paragraph 2.1046, 24.232 (b)

Transmitter RF Power Output - FCC part 24, Paragraph 2.1046, 24.232 (b)

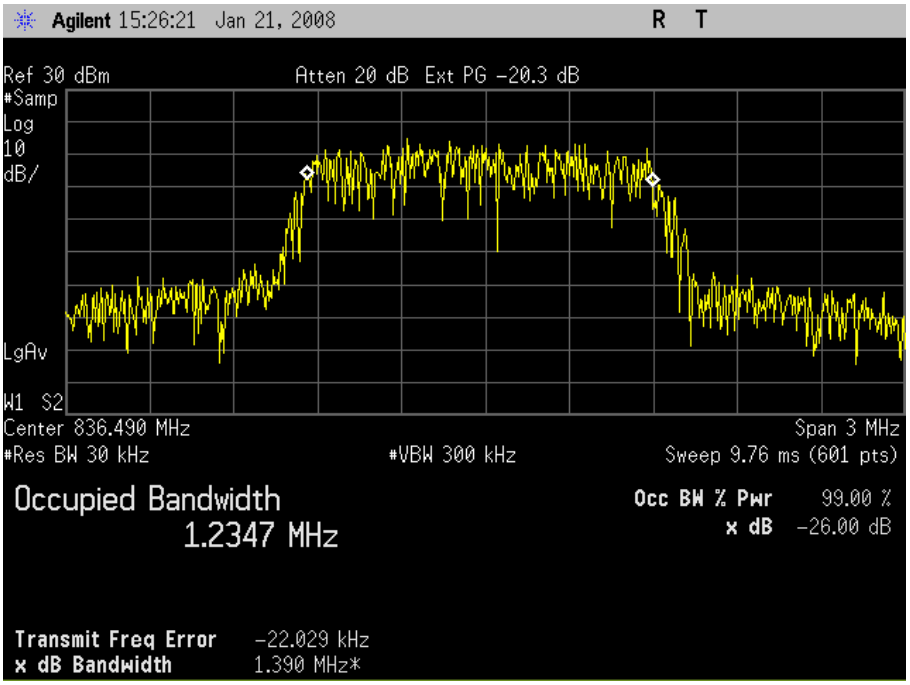
01/23/08

Radiated power -- INGEO S/N 00701446156
The RF output power, **EIRP** was measured in an antenna range anechoic chamber.

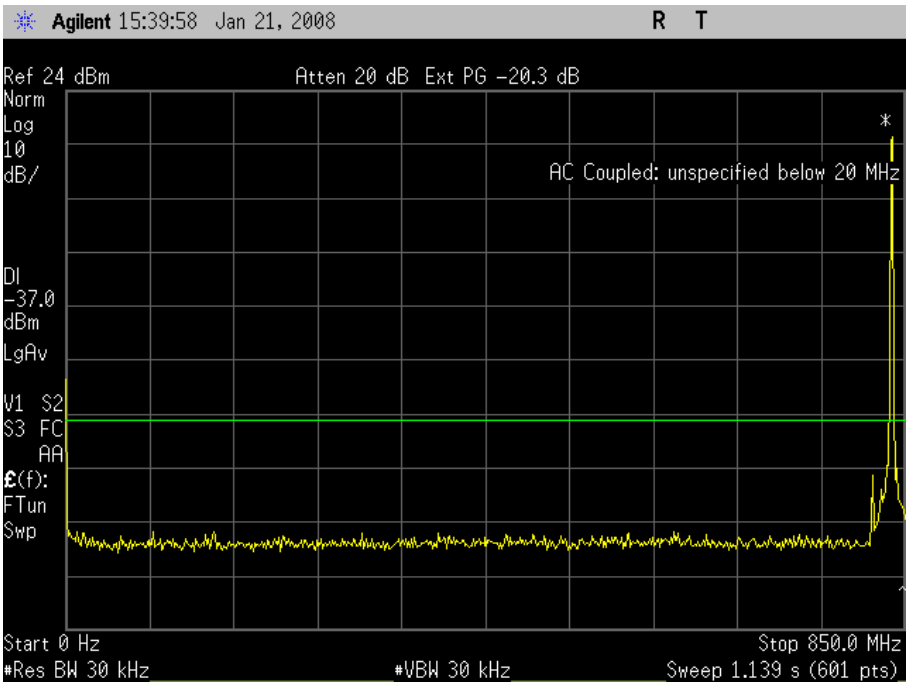
		RF output power (W) - PCS
carrier frequency (MHz)	channel	CDMA
		Measured
1851.25	25	0.234
1880	600	0.218
1908.75	1175	0.229

The PCS band RF radiated power (EIRP) was measured in an antenna range anechoic chamber as shown in exhibit 10. The INGEO device is mounted to the test fixture, a call is established, the INGEO device is set to maximum output power and 100 % duty cycle. A series of elevation and azimuth measurements are performed on INGEO device using the Orbit Fr595 software that controls the measurement system shown in exhibit 10. The Orbit Fr595 software compiles the measurement results and determines the maximum EIRP.

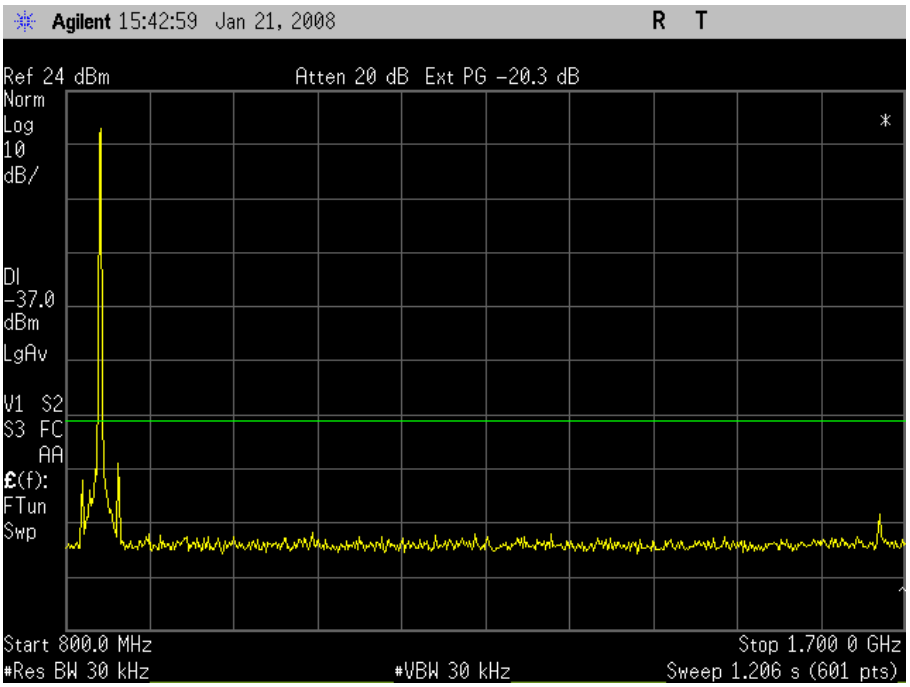
Exhibit 4 – Occupied Bandwidth and Spurious Emission Measured Data - FCC Part 2.1049, 22.917 INGEO S/N 00701446156



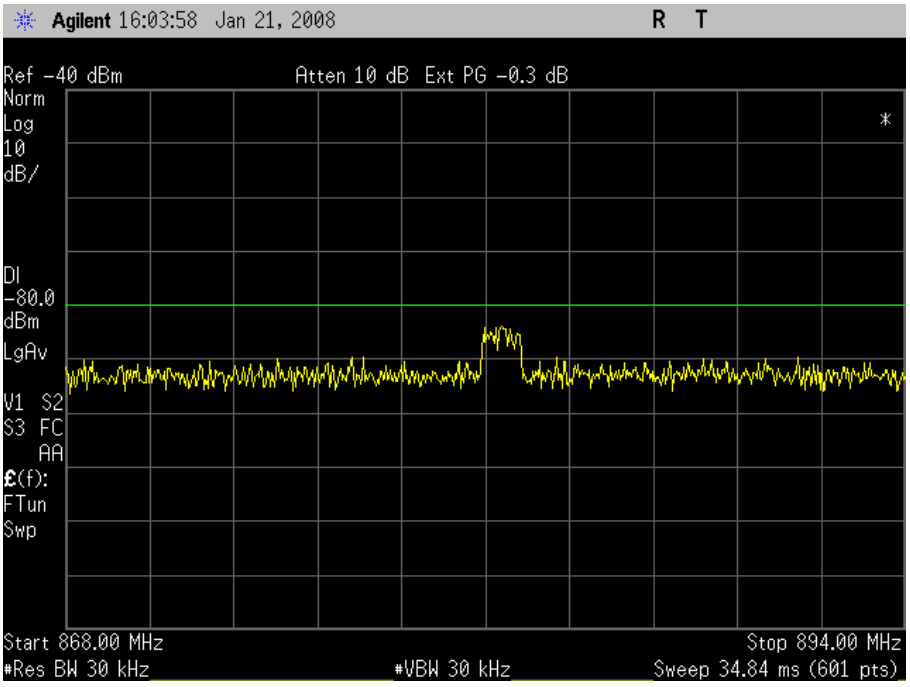
Channel 383



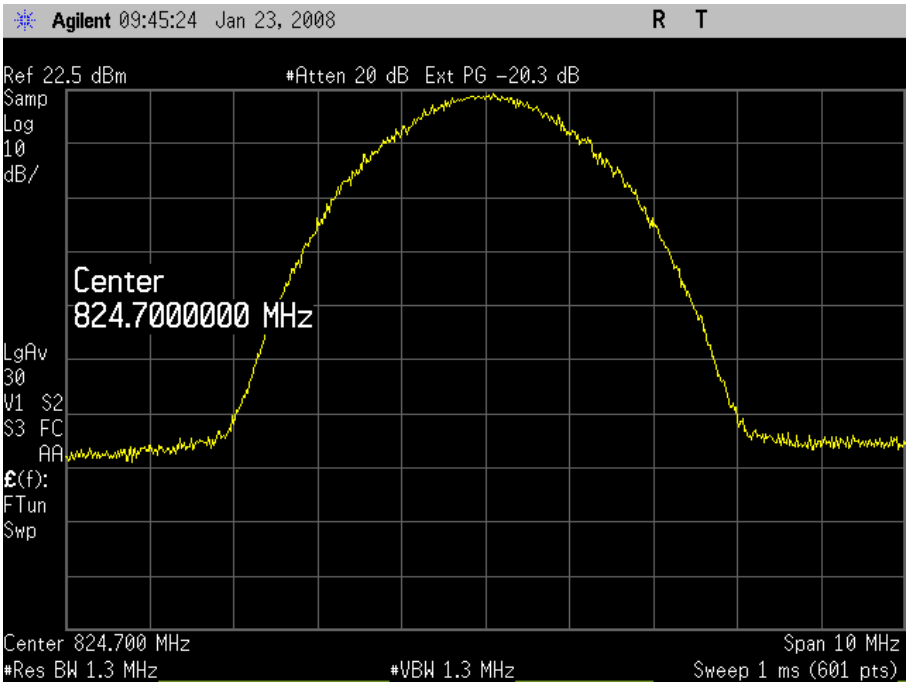
Channel 383



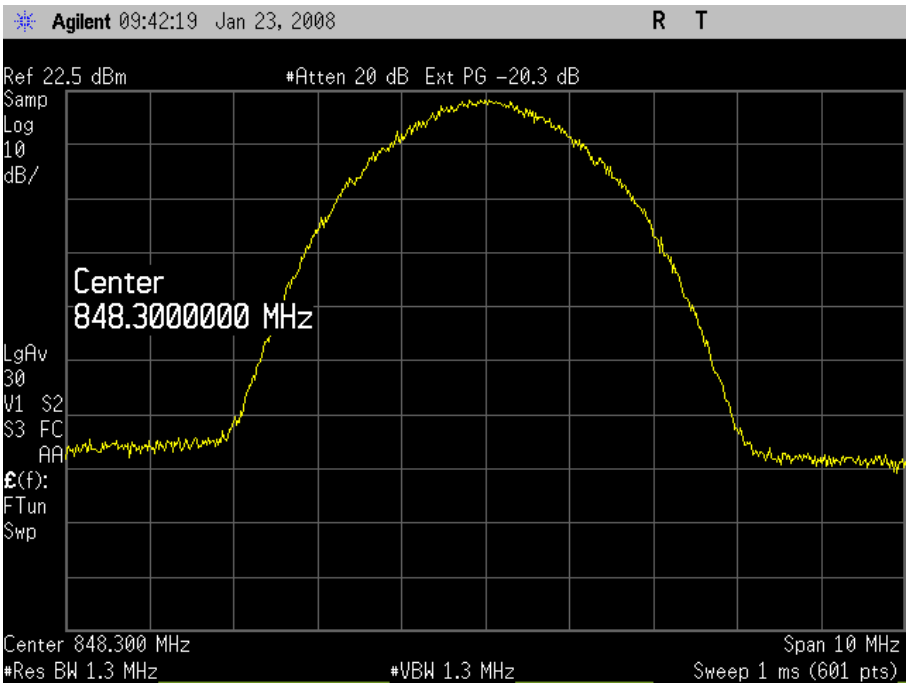
Channel 383



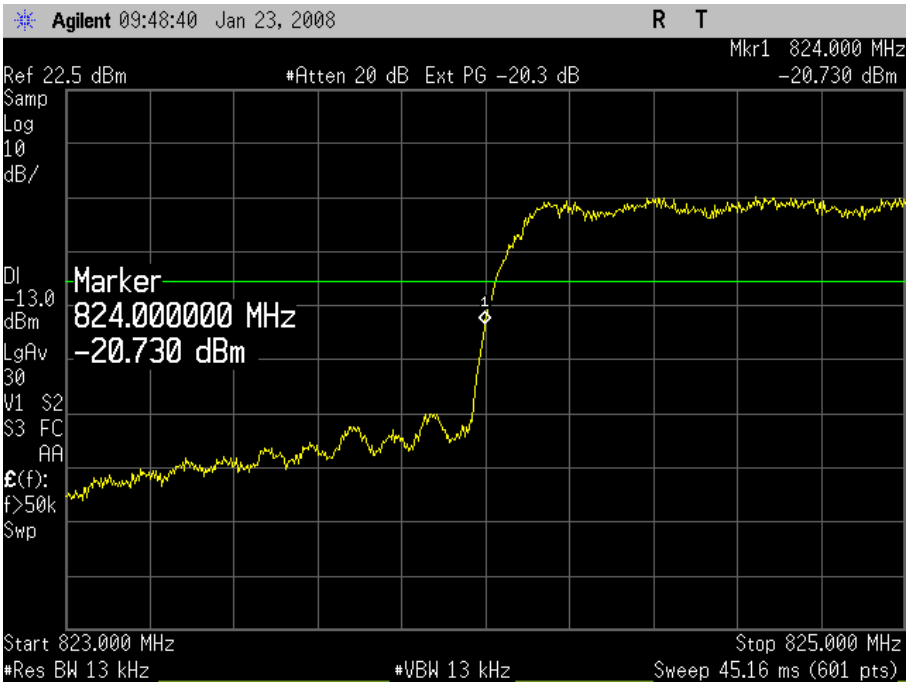
Channel 383



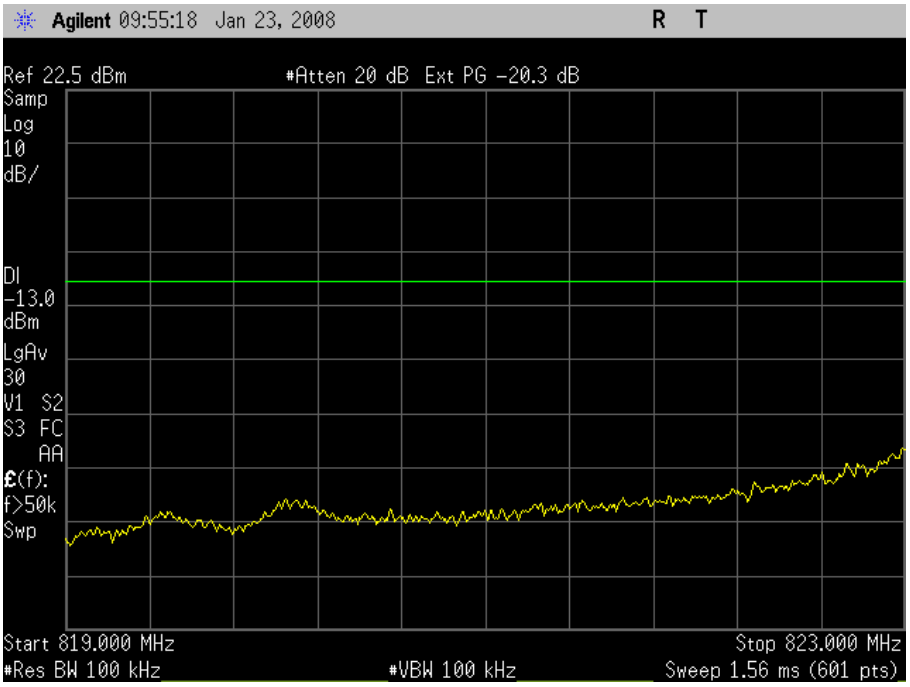
Channel 1013



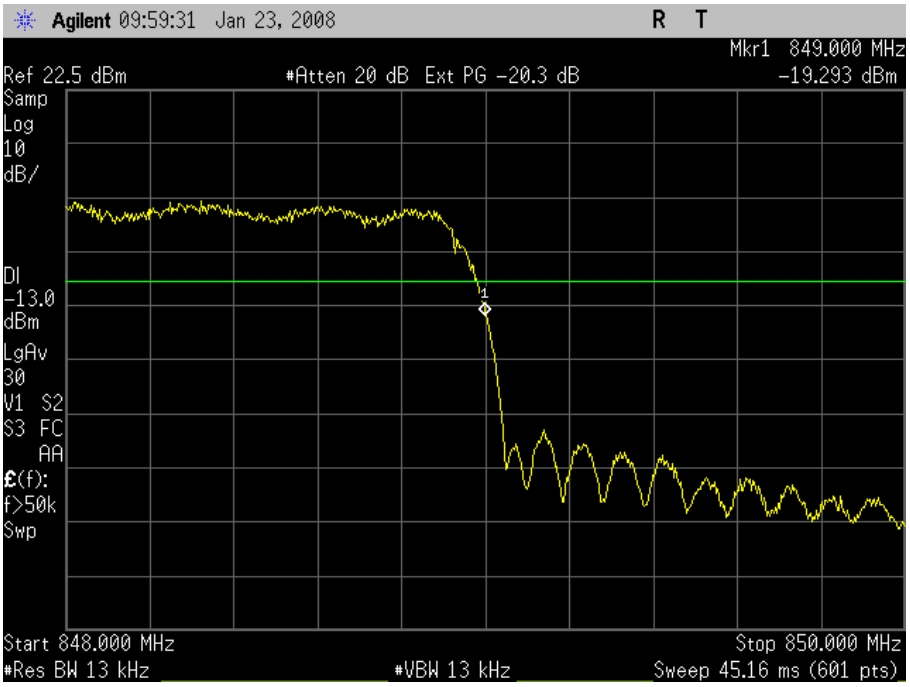
Channel 777



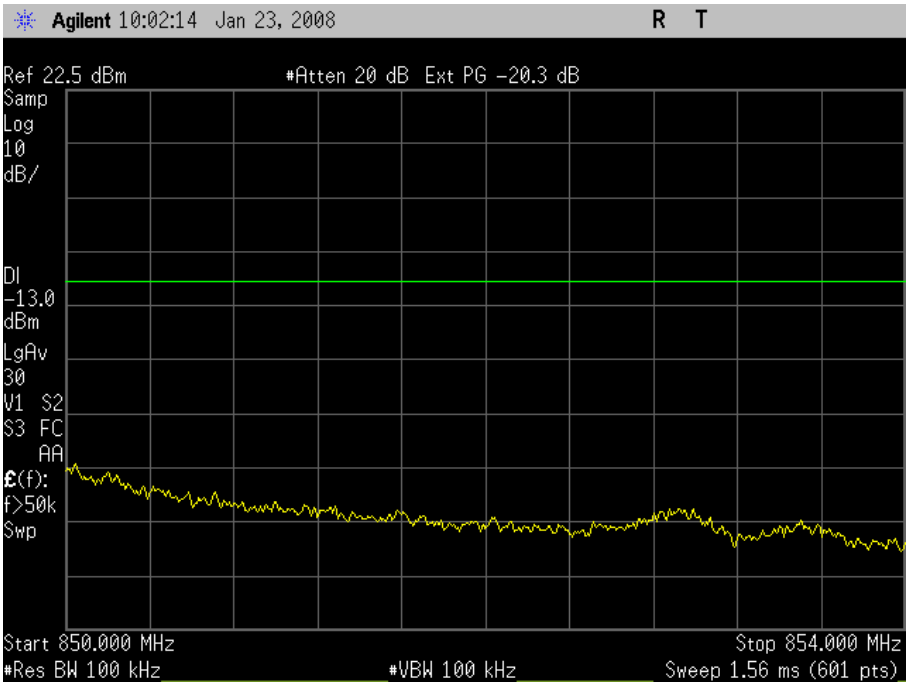
Channel 1013 Band Edge



Channel 1013 Band Edge

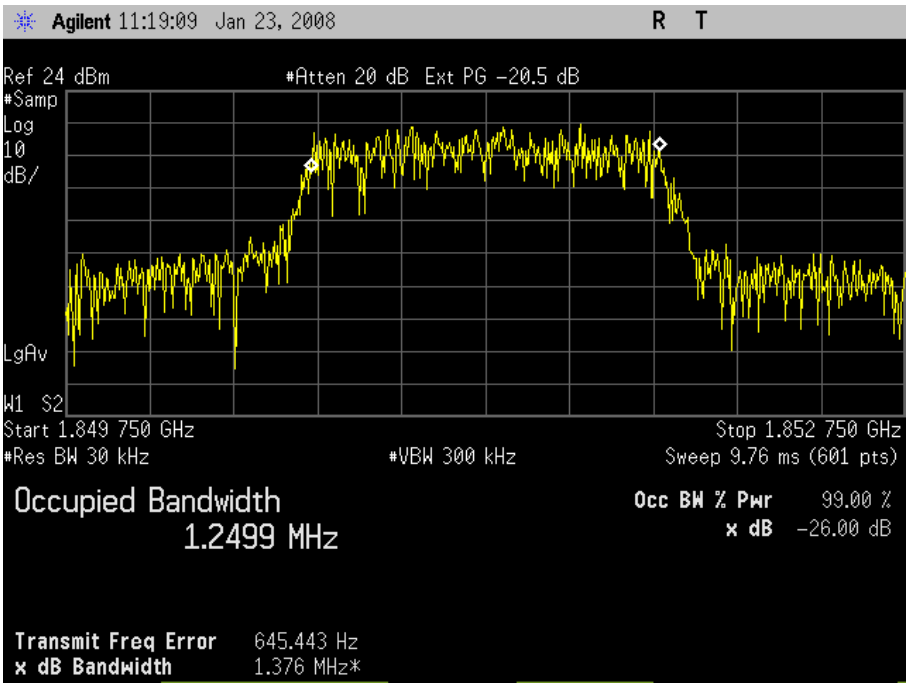


Channel 777 Band Edge

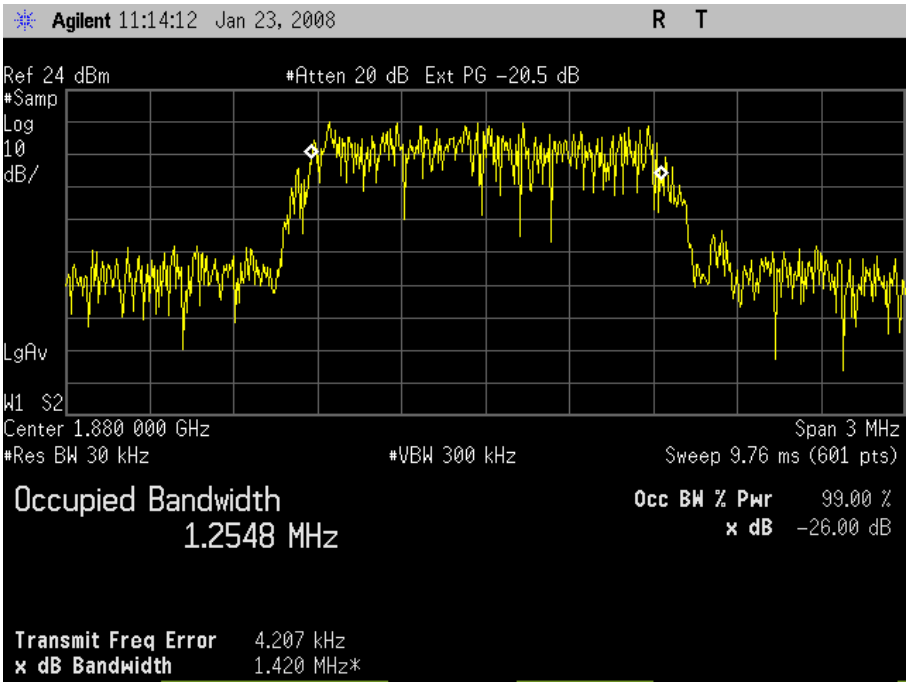


Channel 777 Band Edge

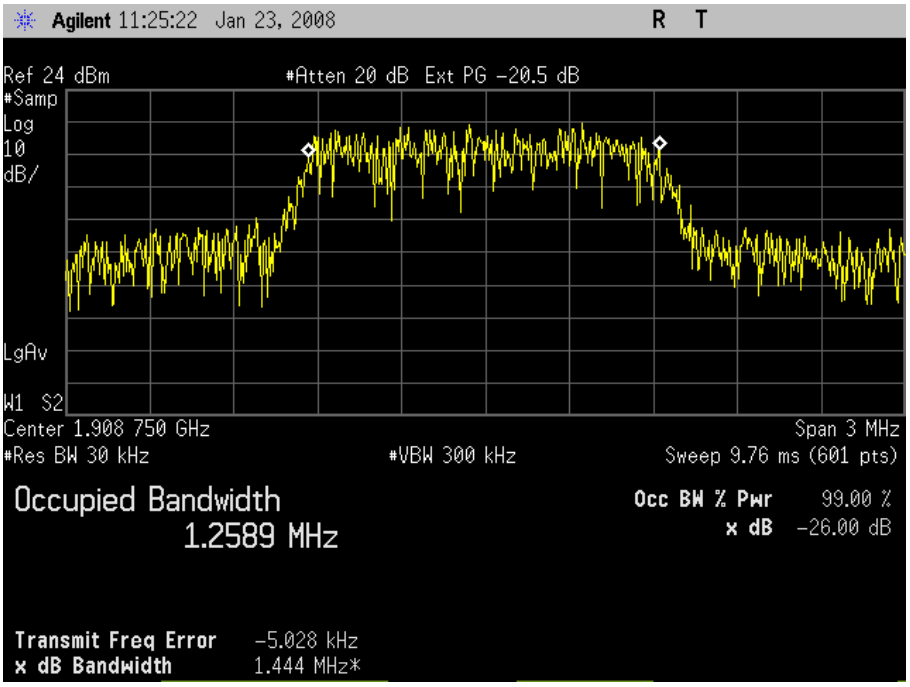
Exhibit 5 – Occupied Bandwidth and Spurious Emission Measured Data – FCC Part 2.1049, 24.238 INGEO S/N 00701446156



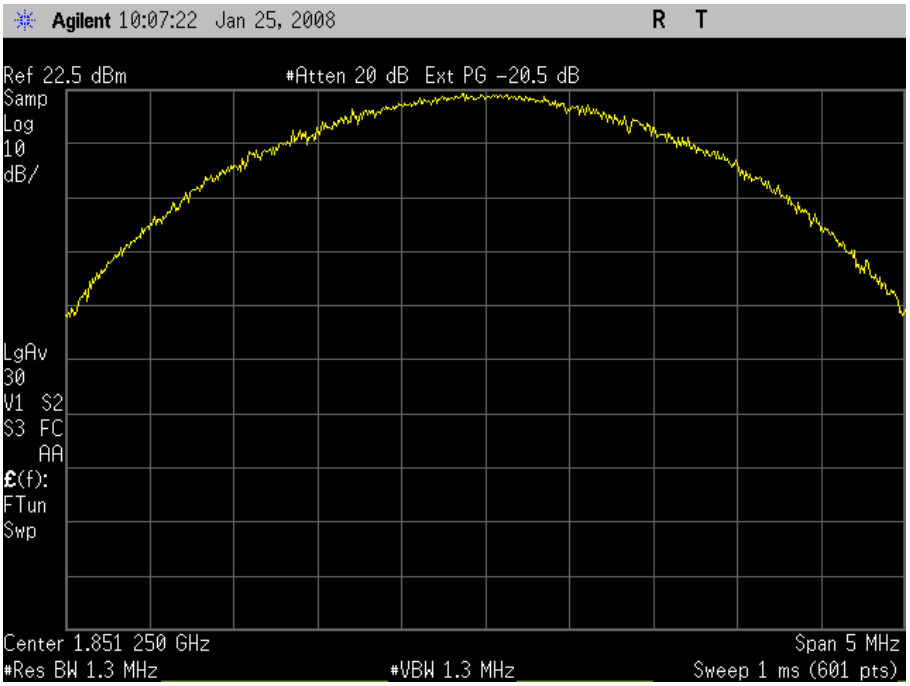
Channel 25



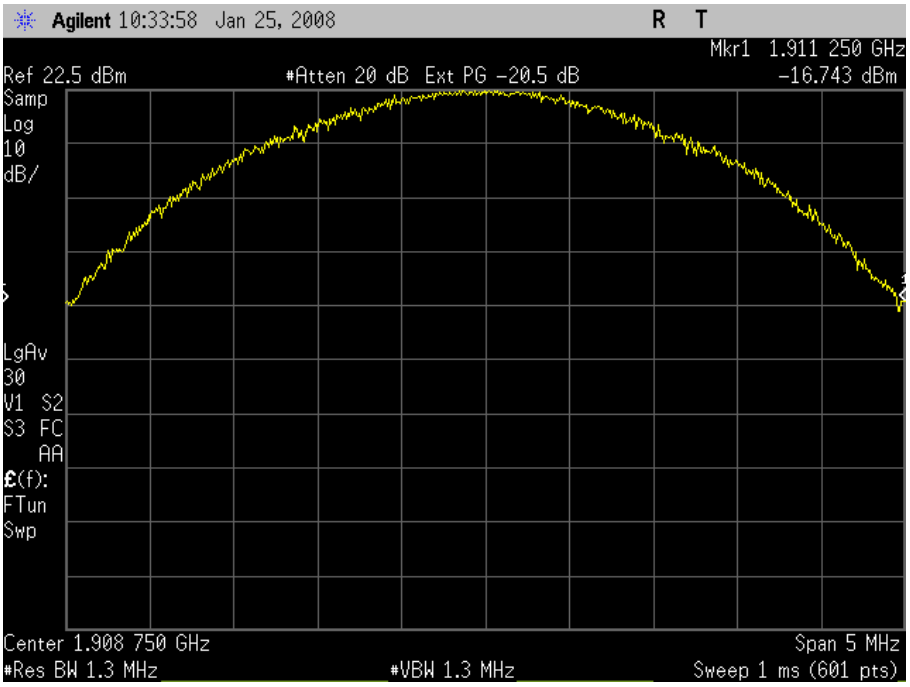
Channel 600



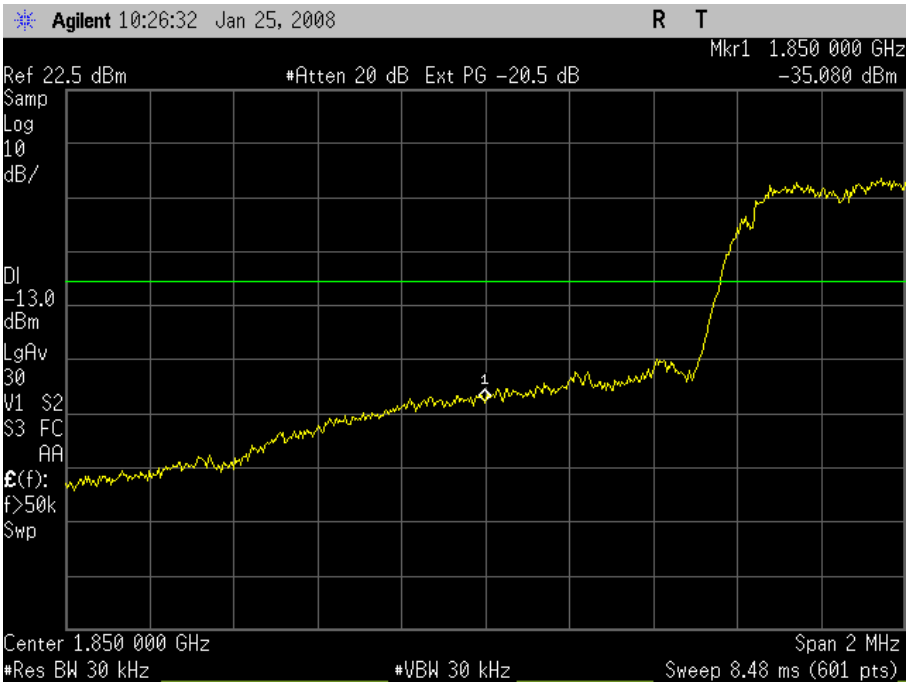
Channel 1175



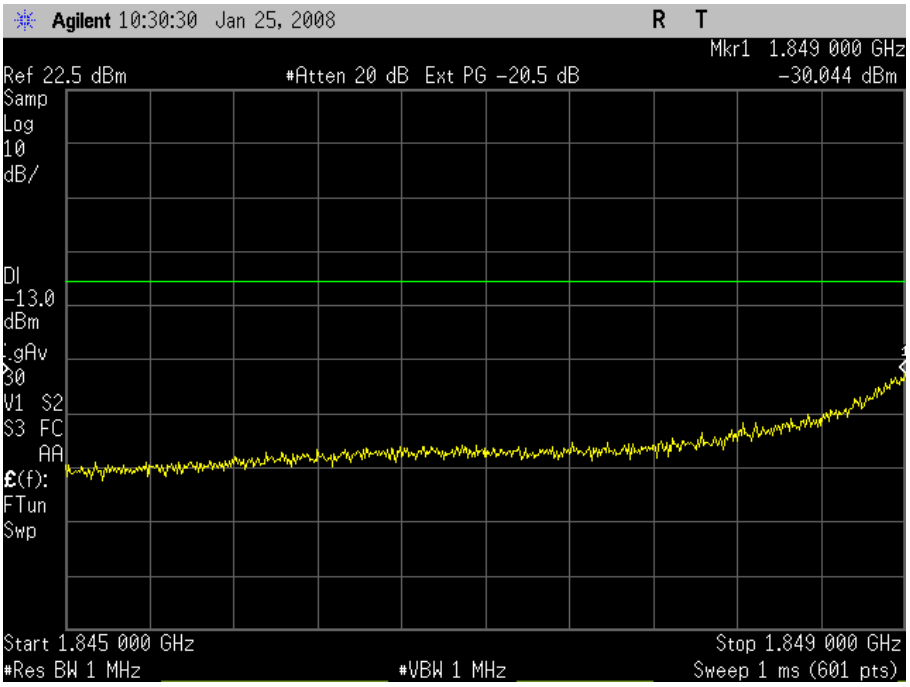
Channel 25



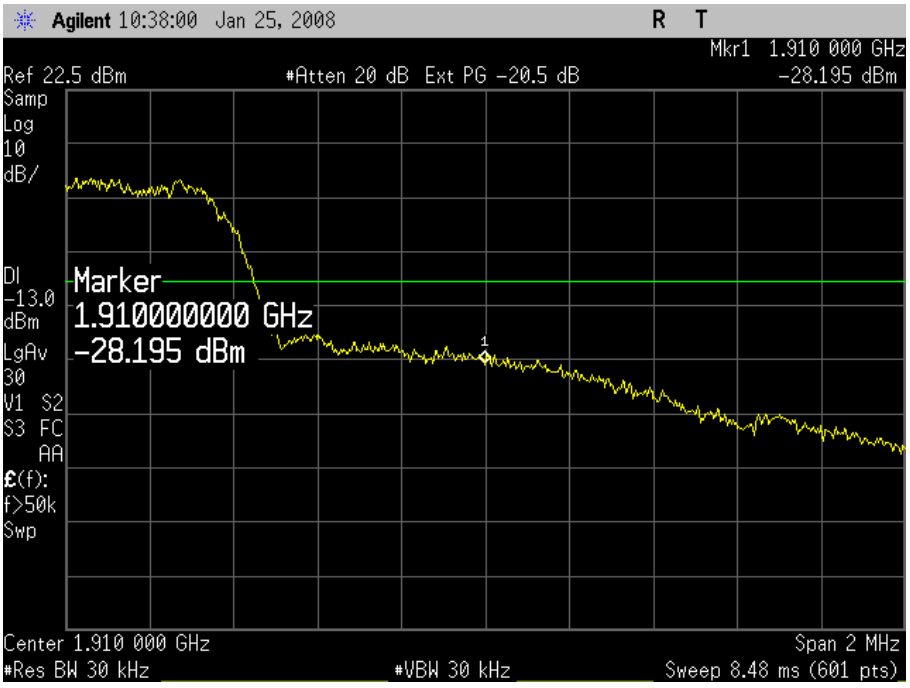
Channel 1175



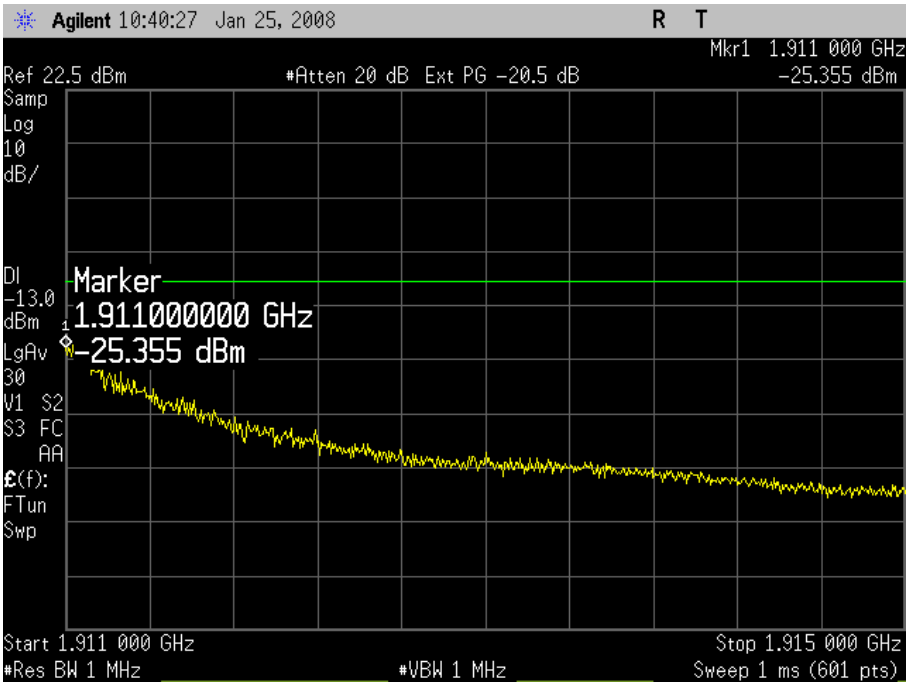
Channel 25 Band Edge



Channel 25 Band Edge

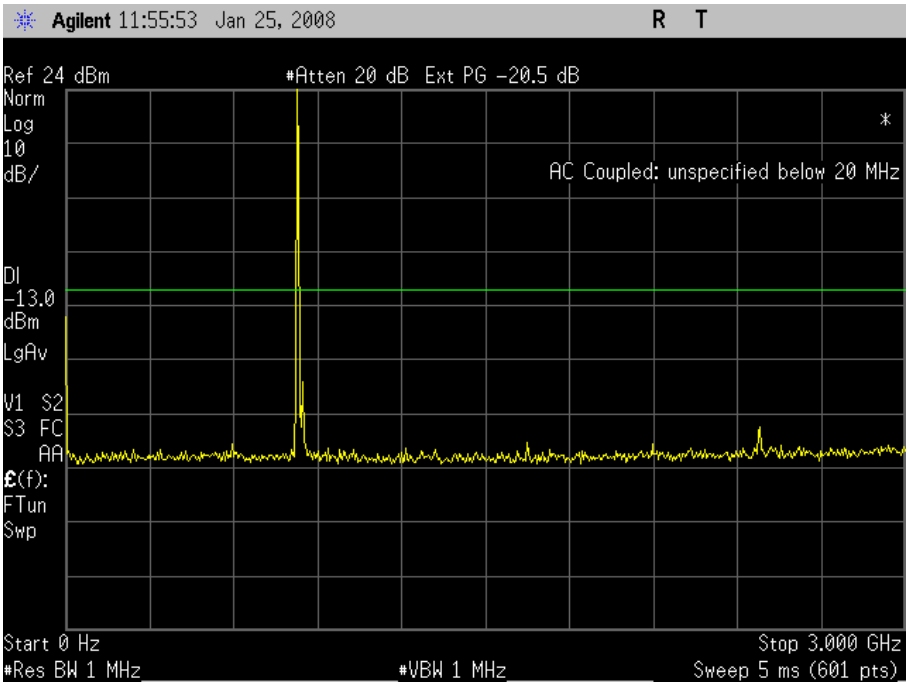


Channel 1175 Band Edge

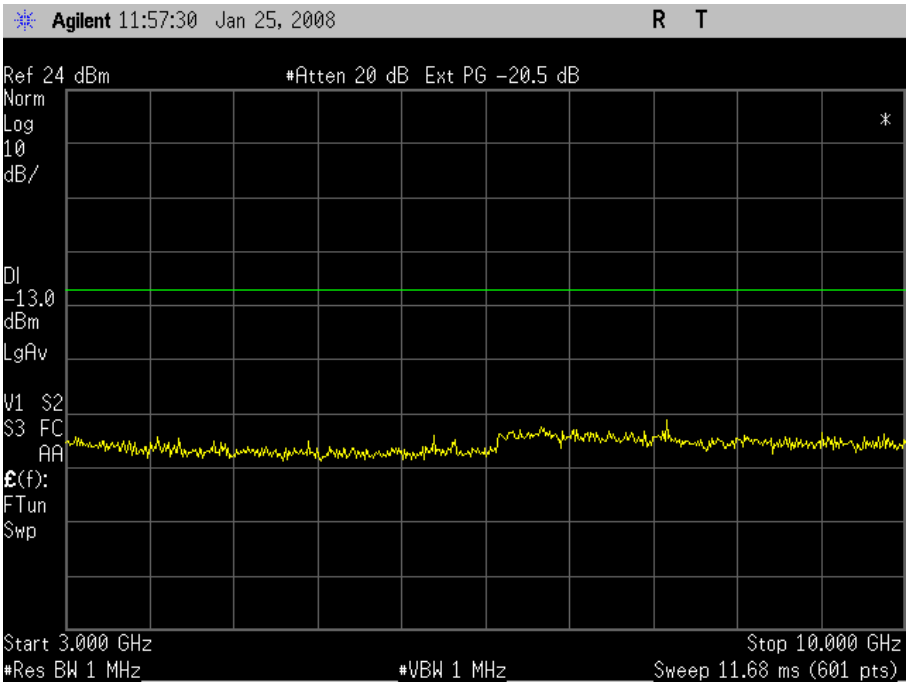


Channel 1175 Band Edge

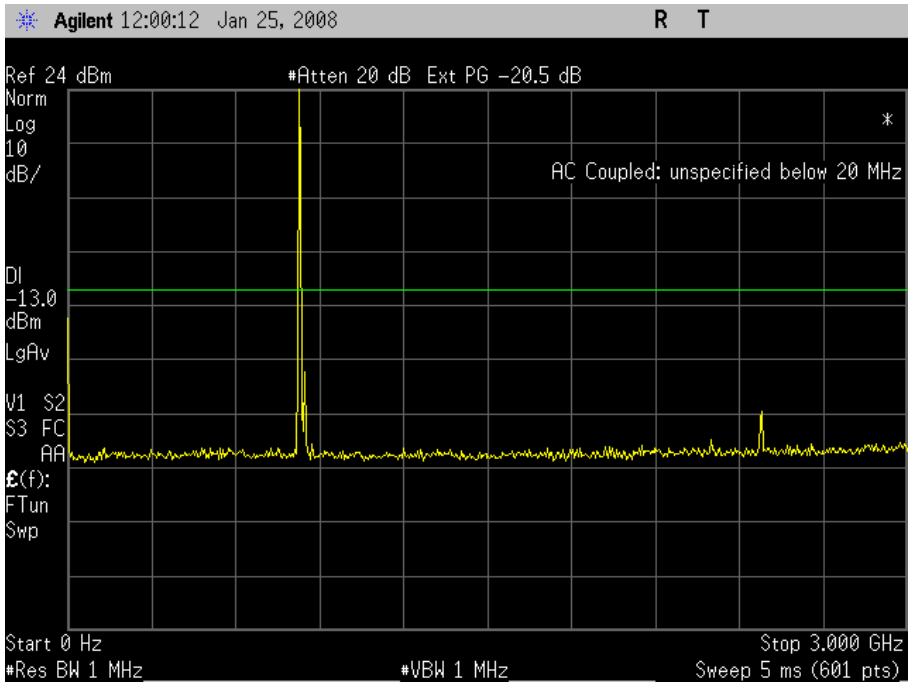
Exhibit 6 – Conducted Emissions Test Results (harmonics) - FCC Part 2 and 22, Paragraph 2.1051, 22.917 INGEO S/N 00701446156



CDMA Channel 1013 TX Max Power

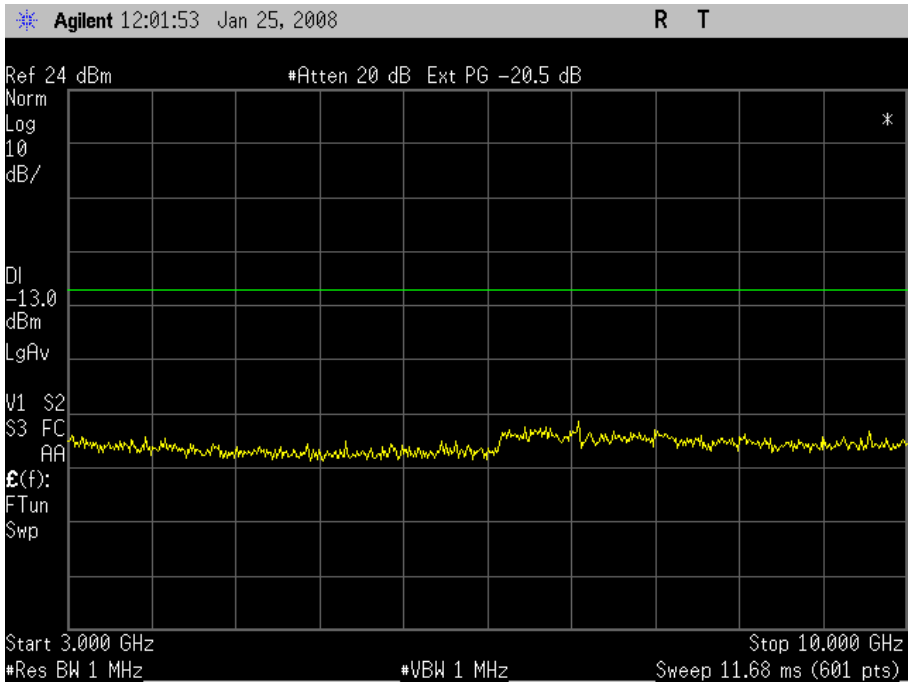


CDMA Channel 1013 TX Max Power

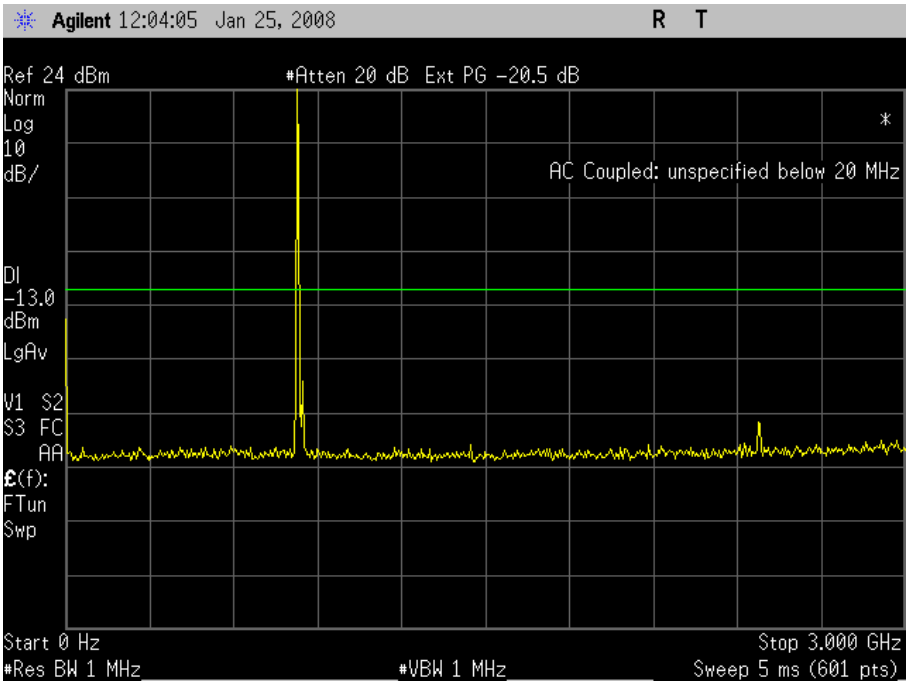


CDMA Channel 383 TX Max Power

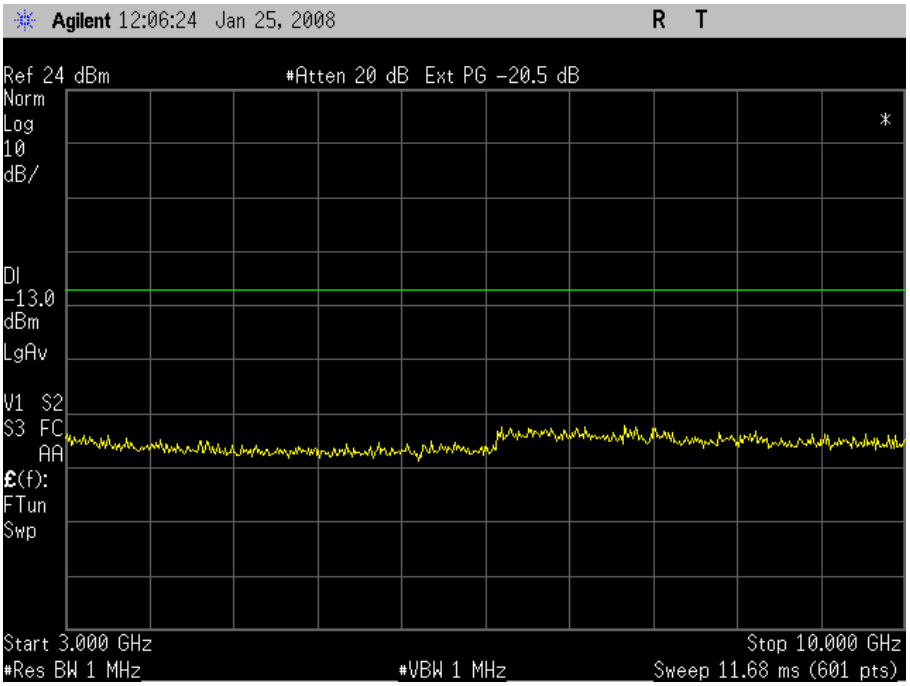
.



CDMA Channel 383 TX Max Power

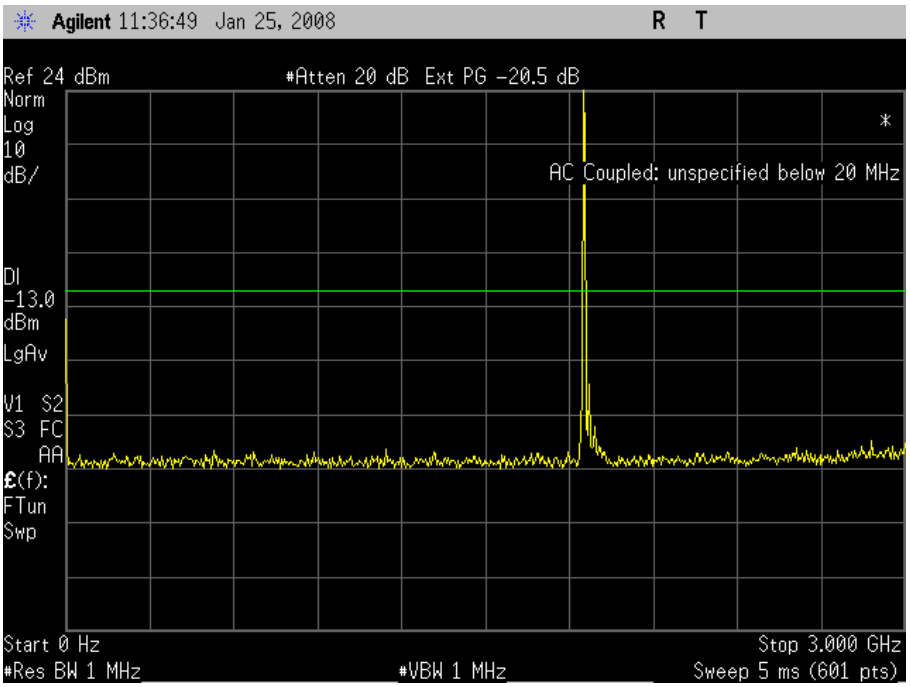


CDMA Channel 777 TX Max Power

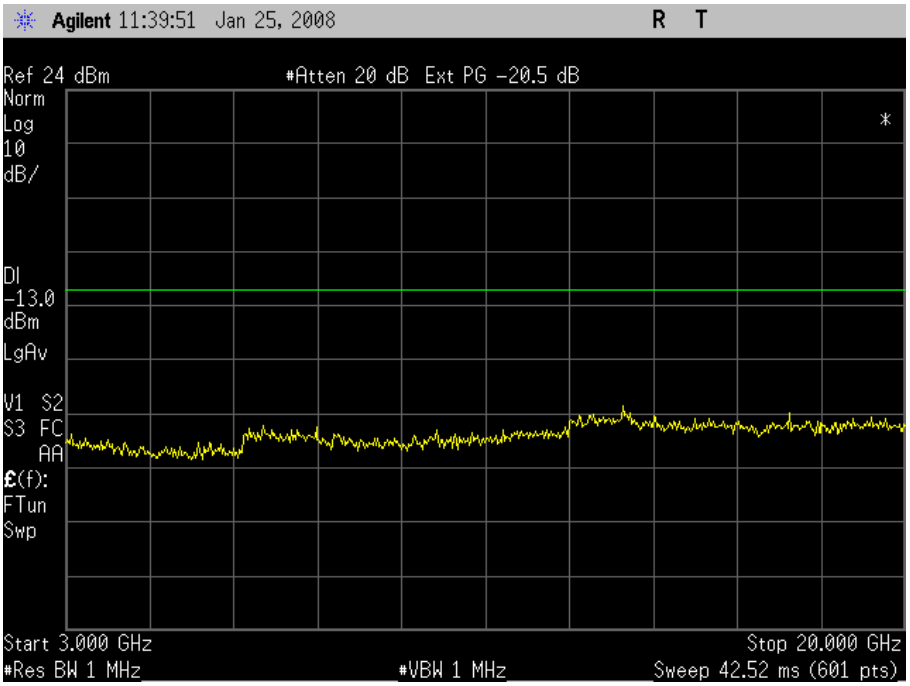


CDMA Channel 777 TX Max Power

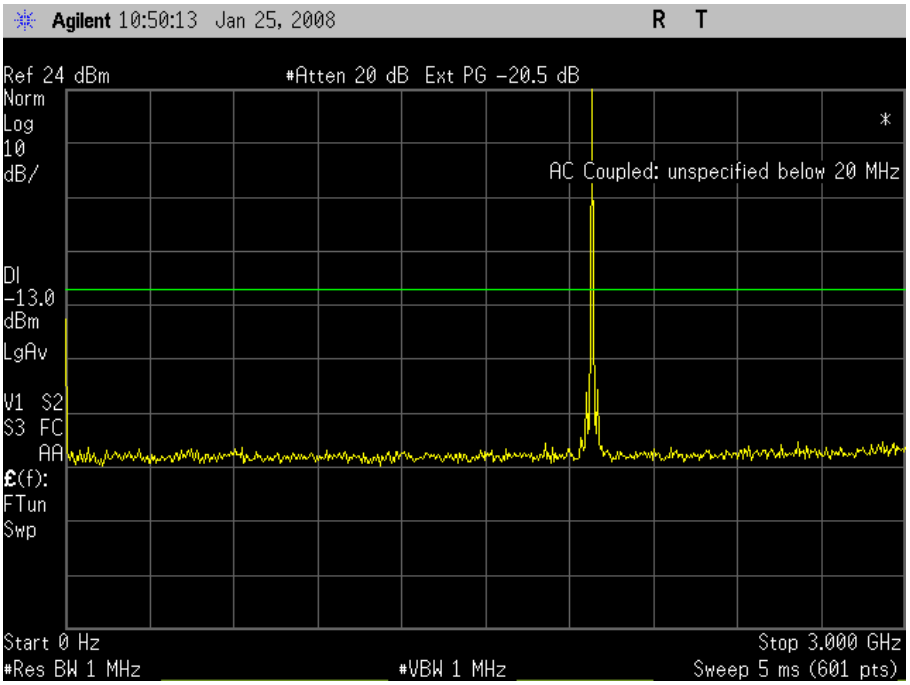
Exhibit 7 – Conducted Emission Test Results (Harmonics) and Spurious Emissions
FCC Part 2 and 24, Paragraph 2.1051, 24.238 INGEO S/N 00701446156



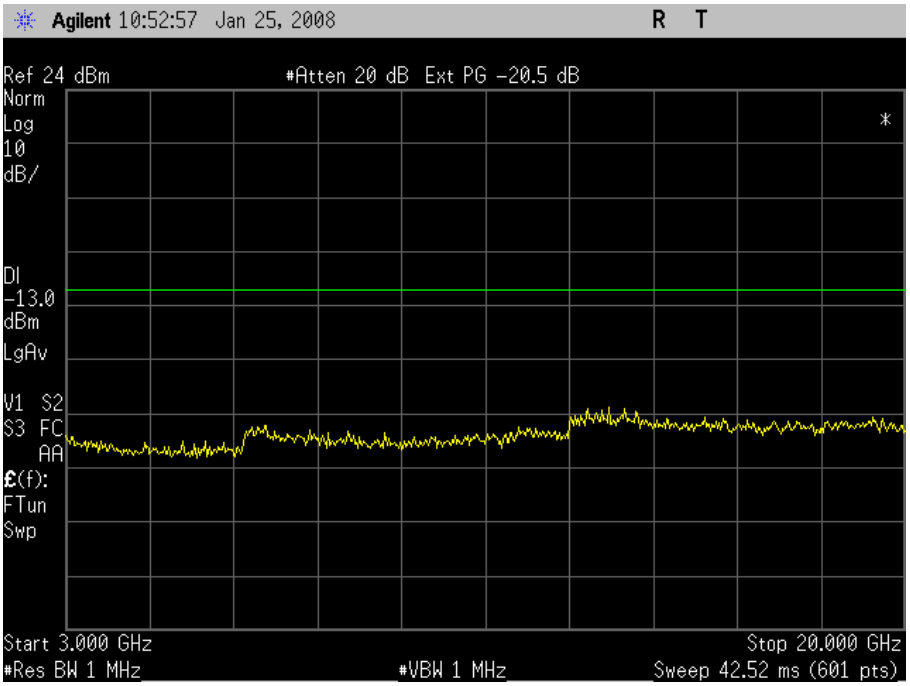
PCS Channel 25 TX Max Power



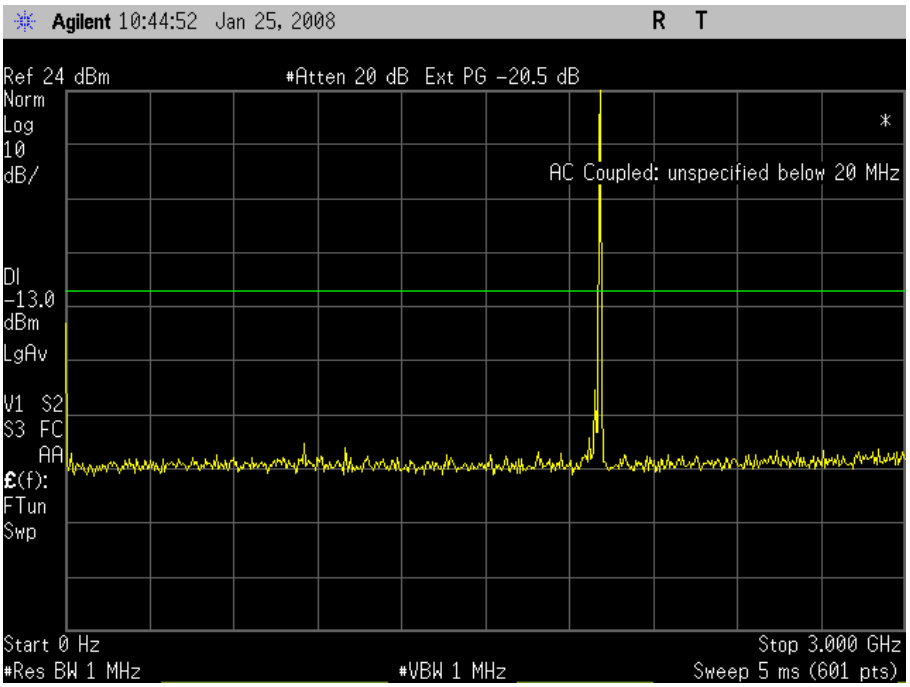
PCS Channel 25 TX Max Power



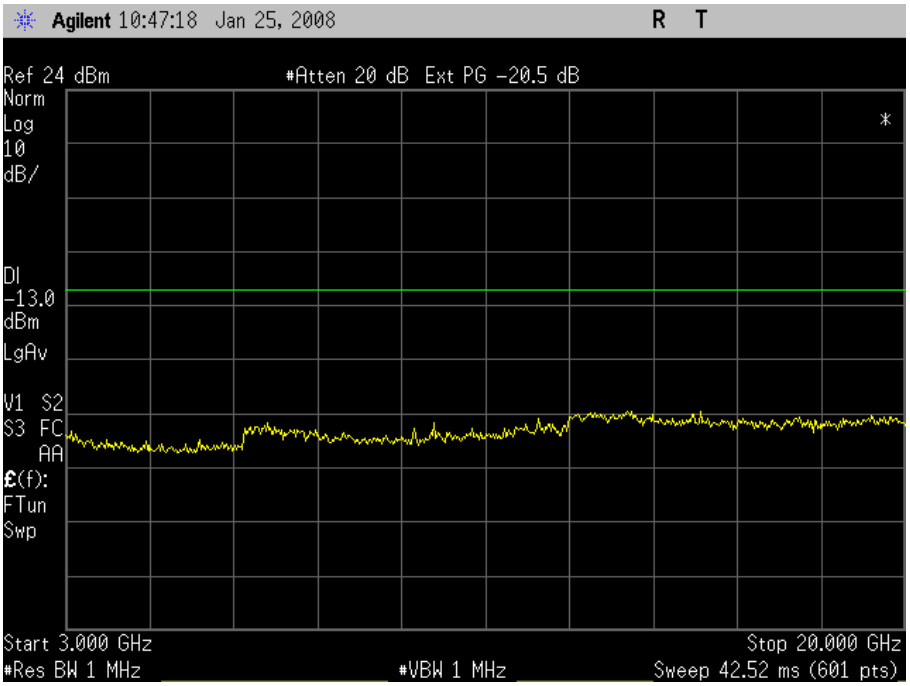
PCS Channel 600 TX Max Power



PCS Channel 600 TX Max Power



PCS Channel 1175 TX Max Power



PCS Channel 1175 TX Max Power

Exhibit 8 – Transmitter RF Carrier Frequency Stability - FCC part 2.1055

Measured with a Agilent Spectrum Analyzer
INGEO asset tracking device, s/n 00701446156
Carrier Frequency Reference at 25 Degrees C: 832753202 Hz

	variation from carrier frequency reference (Hz)						specification	
temp (C)	3.2V	3.4V	3.6V	3.8V	4.0V	4.2V	lower limit	upper limit
-30	-18	22	42	47	82	62	-2091	2091
-20	68	47	30	10	0	-60	-2091	2091
-10	-7	-5	13	38	25	42	-2091	2091
0	0	2	17	35	80	43	-2091	2091
10	-8	33	83	209	158	167	-2091	2091
20	25	8	-17	92	125	8	-2091	2091
30	-13	-38	-30	6	-18	-5	-2091	2091
40	-232	-48	-15	2	-38	-27	-2091	2091
50	-80	-110	-72	-18	-40	-87	-2091	2091
60	-68	-57	-142	-43	-85	-28	-2091	2091

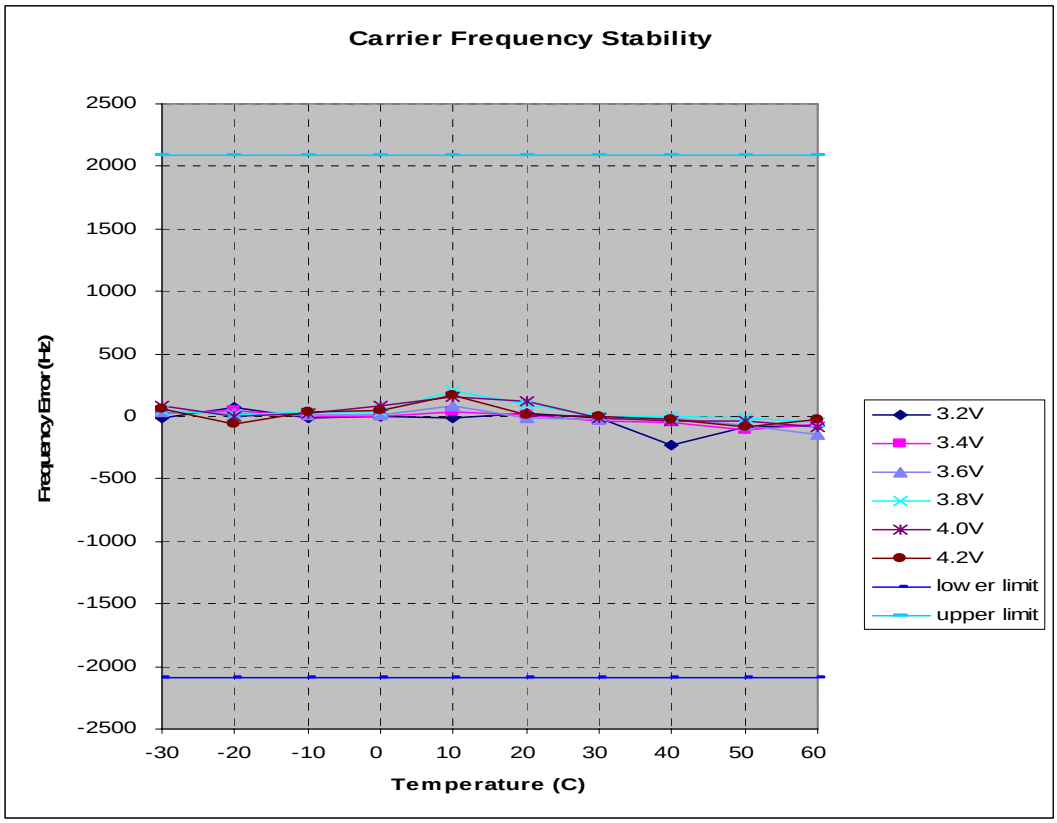


Exhibit 9 – Transmitter RF Carrier Frequency Stability - FCC part 2.1055, 24.235

Measured with a Agilent Spectrum Analyzer
INGEO asset tracking device, s/n 00701446156
Carrier Frequency Reference at 25 Degrees C: 1,879,268,344 Hz

	transmitter carrier frequency (MHz)						specification	
temp. (C)	3.2V	3.4V	3.6V	3.8V	4.0V	4.2V	lower limit	upper limit
-30	-30	-27	2	45	22	57	-4700	4700
-20	-17	-25	-15	14	47	42	-4700	4700
-10	-40	-22	-7	22	43	28	-4700	4700
0	-88	-13	-17	-12	-2	3	-4700	4700
10	-57	-23	-25	0	-28	2	-4700	4700
20	-13	2	-7	-3	4	-2	-4700	4700
30	-17	-13	-43	12	-30	-45	-4700	4700
40	-70	-92	-62	-17	-67	-47	-4700	4700
50	2	-77	-50	-48	-45	-55	-4700	4700
60	-37	-242	-122	-85	-95	-123	-4700	4700

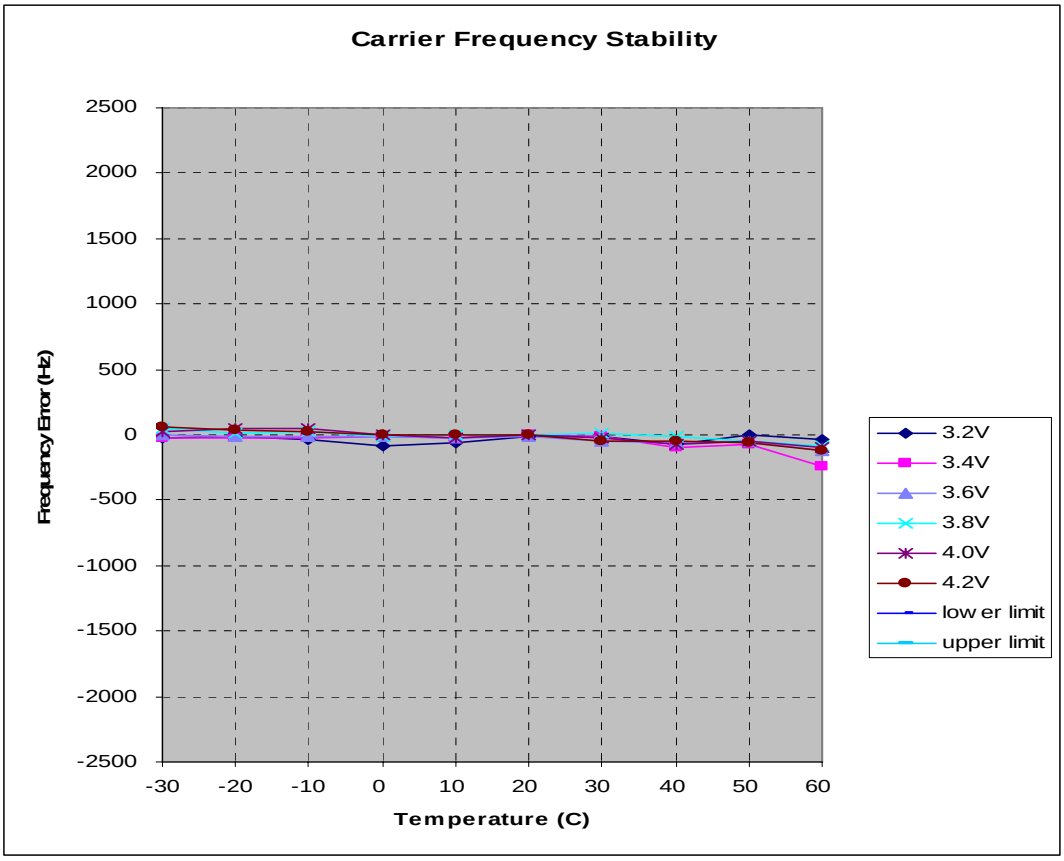


Exhibit 10 – Measurement Procedures and Techniques

List of Equipment

Spectrum Analyzers:
Agilent E4440A, S/N MY44022417, cal due 04/09/08

AC Power Adapter:
Sunny switching adapter
Model # SYS1196-0504-2-W2
Part # SYS1196-0504-2-W2-QC
S/N: G0701405989
Input: 100-240V

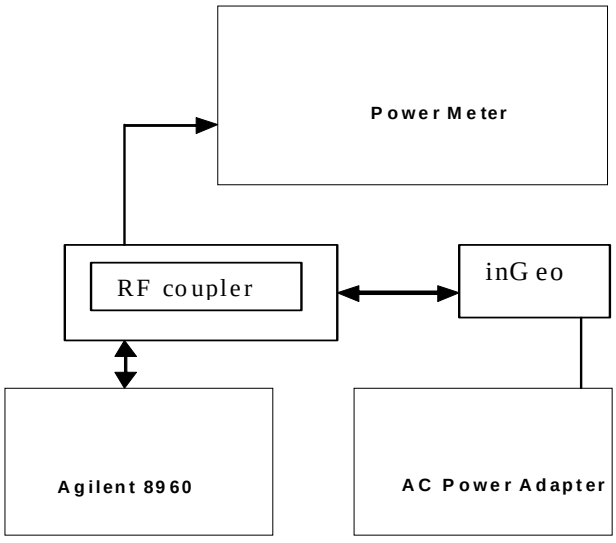
Power Meter
Gigatronics 8542C, S/N K82228, cal due 09/24/08
Gigatronics Sensor 80601A, K90715, cal due 06/18/09
Gigatronics 8542C, S/N K69430, cal due 06/12/09
Gigatronics Sensor 80601A, 1831797, cal due 6/18/09

Call Box
Agilent 8960, S/N GB41070169, cal due 10/17/08
Agilent 8960, S/N GB45070298, cal due 03/05/09

Antenna
Condor 48410-10, Standard gain Horn 750-4500 MHz, cal due 06/18/09

Measurement Procedures

RF Output Power Conducted

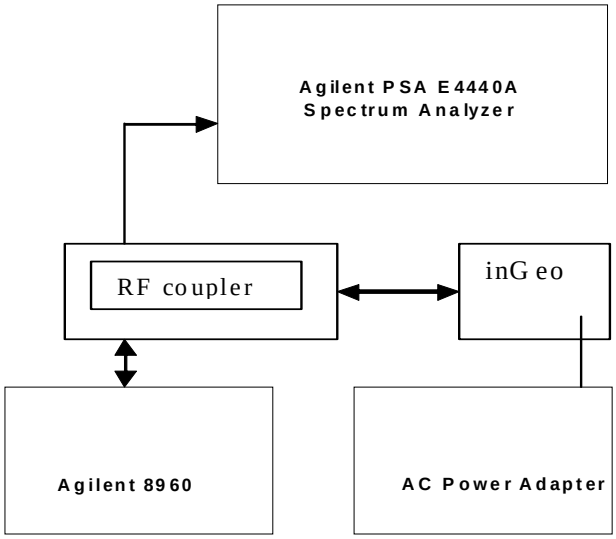


Definition - The output power rating of the transmitter is the power available at the output terminal of the transmitter when the terminal is connected to the normal load.

Method of Measurement - Measure the transmitter output carrier power using a power meter.

Minimum Standard - The transmitter output power shall be maintained within +2 / -4 dB.

Occupied Bandwidth (In Cellular Band)



Definition - The occupied bandwidth is defined as the spectrum noise produced at discrete frequency separations from the carrier due to all sources of unwanted noise within the transmitter in a modulated condition.

Method of Measurement – Connect a spectrum analyzer to the cellular phone's antenna connector. Set the cellular phone to transmit at the maximum RF output level and at full rate. Set the resolution bandwidth of the spectrum analyzer to 30 kHz. The value of the occupied bandwidth is calculated by an external or internal computer by summing all samples stored as "total power". This measurement is accomplished by the CDMA personality that is built into the spectrum analyzer.

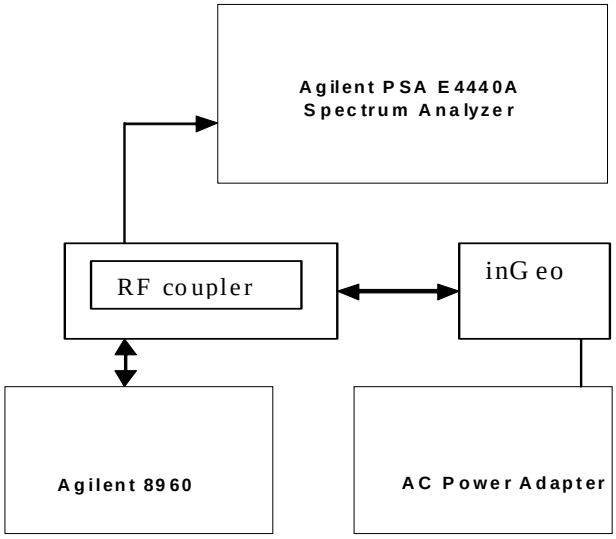
Minimum Standard – The occupied bandwidth shall not exceed 1.48 MHz.

In addition, in a 30 kHz bandwidth centered anywhere between 869 and 894 MHz, the mean power of emissions from the transmitter with modulated carrier shall not exceed -80 dBm.

Occupied Bandwidth – (In PCS Band)

The procedure has been stated in Exhibit 9

Conducted Spurious and Harmonic Emissions at Antenna Terminal



Definition - The conducted harmonic and spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside the authorized bandwidth of the transmitter.

Method of Measurement - Connect a spectrum analyzer to the cellular phone's antenna connector. Set the cellular phone to transmit at the maximum RF output level and at full rate. Set the resolution bandwidth and video bandwidths of the spectrum analyzer to the appropriate values. Measure the desire frequency bands.

Minimum Standard - Conducted harmonic and spurious emissions shall be attenuated below the level of emissions of the carrier frequency by at least 43 + 10 log (mean output power in Watts) dB.

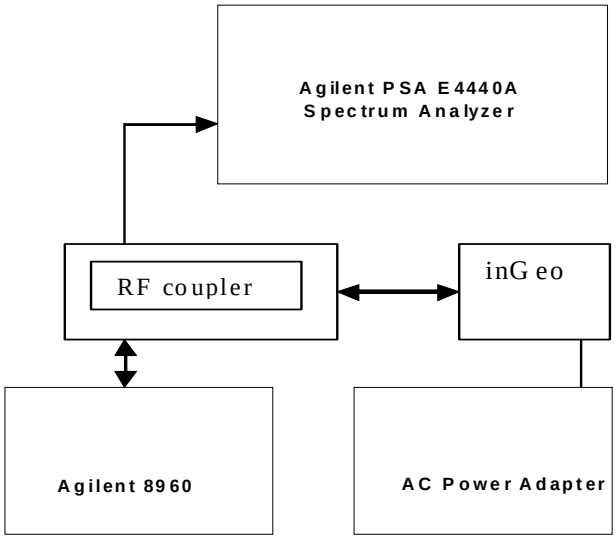
Radiated Spurious and Harmonic Radiation

Definition - The radiated spurious emissions are emissions from the subscriber unit with the attached antenna fully extended. The radiated spurious emissions include those emissions radiated from the attached antenna as well as the equipment cabinet and attached cables.

Method of Measurement - The measurement shall be conducted at standard radiation test site with a search antenna which is movable vertically and can be rotated 90 degrees for vertically and horizontally polarized signals.

Minimum Standard - Radiated spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency by at least 43 + 10 log (mean output power in Watts) dB.

Frequency Stability



Definition - The frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

Method of Measurement - Use the communication tester to sample the transmitter RF output signal and measure its frequency. Very the ambient temperature from -30 to +60 °C, and also vary the DC supply voltage to the equipment from 3.2 to 4.2 V at each temperature.

Minimum Standard - The transmitter carrier frequency shall be maintained within ± 2.5 ppm for the cellular band and shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block for the PCS band.

RF Output Power Radiated

Definition - The effective radiated power (ERP) with respect to a dipole antenna for compliance to FCC Part 22.913 for the cellular frequency band. The effective isotropic radiated power (EIRP) for compliance to FCC Part 24.232 for the PCS frequency band..

Method of Measurement - The RF radiated power (EIRP) was measured in an antenna range anechoic chamber as shown in the following picture. The INGEO device is mounted to the test fixture pedestal, a call is established, the INGEO device is set to maximum output power and 100 % duty cycle. A series of elevation and azimuth measurements are performed on INGEO device using the Orbit Fr595 software that controls the measurement system shown. The Orbit Fr595 software compiles the measurement results and determines the maximum EIRP. For the cellular frequency band the maximum EIRP level is then converted to an ERP result.

Effective radiated power limits - For the cellular frequency band, FCC Part 22.913 states: The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts. For the PCS frequency band, FCC Part 24.232 states: Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

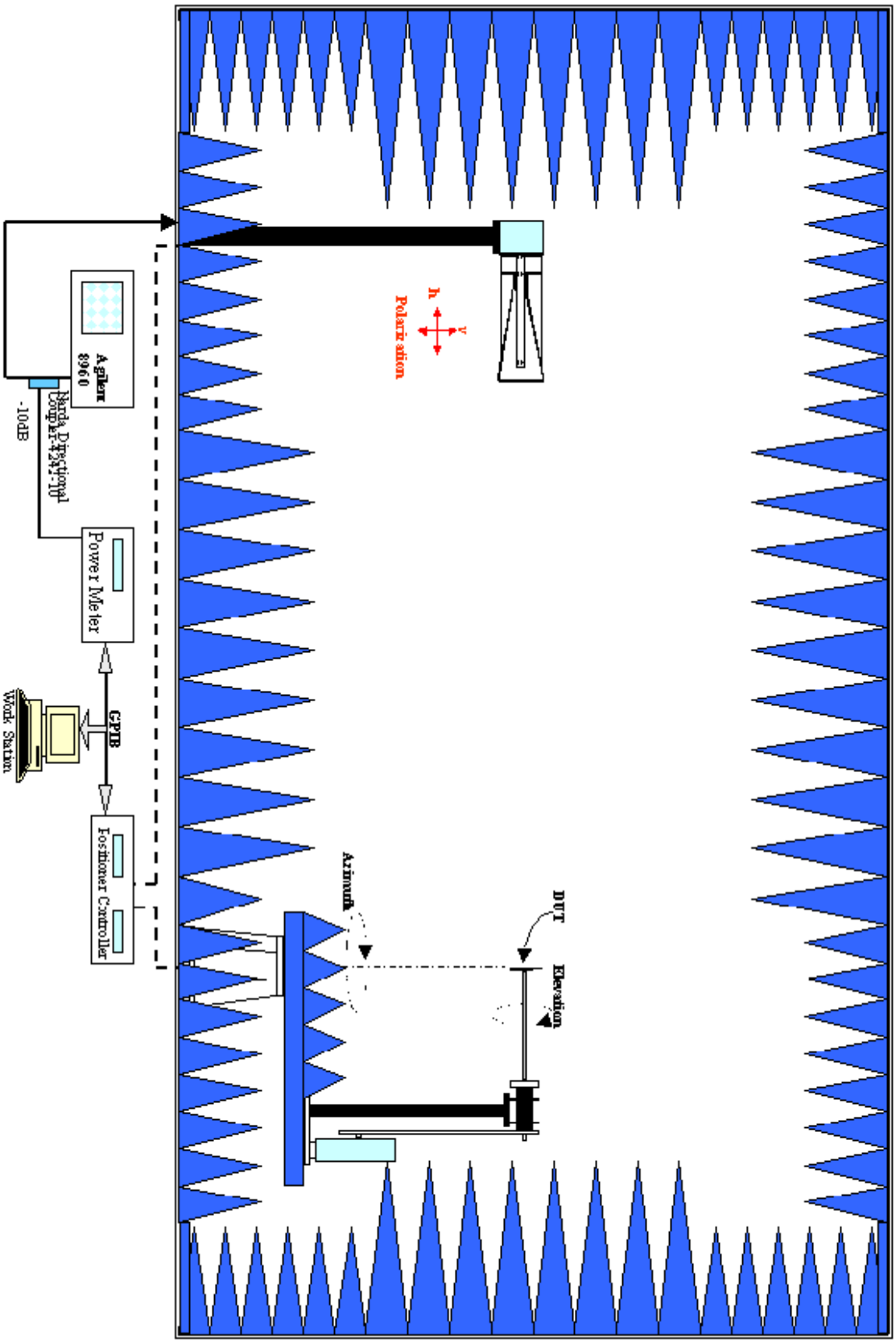


Figure 1. Far Field Antenna Range Wireless Test Configuration