UL LLC
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Order Number: 10275560

Date: March 18, 2014
Rev. 1.0 May 24, 2014

Model: SSDB1S

Electromagnetic Compatibility Test Report

For

Philips Lighting Electronics N. A.

Test Report Details

Tests Performed By:	**UL LLC** **333 Pfingsten Rd.** **Northbrook, IL 60062**
Tests Performed For:	**Philips Lighting Electronics N. A.** **10275 West Higgins Road** **Rosemont, IL 60018**
Applicant Contact: Phone: E-mail:	**Richard Haring** **(847) 390-5195** **richard.haring@philips.com**
Test Report Date: Rev. 1.0 Date	**March 18, 2014** **May 24, 2014**
Product Type:	**Wireless Device**
Product standards	**FCC Part 15, Subpart C, 15.247, RSS-210**
Model Number:	**SSDB1S**
EUT Category:	**Wireless Device**
Testing Start Date:	**January 07, 2014**
Date Testing Complete:	**March 14, 2014**
Overall Results:	**Compliant**

UL LLC reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL LLC shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL LLC issued reports. 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.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report.

Report Directory

Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
Rev1.0 20140524	Minor Editorial Changes	BM	MF

1.0 G E N E R A L - Product Description

1.1 Equipment Description

The EUT is a Wireless DTS 902MHz-928MHz Module.

1.2 Device Configuration During Test

1.2.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Light Controller	Philips	SSDB1S	Module tested as stand alone
AE	Power Supply	Generic	Generic	None

Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)

1.2.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	AC	N	N	Module is powered by AC to DC supply

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

1.2.3 Power Interface:

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	5	-	-	DC	1	Connected to AC to DC supply

1.3 EUT Configurations

Mode #	Description
1	EUT was setup on either 80cm above ground plane support or bench top, connected to 5VDC coming out of 120V/60Hz AC to DC supply.

1.4 EUT Operation Modes

Mode #	Description
1	EUT set to transmit continuously on either low, middle or high channels
2	EUT set to receive on a channel

1.5 Rational for EUT Configuration

Mode #	Description
1	The selected EUT configuration was chosen to maximize emissions

2.0 Summary

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL LLC in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

2.1 Deviations from standard test methods

None

2.2 Device Modifications Necessary for Compliance

None

2.3 Reference Standards

Standard Number	Standard Name	Standard Date
FCC Part 15, Subpart C, 15.247	Code of Federal Regulations, Part 15, Radio Frequency Devices	2012
RSS-210	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment	Issue 8
FCC KDB558074 DTS Meas Guidance V01r01		

2.4 Results Summary

This product is considered Class A

Requirement – Test	Result (Compliant / Non-Compliant)*
Mains Terminal - Conducted Emissions	Compliant
Radiated Emissions – Receiver Mode	Compliant
Spurious Emissions (Antenna Conducted and Radiated)	Compliant
Band Edge Compliance	Compliant
6dB Bandwidth Measurement	Compliant
Maximum Peak Output Power	Compliant
Power Spectral Density	Compliant
99% Power Bandwidth	N/A – Data Only

Test Engineer:

Bartlomiej Mucha (Ext.41216)
Staff Engineer
International EMC Services
UL Verification Services

Reviewer:

Michael Ferrer(Ext.41312)
Project Lead
International EMC Services
UL Verification Services

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

4.0 EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

---------- United States ----------

Code of Federal Regulations Title 47	Part 15, Subpart C, Radio Frequency Devices

---------- Canada ----------

Spectrum Management and Telecommunications Radio Standards Specification	License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 ± 150

Measurement Uncertainty

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	150k-30MHz	LISN	2.29dB
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

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)

4.1 Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN. The EUT was placed approximately 80cm above horizontal ground plane and 40cm from the vertical ground plane (+/- 10%).

Basic Standard	47 CFR Part 15.107, 15.207 RSS-Gen 7.2.4	
UL LPG	80-EM-S0026	
	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Mains

Limits - Class B

Frequency (MHz)	Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 - 56	56 - 46
0.5-5.0	56	46
5.0-30	60	50

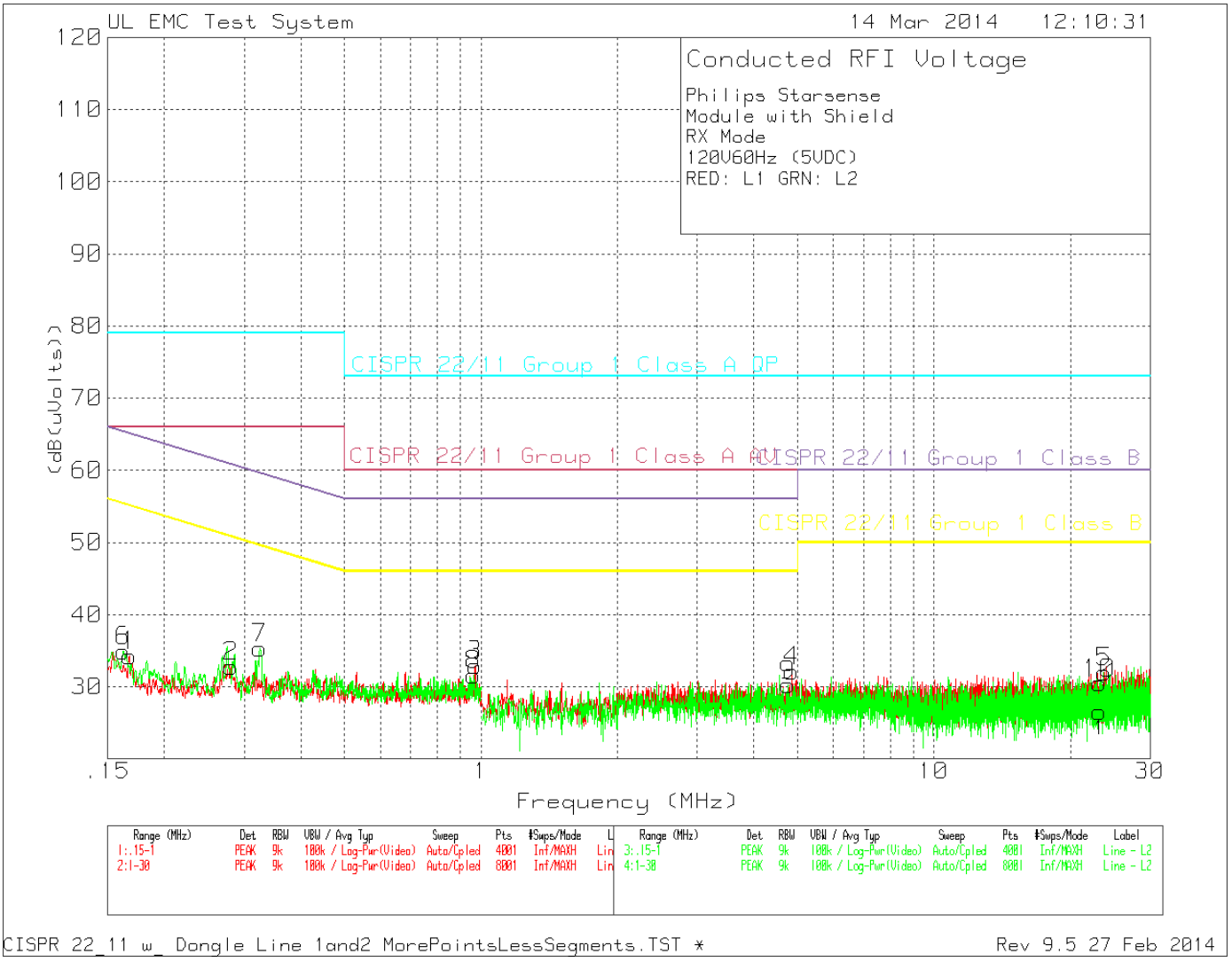
Supplementary information: None

Table 1 Conducted Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1 and 2

Supplementary information: None

Figure 1 Conducted Emissions Graph –Radio RX mode



*No emissions within 6dB of the limit recorded.

** Limits show above are for CISPR22, however the limits are the same for FCC 15.107 and 15.207.

Table 2 Conducted Emissions Data Points – Radio RX mode

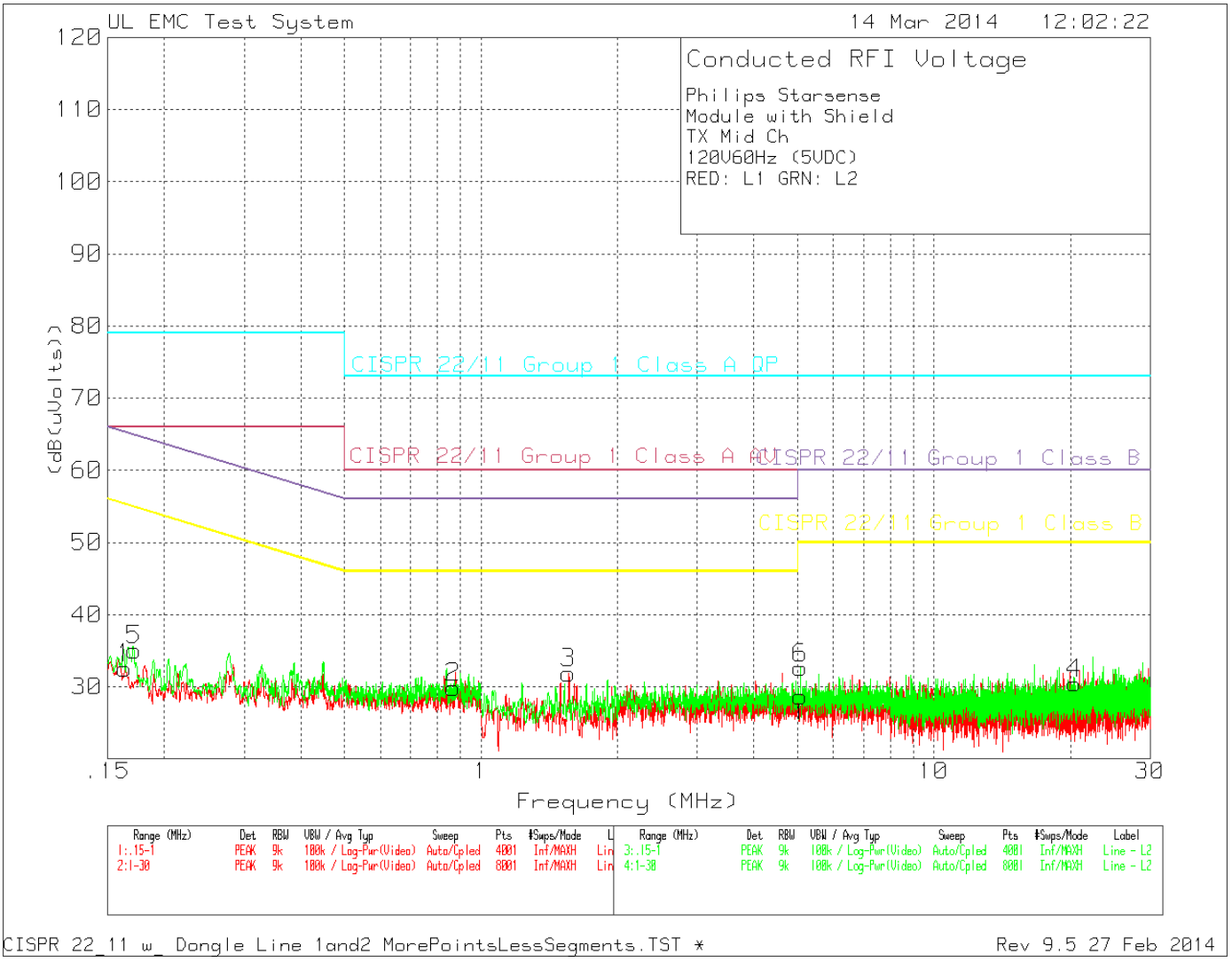
Philips Starsense
Module with Shield
RX Mode
120V60Hz (5VDC)
RED: L1 GRN: L2

Trace Markers No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line – L1											
1	.16721	20.94dBuV PK	.1	13.2	34.24	79	66	65.1	55.1	-	-
					Margin (dB)	-44.76	-31.76	-30.86	-20.86	-	-
2	.28069	21.75dBuV PK	.1	11	32.85	79	66	60.8	50.8	-	-
					Margin (dB)	-46.15	-33.15	-27.95	-17.95	-	-
3	.97046	22.21dBuV PK	.1	10.6	32.91	73	60	56	46	-	-
					Margin (dB)	-40.09	-27.09	-23.09	-13.09	-	-
4	4.86425	21.34dBuV PK	.1	10.7	32.14	73	60	56	46	-	-
					Margin (dB)	-40.86	-27.86	-23.86	-13.86	-	-
5	23.72875	20.16dBuV PK	.3	11.6	32.06	73	60	60	50	-	-
					Margin (dB)	-40.94	-27.94	-27.94	-17.94	-	-
Line - L2											
6	.16233	21.27dBuV PK	.1	13.6	34.97	79	66	65.34	55.34	-	-
					Margin (dB)	-44.03	-31.03	-30.37	-20.37	-	-
7	.32531	24.43dBuV PK	.1	10.8	35.33	79	66	59.57	49.57	-	-
					Margin (dB)	-43.67	-30.67	-24.24	-14.24	-	-
8	.96292	20.9dBuV PK	.1	10.6	31.6	73	60	56	46	-	-
					Margin (dB)	-41.4	-28.4	-24.4	-14.4	-	-
9	4.76638	19.31dBuV PK	.1	10.8	30.21	73	60	56	46	-	-
					Margin (dB)	-42.79	-29.79	-25.79	-15.79	-	-
10	23.214	18.48dBuV PK	.4	11.6	30.48	73	60	60	50	-	-
					Margin (dB)	-42.52	-29.52	-29.52	-19.52	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

PK - Peak detector

Figure 2 Conducted Emissions Graph – Radio TX mode



*No emissions within 6dB of the limit recorded.

** Limits show above are for CISPR22, however the limits are the same for FCC 15.107 and 15.207.

Table 3 Conducted Emissions Data Points – Radio TX mode

Philips Starsense
Module with Shield
TX Mid Ch
120V60Hz (5VDC)
RED: L1 GRN: L2

Trace Markers

No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1											
1	.16381	18.99dBuV PK	.1	13.5	32.59	79	66	65.27	55.27	-	-
					Margin (dB)	-46.41	-33.41	-32.68	-22.68	-	-
2	.86836	19.23dBuV PK	.1	10.6	29.93	73	60	56	46	-	-
					Margin (dB)	-43.07	-30.07	-26.07	-16.07	-	-
3	1.56188	21.14dBuV PK	.1	10.6	31.84	73	60	56	46	-	-
					Margin (dB)	-41.16	-28.16	-24.16	-14.16	-	-
4	20.401	18.87dBuV PK	.2	11.4	30.47	73	60	60	50	-	-
					Margin (dB)	-42.53	-29.53	-29.53	-19.53	-	-
Line - L2											
5	.17146	22.02dBuV PK	.1	12.9	35.02	79	66	64.89	54.89	-	-
					Margin (dB)	-43.98	-30.98	-29.87	-19.87	-	-
6	5.07088	21.7dBuV PK	.1	10.8	32.6	73	60	60	50	-	-
					Margin (dB)	-40.4	-27.4	-27.4	-17.4	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

PK - Peak detector

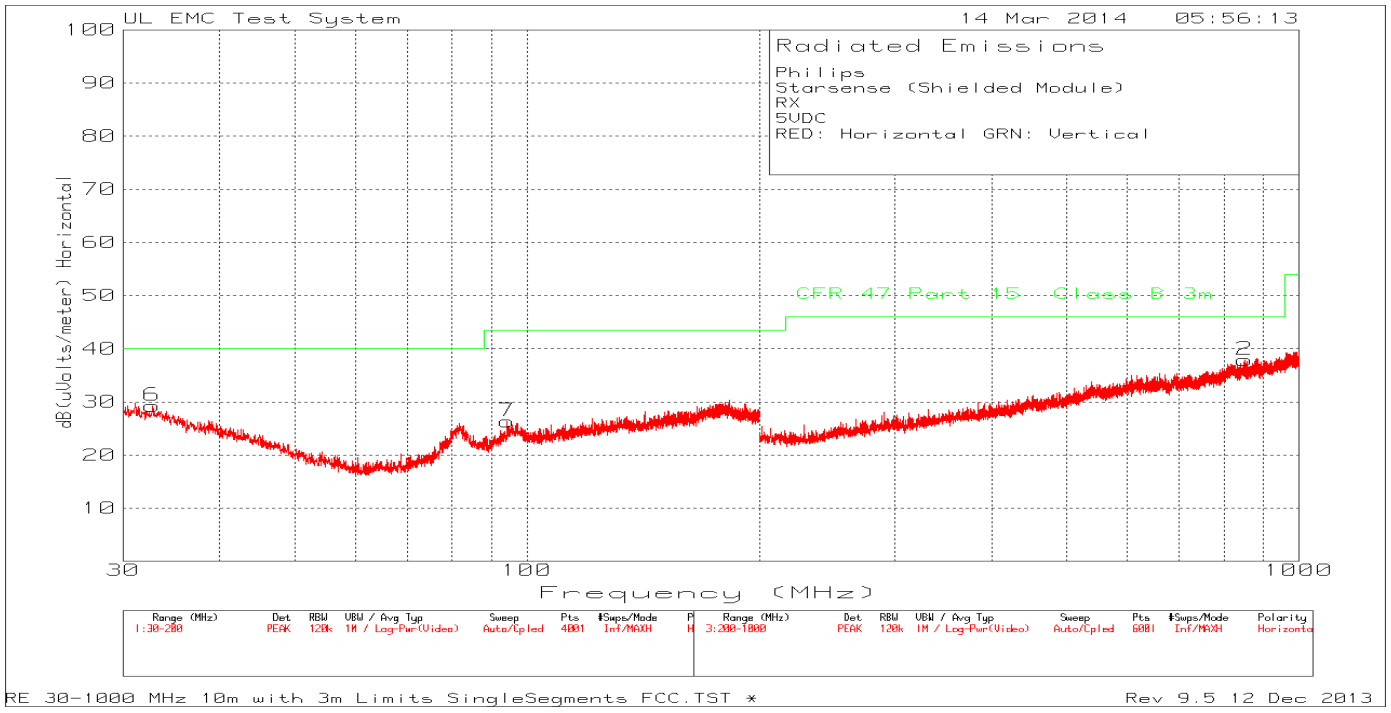
4.2 Test Conditions and Results – RADIATED EMISSIONS Receiver Mode

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10-meter or 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	FCC Part 15, Subpart B		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 5GHz	(10 meter or 3 meter)	
Limits - Class B			
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Average	
30-88	29.54	NA	
88-216	33.06	NA	
216-960	35.56	NA	
960-1000	43.52	NA	
Above 1GHz	NA	54 (at 3-meter)	
Supplementary information: None			

Table 4 Radiated Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	2
Supplementary information: None		

Figure 3 Radiated Emissions Graph 30MHz – 1GHz, RX Mode



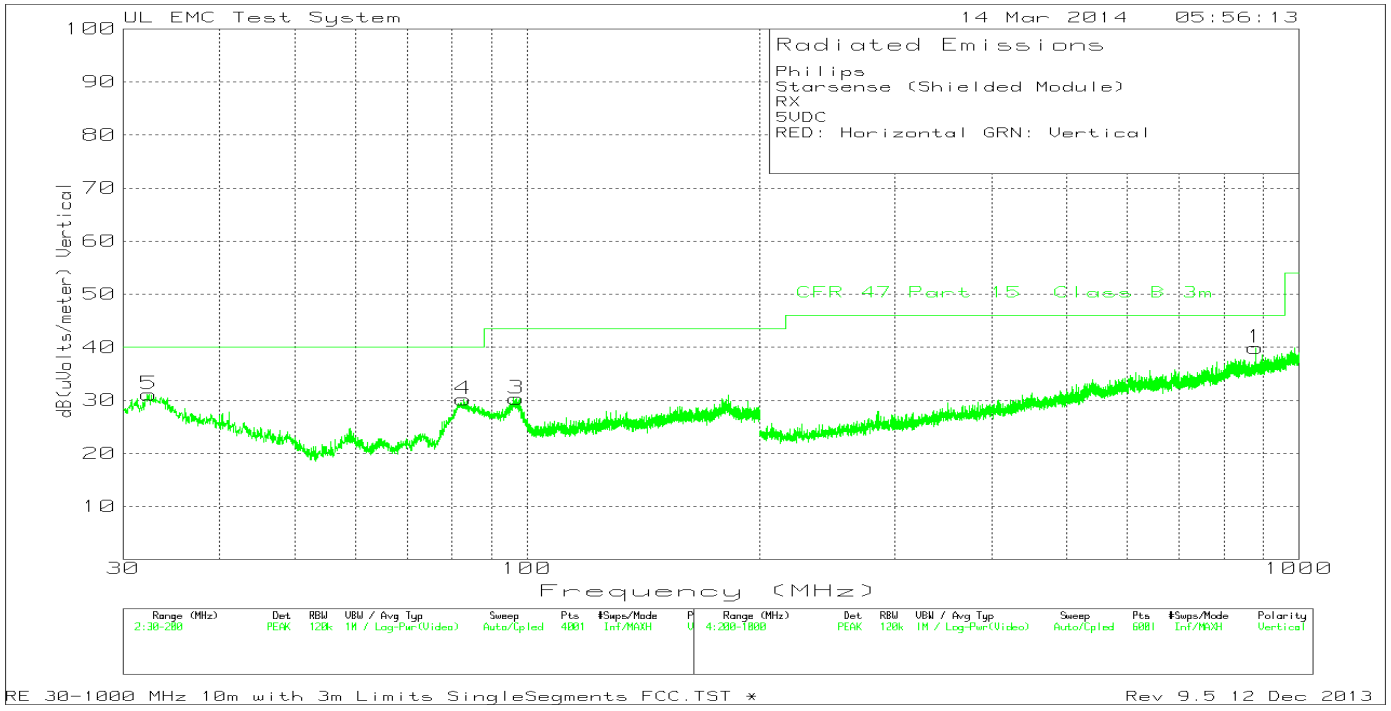


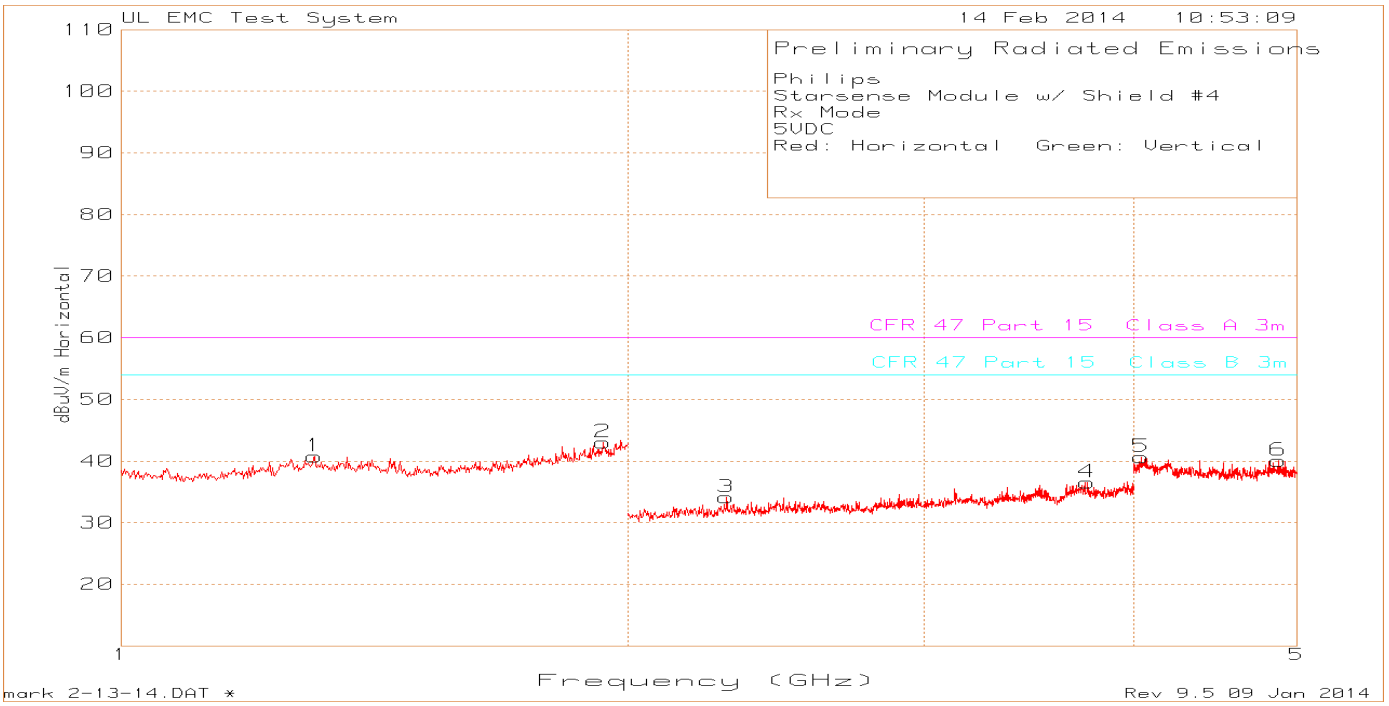
Table 5 Radiated Emissions Data Points 30MHz – 1GHz, Relay Off, RX Mode, Ch5

Philips
Starsense (Shielded Module)
RX
5VDC
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	10m to 3m Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
6	32.72	32.15	PK	16.7	-30.1	10.5	29.25	40	-10.75	0-360	399	H
7	94.3025	35.36	PK	10.4	-29.9	10.5	26.36	43.52	-17.16	0-360	250	H
3	96.98	38.99	PK	10.8	-29.9	10.5	30.39	43.52	-13.13	0-360	99	V
4	82.8275	41.4	PK	8.3	-30	10.5	30.2	40	-9.8	0-360	399	V
5	32.38	34.06	PK	16.7	-30.1	10.5	31.16	40	-8.84	0-360	99	V
2	852.6667	29.83	PK	22.4	-24.8	10.5	37.93	46.02	-8.09	0-360	299	H
1	879.6	31.53	PK	22.8	-24.9	10.5	39.93	46.02	-6.09	0-360	99	V

PK - Peak detector

Figure 4 Radiated Emissions Graph 1GHz-5GHz, RX Mode



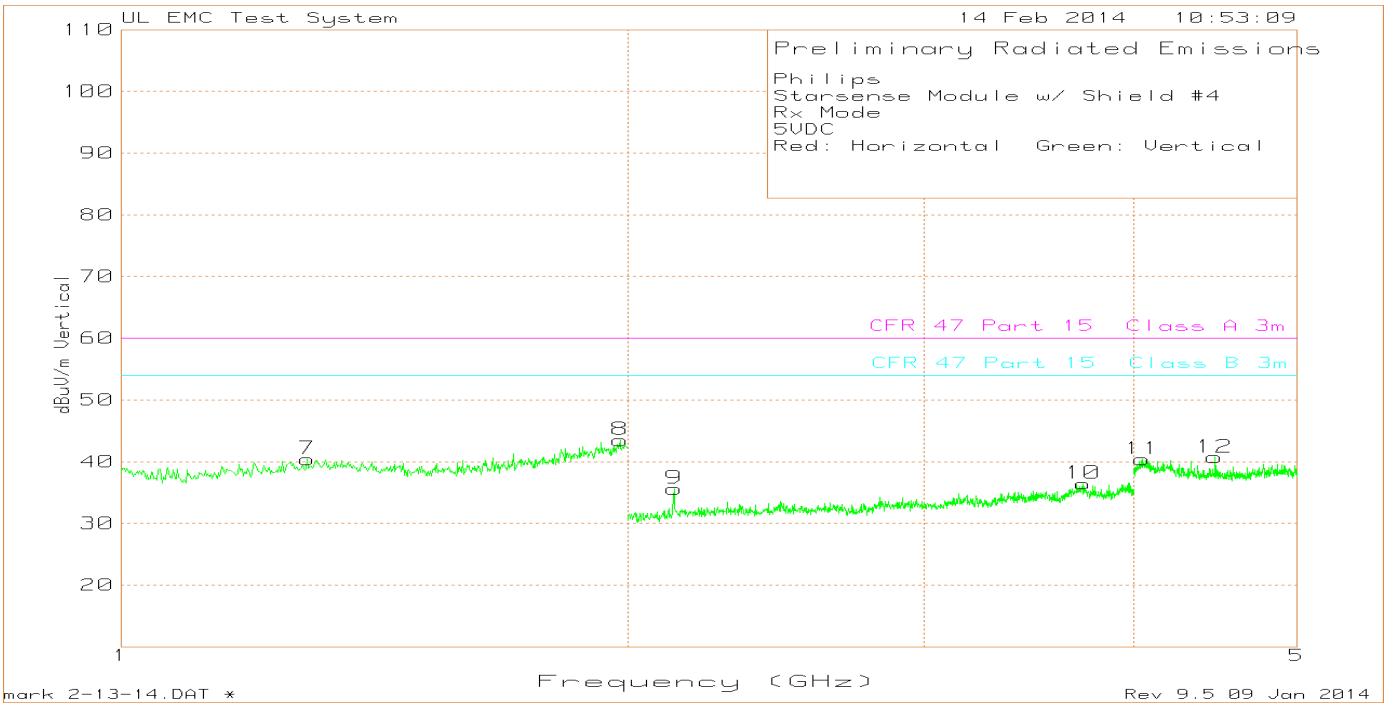


Table 6 Radiated Emissions Data Points 1GHz – 5GHz, RX Mode

Philips
Starsense Module w/ Shield #4
Rx Mode
5VDC
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	900MHz BRF dB	Path Factor dB	Level dBuV/m	Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	1.3026	66.36	PK	29.3	0.3	-55.2	40.8	54	-13.2	0-360	104	H
2	1.9339	64.24	PK	31.3	0.5	-53	43.08	54	-10.92	0-360	149	H
3	2.2903	63.27	PK	21.7	0	-50.9	34.1	54	-19.9	0-360	150	H
4	3.7558	63.15	PK	23.8	0	-50.4	36.58	54	-17.42	0-360	150	H
5	4.0441	62.96	PK	28.5	0	-50.8	40.67	54	-13.33	0-360	150	H
6	4.8778	62.45	PK	27.7	0	-50.1	40.05	54	-13.95	0-360	150	H
7	1.2906	66.16	PK	29.2	0.3	-55.2	40.44	54	-13.56	0-360	150	V
8	1.98	64.23	PK	31.6	0.5	-52.9	43.46	54	-10.54	0-360	150	V
9	2.1321	66.22	PK	21.5	0	-52.1	35.63	54	-18.37	0-360	150	V
10	3.7337	62.45	PK	23.7	0	-49.7	36.47	54	-17.53	0-360	150	V
11	4.0501	62.73	PK	28.4	0	-50.8	40.38	54	-13.62	0-360	150	V
12	4.4689	64.5	PK	27.9	0	-51.7	40.7	54	-13.3	0-360	150	V

PK - Peak detector

4.3 Test Conditions and Results – SPURIOUS EMISSIONS (Antenna Conducted and Radiated)

Test Description	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section15.205(c)).

Basic Standard	47 CFR Part 15.247(d) RSS-210, A8.5 RSS-Gen 7.2.5

	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	10 meter distance and / or antenna port
Fully configured sample scanned over the following frequency range	1GHz – 10GHz	3 meter distance and / or antenna port

Limits (Antenna Conducted)

All emissions must be 20dB below the level of the fundamental frequency.

Limits (Radiated – Restricted Bands Only)

Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Average	
	General Emissions	Fundamental	Spurious
30 – 88	40.0	-	-
88 – 216	43.52	-	-
216 - 960	46.02	-	-
960 - 1000	54	-	-
1,000-25,000	-	-	54

Supplementary information: Radiated Spurious Emissions levels (below) were extrapolated to 3m distance.

Table 7 SPURIOUS EMISSIONS EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 5 30MHz-10GHz Antenna Port Spurious Emissions Plots TX Mode, Low, Middle, High Channels.

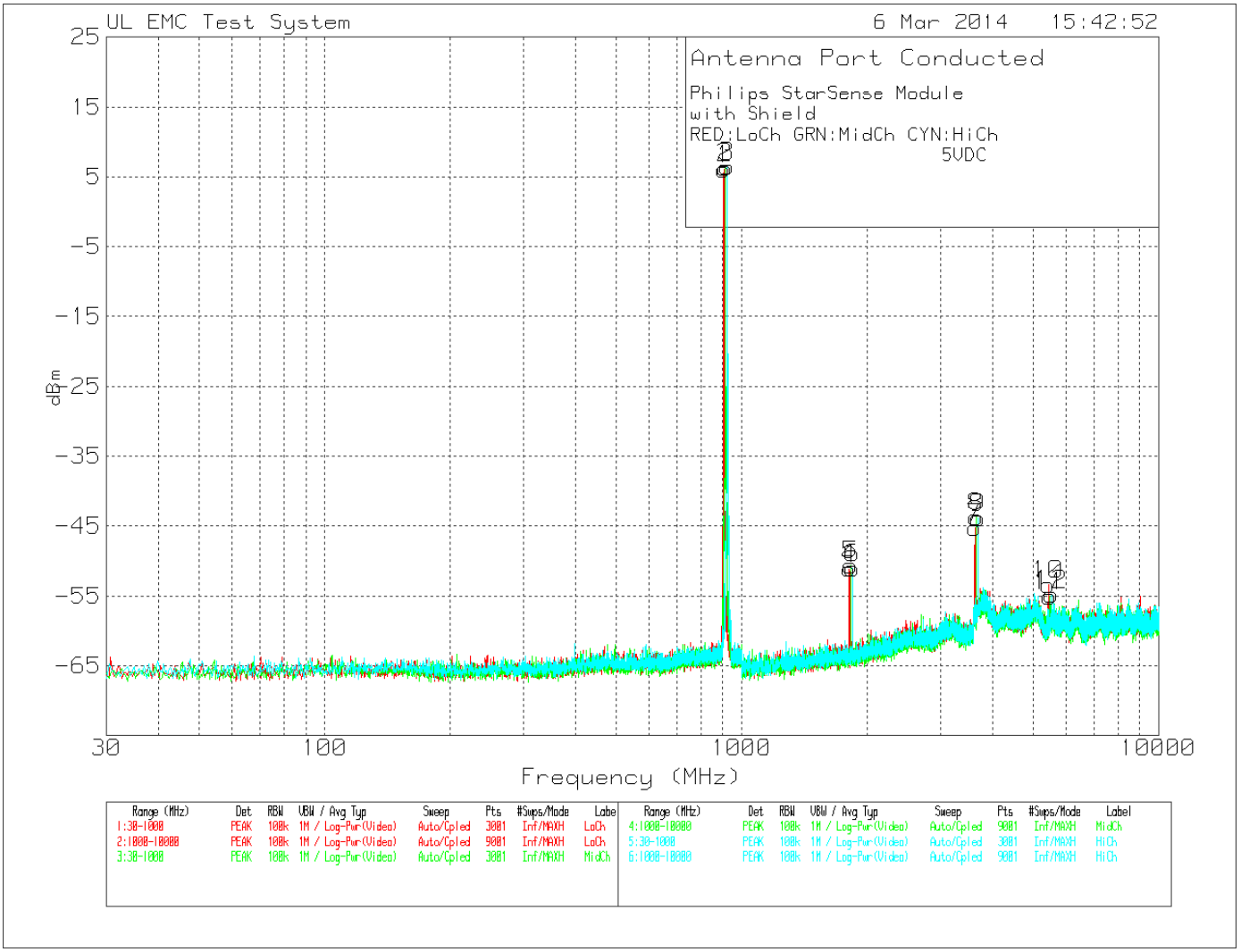
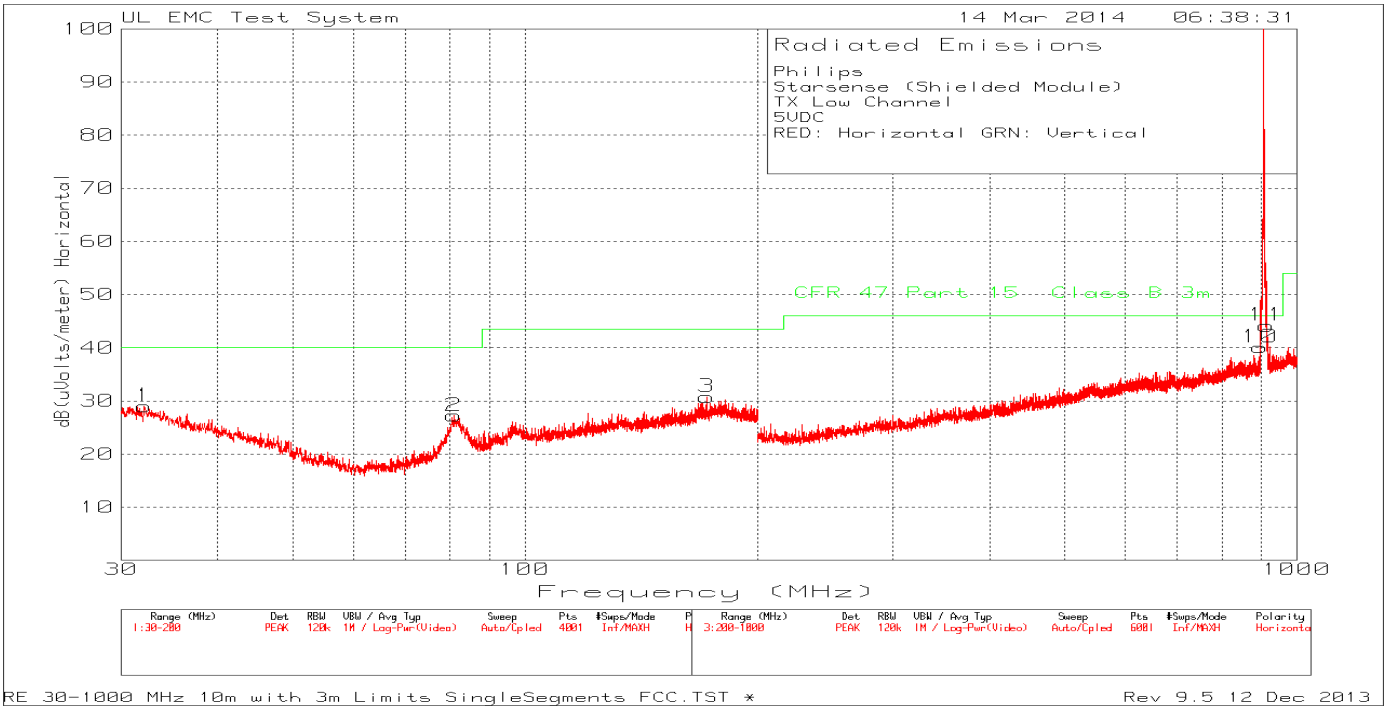
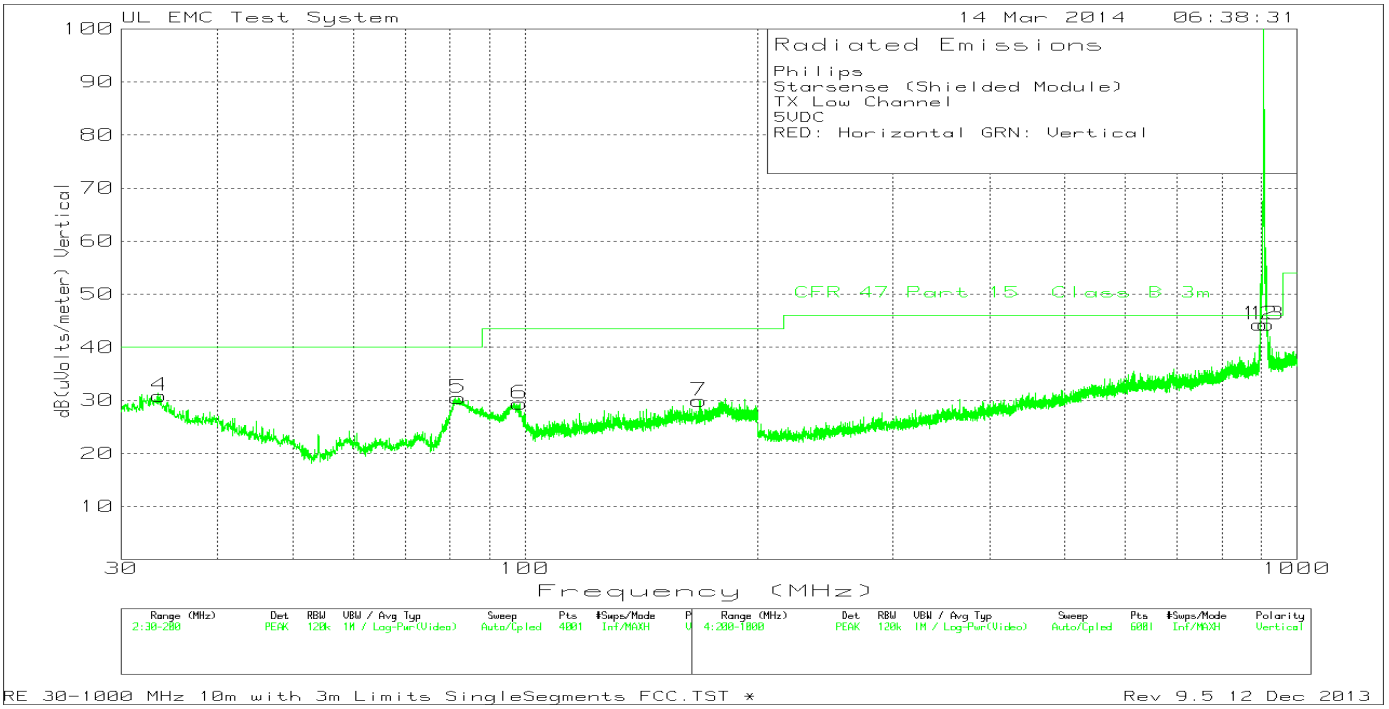


Table 8 Antenna Port Conducted Spurious Emissions 30MHz - 10GHz, Low, Middle, High Channels

Philips StarSense Module with Shield RED:LoCh GRN:MidCh CYN:HiCh 5VDC Trace Markers					
Marker No.	Test Frequency MHz	Meter Reading dBm	Detector	Path Factor dB	Level dBm
Low Channel					
1	905.91	-4.13	PK	10.2	6.07
4	1811	-61.4	PK	10.3	-51.1
7	3624	-55.92	PK	10.7	-45.2
10	5435	-64.28	PK	10.9	-53.4
Middle Channel					
2	913.9933	-3.93	PK	10.2	6.27
5	1827	-61.02	PK	10.4	-50.6
8	3656	-54.43	PK	10.7	-43.7
11	5483	-65.96	PK	10.9	-55.1
High Channel					
3	924.1783	-3.77	PK	10.2	6.43
6	1847	-61.42	PK	10.4	-51
9	3696	-54.56	PK	10.7	-43.9
12	5543	-65.71	PK	10.9	-54.8
PK - Peak detector					

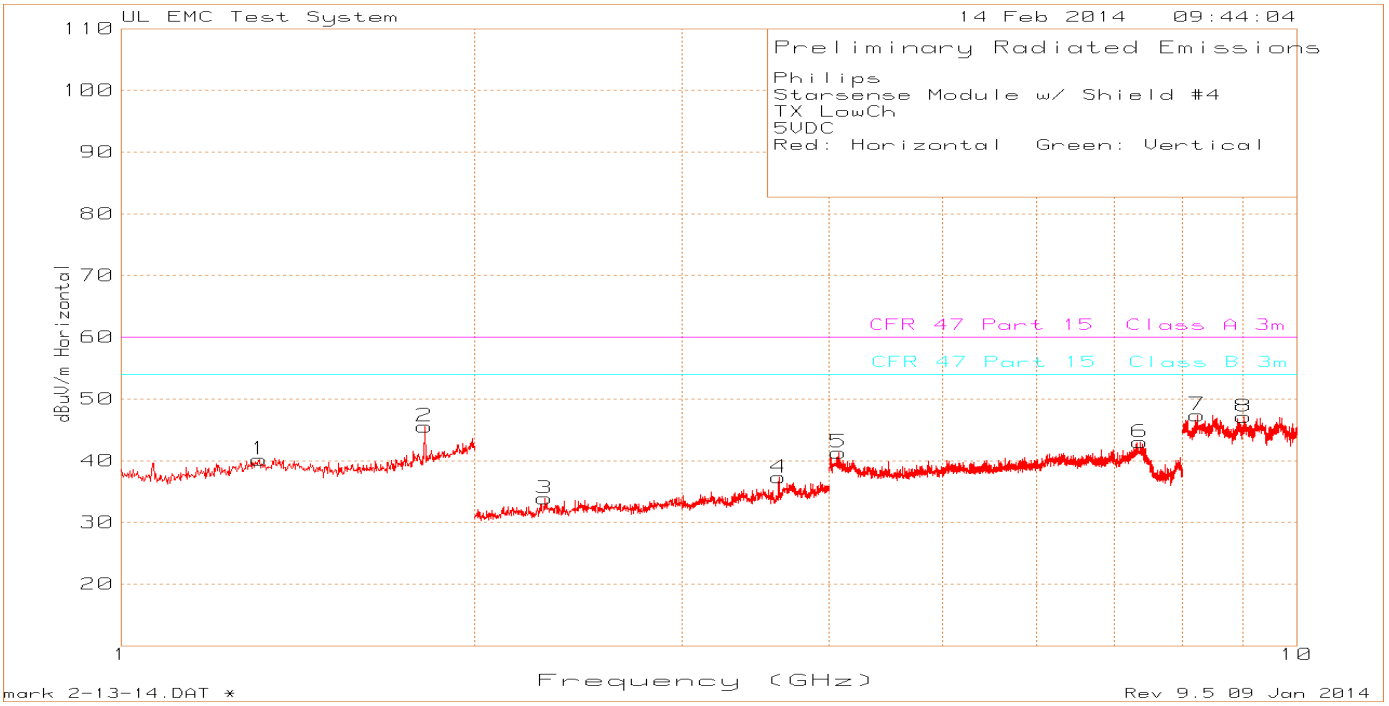
Figure 6 Radiated Spurious Emissions below 1GHz, Low Channel

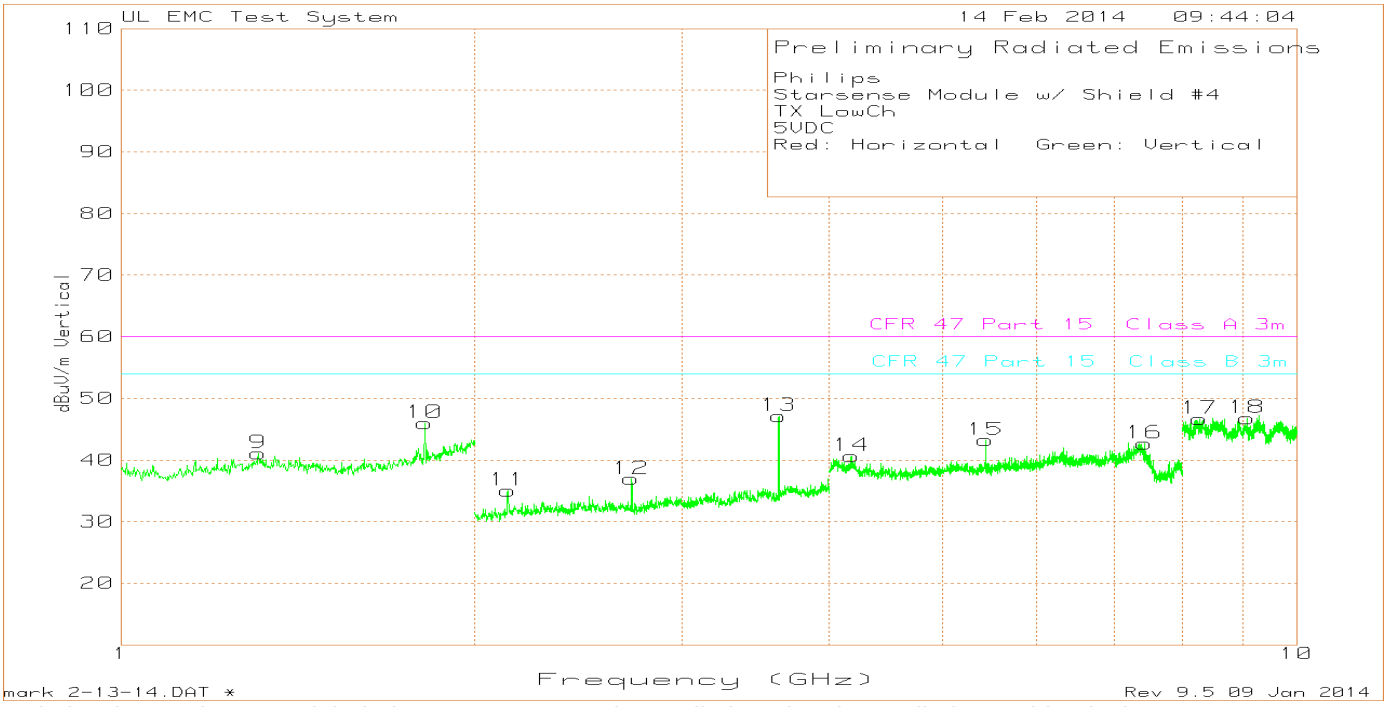




*No emissions in within 6dB of the limit recorded in restricted bands.
**Limits shown above are labeled as FCC part 15, class B limits. The class B limits are identical to FCC part 15.209 limits.

Figure 7 Radiated Spurious Emissions above 1GHz, Low Channel





**Limits shown above are labeled as FCC part 15, class B limits. The class B limits are identical to FCC part 15.209 limits.

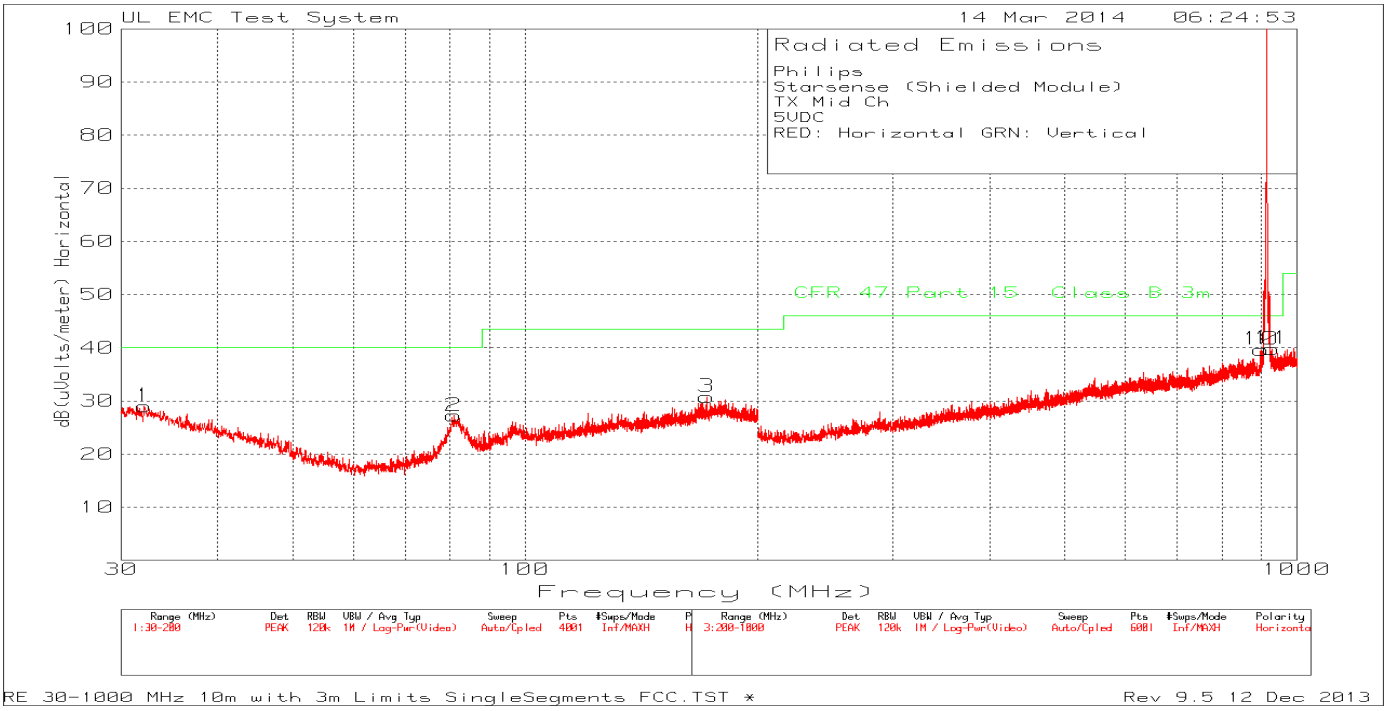
Table 9 Radiated Spurious Emissions above 1GHz, Low Channel

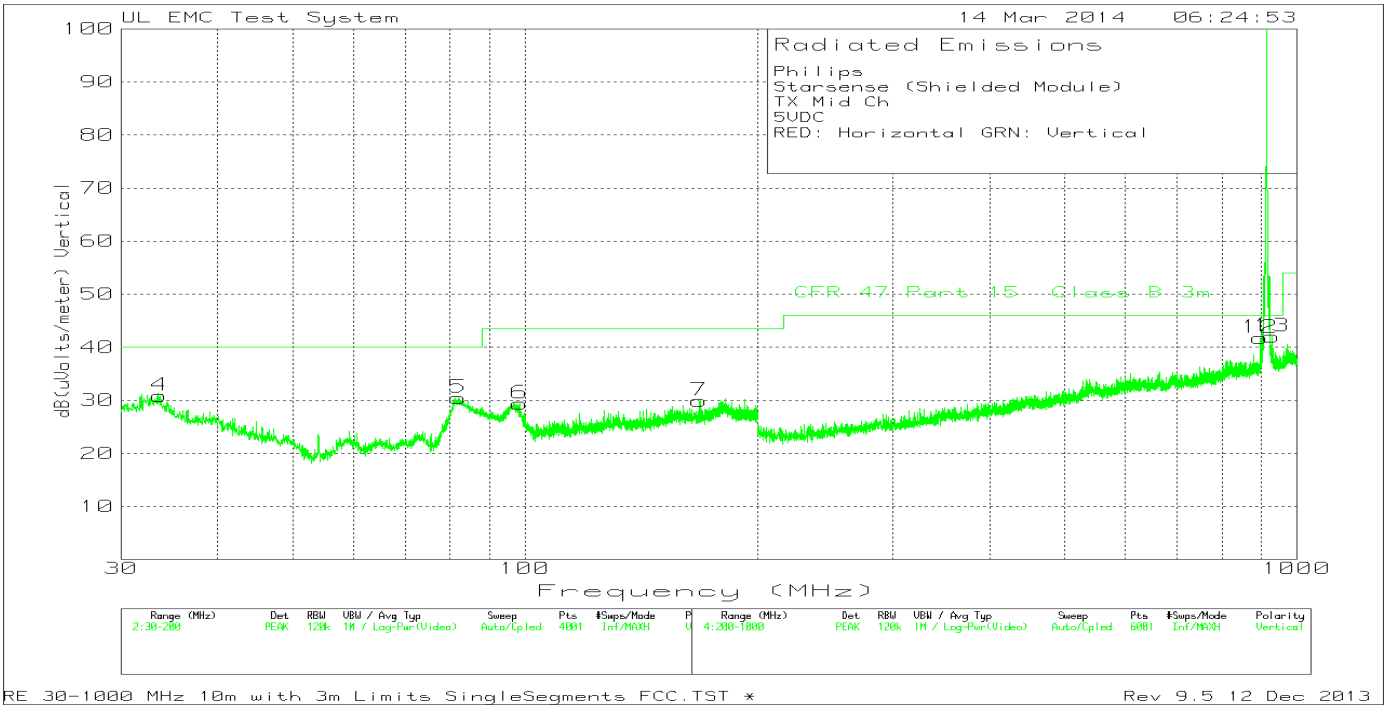
Philips
Starsense Module w/ Shield #4
TX LowCh
5VDC
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	900MHz BRF dB	Path Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.3106	65.72	PK	29.3	0.3	-55.11	40.21	54	-13.79	0-360	149	H
2	1.8136	68.68	PK	30	0.4	-53.54	45.54	54	-8.46	0-360	100	H
3	* 2.2943	63.04	PK	21.7	0	-50.87	33.87	54	-20.13	0-360	150	H
4	* 3.6256	63.96	PK	23.3	0	-49.98	37.28	54	-16.72	0-360	150	H
5	* 4.08	63.38	PK	28.4	0	-50.47	41.31	54	-12.69	0-360	150	H
6	* 7.3637	58.01	PK	30.9	0	-45.92	42.99	54	-11.01	0-360	150	H
7	* 8.2262	57.96	PK	36.4	0	-46.99	47.37	54	-6.63	0-360	150	H
8	* 9.019	59.03	PK	36.1	0	-48.03	47.1	54	-6.9	0-360	150	H
9	* 1.3086	66.61	PK	29.3	0.3	-55.11	41.1	54	-12.9	0-360	150	V
10	1.8136	69.16	PK	30	0.4	-53.54	46.02	54	-7.98	0-360	150	V
11	2.1321	65.69	PK	21.5	0	-52.09	35.1	54	-18.9	0-360	150	V
12	* 2.7167	65.51	PK	22.1	0	-50.67	36.94	54	-17.06	0-360	150	V
13	* 3.6256	73.79	PK	23.3	0	-49.98	47.11	54	-6.89	0-360	150	V
14	* 4.1821	63.29	PK	28.3	0	-50.92	40.67	54	-13.33	0-360	150	V
15	* 5.4367	64.26	PK	28	0	-49.04	43.22	54	-10.78	0-360	150	V
16	* 7.4277	58.49	PK	30.8	0	-46.57	42.72	54	-11.28	0-360	150	V
17	* 8.2703	57.8	PK	36.4	0	-47.53	46.67	54	-7.33	0-360	150	V
18	* 9.0771	59.49	PK	36.2	0	-48.86	46.83	54	-7.17	0-360	150	V

PK - Peak detector
LnAv - Linear Average detector
* Indicates Frequency in Restrictad Bands

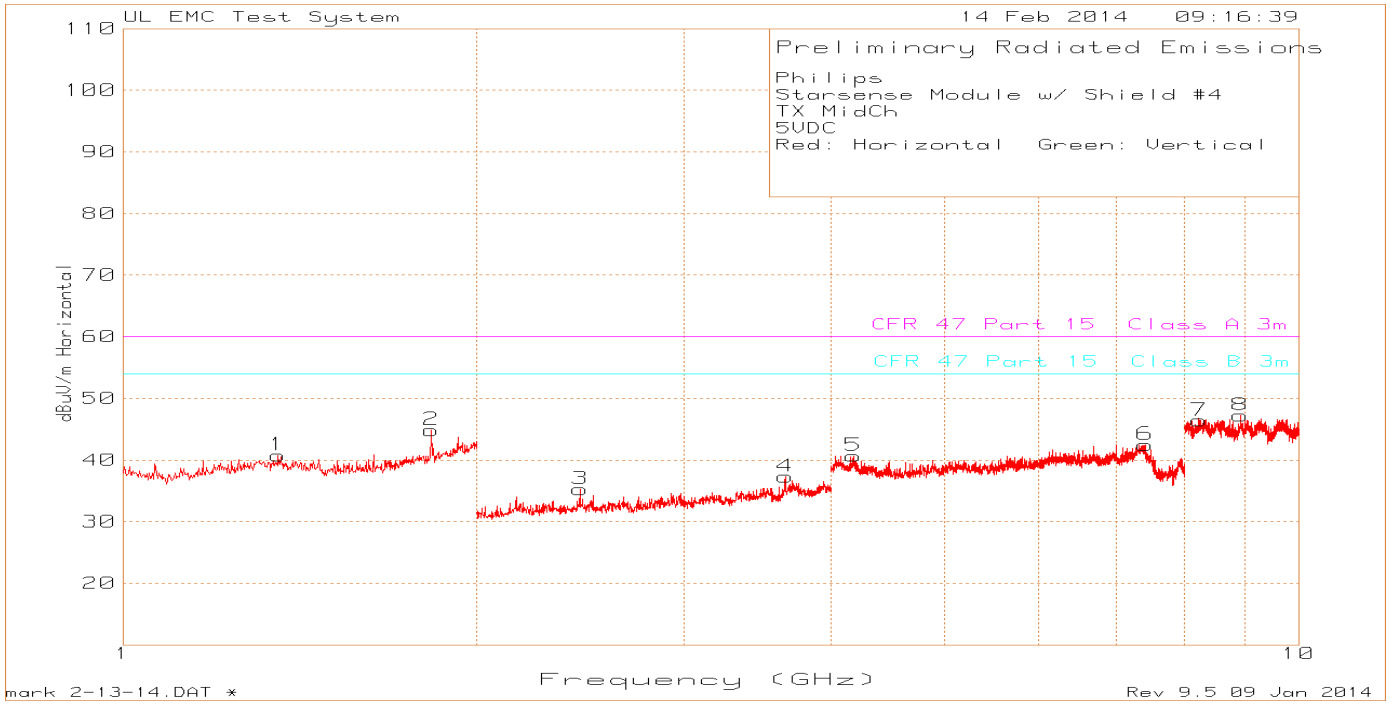
Figure 8 Radiated Spurious Emissions below 1GHz, Middle Channel

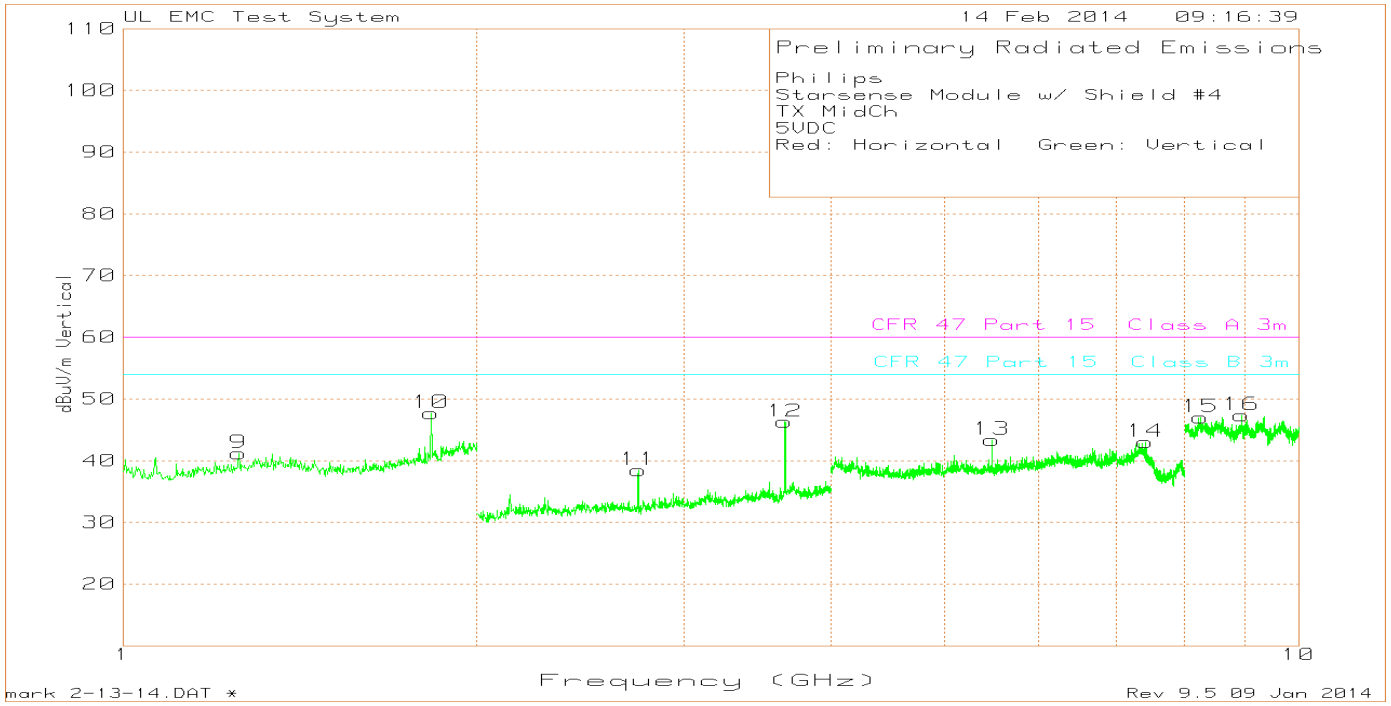




*No emissions in within 6dB of the limit recorded in restricted bands.
**Limits shown above are labeled as FCC part 15, class B limits. The class B limits are identical to FCC part 15.209 limits.

Figure 9 Radiated Spurious Emissions above 1GHz, Middle Channel





**Limits shown above are labeled as FCC part 15, class B limits. The class B limits are identical to FCC part 15.209 limits.

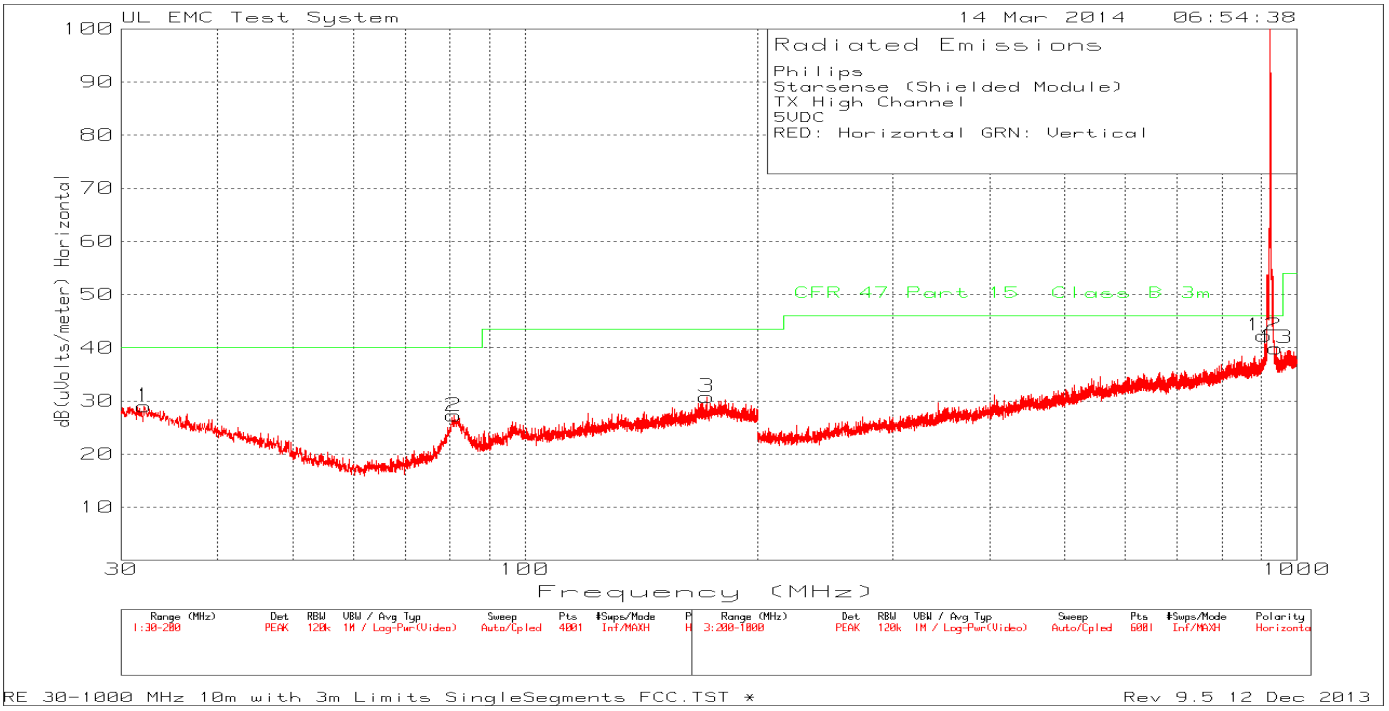
Table 10 Radiated Spurious Emissions above 1GHz, Middle Channel

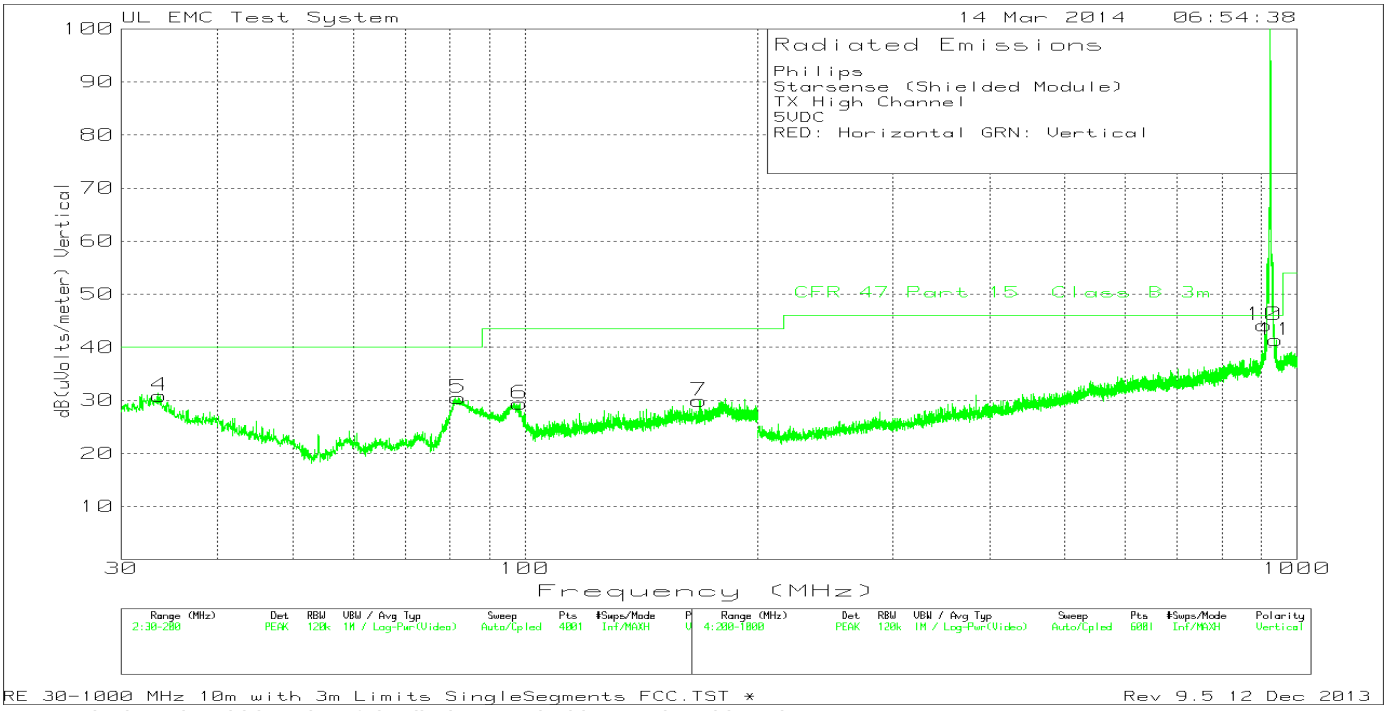
Philips
Starsense Module w/ Shield #4
TX MidCh
5VDC
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	900MHz BRF dB	Path Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.3547	66.56	PK	29.2	0.3	-55.28	40.78	53.97	-13.19	0-360	150	H
2	1.8297	67.76	PK	30.2	0.4	-53.52	44.84	53.97	-9.13	0-360	150	H
3	2.4464	63.88	PK	21.9	0	-50.53	35.25	53.97	-18.72	0-360	150	H
4	* 3.6577	62.93	PK	23.4	0	-49.04	37.29	53.97	-16.68	0-360	150	H
5	* 4.1841	63.32	PK	28.3	0	-50.93	40.69	53.97	-13.28	0-360	150	H
6	* 7.3997	57.62	PK	31.2	0	-46.33	42.49	53.97	-11.48	0-360	150	H
7	* 8.2282	56.99	PK	36.4	0	-46.99	46.4	53.97	-7.57	0-360	150	H
8	8.9249	59.29	PK	36.1	0	-48.18	47.21	53.97	-6.76	0-360	150	H
9	* 1.2545	67.58	PK	28.9	0.3	-55.56	41.22	53.97	-12.75	0-360	150	V
10	1.8277	70.64	PK	30.2	0.4	-53.53	47.71	53.97	-6.26	0-360	150	V
11	* 2.7427	67.07	PK	22.1	0	-50.67	38.5	53.97	-15.47	0-360	150	V
12	* 3.6557	71.99	PK	23.4	0	-49.09	46.3	53.97	-7.67	0-360	150	V
13	5.4847	64.44	PK	28.1	0	-49.17	43.37	53.97	-10.6	0-360	150	V
14	* 7.4017	58.22	PK	31.2	0	-46.35	43.07	53.97	-10.9	0-360	150	V
15	* 8.2563	57.9	PK	36.4	0	-47.25	47.05	53.97	-6.92	0-360	150	V
16	8.9409	59.32	PK	36.1	0	-48.07	47.35	53.97	-6.62	0-360	150	V

PK - Peak detector
LnAv - Linear Average detector
* Indicates Frequency in Restrictad Bands

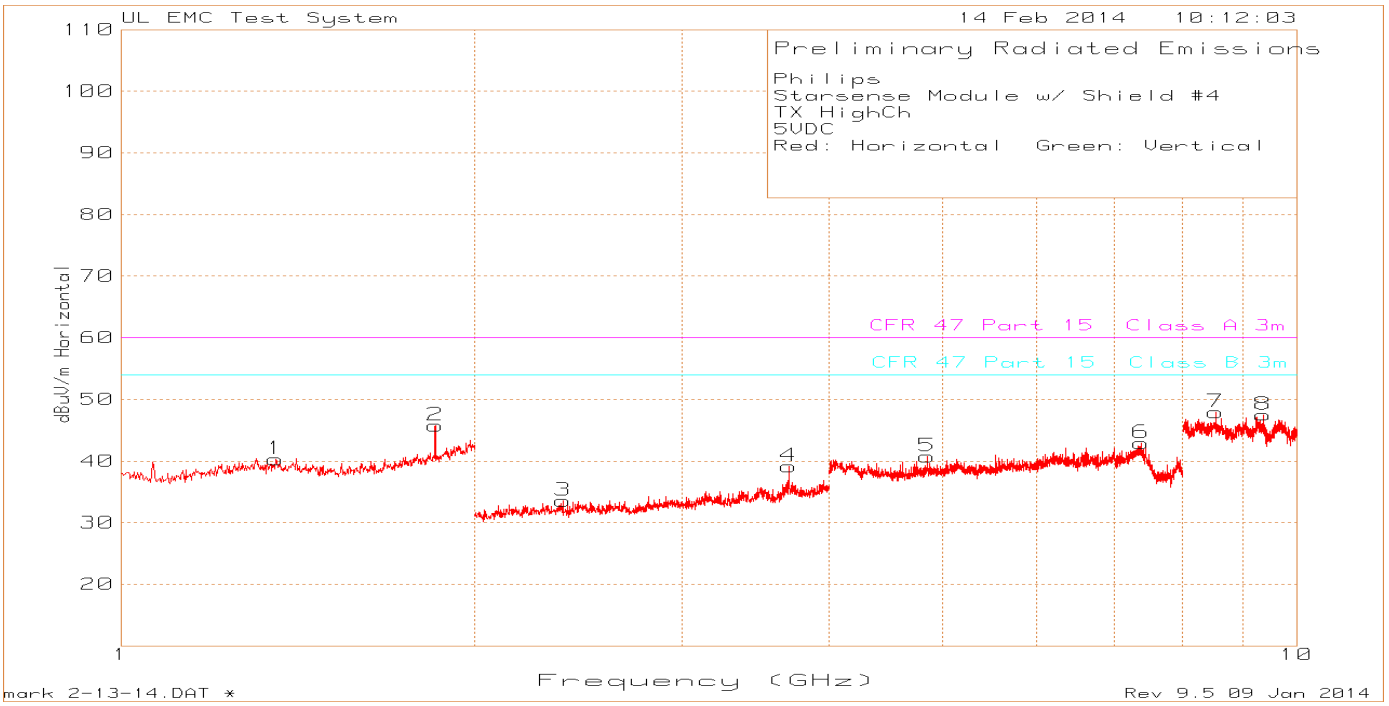
Figure 10 Radiated Spurious Emissions below 1GHz, High Channel

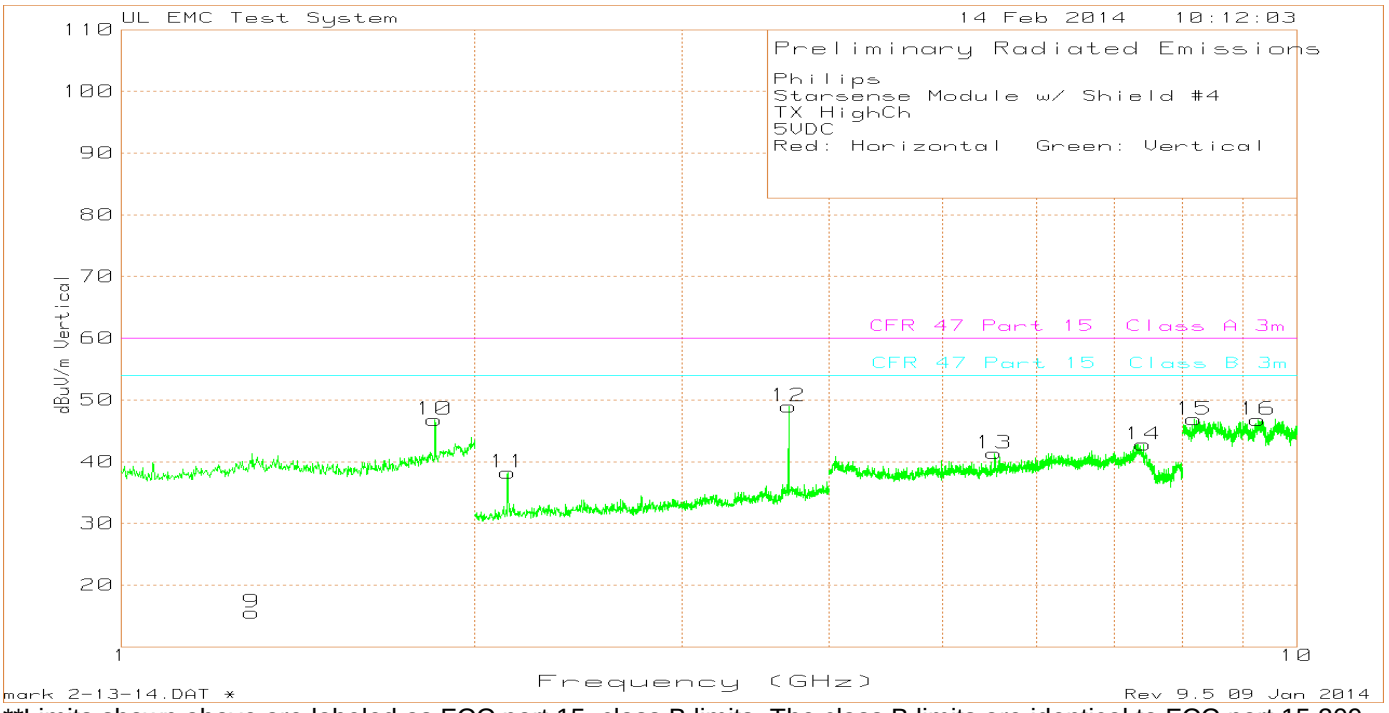




*No emissions in within 6dB of the limit recorded in restricted bands.
**Limits shown above are labeled as FCC part 15, class B limits. The class B limits are identical to FCC part 15.209 limits.

Figure 11 Radiated Spurious Emissions above 1GHz, High Channel





**Limits shown above are labeled as FCC part 15, class B limits. The class B limits are identical to FCC part 15.209 limits.

Table 11 Radiated Spurious Emissions above 1GHz, High Channel

Philips
Starsense Module w/ Shield #4
TX HighCh
5VDC
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	900MHz BRF dB	Path Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.3527	66.12	PK	29.2	0.3	-55.28	40.34	54	-13.66	0-360	100	H
2	1.8497	68.17	PK	30.5	0.5	-53.42	45.75	54	-8.25	0-360	100	H
3	* 2.3764	63.17	PK	21.8	0	-51.42	33.55	54	-20.45	0-360	150	H
4	* 3.6957	64.42	PK	23.5	0	-48.76	39.16	54	-14.84	0-360	150	H
5	* 4.8504	63.27	PK	27.7	0	-50.18	40.79	54	-13.21	0-360	150	H
6	* 7.3797	58	PK	31	0	-46.07	42.93	54	-11.07	0-360	150	H
7	8.5365	59.45	PK	36.6	0	-48.07	47.98	54	-6.02	0-360	150	H
8	* 9.3734	59.69	PK	36.4	0	-48.56	47.53	54	-6.47	0-360	150	H
9	* 1.2926	41.27	PK	29.2	0.3	-55.22	15.55	54	-38.45	0-360	150	V
10	1.8477	69.21	PK	30.5	0.5	-53.44	46.77	54	-7.23	0-360	150	V
11	2.1321	68.83	PK	21.5	0	-52.09	38.24	54	-15.76	0-360	150	V
12	* 3.6957	74.21	PK	23.5	0	-48.76	48.95	54	-5.05	0-360	150	V
13	5.5308	62.64	PK	28.2	0	-49.46	41.38	54	-12.62	0-360	150	V
14	* 7.4057	58.03	PK	31.1	0	-46.37	42.76	54	-11.24	0-360	150	V
15	* 8.1862	58.62	PK	36.3	0	-48.06	46.86	54	-7.14	0-360	150	V
16	9.2773	58.25	PK	36.4	0	-47.81	46.84	54	-7.16	0-360	150	V
Radiated Emission Data												
	* 3.6956	78.36	PK	23.5	0	-48.76	53.1	74	-20.9	215	104	V
	* 3.6959	75.87	LnAv	23.5	0	-48.76	50.61	54	-3.39	215	104	V

PK - Peak detector
LnAv - Linear Average detector
* Indicates Frequency in Restrictad Bands

4.4 Test Conditions and Results – BAND EDGE COMPLIANCE

Test Description	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section15.205(c)).

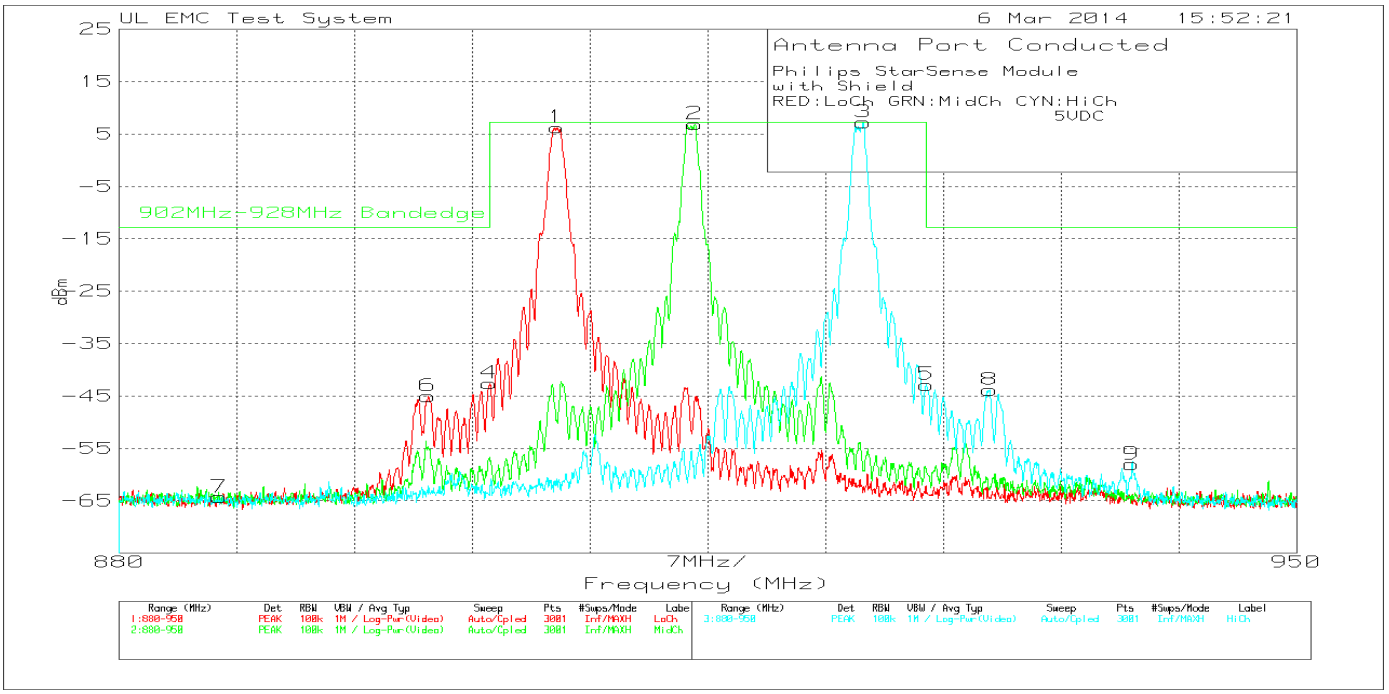
Basic Standard	47 CFR Part 15.247(d) RSS-210, A8.5	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	902MHz – 928MHz	Antenna Conducted

Limits	
Measurement Type	
Conducted	Antenna Conducted – 20dB below the fundamental
Radiated	Must meet the restricted band limit adjacent to the bandedge.
Supplementary information: Radiated Tests are not conducted since there is no restricted bands close to the fundamental frequency range.	

Table 12 Band Edge Compliance EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 12 Antenna Conducted Band Edge Compliance Graph – Low, Middle and High Channels



Philips StarSense Module with Shield RED:LoCh GRN:MidCh CYN:HiCh 5VDC Trace Markers							
Marker No.	Test Frequency MHz	Meter Reading dBm	Detector	Cable Factor dB	Level dBm	902MHz-928MHz Bandedge	Margin (dB)
Low Channel							
1	906.0167	-3.96	PK	10.2	6.24	N/A	N/A
4	902.0000	-52.77	PK	10.2	-42.57	7.22	-49.79
6	898.3633	-55.22	PK	10.2	-45.02	-12.78	-32.24
7	885.95	-74.52	PK	10.2	-64.32	-12.78	-51.54
Middle Channel							
2	914.23	-3.31	PK	10.2	6.89	N/A	N/A
High Channel							
3	924.2167	-2.98	PK	10.2	7.22	N/A	N/A
5	928.0000	-53.06	PK	10.2	-42.86	7.22	-50.08
8	931.7417	-54.05	PK	10.2	-43.85	-12.78	-31.07
9	940.2	-68.24	PK	10.2	-58.04	-12.78	-45.26
PK - Peak detector							

4.5 Test Conditions and Results – 6dB BANDWIDTH

Test Description	Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Basic Standard	47 CFR Part 15.247(a)(2) RSS-210, A8.2(a)

Table 13 6dB Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 14 6dB Bandwidth Results

Mode	Channel	6dB Bandwidth
TX	Low	800.6kHz
	Middle	795.8kHz
	High	809.4kHz

Figure 13 6dB Bandwidth Graphs – Low Channel

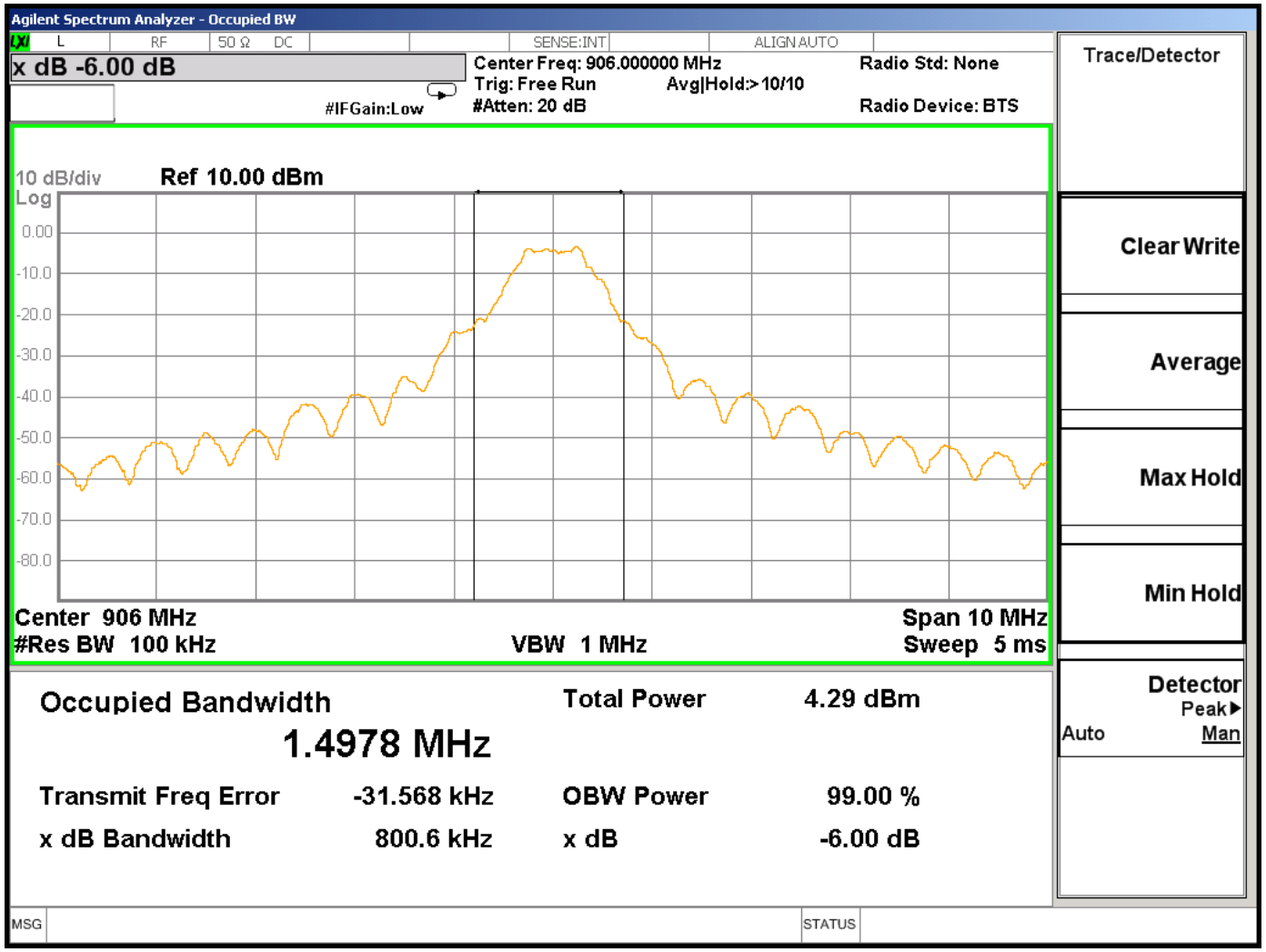


Figure 14 6dB Bandwidth Graphs – Middle Channel

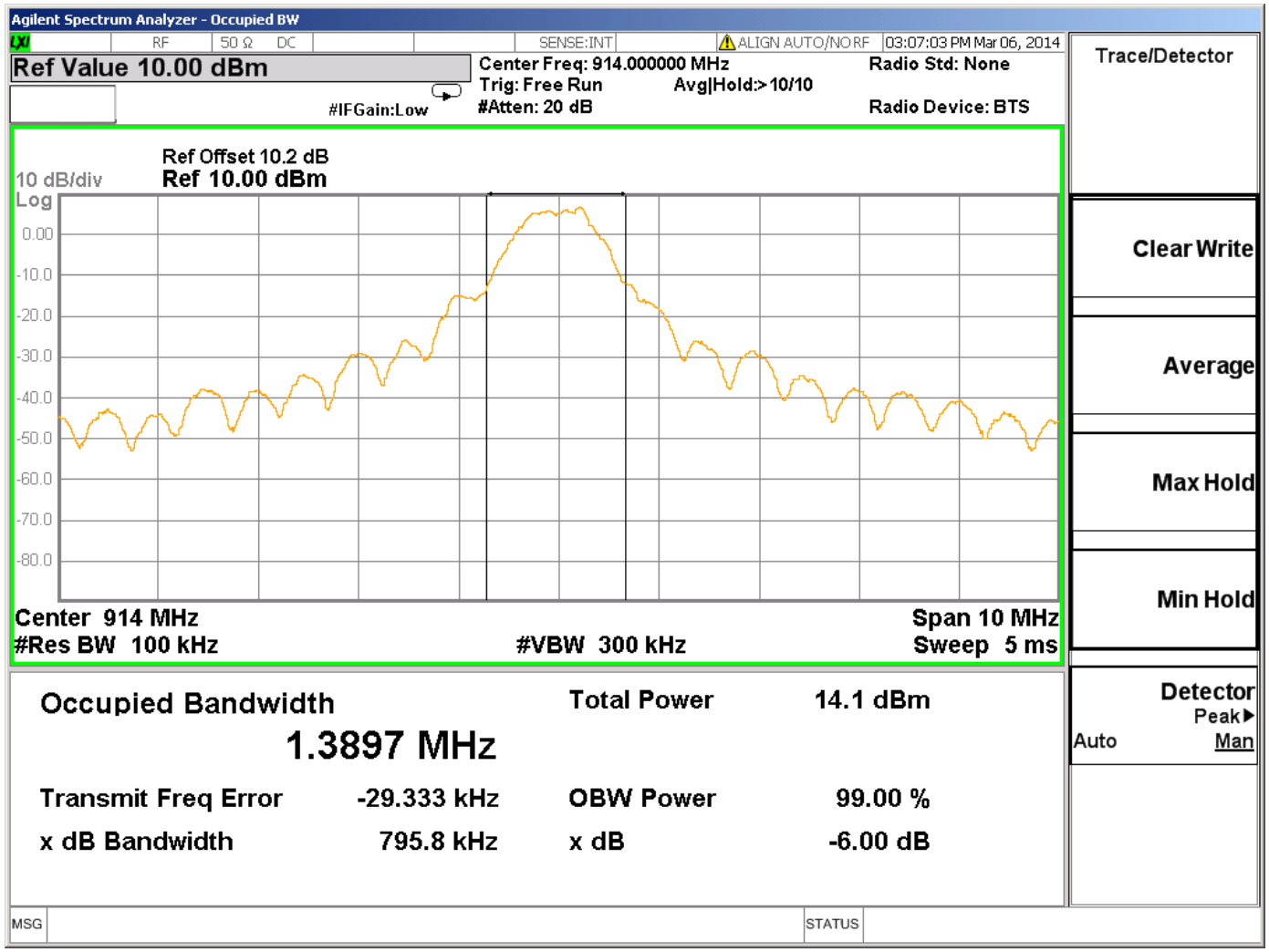
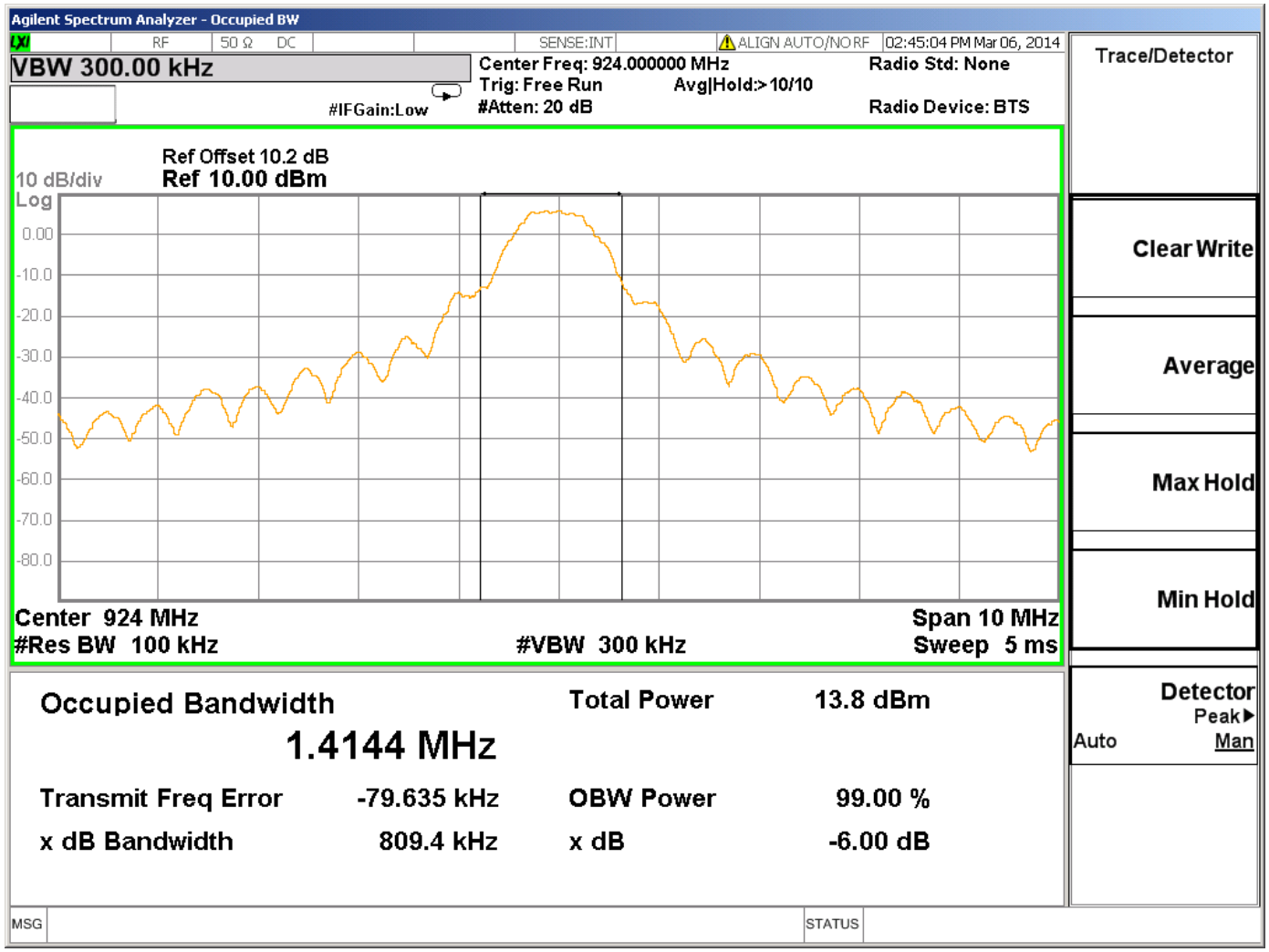


Figure 15 6dB Bandwidth Graphs – High Channel



4.6 Test Conditions and Results – MAXIMUM PEAK OUTPUT POWER

Test Description	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.	
Basic Standard	47 CFR Part 15.247(b)(3) RSS-210, A8.4(4)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	902MHz – 928MHz	Antenna Conducted
Limits		
Frequency (MHz)	Limit mW	
	Peak	
902 - 928	1,000	
Supplementary information: None		

Table 15 Maximum Peak Output Power EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 16 Maximum Peak Output Power Results

Channel	Limit (dBm)	Power dBm	Power W
Low Channel	30	8.424	0.00696
Middle Channel	30	8.563	0.00718
High Channel	30	8.442	0.00696

Figure 16 Maximum Peak Output Power Graphs – Low Channel

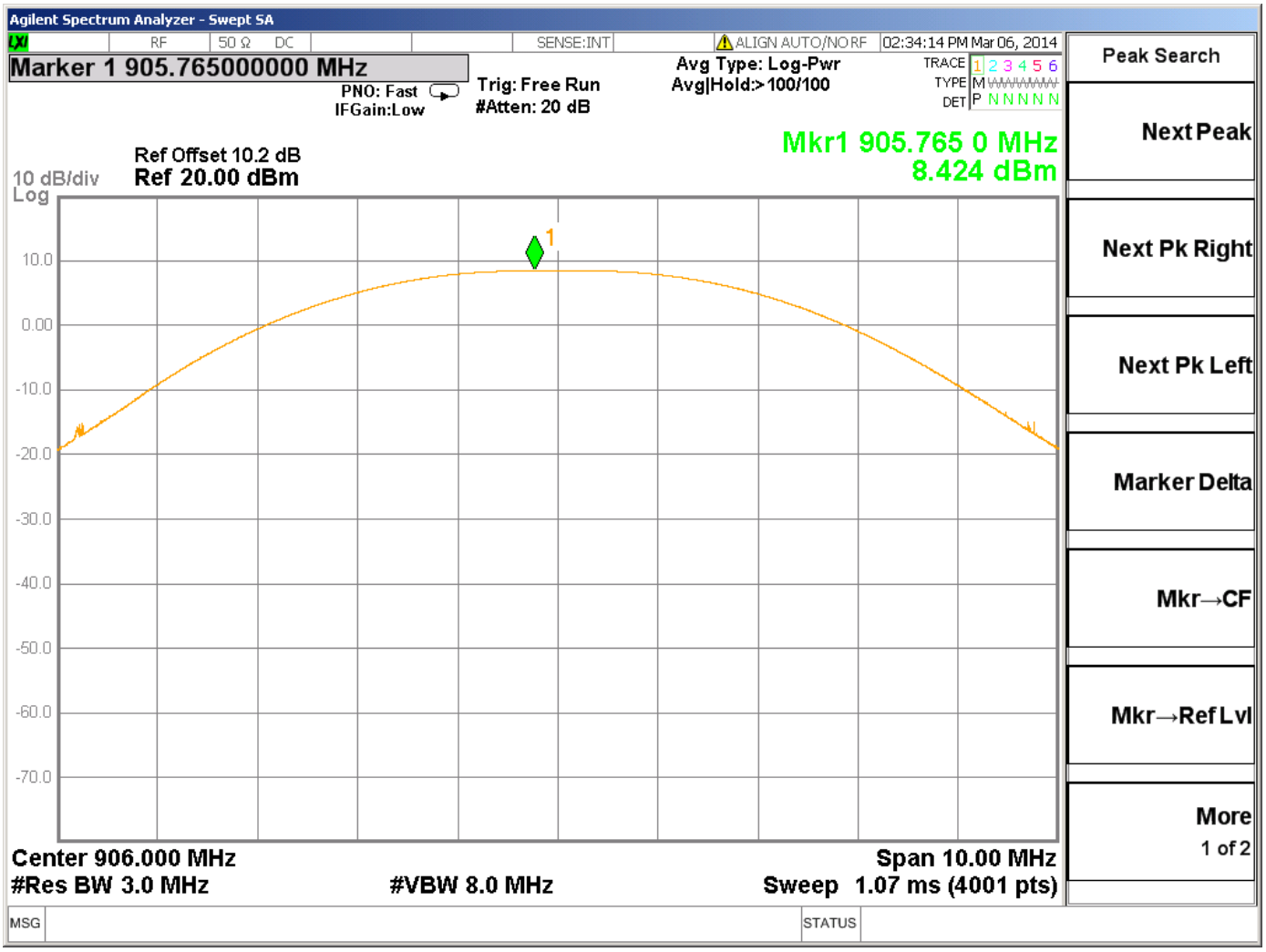


Figure 17 Maximum Peak Output Power Graphs – Mid Channel

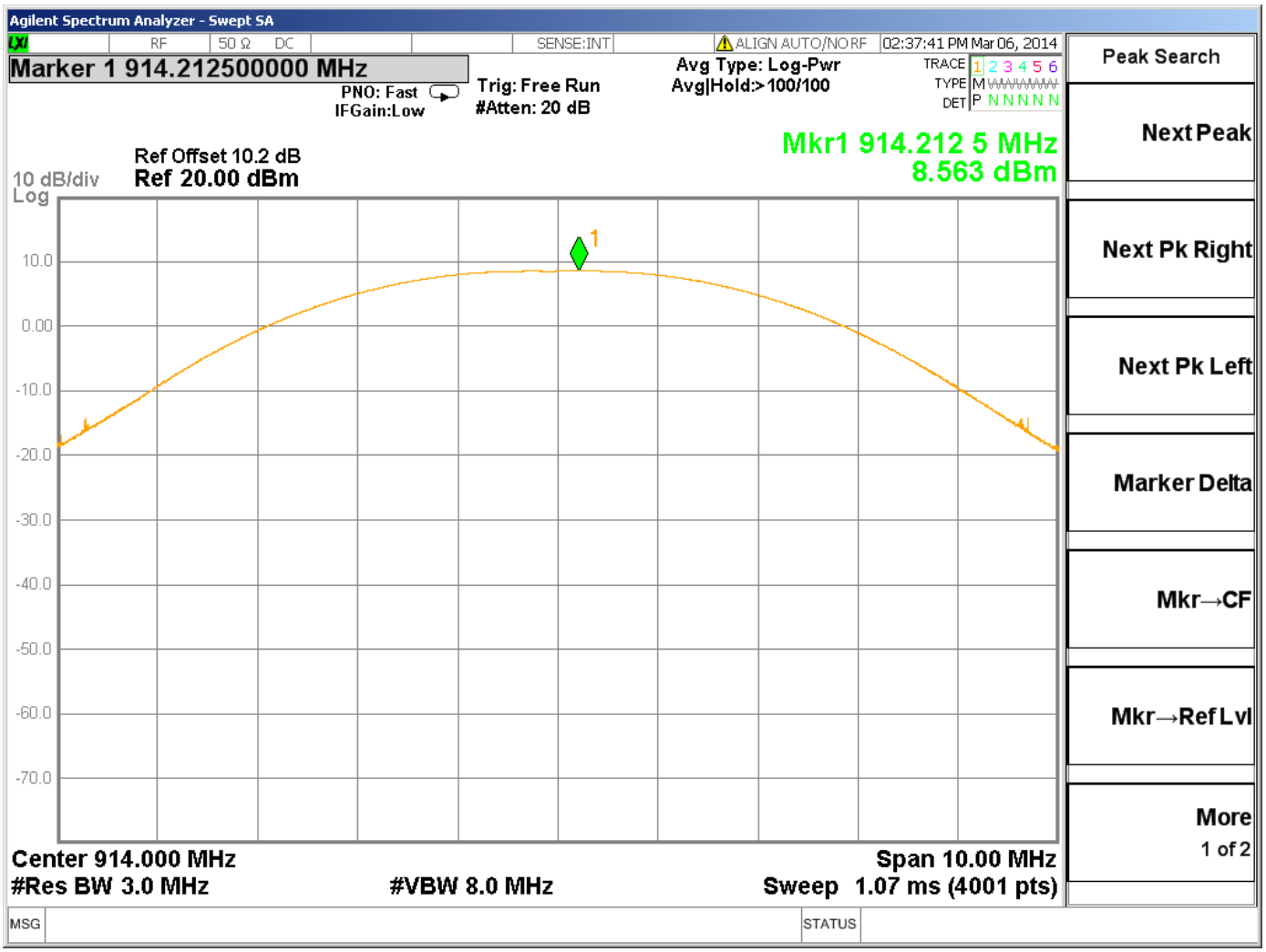
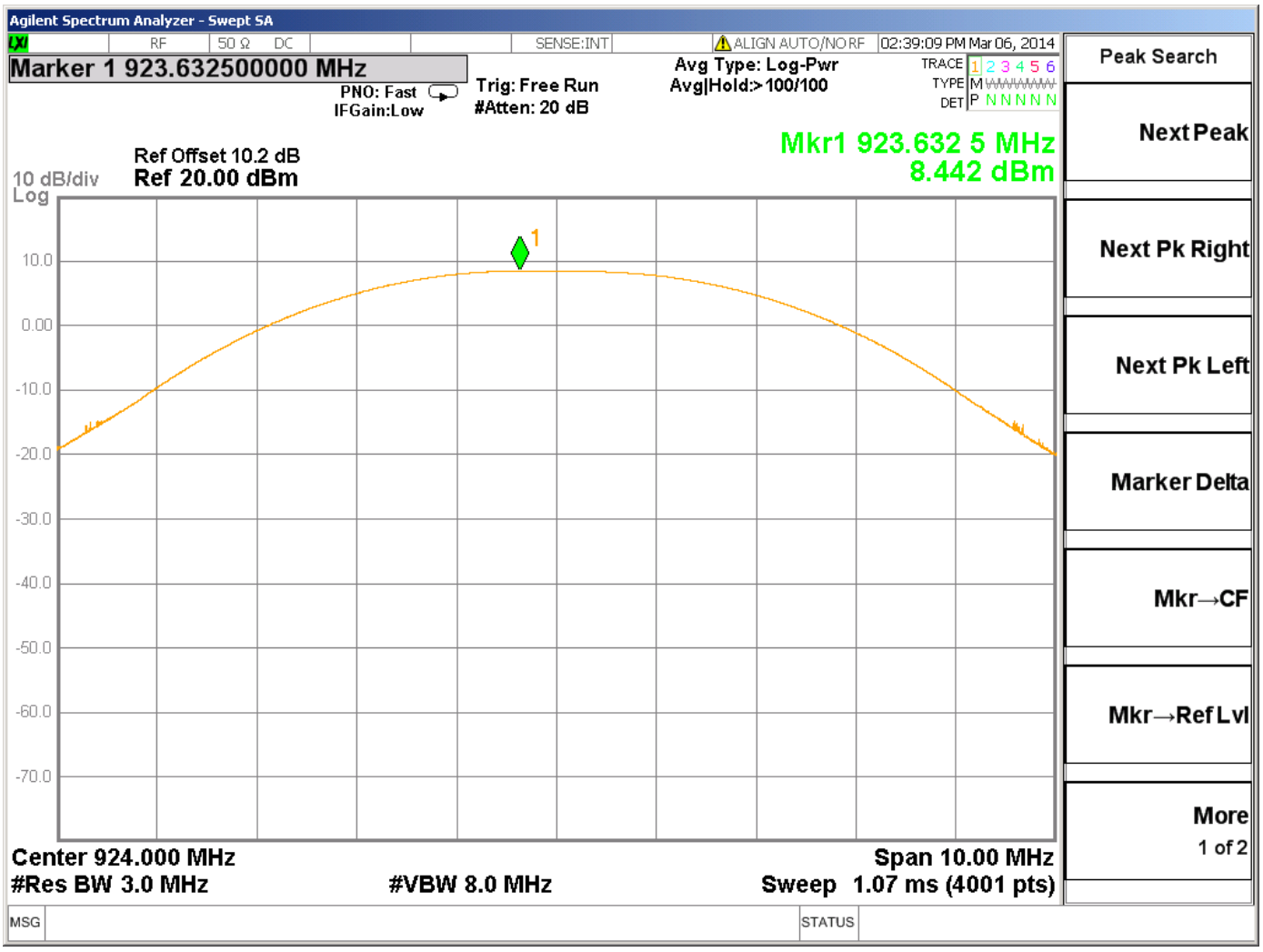


Figure 18 Maximum Peak Output Power Graphs – High Channel



4.7 Test Conditions and Results – POWER SPECTRAL DENSITY

Test Description	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.	
Basic Standard	47 CFR Part 15.247(e) RSS-210, A8.2(b)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	902MHz – 928MHz	Antenna Conducted

Limits	
Frequency (MHz)	Limit mW
	Peak
902 - 928	8dBm (0.00631mW)
Supplementary information: None	

Table 17 Power Spectral Density EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 18 Power Spectral Density Power Results

Channel	Limit (dBm)	Power Density dBm
Low Channel	8	-3.648
Middle Channel	8	-3.026
High Channel	8	-4.192

Figure 19 Power Spectral Density Graphs – Low Channel

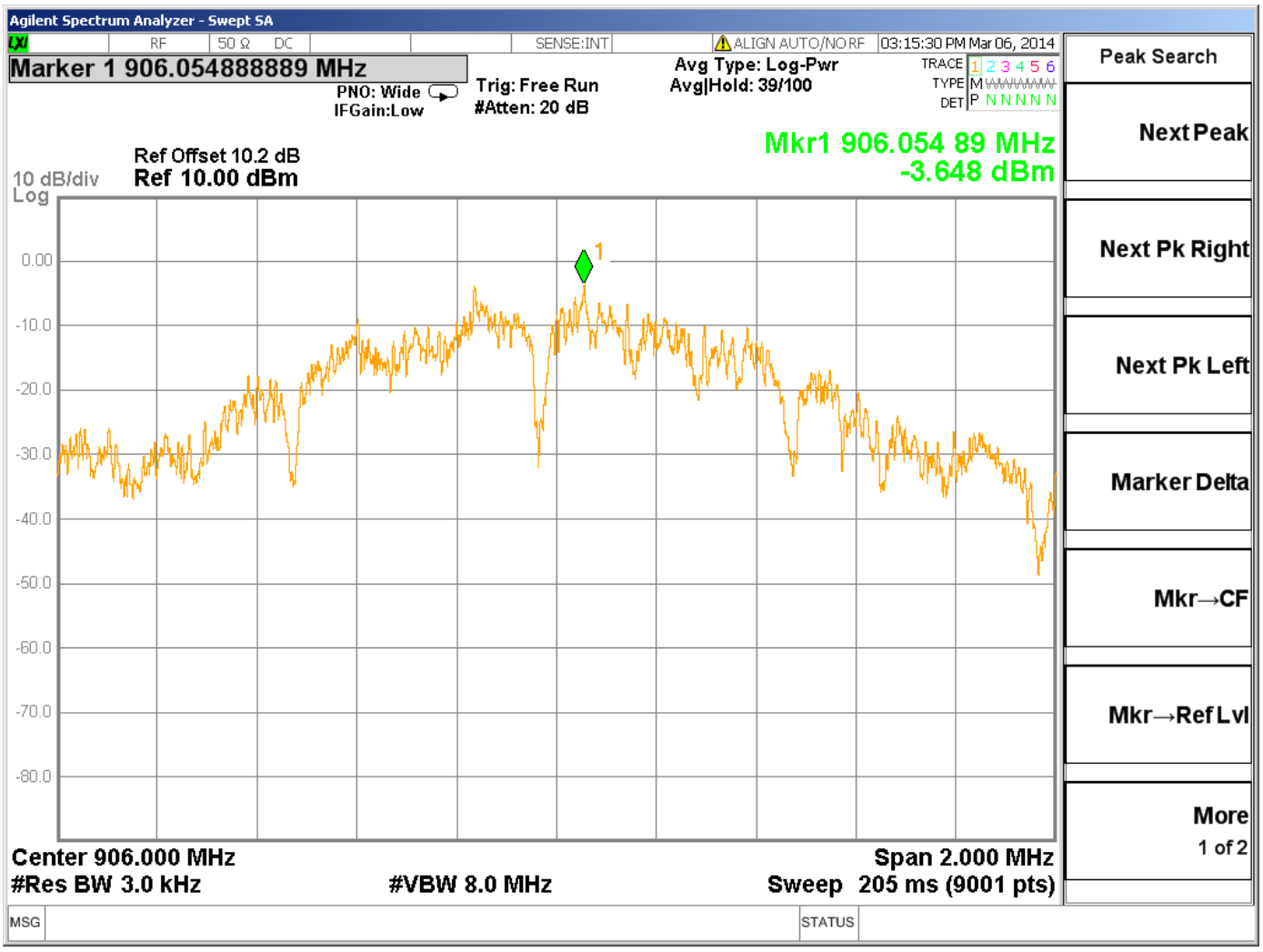


Figure 20 Power Spectral Density Graphs – Middle Channel

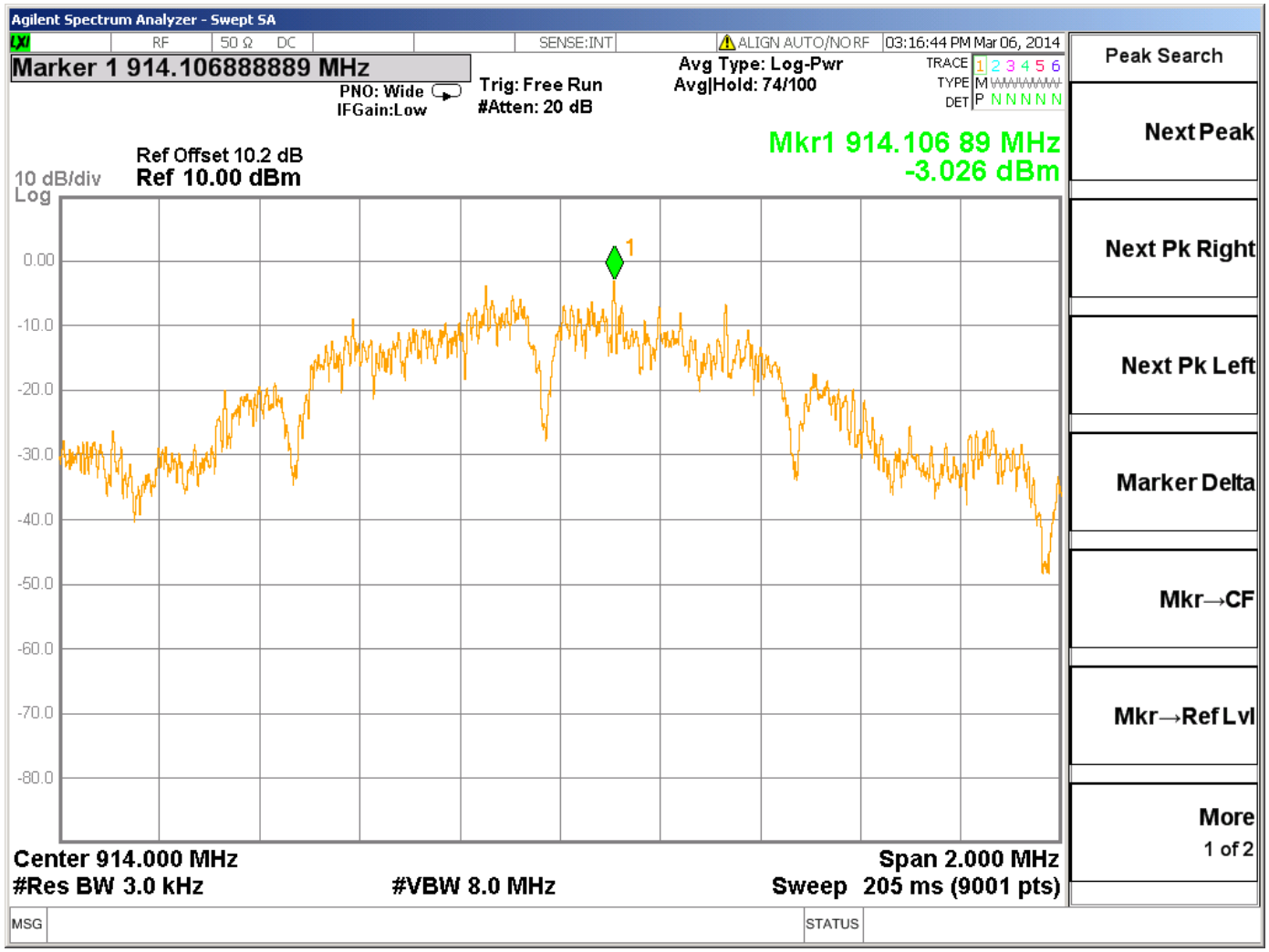
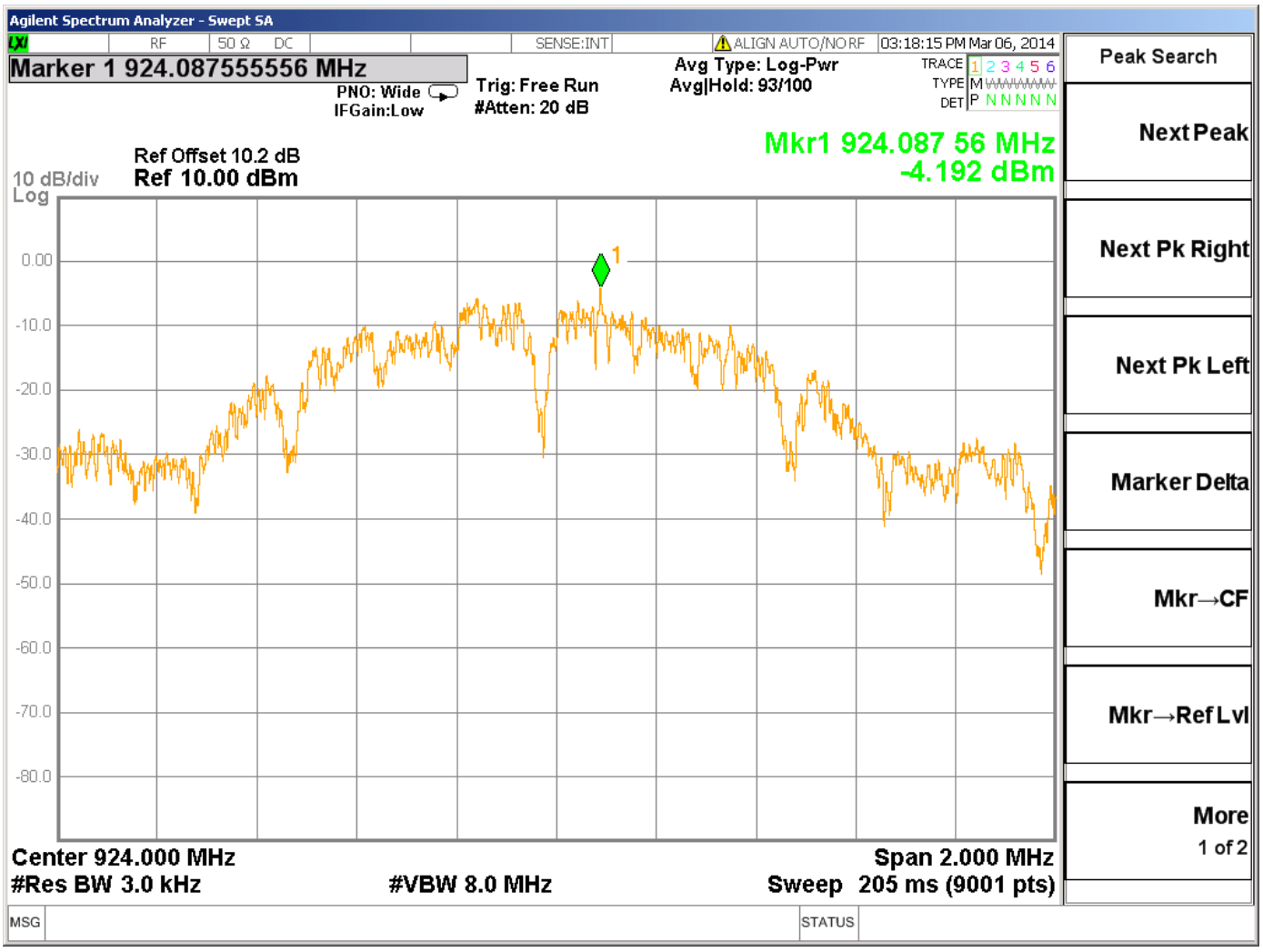


Figure 21 Power Spectral Density Graphs – High Channel



4.8 Test Conditions and Results – 99% Power BANDWIDTH

Test Description	When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
Basic Standard	RSS-Gen, 4.6.1

Table 19 99% Power Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 20 99% Power Bandwidth Results

Mode	Channel	99% Power Bandwidth
TX	Low	1.4880
	Middle	1.3828
	High	1.3982

Figure 22 99% Power Bandwidth Graphs – Low Channel

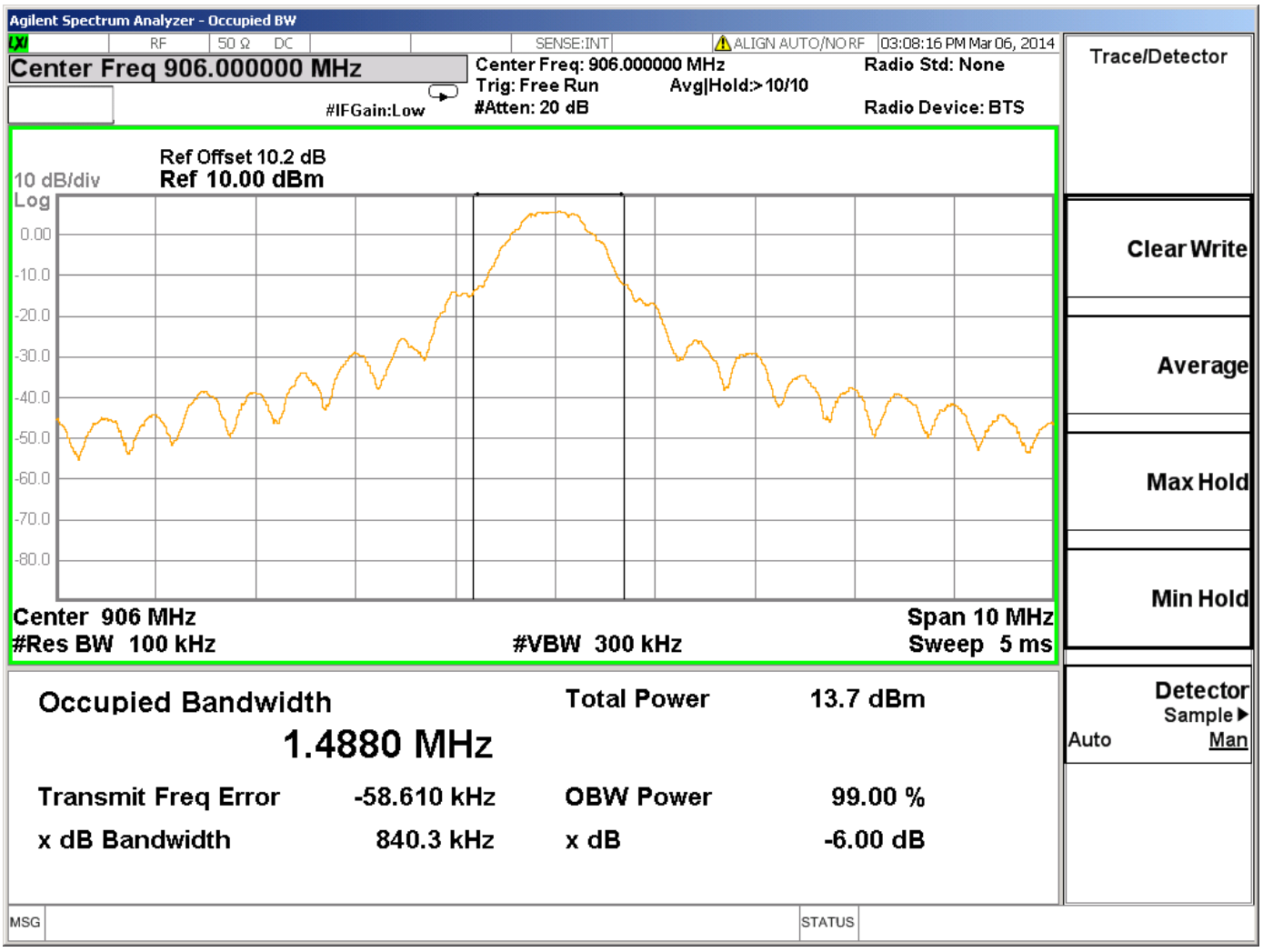


Figure 23 99% Power Bandwidth Graphs – Middle Channel

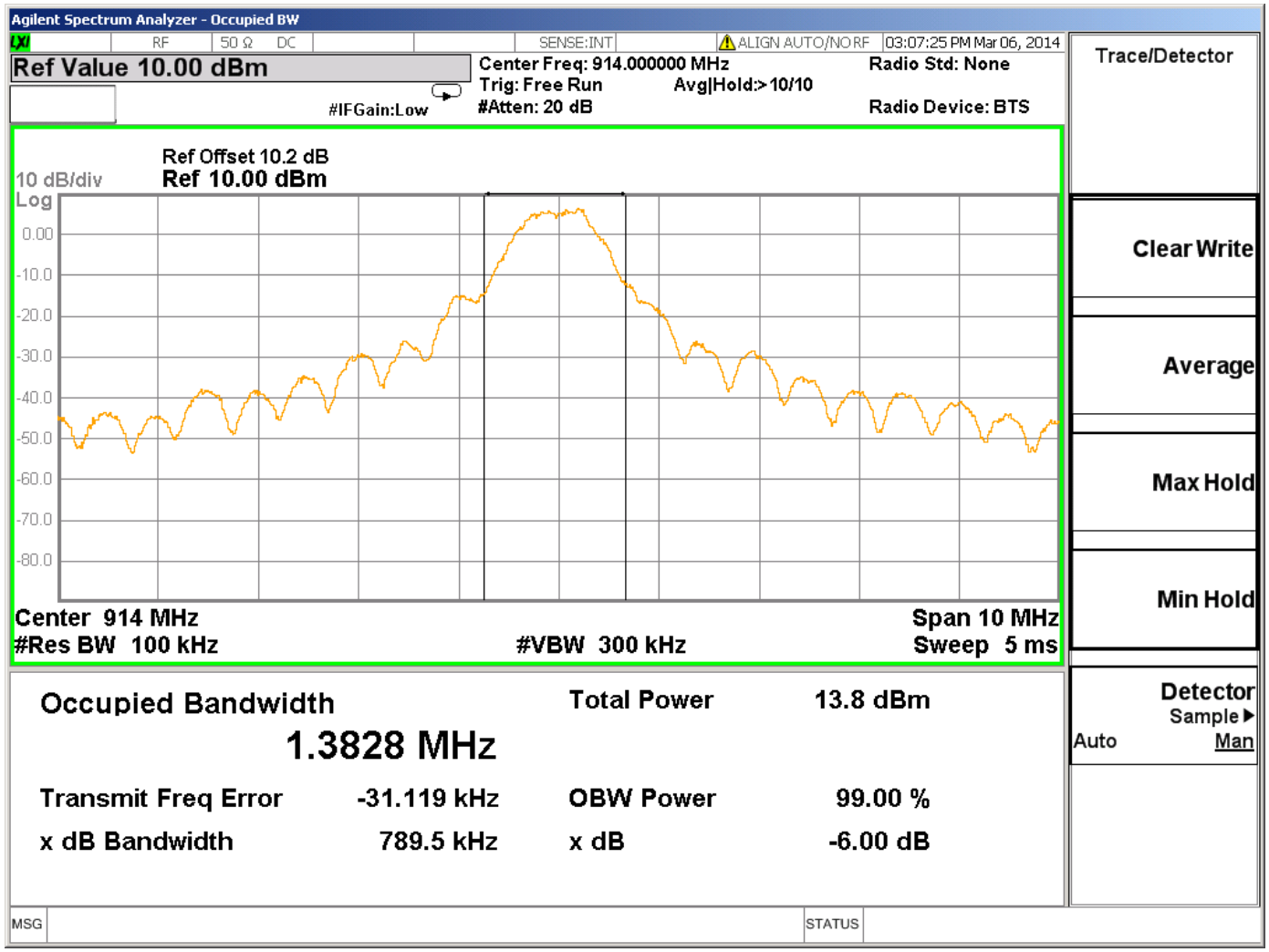
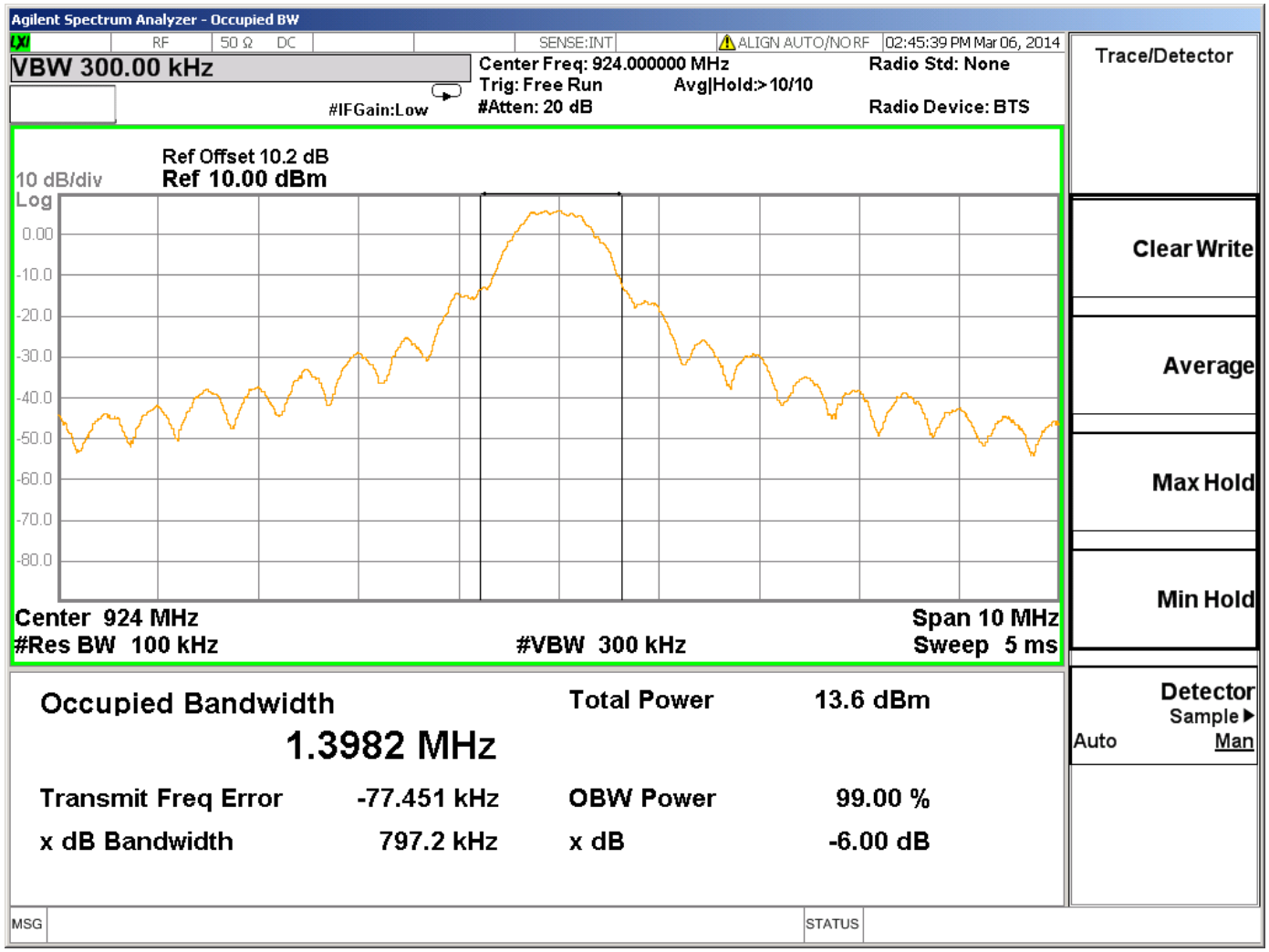


Figure 24 99% Power Bandwidth Graphs – High Channel



Appendix A

Test Setup Photos

Figure 25 – Antenna Port Conducted Emissions

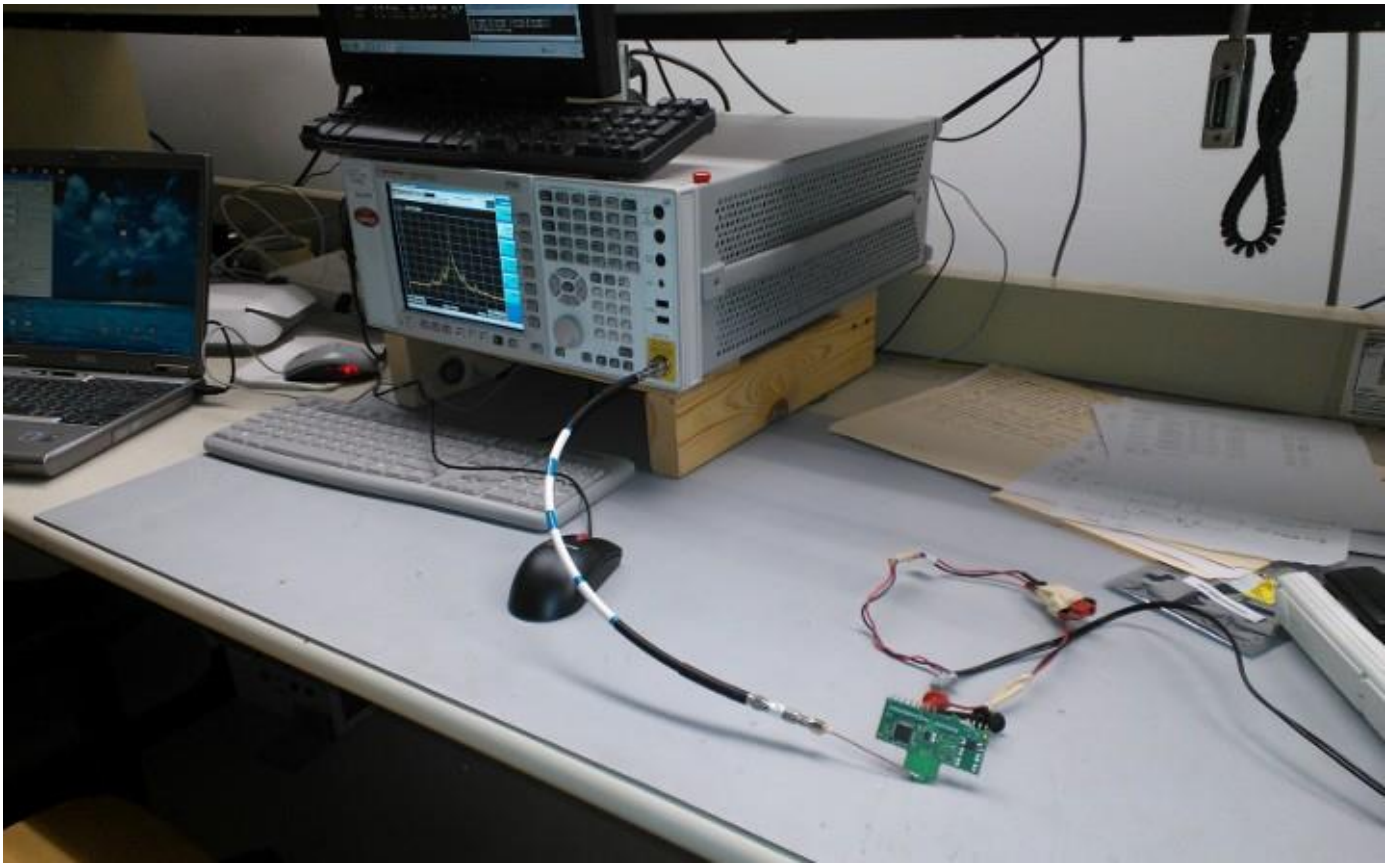


Figure 26 – Radiated Emissions

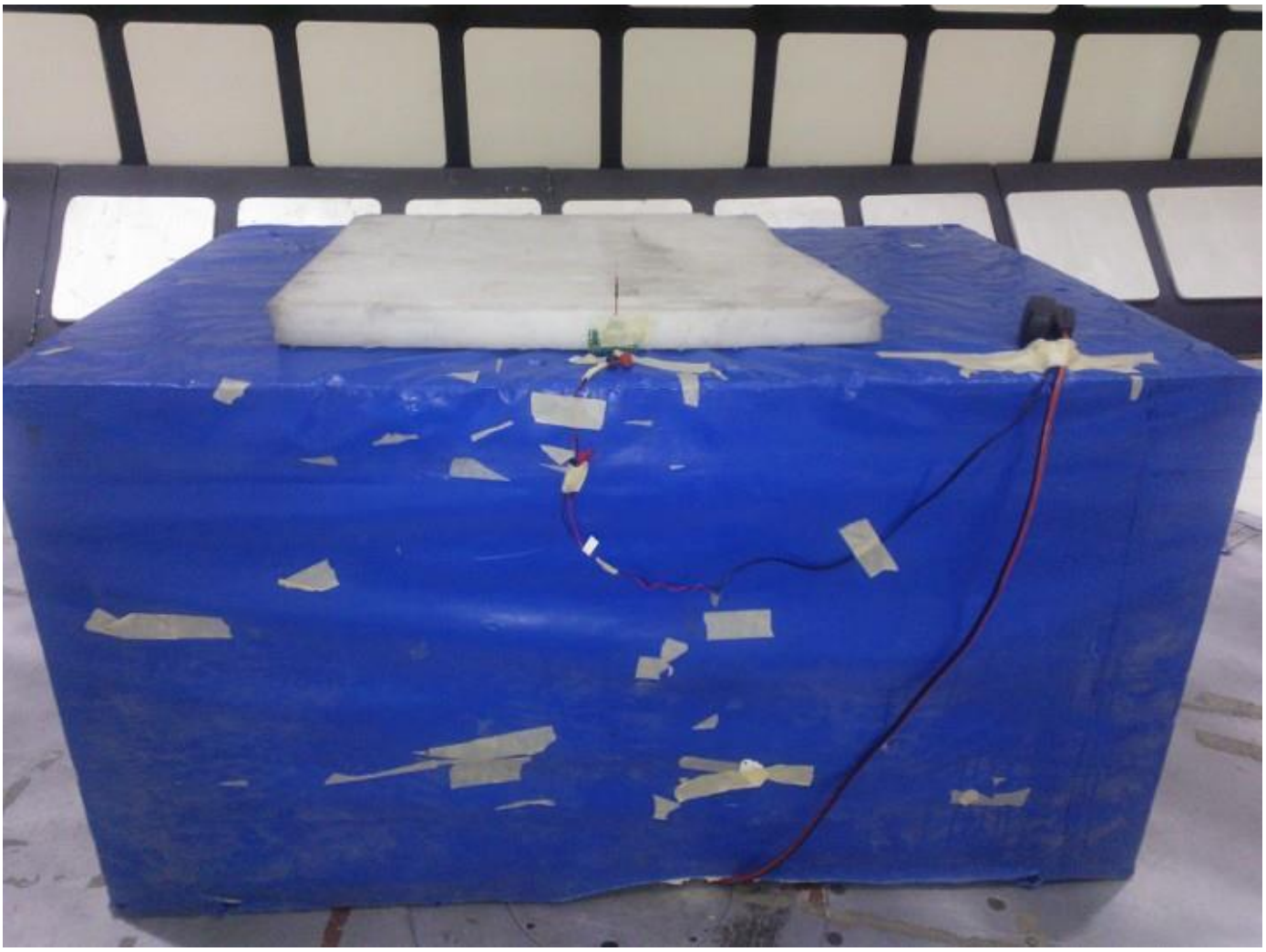


Figure 27 – Radiated Emissions Close up

Figure 28 – Line Conducted Emissions

Appendix B

Test Equipment List

Table 21 Antenna Port Measurements Test Equipment

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum analyzer	Agilent	N9030A	EMC4360	20131221	20141221
Attenuator w/ Cable	Mini Circuits	-	-	*N/A	N/A
* Cable and attenuator ware characterized at the time of testing					

Table 22 Line conducted Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	Dec 30, 2013	Dec 30, 2014
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	885551	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	Jan 15, 2014	Jan 16, 2015
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	Jan 15, 2014	Jan 16, 2015

Table 23 Radiated Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20131227	20141231
Bicon Antenna	Electro-Metrics	EM6912A	EMC4070	20130806	20140830
Log-P Antenna	Chase	UPA6109	EMC4313	20131003	20141003
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20131226	20141231
Antenna Array	UL	BOMS	EMC4276	20130912	20140930

Appendix C

Accreditations and Authorizations

NVLAP Lab code: 100414-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see http://ts.nist.gov/standards/scopes/1004140.htm

FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91044).

Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180

VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: Radiated Emissions R-621, Conducted Emissions C-642.

ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).

NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 2004/108/EC, Annex III (2-3). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.
NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).
NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6