FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

NFC MODULE

MODEL NUMBER: DRT-W127

FCC ID: EW4DRTW127
IC: 4250A-DRTW127

REPORT NUMBER: 12J14452-1, REVISION A

ISSUE DATE: JULY 25, 2012

Prepared for
MITSUMI ELECTRIC CO., LTD.
1601, SAKAI, ASUGI-SHI,
KANAGAWA, 243-8533 JAPAN

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
-	07/23/12	Initial Issue	
A	07/25/12	Revised Section 11	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MITSUMI ELECTRIC CO., LTD.
1601, SAKAI, ASUGI-SHI,
KANAGAWA, 243-8533 JAPAN

EUT DESCRIPTION: NFC MODULE

MODEL: DRT-W127

SERIAL NUMBER: 0063

DATE TESTED: JULY 10 TO 12, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 8	Pass

Compliance Certification Services, Inc. (UL CCS) 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 CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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 CCS By:

THU CHAN
EMC SUPERVISOR
UL CCS

Tested By:

MENGISTU MEKURIA
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, 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 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 13.56MHz NFC card reader/writer Module.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum E field as follows:

Frequency (MHz)	Mode	Fundamental E field @ 30m distance (dBuv/m)
13.56	Normal TX mode	28.20

EIRP = E field at 3m distance – 95.2
E field at 3m distance = 68.20 dBuV/m
EIRP = 68.20 -95.2 = **-27.0 dBm**

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The 13.56MHz antenna is integral PCB loop antenna.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was NFC Test Tool B2 V1.41 (Broadcom).

The test driver used during testing was Virtual Serial COM Port Driver (CDM 2.08.24 WHQL Certified/FTDI).

5.5. WORST-CASE CONFIGURATION AND MODE

EUT was powered from the laptop PC via USB cable.

Three types of tags were measured along with the radio module; type B had the highest fundamental field strength.

Type A uses almost 100% modulation depth, type B use 10% modulation depth and type F uses approximately 25 % modulation depth.

The EUT was investigated in three different orthogonal positions, X, Y, & Z. After the investigations Y position for tag A and B, Z position for tag F were determine to be the worst-case. Therefore, all final radiated testing was performed with the EUT in the Y position.

5.6. DESCRIPTION OF TEST SETUP

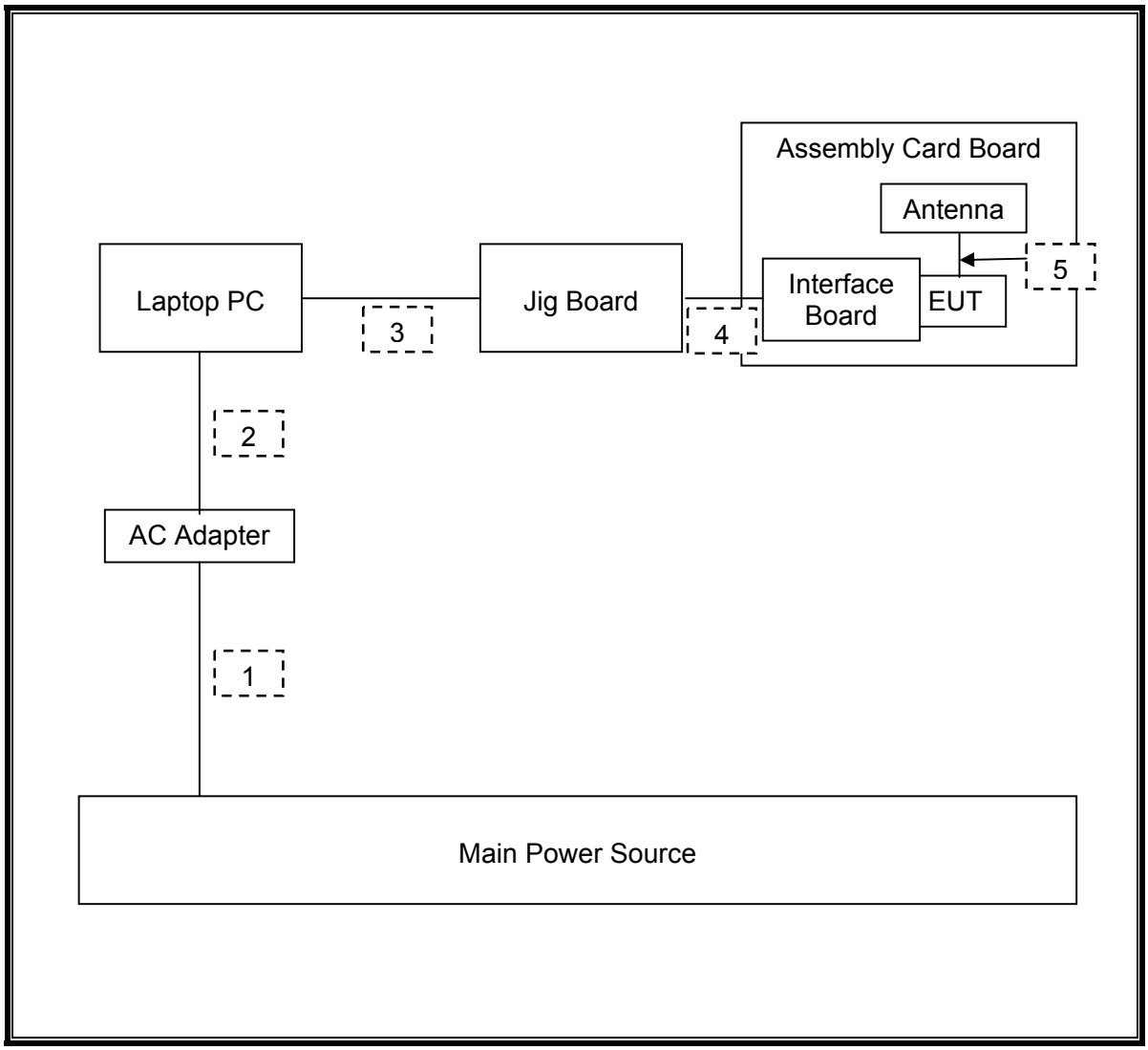
SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop	Dell	Latitude D620	6778905757
AC Adapter	Dell	LA65NS1-00	CN-0YD637-71615-974-21B4
Jig Board	Mitsumi	DRT-W127	JIG 1

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	2m	N/A
2	DC	1	DC	Un-shielded	2m	N/A
3	USB	1	USB	Un-shielded	1m	N/A
4	Data	1	Flat Belt	Un-shielded	0.2m	N/A
5	Twisted Pair	1	Ant	Un-shielded	0.04m	N/A

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	10/20/12
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01161	12/16/12
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	08/04/12
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/19/12
EMI Receiver, 6.5GHz	Agilent / HP	85462A	N/A	06/19/13
Antenna, Loop, 30 MHz	EMCO	6502	C00593	01/12/13
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	N/A	02/07/13
Pre-amplifier	Agilent / HP	8447D	1937A02062	11/11/12
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/12

7. RADIATED EMISSION TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMIT

§15.225
IC RSS-GEN, Section 7.2.5 (Transmitter)
IC RSS-GEN, Section 6 (Receiver)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (μV/m)	Measurement Distance (m)
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.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

ANSI C63.4

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56MHz; therefore, the frequency range was investigated from 30 MHz to 1000 MHz.

The EUT uses the following frequencies:
13MHz and 13.56MHz

RESULTS

7.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

7.2.1. TAG A

FCC Part 15, Subpart B & C **10 Meter Distance Measurement At Open Field**

Company: Mitsumi Electronic
Project #: 12J14452
Model #: DRT-W127
Tester: Mengistu Mekuria
Date: 7/10/2012
Tag A

Frequency (MHz)	PK (dBu/V)	QP (dBu/V)	AV (dBuV)	AF dB/m	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes
Loop Antenna Face On:												
X-Pos												
13.56	48.32	48.32	N/A	10.56	-40.00	18.88	N/A	84.00	N/A	-65.1	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	53.97	53.97	N/A	10.56	-40.00	24.53	N/A	84.00	N/A	-59.5	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	53.83	53.83	N/A	10.56	-40.00	24.39	N/A	84.00	N/A	-59.6	N/A	Fundamental @ 10m Dist
Loop Antenna Face Off:												
X-Pos												
13.56	48.08	48.08	N/A	10.56	-40.00	18.64	N/A	84.00	N/A	-65.4	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	50.09	50.09	N/A	10.56	-40.00	20.65	N/A	84.00	N/A	-63.4	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	50.73	50.73	N/A	10.56	-40.00	21.29	N/A	84.00	N/A	-62.7	N/A	Fundamental @ 10m Dist

* No more emissions were found up to 30MHz

Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak
Q.P. = Quasi Peak Readings
A.F. = Antenna factor

7.2.2. TAG B

FCC Part 15, Subpart B & C **10 Meter Distance Measurement At Open Field**

Company: Mitsumi Electronic
Project #: 12J14452
Model #: DRT-W127
Tester: Mengistu Mekuria
Date: 7/10/2012
Tag B

Frequency (MHz)	PK (dBu/V)	QP (dBu/V)	AV (dBuV)	AF dB/m	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes
Loop Antenna Face On:												
X-Pos												
13.56	53.37	53.37	N/A	10.56	-40.00	23.93	N/A	84.00	N/A	-60.1	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	57.64	57.64	N/A	10.56	-40.00	28.20	N/A	84.00	N/A	-55.8	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	57.35	57.35	N/A	10.56	-40.00	27.91	N/A	84.00	N/A	-56.1	N/A	Fundamental @ 10m Dist
Loop Antenna Face Off:												
X-Pos												
13.56	53.18	53.18	N/A	10.56	-40.00	23.74	N/A	84.00	N/A	-60.3	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	55.47	55.47	N/A	10.56	-40.00	26.03	N/A	84.00	N/A	-58.0	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	55.26	55.26	N/A	10.56	-40.00	25.82	N/A	84.00	N/A	-58.2	N/A	Fundamental @ 10m Dist

* No more emissions were found up to 30MHz

Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak
Q.P. = Quasi Peak Readings
A.F. = Antenna factor

7.2.3. TAG F

FCC Part 15, Subpart B & C 10 Meter Distance Measurement At Open Field

Company: Mitsumi Electronic
Project #: 12J14452
Model #: DRT-W127
Tester: Mengistu Mekuria
Date: 7/10/2012
Tag F

Frequency	PK	QP	AV	AF	Distance	PK Corrected	AV Corrected	QP Limit	AV Limit	PK Margin	AV Margin	Notes
(MHz)	(dBu/V)	(dBu/V)	(dBuV)	dB/m	Correction (dB)	Reading (dBuV/m)	Reading (dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	
Loop Antenna Face On:												
X-Pos												
13.56	47.06	47.06	N/A	10.56	-40.00	17.62	N/A	84.00	N/A	-66.4	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	50.37	50.37	N/A	10.56	-40.00	20.93	N/A	84.00	N/A	-63.1	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	50.87	50.87	N/A	10.56	-40.00	21.43	N/A	84.00	N/A	-62.6	N/A	Fundamental @ 10m Dist
Loop Antenna Face Off:												
X-Pos												
13.56	47.13	47.13	N/A	10.56	-40.00	17.69	N/A	84.00	N/A	-66.3	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	49.22	49.22	N/A	10.56	-40.00	19.78	N/A	84.00	N/A	-64.2	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	49.48	49.49	N/A	10.56	-40.00	20.05	N/A	84.00	N/A	-64.0	N/A	Fundamental @ 10m Dist

* No more emissions were found up to 30MHz

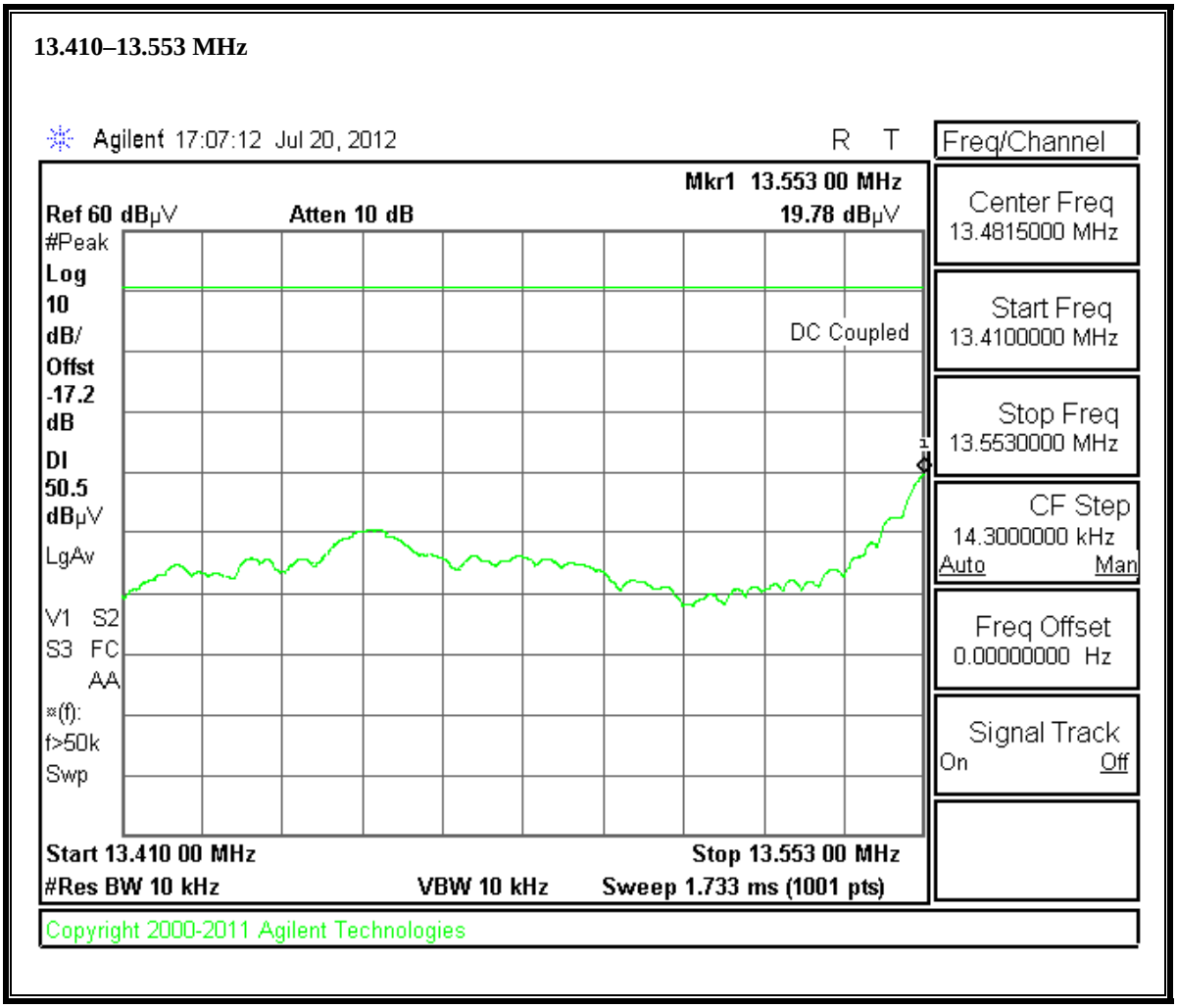
Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak
Q.P. = Quasi Peak Readings
A.F. = Antenna factor

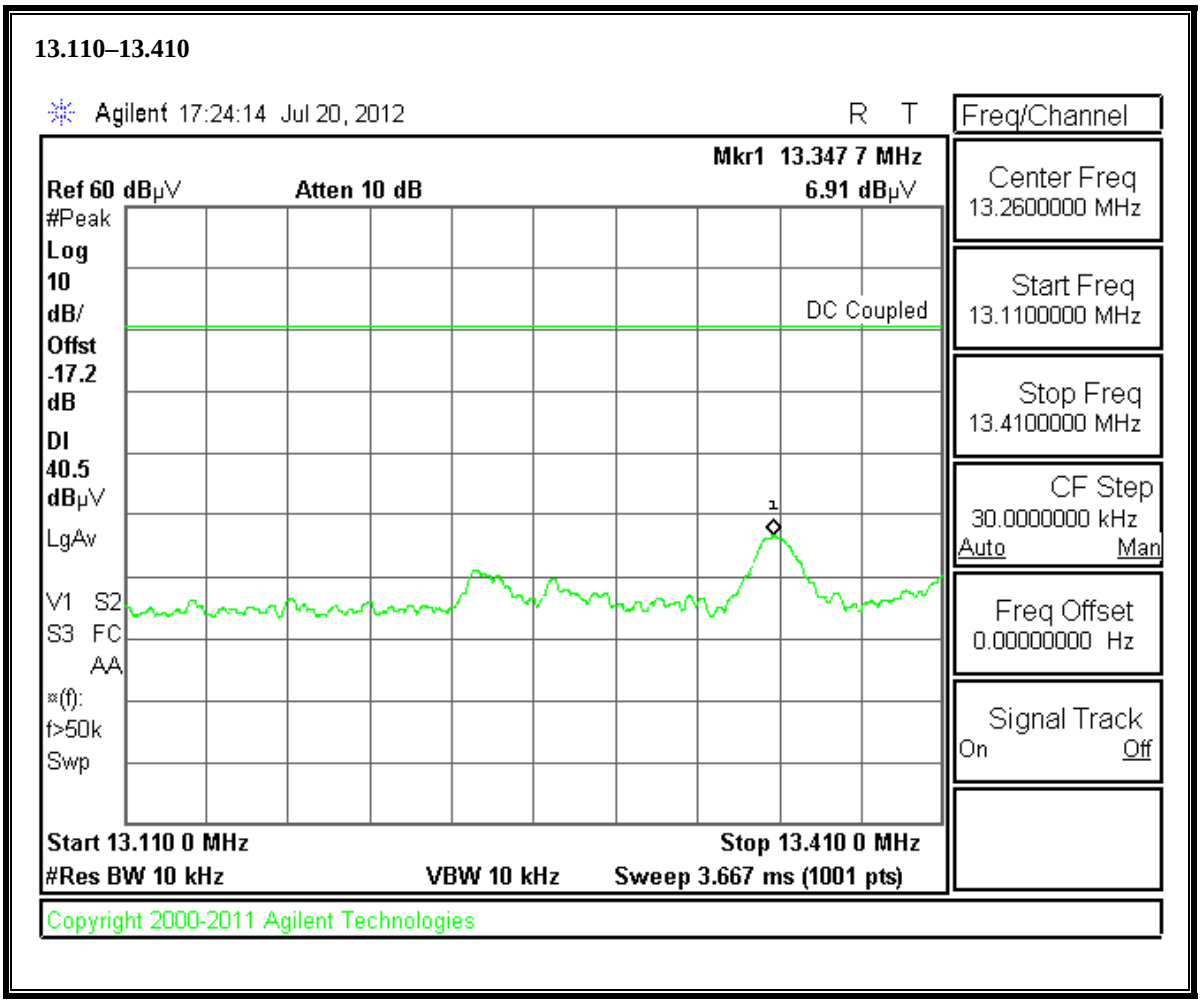
7.3. BAND EDGE MEASUREMENT

7.3.1. TAG A

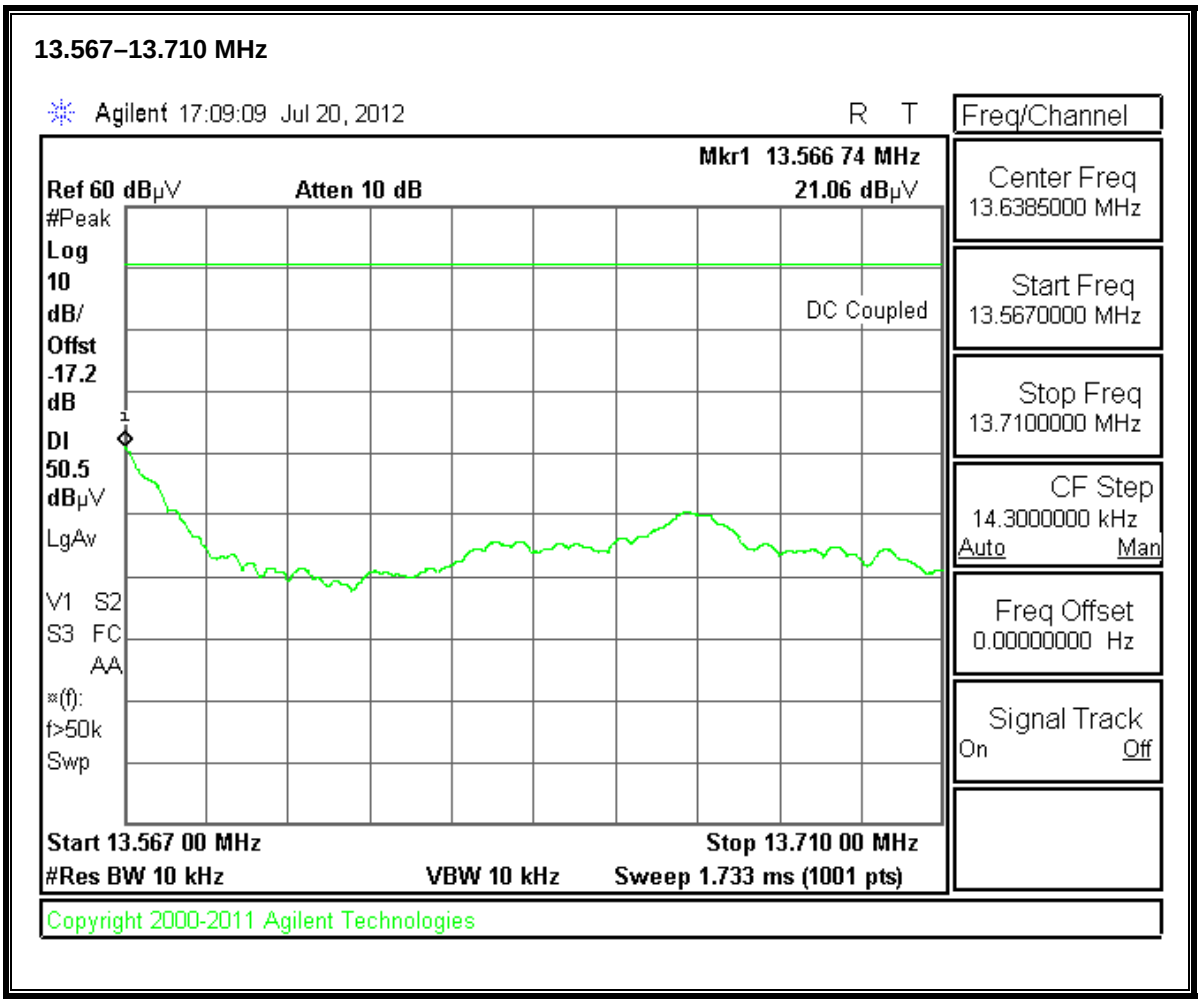
13.410–13.553 MHz



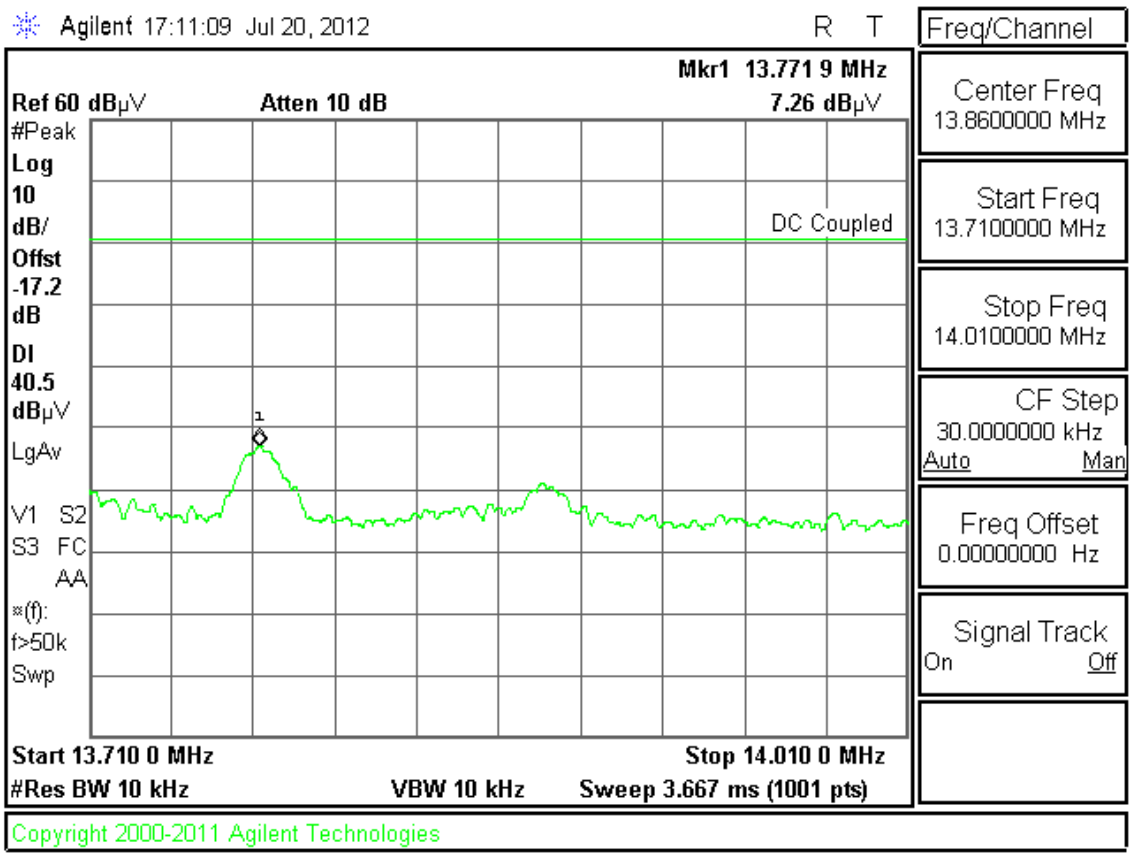
13.110–13.410



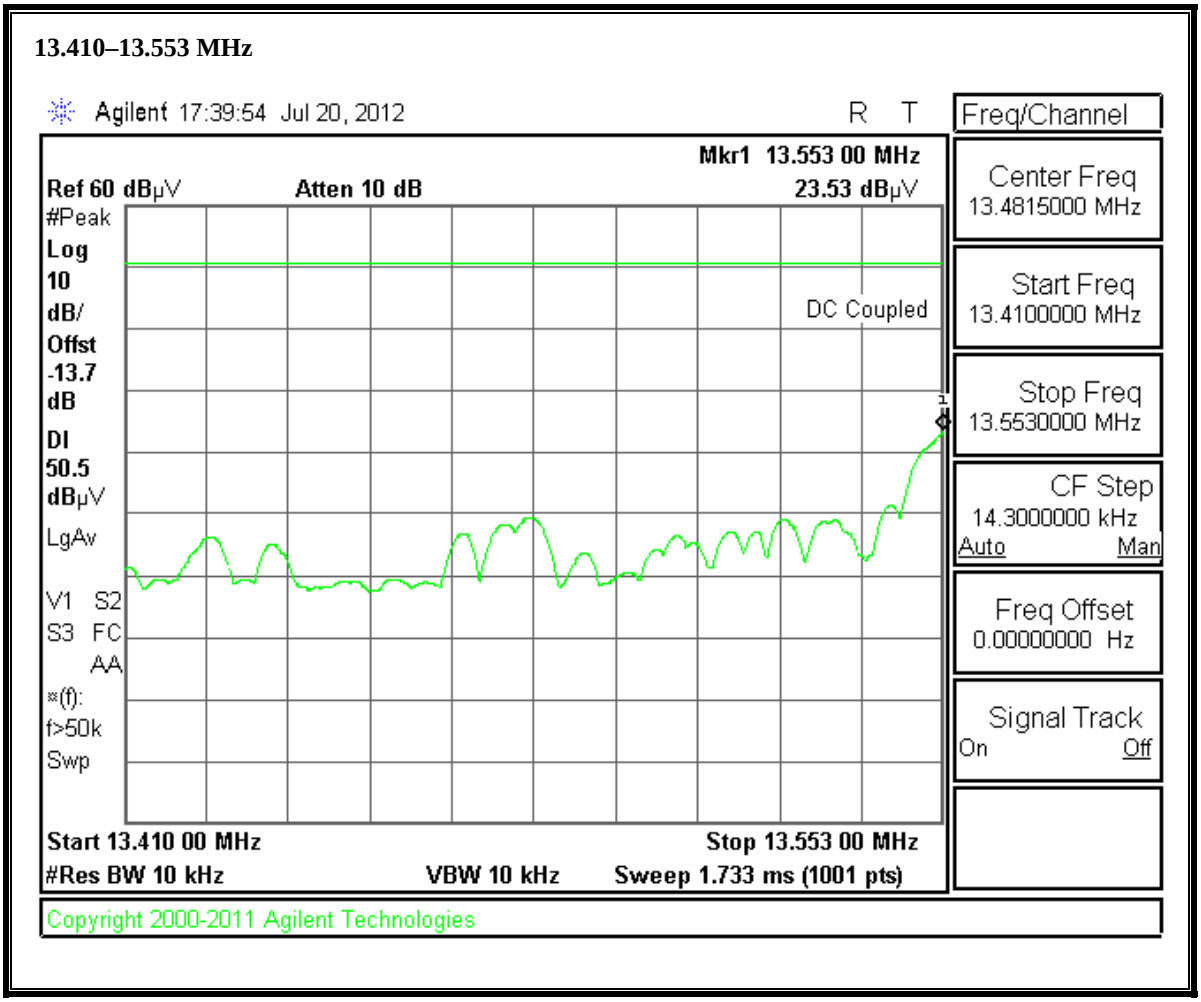
13.567–13.710 MHz



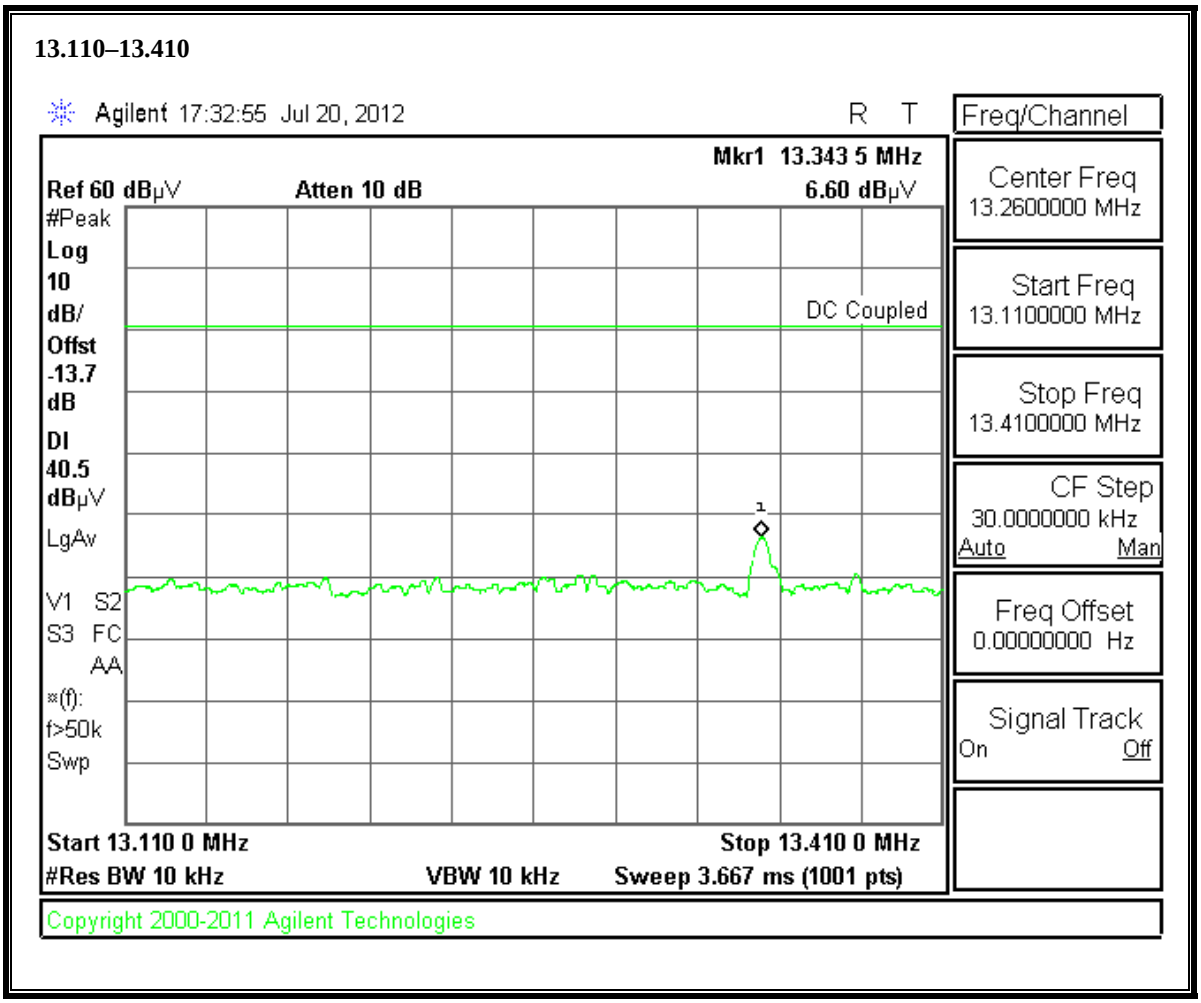
13.710–14.010 MHz



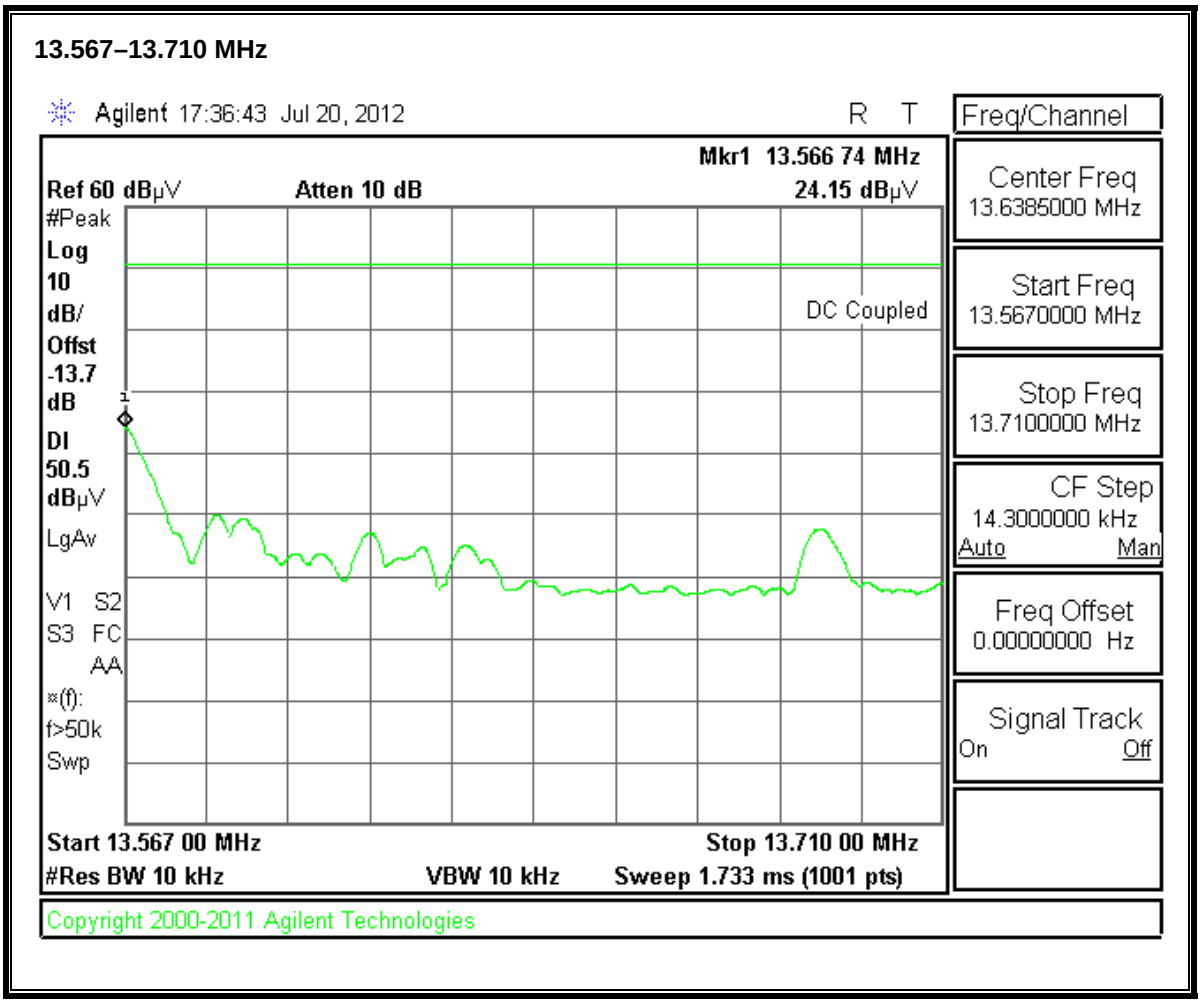
7.3.1. TAG B



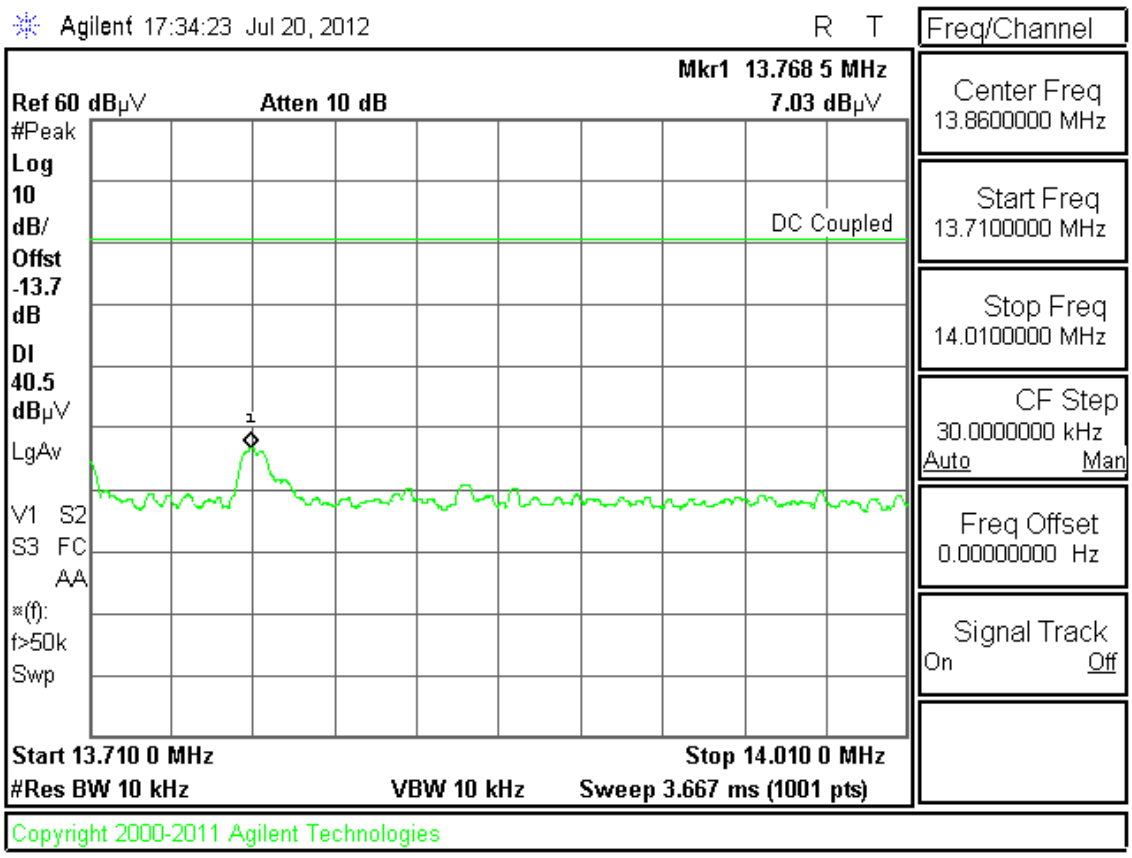
13.110–13.410



13.567–13.710 MHz

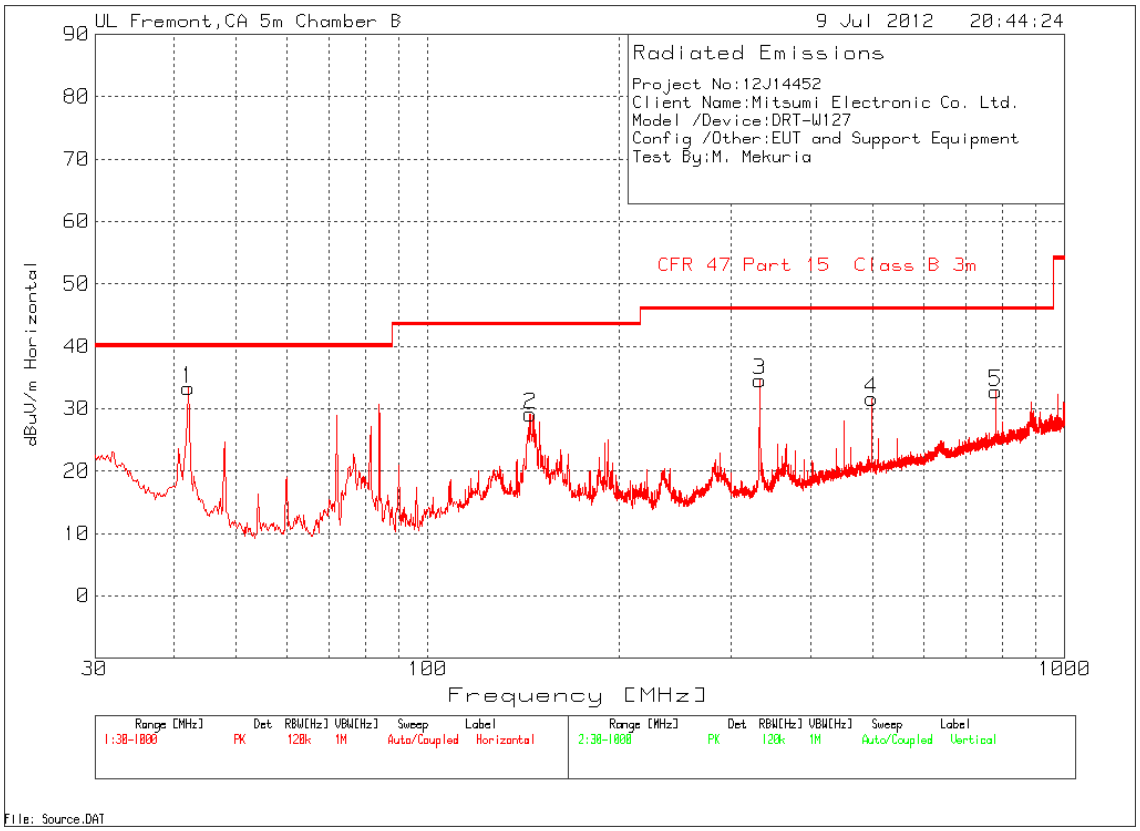


13.710–14.010 MHz

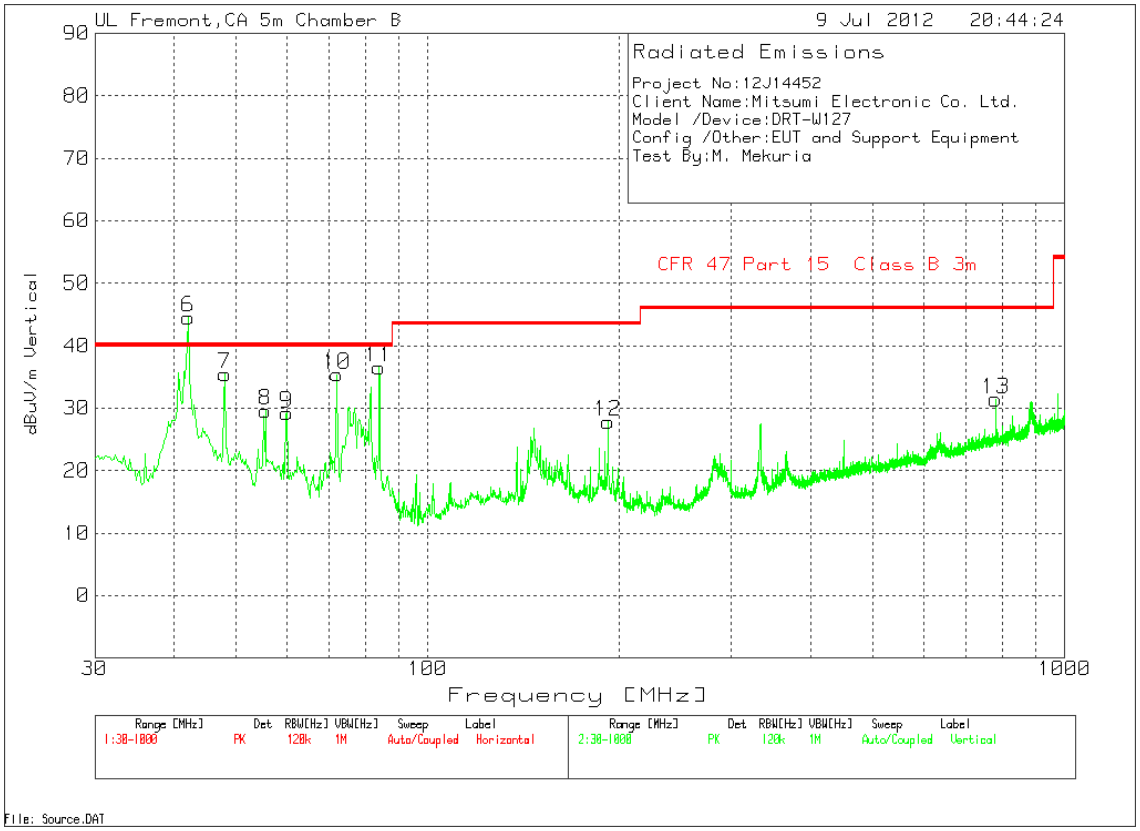


7.4. TX/RX SPURIOUS EMISSION 30 TO 1000 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project No:12J14452
Client Name:Mitsumi Electronic Co. Ltd.
Model /Device:DRT-W127
Config /Other:EUT and Support Equipment
Test By:M. Mekuria

Horizontal 30 - 1000MHz

Test Frequency	Meter Reading	Detector	T122 Sunol Bilog.TXT (dB)	5mB Amp Path 30-1000MHz (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
42.0184	50.18	PK	12.3	-29.2	33.28	40	-6.72	200	Horz
144.95	44.43	PK	12.8	-28.1	29.13	43.5	-14.37	200	Horz
331.8165	47.34	PK	14	-26.8	34.54	46	-11.46	100	Horz
497.9416	40.79	PK	17.7	-26.9	31.59	46	-14.41	200	Horz
779.5983	37.15	PK	21.2	-25.6	32.75	46	-13.25	100	Horz

Vertical 30 - 1000MHz

Test Frequency	Meter Reading	Detector	T122 Sunol Bilog.TXT (dB)	5mB Amp Path 30-1000MHz (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
42.0184	61.38	PK	12.3	-29.2	44.48	40	4.48	100	Vert
42.0184	52.97	QP	12.3	-29.2	36.07	40	-3.93	100	Vert
48.0276	55.76	PK	8.8	-29.1	35.46	40	-4.54	100	Vert
55.5875	51.42	PK	7.2	-29	29.62	40	-10.38	200	Vert
60.046	50.8	PK	7.4	-29	29.2	40	-10.8	100	Vert
72.0643	56	PK	8.2	-28.8	35.4	40	-4.6	100	Vert
83.8889	57.54	PK	7.7	-28.7	36.54	40	-3.46	100	Vert
83.8889	50.05	QP	7.7	-28.7	29.05	40	-10.95	100	Vert
191.8605	44.02	PK	11.5	-27.7	27.82	43.5	-15.68	200	Vert
779.5983	35.83	PK	21.2	-25.6	31.43	46	-14.57	100	Vert

8. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4

LIMIT

§15.207 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range	Limits (dBμV)	
(MHz)	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

RESULTS

8.1. EUT WITHOUT ANTENNA

6 WORST EMISSIONS

Project No:12J14452
Client Name:Mitsumi Electronic Co. Ltd.
Model/Device:DRT-W127 (Ant Port Terminated)
Test Volt/Freq:115VAC/60Hz
Test By:M. Mekuria

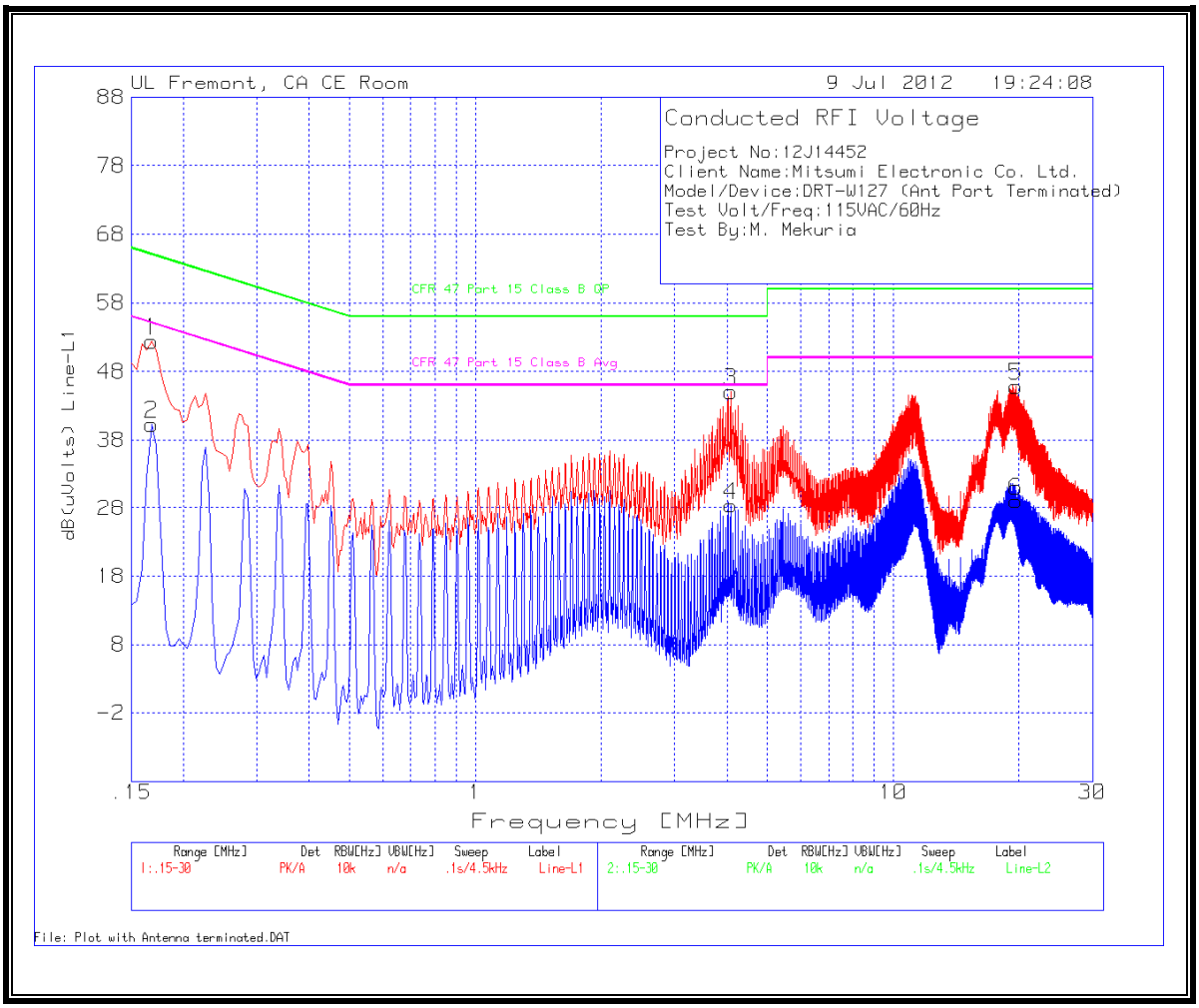
Line-L1 .15 - 30MHz

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
0.168	52.27	PK	0.1	0	52.37	65.1	-12.73	-	-
0.168	40.17	Av	0.1	0	40.27	-	-	55.1	-14.83
4.0785	44.87	PK	0.1	0.1	45.07	56	-10.93	-	-
4.0785	28.29	Av	0.1	0.1	28.49	-	-	46	-17.51
19.653	45.3	PK	0.3	0.2	45.8	60	-14.2	-	-
19.653	28.55	Av	0.3	0.2	29.05	-	-	50	-20.95

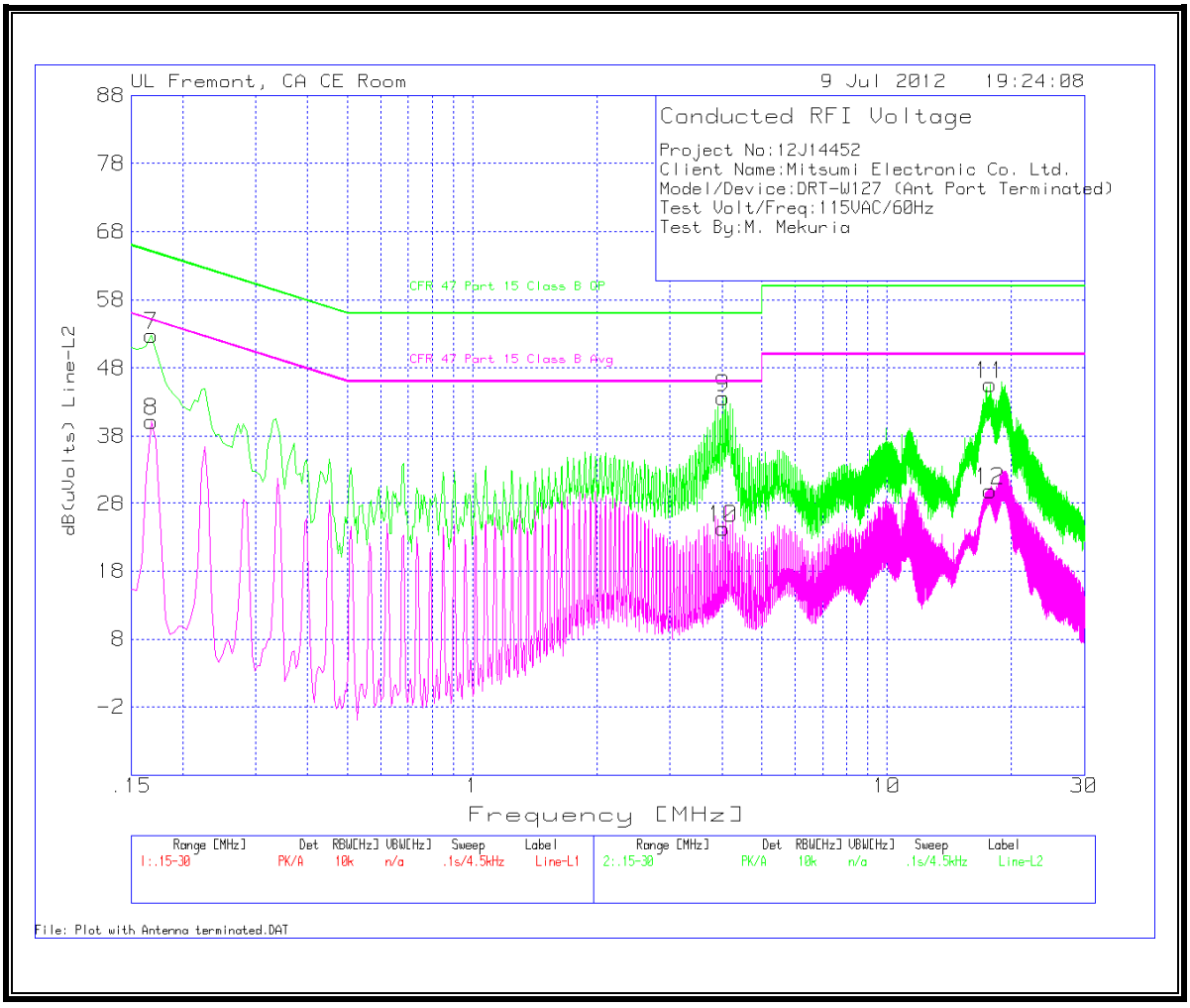
Line-L2 .15 - 30MHz

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
0.168	52.67	PK	0.1	0	52.77	65.1	-12.33	-	-
0.168	40.08	Av	0.1	0	40.18	-	-	55.1	-14.92
4.02	43.49	PK	0.1	0.1	43.69	56	-12.31	-	-
4.02	24.09	Av	0.1	0.1	24.29	-	-	46	-21.71
17.79	45.15	PK	0.2	0.2	45.55	60	-14.45	-	-
17.79	29.54	Av	0.2	0.2	29.94	-	-	50	-20.06

LINE 1 RESULT



LINE 2 RESULTS



8.2. EUT WITH ANTENNA

6 WORST EMISSIONS

Project No:12J14452
Client Name:Mitsumi Electronic Co. Ltd.
Model/Device:DRT-W127(TX Worst Case)
Test Volt/Freq:115VAC/60Hz
Test By:M. Mekuria

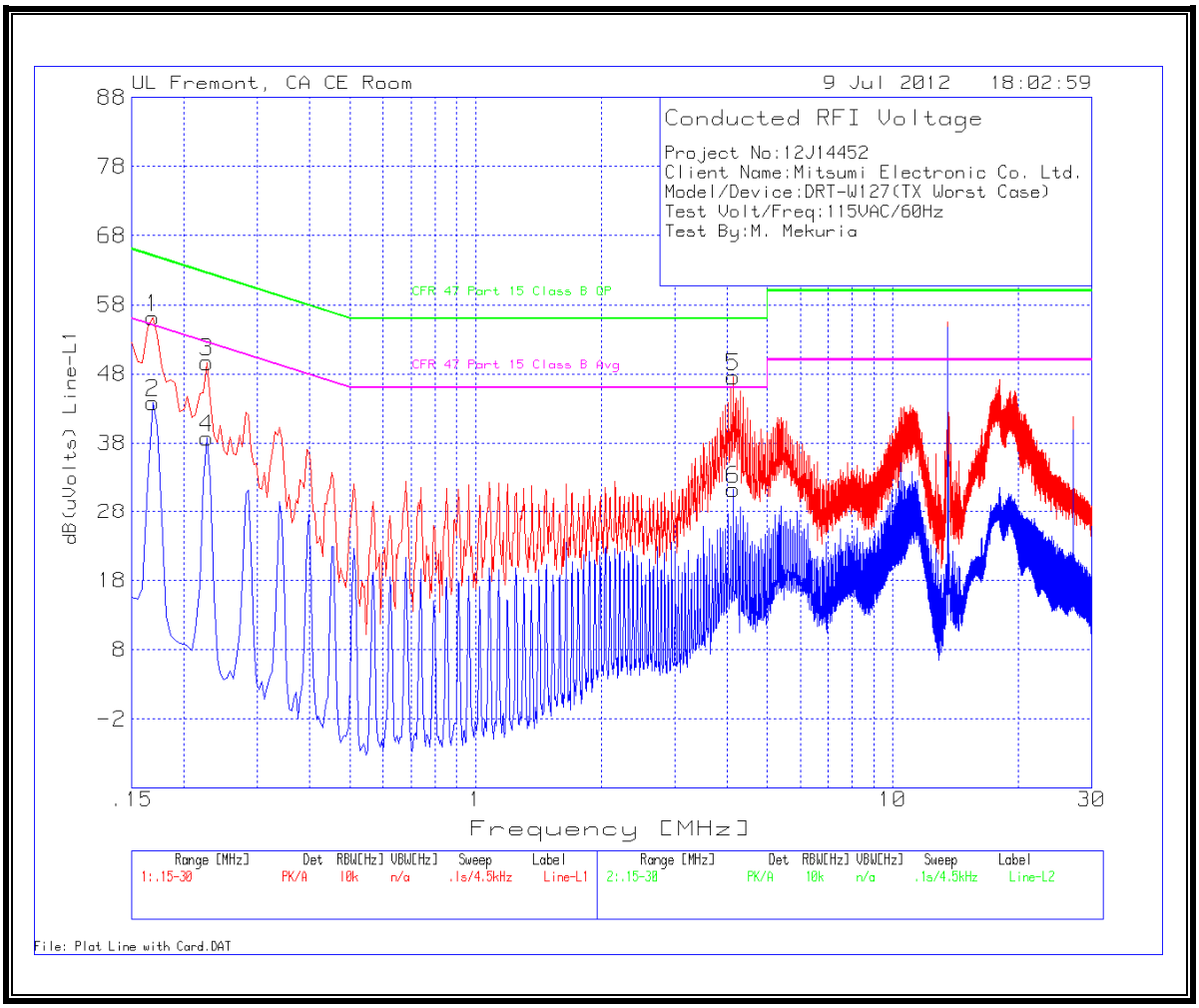
Line-L1 .15 - 30MHz

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
0.168	56.02	PK	0.1	0	56.12	65.1	-8.98	-	-
0.168	43.79	Av	0.1	0	43.89	-	-	55.1	-11.21
0.2265	49.58	PK	0.1	0	49.68	62.6	-12.92	-	-
0.2265	38.64	Av	0.1	0	38.74	-	-	52.6	-13.86
4.146	47.35	PK	0.1	0.1	47.55	56	-8.45	-	-
4.146	31.12	Av	0.1	0.1	31.32	-	-	46	-14.68

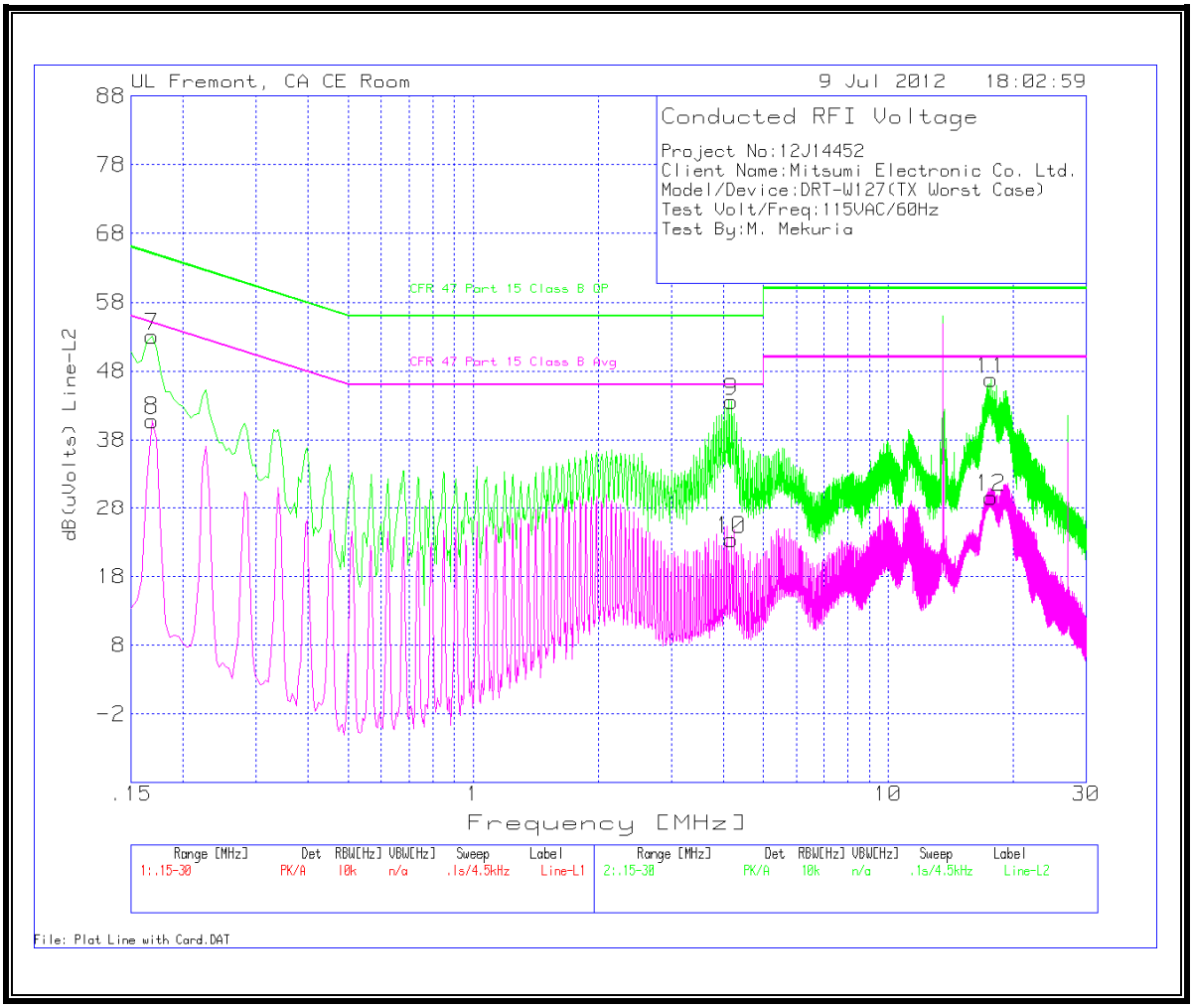
Line-L2 .15 - 30MHz

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
0.168	52.97	PK	0.1	0	53.07	65.1	-12.03	-	-
0.168	40.74	Av	0.1	0	40.84	-	-	55.1	-14.26
4.1955	43.43	PK	0.1	0.1	43.63	56	-12.37	-	-
4.1955	23.22	Av	0.1	0.1	23.42	-	-	46	-22.58
17.6865	46.37	PK	0.2	0.2	46.77	60	-13.23	-	-
17.6865	29.24	Av	0.2	0.2	29.64	-	-	50	-20.36

LINE 1 RESULT



LINE 2 RESULTS



9. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Note: since the EUT operating voltage is 2.6 – 2.9 VDC these values were used for the testing.

TEST PROCEDURE

ANSI C63.4:2009

RESULTS

Tag A

Reference Frequency: EUT Channel 13.5599623 MHz @ 20ºC Limit: ± 100 ppm = 135.600 kHz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (ºC)**	**(MHz)**	**Delta (ppm)**	**Limit (ppm)**
2.80	50	13.5599282	0.025	± 100
2.80	40	13.5599367	0.019	± 100
2.80	30	13.5599497	0.009	± 100
2.80	***20***	***13.5599623***	***0.000***	***± 100***
2.80	10	13.5599977	-0.026	± 100
2.80	0	13.5600425	-0.059	± 100
2.60	20	13.5599682	-0.004	± 100
2.90	20	13.5599486	0.010	± 100

Tag B

Reference Frequency: EUT Channel 13.5599186 MHz @ 20ºC Limit: ± 100 ppm = 135.599 kHz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (ºC)**	**(MHz)**	**Delta (ppm)**	**Limit (ppm)**
2.80	50	13.5599403	-0.016	± 100
2.80	40	13.5599201	-0.001	± 100
2.80	30	13.5599195	-0.001	± 100
2.80	***20***	***13.5599186***	***0.000***	***± 100***
2.80	10	13.5599861	-0.050	± 100
2.80	0	13.5600251	-0.079	± 100
2.60	20	13.5599186	0.000	± 100
2.90	20	13.5599189	0.000	± 100

NOTE: Per the product specification, the power supply voltage conditions are; the normal supply voltage is 2.8VDC, the low supply voltage is 2.6VDC, and the high supply voltage is 2.9VDC.

10. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

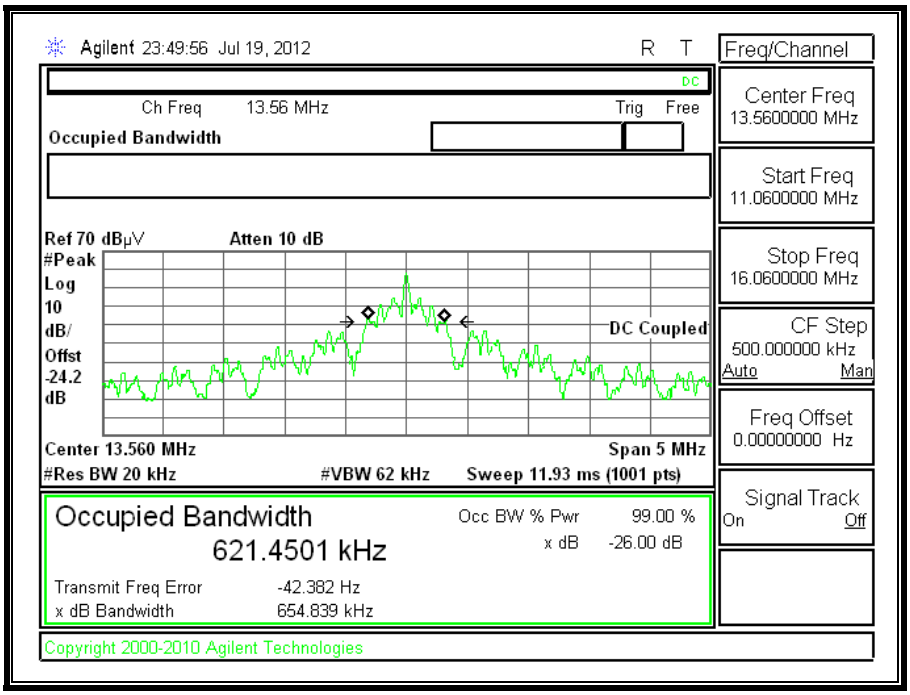
TEST PROCEDURE

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

Frequency (MHz)	99% Bandwidth kHz
13.56	621.4501

99% BANDWIDTH



11. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

EIRP = E field at 3m distance – 95.2
E field at 3m distance = 68.20 dBuV/m
EIRP = 68.20 -95.2 = **-27.0 dBm = 0.002 mW,** this is less than 200 mW based on section 2.5.1 of RSS-102 therefore this test is N/A.