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

CERTIFICATION TEST REPORT

FOR

Base

MODEL NUMBER: IWL200

FCC ID: XKB-IWLBBB
IC: 2586D-IWLBBB

REPORT NUMBER: 10343507C

ISSUE DATE: August 18, 2014

Prepared for
Ingenico SA
9, Avenue de la gare
Rovaltain TGV
26958 Valence Cedex 9 - France

Prepared by
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Revision History

Rev.	Issue Date	Revisions	Revised By
--	08/18/14	Initial Issue	M.Ferrer

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Ingenico SA
9, Avenue de la gare
Rovaltain TGV
26958 Valence Cedex 9 - France

EUT DESCRIPTION: Bluetooth Transmitter

MODEL: Base

SERIAL NUMBER: N/A

DATE TESTED: June 1, 2014 – August 18, 2014

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 Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By:

BART MUCHA
Staff Engineer
UL Verification Services Inc.

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UL Verification Services Inc.

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 333 Pfingsten Road, Northbrook, IL 60062 USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0.

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

Sample Calculations
Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)
Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)
Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

4.3. MEASUREMENT UNCERTAINTY

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

Test	Range	Equipment	Uncertainty k=2
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB
Radiated Emissions	18-26GHz	Horn	6.60dB
Conducted Ant Port	30MHz-26GHz	Spectrum Analyzer	2.94

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Bluetooth transceiver. The unit is AC powered.

The radio module is manufactured by Ingenico.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	4.14	2.59
2402 - 2480	Enhanced QPSK	2.33	1.71
2402 - 2480	Enhanced 8PSK	2.78	1.90

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an IFA antenna, with a maximum gain of 1.1 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

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

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Use	Product Type	Manufacturer	Model	Comments
EUT	Terminal	Ingenico	IWL252	None
EUT	Base	Ingenico	IWL200	None
EUT	Power Supply	Ingenico	192011331	None
EUT	Battery	Intenico	L01J44006	None
Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)				

I/O CABLES

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	AC	Y	N	None
2	USB	IO	Y	Y	None
3	Ethernet	TP	Y	N	None
4	Phone	TP	Y	N	None

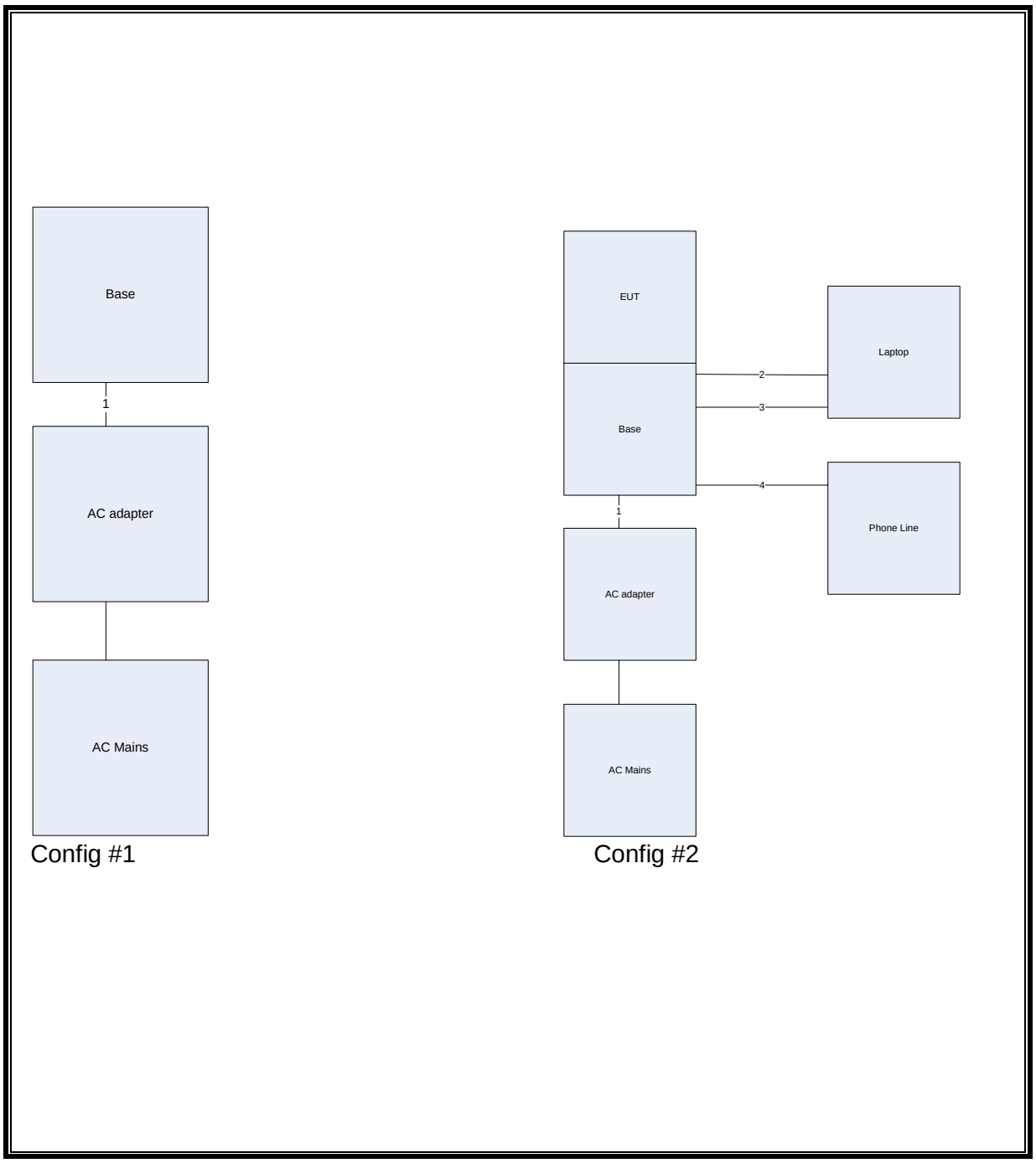
Note:
AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

TEST SETUP

The EUT contains transmitter internal and is the end product. The EUT was put into a BT mode to communicate with a BT call box. The call box was used to set channels, modulations and hopping modes.

Config #1 is EUT in AC powered
Config #2 is EUT in digital mode with all IO ports populated

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	Asset	Cal Date	Cal Due
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20131220	20141231
Bicon Antenna	Chase	VBA6106A	EMC4078	20140401	20150401
Log-P Antenna	Schaffner	UPA6109	EMC4313	20131003	20141003
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20131217	20141231
Antenna Array	UL	BOMS	EMC4276	20121227	20141231
EMI Test Receiver	Agilent	N9030A	EMC4360	20131221	20141221
Antenna	ETS	1003	N/A	N/A	N/A
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	20131217	20141231
LISN	Solar	8602-50-TS-50-N	EMC4052	20140116	20150116
LISN	Solar	8602-50-TS-50-N	EMC4064	20140116	20150116

7. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

7.1. ON TIME AND DUTY CYCLE RESULTS

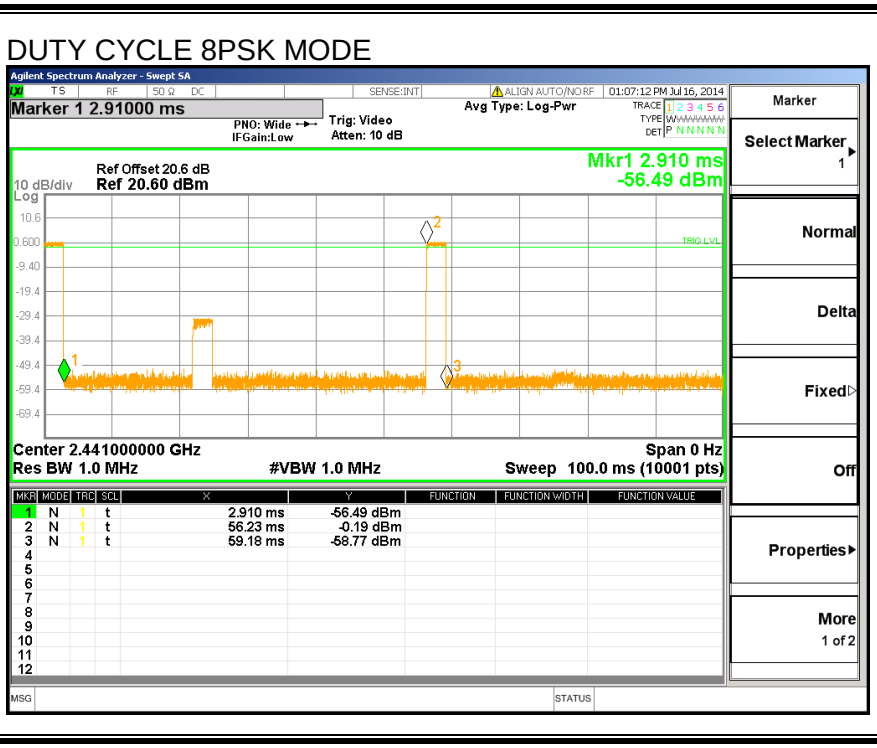
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping ON)						
Bluetooth GFSK	5.820	100	0.058	5.82%	24.70	N/A
Bluetooth 8PSK	5.050	100	0.051	5.05%	25.93	N/A

7.2. DUTY CYCLE PLOTS

HOPPING ON

DUTY CYCLE GFSK MODE

DUTY CYCLE 8PSK MODE



8. ANTENNA PORT TEST RESULTS

Antenna port results will be leverage using results from Terminal ant port testing report #10343507B as seen below.

8.1. BASIC DATA RATE GFSK MODULATION

8.1.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

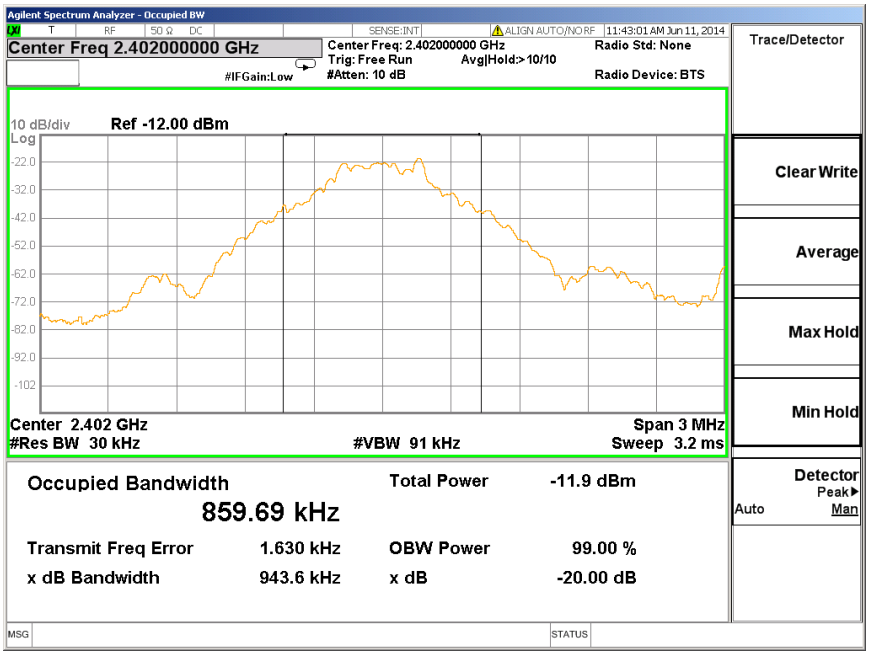
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

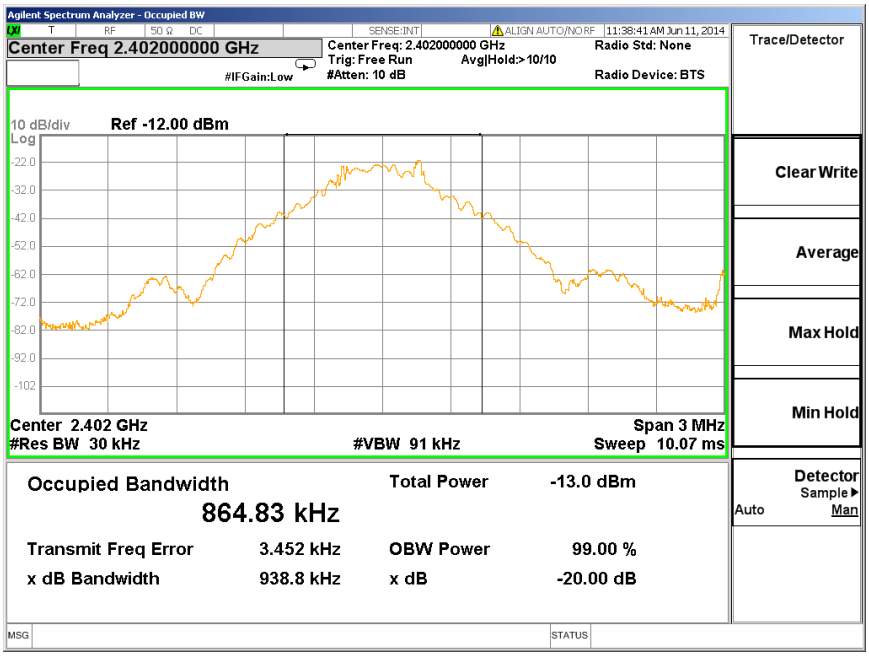
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	943.6	864.83
Middle	2441	941.5	871
High	2480	942.7	868.57

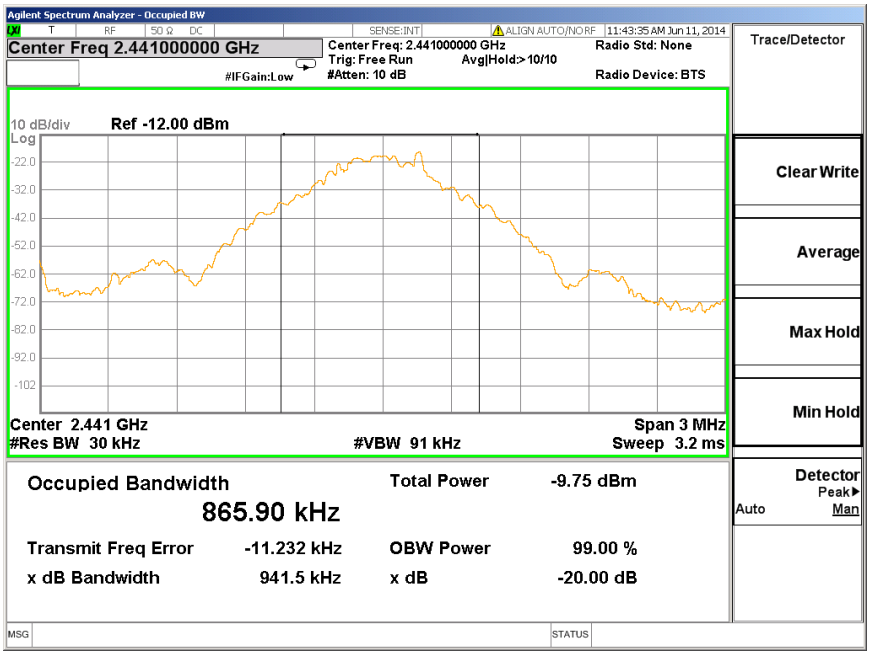
20 dB AND 99% BANDWIDTH

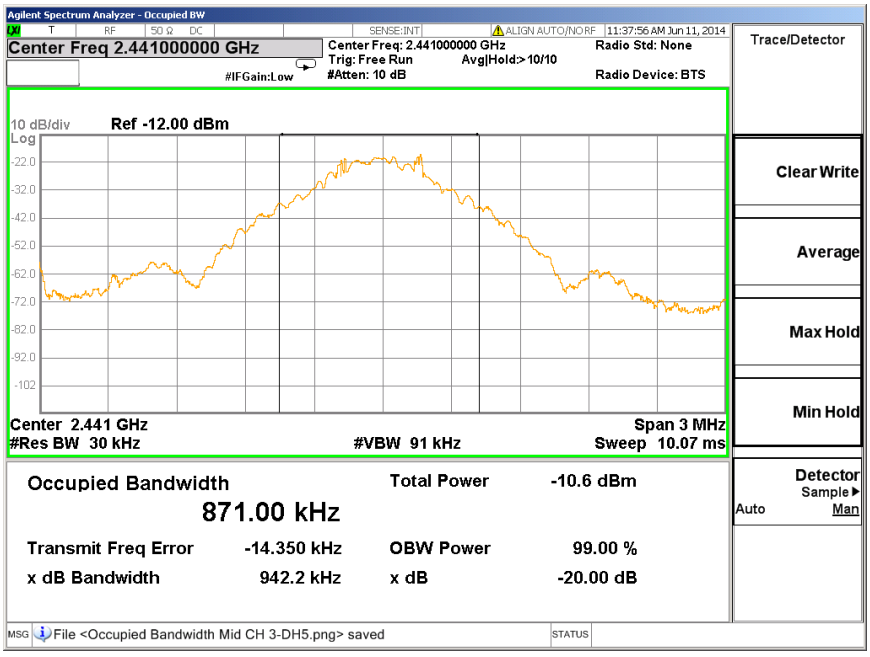
BANDWIDTH LOW CH



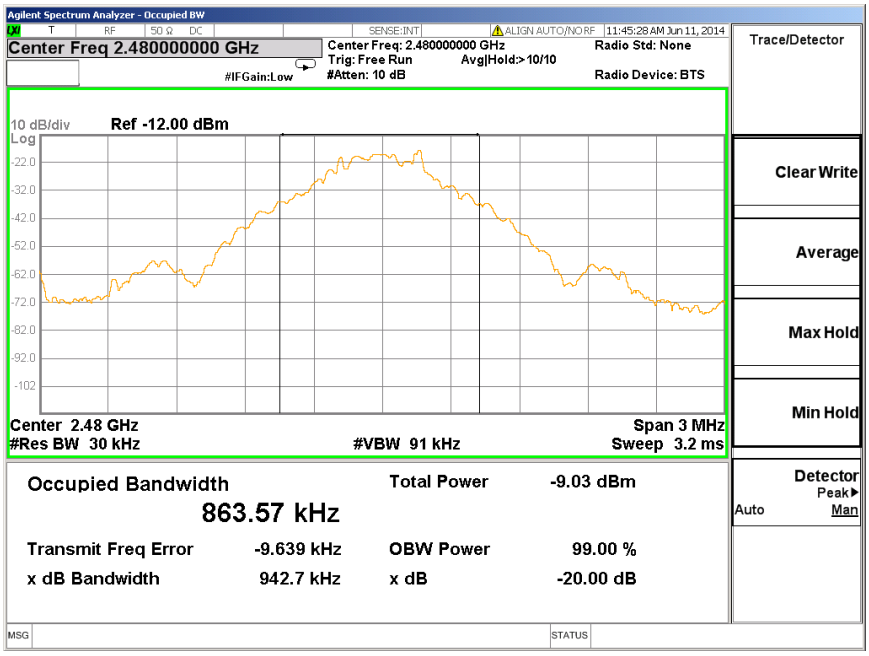


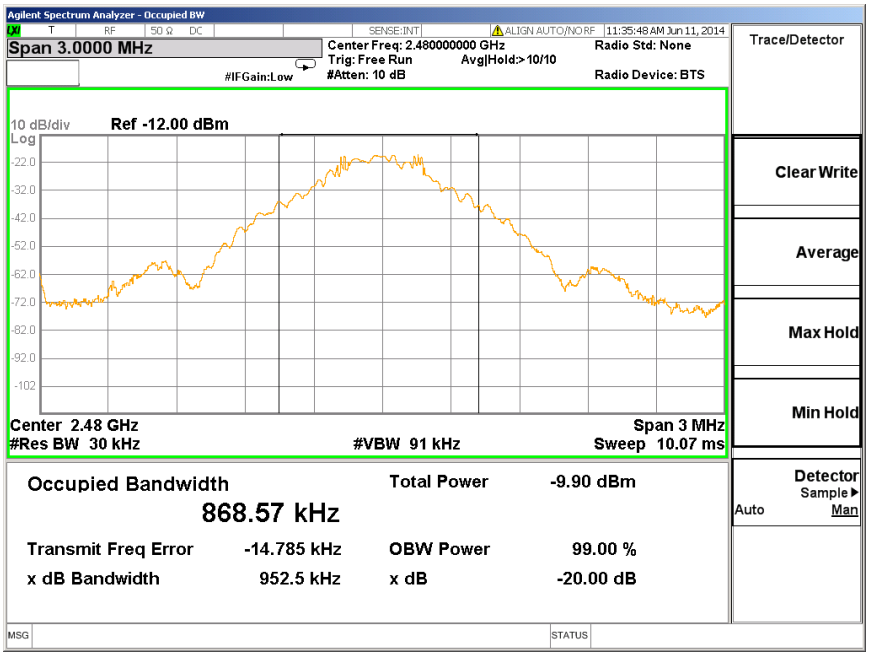
BANDWIDTH MID CH





BANDWIDTH HIGH CH





8.1.2. 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 hoping 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.

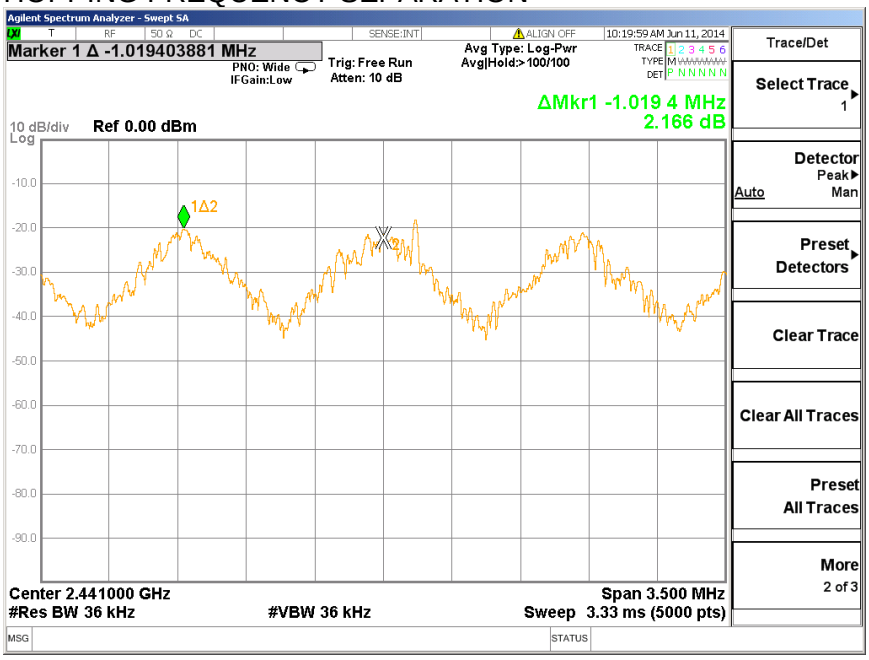
TEST PROCEDURE

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

HOPPING FREQUENCY SEPARATION



8.1.3. 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

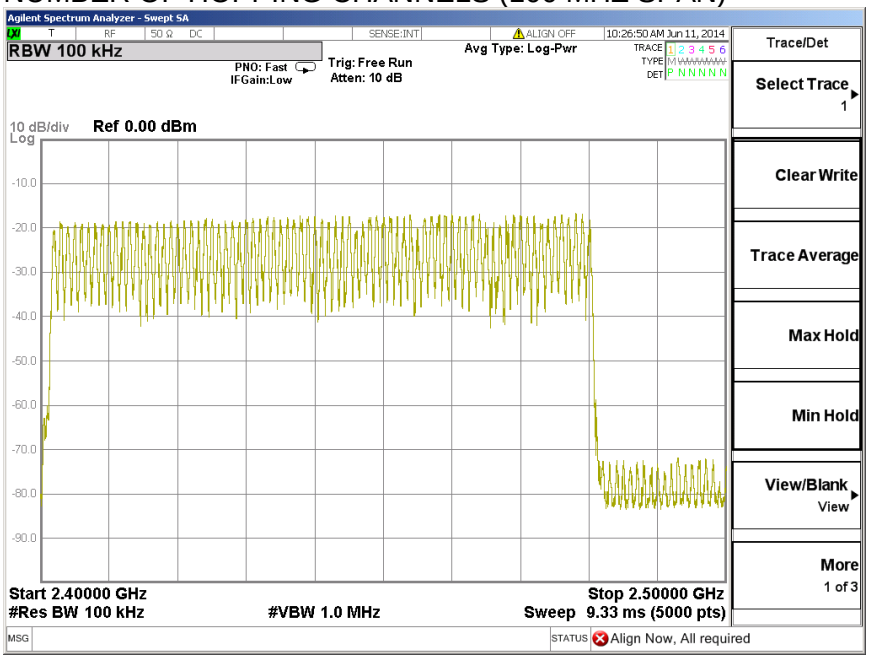
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

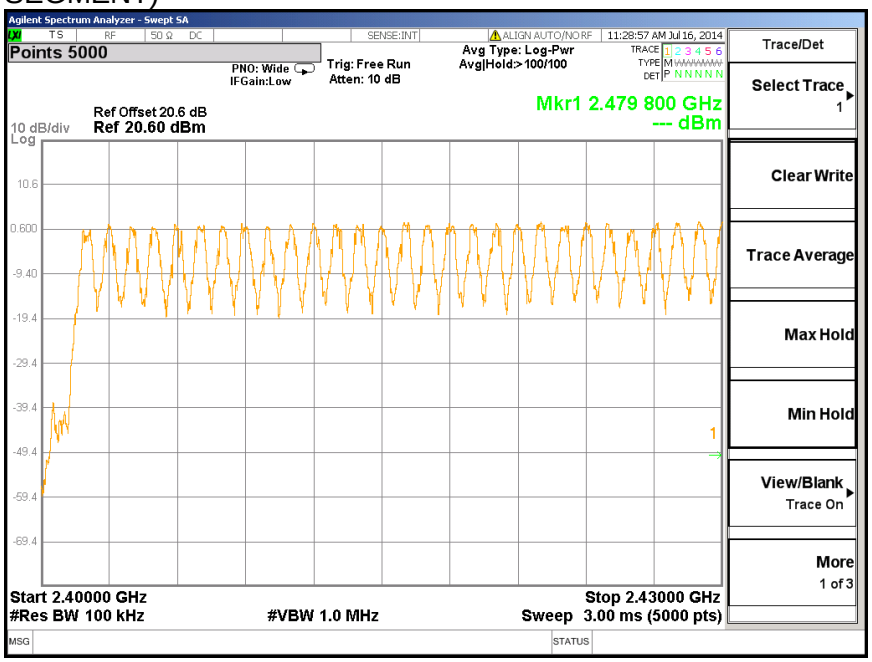
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS

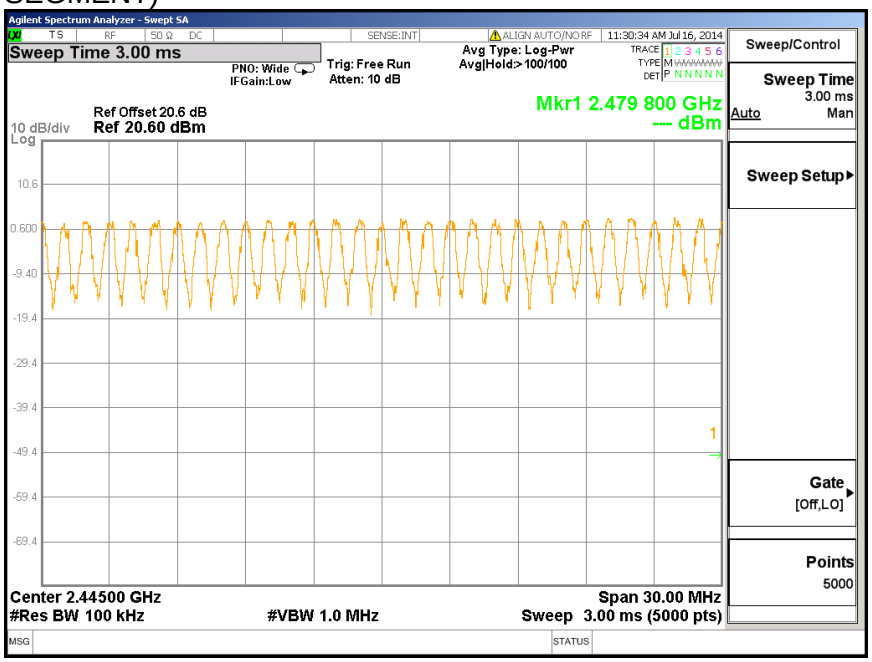
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



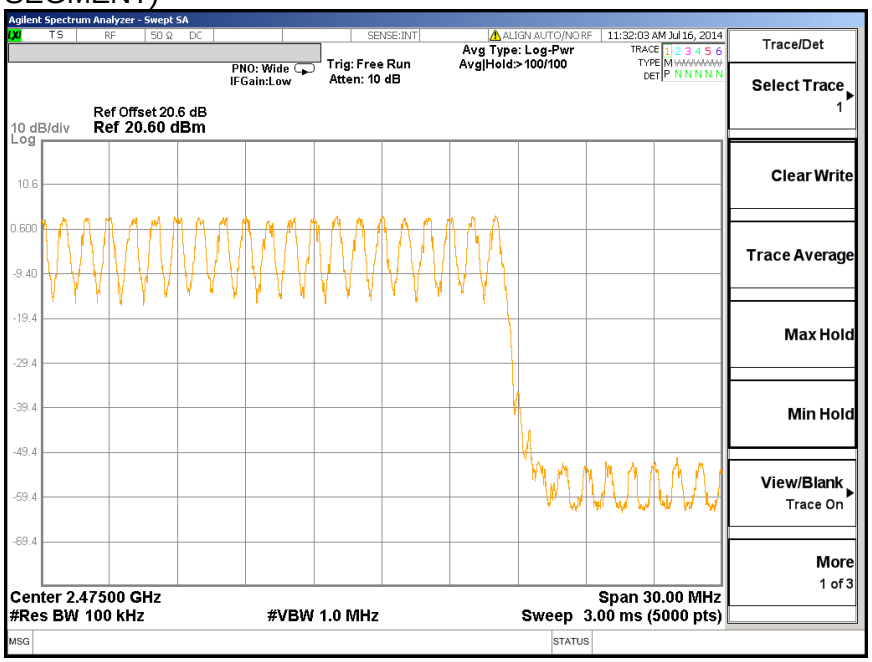
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)



8.1.4. 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 * (# of pulses in 3.16 s) * pulse width.

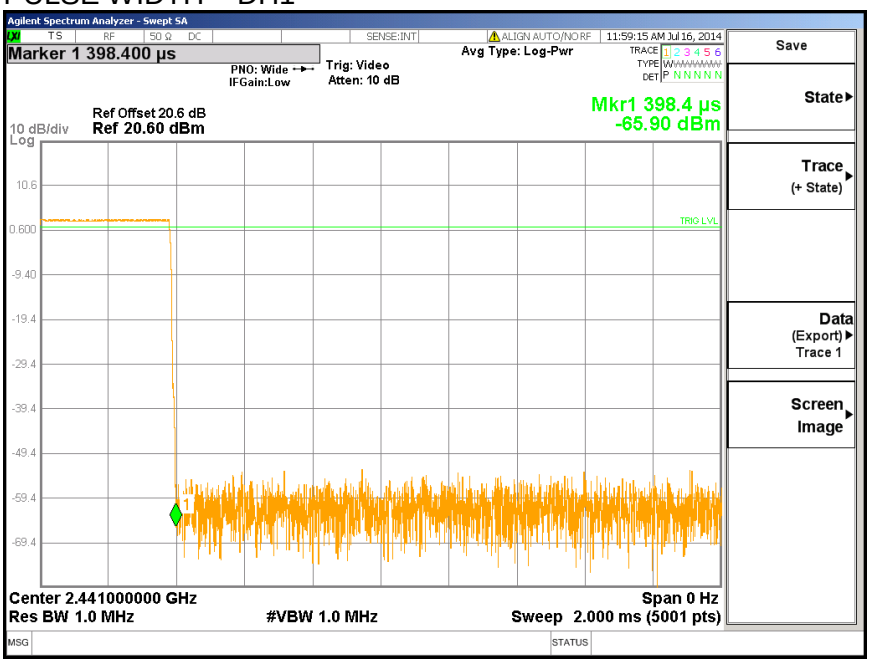
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

RESULTS

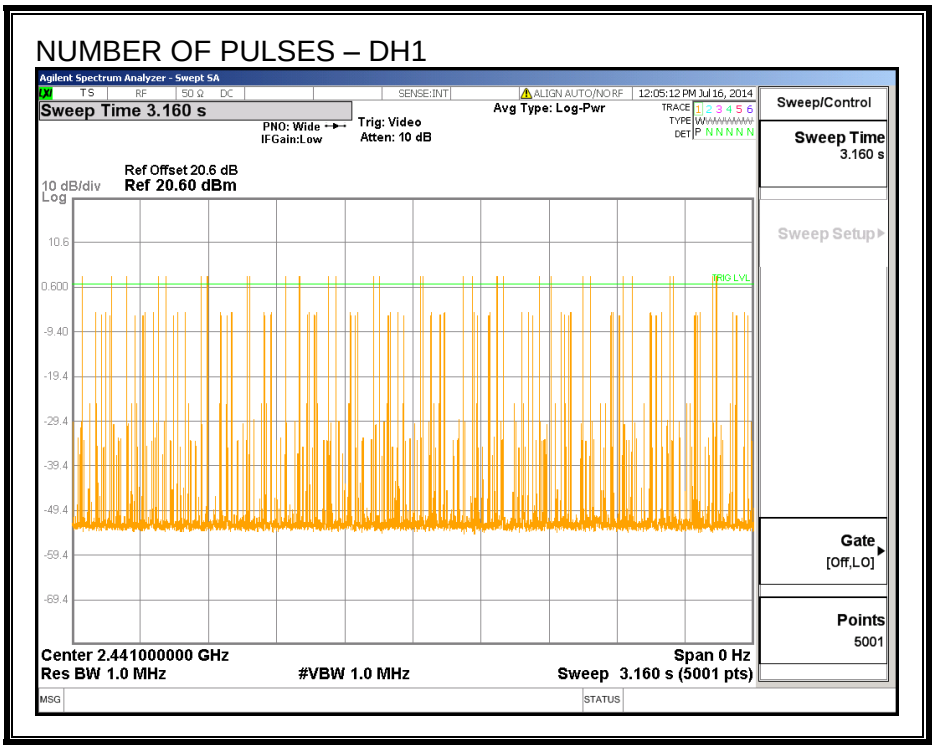
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.398	32	0.127	0.4	-0.273
DH3	1.656	14	0.232	0.4	-0.168
DH5	2.905	12	0.349	0.4	-0.051

PULSE WIDTH - DH1

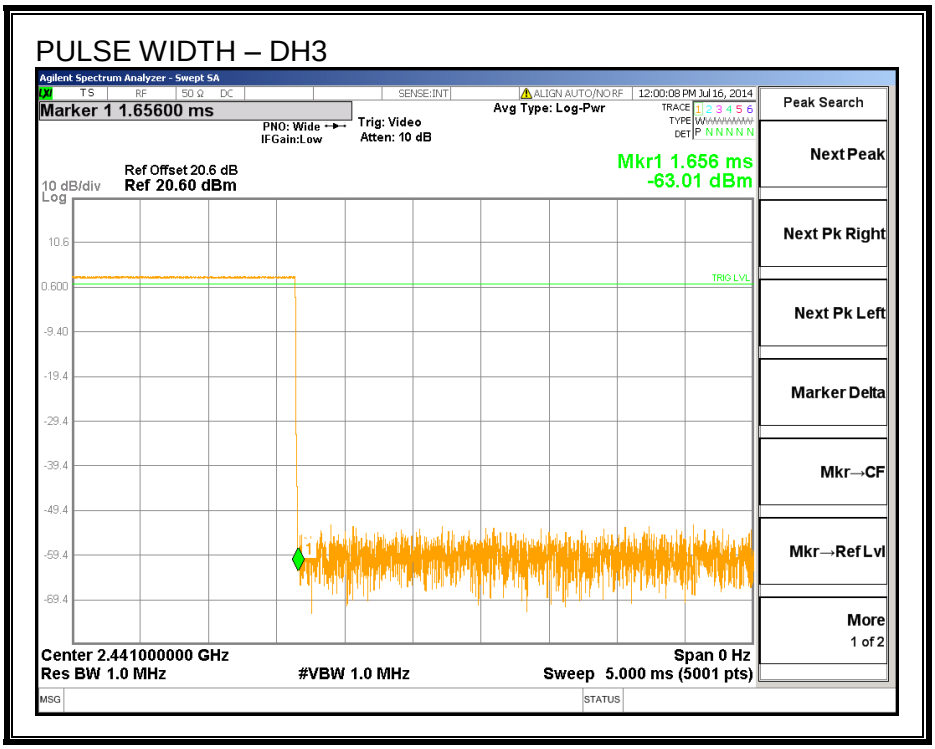
PULSE WIDTH – DH1



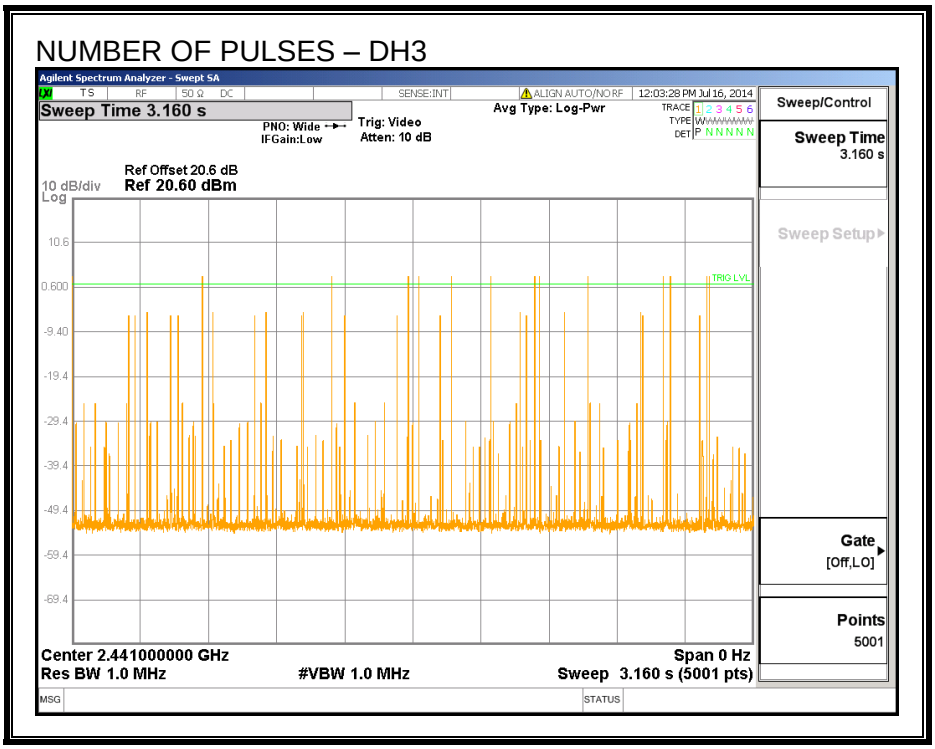
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



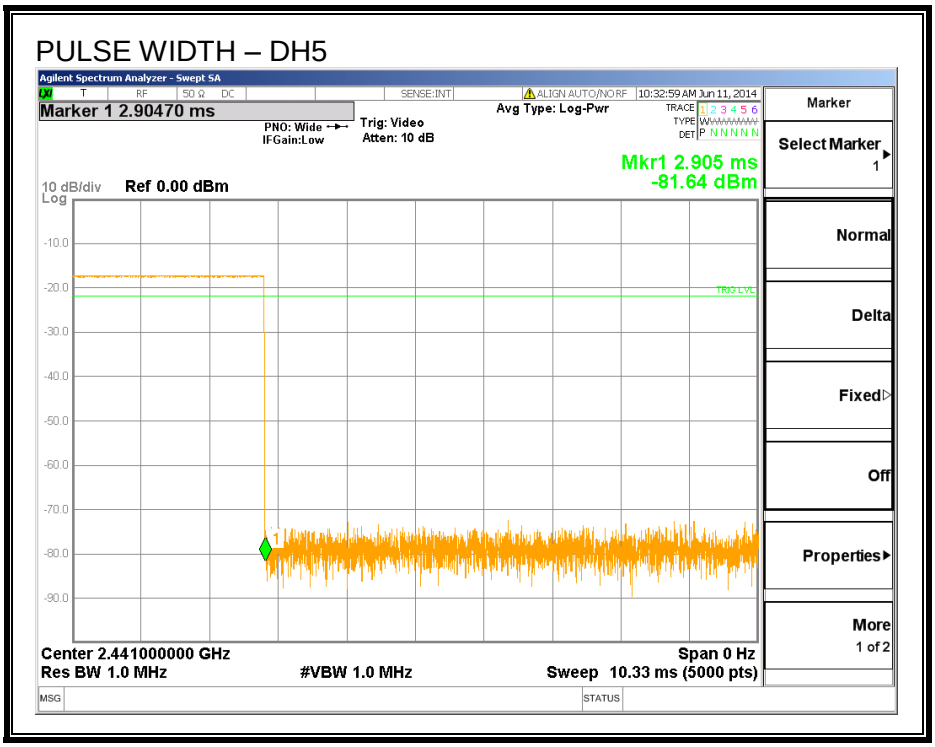
PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

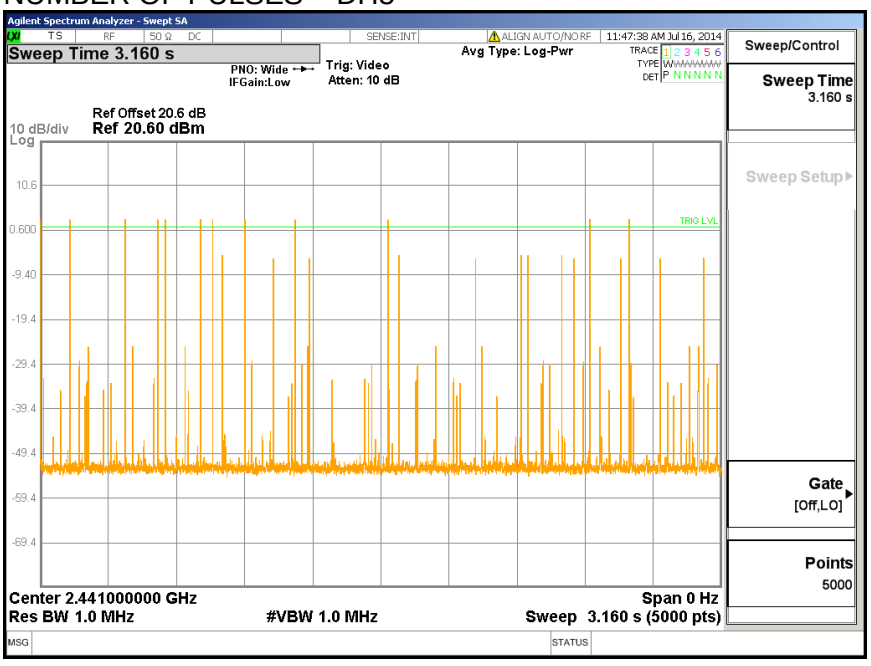


PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

NUMBER OF PULSES – DH5



8.1.5. 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

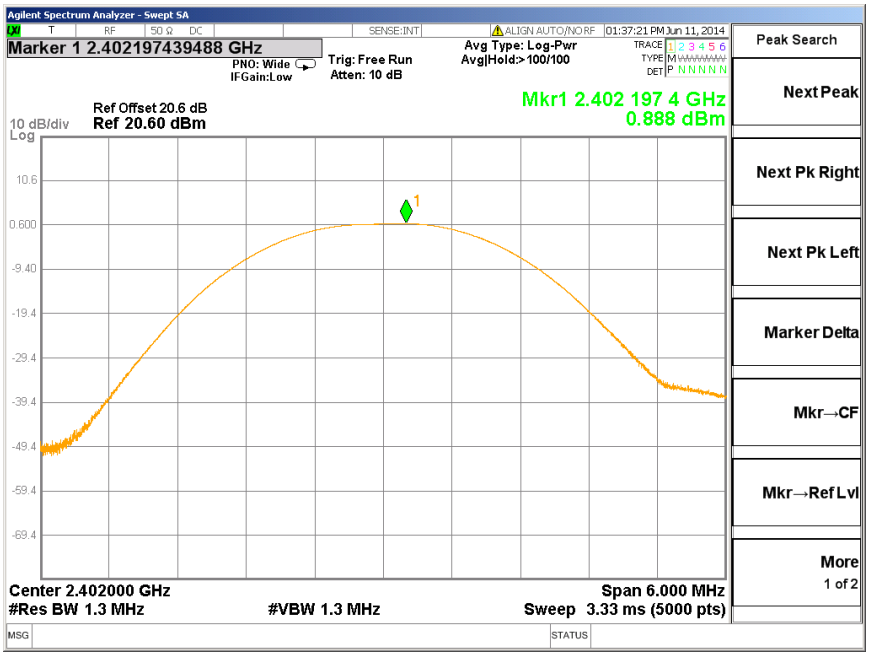
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

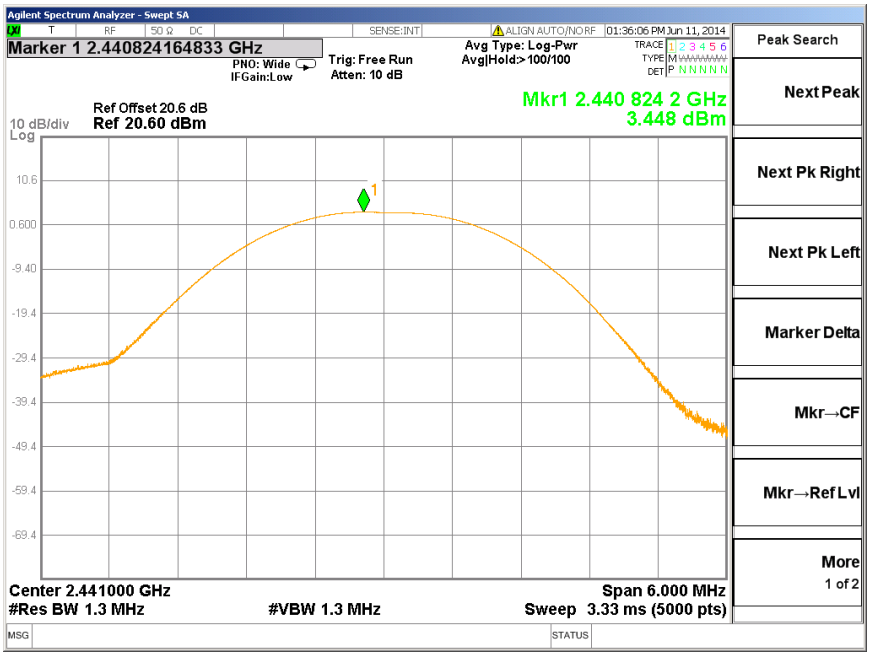
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	0.89	30	-29.11
Middle	2441	3.45	30	-26.55
High	2480	4.14	30	-25.86

OUTPUT POWER

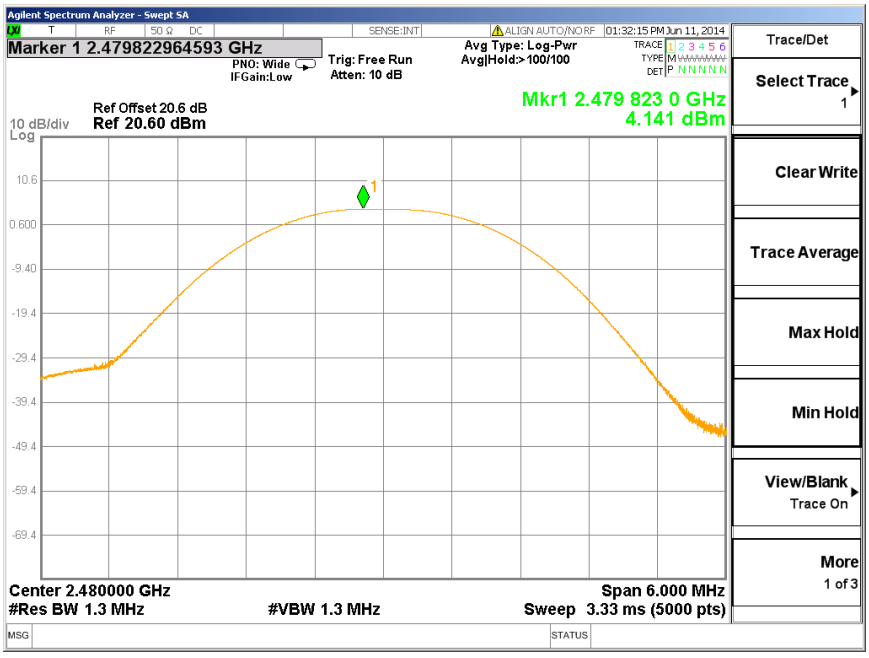
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



8.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 20.6 dB (including 20 dB pad and 0.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	-2.94
Middle	2441	-0.73
High	2480	0.23

8.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

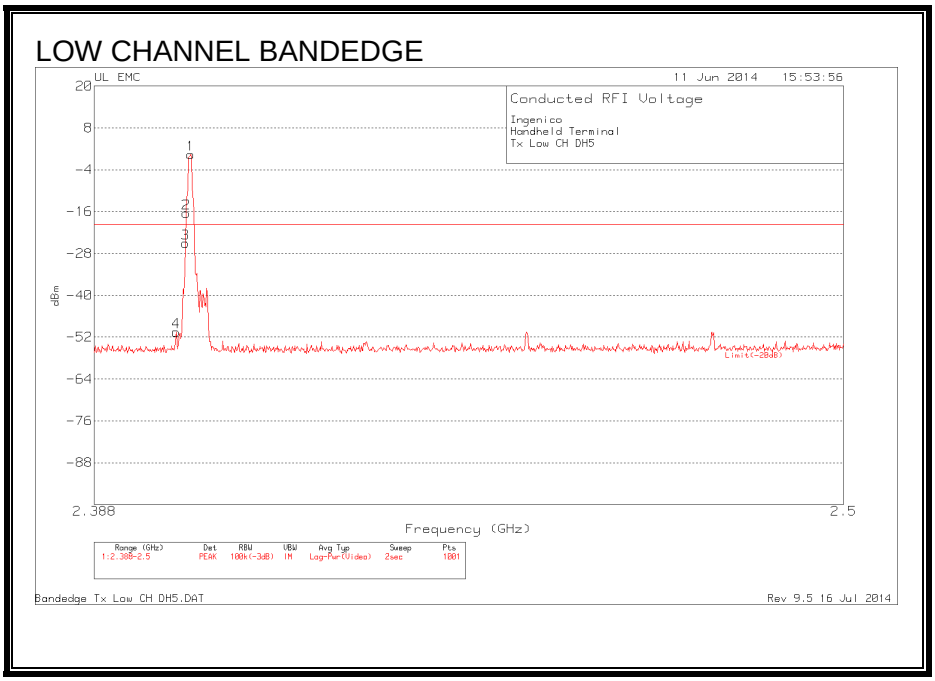
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

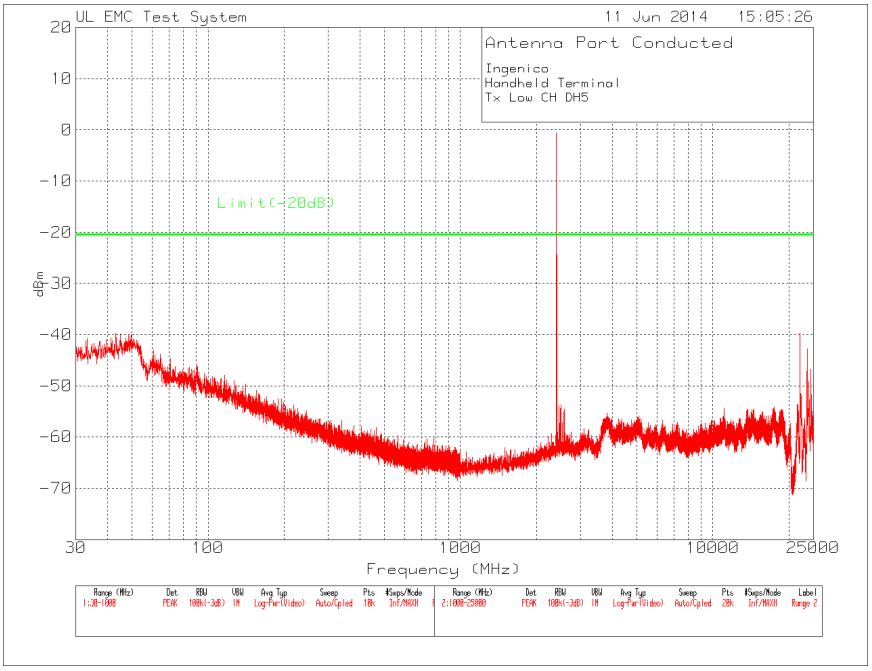


Ingenico
Handheld Terminal
Tx Low CH DH5

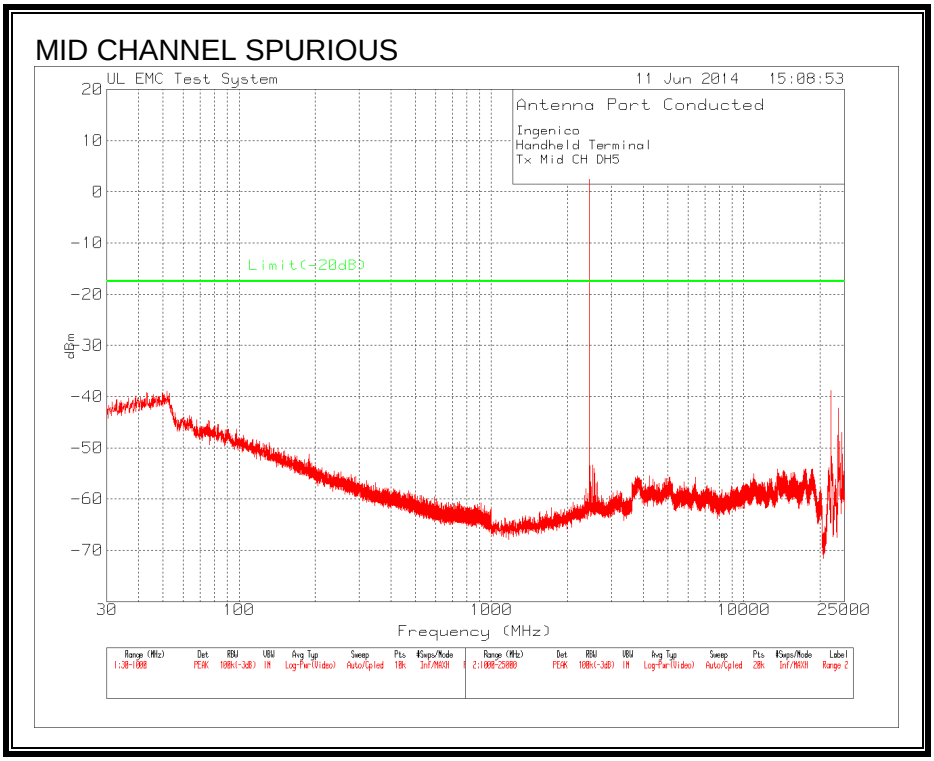
Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Cable Factor	Corrected Reading dBm	Limit	Margin (dB)
1	2.4021	86.76	PK	-107	20.6	0.36	-	-
2	2.4014	69.92	PK	-107	20.6	-16.48	-	-
3	2.4013	61.31	PK	-107	20.6	-25.09	-	-
4	2.4	35.88	PK	-107	20.6	-50.52	-19.64	-30.88

PK - Peak detector

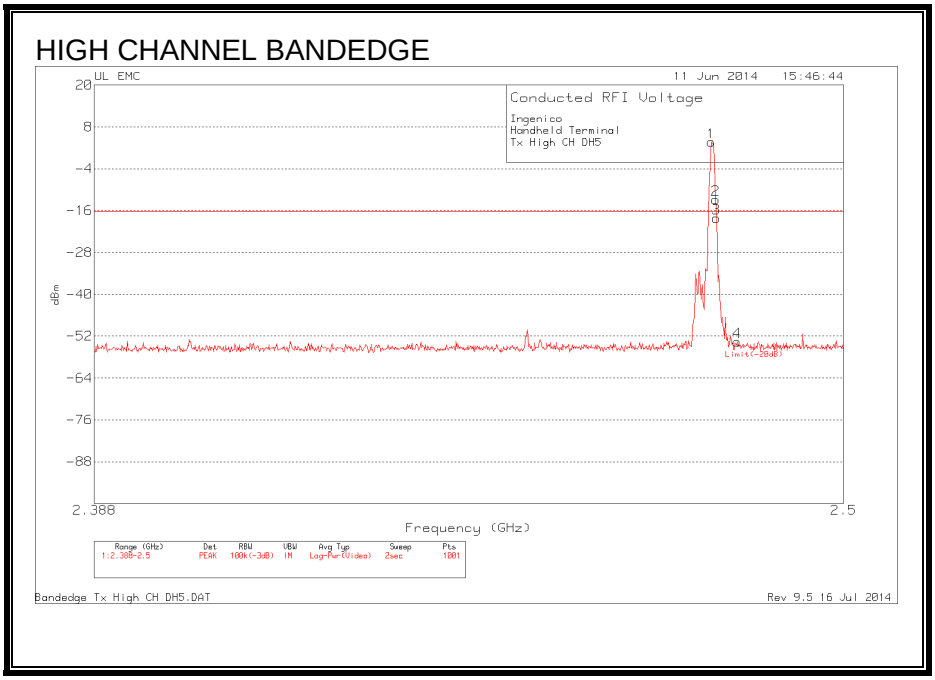
LOW CHANNEL SPURIOUS



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL

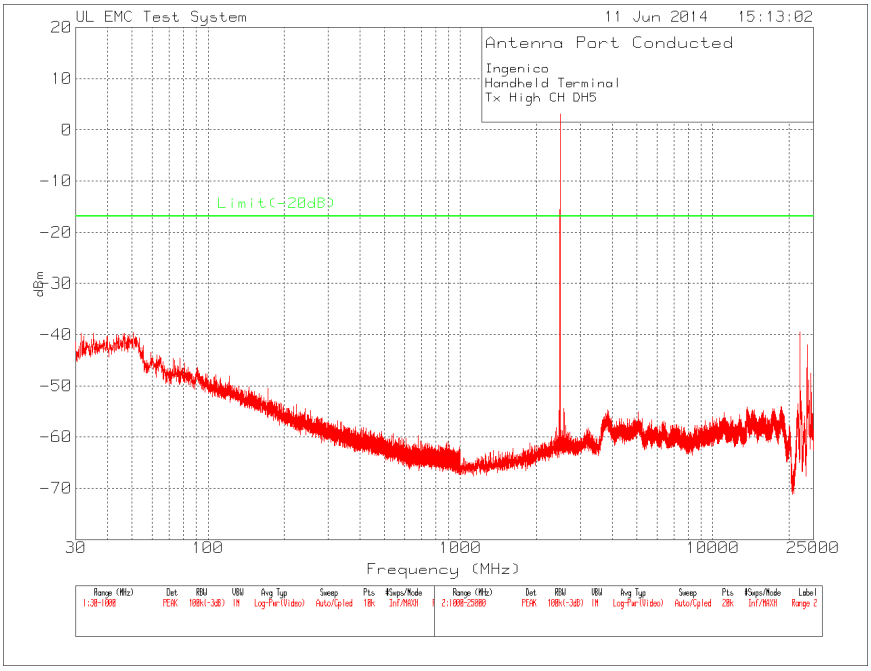


Ingenico
Handheld Terminal
Tx High CH DH5

Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Cable Factor dB	Corrected Reading dBm	Limit	Margin (dB)
1	2.4798	90.08	PK	-107	20.6	3.68	-	-
2	2.4805	73.63	PK	-107	20.6	-12.77	-	-
3	2.4806	68.3	PK	-107	20.6	-18.1	-	-
4	2.4838	32.77	PK	-107	20.6	-53.63	-16.32	-37.31

PK - Peak detector

HIGH CHANNEL SPURIOUS



SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

BANDEDGE WITH HOPPING ON

Ingenico
Handheld Terminal
Tx Hopping CH DH5

Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Cable Factor dB	Corrected Reading dBm	Limit	Margin (dB)
1	2.402	86.3	PK	-107	20.6	-0.1	-	-
2	2.4016	73.77	PK	-107	20.6	-12.63	-	-
3	2.4014	68.86	PK	-107	20.6	-17.54	-	-
4	2.3999	32.2	PK	-107	20.6	-54.2	-16.05	-38.15
5	2.48	89.74	PK	-107	20.6	3.34	-	-
6	2.4804	78.39	PK	-107	20.6	-8.01	-	-
7	2.4805	32.13	PK	-107	20.6	-54.27	-	-
8	2.4839	35.68	PK	-107	20.6	-50.72	-16.05	-34.67

PK - Peak detector

8.2. ENHANCED DATA RATE QPSK MODULATION

8.2.1. 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

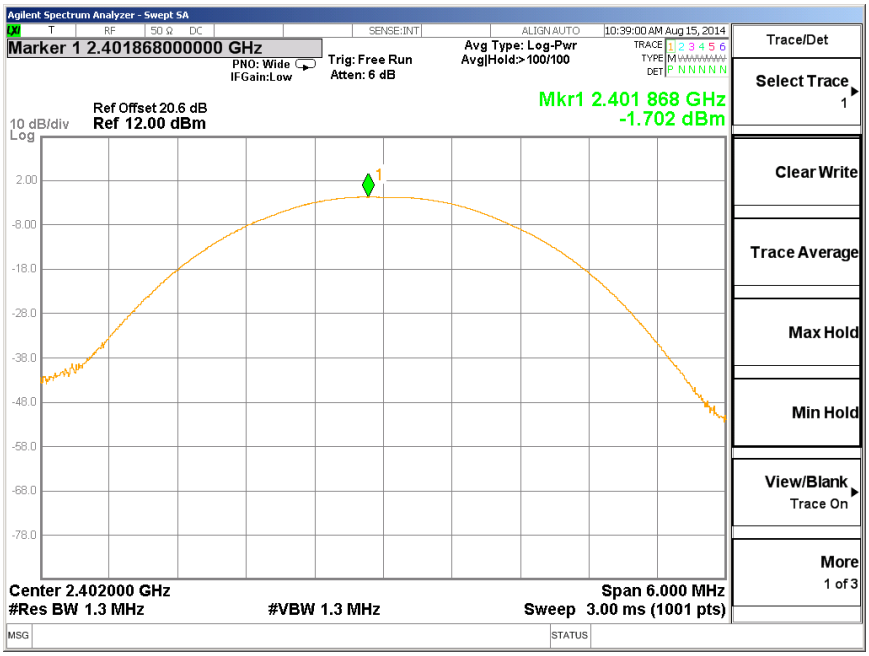
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

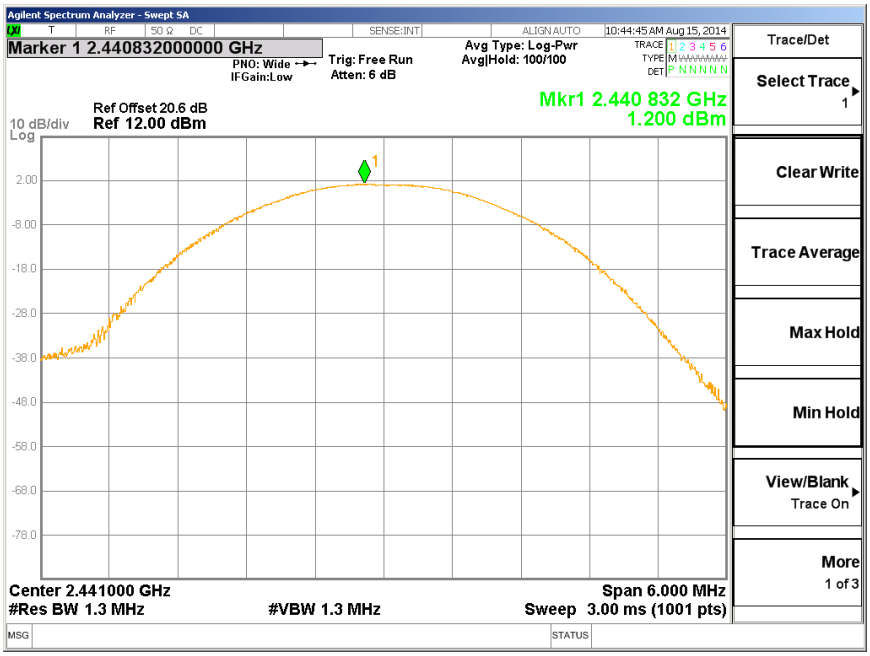
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.70	30	-31.70
Middle	2441	1.20	30	-28.80
High	2480	2.33	30	-27.67

OUTPUT POWER

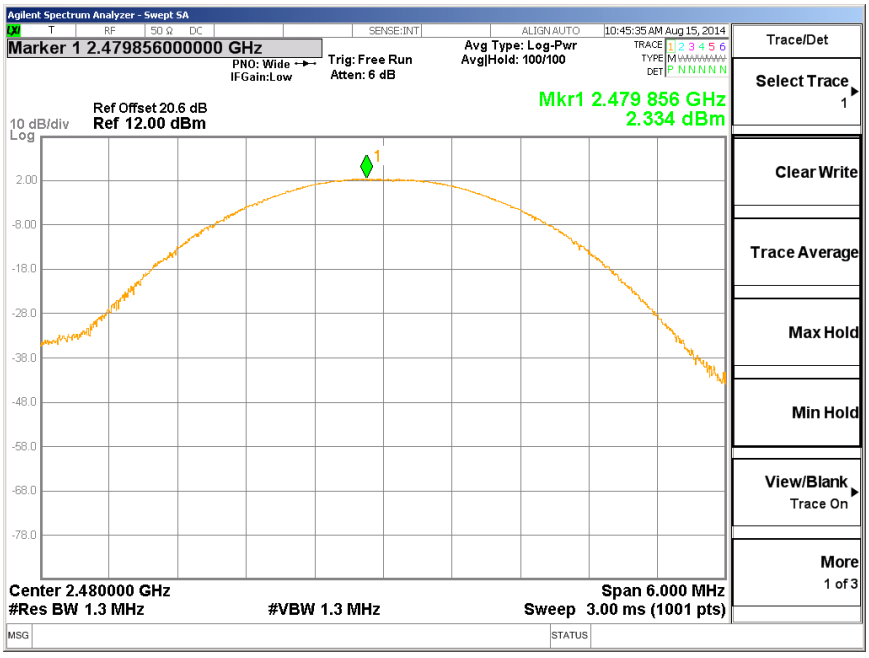
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



8.3. ENHANCED DATA RATE 8PSK MODULATION

8.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

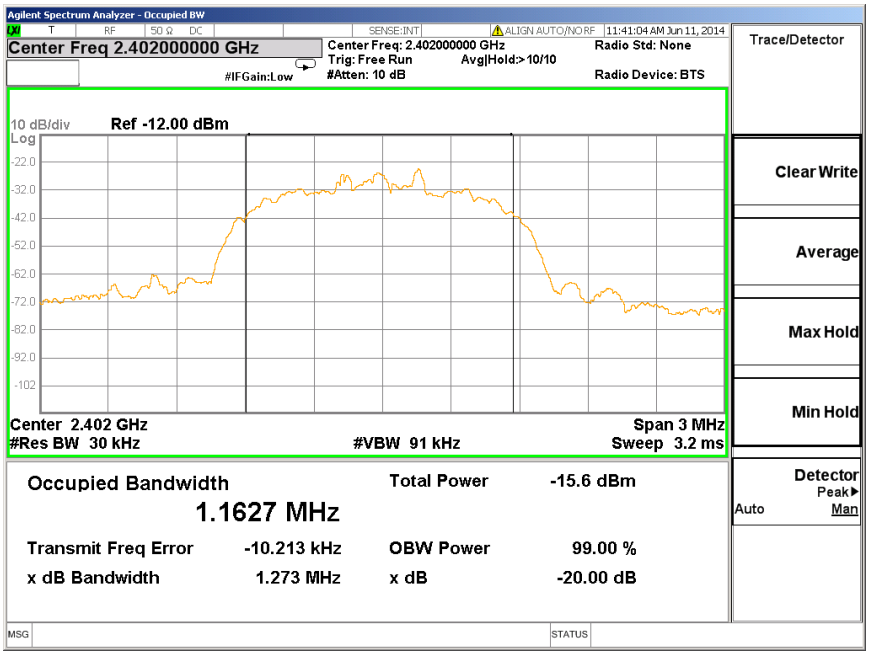
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

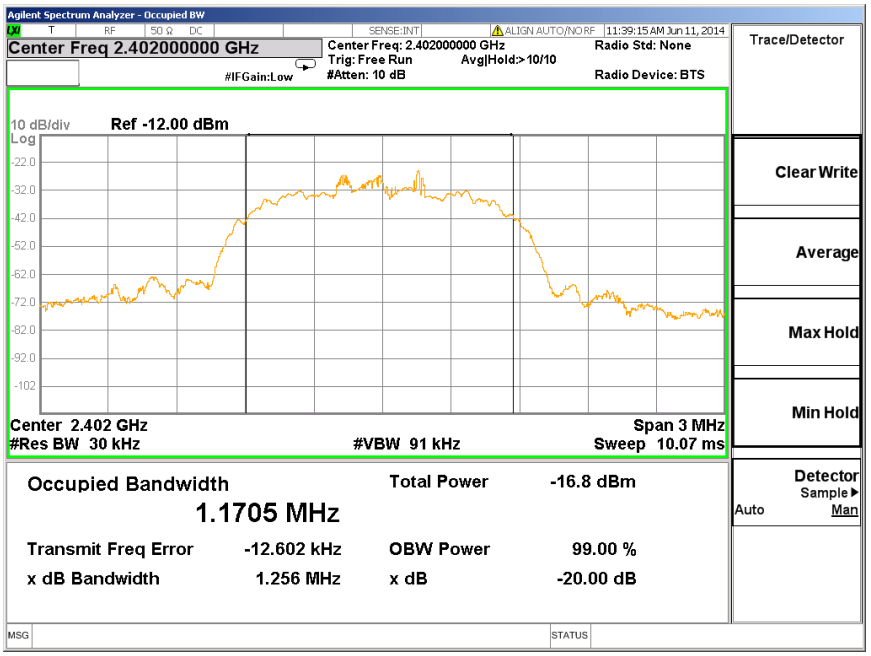
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1.273	1.1705
Middle	2441	1.282	1.1815
High	2480	1.279	1.173

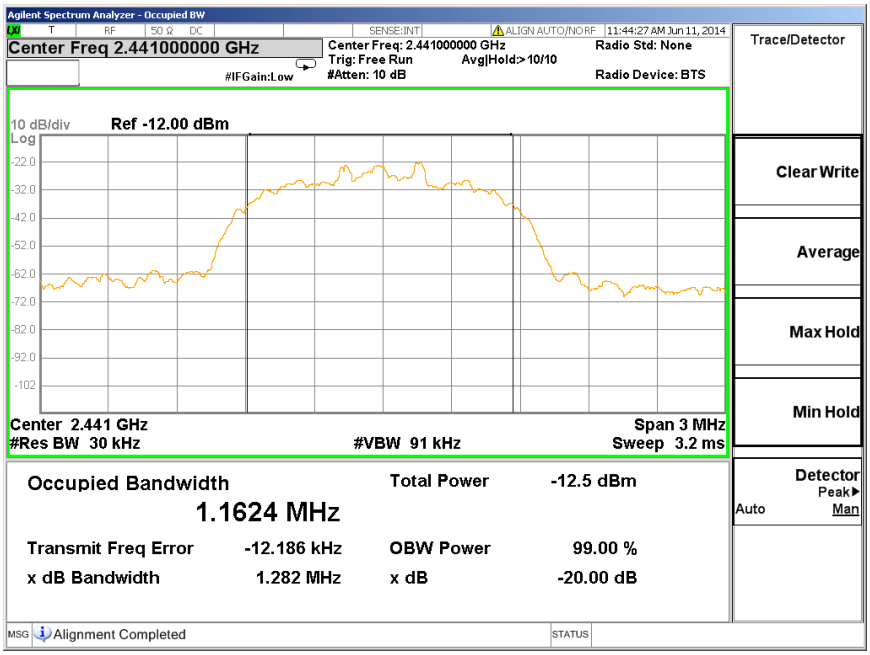
20 dB AND 99% BANDWIDTH

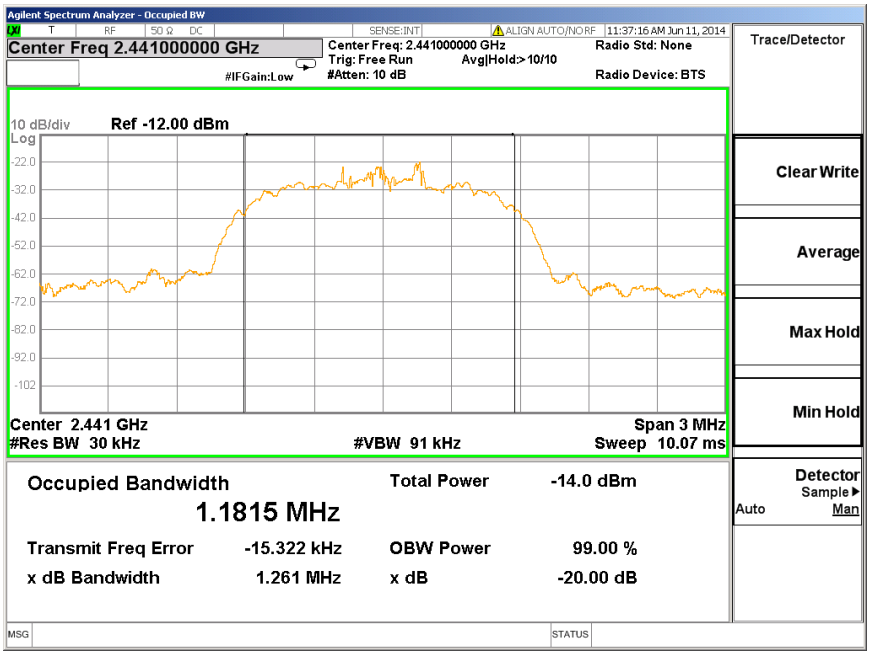
BANDWIDTH LOW CH



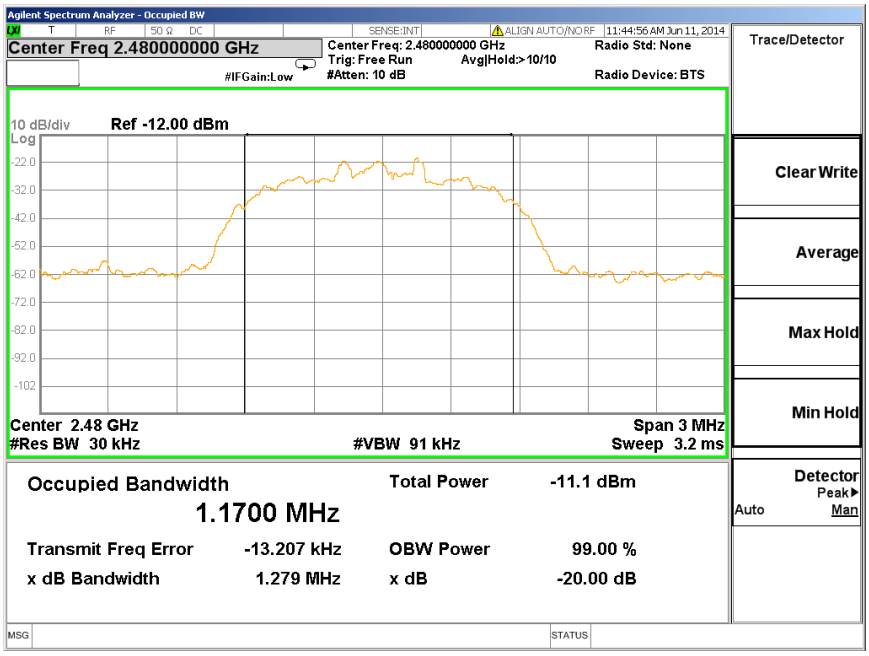


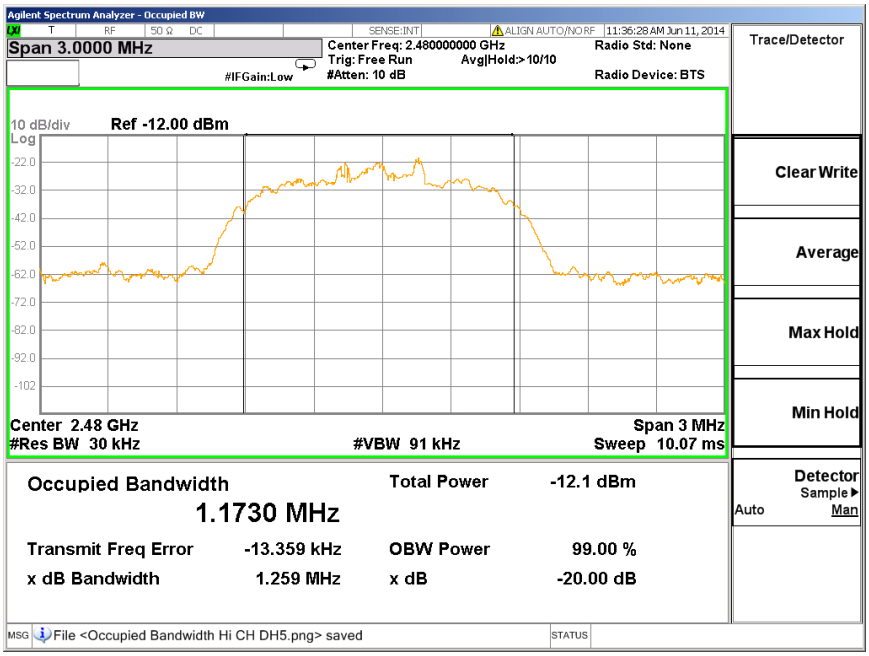
BANDWIDTH MID CH





BANDWIDTH HIGH CH





8.3.2. 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 * (# of pulses in 3.16 s) * pulse width.

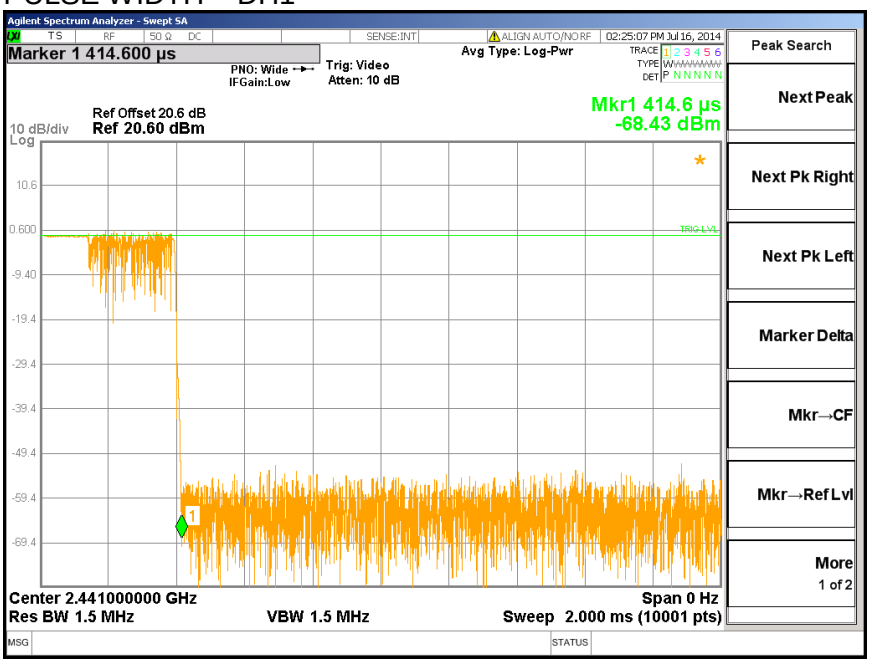
RESULTS

8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.4146	32	0.133	0.4	-0.267
DH3	1.663	17	0.283	0.4	-0.117
DH5	2.915	13	0.379	0.4	-0.021

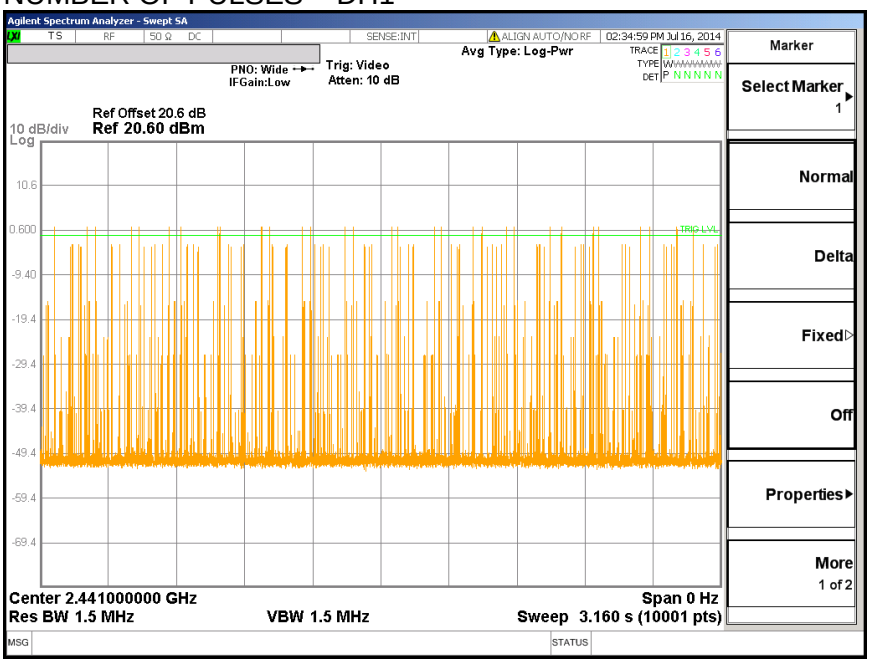
PULSE WIDTH - DH1

PULSE WIDTH – DH1

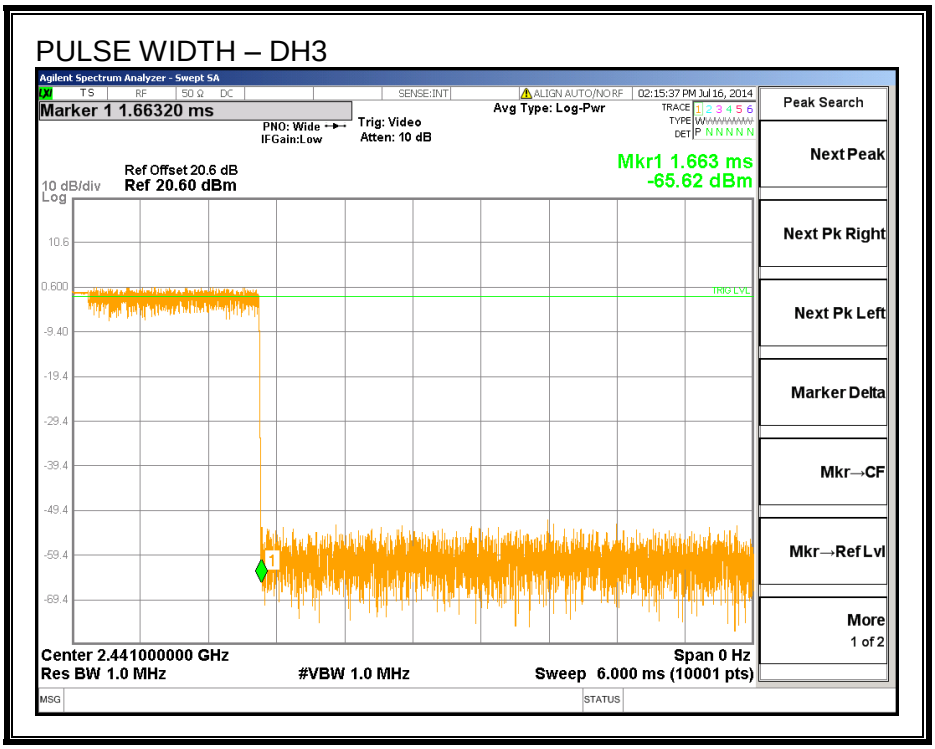


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

NUMBER OF PULSES – DH1

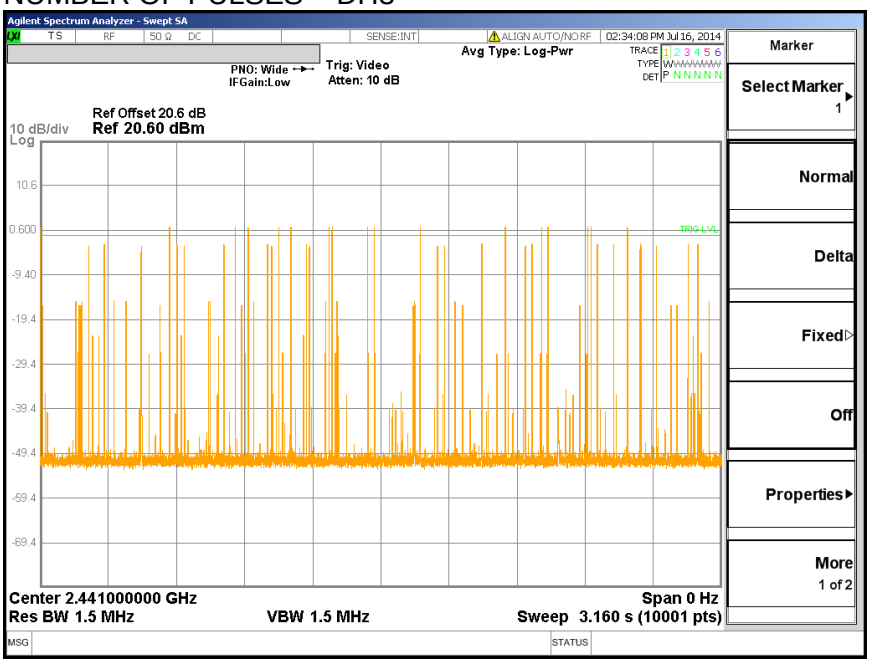


PULSE WIDTH – DH3

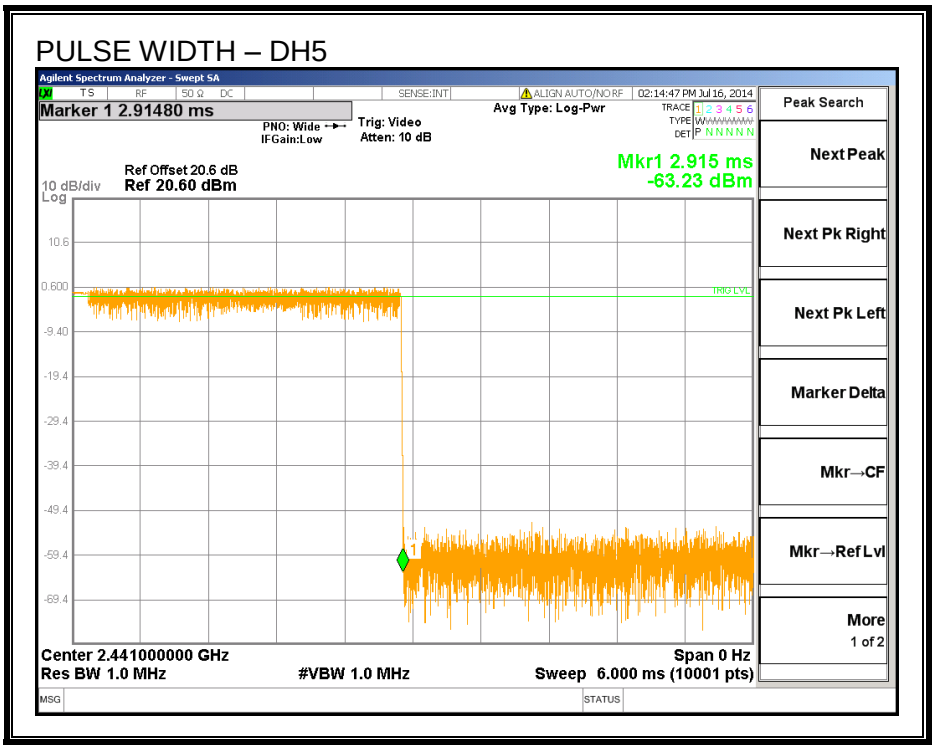


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

NUMBER OF PULSES – DH3

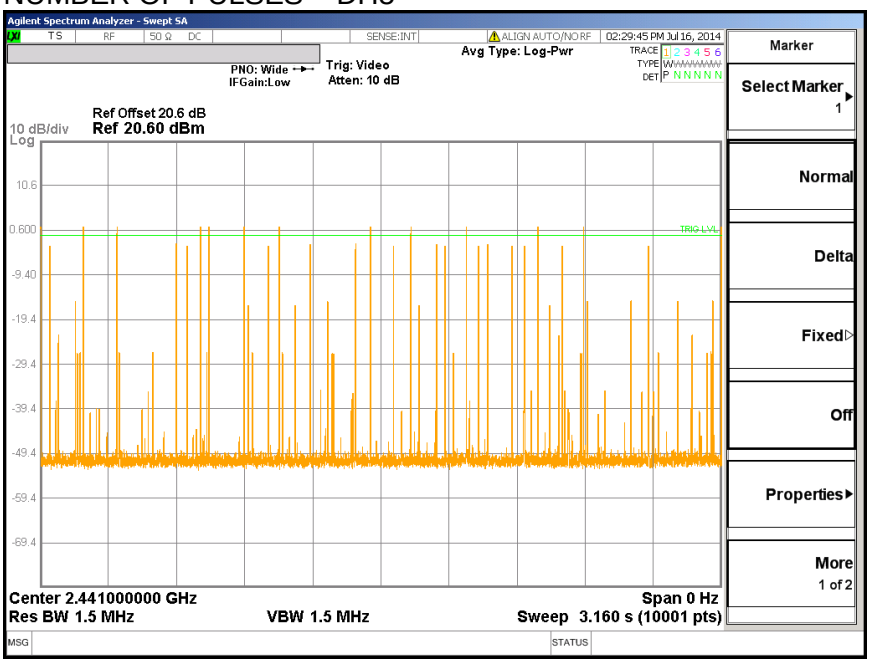


PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

NUMBER OF PULSES – DH5



8.3.3. 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

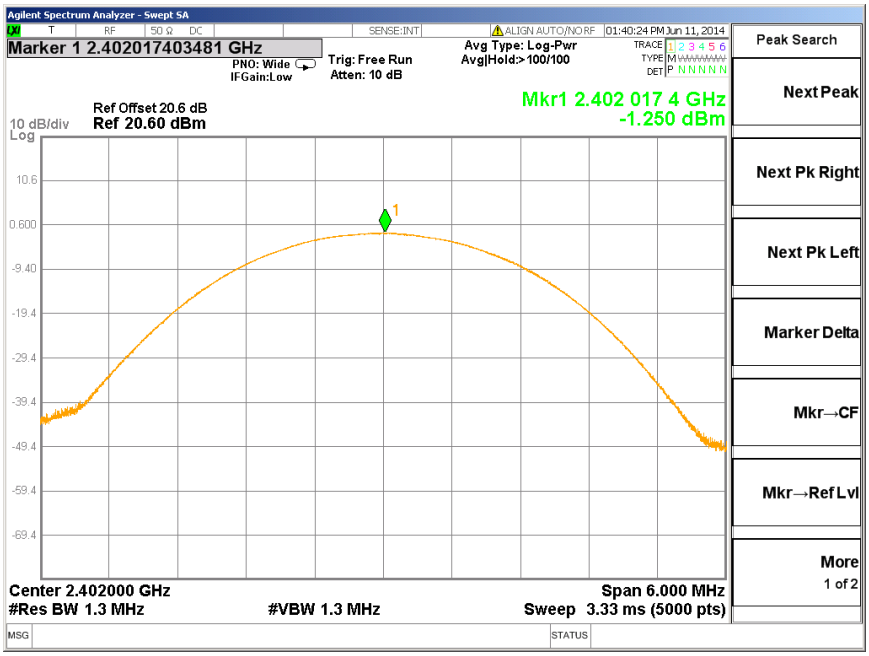
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

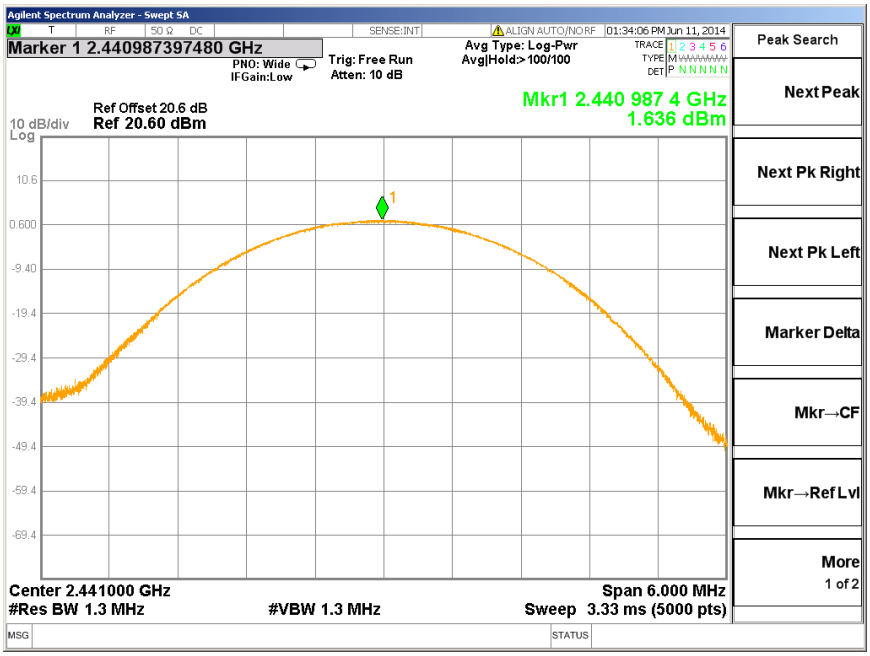
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.25	30	-31.25
Middle	2441	1.64	30	-28.36
High	2480	2.78	30	-27.22

OUTPUT POWER

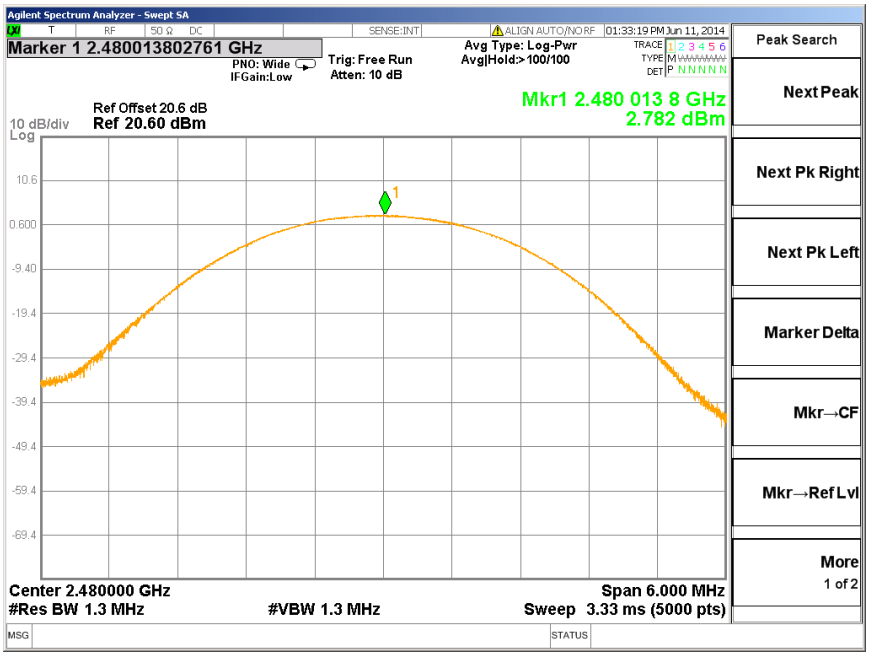
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



8.3.4. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 20.6dB (including 20 dB pad and 0.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	-8.33
Middle	2441	-5.32
High	2480	-3.43

8.3.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

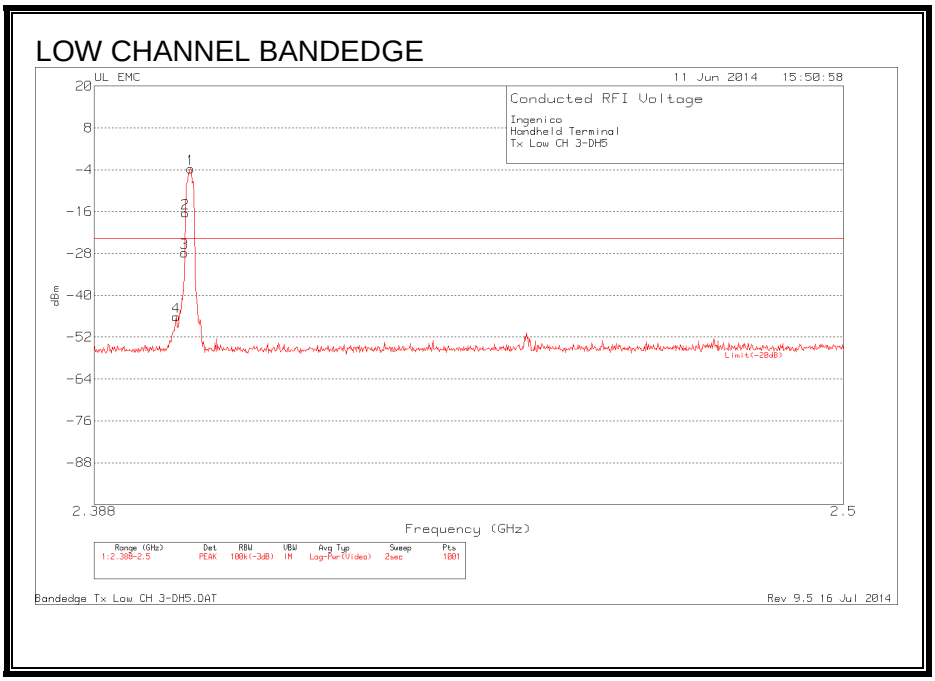
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

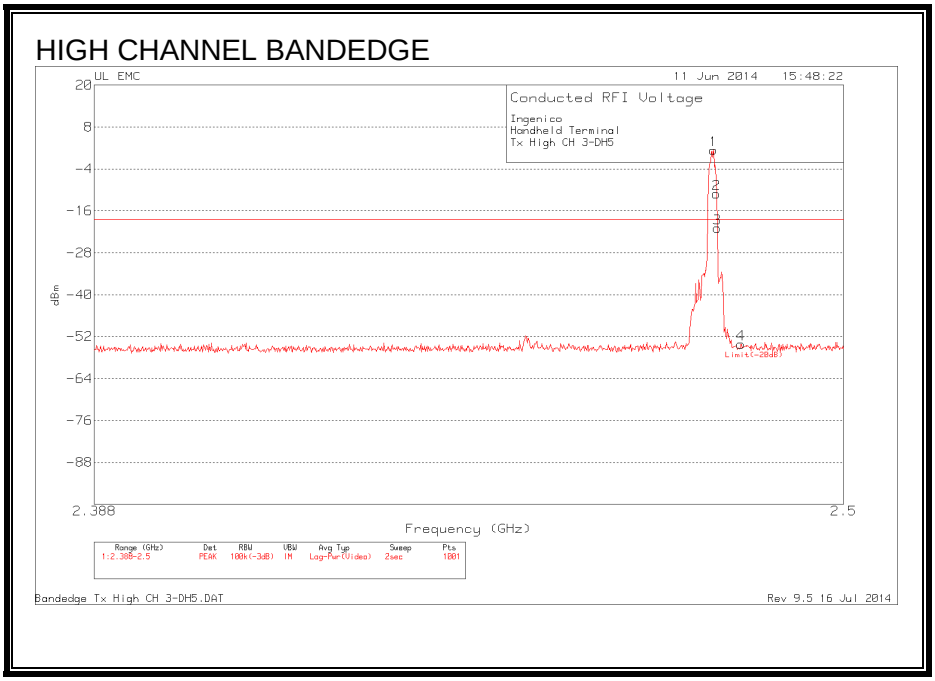


Ingenico
Handheld Terminal
Tx Low CH 3-DH5

Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Cable Factor dB	Corrected Reading dBm	Limit	Margin (dB)
1	2.4021	82.72	PK	-107	20.6	-3.68	-	-
2	2.4013	70.03	PK	-107	20.6	-16.37	-	-
3	2.4012	58.62	PK	-107	20.6	-27.78	-	-
4	2.4	40.28	PK	-107	20.6	-46.12	-23.68	-22.44

PK - Peak detector

SPURIOUS EMISSIONS, HIGH CHANNEL

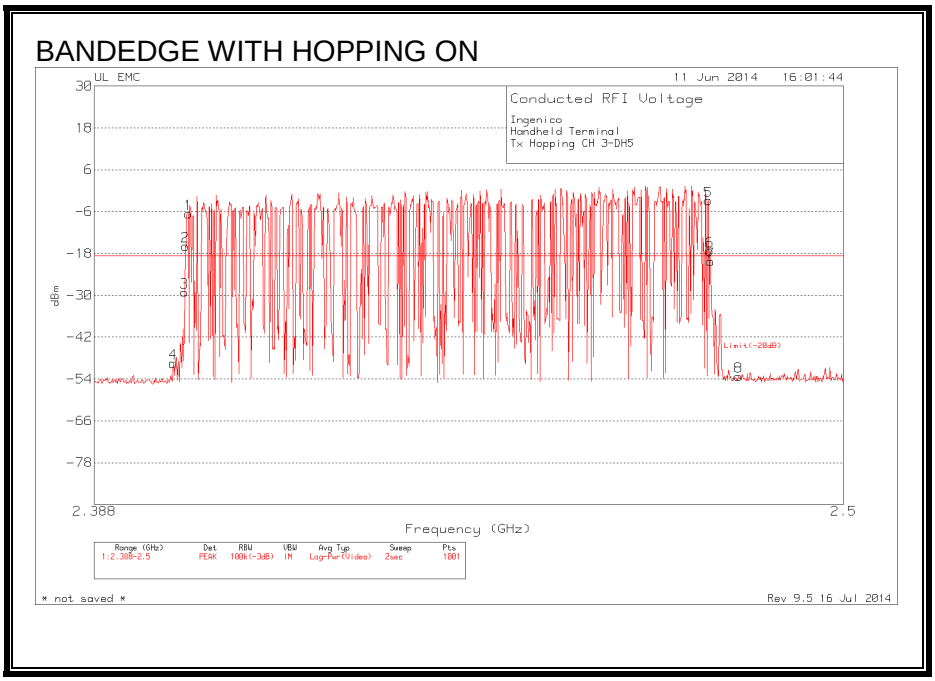


Ingenico
Handheld Terminal
Tx High CH 3-DH5

Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Cable Factor dB	Corrected Reading dBm	Limit	Margin (dB)
1	2.4802	87.81	PK	-107	20.6	1.41	-	-
2	2.4806	75.28	PK	-107	20.6	-11.12	-	-
3	2.4807	65.44	PK	-107	20.6	-20.96	-	-
4	2.4843	32.3	PK	-107	20.6	-54.1	-18.59	-35.51

PK - Peak detector

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



Ingenico
Handheld Terminal
Tx Hopping CH 3-DH5

Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Cable Factor dB	Corrected Reading dBm	Limit	Margin (dB)
1	2.4018	79.81	PK	-107	20.6	-6.59	-	-
2	2.4013	70.55	PK	-107	20.6	-15.85	-	-
3	2.4012	57.3	PK	-107	20.6	-29.1	-	-
4	2.3995	36.97	PK	-107	20.6	-49.43	-18.66	-30.77
5	2.4794	83.56	PK	-107	20.6	-2.84	-	-
6	2.4796	69.16	PK	-107	20.6	-17.24	-	-
7	2.4797	66.1	PK	-107	20.6	-20.3	-	-
8	2.484	33.13	PK	-107	20.6	-53.27	-18.66	-34.61

PK - Peak detector

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

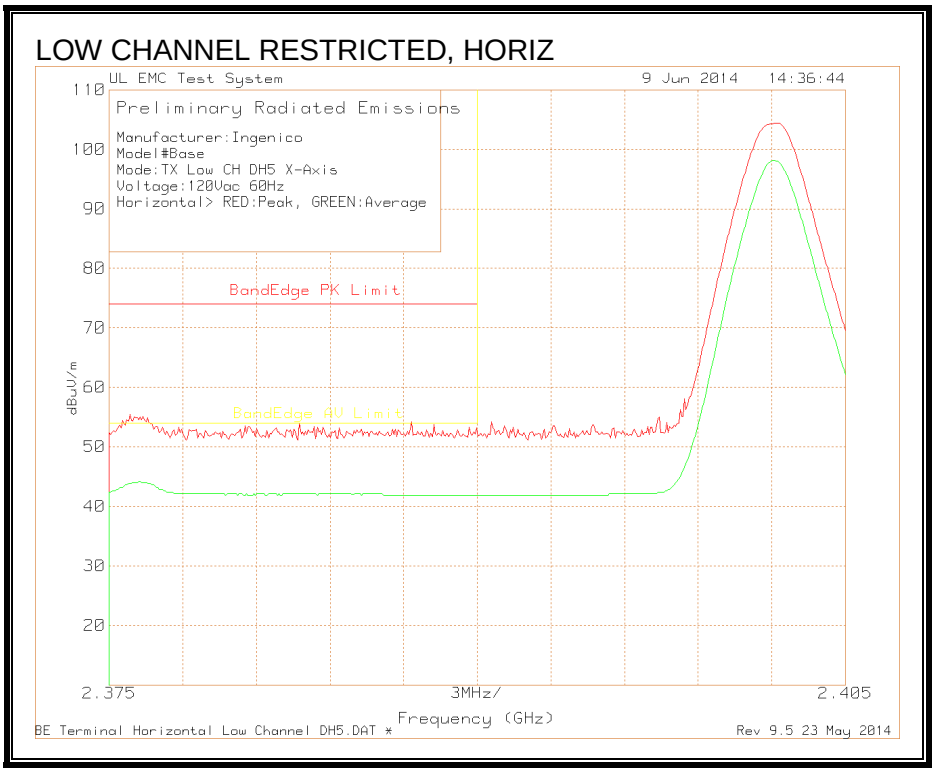
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

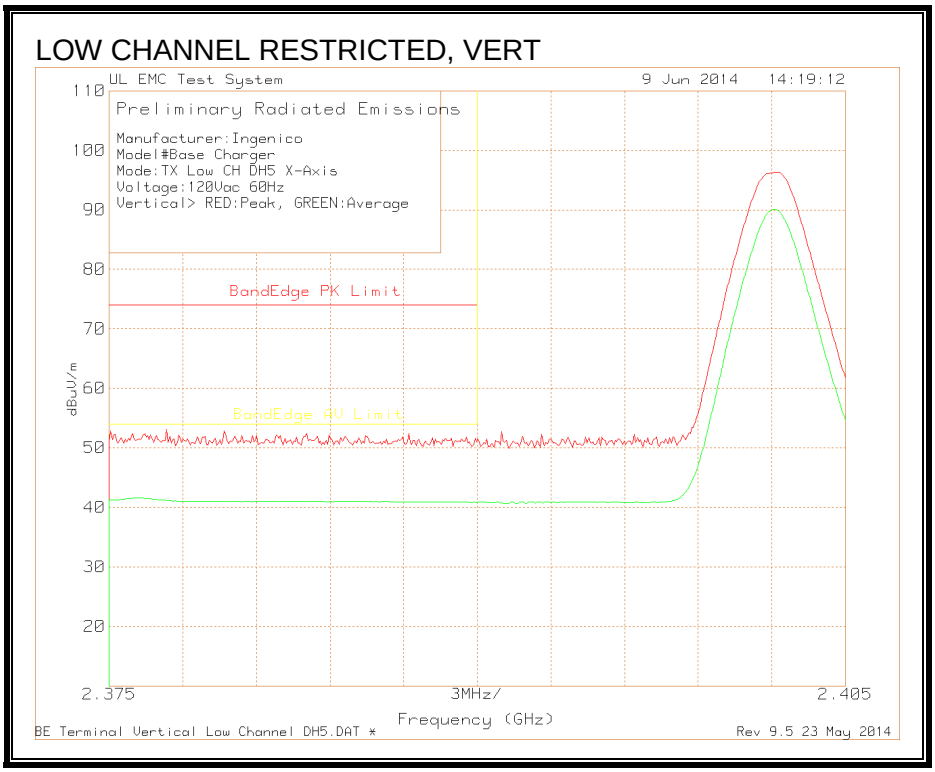
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

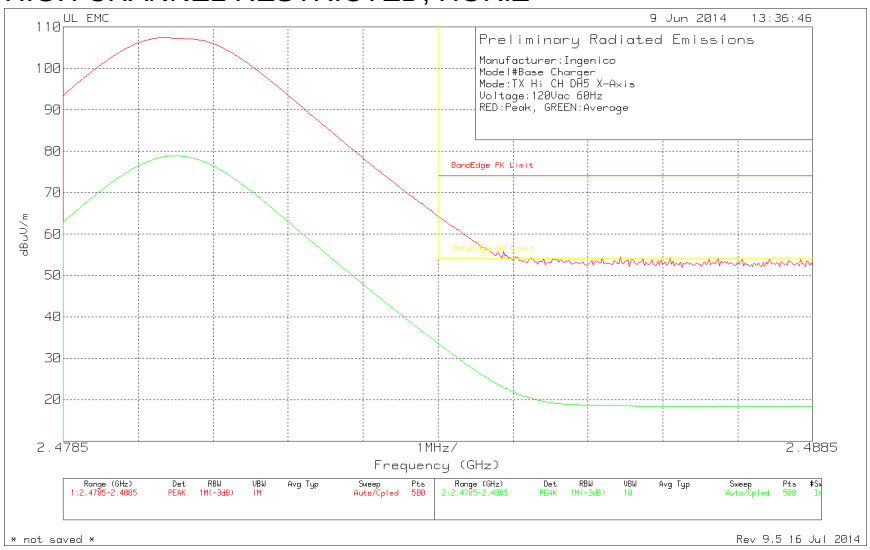


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

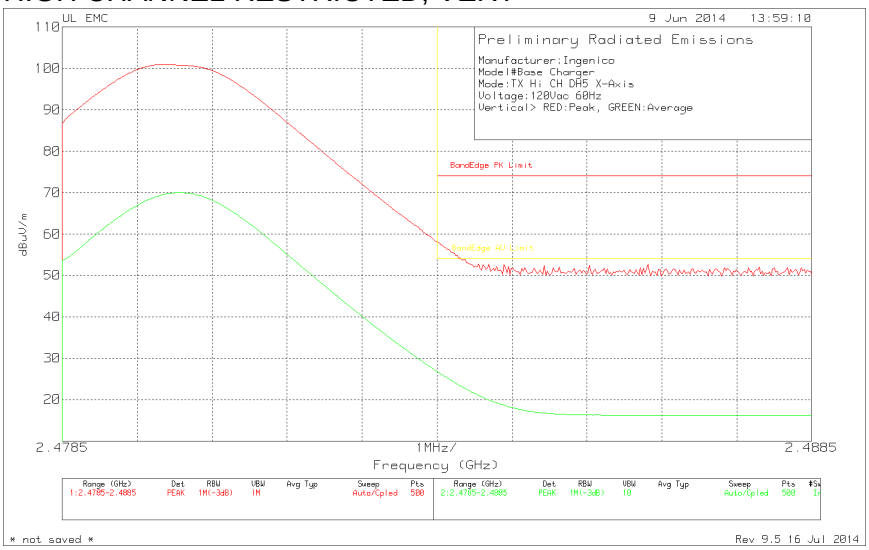
HIGH CHANNEL RESTRICTED, HORIZ



Duty Cycle Used

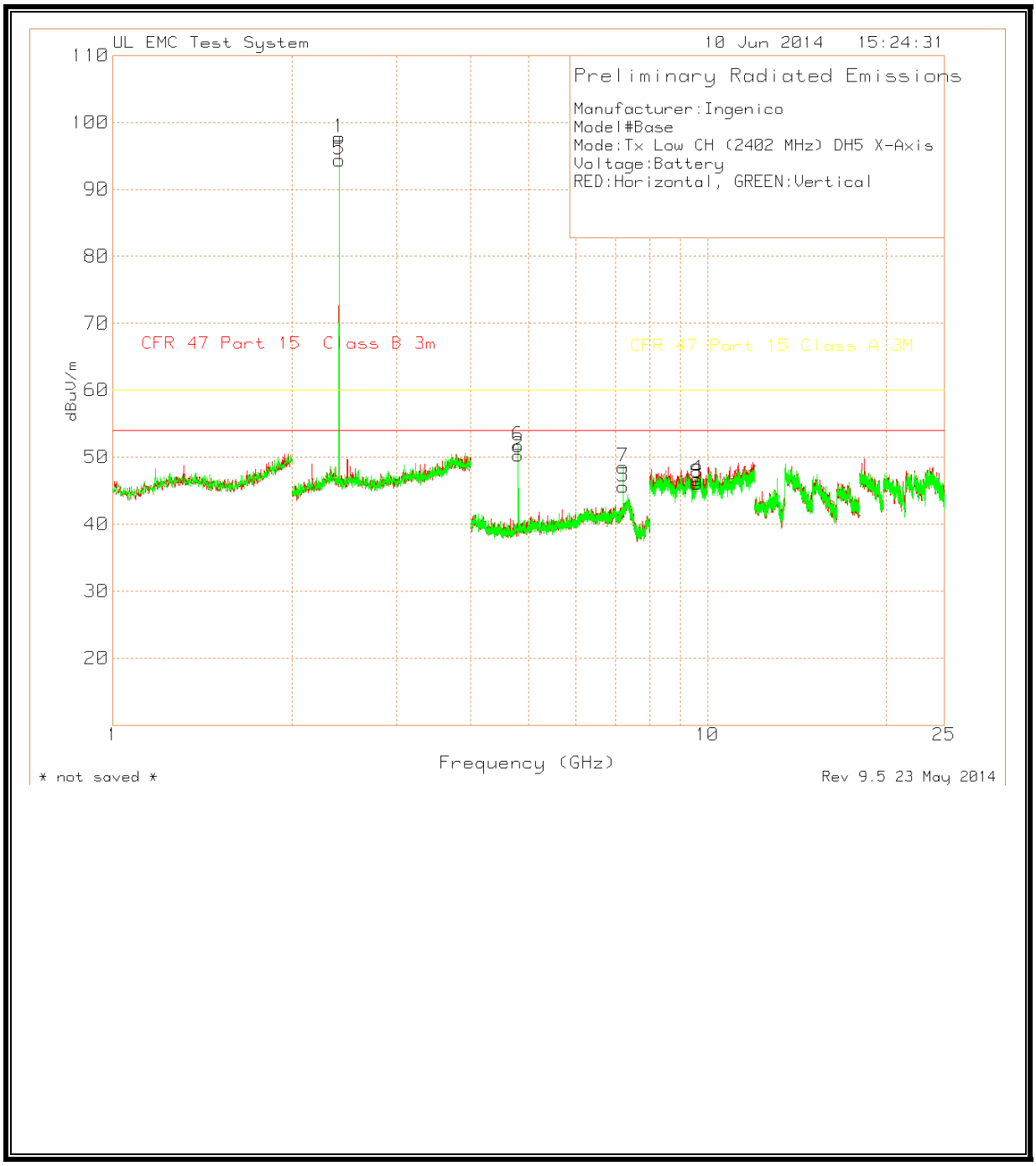
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, VERT



Duty Cycle Used

HARMONICS AND SPURIOUS EMISSIONS

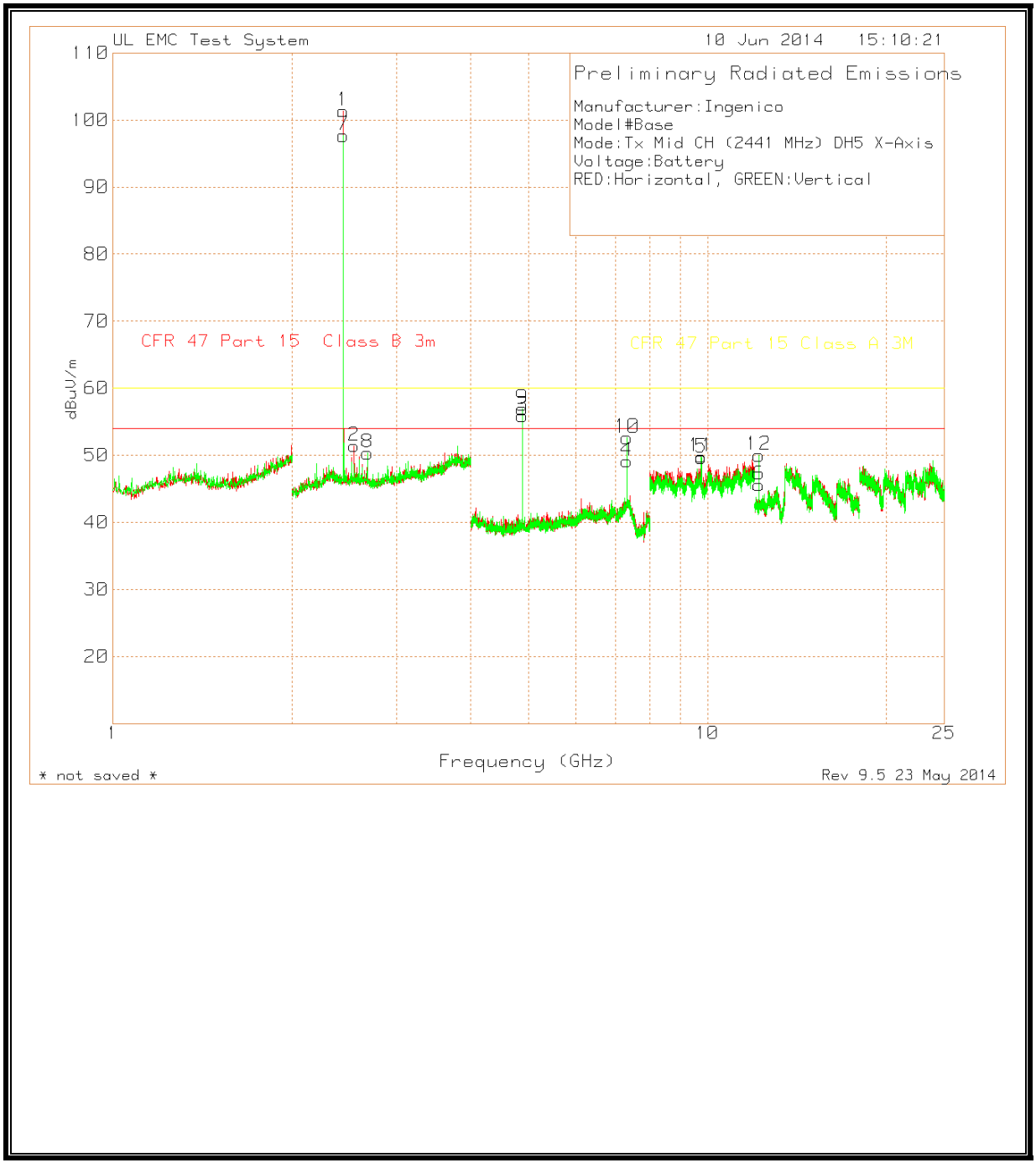


Manufacturer:Ingenico
Model#Base
Mode:Tx Low CH (2402 MHz) DH5 X-Axis
Voltage:Battery
RED:Horizontal, GREEN:Vertical

Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Duty Cycle	Corrected Reading dBuV/m	CFR 47 Part 15 Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
* 4.8043	78.26	PK	27.7	-50.46	0	55.5	74	-18.5	79	105	H
* 4.8041	70.65	LnAv	27.7	-50.46	-24.6	23.29	54	-30.71	79	105	H
7.2065	66.59	PK	29.7	-46.34	0	49.95	74	-24.05	160	104	H
7.2061	56.94	LnAv	29.7	-46.34	-24.6	15.7	54	-38.3	160	104	H
* 4.8043	77.66	PK	27.7	-50.46	0	54.9	74	-19.1	42	130	V
* 4.8041	69.78	LnAv	27.7	-50.46	-24.6	22.42	54	-31.58	42	130	V
7.2065	71.85	PK	29.7	-46.34	0	55.21	74	-18.79	16	102	V
7.2061	63.03	LnAv	29.7	-46.34	-24.6	21.79	54	-32.21	16	102	V

PK - Peak detector
LnAv - Linear (voltage) average detector

HARMONICS AND SPURIOUS EMISSIONS

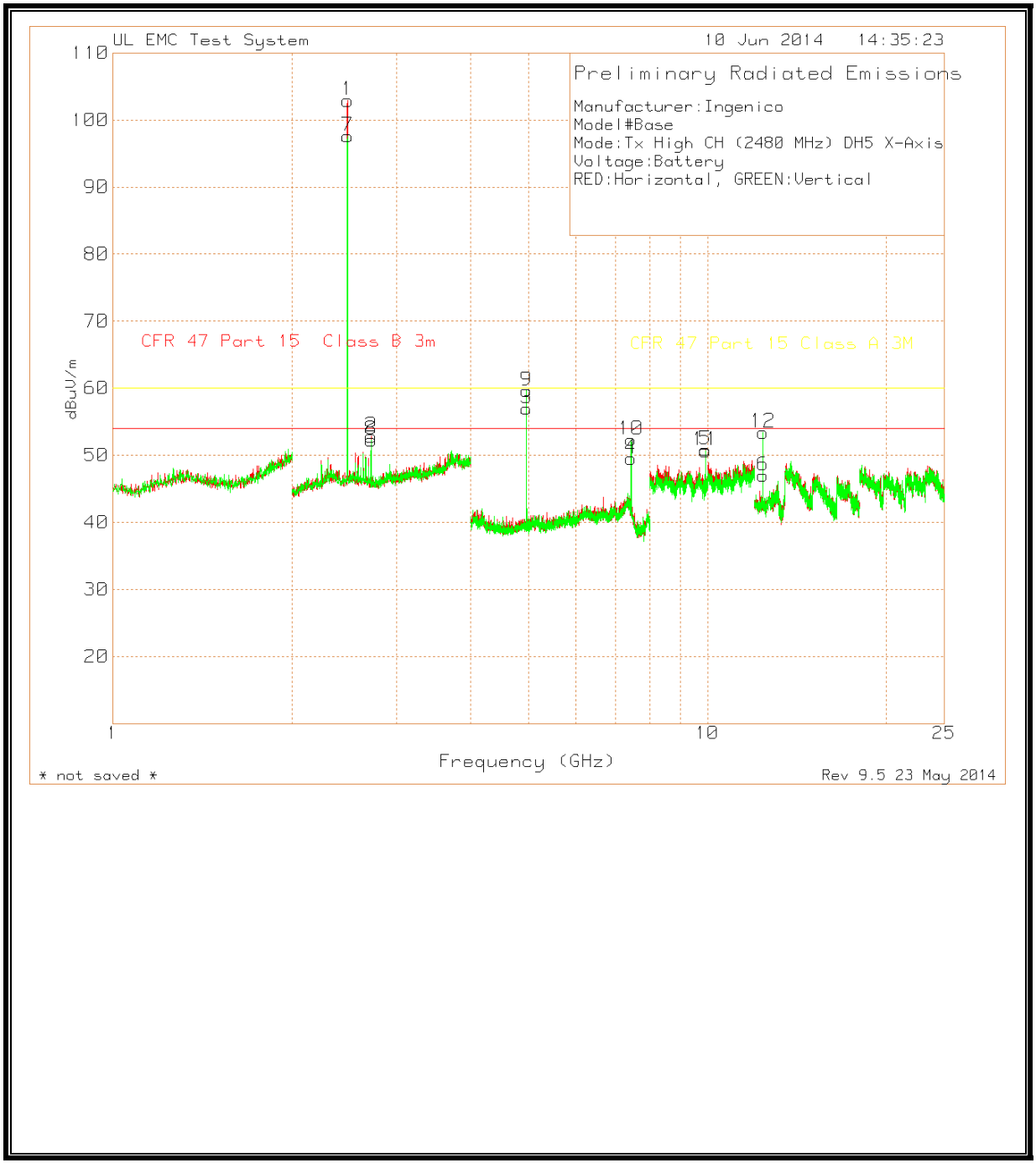


Manufacturer:Ingenico
Model#Base
Mode:Tx Mid CH (2441 MHz) DH5 X-Axis
Voltage:Battery
RED:Horizontal, GREEN:Vertical

Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Duty Cycle	Corrected Reading dBuV/m	CFR 47 Part 15 Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
2.5448	31.7	PK	22.2	4.35	0	58.25	74	-15.75	277	112	H
2.545	22.71	LnAv	22.2	4.35	-24.6	24.66	54	-29.34	277	112	H
* 4.8817	84.15	PK	27.7	-50.11	0	61.74	74	-12.26	83	103	H
* 4.882	76.86	LnAv	27.7	-50.11	-24.6	29.85	54	-24.15	83	103	H
* 7.3224	70.5	PK	30.6	-45.71	0	55.39	74	-18.61	156	102	H
* 7.323	61.8	LnAv	30.6	-45.71	-24.6	22.09	54	-31.91	156	102	H
9.7633	66.89	PK	36.4	-48.7	0	54.59	74	-19.41	180	143	H
9.7639	55.69	LnAv	36.4	-48.72	-24.6	18.77	54	-35.23	180	143	H
* 12.2038	63.59	PK	39.4	-45.53	0	57.46	74	-16.54	0	138	H
* 12.2047	51.71	LnAv	39.4	-45.51	-24.6	21	54	-33	0	138	H
* 2.6808	29.09	PK	22.1	4.44	0	55.63	74	-18.37	311	124	V
* 2.681	18.96	LnAv	22.1	4.44	-24.6	20.9	54	-33.1	311	124	V
* 4.8817	82.95	PK	27.7	-50.11	0	60.54	74	-13.46	47	127	V
* 4.882	75.59	LnAv	27.7	-50.11	-24.6	28.58	54	-25.42	47	127	V
* 7.3225	75.59	PK	30.6	-45.71	0	60.48	74	-13.52	15	101	V
* 7.323	67.05	LnAv	30.6	-45.71	-24.6	27.34	54	-26.66	15	101	V
9.7635	67.18	PK	36.4	-48.71	0	54.87	74	-19.13	231	134	V
9.764	56.04	LnAv	36.4	-48.72	-24.6	19.12	54	-34.88	231	134	V
* 12.2042	65.38	PK	39.4	-45.52	0	59.26	74	-14.74	354	101	V
* 12.2046	53.64	LnAv	39.4	-45.51	-24.6	22.93	54	-31.07	354	101	V

PK - Peak detector
LnAv - Linear (voltage) average detector

HARMONICS AND SPURIOUS EMISSIONS



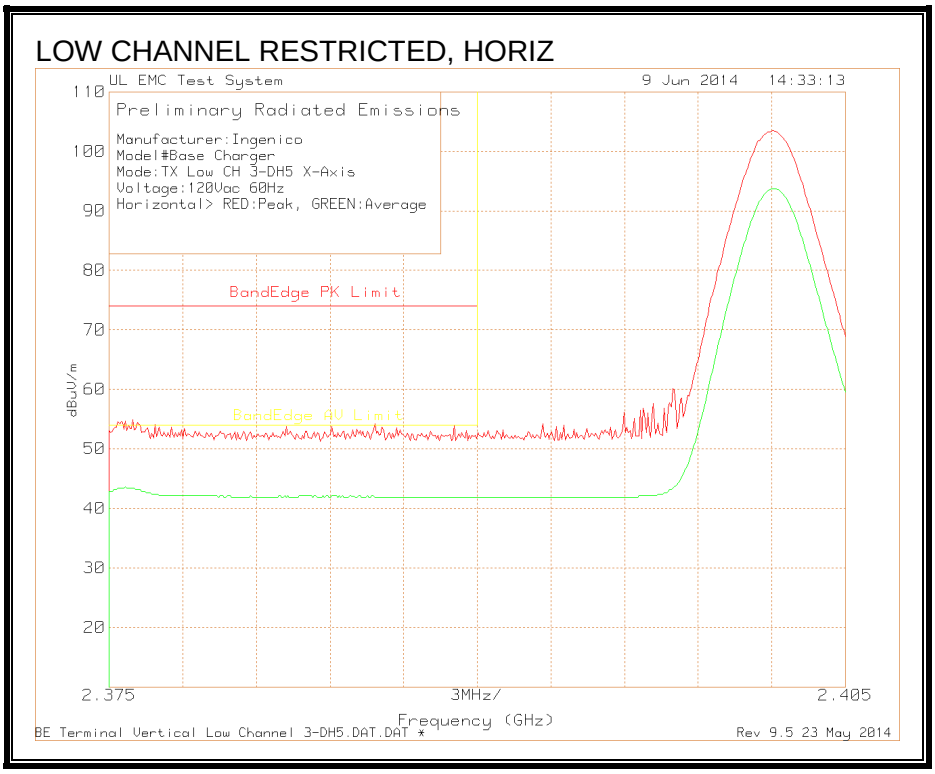
Manufacturer:Ingenico
Model#Base
Mode:Tx High CH (2480 MHz) DH5 X-Axis
Voltage:Battery
RED:Horizontal, GREEN:Vertical

Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Gain dB/m	Gain/Loss (dB)	Duty Cycle	Corrected Reading dBuV/m	CFR 47 Part 15 Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
2.7199	82.64	PK	22.1	-50.65	0	54.09	74	-19.91	18	100	H
2.72	71.94	LnAv	22.1	-50.65	-24.6	18.79	54	-35.21	18	100	H
* 4.9597	77.28	PK	27.8	-50.5	0	54.58	74	-19.42	152	100	H
* 4.96	69.39	LnAv	27.8	-50.5	-24.6	22.09	54	-31.91	152	100	H
* 4.9596	80.67	PK	27.8	-50.5	0	57.97	74	-16.03	326	102	V
* 4.96	72.82	LnAv	27.8	-50.5	-24.6	25.52	54	-28.48	326	102	V
* 12.3993	65.69	PK	39.4	-44.81	0	60.28	74	-13.72	17	100	H
* 12.3995	52.59	LnAv	39.4	-44.81	-24.6	22.58	54	-31.42	17	100	H
* 12.399	65.96	PK	39.4	-44.82	0	60.54	74	-13.46	305	100	V
* 12.3996	54.11	LnAv	39.4	-44.81	-24.6	24.1	54	-29.9	305	100	V

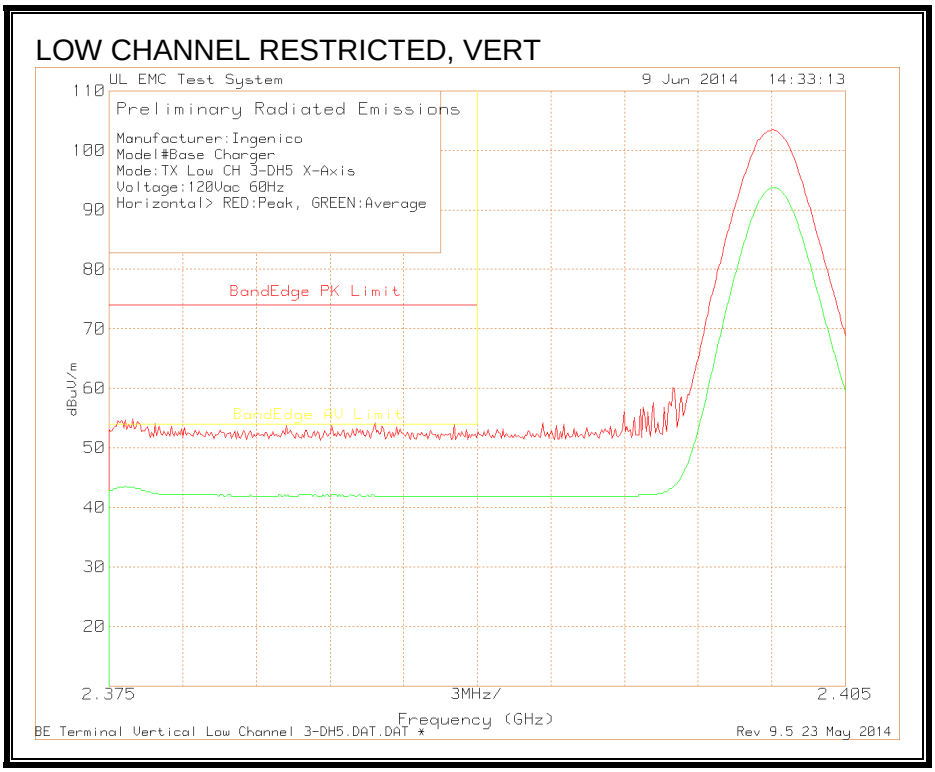
PK - Peak detector
LnAv - Linear (voltage) average detector

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

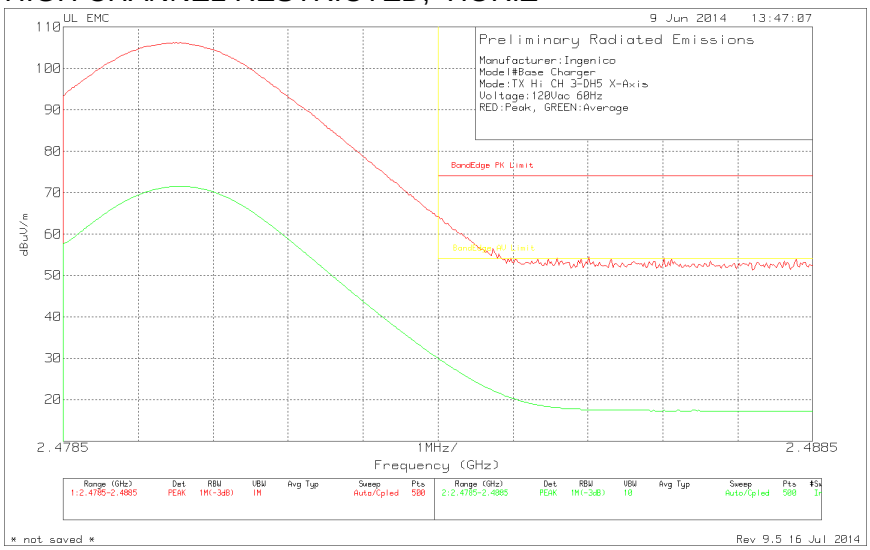


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

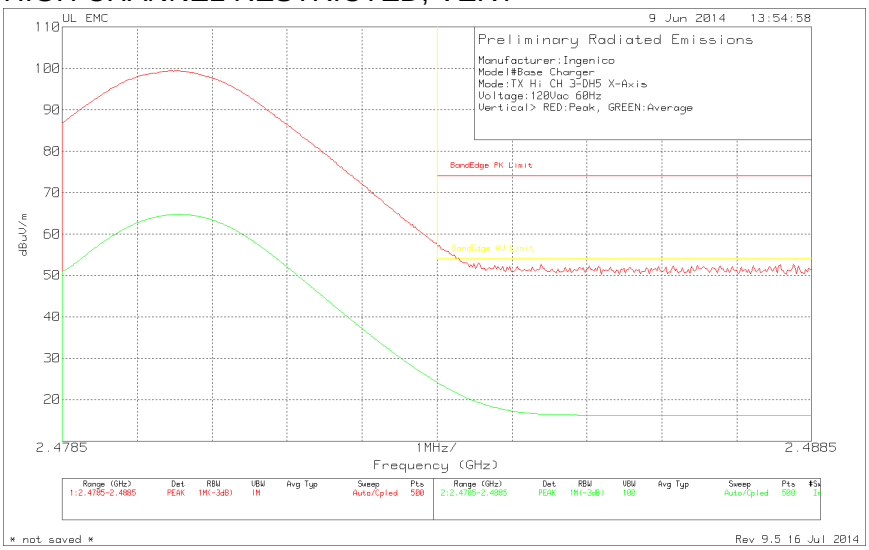
HIGH CHANNEL RESTRICTED, HORIZ



Duty Cycle used

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, VERT

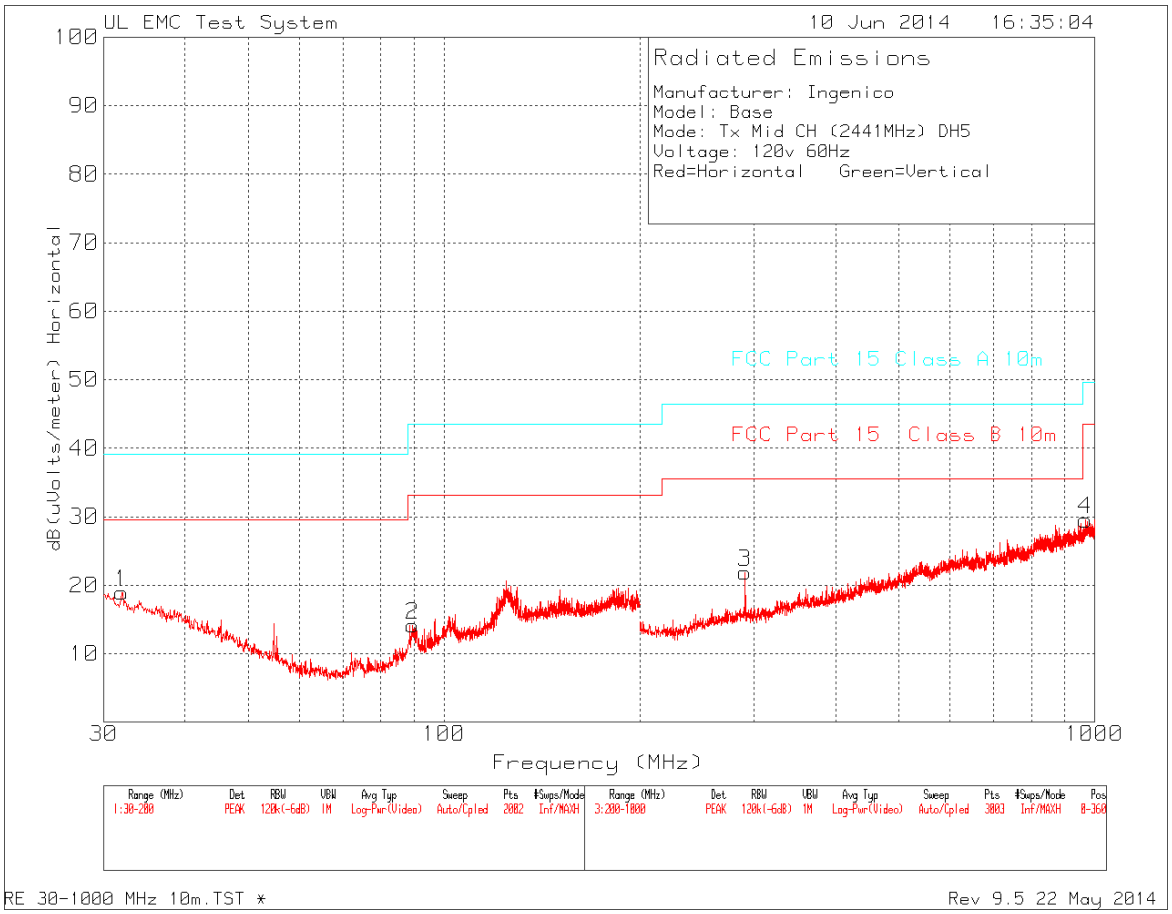


Duty Cycle used

9.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

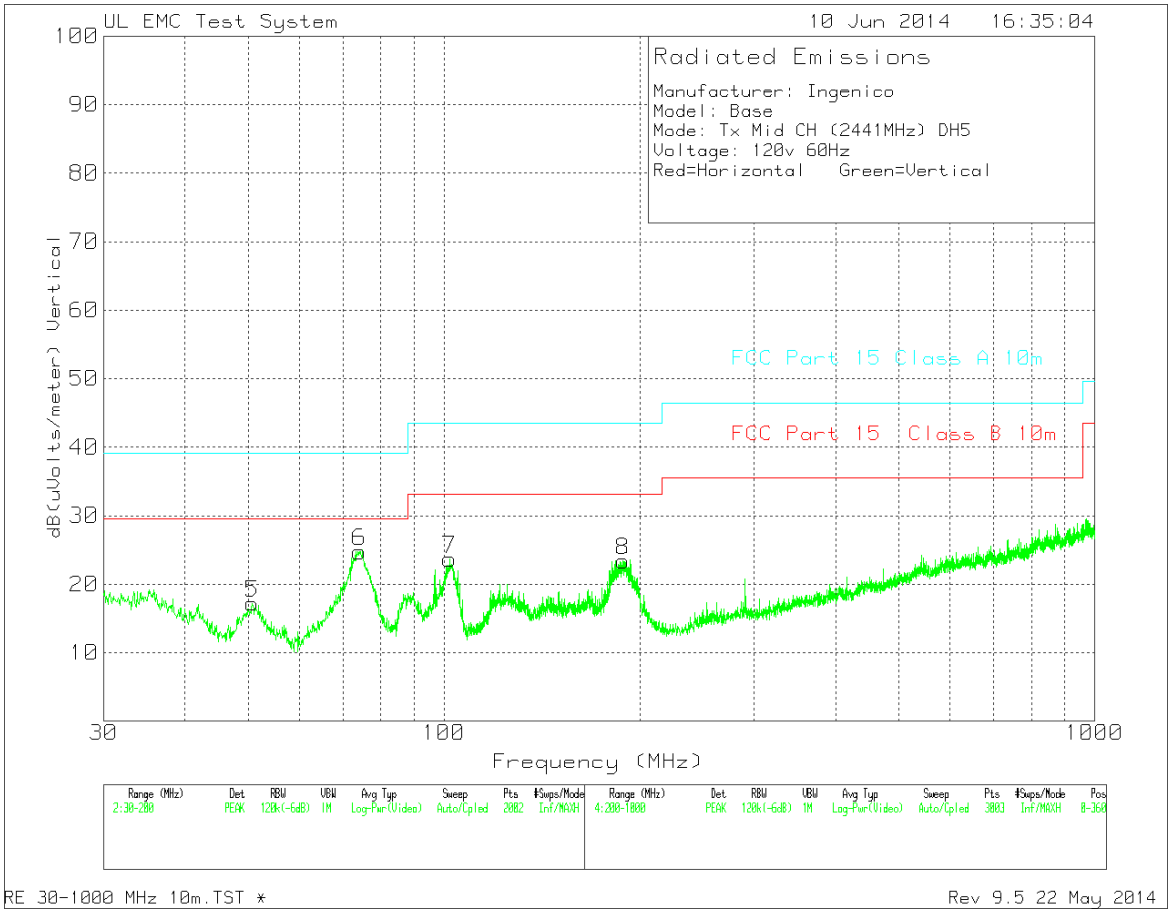
HORIZONTAL PLOT



Emissions at least 6dB below the limit, therefore no further measurements needed.

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



VERTICAL DATA

Manufacturer: Ingenico
Model: Base
Mode: Tx Mid CH (2441MHz) DH5
Voltage: 120v 60Hz
Red=Horizontal Green=Vertical

Marker No.	Test Frequency (MHz)	Meter Reading(dBuV)	Detector	Antenna Factor dB/m	Cable Factor dB	Corrected Reading dB(uVolts/meter)	FCC Part 15 Class A 10m	Margin (dB)	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	31.954	32.04	PK	17	-30.1	18.94	39.08	-20.14	29.55	-10.61	0-360	400	H
2	89.5556	35.06	PK	9	-29.9	14.16	43.52	-29.36	33.07	-18.91	0-360	400	H
5	50.7298	37.33	PK	9.9	-30	17.23	39.08	-21.85	29.55	-12.32	0-360	99	V
6	74.1782	48.48	PK	6.3	-30	24.78	39.08	-14.3	29.55	-4.77	0-360	400	V
7	102.0444	42.47	PK	11	-29.8	23.67	43.52	-19.85	33.07	-9.4	0-360	99	V
8	188.5316	36.61	PK	15.9	-29.1	23.41	43.52	-20.11	33.07	-9.66	0-360	99	V
3	290.3398	34.97	PK	13.2	-26.3	21.87	46.44	-24.57	35.57	-13.7	0-360	299	H
4	968.8208	29.66	PK	24	-24.1	29.56	49.54	-19.98	43.52	-13.96	0-360	199	H

PK - Peak detector

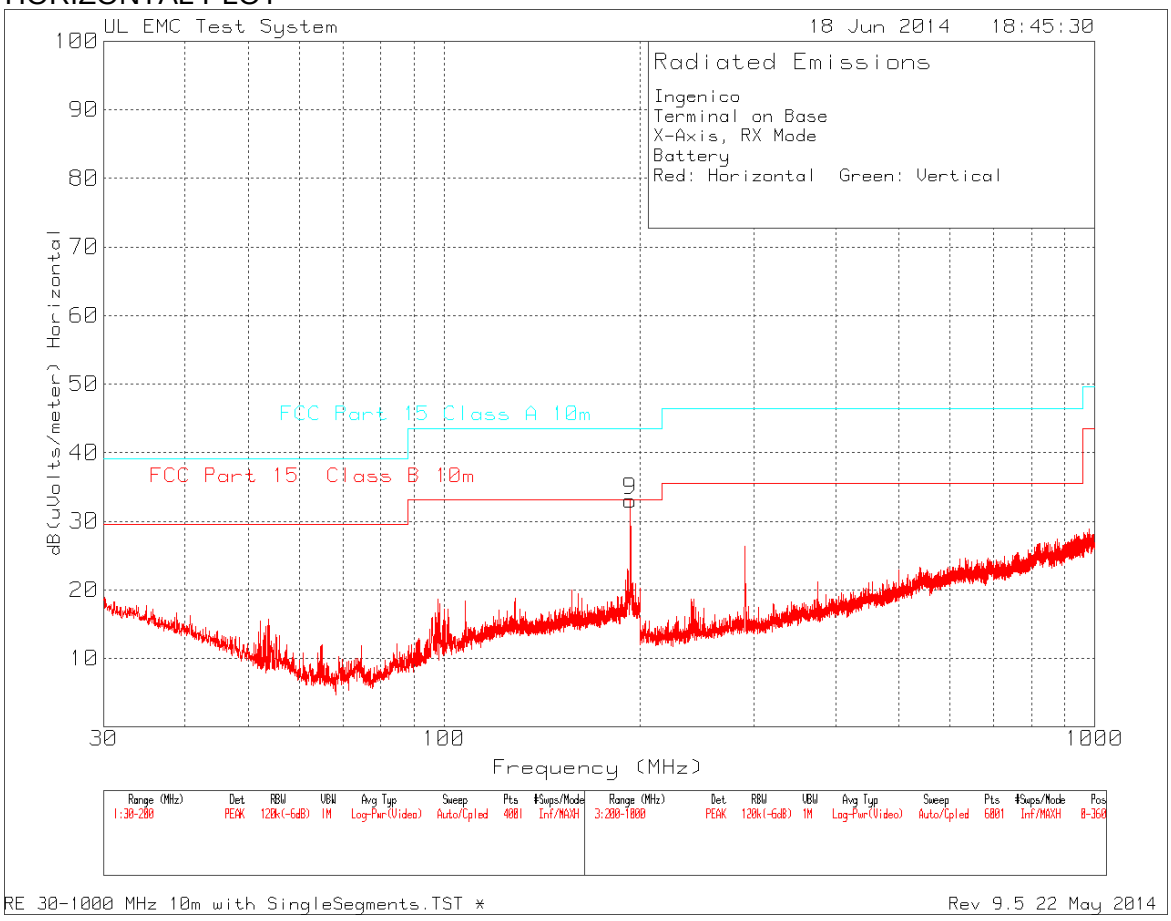
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Cable Factor dB	Corrected Reading dB(uVolts/meter)	FCC Part 15 Class A 10m	Margin (dB)	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
73.153187	42.55	QP	6.3	-30	18.85	39.08	-20.23	29.55	-10.7	182	373	V

QP - Quasi peak

9.4. DIGITAL DEVICE BELOW 1 GHz

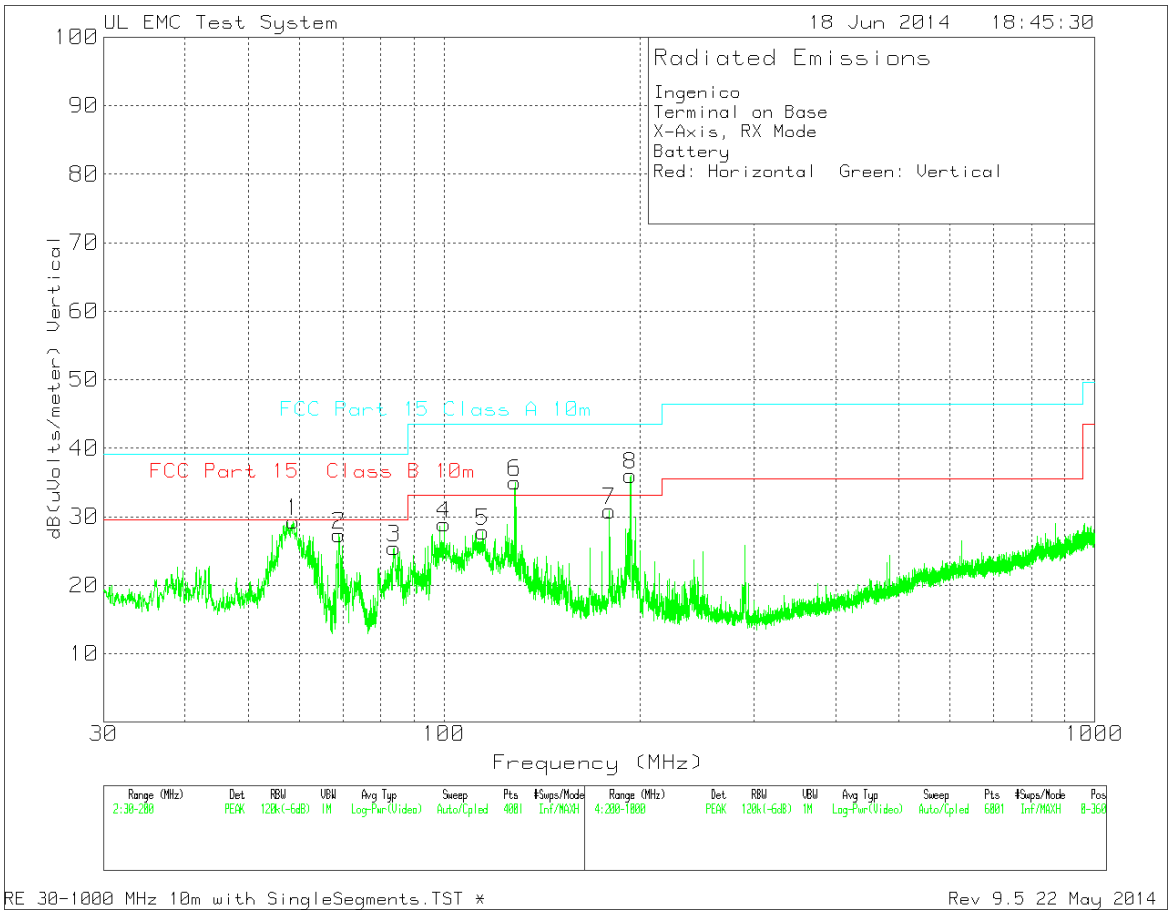
SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, HORIZONTAL)

HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, VERTICAL)

VERTICAL PLOT



DATA

Ingenico
Terminal on Base
X-Axis, RX Mode
Battery
Red: Horizontal Green: Vertical

Marker No.	Test Frequency (MHz)	Meter Reading(dBuV)	Detector	Antenna Factor dB/m	Cable Factor dB	Corrected Reading dB(uVolts/meter)	FCC Part 15 Class A 10m	Margin (dB)	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
9	193.37	45.92	PK	16	-28.9	33.02	43.52	-10.5	33.07	-0.05	0-360	400	H
1	58.6875	52.24	PK	7.2	-30.1	29.34	39.08	-9.74	29.55	-0.21	0-360	249	V
2	68.9725	51.15	PK	6.2	-30	27.35	39.08	-11.73	29.55	-2.2	0-360	249	V
3	83.7625	47.56	PK	7.8	-29.9	25.46	39.08	-13.62	29.55	-4.09	0-360	400	V
4	99.9975	48.24	PK	10.6	-29.9	28.94	43.52	-14.58	33.07	-4.13	0-360	99	V
5	114.7875	44.83	PK	12.8	-29.8	27.83	43.52	-15.69	33.07	-5.24	0-360	249	V
6	128.5575	50.95	PK	13.9	-29.8	35.05	43.52	-8.47	33.07	1.98	0-360	99	V
7	179.6	44.38	PK	15.8	-29.3	30.88	43.52	-12.64	33.07	-2.19	0-360	99	V
8	193.5825	48.85	PK	16.1	-28.9	36.05	43.52	-7.47	33.07	2.98	0-360	99	V

PK - Peak detector

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Cable Factor dB	Corrected Reading dB(uVolts/meter)	FCC Part 15 Class A 10m	Margin (dB)	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
193.5262	46.64	QP	16.1	-28.9	33.84	43.52	-9.68	33.07	0.77	103	100	V

QP - Quasi-Peak detector

Digital Device is Class A

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.

RESULTS

6 WORST EMISSIONS

Manufacturer:Ingenico
Model#Base
Mode:Tx High CH DH5
Voltage:120Vac 60Hz
RED:Line-L1, GREEN:Line-N

Line - L1

Marker No.	Test Frequency (MHz)	Meter Reading(dBuV)	Detector	LISN Factor dB	Cable Factor dB	Corrected Reading (dB(uVolts))	CISPR 22/11 Group 1 Class B QP	Margin (dB)	CISPR 22/11 Group 1 Class B AV	Margin (dB)
1	0.27105	62.07	PK	0.1	11.1	73.27	61.09	12.18	51.09	22.18
2	0.31176	48.95	PK	0.1	10.8	59.85	59.92	-0.07	49.92	9.93
3	0.32702	40.43	PK	0.1	10.8	51.33	59.53	-8.2	49.53	1.8
4	0.40376	39.25	PK	0.1	10.7	50.05	57.78	-7.73	47.78	2.27
5	0.54156	48.68	PK	0.1	10.6	59.38	56	3.38	46	13.38
6	0.59944	41.52	PK	0.1	10.6	52.22	56	-3.78	46	6.22
7	0.68488	41.77	PK	0.1	10.6	52.47	56	-3.53	46	6.47
8	0.76014	40.14	PK	0	10.6	50.74	56	-5.26	46	4.74
Line - L2										
9	0.25028	41.19	PK	0.1	11.2	52.49	61.75	-9.26	51.75	0.74
10	0.25621	42.5	PK	0.1	11.2	53.8	61.55	-7.75	51.55	2.25
11	0.35967	45.25	PK	0.1	10.8	56.15	58.74	-2.59	48.74	7.41

PK - Peak detector

Line - L1 .15 - 1MHz

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor dB	Cable Factor dB	Corrected Reading (dB(uVolts))	CISPR 22/11 Group 1 Class B QP	Margin (dB)	CISPR 22/11 Group 1 Class B AV	Margin (dB)
0.27194	44.99	QP	0.1	11.1	56.19	61.06	-4.87	51.06	5.13
0.31149	38.01	QP	0.1	10.8	48.91	59.93	-11.02	49.93	-1.02
0.32728	40.08	QP	0.1	10.8	50.98	59.52	-8.54	49.52	1.46
0.40362	41.39	QP	0.1	10.7	52.19	57.78	-5.59	47.78	4.41
0.54103	30.62	QP	0.1	10.6	41.32	56	-14.68	46	-4.68
0.59927	34.99	QP	0.1	10.6	45.69	56	-10.31	46	-0.31
0.68513	30.2	QP	0.1	10.6	40.9	56	-15.1	46	-5.1
0.759845	31.96	QP	0.1	10.6	42.66	56	-13.34	46	-3.34
Line - L2 .15 - 1MHz									
0.24934	34.79	QP	0.1	11.2	46.09	61.78	-15.69	51.78	-5.69
0.256393	39.41	QP	0.1	11.2	50.71	61.55	-10.84	51.55	-0.84
0.359575	39.31	QP	0.1	10.8	50.21	58.74	-8.53	48.74	1.47

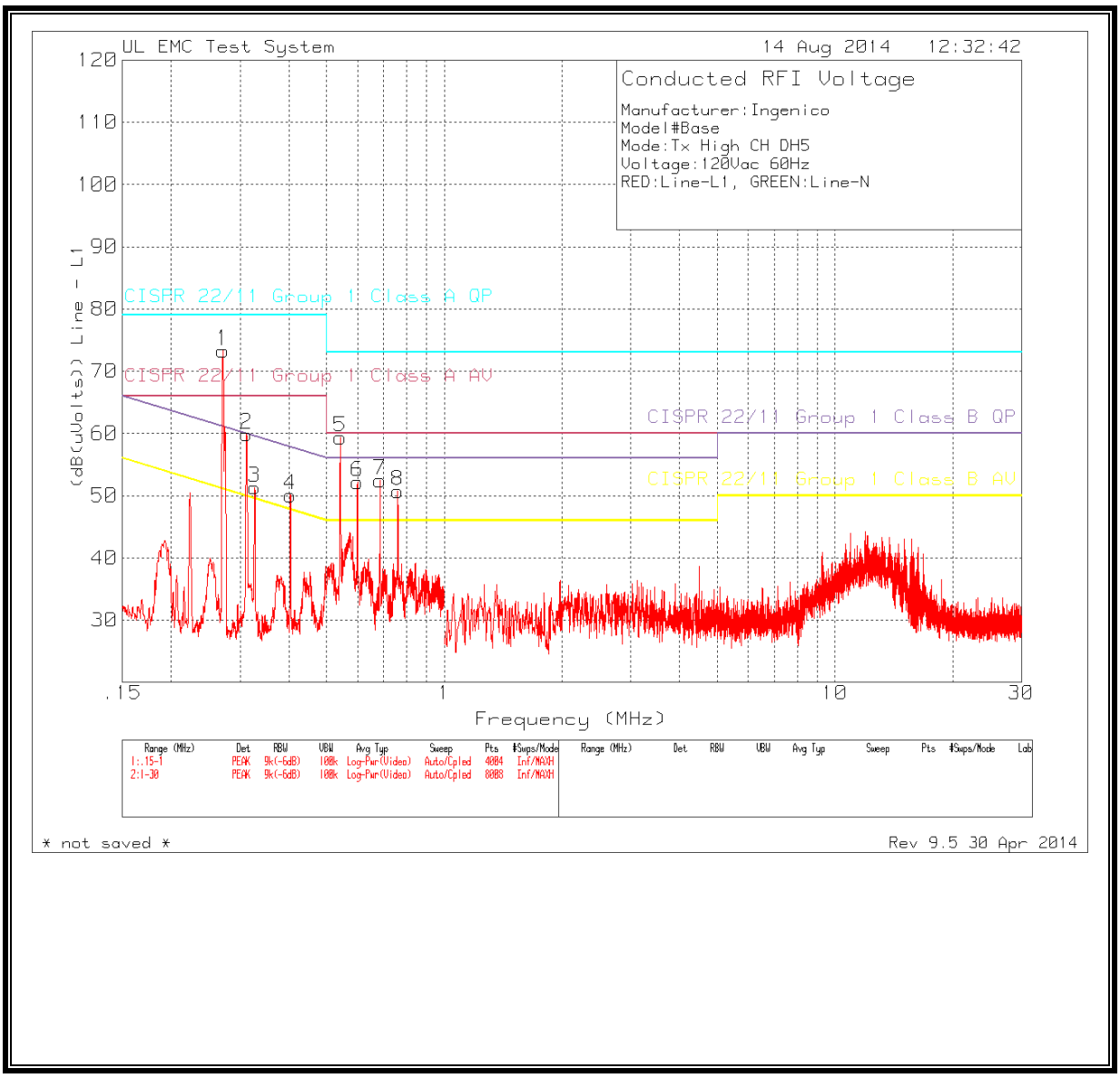
QP - Quasi-Peak detector

Line - L1 .15 - 1MHz

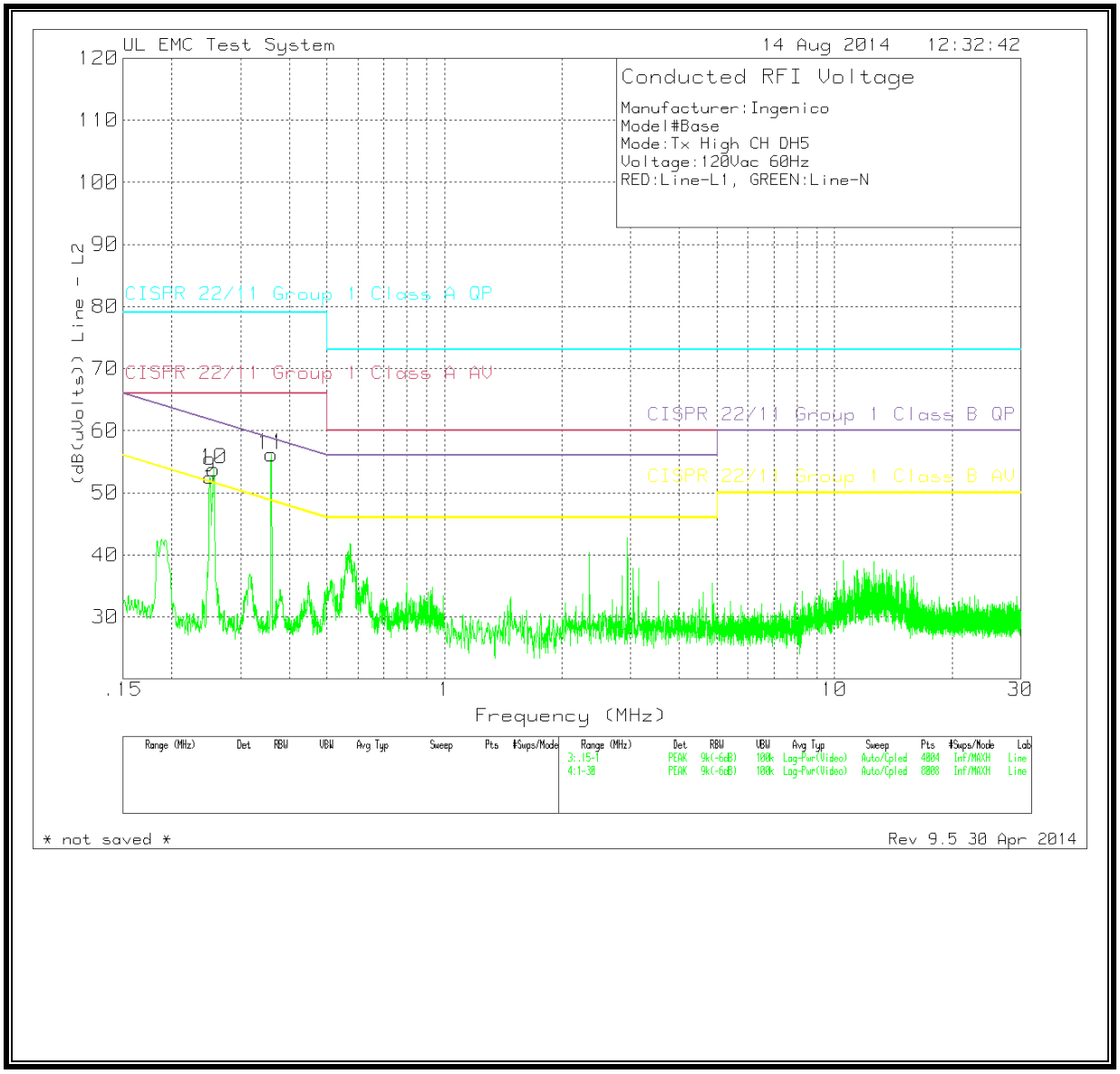
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor dB	Cable Factor dB	Corrected Reading (dB(uVolts))	CISPR 22/11 Group 1 Class B QP	Margin (dB)	CISPR 22/11 Group 1 Class B AV	Margin (dB)
0.27194	21.01	Av	0.1	11.1	32.21	61.06	-28.85	51.06	-18.85
0.31149	14.91	Av	0.1	10.8	25.81	59.93	-34.12	49.93	-24.12
0.32728	14.75	Av	0.1	10.8	25.65	59.52	-33.87	49.52	-23.87
0.40362	15.6	Av	0.1	10.7	26.4	57.78	-31.38	47.78	-21.38
0.54103	10.01	Av	0.1	10.6	20.71	56	-35.29	46	-25.29
0.59927	14.33	Av	0.1	10.6	25.03	56	-30.97	46	-20.97
0.68513	10.49	Av	0.1	10.6	21.19	56	-34.81	46	-24.81
0.759845	12.85	Av	0.1	10.6	23.55	56	-32.45	46	-22.45
Line - L2 .15 - 1MHz									
0.24934	14.04	Av	0.1	11.2	25.34	61.78	-36.44	51.78	-26.44
0.256393	20.92	Av	0.1	11.2	32.22	61.55	-29.33	51.55	-19.33
0.359575	10.92	Av	0.1	10.8	21.82	58.74	-36.92	48.74	-26.92

Av - CISPR average detection

LINE 1 RESULTS



LINE 2 RESULTS



6 WORST EMISSIONS

Ingenico
Device on base charging
120V, 60Hz
Red=L1, Green=L2, Cyan=AVE, Orange=QP
Digital Scan

Line - L1 .15 - 1MHz

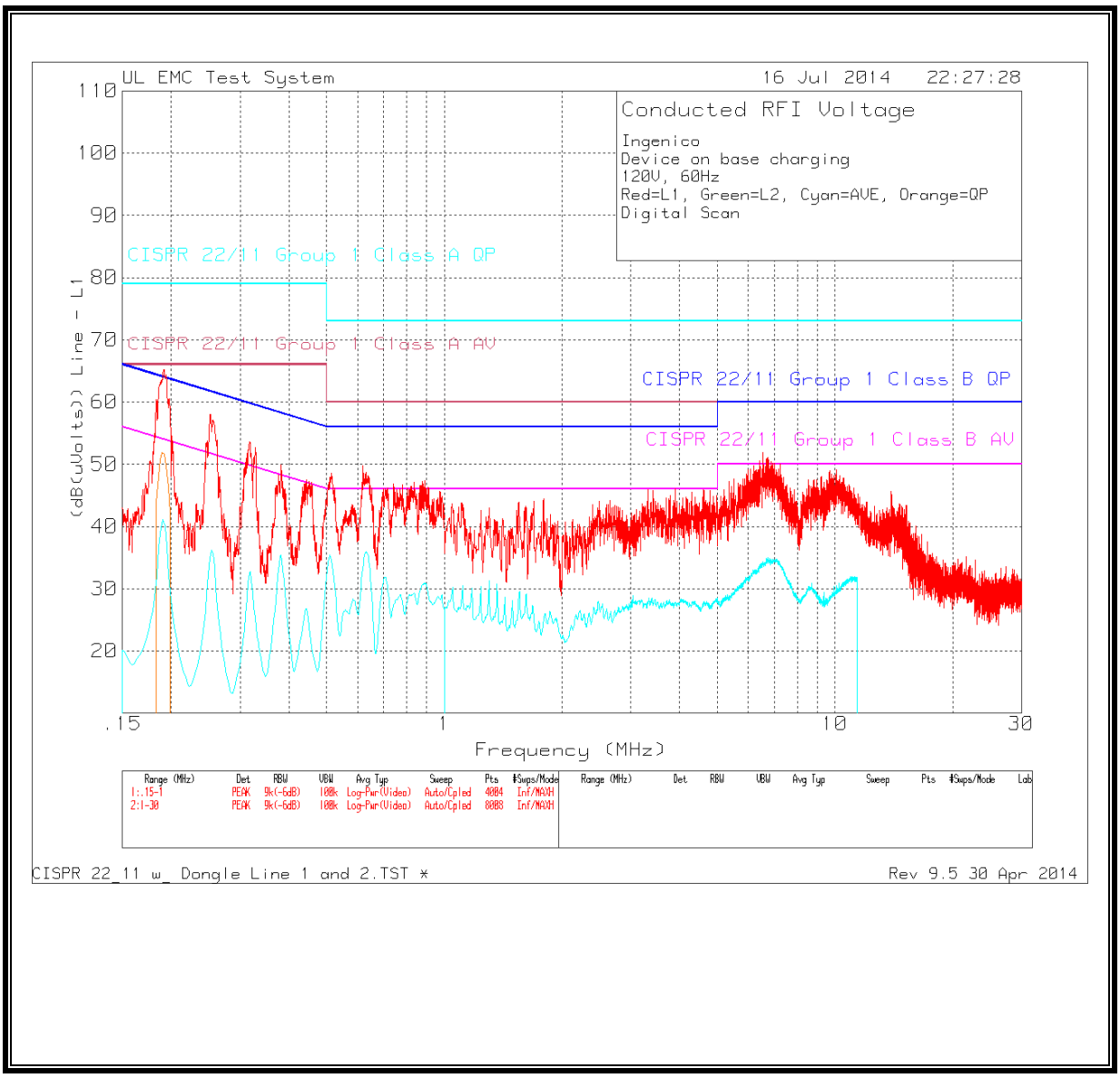
Test Frequency (MHz)	Meter Reading(dBuV)	Detector	LISN Factor dB	Cable Factor dB	Corrected Reading (dB(uVolts))	CISPR 22/11 Group 1 Class B QP	Margin (dB)	CISPR 22/11 Group 1 Class B AV	Margin (dB)
0.1905	29.45	Av	0.1	11.6	41.15	64.01	-22.86	54.01	-12.86
0.2535	24.89	Av	0.1	11.2	36.19	61.64	-25.45	51.64	-15.45
0.31875	21.82	Av	0.1	10.8	32.72	59.74	-27.02	49.74	-17.02
0.38175	24.52	Av	0.1	10.8	35.42	58.24	-22.82	48.24	-12.82
0.44475	16.03	Av	0.1	10.7	26.83	56.97	-30.14	46.97	-20.14
0.51	24.84	Av	0	10.6	35.44	56	-20.56	46	-10.56
0.6315	25.17	Av	0.1	10.6	35.87	56	-20.13	46	-10.13
0.89025	20.17	Av	0.1	10.6	30.87	56	-25.13	46	-15.13
0.18971	40.18	QP	0.1	11.6	51.88	64.05	-12.17	54.05	-2.17
3.394	17.75	Av	0.1	10.6	28.45	56	-27.55	46	-17.55
4.627	17.18	Av	0.1	10.7	27.98	56	-28.02	46	-18.02
6.7285	24.06	Av	0.1	10.8	34.96	60	-25.04	50	-15.04
10.873	20.47	Av	0.2	11	31.67	60	-28.33	50	-18.33
13.91605	34.33	PK	0.2	11.1	45.63	60	-14.37	50	-4.37

Line - L2 .15 - 1MHz

Test Frequency (MHz)	Meter Reading(dBuV)	Detector	LISN Factor dB	Cable Factor dB	Corrected Reading (dB(uVolts))	CISPR 22/11 Group 1 Class B QP	Margin (dB)	CISPR 22/11 Group 1 Class B AV	Margin (dB)
0.1905	27.47	Av	0.1	11.6	39.17	64.01	-24.84	54.01	-14.84
0.2535	19.7	Av	0.1	11.2	31	61.64	-30.64	51.64	-20.64
0.31875	17.12	Av	0.1	10.8	28.02	59.74	-31.72	49.74	-21.72
0.38175	21.66	Av	0.1	10.8	32.56	58.24	-25.68	48.24	-15.68
0.44925	15.4	Av	0.1	10.7	26.2	56.89	-30.69	46.89	-20.69
0.51	19.87	Av	0.1	10.7	30.67	56	-25.33	46	-15.33
0.63375	21.17	Av	0.1	10.6	31.87	56	-24.13	46	-14.13
0.7035	18.94	Av	0.1	10.6	29.64	56	-26.36	46	-16.36
0.879	15.23	Av	0.1	10.6	25.93	56	-30.07	46	-20.07
0.18971	40.16	QP	0.1	11.6	51.86	64.05	-12.19	54.05	-2.19
4.3165	12.37	Av	0.1	10.7	23.17	56	-32.83	46	-22.83
7.0615	18.18	Av	0.1	10.9	29.18	60	-30.82	50	-20.82

PK - Peak detector
QP - Quasi-Peak detector
Av - CISPR average detection

LINE 1 RESULTS



LINE 2 RESULTS