CERTIFICATION TEST REPORT

Report Number. : 12727679-E3V1

Applicant	:	WARMBOARD INC 8035 SOQUEL DR APTOS, CA 95003, U.S.A.
Model	:	WTS-01
FCC ID	:	2ASM7-WTS01
IC	:	24839-WTS01
EUT Description	:	THERMOSTAT WITH LORA WIRELESS COMMUNICATION
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
April 08, 2019

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/8/2019	Initial Issue	--

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: WARMBOARD INC
8035 SOQUEL DR
APTOS, CA 95003, U.S.A.

EUT DESCRIPTION: THERMOSTAT WITH LORA WIRELESS COMMUNICATION

MODEL: WTS-01

SERIAL NUMBER: FCC-LoRa Output (CONDUCTED)
TWS-KEUNING A6 (RADIATED)

DATE TESTED: MARCH 15, 2019 TO MARCH 28, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

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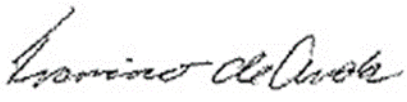
Approved & Released For
UL Verification Services Inc. By:



FRANCISCO DE ANDA
PROJECT LEAD
UL Verification Services Inc.

Prepared By:

ERIC YU
TEST ENGINEER
UL Verification Services Inc.

Reviewed By:

TINA CHU
SENIOR PROJECT ENGINEER
UL Verification Services Inc.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd.
☐ Chamber A (ISED:2324B-1)	☐ Chamber D (ISED:22541-1)	☐ Chamber I (ISED: 2324A-5)
☐ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)	☒ Chamber J (ISED: 2324A-6)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)	☐ Chamber K (ISED: 2324A-1)
	☐ Chamber G (ISED:22541-4)	☐ Chamber L (ISED: 2324A-3)
	☐ Chamber H (ISED:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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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

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a thermostat with LoRa 915 MHz wireless communication, and is categorized as Digital Transmission System (DTS).

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
903 - 927	LoRa	17.21	52.60

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB trace antenna with a maximum gain of -10.76 dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Version 022419
The firmware installed in the EUT during testing was Version 022419

5.5. WORST-CASE CONFIGURATION AND MODE

Band edge and radiated emissions were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The EUT is mounted on wall at Z-Portrait orientation only. Therefore, all final radiated testing was performed with the EUT in Z-Portrait orientation.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	FCC ID/DoC
Laptop	Sony	PCG-31113L	54042658 0003472	DoC
Laptop AC/DC adapter	Sony	VGP-AC19V32	148095531 0289840	DoC

I/O CABLES (CONDUCTED TEST)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length m	Remarks
1	AC	1	AC	Unshielded	1.5	AC Mains to AC/DC adapter
2	DC	1	DC	Unshielded	1.8	AC/DC adapter to laptop
3	USB	1	Serial ports	Shielded	0.95	Laptop to EUT
4	Antenna	1	SMA	Unshielded	0.18	To spectrum analyzer
5	AC	1	2-prong	Unshielded	1.8	To EUT

I/O CABLES (RADIATED TEST AND AC POWER LINE TEST)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length m	Remarks
5	AC	1	2-prong	Unshielded	1.5	To EUT

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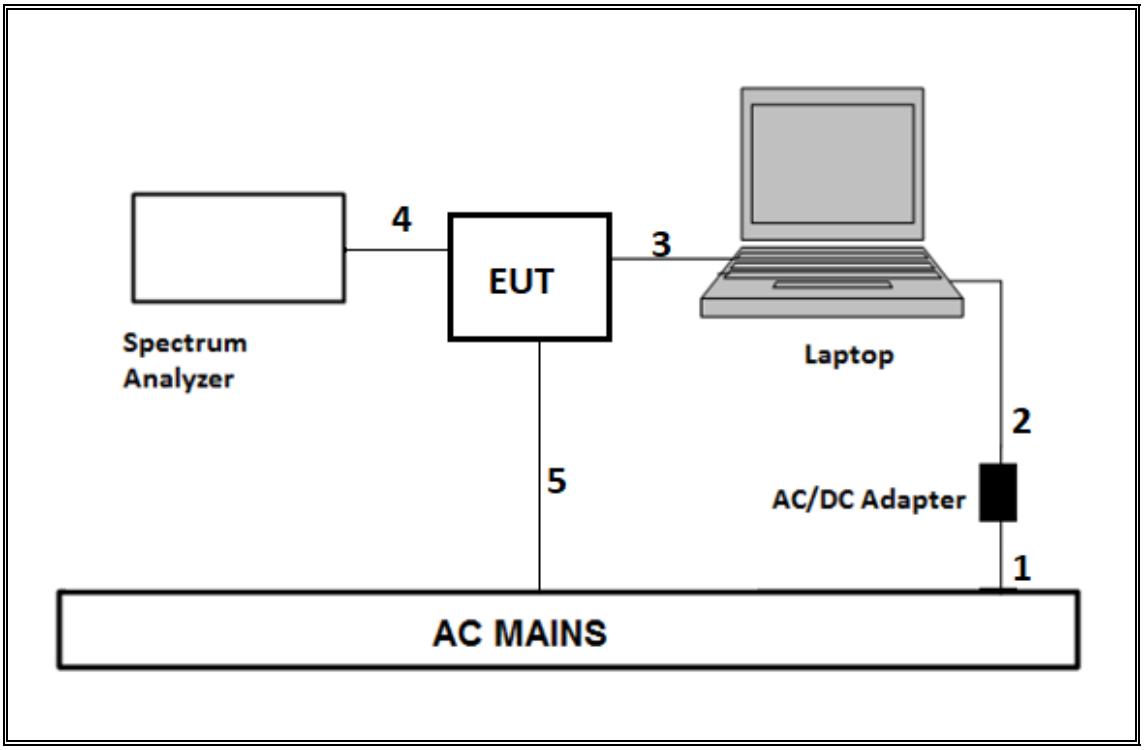
TEST SETUP-CONDUCTED TEST

The EUT is AC powered. Test software exercised the EUT.

SETUP DIAGRAM



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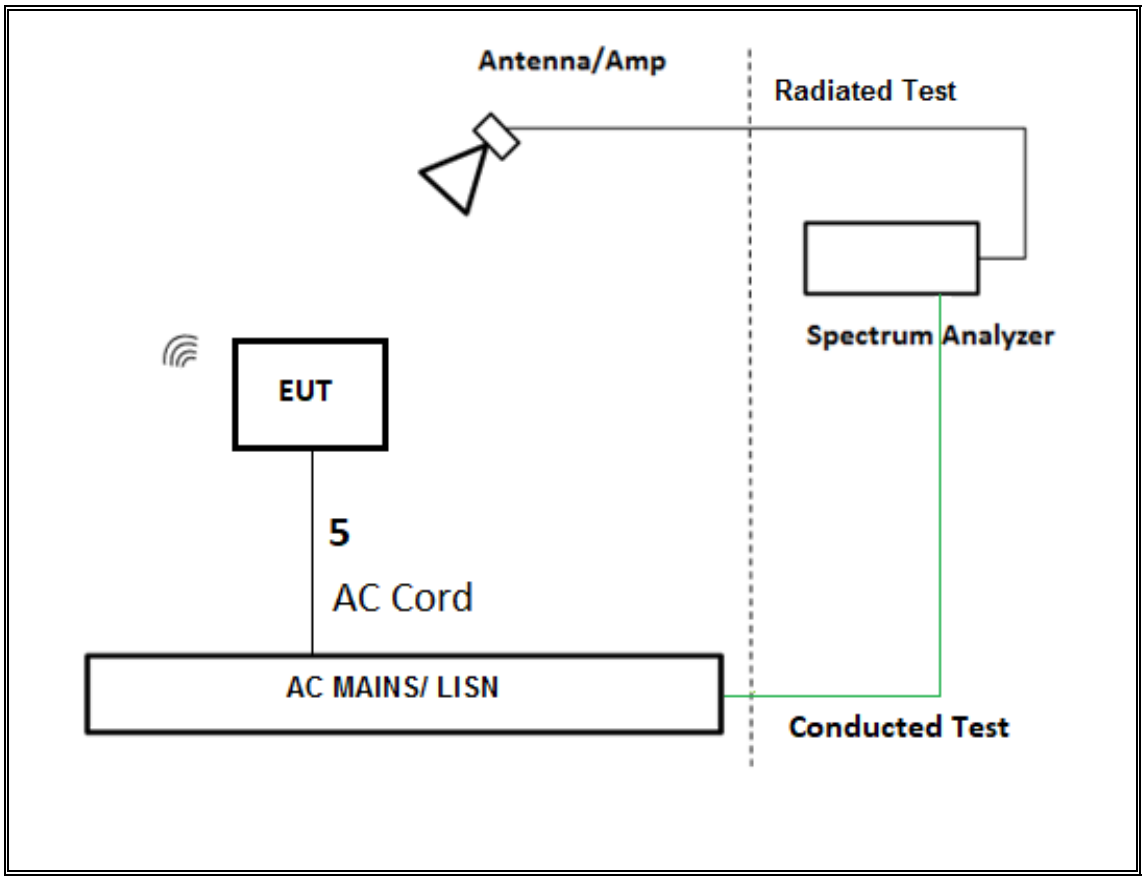
TEST SETUP- RADIATED TEST AND AC POWER LINE TEST

The EUT is AC powered. Test software exercised the EUT. Laptop was removed after test script was started.

SETUP DIAGRAM



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6. MEASUREMENT METHOD

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Average Output Power:ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Subclause -11.13.3.4 Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

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7. 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**	**ID Num**	**Cal Due**	**Last Cal**
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1262	1/31/2020	1/31/2019
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1223	2/25/2020	2/25/2019
Loop Antenna 30Hz-1MHz	Electro Metrics	EM-6871	PRE0179465	5/22/2019	5/22/2018
Loop Antenna 100KHz-30MHz	Electro Metrics	EM-6872	PRE0179467	5/22/2019	5/22/2018
Amplifier, 9KHz to 1GHz, 32dB	Sonoma Instrument	310	PRE0180174	5/31/2019	5/31/2018
Hybrid Antenna, 30MHz to 3GHz	SunAR rf motion	JB3	PRE0181575	8/1/2019	8/1/2018
Antenna, Horn 1-18GHz	AR	AMPL-ATH1G18	PRE0189055	4/20/2019	4/20/2018
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	7/30/2019	7/30/2018
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	5/4/2019	5/4/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T917	1/24/2020	1/24/2019
Filter, BRF 902 to 928MHz	MICRO-TRONICS	BRC50722	T1846	8/16/2019	8/16/2018
Filter, Highpass 1.2GHz	MICRO-TRONICS	HPM50108	PRE0182423	9/4/2019	9/4/2018
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	2/14/2020	2/14/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	6/15/2019	6/15/2018
Test Software List					
Radiated Software	UL	UL EMC		Ver 9.5, Jan 11, 2019	
Antenna Port Software	UL	UL RF		Ver 9.4.1, Feb 19, 2019	
AC Line Conducted Software	UL	UL EMC		Ver 9.5, May 26, 2015	

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

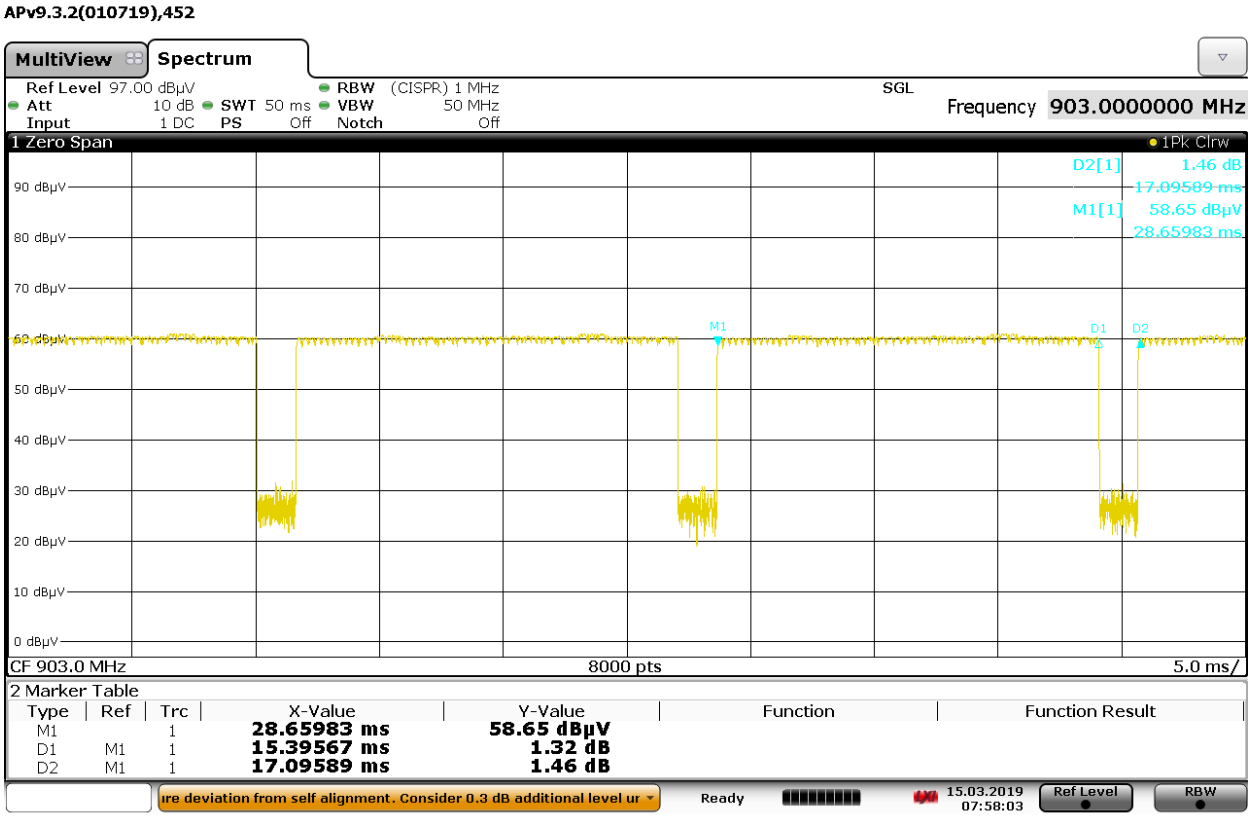
KDB 558074 Zero-Span Spectrum Analyzer Method.

RESULTS

Date:	3/15/2019
Test Engineer:	10649 JR

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
LoRa	15.396	17.096	0.901	90.05%	0.45	0.065



DUTY CYCLE PLOTS

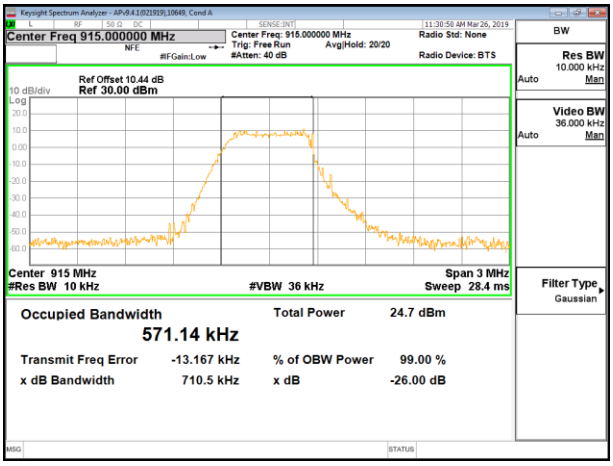
8.2. 99% BANDWIDTH

LIMITS

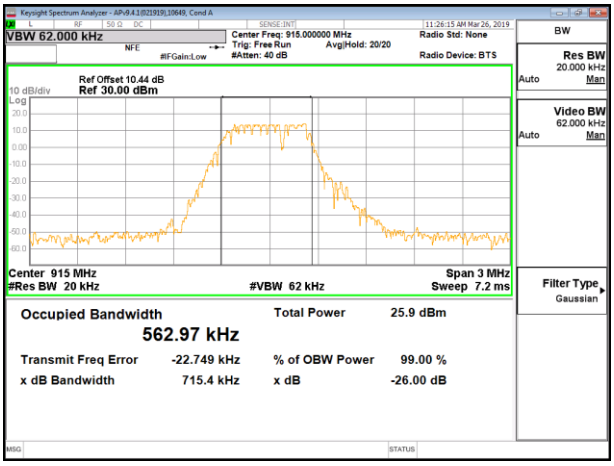
None; for reporting purposes only.

RESULTS

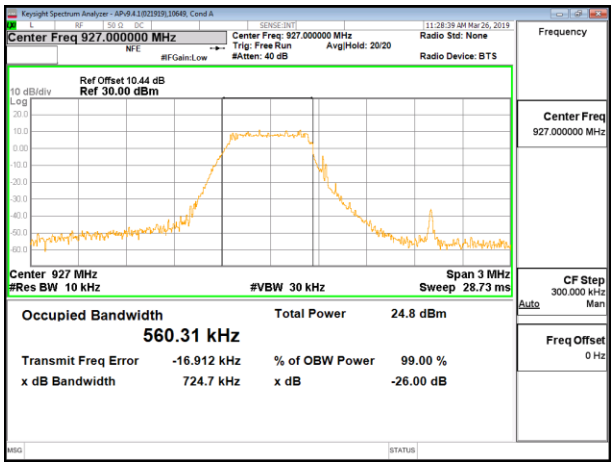
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	903	0.5711
Middle	915	0.5630
High	927	0.5603



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

8.3. 6 dB BANDWIDTH

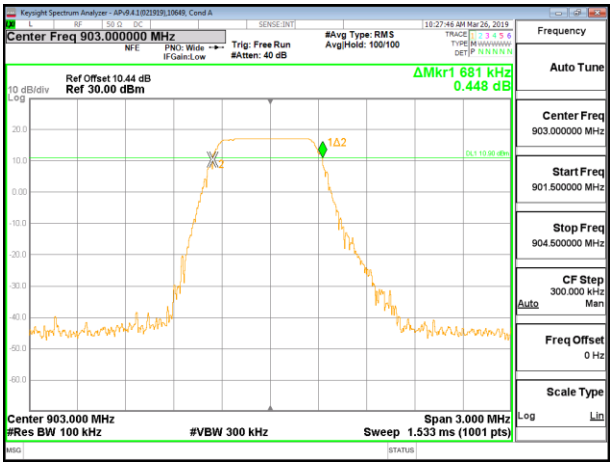
LIMITS

FCC §15.247 (a) (2)
RSS-247 5.2 (a)

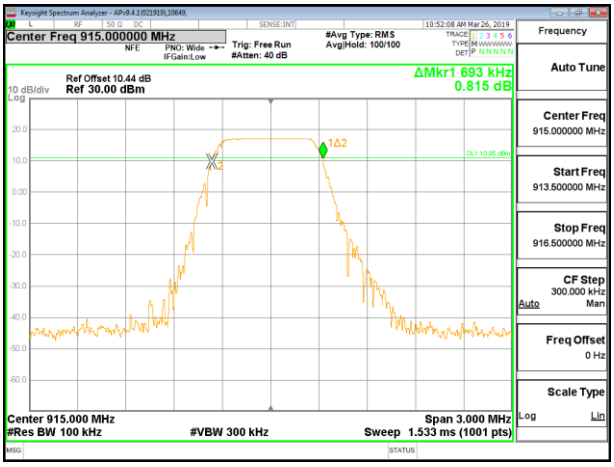
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

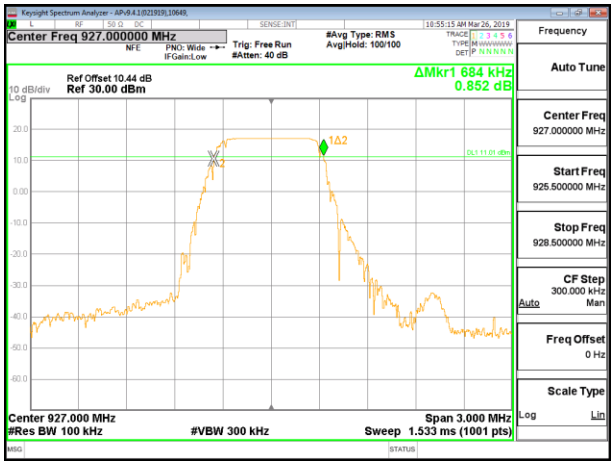
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	903	0.681	0.5
Middle	915	0.693	0.5
High	927	0.684	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)
RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.44 dB (including 10 dB pad and 0.44 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

Tested By:	10649 JR
Date:	3/22/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	903	17.15	30	-12.85
Middle	915	17.18	30	-12.82
High	927	17.21	30	-12.79

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8.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.44dB (including 10 dB pad and 0.44 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

Tested By:	10649 JR
Date:	3/22/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	903	17.02
Middle	915	17.06
High	927	17.09

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8.6. POWER SPECTRAL DENSITY

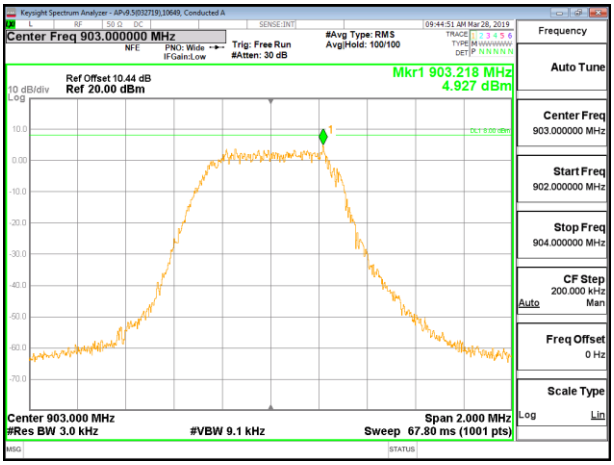
LIMITS

FCC §15.247 (e)
RSS-247 (5.2) (b)

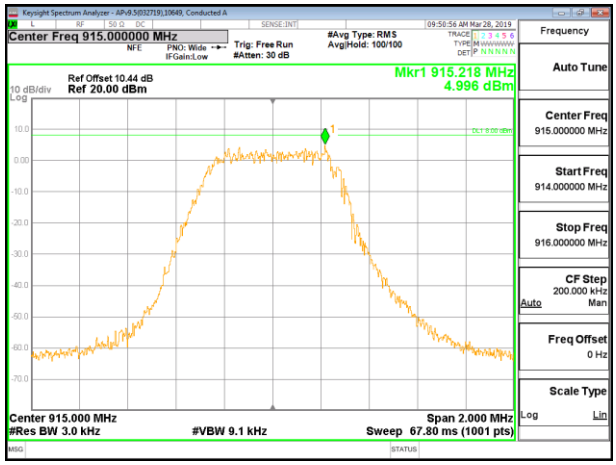
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

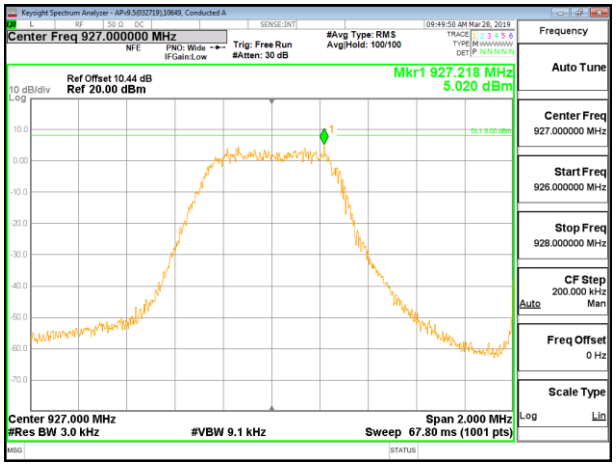
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	903	4.93	8	-3.07
Middle	915	5.00	8	-3.00
High	927	5.02	8	-2.98



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

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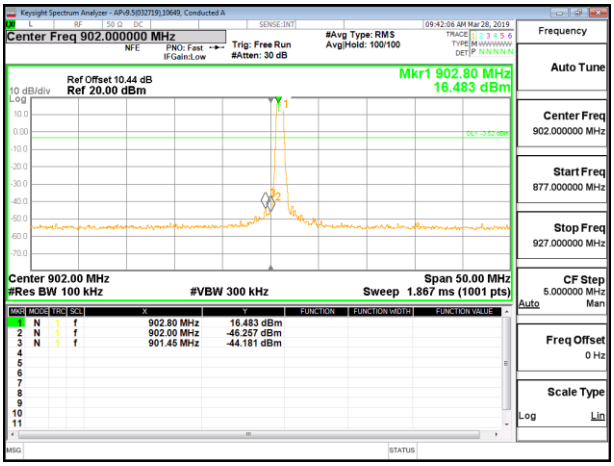
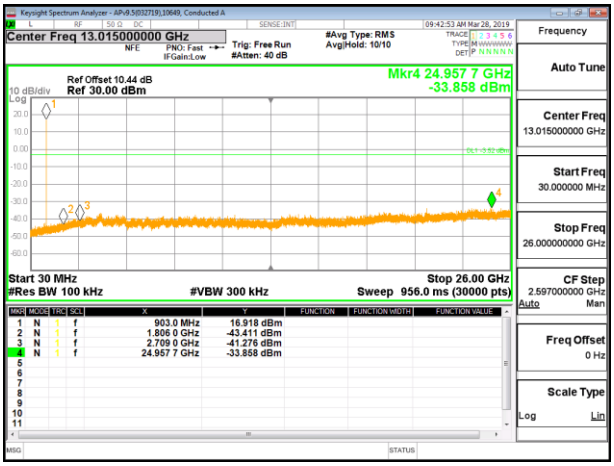
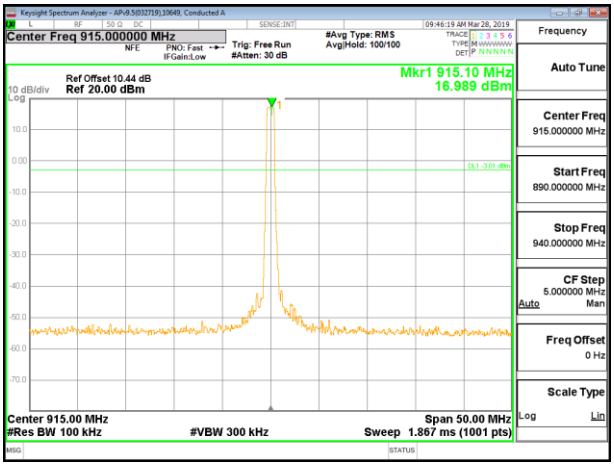


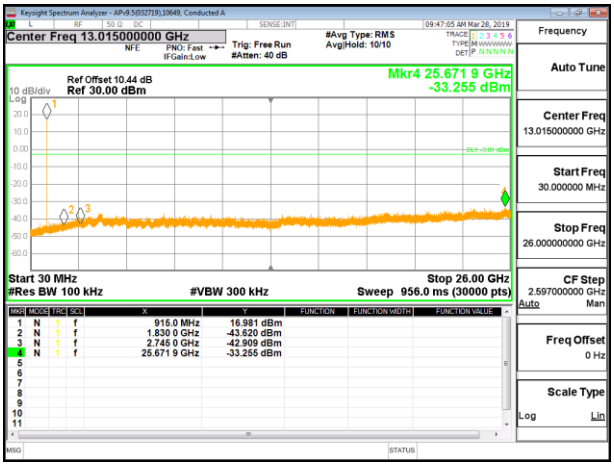
LOW CHANNEL BANDEDGE



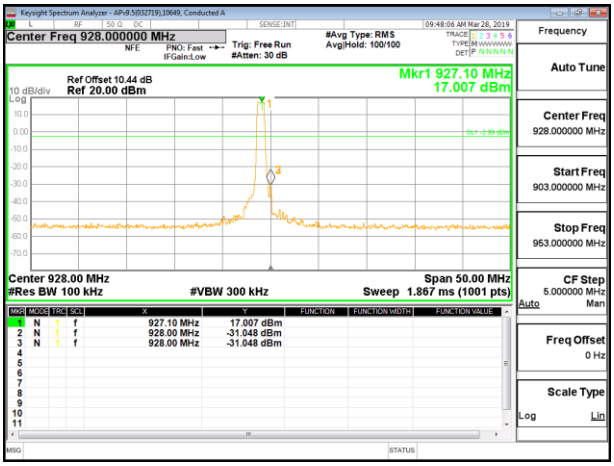
OUT-OF-BAND LOW CHANNEL



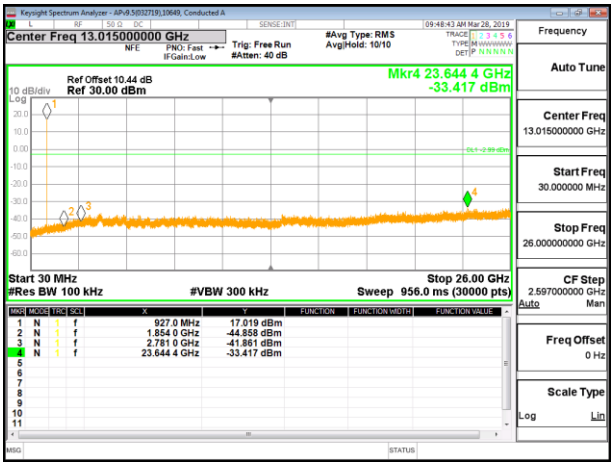
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209
RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

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

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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

For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

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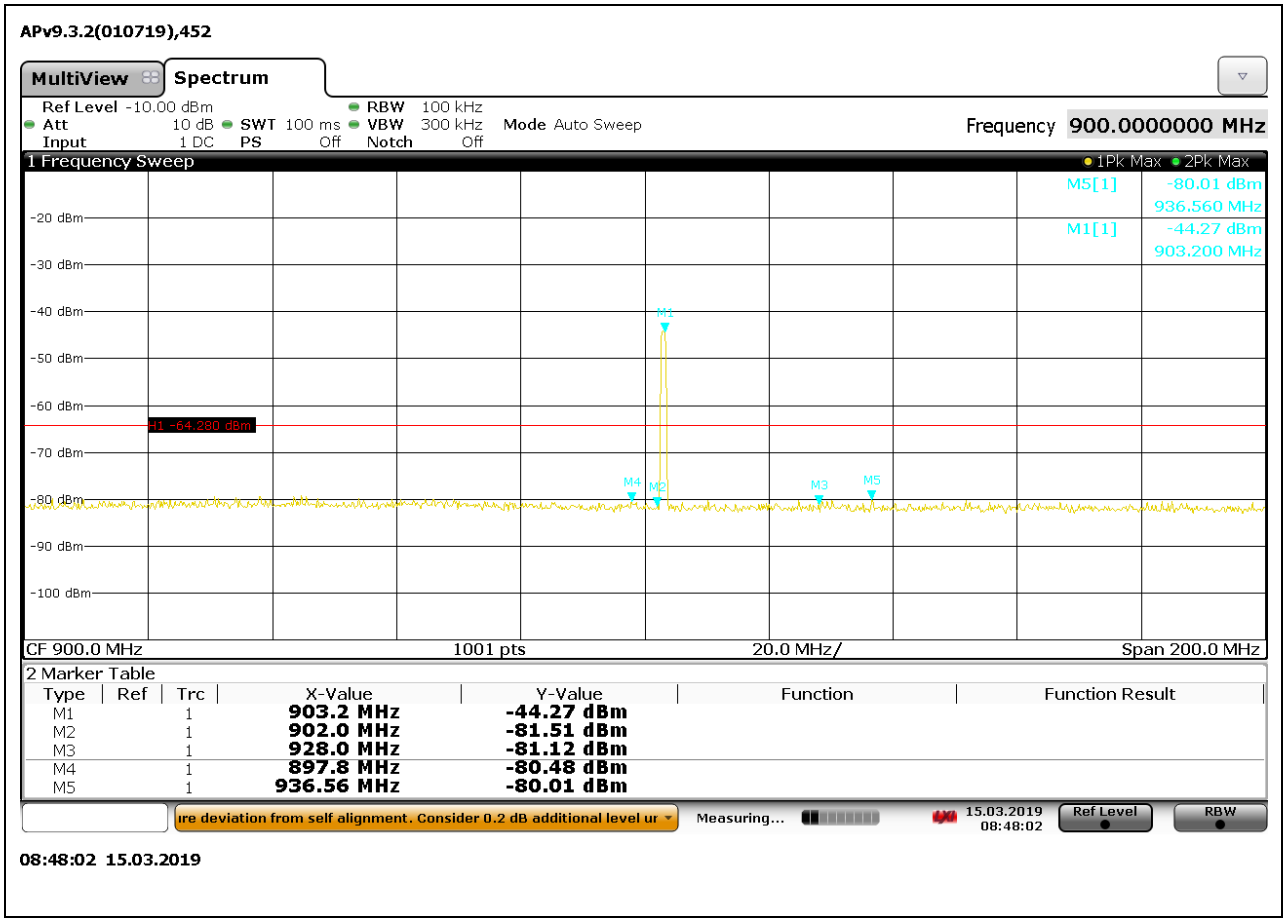
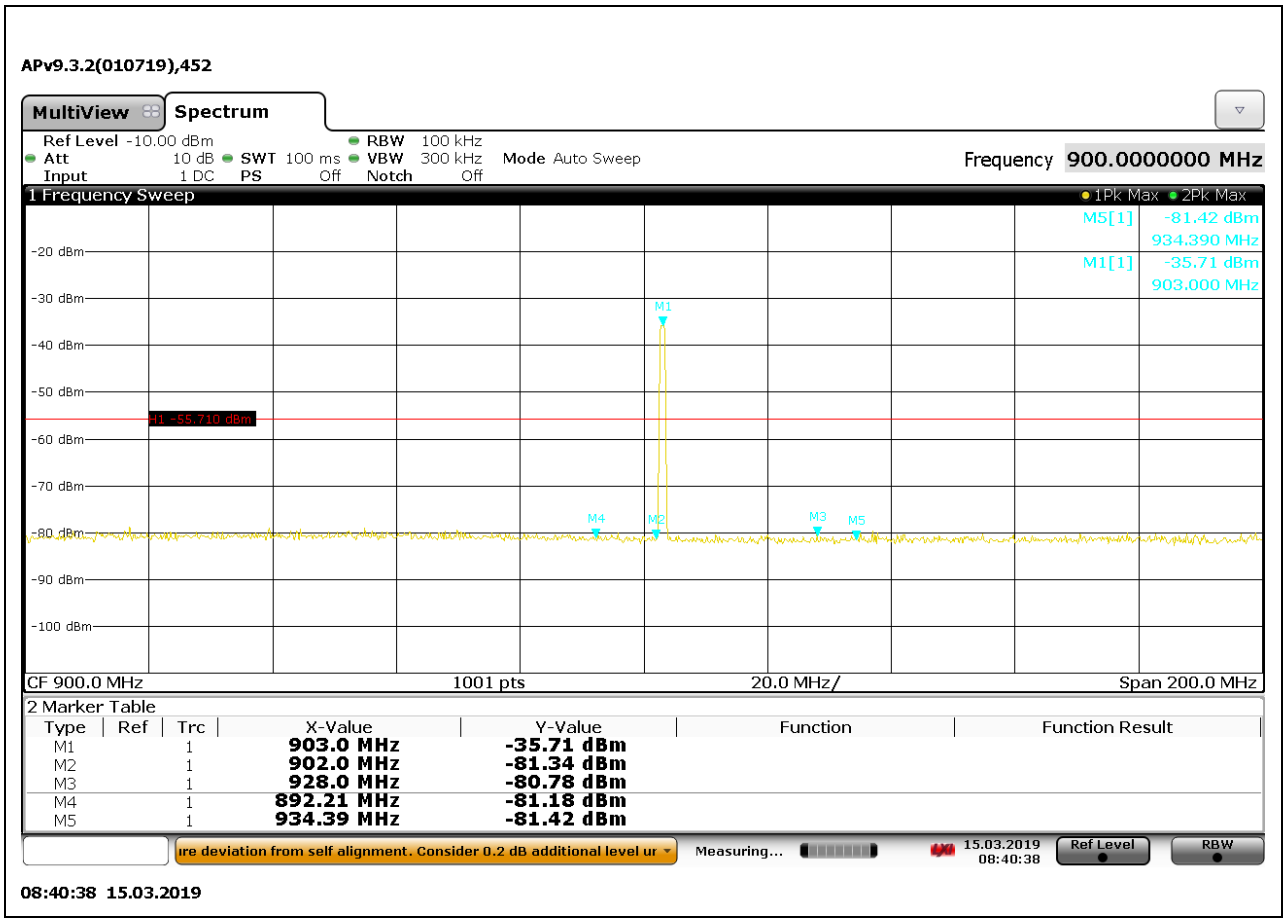
9.2. TRANSMITTER BELOW 1 GHz

-20 dBc BANDEDGE WITHOUT NOTCH FILTER AND PRE-AMPLIFIER (LOW CHANNEL)

HORIZONTAL RESULT



VERTICAL RESULT



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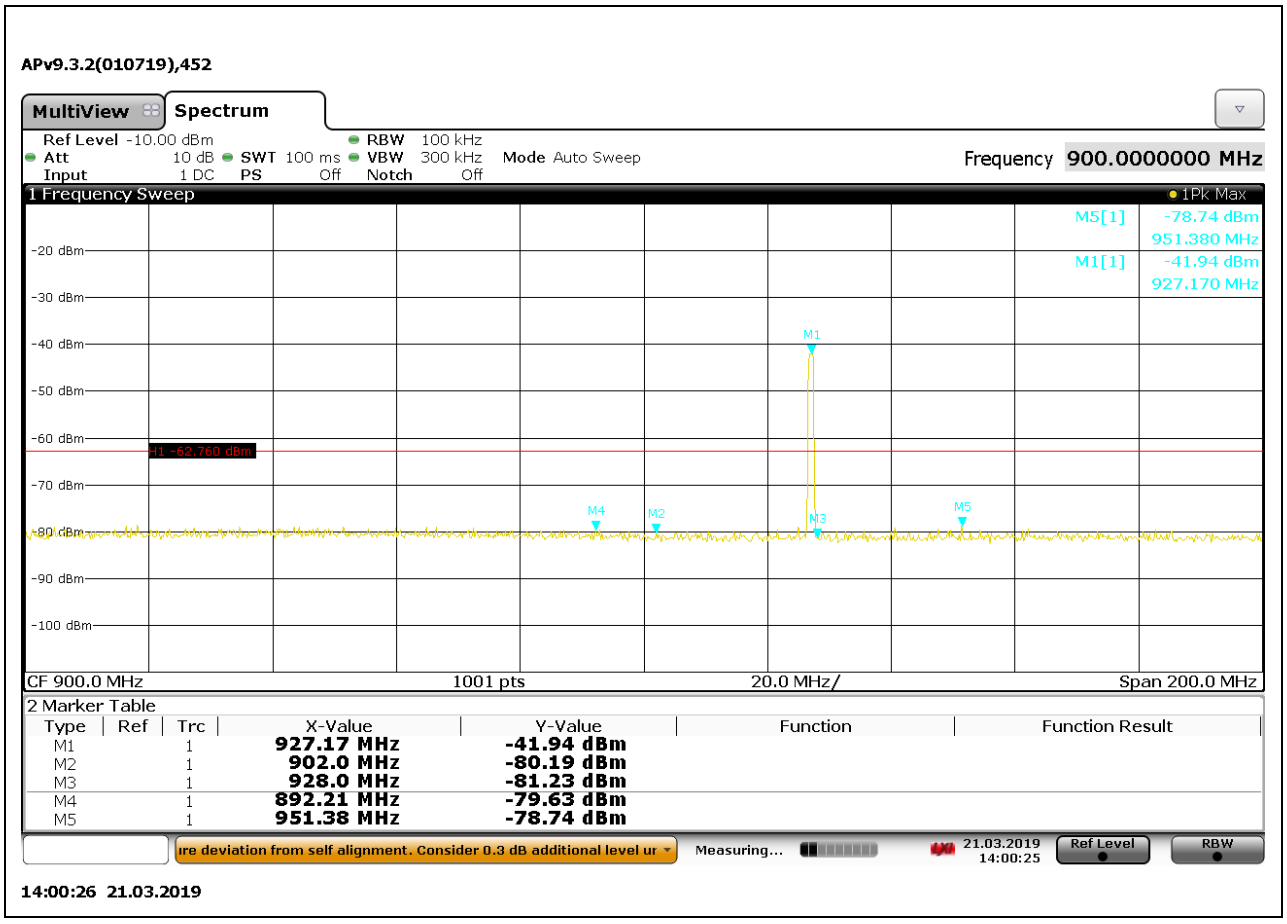
-20 dBc BANDEDGE WITHOUT NOTCH FILTER AND PRE-AMPLIFIER (HIGH CHANNEL)

HORIZONTAL RESULT



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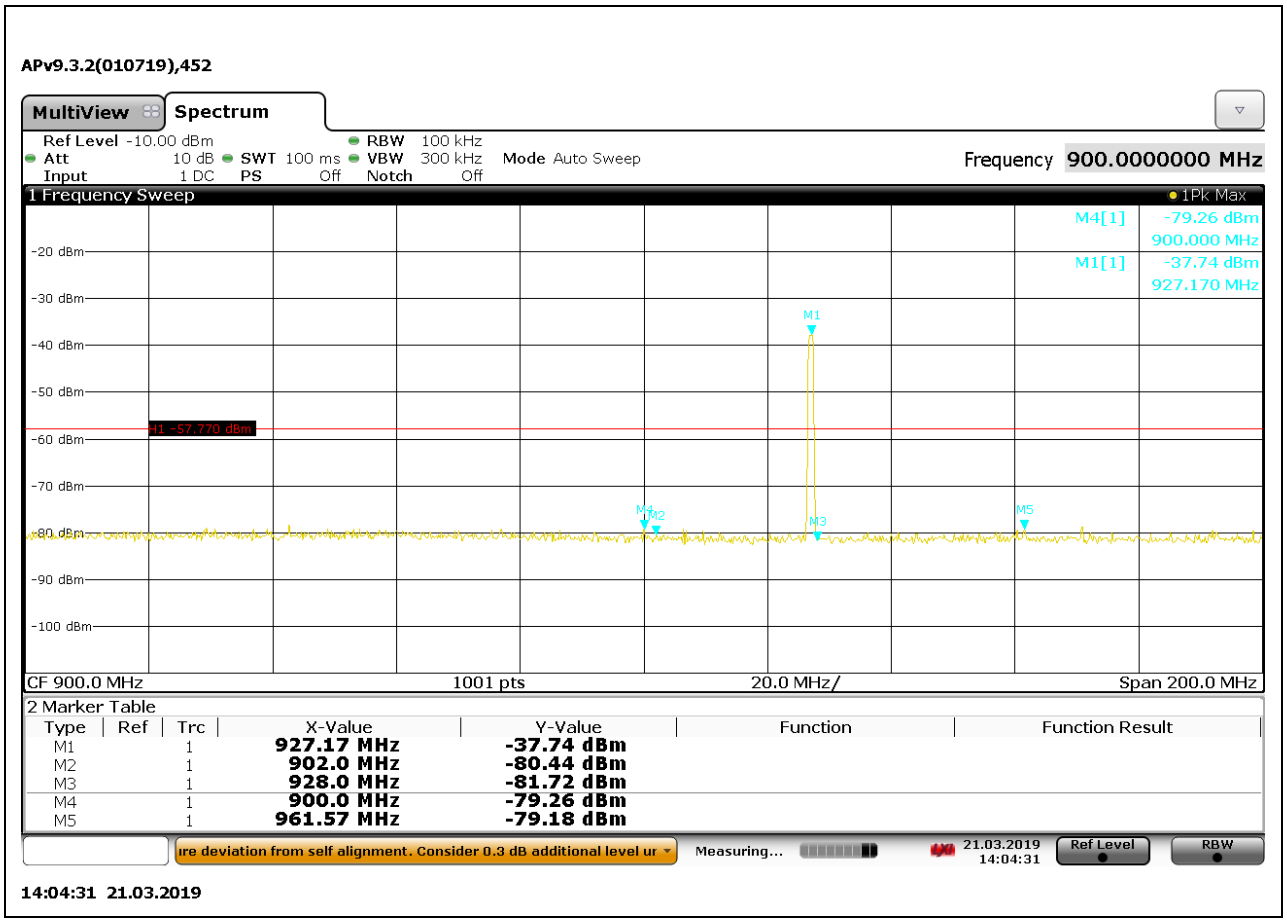
VERTICAL RESULT



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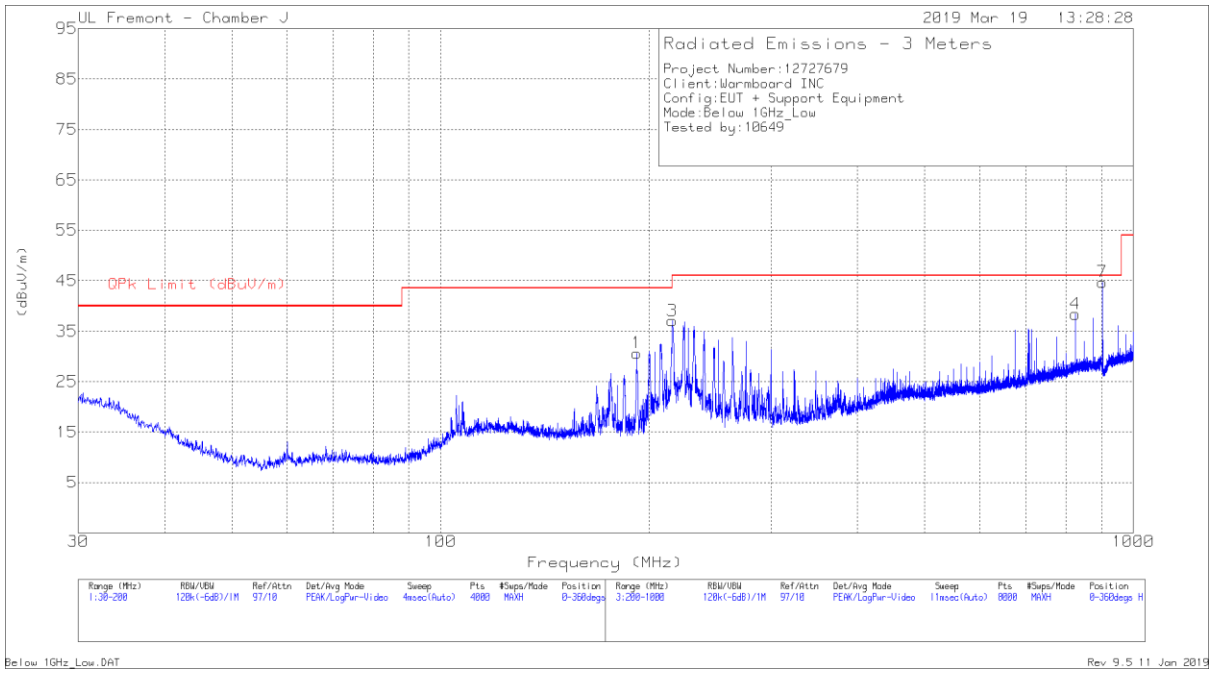
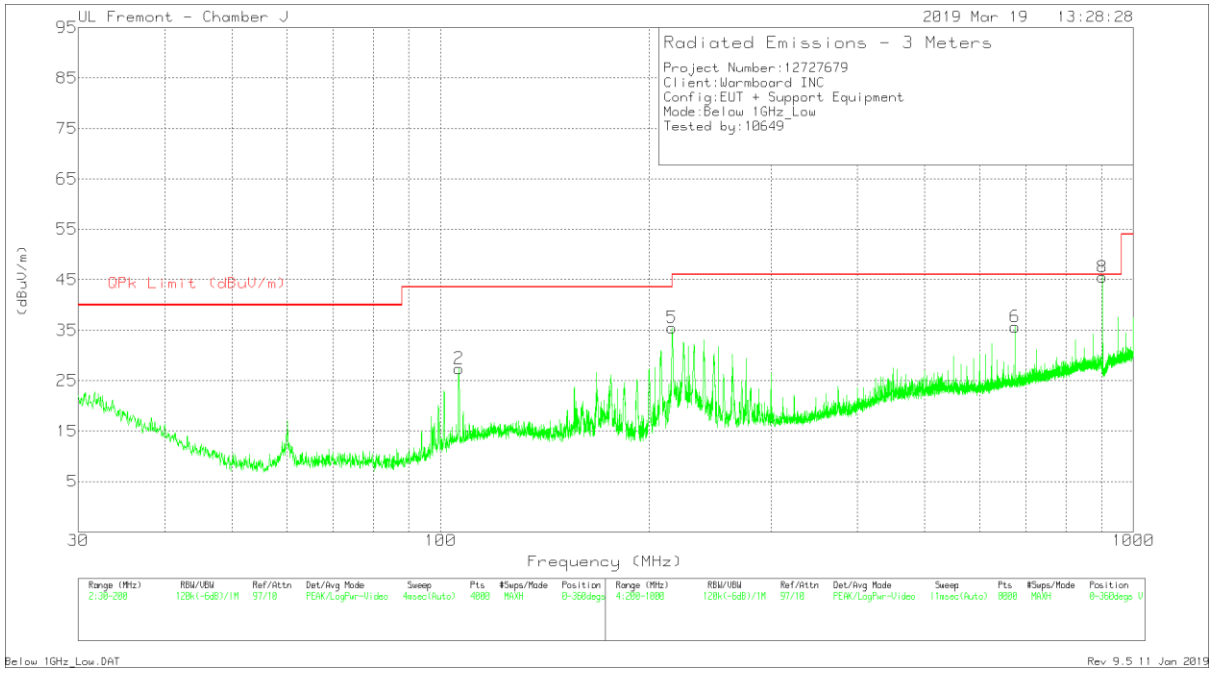
HARMONICS AND SPURIOUS EMISSIONS WITH A NOTCH FILTER

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Filter T1846 (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	192.0094	43.77	Pk	17.4	-30.5	0.5	31.17	43.52	-12.35	0-360	99	H
	191.9965	37.27	Qp	17.4	-30.5	0.5	24.67	43.52	-18.85	82	196	H
2	106.2647	40.3	Pk	18	-30.9	0.5	27.9	43.52	-15.62	0-360	101	V
	106.2604	22	Qp	18	-30.9	0.5	9.6	43.52	-33.92	317	320	V
3	216.1021	50.96	Pk	16.4	-30.3	0.5	37.56	46.02	-8.46	0-360	101	H
	216.0029	49.13	Qp	16.4	-30.3	0.5	35.73	46.02	-10.29	129	148	H
4	824.9812	38.91	Pk	27.6	-28.1	0.5	38.91	46.02	-7.11	0-360	101	H
	825.0258	30.64	Qp	27.6	-28.1	0.5	30.64	46.02	-15.38	173	102	H
5	215.9021	49.41	Pk	16.4	-30.3	0.5	36.01	43.52	-7.51	0-360	198	V
	216.0239	43.29	Qp	16.4	-30.3	0.5	29.89	46.02	-16.13	251	139	V
6	674.9617	38.67	Pk	25.7	-28.7	0.5	36.17	46.02	-9.85	0-360	101	V
	675.0015	36.83	Qp	25.7	-28.7	0.5	34.33	46.02	-11.69	185	116	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

Note:
1. Marker 7 and 8 are fundamental signal of EUT.

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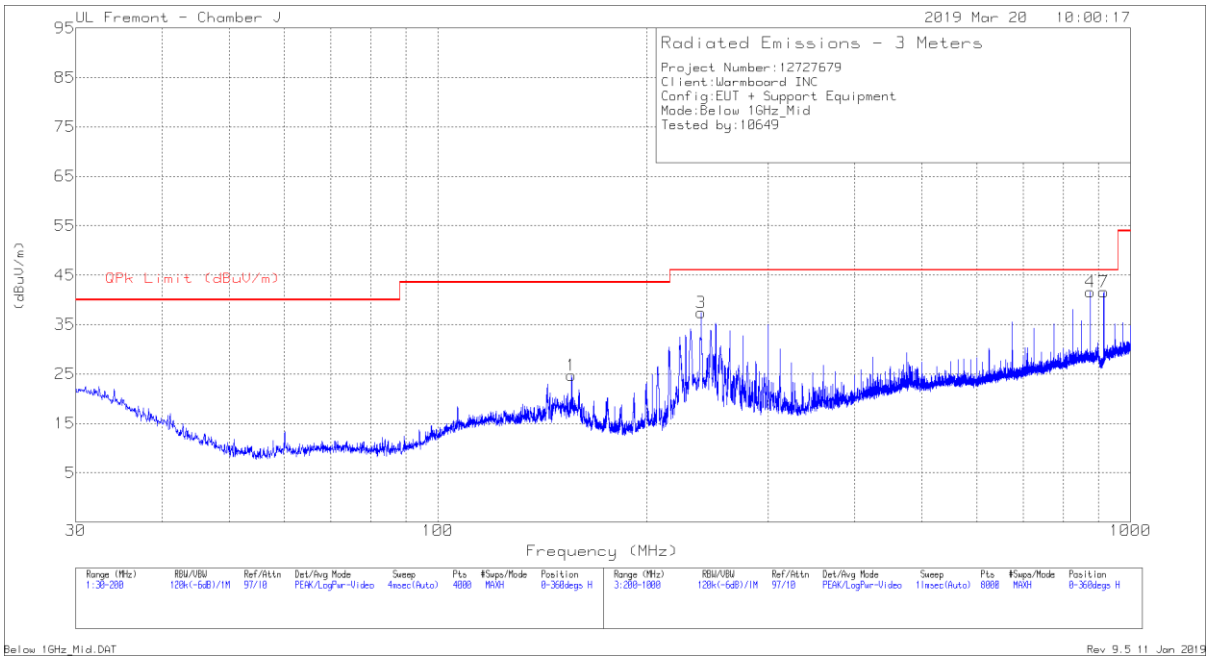
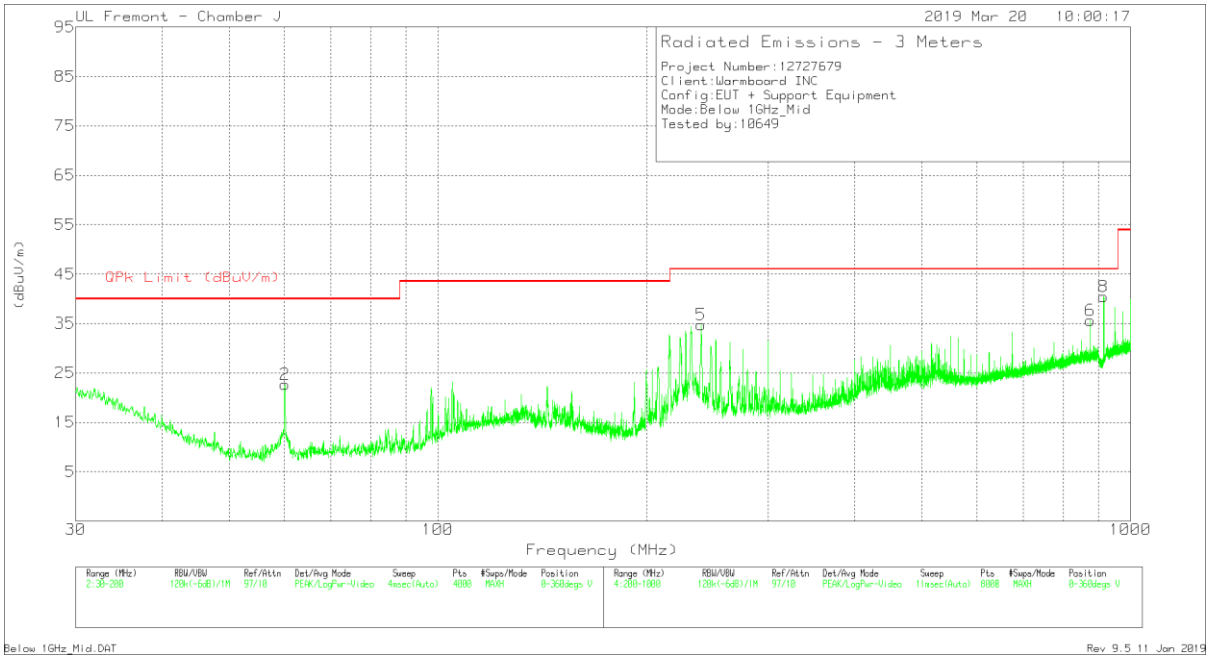
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Filter T1846 (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	156.0026	37	Pk	18.3	-30.6	0.5	25.2	43.52	-18.32	0-360	299	H
	155.9863	35.54	Qp	18.3	-30.6	0.5	23.74	43.52	-19.78	246	169	H
2	60.0978	40.56	Pk	13.3	-31.2	0.5	23.16	40	-16.84	0-360	101	V
	60.0312	26.51	Qp	13.3	-31.2	0.5	9.11	40	-30.89	50	107	V
3	239.9052	50.16	Pk	17.5	-30.2	0.5	37.96	46.02	-8.06	0-360	101	H
	239.77021	42.09	Qp	17.5	-30.2	0.5	29.89	46.02	-16.13	237	100	H
4	874.9877	41.24	Pk	27.8	-27.5	0.5	42.04	46.02	-3.98	0-360	101	H
	874.9997	41.48	Qp	27.8	-27.5	0.5	42.28	46.02	-3.74	182	103	H
5	239.9052	47.39	Pk	17.5	-30.2	0.5	35.19	46.02	-10.83	0-360	198	V
	* 240.0049	44.54	Qp	17.5	-30.2	0.5	32.34	46.02	-13.68	110	113	V
6	874.9877	35.31	Pk	27.8	-27.5	0.5	36.11	46.02	-9.91	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

Note:
1. Marker 7 and 8 are fundamental signal of EUT.

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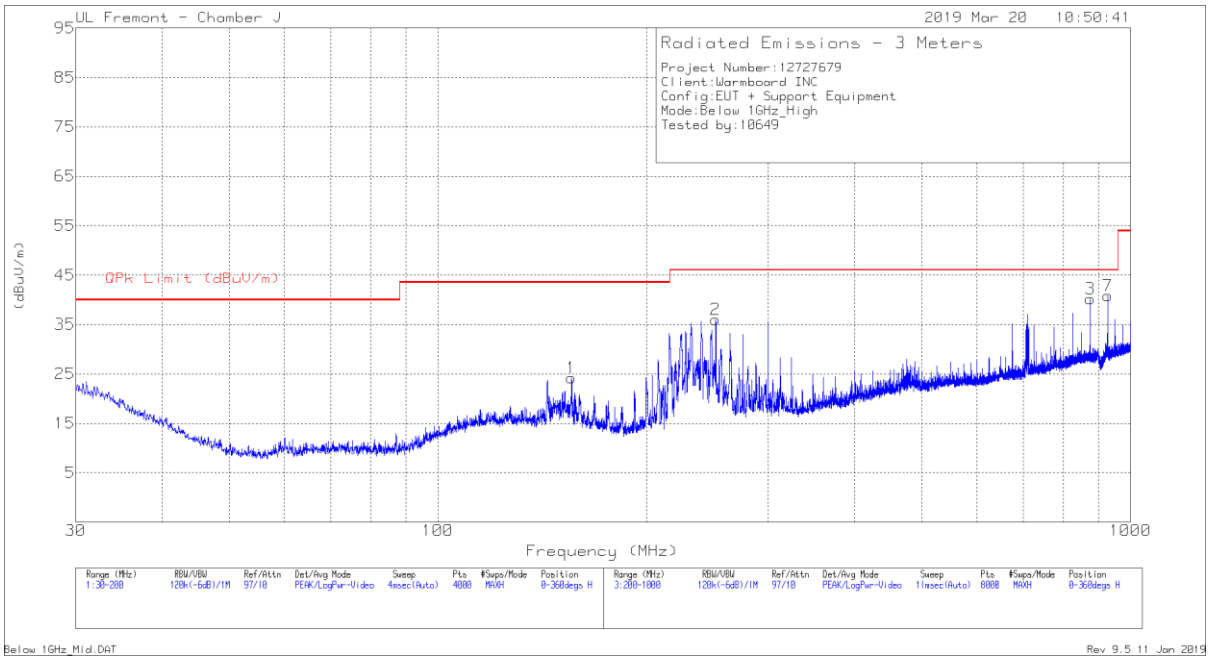
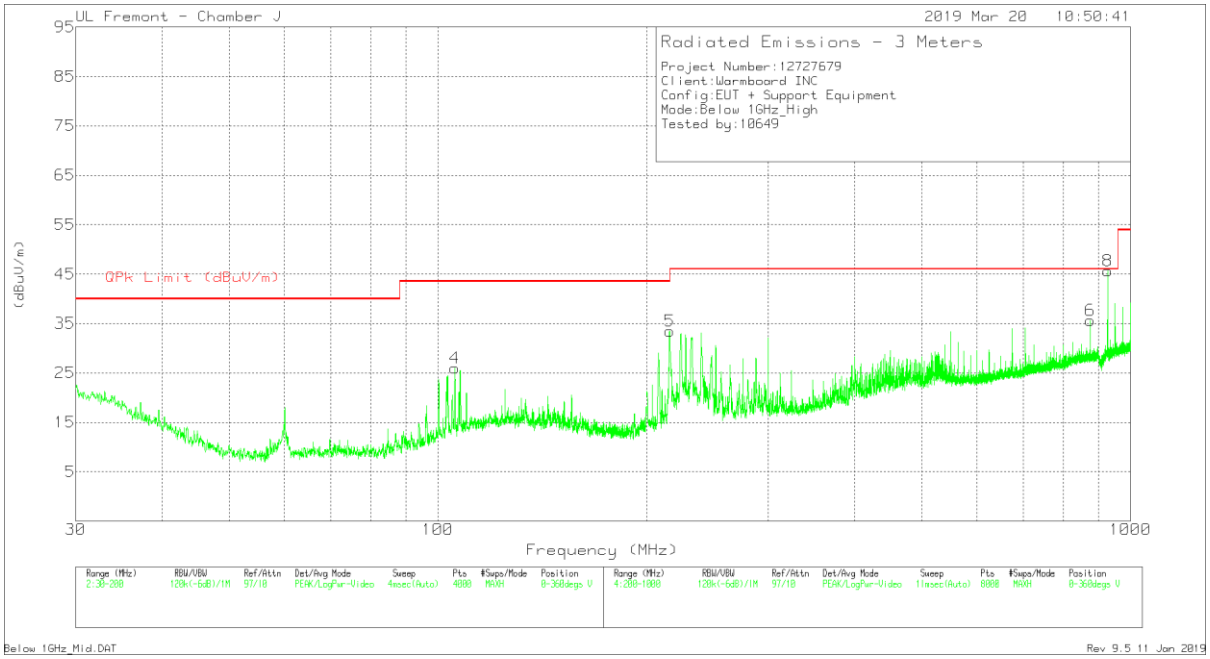
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Filter T1846 (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	156.0026	36.53	Pk	18.3	-30.6	0.5	24.73	43.52	-18.79	0-360	198	H
	156.0084	35.5	Qp	18.3	-30.6	0.5	23.7	43.52	-19.82	242	161	H
4	105.8396	39.04	Pk	17.9	-30.9	0.5	26.54	43.52	-16.98	0-360	101	V
	105.713	22.31	Qp	17.8	-30.9	0.5	9.71	43.52	-33.81	360	203	V
2	* 251.9067	48.78	Pk	17.4	-30.2	0.5	36.48	46.02	-9.54	0-360	101	H
	* 251.9988	47.06	Qp	17.4	-30.2	0.5	34.76	46.02	-11.26	94	145	H
3	874.9877	39.85	Pk	27.8	-27.5	0.5	40.65	46.02	-5.37	0-360	101	H
	875.0131	33.99	Qp	27.8	-27.5	0.5	34.79	46.02	-11.23	26	165	H
5	216.0021	47.36	Pk	16.4	-30.3	0.5	33.96	46.02	-12.06	0-360	198	V
	215.9959	44.42	Qp	16.4	-30.3	0.5	31.02	43.52	-12.5	163	210	V
6	874.9877	35.28	Pk	27.8	-27.5	0.5	36.08	46.02	-9.94	0-360	101	V
	875.0194	32.49	Qp	27.8	-27.5	0.5	33.29	46.02	-12.73	139	201	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

Note:
1. Marker 7 and 8 are fundamental signal of EUT.

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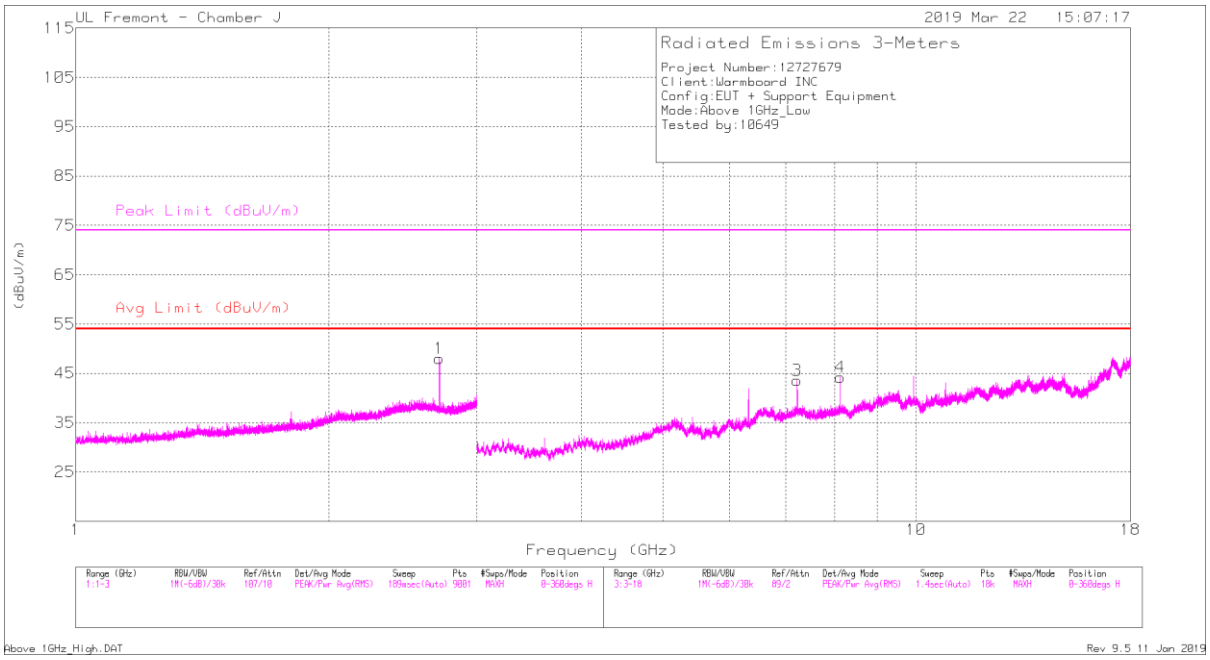
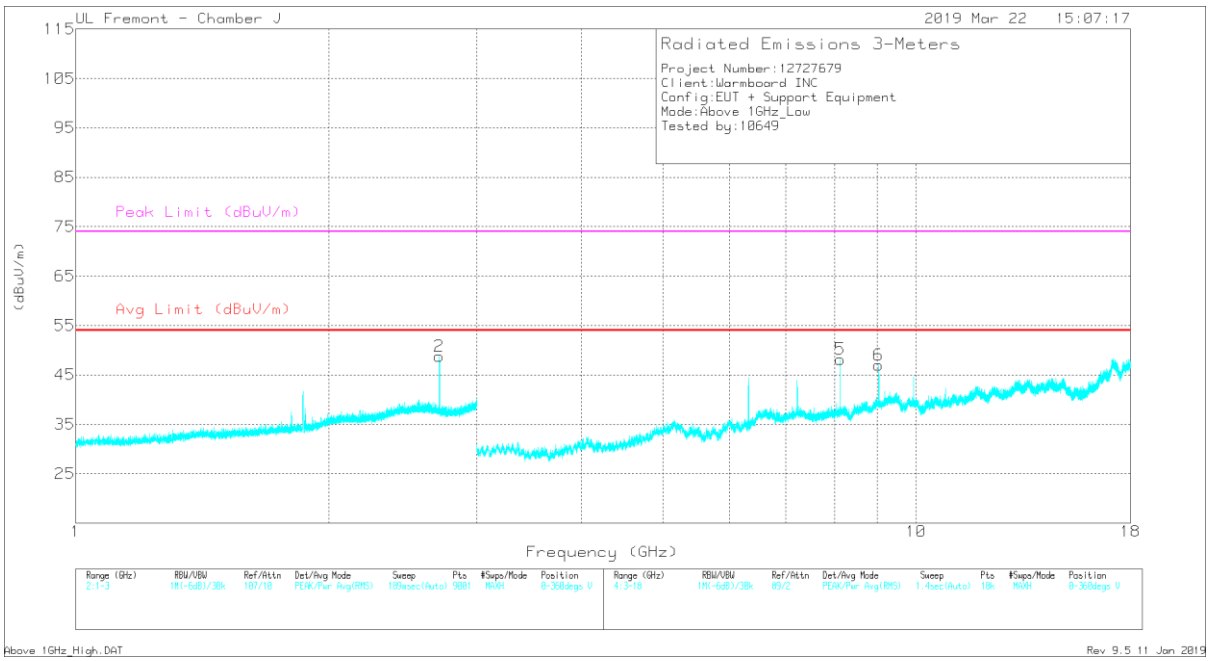
9.3. TRANSMITTER ABOVE 1 GHz

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE01890 55 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	DC Corr (dB)	Filter PRE0182 423 (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.708	47.52	PK2	29.6	-25.5	0	1	52.62	-	-	74	-21.38	134	217	H
	* 2.709	40.17	MAv1	29.6	-25.5	0.45	1	45.72	54	-8.28	-	-	134	217	H
2	* 2.709	47.07	PK2	29.6	-25.5	0	1	52.17	-	-	74	-21.83	119	105	V
	* 2.709	39.27	MAv1	29.6	-25.5	0.45	1	44.82	54	-9.18	-	-	119	105	V
3	7.223	38.21	PK2	38.2	-27.6	0	1	49.81	-	-	-	-	67	110	H
4	* 8.125	38.87	PK2	37.9	-26.8	0	1	50.97	-	-	74	-23.03	60	254	H
	* 8.127	27.37	MAv1	37.9	-26.9	0.45	1	39.82	54	-14.18	-	-	60	254	H
5	* 8.129	40.59	PK2	37.9	-26.8	0	1	52.69	-	-	74	-21.31	80	258	V
	* 8.129	28.2	MAv1	37.9	-26.8	0.45	1	40.75	54	-13.25	-	-	80	258	V
6	* 9.032	37.02	PK2	38.9	-24.7	0	1	52.22	-	-	74	-21.78	91	126	V
	* 9.032	26.63	MAv1	38.9	-24.7	0.45	1	42.28	54	-11.72	-	-	91	126	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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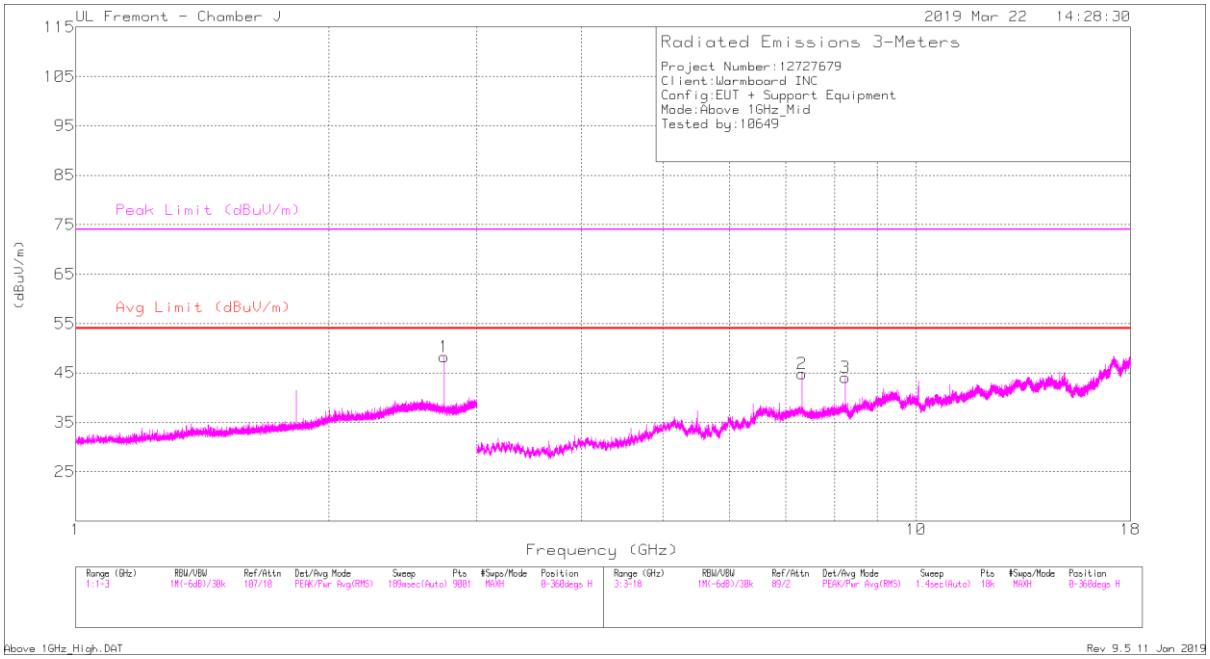
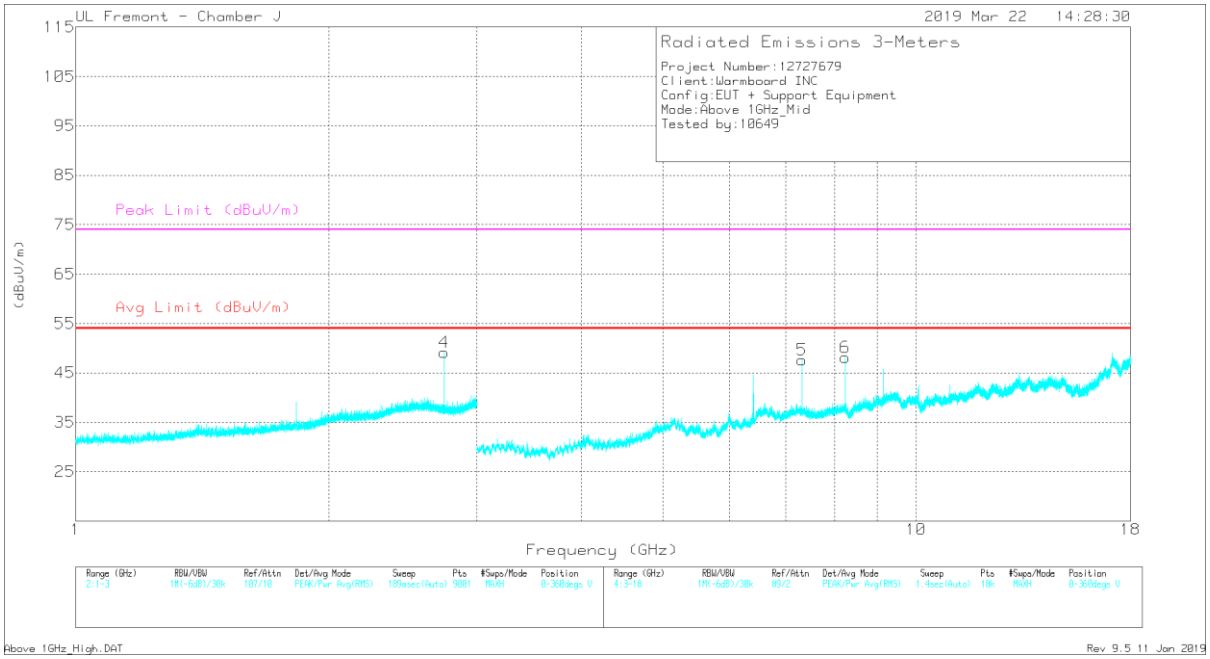
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	DC Corr (dB)	Filter PRE0182423 (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.744	46.76	PK2	29.4	-25.5	0	1	51.66	-	-	74	-22.34	26	103	H
	* 2.745	38.6	MAv1	29.4	-25.5	0.45	1	43.95	54	-10.05	-	-	26	103	H
4	* 2.745	47.31	PK2	29.4	-25.5	0	1	52.21	-	-	74	-21.79	117	136	V
	* 2.745	40.41	MAv1	29.4	-25.5	0.45	1	45.76	54	-8.24	-	-	117	136	V
2	* 7.319	38.86	PK2	38	-27.5	0	1	50.36	-	-	74	-23.64	72	120	H
	* 7.319	28.12	MAv1	38	-27.5	0.45	1	40.07	54	-13.93	-	-	72	120	H
3	* 8.233	37.03	PK2	38.4	-26.6	0	1	49.83	-	-	74	-24.17	60	105	H
	* 8.235	27.01	MAv1	38.4	-26.6	0.45	1	40.26	54	-13.74	-	-	60	105	H
5	* 7.319	40.41	PK2	38	-27.5	0	1	51.91	-	-	74	-22.09	98	131	V
	* 7.319	29.19	MAv1	38	-27.5	0.45	1	41.14	54	-12.86	-	-	98	131	V
6	* 8.235	39.41	PK2	38.4	-26.6	0	1	52.21	-	-	74	-21.79	82	144	V
	* 8.235	27.85	MAv1	38.4	-26.6	0.45	1	41.1	54	-12.9	-	-	82	144	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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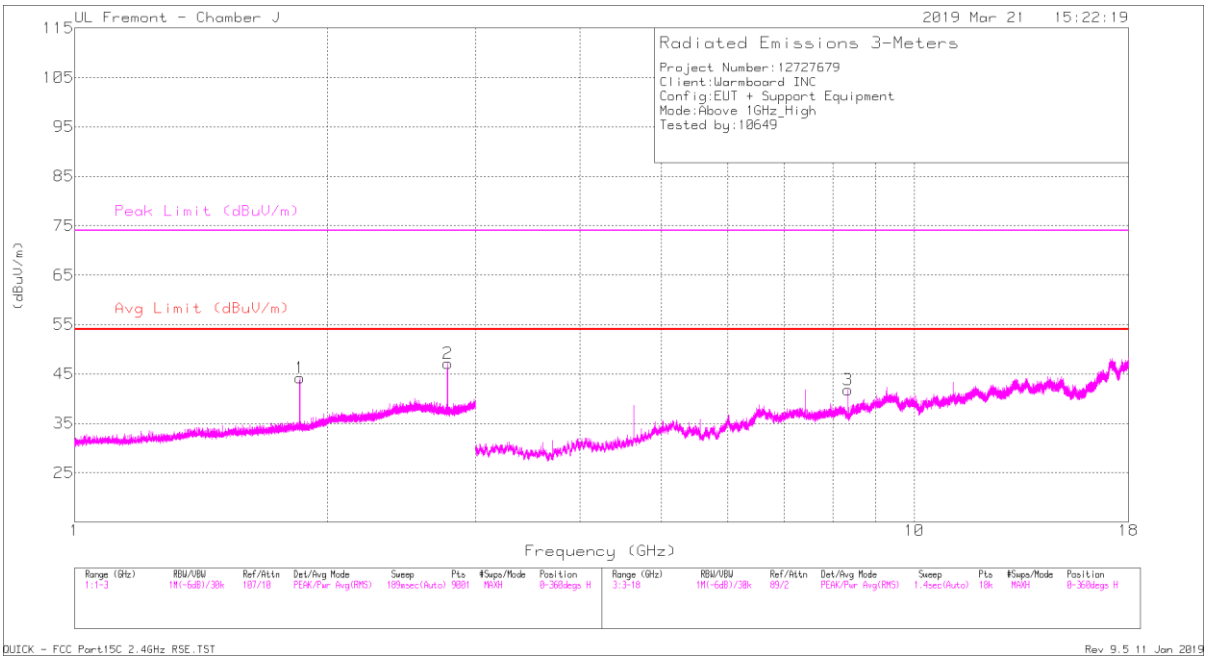
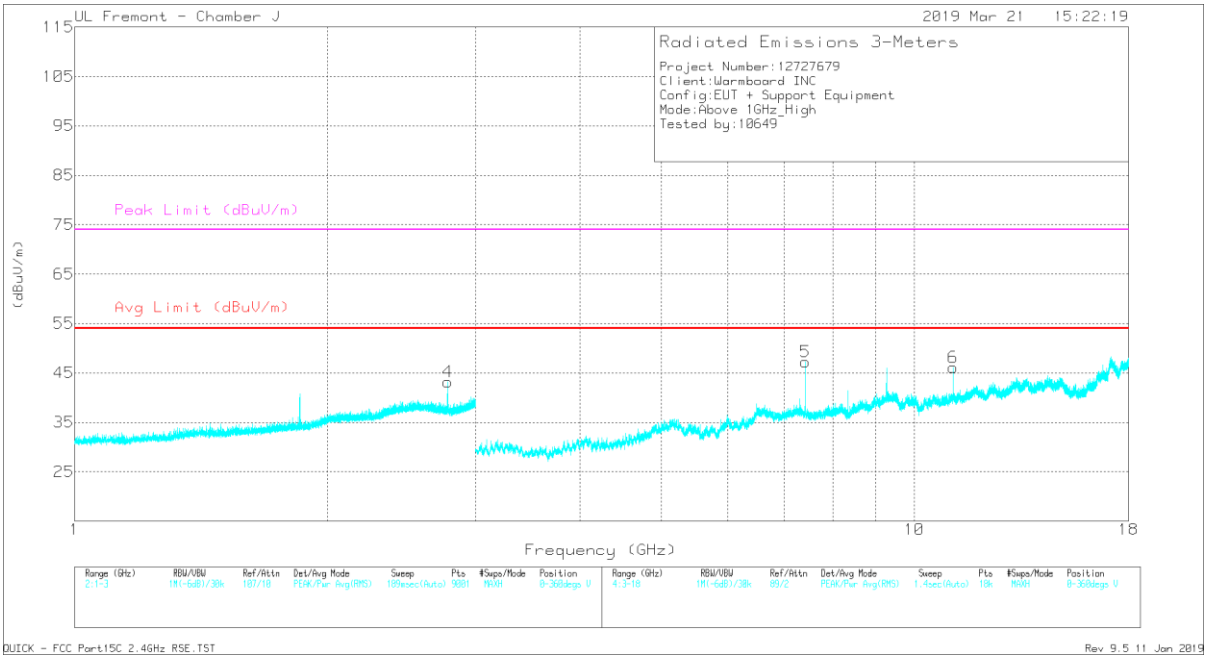
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	DC Corr (dB)	Filter PRE0182423 (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.854	47.41	PK2	26.5	-26.1	0	1	48.81	-	-	-	-	86	148	H
2	* 2.781	46.84	PK2	29.3	-25.5	0	1	51.64	-	-	74	-22.36	104	124	H
	* 2.781	37.8	MAv1	29.3	-25.5	0.45	1	43.05	54	-10.95	-	-	104	124	H
4	* 2.78	46.93	PK2	29.3	-25.5	0	1	51.73	-	-	74	-22.27	185	103	V
	* 2.781	38.23	MAv1	29.3	-25.5	.45	1	43.48	54	-10.52	-	-	185	103	V
3	* 8.343	36.15	PK2	37.7	-26.5	0	1	48.35	-	-	74	-25.65	36	102	H
	* 8.343	25.92	MAv1	37.7	-26.5	0.45	1	38.57	54	-15.43	-	-	36	102	H
5	* 7.416	40.75	PK2	37.7	-27.6	0	1	51.85	-	-	74	-22.15	110	253	V
	* 7.415	28.47	MAv1	37.7	-27.6	.45	1	40.02	54	-13.98	-	-	110	253	V
6	* 11.127	35.31	PK2	39.1	-23.3	0	1	52.11	-	-	74	-21.89	165	169	V
	* 11.124	24.8	MAv1	39.1	-23.3	.45	1	42.05	54	-11.95	-	-	165	169	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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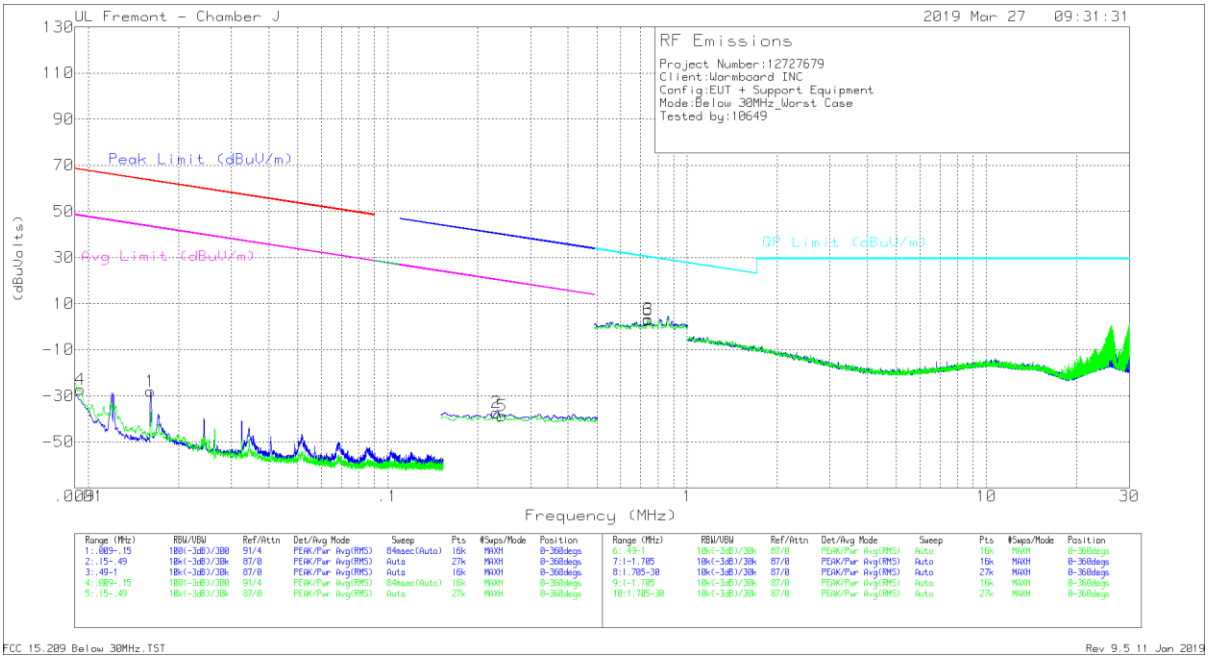
9.4. WORST CASE BELOW 30MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01615	21.06	Pk	59.5	-28.5	-80	-27.94	63.42	-91.36	43.42	-71.36	-	-	-	-	0-360
2	.23104	14.91	Pk	56.3	-28.5	-80	-37.29	-	-	-	-	40.34	-77.63	20.34	-57.63	0-360
4	.00939	20.46	Pk	60.9	-28.5	-80	-27.14	68.13	-95.27	48.13	-75.27	-	-	-	-	0-360
5	.24042	13.66	Pk	56.3	-28.5	-80	-38.54	-	-	-	-	40	-78.54	20	-58.54	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.74144	15.35	Pk	56.3	-28.5	-40	3.15	30.21	-27.06	0-360
6	.74144	15.16	Pk	56.3	-28.5	-40	2.96	30.21	-27.25	0-360

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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 C63.10.

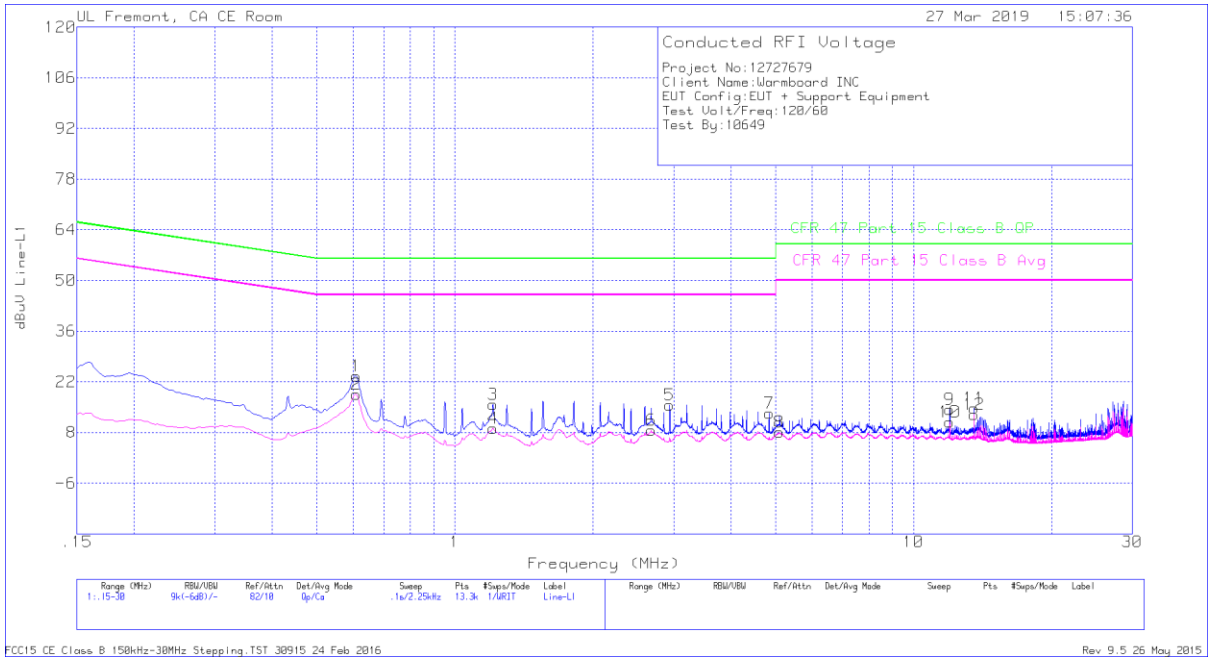
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

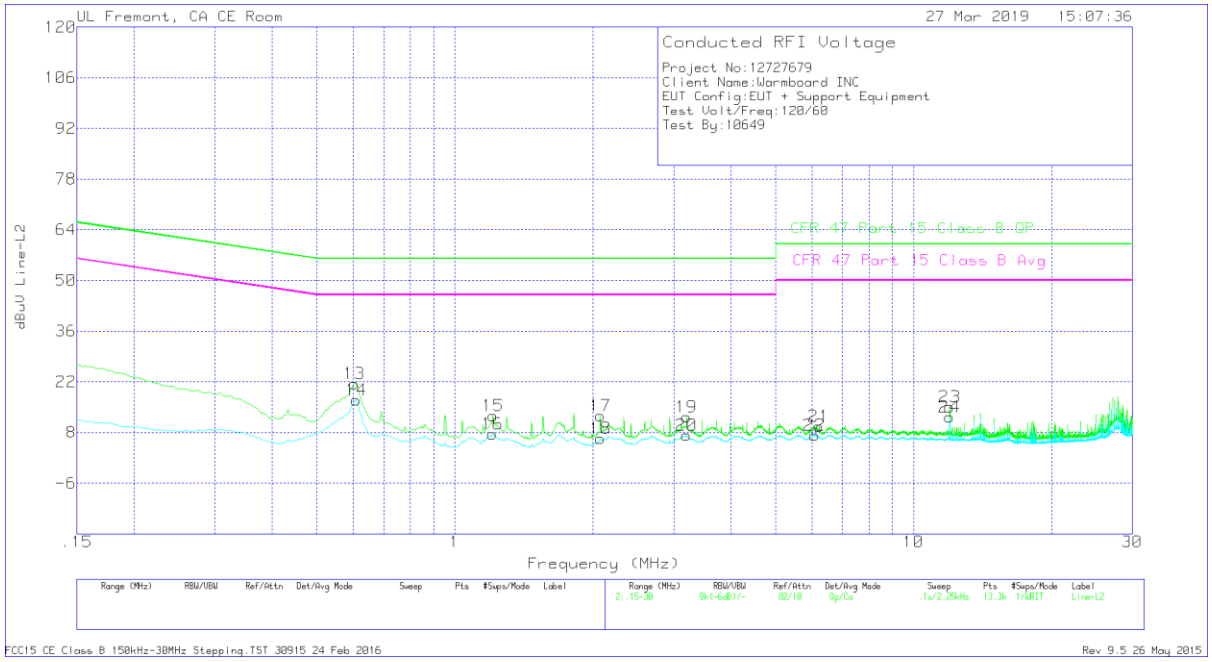
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.609	13.48	Qp	0	0	10.1	23.58	56	-32.42	-	-
2	.609	8.49	Ca	0	0	10.1	18.59	-	-	46	-27.41
3	1.212	5.62	Qp	0	.1	10.1	15.82	56	-40.18	-	-
4	1.212	-1.02	Ca	0	.1	10.1	9.18	-	-	46	-36.82
5	2.94225	5.43	Qp	0	.1	10.1	15.63	56	-40.37	-	-
6	2.68125	-1.61	Ca	0	.1	10.1	8.59	-	-	46	-37.41
7	4.84575	3.13	Qp	0	.1	10.1	13.33	56	-42.67	-	-
8	5.1045	-2.07	Ca	0	.1	10.1	8.13	-	-	50	-41.87
9	12.00075	3.87	Qp	.1	.2	10.2	14.37	60	-45.63	-	-
10	12.00075	.35	Ca	.1	.2	10.2	10.85	-	-	50	-39.15
11	13.56	4.27	Qp	.1	.2	10.2	14.77	60	-45.23	-	-
12	13.56	2.47	Ca	.1	.2	10.2	12.97	-	-	50	-37.03

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.6045	11.39	Qp	0	0	10.1	21.49	56	-34.51	-	-
14	.609	6.81	Ca	0	0	10.1	16.91	-	-	46	-29.09
15	1.212	2.44	Qp	0	.1	10.1	12.64	56	-43.36	-	-
16	1.20975	-2.57	Ca	0	.1	10.1	7.63	-	-	46	-38.37
17	2.076	2.4	Qp	0	.1	10.1	12.6	56	-43.4	-	-
18	2.076	-3.8	Ca	0	.1	10.1	6.4	-	-	46	-39.6
19	3.201	2	Qp	0	.1	10.1	12.2	56	-43.8	-	-
20	3.201	-2.97	Ca	0	.1	10.1	7.23	-	-	46	-38.77
21	6.2295	-.68	Qp	0	.2	10.2	9.72	60	-50.28	-	-
22	6.0765	-3.18	Ca	0	.2	10.2	7.22	-	-	50	-42.78
23	12.00075	4.51	Qp	.1	.2	10.2	15.01	60	-44.99	-	-
24	12.00075	1.82	Ca	.1	.2	10.2	12.32	-	-	50	-37.68

Qp - Quasi-Peak detector
Ca - CISPR average detection