# **TEST REPORT**

	Audio Partnership PLC
Applicant:	· · · · · · · · · · · · · · · · · · ·
Address of Applicant:	Gallery Court, Hankey Place, London, SE1 4BB, United Kingdom
Manufacturer:	Audio Partnership PLC
Address of Manufacturer:	Gallery Court, Hankey Place, London, SE1 4BB, United Kingdom
Product name:	Stereo Receiver
Model:	AXR85, AXR100
Rating(s):	115V/220-240V~ 50/60Hz, 500W (For model AXR85); 115V/220-240V~ 50/60Hz, 550W (For model AXR100)
Trademark:	CAMBRIDGE AUDIO
Standards:	FCC Part 15.247 :2018
FCC ID:	YKBAXR-031
Data of Receipt:	2018-11-27
Date of Test:	2018-11-27~2018-12-25
Date of Issue:	2018-12-25
Test Result	Pass*

\* In the configuration tested, the test item complied with the standards specified above.

## Authorized for issue by:

Test by:

Reviewed by:

Dec.25, 2018	Galen Xiao Gale	n Yiao	Dec.25 2018	Pauler Li Pauler	L!
	Project Engineer			Project Manager	
Date	Name/Position	Signature	Date	Name/Position	Signature

Possible test cas	Possible test case verdicts:				
test case does not apply to the test object:		N/A			
test object does m	neet the requirement:	P (Pass)			
test object does n	ot meet the requirement:	F (Fail)			
Testing Laborato	ory information:				
Testing Laboratory Name:		ITL Co., Ltd			
Address:		No. 8 Jinqianling Street 5, Huangjiang Town Dongguan, Guangdong, 523757 P.R.C.			
Testing location	:	Same as above			
Tel	:	0086-769-39001678			
Fax	:	0086-20-62824387			
E-mail	:	itl@i-testlab.com			

#### General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report would be invalid test report without all the signatures of testing technician and approver. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

#### General product information:

The model AXR85 and AXR100 are identical to each other except for some function.

- 1. AXR100 has two additional optical input ports and one coaxial input port compare with the AXR85.
- 2. The circuit diagram have some different on the DAC board and front board.

All tests were performed on the model AXR100 as representative.

## 1 Test Summary

Test	Test Requirement	Test method	Result
	FCC PART 15 C	FCC PART 15 C	
Antenna Requirement	section 15.247 (c) and Section 15.203	section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.247 (a)(1);	ANSI C63.10:2013 Clause 6.9	PASS
Carrier Frequencies Separated	FCC PART 15 C section 15.247(a)(1);	ANSI C63.10:2013	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10:2013	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(iii);	ANSI C63.10:2013	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(1);	ANSI C63.10:2013 Clause 6.10	PASS
Conducted Spurious Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.247(d);	ANSI C63.10:2013 Clause 6.7	PASS
Radiated Spurious Emission (9 kHz to 25 GHz)	FCC PART 15 C section 15.247(d);	ANSI C63.10:2013 Clause 6.4,6.5 and 6.6	PASS
Band Edges Measurement	FCC PART 15 C section 15.247 (d) &15.205	ANSI C63.10:2013 Clause 6.9	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207;	ANSI C63.10:2013 Clause 6.2	PASS

#### Remark:

N/A: not applicable. Refer to the relative section for the details.

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.10:2013 the detail version is ANSI C63.10:2013 in the whole report.

DA 00-705: "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

# ITL

# 2 Contents

		Page
TEST RE	PORT	1
1 TES	T SUMMARY	
2 CON	ITENTS	
-	IERAL INFORMATION	
5 GEN		
3.1	CLIENT INFORMATION	
3.2	GENERAL DESCRIPTION OF E.U.T.	
3.3	DETAILS OF E.U.T.	•
3.4	DESCRIPTION OF SUPPORT UNITS	
3.5	TEST LOCATION	
3.6	DEVIATION FROM STANDARDS	
3.7	ABNORMALITIES FROM STANDARD CONDITIONS	
3.8	OTHER INFORMATION REQUESTED BY THE CUSTOMER	
3.9	TEST FACILITY	-
3.10	MEASUREMENT UNCERTAINTY	6
4 INS	RUMENTS USED DURING TEST	7
5 TES	T RESULTS	8
5.1	E.U.T. TEST CONDITIONS	
5.2	ANTENNA REQUIREMENT	
5.3	OCCUPIED BANDWIDTH	
5.4	CARRIER FREQUENCIES SEPARATED	
5.5	HOPPING CHANNEL NUMBER	
5.6	DWELL TIME	
5.7	MAXIMUM PEAK OUTPUT POWER	
5.8	CONDUCTED SPURIOUS EMISSIONS	
5.9	RADIATED SPURIOUS EMISSIONS	
5.9.	1 Harmonic and other spurious emissions	
5.10	RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS	
5.11	BAND EDGES REQUIREMENT	
5.12	CONDUCTED EMISSIONS AT MAINS TERMINALS 150 KHZ TO 30 MHZ	71
5.12	.1 Measurement Data	

## **3** General Information

### 3.1 Client Information

Applicant:Audio Partnership PLCAddress of Applicant:Gallery Court, Hankey Place, London, SE1 4BB, United Kingdom

## 3.2 General Description of E.U.T.

Name:	Stereo Receiver
Model No.:	AXR100
Trade Mark:	CAMBRIDGE AUDIO
Operating Frequency:	2402 MHz to 2480 MHz for Bluetooth.
Channels:	79 channels with 1MHz step for Bluetooth
Bluetooth Version:	V2.1 + EDR
	This report is for classic mode.
Modulation Technique:	Frequency Hopping Spread Spectrum (FHSS)
Type of Modulation	GFSK, ( $\pi/4)$ DQPSK and 8DPSK for Bluetooth
Dwell time	Per channel is less than 0.4s.
Antenna Type:	PCB Layout Antenna with 0 dBi peak Gain
Function:	Stereo Receiver

## 3.3 Details of E.U.T.

EUT Power Supply:	AC power
Rated power: Test mode:	120V~ 50/60Hz The program used to control the EUT for staying in continuous transmitting mode is programmed. Channel lowest (2402MHz), middle (2441MHz) and highest (2480MHz) are chosen for Bluetooth full testing. Normal mode: the Bluetooth has been tested on the Modulation of GFSK; EDR mode: the Bluetooth has been tested on the Modulation of ( $\pi$ /4)DQPSK and 8DPSK, compliance test and record the worst case on ( $\pi$ /4)DQPSK and 8DPSK
Power cord:	Direct plug

## 3.4 Description of Support Units

The EUT has been tested as an independent unit for fixed frequency by testing lab.

## 3.5 Test Location

All tests were performed at:

ITL Co., LTD No. 8 Jinqianling Street 5, Huangjiang Town, Dongguan, Guangdong, 523757 P.R.C. 0086-769-39001678 itl@i-testlab.com No tests were sub-contracted.

## 3.6 Deviation from Standards

Biconical and log periodic antennas were used instead of dipole antennas.

### 3.7 Abnormalities from Standard Conditions

None.

## 3.8 Other Information Requested by the Customer

None.

## 3.9 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- CNAS( Lab code:L9342)
- FCC (Registration No.: 239076)
- IC (Registration NO.:CN0025)

## 3.10 Measurement Uncertainty

The below measurement uncertainties given below are based on a 95% confidence level (base on a coverage factor (k=2).)

Parameter	Uncertainty
Radio frequency	2.25%
total RF power, conducted	±1.34 dB
RF power density , conducted	±1.49 dB
All emissions, radiated	±2.72 dB
Temperature	±5.02 dB
Humidity	±0.8°C
DC and low frequency voltages	±1.5 %

## 4 Instruments Used during Test

No.	Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
DGITL- 306	Spectrum Analyzer	Agilent Technologies	N9010A	MY54200334	2017.05.31	2020.05.31
DGITL- 307	Test Receiver	R&S	ESVS 10	840698/013	2018.06.19	2019.06.19
DGITL- 352	Pre Amplifier	MInI-CIrcuits	ZFC- 1000HX	SN29280111 0	2018.06.19	2019.06.19
DGITL- 350	Wideband Amplifier Super Ultra	Mini-circuits	ZVA-183- S+	SN98640142 6	2018.06.19	2019.06.19
DGITL- 308	Biconilog Antenna	ETS•Lindgren	3142E	156975	2017.02.21	2020.02.21
DGITL- 309	Horn Antenna	ETS•Lindgren	3117	SN00152265	2017.02.21	2020.02.21
DGITL- 303a	EMI Test receiver	R&S	ESCI	100910	2018.06.19	2019.06.19
DGITL- 304	L.I.S.N.#1	R&S	ESH3-Z5	100272	2018.06.19	2019.06.19
DGITL- 316	Pulse Limiter	R&S	ESH3-Z2	100327	2018.06.19	2019.06.19
DGITL- 300	50Ω Coaxial Cable	Mini-circuits	CBL	C002	2018.06.19	2019.06.19
DGITL- 301	Anechoic chamber	ETS•Lindgren	9m*6m*6 m	CT000874- 1181	2017.05.31	2020.05.31
DGITL- 363	Loop Antenna	ZHINAN	ZN30900 A	002489	2017.02.21	2020.02.21
DGITL- 364	Horn Antenna	Schwarzbeck	BBHA 9170	B09806543	2017.02.21	2020.02.21
DGITL- 302	Shielded Room	ETS•Lindgren	8*4*3	CT09010	2018.06.19	2019.06.19

## 5 Test Results

## 5.1 E.U.T. test conditions

Test Voltage:	120V 60Hz
Temperature:	20.0 -25.0 °C
Humidity:	38-50 % RH
Atmospheric Pressure:	1000 -1010 mbar
Test frequencies and frequency range:	According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Frequency range in which	Number of	Location in frequency range
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1
		near bottom

#### Number of fundamental frequencies to be tested in EUT transmit band

#### Frequency range of radiated emission measurements

Lowest frequency generated	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz,
At or above 10 GHz to below	5th harmonic of highest fundamental frequency or to 100 GHz,
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz,

Channel	Frequency	Channel	Frequency	Channel	Frequency
	(MHz)		(MHz)		(MHz)
0	2402	11	2413	22	2424
1	2403	12	2414	23	2425
2	2404	13	2415	24	2426
3	2405	14	2416	25	2427
4	2406	15	2417	26	2428
5	2407	16	2418	27	2429
6	2408	17	2419	28	2430
7	2409	18	2420	29	2431
8	2410	19	2421	30	2432
9	2411	20	2422	31	2433
10	2412	21	2423	32	2434
33	2435	49	2451	65	2467
34	2436	50	2452	66	2468
35	2437	51	2453	67	2469
36	2438	52	2454	68	2470
37	2439	53	2455	69	2471
38	2440	54	2456	70	2472
39	2441	55	2457	71	2473
40	2442	56	2458	72	2474
41	2443	57	2459	73	2475
42	2444	58	2460	74	2476
43	2445	59	2461	75	2477
44	2446	60	2462	76	2478
45	2447	61	2463	77	2479
46	2448	62	2464	78	2480
47	2449	63	2465		
48	2450	64	2466		

EUT channels and frequencies list for Bluetooth:

Test frequencies are the lowest channel: 0 channel (2402 MHz), middle channel: 39 channel (2441 MHz) and highest channel: 78 channel (2480 MHz)

## 5.2 Antenna requirement

#### Standard requirement

15.203 requirement:

For intentional device. According 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.

#### 15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz bands that are used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

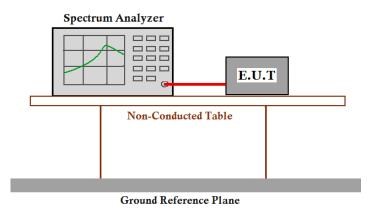
#### EUT Antenna

The antenna is a PCB Layout antenna and no consideration of replacement. The best case gain of the antenna is 0dBi.

Test result: The unit does meet the FCC requirements.

<b>5</b> .3	<b>FL</b> Occupied Bandwidth	Page 11 of 74	Report No.: D181225008
	Test Requirement:	FCC Part 15 C section 15.247	
		(a)(1) Frequency hopping systems sh frequencies separated by a minimum of of the hopping channel, whichever is hopping systems operating in the 24 hopping channel carrier frequencies t two-thirds of the 20 dB bandwidth of th greater, provided the systems operate than 125 mW.	of 25 kHz or the 20 dB bandwidth greater. Alternatively, frequency 00-2483.5 MHz band may have hat are separated by 25 kHz or he hopping channel, whichever is
	Test Method:	ANSI C63.10:2013 Clause 6.9	
	Test Status:	Pre-test the EUT in continuous transmit and highest channel with different dat normal mode (DH5) and EDR mode (3DH	a package. Compliance test in
	Testos		

#### **Test Configuration:**



#### **Test Procedure:**

- 1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
- 2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centring on a hopping channel;
- Set the spectrum analyzer: RBW >= 1% of the 20dB bandwidth VBW >= RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
- 4. Mark the peak frequency and -20dB points bandwidth.

## Test result (-20dB bandwidth), For Bluetooth

#### Normal mode:

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.027	0.685
Middle	0.979	0.653
Highest	1.021	0.681

## EDR mode (3DH5):

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.344	0.896
Middle	1.346	0.897
Highest	1.346	0.897

# ITL

#### For Bluetooth

Result plot as follows:

DH5:

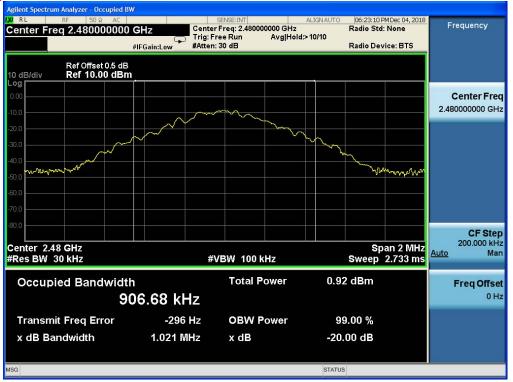
Lowest Channel:



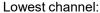
#### Middle Channel:

Agilent Spectrum Analyzer - Occupied	BW				
RL RF 50Ω AC Center Freq 2.44100000	Trig: F	SENSE:INT r Freq: 2.441000000 GHz ree Run Avg Ho : 30 dB	Radio 5 Id:>10/10	14 PMDec 04, 2018 Std: None Device: BTS	Frequency
Ref Offset 0.5 d 10 dB/div Ref 10.00 dB					
Log 0.00 -10.0		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Center Fre 2.441000000 GF
-2010 -30.0 -40.0 -50.0				Mangapana	
60.0 					
Center 2.441 GHz #Res BW 30 kHz	#	VBW 100 kHz	Swee	Span 2 MHz p   2.733 ms	CF Ste 200.000 kł <u>Auto</u> Ma
Occupied Bandwid	<sup>th</sup> 904.53 kHz	Total Power	3.07 d <b>B</b> m		Freq Offs 0 H
Transmit Freq Error x dB Bandwidth	-1.019 kHz	OBW Power	99.00 %		
X dB Bandwidth	978.9 kHz	x dB	-20.00 dB		
153			514105		

#### Highest Channel:



#### 3DH5:





#### Middle channel:



#### Highest channel:



## 5.4 Carrier Frequencies Separated

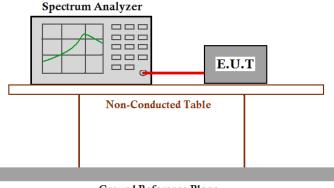
Test Requirement:	FCC Part 15 C section 15.247
-------------------	------------------------------

(a),(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Method: ANSI C63.10:2013

Test Status:Pre-test the EUT in continuous transmitting mode at the lowest,<br/>middle and highest channel with different data package.<br/>Compliance test in normal mode (DH5) and EDR mode (3DH5) as<br/>the worst case was found.

#### Test Configuration:



#### Ground Reference Plane

#### Test Procedure:

- 1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2. Set the spectrum analyzer: RBW >= 1% of the span, VBW >= RBW,. Sweep = auto; Detector

Function = Peak. Trace = Max, hold.

 Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

#### Test result:

#### For Bluetooth

#### DH5

Test Channel	Carrier Frequencies Separated	Pass/Fail			
Lower Channels (channel 0 and channel 1)	1.00MHz	Pass			
Middle Channels (channel 39 and channel 40)	1.00MHz	Pass			
Upper Channels (channel 77 and channel 78)	1.00MHz	Pass			
Remark: The limit is maximum two-thirds of the 20 dB bandwidth: 0.685 MHz					

#### 3DH5

Test Channel	Carrier Frequencies Separated	Pass/Fail				
Lower Channels (channel 0 and channel 1)	0.92MHz	Pass				
Middle Channels (channel 39 and channel 40)	1.03MHz	Pass				
Upper Channels (channel 77 and channel 78)	1.10MHz	Pass				
Remark:						
The limit is maximum two-	The limit is maximum two-thirds of the 20 dB bandwidth: 0.897 MHz					

#### For Bluetooth Carrier Frequencies Separated plot: DH5

## 1. Lowest Channels:



#### 2. Middle Channels:

	Analyzer - Swept SA RF 50 Ω AC 2.44150000	0 GHz	SENSE	Avg	ALIGNAUTO	09:48:43 AM Dec 05, 2018 TRACE 1 2 3 4 5 6	Frequency
R	ef Offset 0.5 dB ef 13.41 dBm	PNO: Wide C IFGain:Low	Trig: Free Ru #Atten: 30 dE		Mkr2	2.442 060 GHz -5.898 dBm	Auto Tur
8.41 6.6			~~~~	~~~	2		<b>Center Fre</b> 2.441500000 GH
6.6 6.6 6.6							<b>Start Fr</b> 2.440000000 G
5.6 5.6 5.6							Stop Fr 2.443000000 G
enter 2.441 Res BW 30	kHz	#VB	W 100 kHz		#Sweep	Span 3.000 MHz 100 ms (601 pts)	CF St 300.000 F
R MODE TRC S	2.4	41 060 GHz 42 060 GHz	→ -5.754 dBm -5.898 dBm		FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> N
3							Freq Offe 0
8							
0							

# ITL

## 3. Highest Channels

Agilent Spectrum Analyzer - Swept SA				
X RL RF 50 Ω AC Center Freq 2.479500000 GHz	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	09:50:42 AM Dec 05, 2018 TRACE 1 2 3 4 5 6	Frequency
PN0: Wide IFGain:Low Ref Offset 0.5 dB		Mkr2	2.480 055 GHz -7.691 dBm	Auto Tune
10 dB/div Ref 12.60 dBm	1	2		Center Freq 2.479500000 GHz
-27.4 -37.4 -47.4			- Jun marking	<b>Start Freq</b> 2.478000000 GHz
-57.4 -67.4 -77.4				<b>Stop Freq</b> 2.481000000 GHz
	BW 100 kHz	#Sweep		CF Step 300.000 kHz
MKR     MODE     TRC     SCL     X       1     N     1     f     2.479     060     GHz	-7.333 dBm	ICTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2     N     1     f     2.480 055 GHz       3     -     -     -     -       4     -     -     -     -       5     -     -     -     -       6     -     -     -     -	-7.691 dBm			Freq Offset 0 Hz
7 8 9 9 10 11				
MSG		STATUS		

#### 3DH5

1. Lowest Channels:

Center Freq 2.402500000 GHz   Trig: Free Run Avg Type: Leg-Pur   Trid: Free Run Trig: Free Run Avg Type: Leg-Pur   Trid: Free Run Trig: Free Run Avg Type: Leg-Pur   Trid: Free Run Trig: Free Run Avg Type: Leg-Pur   Trid: Free Run Avg Type: Leg-Pur   Avg Type: Leg-Pur   Trid: Free Run Avg Type: Leg-Pur   Avg Type: Leg-Pur   Trid: Free Run Avg Type: Leg-Pur   Avg	Agilent Spectrum Analy					i en	
PRO: Wide (FGain:Low)   Trig: Free Run #Atten: 30 dB   Mkr2 2.403 105 GHz -9.030 dBm   Auto Tune     10 dB/div 905	Center Freg 2.	50 Ω AC 402500000 GHz		Avg	ALIGNAUTO	11:12:50 AM Dec 05, 2018 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 0.5 dB   MKR2 2.403 t05 CFR2     10 dB/dl/   Ref 10.95 dBm   -9.030 dBm     905   -9.030 dBm   -9.030 dBm     901   -9.030 dBm   -9.030 dBm     901   -9.030 dBm   -9.030 dBm     100 ms (601 pts)   -9.030 dBm     1   N   1     1   N   1     2   N   1     3   -   -     4   -   -     5   -   -     1   1   1   2.402 105 GHz   -9.030 dBm     3   -   -   -   -     3   -   -   -   -     3   -   -   -   -		PNO: V					A Contract of the second second second
0950   1   2   Center Freq     191   2   1   2   1     191   2   1   2   1     191   2   1   1   2   1     191   2   1   1   2   1     191   2   1   1   1   1   1     191   2   1	10 dB/div Ref				Mkr2	2.403 105 GHz -9.030 dBm	Auto Tune
39.1   All   Start Freq     49.1   All   Start Freq     59.1   Start Freq     69.1   Start Freq     79.1   Start Freq     2.40100000 GHz   Start Freq     #Res BW 30 kHz   #VBW 100 kHz   #Sweep     1   N   1     1   N   1     2   N   1     3   Start Freq     3   Start Freq     2.40400000 GHz   Start Freq     #KR MODE TRC SCL   X   Y     PUNCTION WIDTH   FUNCTION VALUE     MKR MODE TRC SCL   X   Y     2   N   1     1   1   2.403 105 GHz   9.030 dBm     3   Start Freq   Start Freq     3   Start Freq	0.950 -9.05		~1		2	~~~~	
601   791   7	-39.1 www.www.ml						
#Res BW 30 kHz #VBW 100 kHz #Sweep 100 ms (601 pts)   MKR MODE TRC SCL X   1 N 1 f 2.402 105 GHz 9.406 dBm   2 N 1 f 2.403 105 GHz 9.030 dBm   3 4 4 4 4 4   5 6 6 6 6 6   7 8 4 4 6 6   9 4 4 6 6 6   10 10 10 10 10 10	-69.1						
1     1     f     2.402 105 GHz     -9.106 dBm       2     N     1     f     2.403 105 GHz     -9.030 dBm       3     4     4     4     4     6     6     6     6     6     6     6     6     6     7 <td></td> <td></td> <td>#VBW 100 kHz</td> <td></td> <td>#Sweep</td> <td></td> <td>CF Step</td>			#VBW 100 kHz		#Sweep		CF Step
2     N     1     f     2.403 105 GHz     9.030 dBm     Freq Offset     0 Hz       3     4					FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
4     -     -     -     -     -     -     0 Hz       6     -     -     -     -     -     0 Hz     0 Hz       7     -     -     -     -     -     -     0 Hz       9     -     -     -     -     -     -     0 Hz       10     -     -     -     -     -     -     -     0     -     0     -     -     -     0     -     -     -     -     -     0     -     0     -     -     -     -     -     0     -     0     -     -     -     -     -     0     -     0     -     -     -     -     -     0     -     -     -     -     -     0     -     10     -     -     -     -     -     -     11     -     -     -     -     -     -     -     11     -     -							
7 8 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
	7						
	9						
	11						
	MSG				STATUS		

# ITL

## 2. Middle Channels:

Agilent Spectrum Analyzer - Swept SA					
Center Freq 2.441500000	GHz	SENSE;INT	ALIGN AUTO Avg Type: Log-Pwr	TRACE 1 2 3 4 5	Frequency
Ref Offset 0.5 dB	PNO: Wide 🕟 Trig	): Free Run en: 30 dB	Mkr2	түре Милини рет Р Р Р Р Р Р Р 2 2.442 105 GHz -10.477 dBm	Auto Tune
-10.4 -20.4	1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2	~~	Center Freq 2.441500000 GHz
-30.4 -40.4 -50.4					Start Free 2.440000000 GHz
-60.4					<b>Stop Freq</b> 2.443000000 GHz
Center 2.441500 GHz #Res BW 30 kHz MKRI MODEL TRCI SCLI X	#VBW 100			Span 3.000 MHz p 100 ms (601 pts)	
1 N 1 f 2.441	105 GHz -10.2	92 dBm 77 dBm			FreqOffset
4 5 6 7					0 Hz
8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9					
			STATI		

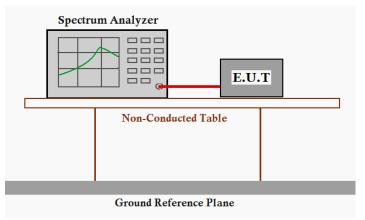
## 3. Highest Channels

enter F	req 2.479	I	PNO: Wide 🗆	SENSE	Av un	aLIGNAUTO g Type: Log-Pwr	TRAC	M Dec 05, 2018 E 1 2 3 4 5 6 E M WWWWWW T P P P P P P	Frequency
IFGain:Low #Atten: 30 dB Ref Offset 0.5 dB 0 dB/div Ref 8.74 dBm						Mkr2	Auto Tu		
og 1.26 11.3			- A	1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2			<b>Center Fr</b> 2.479500000 G
21.3 31.3 11.3 11.3 11.3	aywell							, and the state of the second	<b>Start Fr</b> 2.478000000 G
11.3 11.3 11.3									<b>Stop Fr</b> 2.481000000 G
Res BW			#VB	W 100 kHz			o 100 ms		CF St 300.000 k
KR MODE T 1 N 1 2 N 1 3 4 5 5			05 GHz 05 GHz	√ -11.442 dBm -11.616 dBm		FUNCTION WIDTH	FUNCTIO	N VALUE	Auto M Freq Offs 0
6 7 8 9 0 1									
2 <b>2</b>						STATU	3		

## 5.5 Hopping Channel Number

Test Requirement:	FCC Part15 C section 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Method:	ANSI C63.10:2013
Test Status:	Pre-test the EUT in hopping mode with different data packet. Compliance test in hopping with normal mode (DH5) and EDR mode (3DH5) as the worst case was found.

#### Test Configuration:

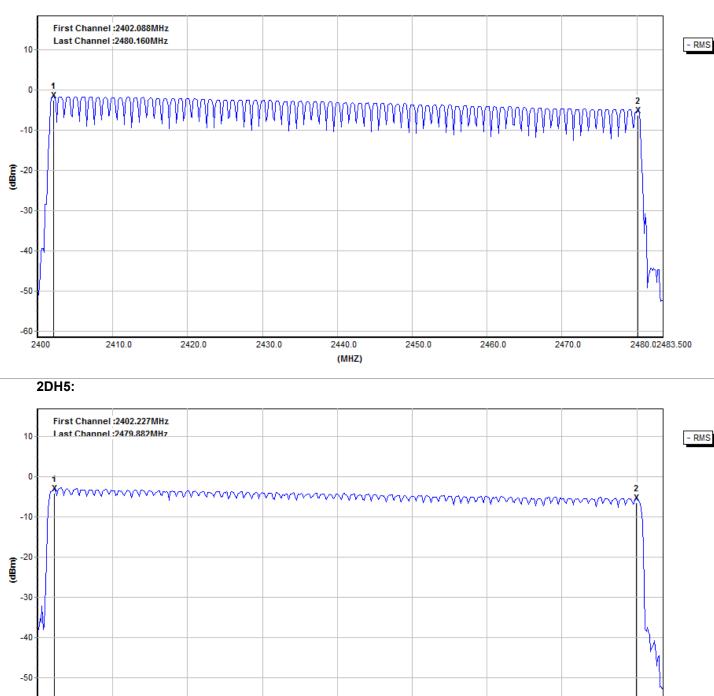


### **Test Procedure:**

- 1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 300 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
- 3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
- 4. Set the spectrum analyzer: start frequency = 2400 MHz. stop frequency = 2483.5 MHz. Submit the test result graph.

#### For Bluetooth

**Test result:** Total channels are 79 channels. **DH5:** 



Test result: The unit does meet the FCC requirements.

2420.0

2430.0

2440.0

(MHZ)

2450.0

2460.0

2470.0

2480.02483.500

2410.0

-<mark>60</mark>

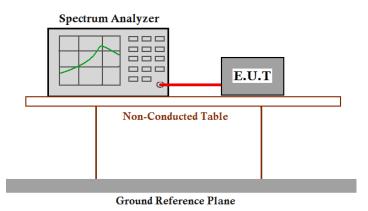
2400

## 5.6 Dwell Time

Test Requirement:FCC Part 15 C section 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall<br/>use at least 15 channels. The average time of occupancy on any channel<br/>shall not be greater than 0.4 seconds within a period of 0.4 seconds<br/>multiplied by the number of hopping channels employed. Frequency hopping<br/>systems may avoid or suppress transmissions on a particular hopping<br/>frequency provided that a minimum of 15 channels are used.Test Method:ANSI C63.10:2013<br/>Pre-test the EUT in continuous transmitting mode at the lowest, middle and

est Status: Pre-test the EUT in continuous transmitting mode at the lowest, middle and highest channel with different data packet. Compliance test in hopping with Normal mode (DH1, DH3, DH5), EDR mode (2DH1, 2DH3, 2DH5) and EDR mode (3DH1, 3DH3, 3DH5) as the worst case was found.

#### **Test Configuration:**



#### **Test Procedure:**

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

2.Set spectrum analyzer span = 0. centered on a hopping channel;

3.Set RBW = 1 MHz and VBW = 3 MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = View;

4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.). Repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

#### **Test Result:**

#### For Bluetooth

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

1. **Channel 0:** 2.402GHz DH1 time slot = 0.40(ms) \* (1600/(2\*79)) \* 31.6 = 128ms DH3 time slot = 1.65 (ms) \* (1600/(4\*79)) \* 31.6 = 264ms DH5 time slot = 2.92 (ms) \* (1600/(6\*79)) \* 31.6 = 311.5ms 2. **Channel 39:** 2.441GHz DH1 time slot = 0.40(ms) \* (1600/(2\*79)) \* 31.6 = 128ms DH3 time slot = 1.65(ms) \* (1600/(4\*79)) \* 31.6 = 264ms DH5 time slot = 2.94 (ms) \* (1600/(6\*79)) \* 31.6 = 313.6ms 3. **Channel 78:** 2.480GHz DH1 time slot = 0.40(ms) \* (1600/(2\*79)) \* 31.6 = 128ms DH3 time slot = 0.40(ms) \* (1600/(2\*79)) \* 31.6 = 128ms DH3 time slot = 1.67(ms) \* (1600/(2\*79)) \* 31.6 = 267.2ms

DH5 time slot = 2.94 (ms) \* (1600/(6\*79)) \* 31.6 = 313.6ms

#### 4. Channel 0: 2.402GHz

2DH1 time slot = 0.38(ms) \* (1600/(2\*79)) \* 31.6 = 121.6ms 2DH3 time slot = 1.65(ms) \* (1600/(4\*79)) \* 31.6 = 264ms 2DH5 time slot = 2.93(ms) \* (1600/(6\*79)) \* 31.6 = 312.5ms

#### 5. Channel 39: 2.441GHz

2DH1 time slot = 0.39(ms) \* (1600/(2\*79)) \* 31.6 = 124.8ms 2DH3 time slot = 1.66(ms) \* (1600/(4\*79)) \* 31.6 = 265.6ms 2DH5 time slot = 2.93(ms) \* (1600/(6\*79)) \* 31.6 = 312.5ms

#### 6. Channel 78: 2.480GHz

2DH1 time slot = 0.39(ms) \* (1600/(2\*79)) \* 31.6 = 124.8ms 2DH3 time slot = 1.66 (ms) \* (1600/(4\*79)) \* 31.6 = 265.6ms 2DH5 time slot = 2.93(ms) \* (1600/(6\*79)) \* 31.6 = 312.5ms

## 7. **Channel 0:** 2.402GHz 3DH1 time slot = 0.39(ms) \* (1600/(2\*79)) \* 31.6 = 124.8ms 3DH3 time slot = 1.65(ms) \* (1600/(4\*79)) \* 31.6 = 264ms 3DH5 time slot = 2.94(ms) \* (1600/(6\*79)) \* 31.6 = 313.6ms 8. **Channel 39:** 2.441GHz 3DH1 time slot = 0.37(ms) \* (1600/(2\*79)) \* 31.6 = 118.4ms 3DH3 time slot = 1.65(ms) \* (1600/(4\*79)) \* 31.6 = 264ms 3DH5 time slot = 2.94(ms) \* (1600/(6\*79)) \* 31.6 = 313.6ms 9. **Channel 78:** 2.480GHz 3DH1 time slot = 0.39(ms) \* (1600/(2\*79)) \* 31.6 = 124.8ms 3DH3 time slot = 1.65 (ms) \* (1600/(4\*79)) \* 31.6 = 264ms 3DH3 time slot = 1.65 (ms) \* (1600/(4\*79)) \* 31.6 = 264ms 3DH3 time slot = 2.94(ms) \* (1600/(4\*79)) \* 31.6 = 264ms 3DH3 time slot = 1.65 (ms) \* (1600/(4\*79)) \* 31.6 = 264ms

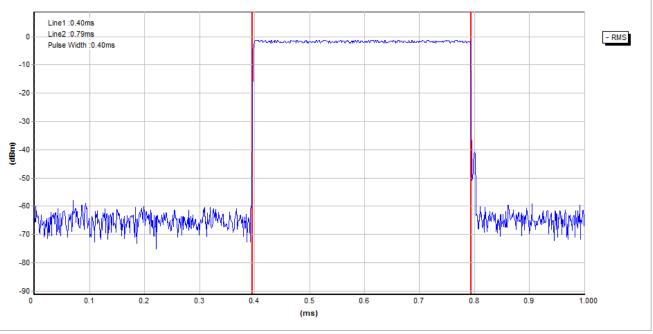
The results are not greater than 0.4 seconds

#### The unit does meet the FCC requirements.

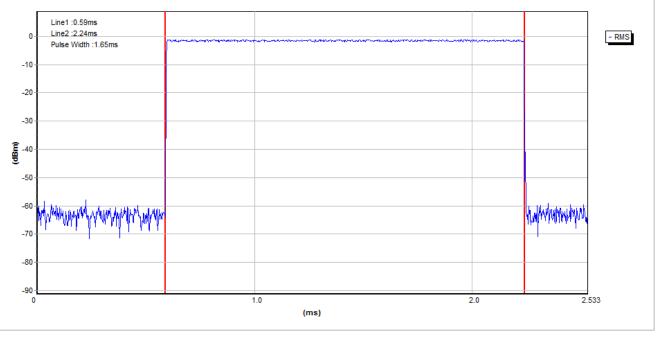
#### For Bluetooth

Please refer the graph as below:

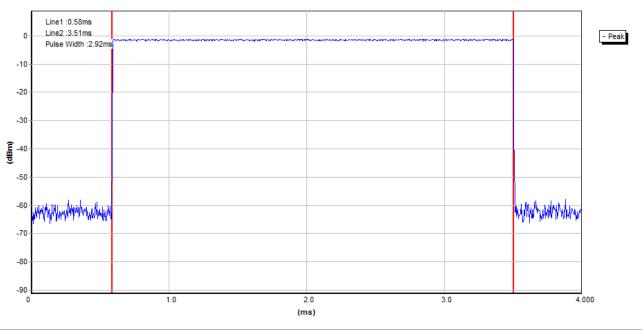
- 1. Lowest channel (2.402 GHz):
- (1) DH1





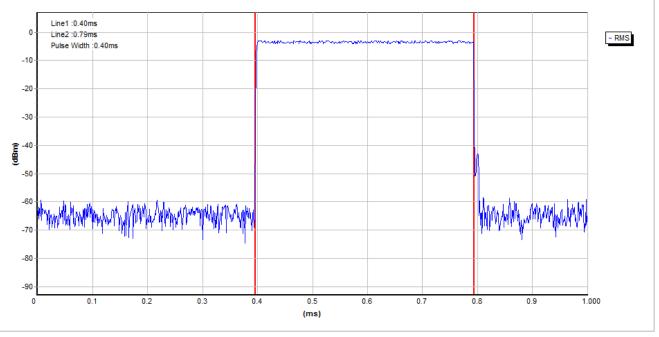




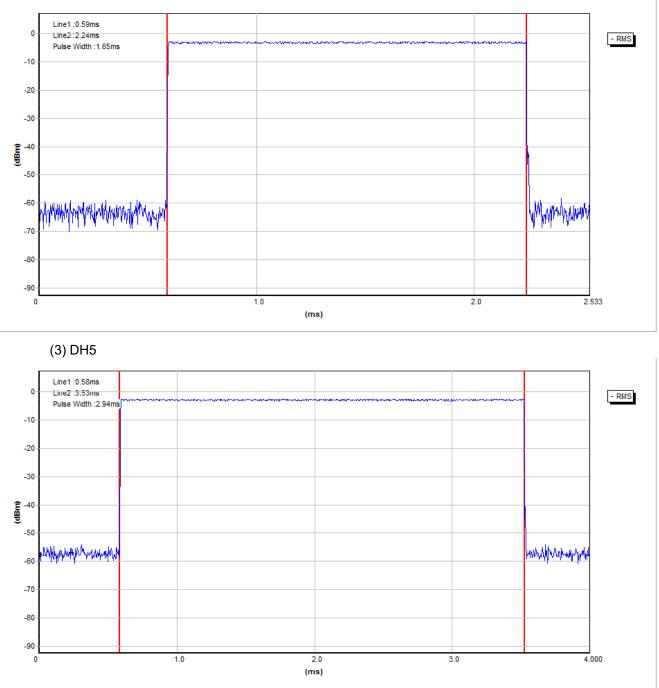


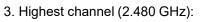


(1) DH1

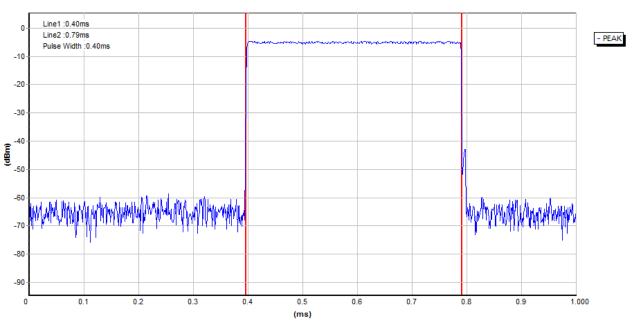


(2) DH3

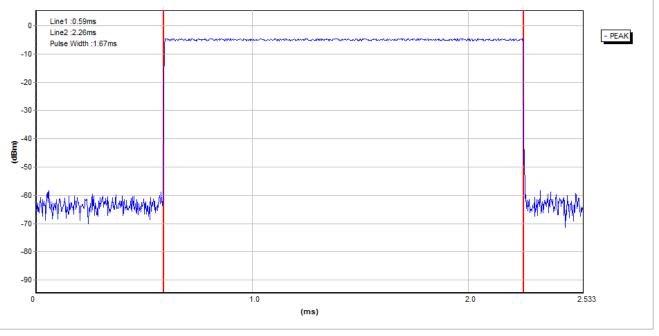




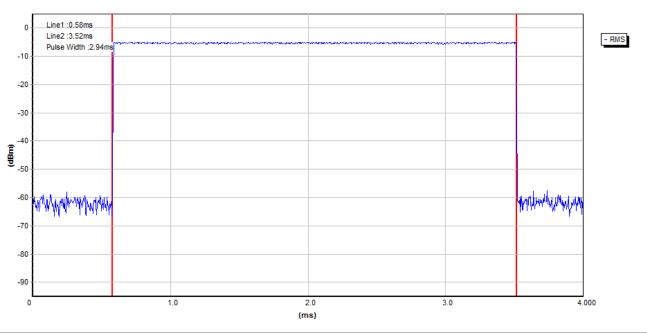


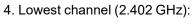




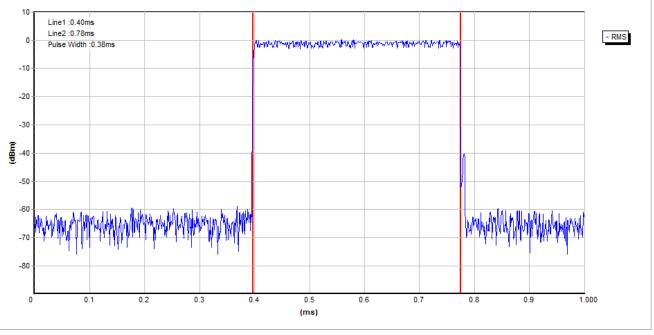








(1) 2DH1



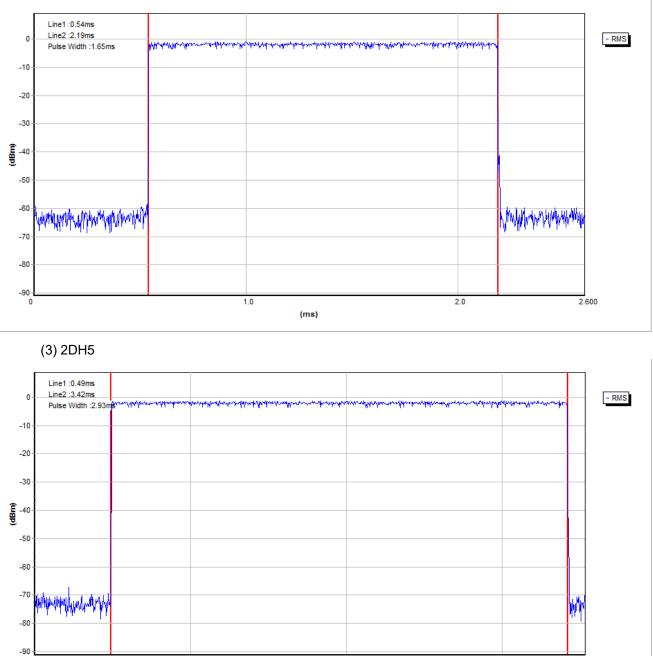
0

1.0

3.0

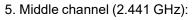
3.533

(2) 2DH3

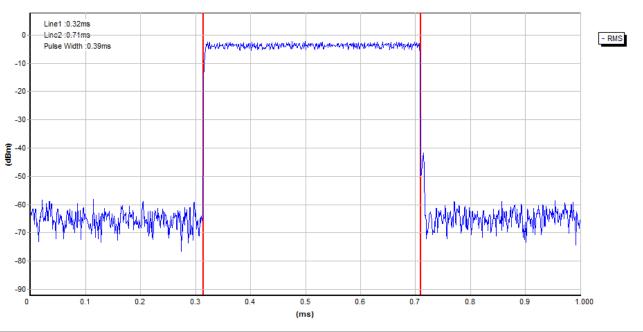


2.0

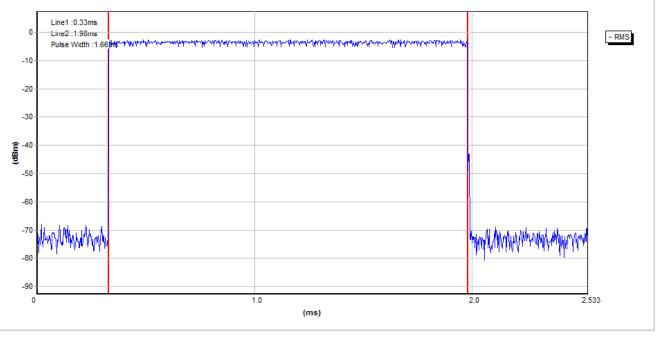
(ms)



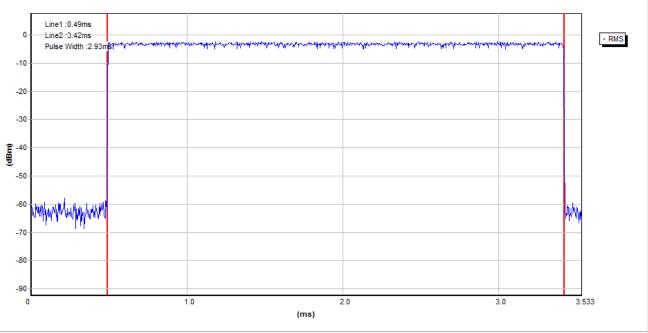


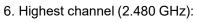




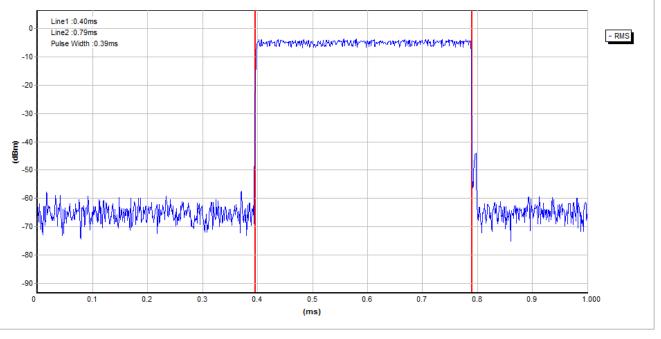


(3) 2DH5

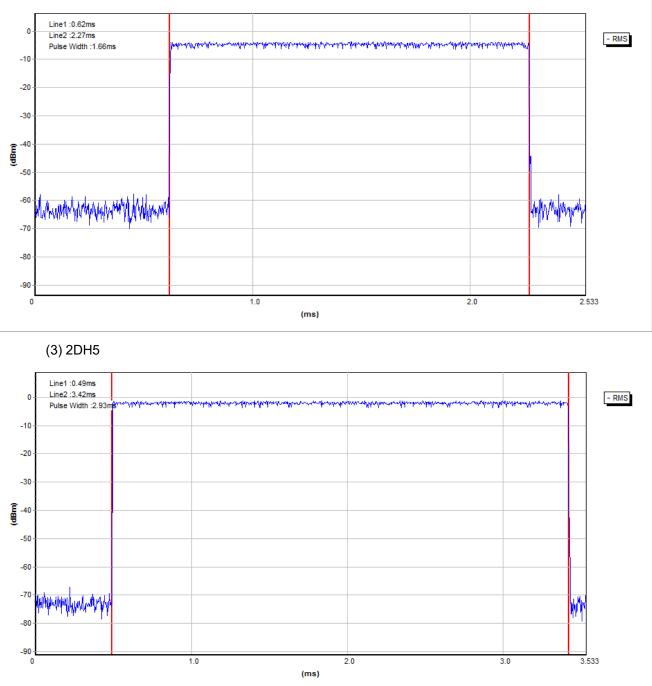




(1) 2DH1

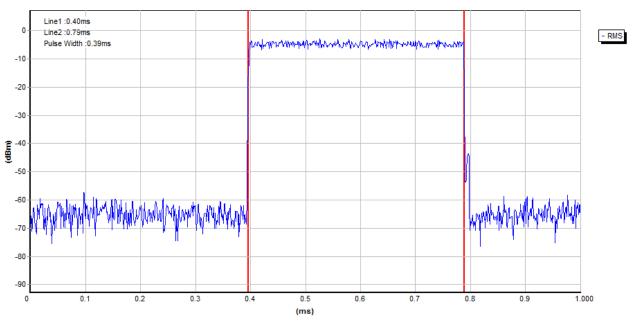


(2) 2DH3

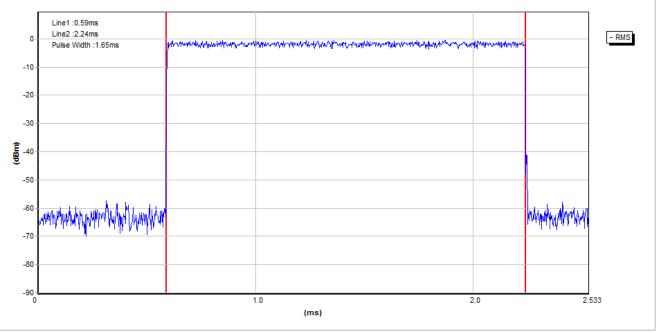


## 7. Lowest channel (2.402 GHz):



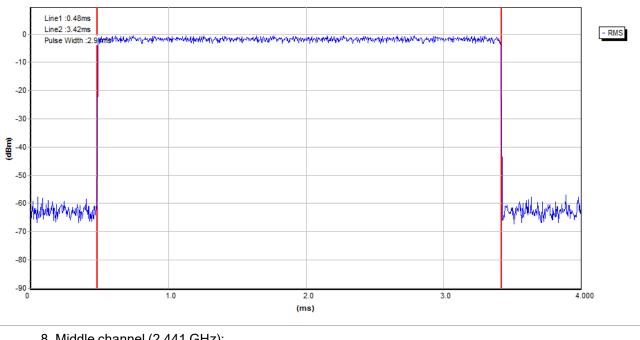


#### (2) 3DH3



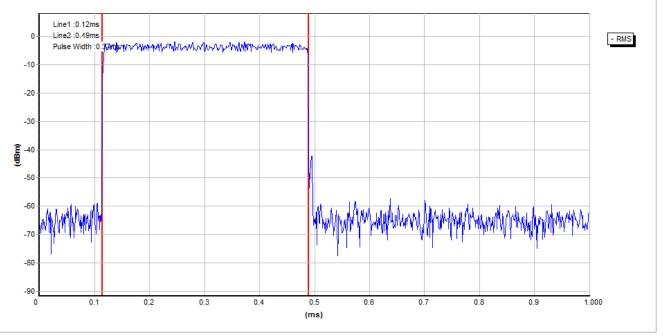
# ITL

(3) 3DH5

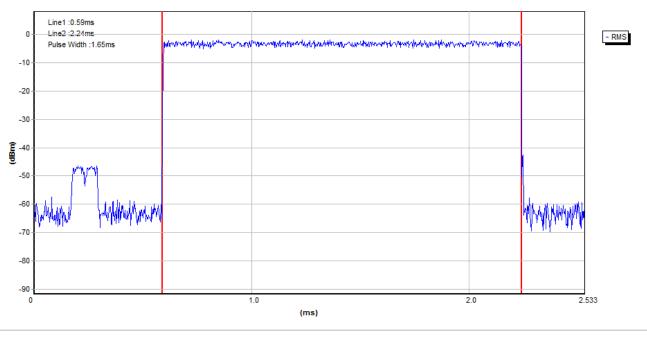


## 8. Middle channel (2.441 GHz):

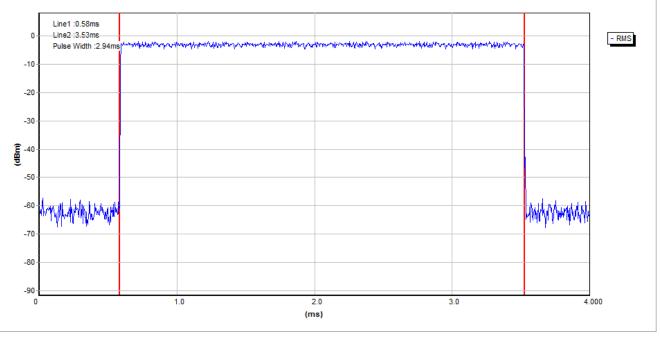
(1) 3DH1





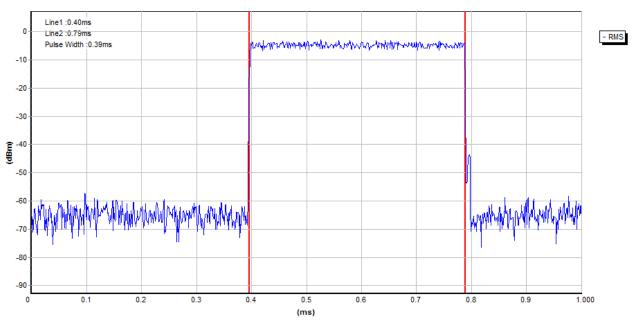


(3) 3DH5

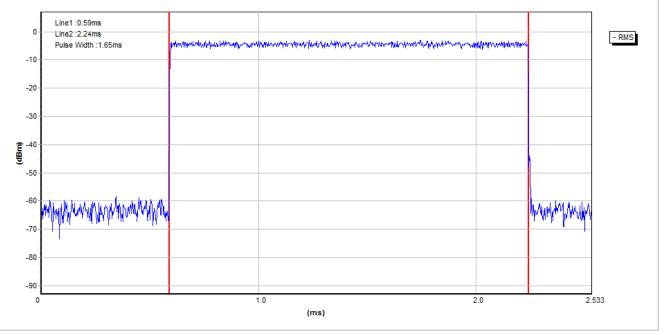


#### 9. Highest channel (2.480 GHz):



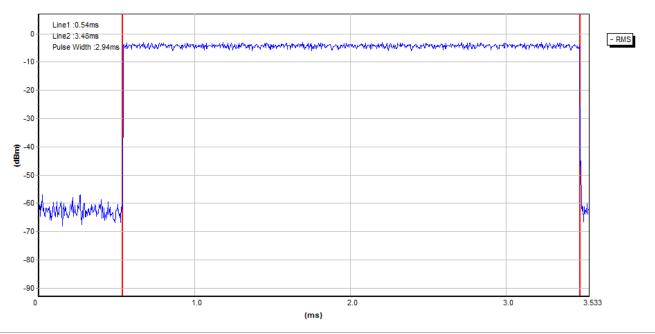


#### (2) 3DH3



# ITL

(3) 3DH5



#### Remark:

In communication data link mode (expect inquiry or page mode) the hopping rate is 1600 per second, the 79 channels will be randomly selected for RF channel, and each channel have equal probability to be selected. The hop selection scheme is defined in Clause 2.6 of Part B of Volume

2 of core specification of Bluetooth.

The Dwell time must be calculated via following formula:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds

So

Dwell time DH1= slot time \* (1600/2/79) \* 31.6

Dwell time DH3= slot time \* (1600/4/79) \* 31.6

Dwell time DH5= slot time \* (1600/6/79) \* 31.6

The RF channel will remain fixed for duration of a packet, that means for DH3 packet the RF frequency will remain unchanged during 3 slots (1slot=1/1600=625us), and for DH5 packet the RF frequency will remain unchanged during 5 slots, illustrated the principle as below:

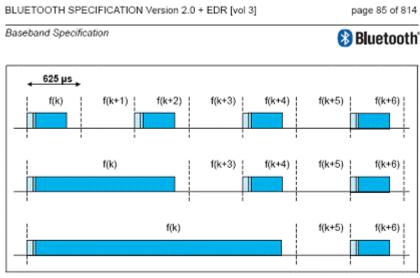


Figure 2.14: Single- and multi-slot packets.

Therefore, in a certain period for different packet types, the quantities of hops (not hopping rate 1600) are different, accurately, the quantity of hops for DH1 is double of DH3's and triple of DH5's. "for DH1 packet, 1 hop in 1 slot; for DH3 packet, ½ hop in 1 slot; for DH5 packet, 1/3 hop in 1 slot.", explained as below:

From the illustrated hopping scheme:

For DH1, in two slots, there are two hops, i.e. f(k) in Slot(k), f(k+1) in Slot(k+1), means DH1 1 hop in 1 slot;

For DH3, in four slots, there are two hops, i.e. f(k) in Slot(k) & Slot(k+1) & Slot(k+2), f(k+3) in

#### Page 41 of 74

ITL

Slot(k+3), means DH3 2 hops in four slots ->  $\frac{1}{2}$  hop in 1 slot; For DH5, in six slots, there are two hops, i.e. f(k) in Slot(k) & Slot(k+1) & Slot(k+2) & Slot(k+3) & S

Slot(k+4), f(k+5) in Slot(k+5), means DH3 2 hops in six slots -> 1/3 hop in 1 slot.

The Hopping rate in the formula should not be fixed value, for DH1, it is 1600/2; for DH3, it is

1600/4; for DH5, it is 1600/6.

To calculate Dwell time of data transmission of Bluetooth system, the worst case is for Bluetooth PICONET that contains two devices only (although Bluetooth PICONET can support up to eight devices), and for Bluetooth data transmission, after device A sending a packet to device B, device A must get response packet from device B to continue data transmission;

For DH1 packet: assume device A is EUT, the worst case is after device A sending a DH1 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 1 time slot for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is half of 1600, i.e. 800 hops per second for EUT;

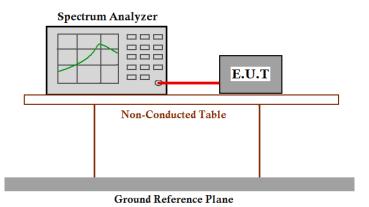
For DH3 packet: assume device A is EUT, the worst case is after device A sending a DH3 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 3 time slots for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is quarter of 1600, i.e. 400 hops per second for EUT;

For DH5 packet: assume device A is EUT, the worst case is after device A sending a DH5 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 5 time slots for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is sixth of 1600, i.e. 1600/6=266.7 hops per second for EUT;

#### 5.7 Maximum Peak Output Power

Test Requirement:	FCC Part 15 C section 15.247
	(b)(1)For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band:
	0.125 watts.
	Refer to the result "Hopping channel number" of this document. The 1 watt (30.0 dBm) limit applies.
Test Method:	ANSI C63.10:2013 Clause 6.10
Test Limit:	
Test mode:	Pre-test the EUT in continuous transmitting mode at the lowest, middle and
	highest channel with different data packet. Compliance test in continuous
	transmitting mode with normal (DH5), EDR mode (3DH5) as the worst case
	was found.

#### **Test Configuration:**



#### **Test Procedure:**

- 1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- Set the spectrum analyzer: RBW = 3 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak.
- 3 . Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

ormal mode:				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	-1.465	21.0	Pass
Middle	2441	-3.008	21.0	Pass
Highest	2480	-5.150	21.0	Pass
DR mode(3DH5	5):			
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	1.308	21.0	Pass
Middle	2441	-1.105	21.0	Pass
Highest	2480	-2.304	21.0	Pass
		,		
emark: cable lo	se=0.5aB			

#### For Bluetooth

#### Normal mode:

#### Lowest Channel:



#### Middle Channel:



#### **Highest Channel:**



EDR mode (3DH5): Lowest Channel:

gilent Spectrum Analyzer - Swept SA				
RL RF 50 Ω AC Center Freq 2.402000000	) GHz PNO: Fast IFGain:Low #Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr Avg Hold:>100/100	06:08:39 PM Dec 04, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	Frequency
Ref Offset 0.5 dB 0 dB/div Ref 11.44 dBm	I Guineow	Mkr1	2.402 000 GHz 1.308 dBm	Auto Tur
og 1.44	1			<b>Center Fr</b> 2.402000000 G
8.56 18.6			The second secon	<b>Start Fr</b> 2.397000000 G
				<b>Stop Fr</b> 2.407000000 G
8.6				CF SI 1.000000 M <u>Auto</u> M
8.6				Freq Off 0
78.6				
enter 2.402000 GHz Res BW 3.0 MHz	#VBW 3.0 MHz	Sweep	Span 10.00 MHz 1.00 ms (601 pts)	
SG		STATUS		

## ITL

#### Middle Channel:



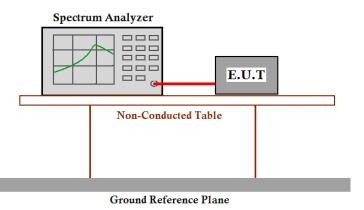
#### **Highest Channel:**



#### 5.8 Conducted Spurious Emissions

Test Requirement:	FCC Part15 C section 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.
Test Method: Test Status:	ANSI C63.10:2013 Clause 6.7 Pre-test the EUT in continuous transmitting mode at the lowest, middle and highest channel with different data packet. Compliance test in continuous transmitting mode with normal (DH5), EDR mode (3DH5) as the worst case was found.

#### **Test Configuration:**



#### **Test Procedure:**

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 100 kHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

#### For Bluetooth

Test result plot as follows (Normal mode): Lowest Channel:

	RF 50 Ω Freq 12.5150		SENSE:INT Trig: Free Run #Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr	06:17:22 PM Dec 04, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWWWW DET P P P P P P	Frequency
10 dB/div Log	Ref Offset 0.5 Ref 2.69 dE			Mk	r1 2.402 2 GHz -2.313 dBm	Auto Tur
-7.31 -17.3 -27.3	1				-22,31 dBini	Center Fre 12.515000000 GH
-37.3 -47.3 -57.3	in the second		والالالداد ومامنات ومام وبادم والاستاد والاور			Start Fre 30.000000 Mi
-67.3 -77.3 -87.3						<b>Stop Fr</b> 25.000000000 G
	V 100 kHz		BW 300 kHz		Stop 25.00 GHz 2.39 s (30001 pts)	CF Sto 2.497000000 G
		× 2.402 2 GHz 24.998 3 GHz	-2.313 dBm -41.162 dBm	UNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> M
3 4 5 6						Freq Offs 0
7 8 9 10						
11 12						
MSG				STATIS		
Idle Channe	el			STATUS		
ddle Channe Agilent Spec	el trum Analyzer - Swe RF 50 ହ Freq 12.5150	AC 000000 GHz PNO: Fast		STATUS ALIGNAUTO Avg Type: Log-Pwr	09:47:20 AM Dec 05, 2018 TRACE 1 2 3 4 5 6 TVPF MUMAAAAAA	Frequency
ddle Chann Agilent Spec W RL Center	trum Analyzer - Swo RF 50 Ω Freq 12.5150 Ref Offset 0.5	AC PNO: Fast IFGain:Low	Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr	09:47:20 AM Dec 05, 2018 TRACE 23 4 5 0 TYPE MUNICIPAL DET P P P P P P1 2.441 3 GHz	
ddle Channe Agilent Spec	trum Analyzer - Swo RF 50 Ω Freq 12.5150 Ref Offset 0.5	AC PNO: Fast IFGain:Low	Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr	09:47:20 AM Dec 05, 2018 TRACE 1 2 3 4 5 5 TYPE MWAMAANA DET P P P P P	Auto Tu Center Fro
ddle Chann Agilent Spec X/ RL Center	trum Analyzer - Swo RF 50 Ω Freq 12.5150 Ref Offset 0.5	AC PNO: Fast IFGain:Low	Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr	D9:47:20 AM Dec 05, 2018 TRACE 23 4 5 6 TYPE 044445 Der P P P P P r1 2,441 3 GHz -4,443 dBm	Auto Tur Center Fra 12.51500000 Gi Start Fra
ddle Chann Agilent Spec X/ RL Center 10 dB/div -9.44 -19.4 -29.4 -39.4	trum Analyzer - Swo RF 50 Ω Freq 12.5150 Ref Offset 0.5	AC PNO: Fast IFGain:Low	Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr	D9:47:20 AM Dec 05, 2018 TRACE 23 4 5 6 TYPE 044445 Der P P P P P r1 2,441 3 GHz -4,443 dBm	Auto Tur Center Fro 12.51500000 Gi Start Fro 30.000000 Mi
Image: Content of the system     Content of the system       10 dB/div     -9.44       -19.4     -39.4       -39.4     -39.4       -39.4     -39.4       -39.4     -39.4       -39.4     -39.4       -39.4     -39.4       -39.4     -39.4       -39.4     -39.4       -39.4     -39.4       -39.4     -39.4	trum Analyzer - Swe RF 50 02 Freq 12.5150 Ref Offset 0.5 Ref 0.56 dE	AC PNO: Fast IFGain:Low	Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr	09:47:20 AM Dec 05, 2018 TRACE 12:3 4 5 6 TYPE MANAAWAY OFF P P P P P r1 2:441 3 GHz -4.443 dBm -24.95 dBm -24.95 dBm	Auto Tur Center Fro 12.51500000 Gi Start Fro 30.000000 Mi Stop Fro
ddle Channe Agitent Spec X RL Center 10 dB/div -9.44 -19.4 -39.4 -	trum Analyzer - Swe RF 50 2 Freq 12.5150 Ref 0.ffset 0.5 Ref 0.56 dE	AC DODOO GHz IFGain:Low 3 dB 3m	Trig: Free Run #Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr Mk	D9:47:20 AM Dec 05, 2018 TRACE 123 4 5 6 TYPE MANAGEMENT 74 2.441 3 GHz -4.443 dBm -24 85 68m -24 85 68m -2	Auto Tur Center Fr 12.51500000 G Start Fr 30.000000 M Stop Fr 25.00000000 G
Agilent Spec (X) RL Center 10 dB/div -9.44 -19.4 -29.4 -39.4	trum Analyzer - Swe RF 50 02 Freq 12.5150 Ref Offset 0.5 Ref 0.56 dB 1 MHz V 100 kHz TRC SCL	AC 00000 GHz IFGain:Low dB 3m	Trig: Free Run #Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr	09:47:20 AM Dec 05, 2018 TRACE 2 3 4 5 0 TYPE 01 AM Dec 05, 2018 TYPE 01 AM Dec 05, 2018 TYP	Auto Tur Center Fr 12.51500000 G Start Fr 30.000000 M Stop Fr 25.00000000 G CF Star 2.497000000 G Auto M
ddle Channe Agilent Spec M RL Center 10 dB/div 9.44 -19.4 -29.4 -3 -3 -3 -3 -3 -4 -3 -3 -3 -4 -3 -3 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5	trum Analyzer - Swe RF 50 Q Freq 12.5150 Ref Offset 0.5 Ref 0.56 dB 1 MHz V 100 kHz TRC SCL 1 f	AC 100000 GHz PN0: Fast IFGain:Low dB 3m 4 4 4 4 4 4 4 4 4 4 4 4 4	Trig: Free Run #Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr Mk	D9:47:20 AM Dec 05, 2018 TRACE 123 4 5 6 TYPE MANAGEMENT 74 2.441 3 GHz -4.443 dBm -24 85 68m -24 85 68m -2	Auto Tur Center Fr 12.51500000 G Start Fr 30.000000 M Stop Fr 25.00000000 G CF Stu 2.497000000 G Auto M
ddle Chann Agilent Spec X RL Center 1 10 dB/div -9.44 -19.4 -29.4 -39.4 -39.4 -39.4 -39.4 -39.4 -39.4 -39.4 -39.4 -59.4	trum Analyzer - Swe RF 50 Q Freq 12.5150 Ref Offset 0.5 Ref 0.56 dB 1 MHz V 100 kHz TRC SCL 1 f	AC 100000 GHz PN0: Fast IFGain:Low dB 3m 4 4 4 4 4 4 4 4 4 4 4 4 4	Trig: Free Run #Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr Mk	D9:47:20 AM Dec 05, 2018 TRACE 123 4 5 6 TYPE MANAGEMENT 74 2.441 3 GHz -4.443 dBm -24 85 68m -24 85 68m -2	Auto Tur Center Fra 12.51500000 Gi Start Fra 30.00000 Mi Stop Fra 25.00000000 Gi

Frequency

Auto Tune

**Center Freq** 12.515000000 GHz

> Start Freq 30.000000 MHz

TYPE MWWWWW DET P P P P P P

-23.85 dB

# ITL

#### **Highest channel**

		ctrur		alyzer - S														
Cen		Ere	RF	50 12.515	Ω ΑC	00 C	Hz		SE	ENSE:INT		Avg		Log-Pwr		PM Dec 04, 2018 CE 1 2 3 4 5 6	F	requency
	ter		~	12.010		P	NO: Fast Gain:Lov		Trig: Fre #Atten: 3			-			T			
10 di	B/div			Offset 0 -1.41										Mk		9 6 GHz 14 dBm		Auto Tune
Log -11.4 -21.4 -31.4				1												-26.79 dBm		Center Fred 15000000 GHz
-41.4 -51.4 -61.4													aya H	n a de la constant de la de la constant de la const			3	Start Fred 0.000000 MHz
-71.4 -81.4 -91.4																	25.00	Stop Fred
Star #Re:	s Bl	N 1	00	kHz	×		#V 6 GHz	9	300 kHz Y -6.414 d		FUNC	TION	FUN	Sweep ction width	2.39 s (	25.00 GHz 30001 pts) ION VALUE	2.49 <u>Auto</u>	CF Step 97000000 GHz Mar
2 3 4 5 6 7 8 9 10 11					2	4.868	5 GHz		0.414 d 40.901 d									Freq Offse 0 Hz
MSG														STATUS				

### Test result plot as follows (EDR mode-3DH5):

Lowest Channel: Agient Spectrum analy IXI RL RF 50 Q AC Center Freq 12.515000000 GHz PN0: Fast IFGain:Low #Atten: 30 dB Agilent XI RL Swept SA 06:14:52 PMDec 04, 2018 TRACE 1 2 3 4 5 6 SENSE:INT Avg Type: Log-Pwr Mkr1 2.402 GHz -3.618 dBm Ref Offset 0.5 dB Ref 1.38 dBm 10 dB/div Log

-78.6 -88.6															Stop Fre 25.000000000 GH
Star #Re				kHz		#	VBW	300 kHz			Sv	veep		5.00 GHz 8001 pts)	CF Ste 2.497000000 GH
MKR	MODE	E TRO	SCL	1	×		12	Y	FUN	CTION	FUNCTION	WIDTH	FUNCTIO	IN VALUE	Auto Ma
1	Ν	1	f			2.402 GH		-3.618 di							
2	Ν	1	f			24.803 GH:	z	-40.231 di	Bm						
4		-		-i-			23					-			Freq Offse
5				ć											0 H
6															
7				6			8								
8		-													
10															
11															
12							13								4
MSG												STATUS			

# ITL

#### Middle Channel

Agilent Spectrum Analyzer - Swept SA	
OV     RL     RF     50 Ω     AC     SENSE:INT     ALIGNAUTO     11:21:27 AM Dec 05, 2018       Center Freq     12.5150000000     GHz     Avg Type: Log-Pwr     TRACE     12.345 E	Frequency
PNO: Fast 🕞 Trig: Free Run	
IFGain:Low #Atten: 30 dB DELIGION	Auto Tune
Ref Offset 0.5 dB	
-11.6	Center Freq
-21.6	.515000000 GHz
-31.6	
-41.6	Start Freq
	30.000000 MHz
-71.6	Stop Freq
-81.6	.000000000 GHz
Start 30 MHz Stop 25.00 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.39 s (8001 pts)	CF Step
Z.	.497000000 GHz
MKP     MODE     TRC     SCL     X     Y     FUNCTION     FUNCTION WIDTH     FUNCTION VALUE     Automatic       1     N     1     f     2.443 GHz     -6.61 dBm     -6.61 dBm	<u>o</u> Man
2 N 1 f 4.884 GHz -38.92 dBm	
	Freq Offset 0 Hz
	0 H2
9	
MSG STATUS	

#### Highest channel

Agilent Spectrum Analyzer - Swept SA	
W RL     RF     50 Ω     AC     SENSE:INT     ALIGNAUTO     11:18:45 AM Dec 05, 2018       Center Freq 12.515000000 GHz     Avg Type: Log-Pwr     TRACE     12 3 4 5 6	Frequency
PNO: Fast C Trig: Free Run Type Mwwwww	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -
Il-bain:Low #Atten: 30 db	Auto Tune
Ref Offset 0.5 dB     Mkr1 2.480 GHz       10 dB/div     Ref -2.13 dBm     -7.125 dBm	Futo Func
Log	Contor From
	Center Freq 515000000 GHz
-22.1	515000000 GHz
	Start Freq
-52.1 Hereita - 1997 -	30.00000 MHz
-72.1	
-82.1	Stop Freq
	000000000 GHz
Start 30 MHz Stop 25.00 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.39 s (8001 pts)	CF Step 497000000 GHz
MKR MODE TRC SCL X Y FUNCTION VIDTH FUNCTION VALUE	
1 N 1 f 2.480 GHz -7.125 dBm 2 N 1 f 24.819 GHz -41.349 dBm	
	Freq Offset
	0 Hz

### 5.9 Radiated Spurious Emissions

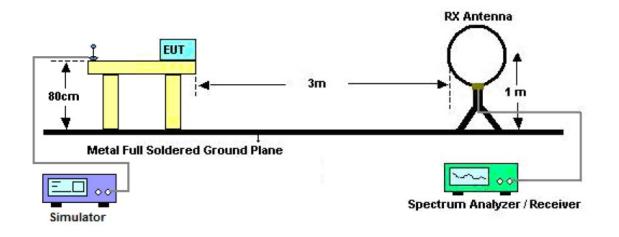
Test Requirement:	FCC Part15 C section 15.247
	(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 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, and provided the transmitter demonstrates compliance with the peak conducted power limits.
Test Method:	ANSI C63.10:2013 Clause 6.4, 6.5 and 6.6
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest, middle and highest channel with different data packet. Compliance test in continuous transmitting mode with normal mode (DH5) as the worst case was found.
Detector:	For PK value:
	RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, 9kHz for <30MHz VBW ≥ RBW Sweep = auto
	Detector function = peak
	Trace = max hold
	For AV value:
	RBW = 1 MHz for $f \ge 1$ GHz, 100 kHz for $f < 1$ GHz, 9kHz for <30MHz
	VBW =10 Hz
	Sweep = auto
	Detector function = peak
	Trace = max hold

#### 15.209 Limit:

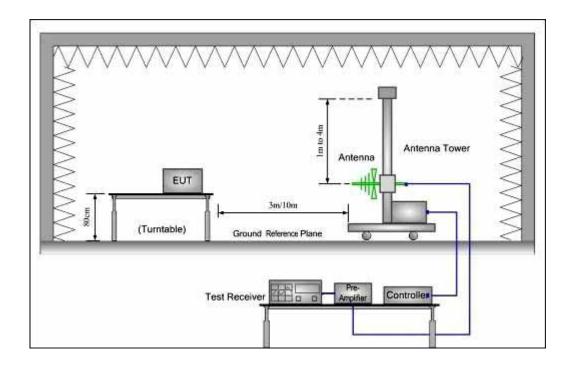
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### **Test Configuration:**

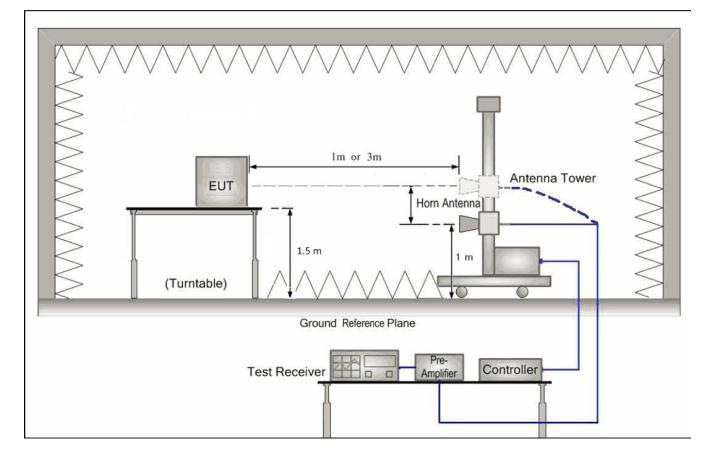
1) 9kHz to 30MHz emissions:



2) 30 MHz to 1 GHz emissions:



#### 3) 1 GHz to 40 GHz emissions:



**Test Procedure:** The receiver was scanned from 30MHz to 25GHz.When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. After pre-test, it was found that the worse radiation emission was get at the X position. So the data shown was the X position only. The worst case emissions were reported.

Now 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 dwell time 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 (dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

### Test at low Channel in transmitting status

9kHz~30MHz Test result

The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which

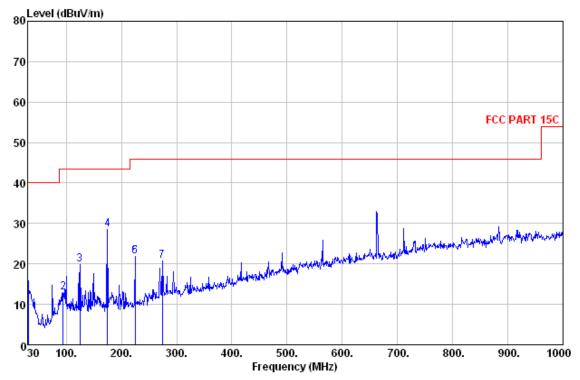
#### was 20dB lower than the limit line per 15.31(o) was not report

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

#### Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
-										
4 5	30.970 125.060 174.530 224.970 274.440 490.750	25.49 38.38 46.86 37.02 33.51 29.08	17.41 7.60 8.21 10.60 12.53 18.12	0.64 1.33 1.58 1.82 2.02 2.75	28.52 28.45 28.18 27.65 27.42 28.65	15.02 18.86 28.47 21.79 20.64 21.30	$\begin{array}{c} 40.00\\ 43.50\\ 43.50\\ 46.00\\ 46.00\\ 46.00\\ 46.00\\ 46.00\end{array}$	-24.98 -24.64 -15.03 -24.21 -25.36 -24.70	HORIZONTAI HORIZONTAI	QP QP QP QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

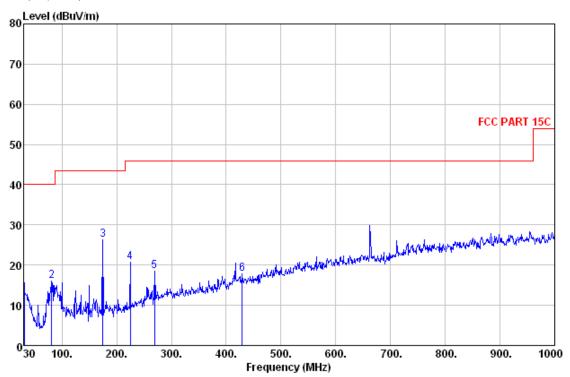
### Test at low Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

#### Vertical:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
-										
4 5	30.000 85.290 174.530 224.970 269.590 430.610	25.90 36.15 44.67 36.07 32.30 27.21	17.70 7.63 8.21 10.60 12.74 16.41	0.63 1.08 1.58 1.82 2.01 2.56	28.50 28.26 28.18 27.65 27.22 28.21	15.73 16.60 26.28 20.84 19.83 17.97	$\begin{array}{c} 40.\ 00\\ 40.\ 00\\ 43.\ 50\\ 46.\ 00\\ 46.\ 00\\ 46.\ 00\\ 46.\ 00\end{array}$	-24.27 -23.40 -17.22 -25.16 -26.17 -28.03		QP QP QP QP QP QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

#### **Peak Measurement:**

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Antenna polarization
4804.000	33.34	9.58	27.63	18.92	34.21	74.00	V
7206.000	36.73	12.13	27.63	15.12	36.65	74.00	V
9608.000	38.84	14.40	27.14	13.33	39.43	74.00	V
4804.000	33.34	9.58	27.63	19.36	34.65	74.00	Н
7206.000	36.73	12.13	27.63	15.51	37.04	74.00	Н
9608.000	38.84	14.40	27.14	13.21	39.31	74.00	Н

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Antenna polarization
4804.000	33.34	9.58	27.63	11.74	27.03	54.00	V
7206.000	36.73	12.13	27.63	7.12	28.65	54.00	V
9608.000	38.84	14.40	27.14	6.33	32.43	54.00	V
4804.000	33.34	9.58	27.63	10.36	34.65	54.00	Н
7206.000	36.73	12.13	27.63	9.51	31.04	54.00	Н
9608.000	38.84	14.40	27.14	5.21	31.31	54.00	Н

#### Test at Middle Channel in transmitting status

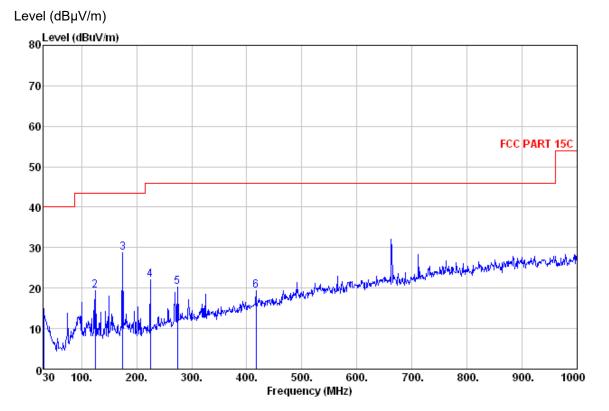
9kHz~30MHz Test result

The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

#### Horizontal:

Peak scan



Quasi-peak measurement

N	o. Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
_										
1 2 3 4 5 6	174.530 224.970	25.36 38.86 47.13 37.31 33.22 28.69	17.41 7.60 8.21 10.60 12.53 16.32	0.64 1.33 1.58 1.82 2.02 2.51	28.52 28.45 28.18 27.65 27.42 28.13	14.89 19.34 28.74 22.08 20.35 19.39	43.50	-25.11 -24.16 -14.76 -23.92 -25.65 -26.61	HORIZONTAI HORIZONTAI	QP QP QP QP QP
-				<b>-</b> .		-				

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

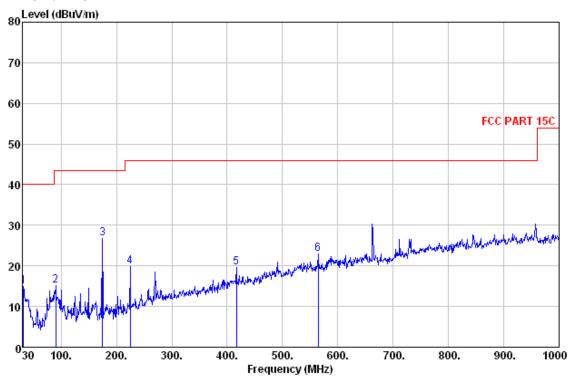
#### Test at Middle Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

#### Vertical:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

No	. Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
-										
1	31.940	25.66	17.12	0.65	28.54	14.89	40.00	-25.11	VERTICAL	QP
2	90.140	34.17	8.20	1.11	28.41	15.07	43.50	-28.43	VERTICAL	QP
3	174.530	45.18	8.21	1.58	28.18	26.79	43.50	-16.71	VERTICAL	QP
4	224.970	35.13	10.60	1.82	27.65	19.90	46.00	-26.10	VERTICAL	QP
5	417.030	28.85	16.32	2.51	28.13	19.55	46.00	-26.45	VERTICAL	QP
6	564.470	29.24	19.44	2.96	28.78	22.86	46.00	-23.14	VERTICAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

#### Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Antenna polarization
4882.000	33.41	9.67	27.61	22.68	38.15	74.00	V
7323.000	36.92	12.25	27.33	15.38	37.22	74.00	V
9764.000	38.91	14.49	27.12	14.43	40.71	74.00	V
4882.000	33.41	9.67	27.61	21.84	37.31	74.00	Н
7323.000	36.92	12.25	27.33	15.45	37.29	74.00	Н
9764.000	38.91	14.49	27.12	14.47	40.75	74.00	Н

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Antenna polarization
4882.000	33.41	9.67	27.61	9.68	25.15	54.00	V
7323.000	36.92	12.25	27.33	6.38	28.22	54.00	V
9764.000	38.91	14.49	27.12	3.43	29.71	54.00	V
4882.000	33.41	9.67	27.61	8.84	24.31	54.00	Н
7323.000	36.92	12.25	27.33	6.45	28.29	54.00	Н
9764.000	38.91	14.49	27.12	5.47	31.75	54.00	Н

#### Test at high Channel in transmitting status

9kHz~30MHz Test result

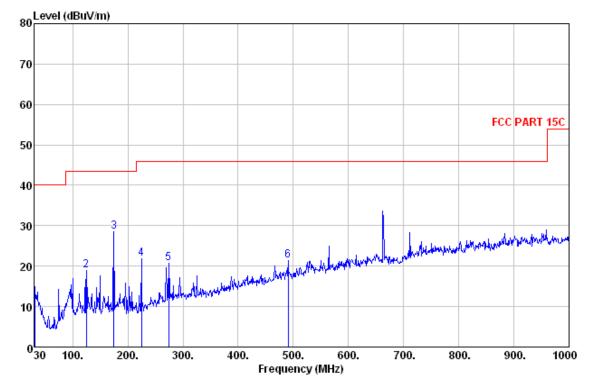
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

#### Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

No	. Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV∕m	Over Limit dB	Pol/Phase	Remark
-										
1	30.970	26.20	17.41	0.64	28.52	15.73	40.00	-24.27	HORIZONTAL	. QP
2	94.020	32.09	8.28	1.13	28.57	12.93	43.50	-30.57	HORIZONTAL	. QP
3	125.060	39.33	7.60	1.33	28.45	19.81	43.50	-23.69	HORIZONTAL	
4	174.530	46.96	8.21	1.58	28.18	28.57	43.50	-14.93	HORIZONTAL	
5	224.970	37.08	10.60	1.82	27.65	21.85	46.00	-24.15	HORIZONTAL	. QP
6	224.970	37.08	10.60	1.82	27.65	21.85	46.00	-24.15	HORIZONTAL	. QP
7	274.440	33.58	12.53	2.02	27.42	20.71	46.00	-25.29	HORIZONTAL	. QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

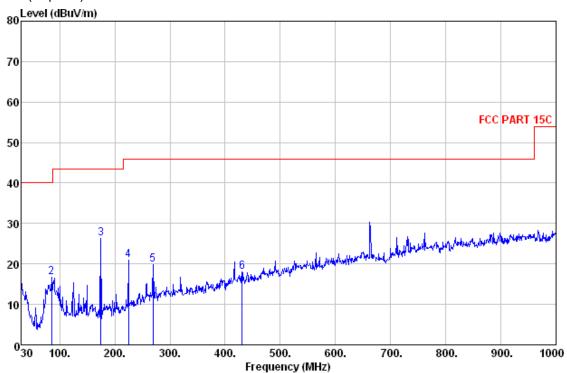
#### Test at High Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

#### Vertical:

Peak scan





Quasi-peak measurement

No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
-										
1	30.970	26.11	17.41	0.64	28.52	15.64	40.00	-24.36		QP
2	81.410	35.73	7.31	1.05	28.14	15.95	40.00	-24.05	VERTICAL	QP
3	174.530	44.79	8.21	1.58	28.18	26.40	43.50	-17.10	VERTICAL	QP
4	224.970	35.89	10.60	1.82	27.65	20.66	46.00	-25.34	VERTICAL	QP
5	269.590	30.95	12.74	2.01	27.22	18.48	46.00	-27.52	VERTICAL	QP
6	429.640	27.07	16.40	2.56	28.19	17.84	46.00	-28.16	VERTICAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

# ITL

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Poak	Measurement:
геак	weasurement.

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Antenna polarization
4960.000	33.47	9.75	27.60	19.88	35.50	74.00	V
7440.000	37.10	12.36	27.32	15.92	38.06	74.00	V
9920.000	38.97	14.58	27.11	14.55	40.99	74.00	V
4960.000	33.47	9.75	27.60	21.63	30.32	74.00	Н
7440.000	37.10	12.36	27.32	16.18	40.75	74.00	Н
9920.000	38.97	14.58	27.11	14.31	33.75	74.00	Н

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Antenna polarization
4960.000	33.47	9.75	27.60	9.88	25.50	54.00	V
7440.000	37.10	12.36	27.32	5.92	28.06	54.00	V
9920.000	38.97	14.58	27.11	-1.45	24.99	54.00	V
4960.000	33.47	9.75	27.60	7.63	23.25	54.00	Н
7440.000	37.10	12.36	27.32	8.18	30.32	54.00	Н
9920.000	38.97	14.58	27.11	7.31	33.75	54.00	Н

Remark:

1). The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Loss –Preamplifier Factor.

- 2). As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 3). The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

Test result: The unit does meet the FCC requirements.

#### 5.10 Radiated Emissions which fall in the restricted bands

Test Requirement:	FCC Part15 C Section 15.247 (d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	ANSI C63.10:2013 Clause 6.4, 6.5 and 6.6
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet. Compliance test in continuous transmitting mode with normal mode (DH5) as the worst case was found.

Measurement Distance: 3m (Semi-Anechoic Chamber)

Limit:

Section 15.209(a)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

**Detector:** 

For PK value:

RBW = 1 MHz for  $f \ge 1$  GHz, 100 kHz for f < 1 GHz VBW  $\ge$  RBW Sweep = auto Detector function = peak

Trace = max hold

For AV value:

RBW = 1 MHz for  $f \ge 1$  GHz, 100 kHz for f < 1 GHz

VBW =10 Hz

Sweep = auto

Detector function = peak

Trace = max hold

rest Result.

#### For Bluetooth

#### 1. Low Channel (2402MHz)

#### Antenna polarization: Vertical

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBµV)	Peak Emission Level (dBµV/m)
2310.000	27.98	6.32	27.76	28.29	34.83
2390.000	27.94	6.45	27.78	34.61	41.22
2500.000	27.90	6.62	27.80	32.89	39.61
2483.500	27.91	6.59	27.80	26.33	33.03

Antenna polarization: Horizontal

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBµV)	Peak Emission Level (dBµV/m)
2310.000	27.98	6.32	27.76	27.44	33.98
2390.000	27.94	6.45	27.78	32.64	39.25
2500.000	27.90	6.62	27.80	33.81	40.53
2483.500	27.91	6.59	27.80	27.13	33.83

#### 2. Middle Channel (2441MHz)

Antenna polarization: Vertical

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBµV)	Peak Emission Level (dBµV/m)
2310.000	33.96	24.63	39.28	28.27	34.81
2390.000	34.24	23.36	39.47	34.83	41.44
2500.000	34.08	24.29	38.60	31.10	37.82
2483.500	35.26	24.06	39.86	28.07	34.77

# ITL

Antenna polarization: Horizontal

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBµV)	Peak Emission Level (dBµV/m)
2310.000	33.05	23.96	38.37	27.18	33.72
2390.000	34.75	22.57	39.98	32.17	38.78
2500.000	34.14	23.55	38.66	27.90	34.20
2483.500	35.07	22.02	39.67	27.91	40.11

#### 3. High Channel (2480MHz)

Antenna polarization: Vertical

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBµV)	Peak Emission Level (dBµV/m)
2310.000	32.33	22.76	37.65	28.04	34.58
2390.000	32.06	23.61	37.29	35.00	41.61
2500.000	33.02	23.35	37.54	31.35	38.07
2483.500	34.76	24.07	39.36	27.51	34.21

Antenna polarization: Horizontal

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBµV)	Peak Emission Level (dBµV/m)
2310.000	24.38	40.28	29.70	26.87	33.41
2390.000	23.07	40.07	28.30	30.86	37.47
2500.000	24.52	38.20	29.04	32.93	33.43
2483.500	23.98	37.24	28.58	26.73	39.65

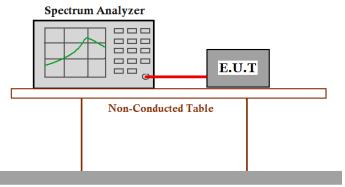
Remark: No any other emission which falls in restricted bands can be detected and be reported.

Test result: The unit does meet the FCC requirements.

### 5.11 Band Edges Requirement

Test Requirement:	FCC Part15 C section 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 emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Frequency Band:	2400 MHz to 2483.5 MHz
Test Method:	ANSI C63.10:2013 Clause 6.9
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), and highest (2480 MHz) channel and hopping mode with different data packet. Compliance test in continuous transmitting mode with normal (DH5) and EDR mode (3DH5) as the worst case was found.

#### **Test Configuration:**



Ground Reference Plane

#### **Test Procedure:**

Set RBW of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 300 kHz with suitable frequency span including 10MHz bandwidth from band edge.

The band edges was measured and recorded Result:

The Lower Edges attenuated more than 20dB.

The Upper Edges attenuated more than 20dB.

The graph as below. Represents the emissions take for this device.

#### For Bluetooth

DH5:

	ectrum	Analyzer -						
RL			ΩΩ AC	SENSE		ALIGNAUTO Type: Log-Pwr	06:16:28 PMDec 04, 2018 TRACE 1 2 3 4 5 6	Frequency
enter	Fred	2.357	<b>'000000 GHz</b> PNO: Fa IFGain:L		un	Type. Log-F Wi		
) dB/div		tef Offset tef 3.31				Mkr2	2.402 026 GHz -1.582 dBm	Auto Tu
og 🔽							12	
.69								Center F
6.7							-21.69 dBm	2.357000000
6.7								
6.7							∧ <sup>4</sup> ∖	Start F
6.7							<u>}_</u>	2.310000000
6.7 mm	and the ball	- Andrewsky	<del></del>	······································	an helin and a state of the second	an and the second	ahighash ala tana ang sa sha sha sha sha sha sha sha sha sha	2.510000000
6.7								
6.7								Stop F
6.7								2.404000000
	0400							
		0 GHz 0 kHz	#	VBW 300 kHz		Sweep 9	Stop 2.40400 GHz ).00 ms (1001 pts)	CF S 9.400000
CO D	TDC (		×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Auto
KR MODE		f	2.399 958 GH					
KR MODE		f l	2.402 026 GH	zi -1.56 dbrr	9			
KR MODE 1 N 2 N 3		f	2.402 026 GH	2 -1.56 dBm				Freq Of
KR MODE 1 N 2 N 3 4 5 5		f	2.402 026 GH	2 -1.36 dBm				the second second
KR MODE 1 N 2 N 3 4 5 5 6		f	2.402 026 GH					Freq Off (
KR MODE 1 N 2 N 3 4 5 5 6 7 8			2.402 026 GH	2 -1.38 dBrf				the second second
KR MODE 1 N 2 N 3 4 5 6 6 7			2.402 026 GH					the second second

#### High channel:

RL RF enter Freq 2	50 Ω AC .489000000 GHz	SENSE:IN	Avg Type: Lo	INAUTO 06:24:54 PMDec 04, 2 g-Pwr TRACE 234	Frequency
dB/div Ref	PNO: IFGair Dffset 0.5 dB -0.42 dBm	Fast 🖵 Trig: Free Run :Low #Atten: 30 dB		TYPE DET PPPP VIkr2 2.483 522 GI -54.791 dB	Iz Auto Tun
<b>D</b> g 0.4 0.4				-25.42	Center Fre
0.4 0.4 0.4	Manna 2	and the second	and and and a star and a star of the star	entranorantitatione	2.478000000 G
0.4					<b>Stop Fr</b> 2.500000000 G
art 2.47800 G Res BW 100 k		#VBW 300 kHz		Stop 2.50000 G reep 2.13 ms (1001 p	Hz ts) CF St 2.200000 M Auto M
1 N 1 f 2 N 1 f 3	2.480 002 G 2.483 522 G	Hz -5.34 dBm Hz -54.79 dBm			Freq Offs
4 6					0
7 B					
0					
3				STATUS	

#### 3DH5: Low channel:

Center F		0Ω AC 0000000 GHz	Fast 😱 Trig: Free		ALIGNAUTO	06:14:04 PM Dec 04, 2018 TRACE 1 2 3 4 5 6 TYPE M M TYPE M DET P P P P P	Frequency
0 dB/div	Ref Offset Ref 1.76	IFGain: 0.5 dB			Mkr2	2.401 932 GHz -3.238 dBm	Auto True
- <b>og</b> 8.24 18.2 28.2						-23.24 dBm	Center Fre 2.357000000 G⊦
38.2	بالم ولمور ولمور الم	Altrander March March March and	مرور مرد المرور مرد المرور مرد المرور مرد مرد مرد مرور مرد مرد مرد مرد مرد مرد مرد مرد مرد مر	manumlinansertenti	م میلاده رو الکور او میلاده می	And	<b>Start Fre</b> 2.310000000 GH
68.2 78.2 88.2							<b>Stop Fro</b> 2.404000000 Gi
	000 GHz 100 kHz	×	#VBW 300 kHz	FUNCTION	Sweep	Stop 2.40400 GHz 9.00 ms (1001 pts)	
1 N 1 2 N 1 3 4 5 6 7 8		2.399 958 GI 2.401 932 GI	Hz -43.73 dl	Bm			Freq Offs 01
9					5	0	

High channel:

Agilent Spectrum Analyzer - Swept SA				
X RL RF 50Ω AC Center Freq 2.489000000 GHz	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	11:17:56 AM Dec 05, 2018 TRACE 1 2 3 4 5 6	Frequency
PNO: Fast IFGain:Low Ref Offset 0.5 dB 10 dB/div Ref -1.74 dBm		Mkr2	2.483 522 GHz -53.811 dBm	Auto Tune
-11.7 -21.7			-26.78 dBm	Center Freq 2.489000000 GHz
-31.7 -41.7 -51.7 -61.7 -71.7	Althon angue to althon of the solar Manager	พร้ายรักษ์เป็นของรายการการการการการการการการการการการการการก	ฟราปารสามารถเป็นการแก่งเป็นการเป็นเกา	<b>Start Freq</b> 2.478000000 GHz
-81.7				<b>Stop Freq</b> 2.50000000 GHz
Start 2.47800 GHz #Res BW 100 kHz #V	BW 300 kHz	Sweep	Stop 2.50000 GHz 2.13 ms (1001 pts)	CF Step 2.200000 MHz Auto Man
1 N 1 f 2.479 958 GHz 2 N 1 f 2.483 522 GHz 3 4 5 6	-6.74 dBm -53.81 dBm			Freq Offset 0 Hz
7     8       9     9       10     11       11     12				
MSG		STATUS	1	

#### DH5:

#### Low channel:

Display L	rum Analyzer - S RF 50 Line -23.34	Ω AC dBm PNO:	SENSE:IN	Avg Type	ALIGN AUTO =: Log-Pwr :> 100/100	12:05:34 PM Dec 05, 2018 TRACE 1 2 3 4 5 5 TYPE MWWWWW DET P N N N N	Display
10 dB/div	Ref Offset ( Ref 15.50		:Low #Atten: 30 dB		Mki	r2 2.400 0 GHz -45.934 dBm	Annotation
-4.50							Title
-24.5 -34.5 -44.5						2 2	Graticul On Of
-54.5	hollow (United Instances	ry al Although and	nelogikhtenskipturunnskihtenseessportbuk	an an transferrant and an	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	unernantal	Display Lin -23.34 dBr
Start 2.31 Res BW			#VBW 300 kHz		Sweep 9	Stop 2.41000 GHz 9.60 ms (1001 pts)	
welling and an		×	Y	FUNCTION FU	NCTION WIDTH	FUNCTION VALUE	
1 N 1		2.402 000 G	Hz -2.848 dBm				
MKR MODE TR 1 N 1 2 N 1 3 4 5 5 6		2.402 000 G 2.400 000 G	Hz -2.848 dBm Hz -45.934 dBm				System Display Settings
1 N 1 2 N 1 3 4 5 5		2.402 000 G 2.400 000 G	Hz -2.848 dBm Hz -45.934 dBm				Display

#### High channel:

Display	12:02:14 PM Dec 05, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWWWW DET P NNNNN	ALIGNAUTO Type: Log-Pwr Iold:>100/100	Avg	SENSE:IN	PNO: Fast	lyzer - Swept SA 50 Ω AC 25.73 dBm	L RF
GHz Annotation	2.483 500 GHz -57.503 dBm			#Atten: 30 dB	IFGain:Low	Offset 0.5 dB 15.50 dBm	
Title							ι Λ Å
Graticul	-25.73 dBm				2		$\vee$ $\vee$
Display Lir -25.73 dB	alaradharatharatharatharatharatharatharath	mana and a second	นใจ-+	มากกับใน <sub>ของ</sub> สุดภาษาสารการการการการการการการการการการการการกา			
1 pts)	Stop 2.50000 GHz 2.13 ms (1001 pts)		FUNCTION	W 300 kHz	#VE		t 2.47800 s BW 100
				-5.733 dBm -57.503 dBm	80 000 GHz 33 500 GHz	2.480	N 1 f N 1 f
System Display Settings							
		STATUS					

#### 3DH5:

#### Low channel:

Display L	.ine -26.59	dBm	0: Fast 🕞	SENSE:IN Trig: Free Run	Avg	ALIGN AUTO Type: Log-Pwr Hold:>100/100	12:06:36 PM Dec 05, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Display
0 dB/div	Ref Offset 0 Ref 15.50	IFG: 0.5 dB	ain:Low	#Atten: 30 dB		Mk	r2 2.400 0 GHz -50.976 dBm	Annotation
.og 5.50 4.50								Title
24.5 34.5 44.5							26.59 dBm	Graticu On C
54.5 64.5 74.5	enely-dereveryl-sylves-wheth	male and a second	Maran Andra A		www.mets	land - magained and and	#rehundpungsnot	Display Lir -26.59 dB
tart 2.31	000 GHz		#VBW	/ 300 kHz		Sweep 9	Stop 2.41000 GHz 9.60 ms (1001 pts)	
Res BW								
	RC  SCL  f	× 2.402 000	GHz	⊻ -4.959 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
Res BW	RC  SCL  f		GHz	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	System Display Settings
Res BW       1     N     1       2     N     1       3     1     1       4     1     1	RC  SCL  f	2.402 000	GHz	⊻ -4.959 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Display

#### High channel:



Test result: The unit does meet the FCC requirements.

#### 5.12 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

Test Requirement:	FCC Part 15 C section 15.207
Test Method:	ANSI C63.10:2013 Clause 6.2
Test Voltage:	AC 120V 60Hz
Frequency Range:	150 kHz to 30 MHz

**Detector:** Peak for pre-scan (9 kHz Resolution Bandwidth)

#### **Test Limit**

- Eroquonov Pongo	Class B Limit dB(µV)					
Frequency Range	Quasi-peak	Average				
0.15 to 0.50	66 to 56	56 to 46				
0.50 to 5	56	46				
5 to 30	60	50				
NOTE 1 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.						

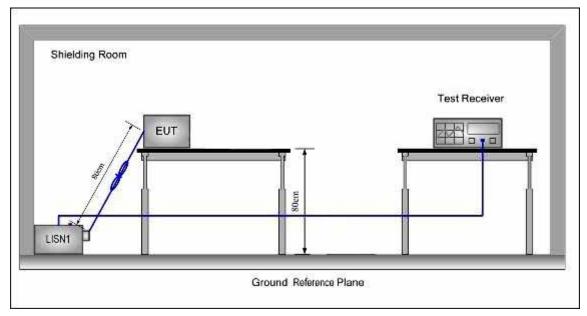
#### Limits for conducted disturbance at the mains ports of class B

EUT Operation:

Test in normal operating mode. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Pre-Scan has been conducted to determine the worstcase mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

#### **Test Configuration:**



#### Test procedure:

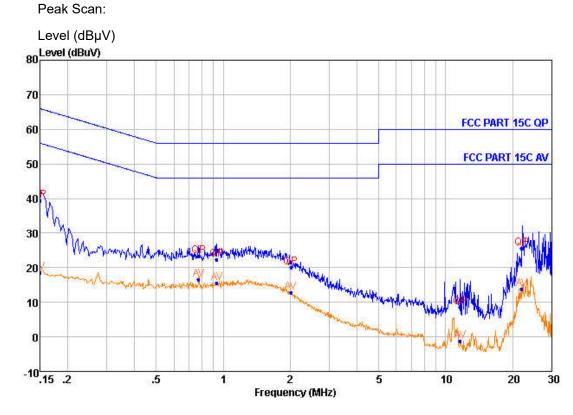
1. The mains terminal disturbance voltage test was conducted in a shielded room.

2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

#### 5.12.1 Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected. For EUT the communicating was worst case mode.

### The following Quasi-Peak and Average measurements were performed on the EUT Live line



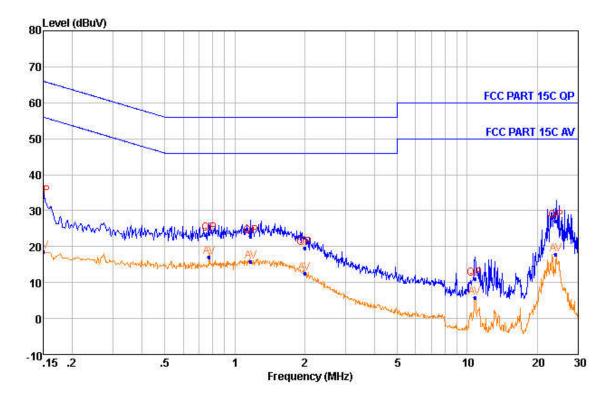
Quasi-peak and Average measurement

NO.	Freq MHz	Level dBuV	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBuV	Margin dB
1	0.150	39.30	QP	9.36	0.20	66.00	-26.70
2	0.150	18.60	Average	9.36	0.20	56.00	-37.40
2 3	0.774	23.34	QP	9.27	0.29	56.00	-32.66
4	0.774	16.65	Average	9.27	0.29	46.00	-29.35
4 5 6 7	0.936	22.33	QP	9.27	0.30	56.00	-33.67
6	0.936	15.48	Average	9.27	0.30	46.00	-30.52
	2.018	20.18	QP	9.32	0.35	56.00	-35.82
8 9	2.018	12.76	Average	9.32	0.35	46.00	-33.24
9	11.600	8.61	QP	9.37	0.45	60.00	-51.39
10	11.600	-1.16	Average	9.37	0.45	50.00	-51.16
11	22.007	25.68	QP	9.74	0.48	60.00	-34.32
12	22.007	13.75	Average	9.74	0.48	50.00	-36.25

#### **Neutral Line**

Peak Scan:

Level (dBµV)



Quasi-peak and Average measurement

NO.	Freq MHz	Level dBu∛	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBuV	Margin dB
1	0.150	33.93	QP	9.38	0.20	66.00	-32.07
2	0.150	18.69	Average	9.38	0.20	56.00	-37.31
3	0.774	23.59	QP	9.36	0.29	56.00	-32.41
4	0.774	17.14	Average	9.36	0.29	46.00	-28.86
5 6	1.169	22.77	QP	9.37	0.32	56.00	-33.23
6	1.169	15.83	Average	9.37	0.32	46.00	-30.17
7	2.000	19.56	QP	9.39	0.35	56.00	-36.44
8 9	2.000	12.63	Average	9.39	0.35	46.00	-33.37
9	10.765	11.15	QP	9.56	0.44	60.00	-48.85
10	10.765	5.83	Average	9.56	0.44	50.00	-44.17
11	24.082	27.02	QP	9.81	0.49	60.00	-32.98
12	24.082	17.78	Average	9.81	0.49	50.00	-32.22

--End of Report--