TEST REPORT

For

2.4GHz Band Data Communication Module

In conformity with

FCC CFR 47 Part15C (01. Oct. 2015) / RSS-247 Issue 2, RSS-Gen Issue 4

Model: XE9721

FCC ID/ IC Certification No.: PH3XE9721/3070C-XE9721

Test Item: 2.4GHz Band Data Communication Module

Report No: ERY1704Z17R1

Issue Date: 17 April, 2017

Prepared for

ALINCO INCORPORATED
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Prepared by

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History

Report No.	Date	Revisions	Issued By
ERY1704Z10R1	10 Apr. 2017	Initial Issue	K.Onishi
ERY1704Z17R1	17 Apr. 2017	Added the Band-edge data (page.23)	K.Onishi

1 General information

1.1 Product description

Test item	: 2.4GHz Band Data Communication Module
Manufacturer	: ALINCO INCORPORATED.
Address	: Yodoyabashi, Dai-Bldg. 13F, 4-4-9, Koraibashi, Chuo-ku, Osaka 541-0043, Japan
Model	: XE9721
FCC ID	: PH3XE9721
ISED Certification No.	: 3070C-XE9721
Serial numbers	: T000401, T000405
Operating Frequency	: 2401 - 2411.5MHz
RF Output Power	: 9.38dBm (measured at the antenna terminal)
Antenna Gain	: -0.66dBi (Printed Half Wave Dipole Antenna) 0.61dBi (Printed 1/4 Wave Monopole Antenna)
Receipt date of EUT	: 24 March, 2017
Nominal power source voltages	: DC 4.5V

1.2 Test(s) performed/ Summary of test result

Test specification(s)	: FCC CFR 47 Part 15 Subpart C (01 Oct. 2015) RSS-247 Issue 2, RSS-Gen Issue 4
Test method(s)	: ANSI C63.10: 2013
Test(s) started	: 2 April, 2017
Test(s) completed	: 16 April, 2017
Purpose of test(s)	: Certification for FCC / ISED
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 : K. Onishi

K. Onishi
Engineer
E&E Lab EMC Testing RF Team

Reviewer : T. Karuishi

T. Karuishi
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.

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 (10 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

1.5.1 Table of test summary

Requirement	Section in FCC/ISED	Result	Section in this report
Occupied Bandwidth (99 %)	2.1049 / RSS-Gen 6.6	Complied	2.1
Occupied Bandwidth (20 dB)	15.247(a)(1) / RSS-247 5.1	Complied	2.2
Hopping Carrier Frequency Separation	15.247(a) / RSS-247 5.1	Complied	2.3
Number of Hopping Channel	15.247(a) / RSS-247 5.1	Complied	2.4
Average Time of Occupancy	15.247(a) / RSS-247 5.1	Complied	2.5
Peak Output Power	15.247(a)(1)/(b)(1) / RSS-247 5.4	Complied	2.6
Conducted Spurious Emissions	15.247(d) / RSS-247 5.5	Complied	2.7
Transmitter Radiated Spurious Emissions	15.205(b)/15.209 / RSS-Gen 6.1.3	Complied	2.8
Transmitter AC Power Line Conducted Emissions	15.207 / RSS-Gen 8.8	Complied	2.9
Receiver Radiated Spurious Emissions	RSS-Gen 7	Complied	2.10
Receiver AC Power Line Conducted Emissions	RSS-Gen 8.8	Complied	2.11

1.6 Setup of equipment under test (EUT)

1.6.1 Test configuration of EUT

Equipment(s) under test:

	Item	Manufacturer	Model No.	Serial No.	Note
A1	2.4GHz Band Data Communication Module	ALINCO INCORPORATED.	XE9721	T000401	ANT: 3148578511
A2	2.4GHz Band Data Communication Module	ALINCO INCORPORATED.	XE9721	T000405	ANT: 3148581511

The EUT has a two type of the printed antenna alternatively. One is the half wave dipole antenna model: 3148581511, the other one is 1/4 wave monopole antenna model: 3148578511.

Support Equipment(s):

	Item	Manufacturer	Model No.	Serial No.	Note
B	Test Kit	-	-	-	
C	AC Adaptor	Logitec	LA-5W5L-02	-	

Connected cable(s):

No.	Item	Identification (Manu. etc.)	Cable Shielded	Ferrite Core	Length (m)	Note
1-1	Control cable	-	No	No	0.5	ANT: 3148578511
1-2	Control cable	-	Yes	Yes	1.7	ANT: 3148581511
2	DC power cable	Logitec	No	No	1.3	

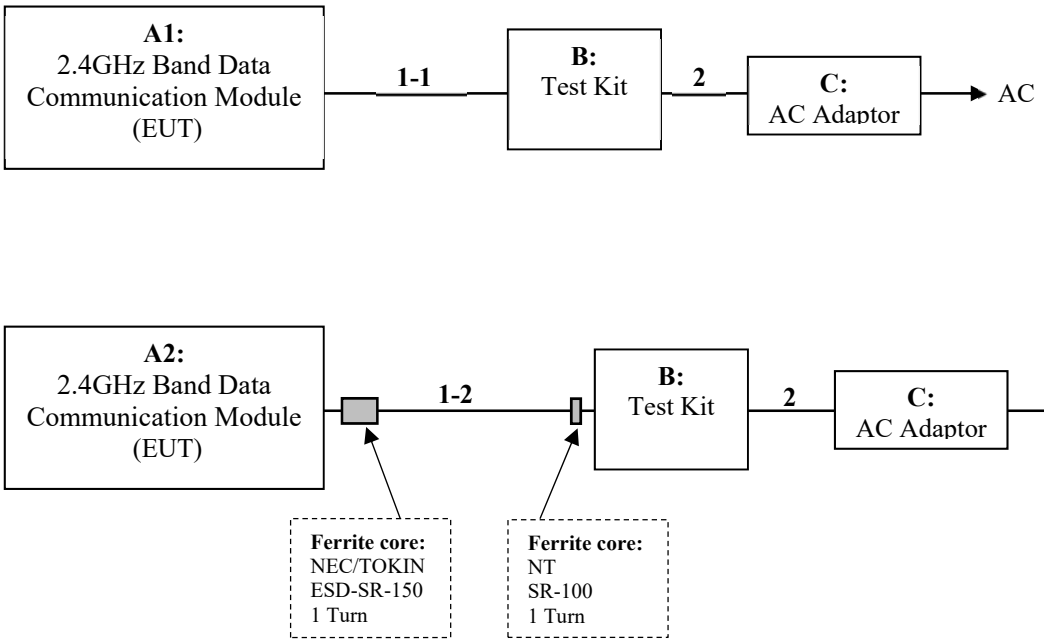
1.6.2 Operating condition:

Operating mode:

The EUT was tested under the following test mode prepared by the applicant;

(1-1) Continuous transmission, hopping off (0ch: 2401MHz)
(1-2) Continuous transmission, hopping off (10ch: 2406MHz)
(1-3) Continuous transmission, hopping off (21ch: 2411.5MHz)
(1-4) Continuous transmission, hopping on (Hopping Group 0)
(1-5) Continuous transmission, hopping on (Hopping Group 10)
(1-6) Continuous transmission, hopping on (Hopping Group 21)
(2-1) Continuous receiving (0ch: 2401MHz)
(2-2) Continuous receiving (10ch: 2406MHz)
(2-3) Continuous receiving (21ch: 2411.5MHz)

1.6.3 Setup diagram of tested system:



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

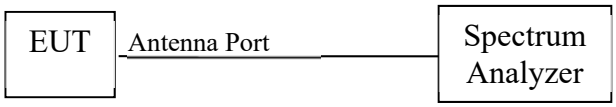
No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Occupied Bandwidth (99 dB)

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 6.9.3

- 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)

SA06	CL36				

Test Date

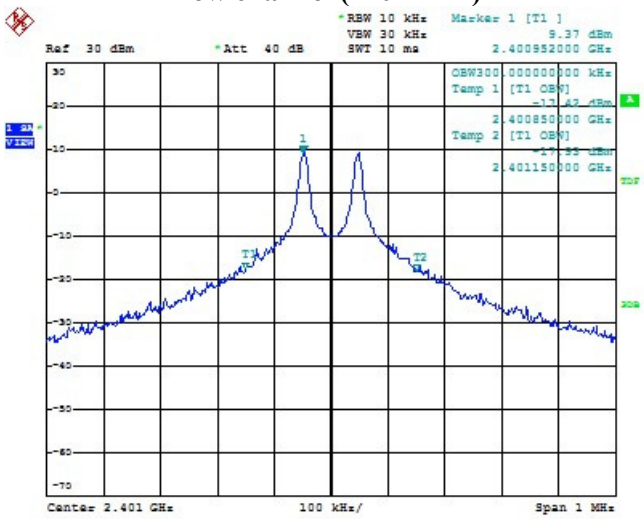
Tested Date:	7 Apr. 2017	Temperature:	21 degC
Humidity:	60 %	Atmos. Press:	1005 hPa

Test results

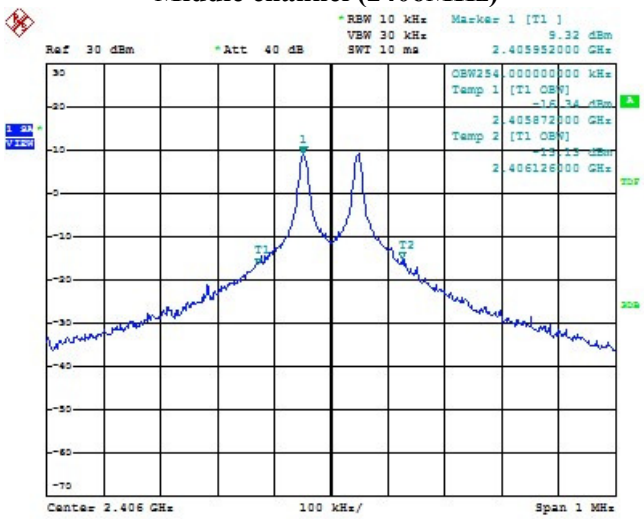
Transmission Channel	Transmission Frequency [MHz]	99% Bandwidth [kHz]
Low (0ch)	2401	300
Middle (10ch)	2406	254
High (21ch)	2411.5	700

[Chart]

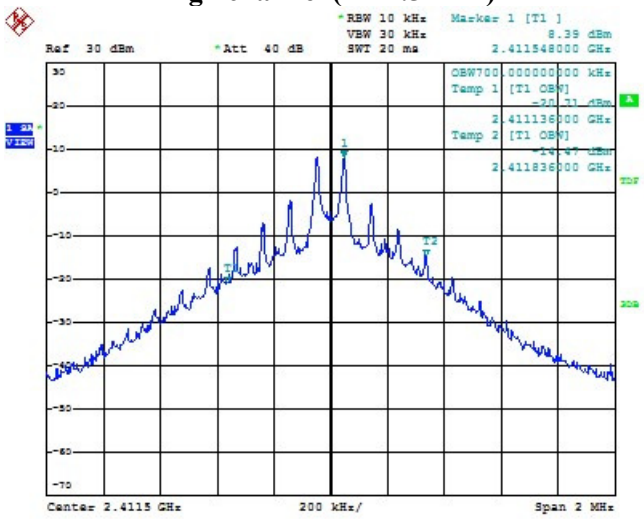
Low channel (2401MHz)



Middle channel (2406MHz)



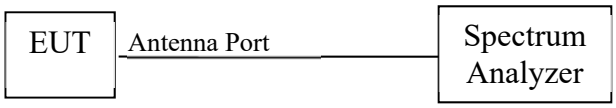
High channel (2411.5MHz)



2.2 Occupied Bandwidth (20 dB)

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 6.9.2

- RBW: 1 to 5 % of OBW
- VBW > 3 x RBW
- Span: OBW x 2 to 5
- Trace: Max hold

Limitation

There are no limitations.
The measurement value is used to calculation of the limitation of the channel separation.

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

SA06	CL36				

Test Date

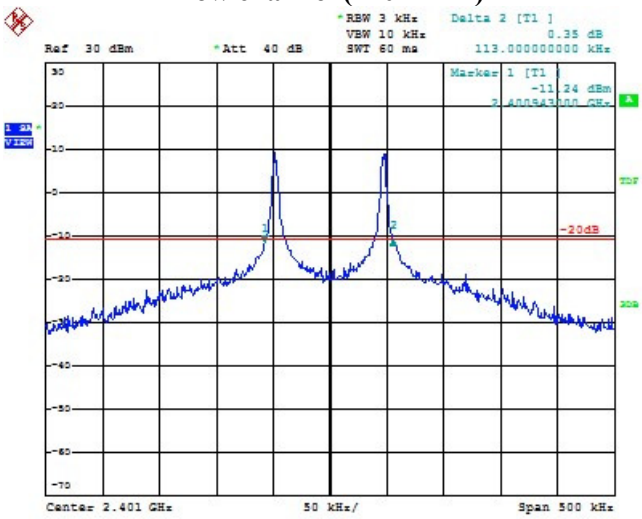
Tested Date:	7 Apr. 2017	Temperature:	21 degC
Humidity:	60 %	Atmos. Press:	1005 hPa

Test results

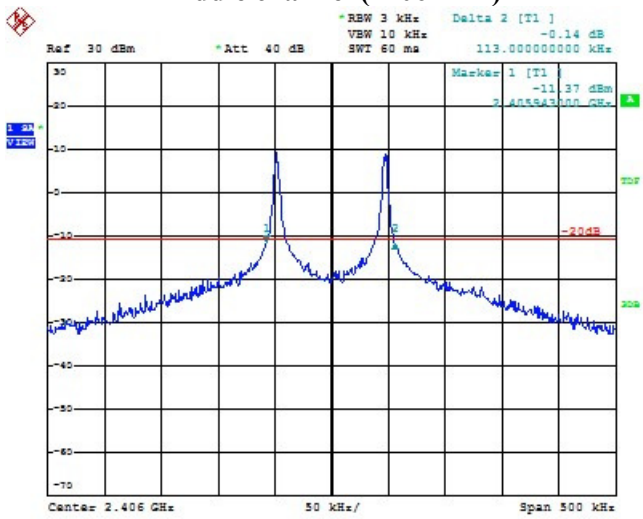
Transmission Channel	Transmission Frequency [MHz]	99% Bandwidth [kHz]
Low (0ch)	2401	113
Middle (10ch)	2406	113
High (21ch)	2411.5	500

[Chart]

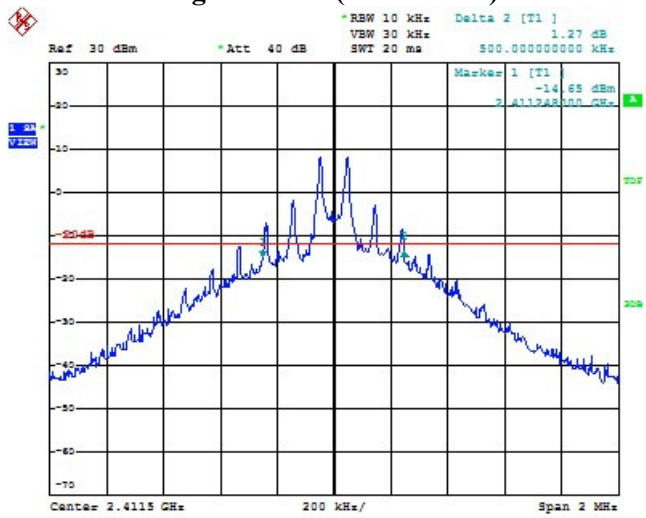
Low channel (2401MHz)



Middle channel (2406MHz)



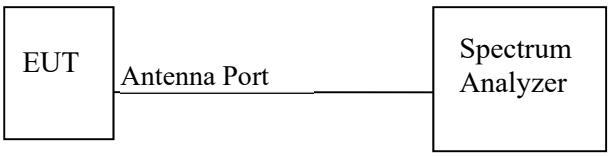
High channel (2411.5MHz)



2.3 Hopping Carrier Frequency Separation

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 7.8.2

Span: Wide enough to capture the peaks of two adjacent channels.
RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
VBW: ≥ RBW.
Trace: Max hold.

Limitation

15.247(a)(1) frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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

SA06	CL36				

Test Date

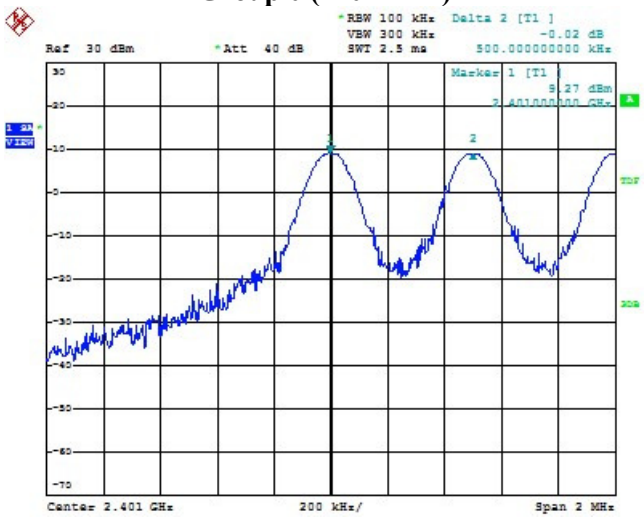
Tested Date: 7 Apr. 2017 Temperature: 21 degC
Humidity: 60 % Atmos. Press: 1005 hPa

Test results – comply with the limitation.

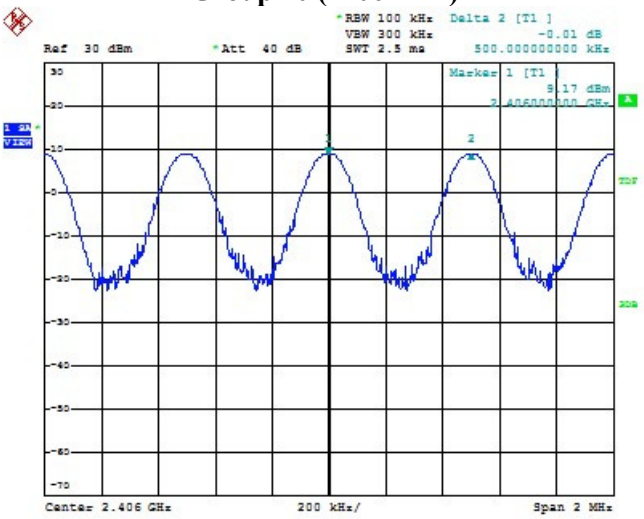
Hopping group	Measured Frequency [MHz]	Frequency Separation [kHz]
Group 0	2401	500
Group 10	2406	500
Group 21	2411.5	500

[Chart]

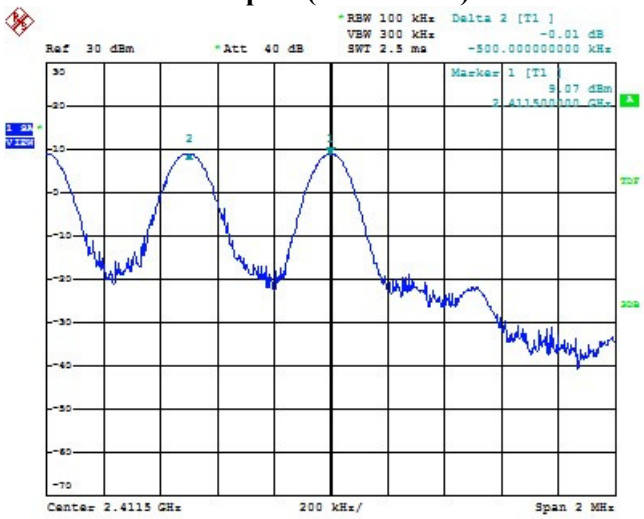
Group 0 (2401MHz)



Group 10 (2406MHz)



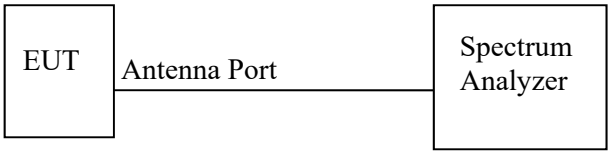
Group 21 (2411.5MHz)



2.4 Number of Hopping Channel

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 7.8.3

Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW: ≥ RBW.
Trace: Max hold.

Limitation

15.247(a) (1) (iii) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

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

SA06	CL36				

Test Date

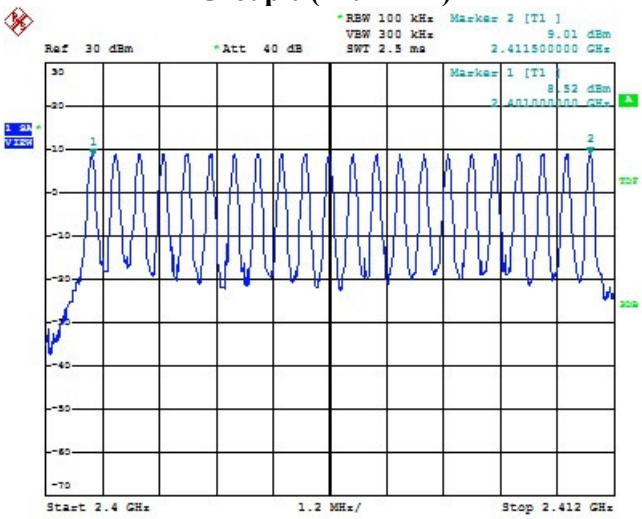
Tested Date: 7 Apr. 2017 Temperature: 21 degC
Humidity: 60 % Atmos. Press: 1005 hPa

Test results – Comply with the limitation

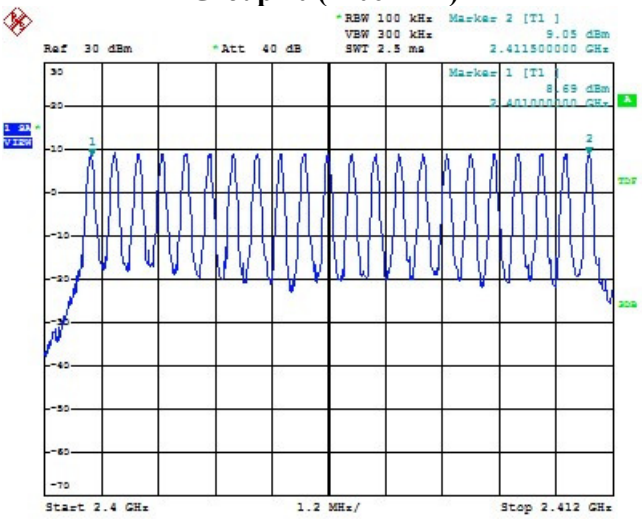
	Hopping group		
	Group 0	Group 10	Group 21
Number of Hopping channel	22	22	22

[Chart]

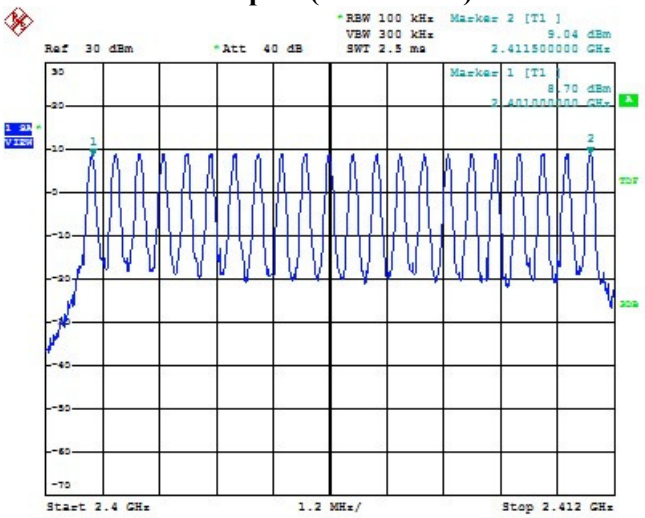
Group 0 (2401MHz)



Group 10 (2406MHz)



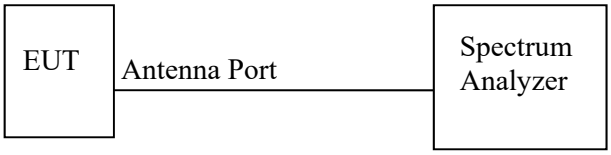
Group 21 (2411.5MHz)



2.5 Average Time of Occupancy

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 7.8.4

Span: Zero span, centered on a hopping channel.
RBW: RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / *T*, where *T* is the expected dwell time per channel.
Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
Trace: Max hold.

Limitation

15.247(a)(1)(iii) The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

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

SA06	CL36				

Test Date

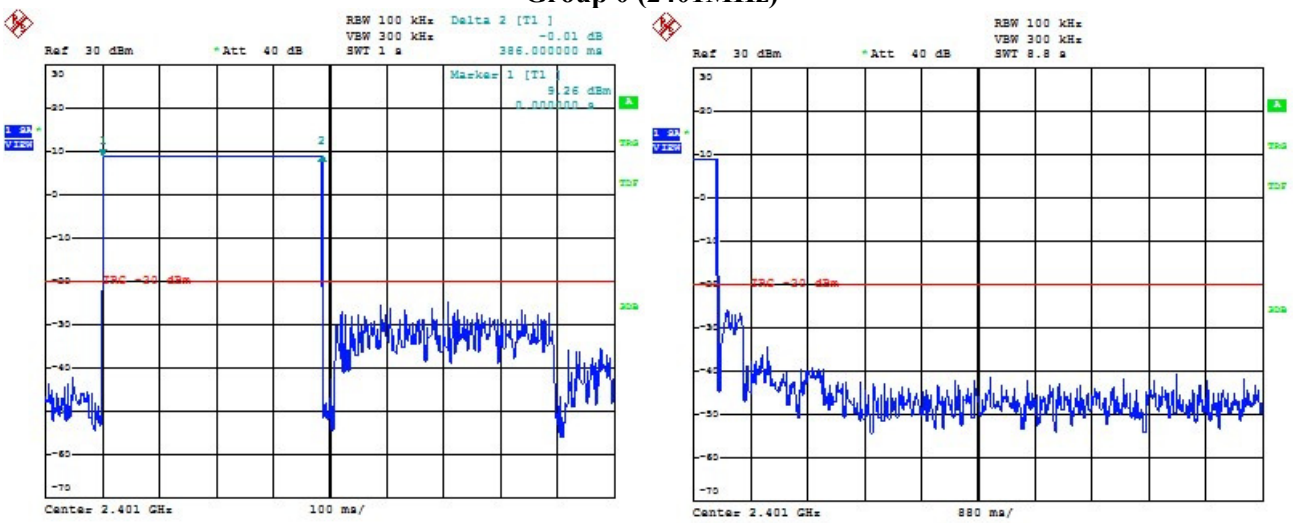
Tested Date: 7 Apr. 2017 Temperature: 21 degC
Humidity: 60 % Atmos. Press: 1005 hPa

Test results – comply with the limitation.

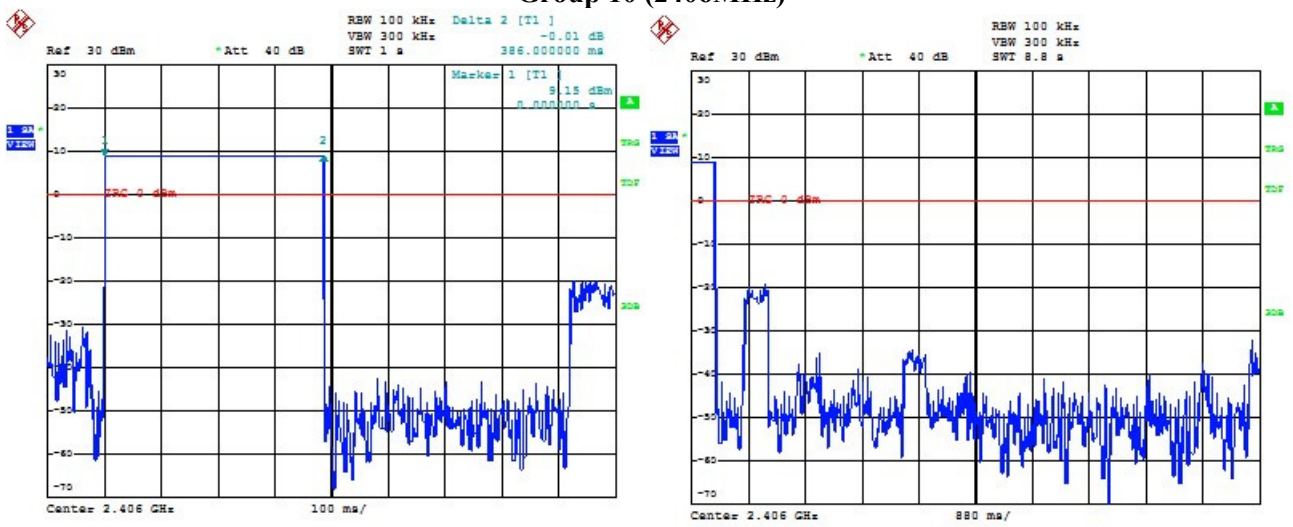
Hopping group	Measured Frequency [MHz]	Time of occupancy [msec]
Group 0	2401	386
Group 10	2406	386
Group 21	2411.5	386

[Chart]

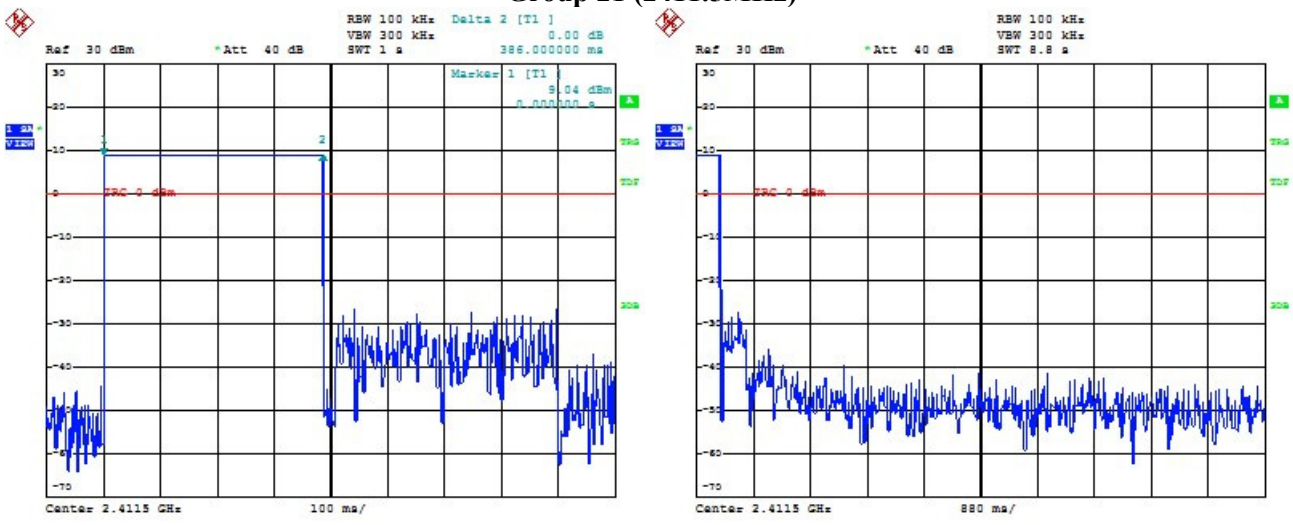
Group 0 (2401MHz)



Group 10 (2406MHz)



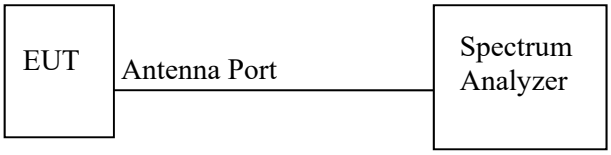
Group 21 (2411.5MHz)



2.6 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 7.8.5

Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
RBW: RBW > 20 dB bandwidth of the emission being measured.
VBW: ≥ RBW.
Trace: Max hold.

Limitation

15.247(a) (1) Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW(21dBm).

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

SA06	CL36				

Test Date

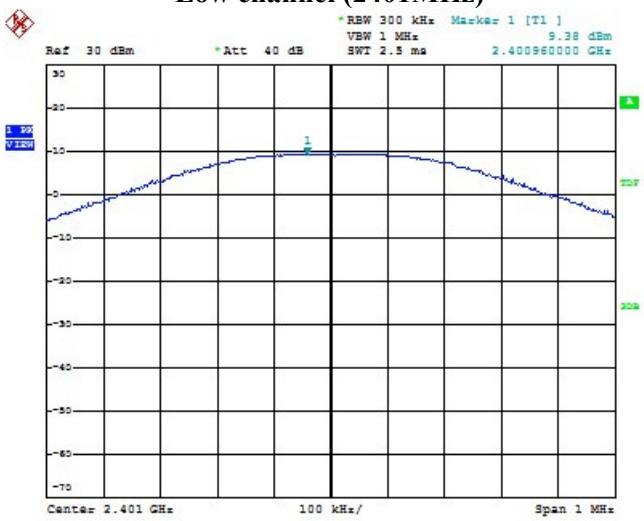
Tested Date: 7 Apr. 2017 Temperature: 21 degC
Humidity: 60 % Atmos. Press: 1005 hPa

Test results – comply with the limitation.

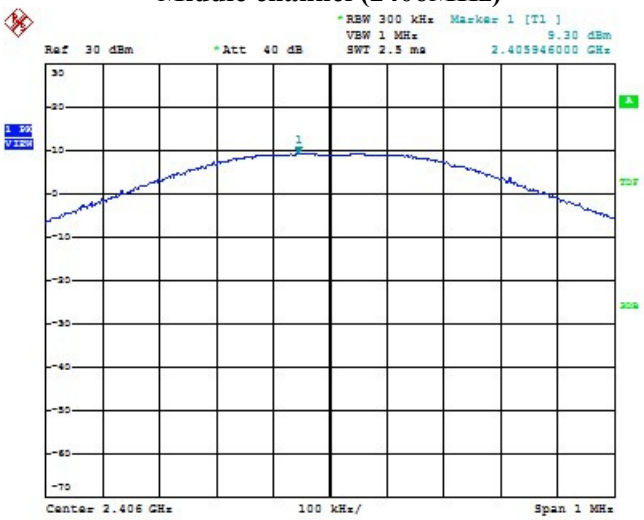
Transmission Channel	Transmission Frequency [MHz]	Output power [dBm]	Output power [mW]
Low (0ch)	2401	9.38	8.67
Middle (10ch)	2406	9.30	8.51
High (21ch)	2411.5	9.18	8.28

[Chart]

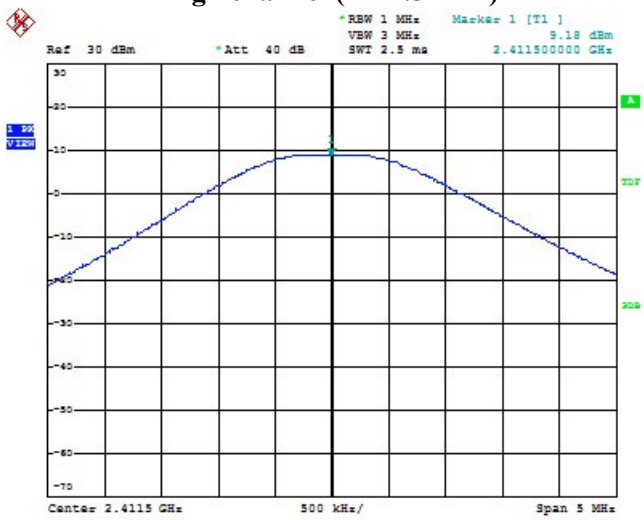
Low channel (2401MHz)



Middle channel (2406MHz)



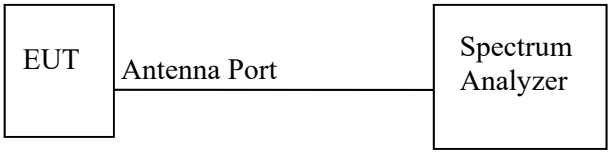
High channel (2411.5MHz)



2.7 Conducted Spurious Emissions (Antenna Port)

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)

SA06	CL36				

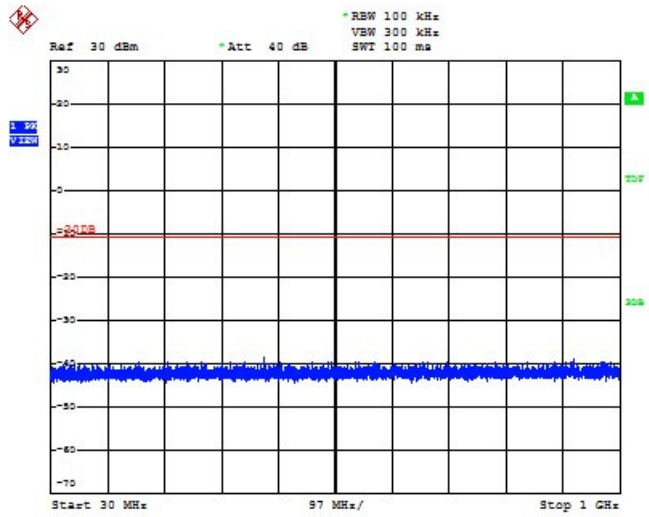
Test Date

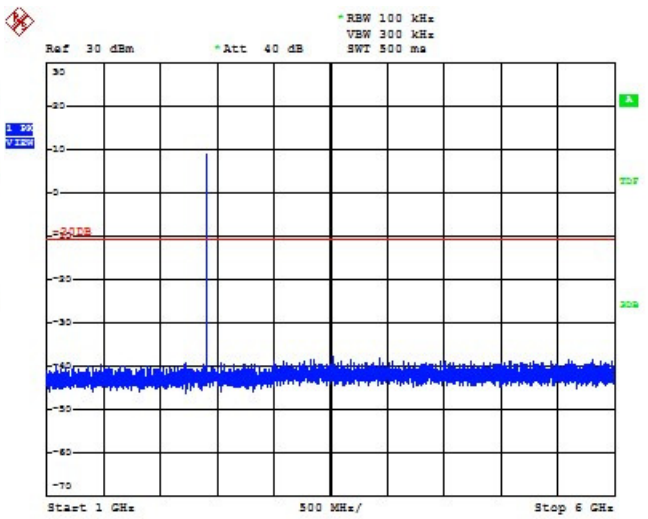
Tested Date:	7 Apr. 2017	Temperature:	21 degC
Humidity:	60 %	Atmos. Press:	1005 hPa
Tested Date:	16 Apr. 2017	Temperature:	20 degC
Humidity:	46 %	Atmos. Press:	1015 hPa

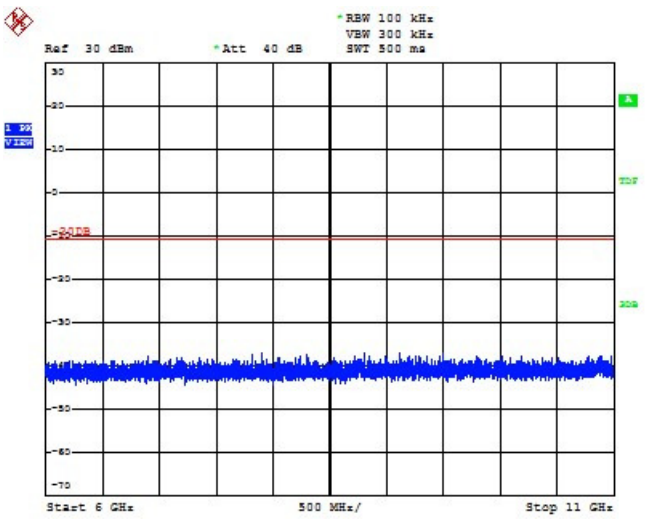
Test results – comply with the limitation.

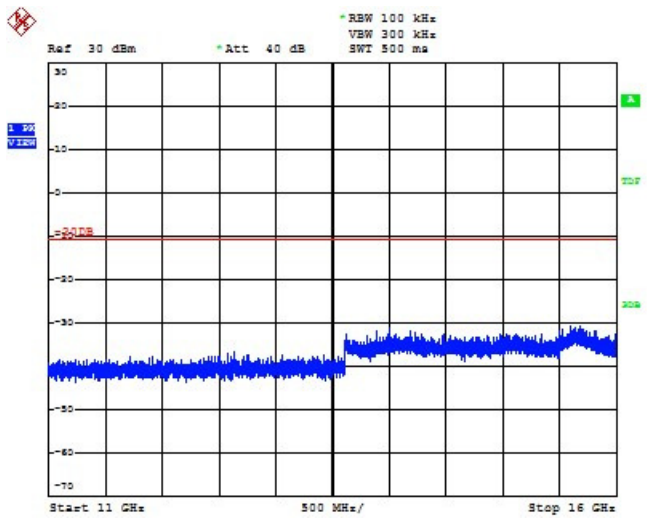
There is no conducted spurious emissions greater than the noise floor.

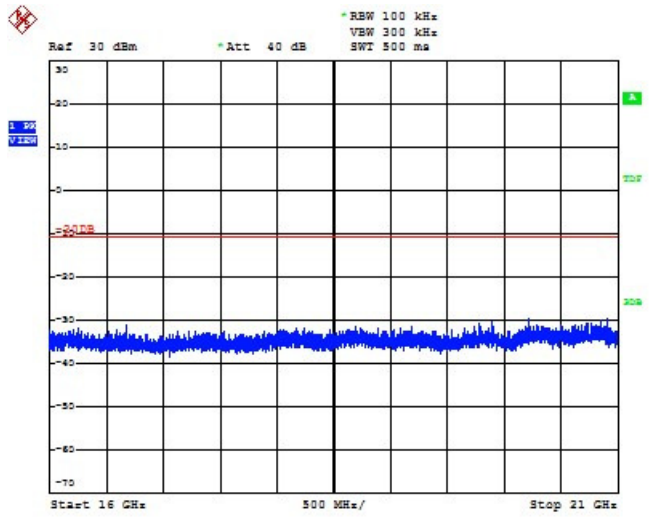
[Chart] Low channel (2401MHz)

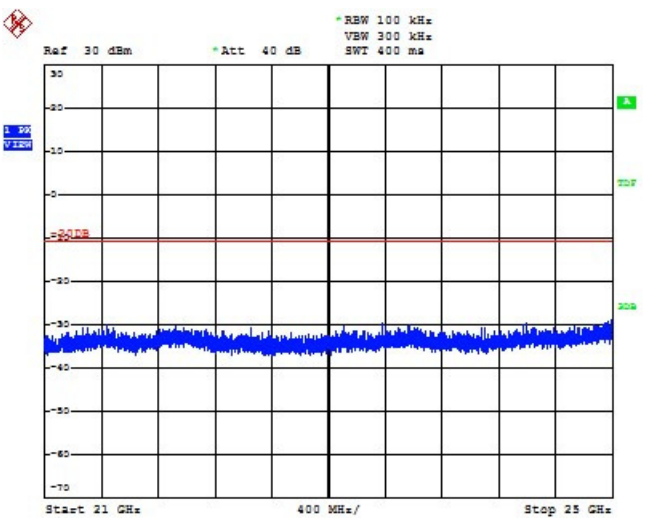




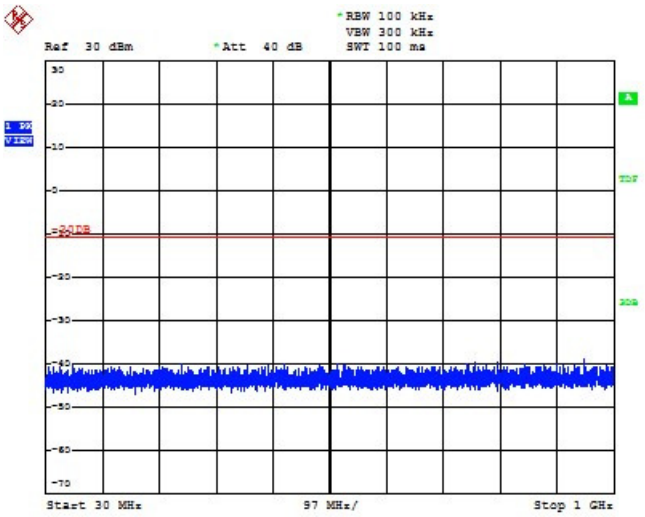


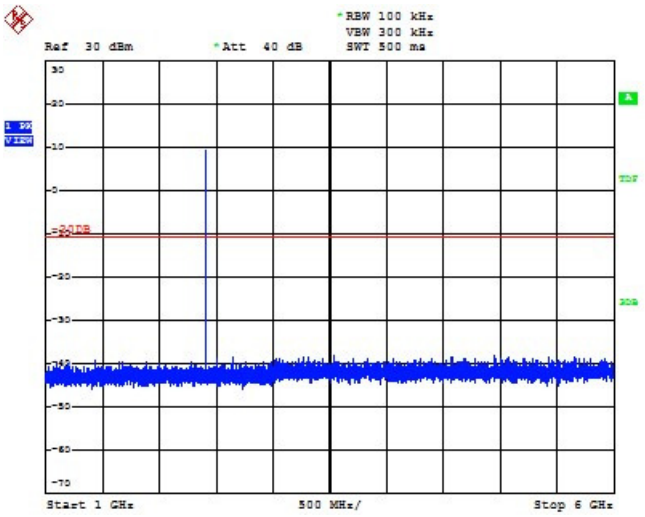


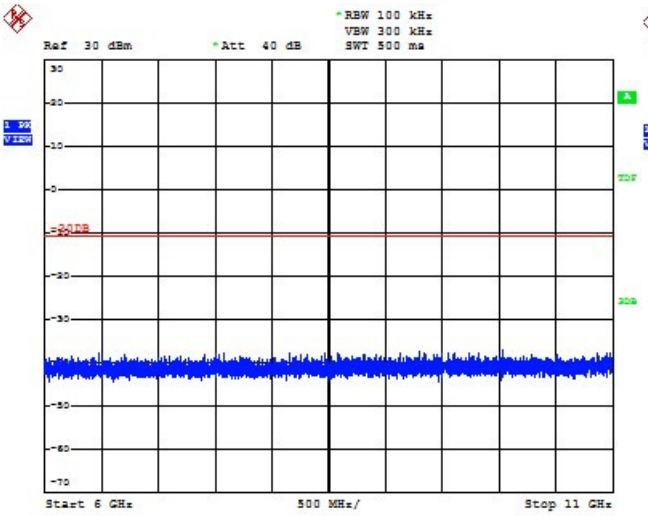


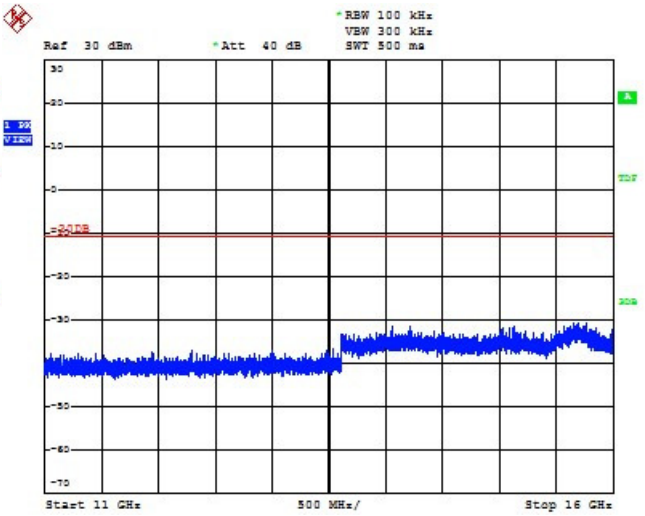


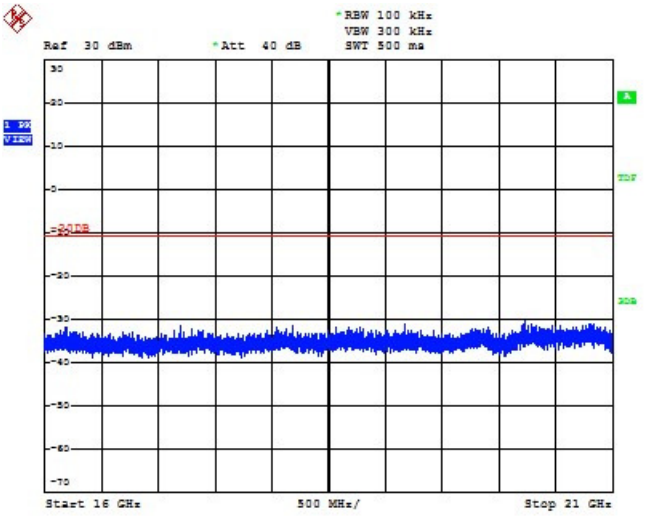
[Chart] Middle channel (2406MHz)

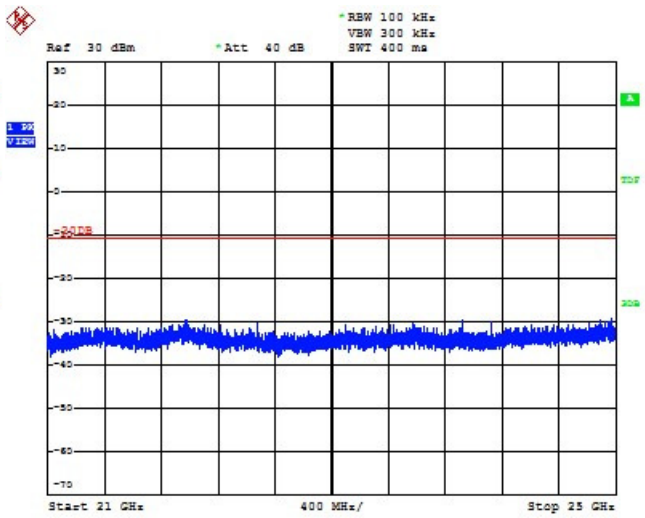




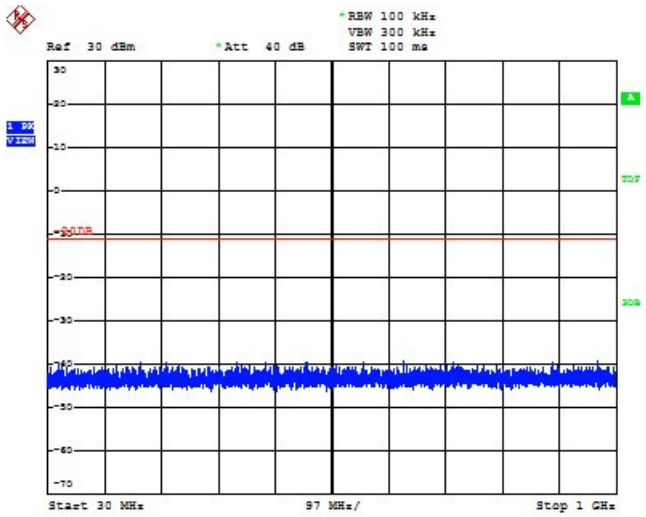


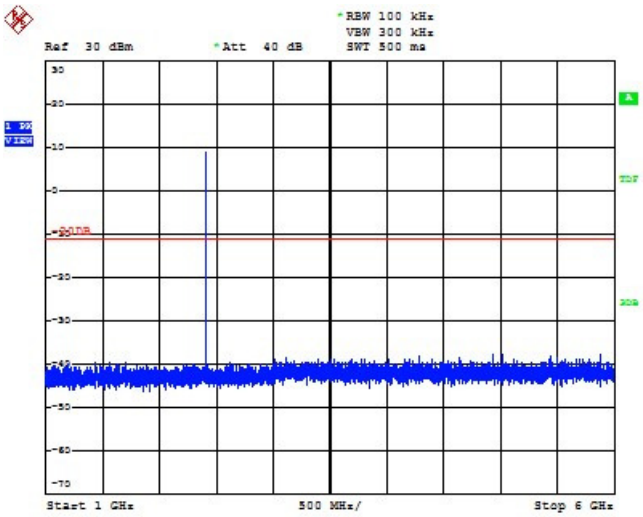


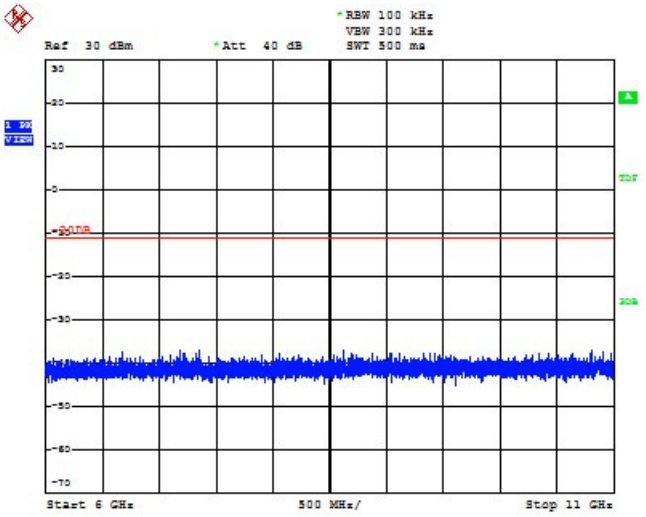


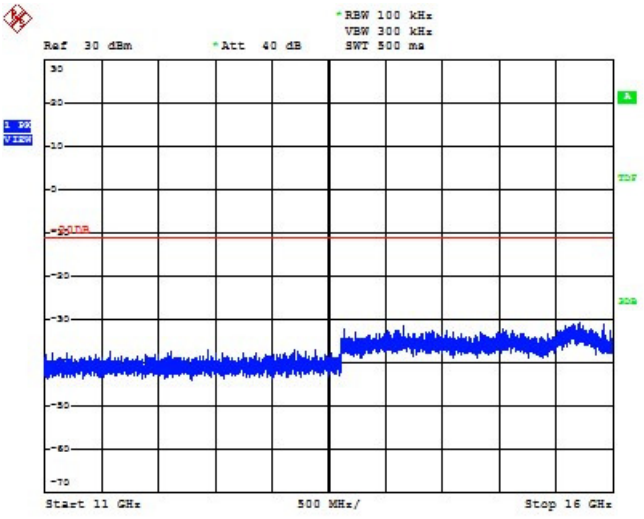


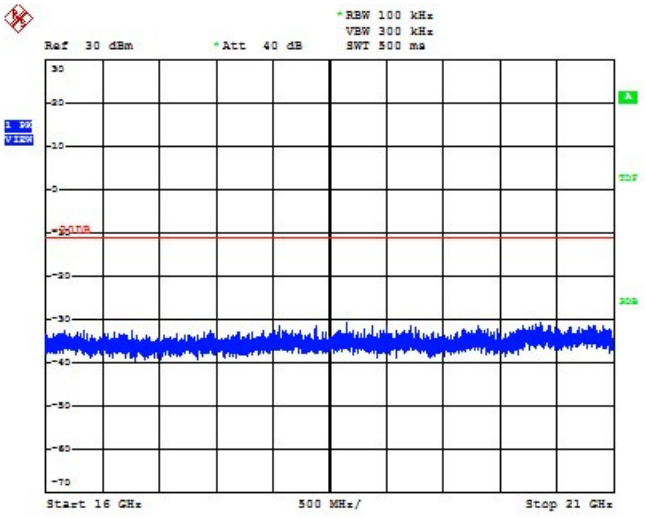
[Chart] High channel (2411.5MHz)

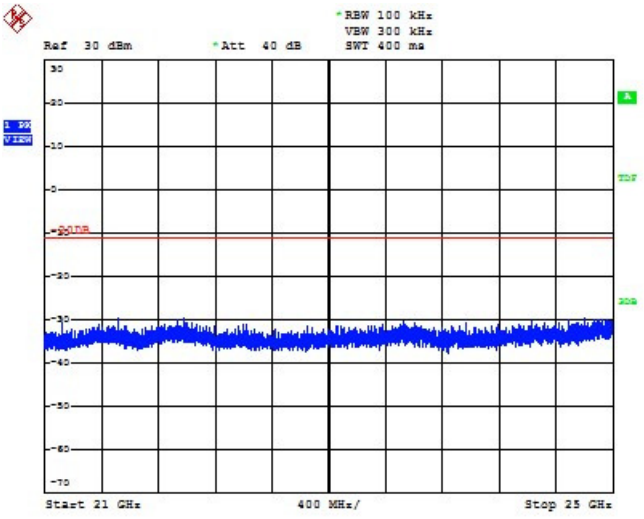






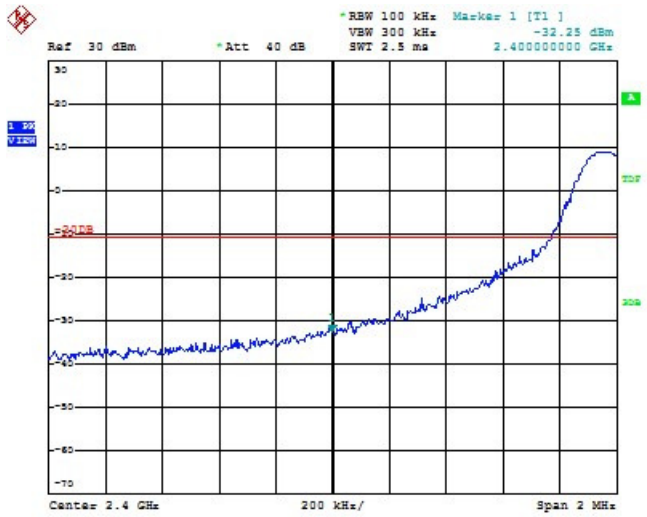


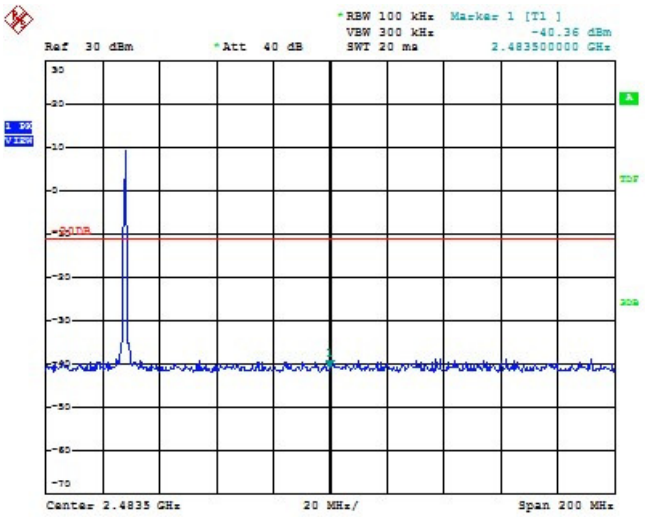




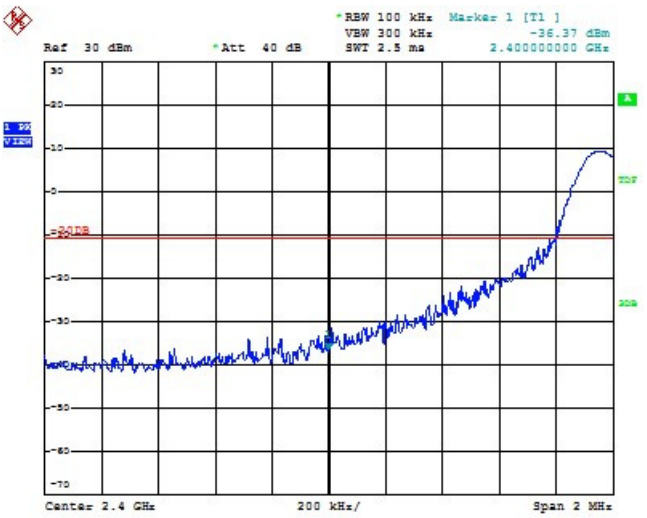
[Chart]

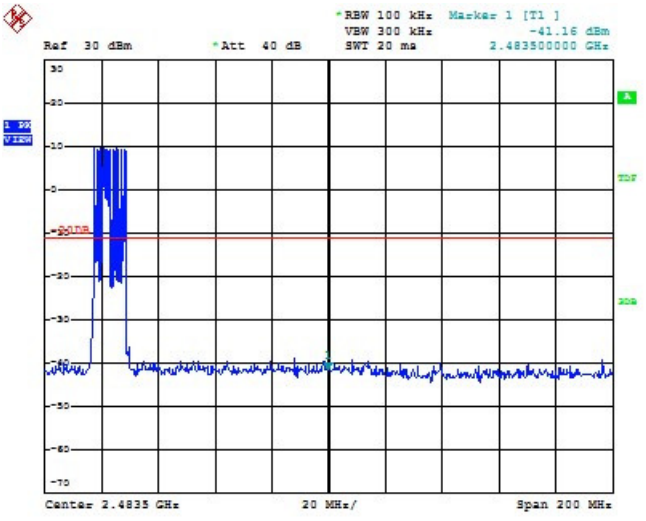
Bandedge (Single hop)





Bandedge (Hopping)

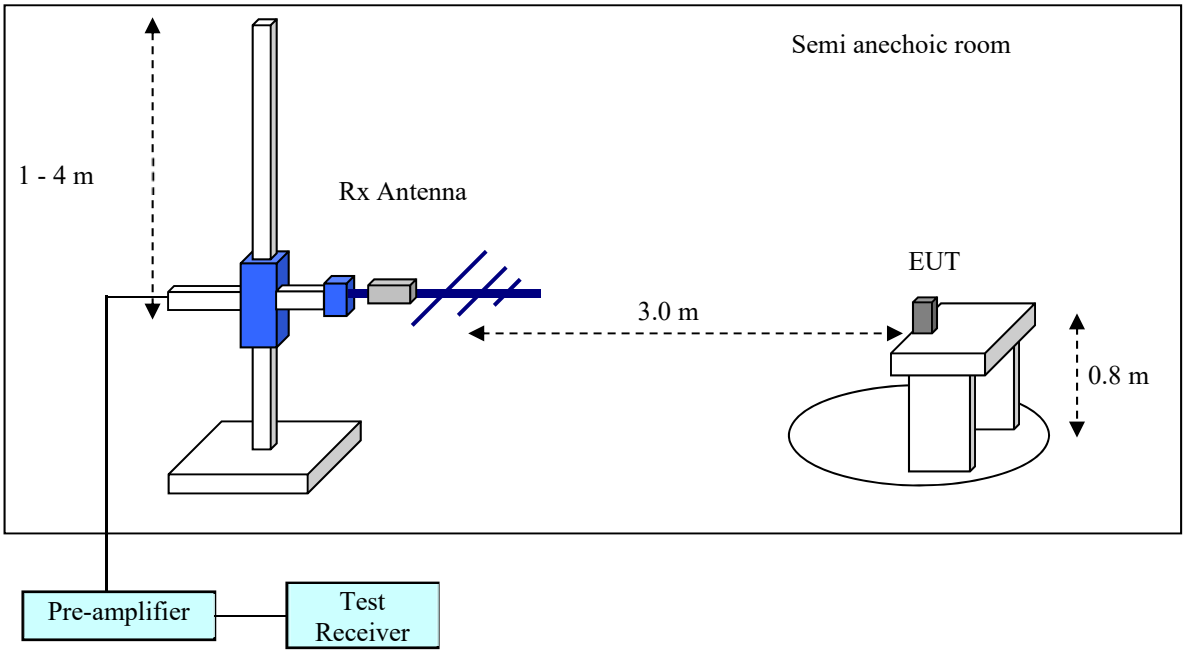




2.8 Radiated emissions (for restricted frequency band)

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

[Below 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 [μV/m]	Measurement Distance [m]	Field Strength [dBμV/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 Date

[Radiated emission (30-1000MHz)]

Tested Date: 9 Apr. 2017 Temperature: 20 degC
Humidity: 65 % Atmos. Press: 1006 hPa

[Radiated emission (1-12GHz)]

Tested Date: 2 Apr. 2017 Temperature: 17 degC
Humidity: 40 % Atmos. Press: 1015 hPa

[Radiated emission (12-25GHz)]

Tested Date: 6 Apr. 2017 Temperature: 20 degC
Humidity: 49 % Atmos. Press: 1026 hPa

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

AC01(EM)	CL11	TR06	PR15	BA07	CL30	CL31	PR12
DH01	CH01	SH01	AT33	BRF12	HPF1		

Test software used

EMI1 Ver. 5.2

Calculation method

The Correction Factor and Result are calculated as followings.

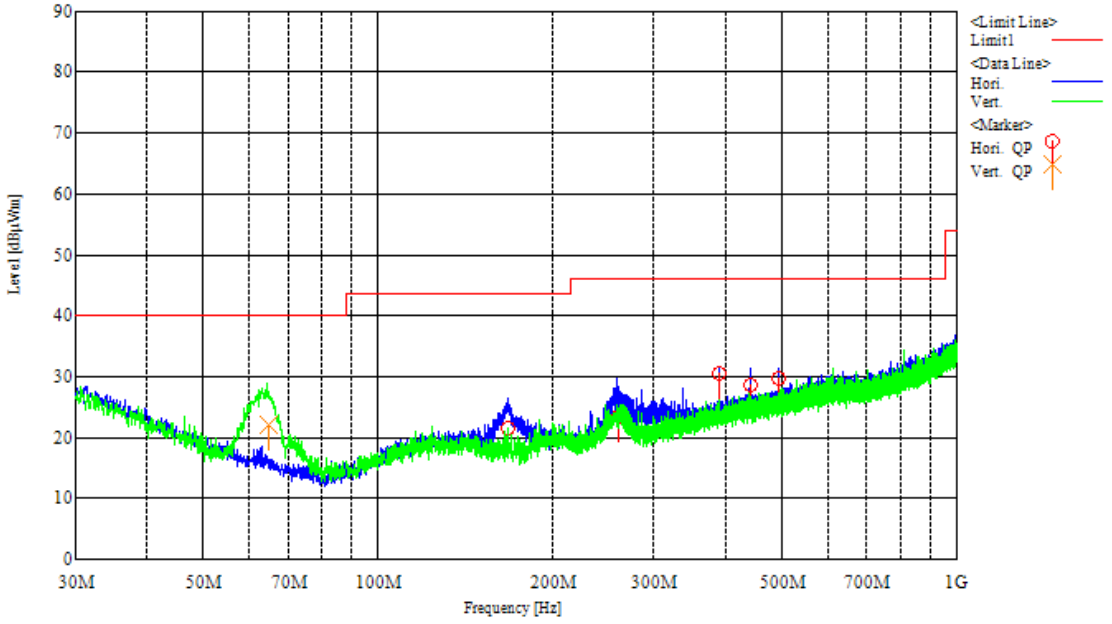
Correction Factor [dB/m] = Ant. Factor [dB/m] + Loss [dB] – Gain [dB]
Result [dBµV/m] = Reading [dBµV] + Correction Factor [dB/m]

Test Data

Emission level (Below 1000MHz)

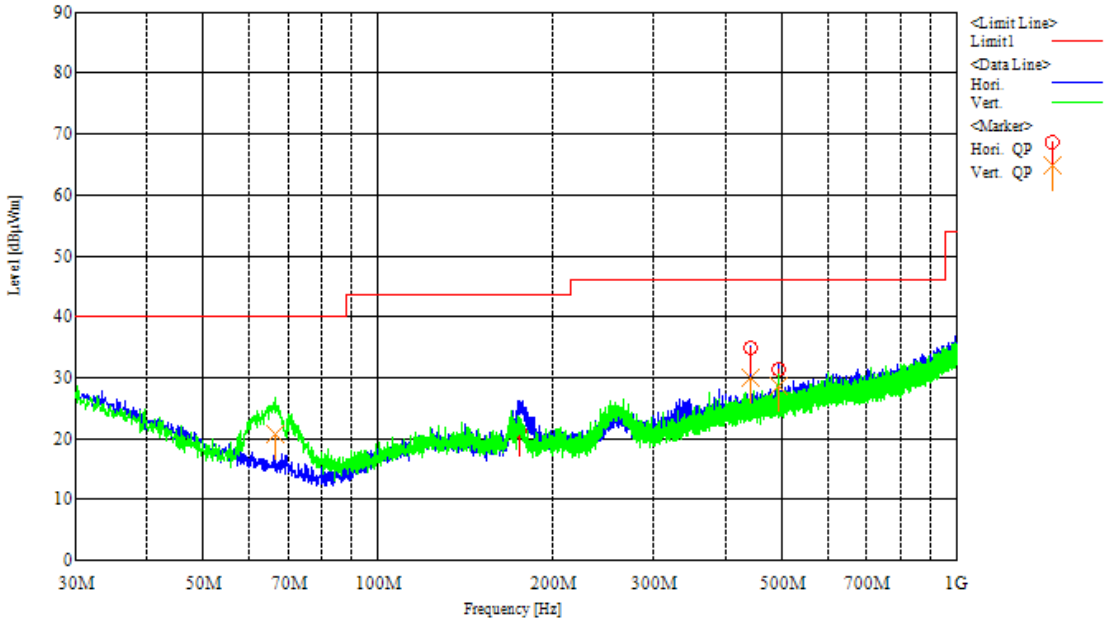
Tested sample: A1
Operating mode: 2401MHz, X-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	168.063	32.7	10.6	8.4	30.2	21.5	43.5	22.0	Hori.
2	260.061	31.8	12.8	9.1	30.2	23.5	46.0	22.5	Hori.
3	**389.987**	**34.7**	**16.0**	**10.0**	**30.3**	**30.4**	**46.0**	**15.6**	**Hori.**
4	441.999	31.7	16.7	10.4	30.2	28.6	46.0	17.4	Hori.
5	494.007	31.9	17.2	10.7	30.1	29.7	46.0	16.3	Hori.
6	64.838	35.3	9.8	7.3	30.3	22.1	40.0	17.9	Vert.



Tested sample: A2
Operating mode: 2401MHz, X-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	175.878	32.5	10.4	8.4	30.1	21.2	43.5	22.3	Hori.
2	**442.010**	**38.1**	**16.7**	**10.4**	**30.2**	**35.0**	**46.0**	**11.0**	**Hori.**
3	493.994	33.6	17.2	10.7	30.1	31.4	46.0	14.6	Hori.
4	66.411	34.2	9.5	7.4	30.3	20.8	40.0	19.2	Vert.
5	442.004	33.2	16.7	10.4	30.2	30.1	46.0	15.9	Vert.
6	493.992	30.8	17.2	10.7	30.1	28.6	46.0	17.4	Vert.



Emission level (Above 1000MHz)

Tested sample: A1

Operating mode: 2401MHz, Y-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	**4802.000**	**52.9**	**49.9**	**3.5**	**56.4**	**53.4**	**73.9**	**53.9**	**17.5**	**0.5**	**Hori.**
2	4802.000	52.5	49.4	3.5	56.0	52.9	73.9	53.9	17.9	1.0	Vert.

Operating mode: 2406MHz, Y-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	4812.000	51.5	47.8	3.5	55.0	51.3	73.9	53.9	18.9	2.6	Hori.
2	4812.000	51.8	48.1	3.5	55.3	51.6	73.9	53.9	18.6	2.3	Vert.

Operating mode: 2411.5MHz, Y-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	4823.000	51.6	47.2	3.5	55.1	50.7	73.9	53.9	18.8	3.2	Hori.
2	4823.000	51.9	48.1	3.5	55.4	51.6	73.9	53.9	18.5	2.3	Vert.

Tested sample: A2

Operating mode: 2401MHz, 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	4802.000	52.1	48.6	3.5	55.6	52.1	73.9	53.9	18.3	1.8	Hori.
2	4802.000	50.8	47.1	3.5	54.3	50.6	73.9	53.9	19.6	3.3	Vert.

Operating mode: 2406MHz, 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	**4812.000**	**52.7**	**49.5**	**3.5**	**56.2**	**53.0**	**73.9**	**53.9**	**17.7**	**0.9**	**Hori.**
2	4812.000	52.3	48.9	3.5	55.8	52.4	73.9	53.9	18.1	1.5	Vert.

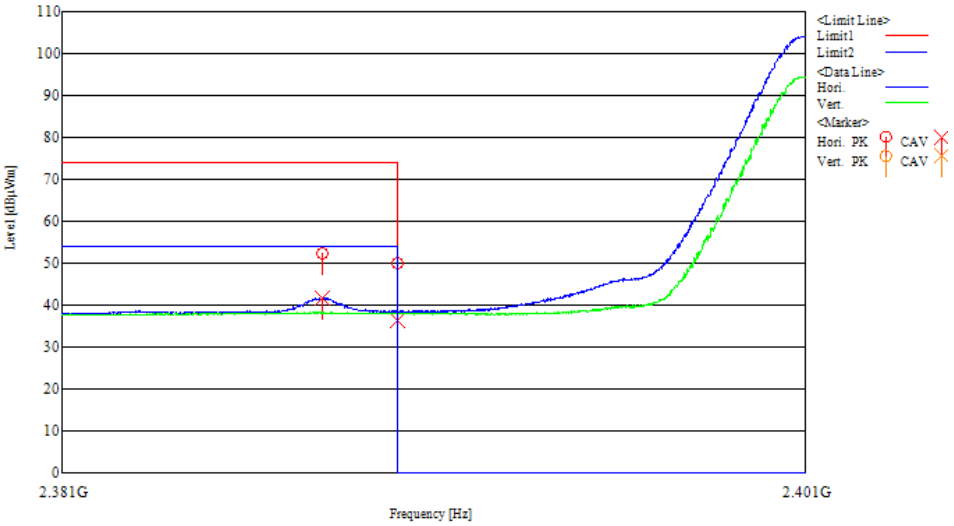
Operating mode: 2411.5MHz, Z-plane (Worst)

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	4823.000	52.8	49.4	3.5	56.3	52.9	73.9	53.9	17.6	1.0	Hori.
2	4823.000	52.2	48.5	3.5	55.7	52.0	73.9	53.9	18.2	1.9	Vert.

Result (Band edge)

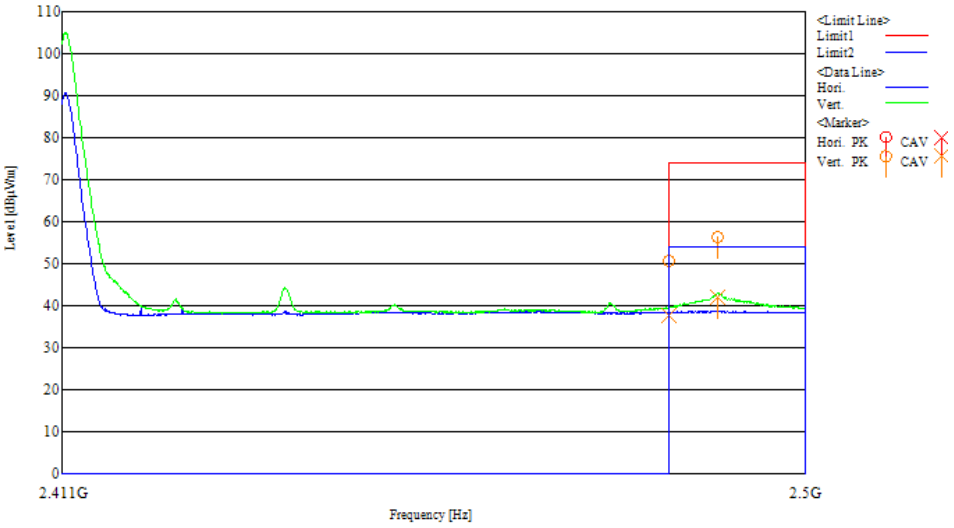
Tested sample: A1
Operating mode: 2401MHz, X-plane (Worst)

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	2388.010	46.9	36.0	5.5	52.4	41.5	73.9	53.9	21.5	12.4	Hori.
2	2390.000	44.4	30.9	5.5	49.9	36.4	73.9	53.9	24.0	17.5	Hori.



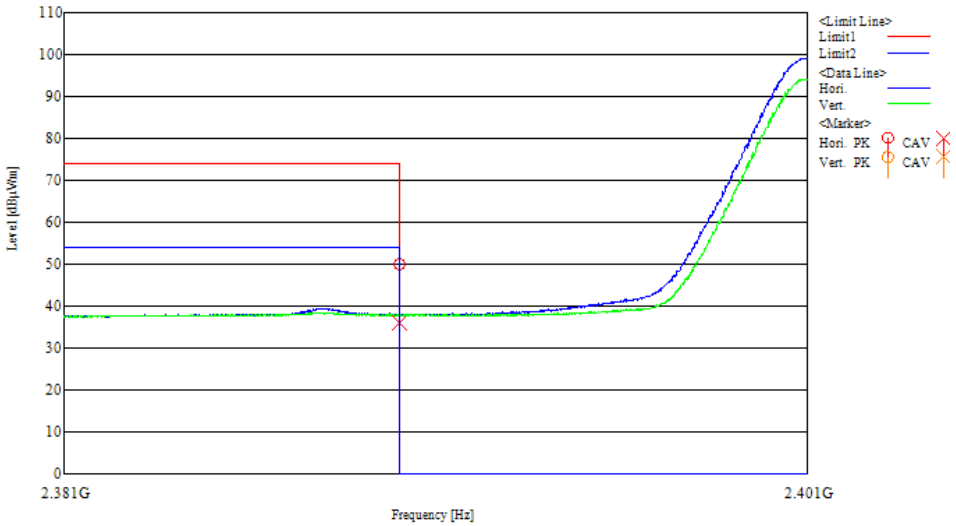
Operating mode: 2411.5MHz, Z-plane (Worst)

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	44.5	31.4	6.2	50.7	37.6	73.9	53.9	23.2	16.3	Vert.
2	2489.471	49.9	35.7	6.3	56.2	42.0	73.9	53.9	17.7	11.9	Vert.



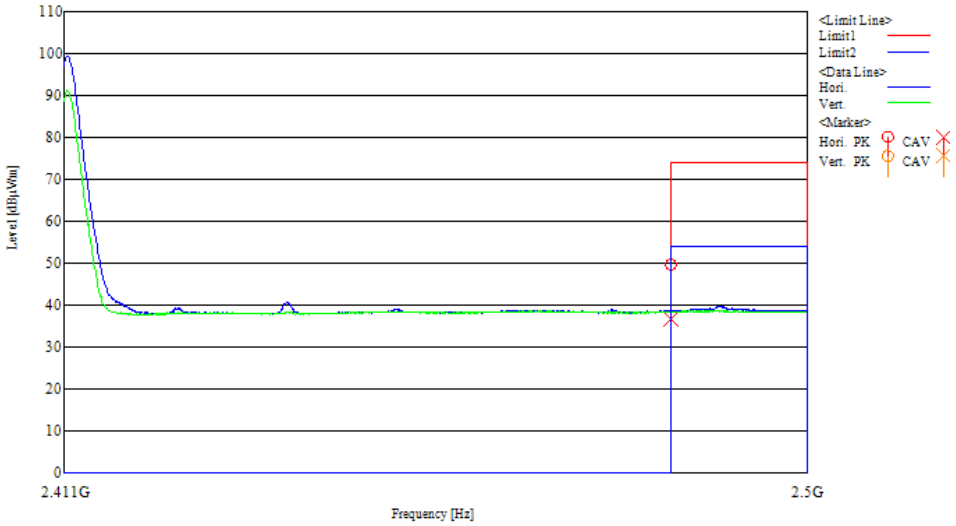
Tested sample: A2
Operating mode: 2401MHz, Z-plane (Worst)

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	2390.000	44.4	30.4	5.5	49.9	35.9	73.9	53.9	24.0	18.0	Hori.



Operating mode: 2411.5MHz, 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	43.4	30.3	6.2	49.6	36.5	73.9	53.9	24.3	17.4	Hori.



2.9 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 [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. The lower limit applies at the band edges.

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

TR09	CL18	LN05

Test software used

EMI Ver. 5.2

Calculation method

The Correction Factor and Result are calculated as followings.

Correction Factor [dB] = ISN Factor [dB] + Loss [dB]
Result [dBµV] = Reading [dBµV] + Correction Factor [dB]

Test date

Tested Date:	9 Apr. 2017	Temperature:	20 degC
Humidity:	65 %	Atmos. Press:	1006 hPa

Test results - *Complied with requirement*

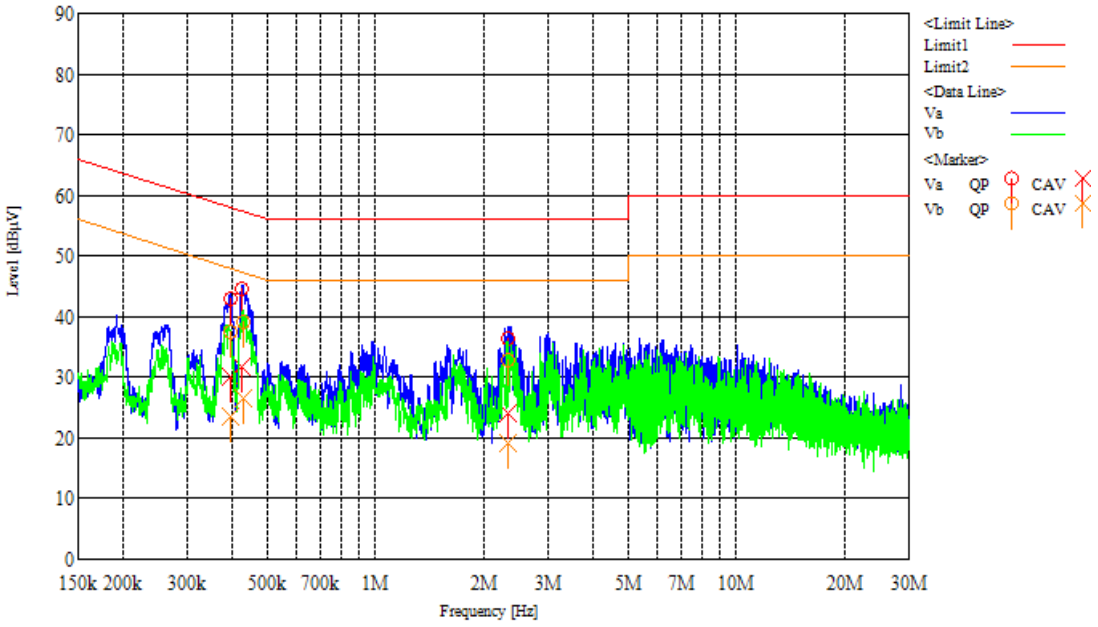
Test Data

Tested sample: A1
Operating mode: 2401MHz (Worst)

[Emission level]

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		Phase
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	0.39591	33.0	20.1	10.1	43.1	30.2	57.9	47.9	14.8	17.7	Va
2	**0.42718**	**34.4**	21.8	**10.1**	**44.5**	31.9	**57.3**	47.3	**12.8**	15.4	**Va**
3	2.31888	26.3	14.0	10.1	36.4	24.1	56.0	46.0	19.6	21.9	Va
4	0.39650	27.4	13.4	10.1	37.5	23.5	57.9	47.9	20.4	24.4	Vb
5	0.42796	29.0	16.5	10.1	39.1	26.6	57.3	47.3	18.2	20.7	Vb
6	2.31838	22.8	9.0	10.1	32.9	19.1	56.0	46.0	23.1	26.9	Vb

[Chart]

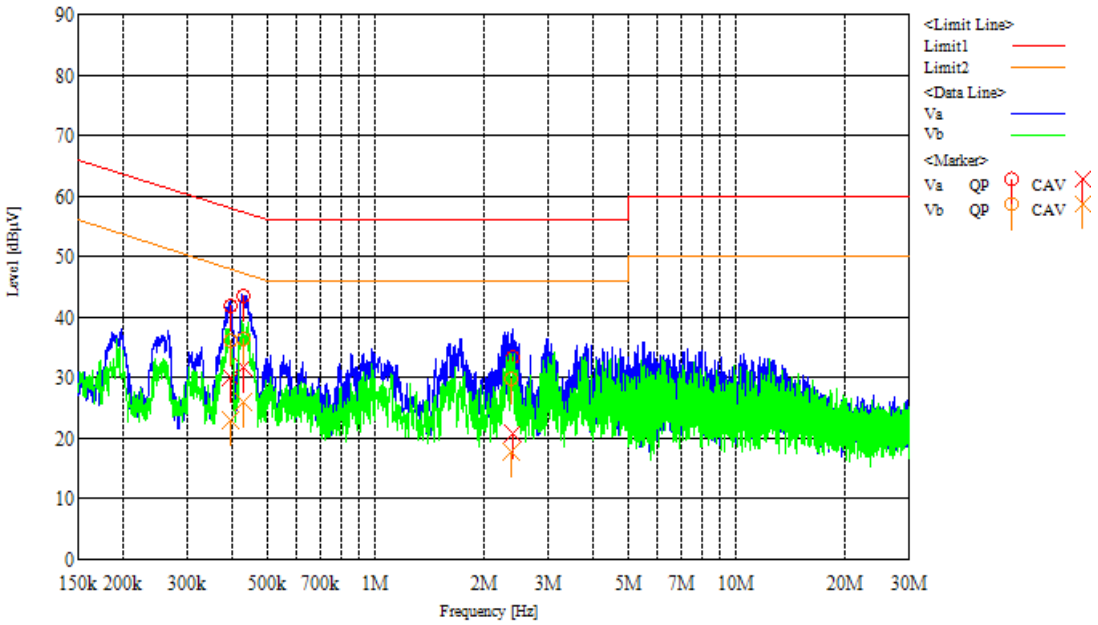


Tested sample: A2
Operating mode: 2401MHz (Worst)

[Emission level]

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		Phase
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	0.39482	31.7	20.0	10.1	41.8	30.1	58.0	48.0	16.2	17.9	Va
2	**0.42800**	**33.4**	21.6	**10.1**	**43.5**	31.7	**57.3**	47.3	**13.8**	15.6	**Va**
3	2.39707	23.4	10.8	10.1	33.5	20.9	56.0	46.0	22.5	25.1	Va
4	0.39569	26.0	13.0	10.1	36.1	23.1	57.9	47.9	21.8	24.8	Vb
5	0.43098	26.4	15.8	10.1	36.5	25.9	57.2	47.2	20.7	21.3	Vb
6	2.37179	19.8	7.7	10.1	29.9	17.8	56.0	46.0	26.1	28.2	Vb

[Chart]



2.11 Receiver Radiated spurious emissions

Test setup - Same as clause 2.8

Test procedure - Same as clause 2.8

Applicable rule and limitation

RSS-Gen 7.1.2 Radiated emission limitation

Frequency [MHz]	Measurement Distance [m]	Field Strength [uV/m]	Field Strength [dBuV/m]
30 – 88	3	100	40.0
88 –216	3	150	43.5
216 – 960	3	200	46.0
Above 960	3	500	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 CISPR quasi-peak detector.

Test date

Tested Date:	9 Apr. 2017	Temperature:	20 degC
Humidity:	65 %	Atmos. Press:	1006 hPa

Test results - *Complied with requirement*.

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

AC01(EM)	CL11	TR06	PR15	BA07	CL30	CL31	PR12
DH01							

Test software used

EMI1 Ver. 5.2

Calculation method

The Correction Factor and Result are calculated as followings.

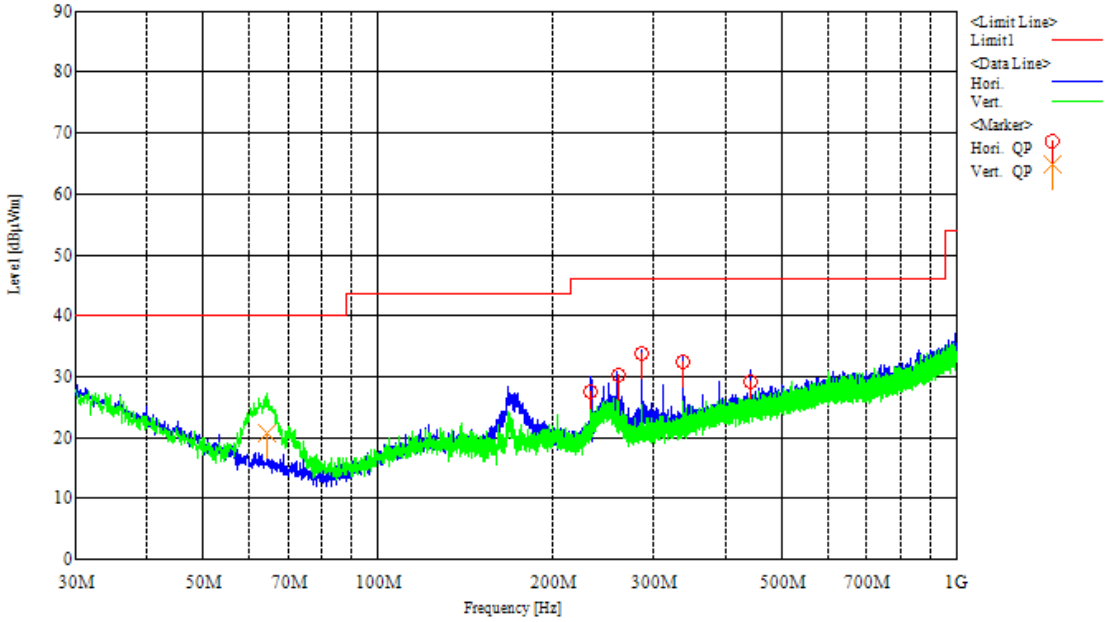
Correction Factor [dB/m] = Ant. Factor [dB/m] + Loss [dB] – Gain [dB]
Result [dBµV/m] = Reading [dBµV] + Correction Factor [dB/m]

Test Data

Emission level (Below 1000MHz)

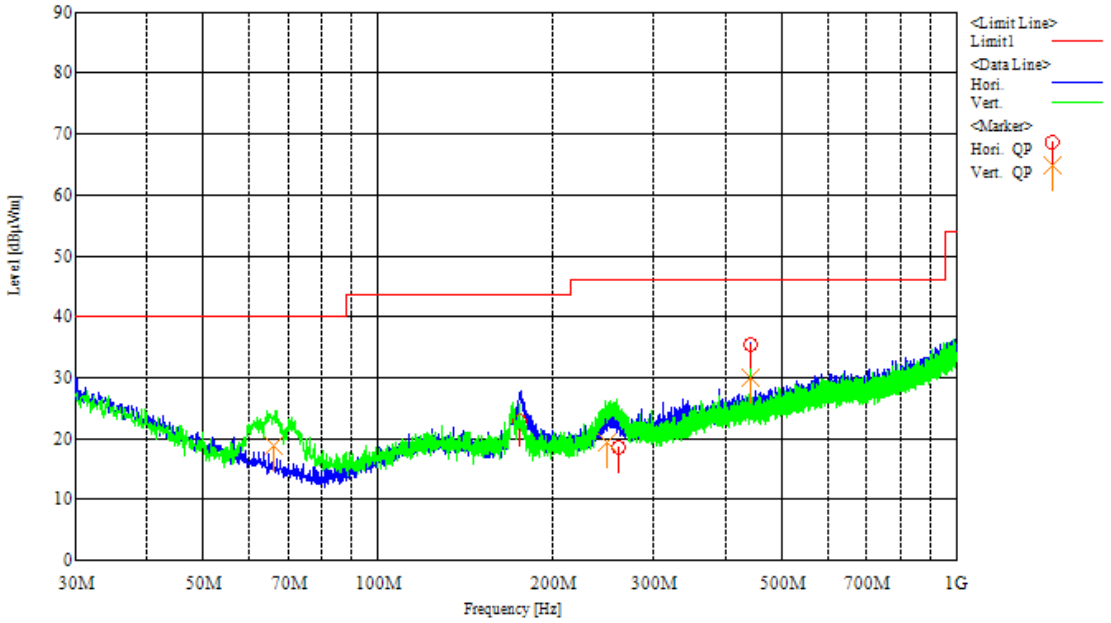
Tested sample: A1
Operating mode: 2401MHz, X-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	233.985	36.5	12.3	8.9	30.1	27.6	46.0	18.4	Hori.
2	260.005	38.6	12.8	9.1	30.2	30.3	46.0	15.7	Hori.
3	**286.002**	**41.4**	**13.2**	**9.3**	**30.2**	**33.7**	**46.0**	**12.3**	**Hori.**
4	338.007	38.3	14.6	9.7	30.2	32.4	46.0	13.6	Hori.
5	442.004	32.3	16.7	10.4	30.2	29.2	46.0	16.8	Hori.
6	64.240	33.9	9.8	7.3	30.3	20.7	40.0	19.3	Vert.



Tested sample: A2
Operating mode: 2401MHz, X-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	175.970	34.2	10.4	8.4	30.1	22.9	43.5	20.6	Hori.
2	260.092	26.8	12.8	9.1	30.2	18.5	46.0	27.5	Hori.
3	**442.003**	**38.5**	**16.7**	**10.4**	**30.2**	**35.4**	**46.0**	**10.6**	**Hori.**
4	66.113	32.2	9.5	7.3	30.3	18.7	40.0	21.3	Vert.
5	249.033	27.8	12.6	9.0	30.1	19.3	46.0	26.7	Vert.
6	442.012	33.0	16.7	10.4	30.2	29.9	46.0	16.1	Vert.



Emission level (Above 1000MHz)

Tested sample: A1

Operating mode: 2401MHz, Y-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	4801.595	37.7	33.4	4.4	35.2	40.3	53.9	13.6	Hori.

Operating mode: 2406MHz, Y-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	4811.593	37.3	33.4	4.4	35.2	39.9	53.9	14.0	Hori.

Operating mode: 2411.5MHz, Y-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	**4822.594**	**37.9**	**33.4**	**4.4**	**35.2**	**40.5**	**53.9**	**13.4**	**Hori.**

Tested sample: A2

Operating mode: 2401MHz, X-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	**4801.596**	**36.1**	**33.4**	**4.4**	**35.2**	**38.7**	**53.9**	**15.2**	**Hori.**

Operating mode: 2406MHz, Y-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	4811.566	35.9	33.4	4.4	35.2	38.5	53.9	15.4	Hori.

Operating mode: 2411.5MHz, Y-plane (Worst)

No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	**4822.640**	**36.1**	**33.4**	**4.4**	**35.2**	**38.7**	**53.9**	**15.2**	**Hori.**

2.12 Receiver AC power line conducted emissions

Test setup - Same as clause 2.9

Test procedure - Same as clause 2.9

Applicable rule and limitation

RSS-Gen 8.8 AC power line conducted emissions limits

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

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

TR09	CL18	LN05

Test software used

EMI Ver. 5.2

Calculation method

The Correction Factor and Result are calculated as followings.

Correction Factor [dB] = ISN Factor [dB] + Loss [dB]
Result [dBµV] = Reading [dBµV] + Correction Factor [dB]

Test date

Tested Date:	9 Apr. 2017	Temperature:	20 degC
Humidity:	65 %	Atmos. Press:	1006 hPa

Test results - *Complied with requirement*

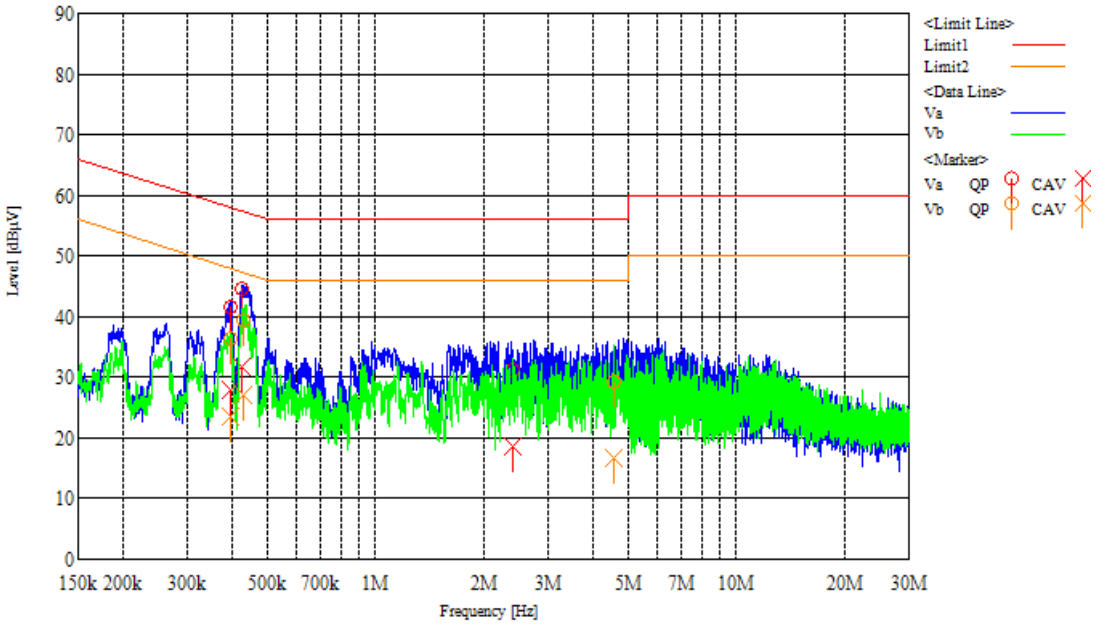
Test Data

Tested sample: A1
Operating mode: 2401MHz (Worst)

[Emission level]

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		Phase
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	0.39716	31.5	17.8	10.1	41.6	27.9	57.9	47.9	16.3	20.0	Va
2	**0.42712**	**34.6**	21.8	**10.1**	**44.7**	31.9	**57.3**	47.3	**12.6**	15.4	**Va**
3	2.40709	21.1	8.5	10.1	31.2	18.6	56.0	46.0	24.8	27.4	Va
4	0.39504	26.4	13.5	10.1	36.5	23.6	58.0	48.0	21.5	24.4	Vb
5	0.42868	29.3	17.0	10.1	39.4	27.1	57.3	47.3	17.9	20.2	Vb
6	4.55699	19.1	6.5	10.1	29.2	16.6	56.0	46.0	26.8	29.4	Vb

[Chart]

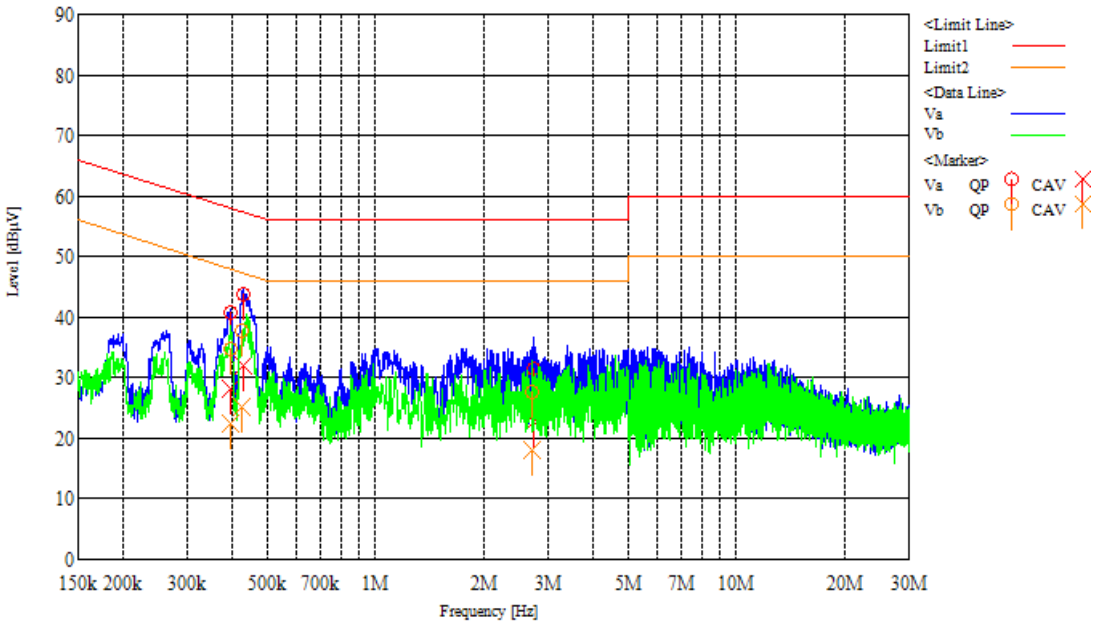


Tested sample: A2
Operating mode: 2401MHz (Worst)

[Emission level]

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		Phase
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	0.39593	30.6	18.2	10.1	40.7	28.3	57.9	47.9	17.2	19.6	Va
2	**0.42836**	**33.7**	21.9	**10.1**	**43.8**	32.0	**57.3**	47.3	**13.5**	15.3	**Va**
3	2.74540	21.5	12.5	10.1	31.6	22.6	56.0	46.0	24.4	23.4	Va
4	0.39515	24.8	12.4	10.1	34.9	22.5	58.0	48.0	23.1	25.5	Vb
5	0.42772	27.8	15.0	10.1	37.9	25.1	57.3	47.3	19.4	22.2	Vb
6	2.71167	17.6	7.9	10.1	27.7	18.0	56.0	46.0	28.3	28.0	Vb

[Chart]



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	JSE	203397C	-	2016/04/23	2017/04/30
AC01(EG)	Anechoic Chamber (1st test room)	JSE	203397C	-	2017/03/18	2018/03/31
AT33	Attenuator 10dB 26GHz	INMET	26A-10	−	2016/07/15	2017/07/31
BA07	Bilogical Antenna	TESEQ	CBL6143A	26670	2016/12/20	2017/12/31
CH01	Conical Horn Antenna (12-18GHz)	ETS-Lindgren	3163-05	00126641	2017/03/29	2019/03/31
CL11	RF Cable for RE	RFT	-	-	2017/03/22	2018/03/31
CL18	RF Cable for CE	RFT	-	-	2017/03/22	2018/03/31
CL30	RF Cable 5 m	SUHNER	SUCOFLEX104PE	MY3599	2016/08/22	2017/08/31
CL36	RF Cable 2 m	Junkosha	MWX221	1502S021	2017/01/05	2018/01/31
CL38	RF Cable 2 m	Junkosha	MWX221	1603S626	2016/04/05	2017/04/30
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2016/01/26	2018/01/31
HPF1	High Pass Filter (3500MHz)	TOKIMEC	TF323DCA	603	2016/06/30	2017/06/30
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2016/05/13	2017/05/31
LP06	Loop Antenna	ETS-Lindgren	6502	00164299	2017/03/16	2018/03/31
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2017/01/18	2018/01/31
PR21	Pre. Amplifier	Anritsu	MH648A	6200467119	2016/12/20	2017/12/31
SA06	Spectrum Analyzer (F/W: 4.50 SP4)	Rohde & Schwarz	FSP40	100071	2016/12/20	2017/12/31
SH01	Standard Horn Antenna (18-26G)	A.H. Systems	SAS-572	208	2016/07/05	2018/07/31
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2016/09/29	2017/09/30

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.