



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

CONTROLLER

MODEL NUMBER: M8936

**FCC ID: AVHM8936
IC: 10329A-M8936**

REPORT NUMBER: 10451636

ISSUE DATE: 2014-09-18

Prepared for
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NVLAP LAB CODE 100255-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	9/18/14	Initial Issue	M. Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: PARTECH INC
8383 SENECA TPKE
NEW HARTFORD, CT, 13413, USA

EUT DESCRIPTION: MULTIFUNCTION TEMPERATURE PROBE

MODEL: M8936

SERIAL NUMBER: NON-SERIALIZED PRODUCTION UNIT

DATE TESTED: 9/17/14 – 9/18/14

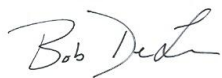
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL LLC By:

Tested By:



BOB DELISI
PRINCIPAL ENGINEER
UL LLC

MICHAEL ANTOLA
PROJECT LEAD
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 1285 Walt Whitman Rd. Melville, NY 11747, USA.

UL Melville is accredited by NVLAP, Laboratory Code 100255-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/1002550.htm>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.3 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.00 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Controller that contains a Bluetooth transceiver operating in the 2402-2480MHz range.

The radio module is manufactured by Panasonic and the Model Number is PAN1326.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak EIRP radiated output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	-26.61	0.00218
2402 - 2480	DQPSK	-22.29	0.00590
2402 - 2480	Enhanced 8PSK	-21.24	0.00752

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integrated chip (SMD) antenna – Manufactured by Murata, Model Number LDA21K - with a maximum gain of 0.9 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was TIPROXY_v102_noBL_09162014.

The EUT driver software installed in the host support equipment during testing was TUSB3410, rev. 6.7.2.0.

The test utility software used during testing was CC256x Bluetooth Hardware Evaluation Tool, ver. 1.0.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission was performed with the EUT set to transmit at the low, middle and high channel with highest output power as worst-case scenario.

Power line conducted emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Though preliminary testing, the worse-case modes were found to be GFSK and 8PSK (DH5 data rate), thus all testing was performed only in these configurations.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Compaq	CQ56-115DX	CNF1134NRP	PPD-AR5B95-H
Charge Cradle	Partech	K8935	SA 13C01356	NA

I/O CABLES

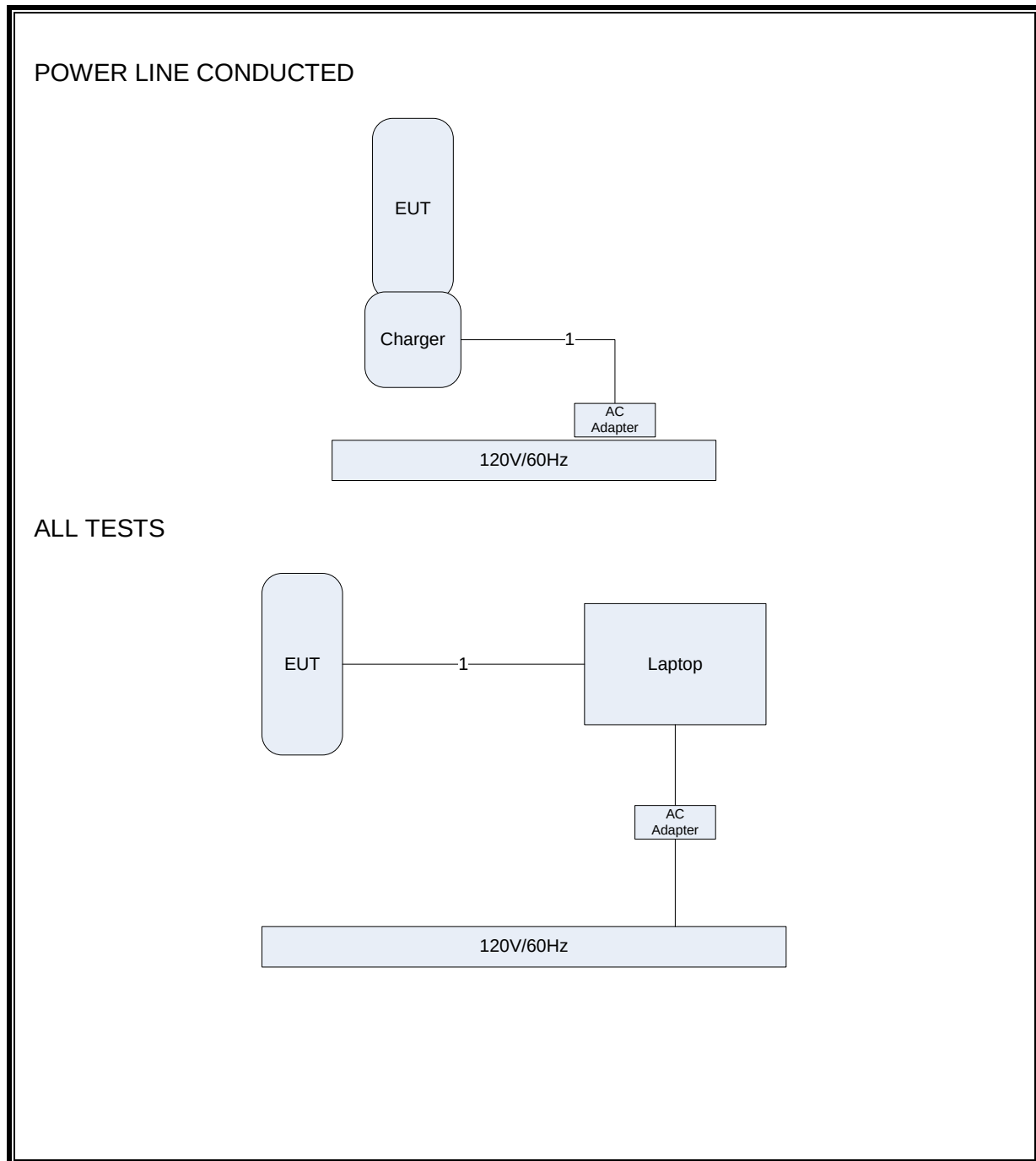
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB-Micro USB	Shielded	<3M	N/A

TEST SETUP

The EUT module is installed in a host device during the tests. Test software exercised the radio module.

For power line conducted emissions, the EUT was tested in two modes – docked in the charge cradle, charge cradle powered from an AC adapter and with the EUT powered through the laptop.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
30-1000MHz					
EMI Receiver	Rohde & Schwarz	ESCI7	75141	2014-01-29	2015-01-31
Hybrid Antenna	Sunol	JB-1	84106	2014-02-19	2015-02-19
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC99V	44396	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22
Multimeter	Fluke	87V	44547	2014-01-29	2015-01-31
Above 1GHz (Band Optimized System)					
Spectrum Analyzer	Agilent	E4446A	72822	2014-06-13	2015-06-13
Horn Antenna (2-4 GHz)	ETS	3161-02 (22°)**	48107	2007-09-27	See * below
Horn Antenna (4-8 GHz)	ETS	3161-03 (22°)**	48106	2007-09-27	See * below
Horn Antenna (8-12 GHz)	ETS	3160-07 (26°)**	8933	2008-11-24	See * below
Horn Antenna (12-18 GHz)	ETS	3160-08 (26°)**	8932	2007-09-27	See * below
Horn Antenna (18-26.5 GHz)	ETS	3160-09 (27°)**	8947	2007-09-26	See * below
Horn Antenna	EMCO	3115	ME5A-766	2013-12-03	2014-12-03
Signal Path Controller	HP	11713A	50250	N/A	N/A
Gain Controller	HP	11713A	50251	N/A	N/A
RF Switch / Preamp Fixture	UL	BOMS1	50249	N/A	N/A
System Controller	UL	BOMS2	50252	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22
Multimeter	Fluke	87V	44547	2014-01-29	2015-01-31

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
* - Note: As allowed by the calibration standard ANSI C63.10 Section 4.4.2, standard gain horns need only a one-time calibration. Only if physical damage occurs will the horn antenna require re-calibration. Gain standard horn antennas (sometimes called standard gain horn antennas) need not be calibrated beyond that which is provided by the manufacturer unless they are damaged or deterioration is suspected, or they are used at a distance closer than $2D^2/\lambda$. Gain standard horn antennas have gains that are fixed by their dimensions and dimensional tolerances. ** - Number in parentheses denotes antenna beam width.					

CONDUCTED EMISSIONS					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Conducted Emissions – GP 1					
EMI Receiver	Rohde & Schwarz	ESIB40	34968	2014-04-09	2015-04-09
LISN	Solar	9252-50-R-24-BNC	ME5A-636	2014-01-28	2015-01-31
Switch Driver	HP	11713A	44397	N/A	N/A
RF Switch Box	UL	4	44404	N/A	N/A
Measurement Software	UL	Version 9.5	44736	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	43734	2014-03-24	2016-04-24
Multimeter	Fluke	87V	64386	2014-01-28	2015-01-31
Solid Room					
EMI Receiver	Rohde & Schwarz	ESR	85496	2014-05-23	2015-05-23
LISN	Solar	9252-50-R-24-BNC	47367	2014-01-28	2015-01-31
Switch Driver	HP	11713A	44403	N/A	N/A
RF Switch Box	UL	2	44400	N/A	N/A
Measurement Software	UL	Version 9.5	44736	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	43734	2014-03-24	2016-04-24
Multimeter	Fluke	87V	64386	2014-01-28	2015-01-31

BENCH TESTS					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Spectrum Analyzer	Agilent	N9030A	85671	2014-06-27	2015-06-27

7. ANTENNA PORT TEST RESULTS

8. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

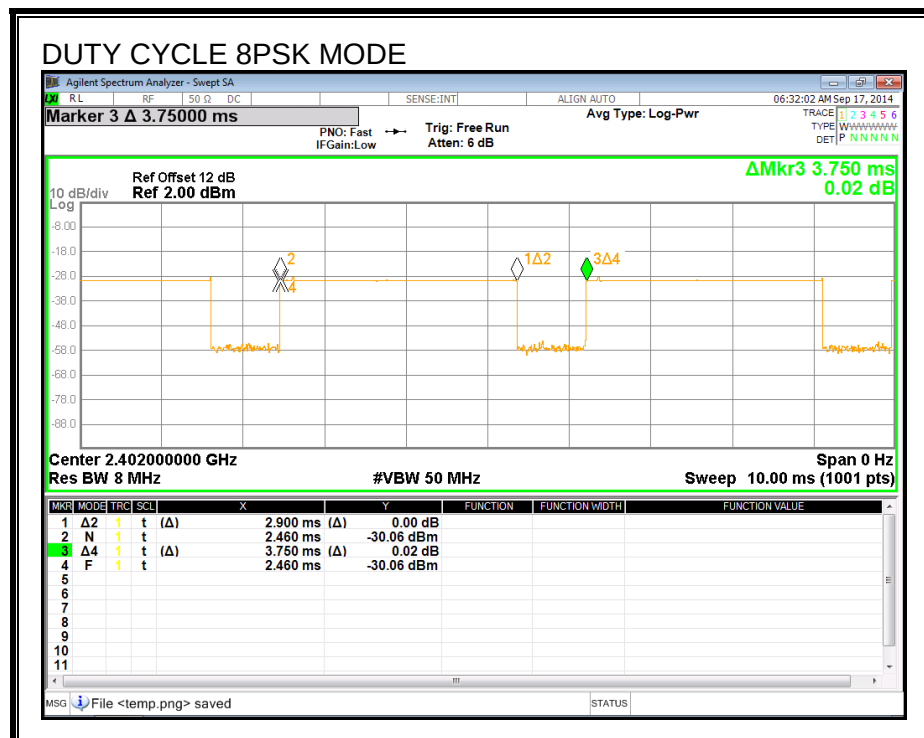
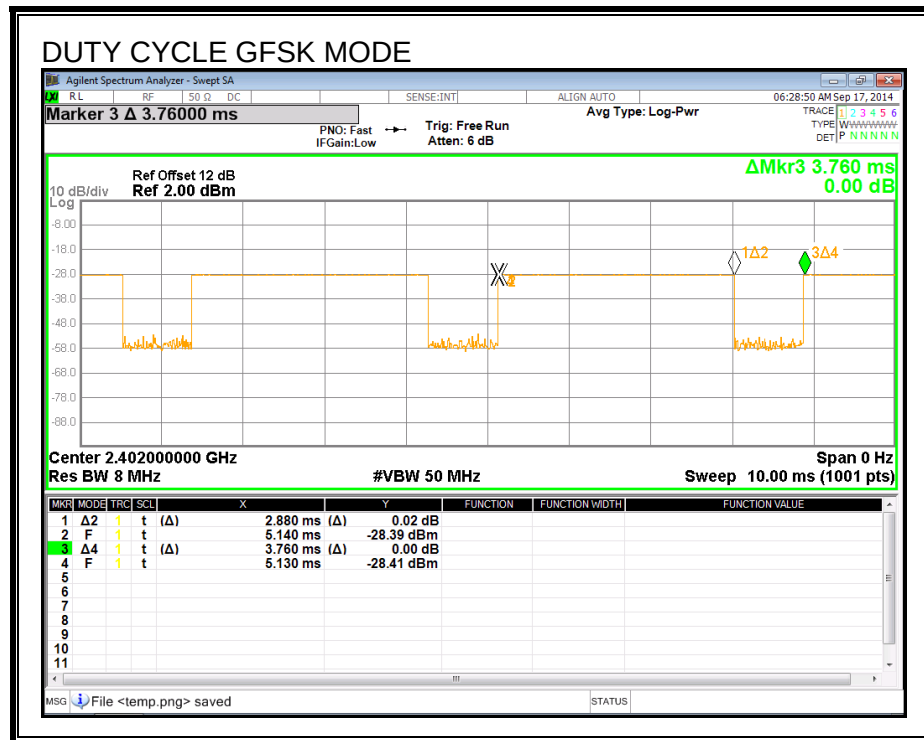
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

8.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping OFF)						
Bluetooth GFSK	2.880	3.760	0.766	76.60%	1.16	0.347
Bluetooth 8PSK	2.900	3.750	0.773	77.33%	1.12	0.345

8.2. DUTY CYCLE PLOTS



8.3. BASIC DATA RATE GFSK MODULATION

8.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

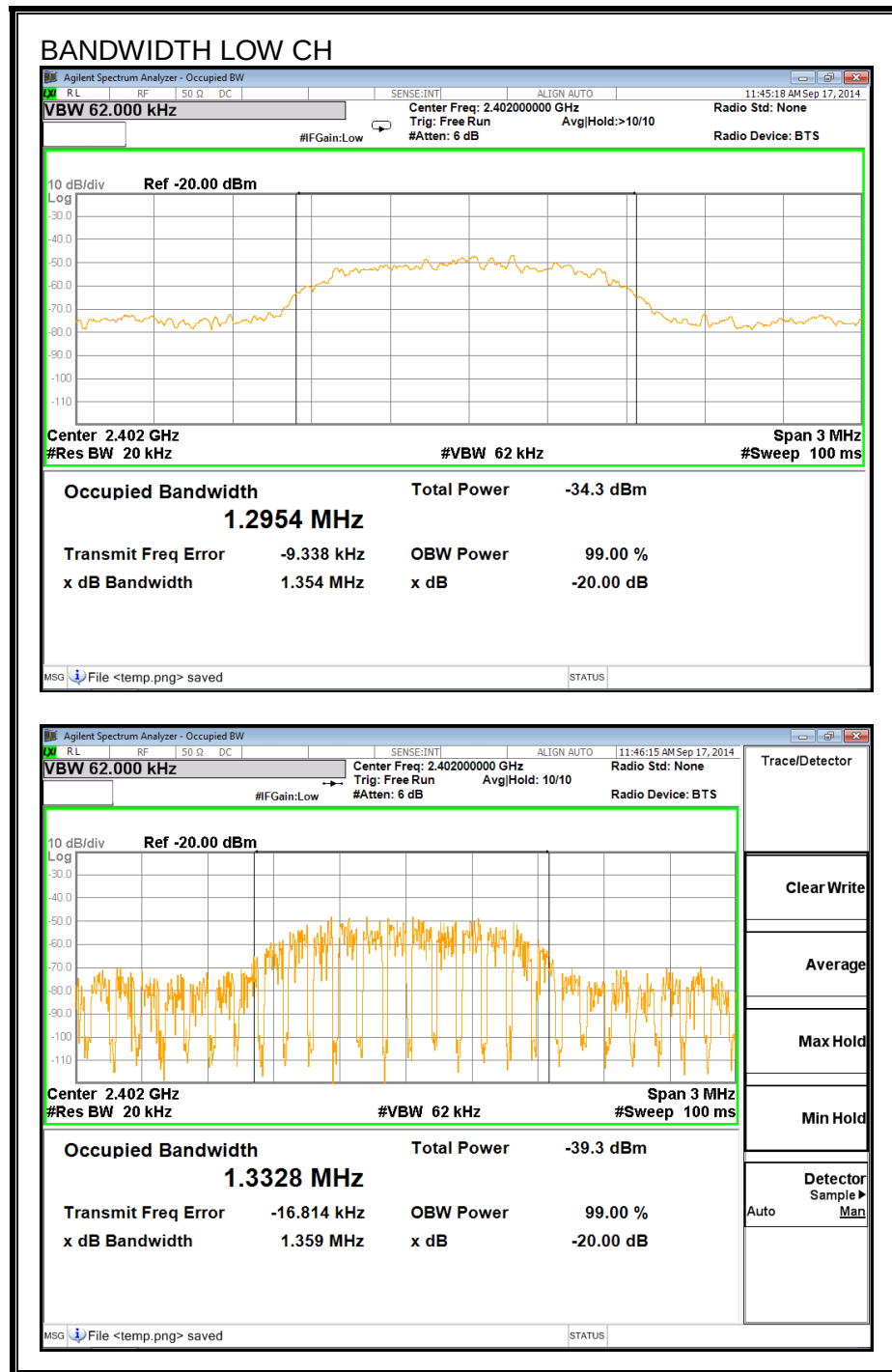
TEST PROCEDURE

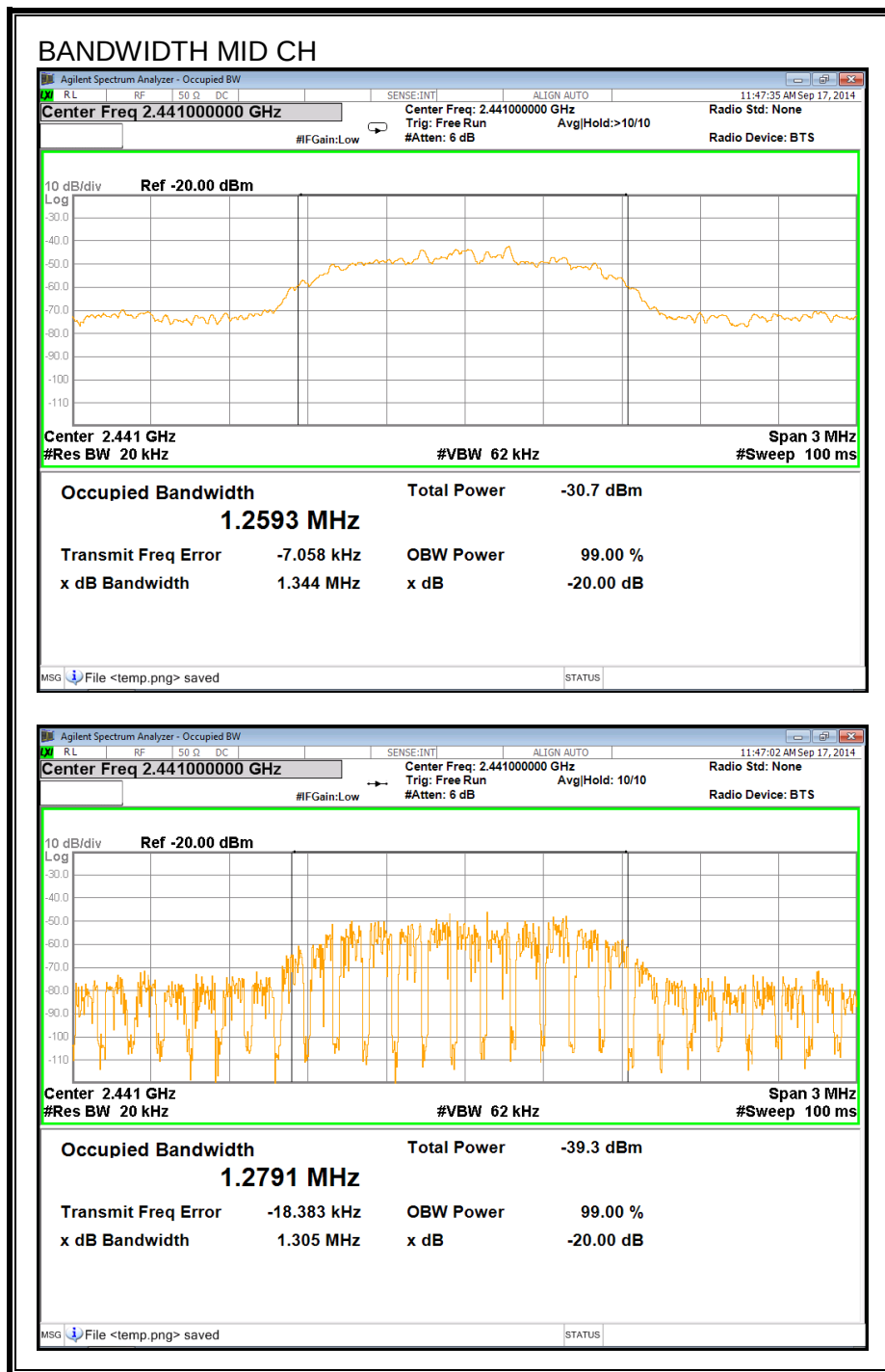
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

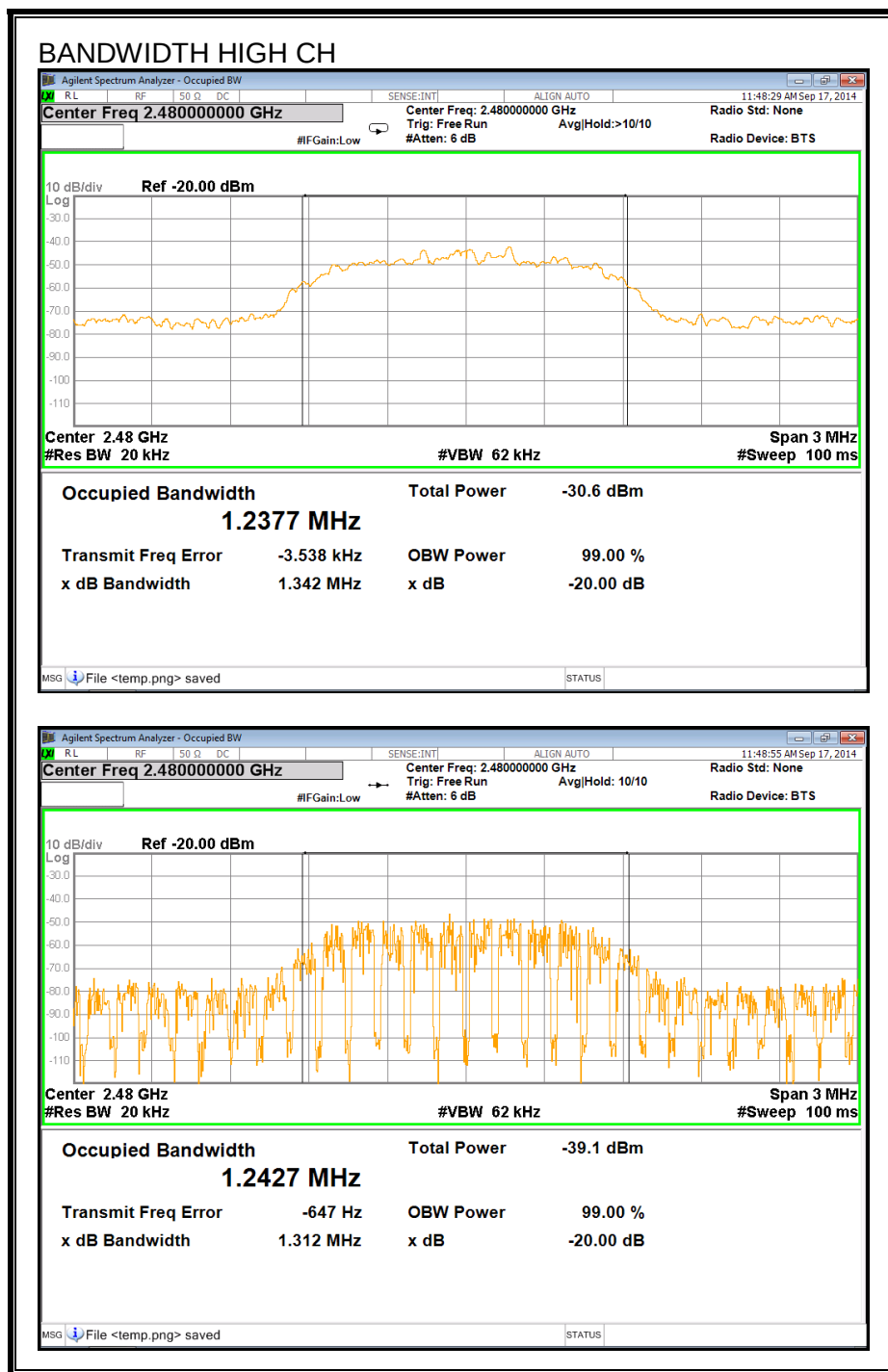
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1354	1332.8
Middle	2441	1344	1279.1
High	2480	1342	1242.7

20 dB AND 99% BANDWIDTH







8.3.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

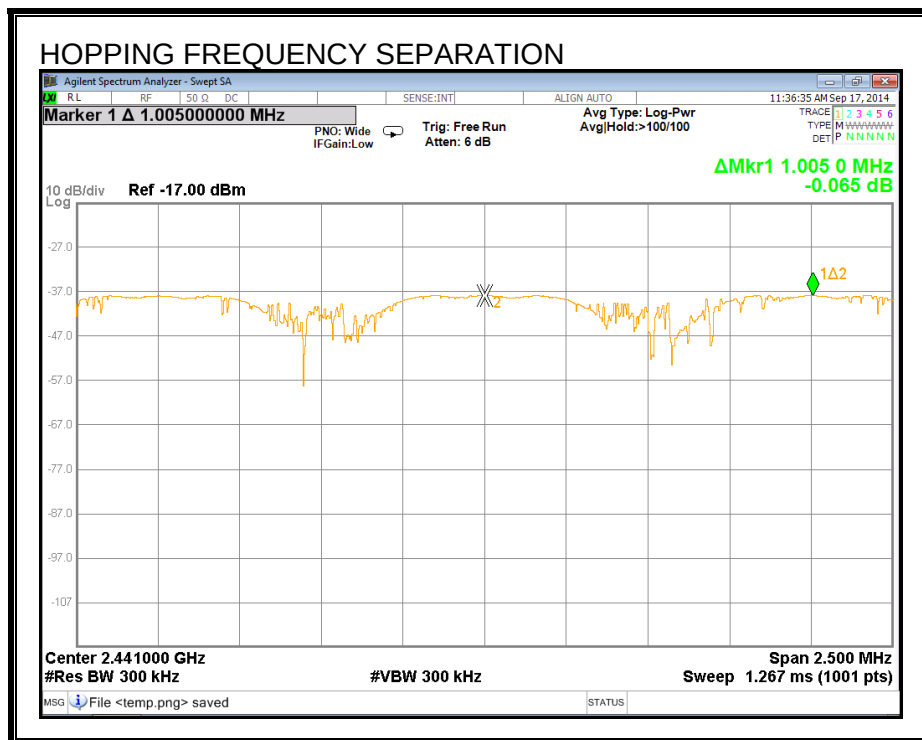
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the span and the VBW is set to $\geq$ the RBW. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



8.3.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

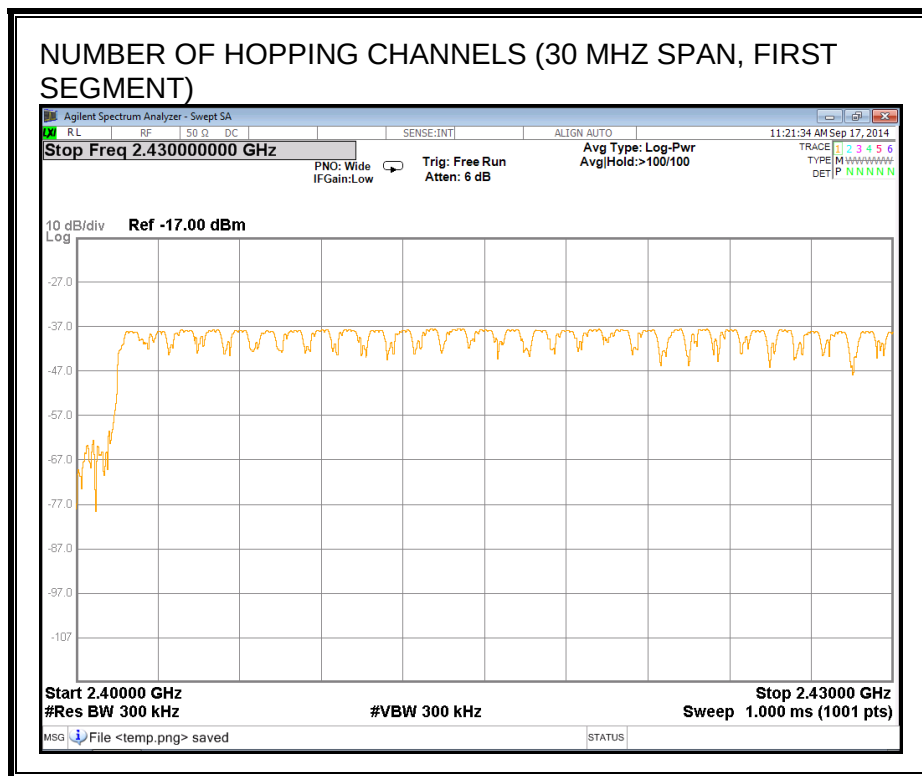
Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

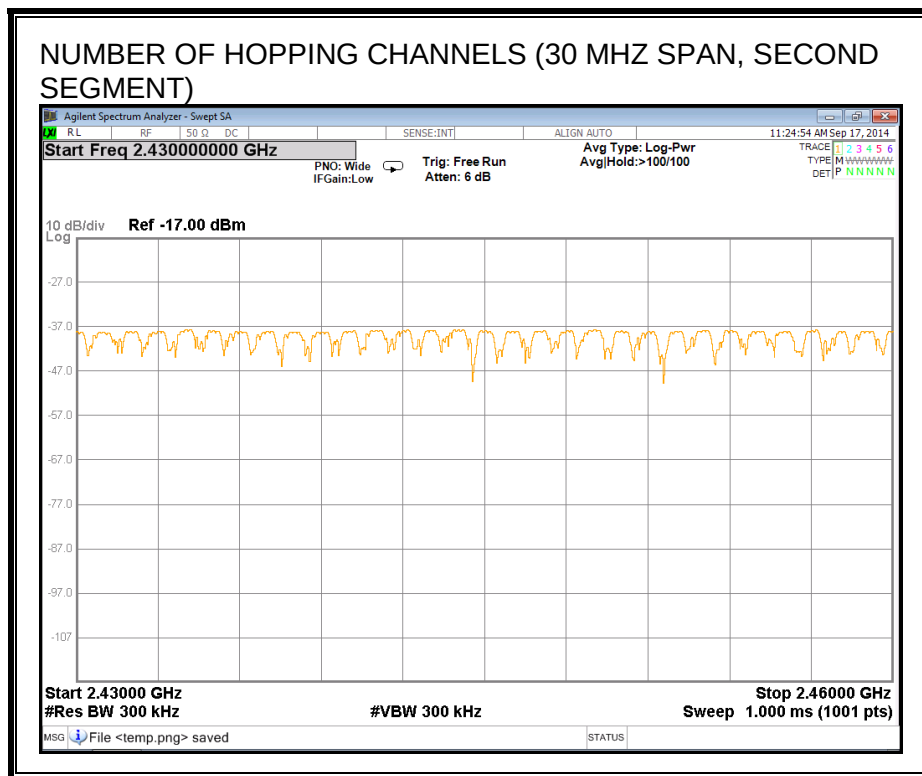
TEST PROCEDURE

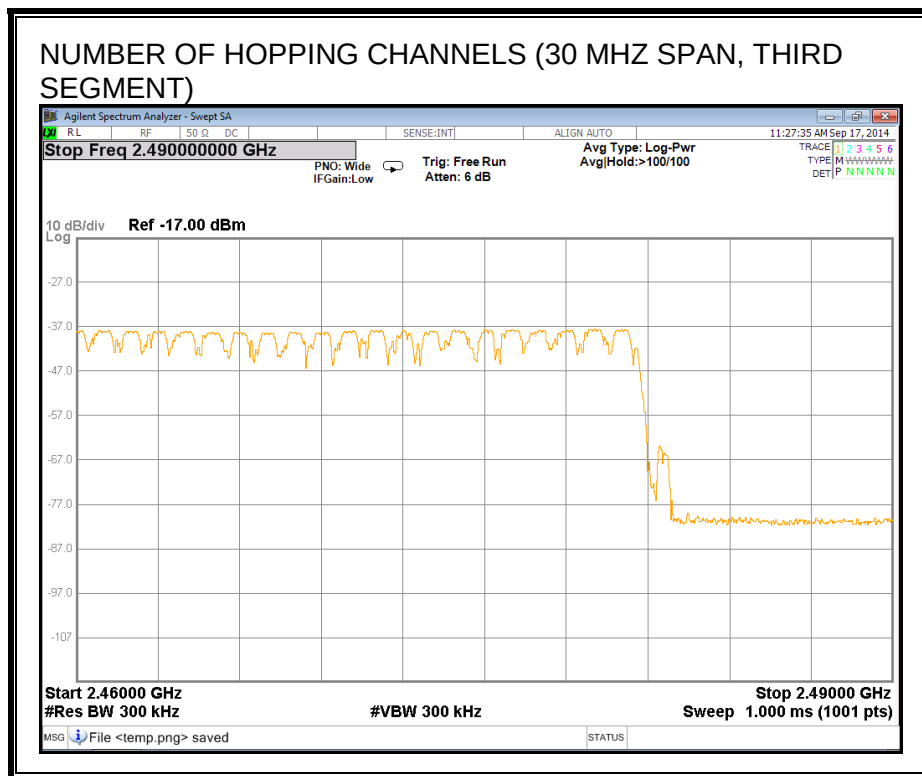
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.







8.3.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

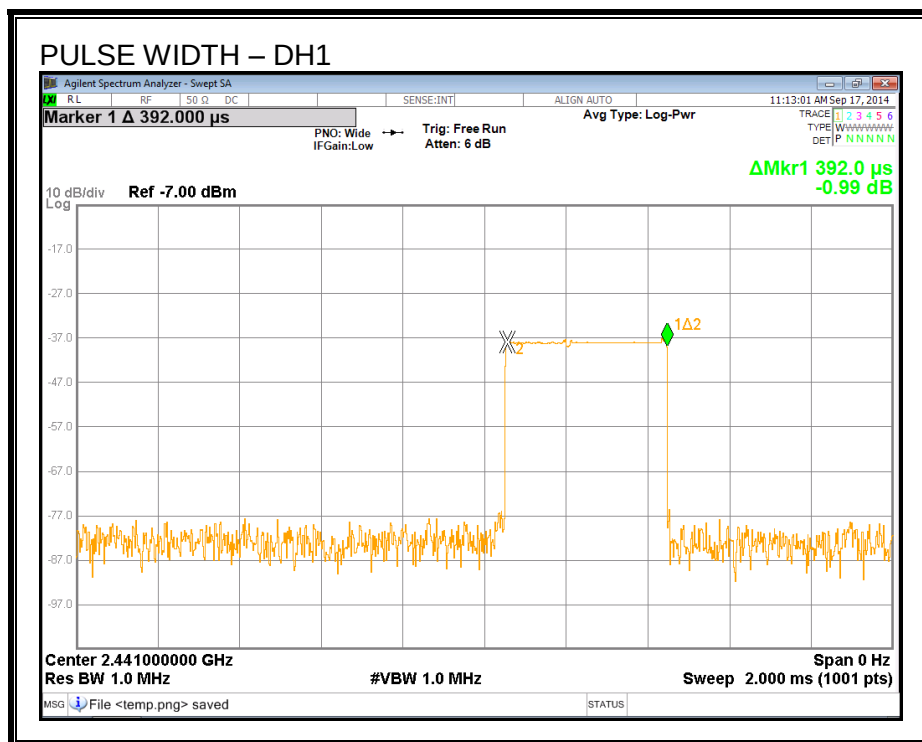
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

RESULTS

8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.392	32	0.125	0.4	-0.275
DH3	1.645	17	0.280	0.4	-0.120
DH5	2.89	10	0.289	0.4	-0.111

PULSE WIDTH - DH1



NUMBER OF PULSES – DH1

Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω DC SENSE:INT ALIGN: AUTO 11:13:49 AM Sep 17, 2014

Sweep Time 3.160 s PNO: Wide IF Gain: Low Trig: Free Run Atten: 6 dB Avg Type: Log-Pwr

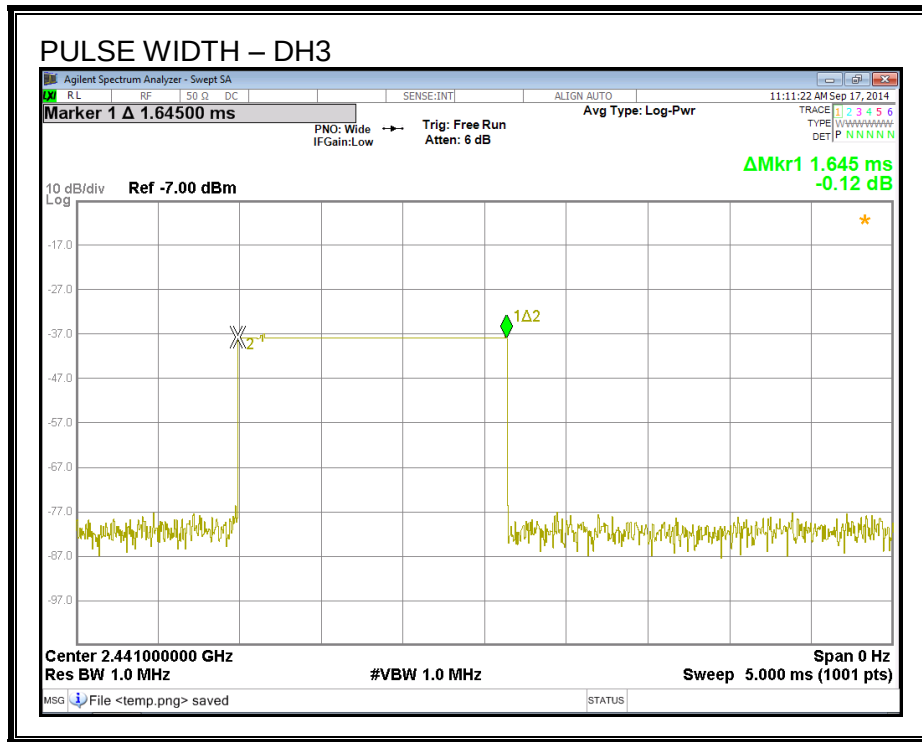
TRACE 1 2 3 4 5 6 TYPE W W W W W W W W DET P N N N N N N

10 dB/div Log Ref -7.00 dBm

Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 3.160 s (1001 pts)

MSG File <temp.png> saved STATUS

PULSE WIDTH – DH3



NUMBER OF PULSES – DH3



PULSE WIDTH – DH5

Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω DC SENSE:INT ALIGN: AUTO 11:06:25 AM Sep 17, 2014

Marker 1 Δ 2.89000 ms

PNO: Wide IFGain:Low Trig: Free Run Att: 6 dB Avg Type: Log-Pwr

TRACE 1 2 3 4 5 6 TYPE W N N N N N DET P N N N N N

10 dB/div Ref -7.00 dBm

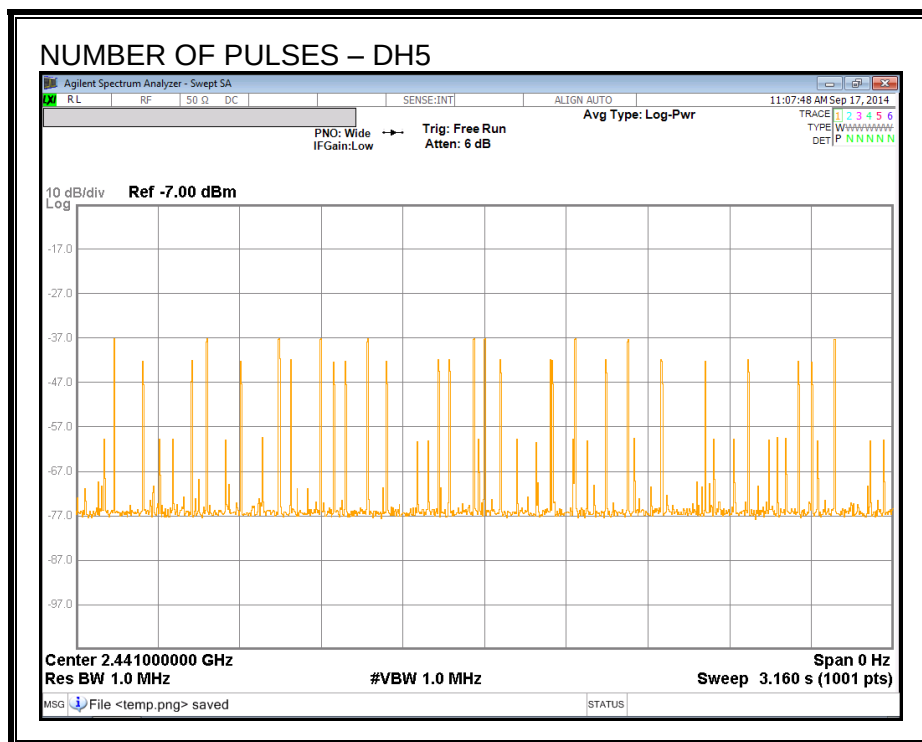
Δ Mkr1 2.890 ms
0.69 pts

Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 10.00 ms (1001 pts)

#VBW 1.0 MHz

MSO File <temp.png> saved STATUS

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.3.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is measured via a radiated measurement (field strength). This value is then converted to an EIRP power measurement by means of the procedure outlined in the FCC document number DA 00-705, March 2000.

RESULTS

Channel	Frequency (MHz)	Output Power (dBuV/m)	EIRP Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	68.16	-26.61	30	-56.61
Middle	2441	67.76	-27.01	30	-57.01
High	2480	66.71	-28.06	30	-58.06

8.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

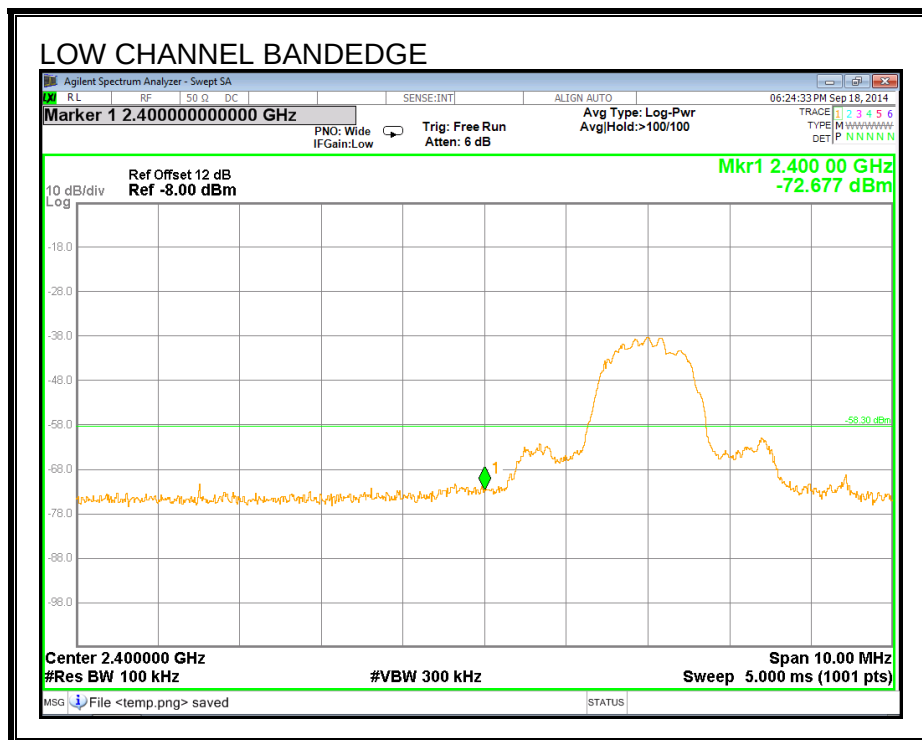
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

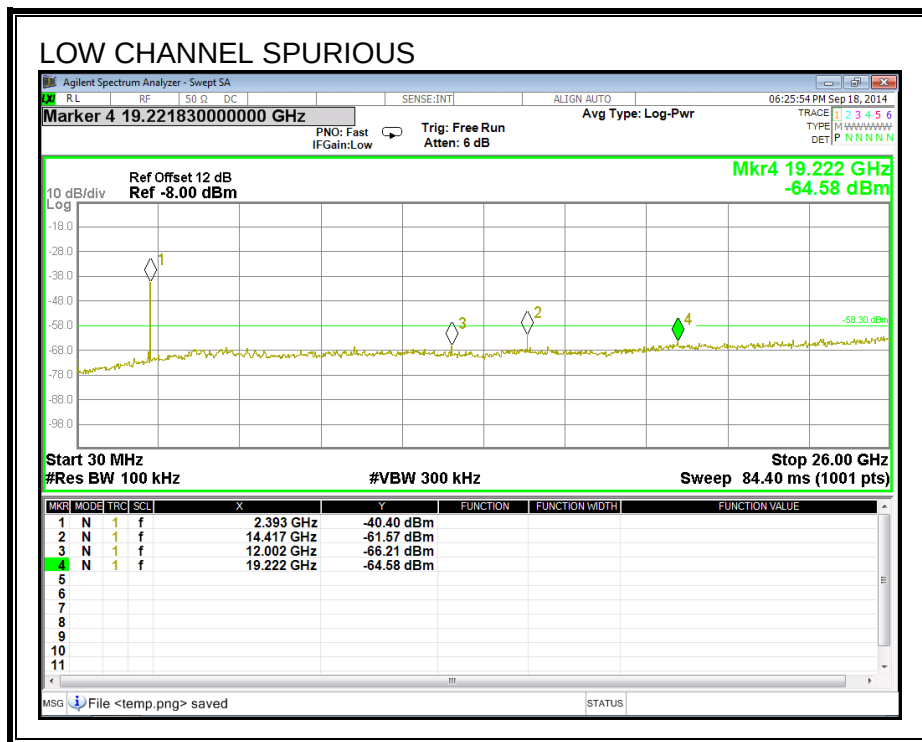
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

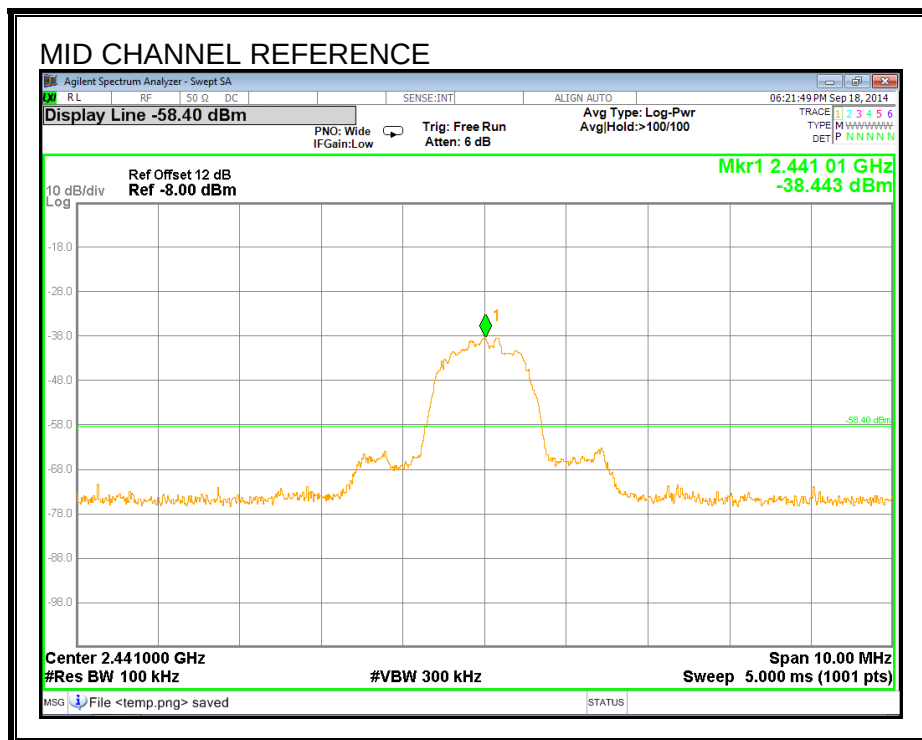
RESULTS

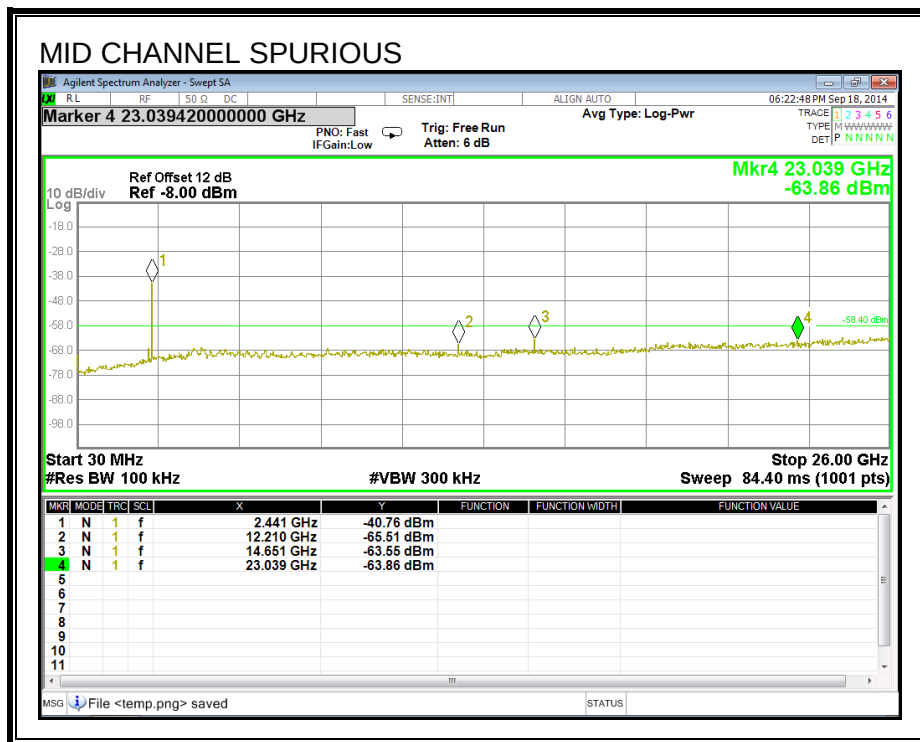
SPURIOUS EMISSIONS, LOW CHANNEL



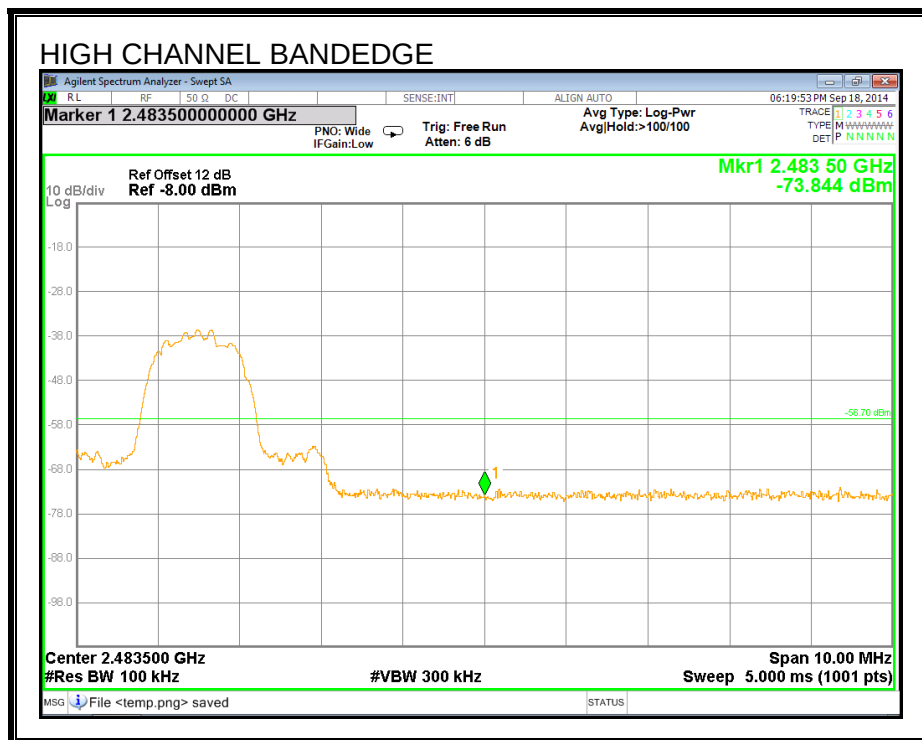


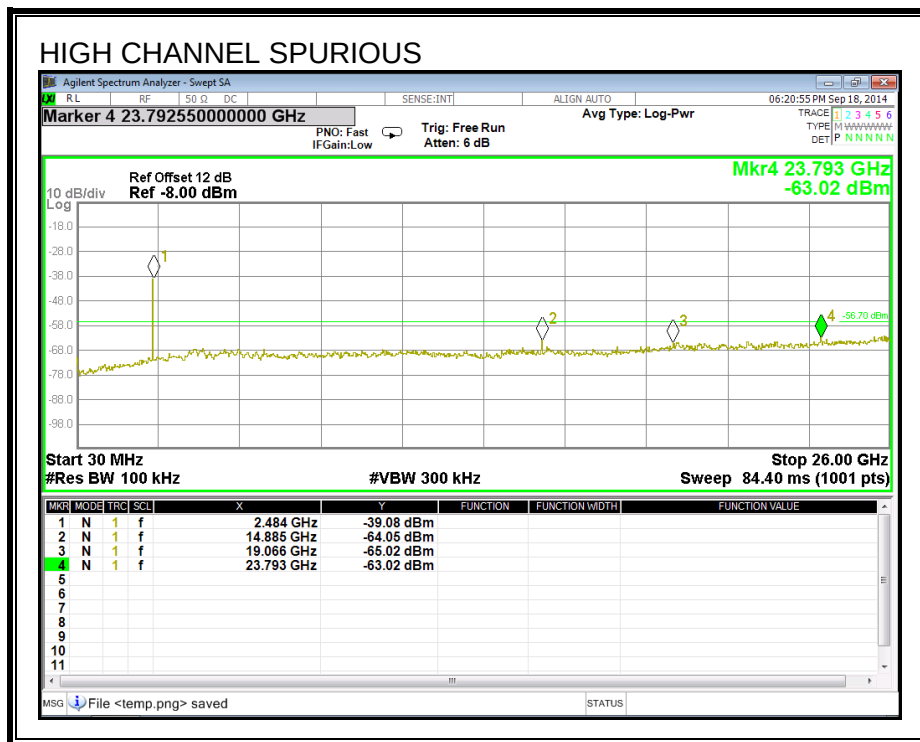
SPURIOUS EMISSIONS, MID CHANNEL



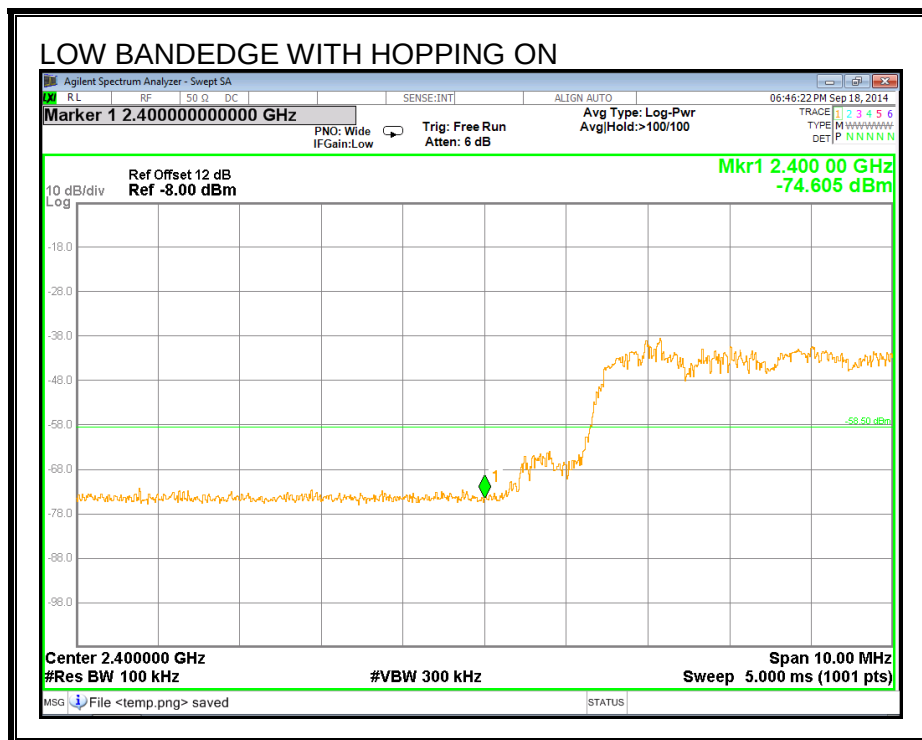


SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





8.4. ENHANCED DATA RATE 8PSK MODULATION

8.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

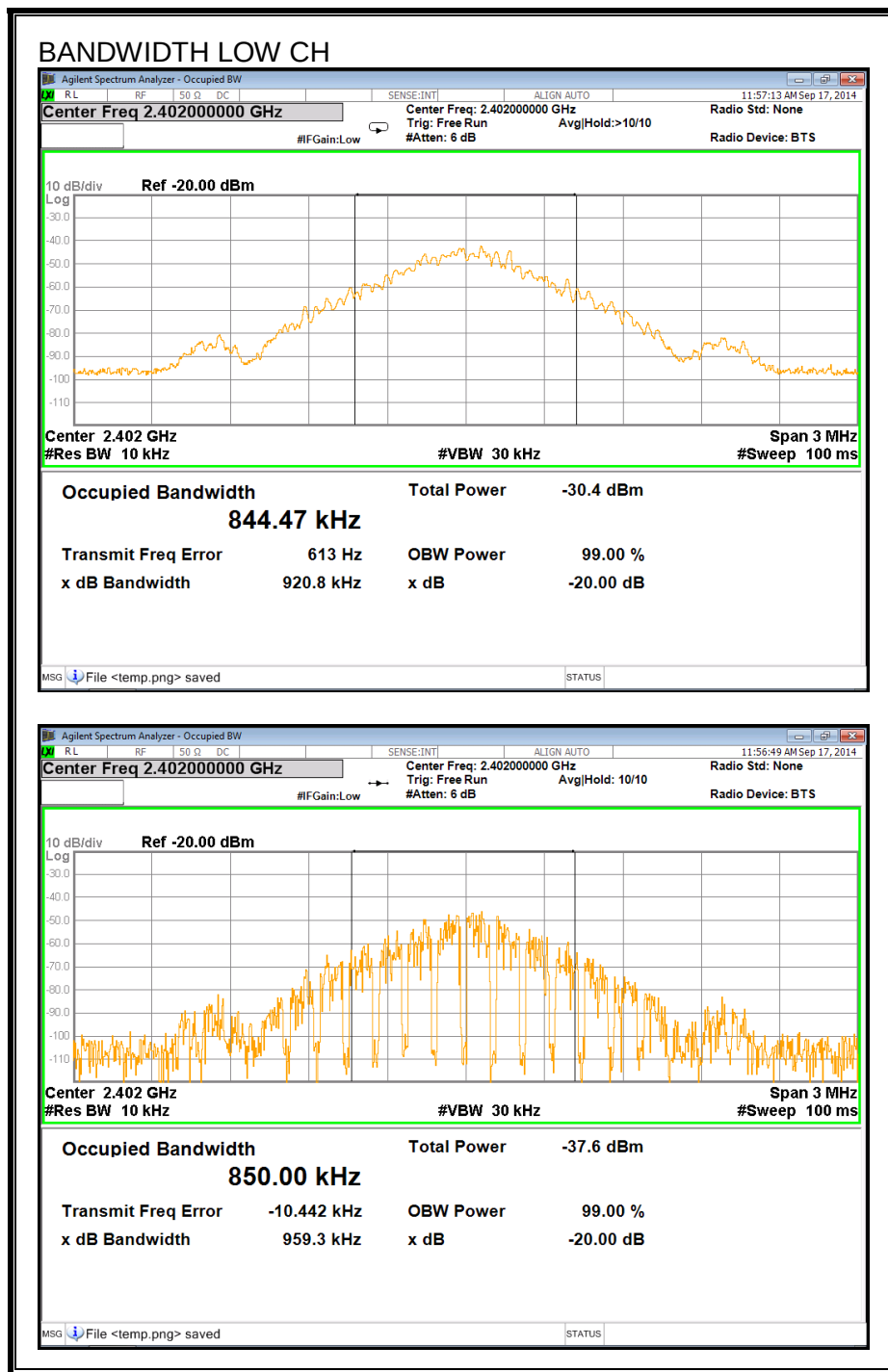
TEST PROCEDURE

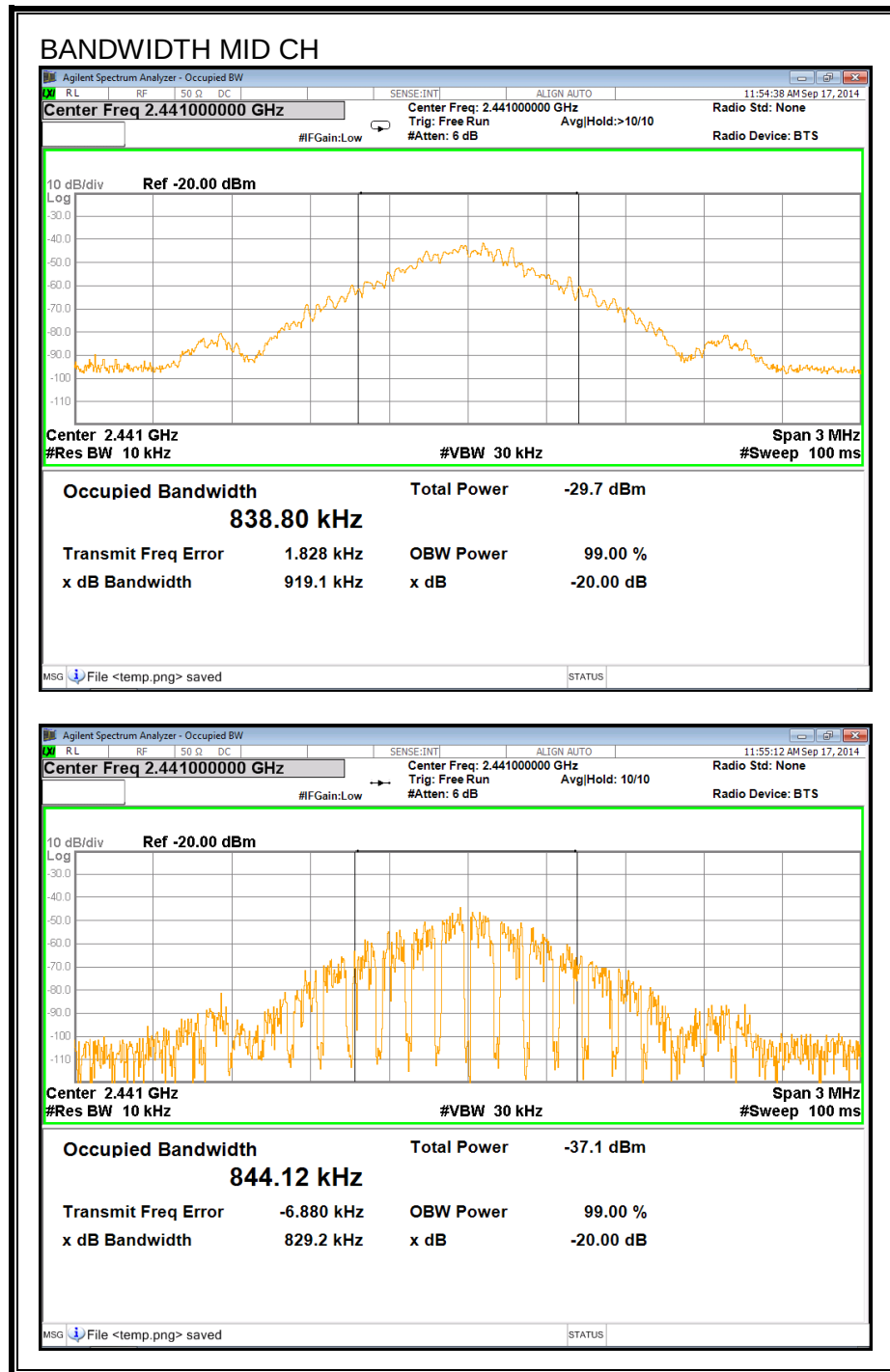
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

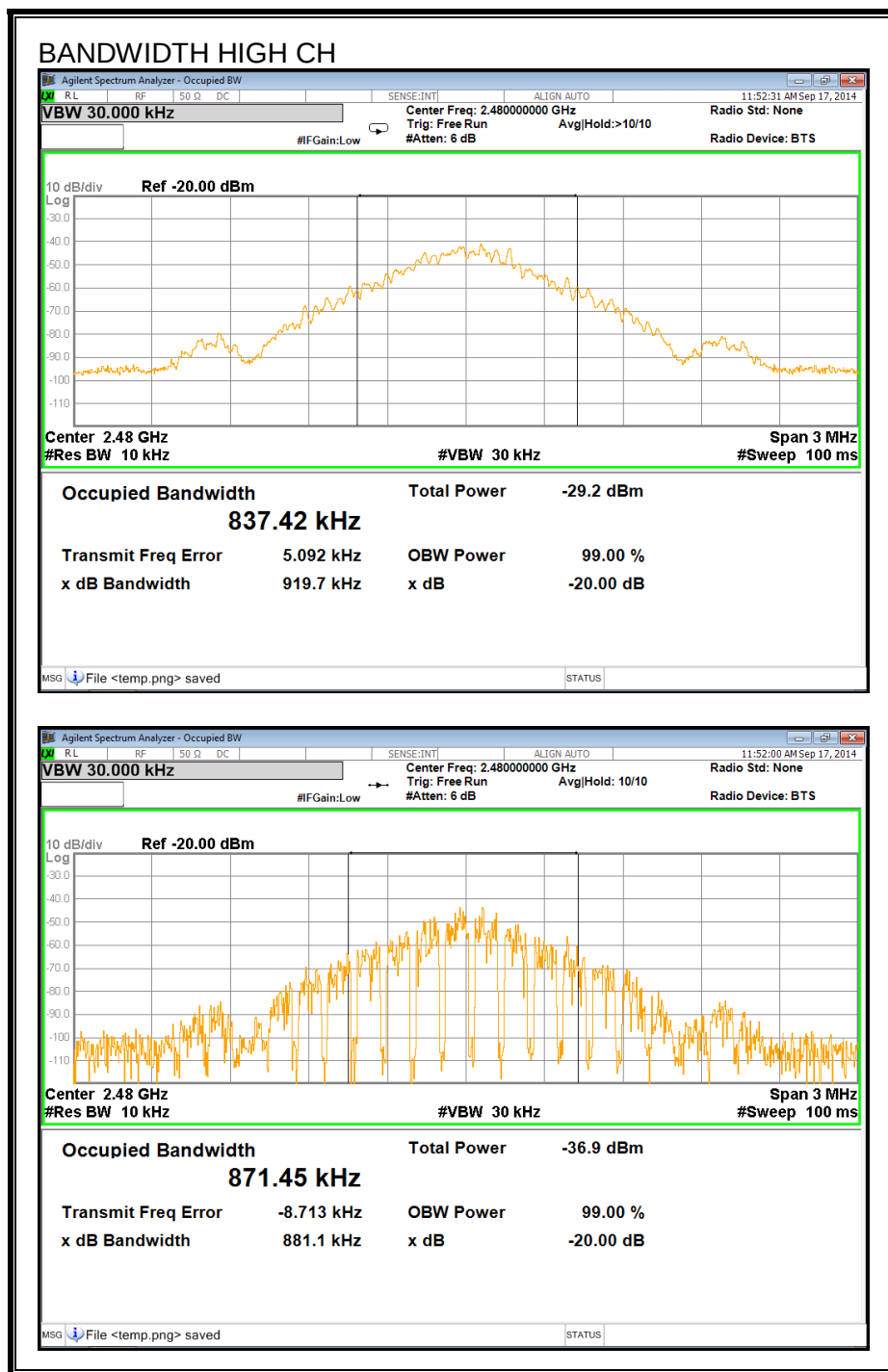
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	920.8	850
Middle	2441	919.1	844.12
High	2480	919.7	871.45

20 dB AND 99% BANDWIDTH







8.4.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

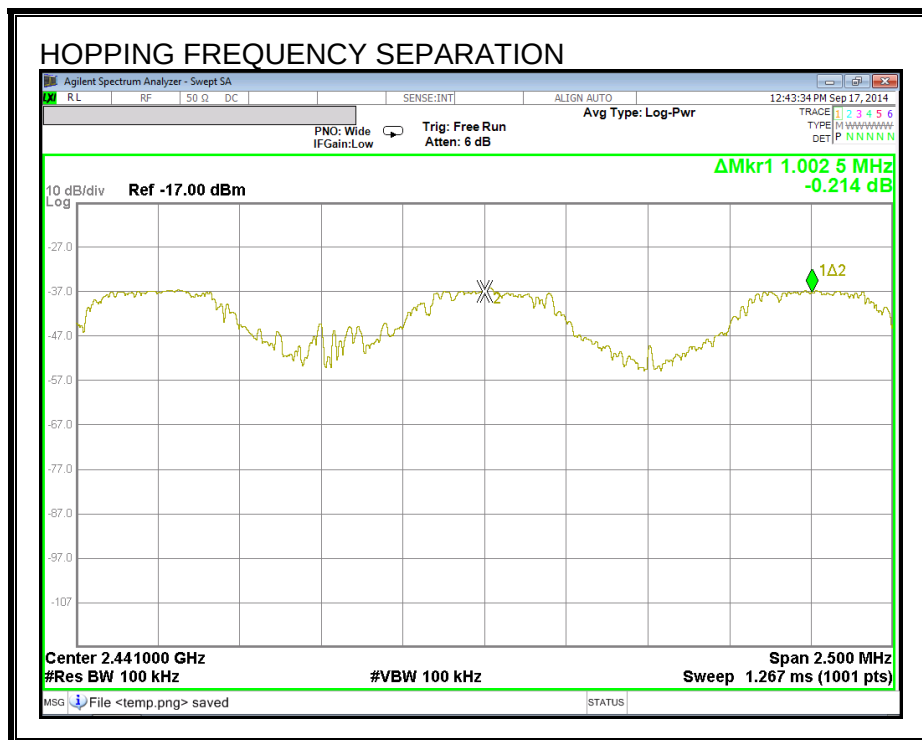
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



8.4.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

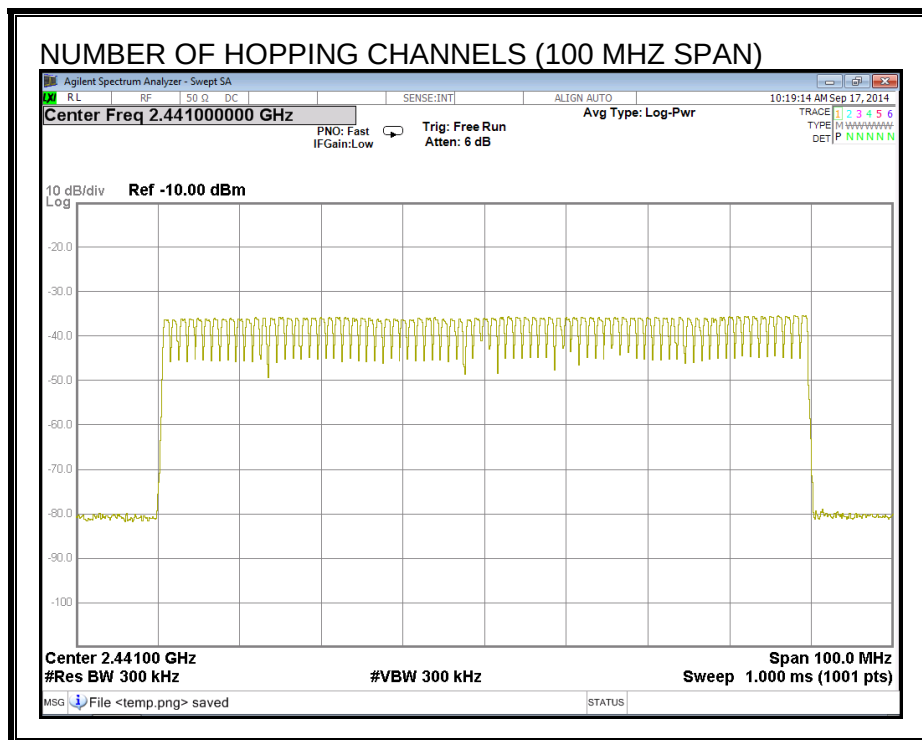
TEST PROCEDURE

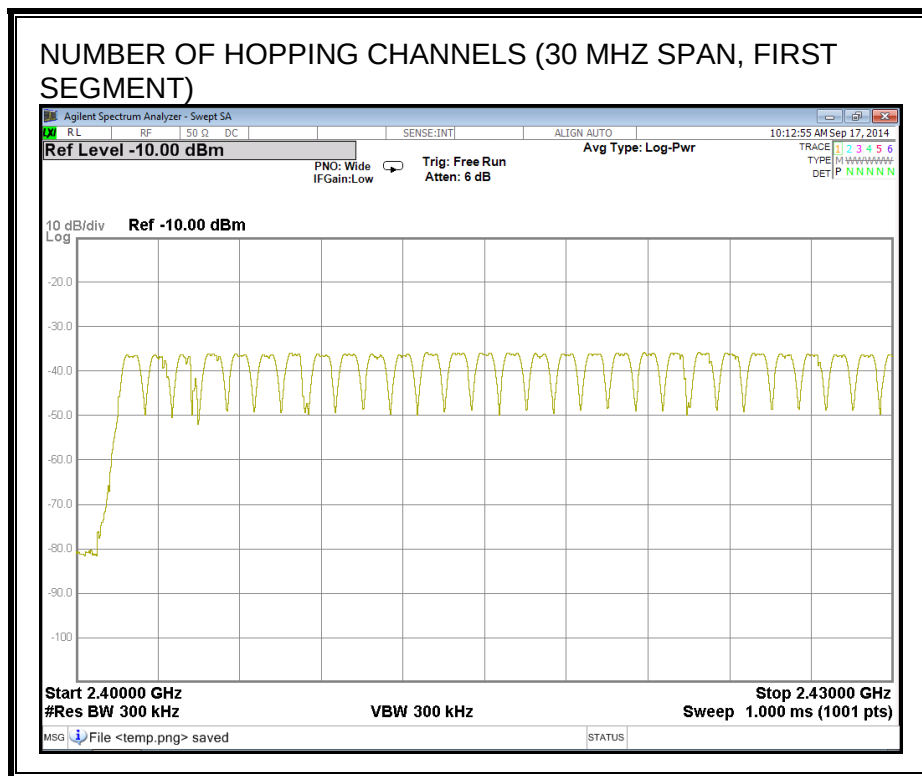
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

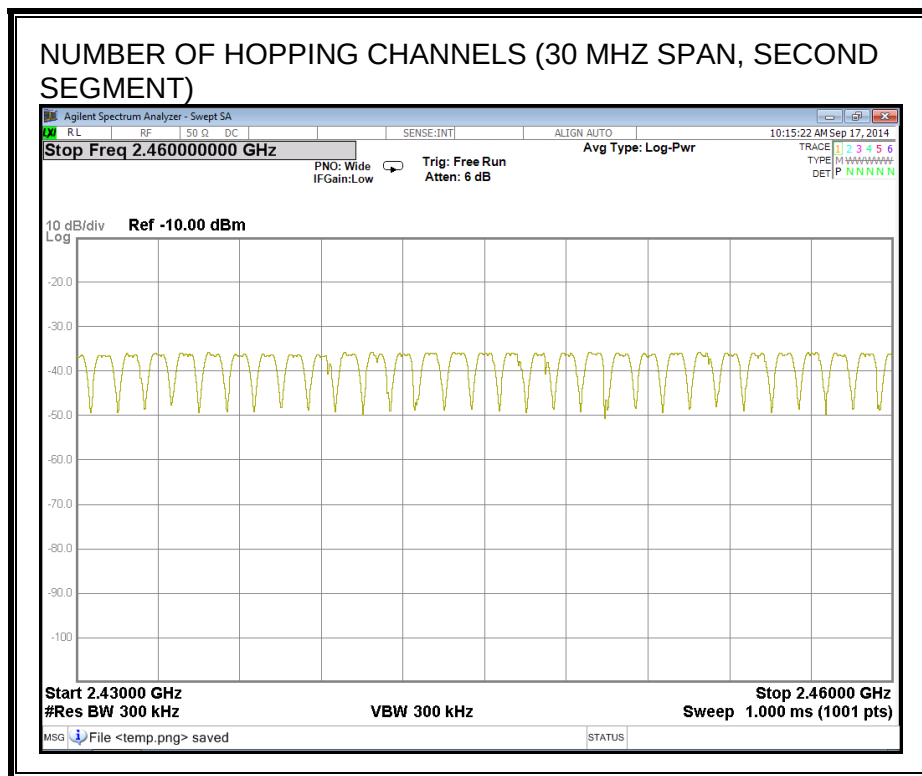
RESULTS

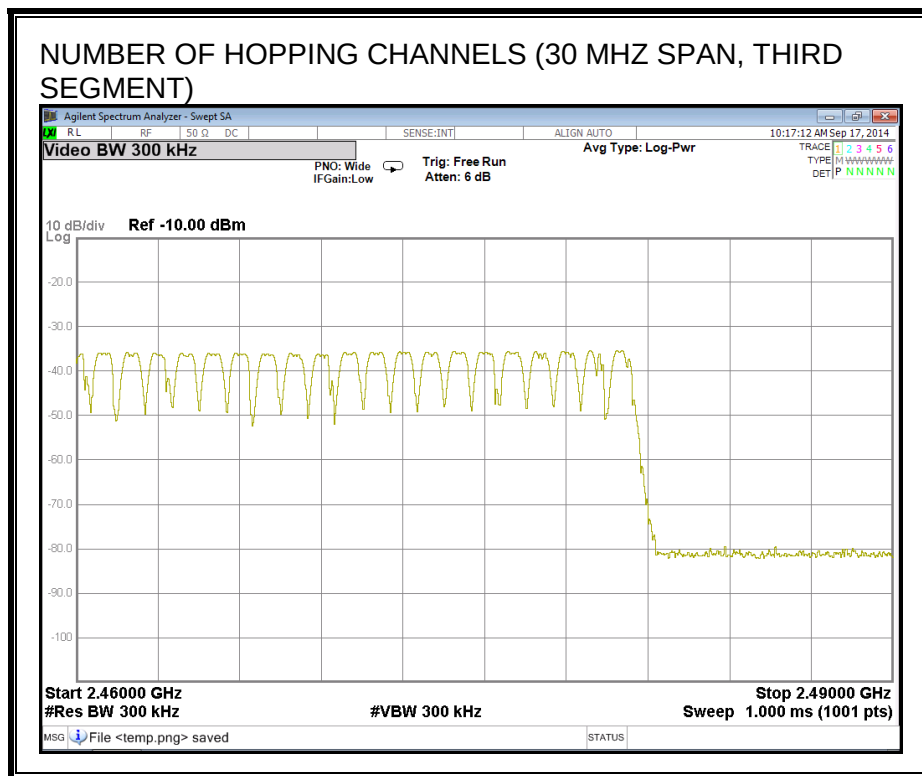
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS









8.4.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

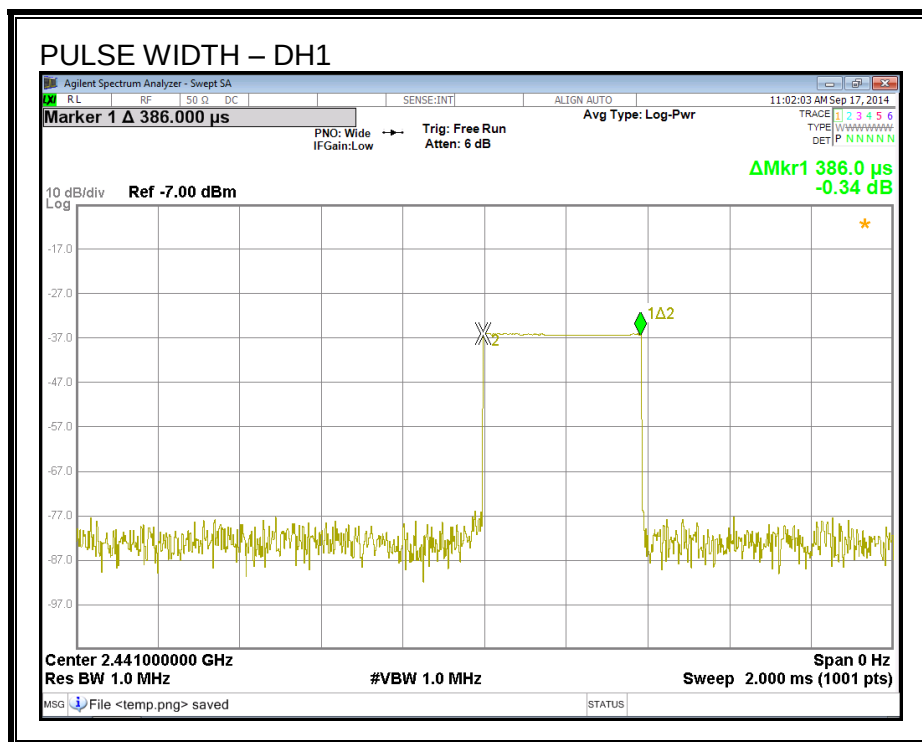
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

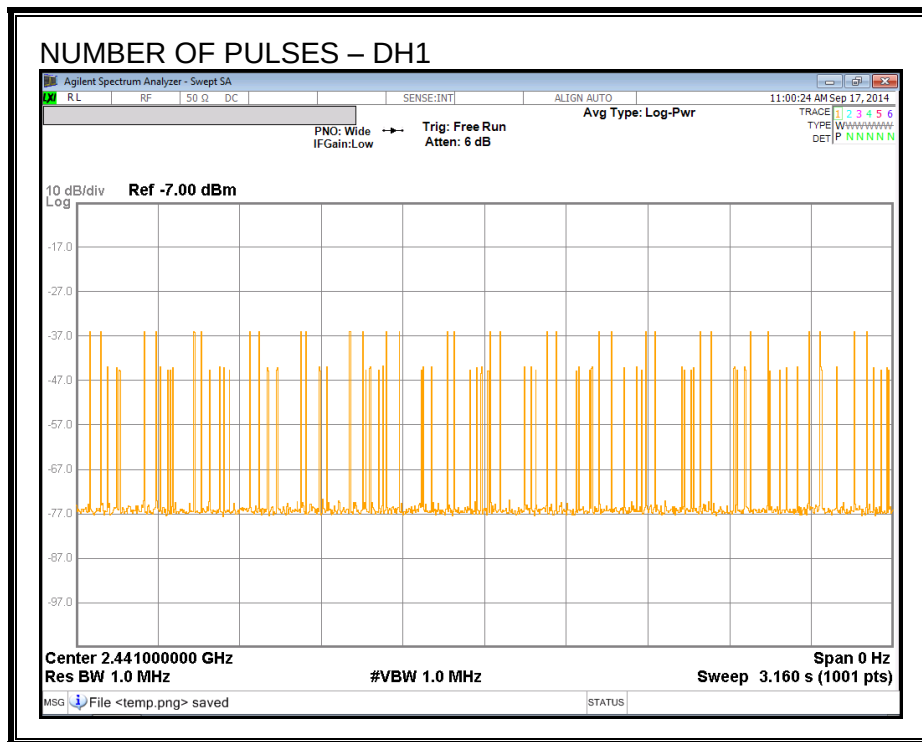
RESULTS

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.386	32	0.124	0.4	-0.276
DH3	1.642	17	0.279	0.4	-0.121
DH5	2.9	10	0.290	0.4	-0.110

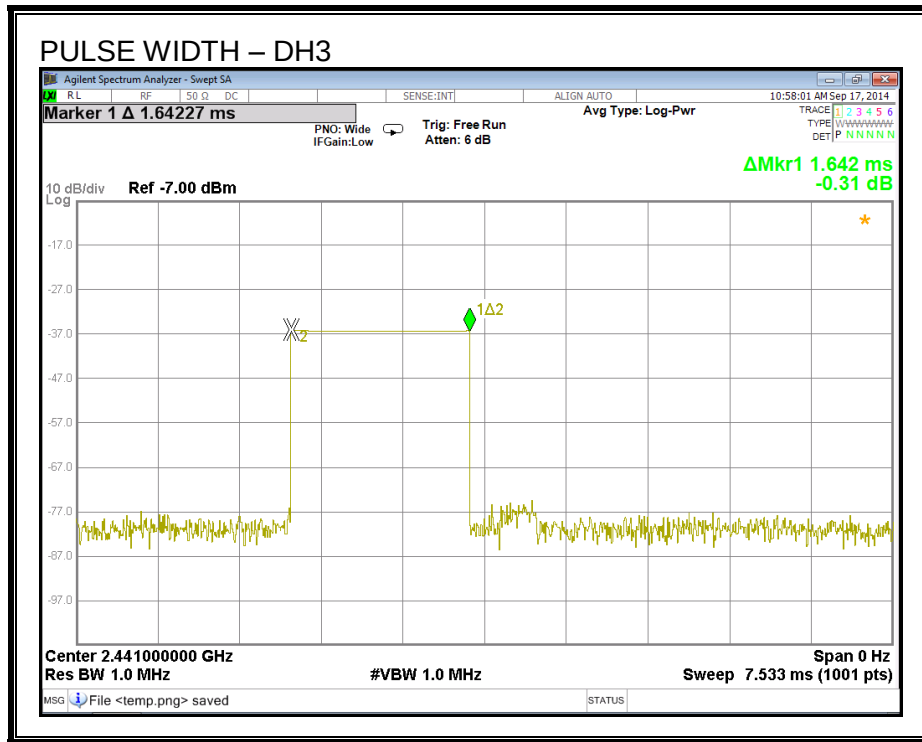
PULSE WIDTH - DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



PULSE WIDTH – DH3



NUMBER OF PULSES – DH3

The screenshot displays an Agilent Spectrum Analyzer interface. The title bar reads "Agilent Spectrum Analyzer - Swept SA". The top panel shows settings: "RL" (RF), "50 Ω", "DC", "SENSE:INT", "ALIGN AUTO", and a timestamp "10:59:23 AM Sep 17, 2014". The "Avg Type: Log-Pwr" is selected. The "PNO: Wide IF Gain: Low" is indicated. The "Trig: Free Run" and "Atten: 6 dB" are shown. The "TRACE" is set to "2 3 4 5 6" and "TYPE" is "W N N N N N". The "DET" is "P". The main display shows a spectrum plot with a vertical scale of "10 dB/div" and a reference level of "Ref -7.00 dBm". The plot shows a series of sharp, narrow pulses. The center frequency is "Center 2.441000000 GHz", the resolution bandwidth is "Res BW 1.0 MHz", the span is "Span 0 Hz", and the sweep time is "Sweep 3.160 s (1001 pts)". The status bar at the bottom indicates "MSG File <temp.png> saved" and "STATUS".

Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω DC SENSE:INT ALIGN AUTO 10:59:23 AM Sep 17, 2014

PNO: Wide IF Gain: Low → Trig: Free Run Atten: 6 dB

Avg Type: Log-Pwr

TRACE 2 3 4 5 6 TYPE W N N N N N DET P

10 dB/div Ref -7.00 dBm

Log

Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 3.160 s (1001 pts)

MSG File <temp.png> saved STATUS

NUMBER OF PULSES – DH5



8.4.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

TEST PROCEDURE

The transmitter output is measured via a radiated measurement (field strength). This value is then converted to an EIRP power measurement by means of the procedure outlined in the FCC document number DA 00-705, March 2000.

RESULTS

Channel	Frequency (MHz)	Output Power (dBuV/m)	EIRP Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	73.26	-21.51	30	-51.51
Middle	2441	66.30	-28.47	30	-58.47
High	2480	73.53	-21.24	30	-51.24

8.4.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

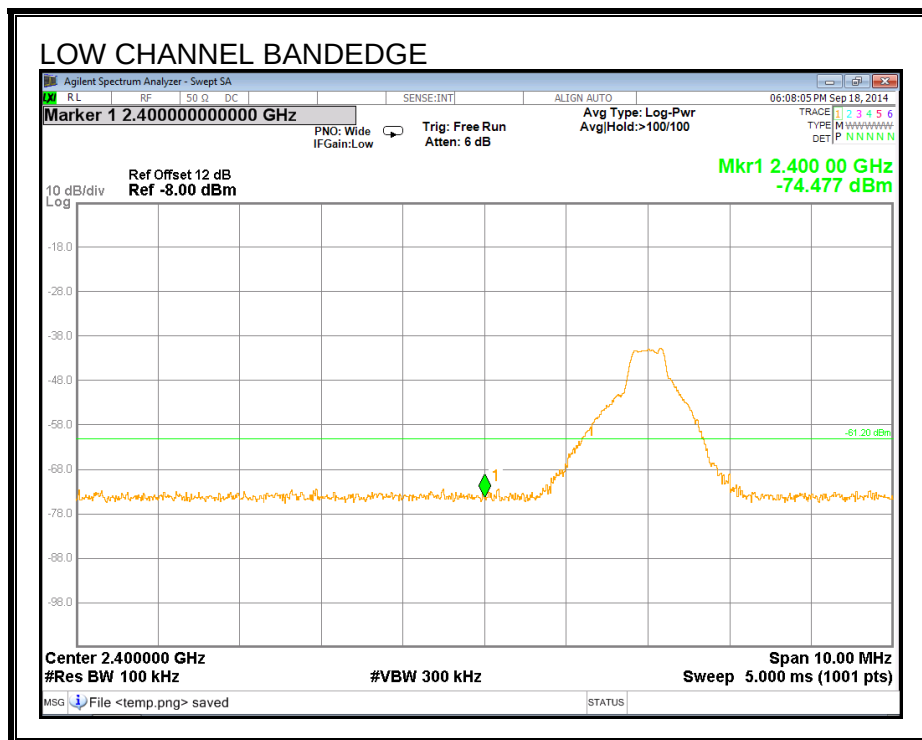
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

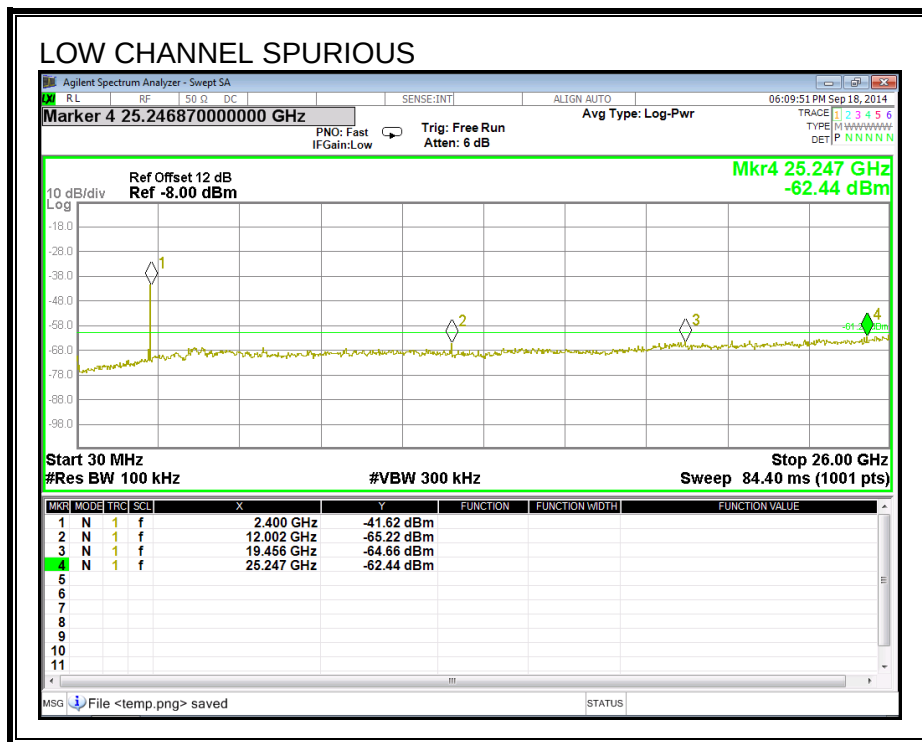
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

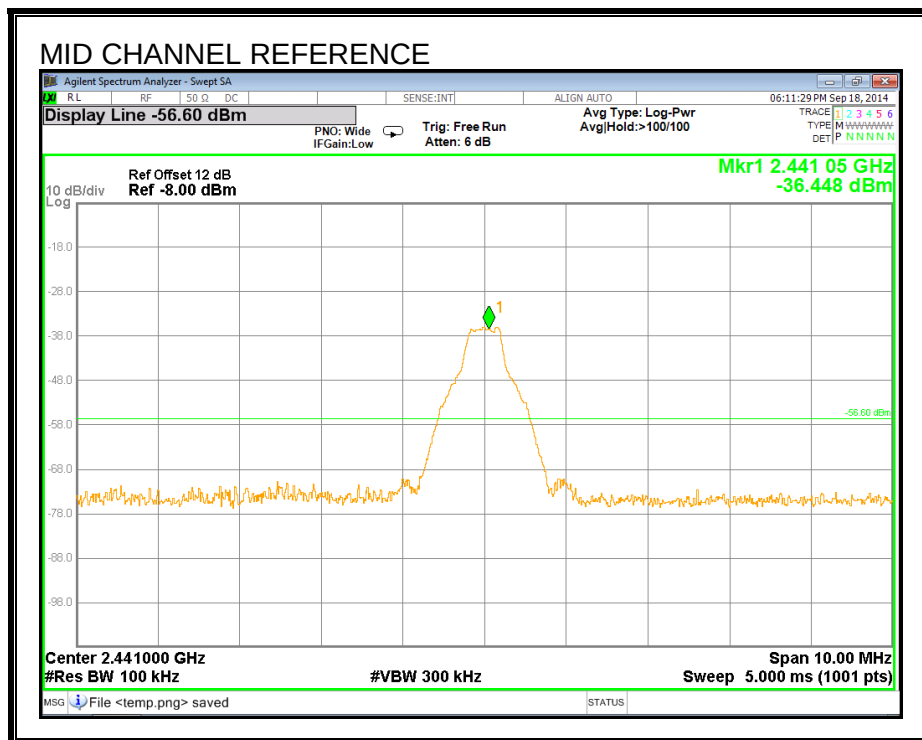
RESULTS

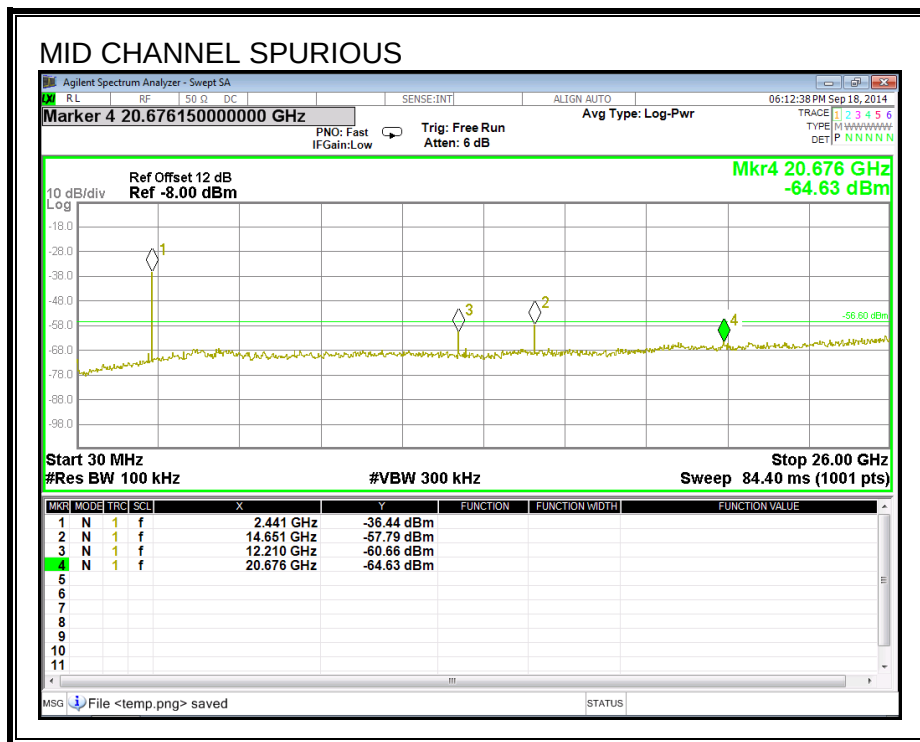
SPURIOUS EMISSIONS, LOW CHANNEL



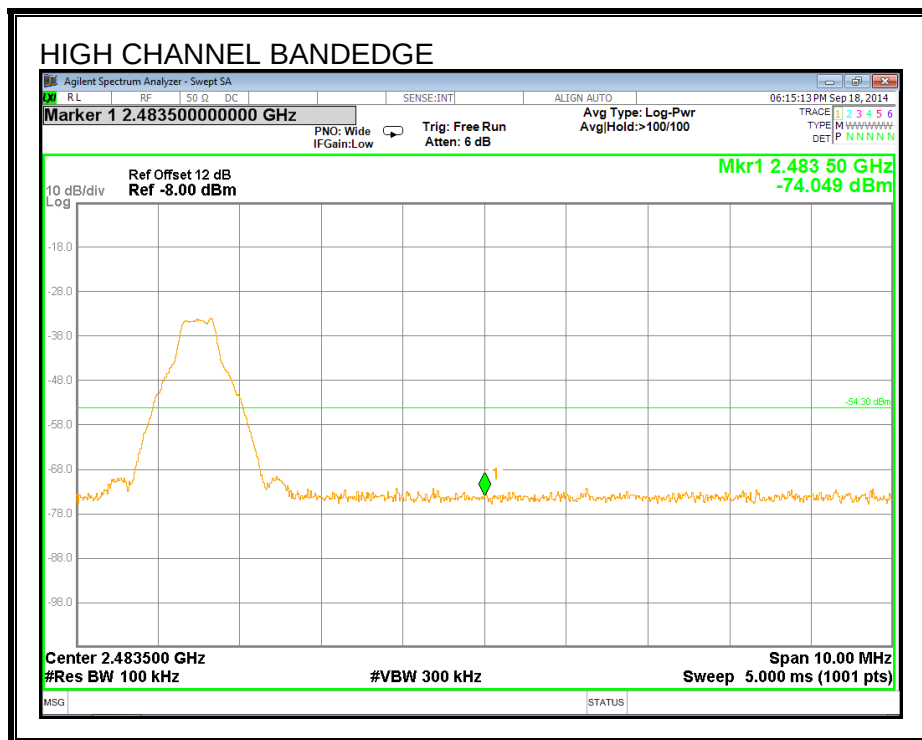


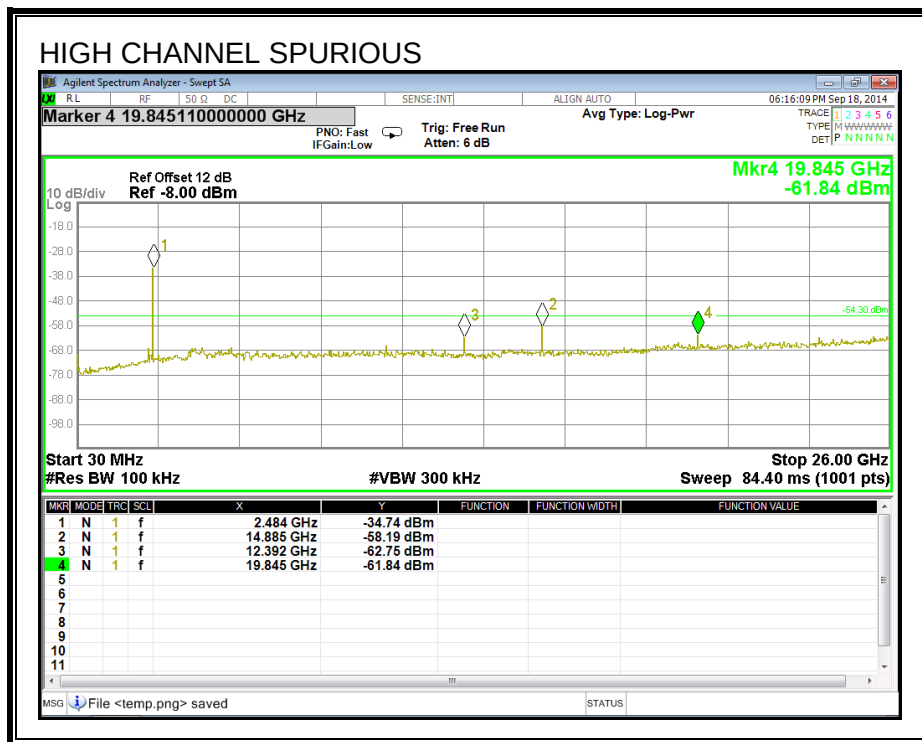
SPURIOUS EMISSIONS, MID CHANNEL



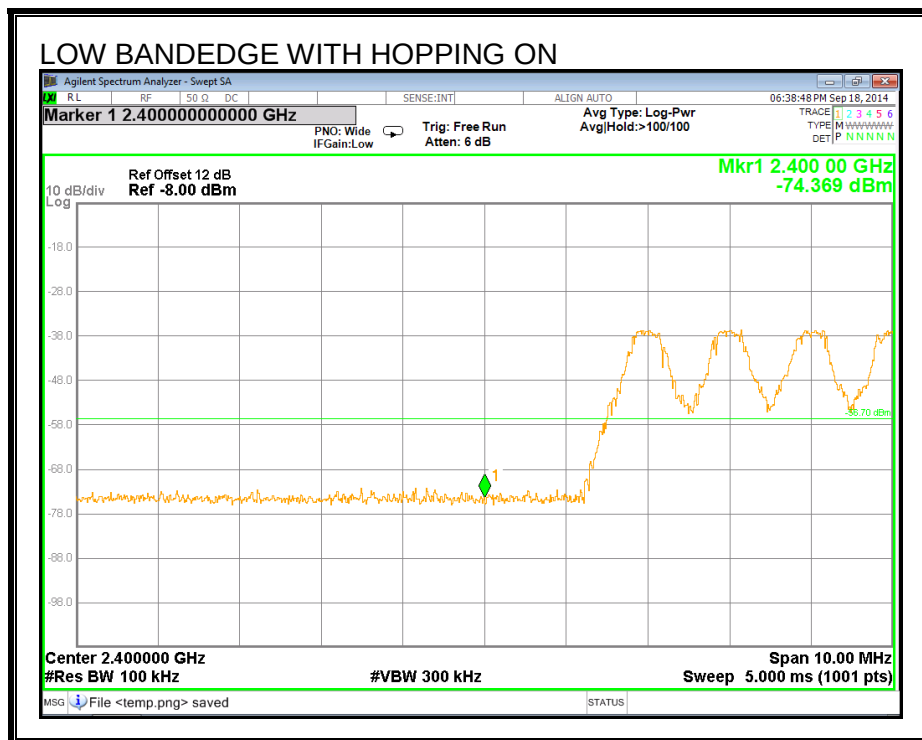


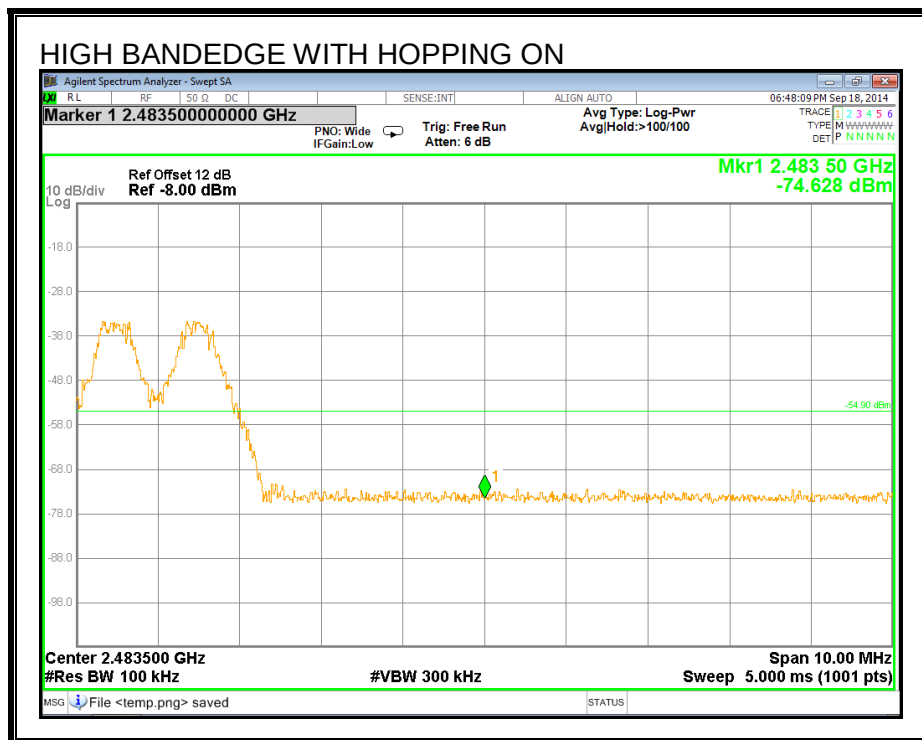
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

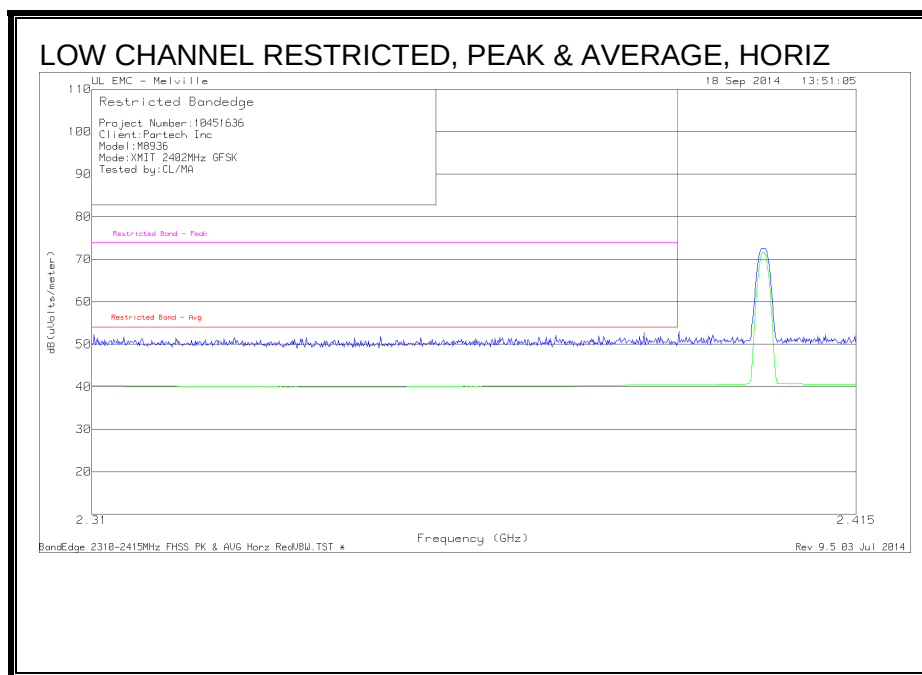
IC RSS-210 Clause 2.6 (Transmitter)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

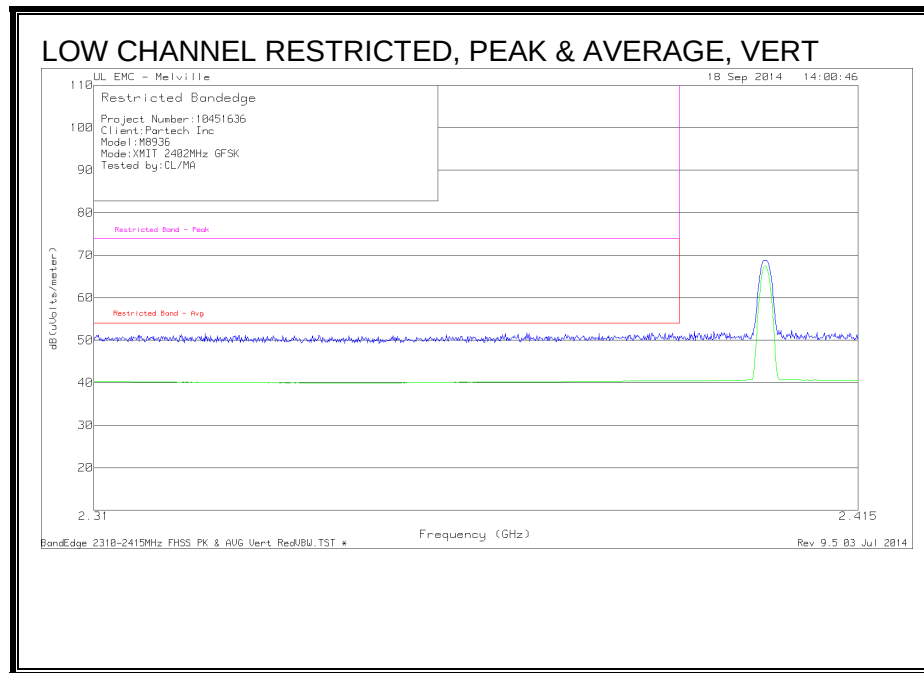
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

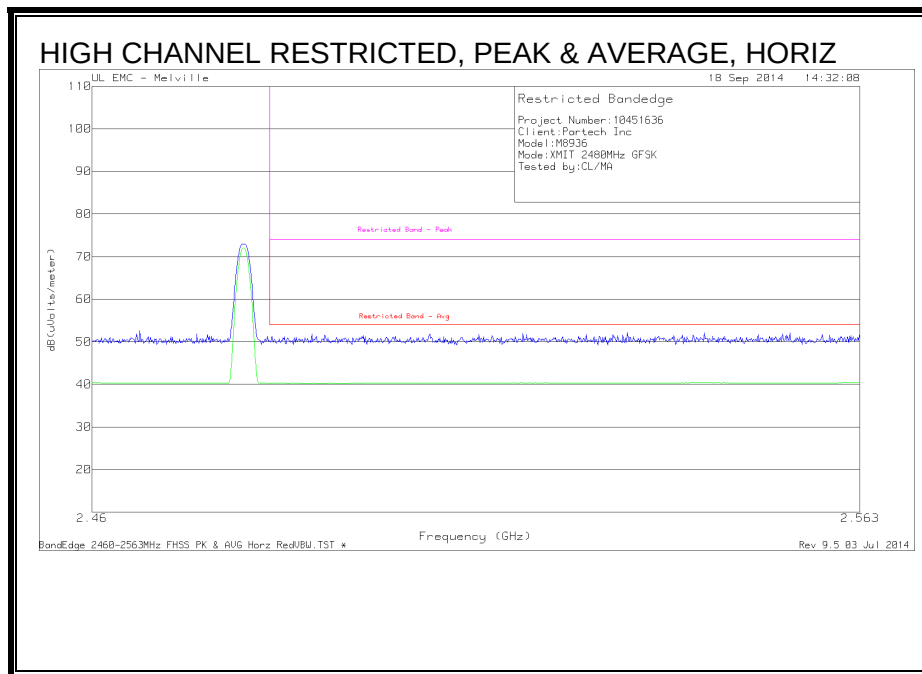
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



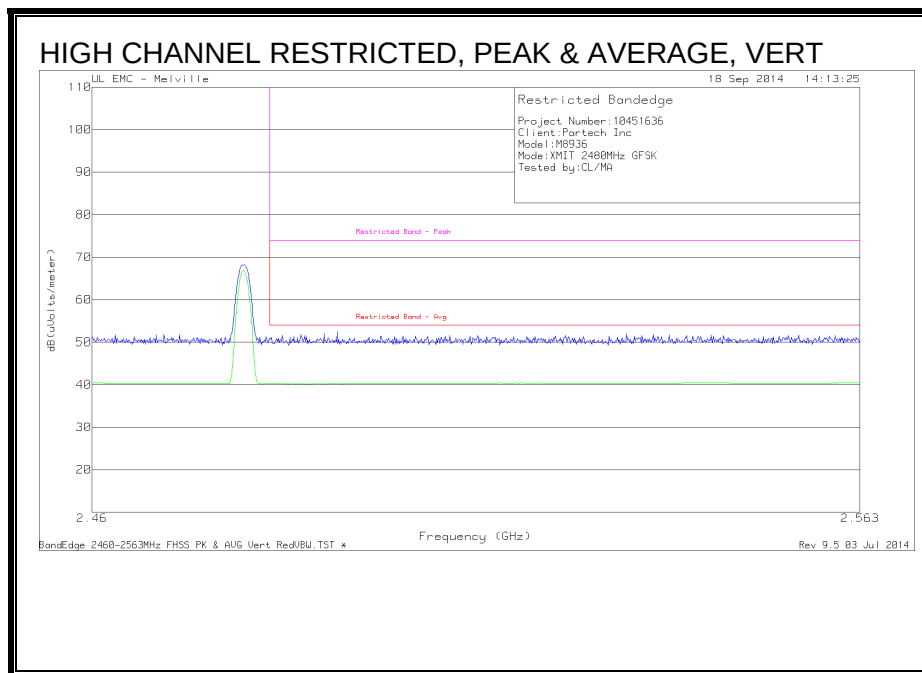
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



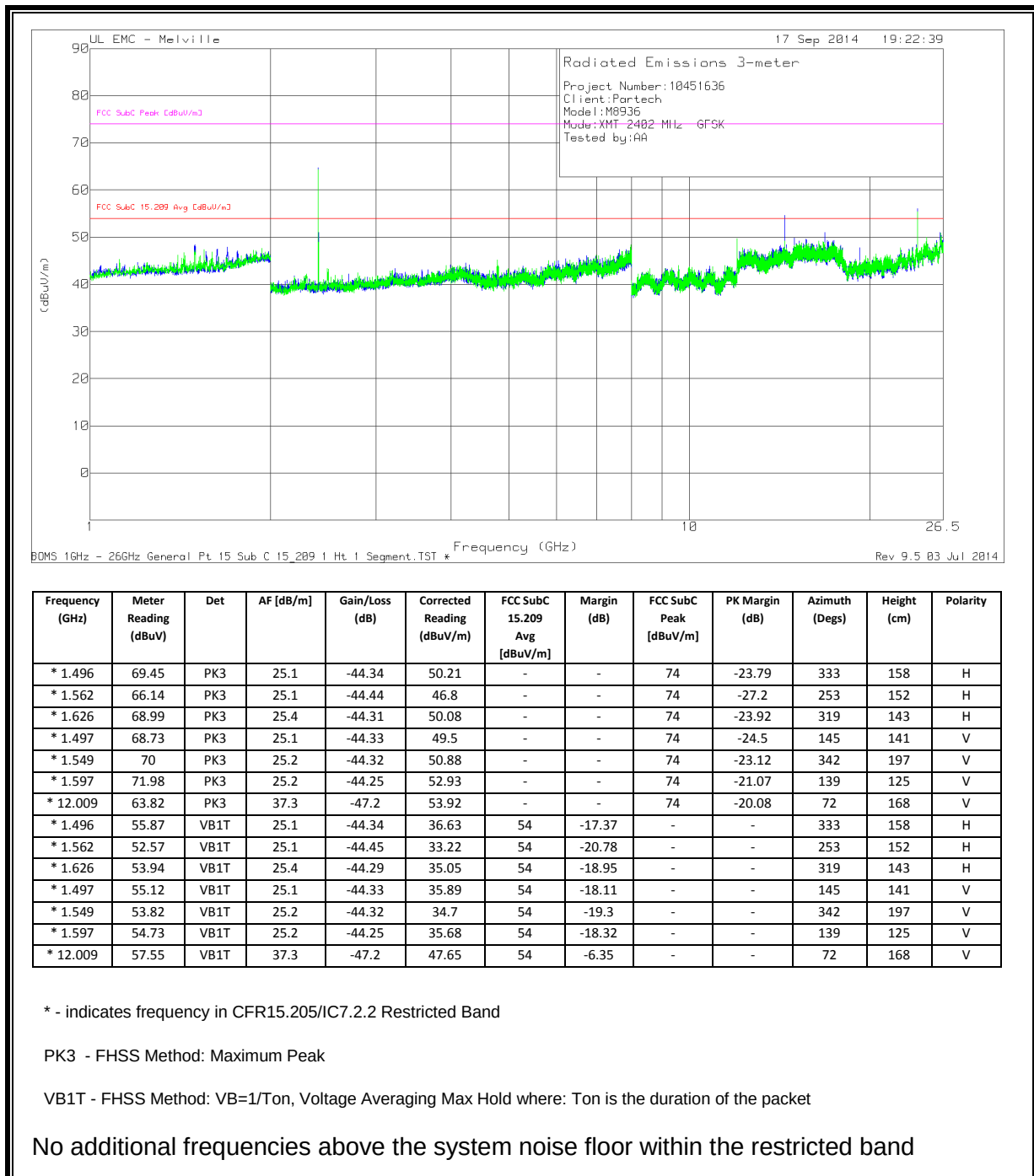
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



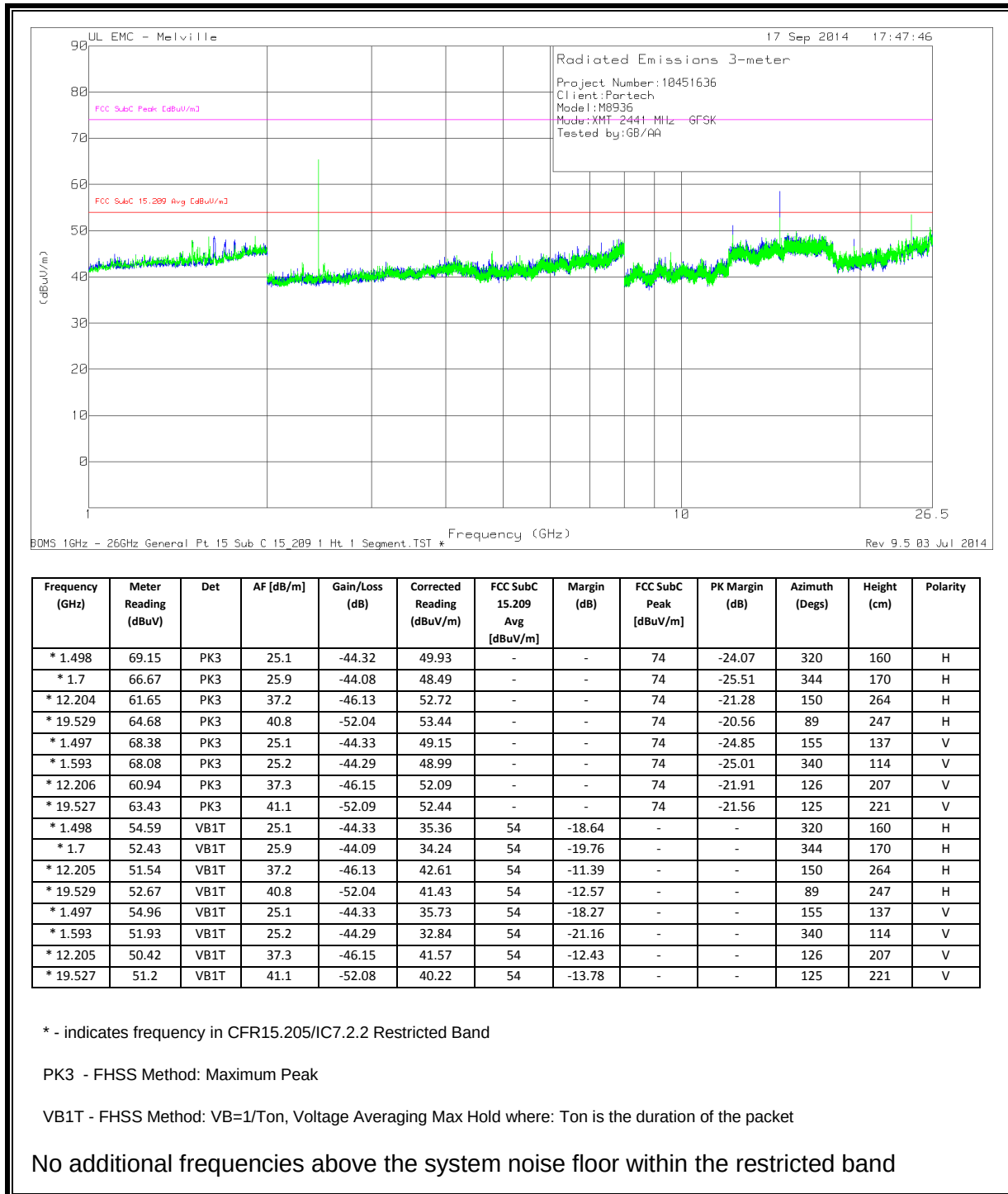
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



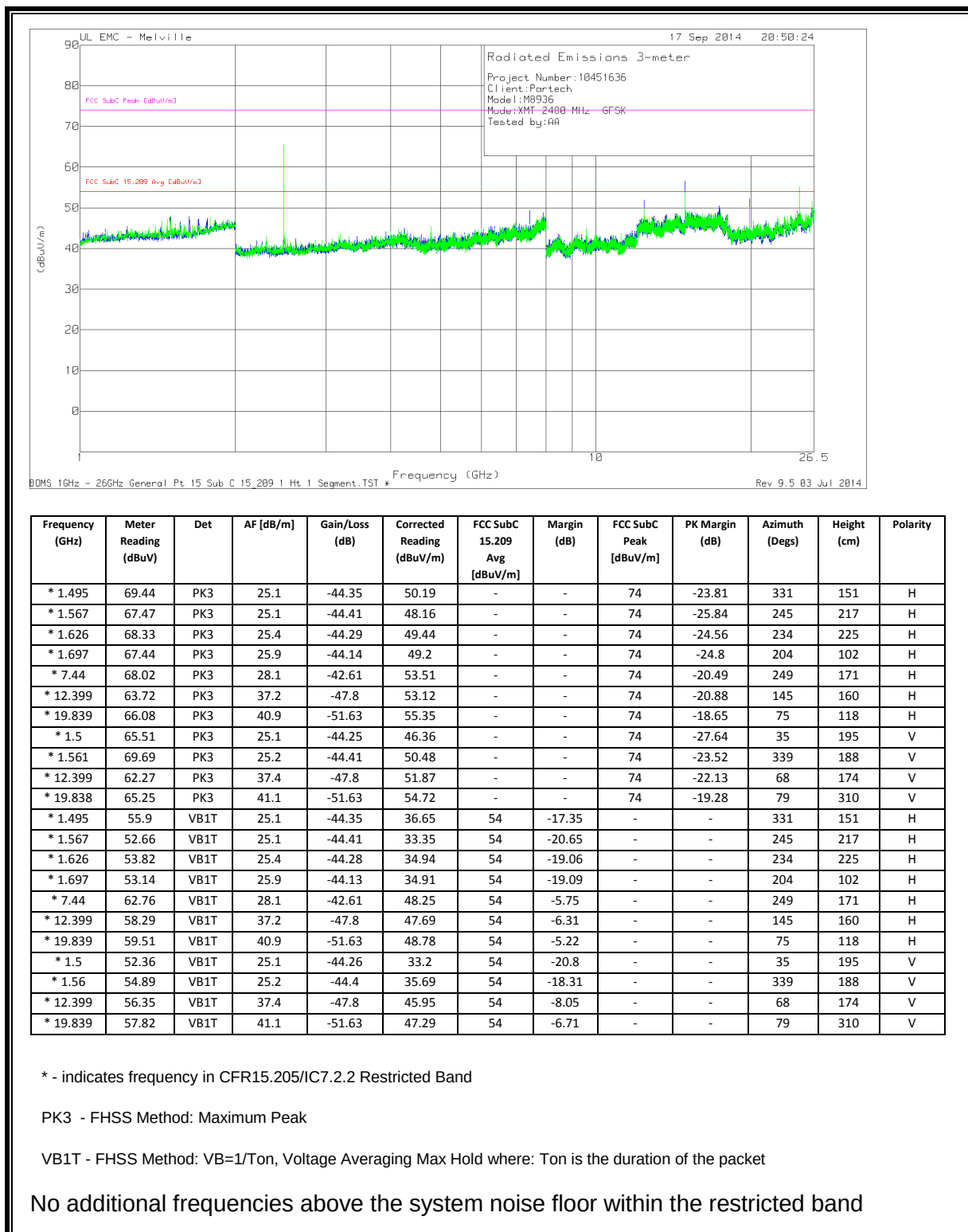
HARMONICS AND SPURIOUS EMISSIONS – LOW CHANNEL



HARMONICS AND SPURIOUS EMISSIONS – MID CHANNEL

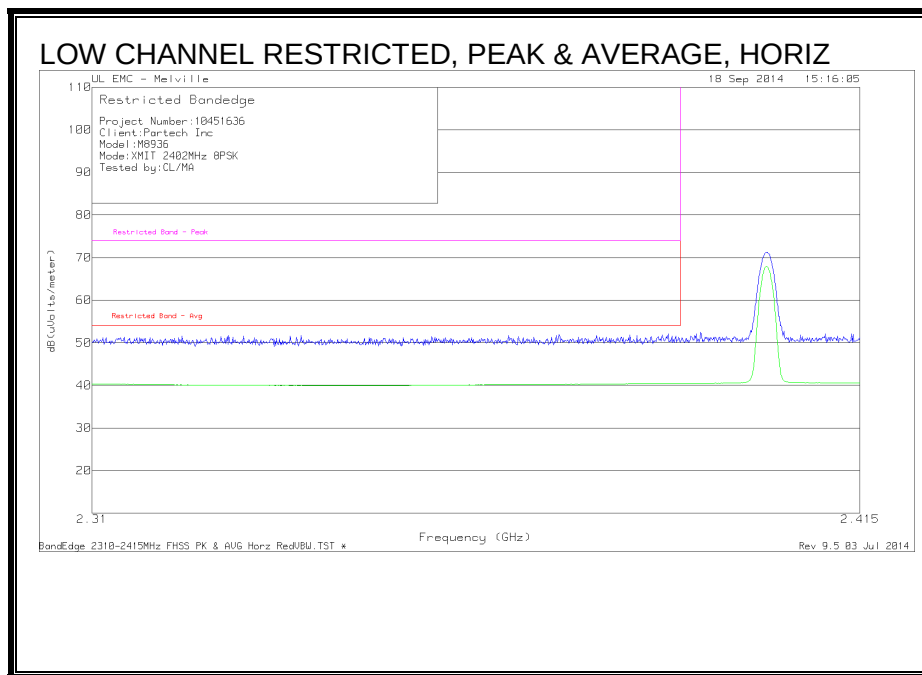


HARMONICS AND SPURIOUS EMISSIONS – HIGH CHANNEL

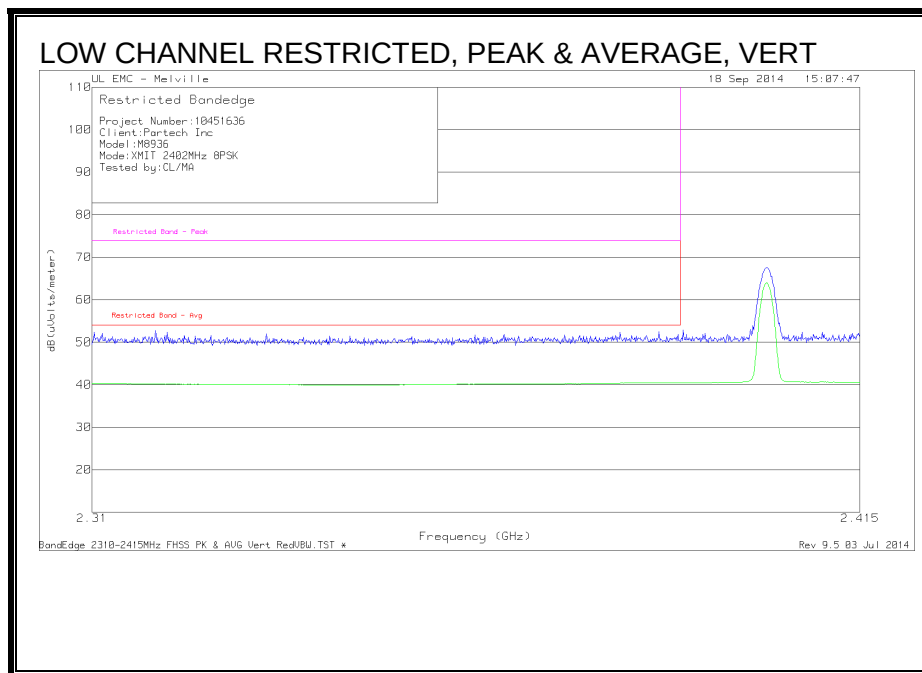


9.2.2. BASIC DATA RATE 8PSK MODULATION

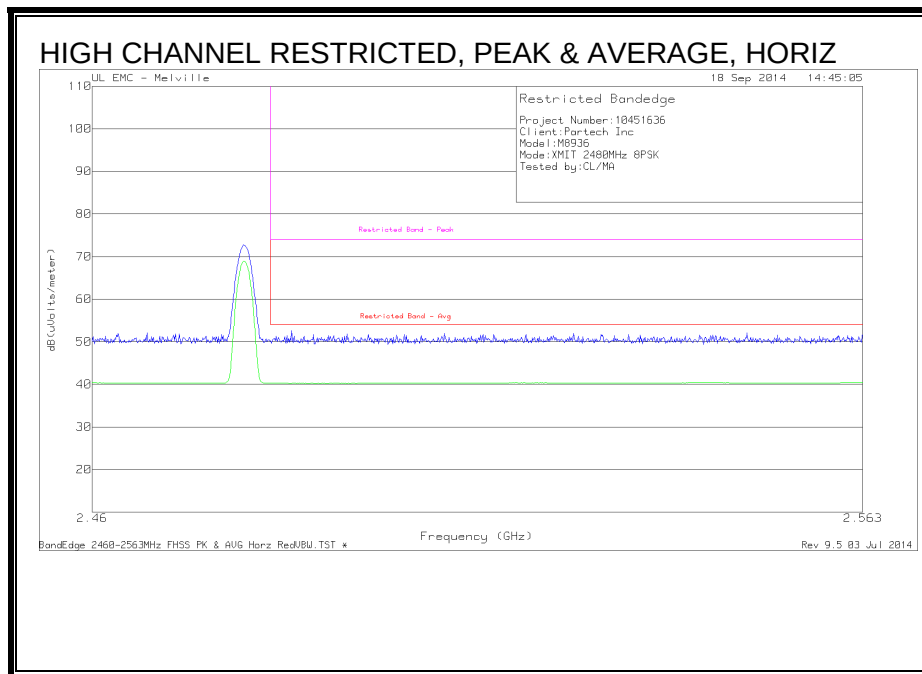
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



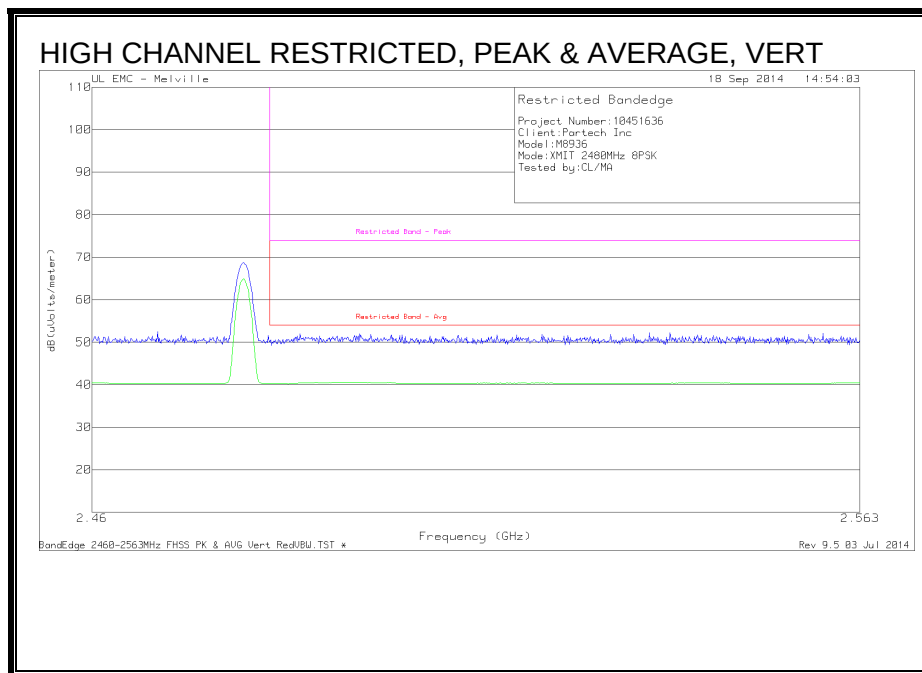
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



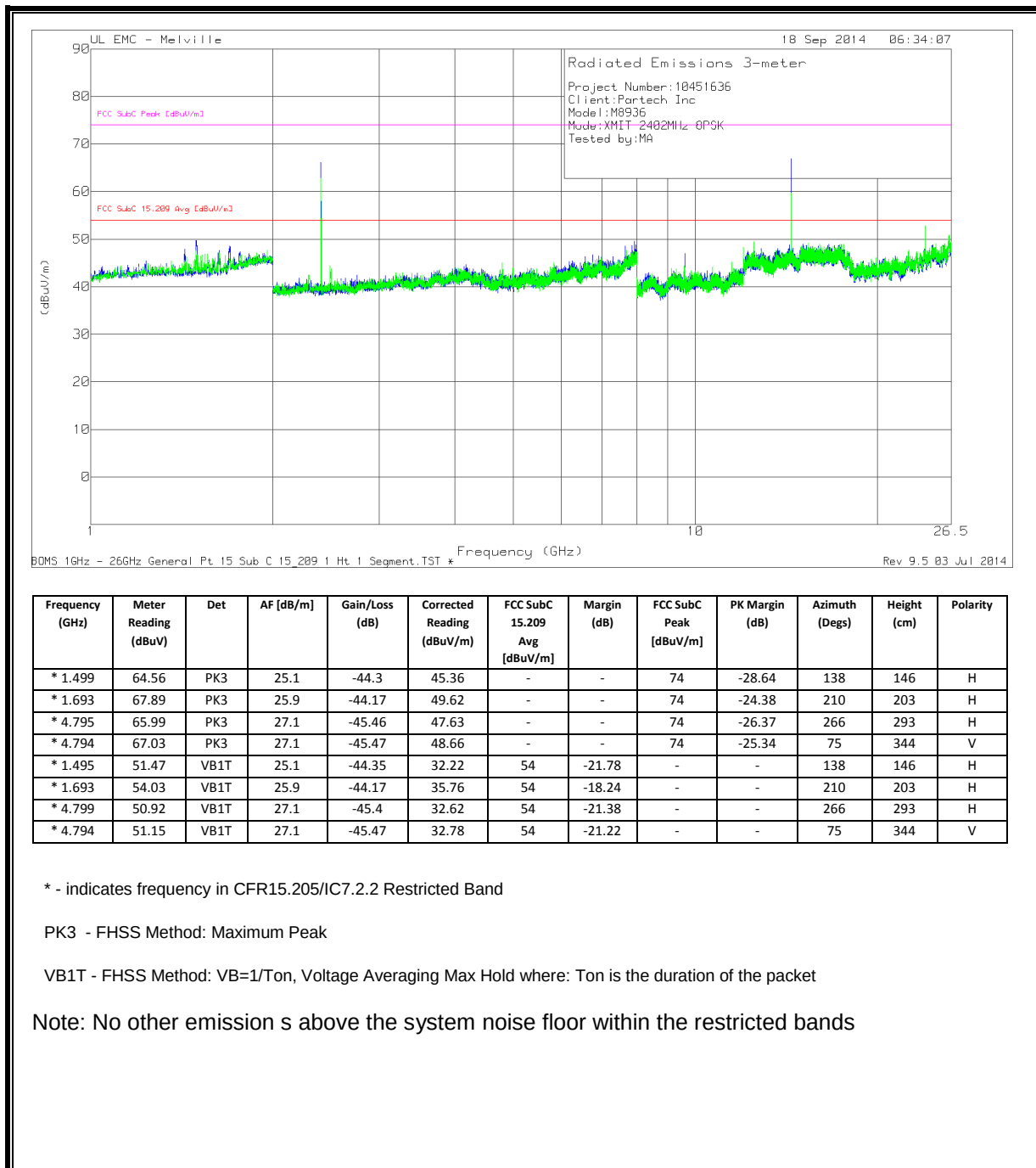
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



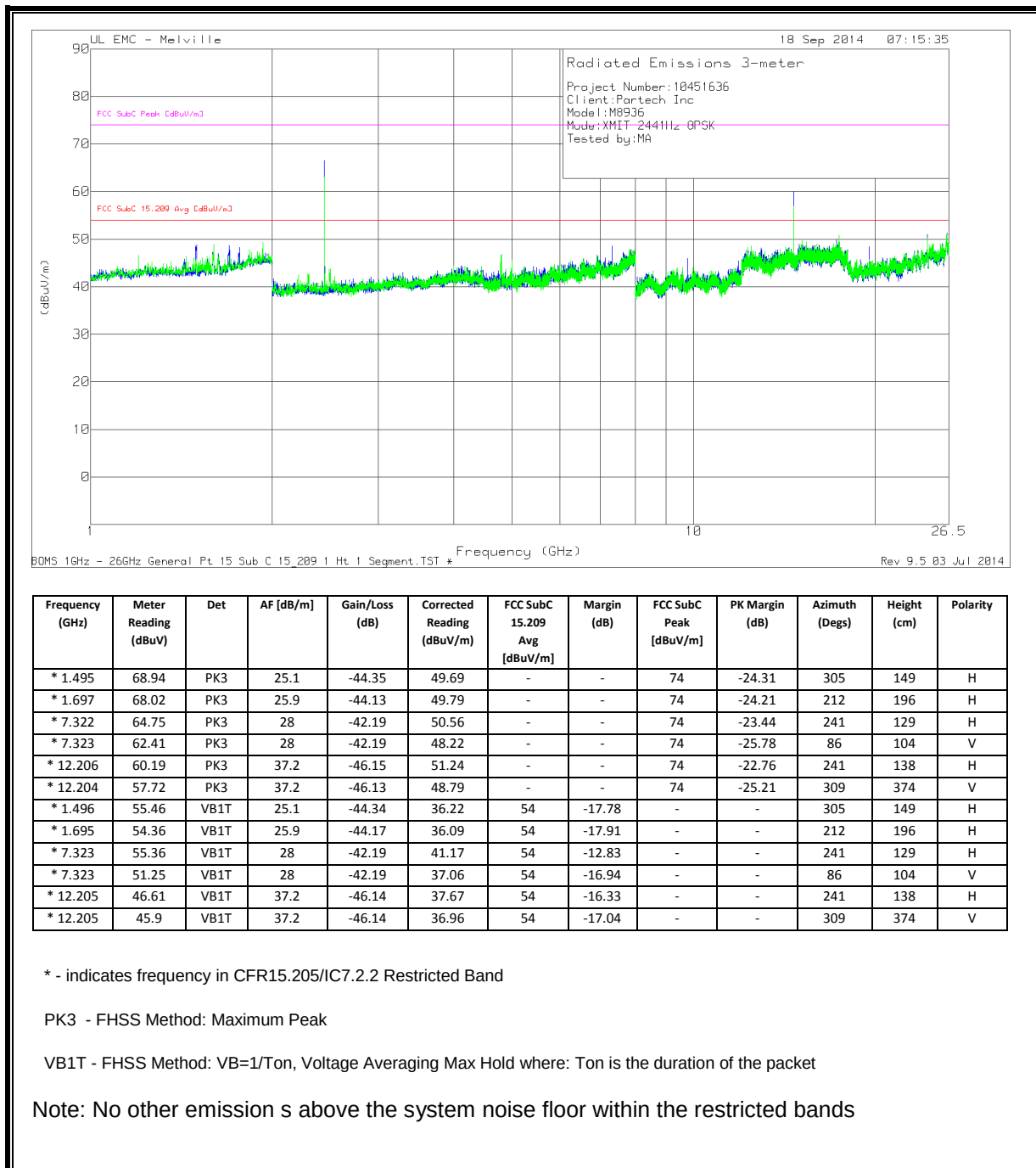
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



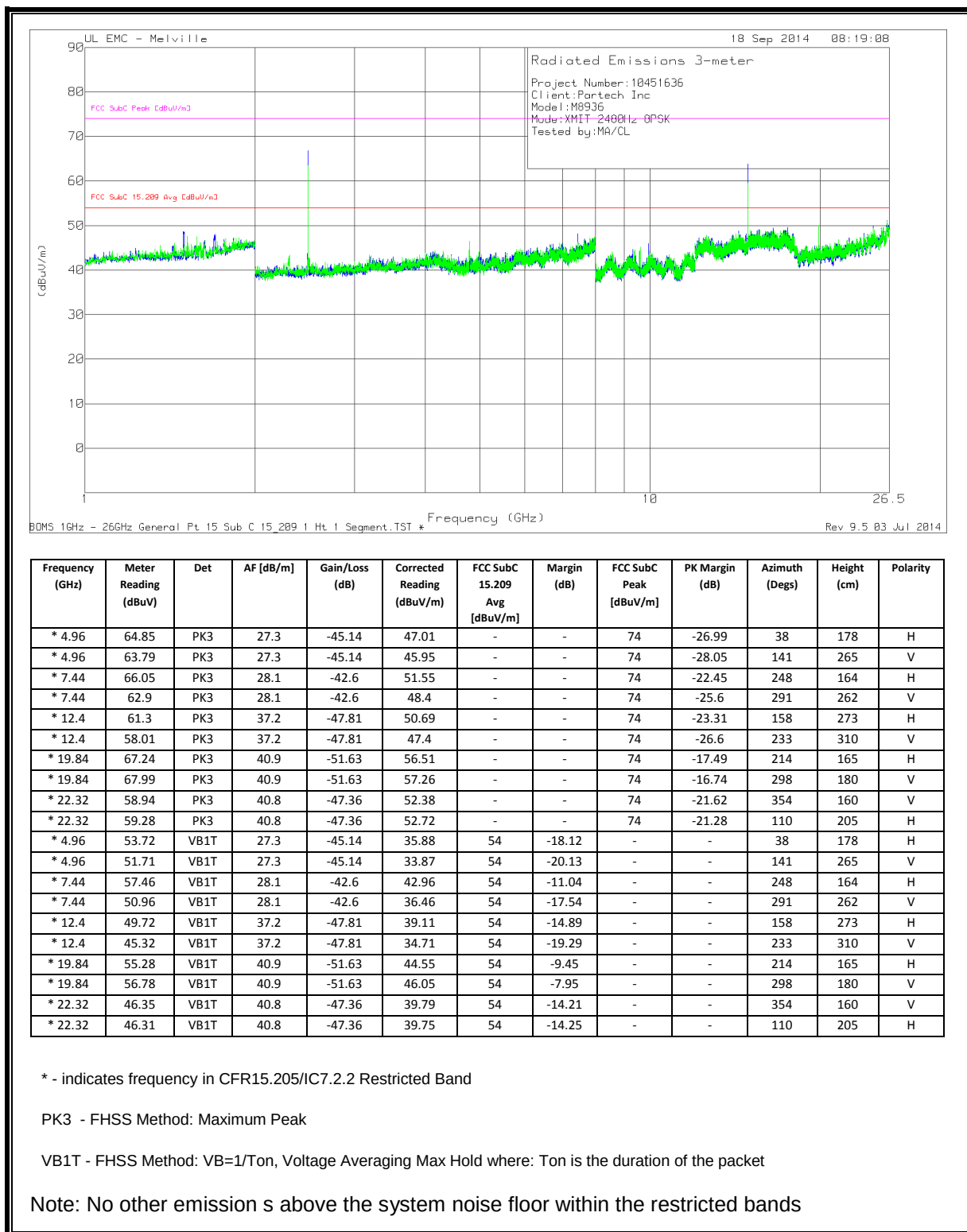
HARMONICS AND SPURIOUS EMISSIONS – LOW CHANNEL



HARMONICS AND SPURIOUS EMISSIONS – MID CHANNEL



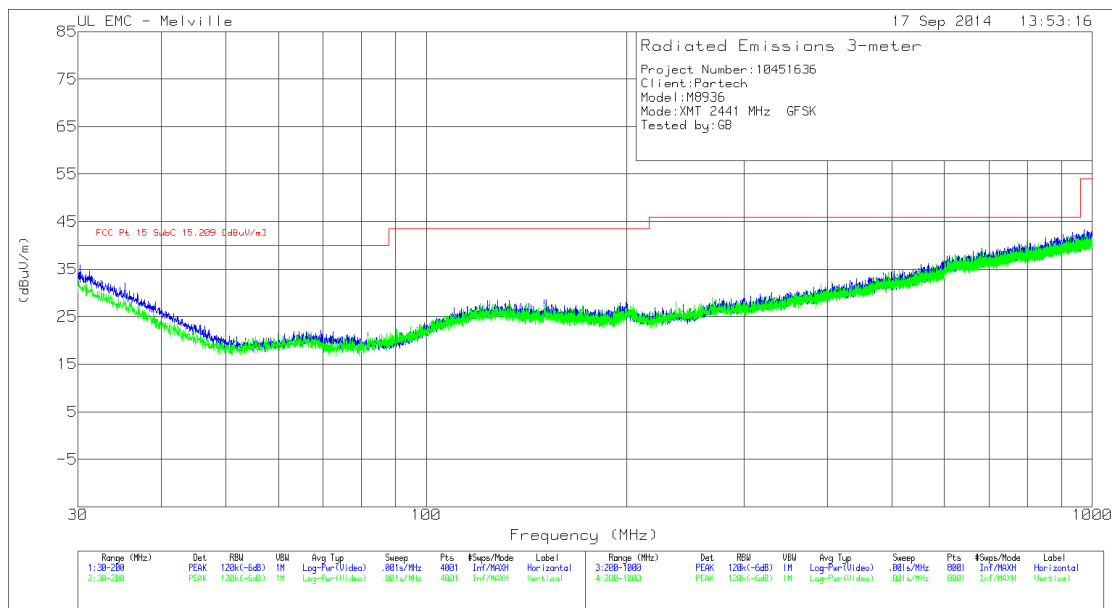
HARMONICS AND SPURIOUS EMISSIONS – HIGH CHANNEL



9.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORSE-CASE GFSK MODE)

HORIZONTAL & VERICAL PLOT



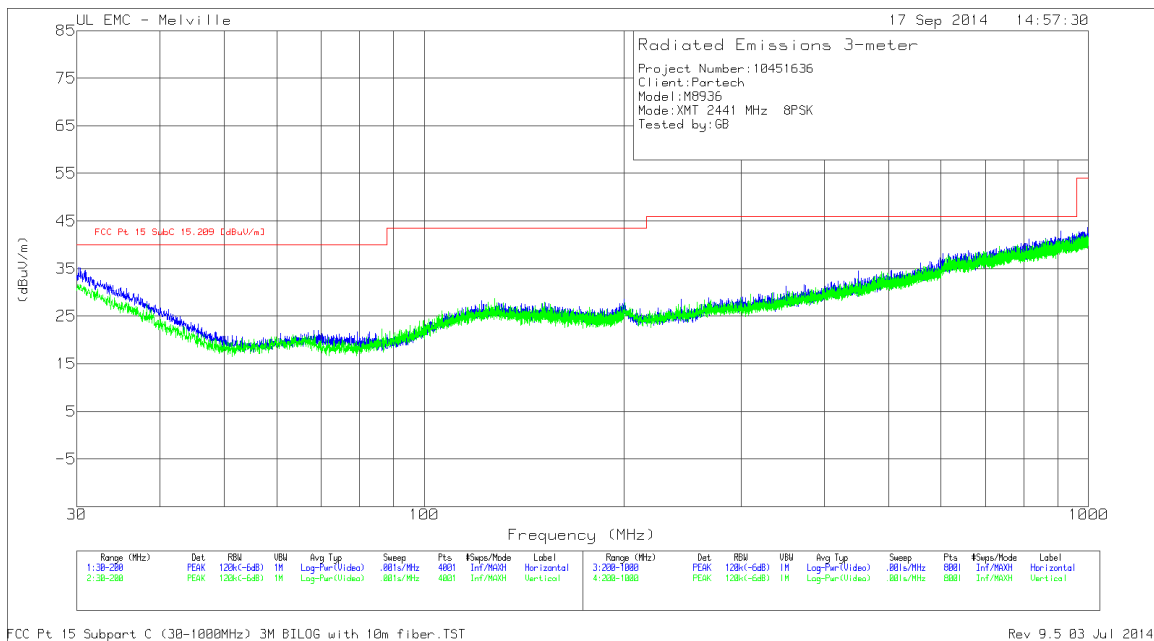
FCC Pt 15 Subpart C (30-1000MHz) 3M BILOG with 10m fiber.TST

Rev 9.5 03 Jul 2014

NOTE: No emissions detected above the system noise floor

SPURIOUS EMISSIONS 30 TO 1000 MHz (OWRSE-CASE 8PSK MODE)

HORIZONTAL & VERTICAL PLOT



NOTE: No emissions detected above the system noise floor

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

Note: Since the fundamental of the RFID module was present on the initial scans, additional scans were performed with the output of the RFID module terminated.

RESULTS

WORST EMISSIONS – CONNECTED THROUGH LAPTOP

Frequency (MHz)	Meter Reading (dBuV)	Det	Line 1 G/L (dB)	Corrected Reading (dBuV)	Class B QPK Limit (dBuV)	Margin (dB)	Class B Avg Limit (dBuV)	Margin (dB)
.15276	20.58	CAV	10	30.58	65.85	-35.27	55.85	-25.27
.15959	20.58	CAV	10	30.58	65.49	-34.91	55.49	-24.91
.19292	36.17	CAV	10	46.17	63.91	-17.74	53.91	-7.74
.20509	35.29	CAV	10	45.29	63.4	-18.11	53.4	-8.11
.26585	34.46	CAV	10	44.46	61.25	-16.79	51.25	-6.79
.27897	25.29	CAV	10	35.29	60.85	-25.56	50.85	-15.56
.29113	17.96	CAV	10	27.96	60.49	-32.53	50.49	-22.53
.31411	21.2	CAV	10	31.2	59.86	-28.66	49.86	-18.66
.32264	21.97	CAV	10	31.97	59.64	-27.67	49.64	-17.67
.33843	22.15	CAV	10	32.15	59.24	-27.09	49.24	-17.09
.34874	14.17	CAV	10	24.17	58.99	-34.82	48.99	-24.82
.37177	12.82	CAV	10	22.82	58.46	-35.64	48.46	-25.64
.3889	17.36	CAV	10	27.36	58.09	-30.73	48.09	-20.73
.4011	17.84	CAV	10	27.84	57.83	-29.99	47.83	-19.99
.40653	17.6	CAV	10	27.6	57.72	-30.12	47.72	-20.12
.412	15.95	CAV	10	25.95	57.61	-31.66	47.61	-21.66
Frequency (MHz)	Meter Reading (dBuV)	Det	Line 2 G/L (dB)	Corrected Reading (dBuV)	Class B QPK Limit (dBuV)	Margin (dB)	Class B Avg Limit (dBuV)	Margin (dB)
.15842	21.04	CAV	10.1	31.14	65.55	-34.41	55.55	-24.41
.17145	20.84	CAV	10	30.84	64.89	-34.05	54.89	-24.05
.18073	21.52	CAV	10	31.52	64.45	-32.93	54.45	-22.93
.19731	35.92	CAV	10	45.92	63.72	-17.8	53.72	-7.8
.20481	34.66	CAV	10	44.66	63.41	-18.75	53.41	-8.75
.25356	26.77	CAV	10	36.77	61.64	-24.87	51.64	-14.87
.274	28.22	CAV	10	38.22	61	-22.78	51	-12.78
.28092	25.68	CAV	10	35.68	60.79	-25.11	50.79	-15.11
.30208	17.72	CAV	10	27.72	60.19	-32.47	50.19	-22.47
.31182	21.82	CAV	10	31.82	59.92	-28.1	49.92	-18.1
.31823	25.09	CAV	10	35.09	59.75	-24.66	49.75	-14.66
.32473	25.29	CAV	10	35.29	59.58	-24.29	49.58	-14.29
.3369	24.73	CAV	10	34.73	59.28	-24.55	49.28	-14.55
.36342	8.92	CAV	10	18.92	58.65	-39.73	48.65	-29.73
.38795	17.48	CAV	10	27.48	58.11	-30.63	48.11	-20.63
.39585	17.17	CAV	10.1	27.27	57.94	-30.67	47.94	-20.67

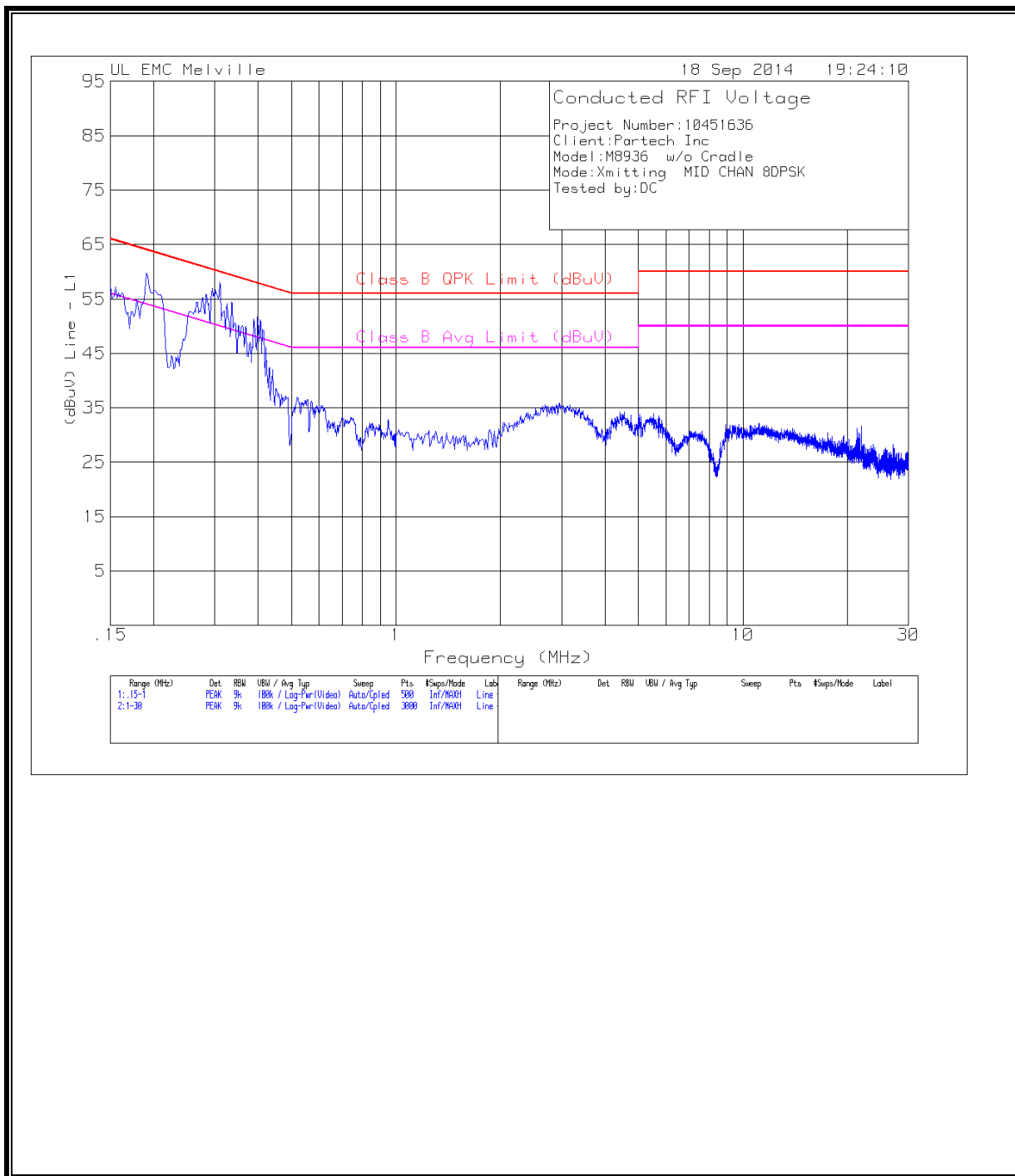
CAV - CISPR average detection

WORST EMISSIONS – CONNECTED THROUGH LAPTOP (CONT)

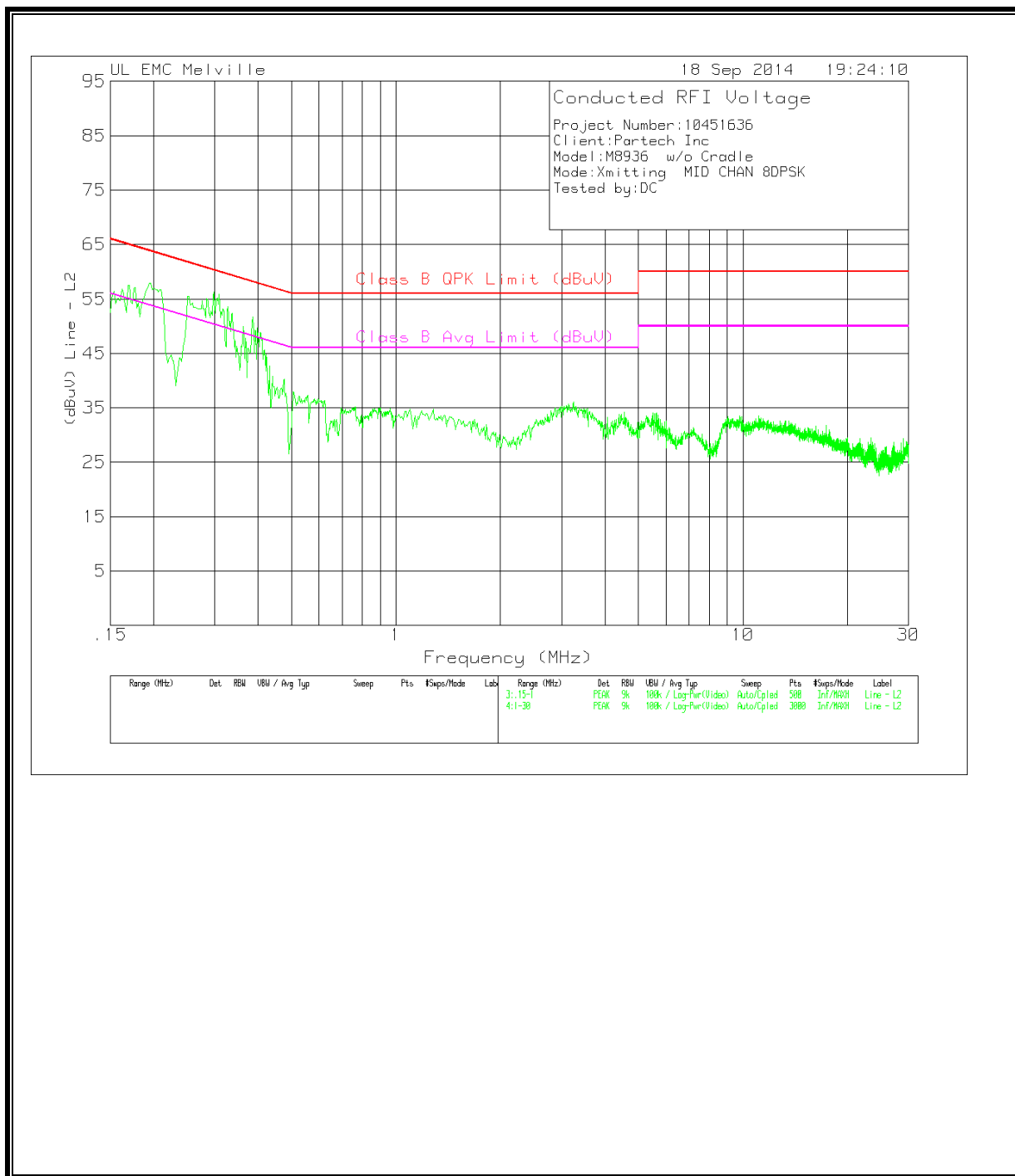
Frequency (MHz)	Meter Reading (dBuV)	Det	Line 1 G/L (dB)	Corrected Reading (dBuV)	Class B QPK Limit (dBuV)	Margin (dB)	Class B Avg Limit (dBuV)	Margin (dB)
.192895	42.55	QP	10	52.55	63.91	-11.36	53.91	-1.36
.279427	36.45	QP	10	46.45	60.83	-14.38	50.83	-4.38
.293925	38.67	QP	10	48.67	60.41	-11.74	50.41	-1.74
.313568	36.54	QP	10	46.54	59.88	-13.34	49.88	-3.34
.323313	36.26	QP	10	46.26	59.62	-13.36	49.62	-3.36
.335525	36.45	QP	10	46.45	59.31	-12.86	49.31	-2.86
.399908	30.75	QP	10	40.75	57.86	-17.11	47.86	-7.11
Frequency (MHz)	Meter Reading (dBuV)	Det	Line 2 G/L (dB)	Corrected Reading (dBuV)	Class B QPK Limit (dBuV)	Margin (dB)	Class B Avg Limit (dBuV)	Margin (dB)
.192798	41.97	QP	10	51.97	63.92	-11.95	53.92	-1.95
.280598	35.78	QP	10	45.78	60.8	-15.02	50.8	-5.02
.302118	37.5	QP	10	47.5	60.18	-12.68	50.18	-2.68
.312243	37.26	QP	10	47.26	59.91	-12.65	49.91	-2.65
.32458	36.9	QP	10	46.9	59.59	-12.69	49.59	-2.69

QP - Quasi-Peak detector

LINE 1 RESULTS – CONNECTED THROUGH LAPTOP



LINE 2 RESULTS – CONNECTED THROUGH LAPTOP



WORST EMISSIONS – WITH ANTENNA CONNECTED

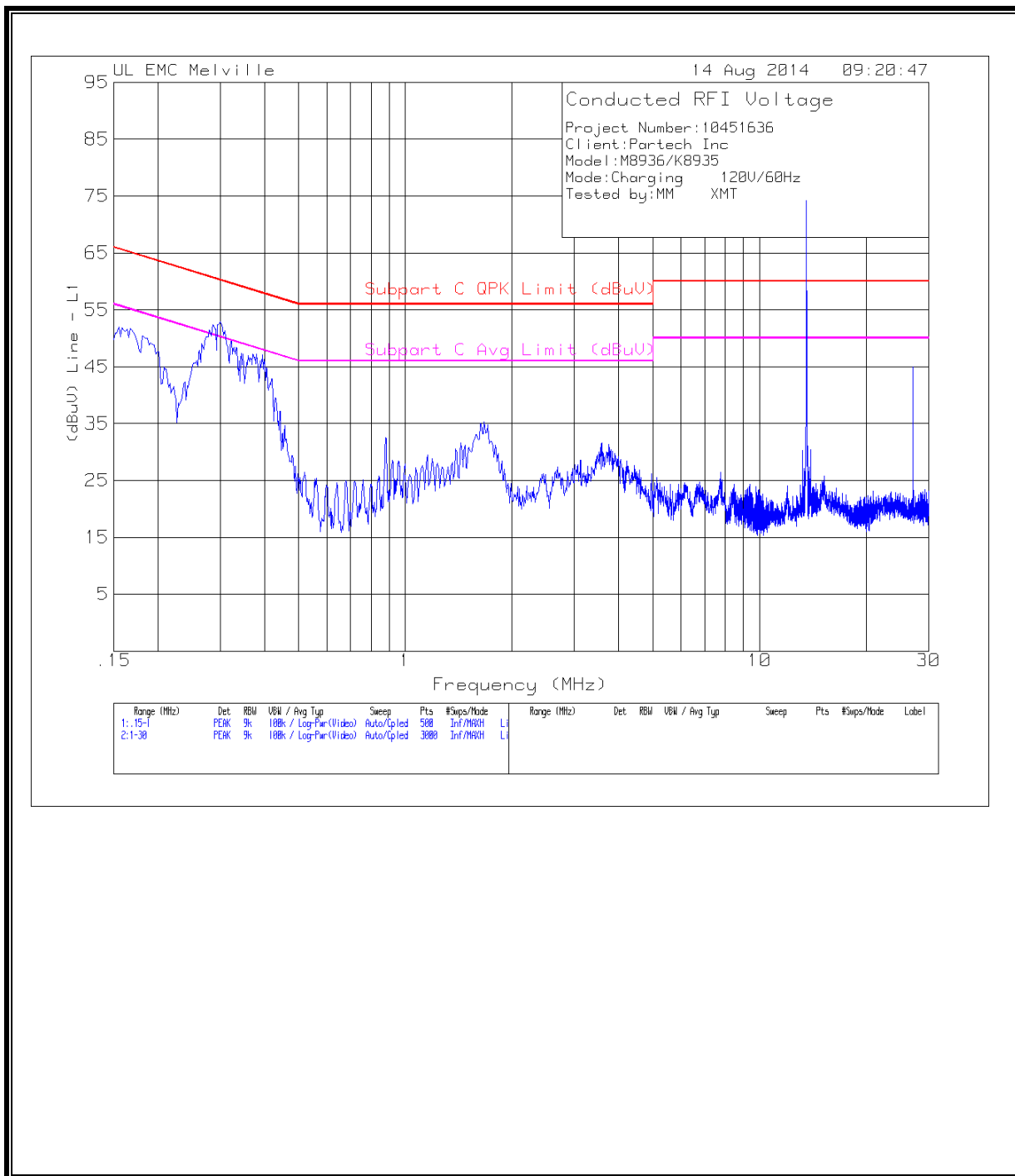
Frequency (MHz)	Meter Reading (dBuV)	Det	Line 1 G/L (dB)	Corrected Reading (dBuV)	Subpart C QPK Limit (dBuV)	Margin (dB)	Subpart C Avg Limit (dBuV)	Margin (dB)
.163753	16.16	CAV	10	26.16	-	-	55.27	-29.11
.27783	16.09	CAV	10	26.09	-	-	50.88	-24.79
.28716	14.61	CAV	10	24.61	-	-	50.61	-26
.317873	14.35	CAV	10	24.35	-	-	49.76	-25.41
.343743	8.41	CAV	10	18.41	-	-	49.11	-30.7
.378083	7.3	CAV	10	17.3	-	-	48.32	-31.02
13.5597	58.88	CAV	10.8	69.68	-	-	50	19.68
27.119125	20.19	CAV	11.8	31.99	-	-	50	-18.01
Frequency (MHz)	Meter Reading (dBuV)	Det	Line 2 G/L (dB)	Corrected Reading (dBuV)	Subpart C QPK Limit (dBuV)	Margin (dB)	Subpart C Avg Limit (dBuV)	Margin (dB)
.175323	14.43	CAV	10	24.43	-	-	54.7	-30.27
.269303	11.08	CAV	10	21.08	-	-	51.14	-30.06
.290325	13.71	CAV	10	23.71	-	-	50.52	-26.81
.337788	8.41	CAV	10	18.41	-	-	49.26	-30.85
.379048	7.1	CAV	10	17.1	-	-	48.3	-31.2
13.559725	55.58	CAV	10.9	66.48	-	-	50	16.48
27.11955	15.8	CAV	11.9	27.7	-	-	50	-22.3

CAV - CISPR average detection

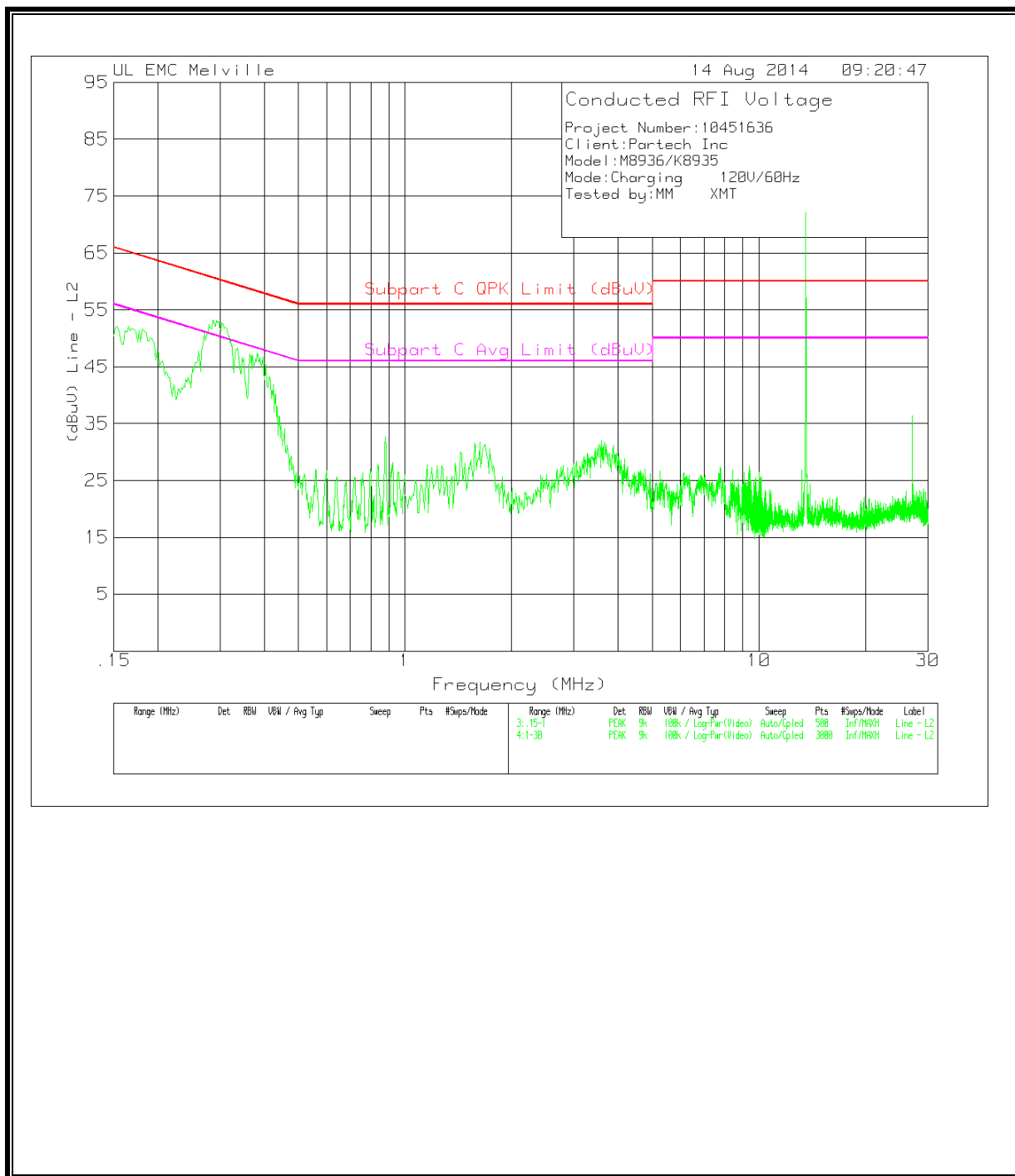
Frequency (MHz)	Meter Reading (dBuV)	Det	Line 1 G/L (dB)	Corrected Reading (dBuV)	Subpart C QPK Limit (dBuV)	Margin (dB)	Subpart C Avg Limit (dBuV)	Margin (dB)
.163753	33.67	QP	10	43.67	65.27	-21.6	-	-
.27783	33.13	QP	10	43.13	60.88	-17.75	-	-
.28716	34.83	QP	10	44.83	60.61	-15.78	-	-
.317873	31.37	QP	10	41.37	59.76	-18.39	-	-
.343743	27.65	QP	10	37.65	59.11	-21.46	-	-
.378083	27.69	QP	10	37.69	58.32	-20.63	-	-
13.5597	63.2	QP	10.8	74	60	14	-	-
27.119125	31.03	QP	11.8	42.83	60	-17.17	-	-
Frequency (MHz)	Meter Reading (dBuV)	Det	Line 2 G/L (dB)	Corrected Reading (dBuV)	Subpart C QPK Limit (dBuV)	Margin (dB)	Subpart C Avg Limit (dBuV)	Margin (dB)
.175323	34.05	QP	10	44.05	64.7	-20.65	-	-
.269303	31.34	QP	10	41.34	61.14	-19.8	-	-
.290325	35.27	QP	10	45.27	60.52	-15.25	-	-
.337788	28.29	QP	10	38.29	59.26	-20.97	-	-
.379048	27.58	QP	10	37.58	58.3	-20.72	-	-
13.559725	59.68	QP	10.9	70.58	60	10.58	-	-
27.11955	23.92	QP	11.9	35.82	60	-24.18	-	-

QP - Quasi-Peak detector

LINE 1 RESULTS – WITH ANTENNA CONNECTED



LINE 2 RESULTS – WITH ANTENNA CONNECTED

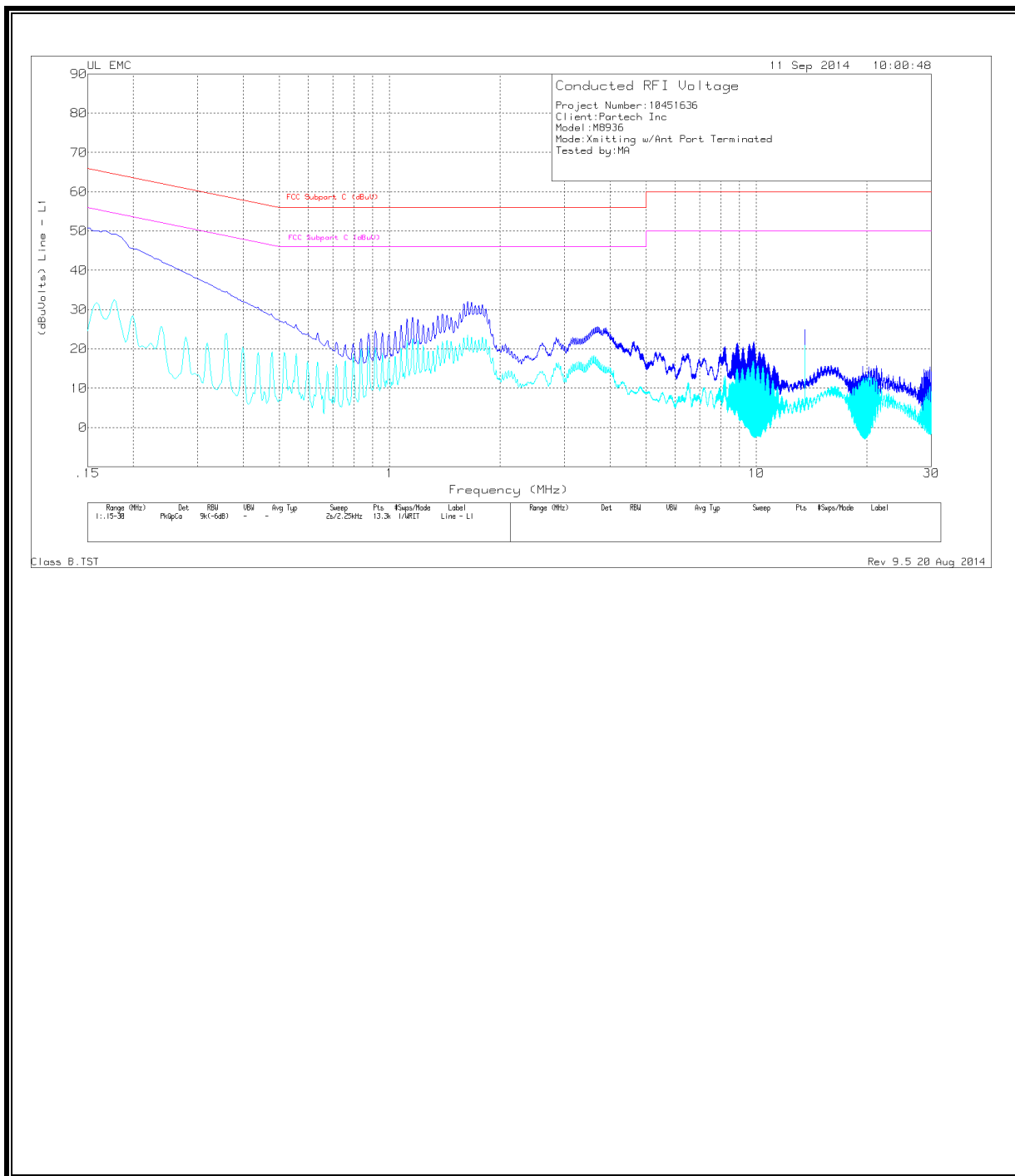


WORST EMISSIONS – WITH ANTENNA PORT TERMINATED

Frequency (MHz)	Meter Reading (dBuV)	Det	K1SWTL (dB)	Corrected Reading (dBuVolts)	FCC Subpart C QPk (dBuV)	QP Margin (dB)	FCC Subpart C Avg (dBuV)	Av(CISPR)Margin (dB)
.15225	17.29	Ca	10	27.29	-	-	55.88	-28.59
.18825	13.13	Ca	10	23.13	-	-	54.11	-30.98
.28275	9.46	Ca	10	19.46	-	-	50.73	-31.27
1.671	12.78	Ca	10.1	22.88	-	-	46	-23.12
13.56	10.62	Ca	10.3	20.92	-	-	50	-29.08
27.1185	-5.06	Ca	10.5	5.44	-	-	50	-44.56
.15225	40.78	Qp	10	50.78	65.88	-15.1	-	-
.18825	37.78	Qp	10	47.78	64.11	-16.33	-	-
.28275	28.94	Qp	10	38.94	60.73	-21.79	-	-
1.671	21.7	Qp	10.1	31.8	56	-24.2	-	-
13.56	14.65	Qp	10.3	24.95	60	-35.05	-	-
27.1185	-.02	Qp	10.5	10.48	60	-49.52	-	-
Frequency (MHz)	Meter Reading (dBuV)	Det	K2SWTL (dB)	Corrected Reading (dBuVolts)	FCC Subpart C QPk (dBuV)	QP Margin (dB)	FCC Subpart C Avg (dBuV)	Av(CISPR)Margin (dB)
.16125	18.23	Ca	10	28.23	-	-	55.4	-27.17
.27375	6.47	Ca	10	16.47	-	-	51	-34.53
1.6305	9.66	Ca	10.1	19.76	-	-	46	-26.24
3.75	3.56	Ca	10.1	13.66	-	-	46	-32.34
13.56	7.96	Ca	10.3	18.26	-	-	50	-31.74
26.36925	-6.61	Ca	10.5	3.89	-	-	50	-46.11
.16125	42.01	Qp	10	52.01	65.4	-13.39	-	-
.27375	32.6	Qp	10	42.6	61	-18.4	-	-
1.6305	18.17	Qp	10.1	28.27	56	-27.73	-	-
3.75	14.41	Qp	10.1	24.51	56	-31.49	-	-
13.56	10.93	Qp	10.3	21.23	60	-38.77	-	-
26.36925	-1.77	Qp	10.5	8.73	60	-51.27	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 1 RESULTS – WITH ANTENNA PORT TERMINATED



LINE 2 RESULTS – WITH ANTENNA PORT TERMINATED

