

TEST REPORT

For

Toshiba Bluetooth device evaluation board

In conformity with

FCC CFR 47 Part15 Subpart C

Model : SAPPHIRE-678FXG

FCC ID : 2AKW4-678FXG

Report No. : ERY1702P16R3

Issue Date : 16 Feb. 2017

Prepared for

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Prepared by

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SGS RF Technologies Inc. is managed to ISO17025 and has the necessary knowledge and test facilities for testing according to the referenced standards. The test results in this report apply only to the sample(s) tested.

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History

Report No.	Date	Revisions	Issued By
ERY1702P01R3	01 Feb. 2017	Initial Issue	T.Kato
ERY1702P16R3	16 Feb. 2017	Add the test result of radiated emission below 30 MHz (Sec 2.6)	T.Kato

1 General information

1.1 Product description

Test item : Toshiba Bluetooth device evaluation board
Manufacturer : RITA ELECTRONICS, LTD.
Address : CHIKUSA NEW TOWER BLDG. 14F, 3-15-31 AOI, HIGASHI-KU
NAGOYA-SHI, AICHI 461-0004, JAPAN
Model : SAPPHIRE-678FXG
FCC ID : 2AKW4-678FXG
Serial number : 0001
Hardware version : 1.0
Software version : 1.0
Operating frequency : 2402 - 2480 MHz
Modulation : GFSK (Bluetooth LE)
Antenna Gain : +2.65 dBi
Receipt date of EUT : 17 Jan. 2017
Nominal power source voltages : DC 3.0 V

1.2 Test(s) performed/ Summary of test result

Test specification(s) : FCC CFR 47 Part 15 Subpart C (01 Oct. 2015)
Test method(s) : ANSI C63.10: 2013
Test(s) started : 17 Jan. 2017
Test(s) completed : 15 Feb. 2017


Summary of test result : Complied

Note: The above judgment is only based on the measurement data and it does not include the measurement uncertainty. Accordingly, the statement below is applied to the test result.


The EUT complies with the limit required in the standard in case that the margin is not less than the measurement uncertainty in the Laboratory.

Compliance of the EUT is more probable than non-compliance is case that the margin is less than the measurement uncertainty in the Laboratory.

Test engineer

: 
T. Kato
E&E Lab. EMC testing

Reviewer

: 
K. Onishi
Team Manager
E&E Lab. EMC testing

1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at SGS RF Technologies Inc., located in 472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 1, 2015.

The description of the test facilities has been filed under registration number 319924 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at <http://www.fcc.gov>.

Registered by Industry Canada (IC): The registered facility number is as follows;

Test site No. 1 (Semi-Anechoic chamber 3m): 6974A-1

Accredited by **National Voluntary Laboratory Accreditation Program (NVLAP)** for the emission tests stated in the scope of the certificate under Certificate Number 200780-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.



NVLAP LAB CODE 200780-0

1.4 Measurement uncertainty

The treatment of uncertainty is based on the general matters on the definition of uncertainty in “Guide to the expression of uncertainty in measurement (GUM)” published by ISO. The Lab’s uncertainty is determined by referring UKAS Publication LAB34: 2002 “The Expression of Uncertainty in EMC Testing” and CISPR16-4-2: 2011 “Uncertainty in EMC Measurements”.

The uncertainty of the measurement result in the level of confidence of approximately 95% ($k=2$) is as follows;

Conducted emission: ± 3.4 dB (150 kHz - 30 MHz)

Radiated emission (9 kHz - 30 MHz): ± 3.3 dB

Radiated emission (30 MHz - 200 MHz): ± 4.8 dB

Radiated emission (200 MHz - 1000 MHz): ± 6.1 dB

Radiated emission (1 GHz - 6 GHz): ± 4.5 dB

Radiated emission (6 GHz - 18 GHz): ± 4.6 dB

Radiated emission (18 GHz - 26 GHz): ± 4.7 dB

1.5 Summary of test results

Requirement	Section in FCC	Result	Section in this report
Occupied Bandwidth (99 %)	2.1049	Complied	2.1
6 dB Bandwidth	15.247 (a) (2)	Complied	2.2
Conducted Output Power	15.247 (b) (3)	Complied	2.3
Conducted Spurious Emission	15.247 (d)	Complied	2.4
Power Spectral Density	15.247 (e)	Complied	2.5
Radiated Emissions	15.247(d), 15.205 (a)	Complied	2.6
AC power line conducted emissions	15.207	Complied	2.7

1.6 Setup of equipment under test (EUT)

1.6.1 Test configuration of EUT

Equipment(s) under test

No.	Item	Manufacture	Model No.	Serial No.
1	Toshiba Bluetooth device evaluation board	RITA ELECTRONICS, LTD.	SAPPHIRE-678FXG	0001

Support Equipment(s)

No.	Item	Manufacture	Model No.	Serial No.
2	Battery (DC 3.0V)	-	-	-
3	AC adaptor (Output: DC 3.0V)	UNIFIVE	US303020	D02-0136115

Connected cable(s)

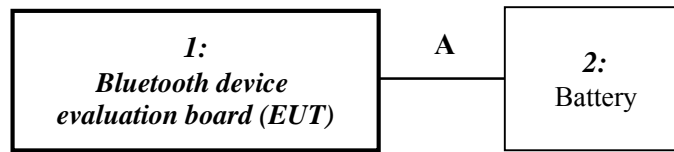
No.	Item	Identification (Manu.etc.)	Cable Shielded	Ferrite Core	Length [m]
A	DC cable	-	No	No	0.15
B	DC cable of AC adaptor	-	No	No	1.0

1.6.2 Operating condition:

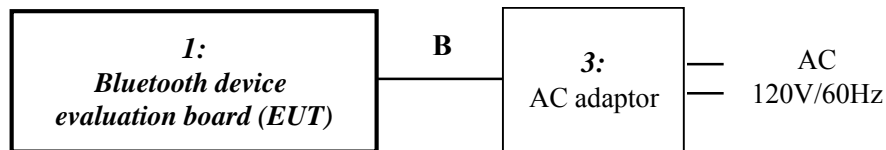
- Tx (2402MHz): The EUT is in normal transmission mode at 2402MHz
- Tx (2440MHz): The EUT is in normal transmission mode at 2440MHz
- Tx (2480MHz): The EUT is in normal transmission mode at 2480MHz

1.6.3 Setup diagram of tested system

[Configuration 1]



[Configuration 2]



1.7 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the applicable standards described in clause 1.2.

1.8 Deviation from the standard

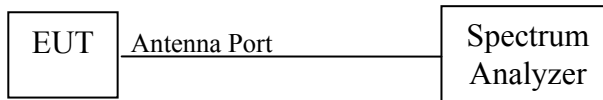
No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Occupied Bandwidth (99%)

Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure

Spectrum analyzer is set as below according to ANSI C63.10 clause 6.9

- RBW : 1 to 5 % of OBW
- VBW > 3 x RBW
- Span : OBW x 1.5 to 5
- Trace : Max hold

Limitation

There are no limitations.

The measurement value is used for the emission designator.

Test equipment used (refer to List of utilized test equipment)

TR06	CL38				
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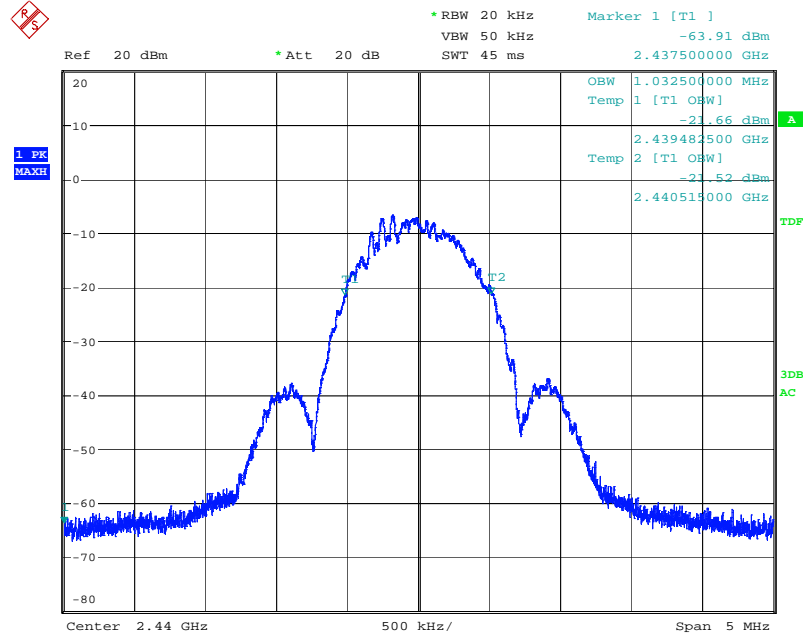
Test results

Configuration: 1

Transmission Frequency [MHz]	Occupied Bandwidth [MHz]
2402	1.033
2440	1.033
2480	1.033

[Chart]

Tx (2440 MHz)



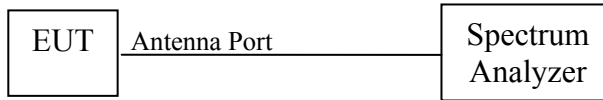
Tested Date: 24 Jan. 2017
Humidity: 30 %

Temperature: 16 degC
Atmos. Press: 1020 hPa

2.2 6dB Bandwidth

Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure

Spectrum analyzer is set as below according to ANSI C63.10 clause 11.8

- RBW = 100 kHz
- VBW : 300 kHz
- Detector : Peak
- Trace : Max hold

Applicable rule and limitation

15.247 (a) (2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test equipment used (refer to List of utilized test equipment)

TR06	CL38				
------	------	--	--	--	--

Test results - Complied with requirement

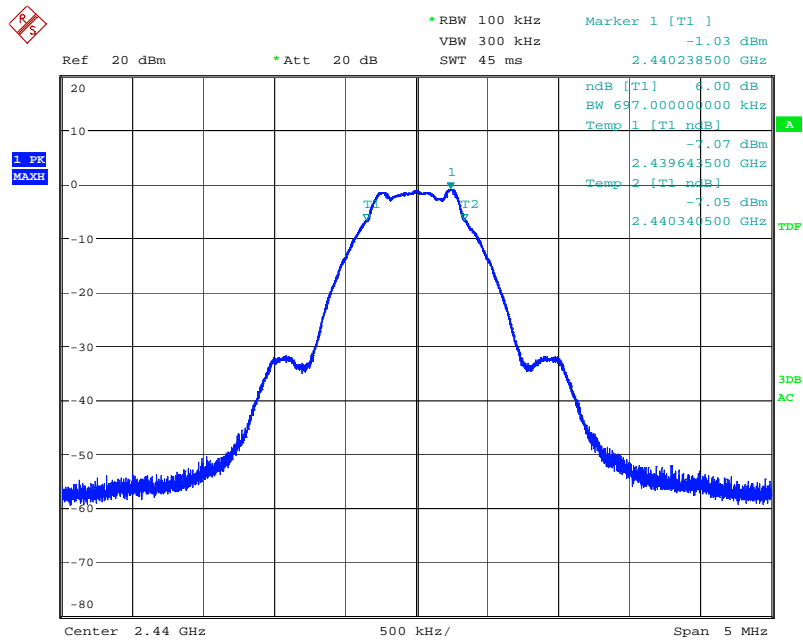
Test Data

Configuration: 1

Transmission Frequency [MHz]	6 dB Bandwidth [kHz]
2402	714
2440	697
2480	690

[Chart]

Tx 2440 MHz



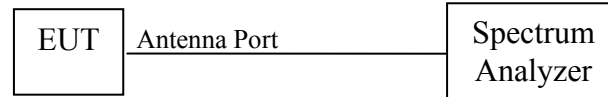
Tested Date: 24 Jan. 2017
Humidity: 30 %

Temperature: 16 degC
Atmos. Press: 1020 hPa

2.3 Peak Output Power

Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure

Spectrum analyzer is set as below according to ANSI C63.10 clause 11.9

- RBW > 6dB BW
- VBW > 3 x RBW
- Span > 3 x RBW
- Detector : Peak
- Trace : Max hold

Applicable rule and limitation

15.247(b) (3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5MHz, and 5725–5850 MHz bands: 1 Watt (30 dBm).

Test equipment used (refer to List of utilized test equipment)

TR06	CL38				
------	------	--	--	--	--

Test results - Complied with requirement

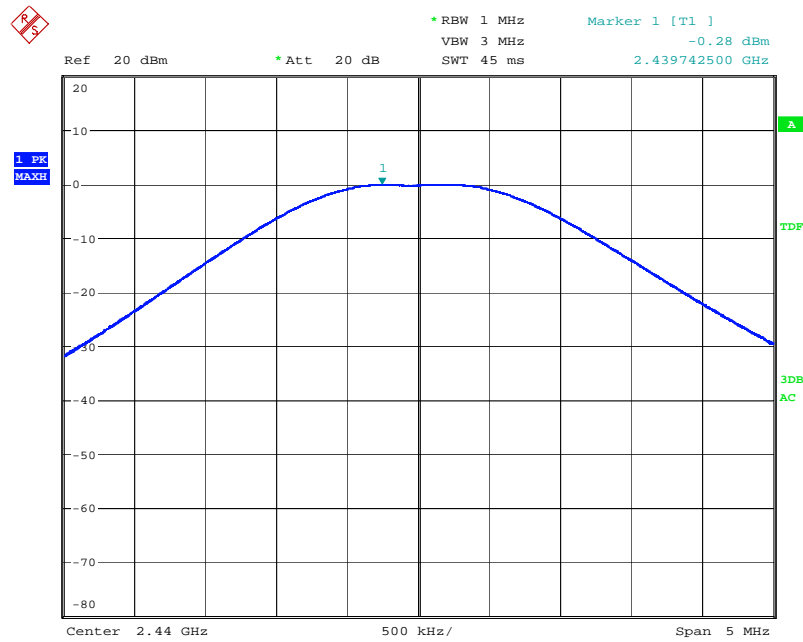
Test Data

Configuration: 1

Transmission Frequency [MHz]	Output Power [dBm]
2402	-0.11
2440	-0.28
2480	-0.51

[Chart]

Tx 2440 MHz



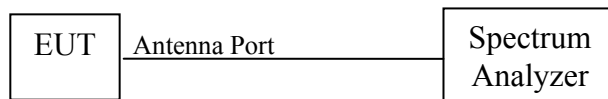
Tested Date: 24 Jan. 2017
Humidity: 30 %

Temperature: 16 degC
Atmos. Press: 1020 hPa

2.4 Conducted Spurious Emissions

Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure

Spectrum analyzer is set as below according to ANSI C63.10 clause 7.8.8

- RBW : 100 kHz
- VBW : 300 kHz
- Detector : Peak
- Trace : Max hold

Limitation

15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test equipment used (refer to List of utilized test equipment)

TR06	CL38				
------	------	--	--	--	--

Test results - Complied with requirement

Test Data

Configuration: 1

Operating mode: Tx (2402 MHz)

Frequency [MHz]	Spurious level [dBm]	Carrier level [dBm]	20dB below [dBm]
7205.3	-55.3	-0.8	-20.8
16815.7	-53.2	-0.8	-20.8

Operating mode: Tx (2440 MHz)

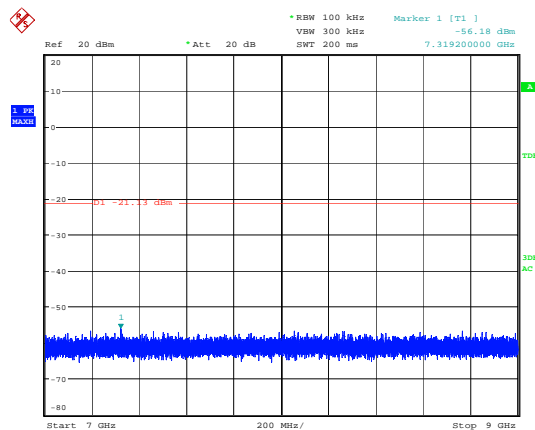
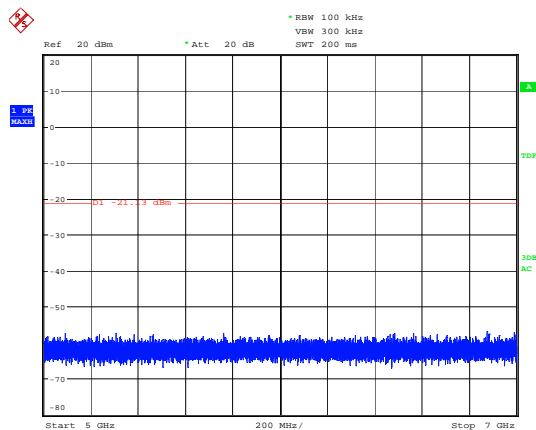
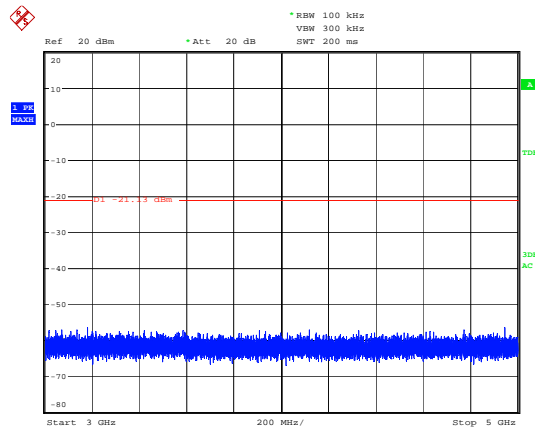
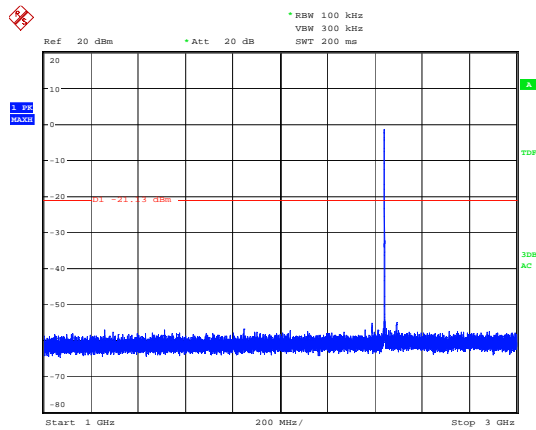
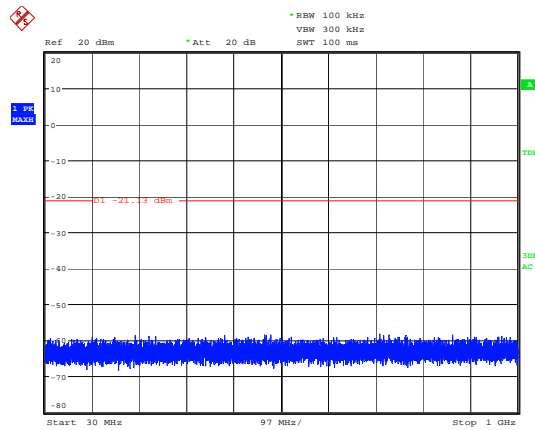
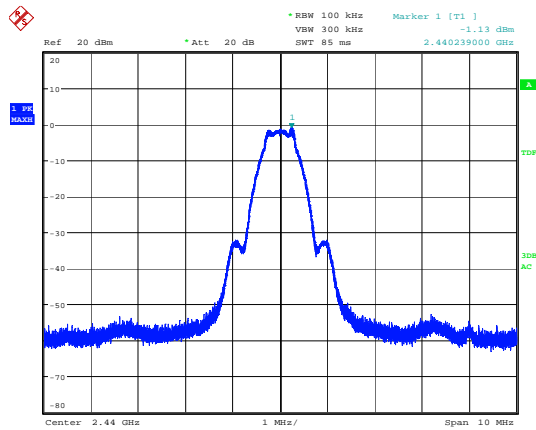
Frequency [MHz]	Spurious level [dBm]	Carrier level [dBm]	20dB below [dBm]
7319.2	-56.1	-1.1	-21.1
17081.7	-52.4	-1.1	-21.1

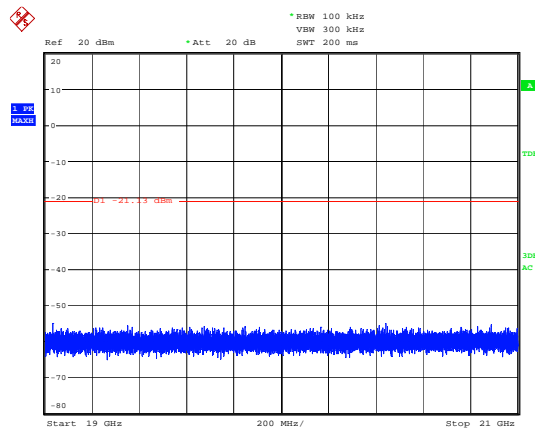
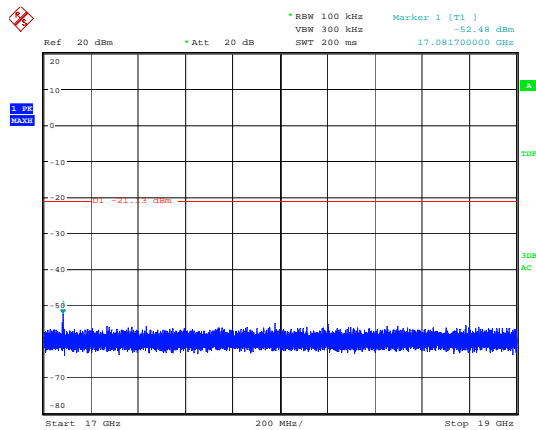
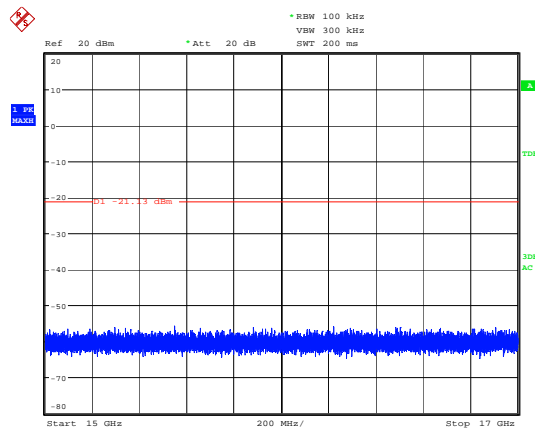
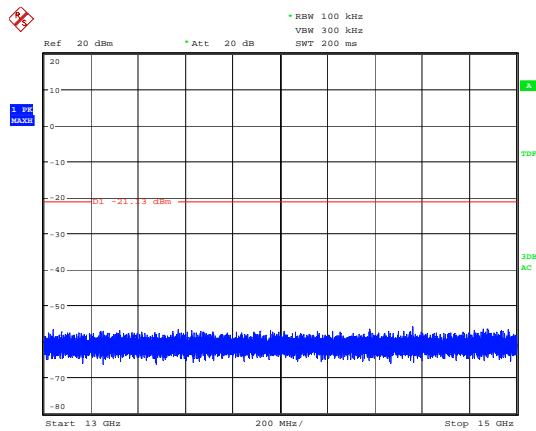
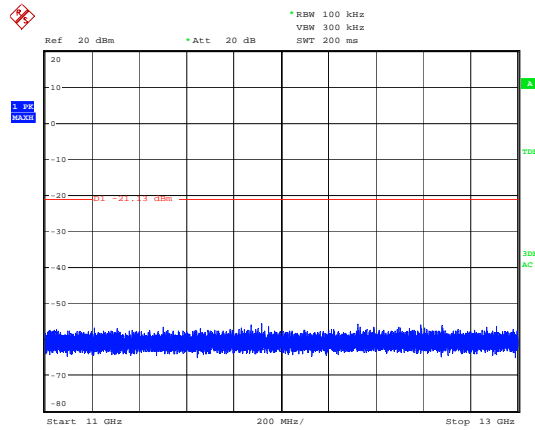
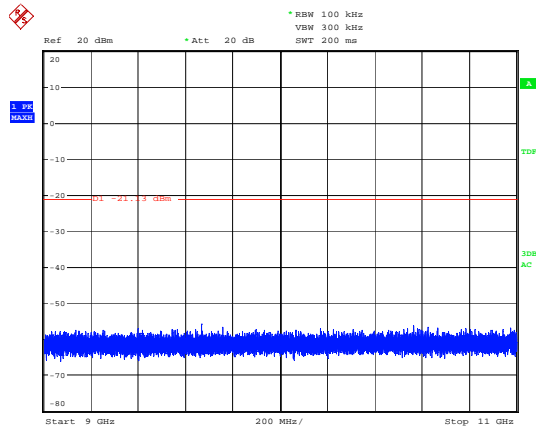
Operating mode: Tx (2480 MHz)

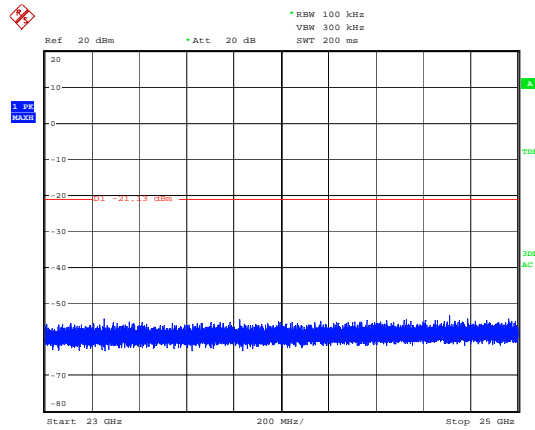
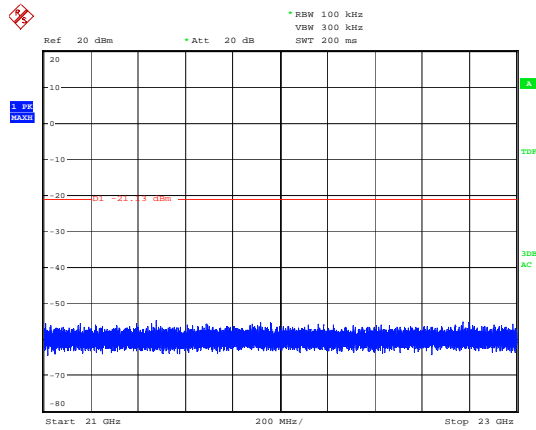
Frequency [MHz]	Spurious level [dBm]	Carrier level [dBm]	20dB below [dBm]
7440.7	-52.5	-1.3	-21.3
17358.1	-51.6	-1.3	-21.3

[Chart]

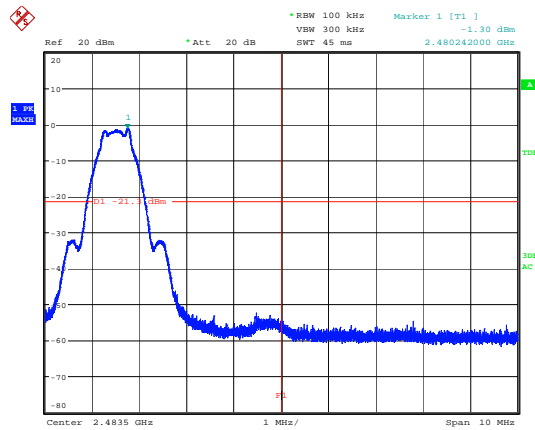
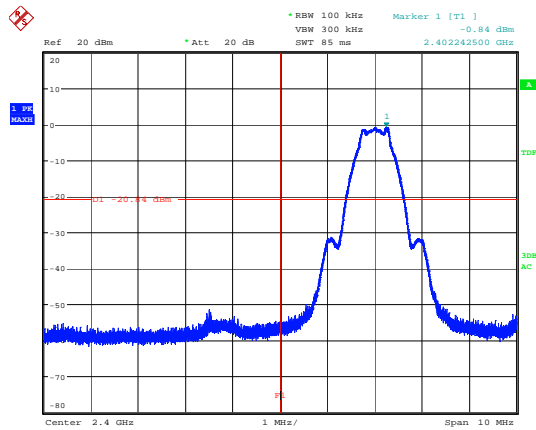
Tx 2440 MHz







[Bandedge]



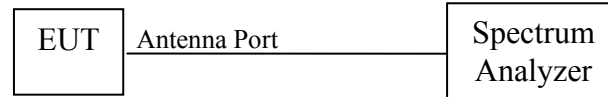
Tested Date: 24 Jan. 2017
Humidity: 30 %

Temperature: 16 degC
Atmos. Press: 1020 hPa

2.5 Power Spectral density

Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure

Spectrum analyzer is set as below according to ANSI C63.10 clause 11.10

- RBW : 3 kHz
- VBW : 10 kHz
- Span > 1.5 x 6dB BW
- Detector : Peak
- Trace : Max hold

Limitation

15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test equipment used (refer to List of utilized test equipment)

TR06	CL38				
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Test results - Complied with requirement

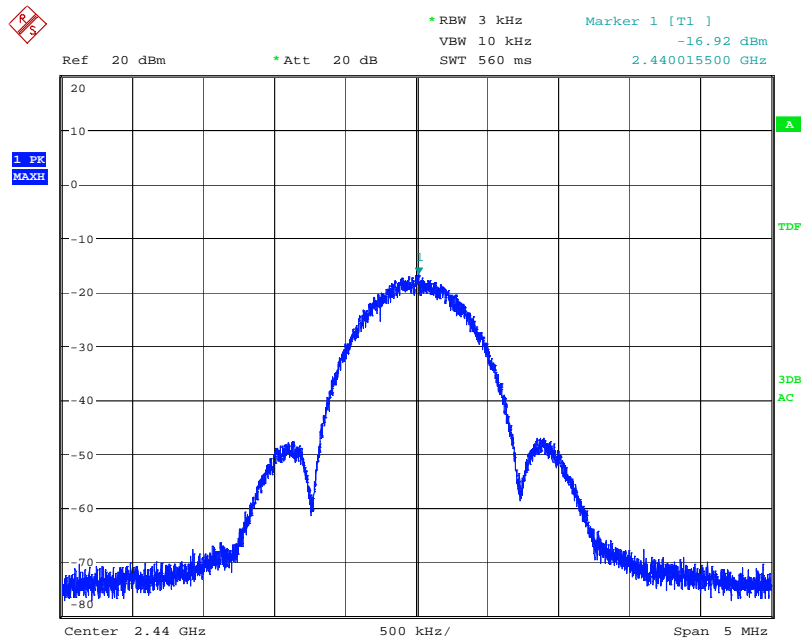
Test Data

Configuration: 1

Transmission Frequency [MHz]	Spectral Density [dBm]
2402	-16.9
2440	-16.9
2480	-17.2

[Chart]

Tx 2440 MHz



Tested Date: 24 Jan. 2017
Humidity: 30 %

Temperature: 16 degC
Atmos. Press: 1020 hPa

2.6 Radiated emissions (for restricted frequency band)

Test setup

Test setup was implemented according to the method of ANSI C63.10 clause 6.

Test procedure

Measurement procedures were implemented according to the method of ANSI C63.10 clauses 6.

The test receiver is set as below

[9 - 150 kHz]

RBW: 200 Hz, Detector: QP

[150 kHz - 30 MHz]

RBW: 9 kHz, Detector: QP

[30 - 1000 MHz]

RBW: 120 kHz, Detector: QP

[above 1000 MHz]

RBW: 1 MHz, Detector: Ave/PK

Applicable rule and limitation

FCC 15.205 restricted bands of operation

Except as shown in paragraph 15.205 (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.490 - 0.510	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	38.6 -

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in FCC 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in FCC 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions.

FCC 15.209 Field strength limits

Frequency [MHz]	Field Strength [μ V/m]	Measurement Distance [m]	Field Strength [dB μ V/m]
30 - 88	100	3	40.0
88 - 216	150	3	43.5
216 - 960	200	3	46.0
Above 960	500	3	53.9

In the emission table above, the tighter limit applies at the band edges.

The emission limits shown in the above table are based on measurements employing a quasi-peak detector.

Test results - Complied with requirement

Test equipment used (refer to List of utilized test equipment)

AC01	CL11	TR06	PR21	BA07	CL30	CL38	PR12
DH01	CH02	SH01	LP06				

Test software used

EMI1 Ver. 4.9

Calculation method

The Correction Factor and Result are calculated as followings.

$$\text{Correction Factor [dB/m]} = \text{Ant. Factor [dB/m]} + \text{Loss [dB]} - \text{Gain [dB]}$$

$$\text{Result [dB}\mu\text{V/m]} = \text{Reading [dB}\mu\text{V]} + \text{Correction Factor [dB/m]}$$

Test Data (30 - 1000MHz)

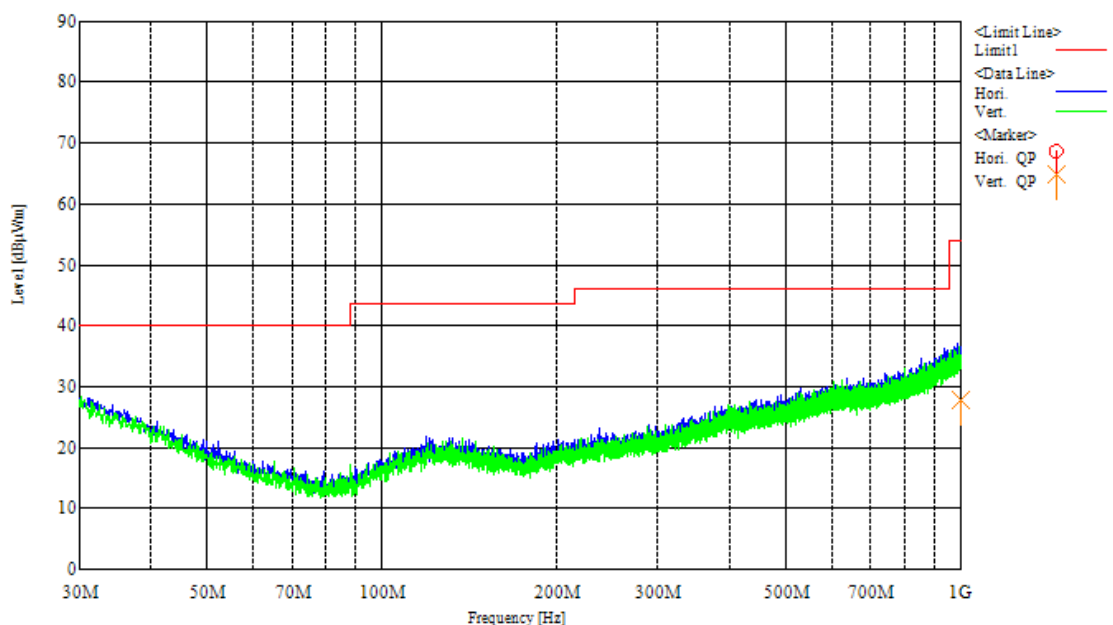
Configuration: 1
Worst operating mode: Tx (2440MHz)

[Emission level] Z-plane (Worst)

No.	Frequency [MHz]	Reading [dB μ V]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Ant.
1	1000.000	21.1	21.5	13.4	28.2	27.8	53.9	26.1	Vert.
-	-	-	-	-	-	-	-	-	-

Note: All other emissions were under noise floor.

[Chart]



Test Data (Above 1000MHz)

Configuration: 1
Operating mode: Tx (2402MHz)

[Emission level] X-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2350.000	50.9	46.3	-4.6	46.3	41.7	73.9	53.9	27.6	12.2	Hori.
2	4804.000	49.9	44.6	2.7	52.6	47.3	73.9	53.9	21.3	6.6	Hori.

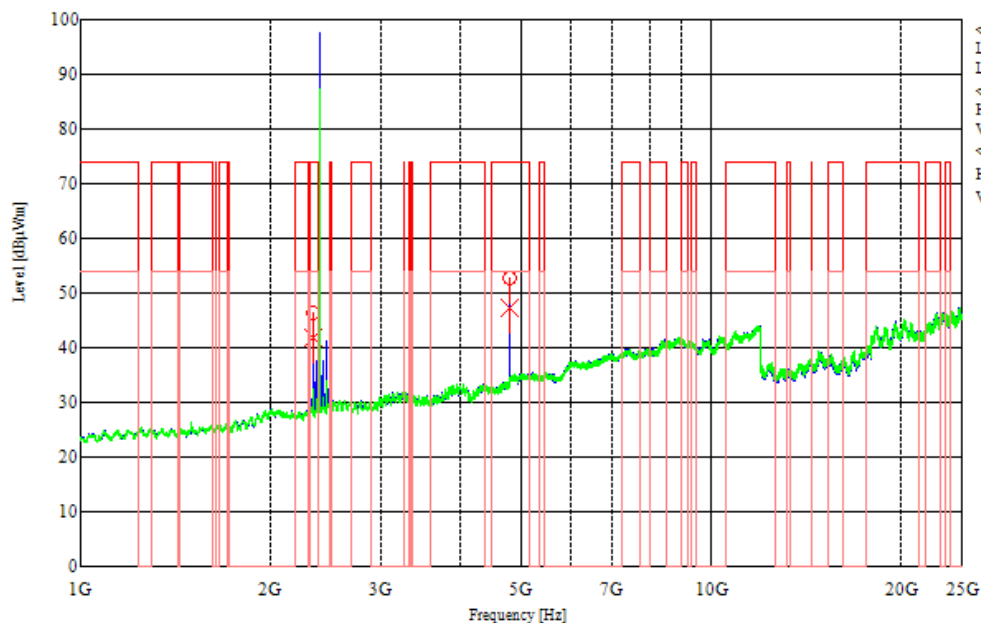
[Emission level] Y-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2350.000	48.8	42.6	-4.6	44.2	38.0	73.9	53.9	29.7	15.9	Hori.
2	4804.000	44.7	34.6	2.7	47.4	37.3	73.9	53.9	26.5	16.6	Hori.
3	2350.000	49.2	44.0	-4.6	44.6	39.4	73.9	53.9	29.3	14.5	Vert.
4	4804.000	46.6	38.6	2.7	49.3	41.3	73.9	53.9	24.6	12.6	Vert.

[Emission level] Z-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2350.000	48.8	43.5	-4.6	44.2	38.9	73.9	53.9	29.7	15.0	Hori.
2	4804.000	46.9	39.7	2.7	49.6	42.4	73.9	53.9	24.3	11.5	Hori.
3	2350.000	50.8	45.8	-4.6	46.2	41.2	73.9	53.9	27.7	12.7	Vert.
4	4804.000	50.0	44.4	2.7	52.7	47.1	73.9	53.9	21.2	6.8	Vert.

[Chart (X-plane)]



Configuration: 1
Operating mode: Tx (2440MHz)

[Emission level] X-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2388.000	51.3	45.7	-4.3	47.0	41.4	73.9	53.9	26.9	12.5	Hori.
2	2492.000	49.8	44.3	-3.6	46.2	40.7	73.9	53.9	27.7	13.2	Hori.
3	4880.000	51.2	46.1	2.8	54.0	48.9	73.9	53.9	19.9	5.0	Hori.

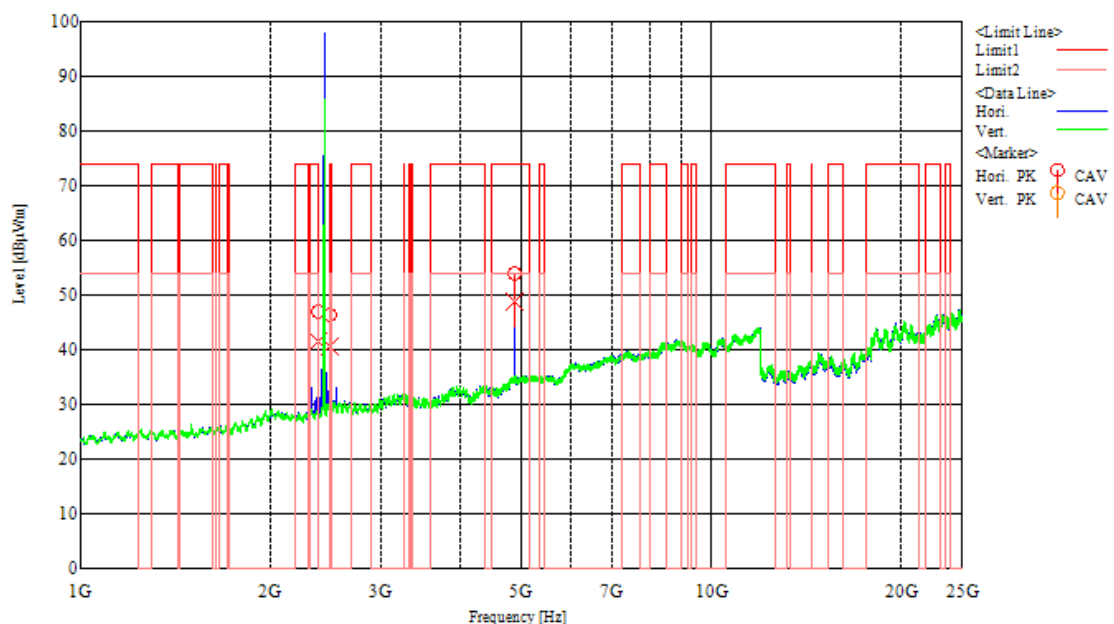
[Emission level] Y-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2388.000	48.5	41.3	-4.3	44.2	37.0	73.9	53.9	29.7	16.9	Hori.
2	2492.000	47.6	40.1	-3.6	44.0	36.5	73.9	53.9	29.9	17.4	Hori.
3	4880.000	46.6	38.3	2.8	49.4	41.1	73.9	53.9	24.5	12.8	Hori.
4	2388.000	49.2	41.9	-4.3	44.9	37.6	73.9	53.9	29.0	16.3	Vert.
5	2492.000	48.0	39.8	-3.6	44.4	36.2	73.9	53.9	29.5	17.7	Vert.
6	4880.000	47.1	39.3	2.8	49.9	42.1	73.9	53.9	24.0	11.8	Vert.

[Emission level] Z-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2388.000	49.6	43.2	-4.3	45.3	38.9	73.9	53.9	28.6	15.0	Hori.
2	2492.000	48.9	41.8	-3.6	45.3	38.2	73.9	53.9	28.6	15.7	Hori.
3	4880.000	46.7	38.8	2.8	49.5	41.6	73.9	53.9	24.4	12.3	Hori.
4	2388.000	50.5	45.1	-4.3	46.2	40.8	73.9	53.9	27.7	13.1	Vert.
5	2492.000	49.5	43.6	-3.6	45.9	40.0	73.9	53.9	28.0	13.9	Vert.
6	4880.000	50.4	44.7	2.8	53.2	47.5	73.9	53.9	20.7	6.4	Vert.

[Chart (X-plane)]



Configuration: 1
Operating mode: Tx (2480MHz)

[Emission level] X-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	4960.000	50.7	45.0	3.0	53.7	48.0	73.9	53.9	20.2	5.9	Hori.
-	-	-	-	-	-	-	-	-	-	-	-

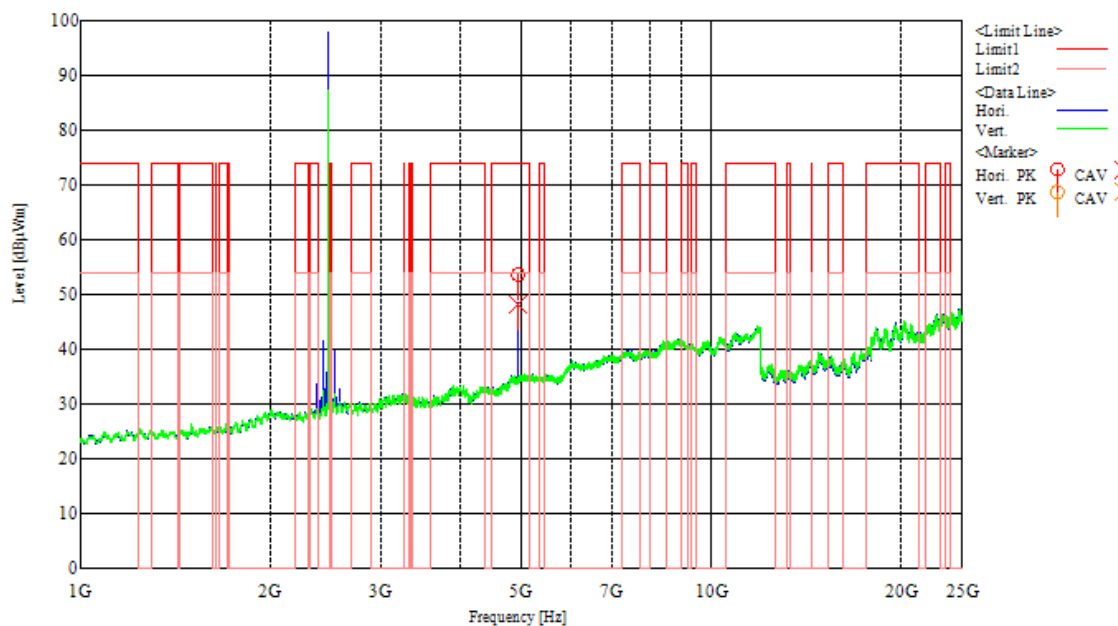
[Emission level] Y-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	4960.000	45.6	35.1	3.0	48.6	38.1	73.9	53.9	25.3	15.8	Hori.
2	4960.000	46.3	37.7	3.0	49.3	40.7	73.9	53.9	24.6	13.2	Vert.

[Emission level] Z-plane

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	4960.000	47.0	39.4	3.0	50.0	42.4	73.9	53.9	23.9	11.5	Hori.
2	4960.000	49.7	43.8	3.0	52.7	46.8	73.9	53.9	21.2	7.1	Vert.

[Chart (X-plane)]



Restricted bandedge measurement

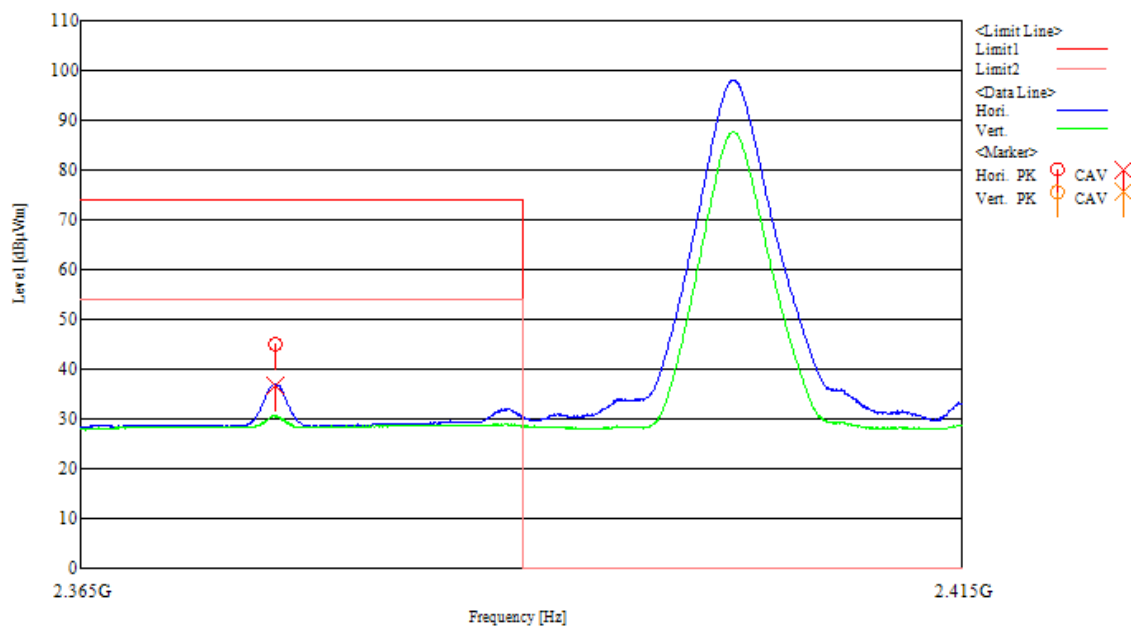
Configuration: 1

Operating mode: Tx (2402MHz)

[Emission level] X-plane (Worst)

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2376.000	49.3	41.0	-4.4	44.9	36.6	73.9	53.9	29.0	17.3	Hori.

[Chart (Bandedge_Low X-plane)]

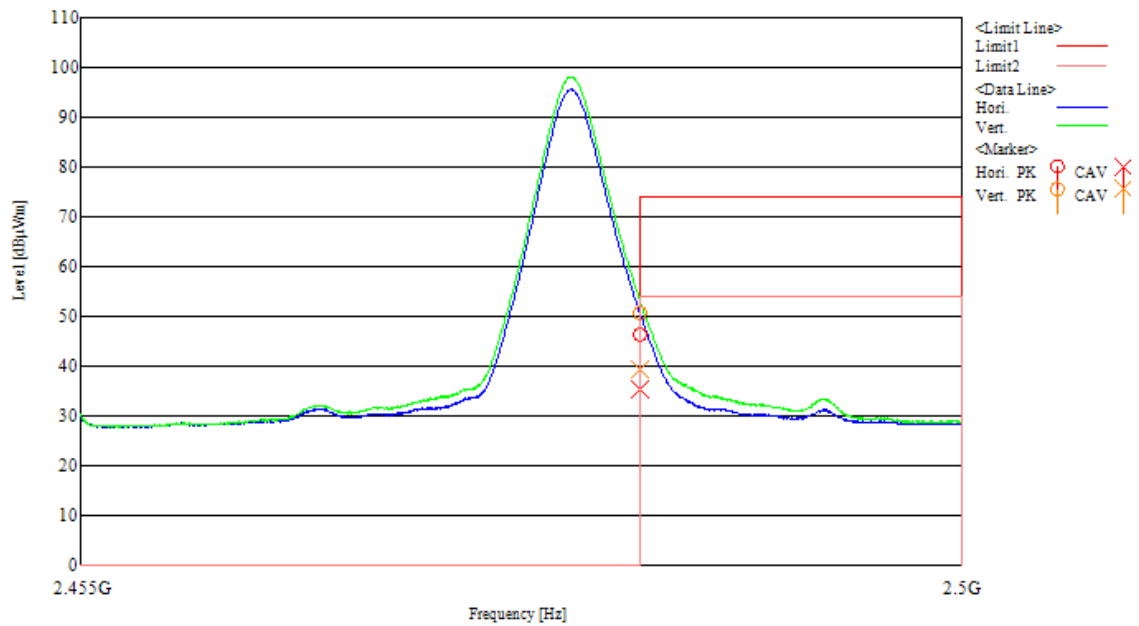


Configuration: 1
Operating mode: Tx (2480MHz)

[Emission level] Z-plane (Worst)

No.	Frequency [MHz]	Reading PK [dBμV]	Reading Ave [dBμV]	C.Factor [dB]	Result PK [dBμV/m]	Result Ave [dBμV/m]	Limit PK [dBμV/m]	Limit Ave [dBμV/m]	Margin PK [dB]	Margin Ave [dB]	Ant.
1	2483.500	50.1	39.1	-3.7	46.4	35.4	73.9	53.9	27.5	18.5	Hori.
2	2483.500	54.5	43.1	-3.7	50.8	39.4	73.9	53.9	23.1	14.5	Vert.

[Chart (Bandedge_High Z-plane)]



Test Data (Below 30 MHz)

[Emission level]

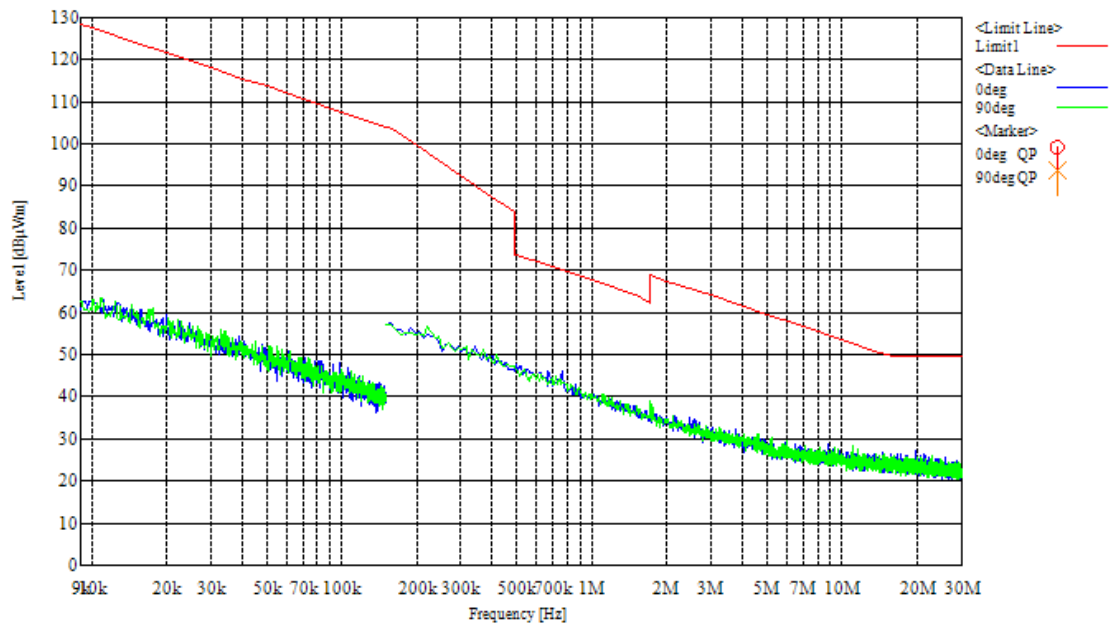
All emissions were under noise floor.

[Chart (Worst)]

Configuration: 1

Operating mode: Tx 2440 MHz

Axis: Z-plane



[Day1: above 1GHz measurement]

Tested Date: 17 Jan. 2017

Humidity: 39 %

Temperature: 15 degC

Atmos. Press: 1023 hPa

[Day2: 30 MHz - 1GHz measurement]

Tested Date: 20 Jan. 2017

Humidity: 34 %

Temperature: 15 degC

Atmos. Press: 1015 hPa

[Day3: below 30 MHz measurement]

Tested Date: 15 Feb. 2017

Humidity: 26 %

Temperature: 17 degC

Atmos. Press: 1026 hPa

2.7 AC power line conducted emissions

Test setup

Test setup was implemented according to the method of ANSI C63.10 clause 6.2.

Test procedure

Measurement procedures were implemented according to the method of ANSI C63.10 clause 6.2.

Applicable rule and limitation

FCC 15.207 AC power line conducted emissions limits

Frequency of Emission [MHz]	Conducted emissions Limit [dB μ V]	
	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. The lower limit applies at the band edges.

Test equipment used (refer to List of utilized test equipment)

TR06	CL18	LN05
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Test software used

EMI Ver. 4.9

Calculation method

The Correction Factor and Result are calculated as followings.

$$\begin{aligned}\text{Correction Factor [dB]} &= \text{ISN Factor [dB]} + \text{Loss [dB]} \\ \text{Result [dB}\mu\text{V]} &= \text{Reading [dB}\mu\text{V]} + \text{Correction Factor [dB]}\end{aligned}$$

Test results - Complied with requirement

Test Data

Configuration: 2
Operating mode: Tx (2402 MHz)

[Emission level]

	Freq. [MHz]	Reading QP [dBμV]	Reading Ave [dBμV]	Factor [dB]	Result QP [dBμV]	Result Ave [dBμV]	Limit QP [dBμV]	Limit Ave [dBμV]	Margin QP [dB]	Margin Ave [dB]	Line
1	0.15000	27.1	7.2	10.3	37.4	17.5	66.0	56.0	28.6	38.5	Va
2	0.18620	22.6	10.8	10.2	32.8	21.0	64.2	54.2	31.4	33.2	Va
3	0.24161	16.8	5.7	10.1	26.9	15.8	62.0	52.0	35.1	36.2	Va
4	0.15000	34.1	13.6	10.3	44.4	23.9	66.0	56.0	21.6	32.1	Vb
5	0.22088	26.3	7.7	10.2	36.5	17.9	62.8	52.8	26.3	34.9	Vb
6	0.39084	13.9	3.9	10.1	24.0	14.0	58.0	48.0	34.0	34.0	Vb

Configuration: 2
Operating mode: Tx (2440 MHz)

[Emission level]

	Freq. [MHz]	Reading QP [dBμV]	Reading Ave [dBμV]	Factor [dB]	Result QP [dBμV]	Result Ave [dBμV]	Limit QP [dBμV]	Limit Ave [dBμV]	Margin QP [dB]	Margin Ave [dB]	Line
1	0.15000	27.1	7.1	10.3	37.4	17.4	66.0	56.0	28.6	38.6	Va
2	0.15544	26.1	6.5	10.3	36.4	16.8	65.7	55.7	29.3	38.9	Va
3	0.19606	21.9	6.0	10.2	32.1	16.2	63.8	53.8	31.7	37.6	Va
4	0.15000	26.9	7.2	10.3	37.2	17.5	66.0	56.0	28.8	38.5	Vb
5	0.20575	21.2	4.3	10.2	31.4	14.5	63.4	53.4	32.0	38.9	Vb
6	0.24790	18.3	3.8	10.2	28.5	14.0	61.8	51.8	33.3	37.8	Vb

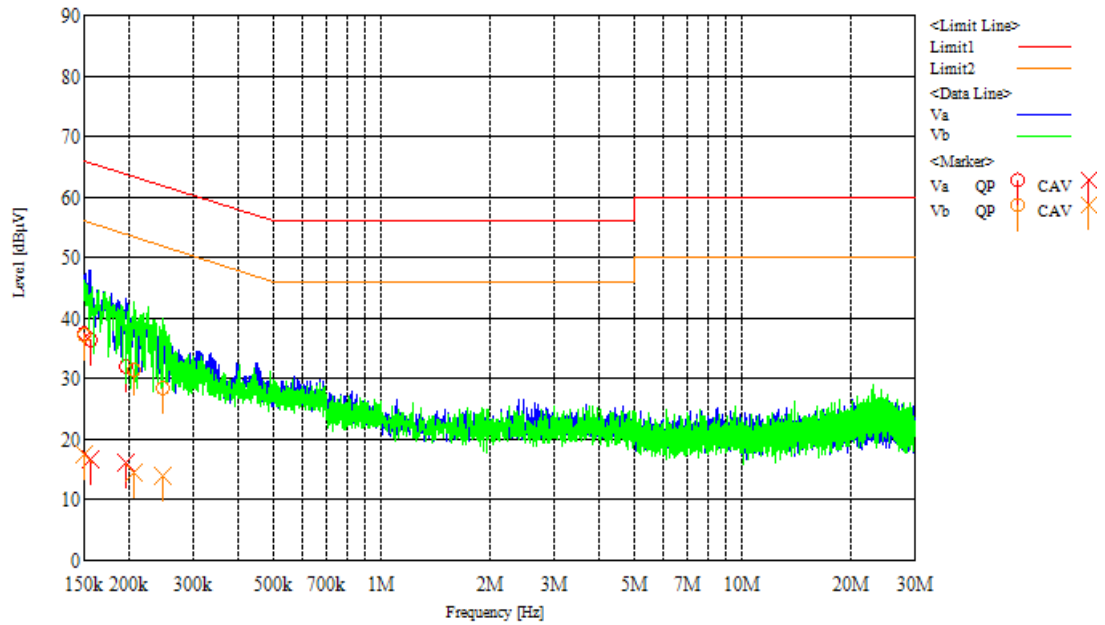
Configuration: 2
Operating mode: Tx (2480 MHz)

[Emission level]

	Freq. [MHz]	Reading QP [dBμV]	Reading Ave [dBμV]	Factor [dB]	Result QP [dBμV]	Result Ave [dBμV]	Limit QP [dBμV]	Limit Ave [dBμV]	Margin QP [dB]	Margin Ave [dB]	Line
1	0.15000	27.0	6.8	10.3	37.3	17.1	66.0	56.0	28.7	38.9	Va
2	0.17142	23.7	5.8	10.2	33.9	16.0	64.9	54.9	31.0	38.9	Va
3	0.21408	20.1	6.4	10.2	30.3	16.6	63.0	53.0	32.7	36.4	Va
4	0.15000	34.0	13.6	10.3	44.3	23.9	66.0	56.0	21.7	32.1	Vb
5	0.21663	26.6	7.6	10.2	36.8	17.8	62.9	52.9	26.1	35.1	Vb
6	0.23175	26.5	8.4	10.2	36.7	18.6	62.4	52.4	25.7	33.8	Vb

[Chart]

Operating mode: Tx (2440 MHz)



Tested Date: 23 Jan. 2017
Humidity: 57 %

Temperature: 19 degC
Atmos. Press: 1012 hPa

4 List of utilized test equipment / calibration

RFT ID No.	Kind of Equipment and Precision	Manufacturer	Model No.	Serial Number	Calibration Date	Calibrated until
AC01(EM)	Anechoic Chamber (1st test room)	JSE	203397C	-	2016/4/23	2017/4/30
AC01(EG)	Anechoic Chamber (1st test room)	JSE	203397C	-	2016/3/26	2017/3/31
BA07	Biological Antenna	TESEQ	CBL6143A	26670	2016/12/20	2017/12/31
CH02	Conical Horn Antenna (12-18GHz)	ETS-Lindgren	3163-05	00164243	2015/3/28	2017/3/31
CL11	RF Cable for RE	RFT	-	-	2016/3/14	2017/3/31
CL18	RF Cable for CE	RFT	-	-	2016/3/14	2017/3/31
CL30	RF Cable 5 m	SUHNER	SUCOFLEX104PE	MY3599	2016/8/22	2017/8/31
CL38	RF Cable 2 m	Junkosha	MWX221	1603S626	2016/4/5	2017/4/30
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2016/1/26	2018/1/31
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2016/5/13	2017/5/31
LP06	Loop Antenna	ETS-Lindgren	6502	00164299	2016/3/9	2017/3/31
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2016/1/29	2017/1/31
PR21	Pre. Amplifier	Anritsu	MH648A	6200467119	2016/12/20	2017/12/31
SH01	Standard Horn Antenna (18-26G)	A.H. Systems	SAS-572	208	2016/7/5	2018/7/31
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2016/9/29	2017/9/30

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.