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#### Report Number: 68.950.13.168.01

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#### **Table of Contents** 1

1	Tabl	le of Contents	2					
2	Deta	Details about the Test Laboratory						
3	Desc	cription of the Equipment Under Test	4					
4	Sum	mary of Test Standards	5					
5	Sum	mary of Test Results	6					
6	Gen	eral Remarks	7					
7	Test	Setups	8					
8	Syst	ems test configuration	9					
9	Tech	hnical Requirement	10					
9	.1	Conducted Emission	10					
9	.2	Conducted peak output power	13					
9	.3	20 dB bandwidth and 99% Occupied Bandwidth	15					
9	.4	Carrier Frequency Separation	20					
9	.5	Number of hopping frequencies	22					
9	.6	Dwell Time	24					
9	.7	Spurious RF conducted emissions	27					
9	.8	Band edge testing	33					
9	.9	Spurious radiated emissions for transmitter and receiver	38					
10	Test Equipment List							
11	System Measurement Uncertainty							



#### 2 **Details about the Test Laboratory**

# Details about the Test Laboratory

Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch 6th Floor, H Hall,Culture Creative Park, No. 4001, Fuqiang Road,
	Futian District 518048, Shenzhen,P.R.C.
Telephone: Fax:	86 755 8828 6998 86 755 828 5299
Test Site 2 Company name:	Audix Technology (shenzhen) Co.,Ltd Block Shenzhen, Science & Industry Park, Nantou, Shenzhen, Guangdong, China
Telephone: Fax:	86 755 2663 9496 86 755 2663 2877



#### **Description of the Equipment Under Test** 3

Product:	Multimedia Speakers 2.0 with Bluetooth				
Model no.:	SPA4270BT/37				
FCC ID:	2AANUSPA4270BT				
IC ID:	11260A-SPA4270BT				
Brand Name:	PHILIPS				
Options and accessories:	NIL				
Rating:	120V~60Hz, 500mA				
RF Transmission	2402-2480MHz				
Frequency: No. of Operated Channel:	79				
Modulation:	GFSK, π/4-DQPSK, 8DPSK				
Duty Cycle:	33.41%				
Antenna Type:	PCB				
Antenna Gain:	0.5dBi				
Description of the EUT:	The Equipment Under Test (EUT) is a Bluetooth Speaker operated at 2.4GHz				



#### **Summary of Test Standards** 4

Test Standards						
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES					
10-1-2013 Edition	Subpart C - Intentional Radiators					
RSS-Gen Issue 3	General Requirements and Information for the Certification of					
December 2010	Radio Apparatus					
RSS-210 Issue 8	RSS-210 — Licence-exempt Radio Apparatus (All Frequency					
December 2010	Bands): Category I Equipment					

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and C63.10 (2009).



#### **Summary of Test Results** 5

	Technical Requirements							
	FCC Part 15 Subpart C, RSS-Gen, RSS-210							
Test Condition			Pages	Test Site	Test Result			
§15.207	RSS-GEN A7.2.4	Conducted emission AC power port	10	Site 2	Pass			
§15.247(b)(1)	RSS-210 A8.4	Conducted peak output power	13	Site 2	Pass			
§15.247(a)(2)	RSS-210 A8.2(a)	6dB bandwidth			N/A			
§15.247(a)(1)	RSS-210 A8.1(a) & RSSGEN 4.6.2	20dB bandwidth and 99% Occupied Bandwidth	15	Site 2	Pass			
§15.247(a)(1)	RSS-210 A8.1(b)	Carrier frequency separation	20	Site 2	Pass			
§15.247(a)(1)(iii)	RSS-210 A8.1(d)	Number of hopping frequencies	22	Site 2	Pass			
§15.247(a)(1)(iii)	RSS-210 A8.1(c)	Dwell Time	24	Site 2	Pass			
§15.247(e)	RSS-210 A8.2(b)	Power spectral density*			N/A			
§15.247(d)	RSS-210 A8.5	Spurious RF conducted emissions	27	Site 2	Pass			
§15.247(d)	RSS-210 A8.5	Band edge	33	Site 2	Pass			
§15.247(d) & §15.209 &	RSS-210 2.5 & RSSGEN 7.2.5 & RSSGEN 6.1	Spurious radiated emissions for transmitter and receiver	38	Site 2	Pass			
§15.203	RSSGEN 7.1.2	Antenna requirement	See	e note 2	Pass			

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a permanently ceramic antenna, which gain is 0dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.



# 6 General Remarks

### Remarks

This submittal(s) (test report) is intended for FCC ID: 2AANUSPA4270BT, IC ID: 11260A-SPA4270BT complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-210.

## SUMMARY:

All tests according to the regulations cited on page 5 were

Performed

- Not Performed

The Equipment Under Test

- - Fulfills the general approval requirements.
- □ **Does not** fulfill the general approval requirements.

Sample Received Date: January 2, 2014

Testing Start Date: January 6, 2014

Testing End Date:

January 17, 2014

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

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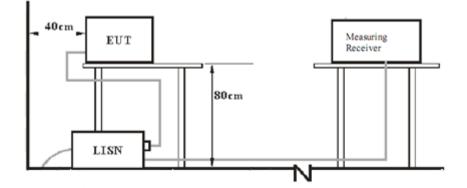
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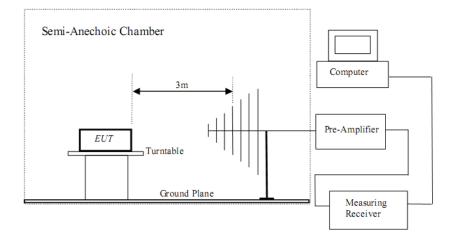


#### **Test Setups** 7

# 7.1 AC Power Line Conducted Emission test setups



# 7.2 Radiated test setups



# 7.3 Conducted RF test setups





# 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
NoteBook	Lenovo	X200	

Test software: ASTTestTool, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power



# 9 Technical Requirement

# 9.1 Conducted Emission

## **Test Method**

- 1. The EUT was placed on a table, which is 0.8m above ground plane
- 2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
- 3. Maximum procedure was performed to ensure EUT compliance
- 4. A EMI test receiver is used to test the emissions from both sides of AC line

## Limit

According to §15.207 & RSS-GEN A7.2.4, conducted emissions limit as below:

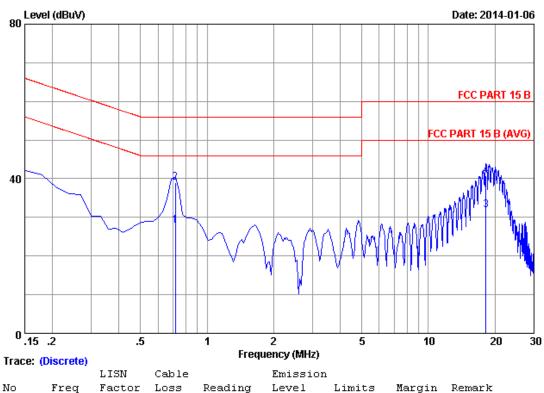
Frequency		QP Limit	AV Limit				
	MHz	dBµV	dBµV				
_	0.150-0.500	66-56*	56-46*				
	0.500-5	56	46				
	5-30	60	50				
D	Decreasing linearly with logarithm of the frequency						

Page 10 of 42



#### **Conducted Emission**

Product Type M/N		Multimedia Speakers 2.0 with Bluetooth SPA4270BT/37
Operating Condition		Transmitting
Test Specification	:	Line
Comment	:	AC 120V/60Hz



NO 	(MHz)	(dB)	LOSS (dB)	(dBuV)	Level (dBuV)	(dBuV)	(dB)	Remark
1	0.71700	0.17	0.03	27.59	27.79	46.00	18.21	Average
2	0.71700	0.17	0.03	38.70	38.90	56.00	17.10	QP
3	18.239	1.46	0.13	30.23	31.82	50.00	18.18	Average
4	18.239	1.46	0.13	39.10	40.69	60.00	19.31	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.

2. If the average limit is met when useing a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

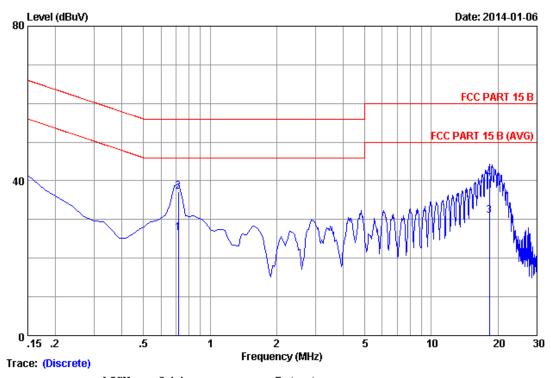


#### **Conducted Emission**

Product Type	:	Μu
M/N	:	SF
Operating Condition	:	Tra
Test Specification	:	Ne
Comment	:	AC

Multimedia Speakers 2.0 with Bluetooth SPA4270BT/37 Transmitting Neutral

AC 120V/60Hz



		LISN	Cable		Emission	1		
No	Freq (MHz)	Factor (dB)	Loss (dB)	Reading (dBuV)	Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.71700	0.27	0.03	26.23	26.53	46.00	19.47	Average
2	0.71700	0.27	0.03	36.90	37.20	56.00	18.80	QP
3	18.298	1.12	0.13	29.78	31.03	50.00	18.97	Average
4	18.298	1.12	0.13	39.20	40.45	60.00	19.55	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.

 If the average limit is met when useing a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

Report Number: 68.950.13.168.01



# 9.2 Conducted peak output power

# **Test Method**

- Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Add a correction factor to the display.
- 3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

# Limits

According to §15.247 (b) (1) and RSS-210 A8.4, conducted peak output power limit as below:

	Frequency Range	Limit	Limit
_	MHz	W	dBm
	2400-2483.5	≤1	≤30



# Conducted peak output power

Bluetooth Mode GFSI	K modulation Test Conducted Peak	t Result
Frequency	Output Power	Result
MHz	dBm	
Low channel 2402MHz	7.40	Pass
Middle channel 2441MHz	6.98	Pass
High channel 2480MHz	8.20	Pass

#### Bluetooth Mode π/4-DQPSK modulation Test Result Conducted Peak

Frequency MHz	Output Power dBm	Result
Low channel 2402MHz	5.93	Pass
Middle channel 2441MHz	5.50	Pass
High channel 2480MHz	6.67	Pass

### Bluetooth Mode 8DPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	6.05	Pass
Middle channel 2441MHz	5.61	Pass
High channel 2480MHz	6.80	Pass



# 9.3 20 dB bandwidth and 99% Occupied Bandwidth

## **Test Method**

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.

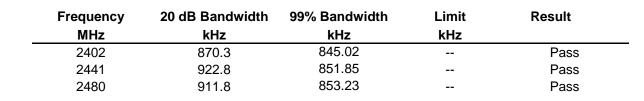
## Limit

Limit [kHz]

N/A



## 20 dB bandwidth and 99% Occupied Bandwidth



Bluetooth Mode GFSK Modulation test result



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#### m Analyzer - Occupied BV GHZ Center Freq: 2.44100000 GHz Trig: Free Run Avg|Hold>10/10 #IFGain:Low #Atten: 30 dB F 01:25:29 PM Jan 06, 2014 Radio Std: None Frequency Center Freq 2.441000000 GHz Radio Device: BTS Ref Offset 1 dB Ref 20.00 dBm Center Fred 2.441000000 GHz CF Step 300.000 kHz Man Center 2.441 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms Auto #VBW 100 kHz Total Power 14.1 dBm **Occupied Bandwidth** Freq Offset 0 Hz 851.85 kHz Transmit Freq Error -159 Hz **OBW Power** 99.00 % 922.8 kHz -20.00 dB x dB Bandwidth x dB Align Now, All required

#### 20 dB bandwidth and 99% Occupied Bandwidth



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## 20 dB bandwidth and 99% Occupied Bandwidth

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
 2402	1215	1143.2		Pass
2441	1215	1142.1		Pass
2480	1215	1138.0		Pass

Bluetooth Mode 8DPSK Modulation test result



Report Number: 68.950.13.168.01







Report Number: 68.950.13.168.01

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# 9.4 Carrier Frequency Separation

## **Test Method**

- 1. Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels, RBW  $\geq$  1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. By using the Max-Hold function record the separation of two adjacent channels.
- 3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
- 4. Repeat above procedures until all frequencies measured were complete.

## Limit

Limit kHz ≥25KHz or 2/3 of the 20 dB bandwidth which is greater

## **GFSK Modulation Limit**

Frequency	2/3 of 20 dB Bandwidth
MHz	kHz
2402	580.20
2441	615.20
2480	607.87



### **Carrier Frequency Separation**

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

#### **GFSK Modulation test result**

Frequency MHz	Carrier Frequency Separation kHz	Result
2402	1000	Pass
2441	1000	Pass
2480	1000	Pass





# 9.5 Number of hopping frequencies

## **Test Method**

- 1. Use the following spectrum analyzer settings:
- Span = wide enough to capture the peaks of two adjacent channels, RBW  $\ge$  1% of the span, VBW)  $\ge$ RBW, Sweep = auto, Detector function = peak
- 2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
- 3. Record all the signals from each channel until each one has been recorded.
- 4. Repeat above procedures until all frequencies measured were complete.

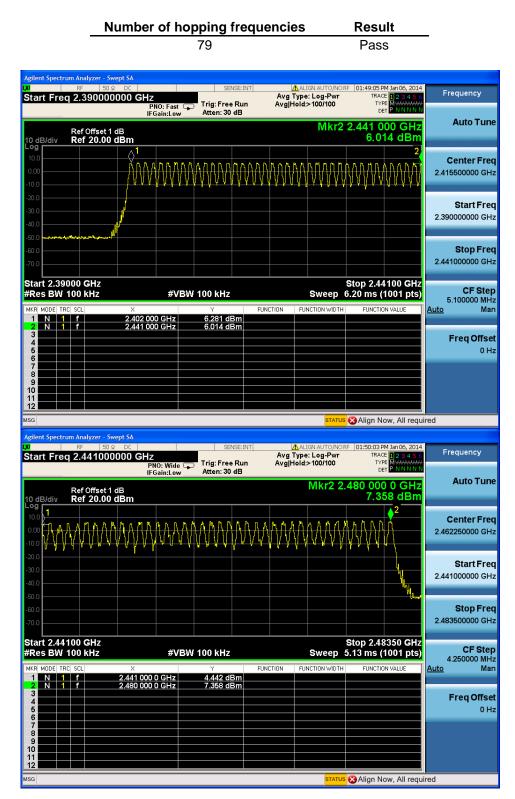
## Limit

Limit <u>number</u> ≥ 15



#### Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.



Report Number: 68.950.13.168.01

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Page 23 of 42



# 9.6 Dwell Time

# **Test Method**

- 1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. Equipment mode: Spectrum analyzer
- 2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
- 3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
- 4. Measure the Dwell Time by spectrum analyzer Marker function.
- 5. Repeat above procedures until all frequencies measured were complete.

## Limit

According to §15.247(a)(1)(iii) & RSS-210 A8.1(c) The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.



#### **Dwell Time**

#### Dwell time

The maximum dwell time shall be 0,4 s.

According to the Bluetooth Core Specification, the worse result (DH5 mode) was reported to show compliance.

The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows: The duration for dwell time calculation: 0.4 [s] \* hopping number = 0.4 [s] \* 79 [ch] = 31.6 [s\*ch]; The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 31.6s for DH5=1600 / 6 / 79 \*31.6=106.67

#### Test Result

Modulation	Mode	Reading (µs)	Total Hops	Test Result (ms)	Limit (ms)	Result
GFSK	DH5	2995	106.67	319.48	< 400	Pass
π/4-DQPSK	2DH5	2990	106.67	318.94	< 400	Pass
8-DPSK	3DH5	2990	106.67	318.94	< 400	Pass

**GFSK Modulation** 





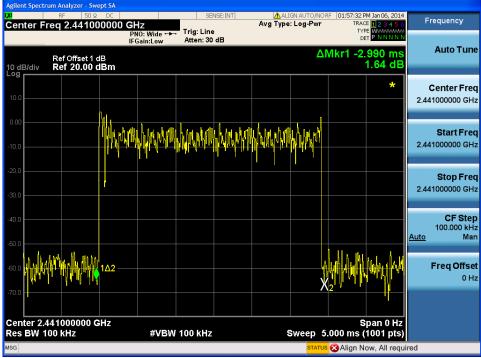
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Page 25 of 42

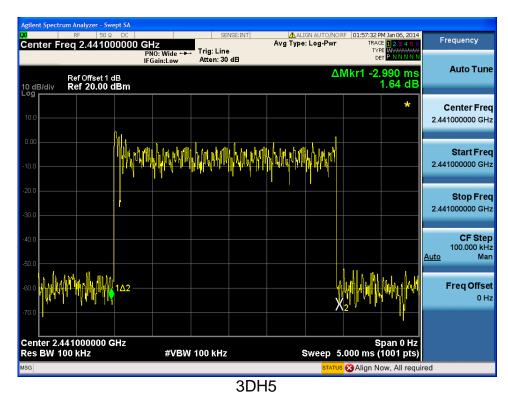


## π/4-DQPSK Modulation



2DH5

# 8-DPSK Modulation



Report Number: 68.950.13.168.01

#### Page 26 of 42



# 9.7 Spurious RF conducted emissions

## **Test Method**

1. Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold

- Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
- 3. The level displayed must comply with the limit specified in this Section. Submit these plots.
- 4. Repeat above procedures until all frequencies measured were complete.

### Limit

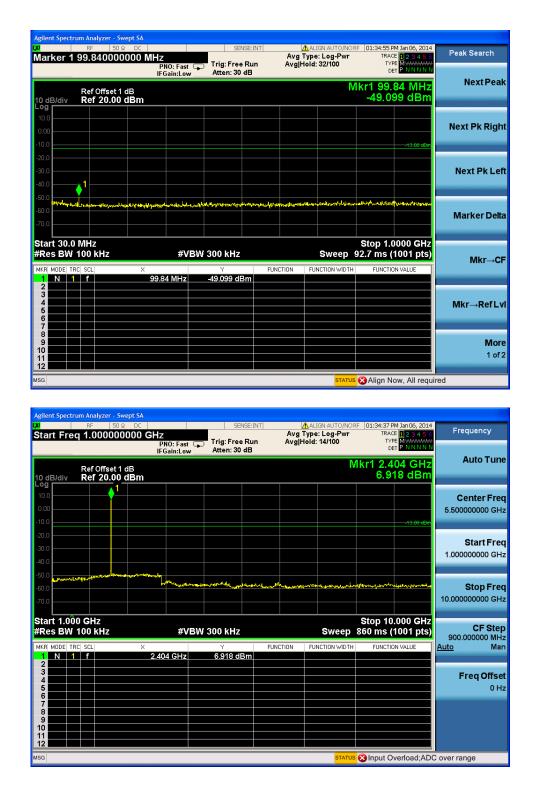
Frequency Range MHz	Limit (dBc)
30-25000	-20



## Spurious RF conducted emissions

Only the worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

#### 2402MHz



Report Number: 68.950.13.168.01

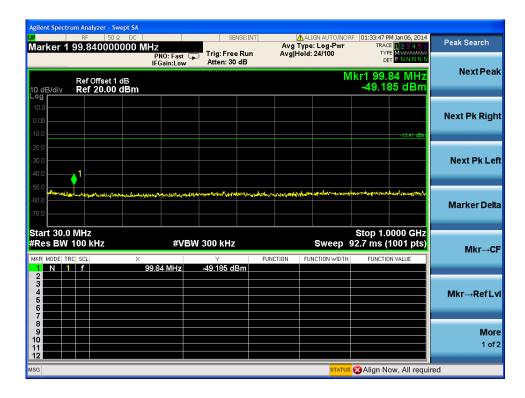
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#### Spurious RF conducted emissions

arker 1 23.9200000000000000000000000000000000000	IO GHZ PNO: Fast C IFGain: I ow Atten: 30 d	Avg Type: Log-Pwr un Avg Hold: 1/100	RF         01:35:06 PM Jan 06, 2014           TRACE         1 2 3 4 5 6           TYPE         MWWWWW           DET         P. N N N N	Peak Search
Ref Offset 1 dB 0 dB/div Ref 20.00 dBm		Μ	kr1 23.920 GHz -53.702 dBm	NextPeak
10.0 0.00 10.0				Next Pk Righ
20.0 30.0 40.0			1	Next Pk Lef
60.0 60.0 <mark>- АНДинтики, Милик, Малик, Суру, Мини</mark> 70.0	hand to differ a statistical poly for the press of a statistical poly of the	allantarhousen an		Marker Delt
Start 10.000 GHz KRes BW 100 kHz KR MODE TRC SCL × 1 N 1 f 23	#VBW 300 kHz 3.920 GHz -53.702 dBr	FUNCTION FUNCTION WIDTH	Stop 25.000 GHz p 1.43 s (1001 pts)	Mkr→Cl
2 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4				Mkr→RefLv
7 8 9				Mon

#### 2441MHz



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Page 29 of 42



tart Freq 1.00	50 Ω DC 0000000 GHz PN0:	SENSE:I™ Fast	Avg	ALIGN AUTO/NOF Type: Log-Pwr Iold: 21/100	TRACE TYPE	123456 MWWWWW	Frequency
OdB/div Ref 2	IFGair fset 1 dB 0.00 dBm			N	1kr1 2.44	<sup>P NNNNN</sup> 0 GHz 5 dBm	Auto Tun
							Center Fre 5.500000000 GH
0.0 0.0 0.0 0.0						-13.41 dBm	<b>Start Fre</b> 1.000000000 Gi
0.0		Augustalauthauthauthauthauthau	and main and an and a second descent	poloninasin'ny oranjina	يو <mark>لەسىمەر يارى</mark>	***** <b>*</b> ******	<b>Stop Fr</b> 10.00000000 G
tart 1.000 GHz Res BW 100 kH	Iz × 2.440 G	#VBW 300 kHz	FUNCTION	Sweep FUNCTION WIDTH	Stop 10.0 860 ms (1 FUNCTION	001 pts)	<b>CF Ste</b> 900.000000 MI <u>Auto</u> M
1 N 1 f							
1         N         1         f           2							Freq Offs 01

larker 1	RF 50 24.14500		GHz PNO: Fast ( EGain: Low				IGN AUTO/NOR 2: Log-Pwr : 2/100	TRACE	1 2 3 4 5 6 MWWWWW P N N N N N	Peak Search
0 dB/div	Ref Offset Ref 20.00	1 dB	Call.LUw				M	(r1 24.14 -52.98	45 GHz 4 dBm	NextPea
. <b>og</b> 10.0 0.00 10.0									-13.41 dBm	Next Pk Rig
20.0 30.0 40.0									1	Next Pk Le
50.0 60.0	1999 an Alland Property and the op	YIR. of the Canadan	stalentad for a state of the	alder meditioner and	ŧ <mark>ġa<sup>l</sup>usk<sub>Y</sub>u ≵piteren</mark> ¶*ü	interferingenetation	a tegan di saas min di sa	all have been appeared and an and		Marker De
IKR MODE T	100 kHz	× 24.1	#VB	W 300 kHz Y -52.984 d	FUN	ICTION FU	Sweep	Stop 25. 1.43 s (1	001 pts)	Mkr→C
2 3 4 5 6 7										Mkr→RefL
8 9 10										<b>Mo</b> 1 o

 Report Number: 68.950.13.168.01
 Page 3

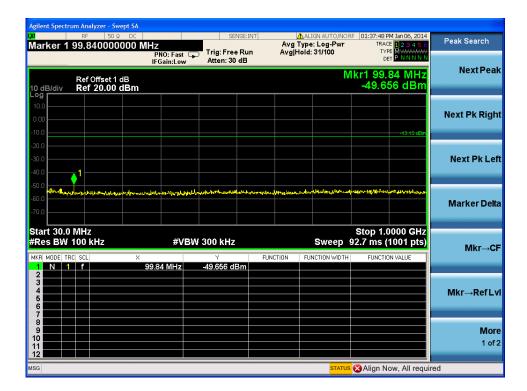
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#### **Spurious RF conducted emissions**

#### 2480MHz







# Spurious RF conducted emissions

Agilent Spectrum Analyzer - Swept X RF 50 Q ( Marker 1 24.61000000	0000 GHz PN0: Fast (	SENSE:II	Avg	ALIGN AUTO/NOF Type: Log-Pwr Iold: 1/100	F 01:37:56 PM Jan 06, 2014 TRACE 1 2 3 4 5 6 TYPE MWWWWWW DET P N N N N N	Peak Search
Ref Offset 1 dB 10 dB/div Ref 20.00 dB	IFGain:Low_	Atten: 30 dB		MI	(r1 24.610 GHz -53.651 dBm	Next Peak
Log 10.0 0.00 -10.0					-13.15 dBm	Next Pk Right
-20.0						Next Pk Lef
50.0	and the state of t	the the second states and the second s	<u>Hananak</u> herikkaappa	watuulkuttu kapananakakka	annan dan bernandera	Marker Delta
Start 10.000 GHz           #Res BW 100 kHz           MKR MODE           1         N           1         N	#VB × 24.610 GHz	W 300 kHz Y -53.651 dBm	FUNCTION	Sweep	Stop 25.000 GHz 1.43 s (1001 pts) FUNCTION VALUE	Mkr→CF
2 3 4 4 5 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7						Mkr→RefLv
8 9 10 11 12						More 1 of 2
ISG				STATUS	SAlign Now, All requir	ed



#### **Test Method**

1 Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW  $\ge$  RBW, Sweep = auto, Detector function = peak, Trace = max hold

- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

### Limit:

According to §15.247(d) and RSS-210 A8.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen7.2.2, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.



**GFSK Modulation Test Result:** Hopping on mode:

gilent Spectrum Analyzer - S RF 50		SENSE:INT	ALIGN AUTO/NC	RF 01:47:02 PM Jan 06, 2014	
tart Freq 2.31000	0000 GHz PNO: Fas	t 🖵 Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN	Frequency
	IFGain:Lo	W Atten: 30 dB	M	kr1 2.402 0 GHz	Auto Tu
Ref Offset 1 0 dB/div Ref 20.00				6.923 dBm	
og 10.0					Center Fre
				ÁDADAAA	2.36000000 GI
10.0				/14444	
20.0					Start Fre
30.0				3	2.310000000 GI
40.0				\$ <sup>2</sup>	
50.0					Stop Fre
70.0					2.41000000 GI
tart 2.31000 GHz				Stop 2.41000 GHz	
Res BW 100 kHz	#\	/BW 300 kHz	Sweep	9.60 ms (1001 pts)	CF Ste
IKR MODE TRC SCL	×	Y 1	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	10.000000 Mi Auto Mi
1 N 1 f 2 N 1 f	2.402 0 GHz 2.390 0 GHz	6.923 dBm -50.718 dBm			
3 N 1 f	2.400 0 GHz	-45.989 dBm			Freq Offs
5					01
7					
8					
0					
2					
GG			STATU	s <mark>⊗</mark> Align Now, All requi	red
gilent Spectrum Analyzer - S RF 50	Ω DC 0000 GHz PNO: Wid	e C Trig: Free Run w Atten: 30 dB		RF 01:46:09 PM Jan 06, 2014	red Frequency
glent Spectrum Analyzer - S RE 50 tart Freq 2.477001 Ref Offset 1 0 dB/div Ref 20.00	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	IRF 01:46:09 PM Jan 06, 2014 TRACE 02:4 5 6	Frequency
si gilent Spectrum Analyzer - S RF   50 tart Freq 2.477000 Ref Offset 1 0 dB/div Ref 20.00 ° ■ ▲ 1	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan 05, 2014 TRACE 12 3 4 5 6 TYPE MUNITOR DET PUNINN N DET PUNINN N 2.479 904 GHz	Frequency Auto Tur
si gilent Spectrum Analyzer - S kart Freq 2.477000 Ref Offset 1 0 dB/div Ref 20.00 0 d 0 d D d 0	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan 05, 2014 TRACE 12 3 4 5 6 TYPE MUNITOR DET PUNINN N DET PUNINN N 2.479 904 GHz	Frequency Auto Tur Center Fre
si gilent Spectrum Analyzer - S RF   50 tart Freq 2.477000 Ref Offset 1 0 dB/div Ref 20.00 ° ■ ▲ 1	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan 05, 2014 TRACE 12 3 4 5 6 TYPE MUNITOR DET PUNINN N DET PUNINN N 2.479 904 GHz	Frequency Auto Tur Center Fre
silent Spectrum Analyzer - So           RF         [So           tart Freq 2.477000           0 dB/div         Ref Offset 1           0 dB/div         Ref 20.00           9         1           10.0         1	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan06, 2014 TRACE 1 2 3 4 5 6 TYPE MUNAWW DET PININN N 2.479 904 GHz 7.615 dBm	Frequency Auto Tur Center Fr 2.493500000 Gi
36         RF         150           tart Freq 2.477000         Ref Offset 1         1           0 dB/div         Ref 20.00         9         1           0.0         0         1         1         1	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan06, 2014 TRACE 1 2 3 4 5 6 TYPE MUNAWW DET PININN N 2.479 904 GHz 7.615 dBm	Frequency Auto Tur Center Fr 2.493500000 G Start Fro
36         RF         150           tart Freq 2.477000         Ref Offset 1         1           0 dB/div         Ref 20.00         9         1           0.00         0         1         1         1           0.00         0         1	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan06, 2014 TRACE 1 2 3 4 5 6 TYPE MUNAWW DET PININN N 2.479 904 GHz 7.615 dBm	Frequency Auto Tur Center Fr 2.493500000 G Start Fro
signet Spectrum Analyzer - 5 RF 50 tart Freq 2.477000 0 dB/div Ref Offset 1 0 dB/div Ref 20.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan06, 2014 TRACE 1 2 3 4 5 6 TYPE MUNAWW DET PININN N 2.479 904 GHz 7.615 dBm	Frequency Auto Tur Center Fro 2.493500000 Gi Start Fro 2.477000000 Gi
signt Spectrum Analyzer - S RF 50 tart Freq 2.477000 G dB/div Ref 20.00 9 10 0 0 0 0 0 0 0 0 0 0 0 0 0	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan06, 2014 TRACE 1 2 3 4 5 6 TYPE MUNAWW DET PININN N 2.479 904 GHz 7.615 dBm	Frequency Auto Tur Center Fr 2.493500000 Gi Start Fr 2.477000000 Gi Stop Fr
signet Spectrum Analyzer - S RF 50 tart Freq 2.477000 G dB/div Ref 20.00 9 9 10 0 0 0 0 0 0 0 0 0 0 0 0 0	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	Auton Auto/No Avg Type: Log-Pwr Avg Hold>100/100	RF 01:46:09 PM Jan06, 2014 TRACE 1 2 3 4 5 6 TYPE MUNAWW DET PININN N 2.479 904 GHz 7.615 dBm	Frequency Auto Tur Center Fre 2.493500000 Gi Start Fre 2.477000000 Gi Stop Fre
gient Spectrum Analyzer _ S RF _ [50 tart Freq 2.477000 0 dB/div Ref 20.00 0 dB/div Ref 20.00 0 dB/div Ref 20.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Ω DC 0000 GHz PNO: Wid IFGain:Lo	e 😱 Trig: Free Run	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	INF         01:46:09 PM Jan06, 2014           TRACE         3:3:4:5:6           TYPE         MWWWW           2.479         904           7.615         dBm           -12:39.45%         -12:39.45%           Stop 2.51000         GHz	Frequency Auto Tur Center Fro 2.493500000 Gi Start Fro 2.477000000 Gi Stop Fro 2.510000000 Gi
signt Spectrum Analyzer - S RF 50 tart Freq 2.477000 Comparison of the second secon	CC C C C C C C C C C C C C C C C C	e 😱 Trig: Free Run	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:46:09 PM Jan06, 2014 TRACE 1 2 3 4 5 6 TYPE MUNAWW DET PININN N 2.479 904 GHz 7.615 dBm	Frequency Auto Tur Center Fr 2.493500000 G Start Fr 2.477000000 G Stop Fr 2.510000000 G
silent Spectrum Analyzer - S RF 0ffset 1 0 dB/div Ref 20.00 0 d	CC     CO     CHz     PN0:Wid     FGain:Lo     I dB     dBm     C	rrig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:46:09 PM Jan05, 2014 TRACE 02:34 5 6 TYPE P VINNEN 2.479 904 GHz 7.615 dBm 12:39 dBm 12:39 dBm 5.000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 Gl Start Fre 2.477000000 Gl Stop Fre 2.510000000 Gl CF Ste 3.300000 Ml
silent Spectrum Analyzer - S RF 0ffset 1 0 dB/div Ref 20.00 0 d	Q DC GHz PN0: Wid If Gain:Lo I dB dBm Q 2 2 4 2 4 2 4 2 4 2 4	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:46:09 PM Janob, 2014 TRACE 02:34 5 6 TYPE P NUMMAN 2.479 904 GHz 7.615 dBm 12:39 dBm 12:39 dBm 5 construction Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 Gl Start Fre 2.477000000 Gl Stop Fre 2.510000000 Gl CF Ste 3.300000 Ml
SG         SIG         Ref Offset 1         O db/div         Ref Offset 1         O db/div         Ref Offset 1         O db/div         O db/di	CC     CO     CHz     PN0:Wid     FGain:Lo     I dB     dBm     C	E Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:46:09 PM Janob, 2014 TRACE 02:34 5 6 TYPE P NUMMAN 2.479 904 GHz 7.615 dBm 12:39 dBm 12:39 dBm 5 construction Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 Gi Start Fre 2.477000000 Gi Stop Fre 2.510000000 Gi 3.300000 Mi Auto M
gilent Spectrum Analyzer _ S       RF       Itart Freq 2.477000       0 </td <td>© DC   0000 GHz PN0: Wid IFGain:Lo 1 dB 0 dBm ↓ 2 ↓ 2 ↓ 2 ↓ 2 ↓ 4 ↓ 2 ↓ 4 ↓</td> <td>E Trig: Free Run Atten: 30 dB</td> <td>ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold&gt;100/100 Mkr1</td> <td>RF 01:46:09 PM Janob, 2014 TRACE 02:34 5 6 TYPE P NUMMAN 2.479 904 GHz 7.615 dBm 12:39 dBm 12:39 dBm 5 construction Stop 2.51000 GHz 3.20 ms (1001 pts)</td> <td>Frequency Auto Tur Center Fre 2.493500000 GH Start Fre 2.477000000 GH 2.510000000 GH 3.300000 MH Auto Mi Freq Offs</td>	© DC   0000 GHz PN0: Wid IFGain:Lo 1 dB 0 dBm ↓ 2 ↓ 2 ↓ 2 ↓ 2 ↓ 4 ↓ 2 ↓ 4 ↓	E Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:46:09 PM Janob, 2014 TRACE 02:34 5 6 TYPE P NUMMAN 2.479 904 GHz 7.615 dBm 12:39 dBm 12:39 dBm 5 construction Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 GH Start Fre 2.477000000 GH 2.510000000 GH 3.300000 MH Auto Mi Freq Offs
gilent Spectrum Analyzer - S       RF ISO       tart Freq 2.477000       O dB/div       Ref Offset 1       O dB/div       Ref Offset 1       O dB/div       Ref Offset 1       O dB/div       O dB/div   <	© DC   0000 GHz PN0: Wid IFGain:Lo 1 dB 0 dBm ↓ 2 ↓ 2 ↓ 2 ↓ 2 ↓ 4 ↓ 2 ↓ 4 ↓	E Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:46:09 PM Janob, 2014 TRACE 02:34 5 6 TYPE P NUMMAN 2.479 904 GHz 7.615 dBm 12:39 dBm 12:39 dBm 5 construction Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 GH Start Fre 2.477000000 GH Stop Fre 2.510000000 GH
363       374       374       374         374       374       374       374         375       374       374       374         376       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       374       374       374         377       3	© DC   0000 GHz PN0: Wid IFGain:Lo 1 dB 0 dBm ↓ 2 ↓ 2 ↓ 2 ↓ 2 ↓ 4 ↓ 2 ↓ 4 ↓	E Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:46:09 PM Janob, 2014 TRACE 02:34 5 6 TYPE P NUMMAN 2.479 904 GHz 7.615 dBm 12:39 dBm 12:39 dBm 5 construction Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 GH Start Fre 2.477000000 GH 2.510000000 GH 2.510000000 GH 3.300000 MH Auto Ma Freq Offs

11

Align Now, All required

 Report Number: 68.950.13.168.01
 Page 3

 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

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### Hopping off mode:

Analyzer - Swept SA Avg Type: Log-Pwr Avg|Hold:>100/100 :55 PM Jan TRACE 1 2 TYPE MV DET P N Frequency Start Freq 2.310000000 GHz Trig: Free Run Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.401 865 GHz 6.994 dBm Ref Offset 1 dB Ref 20.00 dBm **Center Freq** 2.357500000 GHz Start Freq 2.310000000 GHz  $\langle \rangle^2$ Stop Freq 2.40500000 GHz Start 2.31000 GHz #Res BW 100 kHz Stop 2.40500 GHz 9.13 ms (1001 pts) CF Step 9.500000 MHz #VBW 300 kHz Sweep Man Auto 6.994 dBm -50.157 dBm -37.154 dBm 234 2.390 000 GHz 2.400 000 GHz N Freq Offset 156789 0 Hz 10 11 12 MSG 🛿 Align Now, All required Frequency Start Freq 2.477000000 GHz Avg Type: Log-Pwr Avg|Hold:>100/100 HZ PNO: Wide Trig: Free Run IFGain:Low Atten: 30 dB TYPE MWW DET P N N Auto Tune Mkr1 2.479 871 GHz 7.839 dBm Ref Offset 1 dB Ref 20.00 dBm 10 dB/div Log **r Center Freq** 2.493500000 GHz Start Freq 2.477000000 GHz 2  $\langle \rangle$ Stop Freq 2.510000000 GHz Start 2.47700 GHz #Res BW 100 kHz Stop 2.51000 GHz Sweep 3.20 ms (1001 pts) CF Step 3.300000 MHz #VBW 300 kHz Auto Mar 2.479 871 2.483 500 2 500 000 49.070 dBn 49.476 dBn Freq Offset 0 Hz 7 8 9 10 11 12

SG

🔀 Align Now, All required

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8DPSK Modulation Test Result: Hopping on mode:

gilent Spectrum Analyzer - Swe RF 50 Ω		SENSE:INT	ALIGN AUTO/NC	RF 01:43:55 PM Jan 06, 2014	E.
tart Freq 2.3100000	PNO: Fast	Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 123456 TYPE MWWWW DET PNNNNN	Frequency
	IFGain:Low	Atten: 30 dB			Auto Tu
Ref Offset 1 d 0 dB/div Ref 20.00 d			IAII	r1 2.406 9 GHz 5.369 dBm	
log				1	
10.0				A A A B BOOK	Center Fre
0.00				<u> Aradhah da</u>	2.36000000 G
20.0				-14.63 dBm	
30.0					Start Fr
40.0				· 3	2.31000000 G
50.0	والمحاف الانفاصة الرحوان الدريان ووستوادراهم	بالمحود موسيا وموجو ما المحر	-	Land the second	
50.0					Stop Fr
70.0					2.41000000 G
tart 2.31000 GHz				Stop 2.41000 GHz	
Res BW 100 kHz	#VE	SW 300 kHz	Sweep	9.60 ms (1001 pts)	CF Ste
IKR MODE TRC SCL	X	Y	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	10.000000 M Auto M
1 N 1 f 2 N 1 f	2.406 9 GHz 2.390 0 GHz	5.369 dBm -49.664 dBm			
3 N 1 f	2.400 0 GHz	-43.954 dBm			Freq Offs
4 5					. 01
6					
8					
10					
12 SG			STATU	<sup>s</sup> ⊗Align Now, All requi	ired
2 3G cjilent Spectrum Analyzer - Swey RF 50 Q	DC 100 GHz PNO: Wide (	SENSE:INT		RF 01:45:29 PM Jan 06, 2014	red Frequency
i2 sg gilent Spectrum Analyzer - Sweg RF 50 Ω Start Freq 2.4770000 Ref Offset 1 d	DC DOD GHz PNO: Wide ( IFGain:Low	Talas France Dava	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency
glient Spectrum Analyzer - Swee RF 50 Q itart Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:20 PM Jan 06, 2014 TRACE 1234 55 TYPE M DET P NNNNN	Frequency
glient Spectrum Analyzer - Swee RF 50 Q Start Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur
glient Spectrum Analyzer - Swee RF 50 Q Start Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur Center Fre
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur Center Fre
12 glient Spectrum Analyzer - Swee RF 50 Q Start Freq 2.4770000 Ref Offset 1 d Ref 20.00 d 0 00 0	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur Center Fr 2.493500000 G
12 glient Spectrum Analyzer - Swee RF 50 Q Start Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d 0 00 0	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur Center Fr 2.493500000 G Start Fra
12 sc sc sc sc sc sc sc sc sc sc	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur Center Fr 2.493500000 G Start Fra
12 gilent Spectrum Analyzer - Sweg scalart Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d 0 00 0 0 0 00 0 0	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur Center Fr 2.493500000 G Start Fr 2.477000000 G
i2 sG sG sG sG RF SO Ω start Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d 0 0 0 0 0 0 0 0 0 0 0 0 0 0	DC DOD GHz PNO: Wide ( IFGain:Low	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan 06, 2014 TRACE 128 34 55 TYPE MWWWW DET PINNINN 2.479 178 GHz	Frequency Auto Tur Center Fn 2.493500000 G Start Fn 2.477000000 G Stop Fn
12 glient Spectrum Analyzer - Swee itart Freq 2.4770000 0 dB/div Ref 20.00 d 10 0 0 dB/div Ref 20.00 d 10 0 0 00 0 0 0 0 0 0 0 0 0 0 0	DC DOO GHz PNO: Wide ( IFGain:Low B	Trig: Free Run	I <u>A</u> ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100	RF 01:45:29 PM Jan06, 2014 TRACE 12 3 4 5 6 TYPE MWWWW DET PINNINN 2.479 178 GHz 6.150 dBm 13:69 dbm	Frequency Auto Tur Center Fn 2.493500000 G Start Fn 2.477000000 G Stop Fn
2 glient Spectrum Analyzer - Sweg scalart Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 2 2 2 00 GH2 PNO: Wide IFGain:Low B B M 2 2 2 2 2 2 2 2 2 2 2 2 2	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:45:29 PM Jan06, 2014 TRACE 02:3:45 6 TYPE PM WANNAW DET PNNNNN 2.479 178 GHz 6.150 dBm 	Frequency Auto Tu Center Fr 2.493500000 G Start Fr 2.477000000 G Stop Fr 2.510000000 G
i2 gilent Spectrum Analyzer - Swee so and the second sec	DO CHZ PNO: Wide ( IFGain:Low B Bm 2 2 2 4 4 4 4 4 4 4	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:45:29 PM Janob, 2014 TRACE 23 4 5 6 TYPE P NUMBER 2.479 178 GHz 6.150 dBm -13:65 dbm -13:65 dbm Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fro 2.493500000 G Start Fro 2.477000000 G Stop Fro 2.510000000 G
i2         I2           glient Spectrum Analyzer - Sweg         Ref Offset 1 d           o dB/div         Ref Offset 1 d           0 dB/div         Ref 20.00 d           0 dB/div <td>DO GHZ PNO: Wide ( IFGain:Low B Bm 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4</td> <td>Trig: Free Run Atten: 30 dB</td> <td>ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold&gt;100/100 Mkr1</td> <td>RF 01:45:29 PM Janob, 2014 TRACE 23 4 5 6 TYPE P NUMBER 2.479 178 GHz 6.150 dBm -13:65 dbm -13:65 dbm Stop 2.51000 GHz 3.20 ms (1001 pts)</td> <td>Frequency Auto Tur Center Fro 2.493500000 G Start Fro 2.477000000 G Stop Fro 2.510000000 G</td>	DO GHZ PNO: Wide ( IFGain:Low B Bm 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:45:29 PM Janob, 2014 TRACE 23 4 5 6 TYPE P NUMBER 2.479 178 GHz 6.150 dBm -13:65 dbm -13:65 dbm Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fro 2.493500000 G Start Fro 2.477000000 G Stop Fro 2.510000000 G
i2 gilent Spectrum Analyzer - Swei gilent Spectrum Analyzer - Swei start Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d 0 d 0 d 0 d 0 d 0 d 0 d 0 d	DO GHZ PNO: Wide IFGain:Low B Bm 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:45:29 PM Janob, 2014 TRACE 23 4 5 6 TYPE P NUMBER 2.479 178 GHz 6.150 dBm -13:65 dbm -13:65 dbm Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fr 2.493500000 G Start Fr 2.477000000 G Stop Fr 2.510000000 G CF St 3.300000 M Auto M
Ref Offset 1 d           0 dB/div         Ref Offset 1 d           0 d0         1           1 n         1           1 n         1           3 n         1	2.443 500 GHz	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:45:29 PM Janob, 2014 TRACE 23 4 5 6 TYPE P NUMBER 2.479 178 GHz 6.150 dBm -13:65 dbm -13:65 dbm Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 Gi Start Fre 2.477000000 Gi Stop Fre 2.510000000 Gi 3.300000 Mi Auto Mi
Ref Offset 1 d           0 dB/div         Ref Offset 1 d           0 dB/div         Ref 20.00 d           0 d0 d         Ref 20.00 d           0 d1 d1 f         Ref 20.00 d           0 d1 d1 f         Ref 20.00 d	2.443 500 GHz	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:45:29 PM Janob, 2014 TRACE 23 4 5 6 TYPE P NUMBER 2.479 178 GHz 6.150 dBm -13:65 dbm -13:65 dbm Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency Auto Tur Center Fre 2.493500000 Gi Start Fre 2.477000000 Gi Stop Fre 2.510000000 Gi 3.300000 Mi Auto Mi
Start Freq 2.4770000 Ref Offset 1 d 0 dB/div Ref 20.00 d 0 d 0 d 0 d 0 d 0 d 0 d 0 d	2.443 500 GHz	Trig: Free Run Atten: 30 dB	ALIGN AUTO/NC Avg Type: Log-Pwr Avg Hold>100/100 Mkr1	RF 01:45:29 PM Janob, 2014 TRACE 23 4 5 6 TYPE P VINNAW 0 cr P VINNAW 2.479 178 GHz 6.150 dBm -13:65 dbm -13:65 dbm Stop 2.51000 GHz 3.20 ms (1001 pts)	Frequency           Auto Tur           Center Fre           2.493500000 GH           Start Fre           2.477000000 GH           Stop Fre           2.510000000 GH           CF Ste           3.300000 MH

11 12

MSG 🗼 Alignment Completed

Align Now, All required

 Report Number: 68.950.13.168.01
 Page 3

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### Hopping off mode:

Analyzer - Swept SA ALIGN AUTO/NORF 01:42 Avg Type: Log-Pwr Avg|Hold:>100/100 2:04 PM Jani TRACE 1 2 TYPE MW DET P N Frequency Start Freq 2.310000000 GHz Trig: Free Run Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.401 865 GHz 5.471 dBm Ref Offset 1 dB Ref 20.00 dBm **Center Freq** 2.357500000 GHz Start Freq 2.310000000 GHz 3  $\Diamond^2$ Stop Freq 2.40500000 GHz Start 2.31000 GHz #Res BW 100 kHz Stop 2.40500 GHz 9.13 ms (1001 pts) CF Step 9.500000 MHz #VBW 300 kHz Sweep Man Auto 5.471 dBm -49.732 dBm -44.884 dBm 234 2.390 000 GHz 2.400 000 GHz N Freq Offset 156789 0 Hz 10 11 12 MSG 🛿 Align Now, All required Frequency Start Freg 2.477000000 GHz Avg Type: Log-Pwr Avg|Hold:>100/100 PNO: Wide Trig: Free Run IFGain:Low Atten: 30 dB DET P N N N Auto Tune Mkr1 2.480 168 GHz 6.293 dBm Ref Offset 1 dB Ref 20.00 dBm 10 dB/d **Center Freq** 2.493500000 GHz Start Freq 2.477000000 GHz 13 Stop Freq 2.51000000 GHz

 Start 2.47700 GHz

 Stort 2.47700 GHz

 #Res BW 100 kHz
 Storp 2.51000 GHz

 #Res BW 100 kHz
 #VBW 300 kHz
 Storp 2.51000 GHz

 MKR MODE TRC SCL
 X
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 FUNCTION
 FUNCTION width
 FUNCTION Value

 MKR MODE TRC SCL
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 FUNCTION
 FUNCTION width
 FUNCTION Value
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Page 37 of 42



# 9.9 Spurious radiated emissions for transmitter and receiver

## **Test Method**

- 1. The EUT is placed on a turntable, which is 0.8m above ground plane.
- 2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- Use the following spectrum analyzer settings: Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 4. Follow the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(duty cycle/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

## Limit

According to part 15.247(d), the radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency	Field Strength	Field Strength	Detector
MHz	uV/m	dBµV/m	
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK



#### Spurious radiated emissions for transmitter and receiver

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

### Transmitting spurious emission test result as below:

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
39.70	14.26	1.00	0	8.83	24.09	Horizontal	40	QP	Pass
177.44	9.83	1.70	0	18.48	30.01	Horizontal	43.5	QP	Pass
40.57	13.76	1.02	0	21.00	35.78	Vertical	40	QP	Pass
128.94	12.80	1.52	0	19.91	34.23	Vertical	43.5	QP	Pass
*4804	32.85	8.56	35.70	46.22	51.93	Horizontal	74	PK	Pass
*4804	32.85	8.56	35.70	44.77	50.48	Vertical	74	PK	Pass

Bluetooth Mode GFSK Modulation 2402MHz Test Result

Bluetooth Mode GFSK Modulation 2441MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
*4882	32.99	8.64	35.70	45.65	51.58	Horizontal	74	PK	Pass
*4882	32.99	8.64	35.70	46.28	52.21	Vertical	74	PK	Pass

Bluetooth Mode GFSK Modulation 2480MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
*4960	33.13	8.72	35.70	45.77	51.92	Horizontal	74	PK	Pass
*4960	33.13	8.72	35.70	45.17	51.32	Vertical	74	PK	Pass

Remark:

 QP Emission Level= Antenna Factor +Cable Loss + Reading PK Emission Level= Antenna Factor +Cable Loss - Amp. factor + Reading AV Emission Level= PK Emission Level+20log(dutycycle)

- (2) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (3) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

Report Number: 68.950.13.168.01

Page 39 of 42

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## Receiving emission test result as below:

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
39.70	14.26	1.00	0	8.33	23.59	Horizontal	40	QP	Pass
177.44	9.83	1.70	0	18.52	30.05	Horizontal	43.5	QP	Pass
40.57	13.76	1.02	0	17.45	32.23	Vertical	40	QP	Pass
128.94	12.80	1.52	0	16.87	31.19	Vertical	43.5	QP	Pass
1000- 25000						Horizontal	74	PK	Pass
1000- 25000						Vertical	74	PK	Pass

Remark:

(1) QP Emission Level= Antenna Factor +Cable Loss + Reading PK Emission Level= Antenna Factor +Cable Loss - Amp. factor + Reading AV Emission Level= PK Emission Level+20log (dutycycle)

(2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

(3) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section RSS-Gen.

Report Number: 68.950.13.168.01



# **10 Test Equipment List**

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE	
	Test Receiver	Rohde & Schwarz	ESHS10	838693/001	Nov.04, 14	$\square$
	L.I.S.N.#1	Rohde & Schwarz	ESH2-Z5	834066/011	Nov.04, 14	$\square$
	L.I.S.N.#3	Kyoritsu	KNW-242C	8-1920-1	May.07, 14	
CE	RF Cable	3D-2W	Fujikura	LISN Cable 1#	May.07, 14	$\square$
	Coaxial Switch	MP59B	Anritsu	M55367	May.07, 14	$\square$
	Passive Probe	ESH2-Z3	Rohde & Schwarz	299.7810.52	May.07, 14	
	Pulse Limiter	ESH3-Z2	Rohde & Schwarz	100341	May.07, 14	
С	Spectrum	Agilent	E4446A	US44300459	May.08, 14	$\bowtie$
RE < 1	Test Receiver <1GHz	Rohde & Schwarz	ESVS10	834468/011	May.07, 14	$\square$
GHz	Amplifier < 1 GHz	HP	8447D	2648A04738	May.07, 14	$\square$
	HF Cable	Hubersuhne	Sucoflex104	Room 2	May.08, 14	$\square$
	Bilog Antenna	Schaffner	CBL6111C	2598	Oct.25, 14	$\square$
RE	Spectrum > 1GHz	Agilent	E4446A	US44300459	May.08, 14	$\square$
> 1 GHz	Horn Antenna	EMCO	3115	9607-4877	Jun. 24, 14	$\square$
	Amp > 1 Ghz	HP	8449B	3008A08495	May.08, 14	$\square$
	HF Cable	Hubersuhne	Sucoflex104	Room1	May.08, 14	$\square$

## **List of Test Instruments**

C - Conducted RF tests

- Conducted peak output power •
- 6dB bandwidth •
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation •
- Number of hopping frequencies •
- **Dwell Time** •
- Power spectral density\* •
- Spurious RF conducted emissions ٠
- Band edge



# **11 System Measurement Uncertainty**

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Bystern medsurement entertainty					
Items	Extended Uncertainty				
Padiated spurious amission	4.32dB (30MHz-1GHz)				
Radiated spurious emission	2.27dB (1GHz -25GHz)				
Conducted spurious emission	2.10dB(30MHz-25GHz)				
Bandwidth test	1*10 <sup>-9</sup>				
Conducted emission	2.4dB				

#### System Measurement Uncertainty