EMI Test Report

Research In Motion Limited

REPORT NO.: RIM-0206-02

PRODUCT Model No: R6510IN
Type Name: BlackBerry 6110 Wireless Handheld
FCC ID: L6AR6510IN
IC: 2503A-R6510IN

Approved by: ______ Paul G Cardinal ______
Paul G. Cardinal, Ph.D.
Manager, Compliance and Certification

Date: 17 June, 2002

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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, Subpart L, Marketing of Radio Frequency Devices
FCC CFR 47 Part 90, Subpart I, General Technical Standards
Industry Canada, RSS-119 Issue 6, March 25/00, 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	50 Northside Road
Waterloo, Ontario	Ottawa, Ontario
Canada, N2L 3W8	Canada, K2H 5Z6
Phone: 519 888 7465	Phone: 613 829 7465
Fax: 519 888 6906	Fax: 613 829 0800
Web Site: www.rim.net	

The Ottawa facility performed the frequency stability measurements. The testing began on May 09, 2002 and was completed on June 12, 2002. The sample equipment under test (EUT) included:

a. BlackBerry 6110 Wireless Handheld, model number R6510IN, FCC ID: L6AR6510IN, IC: 2503A-R6510IN
b. USB data cable, model number HDW-04162-001, 1.5 metres long.
c. Travel Charger, model number PSM05R-050Q, RIM part number ASY-04078-001 with an output voltage of 5.0 volts dc.
d. Headset, model number HDW-03458-001

The BlackBerry 6110 Wireless Handheld is an 800 MHz portable unit that uses two digital technologies: Quad 16QAM and Time Division Multiple Access (TDMA).

C) Support Equipment Used for the Testing of the EUT

1. PC, Dell, model number MMP, serial number 6SPS20B
2. Monitor, KDS, model number KD-1460, serial number 4530019652
3. Printer, H/P, model number C5884A, serial number US8251W0VQ

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	Jonathan Doll Maurice Battler
FCC CFR 47, Part 2.947, 2.1055 and 90.213 IC RSS-119	Frequency Stability	Yes	Jonathan Doll Maurice Battler Iain Wilson

F) Modifications to EUT

No modifications were required to the EUT.

G) Summary of Results

1) 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.

2) The EUT passed the Conducted Spurious Emissions requirements in the 800 Band as per 47 CFR 2.1051. The EUT was measured in the middle channel. The frequency range investigated was from 10 MHz to 9 GHz. 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 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 (3.50 volts), nominal (3.80 volts) and high (4.20 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, 80 cm high that was positioned on a remotely rotateable turntable. The test distance used between the EUT and the receiving antenna was three metres. 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 turntable was rotated to determine the azimuth of the peak emissions. At this point the emissions were maximized by elevating the antenna in the range of 1 to 4 metres. The maximum emission levels were recorded. The EUT was measured on low, middle and high channels.

The radiated spurious emissions/harmonics investigated was not measurable above the 2nd harmonic since it was below the noise floor of the analyzer. The harmonics were investigated up to the 10th harmonic.

The worst test margin for radiated spurious emissions measured was 27.0 dB below the limit at 1612.025 MHz.

To view the test data see APPENDIX 4.

<u>Sample Calculation:</u>

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	USE
Preamplifier system	TDK RF Solutions	PA-02 080010	02-06-21	Radiated Emissions
Preamplifier	EMC Automation	PA-02-1 030002	02-06-21	Radiated Emissions
Double Ridged Waveguide Horn Antenna.	EMC	3116 2538	02-06-21	Radiated Emissions
Linear Power Supply	EMC Automation	LPS-04 2001300	02-06-21	Radiated Emissions
Preamplifier	Sonoma	310N/11909A 185831	02-06-21	Radiated Emissions
EMC Analyzer	Agilent	E7405A US40240226	03-03-21	Radiated Emissions
L.I.S.N.	Emco	3816/2 1120	02-06-21	Conducted Emissions
L.I.S.N.	Emco	3816/2 1118	02-06-21	Conducted Emissions
Impulse Limiter	Rohde & Schwarz	ESHS-Z2 836248/052	02-06-21	Conducted Emissions
EMI Receiver	Agilent	85462A 3942A00517	03-04-04	Conducted Emissions
RF Filter Section	Agilent	85460A 3704A00481	03-04-04	Conducted Emissions
Spectrum Analyzer	Agilent	8563E 3745A08112	02-08-02	Conducted Emissions
DC Power Supply	HP	6632B US37472179	02-07-30	Conducted Emissions
Environmental Chamber	ESPEC Corp.	SH-241 92000147	N/R	Frequency Stability
Network analyzer	HP	8753ES US39174857	03/03/21	Frequency Stability
Calibration Kit	HP	HP85032B 3217A13134	03-01-04	Frequency Stability
Signal Generator	HP	ESG4433BR US38440638	03-02-14	Frequency Stability
Battery Simulator	HP	66321D GB40180106	03-01-31	Frequency Stability
Vector Signal Analyzer	Agilent	89441/89450A US39313988/ US39312360	02-11-02	Frequency Stability
Temperature Probe	Hart Scientific	61161-302 21352860	03-09-10	Frequency Stability
Hybrid Log Antenna	TDK	HLP-3003C 17301	02-10-03	Radiated Emissions
Horn Antenna	TDK	HRN-0118 090301	02-10-03	Radiated Emissions
Horn Antenna	TDK	HRN-0118 090601	02-10-03	Radiated Emissions
Signal Generator	HP	83712B US37101080	02-08-14	Radiated Emissions
Dipole Antenna	Schwarzbeck	VHAP 1006	03-03-05	Radiated Emissions
Dipole Antenna	Schwarzbeck	VHAP 1007	03-03-05	Radiated Emissions
Power Meter	HP	437 B 3125U10666	02-08-01	Conducted Emissions
Power Meter Sensor	HP	8482A 20A8 04009 04	02-08-01	Conducted Emissions

I) Declaration

Statement of Performance:

The BlackBerry 6110 Wireless Handheld, model R6510IN, tested with the following accessories: Travel Charger, model number PSM05R-050Q, RIM part number ASY-04078-001, Headset, model number HDW-03458-001 and USB data cable, model number HDW-04162-001 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 manufacturer's published specifications.
The test equipment was used within its published operating parameters.
The test methods were consistent with the methods described in the relevant standards.

Maurice Battler
Compliance Specialist

Maurice Battler

Date: 17 June 2002

Masud S. Attayi, P.Eng.
Senior Engineer, Compliance and Certification Date: 17 June 2002

M. Attayi

Reviewed and Approved by:

Paul G. Cardinal, Ph.D.
Manager, Compliance and Certification Date: 17 June 2002

Paul G Cardinal

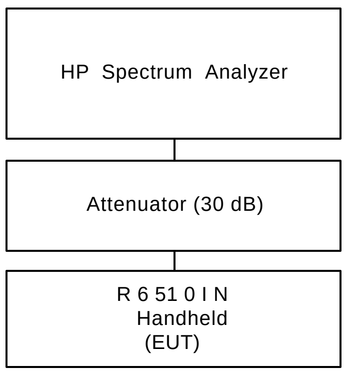
APPENDIX 1

CONDUCTED EMISSIONS TEST DATA/PLOTS

Conducted Emission Test Data

This appendix contains measurement data pertaining to the RF Power at maximum for Masks 47 CFR 90.210(g), 90.691(a), and Occupied Bandwidth 47 CFR 2.1049(h), along with 99% power bandwidth, –26 dBc bandwidth on the high channels of the 800 MHz band.

Test Setup Diagram



Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	HP	8563E	374A08112	30 Hz – 26.5 GHz
Attenuator, 30 dB, 50 W	Weinschel	47-30-43	BJ0923	DC – 18 GHz

The TDM Transmission Slot Multiplex Factor was set to 2 /6 with the RF power output at maximum for all the recorded measurements shown below.

Conducted Emission Test Data Con't

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	21.42	21.33	21.17	25.5	24.75	24.92
815.500	21.33	21.25	21.25	25.17	25.08	24.75
824.988	21.25	21.25	21.25	25	24.75	24.67

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 24 for plots of the Spurious Emission 47 CFR 2.1051 results.

See Figures 25 to 30 for plots of the EA Mask 47 CFR 90.691(a) measured data.
See Figures 25 to 30 for plots of the Occupied Bandwidth.47 CFR 2.1049(h)
Carrier Reference of Occupied Bandwidth at 0.0 dB

See Figures 31 to 36 for plots of the G Mask. 47 CFR 90.210(g) measured data.
See Figures 31 to 36 for plots of the Occupied Bandwidth. 47 CFR 2.1049(h)
Carrier Reference of Occupied Bandwidth at 0.0 dB

Conducted Emission Test Data Con't

Figure 1: Occupied Bandwidth (99%)

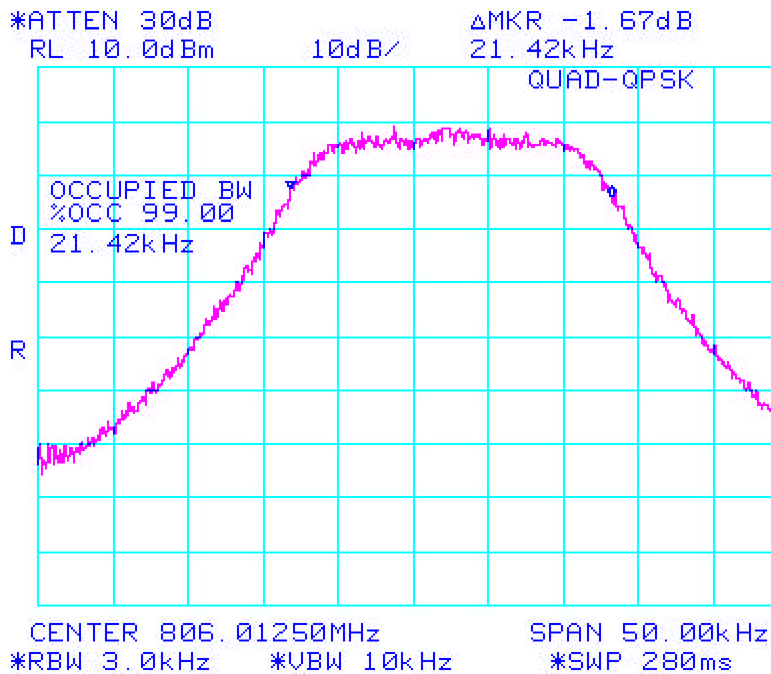
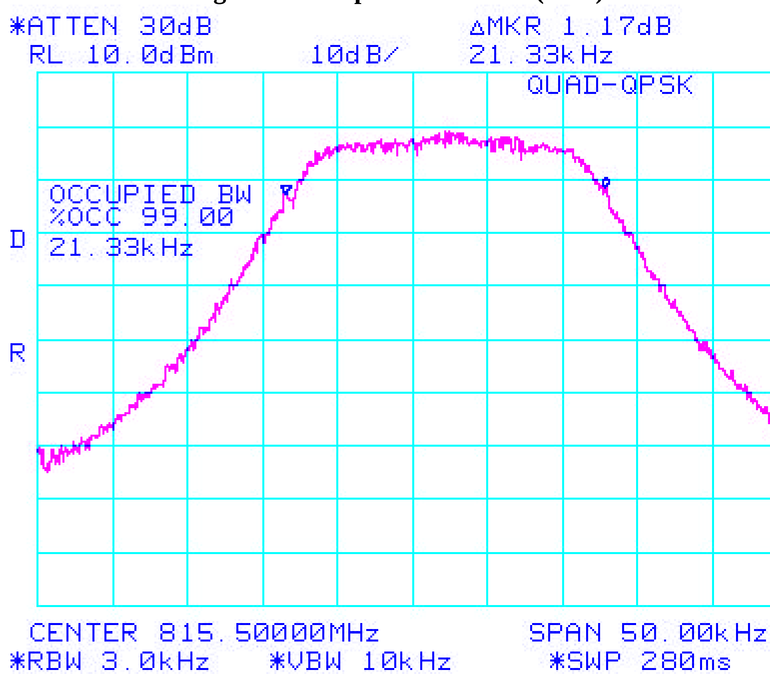


Figure 2: Occupied Bandwidth (99%)



Conducted Emission Test Data Con't

Figure 3: Occupied Bandwidth (99%)

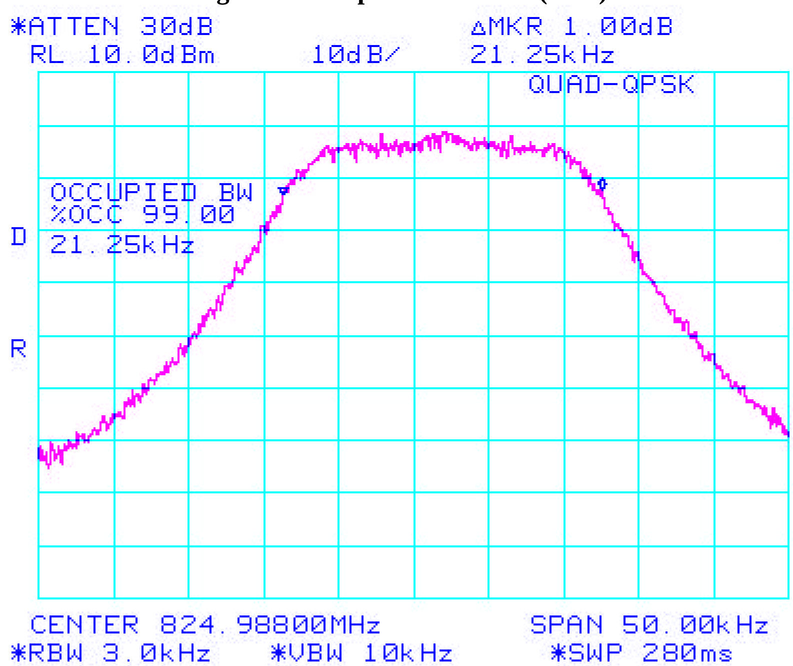
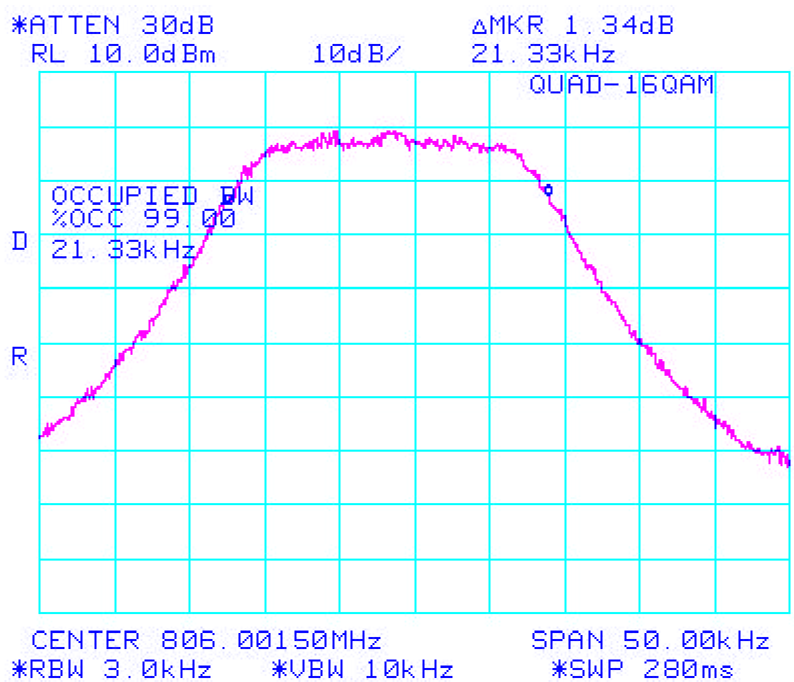


Figure 4: Occupied Bandwidth (99%)



Conducted Emission Test Data Con't

Figure 5: Occupied Bandwidth (99%)

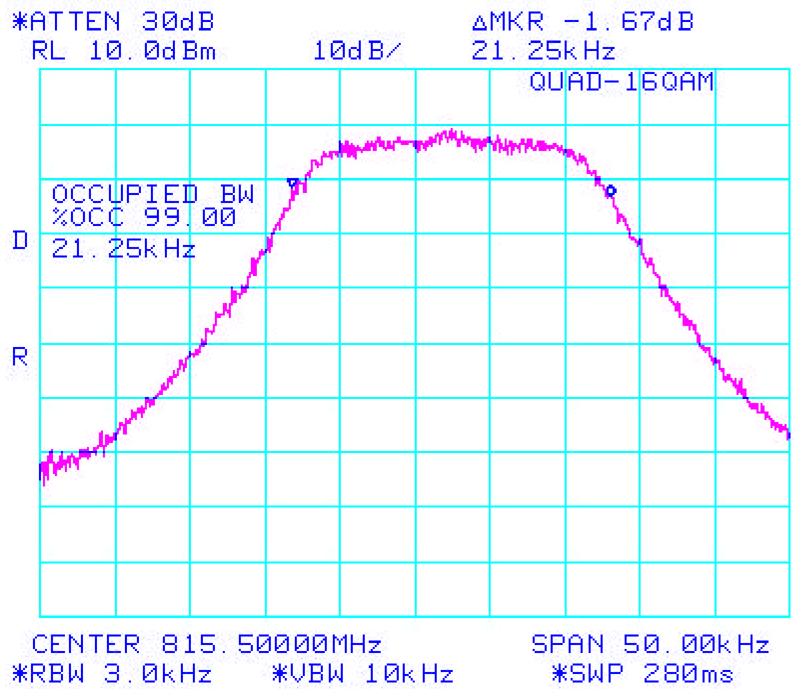
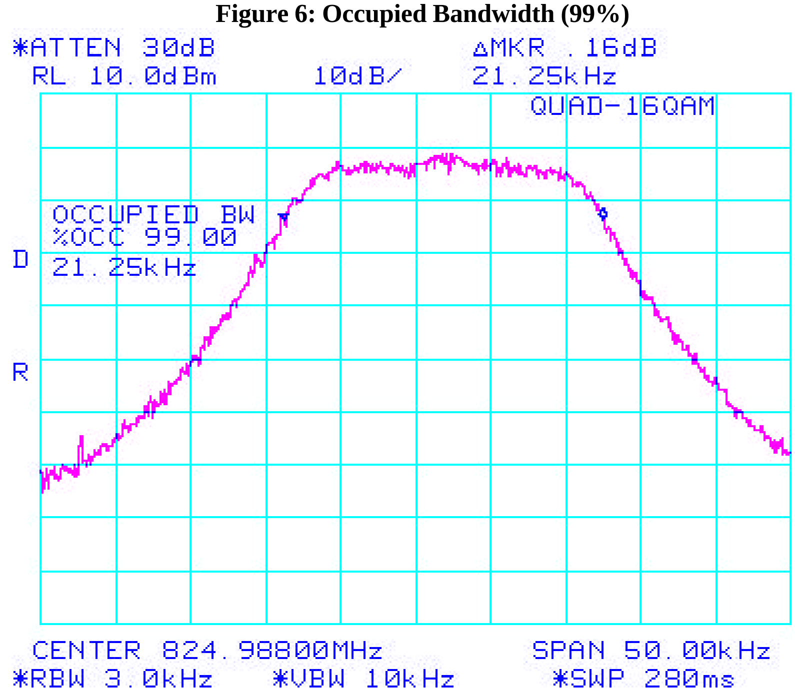


Figure 6: Occupied Bandwidth (99%)



Conducted Emission Test Data Con't

Figure 7: Occupied Bandwidth (99%)

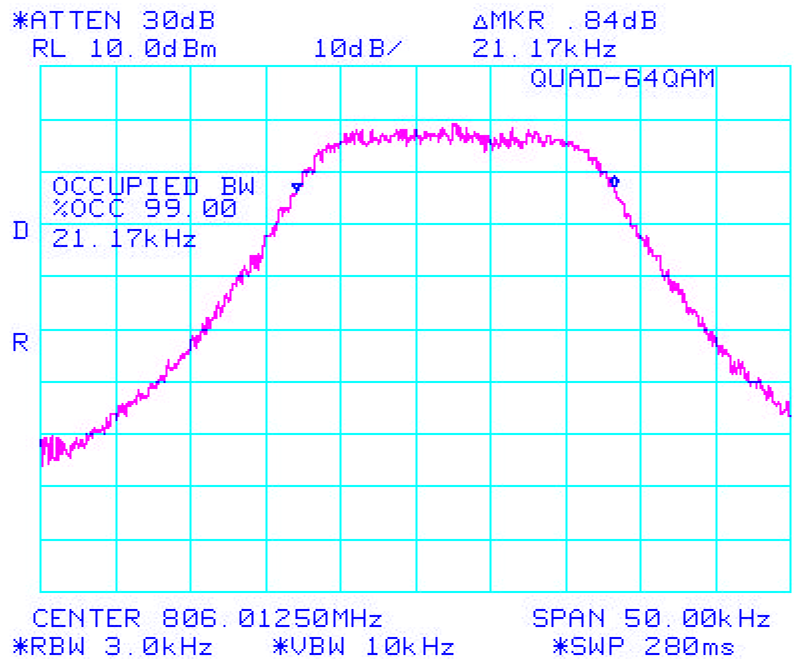
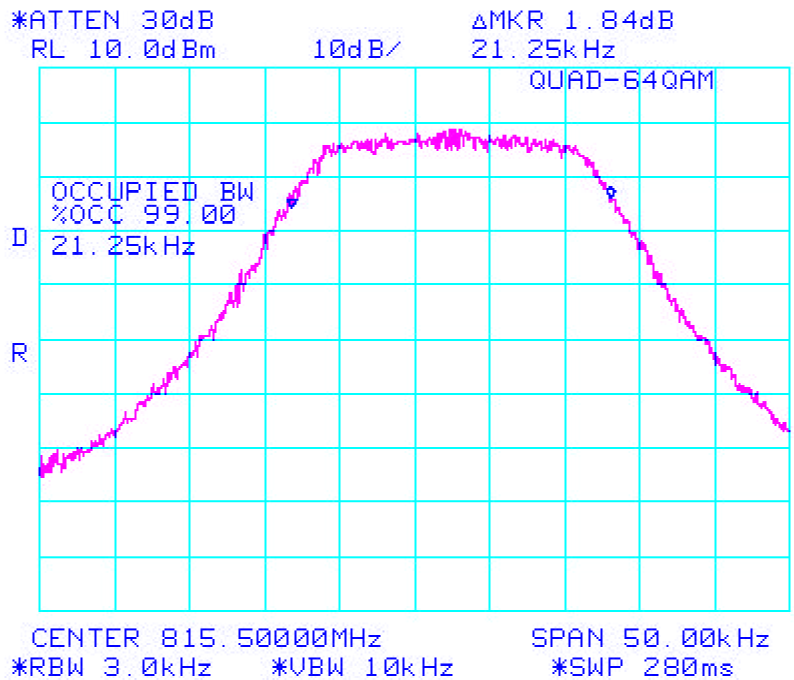


Figure 8: Occupied Bandwidth (99%)



Conducted Emission Test Data Con't

Figure 9: Occupied Bandwidth (99%)

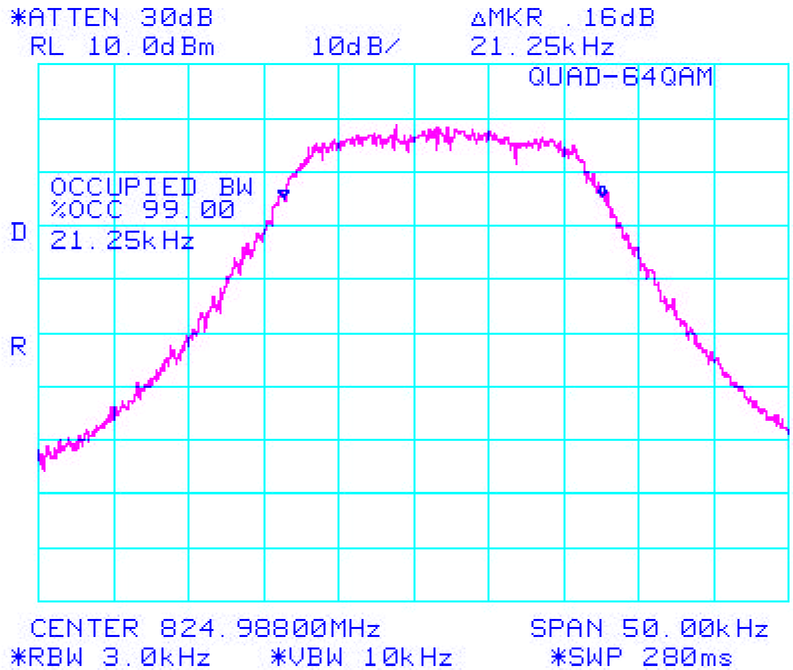
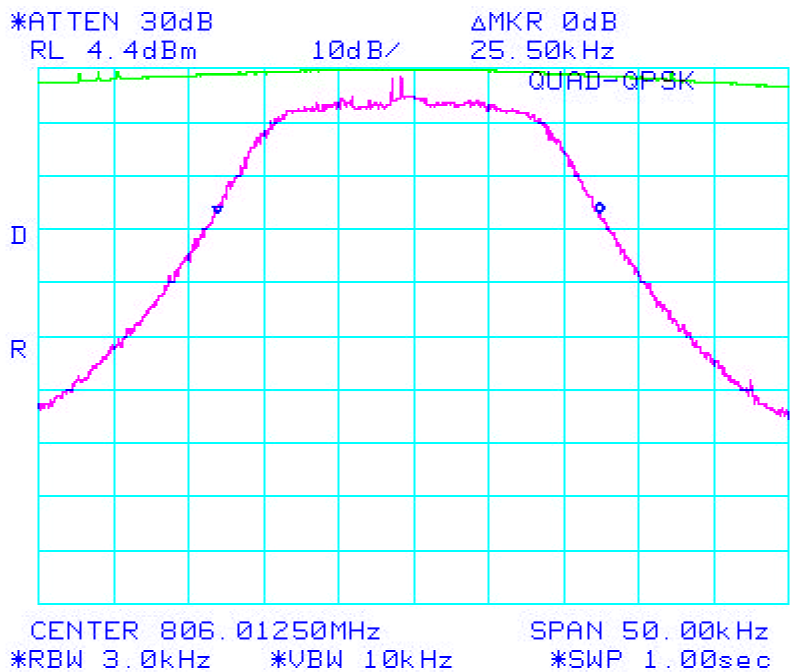


Figure 10: –26 dBc Bandwidth



Conducted Emission Test Data Con't

Figure 11: –26 dBc Bandwidth

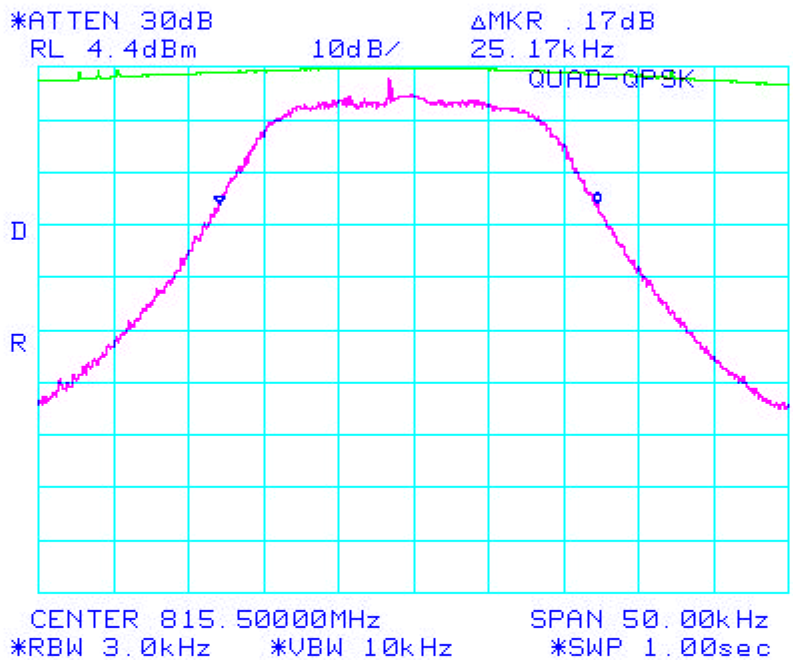
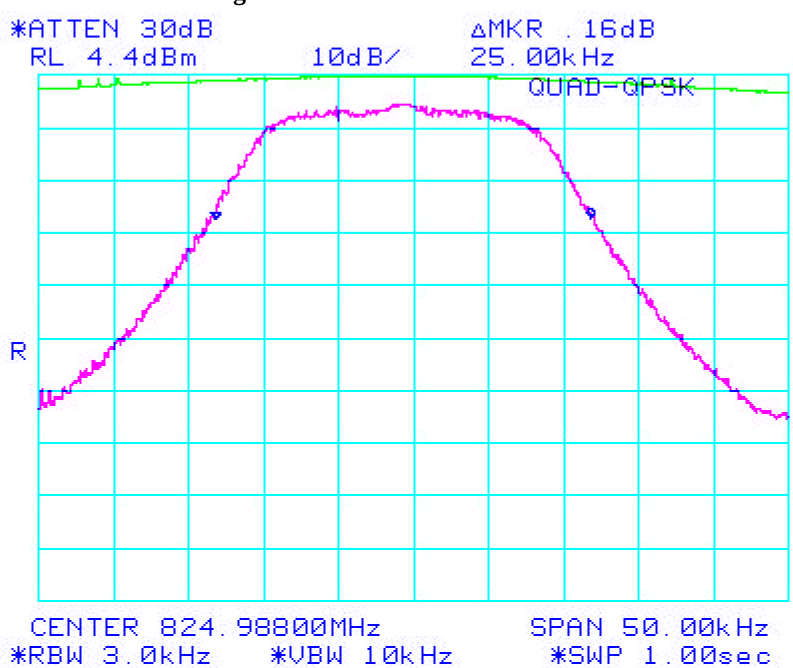


Figure 12: –26 dBc Bandwidth



Conducted Emission Test Data Con't

Figure 13: –26 dBc Bandwidth

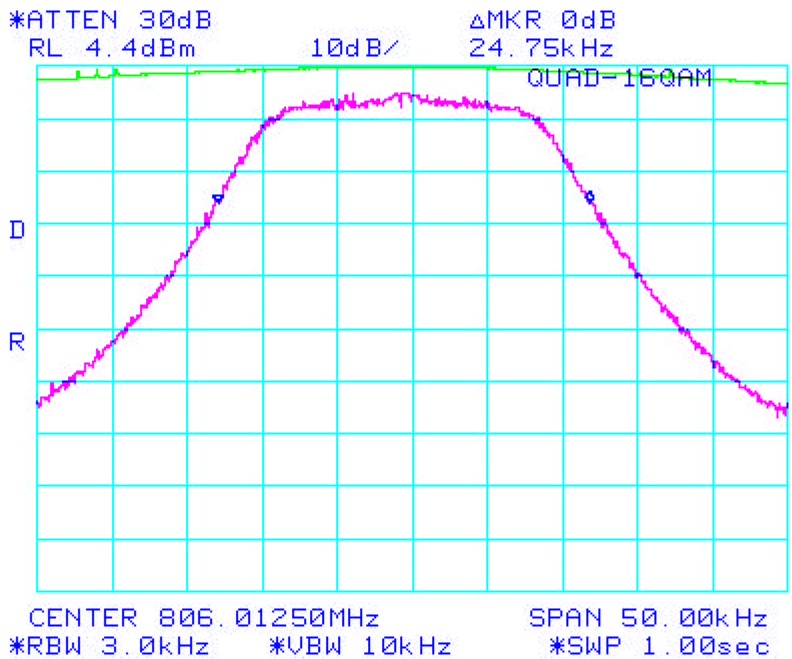
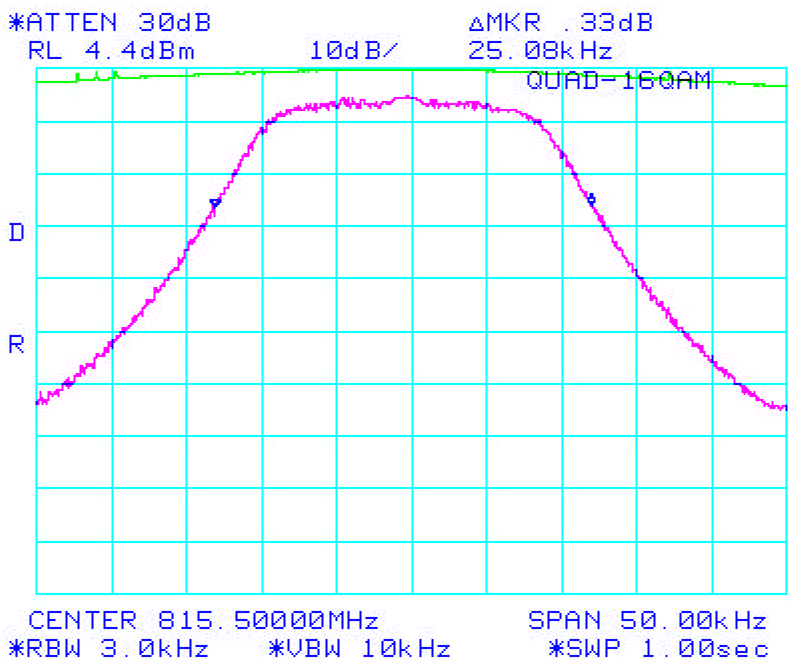


Figure 14: –26 dBc Bandwidth



Conducted Emission Test Data Con't

Figure 15: –26 dBc Bandwidth

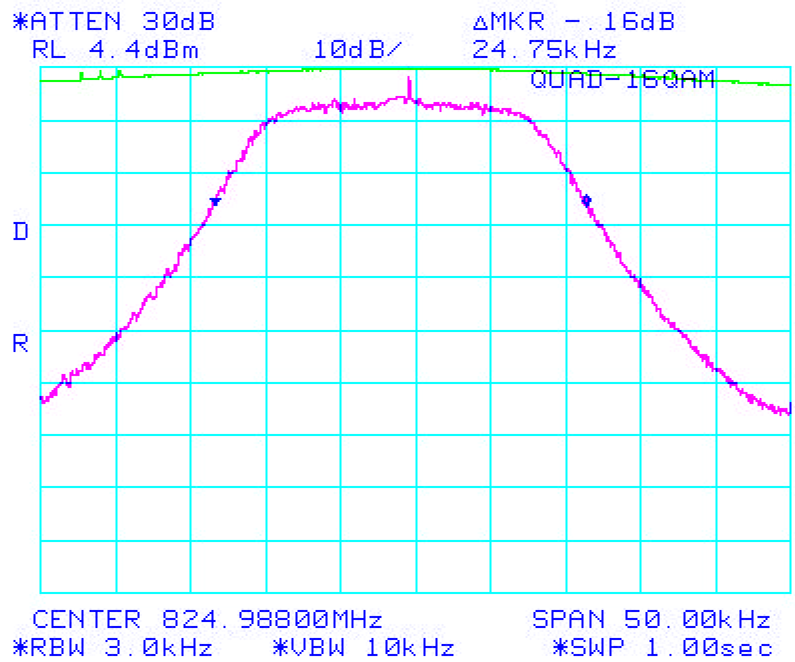
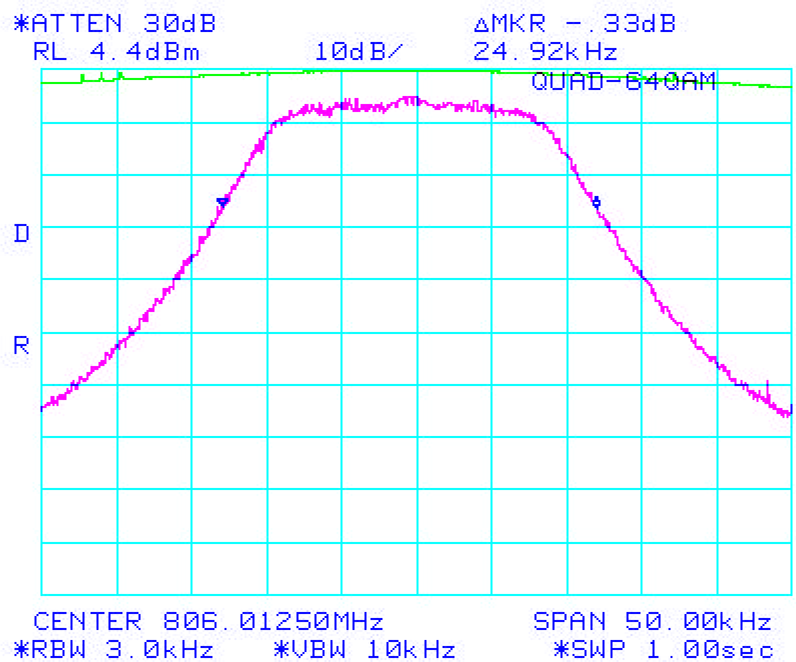


Figure 16: –26 dBc Bandwidth



Conducted Emission Test Data Con't

Figure 17: –26 dBc Bandwidth

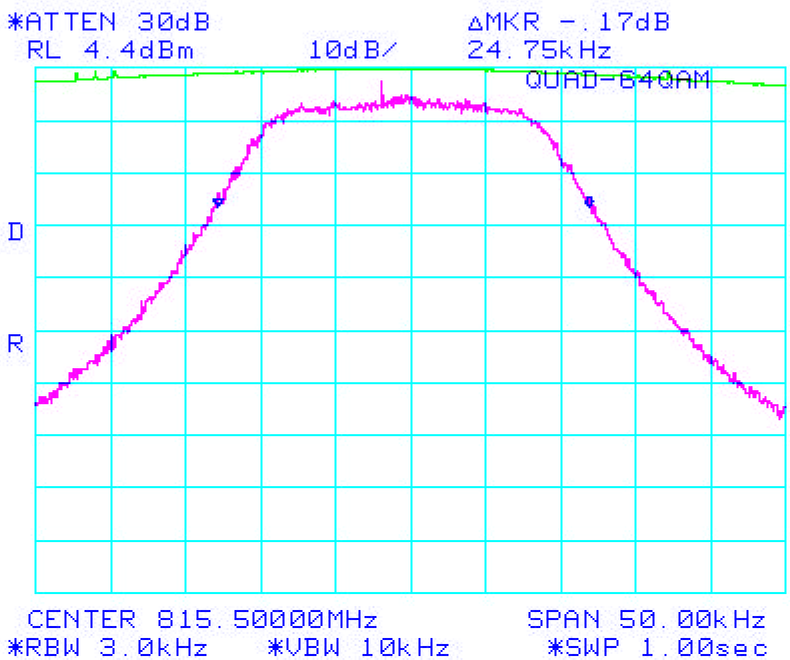
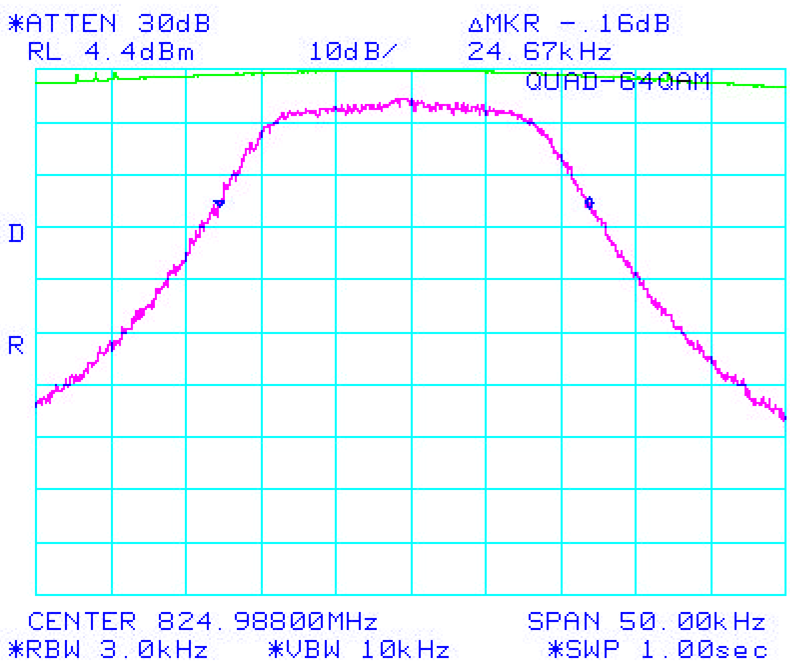


Figure 18: –26 dBc Bandwidth



Conducted Emission Test Data Con't

Figure 19: Spurious Conducted Emissions 2.1051

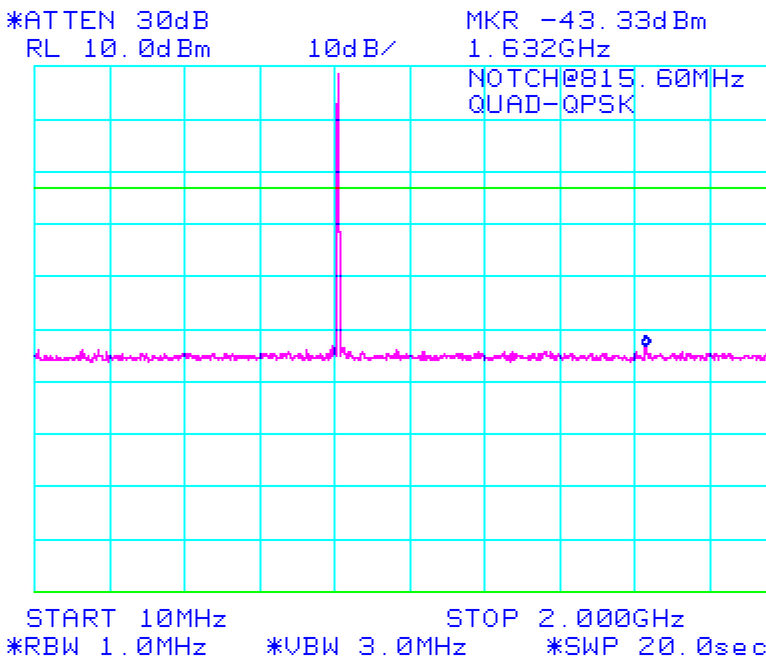
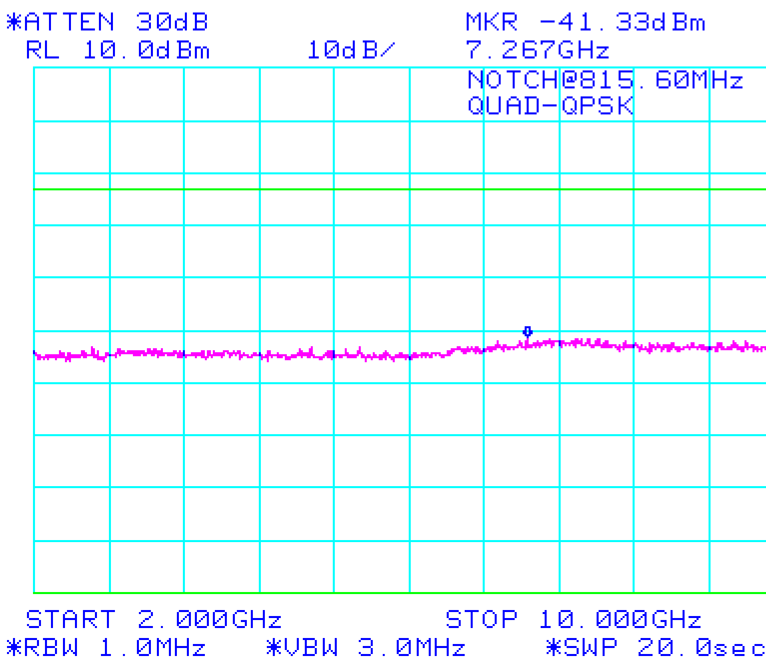


Figure 20: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data Con't

Figure 21: Spurious Conducted Emissions 2.1051

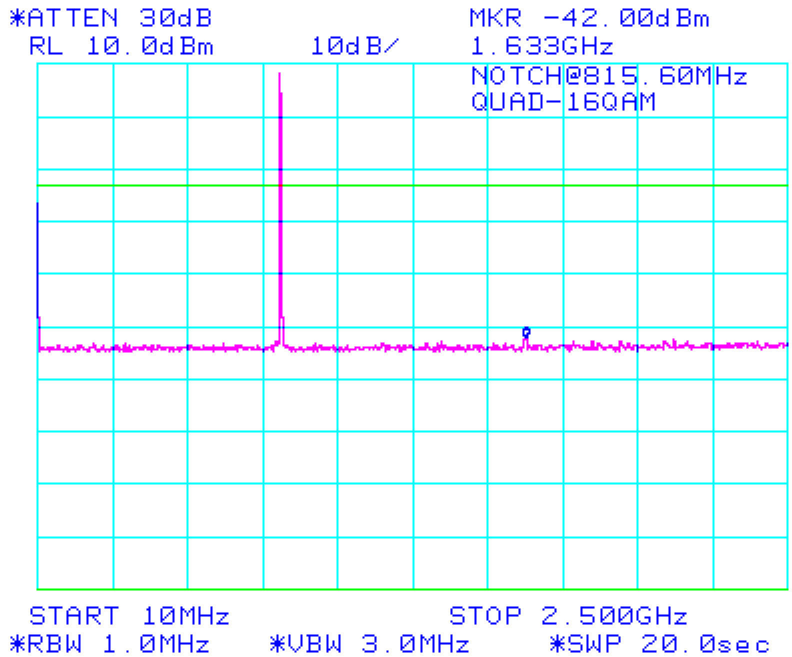
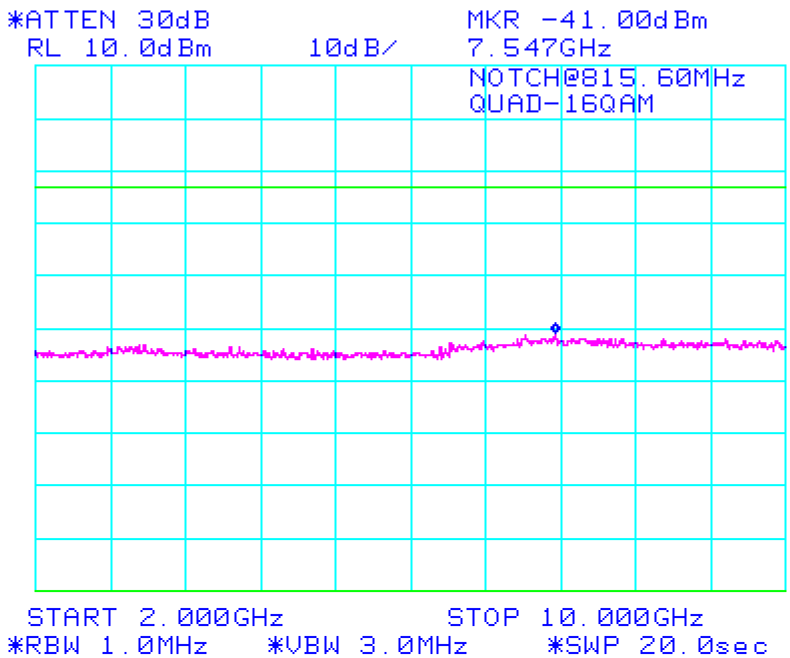


Figure 22: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data Con't

Figure 23: Spurious Conducted Emissions 2.1051

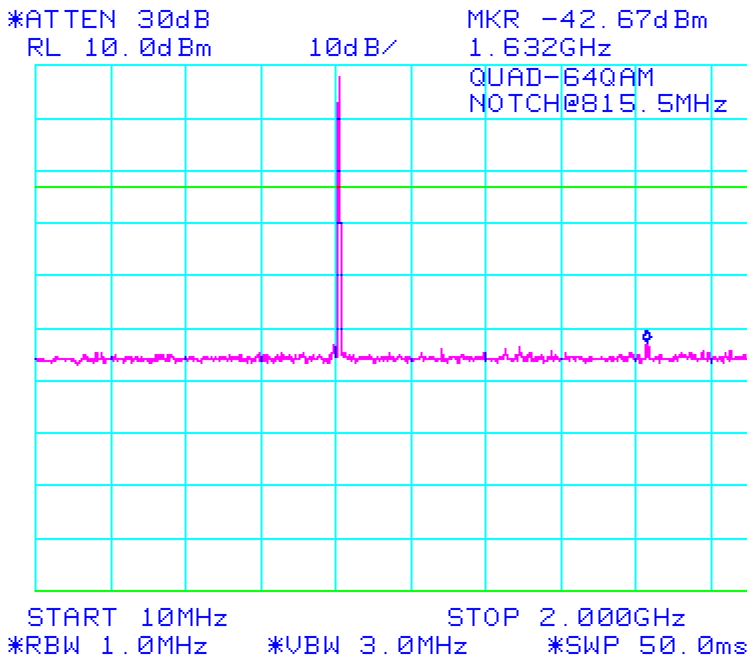
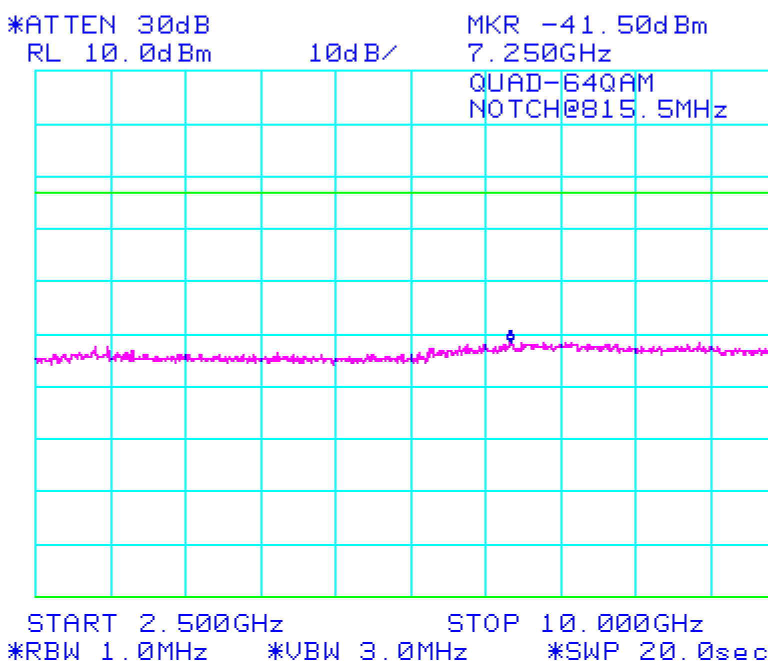


Figure 24: Spurious Conducted Emissions 2.1051



Conducted Emission Test Data Con't

Figure 25: QUAD_QPSK_EA Mask 90.691(a), Occupied Bandwidth 2.1049(h)

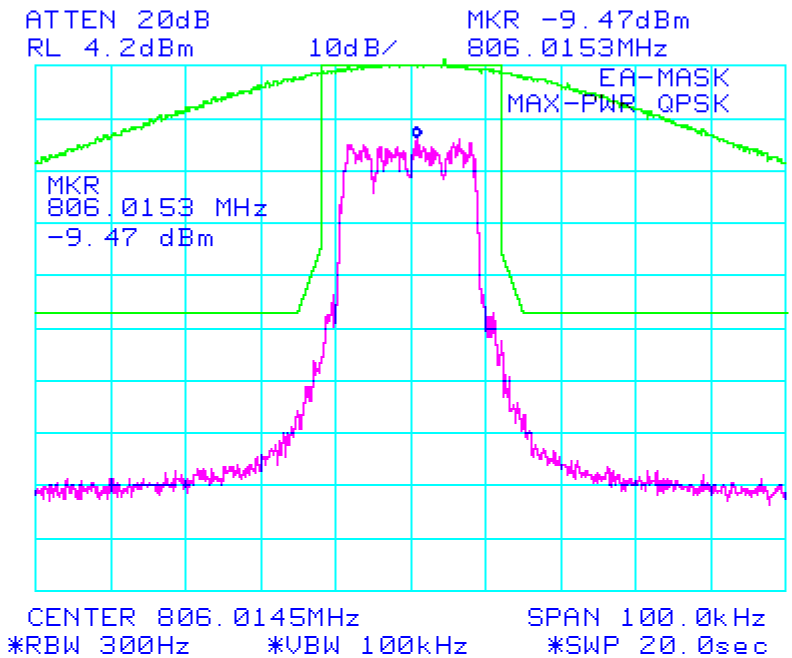
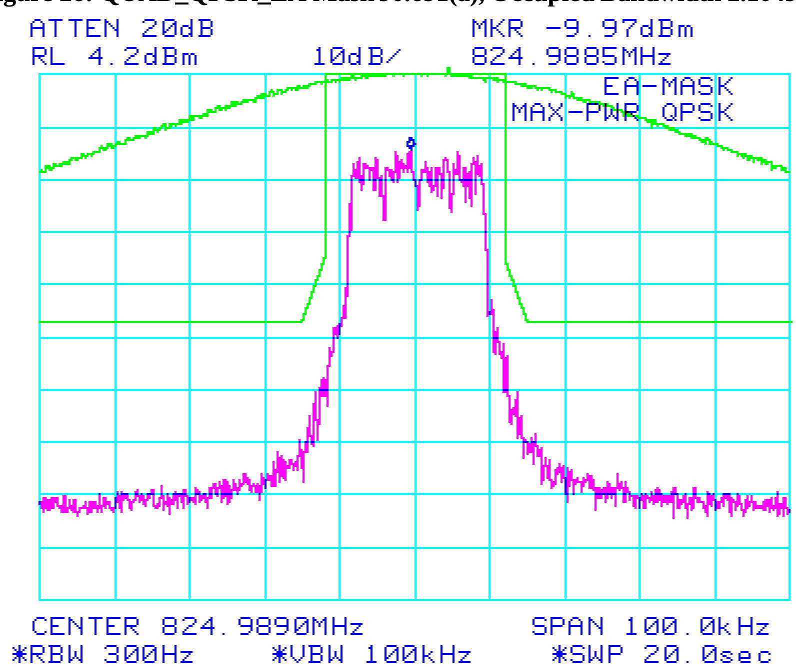


Figure 26: QUAD_QPSK_EA Mask 90.691(a), Occupied Bandwidth 2.1049(h)



Conducted Emission Test Data Con't

Figure 27: QUAD_16QAM_EA Mask 90.691(a), Occupied Bandwidth 2.1049(h)

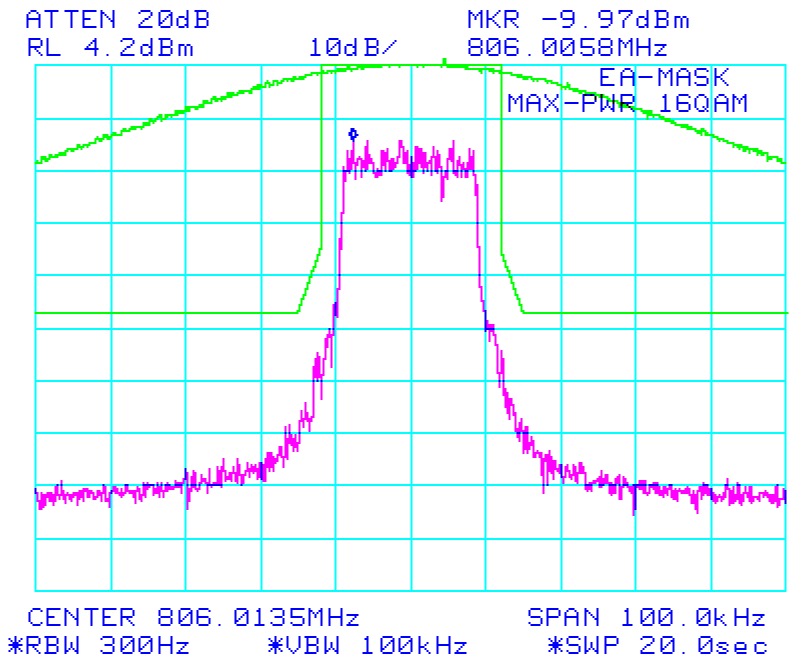
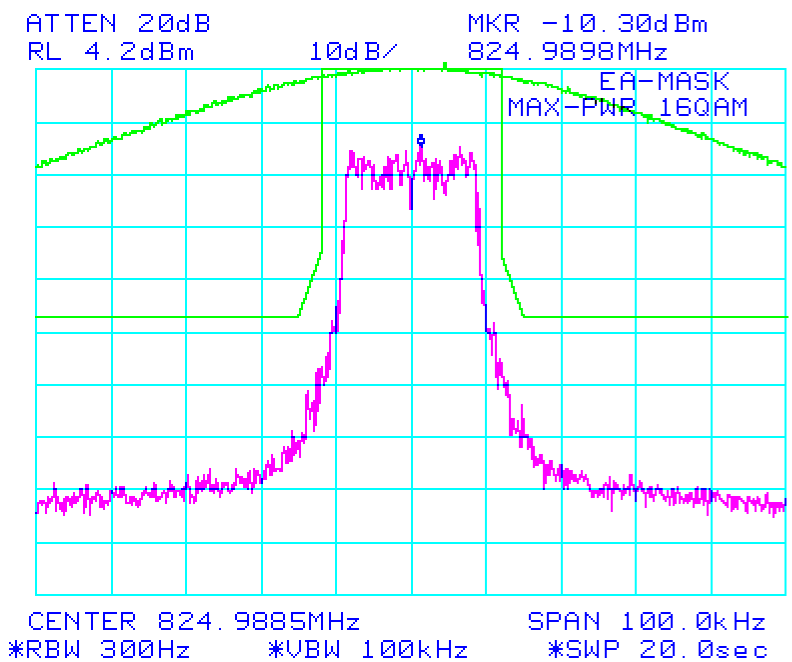


Figure 28: QUAD_16QAM_EA Mask 90.691(a), Occupied Bandwidth 2.1049(h)



Conducted Emission Test Data Con't

Figure29: QUAD_64QAM_EA Mask 90.691(a), Occupied Bandwidth 2.1049(h)

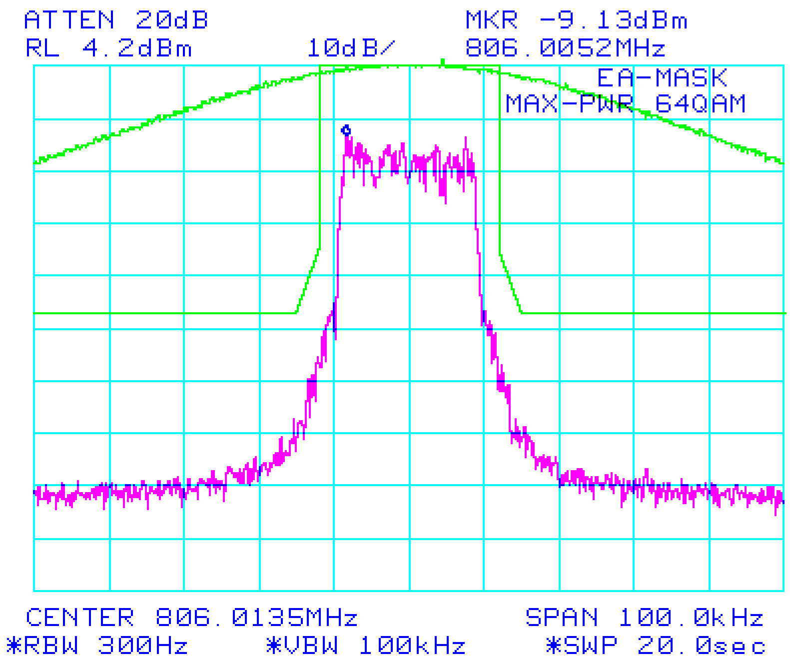
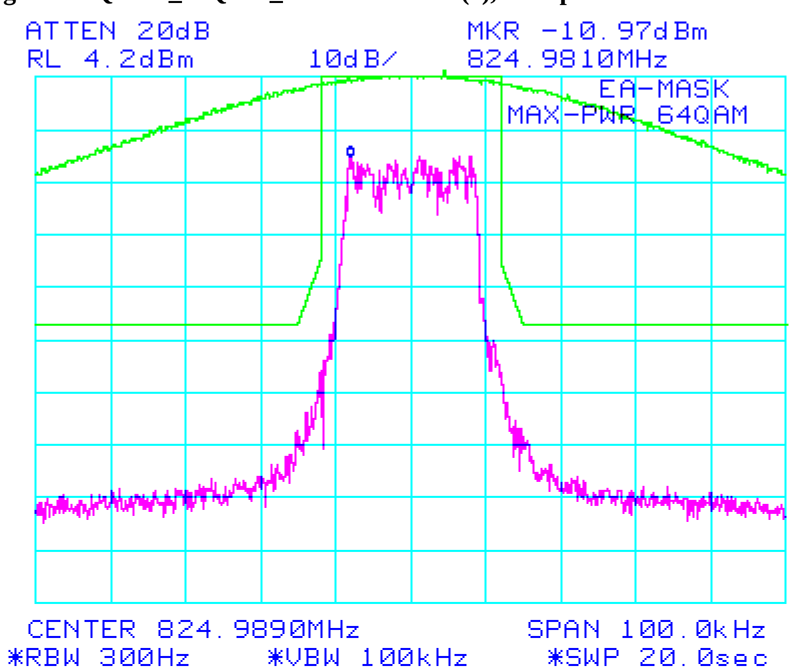


Figure30: QUAD_64QAM_EA Mask 90.691(a), Occupied Bandwidth 2.1049(h)



Conducted Emission Test Data Con't

Figure31: QUAD_QPSK_G Mask 90.210(g) Occupied Bandwidth. 2.1049(h)

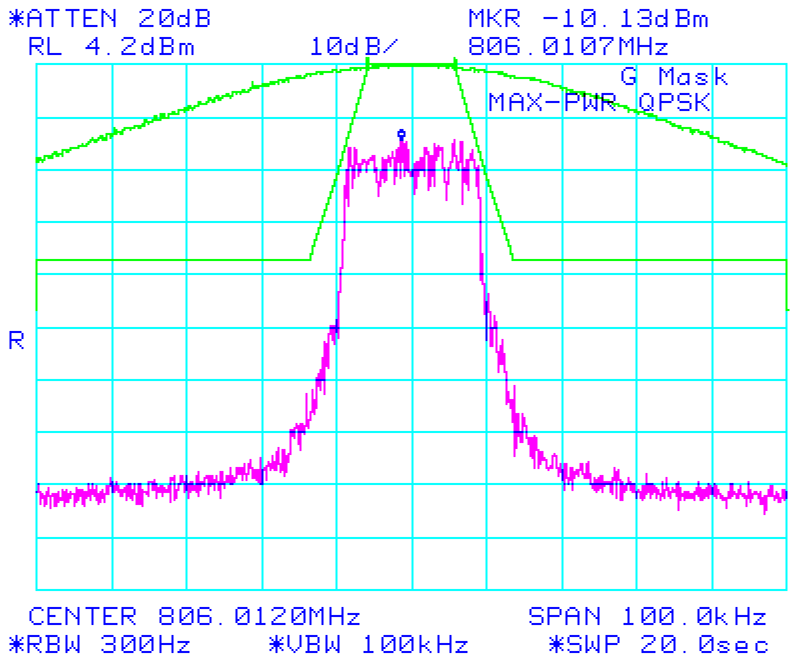
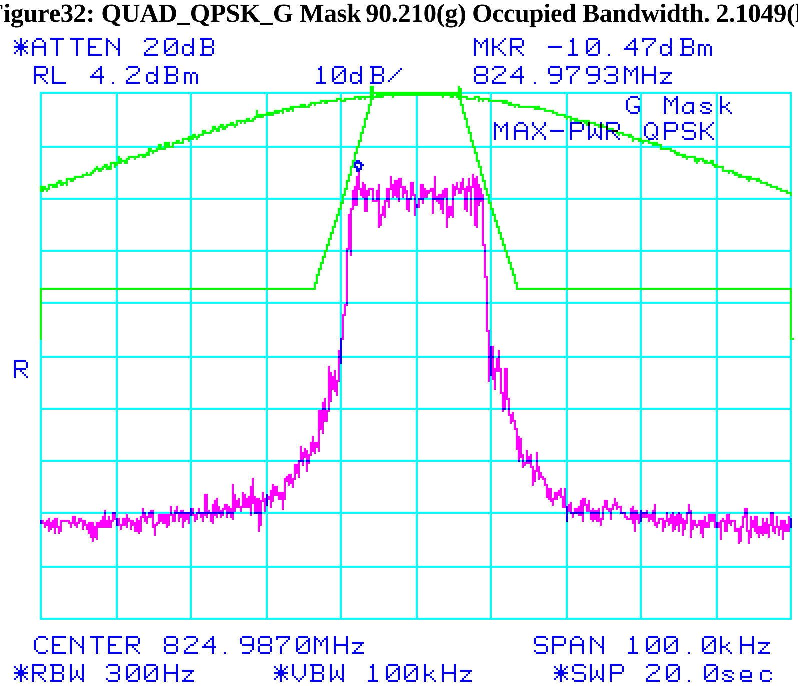


Figure32: QUAD_QPSK_G Mask 90.210(g) Occupied Bandwidth. 2.1049(h)



Conducted Emission Test Data Con't

Figure33: QUAD_16QAM_G Mask 90.210(g) Occupied Bandwidth. 2.1049(h)

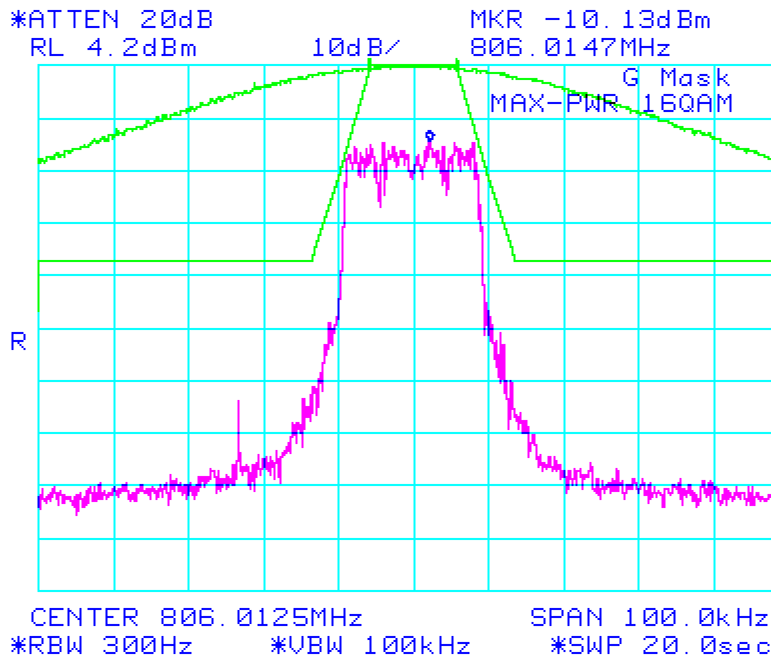
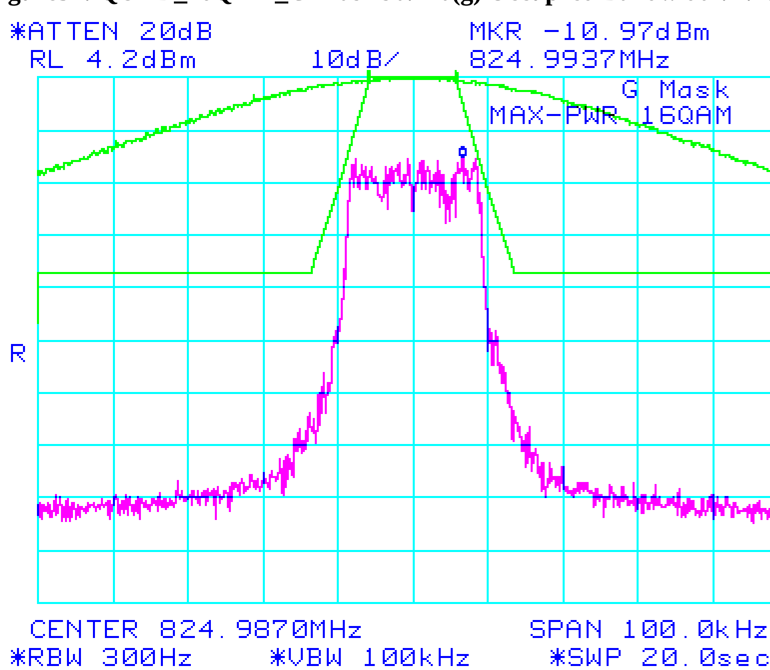


Figure34: QUAD_16QAM_G Mask 90.210(g) Occupi ed Bandwidth. 2.1049(h)



Conducted Emission Test Data Con't

Figure35: QUAD_64QAM_G Mask 90.210(g) Occupied Bandwidth. 2.1049(h)

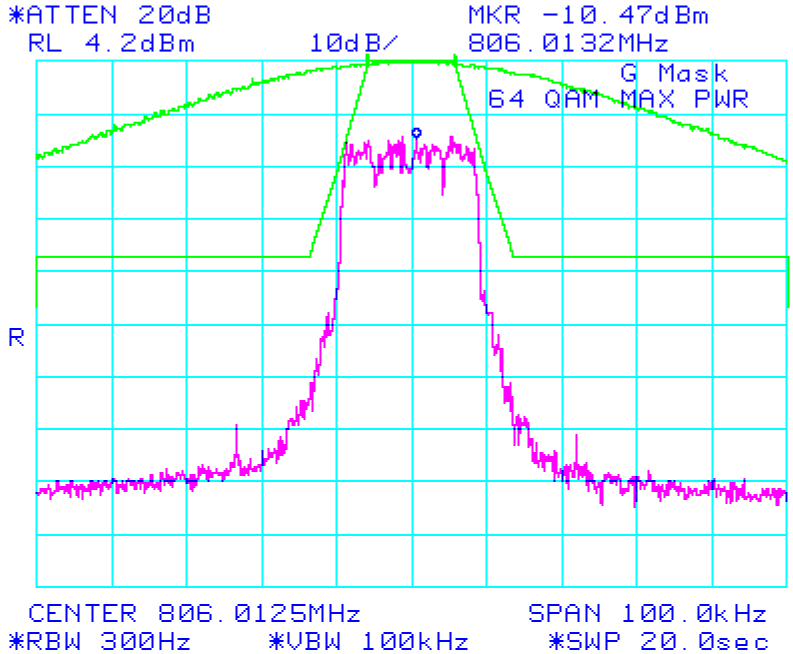
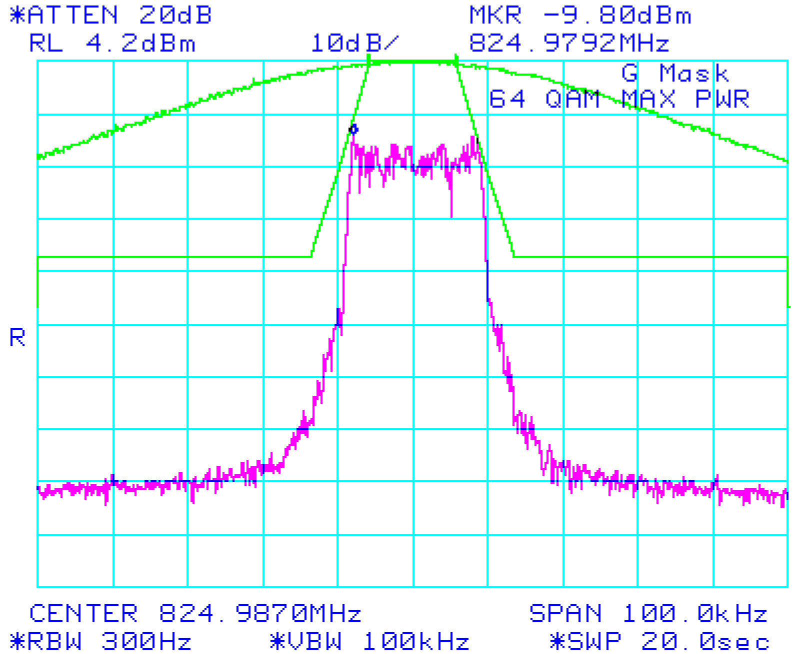
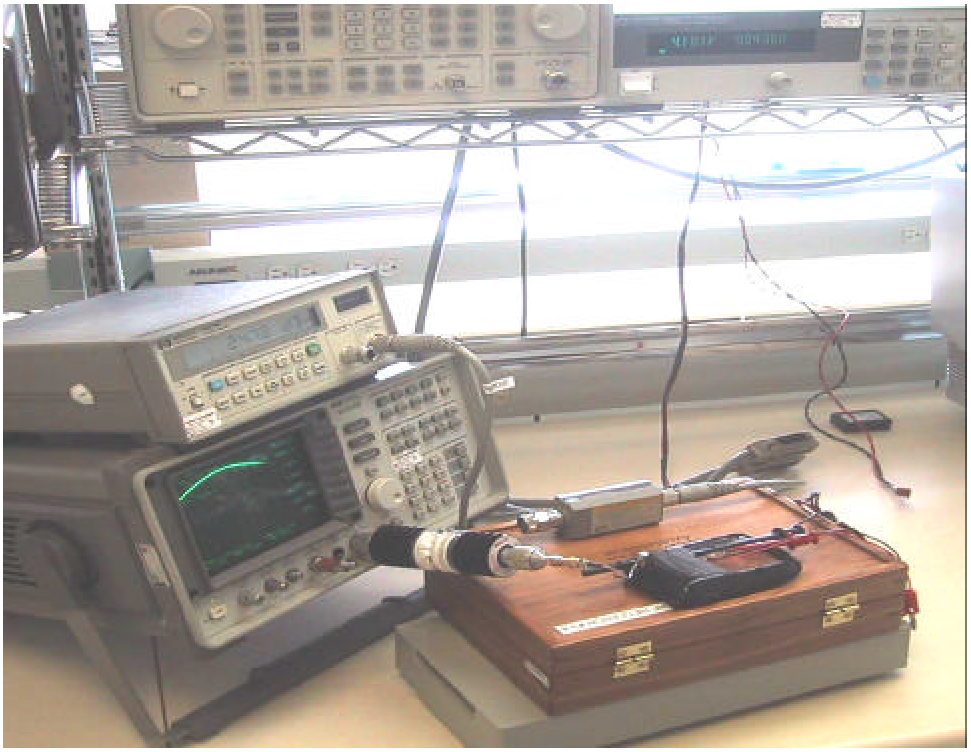


Figure36: QUAD_64QAM_G Mask 90.210(g) Occupied Bandwidth. 2.1049(h)



Conducted Emission Test Data Con't

Test-Setup Photo 47 CFR 2.1046 RF Power Output

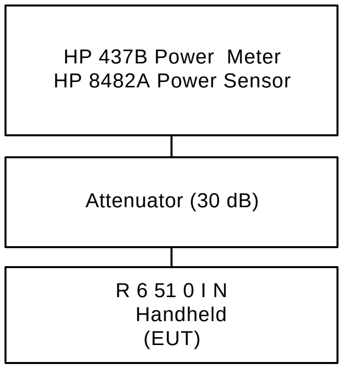


APPENDIX 2

CONDUCTED RF OUTPUT POWER TEST DATA

Conducted RF Output Power Test Data

Test Setup Diagram



Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	HP	437B	3125U10666	100 KHz – 20.0 GHz
Attenuator, 30 dB, 50 W	Weinschel	47-30-43	BJ0923	DC – 18 GHz
Power Sensor	HP	8482A	20A8 04009 04	0.1MHz – 4.20 GHz

Power Output

The maximum radio output power level was measured using the Power Meter. The calibrated insertion loss for the attenuator plus the compensation factor for measuring the TDM pulse produced the following results.

Test Data

RF Power Output at Maximum

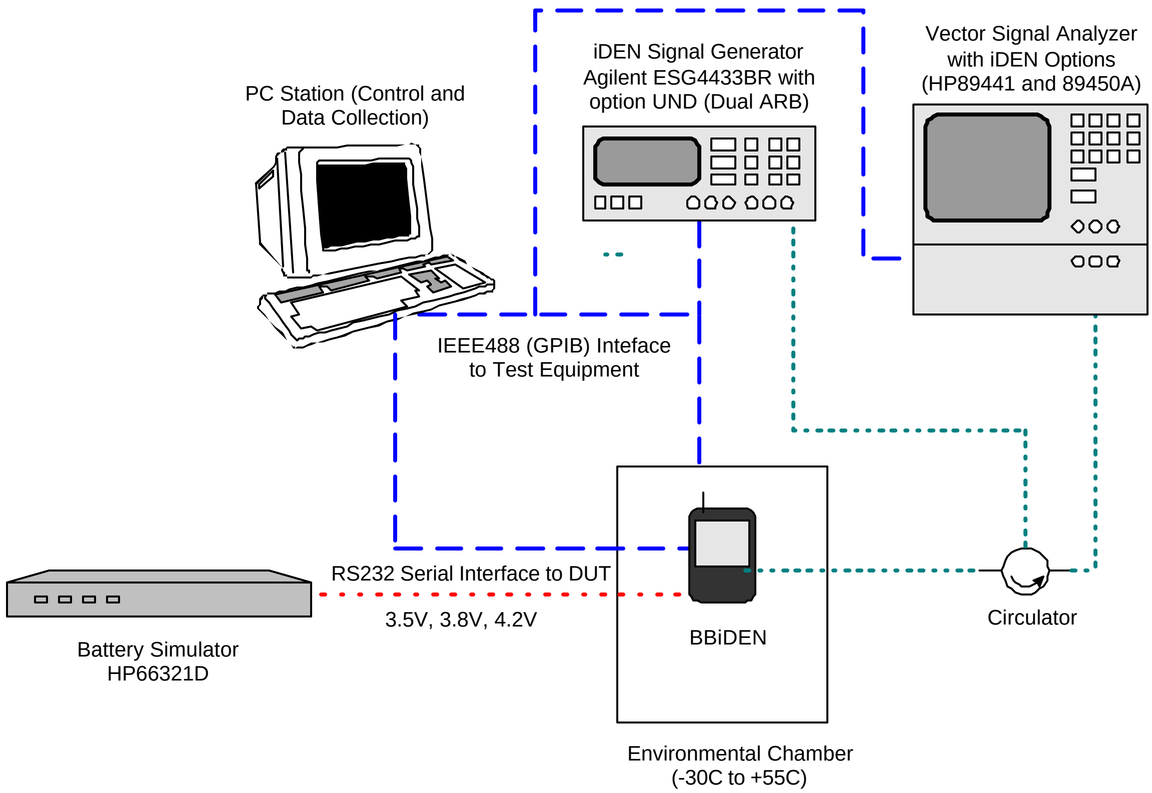
TDM-MF 1/3 QAM-16 Frequency (MHz)	Measured Pulse Average Conducted Power (Watts)	HP_437B Power Meter Measured Pulse Average Conducted Power (dBm)
806.0125	0.684	28.35
815.500	0.684	28.35
824.988	0.700	28.45

Correction Factor plus compensation factor for TDM pulse measurements:
Offset is 34.77 dB

APPENDIX 3

FREQUENCY STABILITY TEST DATA

The following document contains measurement data pertaining to Frequency Stability.



SYSTEM	*Model*	*Serial Number*	*Calibration Date.*
Agilent Vector Signal Analyzer	**HP89441 with HP89450A**	US39313988 and US39312360	2001-11-02
HP Battery Simulator	**HP66321D**	GB40180106	2002-01-31
Signal Generator	**HP ESG4433BR**	US38440638	2002-03-21
Network Analyzer (Calibration)	**HP8753ES**	US39174857	2001-08-08
Calibration Kit	**HP85032B**	3217A13134	2002-01-04
Espec Environmental Chamber	**SH241**	92000147	N/A
Temperature Probe	**61161-302**	21352860	2002-09-10

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 0.1 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 May 9, 2002.

Procedure:
Full two-port calibration of 8753ES using the 85032B was completed. The test set calibration was made over the transmitter band from 806 MHz to 825 MHz using 1601 points. The calibration data was linearly interpolated where the test frequency did not land on an exact calibration point.

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 -30?C.

After the chamber stabilized at -30 ?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 of 28 dBm 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 battery simulator, The ESG4433BR signal generator, the HP89441 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 HP89441 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 by 10?C and soak for 1/2 hour.
13. Repeat steps 4 - 12 for temperatures –20 degrees to 55 degrees Celsius.

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

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
806.0125	28	3.5	20	28.751018	0.0357
815.5000	28	3.5	20	27.566280	0.0338
824.9875	28	3.5	20	28.797299	0.0349

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
806.0125	28	3.8	20	20.603038	0.0256
815.5000	28	3.8	20	24.145834	0.0296
824.9875	28	3.8	20	22.036196	0.0267

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
806.0125	28	4.2	20	21.800609	0.0270
815.5000	28	4.2	20	44.484415	0.0545
824.9875	28	4,2	20	21.134194	0.0256

Channel Results: 806.0125 @ maximum transmitted power

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
806.0125	28	3.5	-30	43.667963	0.0542
806.0125	28	3.5	-20	25.787215	0.0320
806.0125	28	3.5	-10	28.680857	0.0356
806.0125	28	3.5	0	28.842347	0.0358
806.0125	28	3.5	10	35.828591	0.0445
806.0125	28	3.5	20	28.751018	0.0357
806.0125	28	3.5	30	2.868928	0.0036
806.0125	28	3.5	40	11.460446	0.0142
806.0125	28	3.5	50	21.598980	0.0268
806.0125	28	3.5	55	9.223798	0.0114

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
806.0125	28	3.8	-30	11.436584	0.0142
806.0125	28	3.8	-20	35.002903	0.0434
806.0125	28	3.8	-10	47.591972	0.0590
806.0125	28	3.8	0	9.887301	0.0123
806.0125	28	3.8	10	10.865642	0.0135
806.0125	28	3.8	20	20.603038	0.0256
806.0125	28	3.8	30	18.932899	0.0235
806.0125	28	3.8	40	2.032012	0.0025
806.0125	28	3.8	50	17.858993	0.0222
806.0125	28	3.8	55	7.331946	0.0091

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
806.0125	28	4.2	-30	26.504617	0.0329
806.0125	28	4.2	-20	33.521570	0.0416
806.0125	28	4.2	-10	16.413265	0.0204
806.0125	28	4.2	0	11.747696	0.0146
806.0125	28	4.2	10	10.696655	0.0133
806.0125	28	4.2	20	21.800609	0.0270
806.0125	28	4.2	30	14.770236	0.0183
806.0125	28	4.2	40	7.461127	0.0093
806.0125	28	4.2	50	19.228687	0.0239
806.0125	28	4.2	55	13.218990	0.0164

Channel Results: 815.5000 @ maximum transmitted power

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
815.5000	28	3.5	-30	13.065649	0.0160
815.5000	28	3.5	-20	5.313209	0.0065
815.5000	28	3.5	-10	3.296311	0.0040
815.5000	28	3.5	0	18.036117	0.0221
815.5000	28	3.5	10	18.174849	0.0223
815.5000	28	3.5	20	27.566280	0.0338
815.5000	28	3.5	30	2.954188	0.0036
815.5000	28	3.5	40	5.106874	0.0063
815.5000	28	3.5	50	11.968051	0.0147
815.5000	28	3.5	55	13.299770	0.0163

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
815.5000	28	3.8	-30	16.660031	0.0204
815.5000	28	3.8	-20	25.559547	0.0313
815.5000	28	3.8	-10	25.515210	0.0313
815.5000	28	3.8	0	34.642511	0.0425
815.5000	28	3.8	10	17.122303	0.0210
815.5000	28	3.8	20	24.145834	0.0296
815.5000	28	3.8	30	4.473605	0.0055
815.5000	28	3.8	40	9.159386	0.0112
815.5000	28	3.8	50	20.289535	0.0249
815.5000	28	3.8	55	9.667486	0.0119

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
815.5000	28	4.2	-30	28.412396	0.0348
815.5000	28	4.2	-20	11.797997	0.0145
815.5000	28	4.2	-10	9.831839	0.0121
815.5000	28	4.2	0	40.919908	0.0502
815.5000	28	4.2	10	16.302165	0.0200
815.5000	28	4.2	20	44.484412	0.0545
815.5000	28	4.2	30	3.555121	0.0044
815.5000	28	4.2	40	17.479371	0.0214
815.5000	28	4.2	50	10.667632	0.0131
815.5000	28	4.2	55	8.541373	0.0105

Channel Results: 824.9875 @ maximum transmitted power

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
824.9875	28	3.5	-30	4.089849	0.0050
824.9875	28	3.5	-20	1.914657	0.0023
824.9875	28	3.5	-10	23.826534	0.0289
824.9875	28	3.5	0	17.252702	0.0209
824.9875	28	3.5	10	13.296109	0.0161
824.9875	28	3.5	20	28.797299	0.0349
824.9875	28	3.5	30	15.161803	0.0184
824.9875	28	3.5	40	20.283228	0.0246
824.9875	28	3.5	50	40.903458	0.0496
824.9875	28	3.5	55	7.454507	0.0090

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
824.9875	28	3.8	-30	7.117231	0.0086
824.9875	28	3.8	-20	8.142881	0.0099
824.9875	28	3.8	-10	1.590487	0.0019
824.9875	28	3.8	0	23.880563	0.0289
824.9875	28	3.8	10	12.791243	0.0155
824.9875	28	3.8	20	22.036196	0.0267
824.9875	28	3.8	30	5.182751	0.0063
824.9875	28	3.8	40	16.898726	0.0205
824.9875	28	3.8	50	29.700817	0.0360
824.9875	28	3.8	55	11.477239	0.0139

Frequency (MHz)	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
824.9875	28	4.2	-30	17.240838	0.0209
824.9875	28	4.2	-20	34.046492	0.0413
824.9875	28	4.2	-10	9.095900	0.0110
824.9875	28	4.2	0	27.226211	0.0330
824.9875	28	4.2	10	20.926757	0.0254
824.9875	28	4.2	20	21.134194	0.0256
824.9875	28	4.2	30	9.169104	0.0111
824.9875	28	4.2	40	8.990417	0.0109
824.9875	28	4.2	50	24.905927	0.0302
824.9875	28	4.2	55	6.188340	0.0075

APPENDIX 4

RADIATED SPURIOUS/HARMONIC EMISSIONS AND ERP TEST DATA

Radiated Emissions Test Data Results

									Substitution Method				
EUT			Receive Antenna			Spectrum Analyzer			Tracking Generator				
Type	Ch.	Frequency (MHz)	Antenna Type	Pol	Test Dist. (m)	Reading (dBuV)	Corrected Reading (dBuV)	Max. (V,H)	Reading (dBuV)	Corrected Reading (relative to dipole)	Pol.	Limit	Diff. To Limit (dB)
ERP													
Antenna Extended - (handheld standalone, upright position) -													
QAM 16, 1/6 timeslot per frame													
F0	Low	806.0125	Dipole	V	3	89.4	89.4	89.4	15.7	32.0	VV	39.0	-7.0
F0	Low	806.0125	Dipole	H	3	79.6	79.6		13.2		HH		
F0	Mid	815.5000	Dipole	V	3	87	87	87	13.5	29.8	VV	39.0	-9.2
F0	Mid	815.5000	Dipole	H	3	77.9	77.9		11.2		HH		
F0	High	824.9875	Dipole	V	3	87.8	87.8	87.8	13.7	30.0	VV	39.0	-9.0
F0	High	824.9875	Dipole	H	3	77.1	77.1		11.8		HH		
ERP													
Antenna Extended - (Handheld connected to Travel Charger + headset, upright position) -													
QAM 16, 1/6 timeslot per frame													
F0	Low	806.0125	Dipole	V	3	88.2	88.2	88.2	14.6	30.9	VV	39.0	-8.7
F0	Low	806.0125	Dipole	H	3	80.7	80.7		12.0		HH		
F0	Mid	815.5000	Dipole	V	3	86.0	86.0	86.0	12.5	28.8	VV	39.0	-9.6
F0	Mid	815.5000	Dipole	H	3	81.1	81.1		10.1		HH		
F0	High	824.9875	Dipole	V	3	85.8	85.8	85.8	11.4	27.7	VV	39.0	-9.0
F0	High	824.9875	Dipole	H	3	80.7	80.7		9.8		HH		

Radiated Emissions Test Data Results Con't

									Substitution Method				
EUT			Receive Antenna			Spectrum Analyzer			Tracking Generator				
Type	Ch.	Frequency (MHz)	Antenna Type	Pol	Test Dist. (m)	Reading (dBuV)	Corrected Reading (dBuV)	Max. (V,H)	Reading (dBuV)	Corrected Reading (relative to dipole)	Pol.	Limit	Diff. To Limit (dB)
ERP Antenna Extended - Handheld connected to USB + Headset - upright position - QAM 16, 1/6 timeslot per frame													
F0	Low	806.0125	Dipole	V	3	87.9	87.9	87.9	14.3	30.62	VV	39.0	-8.4
F0	Low	806.0125	Dipole	H	3	87.3	87.3		11.7		HH		
F0	Mid	815.5000	Dipole	V	3	86.2	86.2	86.2	12.7	29.02	VV	39.0	-9.98
F0	Mid	815.5000	Dipole	H	3	85.3	85.3		10.3		HH		
F0	High	824.9875	Dipole	V	3	86.5	86.5	86.5	12.4	28.72	VV	39.0	-10.28
F0	High	824.9875	Dipole	H	3	84.4	84.4		10.5		HH		
ERP Antenna retracted - Handheld standalone- upright position - QAM 16, 1/6 timeslot per frame													
F0	Low	806.0125	Dipole	V	3	88.2	88.2	88.2	14.6	30.9	VV	39.0	-8.1
F0	Low	806.0125	Dipole	H	3	80.7	80.7		12.0		HH		
F0	Mid	815.5000	Dipole	V	3	86.0	86.0	86.0	12.5	28.8	VV	39.0	-10.2
F0	Mid	815.5000	Dipole	H	3	81.1	81.1		10.1		HH		
F0	High	824.9875	Dipole	V	3	85.8	85.8	86.8	11.4	27.7	VV	39.0	-11.3
F0	High	824.9875	Dipole	H	3	80.7	80.7		9.8		HH		

Radiated Emissions Test Data Results Con’t

									Substitution Method				
EUT			Receive Antenna			Spectrum Analyzer			Tracking Generator				
Type	Ch.	Frequency (MHz)	Antenna Type	Pol	Test Dist. (m)	Reading (dBuV)	Corrected Reading (dBuV)	Max. (V,H)	Reading (dBuV)	Corrected Reading (relative to dipole)	Pol.	Limit	Diff. To Limit (dB)
Harmonics Antenna Extended - (handheld standalone, upright position) - QAM 4, 1/6 timeslot per frame													
2nd	Low	1612.0250	Horn	V	3	54.6	54.6	54.6	-40.2	-39.5	VV	-13	-26.5
2nd	Low	1612.0250	Horn	H	3	50.2	50.2		-39.8		HH		
2nd	Mid	1631.0000	Horn	V	3	49.8	49.8	49.8	-43.7	-43.2	VV	-13	-30.2
2nd	Mid	1631.0000	Horn	H	3	46.1	46.1		-43.5		HH		
2nd	High	1649.975	Horn	V	3	46.5	46.5	46.5	-44.9	-44.2	VV	-13	-31.2
2nd	High	1649.975	Horn	H	3	42.8	42.8		-44.5		HH		

No emissions above the 2nd harmonics could be seen above the spectrum analyzer’s noise floor. The harmonics were investigated up to the 10th harmonic.

Radiated Emissions Test Data Results Con't

Antenna Extended - (handheld standalone, upright position) - QAM 16, 1/6 timeslot per frame

									Substitution Method				
EUT			Receive Antenna			Spectrum Analyzer			Tracking Generator				
Type	Ch.	Frequency (MHz)	Antenna Type	Pol	Test Dist. (m)	Reading (dBuV)	Corrected Reading (dBuV)	Max. (V,H)	Reading (dBuV)	Corrected Reading (relative to dipole)	Pol.	Limit	Diff. To Limit (dB)
2nd	Low	1612.025	Horn	V	3	54.1	54.1	54.1	-40.8	-40.0	VV	-13	-27.0
2nd	Low	1612.025	Horn	H	3	50	50		-40.3		HH		
2nd	Mid	1631.000	Horn	V	3	50.7	50.7	50.7	-42.8	-42.2	VV	-13	-29.2
2nd	Mid	1631.000	Horn	H	3	47.1	47.1		-42.5		HH		
2nd	High	1649.975	Horn	V	3	46.4	46.4	46.4	-44.9	-44.2	VV	-13	-31.2
2nd	High	1649.975	Horn	H	3	43.0	43.0		-44.5		HH		

No emissions above the 2nd harmonics could be seen above the spectrum analyzer's noise floor. The harmonics were investigated up to the 10th harmonic.

Radiated Emissions Test Data Results Con't

Antenna Extended - (handheld standalone, upright position) - QAM 64, 1/6 timeslot per frame

									Substitution Method				
EUT			Receive Antenna			Spectrum Analyzer			Tracking Generator				
Type	Ch.	Frequency (MHz)	Antenna Type	Pol	Test Dist. (m)	Reading (dBuV)	Corrected Reading (dBuV)	Max. (V,H)	Reading (dBuV)	Corrected Reading (relative to dipole)	Pol.	Limit	Diff. To Limit (dB)
2nd	Low	1612.025	Horn	V	3	54.0	54.0	54.0	-40.8	-40.0	VV	-13	-27.0
2nd	Low	1612.025	Horn	H	3	49.7	49.7		-40.3		HH		
2nd	Mid	1631.000	Horn	V	3	50.9	50.9	50.9	-42.5	-42.0	VV	-13	-29.0
2nd	Mid	1631.000	Horn	H	3	47.0	47.0		-42.3		HH		
2nd	High	1649.975	Horn	V	3	47.5	47.5	47.5	-43.8	-43.1	VV	-13	-30.1
2nd	High	1649.975	Horn	H	3	43.4	43.4		-43.4		HH		

No emissions above the 2nd harmonics could be seen above the spectrum analyzer's noise floor. The harmonics were investigated up to the 10th harmonic.

Radiated Emissions Test Data Results Con't

Radiated Emissions Test Photo

Radiated Emissions at 3.0 metres