RF TEST REPORT

Test item	:	Wireless Audio Transceiver Module
Model No.	:	R2
Order No.	:	1110-01404
Date of receipt	:	2011-10-18
Test duration	:	2011-12-05 ~ 2011-12-16
Date of issue	:	2011-12-21
Use of report	:	FCC Original Grant

Applicant : LG Electronics USA.
1000 Sylvan Avenue Englewood Cliffs, New Jersey, United States

Test laboratory : Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Kyunggi-Do, 449-080, Korea

Test specification	:	FCC Part 15.247 Subpart C
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:	Witnessed by:	Reviewed by:
Engineer S.K.Ryu	N/A	Manager W.J. Lee

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1. Equipment information

1.1 Equipment description

FCC Equipment Class	Digital Transmission System (DTS)
Equipment type	Wireless Audio Transceiver Module
Equipment model name	R2
Equipment add model name	N/A
Equipment serial no.	Identical prototype
Frequency band	2.4GHz Band: 2412 ~ 2464 MHz 5GHz Band: 5736~5814 MHz
Channel number	2.4GHz Band: 3 channels 5GHz Band: 3 channels
Modulation type	QPSK(DSSS)
Antenna type	PIFA Antenna ▪ 2.4GHz Band Max. peak gain Chain A : 2.6 dBi & Chain B : 0.8 dBi ▪ 5GHz Band Max. peak gain Chain A : 3.1 dBi & Chain B : 4.5 dBi
Power Supply	DC 3.3 V

1.2 Ancillary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2. Information about test items

2.1 Test case & Frequency Information

Test case	Band	Channel No.	Frequency [MHz]
Test case 1	2.4GHz	1	2412
		2	2438
		3	2464
Test case 2	5GHz	1	5736
		2	5762
		3	5814

All the testing items are performed at maximum power and each antenna.

2.2 Supported antenna configuration

Band	Single Transmitting and Receiving		Multiple Transmitting
	Chain A	Chain B	
2.4GHz	Yes	Yes	No
5GHz	Yes	Yes	No

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
Notebook	X51RL	85N0AS318314227	ASUSTeK Computer Inc.	-
Mouse	M-B0001	LZ019HR017B	Logitech Inc.	-

2.4 Tested environment

Temperature	:	20 ~ 25 °C
Relative humidity content	:	35 ~ 45 % R.H.
Details of power supply	:	DC 3.3 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Test Items (TX)				
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	**C**
15.247(b)	Transmitter Output Power	< 1Watt		**C**
15.247(c)	Out of Band Emissions / Band Edge	20dBc in any 100kHz BW		**C**
15.247(d)	Transmitter Power Spectral Density	< 8dBm / 3kHz		**C**
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	<FCC 15.209 Limits	Radiated	**C** Note.2
15.207	AC Conducted Emissions	<FCC 15.207 Limits	AC Line Conducted	**C**
15.203	Antenna Requirements	FCC 15.203	-	**C**

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: This test item was performed in each axis and the worst case data were reported.

The sample was tested according to the following specification:
ANSI C-63.4-2003

3.2 Transmitter requirements

3.2.1 6 dB Bandwidth

- Procedure:

The bandwidth at 6 dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal at the highest, middle and the lowest available channels.
After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level.
The marker-delta reading at this point is the 6 dB bandwidth of the emission.

- Measurement Data: Comply

Test Case	Channel	Frequency [MHz]	Test Result [MHz]	
			Chain A	Chain B
1	1	2412	***9.375***	9.097
	2	2438	***9.646***	7.737
	3	2464	***9.715***	7.939
2	1	5736	***9.789***	9.624
	2	5762	***10.191***	8.242
	3	5814	8.713	***9.749***

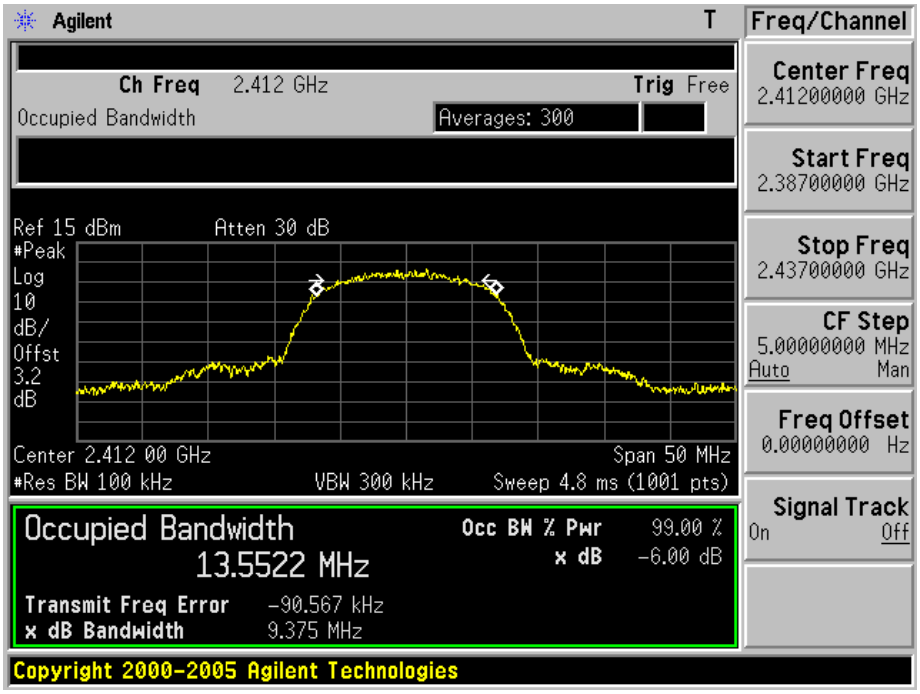
Note 1: The worst case plots in both chains are attached on next page.

- **Minimum Standard:**

The minimum 6 dB bandwidth shall be at least 500 kHz

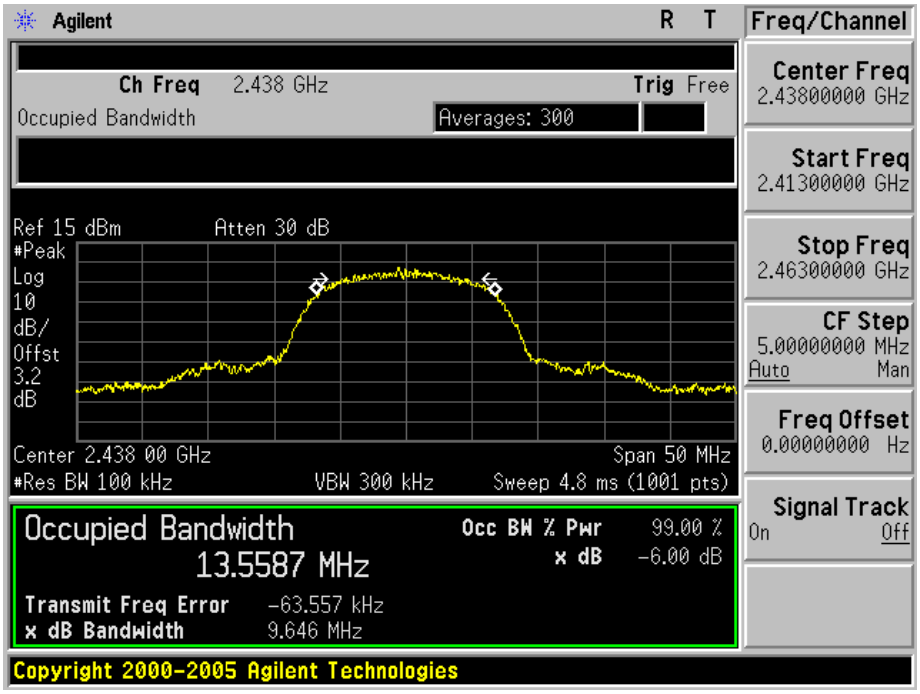
6 dB Bandwidth

Test Case 1 & Ch.1 & Chain A



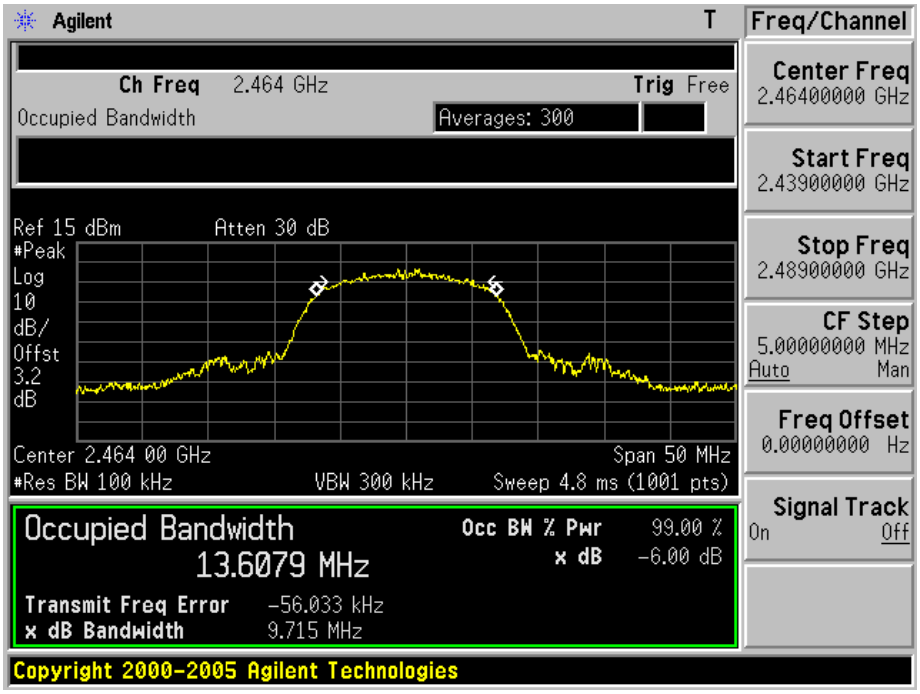
6 dB Bandwidth

Test Case 1 & Ch.2 & Chain A

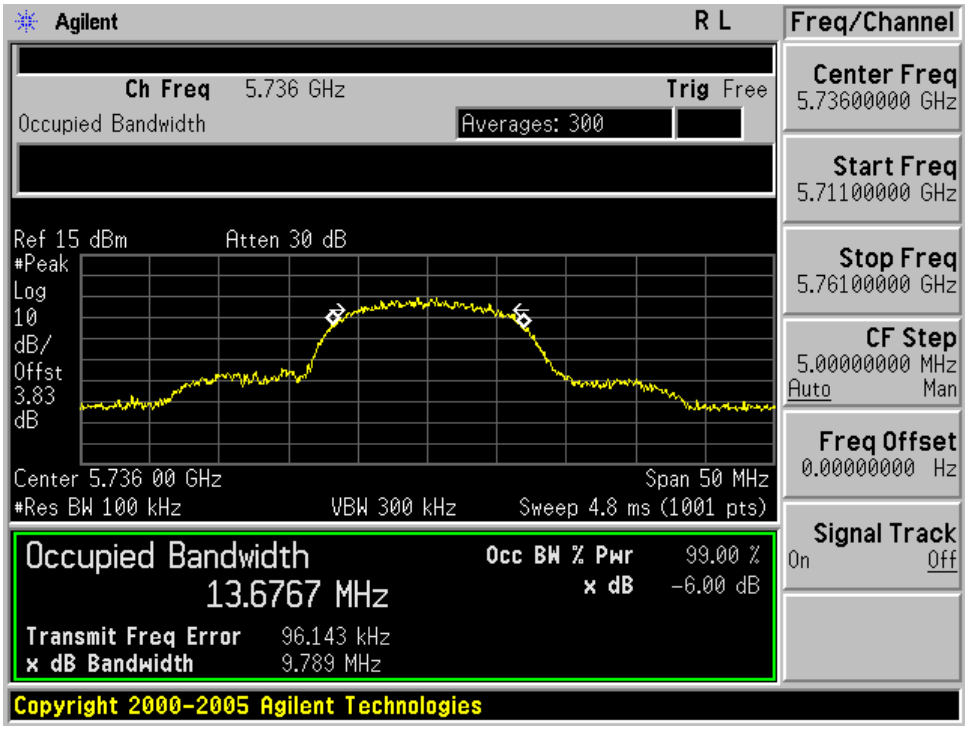


6 dB Bandwidth

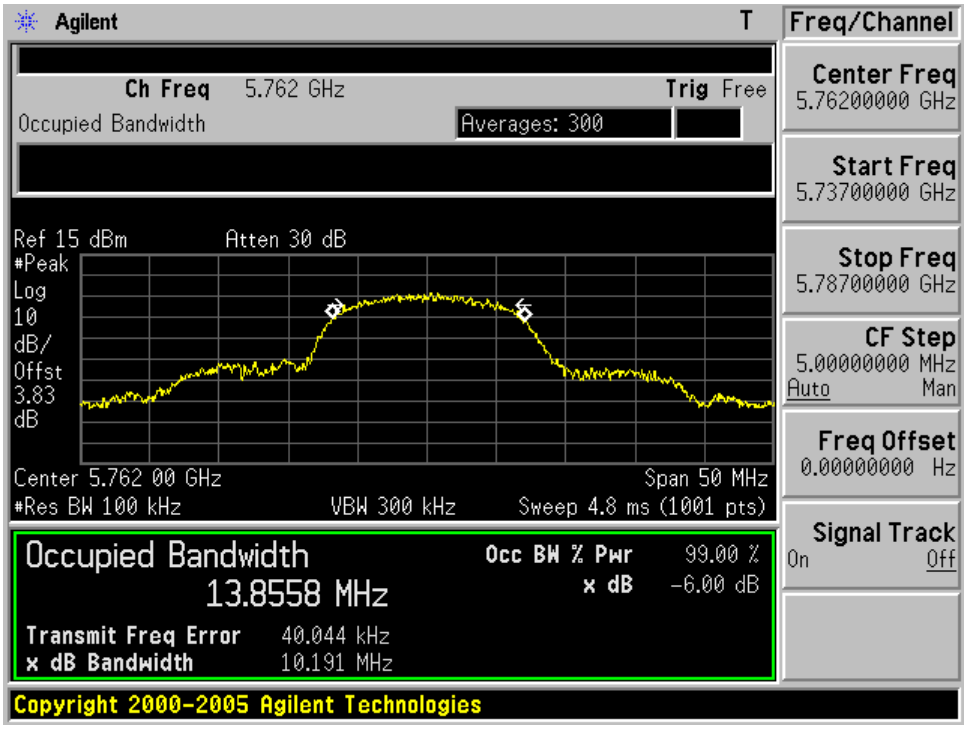
Test Case 1 & Ch.3 & Chain A



6 dB Bandwidth Test Case 2 & Ch.1 & Chain A

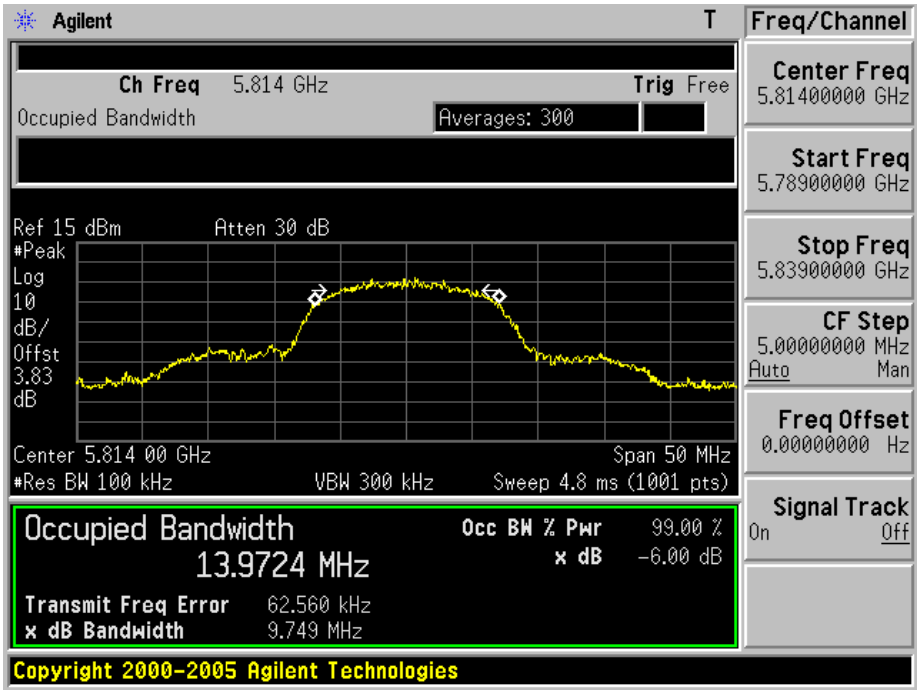


6 dB Bandwidth Test Case 2 & Ch.2 & Chain A



6 dB Bandwidth

Test Case 2 & Ch.3 & Chain B



3.2.2 Peak Output Power

- Test Procedure:

The peak output power was measured RF power sensor. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.(Power Output Option 1)

- **Measurement Data:** Comply

Test Case	Channel	Frequency [MHz]	Test Result			
			Chain A		Chain B	
			[dBm]	[W]	[dBm]	[W]
1	1	2412	***15.89***	0.039	15.28	0.034
	2	2438	***14.63***	0.029	14.23	0.026
	3	2464	***14.56***	0.029	14.38	0.027
2	1	5736	***13.98***	0.025	13.68	0.023
	2	5762	***15.33***	0.034	14.87	0.031
	3	5814	***15.90***	0.039	15.22	0.033

Minimum Standard:	< 1W

3.2.3 Out of Band Emissions / Band Edge

- Procedure:

Set RBW = 100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic for 2.4G Band or 40GHz for 5GHz Band.. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB.

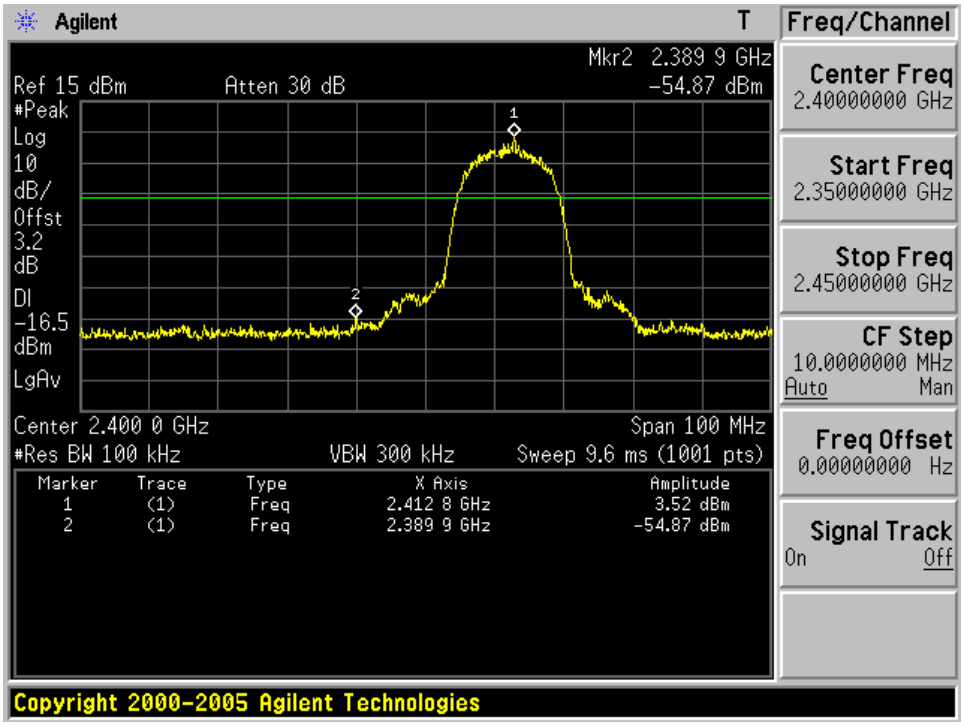
- Measurement Data: Comply

Note 1: The worst case plots in both chains are attached on next page.

Minimum Standard:	Power Output Option 1 > 20 dBc, Power Output Option 2, 3 > 30 dBc,

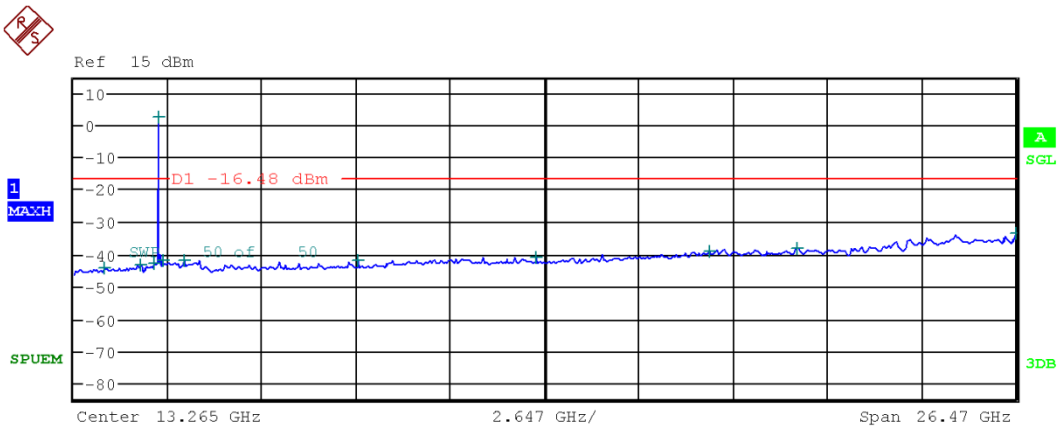
Low Band-edge at 20 dB blow

Test Case 1 & Ch.1 & Chain A



Conducted Spurious Emissions

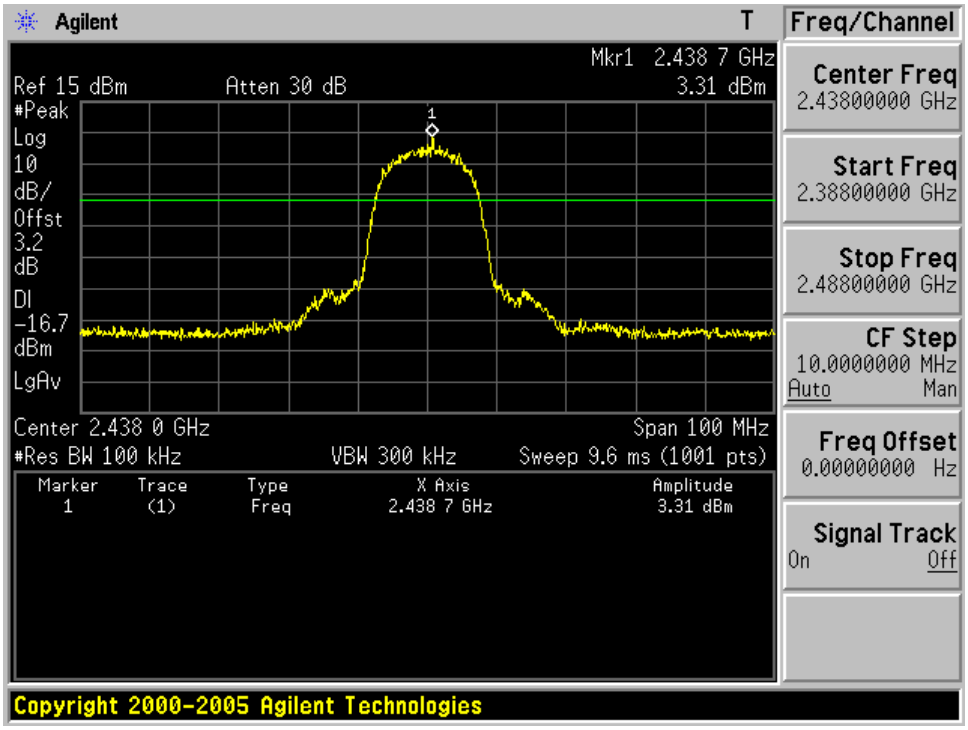
Test Case 1 & Ch.1 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	876.228000 M	-44.44	-200.00
1.000 G	2.000 G	100.00 k	1.910600 G	-43.44	-200.00
2.000 G	2.400 G	100.00 k	2.259600 G	-42.81	-200.00
2.400 G	2.483 G	100.00 k	2.412692 G	2.45	-200.00
2.483 G	3.000 G	100.00 k	2.520286 G	-42.13	-200.00
3.000 G	6.000 G	100.00 k	3.106500 G	-41.96	-200.00
6.000 G	10.000 G	100.00 k	7.988500 G	-41.92	-200.00
10.000 G	14.000 G	100.00 k	13.014500 G	-41.24	-200.00
14.000 G	18.000 G	100.00 k	17.894000 G	-39.43	-200.00
18.000 G	22.000 G	100.00 k	20.338500 G	-38.07	-200.00
22.000 G	26.500 G	100.00 k	26.479750 G	-33.66	-200.00

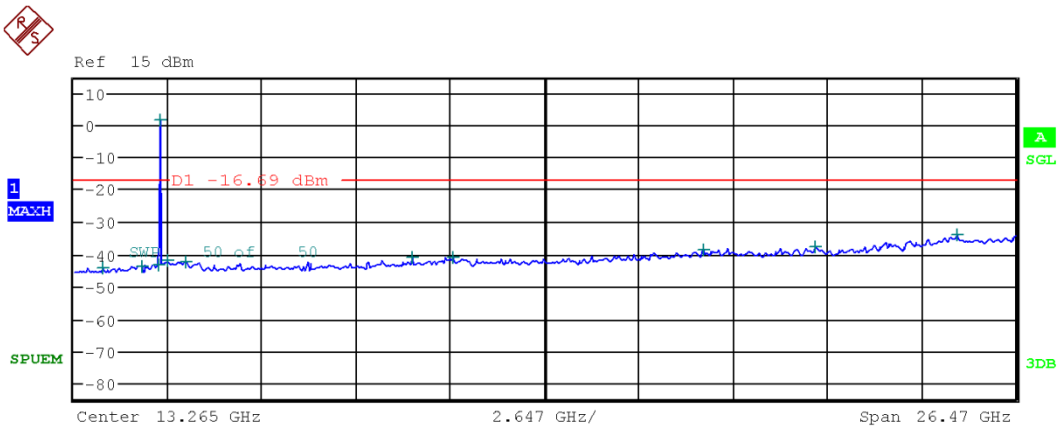
Reference for limit

Test Case 1 & Ch.2 & Chain A



Conducted Spurious Emissions

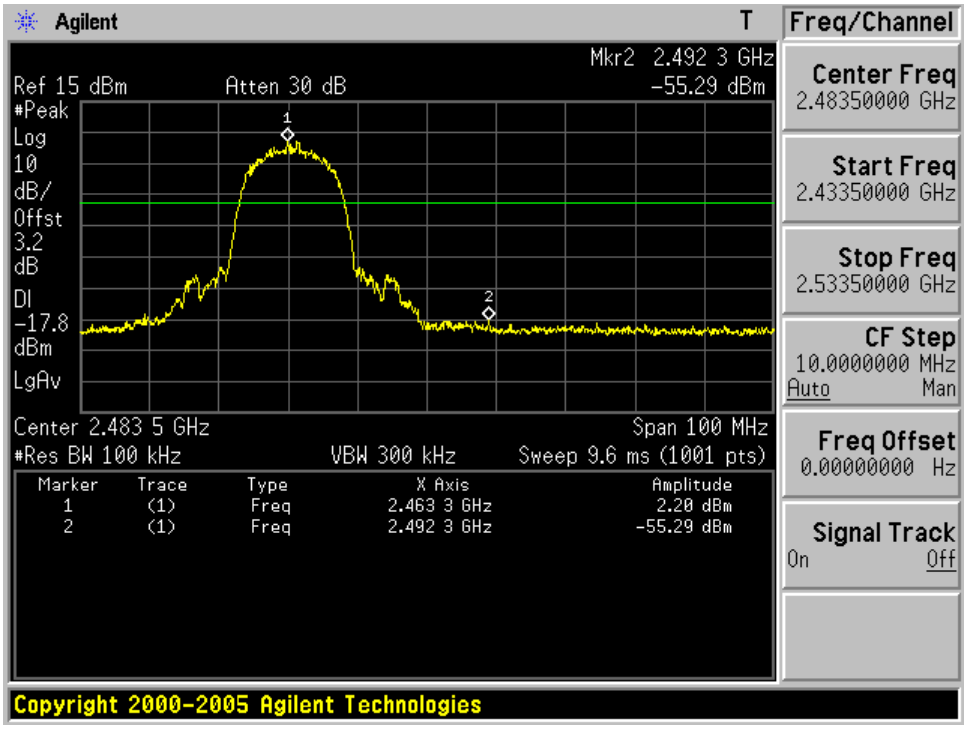
Test Case 1 & Ch.2 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	824.624000 M	-44.38	-200.00
1.000 G	2.000 G	100.00 k	1.932200 G	-43.79	-200.00
2.000 G	2.400 G	100.00 k	2.394889 G	-43.38	-200.00
2.400 G	2.483 G	100.00 k	2.438794 G	1.42	-200.00
2.483 G	3.000 G	100.00 k	2.656528 G	-41.99	-200.00
3.000 G	6.000 G	100.00 k	3.166875 G	-42.48	-200.00
6.000 G	10.000 G	100.00 k	9.521000 G	-41.29	-200.00
10.000 G	14.000 G	100.00 k	10.656500 G	-41.28	-200.00
14.000 G	18.000 G	100.00 k	17.725000 G	-38.56	-200.00
18.000 G	22.000 G	100.00 k	20.840000 G	-38.03	-200.00
22.000 G	26.500 G	100.00 k	24.843438 G	-33.98	-200.00

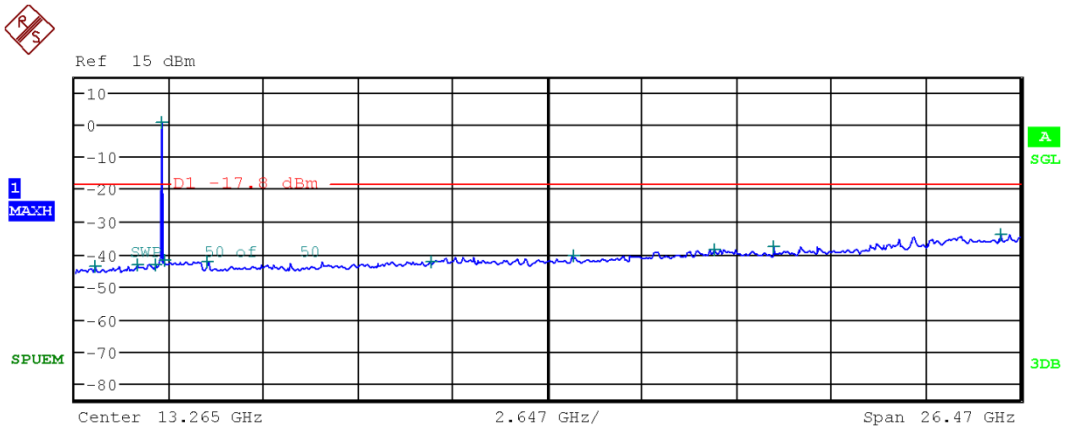
High Band-edge at 20 dB blow

Test Case 1 & Ch.3 & Chain A



Conducted Spurious Emissions

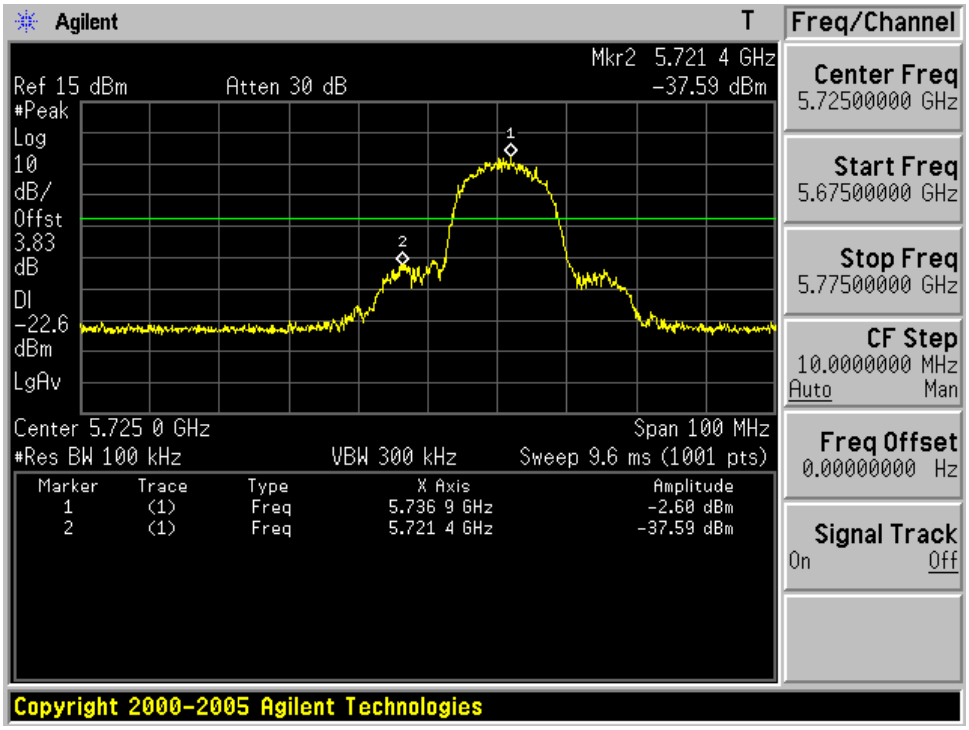
Test Case 1 & Ch.3 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	588.332000 M	-44.14	-200.00
1.000 G	2.000 G	100.00 k	1.761000 G	-43.68	-200.00
2.000 G	2.400 G	100.00 k	2.261600 G	-43.35	-200.00
2.400 G	2.483 G	100.00 k	2.464930 G	0.87	-200.00
2.483 G	3.000 G	100.00 k	2.518622 G	-41.85	-200.00
3.000 G	6.000 G	100.00 k	3.741375 G	-42.34	-200.00
6.000 G	10.000 G	100.00 k	9.985000 G	-42.32	-200.00
10.000 G	14.000 G	100.00 k	13.981500 G	-40.86	-200.00
14.000 G	18.000 G	100.00 k	17.939000 G	-38.70	-200.00
18.000 G	22.000 G	100.00 k	19.567500 G	-37.81	-200.00
22.000 G	26.500 G	100.00 k	25.943125 G	-33.94	-200.00

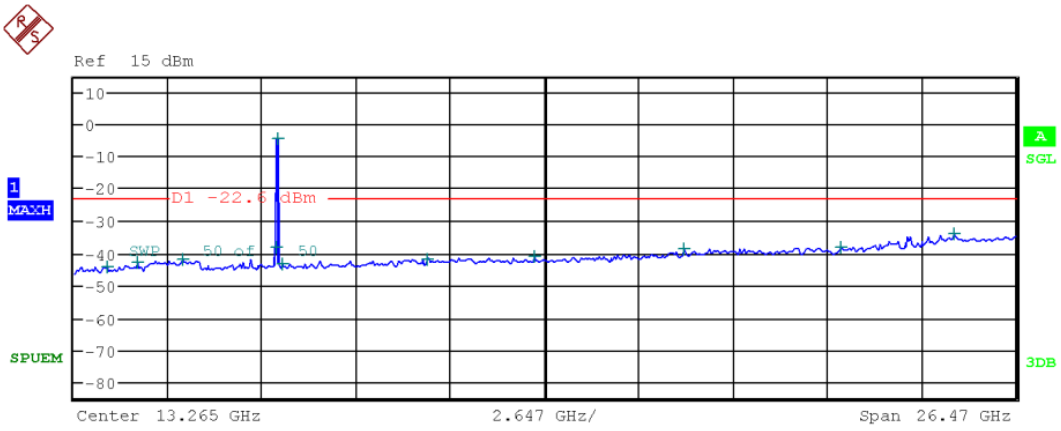
Low Band-edge at 20 dB blow

Test Case 2 & Ch.1 & Chain A



Conducted Spurious Emissions

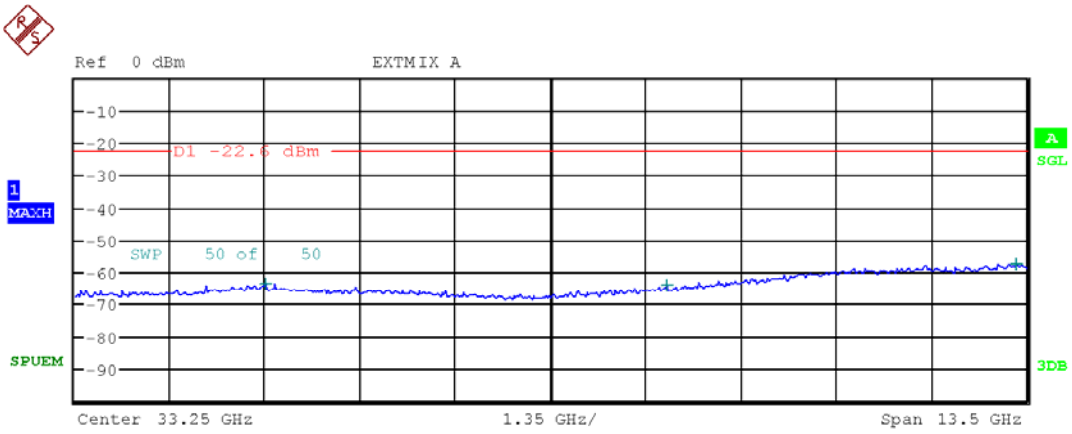
Test Case 2 & Ch.1 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	960.036000 M	-44.33	-200.00
1.000 G	2.000 G	100.00 k	1.812200 G	-43.12	-200.00
2.000 G	5.000 G	100.00 k	3.096125 G	-42.28	-200.00
5.000 G	5.725 G	100.00 k	5.722261 G	-38.18	-200.00
5.725 G	5.850 G	100.00 k	5.736600 G	-4.26	-200.00
5.850 G	6.500 G	100.00 k	5.881344 G	-43.58	-200.00
6.500 G	10.000 G	100.00 k	9.946625 G	-41.84	-200.00
10.000 G	14.000 G	100.00 k	12.974500 G	-41.05	-200.00
14.000 G	18.000 G	100.00 k	17.176500 G	-38.64	-200.00
18.000 G	22.000 G	100.00 k	21.573000 G	-38.10	-200.00
22.000 G	26.500 G	100.00 k	24.763000 G	-34.28	-200.00

Conducted Spurious Emissions

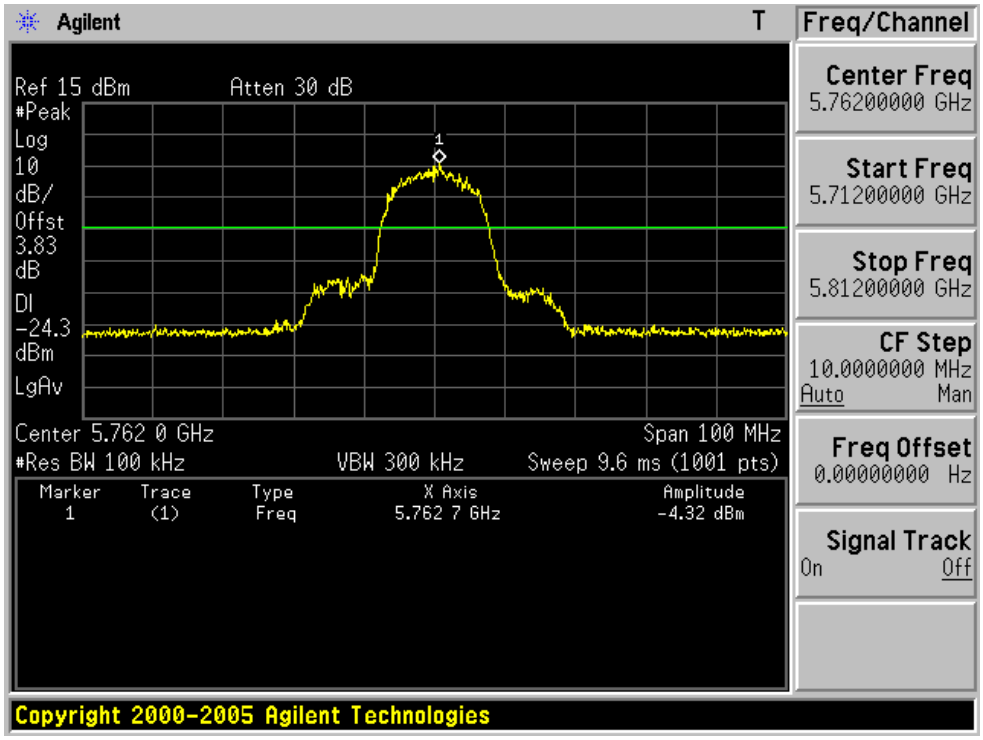
Test Case 2 & Ch.1 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
26.500 G	30.000 G	100.00 k	29.197800 G	-63.58	-200.00
30.000 G	35.000 G	100.00 k	34.889000 G	-64.23	-200.00
35.000 G	40.000 G	100.00 k	39.850000 G	-57.43	-200.00

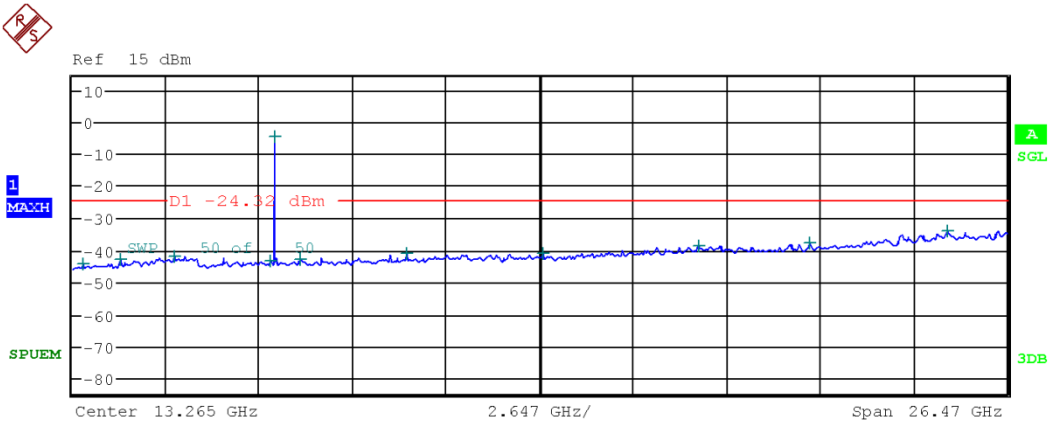
Reference for limit

Test Case 2 & Ch.2 & Chain A



Conducted Spurious Emissions

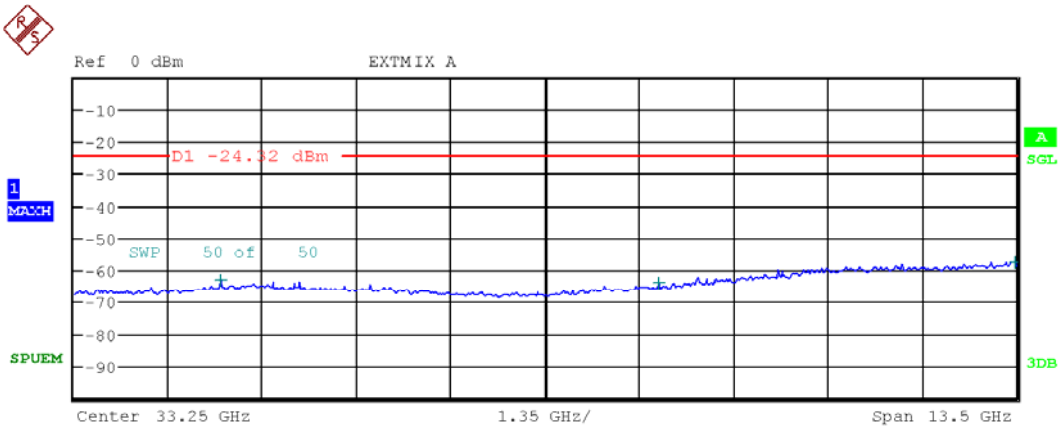
Test Case 2 & Ch.2 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	319.254000 M	-44.50	-200.00
1.000 G	2.000 G	100.00 k	1.402800 G	-43.06	-200.00
2.000 G	5.000 G	100.00 k	2.922875 G	-42.08	-200.00
5.000 G	5.725 G	100.00 k	5.631556 G	-43.35	-200.00
5.725 G	5.850 G	100.00 k	5.759325 G	-4.68	-200.00
5.850 G	6.500 G	100.00 k	6.484761 G	-43.20	-200.00
6.500 G	10.000 G	100.00 k	9.470625 G	-41.04	-200.00
10.000 G	14.000 G	100.00 k	13.370500 G	-41.17	-200.00
14.000 G	18.000 G	100.00 k	17.753500 G	-38.80	-200.00
18.000 G	22.000 G	100.00 k	20.887500 G	-37.82	-200.00
22.000 G	26.500 G	100.00 k	24.787188 G	-34.18	-200.00

Conducted Spurious Emissions

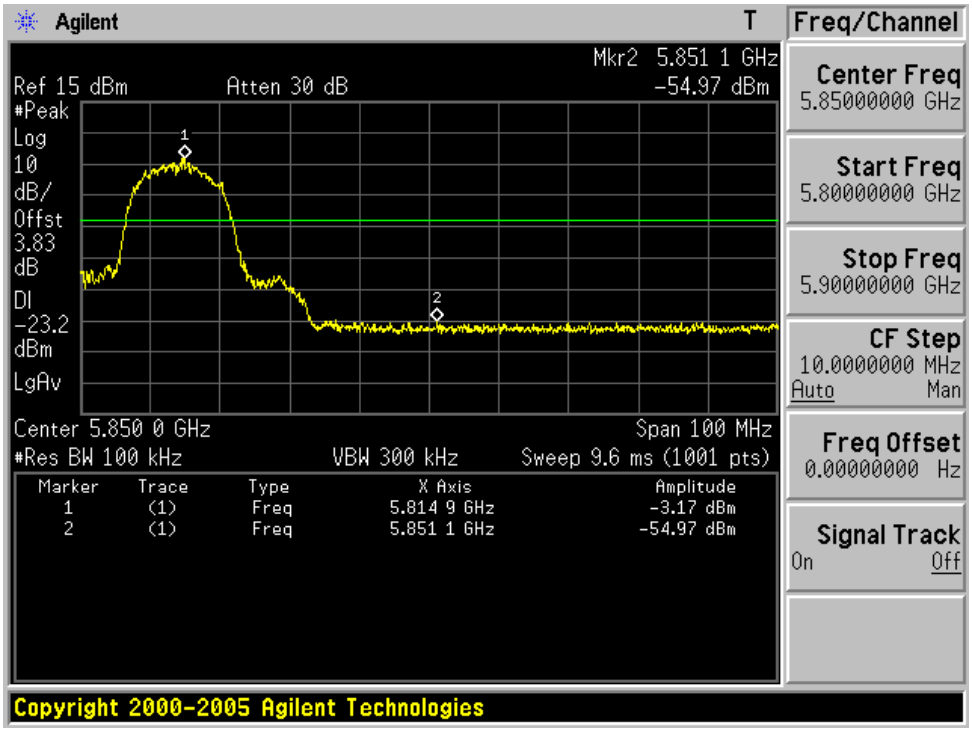
Test Case 2 & Ch.2 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
26.500 G	30.000 G	100.00 k	28.595100 G	-63.33	-200.00
30.000 G	35.000 G	100.00 k	34.869000 G	-64.22	-200.00
35.000 G	40.000 G	100.00 k	39.975000 G	-57.41	-200.00

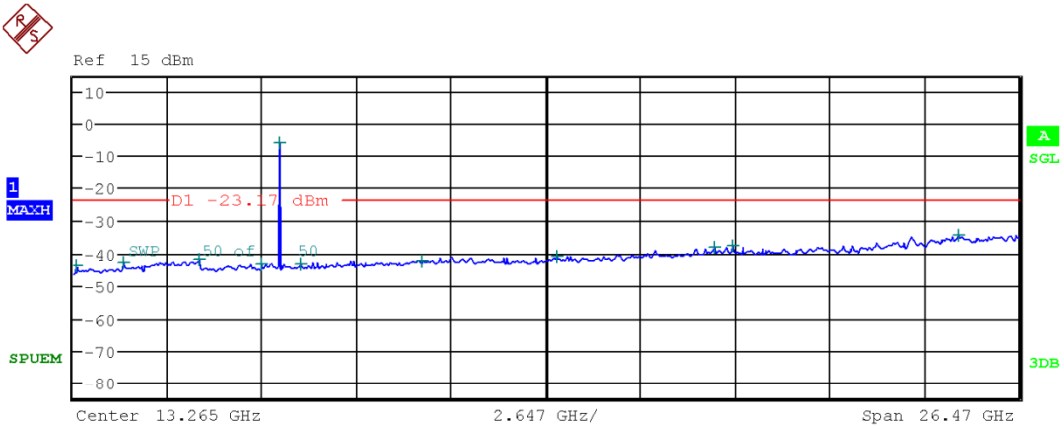
High Band-edge at 20 dB blow

Test Case 2 & Ch.3 & Chain A



Conducted Spurious Emissions

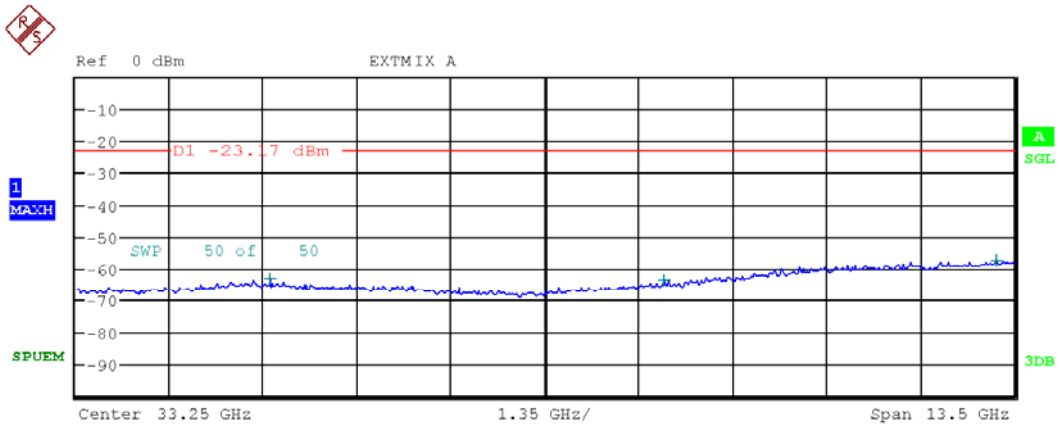
Test Case 2 & Ch.3 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	99.646000 M	-44.15	-200.00
1.000 G	2.000 G	100.00 k	1.449800 G	-42.90	-200.00
2.000 G	5.000 G	100.00 k	3.556250 G	-42.16	-200.00
5.000 G	5.725 G	100.00 k	5.285408 G	-43.46	-200.00
5.725 G	5.850 G	100.00 k	5.814825 G	-5.74	-200.00
5.850 G	6.500 G	100.00 k	6.403872 G	-43.40	-200.00
6.500 G	10.000 G	100.00 k	9.807500 G	-42.45	-200.00
10.000 G	14.000 G	100.00 k	13.550000 G	-40.92	-200.00
14.000 G	18.000 G	100.00 k	17.967000 G	-38.35	-200.00
18.000 G	22.000 G	100.00 k	18.499500 G	-37.97	-200.00
22.000 G	26.500 G	100.00 k	24.823750 G	-34.63	-200.00

Conducted Spurious Emissions

Test Case 2 & Ch.3 & Chain A



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
26.500 G	30.000 G	100.00 k	29.291600 G	-63.04	-200.00
30.000 G	35.000 G	100.00 k	34.962000 G	-63.57	-200.00
35.000 G	40.000 G	100.00 k	39.743000 G	-57.69	-200.00

3.2.4 Out of band Emission – Radiated

- Procedure:

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:
Frequency Range = 30 MHz ~ 10th harmonic for 2.4G or 40 GHz for 5 G band
RBW and VBW = 1. Frequency range: 30MHz ~ 1GHz
RBW = 120KHz / VBW = ≥ RBW
2. Frequency range: 1GHz ~ 10th harmonics or 40 GHz
Peak mode: RBW = 1MHz / VBW = ≥ RBW
Average mode: RBW = 1MHz / VBW = 10Hz
Detector function = Peak Sweep = auto
Trace = max hold

- Measurement Data: Comply

Note 1: This test item was performed in each axis and the worst case data were reported

- Minimum Standard:

▪ FCC Part 15.209(a) and (b)

Frequency (MHz)	Limit (uV/m) @ 3m
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** 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, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ FCC Part 15.205 (a): Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	3600 ~ 4400	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	4.5 ~ 5.15	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	5.35 ~ 5.46	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	7.25 ~ 7.75	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	8.025 ~ 8.5	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.0 ~ 9.2	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	9.3 ~ 9.5	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	10.6 ~ 12.7	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900	13.25 ~ 13.4	
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240			
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

▪ FCC Part 15.205(b): 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.

30MHz ~ 25GHz Radiated Spurious Emissions & Test Case 1 & Chain A

▪ Ch.1

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.725	H	Y axis	QP	51.80	-15.00	36.80	40.00	3.20
95.987	H	X axis	QP	48.10	-11.70	36.40	43.50	7.10
2389.160	V	Z axis	PK	53.90	-2.67	51.23	74.00	22.77
2390.000	V	Z axis	AV	41.32	-2.67	38.65	54.00	15.35
4824.400	V	Z axis	PK	46.12	6.65	52.77	74.00	21.23
4823.920	V	Z axis	AV	33.74	6.65	40.39	54.00	13.61

▪ Ch.2

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.736	H	Y axis	QP	51.60	-15.00	36.60	40.00	3.40
95.958	H	X axis	QP	48.06	-11.70	36.36	43.50	7.14
4875.780	V	Z axis	PK	45.64	6.78	52.42	74.00	21.58
4875.870	V	Z axis	AV	32.72	6.78	39.50	54.00	14.50

▪ Ch.3

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.724	H	Y axis	QP	52.06	-15.00	37.06	40.00	2.94
95.992	H	X axis	QP	48.33	-11.70	36.63	43.50	6.87
2483.640	V	Z axis	PK	60.07	-2.39	57.68	74.00	16.32
2483.610	V	Z axis	AV	42.26	-2.39	39.87	54.00	14.13
4928.350	V	Z axis	PK	45.80	7.09	52.89	74.00	21.11
4928.400	V	Z axis	AV	33.31	7.09	40.40	54.00	13.60

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

30MHz ~ 25GHz Radiated Spurious Emissions & Test Case 1 & Chain B

▪ Ch.1

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.686	H	Y axis	QP	51.79	-15.00	36.79	40.00	3.21
96.013	H	X axis	QP	47.74	-11.70	36.04	43.50	7.46
2437.360	H	Z axis	PK	54.16	-2.67	51.49	74.00	22.51
2372.480	H	Z axis	AV	41.31	-2.67	38.64	54.00	15.36
4824.460	V	Z axis	PK	45.74	6.65	52.39	74.00	21.61
4823.540	V	Z axis	AV	33.57	6.65	40.22	54.00	13.78

▪ Ch.2

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.705	H	Y axis	QP	51.21	-15.00	36.21	40.00	3.79
96.021	H	X axis	QP	48.15	-11.70	36.45	43.50	7.05
4877.000	V	Z axis	PK	45.15	6.78	51.93	74.00	22.07
4875.640	V	Z axis	AV	32.45	6.78	39.23	54.00	14.77

▪ Ch.3

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.731	H	Y axis	QP	51.76	-15.00	36.76	40.00	3.24
96.008	H	X axis	QP	48.37	-11.70	36.67	43.50	6.83
2483.560	H	Z axis	PK	59.87	-2.39	57.48	74.00	16.52
2483.530	H	Z axis	AV	41.68	-2.39	39.29	54.00	14.71
4928.230	V	Z axis	PK	45.72	7.09	52.81	74.00	21.19
4928.340	V	Z axis	AV	33.02	7.09	40.11	54.00	13.89

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

30MHz ~ 25GHz Radiated Spurious Emissions & Test Case 2 & Chain A

▪ Ch.1

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.732	H	Y axis	QP	51.04	-15.00	36.04	40.00	3.96
95.957	H	X axis	QP	48.38	-11.70	36.68	43.50	6.82
7647.000	H	Z axis	PK	45.99	11.66	57.65	74.00	16.35
7647.920	H	Z axis	AV	33.13	11.66	44.79	54.00	9.21

▪ Ch.2

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.696	H	Y axis	QP	52.10	-15.00	37.10	40.00	2.90
95.987	H	X axis	QP	48.07	-11.70	36.37	43.50	7.13
7683.200	H	Z axis	PK	45.18	11.72	56.90	74.00	17.10
7682.400	H	Z axis	AV	33.22	11.72	44.94	54.00	9.06

▪ Ch.3

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.745	H	Y axis	QP	51.12	-15.00	36.12	40.00	3.88
95.955	H	X axis	QP	47.76	-11.70	36.06	43.50	7.44
7751.840	H	Z axis	PK	45.92	11.94	57.86	74.00	16.14
7751.780	H	Z axis	AV	32.73	11.94	44.67	54.00	9.33

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

30MHz ~ 25GHz Radiated Spurious Emissions & Test Case 2 & Chain B

▪ Ch.1

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.776	H	Y axis	QP	50.90	-15.00	35.90	40.00	4.10
95.966	H	X axis	QP	46.98	-11.70	35.28	43.50	8.22
7647.010	H	Z axis	PK	45.99	11.66	57.65	74.00	16.35
7647.920	H	Z axis	AV	33.13	11.66	44.79	54.00	9.21

▪ Ch.2

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.751	H	Y axis	QP	51.32	-15.00	36.32	40.00	3.68
95.961	H	X axis	QP	47.70	-11.70	36.00	43.50	7.50
7683.200	H	Z axis	PK	45.18	11.72	56.90	74.00	17.10
7682.400	H	Z axis	AV	33.22	11.72	44.94	54.00	9.06

▪ Ch.3

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
73.750	H	Y axis	QP	51.95	-15.00	36.95	40.00	3.05
96.005	H	X axis	QP	47.14	-11.70	35.44	43.50	8.06
7751.840	H	Z axis	PK	45.92	11.94	57.86	74.00	16.14
7751.780	H	Z axis	AV	32.73	11.94	44.67	54.00	9.33

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

3.2.5 Transmitter Power Spectral Density

- Procedure:

The transmitter output is connected to a spectrum analyzer. Locate and zoom in on emission peak within the pass band. The maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > RBW, sweep time= (Span/3 kHz). The peak level measured must be no greater than + 8 dBm.

The spectrum analyzer is set to:
Center frequency = the highest, middle and the lowest Frequencies
Span = 900 kHz
RBW = 3 kHz
VBW = ≥ RBW
Trace = max hold
Detector function = peak
Sweep = 300 S

- Measurement Data: Comply

▪ **Single transmitting data**

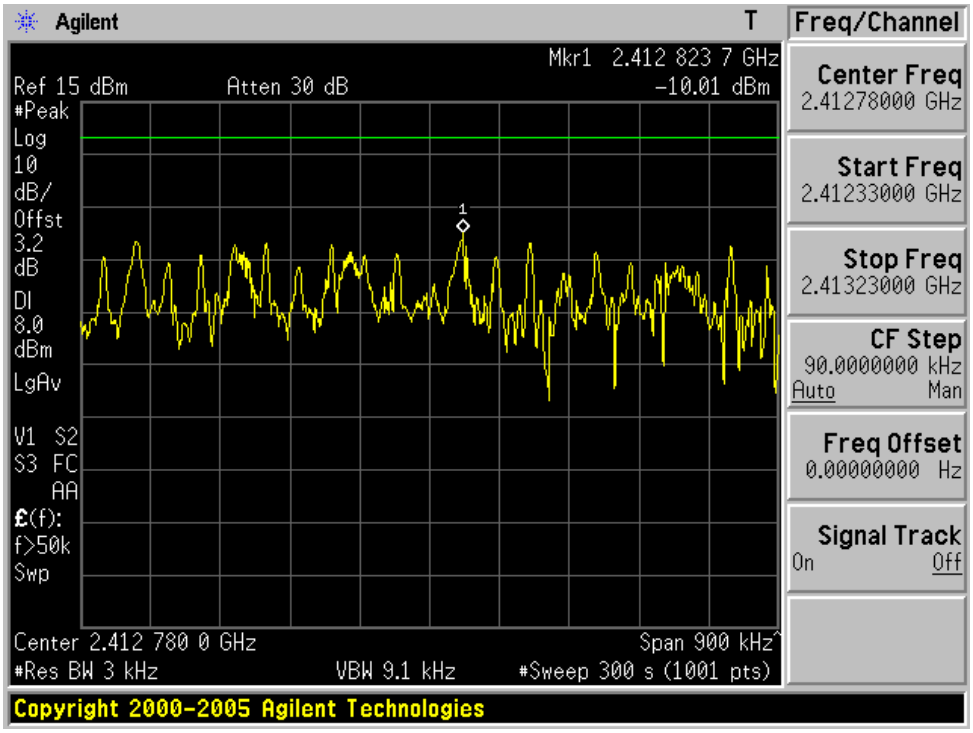
Test Case	Channel	Frequency [MHz]	Test Result [dBm]	
			Chain A	Chain B
1	1	2412	***-10.01***	-10.30
	2	2438	-10.90	***-10.22***
	3	2464	***-10.54***	-10.66
2	1	5736	***-16.86***	-16.94
	2	5762	-16.45	***-15.75***
	3	5814	-15.89	***-14.96***

Note 1: The worst case plots in both chains are attached on next page.

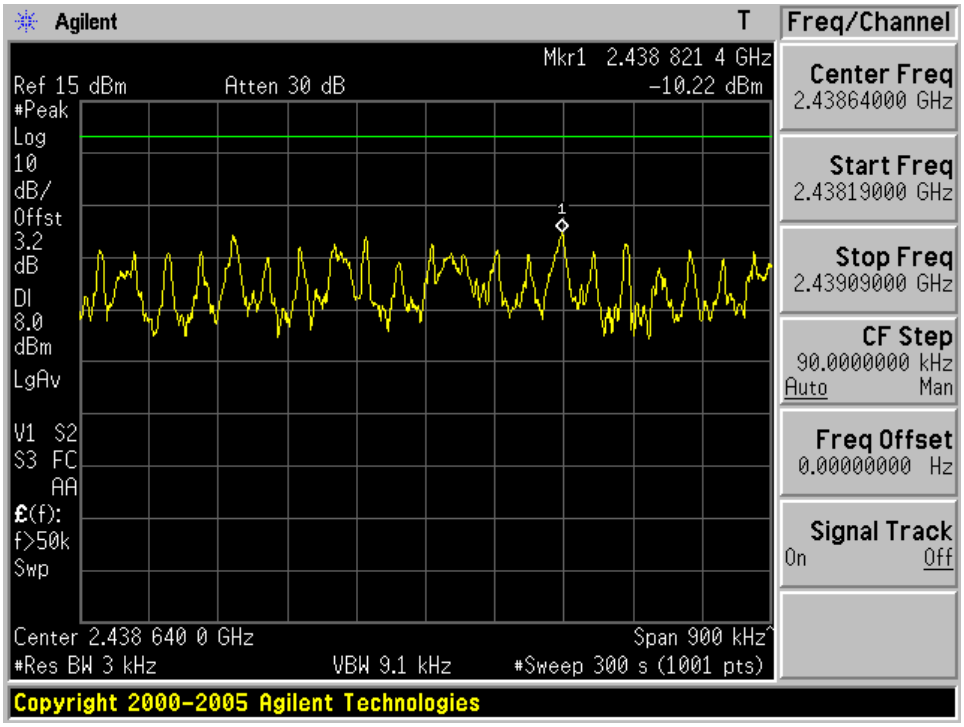
- Minimum Standard:

The transmitter power density average over 1-second interval shall not be greater than 8 dBm in any 3kHz BW.

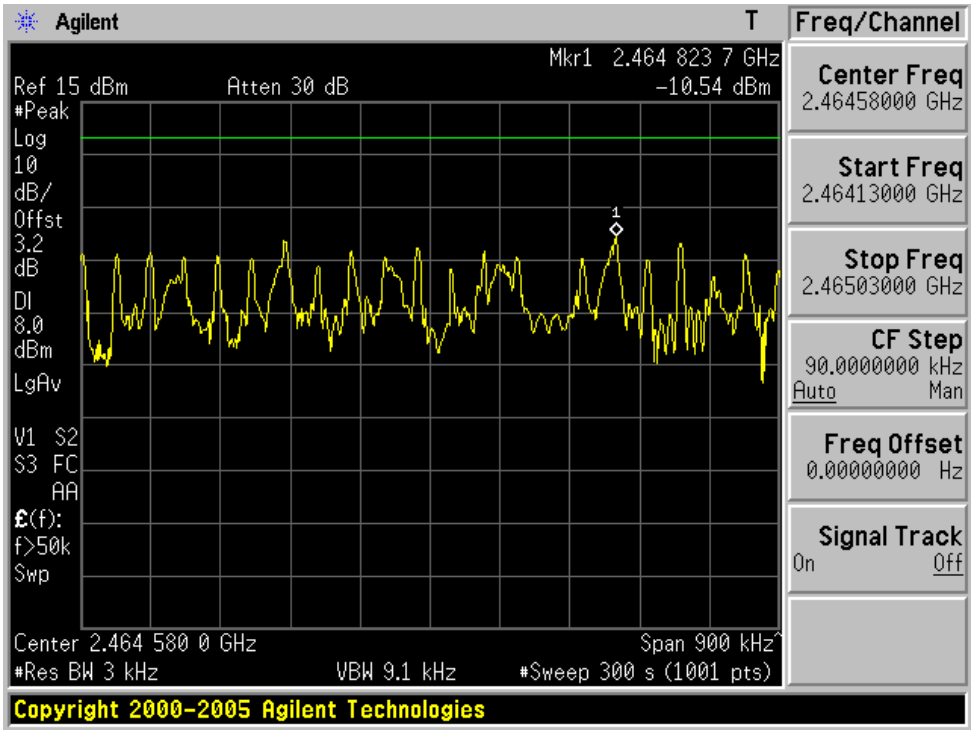
Transmitter Power Spectral Density Test Mode: Test Case 1 & Ch.1 & Chain A



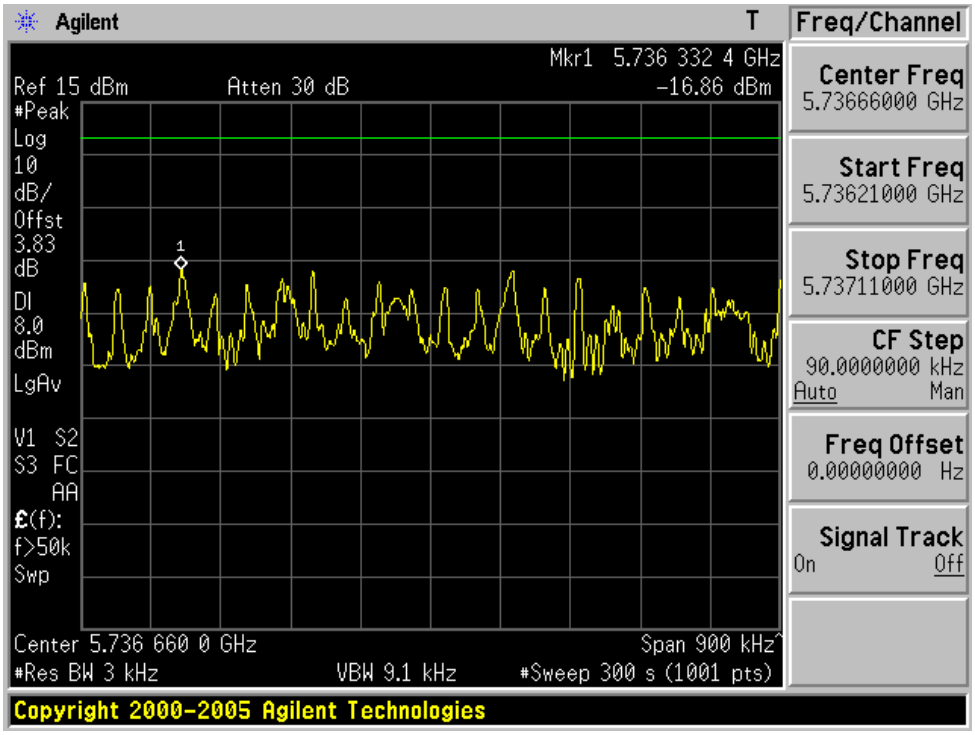
Transmitter Power Spectral Density Test Mode: Test Case 1 & Ch.2 & Chain B



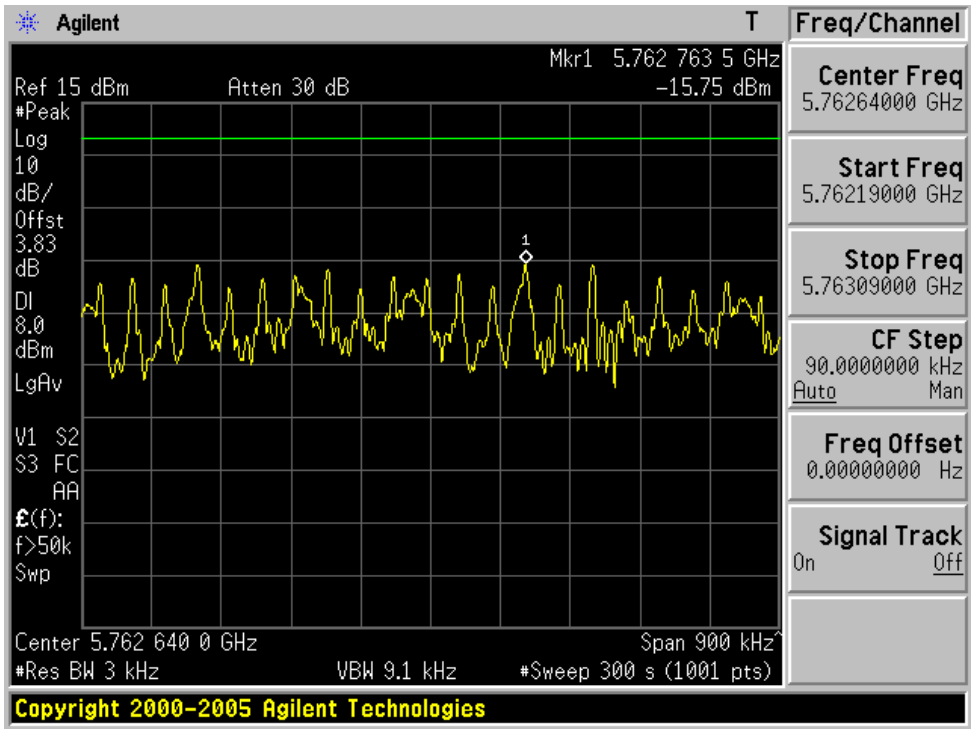
Transmitter Power Spectral Density Test Mode: Test Case 1 & Ch.3 & Chain A



Transmitter Power Spectral Density Test Mode: Test Case 2 & Ch.1 & Chain A

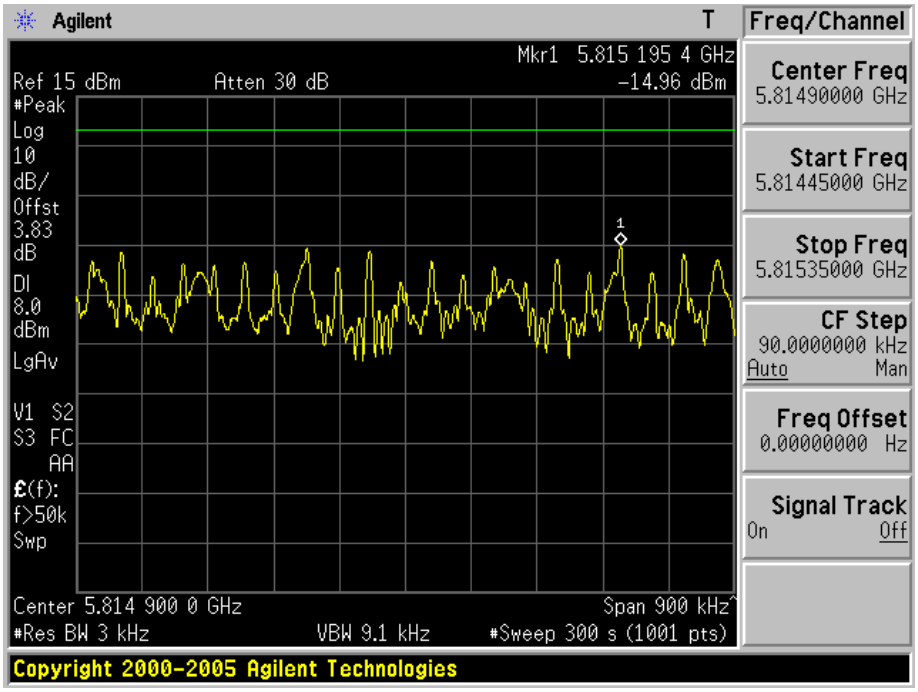


Transmitter Power Spectral Density Test Mode: Test Case 2 & Ch.2 & Chain B



Transmitter Power Spectral Density

Test Mode: Test Case 2 & Ch.3 & Chain B



3.2.6 AC Conducted Emissions

- Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. Emissions closest to the limit are measured in the quasi-peak mode (QP) and average mode (AV) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

- Measurement Data: Comply

Note 1: See next pages for actual measured spectrum plots and data.

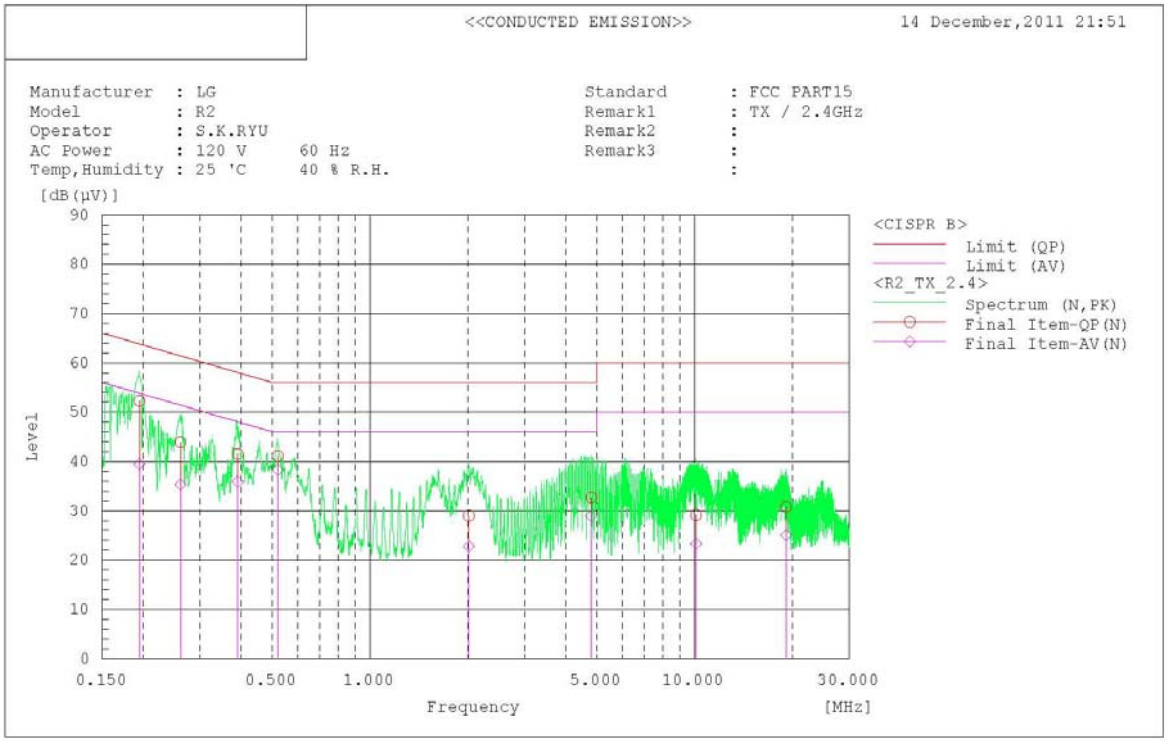
- Minimum Standard: FCC Part 15.207(a)/EN 55022

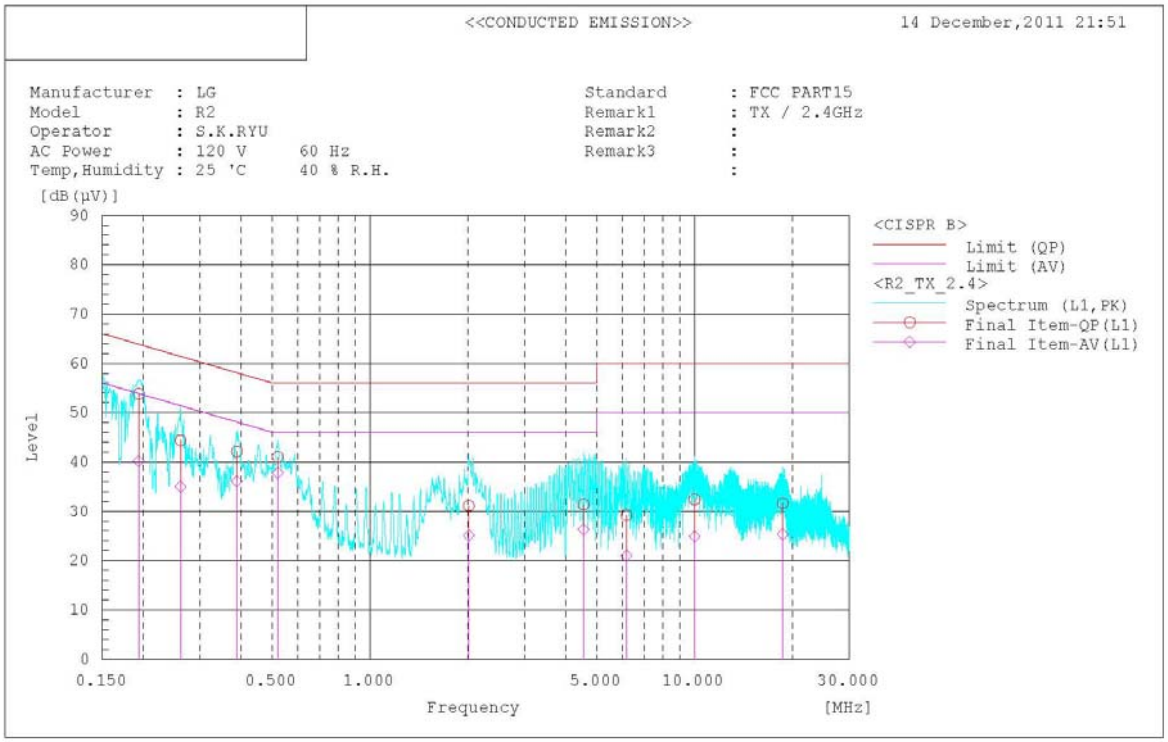
Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

AC Line Conducted Emissions (Graph)

Test Mode: Test Case 1





AC Line Conducted Emissions (Data List)

Test Mode: Test Case 1

<<CONDUCTED EMISSION>>

14 December,2011 21:51

Standard : FCC PART15
Manufacturer : LG
Model : R2
Operator : S.K.RYU
AC Power : 120 V 60 Hz
Temp,Humidity : 25 °C 40 % R.H.
Remark1 : TX / 2.4GHz
Remark2 :
Remark3 :

Final Result

--- N Phase ---

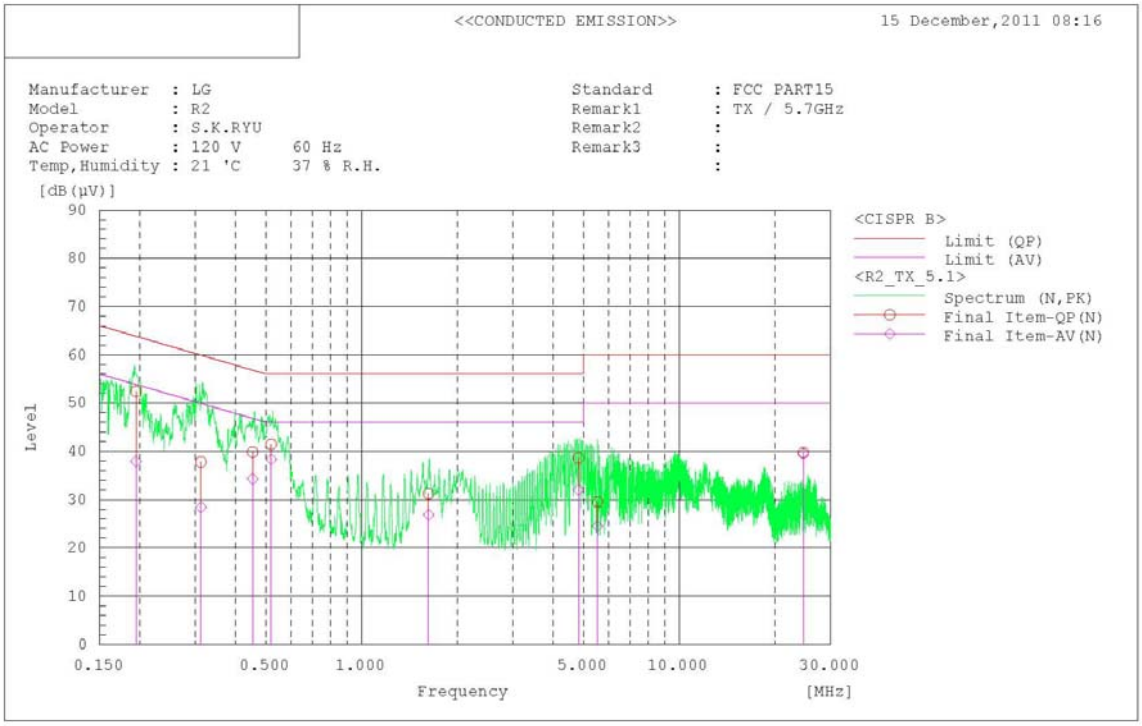
No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]	Remark
1	0.195	52.2	39.4	0.1	52.3	39.5	63.8	53.8	11.5	14.3	
2	0.261	43.8	35.2	0.1	43.9	35.3	61.4	51.4	17.5	16.1	
3	0.391	41.4	35.8	0.1	41.5	35.9	58.0	48.0	16.5	12.1	
4	0.520	41.0	38.2	0.1	41.1	38.3	56.0	46.0	14.9	7.7	
5	2.016	28.8	22.6	0.2	29.0	22.8	56.0	46.0	27.0	23.2	
6	4.806	32.4	28.7	0.3	32.7	29.0	56.0	46.0	23.3	17.0	
7	10.107	28.5	22.7	0.6	29.1	23.3	60.0	50.0	30.9	26.7	
8	19.130	29.7	24.0	1.1	30.8	25.1	60.0	50.0	29.2	24.9	

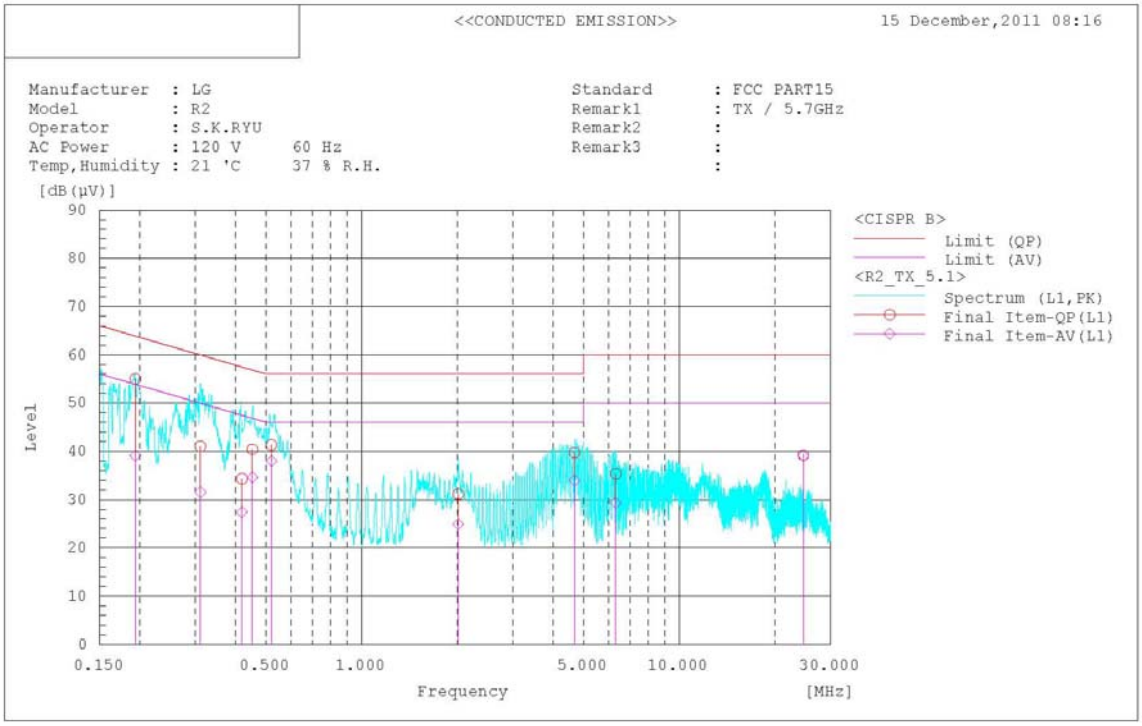
--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]	Remark
1	0.194	53.6	40.0	0.2	53.8	40.2	63.9	53.9	10.1	13.7	
2	0.261	44.2	34.8	0.2	44.4	35.0	61.4	51.4	17.0	16.4	
3	0.389	41.9	35.9	0.2	42.1	36.1	58.1	48.1	16.0	12.0	
4	0.520	40.8	37.6	0.2	41.0	37.8	56.0	46.0	15.0	8.2	
5	2.016	30.8	24.8	0.3	31.1	25.1	56.0	46.0	24.9	20.9	
6	4.548	31.0	25.9	0.4	31.4	26.3	56.0	46.0	24.6	19.7	
7	6.170	28.7	20.5	0.5	29.2	21.0	60.0	50.0	30.8	29.0	
8	9.998	31.7	24.2	0.7	32.4	24.9	60.0	50.0	27.6	25.1	
9	18.680	30.5	24.2	1.1	31.6	25.3	60.0	50.0	28.4	24.7	

AC Line Conducted Emissions (Graph)

Test Mode: Test Case 2





AC Line Conducted Emissions (Data List)

Test Mode: Test Case 2

<<CONDUCTED EMISSION>>

15 December,2011 08:16

Standard : FCC PART15
Manufacturer : LG
Model : R2
Operator : S.K.KYU
AC Power : 120 V 60 Hz
Temp,Humidity : 21 'C 37 % R.H.
Remark1 : TX / 5.7GHz
Remark2 :
Remark3 :
:

Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]	Remark
1	0.195	52.3	37.8	0.1	52.4	37.9	63.8	53.8	11.4	15.9	
2	0.312	37.7	28.3	0.1	37.8	28.4	59.9	49.9	22.1	21.5	
3	0.454	39.7	34.2	0.1	39.8	34.3	56.8	46.8	17.0	12.5	
4	0.519	41.3	38.2	0.1	41.4	38.3	56.0	46.0	14.6	7.7	
5	1.625	31.0	26.7	0.2	31.2	26.9	56.0	46.0	24.8	19.1	
6	4.816	38.3	31.7	0.3	38.6	32.0	56.0	46.0	17.4	14.0	
7	5.532	29.2	24.2	0.3	29.5	24.5	60.0	50.0	30.5	25.5	
8	24.575	38.4	38.2	1.3	39.7	39.5	60.0	50.0	20.3	10.5	

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]	Remark
1	0.194	54.8	38.9	0.2	55.0	39.1	63.9	53.9	8.9	14.8	
2	0.311	40.8	31.3	0.2	41.0	31.5	59.9	49.9	18.9	18.4	
3	0.420	34.1	27.2	0.2	34.3	27.4	57.4	47.4	23.1	20.0	
4	0.453	40.2	34.4	0.2	40.4	34.6	56.8	46.8	16.4	12.2	
5	0.520	41.1	37.8	0.2	41.3	38.0	56.0	46.0	14.7	8.0	
6	2.015	30.8	24.6	0.3	31.1	24.9	56.0	46.0	24.9	21.1	
7	4.682	39.3	33.6	0.4	39.7	34.0	56.0	46.0	16.3	12.0	
8	6.309	34.8	28.8	0.5	35.3	29.3	60.0	50.0	24.7	20.7	
9	24.574	37.9	37.7	1.3	39.2	39.0	60.0	50.0	20.8	11.0	

3.2.7 Antenna Requirements

- Procedure:

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

- Conclusion: Comply

The antenna is permanently attached by soldering. (Refer to Internal Photo file.)

- Minimum Standard:

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.

APPENDIX

TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
☒	Spectrum Analyzer	Agilent	E4440A	11/09/30	12/09/30	MY45304199
☒	Spectrum Analyzer	Rohde Schwarz	FSQ26	11/01/11	12/01/11	200445
☐	Spectrum analyzer	Agilent	E4404B	11/03/08	12/03/08	US41061134
☐	Spectrum Analyzer(RE)	H.P	8563E	11/10/04	12/10/04	3551A04634
☐	MXA Signal Analyzer	Agilent Technologies, Inc	N9020A	11/01/07	12/01/07	MY49100833
☐	Power Meter	H.P	EPM-442A	11/07/01	12/07/01	GB37170413
☐	Power Sensor	H.P	8481A	11/07/01	12/07/01	3318A96332
☒	Wideband Power Sensor	Rohde Schwarz	NRP-Z81	11/06/04	12/06/04	1137.9009.02-101001
☒	Virtual Power Meter(S/W)	Rohde Schwarz	R&S Power Viewer Plus	-	-	V 4.1.0
☐	Power Divider	Agilent	11636B	11/09/30	12/09/30	56471
☐	4-Way Power Divider	ET Industries	D-0526-4	11/12/01	12/12/01	210195001
☐	Power Splitter	Anritsu	K241B	11/09/30	12/09/30	020611
☐	Power Splitter	Anritsu	K241B	11/07/01	12/07/01	017060
☐	Power Splitters & Dividers	Aeroflex/Weinschel	1594	11/02/21	12/02/21	1177
☐	Frequency Counter	H.P	5342A	11/07/01	12/07/01	2119A04450
☐	TEMP & HUMIDITY Chamber	JISCO	KR-100/J-RHC2	11/09/30	12/09/30	30604493/021031
☒	Digital Multimeter	H.P	34401A	11/03/07	12/03/07	3146A13475, US36122178
☐	Multifunction Synthesizer	HP	8904A	11/10/06	12/10/06	3633A08404
☒	Signal Generator	Rohde Schwarz	SMR20	11/03/08	12/03/08	101251
☐	Signal Generator	H.P	ESG-3000A	11/07/01	12/07/01	US37230529
☐	Vector Signal Generator	Rohde Schwarz	SMJ100A	11/01/11	12/01/11	100148
☐	Vector Signal Generator	Rohde Schwarz	SMBV100A	11/01/11	12/01/11	255571
☐	Audio Analyzer	H.P	8903B	11/07/02	12/07/02	3011A09448
☐	Modulation Analyzer	H.P	8901B	11/07/01	12/07/01	3028A03029
☐	8960 Series 10 Wireless Comms. Test Set	Agilent	E5515C	11/03/07	12/03/07	GB43461134
☐	Universal Radio communication Tester	Rohde Schwarz	CMU200	11/03/07	12/03/07	106760
☐	Bluetooth Tester	TESCOM	TC-3000B	11/07/01	12/07/01	3000B000268
☐	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-3
☒	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-2
☐	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-4
☐	AC Power supply	DAEKWANG	5KVA	11/03/08	12/03/08	20060321-1
☒	DC Power Supply	HP	6622A	11/03/07	12/03/07	3448A03760
☐	DC Power Supply	HP	6633A	11/03/07	12/03/07	3524A06634
☐	DC Power Supply	Protek	PWS-3010D	11/09/30	12/09/30	4072702
☐	DC Power Supply	SM techno	SDP30-5D	11/05/20	12/05/20	305DKA013
☐	BAND Reject Filter	Microwave Circuits	N0308372	11/09/30	12/09/30	3125-01DC0352
☐	BAND Reject Filter	Wainwright	WRCG1750	11/09/30	12/09/30	2
☐	High-Pass Filter	ANRITSU	MP526D	11/09/30	12/09/30	M27756

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
☐	High-pass filter	Wainwright	WHNX2.1	11/09/30	12/09/30	1
☒	High-pass filter	Wainwright	WHNX3.0	11/09/30	12/09/30	9
☐	High-pass filter	Wainwright	WHNX5.0	11/09/19	12/09/19	8
☒	High-Pass Filter	Wainwright	WHKX8.5	11/09/19	12/09/19	1
☐	High-Pass Filter	Wainwright	WHKX1.0	11/09/30	12/09/30	9
☐	Tunable Notch Filter	Wainwright	WRCT800.0 /960.0-0.2/40-8SSK	N/A	N/A	32
☐	Tunable Notch Filter	Wainwright	WRCD1700.0 /2000.0-0.2/40-10SSK	N/A	N/A	53
☐	Tunable Notch Filter	Wainwright	WRCT1900.0/ 2200.0-5/40-10SSK	N/A	N/A	30
☐	HORN ANT	ETS	3115	11/09/06	12/09/06	21097
☒	HORN ANT	ETS	3115	11/03/22	12/03/22	6419
☒	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	154
☐	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	155
☒	HORN ANT	SCHWARZBECK	BBHA9120A	10/04/13	12/04/13	322
☐	Dipole Antenna	Schwarzbeck	VHA9103	11/11/22	12/11/22	2116
☐	Dipole Antenna	Schwarzbeck	VHA9103	11/11/22	12/11/22	2117
☐	Dipole Antenna	Schwarzbeck	UHA9105	11/11/22	12/11/22	2261
☐	Dipole Antenna	Schwarzbeck	UHA9105	11/11/22	12/11/22	2262
☐	LOOP Antenna	ETS	6502	10/10/29	12/10/29	3471
☐	Coaxial Fixed Attenuators	Agilent	8491B	11/07/02	12/07/02	MY39260700
☒	Attenuator (3dB)	WEINSCHEL	56-3	11/09/30	12/09/30	Y2342
☐	Attenuator (3dB)	WEINSCHEL	56-3	11/09/30	12/09/30	Y2370
☐	Attenuator (10dB)	WEINSCHEL	23-10-34	11/09/30	12/09/30	BP4386
☐	Attenuator (10dB)	WEINSCHEL	23-10-34	11/01/11	12/01/11	BP4387
☐	Attenuator (10dB)	WEINSCHEL	86-10-11	11/09/30	12/09/30	446
☐	Attenuator (10dB)	WEINSCHEL	86-10-11	11/09/30	12/09/30	408
☐	Attenuator (20dB)	WEINSCHEL	86-20-11	11/09/30	12/09/30	432
☐	Attenuator (30dB)	JFW	50FH-030-300	11/03/07	12/03/07	060320-1
☐	Attenuator (40dB)	WEINSCHEL	57-40-33	11/09/30	12/09/30	NN837
☐	Termination	H.P	HP-909D	11/07/02	12/07/02	02750
☐	Termination	H.P	HP-909D	11/07/02	12/07/02	02702
☐	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0088CAN	11/07/01	12/07/01	788
☐	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0185CAN	11/07/01	12/07/01	790
☐	Amplifier (30dB)	Agilent	8449B	11/03/07	12/03/07	3008A01590
☒	Amplifier (30dB)	H.P	8449B	11/03/07	12/03/07	3008A00370
☐	Amplifier	EMPOWER	BBS3Q7ELU	11/09/30	12/09/30	1020
☐	RF Power Amplifier	OPHIRRF	5069F	11/07/01	12/07/01	1006
☒	EMI TEST RECEIVER	R&S	ESU	11/01/20	12/01/20	100014

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
☒	BILOG ANTENNA	SCHAFFNER	CBL6112B	10/07/14	12/07/14	2737
☒	Amplifier (22dB)	H.P	8447E	11/01/11	12/01/11	2945A02865
☐	EMI TEST RECEIVER	R&S	ESCI	11/03/08	12/03/08	100364
☐	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/11/29	12/11/29	91032789
☐	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/11/29	12/11/29	1098
☐	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/12/21	12/12/21	91031946
☐	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/07/07	12/07/07	0590
☐	Low Noise Pre Amplifier	TSJ	MLA-100K01-B01-2	11/03/07	12/03/07	1252741
☐	Low Noise Pre Amplifier	TSJ	MLA-00108-B02-36	11/01/11	12/01/11	1518831
☒	Amplifier (25dB)	Agilent	8447D	11/03/07	12/03/07	2944A10144
☐	Amplifier (25dB)	Agilent	8447D	11/07/01	12/07/01	2648A04922
☒	Spectrum Analyzer(CE)	H.P	8591E	11/03/07	12/03/07	3649A05889
☒	LISN	Kyoritsu	KNW-407	11/01/11	12/01/11	8-317-8
☒	LISN	Kyoritsu	KNW-242	11/07/02	12/07/02	8-654-15
☒	CVCF	NF Electronic	4420	11/09/15	12/19/15	304935/4420023
☒	50 ohm Terminator	HME	CT-01	11/01/11	12/01/11	N/A
☒	RFI/FIELD Intensity Meter	Kyoritsu	KNM-2402	11/07/02	12/07/02	4N-170-3
☐	EMI Test Receiver	R&S	ECSI	11/03/08	12/03/08	100364
☐	LISN	R&S	ESH2-Z5	11/09/30	12/09/30	8287391006
☐	CVCF	NF Electronic	4420	11/03/08	12/03/08	304935/337980
☐	RFI/FIELD Intensity Meter	ES4152	424059	11/09/30	12/09/30	424059
☐	Wideband Radio Communication Tester	R&S	CMW500	11/09/30	12/09/30	100989