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  Subject: Part 25 GS-Mode Spurious Radiated Emissions Test Plan for Portable UT
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X-Attachments:
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The following is the revised test plan for measuring the field strength of the spurious radiated emissions of the GS SMP UT at TUV, following pre-scans and UT antenna gain measurements performed at Qualcomm.

Portable UT Part 25 GS-Mode Spurious Radiated Emissions Test Plan
Emissions Limits: FCC Part 25, Section 25.202 (f)

Test Setup:

Horizontal UT, resting face up, with horizontal GS antenna extended straight out, in-line with phone body (pointing to zenith if UT were vertical), on nonconductive support on wooden table on test chamber turntable, 1.0 m above ground plane, aimed at (boresighted on) test antenna (0 degrees Azimuth). (Maximum UT antenna gain is in line with antenna axis.) Receive antenna will also be at 1.0 m height, except where E-Field maximization yields higher emissions levels at higher elevations, due to in-phase addition of ground-plane reflected power.

EUT Operation:

The phone will be tested in a special-test stand-alone mode operating on battery power, with pre-loaded test code which permits fine adjustment of output power levels and channel frequencies, and with the phone transmitting a full-power OQPSK CDMA pilot signal. Tests will be performed on 3 TX channels: low (1), middle (6), and high (9). Prior to the start of each test, the UT will be set to transmit using a laptop computer, special data monitor test port cable and charger, and Hyperterminal, as follows:

Hyperterminal link settings, Com 1 port:
- 38400 bps
- 8 bits data,
- No parity
- 1 stop bit
- No flow control

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h       Hardware Menu
gi      GUM Init
tx 2    Transmit Pilot signal
agc 1 [power level]    (000 - 1FF)    Power Adjust Hex Code
rf [rx channel index] [tx channel index]
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- TX Channel 1 > TX Channel Index 4 1610.73 MHz
- TX Channel 6 > TX Channel Index 209 1616.88 MHz
- TX Channel 9 > TX Channel Index 332 1620.57 MHz

- RX Channel 1 > RX Channel Index 3

Phone transmit power shall be adjusted to provide free-space 1.0 W left-hand circularly-polarized (LHCP) EIRP for each selected transmit channel, based on knowledge of previously-measured UT transmit frequency specific antenna gains, and measured conducted power into the UT antenna, as described below. Special test data monitor port and power cable shall be disconnected prior to making radiated emissions measurements at TUV, after establishing appropriate power control setting for 1.0 W EIRP transmissions, using hex code values from the table below, as follows:

A fresh fully-charged UT battery shall be installed in the UT and the antenna hub cover shall be removed prior to start of each channel's radiated emissions test. Conducted transmit power for each channel tested shall be measured by disconnecting the UT antenna transmit coax cable (lowest of the two coax cables) from the internal transmit port and connecting that port to a power meter through the provided OSX test coax cable and a 10 dB pad. Above-described programming sequence shall be followed, loading power adjust hex code values from table below. UT shall remain powered and transmitting into power meter for 20 minutes, at which time the conducted power will be measured and the hex code input value adjusted if required to provide conducted power (correcting for 10 dB pad and cable loss) at or 1 hex code step above the 1.0 W EIRP conducted value from the table below.

After the conducted power level has been established, the antenna coax cable shall be re-connected and the UT shall be disconnected from the charger power/programming cable and set on the test bench as described above for radiated emissions measurements.

EIRP (dBm) - Ant. Gain (dBi) = Cond. Power (dBm)

Channel No.	G.t (dBi)	Cond. Pwr (dBm)	Pwr. Adj (Hex. code)
1	2.28	27.72	0F4
6	3.24	26.76	0E7
9	3.34	26.69	0E5

Empirical Determination of Emissions Limit:

Part 25 Emissions Limit, at frequencies greater than twice the authorized bandwidth away from the band edge: Power in a 4 kHz bandwidth, shall be attenuated by 43 dB + 10*log(EIRP in Watts) below intentional signal power.

Measure Max Inband E-Field in 30 kHz BW (E.o dBuV/m) to establish baseline free-space 1.0 W EIRP equivalent value. (Best accuracy, in measuring Globalsatar and IS-95 CDMA waveform in-band E-field strengths with a spectrum analyzer, is obtained when measuring with a 30 kHz resolution BW, 30 kHz video bandwidth, and 30 sample averaging. Applying a quasi-empirical correction factor of 17 dB, the E-field level so measured will closely correspond to the total power measured using a power meter and (again with a 17 dB correction factor) the power measured with a spectrum analyzer with a CDMA measurement personality PCMCIA card.) Optimize antenna height for each frequency and polarization, starting at height of 1.0 m above ground.

$$E^2 = 30\, P.o / (r^2)$$

$$E.o\ dBuV/m = 120 + 10*\log(30 / r^2) + P.o\ dBW$$

Measure spurious harmonics E-field strengths in a 1 MHz bandwidth, and compare thatlevel to the spurious limit, corrected for difference between measurement and limit bandwidths:

1.0 W EIRP Spurious Emissions Limit (for 1 MHz Res. BW measurement):

$$Pwr\ Limit = P.o\ dBW - 43\ dB - 10*\log(1.0\ W) + 10*\log(1000/4)$$
$$= P.o - 19.0\ dB$$

$$E\text{-}Field\ Limit = E.o\ dBuV/m - 43\ dB - 10\ \log(1.0\ W) + 10*\log(1000/4)$$
$$= E.o\ dBuV/m - 19.0\ dB$$

Test Procedure:

Use 1 MHz resolution BW for spurious emissions ,easurements. (If peak measurements are close to limit value, re-measure using average measurements, with 1 MHz Res. BW, 10 Hz Video BW, 30 samples.) Install test lab-provided previously-characterized high-pass filter in-line, between test instrumentation external pre-amp and antenna, as necessary to prevent pre-amp front-end overload and generation of harmonically-related intermod product test artifacts. (Typically seen when measuring pseudo-noise signals.) If high-pass filter is employed, include plot of filter insertion loss curve with pre-amp gain curve in test report.
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1. Channel 1 Emissions Measurements

   a. Set frequency, load power adjust hex code, and wait 20 minutes for phone to stabilize. Measure Conducted Power out of UT transmit port and adjust hex code input as required to get free-space 1.0 W EIRP conducted power level from above table. Record hex code value and conducted power level.

   b. Set phone on table on OATS turntable per Setup description.

   c. Measure vertically-polarized inband radiated E-Field strength. Optimize antenna height. Calculate and record radiated limit value. Measure E-Field strengths for transmitter harmonic frequencies in table following and record values.

   d. Repeat Step c for Horizontal polarization.

2. Channel 6 Emissions Measurements

   Repeat Steps a-d.

3. Channel 9 Emissions Measurements

   Repeat Steps a-d.

TX Frequency Harmonics to Measure

Harmonic	Frequency (MHz)		
	Ch. 1	Ch. 6	Ch. 9
Fundamental	1610.73	1616.88	1620.57
2	3221.46	3233.76	3241.14
3	4832.19	4850.64	4861.71
4	6442.92	6467.52	6482.28
5	8053.65	8084.40	8102.85
6	9664.38	9701.28	9723.42
7	11275.11	11318.16	11343.99
8	12885.84	12935.04	12964.56
9	14496.57	14551.92	14585.13
10	16107.30	16168.80	16205.70

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