

Radio Test Report

TTC7-23

Audio/Video Codec (BTLE)

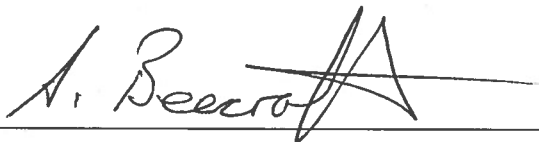
2400-2483.5 MHz

Against the following Specifications:

LP0002:2016 Section 2.8



Cisco Systems
170 West Tasman Drive
San Jose, CA 95134

	
Author: Allan Beecroft Tested By: Allan Beecroft/Jose Aguirre/Chris Blair	Approved By: Gerard Thorpe Title: Manager. MGMT-Engineering Revision: 2.0

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Section 1: Overview**1.1 Test Summary**

The samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

Specifications
LP0002:2016 Section 2.8

Section 2: Assessment Information

2.1 General

This report contains an assessment of an apparatus against Radio Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

- a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.
- b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.

c) All testing was performed under the following environmental conditions:

Temperature	15°C to 35°C (54°F to 95°F)
Atmospheric Pressure	860mbar to 1060mbar (25.4" to 31.3")
Humidity	10% to 75*%

1.All AC testing was performed at one or more of the following supply voltages:

220V 60Hz (+/-20%)

2.2 Units of Measurement

The units of measurements defined in the appendices are reported in specific terms, which are test dependent. Where radiated measurements are concerned these are defined at a particular distance. Basic voltage measurements are defined in units of [dBuV]

As an example, the basic calculation for all measurements is as follows:

Emission level [dBuV] = Indicated voltage level [dBuV] + Cable Loss [dB] + Other correction factors [dB]

The combinations of correction factors are dependent upon the exact test configurations [see test equipment lists for further details] and may include:-

Antenna Factors, Pre Amplifier Gain, LISN Loss, Pulse Limiter Loss and Filter Insertion Loss..

Note: to convert the results from dBuV/m to uV/m use the following formula:-

Level in uV/m = Common Antilogarithm [(X dBuV/m)/20] = Y uV/m

Measurement Uncertainty Values

voltage and power measurements	± 2 dB
conducted EIRP measurements	± 1.4 dB
radiated measurements	± 3.2 dB
frequency measurements	$\pm 2.4^{x10^{-7}}$
temperature measurements	$\pm 0.54^{\circ}\text{C}$
humidity measurements	$\pm 2.3\%$
DC and low frequency measurements	$\pm 2.5\%$

Where relevant measurement uncertainty levels have been estimated for tests performed on the apparatus. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Radiated emissions (expanded uncertainty, confidence interval 95%)

30 MHz - 300 MHz	+/- 3.8 dB
300 MHz - 1000 MHz	+/- 4.3 dB
1 GHz - 10 GHz	+/- 4.0 dB
10 GHz - 18GHz	+/- 8.2 dB
18GHz - 26.5GHz	+/- 4.1 dB
26.5GHz - 40GHz	+/- 3.9 dB

Conducted emissions (expanded uncertainty, confidence interval 95%)

30 MHz – 40GHz	+/- 0.38 dB
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A product is considered to comply with a requirement if the nominal measured value is below the limit line.
The product is considered to not be in compliance in case the nominal measured value is above the limit line.

2.3 Date of testing (initial sample receipt date to last date of testing)

08-May-2017 to 13-May-2017

2.4 Report Issue Date

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called Doc Central. The actual report issue date is embedded into the original file in Doc Central. Any copies of this report, either electronic or paper, that are not in Doc Central must be considered uncontrolled

2.5 Testing facilities

This assessment was performed by:

Testing Laboratory

Cisco Systems, Inc.
125 West Tasman Drive (Building P)
San Jose, CA 95134
USA

Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134
USA

Test Engineers

Test Engineers: Allan Beecroft, Jose Aguirre, Chris Blair

2.6 Equipment Assessed (EUT)

TTC7-23

2.7 EUT Description

The TTC7-23 and TTC7-23 have an Audio/Video codec (encoder/decoder) with a build-in camera and speakers for video-conferencing. The EUT is supplied with 12VDC power from an external AC/DC adapter. Operation of the EUT is via a Touch panel or cellphone. It supports Wifi (802.11a/b/g/n/ac 2.4GHz/5GHz, 2x2 MIMO) and Bluetooth 4.0.

The following antennas are supported by this product series.

The data included in this report represent the worst case data for all antennas.

Frequency	Antenna Type	Antenna Gain 1 (dBi)	Antenna Gain 2 (dBi)
2400	Internal	3.8	4.3
2450	Internal	3.3	4.0
2500	Internal	3.6	3.7

Section 3: Result Summary

3.1 Results Summary Table

Basic Standard	Technical Requirements			Result
LP0002:2016 Section 2.3	RF Voltage conducted back onto the AC power line:			Not Tested*
	Freq. (MHz)	Quasi Peak (dBμV)	Average (dBμV)	
	0.15-0.5	66-56	56-46	
	0.5-5	56	46	
	5-30	60	50	
LP0002:2016 Section 2.8	Field Strength Limits			Pass
		Frequency (MHz)	Field Strength (μV/m)	
	(at 3m)	30(inc.) - 88(inc.)	100	
	(at 3m)	88(exc.) – 216(inc.)	150	
	(at 3m)	216(exc.) – 960(inc.)	200	
	(at 3m)	Above 960(exc.)	500	
LP0002:2016 Section 3.10.1.2	Maximum Peak Output Power ≤ 1 W Exception for antenna directional gain > 6 dBi			Not Tested*
LP0002:2016 Section 3.10.1.3	Antenna Gain Limits For antenna directional gain > 6 dBi, reduced by 1 dB for every 3dB exceeds.			Not Tested*
LP0002:2016 Section 3.10.1.5	Out of Band Radiated Emission Limits > 20 dB below highest level in 100 kHz bandwidth or section 2.9 which has lesser attenuation			Not Tested*
LP0002:2016 Section 3.10.1.6 (2)	Digital Modulation Techniques Systems Minimum 6 dB bandwidth: ≥ 500 kHz Transmitter power spectral density (into the antenna): ≤ 8 dBm (in any 3 kHz band any time of continuous transmission) Processing Gain: > 10 dB			Not Tested*
*Radio module has previous approval. NCC ID: CCAJ15LP6160T6				

Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing.

4.1 Sample Details

Sample No.	Equipment Details	Manufacturer	Hardware Rev.	Firmware Rev.	Software Rev.	Serial Number
S01	TTC7-23	CISCO	G	N/A	s01828-1.3.0 59f36e3 2017-04-28 14:51:39 matchbox	FOC2101NPF4
S02	FSP070-AHAN2 AC/DC Adapter	FSP GROUP INC	A0	N/A	N/A	FST2047IAGX

4.2 System Details

System #	Description	Samples
1	EUT	S01, S02

4.3 Mode of Operation Details

Mode#	Description	Comments
1	TX BTLE	Continuous transmit mode. See Test Assessment Plan for full details.
2	Rx Mode	Receive only mode. See Test Assessment Plan for full details.

Appendix A: Test Results

Transmitter Radiated Spurious Emissions

Radiated Emissions 30MHz to 1GHz

LP0002:2016 (2.8) Additional regulations shall apply except for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Span:	30MHz – 1GHz
Reference Level:	70 dBuV
Attenuation:	10 dB
Sweep Time:	Coupled
Resolution Bandwidth:	100kHz
Video Bandwidth:	300kHz
Detector:	Peak for Pre-scan, Quasi-Peak
	Compliance shall be determined using CISPR quasi-peak detection

Antenna ports terminated in 50 Ohms.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

This report represents the worst case data for all supported operating modes and antennas.

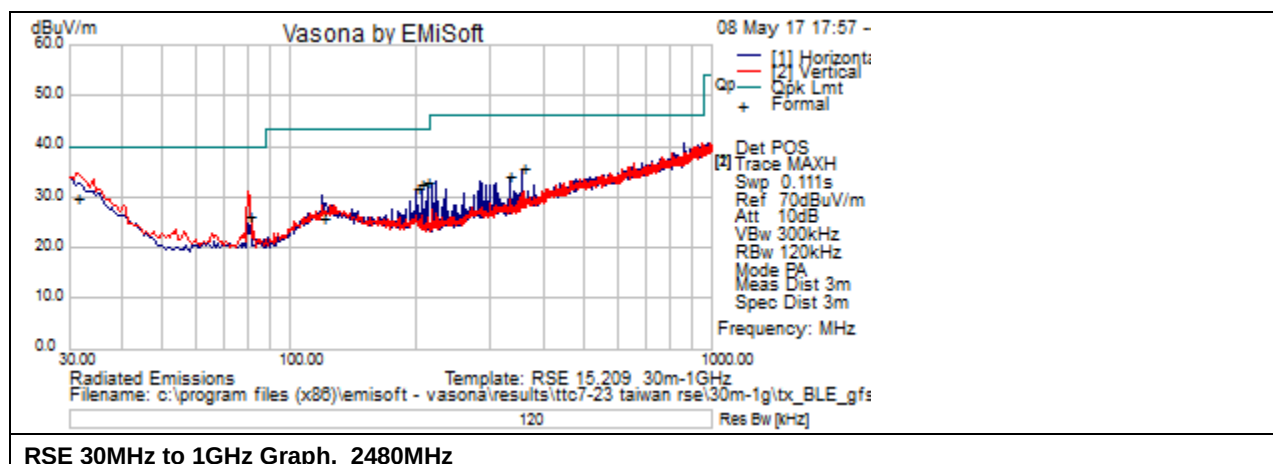
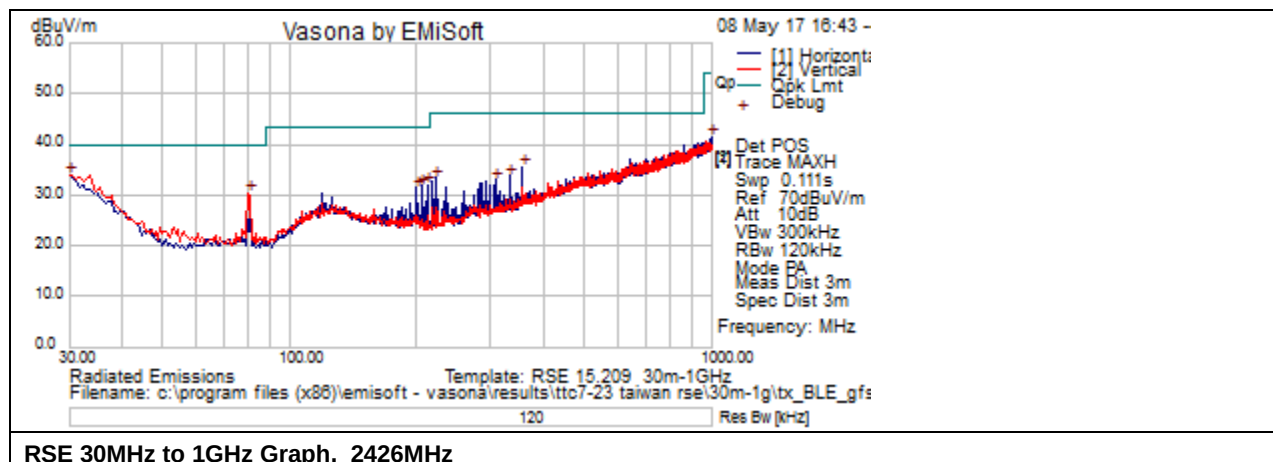
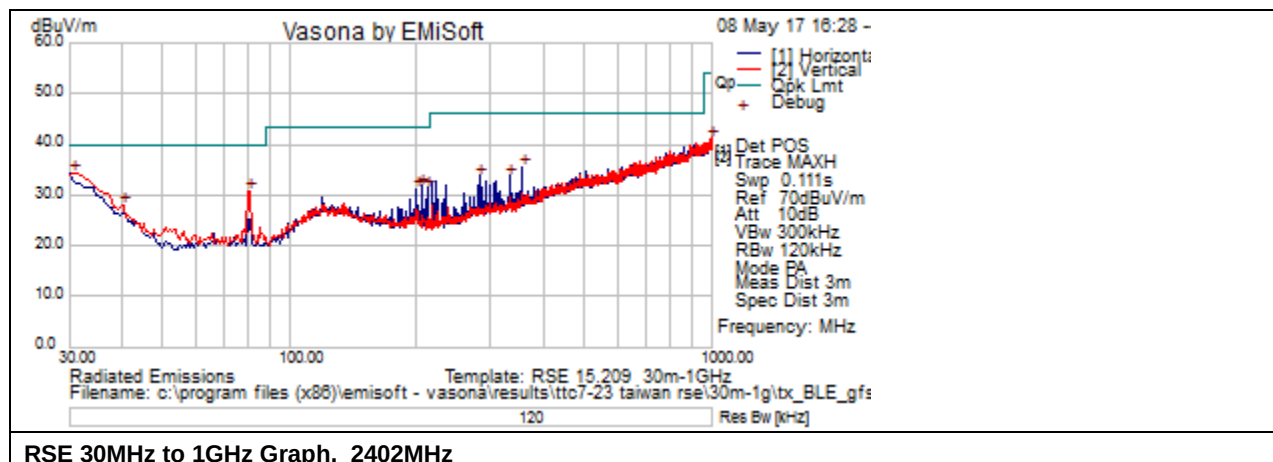
System Number	Description	Samples	System under test	Support equipment
1	EUT	S01, S02	✓	

Tested By : Jose Aguirre	Date of testing: 08-MAY-2017
Test Result : PASS	

See Appendix B for list of test equipment

Graphical Test Results

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Worst Case Test Results Table

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
31.2125	9.04	0.57	20.37	29.98	Quasi Max	V	106	191	40	-10.02	Pass
79.998	17.61	0.89	7.7	26.19	Quasi Max	V	167	79	40	-13.81	Pass
356.355	19.12	1.89	14.73	35.74	Quasi Max	H	103	320	46	-10.26	Pass
211.975	21.1	1.46	10.38	32.93	Quasi Max	H	154	170	43.5	-10.57	Pass
205.827	20.44	1.43	10.63	32.51	Quasi Max	H	141	174	43.5	-10.99	Pass
199.687	18.29	1.41	12.36	32.05	Quasi Max	H	165	184	43.5	-11.45	Pass
331.786	18.36	1.83	14	34.19	Quasi Max	H	105	195	46	-11.81	Pass
119.814	11.01	1.08	13.79	25.88	Quasi Max	V	248	79	43.5	-17.63	Pass

Transmitter Radiated Spurious Emissions 1GHz to 18GHz

LP0002:2016 (2.8) Additional regulations shall apply except for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

	Peak	Average
Span:	1GHz – 18 GHz	1GHz – 18 GHz
Reference Level:	70 dBuV	80 dBuV
Attenuation:	0 dB	0 dB
Sweep Time:	Auto	Auto
Resolution Bandwidth:	1MHz	1MHz
Video Bandwidth:	3 MHz	3 MHz
Detector:	Peak	RMS (Average)

Antenna ports terminated in 50 Ohms.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m

2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

This report represents the worst case data for all supported operating modes and antennas.

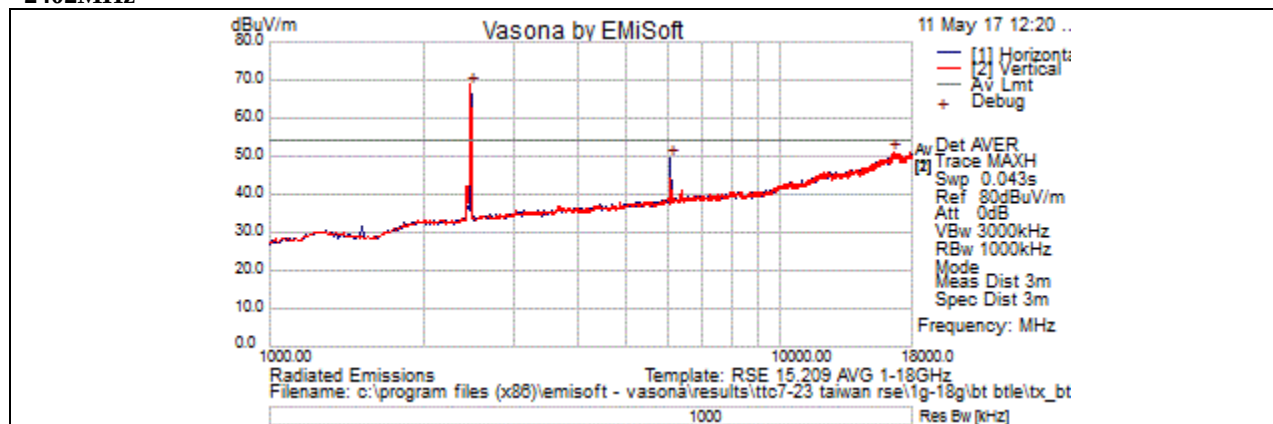
System Number	Description	Samples	System under test	Support equipment
1	EUT	S01, S02	✓	

Tested By : Allan Beecroft	Date of testing: 11-MAY-2017
Test Result : PASS	

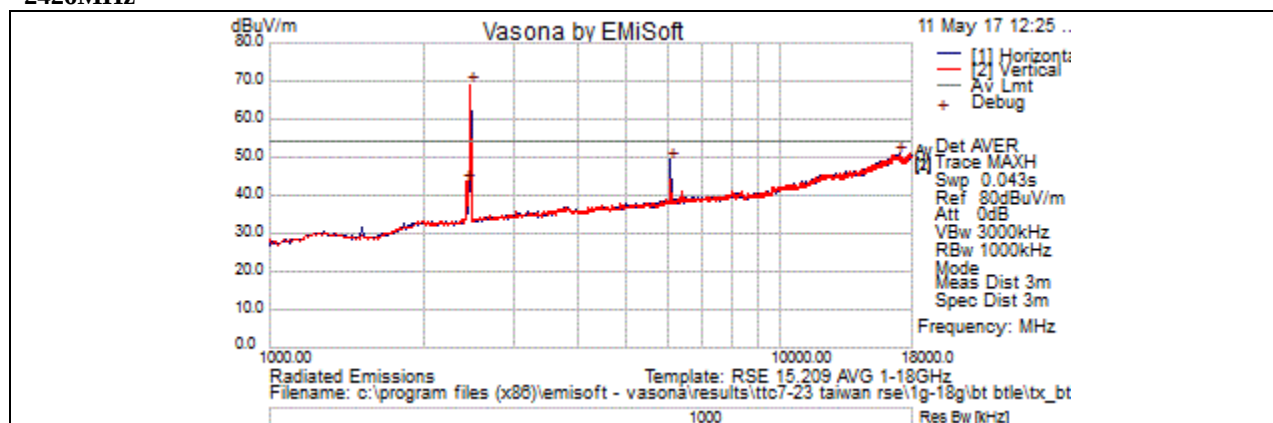
See Appendix B for list of test equipment

Graphs: Average Radiated Transmitter Spurious Emissions

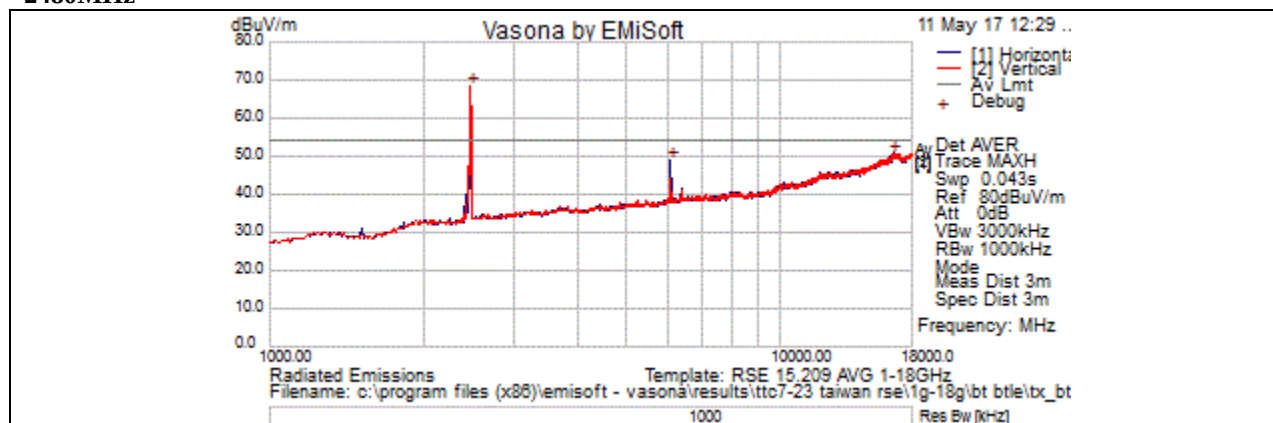
2402MHz



2426MHz



2480MHz



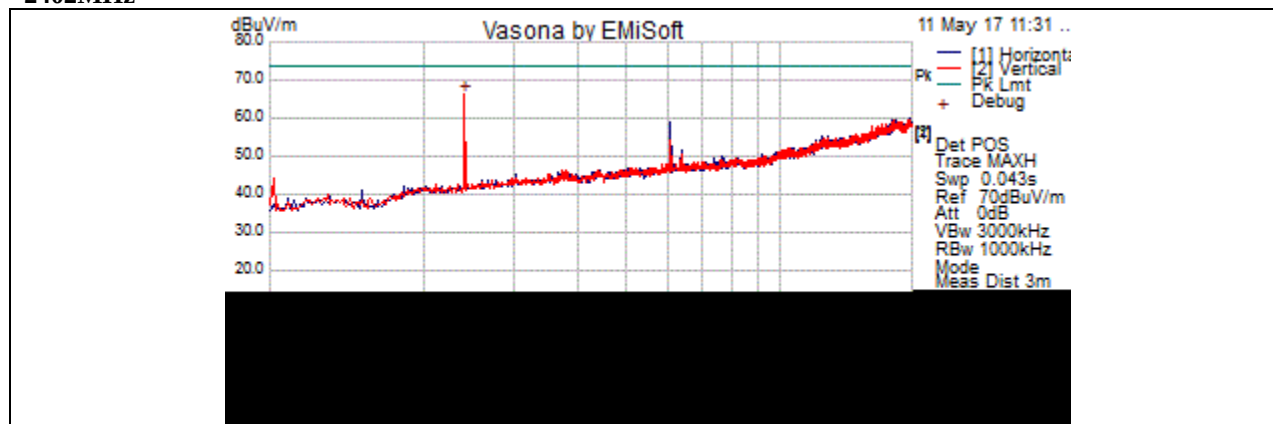
Worst Case Test Results Table Average

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Meas Type	P ol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2476.875	68.2	5.3	-4.9	68.6	Average	V	150	291	54	+14.6	n/a	TX
6086.8	52	8.6	-1.5	59.2	Average	H	189	219	54	+5.2	n/a	Digital*
6086.8	45.5	8.6	-1.5	52.7	Average	V	106	229	54	-1.3	n/a	Digital*
16556.33	27.92	16.13	6.37	50.42	Average	H	150	0	54	-3.58	Pass	
16640.0	28.32	16.13	6.68	51.13	Average	V	150	188	54	-2.87	Pass	
17086.25	28.5	16.7	5.64	50.85	Average	H	150	234	54	-3.15	Pass	

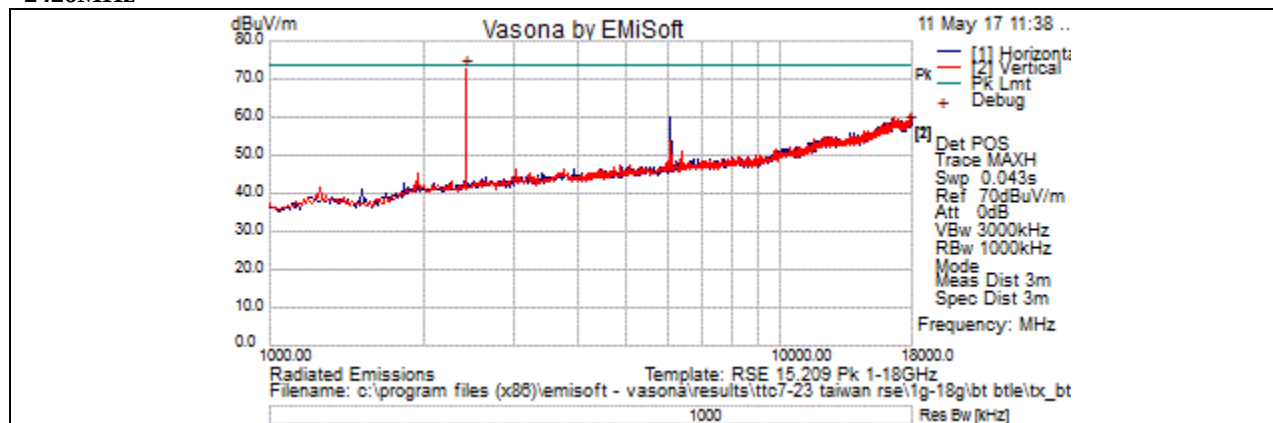
*Non-Radio emission.

Graphs: Peak Radiated Transmitter Spurious Emissions

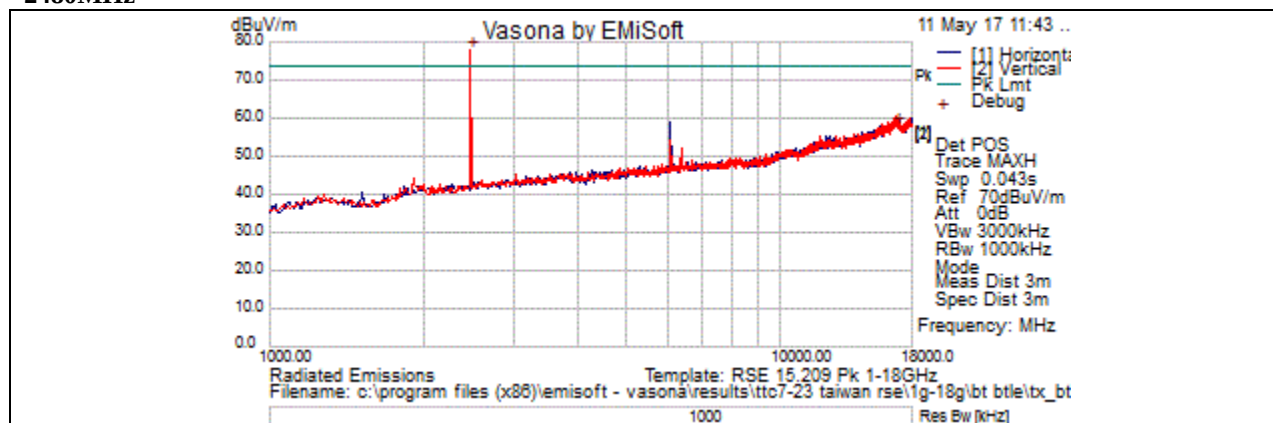
2402MHz



2426MHz



2480MHz



Worst Case Test Results Table Peak

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Meas Type	P ol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comme nts
2402.5	66.3	5.2	-5.1	66.4	Peak	V	150	281	74	-7.6	n/a	TX
2423.750	72.4	5.2	-5.0	72.6	Peak	V	150	292	74	-1.4	n/a	TX
2476.875	77.6	5.3	-4.9	78.0	Peak	H	150	242	74	+4.0	n/a	TX
6086.8	53.5	8.6	-1.5	60.7	Peak	H	147	219	74	-13.3	n/a	Digital*
6086.8	49.3	8.6	-1.5	56.5	Peak	V	148	360	74	-17.5	n/a	Digital*
16.648.97	35.67	16.21	6.64	58.53	Peak	H	150	0	74	-15.47	Pass	
17876.71	34.76	17.35	6.24	58.36	Peak	H	150	0	74	-15.64	Pass	
16811.94	35.82	16.53	5.89	58.25	Peak	H	150	0	74	-15.75	Pass	

*Non-Radio emission.

Transmitter Radiated Spurious Emissions 18GHz to 26.5GHz

LP0002:2016 (2.8) Additional regulations shall apply except for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

	Peak	Average
Span:	18GHz – 26.5 GHz	18GHz – 26.5 GHz
Reference Level:	80 dBuV	80 dBuV
Attenuation:	5 dB	0 dB
Sweep Time:	Auto	Auto
Resolution Bandwidth:	1MHz	1MHz
Video Bandwidth:	3 MHz	3 MHz
Detector:	Peak	RMS (Average)

Antenna ports terminated in 50 Ohms.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m

2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

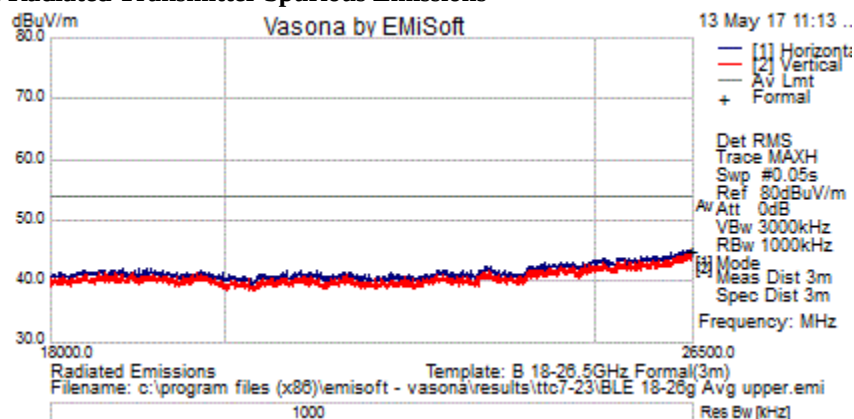
This report represents the worst case data for all supported operating modes and antennas.

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01, S02	✓	

Tested By : Jose Aguirre	Date of testing: 13-May-2017
Test Result : PASS	

See Appendix B for list of test equipment

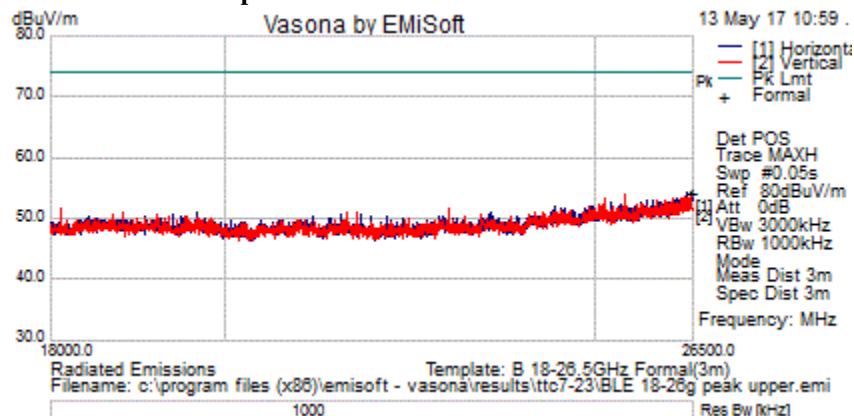
Graphs: Average Radiated Transmitter Spurious Emissions



Worst Case Test Results Table Average

Formal Data													
No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV / m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV / m	Margin dB	Pass / Fail	Comments
1	26448.999	27.5	.0	17.6	45.1	Average.	H	100	0	54.0	-8.9	Pass	

Graphs: Peak Radiated Transmitter Spurious Emissions



Worst Case Test Results Table Peak

Formal Data													
No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV / m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV / m	Margin dB	Pass / Fail	Comments
1	26461.749	36.6	.0	17.6	54.2	Peak.	H	100	0	74.0	-19.8	Pass	

Receiver Radiated Spurious Emissions

Receiver Radiated Emissions 30MHz to 1GHz

LP0002:2016 (2.8) Additional regulations shall apply except for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Span:	30MHz – 1GHz
Reference Level:	70 dBuV
Attenuation:	10 dB
Sweep Time:	Coupled
Resolution Bandwidth:	100kHz
Video Bandwidth:	300kHz
Detector:	Peak for Pre-scan, Quasi-Peak

. Compliance shall be determined using CISPR quasi-peak detection

Antenna ports terminated in 50 Ohms.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

This report represents the worst case data for all supported operating modes and antennas.

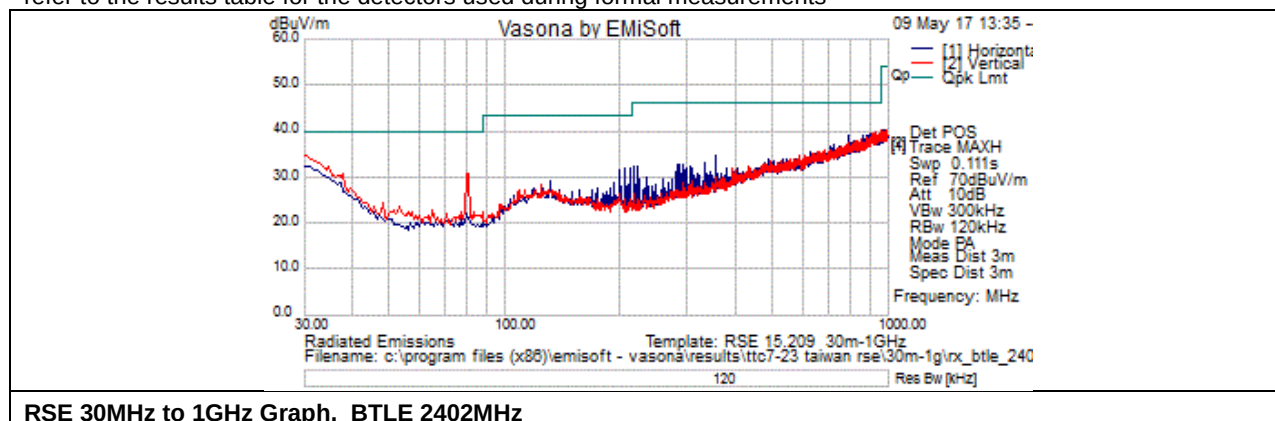
System Number	Description	Samples	System under test	Support equipment
1	EUT	S01, S02	✓	

Tested By : Allan Beecroft	Date of testing: 09-MAY-2017
Test Result : PASS	

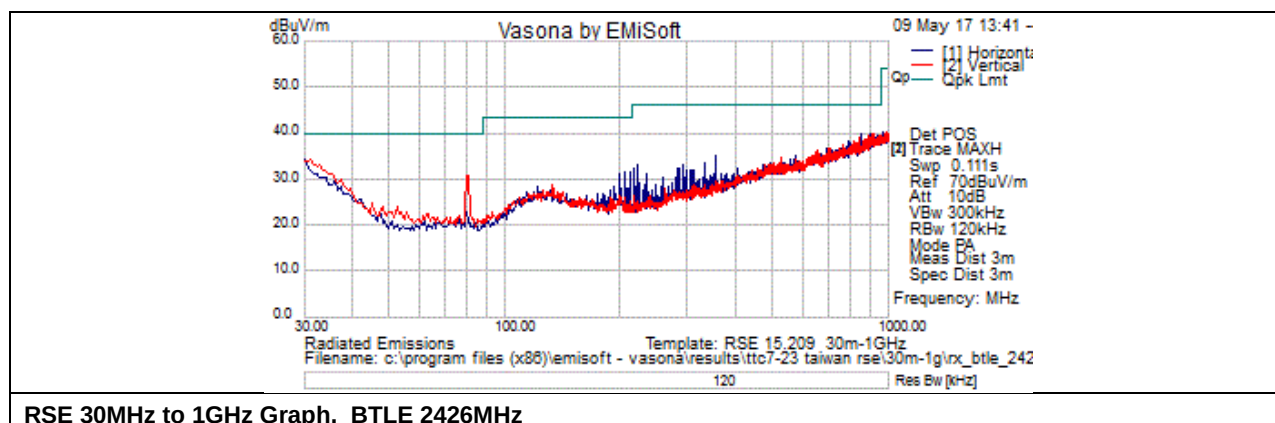
See Appendix B for list of test equipment

Graphical Test Results

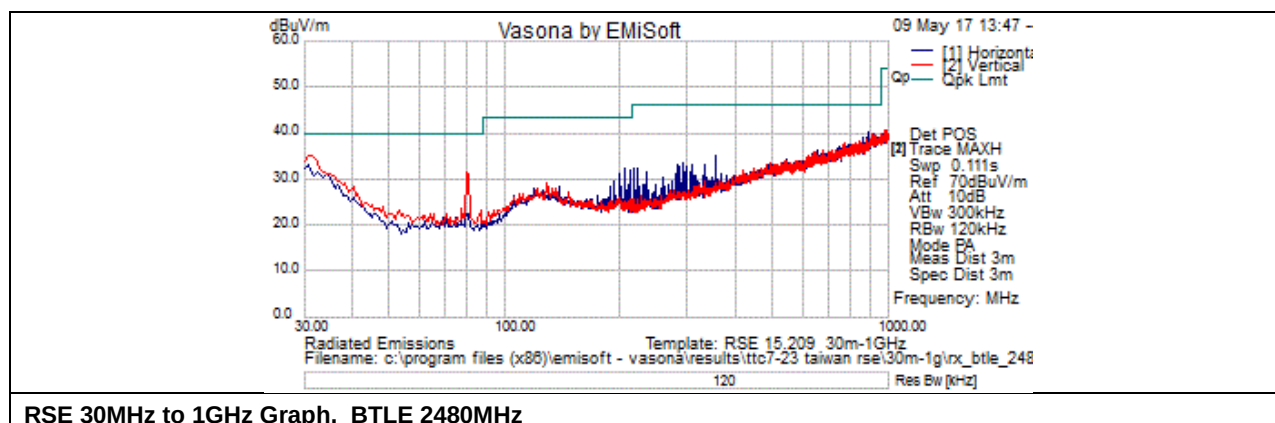
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



RSE 30MHz to 1GHz Graph. BTLE 2402MHz



RSE 30MHz to 1GHz Graph. BTLE 2426MHz



RSE 30MHz to 1GHz Graph. BTLE 2480MHz

Worst Case Test Results Table

Formal Data													
No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV / m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV / m	Margin dB	Pass /Fail	Comments
1	31.213	8.5	.6	20.4	29.5	Quasi Max	V	309	312	40.0	-10.5	Pass	
2	80.000	18.0	.9	7.7	26.6	Quasi Max	V	159	256	40.0	-13.4	Pass	
3	38.488	8.7	.6	15.0	24.4	Quasi Max	V	126	4	40.0	-15.6	Pass	
4	356.353	18.9	1.9	14.7	35.5	Quasi Max	H	103	204	46.0	-10.5	Pass	
5	205.834	19.7	1.4	10.6	31.8	Quasi Max	H	175	172	43.5	-11.7	Pass	
6	211.991	20.2	1.5	10.4	32.0	Quasi Max	H	135	182	43.5	-11.5	Pass	
7	199.688	17.4	1.4	12.4	31.1	Quasi Max	H	138	12	43.5	-12.4	Pass	

Receiver Radiated Spurious Emissions 1GHz to 18GHz

LP0002:2016 (2.8) Additional regulations shall apply except for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

	Peak	Average
Span:	1GHz – 18 GHz	1GHz – 18 GHz
Reference Level:	70 dBuV	80 dBuV
Attenuation:	0 dB	0 dB
Sweep Time:	Auto	Auto
Resolution Bandwidth:	1MHz	1MHz
Video Bandwidth:	3 MHz	3 MHz
Detector:	Peak	RMS (Average)

Antenna ports terminated in 50 Ohms.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m

2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

This report represents the worst case data for all supported operating modes and antennas.

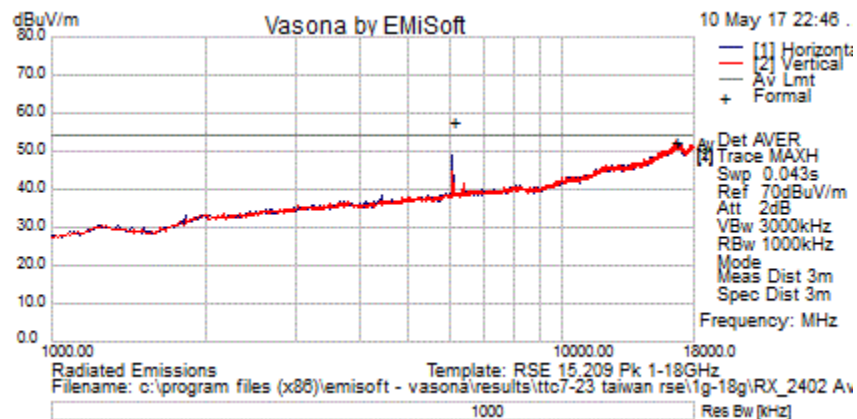
System Number	Description	Samples	System under test	Support equipment
1	EUT	S01, S02	✓	

Tested By : Jose Aguirre	Date of testing: 10-May-2017
Test Result : PASS	

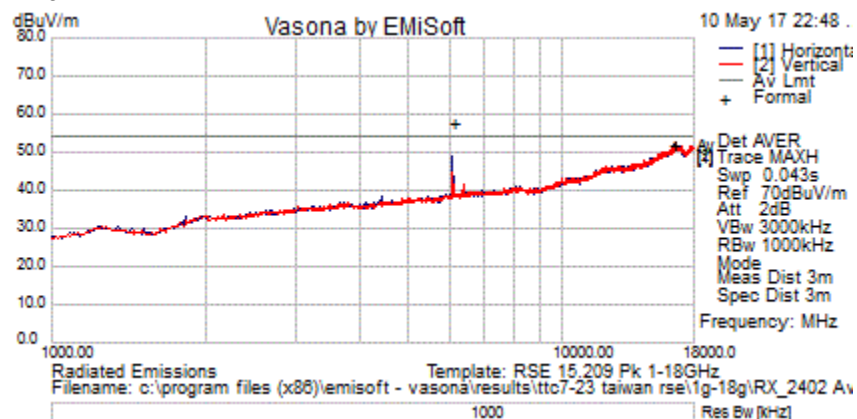
See Appendix B for list of test equipment

Graphs: Average Radiated Receiver Spurious Emissions

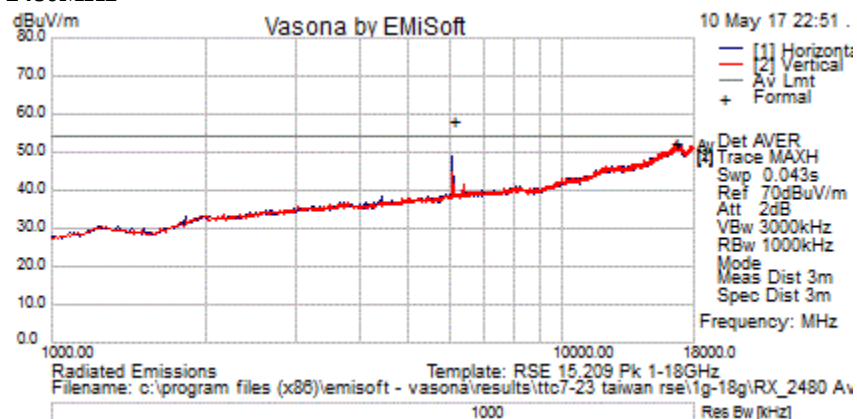
2402MHz



2426MHz



2480MHz



Worst Case Test Results Table Average

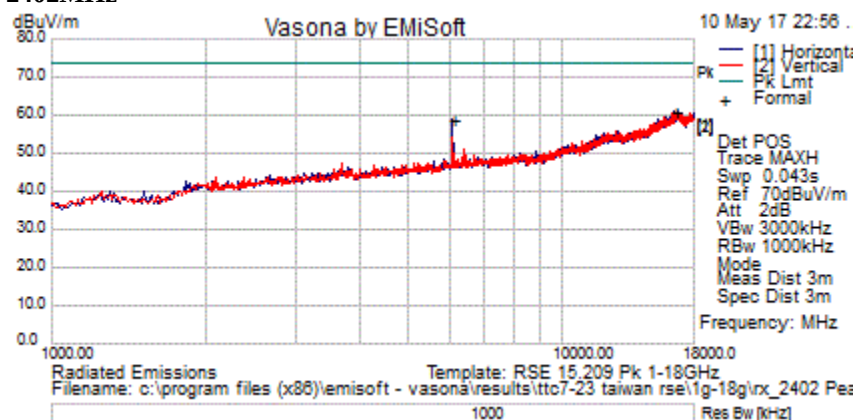
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	P ol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
6086.772	51.4	8.6	-1.5	58.6	Average.	H	145	219	54	+4.6	n/a	Digital*
16651	29.5	16.2	6.6	52.4	Average.	V	147	360	54	-1.6	Pass	
16650.625	29.6	16.2	6.6	52.4	Average.	V	147	339	54	-1.6	Pass	
16482.295	29.9	16.3	5.8	51.9	Average.	H	147	360	54	-2.1	Pass	

*Non-Radio emission.

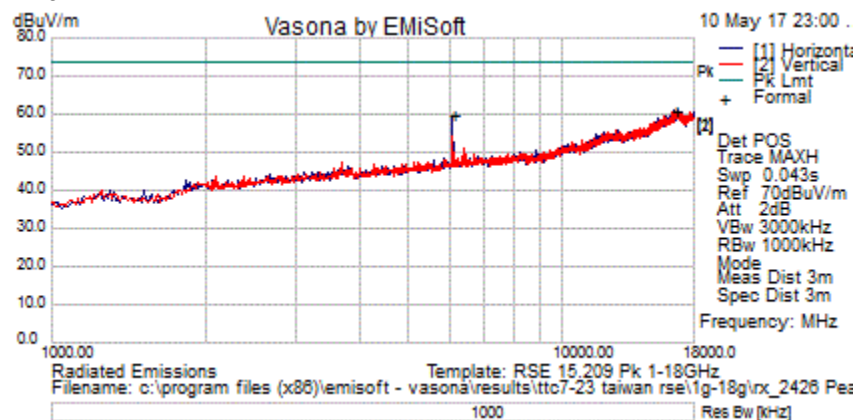
Receiver Radiated Spurious Emissions – Peak Worst case

Graphs: Peak Radiated Receiver Spurious Emissions

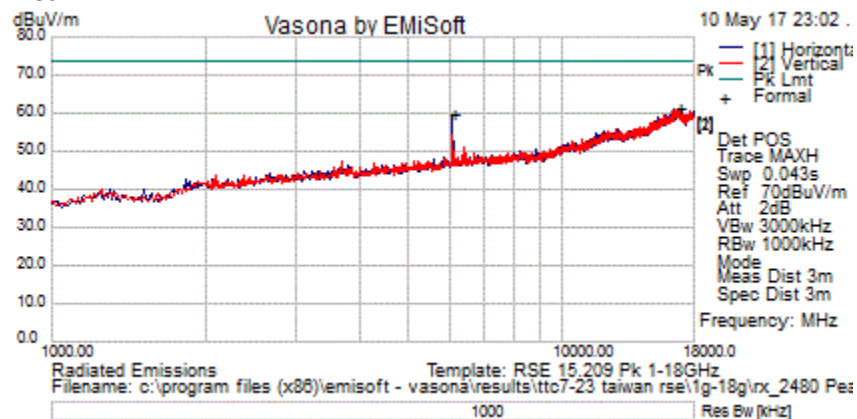
2402MHz



2426MHz



2480MHz



Worst Case Test Results Table Peak

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Meas Type	P ol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comme nts
6086.8	53.5	8.6	-1.5	60.7	Peak	H	147	219	74	-13.3	n/a	Digital*
6086.8	49.3	8.6	-1.5	56.5	Peak	V	148	360	74	-17.5	n/a	Digital*
16641.9	37.21	16.15	6.68	60.03	Peak	H	150	0	74	-13.97	Pass	
16578.21	36.26	16.27	6.15	58.68	Peak	H	150	0	74	-15.32	Pass	
17067.73	36.92	16.74	5.85	59.51	Peak	H	150	0	74	-14.49	Pass	

*Non-Radio emission.

Receiver Radiated Spurious Emissions 18GHz to 26.5GHz

LP0002:2016 (2.8) Additional regulations shall apply except for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

	Peak	Average
Span:	18GHz – 26.5 GHz	18GHz – 26.5 GHz
Reference Level:	80 dBuV	80 dBuV
Attenuation:	0 dB	0 dB
Sweep Time:	Auto	Auto
Resolution Bandwidth:	1MHz	1MHz
Video Bandwidth:	3 MHz	3 MHz
Detector:	Peak	RMS (Average)

Antenna ports terminated in 50 Ohms.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

- Save 2 plots:1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m
2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

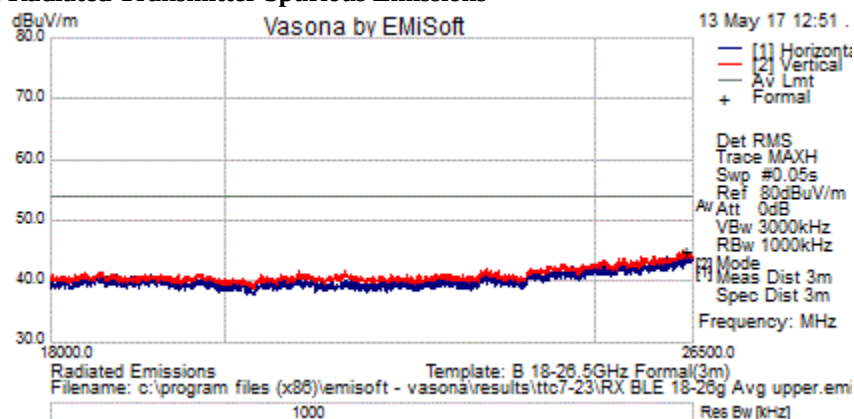
This report represents the worst case data for all supported operating modes and antennas.

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01, S02	✓	

Tested By : Jose Aguirre	Date of testing: 13-May-2017
Test Result : PASS	

See Appendix B for list of test equipment

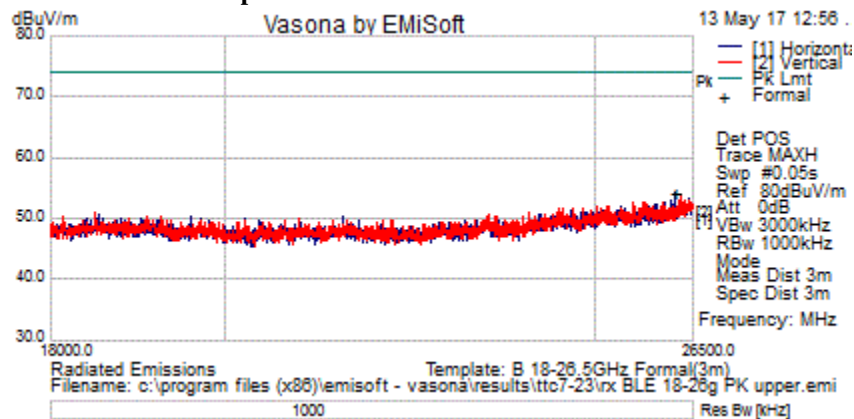
Graphs: Average Radiated Transmitter Spurious Emissions



Worst Case Test Results Table Average

Formal Data													
No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV / m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV / m	Margin dB	Pass / Fail	Comments
1	26363.999	27.9	.0	17.3	45.1	Average.	V	100	0	54.0	-8.9	Pass	

Graphs: Peak Radiated Transmitter Spurious Emissions

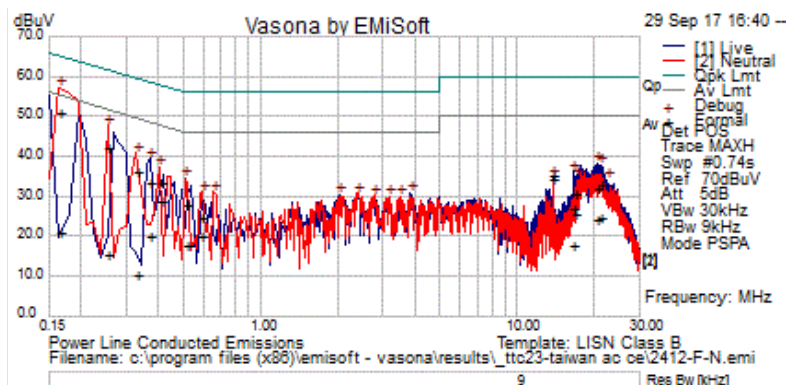


Worst Case Test Results Table Peak

Formal Data													
No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV / m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV / m	Margin dB	Pass / Fail	Comments
1	26223.749	37.3	.0	16.8	54.2	Peak.	H	100	0	74.0	-19.8	Pass	

AC Conducted Emissions

The results for AC Conducted Emissions herein, are representative for all channels and modes of operation.



Formal Data											
No	Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
1	.165	30.2	21.0	.2	51.3	Quasi Peak Neutral	Neutral	65.2	-13.9	Pass	fhss
2	13.824	14.2	20.2	.2	34.6	Average Live	Live	50.0	-15.4	Pass	
3	.408	8.8	20.0	.0	28.8	Average Neutral	Neutral	47.7	-18.8	Pass	
4	.254	21.5	20.5	.1	42.1	Quasi Peak Neutral	Neutral	61.6	-19.5	Pass	fhss
5	.329	16.2	20.3	.1	36.5	Quasi Peak Neutral	Neutral	59.5	-23.0	Pass	fhss
6	.408	13.5	20.0	.0	33.5	Quasi Peak Neutral	Neutral	57.7	-24.2	Pass	hump/fhss
7	16.896	4.9	20.4	.2	25.4	Average Live	Live	50.0	-24.6	Pass	
8	13.824	14.9	20.2	.2	35.4	Quasi Peak Live	Live	60.0	-24.6	Pass	hand
9	.371	13.6	20.1	.0	33.7	Quasi Peak Live	Live	58.5	-24.7	Pass	hump/fhss
10	21.290	4.3	20.4	.3	24.9	Average Live	Live	50.0	-25.1	Pass	
11	20.612	3.5	20.4	.3	24.1	Average Live	Live	50.0	-25.9	Pass	
12	.593	-1.1	19.9	.0	19.9	Average Neutral	Neutral	46.0	-26.1	Pass	
13	21.290	12.2	20.4	.3	32.9	Quasi Peak Live	Live	60.0	-27.1	Pass	bb
14	20.612	11.6	20.4	.3	32.3	Quasi Peak Live	Live	60.0	-27.7	Pass	bb
15	.518	7.9	19.9	.0	27.9	Quasi Peak Neutral	Neutral	56.0	-28.1	Pass	hump/fhss
16	.518	-2.3	19.9	.0	17.7	Average Neutral	Neutral	46.0	-28.3	Pass	
17	.371	-0.0	20.1	.0	20.2	Average Live	Live	48.5	-28.3	Pass	
18	16.896	10.0	20.4	.2	30.6	Quasi Peak Live	Live	60.0	-29.4	Pass	bb/hand
19	.593	4.9	19.9	.0	24.8	Quasi Peak Neutral	Neutral	56.0	-31.2	Pass	hump/fhss
20	16.582	-2.6	20.3	.2	17.9	Average Live	Live	50.0	-32.1	Pass	
21	16.582	6.5	20.3	.2	27.1	Quasi Peak Live	Live	60.0	-32.9	Pass	bb
22	.165	-1.2	21.0	.2	21.0	Average Neutral	Neutral	55.2	-34.3	Pass	
23	.254	-5.1	20.5	.1	15.6	Average Neutral	Neutral	51.6	-36.1	Pass	
24	.329	-9.9	20.3	.1	10.4	Average Neutral	Neutral	49.5	-39.1	Pass	

Appendix B: List of Test Equipment Used to perform the test

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due	
Test Equipment used for Radiated Emissions 30MHz to 1GHz					
30654	SUNOL SCIENCES/JB1	Combination Antenna, 30MHz-2GHz	19-JAN-2017	19-JAN-2018	
49563	HUBER + SUHNER/ Sucoflex 106A	Coaxial Cable, 8m	22-AUG-2016	22-AUG-2017	
21117	MICRO-COAX/ UFB311A-0-2484-520520	Coaxial Cable-18Ghz	19-AUG-2016	19-AUG-2017	
25662	MICRO-COAX/ UFB311A-1-0840-504504	Coaxial Cable, 84.0 in. to 18GHz	21-FEB-2017	21-FEB-2018	
47300	Keysight (Agilent/HP)/ N9038A	EMI Receiver	28-MAR-2017	28-MAR-2018	
54230	NEWPORT/ iBTHP-5-DB9	5 inch Temp/RH/Press Sensor w/20ft cable	11-FEB-2017	11-FEB-2018	
8448	CISCO/ NSA 5m Chamber	NSA 5m Chamber	07-OCT-2016	07-OCT-2017	
54647	STANLEY/ 33-605	Tape Measure, 10m	Cal Not Required	Cal Not Required	
18963	YORK/CNE V	COMPARISON NOISE EMITTER	Cal Not Required	Cal Not Required	
Test Equipment used for Radiated Emissions 1GHz to 18GHz					
32544	ETS Lindgren/3117	Double Ridged Horn Antenna	20-JUN-2016	20-JUN-2017	
7295	MITEQ/NSP1800-25-S1	PREAMPLIFIER	11-OCT-2016	11-OCT-2017	
47300	Keysight (Agilent/HP)/ N9038A	EMI Receiver	28-MAR-2017	28-MAR-2018	
40597	CISCO/Above 1GHz Site Cal	1GHz Cspr Site Verification	25-SEP-2016	25-SEP-2017	
34075	SCHAFFNER/ RSG 2000	Reference Spectrum Generator, 1-18GHz	Cal Not Required	Cal Not Required	
4883	EMCO/3115	HORN ANTENNA	Cal Not Required	Cal Not Required	
49563	HUBER + SUHNER/ Sucoflex 106A	Coaxial Cable, 8m	22-AUG-2016	22-AUG-2017	
21117	MICRO-COAX/ UFB311A-0-2484-520520	Coaxial Cable-18Ghz	19-AUG-2016	19-AUG-2017	
25001					
25662	MICRO-COAX/ UFB311A-1-0840-504504	Coaxial Cable, 84.0 in. to 18GHz	21-FEB-2017	21-FEB-2018	
54230	NEWPORT/ iBTHP-5-DB9	5 inch Temp/RH/Press Sensor w/20ft cable	11-FEB-2017	11-FEB-2018	
54647	STANLEY/ 33-605	Tape Measure, 10m	Cal Not Required	Cal Not Required	
Test Equipment used for Radiated Emissions 18GHz to 26.5GHz					
41979	CISCO/1840	18-40GHz EMI Test Head/Verification Fixture	02-SEP-2016	02-SEP-2017	
44940	Rohde & Schwarz/ESU40	EMI Receiver, 40GHz	14-NOV-2016	14-NOV-2017	
37236	JFW/50CB-015	Control Box, GPIB	Cal Not Required	Cal Not Required	
54230	NEWPORT/ iBTHP-5-DB9	5 inch Temp/RH/Press Sensor w/20ft cable	11-FEB-2017	11-FEB-2018	
Test Equipment Used For AC Conducted Emissions					
5466	Keithley 580	MICRO OHMMETER	31 Oct 2016	31 Oct 2017	

33041	Fluke 175	True RMS Multimeter	01 Jun 2017	01 Jun 2018	
41933	Newport iBTHP-5-DB9	5 inch Temp/RH/Press Sensor w/20ft cable	22 Dec 2016	22 Dec 2017	
49531	TTE H785-150K-50-21378	HIGH PASS FILTER 150kHz	03 May 2017	03 May 2018	
8496	FCC-450B-2.4-N	Pulse Limiter	16 May 2017	16 May 2018	
49468	Coleman RG223	BNC cable	10 Mar 2017	10 Mar 2018	
45990	FCC F-090527-1009-1	LISN	15 Jun 2017	15 Jun 2018	
45991	FCC F-090527-1009-2	LISN adapter	15 Jun 2017	15 Jun 2018	
45050	R&S ESCI	EMI receiver	09 Nov 2016	09 Nov 2017	
46715	Bird 5-T-MB	Termination	16 Mar 2017	16 Mar 2018	
46714	Bird 5-T-MB	Termination	28 Nov 2016	28 Nov 2017	
18963	York CNE V	COMPARISON NOISE EMITTER	NA	NA	
04003	FCC FCC-801-M2-32A	DECOUPLING NETWORK	16 Mar 2017	16 Mar 2018	
8357	Coleman RG223	BNC cable	12 Apr 2017	12 Apr 2018	
54647	Stanley 33-605	10m tape measure	NA	NA	

Appendix C: Abbreviation Key and Definitions

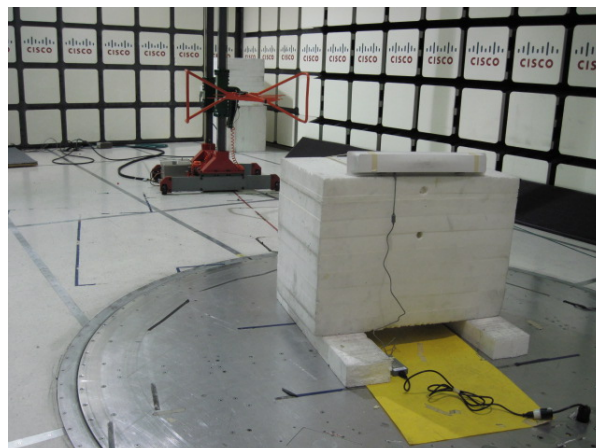
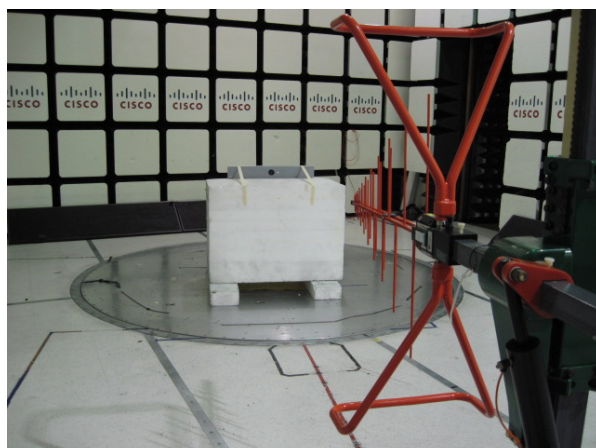
The following table defines abbreviations used within this test report.

Abbreviation	Description	Abbreviation	Description
EMC	Electro Magnetic Compatibility	°F	Degrees Fahrenheit
EMI	Electro Magnetic Interference	°C	Degrees Celsius
EUT	Equipment Under Test	Temp	Temperature
ITE	Information Technology Equipment	S/N	Serial Number
TAP	Test Assessment Schedule	Qty	Quantity
ESD	Electro Static Discharge	emf	Electromotive force
EFT	Electric Fast Transient	RMS	Root mean square
EDCS	Engineering Document Control System	Qp	Quasi Peak
Config	Configuration	Av	Average
CIS#	Cisco Number (unique identification number for Cisco test equipment)	Pk	Peak
Cal	Calibration	kHz	Kilohertz (1x10 ³)
EN	European Norm	MHz	MegaHertz (1x10 ⁶)
IEC	International Electro technical Commission	GHz	Gigahertz (1x10 ⁹)
CISPR	International Special Committee on Radio Interference	H	Horizontal
CDN	Coupling/Decoupling Network	V	Vertical
LISN	Line Impedance Stabilization Network	dB	decibel
PE	Protective Earth	V	Volt
GND	Ground	kV	Kilovolt (1x10 ³)
L1	Line 1	μV	Microvolt (1x10 ⁻⁶)
L2	Line2	A	Amp
L3	Line 3	μA	Micro Amp (1x10 ⁻⁶)
DC	Direct Current	mS	Milli Second (1x10 ⁻³)
RAW	Uncorrected measurement value, as indicated by the measuring device	μS	Micro Second (1x10 ⁻⁶)
RF	Radio Frequency	μS	Micro Second (1x10 ⁻⁶)
SLCE	Signal Line Conducted Emissions	m	Meter
Meas dist	Measurement distance	Spec dist	Specification distance
N/A or NA	Not Applicable	SL	Signal Line (or Telecom Line)
P	Power Line	L	Live Line
N	Neutral Line	R	Return
S	Supply	AC	Alternating Current

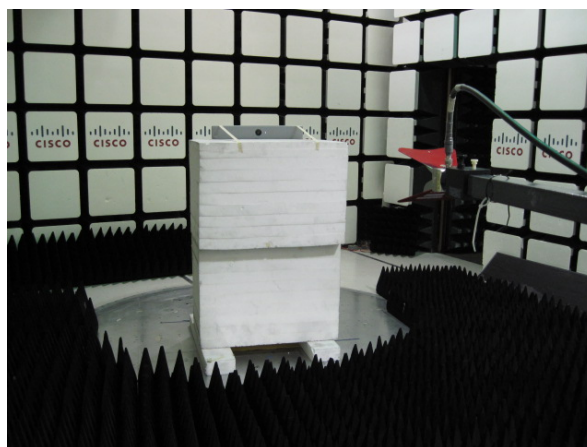
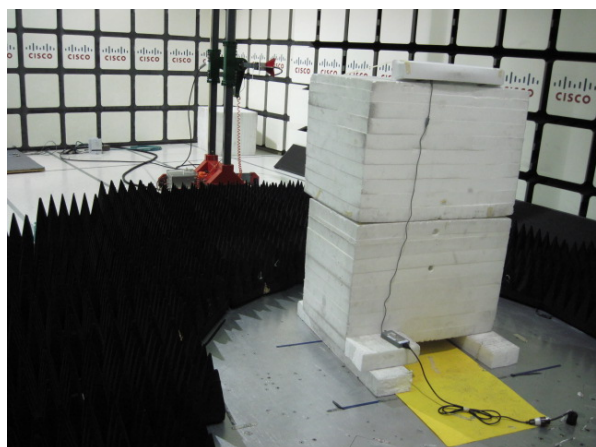
Appendix D: Photographs of EUT and Test Setups



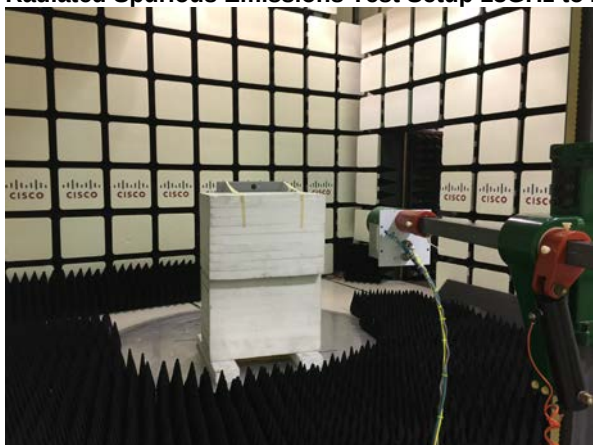
Radiated Spurious Emissions Test Setup 30MHz to 1GHz



Radiated Spurious Emissions Test Setup 1GHz to 18GHz



Radiated Spurious Emissions Test Setup 18GHz to 26.5GHz



AC Conducted Emissions Test Setup



Appendix E: Software Used to Perform Testing

EMIsoft Vasona, version 6.024

Appendix F: Test Procedures

Measurements were made in accordance with

- KDB 558074 - D01 DTS Meas Guidance v03r05
- KDB 662911 - MIMO
- ANSI C63.10 2013 Intentional Radiators
- LP0002:2016

Test procedures are summarized below

FCC 2.4GHz Test Procedures	EDCS # 1445042
FCC 2.4GHz RSE Test Procedures	EDCS # 1480386

Appendix G: Scope of Accreditation (A2LA certificate number 1178-01)

The scope of accreditation of Cisco Systems, Inc. can be found on the A2LA web page at:

<https://www.a2la.org/scopepdf/1178-01.pdf>

Appendix H: Test Assessment Plan

Compliance Test Plan (Excel) EDCS# 11633051.