

Test Report					
1. Client					
• Name: • Address:	Sena Technologies Co., Ltd. 19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea				
2. Use of Repor	t: FCC & IC Approval				
3. Sample Desc	ription				
 Product Nam Model Name 					
4. Date of Rece	ipt: 2023-12-18				
5. Date of Test	2024-01-17 ~ 2024-01-26				
6. Test Method	: FCC Part 15 Subpart C 15.247 RSS-247 Issue 3(2023-08), RSS-GEN Issue 5(2019-03)				
7. Test Results	Refer to the test results				
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Affirmation	Tested by Technical Manager Jong-Myoung, Shin Kyung-Taek, Lee				
	Feb 08, 2024				

EMC Labs Co., Ltd.

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<u>Version</u>

TEST REPORT NO.	DATE	DESCRIPTION
KR0140-RF2402-003	Feb 08, 2024	Initial Issue

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1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant Information

Applicant Sena Technologies Co., Ltd.	
Applicant Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea
Contact Person	Seunghyun Kim
Telephone No.	+82-2-573-7772
Fax No.	+82-2-573-7710
E-mail	shkim77@sena.com

1.2. Manufacturer Information

Manufacturer Sena Technologies Co., Ltd.	
Manufacturer Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea

1.3 Test Laboratory Information

Laboratory	EMC Labs Co., Ltd.		
Laboratory Address	100, Jangjateo-ro, Hobeop-myeon, Icheon-si, Gyeonggi-do, Republic of Korea		
Contact Person	Jong-Myoung, Shin		
Telephone No.	+82-31-637-8895		
Fax No.	+82-505-116-8895		
FCC Designation No.	KR0140		
FCC Registration No.	580000		
IC Site Registration No.	28751		



2. Equipment under Test(EUT) Information

2.1 General Information

Product Name PHANTOM	
Model Name	SP149
FCC ID	S7A-SP149
IC	8154A-SP149
Power Supply	DC 3.7 V

2.2 Additional Information

Operating Frequency	2 410 MHz ~ 2 475 MHz		
Number of Channel 14			
Modulation Type OQPSK			
Antenna Type PCB Pattern Antenna			
Antenna Gain 0.46 dBi			
Firmware Version 1.0			
Hardware Version 1.0			
Test Software CMD v10.0.19044.1889			

2.3 Test Frequency

Test mode	Test Frequency (MHz)		
	Low Frequency	Middle Frequency	High Frequency
MESH 2 410		2 445	2 475

2.4 Used Test Software Setting Value

Test Mode	Setting Item	
Test Mode	Power	
MESH	14	

2.5 Mode of operation during the test

 The EUT continuous transmission mode during the test with set at Low Channel, Middle Channel, and High Channel. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, YZ, XZ planes.

2.6 Modifications of EUT

- None

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3. Test Summary

Applied	FCC Rule	IC Rule	Test Items	Test Condition	Result	
\square	15.203	_	Antenna Requirement		С	
\square	15.247(a)	RSS-247 (5.2)	6 dB Bandwidth		С	
\square	_	RSS GEN (6.7)	Occupied Bandwidth (99%)		С	
\square	15.247(b)	RSS-247 (5.4)	Maximum Peak Output Power	Conducted	С	
\square	15.247(e)	RSS-247 (5.2)	Peak Power Spectral Density		С	
\square	15.247(d)	RSS-247 (5.5)	Conducted Spurious Emission		С	
\square	15.247(d) 15.205 & 15.209	RSS-247 (5.5) RSS-GEN (8.9 & 8.10)	Radiated Spurious Emission Radiated		С	
	15.207	RSS-GEN (8.8)	Conducted Emissions AC Line Conducted		С	
<u>Note 1</u> : C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable						

The sample was tested according to the following specification: ANSI C63.10:2013.

Compliance was determined by specification limits of the applicable standard according to customer requirements.



4. Used equipment on test

Description	Manufacturer	Model Name	Serial Name	Next Cal.
TEMP & HUMID CHAMBER	JFM	JFMA-001	20200929-01	2024.12.07
CONTROLLER	AMWON TECHNOLOGY	TEMI2500	S7800VK191 0707	2024.12.07
PSA SERIES SPECTRUM ANALYZER	AGILENT	E4440A	MY45304057	2024.12.08
MXG ANALOG SIGNAL GENERATOR	AGILENT	N5183A	MY50141890	2024.12.08
SYSTEM DC POWER SUPPLY	AGILENT	6674A	MY53000118	2024.12.11
VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	257524	2024.12.08
BLUETOOTH TESTER	TESCOM	TC-3000A	3000A480088	2024.12.08
DIRECTIONAL COUPLER	AGILENT	773D	2839A01855	2024.12.08
ATTENUATOR	AGILENT	8493C	73193	2024.12.08
TERMINATIOM	HEWLETT PACKARD	909D	07492	2024.12.08
POWER DIVIDER	HEWLETT PACKARD	11636A	06916	2024.12.08
SLIDE-AC	DAEKWANG TECH	SV-1023	NONE	2024.11.10
DIGITAL MULTIMETER	HUMANTECHSTORE	15B+	50561541WS	2024.12.08
ATTENUATOR	ACE RF COMM	ATT SMA 20W 20dB 8GHz	A-0820.SM20.2	2024.04.04
DC POWER SUPPLY	AGILENT	E3634A	MY40012120	2024.02.23
USB Peak Power Sensor	Anritsu	MA24408A	12321	2024.11.09
High Pass Filter	WT Microwave INC.	WT-A3314-HS	WT22111804-1	2024.12.08
High Pass Filter	WT Microwave INC.	WT-A1935-HS	WT22111804-2	2024.12.08
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSU26	200444	2024.02.22
ACTIVE LOOP ANTENNA	TESEQ	HLA 6121	55685	2024.12.22
Biconilog ANT	Schwarzbeck	VULB 9160	3260	2025.01.09
Biconilog ANT	Schwarzbeck	VULB9168	902	2024.11.30
Horn ANT	Schwarzbeck	BBHA9120D	974	2024.11.30
Horn ANT	Schwarzbeck	BBHA9120D	1497	2025.01.04
Amplifier	TESTEK	TK-PA18H	200104-L	2024.03.14
Horn ANT	Schwarzbeck	BBHA9170	01188	2024.03.16
Horn ANT	Schwarzbeck	BBHA9170	01189	2024.03.16
AMPLIFIER	TESTEK	TK-PA1840H	220105-L	2024.03.14
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101952	2024.03.14
Test Receiver	ROHDE & SCHWARZ	ESR7	101616	2024.06.27
LISN	ROHDE & SCHWARZ	ENV216	100409	2025.01.04
PULSE LIMITER	lignex1	EPL-30	NONE	2025.01.04

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5. Antenna Requirement

Accoding to §15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Accoding to §15.247(b)(4) e conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1 Result

Complies

(The transmitter has a PCB Pattern Antenna. The directional peak gain of the antenna is 0.46 dBi.)



6. 6 dB Bandwidth

6.1 Test Setup

Refer to the APPENDIX I.

6.2 Limit

The minimum permissible 6 dB bandwidth is 500 kHz.

6.3 Test Procedure

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the EUT's antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

- 1. Set resolution bandwidth (RBW) = 100 kHz
- 2. Set the video bandwidth (VBW) \geq 3 x RBW.
- 3. Detector = Peak.
- 4. Trace mode = Max Hold.
- 5. Sweep = Auto
- 6. Allow the trace to stabilize.
- 7. Option 1 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
 - Option 2 The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 x RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

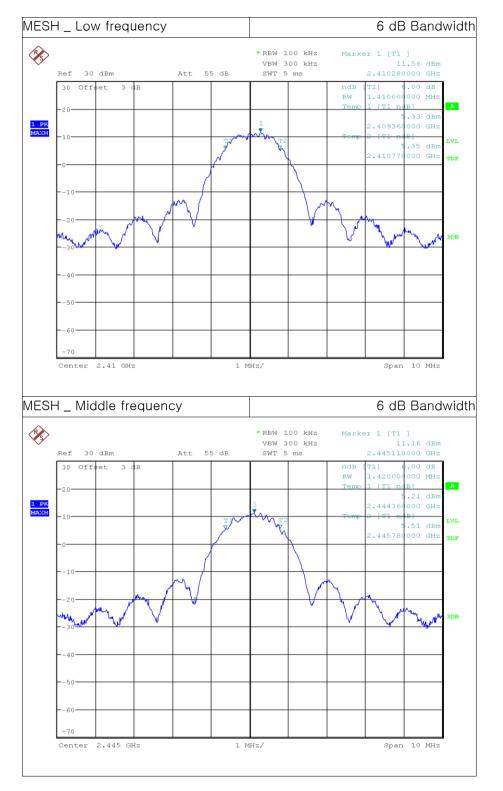
6.4 Test Result

Test Mode	Test Frequency	6 dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
	Low	1.410	2.320
MESH	Middle	1.420	2.350
	High	1.460	2.340

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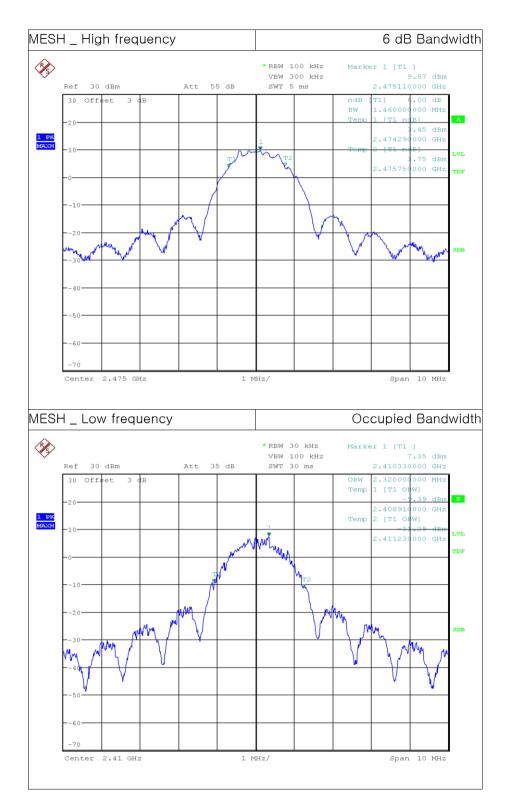


6.5 Test Plot



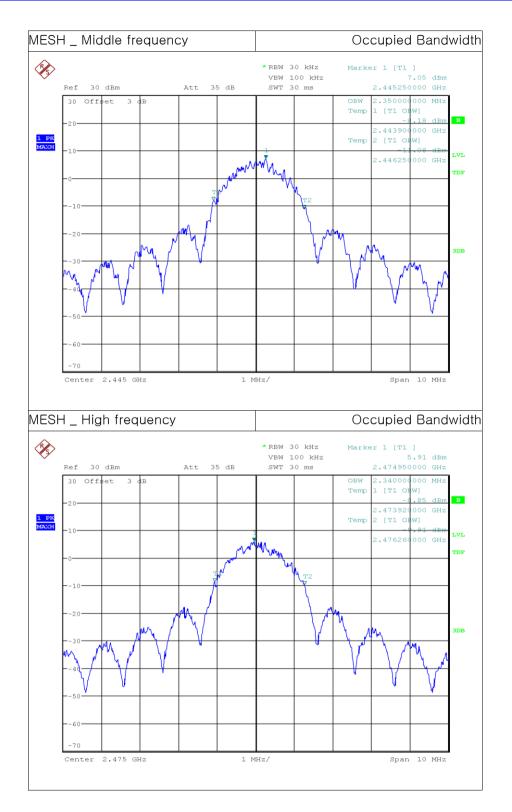
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7. Maximum Peak Output Power

7.1 Test Setup

Refer to the APPENDIX I.

7.2 Limit

The maximum permissible conducted output power is 1 Watt.

7.3 Test Procedure

A transmitter antenna terminal of EUT is connected to the input of a spectrum analyzer. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

- 1. Set the RBW \geq DTS bandwidth
- 2. Set VBW \geq 3 x RBW
- 3. Set span \geq 3 x RBW.
- 4. Sweep time = auto couple
- 5. Detector = peak
- 6. Trace mode = max hold
- 7. Allow trace to fully stabilize
- 8. Use peak search function to determine the peak amplitude level.

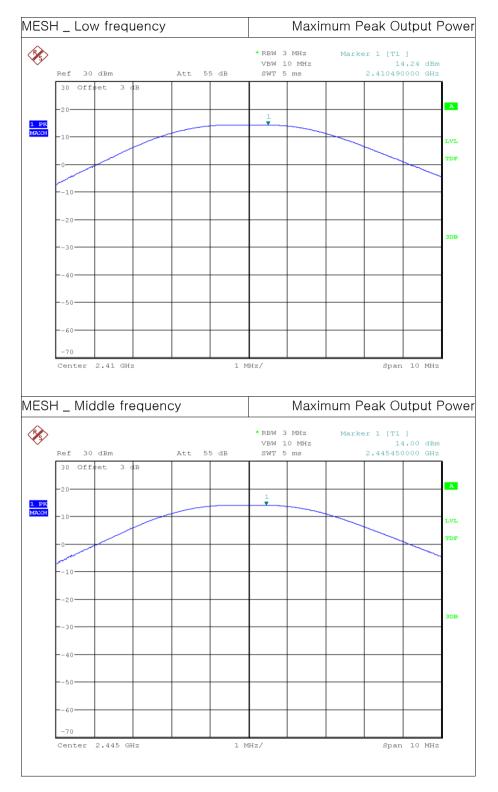
7.4 Test Result

Test Mode	Toot Fraguanay	Peak Output Power				
Test Mode	Test Frequency	dBm	mW			
	Low	14.24	26.55			
MESH	Middle	14.00	25.12			
	High	13.30	21.38			

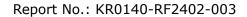
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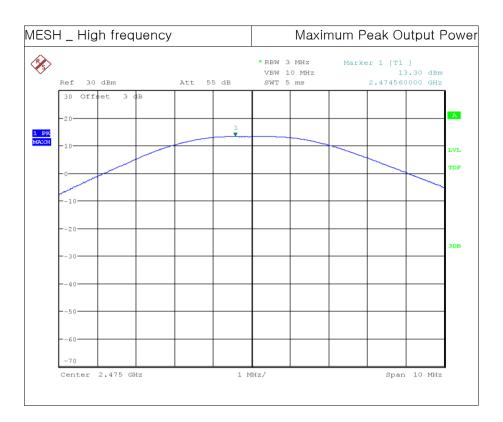
7.5 Test Plot



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8. Peak Power Spectral Density

8.1 Test Setup

Refer to the APPENDIX I.

8.2 Limit

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

8.3 Test Procedure

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

(ANSI C63.10-2013 _ Section 11.10.2 - Method PKPSD)

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. Set the span to 1.5 times the DTS bandwidth.
- 3. Set the RBW : 3 kHz \leq RBW \leq 100 kHz.
- 4. Set the VBW \geq 3 x RBW.
- 5. Detector = Peak.
- 6. Sweep time = Auto
- 7. Trace mode = Max Hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level within the RBW.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

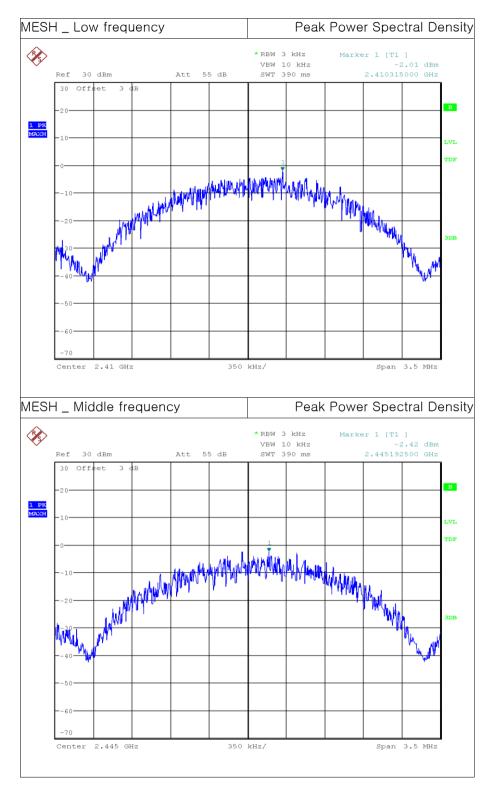
Test Mode	Test Frequency	Peak Power Spectral Density (dBm)
	Low	-2.01
MESH	Middle	-2.42
	High	-3.40

8.4 Test Result

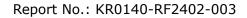
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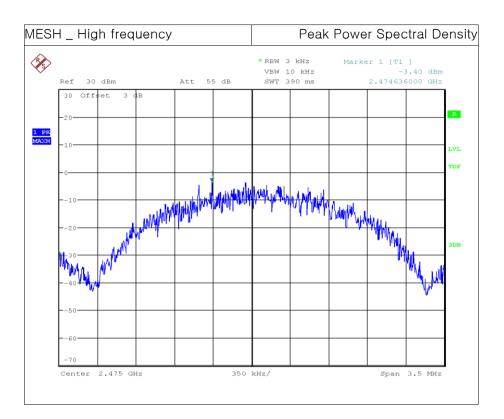
8.5 Test Plot



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9. TX Radiated Spurious Emission and Conducted Spurious Emission

9.1 Test Setup

Refer to the APPENDIX I.

9.2 Limit

According to §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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional

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Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1705	24000/F (kHz)	30
1705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

radiator shall not exceed the field strength levels specified in the following table

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.



According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

nequency bands listed			
MHz	MHz	MHz	GHz
0.009 ~ 0.110	16.42 ~ 16.423	399.90 ~ 410	4.5 ~ 5.15
0.495 ~ 0.505	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.	1435 ~ 1626.5	9.0 ~ 9.2
4.20725 ~ 4.20775	25 73 ~ 74.6	1645.5 ~ 1646.5	9.3 ~ 9.5
4.17725 ~ 4.17775	74.8 ~ 75.2	1660 ~ 1710	10.6 ~ 12.7
6.215 ~ 6.218	108 ~ 121.94	1718.8 ~ 1722.2	13.25 ~ 13.4
6.26775 ~ 6.26825	149.9 ~ 150.05	2200 ~ 2300	14.47 ~ 14.5
6.31175 ~ 6.31225	156.52475 ~ 156.52525	2310 ~ 2390	15.35 ~ 16.2
8.291 ~ 8.294	156.7 ~ 156.9	2483.5 ~ 2500	17.7 ~ 21.4
8.362 ~ 8.366	162.0125 ~ 167.17	2690 ~ 2900	22.01 ~ 23.12
8.37625 ~ 8.38675	3345.8 ~ 3358	3260 ~ 3267	23.6 ~ 24.0
8.41425 ~ 8.41475	3600 ~ 4400	3332 ~ 3339	31.2 ~ 31.8
12.51975 ~ 12.52025	3345.8 ~ 3358	240 ~ 285	36.43 ~ 36.5
12.57675 ~ 12.57725	3600 ~ 4400	322 ~ 335.4	Above 38.6
13.36 ~ 13.41			
8.291 ~ 8.294 8.362 ~ 8.366 8.37625 ~ 8.38675 8.41425 ~ 8.41475 12.51975 ~ 12.52025 12.57675 ~ 12.57725	156.7 ~ 156.9 162.0125 ~ 167.17 3345.8 ~ 3358 3600 ~ 4400 3345.8 ~ 3358	2483.5 ~ 2500 2690 ~ 2900 3260 ~ 3267 3332 ~ 3339 240 ~ 285	$\begin{array}{c} 17.7 \sim 21.4 \\ 22.01 \sim 23.12 \\ 23.6 \sim 24.0 \\ 31.2 \sim 31.8 \\ 36.43 \sim 36.5 \end{array}$

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.



9.3 Test Procedure for Radiated Spurious Emission

- 1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3.75 meter away from the interference-receiving antenna.
- 3. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
- 4. The antenna is a Broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading. (The EUT was pre-tested with three axes (X, Y, Z) and the final test was performed at the worst case.)
- 6. Repeat above procedures until the measurements for all frequencies are complete.

Measurement Instrument Setting

- 1. Frequency Range: Below 1 GHz RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak
- 2. Frequency Range: Above 1 GHz

```
Peak Measurement
RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto,
Trace mode = Max Hold until the trace stabilizes
```

Average Measurement RBW = 1 MHz, VBW = 3 MHz, Detector = RMS (Number of points ≥ 2 x Span / RBW), Trace Mode = Average (Averaging type = power(i.e. RMS)), Sweep Time = Auto, Sweep Count = at least 100 traces

A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

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- 1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
- 2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
- 3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than tuming on and off with the transmit cycle, then no duty cycle correction is required for that emission.

9.4 Test Procedure for Conducted Spurious Emission

- 1. The transmitter output was connected to the spectrum analyzer.
- 2. The reference level of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 kHz, VBW = 300 kHz.
- 3. The conducted spurious emission was tested each ranges were set as below. Frequency range: 30 MHz ~ 26.5 GHz RBW = 100 kHz, VBW = 300 kHz, Sweep Time = Auto, Detector = Peak, Trace = Max Hold

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)



9.5 Test Result

9 kHz \sim 25 GHz Data for MESH

• Low frequency

	Rea	ding			T C	0.005	Lin	nits	Re	sult	Mai	rgin
Frequency	(dBuV/m)		Pol.	T.F (dB)	DCCF (dB)	(dBu	V/m)	(dBu	V/m)	(d	B)	
(MHz)	AV ,	/ Peak		(00)	(00)	AV /	Peak	AV /	Peak	AV /	Peak	
2 389.48	N/A	34.56	Н	9.78	-34.24	54.0	74.0	10.1	44.3	43.9	29.7	
4 819.20	N/A	54.33	V	-0.19	-34.24	54.0	74.0	19.9	54.1	34.1	19.9	
7 228.74	N/A	47.50	V	9.17	-34.24	54.0	74.0	22.4	56.7	31.6	17.3	
9 642.45	N/A	37.18	V	11.45	-34.24	54.0	74.0	14.4	48.6	39.6	25.4	

• Middle frequency

	Rea	ding				Lin	nits	Re	sult	Mai	rgin
Frequency	(dBuV/m)		Pol. T.F (dB)		DCCF (dB)	(dBuV/m)		(dBuV/m)		(dB)	
(MHz)	AV ,	/ Peak		(48)	(48)	AV /	Peak	AV /	Peak	AV /	Peak
4 889.11	N/A	49.75	V	-0.19	-34.24	54.0	74.0	15.3	49.6	38.7	24.4
7 333.73	N/A	42.07	V	9.33	-34.24	54.0	74.0	17.2	51.4	36.8	22.6

• High frequency

Fraguanay	Rea	ding					0.005	Lin	nits	Re	sult	Ма	rgin
Frequency	(dBuV/m)		equency (dB		Pol.	T.F (dB)	DCCF (dB)	(dBu	ıV/m)	(dBu	V/m)	(d	B)
(MHz)	AV ,	/ Peak		(00)	(00)	AV /	Peak	AV /	Peak	AV /	Peak		
2 483.54	N/A	49.41	Н	10.61	-34.24	54.0	74.0	25.8	60.0	28.2	14.0		
4 949.11	N/A	45.58	V	-0.09	-34.24	54.0	74.0	11.3	45.5	42.7	28.5		
7 426.64	N/A	38.15	V	9.46	-34.24	54.0	74.0	13.4	47.6	40.6	26.4		

Note 1: The radiated emissions were investigated 9 kHz to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.

Note 2: DCCF(Duty Cycle Correction Factor)

- T_{on} = 0.647 ms / T_{off} = 39.46 ms

- DCCF = $20 \times \log(\text{The Worst Case Dwell Time / 100 ms}) dB = <math>20 \times \log(1.941 / 100) dB = -34.24 dB$ Note 3: Sample Calculation.

Margin = Limit - Result / Peak Result = Peak Reading + TF / Average Result = Peak Reading + TF + DCCF TF = Ant factor + Cable Loss + Filter Loss - Amp Gain + Distance Factor

Distance Factor = 20log(applied distance/required distance) = 20log(3.75m/3m) = 1.94



9.6 Test Plot for Radiated Spurious Emission MESH

• MESH _ Low frequency

							restricte	ed Ban	u rea
MultiView 🕀	Spectrum	Spectru	m 2 🕱	Spectrum 3	X Spectru	ım 4 🛛 🕱	l		▼
Ref Level 97 Att Input	.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV On Not	W 1 MHz W 3 MHz Mod ch Off	e Auto Sweep			Fre	equency 2.3	500000 GHz
1 Frequency S								M1[1]	
90 dBµV								:	2.3894805 GHz
80 dBµV									
70 dBuV									
іО dBµV									
50 dBµV									
0 dBµV									W1
10 dBµV								the second second	and warman
Malana	epersolomouport-M	un altrated	emention	naturation	philipping	Wondynahillan	e Andread and	Marine Marine	
20 dBµV									
0 dBµV									
) dBµV									
о dBµV 2.31 GHz			1001 pt	s	8	.0 MHz/			2.39 GHz
			1001 pt	S	8	.0 MHz/	G	Spuriou	
2.31 GHz MultiView	Spectrum		ectrum 2	s X Spectr		2		Spuriou	
2.31 GHz MultiView Ref Level 80. Att Input	00 dBµV 0 dB SWT 1 AC PS	● RBW		X Spectr		2			s - Pea v
2.31 GHz MultiView Ref Level 80. Att Input	00 dBµV 0 dB SWT 1 AC PS	● RBW	ectrum 2	X Spectr		2		equency 4.82	s – Pea v 200000 GHz • 1Pk Max 54.33 dBµV
2.31 GHz MultiView Ref Level 80. Att Input Frequency S	00 dBµV 0 dB SWT 1 AC PS	● RBW	ectrum 2	X Spectr		2		equency 4.82	s - Pea v 200000 GHz • 1Pk Max
2.31 GHz	00 dBµV 0 dB SWT 1 AC PS	● RBW	ectrum 2	Auto Sweep		2		equency 4.82	s - Pea v 200000 GHz 1Pk Max 54.33 dByV
2.31 GHz MultiView Ref Level 801 Att Input Frequency S 0 dsµV	00 dBµV 0 dB SWT 1 AC PS	● RBW	ectrum 2	X Spectr		2		equency 4.82	s – Pea v 200000 GHz • 1Pk Max 54.33 dBµV
2.31 GHz MultiView Ref Level 801 Att Input Frequency S 70 dsµV	00 dBµV 0 dB SWT 1 AC PS	● RBW	ectrum 2	X Spectr Auto Sweep		2	Fre	equency 4.82	s – Pea v 200000 GHz • 1Pk Max 54.33 dBµV
2.31 GHz MultiView Я Ref Level 80.1 Att Input Frequency S 0 dвµV	00 dBµV 0 dB SWT 1 AC PS	RBW 1.01 ms • VBW Off Note	ectrum 2	X Spectr Auto Sweep		2		equency 4.82	s – Pea 200000 GHz 1Pk Max 54.33 dBpV 81920080 GHz
2.31 GHz MultiView Ref Level 801 Att Input Frequency S 0 d8µv 0 d8µv 0 d8µv 0 d8µv	00 dBµV 0 dB SWT 1AC PS weep	RBW 1.01 ms • VBW Off Note	ectrum 2	X Spectr Auto Sweep		2	Fre	equency 4.8 2 M1[1] 4.	s – Pea 200000 GHz 1Pk Max 54.33 dBpv 81920080 GHz
2.31 GHz	00 dBµV 0 dB SWT 1AC PS weep	RBW 1.01 ms • VBW Off Note	ectrum 2	X Spectr Auto Sweep		2	Fre	equency 4.8 2 M1[1] 4.	s – Pea 200000 GHz 1Pk Max 54.33 dBpv 81920080 GHz
2.31 GHz MultiView Ref Level 80.1 Input Frequency S 10 dbµV	00 dBµV 0 dB SWT 1AC PS weep	RBW 1.01 ms • VBW Off Note	ectrum 2	X Spectr Auto Sweep		2	Fre	equency 4.8 2 M1[1] 4.	s – Pea 200000 GHz 1Pk Max 54.33 dBpV 81920080 GHz
2.31 GHz	00 dBµV 0 dB SWT 1AC PS weep	RBW 1.01 ms • VBW Off Note	ectrum 2	X Spectr Auto Sweep		2	Fre	equency 4.8 2 M1[1] 4.	s – Pea 200000 GHz 1Pk Max 54.33 dBpV 81920080 GHz
2.31 GHz MultiView Ref Level 80.0 Input Frequency S 10 dbµV	00 dBµV 0 dB SWT 1AC PS weep	RBW 1.01 ms • VBW Off Note	ectrum 2	X Spectr Auto Sweep		2	Fre	equency 4.8 2 M1[1] 4.	s – Pea 200000 GHz 1Pk Max 54.33 dBpV 81920080 GHz
2.31 GHz	00 dBµV 0 dB SWT 1AC PS weep	RBW 1.01 ms • VBW Off Note	ectrum 2	X Spectr Auto Sweep		2	Fre	equency 4.8 2 M1[1] 4.	s – Pea 200000 GHz 1Pk Max 54.33 dBpV 81920080 GHz
2.31 GHz MultiView Ref Level 80.0 Att Input Frequency S 0 d8µV 0 d8µV	00 dBµV 0 dB SWT 1AC PS weep	RBW 1.01 ms VBW Off Note	ectrum 2	X Spectr	um 3 (x	2	Fre	equency 4.82	s – Pea 200000 GHz 1Pk Max 54.33 dBpV 81920080 GHz

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				S	puriou	s – Pea
MultiView 🗄 Spectr	um 🕱 Spectrum 2	X Spectrum 3	X			▽
Ref Level 80.00 dBµV Att 0 dB SV Input 1 AC PS	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz Mo S Off Notch Off	de Auto Sweep		Fre	quency 7.23	300000 GHz
Frequency Sweep					M1[1]	 1Pk Max 47.50 dBμV
70 dвµv					7.	22874126 GHz
0 dBµV						
0 dBµV		~~~				
Ю dBµV			et and a second s	Mul war	٨	
Umrent Marchall	and all amount				Jam Malan	hamana
0.0014						
0 dBµV						
) dBµV						
dBµV						
10 dBμV						
F 7.23 GHz	1001	pts	1.0 MHz/		ç	pan 10.0 MHz
F 7.23 GHz	1001	pts	1.0 MHz/	S		
				S		s – Pea
MultiView Spectr RefLevel 80.00 dBµV Att 0 dB	um x Spectrum 2 ● RBW 1 MHz WT 1.2 ms ● WBW 3 MHz Mor	X Spectrum 3	1.0 MHz/		puriou	s – Pea
IultiView # Spectr Ref Level 80.00 dBµV Att 0 dB BV Input 1 AC P8	um x Spectrum 2 ● RBW 1 MHz WT 1.2 ms ● WBW 3 MHz Mor	X Spectrum 3			puriou	s – Pea v 400000 GHz • 1Pk Max
1ultiView E Spectr Ref Level 80.00 dBµV Att 0 dB si Input 1 AC Pt Frequency Sweep	um x Spectrum 2 ● RBW 1 MHz WT 1.2 ms ● WBW 3 MHz Mor	X Spectrum 3			quency 9.64	s – Pea v 400000 GHz • 1Pk Max 37.18 dByV
Spectr Spectr Ref Level 80.00 dBµ/ Att 0 dB si Input 1 AC PS Frequency Sweep D dBµ/	um x Spectrum 2 ● RBW 1 MHz WT 1.2 ms ● WBW 3 MHz Mor	X Spectrum 3			quency 9.64	s – Pea v 400000 GH: •1Pk Max 37.18 dBµV
Spectr Spectr Ref Level 80.00 dBµ/ Att 0 dB si Input 1 AC PS Frequency Sweep D dBµ/	um x Spectrum 2 ● RBW 1 MHz WT 1.2 ms ● WBW 3 MHz Mor	X Spectrum 3			quency 9.64	s – Pea v 400000 GHz • 1Pk Max 37.18 dByV
MultiView Spectr Ref Level 80.00 dBy// Att 0 dB SS Input 1 AC PS Frequency Sweep 0 dB MV 0 dByV 0 dB MV	um x Spectrum 2 ● RBW 1 MHz WT 1.2 ms ● WBW 3 MHz Mor	X Spectrum 3			quency 9.64	s - Pea v 100000 GHz 1Pk Max 37.18 dBpV
IultiView Spectr Ref Level 80.00 dBµV Att 0 dB Si input 1 AC PF Frequency Sweep 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV	um x Spectrum 2 ● RBW 1 MHz WT 1.2 ms ● WBW 3 MHz Mor	X Spectrum 3		Fre	quency 9.64	s – Pea v 400000 GHz • 1Pk Max 37.18 dByV
IultiView Spectr Ref Level 80.00 By// Att 0 dB St input 1 AC PF Frequency Sweep 0 dBµ/ 0 dBµ/ 0	UT 12 ms VBW 31Mtz WT 12 ms VBW 31Mtz Moc Off Notch Off	X Spectrum 3			quency 9.64	s – Pea v 400000 GHz • 1Pk Max 37.18 dByV
AultiView Spectr Ref Level 80.00 By// Att 0 dB St input 1 AC PF Frequency Sweep 0 dBµ/ 0 dBµ/ 0	UT 12 ms VBW 31Mtz WT 12 ms VBW 31Mtz Moc Off Notch Off	X Spectrum 3		Fre	quency 9.64	s - Pea v 400000 GH: 37.18 dBµ 54244755 GHz
IultiView Spectr Ref Level 80.00 By// Att 0 dB SI Input 1 AC P2 Frequency Sweep	UT 12 ms VBW 31Mtz WT 12 ms VBW 31Mtz Moc Off Notch Off	X Spectrum 3		Fre	quency 9.64	s - Pea v 400000 GH: 37.18 dBµ 54244755 GHz
AultiView Spectr Ref Level 80.00 Økly/ Att 0 dB Si Input 1 AC PS Frequency Sweep 0 0 dBµV 0	UT 12 ms VBW 31Mtz WT 12 ms VBW 31Mtz Moc Off Notch Off	X Spectrum 3		Fre	quency 9.64	s - Pea
Input 1 AC Pt Frequency Sweep 0 dвµV	UT 12 ms VBW 31Mtz WT 12 ms VBW 31Mtz Moc Off Notch Off	X Spectrum 3		Fre	quency 9.64	s - Pea
Autiview Spectr Ref Level 80.00 dBµ/ 0 dB Si Input 1 AC PS Frequency Sweep 0 0 0 dBµ/ 0 0	UT 12 ms VBW 31Mtz WT 12 ms VBW 31Mtz Moc Off Notch Off	X Spectrum 3		Fre	quency 9.64	s - Pea
MultiView Spectr Ref Level 80.00 dBµ/ 0 dB Si Nut 0 dB Si Input 1 AC PS Frequency Sweep 0 0 dBµ/ 0	UT 12 ms VBW 31Mtz WT 12 ms VBW 31Mtz Moc Off Notch Off	X Spectrum 3		Fre	quency 9.64	s - Pea

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• MESH _ Middle frequency

MultiView 🗄							, L	Spuriou	5 - Fea
	Spectrum	x Spe	ectrum 2	X Spect	rum 3 🛛 🕅]			▼
Ref Level 80.00 Att	0 dB SWT 1.0	● RBW D1 ms ● VBW	3 MHz Mode	Auto Sweep			Fn	equency 4.8	900000 GH:
Input Frequency Sw	1 AC PS veep	Off Notch	n Off						• 1Pk Max
								M1[1]	49.75 dBµ\ 88911089 GHz
0 dBµV									
0 dBµV									
) dBµV				M1					
			. and		- and the second	and the second s			
) dBUV	meterminister	AWale Marker Mrs	e				Martin Carlor	mmanterretal	mudulum
0 dBµV									
) dBµV									
) dBµV									
dBµV									
ιο dBμV									
F 4.89 GHz			1001 pt	s s	1	.0 MHz/			span 10.0 MHz
							·		- Dec
							3	Spuriou	s – Pea
IultiView 🗄	Spectrum	x Spe	ectrum 2	X Spect	rum 3 🛛 🕱]			_ ▽
Ref Level 80.00 Att	0 dBµV 0 dB SWT 1.0	● RBW 01 ms ● VBW		e Auto Sweep			Fn	equency 7.3	350000 GH
Input Frequency Sw	1 AC PS veep	Off Notch	n Off					, ,	• 1Pk Max
								M1[1]	42.07 dBµ\ 33373127 GHz
) dBµV									
о dвµV									
			M1						
0 dBµV			MI	March and and a	a, dutter	and and the state			
0 dBµV	- Marchard	broken		the and the state of the state	Sandara Madara San	and the second	and the second and the	Jack Martin Martin	nurrelleven
D dBµV		Jan Marine		Mandonaldon	the also and the also and the	an and the second	and and the second and the	Jarmanhalana	number
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0 dBµV	yddiaudi-al-dodoro	June March		hand and the second second	the along the along the		and the second as	a destrong and a second	ins with Upplane
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0 dbµv 0 dbµv 0 dbµv 0 dbµv 0 dbµv 0 dbµv 0 dbµv 0 dbµv		burnet under		le de la constante	The star of the st		and the second and th	Jakore (Marcona)	Transit Markow
0 dBµV		bureture		len or other			and the second and th	Jahne belge and	

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• MESH _ High frequency

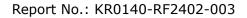
				F	lestricte	ed Ban	d - Peak
MultiView 🗄 Spectrum	Spectrum 2	X Spectrum 3	X Spectru	ım 4 🕅 🕱			∇
Input 1 AC PS	● RBW 1 Mi WT 1.01 ms ● VBW 3 Mi On Notch 0	Hz Mode Auto Sweep			Fre	equency 2.4	917500 GHz
l Frequency Sweep					M	1[1]	● 1Pk Max 49.41 dBµV
90 dBµV							2.4835412 GHz
30 dBµV							
70 dBµV							
50 dBµV							
1 О dвµV							
ю dBµV	- warmen -	and a company to the state					
10 dBµV			man	mathere	man when the server	Mundhange	an how and
10 dBµV							
0 dBµV							
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2.4835 GHz		1001 pts	1.	65 MHz/			2.5 GHz
2.4835 GHz	m 🕱 Spectru				S	Spuriou	
2.4835 GHz MultiView Spectru Ref Level 80.00 dBµ/ Att 0 dB SW Input 1 AC PS	● RBW 1 MH T 1.01 ms ● VBW 3 MH	m 2 X Spect					IS - Pea v
2.4835 GHz MultiView Spectru Ref Level 80.00 dBµ/ Att 0 dB SW Input 1 AC PS	● RBW 1 MH T 1.01 ms ● VBW 3 MH	m 2 X Spect				equency 4.9	IS - Peal ▼ 5500000 GHz ■1Pk Max 45.58 dByV
2.4835 GHz MultiView Spectru Ref Level 80.00 dbµV Att 0 dB SW Input 1AC PS Frequency Sweep	● RBW 1 MH T 1.01 ms ● VBW 3 MH	m 2 X Spect				equency 4.9	IS – Peal v 500000 GHz
2.4835 GHz MultiView Spectru Ref Level 80.00 dbµV Att 0 dB SW Input 1AC PS Frequency Sweep To dbµV	● RBW 1 MH T 1.01 ms ● VBW 3 MH	m 2 X Spect				equency 4.9	IS - Peal ▼ 5500000 GHz ■1Pk Max 45.58 dByV
2.4835 GHz MultiView Spectru Ref Level 80.00 dBµV Att 0 dB yw Input 1 AC PS Frequency Sweep 70 dBµV	● RBW 1 MH T 1.01 ms ● VBW 3 MH	m 2 🗶 Spect				equency 4.9	IS - Peal ▼ 5500000 GHz ■1Pk Max 45.58 dByV
2.4835 GHz MultiView Spectru RefLevel 80.00 dBµV Att 0 dB SW Input 1 AC PS Frequency Sweep 70 dBµV 10 dBµV 10 dBµV 10 dBµV 10 dBµV		m 2 Spect			Fre	MI[1]	IS − Peal 500000 GHz 1500000 GHz 45.58 dBµV 134911089 GHz
2.4835 GHz MultiView Spectru Ref Level 80.00 dBµV Att 0 dB SW Input 1 AC PS Frequency Sweep 70 dBµV 10 dBµV 10 dBµV 10 dBµV 10 dBµV		m 2 Spect			Fre	equency 4.9	IS − Peal 500000 GHz 1500000 GHz 45.58 dBµV 134911089 GHz
2.4835 GHz MultiView Spectru Ref Level 80.00 dBµ/ Att 0 dB SW Input 1 AC PS Frequency Sweep 10 dBµ/ 10 dBµ/ 10 dBµ/ 10 dBµ/		m 2 Spect			Fre	MI[1]	IS − Peal 500000 GHz 1500000 GHz 45.58 dBµV 134911089 GHz
2.4835 GHz MultiView Spectru Ref Level 80.00 dBW Att 0 dB SW Input 1 AC PS Frequency Sweep 0 dBW 0		m 2 Spect			Fre	MI[1]	IS − Peal 500000 GHz 1500000 GHz 45.58 dBµV 134911089 GHz
2.4835 GHz MultiView Spectru Ref Level 80.00 dBW Att 0 dB Spectru Input 1AC PS Frequency Sweep 0 dBW 0		m 2 Spect			Fre	MI[1]	IS − Peal 500000 GHz 1500000 GHz 45.58 dBµV 134911089 GHz
2.4835 GHz MultiView Spectru Ref Level 80.00 dBuV Att 0 dB S Frequency Sweep 0 dBuV 1 dBuV 1 dBuV 1 dBuV 1 dBuV 1 dBuV 1 dBuV		m 2 Spect			Fre	MI[1]	IS − Peal 500000 GHz 1500000 GHz 45.58 dBpV 19911089 GHz
2.4835 GHz MultiView Spectru RefLevel 80.00 dBµ/ Att 0 dB SW		m 2 Spect			Fre	MI[1]	IS − Peal 500000 GHz 1500000 GHz 45.58 dBpV 19911089 GHz

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AultiView 🗄 S		Spectrum 2	X Spect	rum 3 🛛 🛛				∇
Input 1	dB SWT 1.01 ms AC PS Off	 RBW 1 MHz VBW 3 MHz Mo Notch Off 	de Auto Sweep			Fre	equency 7.4	250000 GH
Frequency Swee							M1[1] 7	● 1Pk Max 38.15 dBµ .42663836 GH
) dBµV								
) dBµV								
) dBµV								
	welne	mmanhanna	un marine and a second	manna	MI	man and special	unnunuuu	ورابعاتها معادر ورسام
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0 dBµV								
dBµV				1				1
dвµv								

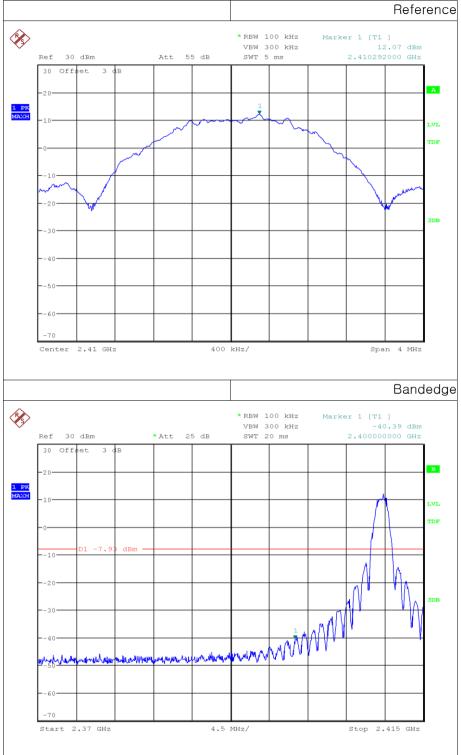
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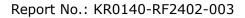


9.7 Test Plot for Conducted Spurious Emission

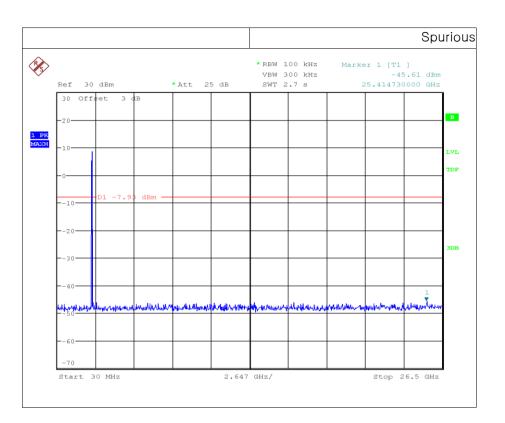
• MESH _ Low frequency



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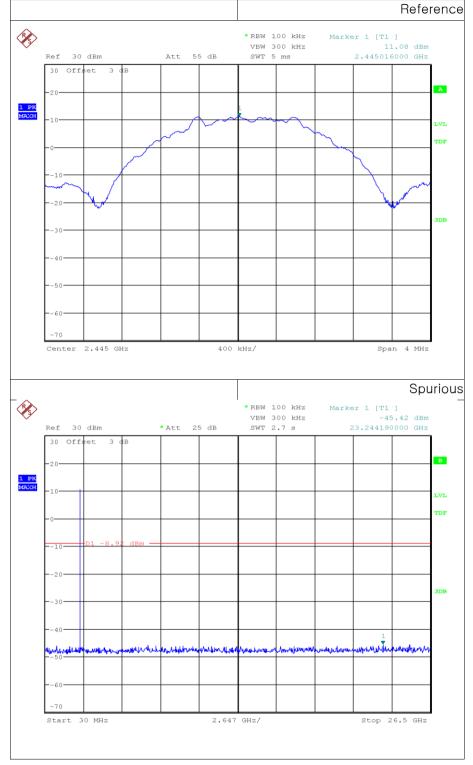








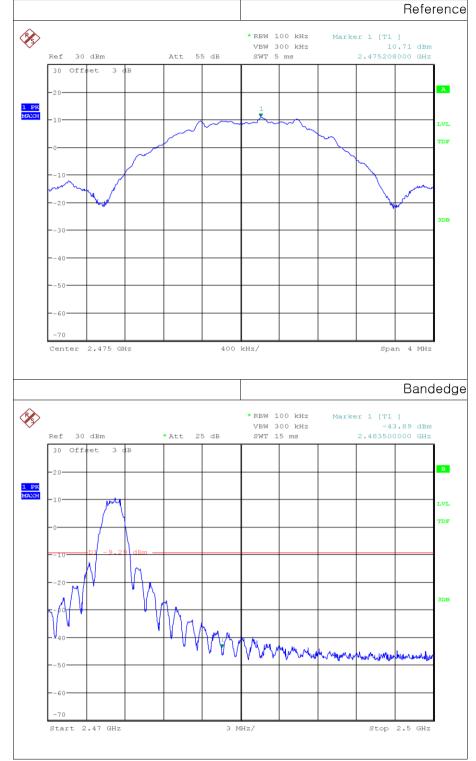
• MESH _ Middle frequency



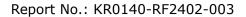
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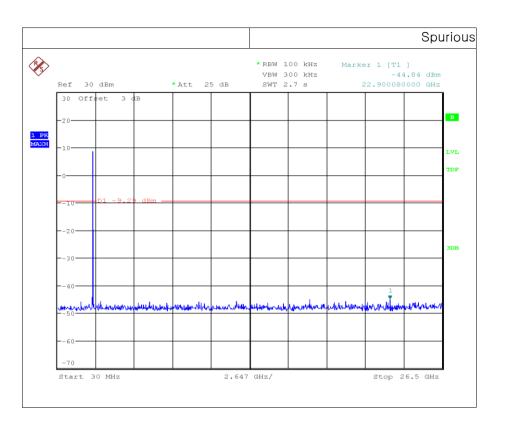
MESH _ High frequency



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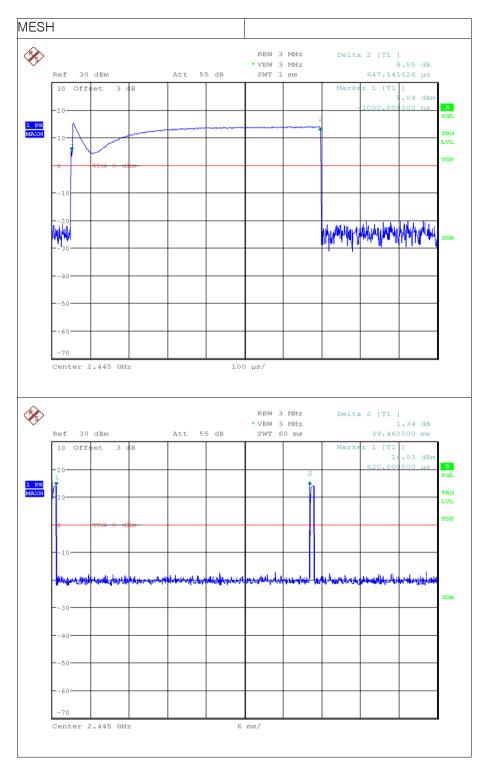








9.8 Test Plot for Duty Cycle



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10. Conducted Emission

10.1 Test Setup

See test photographs for the actual connections between EUT and support equipment.

10.2 Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)				
Frequency hange (MHZ)	Quasi-Peak	Average			
0.15 ~ 0.5	66 to 56 *	56 to 46 *			
0.5 ~ 5	56	46			
5 ~ 30	60	50			

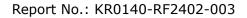
* Decreases with the logarithm of the frequency

10.3 Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10.

- The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
- 2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
- 3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
- 4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

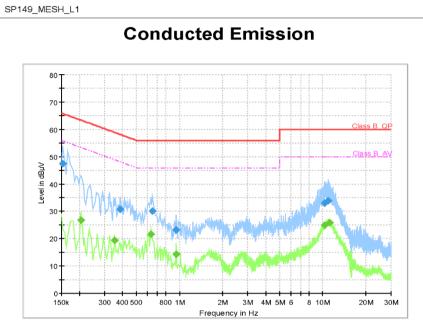
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10.4 Test Result

• AC Line Conducted Emission (Graph)



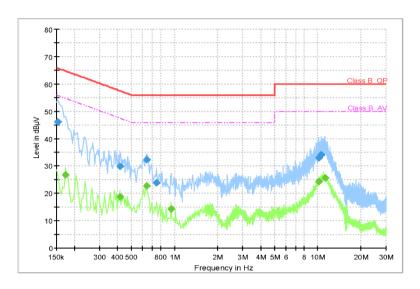
Final_Result

Frequency (MHz)	QuasiPeak	CAverage	Limit	Margin	Bandwidth	Line	Corr.
	(dBµV)	(dBµV)	(dBµV)	(dB)	(kHz)		(dB)
0.154	47.56		65.78	18.23	9	L1	10.6
0.206		26.74	53.37	26.63	9	L1	10.6
0.354		19.37	48.87	29.50	9	L1	10.7
0.386	30.83		58.15	27.32	9	L1	10.7
0.630		21.59	46.00	24.41	9	L1	10.5
0.650	30.15		56.00	25.85	9	L1	10.3
0.950	23.15		56.00	32.85	9	L1	10.0
0.950		14.30	46.00	31.70	9	L1	10.0
10.250	32.93		60.00	27.07	9	L1	9.9
10.360		24.86	50.00	25.14	9	L1	9.9
10.960	33.92		60.00	26.08	9	L1	9.9
11.180		25.87	50.00	24.13	9	L1	9.9

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SP149_MESH_N



Conducted Emission

Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.154	46.19	(abpt) 	65.78	19.60	9	N	10.6
0.174		26.83	54.77	27.94	9	N	10.8
0.418		18.80	47.49	28.69	9	N	10.7
0.418	29.82		57.49	27.67	9	N	10.7
0.640		22.64	46.00	23.36	9	N	10.4
0.640	32.23		56.00	23.77	9	N	10.4
0.750	23.83		56.00	32.17	9	N	9.9
0.950		14.22	46.00	31.78	9	N	10.0
10.190	32.93		60.00	27.07	9	N	9.9
10.240		24.35	50.00	25.65	9	N	9.9
10.570	34.01		60.00	25.99	9	N	9.9
11.250		25.57	50.00	24.43	9	N	9.9

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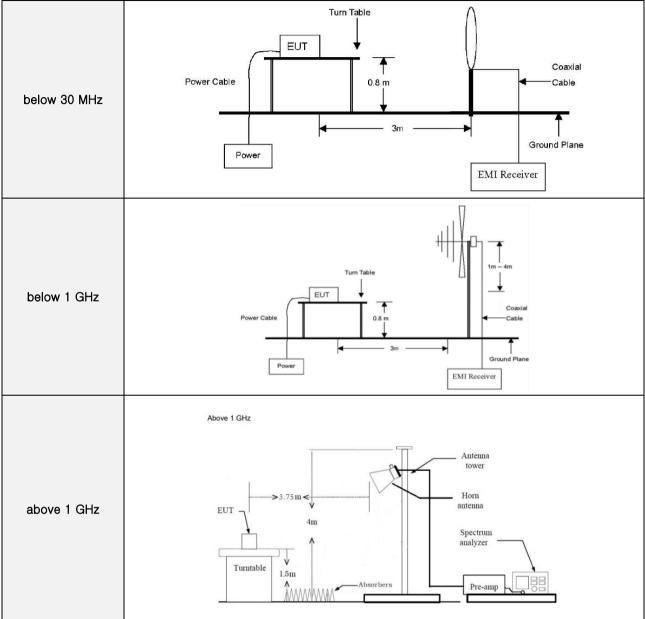
APPENDIX I

TEST SETUP

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Radiated Measurement



• Conducted Measurement

	_				
Conducted		EUT	 Attenuator	Spectrum Analyzer	

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APPENDIX II

UNCERTAINTY

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Measurement Item	Expanded Uncertainty U = <i>k</i> Uc (<i>k</i> =2)
Conducted RF power	0.32 dB
Conducted Spurious Emissions	0.32 dB
Radiated Spurious Emissions	6.34 dB
Conducted Emissions	1.74 dB