9. 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

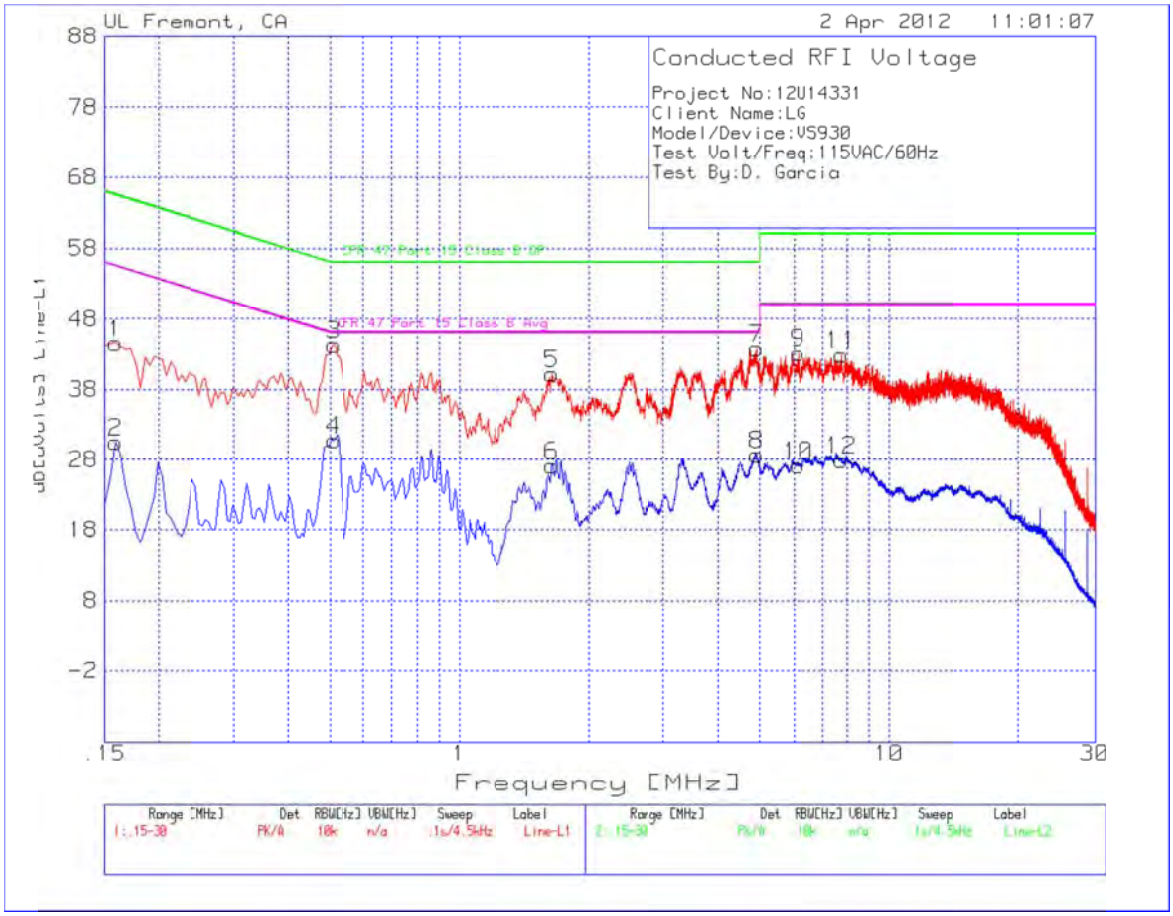
STANDARD COVER

6 WORST EMISSIONS

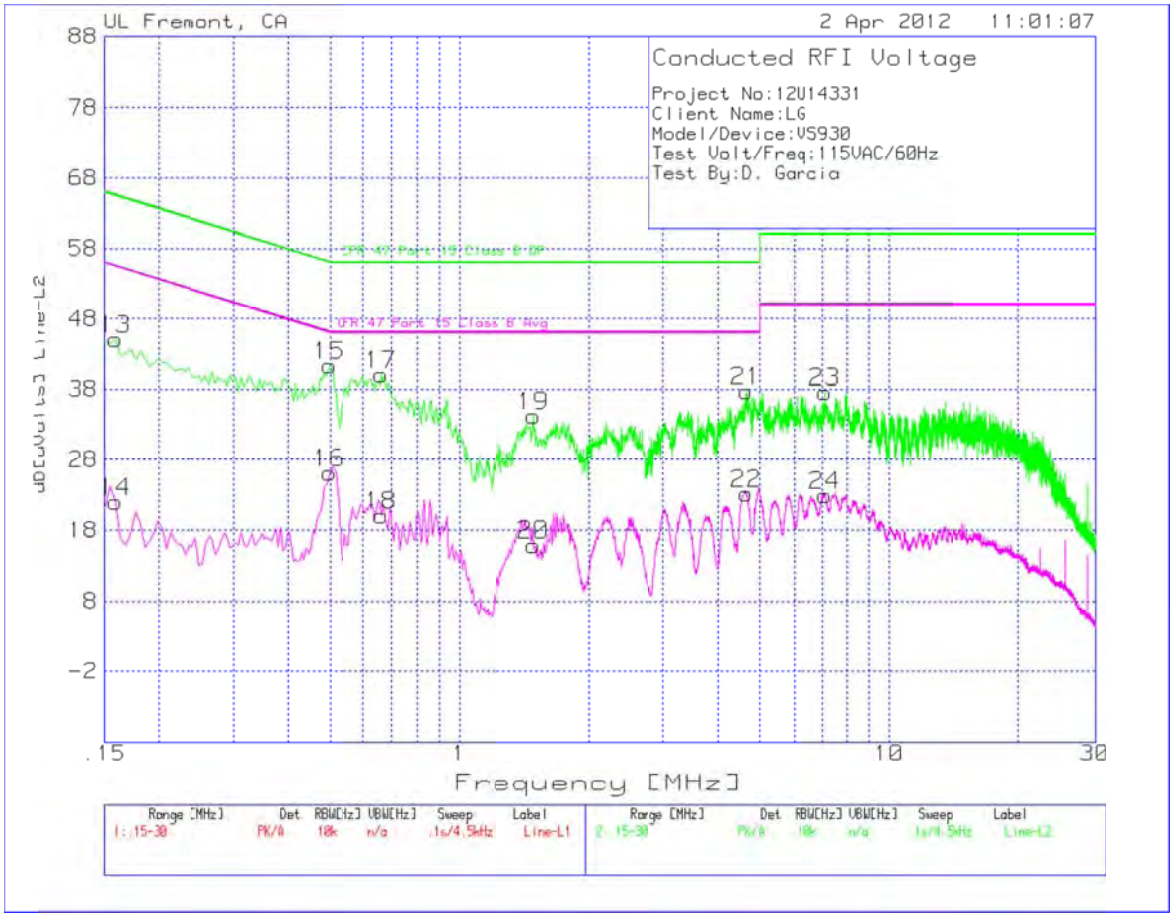
Line-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dB[uVolts]	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.159	44.39	PK	0.1	0	44.49	65.5	-21.01	-	-
0.159	30.36	Av	0.1	0	30.46	-	-	55.5	-25.04
0.51	44.23	PK	0.1	0	44.33	56	-11.67	-	-
0.51	30.67	Av	0.1	0	30.77	-	-	46	-15.23
1.6485	39.93	PK	0.1	0.1	40.13	56	-15.87	-	-
1.6485	26.98	Av	0.1	0.1	27.18	-	-	46	-18.82
4.9155	43.53	PK	0.1	0.1	43.73	56	-12.27	-	-
4.9155	28.48	Av	0.1	0.1	28.68	-	-	46	-17.32
6.153	42.88	PK	0.1	0.1	43.08	60	-16.92	-	-
6.153	26.99	Av	0.1	0.1	27.19	-	-	50	-22.81
7.764	42.72	PK	0.1	0.1	42.92	60	-17.08	-	-
7.764	27.74	Av	0.1	0.1	27.94	-	-	50	-22.06
Line-L2 .15 - 30MHz									
0.159	44.95	PK	0.1	0	45.05	65.5	-20.45	-	-
0.159	21.88	Av	0.1	0	21.98	-	-	55.5	-33.52
0.4965	41.17	PK	0.1	0	41.27	56.1	-14.83	-	-
0.4965	25.98	Av	0.1	0	26.08	-	-	46.1	-20.02
0.663	39.96	PK	0.1	0	40.06	56	-15.94	-	-
0.663	19.93	Av	0.1	0	20.03	-	-	46	-25.97
1.491	34.06	PK	0.1	0.1	34.26	56	-21.74	-	-
1.491	15.74	Av	0.1	0.1	15.94	-	-	46	-30.06
4.65	37.46	PK	0.1	0.1	37.66	56	-18.34	-	-
4.65	22.97	Av	0.1	0.1	23.17	-	-	46	-22.83
7.116	37.39	PK	0.1	0.1	37.59	60	-22.41	-	-
7.116	22.65	Av	0.1	0.1	22.85	-	-	50	-27.15

STANDARD COVER

LINE 1 RESULTS



LINE 2 RESULTS



RESULTS

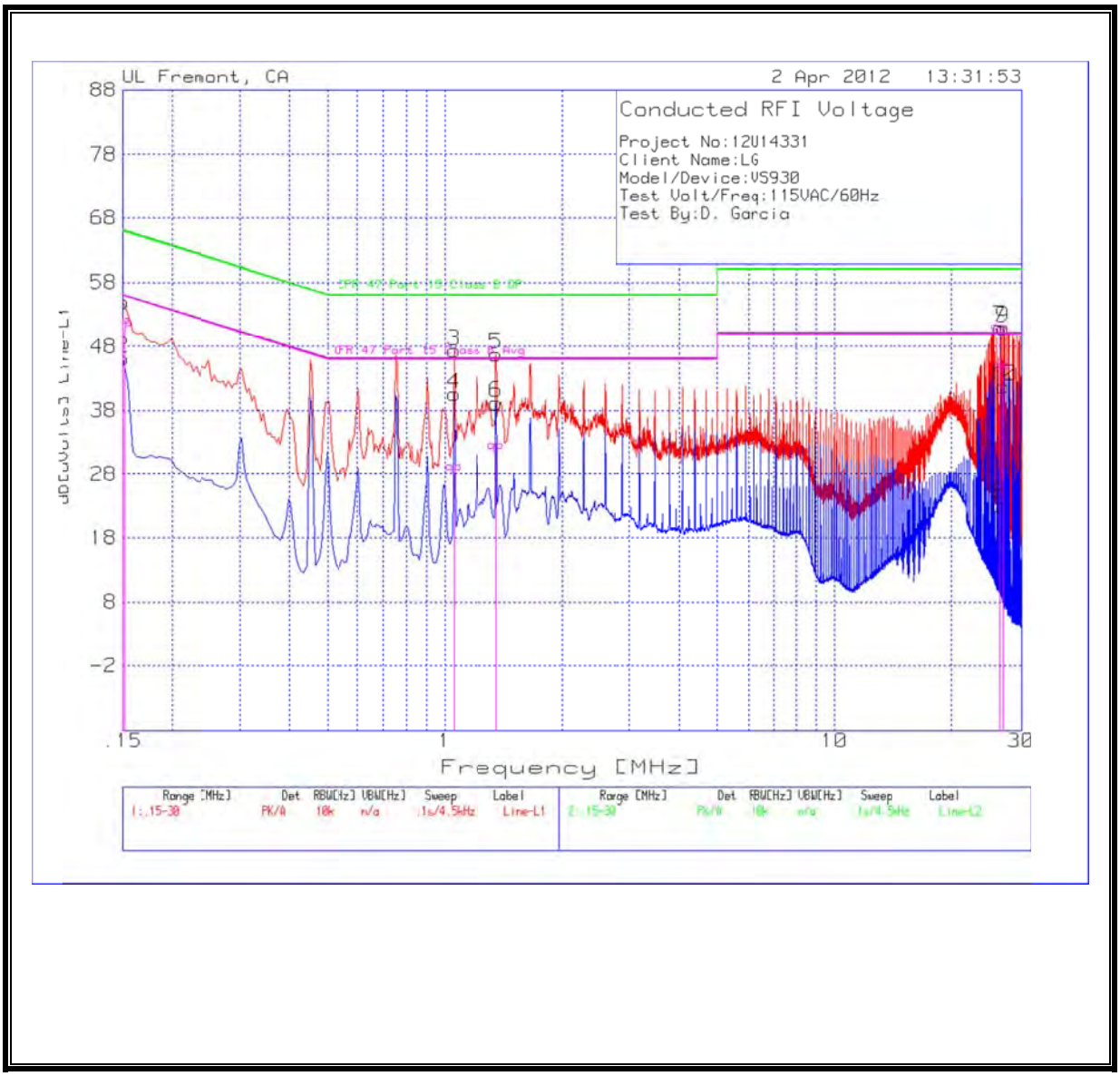
INDUCTIVE COVER

6 WORST EMISSIONS

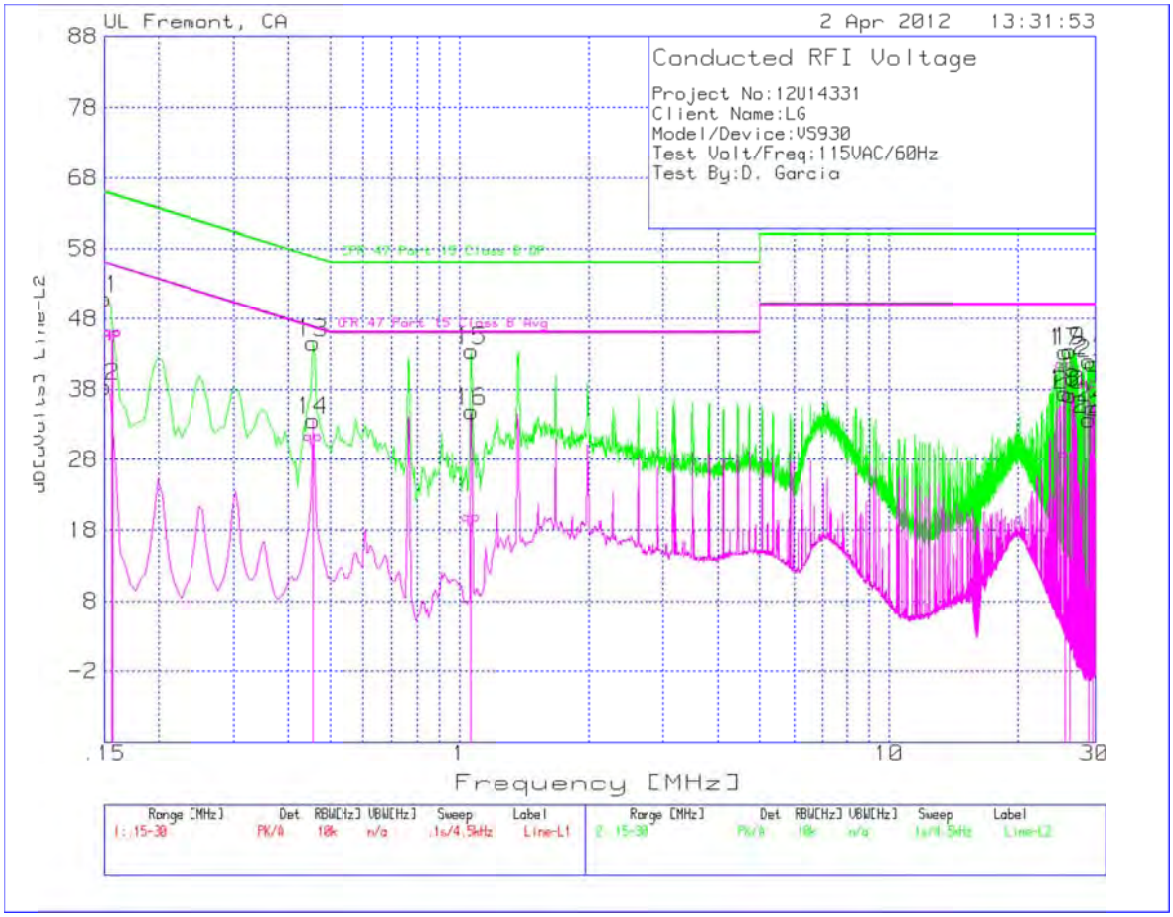
Project No:12U14331							
Client Name:LG							
Model/Device:VS930							
Test Volt/Freq:115VAC/60Hz							
Test By:D. Garcia							
Line-L1 .15 - 30MHz							
Frequency	Reading	Detector	Cable Loss	Part 15B	Margin	Part 15B	Margin
0.15	50.9	QP	0.1	66	-15	-	-
0.152	50.56	QP	0.1	65.89	-15.23	-	-
1.0565	28	QP	0.1	56	-27.9	-	-
1.3595	31.28	QP	0.2	56	-24.52	-	-
26.4685	49.29	QP	0.8	60	-9.91	-	-
26.934	43.18	QP	0.8	60	-16.02	-	-
Line-L2 .15 - 30MHz							
Frequency	Reading	Detector	Cable Loss	Part 15B	Margin	Part 15B	Margin
0.156	44.8	QP	0.1	65.67	-20.77	-	-
0.157	44.84	QP	0.1	65.62	-20.68	-	-
0.456	30.03	QP	0.1	56.77	-26.64	-	-
1.064	18.6	QP	0.2	56	-37.3	-	-
25.6115	39.5	QP	0.8	60	-19.7	-	-
26.2175	26.88	QP	0.8	60	-32.32	-	-
29.0675	36.98	QP	0.8	60	-22.22	-	-
29.6775	7.01	QP	0.8	60	-52.19	-	-

INDUCTIVE COVER

LINE 1 RESULTS



LINE 2 RESULTS



RESULTS

INDUCTIVE CHARGER PAD

EUT WITH ANTENNA

6 WORST EMISSIONS

Project No:12U14331									
Client Name:LG Electronics									
Model/Device:VS930									
Test Volt/Freq:115VAC/60Hz									
Test By:M. Mekuria									
Line-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1	LC Cables	dB[uVolts]	Part 15B QP	Margin	Part 15B Avg	Margin
0.789	49.83	PK	0.1	0	49.93	56	-6.07	-	-
0.789	42.89	Av	0.1	0	42.99	-	-	46	-3.01
1.104	49.71	PK	0.1	0	49.81	56	-6.19	-	-
1.104	42.04	Av	0.1	0	42.14	-	-	46	-3.86
13.56	56.35	PK	0.2	0.2	56.75	60	-3.25	-	-
13.56	52.01	Av	0.2	0.2	52.41	-	-	50	2.41
Line-L2 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1	LC Cables	dB[uVolts]	Part 15B QP	Margin	Part 15B Avg	Margin
0.483	47.4	PK	0.1	0	47.5	56.3	-8.8	-	-
0.483	36.51	Av	0.1	0	36.61	-	-	46.3	-9.69
1.0995	45.4	PK	0.1	0.1	45.6	56	-10.4	-	-
1.0995	36.67	Av	0.1	0.1	36.87	-	-	46	-9.13
13.56	51.45	PK	0.2	0.2	51.85	60	-8.15	-	-
13.56	46.33	Av	0.2	0.2	46.73	-	-	50	-3.27

EUT WITH 50 OHM TERMINATOR

6 WORST EMISSIONS

Project No:12U14331
Client Name:LG Electronics
Model/Device:VS930
Test Volt/Freq:115VAC/60Hz
Test By:M. Mekuria

Line-L1 .15 - 30MHz

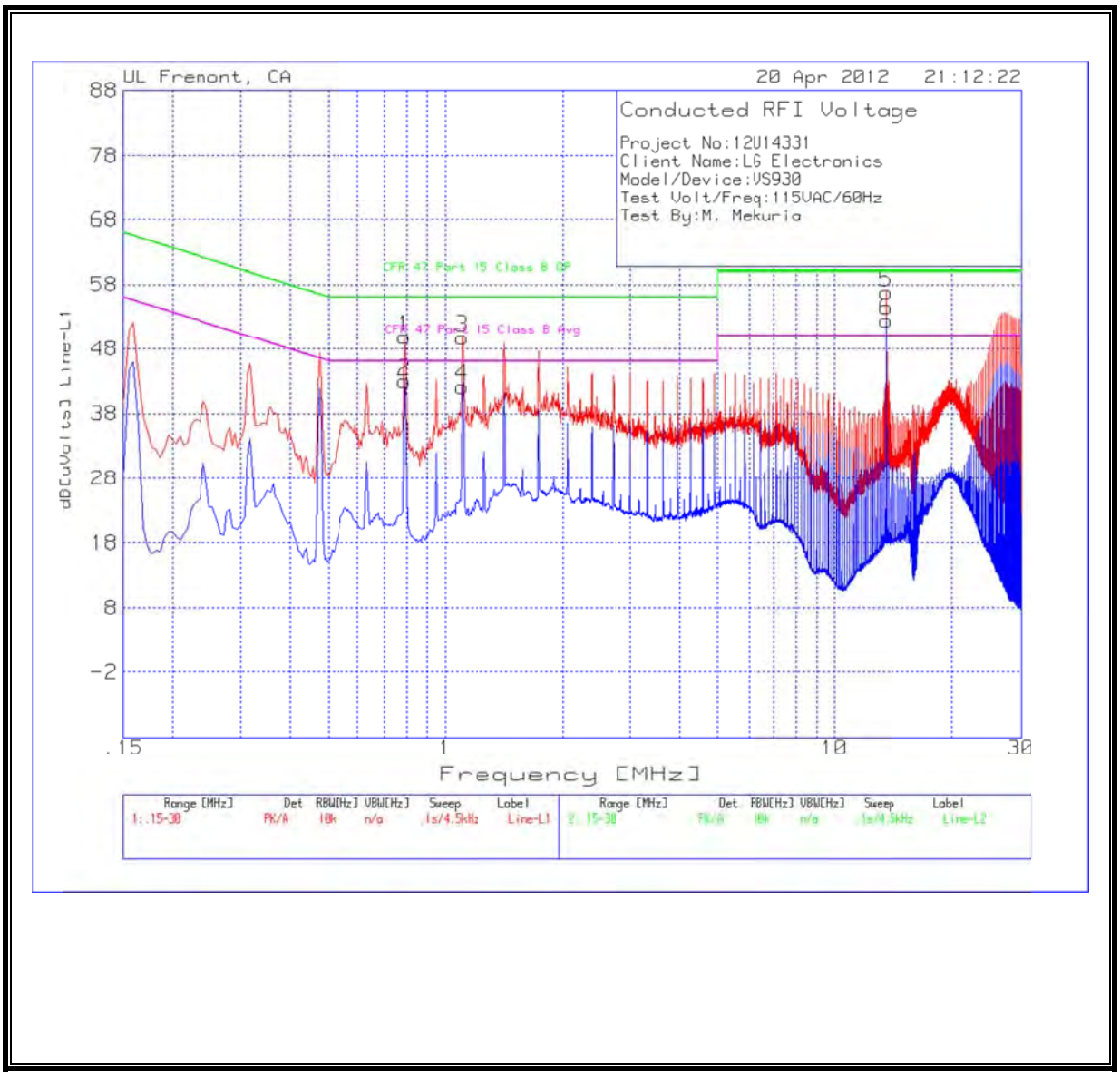
Test Frequency	Meter Reading	Detector	T24 L L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dB[uVolts]	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.4515	51.38	PK	0.1	0	51.48	56.8	-5.32	-	-
0.4515	42.77	Av	0.1	0	42.87	-	-	46.8	-3.93
1.059	51.72	PK	0.1	0	51.82	56	-4.18	-	-
1.059	42.79	Av	0.1	0	42.89	-	-	46	-3.11
27.1275	53.22	PK	0.5	0.3	54.02	60	-5.98	-	-
27.1275	45.01	Av	0.5	0.3	45.81	-	-	50	-4.19

ne-L2 .15 - 30MHz

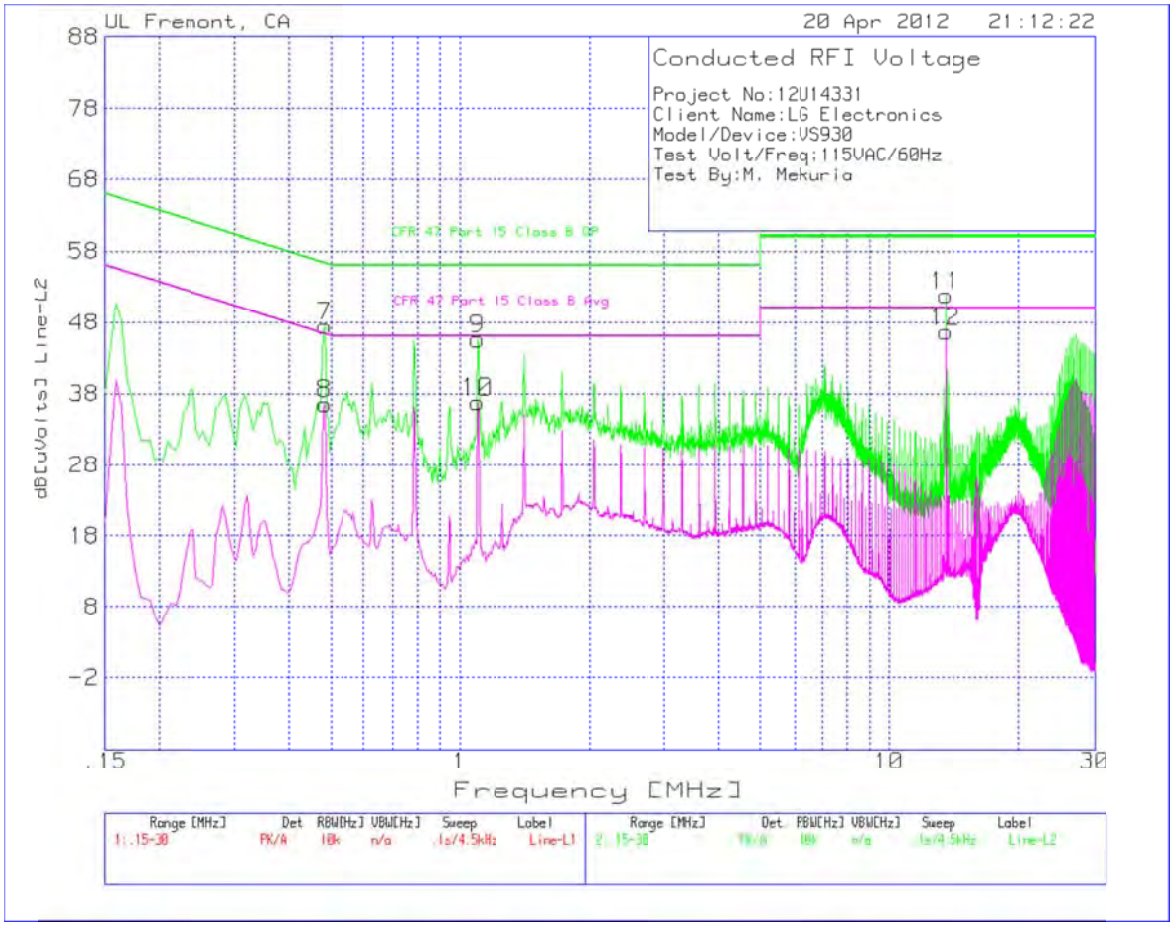
Test Frequency	Meter Reading	Detector	T24 L L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dB[uVolts]	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.4515	48.03	PK	0.1	0	48.13	56.8	-8.67	-	-
0.4515	36.34	Av	0.1	0	36.44	-	-	46.8	-10.36
1.05	48.05	PK	0.1	0	48.15	56	-7.85	-	-
1.05	38.07	Av	0.1	0	38.17	-	-	46	-7.83
1.3425	48.33	PK	0.1	0	48.43	56	-7.57	-	-
1.3425	37.48	Av	0.1	0	37.58	-	-	46	-8.42

INDUCTIVE CHARGER PAD WITH ANTENNA

LINE 1 RESULTS

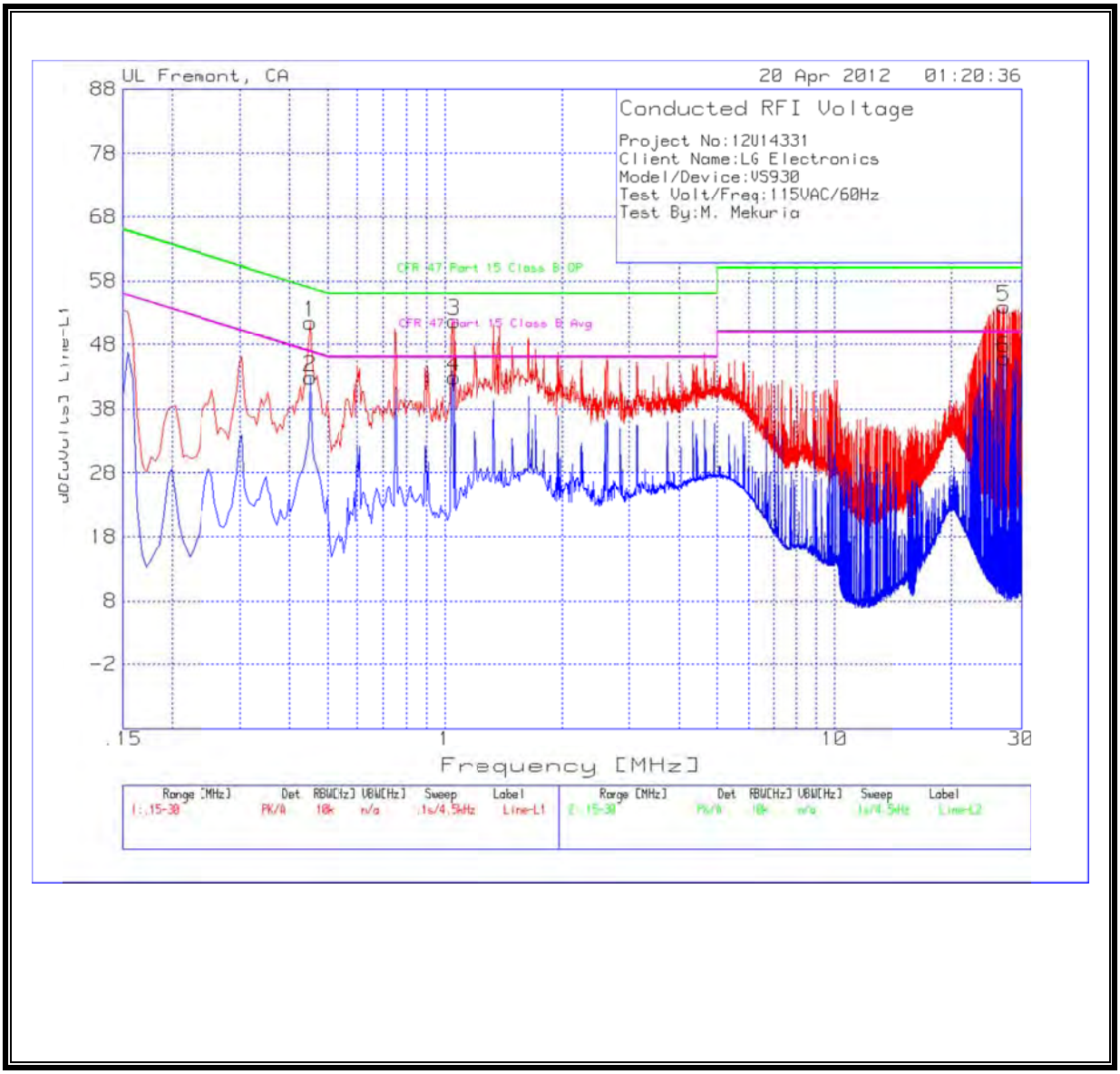


LINE 2 RESULTS

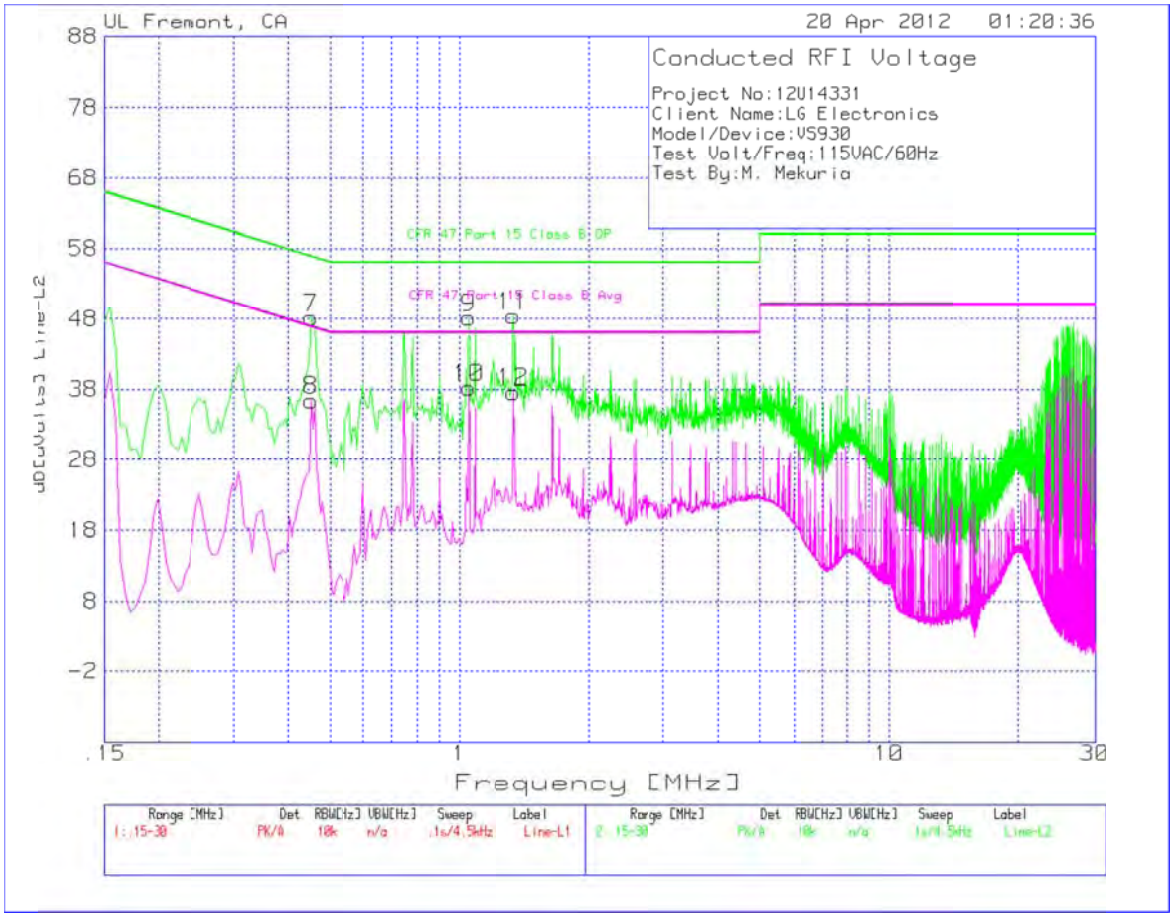


INDUCTIVE CHARGER PAD WITH 50 Ohm Terminator

LINE 1 RESULTS



LINE 2 RESULTS



10. DYNAMIC FREQUENCY SELECTION

10.1. OVERVIEW

10.1.1. LIMITS

FCC

§15.407 (h) and FCC 06-96 APPENDIX “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION”.

Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	Client (without radar detection)	Client (with radar detection)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client **(without DFS)**	Client **(with DFS)**
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period

The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:
For the Short pulse radar Test Signals this instant is the end of the *Burst*.
For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.
For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.
The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Table 6 – Long Pulse Radar Test Signal

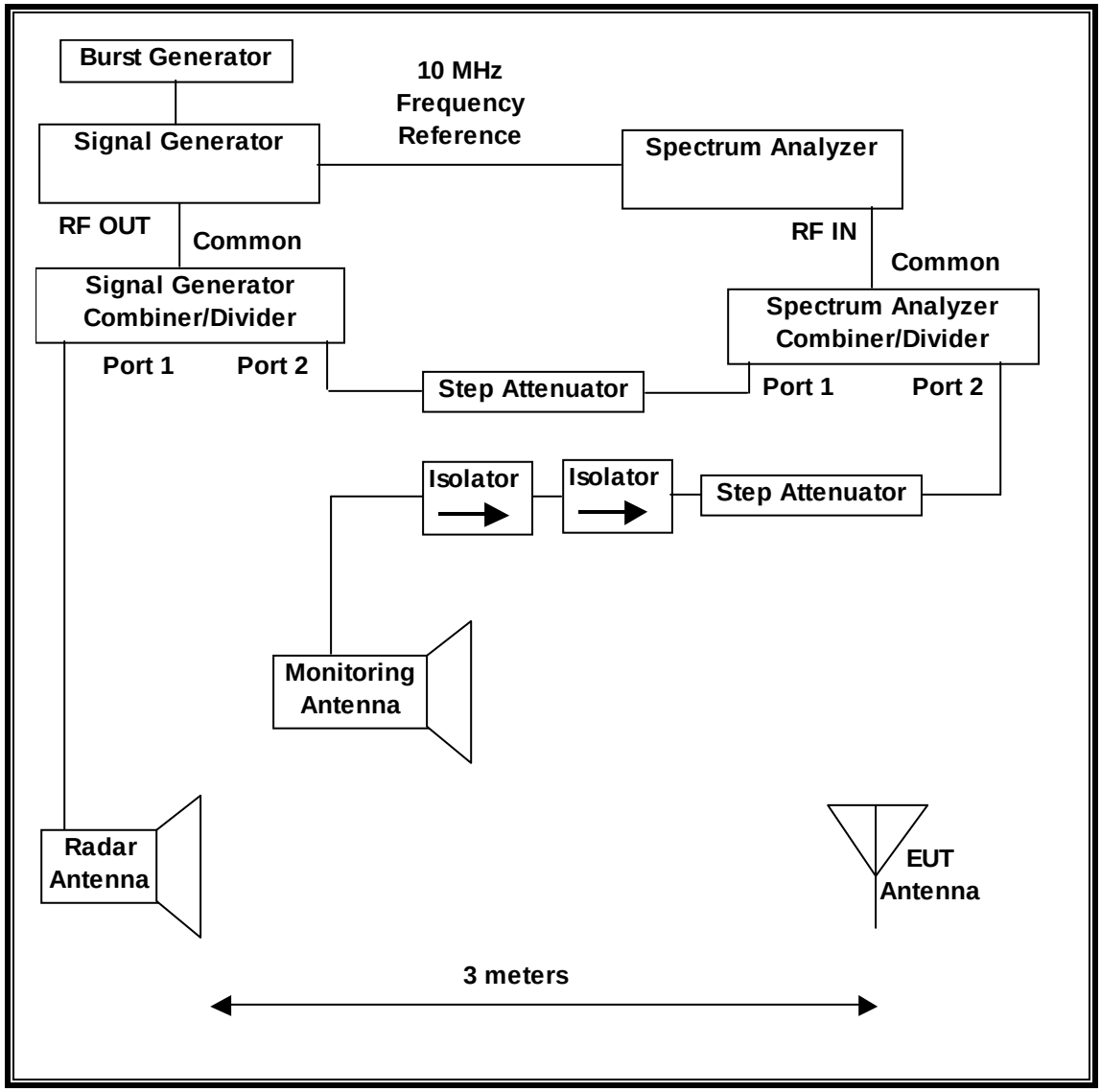
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

10.1.2. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM



SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Freqeuncy Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from F_L to F_H for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

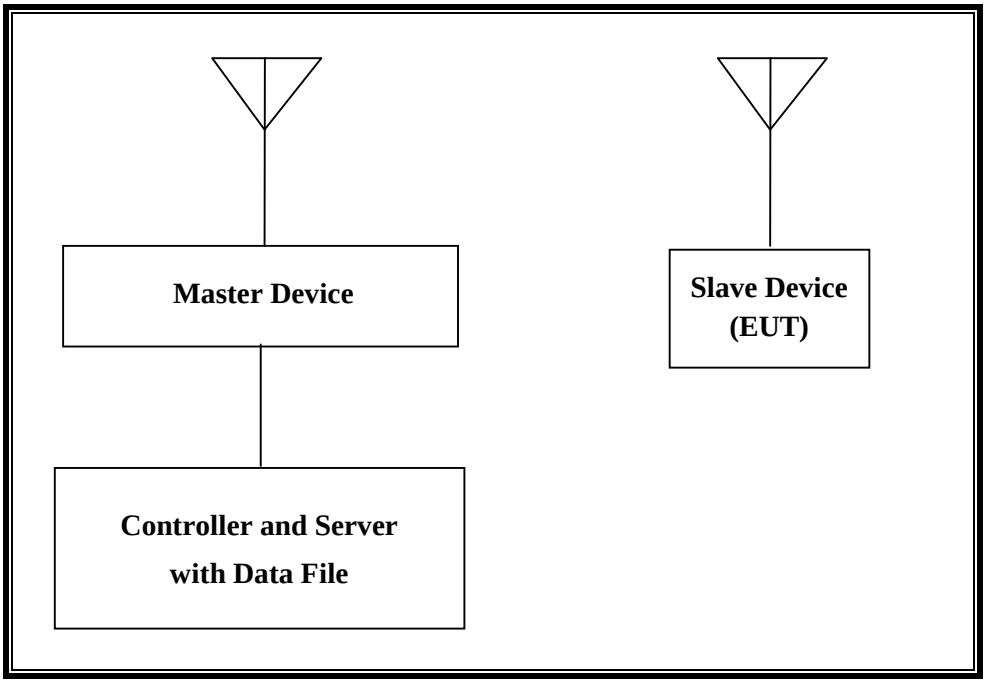
TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset Number**	**Cal Due**
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/15/12
Vector Signal Generator, 20GHz	Agilent / HP	E8267C	C01066	11/17/12

10.1.3. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter (Slave)	LG Electronics	STA-U34WRI	RC1X0009771	DoC
Notebook PC (Controller/Server)	Dell	PP18L	10657517725	DoC
AC Adapter (Notebook PC)	Dell	LA65SN0-00	CN-ODF263-71615-6AU-1019	DoC
Wireless Access Point	Cisco	AIR-AP1252AG-A-K9	FTX120690N2	LDK102061
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH112490BD	DoC

10.1.4. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Slave Device.

The highest power level within these bands is 10.21 dBm EIRP in the 5250-5350 MHz band and 14.85 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of -2.28 dBi in the 5.3 GHz band and +0.95 dBi in the 5.5 GHz band.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides margin to the limit.

The EUT uses one transmitter/receiver chain, connected to an antenna to perform radiated tests.

Traffic is generated by transferring a 4.1Gbyte file from the controller/server PC to the EUT using FTP software package FileZilla version 3.5.0 as referenced in KDB 581937.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11a/n architecture. One nominal channel bandwidth, 20 MHz, is implemented.

The software installed in the EUT is revision VS930_0311.

UNIFORM CHANNEL SPREADING

This requirement is not applicable to Slave radio devices.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is a Cisco Access Point, FCC ID: LDK102061. The minimum antenna gain for the Master Device is 3.5 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides margin to the limit.

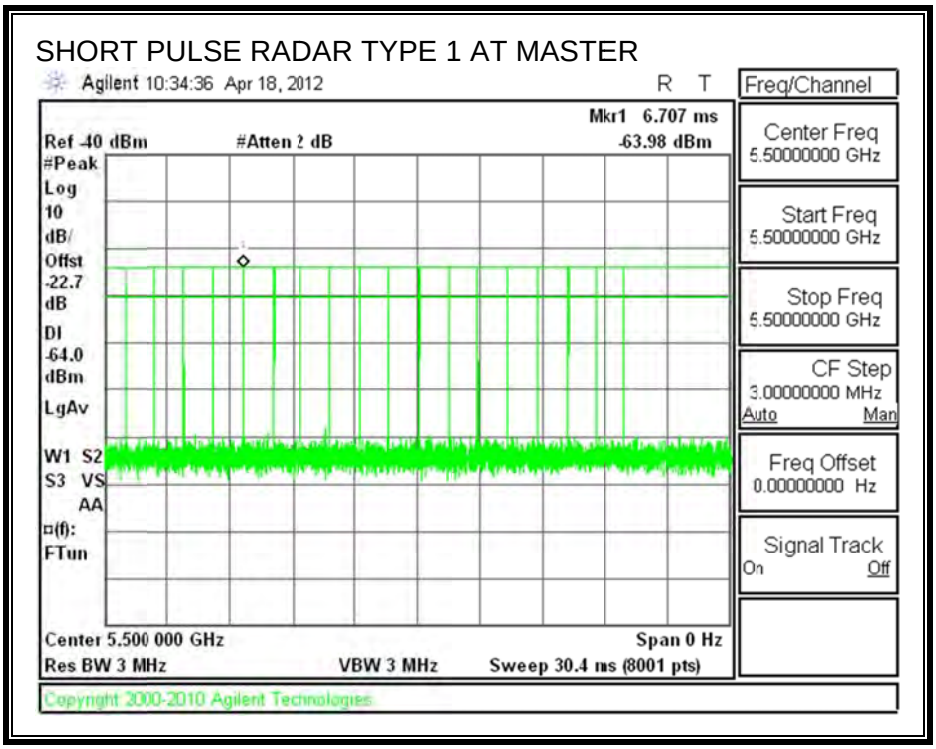
10.2. RESULTS FOR 20 MHz BANDWIDTH

10.2.1. TEST CHANNEL

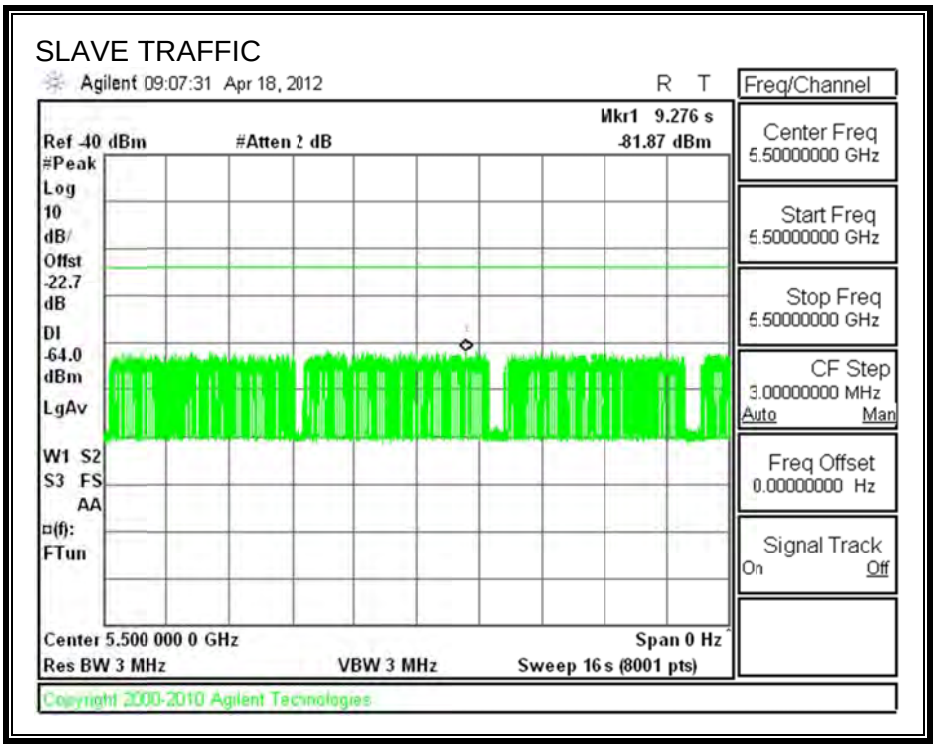
All tests were performed at a channel center frequency of 5500 MHz.

10.2.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



10.2.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

10.2.4. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

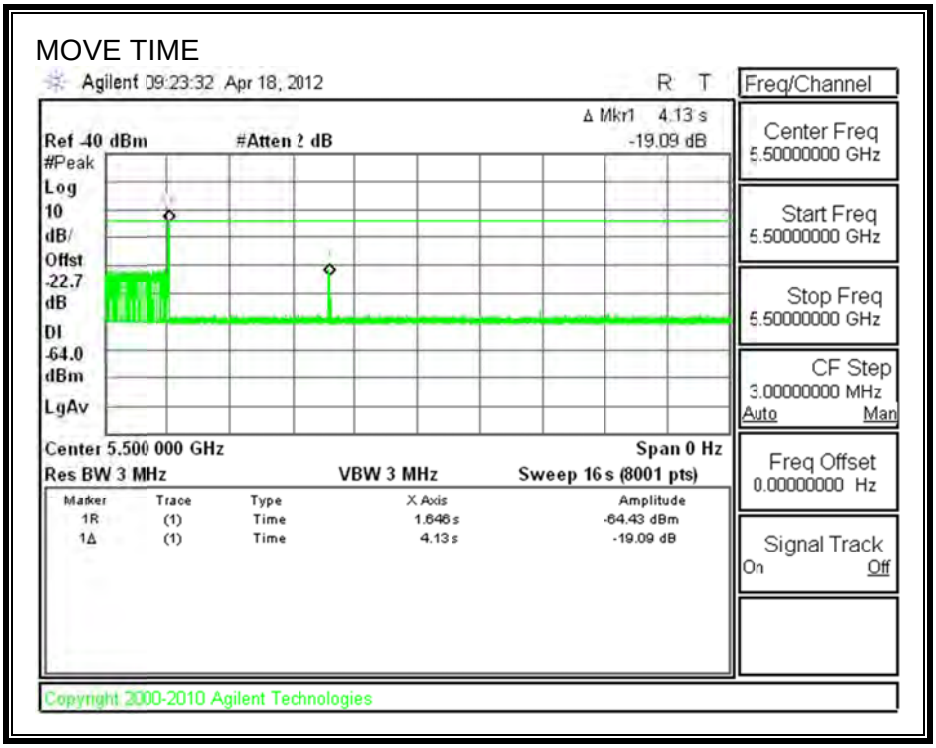
The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
4.130	10

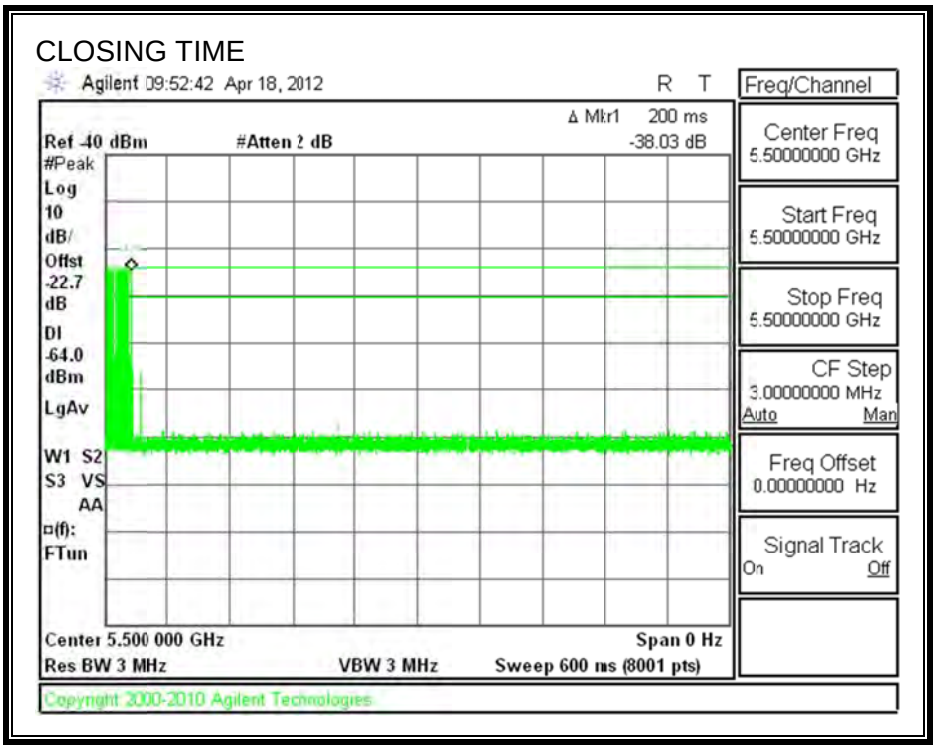
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
20.0	60

MOVE TIME



Note: The manufacturer has attested that spike after radar is a control signal and not normal traffic. Additional close-up observations show that the observed signal has a different pattern than the normal traffic.

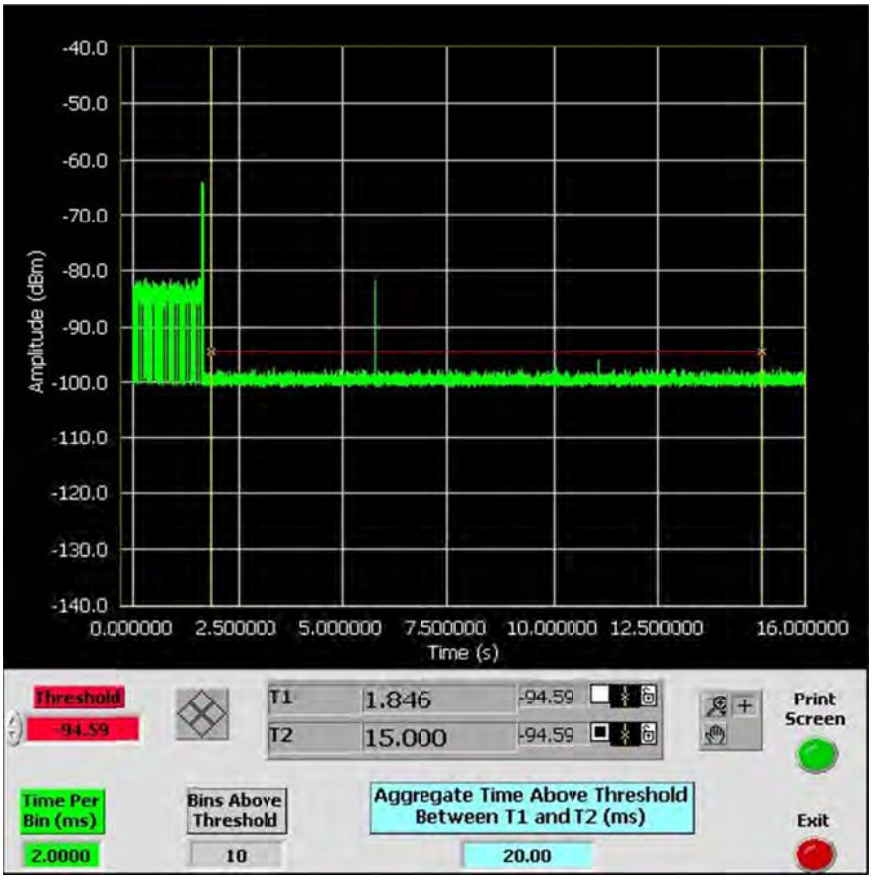
CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the FCC aggregate monitoring period.

FCC AGGREGATE CLOSING TIME



10.2.5. NON-OCCUPANCY PERIOD

RESULTS

No EUT transmissions were observed on the test channel during the 30-minute observation time.