

TEST REPORT

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1. Client	
• Name	: Sena Technologies Co., Ltd.
Address	: 19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea
2. Use of Report	: FCC Approval
3. Sample Description	
• Product Name :	Wireless Communication Systems
• Model Name :	BMW Motorrad ConnectedRide COM P1
4. Date of Receipt	: 2024-12-10
5. Date of Test	: 2025-01-07 ~ 2025-01-24
6. Test Method	: FCC Part 15 Subpart C 15.247
7. Test Results	: Refer to the test results
	test report are the results of testing the samples provided. ad according to the requirements of ISO / IEC 17025.
Affirmation Jong-My	voung, Shin (Sign) Kyung-Taek, Lee (Sign)
EN	Feb 03, 2025



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<u>Version</u>

TEST REPORT NO.	DATE	DESCRIPTION
KR0140-RF2502-003	Feb 03, 2025	Initial Issue

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1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant Information

Applicant	Sena Technologies Co., Ltd.	
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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
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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	Wireless Communication Systems	
Model Name	BMW Motorrad ConnectedRide COM P1	
FCC ID	S7A-SP175	
Power Supply	DC 3.7 V	

2.2 Additional Information

Operating Frequency	2 410 MHz ~ 2 475 MHz	
Number of channel	14	
Modulation Type	DQPSK	
Antenna Type & Gain	PCB Pattern Antenna(with Max gain: 0.56 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	MESH 2 410		2 475

2.4 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.

2.5 EUT Description

EUT	1	2	
Model Name	BMW Motorrad ConnectedRide COM P1		
Control Unit	BMW Motorrad ConnectedRide BMW Motorrad Connect COM P1 GS COM P1 System 8		
Hardware	USB type C (without audio function)		
Accessory	Headphone Microphone Audio Kit		
Note	The difference is related to optional control unit, but the product is exactly the same.		

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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%)	Canduatad	С
	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
	15.247(d)	RSS-247 (5.5)	Conducted Spurious Emission		С
	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 I Conducted		С
Note 1: 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	2025.11.06
CONTROLLER	AMWON TECHNOLOGY	TEMI2500	S7800VK191 0707	2025.11.06
PSA SERIES SPECTRUM ANALYZER	AGILENT	E4440A	MY45304057	2025.11.07
MXG ANALOG SIGNAL GENERATOR	AGILENT	N5183A	MY50141890	2025.11.07
SYSTEM DC POWER SUPPLY	AGILENT	6674A	MY53000118	2025.11.07
VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	257524	2025.11.07
DIRECTIONAL COUPLER	AGILENT	773D	2839A01855	2025.11.07
ATTENUATOR	AGILENT	8493C	73193	2025.11.07
POWER DIVIDER	HEWLETT PACKARD	11636A	06916	2025.11.07
SLIDE-AC	DAEKWANG TECH	SV-1023	NONE	2025.11.07
DIGITAL MULTIMETER	HUMANTECHSTORE	15B+	50561541WS	2025.11.07
ATTENUATOR	ACE RF COMM	ATT SMA 20W 20dB 8GHz	A-0820.SM20.2	2025.04.04
DC POWER SUPPLY	AGILENT	E3634A	MY40012120	2025.02.22
USB Peak Power Sensor	Anritsu	MA24408A	12321	2025.11.08
High Pass Filter	WT Microwave INC.	WT-A3314-HS	WT22111804-1	2025.11.07
High Pass Filter	WT Microwave INC.	WT-A1935-HS	WT22111804-2	2025.12.06
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSU26	200444	2025.02.22
ATTENUATOR	Mini-Circuits	BW-K3-2W44+	2318-1	2025.06.28
ATTENUATOR	Mini-Circuits	BW-K3-2W44+	2318-2	2025.06.28
Balanced Temperature and Humidity Control System	ESPEC CORP.	SH-241	92004650	2025.06.13
ACTIVE LOOP ANTENNA	TESEQ	HLA 6121	55685	2026.12.20
Biconilog ANT	Schwarzbeck	VULB 9160	3260	2026.04.01
Biconilog ANT	Schwarzbeck	VULB9168	902	2026.08.28
Horn ANT	Schwarzbeck	BBHA9120D	974	2025.11.29
Horn ANT	Schwarzbeck	BBHA9120D	1497	2026.01.03
Amplifier	TESTEK	TK-PA18H	200104-L	2025.03.14
Horn ANT	Schwarzbeck	BBHA9170	01188	2025.03.19
Horn ANT	Schwarzbeck	BBHA9170	01189	2025.03.19
AMPLIFIER	TESTEK	TK-PA1840H	220105-L	2025.03.14
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101952	2025.03.14
Test Receiver	ROHDE & SCHWARZ	ESR7	101616	2025.06.27
TWO LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	102596	2025.08.20
PULSE LIMITER	lignex1	EPL-30	NONE	2026.01.04
RF Cable	OSI MICROWAVE	PLH16D	EMC-C-009	2025.07.26
RF Cable	OSI MICROWAVE	PLH16D	RF-K-001	2025.07.26

* RF cables are managed by self-inspection per one year.

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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 0.56 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	1.426	2.240
MESH	Middle	1.441	2.308
	High	1.551	2.316

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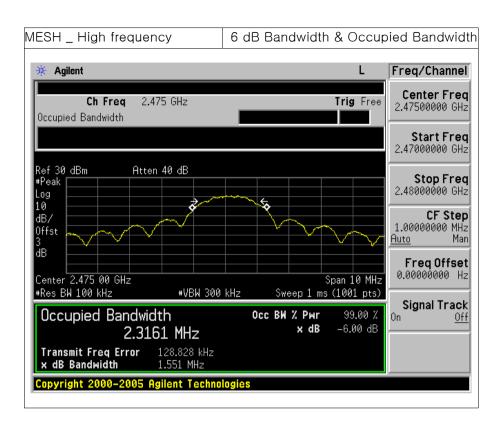


6.5 Test Plot



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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.

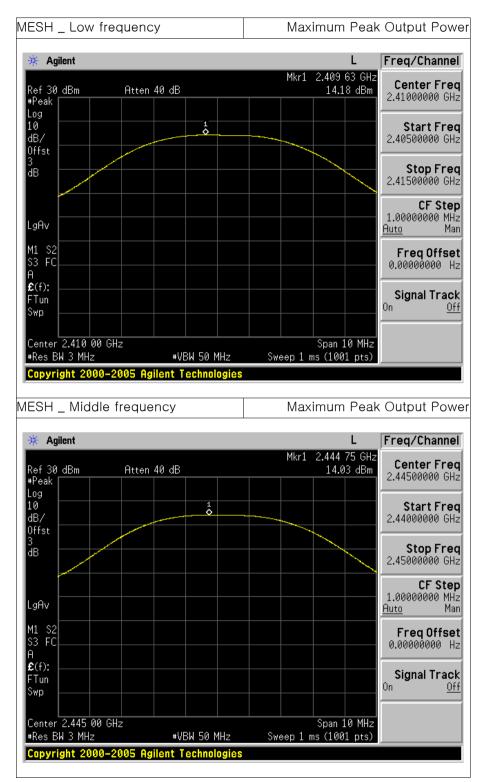
7.4 Test Result

Test Mode	Test Frequency	Peak Out	out Power
Test Mode	Test Frequency	dBm	mW
	Low	14.18	26.18
MESH	Middle	14.03	25.29
	High	13.48	22.28



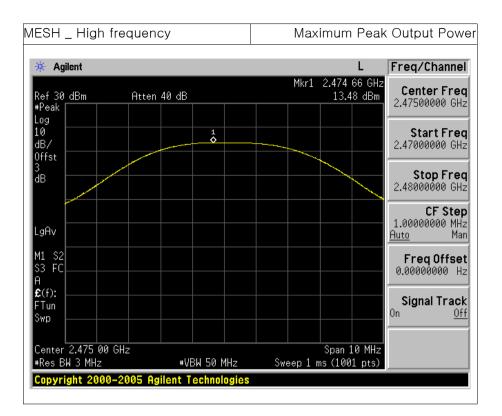


7.5 Test Plot



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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.

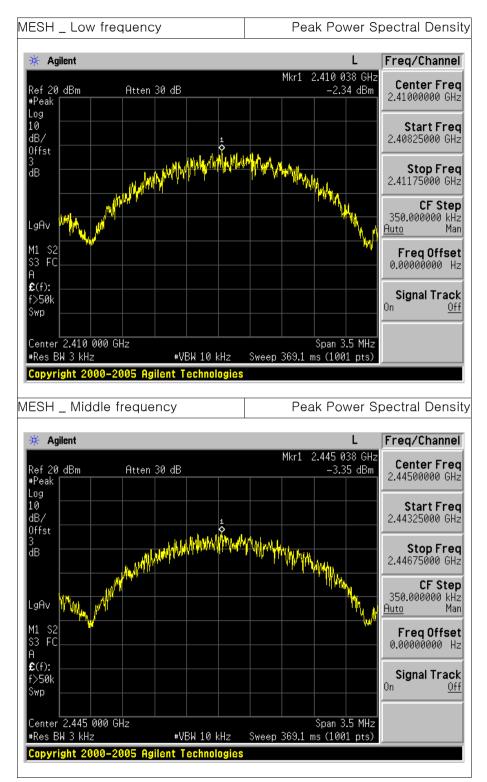
Test Mode	Test Frequency	Peak Power Spectral Density (dBm)
	Low	-2.34
MESH	Middle	-3.35
	High	-3.81

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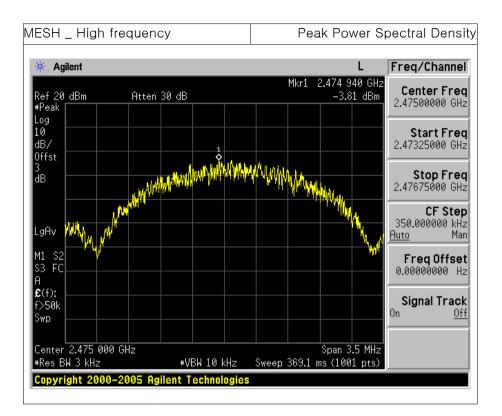


8.5 Test Plot



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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

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:

001011		
MHz	MHz	GHz
16.42 ~ 16.423	399.90 ~ 410	4.5 ~ 5.15
16.69475 ~ 16.69525	608 ~ 614	5.35 ~ 5.46
16.80425 ~ 16.80475	960 ~ 1240	7.25 ~ 7.75
25.5 ~ 25.67	1300 ~ 1427	8.025 ~ 8.5
37.5 ~ 38.	1435 ~ 1626.5	9.0 ~ 9.2
25 73 ~ 74.6	1645.5 ~ 1646.5	9.3 ~ 9.5
74.8 ~ 75.2	1660 ~ 1710	10.6 ~ 12.7
108 ~ 121.94	1718.8 ~ 1722.2	13.25 ~ 13.4
149.9 ~ 150.05	2200 ~ 2300	14.47 ~ 14.5
156.52475 ~ 156.52525	2310 ~ 2390	15.35 ~ 16.2
156.7 ~ 156.9	2483.5 ~ 2500	17.7 ~ 21.4
162.0125 ~ 167.17	2690 ~ 2900	22.01 ~ 23.12
3345.8 ~ 3358	3260 ~ 3267	23.6 ~ 24.0
3600 ~ 4400	3332 ~ 3339	31.2 ~ 31.8
3345.8 ~ 3358	240 ~ 285	36.43 ~ 36.5
3600 ~ 4400	322 ~ 335.4	Above 38.6
	$\begin{array}{r} \mbox{MHz} \\ 16.42 \sim 16.423 \\ 16.69475 \sim 16.69525 \\ 16.80425 \sim 16.80475 \\ 25.5 \sim 25.67 \\ 37.5 \sim 38. \\ 25.73 \sim 74.6 \\ 74.8 \sim 75.2 \\ 108 \sim 121.94 \\ 149.9 \sim 150.05 \\ 156.52475 \sim 156.52525 \\ 156.7 \sim 156.9 \\ 162.0125 \sim 167.17 \\ 3345.8 \sim 3358 \\ 3600 \sim 4400 \\ 3345.8 \sim 3358 \\ \end{array}$	MHzMHz $16.42 \sim 16.423$ $399.90 \sim 410$ $16.69475 \sim 16.69525$ $608 \sim 614$ $16.80425 \sim 16.80475$ $960 \sim 1240$ $25.5 \sim 25.67$ $1300 \sim 1427$ $37.5 \sim 38.$ $1435 \sim 1626.5$ $25 73 \sim 74.6$ $1645.5 \sim 1646.5$ $74.8 \sim 75.2$ $1660 \sim 1710$ $108 \sim 121.94$ $1718.8 \sim 1722.2$ $149.9 \sim 150.05$ $2200 \sim 2300$ $156.52475 \sim 156.52525$ $2310 \sim 2390$ $156.7 \sim 156.9$ $2483.5 \sim 2500$ $162.0125 \sim 167.17$ $2690 \sim 3267$ $3600 \sim 4400$ $3332 \sim 3339$ $3345.8 \sim 3358$ $240 \sim 285$

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

Frequency	Reading (dBuV/m)			ŦĊ	0.005	Lin	nits	Re	sult	Mai	rgin
Trequency			Pol.	T.F (dB)	DCCF (dB)	(dBuV/m)		(dBuV/m)		(dB)	
(MHz)	AV /	/ Peak		(40)	(48)	AV / Peak		AV / Peak		AV / Peak	
2 388.92	N/A	29.42	Н	9.51	-34.28	54.0	74.0	4.7	38.9	49.3	35.1
4 821.26	N/A	58.20	V	-1.18	-34.28	54.0	74.0	22.7	57.0	31.3	17.0
7 228.83	N/A	56.05	V	8.33	-34.28	54.0	74.0	30.1	64.4	23.9	9.6

• Middle frequency

Fraguaday	Reading (dBuV/m)			тc	2005	Lin	nits	Re	sult	Mar	rgin				
Frequency			Pol.	T.F (dB)	DCCF (dB)	(dBuV/m)		(dBuV/m)		(dB)					
(MHz)	AV / Peak			(48)	(00)	AV / Peak		AV / Peak		AV / Peak		AV /	Peak	AV /	Peak
4 889.22	N/A	58.17	V	-1.08	-34.28	54.0	74.0	22.8	57.1	31.2	16.9				
7 334.01	N/A	54.51	V	8.34	-34.28	54.0	74.0	28.6	62.9	25.4	11.2				

• High frequency

	Reading (dBuV/m)				0.005	Lin	nits	Re	sult	Mai	rgin				
Frequency			Pol.	T.F (dB)	DCCF (dB)	(dBuV/m)		(dBuV/m)		(dB)					
(MHz)	AV / Peak			(00)			AV / Peak		AV / Peak		AV / Peak		Peak	AV /	Peak
2 483.53	N/A	39.66	Н	9.25	-34.28	54.0	74.0	14.6	48.9	39.4	25.1				
4 951.21	N/A	57.27	V	-1.14	-34.28	54.0	74.0	21.9	56.1	32.1	17.9				
7 426.87	N/A	52.61	V	8.49	-34.28	54.0	74.0	26.8	61.1	27.2	12.9				

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} = 0.644 ms / T_{off} = 39.30 ms

- DCCF = $20 \times \log(\text{The Worst Case Dwell Time / 100 ms}) dB = <math>20 \times \log(1.932 / 100) dB = -34.28 dB$ 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

						F	Restricte	ed Band	d – Peak
MultiView 🕀	Spectrum	Spectrur	n 2 🕱	Spectrum 3	X Spectru	um 4 🕱			_ ▽
Ref Level 97 Att	0 dB SWT	1.01 ms ⊜ VB₩	/ 1 MHz / 3 MHz Mod	e Auto Sweep			Fre	equency 2.35	00000 GHz
Input 1 Frequency S	1 AC PS Sweep	On Note	sh Off						• 1Pk Max
90 dBµV								M1[1]	29.42 dBµV .3889210 GHz
80 dBµV									
70 dBµV									
60 dBµV									
50 dBµV									
40 dBµV									
									M1
30 dBµV								montalities	manuallin
20 dBµV-	s-March may have a	myhannetherer	annon anna	Munnuh	www.anduww	n n han han han han han han han han han	Rhan Municipality		
10 dBµV									
0 dBµV									
2.31 GHz			1001 pt	S	8	.0 MHz/			2.39 GHz
								Spurious	s – Peak
MultiView	# Spectrum	x Sp	ectrum 2	X Specti	.um 3 🛛 🕅	3			
Ref Level 97 Att	0 dB SWT	1.01 ms 🖶 VBV	/ 1 MHz / 3 MHz Mod	e Auto Sweep		<u> </u>	Fre	equency 4.82	200000 GHz
Input 1 Frequency S	1 AC PS Sweep	On Note	sh Off						• 1Pk Max
90 dBµV								M1[1] 4;	58.20 dBµV 82125874 GHz
80 dBµV									
70 dBµV									
60 dBµV						M1			
оо авру-									
50 dBµV			and the second se				A CONTRACT		
40 dBµV	مددي ادم در ا	Harris and the state of the sta					- Autor	Mary Markerson	Mark De La Sala
40 dBUV	and and the second second								manfactionader
30 dBµV									
20 dBµV									
10 dBµV									
0 dBµV									
CF 4.82 GHz			1001 pt	s	1	.0 MHz/		S	pan 10.0 MHz

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			Spurious - Peak
MultiView # Spectrum	X Spectrum 2 X Spect	rum 3 🛛 🕱	
Input 1 AC PS	BBW 1 MHz Sweep On Notch Off		Frequency 7.2300000 GHz
90 dBµV			• 1Pk Max M1[1] 56.05 dBµV 7.22883117 GHz
80 d8µV			
70 dBµV			
60 dBµV	ML		
50 dBµV			
40 dByV			What we wanted and the second
30 dBµV			
20 dBµV			
10 dBµV			
о dBµV	1001 pts	1.0 MHz/	Span 10.0 MHz

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• MESH _ Middle frequency

								spunou	s – Peal
MultiViou	Spectrum	x Sp	ectrum 2	X Spectr	rum 3 🛛 🕱	,			▽
Ref Level 97	.00 dBuV	• RBV	₩ 1 MHz			<u> </u>			
 Att Input 	1 AC PS	1.01 ms ● VB¥ On Not	W 3 MHz Mod ch Off	e Auto Sweep			Fre	equency 4.89	900000 GHz
1 Frequency S	sweep							M1[1]	 1Pk Max 58.17 dBμV
90 dBµV								4.	88922078 GHz
80 dBµV									
70 dBµV									
60 dBµV				M1					
			June						
50 dBµV			are a construction of the second s				the way		
40 dBµV		a human					MAL	Man and the second second	Avanna
40 dBµV									an al an an an a day of a
30 dBµV									
20 dBµV									
10 dBµV									
0 dBµV									
			1001 pt	s	1	.0 MHz/		5	pan 10.0 MHz
			1001 pt	S	1	.0 MHz/	S		s – Peal
CF 4.89 GHz	· · · · · · · · · · · · · · · · · · ·					2	C C		s – Peał
CF 4.89 GHz MultiView	Spectrum		ectrum 2	s x Spectr		2	Ç		
CF 4.89 GHz	'.00 dBµV	• RBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou	s – Peał
CF 4.89 GHz MultiView Ref Level 97	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3:	s - Peał v 350000 GHz • 1Pk Max
MultiView Ref Level 97 Att Input I Frequency S	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peał
MultiView Ref Level 97 Att Input I Frequency S	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peal 350000 GHz 1Pk Max 54.51 dBpv
CF 4.89 GHz MultiView Ref Level 97 Att Input I Frequency S 90 dBµV	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
CF 4.89 GHz MultiView Ref Level 97 Att Input I Frequency S 90 dBµV	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
CF 4.89 GHz MultiView Ref Level 97 Att Input I Frequency S 90 dBµV	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
CF 4.89 GHz MultiView Ref Level 97 Att Input I Frequency S 90 dBµV	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
СF 4.89 GHz MultiView Ref Level 97 Att Input I Frequency S 90 dBµV	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
СГ 4.89 GHz МиltiView Ref Level 97 Э Att I приt I Frequency S 90 dBµV	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
СF 4.89 GHz МultiView Ref Level 97 а Att Input I Frequency S 90 dBµV 80 dBµV 70 dBµV 50 dBµV 50 dBµV	1.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
СF 4.89 GHz МultiView Ref Level 97 ● Att Input 1 Frequency S 90 dвµV	00 dBµV 0 dB SWT 1 AC PS Weep	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	v 350000 GHz 1Pk Max 54.51 dbyv 33401099 GHz
СГ 4.89 GHz МиltiView Ref Level 97 Э Att Input 1 Frequency S 90 dBµV 80 dBµV 70 dBµV 60 dBµV 50 dBµV	00 dBµV 0 dB SWT 1 AC PS Weep	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	s - Peak 350000 GHz 1Pk Max 54.51 dBpv
СF 4.89 GHz МultiView · Ref Level 97 Input 1 Frequency S 90 dBµV 80 dBµV 70 dBµV 60 dBµV 40 dBµV 40 dBµV 	00 dBµV 0 dB SWT 1 AC PS Weep	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	v 350000 GHz 1Pk Max 54.51 dbyv 33401099 GHz
СF 4.89 GHz МultiView · Ref Level 97 Input 1 Frequency S 90 dBµV 80 dBµV 70 dBµV 60 dBµV 40 dBµV 40 dBµV 	00 dBµV 0 dB SWT 1 AC PS Weep	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	v 350000 GHz 1Pk Max 54.51 dbyv 33401099 GHz
СF 4.89 GHz MultiView Ref Level 97 Input 1 Frequency S 90 dBµV 60 dBµV 70 dBµV 60 dBµV 60 dBµV 40 dBµV 20 dBµV 20 dBµV 20 dBµV	00 dBµV 0 dB SWT 1 AC PS Weep	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	v 350000 GHz 1Pk Max 54.51 dbyv 33401099 GHz
СF 4.89 GHz МultiView ··· Ref Level 97 Input 1 Frequency S 90 dвµV ···· 80 dвµV ···· 60 dвµV ···· 50 dвµV ···· 40 dвµV ···· 30 dвµV ····	00 dBµV 0 dB SWT 1 AC PS Weep	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	v 350000 GHz 1Pk Max 54.51 dbyv 33401099 GHz
СF 4.89 GHz МиltiView ··· Ref Level 97 Input 1 Frequency S 90 dвµV ···· 80 dвµV ···· 60 dвµV ···· 50 dвµV ···· 40 dвµV ···· 30 dвµV ···· 20 dвµV ····	00 dBµV 0 dB SWT 1 AC PS Weep	● RBV 1.01 ms ● VBV	ectrum 2 ₩ 1 MHz ₩ 3 MHz Mod	X Spectr		2		Spuriou equency 7.3: MI[1]	v 350000 GHz 1Pk Max 54.51 dbyv 33401099 GHz

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• MESH _ High frequency

						F	Restricte	ed Ban	d – Peak
MultiView	Spectrum	Spectrur	n 2 🕱	Spectrum 3	X Spectru	um 4 🕱			∇
RefLevel 9 Att	0 dB SWT	1.01 ms 🖶 VBVA	/ 1 MHz / 3 MHz Mod	e Auto Sweep			Fre	equency 2.49	917500 GHz
Input 1 Frequency	1 AC PS Sweep	On Note	sh Off						.01Pk Max
90 dBµV							Ň	1[1]	39.66 dBµV 2.4835250 GHz
80 dBµV									
70 dBµV									
60 dBµV									
50 dBµV									
м1 (40 dBµV									
30 dBµV	all many and and a	Margane Margan	Marting	the second s					
				1000 Mar 100	Mumalanday	while provide	er warden and the second	vid had a more view	munum
20 dBµV									
10 dBµV	-								
0 dBµV									
2.4835 GHz			1001 pt	s	1.	.65 MHz/			2.5 GHz
							ç	Spuriou	s – Peak
						2			▽
Ref Level 9 Att	7.00 dBµV	• RBW	ectrum 2	X Spectr	um 3 🛛 🛛			4.01	
Input I Frequency	1 AC PS	1.01 ms ⊕ VB₩ On Note	sh Off	e Auto Sweep			FI6	equency 4.9	• 1Pk Max
90 dBµV								M1[1] 4.	57.27 dBµV 95120879 GHz
80 dBµV									
70 dBµV									
60 dBµV						801			
00 0000						Ť.			
50 dBµV		 VL							
40 dBµV	www.waluani	Hannahar					n vie	while an all the	MMmmman
									- · · · · · · · · · · · · · · · · · · ·
30 dBµV									
20 dBµV									
		1				1			
10 dBµV									
10 dBµV									

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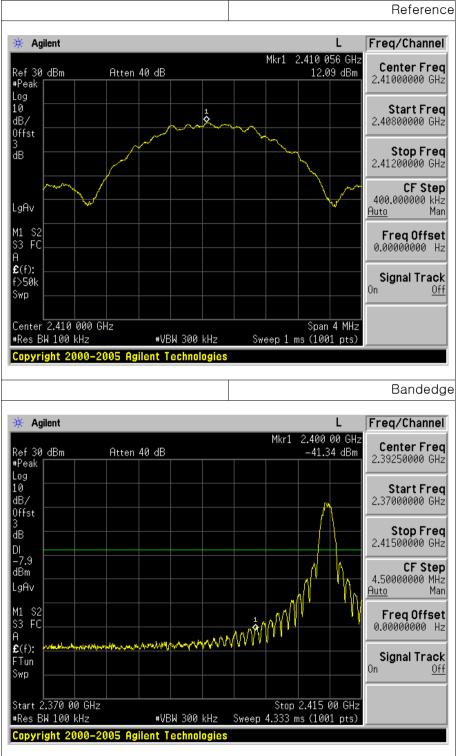
			Spurious – Peak
	pectrum 2 🕱 Spectr	rum 3 🛛 🕱	$\overline{\nabla}$
Att 0 dB SWT 1.01 ms ● VB Input 1 AC PS On No	W 1 MHz W 3 MHz Mode Auto Sweep tch Off		Frequency 7.4250000 GHz
1 Frequency Sweep			• 1Рk Мах M1[1] 52.61 dBµV 7.42686813 GHz
80 dBµV			
70 dBµV			
60 dBµV		M1	
50 dBµV		Line Line Line Line Line Line Line Line	
40 dbpv-			and the second and th
30 dBµV			
20 dBµV			
10 dBµV			
о dвµv СF 7.425 GHz	1001 pts	1.0 MHz/	Span 10.0 MHz

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9.7 Test Plot for Conducted Spurious Emission

• MESH _ Low frequency



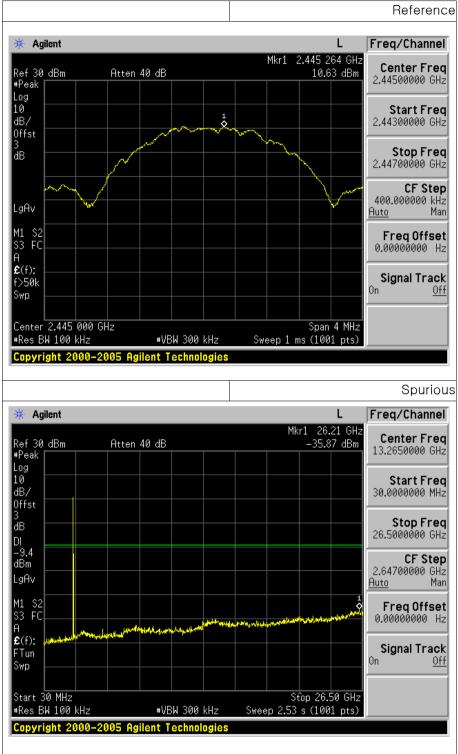
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				Spurio
🗧 Agilent			L	Freq/Channel
ef 30 dBm Peak	Atten 40 dB		Mkr1 25.88 GHz -36.23 dBm	Center Fred 13.2650000 GHz
og Ø B/				Start Frec 30.0000000 MHz
ffst B I				Stop Fred 26.5000000 GH:
7.9 Bm gAv				CF Step 2.64700000 GH: <u>Auto</u> Mar
1 \$2 3 FC		يديد المدين المناجم المناس المناس المناس	and the second of the second o	Freq Offse 0.00000000 H:
(f):				Signal Tracl ^{On <u>Of</u>}
tart 30 MHz Res BW 100 kHz	#V <u>B</u> W 3	 300 kHz Sw	Stop 26.50 GHz eep 2.53 s (1001 pts)	



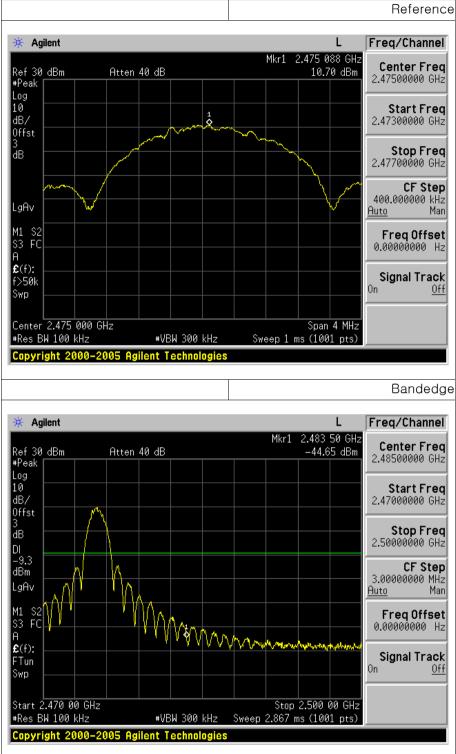
• MESH _ Middle frequency



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• MESH _ High frequency



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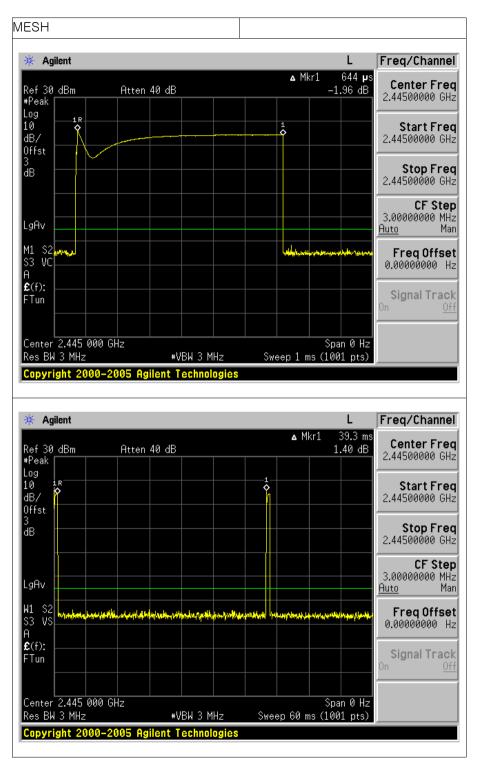


				Spurio
Agilent			L	Freq/Channel
Ref 30 dBm PPeak	Atten 40 dB		Mkr1 25.23 (-36.59 dl	Contor Eroc
uog LØ HB/				Start Fred 30.0000000 MHz
: IB II				Stop Frec 26.5000000 GHz
-9.3 JBm .gAv				CF Step 2.64700000 GHz <u>Auto</u> Mar
11 S2 53 FC		Herewith after the starting related	مىلىدىم بىرى ئىلى بىرى بىلى بىرى بىلى بىرى بىلى بىرى بىلى بىرى بىلى بىل	Freq Offset
C(f): Wayner (******* Tun Gwp				Signal Track On <u>Of</u>
Start 30 MHz Res BW 100 kHz	#VBW	300 kHz S	Stop 26.50 G weep 2.53 s (1001 pt	

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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.

	Conducted Limit (dBuV)				
Frequency Range (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.

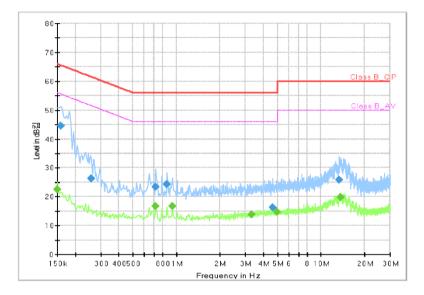
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10.4 Test Result

• AC Line Conducted Emission (Graph)

BMW Motorrad ConnectedRide COM P1_MESH_L1



Conducted Emission

Final F	Result
---------	--------

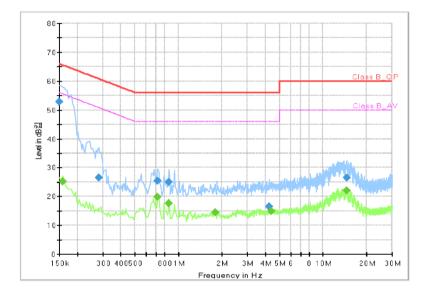
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.150		22.56	56.00	33.44	9	L1	19.5
0.158	44.47		65.57	21.09	9	L1	19.6
0.258	26.19		61.50	35.31	9	L1	19.5
0.720		16.71	46.00	29.29	9	L1	19.8
0.720	23.45		56.00	32.55	9	L1	19.8
0.860	24.21		56.00	31.79	9	L1	19.8
0.940		16.67	46.00	29.33	9	L1	19.8
3.300		13.78	46.00	32.22	9	L1	19.7
4.650	16.33		56.00	39.67	9	L1	19.8
4.950		14.65	46.00	31.35	9	L1	19.8
13.390	25.88		60.00	34.12	9	L1	20.0
13.680		19.80	50.00	30.20	9	L1	20.0

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BMW Motorrad ConnectedRide COM P1_MESH_N



Conducted Emission

Final_Resu	ult	
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)
0.150	52.89	

I IIIai_I COO	ше						
Frequency	QuasiPeak	CAverage	Limit	Margin	Bandwidth	Line	Corr.
(MHz)	(dBµV)	(dBµV)	(dBµV)	(dB)	(kHz)		(dB)
0.150	52.89		66.00	13.11	9	N	19.4
0.158		25.10	55.57	30.47	9	N	19.6
0.282	26.55		60.76	34.20	9	N	19.5
0.720		19.83	46.00	26.17	9	N	19.7
0.720	25.51		56.00	30.49	9	N	19.7
0.860		17.51	46.00	28.49	9	N	19.7
0.860	24.92		56.00	31.08	9	N	19.7
1.800		14.57	46.00	31.43	9	N	19.6
4.250	16.49		56.00	39.51	9	N	19.7
4.380		14.90	46.00	31.10	9	N	19.7
14.620	26.41		60.00	33.59	9	N	19.9
14.630		22.04	50.00	27.96	9	N	19.9

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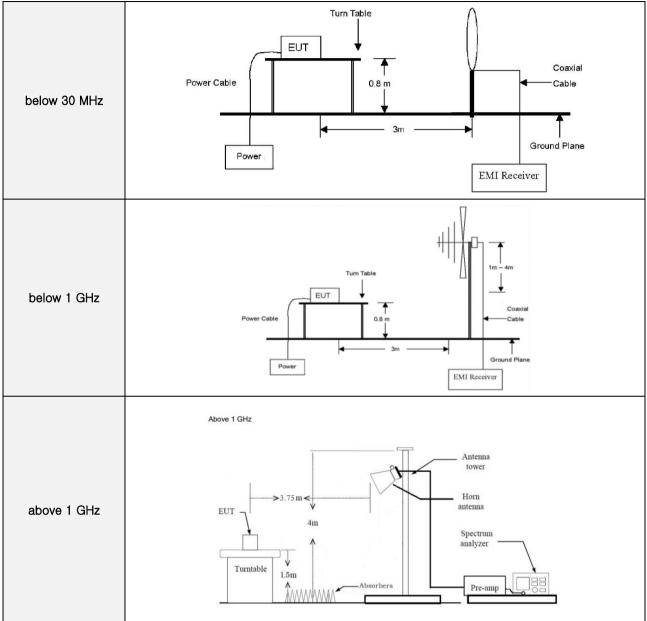
APPENDIX I

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	0.34 dB
Conducted Spurious Emissions	0.34 dB
Radiated Spurious Emissions	5.82 dB
Conducted Emissions	2.00 dB