EMI Test Report

Tested in accordance with
Federal Communications Commission (FCC)
Personal Communications Services
CFR 47, Parts 2 and 90
And
Industry Canada, RSS-119

Research In Motion Limited

REPORT NO.: RIM-0102-0408-03

PRODUCT Model No: RAL11IN
Type Name: BlackBerry Wireless Handheld
FCC ID: L6ARAL11IN
IC: 2503A-RAL11IN

Date: 10 September 2004

Declaration

Statement of Performance:

The BlackBerry Wireless Handheld, model RAL11IN and accessories when configured and operated per RIM's operation instructions, performs within the requirements of the test standards.

Declaration:

We hereby certify that:
The test data reported herein is an accurate record of the performance of the sample(s) tested.
The test equipment used was suitable for the tests performed and within the manufacturers published specifications and operating parameters.
The test methods were consistent with the methods described in the relevant standards.

Tested by

Maurice Battler
Compliance Specialist Date: 10 September 2004

Masud S. Attayi, P.Eng.
Senior Compliance and Certification Engineer Date: 13 September 2004

Reviewed by:

Paul Lock
Senior Compliance Specialist Date: 20 September 2004

Approved by:

Paul G. Cardinal, Ph.D.
Manager, Compliance and Certification Date: 20 September 2004

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A) Scope

This report details the results of compliance tests which were performed in accordance with the requirements of:

FCC CFR 47 Part 2, Oct. 1, 2000, Subpart L, Marketing of Radio Frequency Devices
FCC CFR 47 Part 90, Oct. 1, 2000, Subpart I, General Technical Standards
Industry Canada, RSS-119 Issue 6, March 25, 2000, Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz.

B) Product Identification

The equipment under test (EUT) was tested at the Research In Motion Limited (RIM) EMI test facilities, located at:

305 Phillip Street
Waterloo, Ontario
Canada, N2L 3W8
Phone: 519 888 7465
Fax: 519 888 6906

and

50 Northside Road
Ottawa, Ontario
Canada, K2H 5Z6
Phone: 613 829 7465
Fax: 613 829 0800

Web Site: www.rim.com

The testing began on July 21, 2004 and was completed on August 13, 2004. The Ottawa facility performed the frequency stability measurements. The sample equipment under test (EUT) included:

1a. BlackBerry Wireless Handheld, model number RAL11IN, ASY-07523-001 Rev. A, serial number 7520REV2-033, FCC ID L6ARAL11IN, IC: 2503A-RAL11IN.
1b. BlackBerry Wireless Handheld, model number RAL11IN, ASY-07523-001 Rev. A, serial number 7520REV2-022, FCC ID L6ARAL11IN, IC: 2503A-RAL11IN.
1c. BlackBerry Wireless Handheld, model number RAL11IN, ASY-07523-001 Rev. A, IMEI 010000.00.501919.0, FCC ID L6ARAL11IN, IC: 2503A-RAL11IN.
2. Travel Charger, model number PSM05R-050CH, part number ASY-03746-003 with an output voltage of 5.0 volts dc, 1.5 amps and attached USB data cable with a lead length of 0.71 metres.
3. External Battery Charger model number BCM6720A, part number ASY-06630-001 with a dc output of 4.2 volts, 0.75 amps for charging the internal battery and 5.1 volts, 0.75 amps for charging an external battery.
4. North American Travel Charger, model number PSM04A-050RIM, part number ASY-07040-001 with an output voltage of 5.0 volts dc, 0.85 amps and attached USB data cable with a lead length of 0.73 metres.
5. Travel Charger, model number PSM05R-050Q, part number ASY-04078-001 with an output of 5.0 volts dc, 0.5 amps.

6. Rapid Battery Travel Charger, model number PSM08R-050RIM, part number ASY-07041-001 with an output voltage of 5.0 volts dc, 1.6 amps and attached USB data cable with a lead length of 0.85 metres.
7. USB data cable, model number HDW-06610-001, 1.45 metres long.
8. Headset, model number HDW-03458-001. The lead length was 1.25 metres long.

The BlackBerry Wireless Handheld is an 800 MHz portable unit that uses two digital technologies: Quad 16QAM and Time Division Multiple Access (TDMA). This device also has Bluetooth functionality operating in the frequency range of 2402 to 2480 MHz.

C) Support Equipment Used for the Testing of the EUT

1). DC power supply, HP, model number 6632B, serial number US37472178
2). DC power supply, HP, model number 66321D, serial number US38440638

D) Test Voltage

The ac input voltage was 120 volts, 60 Hz. This configuration was per manufacturer's specifications.

E) Test Results Chart

SPECIFICATION	Test Type	MEETS REQUIREMENTS	Performed By
FCC CFR 47 Part 2, Subpart L IC RSS-119	Radiated Spurious/harmonic Emissions, ERP	Yes	Masud Attayi
FCC CFR 47 Part 2, Subpart L, Part 90, Subpart I IC RSS-119	Conducted Emissions, Occupied Bandwidth	Yes	Maurice Battler
FCC CFR 47, Part 2.947, 2.1055 and 90.213 IC RSS-119	Frequency Stability	Yes	Johanna Dwyer

F) Modifications to EUT

No modifications were required to the EUT.

G) **Summary of Results**

1) The EUT passed the Conducted Spurious Emissions requirements in the 800 Band as per 47 CFR 2.1051. The EUT was measured in the low, middle and high channels. The frequency range investigated was from 10 MHz to 10 GHz.
   See APPENDIX 1 for the test data

2) The EUT passed the Occupied Bandwidth and emission mask requirements as per 47 CFR 2.1049, 2.1053, 90.210 and 90.691. The channels measured were low, middle and high.
   See APPENDIX 1 for the test data.

3) The EUT passed the Conducted RF Output Power requirements as per 47 CFR 2.1046 and 2.1033. The channels measured were low, middle and high.
   See APPENDIX 2 for the test data.

4) The EUT passed the Frequency Stability vs. Temperature and Voltage requirements as per CFR 47 2.1055, 90.213 and RSS-119. The maximum frequency error measured was less than 0.1 PPM.
   The temperature range was from -30°C to +55°C in 10 degree temperature steps. The EUT was measured on low, middle and high channels at each temperature step. The EUT was measured at low (3.5 volts), nominal (3.8 volts) and high (4.2 volts) dc input voltage at each temperature step and channel at maximum output power. The Handheld's frequency was locked to the base station simulator.
   See APPENDIX 3 for the test data.

5) The radiated spurious emissions/harmonics and ERP were measured. The results are within the limits. The EUT was placed on a nonconductive wooden table, 100 cm high that was positioned on a remotely rotatable turntable. The test distance used between the EUT and the receiving antenna was three metres. At this point the emissions were maximized by elevating the antenna in the range of 1 to 4 metres. The turntable was rotated to determine the azimuth of the peak emissions. The maximum emissions level was recorded. The measurements were performed in a semi-anechoic chamber. The semi-anechoic chamber FCC registration number is **778487** and the Industry Canada file number is **IC4240**. The EUT was measured on the low, middle and high channels.
   The highest ERP measured was 31.9 dBm at 815.5 MHz.
   To view the test data see APPENDIX 4.

6) The radiated spurious emissions/harmonics investigated were investigated up to the 10th harmonic.
The worst test margin for radiated spurious emissions measured was 3.2 dB below the limit at 4893.0 MHz.
To view the test data see APPENDIX 4.

The EUT's RF local oscillator emissions were measured on the high channel in the standalone upright position. Both the horizontal and vertical polarizations were measured. The system **passed** with a worse case emission test margin of greater than 20 dB.

The EUT's IF local oscillator emissions were measured in the standalone upright position. Both the horizontal and vertical polarizations were measured. The EUT **passed** with a worse case emission test margin of greater than 20 dB.

7) The radiated spurious emissions/harmonics were investigated up to the 10th harmonic for iDEN and Bluetooth transmitting simultaneously. The worst test margin for radiated spurious emissions measured was 3.2 dB below the limit at 4949.925 MHz.
To view the test data see APPENDIX 4.

Sample Calculation:

Field Strength (dBμV/m) is calculated as follows:
FS = Measured Level (dBμV) + A.F. (dB/m) + Cable Loss (dB) - Preamp (dB) + Filter Loss (dB)

Measurement Uncertainty ±4.0 dB

H) Compliance Test Equipment Used

UNIT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL DUE DATE (YY MM DD)	USE
Environmental Chamber	ESPEC Corp.	SH-241	92000147	N/R	Frequency Stability
Signal Generator	HP	ESG4433BR	US38440638	05-08-25	Frequency Stability
DC Power Supply	HP	66321D	GB40180110	04-08-19	Frequency Stability
Vector Signal Analyzer	Agilent	89441	US39313988	05-08-25	Frequency Stability
Temperature Probe	Hart Scientific	61161-302	21352860	04-09-15	Frequency Stability
Power Meter	HP	E4419B	MY40511065	05-08-20	Frequency Stability
Power Sensor	HP	8482H	MY41090594	05-08-20	Frequency Stability
DC Power Supply	HP	66321D	GB40180110	04-08-19	Frequency Stability
Preamplifier system	TDK RF Solutions	PA-02	080010	04-11-05	Radiated Emissions
Preamplifier	Sonoma	310N/11909A	185831	04-11-05	Radiated Emissions
EMC Analyzer	Agilent	E7405A	US40240226	05-07-29	Radiated Emissions
Environment Monitor	Control Company	1870	230355190	06-01-11	Radiated Emissions
Hybrid Log Antenna	TDK	HLP-3003C	17301	03-12-11	Radiated Emissions
Horn Antenna	TDK	HRN-0118	130092	04-09-16	Radiated Emissions
Horn Antenna	TDK	HRN-0118	030201	05-01-08	Radiated Emissions
Horn Antenna	Emco	3116	2538	04-09-22	Radiated Emissions
Pre-Amplifier	TDK	18-26	030002	04-11-27	Radiated Emissions
Signal Generator	HP	83630B	3844A00927	06-08-04	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	974	04-09-25	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	973	04-12-01	Radiated Emissions
Power Meter	Giga-Tronics	8541C	1837762	05-08-01	Conducted Emissions
Power Sensor	Giga-Tronics	80401A	1835838	05-08-01	Conducted Emissions
Spectrum Analyzer	HP	8563E	3745A08112	05-08-01	Conducted Emissions
DC Power Supply	HP	6632B	US37472178	05-08-01	Conducted Emissions

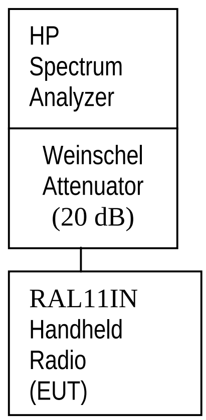
APPENDIX 1

RF CONDUCTED EMISSIONS TEST DATA/PLOTS

Conducted Emission Test Data

This appendix contains measurement data pertaining to the RF Power at maximum for conducted spurious emissions, Masks 47 CFR 2.1051, 90.210(g), 90.691(a), and Occupied Bandwidth 47 CFR 2.1049(h), along with 99% power bandwidth, –26 dBc bandwidth.

Test Setup Diagram



The environmental test conditions were: Temperature 24ºC
Pressure 975 mb
Relative Humidity 32%

Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	HP	8563E	374A08112	30 Hz – 26.5 GHz
Attenuator	Weinschel	33-20-33	BL8170	DC – 18 GHz

Conducted Emission Test Data cont'd

The TDM Transmission Slot Multiplex Factor was set to 2 /6 with the RF power output at maximum for all the recorded measurements of the –26dBc and 99% occupied bandwidth.

Test Data for TDM selected Frequencies

TDM-MF 2/6 Frequency (MHz)	QPSK_4 Occupied Bandwidth (kHz)	QAM_16 Occupied Bandwidth (kHz)	QAM_64 Occupied Bandwidth (kHz)	QPSK_4 - 26dBc Bandwidth (kHz)	QAM_16 - 26dBc Bandwidth (kHz)	QAM_64 - 26dBc Bandwidth (kHz)
806.0125	21.08	21.00	20.92	24.83	24.91	24.83
815.5000	20.92	20.92	21.00	25.00	24.75	24.75
824.9880	20.83	20.83	20.92	25.08	25.17	24.75

The conducted spurious emissions – Pursuant to 47 CFR 2.1051 were measured from 10 MHz to 10 GHz. No emissions could be seen above the noise floor of the spectrum analyzer.

Measurement Plots for TDMA, QPSK_4, QAM-16, QAM_64.

Refer to the following figures for the measurement plots.

See Figures 1 to 9 for the plots of the 99% Occupied Bandwidth results.

See Figures 10 to 18 for the plots of the –26 dBc Bandwidth results.
Carrier Reference at 0.0 dB

See Figures 19 to 36 for plots of the Spurious Emission 47 CFR 2.1051 results.

See Figures 37 to 43 for plots of the EA Mask 47 CFR 90.691(a) measured data.

See Figures 44 to 52 for plots of the G Mask. 47 CFR 90.210(g) measured data.

Conducted Emission Test Data cont'd

Figure 1: Occupied Bandwidth (99%)

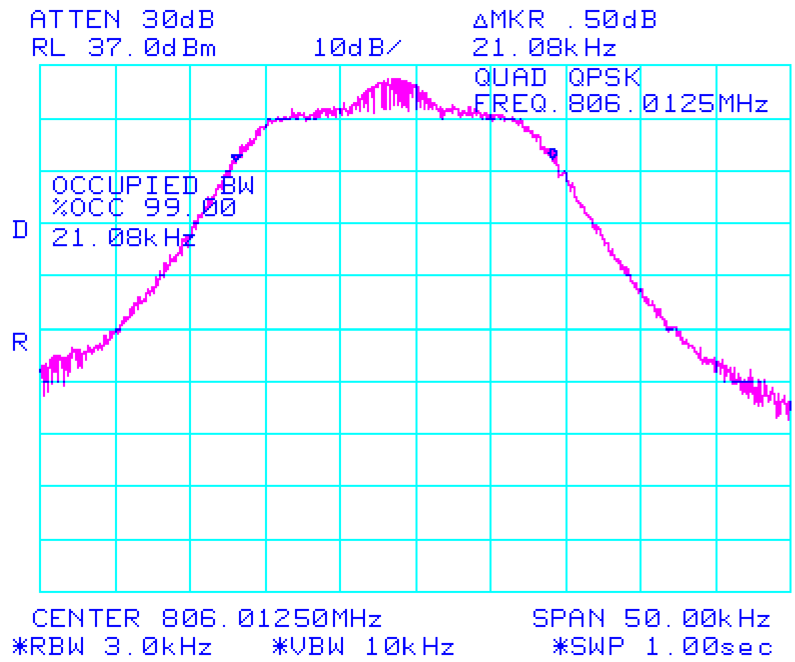
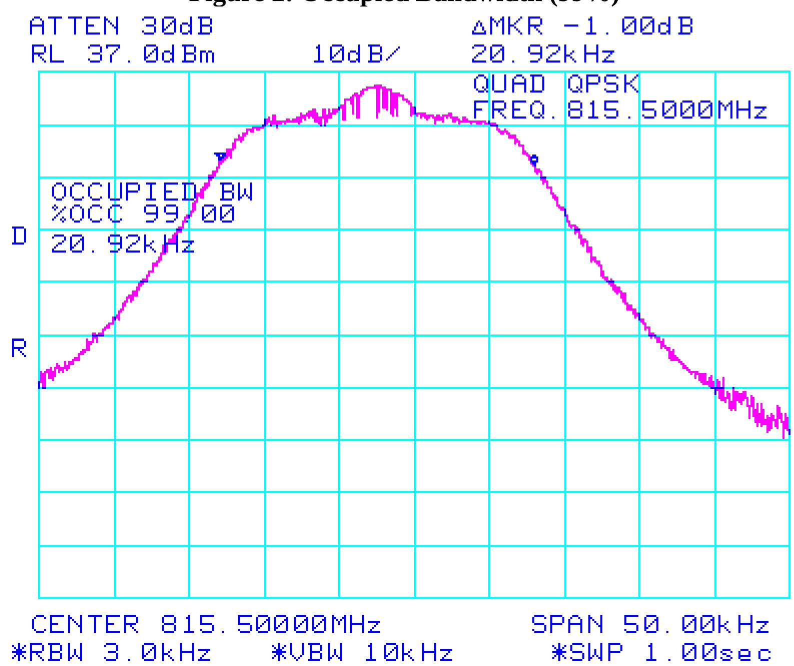


Figure 2: Occupied Bandwidth (99%)



Conducted Emission Test Data cont'd

Figure 3: Occupied Bandwidth (99%)

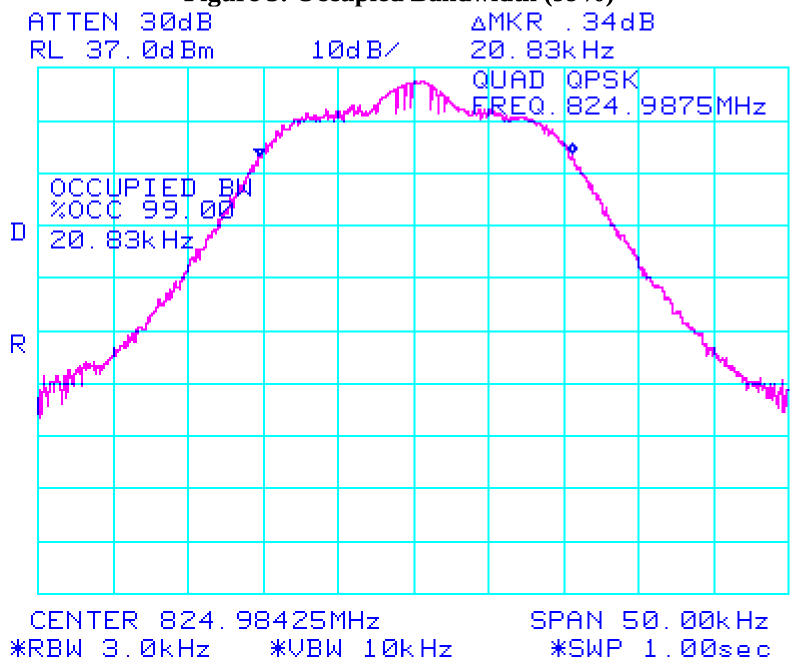
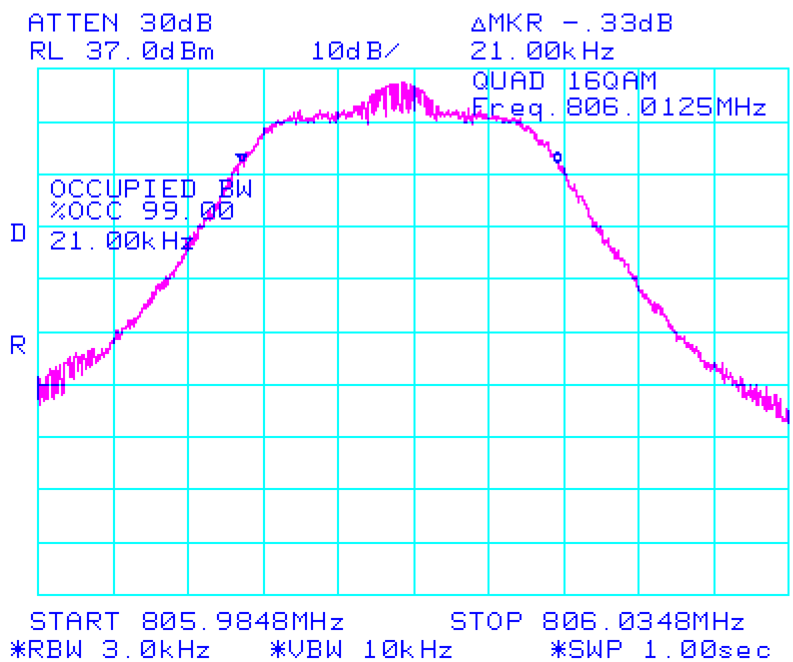


Figure 4: Occupied Bandwidth (99%)



Conducted Emission Test Data cont'd

Figure 5: Occupied Bandwidth (99%)

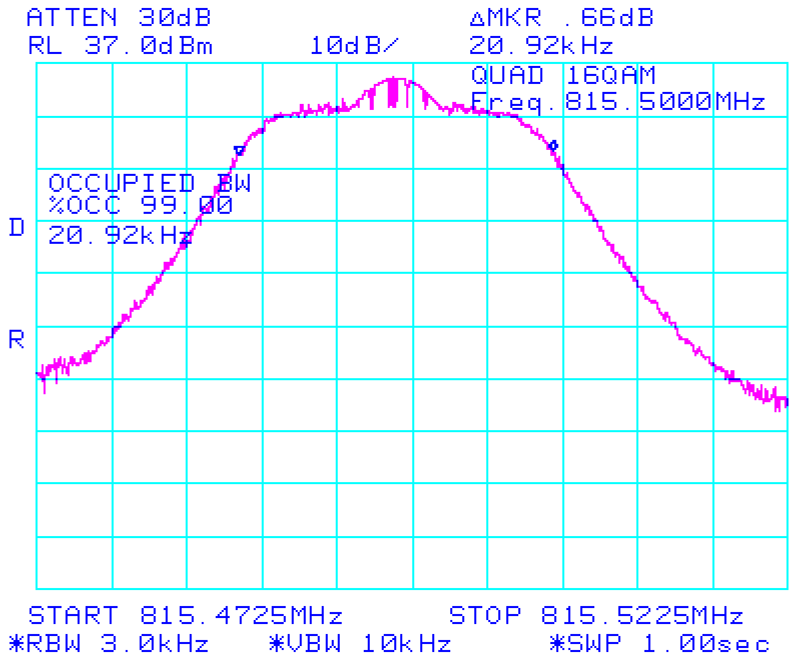
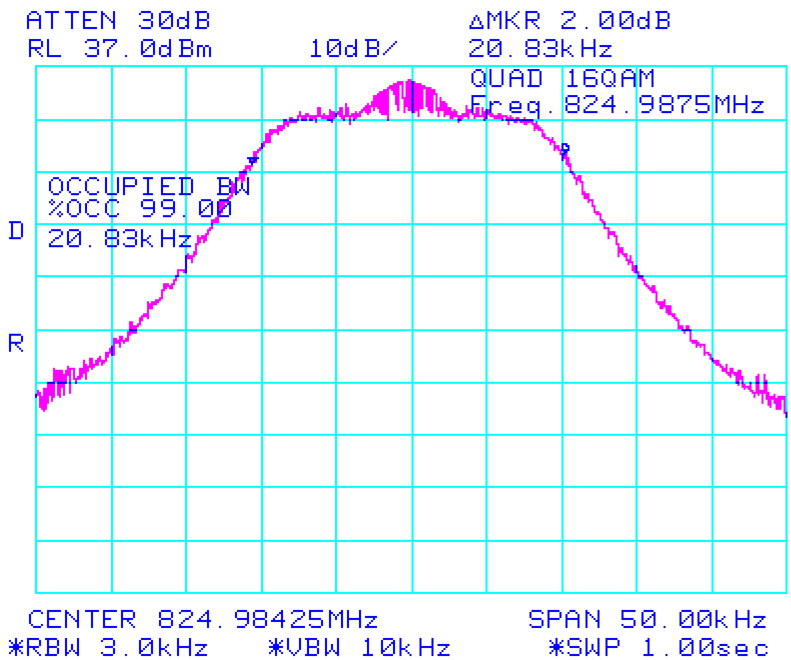


Figure 6: Occupied Bandwidth (99%)



Conducted Emission Test Data cont'd

Figure 7: Occupied Bandwidth (99%)

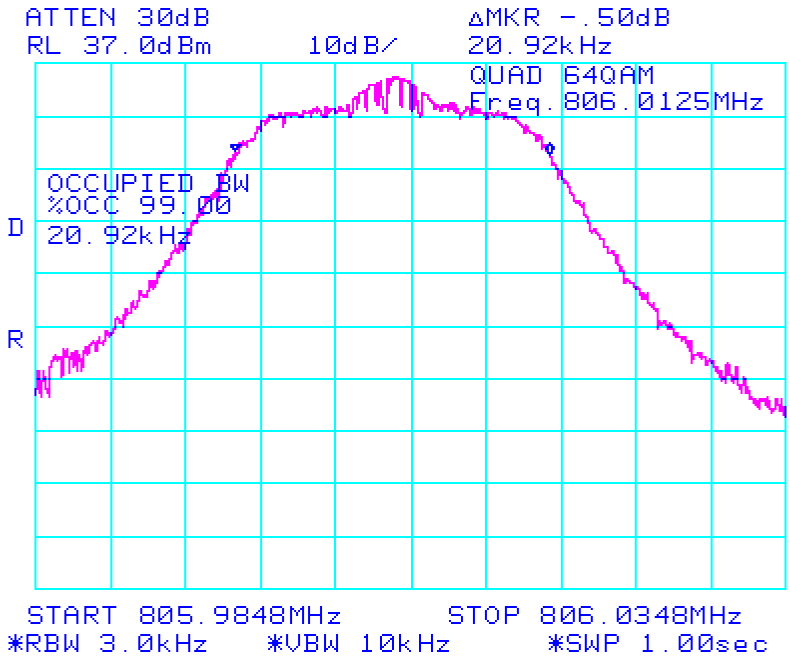
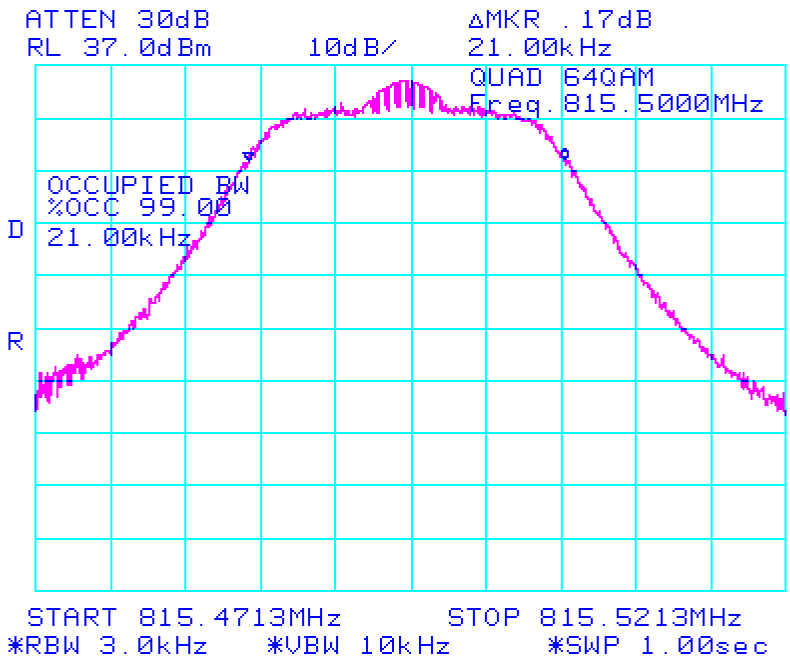


Figure 8: Occupied Bandwidth (99%)



Conducted Emission Test Data cont'd

Figure 9: Occupied Bandwidth (99%)

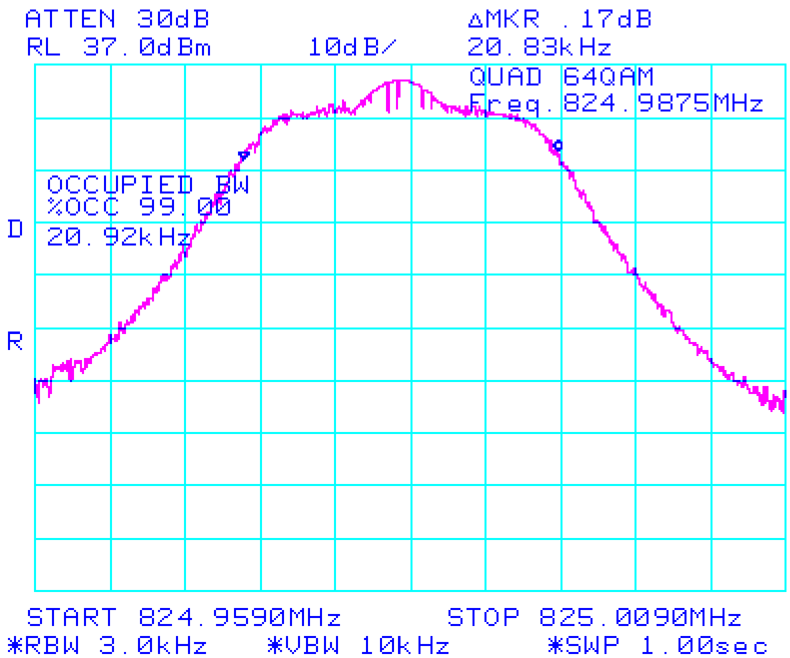
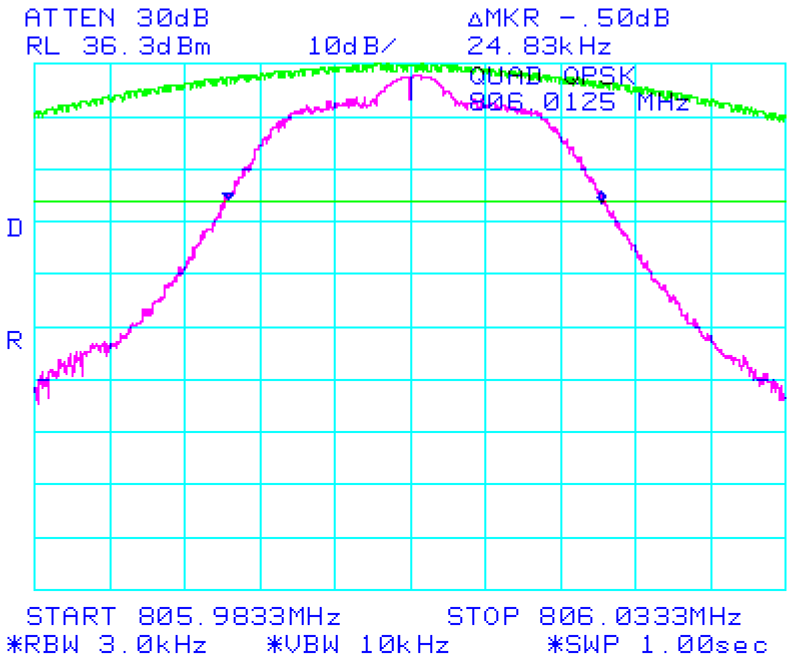


Figure 10: –26 dBc Bandwidth



Conducted Emission Test Data cont'd

Figure 11: –26 dBc Bandwidth

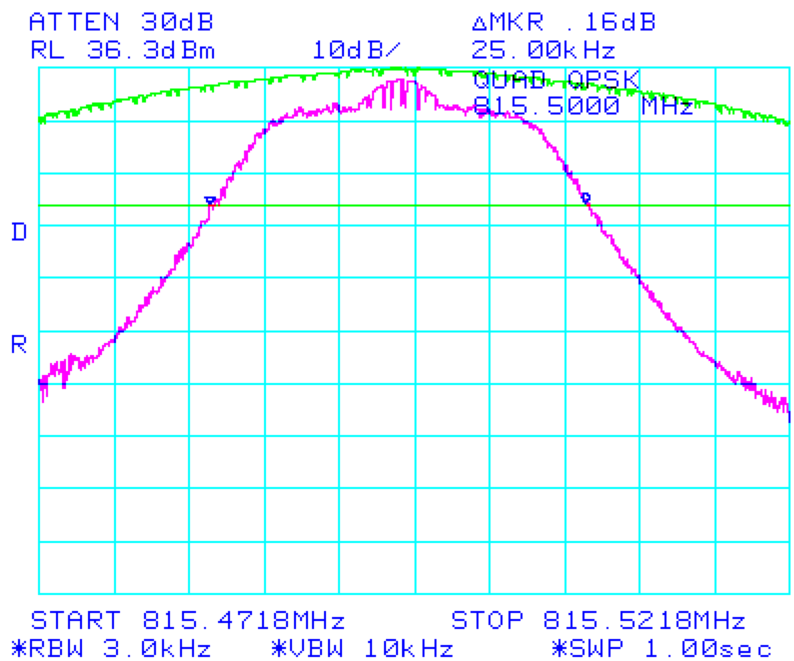
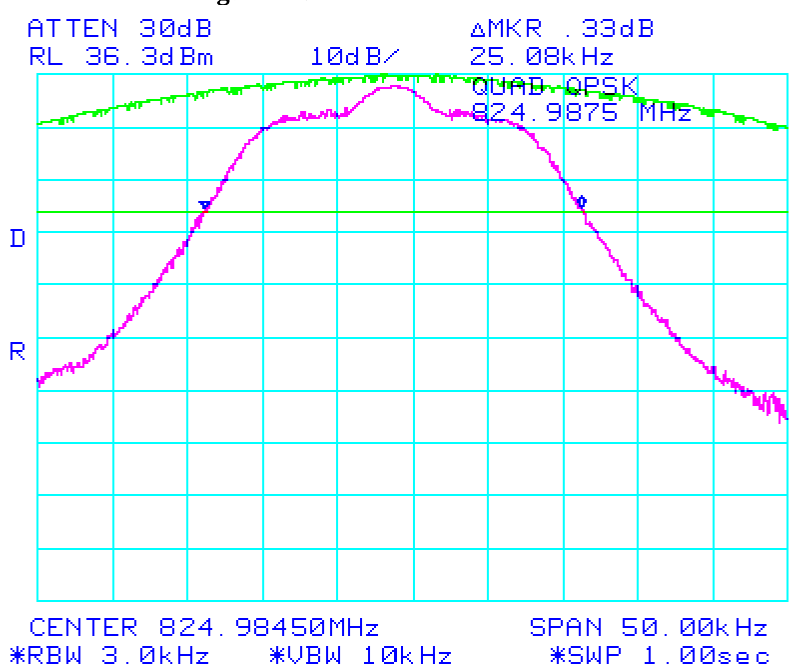


Figure 12: –26 dBc Bandwidth



Conducted Emission Test Data cont'd

Figure 13: –26 dBc Bandwidth

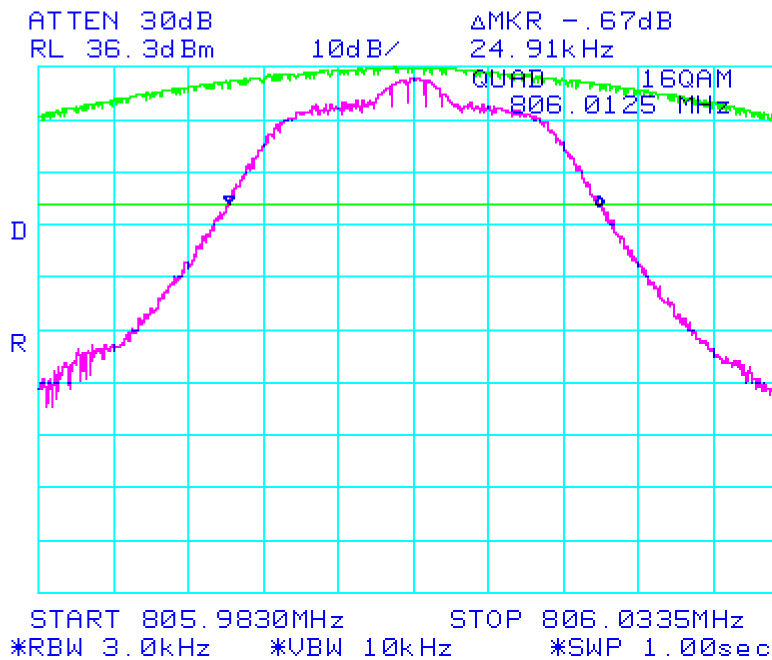
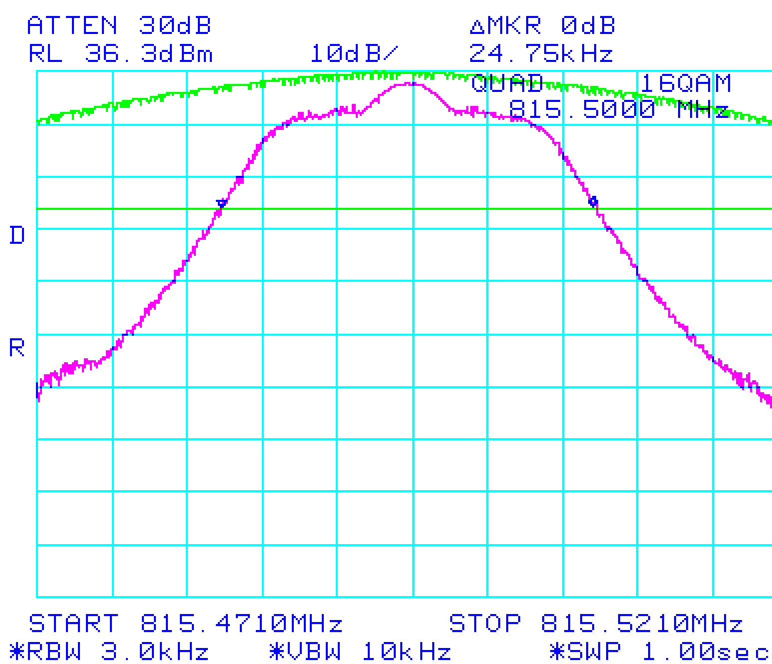


Figure 14: –26 dBc Bandwidth



Conducted Emission Test Data cont'd

Figure 15: –26 dBc Bandwidth

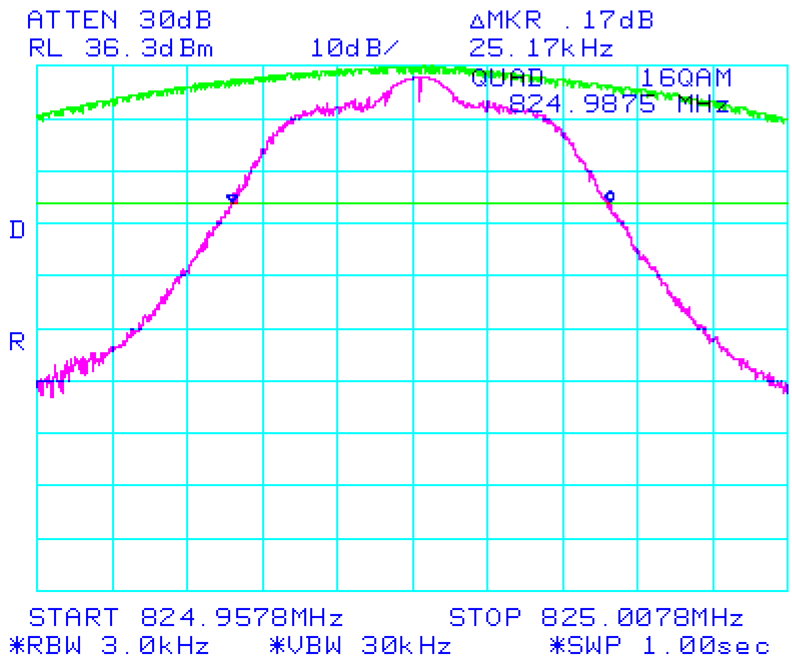
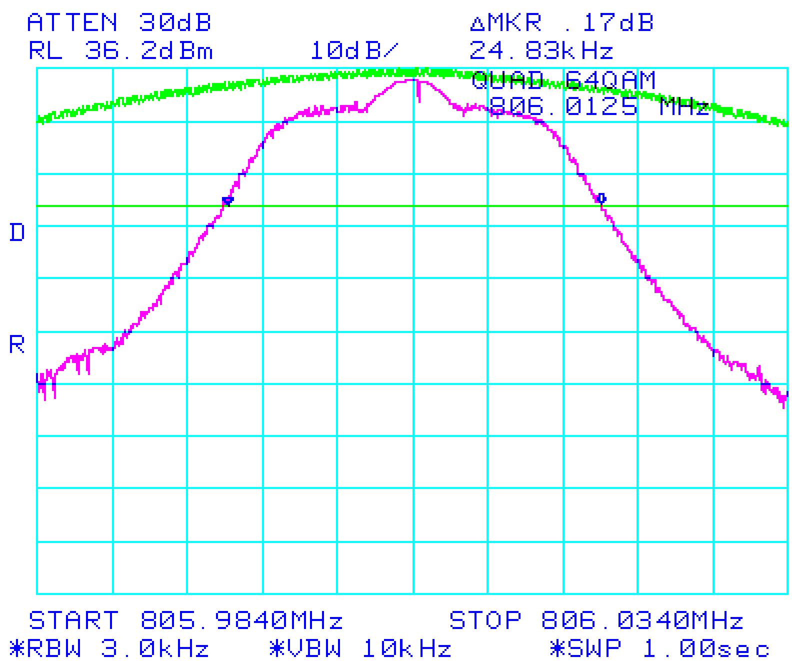


Figure 16: –26 dBc Bandwidth



Conducted Emission Test Data cont'd

Figure 17: –26 dBc Bandwidth

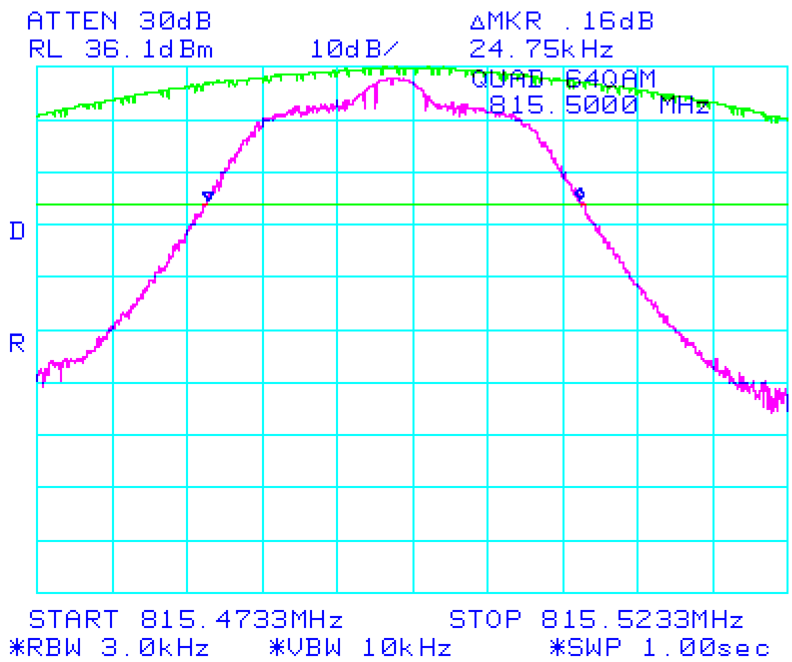
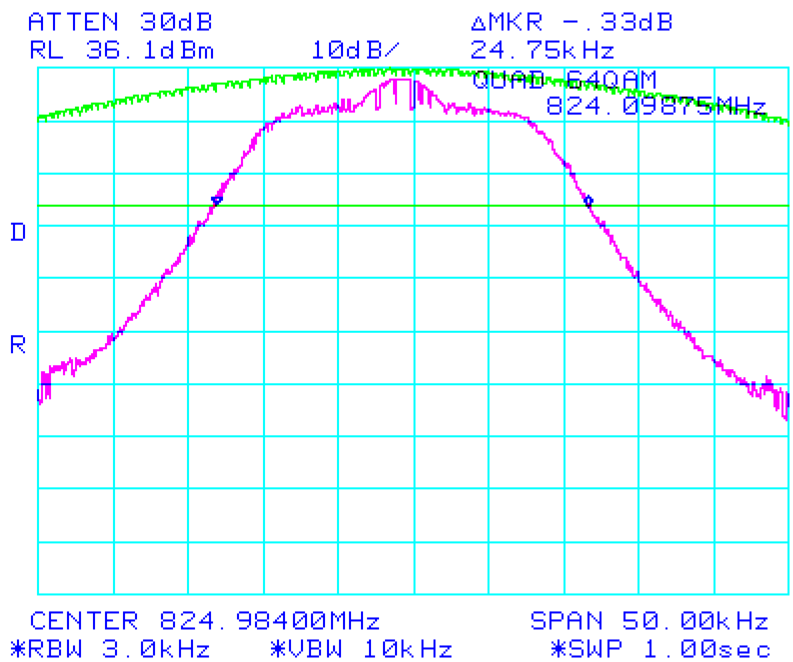


Figure 18: –26 dBc Bandwidth



Conducted Emission Test Data cont'd

Figure 19: Spurious Conducted Emissions 2.1051

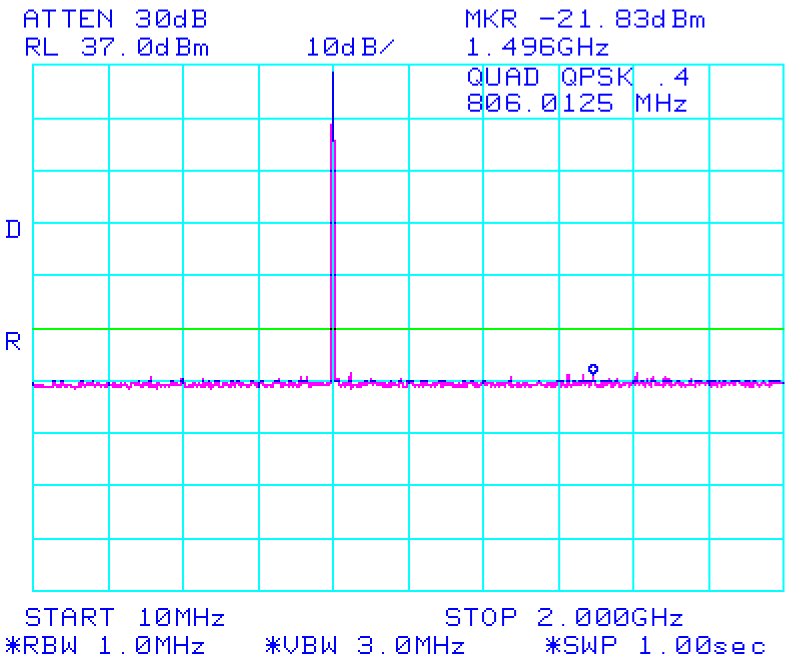
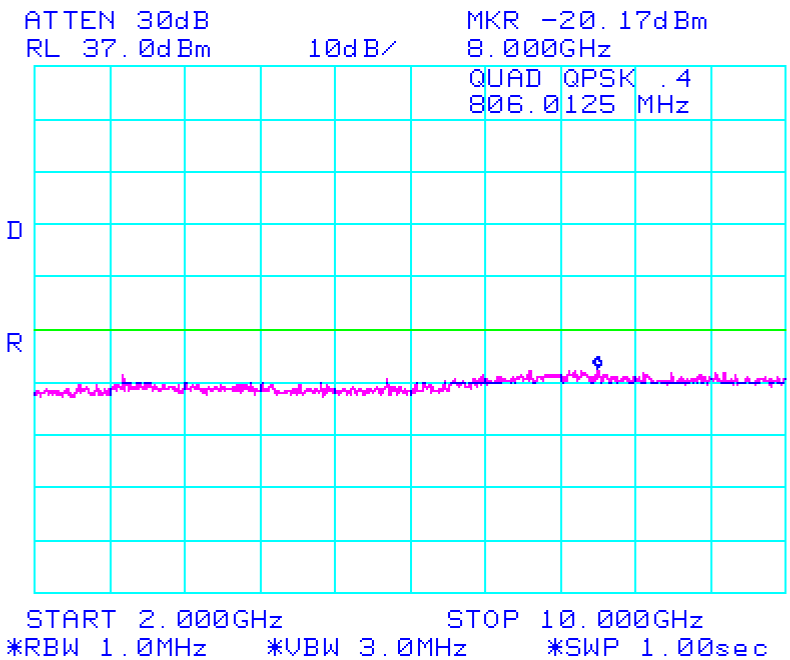


Figure 20: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 21: Spurious Conducted Emissions 2.1051

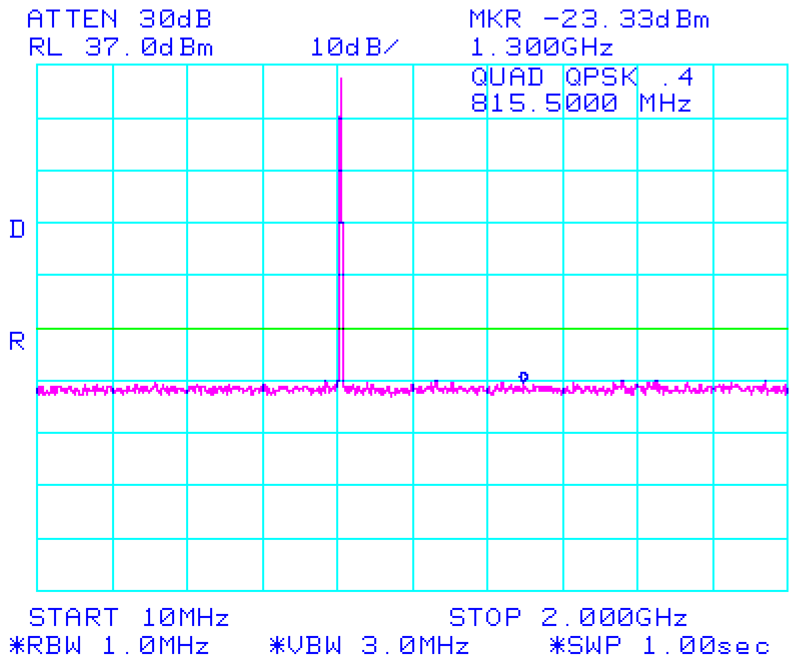
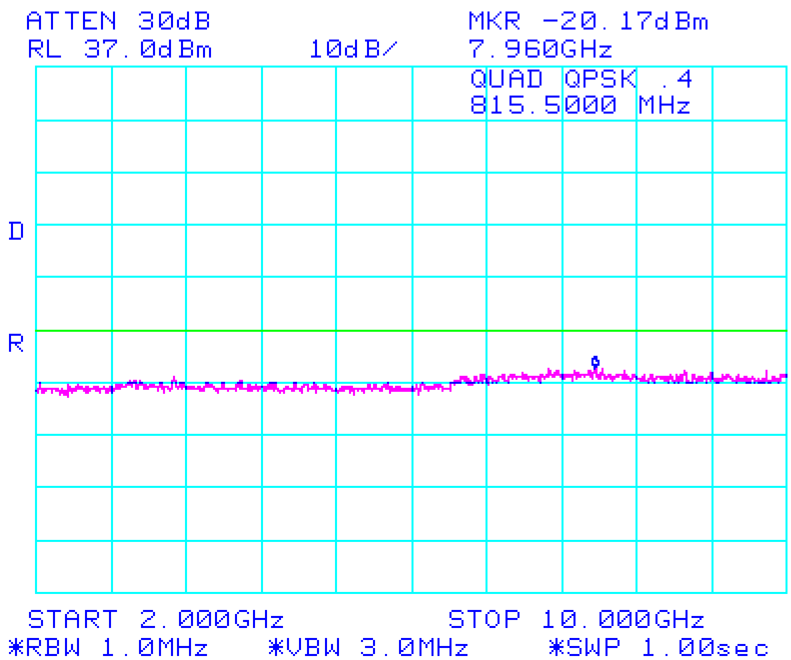


Figure 22: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 23: Spurious Conducted Emissions 2.1051

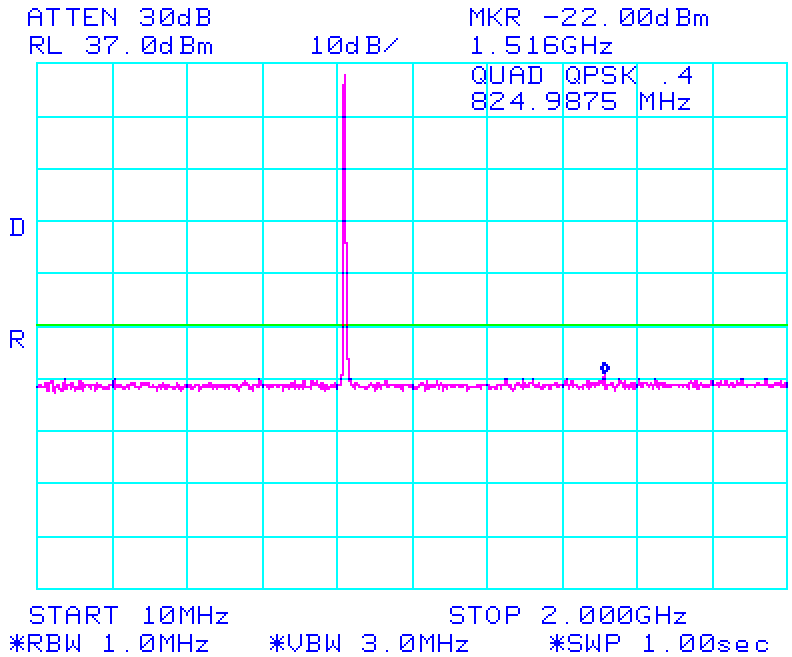
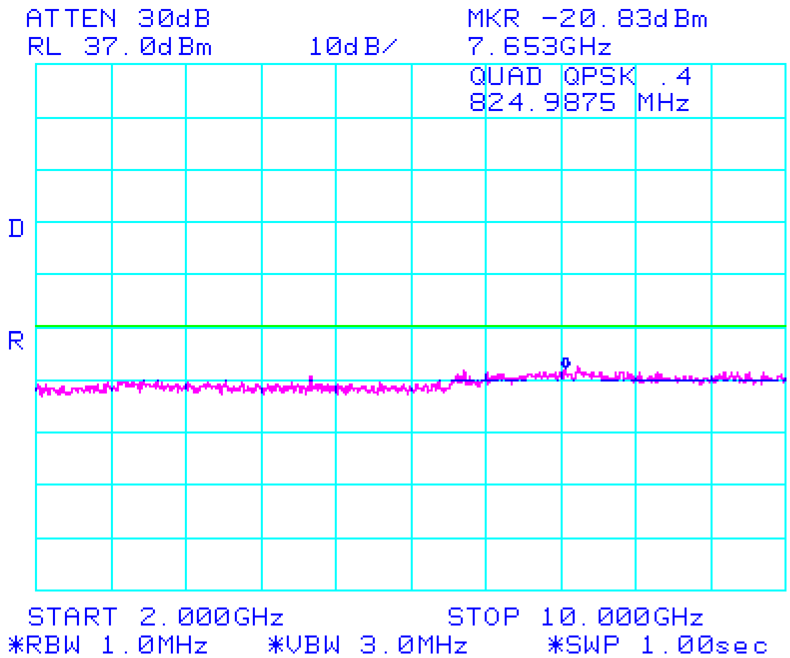


Figure 24: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 25: Spurious Conducted Emissions 2.1051

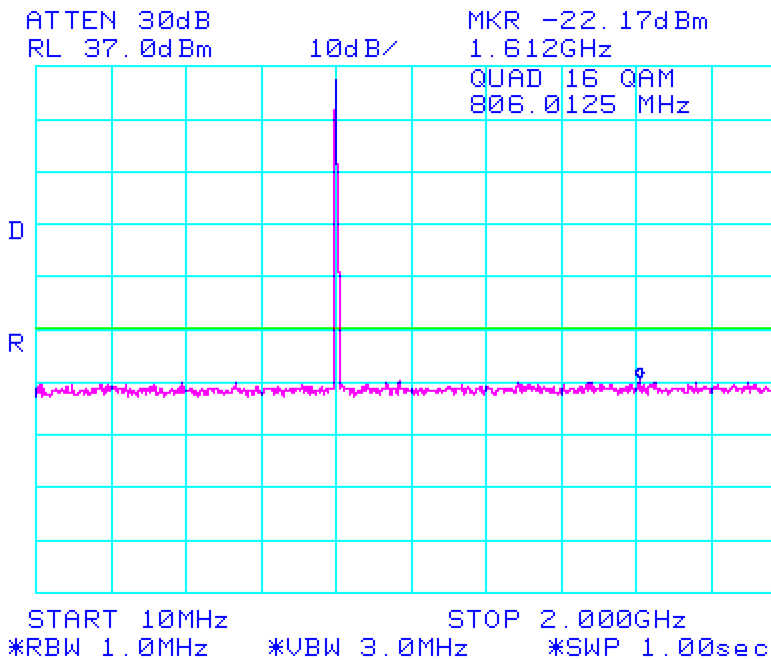
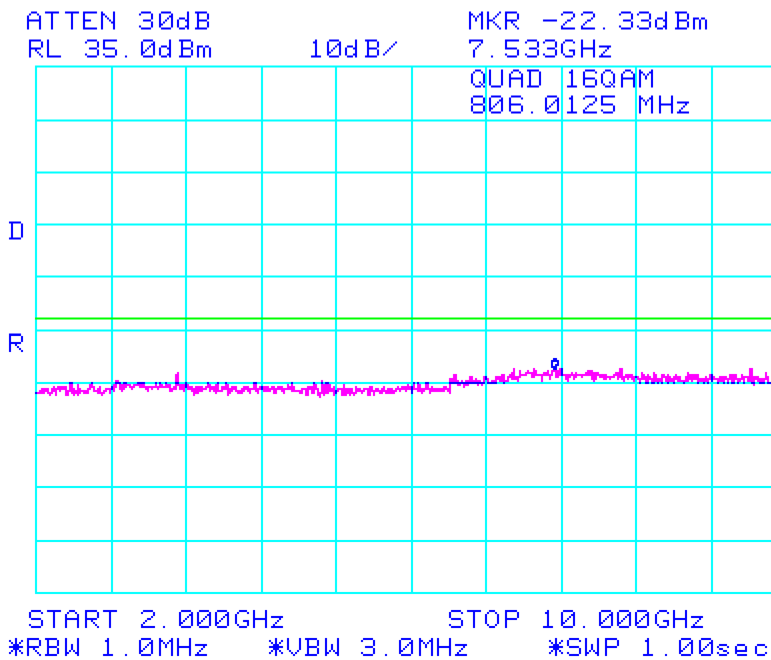


Figure 26: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 27: Spurious Conducted Emissions 2.1051

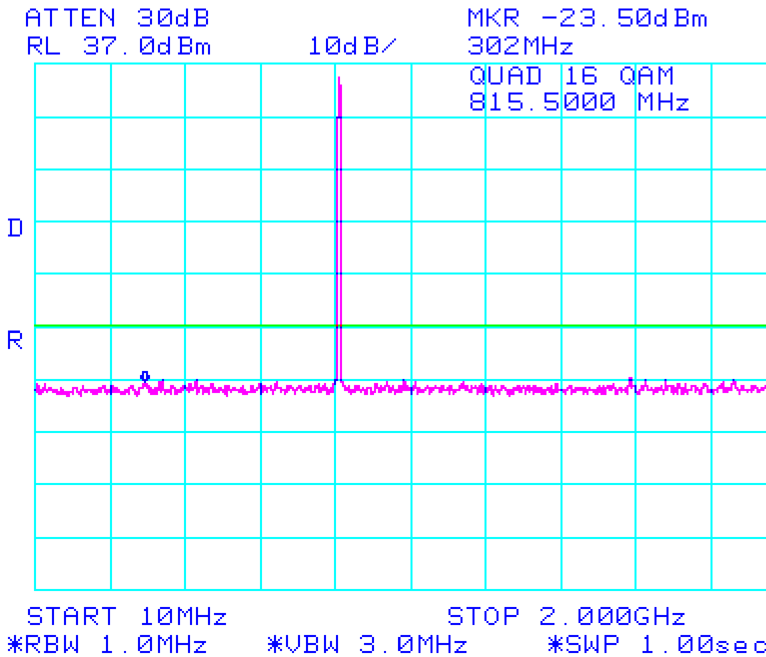
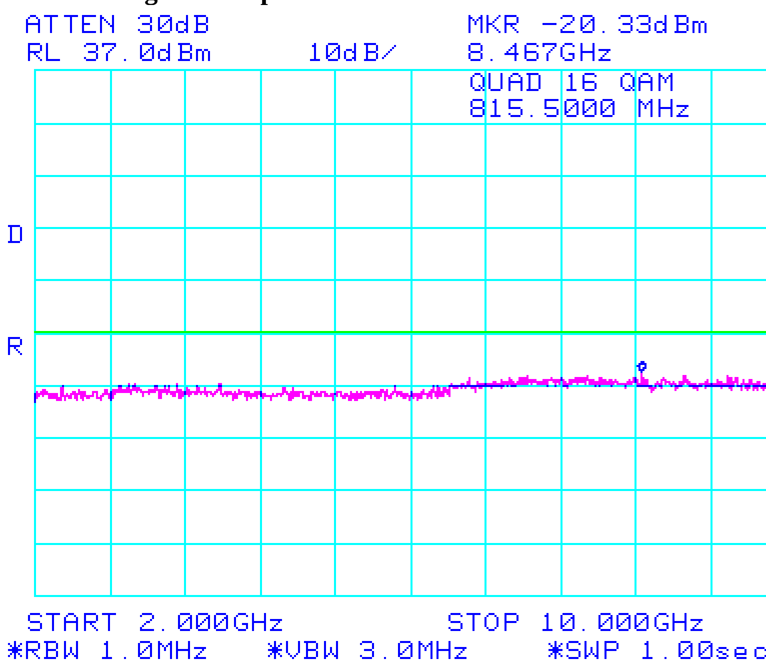


Figure 28: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 29: Spurious Conducted Emissions 2.1051

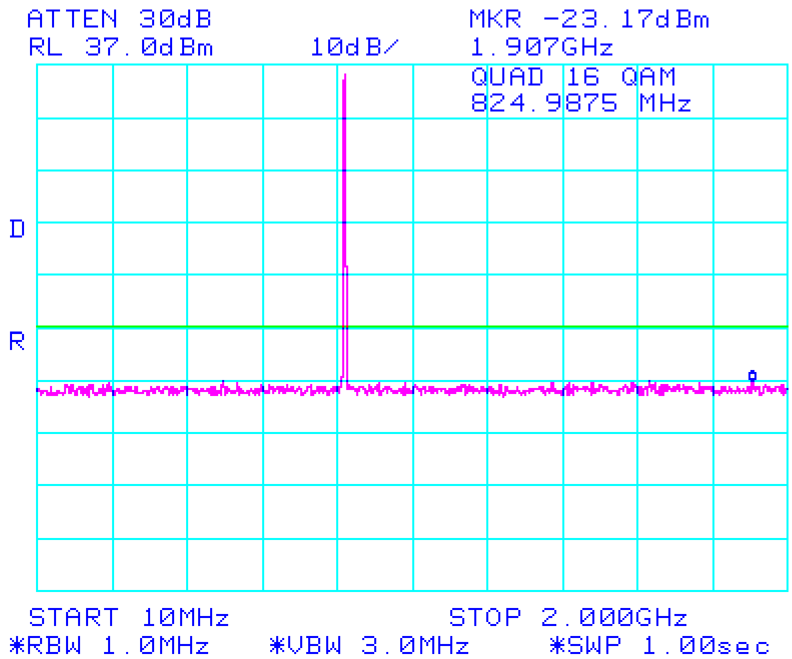
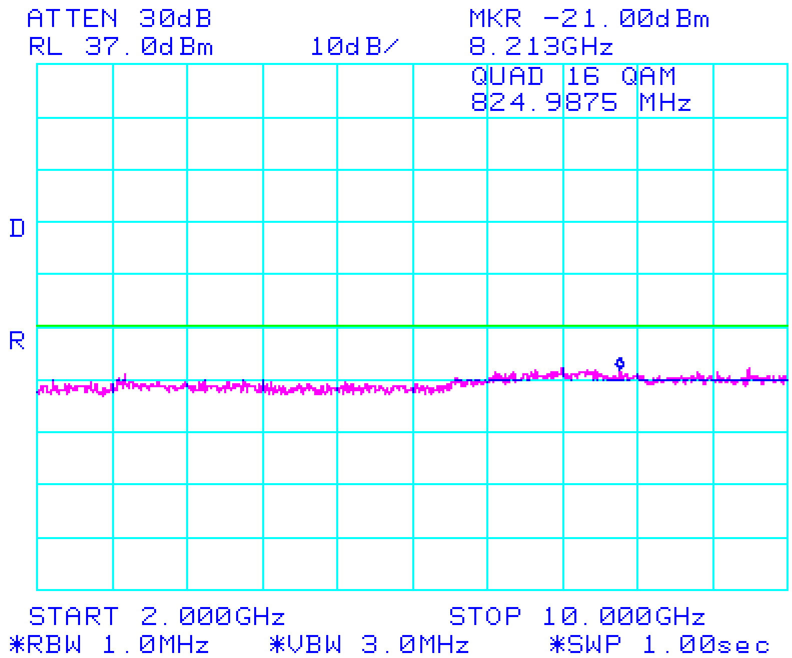


Figure 30: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 31: Spurious Conducted Emissions 2.1051

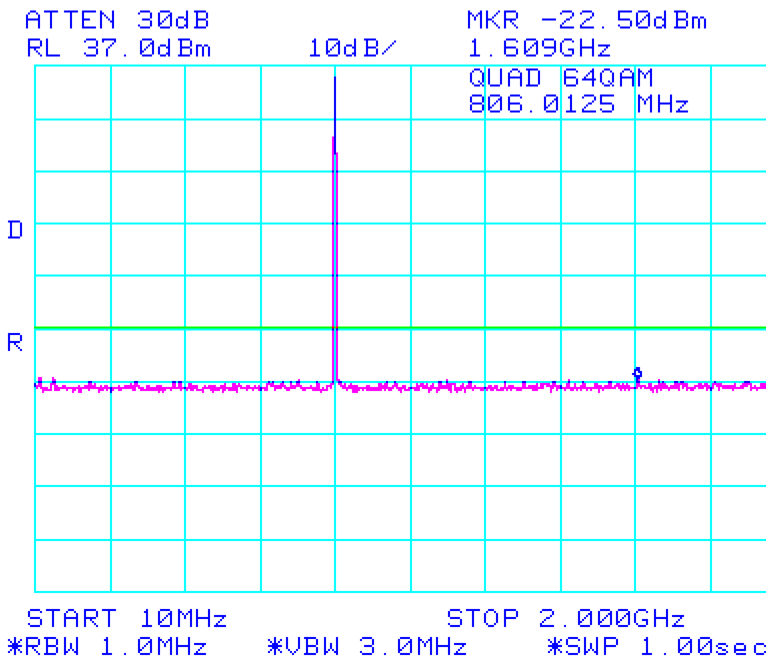
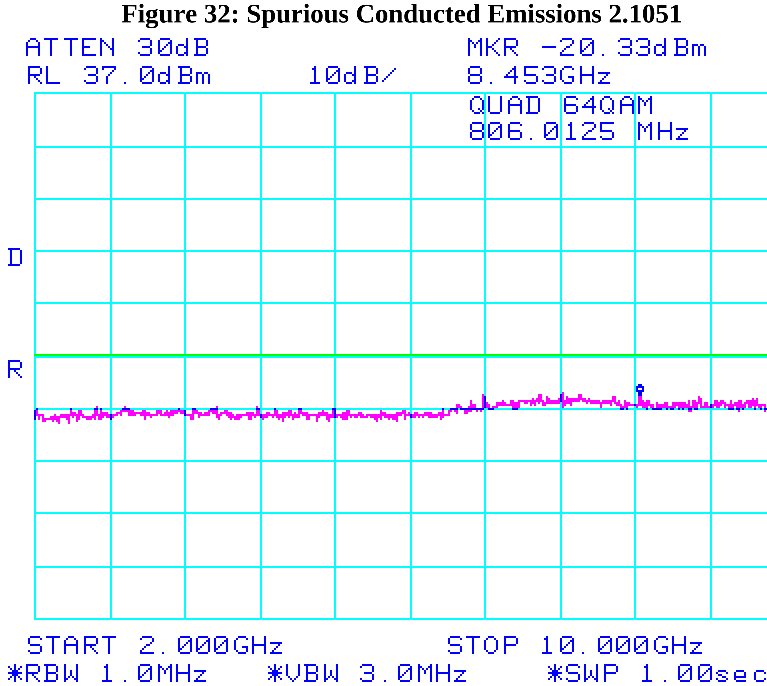


Figure 32: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 33: Spurious Conducted Emissions 2.1051

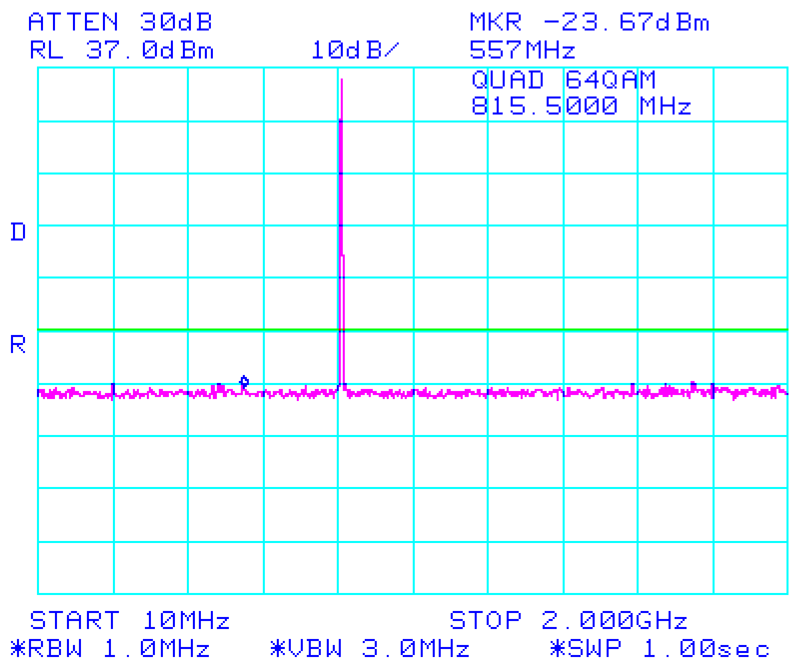
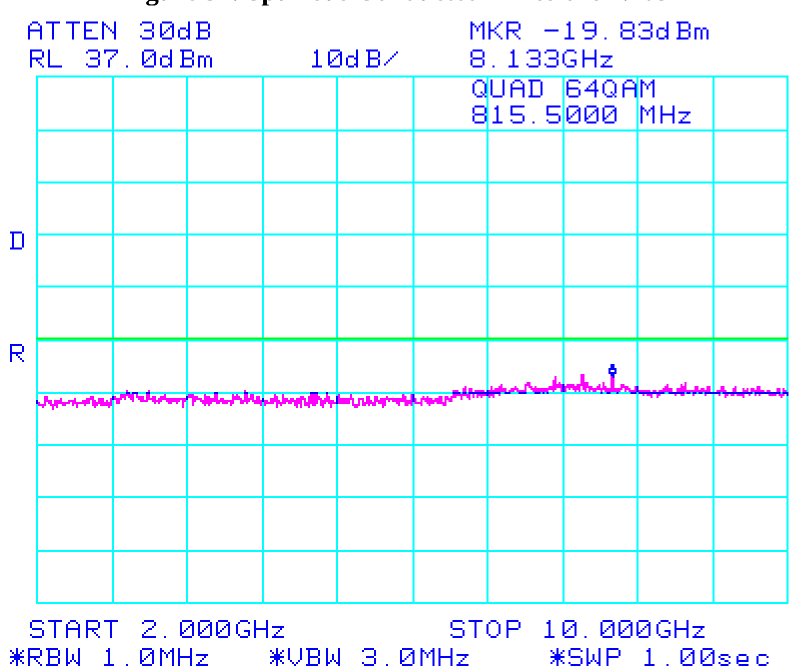


Figure 34: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 35: Spurious Conducted Emissions 2.1051

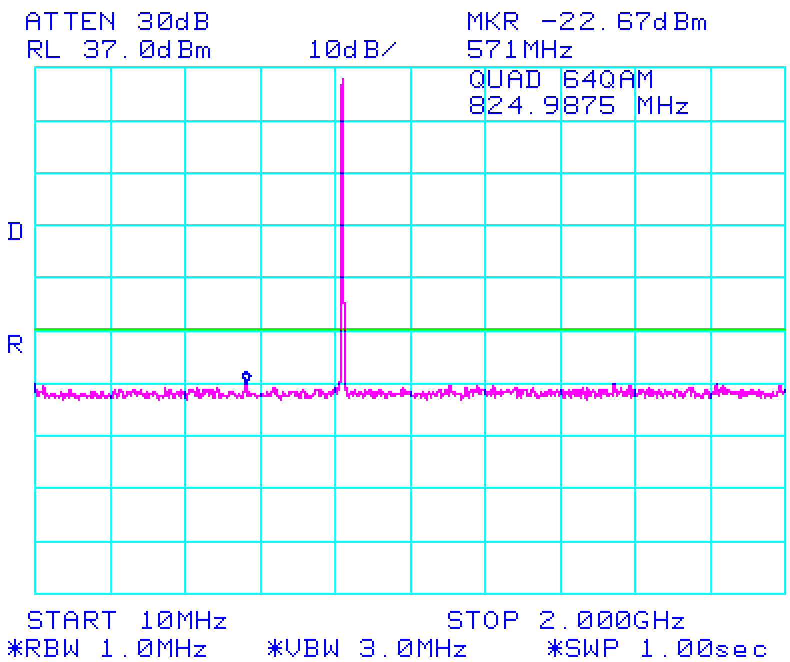
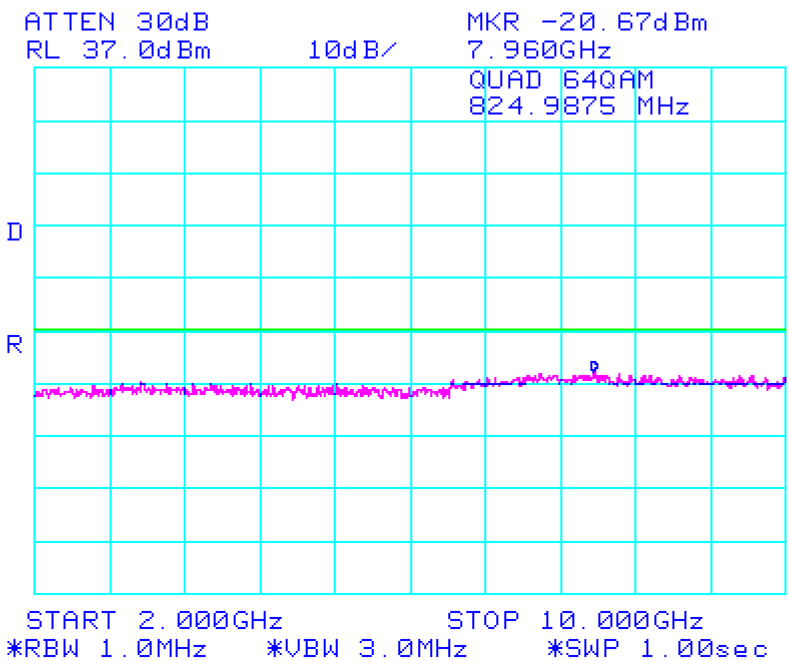


Figure 36: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data cont'd

Figure 37: QUAD_QPSK_EA Mask 90.691(a)

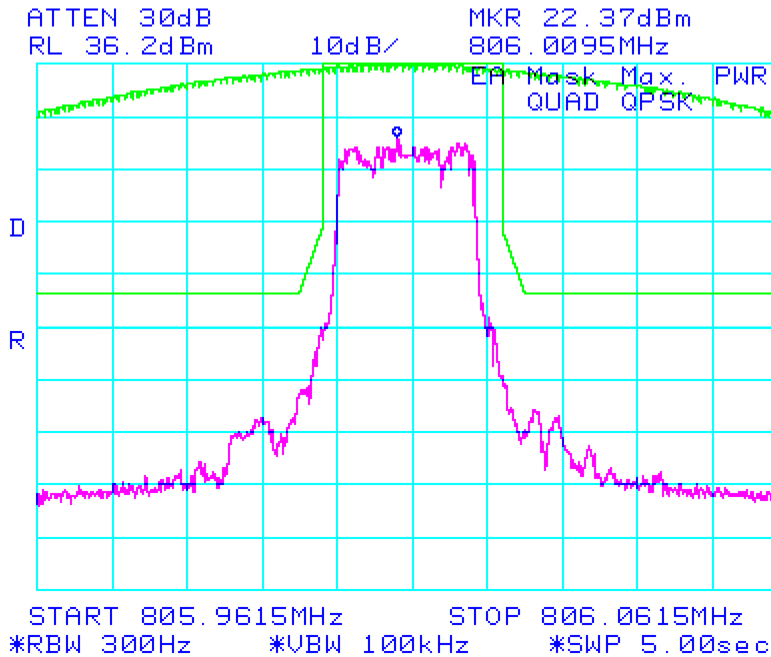
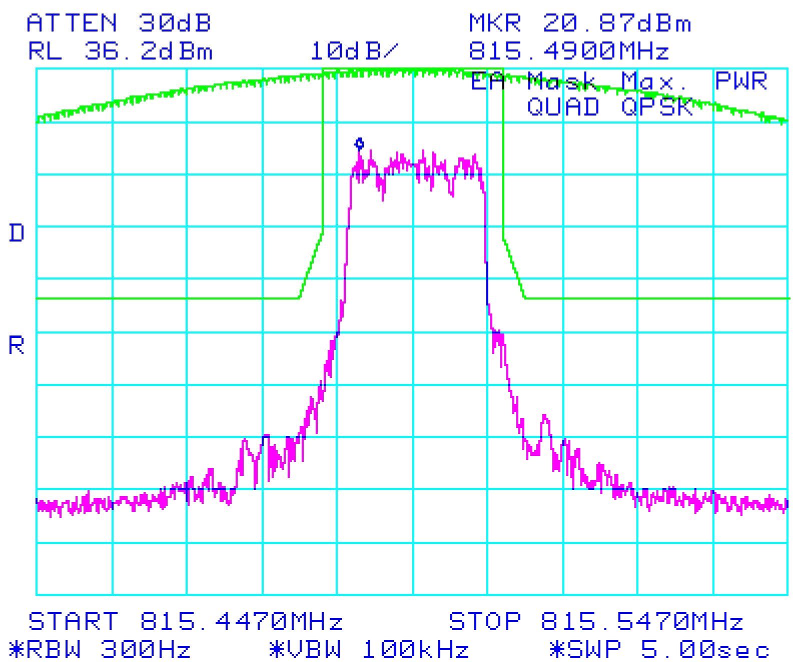


Figure 38: QUAD_QPSK_EA Mask 90.691(a)



Conducted Emission Test Data cont'd

Figure 39: QUAD_QPSK_EA Mask 90.691(a)

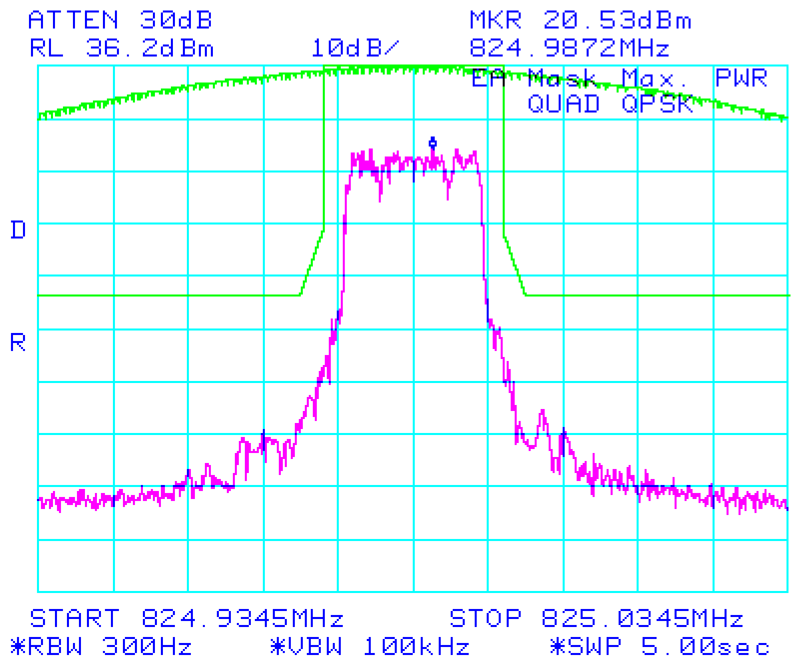
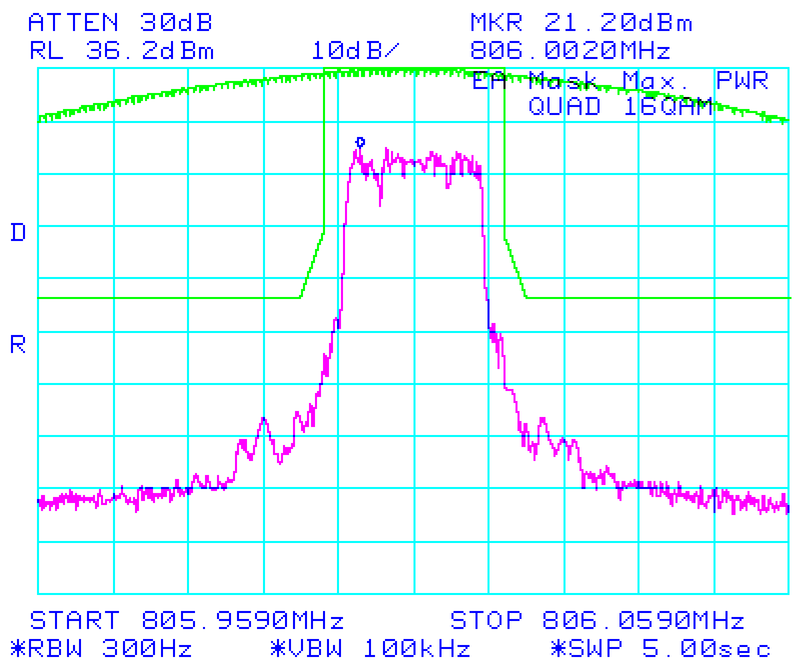


Figure 40: QUAD_16QAM_EA Mask 90.691(a)



Conducted Emission Test Data cont'd

Figure 41: QUAD_16QAM_EA Mask 90.691(a)

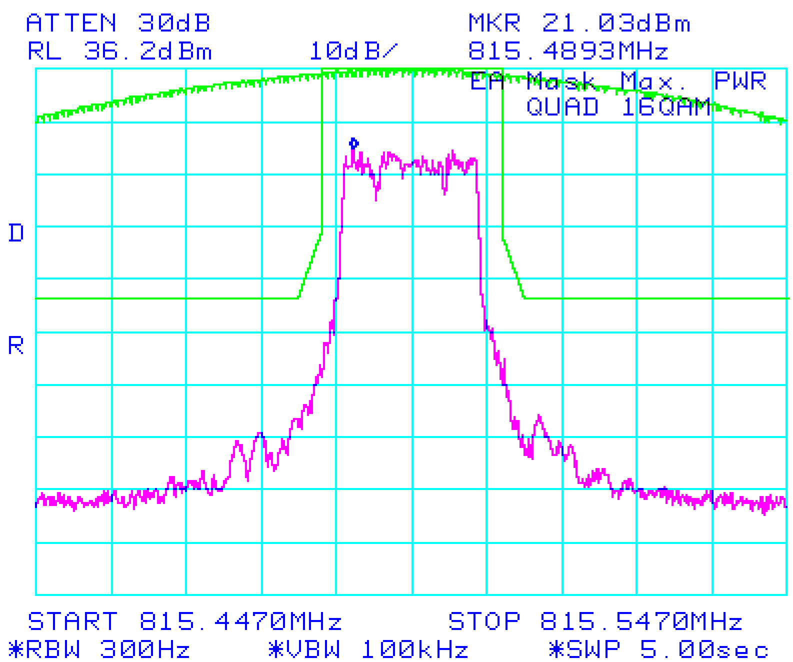
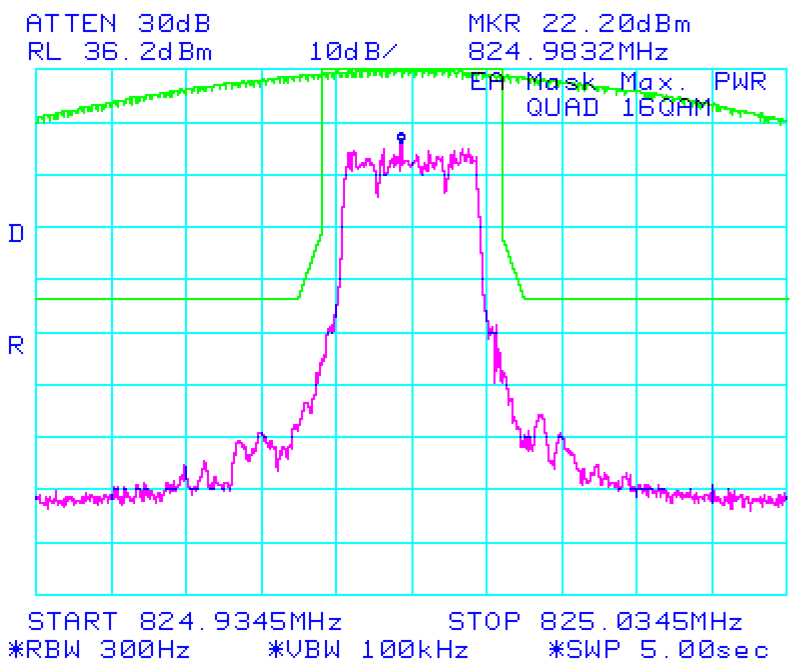


Figure 42: QUAD_16QAM_EA Mask 90.691(a)



Conducted Emission Test Data cont'd

Figure 43: QUAD_64QAM_EA Mask 90.691(a)

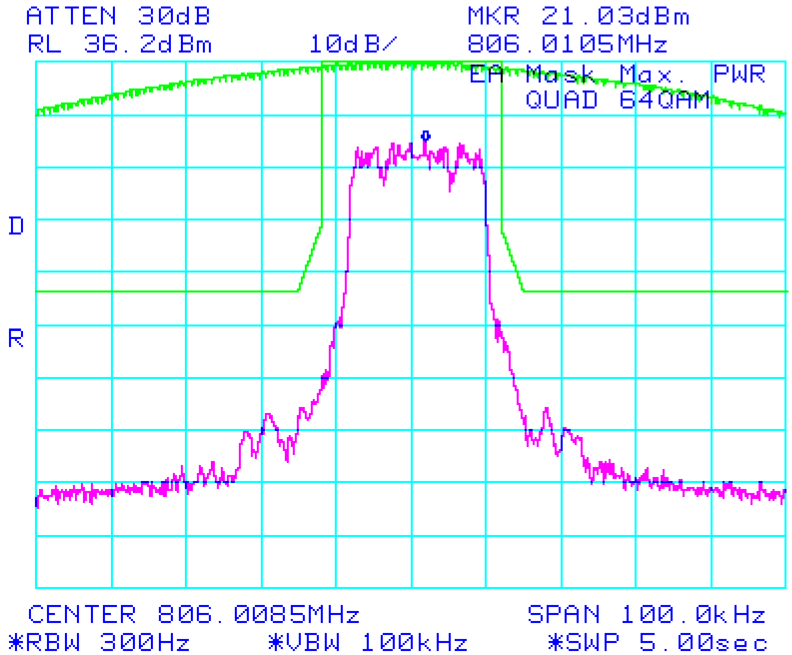
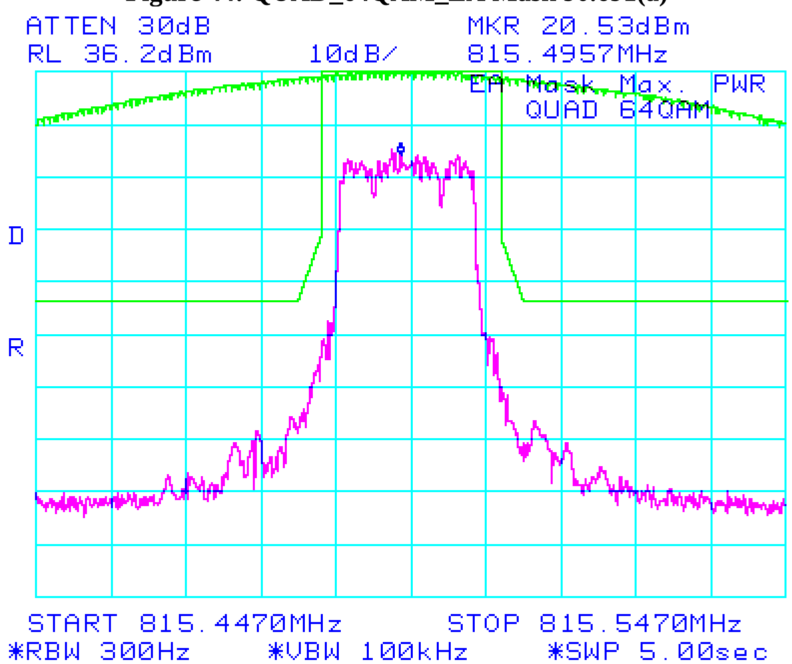


Figure 44: QUAD_64QAM_EA Mask 90.691(a)



Conducted Emission Test Data cont'd

Figure 43: QUAD_64QAM_EA Mask 90.691(a)

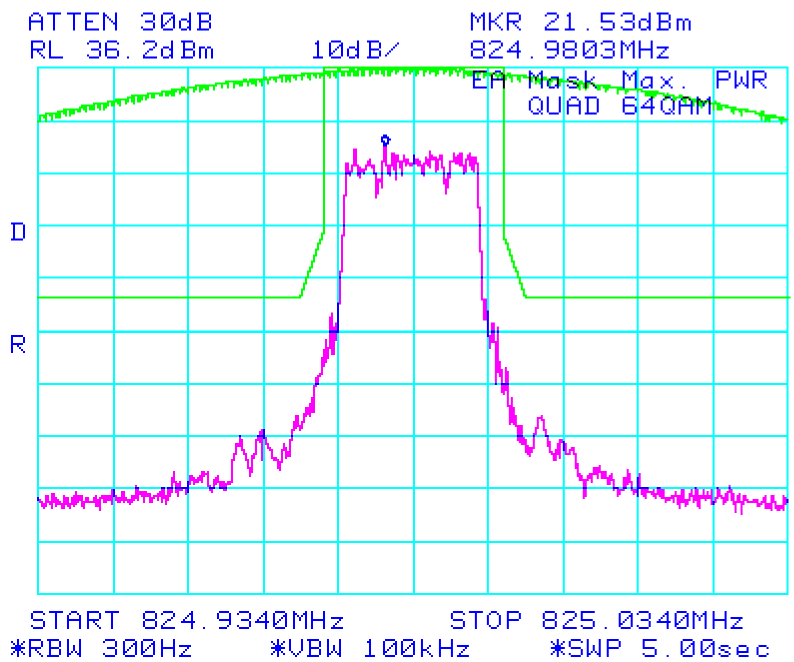
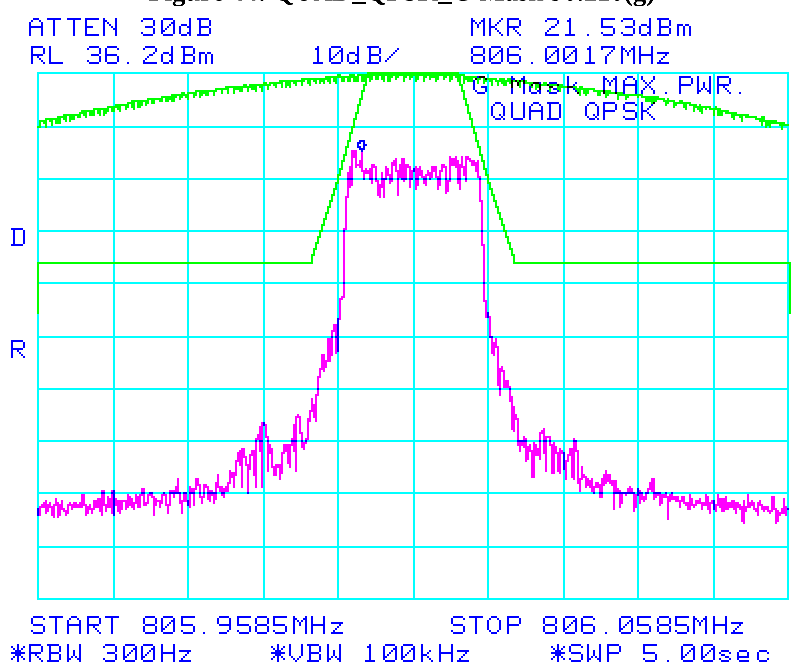


Figure 44: QUAD_QPSK_G Mask 90.210(g)



Conducted Emission Test Data cont'd

Figure 45: QUAD_QPSK_G Mask 90.210(g)

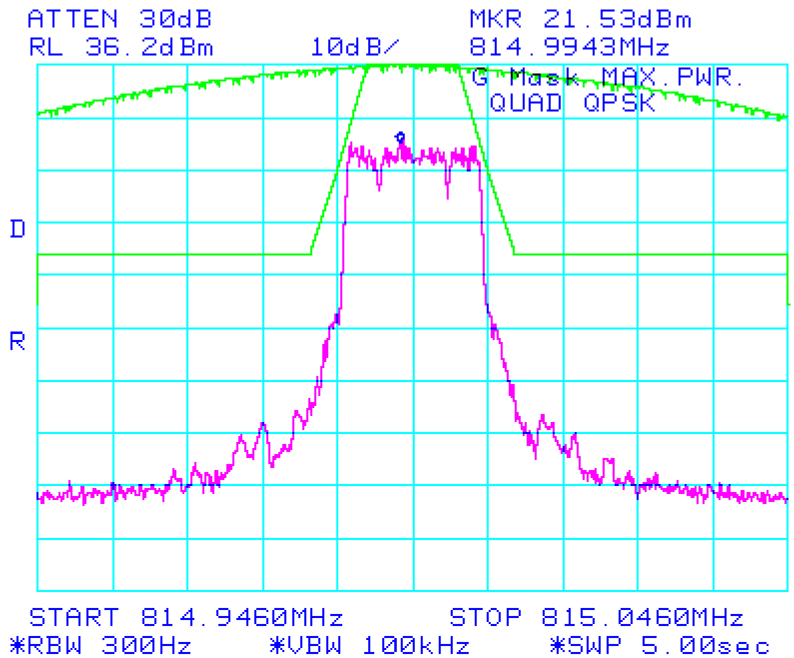
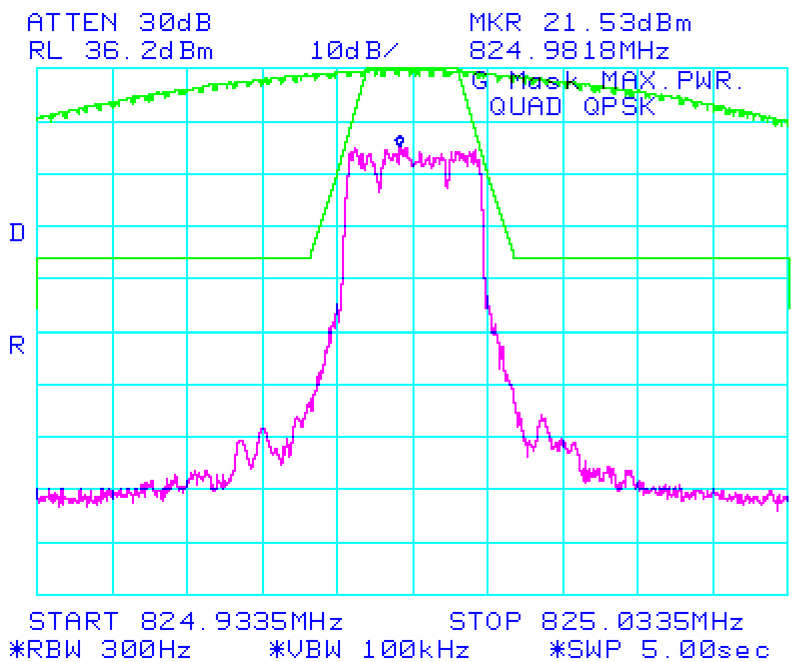


Figure 46: QUAD_QPSK_G Mask 90.210(g)



Conducted Emission Test Data cont'd

Figure 47: QUAD_16QAM_G Mask 90.210(g)

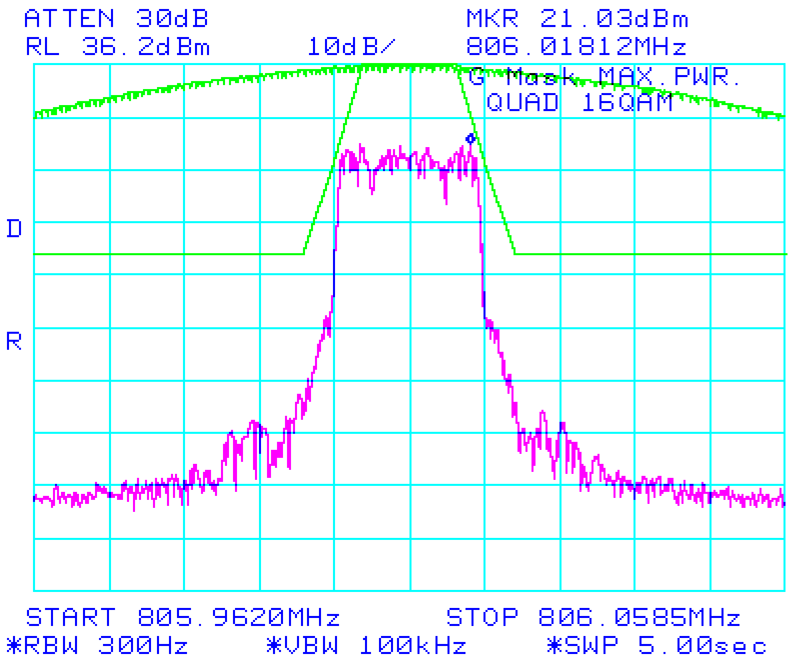
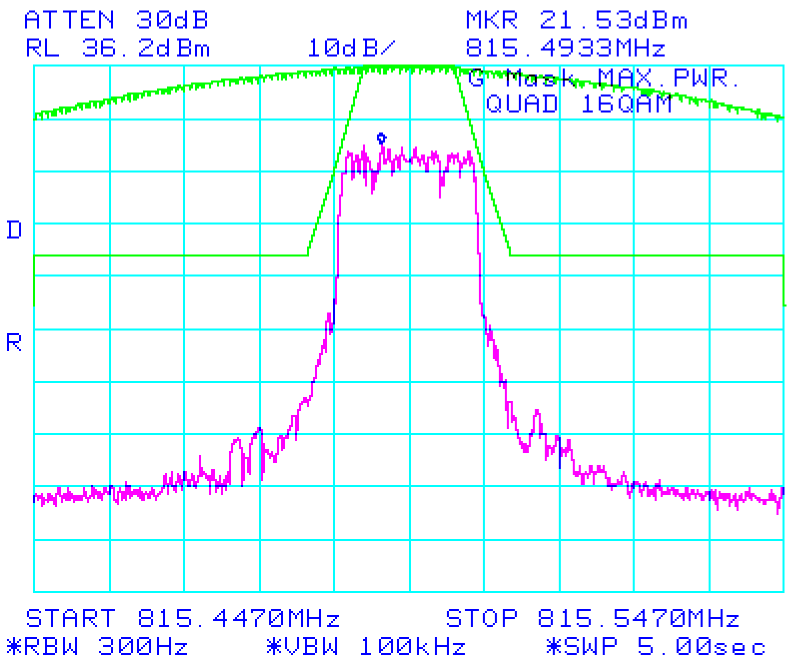


Figure 48: QUAD_16QAM_G Mask 90.210(g)



Conducted Emission Test Data cont'd

Figure 49: QUAD_16QAM_G Mask 90.210(g)

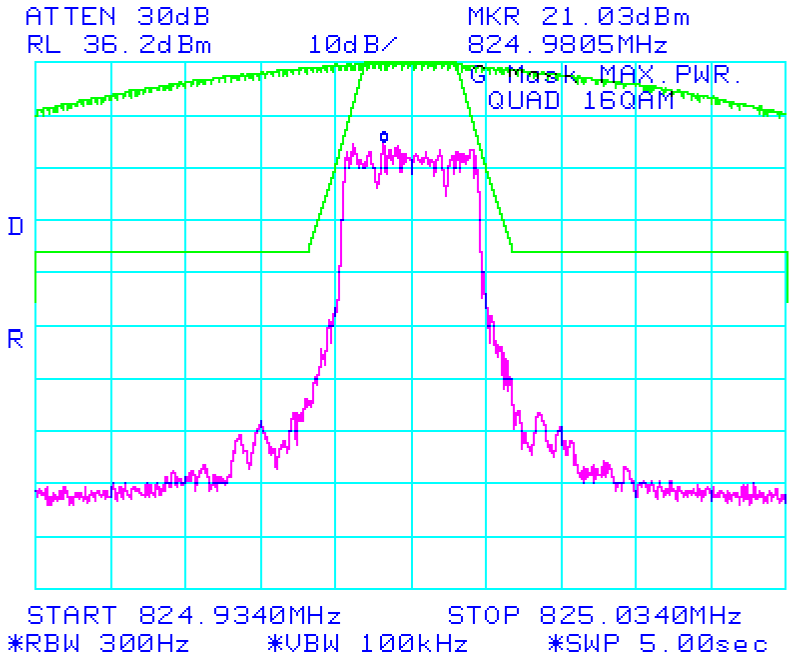
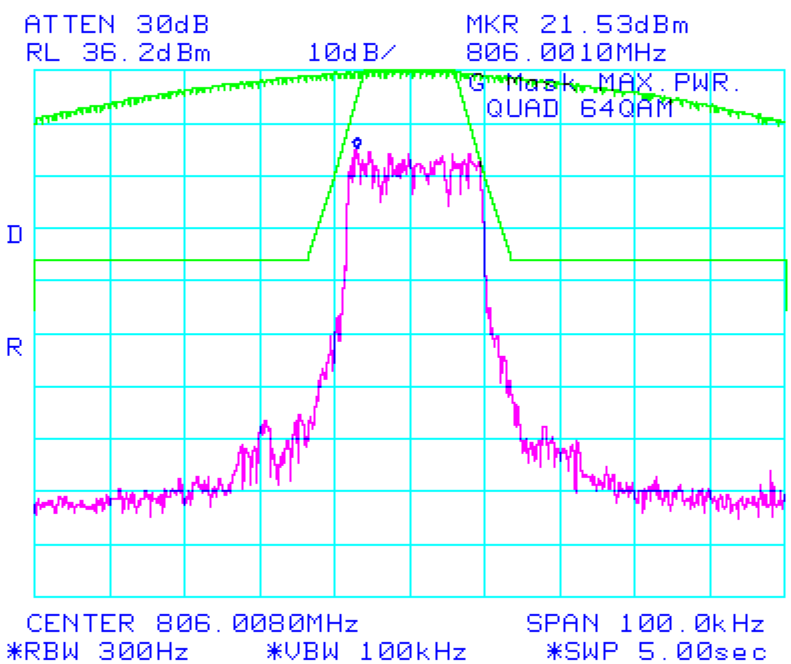


Figure 50: QUAD_64QAM_G Mask 90.210(g)



Conducted Emission Test Data cont'd

Figure 51: QUAD_64QAM_G Mask 90.210(g)

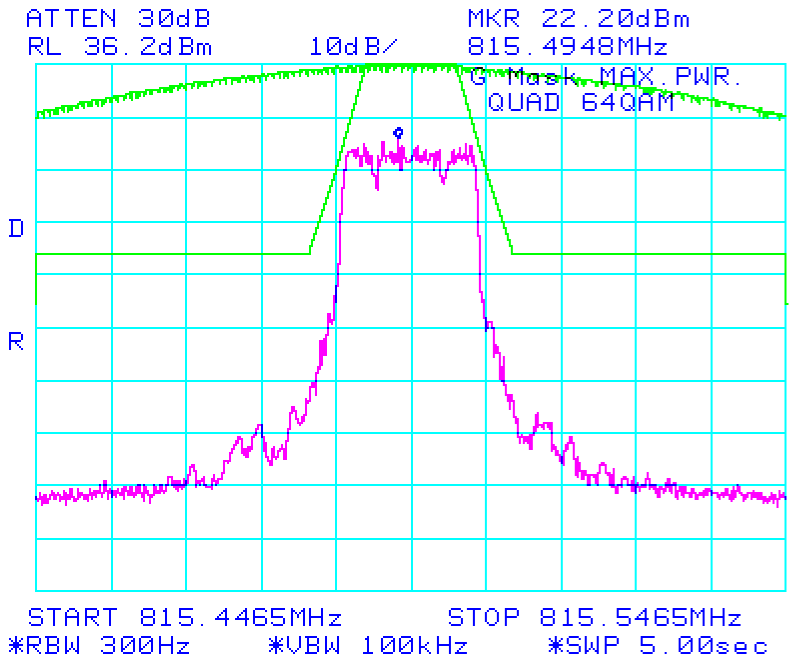
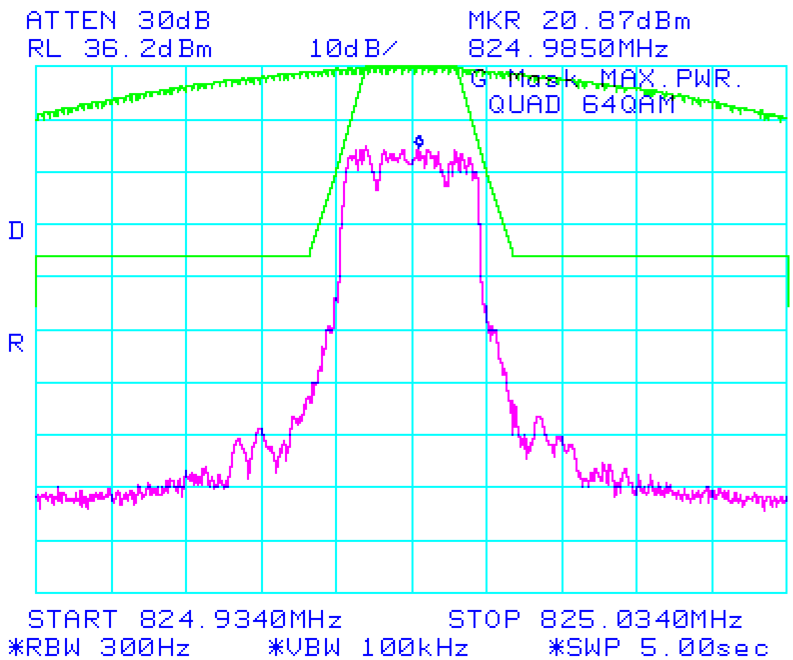
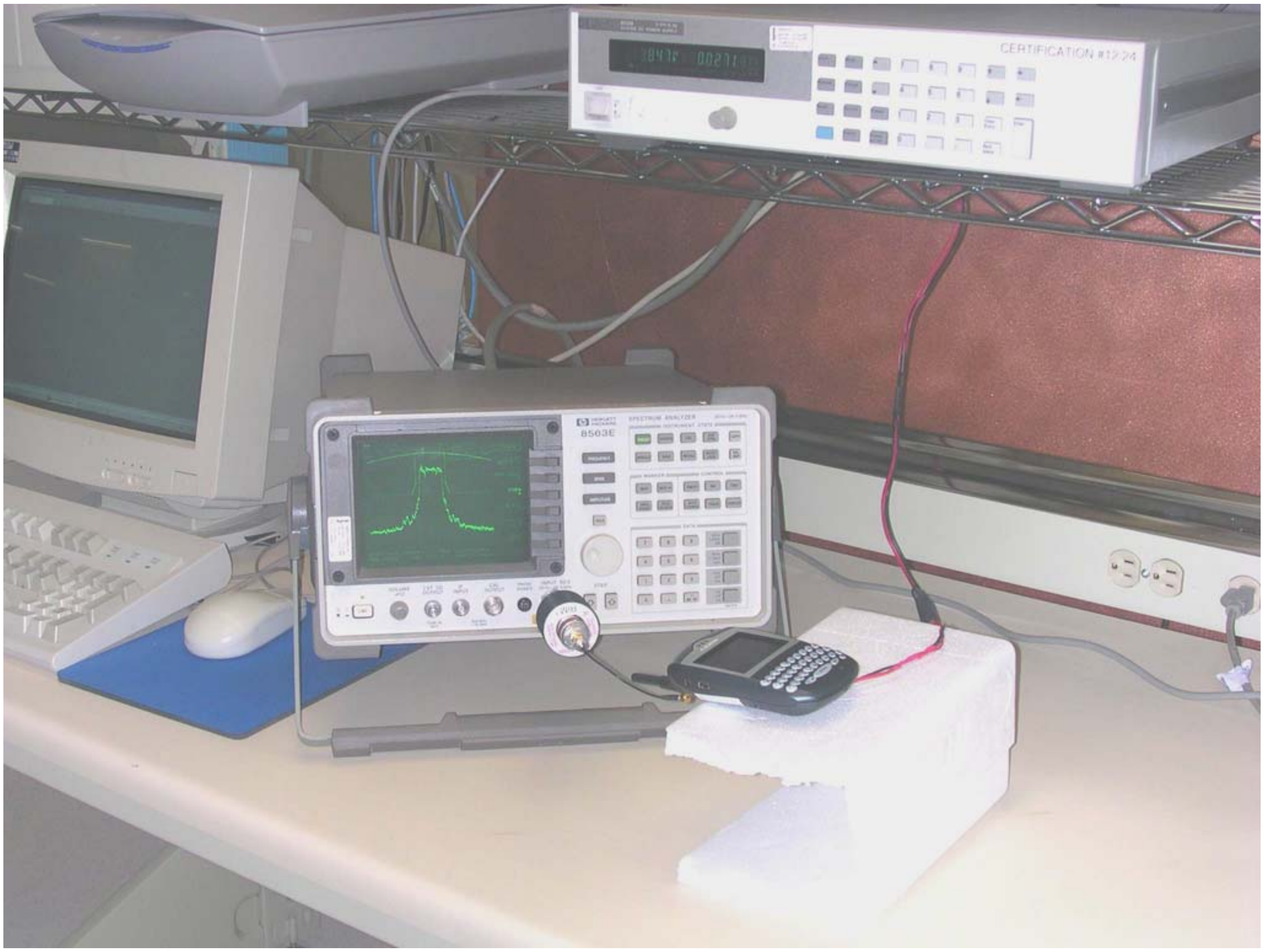


Figure 52: QUAD_64QAM_G Mask 90.210(g)



Conducted Emission Test Data cont'd

Test-Setup Photo

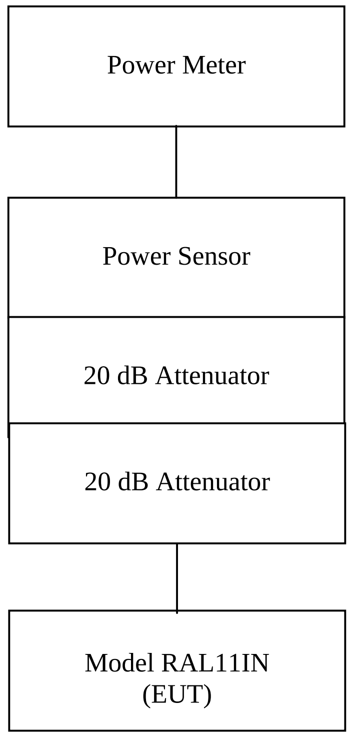


APPENDIX 2

CONDUCTED RF OUTPUT POWER TEST DATA

Conducted RF Output Power Test Data

Test Setup Diagram



The environmental test conditions were: Temperature 24ºC
Pressure 975 mb
Relative Humidity 32%

Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Giga-Tronics	8541C	1837762	.01 – 18.0 GHz
Power Sensor	Giga-Tronics	80401A	1835838	.01 – 18.0 GHz
Attenuator, 20 dB, 25 W	Weinschel	33-20-33	BL8170	DC – 18 GHz
Attenuator, 20 dB, 25 W	Weinschel	33-20-34	BM0697	DC – 18 GHz

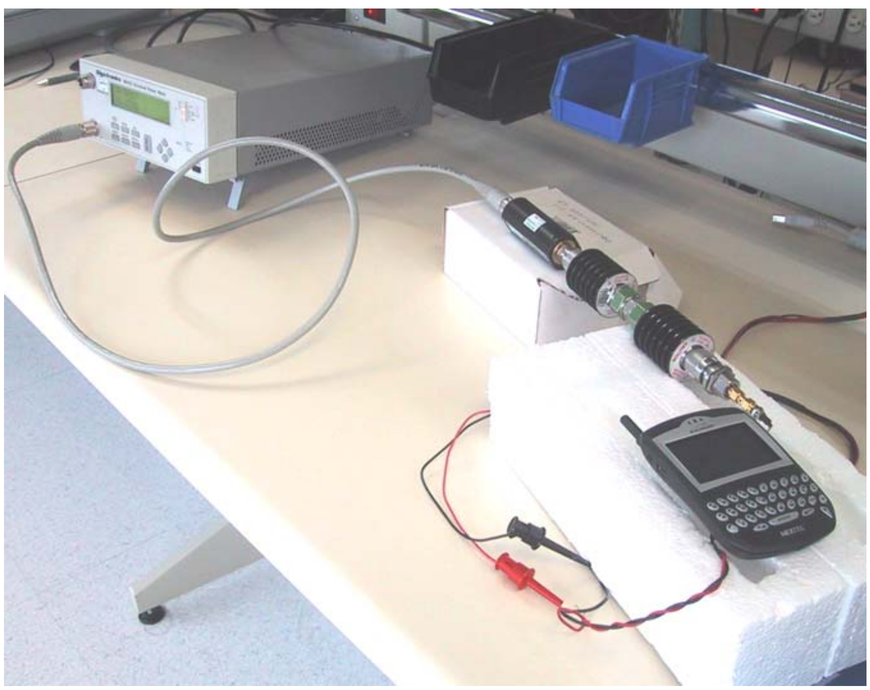
RF Power Output at Maximum

At three transmit frequencies the maximum radio output power level with a duty cycle of 33% was measured using the power meter. The calibrated insertion loss measured for the attenuator and cable assembly was added to the power measurements that produced the following results.

Test Data

Frequency (MHz)	Measured Pulse Average Conducted Power (dBm)	Total Correction Factor (dB)	Corrected Pulse Average Conducted Power (dBm)
806.0125	-12.30	40.4	28.1
815.500	-12.30	40.4	28.1
824.9875	-12.20	40.4	28.2

Conducted RF Output Power Test Data Photo

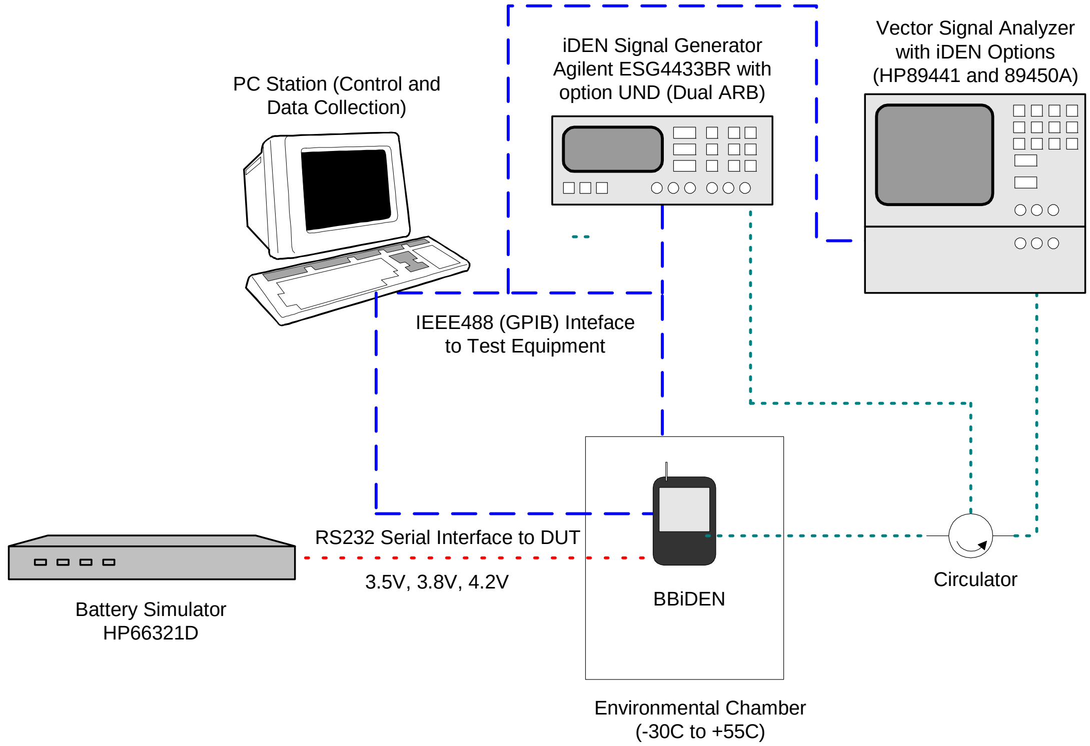


APPENDIX 3

FREQUENCY STABILITY TEST DATA

Frequency Stability Test Data

The following document contains measurement data pertaining to Frequency Stability.



SYSTEM	*Model*	*Serial Number*
Agilent Vector Signal Analyzer	HP89441A	US39313988
HP DC Power Supply	HP66321D	GB40180110
Signal Generator	HP ESG4433BR	US38440638
Network Analyzer (Calibration)	E5071B-ATO-7083	MY4210062
Espec Environmental Chamber	SH241	92000147
Temperature Probe	61161-302	21352860
Power Meter	E4419B	MY40511065
Power Sensor	8482H	MY41090594
HP DC Power Supply	66321D	GB40180110

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2.947, 2.1055 and 90.213

Required Measurements for Frequency Stability

Procedures

Temperature Variation

Voltage Variation

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

The BlackBerry iDEN Handheld's (referred to as EUT from hereinafter) transmitted frequency stability is less than 0.2 ppm of the ideal transmit frequency. The frequency accuracy is measured by the HP89441 Vector Signal Analyzer.

The BlackBerry iDEN Handheld meets the requirements as stated in CFR 47 chapter 1, Section 2.947, 2.1055 and 90.213, Frequency Stability.

Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, temperatures, and stepped voltages which were controlled via GPIB interfaces linked to the Environmental chamber, a Battery Simulator, a Signal Generator and the Vector Signal Analyzer. The test set was calibrated to characterize the insertion loss for the transmitted frequencies between the RF input of the Vector Signal Analyzer and the EUT antenna port. The EUT is located inside the environmental chamber.
Calibration for the cable loss was performed in the Ottawa RF Laboratory on August 09, 2004.

Procedure:

The EUT was placed in the temperature chamber and connected to the test set. The EUT was kept in idle mode at all times except when the measurements were to be made.

The chamber was switched on, and the temperature was set to –30º C.

After the chamber stabilized at -30º C there was a soak period of 30 minutes. A period of thirty minutes soak was maintained between each ascending temperature step prior to the start of the next measurement test cycle.
A computer system controlled the automated software. All the test equipment intrinsic to the temperature and voltage tests was controlled via the GPIB Bus. The EUT communication was passed through a RS232 serial connection.

The frequency accuracy was averaged over 16 transmit bursts for each combination temperature, voltage and frequency. Three frequencies were selected: 806.0125, 815.5000 and 824.9875 MHz.

The power supply was cycled from minimum voltage of 3.5 volts to 3.8 volts nominal and 4.2V maximum operating voltage under load. The frequency error was measured at the maximum output power and recorded by the automated system test software. The frequency was recorded in MHz and deviation from nominal, in Parts Per Million.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

1. Switch on the HP66321D dc power supply, the ESG4433BR signal generator, the HP89441A Vector Signal Analyzer.
2. Start system test program
3. Set the Temperature to –30 degrees Celsius and maintain a period of thirty minutes soak time, with the EUT supply voltage disabled.
4. Set power supply voltage to 3.5 volts
5. Set up HP89441A Vector Signal Analyzer.
6. Set the VSA to 806.0125 MHz.
7. Enable the voltage to the EUT, and connect a link to the VSA.
8. Set the transmit frequency of the EUT to 806.0125MHz and put the EUT in RTR (receive/transmit) mode.
9. Capture 16 bursts with the VSA and record the average frequency error over the 16 bursts.
10. Put the EUT back into IDLE mode, change the frequency on the VSA and the EUT to 815.5000 MHz and repeat steps 7, to 9. Repeat again for 824.9875 MHz.
11. Repeat steps 5, to 10 changing the supply voltage to 3.8 volts. Then repeat with the supply voltage at 4.2 volts.
12. Increase temperature to the next temperature step and soak for 1/2 hour.
13. Repeat steps 4 - 12 for temperatures –30 degrees to 55 degrees Celsius.

The maximum frequency error measured was 0.0405 PPM.

Channel results: 806.0125MHz, 815.5MHz and 824.9875MHz @ 20º C and maximum transmitted power.

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
806.0125	3.5	20	-25.25	-0.0313
815.5000	3.5	20	-10.01	-0.0123
824.9875	3.5	20	5.62	0.0068

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
806.0125	3.8	20	12.35	0.0153
815.5000	3.8	20	-4.34	-0.0053
824.9875	3.8	20	13.72	0.0166

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
806.0125	4.2	20	-24.45	-0.0303
815.5000	4.2	20	7.05	0.0086
824.9875	4.2	20	-10.91	-0.0132

Channel Results: 806.0125 @ maximum transmitted power

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
806.0125	3.5	-30	2.67	0.0033
806.0125	3.5	-20	-12.74	-0.0158
806.0125	3.5	-10	-6.42	-0.0080
806.0125	3.5	0	-16.16	-0.0201
806.0125	3.5	10	5.50	0.0068
806.0125	3.5	20	-25.25	-0.0313
806.0125	3.5	30	-24.05	-0.0298
806.0125	3.5	40	-26.11	-0.0324
806.0125	3.5	50	-27.80	-0.0345
806.0125	3.5	55	14.88	0.0185

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
806.0125	3.8	-30	7.06	0.0088
806.0125	3.8	-20	-29.24	-0.0363
806.0125	3.8	-10	8.70	0.0108
806.0125	3.8	0	5.49	0.0068
806.0125	3.8	10	8.11	0.0101
806.0125	3.8	20	12.35	0.0153
806.0125	3.8	30	-25.12	-0.0312
806.0125	3.8	40	2.03	0.0025
806.0125	3.8	50	-6.48	-0.0080
806.0125	3.8	55	-10.38	-0.0129

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
806.0125	4.2	-30	-20.56	-0.0255
806.0125	4.2	-20	-4.63	-0.0057
806.0125	4.2	-10	-21.22	-0.0263
806.0125	4.2	0	8.05	0.0100
806.0125	4.2	10	-9.03	-0.0112
806.0125	4.2	20	-24.45	-0.0303
806.0125	4.2	30	-0.89	-0.0011
806.0125	4.2	40	-12.41	-0.0154
806.0125	4.2	50	3.90	0.0048
806.0125	4.2	55	-32.62	-0.0405

Channel Results: 815.5000 @ maximum transmitted power

Frequency (MHz)	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
815.5000	3.5	-30	8.57	0.0105
815.5000	3.5	-20	-11.78	-0.0144
815.5000	3.5	-10	11.48	0.0141
815.5000	3.5	0	-10.63	-0.0130
815.5000	3.5	10	-8.01	-0.0098
815.5000	3.5	20	-10.01	-0.0123
815.5000	3.5	30	-3.62	-0.0044
815.5000	3.5	40	-15.38	-0.0189
815.5000	3.5	50	-7.97	-0.0098
815.5000	3.5	55	8.17	0.0100

Frequency (MHz)	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
815.5000	3.8	-30	7.43	0.0091
815.5000	3.8	-20	6.85	0.0084
815.5000	3.8	-10	-1.97	-0.0024
815.5000	3.8	0	-5.99	-0.0073
815.5000	3.8	10	12.99	0.0159
815.5000	3.8	20	-4.34	-0.0053
815.5000	3.8	30	-17.01	-0.0209
815.5000	3.8	40	-15.36	-0.0188
815.5000	3.8	50	-20.48	-0.0251
815.5000	3.8	55	0.16	0.0002

Frequency (MHz)	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
815.5000	4.2	-30	-4.76	-0.0058
815.5000	4.2	-20	8.57	0.0105
815.5000	4.2	-10	9.72	0.0119
815.5000	4.2	0	-16.08	-0.0197
815.5000	4.2	10	17.12	0.0210
815.5000	4.2	20	7.05	0.0086
815.5000	4.2	30	5.99	0.0073
815.5000	4.2	40	-5.21	-0.0064
815.5000	4.2	50	12.80	0.0157
815.5000	4.2	55	-7.82	-0.0096

Channel Results: 824.9875 @ maximum transmitted power

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
824.9875	3.5	-30	5.76	0.0070
824.9875	3.5	-20	-13.96	-0.0169
824.9875	3.5	-10	-17.90	-0.0217
824.9875	3.5	0	-4.09	-0.0050
824.9875	3.5	10	-4.03	-0.0049
824.9875	3.5	20	5.62	0.0068
824.9875	3.5	30	-11.74	-0.0142
824.9875	3.5	40	7.55	0.0091
824.9875	3.5	50	-15.44	-0.0187
824.9875	3.5	55	-24.08	-0.0292

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
824.9875	3.8	-30	-17.43	-0.0211
824.9875	3.8	-20	-10.26	-0.0124
824.9875	3.8	-10	-13.88	-0.0168
824.9875	3.8	0	-17.44	-0.0211
824.9875	3.8	10	17.46	0.0212
824.9875	3.8	20	13.72	0.0166
824.9875	3.8	30	-16.38	-0.0199
824.9875	3.8	40	-5.43	-0.0066
824.9875	3.8	50	0.02	0.0000
824.9875	3.8	55	-21.63	-0.0262

Frequency (MHz)	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
824.9875	4.2	-30	-12.21	-0.0148
824.9875	4.2	-20	10.76	0.0130
824.9875	4.2	-10	-13.72	-0.0166
824.9875	4.2	0	13.92	0.0169
824.9875	4.2	10	10.24	0.0124
824.9875	4.2	20	-10.91	-0.0132
824.9875	4.2	30	4.12	0.0050
824.9875	4.2	40	5.96	0.0072
824.9875	4.2	50	-11.49	-0.0139
824.9875	4.2	55	-22.42	-0.0272

APPENDIX 4

RADIATED SPURIOUS/HARMONIC EMISSIONS AND ERP TEST DATA

Radiated Emissions Test Data Results

Test distance is 3.0 metres. EUT at 1.0 metre height. July 21, 2004

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method: Tracking Generator				
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to dipole)	Limit (dBm)	Diff to Limit (dB)
(ERP) Antenna Extended – (Handheld standalone, upright position) QAM (Quad QPSK), 1/3 (Three slots per frame)												
F0	Low	806.0125	800	Dipole	V	90.1	90.1	V V	14.6	31.4	39.00	-7.7
F0	Low	806.0125	800	Dipole	H	80.4		H H	13.2			
F0	Mid.	815.5000	800	Dipole	V	90.3	90.3	V V	15.1	31.9	39.00	-7.2
F0	Mid.	815.5000	800	Dipole	H	78.5		H H	13.4			
FO	High	824.9875	800	Dipole	V	89.9	89.9	V V	15.1	31.9	39.00	-7.2
FO	High	824.9875	800	Dipole	V	74.3		H H	13.5			

ERP = Tracking Generator Level + Antenna Loss – Cable Loss + Preamp

Example: 806.0125 MHz = 14.6 (Tracking Generator Level) – 7.7 (Antenna Loss) – 2.15 (Dipole Factor) – 3.7 (Cable Loss) + 30.3 (Preamp Gain) = 31.4 dBm (Reading Relative to Dipole)

Radiated Emissions Test Data Results cont'd

Test distance is 3.0 metres. EUT at 1.0 metre height. July 21, 2004

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator				
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to dipole)	Limit (dBm)	Diff to Limit (dB)
Harmonics												
Antenna Extended - (Handheld standalone, upright position) QAM16 (Quad QPSK), 1/3 (Three slot per frame)												
Low Channel – 806.0125 MHz												
2nd	Low	1612.0250	800	Horn	V	74.5	74.5	V V	-28.1	-24.7	-13	-11.7
2nd	Low	1612.0250	800	Horn	H	73.7		H H	-28.0			
3rd	Low	2418.0375	800	Horn	V	54.6	54.6	V V	-39.1	-28.8	-13	-15.8
3rd	Low	2418.0375	800	Horn	H	53.4		H H	-40.1			
4th	Low	3224.0500	800	Horn	V	52.6	61.2	V V	-32.9	-28.8	-13	-15.8
4th	Low	3224.0500	800	Horn	H	61.2		H H	-33.0			
5th	Low	4030.0625	800	Horn	V	65.2	65.6	V V	-24.0	-20.7	-13	-7.7
5th	Low	4030.0625	800	Horn	H	65.6		H H	-24.5			
6th	Low	4836.0750	800	Horn	V	62.8	62.8	V V	-21.4	-18.6	-13	-5.6
6th	Low	4836.0750	800	Horn	H	61.2		H H	-21.9			
7th	Low	5642.0875	800	Horn	V	56.3	59.9	V V	-20.5	-18.4	-13	-5.4
7th	Low	5642.0875	800	Horn	H	59.9		H H	-21.2			
The harmonics were investigated up to the 10th harmonic. Emissions above the 7th harmonic were in the noise floor (NF)												
Middle Channel – 815.5000 MHz												
2nd	Mid.	1631.000	800	Horn	V	73.7	73.7	V V	-28.5	-25.2	-13	-12.2
2nd	Mid.	1631.000	800	Horn	H	68.8		H H	-28.8			

Radiated Emissions Test Data Results cont'd

Test distance is 3.0 metres. EUT at 1.0 metre height. July 21, 2004

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator				
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to dipole)	Limit (dBm)	Diff to Limit (dB)
3^{rd}	Mid.	2446.5000	800	Horn	V	48.0	58.0	V V	-35.5	-31.0	-13	-18.0
3^{rd}	Mid.	2446.5000	800	Horn	H	58.0		H H	-36.7			
4^{th}	Mid.	3264.0000	800	Horn	V	NF	-	V V	-	-	-	-
4^{th}	Mid.	3262.0000	800	Horn	H	NF		H H	-			
5^{th}	Mid.	4077.5000	800	Horn	V	60.2	60.5	V V	-30.2	-26.9	-13	-13.9
5^{th}	Mid.	4077.5000	800	Horn	H	60.5		H H	-30.7			
6^{th}	Mid.	4893.0000	800	Horn	V	63.0	64.3	V V	-19.1	-16.2	-13	-3.2
6^{th}	Mid.	4893.0000	800	Horn	H	64.3		H H	-19.0			
7^{th}	Mid.	5642.0875	800	Horn	V	54.3	55.0	V V	-30.6	-28.5	-13	-15.5
7^{th}	Mid.	5642.0875	800	Horn	H	55.0		H H	-30.7			
The harmonics were investigated up to the 10^{th} harmonic. Emissions above the 7^{th} harmonic were in the NF **High Channel** – 824.9875 MHz												
2^{nd}	High	1649.9750	800	Horn	V	73.3	73.3	V V	-28.4	-25.1	-13	-12.1
2^{nd}	High	1649.9750	800	Horn	H	65.1		H H	-28.9			
3^{rd}	High	2474.9625	800	Horn	V	46.6	56.2	V V	-37.5	-33.0	-13	-20.0
3^{rd}	High	2474.9625	800	Horn	H	56.2		H H	-38.5			
4^{th}	High	3299.95000	800	Horn	V	NF	-	V V	-	-	-	-
4^{th}	High	3299.95000	800	Horn	H	NF		H H	-			
5^{th}	High	4124.9375	800	Horn	V	60.7	63.2	V V	-25.2	-21.9	-13	-8.9
5^{th}	High	4124.9375	800	Horn	H	63.2		H H	-25.3			
6^{th}	High	4949.9250	800	Horn	V	61.6	63.8	V V	-19.2	-16.3	-13	-3.3
6^{th}	High	4949.9250	800	Horn	H	63.8		H H	-19.1			

Radiated Emissions Test Data Results cont'd

Test distance is 3.0 metres. EUT at 1.0 metre height. July 21, 2004

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator				
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to dipole)	Limit (dBm)	Diff to Limit (dB)
7th	High	5774.9125	800	Horn	V	54.2	57.2	V V	-26.1	-24.0	-13	-11.0
7th	High	5774.9125	800	Horn	H	57.2		H H	-26.5			
The harmonics were investigated up to the 10th harmonic. Emissions above the 7th harmonic were in the NF												

The measurements were performed with the handheld in an upright position.
QAM16 (Quad QPSK), 1/6 (0ne slot per frame).

Test distance is 3.0 metres. EUT at 1.0 metre height. July 21, 2004

EUT			Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator				
Type	Ch	Frequency (MHz)	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to dipole)	Limit (dBm)	Diff to Limit (dB)
RF LO (Tx)	High	979.6500	HLP	V	55.3	55.3	V V	-29.9	-44.3	-13	-31.3
RF LO (Tx)	High	979.6500	HLP	H	48.5		H H	-31.8			
IF		154.6500	HLP	V	49.2	49.2	V V	-54.9	-66.2	-13	-53.2
IF		154.6500	HLP	H	39.4		H H	-60.0			
2xIF (VCO)		309.3000	HLP	V	NF	-	-	-	-	-	-
2xIF (VCO)		309.3000	HLP	H	NF		-	-			
No Emissions could be seen.											

Radiated Emissions Test Data Results cont'd

Test distance is 3.0 metres. EUT at 1.0 metre height. July 21, 2004

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator				
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to dipole)	Limit (dBm)	Diff to Limit (dB)
Harmonics with Bluetooth transmitting simultaneously with iDEN												
Antenna Extended - (Handheld standalone, upright position) QAM16 (Quad QPSK), 1/3 (Three slot per frame)												
Low Channel – 806.0125 MHz												
2^{nd}	Low	1612.0250	800	Horn	V	72.5	72.5	V V	-30.2	-26.7	-13	-13.7
2^{nd}	Low	1612.0250	800	Horn	H	71.7		H H	-30.0			
3^{rd}	Low	2418.0375	800	Horn	V	NF	-	V V	-	-	-	-
3^{rd}	Low	2418.0375	800	Horn	H	NF		H H	-			
4^{th}	Low	3224.0500	800	Horn	V	54.9	63.2	V V	-29.9	-25.8	-13	-12.8
4^{th}	Low	3224.0500	800	Horn	H	63.2		H H	-30.2			
5^{th}	Low	4030.0625	800	Horn	V	64.3	64.3	V V	-25.4	-22.1	-13	-9.1
5^{th}	Low	4030.0625	800	Horn	H	63.8		H H	-26.1			
6^{th}	Low	4836.0750	800	Horn	V	62.7	62.7	V V	-21.6	-18.8	-13	-5.8
6^{th}	Low	4836.0750	800	Horn	H	60.9		H H	-21.9			
7^{th}	Low	5642.0875	800	Horn	V	55.9	59.7	V V	-20.6	-18.5	-13	-5.5
7^{th}	Low	5642.0875	800	Horn	H	59.7		H H	-21.3			
The harmonics were investigated up to the 10^{th} harmonic. Emissions above the 7^{th} harmonic were in the noise floor (NF)												
Middle Channel – 815.5000 MHz												
2^{nd}	Mid.	1631.000	800	Horn	V	73.1	73.1	V V	-28.9	-25.6	-13	-12.6
2^{nd}	Mid.	1631.000	800	Horn	H	69.7		H H	-29.4			

Radiated Emissions Test Data Results cont'd

Test distance is 3.0 metres. EUT at 1.0 metre height. July 21, 2004

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator				
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to dipole)	Limit (dBm)	Diff to Limit (dB)
3rd	Mid.	2446.5000	800	Horn	V	NF	-	V V	-	-	-	-
3rd	Mid.	2446.5000	800	Horn	H	NF		H H	-			
4th	Mid.	3264.0000	800	Horn	V	NF	-	V V	-	-	-	-
4th	Mid.	3262.0000	800	Horn	H	NF		H H	-			
5th	Mid.	4077.5000	800	Horn	V	60.9	63.6	V V	-26.0	-22.7	-13	-9.7
5th	Mid.	4077.5000	800	Horn	H	63.9		H H	-26.2			
6th	Mid.	4893.0000	800	Horn	V	62.9	62.9	V V	-20.1	-17.3	-13	-4.3
6th	Mid.	4893.0000	800	Horn	H	62.1		H H	-20.6			
The harmonics were investigated up to the 10th harmonic. Emissions above the 6th harmonic were in the NF												
High Channel – 824.9875 MHz												
2nd	High	1649.9750	800	Horn	V	74.2	74.2	V V	-28.2	-24.7	-13	-11.7
2nd	High	1649.9750	800	Horn	H	66.7		H H	-28.0			
3rd	High	2474.9625	800	Horn	V	NF	-	V V	-	-	-	-
3rd	High	2474.9625	800	Horn	H	NF		H H	-			
4th	High	3299.95000	800	Horn	V	NF	-	V V	-	-	-	-
4th	High	3299.95000	800	Horn	H	NF		H H	-			
5th	High	4124.9375	800	Horn	V	64.0	64.0	V V	-24.2	-20.9	-13	-7.9
5th	High	4124.9375	800	Horn	H	62.8		H H	-24.6			
6th	High	4949.9250	800	Horn	V	63.2	63.6	V V	-19.0	-16.2	-13	-3.2
6th	High	4949.9250	800	Horn	H	63.6		H H	-19.1			
7th	High	5774.9125	800	Horn	V	50.4	55.1	V V	-30.1	-28.0	-13	-15.0
7th	High	5774.9125	800	Horn	H	55.1		H H	-30.5			
The harmonics were investigated up to the 10th harmonic. Emissions above the 7th harmonic were in the NF												

Radiated Emissions Test Data Results cont'd

Radiated Emissions Test Photo

Radiated Emissions at 3.0 metres