FCC Report

Report Number	KR0140-FCC-2022-0023
Client Name :	SENA TECHNOLOGIES.Inc
Client Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea
Receipt Date :	2022.05.16
Test Date :	2022.07.15 ~ 2022.08.09
Test method :	FCC Part 15 Subpart C 15.247 RSS-247 Issue 2(2017-02), RSS-GEN Issue 5(2019-03)
Testing Environment :	25.0 ℃, 55.0 %
Issued Date :	2022.08.12
Test Results :	Refer to the test results

This test report must not be reproduced or reproduced in any way.
The results shown in this test report are the results of testing the samples provided.
This test report is prepared according to the requirements of ISO / IEC 17025.

Tested by Dae-Seong, Choi	(signature)	Technical Manager Yong-Min, Won	(signature)

Oct 12, 2022

EMC Labs Co., Ltd. (seal)

Contents

Version

TEST REPORT NO.	DATE	DESCRIPTION
KR0140-FCC-2022-0023	Oct 12, 2022	Initial Issue

1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant Information

Applicant	SENA TECHNOLOGIES.Inc
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1.2. Manufacturer Information

Manufacturer	SENA TECHNOLOGIES.Inc
Manufacturer Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea

1.3 Test Laboratory Information

Laboratory	EMC Labs Co., Ltd.
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FCC Designation No.	KR0140
FCC Registration No.	58000
IC Site Registration No.	28751

2. Equipment under Test(EUT) Information

2.1 General Information

Product Name	SMART HJC 50B
Model Name	SP131
FCC ID	S7A-SP131
IC	8154A-SP131
Power Supply	DC 3.8 V

2.2 Additional Information

Operating Frequency	2 402 MHz ~ 2 480 MHz
RF Output Power	- dBm
Number of channel	79
Modulation Type	GFSK
Antenna Type	PCB Pattern Antenna
Antenna Gain	0.46 dBi
Firmware Version	1.0
Hardware Version	1.0
Test software	CSR BlueTest V3.3.5

2.3 Test Frequency

Test mode	Test Frequency (MHz)		
	Low Frequency	Middle Frequency	High Frequency
BLE	2 402	2 442	2 480

2.4 Used Test Software Setting Value

Test Mode	Setting Item
	Power
BLE	12

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

3. Test Summary

Applied	FCC Rule	IC Rule	Test Items	Test Condition	Result
☒	15.203	-	Antenna Requirement	Conducted	C
☒	15.247(a)	RSS-247 (5.2)	6 dB Bandwidth		C
☒	-	RSS GEN (6.7)	Occupied Bandwidth (99%)		C
☒	15.247(b)	RSS-247 (5.4)	Maximum Peak Output Power		C
☒	15.247(e)	RSS-247 (5.2)	Peak Power Spectral Density		C
☒	15.247(d)	RSS-247 (5.5)	Conducted Spurious Emission		C
☒	15.247(d) 15.205 & 15.209	RSS-247 (5.5) RSS-GEN (8.9 & 8.10)	Radiated Spurious Emission	Radiated	C
☒	15.207	RSS-GEN (8.8)	Conducted Emissions	AC Line Conducted	C

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	2022.12.17
■	CONTROLLER	AMWON TECHNOLOGY	TEMI2500	S7800VK191 0707	2022.12.17
■	PSA SERIES SPECTRUM ANALYZER	AGILENT	E4440A	MY45304057	2022.12.15
■	MXG ANALOG SIGNAL GENERATOR	AGILENT	N5183A	MY50141890	2022.12.15
■	SYSTEM DC POWER SUPPLY	AGILENT	6674A	MY53000118	2022.12.15
□	VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	257524	2022.12.15
□	BLUETOOTH TESTER	TESCOM	TC-3000A	3000A480088	2022.12.15
□	DIRECTIONAL COUPLER	AGILENT	773D	2839A01855	2022.12.15
□	ATTENUATOR	AGILENT	8493C	73193	2022.12.15
■	ATTENUATOR	ACE RF COMM	ATT SMA 20W 20dB 8GHz	A-0820.SM20.2	2023.04.11
□	TERMINATIOM	HEWLETT PACKARD	909D	07492	2022.12.15
□	POWER DIVIDER	HEWLETT PACKARD	11636A	06916	2022.12.15
□	SLIDE-AC	DAEKWANG TECH	SV-1023	-	-
□	DIGITAL MULTIMETER	HUMANTECHSTORE	15B+	50561541WS	2022.12.15
■	ACTIVE LOOP ANTENNA	TESEQ	HLA 6121	55685	2022.12.30
■	Biconilog ANT	Schwarzbeck	VULB 9160	3260	2023.02.03
□	Biconilog ANT	Schwarzbeck	VULB9168	902	2023.01.14
■	Horn Ant.	Schwarzbeck	BBHA9120D	974	2023.01.08
□	Horn Ant.	S/B	BBHA9120D	1497	2023.01.25
■	Amplifier	TESTEK	TK-PA18H	200104-L	2023.03.17
■	EMI TEST RECEIVER	ROHDE& SCHWARZ	ESW44	101952	2023.04.07
□	PROGRAMMABLE DC POWER SUPPLY	ODA	OPE-305Q	oda-01-09-23-1831	2023.01.10
□	DC POWER SUPPLY	AGILENT	E3634A	MY40012120	2023.02.03
■	POWER SENSOR	AGILENT	U2001H	MY51140028	2023.02.19
■	Test Receiver	ROHDE & SCHWARZ	ESR7	101616	2023.06.28
■	LISN	ROHDE & SCHWARZ	ENV216	100409	2023.01.10
■	PULSE LIMITER	lignex1	EPL-30	NONE	2023.01.24

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) ≥ 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.

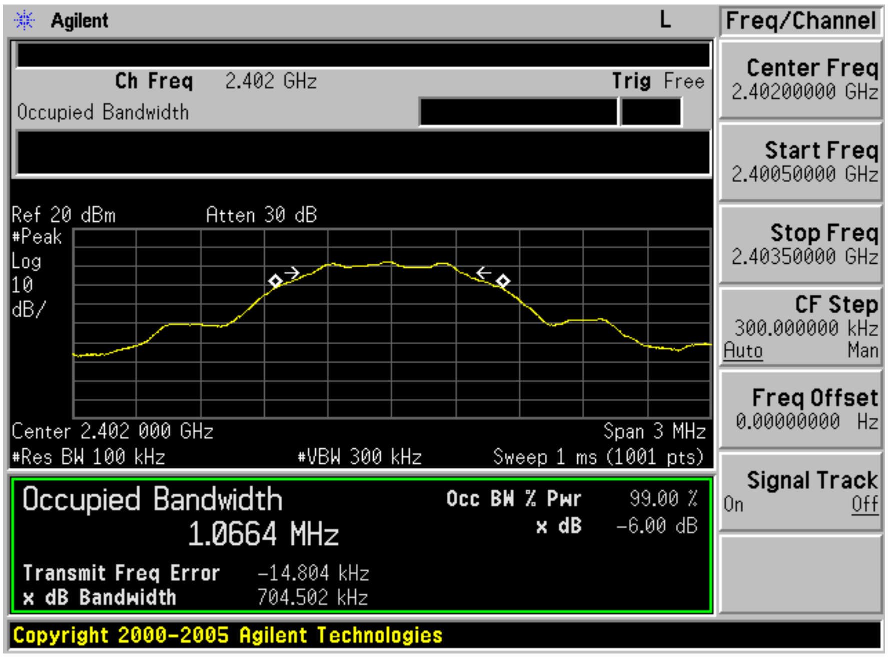
   Option 2 – The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 x RBW, peak detector with maximum hold) is implemented by the instrumentation function. When 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

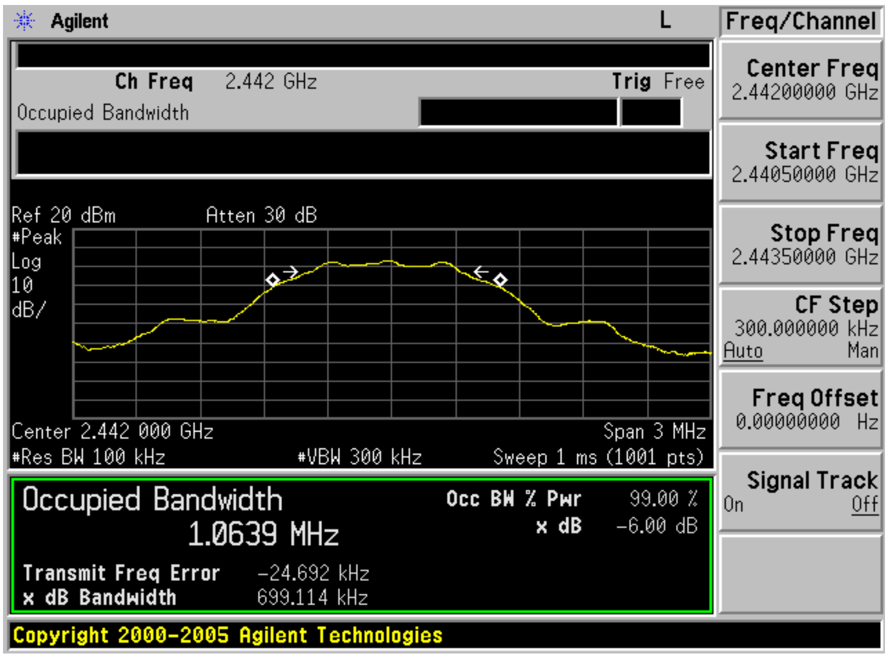
Test Mode	Test Frequency	6 dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
BLE	Low	0.705	1.034
	Middle	0.699	1.033
	High	0.697	1.034

6.5 Test Plot

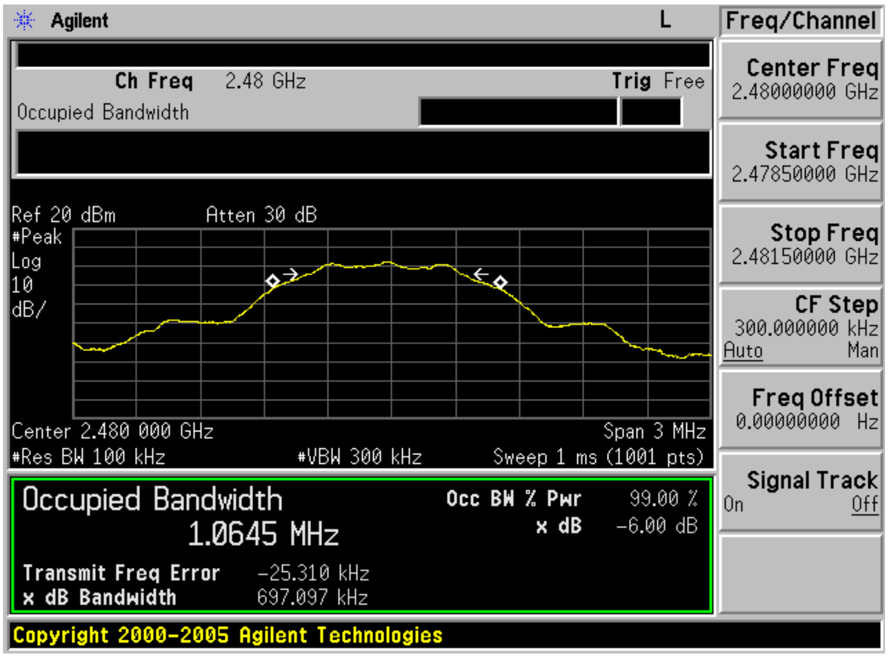
BLE _ Low frequency	6 dB Bandwidth



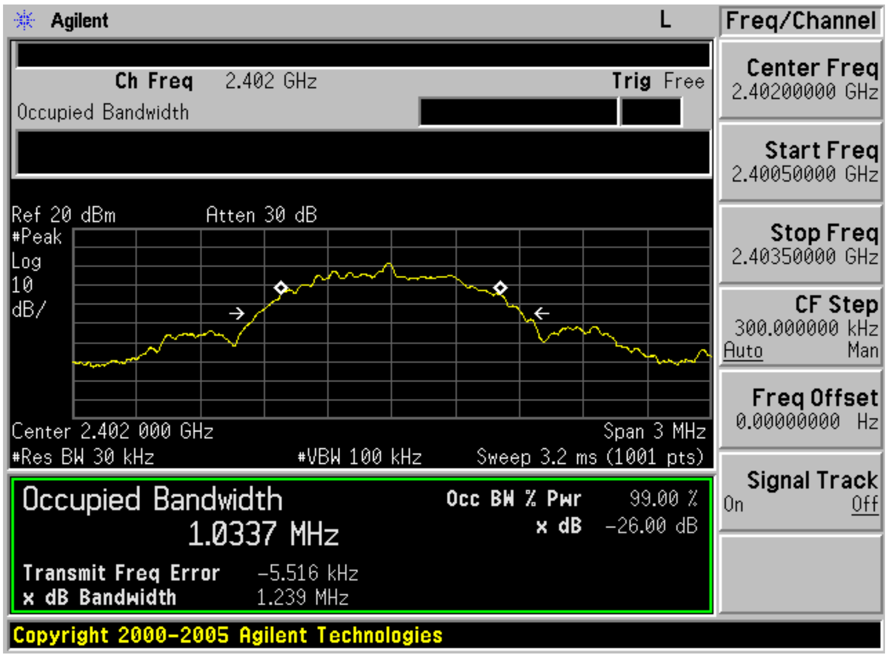
BLE _ Middle frequency	6 dB Bandwidth



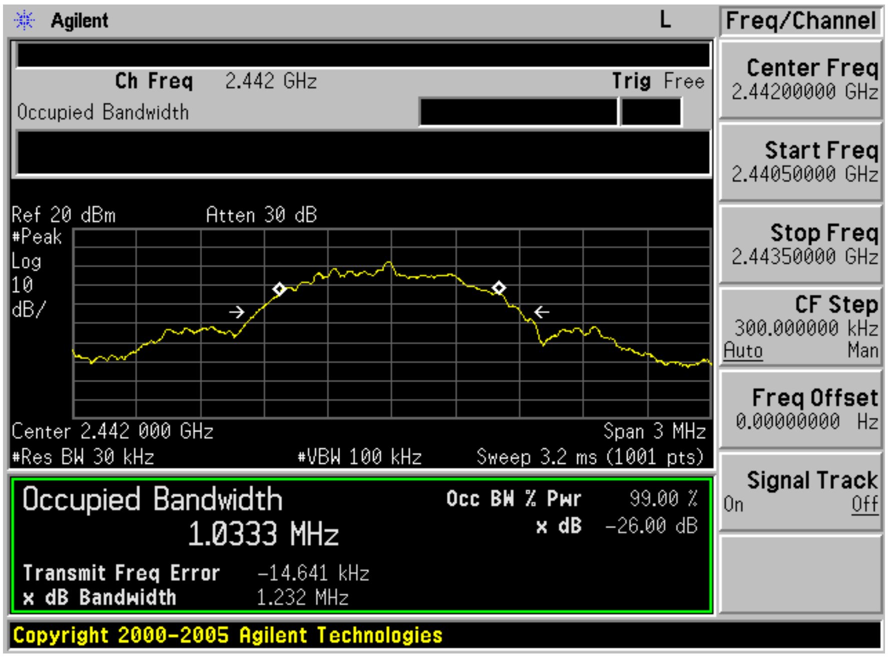
BLE _ High frequency	6 dB Bandwidth



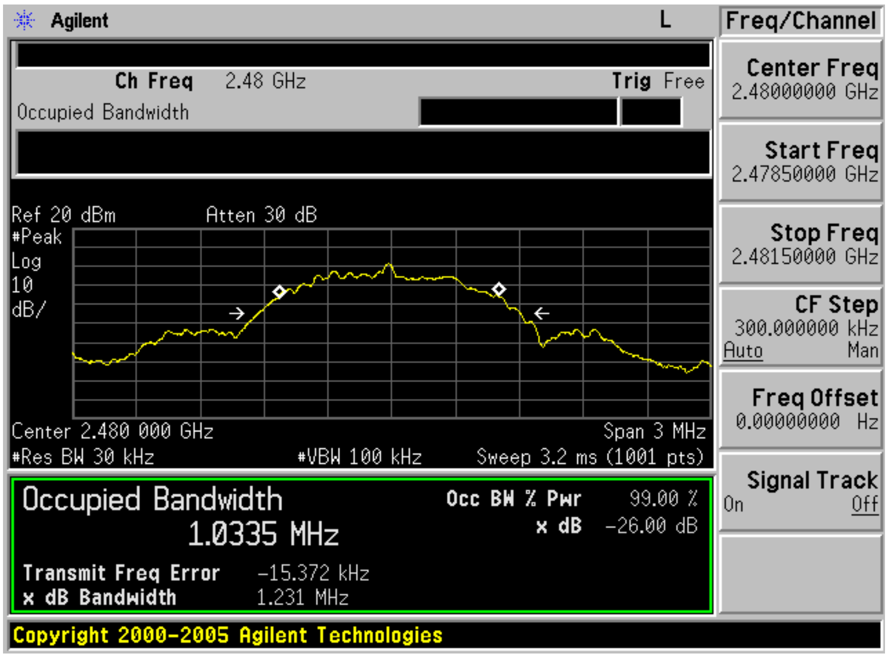
BLE _ Low frequency	Occupied Bandwidth



BLE _ Middle frequency	Occupied Bandwidth



BLE _ High frequency	Occupied Bandwidth



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.

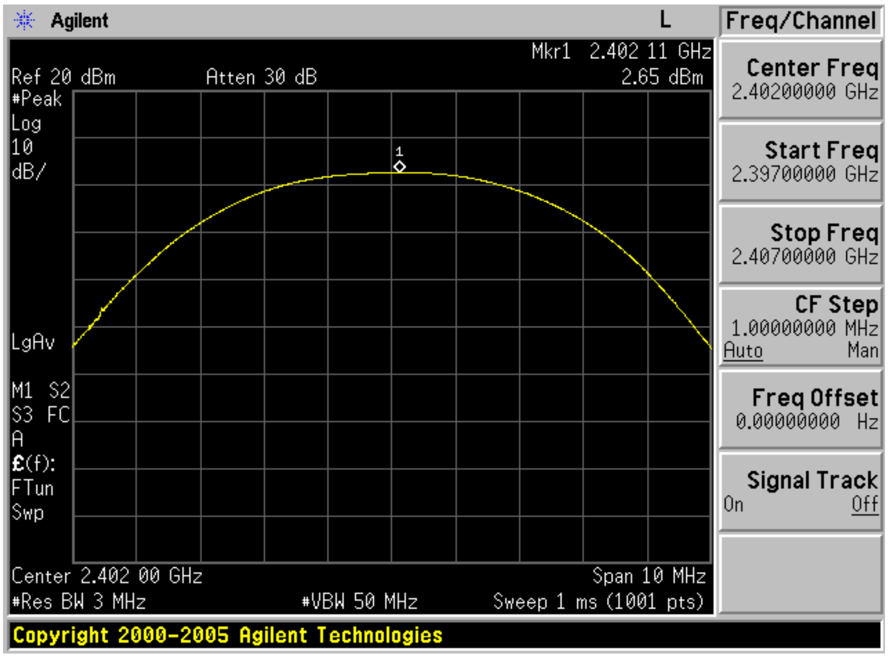
1. Set the RBW ≥ DTS bandwidth
2. Set VBW ≥ 3 x RBW
3. Set span ≥ 3 x RBW.
4. Sweep time = auto couple
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use peak search function to determine the peak amplitude level.

7.4 Test Result

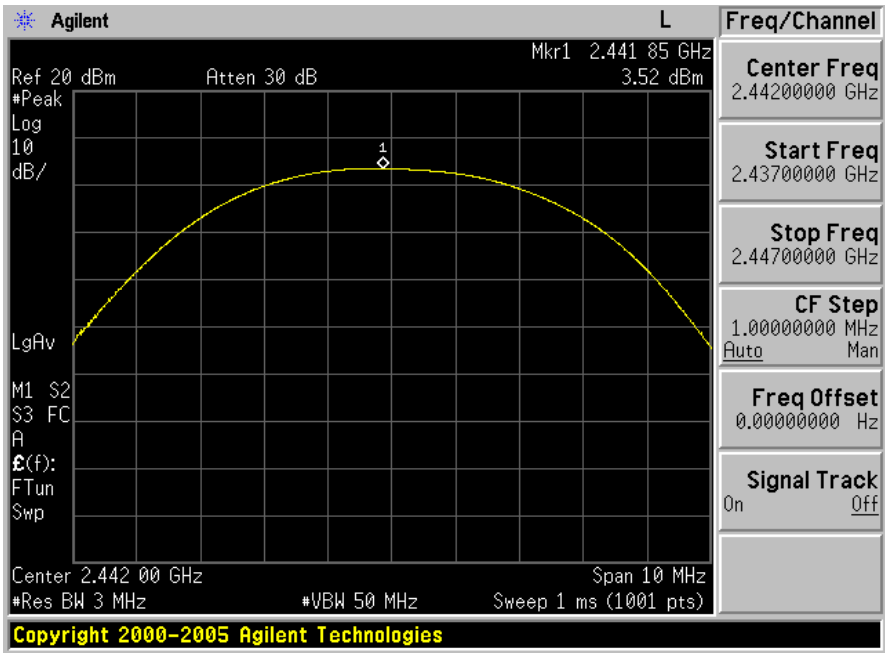
Test Mode	Test Frequency	Peak Output Power	
		dBm	mW
BLE	Low	2.65	1.84
	Middle	3.52	2.25
	High	2.52	1.79

7.5 Test Plot

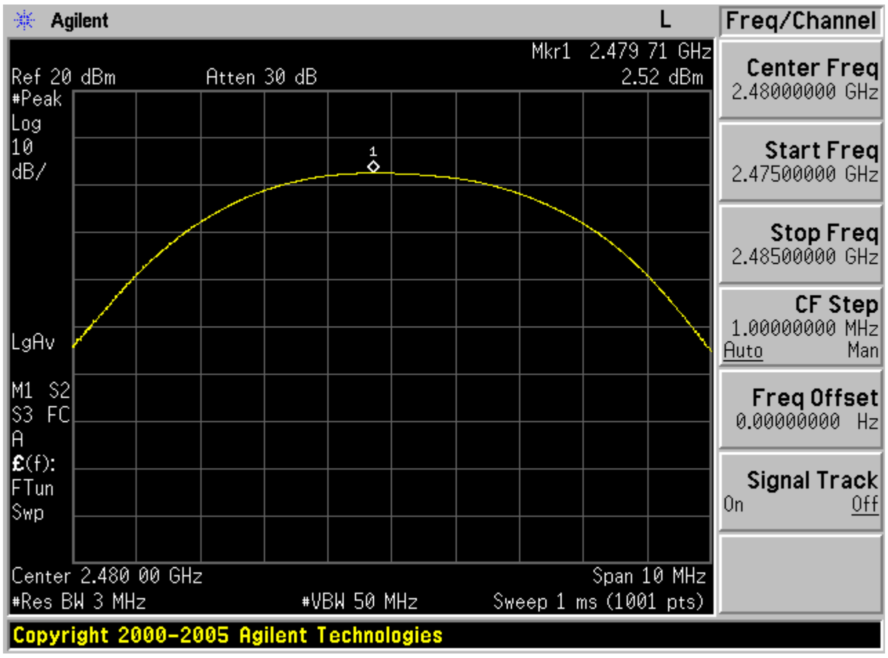
BLE _ Low frequency	Maximum Peak Output Power



BLE _ Middle frequency	Maximum Peak Output Power



BLE _ High frequency	Maximum Peak Output Power



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.

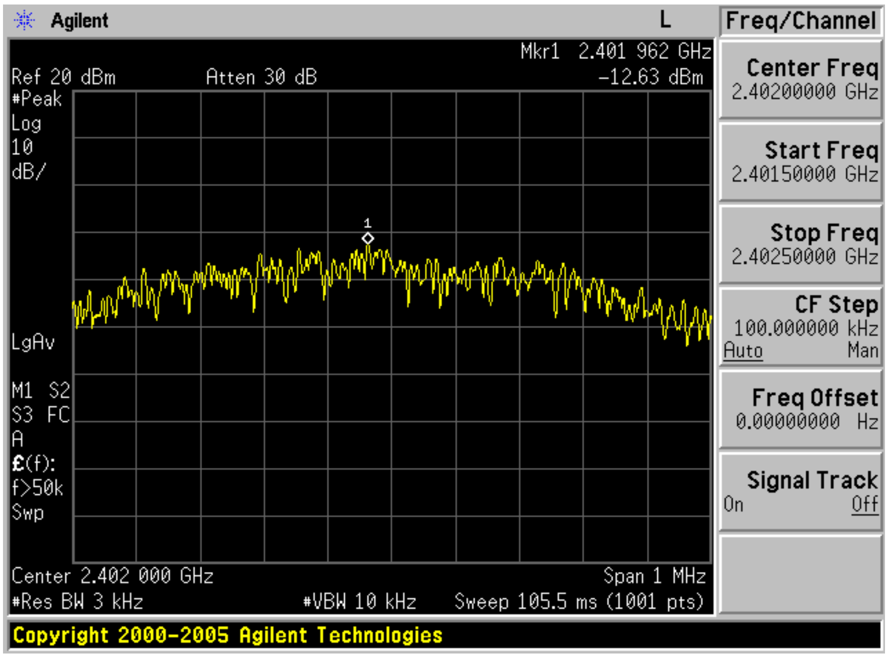
(ANSI C63.10-2013 _ Section 11.10.2 – Method PKPSD)
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW : 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = Peak.
6. Sweep time = Auto
7. Trace mode = Max Hold.
8. 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.

8.4 Test Result

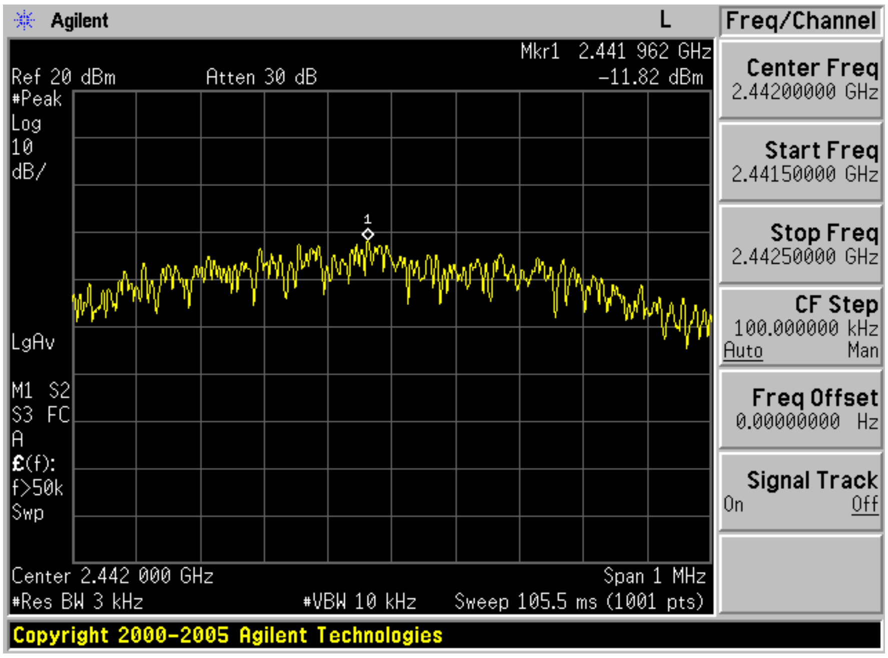
Test Mode	Test Frequency	Peak Power Spectral Density (dBm)
BLE	Low	-12.63
	Middle	-11.82
	High	-12.99

8.5 Test Plot

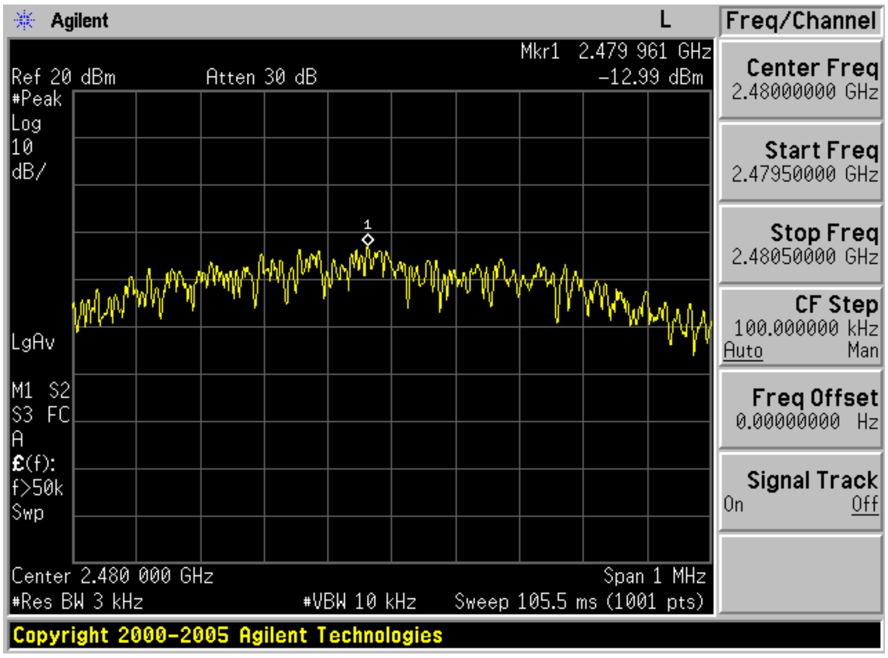
BLE _ Low frequency	Peak Power Spectral Density



BLE _ Middle frequency	Peak Power Spectral Density



BLE _ High frequency	Peak Power Spectral Density



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

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

** 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:

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			

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 1 or 3 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.

5. 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:

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 ~ 25 GHz Data BLE

- Low frequency

Frequency	Reading (dBuV/m)		Pol.	Factor (dB)	DCCF (dB)	Limits (dBuV/m)		Result (dBuV/m)		Margin (dB)	
(MHz)	AV / Peak					AV / Peak		AV / Peak		AV / Peak	
2 375.89	18.26	27.24	H	11.84	1.71	54.0	74.0	31.8	39.1	22.2	34.9
4 804.04	44.20	49.69	V	4.30	1.71	54.0	74.0	50.2	54.0	3.8	20.0
7 205.18	20.84	32.27	H	20.22	1.71	54.0	74.0	42.8	52.5	11.2	21.5

- Middle frequency

Frequency	Reading (dBuV/m)		Pol.	Factor (dB)	DCCF (dB)	Limits (dBuV/m)		Result (dBuV/m)		Margin (dB)	
(MHz)	AV / Peak					AV / Peak		AV / Peak		AV / Peak	
4 883.52	45.99	51.80	V	4.04	1.71	54.0	74.0	51.7	55.8	2.3	18.2
7 325.18	25.55	35.43	H	20.53	1.71	54.0	74.0	47.8	56.0	6.2	18.0

- High frequency

Frequency	Reading (dBuV/m)		Pol.	Factor (dB)	DCCF (dB)	Limits (dBuV/m)		Result (dBuV/m)		Margin (dB)	
(MHz)	AV / Peak					AV / Peak		AV / Peak		AV / Peak	
2 483.51	26.63	37.05	H	12.21	1.71	54.0	74.0	40.6	49.3	13.4	24.7
4 959.48	45.63	50.80	V	4.21	1.71	54.0	74.0	51.6	55.0	2.4	19.0
7 439.22	23.53	33.46	H	20.37	1.71	54.0	74.0	45.6	53.8	8.4	20.2

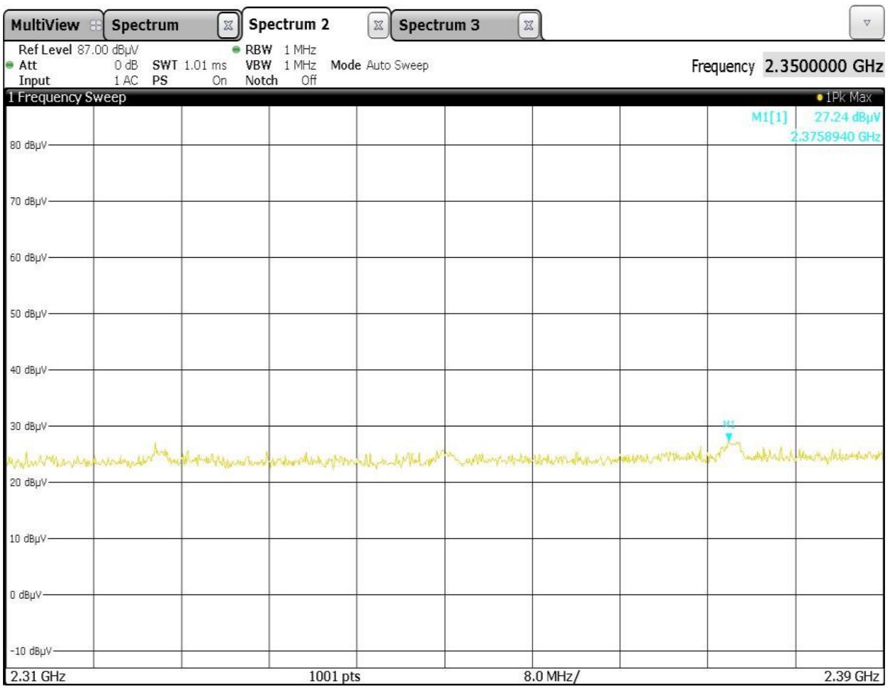
Note 1: The radiated emissions were investigated 9 kHz to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
Note 2: DCF(Duty Cycle Factor)
- T_{on} = 0.494 ms / T_{off} = 0.239 ms
- Duty Cycle = T_{on} / (T_{on}+T_{off}) = 0.494 / (0.494+0.239) = 0.674
- DCF = 10 x log(1/Duty Cycle) dB = 10 x log(1/0.674) dB = 1.71 dB

Note 3: Sample Calculation.
Margin = Limit – Result / Peak Result = Peak Reading + TF / Average Result = Average Reading + TF + DCCF
TF = Ant factor + Cable Loss + Filter Loss – Amp Gain

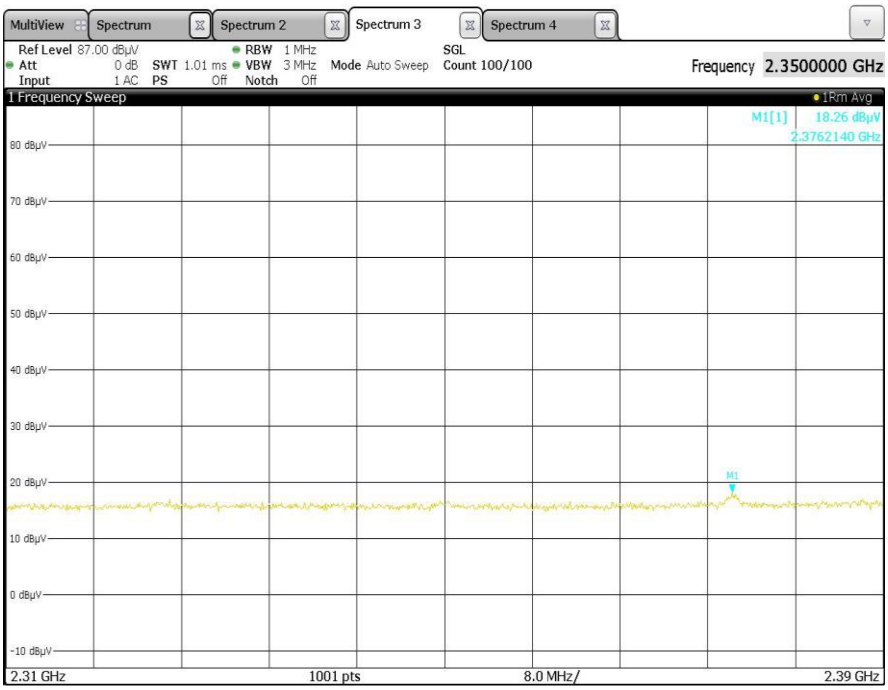
9.6 Test Plot for Radiated Spurious Emission

- BLE _ Low frequency

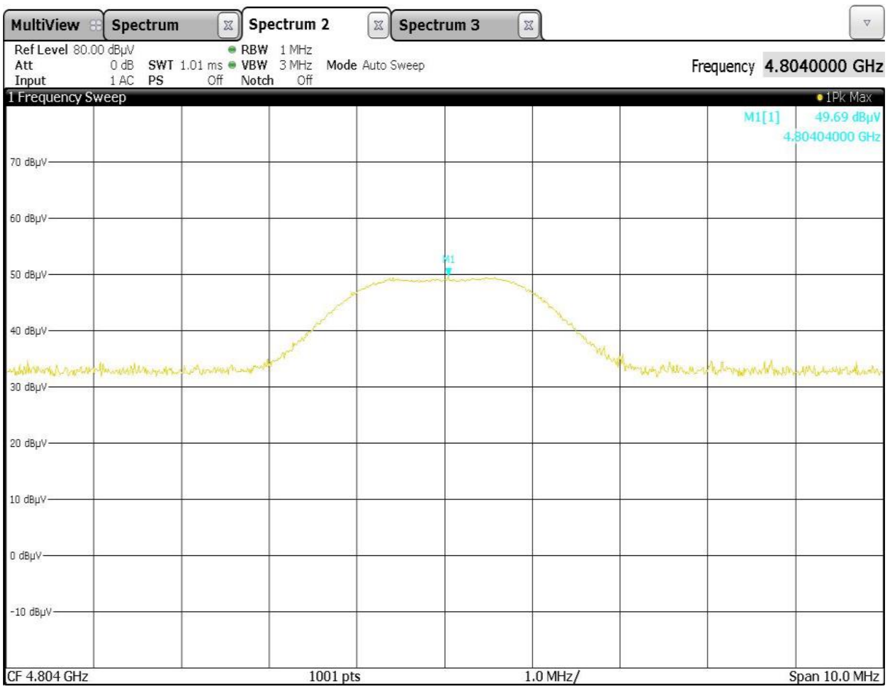
Restricted Band – Peak



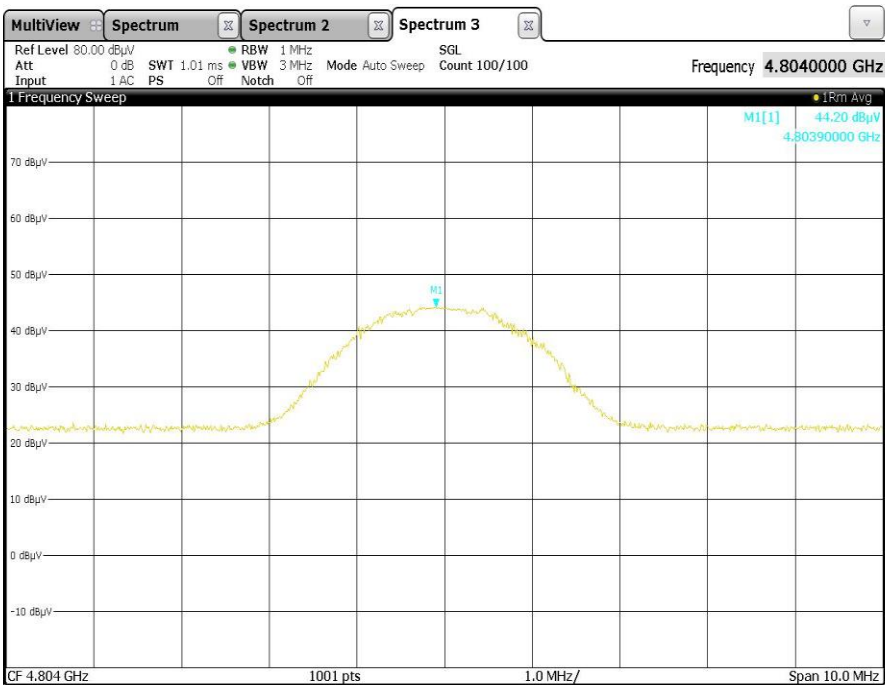
Restricted Band – Average



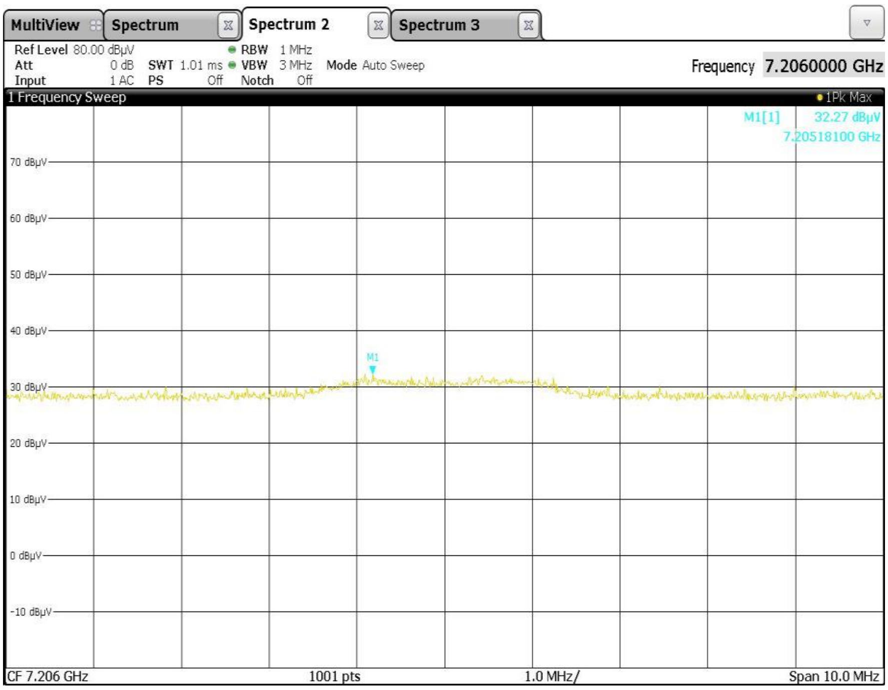
	Spurious – Peak



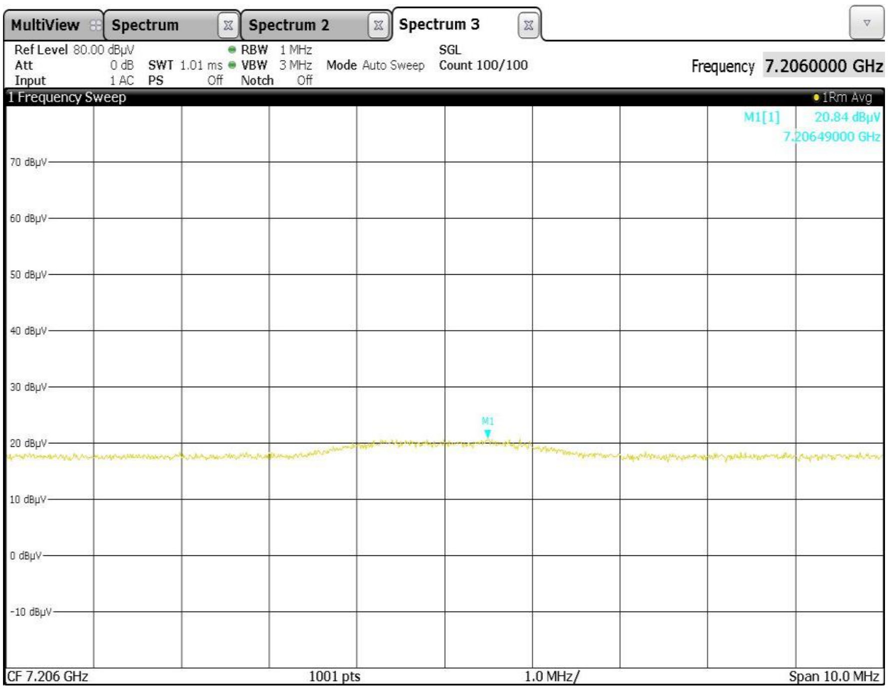
	Spurious – Average



	Spurious – Peak

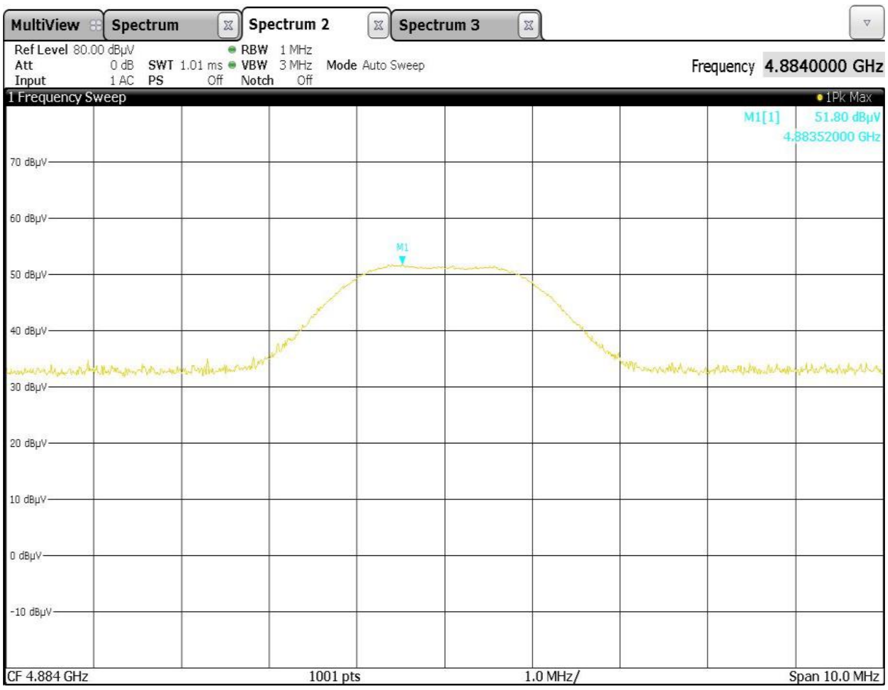


	Spurious – Average



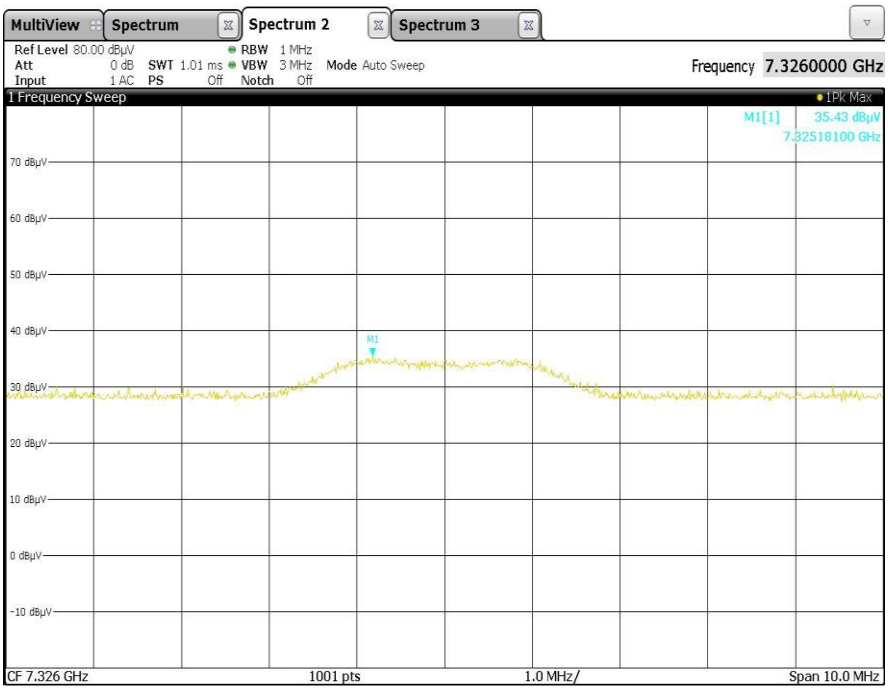
- BLE _ Middle frequency

	Spurious – Peak



	Spurious – Average

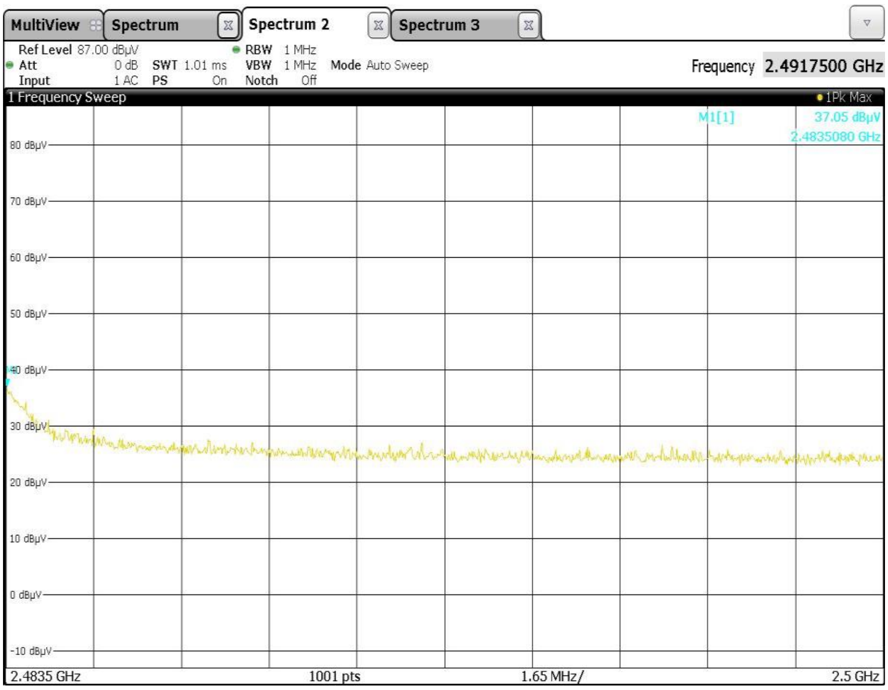
	Spurious – Peak



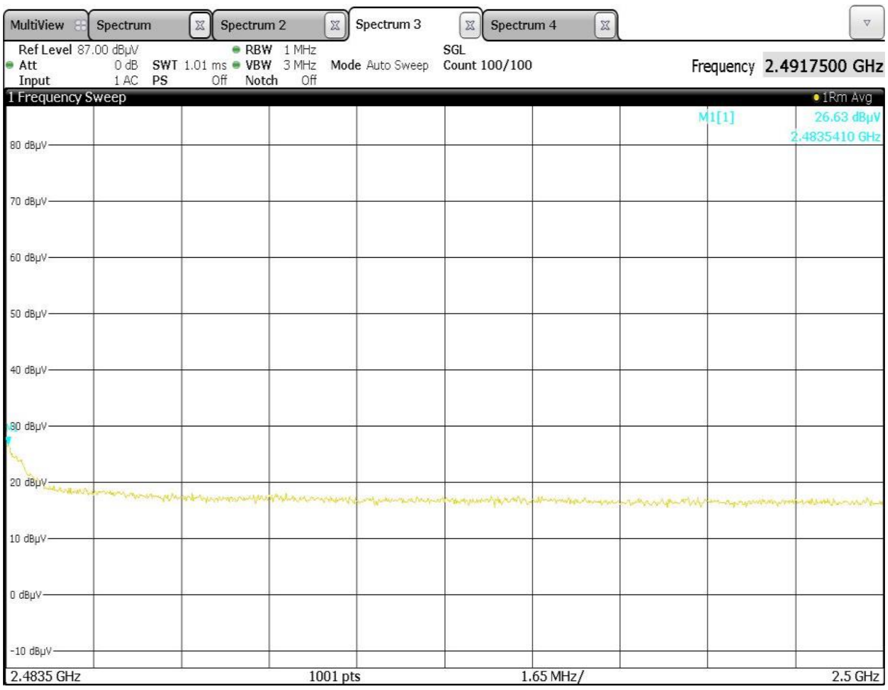
	Spurious – Average

- BLE _ High frequency

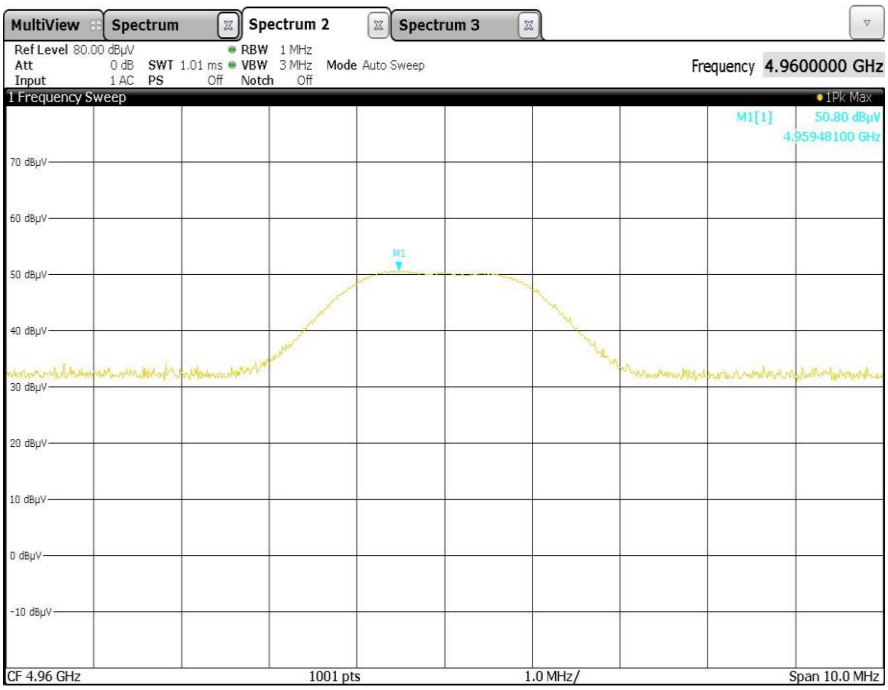
	Restricted Band – Peak



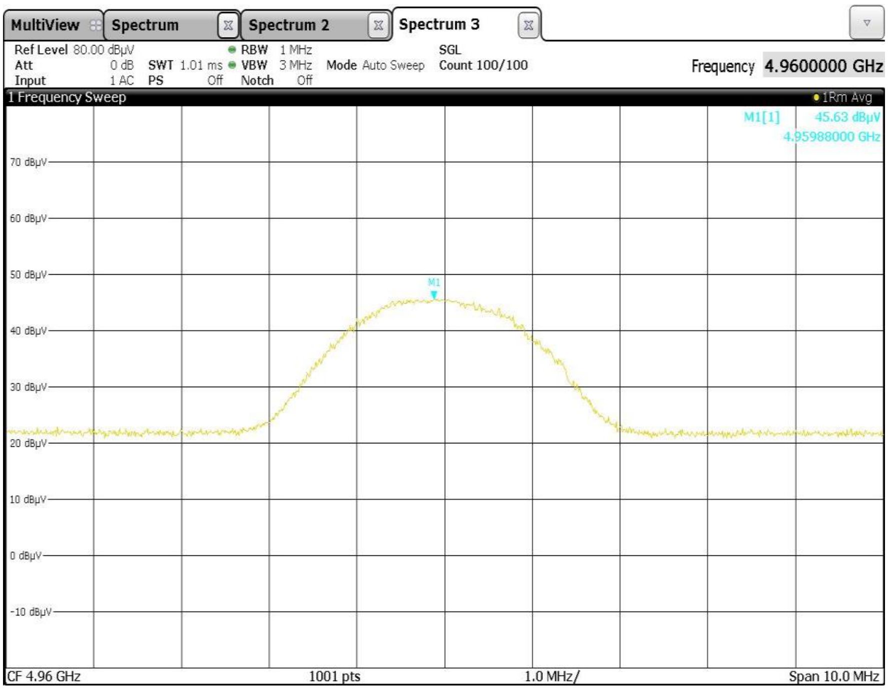
	Restricted Band – Average



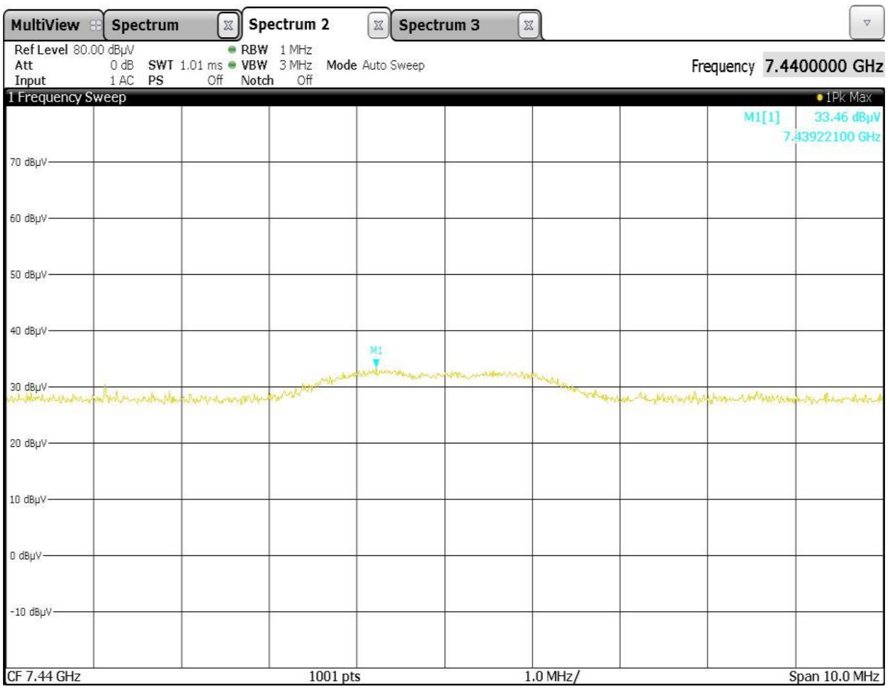
	Spurious – Peak



	Spurious – Average



	Spurious – Peak

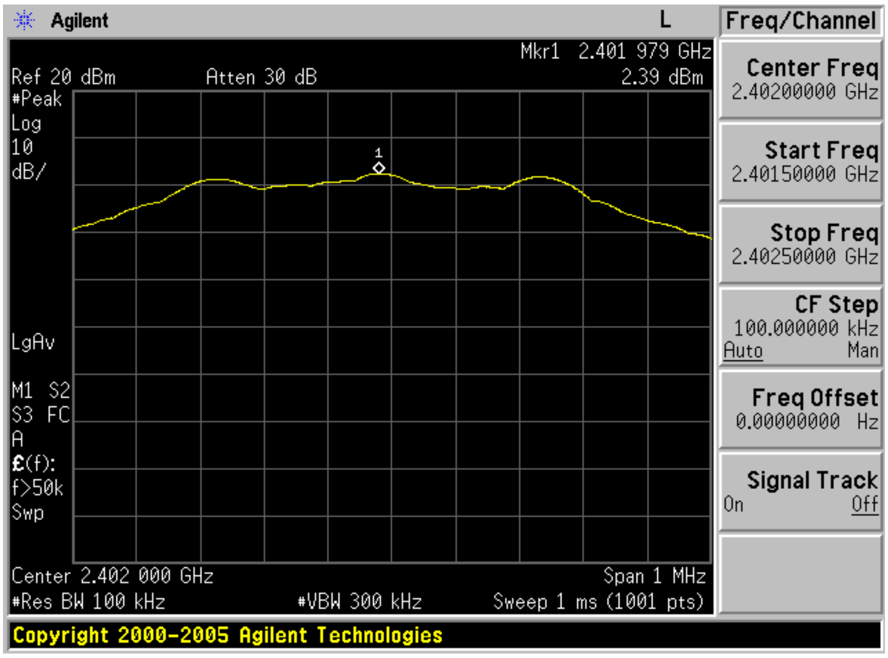


	Spurious – Average

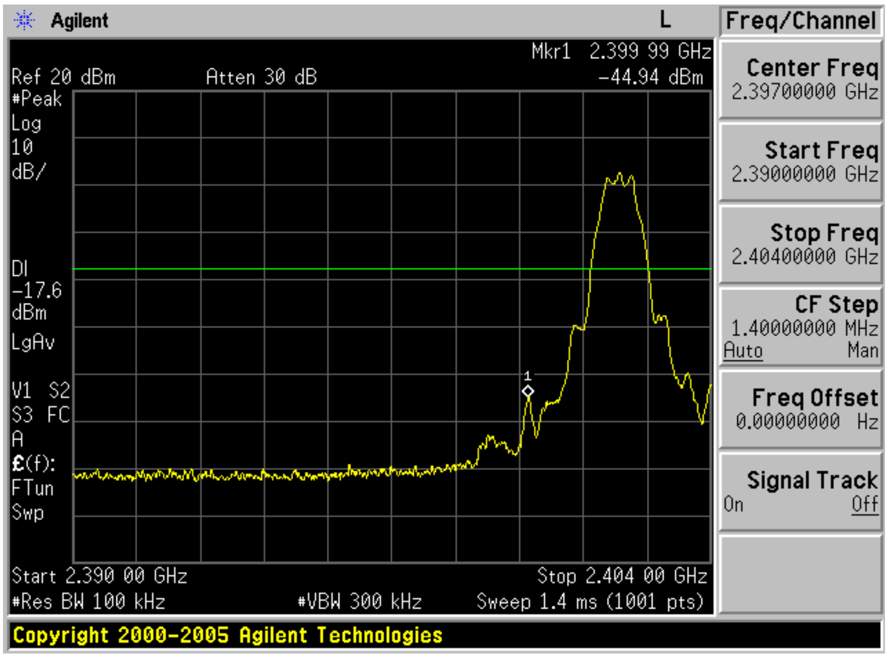
9.7 Test Plot for Conducted Spurious Emission

- BLE _ Low frequency

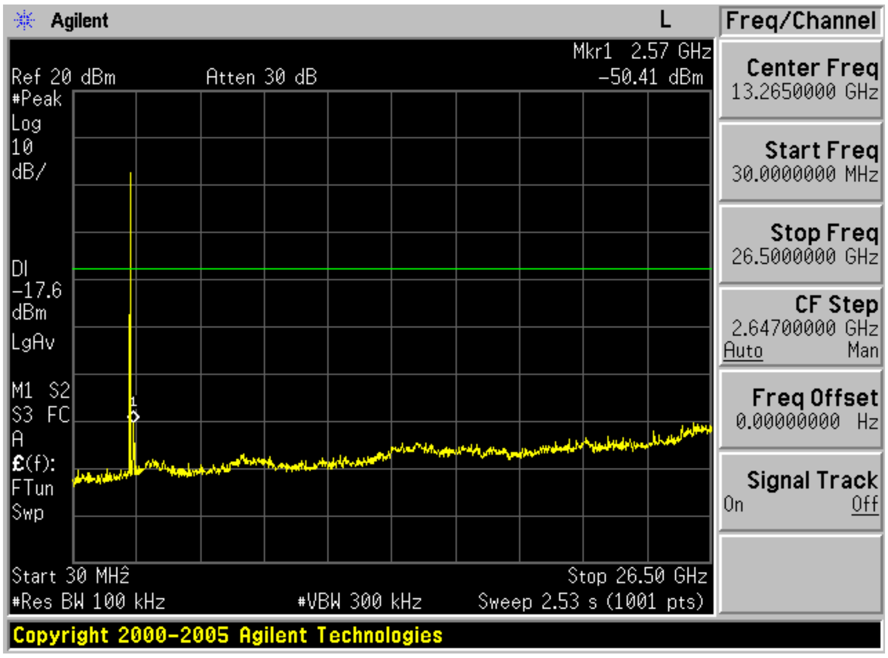
	Reference



	Bandedge

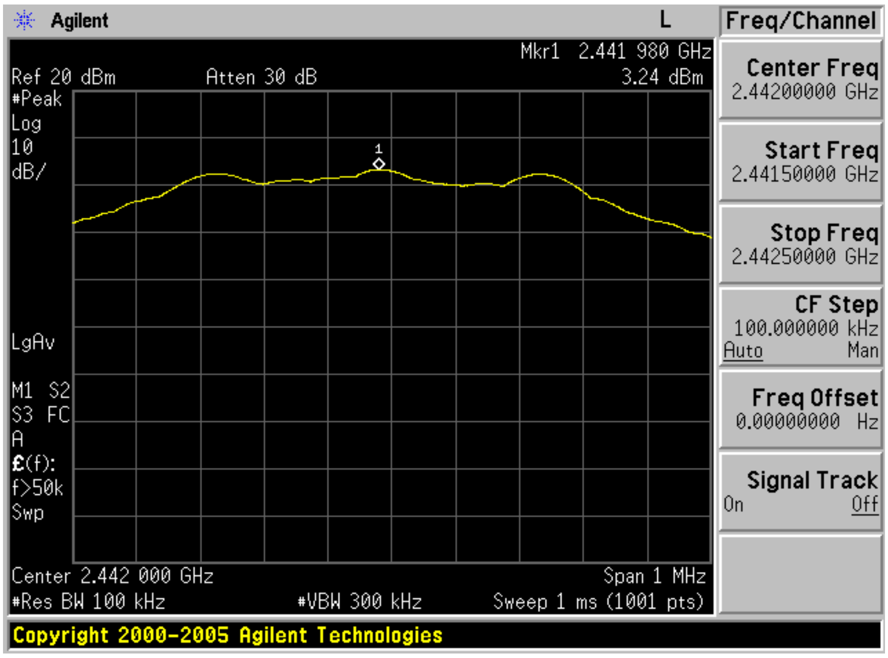


	Spurious

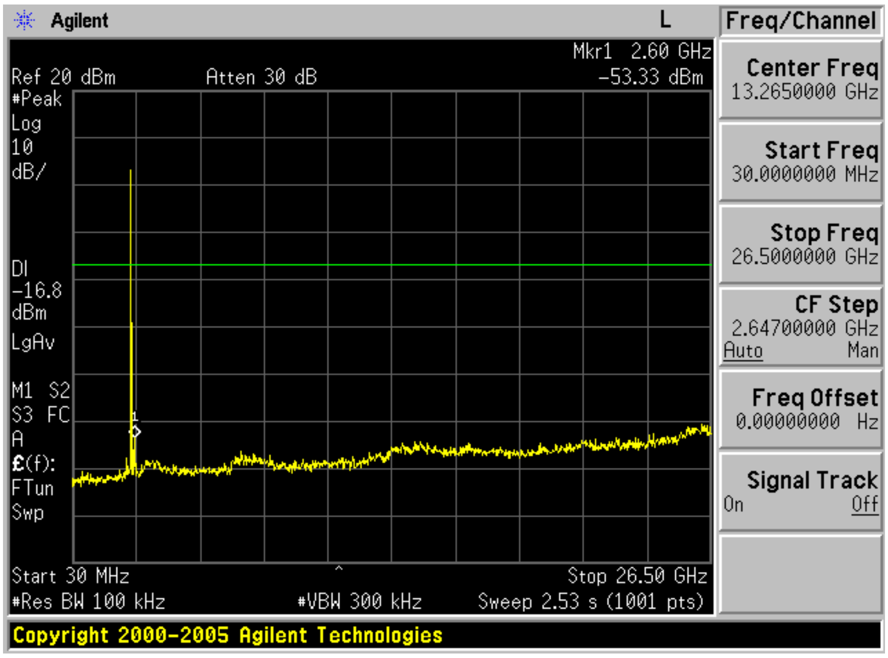

Agilent
L
Mkr1 2.57 GHz
-50.41 dBm
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
Dl
-17.6
dBm
LgAv
M1 S2
S3 FC
A
£(f):
FTun
Swp
Start 30 MHz
Stop 26.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.53 s (1001 pts)
Freq/Channel
Center Freq
13.2650000 GHz
Start Freq
30.0000000 MHz
Stop Freq
26.5000000 GHz
CF Step
2.64700000 GHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Copyright 2000-2005 Agilent Technologies

- BLE _ Middle frequency

	Reference

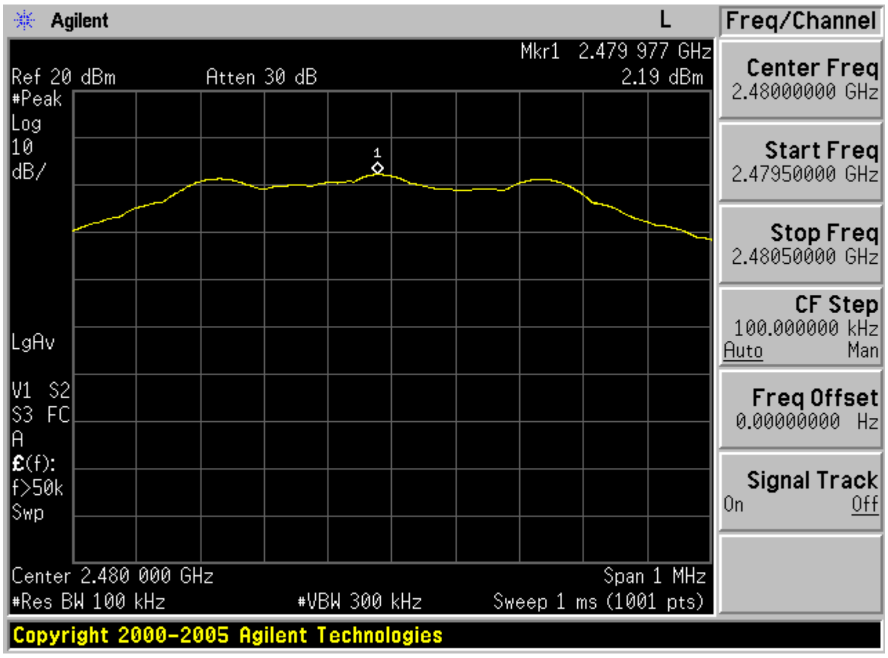


	Spurious

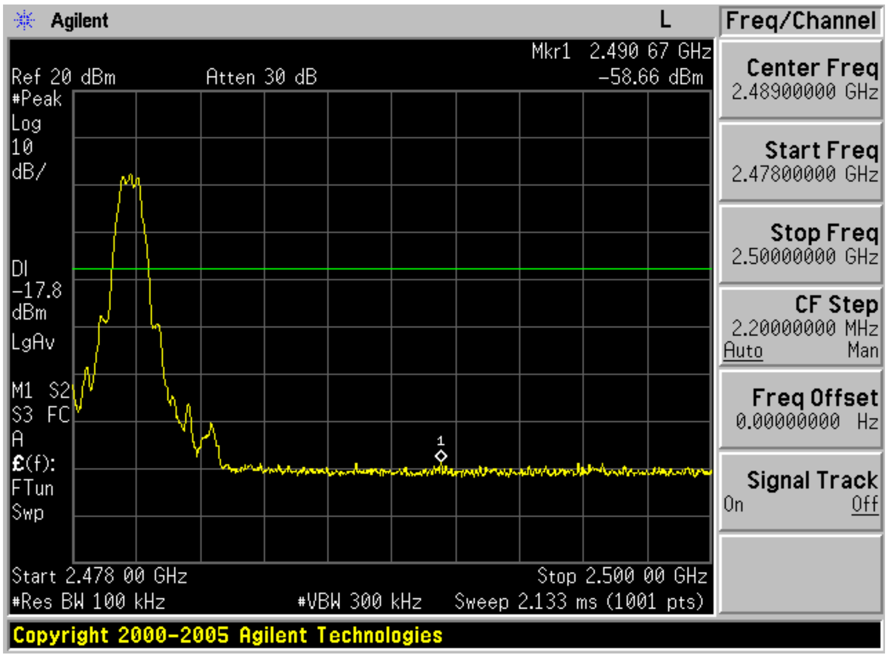


- BLE _ High frequency

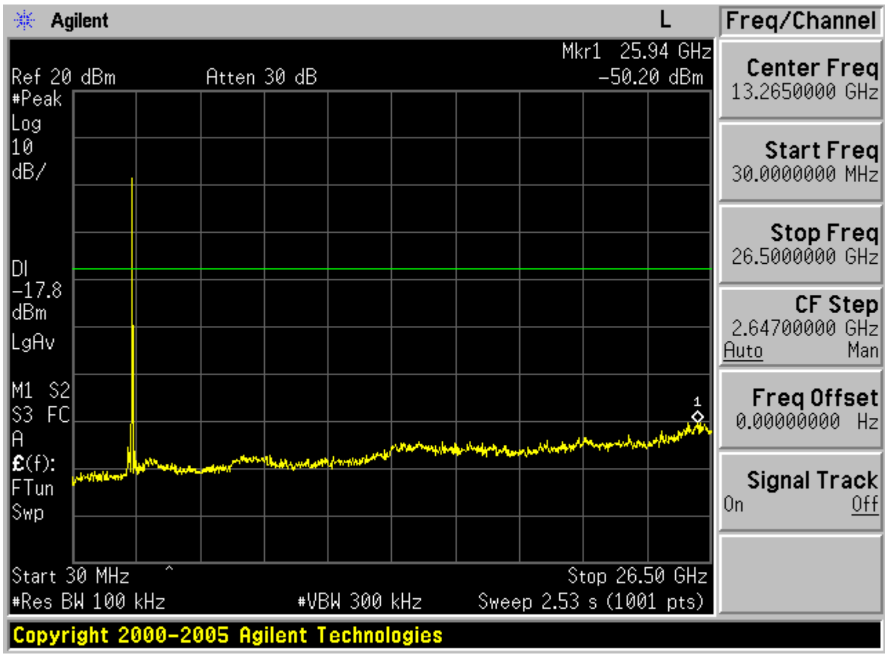
	Reference



	Bandedge

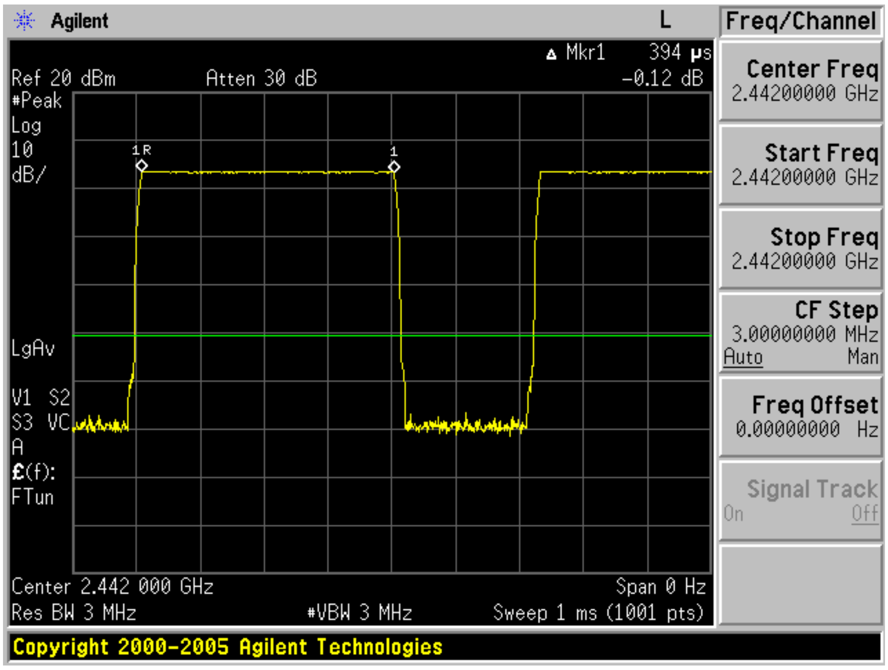


	Spurious


Agilent
L
Mkr1 25.94 GHz
Ref 20 dBm
Atten 30 dB
-50.20 dBm
#Peak
Log
10
dB/
Dl
-17.8
dBm
LgAv
M1 S2
S3 FC
A
£(f):
FTun
Swp
Start 30 MHz
Stop 26.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.53 s (1001 pts)
Freq/Channel
Center Freq
13.2650000 GHz
Start Freq
30.0000000 MHz
Stop Freq
26.5000000 GHz
CF Step
2.64700000 GHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Copyright 2000-2005 Agilent Technologies

9.8 Test Plot for Duty Cycle

BLE	



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)	
	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.

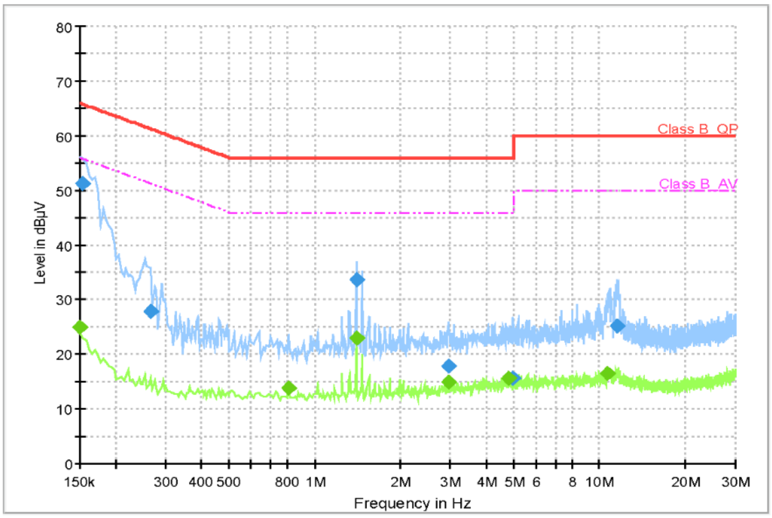
1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected 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.

10.4 Test Result

- AC Line Conducted Emission (Graph)

SP131_BLE_L1

Conducted Emission

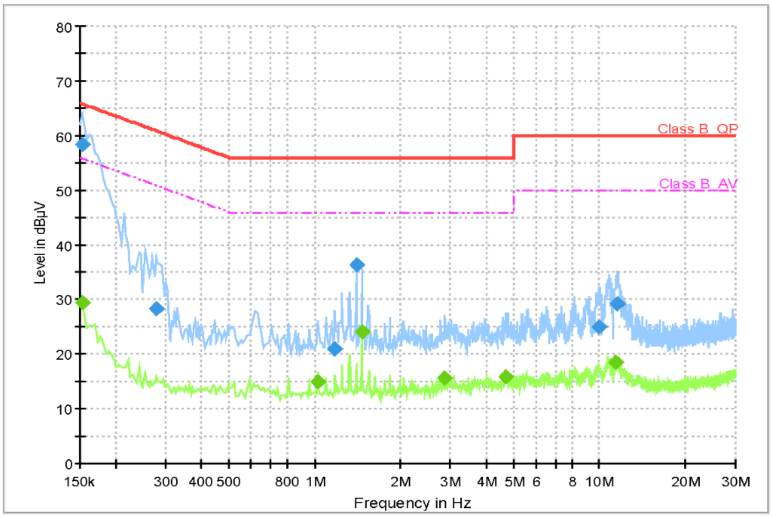


Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.150	---	24.97	56.00	31.03	9	L1	19.2
0.154	51.23	---	65.78	14.55	9	L1	19.3
0.266	27.76	---	61.24	33.48	9	L1	19.3
0.810	---	13.74	46.00	32.26	9	L1	19.8
1.400	33.54	---	56.00	22.46	9	L1	19.7
1.400	---	23.01	46.00	22.99	9	L1	19.7
2.940	17.93	---	56.00	38.07	9	L1	19.7
2.940	---	14.83	46.00	31.17	9	L1	19.7
4.780	---	15.62	46.00	30.38	9	L1	19.8
4.980	15.65	---	56.00	40.35	9	L1	19.8
10.690	---	16.44	50.00	33.56	9	L1	20.0
11.550	25.27	---	60.00	34.73	9	L1	20.0

SP131_BLE_N

Conducted Emission



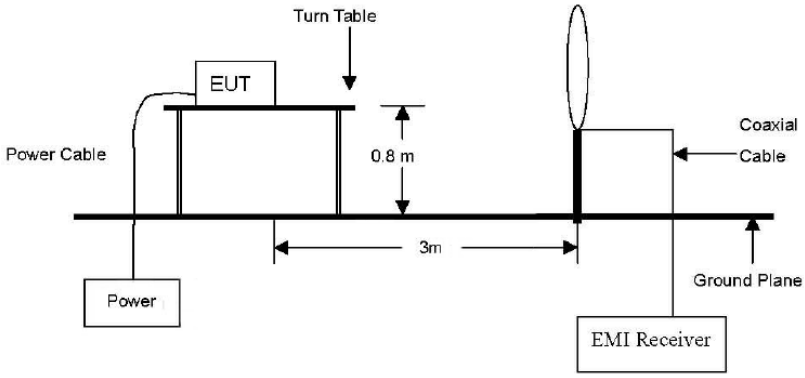
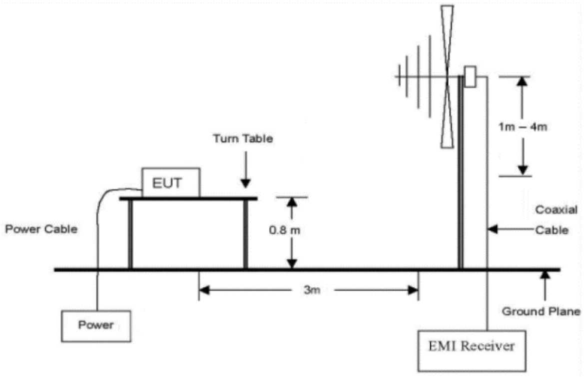
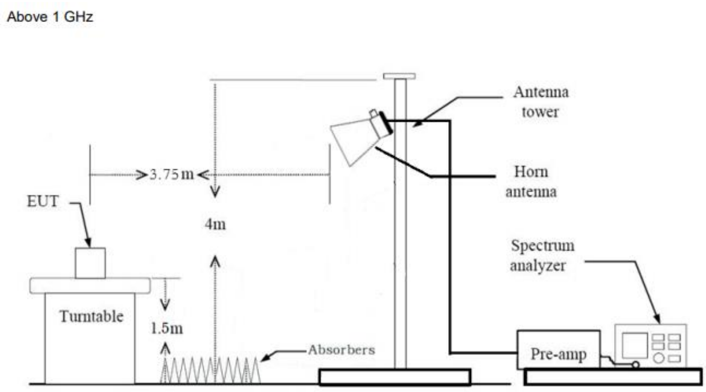
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.154	---	29.48	55.78	26.31	9	N	19.3
0.154	58.31	---	65.78	7.47	9	N	19.3
0.278	28.27	---	60.88	32.60	9	N	19.4
1.030	---	15.03	46.00	30.97	9	N	19.7
1.180	20.97	---	56.00	35.03	9	N	19.7
1.400	36.37	---	56.00	19.63	9	N	19.7
1.470	---	24.17	46.00	21.83	9	N	19.7
2.870	---	15.58	46.00	30.42	9	N	19.7
4.710	---	15.93	46.00	30.07	9	N	19.8
9.960	24.86	---	60.00	35.14	9	N	20.0
11.430	---	18.56	50.00	31.44	9	N	20.0
11.560	29.12	---	60.00	30.88	9	N	20.0

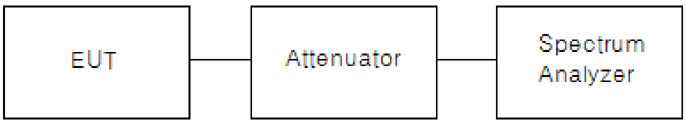
APPENDIX I

TEST SETUP

- Radiated Measurement

below 30 MHz	
below 1 GHz	
above 1 GHz	

- Conducted Measurement

Conducted	

APPENDIX II

TEST EQUIPMENT USED FOR TESTS

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