



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

CERTIFICATION TEST REPORT

FOR

POWER METER OPTICAL READER

MODEL NUMBER: ST-VM-TESEPROBE-W-HD (OPTICAL READER)

FCC ID: Y8E-VM2014

REPORT NUMBER: R10008567-ORRF

ISSUE DATE: 2013-11-27

Prepared for
VISION METERING, LLC
7 ROSS CANNON ST
YORK, SC
29745, USA

Prepared by
UL LLC
12 LABORATORY DR.
RESEARCH TRIANGLE PARK, NC 27709 USA
TEL: (919) 549-1400

NVLAP[®]
NVLAP LAB CODE 200246-0

Revision History

Rev.	Date	Revisions	Revised By
--	2013-11-27	Initial Issue	Jeff Moser

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: VISION METERING LLC
7 ROSS CANNON ST
YORK, SC 29745, USA

EUT DESCRIPTION: POWER METER OPTICAL READER

MODEL: ST-VM-TESEPROBE-W-HD

SERIAL NUMBER: Non-serialized samples

DATE TESTED: 2013-09-13 through 2013-10-24

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:



Mike Antola
EMC Project Lead
UL - WiSE
Wireless, Interoperability, Security/Payments & EMC

Prepared By:



Jeff Moser
EMC Program Manager
UL - WiSE

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, 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 12 Laboratory Dr., Research Triangle Park, NC 27709, USA.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2002460.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:

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

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	+/- 2.5 dB
Radiated Disturbance, 30 to 1000 MHz	+/- 3.4 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 903-927 MHz transceiver device for Power Meters. The EUT is sold as part of a kit (model number ST-VM-TESEPROBE-W) that includes the Optical Head Reader (ST-VM-TESEPROBE-W-HD) and RF Adapter Reader (ST-VM-TESEPROBE-W-AD). This report covers the Optical Head Reader portion of the kit.

The radio module is manufactured by TestPro.

5.2. MAXIMUM OUTPUT E-FIELD STRENGTH

The transmitter has a maximum output peak E-field as follows:

Frequency Range (MHz)	Mode	Output PK E-field Strength (dBuV/m)
903-927	Optical Reader (GFSK)	85.94

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a monopole antenna, with a maximum gain of 3 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was A590, rev. 2.0.

The EUT driver software installed during testing was TesPro USB Optical Driver, rev. 1.01.

The test utility software used during testing was TS-SPRF900, rev. 2.0.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest peak E-field.

During testing of the optical reader, it was attached magnetically to partial meter face-plate with an ANSI type 2 optical port. The optical reader was oriented as it would normally be used in the field. That is, aligned for maximum coupling between the meter's and reader's optical ports.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	Lenovo	7661-CC2	L3-AB229	NA
AC Adapter	Lenovo	92P1109	11S92P1109Z1ZBTZ 718B5W	NA
USB to DB9 Serial Adapter	Aten	UC-232A	Z3844194BL60079	NA
Partial meter face-plate with ANSI type 2 optical port	-	-	-	NA

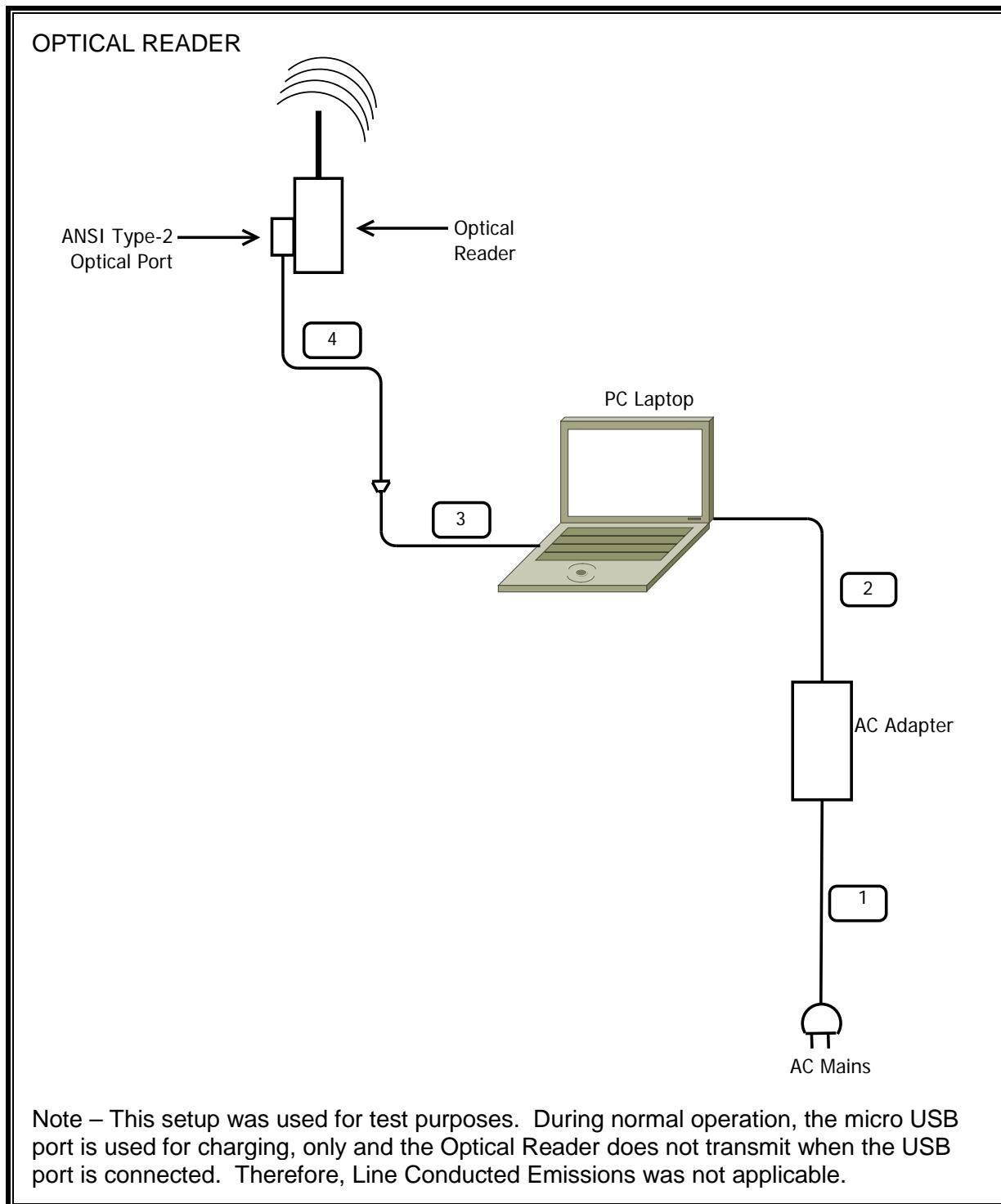
I/O CABLES

I/O Cable List					
Cable No	Port	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC In	AC inlet	Unshielded	1	Detachable Ac power cord to AC adapter.
2	DC Out	NA	Unshielded	1.7	Non-detachable power cable from AC adapter to laptop PC.
3	USB	USB	Shielded	0.3	USB-to-DB9 adapter cable between laptop PC and optical port.
4	DB9	DB9	Unshielded	2.4	2-conductor cable to optical port of meter face.

TEST SETUP

During testing of the optical reader, the EUT was attached magnetically to partial meter face-plate with an ANSI type 2 optical port. The optical reader was oriented as it would normally be used in the field. That is, aligned for maximum coupling between the meter's and reader's optical ports.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Antenna-port Measurements

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0016	Spectrum Analyzer	Agilent	N9030A	2013-09-04	2014-09-30
HI0041	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2013-01-25	2014-01-25

Radiated Disturbance Emissions

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0037	Loop Antenna (Low Range)	Electro-Metrics	EM-6871	2013-06-19	2014-06-30
AT0036	Loop Antenna (High Range)	Electro-Metrics	EM-6872	2013-06-20	2014-06-30
AT0022	Log-periodic Antenna, 200 MHz to 1000 MHz	Chase	UPA6109	2013-01-29	2014-01-31
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner-Chase EMC Ltd.	VBA6106A	2013-06-14	2014-06-30
AT0062	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2013-08-27	2014-08-31
SAC_C (Biconical 3m location)	Gain-Loss string for biconical antenna at 3m	Various	Various	2013-09-06	2014-09-30
SAC_D (Log-Periodic 3m location)	Gain-Loss string for log-periodic antenna at 3m	Various	Various	2013-09-06	2014-09-30
SAC_E_LR (Loop & Rod 3m location)	Gain-Loss string for loop/rod antenna at 3m	Various	Various	2013-09-06	2014-09-30
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	ESIB40 (1088.7490.40)	2013-09-03	2014-09-30
SA0016	Spectrum Analyzer	Agilent	N9030A	2013-09-04	2014-09-30
AMP011	RF Amp, 1-20GHz	Miteq	AMF-6D-01002000-22-10P	2013-09-04	2014-09-30
HI0034	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2013-01-25	2014-01-25
72669	Band Reject Filter: 902-928MHz	Lorch Microwave	5BR8-915/26-S	2013-07-14	2014-07-31
HPF005	High-pass Filter: 1500-1800MHz	Microtronics	HPM50114-01	2013-09-04	2014-09-30
HPF009	High-pass Filter: 1000-10,000GHz	Microtronics	HPM17672	2013-10-14	2014-10-30
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA

7. TEST RESULTS

7.1.1. 99% BANDWIDTH – OPTICAL READER

LIMITS

None; for reporting purposes only.

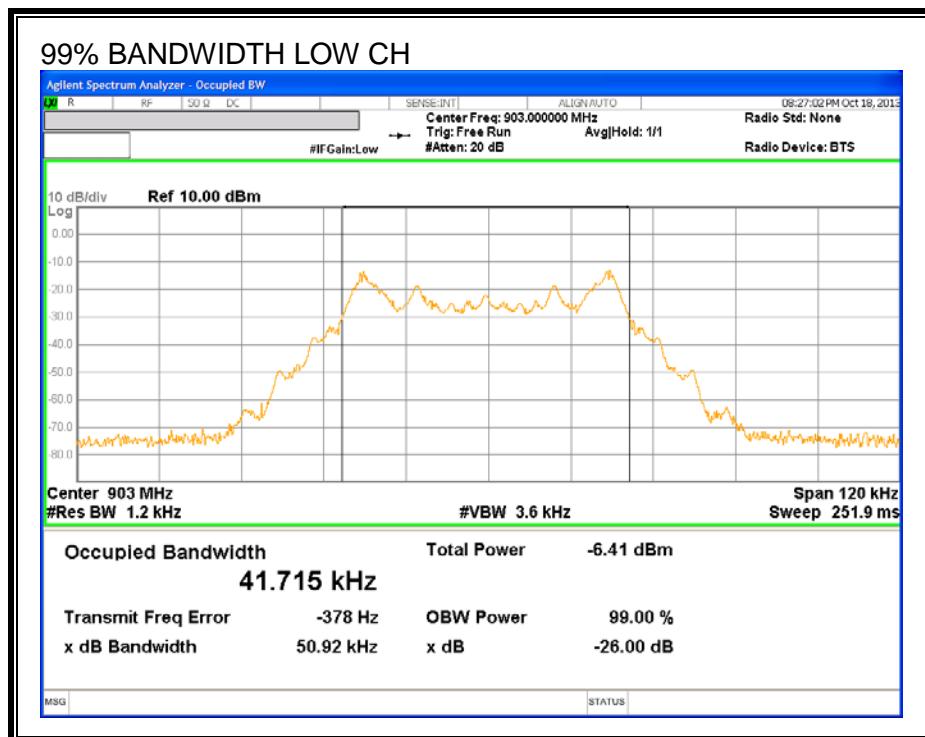
TEST PROCEDURE

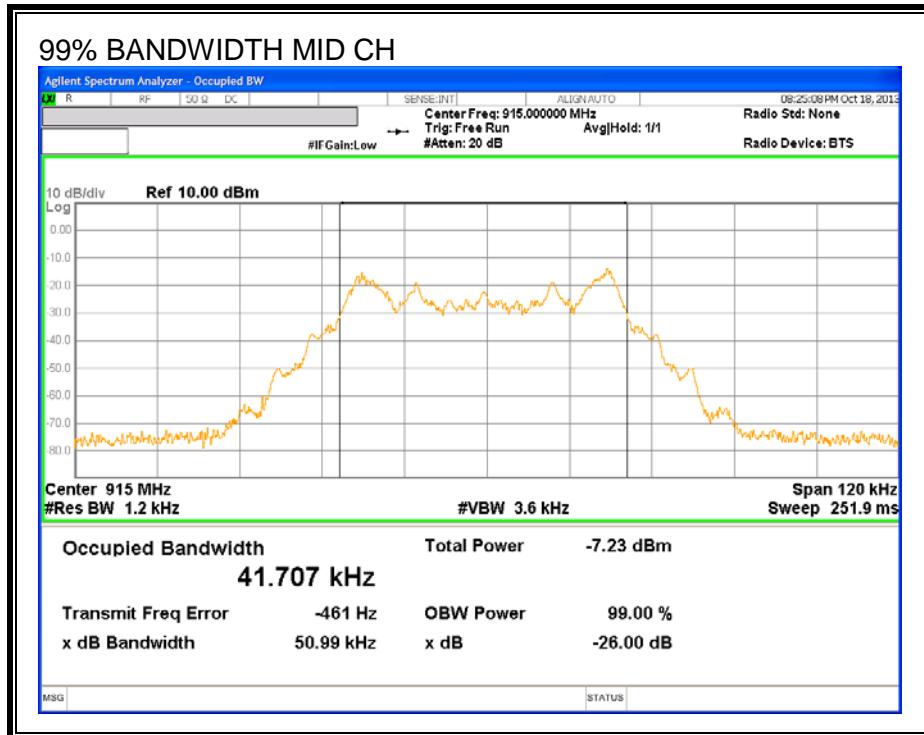
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

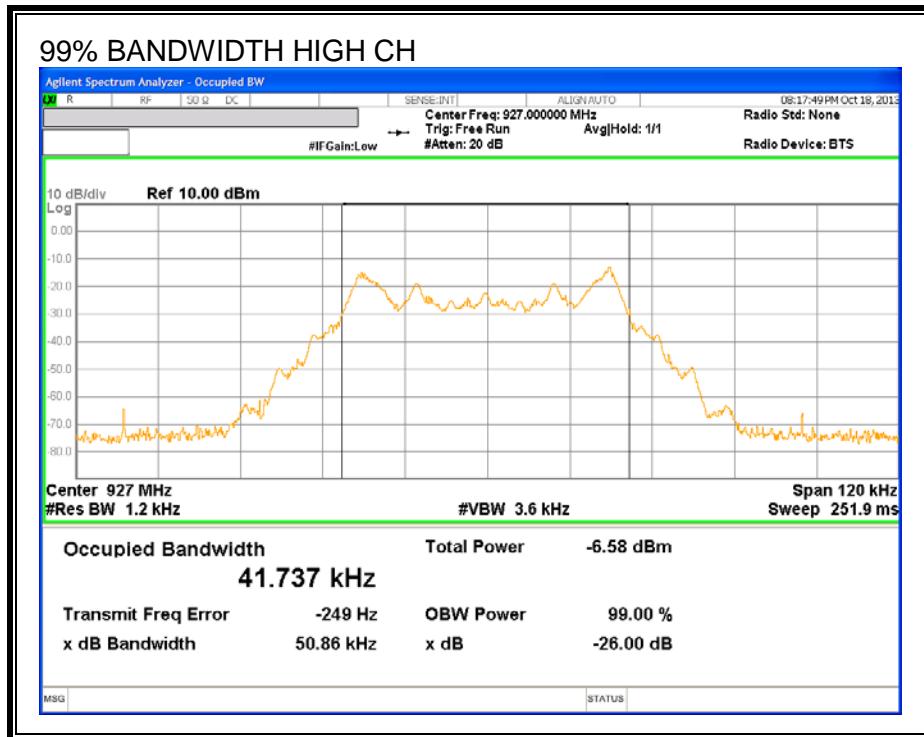
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)	99% Bandwidth (kHz)
Low	903	0.0417	41.715
Middle	915	0.0417	41.707
High	927	0.0417	41.737

99% BANDWIDTH







7.2. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4

LIMIT

IC RSS-210, A2.9
FCC 15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

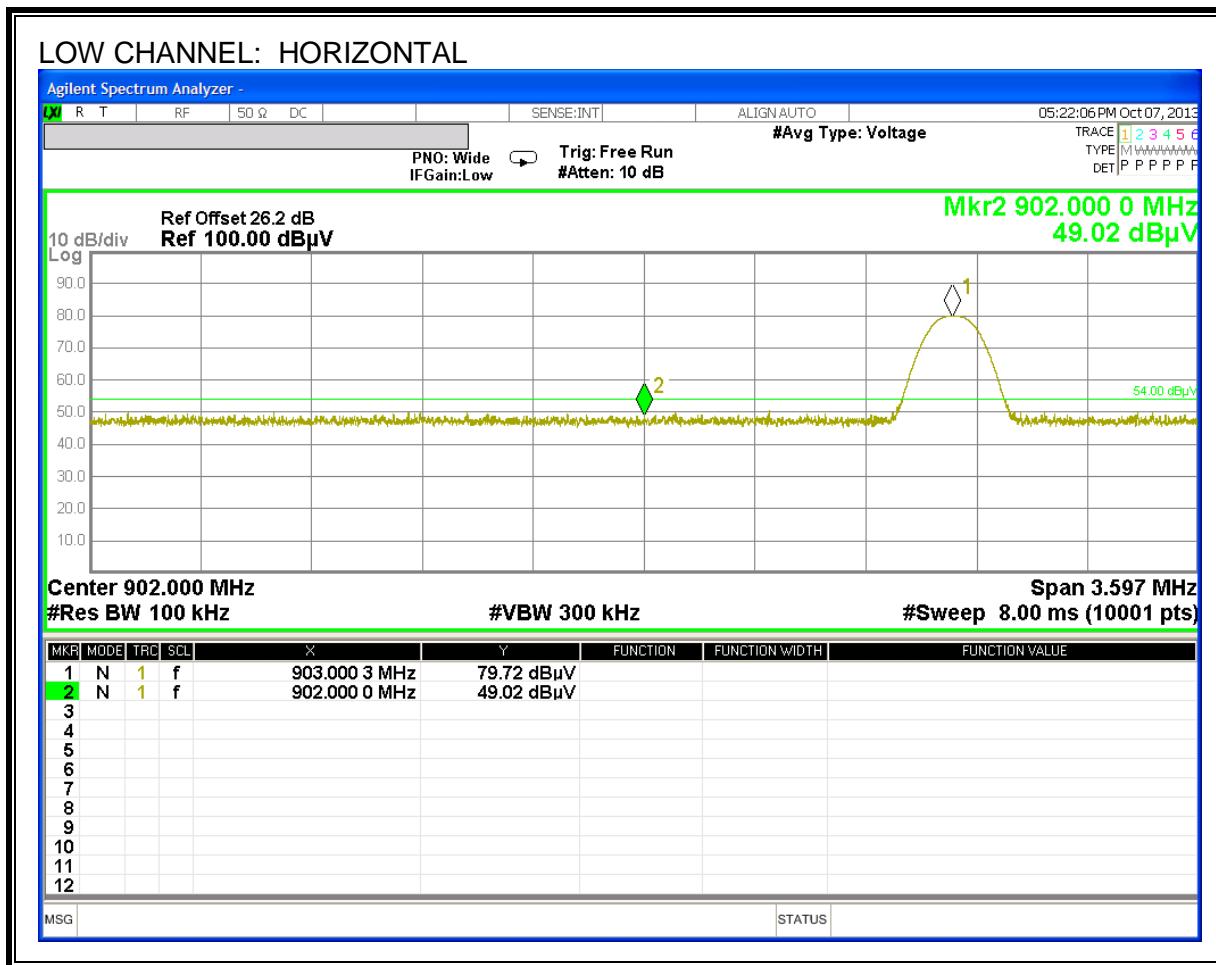
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

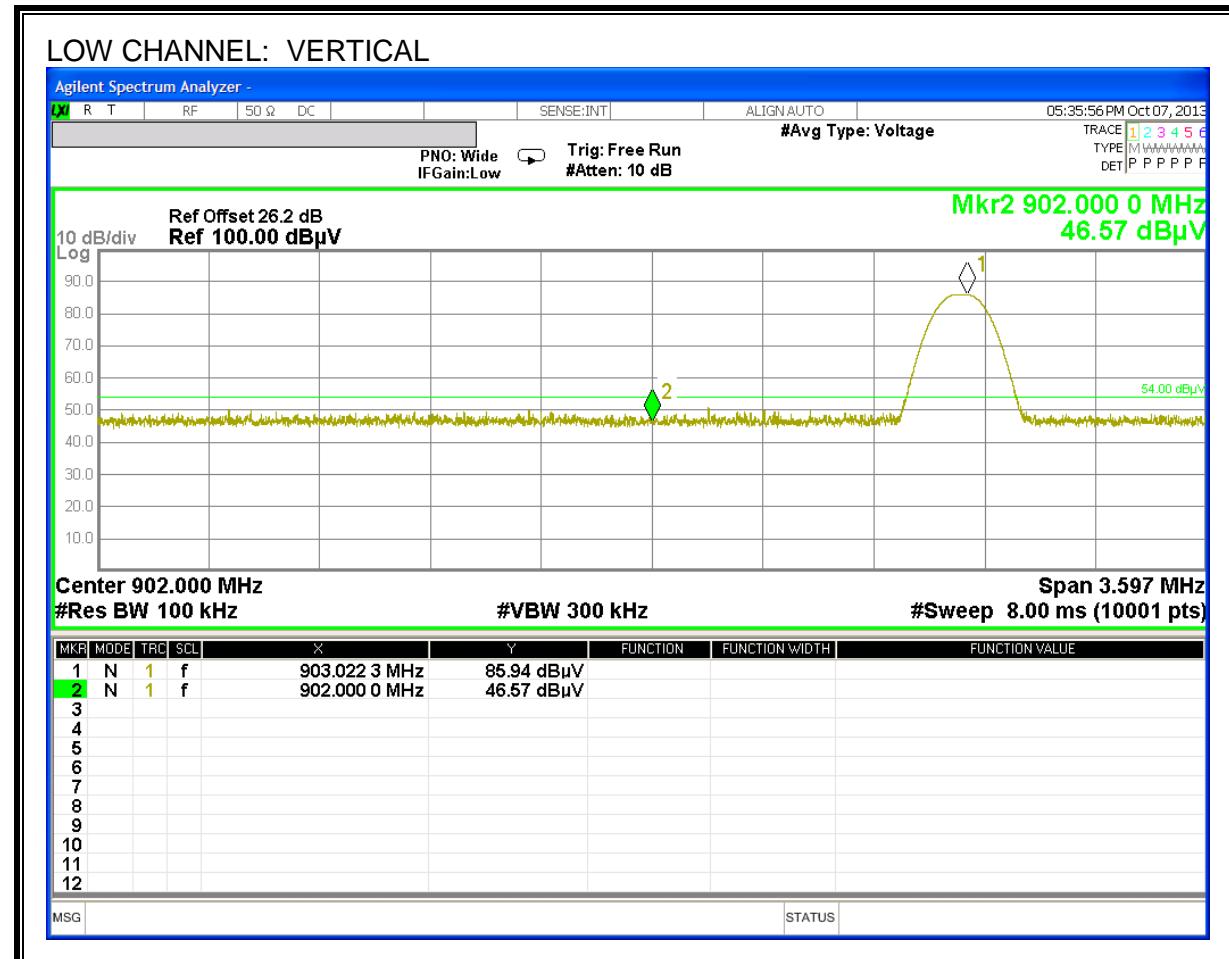
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

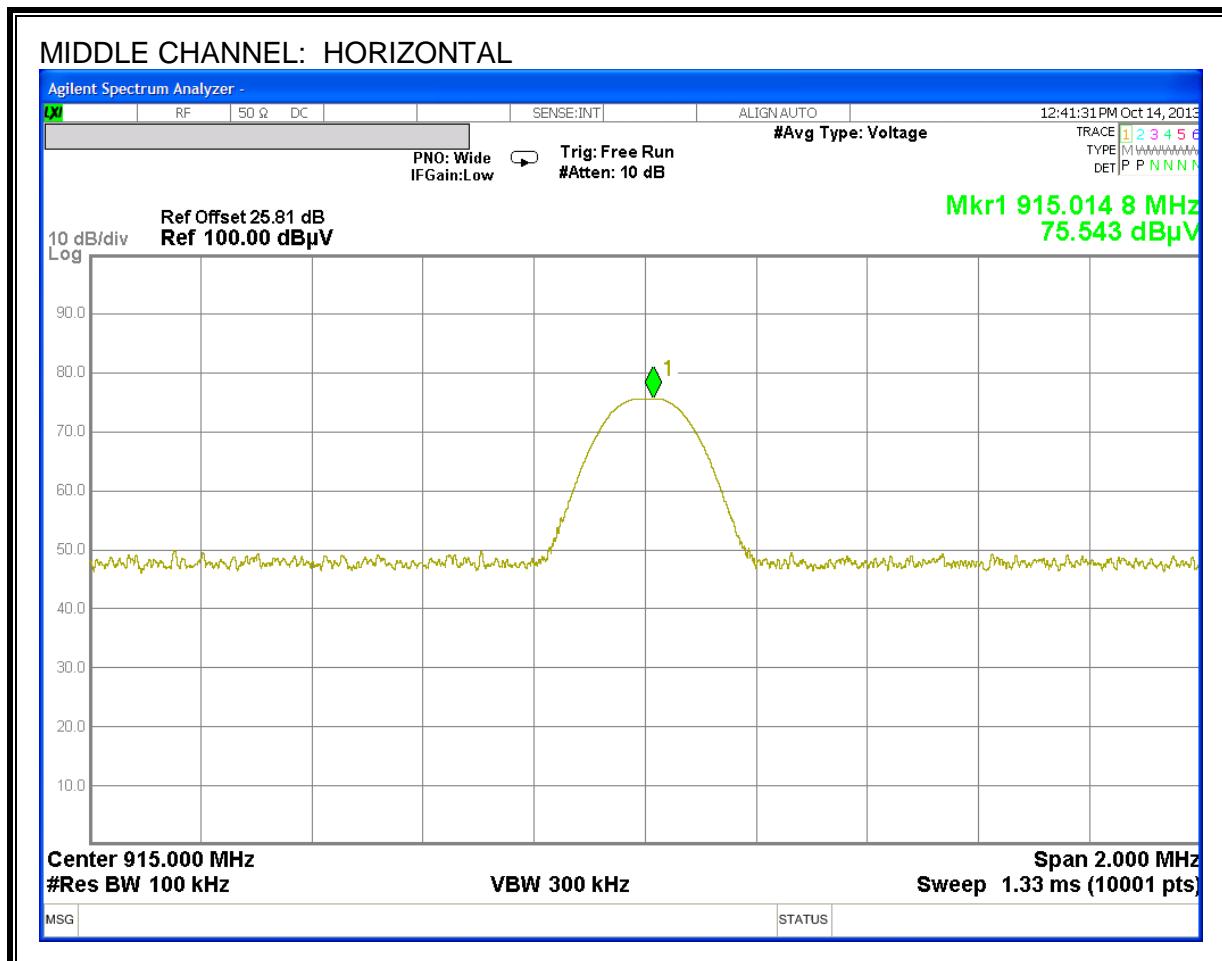
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

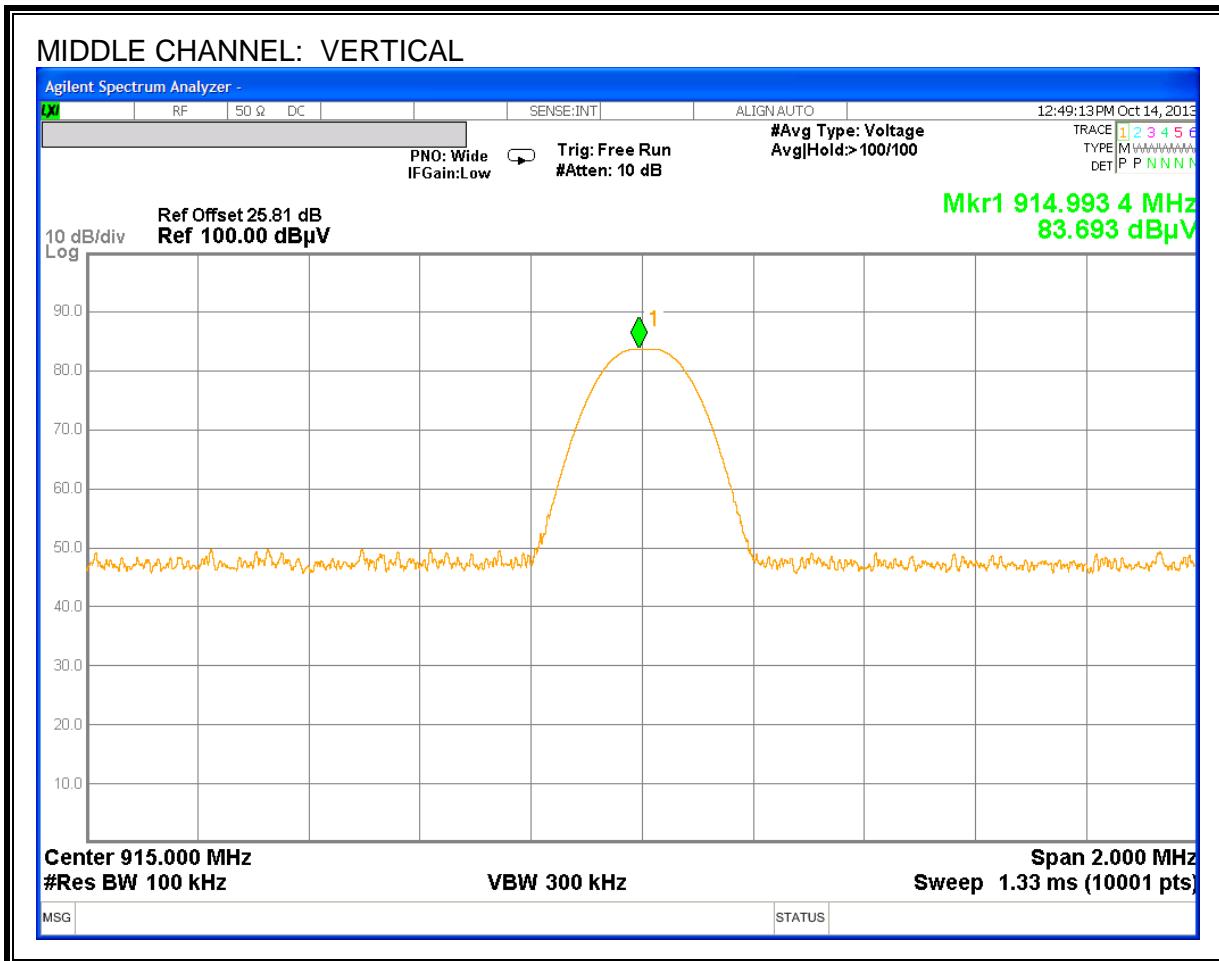
RESULTS

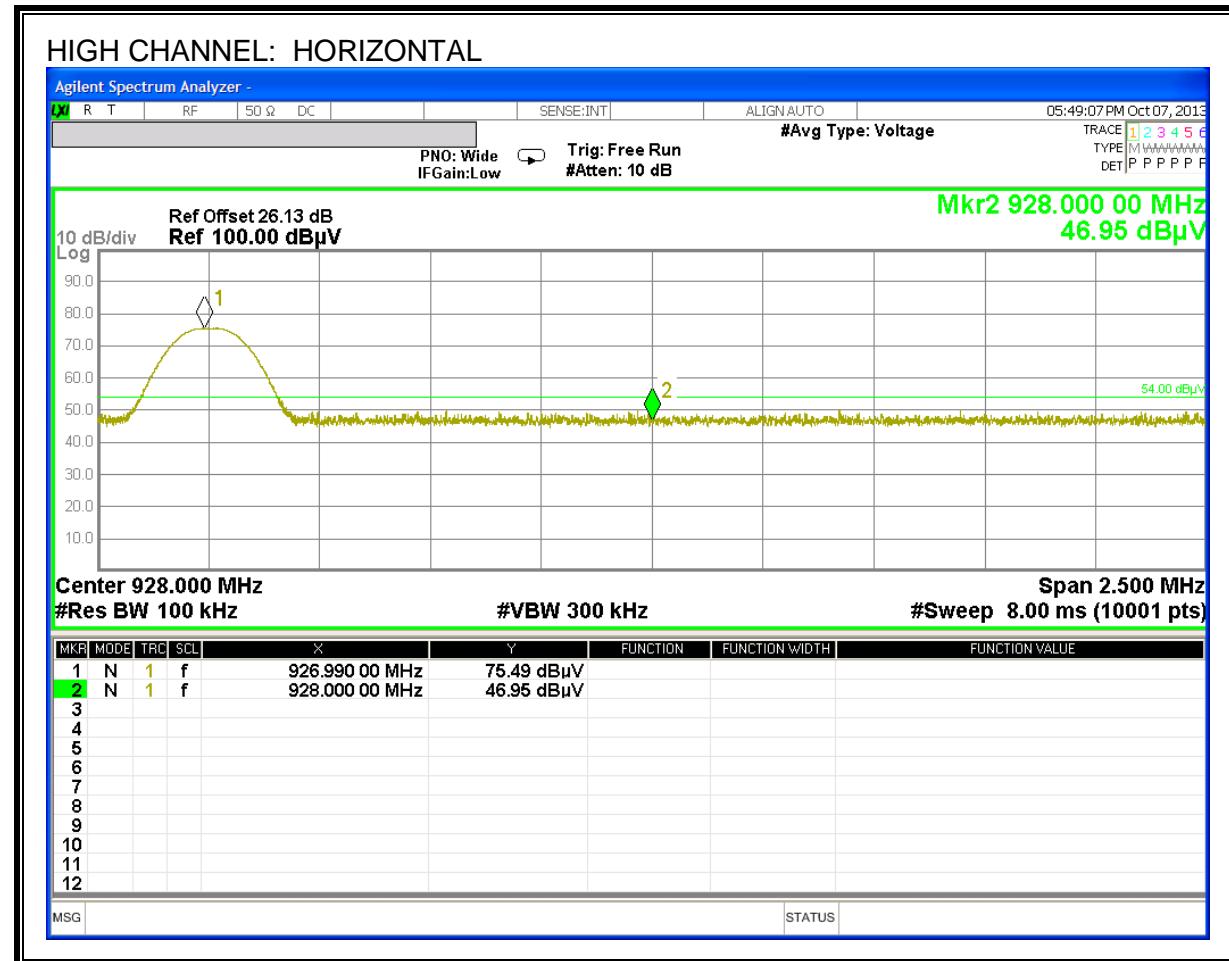
7.2.1. FUNDAMENTAL FREQUENCY RADIATED EMISSION – OPTICAL READER

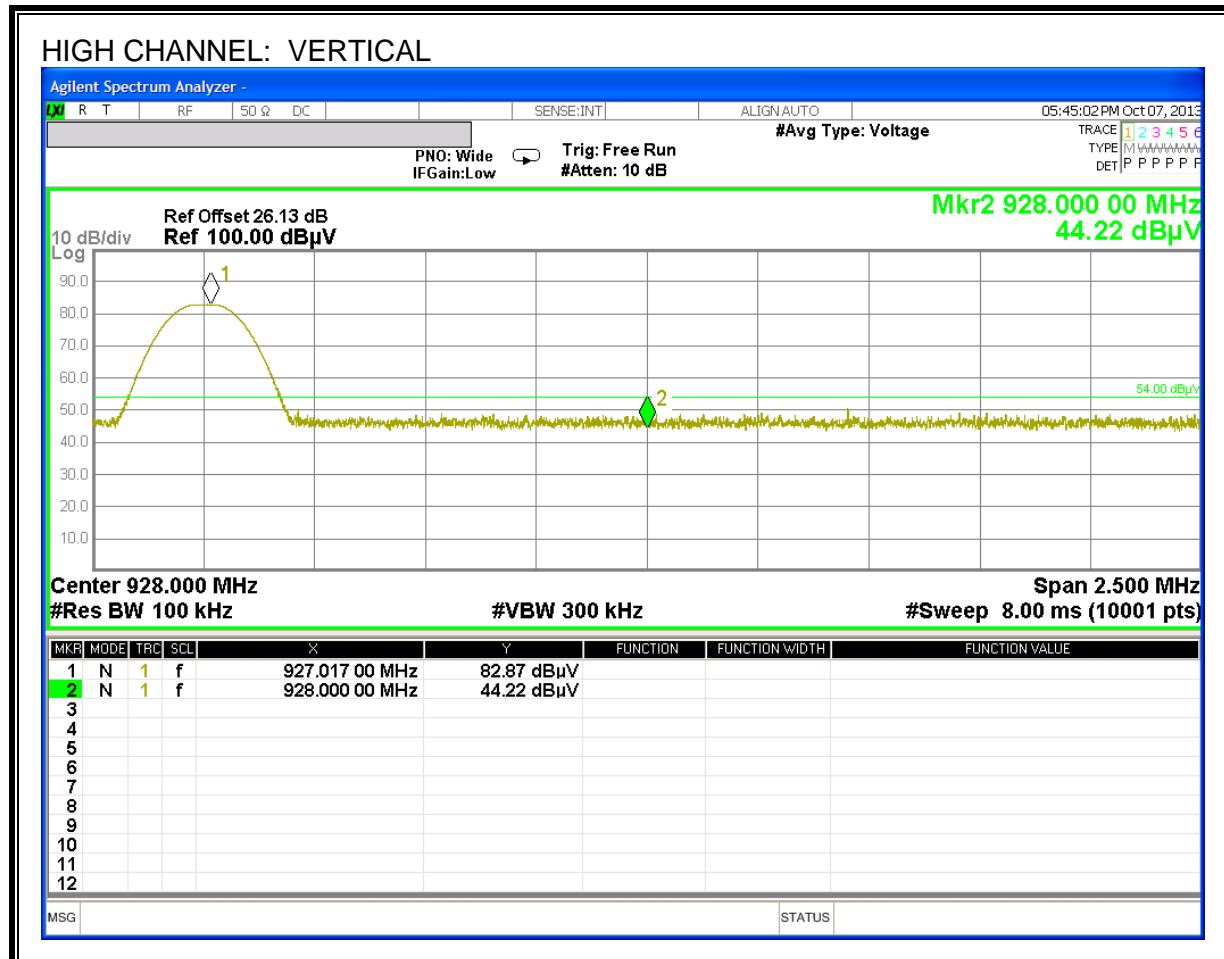






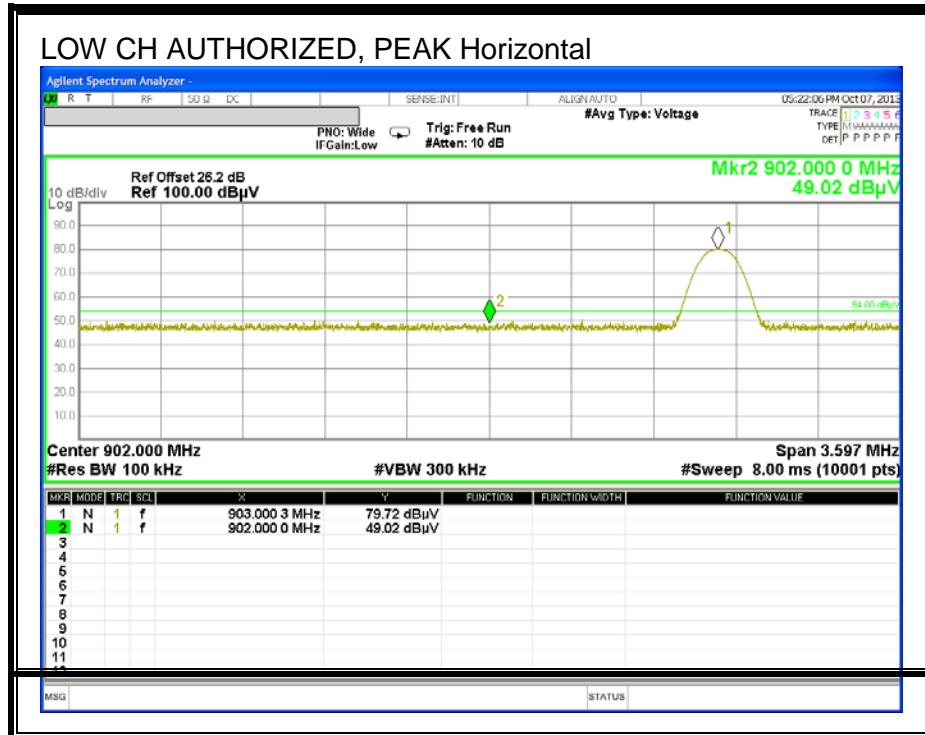




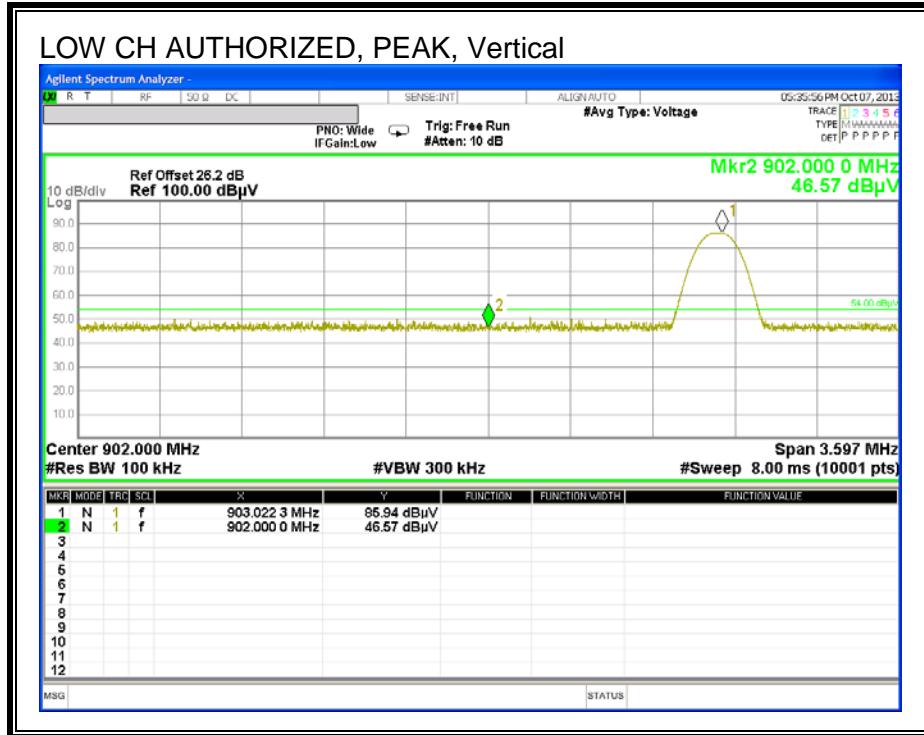


7.2.2. TRANSMITTER AUTHORIZED BAND EDGES – OPTICAL READER

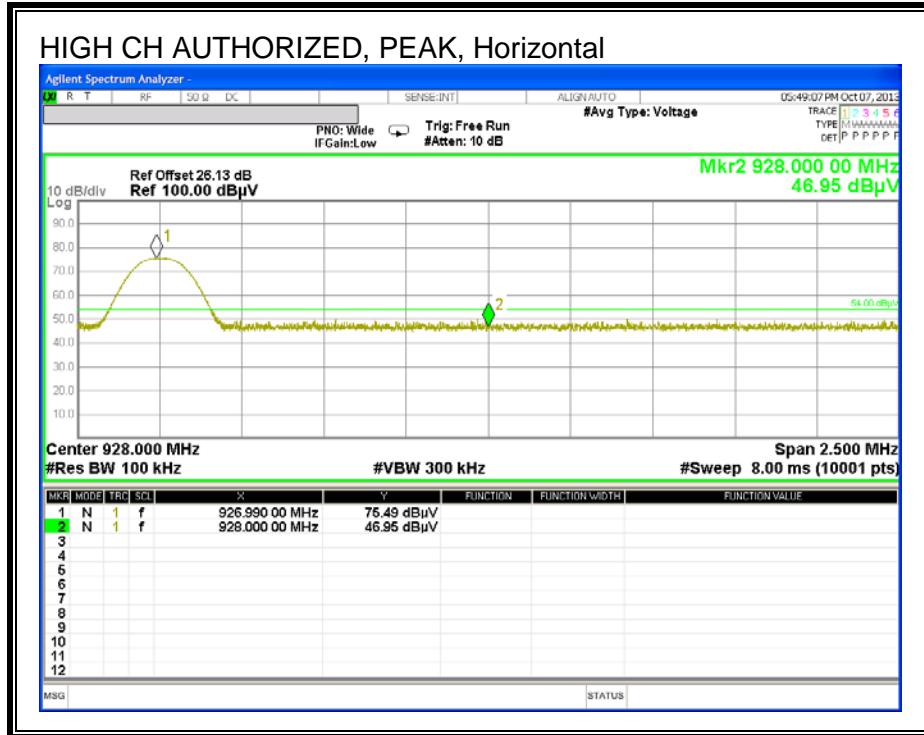
AUTHORIZED BANEDGE (LOW CHANNEL, HORIZONTAL)



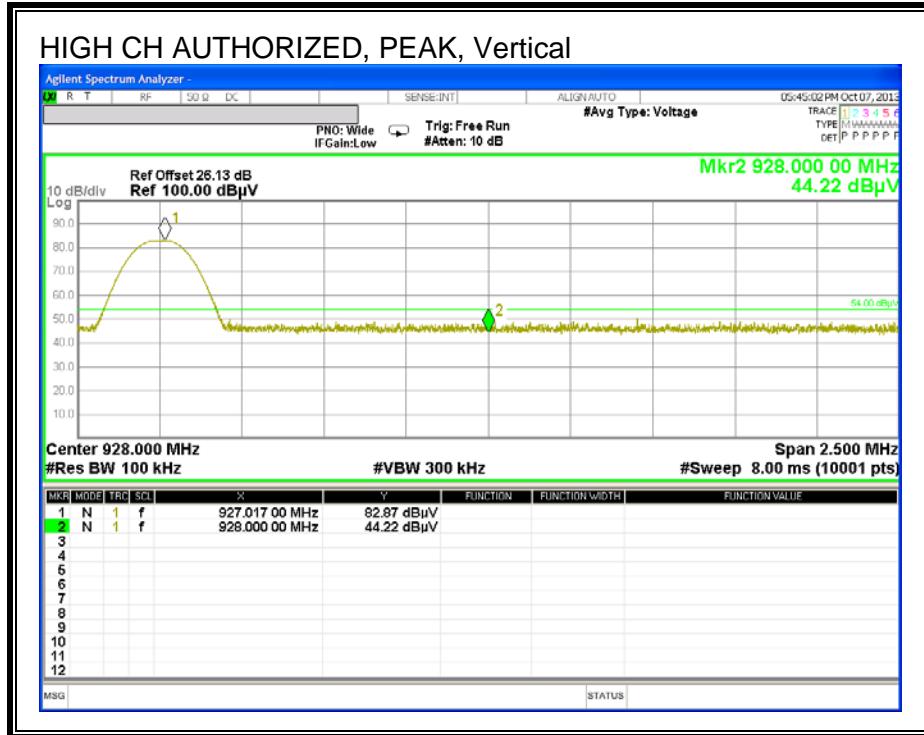
AUTHORIZED BANDEDGE (LOW CHANNEL, VERTICAL)



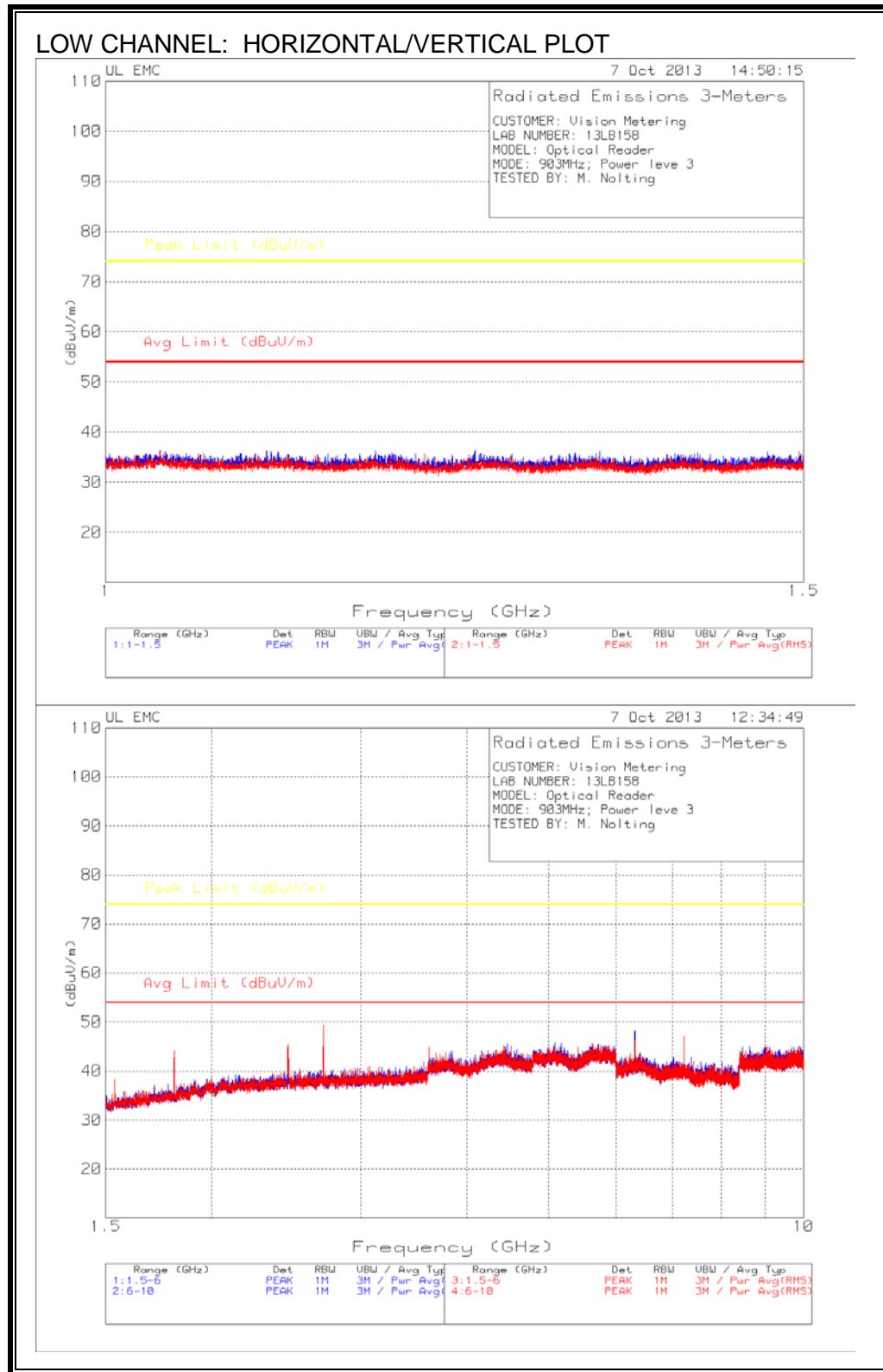
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)



7.2.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz – OPTICAL READER



LOW CHANNEL: TABULAR DATA

CUSTOMER: Vision Metering

LAB NUMBER: 13LB158

MODEL: Optical Reader

MODE: 903MHz; Power level 3

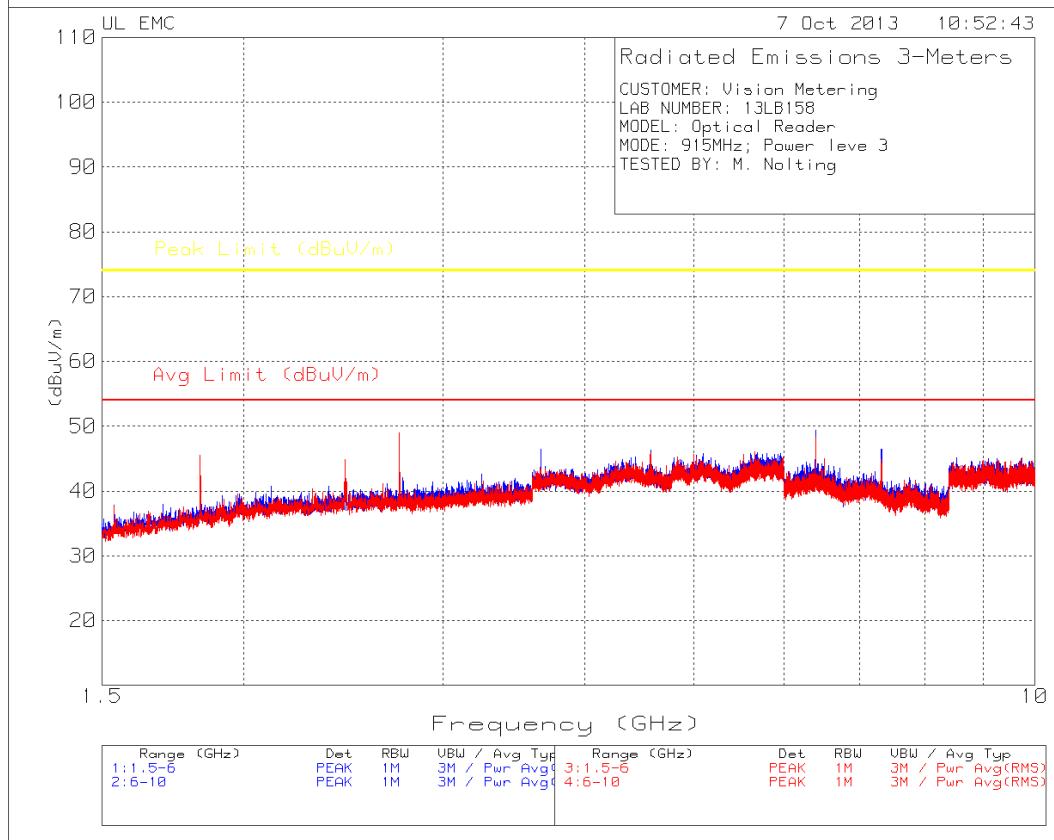
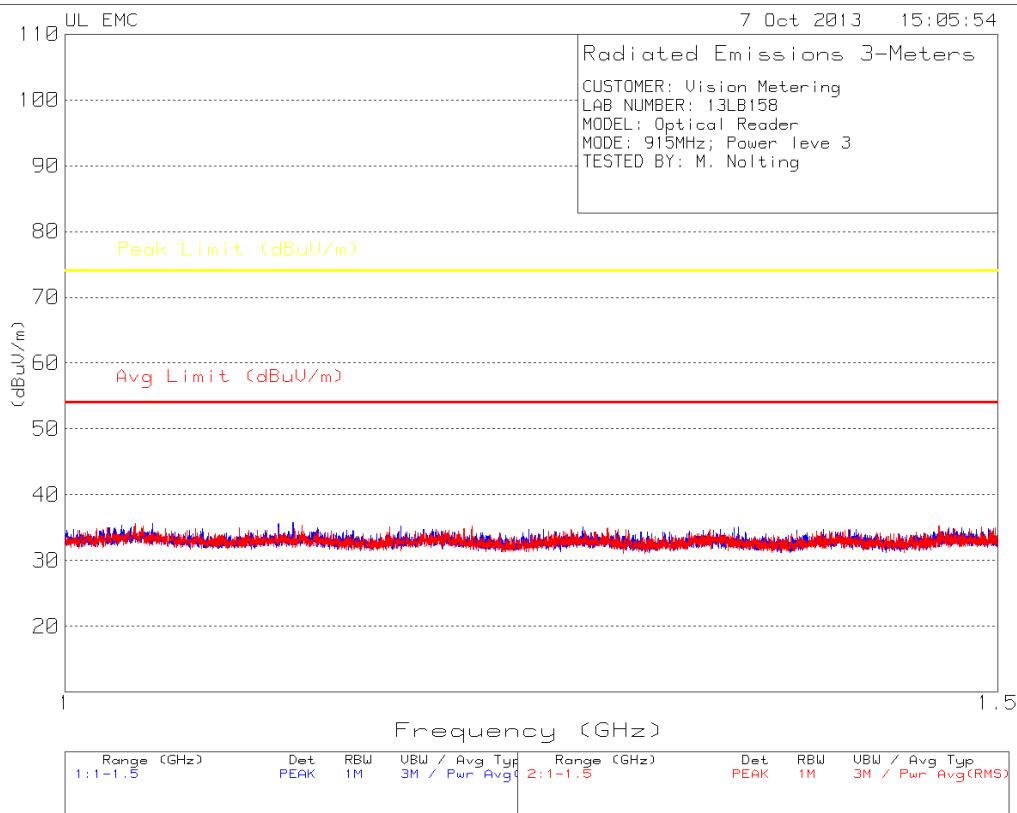
TESTED BY: M. Notling

Test Frequency [GHz]	Meter Reading [dBuV]	Detector*	Antenna [dB/m]	Gain/Loss [dB]	Field Strength [dBuV/m]	FCC AV [dBuV/m]	Margin [dB]	FCC PK [dBuV/m]	Margin [dB]	Polarity
1.807	51.14	PK	30.00	-39.30	41.84	54.0	-12.2	74.0	-32.2	H
2.462	47.78	PK	32.00	-38.10	41.68	54.0	-12.3	74.0	-32.3	H
2.710	50.43	PK	32.40	-37.70	45.13	54.0	-8.9	74.0	-28.9	H
6.322	45.83	PK	35.40	-33.10	48.13	54.0	-5.9	74.0	-25.9	H
7.225	43.17	PK	35.70	-32.80	46.07	54.0	-7.9	74.0	-27.9	H
1.807	53.45	PK	30.00	-39.30	44.15	54.0	-9.9	74.0	-29.9	V
2.461	51.51	PK	32.00	-38.10	45.41	54.0	-8.6	74.0	-28.6	V
2.710	54.62	PK	32.40	-37.70	49.32	-	-	74.0	-24.7	V
6.322	43.92	PK	35.40	-33.10	46.22	54.0	-7.8	74.0	-27.8	V
7.225	44.17	PK	35.70	-32.80	47.07	54.0	-6.9	74.0	-26.9	V
2.709	54.91	VB10Hz	32.40	-37.70	49.61	54.0	-4.4	-	-	V

*PK: Peak Detector

*VB10Hz: 1MHz RBW, 10Hz VBW

MIDDLE CHANNEL: HORIZONTAL/VERTICAL PLOT



MIDDLE CHANNEL: TABULAR DATA

CUSTOMER: Vision Metering

LAB NUMBER: 13LB158

MODEL: Optical Reader

MODE: 915MHz; Power level 3

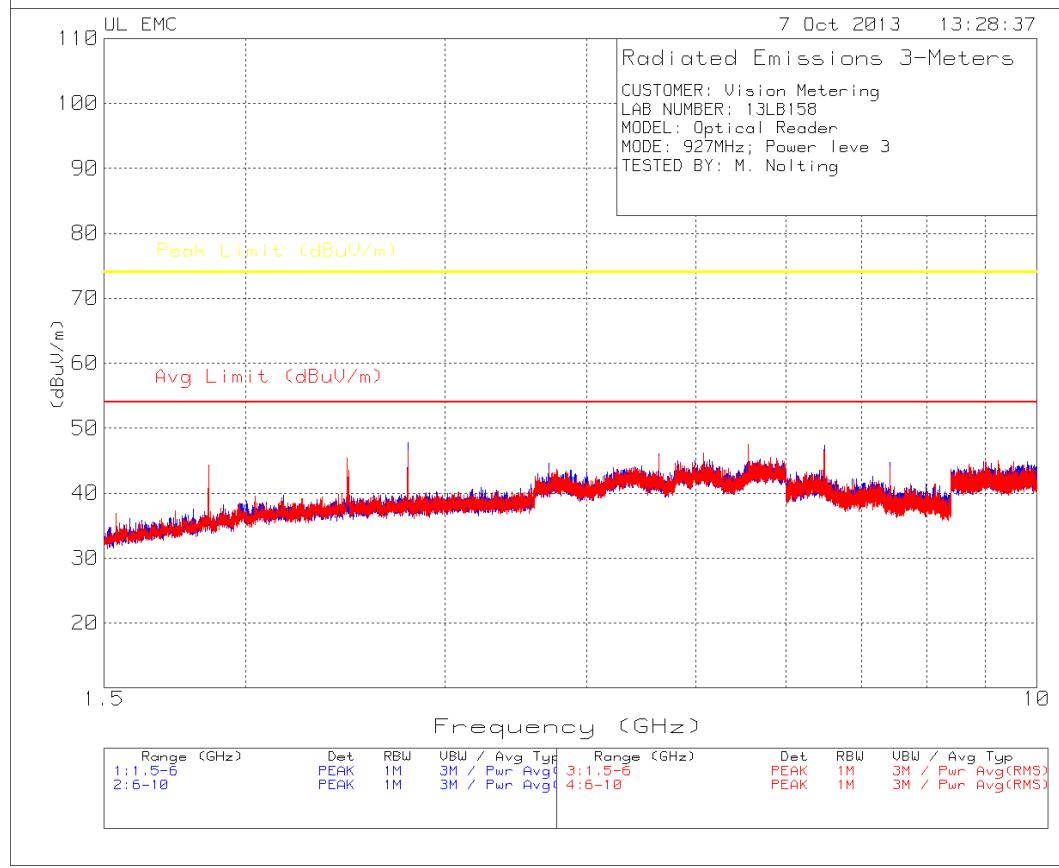
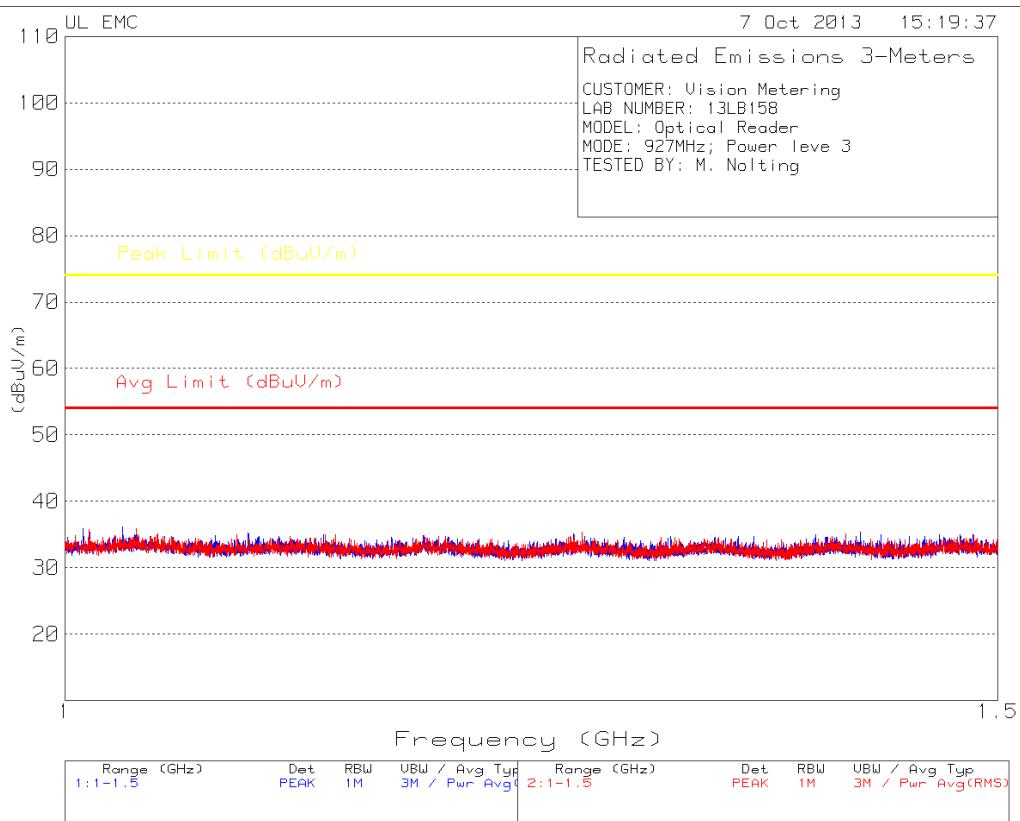
TESTED BY: M. Nolting

Test Frequency [GHz]	Meter Reading [dBuV]	Detector*	Antenna [dB/m]	Gain/Loss [dB]	Field Strength [dBuV/m]	FCC AV [dBuV/m]	Margin [dB]	FCC PK [dBuV/m]	Margin [dB]	Polarity
1.831	52.54	PK	30.20	-39.30	43.44	54.0	-10.6	74.0	-30.6	H
2.746	54.32	PK	32.40	-37.70	49.02	-	-	74.0	-25.0	H
3.661	50.30	PK	33.30	-37.20	46.40	54.0	-7.6	74.0	-27.6	H
6.406	46.73	PK	35.50	-32.90	49.33	-	-	74.0	-24.7	H
7.321	43.31	PK	35.60	-32.50	46.41	54.0	-7.6	74.0	-27.6	H
2.745	50.28	VB10Hz	32.40	-37.70	44.98	54.0	-9.0	-	-	H
6.405	42.64	VB10Hz	35.50	-32.90	45.24	54.0	-8.8	-	-	H
1.831	54.59	PK	30.20	-39.30	45.49	54.0	-8.5	74.0	-28.5	V
2.460	50.92	PK	32.00	-38.10	44.82	54.0	-9.2	74.0	-29.2	V
2.746	54.23	PK	32.40	-37.70	48.93	-	-	74.0	-25.1	V
6.406	45.65	PK	35.50	-32.90	48.25	-	-	74.0	-25.8	V
7.321	41.81	PK	35.60	-32.50	44.91	54.0	-9.1	74.0	-29.1	V
2.745	56.02	VB10Hz	32.40	-37.70	50.72	54.0	-3.3	-	-	V
6.405	42.19	VB10Hz	35.50	-32.90	44.79	54.0	-9.2	-	-	V

*PK: Peak Detector

*VB10Hz: 1MHz RBW, 10Hz VBW

HIGH CHANNEL: HORIZONTAL/VERTICAL PLOT



HIGH CHANNEL: TABULAR DATA

CUSTOMER: Vision Metering

LAB NUMBER: 13LB158

MODEL: Optical Reader

MODE: 927MHz; Power level 3

TESTED BY: M. Nolting

Test Frequency [GHz]	Meter Reading [dBuV]	Detector*	Antenna [dB/m]	Gain/Loss [dB]	Field Strength [dBuV/m]	FCC AV [dBuV/m]	Margin [dB]	FCC PK [dBuV/m]	Margin [dB]	Polarity
1.855	50.50	PK	30.40	-39.20	41.70	54.0	-12.3	74.0	-32.3	H
2.782	53.03	PK	32.50	-37.80	47.73	54.0	-6.3	74.0	-26.3	H
4.636	48.29	PK	34.00	-36.30	45.99	54.0	-8.0	74.0	-28.0	H
6.490	44.57	PK	35.60	-32.80	47.37	54.0	-6.6	74.0	-26.6	H
7.416	41.46	PK	35.60	-32.40	44.66	54.0	-9.3	74.0	-29.3	H
1.855	53.10	PK	30.40	-39.20	44.30	54.0	-9.7	74.0	-29.7	V
2.460	51.52	PK	32.00	-38.10	45.42	54.0	-8.6	74.0	-28.6	V
2.782	51.84	PK	32.50	-37.80	46.54	54.0	-7.5	74.0	-27.5	V
4.636	48.01	PK	34.00	-36.30	45.71	54.0	-8.3	74.0	-28.3	V
5.563	47.55	PK	34.50	-34.50	47.55	54.0	-6.5	74.0	-26.5	V
6.489	43.87	PK	35.60	-32.80	46.67	54.0	-7.3	74.0	-27.3	V
7.416	40.77	PK	35.60	-32.40	43.97	54.0	-10.0	74.0	-30.0	V

*PK: Peak Detector

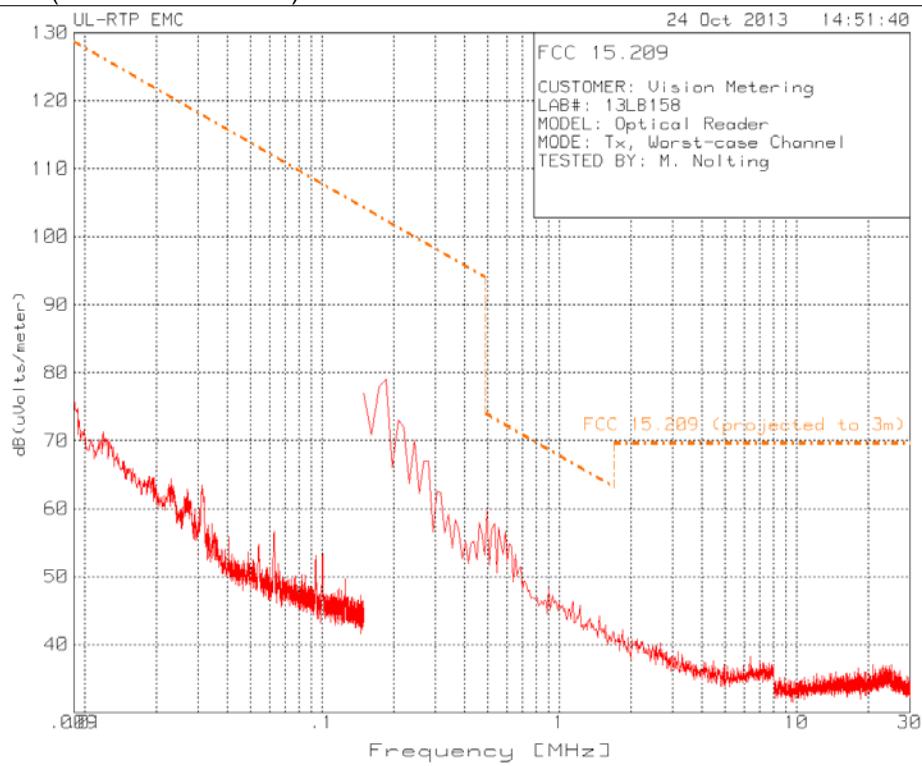
*VB10Hz: 1MHz RBW, 10Hz VBW

7.2.4. WORST-CASE BELOW 1 GHz – OPTICAL READER

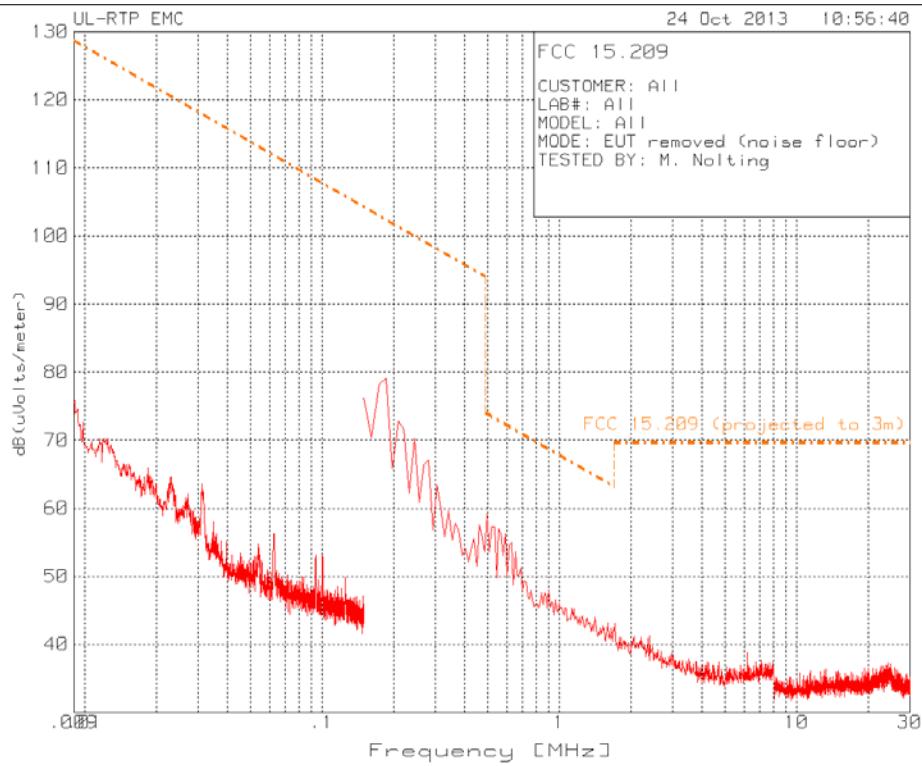
SPURIOUS EMISSIONS BELOW 30 MHz

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were $40 \times \log$ (specification distance / test distance).

EUT (OPTICAL READER) PLOT

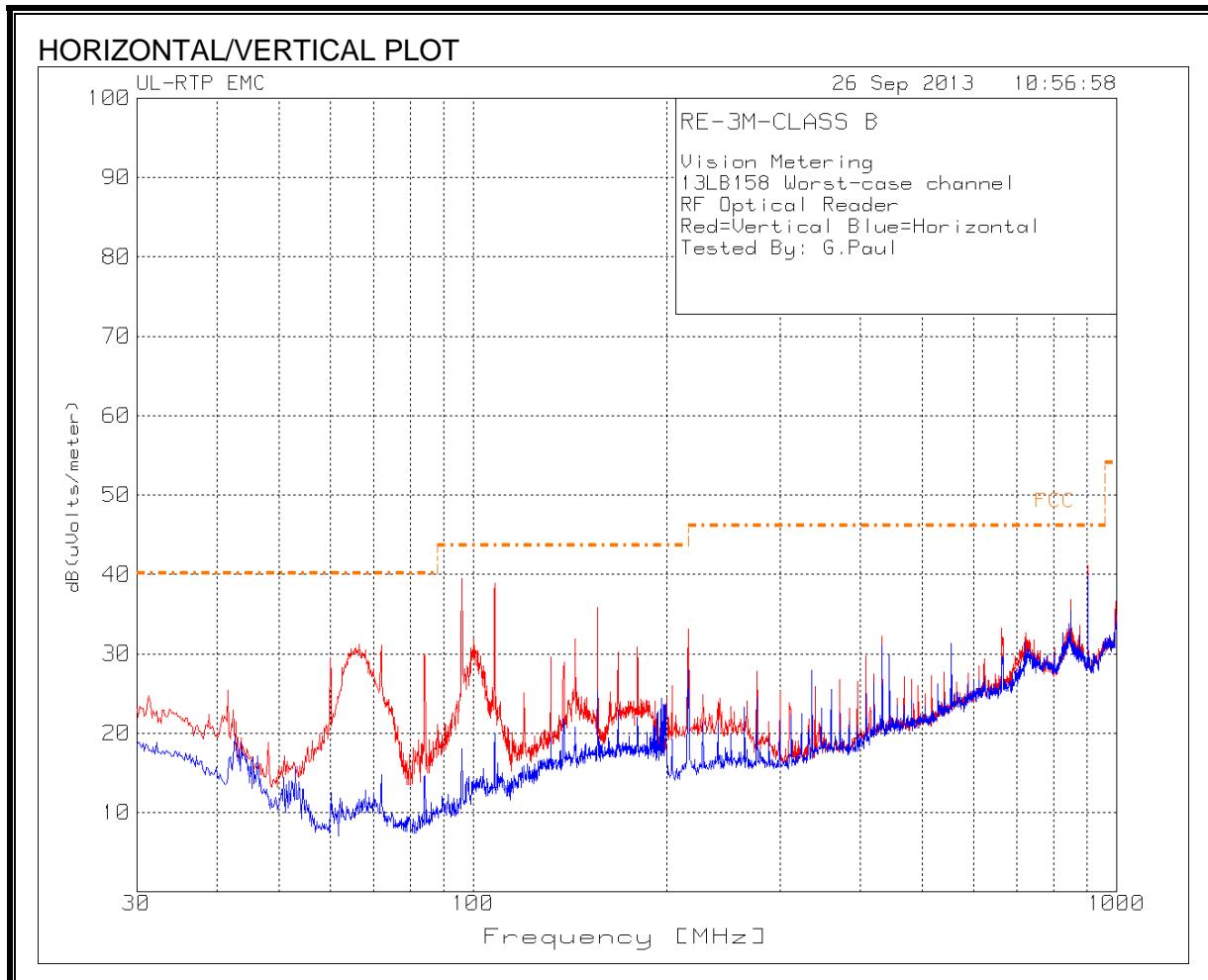


NOISE-FLOOR PLOT



The above plots demonstrate there were no EUT-related emissions of interest relative to the FCC 15.209 limit below 30MHz.

SPURIOUS EMISSIONS 30 TO 1000 MHz



TABULAR DATA

Vision Metering
13LB158 Worst-case Channel
RF Optical Reader
Red=Vertical Blue=Horizontal
Tested By: G.Paul

Test Frequency [MHz]	Meter Reading [dBuV]	Detector*	Antenna [dB/m]	Gain/Loss [dB]	Field Strength [dBuV/m]	FCC 15.249 Limit [dBuV/m]	Margin [dB]	Polarity
96.039	57.41	QP	10.60	-28.40	39.61	43.5	-3.9	V
108.032	48.68	QP	12.40	-28.40	32.68	43.5	-10.8	V
156.096	49.08	PK	15.00	-28.20	35.88	43.5	-7.6	V
216.011	50.63	PK	10.90	-28.40	33.13	46.0	-12.9	V
850.033	38.91	PK	22.90	-24.90	36.91	46.0	-9.1	V

*PK = Peak, QP = Quasi-Peak.

8. 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

ANSI C63.4

RESULTS

Note – During normal operation, the micro USB port is used for charging, only and the Optical Reader's transceiver is disabled and does not transmit when the USB port is connected. Therefore, 15.207 Line Conducted Emissions was not applicable. Note, 15.107 Line Conducted Emissions was performed and can be found in R10008567-FCC15B.

END OF REPORT