Radio Frequency

TEST REPORT

Report No.: 180300165TWN-001
Model No.: #7447,#7447-CN, #7447-US, #7447-USK, #7447-K,#7447-LG, 620381, 1617861, 7447-W85-A
Issued Date: Mar. 23, 2018

Applicant: GENIUS TOY TAIWAN CO.,LTD
7F-2,No.406,TAIWAN BLVD. SEC. 2, TAICHUNG TAIWAN

Test Method/ Standard: 47 CFR FCC Part 15.249 & ANSI C63.10 2013

Test Site: 960839

Test By: Intertek Testing Services Taiwan Ltd.
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
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Testing Laboratory
0597

The test report was prepared by: Candy Liu

Candy Liu/ Assistant

These measurements were taken by: Durant Wei

Durant Wei/ Engineer

The test report was reviewed by: Rico Deng

Name Rico Deng
Title Supervisor

Revision History

Report No.	Issue Date	Revision Summary
180300165TWN-001	Mar. 23, 2018	Original report

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Summary of Tests

Test	Reference	Results
20dB Bandwidth	15.215(c)	Pass
Radiated Emission test	15.249(c), 15.209	Pass
Emission on the Band Edge	15.249(d)	Pass
Conducted Emission of AC Power	15.207	N/A
Antenna Requirement	15.203	Pass

1. General information

1.1 Identification of the EUT

Product:	Remote-Control Machines: Farm Vehicle-Remote control Unit
Model No.:	#7447-US
Frequency Range:	2440MHz, 2467MHz, 2477MHz
Channel Number:	3 Channels
Type of Modulation:	RF
Rated Power:	DC 3 V from battery
Power Cord:	N/A
Sample Received:	Feb. 09, 2018
Sample condition:	Workable
Test Date(s):	Feb. 12, 2018 ~ Mar. 08, 2018

Note 1: The test report only allows to be revised within three years from its original issued date unless further standard or the requirement was noticed.
Note 2: When determining the test conclusion, the Measurement Uncertainty of test has been considered.
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1.2 Description of EUT

The EUT is a Remote-Control Machines: Farm Vehicle-Remote control Unit, and was defined as information technology equipment.

#7447,#7447-CN, #7447-USK, #7447-K,#7447-LG, 620381, 1617861, 7447-W85-B are identical in cosmetics, electrical, mechanical and physical design, including software/firmware with previous Model no. #7447-US except the item numbers which depend on different countries for the buyers and packaging.
For more detail features, please refer to user's Manual.

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain:	0 dBi
Antenna Type:	Monopole Antenna
Connector Type:	Fixed

1.4 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Description of Data Cable
Battery 1.5V × 2	Panasonic	AA	N/A	N/A

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Paragraph 15.249 for non-spread spectrum devices.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT is supplied with DC 3 V from battery.

TX-MODE: Press EUT button to change different channel.

The signal is maximized through rotation and placement in the three orthogonal axes.

X axis

Y axis

Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at X axis. The final test data was executed under this configuration.

3. 20dB Bandwidth test

3.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure:	1008	hPa

3.2 Test setup & procedure

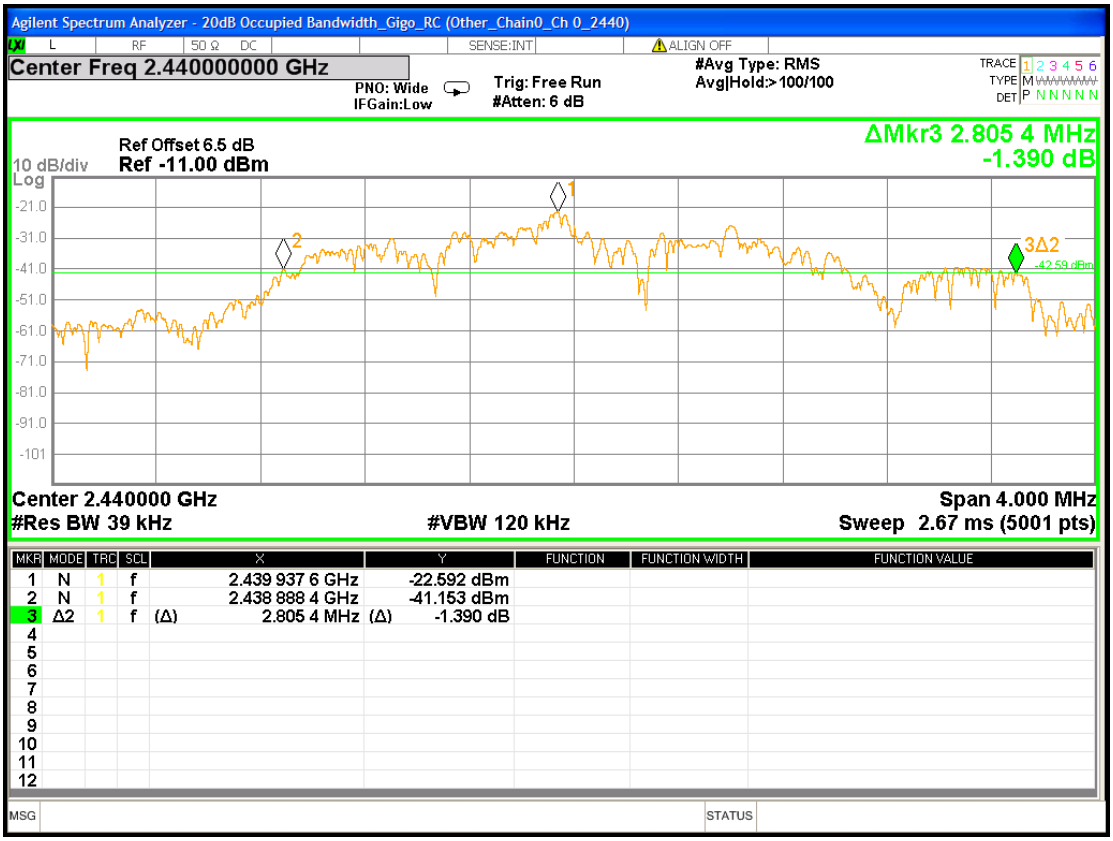
Step 1: The 20dB bandwidth was measured using a 50 ohm spectrum analyzer
Step 2: The span range for the SA display shall be between two times and five times the OBW.
Step 3: The nominal IF filter bandwidth (3 dB RBW) should be approximately 1 % to 5 % of the OBW, unless otherwise specified, depending on the applicable requirement.
Step 4: The test was performed at 3 channels (lowest, middle and highest channel). The maximum 20dB modulation bandwidth is in the following Table.

3.3 Measured data of modulated bandwidth test results

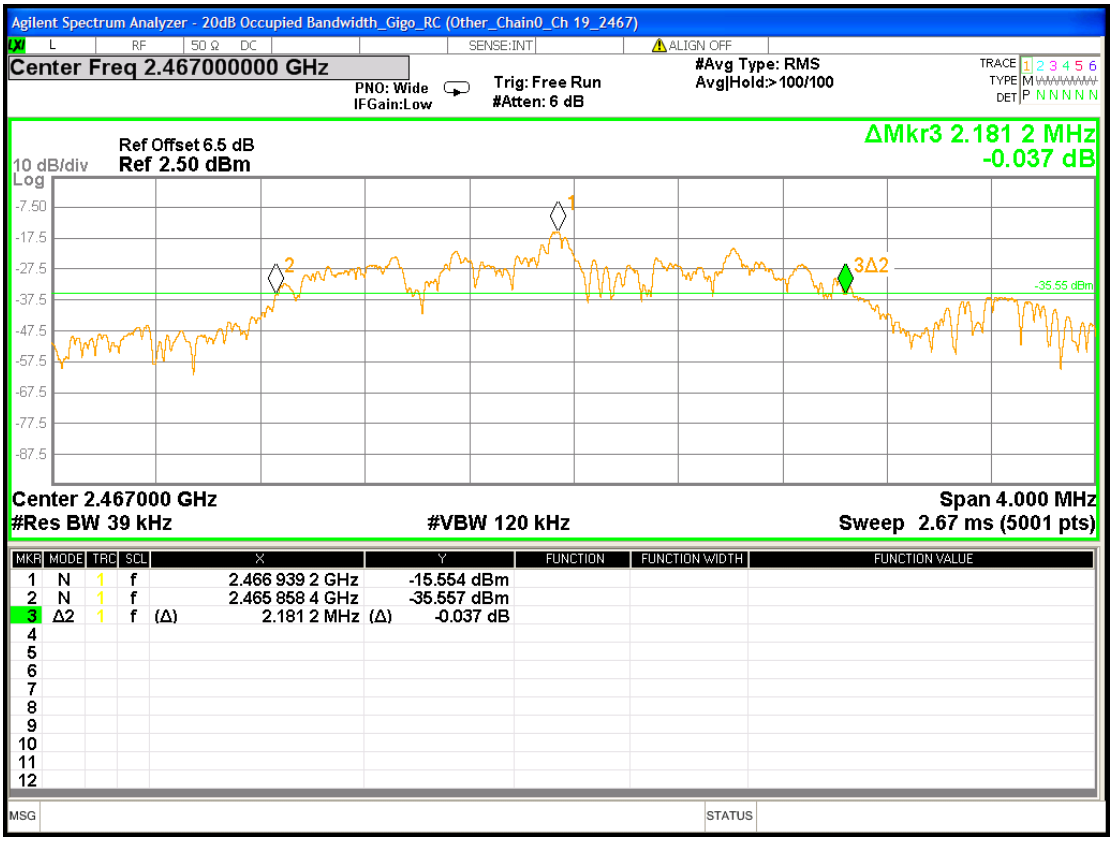
Mode	Frequency (MHz)	20dB Occupied Bandwidth (MHz)
RF	2440	2.8054
	2467	2.1812
	2477	2.1744

Please see the plot below.

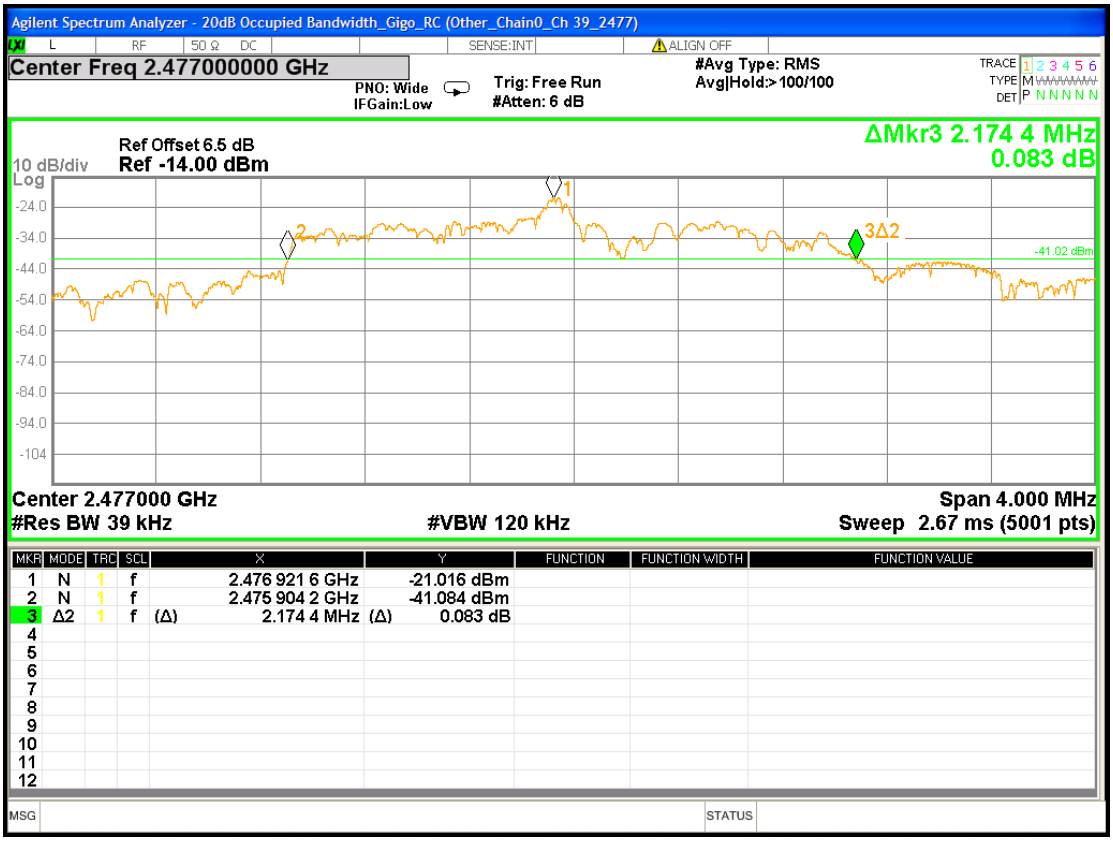
Chain0 : 20dB Bandwidth @ Channel Low



Chain0 : 20dB Bandwidth @ Channel Mid



Chain0 : 20dB Bandwidth @ Channel High



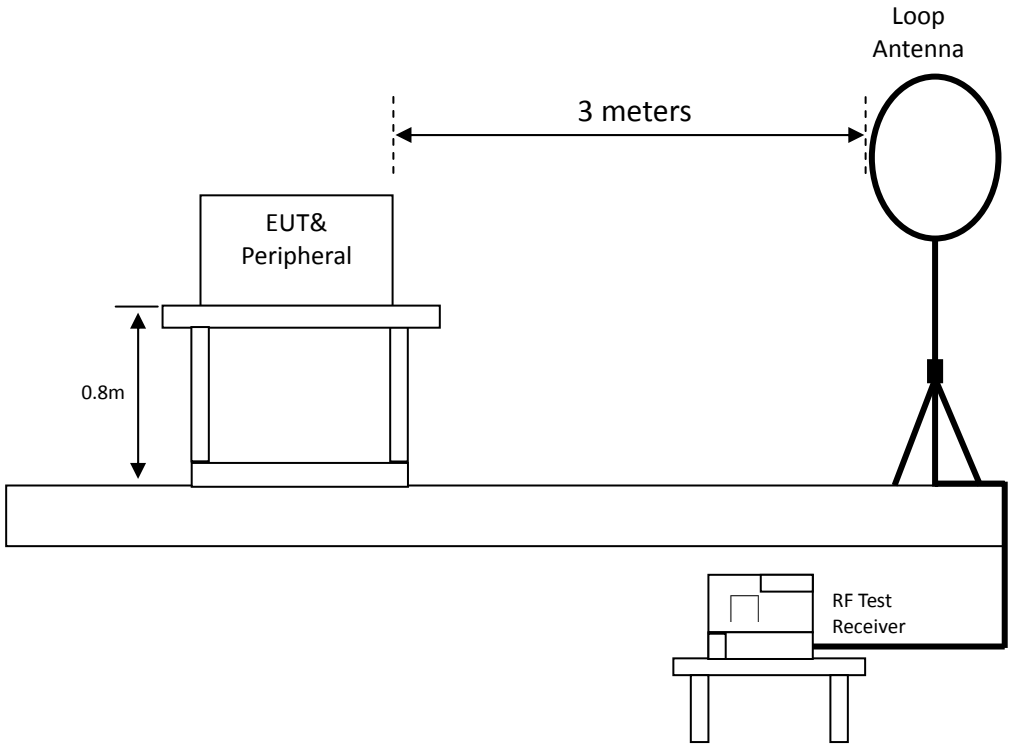
4. Radiated emission test FCC 15.249 (C)

4.1 Operating environment

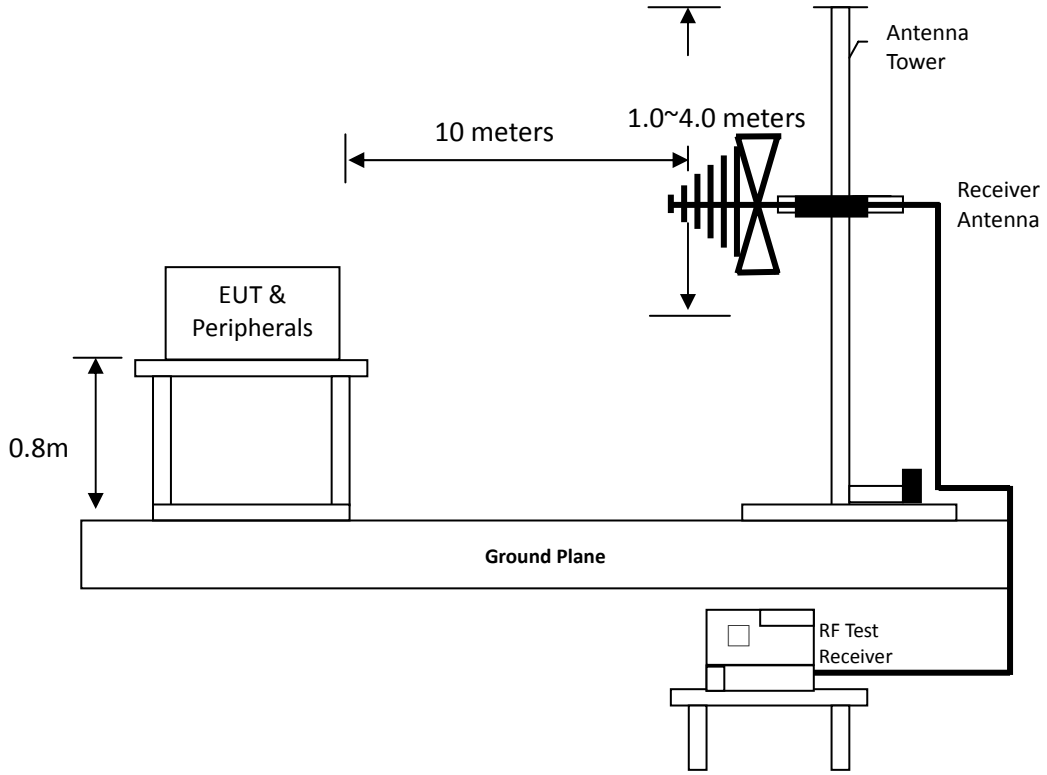
Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure:	1008	hPa

4.2 Test setup & procedure

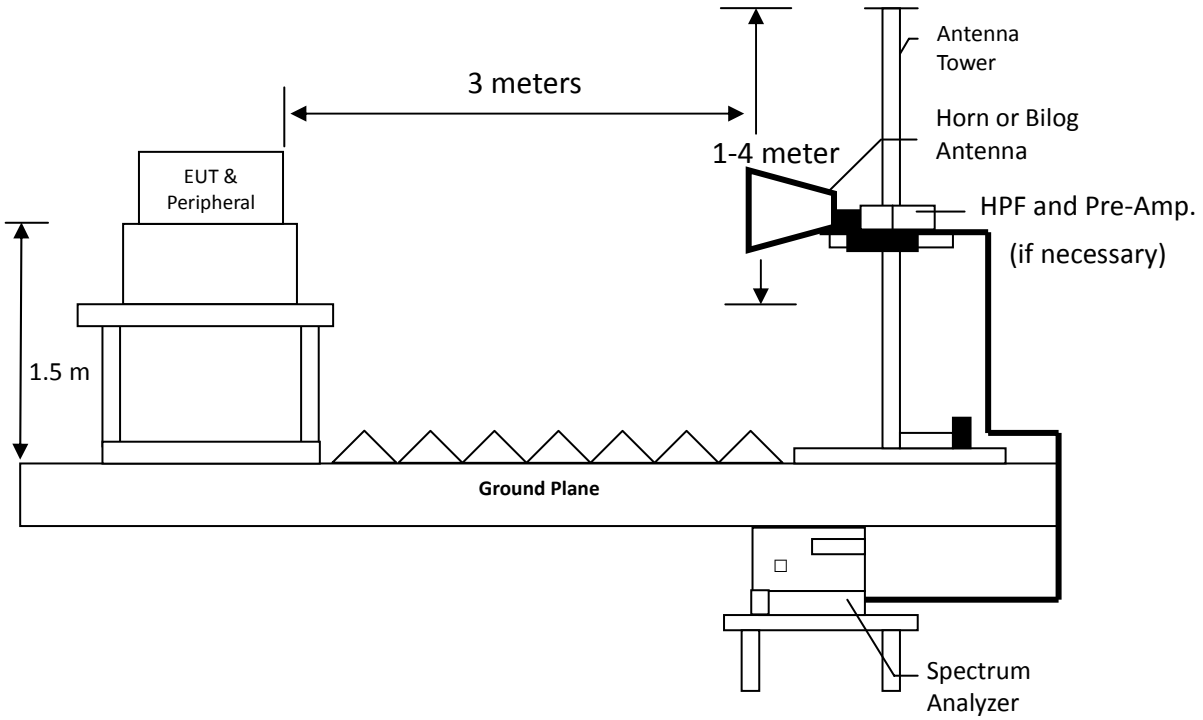
Radiated emission from 9kHz to 30MHz uses Loop Antenna:



Radiated emission below 1GHz using Bilog Antenna



Radiated emission above 1GHz using Horn Antenna



Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1 MHz RBW/ 3 MHz VBW) recorded also on the report.
The EUT for testing is arranged on a turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The EUT configuration please refers to the “Spurious set-up photo.pdf”.

4.3 Emission limit

4.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(mV/m@3m)	(dBuV/m@3m)	(uV/m@3m)	(dBuV/m@3m)
2400-2483.5	50	94	500	54

4.3.2 General radiated emission limits

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

Frequency MHz	15.209 Limits (dBμV/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

4.4 Radiated spurious emission test data

4.4.1 Measurement results: frequency range from 9 kHz to 30 MHz

Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBμV)	Calculated level (dBμV/m)	Limit @ 3m (dBμV/m)	Margin (dB)
0.02	PK	20.29	21.56	41.85	121.58	-79.73
0.03	PK	20.41	23.45	43.86	118.06	-74.20
0.07	PK	19.55	25.91	45.46	110.70	-65.24
0.10	QP	19.17	25.06	44.23	107.60	-63.37
0.12	PK	19.11	22.39	41.50	106.02	-64.52
0.13	PK	19.10	19.81	38.92	105.33	-66.41
0.15	PK	19.09	28.50	47.59	104.08	-56.49
0.45	PK	18.95	24.48	43.42	94.54	-51.12
0.69	QP	18.99	19.70	38.69	70.83	-32.14
1.16	QP	19.07	15.47	34.54	66.32	-31.78
2.12	QP	18.84	15.75	34.59	69.54	-34.95
5.05	QP	20.34	9.69	30.03	69.54	-39.51

4.4.2 Measurement results: frequencies equal to or less than 1 GHz

The test was performed on EUT under RF mode. The worst case occurred at RF mode at Middle channel

EUT: #7447-US
Worst case: 2467MHz, X-axis

Antenna Polarized (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
V	59.10	QP	19.50	0.11	19.62	40.00	-20.38
V	134.76	QP	19.67	0.85	20.52	43.50	-22.98
V	150.28	QP	20.55	0.39	20.94	43.50	-22.56
V	169.68	QP	20.56	4.53	25.09	43.50	-18.41
V	175.50	QP	19.74	6.21	25.95	43.50	-17.55
V	730.34	QP	31.21	4.04	35.25	46.00	-10.75
H	30.00	QP	19.14	1.60	20.74	40.00	-19.26
H	171.62	QP	20.32	15.99	36.31	43.50	-7.19
H	258.92	QP	20.28	2.93	23.22	46.00	-22.78
H	450.98	QP	25.89	1.09	26.98	46.00	-19.02
H	619.76	QP	29.40	2.21	31.61	46.00	-14.39
H	730.34	QP	31.21	3.21	34.41	46.00	-11.59

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

4.4.3 Measurement results: frequency above 1GHz

EUT : #7447-US

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Corr. Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dB)
Channel Low 2440MHz	2321	PK	V	35.01	15.95	50.96	74.00	-23.04
	2385	PK	V	35.04	18.56	53.60	74.00	-20.40
	2385	AV	V	35.04	3.06	38.10	54.00	-15.90
	2420	PK	V	35.06	19.55	54.61	74.00	-19.39
	2420	AV	V	35.06	3.87	38.93	54.00	-15.07
	2428	PK	V	35.06	24.85	59.92	74.00	-14.08
	2428	AV	V	35.06	4.01	39.07	54.00	-14.93
	2472	PK	V	35.09	21.18	56.27	74.00	-17.73
	2472	AV	V	35.09	4.35	39.44	54.00	-14.56
	4880	PK	V	6.04	46.84	52.88	74.00	-21.12
	7320	PK	V	12.75	48.34	61.10	74.00	-12.90
	7320	AV	V	12.75	23.47	36.22	54.00	-17.78
	9760	PK	V	16.73	32.16	48.89	74.00	-25.11
	2460	PK	H	35.08	17.95	53.03	74.00	-20.97
	2476	PK	H	35.09	18.17	53.25	74.00	-20.75
	4880	PK	H	6.04	47.38	53.42	74.00	-20.58
	7320	PK	H	12.75	48.33	61.09	74.00	-12.91
	7320	AV	H	12.75	23.39	36.14	54.00	-17.86
	9760	PK	H	16.73	31.01	47.74	74.00	-26.26

Remark:

1. Correction Factor = Antenna Factor + Cable Loss– Preamp. Gain
2. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

EUT : #7447-US

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Corr. Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3m (dBμV/m)	Margin (dB)
Channel Mid 2467MHz	2324	PK	V	35.01	16.88	51.89	74.00	-22.11
	2440	PK	V	35.07	15.91	50.98	74.00	-23.02
	2504	PK	V	35.11	17.71	52.82	74.00	-21.18
	2536	PK	V	35.22	16.67	51.89	74.00	-22.11
	4934	PK	V	6.24	49.24	55.49	74.00	-18.51
	4934	AV	V	6.24	24.09	30.33	54.00	-23.67
	7401	PK	V	13.03	45.50	58.54	74.00	-15.46
	7401	AV	V	13.03	22.23	35.26	54.00	-18.74
	9870	PK	V	17.10	31.66	48.76	74.00	-25.24
	2440	PK	H	35.07	15.49	50.56	74.00	-23.44
	2488	PK	H	35.09	21.77	56.86	74.00	-17.14
	2488	AV	H	35.09	4.39	39.48	54.00	-14.52
	2504	PK	H	35.11	19.31	54.43	74.00	-19.57
	2504	AV	H	35.11	4.21	39.32	54.00	-14.68
	4934	PK	H	6.24	49.36	55.60	74.00	-18.40
	4934	AV	H	6.24	27.23	33.47	54.00	-20.53
	7401	PK	H	13.03	44.17	57.20	74.00	-16.80
	7401	AV	H	13.03	21.91	34.94	54.00	-19.06
	9870	PK	H	17.10	29.80	46.89	74.00	-27.11

Remark:

1. Correction Factor = Antenna Factor + Cable Loss– Preamp. Gain
2. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

EUT : #7447-US

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Corr. Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3m (dBμV/m)	Margin (dB)
Channel High 2477MHz	2320	PK	V	35.01	16.17	51.18	74.00	-22.82
	2372	PK	V	35.03	16.93	51.96	74.00	-22.04
	2400	PK	V	35.05	21.92	56.97	74.00	-17.03
	2400	AV	V	35.05	4.04	39.09	54.00	-14.91
	2416	PK	V	35.06	18.41	53.47	74.00	-20.53
	2444	PK	V	35.07	19.68	54.75	74.00	-19.25
	2444	AV	V	35.07	4.20	39.27	54.00	-14.73
	2460	PK	V	35.08	20.36	55.44	74.00	-18.56
	2460	AV	V	35.08	4.25	39.33	54.00	-14.67
	2512	PK	V	35.14	17.88	53.02	74.00	-20.98
	4954	PK	V	6.32	43.80	50.12	74.00	-23.88
	7431	PK	V	13.14	38.52	51.65	74.00	-22.35
	2400	PK	H	35.05	19.01	54.06	74.00	-19.94
	2400	AV	H	35.05	4.09	39.14	54.00	-14.86
	2448	PK	H	35.07	19.05	54.12	74.00	-19.88
	2448	AV	H	35.07	4.14	39.21	54.00	-14.79
	2512	PK	H	35.14	13.00	48.14	74.00	-25.86
	4954	PK	H	6.32	46.28	52.60	74.00	-21.40
	7431	PK	H	13.14	44.53	57.67	74.00	-16.33
	7431	AV	H	13.14	22.41	35.55	54.00	-18.45

Remark:

1. Correction Factor = Antenna Factor + Cable Loss– Preamp. Gain
2. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

4.4.4 Measurement results: Fundamental and harmonics emission

EUT : #7447-US

Mode	Frequency (MHz)	Spectrum Analyzer	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
Channel Low 2440MHz	2440	PK	V	35.07	61	96.07	114	-17.93
	2440	AV	V	35.07	6.44	41.51	94	-52.49
	2440	PK	H	35.07	59.62	94.68	114	-19.32
	2440	AV	H	35.07	6.60	41.67	94	-52.33
Channel Mid 2467MHz	2467	PK	V	35.08	61.08	96.16	114	-17.84
	2467	AV	V	35.08	6.36	41.44	94	-52.56
	2467	PK	H	35.08	60.05	95.13	114	-18.87
	2467	AV	H	35.08	6.31	41.39	94	-52.61
Channel High 2477MHz	2477	PK	V	35.09	60.96	96.05	114	-17.95
	2477	AV	V	35.09	6.42	41.51	94	-52.49
	2477	PK	H	35.09	59.72	94.81	114	-19.19
	2477	AV	H	35.09	5.89	40.98	94	-53.02

Remark:

1. Correction Factor = Antenna Factor + Cable Loss– Preamp. Gain
2. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

5. Radiated emission on the band edge FCC 15.249(d)

5.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure:	1008	hPa

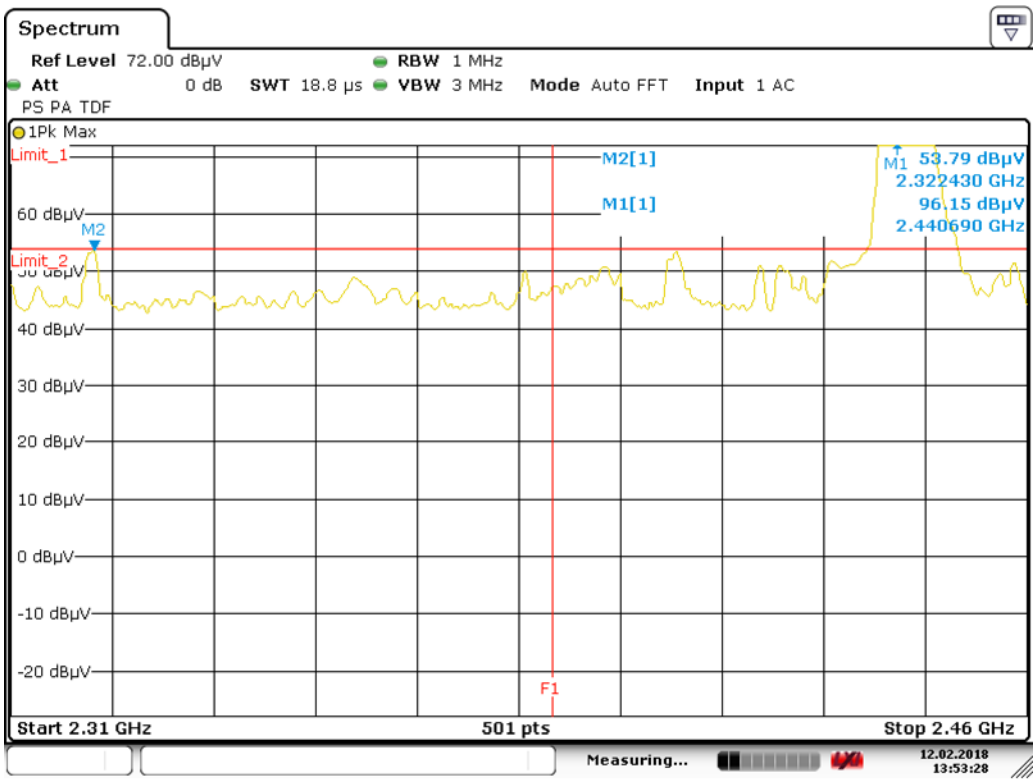
5.2 Radiated emission on the band edge test data

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental (2440~2477MHz) or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
RF	2322.43	PK	V	35.46	18.33	53.79	74	-20.21	2310~2390
	2390.00	AV	V	35.36	-3.18	32.18	54	-21.82	
	2483.50	PK	V	35.23	20.19	55.42	74	-18.58	2483.5~2500
	2491.02	AV	V	35.21	-2.57	32.64	54	-21.36	

Remark: Correction Factor = Antenna Factor + Cable Loss

Chain0 : Bandedge @ mode Ch Low Peak



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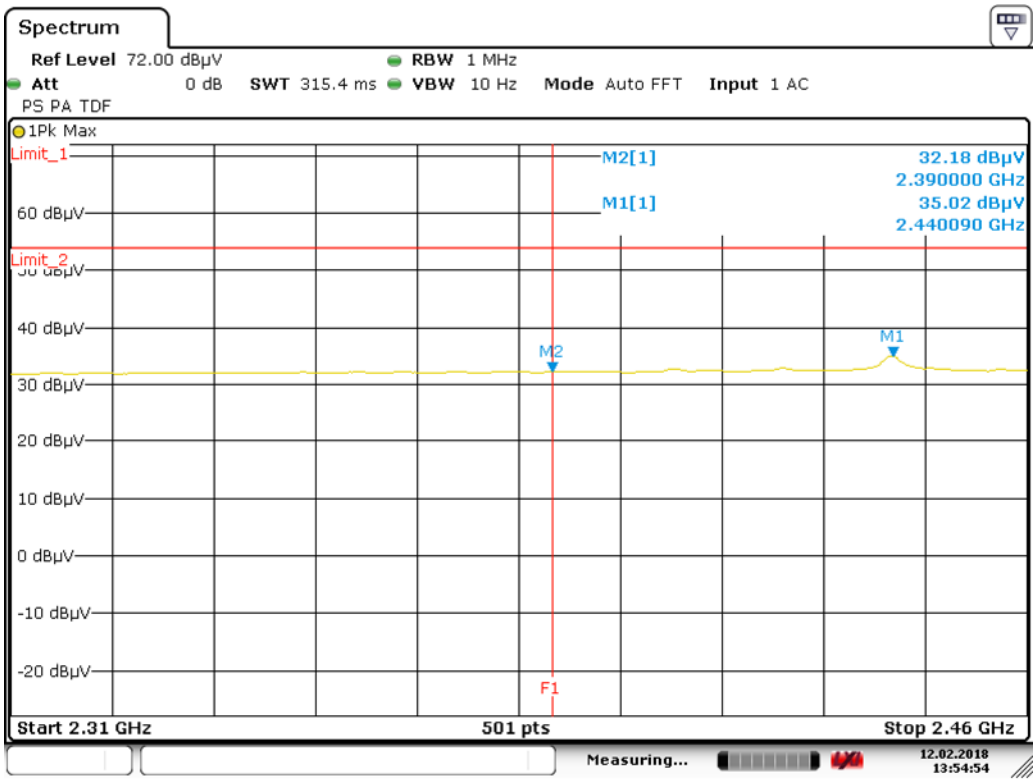
Chain0 : Bandedge @ mode Ch Low Average



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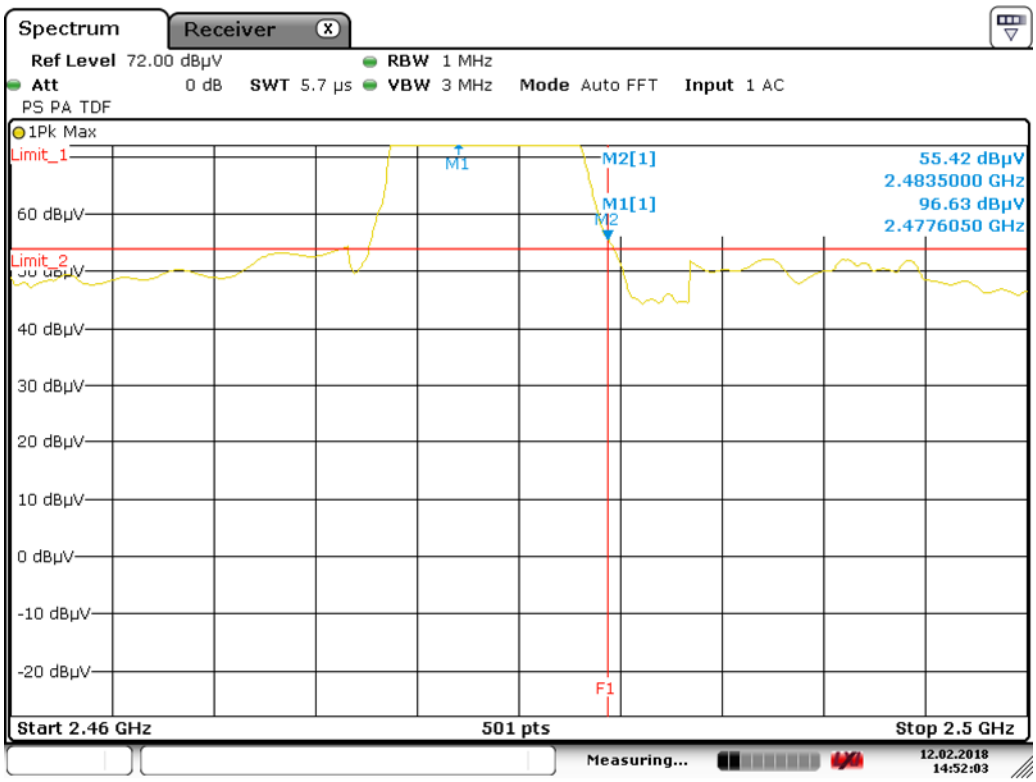

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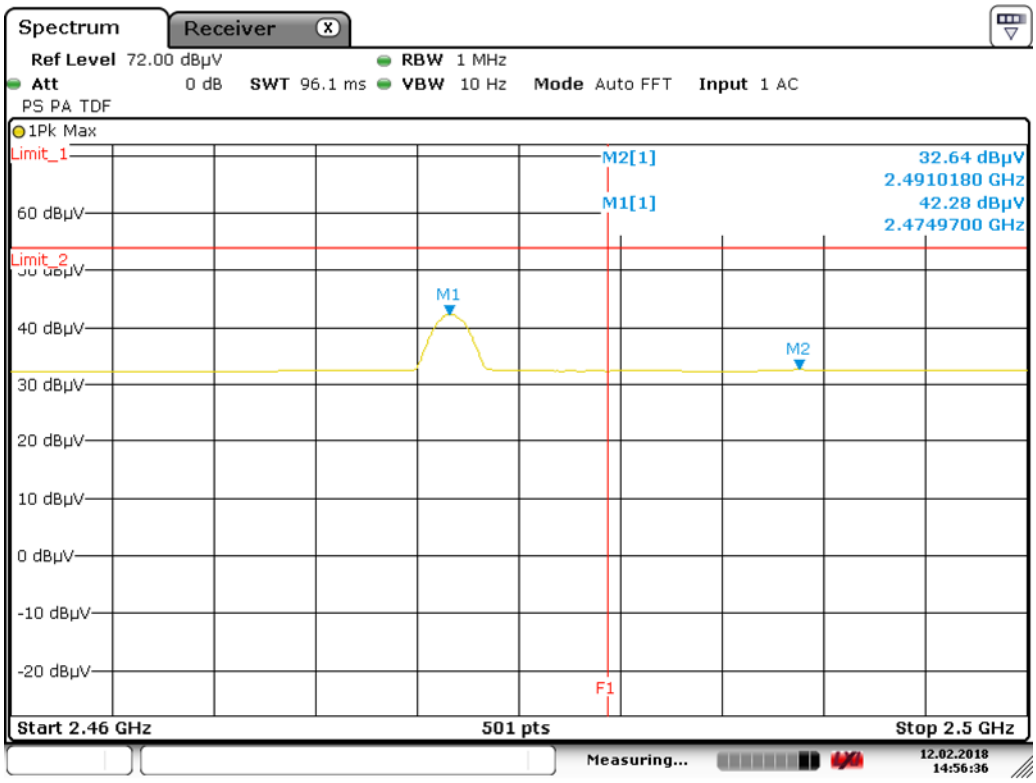
Chain0 : Bandedge @ mode Ch High Average



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6. Conducted emission test FCC 15.207

Since the EUT is connected to DC source, therefore, the test can be waived.

Appendix A: Test equipment list

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
ESCI EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2017/11/21	2018/11/20
Spectrum Analyzer	Rohde & Schwarz	FSP30	100245	2018/02/23	2019/02/22
Horn Antenna (1-18G)	SHWARZBECK	BBHA 9120 D	9120D-456	2018/01/23	2019/01/22
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2017/09/04	2020/09/02
Broadband Antenna	SHWARZBECK	VULB 9168	9168-172	2017/04/05	2018/04/04
Pre-Amplifier	EMC Co.	EMC12635SE	980205	2017/11/28	2018/11/27
Pre-Amplifier	MITEQ	JS4-26004000--27-8A	828825	2017/08/23	2018/08/22
Power Meter	Anritsu	ML2495A	0844001	2017/10/18	2018/10/17
Power Sensor	Anritsu	MA2411B	0738452	2017/05/23	2018/05/22
Signal Analyzer	Agilent	N9030A	MY51380492	2017/08/29	2018/08/28
966-2(A) Cable 9kHz~26.5GHz	SUHNER	SMA / EX 100	N/A	2017/08/15	2018/08/14
966-2(B) Cable 9kHz~26.5GHz	SUHNER	SUCOFLEX 104P	CB0005	2017/08/15	2018/08/14
RF Cable 9kHz~26.5GHz	SUHNER	SUCOFLEX 102	CB0006	2017/05/04	2018/05/03
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2017/03/29	2018/03/28
High Pass Filter	Wainwright	WHKX3.0/ 18G-12SS	N/A	2017/06/02	2018/06/01
Active Loop Antenna	SCHWARZBECK MESS-ELEKTRONIC	FMZB1519	1519-067	2017/03/30	2018/03/29

Note: No Calibration Required (NCR).

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of *k*=2.

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.14 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.22 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.64 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.64 dB
Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	2.68 dB
Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	2.68 dB
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	3.54 dB
Emission on the Band Edge Test	3.64 dB
20dB Bandwidth	1.22 dB
AC Power Line Conducted Emission	2.48 dB